



FCC TEST REPORT

FCC ID: 2A3RU-BM1512WB

Product : 15 Wireless Control Tubular Motor

Model Name : BM1512WB

Brand : N/A

Report No. : PTC21110203101E-FC01

Prepared for

NINGBO BEFUN HOME TECH CO.,LTD.
No.63 Zhenxing W Rd, Yuyao, Zhejiang, China 315400

Prepared by

Precise Testing & Certification Co., Ltd
Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China



TEST RESULT CERTIFICATION

Applicant's name : NINGBO BEFUN HOME TECH CO.,LTD.
Address : No.63 Zhenxing W Rd, Yuyao, Zhejiang, China 315400
Manufacture's name : NINGBO BEFUN HOME TECH CO.,LTD.
Address : No.63 Zhenxing W Rd, Yuyao, Zhejiang, China 315400
Product : 15 Wireless Control Tubular Motor
Model : BM1512WB
Standards : FCC CFR47 Part 15 Section 15.231
Test procedure : ANSI C63.10:2013
Test Date : Nov.08, 2021 to Nov. 22, 2021
Date of Issue : Nov. 23, 2021
Test Result : Pass

This device described above has been tested by PTS, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Engineer:

A handwritten signature in black ink that reads 'Leo Yang'.

Leo Yang / Engineer

Technical Manager:

A handwritten signature in black ink that appears to read 'Chris Du'.

Chris Du / Manager



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2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	N/A
Radiated Emission	15.231(a) 15.209 15.205(a)	PASS
Periodic Operation	15.35(c)	PASS
Outside of Band Emission	15.231(a) 15.205 15.209	PASS
20dB Bandwidth	15:215(c)	PASS
Antenna Requirement	15.203	PASS
Remark: N/A: Not Applicable		



3 General Information

3.1 General Description of E.U.T.

Product Name : 15 Wireless Control Tubular Motor
Model Name : BM1512WB
Operation Frequency: : 433.92MHz
Antenna installation: : PCB ANTENNA
Antenna Gain: : 0dBi
Type of Modulation : ASK
The lowest oscillator : 433.92MHz
Power supply : DC 3V Battery
Hardware Version : V1.0
Software Version : V1.0

3.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Modulation	Test mode	Low channel	Middle channel	High channel
ASK	continuously Transmitting	433.92MHz	\	\

3.3 Test Site

Precise Testing & Certification Co., Ltd
Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China
FCC Registration Number: 790290



4 Equipment During Test

4.1 Equipments List

Radiated Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde & Schwarz	ESCI	101417	Aug. 21, 2021	Aug. 20, 2022	1 year
2	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	Aug. 21, 2021	Aug. 20, 2022	1 year
3	Trilog Broadband Antenna	SCHWARZ BECK	VULB9160	9160-3355	Aug. 21, 2021	Aug. 20, 2022	1 year
4	Amplifier	EM	EM-30180	060538	Aug. 21, 2021	Aug. 20, 2022	1 year
5	Horn Antenna	SCHWARZ BECK	BBHA9120 D	9120D-1246	Aug. 21, 2021	Aug. 20, 2022	1 year
6	Coaxial Cable(below 1GHz)	LARGE	CALB1	-	Aug. 21, 2021	Aug. 20, 2022	1 year
7	Coaxial Cable(above 1GHz)	LARGE	CALB2	-	Aug. 21, 2021	Aug. 20, 2022	1 year

4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10 ⁻⁶
Bandwidth	± 1.5 x 10 ⁻⁶
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB

4.3 Description of Support Units

Equipment	Model No.	Series No.

5 Conducted Emission

Test Requirement:	: FCC CFR 47 Part 15 Section 15.207
Test Method:	: ANSI C63.10:2013
Frequency Range:	: 150kHz to 30MHz
Class/Severity:	: Class B
Limit:	: 66-56 dB μ V between 0.15MHz & 0.5MHz
	: 56 dB μ V between 0.5MHz & 5MHz
	: 60 dB μ V between 5MHz & 30MHz
Detector:	: Peak for pre-scan (9kHz Resolution Bandwidth)
Test Result:	: Pass

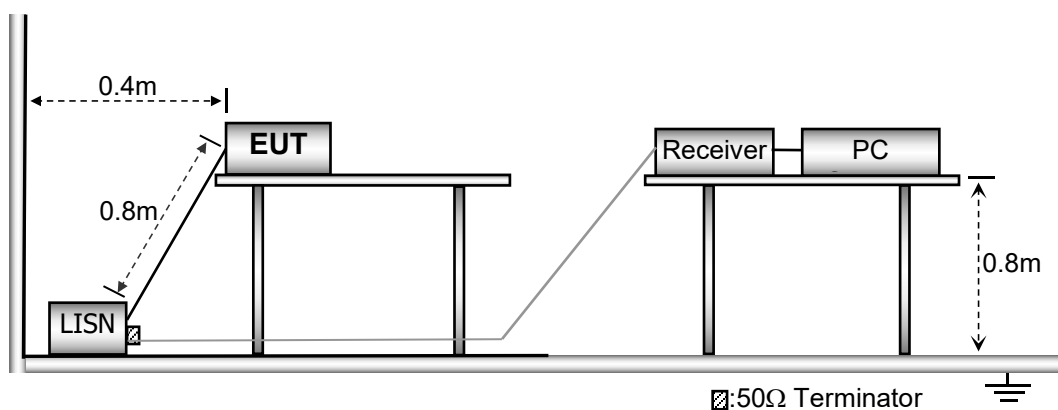
5.1 E.U.T. Operation

Operating Environment :

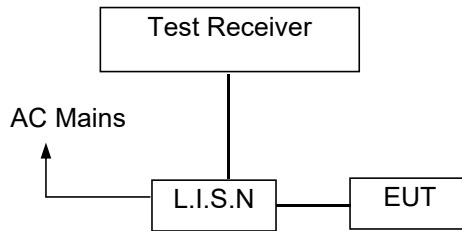
Temperature	: 25.5 °C
Humidity	: 51 % RH
Atmospheric Pressure	: 101.2kPa

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



5.3 Test SET-UP (Block Diagram of Configuration)



5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.6 Measurement Description

The maximised peak emissions from the EUT was scanned with both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line. The worst case was recorded by TX with AC 120V 60Hz.

5.7 Conducted Emission Test Result

N/A

EUT was power by battery.



6 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor (dB)=20 * Log₁₀(Duty Cycle(%))

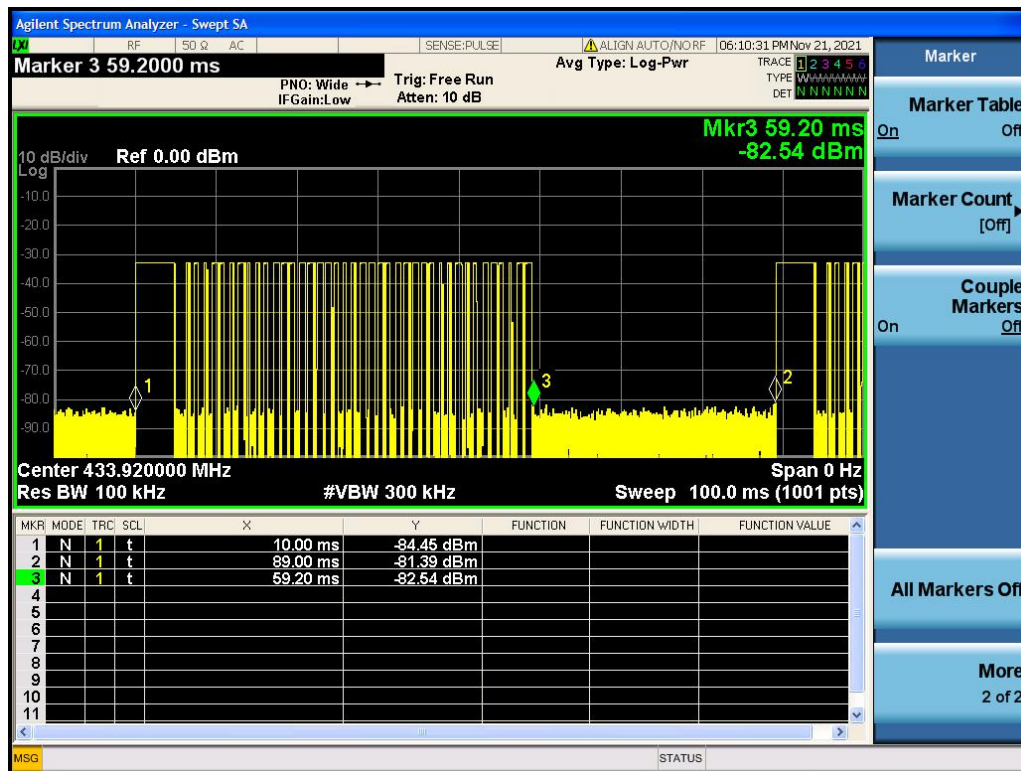
Total transmission time(ms)	4.751+0.35*20+0.71*20=25.951
Length of a complete transmission period(ms)	79
Duty Cycle(%)	32.85
Duty Cycle Correction Factor(dB)	-9.67

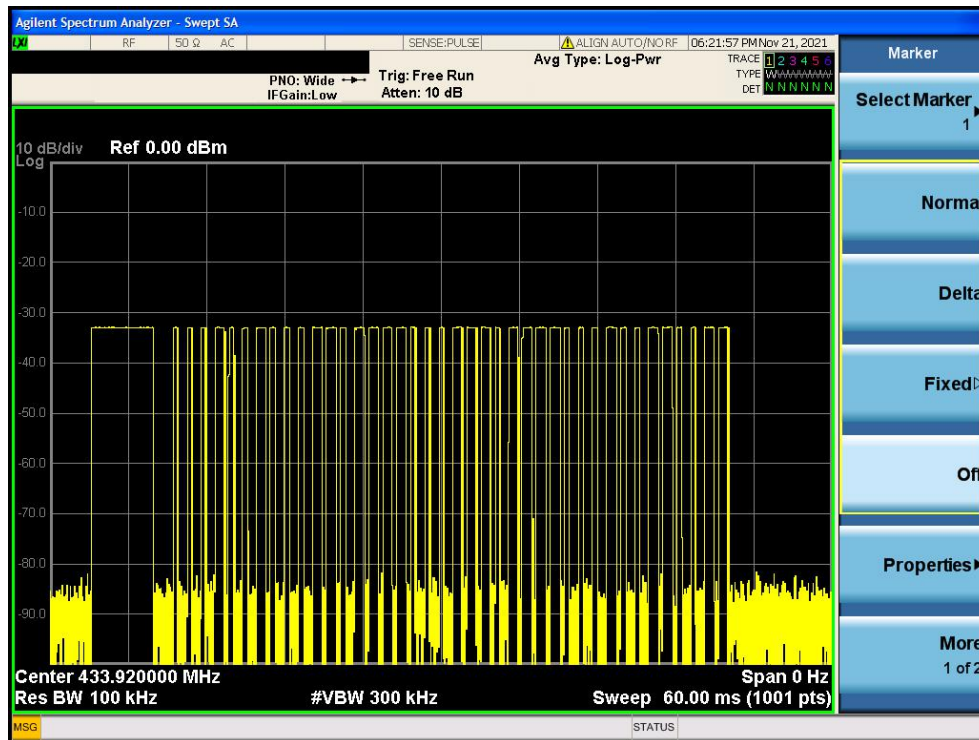
Refer to the duty cycle plot (as below), This device meets the FCC requirement.

Length of a complete pulse train:

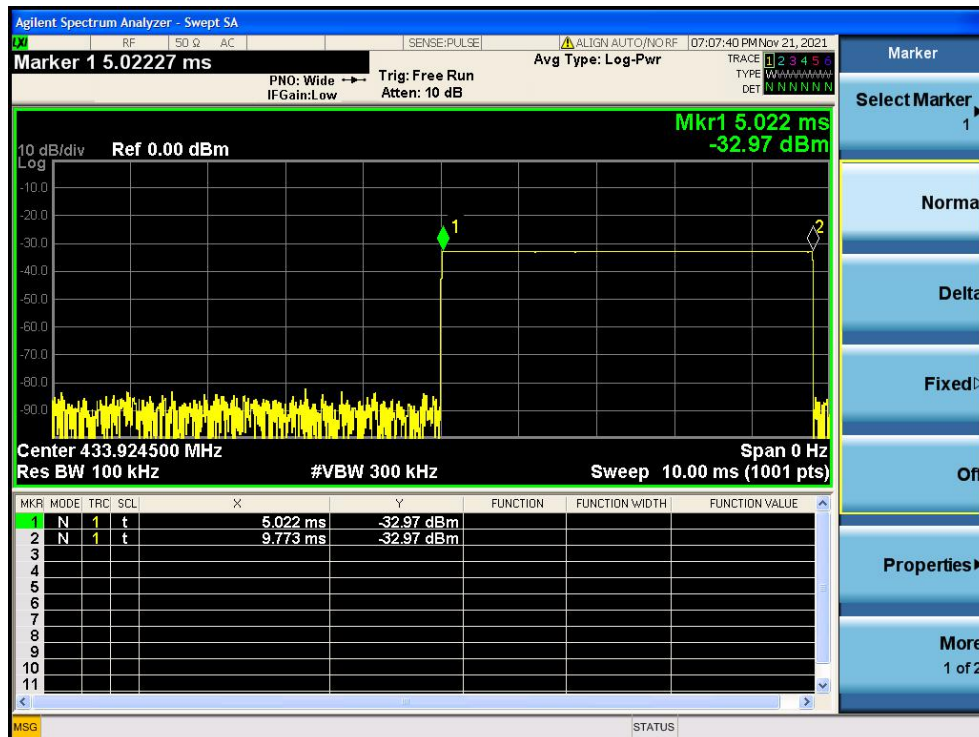
Remark: FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Tp



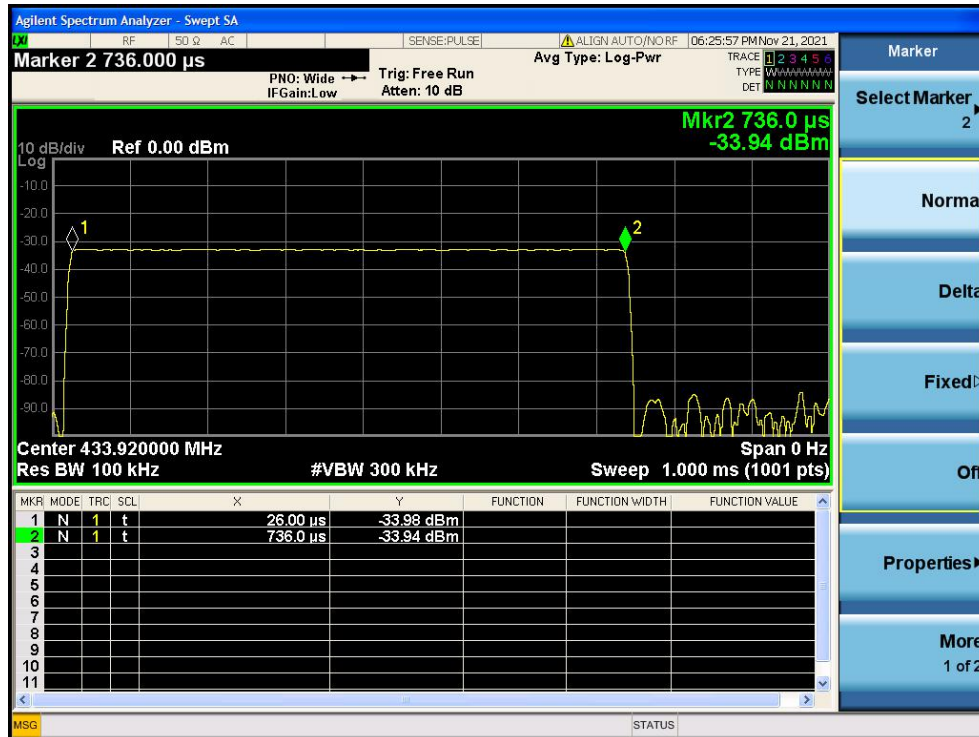


Pulse 1

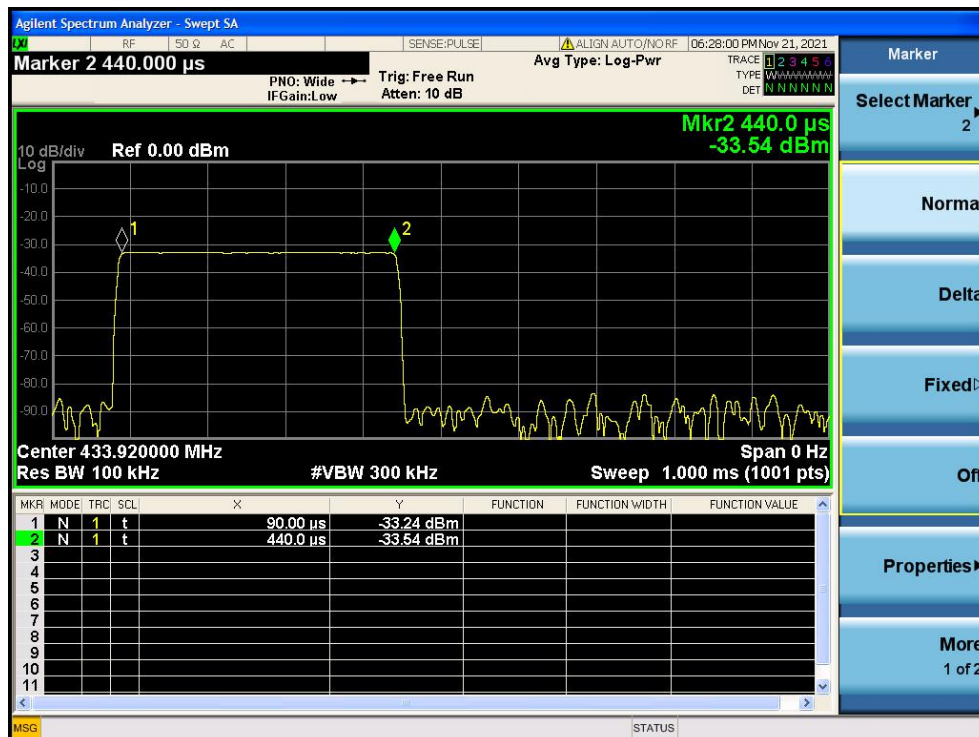




Pulse 2



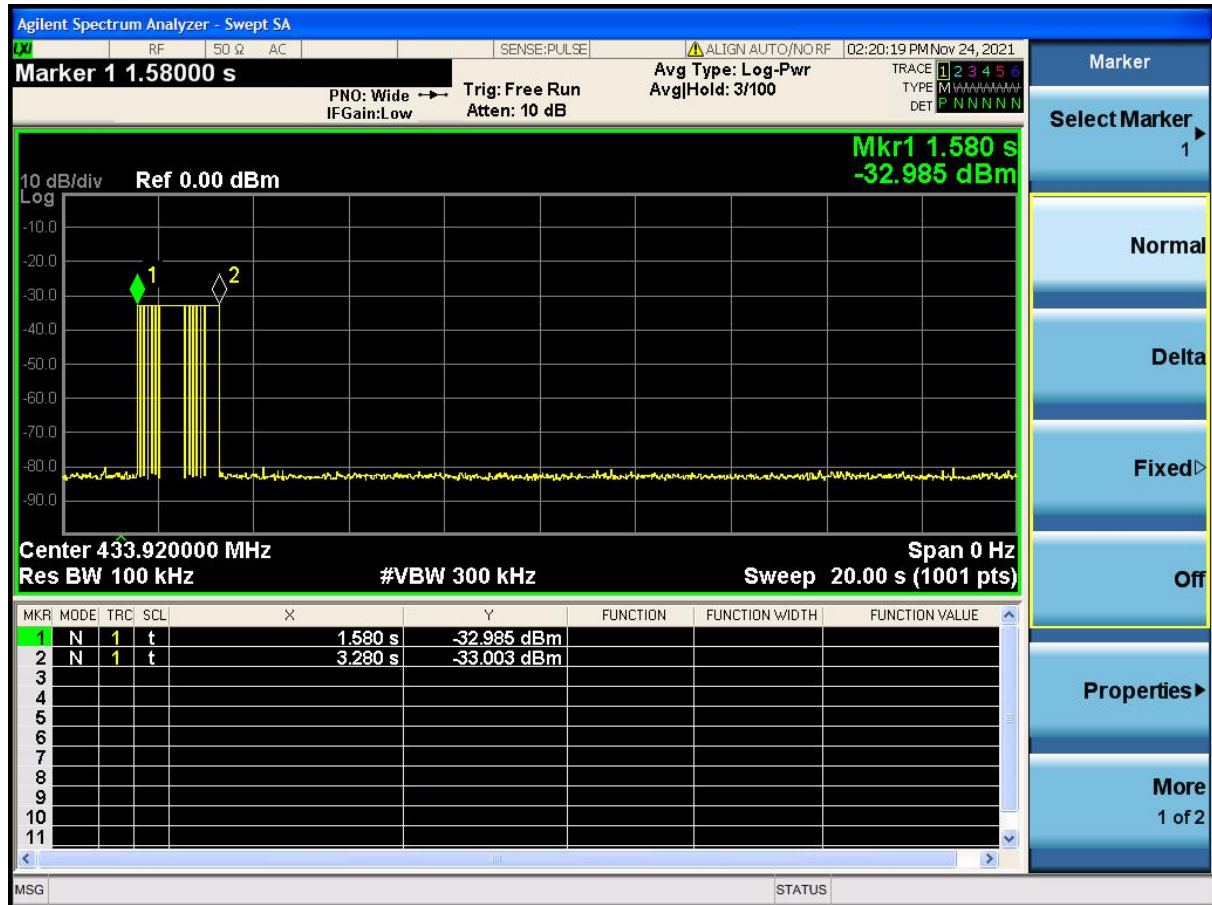
Pulse 3





FCC Part15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2)A transmitter activated automatically shall cease transmission within 5 seconds after activation.





7 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.231 & 15.207 & 15.205
Test Method: : ANSI C63.10:2013
Test Result: : PASS
Measurement Distance: : 3m
Limit: : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

7.1 EUT Operation

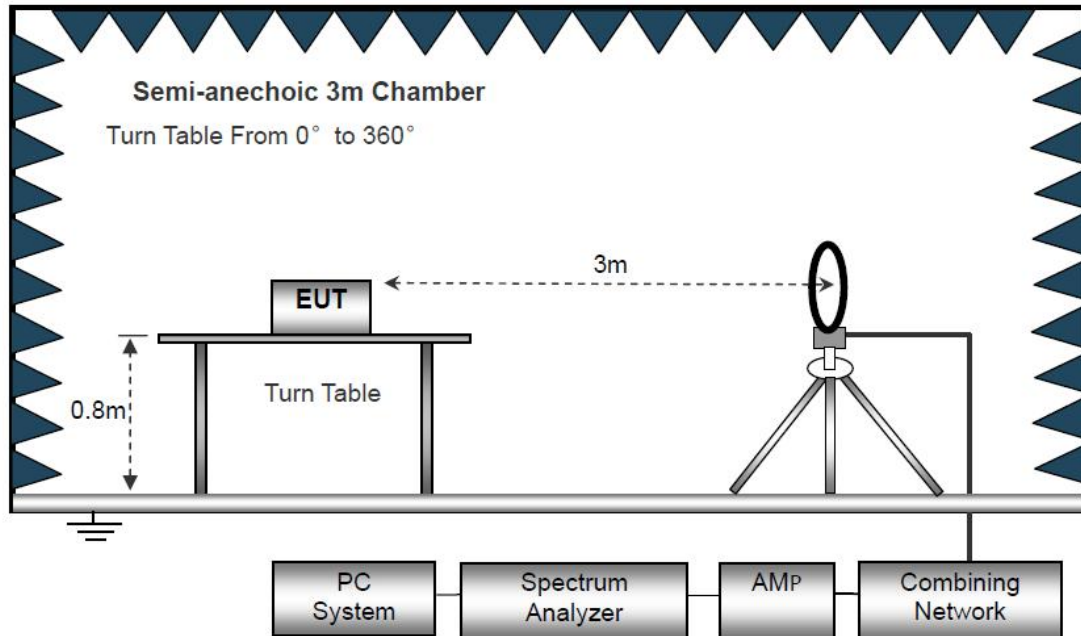
Operating Environment :

Temperature: : 23.5 °C
Humidity: : 51.1 % RH
Atmospheric Pressure: : 101.2kPa
EUT Operation : : continuously Transmitting

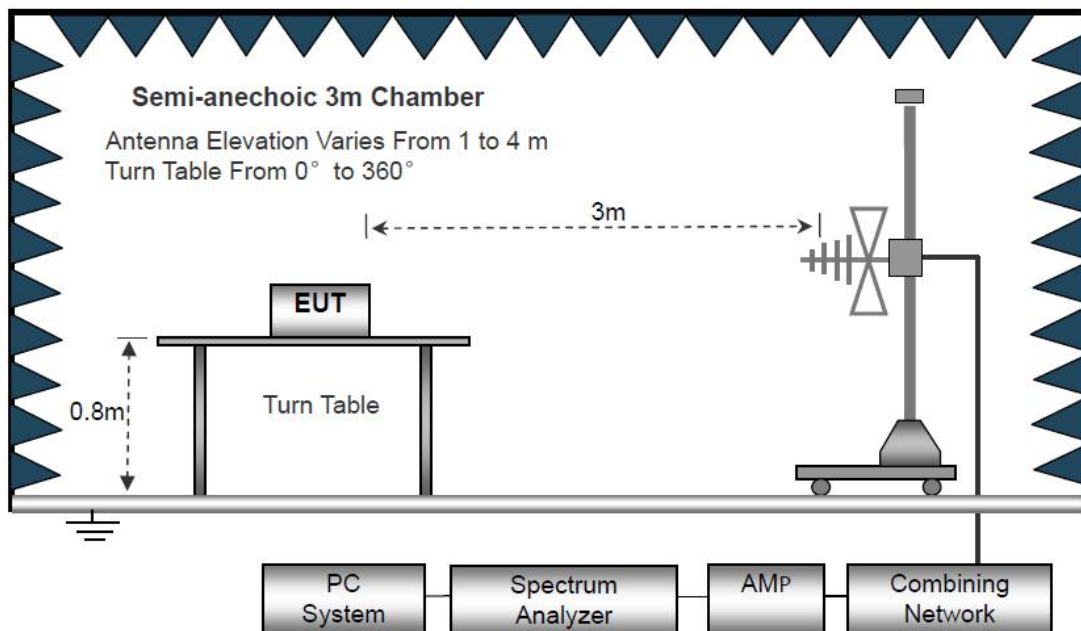
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

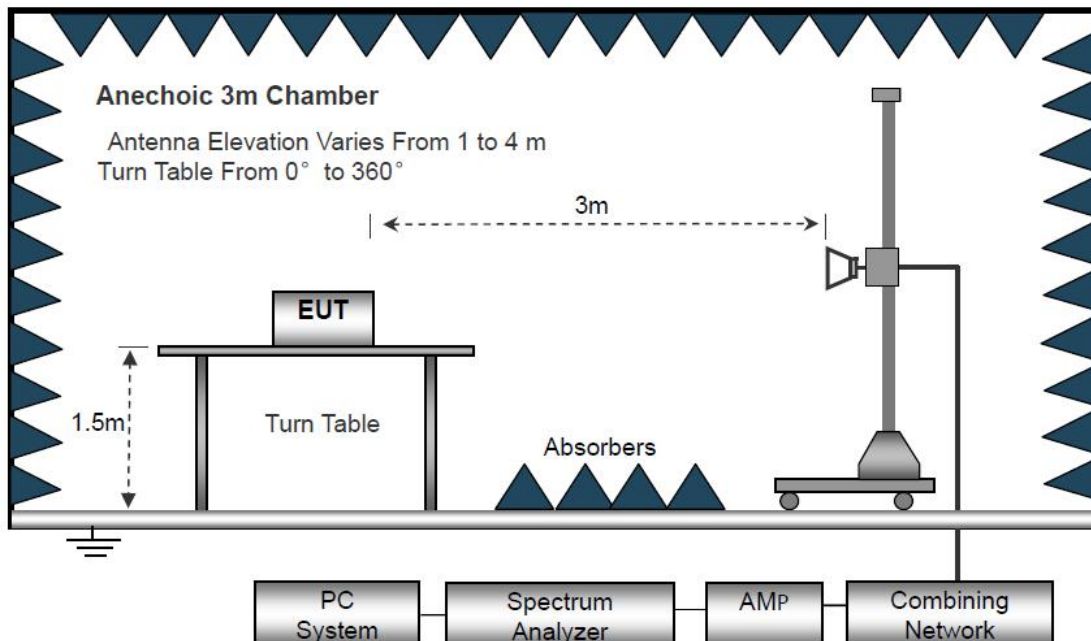
The test setup for emission measurement below 30MHz



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz



7.3 Spectrum Analyzer Setup

Below 30MHz

IF Bandwidth	10kHz
Resolution Bandwidth	10kHz
Video Bandwidth	10kHz

30MHz ~ 1GHz

Detector	: PK
Resolution Bandwidth	: 100kHz
Video Bandwidth	: 300kHz
Detector	: QP
Resolution Bandwidth	: 120kHz
Video Bandwidth	: 300kHz

Above 1GHz

Detector	: PK
Resolution Bandwidth	: 1MHz
Video Bandwidth	: 3MHz
Detector	: AV
Resolution Bandwidth	: 1MHz
Video Bandwidth	: 10Hz



7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m or 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.
8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room



7.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

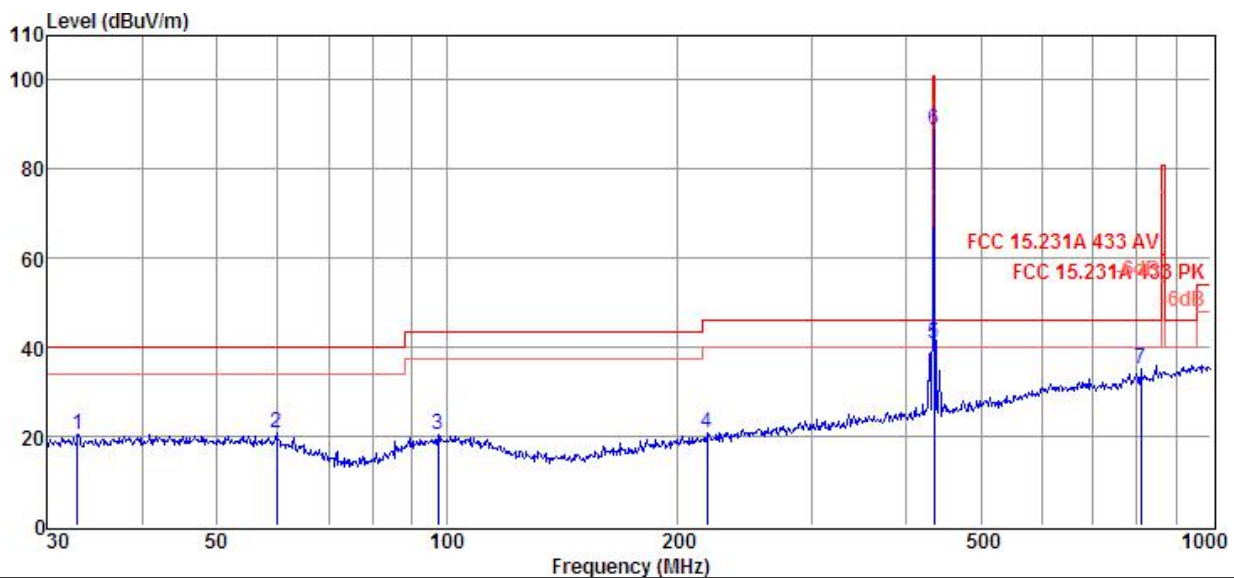
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor = $40\log(\text{Specific distance}/\text{test distance})$ (dB);

Limit line = Specific limits (dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

All applicable test modes have been tested with TX mode(433.92MHz)



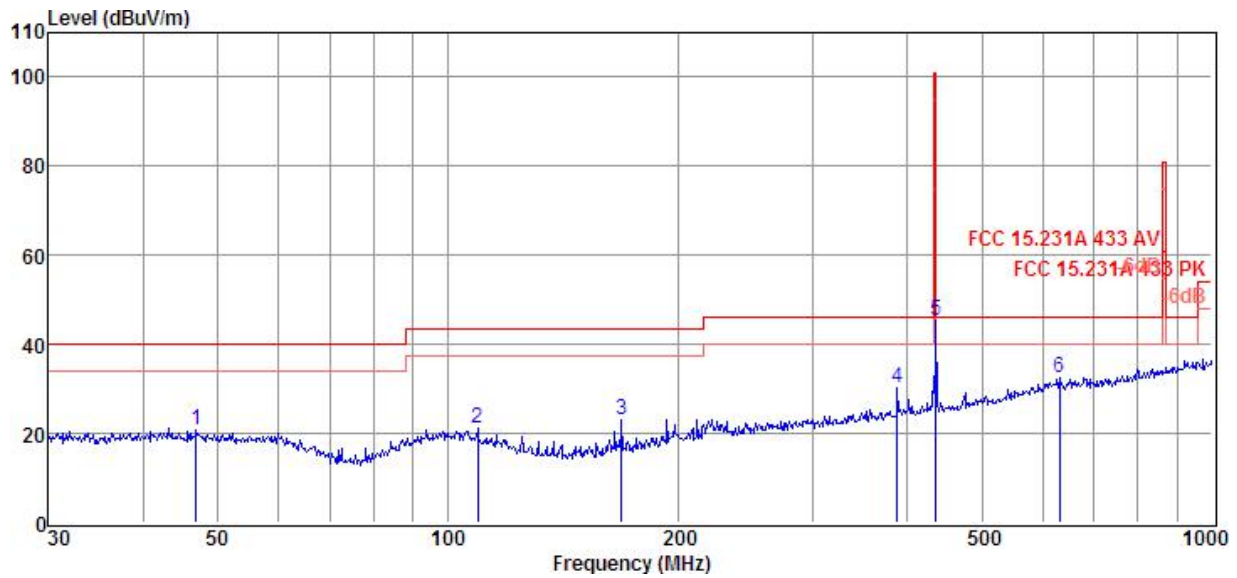
Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	32.86	5.24	11.49	3.71	20.44	40.00	-19.56	Peak	HORIZONTAL
2	59.86	5.17	11.70	3.98	20.85	40.00	-19.15	Peak	HORIZONTAL
3	97.46	4.17	11.80	4.28	20.25	43.50	-23.25	Peak	HORIZONTAL
4	219.08	4.71	11.25	4.99	20.95	46.00	-25.05	Peak	HORIZONTAL
5	433.92	/	/	/	76.26	80.83	-3.63	Average	HORIZONTAL
6	433.92	63.68	16.32	5.93	85.93	100.83	-14.90	Peak	HORIZONTAL
7	810.27	6.68	21.21	7.15	35.04	46.00	-10.96	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

4. Note: AV of 433.92MHz=PK-duty cycle factor=85.93-9.67=76.26dBμV/m



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	46.83	4.55	12.24	3.86	20.65	40.00	-19.35	Peak	VERTICAL
2	109.41	5.61	11.07	4.35	21.03	43.50	-22.47	Peak	VERTICAL
3	169.01	10.12	8.36	4.71	23.19	43.50	-20.31	Peak	VERTICAL
4	387.99	8.87	15.44	5.75	30.06	46.00	-15.94	Peak	VERTICAL
5	433.92	22.93	16.37	5.93	45.23	100.83	-55.60	Peak	VERTICAL
6	631.69	6.35	19.38	6.61	32.34	46.00	-13.66	Peak	VERTICAL

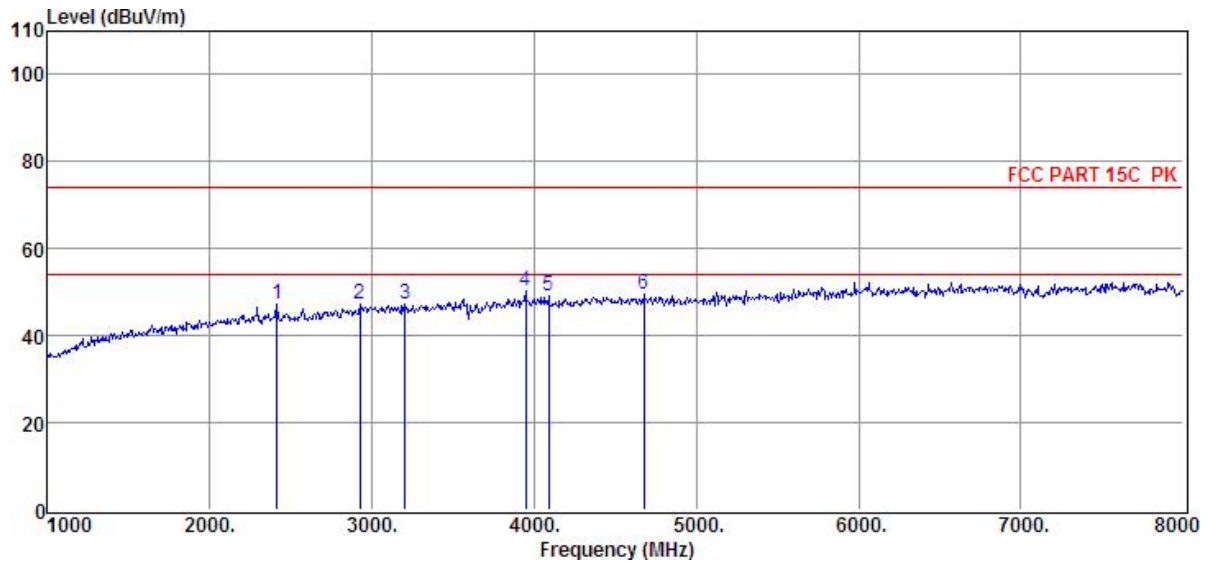
Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.



Test Frequency: Above 1GHz

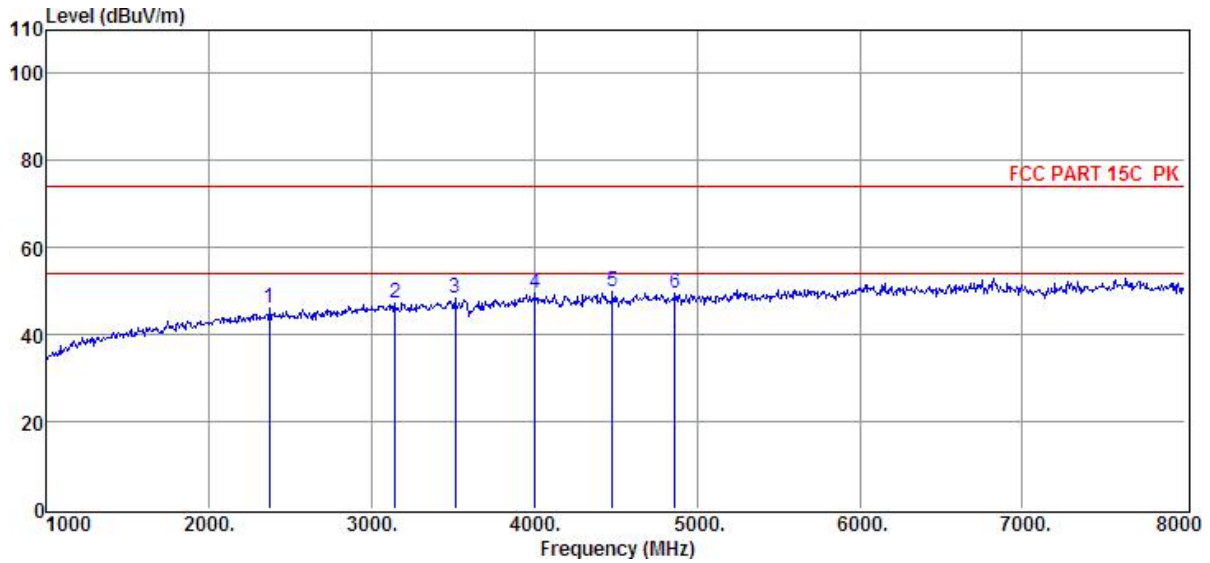


Item (Mark)	Freq. (MHz)	Read Level (dBUV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBUV/m)	Limit Line (dBUV/m)	Over Limit (dB)	Detector	Polarization
1	2414.00	40.87	29.87	29.48	6.03	47.29	74.00	-26.71	Peak	VERTICAL
2	2925.00	39.08	31.49	30.17	6.68	47.08	74.00	-26.92	Peak	VERTICAL
3	3205.00	38.68	31.79	30.04	6.98	47.41	74.00	-26.59	Peak	VERTICAL
4	3947.00	38.38	33.25	29.07	7.58	50.14	74.00	-23.86	Peak	VERTICAL
5	4087.00	37.14	33.47	29.06	7.69	49.24	74.00	-24.76	Peak	VERTICAL
6	4675.00	36.80	33.76	29.28	8.33	49.61	74.00	-24.39	Peak	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.



Item (Mark)	Freq. (MHz)	Read Level (dBUV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBUV/m)	Limit Line (dBUV/m)	Over Limit (dB)	Detector	Polarization
1	2372.00	39.67	29.71	29.37	6.01	46.02	74.00	-27.98	Peak	HORIZONTAL
2	3142.00	38.84	31.76	30.10	6.94	47.44	74.00	-26.56	Peak	HORIZONTAL
3	3513.00	38.49	31.94	29.51	7.30	48.22	74.00	-25.78	Peak	HORIZONTAL
4	4003.00	37.54	33.40	29.04	7.61	49.51	74.00	-24.49	Peak	HORIZONTAL
5	4479.00	37.21	33.78	29.20	8.12	49.91	74.00	-24.09	Peak	HORIZONTAL
6	4864.00	36.62	33.73	29.33	8.56	49.58	74.00	-24.42	Peak	HORIZONTAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.



8 20dB Bandwidth Measurement

Test Requirement	: FCC Part15.231(c)
Test Method	: FCC Part15.231(c)
Test Mode	: continuously Transmitting
Limit	: The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

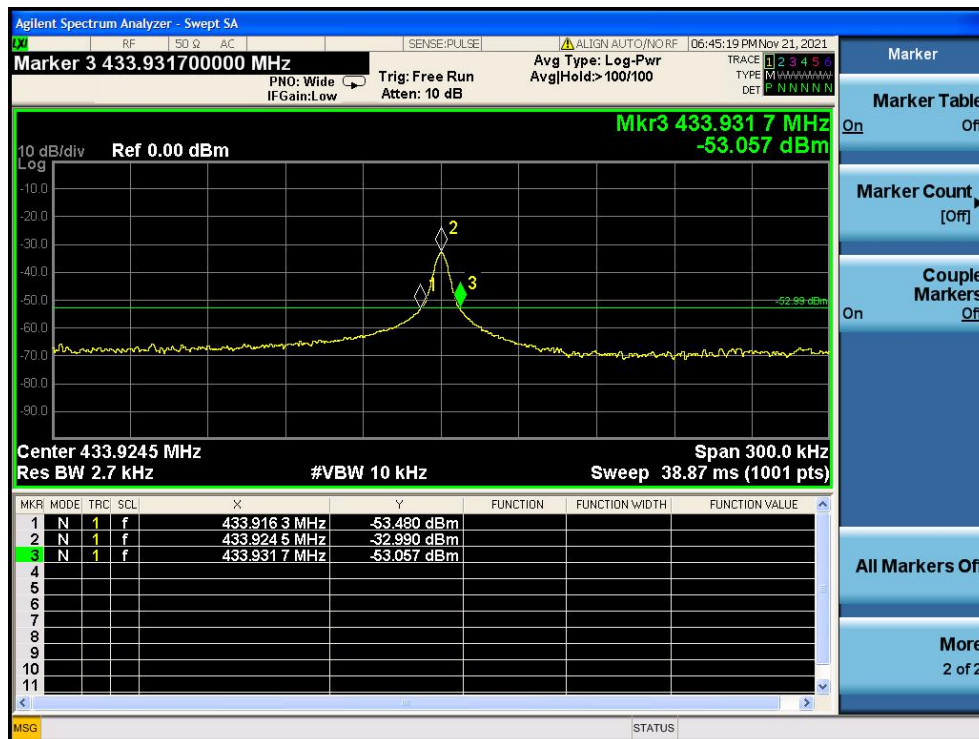
8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 2.7 kHz, VBW = 10kHz,

8.2 Test Result

Test Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Result
433.92	15.4	1084.80	pass

Test plots





9 Antenna Requirement

According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an PCB ANTENNA which meet the requirement of this section.

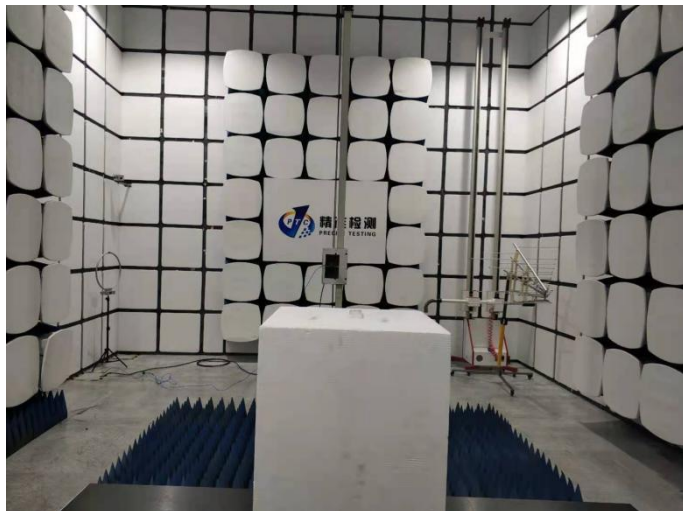


10 Test Setup

Radiated Spurious Emissions
From 30MHz-1000MHz



Above 1GHz



11 EUT Photos

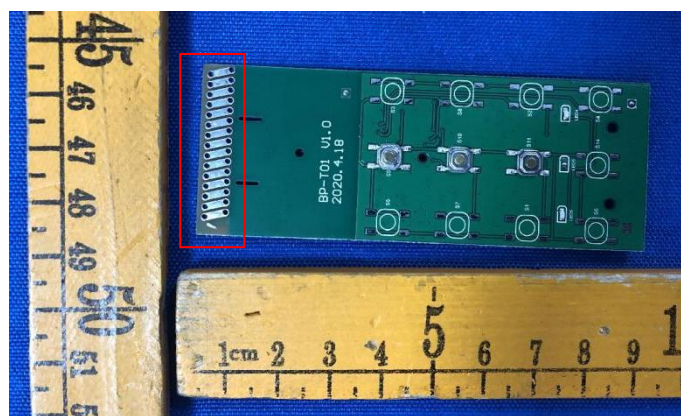
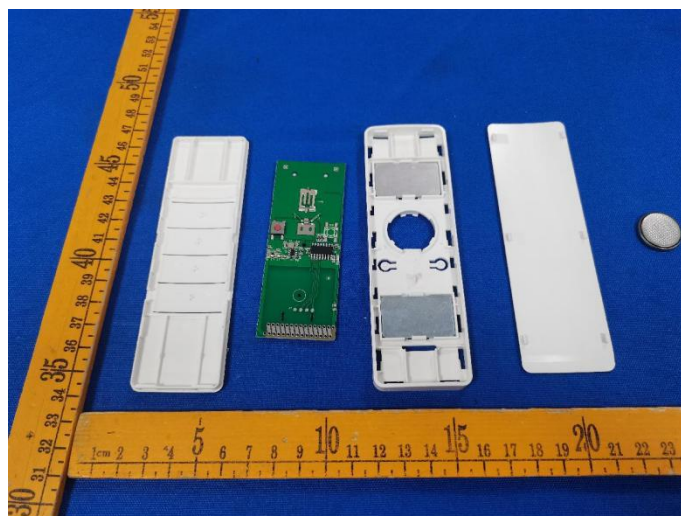




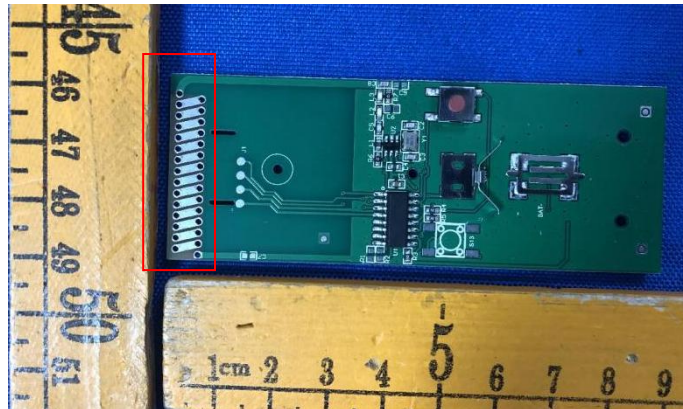
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Antenna



antenna

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