REPORT No.: SZ19020192W01

TEST REPORT

APPLICANT	:	Hangzhou Great Star Industrial Co., Ltd.
PRODUCT NAME	:	Mini HUB
MODEL NAME	:	IM050101
BRAND NAME	:	N/A
FCC ID	:	2AMI2-IM050101
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2019-01-11
TEST DATE	:	2019-03-27 to 2019-03-29
ISSUE DATE	:	2019-04-10

Edited by: Zeng Xiaoying (Rapporteur)

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Change History		
Version	**Date**	**Reason for change**
1.0	2019-04-10	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Hangzhou Great Star Industrial Co., Ltd.
Applicant Address:	No.35, Jiuhuan Road, Jianggan District, Hangzhou, China
Manufacturer:	Zhejiang Great Star Industrial Co., Ltd
Manufacturer Address:	No.1 Building, No.11, Qihui Road, Changan Town(Agriculture Development Zone) Haining, Zhejiang Province, China

1.2. Equipment Under Test (EUT) Description

Product Name:	Mini HUB	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	kphub_hv_1.0.0	
Software Version:	kphub_rv_1.0.0	
Equipment type:	Zigbee	
Modulation Type:	GFSK	
Operating Frequency Range:	The frequency range used is 2405MHz - 2480MHz (16 channels, at intervals of 5MHz)	
Antenna Type:	PCB Antenna	
Antenna Gain:	3.0 dBi	
Accessory Information:	AC Adapter	
	Brand Name:	TEN PAO
	Model No.:	S005AYU0500100
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5V⎓1A
	Rated Input:	100-240V ～ 50/60Hz 0.2A

Note 1: This test report is updated from original report SZ18120323W02 (Model: Kit Pro-Hub, FCC ID: 2AJZ4-KPHUB). Based on the similarity between before, only the applicant and applicant address, the manufacturer and manufacturer address, the product name, the model name, the brand name are changed. The changes do not affect the test results.

Note 2: The EUT is operating at 2.4GHz ISM band. The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 11 (2405MHz), 18 (2440MHz) and 26 (2480MHz).

Note 3: The EUT connected to the serial port of the computer with a serial communication cable, we use the dedicated software to control the EUT continuous transmission.

Note 4: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. 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
1	15.203	Antenna Requirement	N/A	N/A	**PASS** Note1
2	N/A	Duty Cycle Of Test Signal	Mar 29, 2019	Zhang Guofeng	**PASS** Note1
3	15.247(b)	Maximum Peak Conducted Output Power	Mar 29, 2019	Zhang Guofeng	**PASS** Note1
4	15.247(b)	Maximum Average Conducted Output Power	Mar 29, 2019	Zhang Guofeng	**PASS** Note1
5	15.247(a)	Bandwidth	Mar 29, 2019	Zhang Guofeng	**PASS** Note1
6	15.247(d)	Conducted Spurious Emission and Band Edge	Mar 29, 2019	Zhang Guofeng	**PASS** Note1
7	15.247(e)	Power spectral density (PSD)	Mar 29, 2019	Zhang Guofeng	**PASS** Note1
8	15.207	Conducted Emission	Mar 27, 2019	Zheng Fengjian	**PASS** Note1
9	15.247(d)	Restricted Frequency Bands	Mar 27, 2019	Zheng Fengjian	**PASS** Note1
10	15.209, 15.247(d)	Radiated Emission	Mar 27, 2019	Zheng Fengjian	**PASS** Note1

Note 1: The test results of all test items in this report refer to the test report (Report No.: SZ18120323W02).

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 11.5dB means the cable loss is 11.5dB.

1.4. 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. Result: Compliant

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

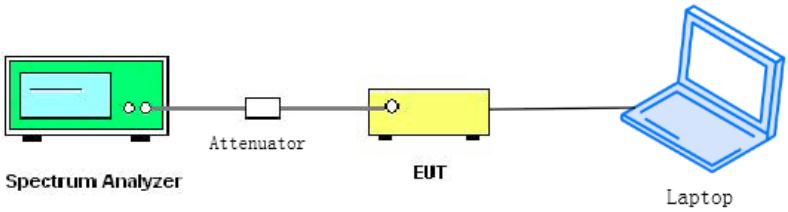
2.2. Duty Cycle Of Test Signal

2.2.1. Requirement

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

2.2.2. Test Description

A. Test Set:



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

B. Equipments List:

Please refer ANNEX B(4).

2.2.3. Test Result

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
GFSK	45.75	3.40

2.3. Maximum Peak Conducted Output Power

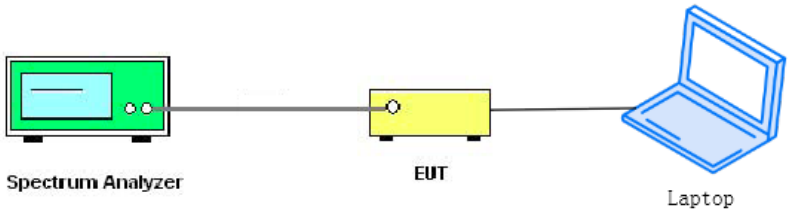
2.3.1. Requirement

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.

A. 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.

A. Equipments List:

Please refer ANNEX B (4).

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 the RBW ≥DTS Bandwidth
c) Set VBW ≥3×RBW
d) Set span to ≥3×RBW
e) Sweep time to 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.

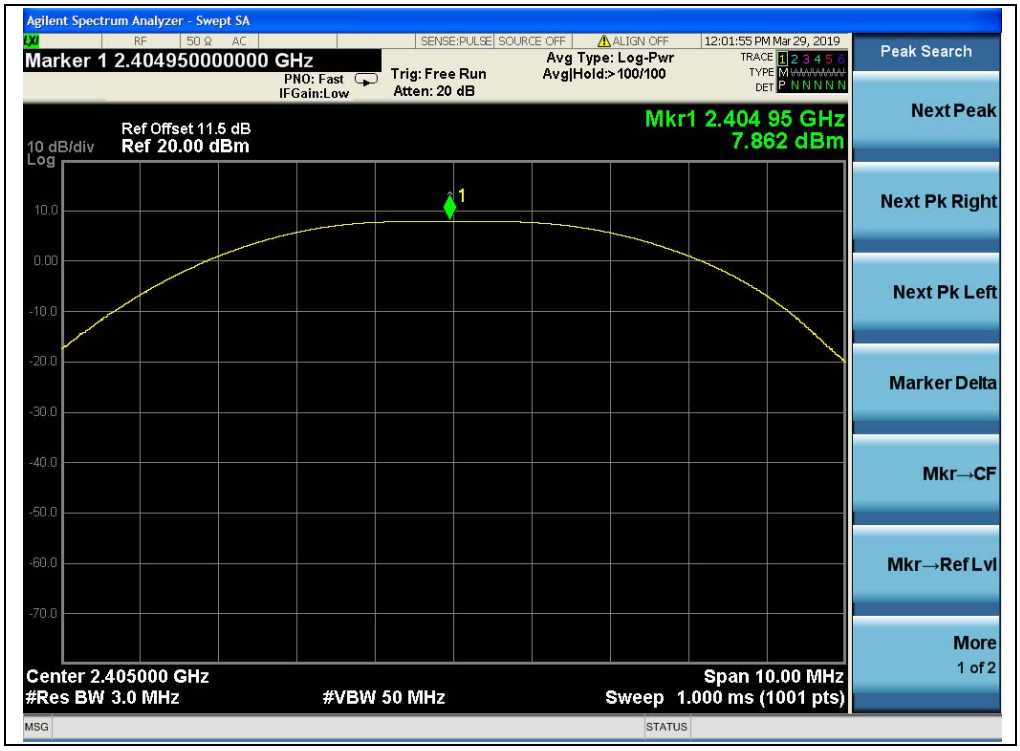
2.3.4. Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

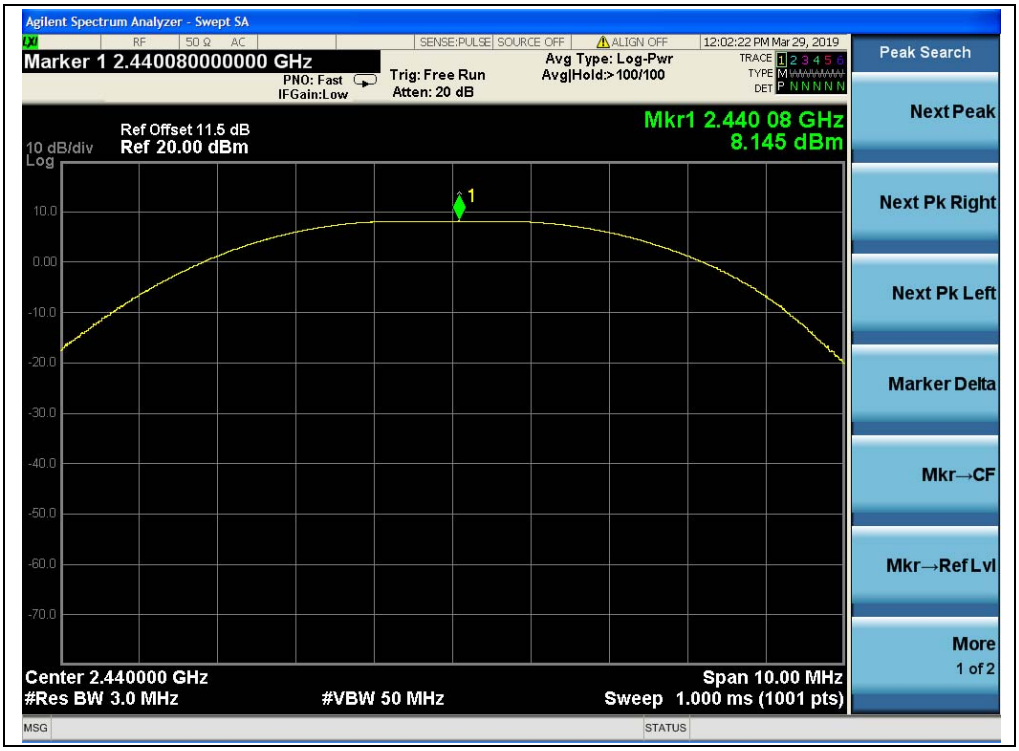
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
11	2405	7.86	0.006	30	1	PASS
18	2440	8.15	0.007			PASS
26	2480	8.54	0.007			PASS

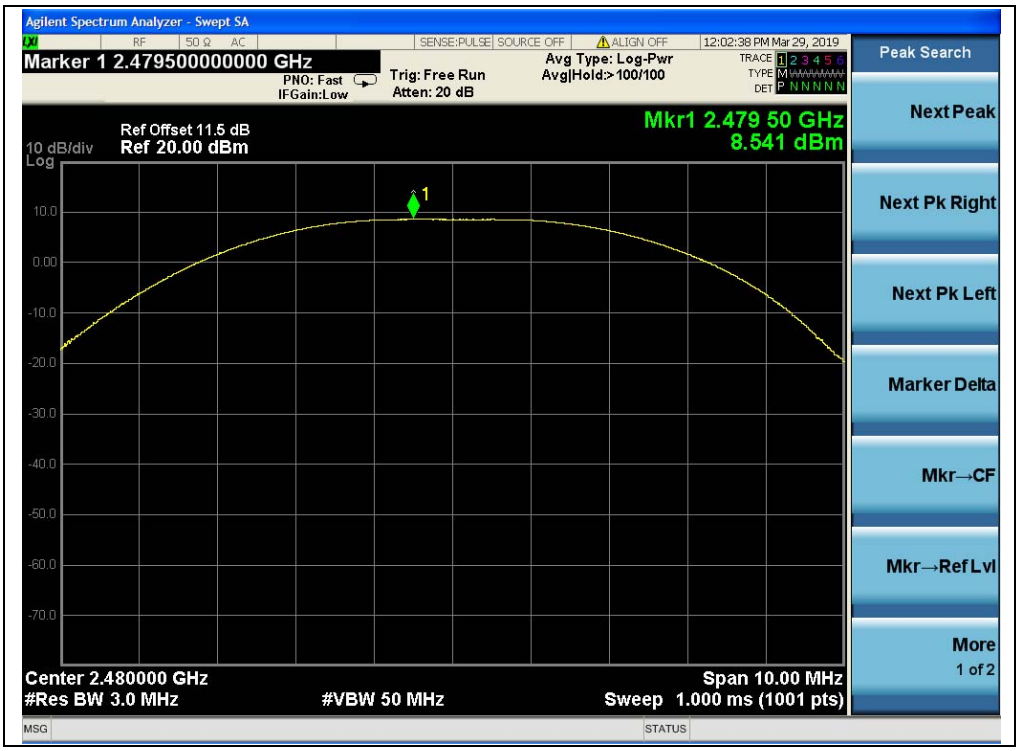
B. Test Plots:



(Channel 11, 2405MHz)



(Channel 18, 2440MHz)



(Channel 26, 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 USB Wideband Power Sensor and calibration.

A. 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, all test result in power meter.

B. Equipments List:

Please refer ANNEX B (4).

2.4.3. Test procedure

The test procedure is according to section 9.2.3.2 in KDB 558074 D01.

2.4.4. Test Result

Channel	Frequency (MHz)	Average Power			Limit		Verdict
		Measured	Duty factor Calculated				
		dBm	dBm	W	dBm	W	
11	2405	7.01	10.41	0.011	30	1	PASS
18	2440	7.09	10.49	0.011			PASS
26	2480	7.09	10.49	0.011			PASS

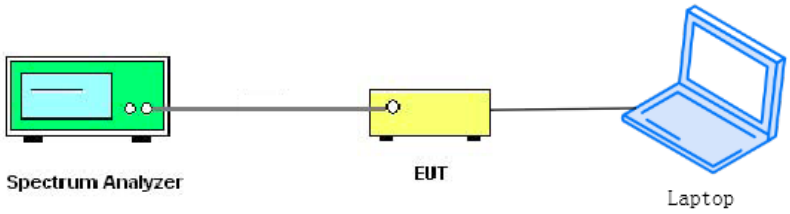
2.5. 6dB Bandwidth

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 6 dB bandwidth shall be at least 500 kHz.

2.5.2. Test Description

A. Test Set:



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.

B. Equipments List:

Please refer ANNEX B (4).

2.5.3. Test procedure

The steps for the first option are as follows:
（1）Set analyzer center frequency to channel center frequency.
a) Set RBW = 100 kHz.
b) Set the VBW=300 kHz.
c) Detector = peak.
d) Trace mode = max hold.
e) Sweep = auto couple
f) Allow the trace to stabilize.
g) 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 by 6 dB relative to the maximum level measured in the fundamental emission.

（2）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.

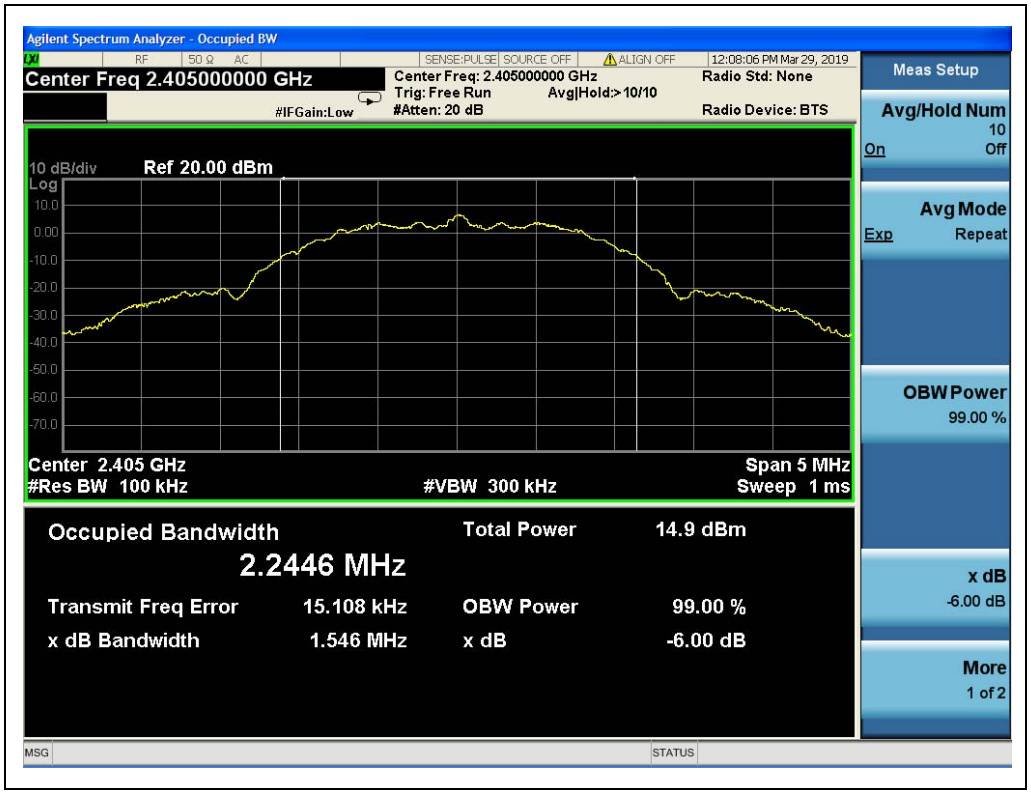
2.5.4. Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the module.

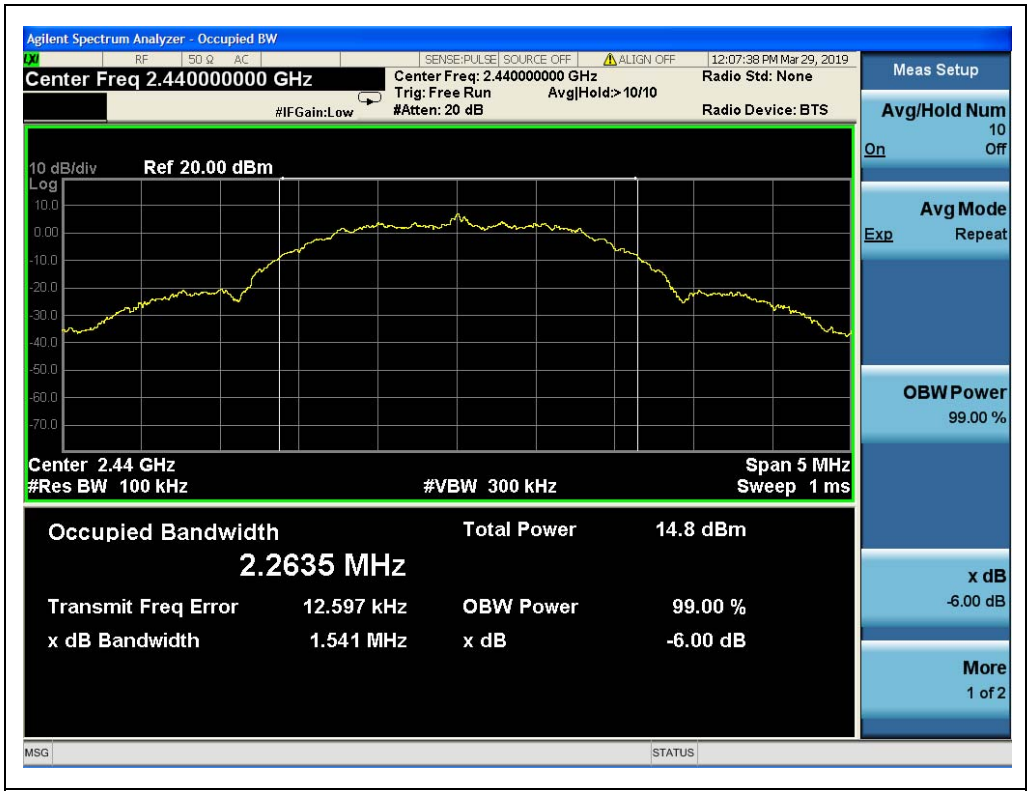
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
11	2405	1.546	≥500	PASS
18	2440	1.541	≥500	PASS
26	2480	1.536	≥500	PASS

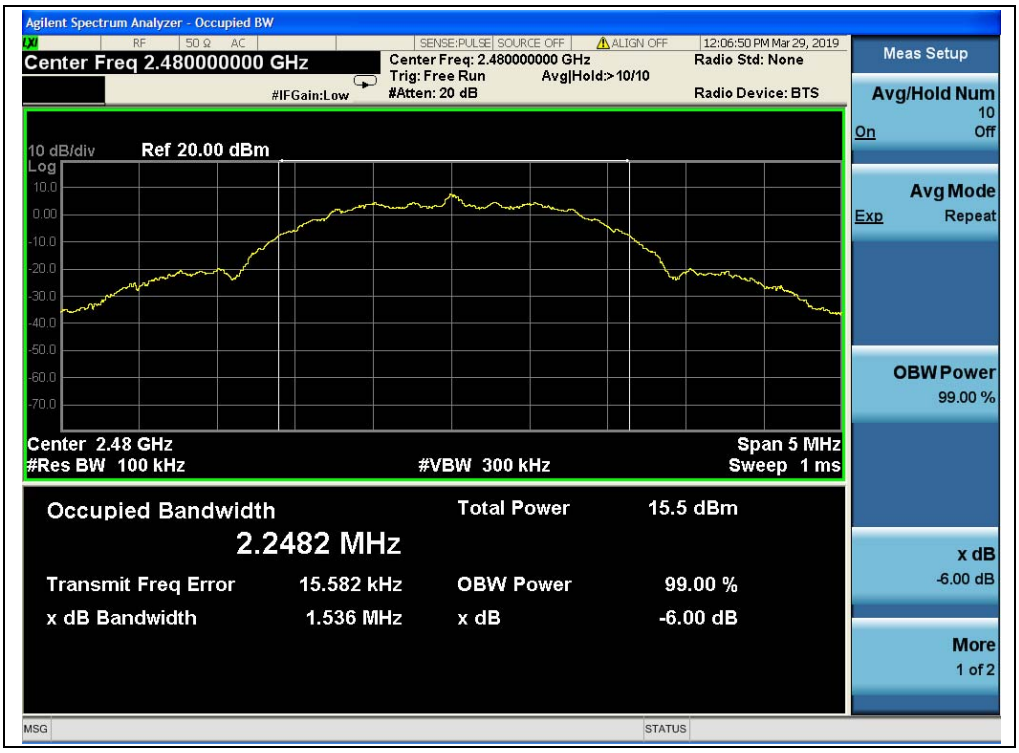
B. Test Plots:



(Channel 11, 2405MHz)



(Channel 18, 2440 MHz)



(Channel 26, 2480MHz)

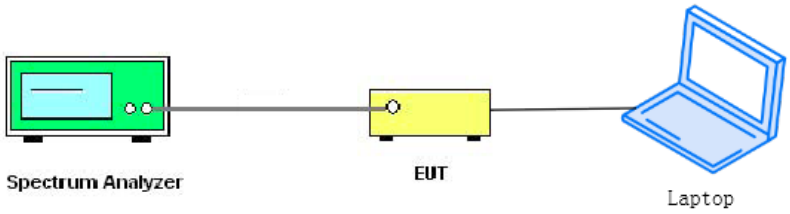
2.6. Conducted Spurious Emissions and Band Edge

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

A. Test Set:



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.

B. Equipments List:

Please refer ANNEX B (4).

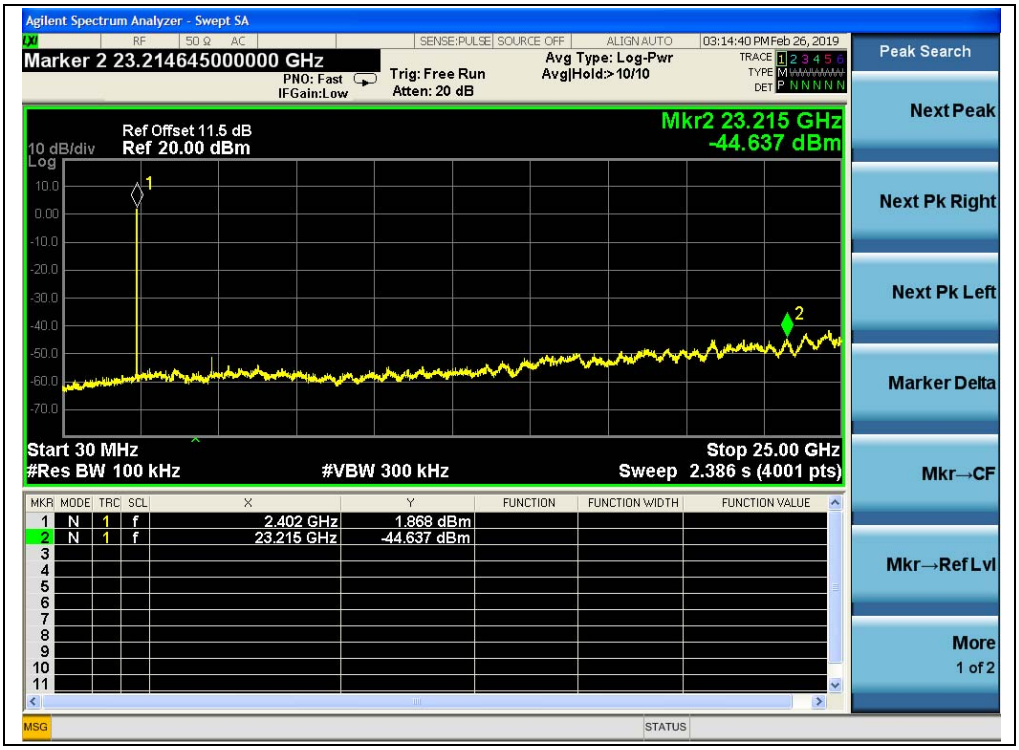
2.6.3. Test Result

The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

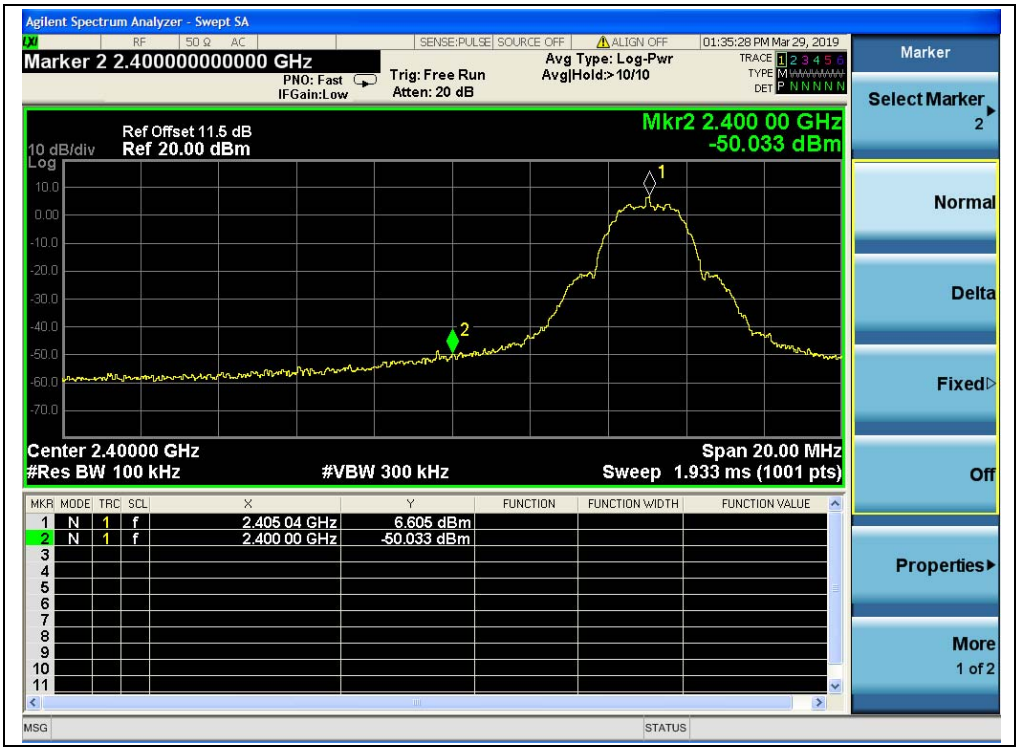
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
11	2405	-44.64	1.87	-18.13	PASS
18	2440	-42.72	2.37	-17.63	PASS
26	2480	-42.70	3.66	-16.34	PASS

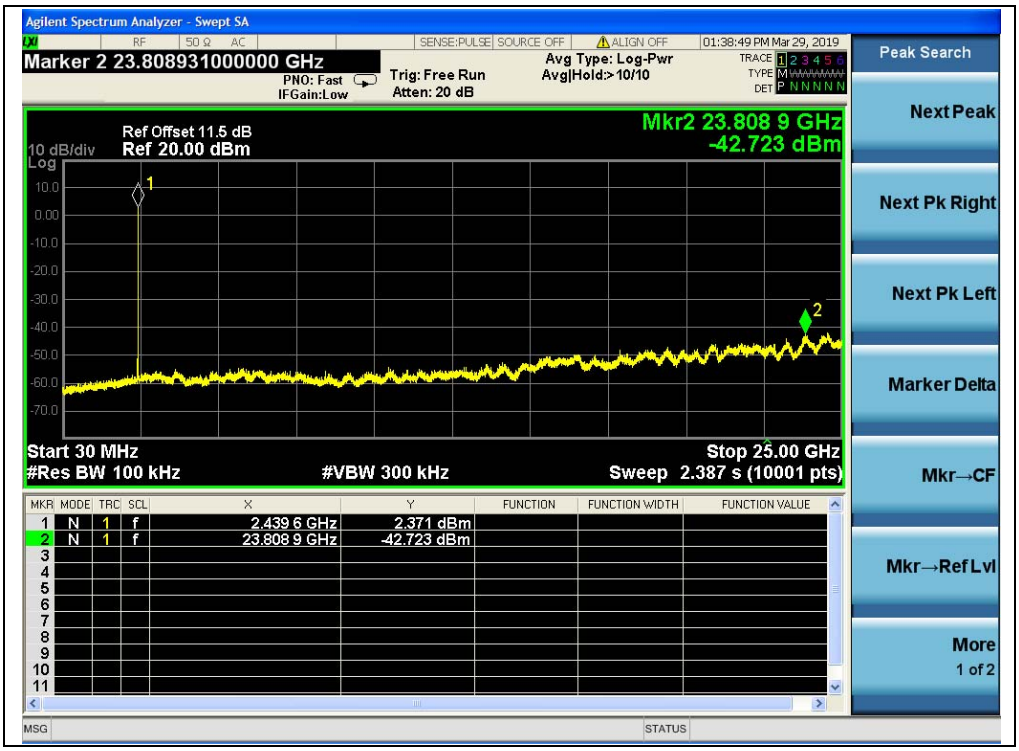
B. Test Plots:



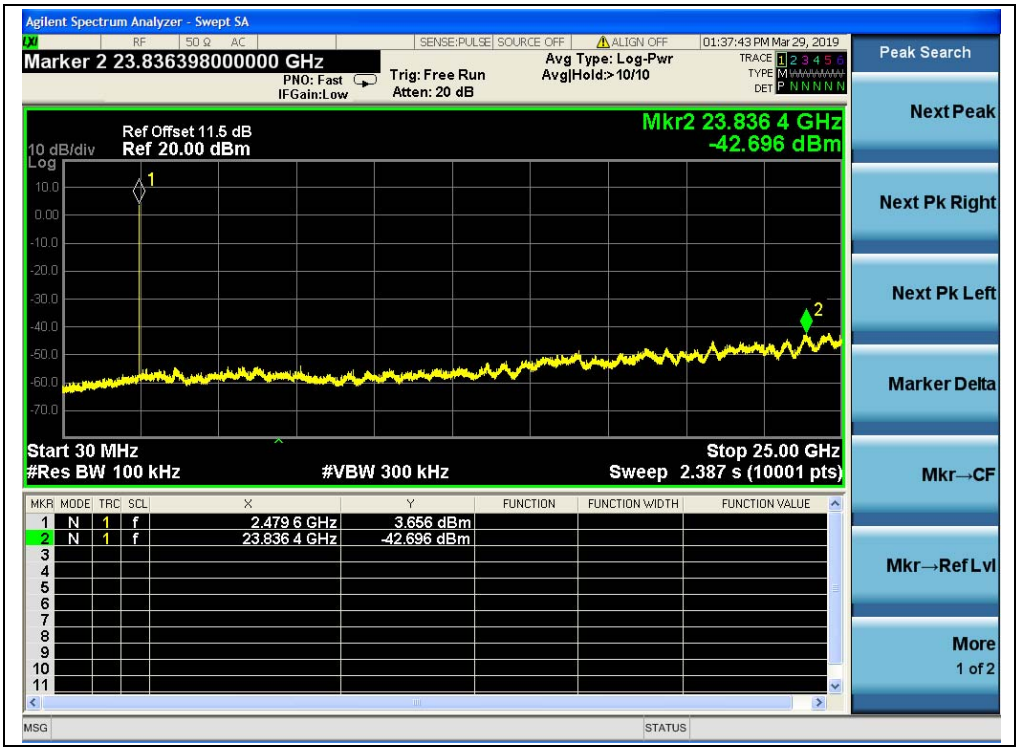
(Channel = 11, 30MHz to 25GHz)



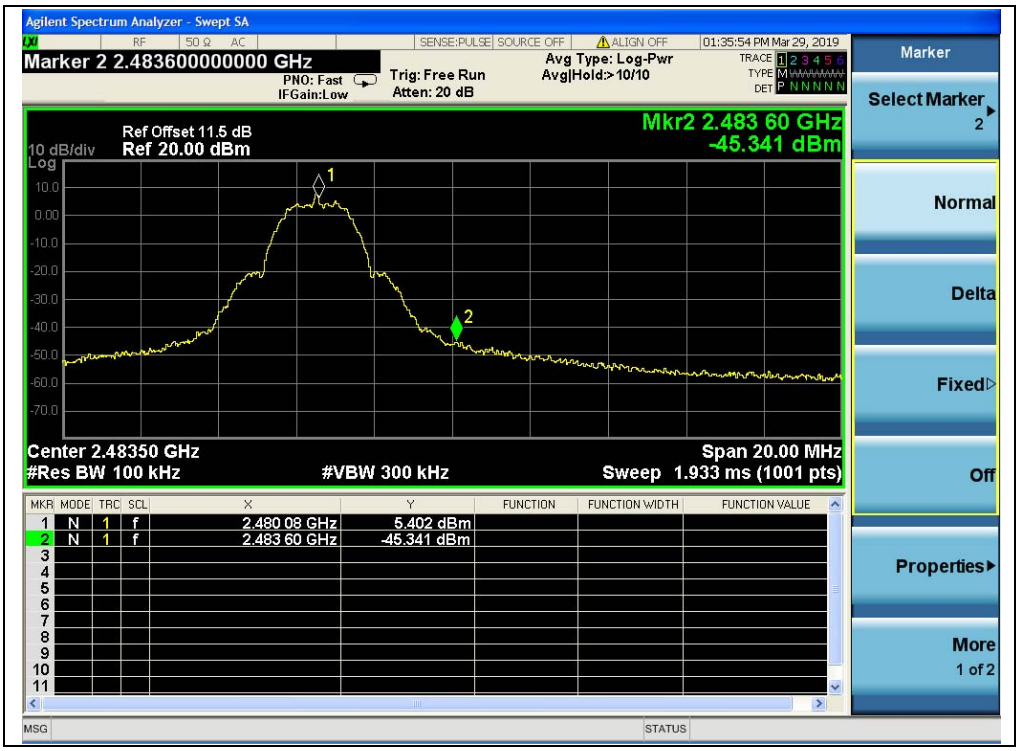
(Band Edge, Channel = 11)



(Channel = 18, 30MHz to 25GHz)



(Channel = 26, 30MHz to 25GHz)



(Band Edge, Channel = 26)

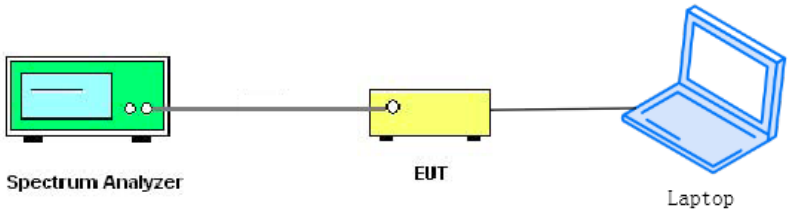
2.7. Power spectral density (PSD)

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

A. Test Set:



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.

B. Equipments List:

Please refer ANNEX B (4).

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 the span to 1.5 times DTS
c) Set the RBW to 3 kHz
d) Set the VBW to 10 kHz
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

The lowest, middle and highest channels are tested.

A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
11	2405	-6.50	8	PASS
18	2440	-6.87	8	PASS
26	2480	-6.29	8	PASS

B. Test Plots:

(Channel = 11, 2405MHz)

(Channel = 18, 2440MHz)

(Channel = 26, 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

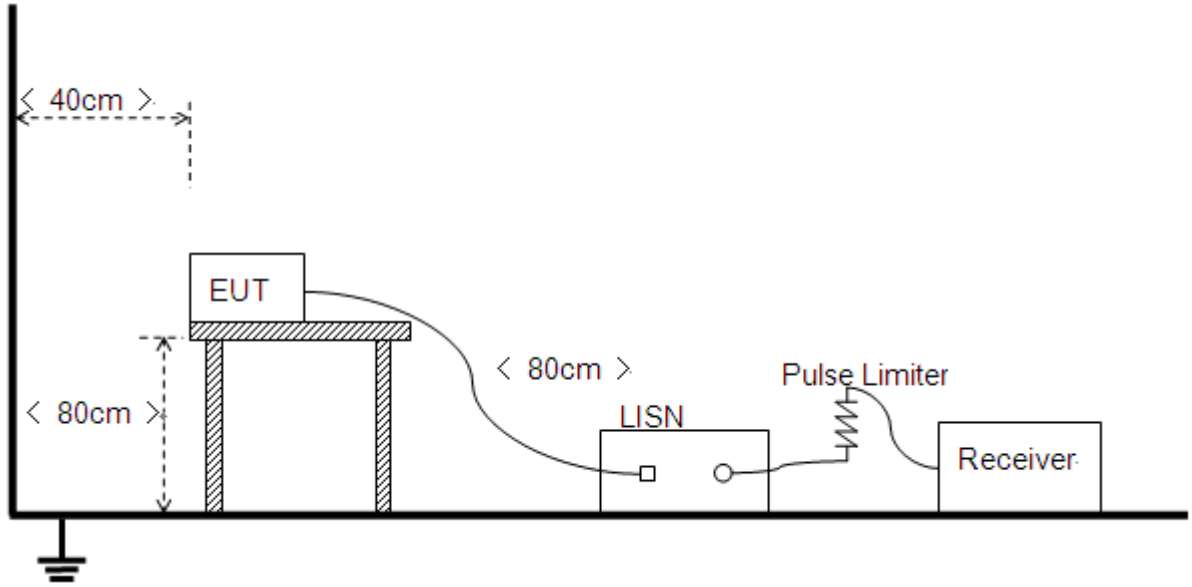
NOTE:

(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

A. 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.

B. Equipments List:

Please refer ANNEX B (4).

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. 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: Adapter + EUT + Zigbee TX

Test Voltage: AC 120V/60Hz

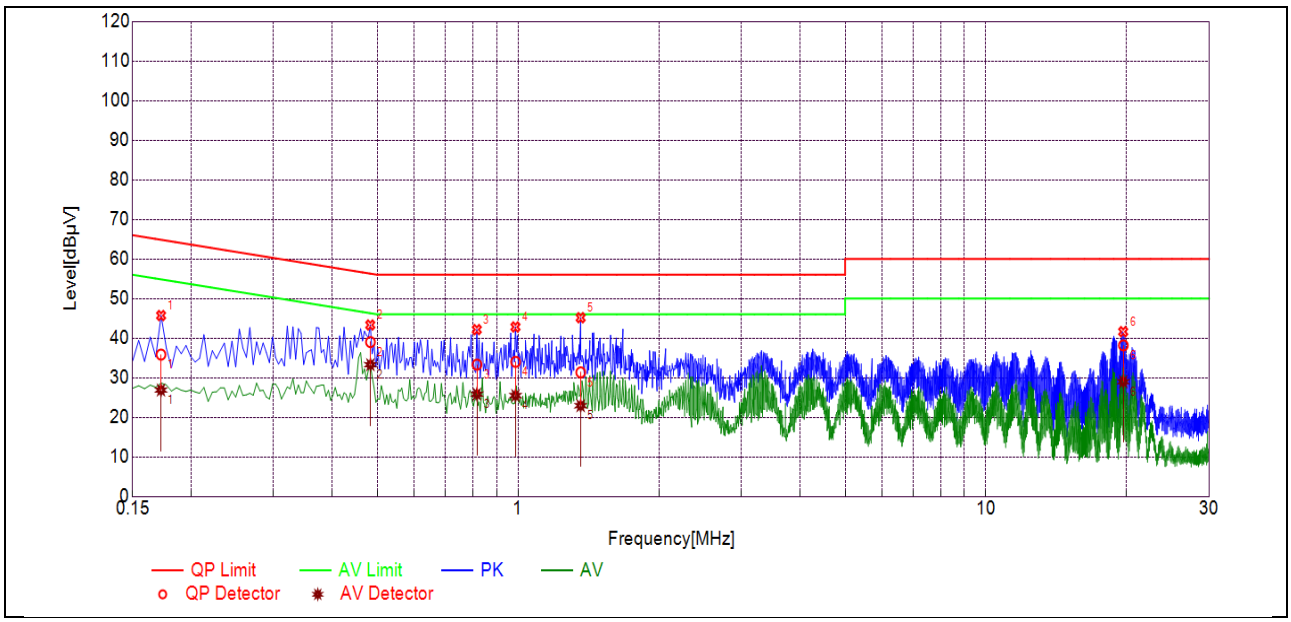
The measurement results are obtained as below:

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

U_R: Receiver Reading

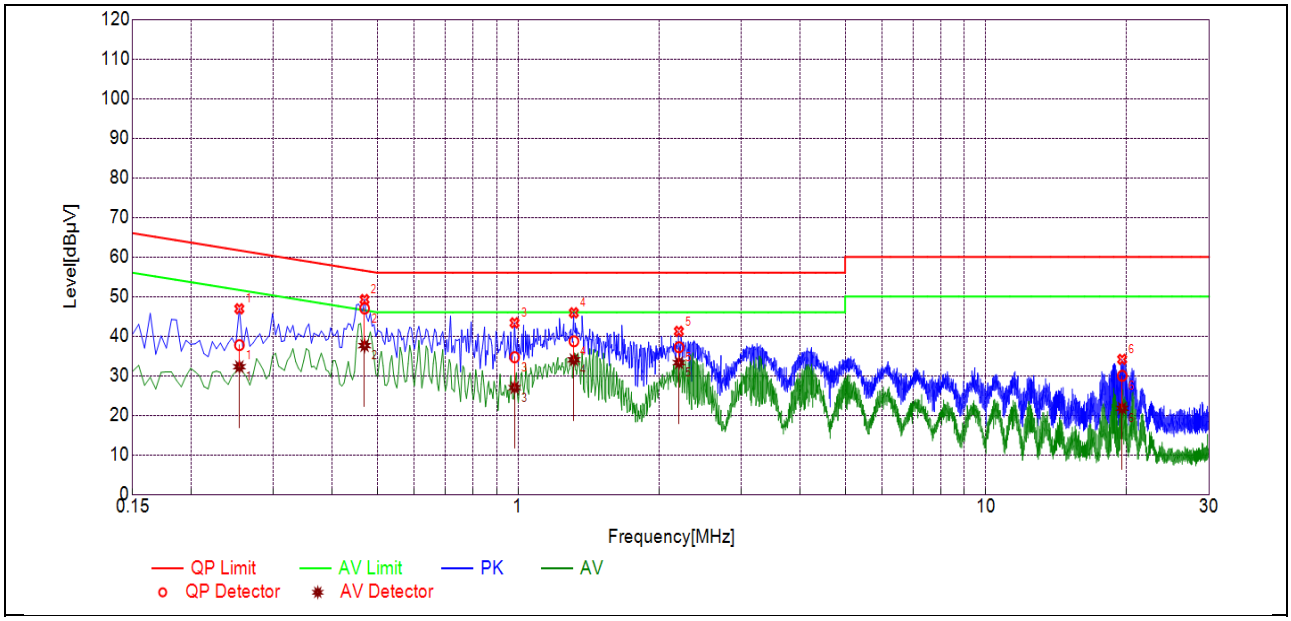
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1724	35.84	26.88	64.84	54.84	Line	PASS
2	0.4833	39.01	33.28	56.28	46.28		PASS
3	0.8165	33.30	25.84	56.00	46.00		PASS
4	0.9873	34.01	25.49	56.00	46.00		PASS
5	1.3605	31.34	22.93	56.00	46.00		PASS
6	19.6689	38.17	28.99	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	0.2536	37.73	32.25	61.64	51.64	Neutral	PASS
2	0.4696	46.98	37.61	56.52	46.52		PASS
3	0.9828	34.67	26.99	56.00	46.00		PASS
4	1.3159	38.70	34.01	56.00	46.00		PASS
5	2.2081	37.19	33.28	56.00	46.00		PASS
6	19.5560	29.98	21.78	60.00	50.00		PASS

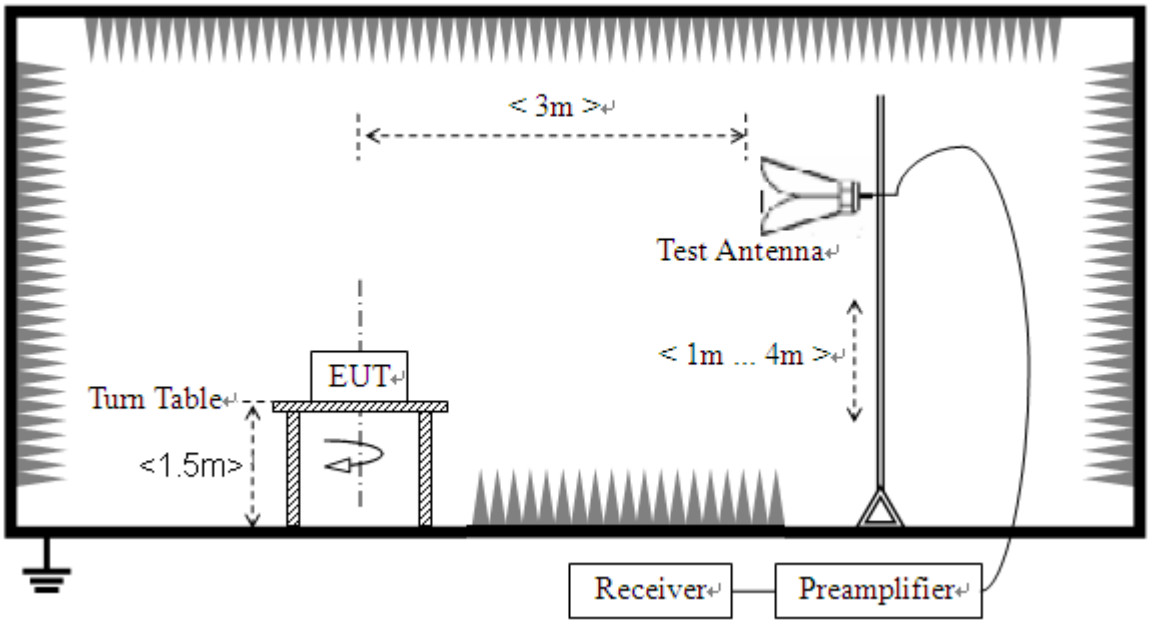
2.9. Restricted Frequency Bands

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

A. 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.

B. Equipments List:

Please refer ANNEX B(4).

2.9.3. Test Result

The lowest and highest channels are tested to verify the Restricted Frequency Bands.

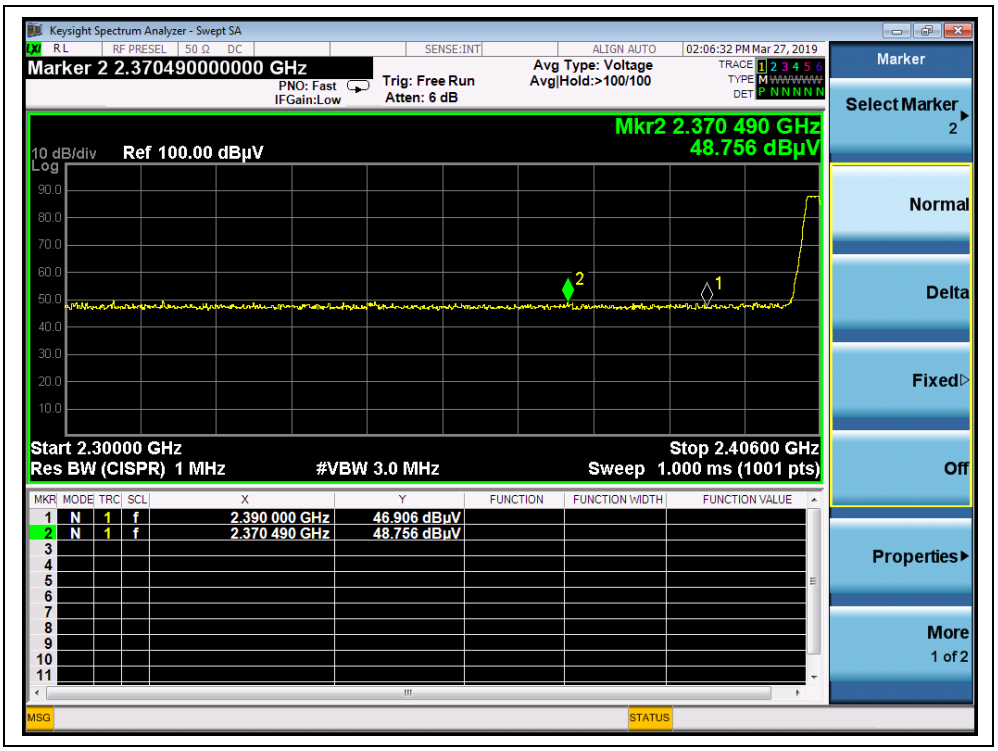
The measurement results are obtained as below:
$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

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.

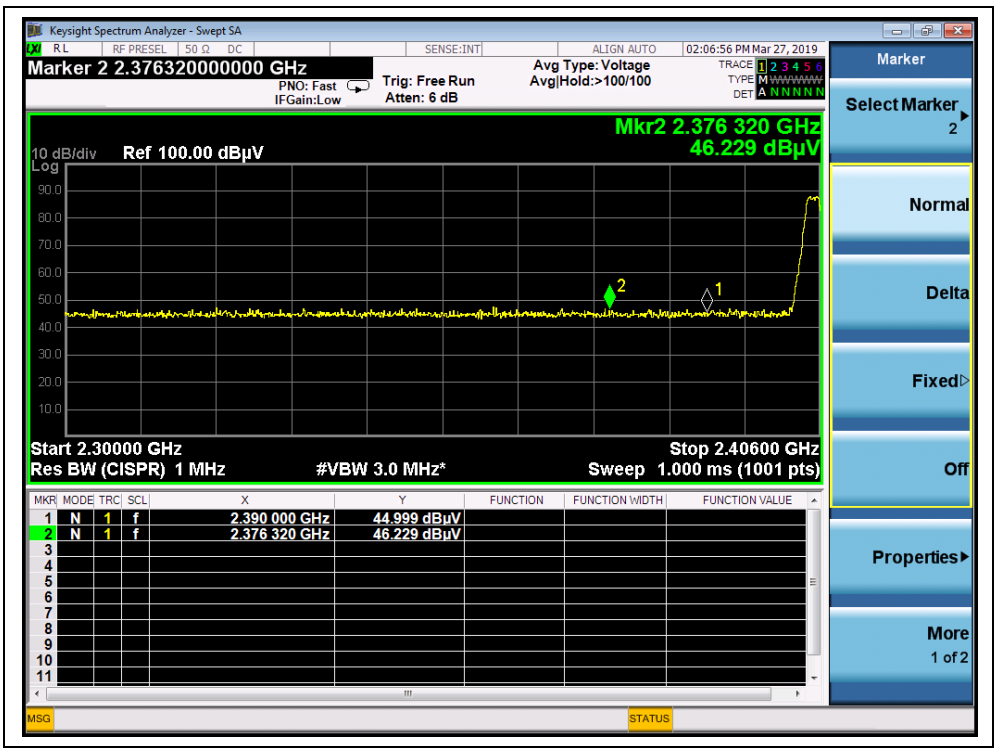
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
11	2370.49	PK	48.76	-29.67	32.56	51.65	74	PASS
11	2376.32	AV	46.23	-29.67	32.56	49.12	54	PASS
26	2486.16	PK	48.50	-29.67	32.56	51.39	74	PASS
26	2483.50	AV	45.09	-29.67	32.56	47.98	54	PASS

B. Test Plots:

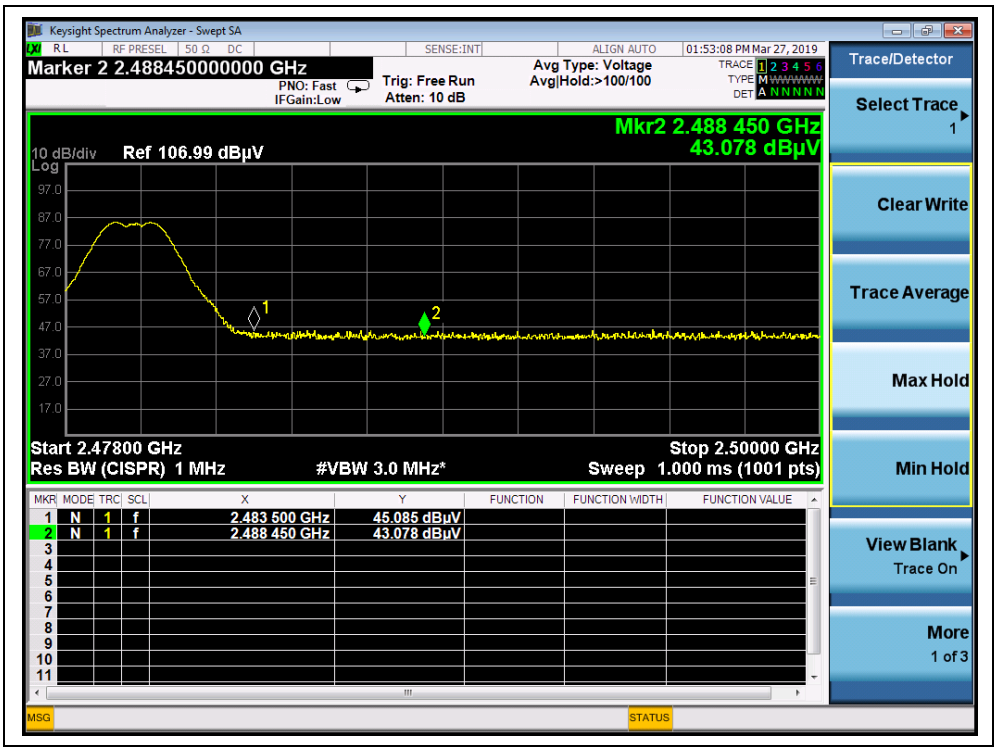


(Channel = 11, PEAK)



(Channel = 11, AVG)

(Channel = 26, PEAK)



(Channel = 26, AVG)

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

Note:

1. 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.

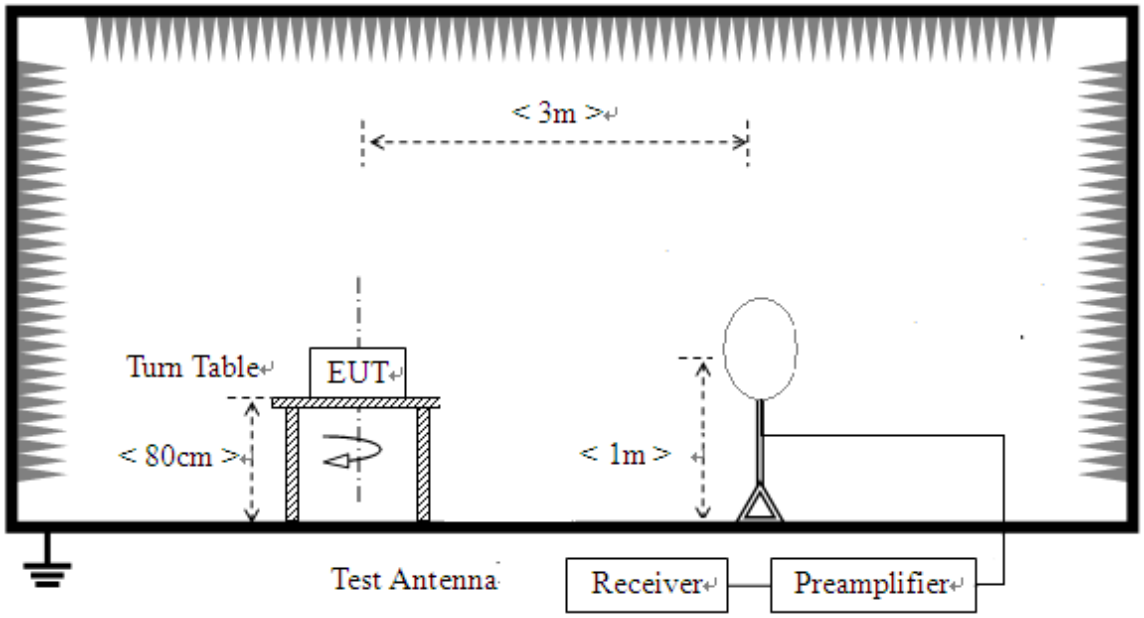
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

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)

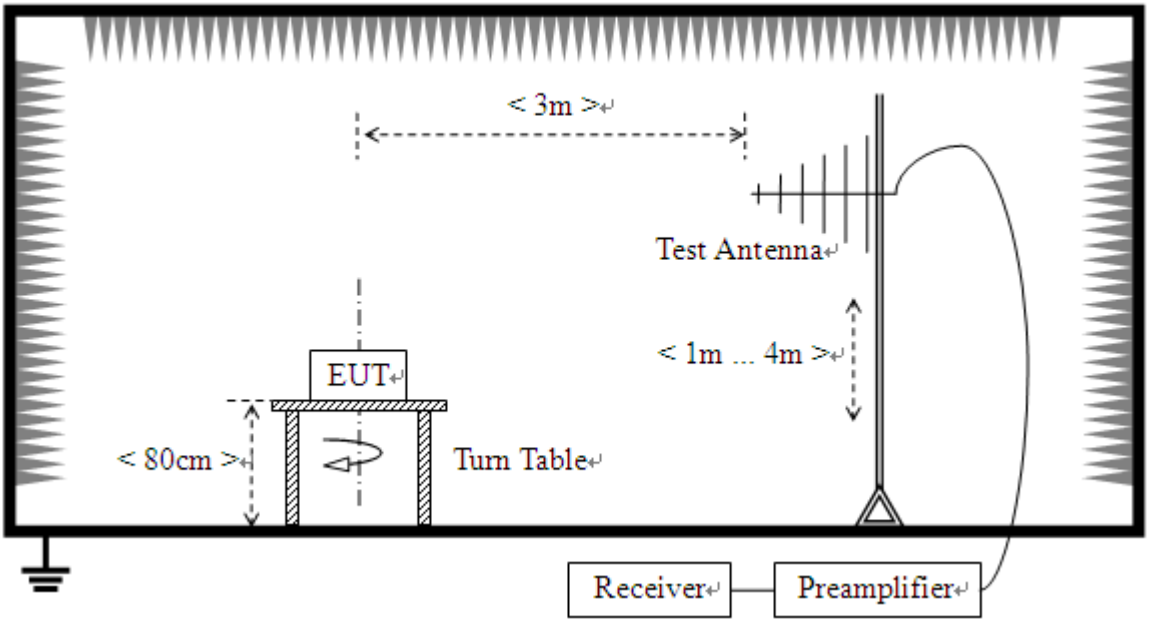
2.10.2. Test Description

A. Test Setup:

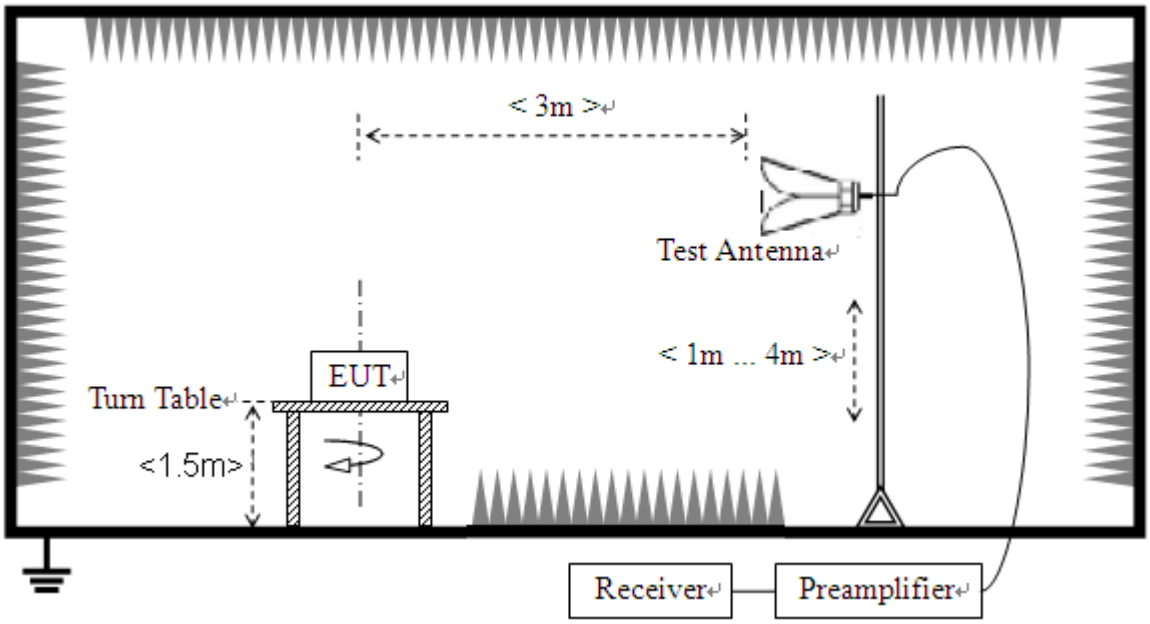
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz. Test site have a minimum area of the ground plane covered with RF absorbing material as specified in Figure 6 of ANSI C63.4: 2014.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10:2013. For radiated emissions below or equal to 1GHz, The EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2013.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant

emissions, with polarization oriented for maximum response. The test antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Please refer ANNEX B (4).

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 limit, it is unnecessary to perform an quasi-peak measurement.

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

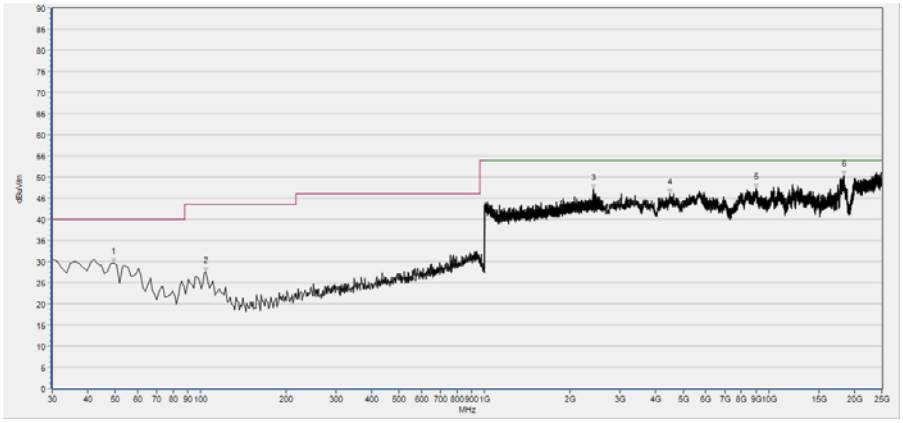
During the test, the total correction Factor A_T and A_{Factor} were built in test software.

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 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

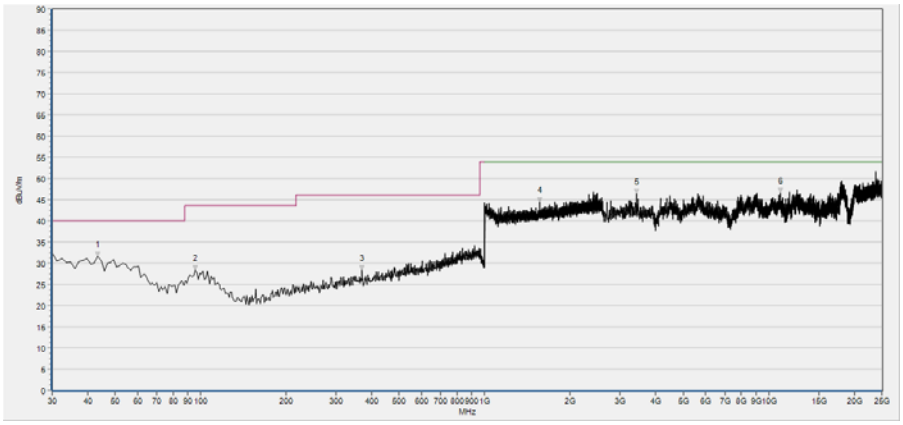
Note3: For the frequency, which started from 25GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Plots 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
49.424	29.57	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
104.055	27.50	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2406.643	47.15	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4486.016	46.04	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9032.006	47.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
18376.541	50.40	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

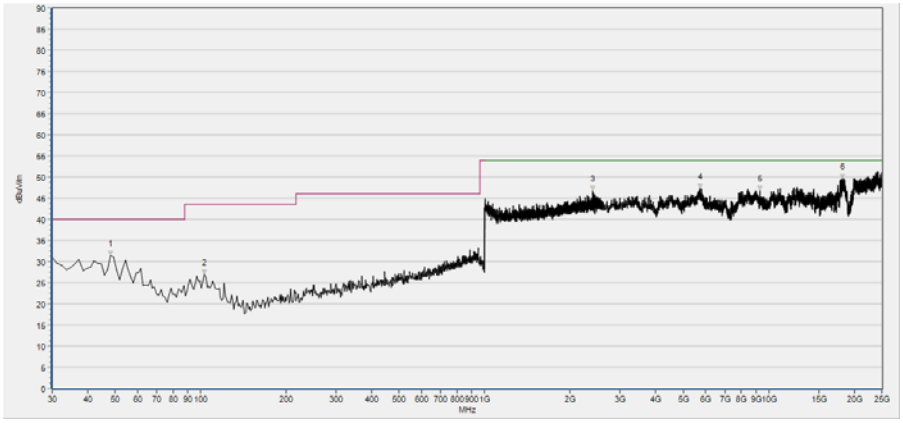
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	31.56	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
95.557	28.41	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
369.925	28.47	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1558.303	44.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3414.694	46.44	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10979.123	46.54	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

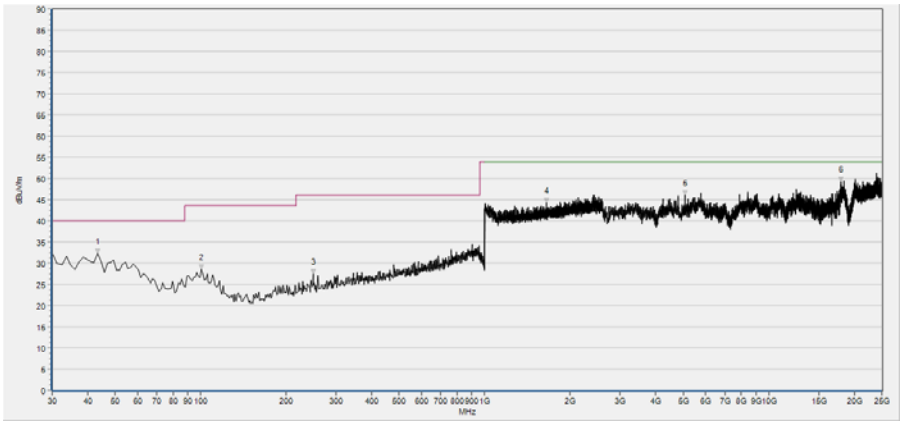
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 18



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
48.210	31.37	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
102.841	26.93	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2403.441	46.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5744.717	47.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9292.708	46.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
18172.868	49.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

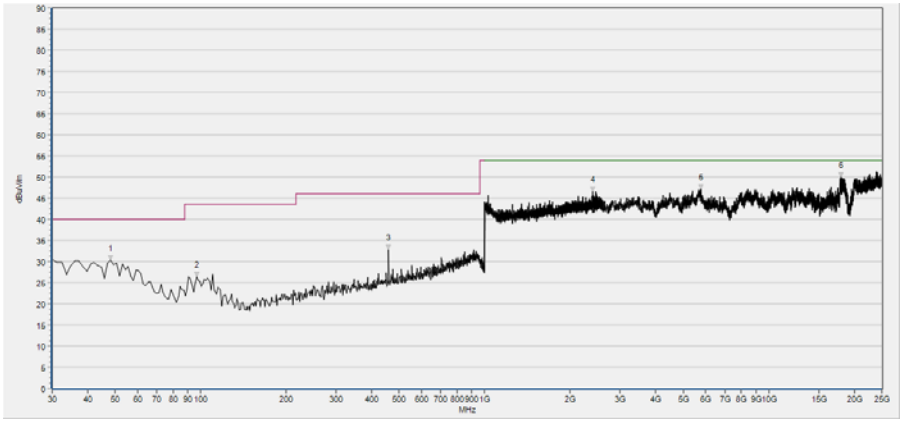
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	32.29	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
100.413	28.56	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
248.523	27.55	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1647.939	44.35	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5080.742	46.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
17965.121	49.20	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

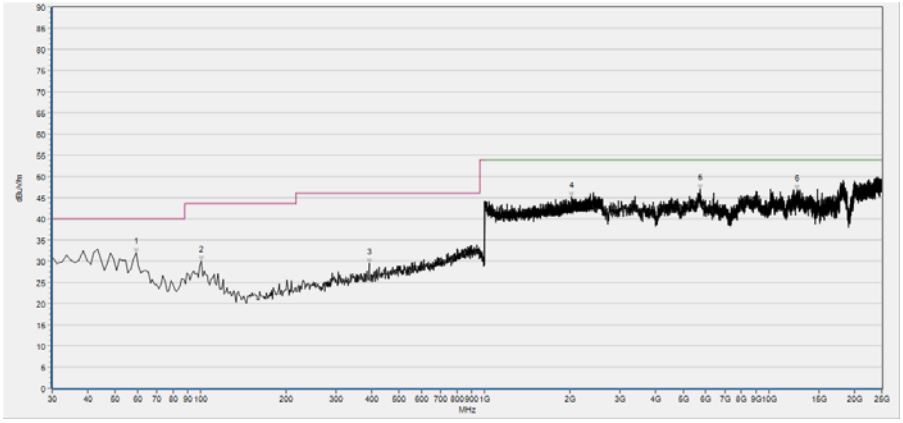
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 26



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
48.210	30.29	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
96.771	26.39	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
458.548	32.82	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2403.441	46.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5773.231	47.14	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
17985.488	49.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
59.136	32.05	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
100.413	29.97	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
391.777	29.41	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2018.647	45.15	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5732.497	46.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12579.996	46.83	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

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 (PSD)	±2.22dB
Bandwidth	±5%
Conducted Spurious Emission	±2.77 dB
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. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2018.11.06	2019.11.05
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
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2018.04.17	2019.04.16
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2018.05.08	2019.05.07
LISN	812744	NSLK 8127	Schwarzbeck	2018.05.08	2019.05.07
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2018.05.08	2019.05.07
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	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V 1.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2018.08.04	2019.08.03
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2018.05.18	2019.05.17
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.15	2020.02.14
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2018.08.06	2019.08.05
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2018.08.02	2019.08.01
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
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2018.05.08	2019.05.07
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2018.05.08	2019.05.07
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2018.12.01	2019.11.30
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

END OF REPORT