TEST REPORT

APPLICANT	:	Savant Technologies LLC, dba GE Lighting, a Savant Company
PRODUCT NAME	:	LED LAMP
MODEL NAME	:	CLEDBM6LDGF
BRAND NAME	:	GE
FCC ID	:	PUU-BM-DMSW
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2021-10-19
TEST DATE	:	2021-10-26 to 2021-11-08
ISSUE DATE	:	2021-11-23

Edited by: Peng Mi (Rapporteur)

Approved by: Shen Junsheng (Supervisor)

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MORLAB

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Change History		
Version	Date	Reason for change
1.0	2021-11-23	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Savant Technologies LLC, dba GE Lighting, a Savant Company
Applicant Address:	1975 Noble Road Cleveland, OH 44112 United States of America
Manufacturer:	Xiamen Topstar lighting Co.,Ltd.
Manufacturer Address:	676 Meixi Avenue, Tong'an District, Xiamen, China

1.2. Equipment Under Test (EUT) Description

Product Name:	LED LAMP
Sample No.:	2#
Hardware Version:	N/A
Software Version:	N/A
Modulation Technology:	DSSS, OFDM
Modulation Mode:	802.11b, 802.11g, 802.11n (HT20)
Operating Frequency Range:	802.11b/g/ n (HT20): 2412MHz–2462MHz
Antenna Type:	Ceramic Antenna
Antenna Gain:	1.5dBi

Note 1: This test report is variant from the original report (Report No.: SZ21100122W02, FCC ID: PUU-ST19-DMSW), based on the similarity between before, changed the model name, FCC ID and the light shape. In addition to the differences described above, the others are the same. No other changes, all RF parameters remain the same as before.

Note 2: We use the dedicated software to control the EUT continuous transmission.

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

1.3. 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		
	6	**2437**		
	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	Nov 02, 2021	Liu Bo	PASS$_{Note1}$	No deviation
3	15.247(b)	Maximum Peak and Average Conducted Output Power	Nov 02, 2021	Liu Bo	PASS$_{Note1}$	No deviation
4	15.247(a)	Bandwidth	Nov 02, 2021	Liu Bo	PASS$_{Note1}$	No deviation
5	15.247(d)	Conducted Spurious Emission and Band Edge	Nov 02, 2021	Liu Bo	PASS$_{Note1}$	No deviation
6	15.247(e)	Power Spectral Density	Nov 02, 2021	Liu Bo	PASS$_{Note1}$	No deviation
7	15.207	Conducted Emission	Nov 02, 2021	Su Zhan	PASS$_{Note1}$	No deviation
8	15.247(d)	Restricted Frequency Bands	Oct 26, 2021	Huang Zhiye	PASS$_{Note1}$	No deviation
9	15.209, 15.247(d)	Radiated Emission	Oct 26, 2021 Nov 08, 2021	Huang Zhiye	PASS$_{Note1}$	No deviation
Note 1: The test results of these test items in this report refer to the test report (Report No.: SZ21100122W02).						

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 11.5dB contains two parts that cable loss 1.5dB 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% confidence intervals.

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.

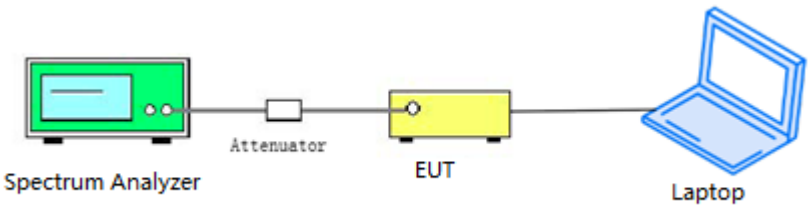
2.2. Duty Cycle of Test Signal

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 ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.2.2. Test Description

Test Setup:



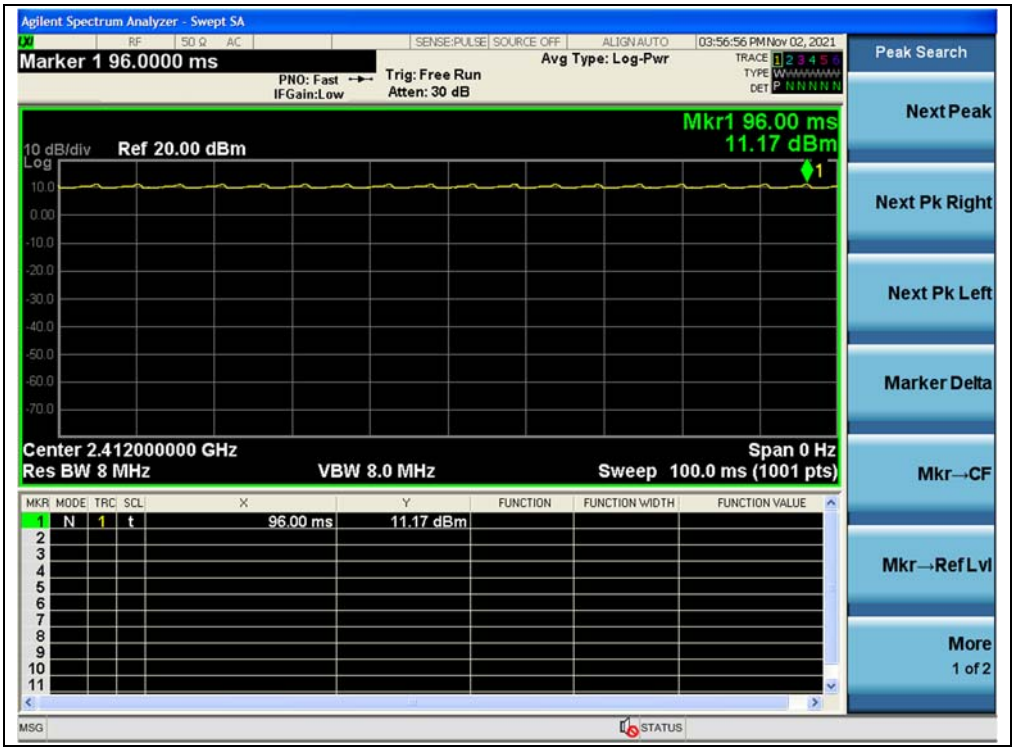
ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

2.2.3. Test Result

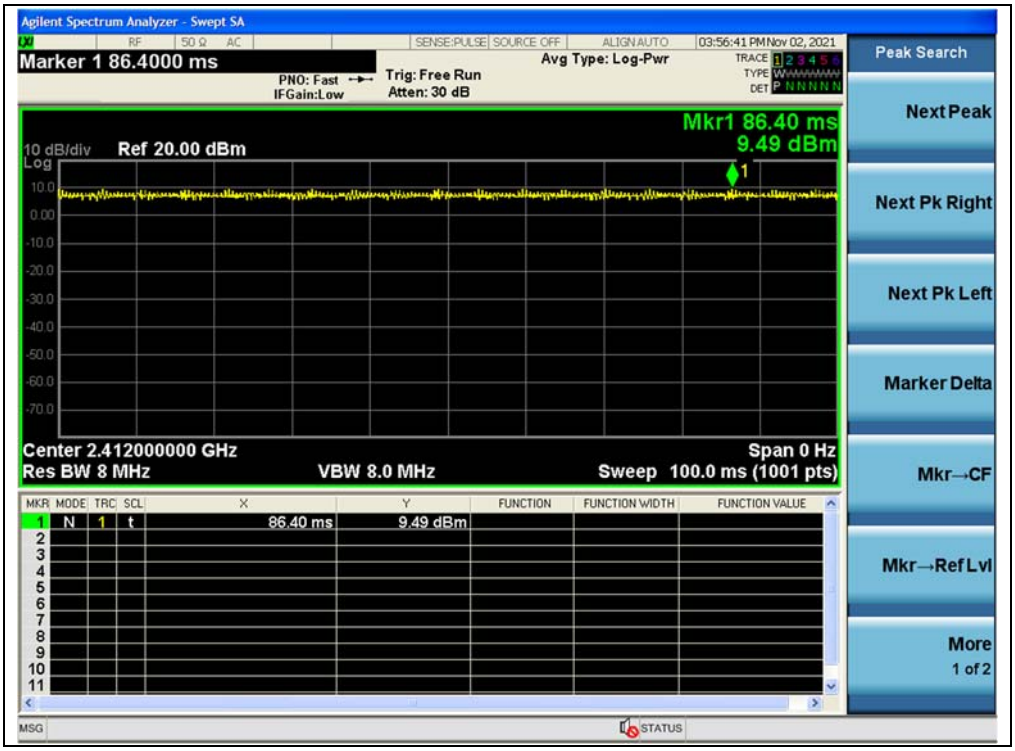
A. Test Verdict:

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

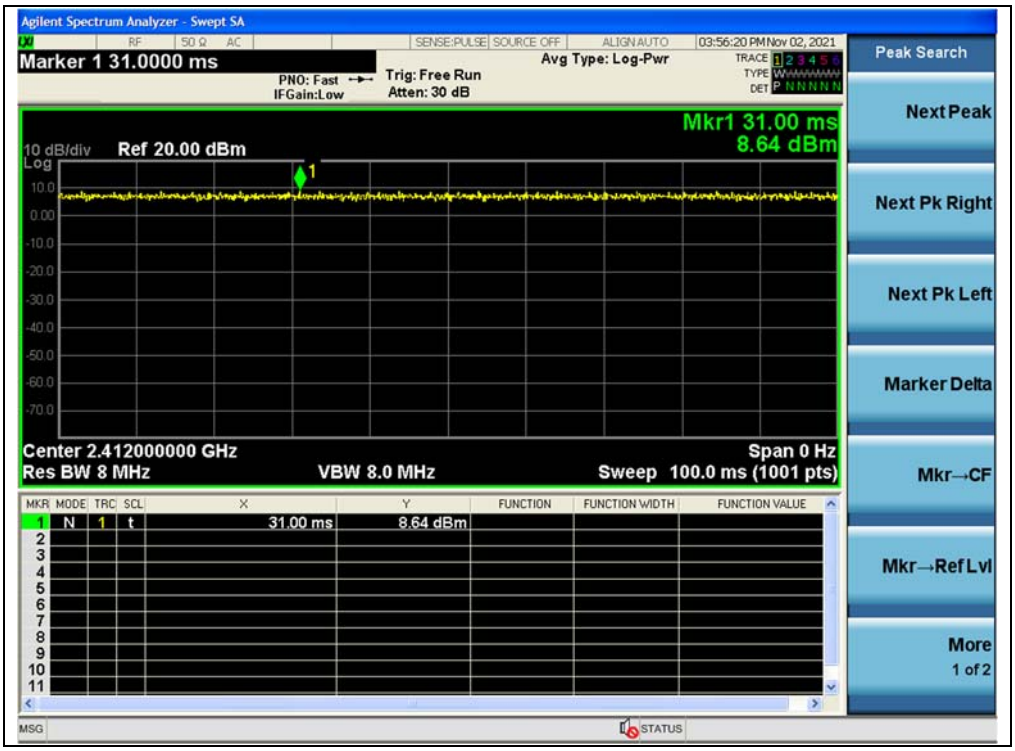
B. Test Plot:



(Channel 1, 802.11b)



(Channel 1, 802.11g)



(Channel 1, 802.11n (HT20))

2.3. Maximum Peak and Average Conducted Output Power

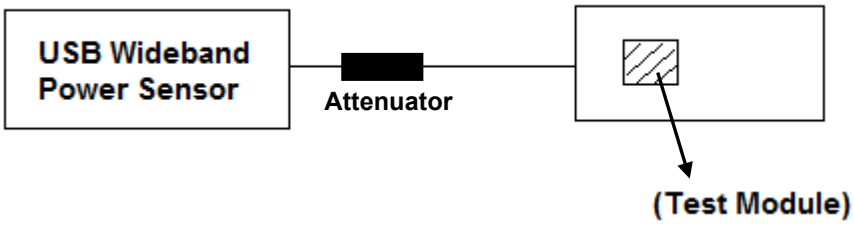
2.3.1. Requirement

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 exceed1 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	**25.41**	**0.348**	30	1	PASS
6	2437	25.37	0.344			PASS
11	2462	25.36	0.344			PASS

802.11g Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	24.11	0.258	30	1	PASS
6	2437	25.16	0.328			PASS
11	2462	24.11	0.258			PASS

802.11n (HT20) Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	22.89	0.195	30	1	PASS
6	2437	24.31	0.270			PASS
11	2462	23.66	0.232			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	17.66	0.00	**17.66**	**0.058**	30	1	PASS
6	2437	17.38		17.38	0.055			PASS
11	2462	17.56		17.56	0.057			PASS

802.11g Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
1	2412	16.05	0.00	16.05	0.040	30	1	PASS
6	2437	17.21		17.21	0.053			PASS
11	2462	15.69		15.69	0.037			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	15.58	0.00	15.58	0.036	30	1	PASS
6	2437	16.69		16.69	0.047			PASS
11	2462	15.69		15.69	0.037			PASS

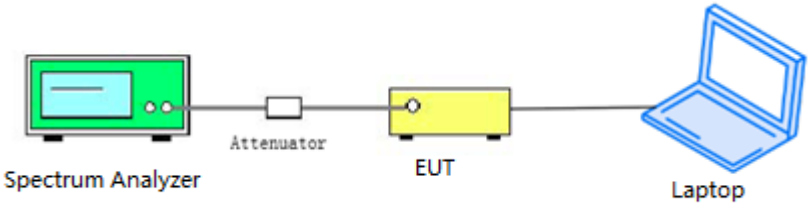
2.4. Bandwidth

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 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

2.4.3. Test Procedure

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

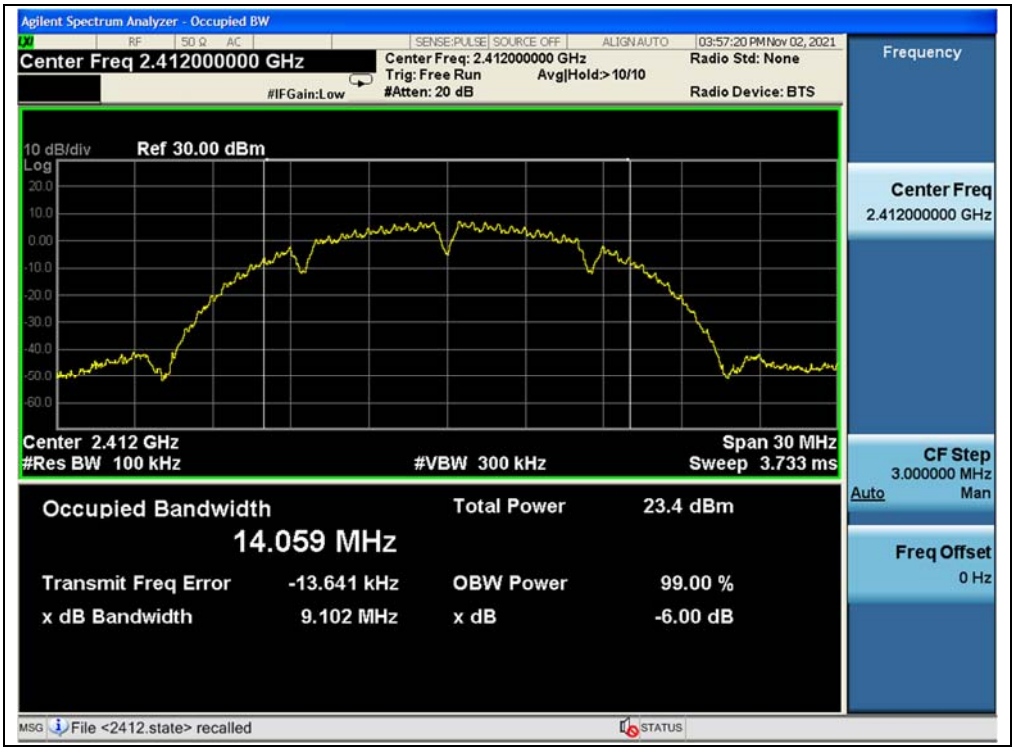
2.4.4. Test Result

802.11b Mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	9.102	≥500	PASS
6	2437	9.094	≥500	PASS
11	2462	9.092	≥500	PASS

B. Test Plot:



(Channel 1, 802.11b)

(Channel 6, 802.11b)

(Channel 11, 802.11b)

802.11g Mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	16.53	≥500	PASS
6	2437	16.53	≥500	PASS
11	2462	16.54	≥500	PASS

B. Test Plot:

(Channel 1, 802.11g)

(Channel 6, 802.11g)

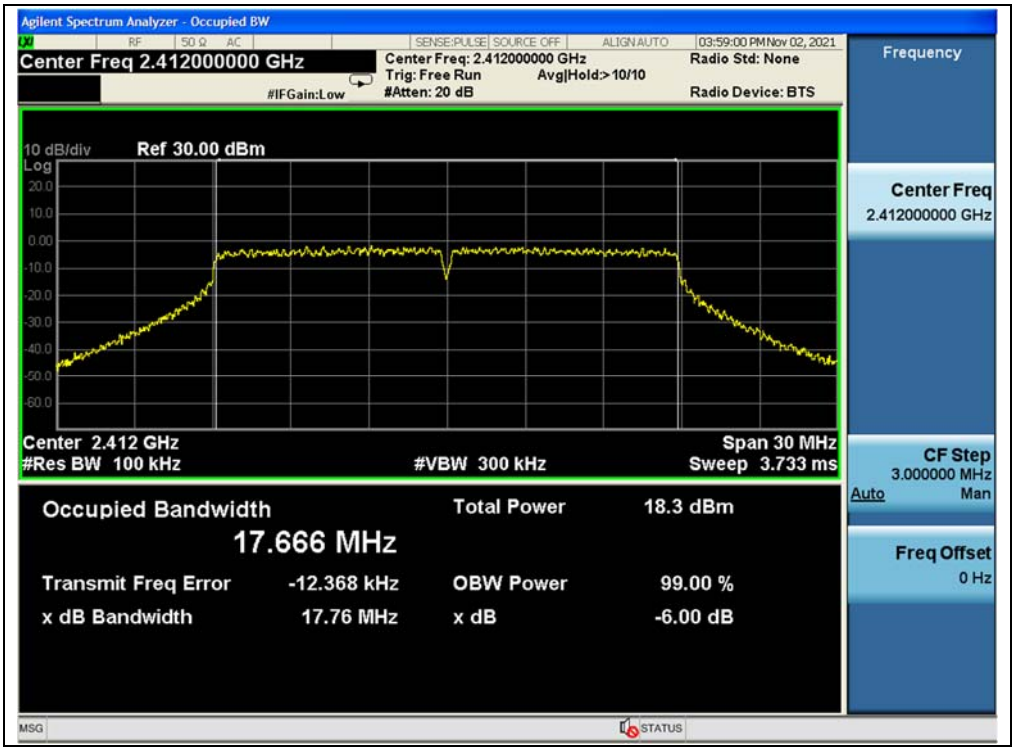
(Channel 11, 802.11g)

802.11n (HT20) Mode

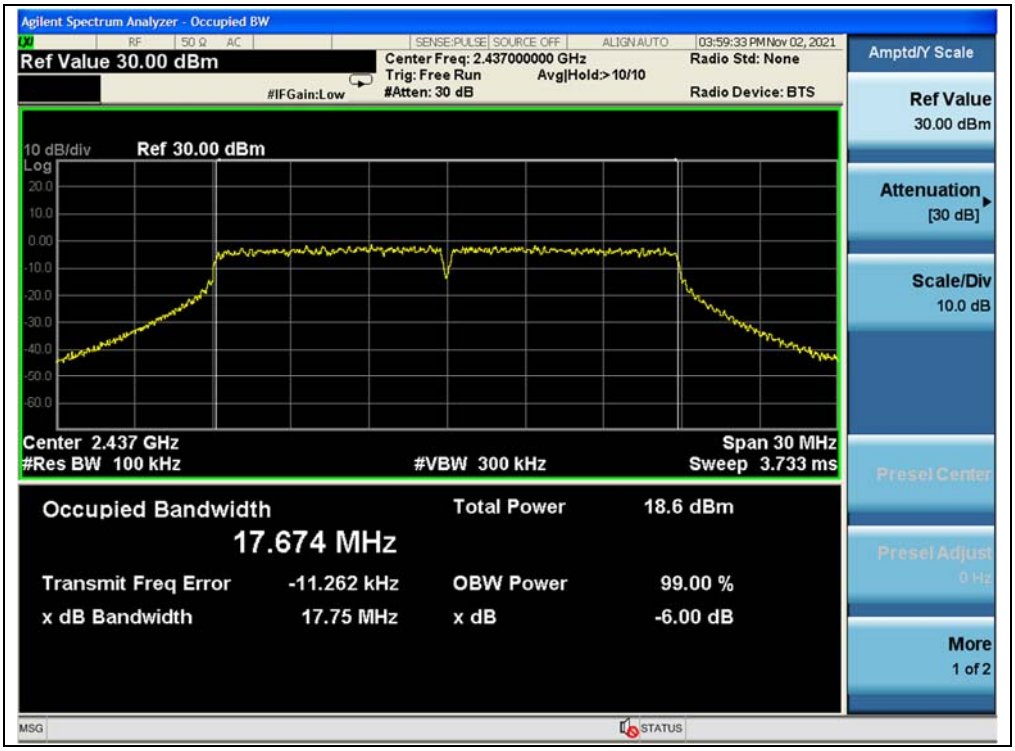
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	17.76	≥500	PASS
6	2437	17.75	≥500	PASS
11	2462	17.74	≥500	PASS

B. Test Plot:



(Channel 1, 802.11n (HT20))



(Channel 6, 802.11n (HT20))

(Channel 11, 802.11n (HT20))

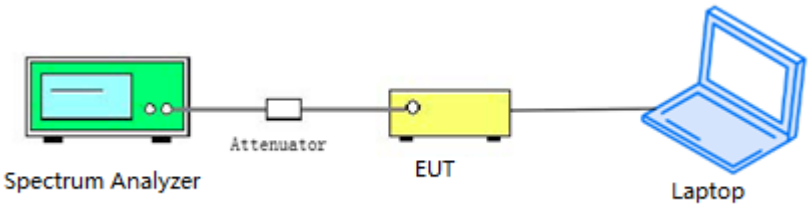
2.5. Conducted Spurious Emissions and Band Edge

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.

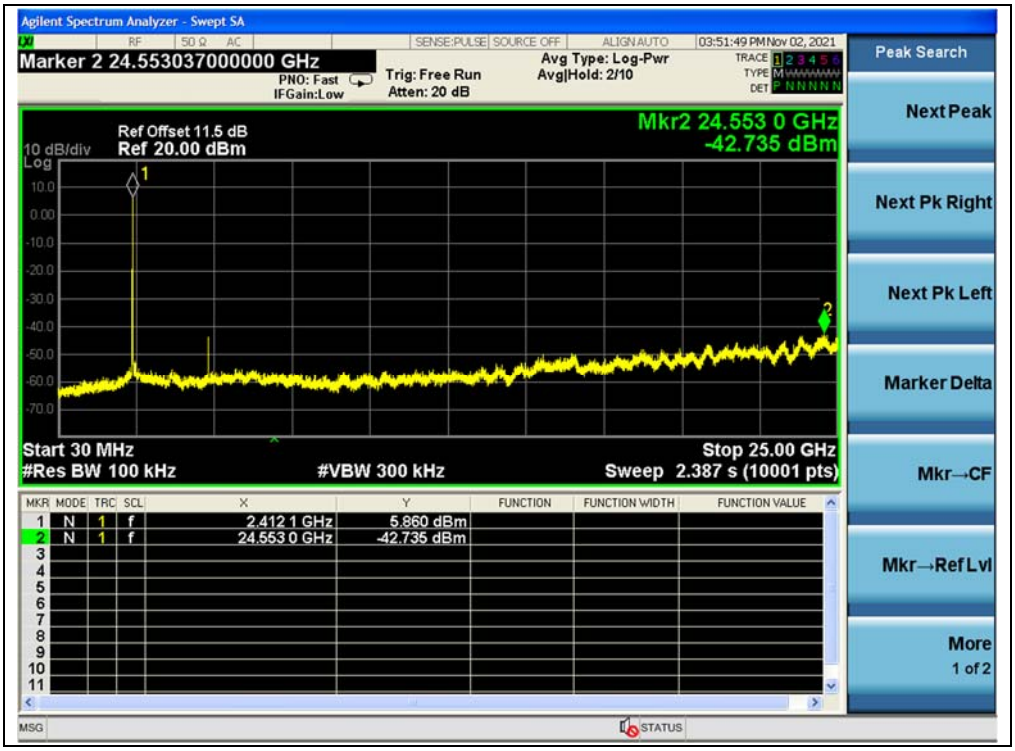
2.5.4. Test Result

802.11b Mode

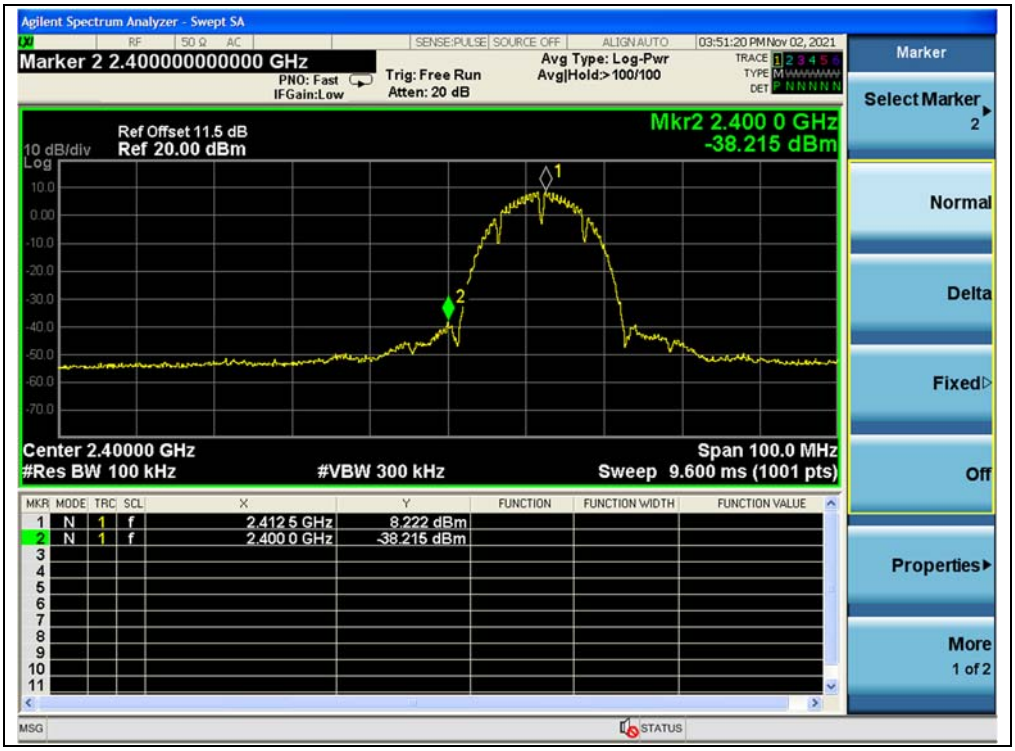
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-42.74	5.86	-14.14	PASS
6	2437	-43.25	5.98	-14.02	PASS
11	2462	-42.71	6.02	-13.98	PASS

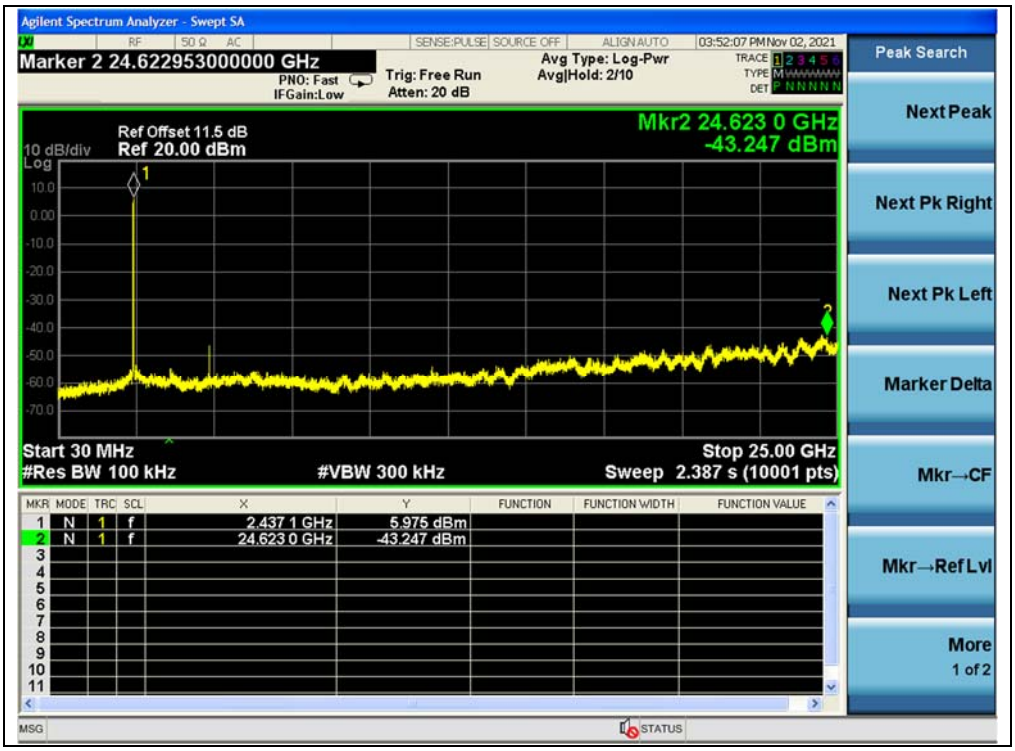
B. Test Plot:



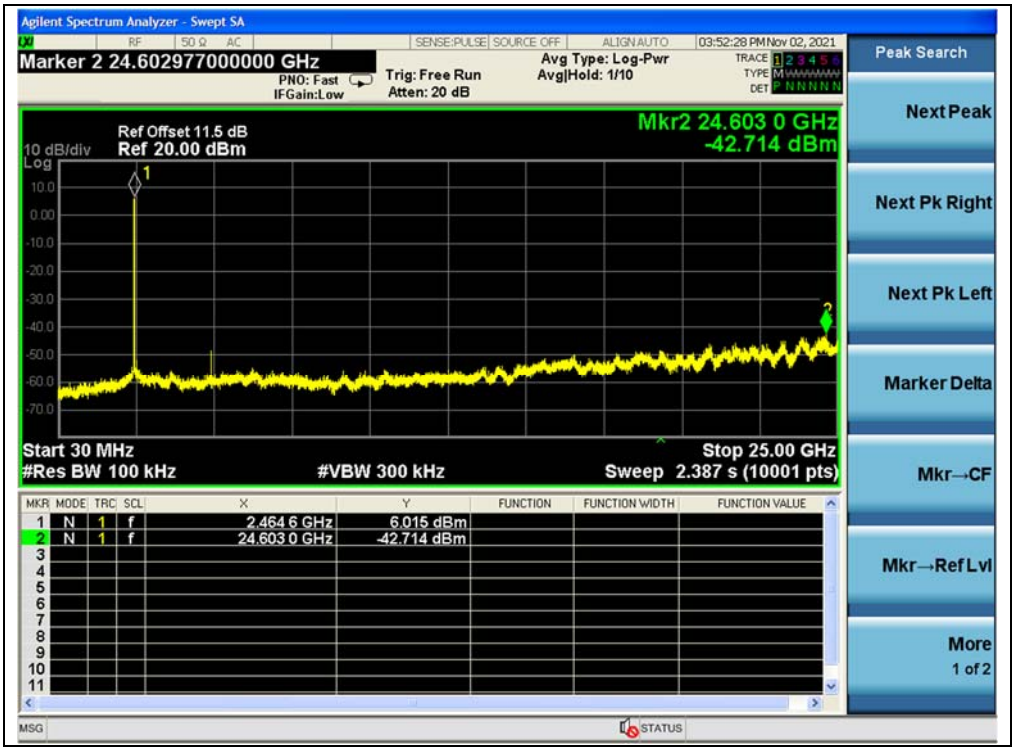
(30MHz to 25GHz, Channel 1, 802.11b)



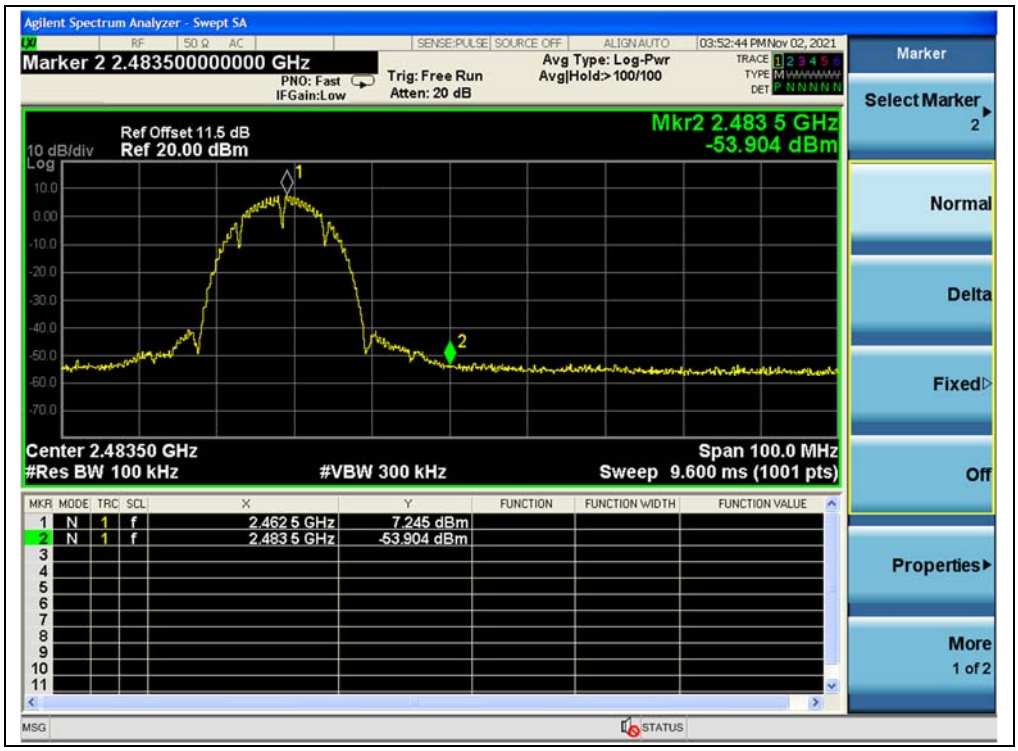
(Band Edge, Channel 1, 802.11b)



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



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



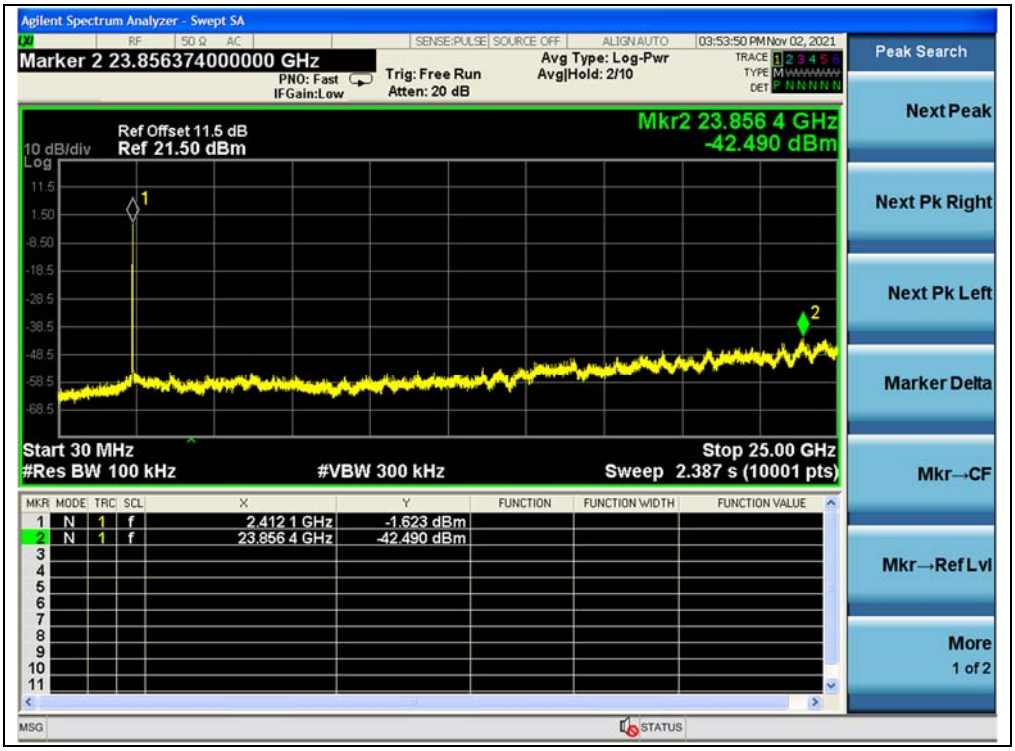
(Band Edge, Channel 11, 802.11b)

802.11g Mode

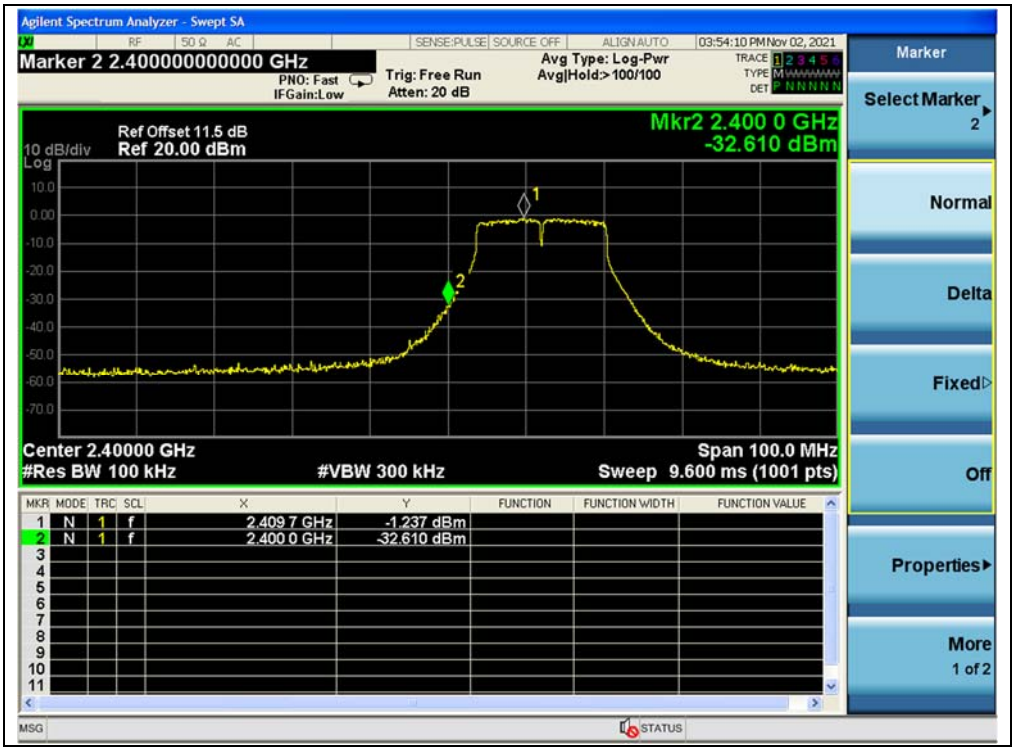
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-42.49	-1.62	-21.62	PASS
6	2437	-42.48	-2.00	-22.00	PASS
11	2462	-42.85	-1.48	-21.48	PASS

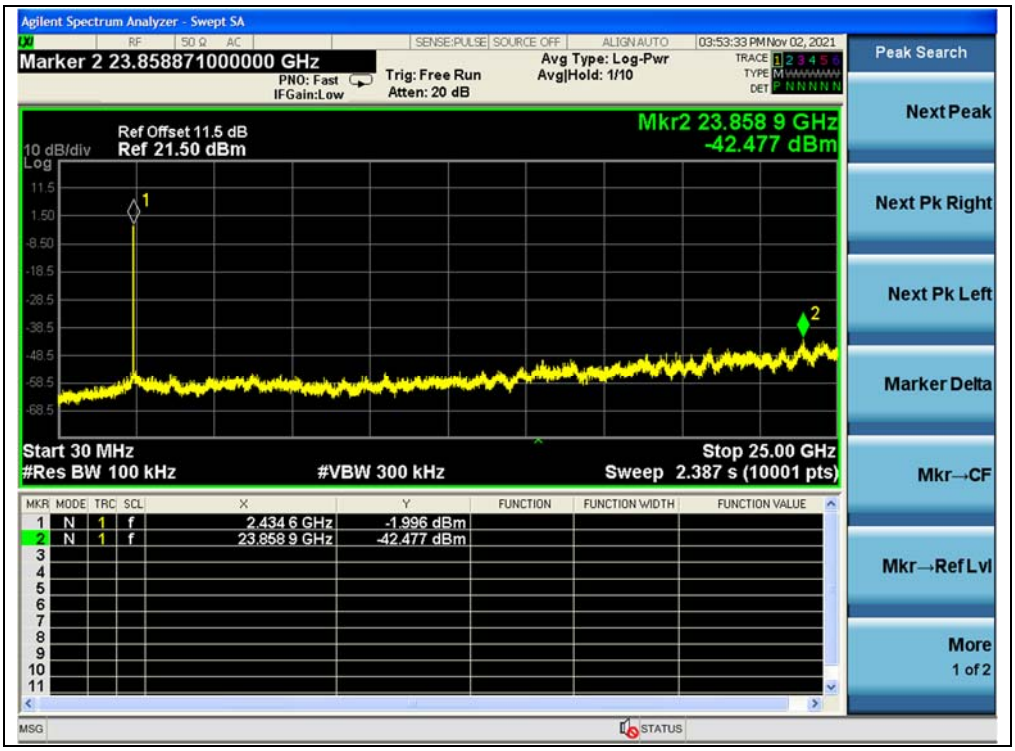
B. Test Plot:



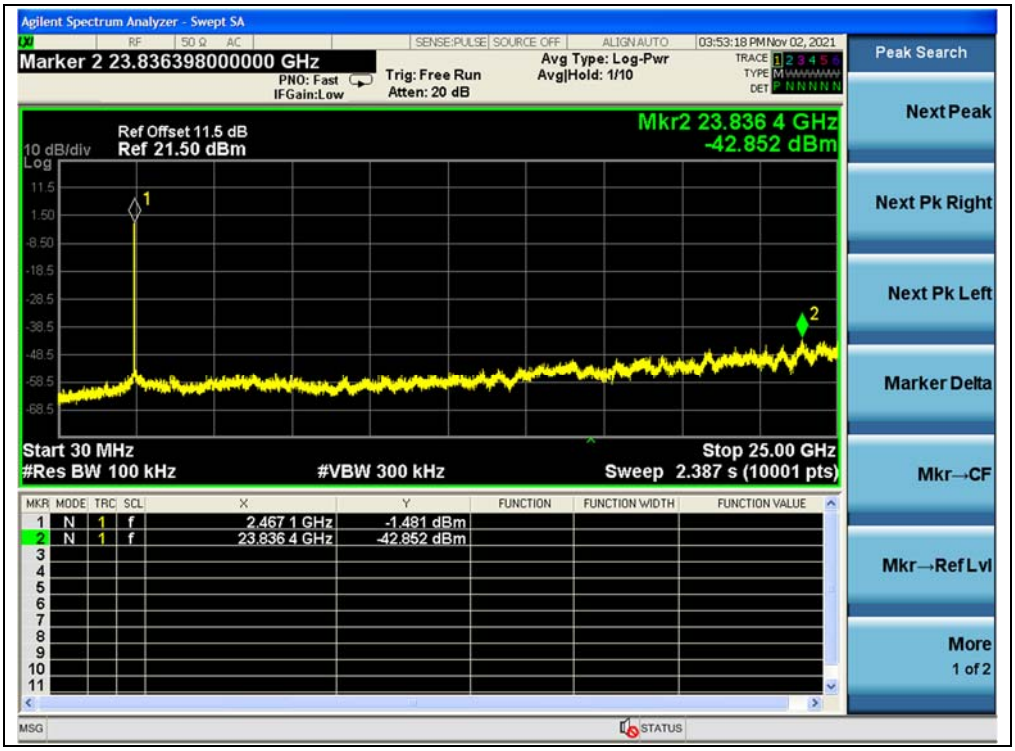
(30MHz to 25GHz, Channel 1, 802.11g)



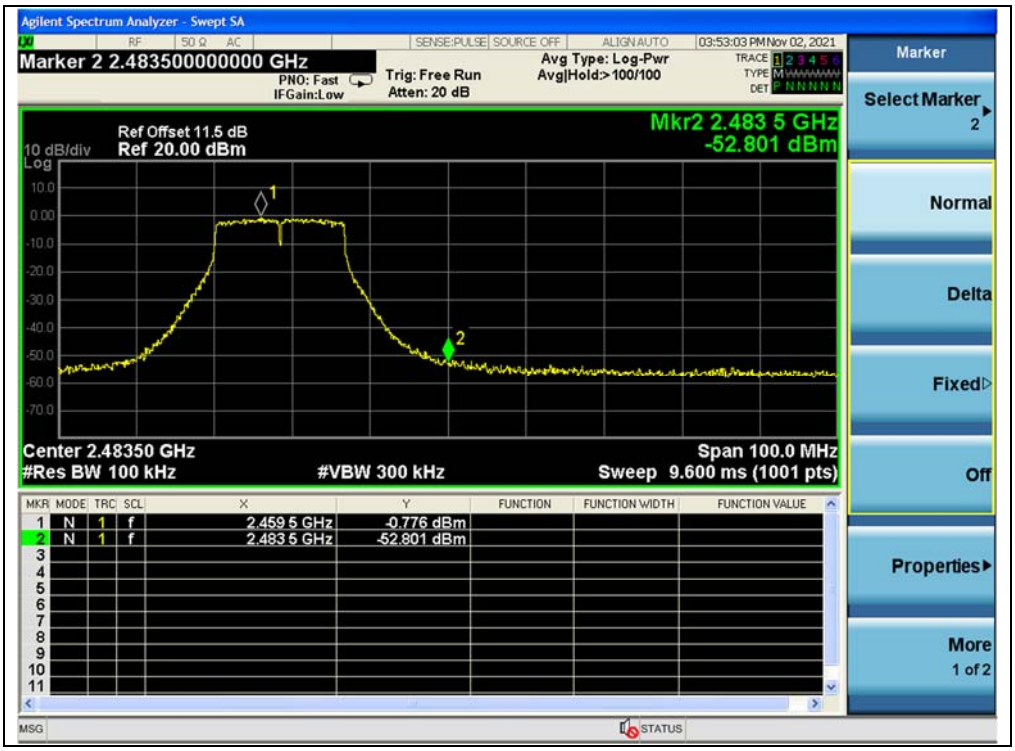
(Band Edge, Channel 1, 802.11g)



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



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



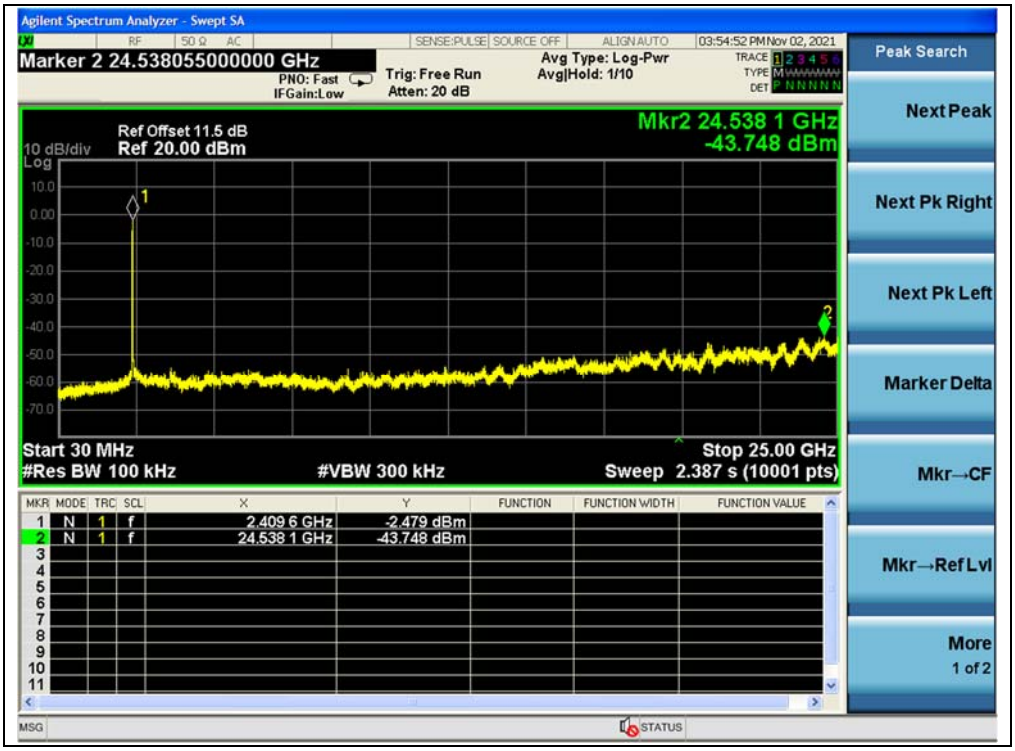
(Band Edge, Channel 11, 802.11g)

802.11n (HT20) Mode

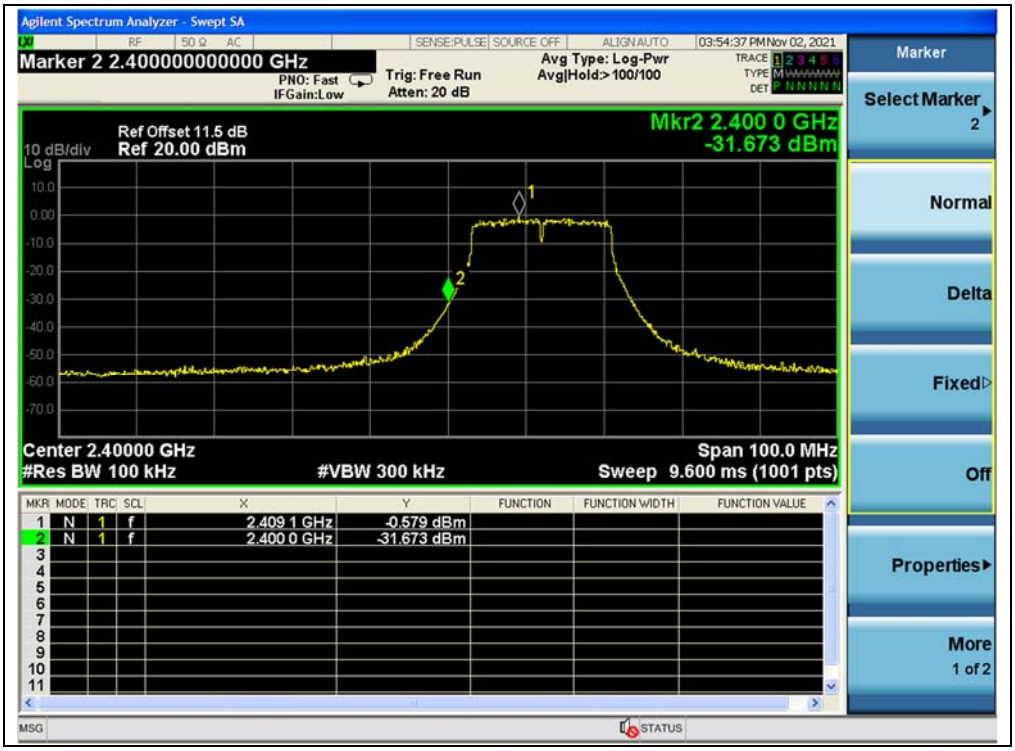
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-43.75	-2.48	-22.48	PASS
6	2437	-43.51	-2.15	-22.15	PASS
11	2462	-43.57	-1.47	-21.47	PASS

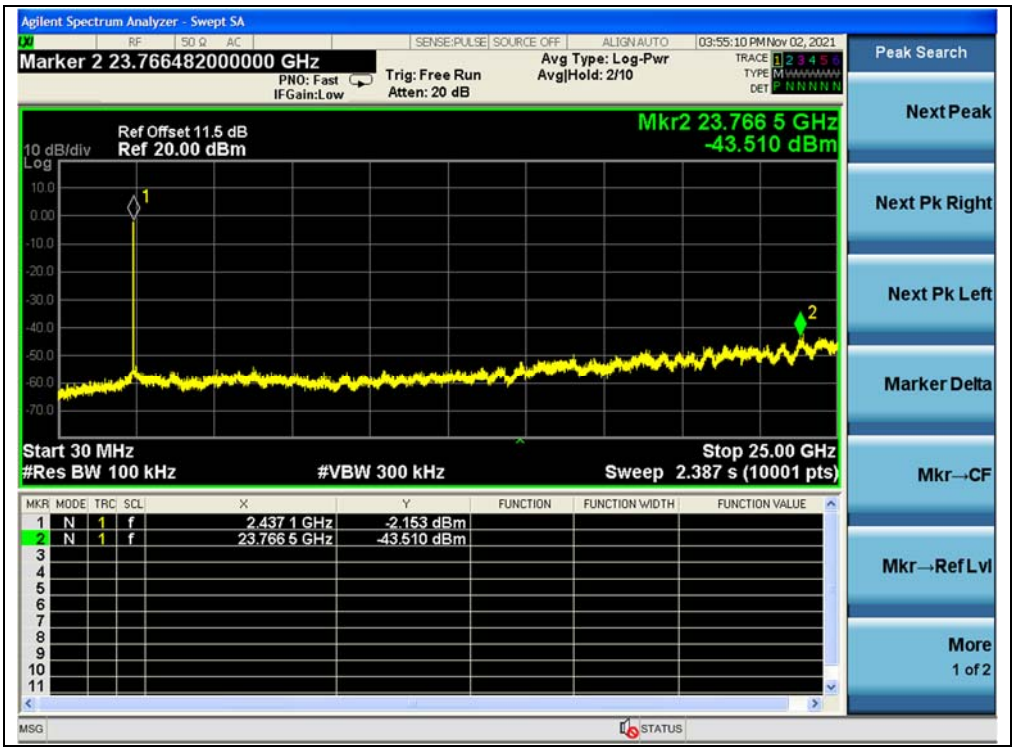
B. Test Plot:



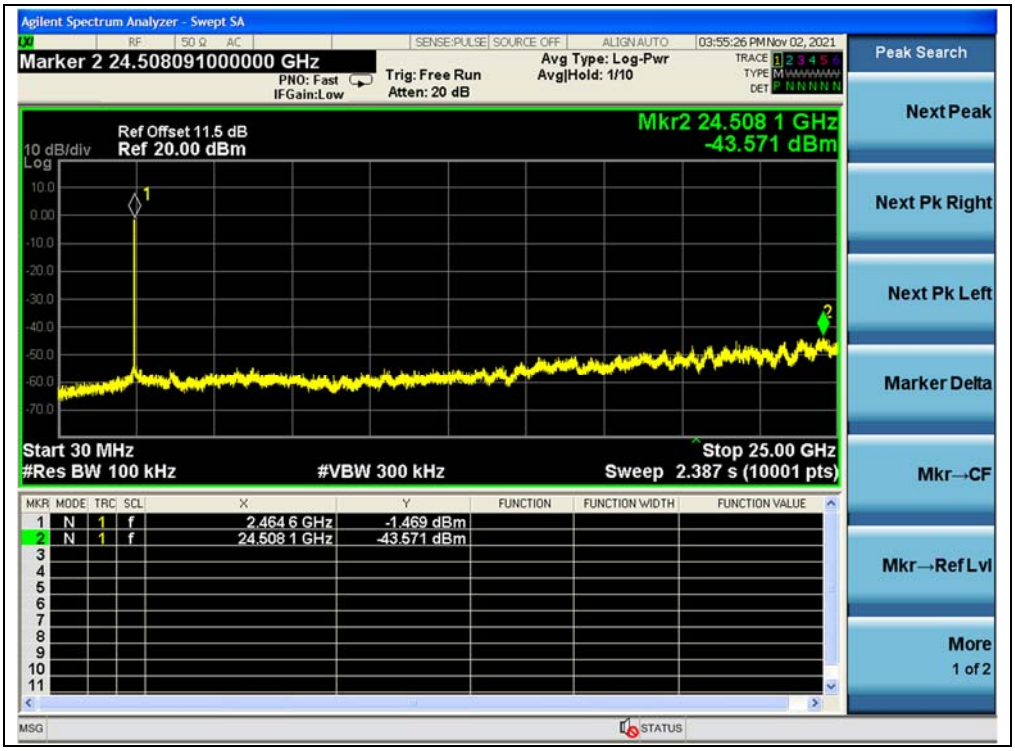
(30MHz to 25GHz, Channel 1, 802.11n (HT20))



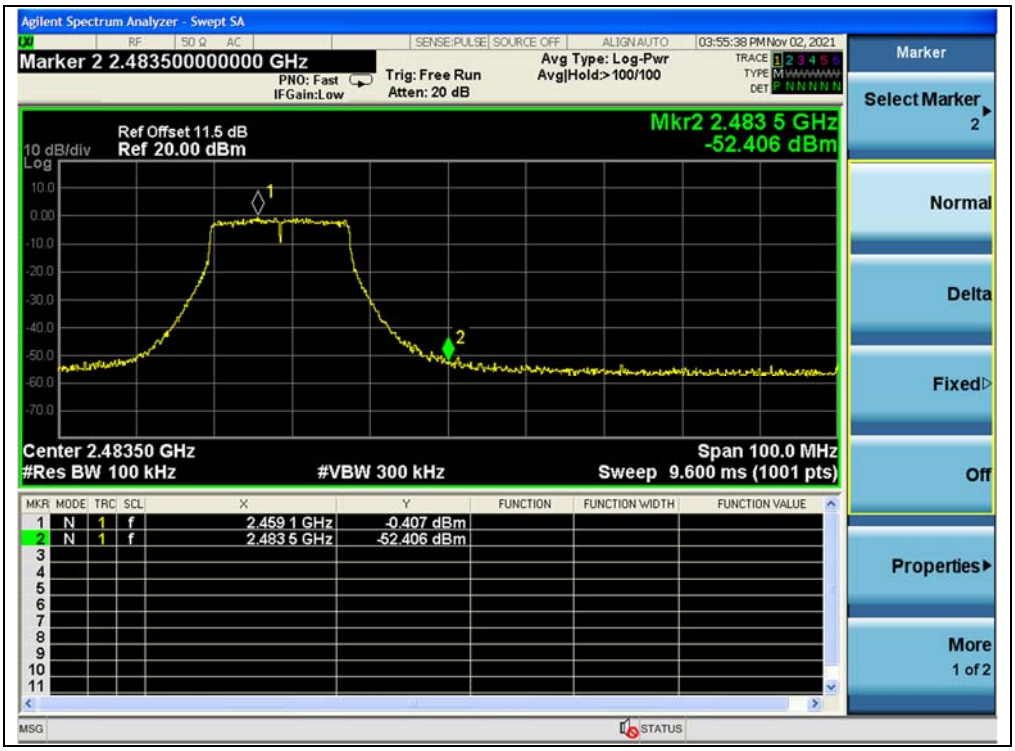
(Band Edge, Channel 1, 802.11n (HT20))



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



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



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

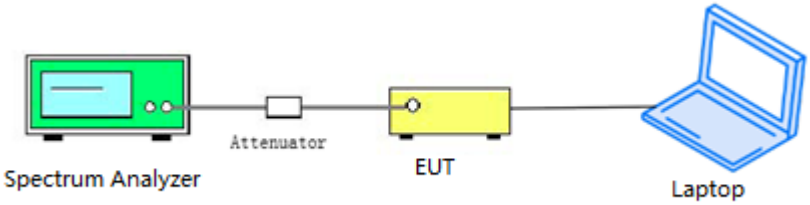
2.6. Power Spectral Density

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	-11.98	8	PASS
6	2437	-11.83	8	PASS
11	2462	-11.68	8	PASS

B. Test Plot:

(Channel 1, 802.11b)

(Channel 6, 802.11b)

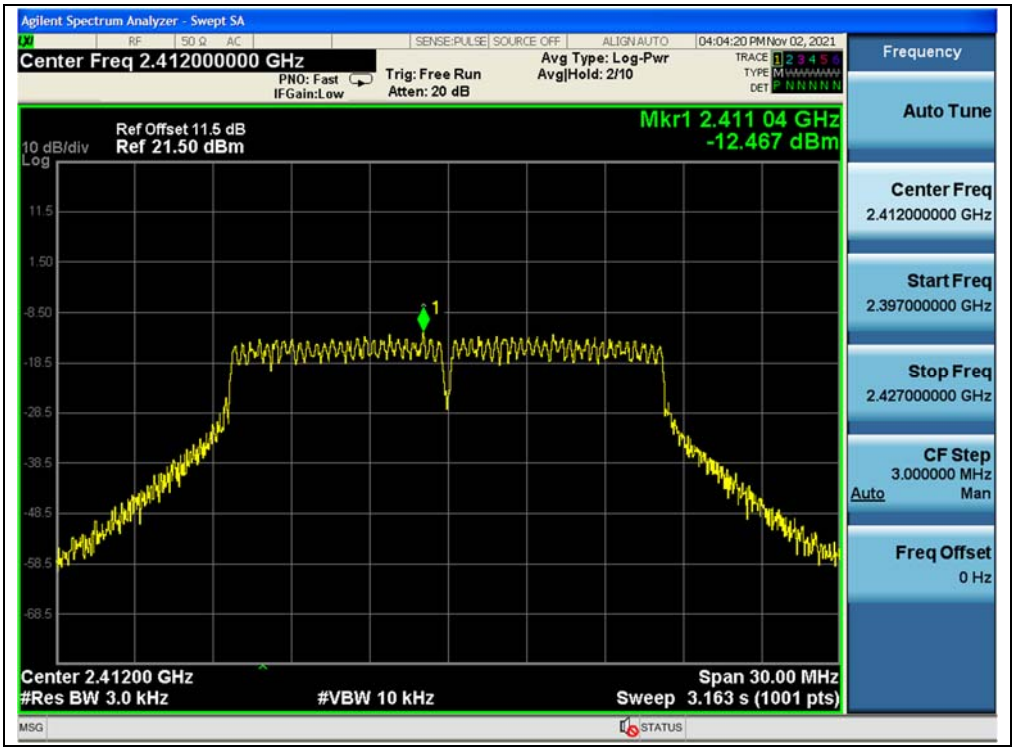
(Channel 11, 802.11b)

802.11g Mode

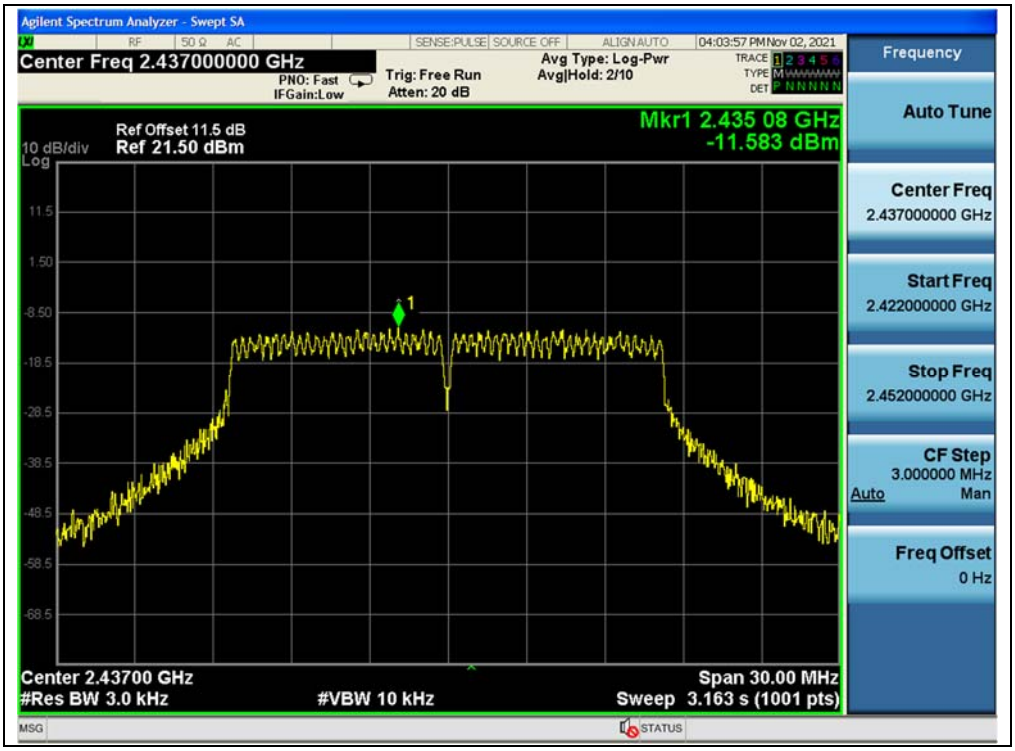
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-12.47	8	PASS
6	2437	-11.58	8	PASS
11	2462	-12.26	8	PASS

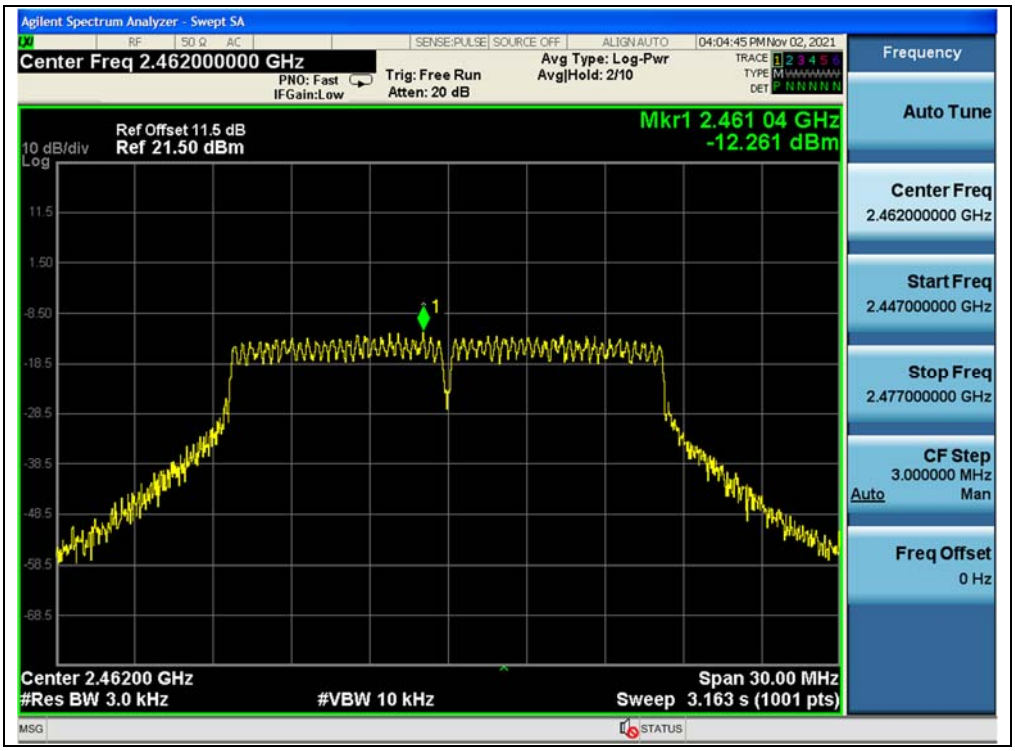
B. Test Plot:



(Channel 1, 802.11g)



(Channel 6, 802.11g)



(Channel 11, 802.11g)

802.11n (HT20) Mode

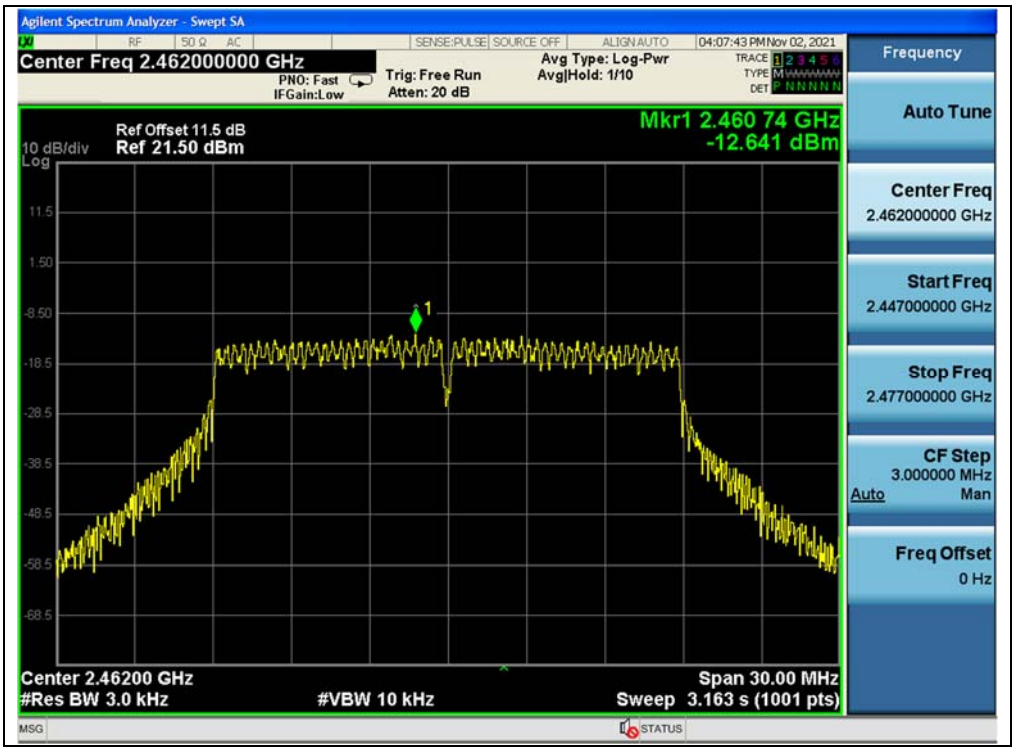
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-14.87	8	PASS
6	2437	-12.80	8	PASS
11	2462	-12.64	8	PASS

B. Test Plot:

(Channel 1, 802.11n (HT20))

(Channel 6, 802.11n (HT20))



(Channel 11, 802.11n (HT20))

2.7. Conducted Emission

2.7.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

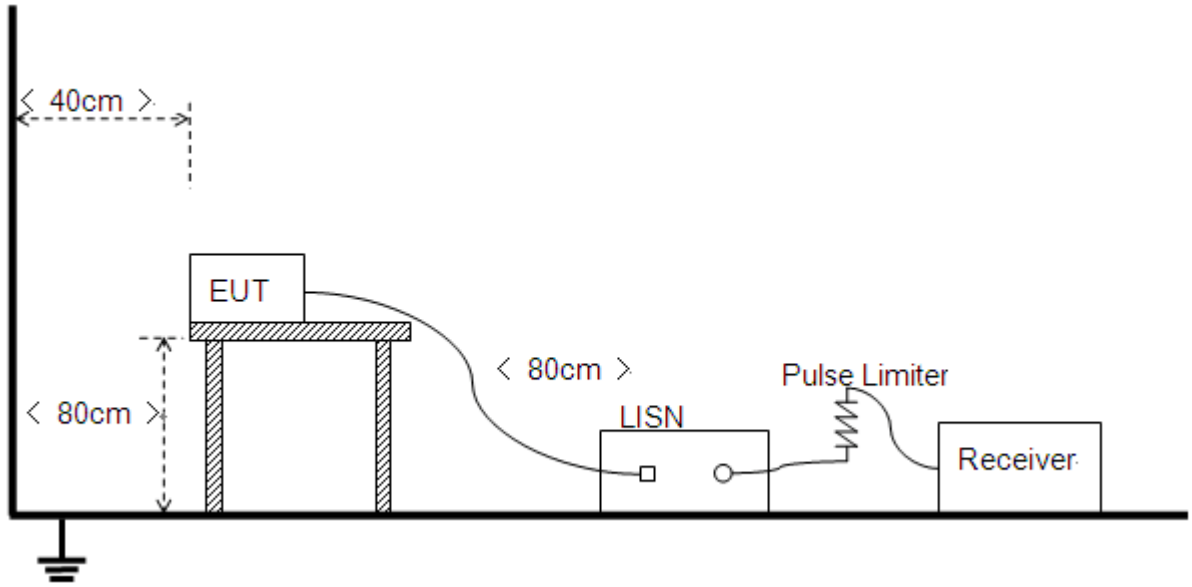
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2. Test Description

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. Set RBW=9kHz, VBW=30kHz. 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+ WIFI TX

Test Voltage: AC 120V/60Hz

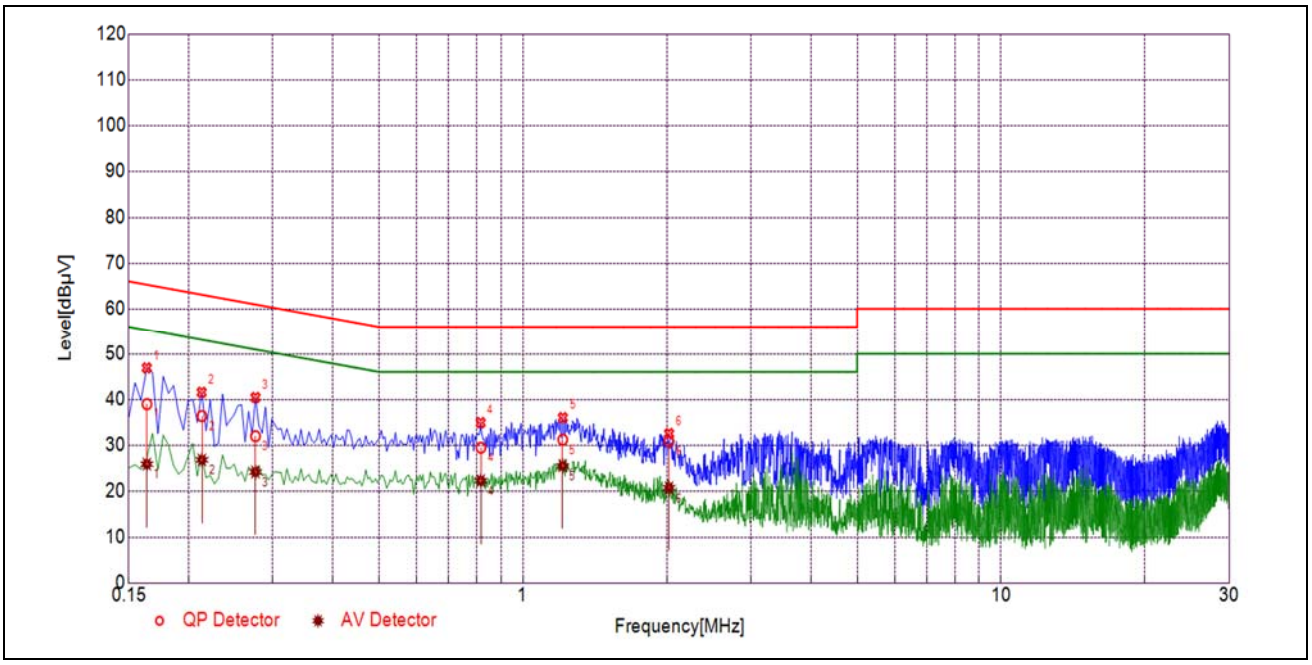
The measurement results are obtained as below:

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

U_R: Receiver Reading

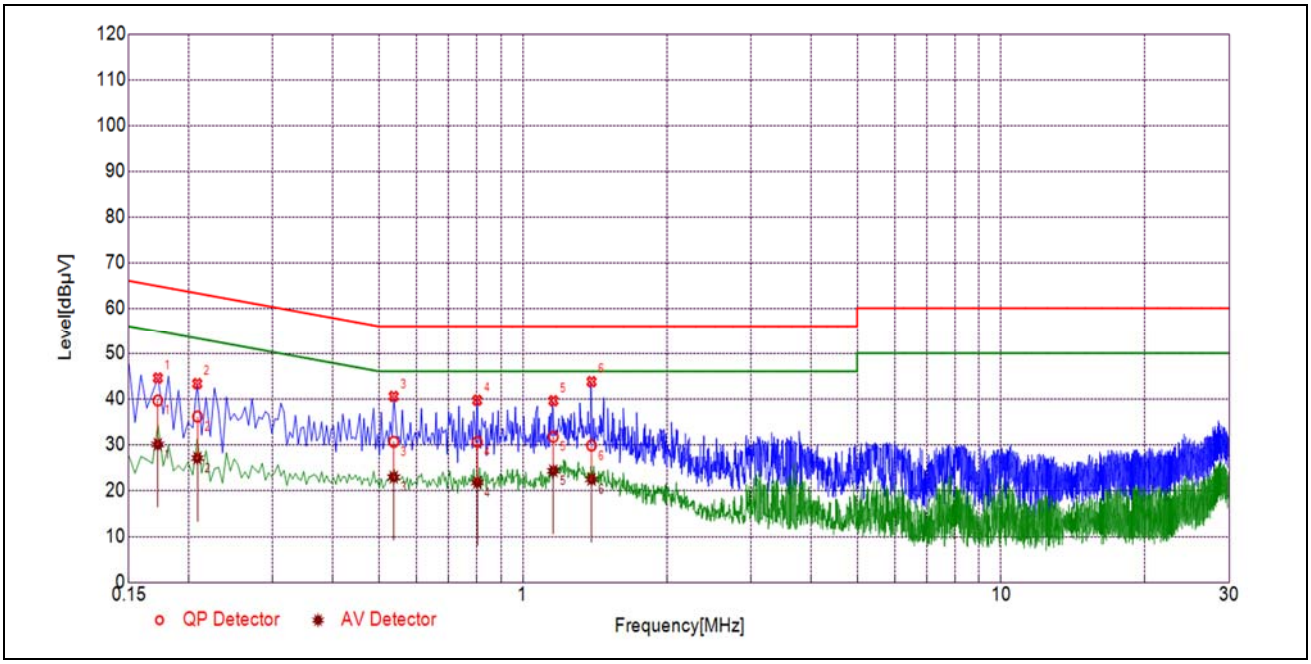
A_{Factor}: Voltage division factor of LISN

B. Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1636	38.95	25.83	65.28	55.28	Line	PASS
2	0.2132	36.35	26.75	63.08	53.08		PASS
3	0.2759	31.95	24.10	60.94	50.94		PASS
4	0.8167	29.41	22.21	56.00	46.00		PASS
5	1.2111	31.18	25.44	56.00	46.00		PASS
6	2.0210	30.80	20.67	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	0.1724	39.62	30.00	64.84	54.84	Neutral	PASS
2	0.2087	36.11	27.02	63.26	53.26		PASS
3	0.5370	30.56	22.84	56.00	46.00		PASS
4	0.8030	30.57	21.68	56.00	46.00		PASS
5	1.1579	31.68	24.24	56.00	46.00		PASS
6	1.3915	29.77	22.36	56.00	46.00		PASS

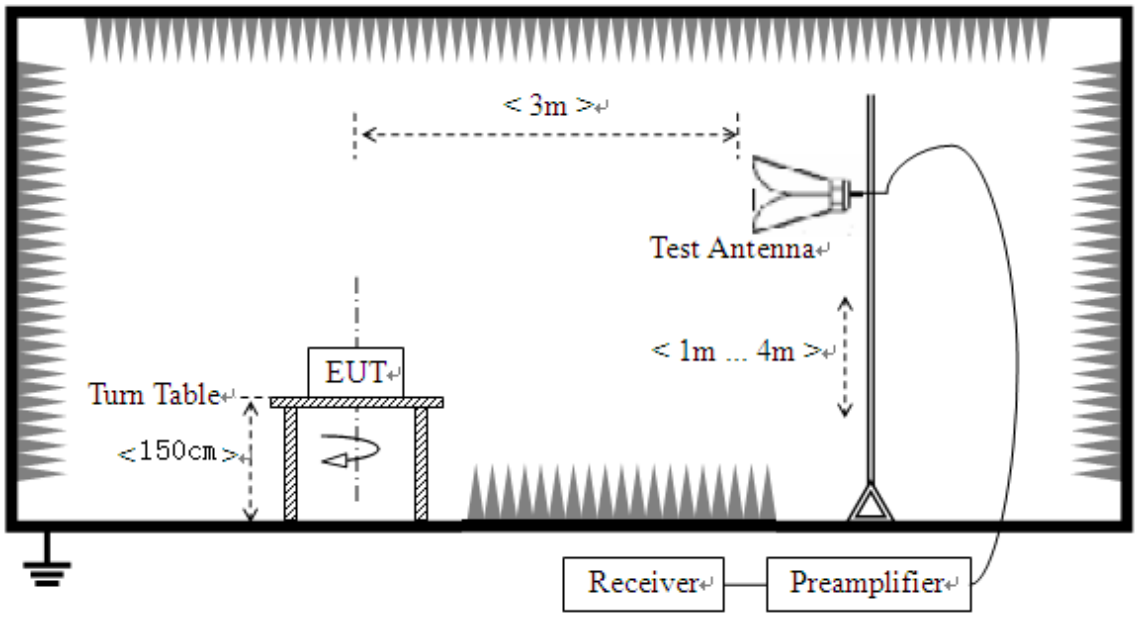
2.8. Restricted Frequency Bands

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

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1GHz
VBW = 3 MHz
Sweep = auto
Detector function = peak/average
Trace = max hold

Allow the trace to stabilize

2.8.4. Test Result

The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

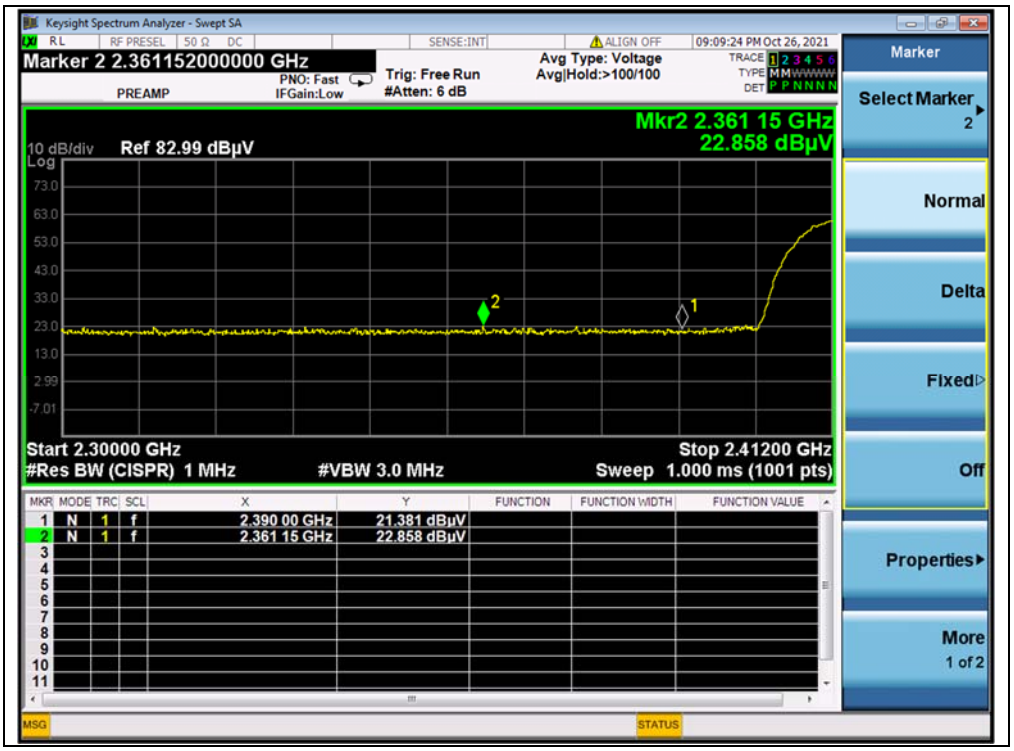
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

802.11b Mode

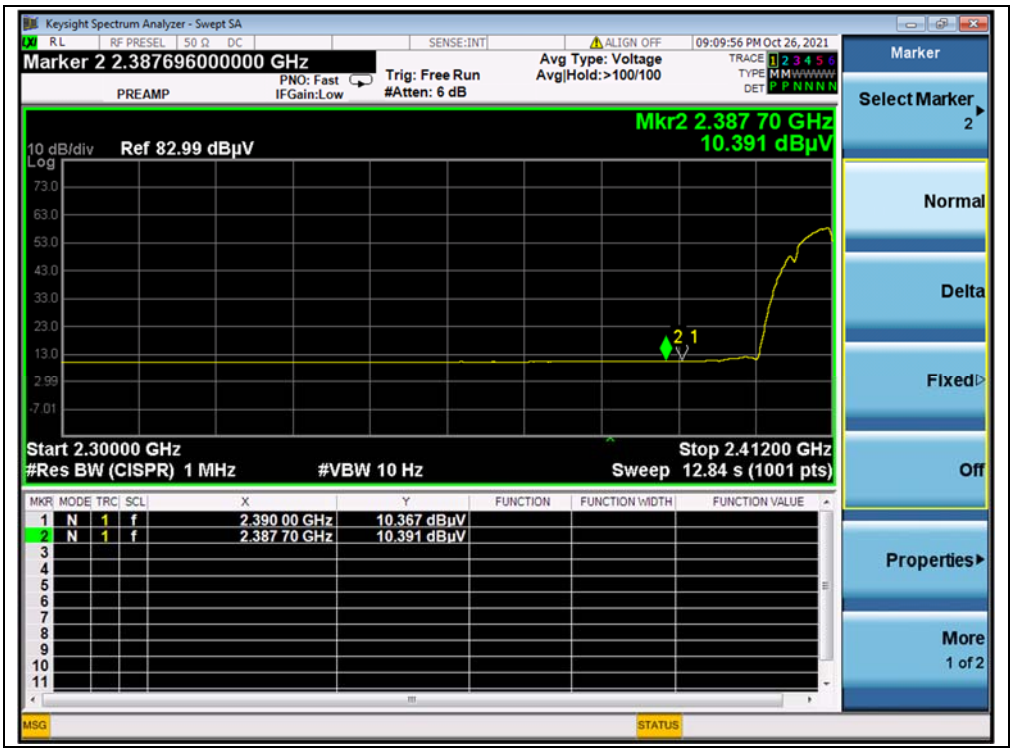
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2361.15	PK	22.86	6.74	27.20	56.80	74	PASS
1	2387.70	AV	10.39	6.74	27.20	44.33	54	PASS
11	2487.65	PK	22.84	6.74	27.20	56.78	74	PASS
11	2483.50	AV	10.12	6.74	27.20	44.06	54	PASS

B. Test Plot:



(PEAK, Channel 1, 802.11b)



(AVERAGE, Channel 1, 802.11b)

(PEAK, Channel 11, 802.11b)

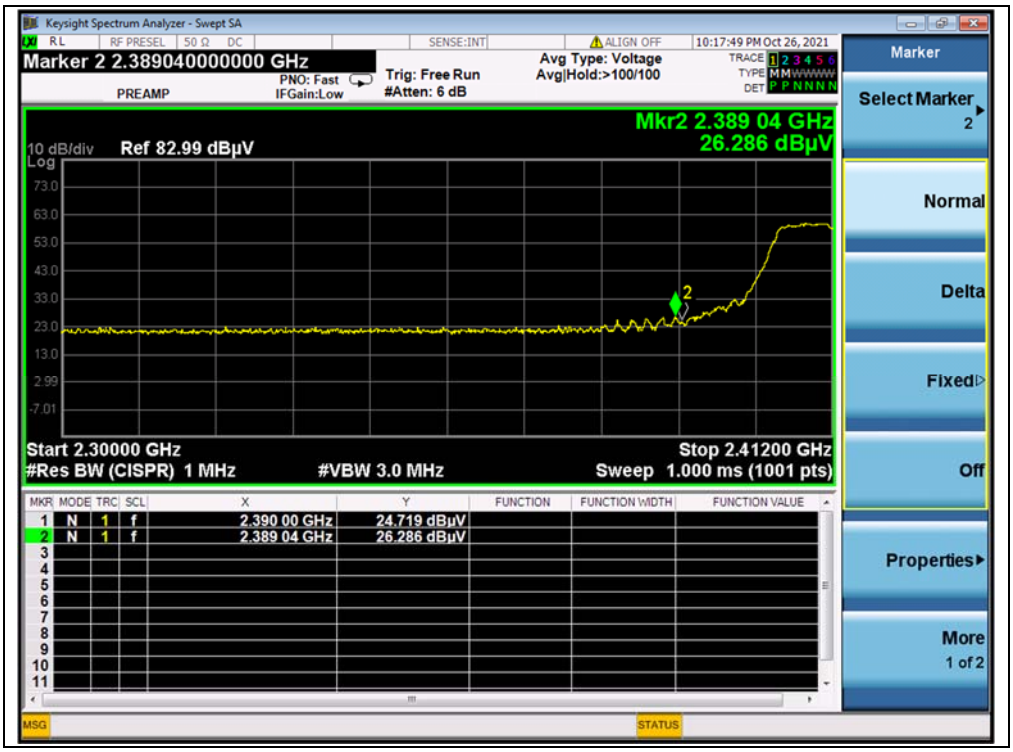
(AVERAGE, Channel 11, 802.11b)

802.11g Mode

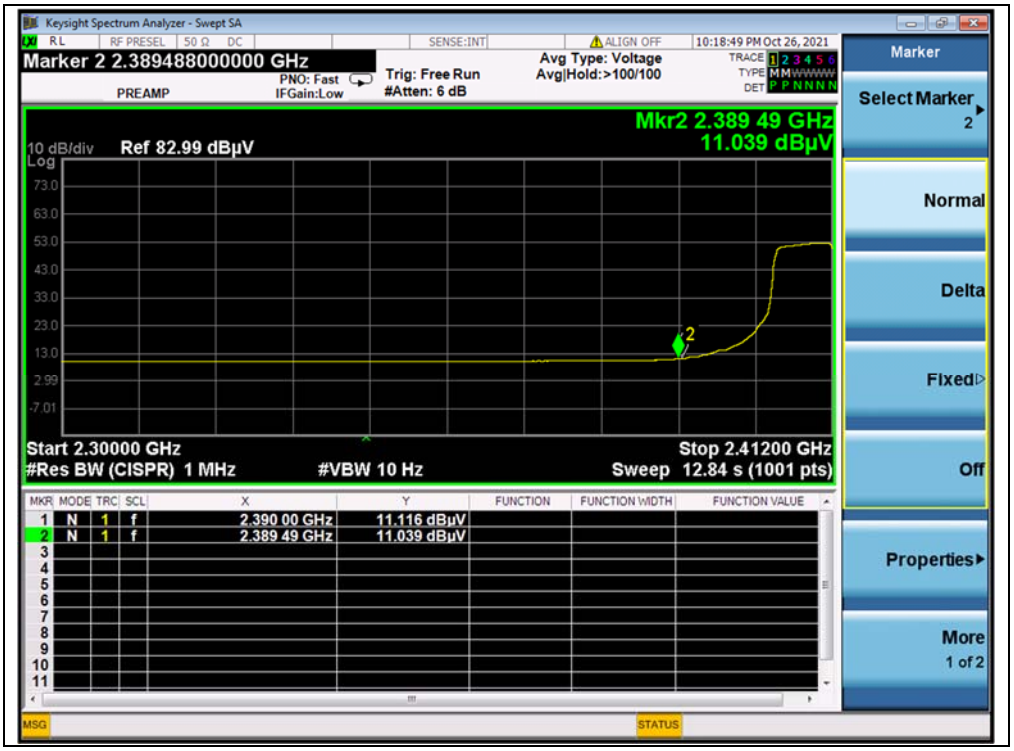
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2389.04	PK	26.29	6.74	27.20	60.23	74	PASS
1	2390.00	AV	11.12	6.74	27.20	45.06	54	PASS
11	2483.74	PK	24.87	6.74	27.20	58.81	74	PASS
11	2483.50	AV	11.74	6.74	27.20	45.68	54	PASS

B. Test Plot:

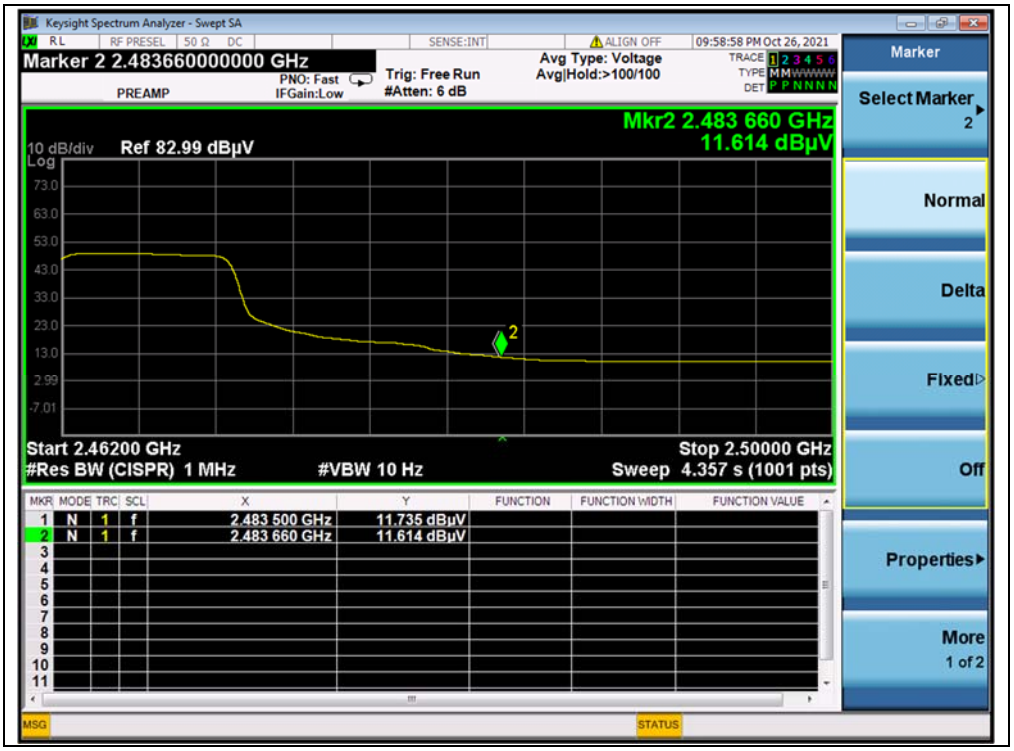


(PEAK, Channel 1, 802.11g)



(AVERAGE, Channel 1, 802.11g)

(PEAK, Channel 11, 802.11g)



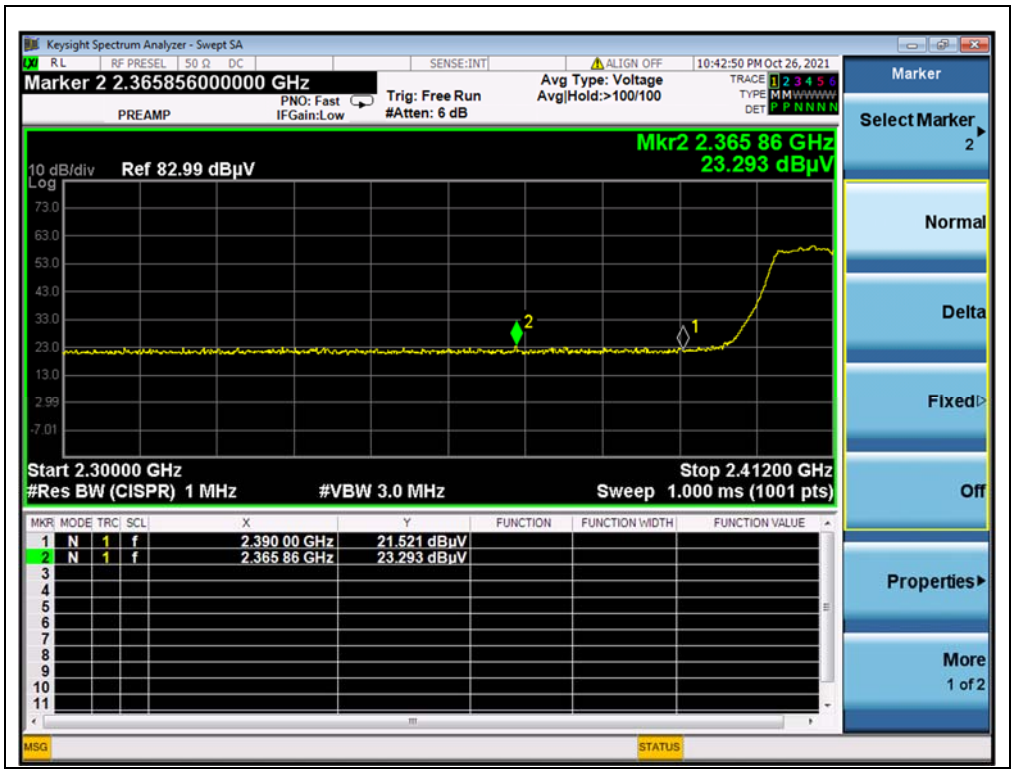
(AVERAGE, Channel 11, 802.11g)

802.11n (HT20) Mode

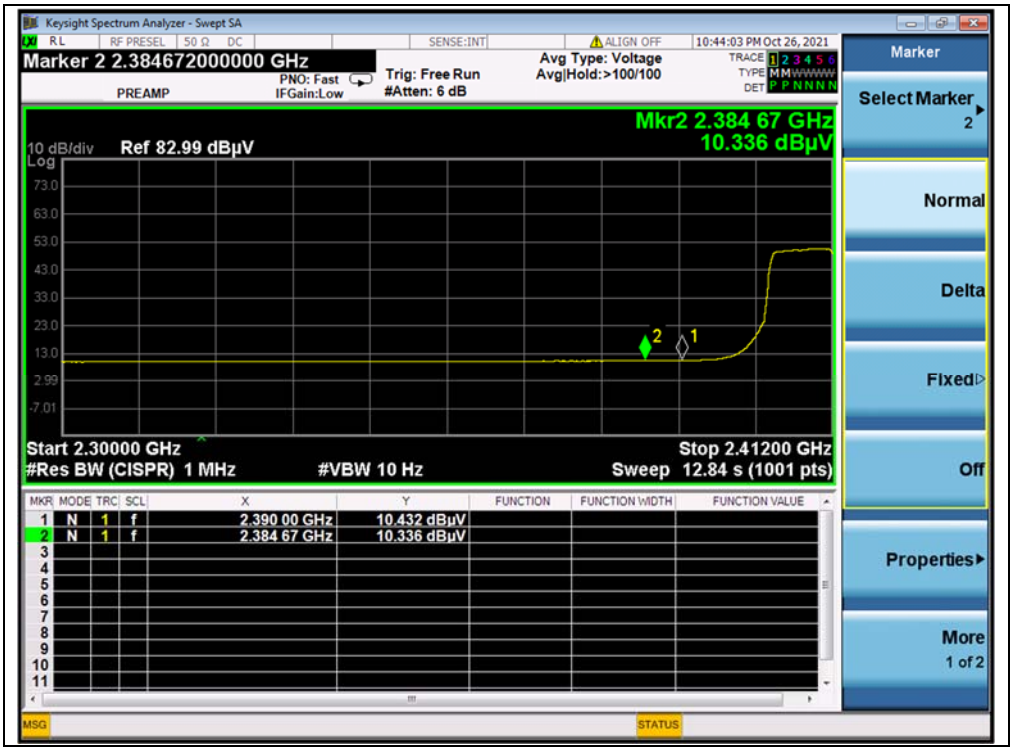
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2365.86	PK	23.29	6.74	27.20	57.23	74	PASS
1	2390.00	AV	10.43	6.74	27.20	44.37	54	PASS
11	2483.77	PK	27.04	6.74	27.20	60.98	74	PASS
11	2483.50	AV	12.32	6.74	27.20	46.26	54	PASS

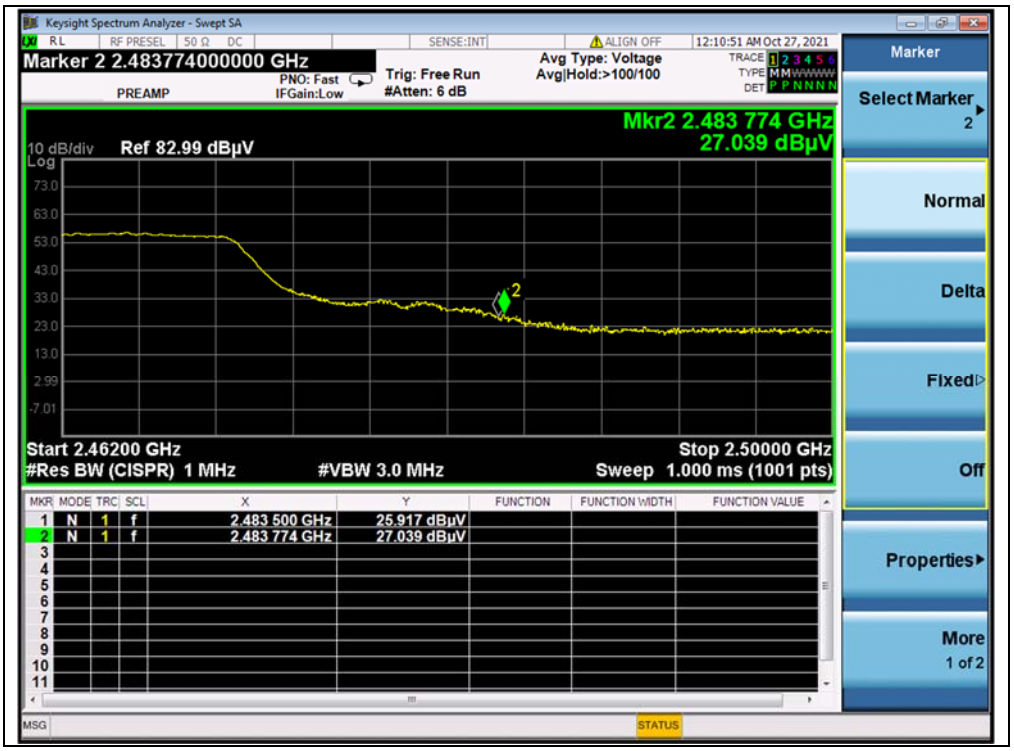
B. Test Plot:



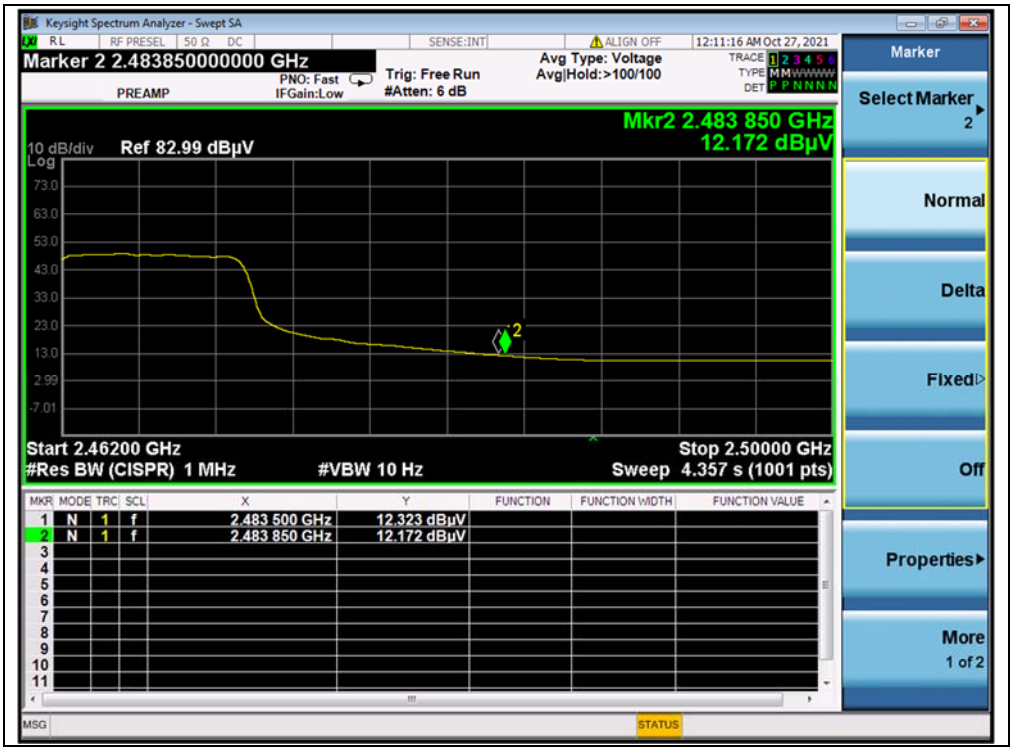
(PEAK, Channel 1, 802.11n (HT20))



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



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



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

2.9. Radiated Emission

2.9.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

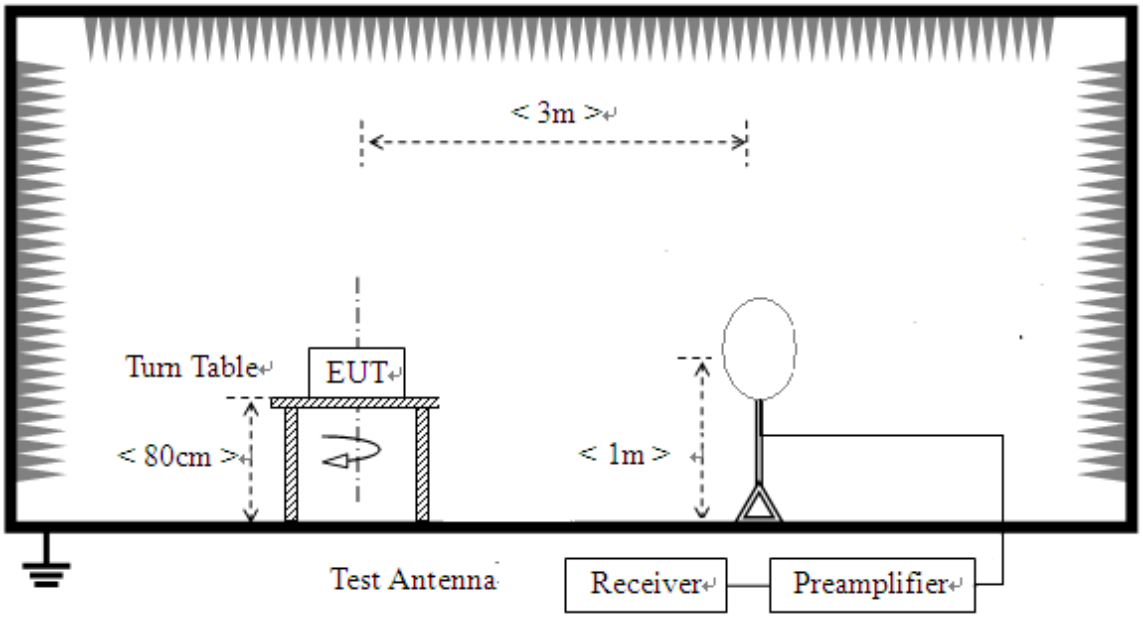
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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).

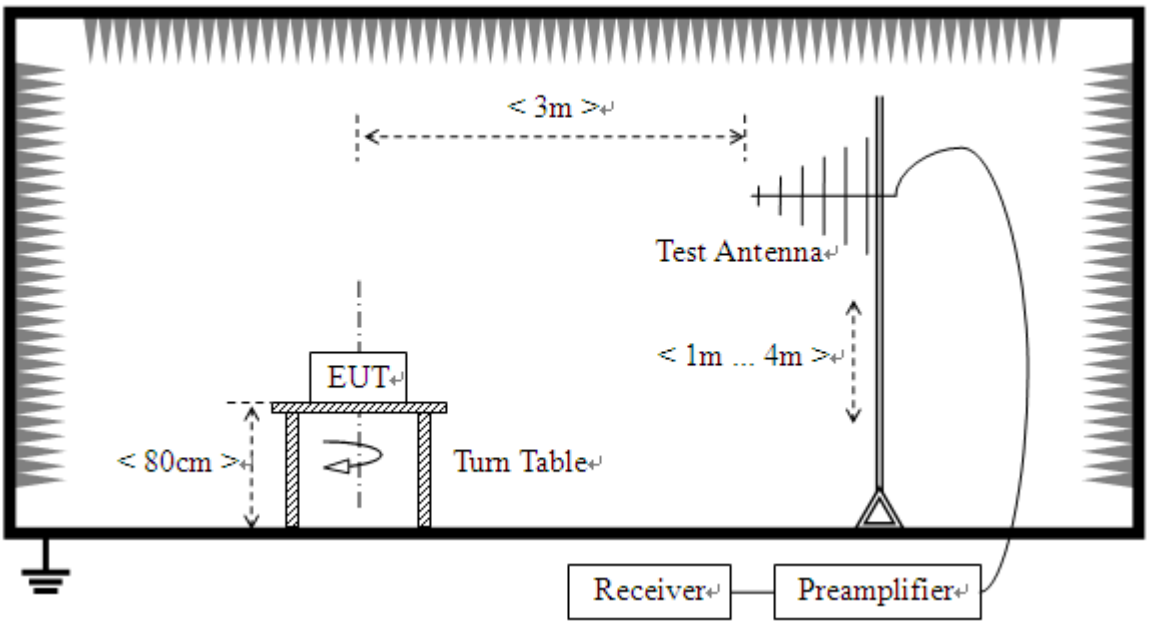
2.9.2. Test Description

Test Setup:

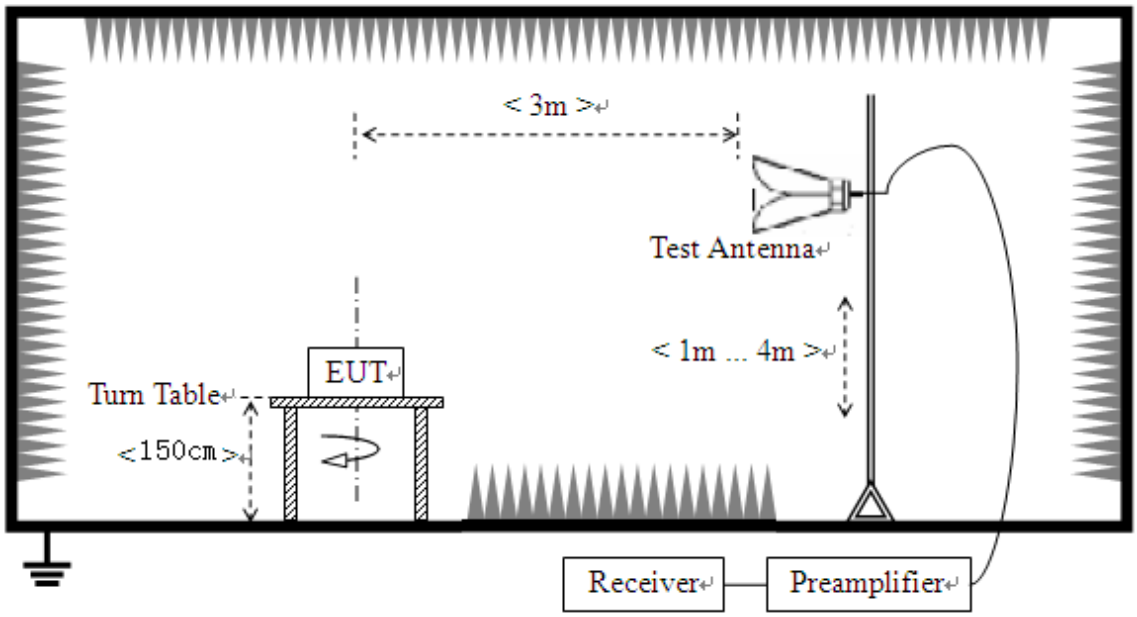
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz.The antenna to EUT distance is 3meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video band width is set to 3MHz for peak measurements and as applicable for average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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 (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).

The measurement results are obtained as below:

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

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

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

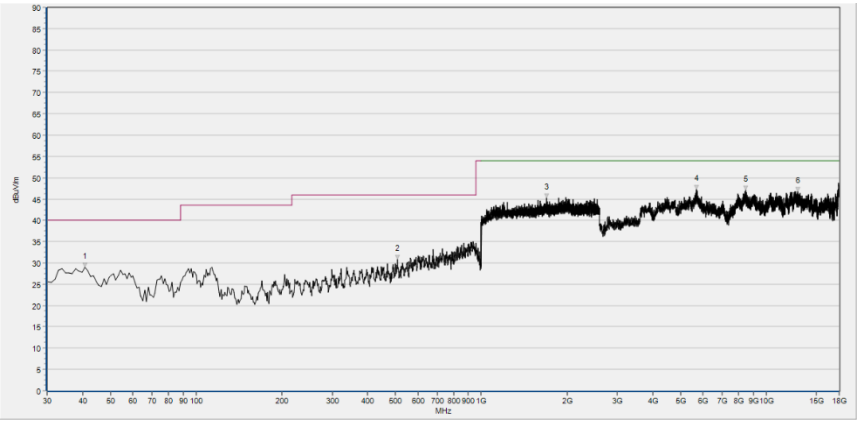
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note2: For the frequency, which started from 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.

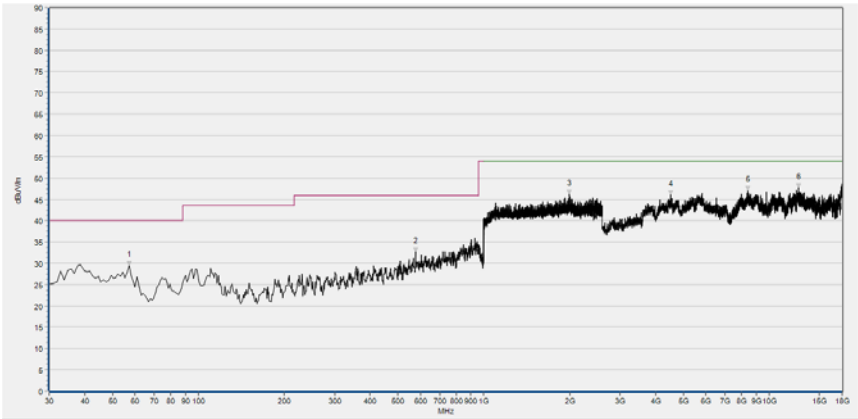
802.11b Mode

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
40.670	29.03	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
508.210	30.80	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1691.733	45.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5670.760	47.25	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8448.920	47.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12911.840	46.80	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

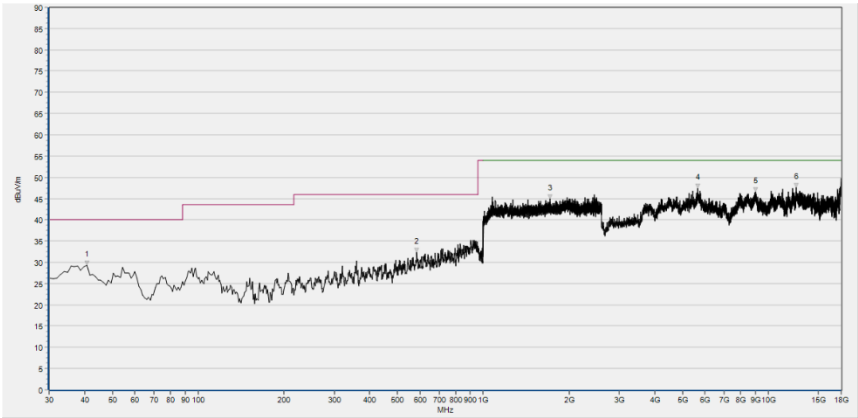
(Antenna Horizontal, 30MHz to 18GHz)



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
57.160	29.43	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
576.110	32.69	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1996.800	46.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4506.520	46.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8415.040	47.16	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12687.000	47.71	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

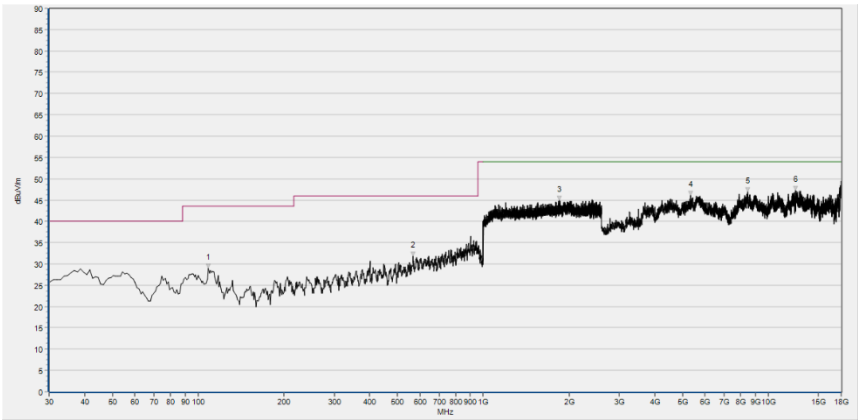
(Antenna Vertical, 30MHz to 18GHz)

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
40.670	29.29	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
584.840	32.27	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1712.000	44.90	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5639.960	47.42	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9006.400	46.59	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12517.600	47.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

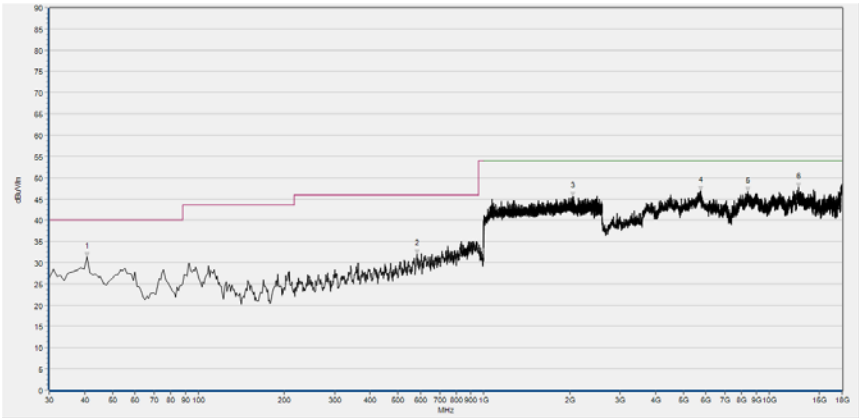
(Antenna Horizontal, 30MHz to 18GHz)



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
108.570	28.94	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
566.410	31.77	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1848.000	44.96	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5328.880	46.06	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8476.640	46.92	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12477.560	47.19	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

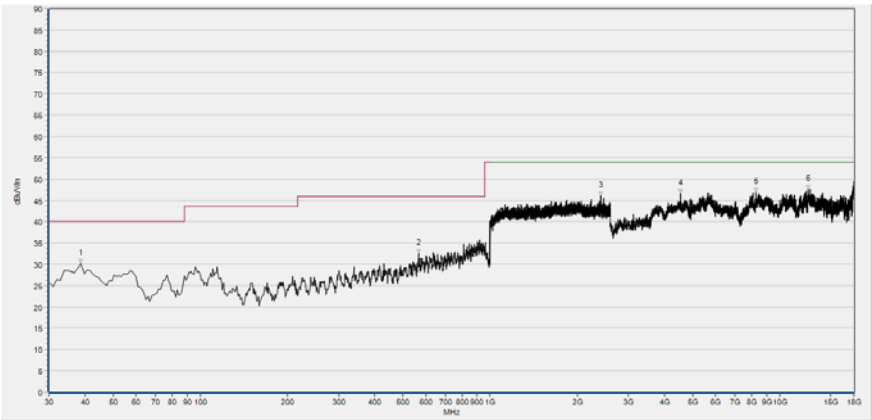
(Antenna Vertical, 30MHz to 18GHz)

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
40.670	31.28	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
581.930	31.98	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2051.733	45.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5735.440	46.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8393.480	46.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12683.920	47.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

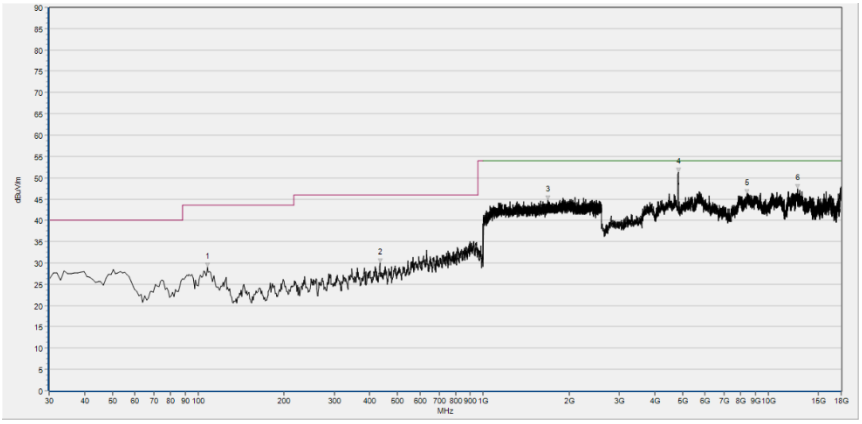


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
38.730	30.23	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
565.440	32.51	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2408.533	46.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4546.560	46.62	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8279.520	46.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12502.200	47.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

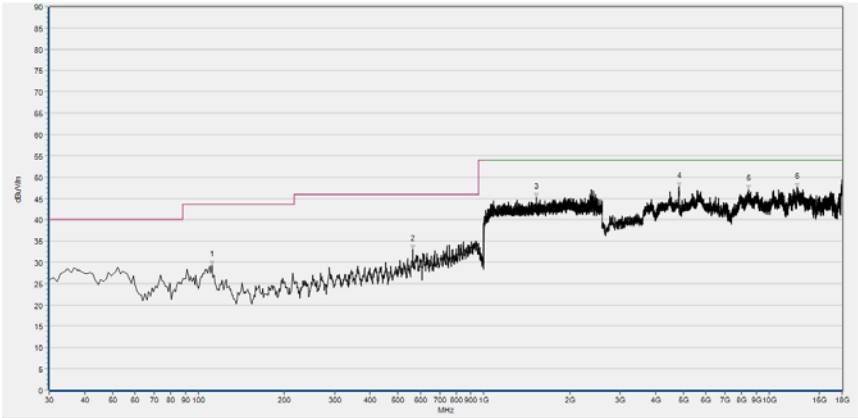
802.11g Mode

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
107.600	28.97	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
434.490	30.06	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1684.267	44.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4824.700	51.36	N/A	44.96	74.00	N/A	54.00	Horizontal	PASS
8402.720	46.22	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12674.680	47.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

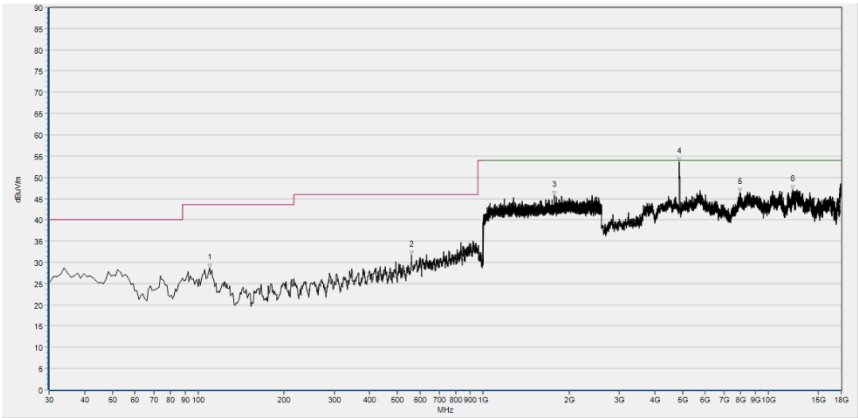
(Antenna Horizontal, 30MHz to 18GHz)



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
111.480	29.34	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
563.500	33.02	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1524.267	45.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4823.760	47.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8439.680	47.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12508.360	47.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

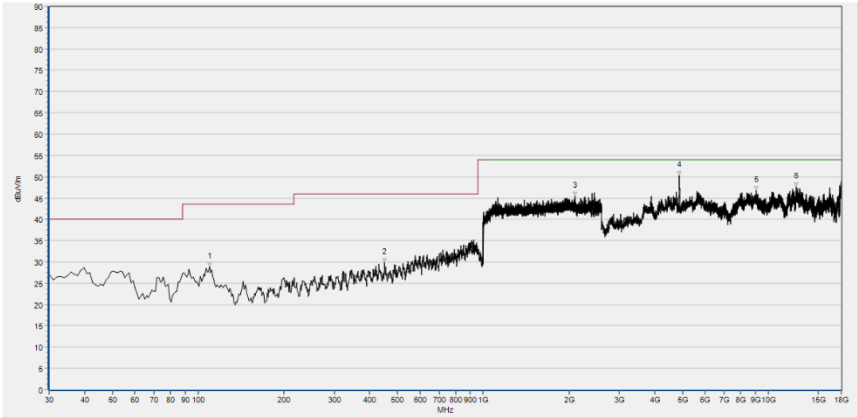
(Antenna Vertical, 30MHz to 18GHz)

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
109.540	28.68	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
560.590	31.75	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1779.733	45.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4870.300	53.64	N/A	47.25	74.00	N/A	54.00	Horizontal	PASS
7931.480	46.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12163.400	47.13	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

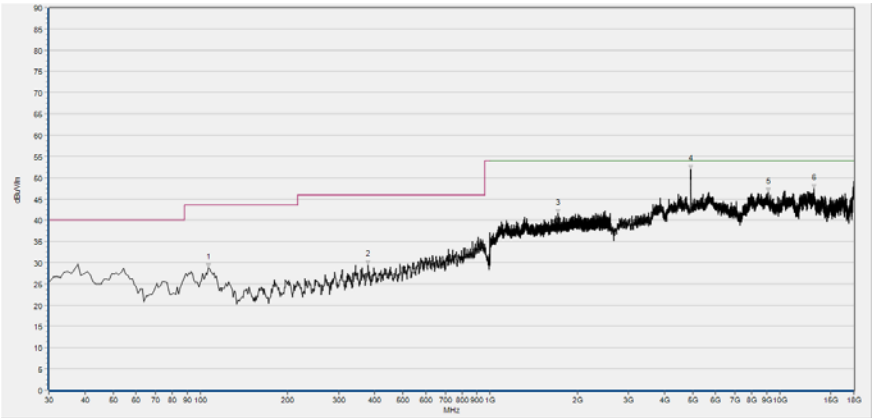
(Antenna Horizontal, 30MHz to 18GHz)



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
109.540	28.87	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
450.980	29.85	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2097.600	45.40	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4876.120	50.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9055.680	46.69	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12499.120	47.60	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

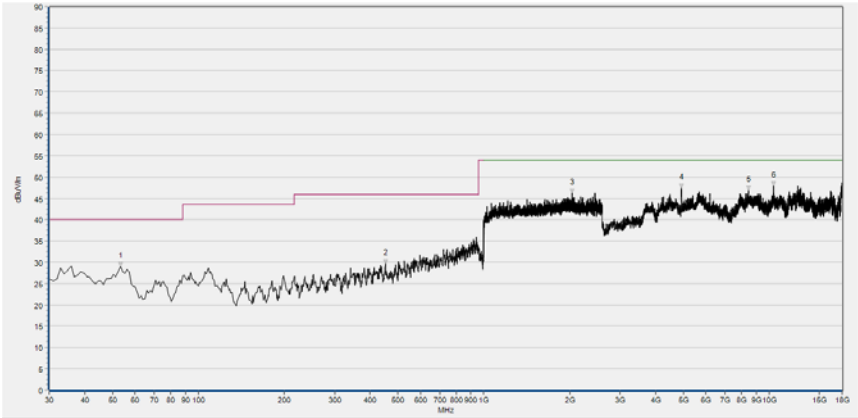
(Antenna Vertical, 30MHz to 18GHz)

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
106.630	28.89	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
379.200	29.43	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1718.933	41.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4924.700	51.97	N/A	46.48	74.00	N/A	54.00	Horizontal	PASS
9138.840	46.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13087.400	47.51	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

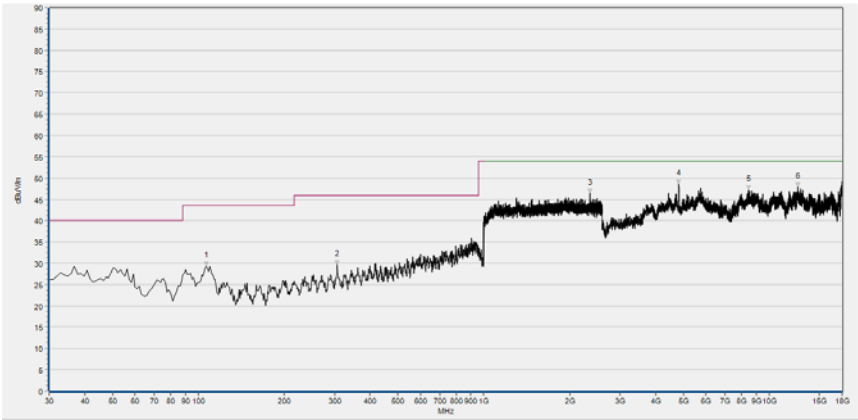


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
53.280	28.98	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
451.950	29.63	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2036.267	46.26	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4925.400	47.47	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8455.080	46.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10355.440	47.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

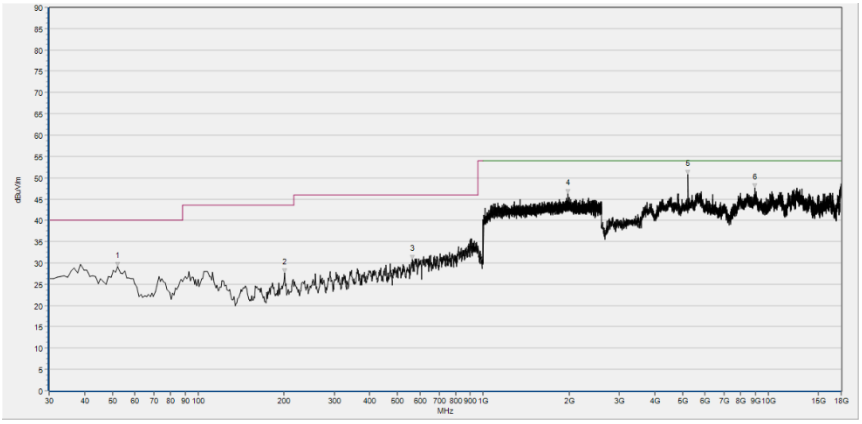
802.11n (HT20) Mode

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
106.630	29.39	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
306.450	29.64	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2352.533	46.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4820.680	48.58	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8461.240	47.25	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12597.680	48.00	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

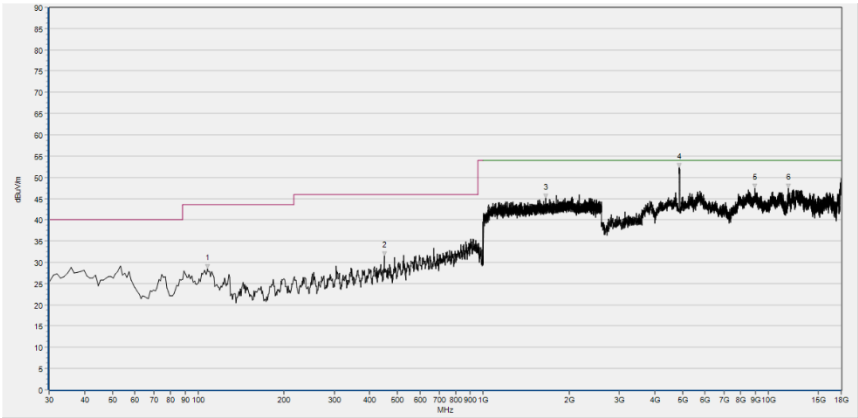
(Antenna Horizontal, 30MHz to 18GHz)



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
52.310	29.18	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
200.720	27.63	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
564.470	30.82	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1985.600	46.19	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5227.240	50.77	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8975.600	47.56	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

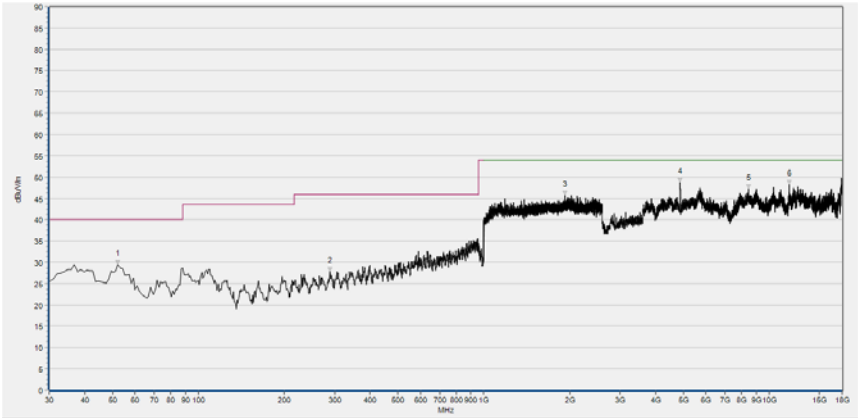
(Antenna Vertical, 30MHz to 18GHz)

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
107.600	28.46	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
449.040	31.53	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1655.467	45.05	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4871.300	52.28	N/A	43.76	74.00	N/A	54.00	Horizontal	PASS
8950.960	47.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
11735.280	47.40	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

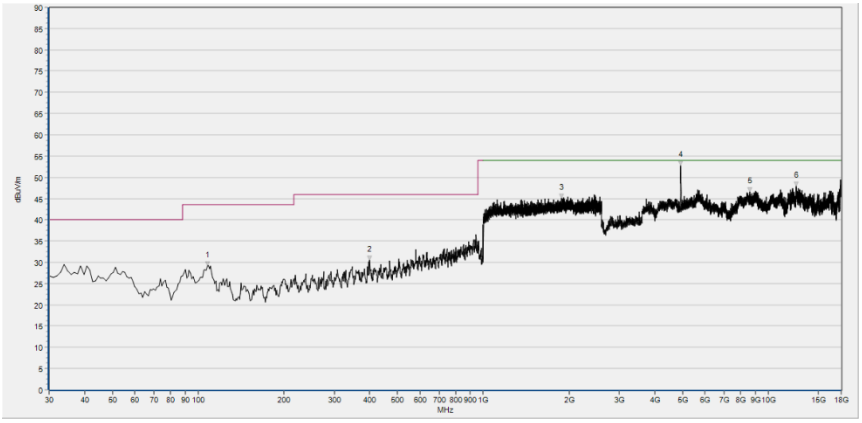
(Antenna Horizontal, 30MHz to 18GHz)



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
52.310	29.56	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
288.990	27.87	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1922.667	45.80	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4873.040	48.72	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8452.000	47.28	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
11744.520	48.35	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

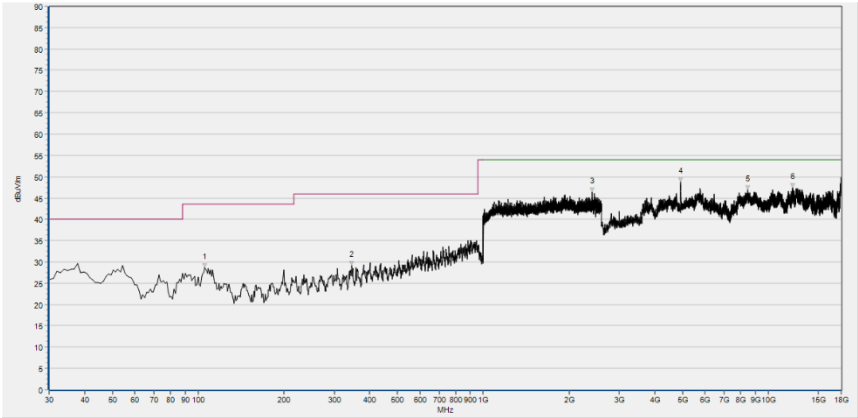
(Antenna Vertical, 30MHz to 18GHz)

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
107.600	29.14	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
399.570	30.42	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1880.000	45.05	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4922.200	52.74	N/A	46.52	74.00	N/A	54.00	Horizontal	PASS
8590.600	46.62	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12499.120	48.01	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
105.660	28.70	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
346.220	29.24	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2409.600	46.44	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4928.480	48.75	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8436.600	46.85	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12135.680	47.35	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	±2.22dB
Power Spectral Density	±2.22dB
Bandwidth	±5%
Conducted Spurious Emission	±2.77dB
Restricted Frequency Bands	±5%
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

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

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
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.
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	2021.03.25	2022.03.24
USB Wideband Power Sensor	MY54180008	U2021XA	Agilent	2021.10.21	2022.10.20
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	2021.03.09	2022.03.08
LISN	812744	NSLK 8127	Schwarzbeck	2021.03.09	2022.03.08
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2021.07.21	2022.07.20
Coaxial Cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
NOTEBOOK	DF2DR A01 DPC	VOSTRO 5370	DELL	N/A	N/A
ADAPTER	OKXTTW	LA45NM1 40	DELL	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test System	Tonscend	V2.5.77.0418
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	2021.07.15	2022.07.16
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	S020180L3203	Tonscend	2021.07.15	2022.07.16
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2021.07.15	2022.07.16
26-40GHz pre-Amplifier	56774	S40M400L4002	Tonscend	2021.07.15	2022.07.16
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2021.07.15	2022.07.16
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT