REPORT No.: SZ21100132W01

TEST REPORT

APPLICANT	:	Reliance Communications LLC
PRODUCT NAME	:	Orbic Tab10R 5G
MODEL NAME	:	R10L5TR
BRAND NAME	:	Orbic
FCC ID	:	2ABGH-R10L5TR
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2021-07-01
TEST DATE	:	2021-07-22 to 2022-01-26
ISSUE DATE	:	2022-01-27

Edited by: Zeng Xiaoying (Rapporteur)

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DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2022-01-27	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Reliance Communications LLC
Applicant Address:	91 Colin Drive, Unit 1, HOLBROOK, New York 11741, United States
Manufacturer:	ZJY RIGHT SOURCE INDIA PRIVATE LIMITED
Manufacturer Address:	MIDC industrial Area, Shiravane, Nerul, India

1.2. Equipment Under Test (EUT) Description

Product Name:	Orbic Tab10R 5G	
Sample No.:	2#	
Hardware Version:	V1.1	
Software Version:	ORB10L5TR_v1.0.5_BVZ	
Equipment Type:	Bluetooth LE	
Bluetooth Version:	5.1	
Modulation Type:	GFSK	
Data Rate:	1Mbps, 2Mbps	
Operating Frequency Range:	2402MHz-2480MHz	
Antenna Type:	PIFA Antenna	
Antenna Gain:	-1.0dBi	
Accessory Information:	Battery	
	Brand Name:	Orbic
	Model No.:	BTE-6001
	Serial No.:	N/A
	Capacity:	6000mAh
	Rated Voltage:	3.85V
	Charge Limit:	4.4V
	Manufacturer:	HUIZHOU DXDRAGON INC

Accessory Information:	AC Adapter	
	Brand Name:	Orbic
	Model No.:	BLJ-QC06HU
	Serial No.:	N/A
	Rated Output:	5V⎓3A, 9V⎓2A, 12V⎓1.5A
	Rated Input:	100-240V~50/60Hz, 0.5A
	Manufacturer:	Zhongshan Baolijin Electronic Co., Ltd.

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

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

1.3. The Channel Number and Frequency

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	**19**	**2440**	29	2460	**39**	**2480**

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

1.4. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method Determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	N/A	Duty Cycle of Test Signal	Jul 22, 2021	Su Xiaoxian	PASS	No deviation
3	15.247(b)	Maximum Peak Conducted Output Power	Jul 22, 2021	Su Xiaoxian	PASS	No deviation
4	15.247(b)	Maximum Average Conducted Output Power	Jul 22, 2021	Su Xiaoxian	PASS	No deviation
5	15.247(a)	Bandwidth	Jul 22, 2021	Su Xiaoxian	PASS	No deviation
6	15.247(d)	Conducted Spurious Emission and Band Edge	Jul 22, 2021	Su Xiaoxian	PASS	No deviation
7	15.247(e)	Power Spectral Density	Jul 22, 2021	Su Xiaoxian	PASS	No deviation
8	15.207	Conducted Emission	Jan 11, 2022	Huang Zhiye	PASS	No deviation
9	15.247(d)	Restricted Frequency Bands	Jan 26, 2022	Lin Jiayong	PASS	No deviation
10	15.209, 15.247(d)	Radiated Emission	Jan 25, 2022	Lin Jiayong	PASS	No deviation
Note 1: The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013 and 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 1.5dB means the cable loss is 1.5dB.
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.

1.5. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna Requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2. Test Result: Compliant

Inside of the EUT has a PIFA antenna coupled with the metal shrapnel. Please refer to the EUT internal photos.

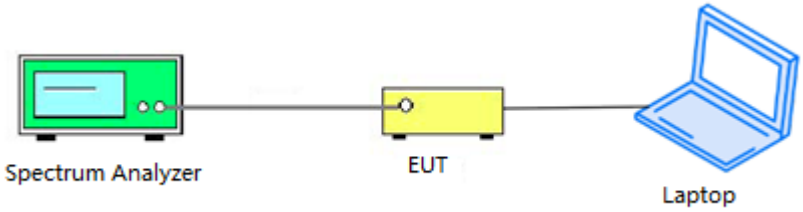
2.2. Duty Cycle of Test Signal

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 sub clause, 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 non constant.

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

Test Mode	Data Rate	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
GFSK	1Mbps	61.54	2.11
	2Mbps	32.54	4.88

2.3. Maximum Peak Conducted Output Power

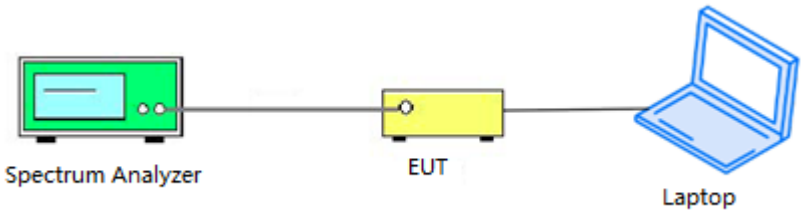
2.3.1. Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

2.3.2. Test Description

The measured output power was calculated by the reading of the spectrum analyzer and calibration.

Test Setup:



The EUT (Equipment under the test) 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, all test result in Spectrum analyzer.

2.3.3. Test Procedure

The measured output power was calculated by the reading of the spectrum analyzer and calibration. Following is the test procedure for Peak Output Power test on the spectrum analyzer:
a) Set analyzer center frequency to channel center frequency
b) Set RBW to1MHz
c) Set VBW to 3MHz
d) Set span to 3MHz
e) Sweep time = auto couple
f) Detector = peak
g) Trace mode = max hold
h) Allow trace to fully stabilize
i) Use peak marker function to determine the peak amplitude level

2.3.4. Test Result

1Mbps

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-3.68	0.0004	30	1	PASS
19	2440	-4.10	0.0004			PASS
39	2480	-1.72	0.0007			PASS

B. Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440MHz)

(Channel 39, 2480MHz)

2Mbps

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-3.20	0.0005	30	1	PASS
19	2440	-4.07	0.0004			PASS
39	2480	**-1.49**	**0.0007**			PASS

B. Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440MHz)

(Channel 39, 2480MHz)

2.4. Maximum Average Conducted Output Power

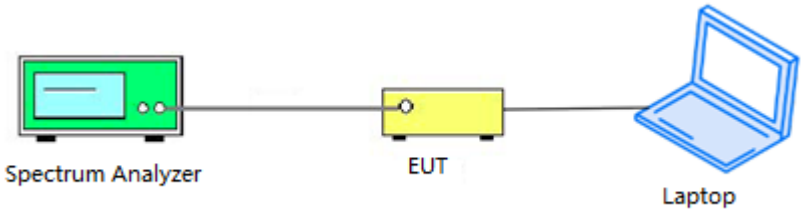
2.4.1. Requirement

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 average conducted output power of the intentional radiator shall not exceed 1 Watt.

2.4.2. Test Description

The measured output power was calculated by the reading of the spectrum analyzer and calibration.

Test Setup:



The EUT (Equipment under the test) 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, all test result in Spectrum analyzer.

2.4.3. Test Procedure

KDB 558074 Section 8.3.2 was used in order to prove compliance.

2.4.4. Test Result

1Mbps

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	-6.34	2.11	-4.23	0.0004	30	1	PASS
19	2440	-6.82		-4.71	0.0003			PASS
39	2480	-4.77		-2.66	0.0005			PASS

2Mbps

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	-8.74	4.88	-3.86	0.0004	30	1	PASS
19	2440	-9.17		-4.29	0.0004			PASS
39	2480	-6.79		**-1.91**	**0.0006**			PASS

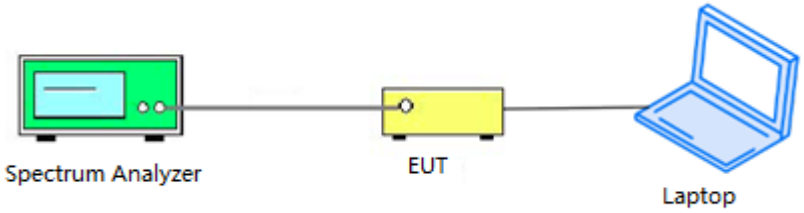
2.5. 6 dB Bandwidth

2.5.1. 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 6dB bandwidth shall be at least 500 kHz.

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

The steps for the first option are as follows:
a) Set analyzer center frequency to channel center frequency
b) Set RBW to100kHz
c) Set VBW to 300kHz
d) Detector = peak.
e) Trace mode = max hold
f) Sweep time = auto couple
g) Allow the trace to fully stabilize
h) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by6 dB relative to the maximum level measured in the fundamental emission

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW ≥ 3 ×RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6 dB.

2.5.4. Test Result

1Mbps

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
0	2402	0.671	≥500	PASS
19	2440	0.671	≥500	PASS
39	2480	0.666	≥500	PASS

B. Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440 MHz)

(Channel 39, 2480MHz)

2Mbps

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
0	2402	1.147	≥500	PASS
19	2440	1.145	≥500	PASS
39	2480	1.155	≥500	PASS

B.Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440 MHz)

(Channel 39, 2480MHz)

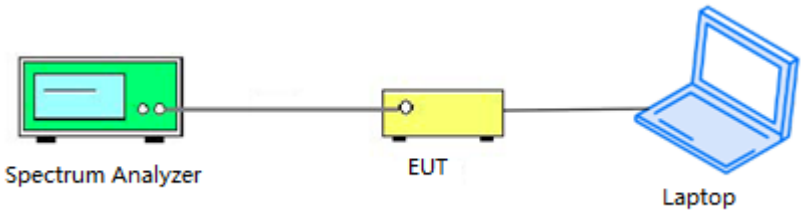
2.6. Conducted Spurious Emissions and Band Edge

2.6.1. 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, based on either an RF conducted or a radiated measurement.

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.
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.

2.6.3. Test Procedure

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

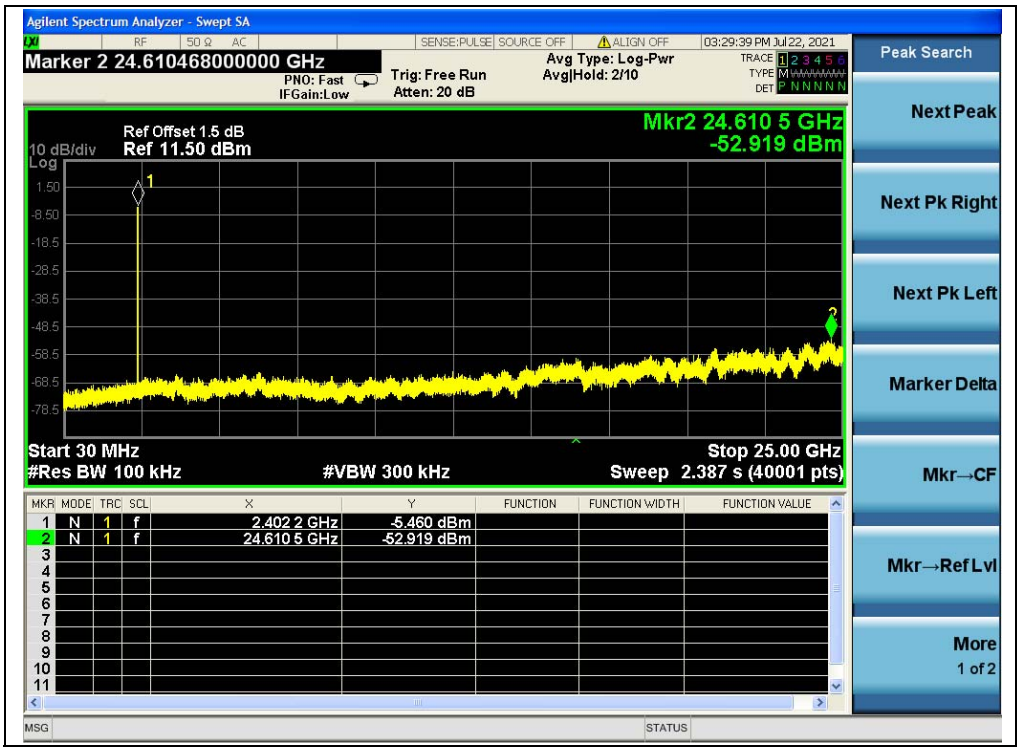
2.6.4. Test Result

1Mbps

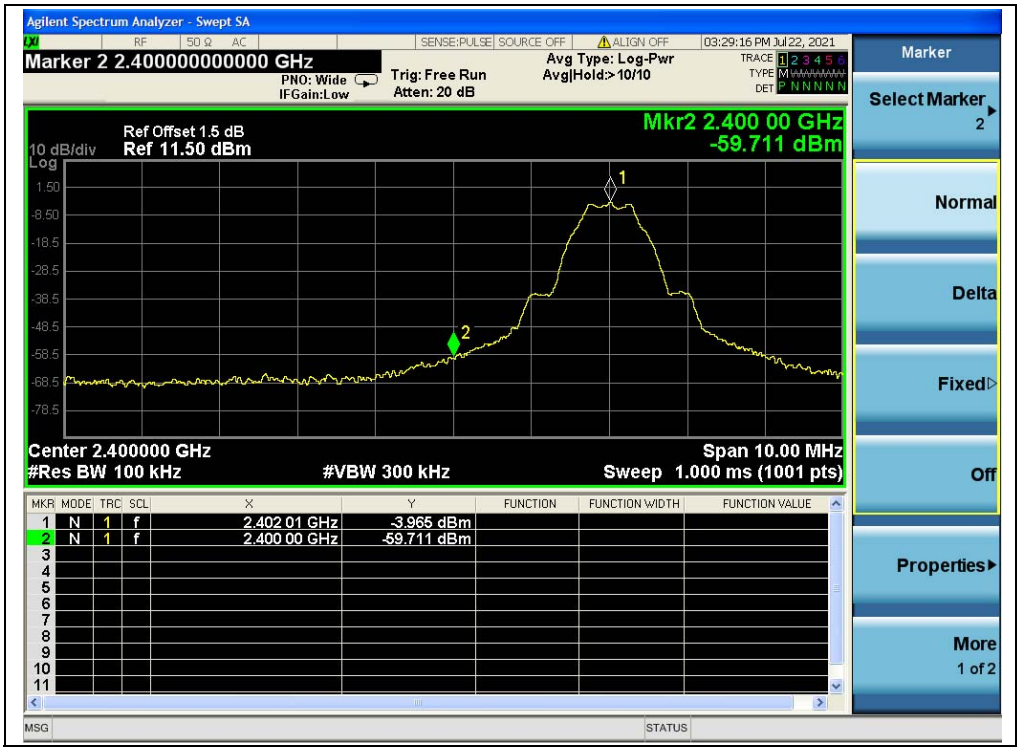
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-52.92	-5.46	-25.46	PASS
19	2440	-53.61	-6.57	-26.57	PASS
39	2480	-53.25	-5.85	-25.85	PASS

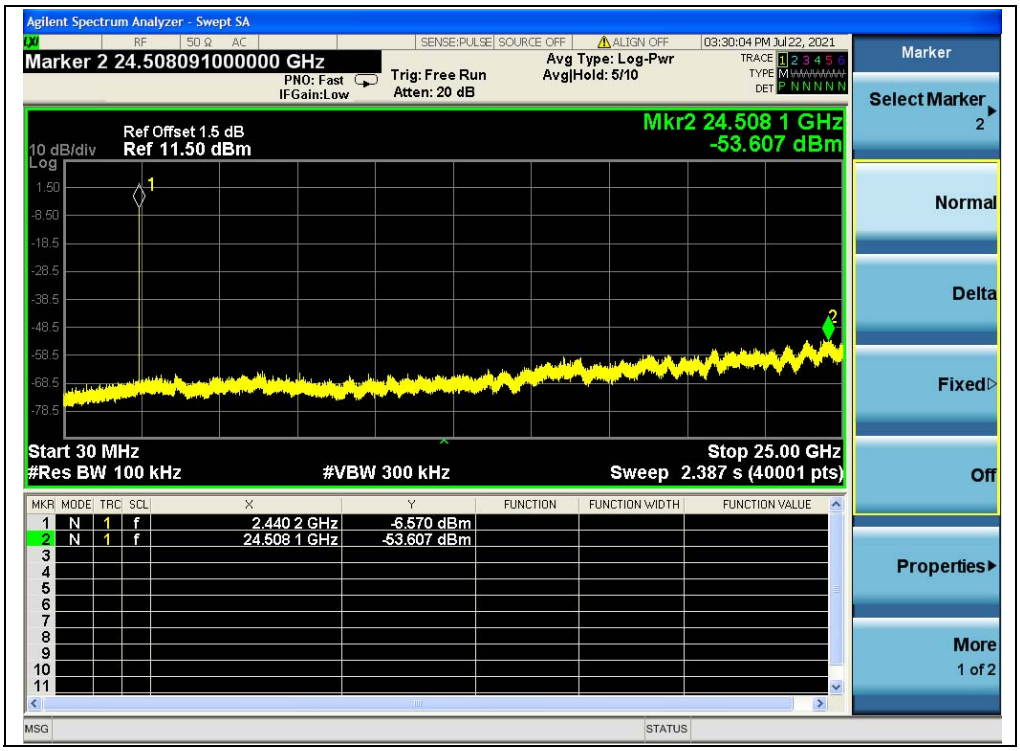
B. Test Plot:



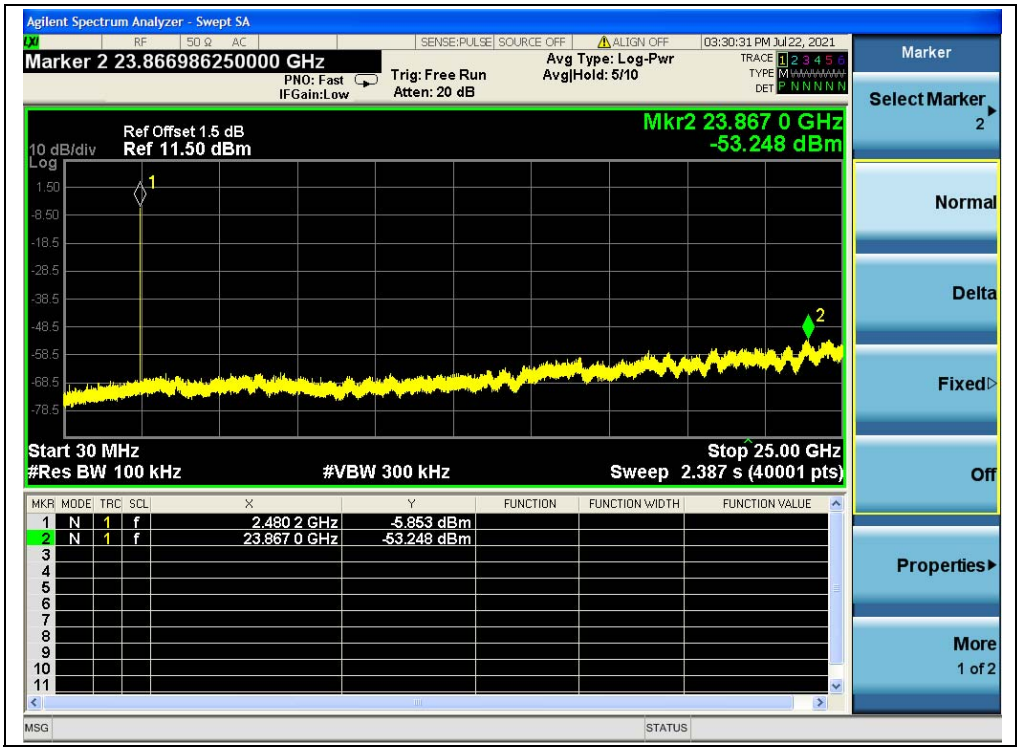
(30MHz to 25GHz, Channel 0)



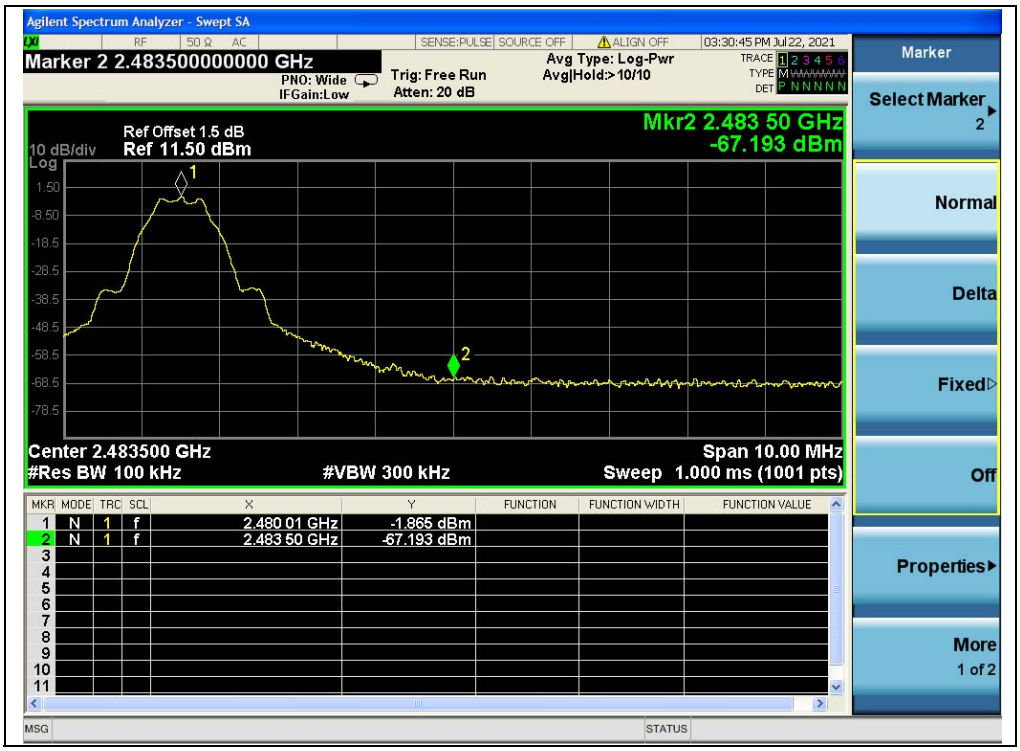
(Band Edge, Channel 0)



(30MHz to 25GHz, Channel 19)



(30MHz to 25GHz, Channel 39)



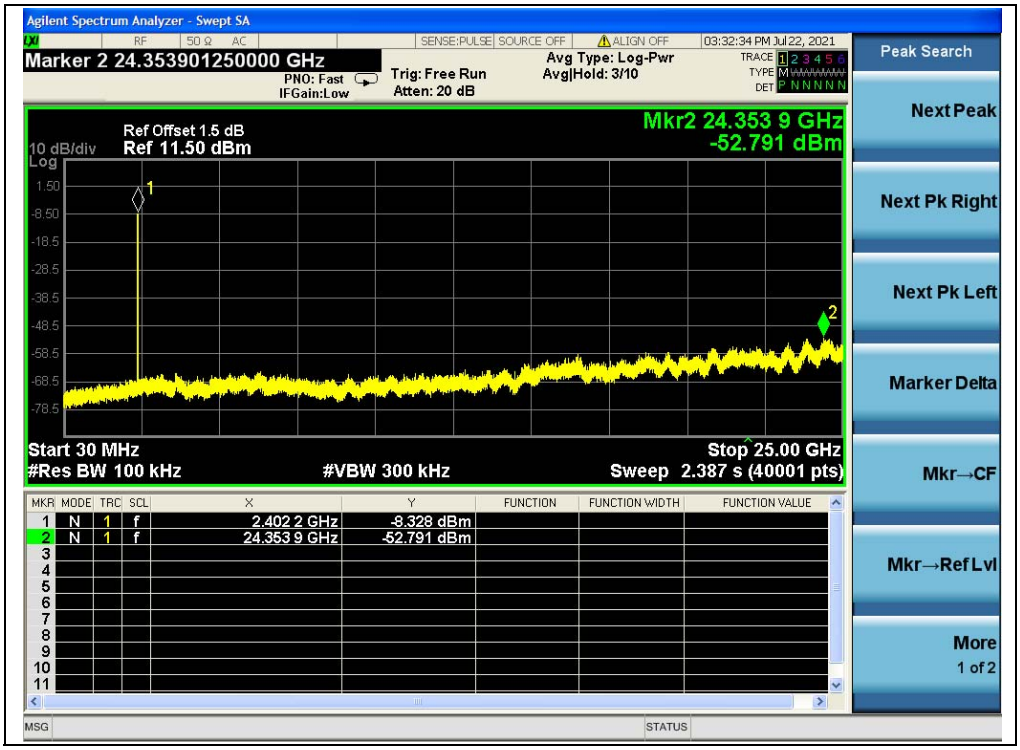
(Band Edge, Channel 39)

2Mbps

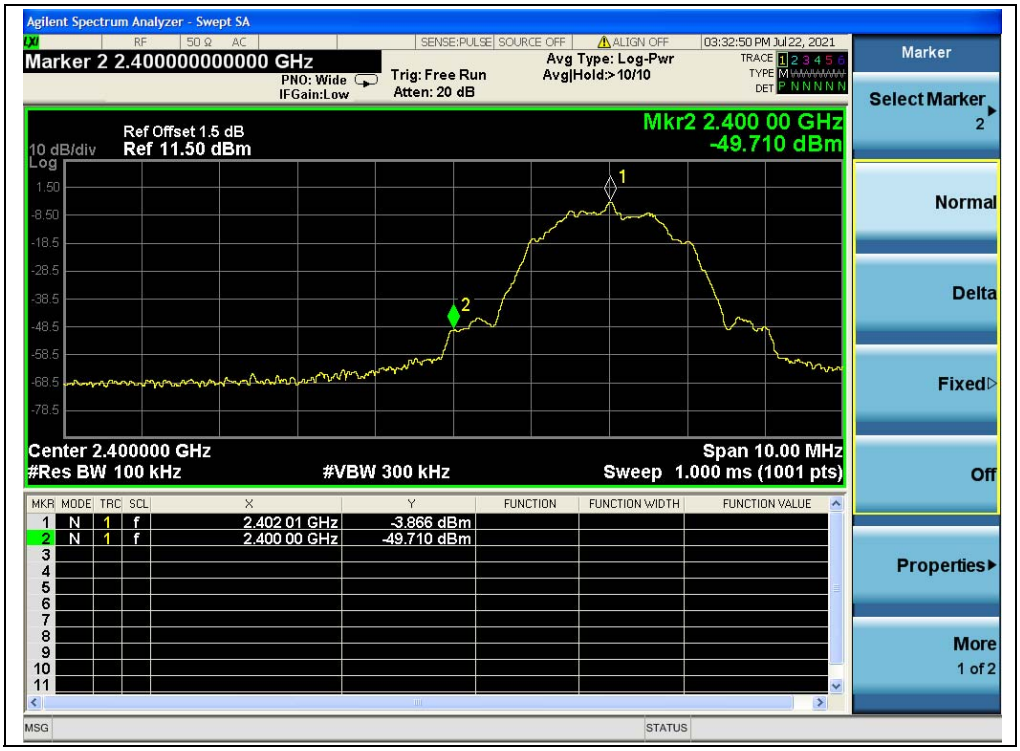
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-52.79	-8.33	-28.33	PASS
19	2440	-52.87	-8.84	-28.84	PASS
39	2480	-53.64	-5.71	-25.71	PASS

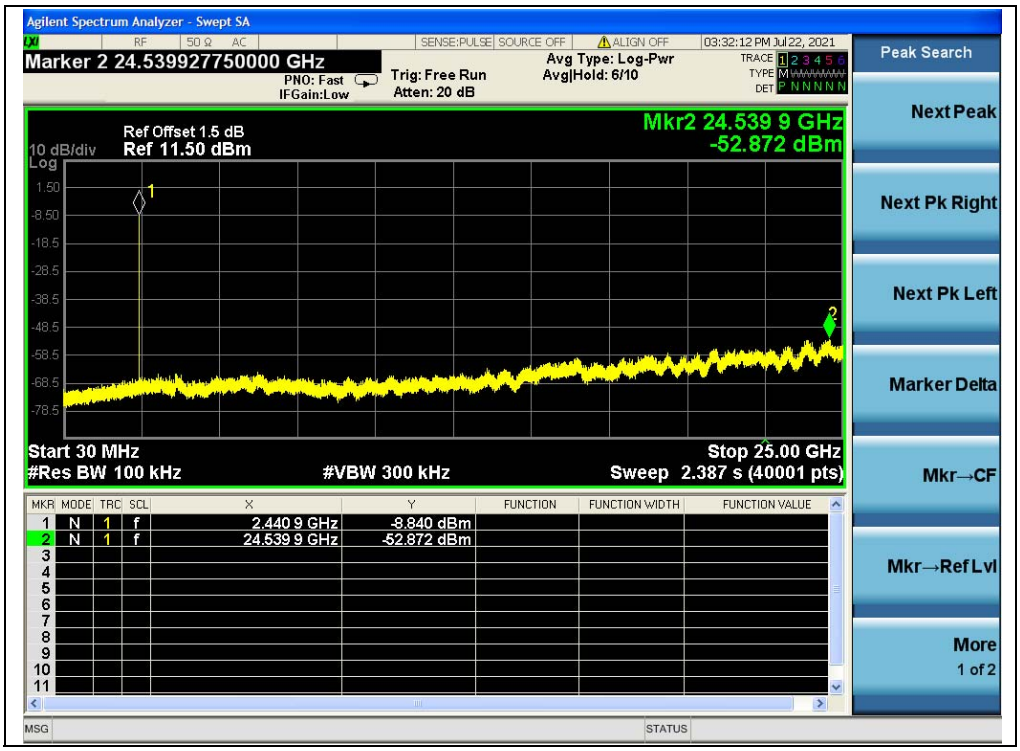
B. Test Plot:



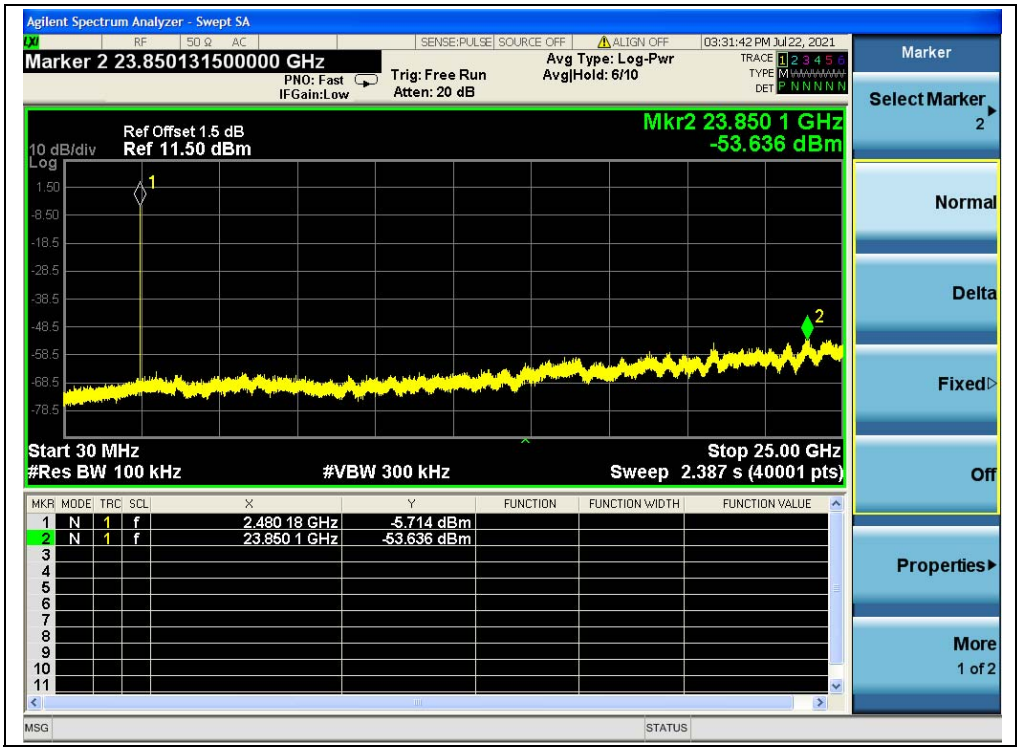
(30MHz to 25GHz, Channel 0)



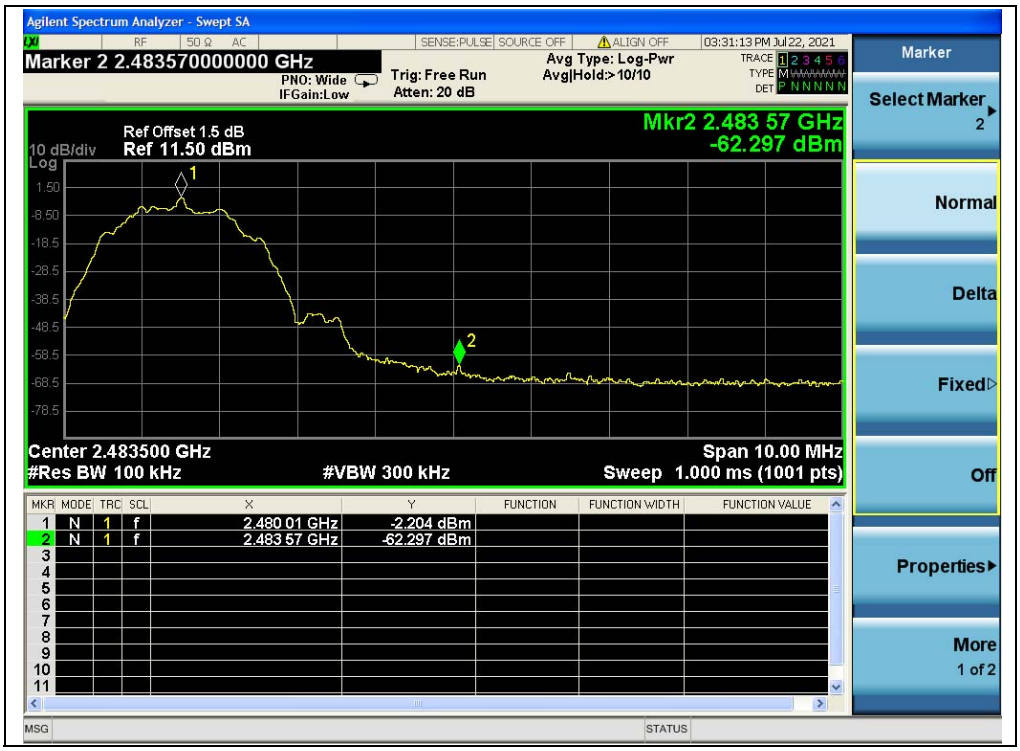
(Band Edge, Channel 0)



(30MHz to 25GHz, Channel 19)



(30MHz to 25GHz, Channel 39)



(Band Edge, Channel 39)

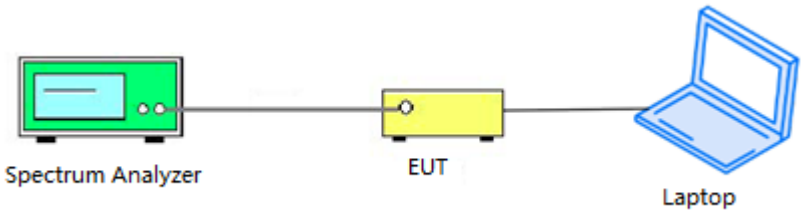
2.7. Power Spectral Density

2.7.1. 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.

2.7.2. 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.

2.7.3. Test Procedure

The measured power spectral density was calculated by the reading of the spectrum analyzer and calibration. Following is the test procedure for PSD test:
a) Set analyzer center frequency to channel center frequency
b) Set span to1.5 times DTS
c) Set RBW to 3kHz
d) Set VBW to 10kHz
e) Detector = peak
f) Sweep time = auto couple
g) Trace mode = max hold
h) Allow trace to fully stabilize
i) Use the peak marker function to determine the maximum amplitude level within the RBW

2.7.4. Test Result

1Mbps

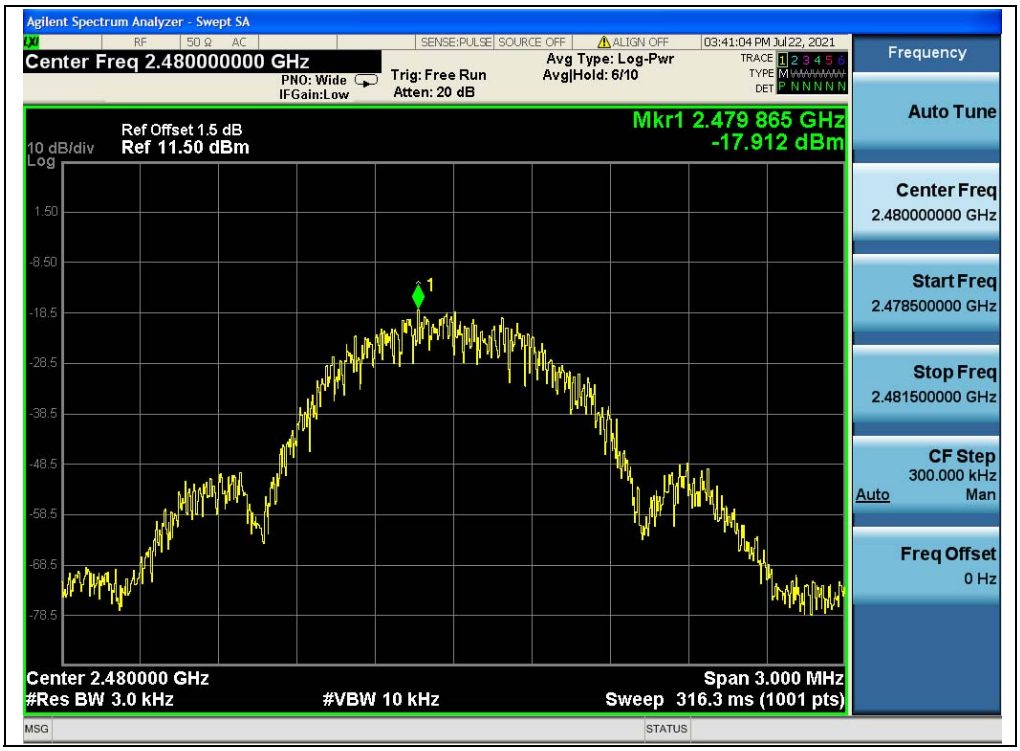
A. Test Verdict:

Spectral Power Density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
0	2402	-18.53	8	PASS
19	2440	-19.18	8	PASS
39	2480	-17.91	8	PASS

B. Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440MHz)



(Channel 39, 2480MHz)

2Mbps

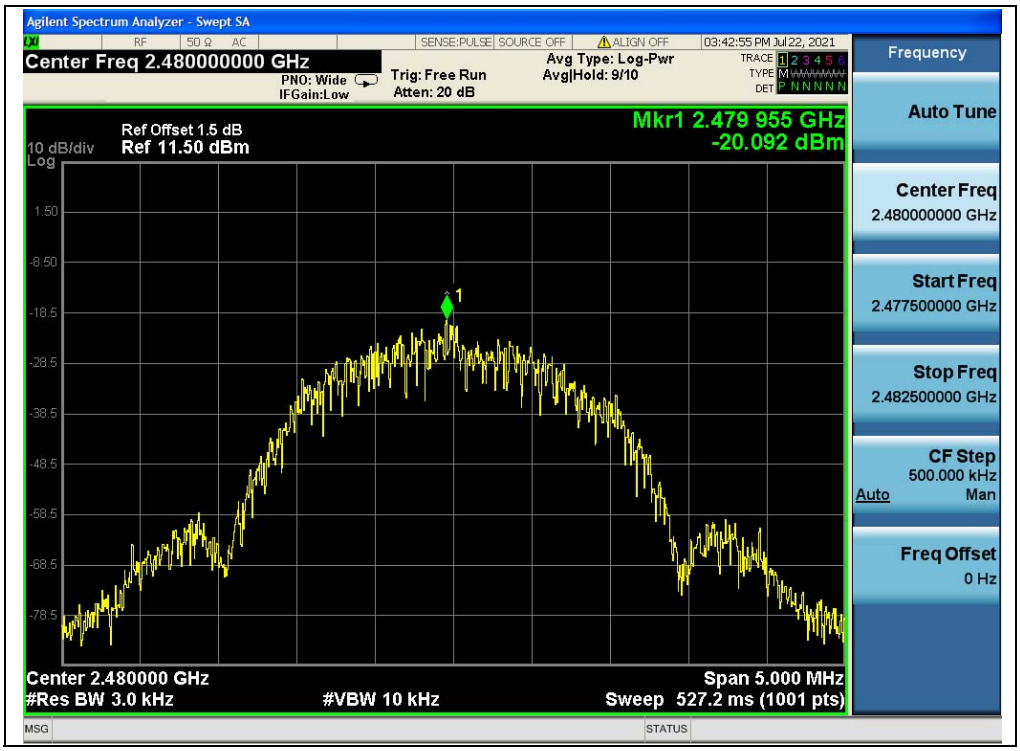
A.Test Verdict:

Spectral Power Density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
0	2402	-21.87	8	PASS
19	2440	-22.48	8	PASS
39	2480	-20.09	8	PASS

B.Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440MHz)



(Channel 39, 2480MHz)

2.8. Conducted Emission

2.8.1. 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

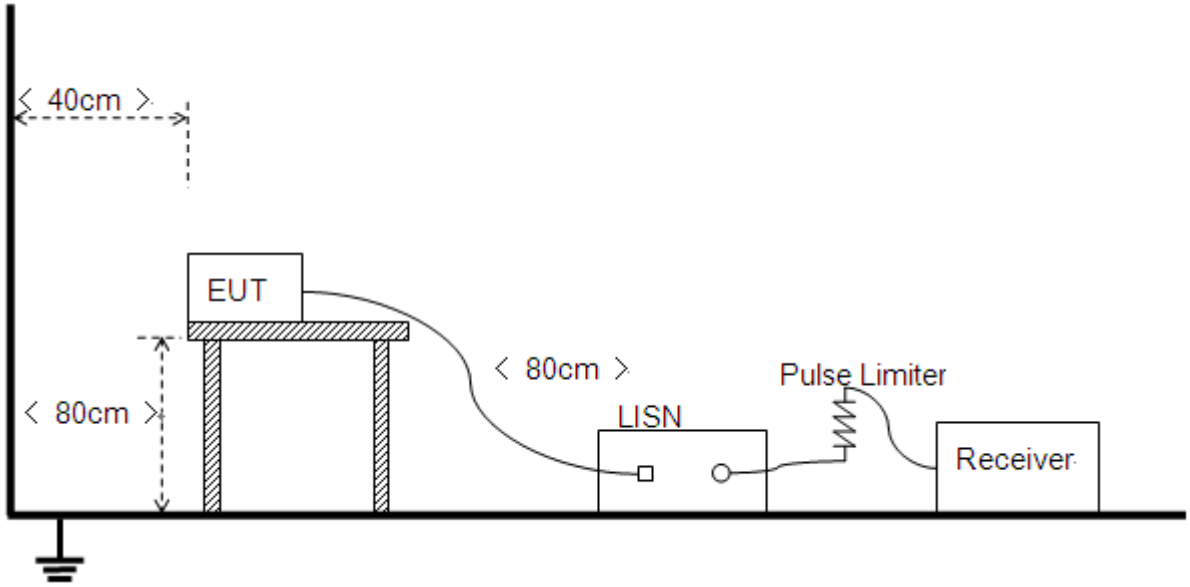
Note:

(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.

2.8.2. 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.

2.8.3. 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+Adapter+Earphone+ BT TX

Test voltage: AC 120V/60Hz

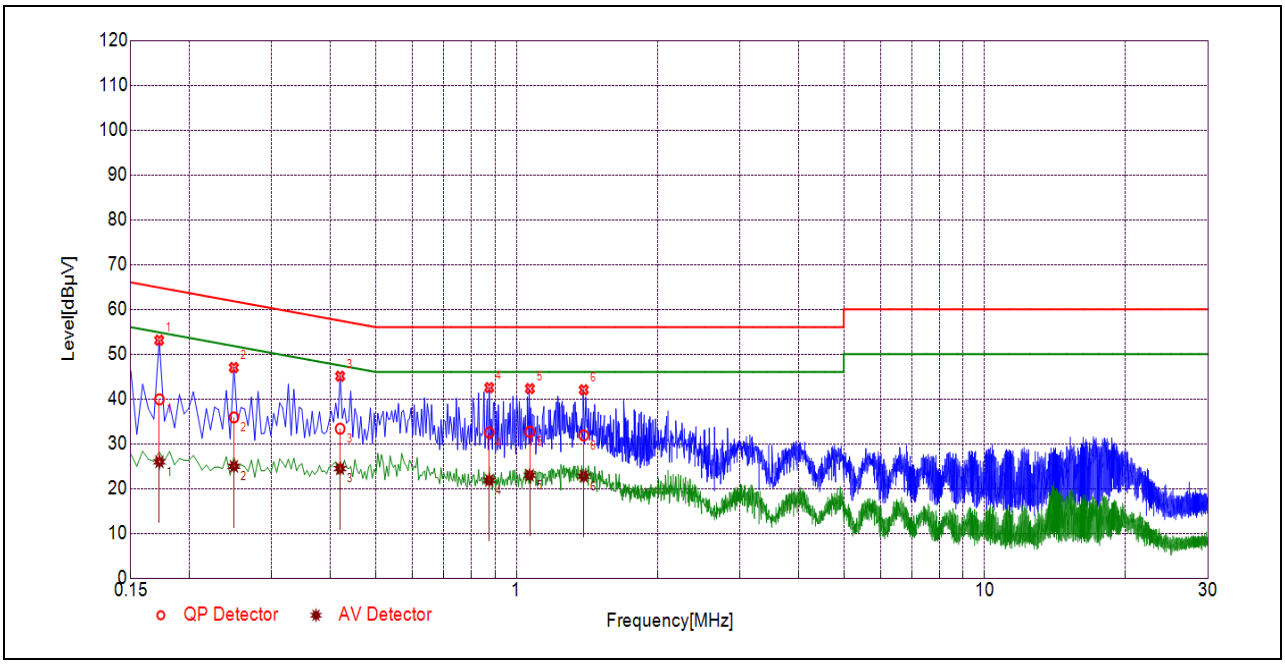
The measurement results are obtained as below:

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

U_R: Receiver Reading

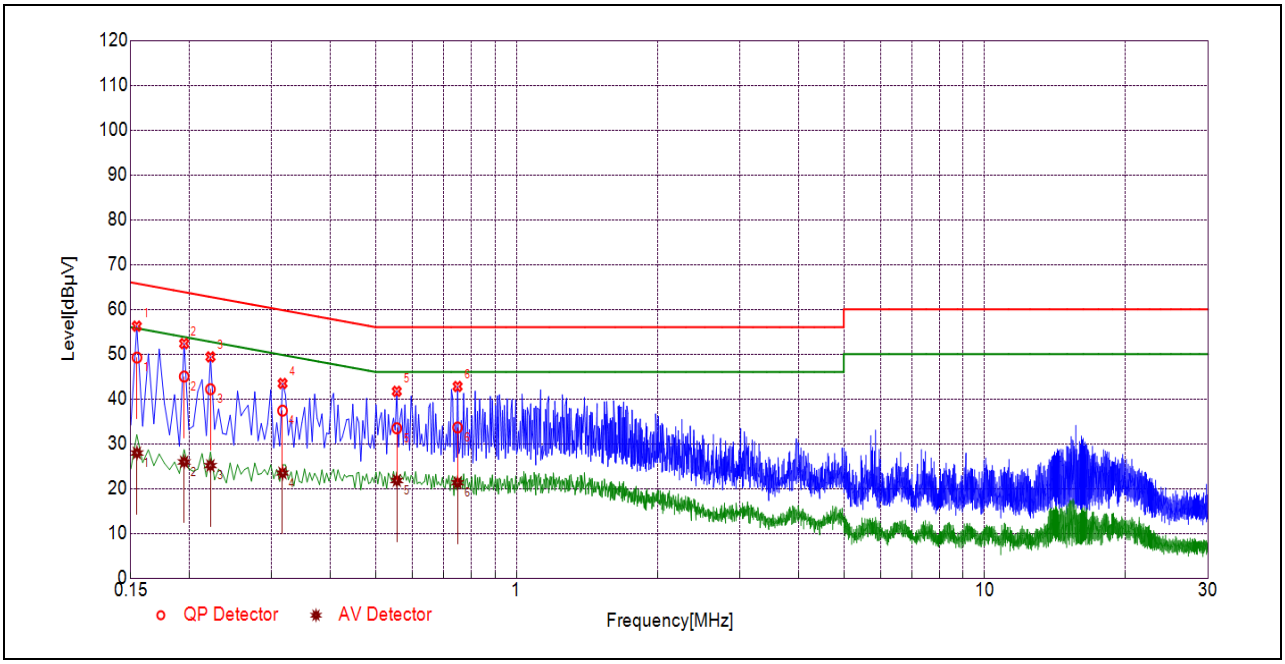
A_{Factor}: Voltage division factor of LISN

B. Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1727	39.90	25.95	64.83	54.83	Line	PASS
2	0.2491	35.87	24.95	61.79	51.79		PASS
3	0.4199	33.33	24.43	57.45	47.45		PASS
4	0.8745	32.45	21.81	56.00	46.00		PASS
5	1.0670	32.62	22.94	56.00	46.00		PASS
6	1.3914	31.83	22.72	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	0.1546	49.22	27.91	65.75	55.75	Neutral	PASS
2	0.1950	44.98	25.92	63.82	53.82		PASS
3	0.2219	42.16	25.11	62.75	52.75		PASS
4	0.3163	37.37	23.45	59.80	49.80		PASS
5	0.5550	33.44	21.78	56.00	46.00		PASS
6	0.7482	33.61	21.28	56.00	46.00		PASS

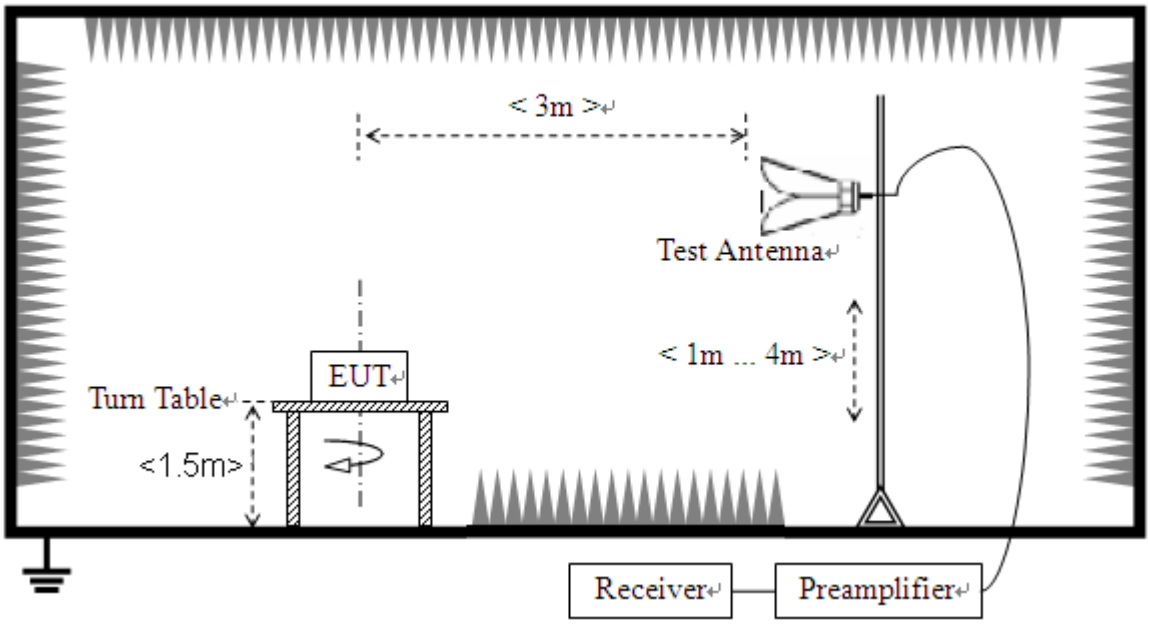
2.9. Restricted Frequency Bands

2.9.1. 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).

2.9.2. 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.

2.9.3. 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

2.9.4. Test Result

The lowest and highest channels are tested to verify the 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

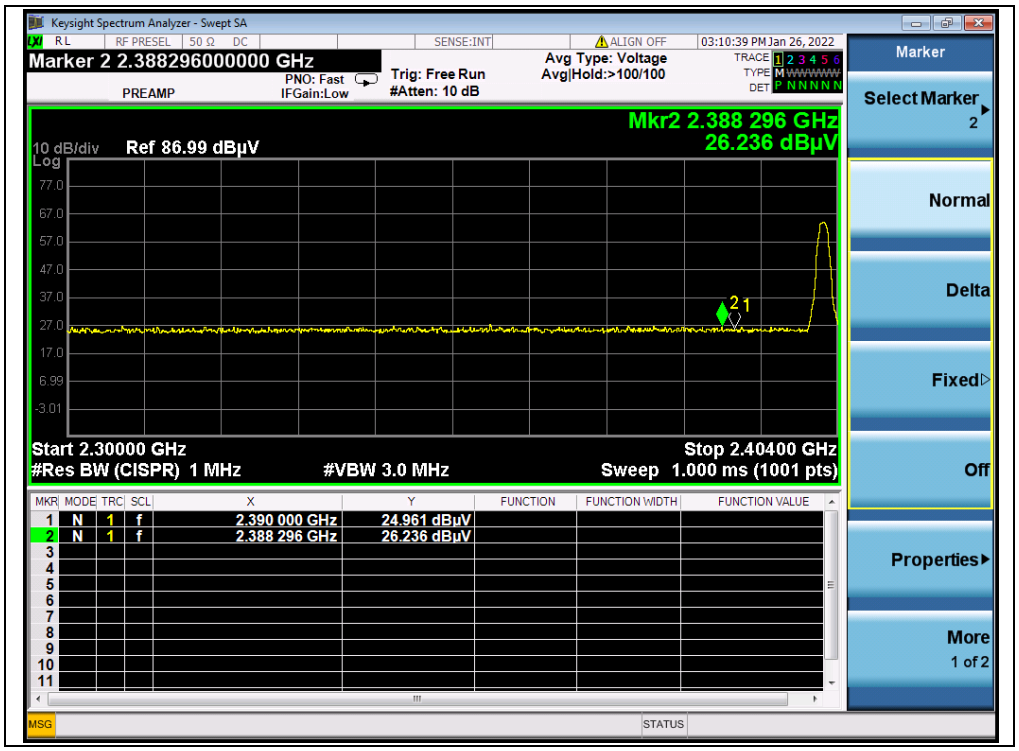
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

1Mbps

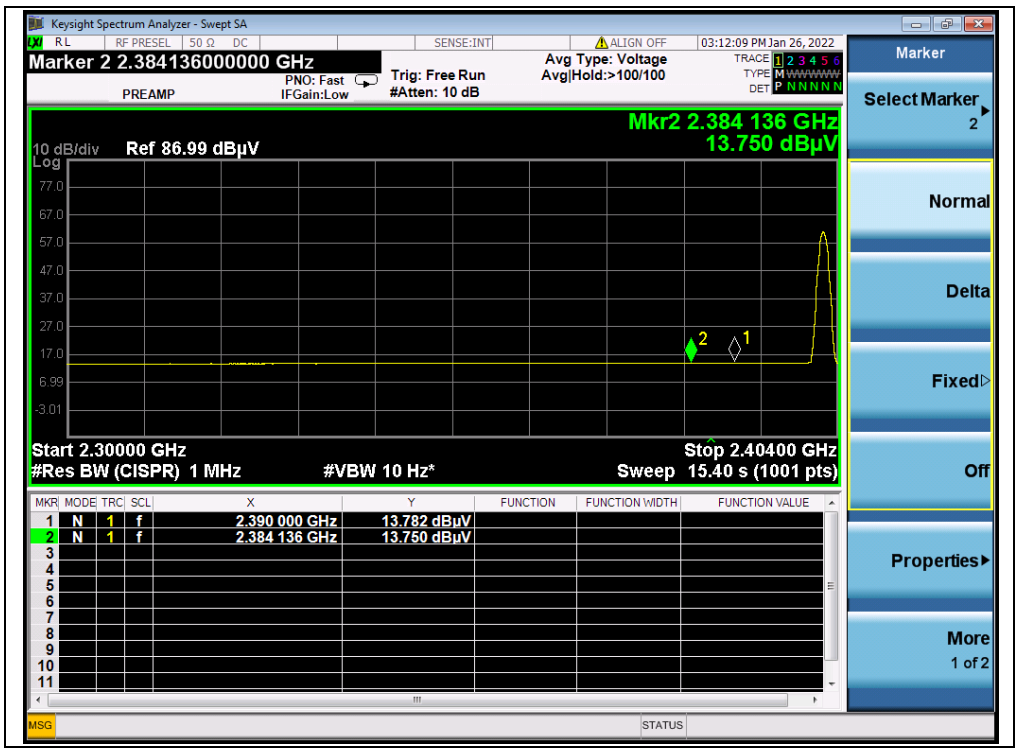
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
0	2388.30	PK	26.24	6.74	27.20	60.18	74	PASS
0	2390.00	AV	13.78	6.74	27.20	47.72	54	PASS
39	2490.96	PK	27.59	6.74	27.20	61.53	74	PASS
39	2483.50	AV	13.55	6.74	27.20	47.49	54	PASS

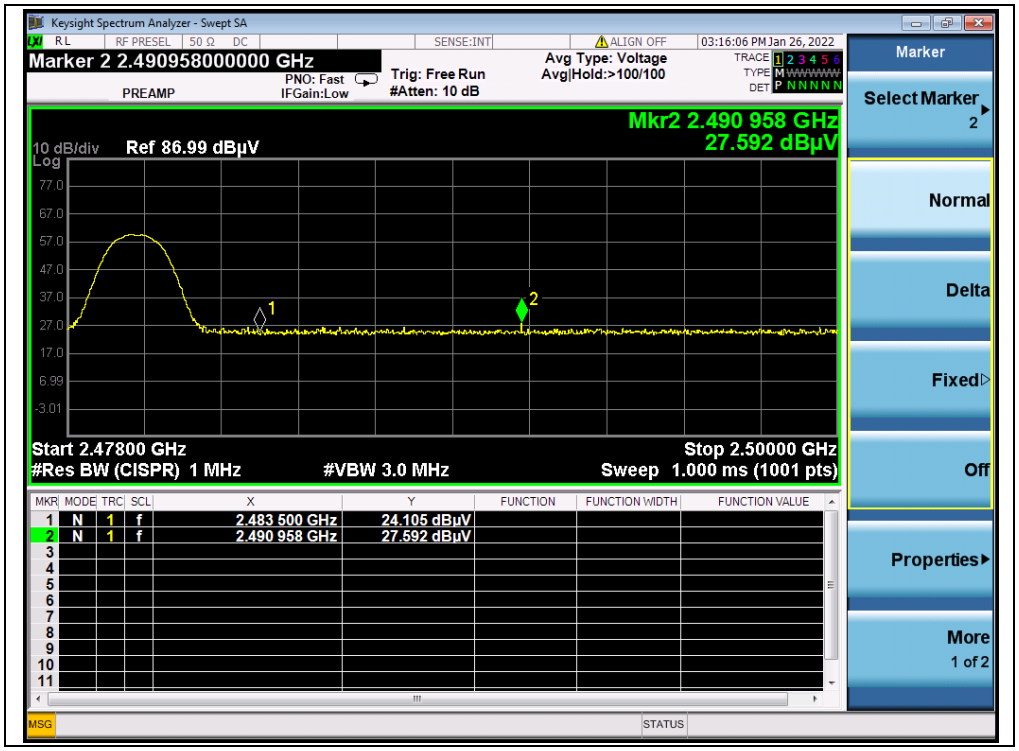
B. Test Plot:



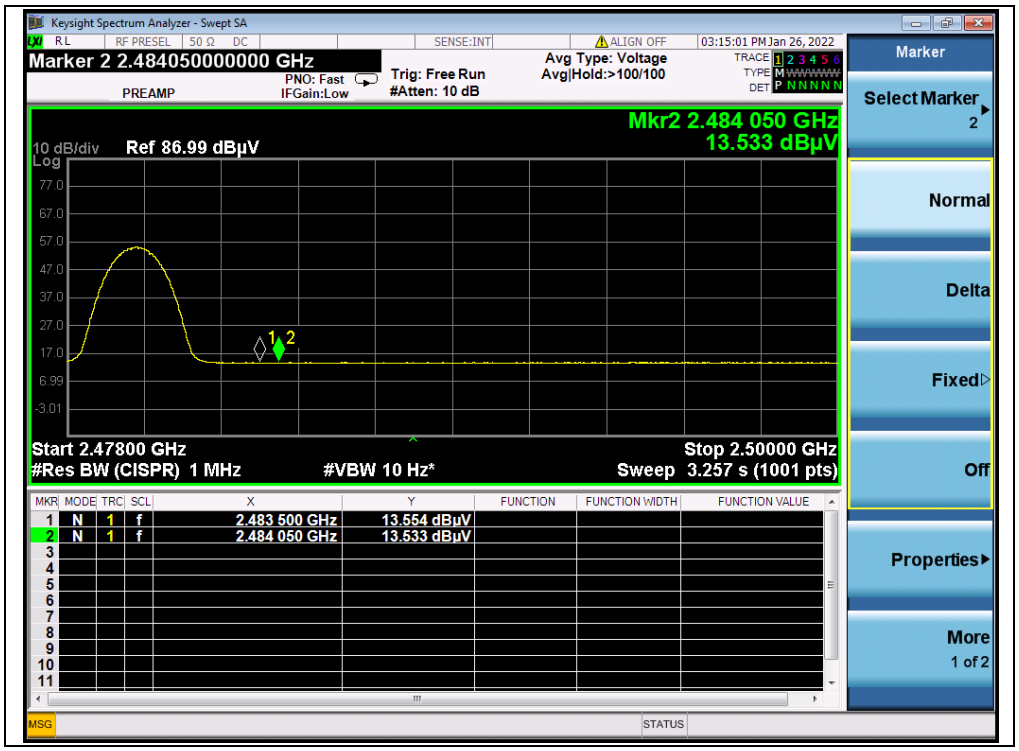
(PEAK, Channel 0)



(AVERAGE, Channel 0)



(PEAK, Channel 39)



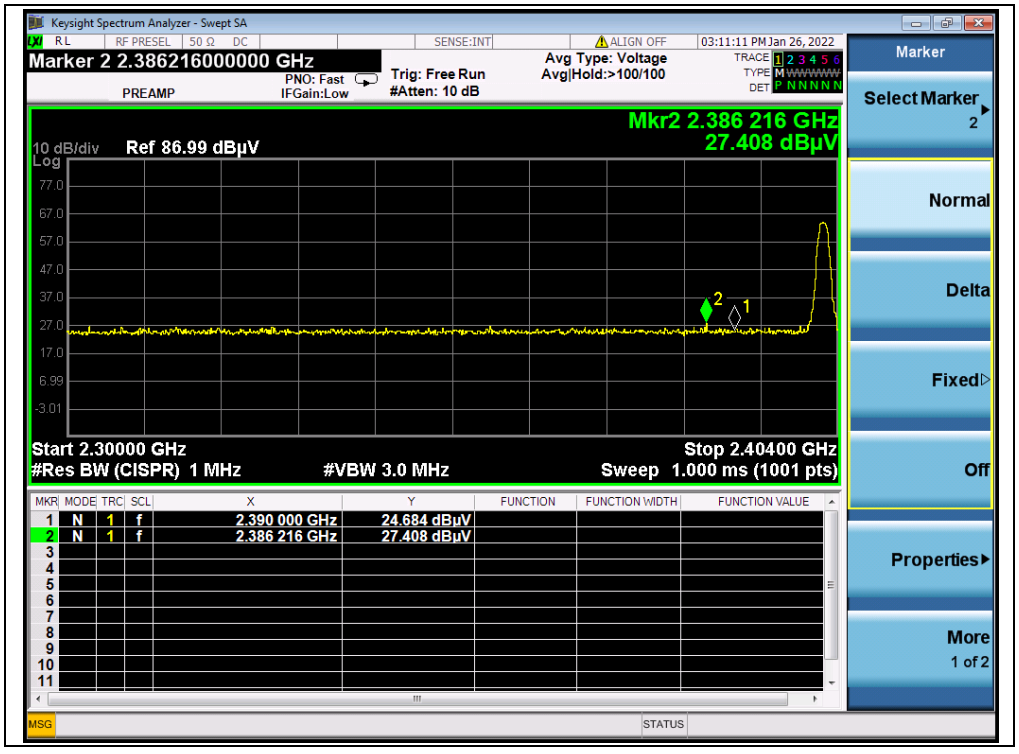
(AVERAGE, Channel 39)

2Mbps

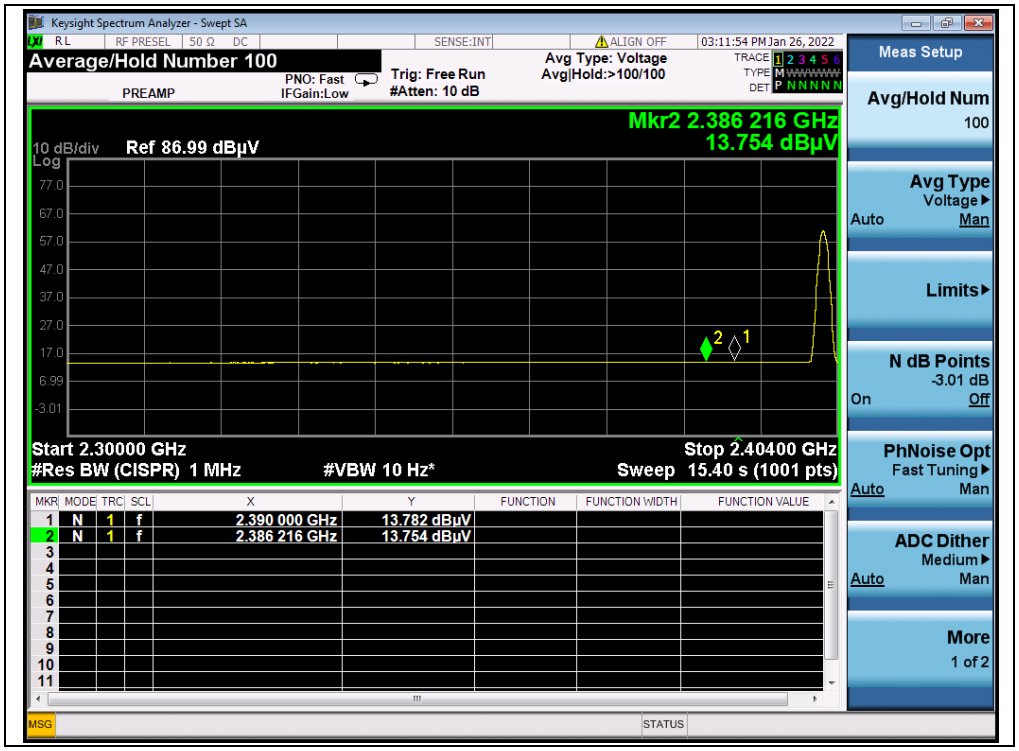
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
0	2386.22	PK	27.41	6.74	27.20	61.35	74	PASS
0	2390.00	AV	13.78	6.74	27.20	47.72	54	PASS
39	2484.56	PK	25.89	6.74	27.20	59.83	74	PASS
39	2483.50	AV	13.55	6.74	27.20	47.49	54	PASS

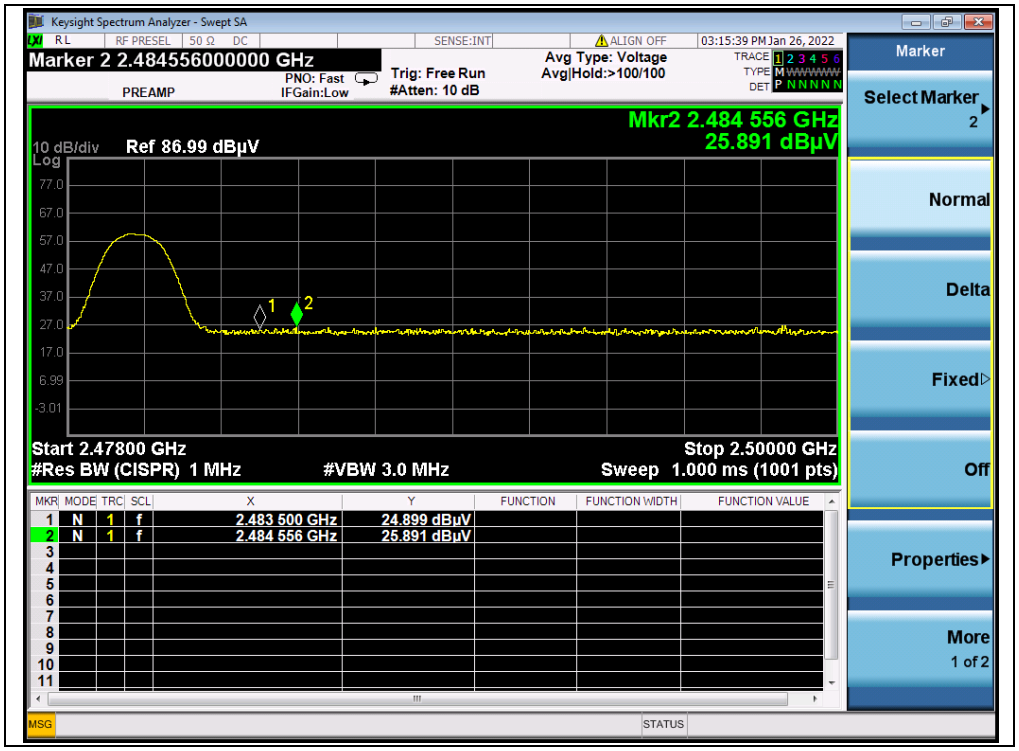
B. Test Plot:



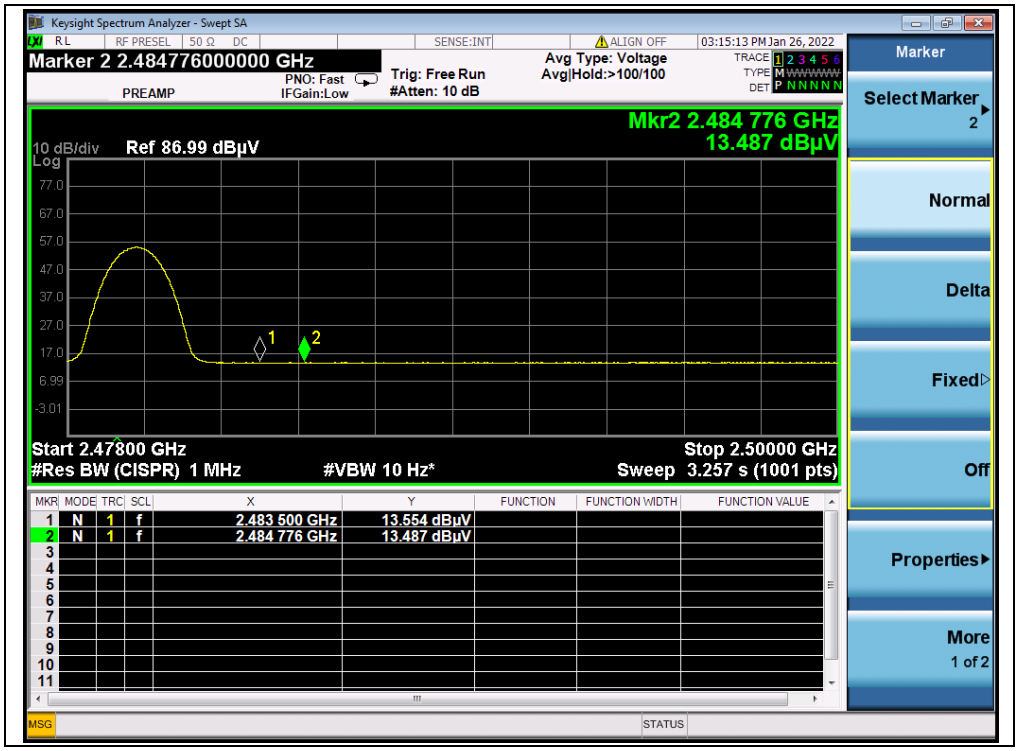
(PEAK, Channel 0)



(AVERAGE, Channel 0)



(PEAK, Channel 39)



(AVERAGE, Channel 39)

2.10. Radiated Emission

2.10.1. 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:

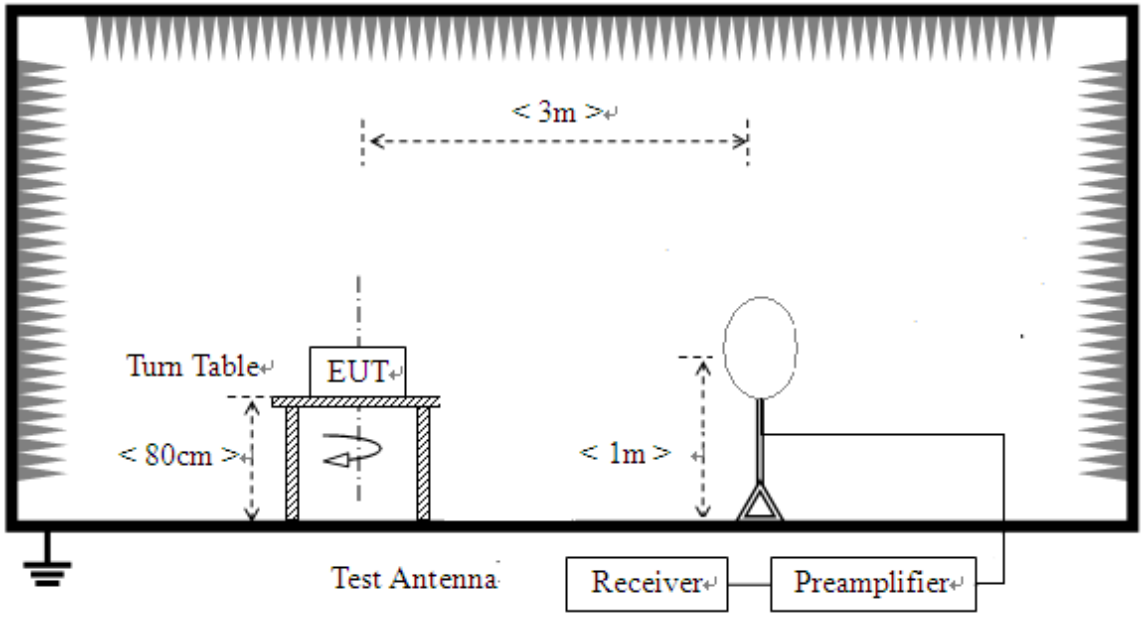
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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).

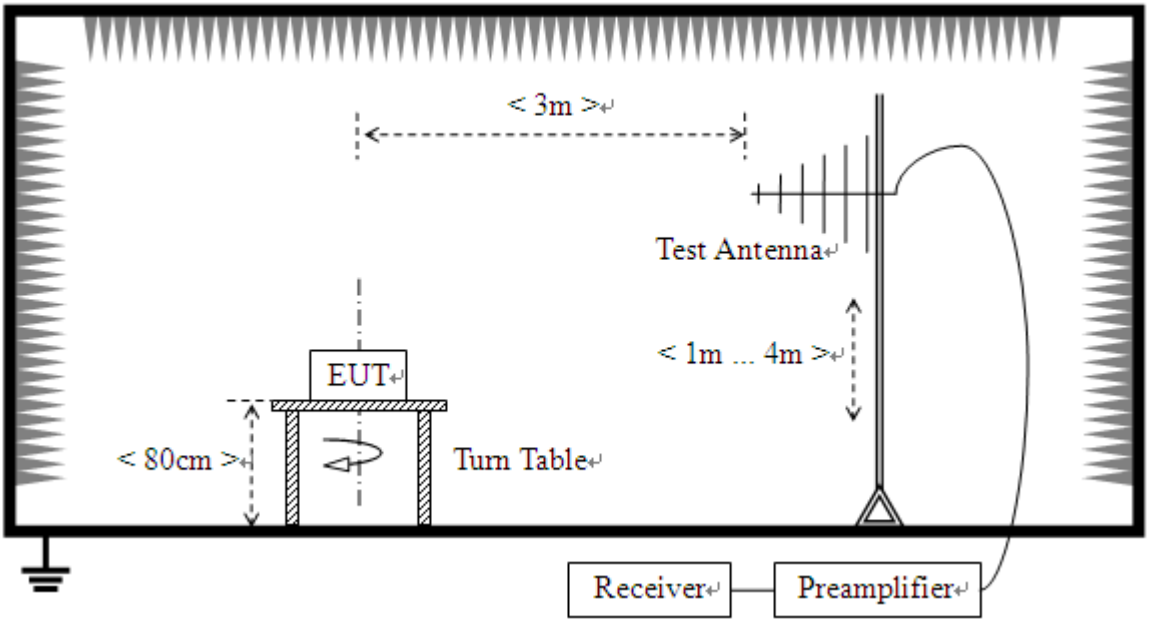
2.10.2. Test Description

Test Setup:

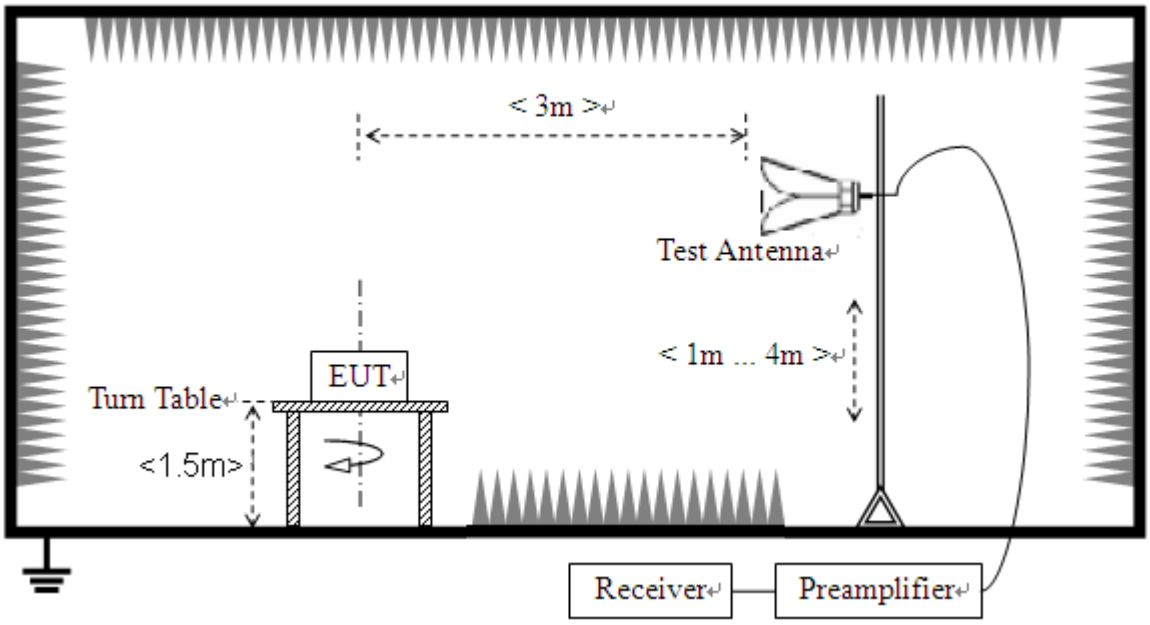
1) For radiated emissions from 9kHz to 30MHz



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.

2.10.3. 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:

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

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.

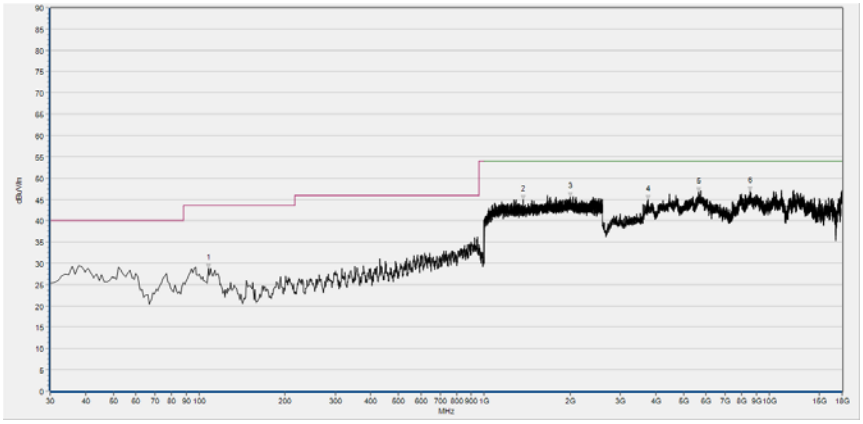
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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.

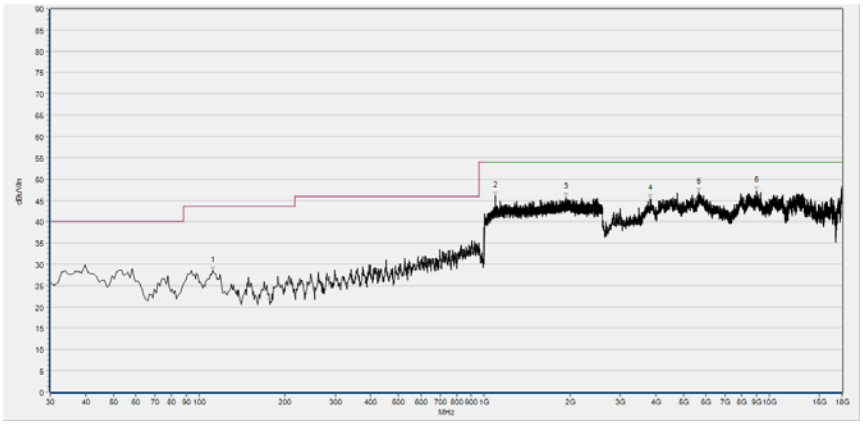
1Mbps

Plot for Channel 0



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	28.86	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1368.533	44.92	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2001.600	45.51	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3764.240	44.88	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5649.200	46.72	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8575.200	46.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

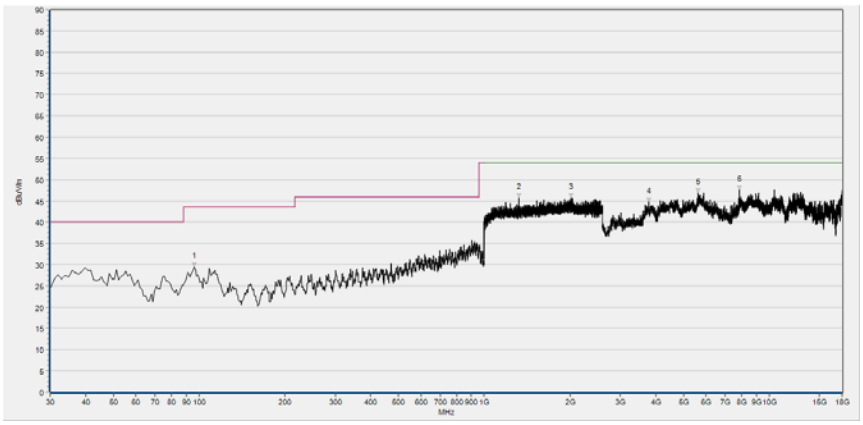
(Antenna Horizontal, 30MHz to 18GHz)



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	28.50	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1095.467	46.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
1932.800	45.78	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3825.840	45.47	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5649.200	46.88	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9006.400	47.25	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

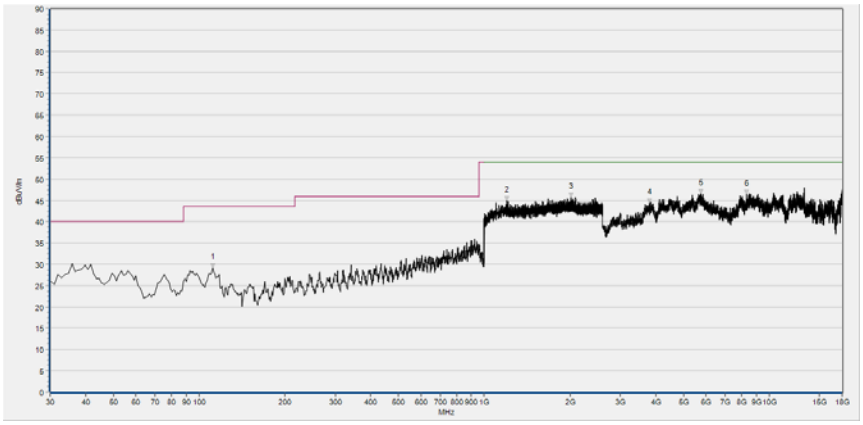
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 19



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
95.960	29.50	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1320.000	45.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2010.133	45.77	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3767.320	44.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5633.800	46.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7851.400	47.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

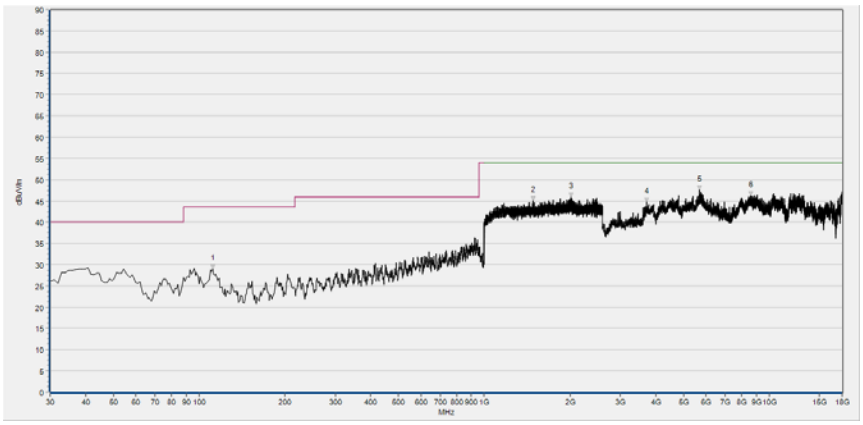
(Antenna Horizontal, 30MHz to 18GHz)



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	29.21	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1200.000	44.92	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2009.600	45.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3788.880	44.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5763.160	46.59	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8301.080	46.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

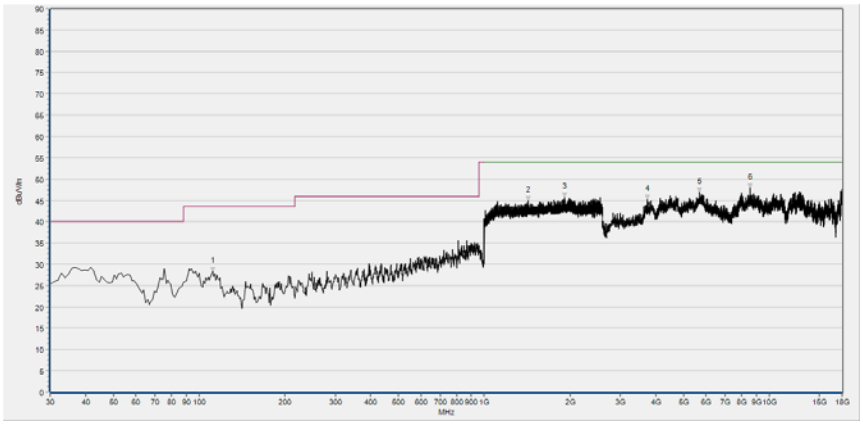
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 39



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	29.02	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1484.800	45.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2010.133	45.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3708.800	44.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5683.080	47.61	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8615.240	46.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

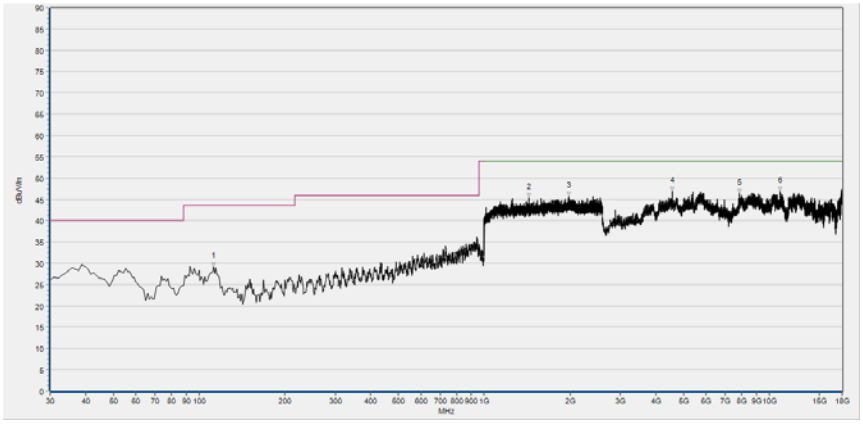


Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
111.480	28.35	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1422.400	44.95	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
1910.933	45.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3724.200	45.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5698.480	46.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8538.240	47.91	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

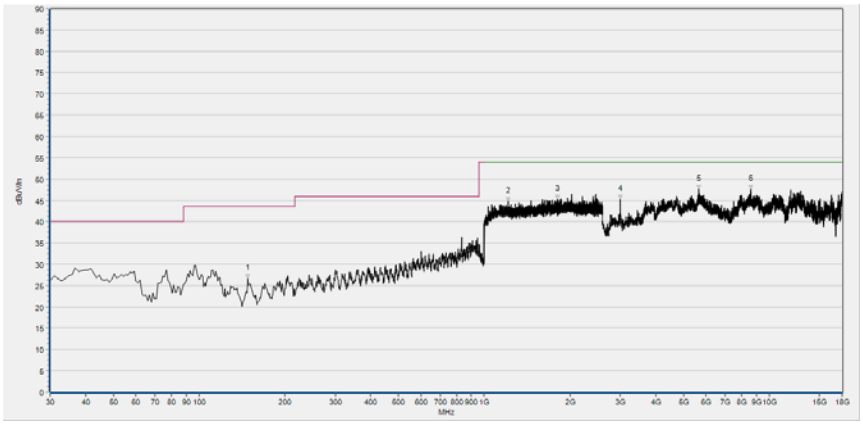
2Mbps

Plot for Channel 0



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
112.450	29.17	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1437.333	45.40	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
1985.067	45.76	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4565.040	46.93	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7863.720	46.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10888.280	46.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

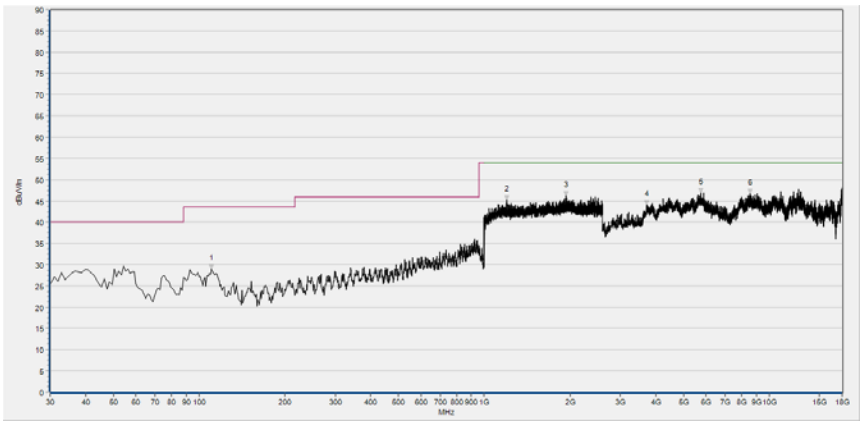
(Antenna Horizontal, 30MHz to 18GHz)



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
148.340	26.70	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1215.467	44.69	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
1801.067	45.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2994.240	45.26	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5661.520	47.64	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8621.400	47.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

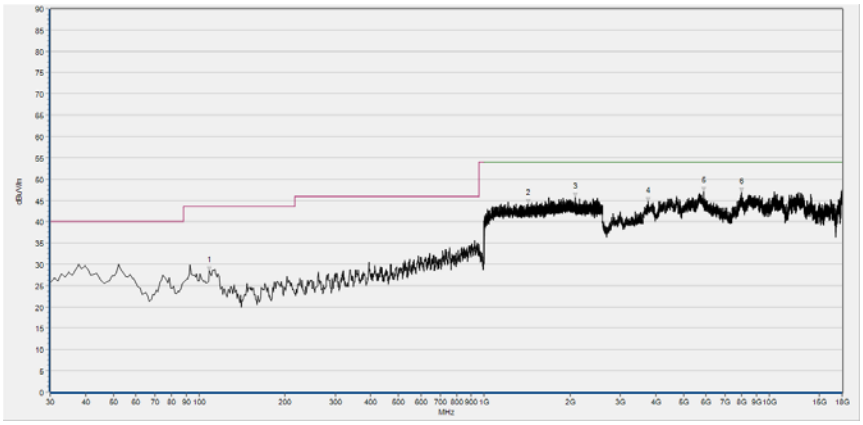
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 19



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
110.510	29.01	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1198.400	45.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
1934.933	46.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3702.640	44.02	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5747.760	46.89	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8553.640	46.77	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

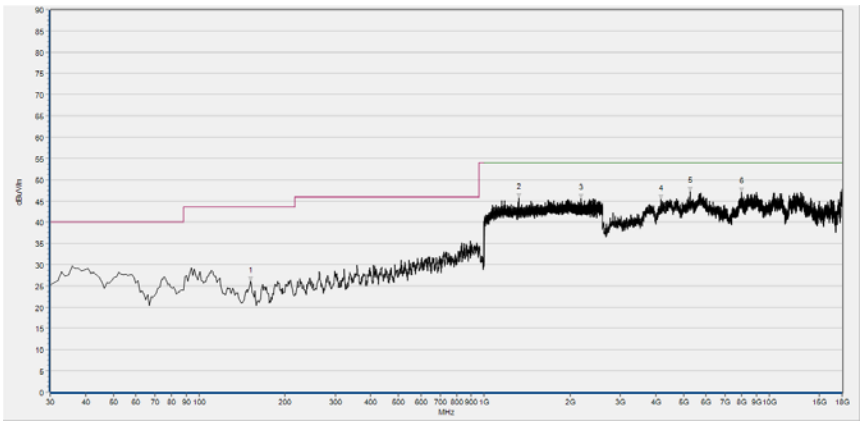
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
108.570	28.53	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1423.467	44.32	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2090.133	45.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3764.240	44.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5889.440	47.03	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7986.920	46.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

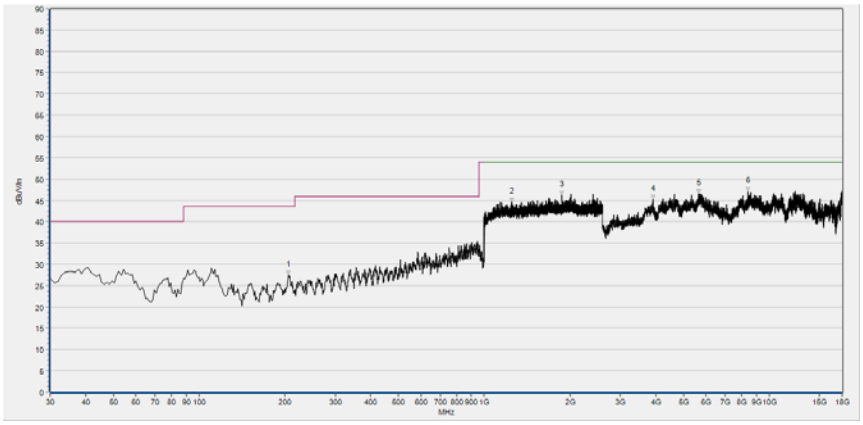
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 39



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
151.250	26.15	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1321.600	45.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2189.333	45.51	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4167.720	45.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5288.840	47.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7999.240	47.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
205.570	27.45	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1251.200	44.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
1874.133	46.29	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3905.920	45.20	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5664.600	46.54	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8408.880	47.11	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 C63.10-2013and 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
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2021.03.25	2022.03.24
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	8127449	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

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	FMZB1520	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2022.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA 9170	Schwarzbeck	2019.07.26	2022.07.25
Coaxial Cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial Cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial Cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
Coaxial Cable (N male) (30MHz-40GHz)	CB05	EMC05	Morlab	N/A	N/A
1-18GHz pre-Amplifier	61171/61172	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