TEST REPORT

APPLICANT	:	Fell Technology AS
PRODUCT NAME	:	Waterguard Water Sensor
MODEL NAME	:	W3703
BRAND NAME	:	Fell Technology AS
FCC ID	:	2AFOZW3703
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2022-02-21
TEST DATE	:	2022-03-10 to 2022-05-11
ISSUE DATE	:	2022-08-11

Edited by: Zeng Xiaoying (Rapporteur)

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Change History		
Version	Date	Reason for change
1.0	2022-08-11	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Fell Technology AS
Applicant Address:	Bragernes Torg 2 3017 Drammen Norway
Manufacturer:	Fell Technology AS
Manufacturer Address:	Bragernes Torg 2 3017 Drammen Norway

1.2. Equipment Under Test (EUT) Description

Product Name:	Waterguard Water Sensor
Sample No.:	2#
Hardware Version:	1.0
Software Version:	1.0
Equipment Type:	Bluetooth LE
Bluetooth Version:	5.2
Modulation Type:	GFSK
Data Rate:	1Mbps, 2Mbps
Operating Frequency Range:	2402MHz-2480MHz
Antenna Type:	Fixed Internal Antenna
Antenna Gain:	-4.2dBi

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	Mar. 10, 2022	Zou Yuantao	PASS	No deviation
3	15.247(b)	Maximum Peak Conducted Output Power	Mar. 10, 2022	Zou Yuantao	PASS	No deviation
4	15.247(b)	Maximum Average Conducted Output Power	Mar. 10, 2022	Zou Yuantao	PASS	No deviation
5	15.247(a)	Bandwidth	Mar. 28, 2022	Zou Yuantao	PASS	No deviation
6	15.247(d)	Conducted Spurious Emission and Band Edge	Mar. 28, 2022	Zou Yuantao	PASS	No deviation
7	15.247(e)	Power Spectral Density	Mar. 28, 2022	Zou Yuantao	PASS	No deviation
8	15.207	Conducted Emission	N/A	N/A	N/A$_{Note1}$	N/A
9	15.247(d)	Restricted Frequency Bands	May 10, 2022	Lin Jiayong	PASS	No deviation
10	15.209, 15.247(d)	Radiated Emission	May 11, 2022	Lin Jiayong	PASS	No deviation
Note 1: Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the						

AC power lines or contain provisions for operation while connected to the AC power lines.
Note 2: The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013 and KDB558074 D01 v05r02.
Note 3: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The Ref offset 1.0dB means the cable loss is 1.0dB.
Note 4: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.
Note 5: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

1.5. 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

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

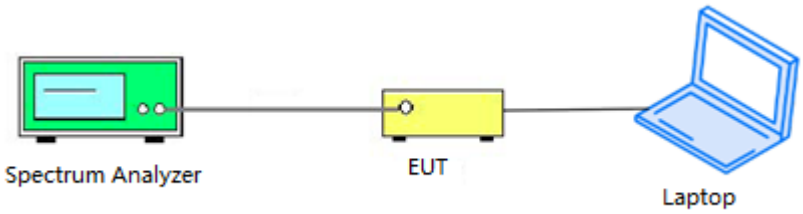
2.2. Duty Cycle of Test Signal

2.2.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration(T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e.,no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this 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	100.00	0.00
	2Mbps	100.00	0.00

2.3. Maximum Peak Conducted Output Power

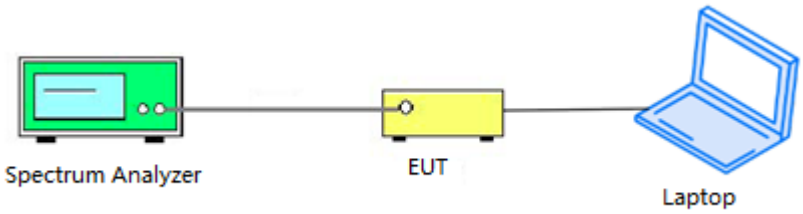
2.3.1. Requirement

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	**-3.26**	**0.0005**	30	1	PASS
19	2440	-3.60	0.0004			PASS
39	2480	-4.52	0.0004			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	-3.28	0.0005	30	1	PASS
19	2440	-3.66	0.0004			PASS
39	2480	-4.56	0.0003			PASS

B. Test Plot:

(Channel 0, 2402MHz)

(Channel 19, 2440MHz)

(Channel 39, 2480MHz)

2.4. Maximum Average Conducted Output Power

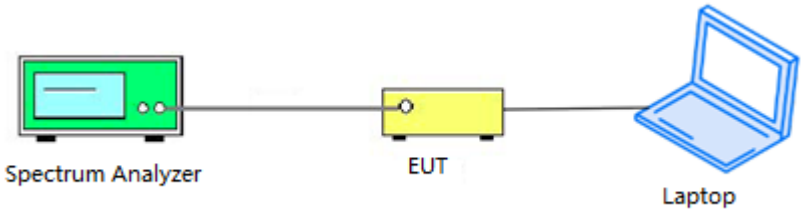
2.4.1. Requirement

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	-3.78	0.00	**-3.78**	**0.0004**	30	1	PASS
19	2440	-4.35		-4.35	0.0004			PASS
39	2480	-5.15		-5.15	0.0003			PASS

2Mbps

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
0	2402	-4.05	0.00	-4.05	0.0004	30	1	PASS
19	2440	-4.67		-4.67	0.0003			PASS
39	2480	-5.36		-5.36	0.0003			PASS

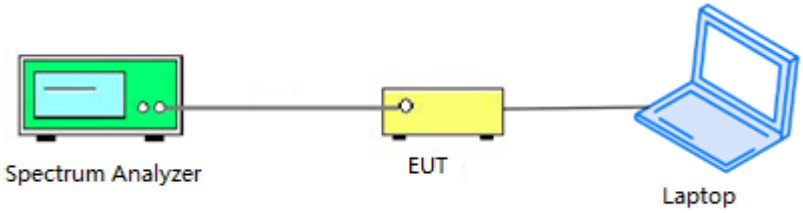
2.5. 6 dB Bandwidth

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.

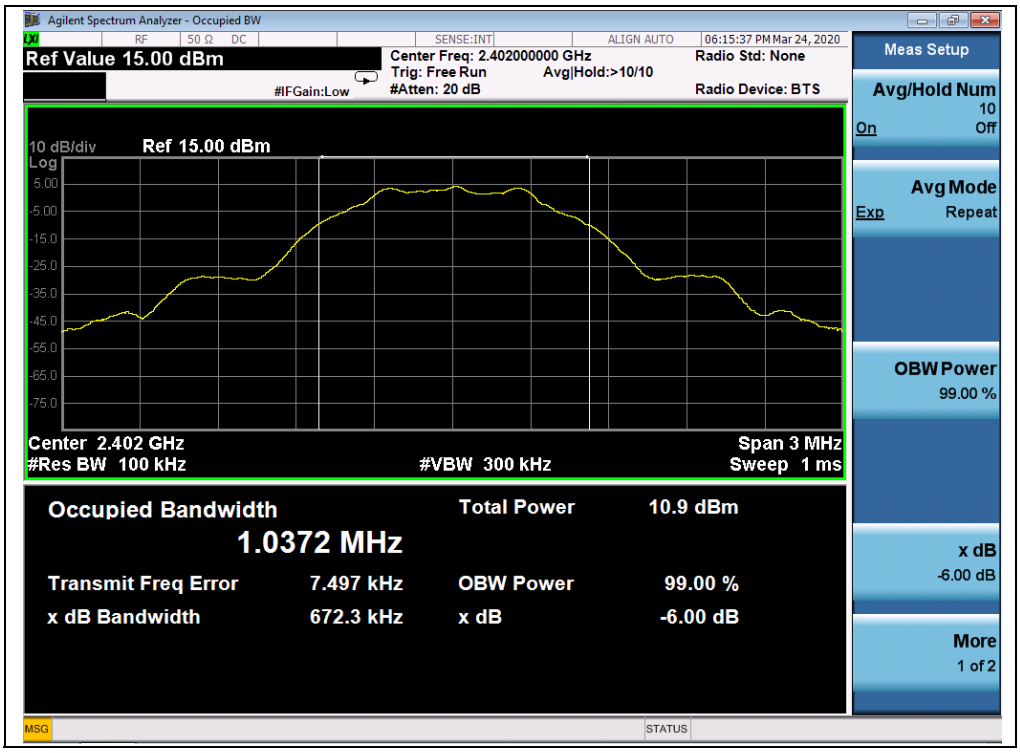
2.5.4. Test Result

1Mbps

A. Test Verdict:

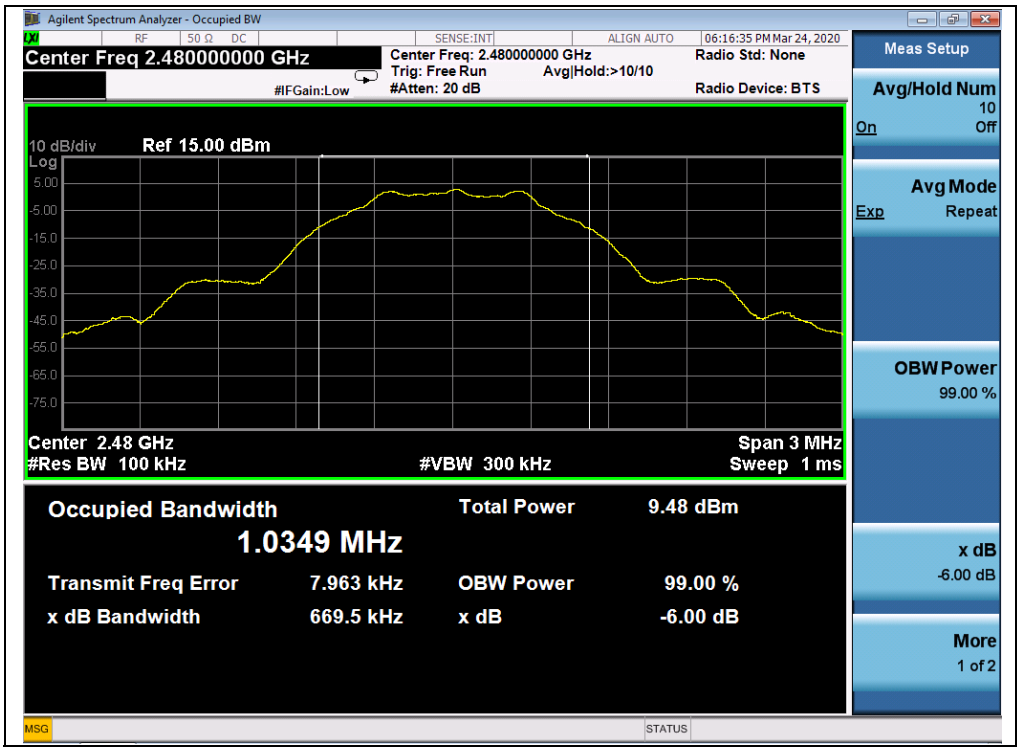
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
0	2402	0.672	≥500	PASS
19	2440	0.674	≥500	PASS
39	2480	0.670	≥500	PASS

B. Test Plot:



(Channel 0, 2402MHz)

(Channel 19, 2440 MHz)



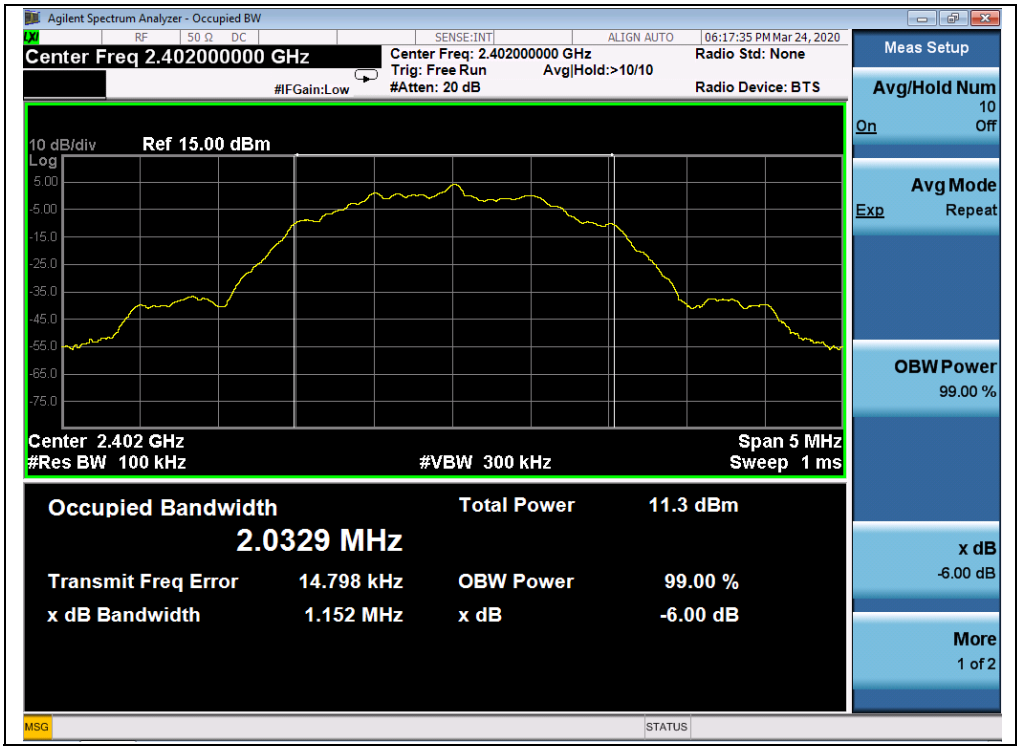
(Channel 39, 2480MHz)

2Mbps

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
0	2402	1.152	≥500	PASS
19	2440	1.154	≥500	PASS
39	2480	1.149	≥500	PASS

B.Test Plot:



(Channel 0, 2402MHz)

(Channel 19, 2440 MHz)

(Channel 39, 2480MHz)

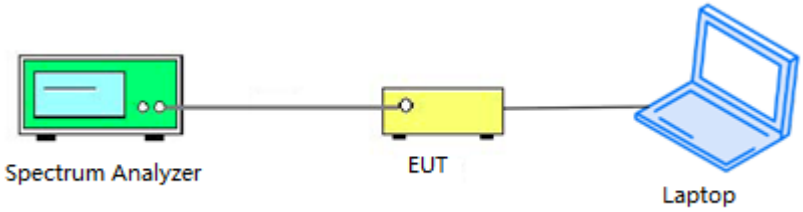
2.6. Conducted Spurious Emissions and Band Edge

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.

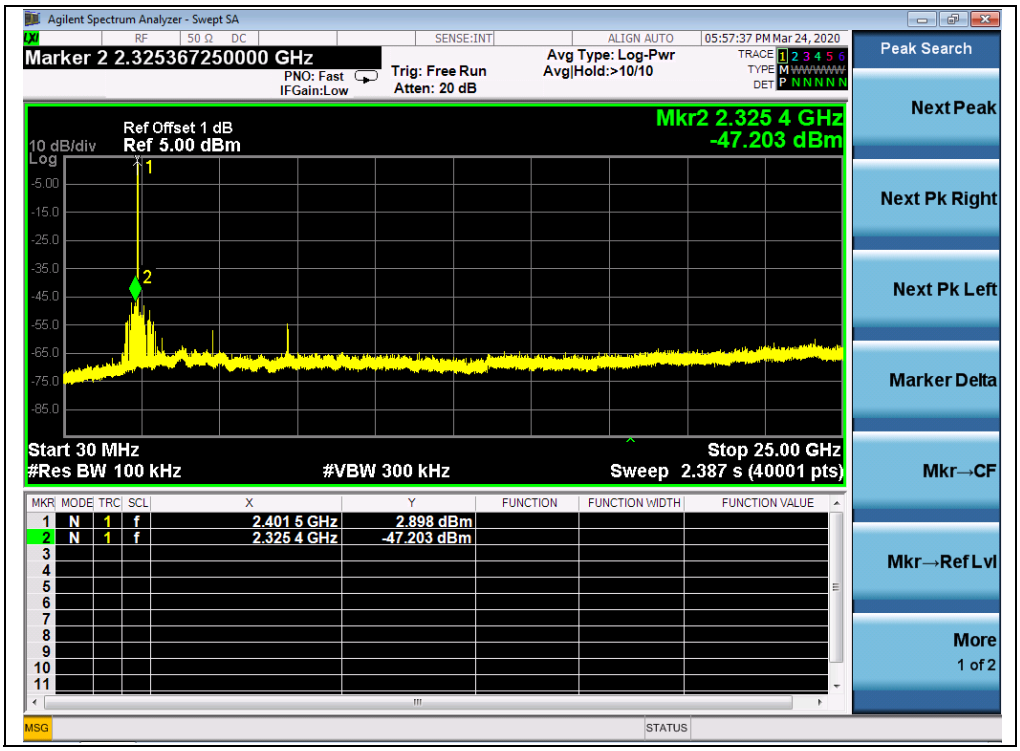
2.6.4. Test Result

1Mbps

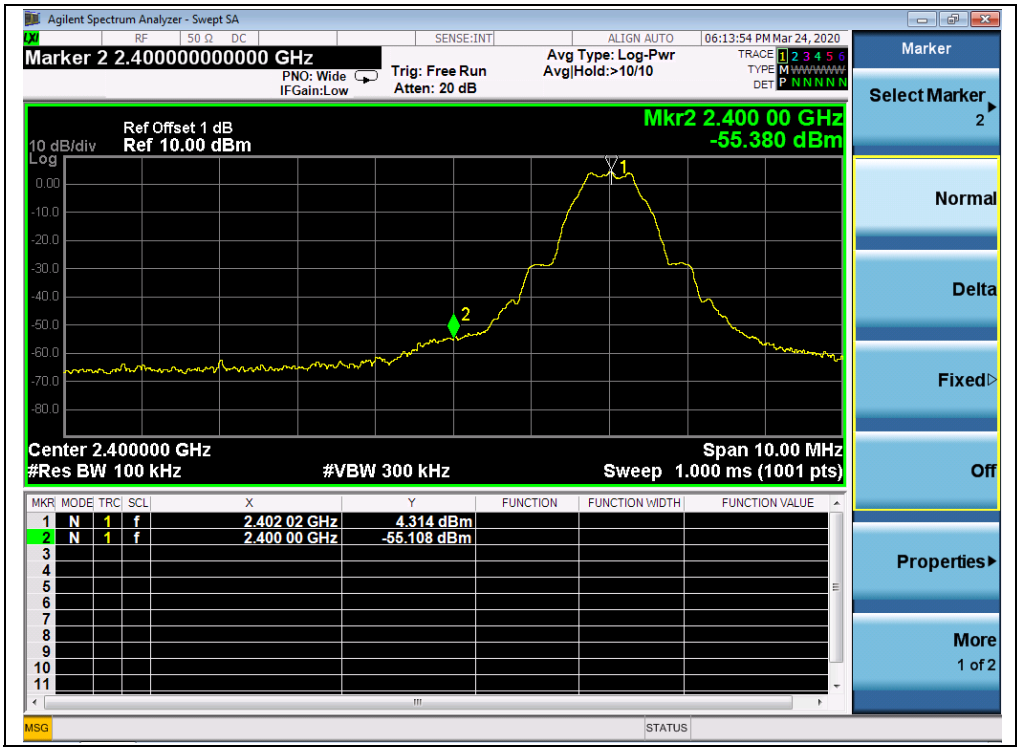
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-47.20	2.90	-17.10	PASS
19	2440	-46.24	1.70	-18.30	PASS
39	2480	-43.33	1.34	-18.66	PASS

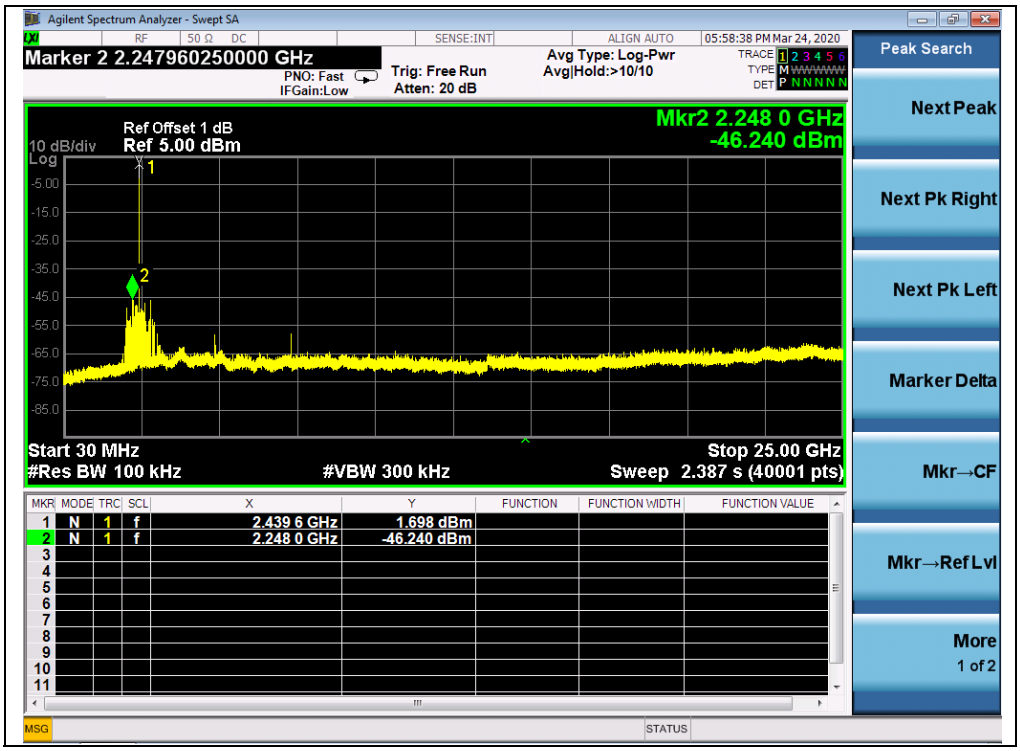
B. Test Plot:



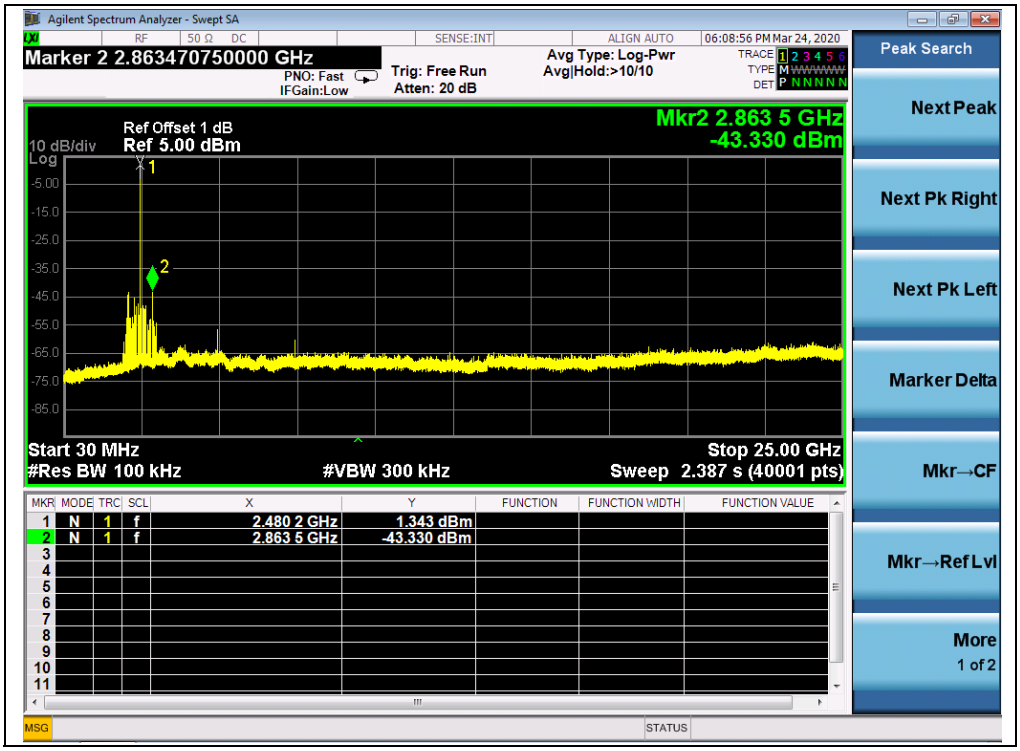
(30MHz to 25GHz, Channel 0)



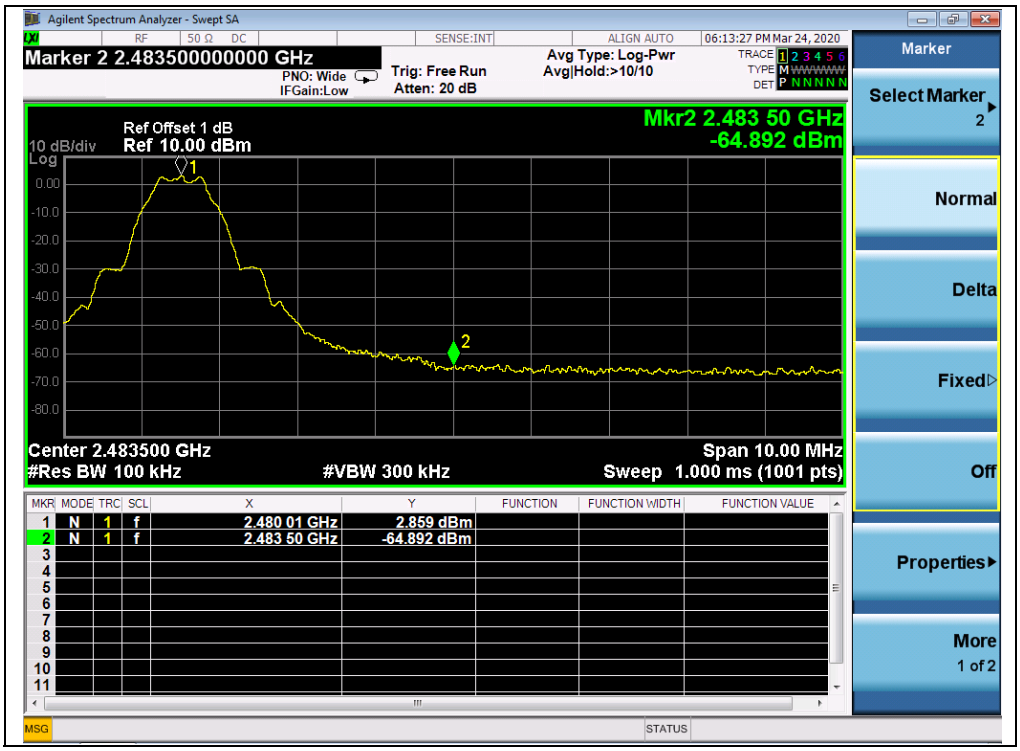
(Band Edge, Channel 0)



(30MHz to 25GHz, Channel 19)



(30MHz to 25GHz, Channel 39)



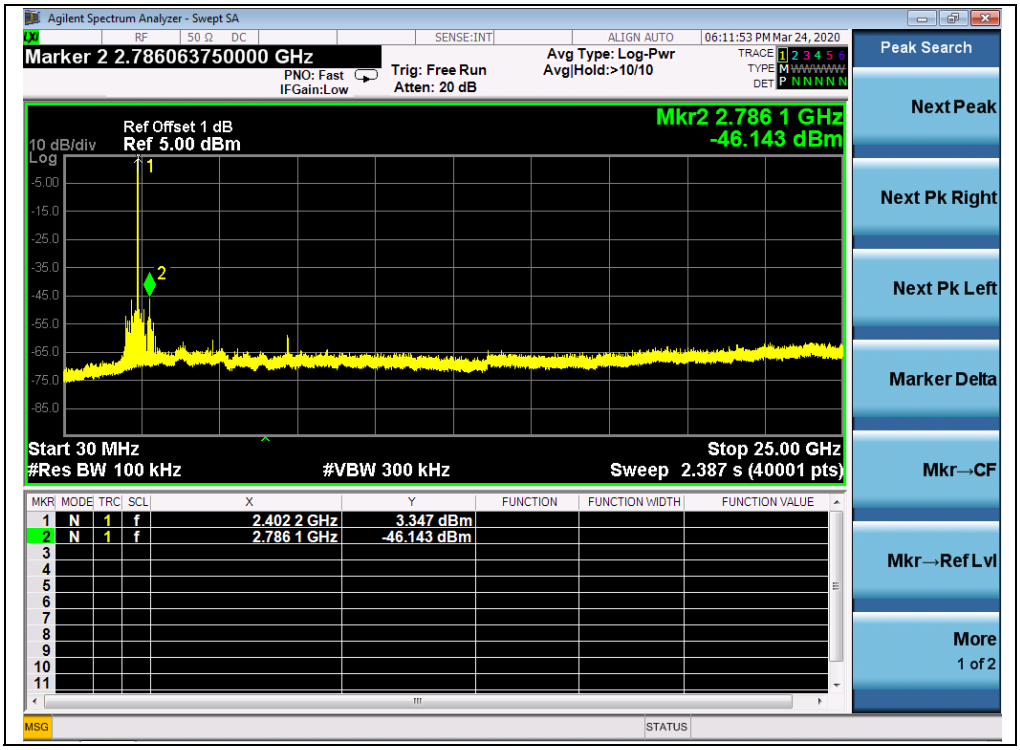
(Band Edge, Channel 39)

2Mbps

A. Test Verdict:

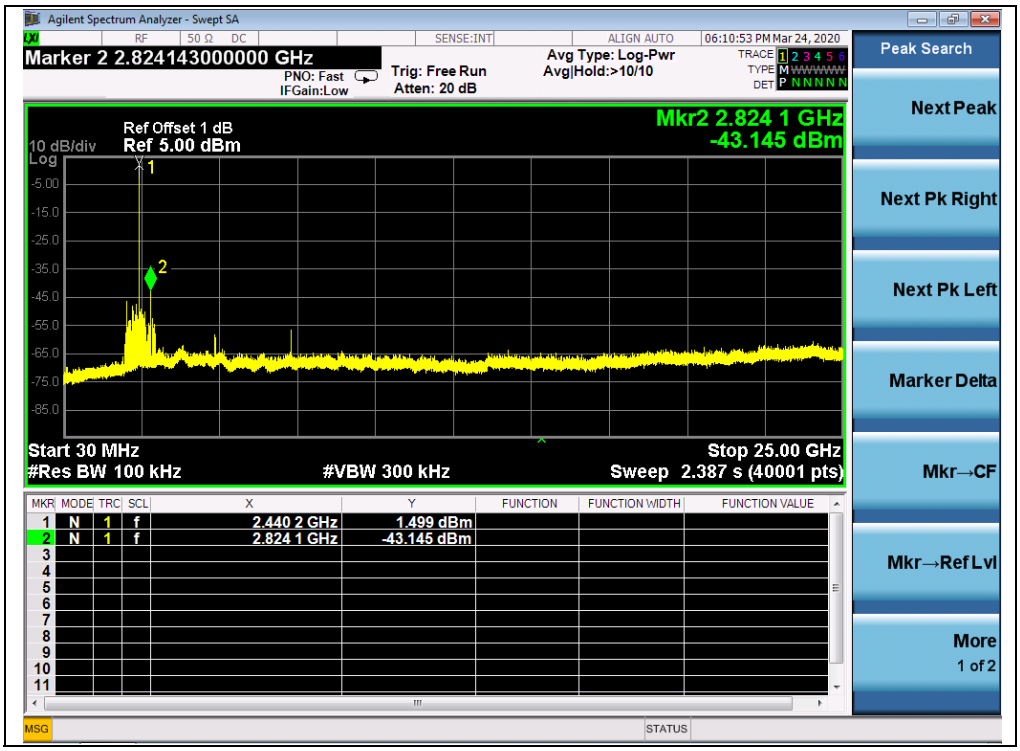
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
0	2402	-46.14	3.35	-16.65	PASS
19	2440	-43.15	1.50	-18.50	PASS
39	2480	-44.82	-0.92	-20.92	PASS

B. Test Plot:

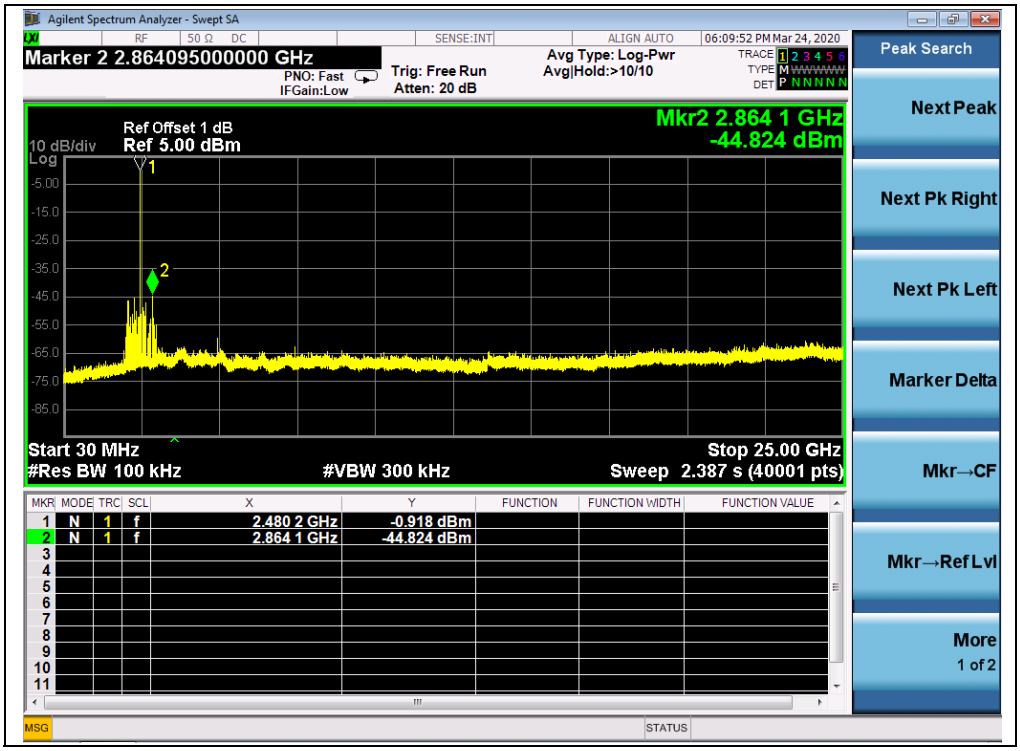


(30MHz to 25GHz, Channel 0)

(Band Edge, Channel 0)



(30MHz to 25GHz, Channel 19)



(30MHz to 25GHz, Channel 39)

(Band Edge, Channel 39)

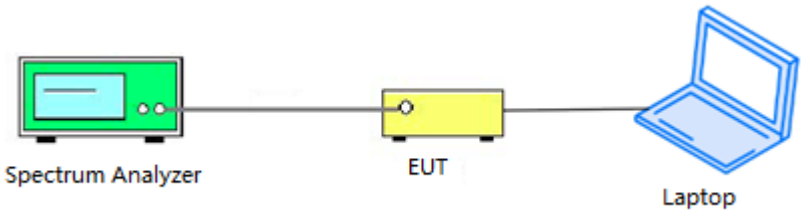
2.7. Power Spectral Density

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

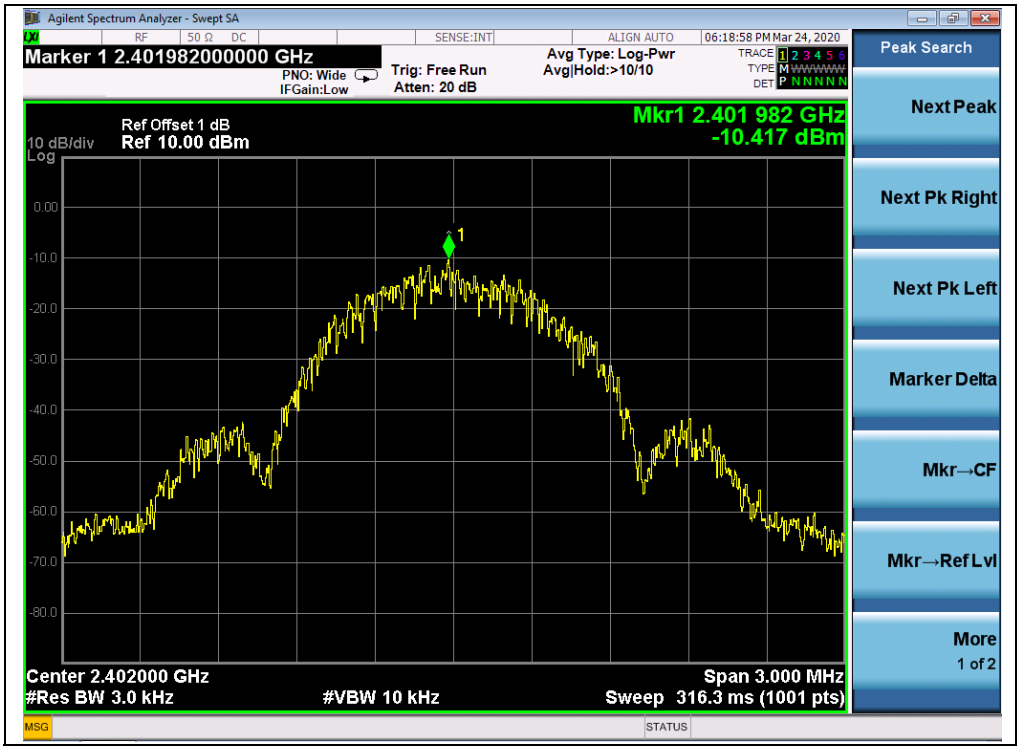
2.7.4. Test Result

1Mbps

A. Test Verdict:

Spectral Power Density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
0	2402	-10.42	8	PASS
19	2440	-11.78	8	PASS
39	2480	-11.74	8	PASS

B. Test Plot:



(Channel 0, 2402MHz)

(Channel 19, 2440MHz)

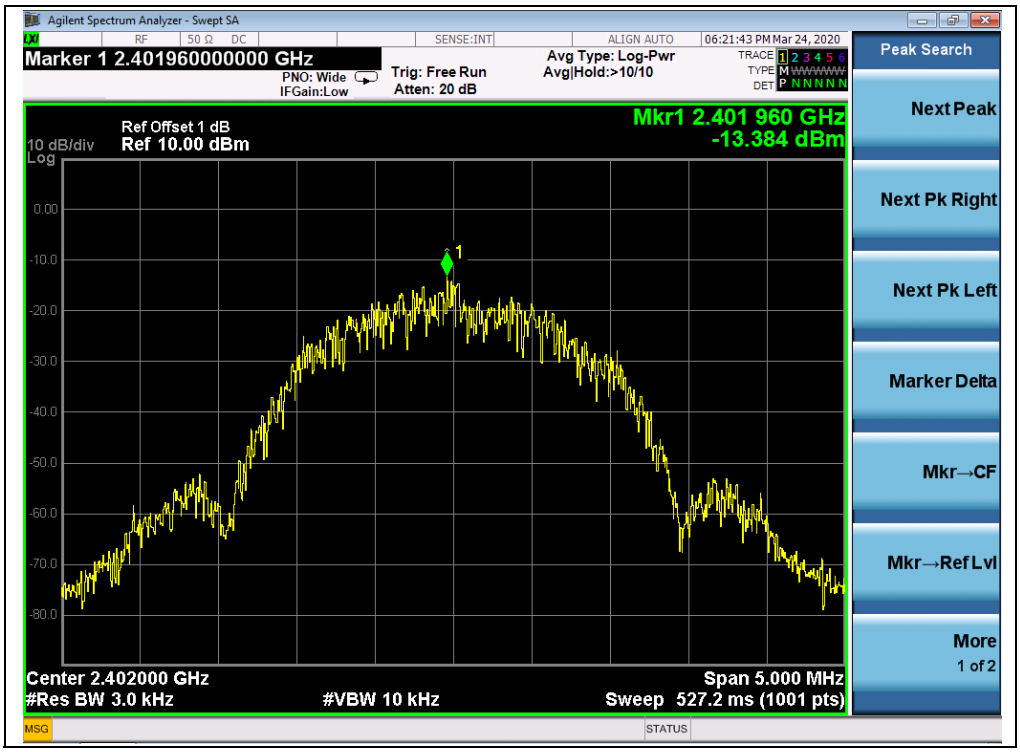
(Channel 39, 2480MHz)

2Mbps

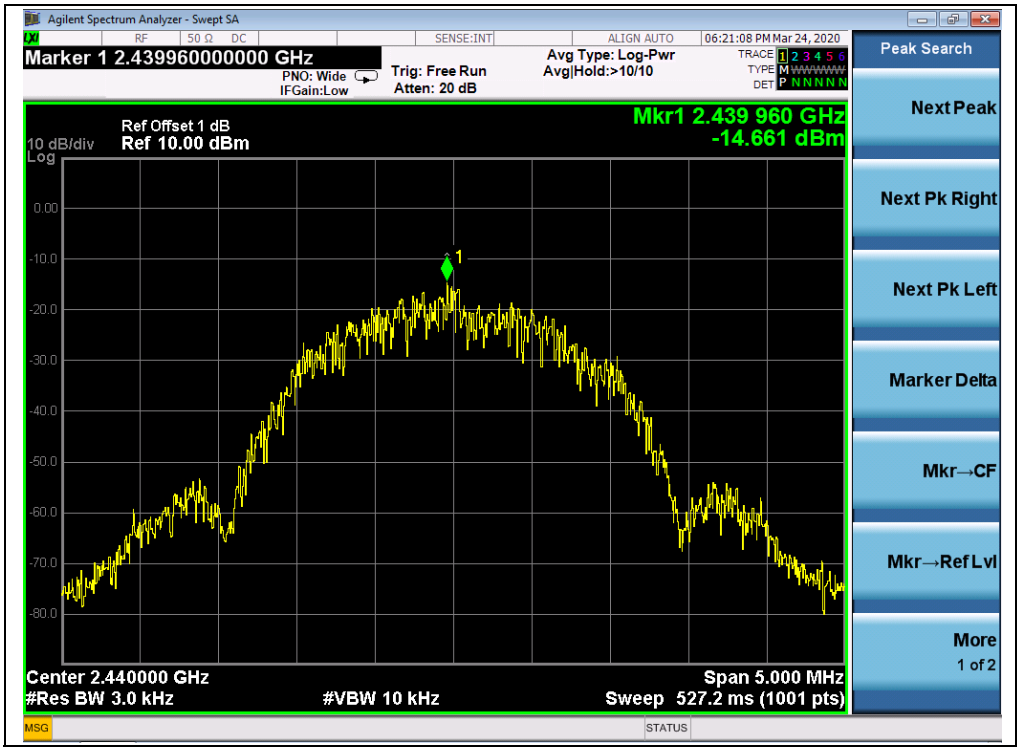
A.Test Verdict:

Spectral Power Density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
0	2402	-13.38	8	PASS
19	2440	-14.66	8	PASS
39	2480	-14.76	8	PASS

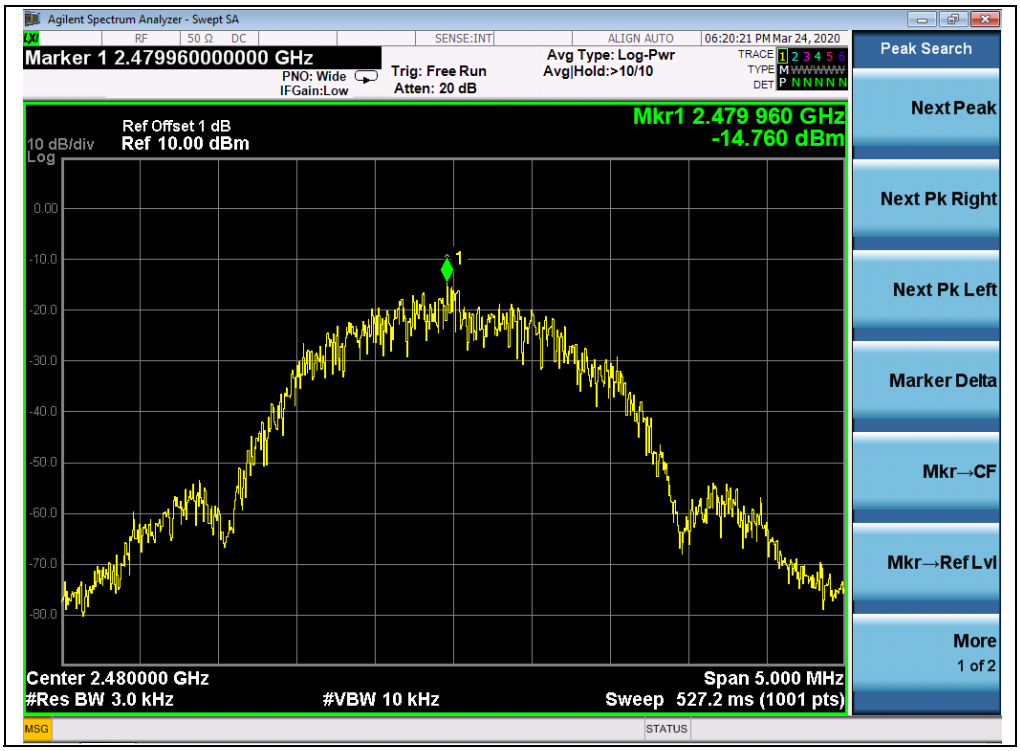
B.Test Plot:



(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

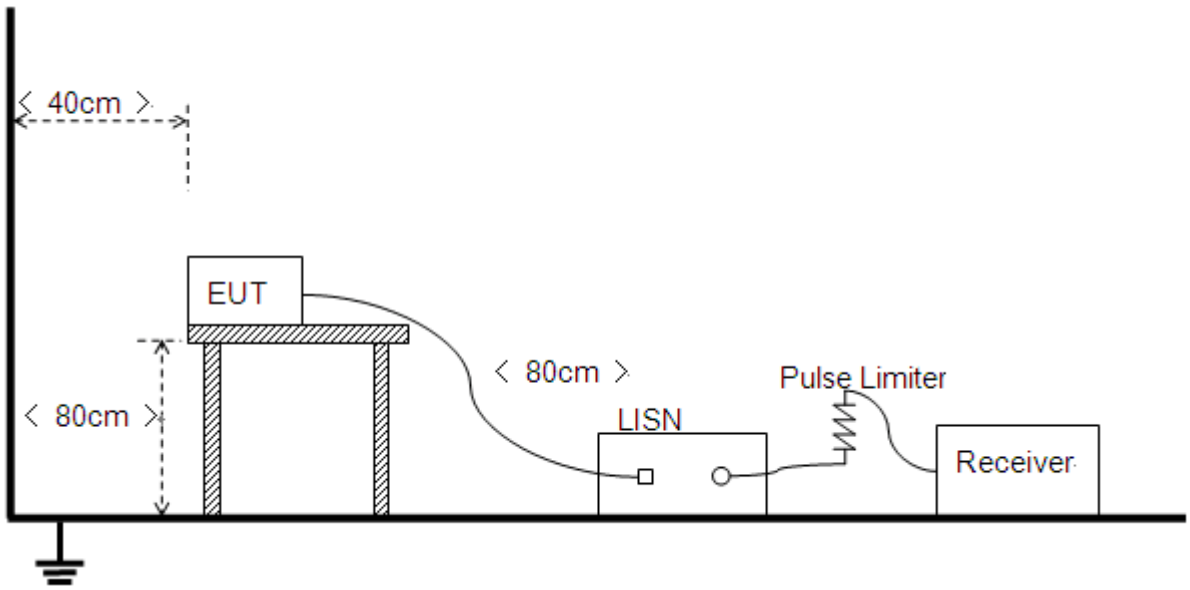
Note:

(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

This test case does not apply this kind of EUT.

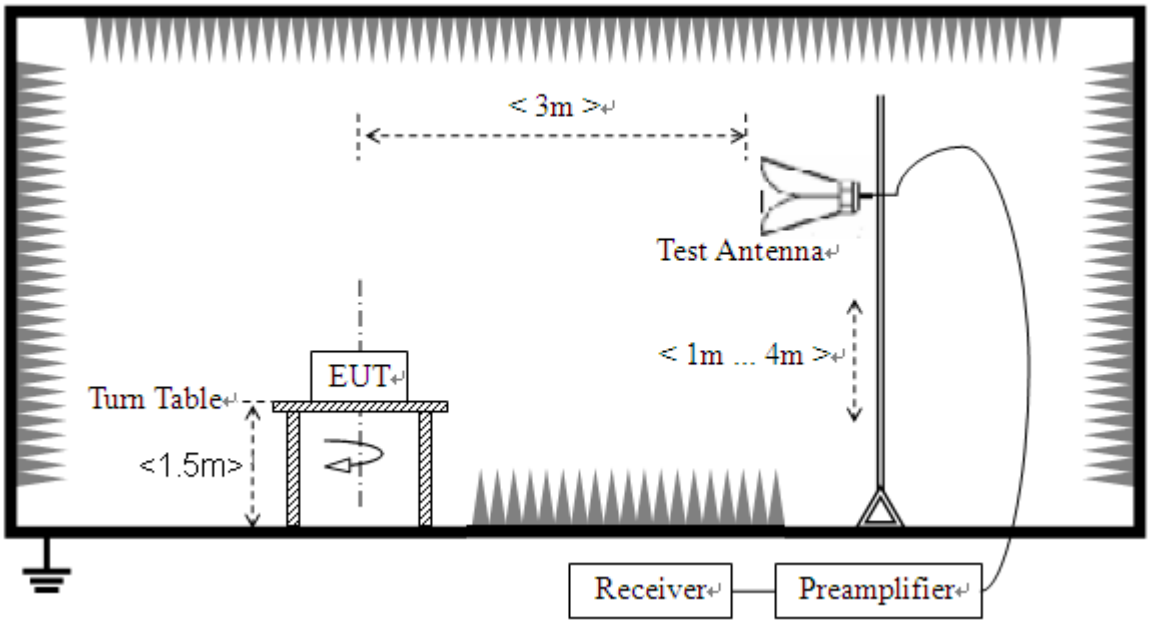
2.9. Restricted Frequency Bands

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

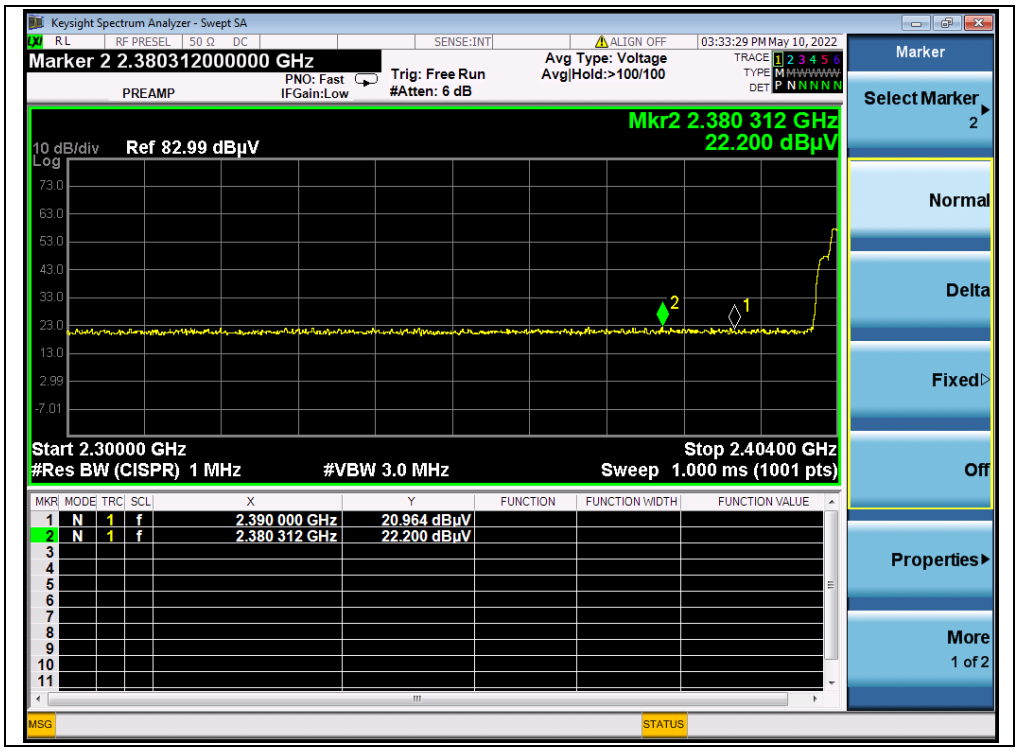
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

1Mbps

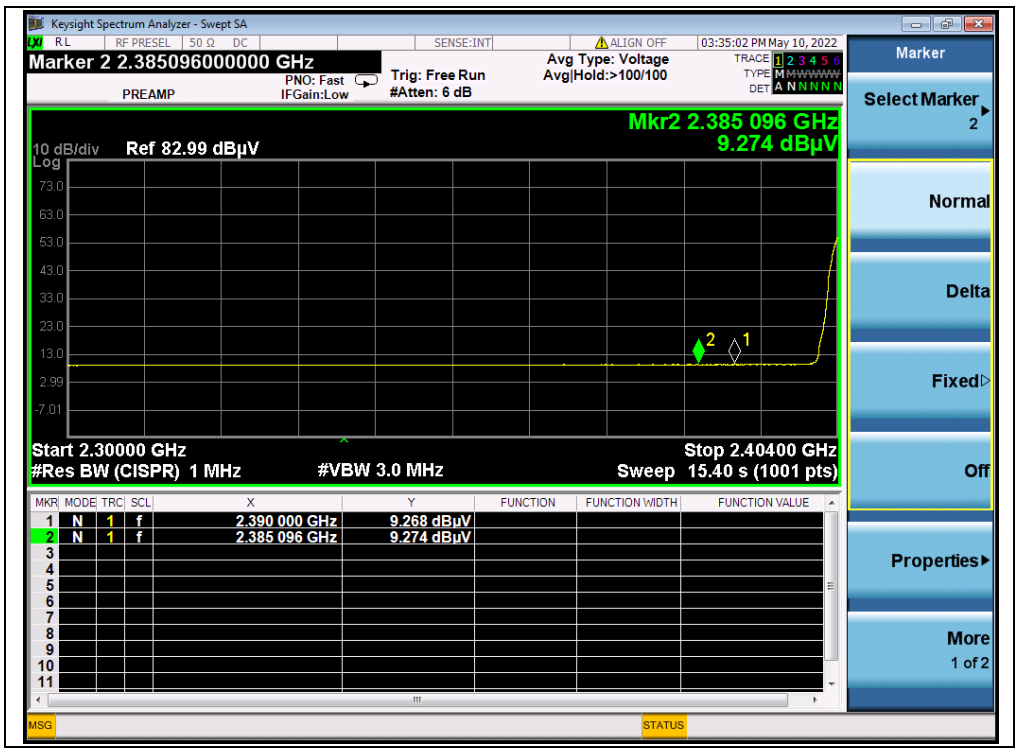
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2380.31	PK	22.20	6.74	27.20	56.14	74	PASS
0	2385.10	AV	9.27	6.74	27.20	43.21	54	PASS
39	2484.73	PK	22.42	6.74	27.20	56.36	74	PASS
39	2483.50	AV	10.52	6.74	27.20	44.46	54	PASS

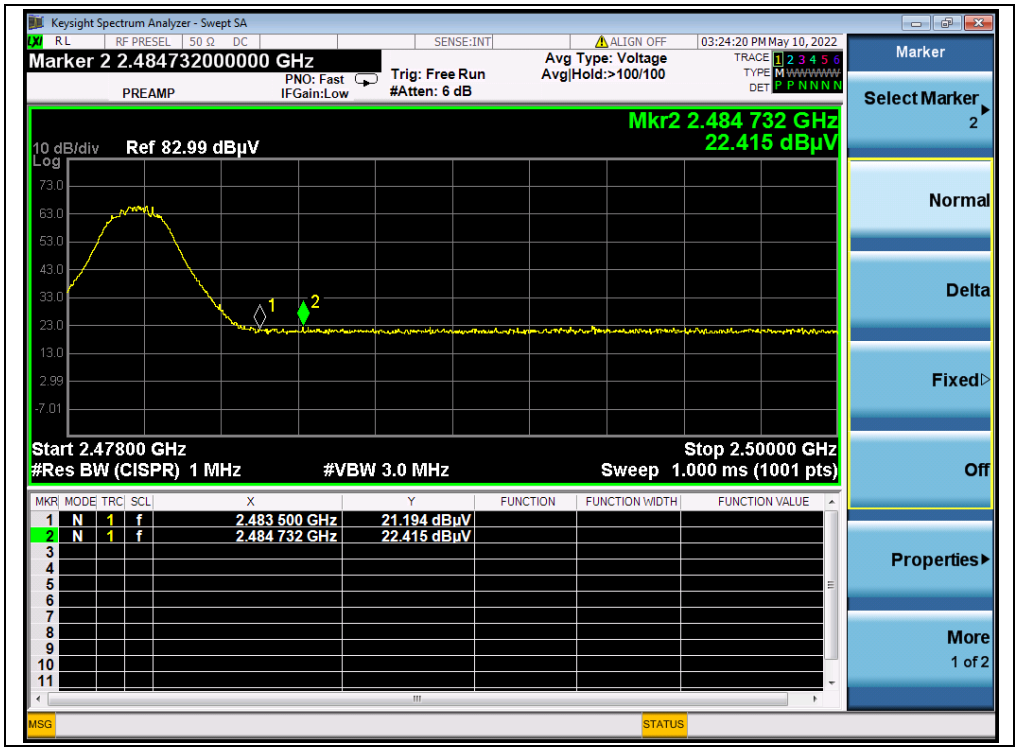
B. Test Plot:



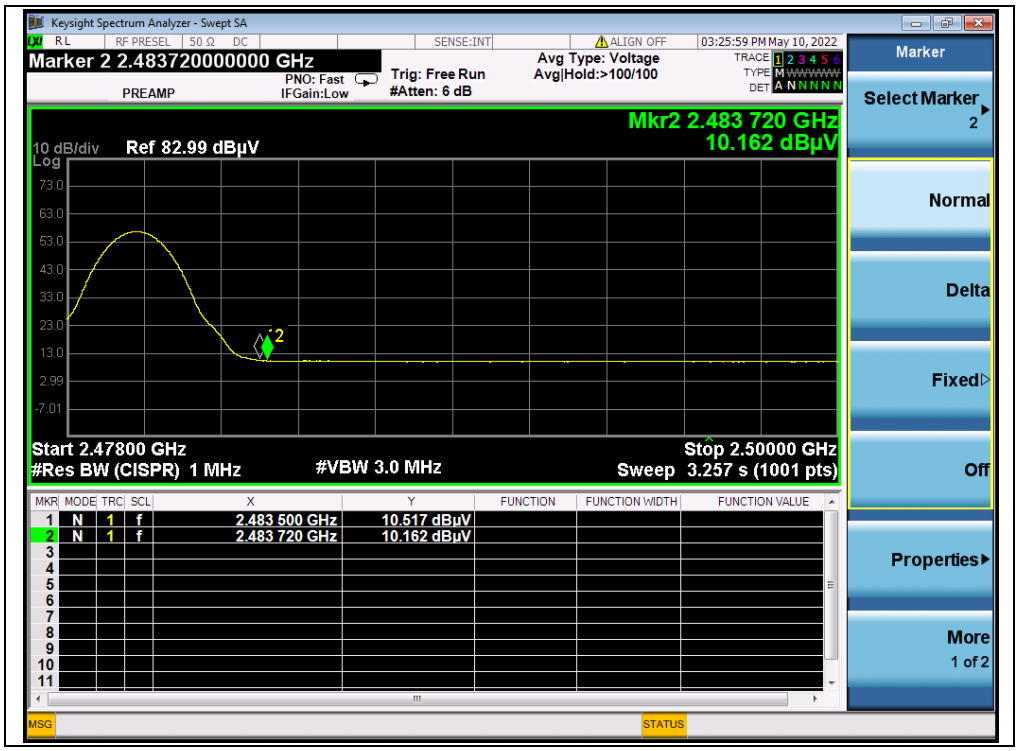
(PEAK, Channel 0)



(AVERAGE, Channel 0)



(PEAK, Channel 39)



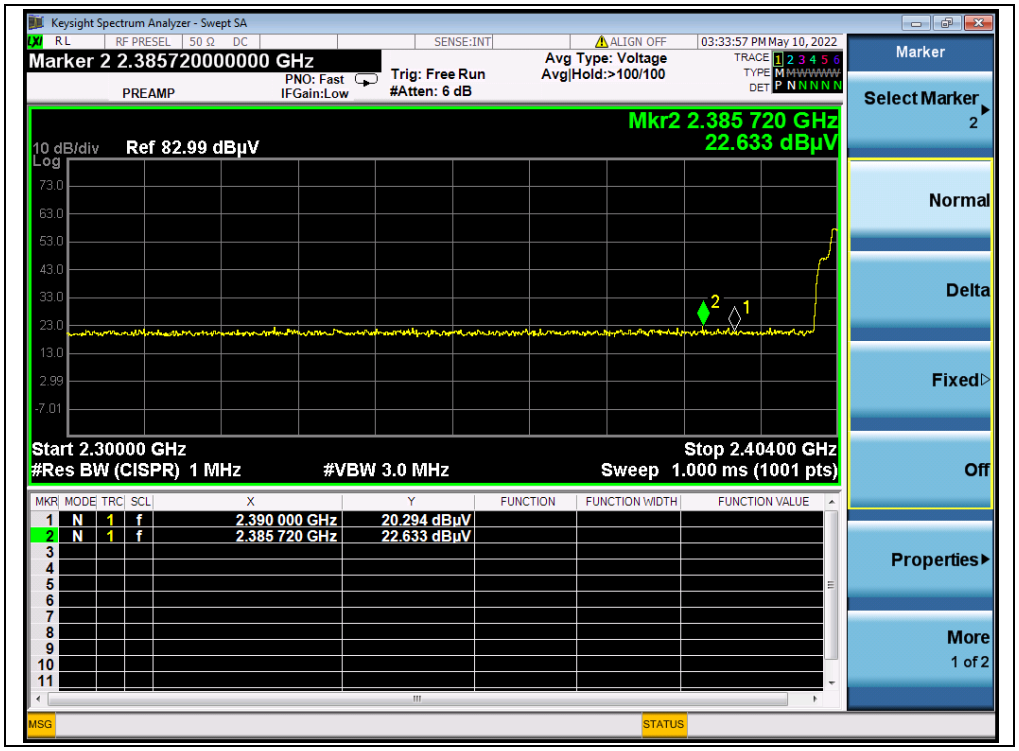
(AVERAGE, Channel 39)

2Mbps

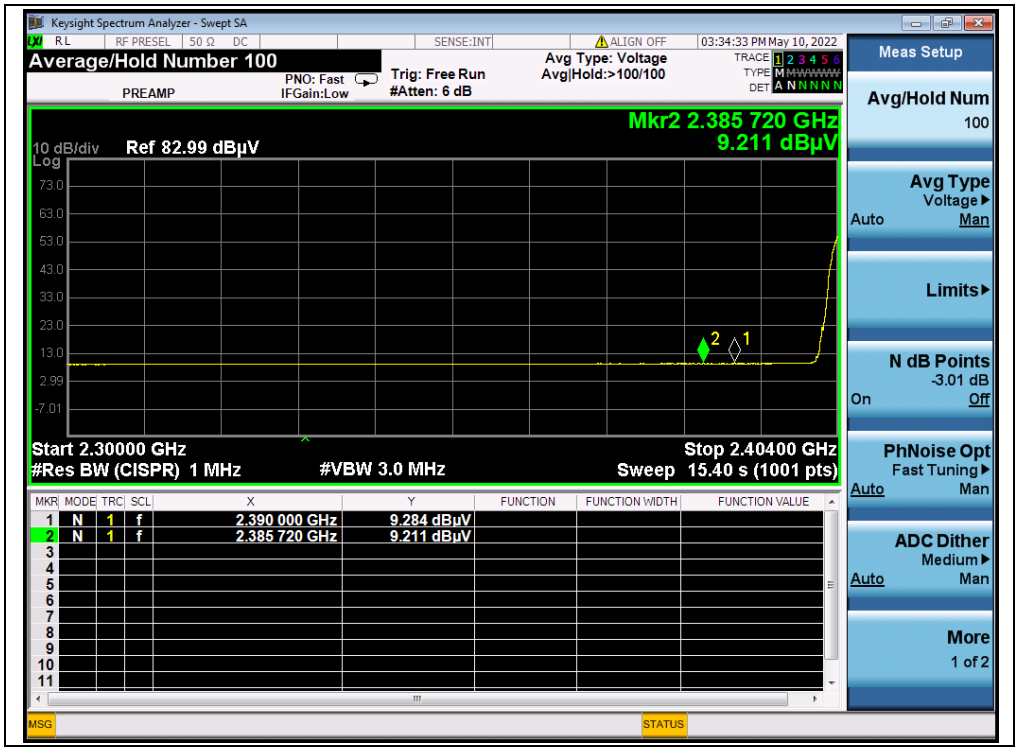
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2385.72	PK	22.63	6.74	27.20	56.57	74	PASS
0	2390.00	AV	9.28	6.74	27.20	43.22	54	PASS
39	2485.55	PK	21.22	6.74	27.20	55.16	74	PASS
39	2483.50	AV	10.37	6.74	27.20	44.31	54	PASS

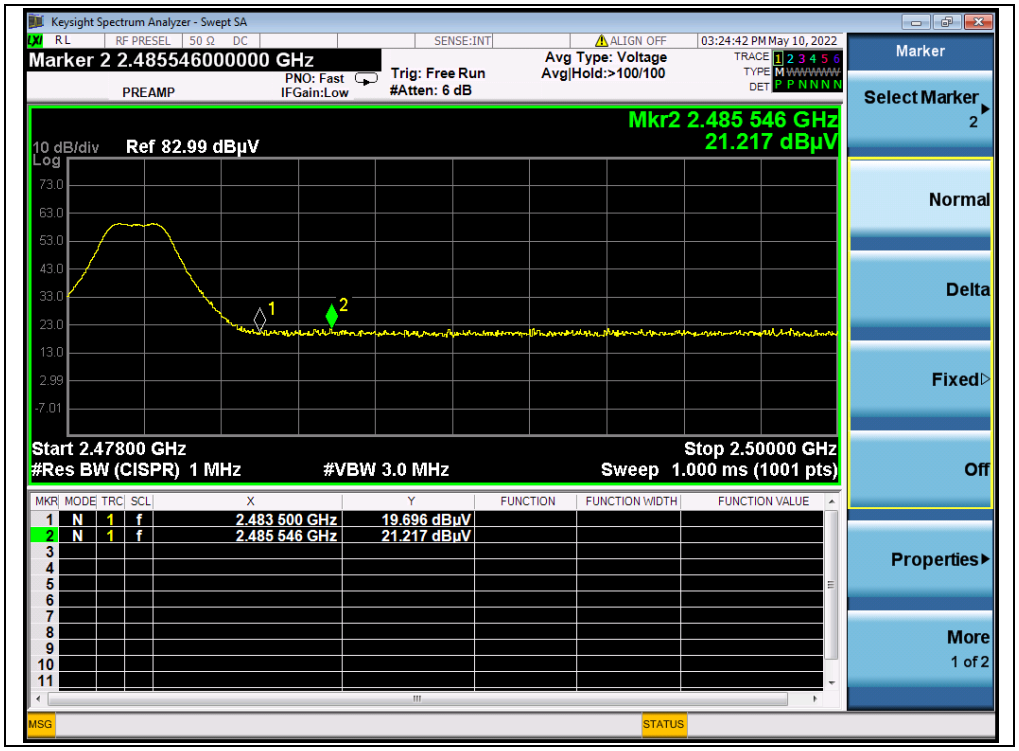
B. Test Plot:



(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:

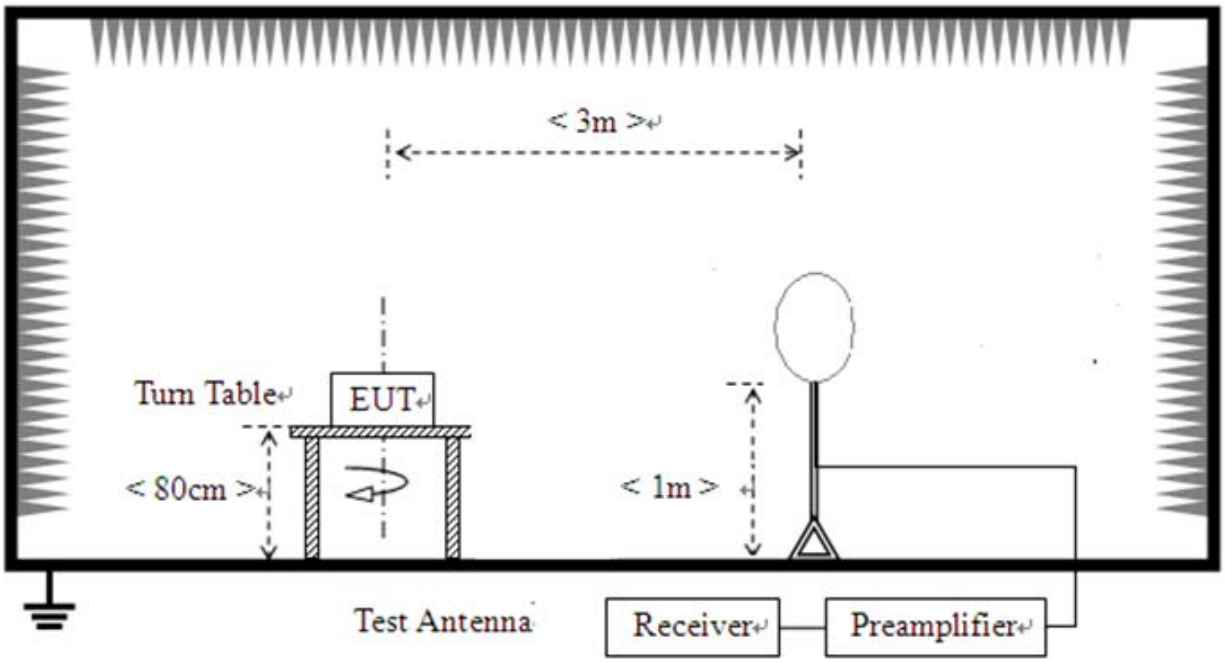
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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).

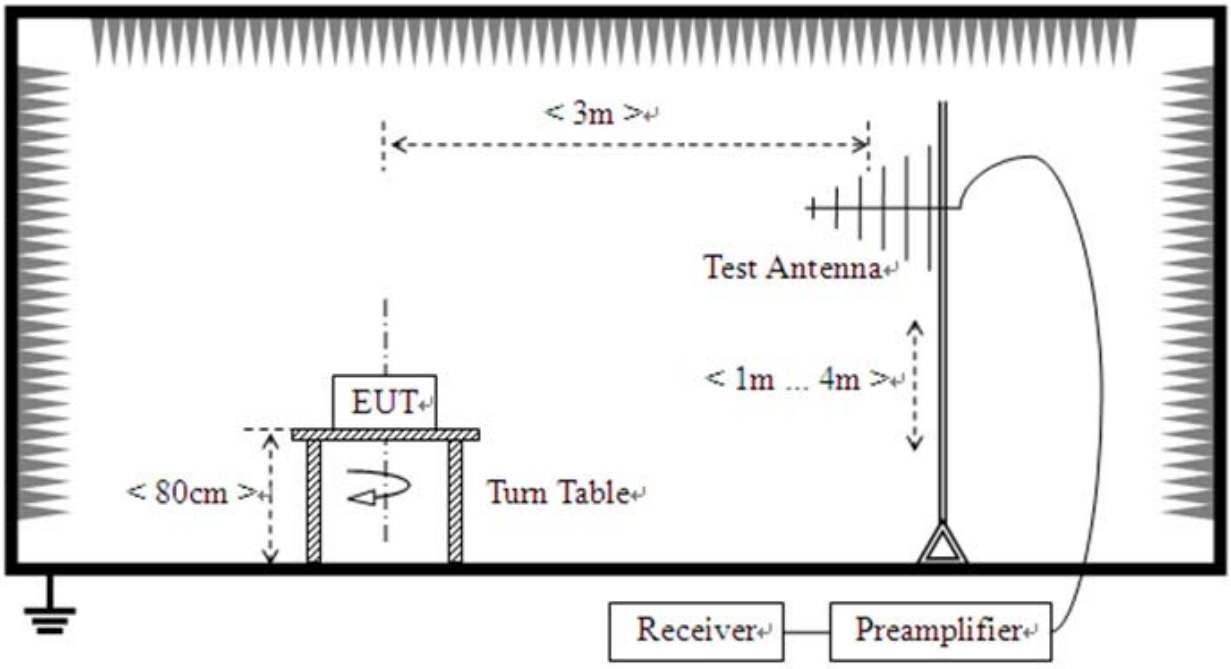
2.10.2. Test Description

Test Setup:

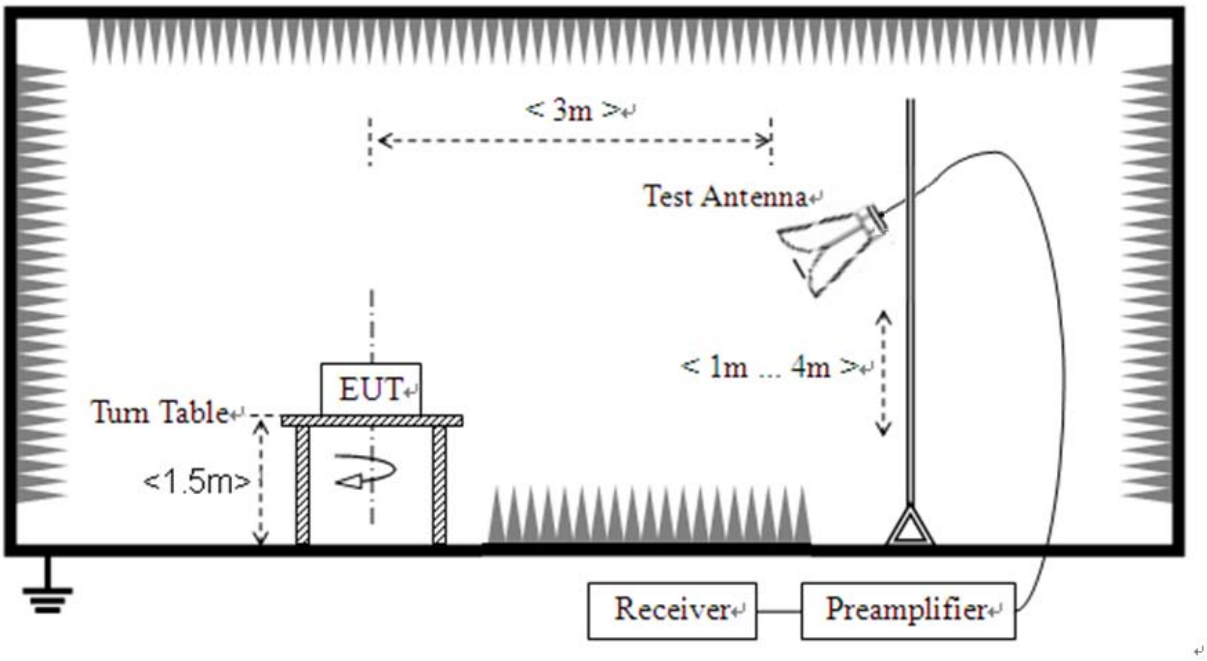
1) For radiated emissions from 9kHz to 30MHz



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 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. For measurements above 1 GHz, keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.

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 [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.

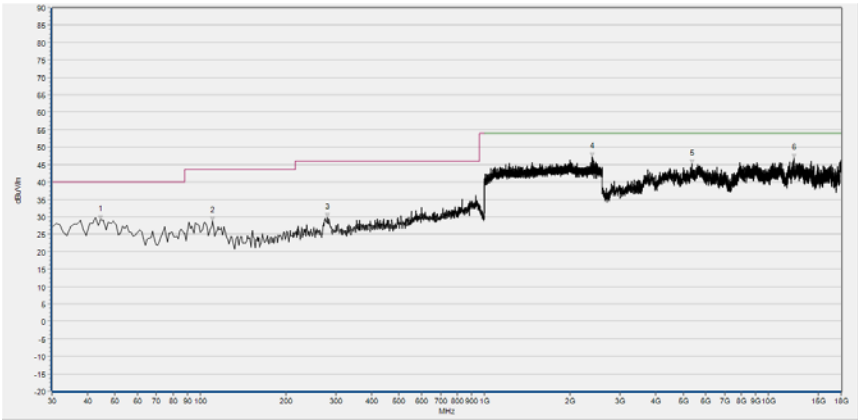
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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 10th harmonic of the highest frequency, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

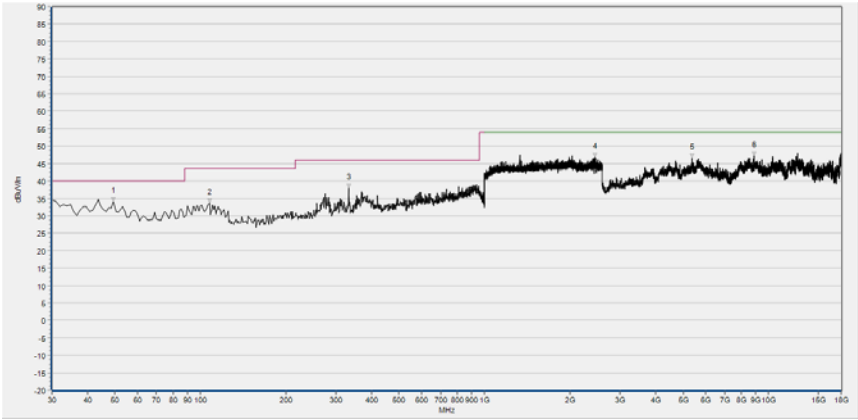
1Mbps

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
44.550	29.26	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
110.510	28.72	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
280.260	29.88	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2389.333	47.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5381.240	45.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12305.080	46.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

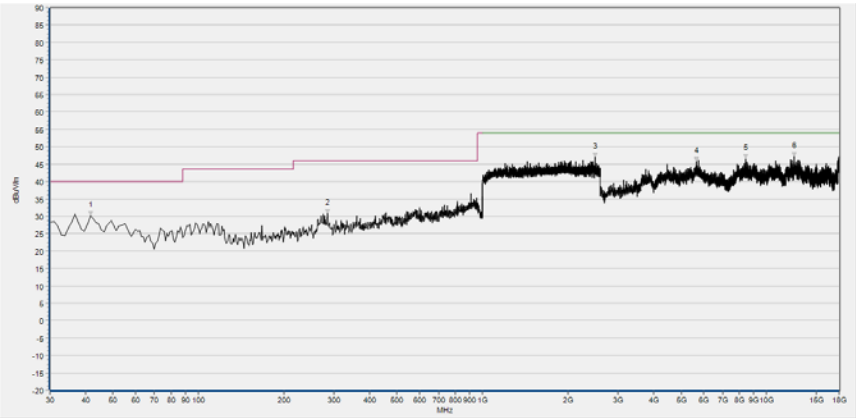
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
49.400	34.06	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
107.600	33.62	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
332.640	38.00	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2445.867	46.74	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5375.080	46.58	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8867.800	47.16	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

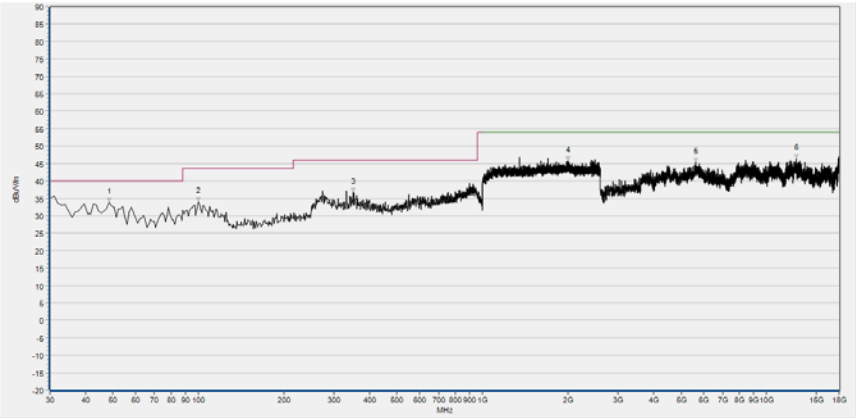
(Antenna Vertical, 30MHz to 18GHz)

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
41.640	30.25	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
285.110	30.81	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2490.667	46.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5664.600	45.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8448.920	46.59	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12489.880	47.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

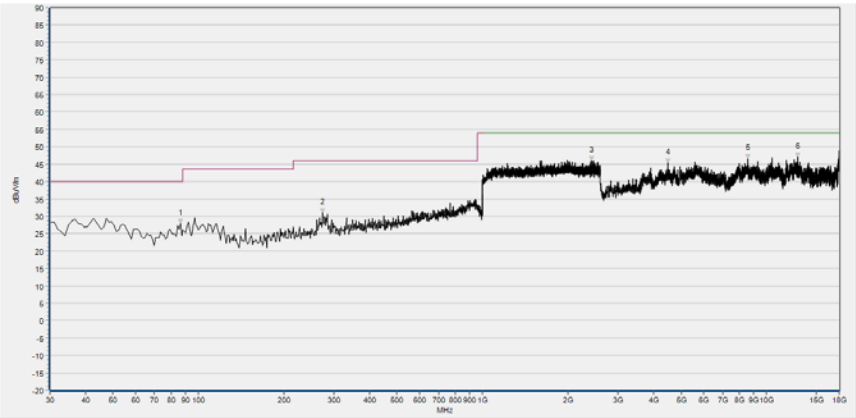
(Antenna Horizontal, 30MHz to 18GHz)



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
48.430	33.80	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
99.840	34.05	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
350.100	36.75	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1997.867	45.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5612.240	45.37	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12687.000	46.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

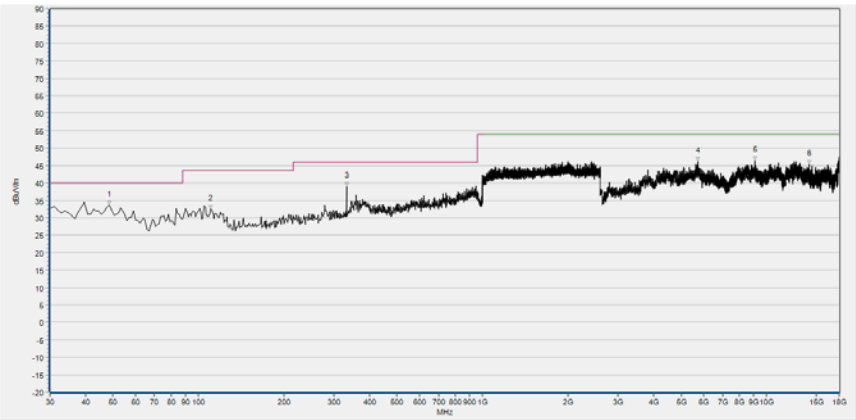
(Antenna Vertical, 30MHz to 18GHz)

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
86.260	27.93	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
273.470	30.94	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2413.867	46.04	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4488.040	45.25	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8596.760	46.66	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12896.440	46.93	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

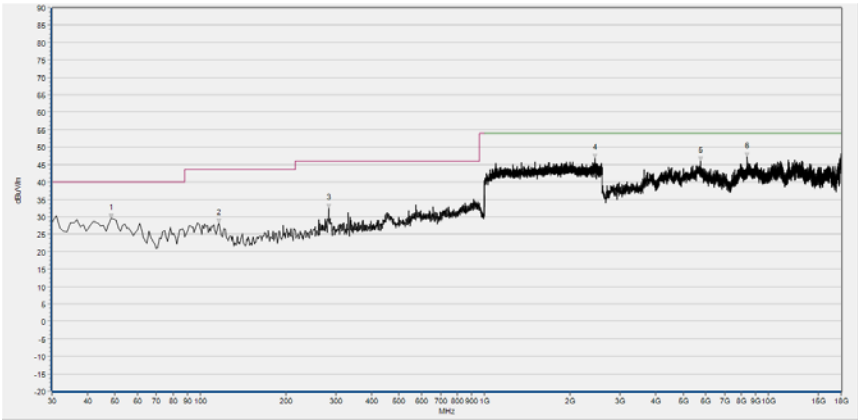


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.430	33.61	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
110.510	32.46	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
332.640	39.01	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5732.360	46.08	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9098.800	46.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
14082.240	45.42	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

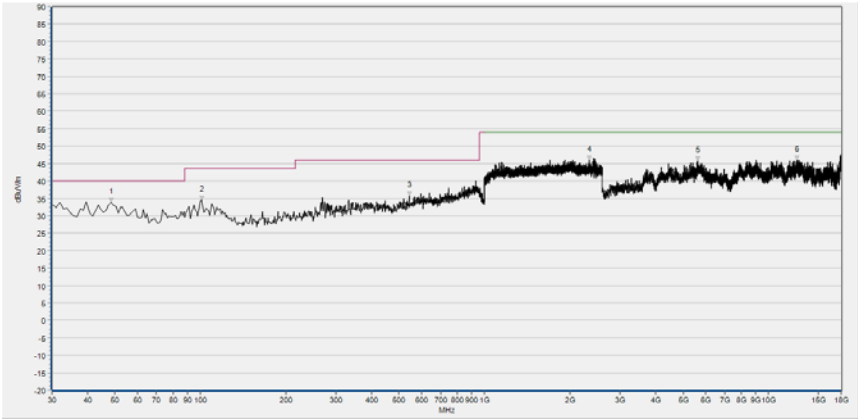
2Mbps

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
48.430	29.47	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
116.330	28.07	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
282.200	32.48	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2450.667	46.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5763.160	45.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8408.880	47.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

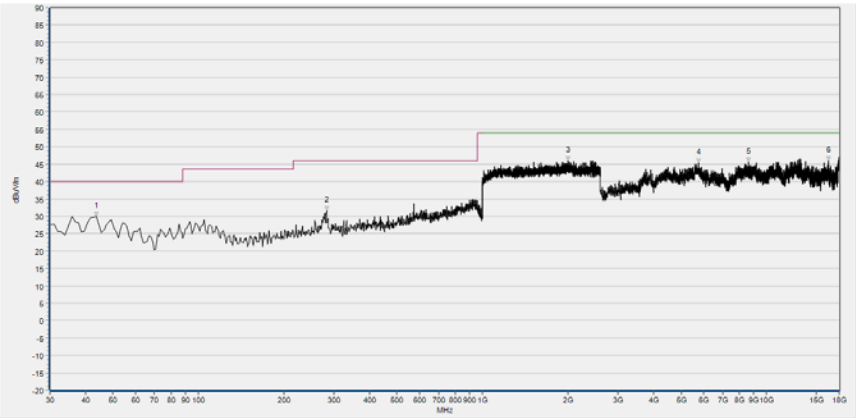
(Antenna Horizontal, 30MHz to 18GHz)



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
48.430	33.89	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
100.810	34.49	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
543.130	35.81	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2338.133	45.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5630.720	45.66	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12551.480	46.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

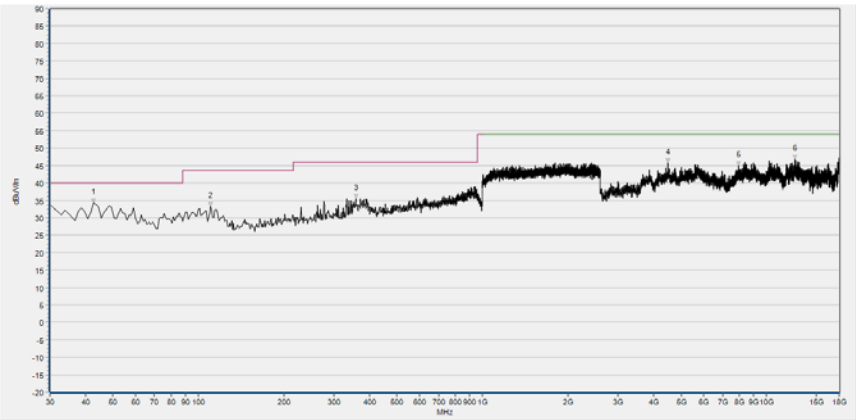
(Antenna Vertical, 30MHz to 18GHz)

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
43.580	29.92	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
282.200	31.57	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1996.267	46.02	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5766.240	45.25	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8615.240	45.49	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
16530.840	45.97	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

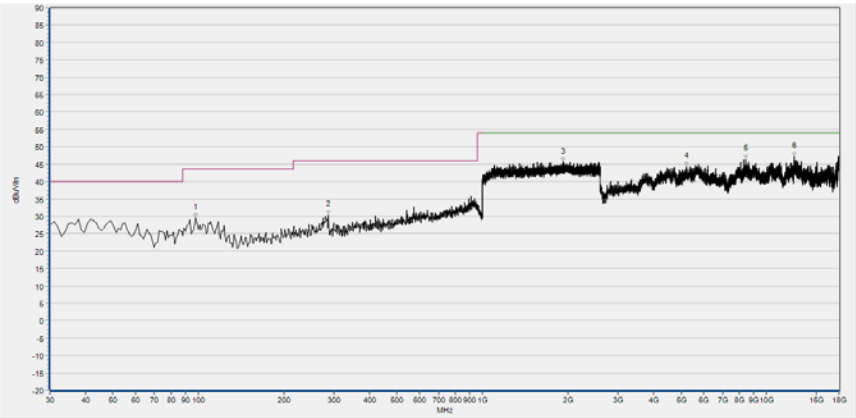
(Antenna Horizontal, 30MHz to 18GHz)



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
42.610	34.36	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
110.510	33.16	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
357.860	35.59	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
4500.360	45.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7962.280	44.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12597.680	46.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

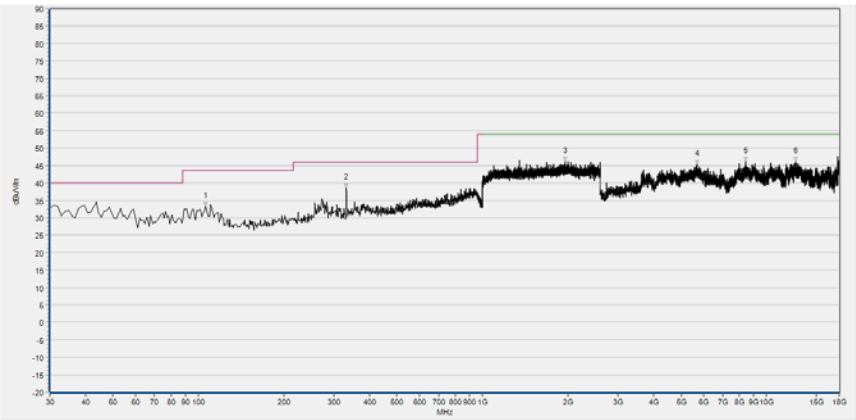
(Antenna Vertical, 30MHz to 18GHz)

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
97.900	29.51	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
287.050	30.34	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1924.800	45.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5233.400	44.25	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8421.200	46.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12517.600	47.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
105.660	33.26	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
331.670	38.56	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1956.800	46.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5680.000	45.27	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8452.000	46.16	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12668.520	46.19	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	2022.03.01	2023.02.28
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 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	2022.02.11	2025.02.10
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