

TEST REPORT

Reference No. : WTD19S08054632W V1
FCC ID..... : S5OHUM-1600T
Applicant : Hylex Electronics Co., Ltd.
Address : No. 26, Ta Ho Street, Taichung 407, Taiwan
Manufacturer : Hylex Electronics Co., Ltd.
Address : No. 26, Ta Ho Street, Taichung 407, Taiwan
Product..... : WIRELESS MICROPHONE
Model(s)..... : HUM-1600T, HUM-5600T, HUM-520T, HUM-616T, HUM-64T, HUM-064T
Brand Name : Hylex
Standards..... : FCC CFR47 Part 74:2019
Date of Receipt sample : 2019-08-07
Date of Test..... : 2019-08-08 to 2019-09-10
Date of Issue : 2019-09-11
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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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)

in accordance with the following Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ SDoC	1
Canada		IC ID \ VOC	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

	Page
1 LABORATORIES INTRODUCTION.....	2
1.1 TEST FACILITY.....	3
2 CONTENTS	4
3 REVISION HISTORY	6
4 GENERAL INFORMATION.....	7
4.1 GENERAL DESCRIPTION OF E.U.T.	7
4.2 DETAILS OF E.U.T.....	7
4.3 CHANNEL LISTS.....	7
5 EQUIPMENT USED DURING TEST	9
5.1 EQUIPMENTS LIST	9
5.2 MEASUREMENT UNCERTAINTY	10
5.3 SUBCONTRACTED.....	10
6 TEST SUMMARY	11
7 RF OUTPUT POWER	12
7.1 TEST PROCEDURE	12
7.2 TEST RESULT.....	12
8 MODULATION CHARACTERISTICS	16
8.1 TEST PROCEDURE	16
8.2 TEST RESULT	20
9 OCCUPIED BANDWIDTH OF EMISSION	23
9.1 TEST PROCEDURE	23
9.2 TEST RESULT	23
10 EMISSION MASK AND SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....	27
10.1 TEST PROCEDURE.....	27
10.2 TEST DATA	28
11 RADIATED EMISSION TEST	37
11.1 EUT SETUP	37
11.2 SPECTRUM ANALYZER SETUP.....	39
11.3 TEST PROCEDURE.....	39
11.4 CORRECTED AMPLITUDE & MARGIN CALCULATION	40
11.5 TEST RESULT	41
12 FREQUENCY STABILITY.....	43
12.1 TEST CONFIGURATION	43
12.2 TEST PROCEDURE.....	43
12.3 TEST RESULT	44
13 FCC ID: S50HUM-1600T RF EXPOSURE REPORT.....	47
13.1 REQUIREMENTS.....	47
13.2 THE PROCEDURES / LIMIT	47
13.3 RESULT: COMPLIANCE	47
14 PHOTOGRAPHS –MODEL HUM-1600T TEST SETUP	48
14.1 PHOTOGRAPH – RADIATION SPURIOUS EMISSION TEST SETUP.....	48

15 PHOTOGRAPHS – CONSTRUCTIONAL DETAILS 50

15.1 EUT –MODEL HUM-1600T EXTERNAL PHOTOS 50

15.2 EUT –MODEL HUM-1600T INTERNAL PHOTOS 53

3 Revision History

Test Report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD19S08054632W	2019-08-07	2019-08-08 to 2019-09-02	2019-09-03	original	-	Replaced
WTD19S08054632W	2019-08-07	2019-08-08 to 2019-09-10	2019-09-11	revision1	revised	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	WIRELESS MICROPHONE
Model(s):	HUM-1600T, HUM-5600T, HUM-520T, HUM-616T, HUM-64T, HUM-064T
Model Description:	Only the model names are different, the model HUM-1600T is the tested sample.
Operation Frequency:	530.20MHz-579.95MHz, 200channels
Antenna installation:	Internal permanently attached antenna
Antenna Gain:	1dBi
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

4.3 Channel Lists

Band 1 Channel Lists (530.20MHz - 554.95MHz)

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
00	530.20	01	531.45	02	533.95	03	537.95
04	540.70	05	530.70	06	532.45	07	534.45
08	539.45	09	542.20	10	530.45	11	531.70
12	535..20	13	535.70	14	537.45	15	530.95
16	531.95	17	533.45	18	538.45	19	541.20
20	531.20	21	532.95	22	534.95	23	536.45
24	539.20	25	532.20	26	533.70	27	535.95
28	539.95	29	541.95	30	532.70	31	534.20
32	535.45	33	536.70	34	537.20	35	538.20
36	538.95	37	540.20	38	541.45	39	542.45
40	533.20	41	534.70	42	536.20	43	536.95
44	537.70	45	538.70	46	539.70	47	540.45
48	540.95	49	541.70	50	542.70	51	543.95
52	546.45	53	550.45	54	553.20	55	543.20
56	544.95	57	546.95	58	551.95	59	554.70
60	542.95	61	544.20	62	547.70	63	548.20
64	549.95	65	543.45	66	544.45	67	545.95

68	550.95	69	553.70	70	543.7	71	545.45
72	547.45	73	548.95	74	551.7	75	544.70
76	546.20	77	548.45	78	552.45	79	554.45
80	545.20	81	546.70	82	547.95	83	549.20
84	549.70	85	550.70	86	551.45	87	552.70
88	553.95	89	554.95	90	545.70	91	547.20
92	548.70	93	549.45	94	550.20	95	551.20
96	552.20	97	552.95	98	553.45	99	554.20

Band 2 Channel Lists (555.20MHz – 579.95MHz)

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
100	555.20	101	555.70	102	557.45	103	561.95
104	565.20	105	556.45	106	557.95	107	559.45
108	563.95	109	566.95	110	555.45	111	557.20
112	558.70	113	559.70	114	564.45	115	556.20
116	557.70	117	562.45	118	565.45	119	566.70
120	555.95	121	556.95	122	559.95	123	561.20
124	564.70	125	556.70	126	560.45	127	562.70
128	565.70	129	567.45	130	558.20	131	558.95
132	560.20	133	560.95	134	561.70	135	562.95
136	563.45	137	564.20	138	565.95	139	566.45
140	558.45	141	559.20	142	560.70	143	561.45
144	562.20	145	563.20	146	563.70	147	564.95
148	566.20	149	567.20	150	567.70	151	568.20
152	569.95	153	574.45	154	577.70	155	568.95
156	570.45	157	571.95	158	576.45	159	579.45
160	567.95	161	569.70	162	571.20	163	572.20
164	576.95	165	568.70	166	570.20	167	574.95
168	577.95	169	579.20	170	568.45	171	569.45
172	572.45	173	573.70	174	577.20	175	569.20
176	572.95	177	575.20	178	578.20	179	579.95
180	570.70	181	571.45	182	572.70	183	573.45
184	574.20	185	575.45	186	575.95	187	576.70
188	578.45	189	578.95	190	570.95	191	571.70
192	573.20	193	573.95	194	574.70	195	575.70
196	576.20	197	577.45	198	578.70	199	579.70

5 Equipment Used during Test

5.1 Equipments List

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)	-	2018-09-12	2019-09-11
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	-	2018-09-12	2019-09-11
3	Antenna Connector*	Realacc	45RSm	-	2018-09-12	2019-09-11
4	DC Block	Gwave	GDCB-3G-N-SMA	140307001	2018-09-12	2019-09-11
“*”: 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	$\pm 1 \times 10^{-6}$
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
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 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).

7.1 Test Procedure

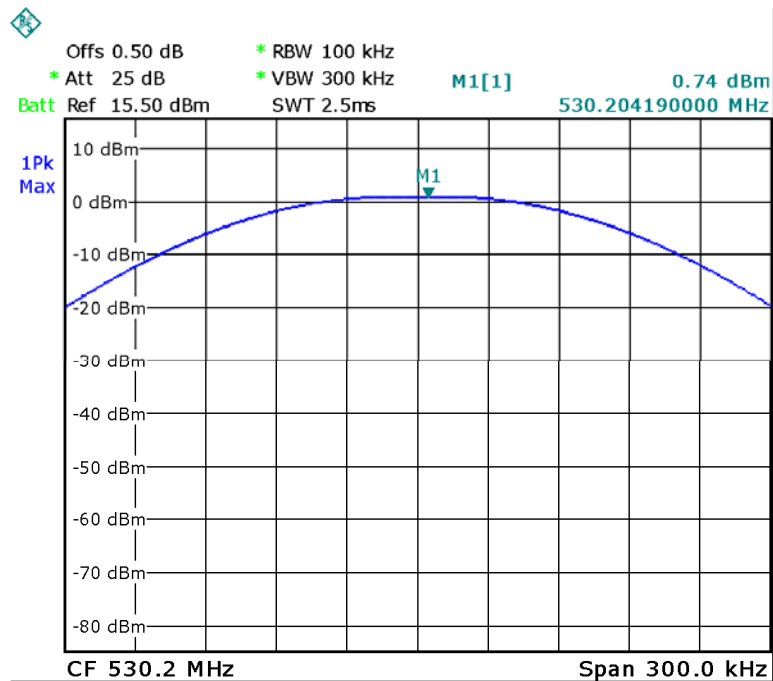
The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation.

7.2 Test result

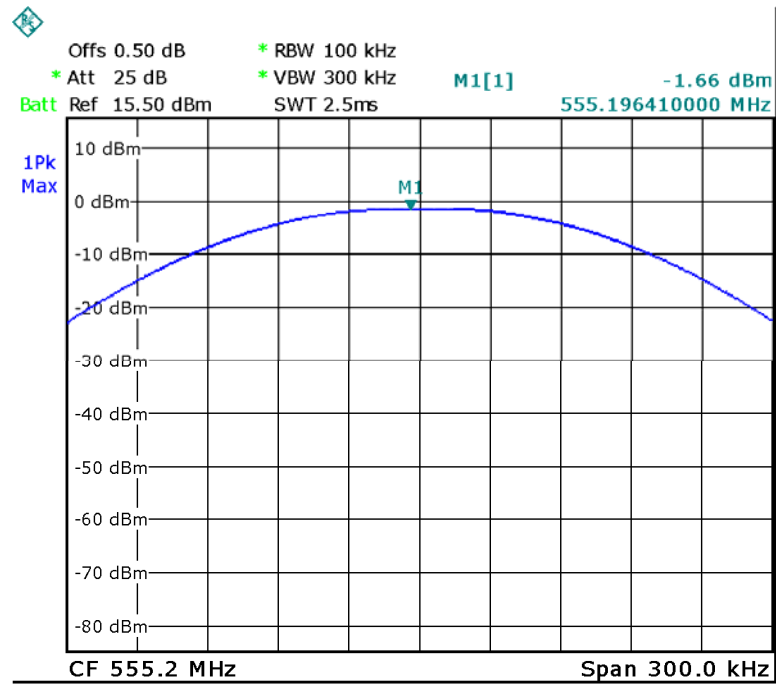
Power	Frequency (MHz)	RF Output Power (dBm)	Limit (dBm)	Result
Low	530.20	0.74	23.98	PASS
	555.20	-1.66	23.98	PASS
	579.95	-2.74	23.98	PASS
High	530.20	7.71	23.98	PASS
	555.20	5.31	23.98	PASS
	579.95	4.23	23.98	PASS

Please refer to following plot:

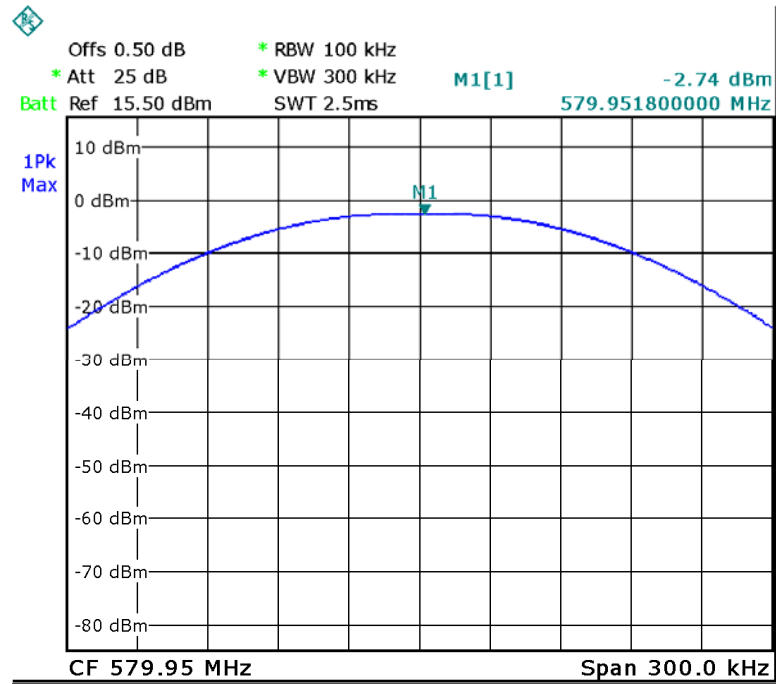
Low Power
Low channel



Middle channel

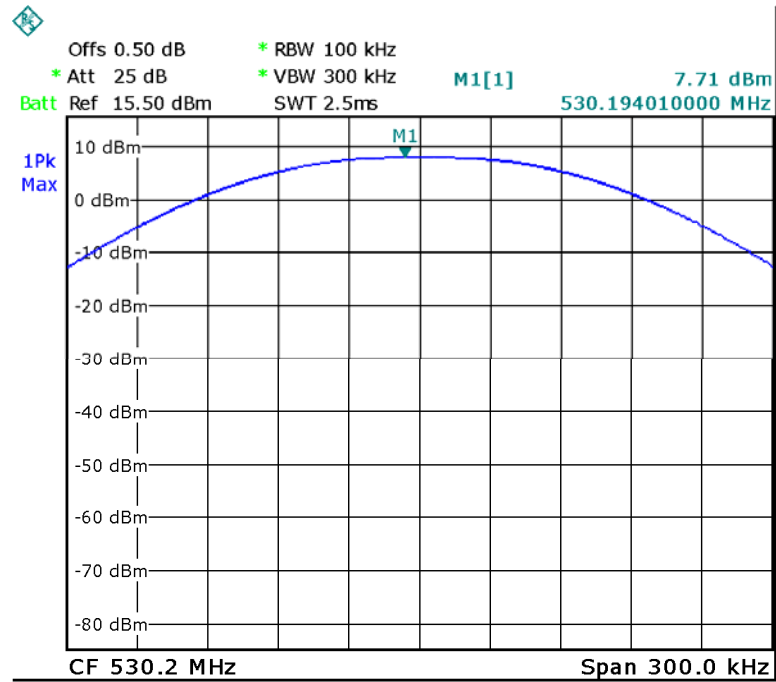


High channel

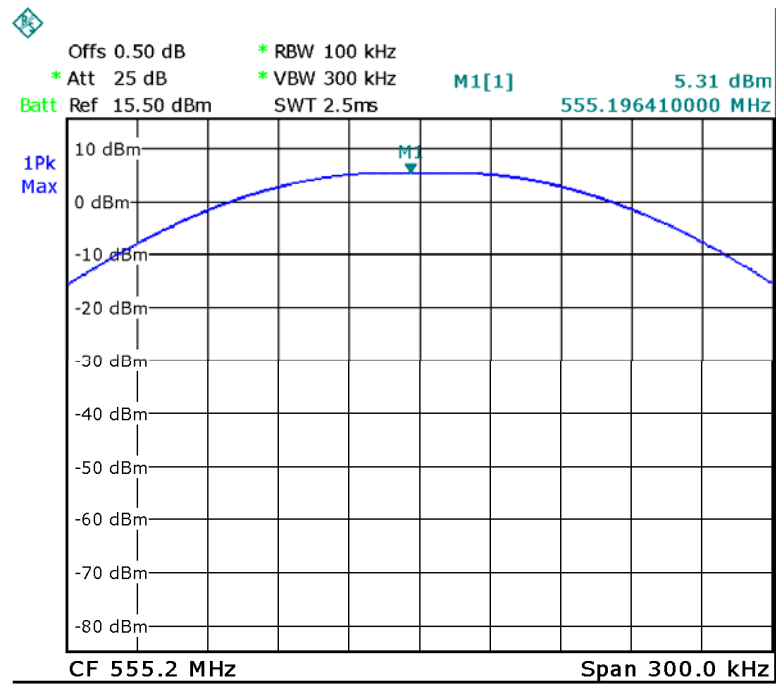


Please refer to following plot:

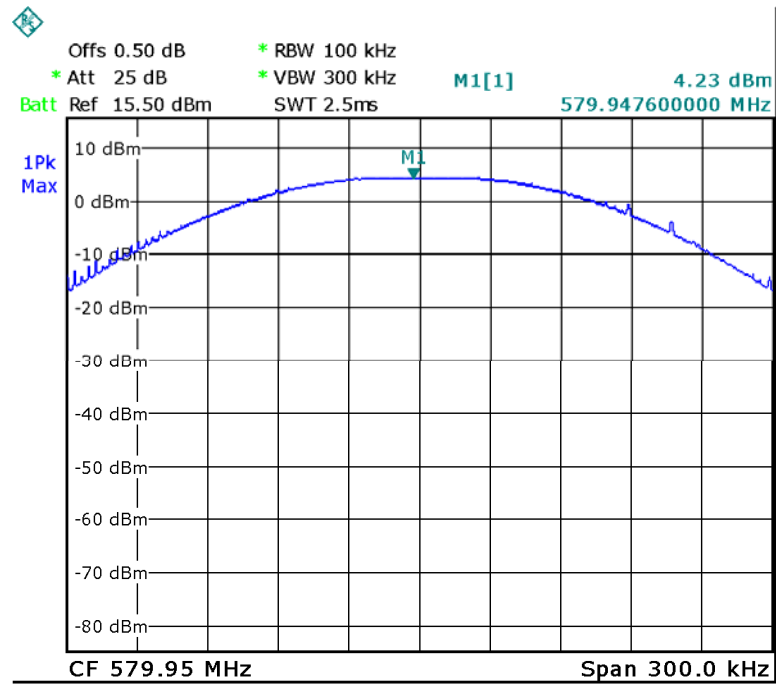
High Power
Low channel



Middle channel



High channel



8 Modulation Characteristics

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

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

Requirement: Any form of modulation may be used.

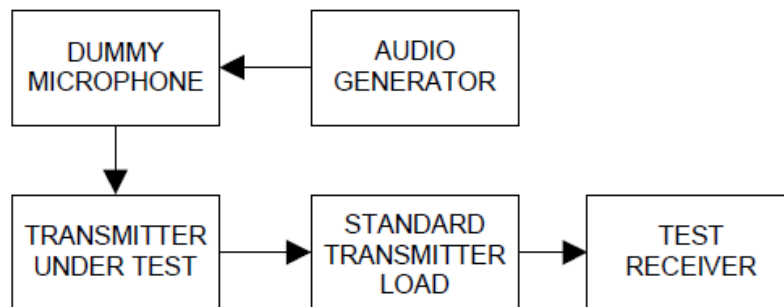
A maximum deviation of $\pm 75\text{kHz}$ is permitted when frequency modulation is employed.

8.1 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.

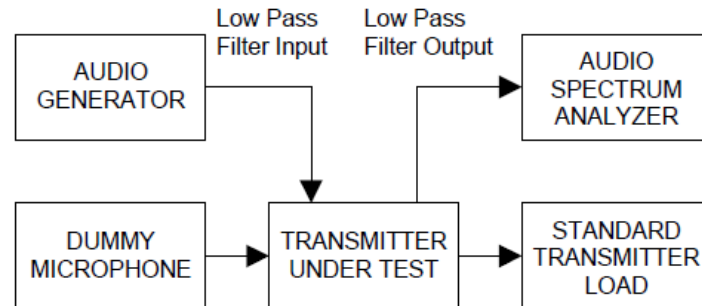
Method of Measurement



- 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 $\leq 0.25\text{ Hz}$ to $\geq 15,000\text{ Hz}$. 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 to 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:

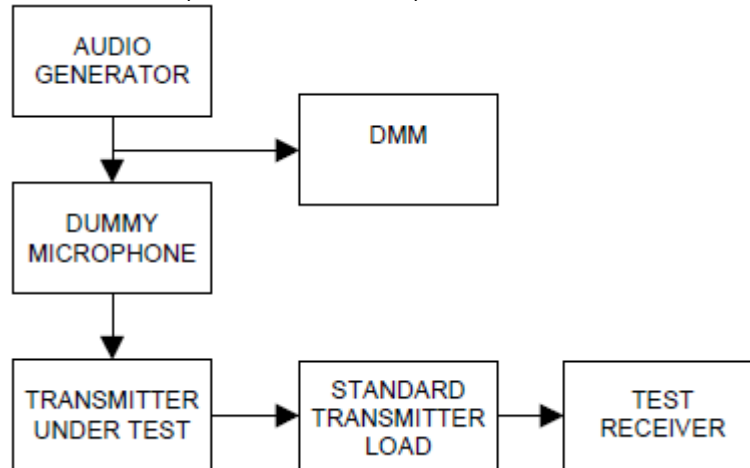
$$\text{low pass frequency response} = \text{LEVFREQ} - \text{LEVREF}$$
- j) Repeat steps f) through i) for all the desired test frequencies.

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)

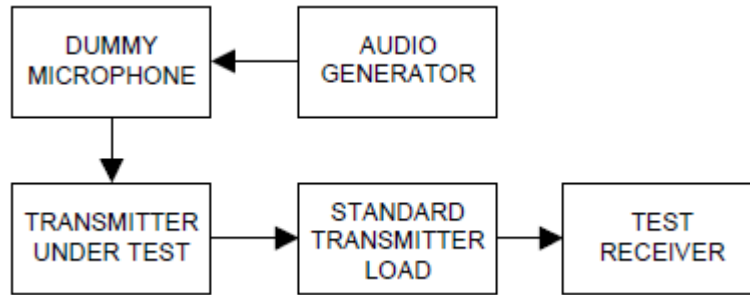


- a) Connect the equipment as illustrated.
- b) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤ 50 Hz to $\geq 15,000$ Hz. Turn the de-emphasis function off.
- c) Set the DMM to measure rms voltage.
- d) Adjust the transmitter per the manufacturer's procedure for 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 V_{REF} .
- 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 V_{FREQ} .
- k) Calculate the audio frequency response at the present frequency as:

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

- 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 $\geq 15,000$ 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:

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

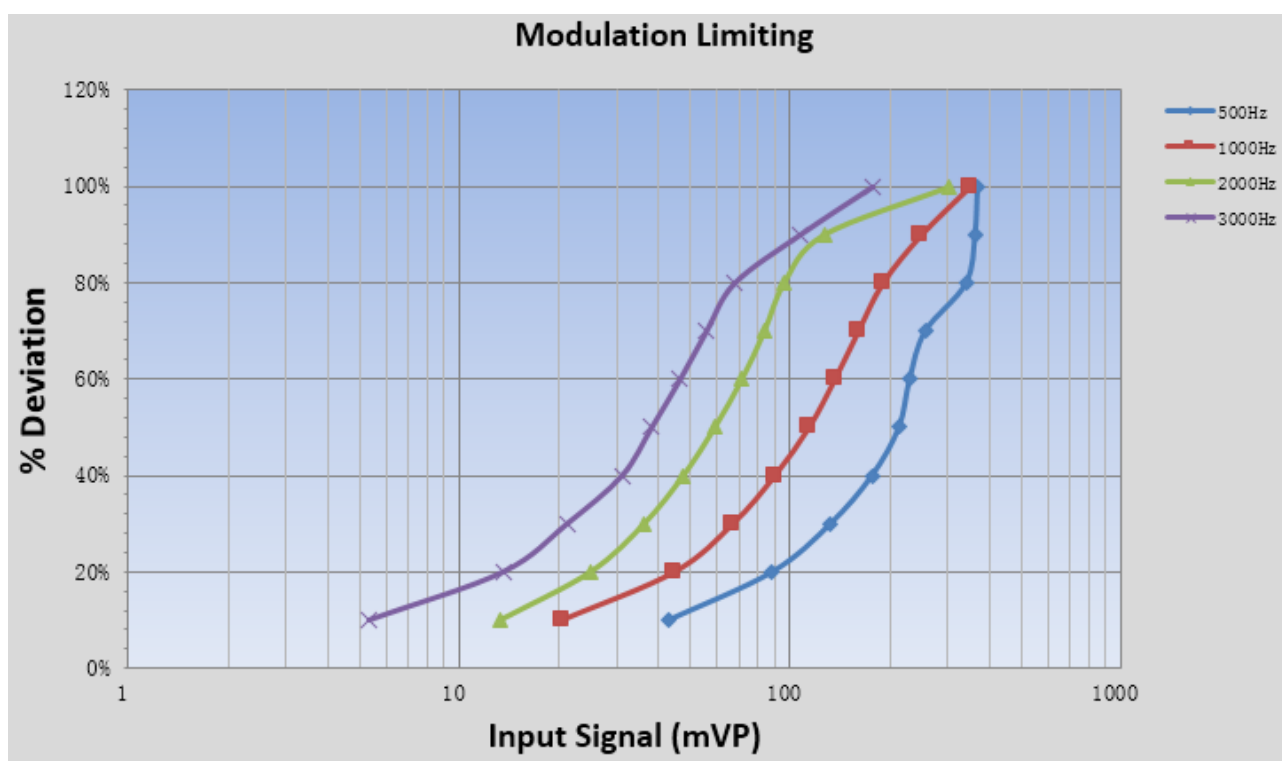
- i) Repeat steps f) through h) for all the desired test frequencies.

8.2 Test Result

Modulation Limiting Test Result

Middle Channel

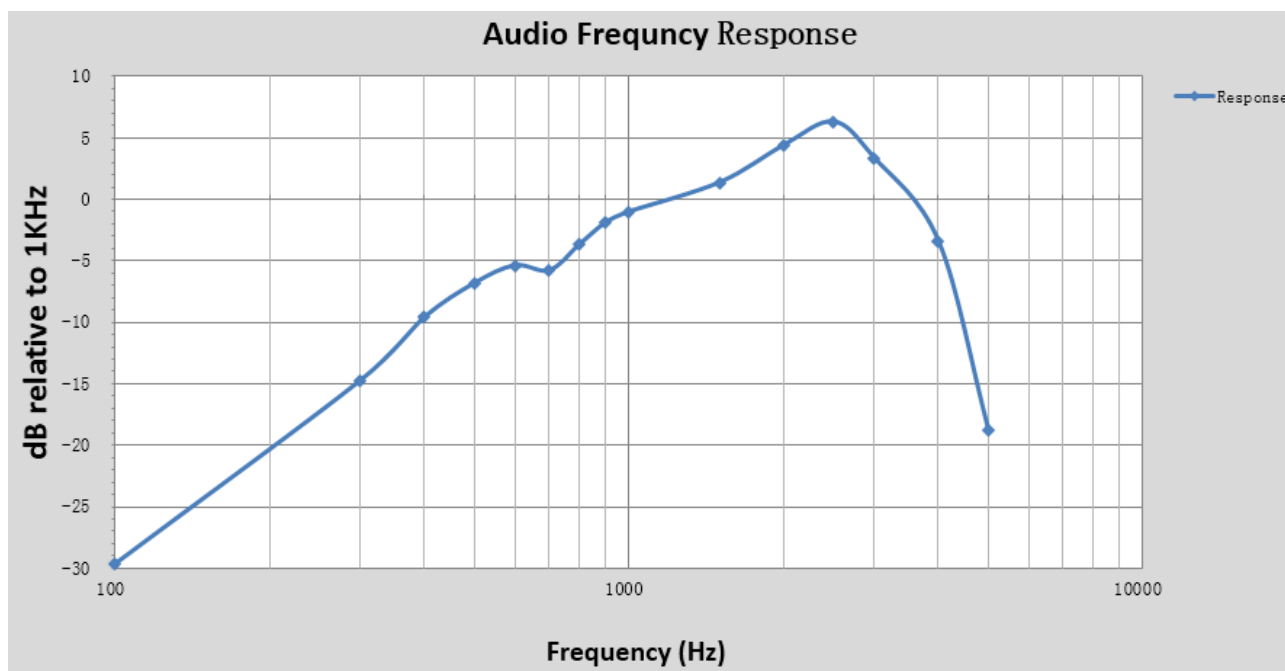
% Deviation	Input Signal (mVP)			
	500 Hz	1000 Hz	2000 Hz	3000 Hz
10%	43	20	13	5
20%	88	45	25	14
30%	133	67	36	21
40%	177	90	47	31
50%	214	114	59	38
60%	230	136	71	46
70%	257	160	83	56
80%	341	190	96	68
90%	363	249	126	107
100%	370	349	303	177



Audio Frequency Response Test Result

Middle channel

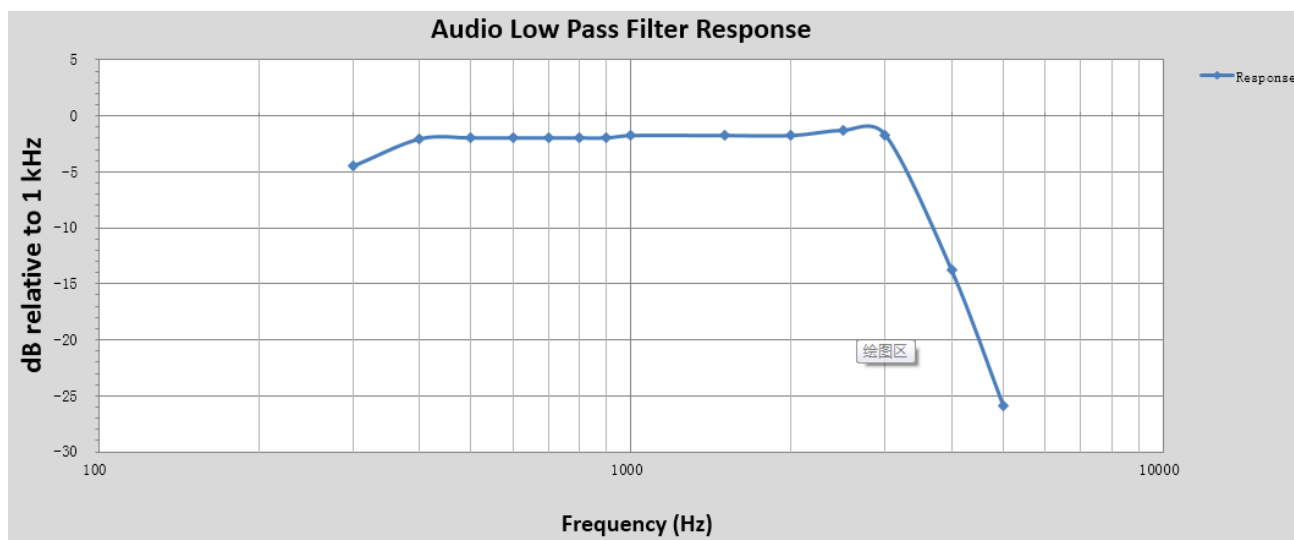
Frequency(Hz)	Audio Frequency Response(Hz)	Audio Frequency Response(dB)
100	28	-29.7
300	188	-14.8
400	319	-9.6
500	388	-6.9
600	458	-5.4
700	528	-5.8
800	598	-3.7
900	658	-1.9
1000	739	-1.0
1500	1119	1.3
2000	1479	4.4
2500	1839	6.3
3000	1978	3.3
4000	639	-3.4
5000	109	-18.8



Audio Low Pass Filter Response Test Result

Middle channel

Frequency(Hz)	Audio Frequency Response(Hz)	Audio Frequency Response(dB)
300	1045	-4.5
400	1414	-2.1
500	1470	-2.0
600	1470	-2.0
700	1470	-2.0
800	1470	-2.0
900	1470	-2.0
1000	1480	-1.8
1500	1480	-1.8
2000	1480	-1.8
2500	1535	-1.3
3000	1420	-1.7
4000	371	-13.8
5000	55	-25.9



9 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.

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.
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 $1.5 \times \text{OBW}$ 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 $\geq 3 \times \text{RBW}$.

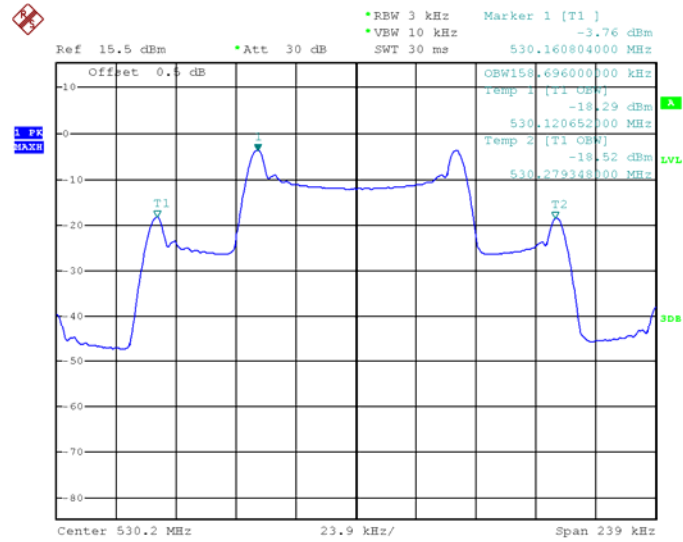
9.2 Test Result

power	Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Result
Low	530.20	158.70	200	PASS
	555.20	148.74	200	PASS
	579.95	143.42	200	PASS
High	530.20	158.70	200	PASS
	555.20	149.18	200	PASS
	579.95	143.42	200	PASS

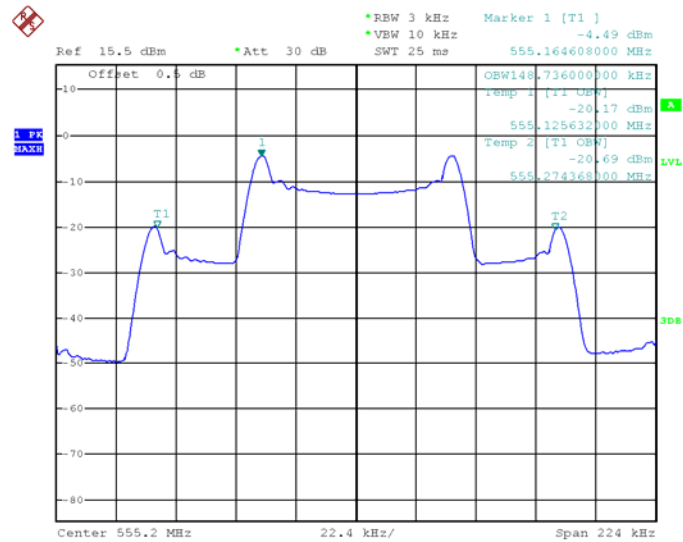
Test Plot:

Low power

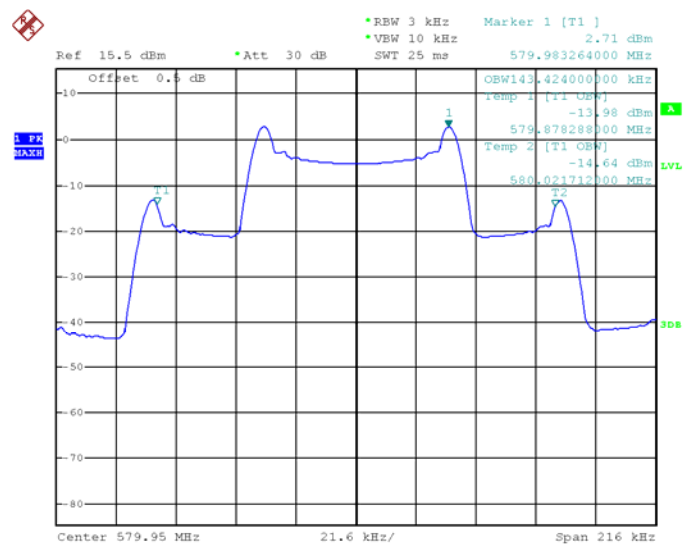
Low channel



Middle channel



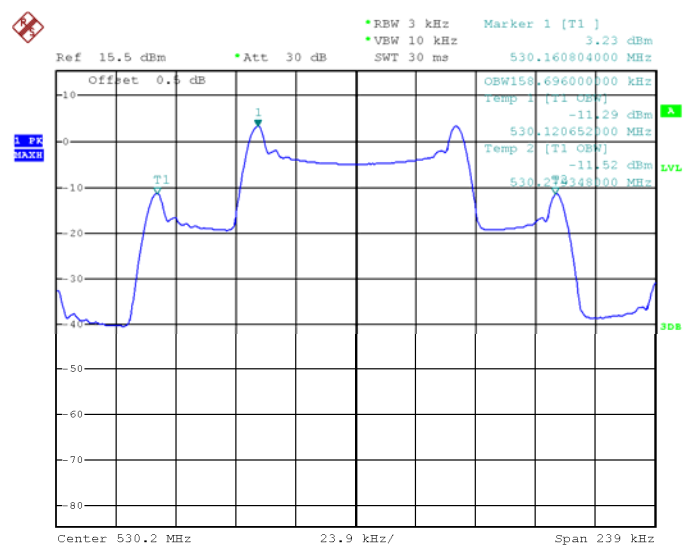
High channel



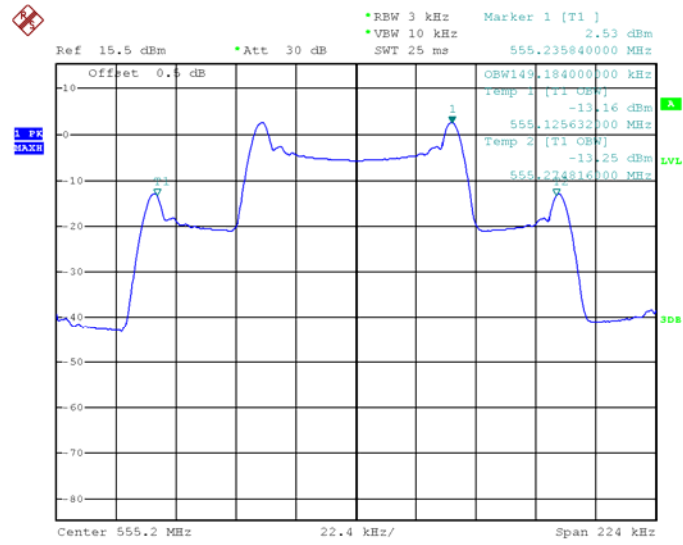
Test Plot:

High power

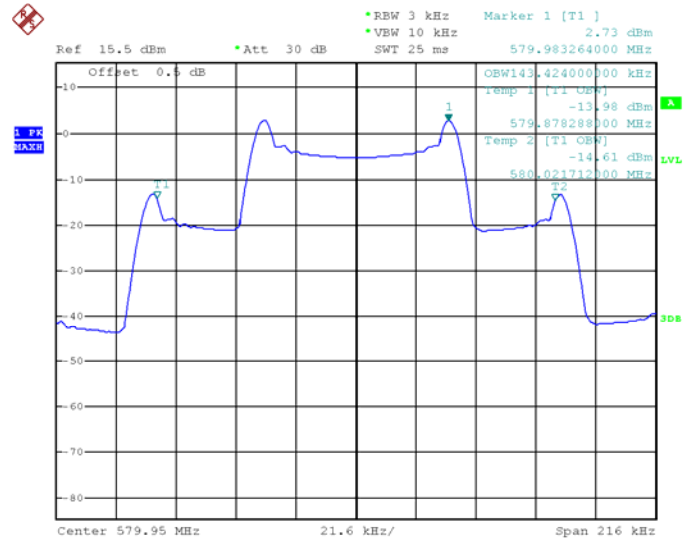
Low channel



Middle channel



High channel



10 Emission Mask and Spurious Emissions at Antenna Terminals

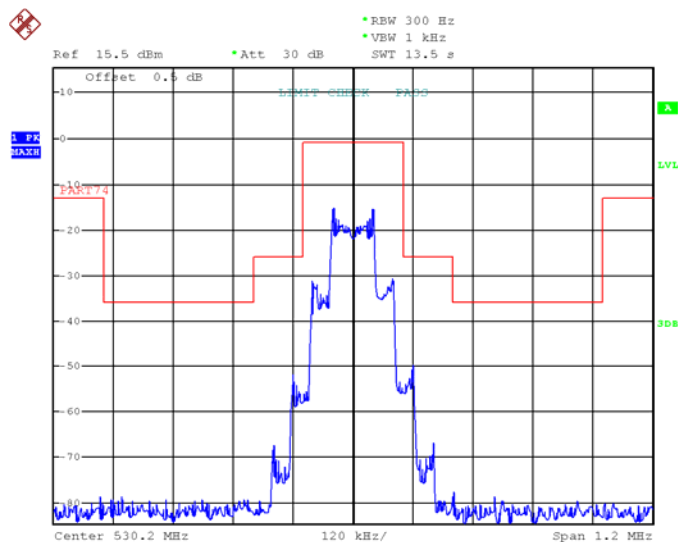
Test requirement:	FCC CFR47 Part 2 Section 2.1053
Test method:	Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015
Limit:	According to Part 74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule: (i) on any frequency 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.

10.1 Test Procedure

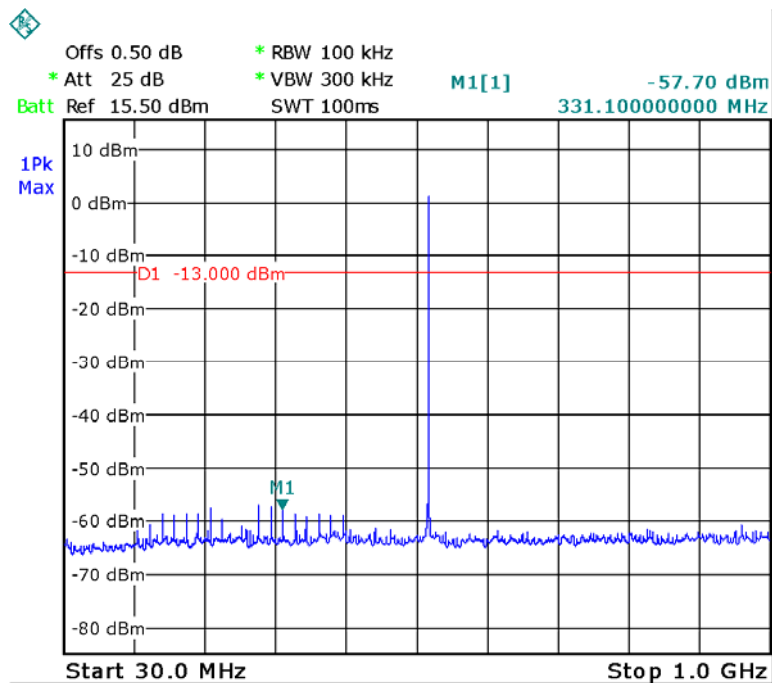
1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
2. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting 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.
5. The authorized BW is 200 kHz.
6. RBW=300 Hz, VBW=1 kHz.

10.2 Test Data

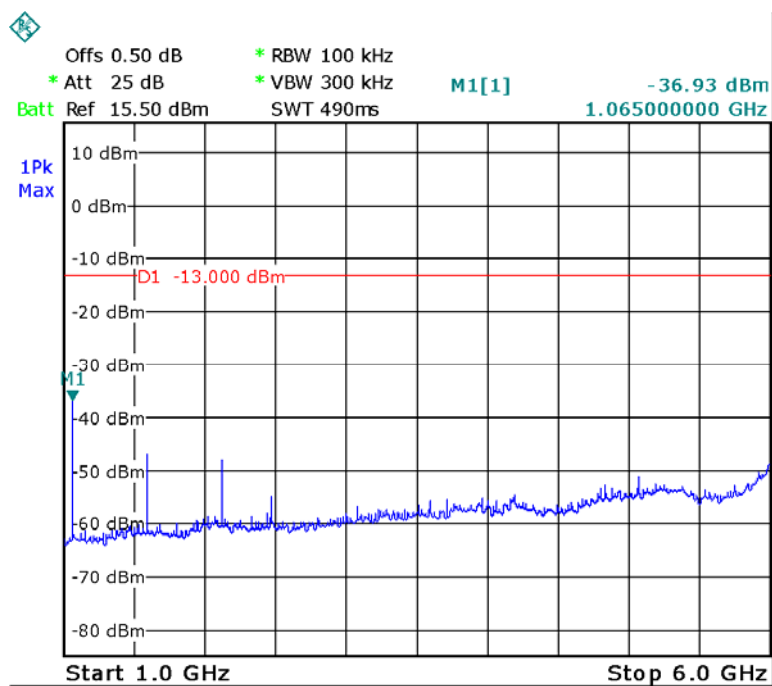
Low Power Low Channel (530.20MHz) Emission Mask



30MHz-1GHz

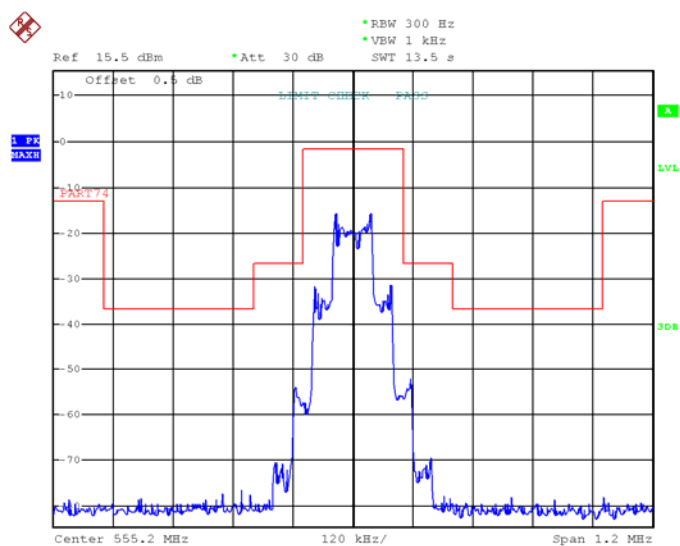


1GHz-6GHz

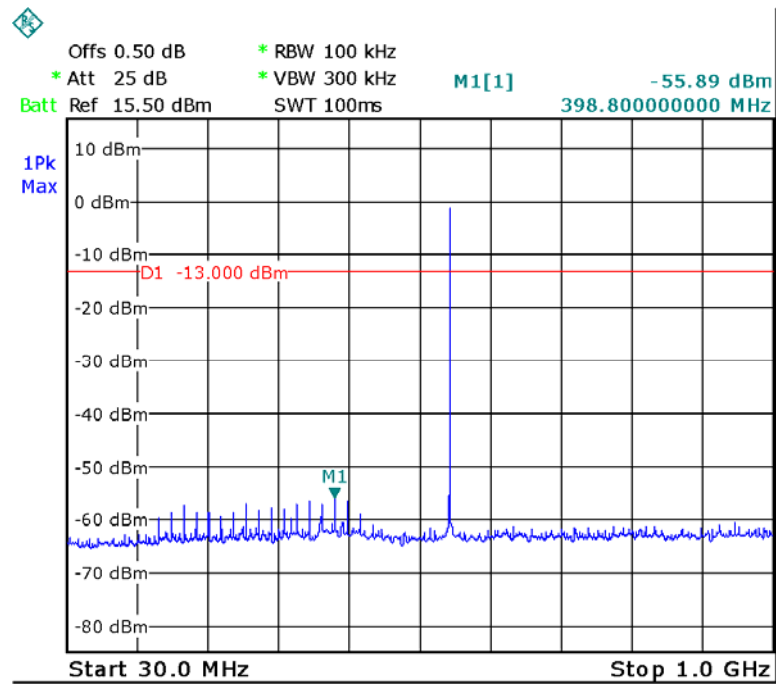


Middle Channel (555.20MHz)

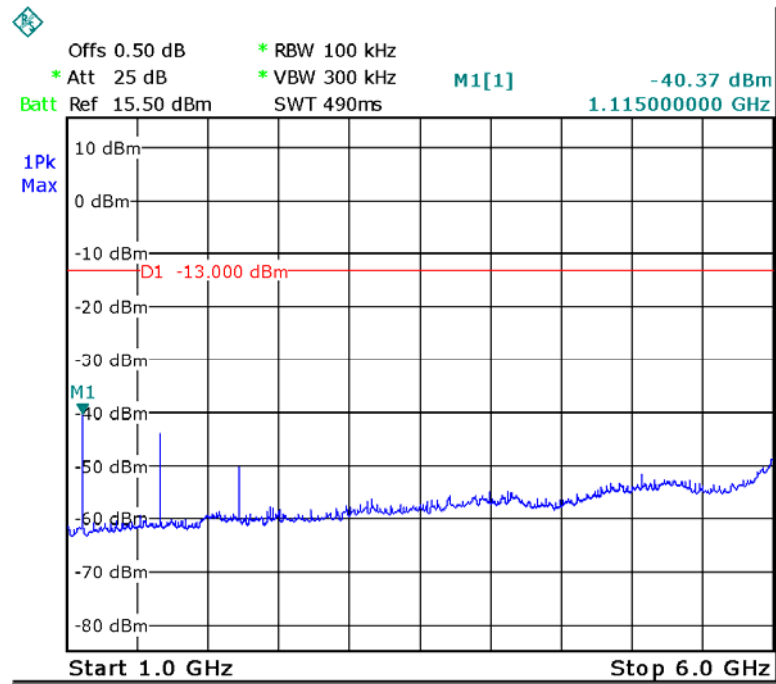
Emission Mask



30MHz-1GHz

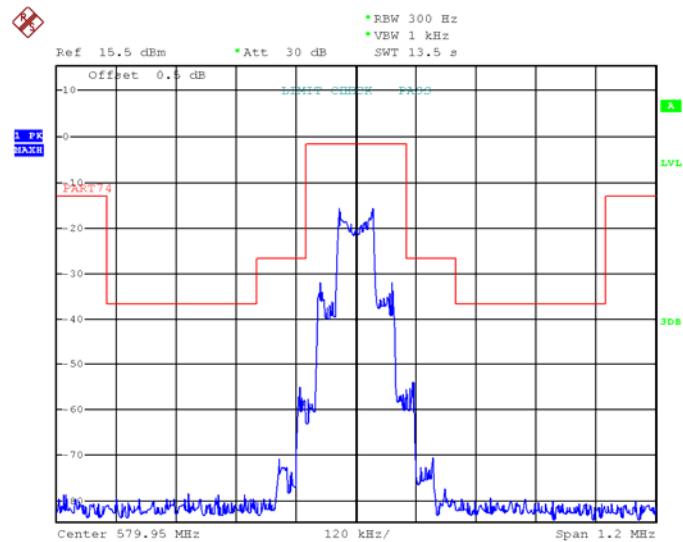


1GHz-6GHz

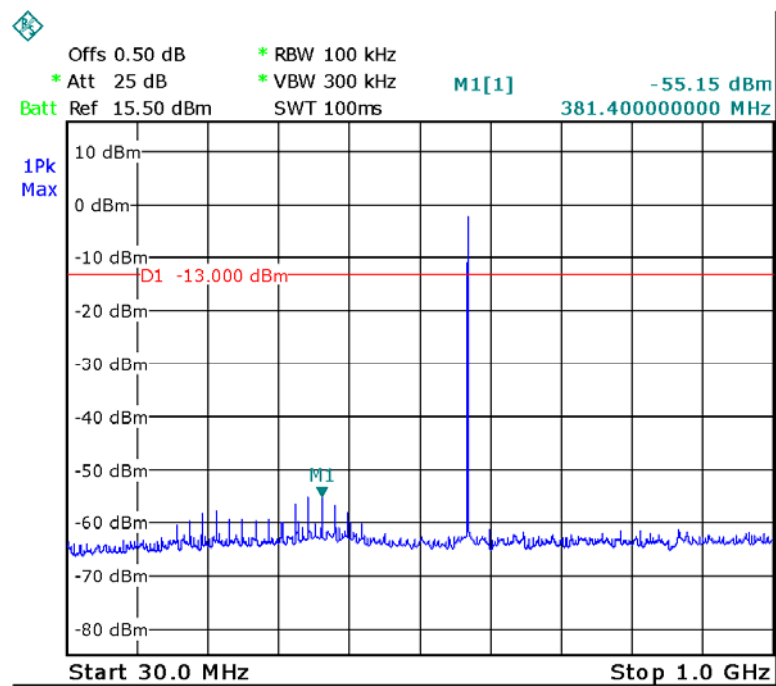


High Channel (579.95MHz)

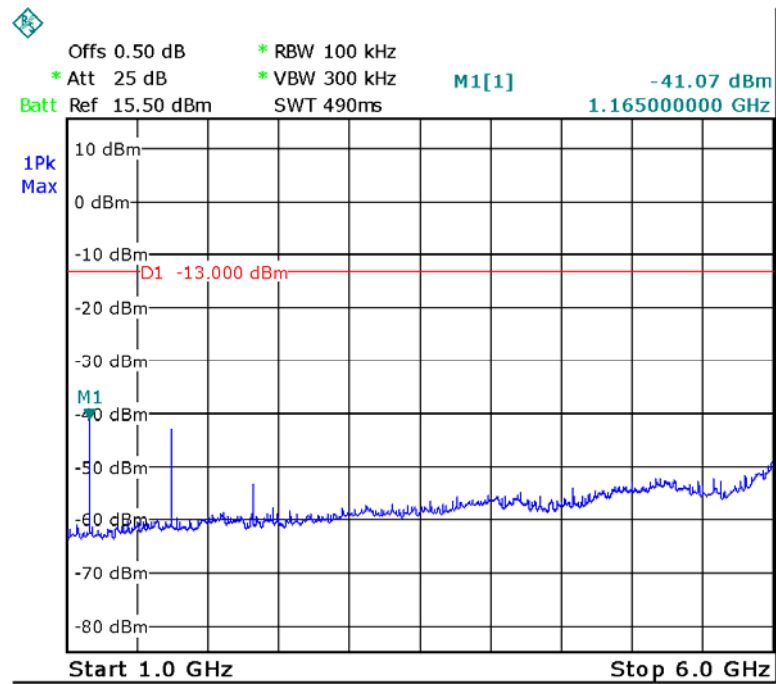
Emission Mask



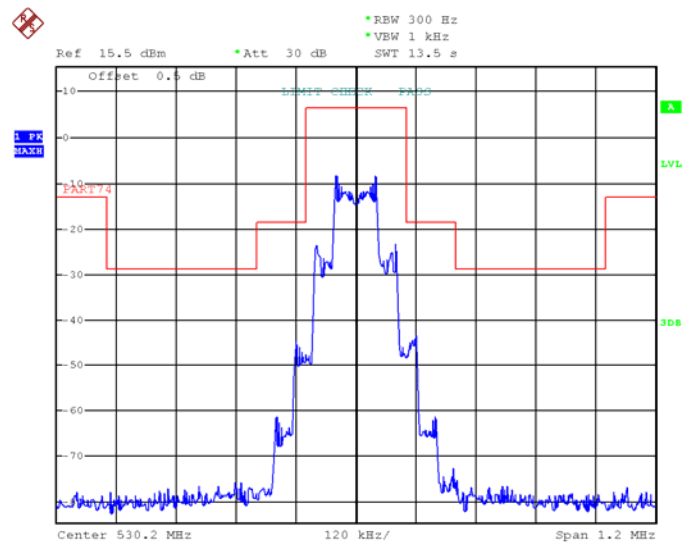
30MHz-1GHz



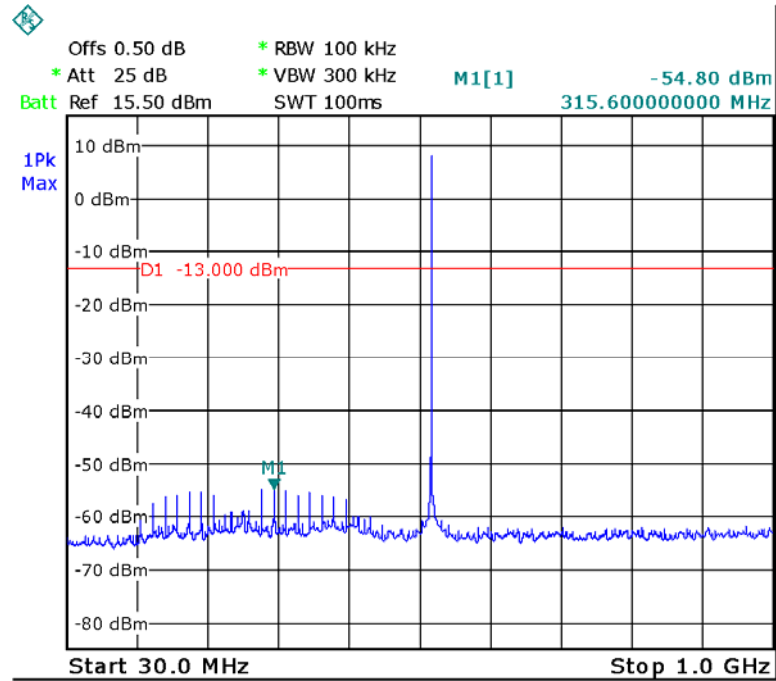
1GHz-6GHz



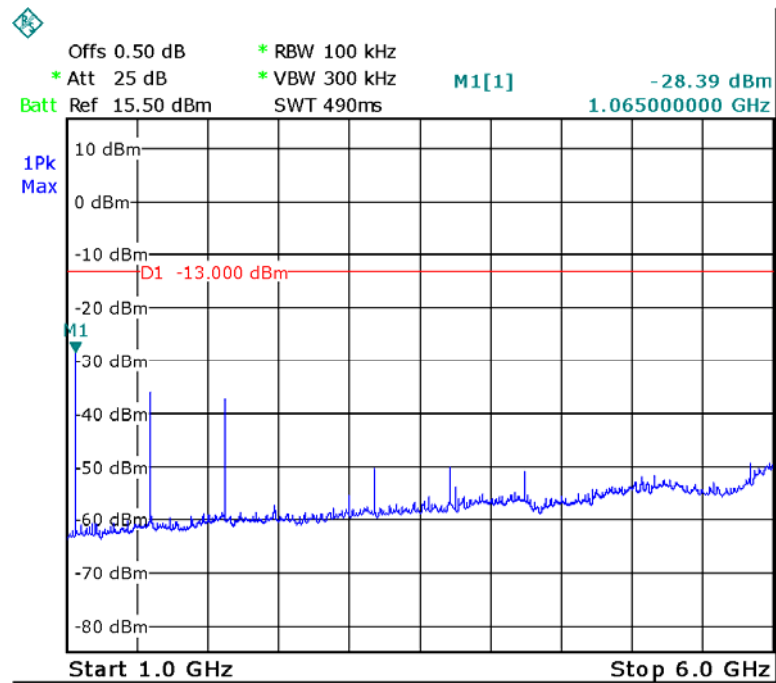
High Power
Low Channel (530.20MHz)
Emission Mask



30MHz-1GHz

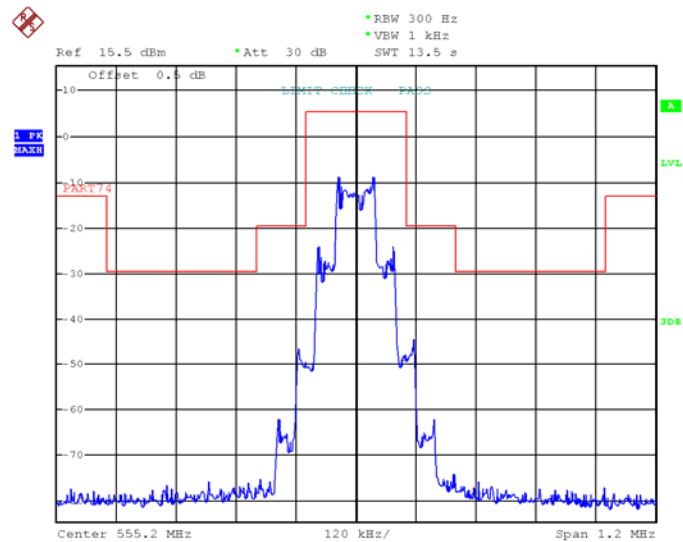


1GHz-6GHz

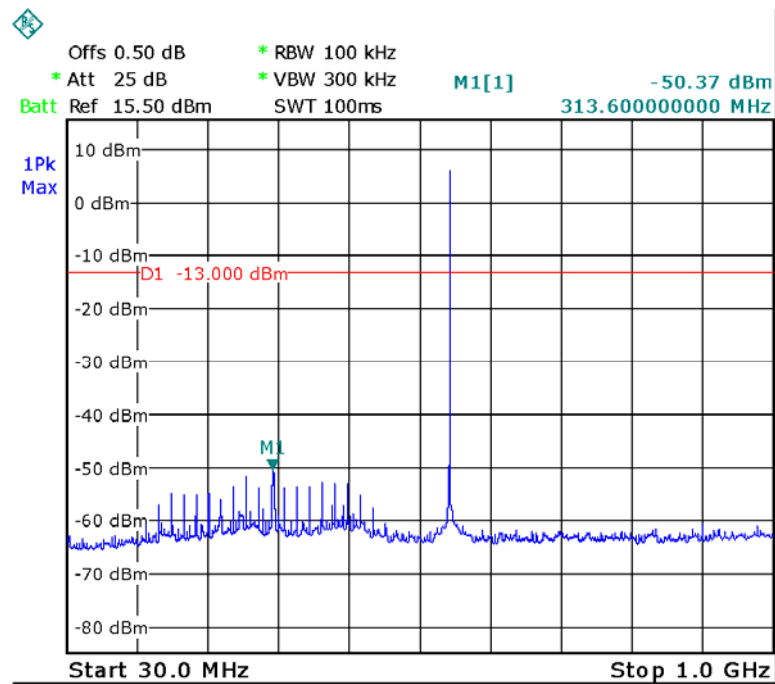


Middle Channel (555.20MHz)

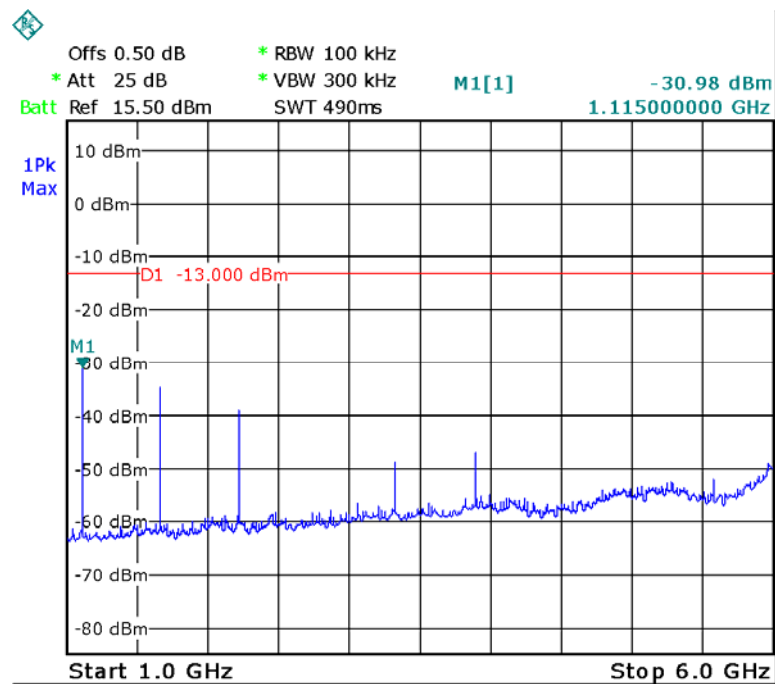
Emission Mask



30MHz-1GHz

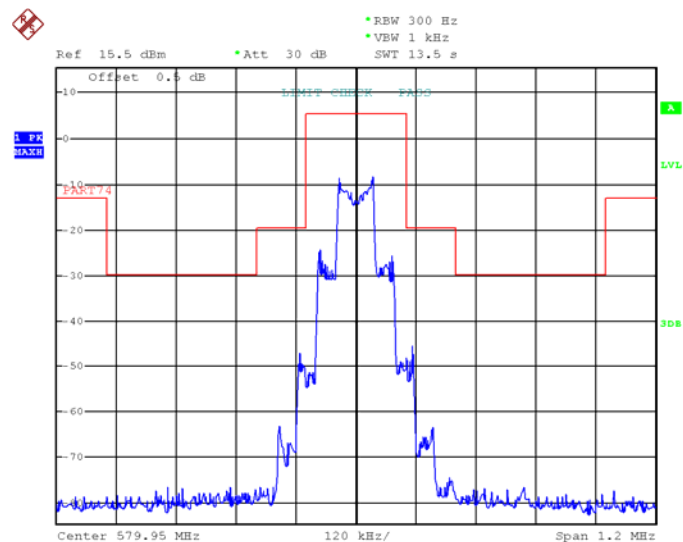


1GHz-6GHz

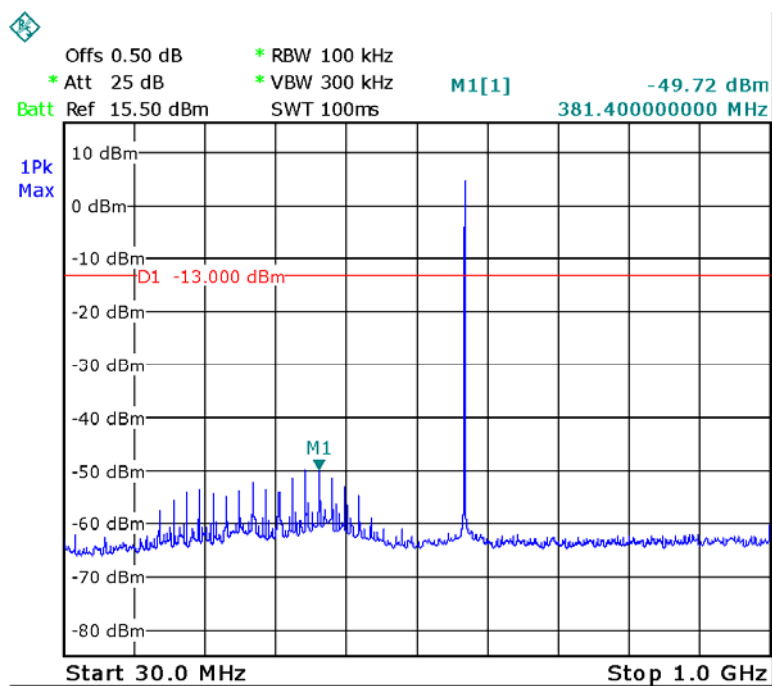


High Channel (579.95MHz)

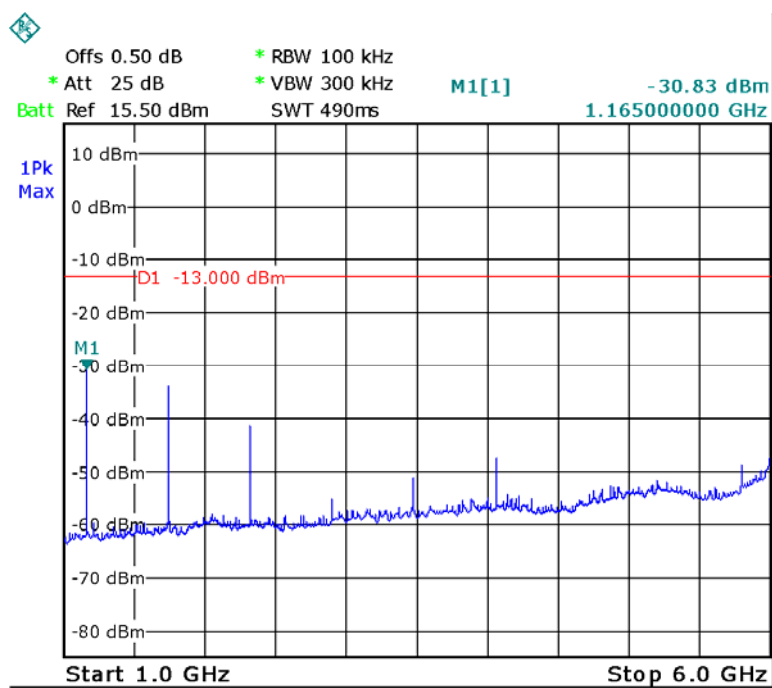
Emission Mask



30MHz-1GHz



1GHz-6GHz



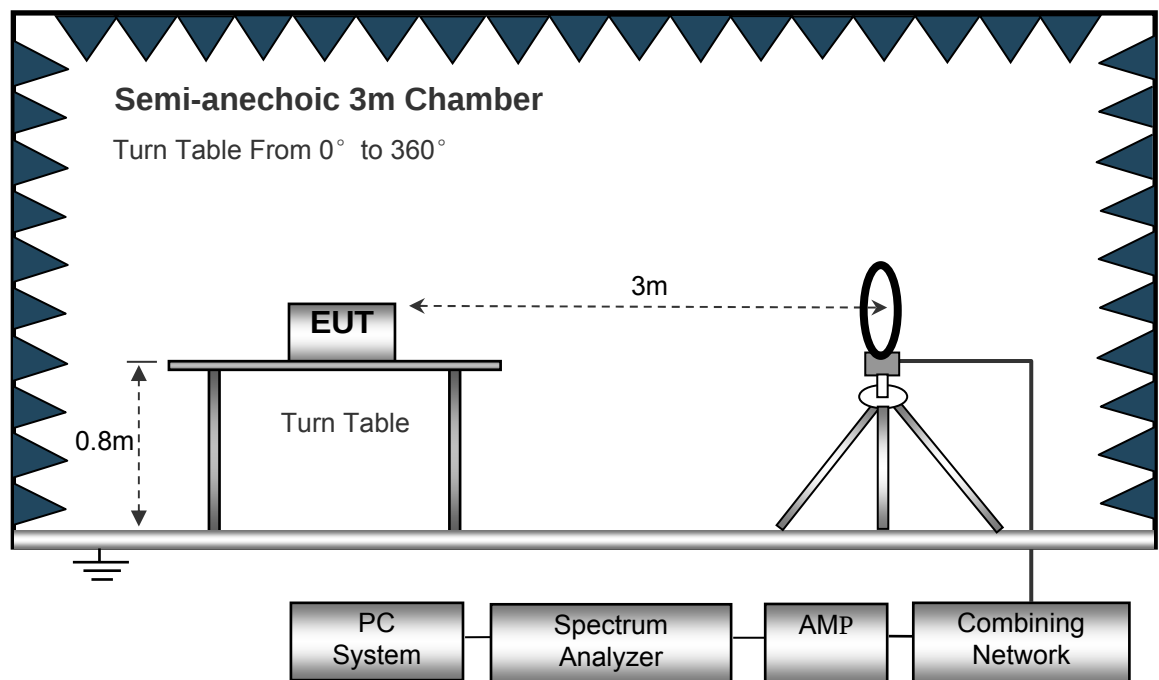
11 Radiated Emission Test

Test requirement:	FCC CFR47 Part 2 Section 2.1053
Test method:	Based on ANSI/TIA-603-E:2016, ANSI C63.26:2015, C63.4:2014
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.

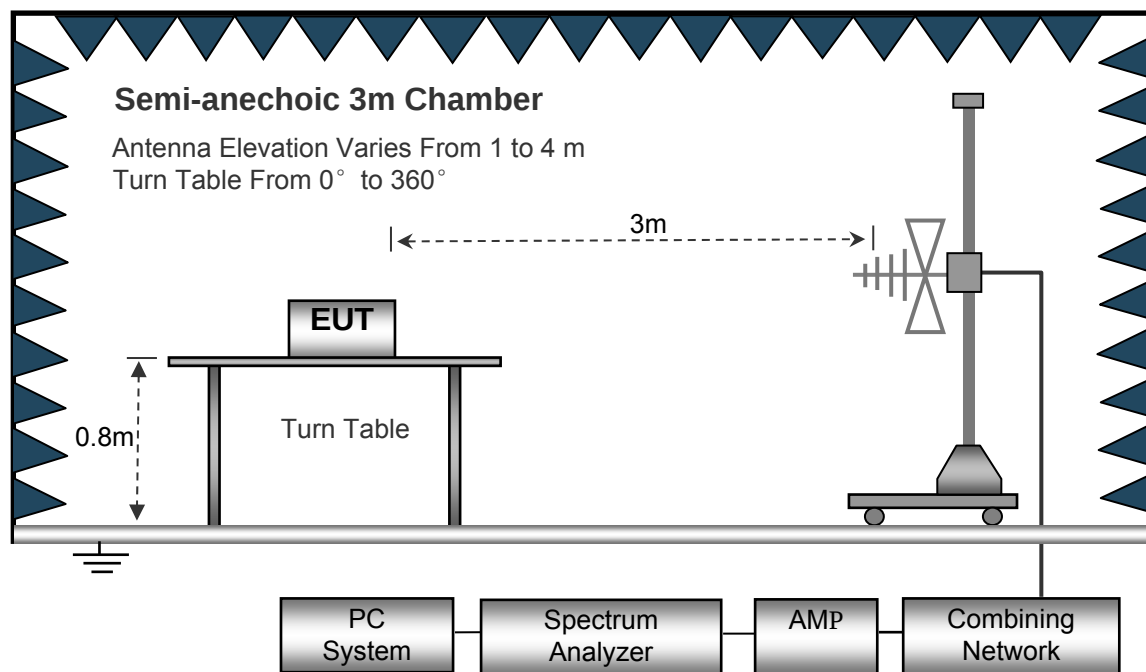
11.1 EUT Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4:2014

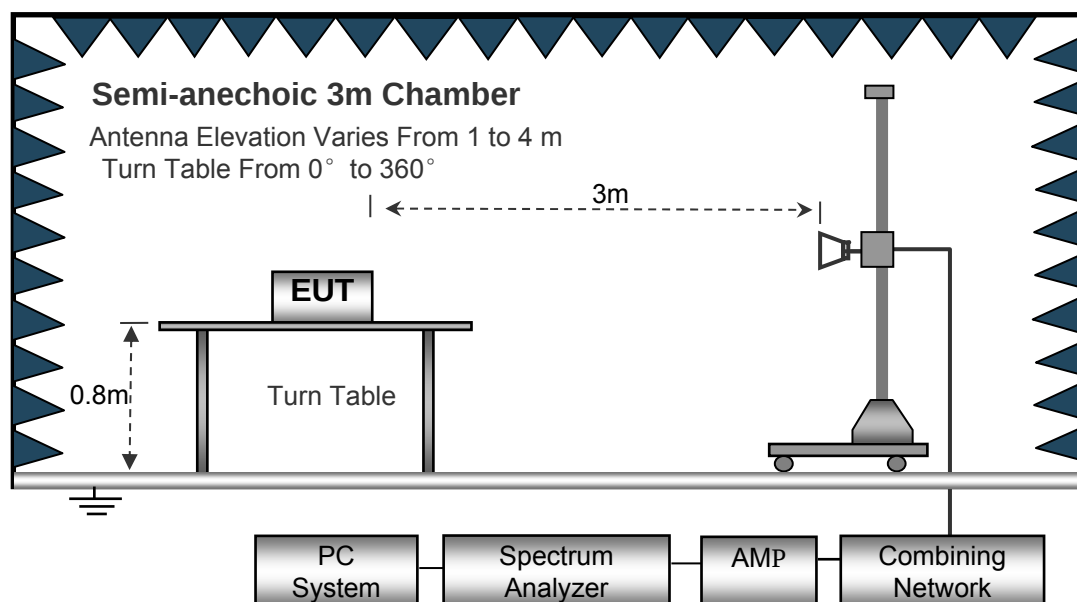
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 KHz to 30 MHz Emissions.



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.



11.2 Spectrum Analyzer Setup

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

11.3 Test Procedure

1. The EUT is placed on a turntable. the EUT is 0.8m 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.

11.4 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

11.5 Test Result

Low Power

Frequency	Detector	Ant.	Antenna Height	Turntable Angle	Emission Level	Limit	Margin
(MHz)		Pol	(m)	(°)	(dBm)	(dBm)	(dB)
Low Channel: 530.20MHz							
1060.40	Peak	H	1.7	199	-45.23	-13	-32.23
1060.40	Peak	V	1.8	180	-46.05	-13	-33.05
1590.60	Peak	H	1.4	222	-44.68	-13	-31.68
1590.60	Peak	V	1.2	149	-45.84	-13	-32.84
2120.80	Peak	H	1.4	171	-49.27	-13	-36.27
2120.80	Peak	V	1.3	128	-50.19	-13	-37.19
Middle Channel: 555.20MHz							
1110.40	Peak	H	1.6	189	-44.41	-13	-31.41
1110.40	Peak	V	1.6	101	-45.41	-13	-32.41
1665.60	Peak	H	1.3	156	-44.53	-13	-31.53
1665.60	Peak	V	1.6	272	-46.70	-13	-33.70
2220.80	Peak	H	1.6	31	-49.20	-13	-36.20
2220.80	Peak	V	1.4	191	-49.37	-13	-36.37
High Channel: 579.95MHz							
1159.90	Peak	H	1.0	312	-47.11	-13	-34.11
1159.90	Peak	V	1.0	26	-47.83	-13	-34.83
1739.85	Peak	H	1.1	139	-46.19	-13	-33.19
1739.85	Peak	V	1.7	206	-47.25	-13	-34.25
2319.80	Peak	H	1.0	122	-50.91	-13	-37.91
2319.80	Peak	V	1.8	210	-51.78	-13	-38.78

High Power

Frequency (MHz)	Detector	Ant. Pol	Antenna Height (m)	Turntable Angle (°)	Emission Level (dBm)	Limit (dBm)	Margin (dB)
Low Channel: 530.20MHz							
1060.40	Peak	H	1.2	285	-40.93	-13	-27.93
1060.40	Peak	V	1.9	50	-41.74	-13	-28.74
1590.60	Peak	H	1.9	136	-40.59	-13	-27.59
1590.60	Peak	V	1.5	251	-40.93	-13	-27.93
2120.80	Peak	H	2.0	131	-44.73	-13	-31.73
2120.80	Peak	V	1.3	211	-45.81	-13	-32.81
Middle Channel: 555.20MHz							
1110.40	Peak	H	1.1	242	-40.70	-13	-27.70
1110.40	Peak	V	1.1	299	-41.09	-13	-28.09
1665.60	Peak	H	1.3	322	-40.43	-13	-27.43
1665.60	Peak	V	1.7	172	-40.36	-13	-27.36
2220.80	Peak	H	1.1	44	-44.29	-13	-31.29
2220.80	Peak	V	1.1	194	-46.76	-13	-33.76
High Channel: 579.95MHz							
1159.90	Peak	H	1.7	357	-42.28	-13	-29.28
1159.90	Peak	V	1.5	43	-43.60	-13	-30.60
1739.85	Peak	H	1.4	142	-41.63	-13	-28.63
1739.85	Peak	V	1.8	101	-42.29	-13	-29.29
2319.80	Peak	H	1.4	261	-46.59	-13	-33.59
2319.80	Peak	V	1.6	282	-47.16	-13	-34.16

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

12 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.

12.1 Test Configuration

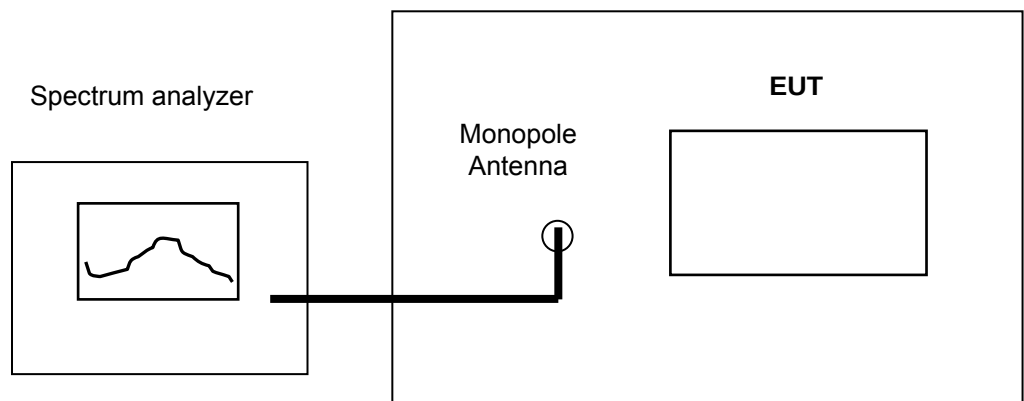


Figure 1

12.2 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 °C. 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 50°C. 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 10°C decreased per stage until the lowest temperature -30°C is measured, record all measurement frequencies.

12.3 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 $\pm 10\%$ 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 (°C)	Frequency Measured	Frequency Tolerance (%)
2.7V, DC	530.20	24.2	530.204	0.00080
3.3V, DC	530.20	24.2	530.202	0.00030

Middle channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (°C)	Frequency Measured	Frequency Tolerance (%)
2.7V, DC	555.20	24.2	555.197	0.00053
3.3V, DC	555.20	24.2	555.197	0.00054

High channel

Power Supply	Reference Frequency (MHz)	Environment Temperature (°C)	Frequency Measured	Frequency Tolerance (%)
2.7V, DC	579.95	24.2	579.951	0.00019
3.3V, DC	579.95	24.2	579.952	0.00040

Frequency stability versus environmental temperature

Low Frequency: 530.20MHz, Limit: 0.005%			
Environment Temperature(°C)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3V, DC	530.195	0.00089
40	3V, DC	530.196	0.00068
30	3V, DC	530.202	0.00045
20	3V, DC	530.195	0.00091
10	3V, DC	530.205	0.00098
0	3V, DC	530.205	0.00092
-10	3V, DC	530.195	0.00099
-20	3V, DC	530.204	0.00070
-30	3V, DC	530.199	0.00022

Middle Frequency: 555.20MHz, Limit: 0.005%			
Environment Temperature(°C)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3V, DC	555.195	0.00094
40	3V, DC	555.196	0.00066
30	3V, DC	555.201	0.00019
20	3V, DC	555.202	0.00033
10	3V, DC	555.200	0.00008
0	3V, DC	555.196	0.00078
-10	3V, DC	555.198	0.00032
-20	3V, DC	555.202	0.00040
-30	3V, DC	555.201	0.00018

High Frequency: 579.95MHz, Limit: 0.005%			
Environment Temperature(°C)	Power Supply	Frequency Deviation measured with time Elapse(30 minutes)	
		MHz	%
50	3V, DC	579.950	0.00006
40	3V, DC	579.944	0.00098
30	3V, DC	579.954	0.00062
20	3V, DC	579.950	0.00000
10	3V, DC	579.952	0.00036
0	3V, DC	579.947	0.00055
-10	3V, DC	579.950	0.00002
-20	3V, DC	579.953	0.00056
-30	3V, DC	579.954	0.00073

Test Result: The max frequency tolerance rating is 0.00099% < 0.005%. Passed.

13 FCC ID: S5OHUM-1600T RF Exposure Report

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1093 & 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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR where

1. $f(\text{GHz})$ 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
7.71	5.90	5.90	5	0.90	3.0	Compliance

Remark: Max. duty factor is 100%

Low Channel: $f=530.20\text{MHz}=0.53020\text{GHz}$, so $\sqrt{f(\text{GHz})}=0.728$

High Channel: $f=579.95\text{MHz}=0.57995\text{GHz}$, so $\sqrt{f(\text{GHz})}=0.762$

13.3 Result: Compliance

No SAR measurement is required.

14 Photographs –Model HUM-1600T Test Setup

14.1 Photograph – Radiation Spurious Emission Test Setup

9kHz to 30MHz



30MHz to 1GHz



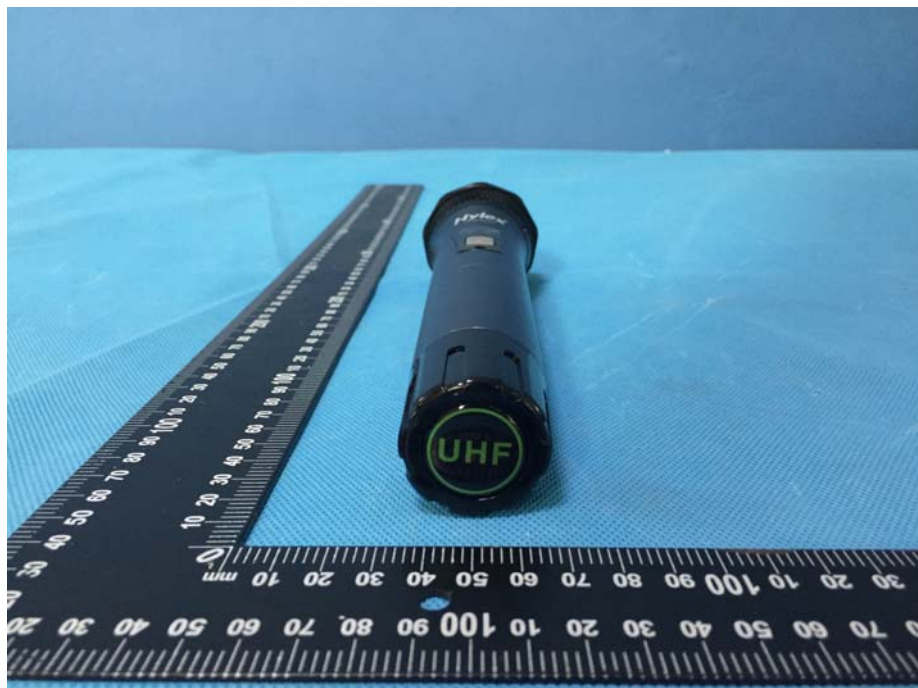
1GHz to 6GHz



15 Photographs – Constructional Details

15.1 EUT –Model HUM-1600T External Photos



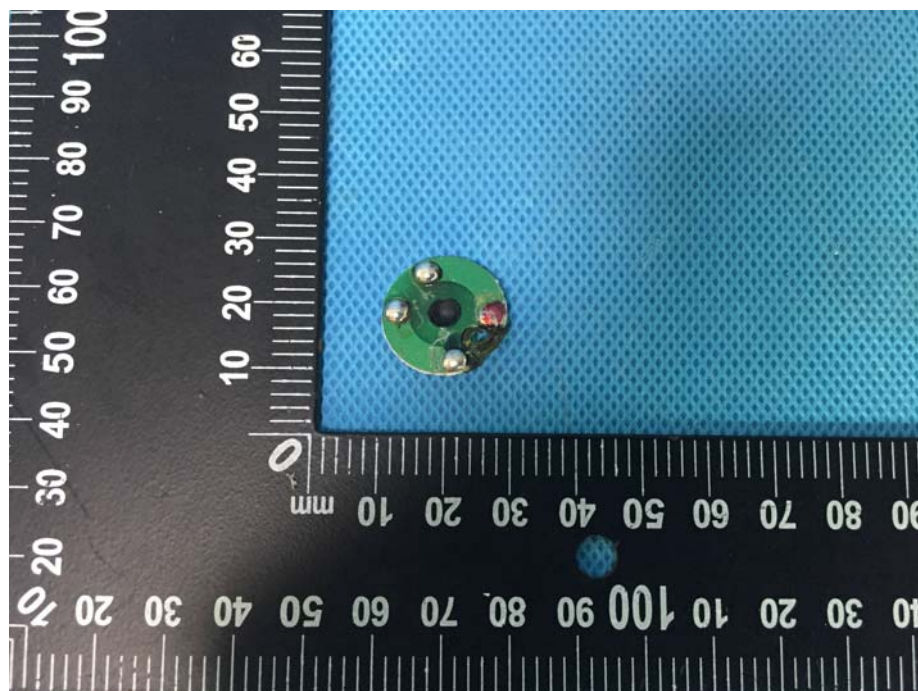


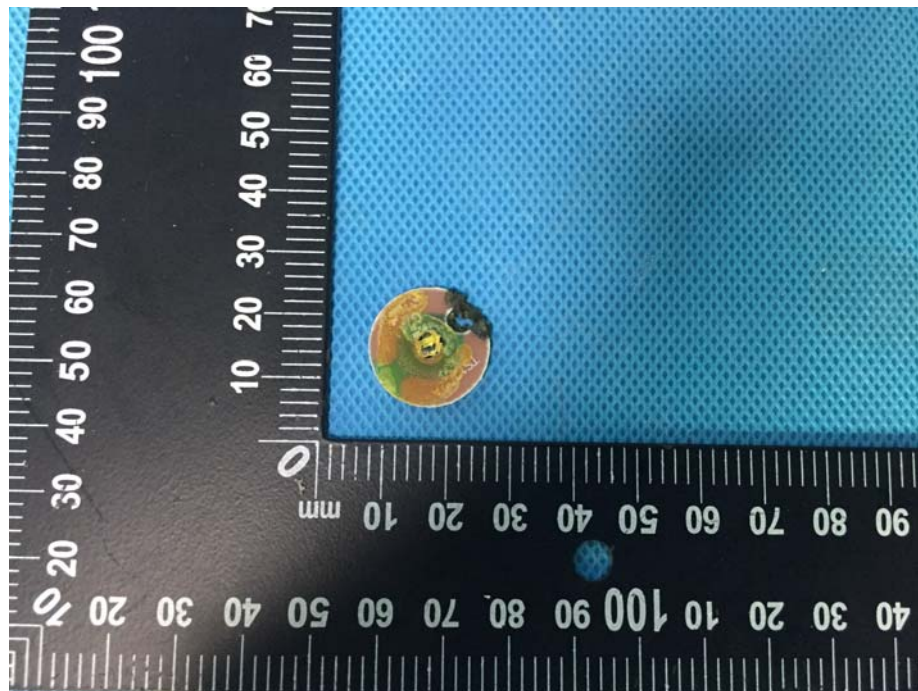


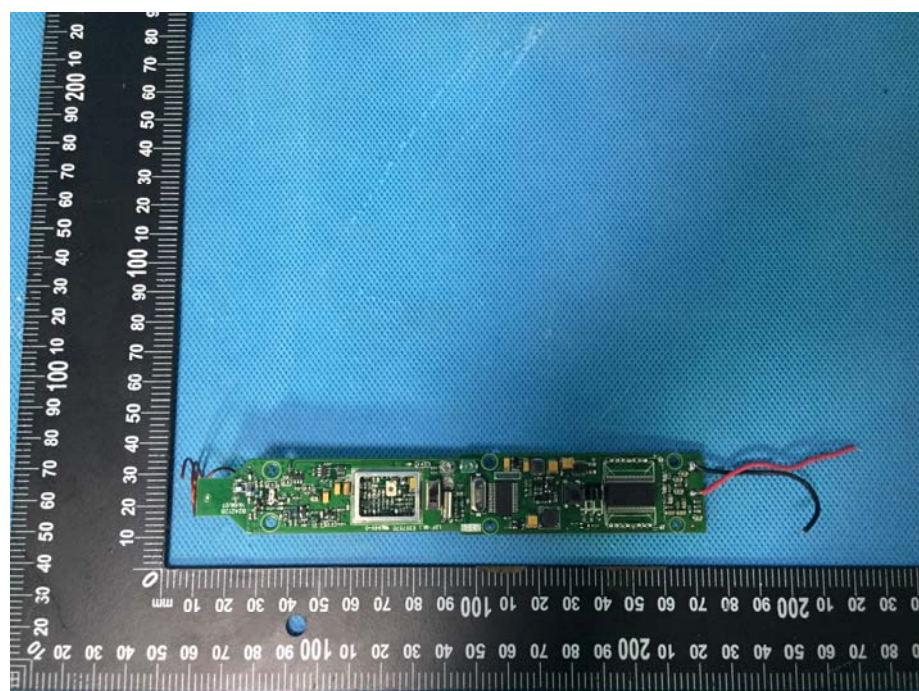
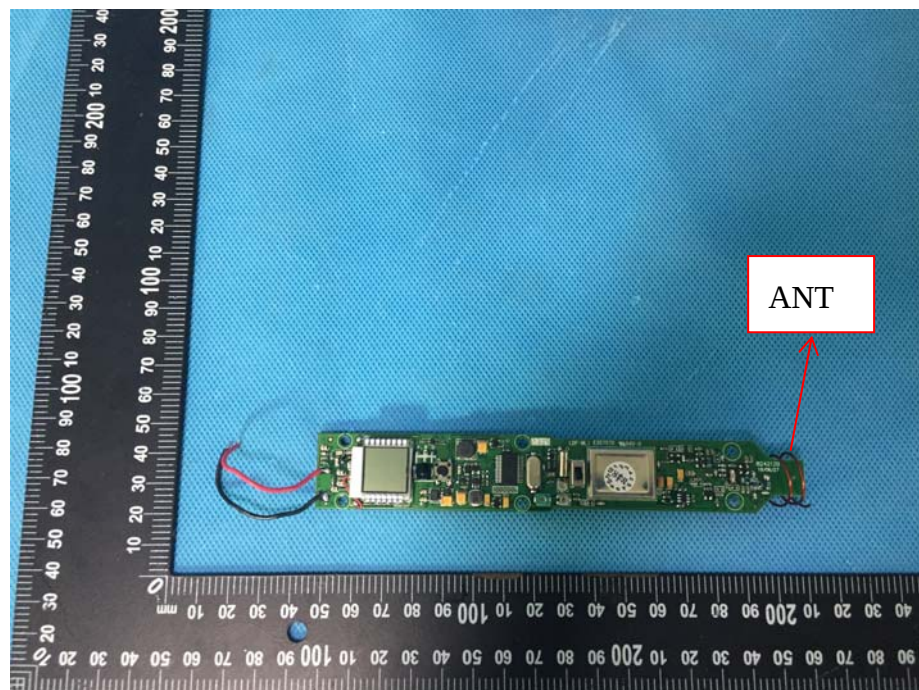
15.2 EUT –Model HUM-1600T Internal Photos

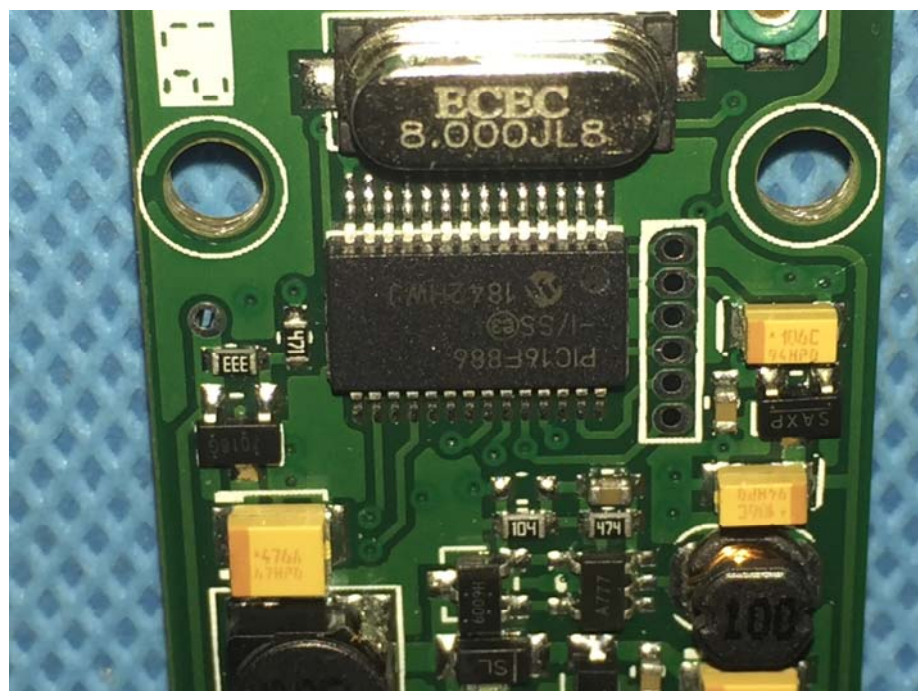


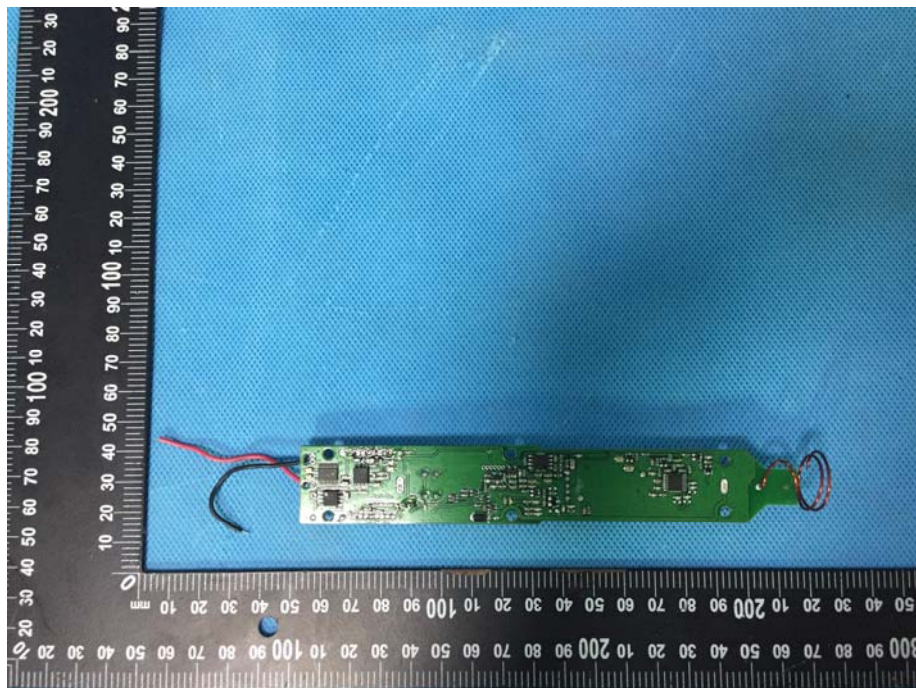
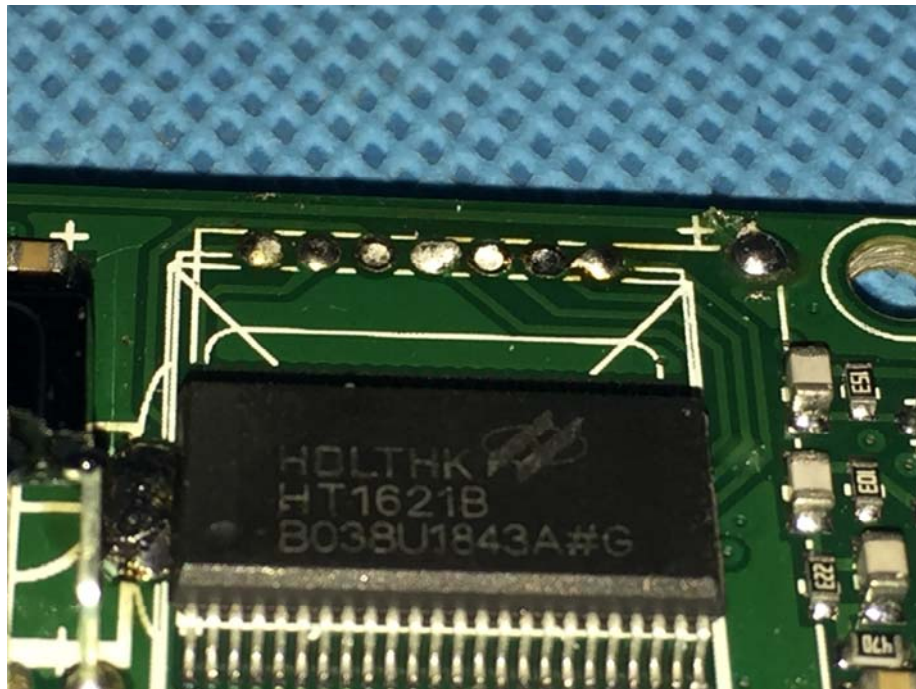


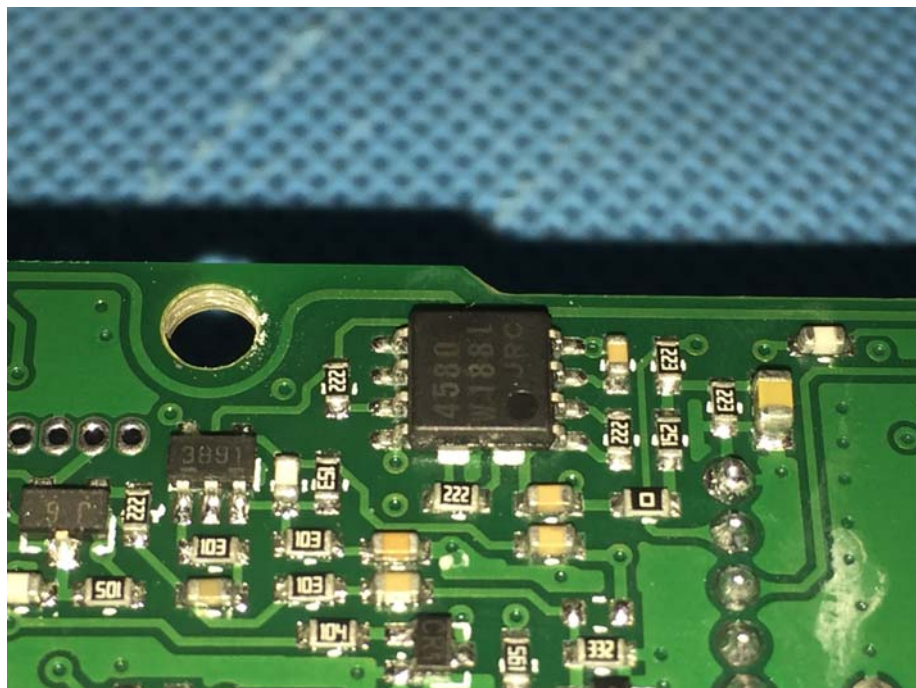
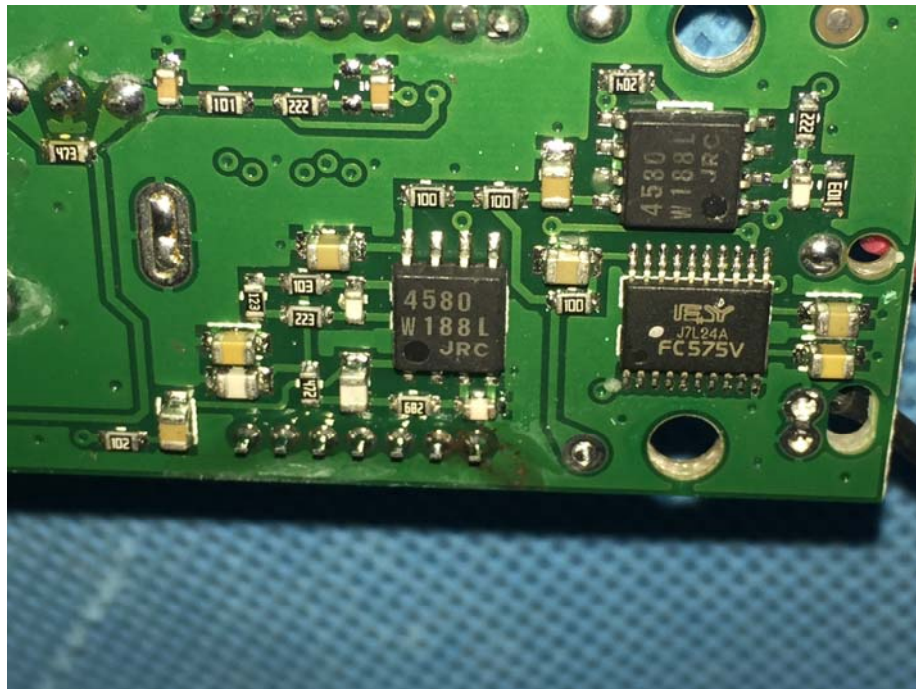


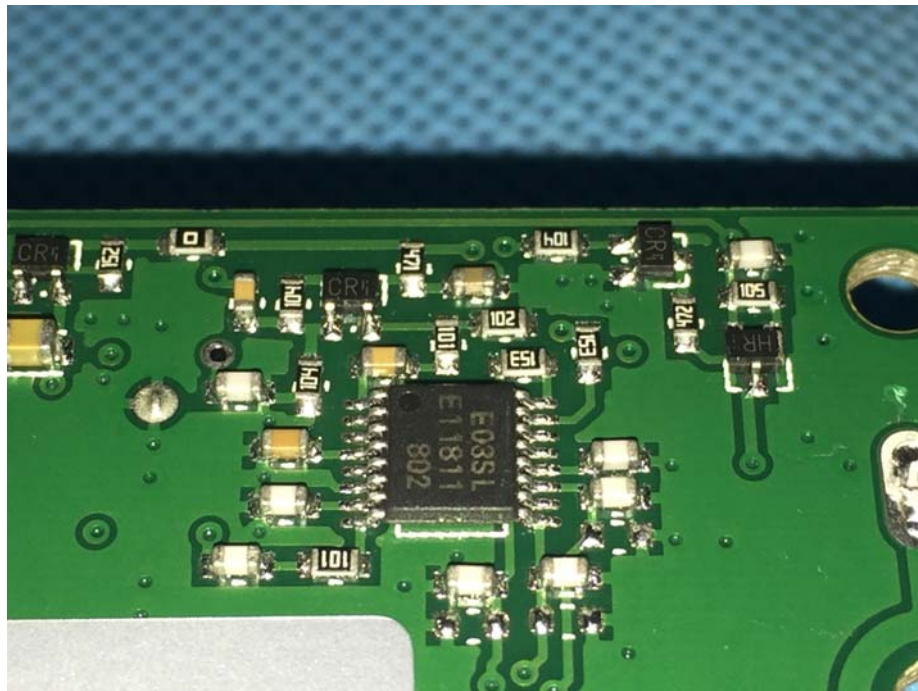












=====End of Report=====