TEST REPORT

Reference No.	:	WTD19S09067021W
FCC ID.....	:	CCRAL2K
Applicant	:	Sam Ash Music Corporation
Address	:	262 Duffy Avenue, Hicksville, New York 11801, United States
Manufacturer	:	Sam Ash Music Corporation
Address	:	262 Duffy Avenue, Hicksville, New York 11801, United States
Product.....	:	Wireless Microphone Transmitter
Model(s).....	:	AL2
Standards.....	:	FCC CFR47 Part 74:2019
Date of Receipt sample....	:	2019-09-25
Date of Test.....	:	2019-09-25 to 2019-10-11
Date of Issue	:	2019-10-12
Test Result	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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Compiled by: Approved by:

Robin Zhou / Test Engineer

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1 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China.Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.

Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

1.1 Test Facility

A. Accreditations for Conformity Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ SDoC	1
Canada		IC ID \ SDoC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand		NTC	-
Singapore		IDA	-

Note:

1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.
2. ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

B.TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of …	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd.	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

2 Contents

3 Revision History

Test Report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD19S09067021W	2019-09-25	2019-09-25 to 2019-10-11	2019-10-12	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	Wireless Microphone Transmitter
Model(s):	AL2
Model Description:	N/A
Operation Frequency:	477.525MHz-492.425MHz, 6channels
Antenna installation:	Internal Integral Antenna
Antenna Gain:	2.14dBi
Modulation:	FM
Rated System Deviation:	± 15KHz
Maximum System Deviation:	± 30KHz

4.2 Details of E.U.T.

Technical Data: DC 3.7V, 350mAh by battery
Charging: DC 5V 1000mA by Switching Mode Power Supply
(Model: GPE053B-V050100-Z, Input: 100-240V~50/60Hz 0.2A)

4.3 Channel Lists

Channel Lists (477.525MHz-492.425MHz)

Channel No.	Frequency （MHz）	Channel No.	Frequency （MHz）	Channel No.	Frequency （MHz）
K1	489.050	K2	490.975	K3	492.425
K4	477.525	K5	479.100	K6	480.475

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMI Test Receiver	R&S	ESCI	101155	2019-09-17	2020-09-16
2	LISN	SCHWARZBECK	NSLK 8128	8128-259	2019-09-17	2020-09-16
3	Limiter	CYBERTEK	EM5010	261115-001-0024	2019-09-17	2020-09-16
4	Cable	Laplace	RF300	-	2019-09-17	2020-09-16
3m Semi-anechoic Chamber for Radiation Emissions(SAEMC)						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	Spectrum Analyzer	R&S	FSP30	100091	2019-04-19	2020-04-18
2	Broad-band Horn Antenna(1-18GHz)	SCHWARZBECK	BBHA 9120 D	667	2019-04-19	2020-04-18
3	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-19	2020-04-18
4	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	2019-04-19	2020-04-18
3m Semi-anechoic Chamber for Radiation Emissions(TDK)						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	2019-04-20	2020-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-05-24	2020-05-23
3	Active Loop Antenna	Com-power	AL-130R	10160007	2019-04-28	2020-04-27
4	Amplifier	ANRITSU	MH648A	M43381	2019-04-19	2020-04-18
5	Cable	HUBER+SUHNER	CBL2	525178	2019-04-20	2020-04-19
6	Coaxial Cable (below 1GHz)	Top	TYPE16 (13M)	-	2019-09-12	2020-09-11
RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	Spectrum Analyzer	R&S	FSL6	100959	2018-11-18	2019-11-17
2	Coaxial Cable	Top	10Hz-30GHz	-	2019-09-12	2020-09-11

3	Antenna Connector*	Realacc	45RSm	-	2019-09-12	2020-09-11
4	DC Block	Gwave	GDCB-3G-N-SMA	140307001	2019-09-12	2020-09-11
"*": 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.						

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Confidence interval：95%. Confidence factor:k=2	

5.3 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test Lab: N/A

Lab address: N/A

Test items: N/A

6 Test Summary

Test Items	Test Requirement	Test Method	Result
Conducted Emission	15.207	ANSI C63.10:2013	PASS
RF Output Power	74.861(e)(1)(ii)	ANSI/TIA-603-E:2016 ANSI C63.26:2015	PASS
Modulation Characteristics	74.861 (e) (3)	ANSI/TIA-603-E:2016 ANSI C63.26:2015	PASS
Occupied Bandwidth	2.1049(c)(1)	ANSI/TIA-603-E:2016 ANSI C63.26:2015	PASS
Radiated Emissions	2.1053 & 74.861(e)(6)	ANSI/TIA-603-E:2016 ANSI C63.26:2015	PASS
Emission Mask and Spurious emissions at antenna terminals	2.1051	ANSI/TIA-603-E:2016 ANSI C63.26:2015	PASS
Frequencies Stability	2.1055(a)(1)	ANSI/TIA-603-E:2016 ANSI C63.26:2015	PASS
RF Exposure	1.1307(b)(1)	KDB 447498 D01	PASS
Note: Pass=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.			

7 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

Limit:

Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5.0	56	46
5.0 to 30	60	50
*Decreases with the logarithm of the frequency.		

7.1 E.U.T. Operation

Operating Environment **:**

Temperature: 22.4 °C

Humidity: 53.7 % RH

Atmospheric Pressure: 101.8kPa

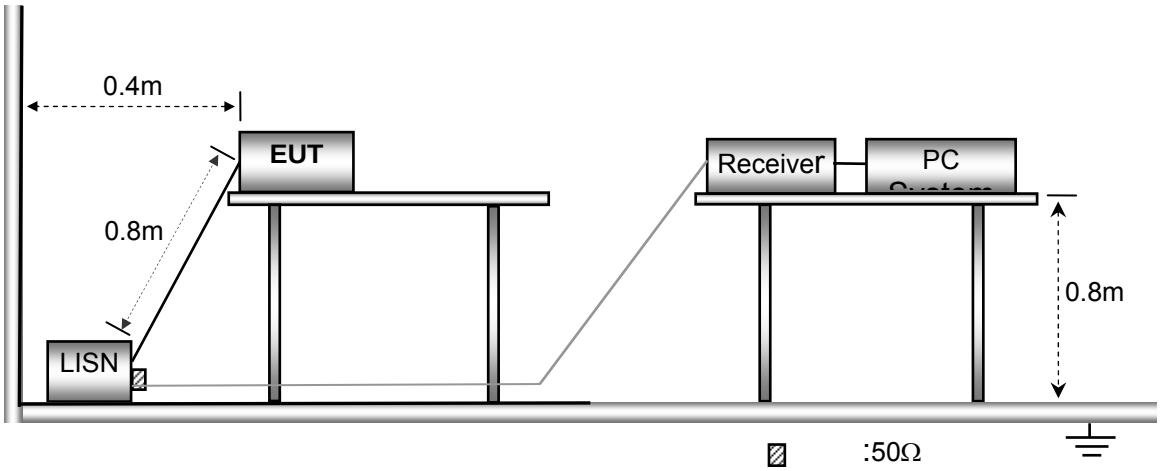
Test Voltage: AC 120V, 60Hz

EUT Operation **:**

The test was performed in Charging mode, the test data were shown in the report.

7.2 EUT Setup

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

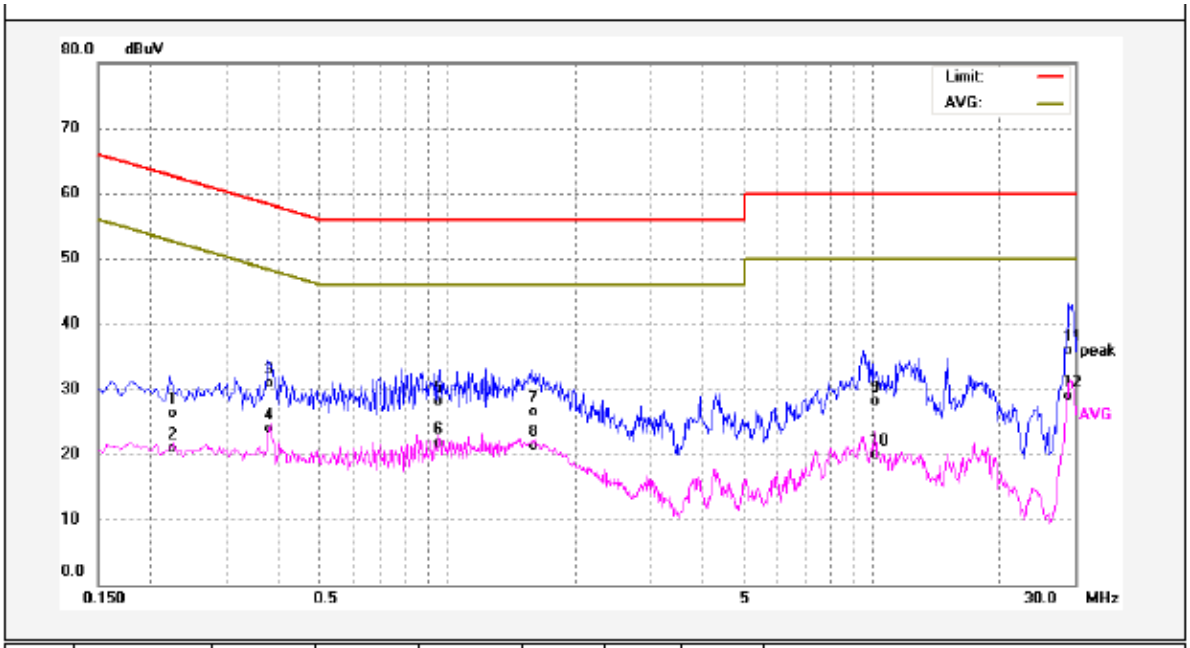


7.3 Measurement Description

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.

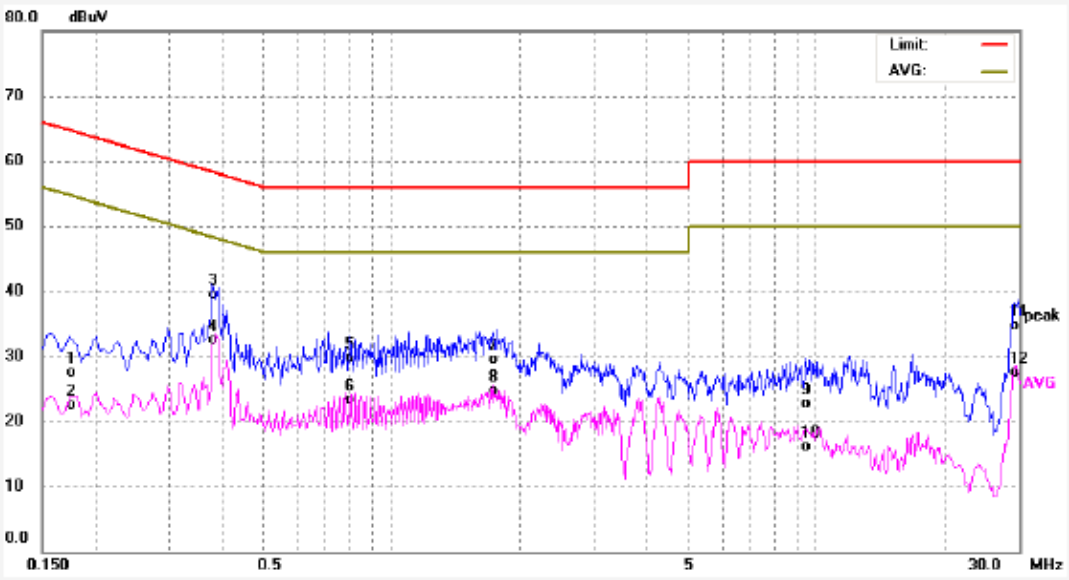
7.4 Conducted Emission Test Result

Live Line :



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2260	16.04	10.36	26.40	62.59	-36.19	QP	
2	0.2260	10.61	10.36	20.97	52.59	-31.62	AVG	
3	0.3820	20.58	10.42	31.00	58.23	-27.23	QP	
4	0.3820	13.45	10.42	23.87	48.23	-24.36	AVG	
5	0.9580	17.66	10.44	28.10	56.00	-27.90	QP	
6	0.9580	11.36	10.44	21.80	46.00	-24.20	AVG	
7	1.6100	15.97	10.50	26.47	56.00	-29.53	QP	
8	1.6100	10.77	10.50	21.27	46.00	-24.73	AVG	
9	10.1540	16.96	11.22	28.18	60.00	-31.82	QP	
10	10.1540	8.77	11.22	19.99	50.00	-30.01	AVG	
11	29.1340	25.67	10.31	35.98	60.00	-24.02	QP	
12	29.1340	18.66	10.31	28.97	50.00	-21.03	AVG	

Neutral Line :



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1740	17.31	10.29	27.60	64.76	-37.16	QP	
2	0.1740	12.15	10.29	22.44	54.76	-32.32	AVG	
3	0.3780	29.15	10.42	39.57	58.32	-18.75	QP	
4	0.3780	22.06	10.42	32.48	48.32	-15.84	AVG	
5	0.7980	19.18	10.44	29.62	56.00	-26.38	QP	
6	0.7980	12.96	10.44	23.40	46.00	-22.60	AVG	
7	1.7620	18.99	10.52	29.51	56.00	-26.49	QP	
8	1.7620	14.25	10.52	24.77	46.00	-21.23	AVG	
9	9.4700	11.46	11.19	22.65	60.00	-37.35	QP	
10	9.4700	4.88	11.19	16.07	50.00	-33.93	AVG	
11	29.9060	24.46	10.27	34.73	60.00	-25.27	QP	
12	29.9060	17.24	10.27	27.51	50.00	-22.49	AVG	

8 RF Output Power

Test requirement: FCC CFR47 Part 74 Section 74.861(e)(1)(ii)

Test method: Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015

Limit: According to Part 74.861(e)(1)(ii), the output power shall not exceed 250mW (23.98 dBm).

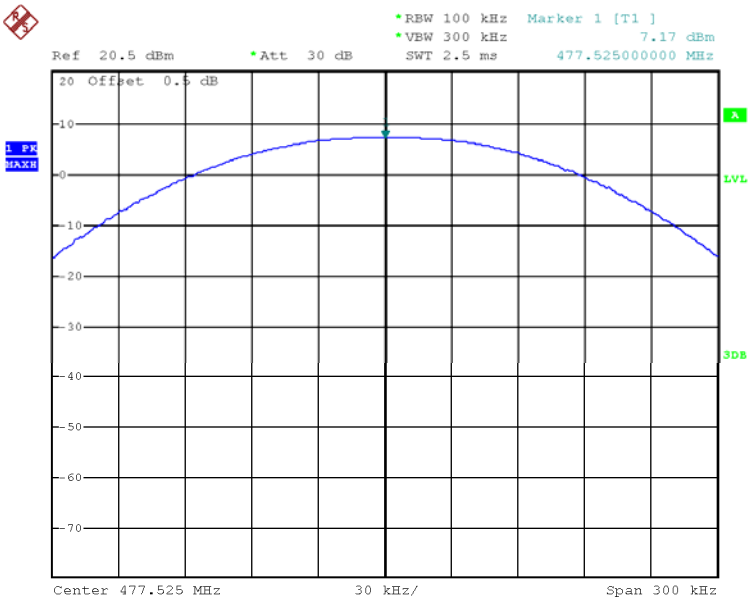
8.1 Test Procedure

The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation.

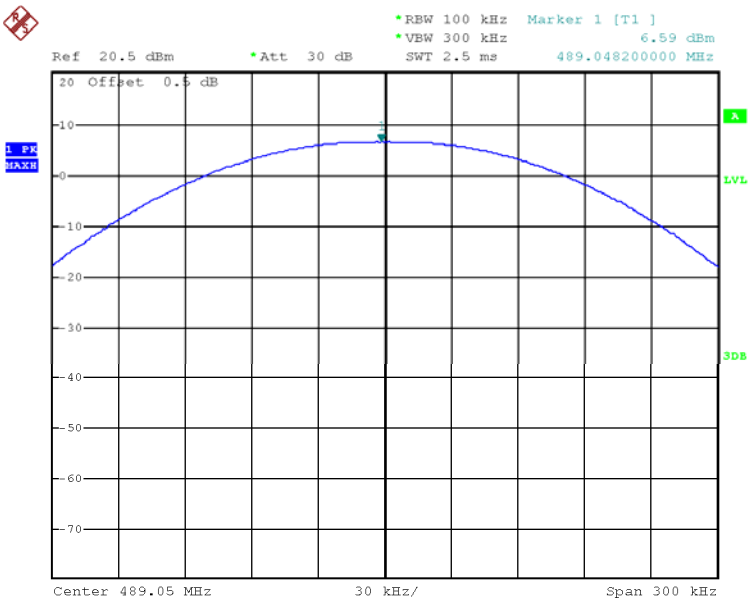
8.2 Test result

Frequency (MHz)	RF Output Power (dBm)	Limit (dBm)	Result
477.525	**7.17**	23.98	PASS
489.050	6.59	23.98	PASS
492.425	7.08	23.98	PASS

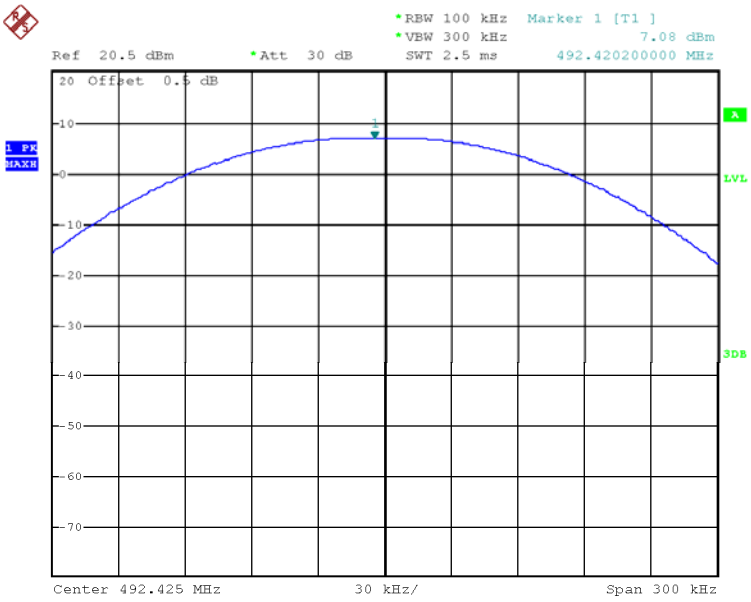
Please refer to following plot:
Low channel



Middle channel



High channel



9 Modulation Characteristics

Test requirement: FCC CFR47 §74.861 (e) (3)

Test method: Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015

Requirement: Any form of modulation may be used.

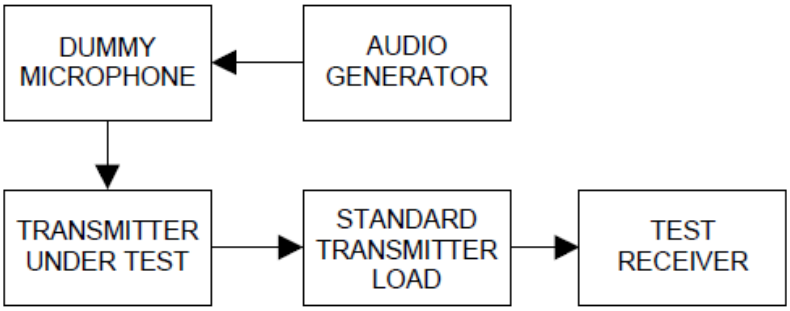
A maximum deviation of ±75kHz is permitted when frequency modulation is employed.

9.1 Test Procedure

Modulation Limiting (ANSI/TIA-603-E:2016 Section 2.2.3)

Modulation limiting is the transmitter circuit's ability to limit the transmitter from producing deviations in excess of a rated system deviation.

Method of Measurement



a) Connect the equipment as illustrated.

b) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

c) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤0.25 Hz to ≥15,000 Hz. Turn the de-emphasis function off.

d) Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation.

e) Increase the level from the audio frequency generator by 20 dB in one step (rise time between the 10% and 90% points shall be 0.1 second maximum).

f) Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.

g) With the level from the audio frequency generator held constant at the level obtained in step e), slowly vary the audio frequency from 300 Hz to 3000 Hz and observe the steady-state deviation. Record the maximum deviation.

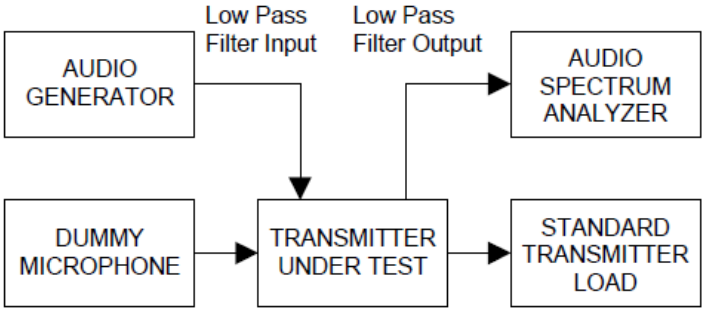
h) Set the test receiver to measure peak negative deviation and repeat steps d) through g).

i) The values recorded in steps g) and h) are the modulation limiting.

Audio Low Pass Filter Response (ANSI/TIA-603-E:2016 Section 2.2.15)

The audio low pass filter response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

Method of Measurement



a) Connect the equipment as illustrated.

b) Connect the audio frequency generator as close as possible the input of the post limiter low pass filter within the transmitter under test.

c) Connect the audio spectrum analyzer to the output of the post limiter low pass filter within the transmitter under test.

d) Apply a 1000 Hz tone from the audio frequency generator and adjust the level per manufacturer's specifications.

e) Record the dB level of the 1000 Hz spectral line on the audio spectrum analyzer as *LEVREF.*

f) Set the audio frequency generator to the desired test frequency between 3000 Hz and the upper low pass filter limit.

g) Record audio spectrum analyzer levels, at the test frequency in step f).

h) Record the dB level on the audio spectrum analyzer as *LEVFREQ* .

i) Calculate the audio frequency response at the test frequency as:
low pass frequency response = *LEVFREQ - LEVREF*

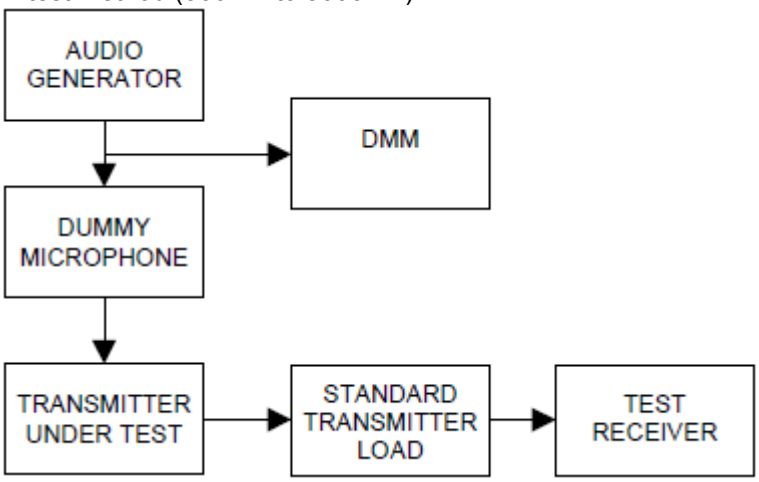
j) Repeat steps f) through i) for all the desired test frequencies.

Audio Frequency Response (ANSI/TIA-603-E:2016 Section 2.2.6)

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

Method of Measurement

Constant deviation test method (300 Hz to 3000 Hz)



a) Connect the equipment as illustrated.

b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤50 Hz to ≥15,000 Hz. Turn the de-emphasis function off.

c) Set the DMM to measure rms voltage.

d) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

e) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.

f) Set the test receiver to measure rms deviation and record the deviation reading.

g) Record the DMM reading as VREF .

h) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.

i) Vary the audio frequency generator output level until the deviation reading that was recorded in step f) is obtained.

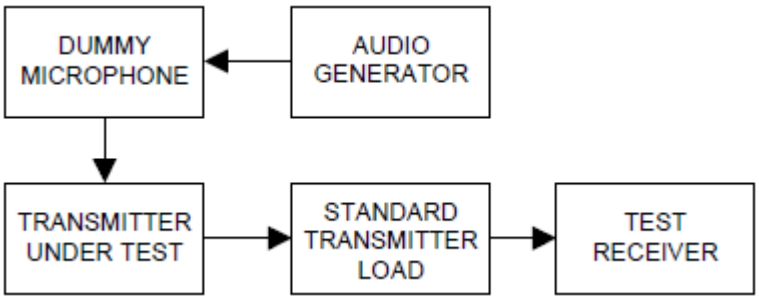
j) Record the DMM reading as VFREQ .

k) Calculate the audio frequency response at the present frequency as:

$$audio\ frequency\ response = 20\ \log_{10}\left(\frac{V_{FREQ}}{V_{REF}}\right)$$

l) Repeat steps h) through k) for all the desired test frequencies.

Constant Input Test Method (300 Hz to 3000 Hz)



a) Connect the equipment as illustrated.

b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤50 Hz to ≥15,000 Hz. Turn the de-emphasis function off.

c) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.

d) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.

e) Set the test receiver to measure rms deviation and record the deviation reading as DEVREF .

f) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.

g) Record the test receiver deviation reading as DEVFREQ .

h) Calculate the audio frequency response at the present frequency as:

$$audio\ frequency\ response = 20\ \log_{10}\left(\frac{DEV_{FREQ}}{DEV_{REF}}\right)$$

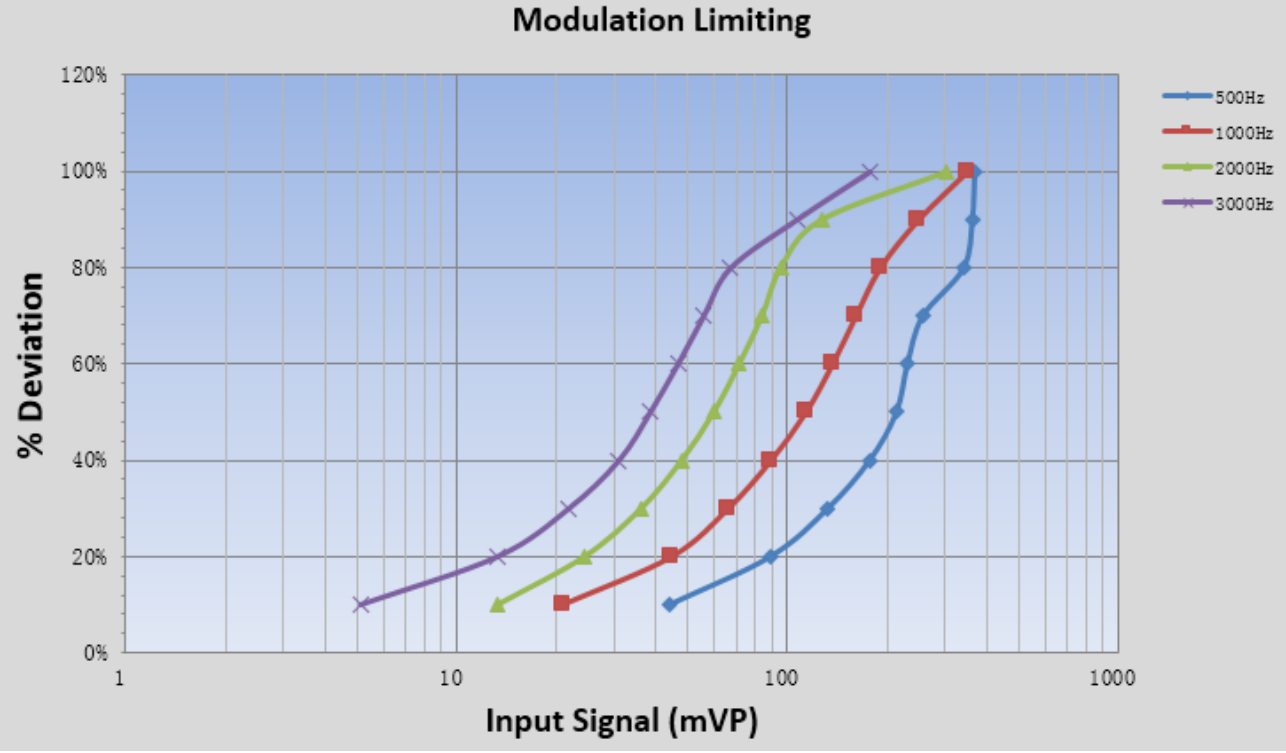
i) Repeat steps f) through h) for all the desired test frequencies.

9.2 Test Result

Modulation Limiting Test Result

Middle Channel

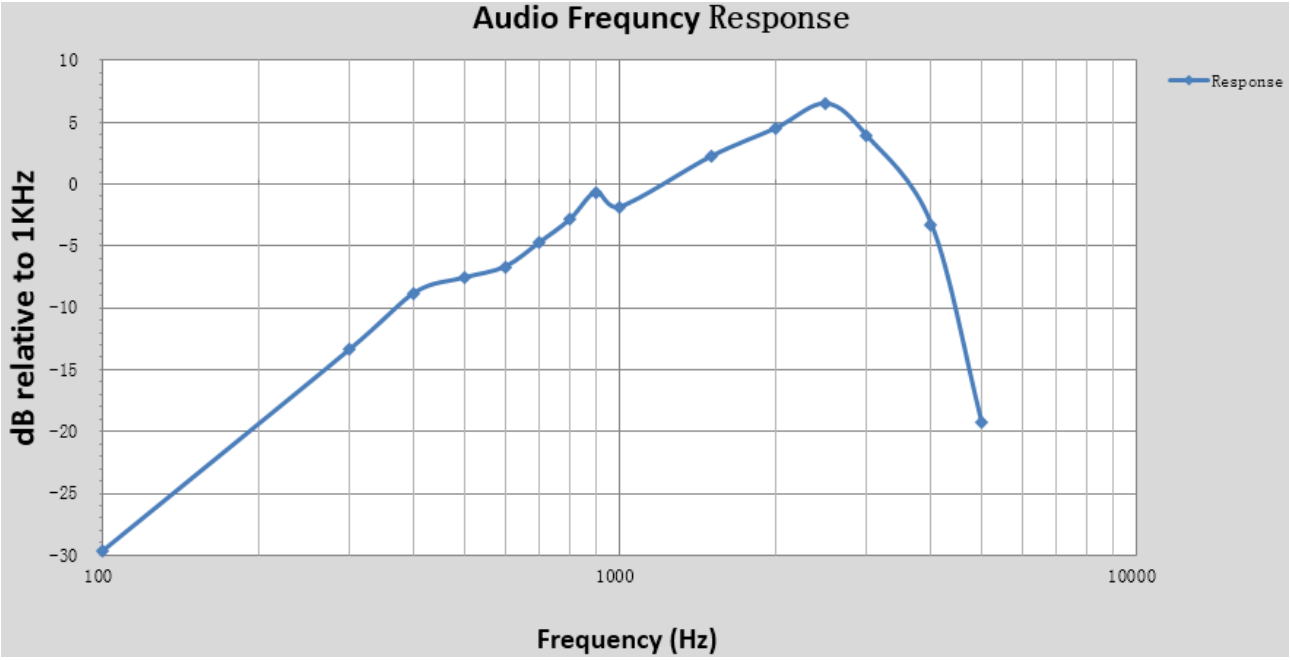
% Deviation	Input Signal (mVP)			
	500 Hz	1000 Hz	2000 Hz	3000 Hz
10%	44	21	13	5
20%	89	45	24	13
30%	132	66	36	22
40%	177	89	48	31
50%	214	114	60	38
60%	231	137	71	47
70%	257	161	84	56
80%	342	190	95	67
90%	363	248	126	106
100%	369	349	302	177



Audio Frequency Response Test Result

Middle channel

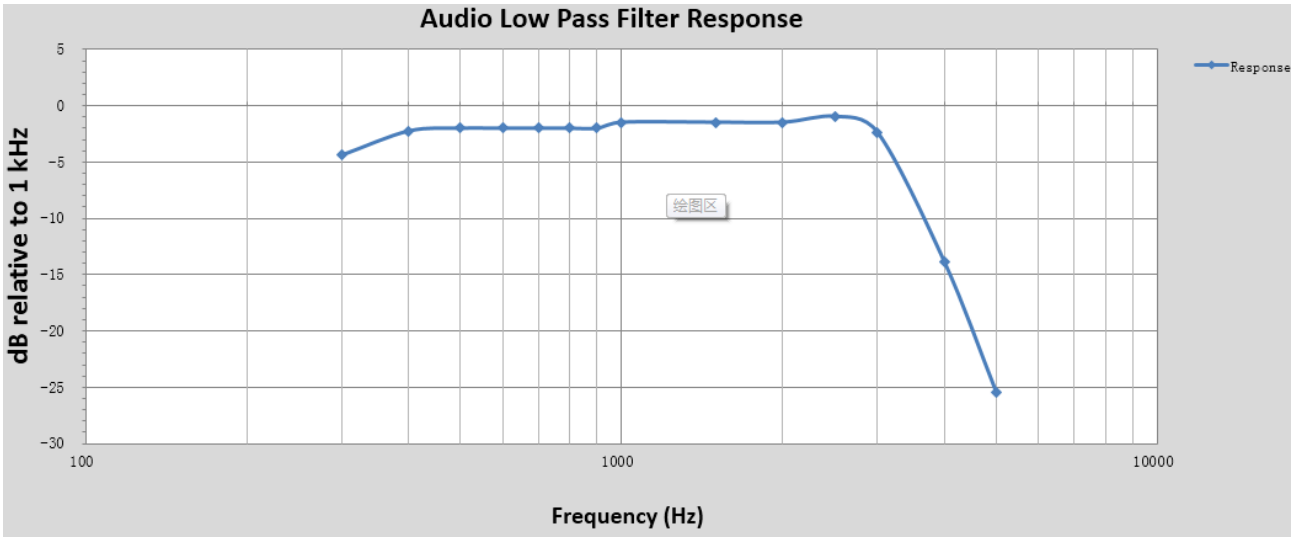
Frequency(Hz)	Audio Frequency Response(Hz)	Audio Frequency Response(dB)
100	28	-29.6
300	189	-13.4
400	319	-8.8
500	388	-7.6
600	459	-6.7
700	528	-4.7
800	599	-2.9
900	658	-0.7
1000	739	-1.9
1500	1119	2.2
2000	1478	4.5
2500	1839	6.5
3000	1978	3.9
4000	638	-3.3
5000	108	-19.2



Audio Low Pass Filter Response Test Result

Middle channel

Frequency(Hz)	Audio Frequency Response(Hz)	Audio Frequency Response(dB)
300	1041	-4.4
400	1413	-2.3
500	1475	-2.0
600	1475	-2.0
700	1475	-2.0
800	1475	-2.0
900	1475	-2.0
1000	1483	-1.5
1500	1483	-1.5
2000	1483	-1.5
2500	1532	-0.9
3000	1425	-2.4
4000	372	-13.9
5000	52	-25.5



10 Occupied Bandwidth of Emission

Test requirement:	FCC CFR47 Part 2 Section 2.1049©(1)
Test method:	Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015
Limit:	According to FCC 74.861 (e)(5), the frequency emission bandwidth shall not exceed 200 kHz.

10.1 Test Procedure

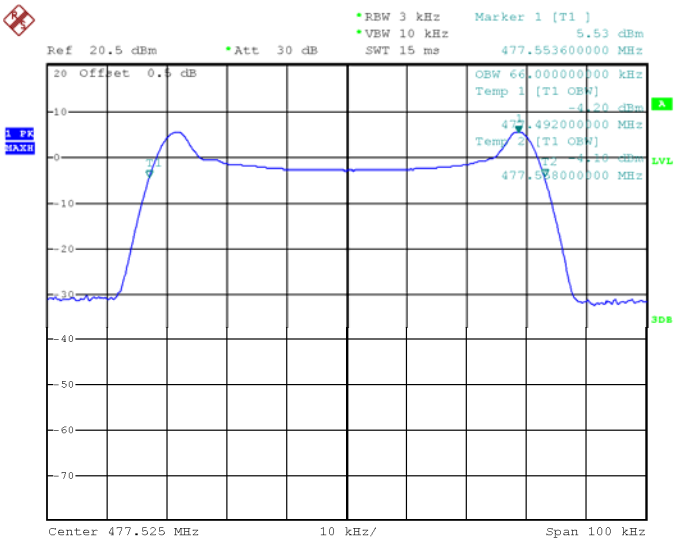
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and set it to any one convenient frequency within its operating range.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
4. The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

10.2 Test Result

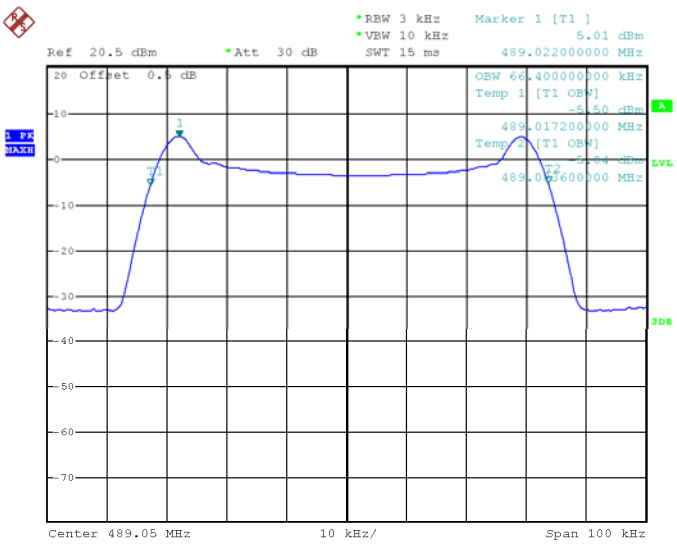
Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Result
477.525	66.00	200	PASS
489.050	66.40	200	PASS
492.425	66.20	200	PASS

Test Plot:

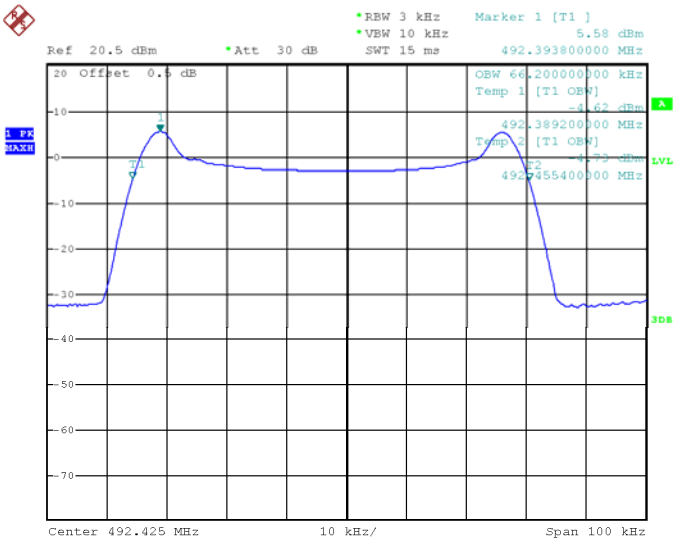
Low channel



Middle channel



High channel



11 Emission Mask and Spurious Emissions at Antenna Terminals

Test requirement:	FCC CFR47 Part 2 Section 2.1053
Test method:	Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015
Limit:	According to Part 74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule: (i) on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB. (ii) on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB. (iii) on any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 + 10 Log (output power in watts)dB.

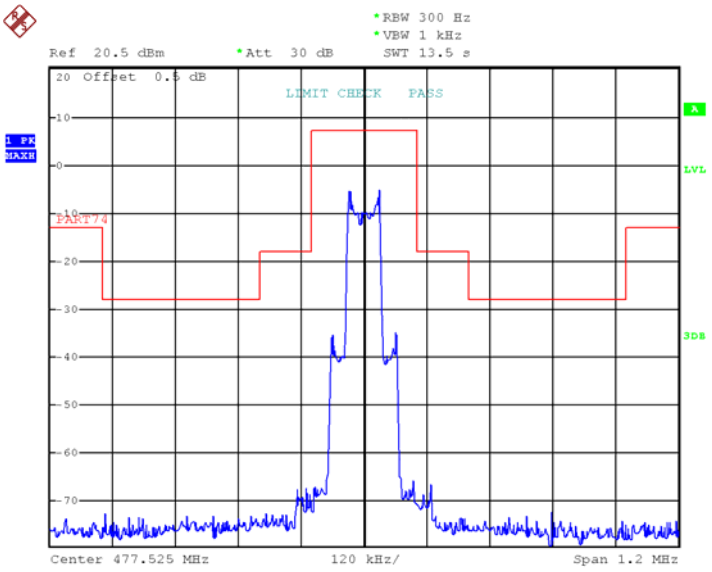
11.1 Test Procedure

1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
2. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
3. Set the SA on View mode and then plot the result on SA screen.
4. Repeat above procedures until all frequencies measured were complete.
5. The authorized BW is 200 kHz.
6. RBW=300 Hz, VBW=1 kHz.

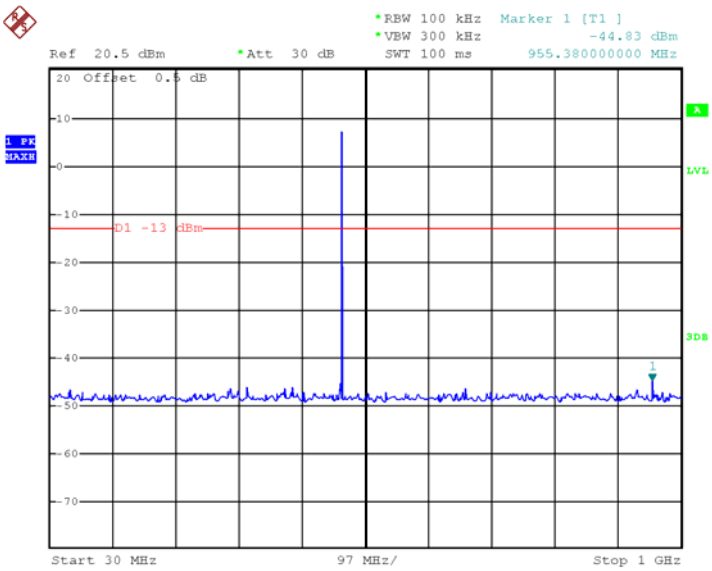
11.2 Test Data

Low Channel (477.525MHz)

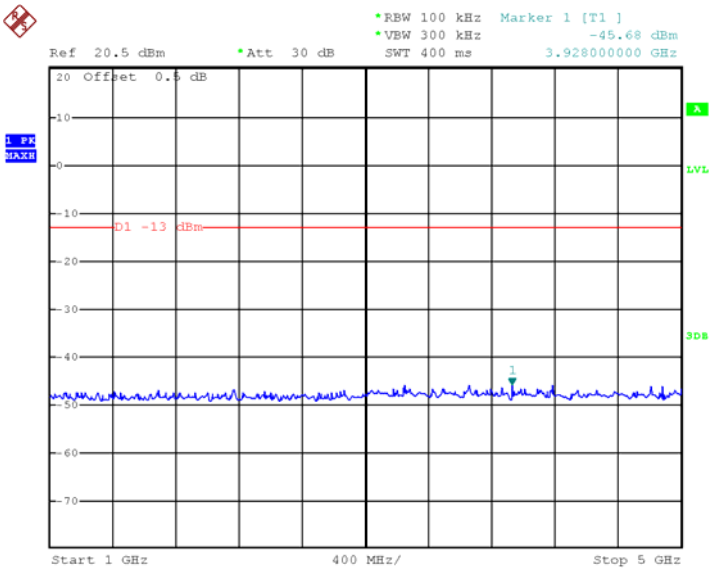
Emission Mask



30MHz-1GHz

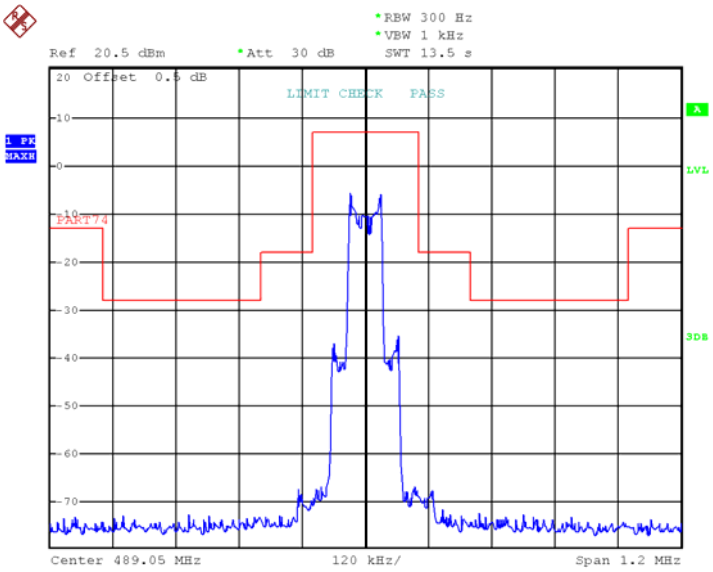


1GHz-5GHz

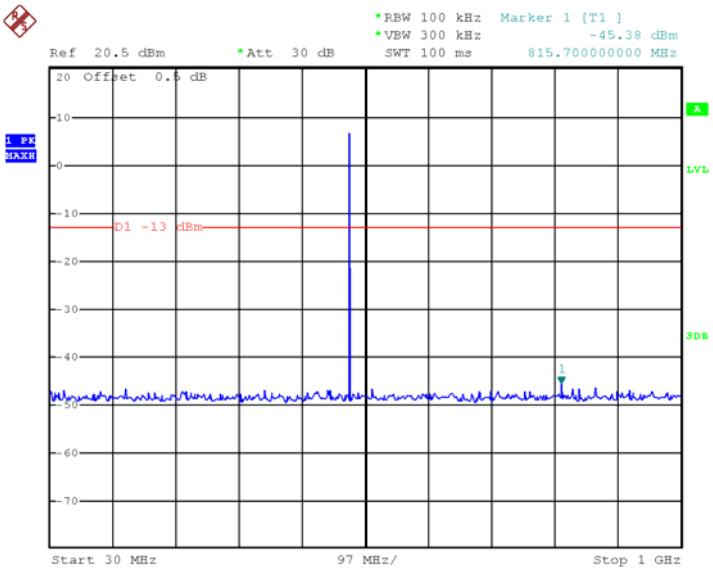


Middle Channel (489.050MHz)

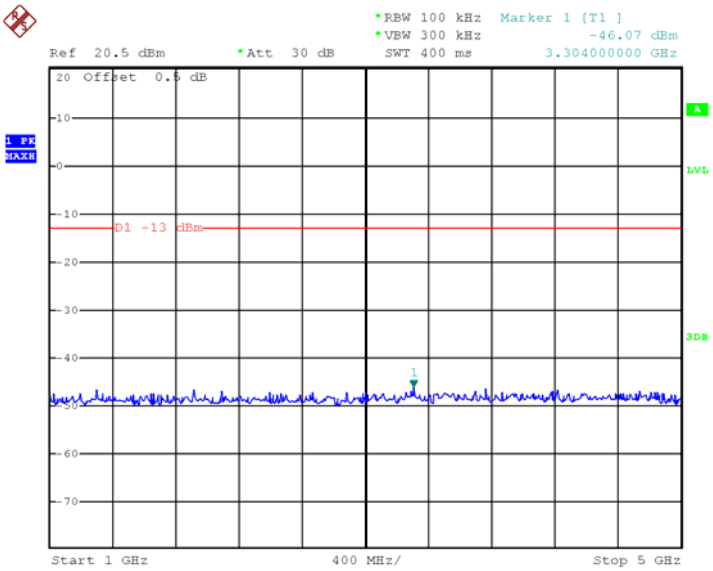
Emission Mask



30MHz-1GHz

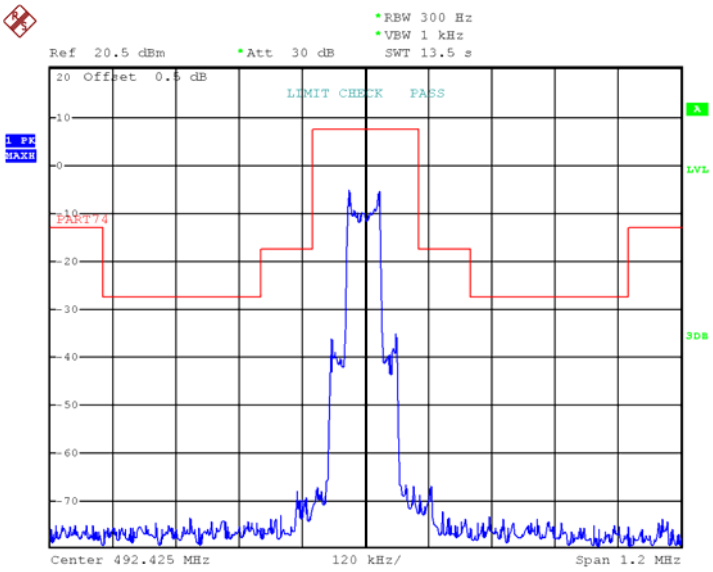


1GHz-5GHz

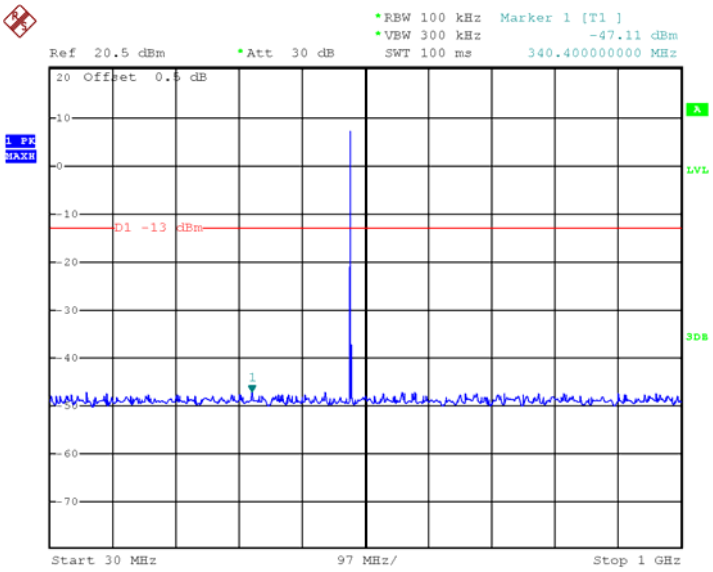


High Channel (492.425MHz)

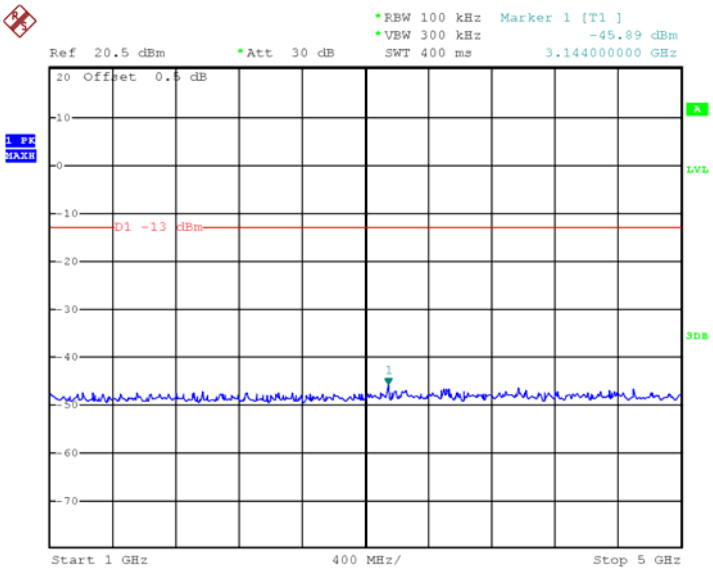
Emission Mask



30MHz-1GHz



1GHz-5GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-45.89 dBm
3.144000000 GHz
Ref 20.5 dBm
Att 30 dB
Offset 0.5 dB
1 PK
MAXH
D1 -13 dBm
A
LVL
3DB
Start 1 GHz
400 MHz/
Stop 5 GHz

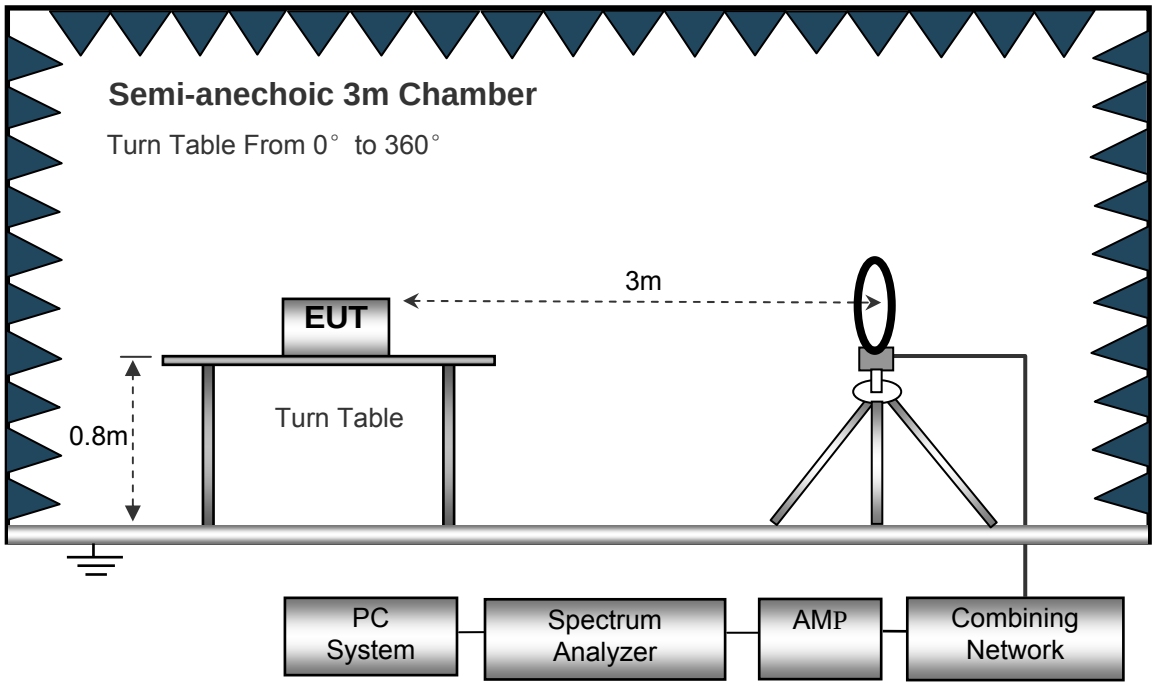
12 Radiated Emission Test

Test requirement:	FCC CFR47 Part 2 Section 2.1053
Test method:	Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015, C63.10:2013
Limit:	According to Part 74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule: (i) on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB. (ii) on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB. (iii) on any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 + 10 Log (output power in watts)dB.

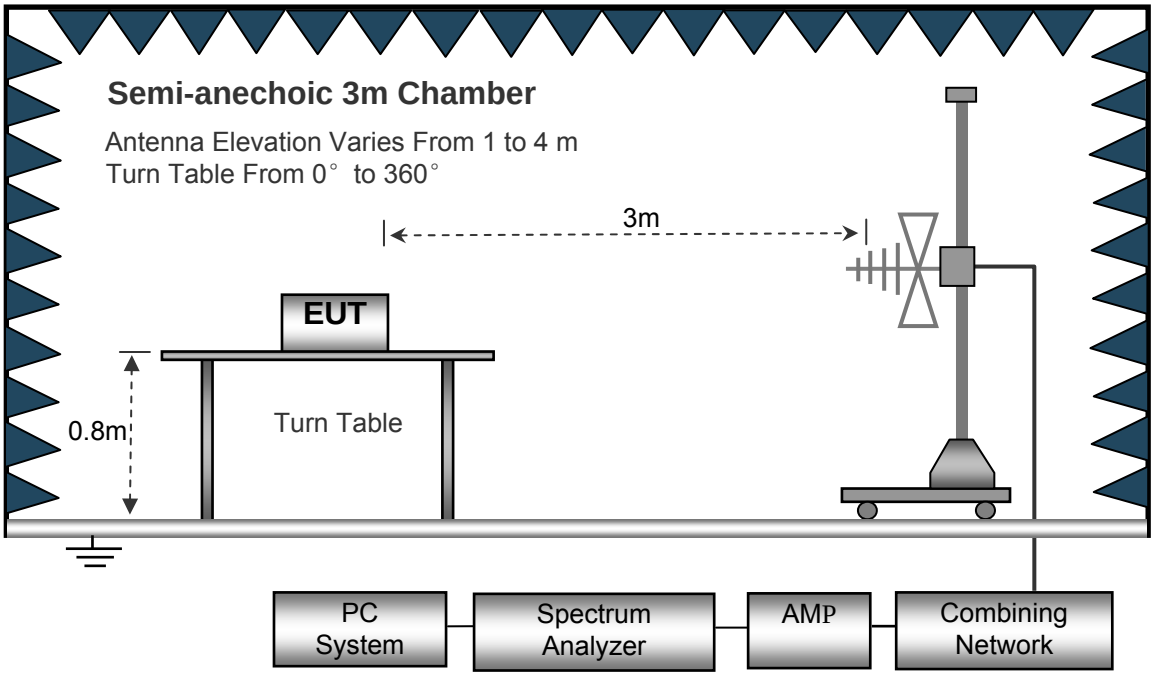
12.1 EUT Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013

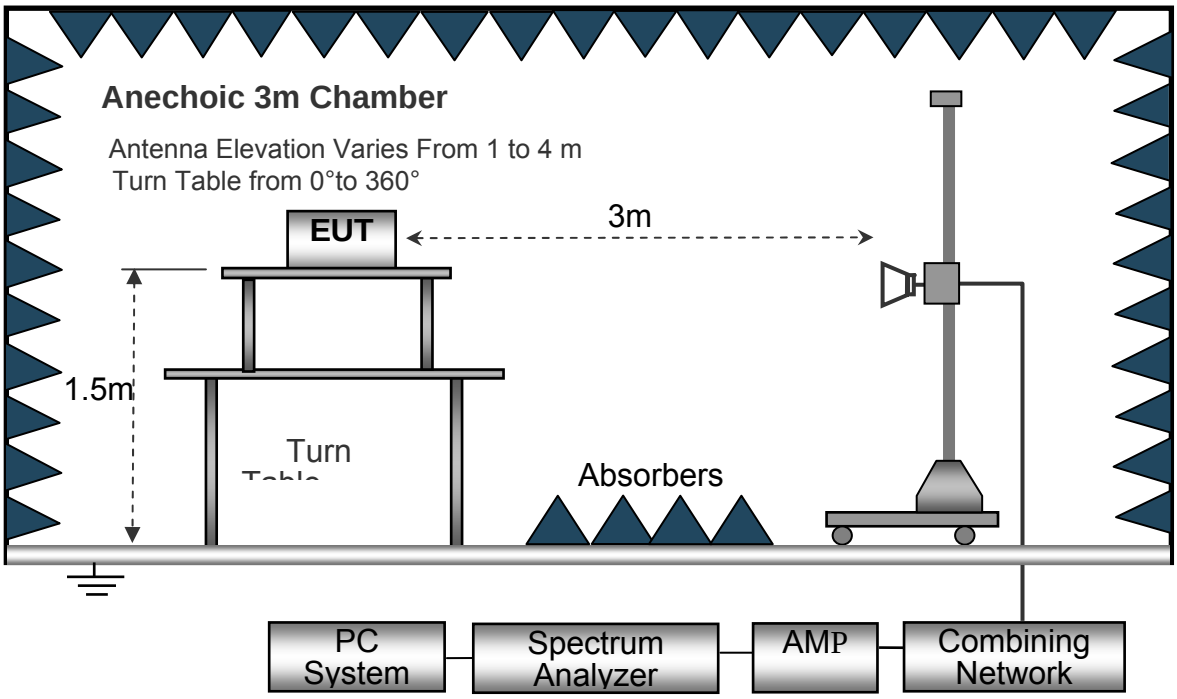
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz Emissions.



12.2 Spectrum Analyzer Setup

According to FCC Part 2 Section 2.1053 Rules, the system was tested 9 kHz to 5000MHz.

9 kHz ~ 30MHz

Start Frequency 9kHz
Stop Frequency 30MHz
Sweep Speed ..... Auto
IF Bandwidth 10KHz
Video Bandwidth 10KHz
Resolution Bandwidth 10KHz

30MHz ~ 1GHz

Start Frequency ..... 30 MHz
Stop Frequency 1000MHz
Sweep Speed ..... Auto
IF Bandwidth ..... 120 KHz
Video Bandwidth 300KHz
Quasi-Peak Adapter Bandwidth ..... 120 KHz
Quasi-Peak Adapter Mode ..... Normal
Resolution Bandwidth 100KHz

Above 1GHz

Start Frequency ..... 1000 MHz
Stop Frequency 7000MHz
Sweep Speed ..... Auto
IF Bandwidth ..... 120 KHz
Video Bandwidth 3MHz
Quasi-Peak Adapter Bandwidth ..... 120 KHz
Quasi-Peak Adapter Mode ..... Normal
Resolution Bandwidth 1MHz

12.3 Test Procedure

1. The EUT is placed on a turntable.the EUT is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
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.

12.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Class B Limit

12.5 Test Result

Frequency (MHz)	Detector	Ant. Pol	Antenna Height (m)	Turntable Angle (°)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
Low Channel:477.525MHz							
955.05	Peak	H	1.1	187	-44.76	-13	-31.76
955.05	Peak	V	1.9	234	-45.98	-13	-32.98
1432.58	Peak	H	1.5	256	-45.05	-13	-32.05
1432.58	Peak	V	1.3	308	-45.37	-13	-32.37
1910.10	Peak	H	1.6	340	-46.29	-13	-33.29
1910.10	Peak	V	1.0	21	-46.34	-13	-33.34
Middle Channel:489.050MHz							
978.10	Peak	H	1.7	26	-43.84	-13	-30.84
978.10	Peak	V	1.1	82	-46.13	-13	-33.13
1467.15	Peak	H	1.0	298	-44.43	-13	-31.43
1467.15	Peak	V	1.7	25	-45.10	-13	-32.10
1956.20	Peak	H	1.9	50	-45.66	-13	-32.66
1956.20	Peak	V	1.6	266	-46.45	-13	-33.45
High Channel:492.425MHz							
984.85	Peak	H	1.7	263	-45.83	-13	-32.83
984.85	Peak	V	1.1	179	-47.45	-13	-34.45
1477.28	Peak	H	1.8	111	-46.88	-13	-33.88
1477.28	Peak	V	1.6	358	-46.73	-13	-33.73
1969.70	Peak	H	2.0	290	-48.28	-13	-35.28
1969.70	Peak	V	1.2	184	-48.06	-13	-35.06

13 Frequency Stability

Test requirement:	FCC CFR47 Part 2 Section 2.1055(a)(a)
Test method:	Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015
Limit:	According to FCC 74.86(e)(4), the frequency tolerance of the transmitter shall be 0.005 percent.

13.1 Test Configuration

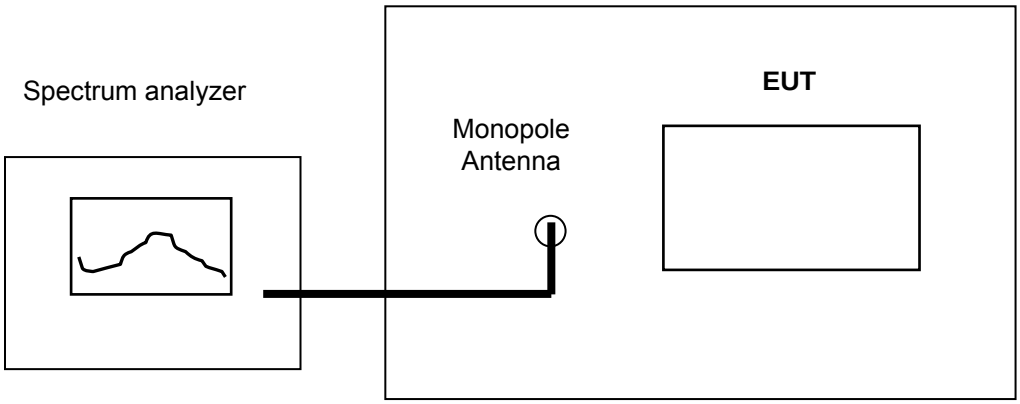


Figure 1

13.2 Test Procedure

A) Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at an environmental chamber whose temperature is set to 20 ºC. Install new batteries in the EUT.
2. Set SA center frequency to the EUT operation frequency. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

B) Frequency stability versus environmental temperature

1. Setup the configuration per figure 1 for frequencies measured at an environmental chamber, Install new batteries in the EUT.
2. Turn on EUT and set SA center frequency to the EUT operation frequency, then set SA RBW to 30kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to 50ºC. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10ºC decreased per stage until the lowest temperature -30ºC is measured, record all measurement frequencies.

13.3 Test Result

a) Frequency stability versus input voltage

b) The EUT is power by one rechargeable lithium battery. The nominal voltage is DC 3.7V .so we select the extreme condition ±10% according with ANSI/TIA-603-E:2016 section 1.4.4.3. low voltage is 3.33V DC and high voltage is 4.07V DC.

Low channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (ºC)	Frequency Measured	Frequency Tolerance (%)
3.33V, DC	477.525	24.5	477.527	0.00041
4.07V, DC	477.525	24.5	477.522	0.00053

Middle channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (ºC)	Frequency Measured	Frequency Tolerance (%)
3.33V, DC	489.050	24.5	489.055	0.00100
4.07V, DC	489.050	24.5	489.051	0.00020

High channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (ºC)	Frequency Measured	Frequency Tolerance (%)
3.33V, DC	492.425	24.5	492.420	0.00093
4.07V, DC	492.425	24.5	492.425	0.00002

Frequency stability versus environmental temperature

Low Frequency:477.525MHz, Limit: 0.005%			
Environment Temperature(ºC)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3.7V, DC	477.525	0.00007
40	3.7V, DC	477.522	0.00072
30	3.7V, DC	477.527	0.00052
20	3.7V, DC	477.526	0.00014
10	3.7V, DC	477.519	0.00116
0	3.7V, DC	477.522	0.00069
-10	3.7V, DC	477.525	0.00002
-20	3.7V, DC	477.520	0.00110
-30	3.7V, DC	477.526	0.00027

Middle Frequency: 489.050MHz, Limit: 0.005%			
Environment Temperature(ºC)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3.7V, DC	489.053	0.00064
40	3.7V, DC	489.053	0.00070
30	3.7V, DC	489.047	0.00065
20	3.7V, DC	489.052	0.00032
10	3.7V, DC	489.047	0.00069
0	3.7V, DC	489.052	0.00046
-10	3.7V, DC	489.046	0.00082
-20	3.7V, DC	489.046	0.00079
-30	3.7V, DC	489.050	0.00007

High Frequency: 492.425MHz, Limit: 0.005%			
Environment Temperature(ºC)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3.7V, DC	492.421	0.00079
40	3.7V, DC	492.425	0.00006
30	3.7V, DC	492.429	0.00073
20	3.7V, DC	492.421	0.00083
10	3.7V, DC	492.428	0.00066
0	3.7V, DC	492.420	0.00106
-10	3.7V, DC	492.428	0.00065
-20	3.7V, DC	492.430	0.00095
-30	3.7V, DC	492.431	0.00117

Test Result: The max frequency tolerance rating is 0.00117% < 0.005%. Passed.

13 FCC ID: CCRAL2K RF Exposure Report

Test Requirement: FCC Part 1.1307

Evaluation Method FCC Part2.1093 & KDB 447498 D01 General RF Exposure Guidance v06

13.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR where

1. f(GHz) is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

13.2 The procedures / limit

Conducted Peak power(dBm)	Conducted Peak power(mW)	Source-based time-averaged maximum conducted output power(mW)	Minimum test separation distance required for the exposure conditions (mm)	SAR Test Exclusion Thresholds Calculation Value	SAR Test Exclusion Thresholds Limit	Result
7.17	5.21	5.21	5	0.731	3.0	Compliance

Remark: Max. duty factor is 100%

Low Chanel: f=477.525MHz=0.477525GHz, so √f(GHz)=0.691

High Chanel: f=492.425MHz=0.492425GHz, so √f(GHz)=0.702

13.3 Result: Compliance

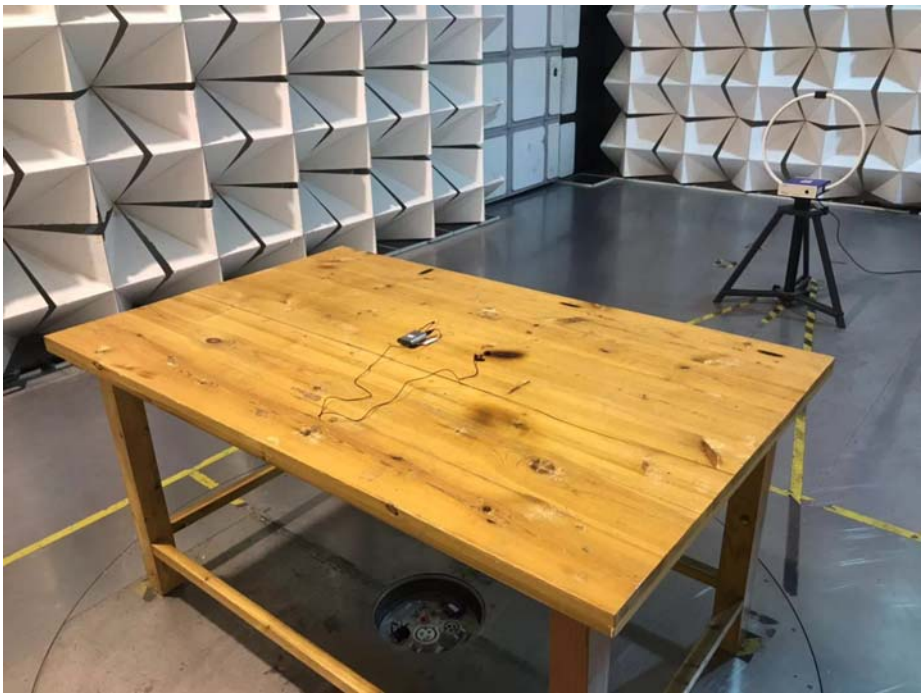
No SAR measurement is required.

14 Photographs –Model AL2 Test Setup

14.1 Photograph-Conducted Emissions Test Setup Photos

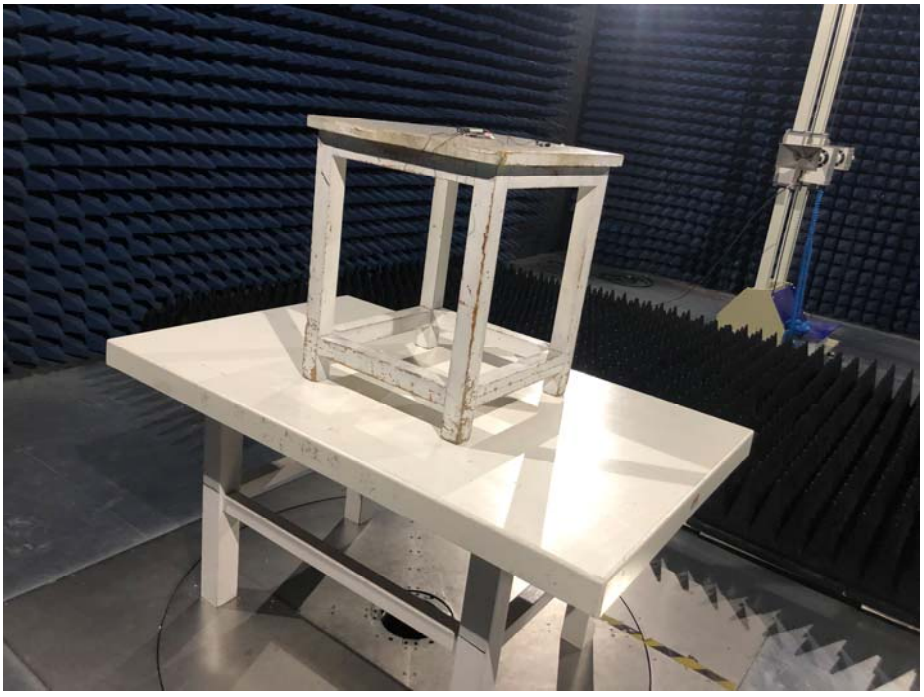
14.2 Photograph – Radiation Spurious Emission Test Setup

9kHz to 30MHz



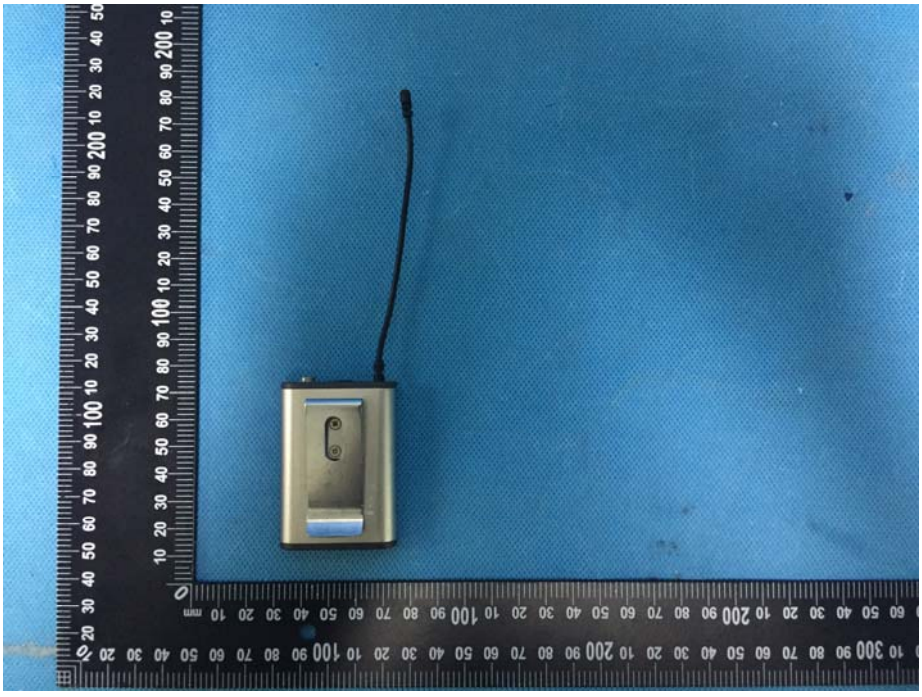
30MHz to 1GHz

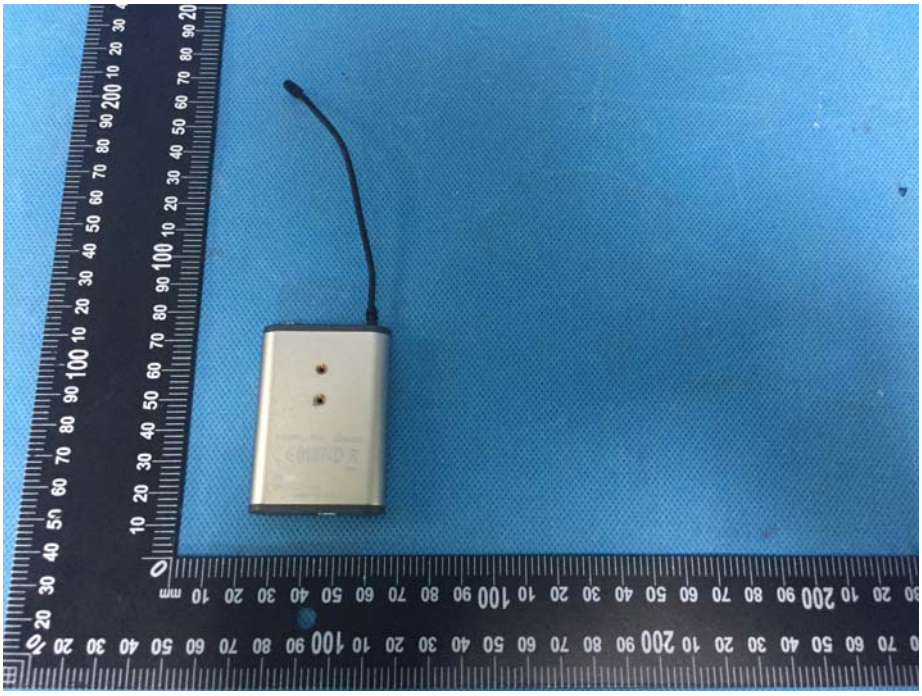
1GHz to 5GHz



15 Photographs – Constructional Details

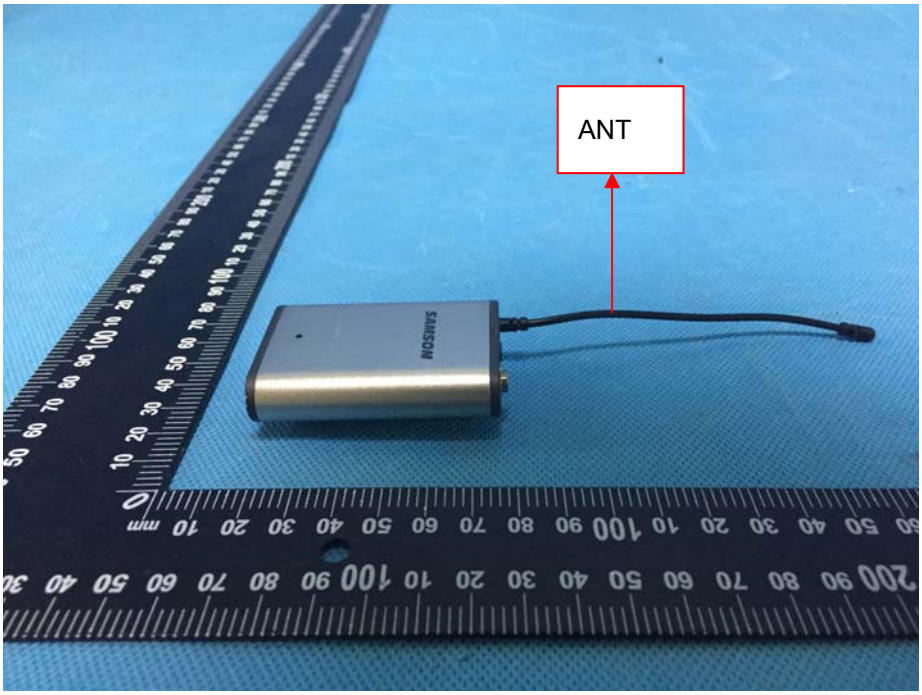
15.1 EUT –Model AL2 External Photos

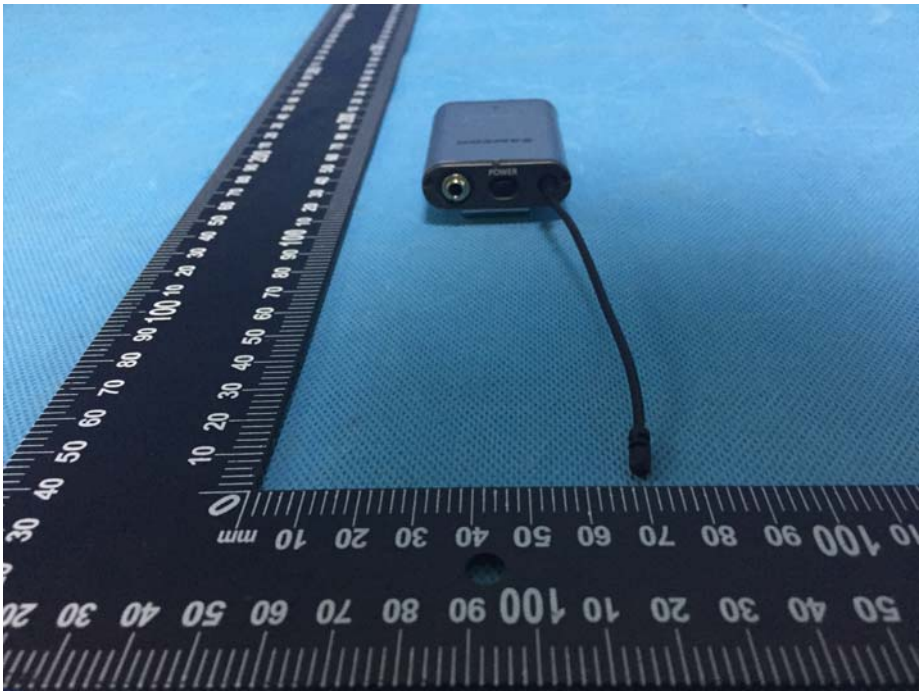




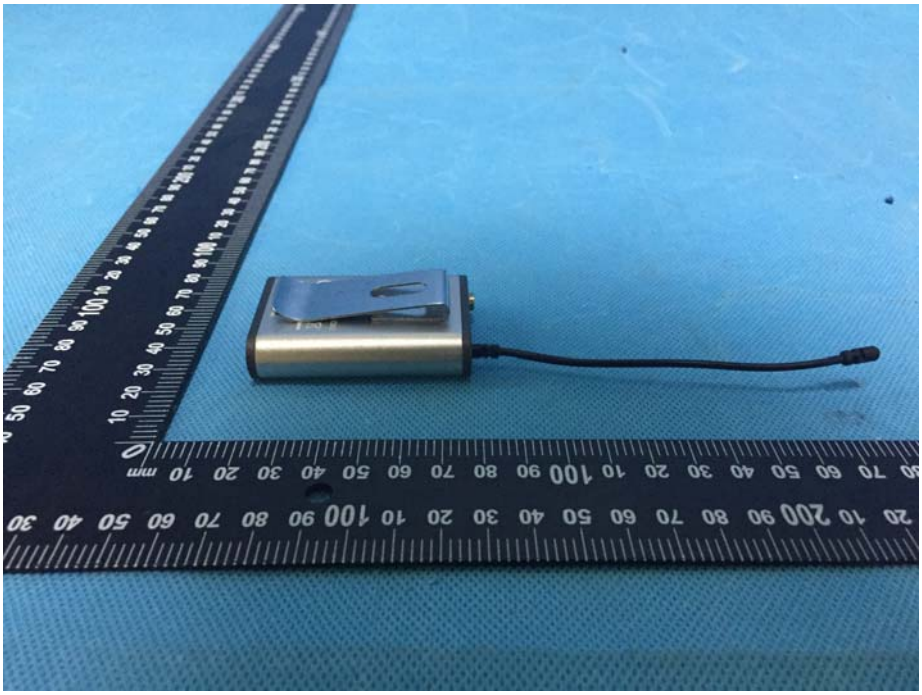

SAMSON
DC IN
-15dB 0dB
PAD


DC IN
-15dB 0dB
PAD


ANT
SAMSON

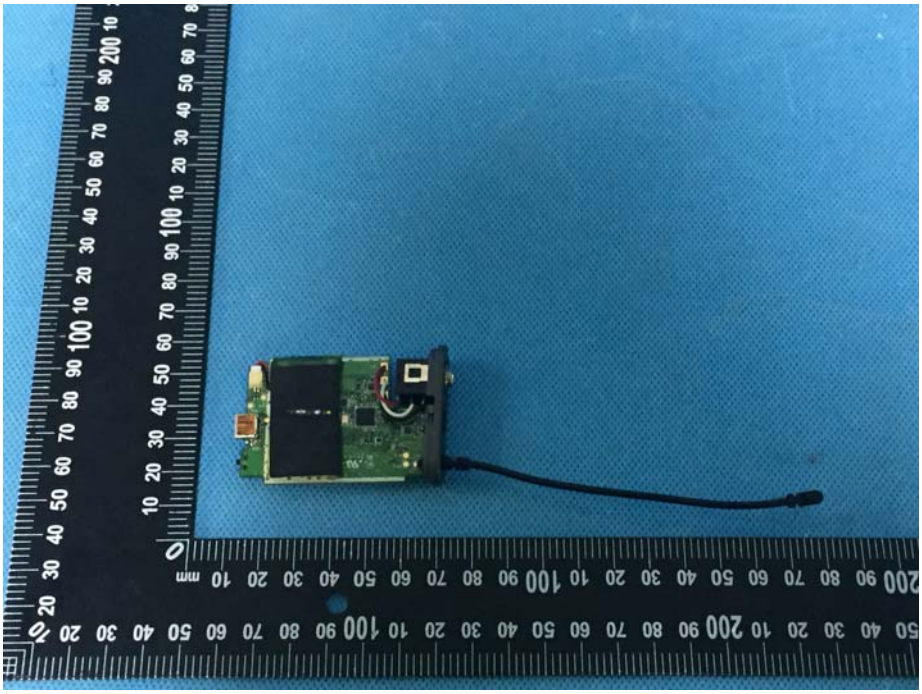



POWER

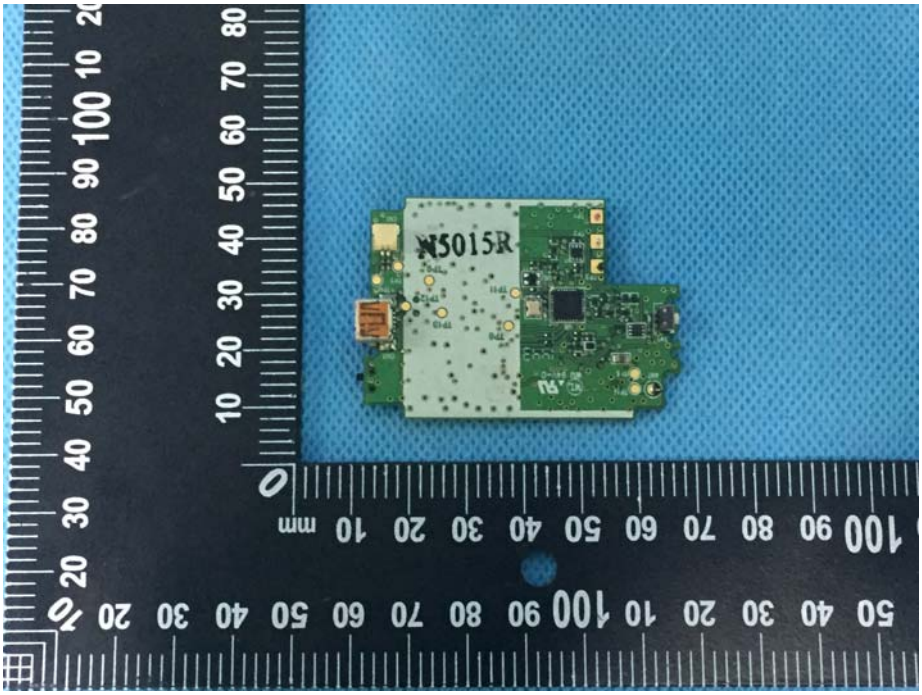


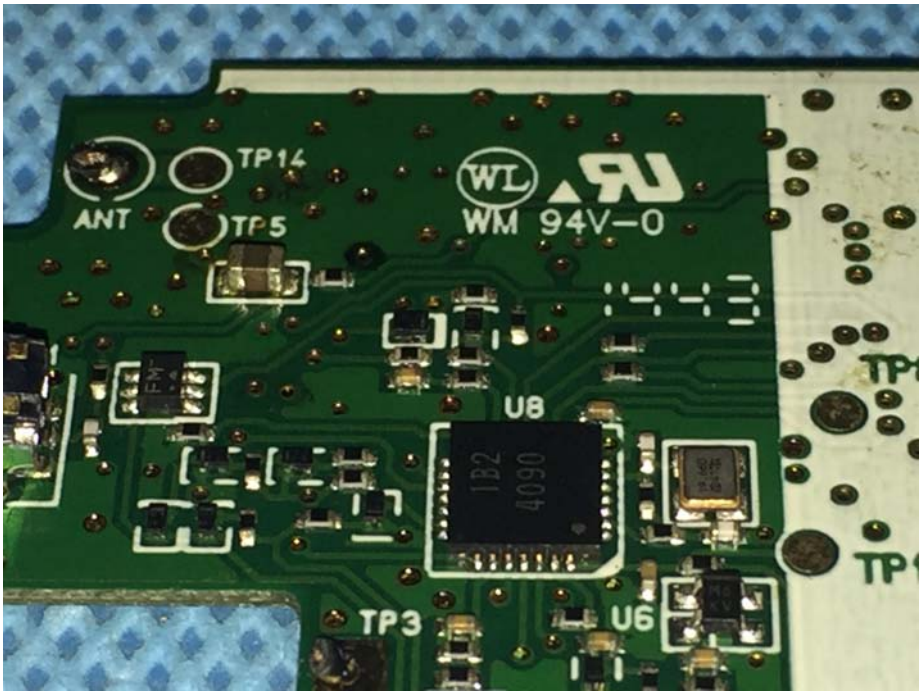

GPE
GOLDEN PROFIT
ELECTRONICS LTD.
SWITCHING MODE POWER SUPPLY
MODEL: GPE053B-V050100-Z
INPUT: 100-240V~50/60Hz 0.2A
OUTPUT:5.0V 1000mA 5W LPS
APPROVAL NO:SAA-151621-EA
Made in China
c UL us
LISTED
E221142
1NW6
Audio/Video POWER SUPPLY

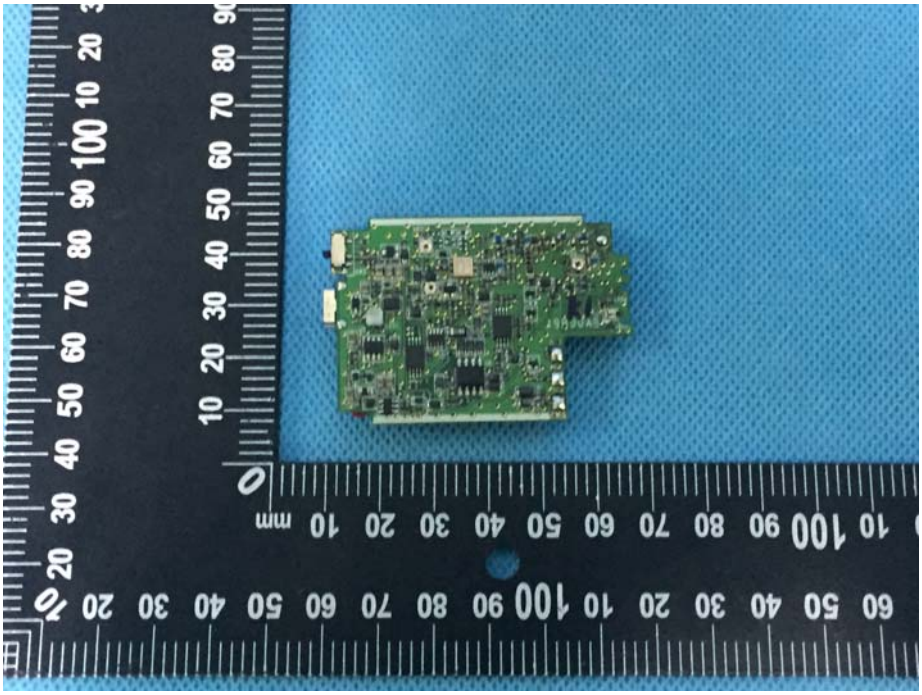
15.2 EUT –Model AL2 Internal Photos

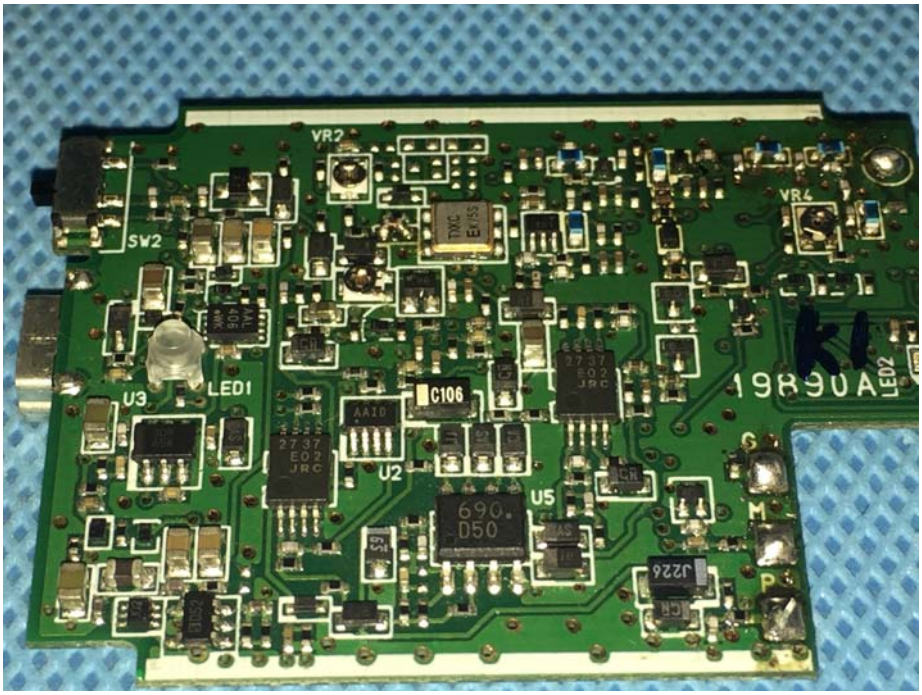


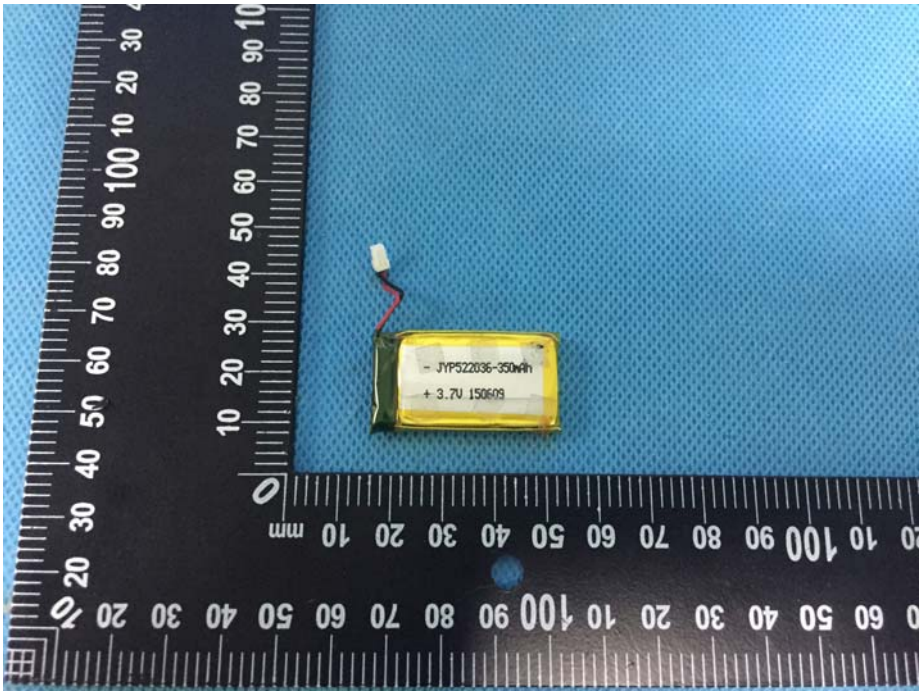

N5015R

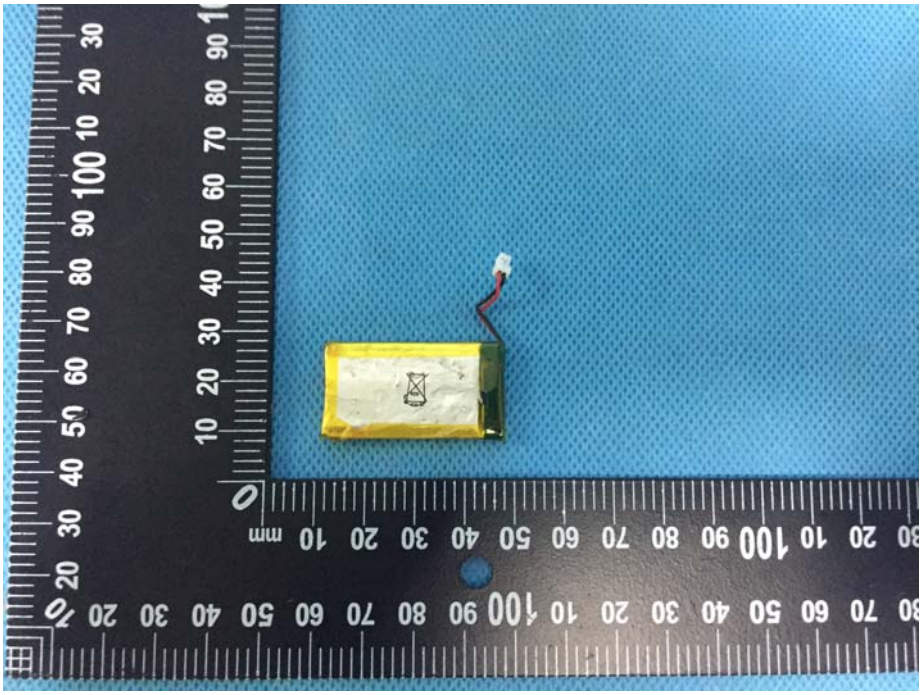

N5015R


TP14
ANT
TP5
WL
WM 94V-0
U8
TP3
U6




VR2
SW2
VR4
LED1
U3
C106
U2
U5
LED2


JYPS22036-350mAh
3.7V 150609



======End of Report======