TEST REPORT

Reference No.	:	WTS17S0372802-1E
FCC ID	:	2ACZKAWS2KP
Applicant	:	Gradus Group
Address	:	370 West 35th Street, New York, NY 10001, United States
Manufacturer	:	Gradus Group
Address	:	370 West 35th Street, New York, NY 10001, United States
Factory	:	Relacart Electronics Co.,Ltd.
Address	:	No. 10 Fuxing Road, Pingshi Industrial District, Enping City, Guangdong, China-529400
Product Name	:	Plug-In Transmitter for AWS-2000
Model No.	:	AWS-2000P
Brand Name	:	senal
Standards	:	FCC CFR47 Part 74
Date of Receipt sample	:	Mar. 07, 2017
Date of Test	:	Apr. 22 – Jun. 19, 2017
Date of Issue	:	Jun. 23, 2017
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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2 Contents

Page

1 COVER PAGE 1
2 CONTENTS 2
3 REVISION HISTORY 4
4 GENERAL INFORMATION 5
4.1 General Description of E.U.T. 5
4.2 Details of E.U.T. 5
4.3 Channel Plan & List 5
4.4 Test Mode 6
4.5 Test Facility 6
5 EQUIPMENT USED DURING TEST 7
5.1 Equipments List 7
5.2 Measurement Uncertainty 8
5.3 Test Equipment Calibration 8
6 TEST SUMMARY 9
7 RF OUTPUT POWER 10
7.1 Test Procedure 10
7.2 Test result 10
8 MODULATION CHARACTERISTICS 14
8.1 Test Procedure 14
8.2 Test Result 18
9 OCCUPIED BANDWIDTH OF EMISSION 21
9.1 Test Procedure 21
9.2 Test Result 21
10 SPURIOUS EMISSIONS AT ANTENNA TERMINALS 26
10.1 Test Procedure 26
10.2 Test Data 27
11 CONDUCTED EMISSIONS 33
11.1 E.U.T. Operation 33
11.2 EUT Setup 33
11.3 Measurement Description 33
11.4 Conducted Emission Test Result 34
12 RADIATED EMISSION TEST 36
12.1 EUT Setup 36
12.2 Spectrum Analyzer Setup 38
12.3 Test Procedure 38
12.4 Corrected Amplitude & Margin Calculation 39
12.5 Test Result 40
13 FREQUENCY STABILITY 42
13.1 Test Configuration 42
13.2 Test Procedure 42
13.3 Test Result 43

14 RF EXPOSURE 46

15 PHOTOGRAPHS –MODEL AWS-2000P TEST SETUP 47

15.1 PHOTOGRAPH – RADIATION SPURIOUS EMISSION TEST SETUP 47
15.2 PHOTOGRAPH – CONDUCTED EMISSIONS TEST SETUP 49

16 PHOTOGRAPHS – CONSTRUCTIONAL DETAILS 50

16.1 EUT –MODEL AWS-2000P EXTERNAL PHOTOS 50
16.2 EUT –MODEL AWS-2000P INTERNAL PHOTOS 54

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0372802-1E	Mar. 07, 2017	Apr. 22 – Jun. 19, 2017	Jun. 23, 2017	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name	: Plug-In Transmitter for AWS-2000
Model No.	: AWS-2000P
Differences Describe	: N/A
Operation Frequency	: 522MHz-586MHz, 172channels
The Lowest Oscillator	: 16MHz
Antenna installation	: Internal permanently attached antenna
Antenna Gain	: 1dBi(Max.)
Modulation	: FM
Rated System Deviation	:± 30KHz
Maximum System Deviation	:± 75KHz

4.2 Details of E.U.T.

Technical Data: : DC 3V by 2*1.5V(size “AA”) batteries,
Charging: DC 5V by USB from PC.

4.3 Channel Plan & List

Band A Channel List (522MHz-554MHz)

Group / Channel	1	2	3	4	5	6	7	8	9	10
1	523.025	522.725	522.800	522.925	522.650	523.550	523.750	523.850	523.950	523.000
2	525.475	523.450	526.000	525.375	525.100	526.650	525.500	527.625	526.100	524.050
3	526.875	526.475	528.400	529.375	529.100	529.250	527.375	531.175	528.500	527.825
4	529.475	530.925	530.150	534.225	533.950	532.200	529.500	537.200	530.250	531.375
5	532.425	532.350	533.200	538.875	538.600	534.100	531.375	541.600	533.300	537.400
6	534.325	534.825	537.200	543.425	543.950	538.750	533.375	547.675	537.300	541.800
7	538.975	536.300	539.950	548.175	547.900	544.100	537.375		540.050	547.875
8	544.325	540.625	544.975			548.050	538.625		545.075	
9	548.275	545.175	547.675				542.625		547.775	
10		553.725	549.000				548.125		549.100	
11			552.400				552.000			

Band B Channel List (554MHz-586MHz)

Group / Channel	1	2	3	4	5	6	7	8	9	10
1	559.750	558.800	558.000	558.350	559.575	558.825	560.250	554.550	561.425	557.800
2	560.850	560.250	559.750	561.425	561.900	561.225	562.050	558.225	563.150	562.350
3	562.700	565.300	560.850	564.425	563.475	565.350	564.000	560.700	566.300	564.375
4	564.850	570.700	562.700	567.275	565.725	567.375	567.500	568.575	569.525	566.625
5	567.500	572.775	564.850	569.675	569.625	572.550	569.050	570.675	571.250	570.000
6	569.050	574.325	573.450	573.875	574.725	575.625	577.600	573.300	574.550	572.925
7	571.450	576.450	578.325	576.425	576.150	578.925	580.050	575.175	576.575	575.775
8	581.000	584.375	584.100	583.250	581.475	583.575	585.300	579.450	579.875	578.475
9				584.225	585.900	585.975		582.375	582.725	580.800

4.4 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.

Test mode	Low channel	Middle channel	High channel
Transmitting	522.650MHz	553.725MHz	585.975MHz

Test Item	Test Mode
Radiated Emissions	Charging + Transmitting
Conducted Emissions	Charging + Transmitting

4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

  Waltek Services (Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A-1, October 15, 2015

- **FCC Test Site– Registration No.: 328995**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

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	Sep.15,2016	Sep.14,2017
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.15,2016	Sep.14,2017
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.15,2016	Sep.14,2017
4.	Cable	LARGE	RF300	-	Sep.15,2016	Sep.14,2017
3m Semi-anechoic Chamber for Radiation Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2016	Sep.14,2017
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2016	Sep.14,2017
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2017	Apr.18,2018
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2016	Sep.14,2017
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2017	Apr.18,2018
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2017	Apr.18,2018
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2017	Mar.16,2018
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2017	Apr.09,2018
9	Test Receiver	R&S	ESCI	101296	Sep.15,2016	Sep.14,2017
10	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.15,2016	Sep.14,2017
11	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2016	Sep.14,2017
12	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2016	Sep.14,2017
RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.15,2016	Sep.14,2017
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.15,2016	Sep.14,2017
3.	Signal Analyzer	Agilent	N9010A	MY50520207	Sep.15,2016	Sep.14,2017

	(9k~26.5GHz)					

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 (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave, Tianhe District, Guangzhou, Guangdong, China.

6 Test Summary

Test Items	Test Requirement	Test Method	Result
RF Output Power	74.861(e)(1)(ii)	ANSI/TIA-603-D:2010	C
Modulation Characteristics	74.861 (e) (3)	ANSI/TIA-603-D:2010	C
Occupied Bandwidth	2.1049(c)(1)	ANSI/TIA-603-D:2010	C
Conducted Emissions	15.207(a)	ANSI C63.10:2013	C
Radiated Emissions	2.1053 & 74.861(e)(6)	ANSI/TIA-603-D:2010	C
Spurious emissions at antenna terminals	2.1051	ANSI/TIA-603-D:2010	C
Frequencies Stability	2.1055(a)(1)	ANSI/TIA-603-D:2010	C
SAR Evaluation	1.1307(b)(1)	KDB 447498 D01	C
Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.			

7 RF Output Power

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

Test method: Based on ANSI/TIA-603-D:2010

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

7.1 Test Procedure

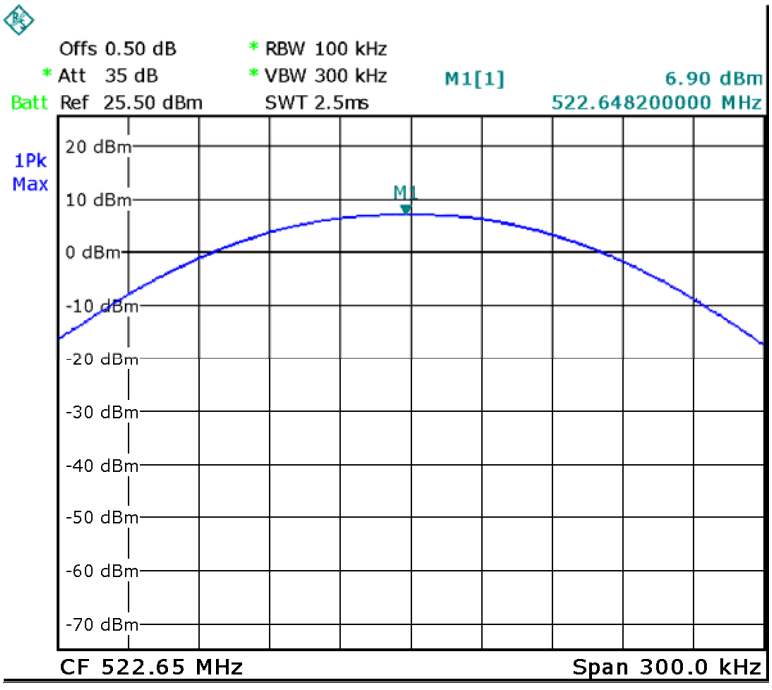
The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation.

7.2 Test result

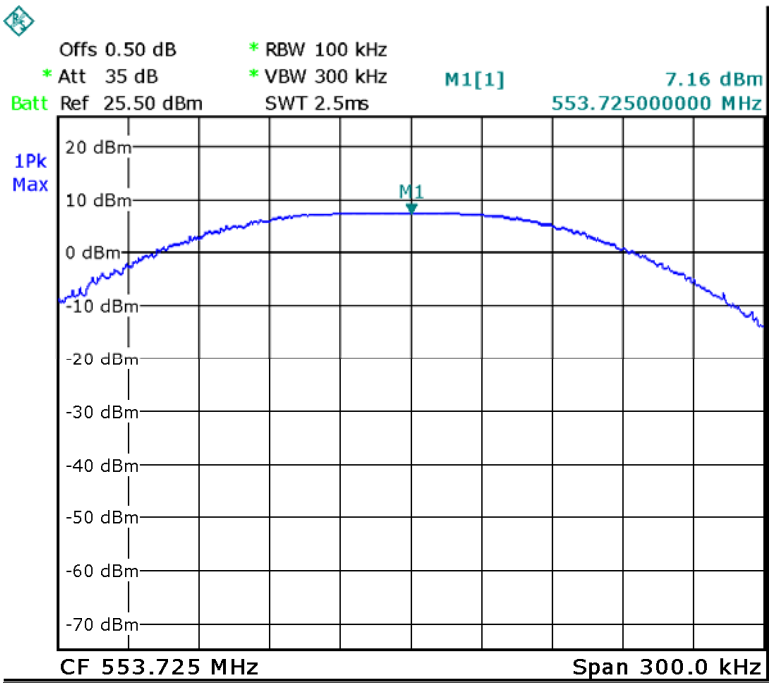
Power	Test Channel	RF Output Power (dBm)	Limit (dBm)	Result
Low	Low Channel	6.90	23.98	PASS
	Middle Channel	7.16	23.98	PASS
	High Channel	8.12	23.98	PASS
High	Low Channel	15.01	23.98	PASS
	Middle Channel	15.38	23.98	PASS
	High Channel	16.19	23.98	PASS

Please refer to following plot:

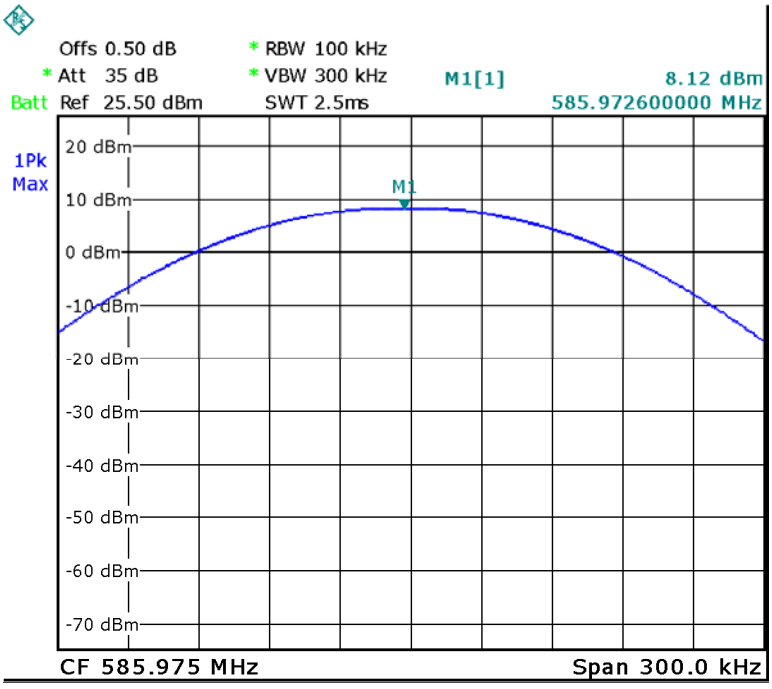
Low Power
Low Channel



Middle Channel

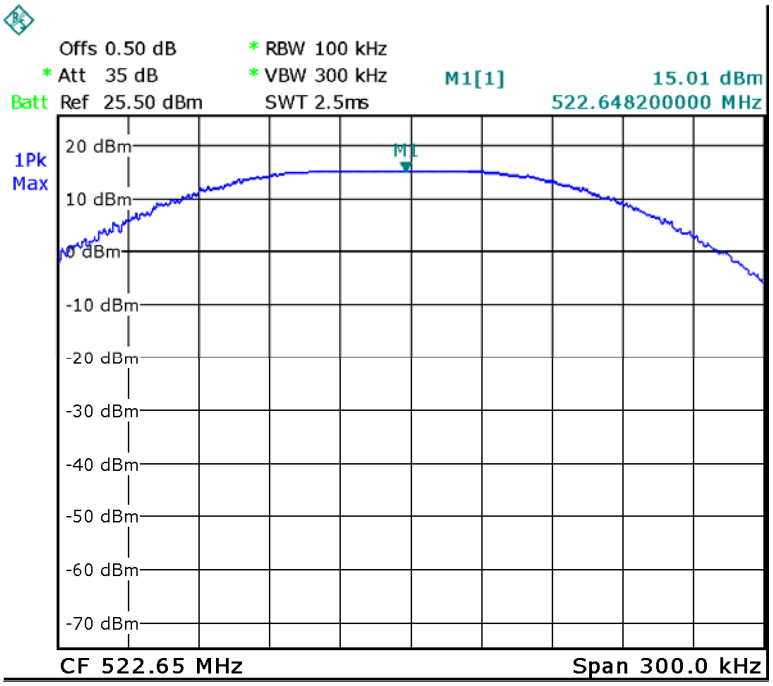


High Channel

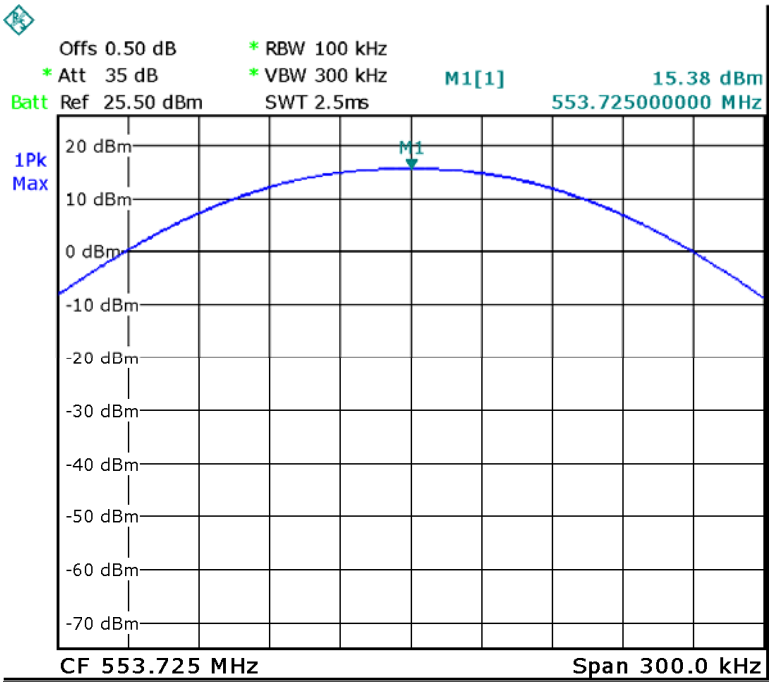


Please refer to following plot:

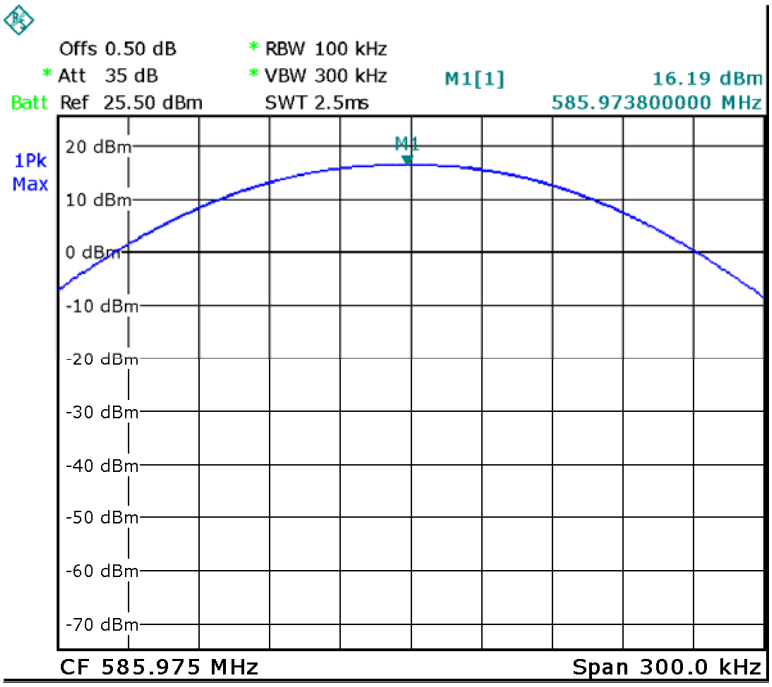
High Power
Low Channel



Middle Channel



High Channel



8 Modulation Characteristics

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

Test method: Based on ANSI/TIA-603-D:2010

Requirement: Any form of modulation may be used.

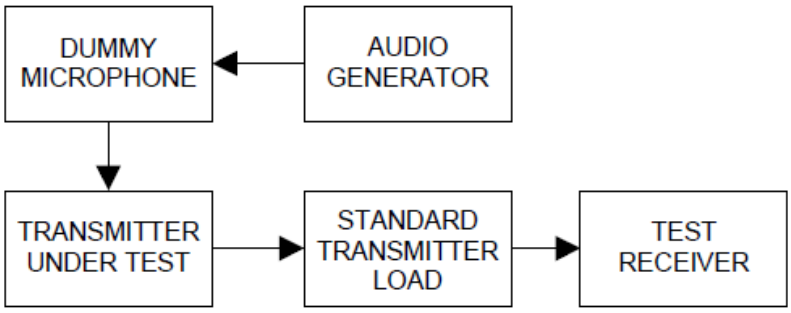
A maximum deviation of ±75kHz is permitted when frequency modulation is employed.

8.1 Test Procedure

Modulation Limiting (TIA-603D:2010 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.

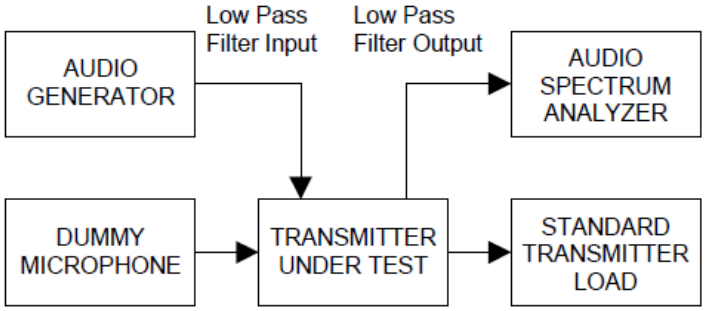
h) Set the test receiver to measure peak negative deviation and repeat steps d) through g).

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

Audio Low Pass Filter Response (TIA-603D:2010 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 $LEV_{REF.}$

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 LEV_{FREQ}.

i) Calculate the audio frequency response at the test frequency as:

$$low\ pass\ frequency\ response = LEV_{FREQ} - LEV_{REF}$$

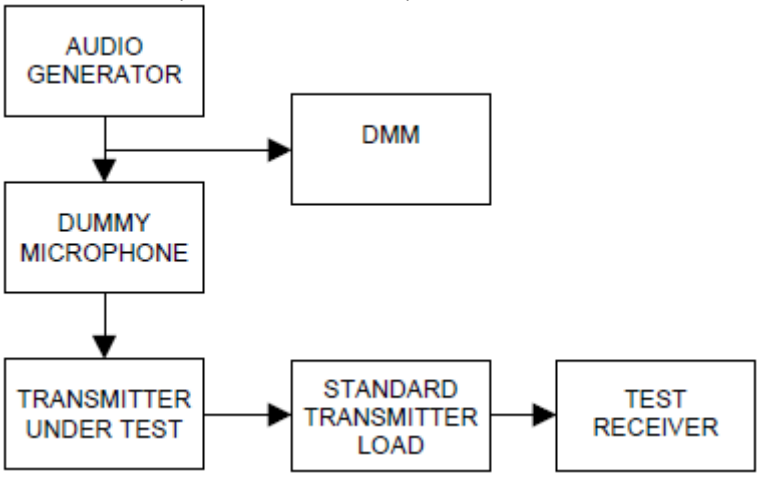
j) Repeat steps f) through i) for all the desired test frequencies.

Audio Frequency Response (TIA-603D:2010 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.

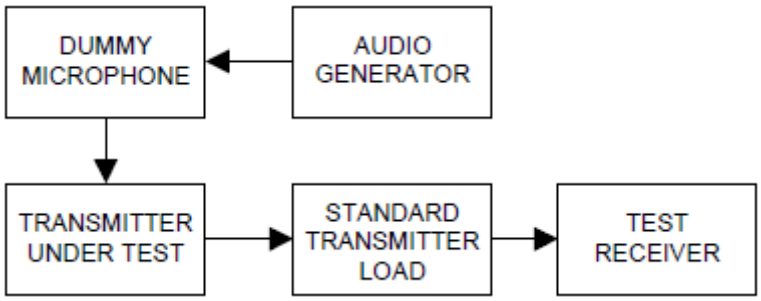
j) Record the DMM reading as VFREQ .

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:

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

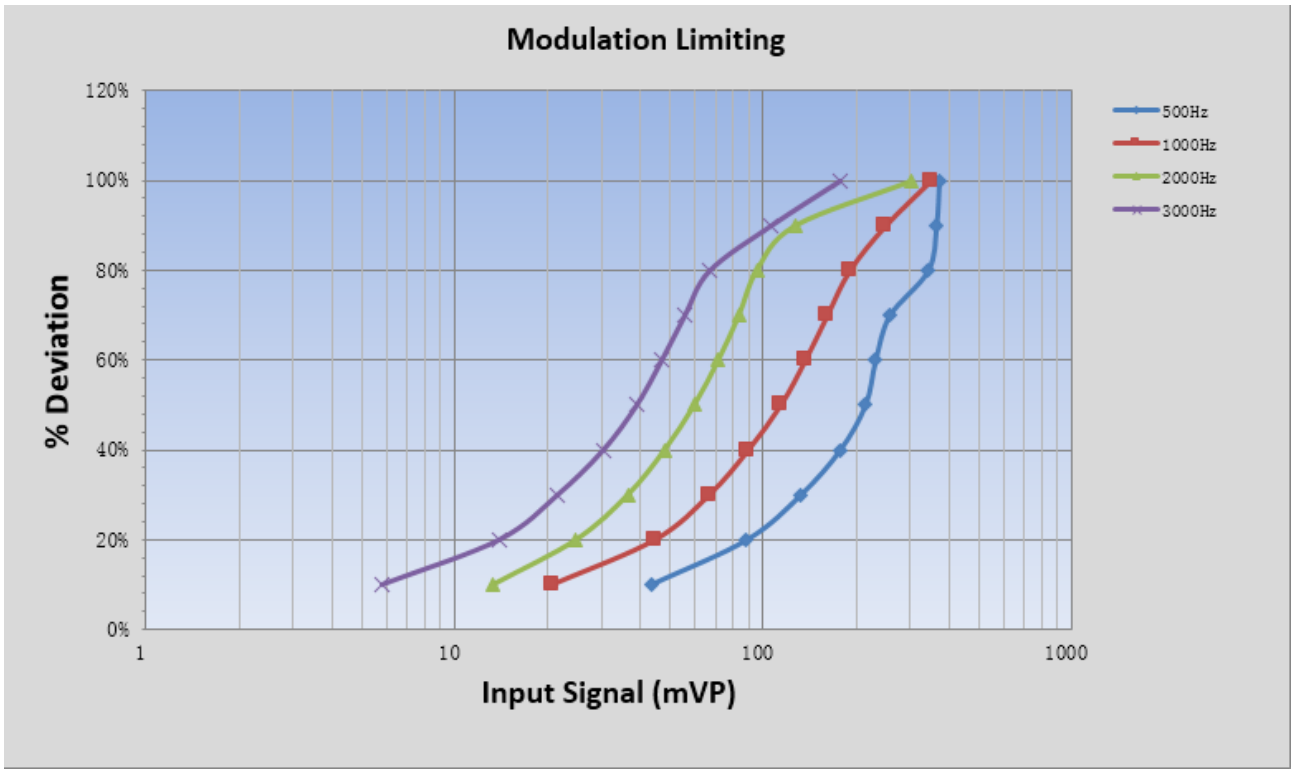
i) Repeat steps f) through h) for all the desired test frequencies.

8.2 Test Result

Modulation Limiting Test Result

Middle Channel

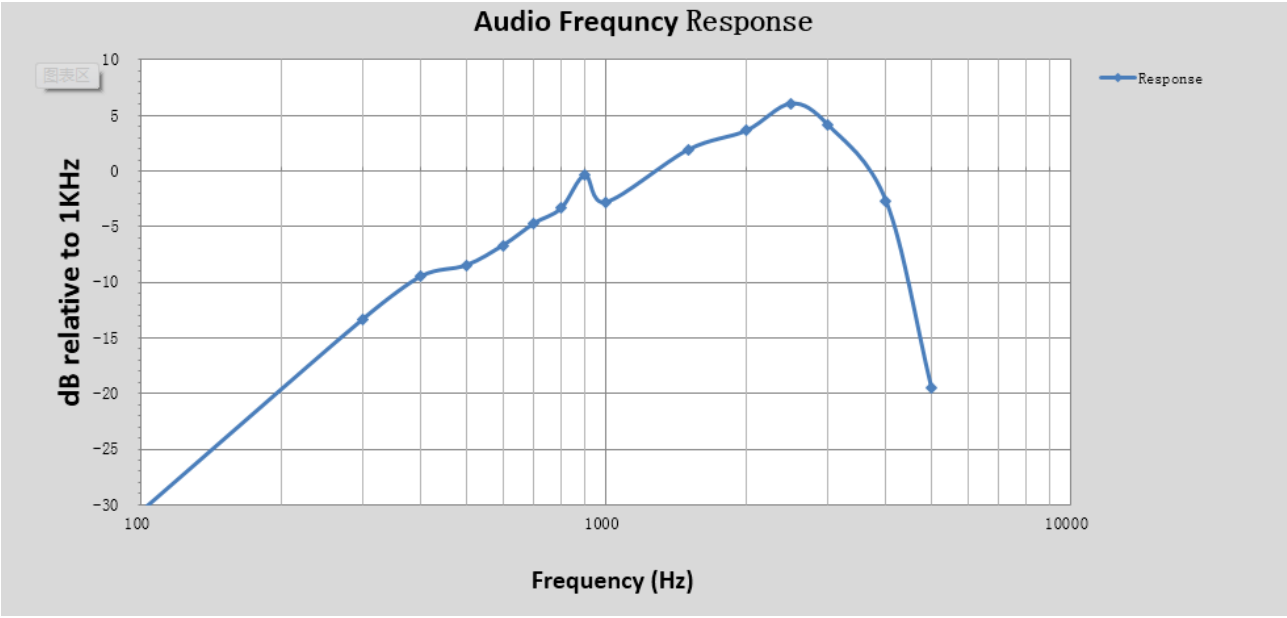
% Deviation	Input Signal (mVP)			
	500 Hz	1000 Hz	2000 Hz	3000 Hz
10%	43	21	13	6
20%	88	44	25	14
30%	132	67	36	22
40%	177	89	48	30
50%	214	114	60	39
60%	231	137	72	47
70%	257	161	83	56
80%	342	190	95	67
90%	364	248	127	106
100%	371	348	302	177



Audio Frequency Response Test Result

Middle channel

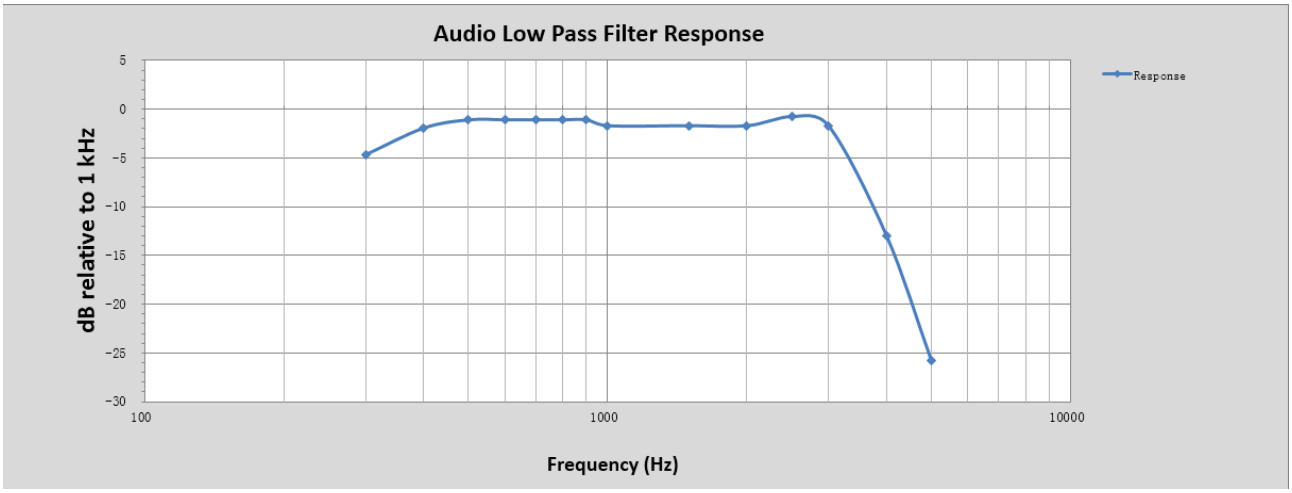
Frequency(Hz)	Audio Frequency Response(Hz)	Audio Frequency Response(dB)
100	29	-30.6
300	188	-13.3
400	319	-9.5
500	388	-8.5
600	458	-6.7
700	528	-4.7
800	599	-3.4
900	659	-0.4
1000	739	-2.8
1500	1118	1.9
2000	1479	3.6
2500	1838	6.1
3000	1978	4.1
4000	639	-2.8
5000	109	-19.5



Audio Low Pass Filter Response Test Result

Middle channel

Frequency(Hz)	Audio Frequency Response(Hz)	Audio Frequency Response(dB)
300	1042	-4.7
400	1411	-2.0
500	1473	-1.1
600	1473	-1.1
700	1473	-1.1
800	1473	-1.1
900	1473	-1.1
1000	1483	-1.7
1500	1483	-1.7
2000	1483	-1.7
2500	1532	-0.8
3000	1423	-1.8
4000	373	-13.0
5000	55	-25.8



9 Occupied Bandwidth of Emission

Test requirement: FCC CFR47 Part 2 Section 2.1049©(1)

Test method: Based on ANSI/TIA-603-D:2010

Limit: According to FCC 74.861 (e)(5), the frequency emission bandwidth shall not exceed 200 kHz.

9.1 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.

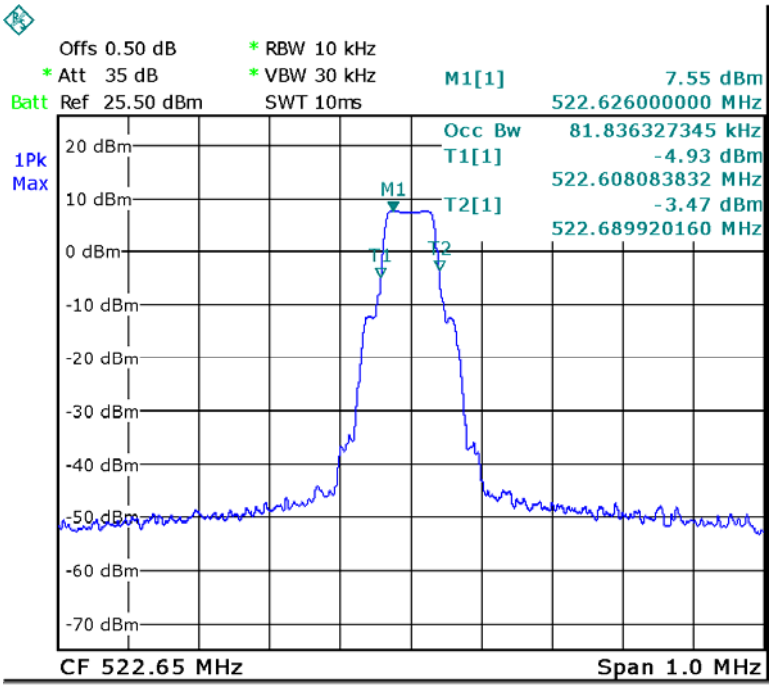
9.2 Test Result

power	Test Channel	99% Bandwidth (kHz)	Limit (kHz)	Result
Low	Low Channel	81.836	200	PASS
	Middle Channel	83.832	200	PASS
	High Channel	79.840	200	PASS
High	Low Channel	77.844	200	PASS
	Middle Channel	75.848	200	PASS
	High Channel	81.836	200	PASS

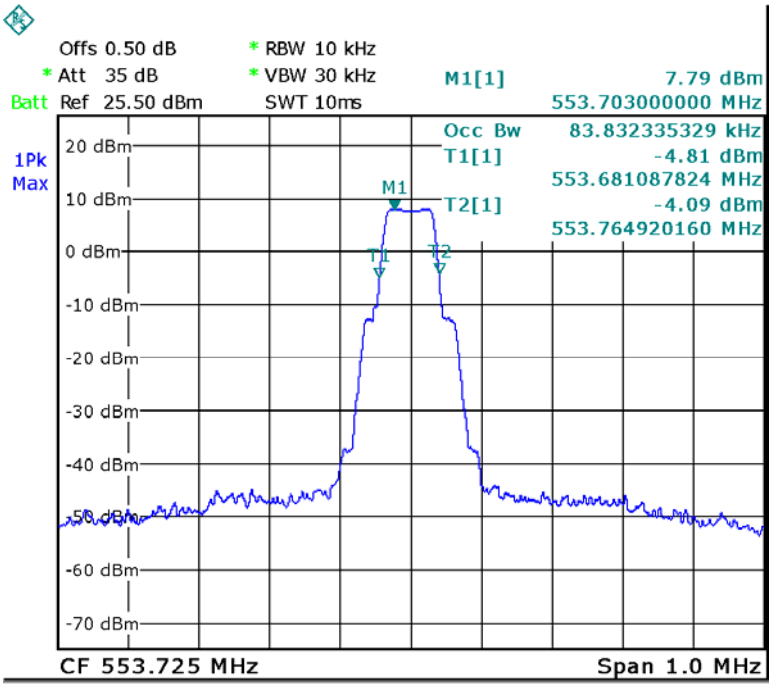
Test Plot:

Low power

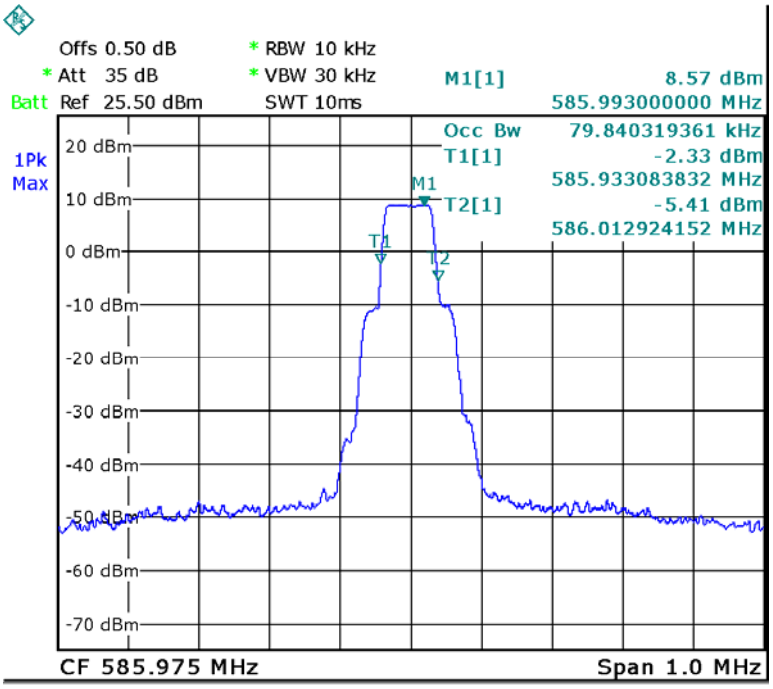
Low Channel



Middle Channel



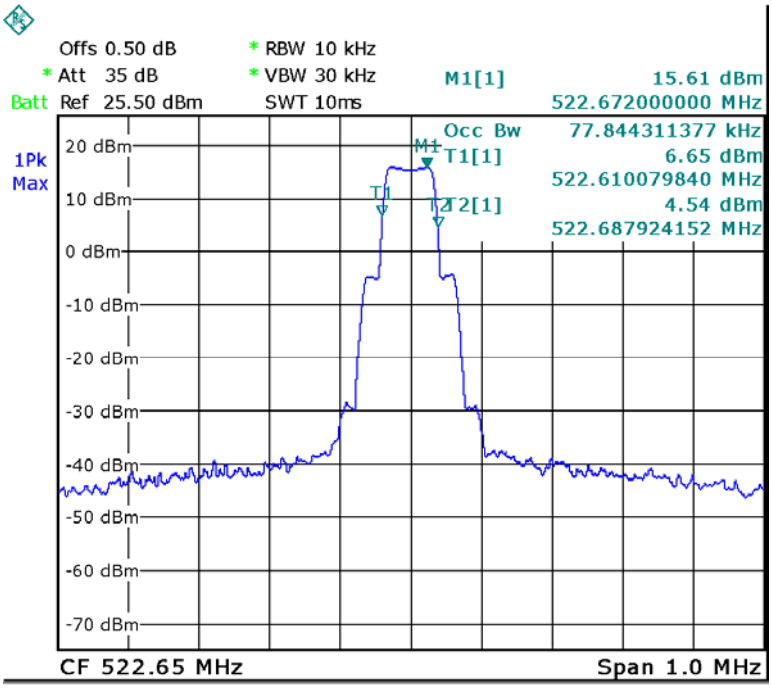
High Channel



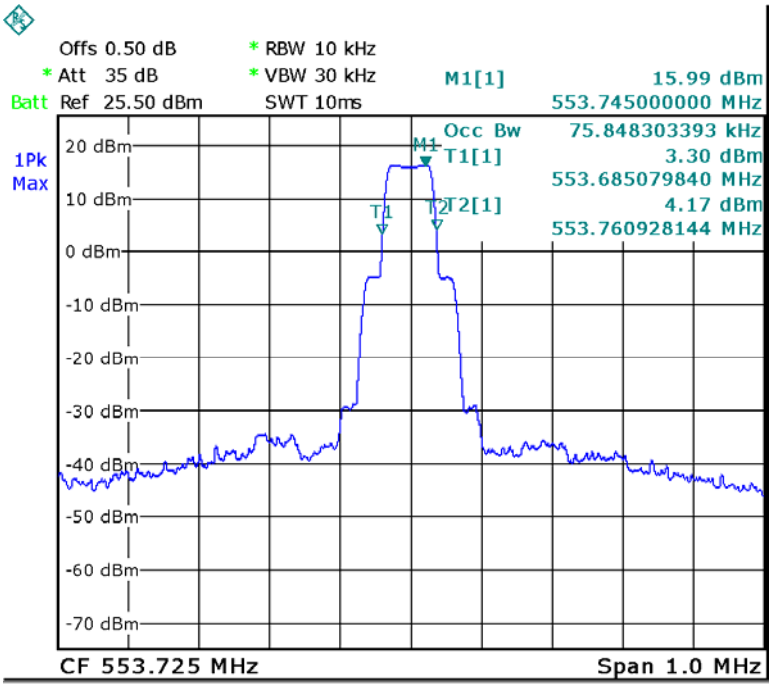
Test Plot:

High power

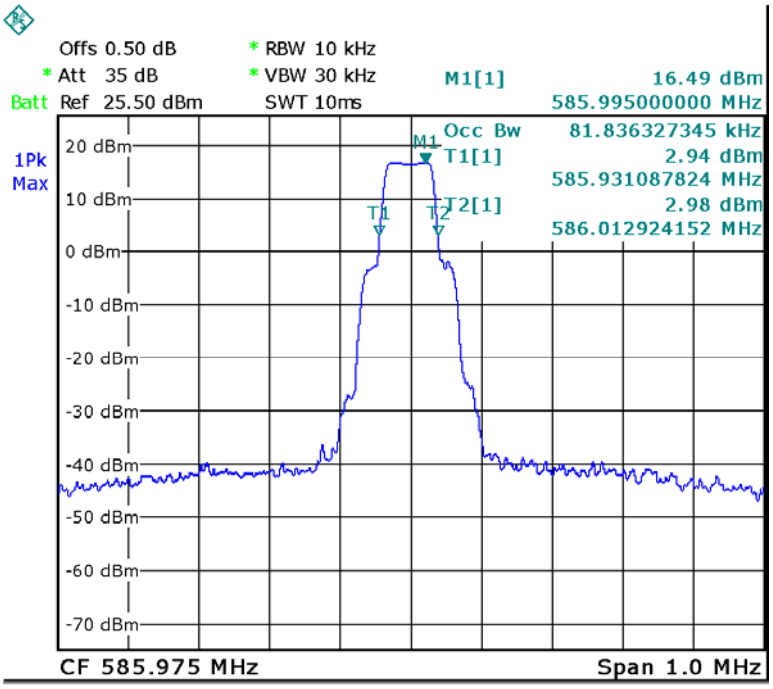
Low Channel



Middle Channel



High Channel



10 Spurious Emissions at Antenna Terminals

Test requirement:	FCC CFR47 Part 2 Section 2.1053
Test method:	Based on ANSI/TIA-603-D:2010
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.

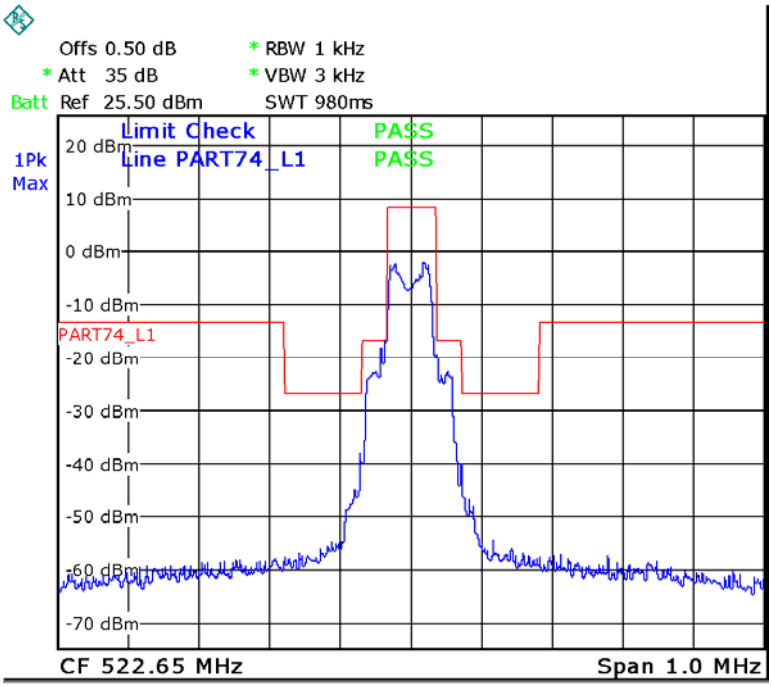
10.1 Test Procedure

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.

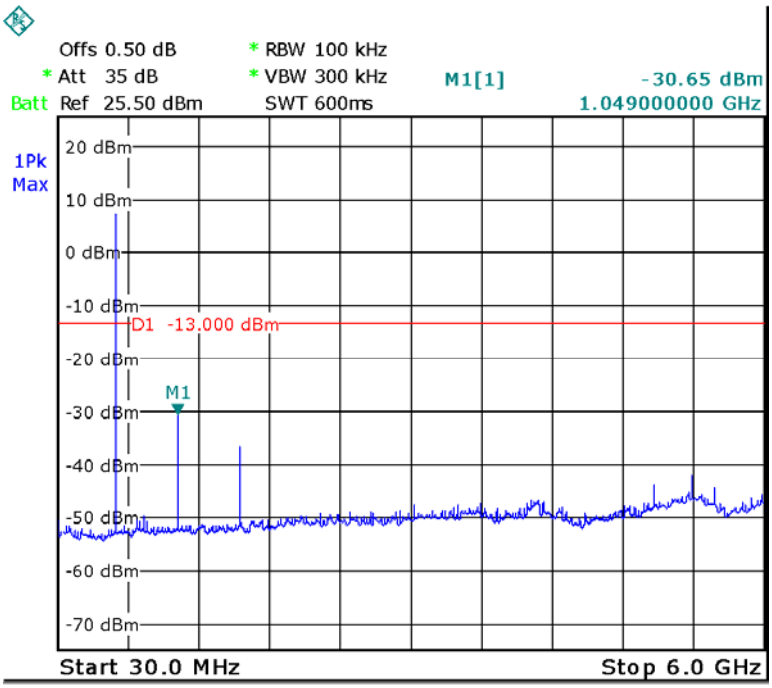
10.2 Test Data

Low Power Emission Mask

Low Channel

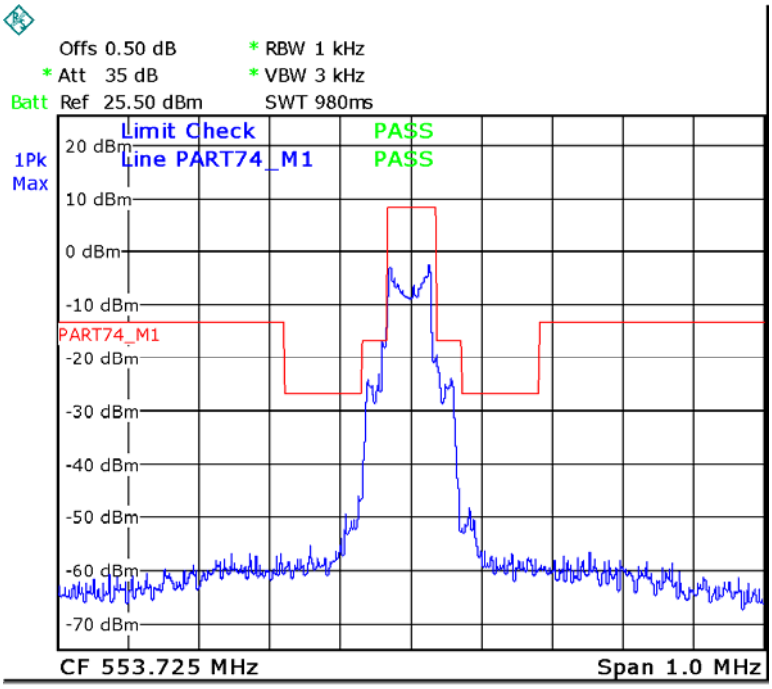


30MHz-6GHz

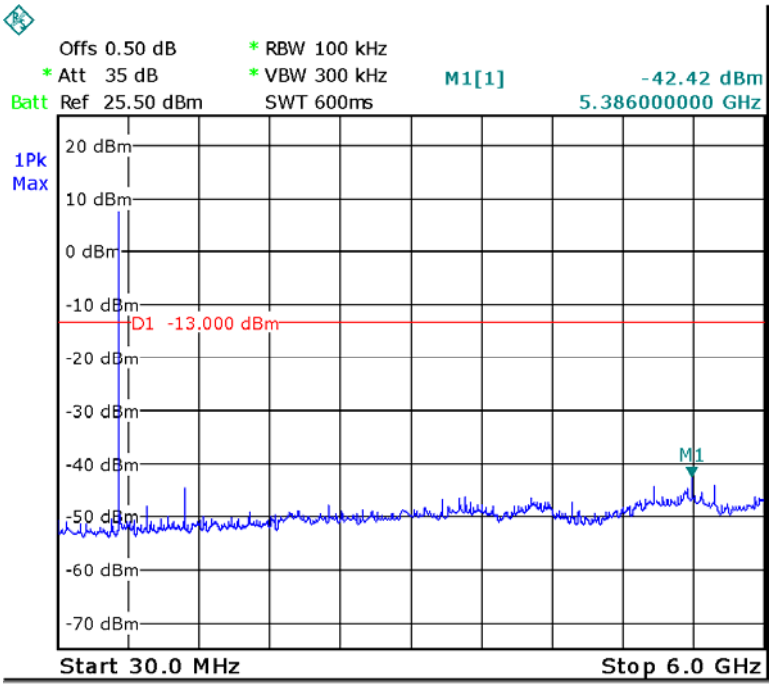


Low Power Emission Mask

Middle Channel

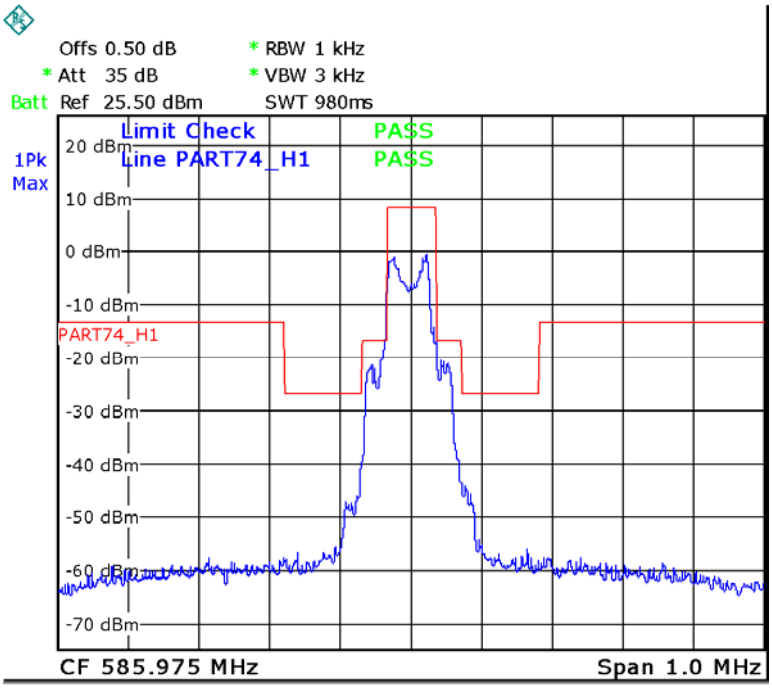


30MHz-6GHz

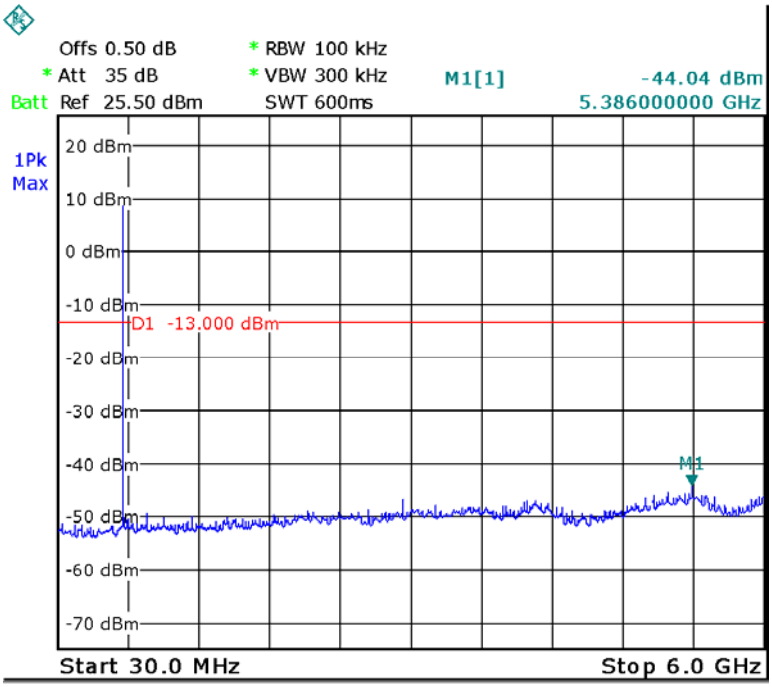


Low Power Emission Mask

High Channel

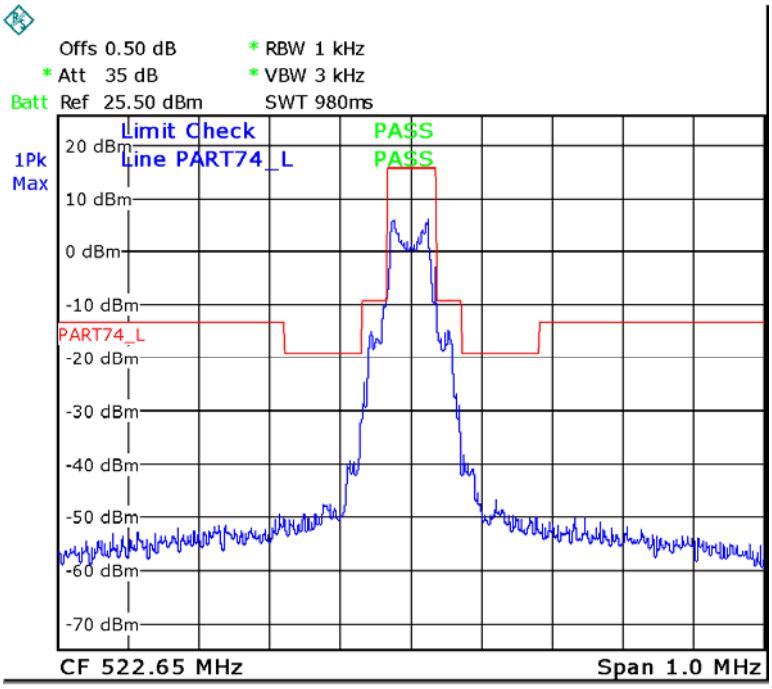


30MHz-6GHz

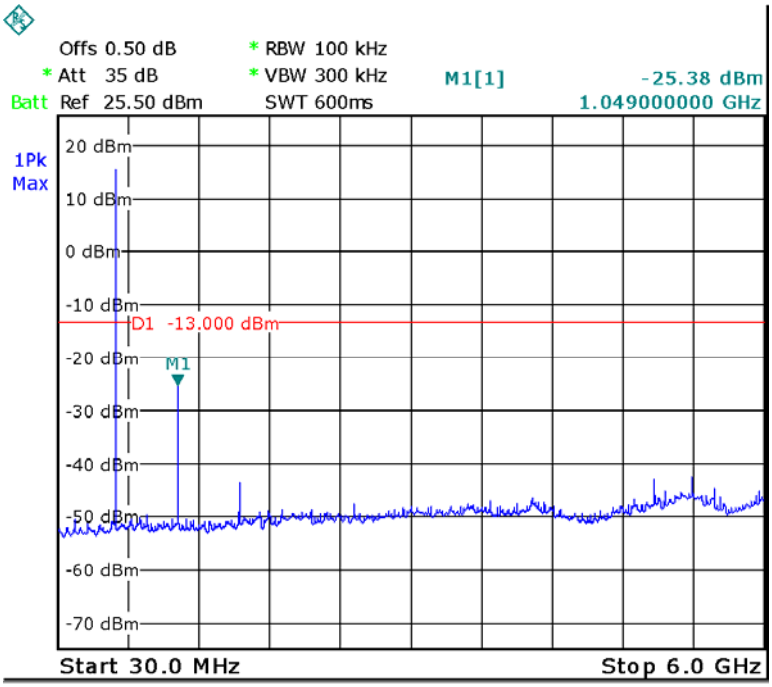


High Power Emission Mask

Low Channel

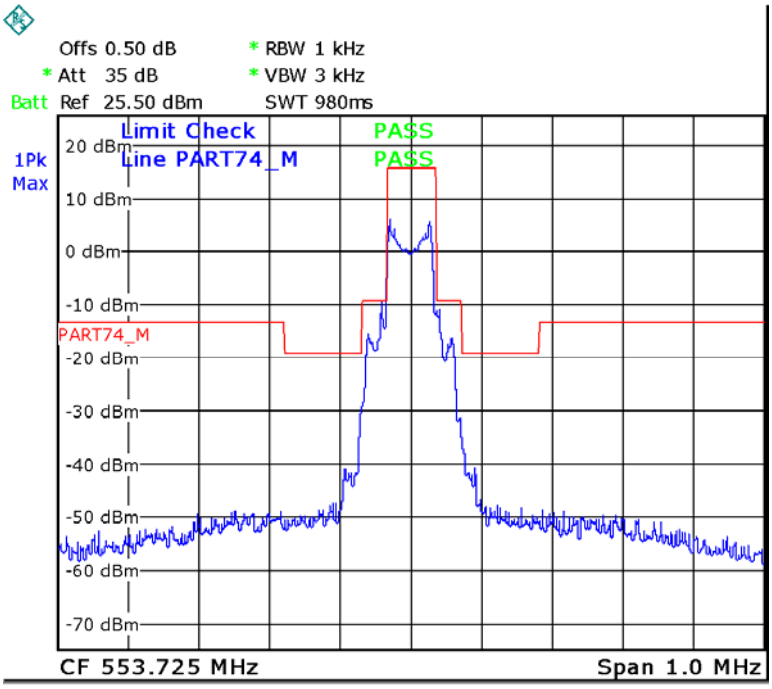


30MHz-6GHz

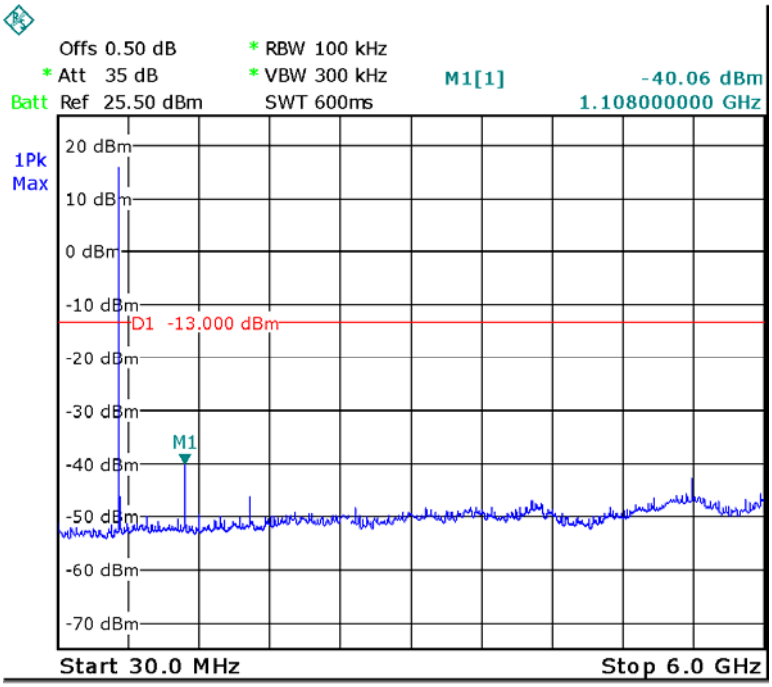


High Power Emission Mask

Middle Channel

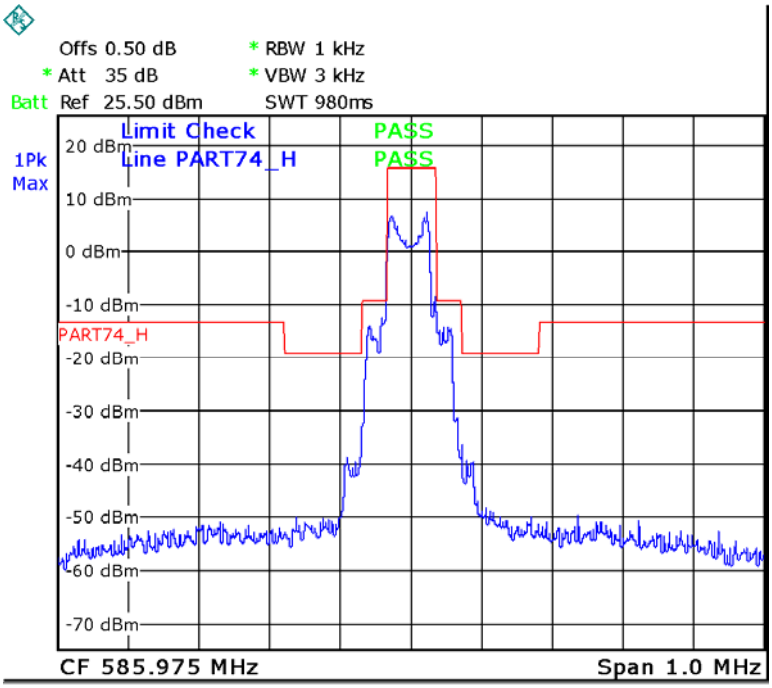


30MHz-6GHz

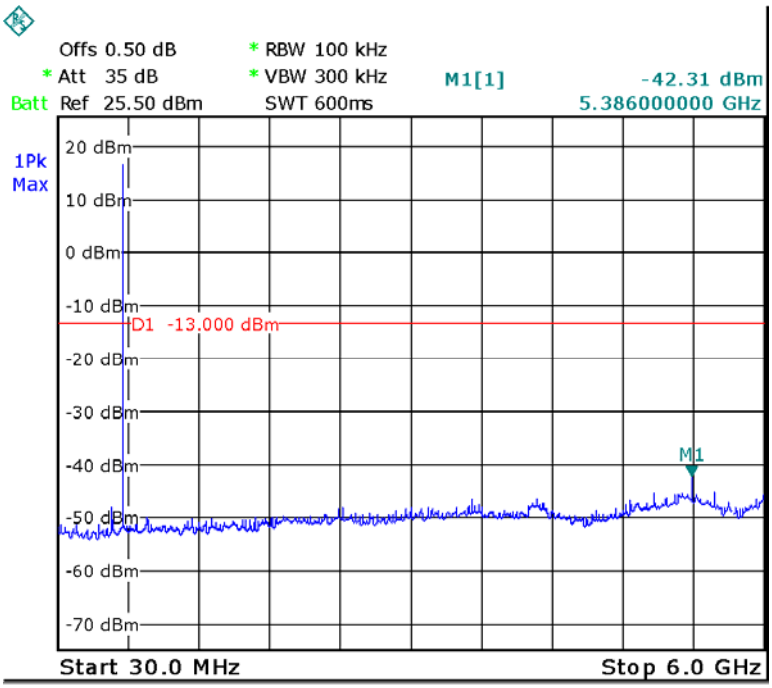


High Power Emission Mask

High Channel



30MHz-1GHz



11 Conducted Emissions

Test Requirement: FCC CFR 47 Part 15 Section 15.207

Test Method: ANSI C63.10:2013,ANSI C63.4:2014

Test Result: PASS

Frequency Range: 150kHz to 30MHz

Class/Severity: Class B

Limit:

Frequency (MHz)	Conducted Limit (dBμV)	
	Qsi-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.		

11.1 E.U.T. Operation

Operating Environment **:**

Temperature: 25.5 °C

Humidity: 51 % RH

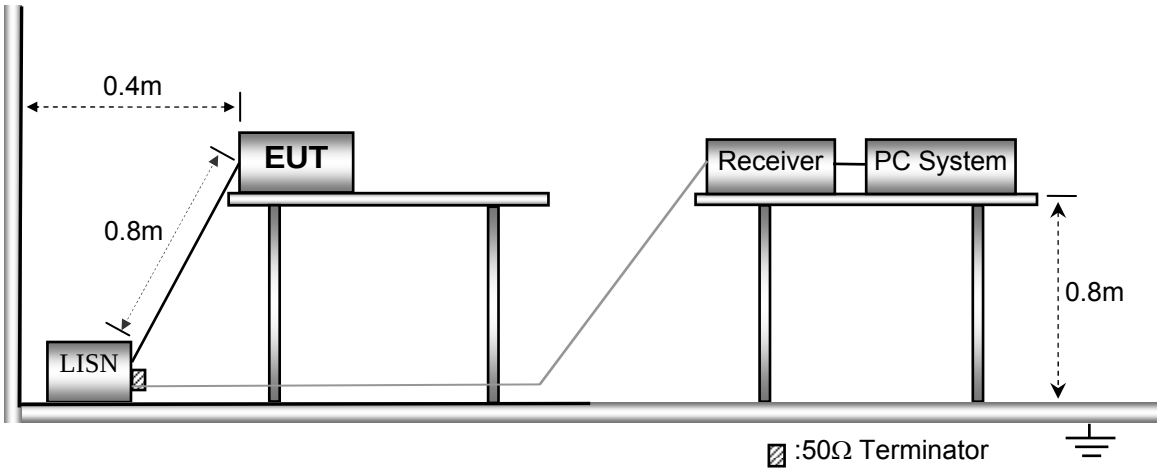
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

Refer to section 4.4

11.2 EUT Setup

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

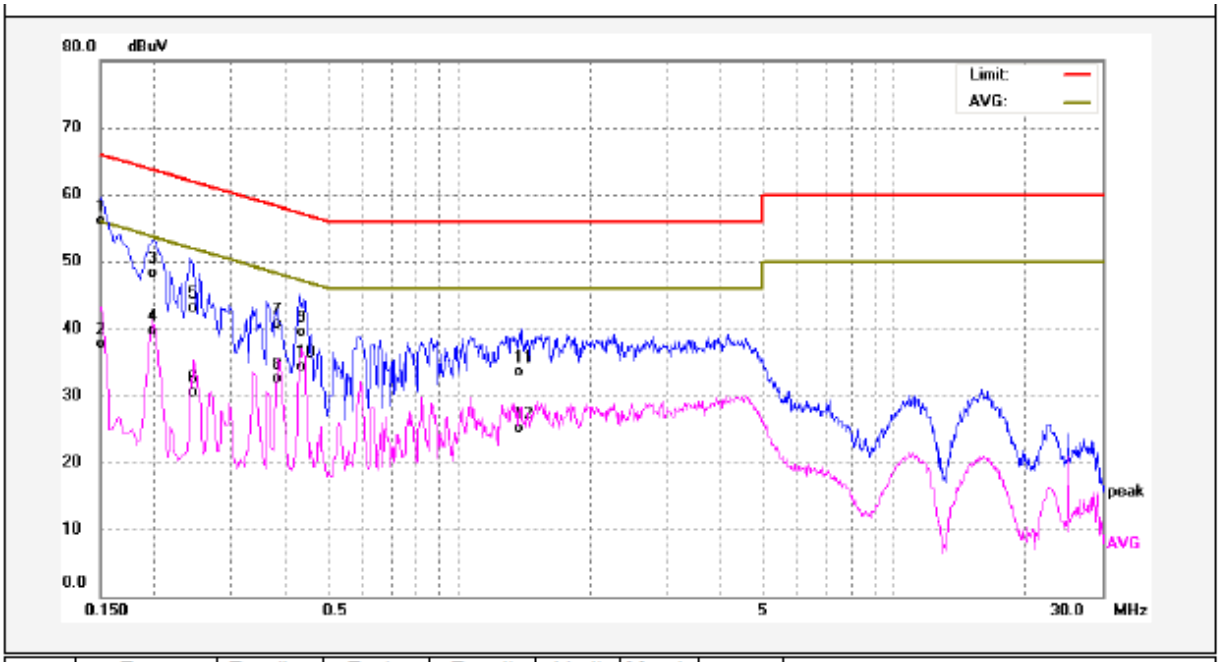


11.3 Measurement Description

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.

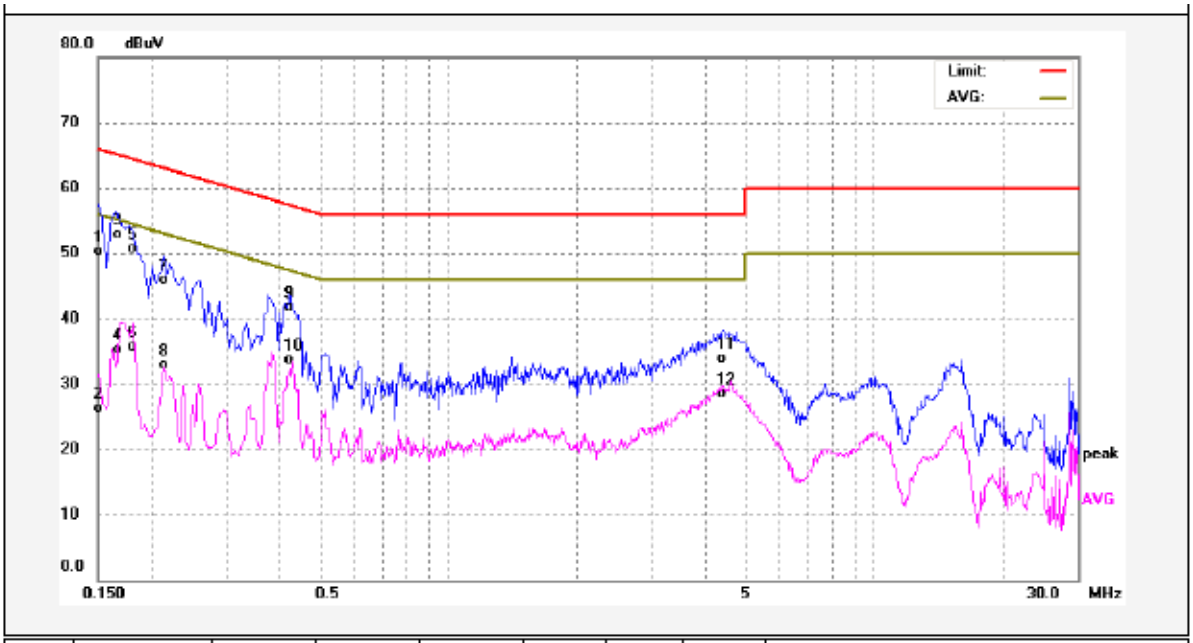
11.4 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	46.14	10.06	56.20	65.99	-9.79	QP	
2	0.1500	27.58	10.06	37.64	55.99	-18.35	AVG	
3	0.1980	38.51	9.87	48.38	63.69	-15.31	QP	
4	0.1980	29.91	9.87	39.78	53.69	-13.91	AVG	
5	0.2420	33.13	9.99	43.12	62.02	-18.90	QP	
6	0.2420	20.42	9.99	30.41	52.02	-21.61	AVG	
7	0.3820	30.59	10.04	40.63	58.23	-17.60	QP	
8	0.3820	22.42	10.04	32.46	48.23	-15.77	AVG	
9	0.4420	29.37	10.05	39.42	57.02	-17.60	QP	
10	0.4420	24.27	10.05	34.32	47.02	-12.70	AVG	
11	1.3900	23.43	10.11	33.54	56.00	-22.46	QP	
12	1.3900	15.09	10.11	25.20	46.00	-20.80	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	40.33	10.06	50.39	65.99	-15.60	QP	
2	0.1500	16.28	10.06	26.34	55.99	-29.65	AVG	
3	0.1660	43.07	9.90	52.97	65.15	-12.18	QP	
4	0.1660	25.48	9.90	35.38	55.15	-19.77	AVG	
5	0.1787	40.76	9.86	50.62	64.54	-13.92	QP	
6	0.1787	25.94	9.86	35.80	54.54	-18.74	AVG	
7	0.2140	35.94	9.91	45.85	63.04	-17.19	QP	
8	0.2140	23.05	9.91	32.96	53.04	-20.08	AVG	
9	0.4220	31.59	10.04	41.63	57.41	-15.78	QP	
10	0.4220	23.72	10.04	33.76	47.41	-13.65	AVG	
11	4.4100	23.63	10.26	33.89	56.00	-22.11	QP	
12	4.4100	18.28	10.26	28.54	46.00	-17.46	AVG	

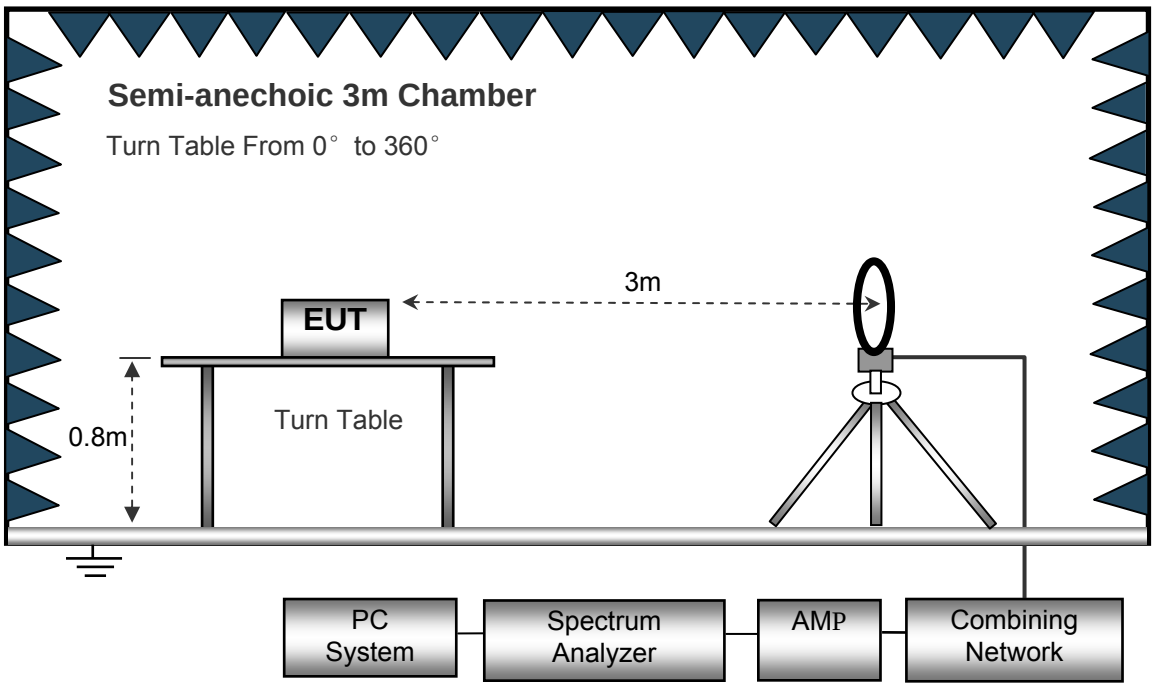
12 Radiated Emission Test

Test requirement:	FCC CFR47 Part 2 Section 2.1053
Test method:	Based on ANSI/TIA-603-D:2010
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.

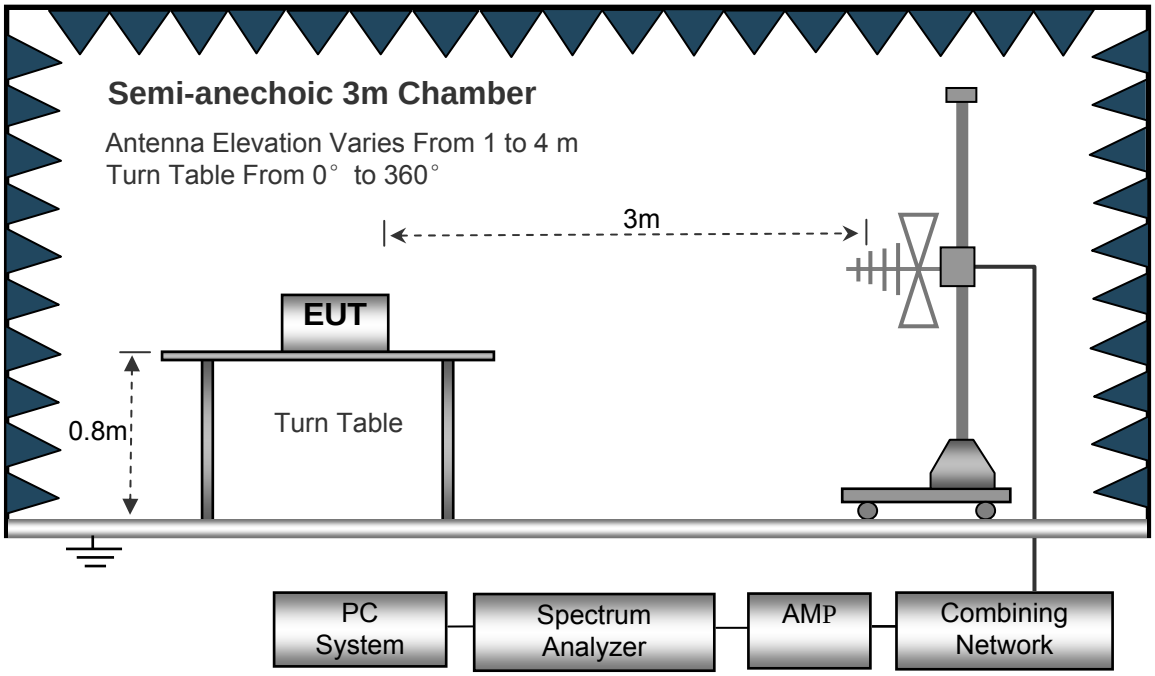
12.1 EUT Setup

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

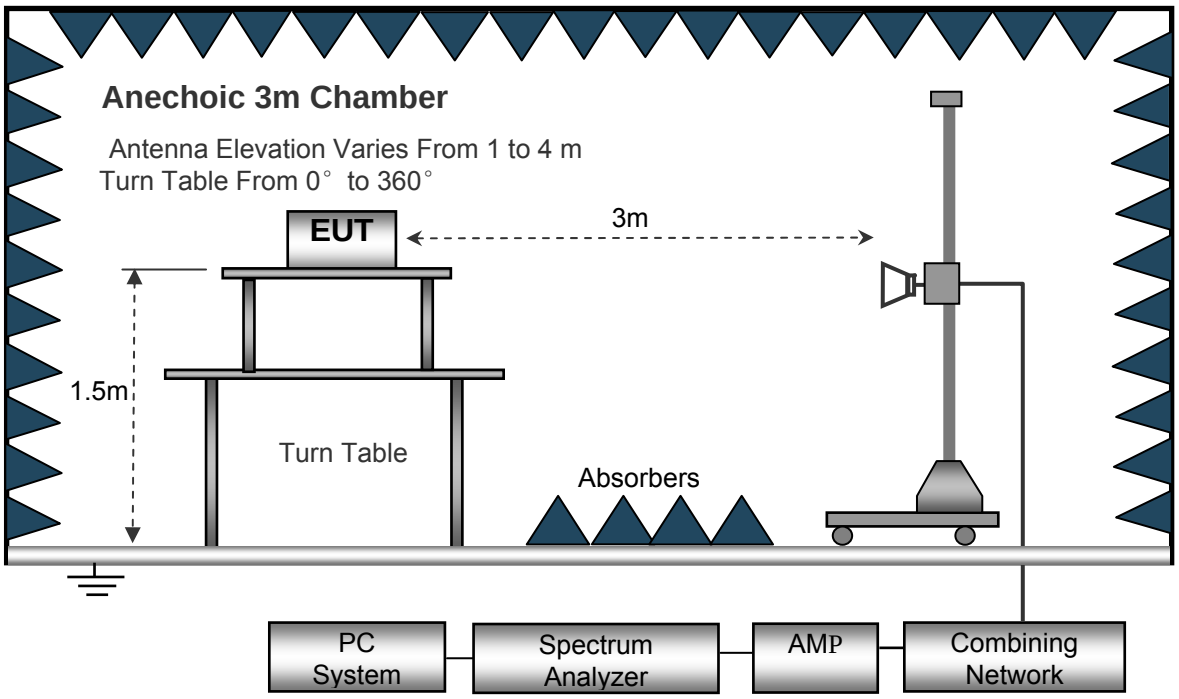
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 KHz to 30 MHz Emissions.



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 16MHz to 6000MHz.

9kHz ~ 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. For below 1GHz, the EUT is 0.8m above ground plane; For above1GHz, the EUT 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.

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

Low Power

Frequency (MHz)	Detector	Ant. Pol	Antenna Height (m)	Turntable Angle (°)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
Low Channel:522.650MHz							
1045.30	Peak	H	1.4	135	-42.21	-13	-29.21
1045.30	Peak	V	1.1	137	-43.04	-13	-30.04
1567.95	Peak	H	2.0	355	-44.36	-13	-31.36
1567.95	Peak	V	1.9	175	-45.68	-13	-32.68
2090.60	Peak	H	1.4	21	-45.94	-13	-32.94
2090.60	Peak	V	1.9	299	-46.34	-13	-33.34
Middle Channel:553.725MHz							
1107.45	Peak	H	1.7	217	-42.90	-13	-29.90
1107.45	Peak	V	1.4	14	-42.64	-13	-29.64
1661.18	Peak	H	1.2	173	-46.96	-13	-33.96
1661.18	Peak	V	1.8	25	-43.32	-13	-30.32
2214.90	Peak	H	1.0	62	-42.71	-13	-29.71
2214.90	Peak	V	1.2	102	-46.31	-13	-33.31
High Channel:585.975MHz							
1171.95	Peak	H	1.0	210	-44.32	-13	-31.32
1171.95	Peak	V	1.5	202	-47.31	-13	-34.31
1757.93	Peak	H	1.1	86	-47.63	-13	-34.63
1757.93	Peak	V	1.8	87	-42.36	-13	-29.36
2343.90	Peak	H	1.1	178	-44.31	-13	-31.31
2343.90	Peak	V	2.0	106	-47.36	-13	-34.36

High Power

Frequency (MHz)	Detector	Ant. Pol	Antenna Height (m)	Turntable Angle (°)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
Low Channel:522.650MHz							
1045.30	Peak	H	1.2	201	-41.36	-13	-28.36
1045.30	Peak	V	1.6	95	-42.39	-13	-29.39
1567.95	Peak	H	1.1	328	-44.74	-13	-31.74
1567.95	Peak	V	1.8	269	-45.11	-13	-32.11
2090.60	Peak	H	1.4	335	-44.12	-13	-31.12
2090.60	Peak	V	1.9	217	-43.39	-13	-30.39
Middle Channel:553.725MHz							
1107.45	Peak	H	1.6	321	-42.18	-13	-29.18
1107.45	Peak	V	1.1	131	-43.64	-13	-30.64
1661.18	Peak	H	1.8	307	-46.58	-13	-33.58
1661.18	Peak	V	1.5	105	-44.29	-13	-31.29
2214.90	Peak	H	1.6	231	-43.66	-13	-30.66
2214.90	Peak	V	1.1	350	-45.32	-13	-32.32
High Channel:585.975MHz							
1171.95	Peak	H	1.8	315	-44.34	-13	-31.34
1171.95	Peak	V	1.0	113	-47.36	-13	-34.36
1757.93	Peak	H	1.4	250	-48.31	-13	-35.31
1757.93	Peak	V	1.8	330	-42.37	-13	-29.37
2343.90	Peak	H	1.4	143	-44.39	-13	-31.39
2343.90	Peak	V	1.9	294	-48.36	-13	-35.36

The measurements below 1G were more than 20 dB below the limit and not reported.

13 Frequency Stability

Test requirement:	FCC CFR47 Part 2 Section 2.1055(a)(a)
Test method:	Based on ANSI/TIA-603-D:2010
Limit:	According to FCC 74.86(e)(4), the frequency tolerance of the transmitter shall be 0.005 percent.

13.1 Test Configuration

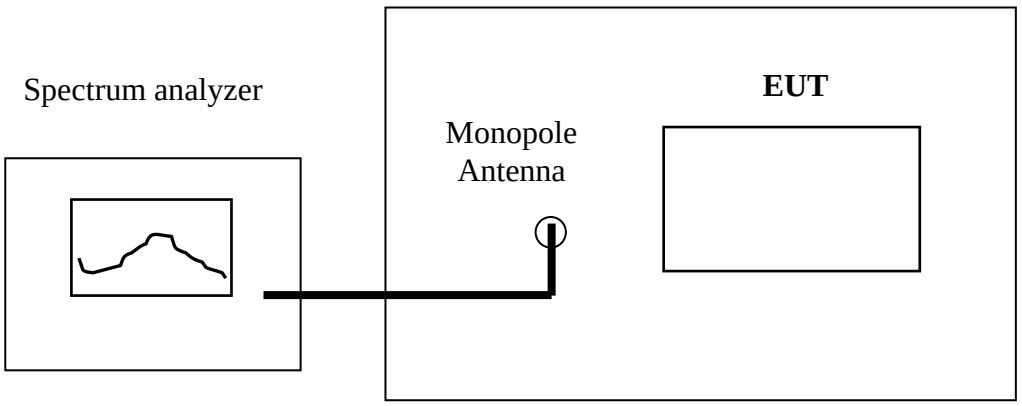


Figure 1

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 two 5# Non-rechargeable AA batteries. The nominal voltage is DC 3V .so we select the extreme condition ±10% according with TIA-C603D section 1.4.4.3. low voltage is 2.7V DC and high voltage is 3.3V DC.

Low Channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (ºC)	Frequency Measured	Frequency Tolerance (%)
2.7V，DC	522.650	20	522.646	0.00084
3.3V，DC	522.650	20	522.646	0.00067

Middle Channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (ºC)	Frequency Measured	Frequency Tolerance (%)
2.7V，DC	553.725	20	553.730	0.00088
3.3V，DC	553.725	20	553.730	0.00082

High Channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (ºC)	Frequency Measured	Frequency Tolerance (%)
2.7V，DC	585.975	20	585.973	0.00039
3.3V，DC	585.975	20	585.978	0.00043

c) Frequency stability versus environmental temperature

Low Channel:522.650MHz, Limit: 0.005%			
Environment Temperature(ºC)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3V，DC	522.654	0.00067
40	3V，DC	522.648	0.00040
30	3V，DC	522.646	0.00072
20	3V，DC	522.651	0.00019
10	3V，DC	522.651	0.00011
0	3V，DC	522.655	0.00098
-10	3V，DC	522.648	0.00040
-20	3V，DC	522.649	0.00017
-30	3V，DC	522.645	0.00094

Middle Channel: 553.725MHz, Limit: 0.005%			
Environment Temperature(ºC)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3V，DC	553.728	0.00061
40	3V，DC	553.729	0.00069
30	3V，DC	553.721	0.00066
20	3V，DC	553.719	0.00101
10	3V，DC	553.730	0.00098
0	3V，DC	553.727	0.00041
-10	3V，DC	553.724	0.00012
-20	3V，DC	553.726	0.00023
-30	3V，DC	553.723	0.00032

High Channel: 585.975MHz, Limit: 0.005%			
Environment Temperature(ºC)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3V，DC	585.978	0.00058
40	3V，DC	585.979	0.00063
30	3V，DC	585.969	0.00102
20	3V，DC	585.973	0.00028
10	3V，DC	585.973	0.00037
0	3V，DC	585.971	0.00064
-10	3V，DC	585.978	0.00054
-20	3V，DC	585.974	0.00017
-30	3V，DC	585.973	0.00034

Test Result: The max frequency tolerance rating is 0.00102% < 0.005%. Passed.

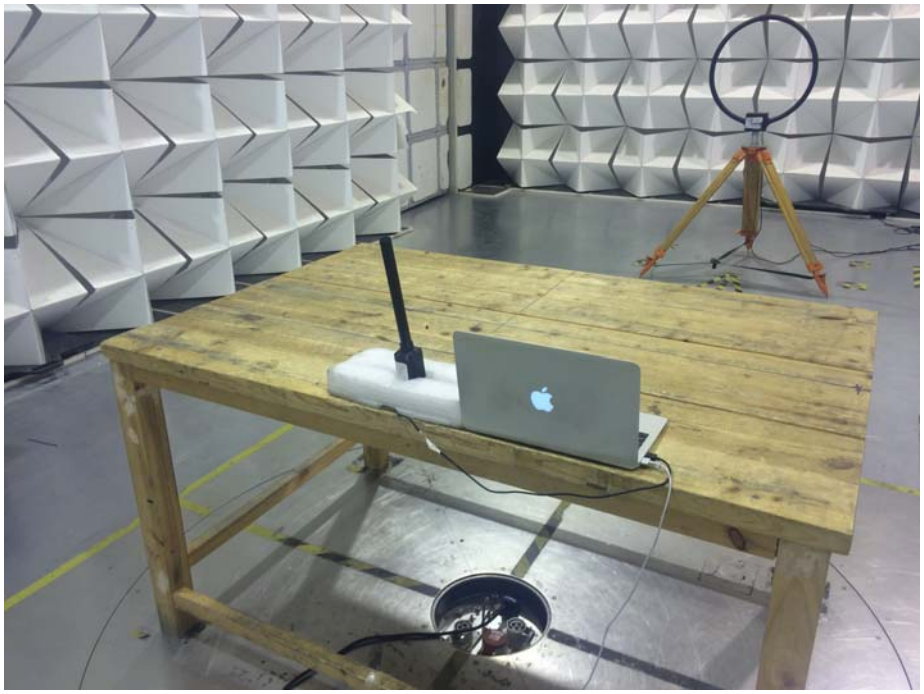
14 RF Exposure

Remark: refer to WTS17S0372802-2E SAR Test Report

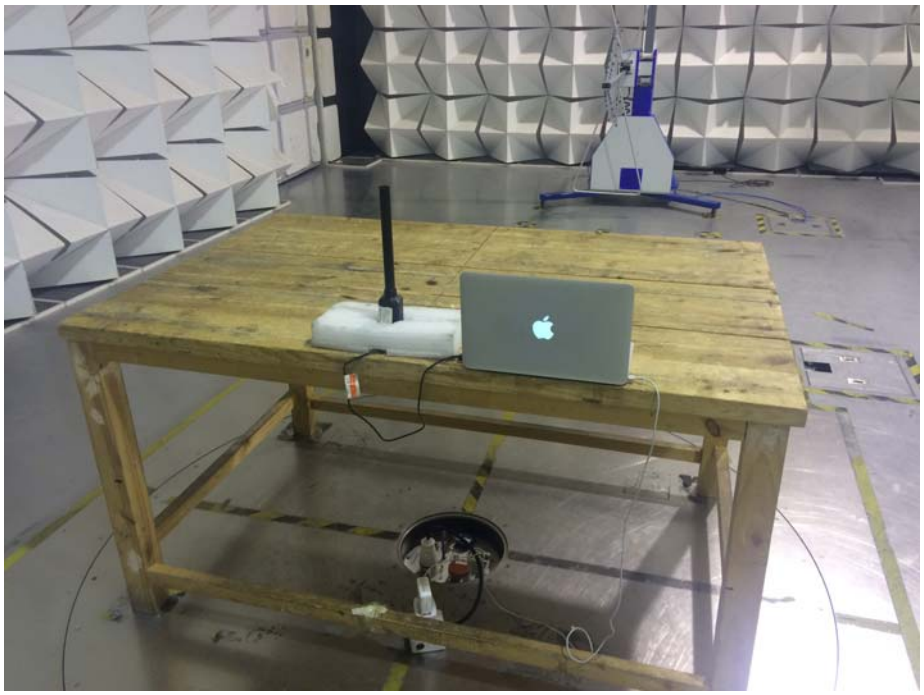
15 Photographs –Model AWS-2000P Test Setup

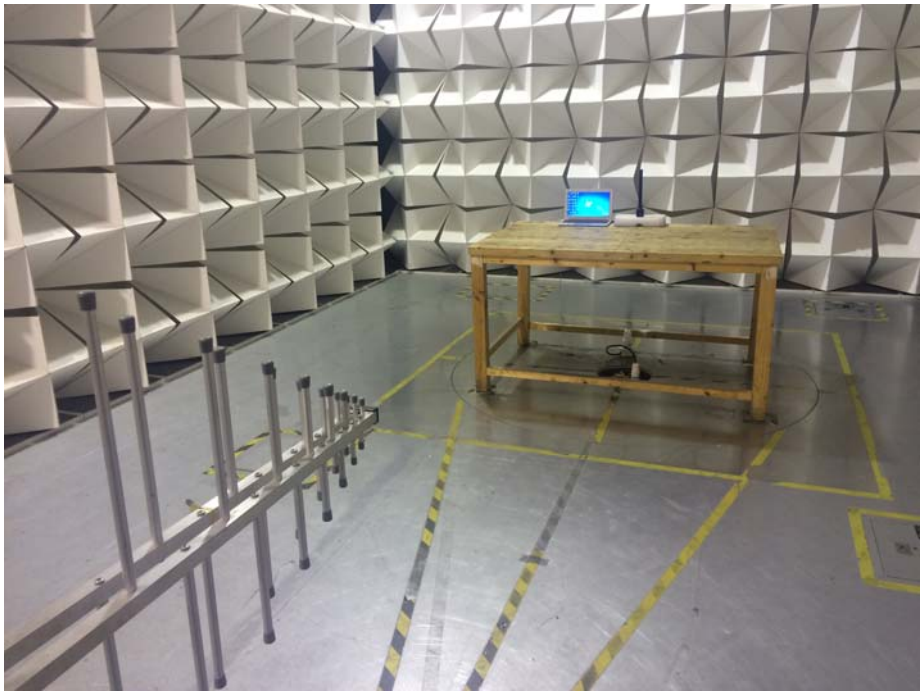
15.1 Photograph – Radiation Spurious Emission Test Setup

9KHz~30MHz

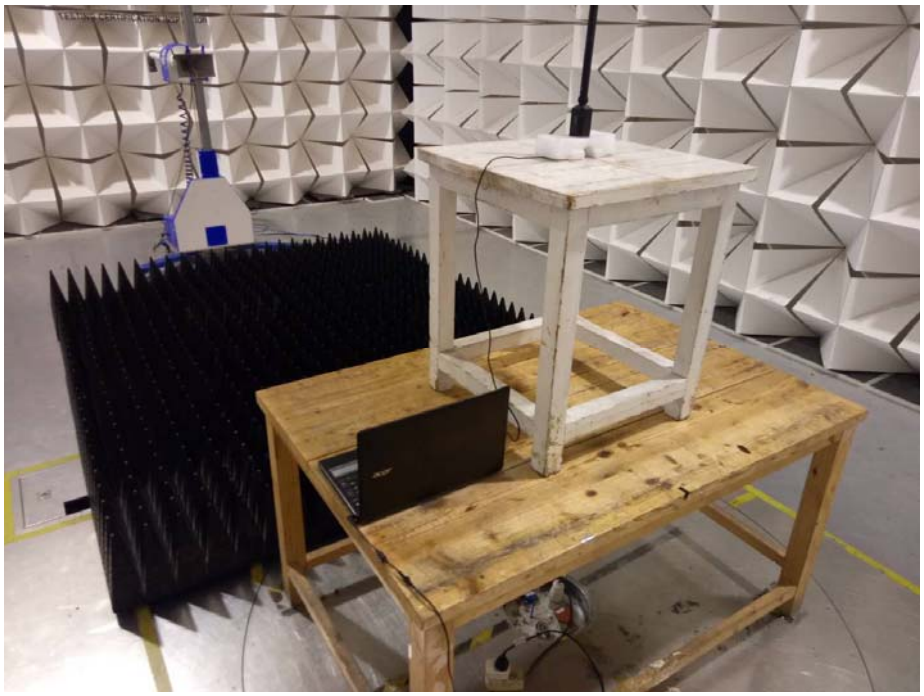


30MHz-1GHz





1GHz-6GHz



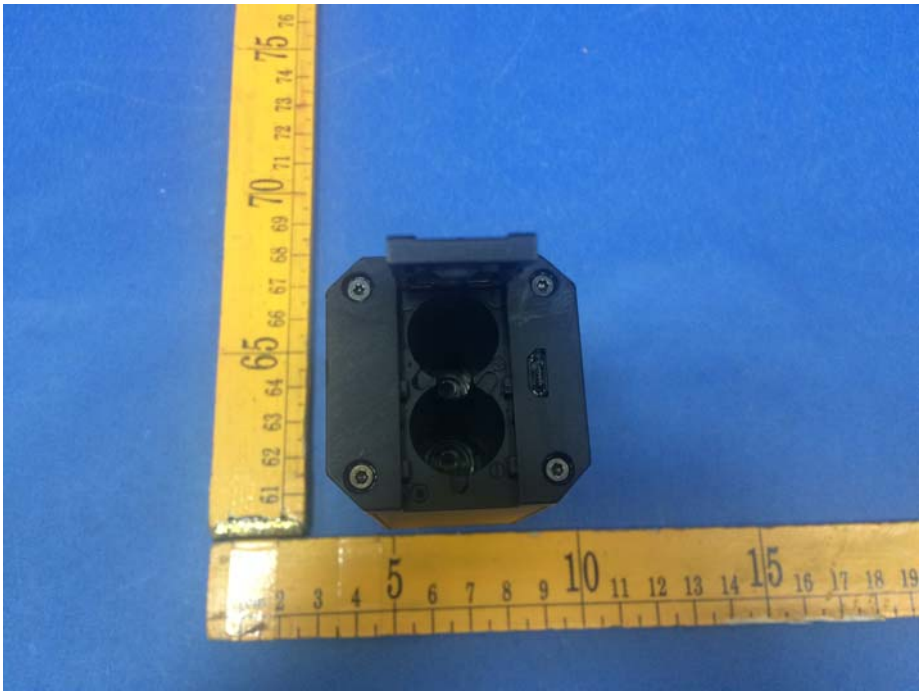
15.2 Photograph – Conducted Emissions Test Setup

16 Photographs – Constructional Details

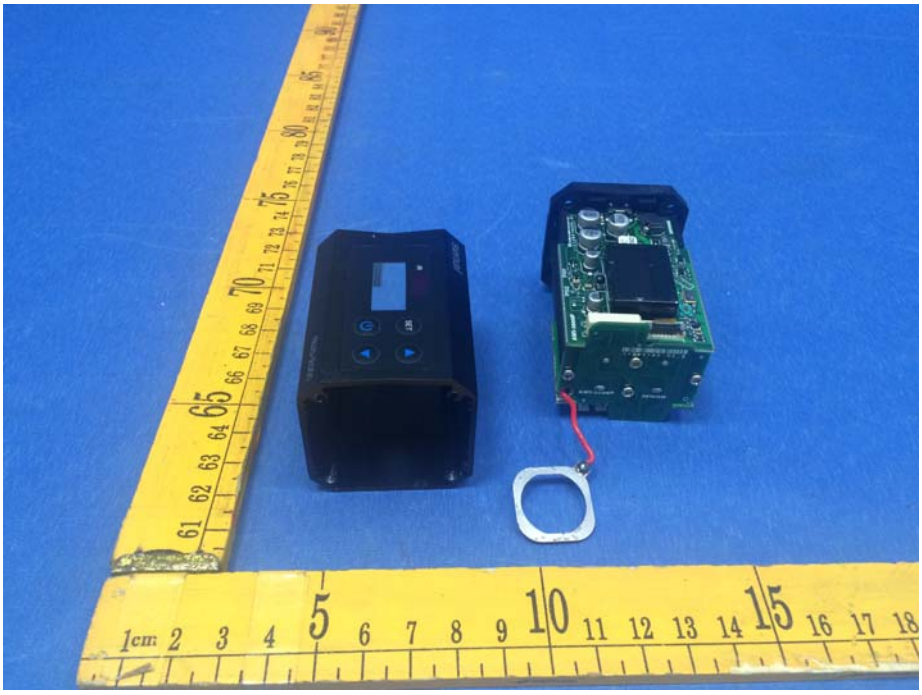
16.1 EUT –Model AWS-2000P External Photos

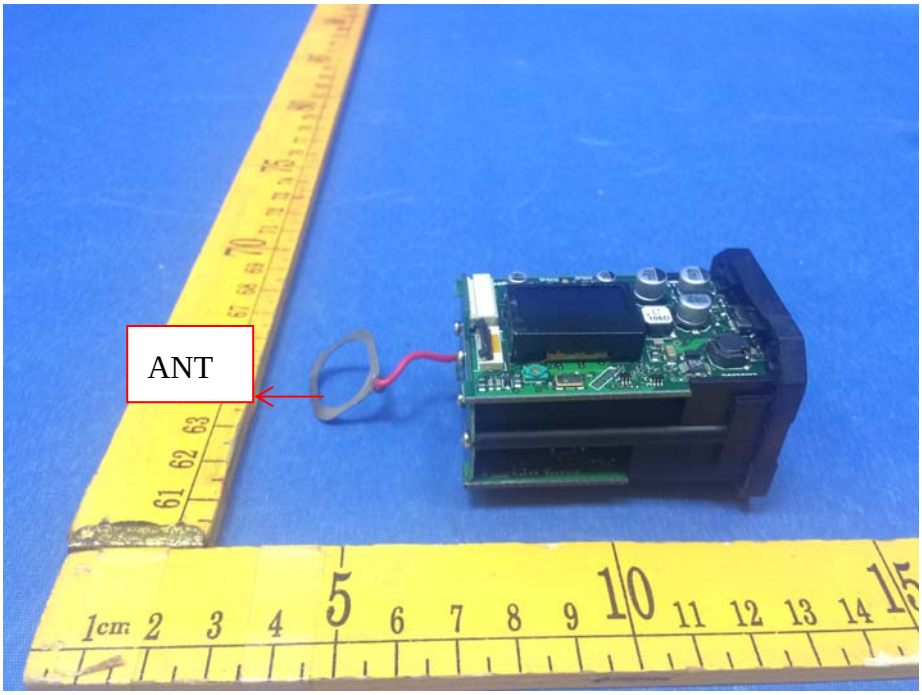

senal
SET
1cm 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

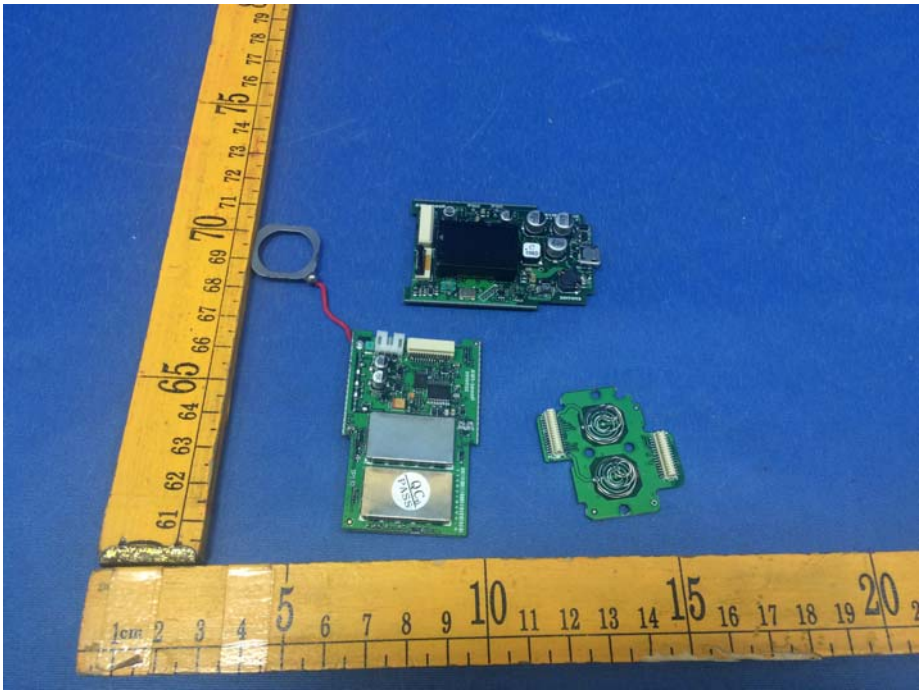

1cm 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

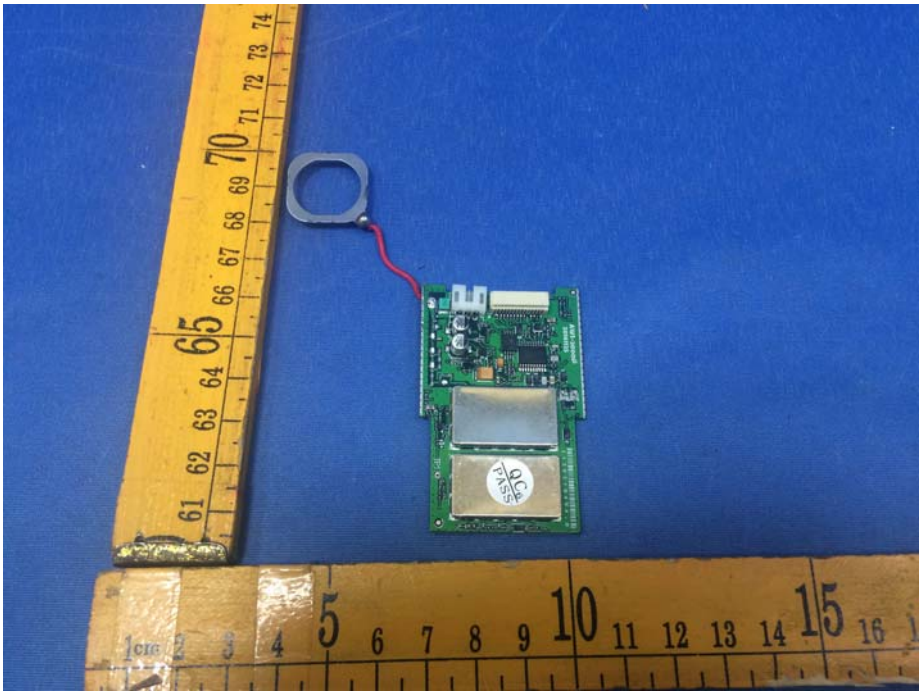


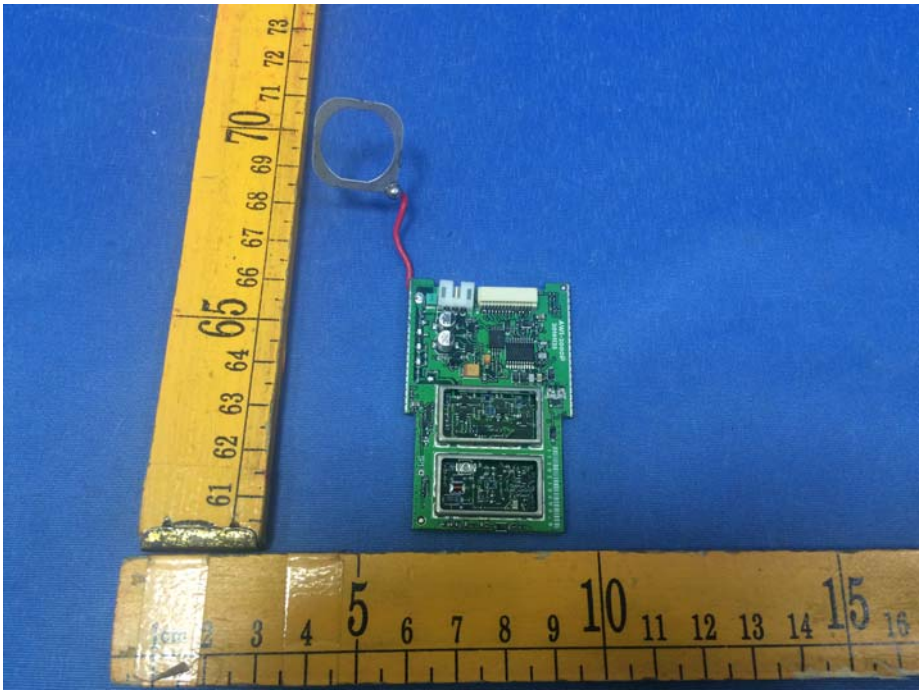
16.2 EUT –Model AWS-2000P Internal Photos

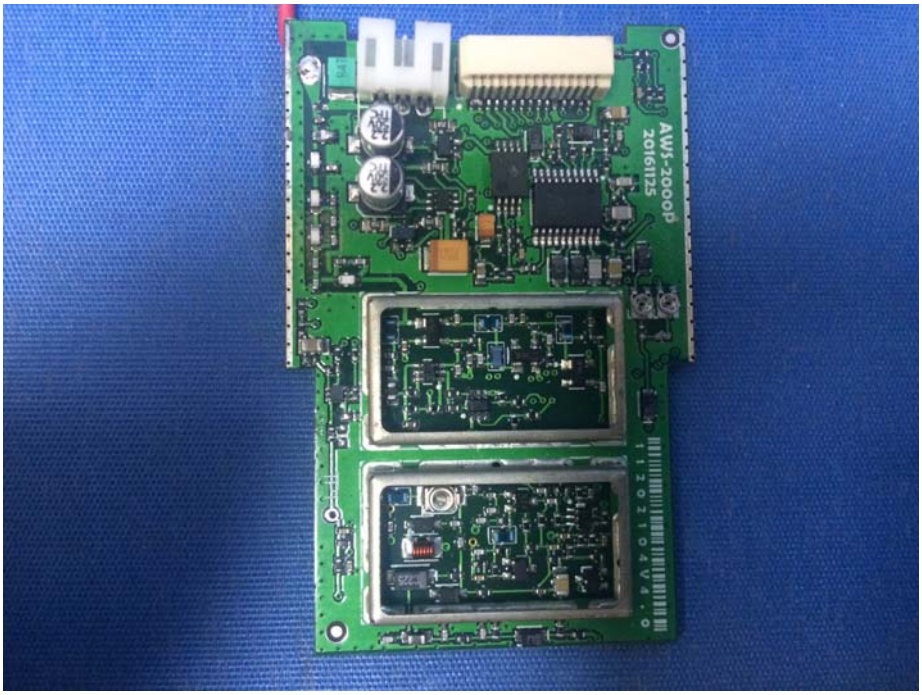


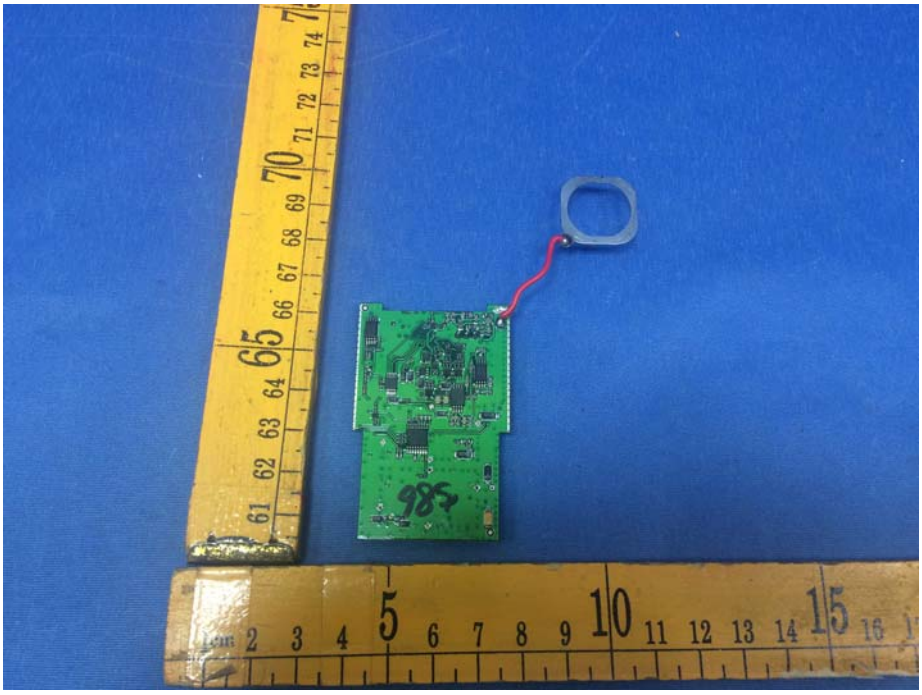

ANT

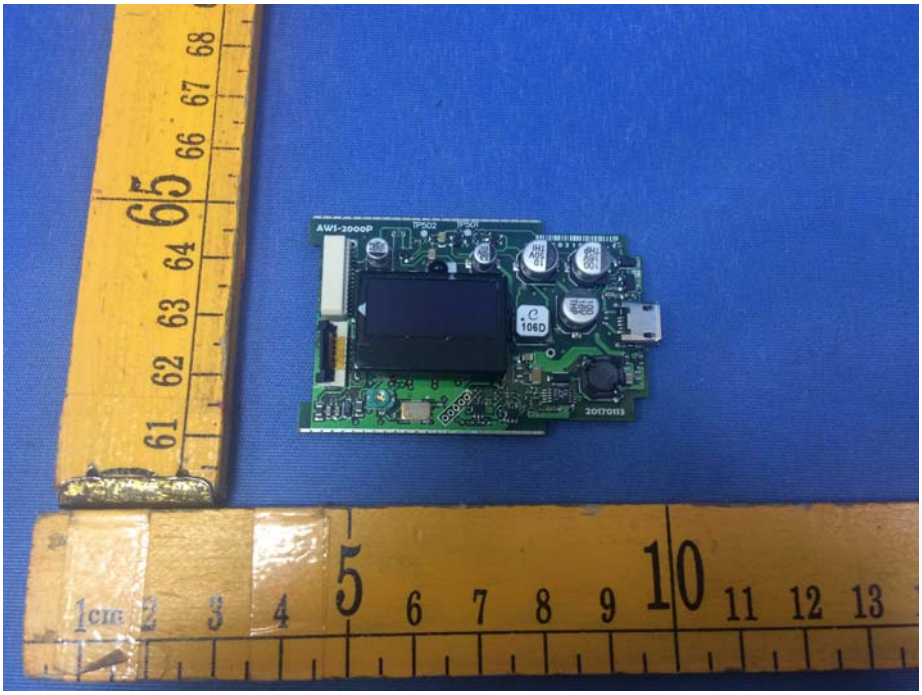


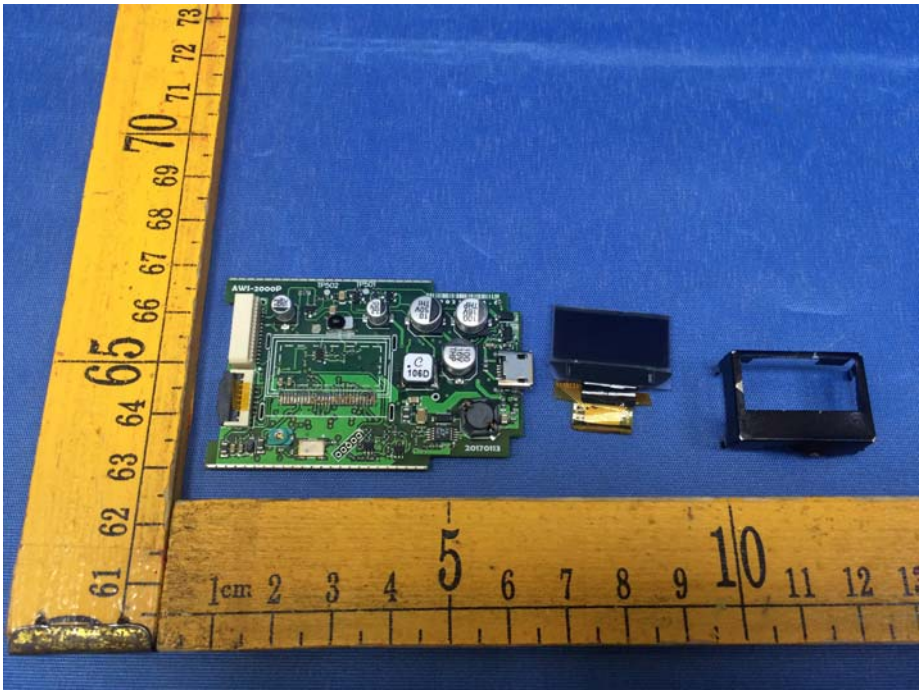


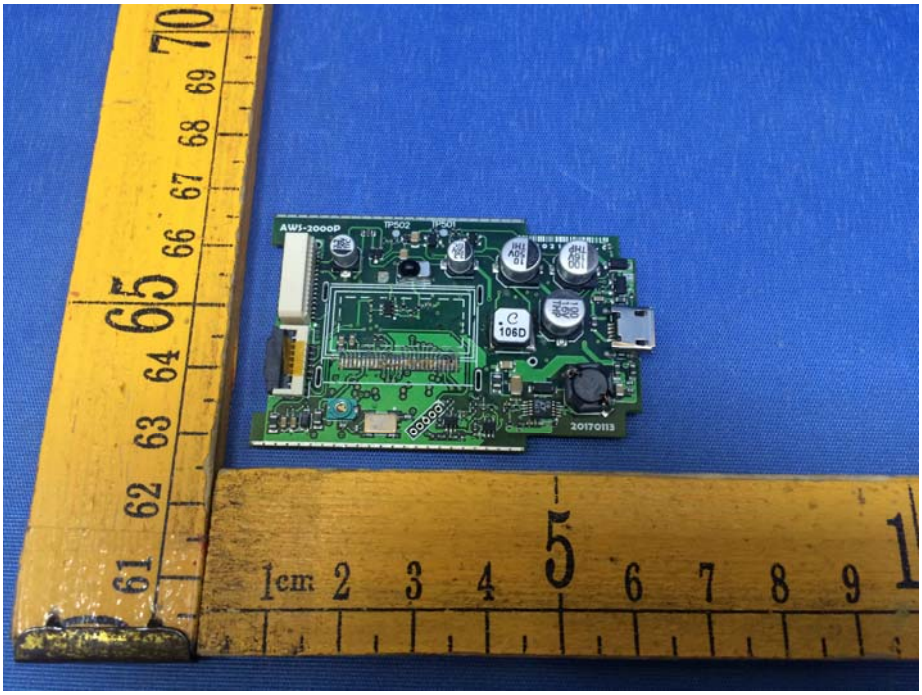


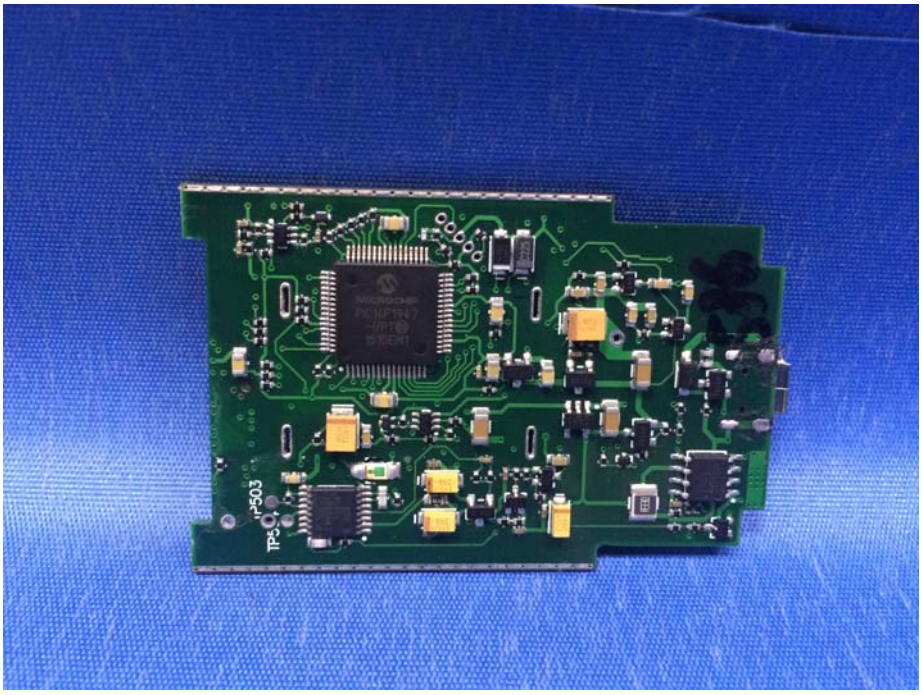

AW5-2000P
20161125

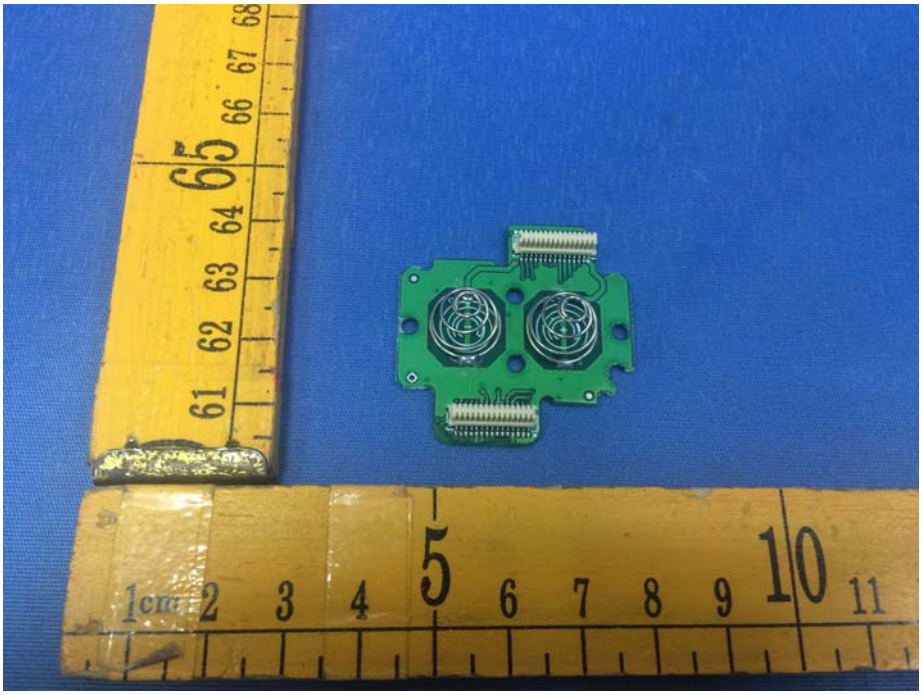


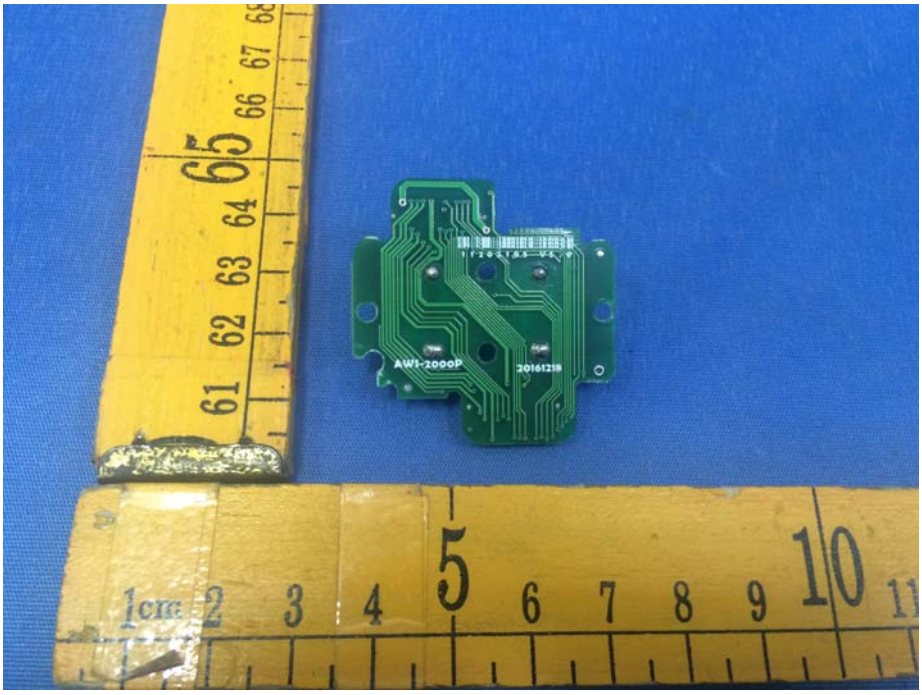

AW1-2000P



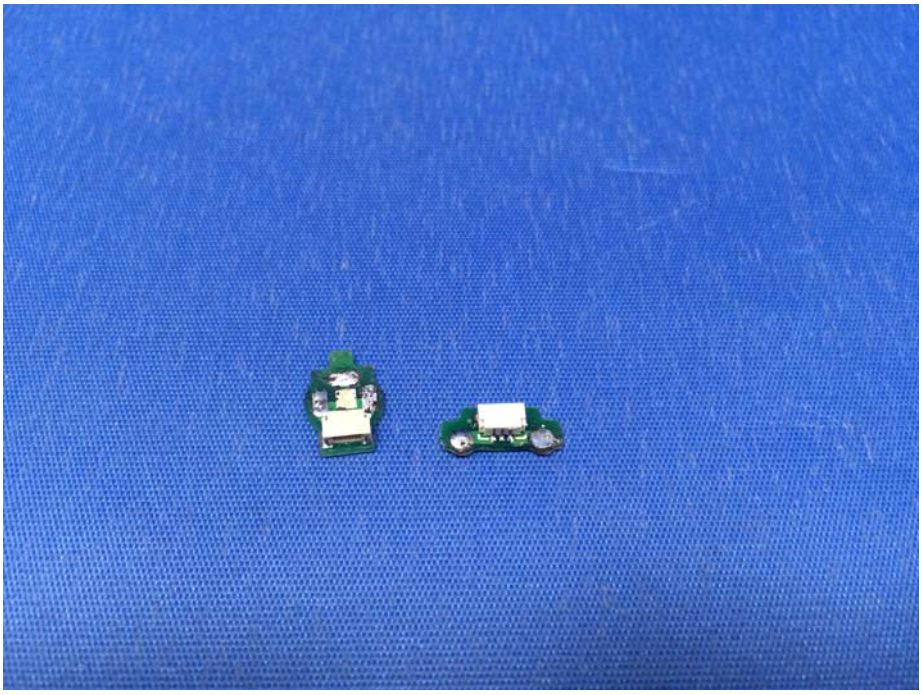







AW1-2000P
20161219
1cm


1cm



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