FCC TEST REPORT

FCC ID: 2AOPF-433

Product	:	RF Remote Control used for Christmas trees, wreaths or garlands
Model Name	:	433
Brand	:	N/A
Report No.	:	PTC19030703601E-FC01

Prepared for

Terry Electronics Technology Company Limited

2/F, Building D, Dingfeng Technology Park, Changcheng Road, Shuitian Community, Shiyan,Baoan Shenzhen, China

Prepared by

Dongguan Precise Testing & Certification Corp., Ltd.

Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China

1 TEST RESULT CERTIFICATION

Applicant's name	:	Terry Electronics Technology Company Limited
Address	:	2/F, Building D, Dingfeng Technology Park, Changcheng Road, Shuitian Community, Shiyan,Baoan Shenzhen, China
Manufacture's name	:	SHENZHEN XINDAJING ELECTRONICS CO., LTD
Address	:	2F, Xingyongfeng industrial park, NO.49 Yangtaishan road, Liguang community, Shiyan street, Baoan District, Shenzhen
Product name	:	RF Remote Control used for Christmas trees, wreaths or garlands
Model name	:	433
Standards	:	FCC CFR47 Part 15 Section 15.231
Test procedure	:	ANSI C63.10:2013
Test Date	:	March 04, 2019 to March 11, 2019
Date of Issue	:	March 11, 2019
Test Result	:	Pass

This device described above has been tested by PTC, 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:

Leo Yang

Leo Yang / Engineer

Technical Manager:

Chris Du / Manager

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2 Test Summary

Test Items	Test Requirement	Result
Conducted Emission	15.207	N/A
Radiated Spurious Emissions	15.209	PASS
Restricted Bands of Operation	15.205(a)	PASS
Field Strength of Fundamental and Harmonics	15.231(b)	PASS
Occupied Bandwidth	15.231(c)	PASS
Transmission Time	15.231(a)(1)	PASS
Duty Cycle	15.231	PASS
Antenna Requirement	15.203	PASS
Remark: N/A: Not Applicable		

Note:

1. Note: The EUT only powered by battery, no need to evaluate AC Power Conducted Emission.

2. The EUT is powered by new batteries during the test.

3 General Information

3.1 General Description of E.U.T.

Product Name	:	RF Remote Control used for Christmas trees, wreaths or garlands
Model Name	:	433
Operation Frequency	:	433.92MHz
Number of Channel	:	1
Type of Modulation	:	FSK
Antenna installation	:	Internal PCB Antenna
Antenna Gain	:	0 dBi
Power supply	:	DC 3V Battery
Hardware Version	:	V1.0
Software Version	:	V1.0

3.2 Test Methodology

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

3.3 Test Site

Dongguan Precise Testing & Certification Corp., Ltd.

Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

4 Equipment During Test

4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
MXG Signal Analyzer	Agilent	N9020A	MY56070279	10Hz-30GHz	Sep. 19, 2019
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Sep. 19, 2019

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions(Test Frequency from 9KHz-18GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 19, 2019
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Sep. 19, 2019
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Sep. 19, 2019
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Sep. 19, 2019
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Sep. 19, 2019
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Sep. 19, 2019
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Sep. 19, 2019
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	Sep. 19, 2019
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Sep. 19, 2019

Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 19, 2019
Artificial Mains Network	Rohde&Schwarz	L2-16B	000WX31025	9KHz-300MHz	Sep. 19, 2019
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Sep. 19, 2019

4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
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.
N/A	N/A	N/A

5 Conducted Emission

Test Requirement:	:	FCC CFR 47 Part 15 Section 15.207
Test Method:	:	ANSI C63.10: 2013
Test Result:	:	PASS
Frequency Range:	:	150kHz to 30MHz
Class/Severity:	:	Class B

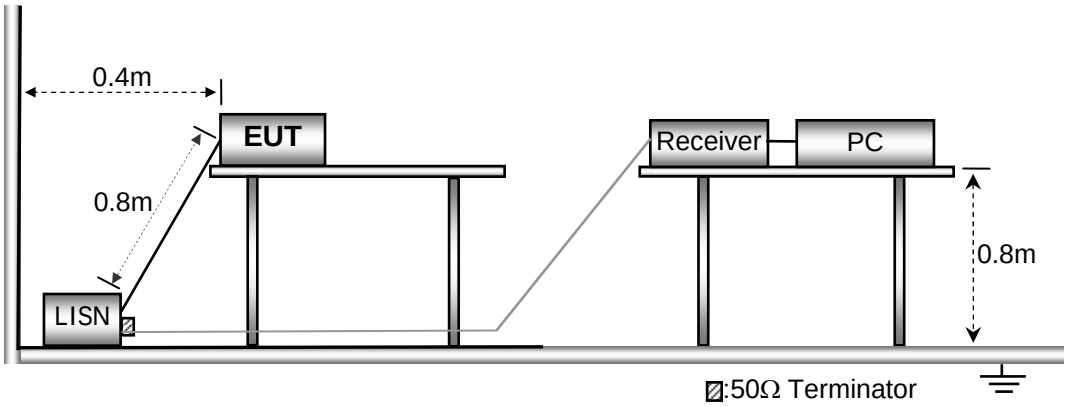
5.1 E.U.T. Operation

Operating Environment **:**

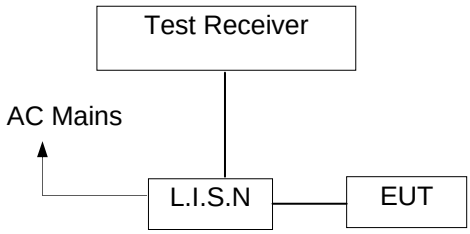
Temperature:	:	25.5 °C
Humidity:	:	51 % RH
Atmospheric Pressure:	:	101.2kPa

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 and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

N/A.

The EUT is only powered by battery, it no need to Conducted Emission Test.

6 Radiated Spurious Emissions

Test Requirement:	:	FCC CFR47 Part 15 Section 15.209
Test Method:	:	ANSI C63.10:2013
Test Result:	:	PASS
Measurement Distance:	:	3m
Limit:	:	See the follow table

FCC 15.205 Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

FCC 15.209 Limit:

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
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

FCC 15.231 Limit:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

The field intensity in micro-volts per meter can then be determined by the following equation: FI(V/ m) = 10FI (dBV/ m) / 20 The FCC specified emission limits were calculated according the EUT operating frequency and obtained by following linear interpolation equations:

(a) For fundamental frequency:

fEUT : EUT Operating Frequency Emission Limit (V/m)

$$= [fEUT(MHz) - 260(MHz)] \times \frac{12500(V/m) - 3750(V/m)}{470(MHz) - 260(MHz)} + 3750(V/m)$$

(b) For spurious frequencies:

fEUT : EUT Operating Frequency Emission Limit (V/m)

$$= [fEUT(MHz) - 260(MHz)] \times \frac{1250(V/m) - 375(V/m)}{470(MHz) - 260(MHz)} + 375(V/m)$$

Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 1 5.209(a) limit in the table below has to be followed.

Note:

(1) The tighter limit applies at the band edges.

(2) Emission level (dBuV/m)=20log Emission level (uV/m).

FCC Part15 (15.231) , Subpart C		
Fundamental Frequency	Field Strength Of Fundamental	Field Strength of Spurious Emissions
433.92MHz	AV:80.82 dBuV/m at 3m distance	AV:60.82 dBuV/m at 3m distance
	PK:100.82dBuV/m at 3m distance	PK:80.82 dBuV/m at 3m distance

6.1 EUT Operation

Operating Environment :

Temperature: : 23.5 °C

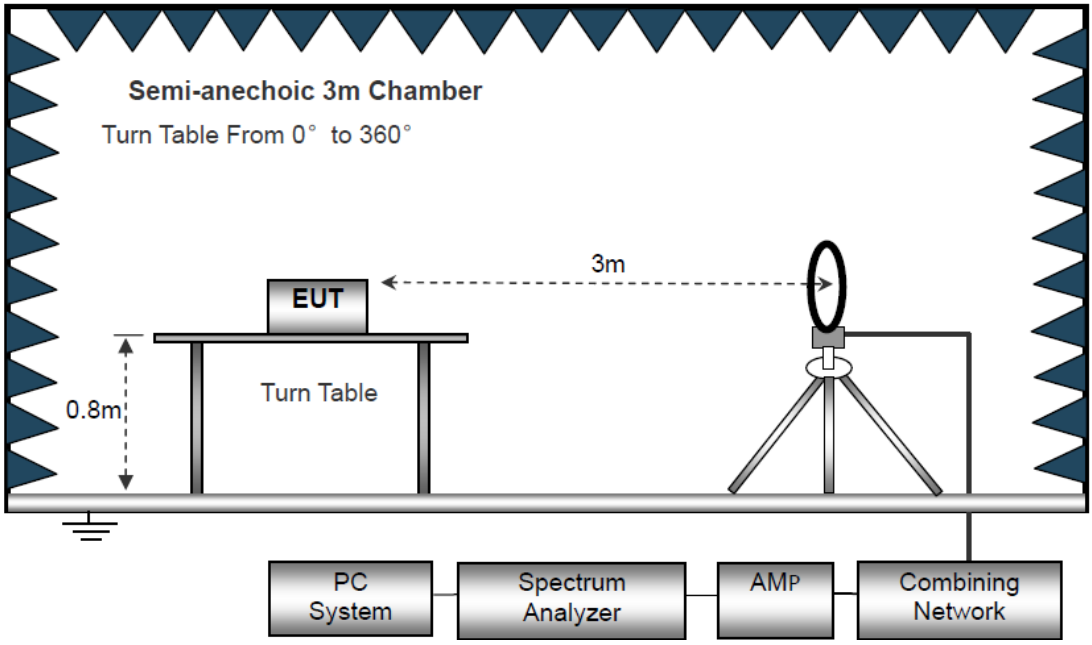
Humidity: : 51.1 % RH

Atmospheric Pressure: : 101.2kPa

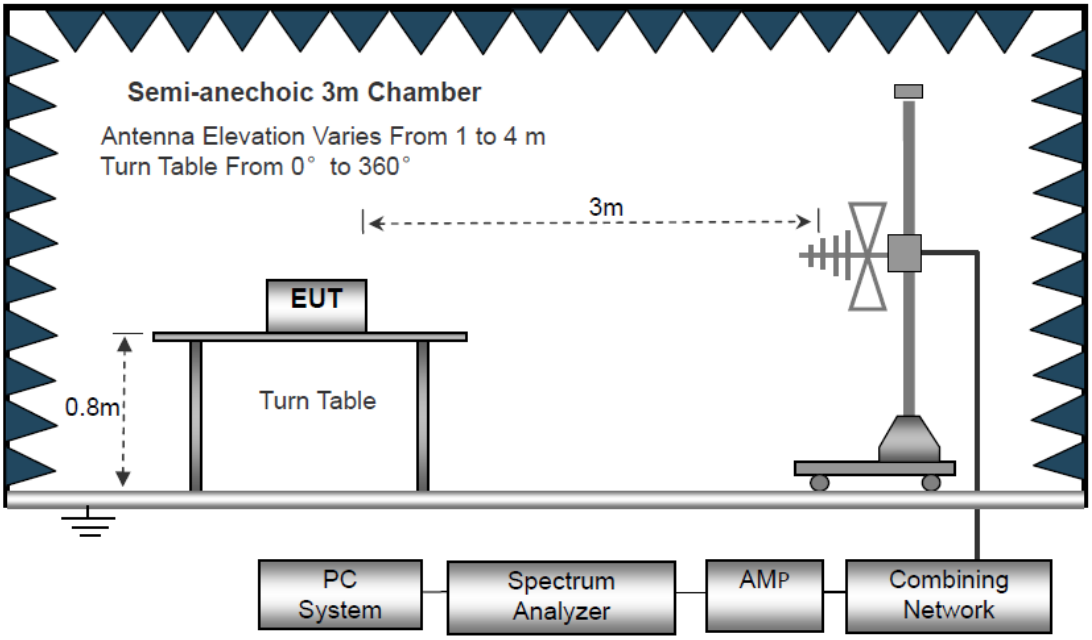
6.2 Test Setup

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

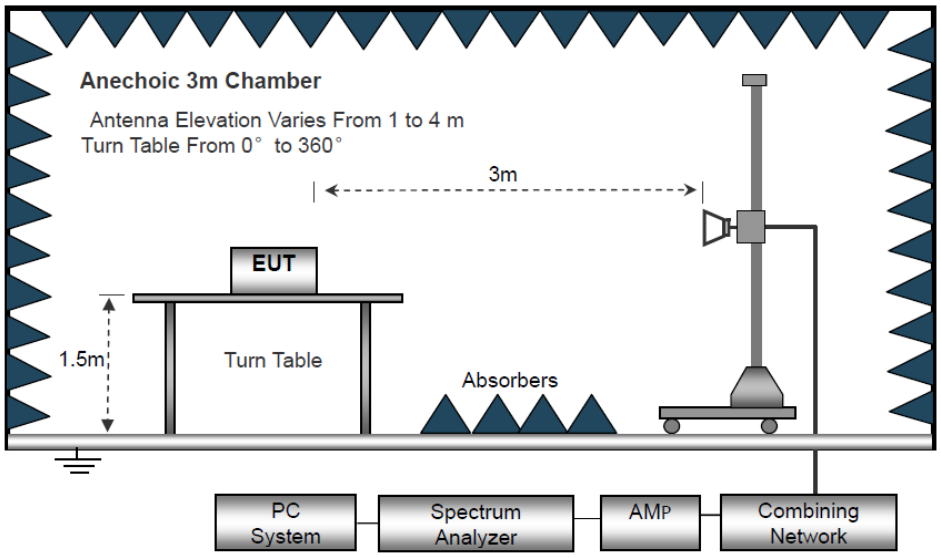
The test setup for emission measurement below 30MHz



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



The test setup for emission measurement above 1 GHz



6.3 Spectrum Analyzer Setup

Below 30MHz			
IF Bandwidth	:	10kHz	
Resolution Bandwidth	:	10kHz	
Video Bandwidth	:	10kHz	
30MHz ~ 1GHz			
Detector	:	PK	QP
Resolution Bandwidth	:	100kHz	120kHz
Video Bandwidth	:	300kHz	300kHz
Above 1GHz			
Detector	:	PK	AV
Resolution Bandwidth	:	1MHz	1MHz
Video Bandwidth	:	3MHz	10Hz

6.4 Test Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane, And above 1000MHz, The EUT was placed on a styrofoam table which is 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

6.5 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:

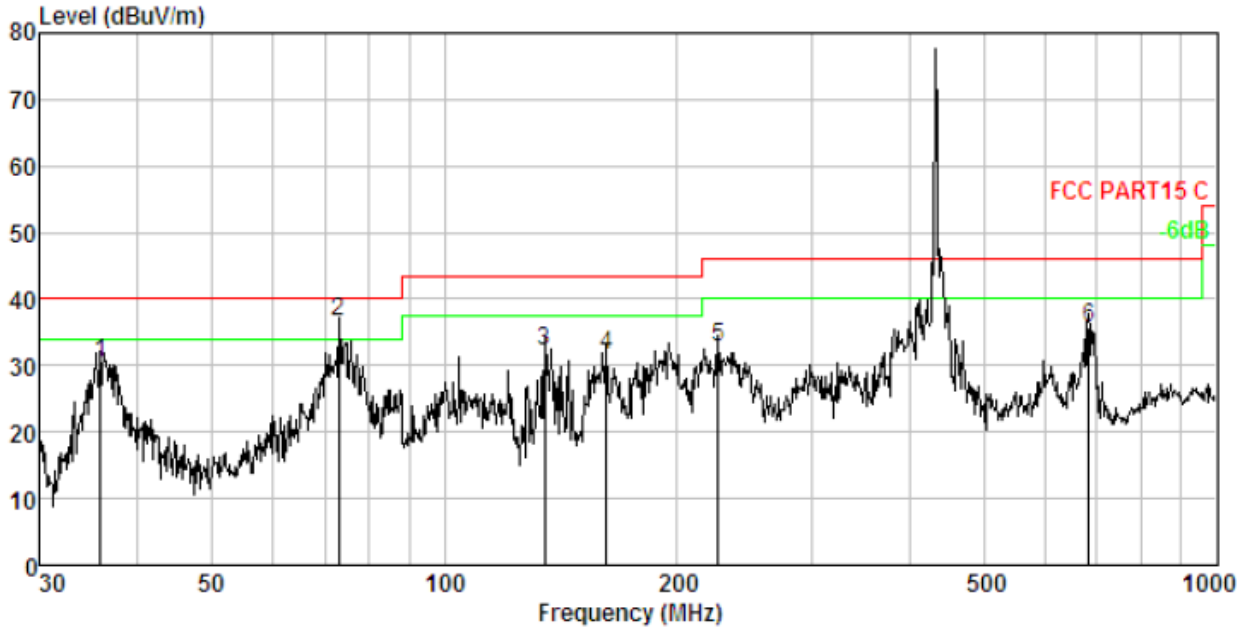
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots:

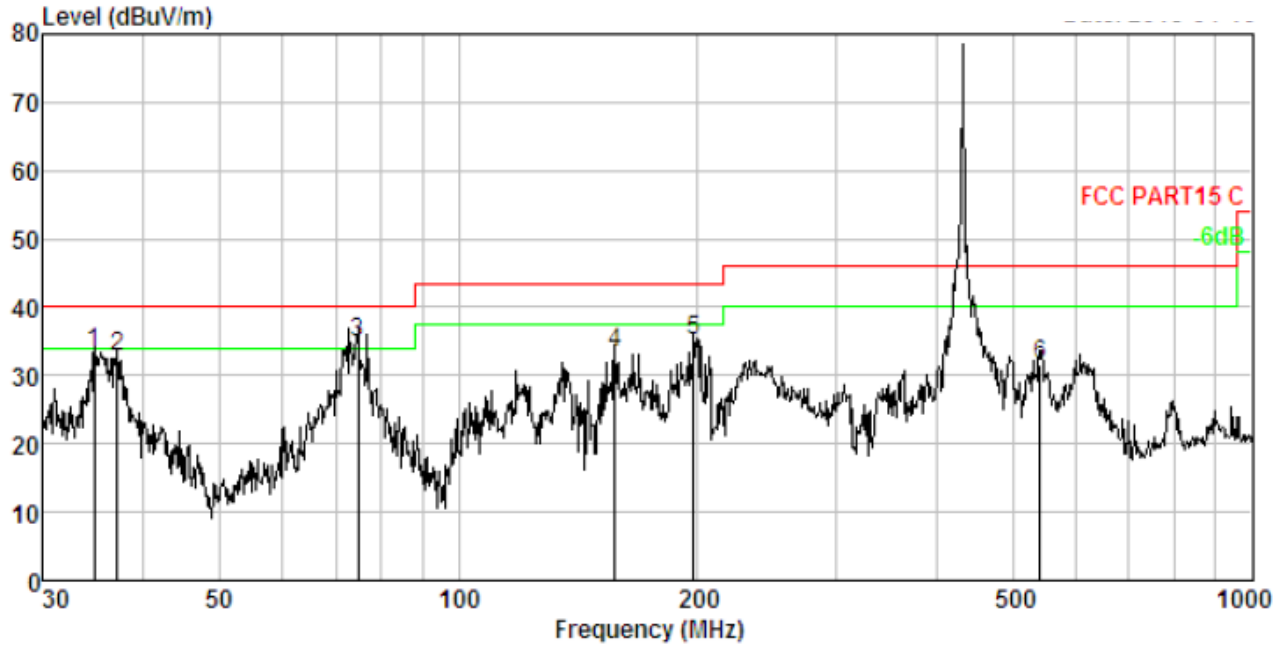
Antenna Polarization: Horizontal



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	35.875	1.22	13.44	45.69	30.03	30.32	40.00	-9.68	QP
2.	73.103	1.86	9.91	54.98	30.28	36.47	40.00	-3.53	QP
3.	135.032	2.42	13.00	47.19	30.49	32.12	43.50	-11.38	QP
4.	162.041	2.58	13.76	45.70	30.56	31.48	43.50	-12.02	QP
5.	226.099	2.88	11.06	49.41	30.67	32.68	46.00	-13.32	QP
6.	682.348	3.88	19.92	42.92	31.06	35.66	46.00	-10.34	QP

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Antenna Polarization: Vertical



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	34.760	1.19	13.38	48.74	30.02	33.29	40.00	-6.71	QP
2.	37.155	1.25	13.50	48.03	30.04	32.74	40.00	-7.26	QP
3.	74.657	1.88	9.88	53.48	30.29	34.95	40.00	-5.05	QP
4.	157.559	2.56	13.88	47.56	30.55	33.45	43.50	-10.05	QP
5.	197.893	2.76	10.53	52.42	30.63	35.08	43.50	-8.42	QP
6.	541.373	3.67	17.71	41.14	30.98	31.54	46.00	-14.46	QP

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Fundamental and Harmonics Average Result

Frequency	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin
(MHz)	H/V	PK	AV	PK	AV	(dB)
433.92	H	76.24	68.41	100.82	80.82	-24.58
433.92	V	78.35	70.52	100.82	80.82	-22.47
867.84	H	56.32	48.49	80.82	60.82	-24.5
867.84	V	58.32	50.49	80.82	60.82	-22.5

Test Frequency: From 1GHz to 5GHz

Freq.	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
1301.76	V	54.15	46.32	80.82	60.82	-26.67	-14.5
1735.68	V	50.29	42.46	80.82	60.82	-30.53	-18.36
2169.60	V	48.32	40.49	80.82	60.82	-32.5	-20.33
2603.52	V	44.62	36.79	80.82	60.82	-36.2	-24.03
1301.76	H	54.18	46.35	80.82	60.82	-26.64	-14.47
1735.68	H	51.96	44.13	80.82	60.82	-28.86	-16.69
2169.60	H	48.26	40.43	80.82	60.82	-32.56	-20.39
2603.52	H	47.04	39.21	80.82	60.82	-33.78	-21.61

Note:

1. All other emissions more than 30dB below the limit.
2. Average=Peak Value+20log(Duty Cycle)
   Margin=Emission Level-Limit
3. X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

7 OCCUPIED BANDWIDTH

7.1 Applicable Standard

According to FCC Part 2.1049 and part 15.231(c)

7.2 Conformance 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

7.3 Test Procedure

The EUT was operating in transmit mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously
Set RBW = 1% occupied bandwidth (10KHz).
Set the video bandwidth (VBW) =30KHz.
Set Span= approximately 2 to 3 times the occupied bandwidth
Set Detector = Peak.
Set Trace mode = max hold.
Set Sweep = auto couple.

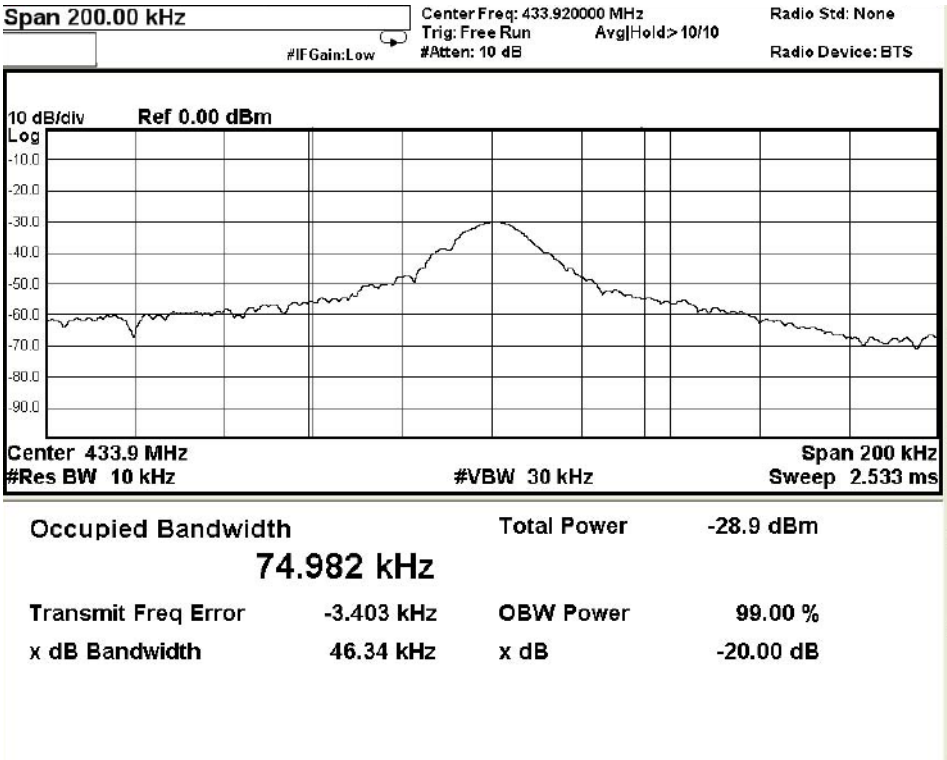
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 99% down one side of the emission. Reset the markerdelta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 99% bandwidth of the emission.

If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

Measure and record the results in the test report.

7.4 Test Result

Modulation	Channel Frequency(MHz)	Measurement Bandwidth(KHz)	99%Bandwidth (KHz)	Limit(KHz)	Verdict
ASK	433.92	46.34	74.982	≤1084.8	PASS
Note: BW=0.25% of the center frequency.					



8 TRANSMISSION REQUIREMENT

8.1 Applicable Standard

According to FCC Part 15.231.

8.2 Conformance Limit

According to FCC 15.231a, A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

8.3 Test Procedure

The following table is the setting of spectrum analyzer.

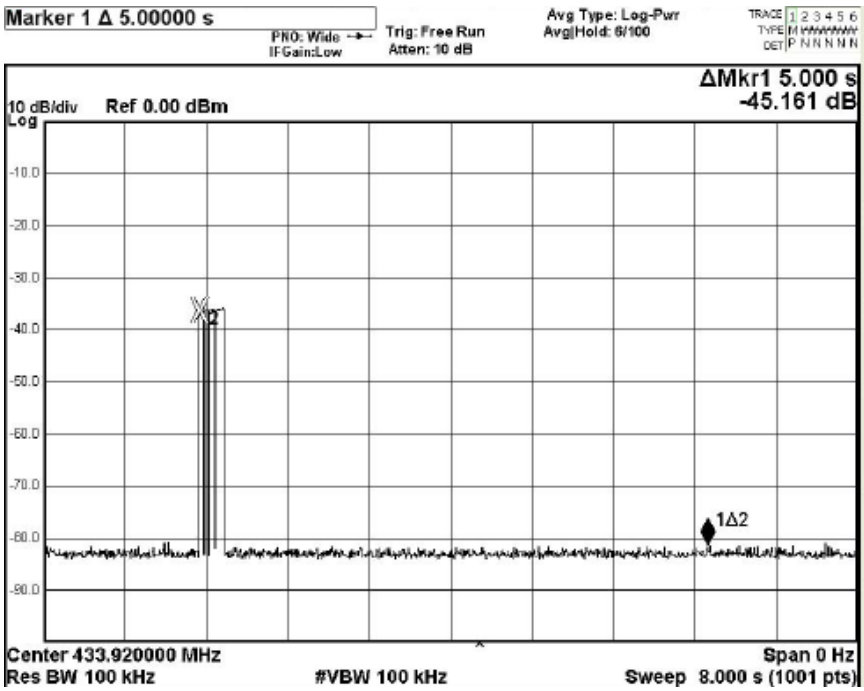
Spectrum analyzer	Setting
Attenuation	Auto
Span Frequency	0Hz
RBW	1M
VBW	1M
Detector	Peak
Trace	Max hold
Sweep Time	10S

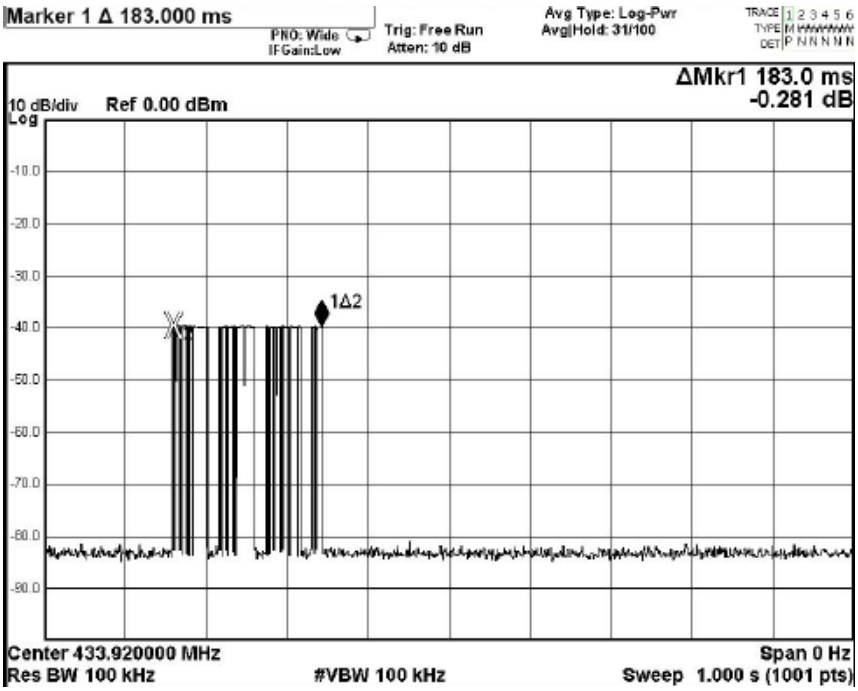
a. The transmitter output (antenna port) was connected to the spectrum analyzer.

b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz, Set Detector to Peak, Trace to Max Hold. c. Set the span to 0Hz and the sweep time to 10s and record the value.

8.4 Test Result

Frequency(MHz)	Silent period between transmissions	Limit	Verdict
433.92	0.183s	5 seconds	PASS




Marker 1 Δ 183.000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 31/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
ΔMkr1 183.0 ms
-0.281 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
Center 433.920000 MHz
Span 0 Hz
Res BW 100 kHz
#VBW 100 kHz
Sweep 1.000 s (1001 pts)

9 DUTY CYCLE

9.1 Test Procedure

Place the EUT on the table and set it in the transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Set centre frequency of spectrum analyzer=operating frequency.
Set the spectrum analyzer as RBW=1MHz, VBW=1MHz to obtain the “worst-case” pulse on time
Repeat above procedures until all frequency measured was complete.

9.2 Test Result

The duty cycle is simply the on-time divided by the period:

Ton=1.100*33+0.240*18=40.62(ms)

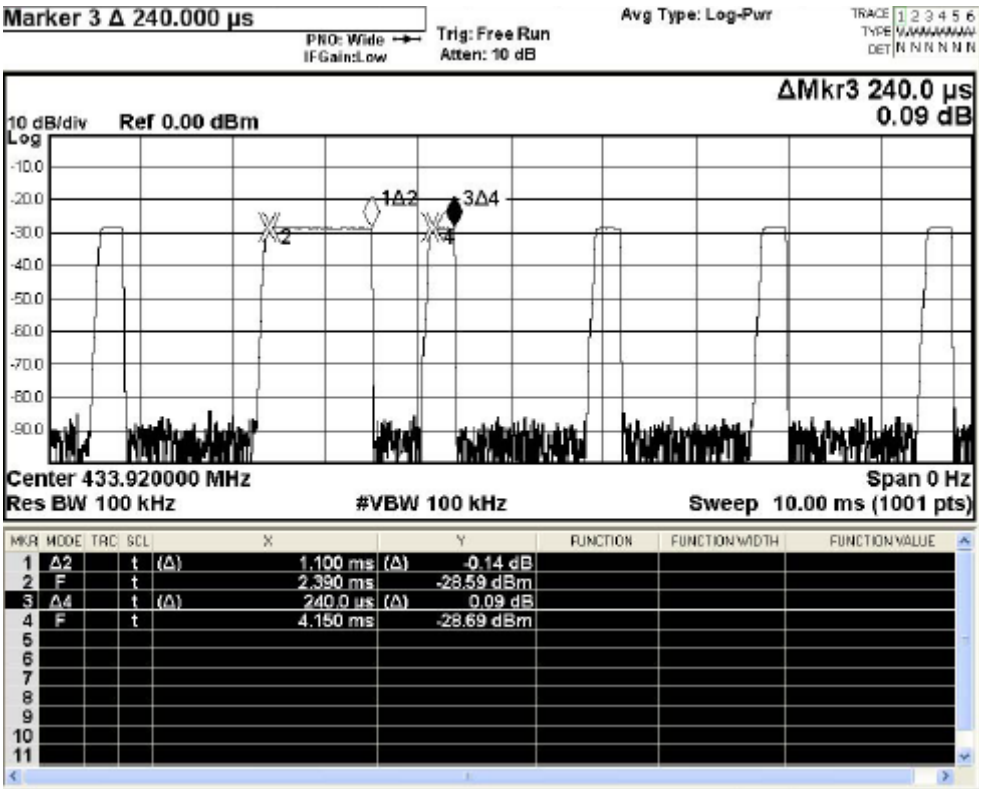
Tp=100(ms)

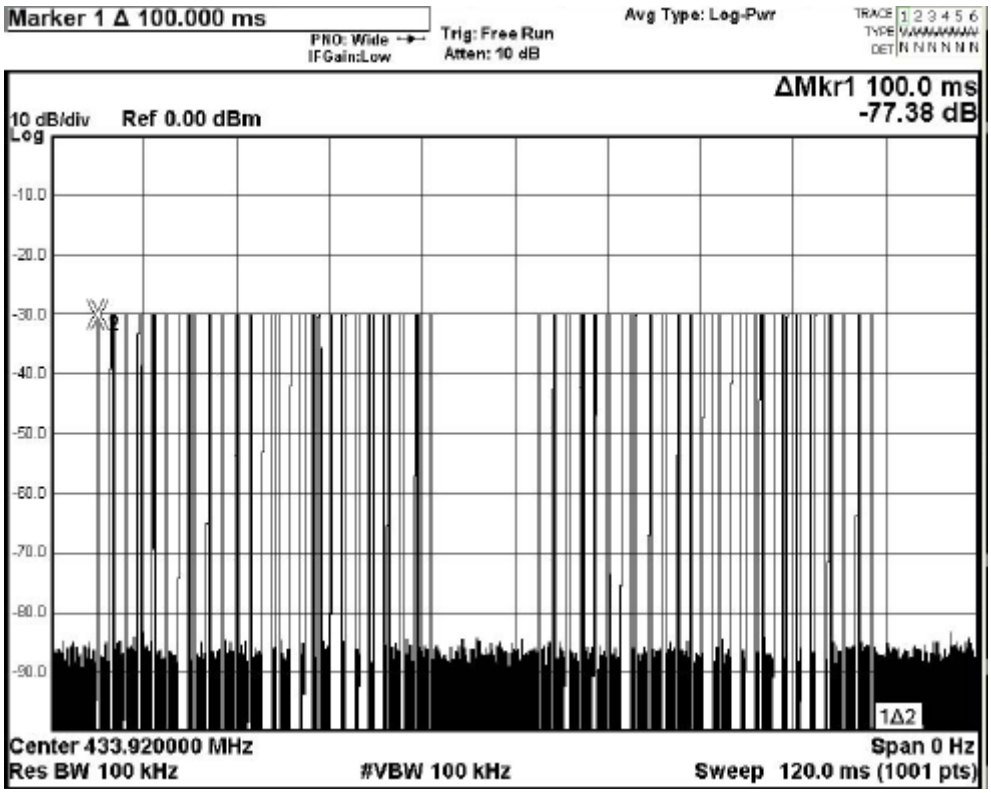
The duty cycle=40.62/100=40.62%

Average Correction Factor=20log(Ton/Tp)=20log(40.62/100)=-7.83dB

Note: The signal bandwidth was measured and less than 100KHz RBW, so PDCF is no needed.

Please see below test plots:




Marker 1 Δ 100.000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE
DET N N N N N N
ΔMkr1 100.0 ms
-77.38 dB
10 dB/div Ref 0.00 dBm
Log
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
Center 433.920000 MHz
Span 0 Hz
Res BW 100 kHz
#VBW 100 kHz
Sweep 120.0 ms (1001 pts)

10 Antenna Application

10.1 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 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. And if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

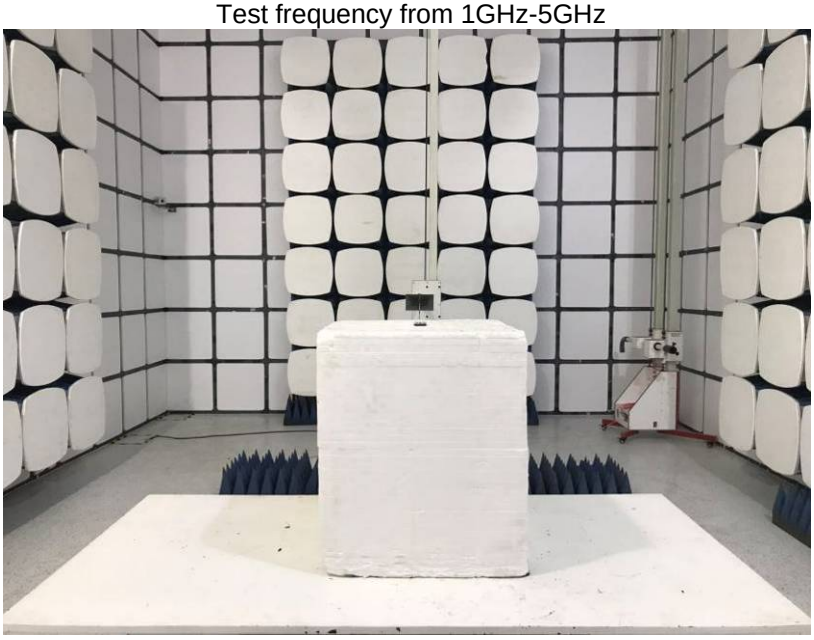
10.2 Result

The EUT'S antenna, permanent attached antenna, is internal PCB antenna. The antenna's gain is 0dBi and meets the requirement.

11 Test Setup

Radiated Spurious Emissions
From 30MHz-1000MHz

Test frequency from 1GHz-5GHz



12 EUT Photos

C18D009K_resize

U17D011E_resize

U17D400I resize

U17D400I resize

U17G013L_resize

U17G013L-1_resize

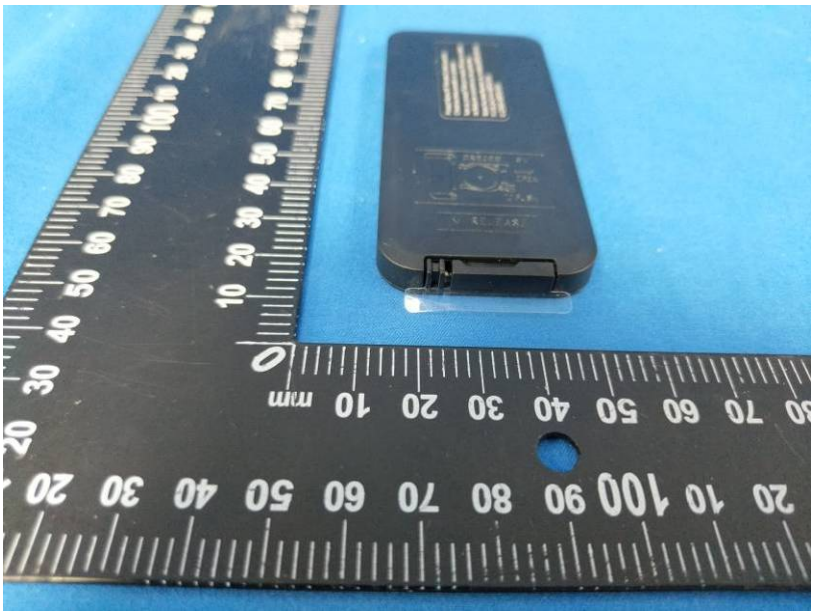
U18D009K-1_resize

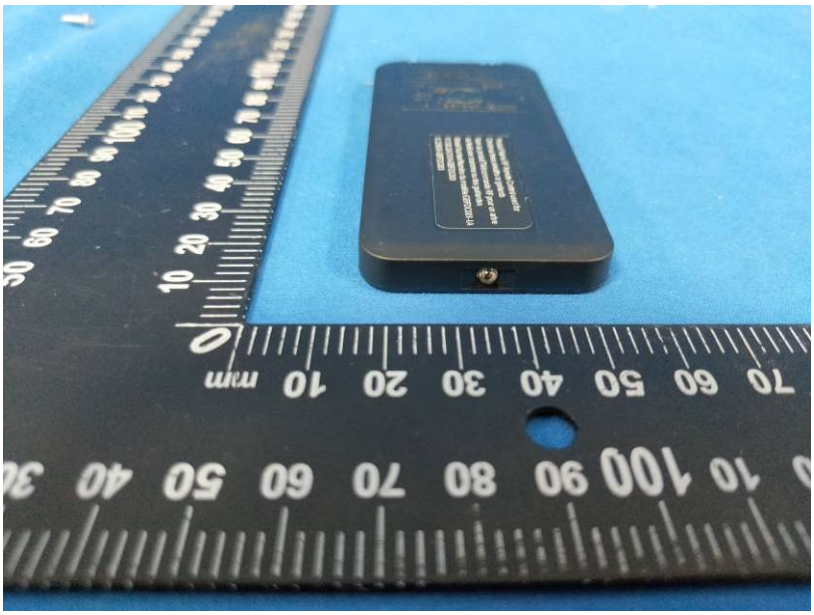
U18D713A-A_resize

U18D713A-B_resize

ON
OFF
Marche
Arrêt
FN
1
2
3
4
5
6
7
8
RF

RELEASE

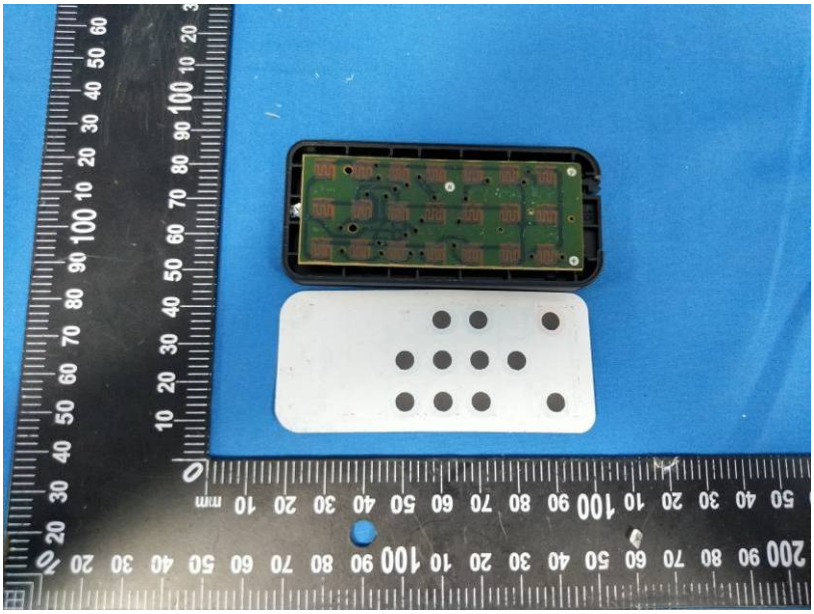


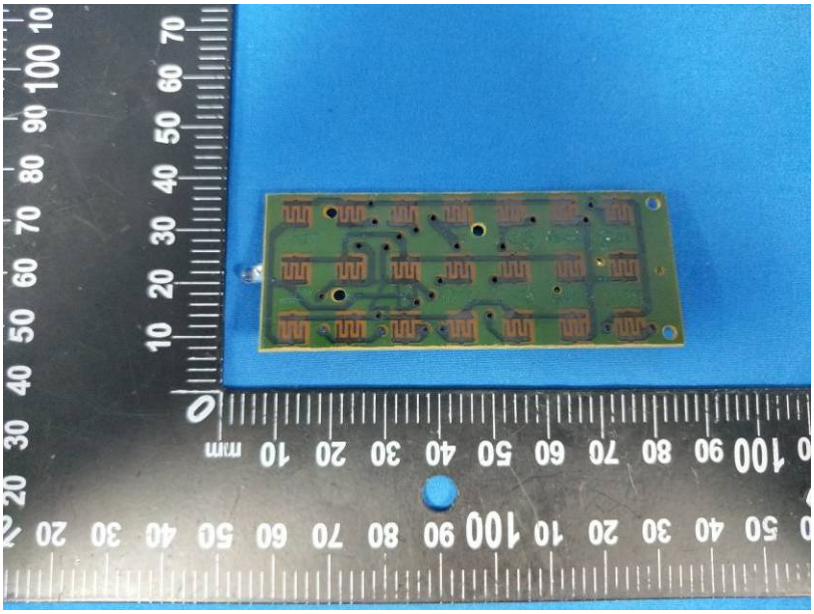


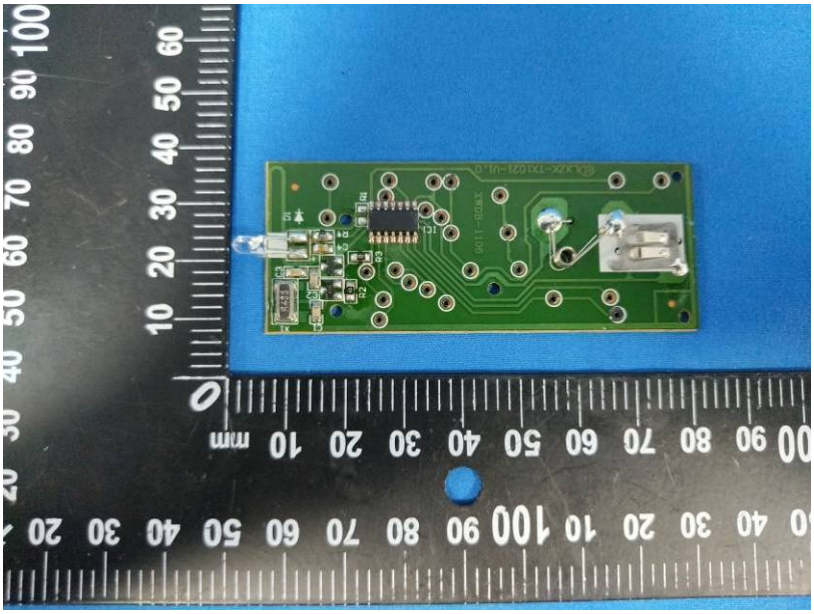
OFF
ON
TIMER
4H
8H
2H
6H
RF

RF
8H
6H
4H
2H
TIMER
OFF
ON

RF







********THE END REPORT********