



REPORT No.: SZ20080275W01

TEST REPORT

APPLICANT : LIFI LABS INC.

PRODUCT NAME : Wifi module

MODEL NAME : LCM3T

BRAND NAME : LIFX

FCC ID : 2AA53-LCM3

STANDARD(S) : 47 CFR Part 15 Subpart C

RECEIPT DATE : 2020-08-24

TEST DATE : 2020-09-07 to 2020-10-22

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Peng Huarui (Supervisor)

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MORLAB

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Change History		
Version	Date	Reason for change
1.0	2020-11-09	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	LIFI LABS INC.
Applicant Address:	LIFI LABS INC. dba LIFX 350 Townsend Street #830 San Francisco, CA 94107
Manufacturer:	LIFI LABS INC.
Manufacturer Address:	LIFI LABS INC. dba LIFX 350 Townsend Street #830 San Francisco, CA 94107

1.2. Equipment Under Test (EUT) Description

Product Name:	Wifi module
Serial No.:	(N/A, marked #1 by test site)
Hardware Version:	005
Software Version:	N/A
Modulation Technology:	DSSS, OFDM
Modulation Type:	Refer to section 1.3
Operating Frequency Range:	802.11b/g/n (HT20): 2412MHz–2472MHz
Antenna Type:	PCB Antenna
Antenna Gain:	1.9dBi

Note 1: This is a variant report from the original report (Report No.: SZ17090079W01A, FCC ID: 2AA53-LCM3), based on the similarity between before, only added channel 12 and channel 13, no others changed. We have tested all the test items of channel 12, channel 13 and added the result in this report.

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

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		

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 _{Note1}	No deviation
2	N/A	Duty Cycle Of Test Signal	Sep 09, 2017	Tu Ya'nan	PASS _{Note1}	No deviation
3	15.247(b)	Maximum Peak and Average Conducted Output Power	Sep 09, 2017 Sep 11, 2020	Tu Ya'nan	PASS _{Note1}	No deviation
4	15.247(a)	Bandwidth	Sep 09, 2017 Oct 06, 2020	Tu Ya'nan	PASS _{Note1}	No deviation
5	15.247(d)	Conducted Spurious Emission and Band Edge	Sep 09, 2017 Oct 06, 2020	Tu Ya'nan	PASS _{Note1}	No deviation
6	15.247(e)	Power Spectral Density (PSD)	Sep 09, 2017 Sep 09, 2020	Tu Ya'nan	PASS _{Note1}	No deviation
7	15.207	Conducted Emission	Sep 21, 2017	Gao Jianrou	PASS _{Note1}	No deviation
8	15.247(d)	Restricted Frequency Bands	Sep 13, 2017 Oct 15&22, 2020	Gao Jianrou	PASS _{Note1}	No deviation
9	15.209, 15.247(d)	Radiated Emission	Sep 13, 2017 Sep 07, 2020	Gao Jianrou	PASS _{Note1}	No deviation

Note1: Except for the test results of channel 12 and channel 13, the other test results of these test items in this report refer to the test report (Report No.: SZ19090079W01A).



Note 2: The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013, KDB558074 D01 v05r02.

Note 3: 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 4: 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 5: 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. Test 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

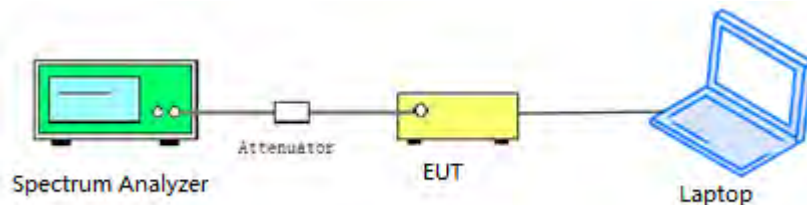
2.2.1. Requirement

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 $\pm 2\%$; 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.

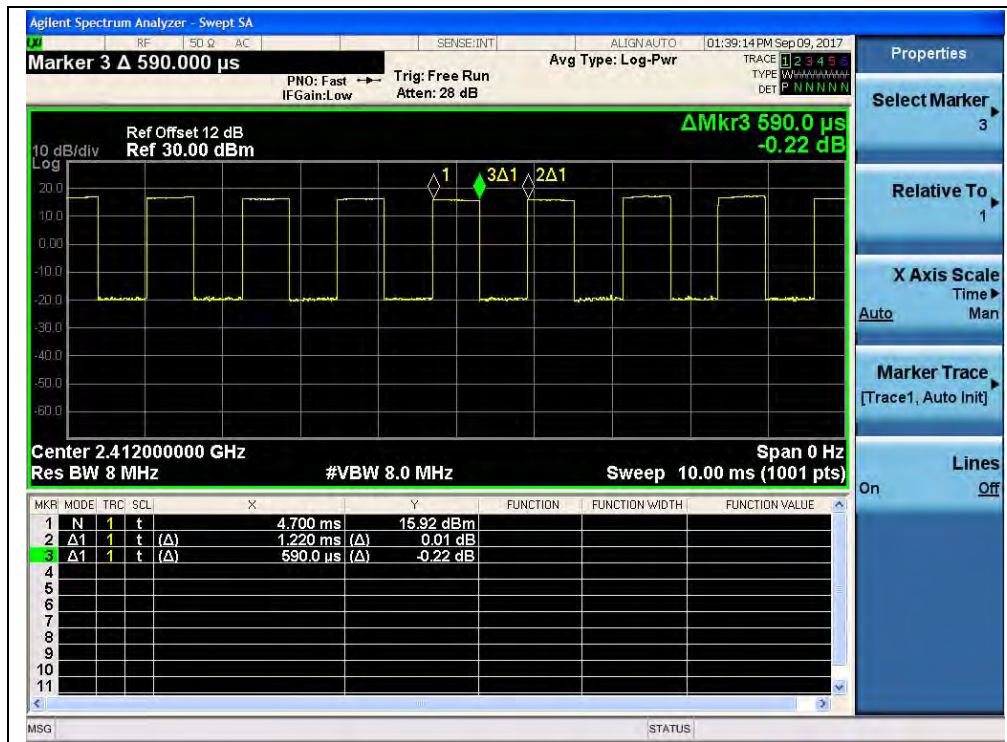


2.2.3. Test Result

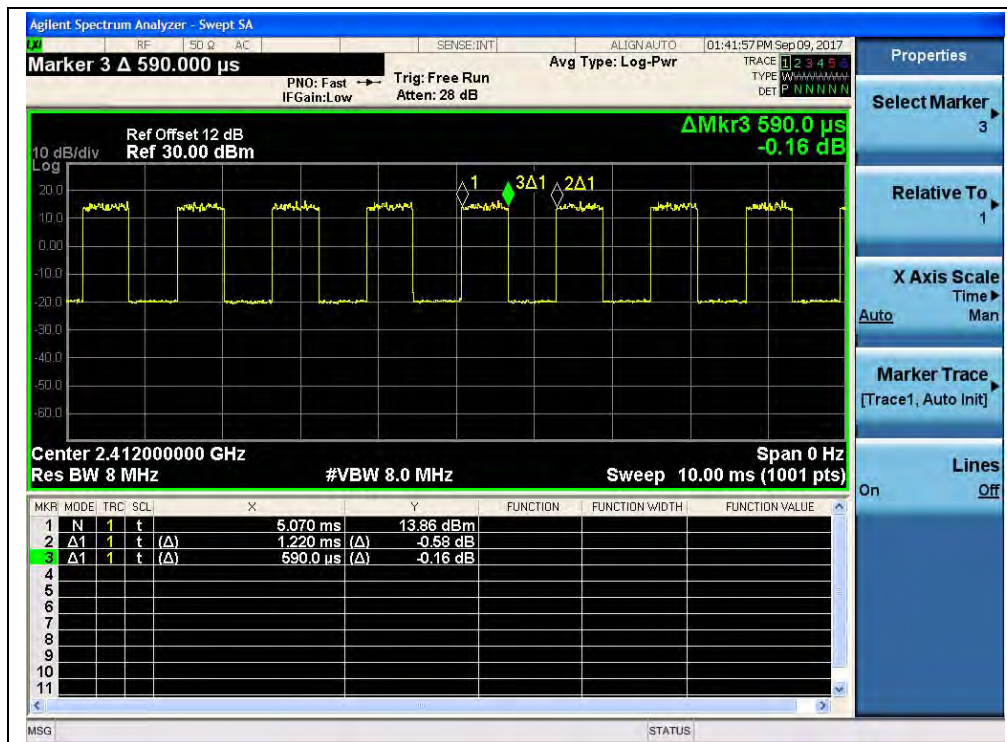
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor ($10 \cdot \lg[1/D]$)
802.11b	48.36	3.16
802.11g	48.36	3.16
802.11n (HT20)	47.06	3.27

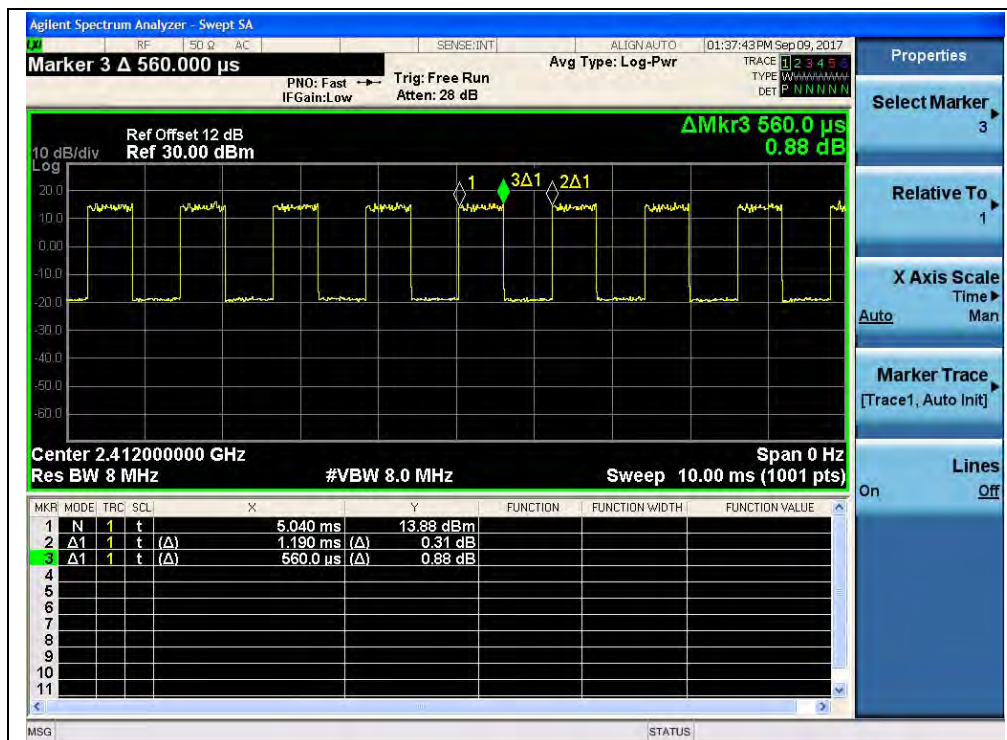
B. Test Plot:



(Channel 1, 802.11b)



(Channel 1, 802.11g)



(Channel 1, 802.11n (HT20))

2.3. Maximum Peak and Average Conducted Output Power

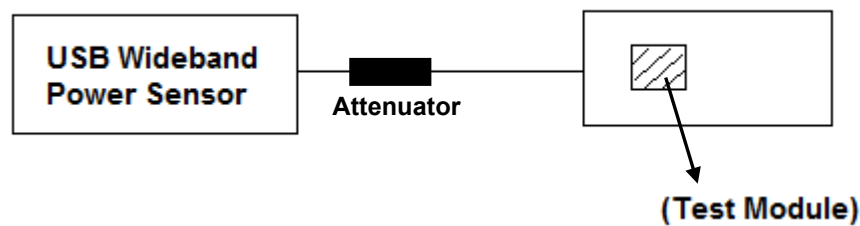
2.3.1. Requirement

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 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	18.82	0.076	30	1	PASS
6	2437	16.83	0.048			PASS
11	2462	15.75	0.038			PASS
12	2467	13.97	0.025			PASS
13	2472	13.58	0.023			PASS

802.11g Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	18.48	0.070	30	1	PASS
6	2437	17.38	0.055			PASS
11	2462	16.59	0.046			PASS
12	2467	18.31	0.068			PASS
13	2472	17.97	0.063			PASS

802.11n (HT20) Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	18.19	0.066	30	1	PASS
6	2437	17.33	0.054			PASS
11	2462	16.37	0.043			PASS
12	2467	18.47	0.070			PASS
13	2472	18.20	0.066			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	11.54	3.16	14.70	0.030	30	1	PASS
6	2437	10.48		13.64	0.023			PASS
11	2462	9.59		12.75	0.019			PASS
12	2467	7.49		10.65	0.012			PASS
13	2472	7.04		10.20	0.010			PASS

802.11g Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
1	2412	11.02	3.16	14.18	0.026	30	1	PASS
6	2437	10.22		13.38	0.022			PASS
11	2462	9.02		12.18	0.017			PASS
12	2467	7.43		10.59	0.011			PASS
13	2472	6.93		10.09	0.010			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	10.97	3.27	14.24	0.027	30	1	PASS
6	2437	9.86		13.13	0.021			PASS
11	2462	9.14		12.41	0.017			PASS
12	2467	7.18		10.45	0.011			PASS
13	2472	6.80		10.07	0.010			PASS

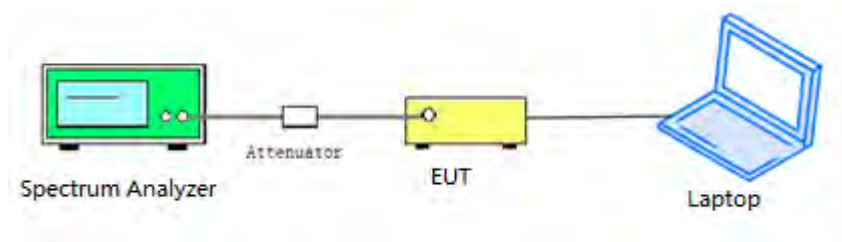
2.4. Bandwidth

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	8.101	≥500	PASS
6	2437	8.107	≥500	PASS
11	2462	8.105	≥500	PASS
12	2467	8.095	≥500	PASS
13	2472	8.097	≥500	PASS

B. Test Plot:



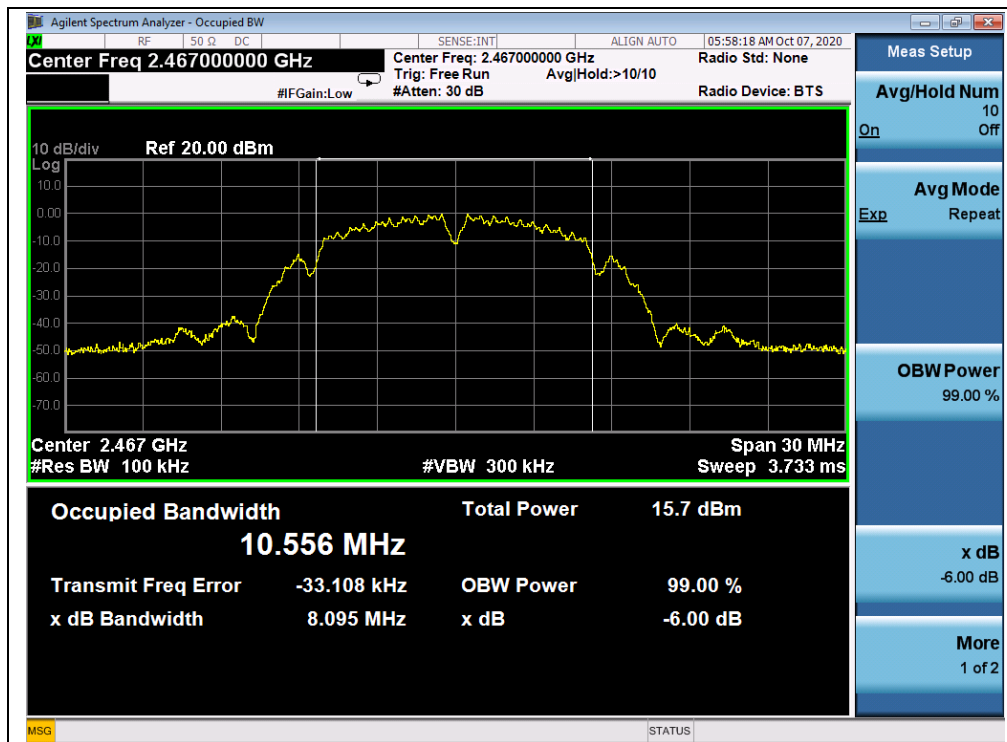
(Channel 1, 802.11b)



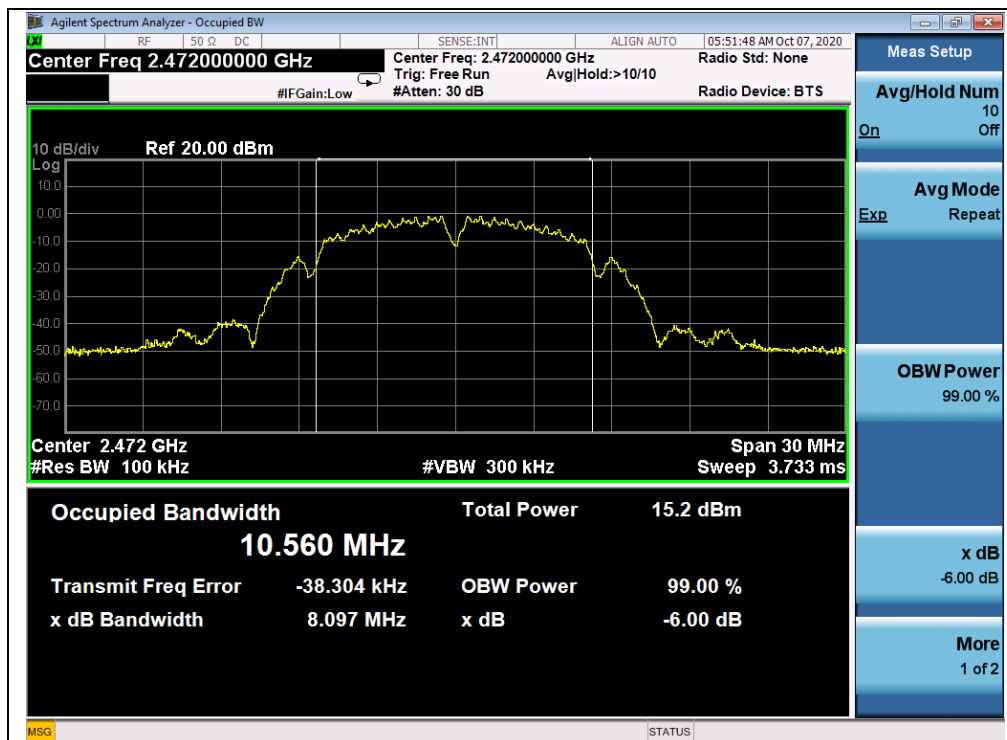
(Channel 6, 802.11b)



(Channel 11, 802.11b)



(Channel 12, 802.11b)



(Channel 13, 802.11b)



802.11g Mode

A.Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	16.32	≥500	PASS
6	2437	16.31	≥500	PASS
11	2462	16.32	≥500	PASS
12	2467	16.35	≥500	PASS
13	2472	16.36	≥500	PASS

B.Test Plot:



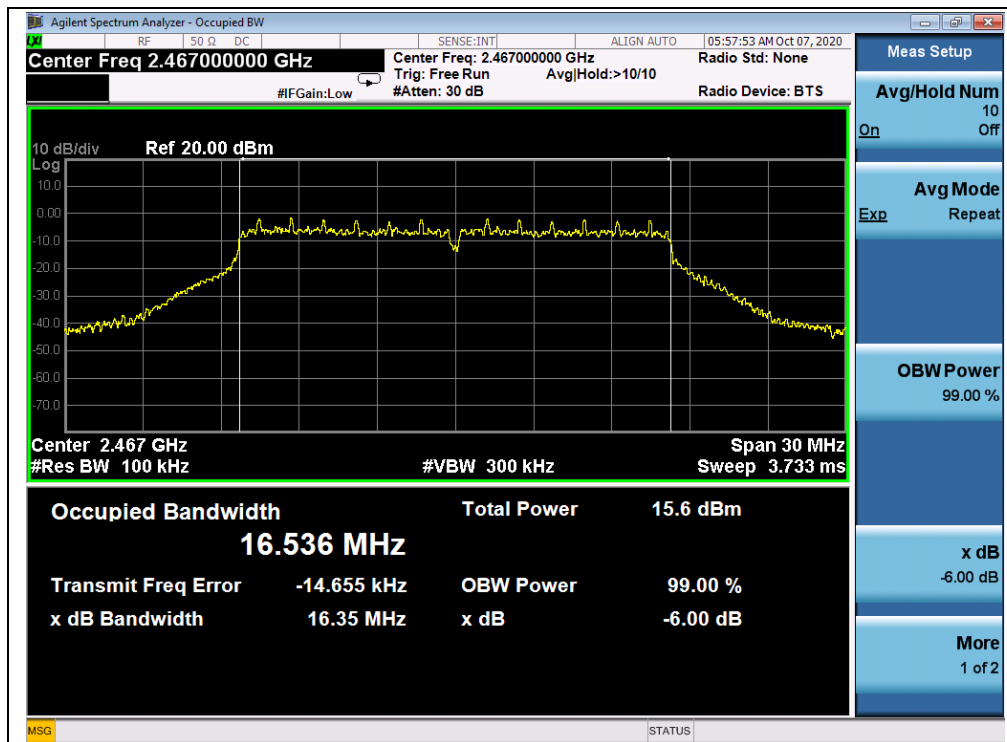
(Channel 1, 802.11g)



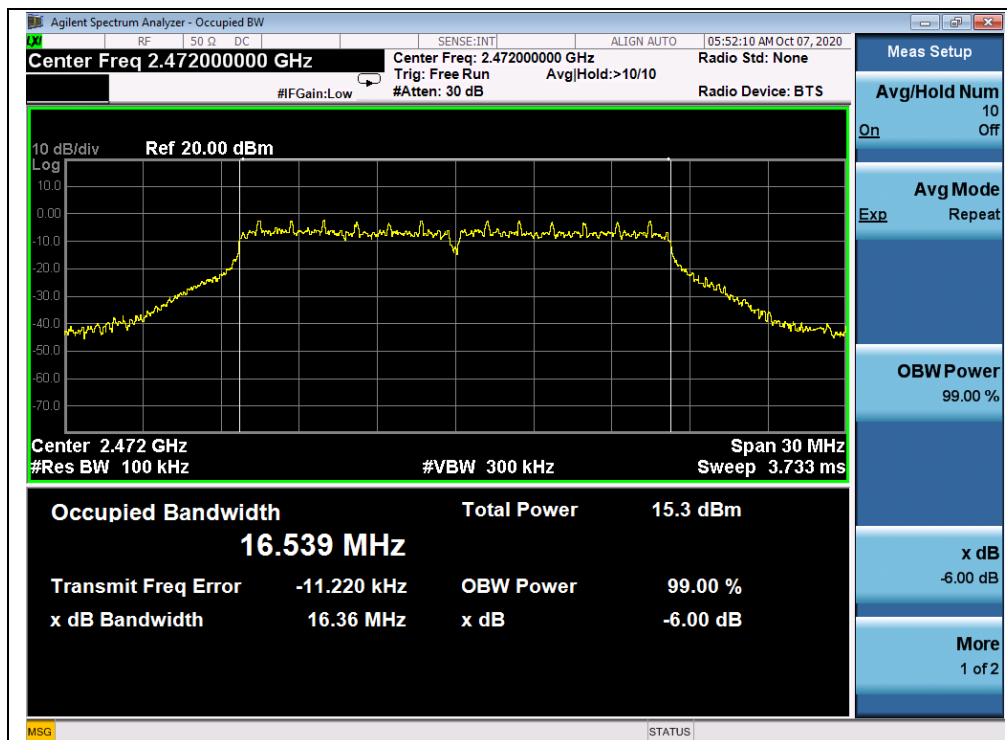
(Channel 6, 802.11g)



(Channel 11, 802.11g)



(Channel 12, 802.11g)



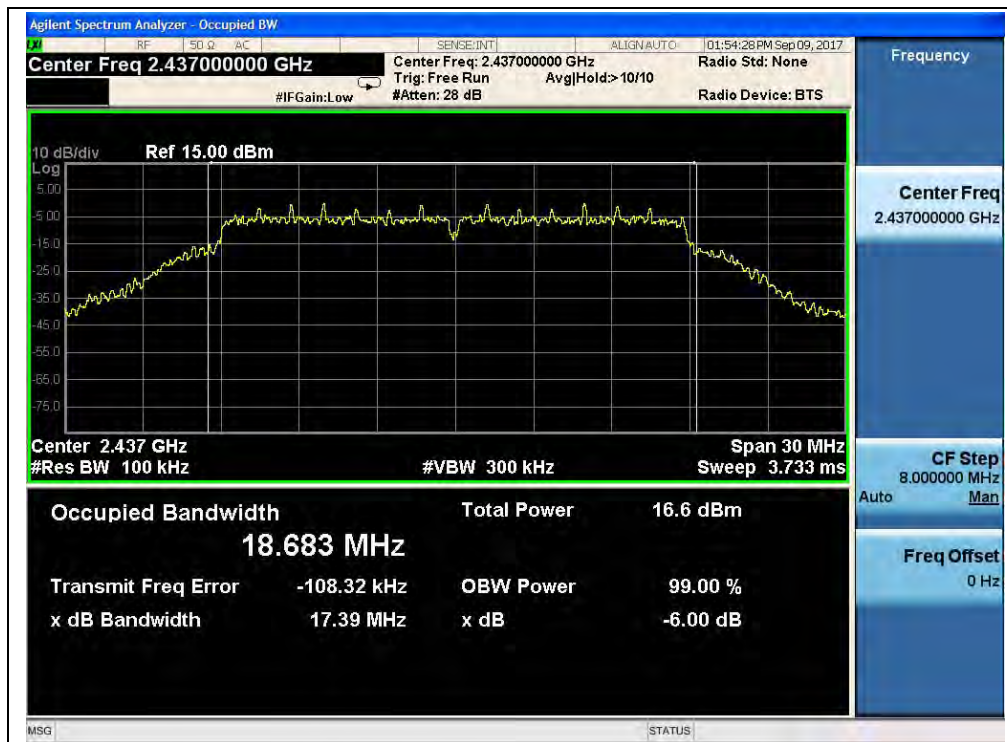
(Channel 13, 802.11g)

**802.11n (HT20) Mode****A.Test Verdict:**

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	17.39	≥500	PASS
6	2437	17.39	≥500	PASS
11	2462	17.39	≥500	PASS
12	2467	17.53	≥500	PASS
13	2472	17.55	≥500	PASS

B.Test Plot:

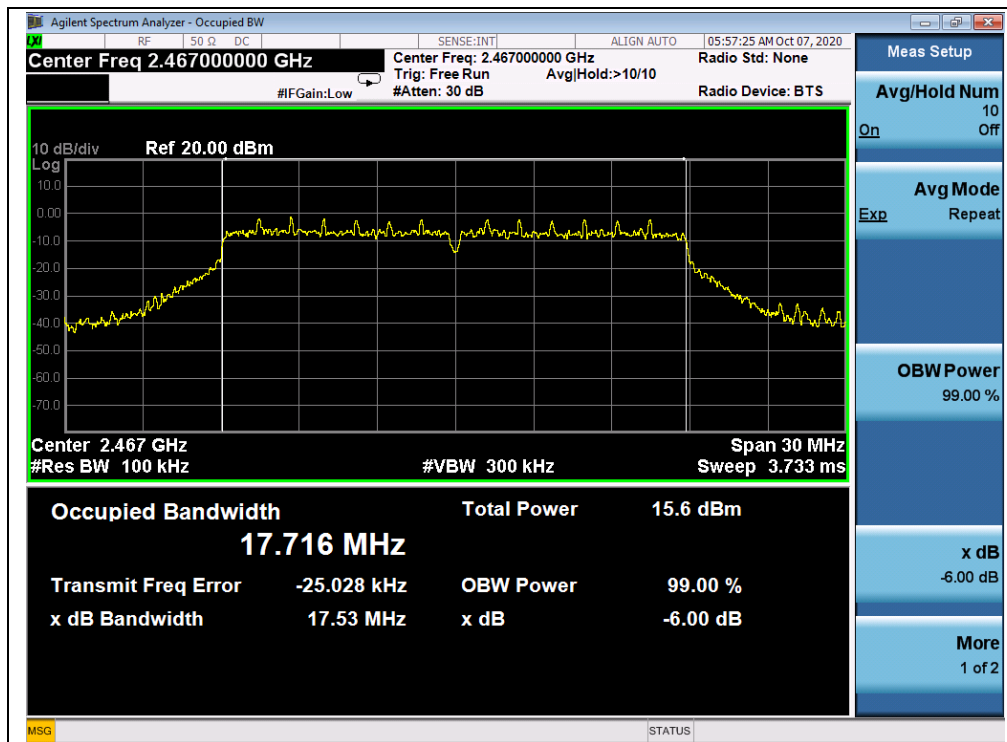
(Channel 1, 802.11n (HT20))



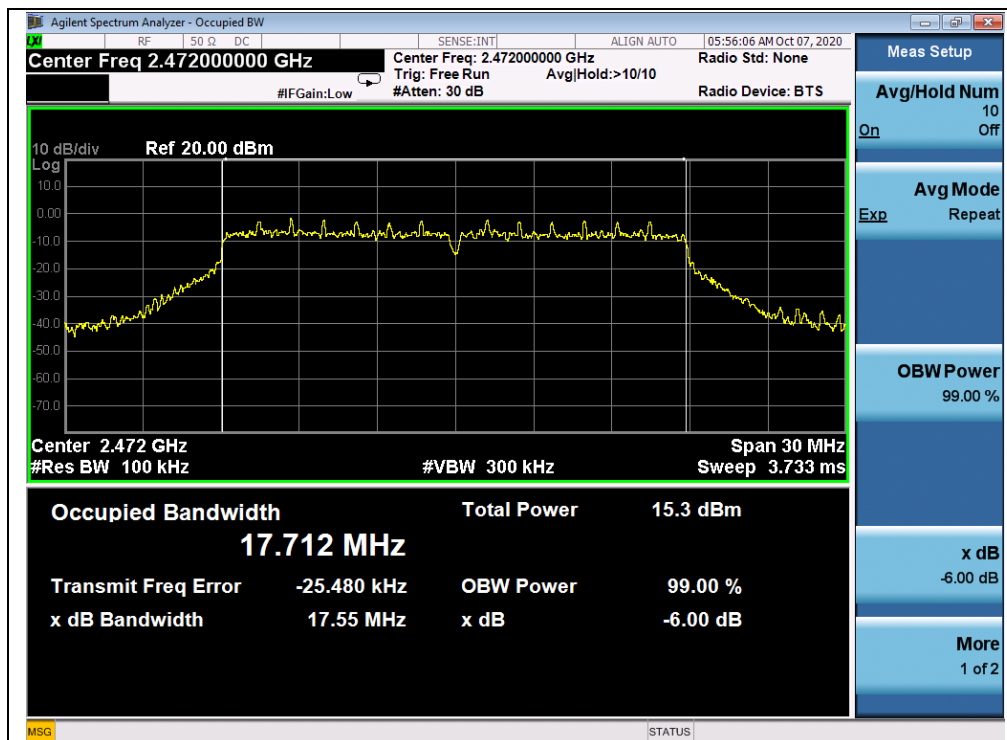
(Channel 6, 802.11n (HT20))



(Channel 11, 802.11n (HT20))



(Channel 12, 802.11n (HT20))



(Channel 13, 802.11n (HT20))

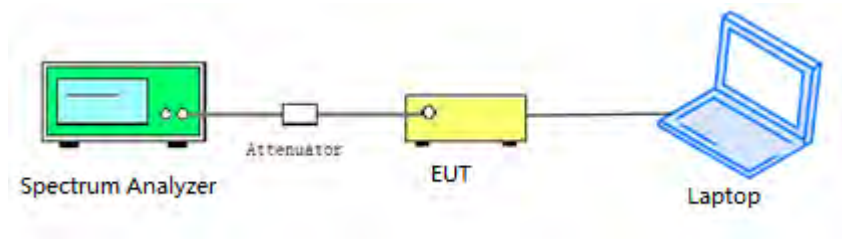
2.5. Conducted Spurious Emissions and Band Edge

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

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

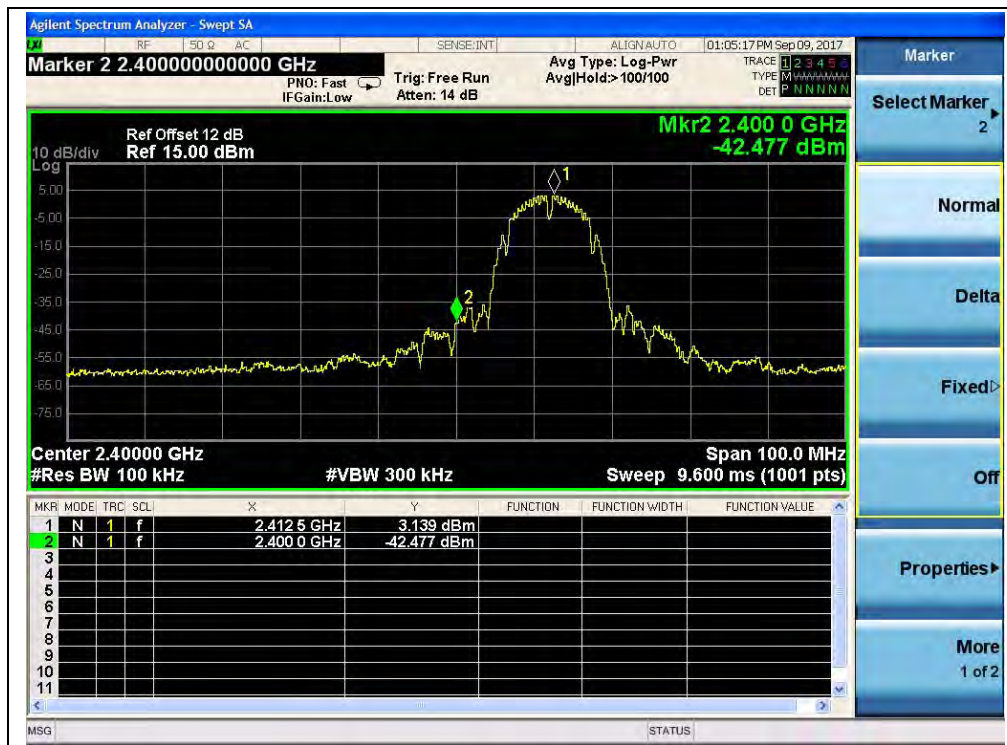
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-42.71	2.61	-17.39	PASS
6	2437	-41.71	1.69	-18.31	PASS
11	2462	-42.59	0.80	-19.20	PASS
12	2467	-44.18	-0.92	-20.92	PASS
13	2472	-43.93	-1.58	-21.58	PASS

B. Test Plot:



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



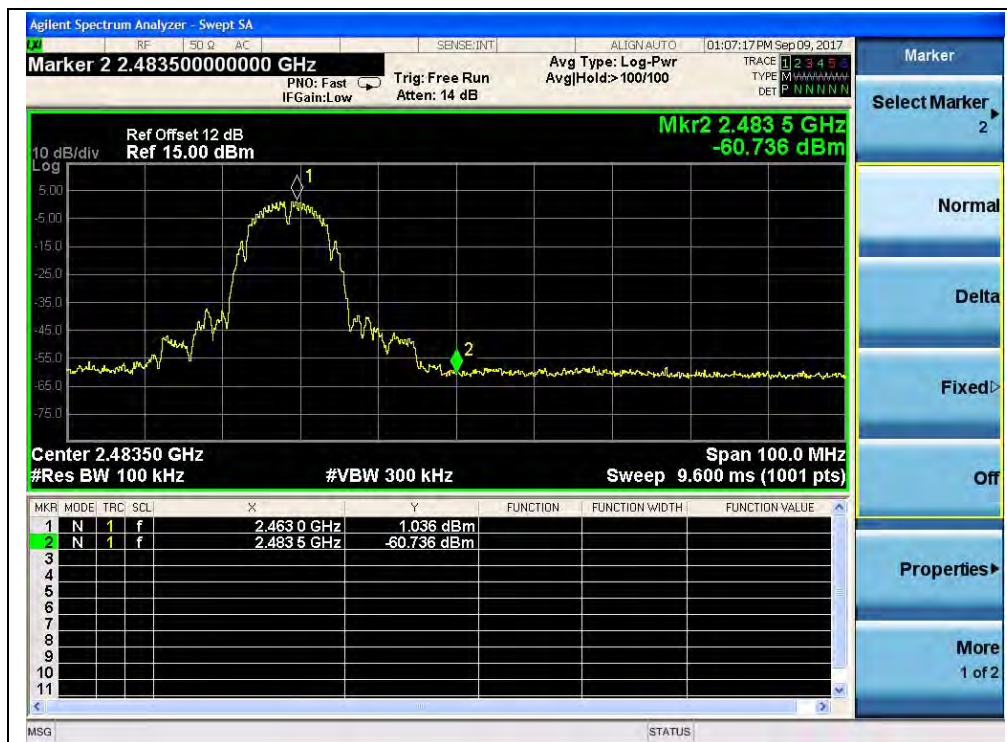
(Band Edge, Channel 1, 802.11b)



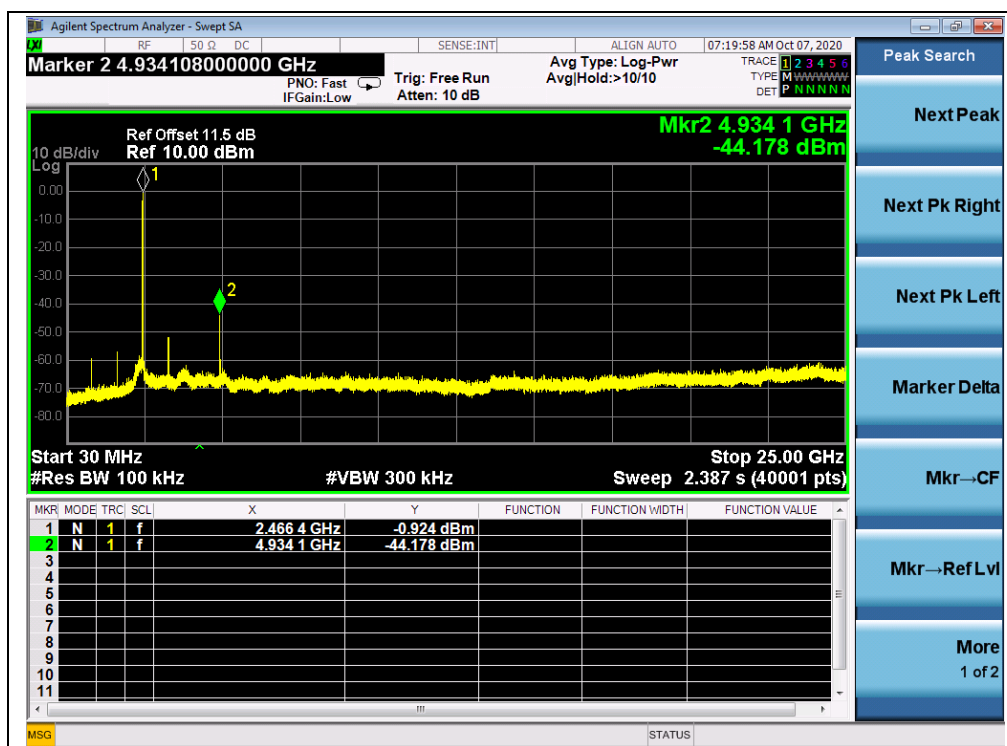
(30MHz to 25GHz, Channel 6, 802.11b)



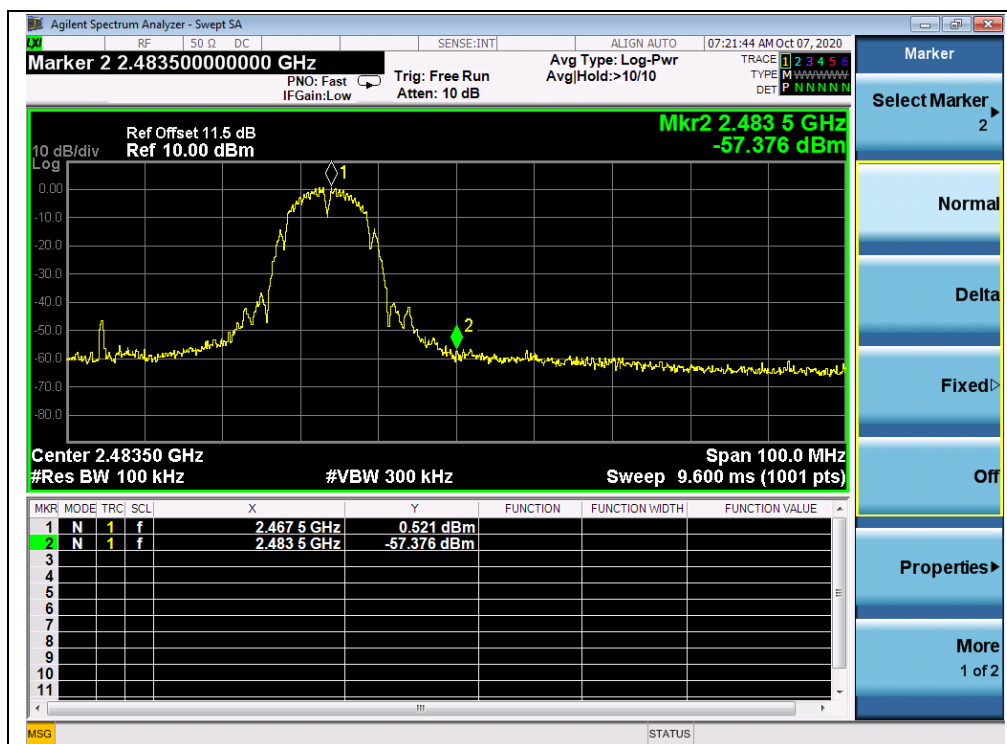
(30MHz to 25GHz, Channel 11, 802.11b)



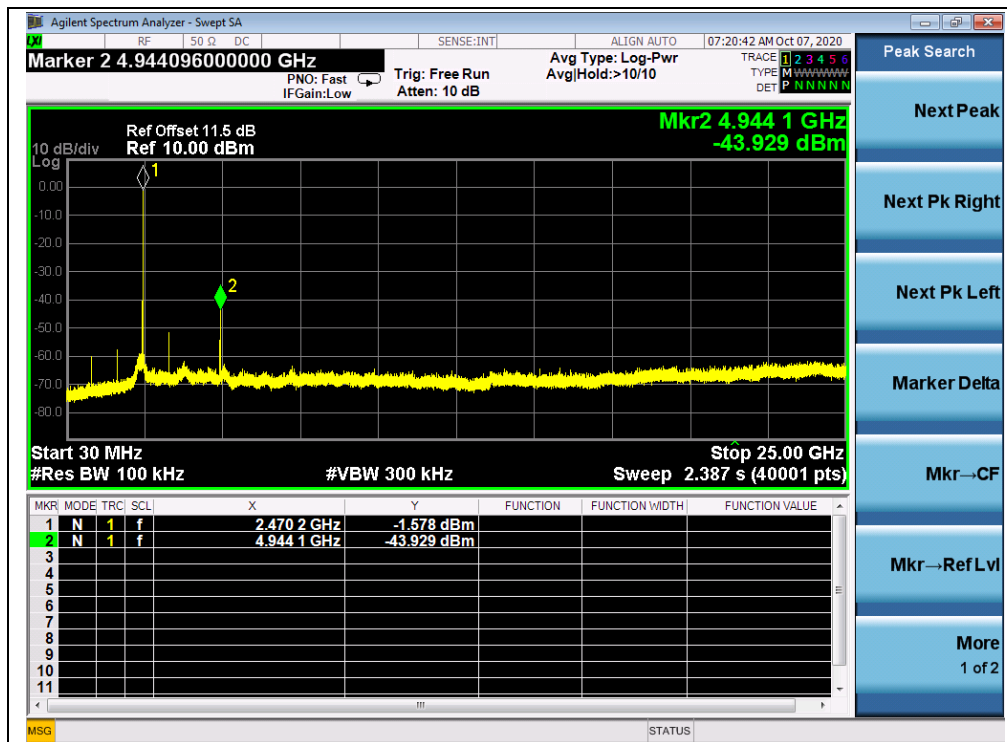
(Band Edge, Channel 11, 802.11b)



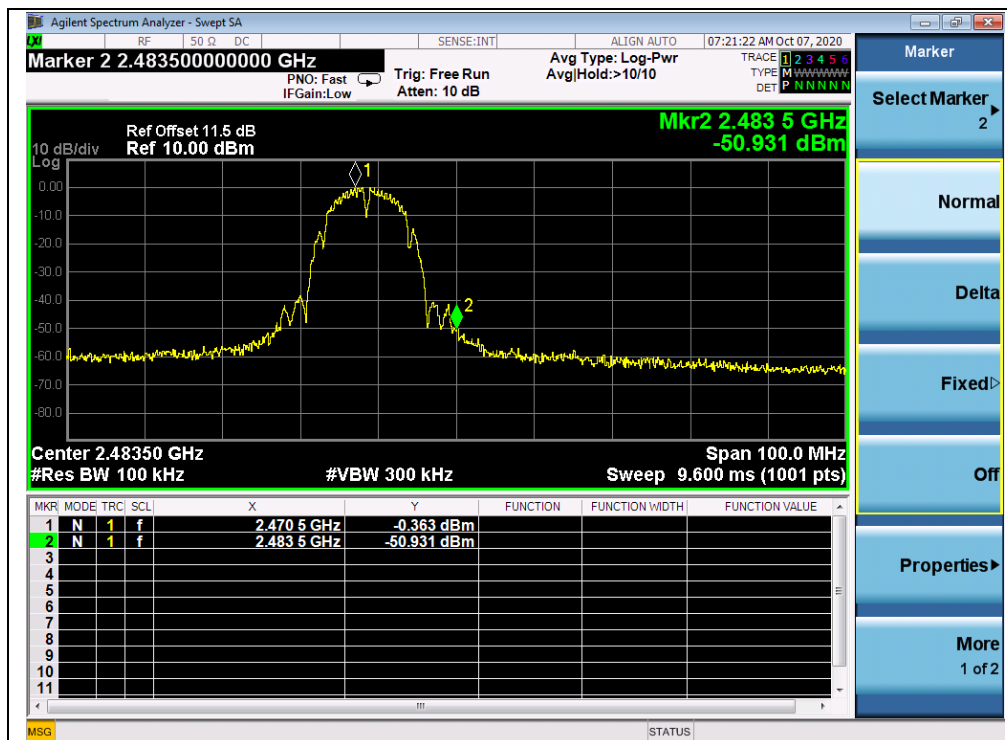
(30MHz to 25GHz, Channel 12, 802.11b)



(Band Edge, Channel 12, 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	-50.87	1.56	-18.44	PASS
6	2437	-49.21	0.84	-19.16	PASS
11	2462	-47.04	0.17	-19.83	PASS
12	2467	-51.84	-4.60	-24.60	PASS
13	2472	-51.76	-3.58	-23.58	PASS

B.Test Plot:



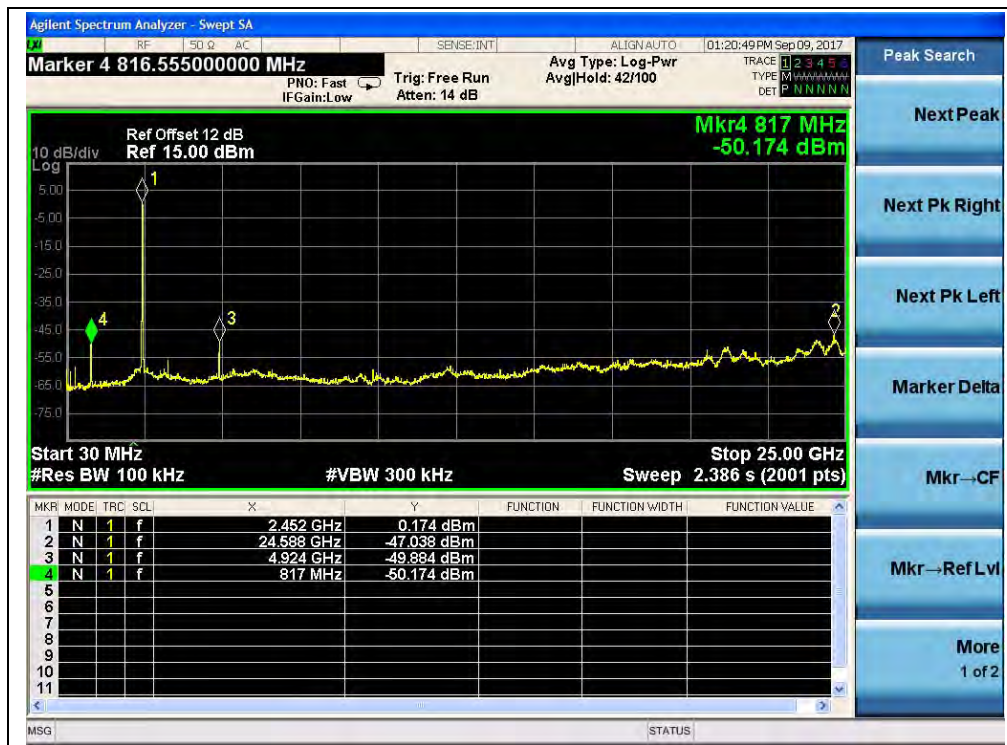
(30MHz to 25GHz, Channel 1, 802.11g)



(Band Edge, Channel 1, 802.11g)



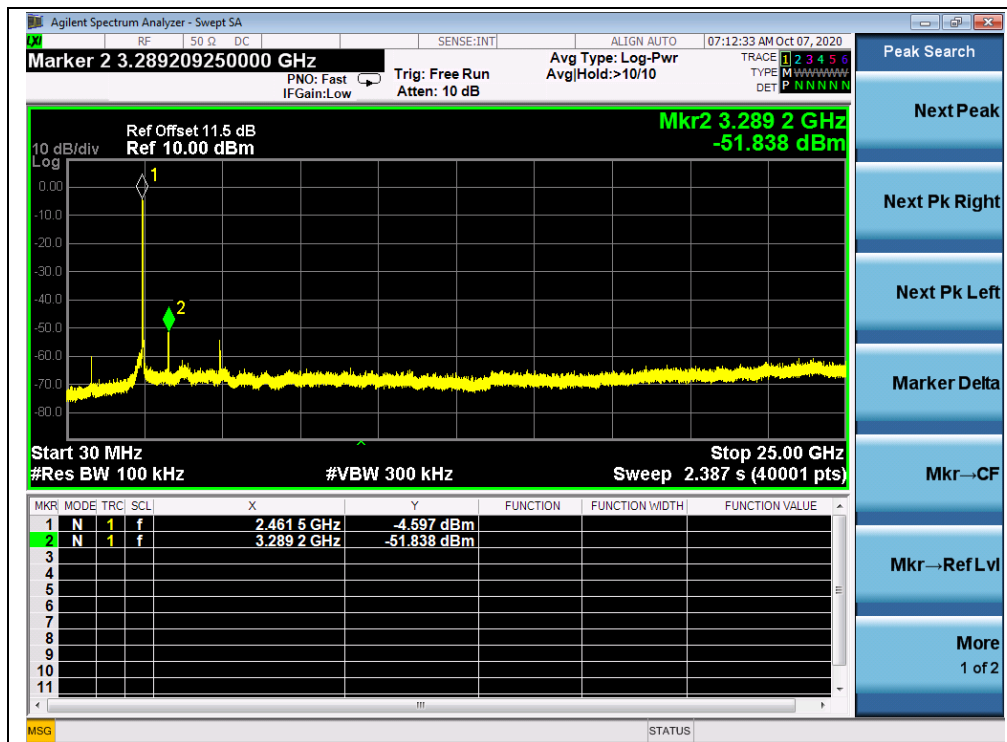
(30MHz to 25GHz, Channel 6, 802.11g)



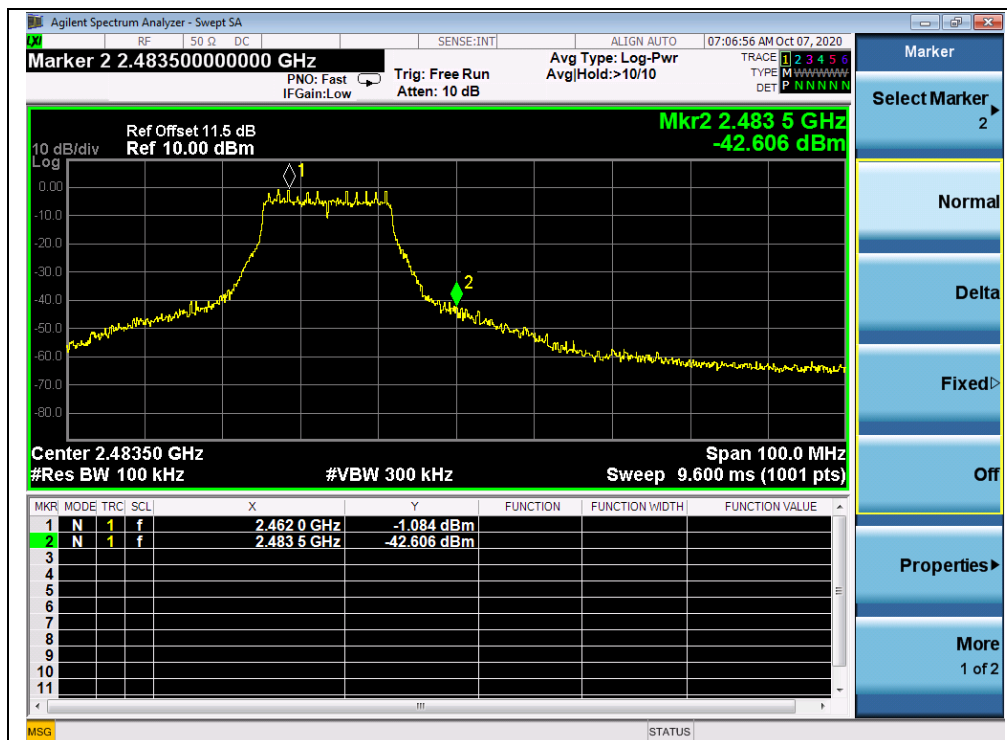
(30MHz to 25GHz, Channel 11, 802.11g)



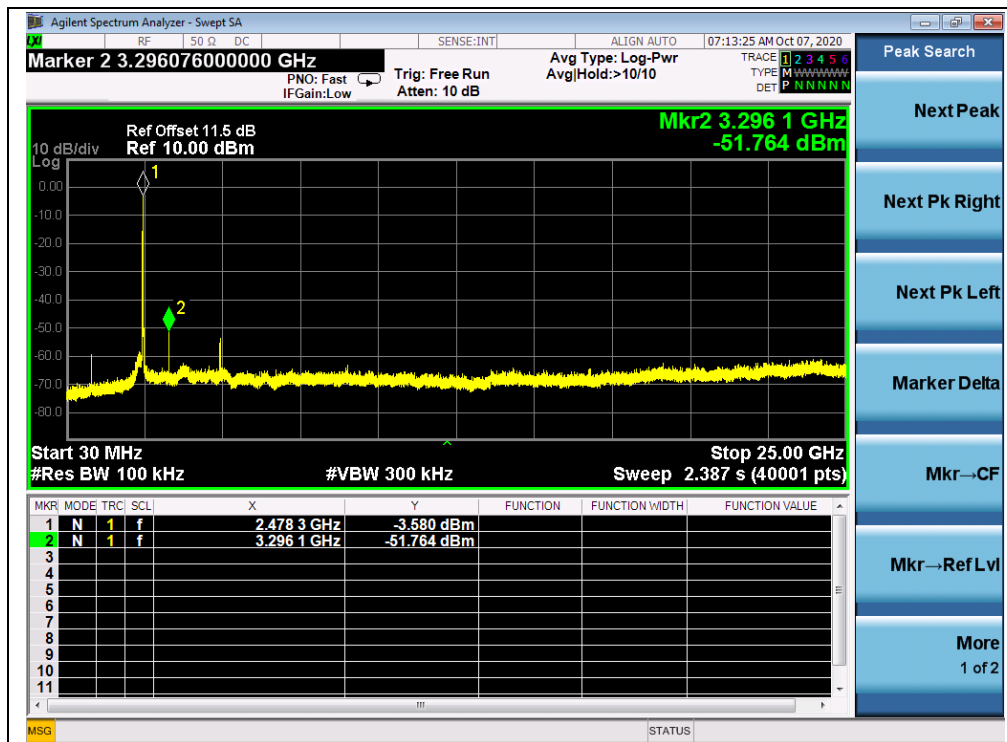
(Band Edge, Channel 11, 802.11g)



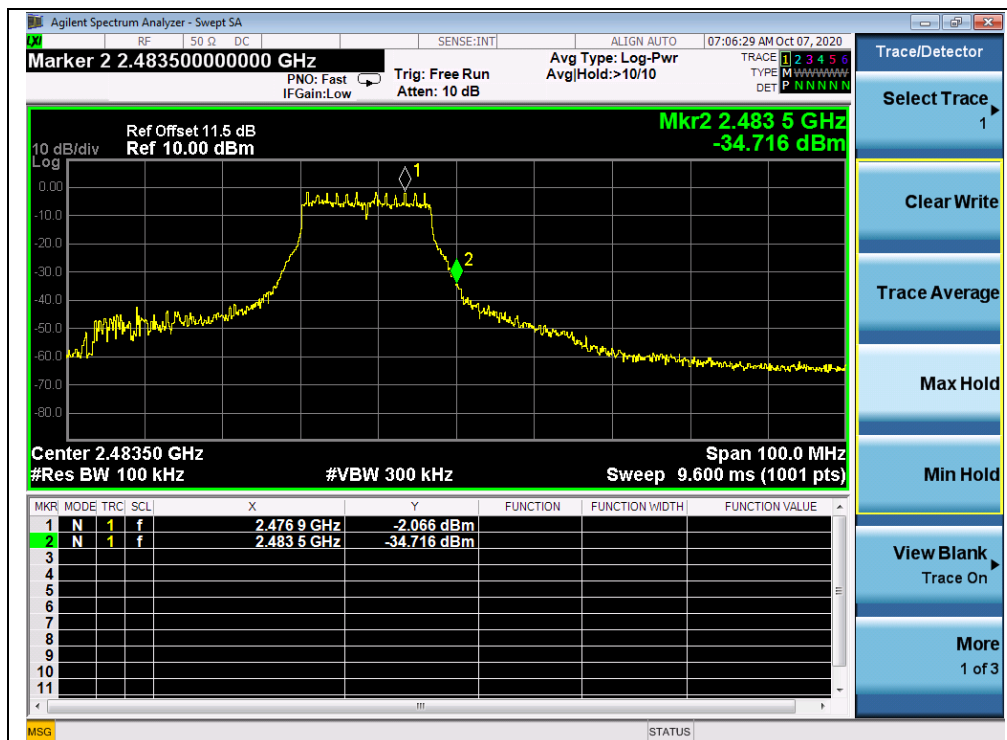
(30MHz to 25GHz, Channel 12, 802.11g)



(Band Edge, Channel 12, 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	-49.92	0.19	-19.81	PASS
6	2437	-51.45	-0.07	-20.07	PASS
11	2462	-49.64	-3.25	-23.25	PASS
12	2467	-51.92	-1.62	-21.62	PASS
13	2472	-51.58	-3.32	-23.32	PASS

B.Test Plot:



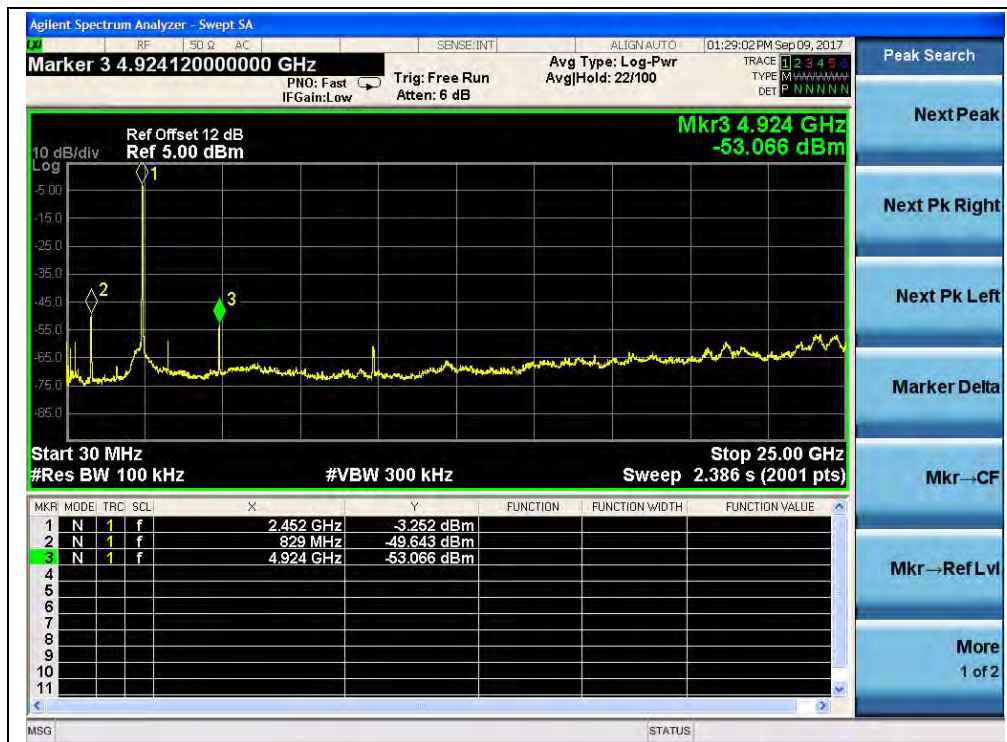
(30MHz to 25GHz, Channel 1, 802.11n (HT20))



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



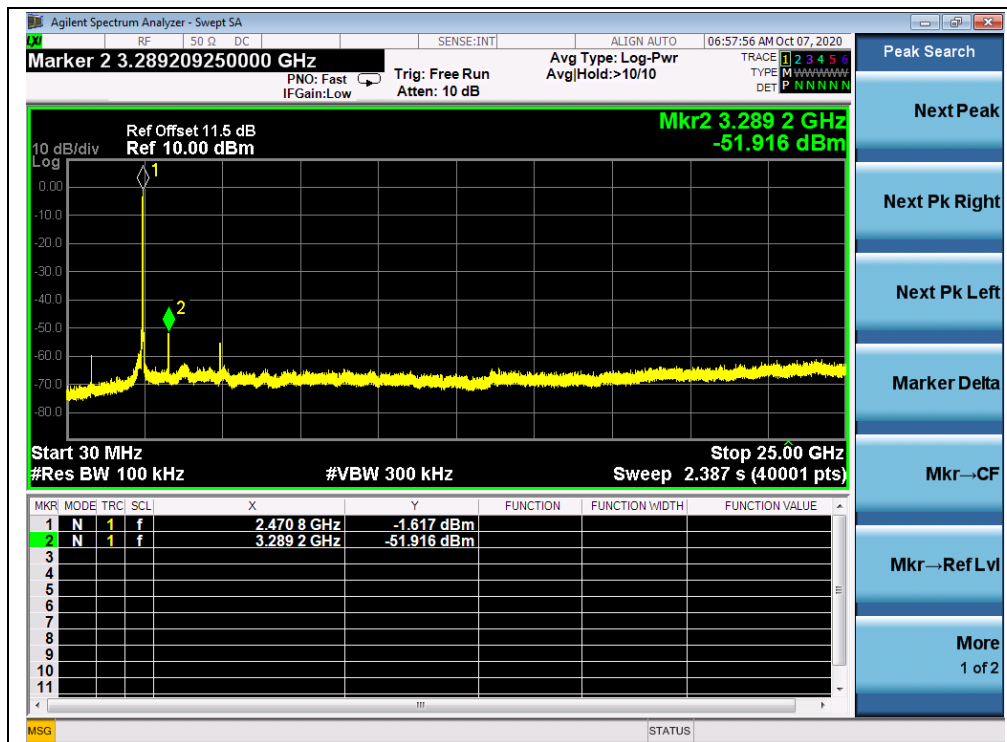
(30MHz to 25GHz, Channel 6, 802.11n (HT20))



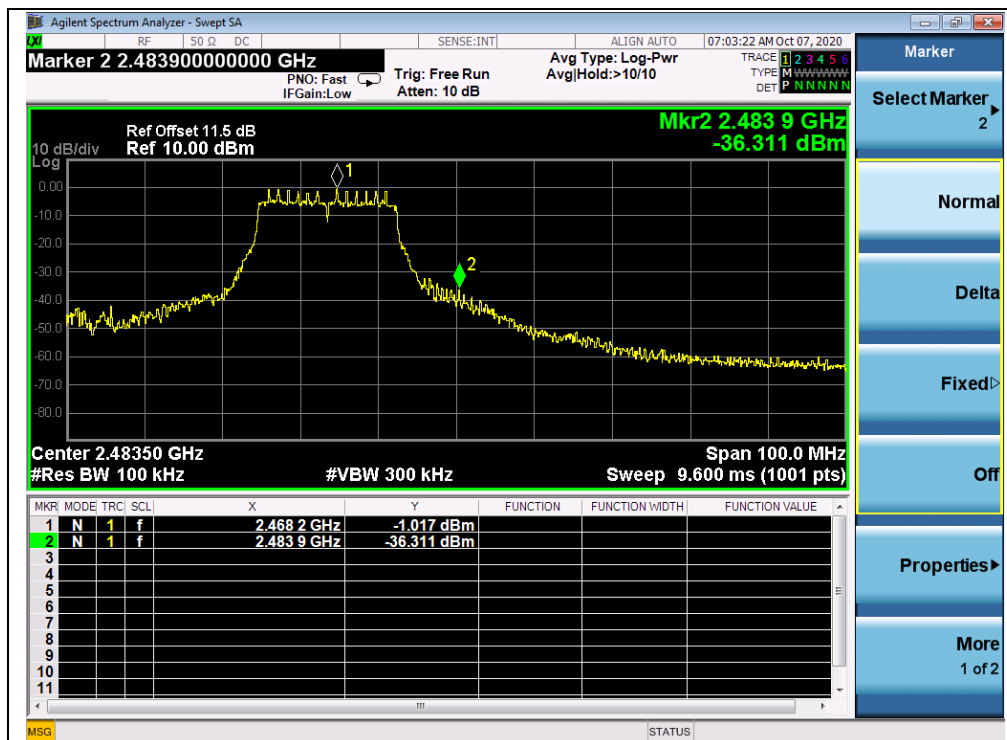
(30MHz to 25GHz, Channel 11, 802.11n (HT20))



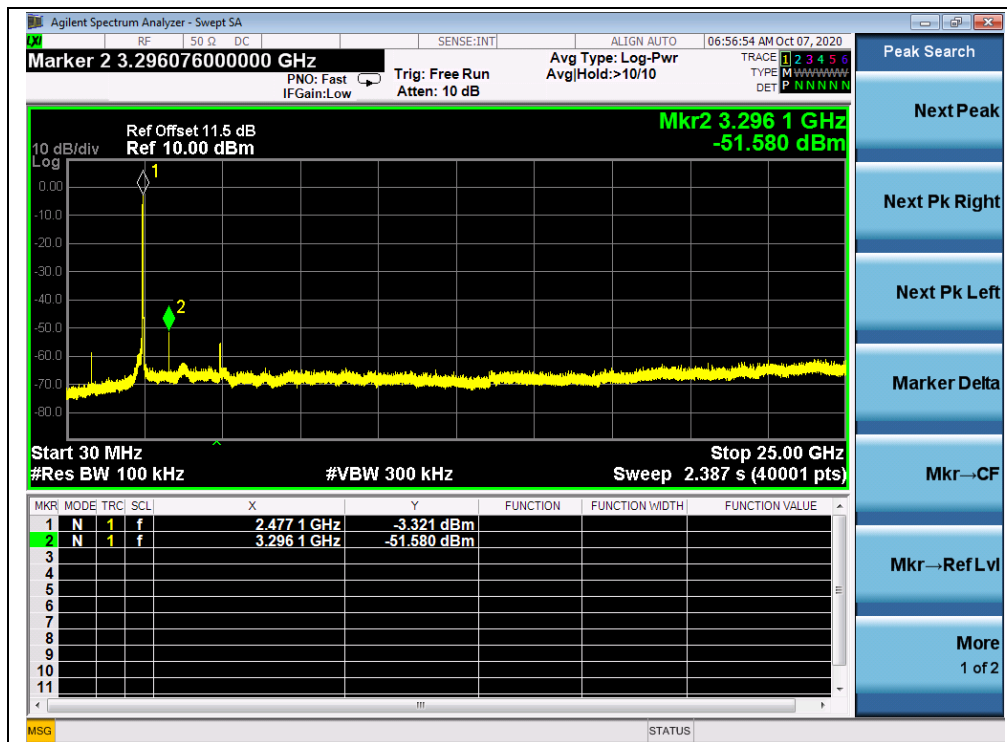
(Band Edge, Channel 11, 802.11n (HT20))



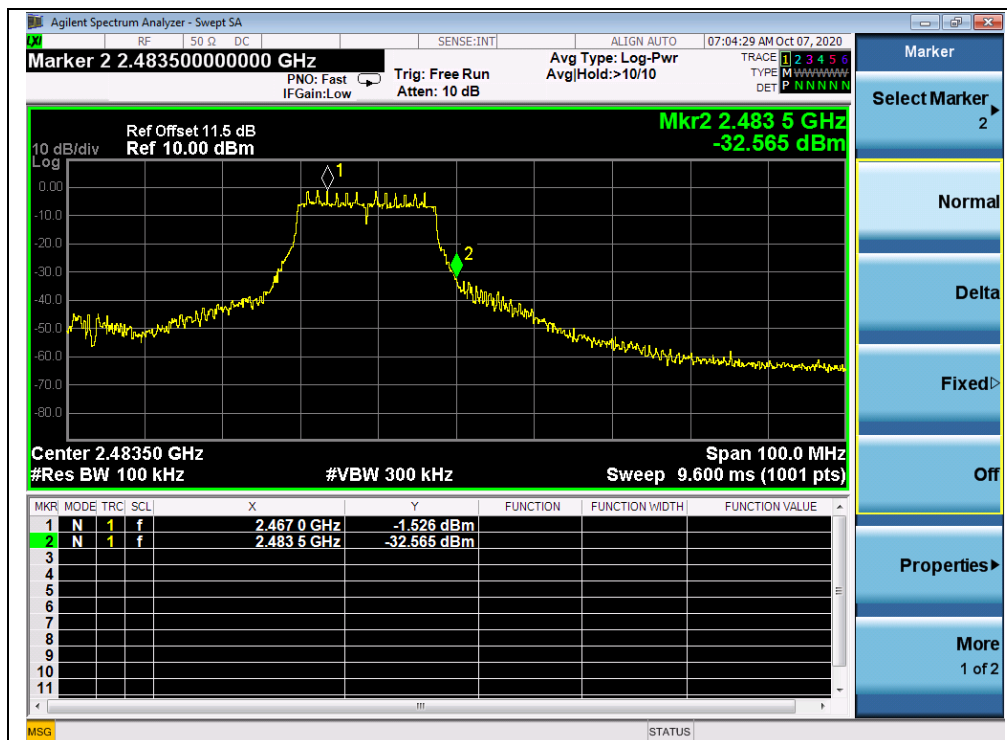
(30MHz to 25GHz, Channel 12, 802.11n (HT20))



(Band Edge, Channel 12, 802.11n (HT20))



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



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

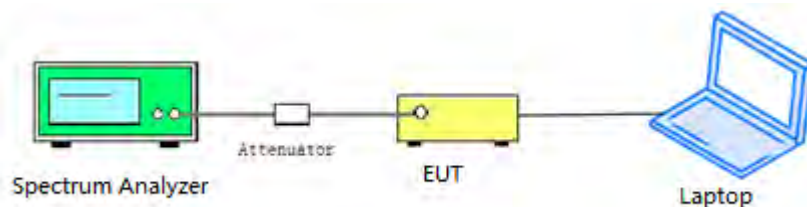
2.6. Power Spectral Density (PSD)

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	-9.53	8	PASS
6	2437	-10.71	8	PASS
11	2462	-11.78	8	PASS
12	2467	-11.15	8	PASS
13	2472	-11.69	8	PASS

B. Test Plot:



(Channel 1, 802.11b)



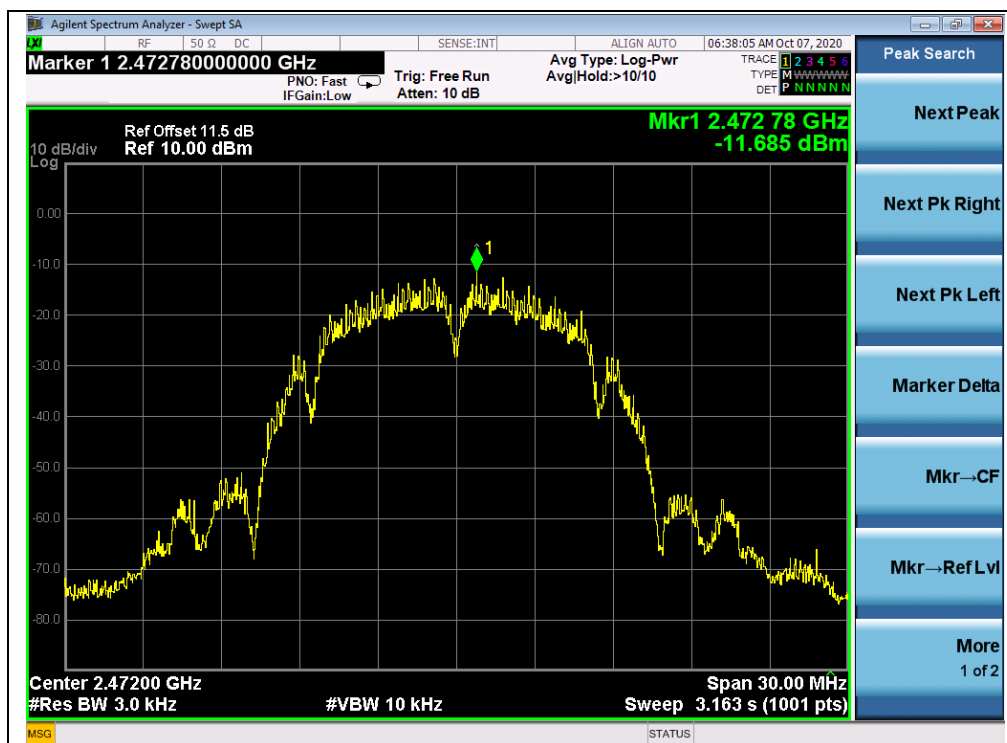
(Channel 6, 802.11b)



(Channel 11, 802.11b)



(Channel 12, 802.11b)



(Channel 13, 802.11b)

**802.11g Mode****A.Test Verdict:**

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-14.37	8	PASS
6	2437	-15.07	8	PASS
11	2462	-15.95	8	PASS
12	2467		8	PASS
13	2472		8	PASS

B.Test Plot:

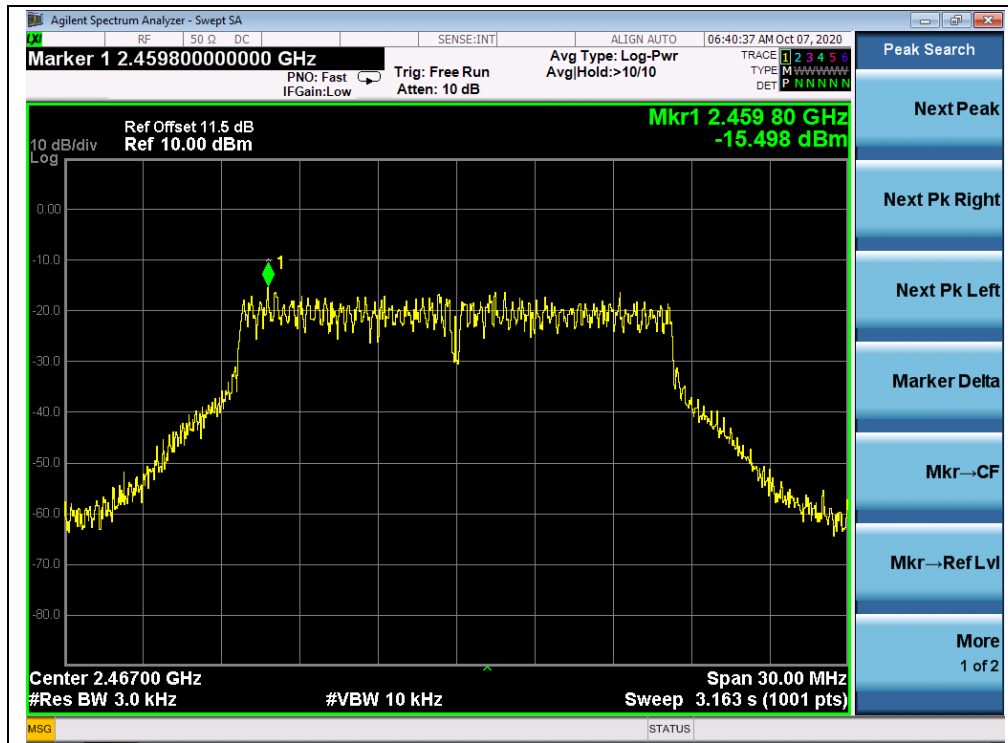
(Channel 1, 802.11g)



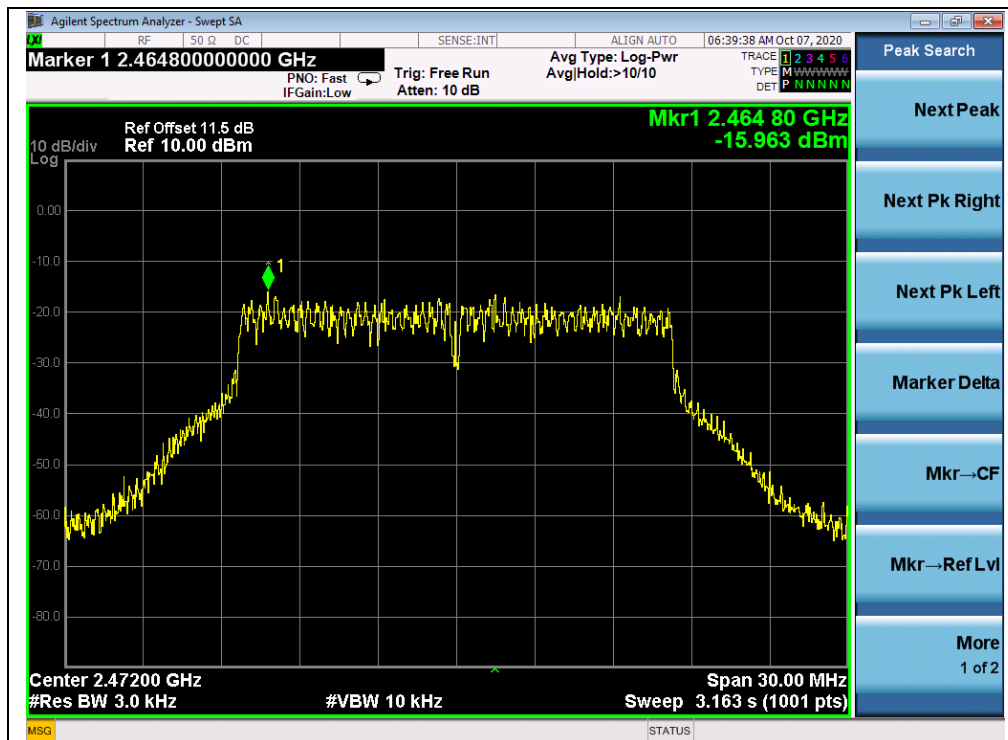
(Channel 6, 802.11g)



(Channel 11, 802.11g)



(Channel 12, 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	-15.00	8	PASS
6	2437	-16.15	8	PASS
11	2462	-17.36	8	PASS
12	2467		8	PASS
13	2472		8	PASS

B.Test Plot:



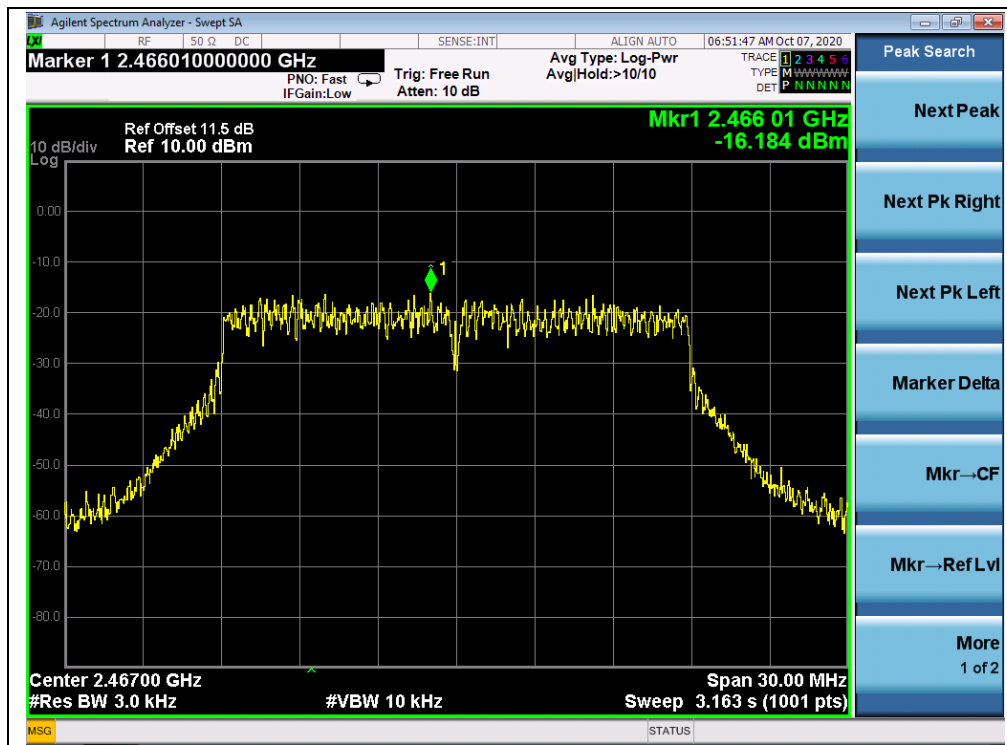
(Channel 1, 802.11n (HT20))



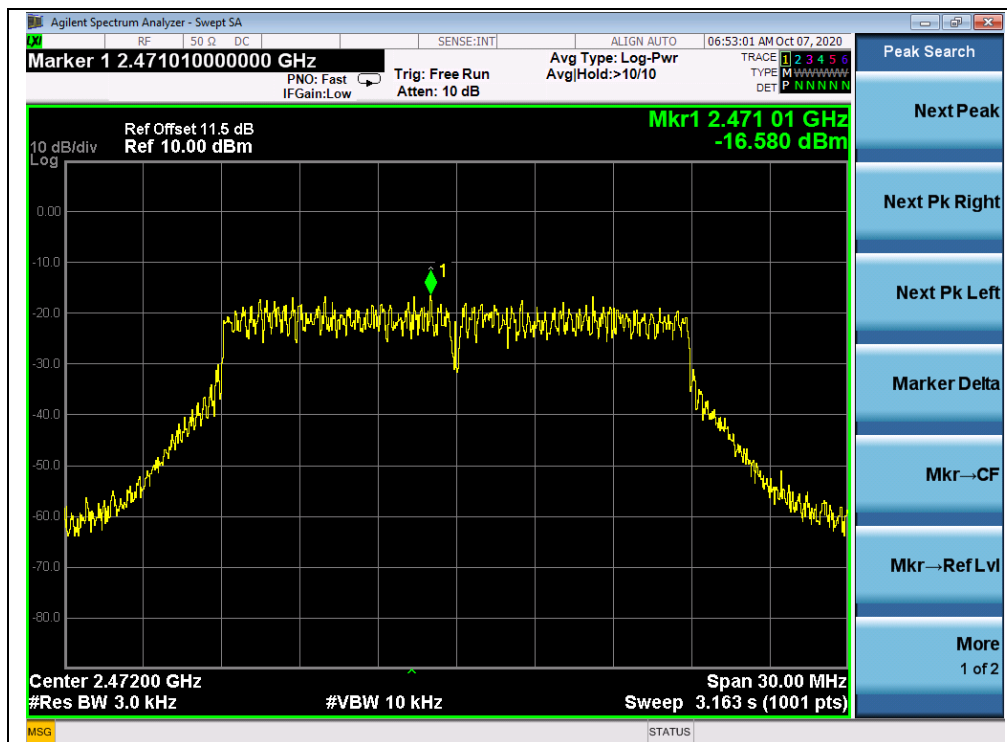
(Channel 6, 802.11n (HT20))



(Channel 11, 802.11n (HT20))



(Channel 12, 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 50 μ H/50 Ω line impedance stabilization network (LISN).

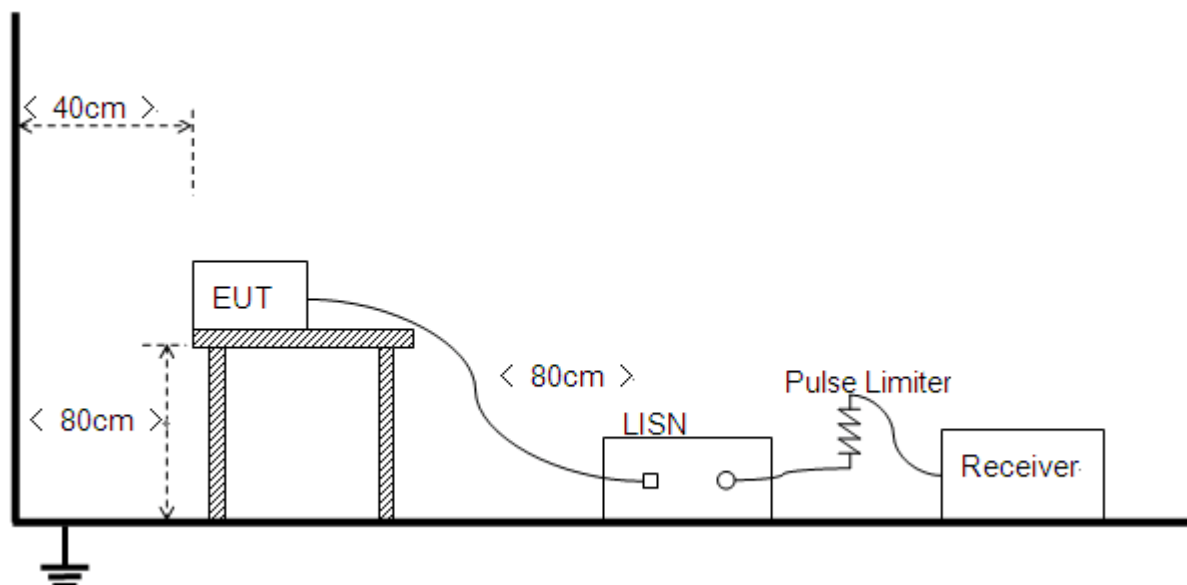
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (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

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+ADAPTOR+ WIFI TX

Test Voltage: AC 120V/60Hz

The measurement results are obtained as below:

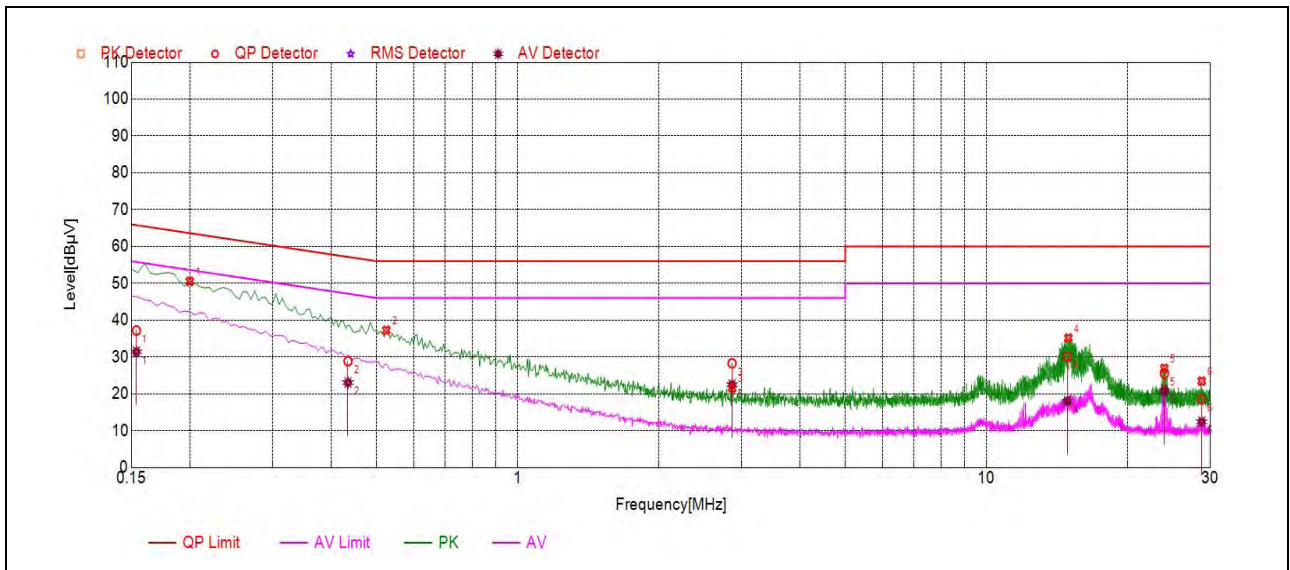
$$E \text{ [dB}\mu\text{V]} = U_R + L_{\text{Cable loss [dB]} + A_{\text{Factor}}$$

U_R : Receiver Reading

A_{Factor} : Voltage division factor of LISN

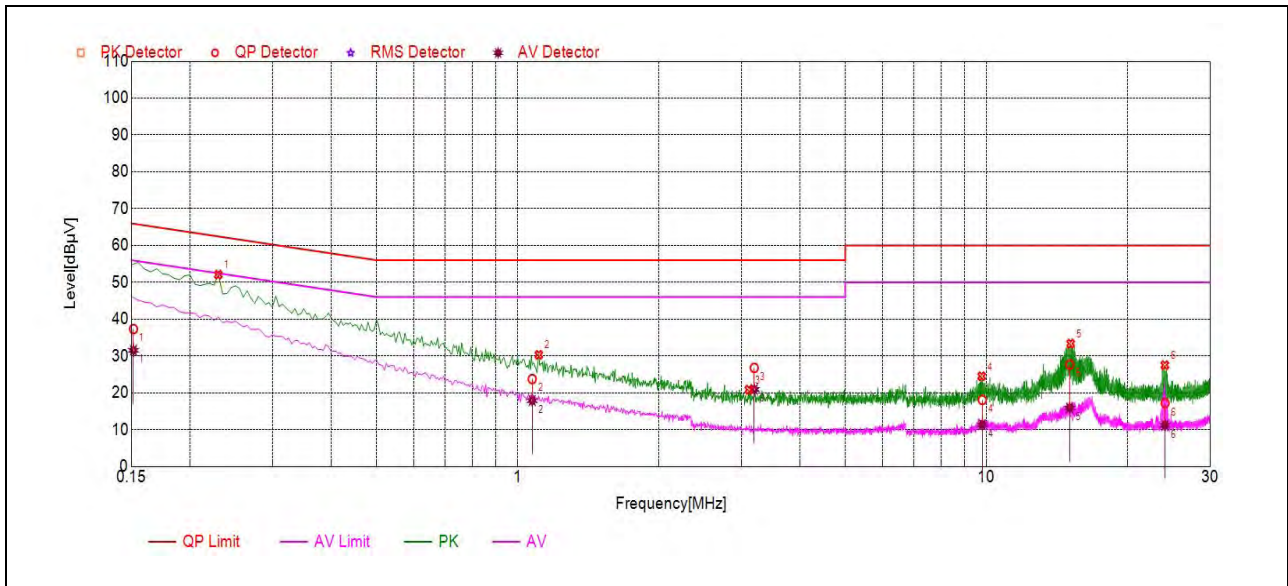


B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1538	37.18	31.41	65.89	55.89	Line	PASS
2	0.4348	28.83	23.04	57.86	47.86		PASS
3	2.8682	28.26	22.46	56.00	46.00		PASS
4	14.8884	30.10	17.94	60.00	50.00		PASS
5	23.9746	25.48	20.84	60.00	50.00		PASS
6	28.7884	18.47	12.41	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	0.1516	37.31	31.54	65.95	55.95	Neutral	PASS
2	1.0746	23.74	17.88	56.00	46.00		PASS
3	3.198	26.76	20.92	56.00	46.00		PASS
4	9.8012	18.05	11.33	60.00	50.00		PASS
5	15.0548	27.68	15.91	60.00	50.00		PASS
6	24.0474	17.20	11.17	60.00	50.00		PASS

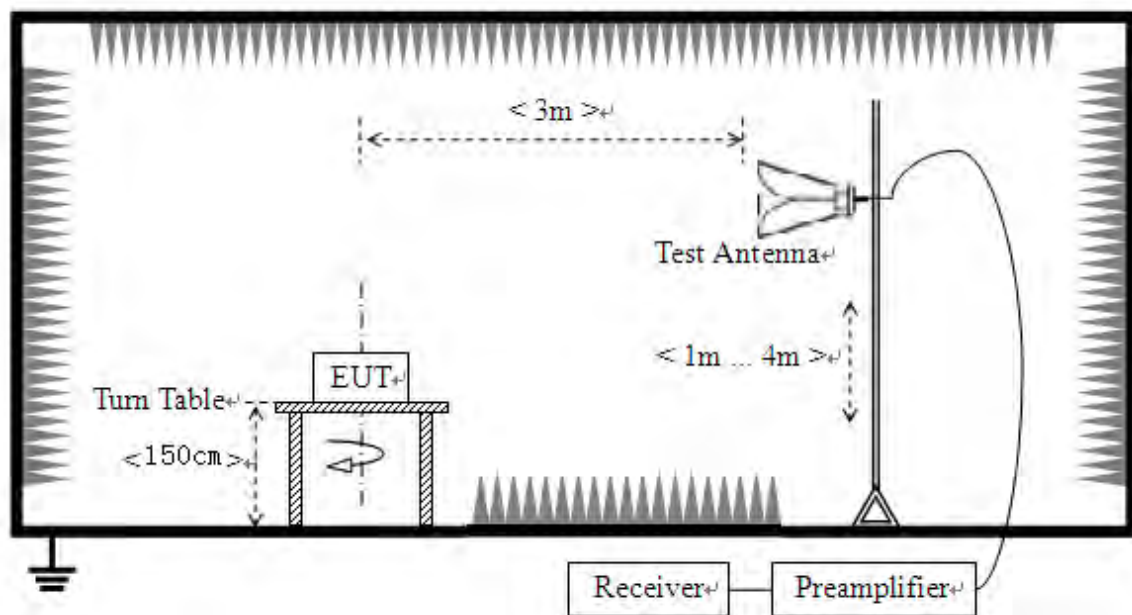
2.8. Restricted Frequency Bands

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

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.

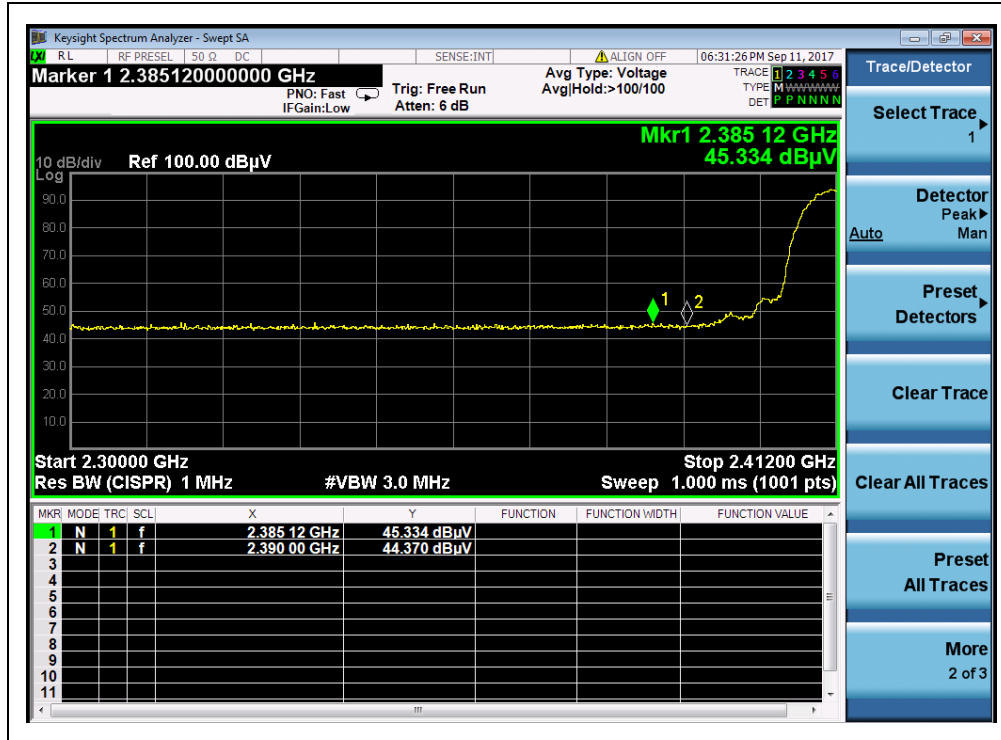
802.11b Mode

A.Test Verdict:

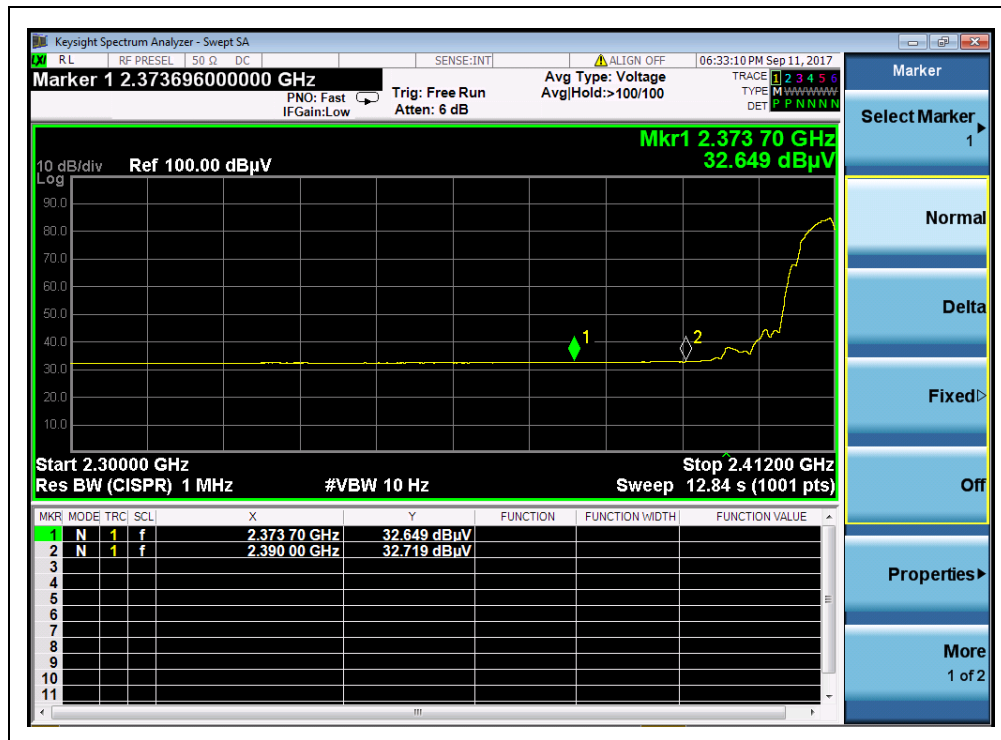
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dB μ V)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dB μ V/m)	Limit (dB μ V/m)	Verdict
		PK/ AV						
1	2385.12	PK	45.33	-33.63	32.56	44.26	74	PASS
1	2373.70	AV	32.65	-33.63	32.56	31.58	54	PASS
11	2485.44	PK	46.39	-33.18	32.50	45.71	74	PASS
11	2486.09	AV	32.44	-33.18	32.50	31.76	54	PASS
12	2485.33	PK	46.01	-31.01	31.60	46.60	74	PASS
12	2485.14	AV	43.84	-31.01	31.60	44.43	54	PASS
13	2484.04	PK	49.03	-31.01	31.60	49.62	74	PASS
13	2484.34	AV	45.06	-31.01	31.60	45.65	54	PASS



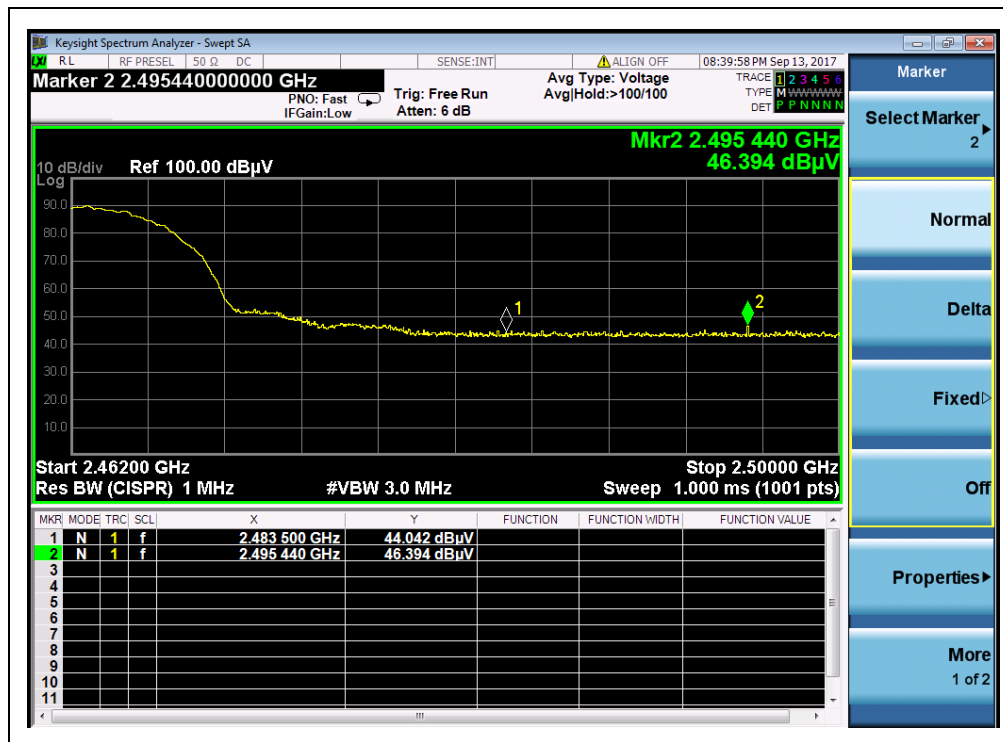
B.Test Plot:



(PEAK, Channel 1, 802.11b)



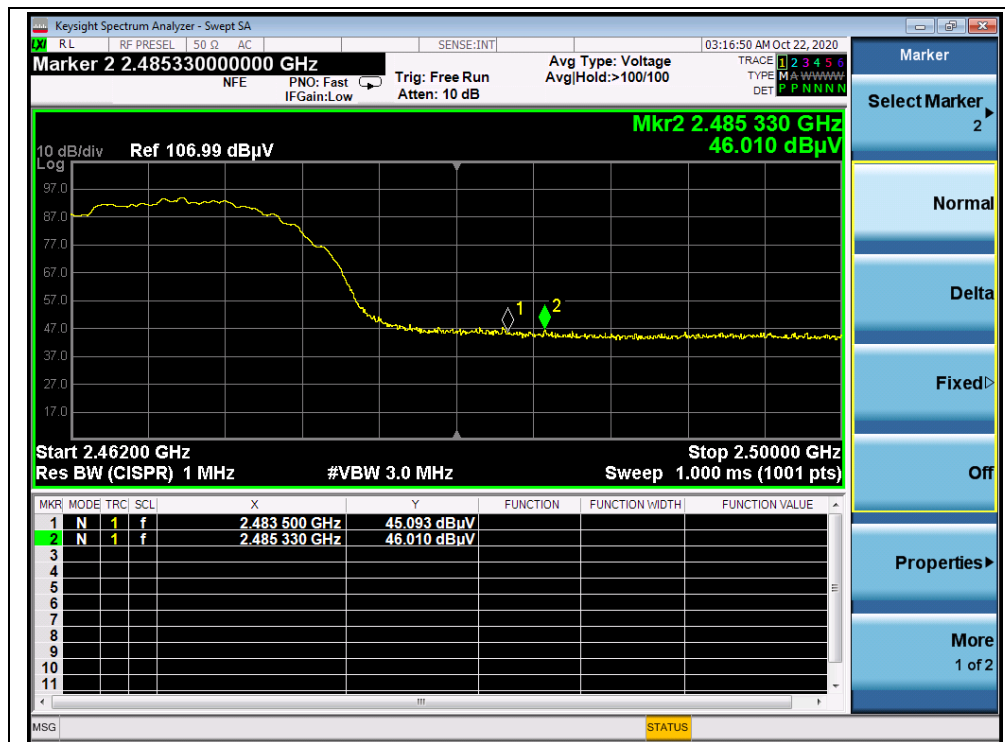
(AVERAGE, Channel 1, 802.11b)



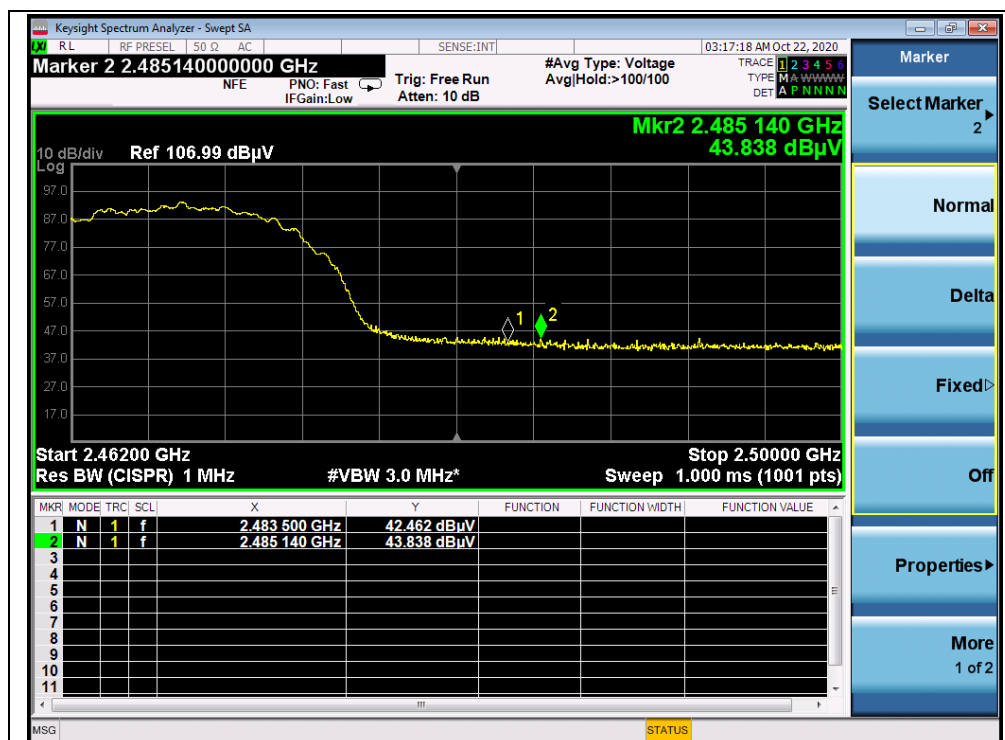
(PEAK, Channel 11, 802.11b)



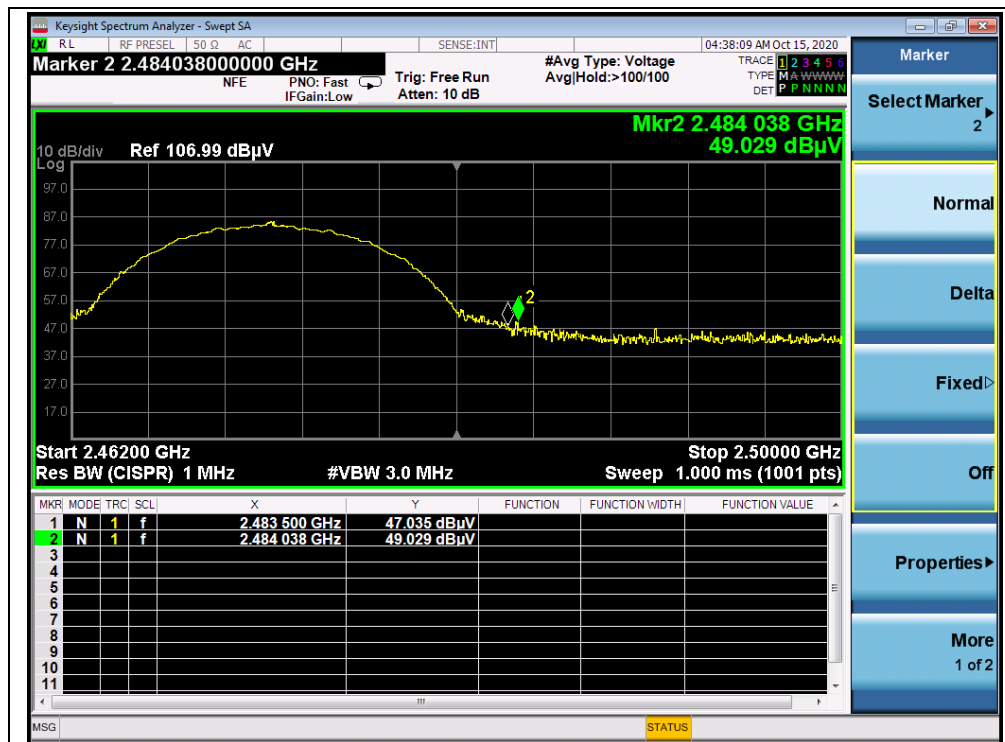
(AVERAGE, Channel 11, 802.11b)



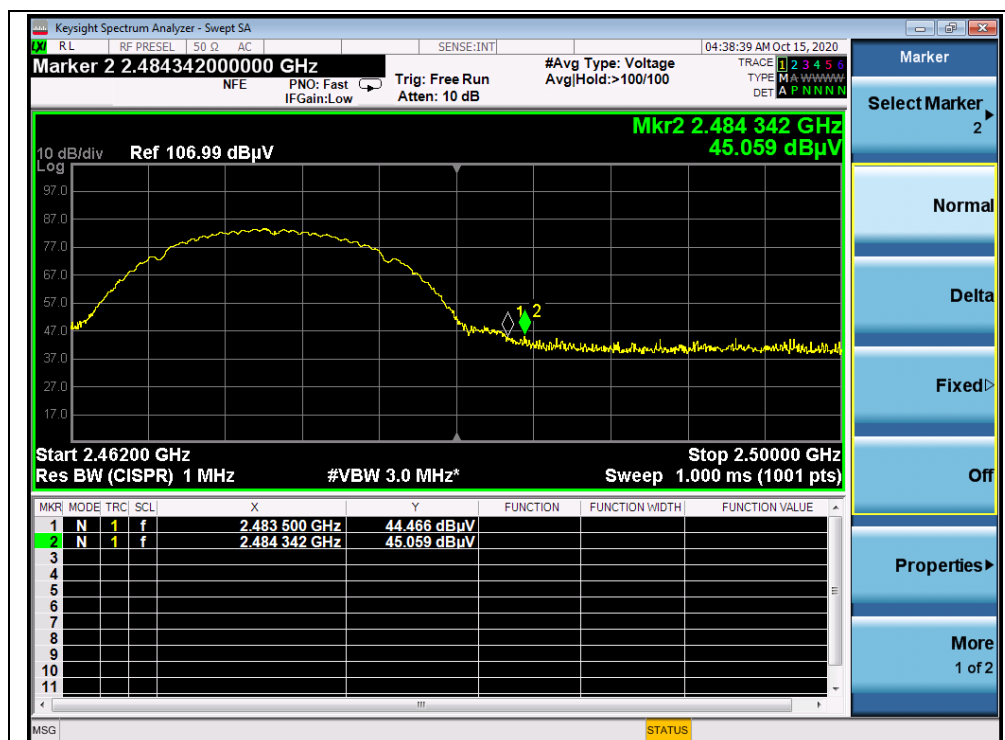
(PEAK, Channel 12, 802.11b)



(AVERAGE, Channel 12, 802.11b)



(PEAK, Channel 13, 802.11b)



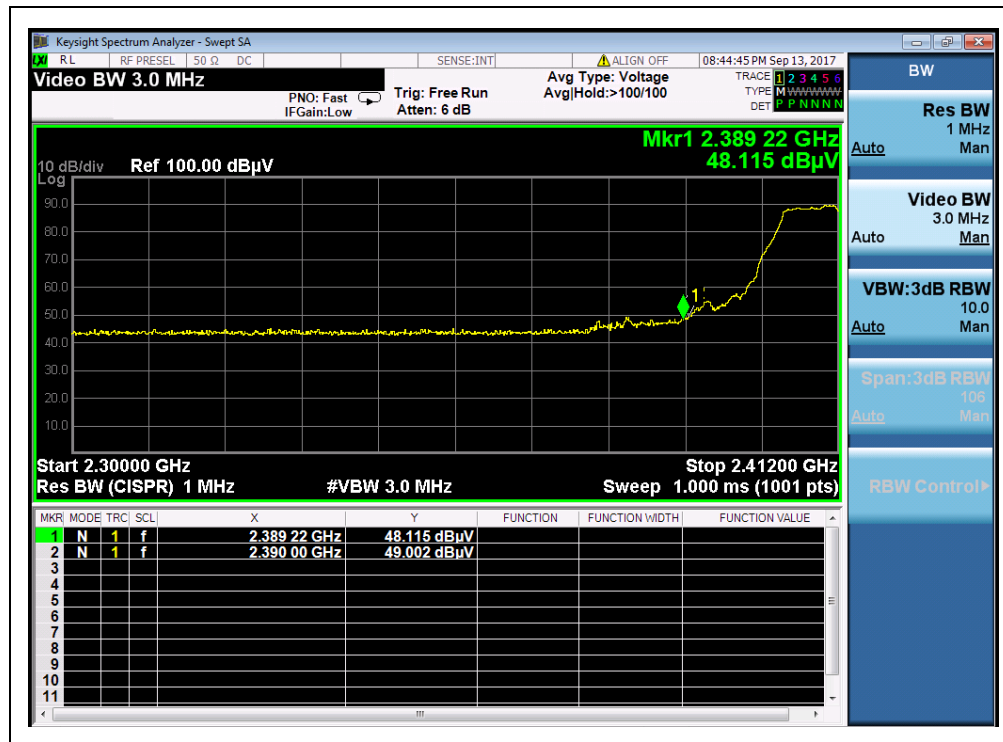
(AVERAGE, Channel 13, 802.11b)

**802.11g Mode****A.Test Verdict:**

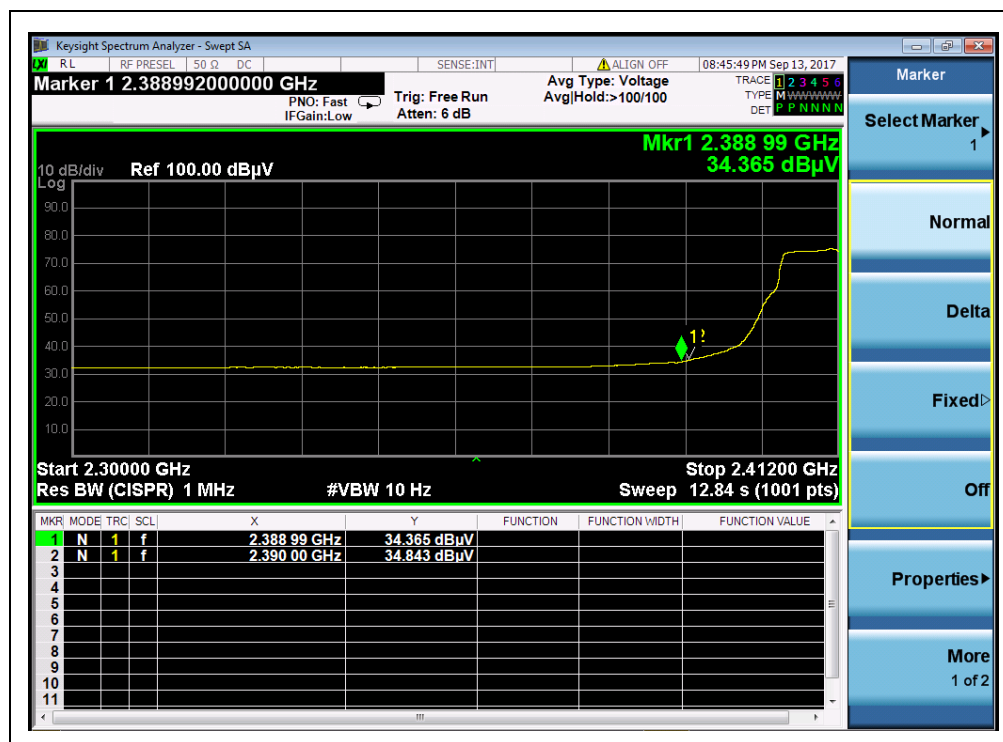
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dB μ V)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dB μ V/m)	Limit (dB μ V/m)	Verdict
		PK/ AV						
1	2389.22	PK	48.12	-33.63	32.56	47.05	74	PASS
1	2388.99	AV	34.37	-33.63	32.56	33.30	54	PASS
11	2484.08	PK	47.20	-33.18	32.50	46.52	74	PASS
11	2484.08	AV	34.09	-33.18	32.50	33.41	54	PASS
12	2483.50	PK	46.65	-31.01	31.60	47.24	74	PASS
12	2483.89	AV	43.89	-31.01	31.60	44.48	54	PASS
13	2483.50	PK	66.29	-31.01	31.60	66.88	74	PASS
13	2483.50	AV	33.40	-31.01	31.60	33.99	54	PASS



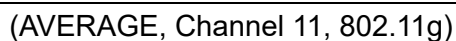
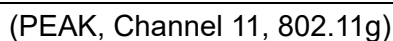
B.Test Plot:

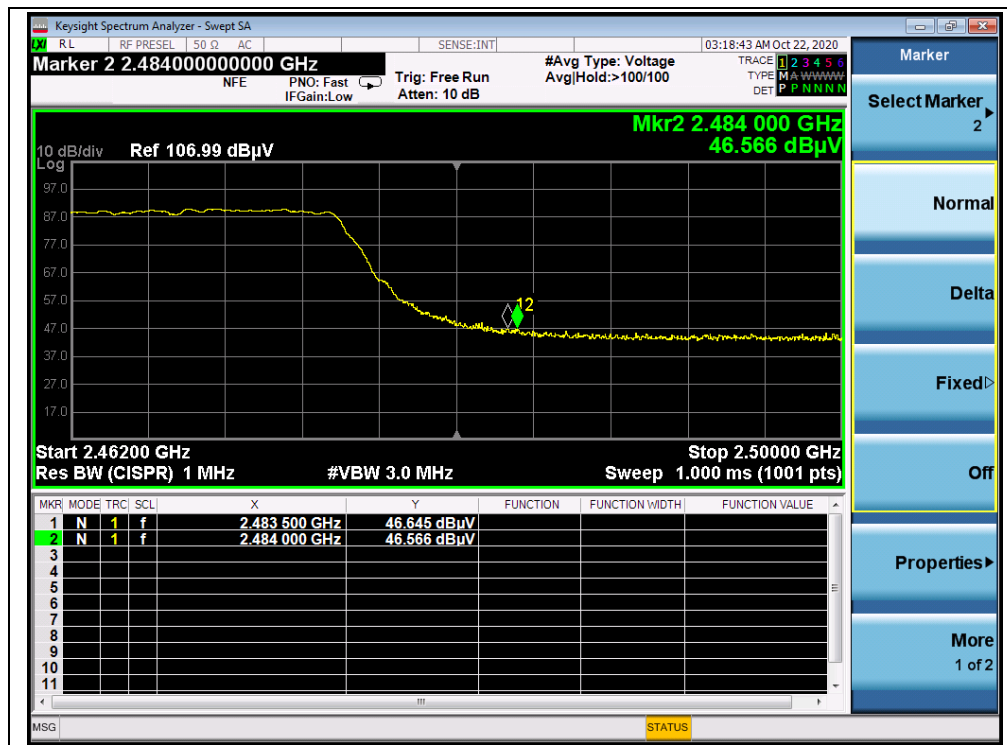


(PEAK, Channel 1, 802.11g)

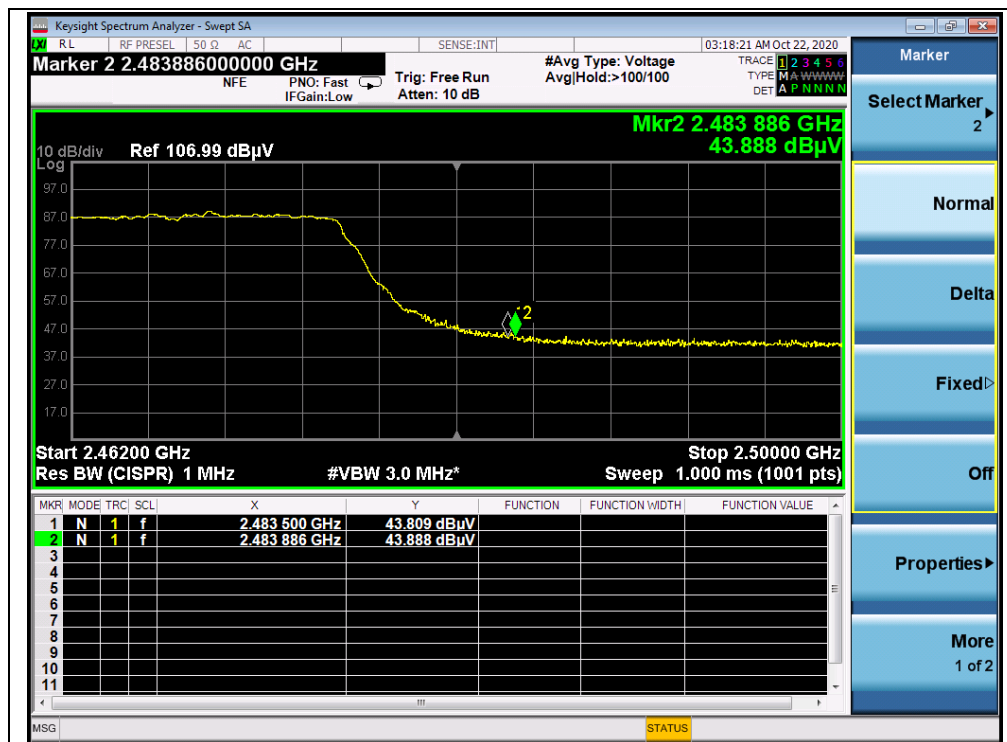


(AVERAGE, Channel 1, 802.11g)

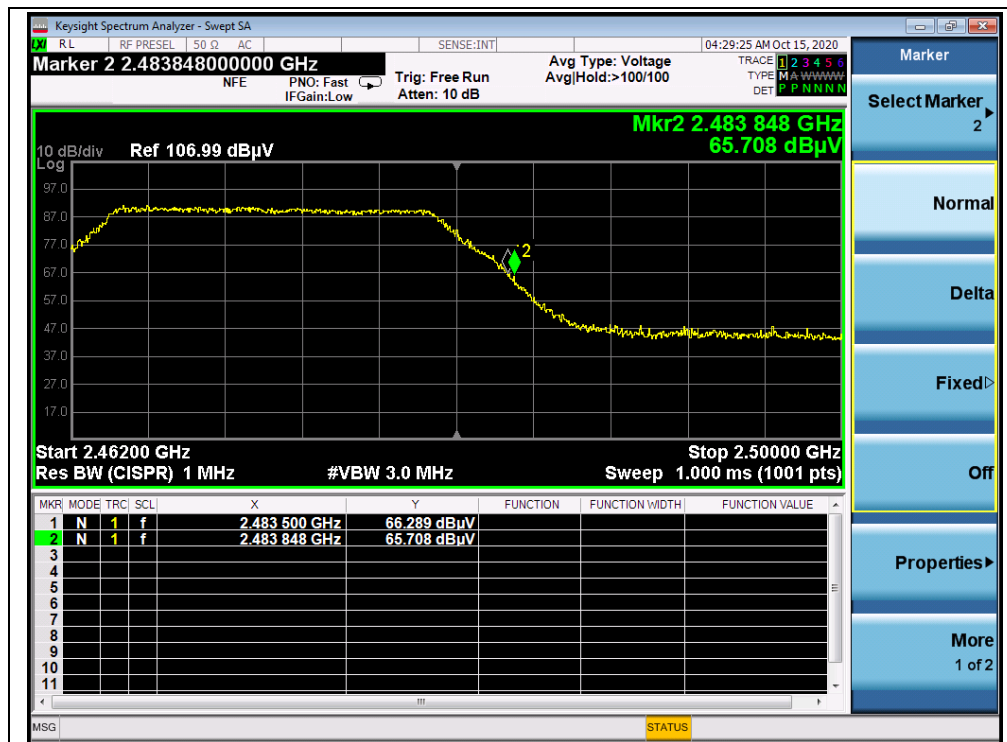




(PEAK, Channel 12, 802.11g)



(AVERAGE, Channel 12, 802.11g)



(PEAK, Channel 13, 802.11g)



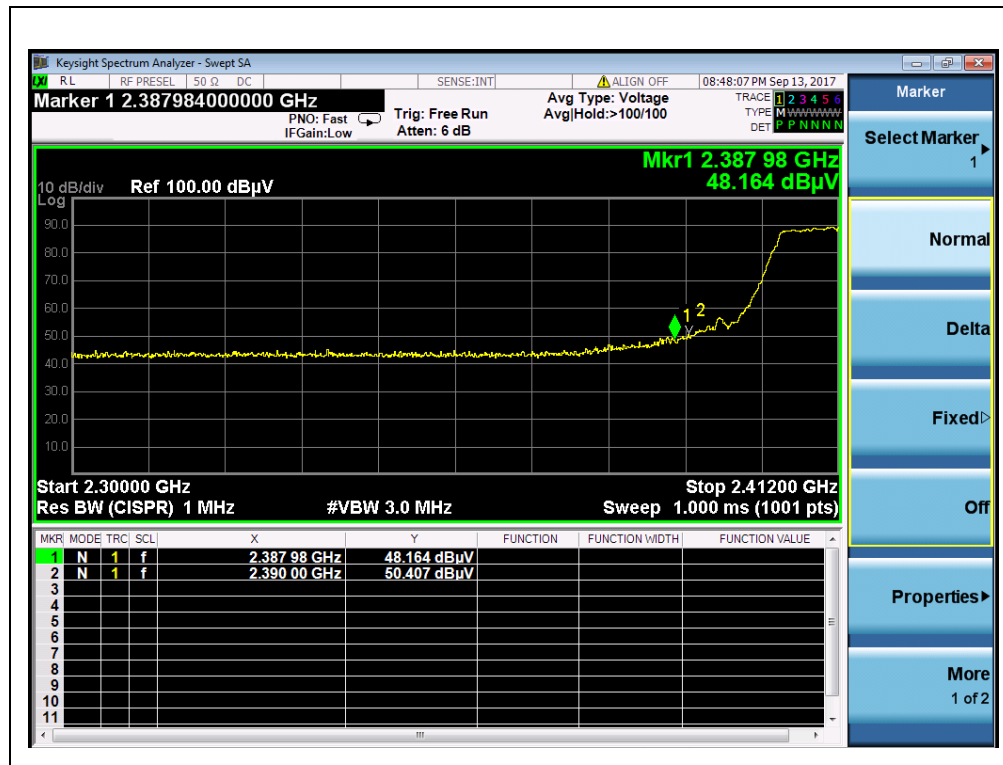
(AVERAGE, Channel 13, 802.11g)

**802.11n (HT20) Mode****A.Test Verdict:**

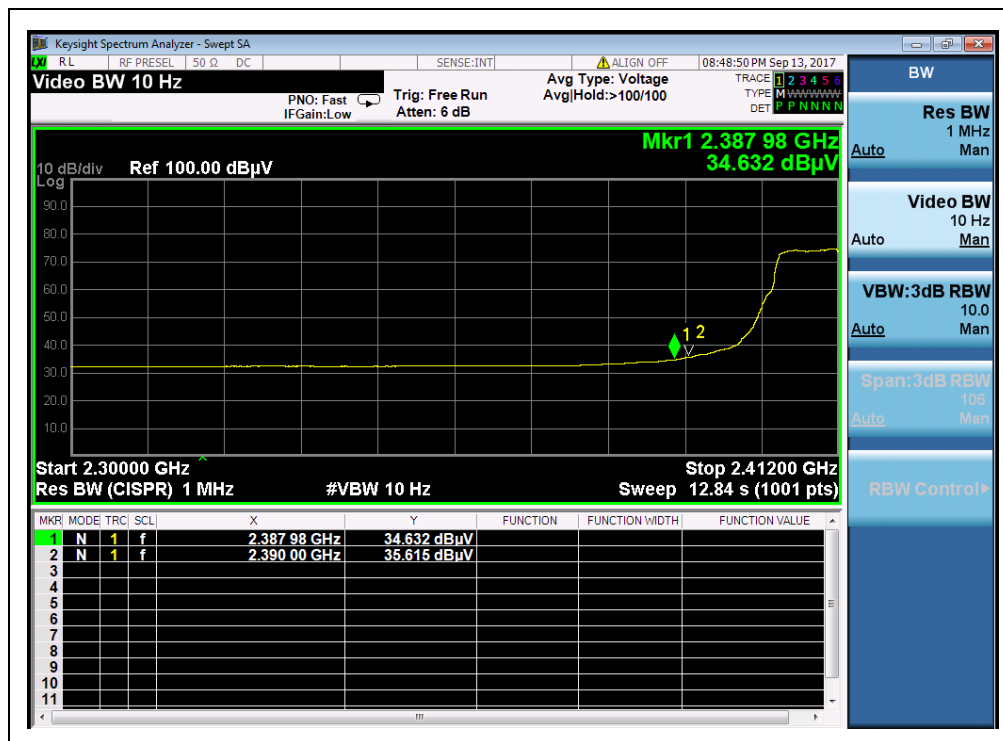
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dB μ V)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dB μ V/m)	Limit (dB μ V/m)	Verdict
		PK/ AV						
1	2387.98	PK	48.16	-33.63	32.56	47.09	74	PASS
1	2387.98	AV	34.63	-33.63	32.56	33.56	54	PASS
11	2484.50	PK	48.72	-33.18	32.50	48.04	74	PASS
11	2485.52	AV	33.91	-33.18	32.50	33.23	54	PASS
12	2485.86	PK	45.96	-31.01	31.60	46.55	74	PASS
12	2483.50	AV	43.83	-31.01	31.60	44.42	54	PASS
13	2483.50	PK	58.93	-31.01	31.60	59.52	74	PASS
13	2483.50	AV	32.94	-31.01	31.60	33.53	54	PASS



B.Test Plot:



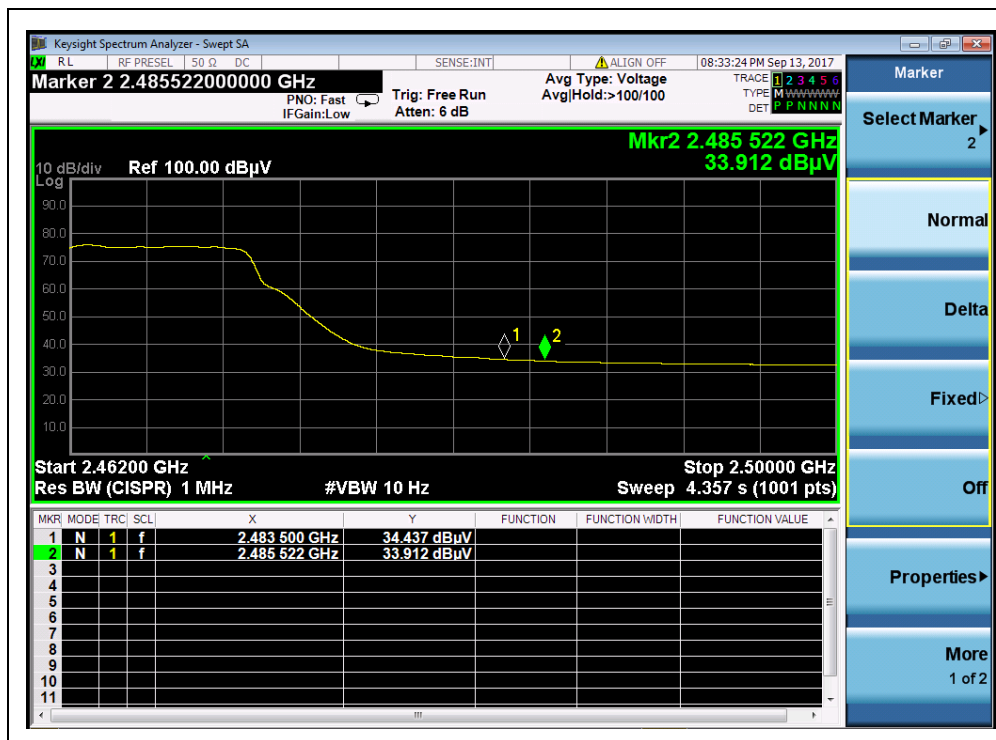
(PEAK, Channel 1, 802.11n (HT20))



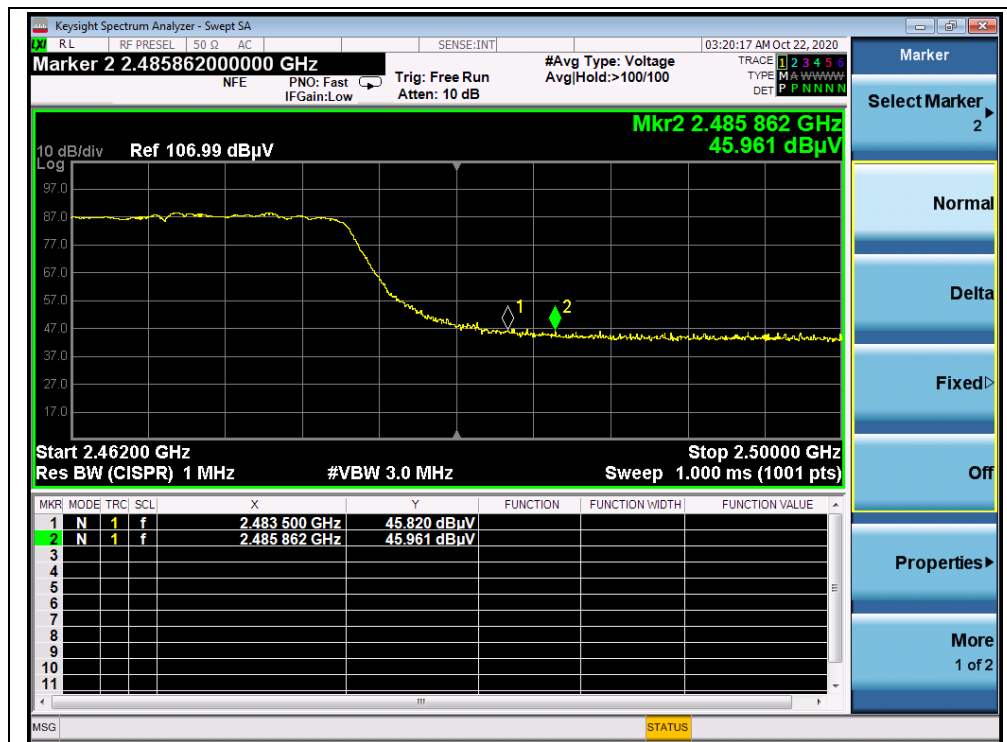
(AVERAGE, Channel 1, 802.11n (HT20))



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



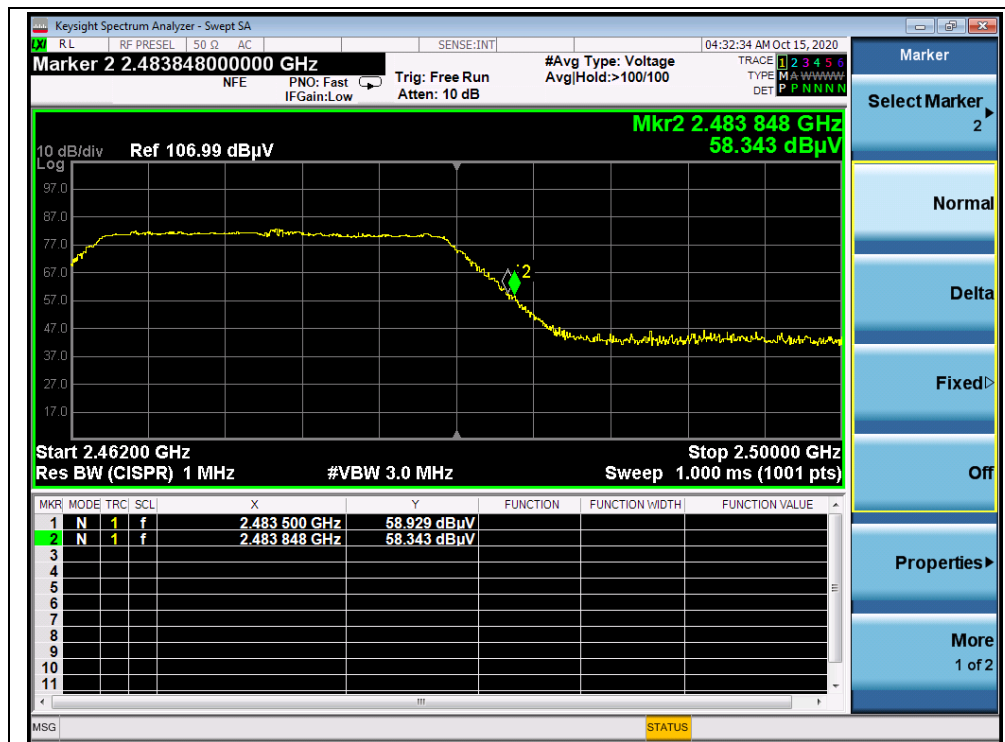
(AVERAGE, Channel 11, 802.11n (HT20))



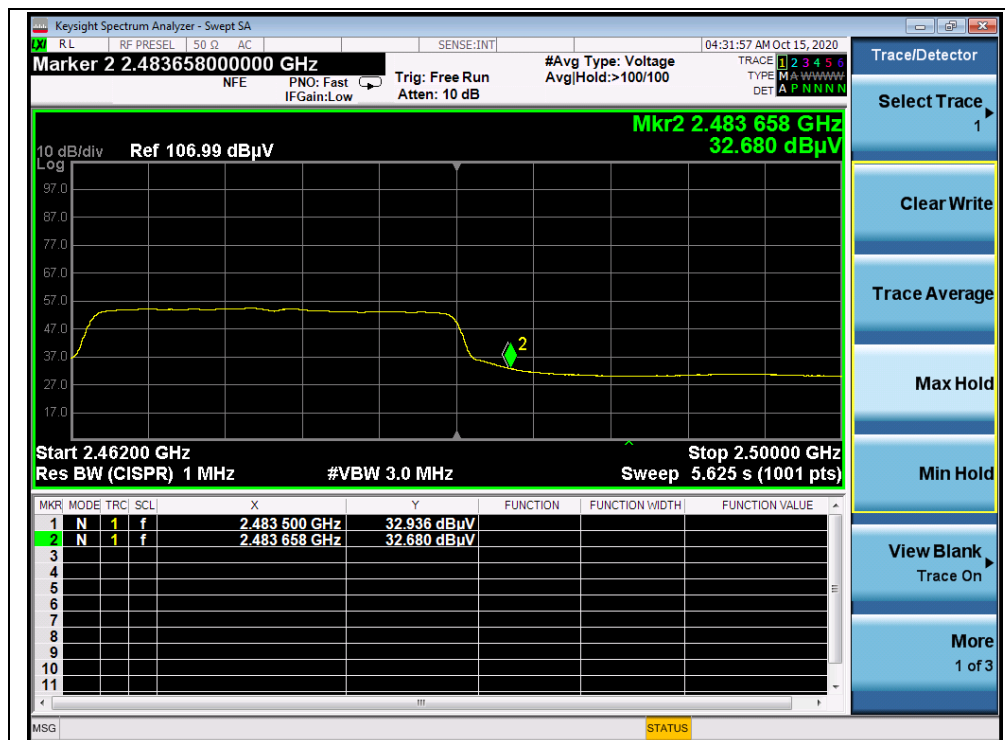
(PEAK, Channel 12, 802.11n (HT20))



(AVERAGE, Channel 12, 802.11n (HT20))



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



(AVERAGE, Channel 13, 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 ($\mu\text{V/m}$)	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

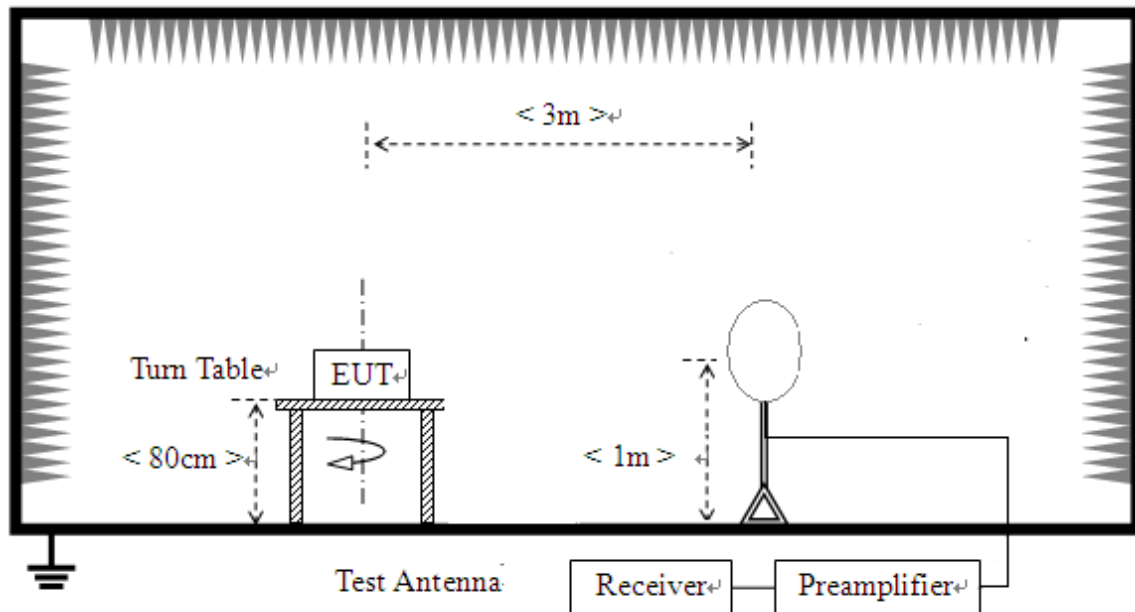
Note1: For above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

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).

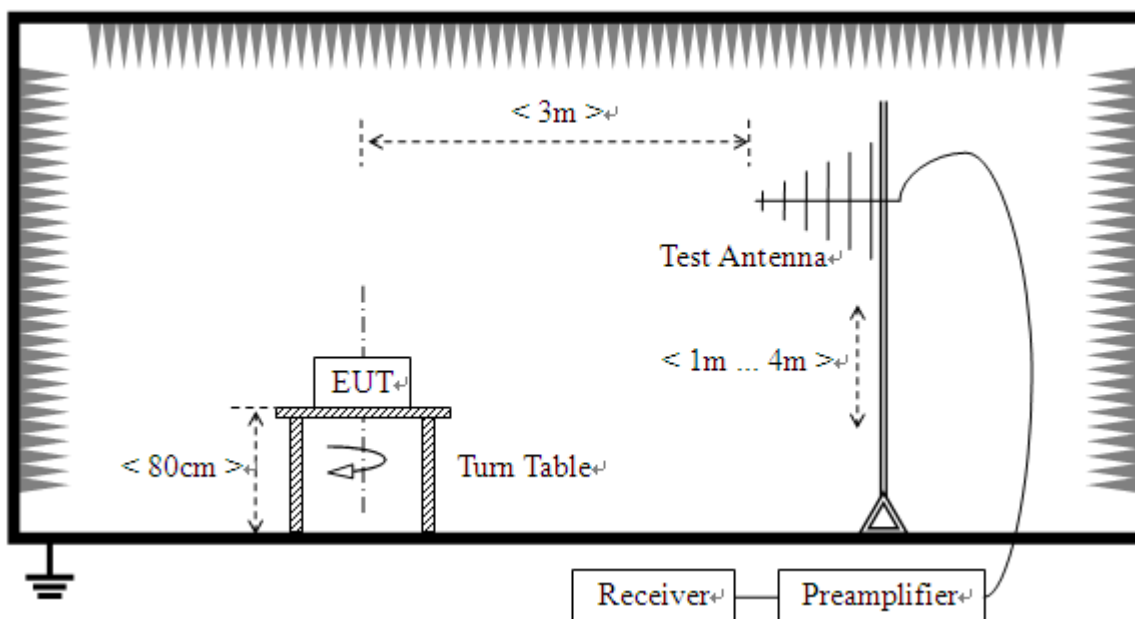
2.9.2. Test Description

Test Setup:

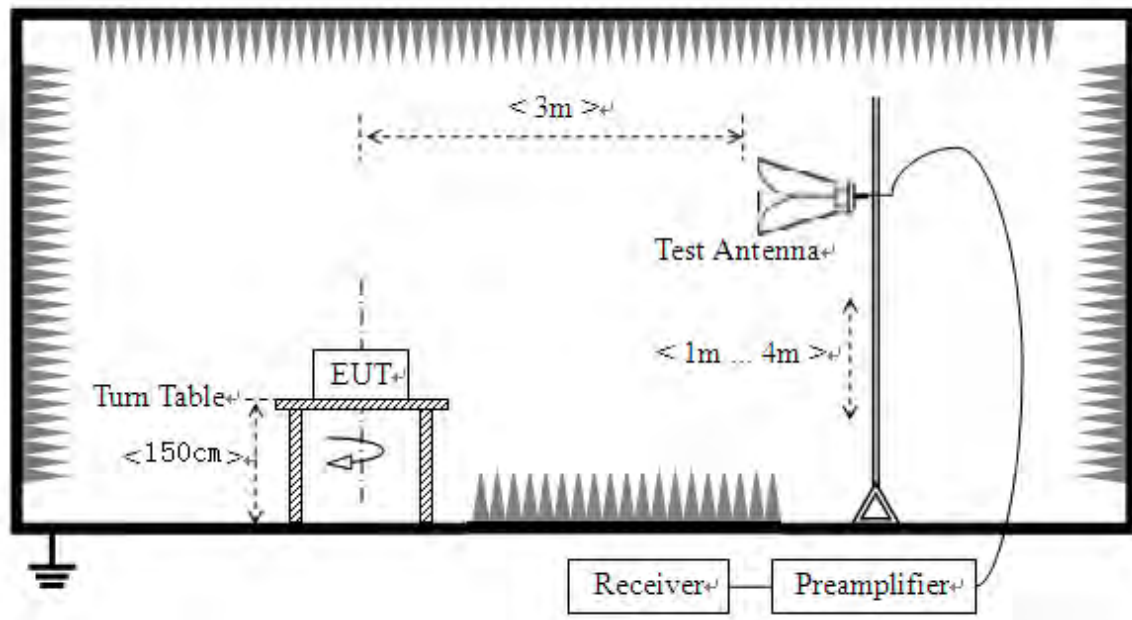
- 1) For radiated emissions from 9kHz to 30MHz



- 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.

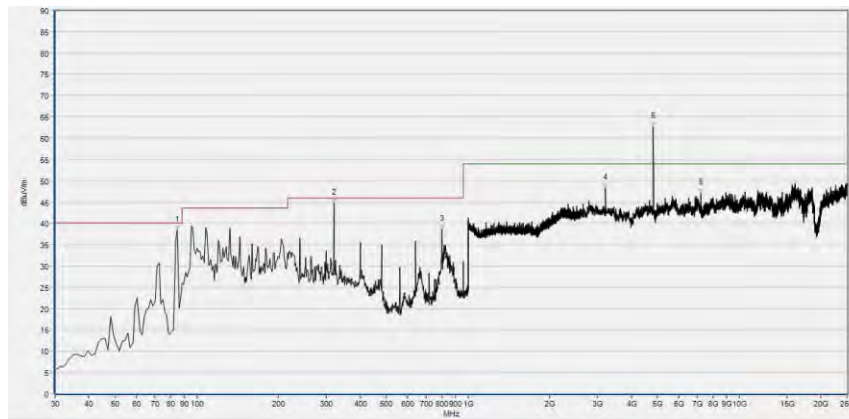
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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
84.631	38.31	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
320.150	44.71	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
799.687	38.60	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3215.094	48.26	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4823.800	63.21	N/A	51.86	74.00	N/A	54.00	Horizontal	PASS
7235.606	47.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

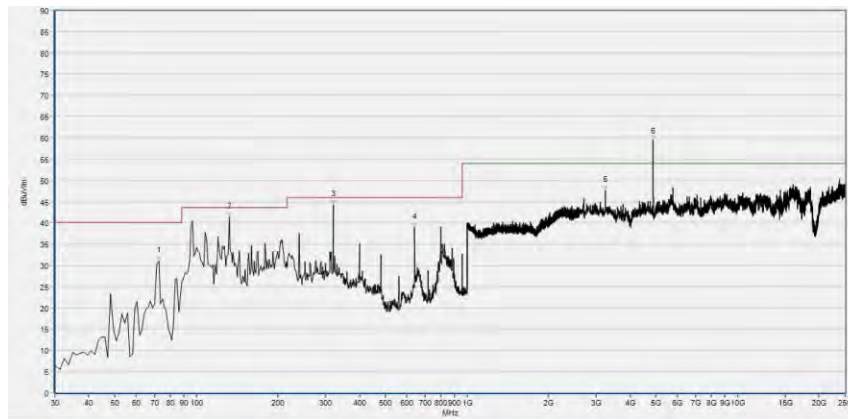
(Antenna Horizontal, 30MHz to 25GHz)



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
59.860	25.74	21.35	N/A	N/A	40.00	N/A	Vertical	PASS
320.150	33.76	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.437	41.13	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2219.048	44.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4823.900	60.13	N/A	50.23	74.00	N/A	54.00	Vertical	PASS
12156.356	48.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel 6



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
72.491	31.07	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
131.977	41.43	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
320.150	44.26	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	38.87	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3247.681	47.65	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4873.900	59.45	N/A	51.71	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

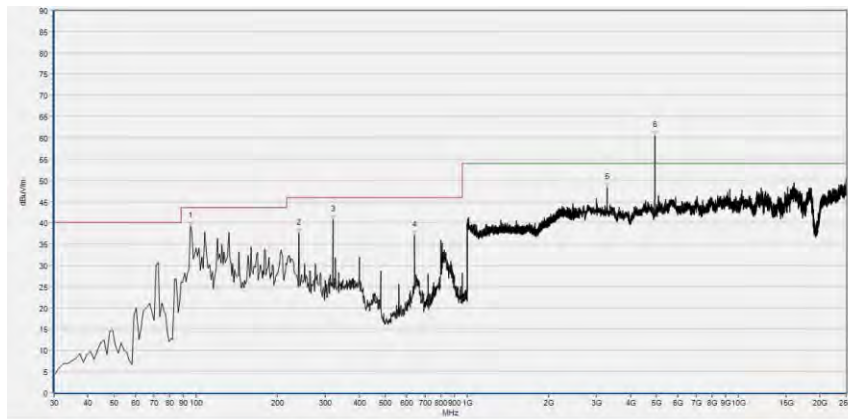


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
168.398	36.33	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	34.02	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.437	31.14	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3247.681	46.45	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4873.900	58.81	N/A	48.90	74.00	N/A	54.00	Vertical	PASS
12152.282	47.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

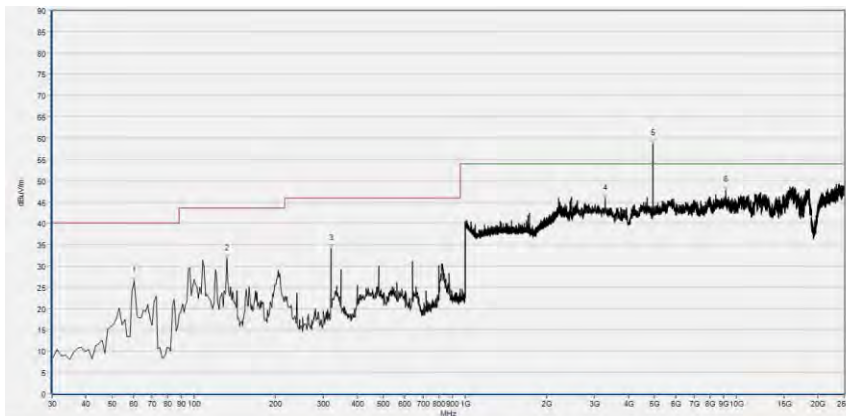


Plot for Channel 11



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
95.557	39.18	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
240.025	37.62	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
320.150	40.70	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	37.05	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3284.343	48.27	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4923.800	59.99	N/A	51.73	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

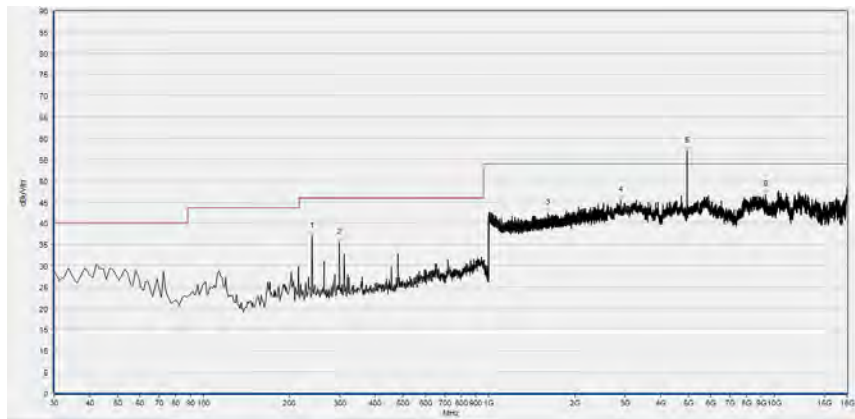


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
60.350	26.47	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
131.977	31.71	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	33.97	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3284.343	45.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4923.900	58.70	N/A	48.85	74.00	N/A	54.00	Vertical	PASS
9121.622	47.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

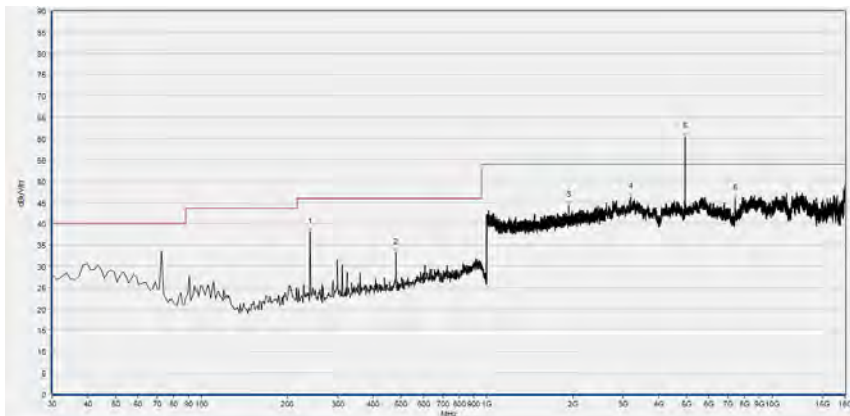


Plot for Channel 12



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
240.025	36.86	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
299.512	35.37	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1611.445	42.36	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2894.053	45.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4934.000	61.79	N/A	42.29	74.00	N/A	54.00	Horizontal	PASS
9335.225	46.77	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

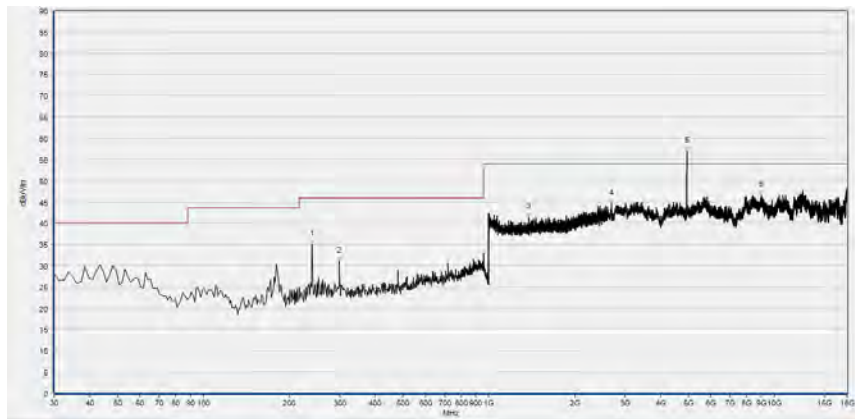


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
240.025	38.09	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
480.401	33.24	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1936.695	44.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3199.309	46.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4934.000	60.27	N/A	41.14	74.00	N/A	54.00	Vertical	PASS
7416.876	45.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

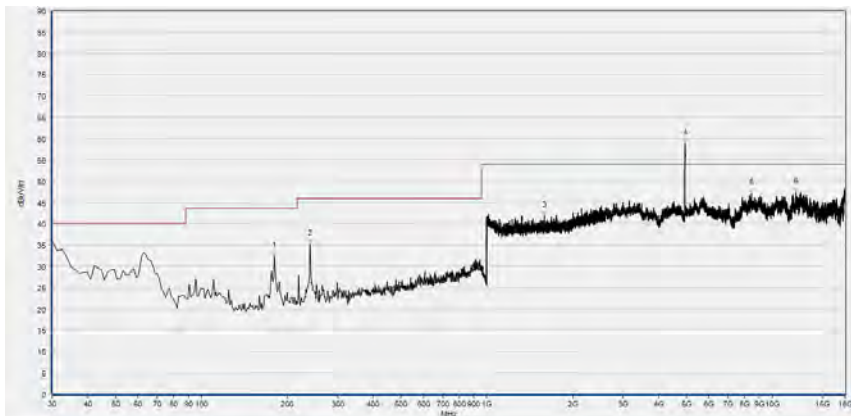


Plot for Channel 13



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
240.025	34.96	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
299.512	31.07	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1380.952	41.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2692.417	44.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4944.000	59.04	N/A	49.49	74.00	N/A	54.00	Horizontal	PASS
9013.166	46.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

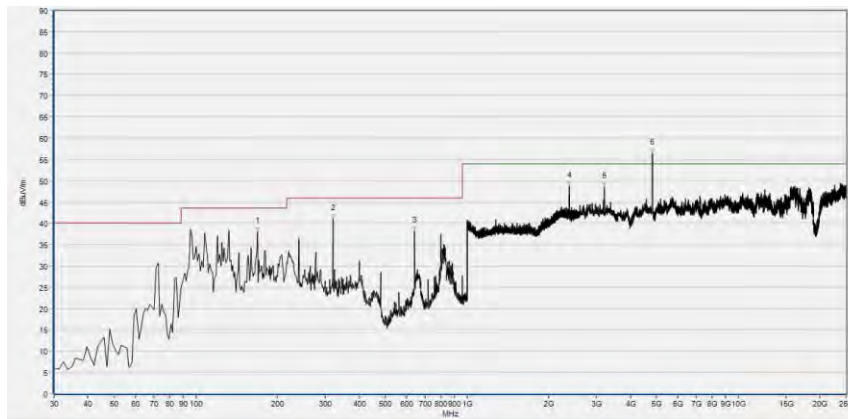


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
180.538	32.27	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
240.025	35.19	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1591.597	41.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4943.900	58.35	N/A	48.90	74.00	N/A	54.00	Vertical	PASS
8468.100	46.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12071.322	47.37	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
168.398	37.99	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
320.150	41.11	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	38.25	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2381.032	48.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3215.094	48.61	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4821.600	56.67	N/A	41.46	74.00	N/A	54.00	Horizontal	PASS

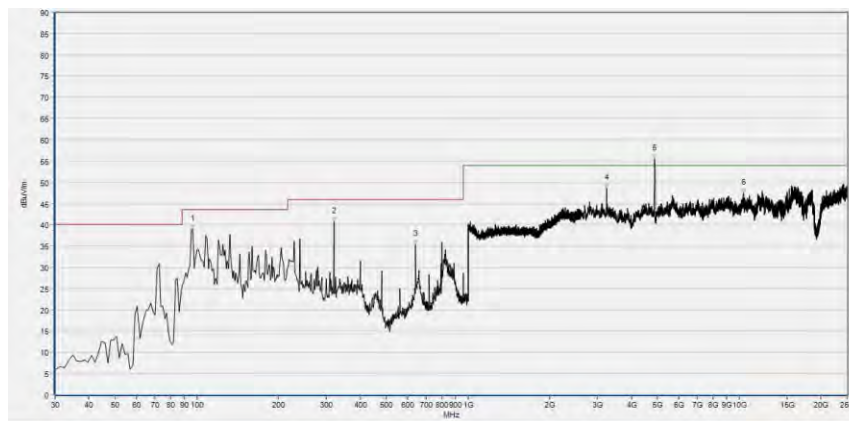
(Antenna Horizontal, 30MHz to 25GHz)



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
131.977	31.21	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	34.06	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
480.401	29.66	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2381.500	53.77	N/A	33.64	74.00	N/A	54.00	Vertical	PASS
4821.400	54.65	N/A	38.18	74.00	N/A	54.00	Vertical	PASS
11887.507	48.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel 6



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
96.771	38.95	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
320.150	40.74	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	35.32	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3247.681	48.61	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4880.800	56.58	N/A	40.45	74.00	N/A	54.00	Horizontal	PASS
10355.883	47.46	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

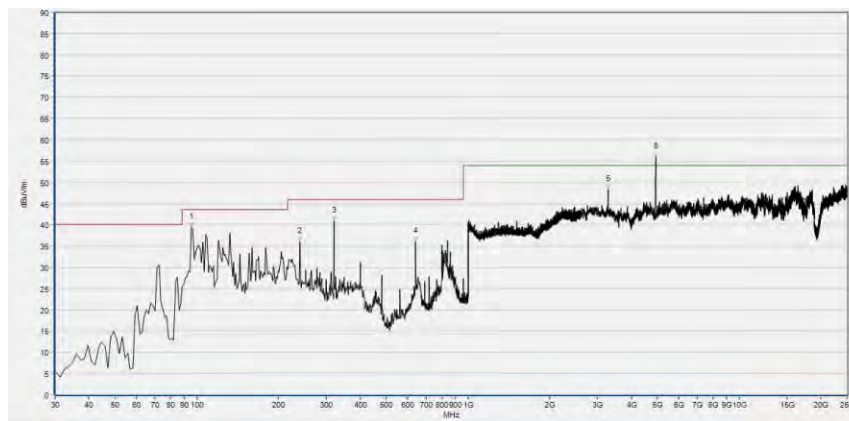
(Antenna Horizontal, 30MHz to 25GHz)



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
95.557	28.70	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
204.819	30.23	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	33.91	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2227.371	44.62	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4879.200	56.93	N/A	40.77	74.00	N/A	54.00	Vertical	PASS
8999.418	47.32	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel 11



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
95.557	39.33	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
240.025	36.04	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
320.150	40.84	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	36.11	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3284.343	48.31	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4921.400	57.50	N/A	47.62	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

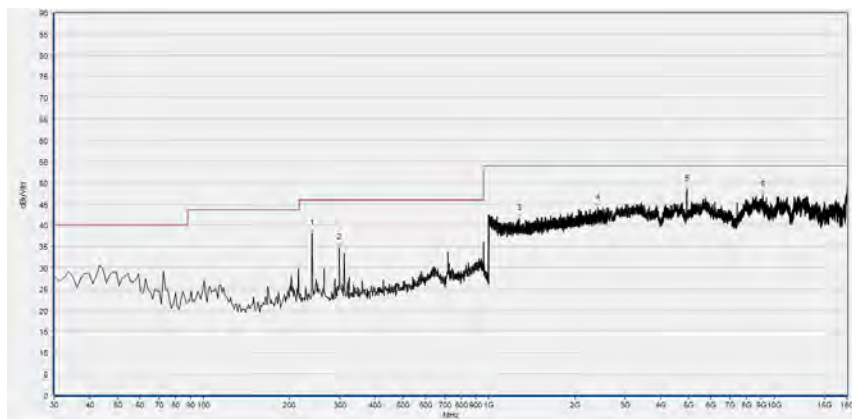


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
144.118	39.39	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	33.99	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.437	31.15	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2465.546	46.40	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4926.700	54.33	N/A	36.02	74.00	N/A	54.00	Vertical	PASS
12140.062	48.13	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

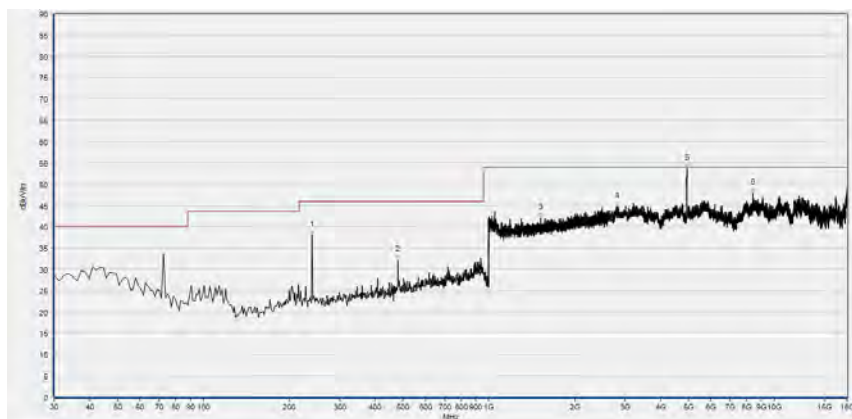


Plot for Channel 12



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
240.025	38.06	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
299.512	34.76	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1277.231	41.49	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2411.124	44.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4933.425	48.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9105.583	47.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

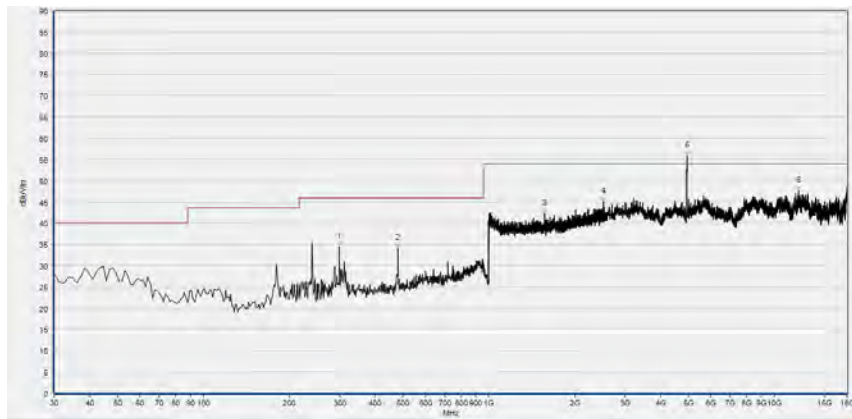


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
240.025	38.01	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
480.401	32.14	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1521.809	42.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2810.038	44.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4933.000	54.98	N/A	33.37	74.00	N/A	54.00	Vertical	PASS
8425.059	47.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

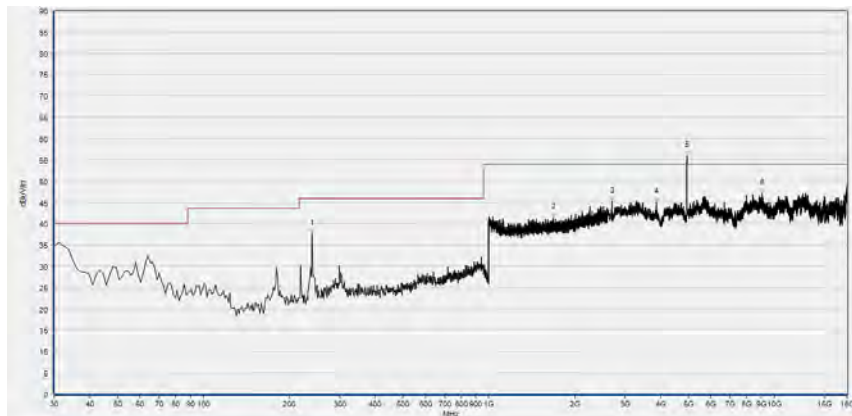


Plot for Channel 13



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
299.512	34.28	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
480.401	34.03	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1567.267	42.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2515.486	45.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4938.900	55.02	N/A	43.97	74.00	N/A	54.00	Horizontal	PASS
12138.534	47.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

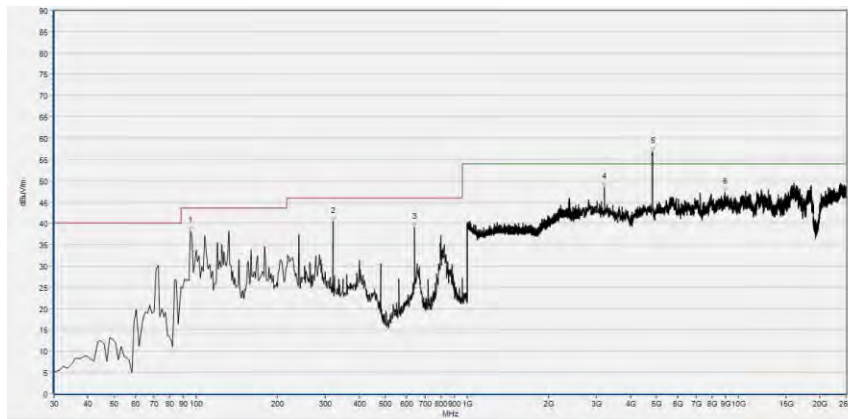


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
240.025	37.66	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1684.434	41.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2695.217	45.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3860.229	45.03	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4941.600	54.88	N/A	42.85	74.00	N/A	54.00	Vertical	PASS
9069.176	47.02	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
95.557	38.15	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
320.150	40.38	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	39.00	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3215.094	48.45	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4823.400	57.90	N/A	49.62	74.00	N/A	54.00	Horizontal	PASS
8946.463	47.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

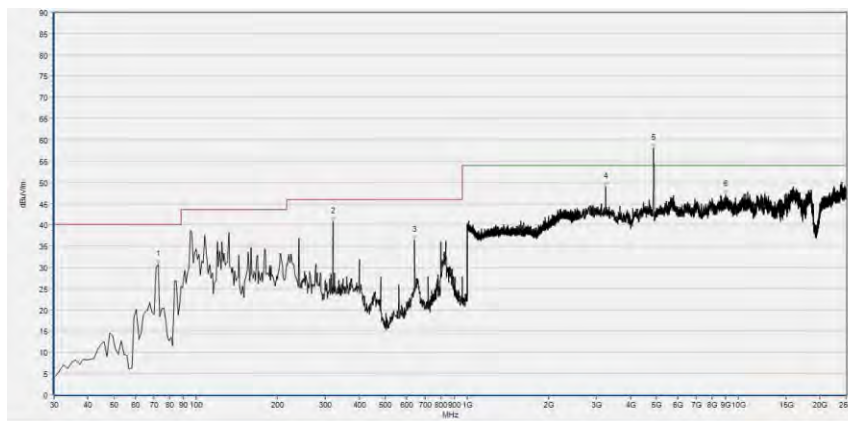
(Antenna Horizontal, 30MHz to 25GHz)



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
107.697	30.92	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	34.09	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.437	33.21	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2382.953	52.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4830.500	55.18	N/A	38.33	74.00	N/A	54.00	Vertical	PASS
7227.460	47.76	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel 6



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
72.491	30.68	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
320.150	40.76	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	36.41	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3247.681	48.95	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4873.100	56.75	N/A	39.51	74.00	N/A	54.00	Horizontal	PASS
8962.757	47.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

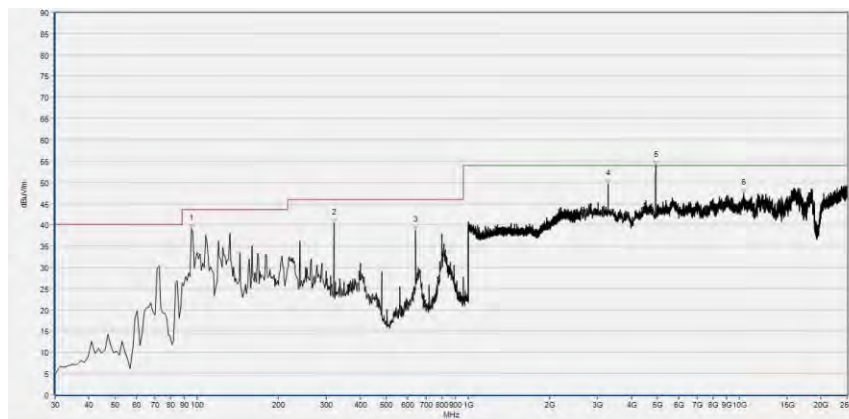


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
131.977	32.19	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	34.15	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.437	31.48	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3247.681	45.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4869.300	52.76	N/A	36.41	74.00	N/A	54.00	Vertical	PASS
11740.862	47.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)



Plot for Channel 11



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
95.557	39.02	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
320.150	40.40	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
639.437	38.80	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3284.343	49.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4918.100	54.86	N/A	38.40	74.00	N/A	54.00	Horizontal	PASS
10372.177	47.41	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

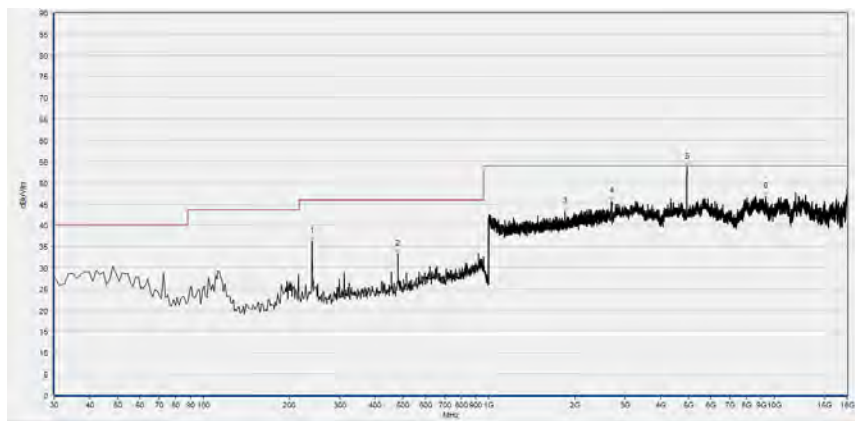


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
131.977	32.48	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
320.150	33.43	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.437	35.92	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1585.194	47.76	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3284.343	46.47	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4930.600	53.90	N/A	47.87	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)



Plot for Channel 12



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
240.025	36.25	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
480.401	33.15	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1852.181	43.32	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2689.616	45.65	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4935.100	56.21	N/A	33.44	74.00	N/A	54.00	Horizontal	PASS
9326.823	46.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

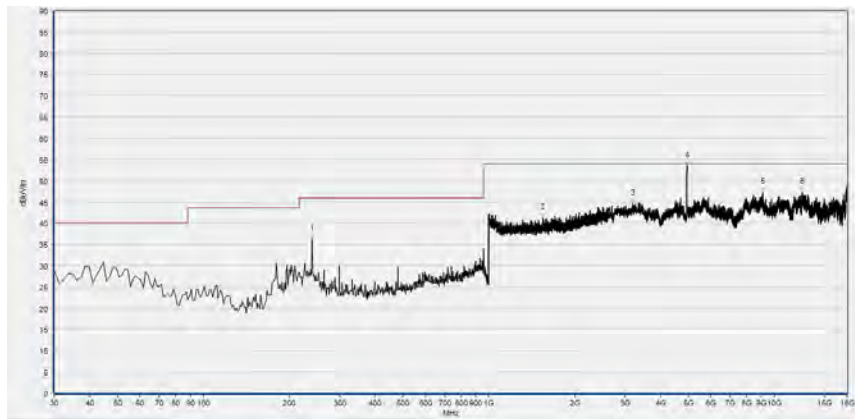


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
240.025	39.01	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
311.652	33.21	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1747.179	43.07	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3224.514	46.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4935.400	58.20	N/A	34.46	74.00	N/A	54.00	Vertical	PASS
12286.961	47.67	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

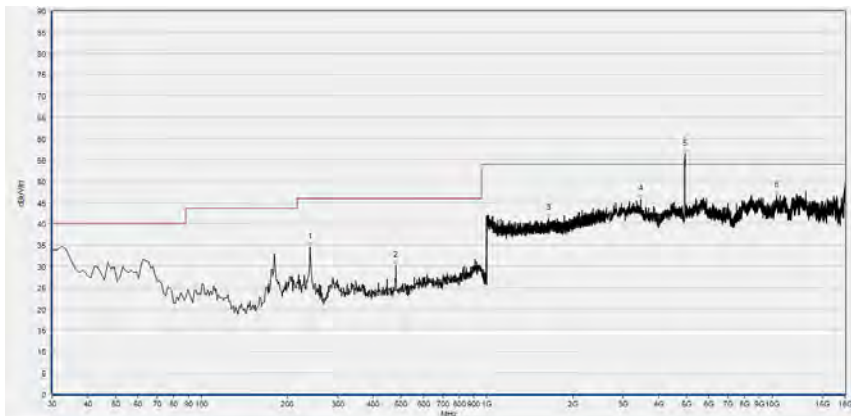


Plot for Channel 13



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
240.025	36.18	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1544.218	41.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3196.508	44.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4942.300	55.23	N/A	42.30	74.00	N/A	54.00	Horizontal	PASS
9133.588	47.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12536.207	47.33	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
240.025	34.47	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
480.401	30.23	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1644.098	41.17	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3454.155	45.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4941.800	58.03	N/A	45.35	74.00	N/A	54.00	Vertical	PASS
10363.011	46.62	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	Due Date
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
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
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	9163-519	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1519-022	FMZB1519	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	BBHA9170	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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