FCC TEST REPORT

Report No: STS1907035W01

Issued for

H & F TECHNOLOGIES, INCORPORATED

650 FLINN AVENUE MOORPARK, CA 93021 USA

Product Name:	wireless microphone
Brand Name:	Audio2000's
Model Name:	AWX6601U
Series Model:	N/A
FCC ID:	2ADV7AWX6601U
Test Standard:	FCC Part 74 Rules

Shenzhen STS Test Services Co., Ltd.
1/F, Building B, Zhuoke Science Park, No.190,Chongqing Road,
Fuyong Street, Bao'an District, Shenzhen, Guangdong,China
TEL: +86-755 3688 6288 FAX: +86-755 3688 6277 E-mail:sts@stsapp.com

TEST RESULT CERTIFICATION

Applicant's Name ..... : H & F TECHNOLOGIES, INCORPORATED

Address ..... : 650 FLINN AVENUE MOORPARK, CA 93021 USA

Manufacture's Name ..... : H & F TECHNOLOGIES, INCORPORATED

Address ..... : 650 FLINN AVENUE MOORPARK, CA 93021 USA

Product Description

Product Name ..... : wireless microphone

Brand Name ..... : Audio2000's

Model Name ..... : AWX6601U

Series Model ..... : N/A

Test Standards ..... : FCC Part 74 Rules

Test Procedure ..... : ANSI C63.4:2014;TIA/EIA 603

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

This report shall not be reproduced except in full, without the written approval of STS, this document only be altered or revised by STS, personal only, and shall be noted in the revision of the document.

Date of Test ..... :

Date of performance of tests ..... : 05 July 2019 ~ 16 Aug. 2019

Date of Issue ..... : 16 Aug. 2019

Test Result ..... : Pass

Testing Engineer : Chris Chen

(Chris Chen)

Technical Manager : Sunday Hu

(Sunday Hu)

Authorized Signatory : Vita Li

(Vita Li)

Table of Contents Page

Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	16 Aug. 2019	STS1907035W01	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
The EUT has been tested according to FCC CFR 47:
Part 2: Frequency Allocations and Radio Treaty Matters: General Rules and Regulations (10-1-05 Edition)
Part 74: Experimental Radio, Auxiliary, Special Broadcast and other program distributional services

Emission			
Standard	Item	Limit	Result
FCC 2.1053; 74.861(e)(6)	Radiated Spurious Emission	Refer to 74.861e(6)	PASS
FCC 2.1046 (a), 74.861(e)(1)	RF Output Power	250 mW	PASS
FCC 2.1047 (b), 74.861(e)(3)	Modulation Deviation	Refer to 74.861e(2)	PASS
FCC 2.1047 (a)	Audio Frequency Response	Refer to 2.1047(a)	PASS
FCC 74.861 (e)(5)	Occupied Bandwidth	< 200 KHz	PASS
FCC 74.861 (e)(6)(i) (ii); FCC 2.1049	Emission Mask	Refer to 74.861e(6)	PASS
2.1055(b); 74.861 e(4)	Frequency Stability vs. Temperature	Refer to 74.861e(4)	PASS
2.1055(a)(1); 74.861 e(4)	Frequency Stability vs. Voltage	Refer to 74.861e(4)	PASS
FCC 15.207	Line Conducted Emissions	--	N/A

NOTE:
(1)" N/A" denotes test is not applicable in this Test Report

1.1 TEST FACTORY

Shenzhen STS Test Services Co., Ltd.
Add.: 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road,
Fuyong Street, Bao'an District, Shenzhen, Guangdong, China
FCC test Firm Registration Number: 625569
A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.71dB
2	Unwanted Emissions, conducted	±0.63dB
3	All emissions, radiated 30-200MHz	±3.43dB
4	All emissions, radiated 200MHz-1GHz	±3.57dB
5	All emissions, radiated>1G	±4.13dB
6	Conducted Emission (9KHz-150KHz)	±3.18dB
7	Conducted Emission (150KHz-30MHz)	±2.70dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name:	wireless microphone
Brand Name:	Audio2000's
Model Name:	AWX6601U
Series Model :	N/A
Model Difference description:	N/A
Emission Bandwidth:	90.722KHz
Battery:	DC 3V form AA*2 Battery
Operation Frequency Range	512.55 MHz-536.25 MHz 565.15 MHz-588.85 MHz
Maximum Transmitter Power:	5.749 mW(7.596dBm)
Modulation mode / type:	FM
Frequency Tolerance	0.000200%
Temperature Range:	-30℃-50℃
Test frequency list:	See Note 5
Software version number:	HV1.0
Hardware version number:	SV1.0

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Note: The product has the same digital working characters when operating in both two digitized voice/data mode. So only one set of test results for digital modulation modes are provided in this test report.
3. Please refer to the photographs of the EUT. For more details, please refer to the User's manual of the EUT.

4.

Channel List(512.55-536.25MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	512.55	21	518.55	41	524.55	61	530.55
2	512.85	22	518.85	42	524.85	62	530.85
3	513.15	23	519.15	43	525.15	63	531.15
4	513.45	24	519.45	44	525.45	64	531.45
5	513.75	25	519.75	45	525.75	65	531.75
6	514.05	26	520.05	46	526.05	66	532.05
7	514.35	27	520.35	47	526.35	67	532.35
8	514.65	28	520.65	48	526.65	68	532.65
9	514.95	29	520.95	49	526.95	69	532.95
10	515.25	30	521.25	50	527.25	70	533.25
11	515.55	31	521.55	51	527.55	71	533.55
12	515.85	32	521.85	52	527.85	72	533.85
13	516.15	33	522.15	53	528.15	73	534.15
14	516.45	34	522.45	54	528.45	74	534.45
15	516.75	35	522.75	55	528.75	75	534.75
16	517.05	36	523.05	56	529.05	76	535.05
17	517.35	37	523.35	57	529.35	77	535.35
18	517.65	38	523.65	58	529.65	78	535.65
19	517.95	39	523.95	59	529.95	79	535.95
20	518.25	40	524.25	60	530.25	80	536.25

Note, the frequency of a total of 80CH

Channel List(565.15-588.85MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	565.15	21	571.15	41	577.15	61	583.15
2	565.45	22	571.45	42	577.45	62	583.45
3	565.75	23	571.75	43	577.75	63	583.75
4	566.05	24	572.05	44	578.05	64	584.05
5	566.35	25	572.35	45	578.35	65	584.35
6	566.65	26	572.65	46	578.65	66	584.65
7	566.95	27	572.95	47	578.95	67	584.95
8	567.25	28	573.25	48	579.25	68	585.25
9	567.55	29	573.55	49	579.55	69	585.55
10	567.85	30	573.85	50	579.85	70	585.85
11	568.15	31	574.15	51	580.15	71	586.15
12	568.45	32	574.45	52	580.45	72	586.45
13	568.75	33	574.75	53	580.75	73	586.75
14	569.05	34	575.05	54	581.05	74	587.05
15	569.35	35	575.35	55	581.35	75	587.35
16	569.65	36	575.65	56	581.65	76	587.65
17	569.95	37	575.95	57	581.95	77	587.95
18	570.25	38	576.25	58	582.25	78	588.25
19	570.55	39	576.55	59	582.55	79	588.55
20	570.85	40	576.85	60	582.85	80	588.85

Note, the frequency of a total of 80CH

5. Test frequency list

Test Channel List(512.55-536.25MHz)		
Test Channel	EUT Channel	Test Frequency (MHz)
lowest	CH01	512.55
middle	CH40	524.25
highest	CH80	536.25

Test Channel List(565.15-588.85MHz)		
Test Channel	EUT Channel	Test Frequency (MHz)
lowest	CH01	565.15
middle	CH40	576.85
highest	CH80	588.85

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test,please see the above listed frequency for testing.

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	Low Channel
Mode 2	Middle Channel
Mode 3	High Channel
Mode 4	Link Mode

For Radiated Emission	
Final Test Mode	Description
Mode 1	Low Channel
Mode 2	Middle Channel
Mode 3	High Channel
Mode 4	Link Mode

Note:

(1) Due to the different configuration and test, in this list only some worse mode. The worst test data of the worse modeis reported by this report.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

E-1
EUT

2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.5 TEST EQUIPMENT

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.1
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2018.10.13	2019.10.12
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2018.10.13	2019.10.12
Signal Analyzer	Agilent	N9020A	MY51110105	2019.03.02	2020.03.01
Temperature & Humitidy	HH660	Mieo	N/A	2018.10.11	2019.10.10
trun table	EM	SC100_1	60531	N/A	N/A
Antnna mast	EM	SC100	N/A	N/A	N/A
AC Power Source	APC	KDF-11010G	F214050035	N.C.R	N.C.R
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

RF Connected Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2018.10.13	2019.10.12
Signal Generator	Agilent	N5182A	MY46240556	2018.10.16	2019.10.15
Signal Analyzer	Agilent	N9020A	MY49100060	2018.10.13	2019.10.12
Universal Radio communication tester	R&S	CMU200	11764	2018.10.13	2019.10.12
Audio analyzer	R&S	UPL	N/A	2019.03.11	2020.03.10
Temperature & Humitidy	HH660	Mieo	N/A	2018.10.11	2019.10.10
programmable power supply	Agilent	E3642A	MY40002025	2018.10.13	2019.10.12
Attenuator	HP	8494B	DC-18G	2019.05.06	2020.05.05
AC Power Source	APC	KDF-11010G	F214050035	N.C.R	N.C.R
Test SW	FARAD	LZ-RF /LzRf-3A3			

3. TEST METHODOLOGY

3.1 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirement in Section 13.1.4.1 of ANSI C63.4:2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Not Applicable (Since the EUT is powered by battery)

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4:2003.

3.2 DESCRIPTION OF TEST MODES

The EUT has been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.

3.3 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b)Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

4. FCC PART 74 REQUIREMENTS

4.1 RADIATED SPURIOUS EMISSION

TEST LIMITS

According to CFR 47 section 74.861 e (6)(iii), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.
It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

= P(dBW) - [43 + 10log(P)] (dB)

= [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)

= -13dBm.

4.2 EMISSION MASK I

TEST LIMITS

- According to CFR 47 section 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:

a. (1) 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;
(2) 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;
(3) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43+10log 10 *(mean output power in watts) dB;

4.3 EMISSION MASK II

TEST LIMITS

- According to ETSI EN 300 422-1 V1.5.1 Clause 8.3.1.2,

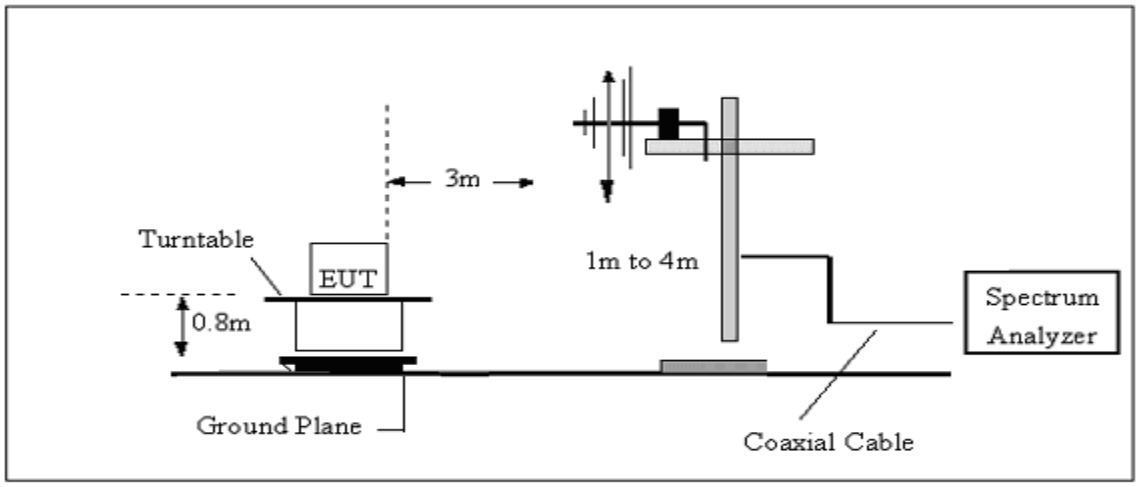
a. The transmitter output spectrum shall be within the mask defined in figure 3 where B is the declared channel bandwidth

TEST PROCEDURE

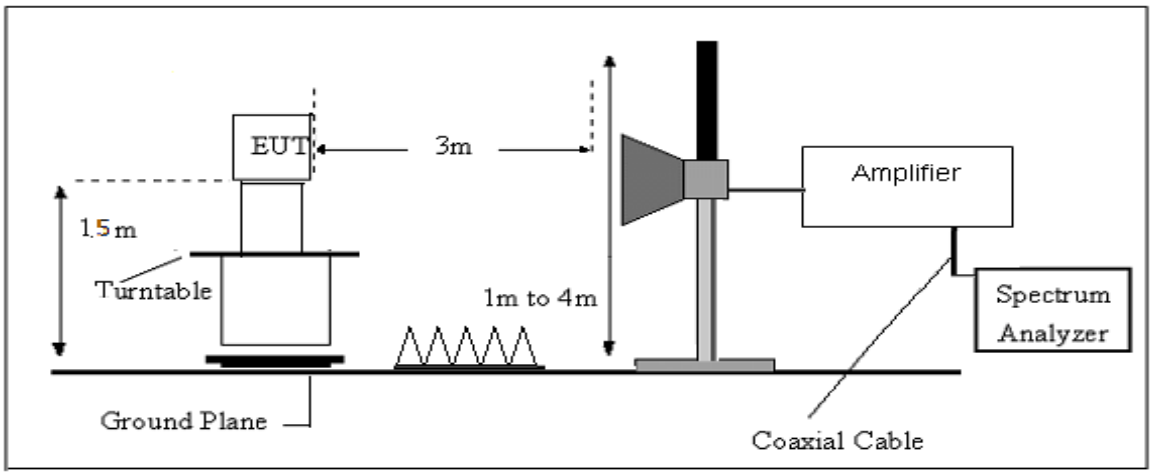
a. On a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
b. The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
c. The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
d. The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
e. The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
f. The transmitter shall than be rotated through 360°in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
g The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
h The maximum signal level detected by the measuring receiver shall be noted.
i The measurement shall be repeated with the test antenna set to horizontal polarization.
j Replace the antenna with a proper Antenna (substitution antenna).
k The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
l The substitution antenna shall be connected to a calibrated signal generator.
m If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
n The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
o The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
p The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
q The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

TEST CONFIGURATION

（A）Radiated Emission Test-Up Frequency Above 30MHz



（B）Radiated Emission Test-Up Frequency Above 1GHz



TEST RESULTS

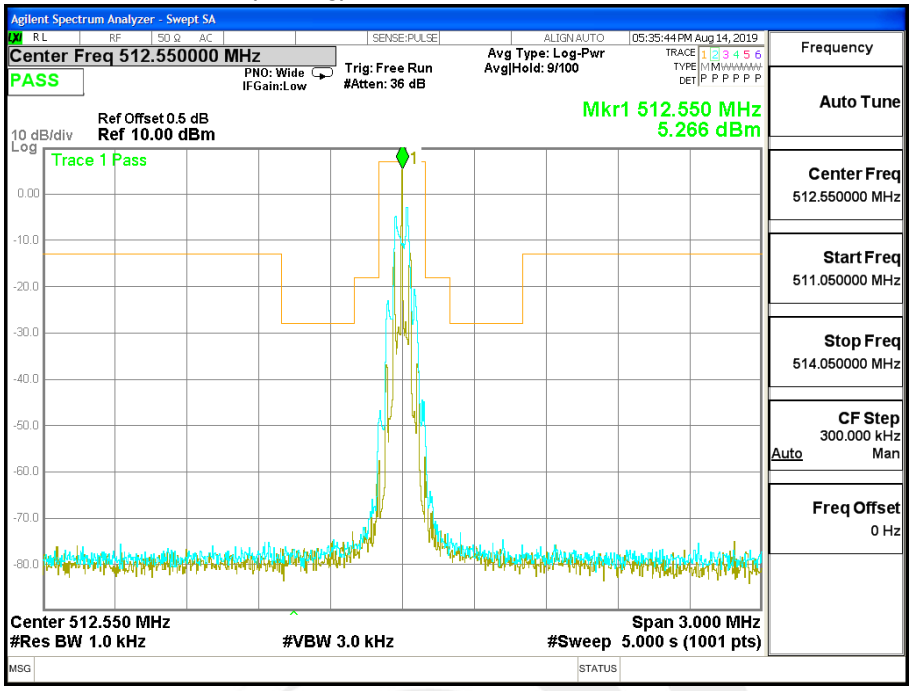
(30-6000)MHz							
The Worst Test Results Low Channel 512.55 MHz							
Frequency(MHz)	S G.Lev (dBm)	Ant(dBi)	Loss	PMea (dBm)	Limit （dBm）	Margin (dBm)	Polarity
1024.92	-39.91	6.00	3.13	-37.04	-13.00	-24.04	H
1537.48	-38.99	9.40	5.84	-35.43	-13.00	-22.43	H
2050.02	-30.65	10.40	7.64	-27.89	-13.00	-14.89	H
1025.16	-43.34	6.00	3.13	-40.47	-13.00	-27.47	V
1537.27	-43.82	9.40	5.84	-40.26	-13.00	-27.26	V
2050.36	-42.84	10.40	7.64	-40.08	-13.00	-27.08	V
The Worst Test Results Mid Channel 524.25 MHz							
Frequency(MHz)	S G.Lev (dBm)	Ant(dBi)	Loss	PMea (dBm)	Limit （dBm）	Margin (dBm)	Polarity
1048.07	-36.51	6.00	3.13	-33.64	-13.00	-20.64	H
1572.66	-43.23	9.40	5.84	-39.67	-13.00	-26.67	H
2097.37	-37.94	10.40	7.64	-35.18	-13.00	-22.18	H
1048.09	-37.54	6.00	3.13	-34.67	-13.00	-21.67	V
1572.47	-31.57	9.40	5.84	-28.01	-13.00	-15.01	V
2097.29	-36.69	10.40	7.64	-33.93	-13.00	-20.93	V
The Worst Test Results High Channel 536.25 MHz							
Frequency(MHz)	S G.Lev (dBm)	Ant(dBi)	Loss	PMea (dBm)	Limit （dBm）	Margin (dBm)	Polarity
1072.52	-35.79	6.00	3.13	-32.92	-13.00	-19.92	H
1608.66	-42.83	9.40	5.84	-39.27	-13.00	-26.27	H
2145.62	-38.02	10.40	7.64	-35.26	-13.00	-22.26	H
1072.79	-37.55	6.00	3.13	-34.68	-13.00	-21.68	V
1608.59	-32.07	9.40	5.84	-28.51	-13.00	-15.51	V
2145.57	-36.17	10.40	7.64	-33.41	-13.00	-20.41	V

(30-6000)MHz							
The Worst Test Results Low Channel 565.15 MHz							
Frequency(MHz)	S G.Lev (dBm)	Ant(dBi)	Loss	PMea (dBm)	Limit （dBm）	Margin (dBm)	Polarity
1129.95	-39.73	7.50	3.27	-35.50	-13.00	-22.50	H
1695.38	-38.82	10.40	5.94	-34.36	-13.00	-21.36	H
2260.40	-30.54	10.40	8.44	-28.58	-13.00	-15.58	H
1129.93	-42.66	7.50	3.27	-38.43	-13.00	-25.43	V
1695.62	-43.53	10.40	5.94	-39.07	-13.00	-26.07	V
2260.28	-42.31	10.40	8.44	-40.35	-13.00	-27.35	V
The Worst Test Results Mid Channel 576.85 MHz							
Frequency(MHz)	S G.Lev (dBm)	Ant(dBi)	Loss	PMea (dBm)	Limit （dBm）	Margin (dBm)	Polarity
1169.90	-36.19	7.50	3.27	-31.96	-13.00	-18.96	H
1730.37	-42.66	10.40	5.94	-38.20	-13.00	-25.20	H
2307.38	-37.96	10.40	8.44	-36.00	-13.00	-23.00	H
1169.86	-37.37	7.50	3.27	-33.14	-13.00	-20.14	V
1730.81	-31.63	10.40	5.94	-27.17	-13.00	-14.17	V
2307.08	-36.61	10.40	8.44	-34.65	-13.00	-21.65	V
The Worst Test Results High Channel 588.85 MHz							
Frequency(MHz)	S G.Lev (dBm)	Ant(dBi)	Loss	PMea (dBm)	Limit （dBm）	Margin (dBm)	Polarity
1177.83	-36.18	7.50	3.27	-31.95	-13.00	-18.95	H
1766.51	-42.70	10.40	5.94	-38.24	-13.00	-25.24	H
2355.23	-38.01	10.40	8.44	-36.05	-13.00	-23.05	H
1177.82	-37.27	7.50	3.27	-33.04	-13.00	-20.04	V
1766.75	-31.72	10.40	5.94	-27.26	-13.00	-14.26	V
2355.42	-36.25	10.40	8.44	-34.29	-13.00	-21.29	V

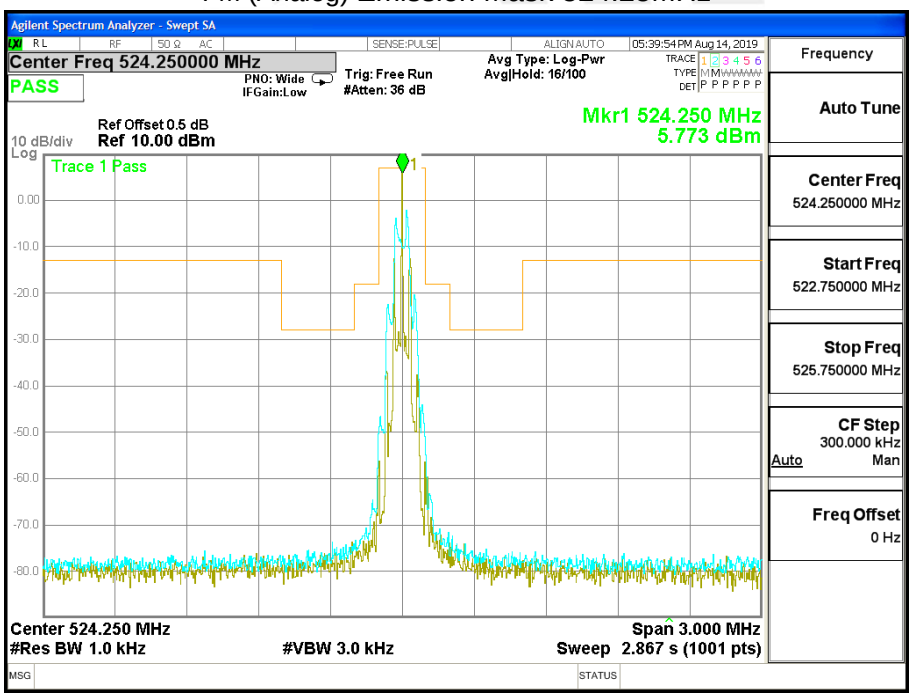
Note: PMea = S G. Level - Loss + Ant
Margin = PMea - Limit

Emission Mask I

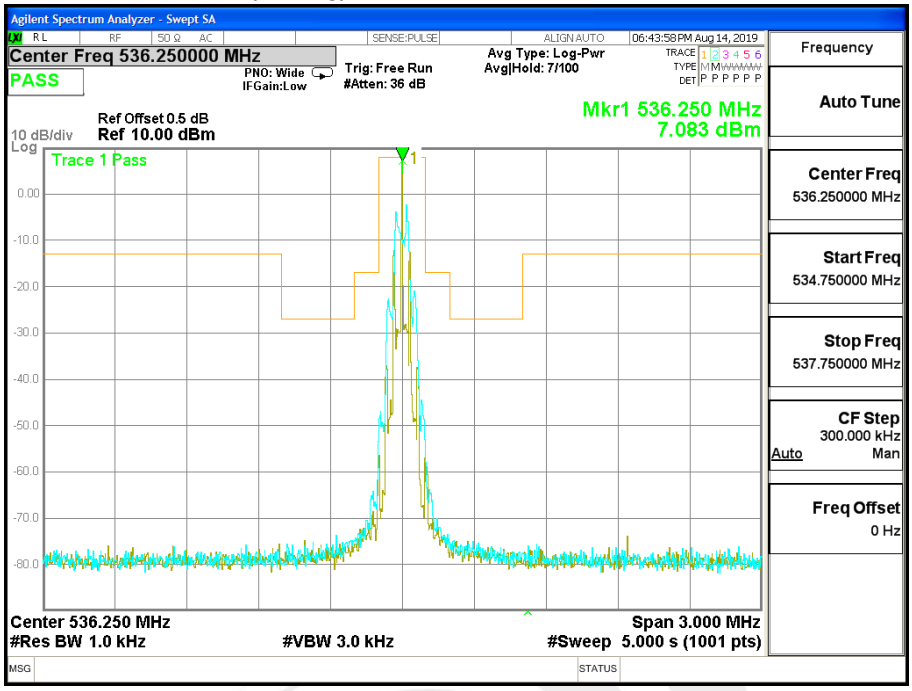
FM (Analog) Emission Mask 512.55MHz



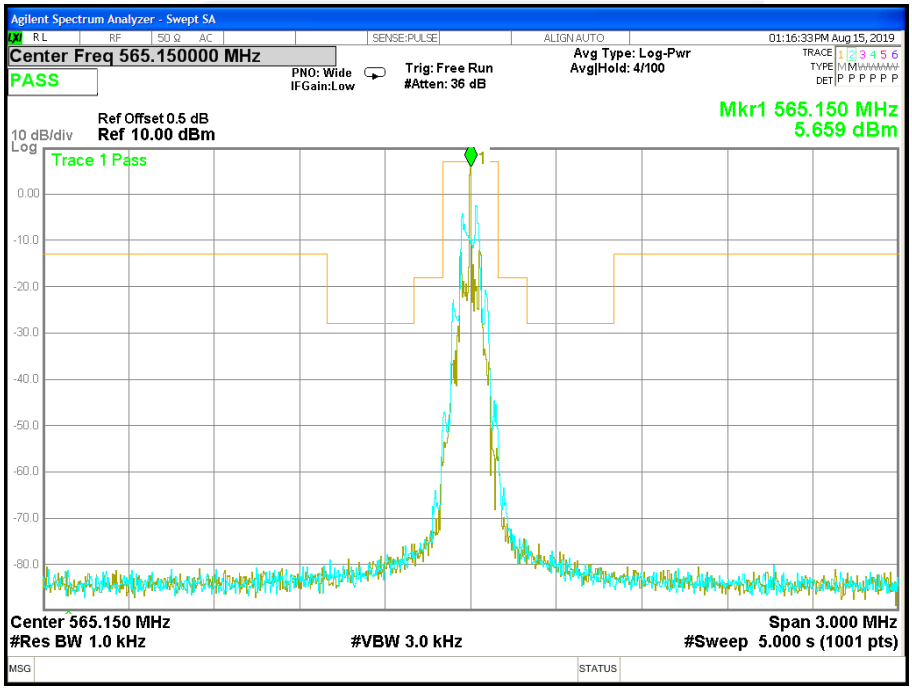
FM (Analog) Emission Mask 524.25MHz



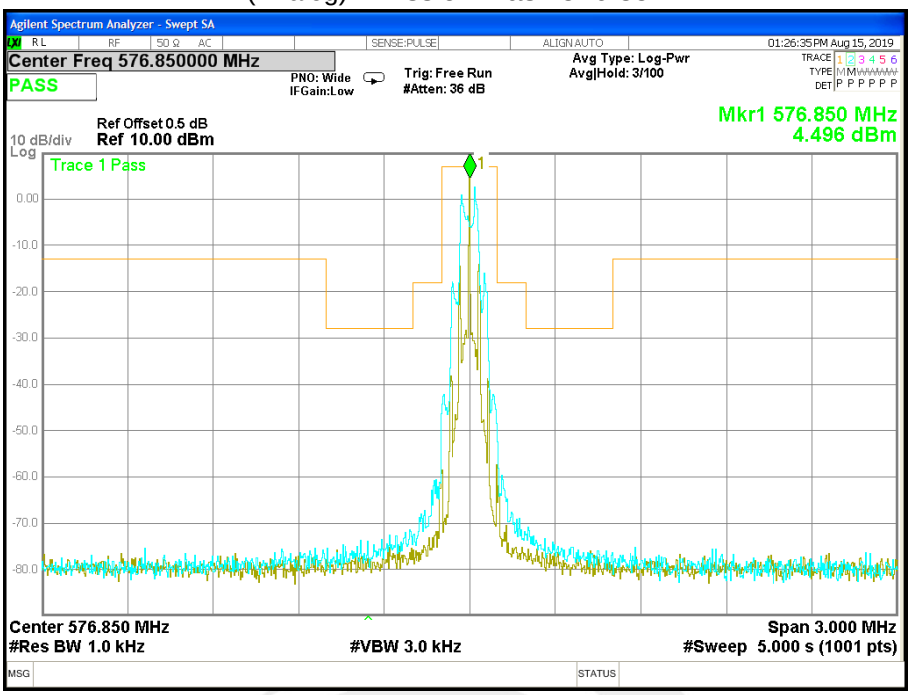
FM (Analog) Emission Mask 536.25MHz



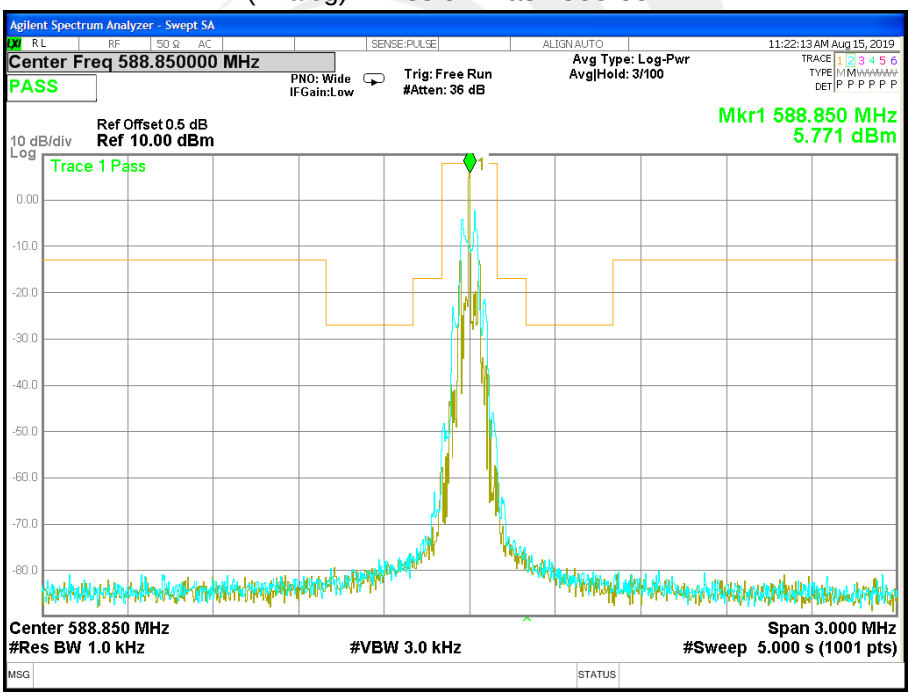
FM (Analog) Emission Mask 565.15MHz



FM (Analog) Emission Mask 576.85MHz



FM (Analog) Emission Mask 588.85MHz



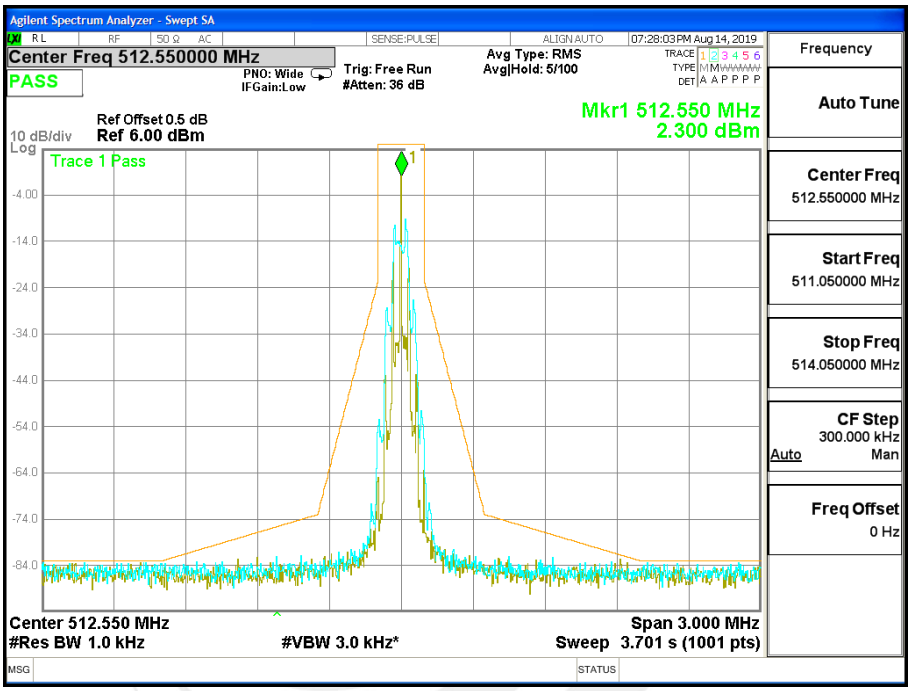
Emission Mask II

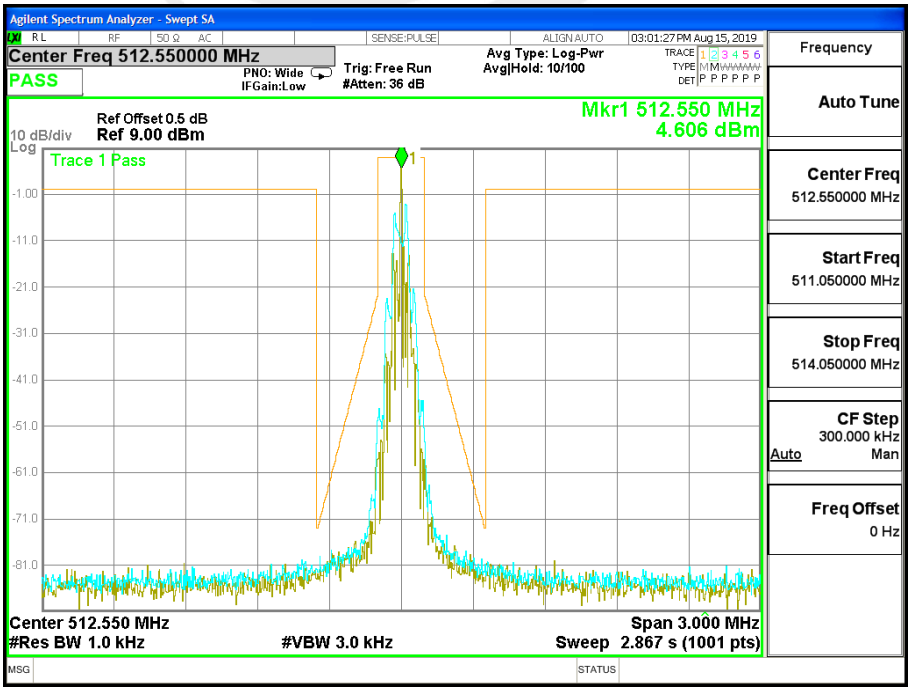
ETSI EN 300 422-1 V1.5.1 Clause 8.3.1.2 The Maximum Measurement of Necessary Bandwidth

Test Plot:

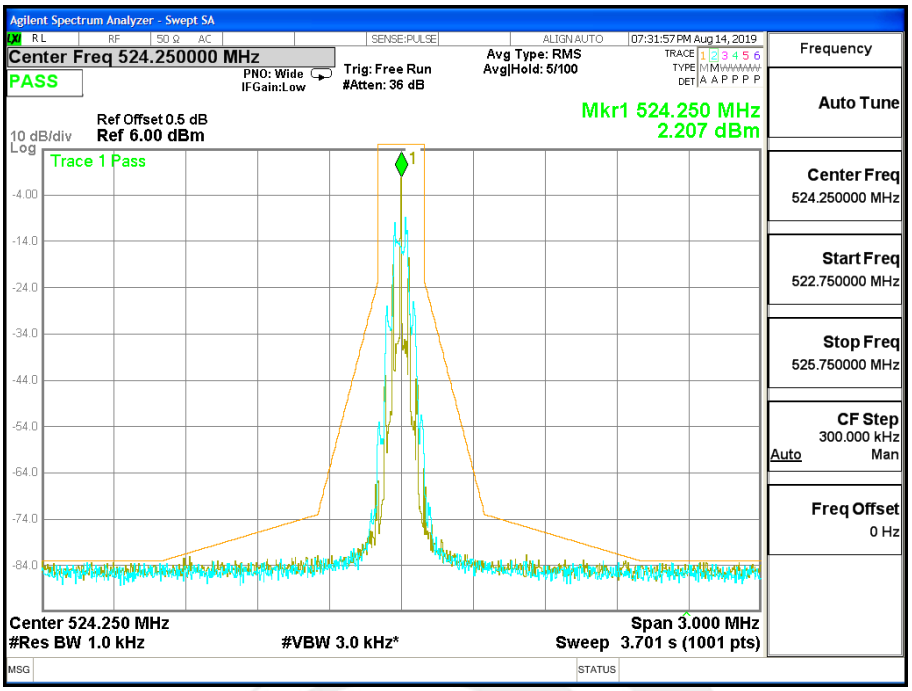
Frequency	Declared Bandwidth	B/2	0.35B
512.55 MHz	100K	50K	35K
524.25 MHz	100K	50K	35K
536.25 MHz	100K	50K	35K

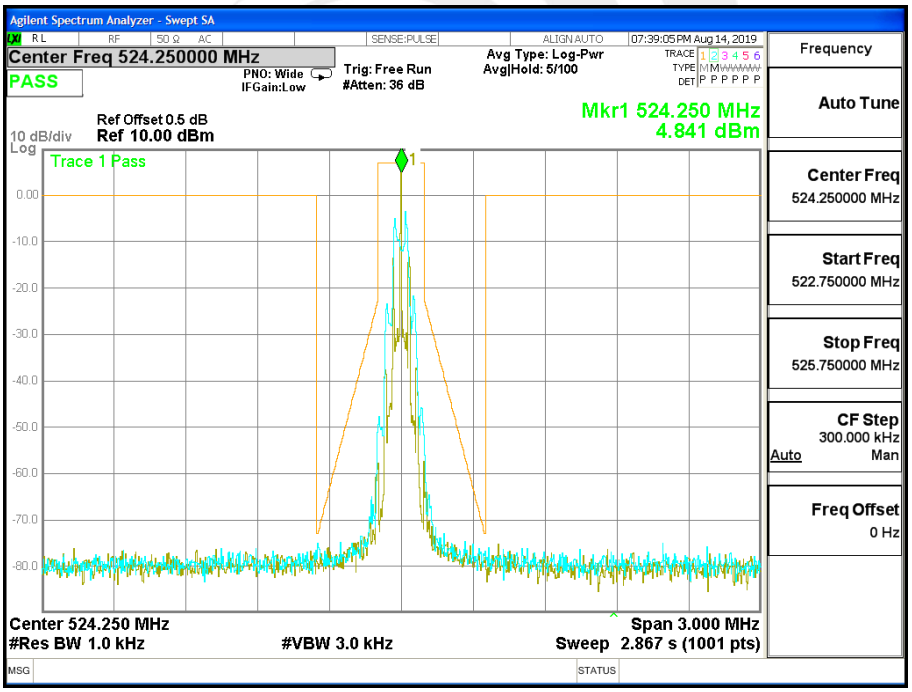
Low CH



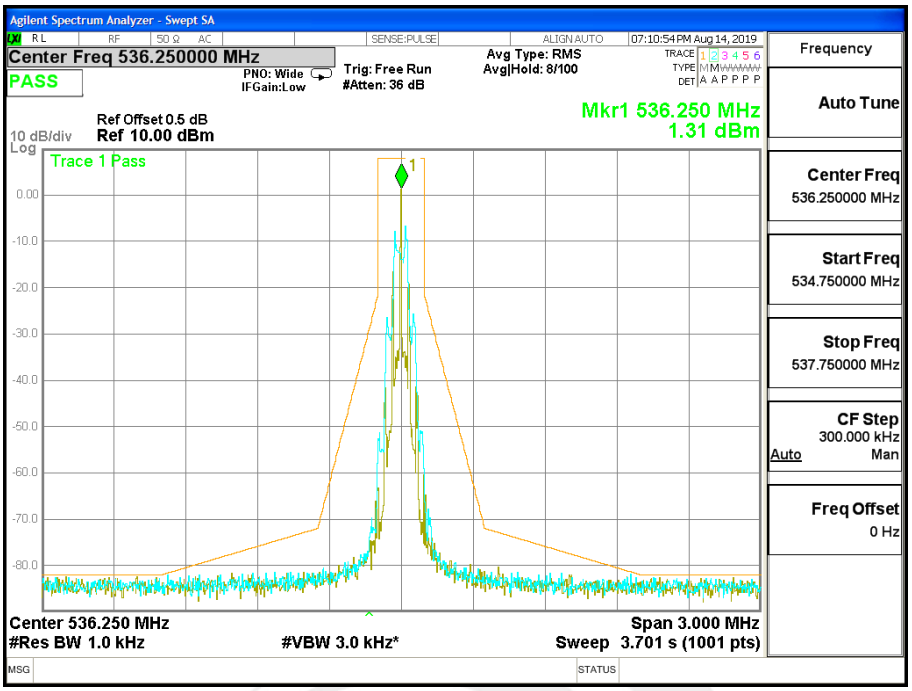


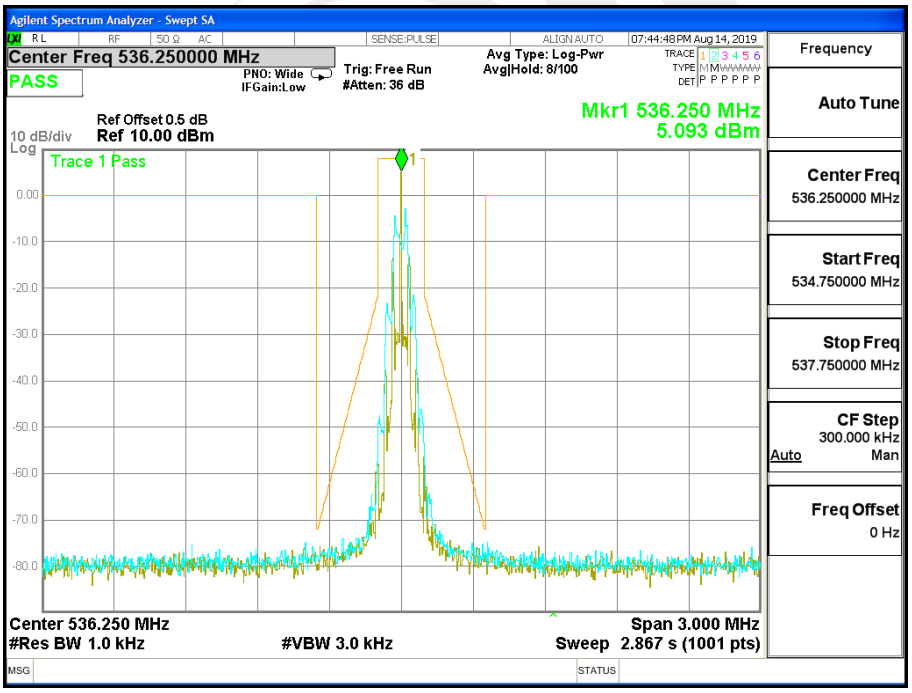
Mid CH


Agilent Spectrum Analyzer - Swept SA
Center Freq 524.250000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: RMS
Avg|Hold: 5/100
07:31:57 PM Aug 14, 2019
Mkr1 524.250 MHz
2.207 dBm
Ref Offset 0.5 dB
10 dB/div
Ref 6.00 dBm
Log
Trace 1 Pass
-4.00
-14.0
-24.0
-34.0
-44.0
-54.0
-64.0
-74.0
-84.0
Center 524.250 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz*
Span 3.000 MHz
Sweep 3.701 s (1001 pts)
Frequency
Auto Tune
Center Freq
524.250000 MHz
Start Freq
522.750000 MHz
Stop Freq
525.750000 MHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 524.250000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold: 5/100
07:39:05 PM Aug 14, 2019
Mkr1 524.250 MHz
4.841 dBm
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Trace 1 Pass
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 524.250 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz
Span 3.000 MHz
Sweep 2.867 s (1001 pts)
Frequency
Auto Tune
Center Freq
524.250000 MHz
Start Freq
522.750000 MHz
Stop Freq
525.750000 MHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

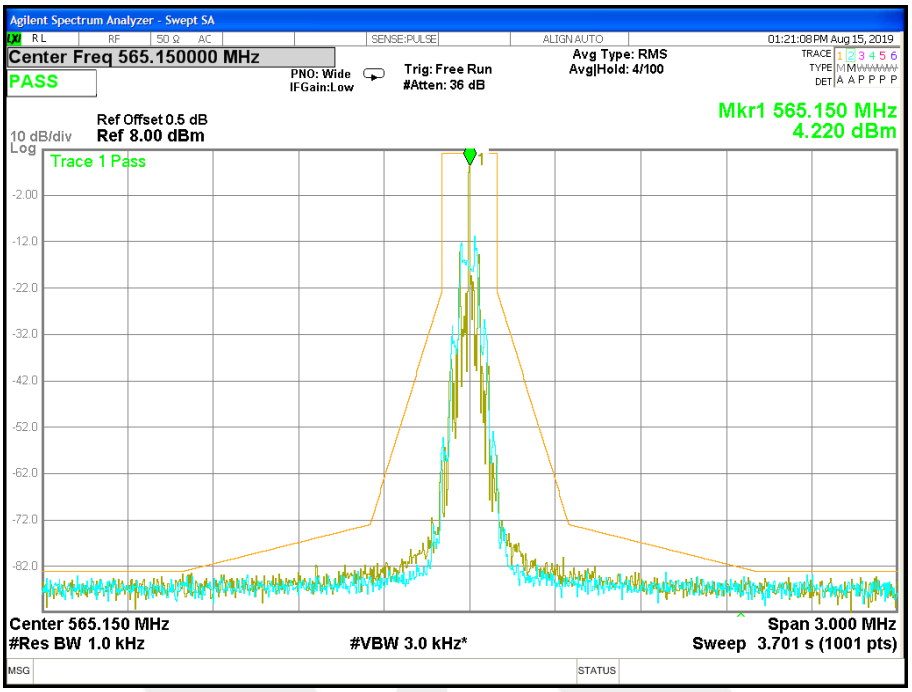
High CH

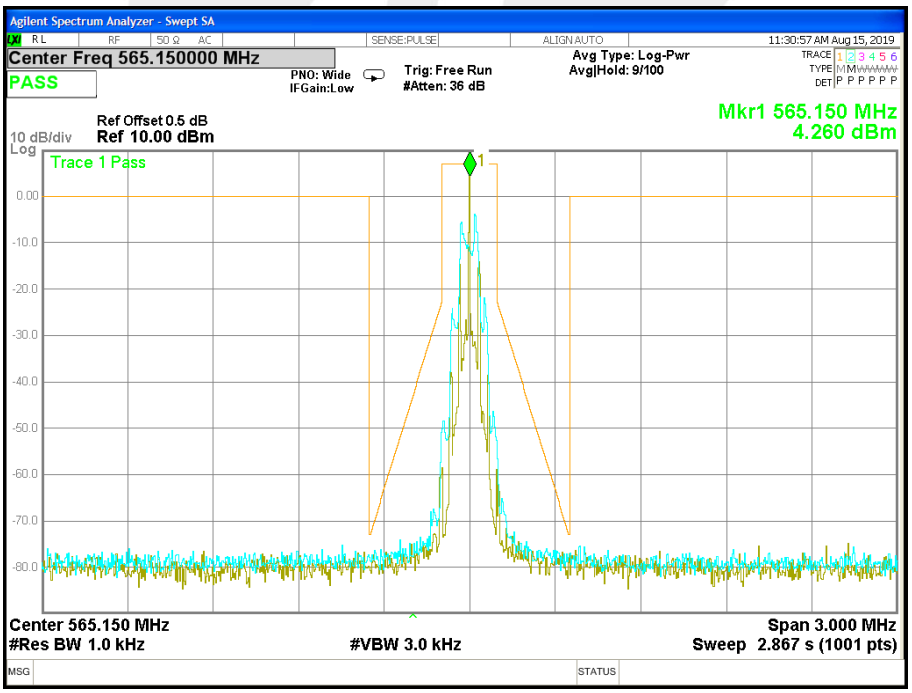

Agilent Spectrum Analyzer - Swept SA
Center Freq 536.250000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: RMS
Avg|Hold: 8/100
07:10:54 PM Aug 14, 2019
Mkr1 536.250 MHz
1.31 dBm
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Trace 1 Pass
Center 536.250 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz*
Span 3.000 MHz
Sweep 3.701 s (1001 pts)
Frequency
Auto Tune
Center Freq
536.250000 MHz
Start Freq
534.750000 MHz
Stop Freq
537.750000 MHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 536.250000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold: 8/100
07:44:48 PM Aug 14, 2019
Mkr1 536.250 MHz
5.093 dBm
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Trace 1 Pass
Center 536.250 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz
Span 3.000 MHz
Sweep 2.867 s (1001 pts)
Frequency
Auto Tune
Center Freq
536.250000 MHz
Start Freq
534.750000 MHz
Stop Freq
537.750000 MHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz

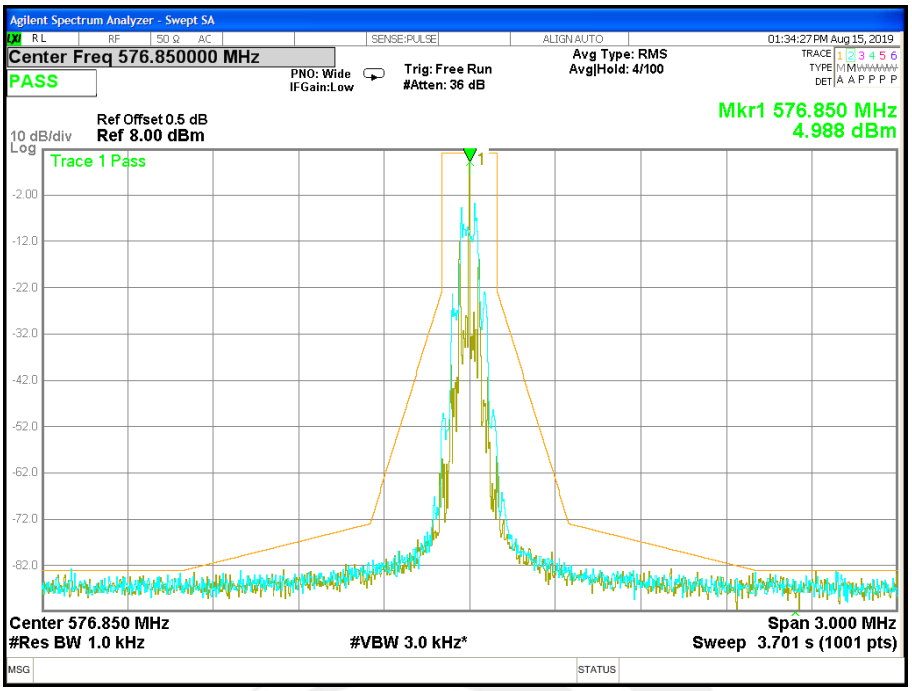
Frequency	Declared Bandwidth	B/2	0.35B
565.15 MHz	100K	50K	35K
576.85 MHz	100K	50K	35K
588.85 MHz	100K	50K	35K

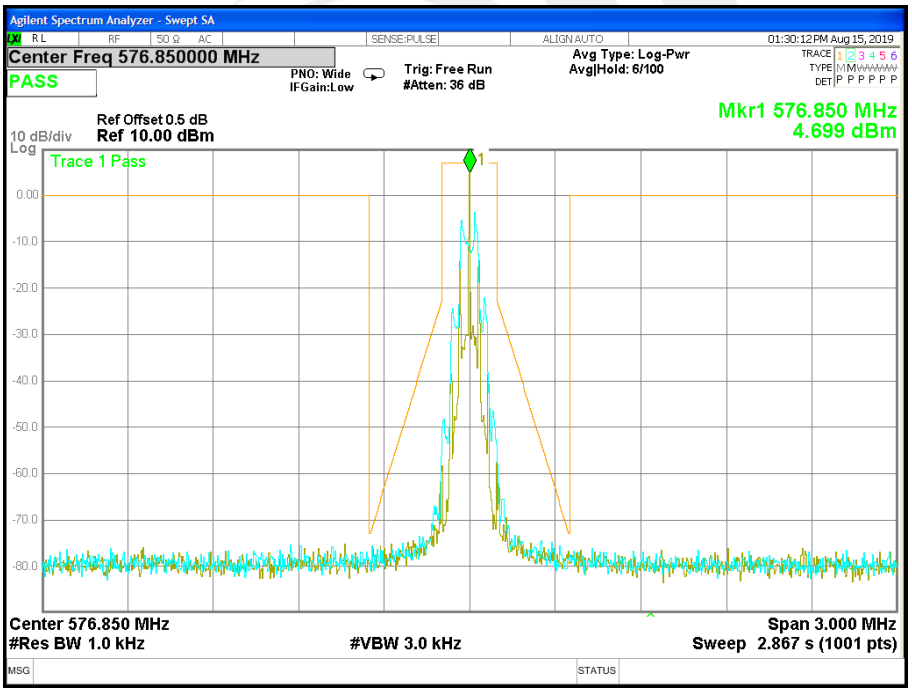
Low CH



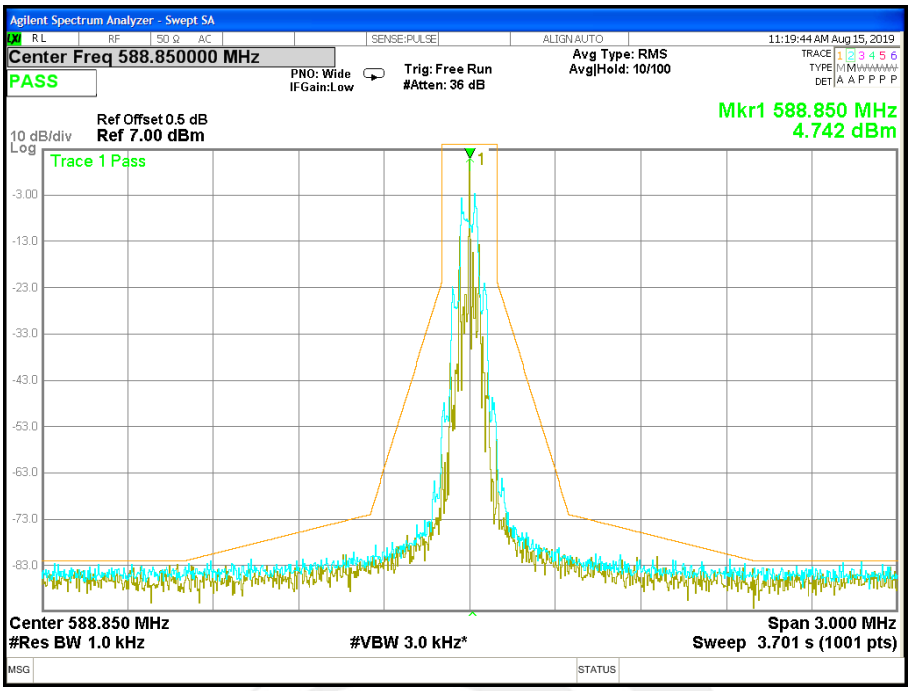


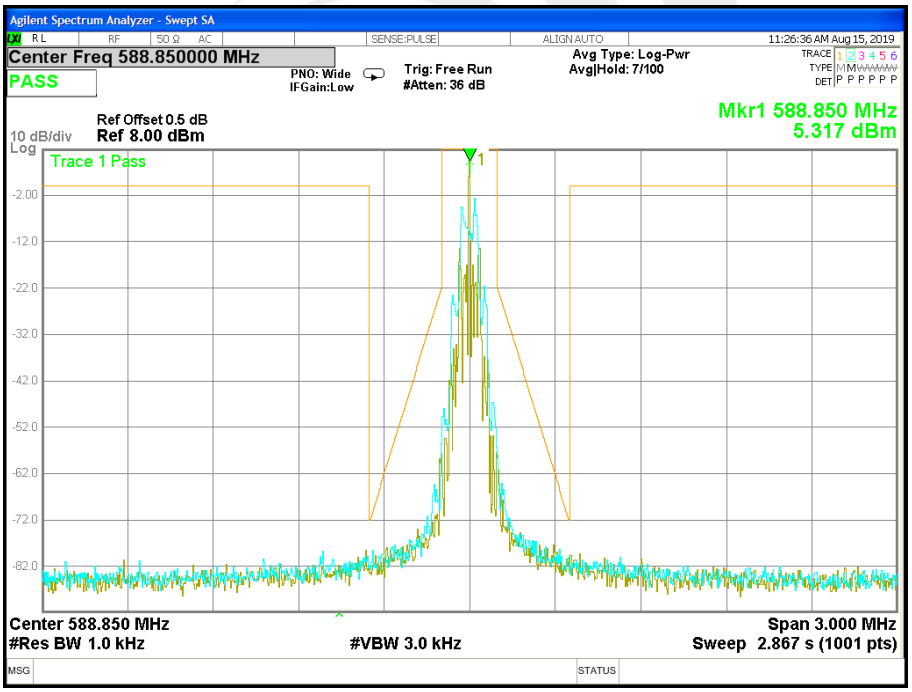
Mid CH


Agilent Spectrum Analyzer - Swept SA
Center Freq 576.850000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: RMS
Avg|Hold: 4/100
01:34:27 PM Aug 15, 2019
Ref Offset 0.5 dB
10 dB/div
Ref 8.00 dBm
Log
Mkr1 576.850 MHz
4.988 dBm
Trace 1 Pass
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
-62.0
-72.0
-82.0
Center 576.850 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz*
Span 3.000 MHz
Sweep 3.701 s (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Center Freq 576.850000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold: 6/100
01:30:12 PM Aug 15, 2019
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 576.850 MHz
4.699 dBm
Trace 1 Pass
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 576.850 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz
Span 3.000 MHz
Sweep 2.867 s (1001 pts)

High CH


Agilent Spectrum Analyzer - Swept SA
Center Freq 588.850000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: RMS
Avg|Hold: 10/100
11:19:44 AM Aug 15, 2019
Ref Offset 0.5 dB
10 dB/div
Log
Ref 7.00 dBm
Mkr1 588.850 MHz
4.742 dBm
Trace 1 Pass
-3.00
-13.0
-23.0
-33.0
-43.0
-53.0
-63.0
-73.0
-83.0
Center 588.850 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz*
Span 3.000 MHz
Sweep 3.701 s (1001 pts)
MSG
STATUS

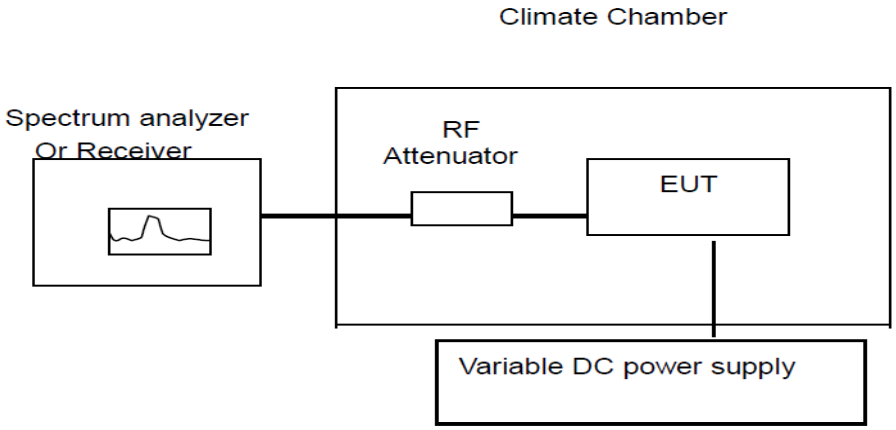

Agilent Spectrum Analyzer - Swept SA
Center Freq 588.850000 MHz
PASS
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 36 dB
Avg Type: Log-Pwr
Avg|Hold: 7/100
11:26:36 AM Aug 15, 2019
Ref Offset 0.5 dB
10 dB/div
Log
Ref 8.00 dBm
Mkr1 588.850 MHz
5.317 dBm
Trace 1 Pass
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
-62.0
-72.0
-82.0
Center 588.850 MHz
#Res BW 1.0 kHz
#VBW 3.0 kHz
Span 3.000 MHz
Sweep 2.867 s (1001 pts)
MSG
STATUS

4.4 FREQUENCY STABILITY VS. TEMPERATURE & VOLTAGE

TEST LIMIT

According to CFR 47 section 74.861 e (4), the frequency tolerance of the transmitter shall be 0.005 percent.

TEST CONFIGURATION



TEST PROCEDURE

a The EUT was connected to an external DC power supply and the RF output was connected to a frequency counter via feed through attenuators. The EUT was placed inside the temperature chamber. The DC leads and the RF output cable, exited the chamber through an opening made for that purpose.
After the temperature stabilized the frequency output was recorded form the counter.
An external variable DC power supply was connected to the battery terminals of the equipment under test.

b. For hand carried, battery powered equipment primary supply voltage was reduced to the battery operating end point as specified by the manufacturer. The output frequency was recorded for each battery voltage.

TEST RESULTS

(1) Frequency stability versus input voltage (Supply Nominal voltage is DC 3V)

(2) Frequency stability versus input voltage (Supply battery operating end point which shall be specified by the manufacturer DC 2.7V)

Reference Frequency: 512.55MHz			
Power Supply	Environment Temperature (ºC)	Frequency Error (Hz)	Frequency Error (%)
2.7V, DC	20	1010	0.000197
3.0V, DC	20	1008	0.000197
3.3V, DC	20	1013	0.000198
BEP	20	1015	0.000198

Reference Frequency: 512.55MHz				
Environment Temperature(ºC)	Frequency Deviation measured with time Elapse(30 minutes)			
	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Results
50	1023	0.000200	0.00500	PASS
40	1015	0.000198		
30	1010	0.000197		
20	1008	0.000197		
10	1006	0.000196		
0	1002	0.000195		
-10	1006	0.000196		
-20	1009	0.000197		
-30	1013	0.000198		

Reference Frequency: 524.25MHz			
Power Supply	Environment Temperature (ºC)	Frequency Error (Hz)	Frequency Error (%)
2.7V, DC	20	1013	0.000193
3.0V, DC	20	1011	0.000193
3.3V, DC	20	1015	0.000194
BEP	20	1013	0.000193

Reference Frequency: 524.25MHz				
Environment Temperature(ºC)	Frequency Deviation measured with time Elapse(30 minutes)			
	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Results
50	1022	0.000195	0.00500	PASS
40	1016	0.000194		
30	1016	0.000194		
20	1012	0.000193		
10	1010	0.000193		
0	1006	0.000192		
-10	1007	0.000192		
-20	1012	0.000193		
-30	1016	0.000194		

Reference Frequency: 536.25MHz			
Power Supply	Environment Temperature (ºC)	Frequency Error (Hz)	Frequency Error (%)
2.7V, DC	20	1016	0.000189
3.0V, DC	20	1010	0.000188
3.3V, DC	20	1013	0.000189
BEP	20	1015	0.000189

Reference Frequency: 536.25MHz				
Environment Temperature(ºC)	Frequency Deviation measured with time Elapse(30 minutes)			
	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Results
50	1025	0.000191	0.00500	PASS
40	1021	0.000190		
30	1019	0.000190		
20	1016	0.000189		
10	1015	0.000189		
0	1010	0.000188		
-10	1012	0.000189		
-20	1016	0.000189		
-30	1019	0.000190		

Reference Frequency: 565.15MHz			
Power Supply	Environment Temperature (ºC)	Frequency Error (Hz)	Frequency Error (%)
2.7V, DC	20	1013	0.000178
3.0V, DC	20	1010	0.000178
3.3V, DC	20	1012	0.000178
BEP	20	1016	0.000179

Reference Frequency: 565.15MHz				
Environment Temperature(ºC)	Frequency Deviation measured with time Elapse(30 minutes)			
	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Results
50	1018	0.000179	0.00500	PASS
40	1015	0.000179		
30	1013	0.000178		
20	1012	0.000178		
10	1010	0.000178		
0	1008	0.000177		
-10	1013	0.000178		
-20	1016	0.000179		
-30	1019	0.000179		

Reference Frequency: 576.85MHz			
Power Supply	Environment Temperature (ºC)	Frequency Error (Hz)	Frequency Error (%)
2.7V, DC	20	1009	0.000173
3.0V, DC	20	1006	0.000172
3.3V, DC	20	1012	0.000173
BEP	20	1012	0.000173

Reference Frequency: 576.85MHz				
Environment Temperature(ºC)	Frequency Deviation measured with time Elapse(30 minutes)			
	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Results
50	1021	0.000175	0.00500	PASS
40	1020	0.000174		
30	1016	0.000174		
20	1016	0.000174		
10	1012	0.000173		
0	1009	0.000173		
-10	1010	0.000173		
-20	1016	0.000174		
-30	1015	0.000174		

Reference Frequency: 588.85MHz			
Power Supply	Environment Temperature (ºC)	Frequency Error (Hz)	Frequency Error (%)
2.7V, DC	20	1013	0.000169
3.0V, DC	20	1012	0.000169
3.3V, DC	20	1016	0.000169
BEP	20	1016	0.000169

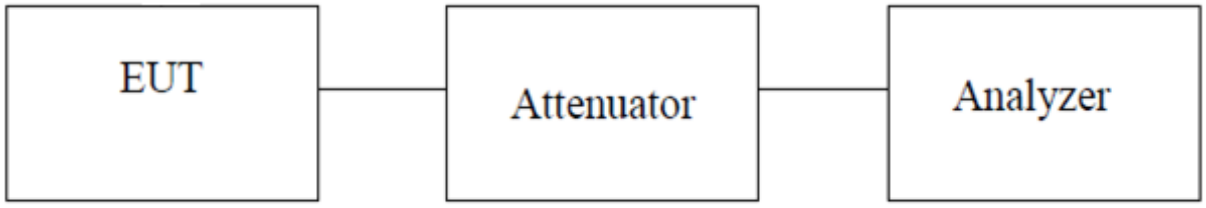
Reference Frequency: 588.85MHz				
Environment Temperature(ºC)	Frequency Deviation measured with time Elapse(30 minutes)			
	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Results
50	1022	0.000170	0.00500	PASS
40	1020	0.000170		
30	1017	0.000170		
20	1015	0.000169		
10	1013	0.000169		
0	1008	0.000168		
-10	1016	0.000169		
-20	1018	0.000170		
-30	1019	0.000170		

4.5 OCCUPIED BANDWIDTH

TEST LIMIT

According to CFR 47 section 74.861 e (5), the operating bandwidth shall no exceed 200 KHz. Near the carrier an emission mask is defined by the standard.

TEST CONFIGURATION



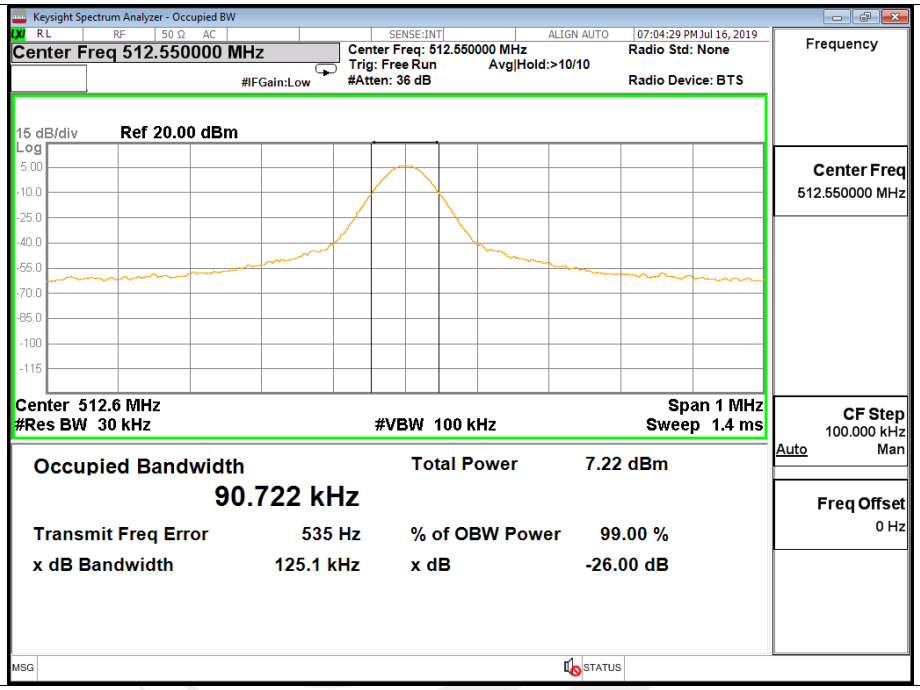
TEST PROCEDURE

a. The RF output of the transceiver was connected to the input of the spectrum analyzer through sufficient attenuation.
Set Occupied Bandwidth was measured with a occupied bandwidth function of the analyzer.
b. The near the carrier emissions are measured by normal power measurement function of the analyzer.
c. Set SPA Max hold. Mark peak, 99%.

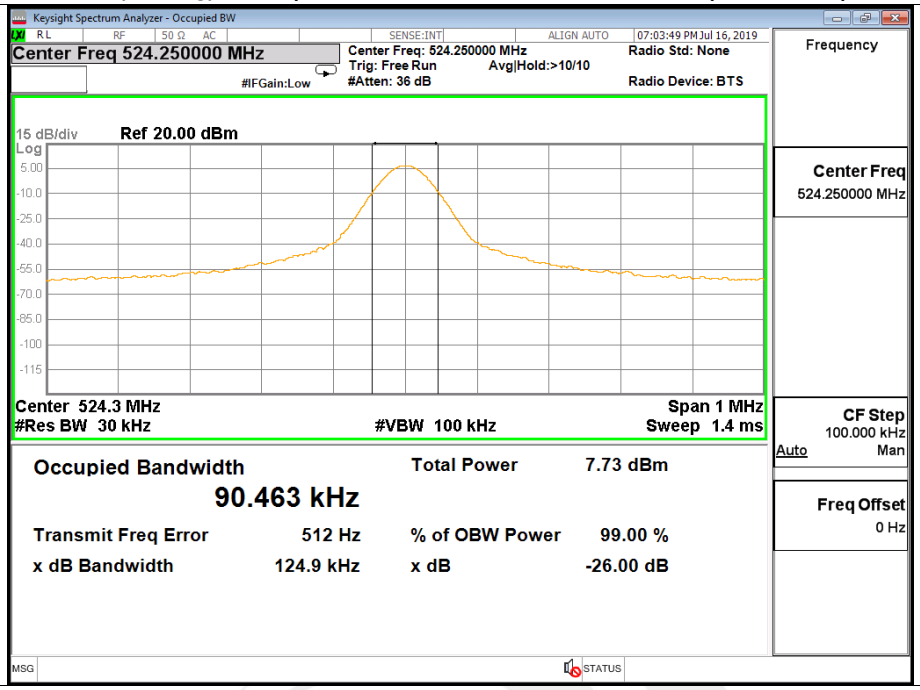
TEST RESULT

Frequency(MHz)	Occupied Bandwidth(KHz)	Limit(KHz)
512.55	90.722	200
524.25	90.463	200
536.25	89.821	200

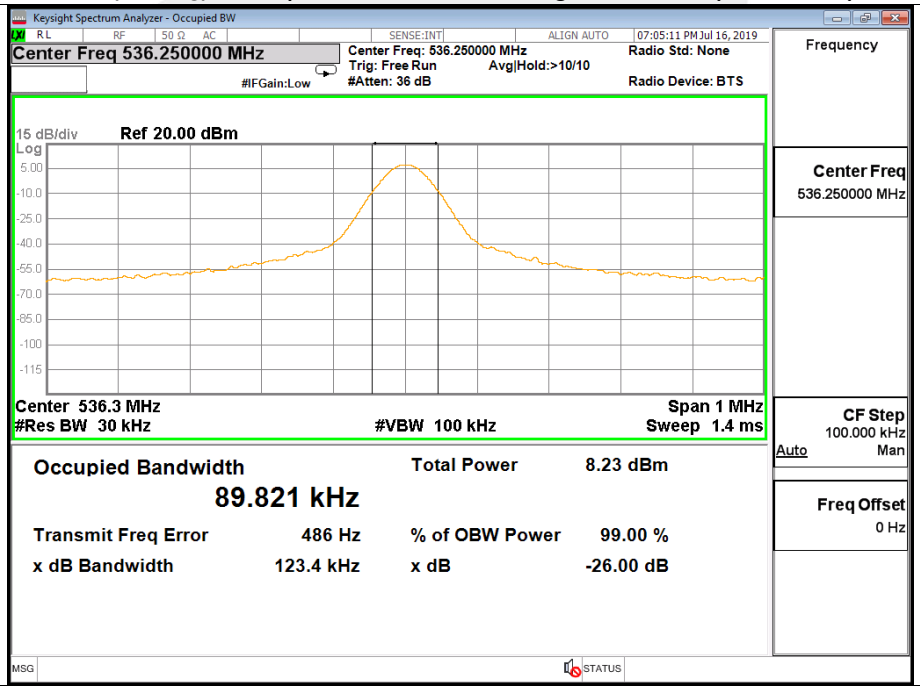
FM (Analog) Occupied bandwidth of Low Channel (Maximum)



FM (Analog) Occupied bandwidth of Mid Channel (Maximum)

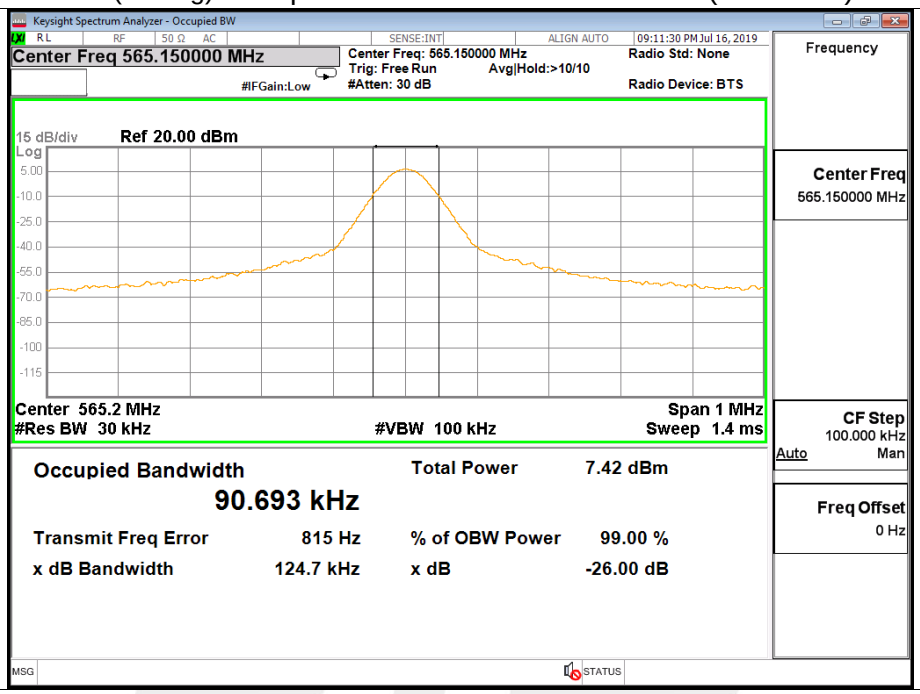


FM (Analog) Occupied bandwidth of High Channel (Maximum)

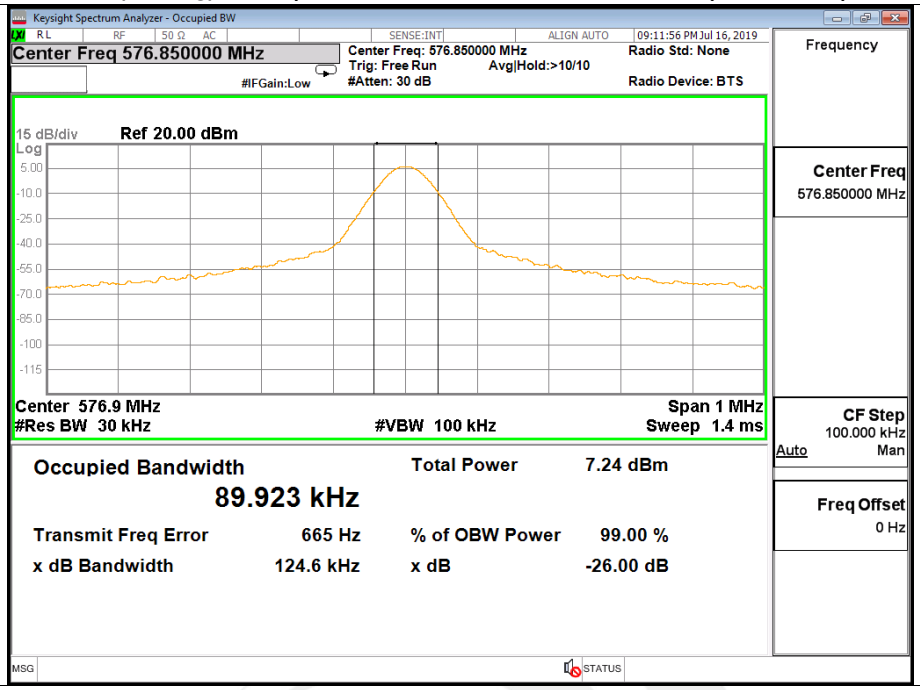


Frequency(MHz)	Occupied Bandwidth(KHz)	Limit(KHz)
565.15	90.693	200
576.85	89.923	200
588.85	89.094	200

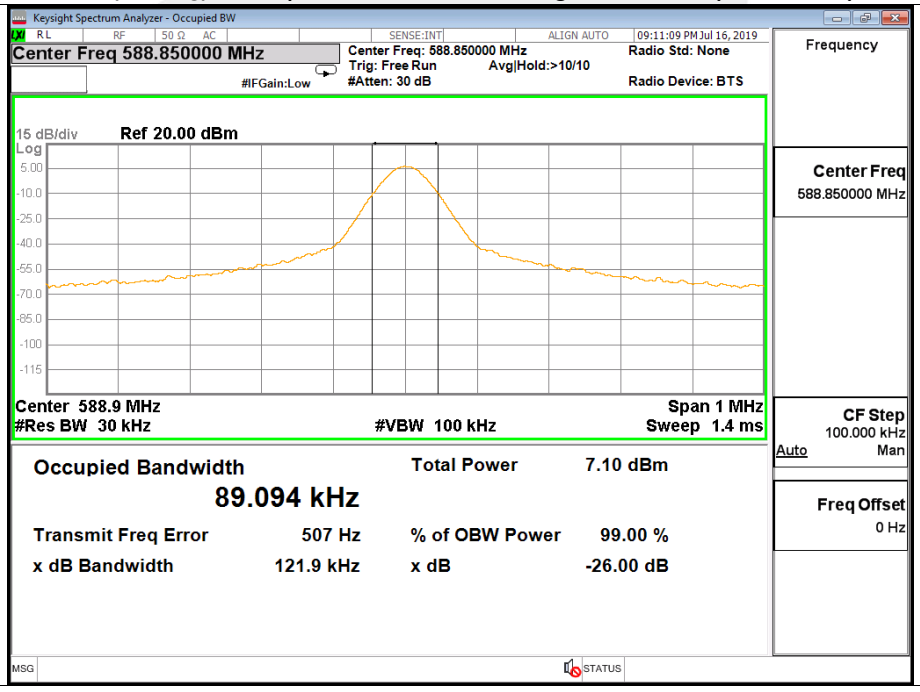
FM (Analog) Occupied bandwidth of Low Channel (Maximum)



FM (Analog) Occupied bandwidth of Mid Channel (Maximum)



FM (Analog) Occupied bandwidth of High Channel (Maximum)



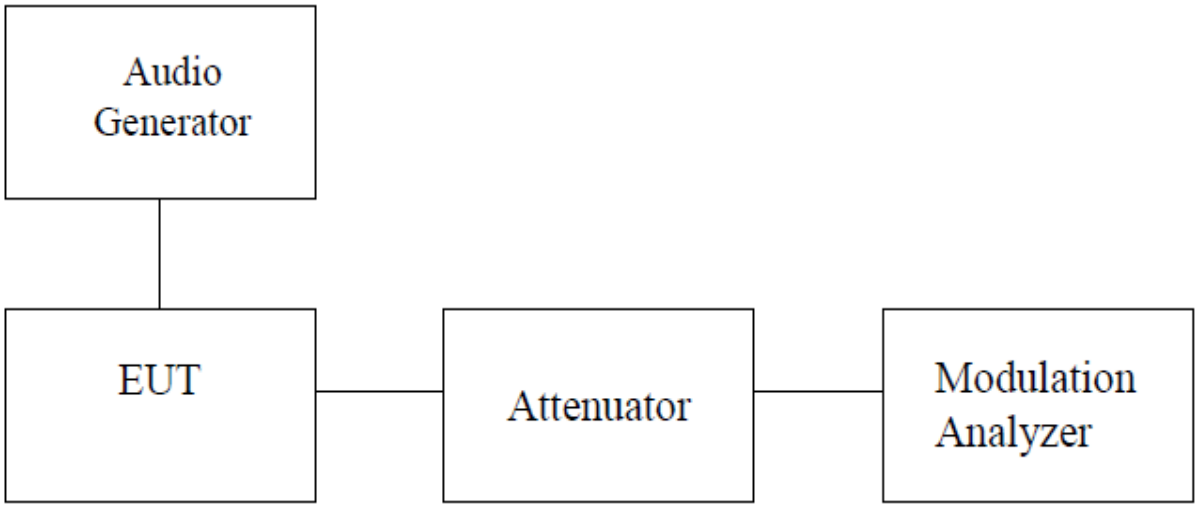
4.6 AUDIO FREQUENCY RESPONSE

TEST LIMIT

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.The frequency response of the audio modulation part is measured over a frequency range of 100 Hz to 5000 Hz.

According to CFR 47 section 74.861 e (1), any form of modulation may be used. A maximum deviation of ±75 KHz is permitted when frequency modulation is employed.

TEST CONFIGURATION



.

TEST PROCEDURE

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

b. The frequency response of the audio modulation part is measured over a frequency range of 100Hz to 5000 Hz.

c. For 1000 Hz tone reference signal the audio generator level is adjusted to get 20% of the rated system deviation.

d. The deviations obtained over the frequency range from 100 HZ to 5000 Hz are recorded and compared with the reference deviation as follows:
Audio Frequency Response= 20 log (DEV freq/ Dev ref)

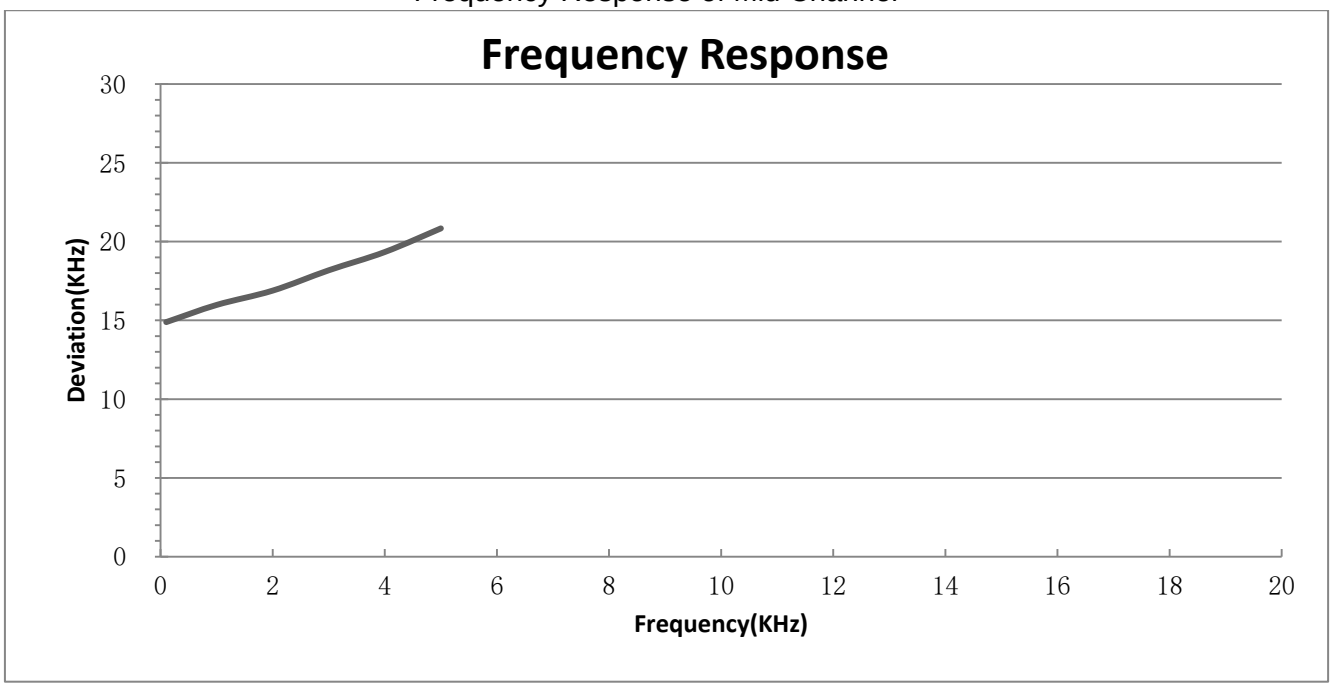
TEST RESULT

Audio Frequency Response:

512.55-536.25MHz:

Frequency(KHz)	Deviation(KHz)
0.01	14.89
1	15.98
2	16.89
3	18.18
4	19.34
5	20.84

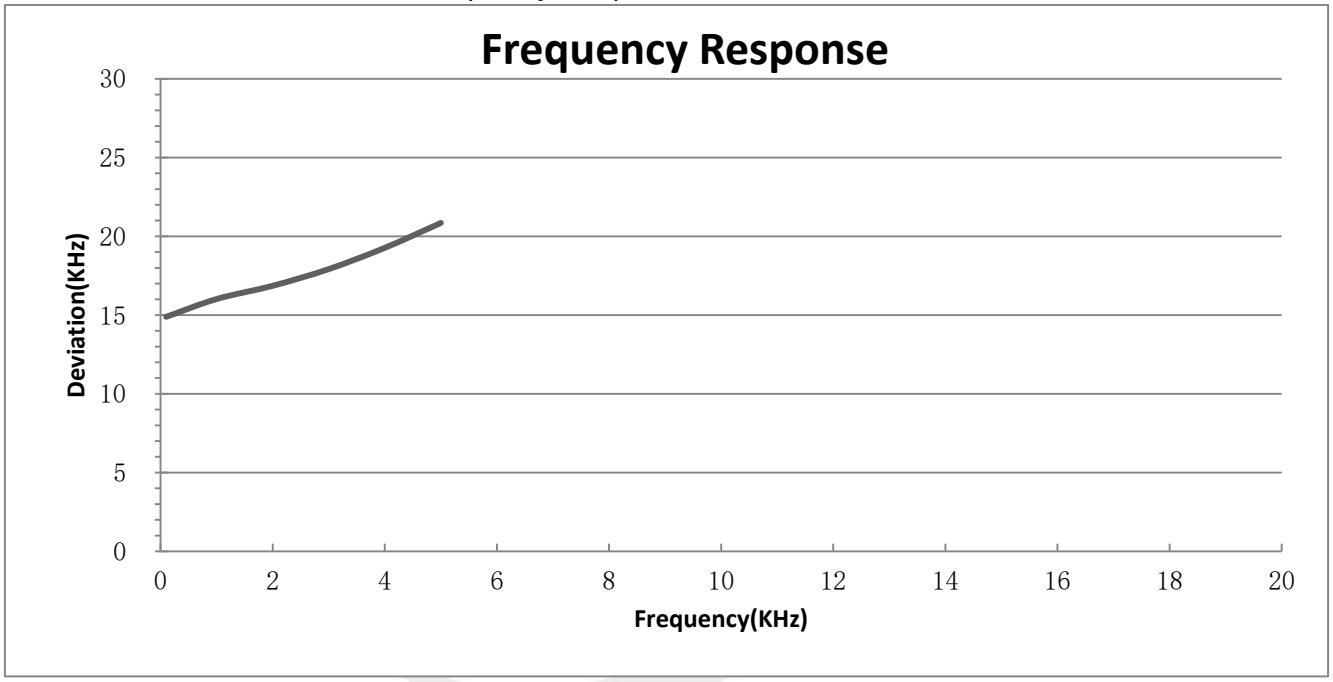
Frequency Response of Mid Channel



565.15-588.85MHz:

Frequency(KHz)	Deviation(KHz)
0.01	14.89
1	16.02
2	16.86
3	17.92
4	19.27
5	20.85

Frequency Response of Mid Channel



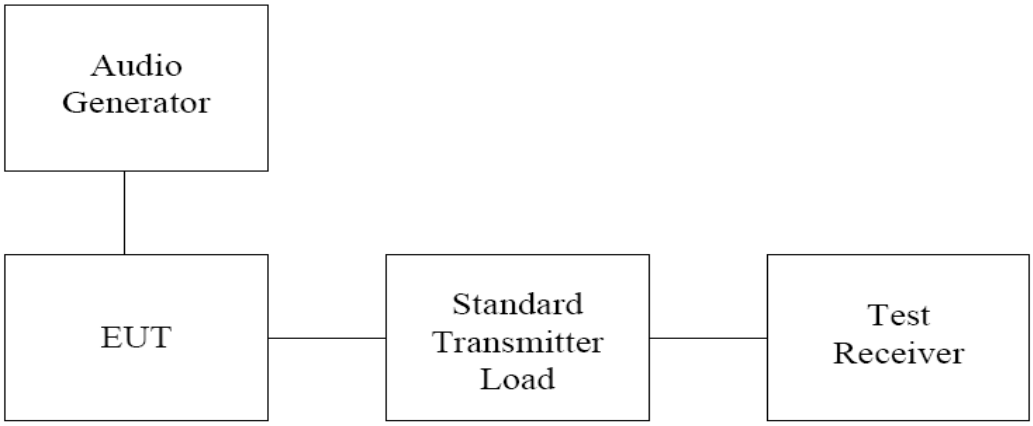
4.7 MODULATION DEVIATION

TEST LIMIT

According to CFR 47 section 2.1047 a, for Voice modulation communication equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000 Hz shall be measured.

According to CFR 47 section 74.861 e (3), any form of modulation may be used. A maximum deviation of ±75 KHz is permitted when frequency modulation is employed.

TEST CONFIGURATION



.

TEST PROCEDURE

a. Modulation limits is the transmitter circuit's ability to limit the transmitter form producing deviations in excess of rated system deviation.
b. The audio signal generator is connected to the audio input of the EUT with its full rating.
c. The modulation response is measured at certain modulation frequencies, related to 1000 Hz reference signal.
d. Tests are performed for positive and negative modulation.

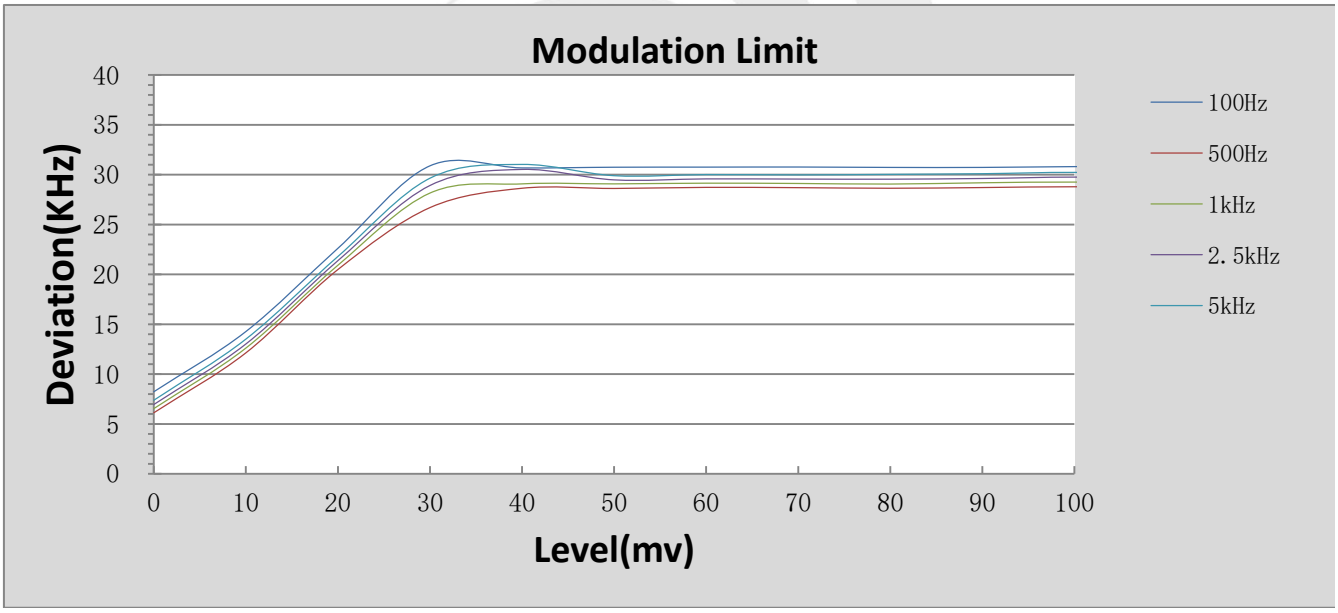
TEST RESULT

Modulation Deviation

512.55-536.25MHz:

Level(mv)	100Hz	500Hz	1kHz	2.5kHz	5kHz
0	8.23	6.12	6.54	6.95	7.38
10	14.27	12.13	12.61	13.02	13.51
20	22.62	20.49	20.92	21.38	21.80
30	30.89	26.70	28.16	28.92	29.65
40	30.68	28.64	29.08	30.53	31.03
50	30.75	28.62	29.08	29.48	29.90
60	30.76	28.73	29.15	29.58	30.01
70	30.77	28.70	29.12	29.56	29.98
80	30.73	28.64	29.06	29.55	30.03
90	30.73	28.71	29.19	29.62	30.10
100	30.81	28.79	29.26	29.76	30.23
110	30.82	28.68	29.14	29.61	30.02

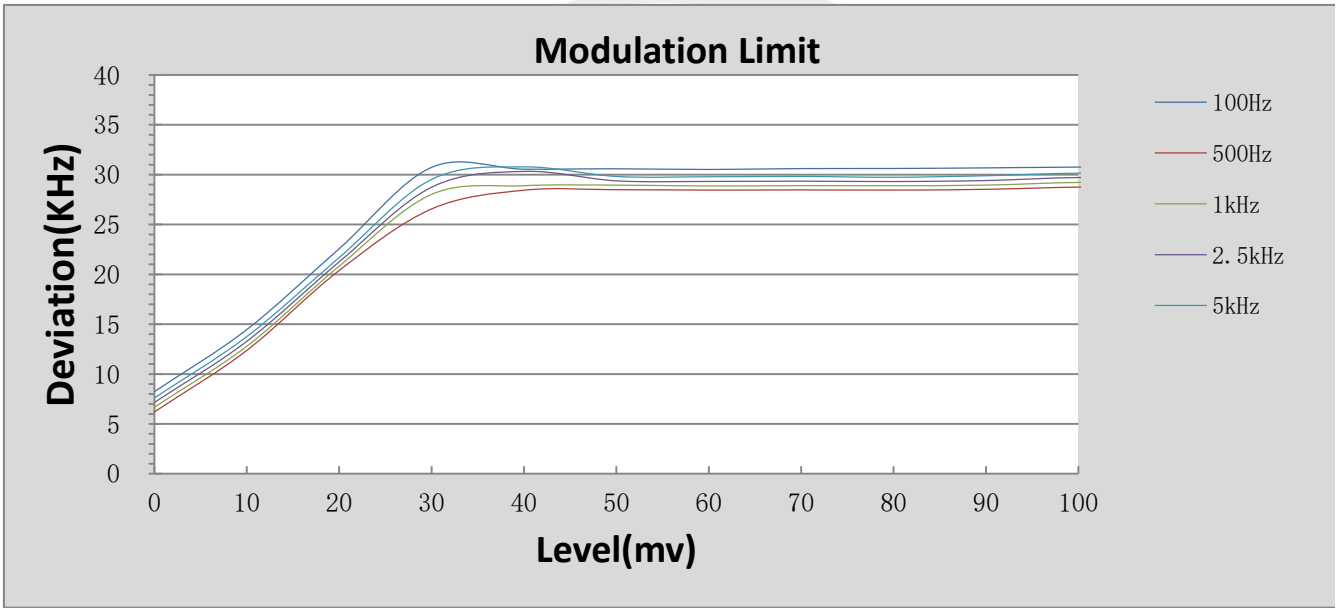
Modulation Deviation of Mid Channel



565.15-588.85MHz:

Level(mv)	100Hz	500Hz	1kHz	2.5kHz	5kHz
0	8.23	6.20	6.68	7.15	7.61
10	14.46	12.37	12.79	13.28	13.76
20	22.57	20.39	20.82	21.25	21.68
30	30.73	26.56	28.02	28.74	29.52
40	30.55	28.44	28.89	30.33	30.78
50	30.59	28.49	28.95	29.38	29.82
60	30.52	28.45	28.86	29.32	29.79
70	30.61	28.47	28.90	29.35	29.82
80	30.62	28.45	28.89	29.31	29.74
90	30.68	28.53	28.95	29.41	29.89
100	30.76	28.75	29.22	29.71	30.15
110	30.81	28.76	29.17	29.59	30.08

Modulation Deviation of Mid Channel



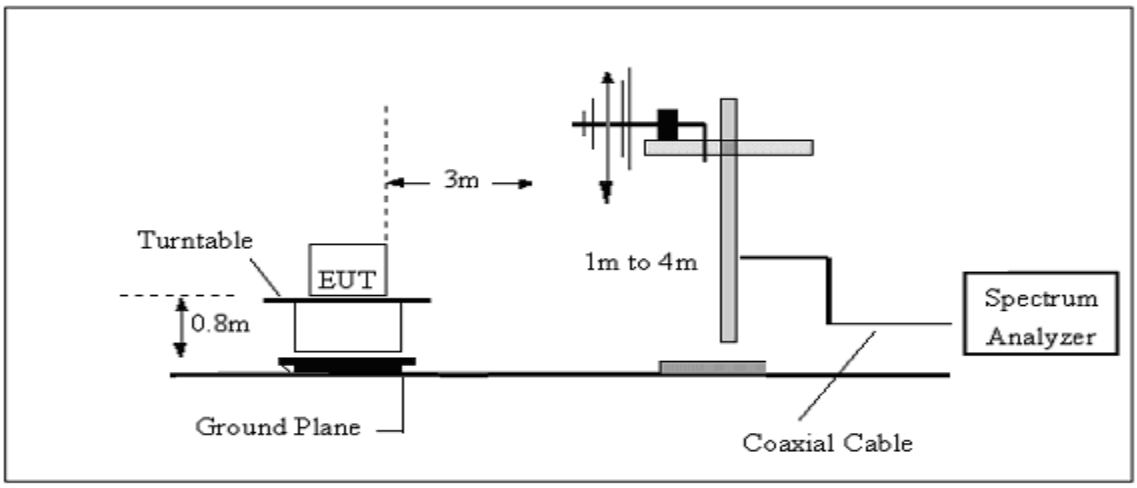
4.8 RF OUTPUT POWER

TEST LIMIT

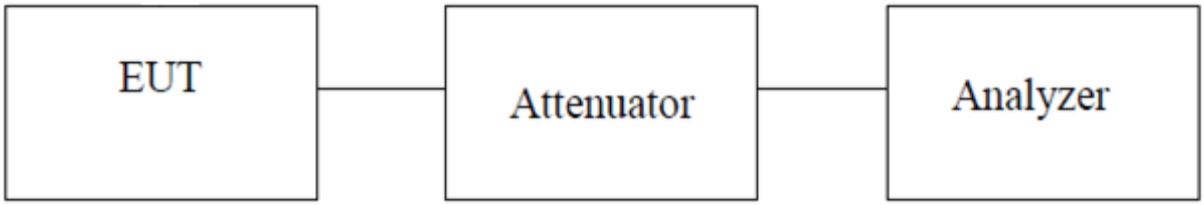
According to CFR 47 section 74.861 e (1), the power of the measured unmodulated carrier power at the output of the transmitter power amplifier (antenna input power) may not exceed the following:
(i) 54-72, 76-88, and 174-216 MHz bands: 50 mW EIRP
(ii) 470-608 and 614-698: 250 mW conducted power
(iii) 600 MHz duplex gap: 20 mW EIRP

TEST CONFIGURATION

Radiation



Conduction



TEST PROCEDURE(Radiation)

a. On a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
b. The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
c. The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
d. The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
e. The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
f. The transmitter shall than be rotated through 360°in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
g The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
h The maximum signal level detected by the measuring receiver shall be noted.
i The measurement shall be repeated with the test antenna set to horizontal polarization.
j Replace the antenna with a proper Antenna (substitution antenna).
k The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.

l The substitution antenna shall be connected to a calibrated signal generator.

m If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.

n The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.

o The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.

p The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.

q The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

TEST PROCEDURE (Conduction)

a. The RF output of the transceiver was connected to the input of the spectrum analyzer through sufficient attenuation.

b. Set the RBW >20BW,VBW>3xRBW.

c. Detector = peak.

d Sweep time = auto couple.

e Trace mode = max hold.

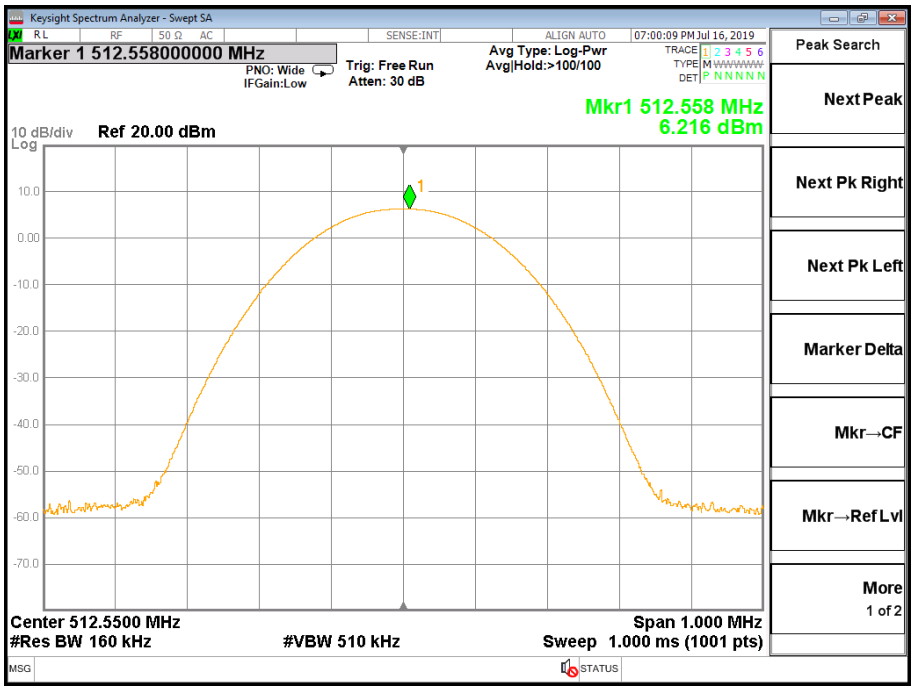
f Allow trace to fully stabilize.

g Use the peak marker function to determine the maximum amplitude level.

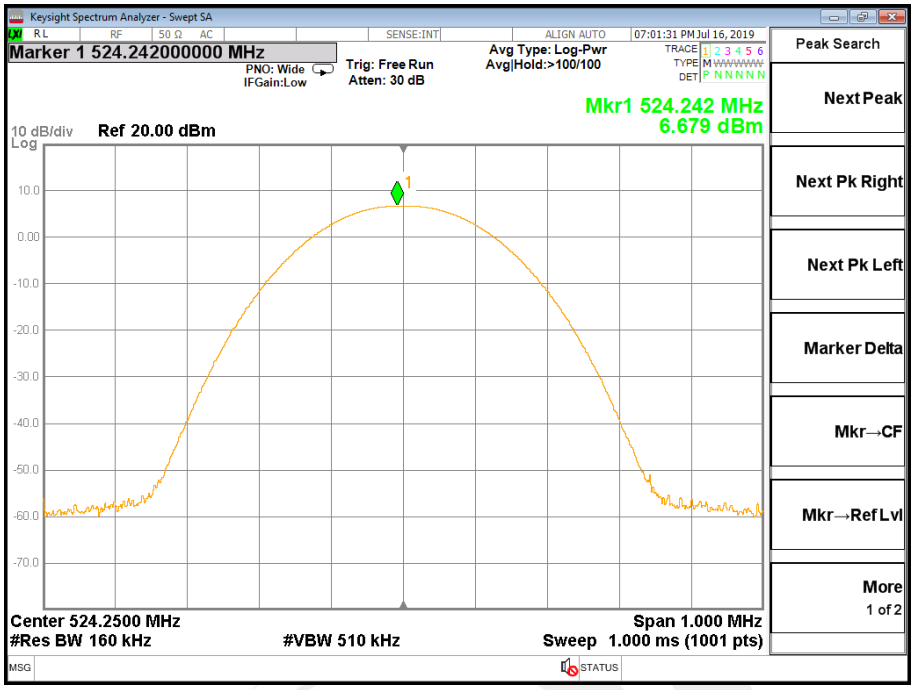
TEST RESULT

Frequency Channel (MHz)	Peak Output Power (dBm)	Transmitter Power (mW)	Limits (mW)
512.55	6.216	4.184	250
524.25	6.679	4.655	250
536.25	7.25	5.309	250

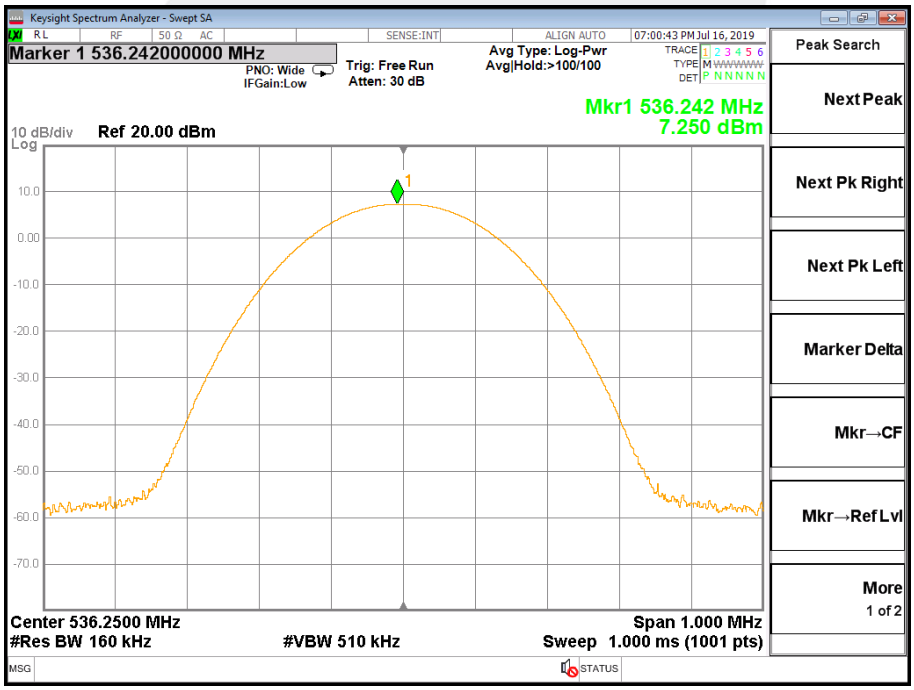
Low Channel



Mid Channel

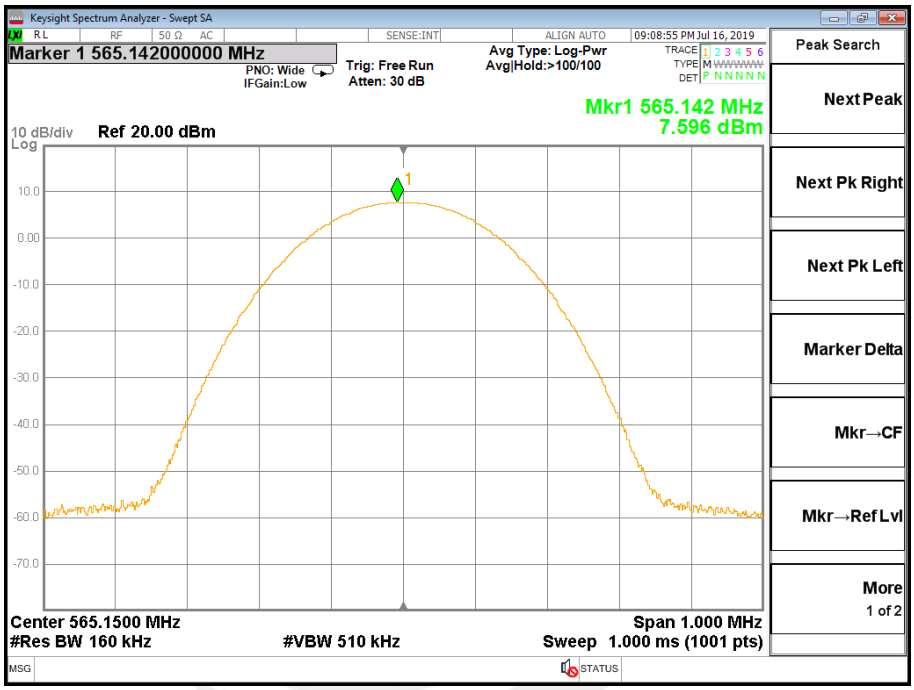


High Channel

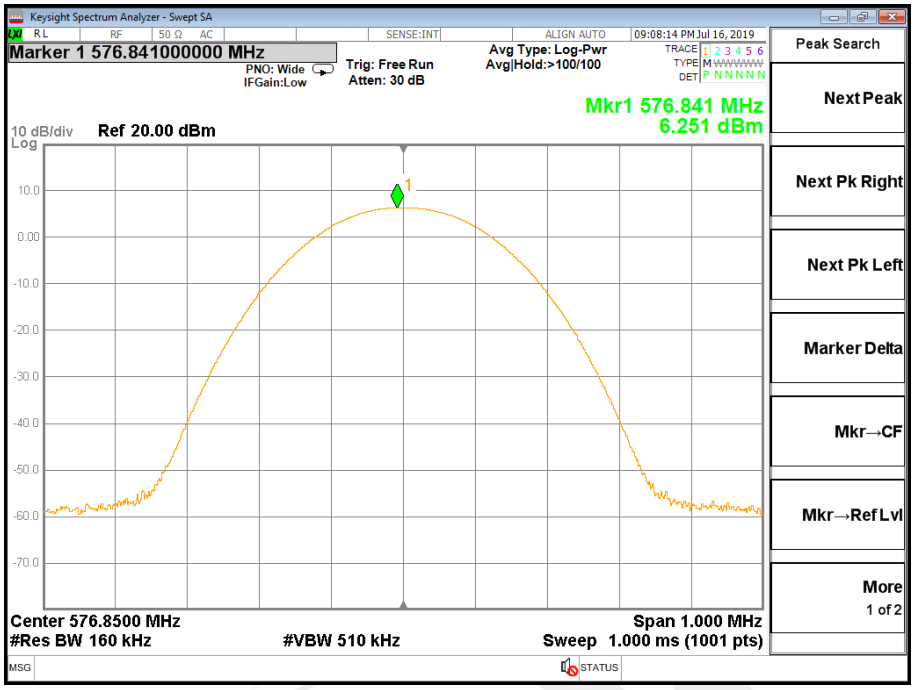


Frequency Channel (MHz)	Peak Output Power (dBm)	Transmitter Power (mW)	Limits (mW)
565.15	7.596	5.749	250
576.85	6.251	4.218	250
588.85	5.837	3.834	250

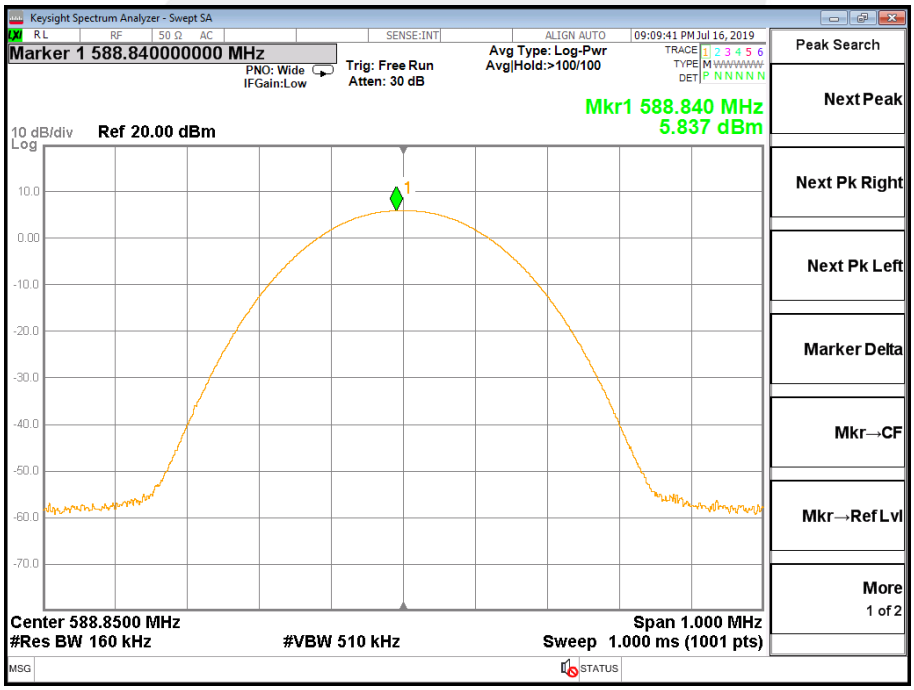
Low Channel



Mid Channel



High Channel



PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※