TEST REPORT

APPLICANT	:	Japan Computer Vision Corp.
PRODUCT NAME	:	SensePass Pro Face Recognition Integrated Terminal
MODEL NAME	:	SPS020-PRO-OM, SPS020-PRO
BRAND NAME	:	JCV
FCC ID	:	2AW3VSPS020PRO
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2021-07-16
TEST DATE	:	2021-07-28 to 2021-08-05
ISSUE DATE	:	2021-08-27

Edited by: Zeng Xiaoying (Rapporteur)

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Change History		
Version	Date	Reason for change
1.0	2021-08-27	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Japan Computer Vision Corp.
Applicant Address:	6F, 2-5-1, Kojimachi, Chiyoda City, Tokyo, 102-0083, Japan
Manufacturer:	Japan Computer Vision Corp.
Manufacturer Address:	6F, 2-5-1, Kojimachi, Chiyoda City, Tokyo, 102-0083, Japan

1.2. Equipment Under Test (EUT) Description

Product Name:	SensePass Pro Face Recognition Integrated Terminal	
Sample No.:	4#	
Hardware Version:	V2	
Software Version:	V2.3.1	
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:	PIFA Antenna	
Antenna Gain:	2.1dBi	
Accessory Information:	Button Battery	
	Brand Name:	Panasonic
	Model No.:	CR1220
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	35mAh
	Rated Voltage:	3V
	Charge Limit:	N/A
	Manufacturer:	PT. PANASONIC GOBEL ENERGY INDONESIA

Note 1: According to the certificate holder, they declared that the model SPS020-PRO-OM and SPS020-PRO are accordant in both hardware and software. The only different between these two models is the model name. Application information of SPS020-PRO-OM and SPS020-PRO are identical, only except the mentioned above. The main measuring model is SPS020-PRO-OM, only the results for SPS020-PRO-OM were recorded in this report.

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	No deviation
2	N/A	Duty Cycle Of Test Signal	Aug 05, 2021	Su Xiaoxian	PASS	No deviation
3	15.247(b)	Maximum Peak and Average Conducted Output Power	Aug 05, 2021	Su Xiaoxian	PASS	No deviation
4	15.247(a)	Bandwidth	Aug 05, 2021	Su Xiaoxian	PASS	No deviation
5	15.247(d)	Conducted Spurious Emission and Band Edge	Aug 05, 2021	Su Xiaoxian	PASS	No deviation
6	15.247(e)	Power Spectral Density	Aug 05, 2021	Su Xiaoxian	PASS	No deviation
7	15.207	Conducted Emission	Jul 28, 2021	Su Zhan	PASS	No deviation
8	15.247(d)	Restricted Frequency Bands	Aug 05, 2021	Lin Jiayong	PASS	No deviation
9	15.209, 15.247(d)	Radiated Emission	Aug 04, 2021	Lin Jiayong	PASS	No deviation

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

Note 2: The path loss during the RF test is calibrated to correct the results by the offset setting

in the test equipments. The ref offset 11.5dB contains two parts that cable loss 1.5dB and Attenuator 10dB.

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

Note 4: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% 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 PIFA antenna coupled with the I-PEX connector. Please refer to the EUT internal photos.

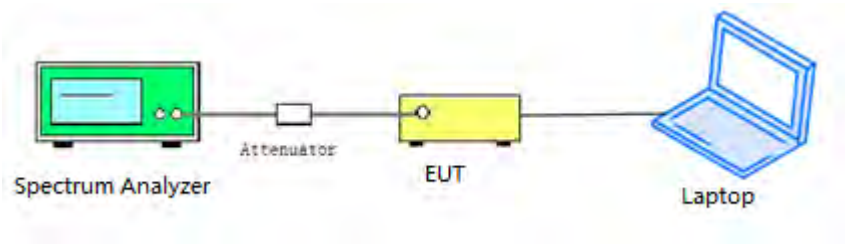
2.2. Duty Cycle of Test Signal

2.2.1. Requirement

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

2.2.2. Test Description

Test Setup:



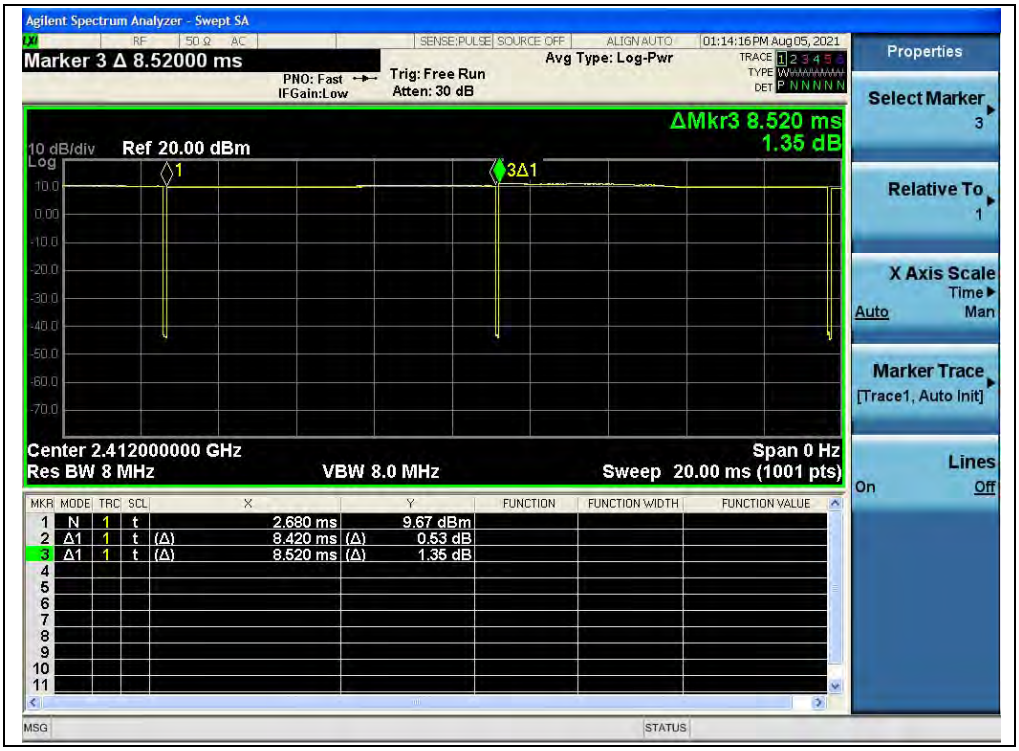
ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

2.2.3. Test Result

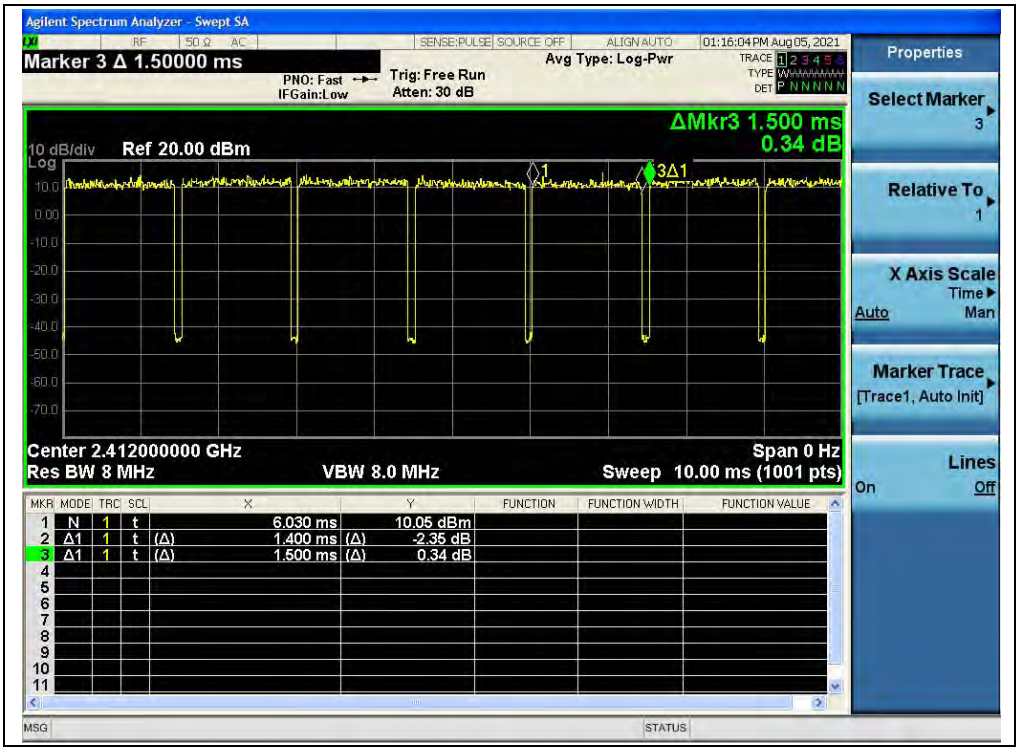
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
802.11b	100.00	0.00
802.11g	93.30	0.30
802.11n (HT20)	91.07	0.41

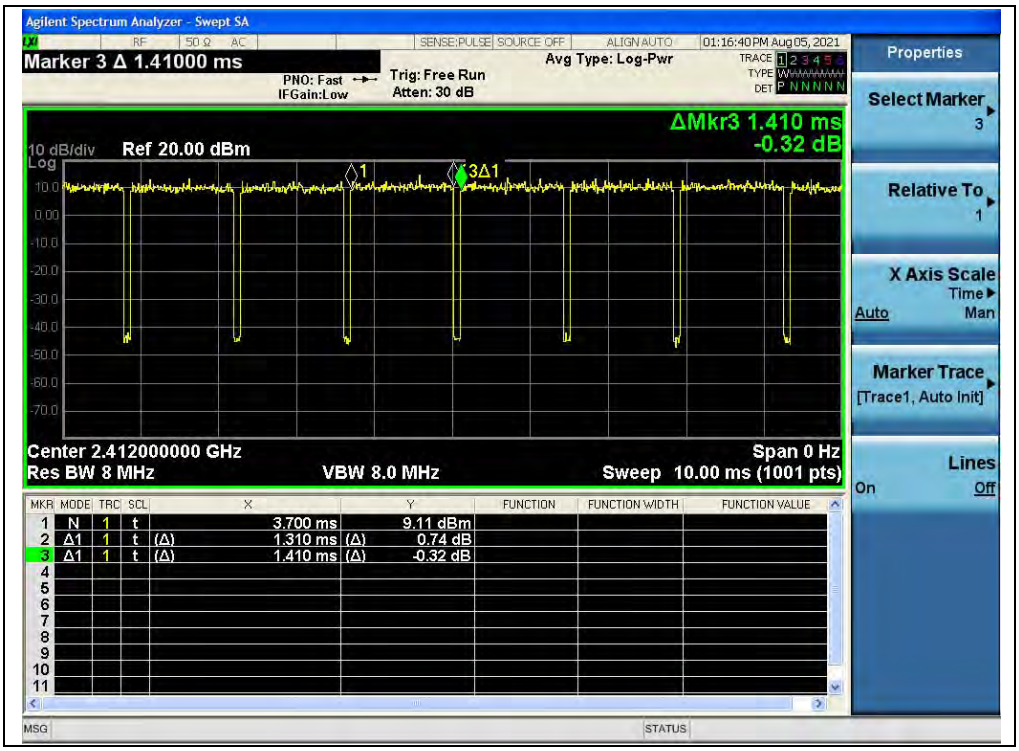
B. Test Plot:



(Channel 1, 802.11b)



(Channel 1, 802.11g)



(Channel 1, 802.11n (HT20))

2.3. Maximum Peak and Average Conducted Output Power

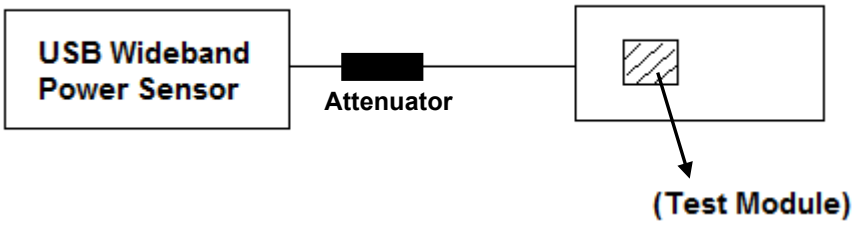
2.3.1. Requirement

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	21.17	0.131	30	1	PASS
6	2437	20.19	0.104			PASS
11	2462	20.06	0.101			PASS

802.11g Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	25.89	0.388	30	1	PASS
6	2437	25.41	0.348			PASS
11	2462	25.14	0.327			PASS

802.11n (HT20) Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	**25.91**	**0.390**	30	1	PASS
6	2437	25.04	0.319			PASS
11	2462	24.84	0.305			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	18.54	0.00	**18.54**	**0.071**	30	1	PASS
6	2437	17.78		17.78	0.060			PASS
11	2462	17.68		17.68	0.059			PASS

802.11g Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
1	2412	18.02	0.30	18.32	0.068	30	1	PASS
6	2437	17.86		18.16	0.065			PASS
11	2462	17.39		17.69	0.059			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	16.97	0.41	17.38	0.055	30	1	PASS
6	2437	16.61		17.02	0.050			PASS
11	2462	16.38		16.79	0.048			PASS

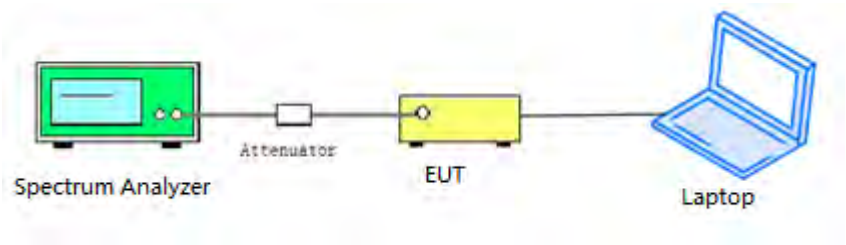
2.4. Bandwidth

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	9.020	≥500	PASS
6	2437	9.029	≥500	PASS
11	2462	8.546	≥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	15.03	≥500	PASS
6	2437	15.10	≥500	PASS
11	2462	15.09	≥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	15.11	≥500	PASS
6	2437	15.11	≥500	PASS
11	2462	15.05	≥500	PASS

B. Test Plot:

(Channel 1, 802.11n (HT20))

(Channel 6, 802.11n (HT20))

(Channel 11, 802.11n (HT20))

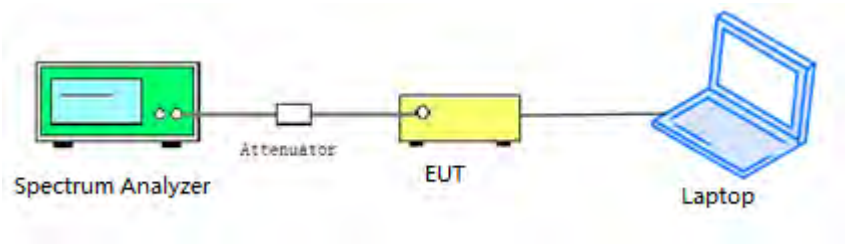
2.5. Conducted Spurious Emissions and Band Edge

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.

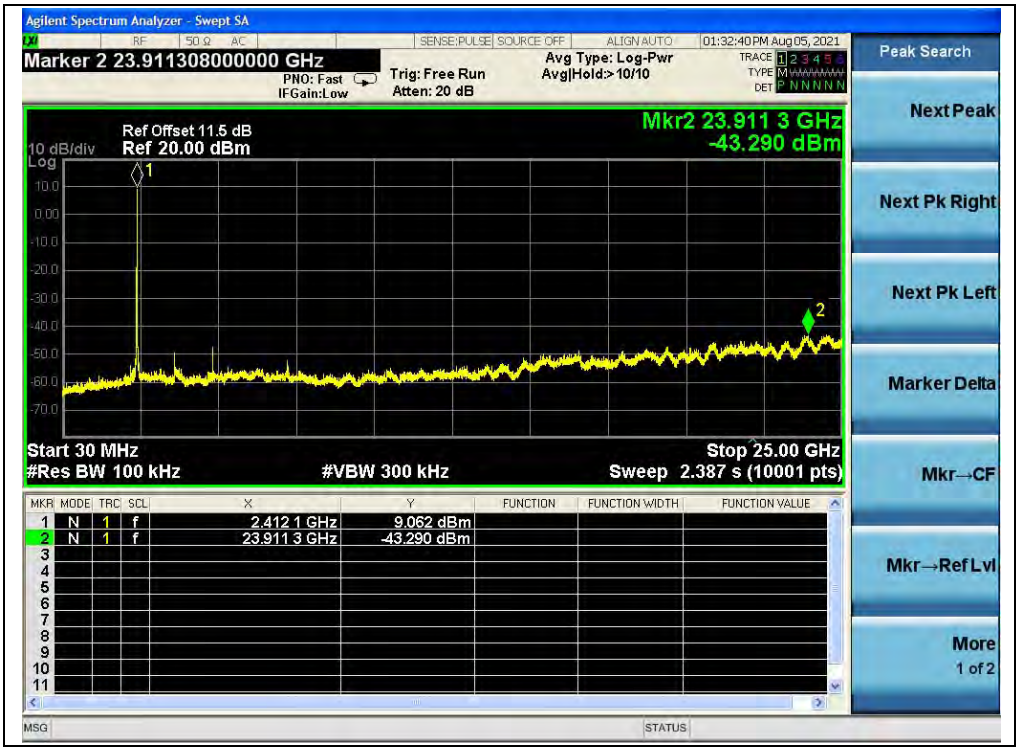
2.5.4. Test Result

802.11b Mode

A. Test Verdict:

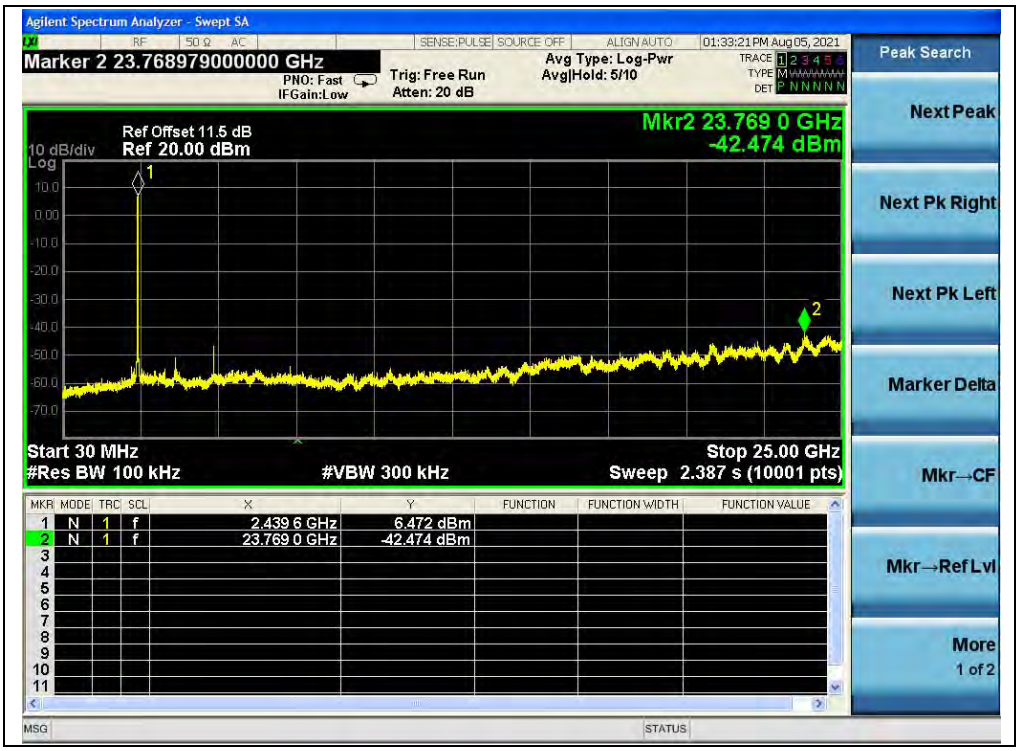
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-43.29	9.06	-10.94	PASS
6	2437	-42.47	6.47	-13.53	PASS
11	2462	-42.47	10.06	-9.94	PASS

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)

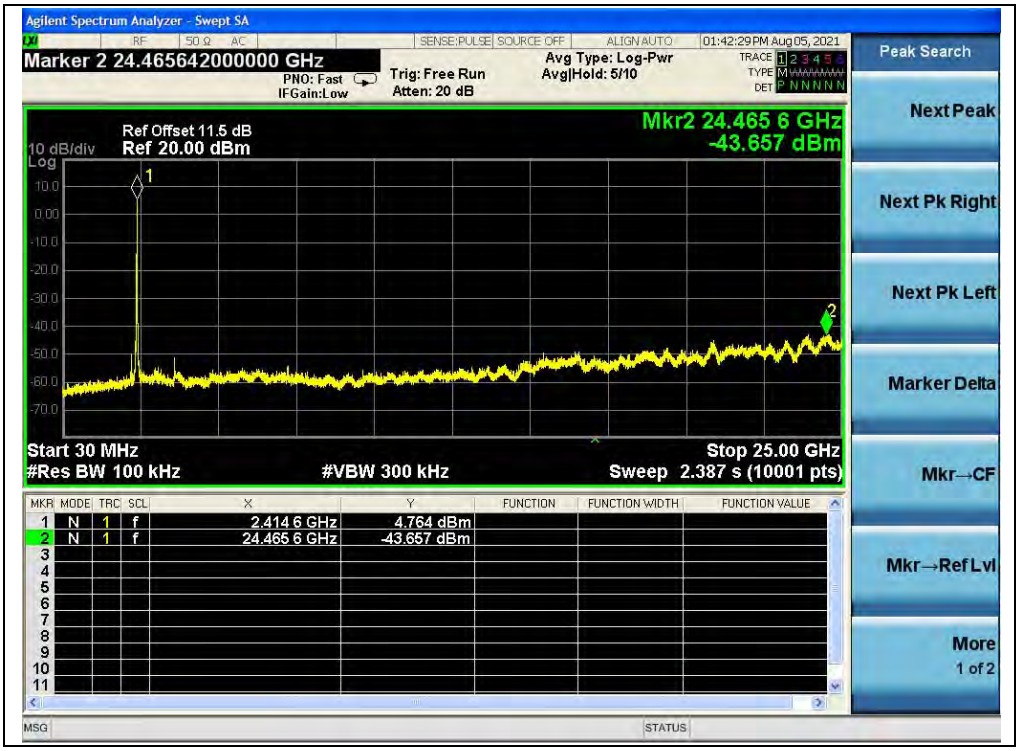
(Band Edge, Channel 11, 802.11b)

802.11g Mode

A. Test Verdict:

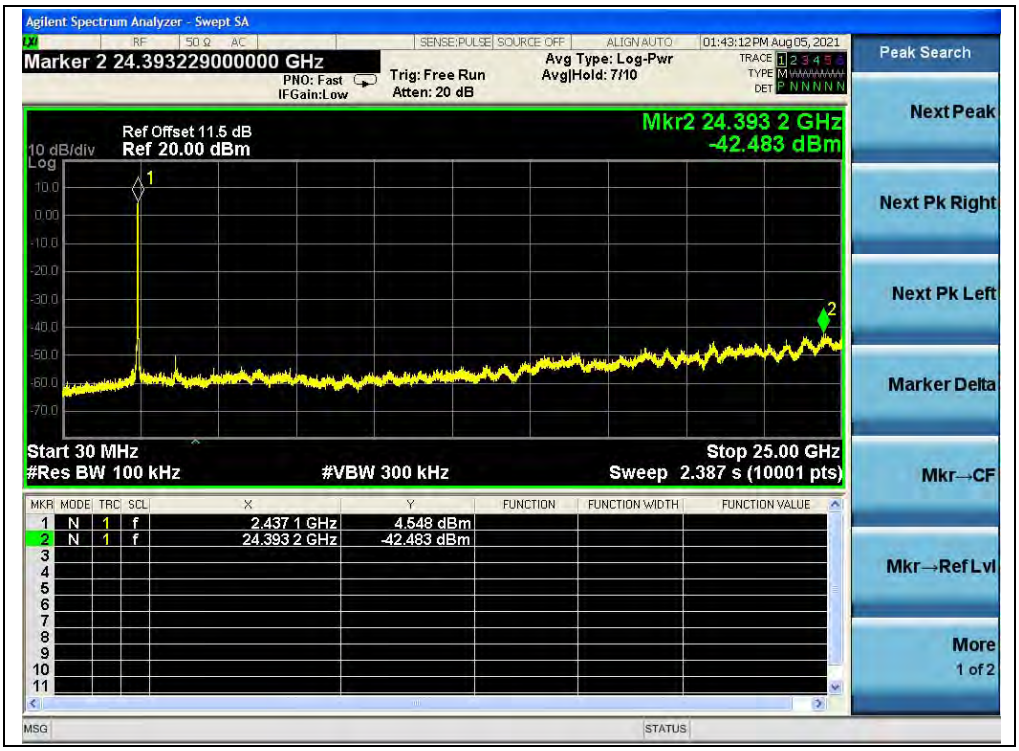
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-43.66	4.76	-15.24	PASS
6	2437	-42.48	4.55	-15.45	PASS
11	2462	-42.54	4.06	-15.94	PASS

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)

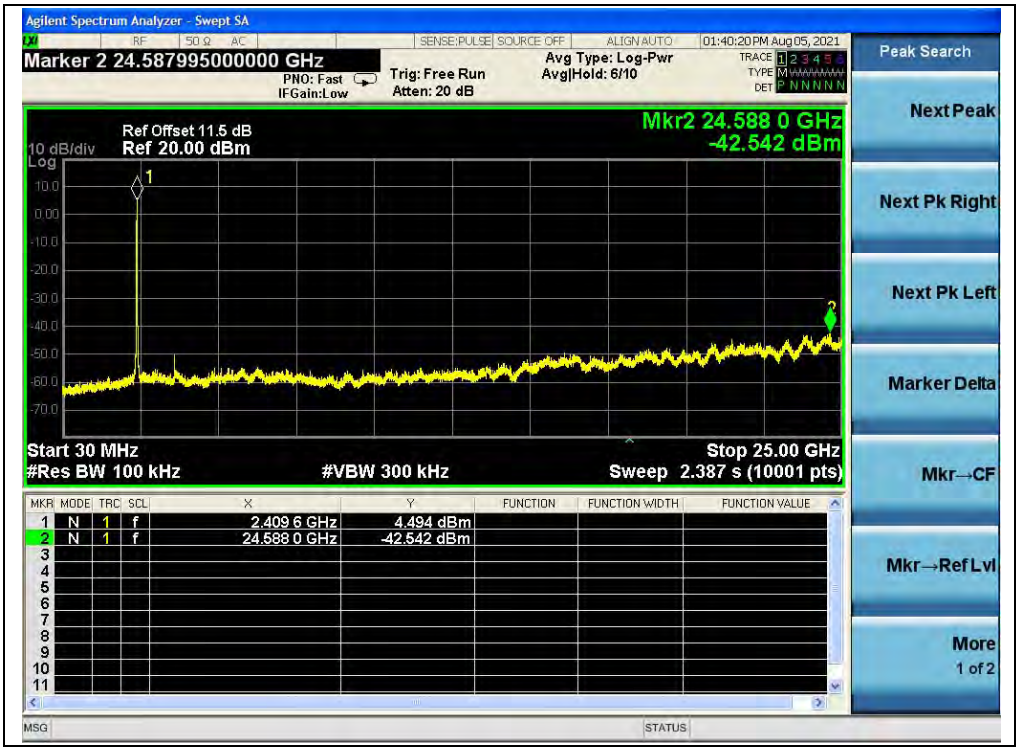
(Band Edge, Channel 11, 802.11g)

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	-42.54	4.49	-15.51	PASS
6	2437	-42.16	3.66	-16.34	PASS
11	2462	-43.10	2.18	-17.82	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))

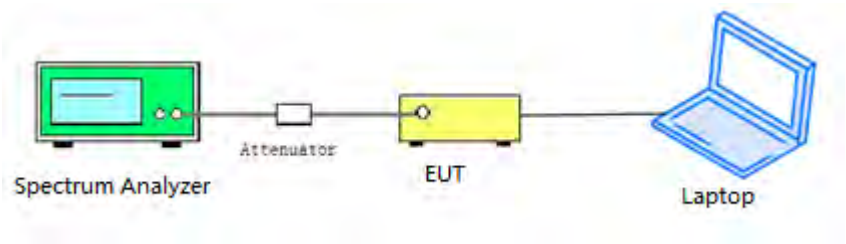
2.6. Power Spectral Density

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	-3.37	8	PASS
6	2437	-3.39	8	PASS
11	2462	-3.96	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	-6.01	8	PASS
6	2437	-6.66	8	PASS
11	2462	-6.79	8	PASS

B. Test Plot:

(Channel 1, 802.11g)

(Channel 6, 802.11g)

(Channel 11, 802.11g)

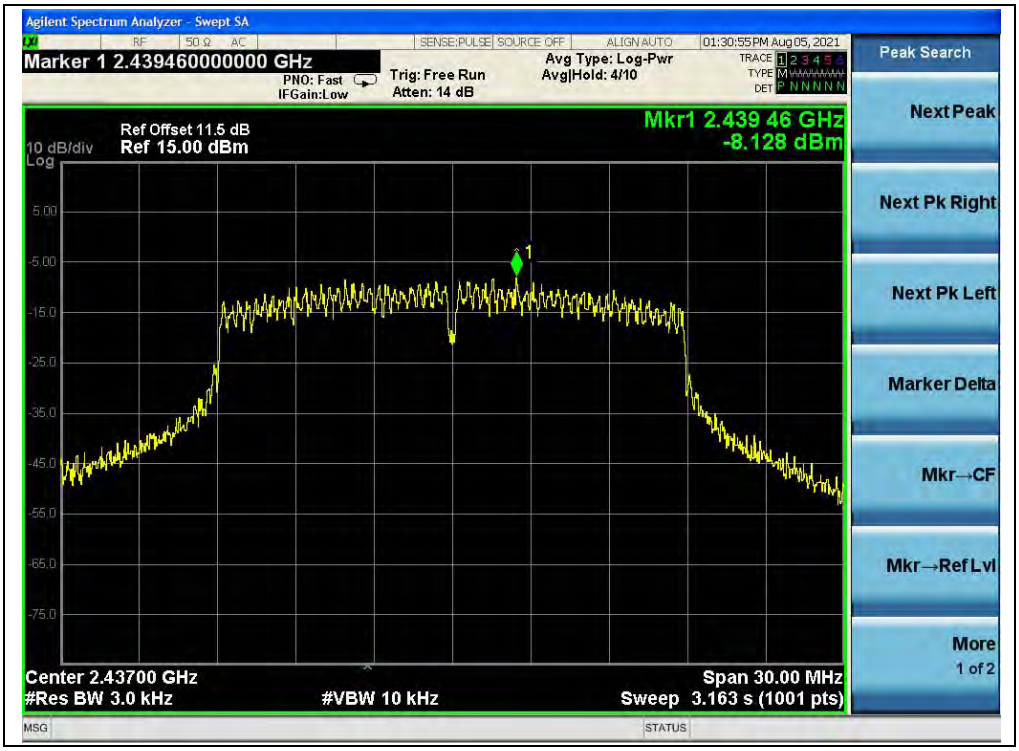
802.11n (HT20) Mode

A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-7.30	8	PASS
6	2437	-8.13	8	PASS
11	2462	-7.42	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

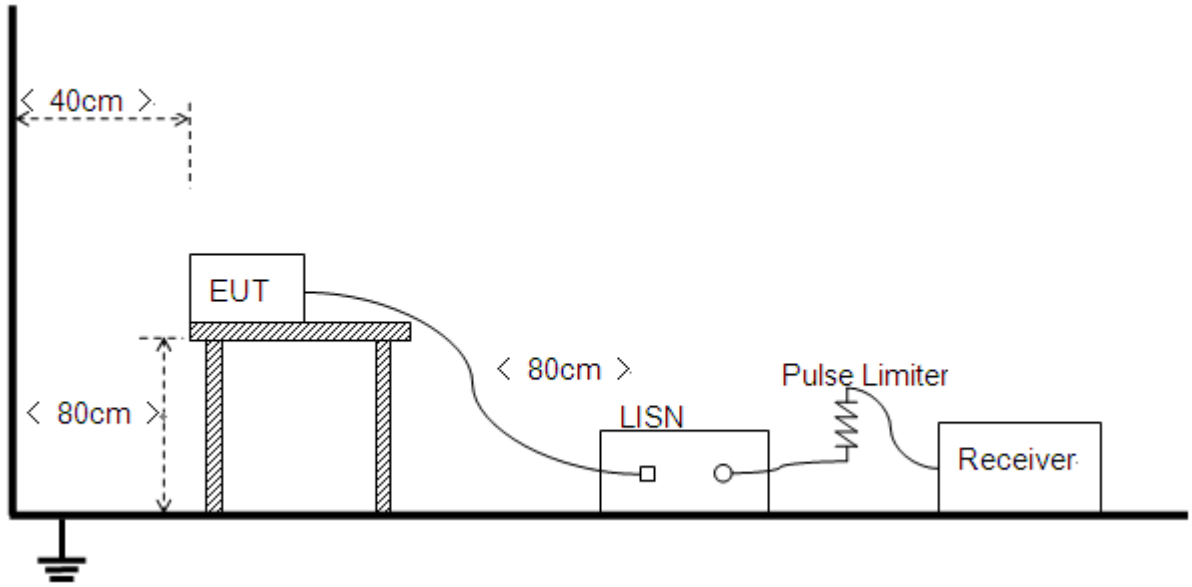
NOTE:

(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+ADAPTOR+ WIFI TX

Test Voltage: AC 120V/60Hz

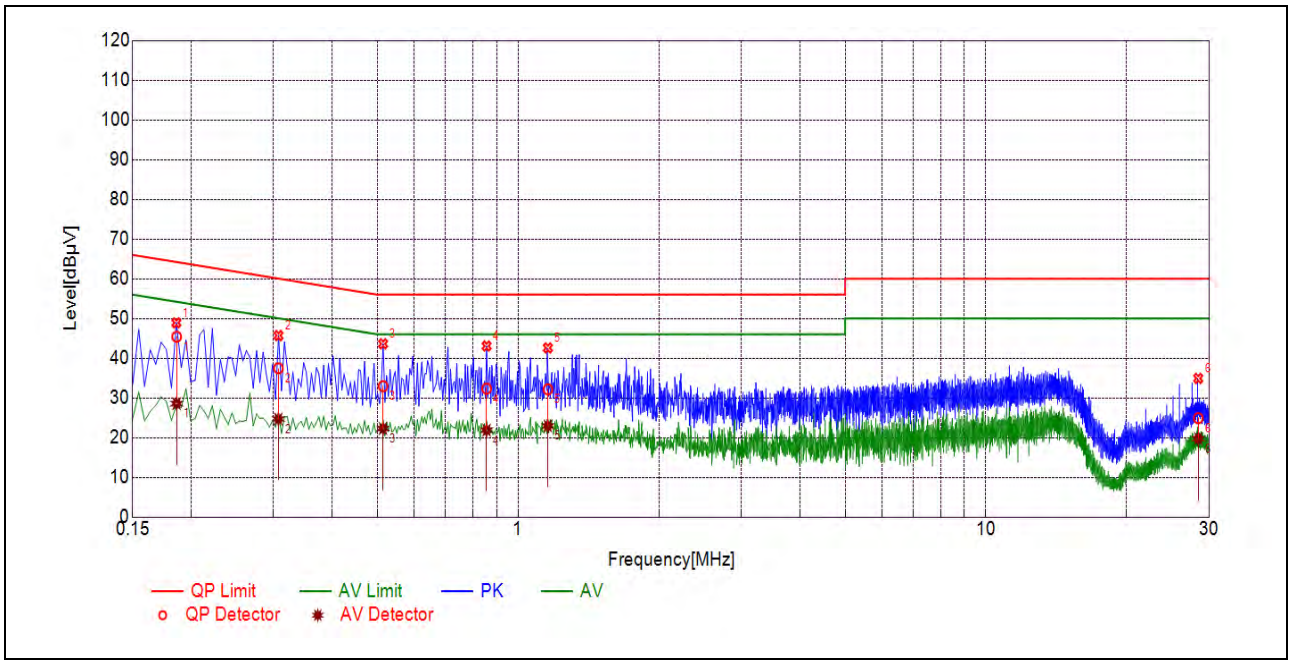
The measurement results are obtained as below:

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

U_R: Receiver Reading

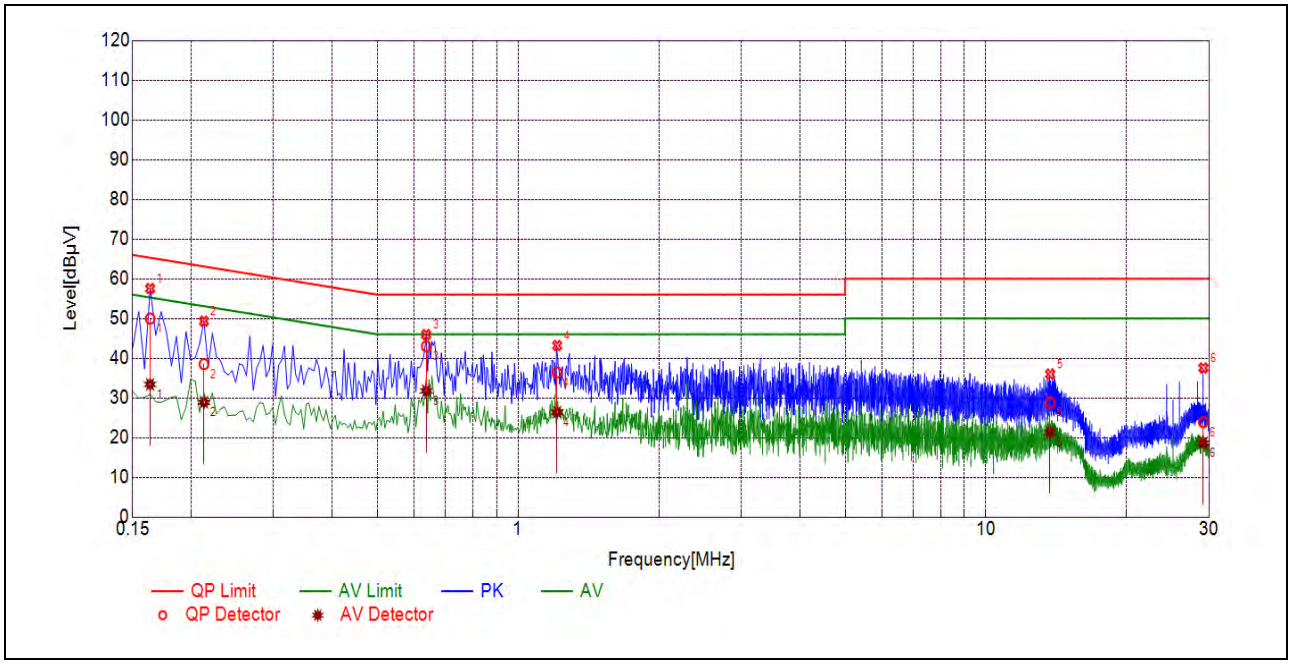
A_{Factor}: Voltage division factor of LISN

B. Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1862	45.41	28.57	64.21	54.21	Line	PASS
2	0.3072	37.45	24.69	60.05	50.05		PASS
3	0.5143	32.96	22.29	56.00	46.00		PASS
4	0.8563	32.34	21.88	56.00	46.00		PASS
5	1.1576	32.17	22.92	56.00	46.00		PASS
6	28.4434	24.90	19.74	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	0.1634	49.96	33.40	65.29	55.29	Neutral	PASS
2	0.2130	38.50	28.92	63.09	53.09		PASS
3	0.6362	43.01	31.78	56.00	46.00		PASS
4	1.2114	36.41	26.42	56.00	46.00		PASS
5	13.7139	28.82	21.32	60.00	50.00		PASS
6	29.1583	23.91	18.66	60.00	50.00		PASS

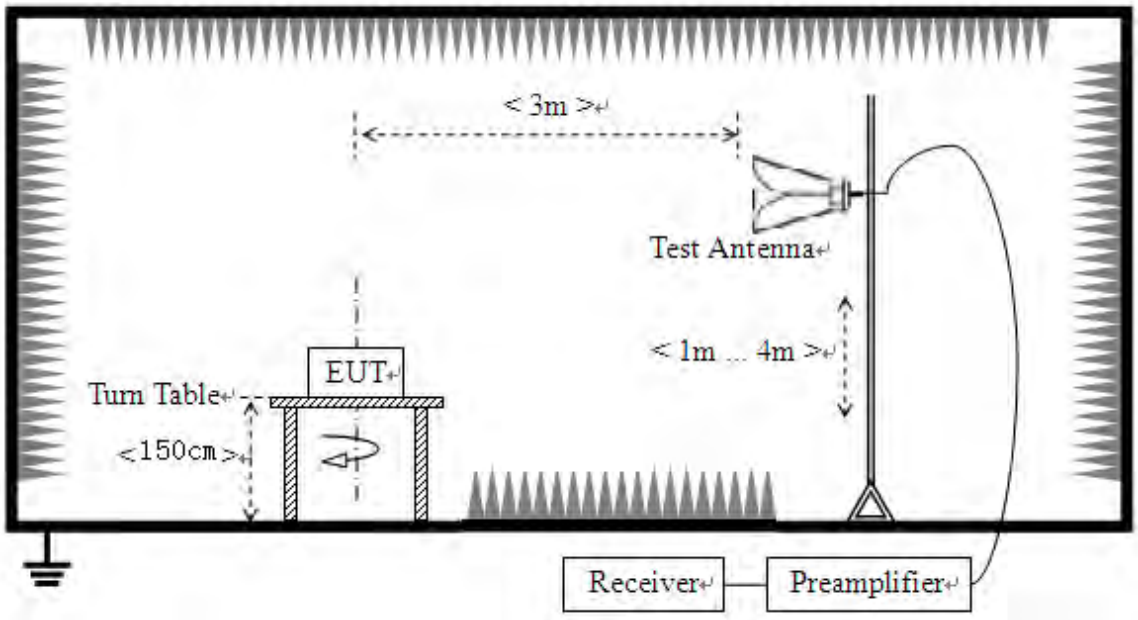
2.8. Restricted Frequency Bands

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

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

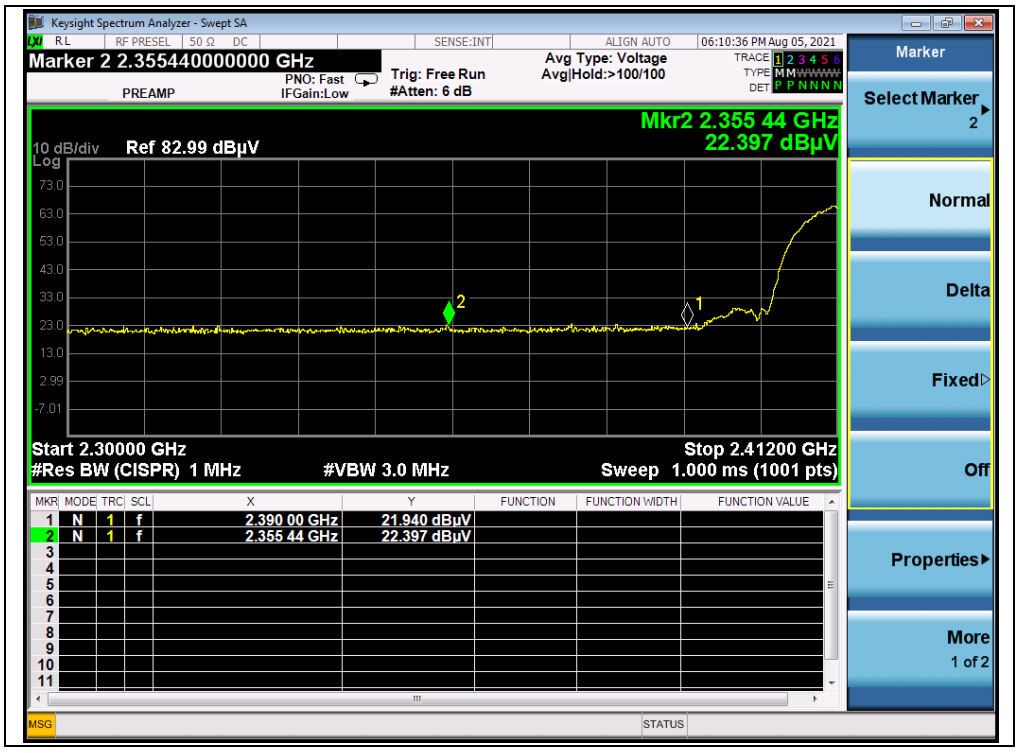
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

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	2355.44	PK	22.40	6.74	27.20	56.34	74	PASS
1	2387.58	AV	11.87	6.74	27.20	45.81	54	PASS
11	2484.42	PK	22.17	6.74	27.20	56.11	74	PASS
11	2484.27	AV	10.63	6.74	27.20	44.57	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)

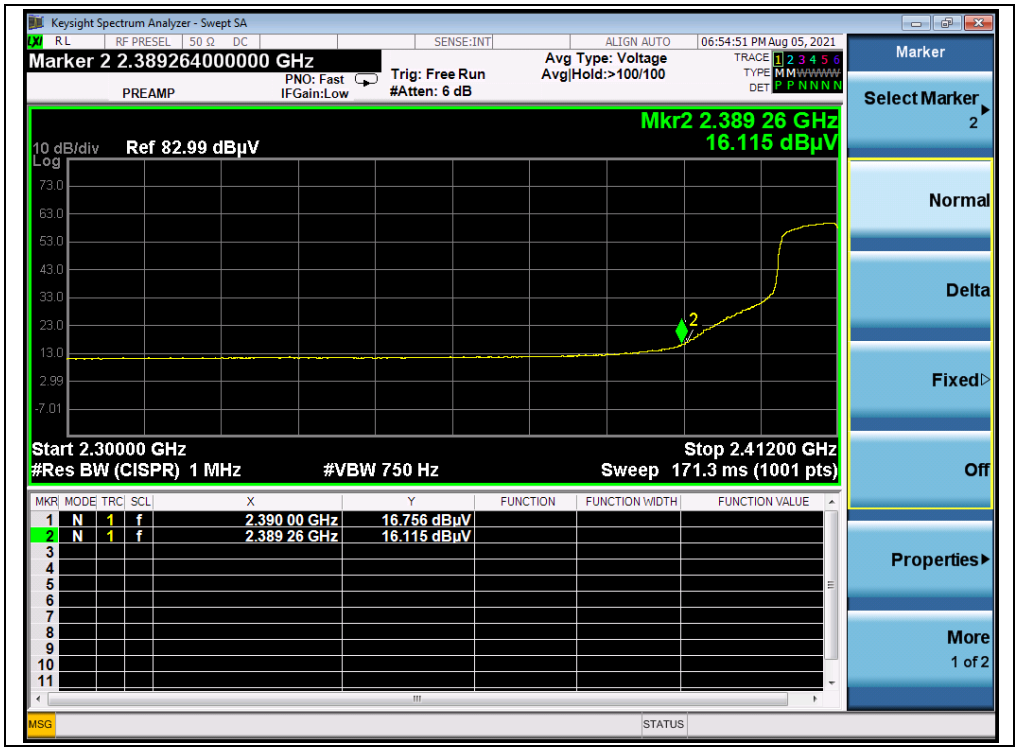
802.11g Mode

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	2388.59	PK	36.28	6.74	27.20	70.22	74	PASS
1	2390.00	AV	16.76	6.74	27.20	50.70	54	PASS
11	2484.34	PK	35.71	6.74	27.20	69.65	74	PASS
11	2483.50	AV	17.44	6.74	27.20	51.38	54	PASS

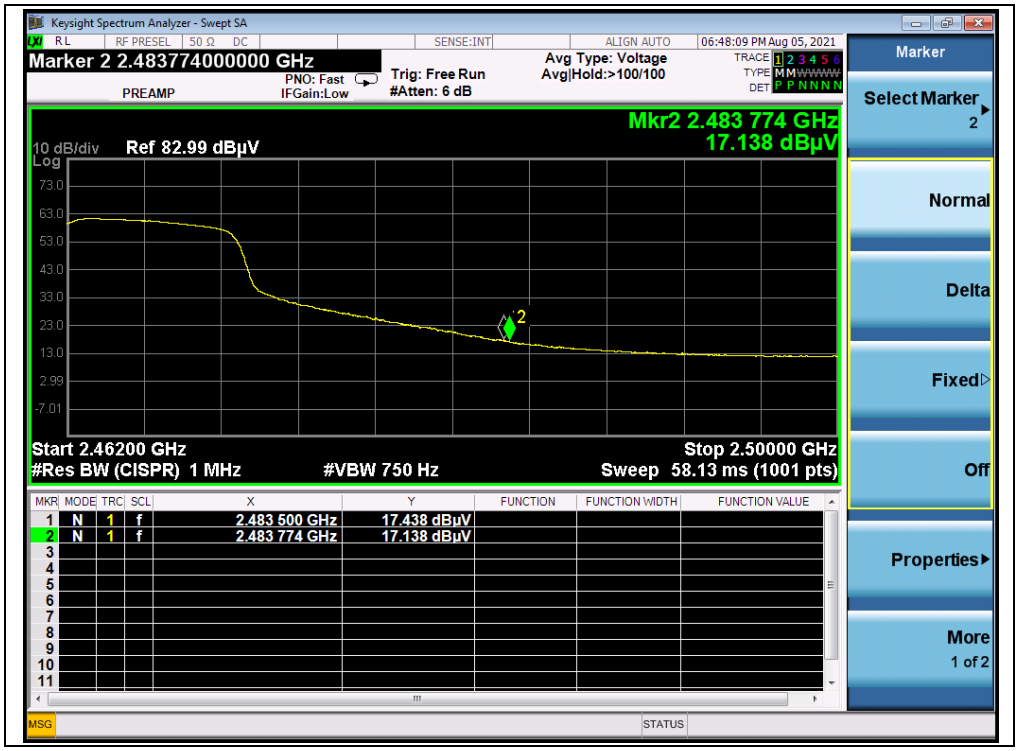
B. Test Plot:

(PEAK, Channel 1, 802.11g)



(AVERAGE, Channel 1, 802.11g)

(PEAK, Channel 11, 802.11g)



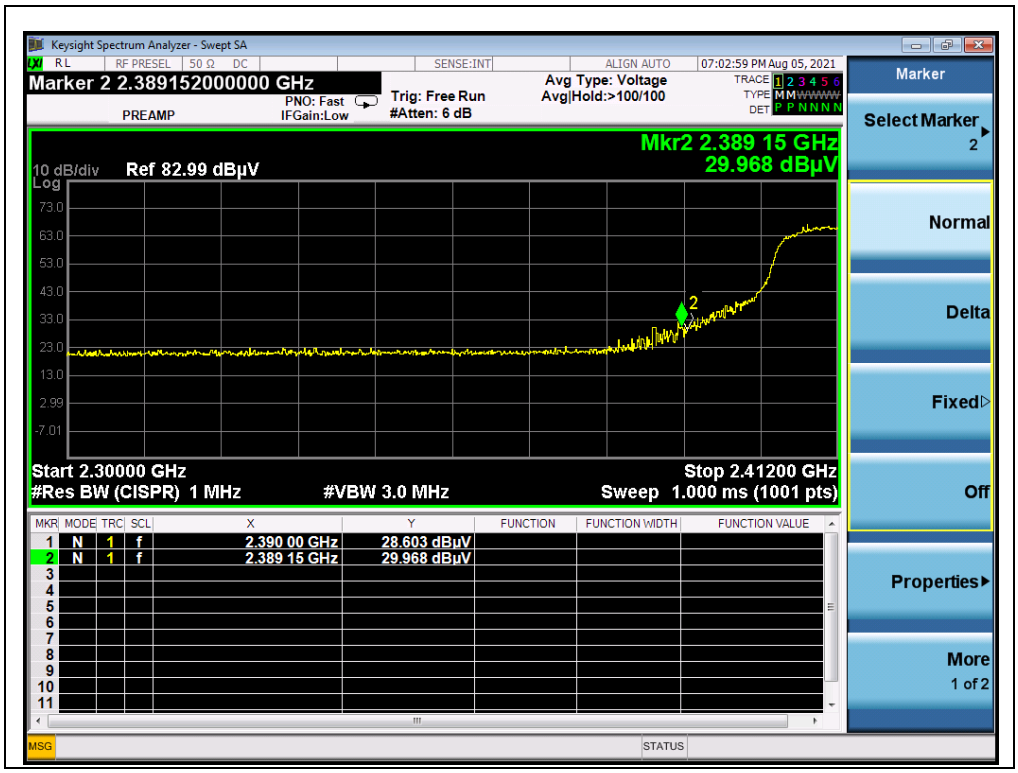
(AVERAGE, Channel 11, 802.11g)

802.11n (HT20) Mode

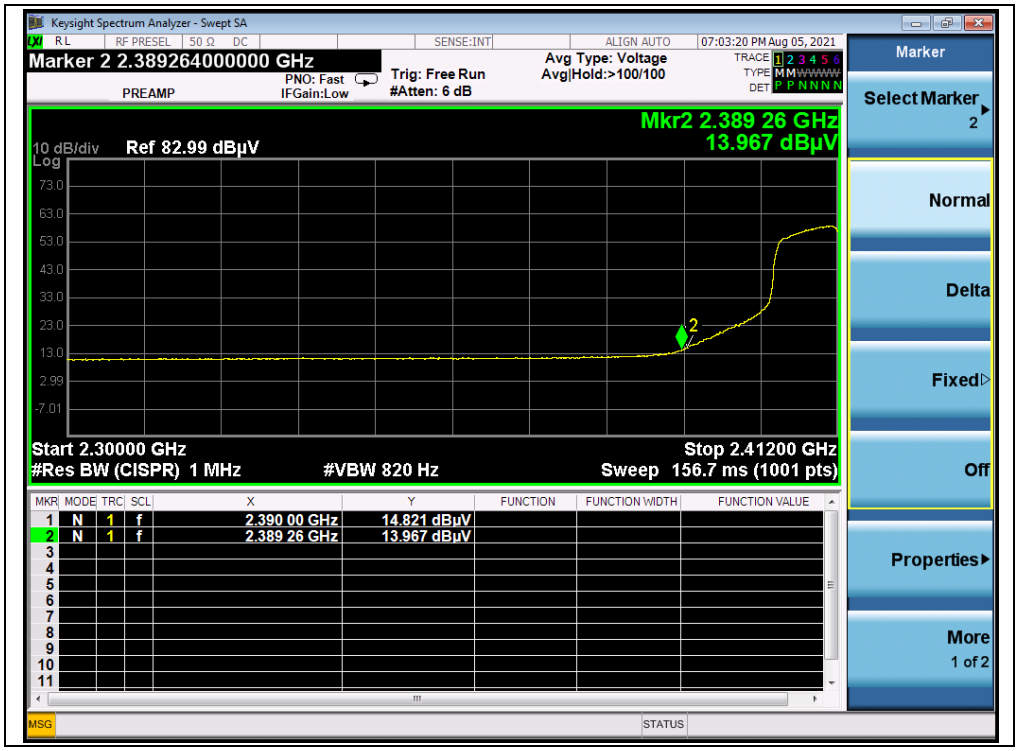
A. Test Verdict:

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	2389.15	PK	29.97	6.74	27.20	63.91	74	PASS
1	2390.00	AV	14.82	6.74	27.20	48.76	54	PASS
11	2484.15	PK	34.46	6.74	27.20	68.40	74	PASS
11	2483.50	AV	15.14	6.74	27.20	49.08	54	PASS

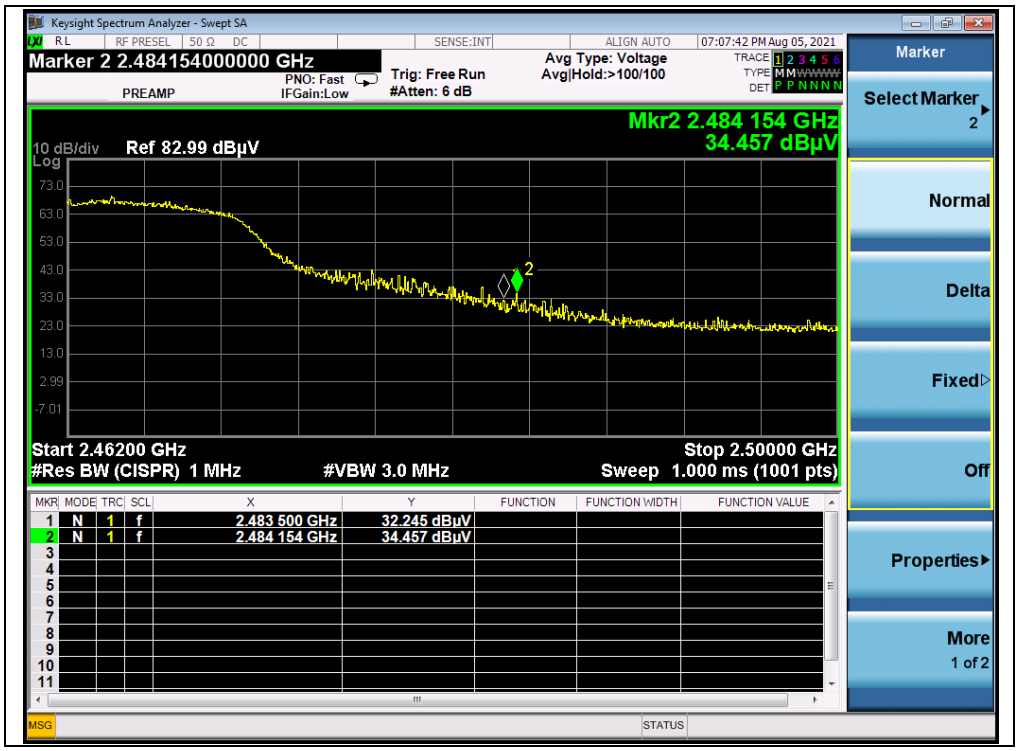
B. Test Plot:



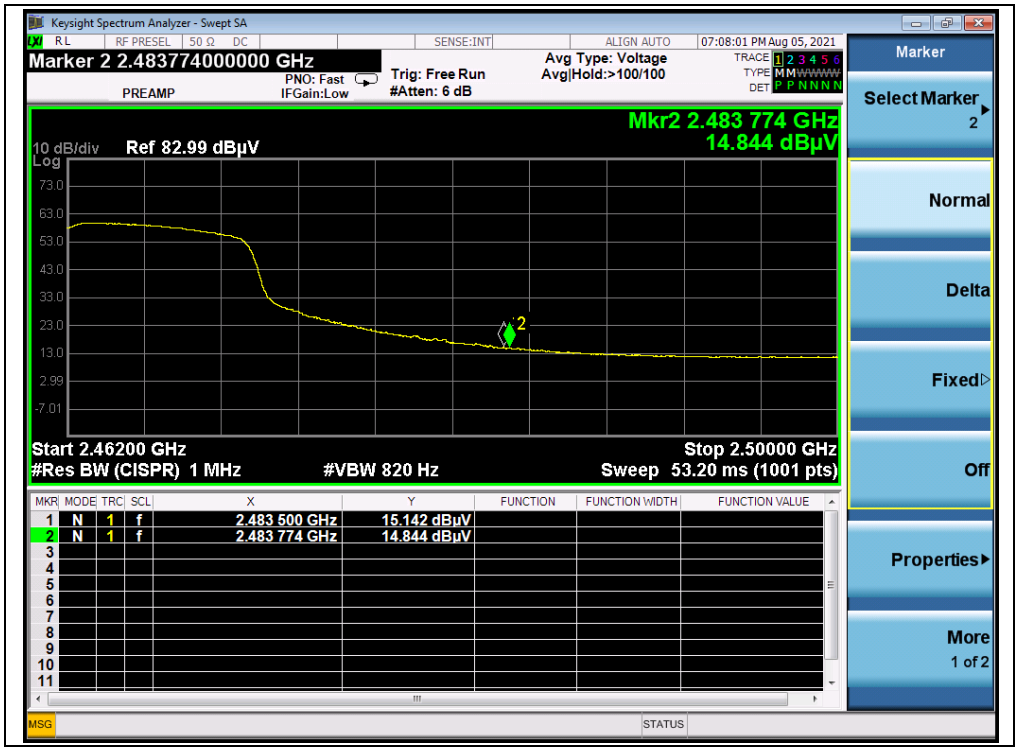
(PEAK, Channel 1, 802.11n (HT20))



(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:

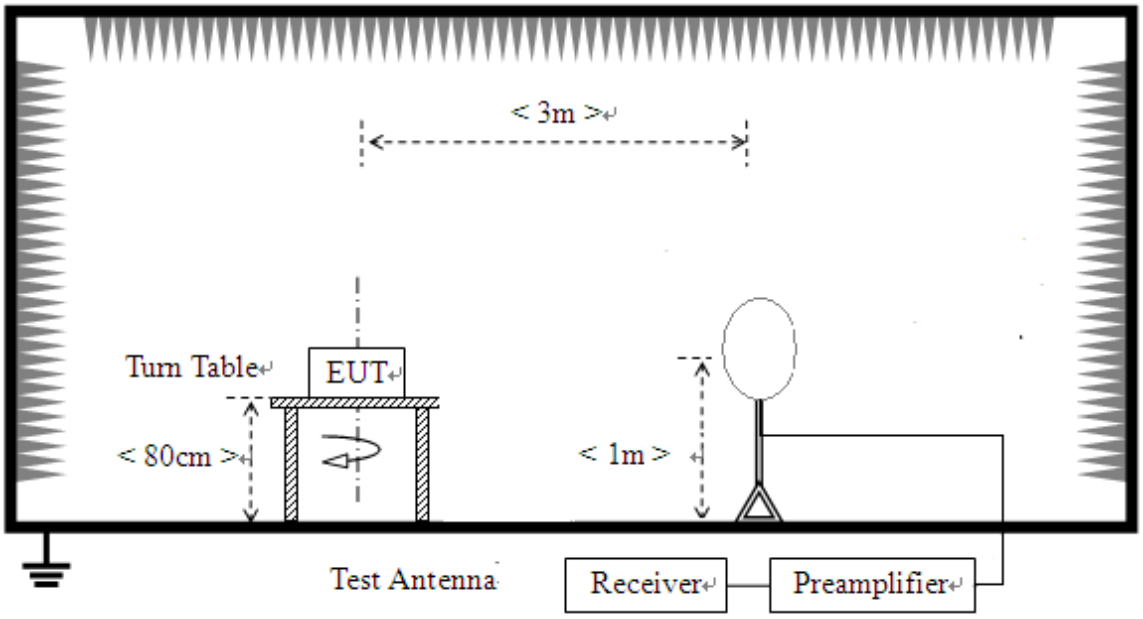
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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).

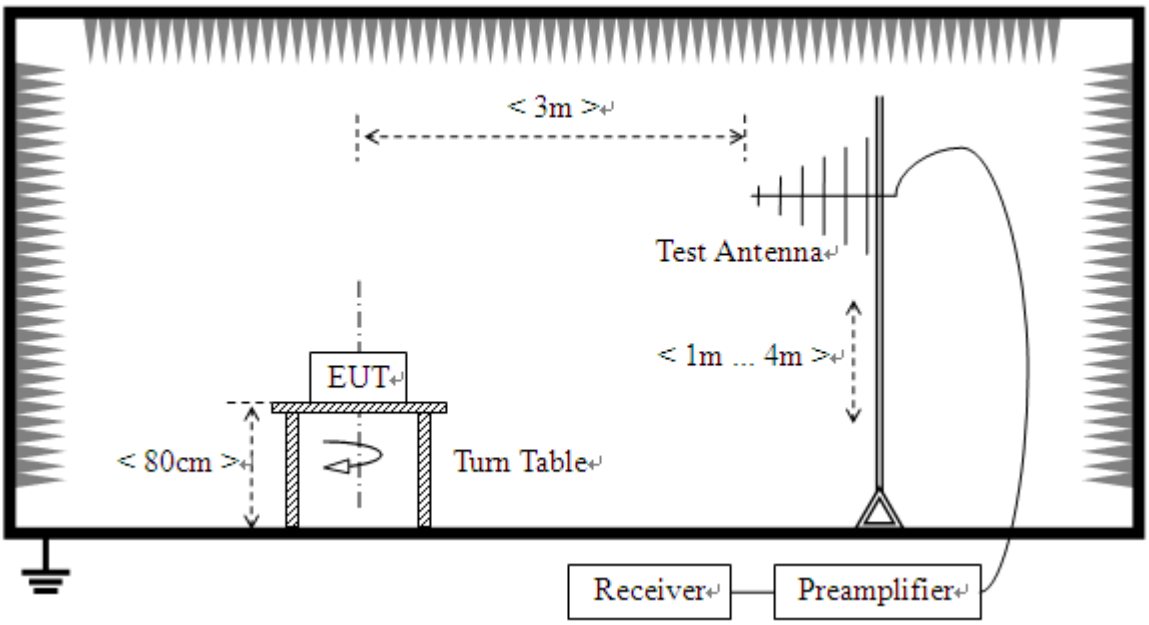
2.9.2. Test Description

Test Setup:

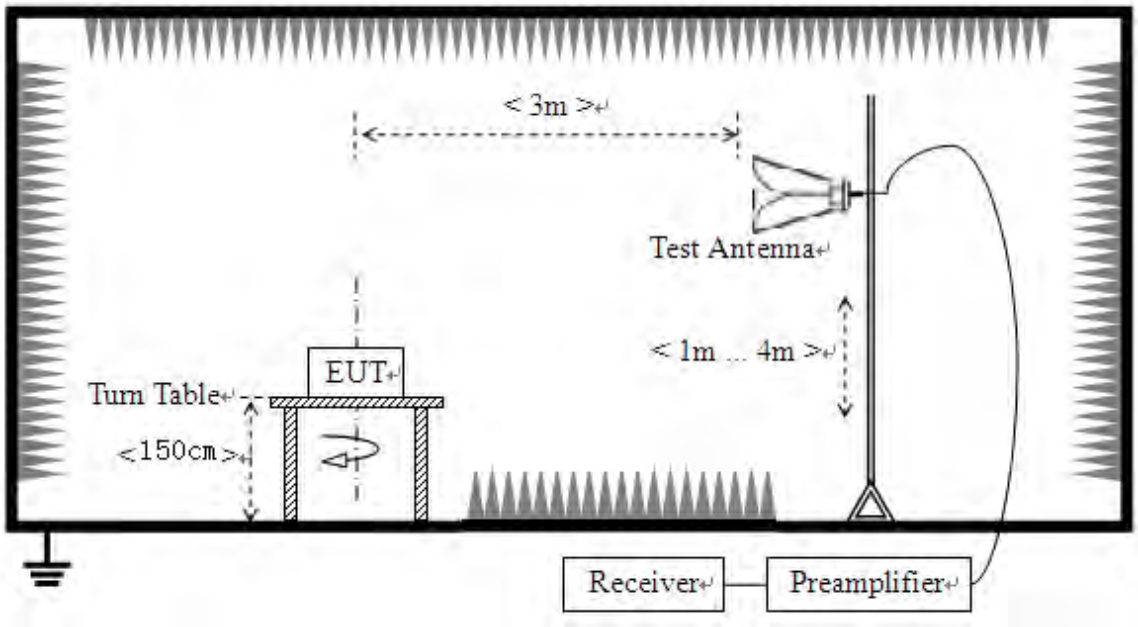
1) For radiated emissions from 9kHz to 30MHz



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.

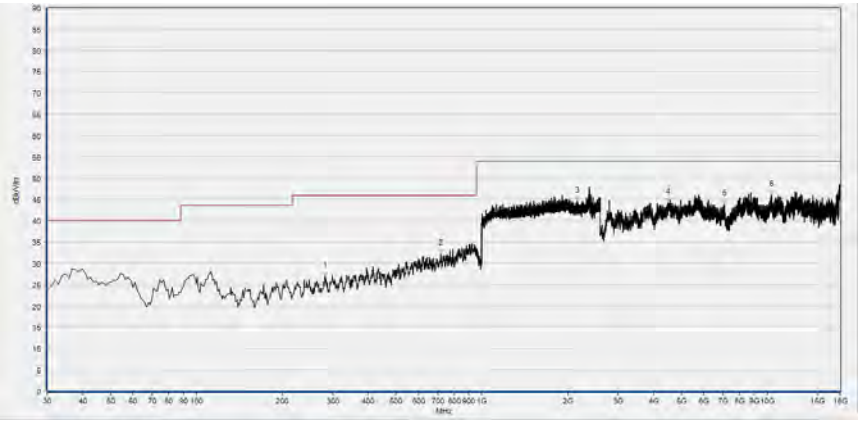
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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.

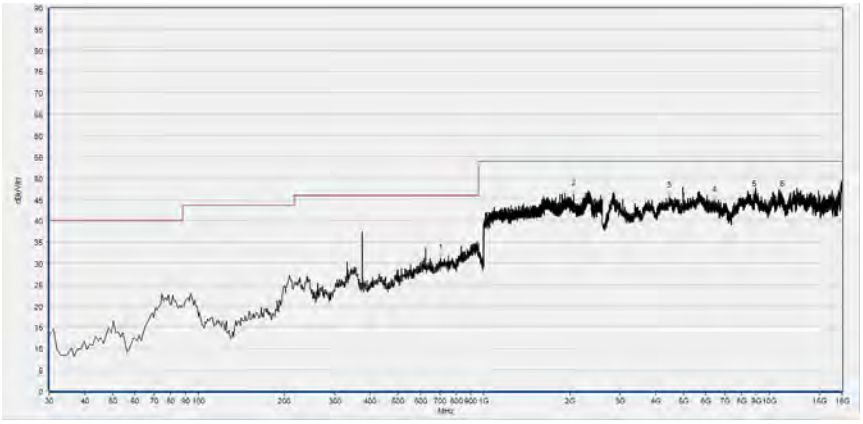
802.11b Mode

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
282.200	27.03	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
718.700	32.22	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2156.267	44.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4484.960	44.32	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7075.240	43.86	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10370.840	46.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

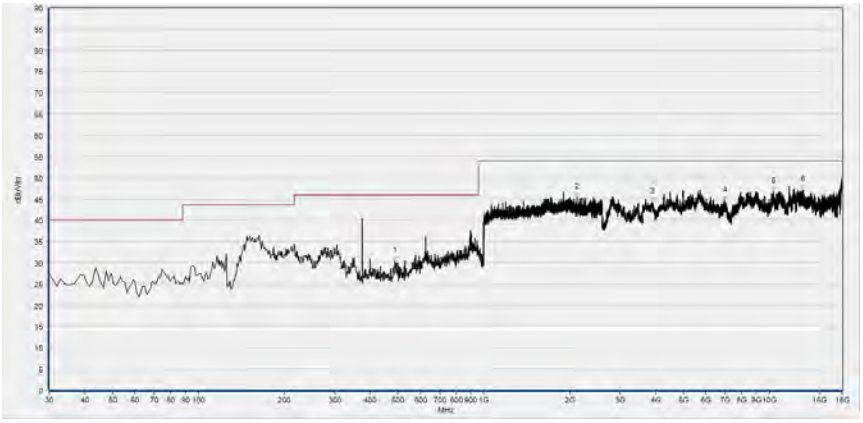
(Antenna Horizontal, 30MHz to 18GHz)



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
704.150	31.22	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2067.200	46.23	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4454.160	45.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6397.640	44.74	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8867.800	46.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
11091.560	46.10	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

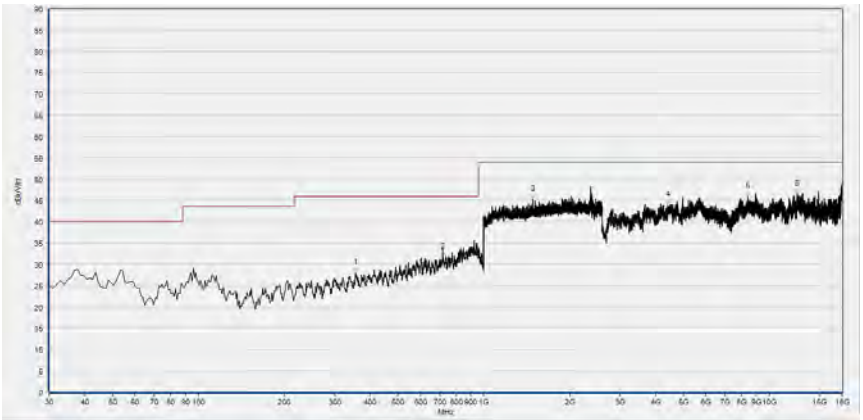
(Antenna Vertical, 30MHz to 18GHz)

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
488.810	30.42	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2126.933	45.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3893.600	44.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6989.000	44.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10333.880	46.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13108.960	47.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

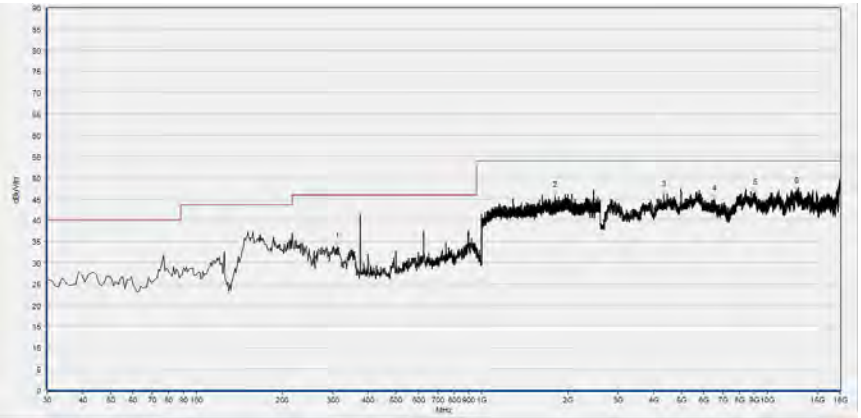
(Antenna Horizontal, 30MHz to 18GHz)



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
354.950	27.95	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
719.670	31.65	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1485.867	45.19	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4411.040	43.83	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8418.120	45.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12520.680	46.46	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

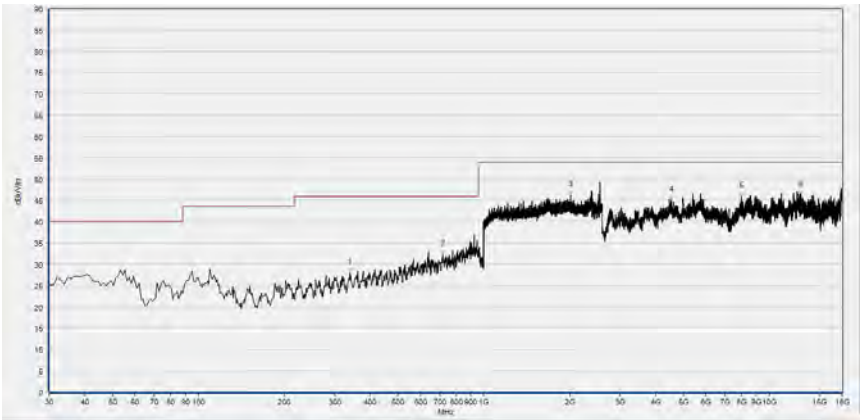
(Antenna Vertical, 30MHz to 18GHz)

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
311.300	33.75	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1802.667	45.73	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4334.040	45.89	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6517.760	44.87	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9077.240	46.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12674.680	46.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

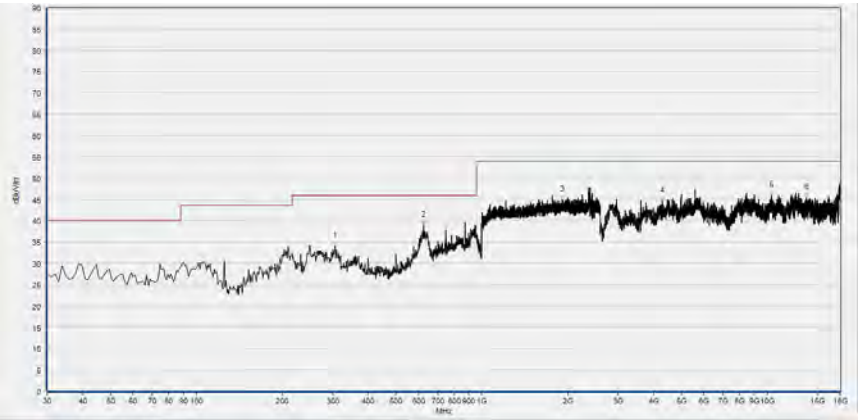


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
340.400	28.02	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
718.700	32.29	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2009.067	46.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4552.720	45.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7996.160	45.92	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12884.120	46.32	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

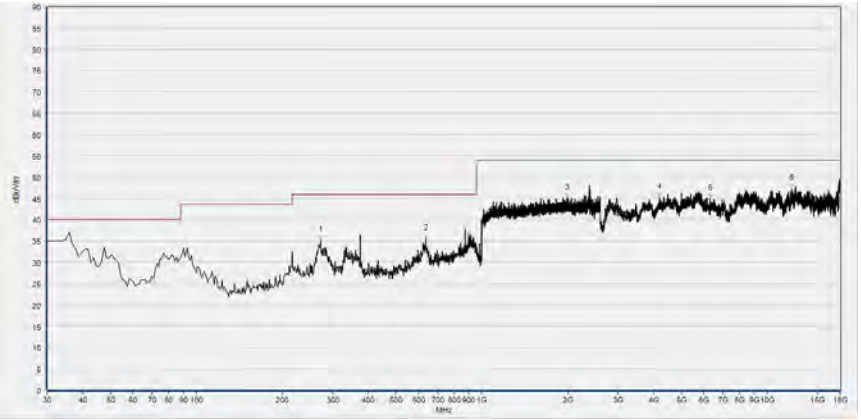
802.11g Mode

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
306.450	34.03	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
624.610	38.92	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1909.333	44.83	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4297.080	44.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10340.040	46.00	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13715.720	45.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

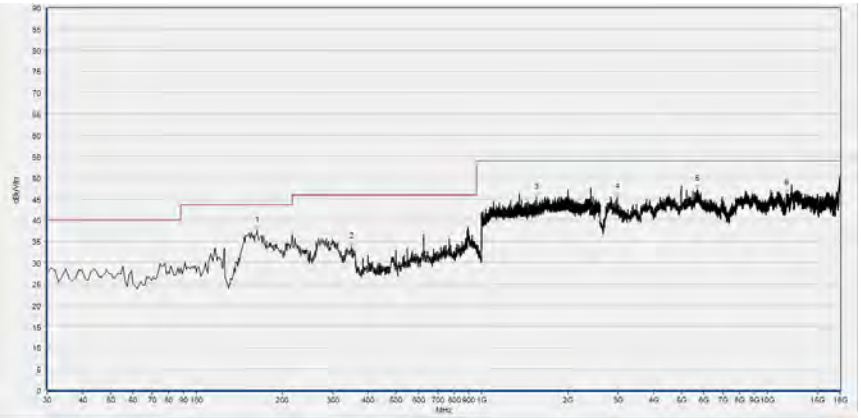
(Antenna Horizontal, 30MHz to 18GHz)



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
272.500	35.18	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
636.250	35.46	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1990.933	45.08	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4186.200	45.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6302.160	44.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12135.680	47.31	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

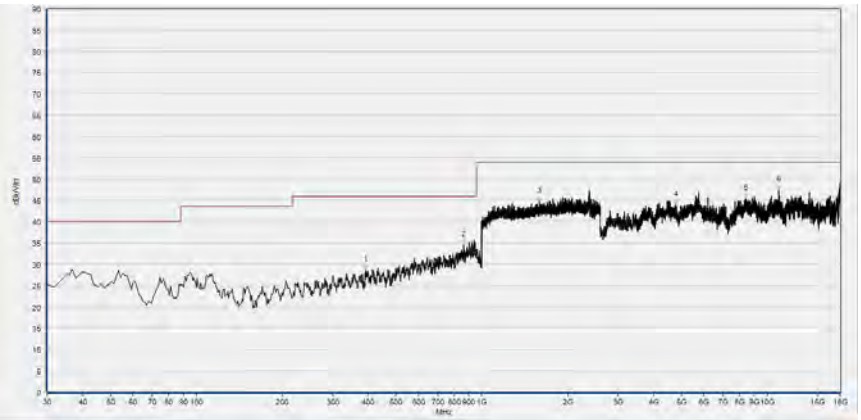
(Antenna Vertical, 30MHz to 18GHz)

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
162.890	37.57	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
349.130	33.64	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1556.267	45.36	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2985.000	45.49	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5686.160	47.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
11692.160	46.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

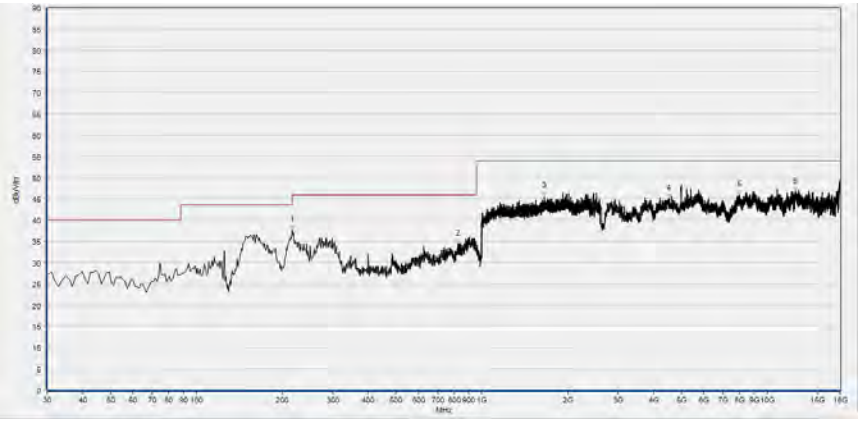
(Antenna Horizontal, 30MHz to 18GHz)



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
391.810	28.74	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
864.200	34.45	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1592.533	44.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4786.800	43.95	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8393.480	45.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10959.120	47.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

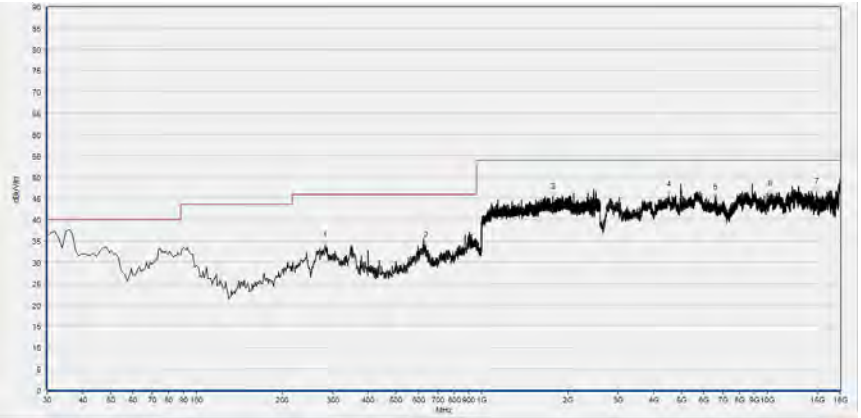
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 11



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
216.240	37.69	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
825.400	34.36	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1656.533	45.60	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4512.680	45.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7996.160	45.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12536.080	46.66	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

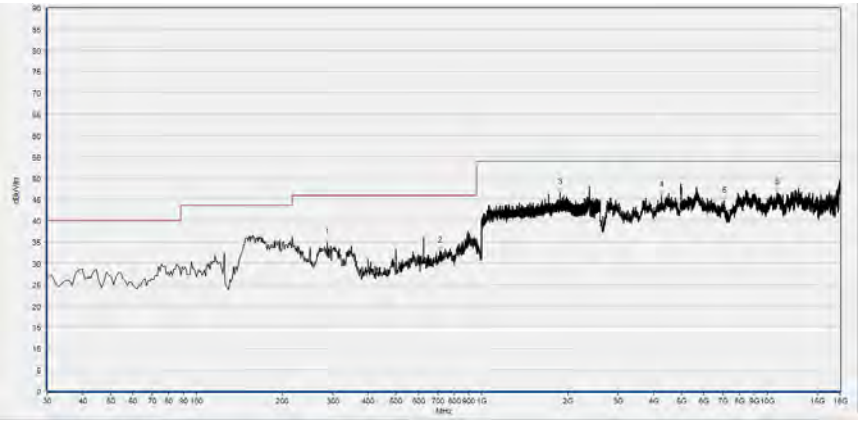


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
282.200	33.79	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
636.250	33.77	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1774.400	45.29	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4509.600	45.67	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6548.560	45.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10207.600	45.85	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

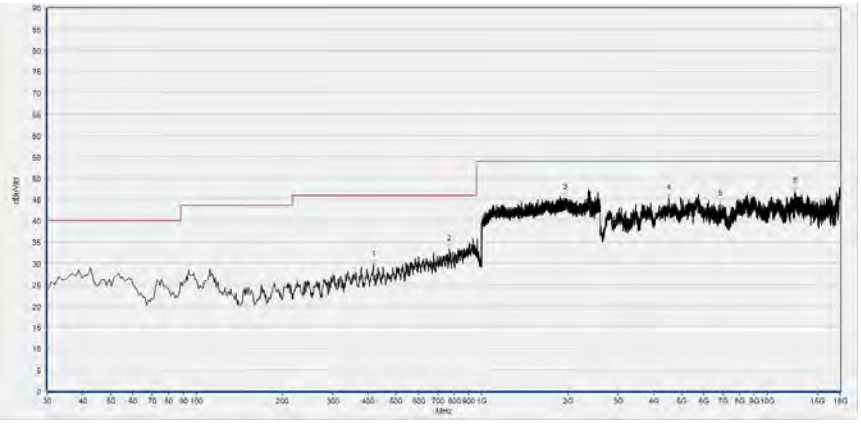
802.11n (HT20) Mode

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
288.020	34.93	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
712.880	32.80	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1884.267	46.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4263.200	45.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7059.840	44.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10857.480	46.58	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

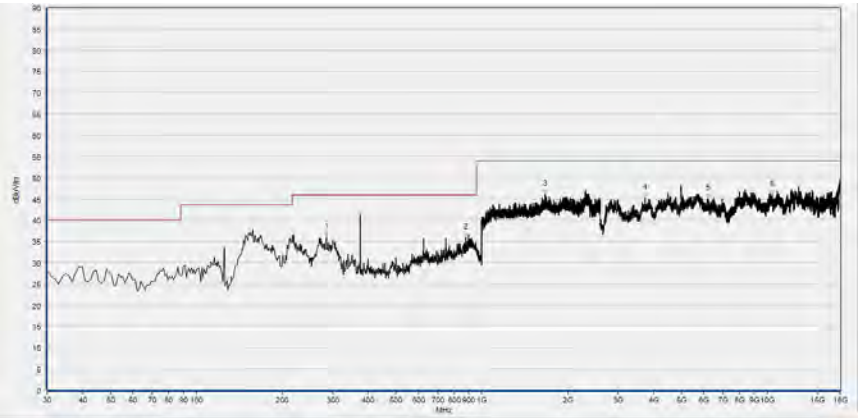
(Antenna Horizontal, 30MHz to 18GHz)



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
417.030	29.64	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
771.080	33.31	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1957.333	45.46	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4525.000	45.17	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
6835.000	43.91	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12508.360	46.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

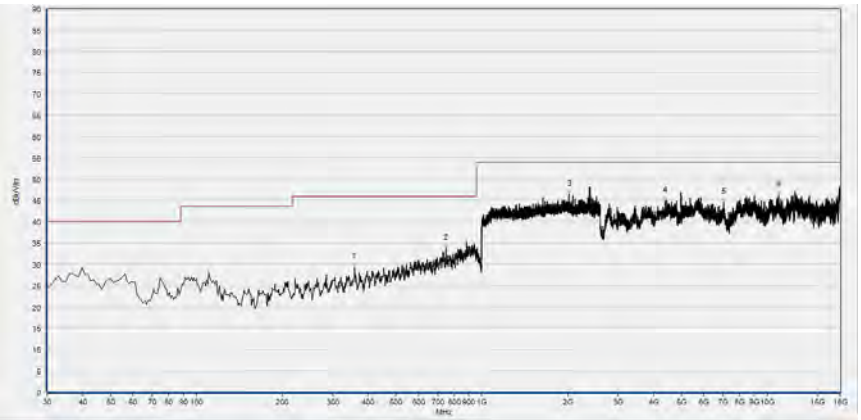
(Antenna Vertical, 30MHz to 18GHz)

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
285.110	35.99	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
878.750	35.80	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1664.000	46.13	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3730.360	45.30	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6203.600	45.12	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10429.360	45.92	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

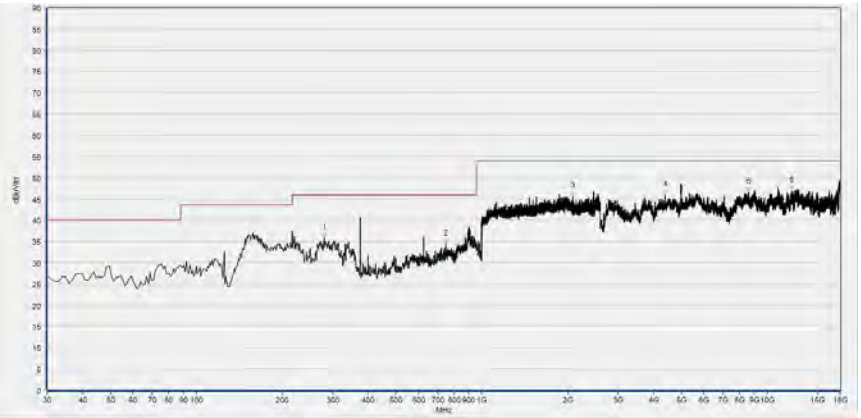
(Antenna Horizontal, 30MHz to 18GHz)



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
357.860	29.26	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
749.740	33.69	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2020.800	46.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4392.560	44.95	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7029.040	44.65	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10956.040	46.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

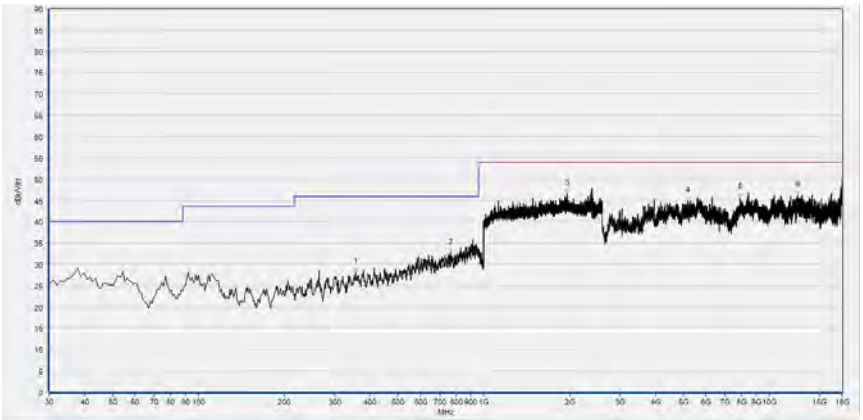
(Antenna Vertical, 30MHz to 18GHz)

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
280.260	35.85	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
749.740	34.44	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2087.467	45.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4377.160	45.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8612.160	46.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12163.400	46.90	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
355.920	28.12	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
767.200	32.62	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1954.667	46.58	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5181.040	44.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7888.360	45.63	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12591.520	46.18	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	2020.10.23	2021.10.22
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
Prototype adapter	N/A	KW300-12 0L20	SHANJANG	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	2021.07.16	2022.07.15
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	2021.07.16	2022.07.15
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2021.07.16	2022.07.15
26-40GHz pre-Amplifier	56774	S40M400L4002	Tonscend	2021.07.16	2022.07.15
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2021.07.16	2022.07.15
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT