FCC Part 74 Subpart H
Class II Permissive Change
TEST REPORT

of

E.U.T. : Wireless Microphone
FCC ID. : DLAWM-5225
Model No. : WM-5225
Working Frequency : 506~538 MHz

for

APPLICANT : TOA Corporation
ADDRESS : 2-1 Takamatsu-cho, Takarazuka-shi, Hyogo-ken, 665-0043, Japan

Test Performed by

ELECTRONICS TESTING CENTER (ETC) , TAIWAN
NO. 34. LIN 5, DINGFU VIL., LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
TEL : (02)26023052 FAX : (02)26010910
http:// www.etc.org.tw ; e-mail:emc@etc.org.tw

Report Number : 17-03-RBF-008-01

TEST REPORT CERTIFICATION

Applicant	:	TOA Corporation 2-1 Takamatsu-cho, Takarazuka-shi, Hyogo-ken, 665-0043, Japan
Manufacturer	:	Dynatron Industrial Co., Ltd. No.89, Din Pin Rd., Ray Fong Industrial Area, Ray Fong Dist, New Taipei City, Taiwan
Description of EUT	:	
a) Type of EUT	:	Wireless Microphone
b) Trade Name	:	TOA
c) Model No.	:	WM-5225
d) FCC ID	:	DLAWM-5225
e) Working Frequency	:	506~538 MHz
f) Power Supply	:	Battery DC 1.5V

Regulation Applied: FCC Rules and Regulations Part 74 Subpart H

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Issued Date : May 09, 2017

Test Engineer : Kazuma Ho
(Brian Huang, Engineer)

Approve & Authorized Signer : S. S. Liou
S. S. Liou, Section Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

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1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT	:	Wireless Microphone
b) Trade Name	:	TOA
c) Model No.	:	WM-5225
d) FCC ID	:	DLAWM-5225
e) Working Frequency	:	506~538 MHz
f) Power Supply	:	Battery DC 1.5V
g) Emission Designator	:	108KF3E 2M+2DK=2x(1kHz)+2x(53.1kHz)x1=108.2kHz

1.2 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.10-2013. Test also follow "TIA-603-D(2010)-Land Mobile FM or PM Communications Equipment Measurement and Performance Standsrds" and section 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, and 2.1055 of Part 2 of CFR 47.

Measueement Software

Software	Version	Note
e3	Version 6.100618b	Radiated Emission Test
e3	Version 6.100421	Conducted Emission Test

1.3 Test Facility

Location of the Test site: No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.

Designation Number: TW2628.

2. REQUIREMENTS OF PROVISIONS

2.1 Definition

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Frequencies Available

According to sec. 74.802 of Part 74, the following frequencies are available for low power auxiliary station :

Frequencies (MHz)

26.100-26.480	455.000-456.000
54.000-72.000	470.000-488.000
76.000-88.000	488.000-494.000
161.625-161.775	494.000-608.000
174.000-216.000	614.000-806.000
450.000-451.000	944.000-952.000

2.3 Requirements for Radio Equipment on Certification

(1) RF Output Power
For transmitters, the power output shall be measured at the RF output terminals.

(2) Modulation Characteristics
For Voice Modulated Communication Equipment, a curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted.

(3) Occupied Bandwidth
For radiotelephone transmitter, other than single sideband or indenpent sideband transmitter, when modulateed by a 2.5kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

(4) Spurious Emissions at Antenna Terminals
The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminal when properly loaded with a suitable artificial antenna.

(5) Field Strength of Spurious Emissions

Measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal condition of installation and operation.

(6) Frequencies Tolerance

a) The frequency stability shall be measured with variation of ambient temperature.
b) The frequency stability shall be measured with variation of primary supply voltage.

2.4 Labeling Requirement

Each equipment for which a type acceptance application is filed on or after May 1,1981, shall bear an identification plate or label pursuant to §2.925（Identification of equipment） and §2.926（FCC identifier）.

3. OUTPUT POWER MEASUREMENT

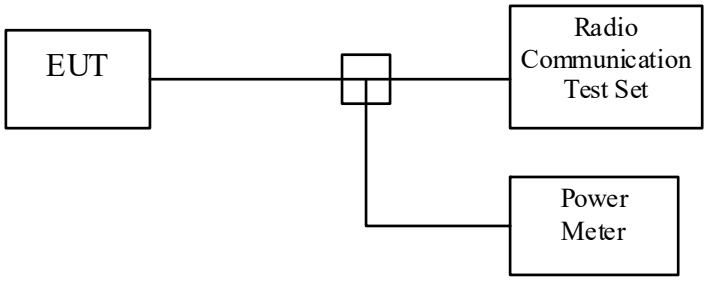
3.1 Provision Applicable

According to §74.861(e)(1)(ii), the output power shall not exceed 250 milliwatts.

3.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1, and Install new batteries in the EUT. Turn on the EUT ant set it to any one convenient frequency within its operating range.
3. Apply a 2.5 kHz modulation signal to EUT. Record the readings on the instrument.
4. Repeat above procedures until all frequencies measured were complete.

Figure 1: Transmit power measurement configuration.



3.3 Test Data

Operated mode : TX
Temperature : 25°C
Test Date : Apr. 19, 2017
Humidity : 55 %

Frequency (MHz)	Transmit Power		Limit (mW)
	(dBm)	(mW)	
506.002	9.77	9.484	250.0
522.004	9.49	8.892	250.0
538.000	9.36	8.630	250.0

3.4 Test Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
POWER METER +SENSOR	ANRITSU	ML2487A +MA2491A	2016/05/12	2017/05/11
Communications Service Monitor	AEROFLEX	2945B	2017/01/09	2018/01/08

4. MODULATION CHARACTERISTICS

4.1 Provisions Applicable

According to § 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be measured.

4.2 Measurement Method

A) Modulation Limit

1. Position the EUT as shown in figure 2, adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level.

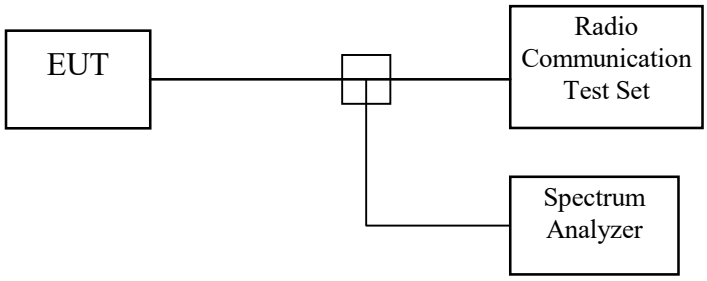
2. Repeat step 1 with changing the input frequency for 200, 500, 1000, 3000, and 5000 Hz in sequence.

B) Frequency response of all circuits

1. Position the EUT as shown in figure 2.

2. Vary the modulating frequency from 100 Hz to 15000 Hz with constant input voltage (derived from 5.4(a) of this test report), and observe the change in output.

Figure 2 : Modulation characteristic measurement configuration



4.3 Measurement Instrument

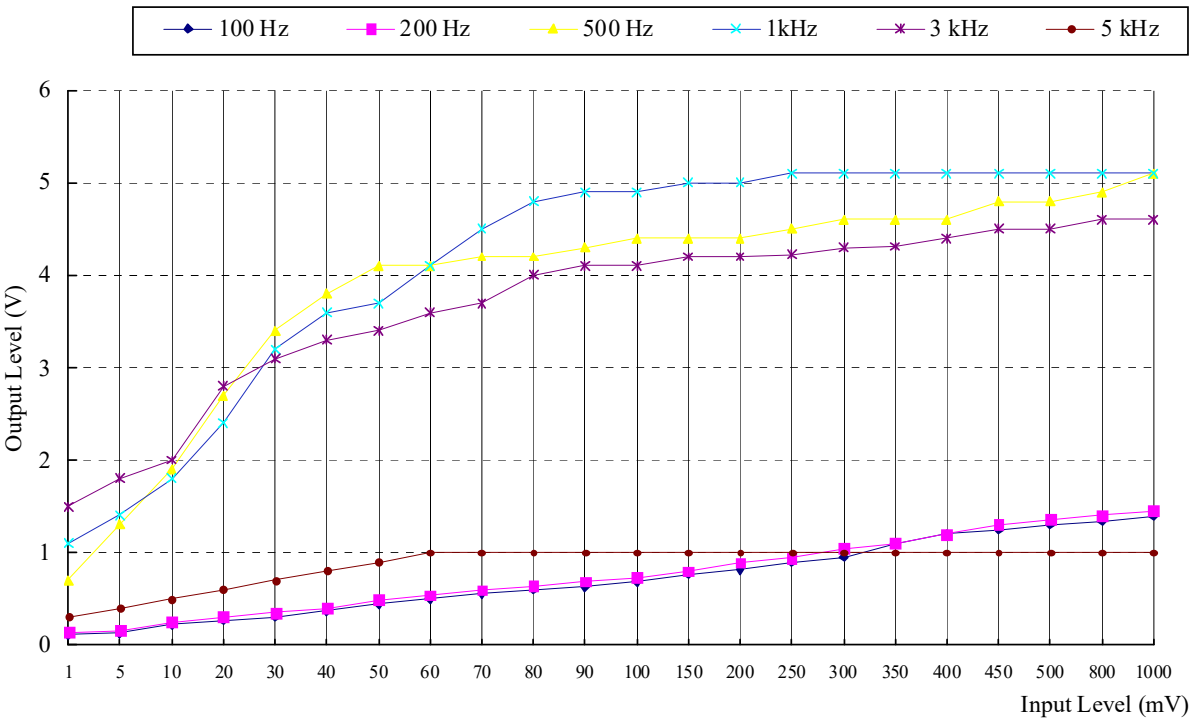
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Communications Service Monitor	AEROFLEX	2945B	2017/01/09	2018/01/08
Spectrum Analyzer	Rohde & Schwarz	FSP40	2016/10/03	2017/10/02

4.4 Measurement Result

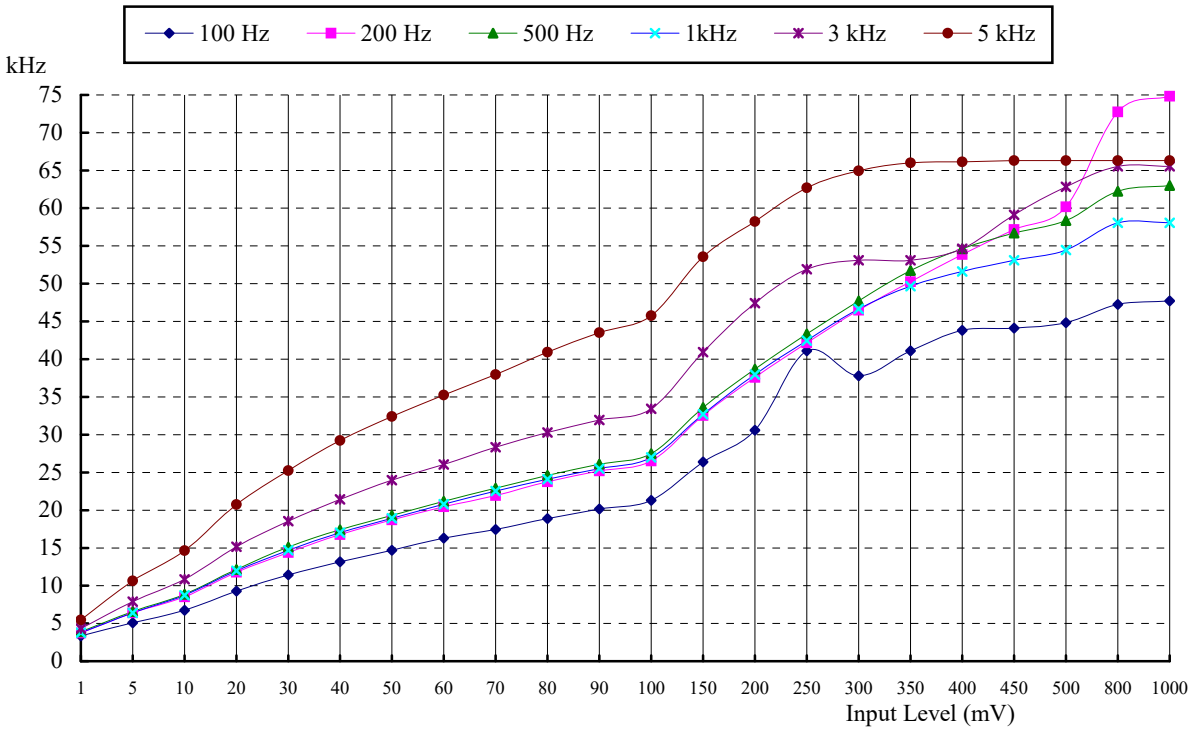
RF Frequency : 506MHz

Test Date : Apr. 19, 2017 Temperature : 25 °C Humidity : 55 %

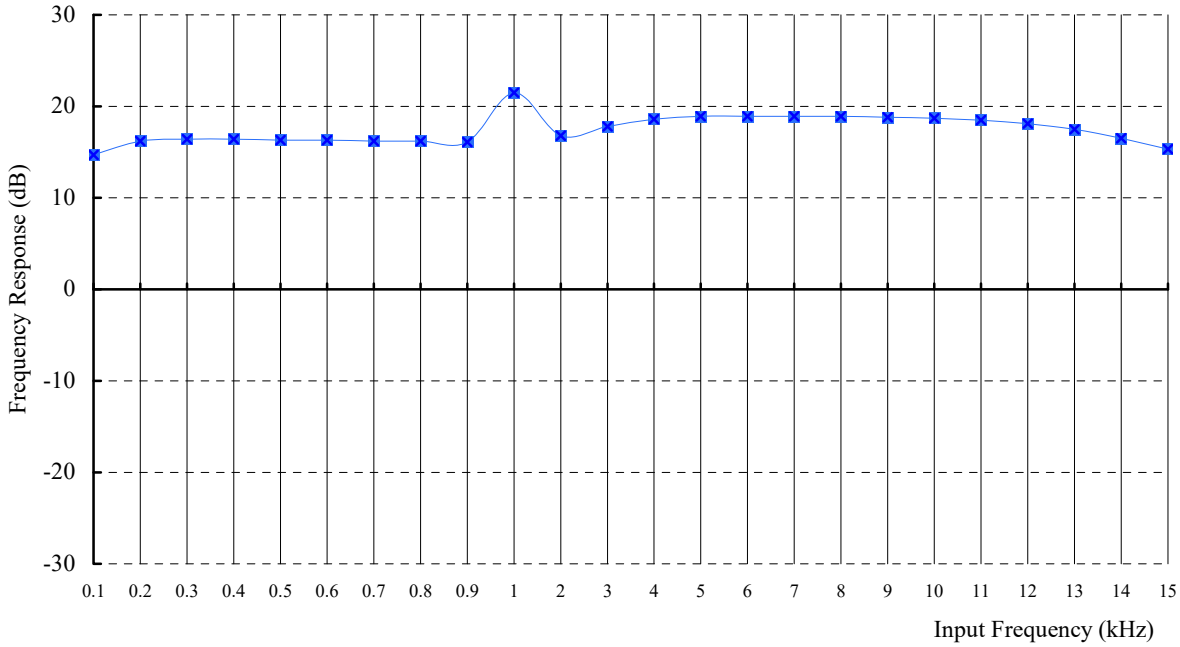
A). Frequency response



B). Modulation Limit



C). Frequency response of all circuits



5. OCCUPIED BANDWIDTH OF EMISSION

5.1 Provisions Applicable

According to §2.1049 (c)(1), For radiotelephone transmitter, other than single sideband or indenpent sideband transmitter, when modulateed by a 2.5kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.
According to §74.861(e)(5), the frequency emission bandwidth shall not exceed 200 kHz.

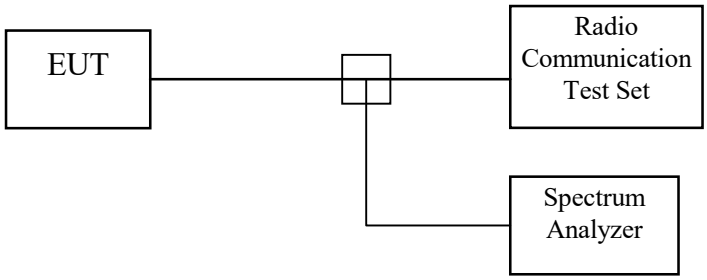
5.2 Measurement Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT as shown in figure 3, and Install new batteries in the EUT. Turn on the EUT ant set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3. Apply a 2.5 kHz modulation signal to EUT and measure the frequencies of the modulated signal from the EUT where it is the specified number of dB below the reference level set in step 2. This is the occupied bandwidth specified.

Figure 3 : Occupied bandwidth measurement configuration



5.3 Occupied Bandwidth Test Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Communications Service Monitor	AEROFLEX	2945B	2017/01/09	2018/01/08
Spectrum Analyzer	Rohde & Schwarz	FSP40	2016/10/03	2017/10/02

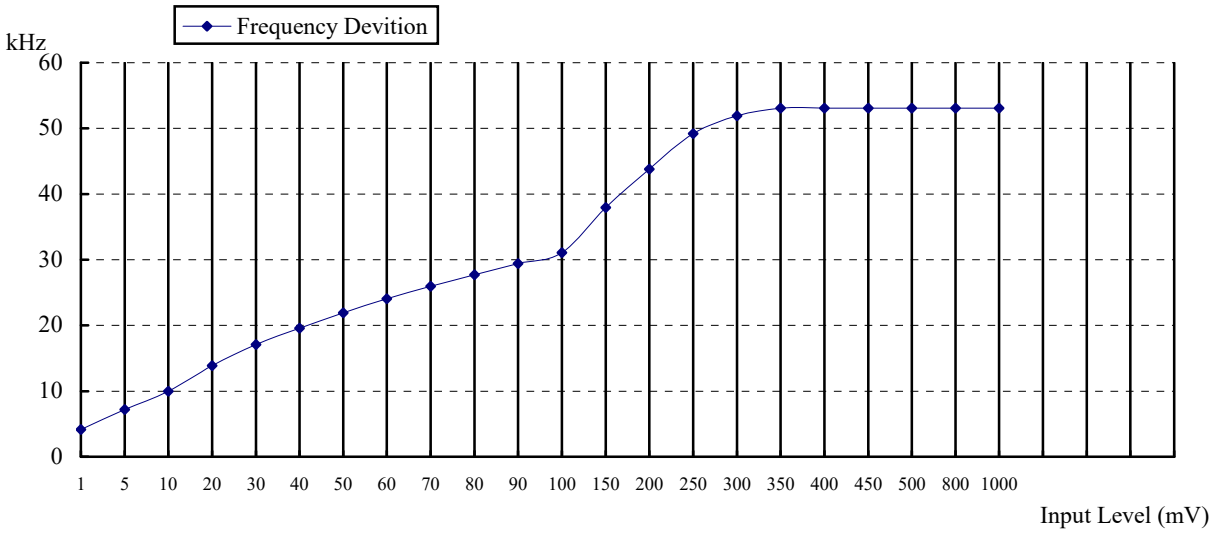
5.4 Bandwidth Measured

5.4.1 Input Level Derived

RF Frequency : 506MHz

Test Date : Apr. 19, 2017 Temperature : 25 °C Humidity : 55 %

Input Audio Frequency : 2.5 kHz, Sine Wave

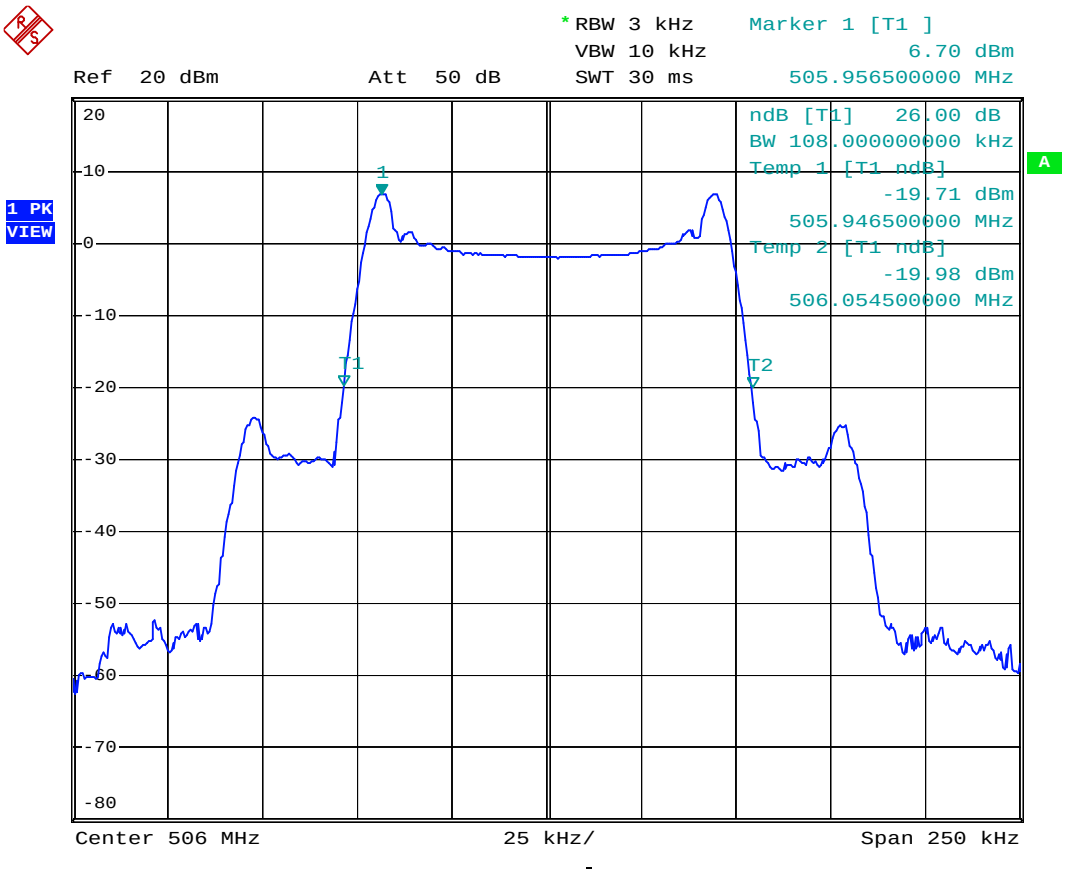


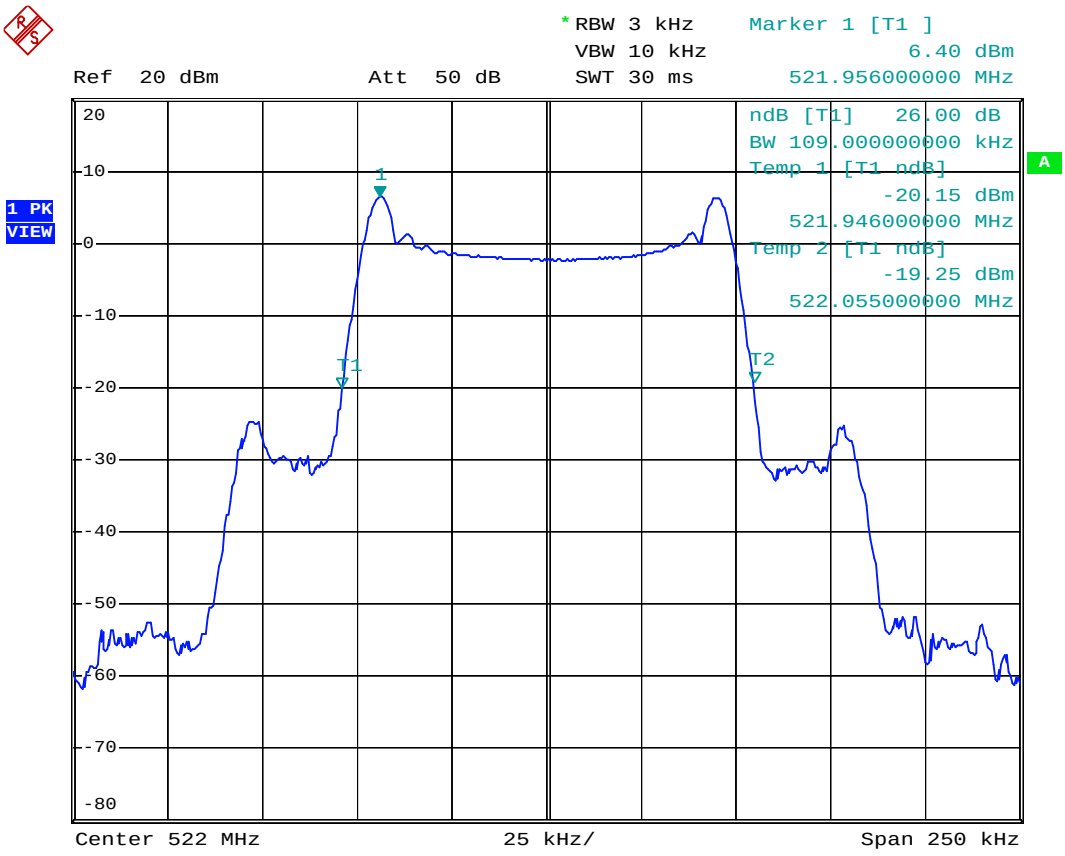
The Level input to produce 50% modulation is 60 mV, therefore the magnitude 16 dB greater than it is 378 mV.

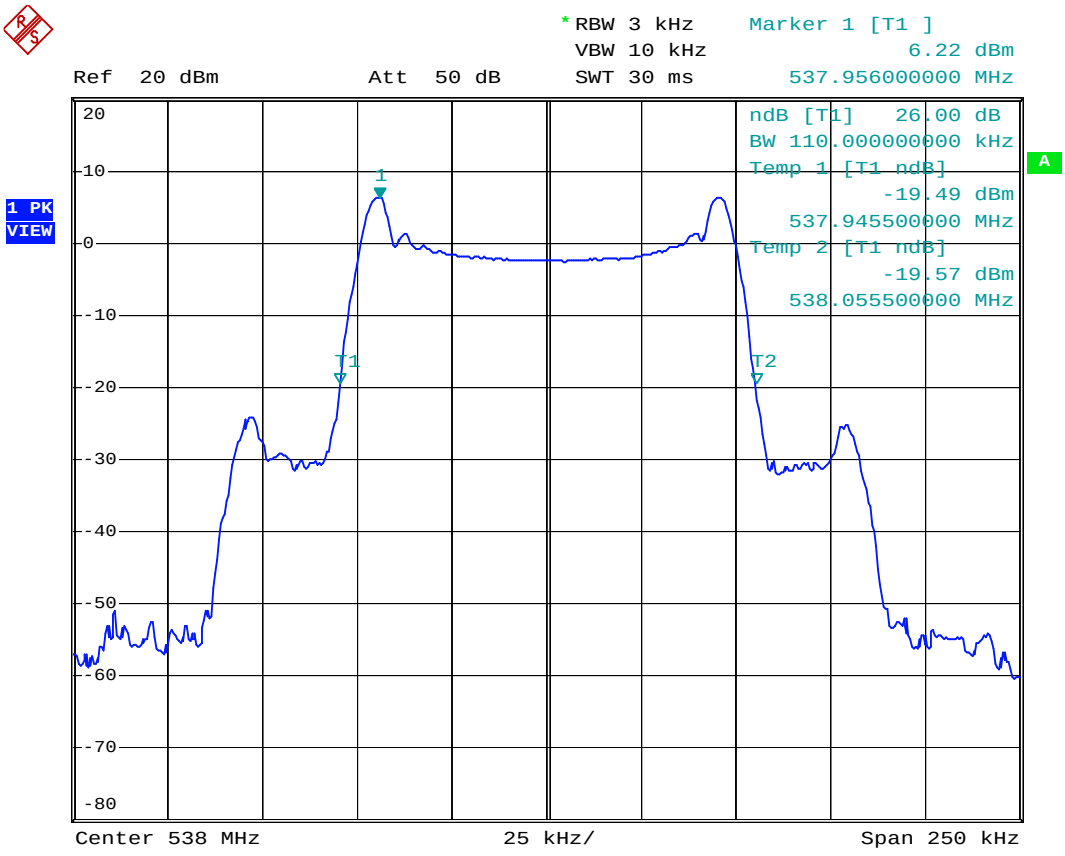
5.4.2 Occupied Bandwidth Plotted

Test Date : Apr. 19, 2017 Temperature : 25 °C Humidity : 55 %

RF Frequency (MHz)	26 dB Bandwidth (kHz)
506	108.0
522	109.0
538	110.0


*RBW 3 kHz
VBW 10 kHz
SWT 30 ms
Marker 1 [T1]
6.70 dBm
505.956500000 MHz
Ref 20 dBm
Att 50 dB
ndB [T1] 26.00 dB
BW 108.000000000 kHz
Temp 1 [T1 ndB]
-19.71 dBm
505.946500000 MHz
Temp 2 [T1 ndB]
-19.98 dBm
506.054500000 MHz
1 PK
VIEW
A
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1
T1
T2
Center 506 MHz
25 kHz/
Span 250 kHz


*RBW 3 kHz
VBW 10 kHz
SWT 30 ms
Marker 1 [T1]
6.40 dBm
521.956000000 MHz
Ref 20 dBm
Att 50 dB
ndB [T1] 26.00 dB
BW 109.000000000 kHz
Temp 1 [T1 ndB]
-20.15 dBm
521.946000000 MHz
Temp 2 [T1 ndB]
-19.25 dBm
522.055000000 MHz
1 PK
VIEW
A
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1
T1
T2
Center 522 MHz
25 kHz/
Span 250 kHz


*RBW 3 kHz
VBW 10 kHz
SWT 30 ms
Marker 1 [T1]
6.22 dBm
537.956000000 MHz
Ref 20 dBm
Att 50 dB
ndB [T1] 26.00 dB
BW 110.000000000 kHz
Temp 1 [T1 ndB]
-19.49 dBm
537.945500000 MHz
Temp 2 [T1 ndB]
-19.57 dBm
538.055500000 MHz
1 PK
VIEW
A
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1
T1
T2
Center 538 MHz
25 kHz/
Span 250 kHz

6. FIELD STRENGTH OF EMISSION

6.1 Provisions Applicable

According to §2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to §74.861(e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the follwing sceedule:

(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 of the authorized bandwidth shall be attenuated below the unmodulated carrier by at least 43 plus 10 Log(output power in watts) dB.

6.2 Measurement Procedure

1. Setup the configuration per figure 4 and 5 for frequencies measured below and above 1 GHz respectively.

2. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively.

3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

4. Repeat step 3 until all frequencies need to be measured were complete.

5. Repeat step 5 with search antenna in vertical polarized orientations.

6. Check the three frequencies of highest emission with varying the placement of cables associated with EUT (if any) to obtain the worse case and record the result.

Note:
According to 12.7.2(d)(2) of ANSI C63.10-2013:

$$E[dB\mu V/m] = EIRP[dBm] + 95.2, \text{ for } d = 3 \text{ m}.$$

12.7.2(e) of ANSI C63.10-2013:
For conducted measurements below 1000 MHz, the field strength shall be computed as specified in item d), and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

Figure 4 : Frequencies measured below 1 GHz configuration

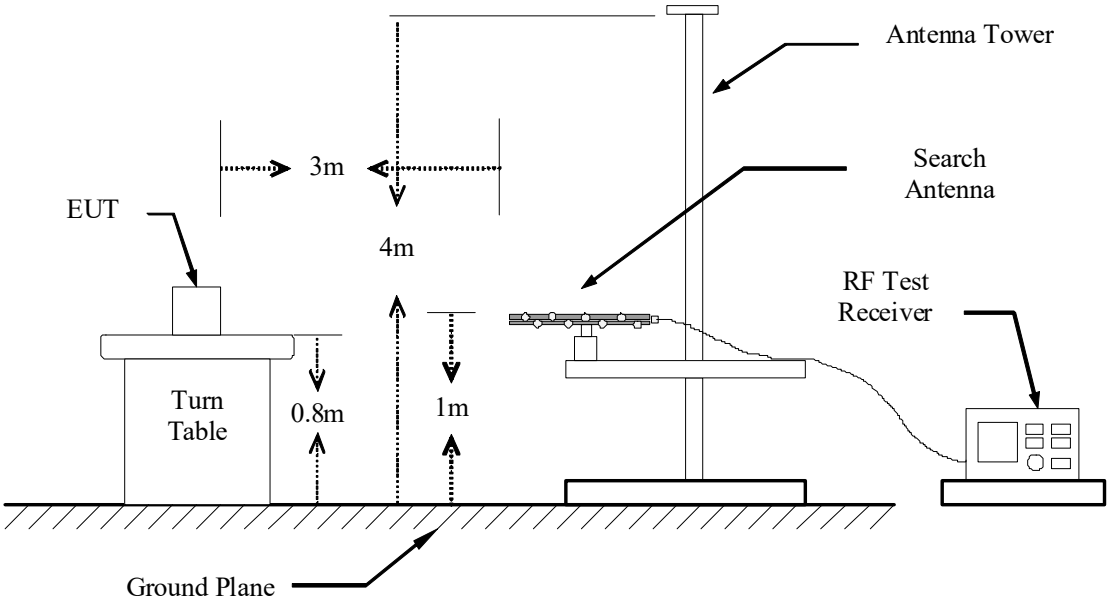
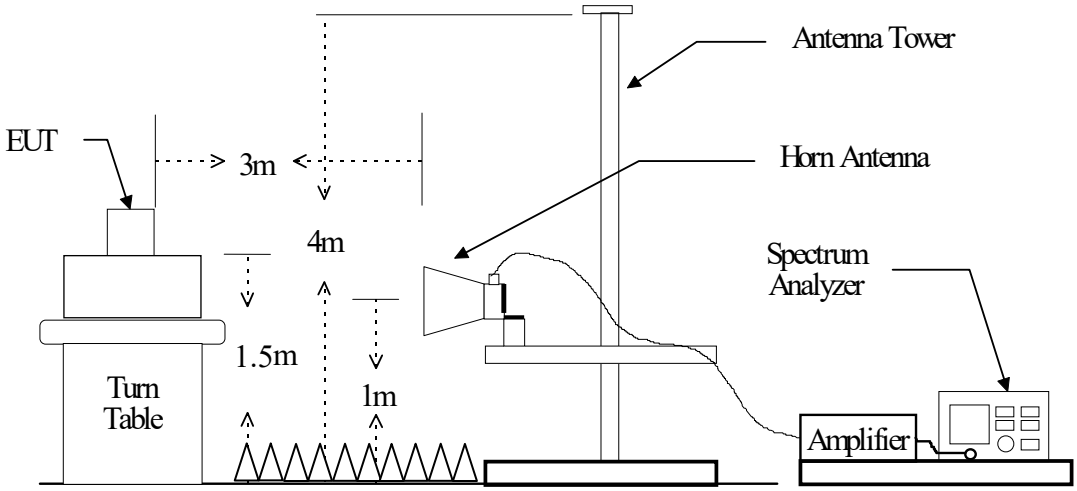


Figure 5 : Frequencies measured above 1 GHz configuration



6.3 Measuring Instrument

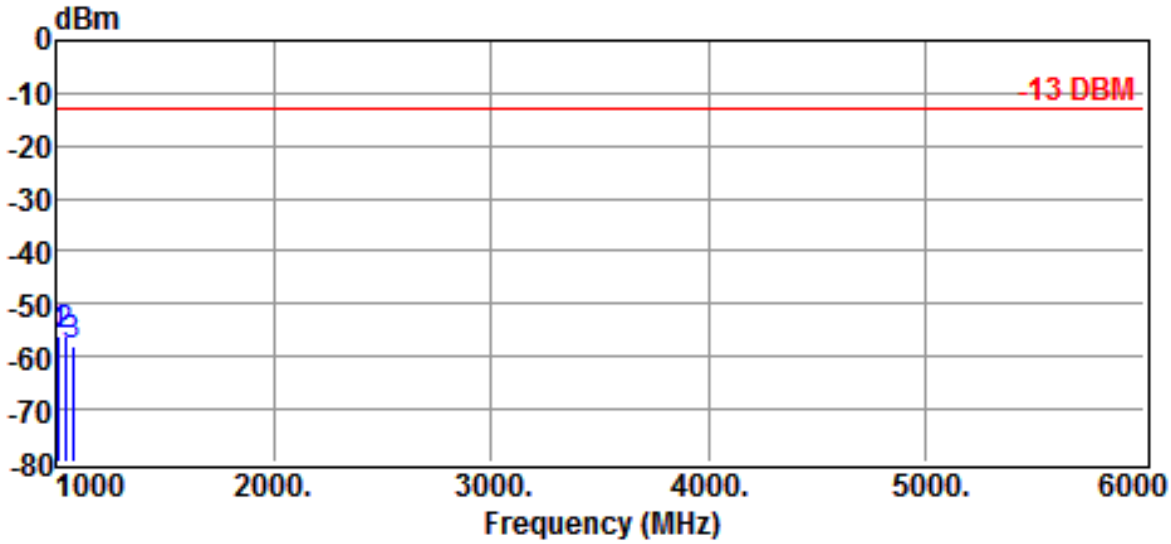
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2016/10/03	2017/10/02
Double Ridged Antenna	EMCO	3115	2016/10/05	2017/10/04
Log-periodic Antenna	EMCO	3146	2016/07/05	2017/07/04
Biconical Antenna	EMCO	3110	2016/07/05	2017/07/04
Amplifier	HP	8449B	2016/10/14	2017/10/13
Amplifier	HP	8447D	2016/12/05	2017/12/04
Signal generator	HP	83732B	2016/12/06	2017/12/05

Measuring instrument setup in frequency band measured is as following :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz

6.4 Measuring Data

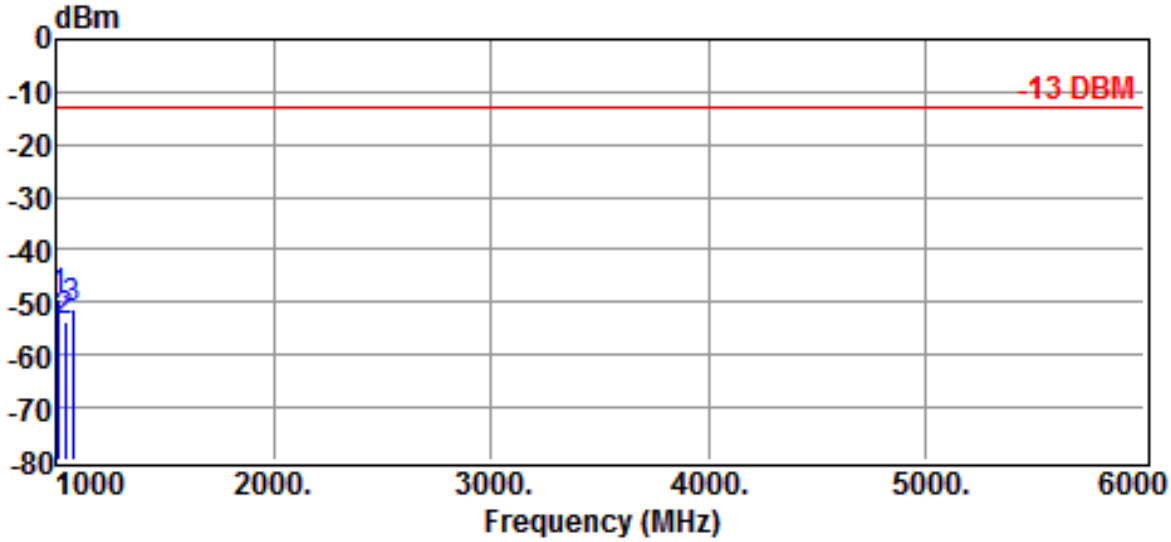
6.4.1. Harmonic Frequencies



Site	:CHAMBER # 2	Date	:2017-03-14
Limit	:-13 DBM	Ant. Pol.	:HORIZONTAL
EUT	:Wireless Microphone	Model	:WM-5225
Power Rating	:DC1.5V Battery	Temp.	:19˚C
Engineer	:Kazuma Ho	Humi.	:62 %
Test Mode	:CH Low 506MHz-Middle 522MHz-High 538MHz		

Freq MHz	Reading dBμV	Correction Factor dB	Result dBm	Limits dBm	Over limit dB	Detector
1012.0000	52.70	-108.58	-55.88	-13.00	-42.88	Peak
1044.0000	52.30	-108.44	-56.14	-13.00	-43.14	Peak
1076.0000	50.43	-108.38	-57.95	-13.00	-44.95	Peak

Note :
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)-EIRP Factor-2.15dB
   {EIRP Factor = -99.9dB (30MHz-1GHz) or -95.2dB (1GHz Above)}
   {ERP = EIRP – 2.15dB}
3. The margin value=Limit - Result

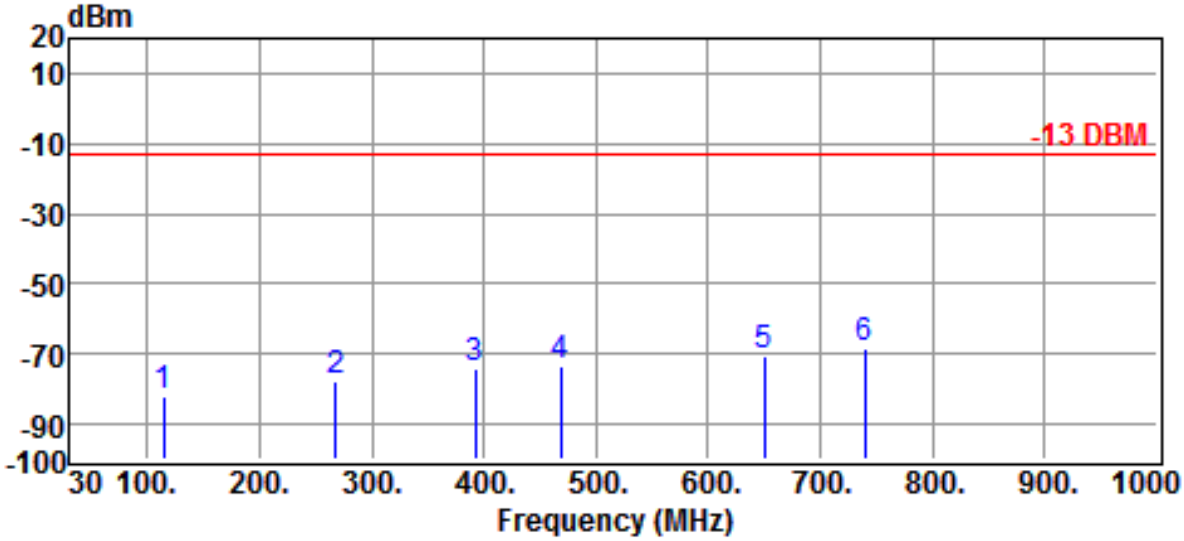


Site	:CHAMBER # 2	Date	:2017-03-14
Limit	:-13 DBM	Ant. Pol.	:VERTICAL
EUT	:Wireless Microphone	Model	:WM-5225
Power Rating	:DC1.5V Battery	Temp.	:19˚C
Engineer	:Kazuma Ho	Humi.	:62 %
Test Mode	:CH Low 506MHz-Middle 522MHz-High 538MHz		

Freq MHz	Reading dBμV	Correction Factor dB	Result dBm	Limits dBm	Over limit dB	Detector
1012.0000	59.22	-108.58	-49.36	-13.00	-36.36	Peak
1044.0000	54.77	-108.44	-53.67	-13.00	-40.67	Peak
1076.0000	57.17	-108.38	-51.21	-13.00	-38.21	Peak

Note :
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)-EIRP Factor-2.15dB
   {EIRP Factor = -99.9dB (30MHz-1GHz) or -95.2dB (1GHz Above)}
   {ERP = EIRP – 2.15dB}
3. The margin value=Limit - Result

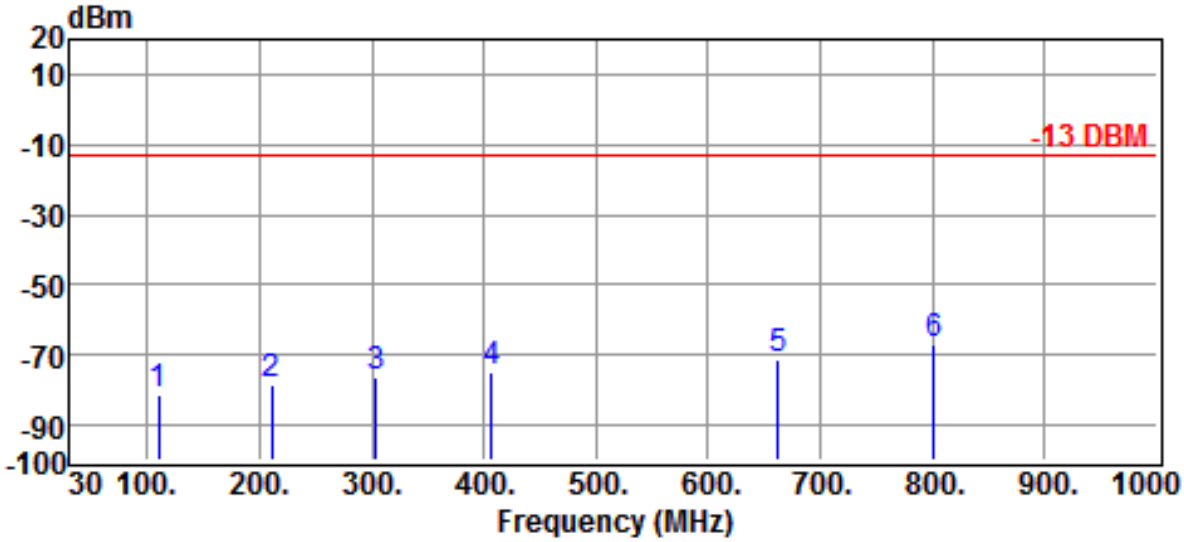
6.4.2 Spurious Emissions



Site	:CHAMBER #2	Date	:2017-03-16
Limit	:-13 DBM	Ant. Pol.	:HORIZONTAL
EUT	:Wireless Microphone	Model	:WM-5225
Power Rating	:DC1.5V Battery	Temp.	:17˚C
Engineer	:Kazuma Ho	Humi.	:65 %
Test Mode	:CH Low 506MHz-Middle 522MHz-High 538MHz		

Freq MHz	Reading dBμV	Correction Factor dB	Result dBm	Limits dBm	Over limit dB	Detector
114.3900	28.02	-110.35	-82.33	-13.00	-69.33	Peak
267.6500	28.77	-106.78	-78.01	-13.00	-65.01	Peak
391.8100	29.57	-103.66	-74.09	-13.00	-61.09	Peak
468.4400	29.70	-102.76	-73.06	-13.00	-60.06	Peak
649.8300	29.65	-100.01	-70.36	-13.00	-57.36	Peak
739.0700	30.20	-98.91	-68.71	-13.00	-55.71	Peak

Note :
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)-EIRP Factor-2.15dB
   {EIRP Factor = -99.9dB (30MHz-1GHz) or -95.2dB (1GHz Above)}
   {ERP = EIRP – 2.15dB}
3. The margin value=Limit - Result

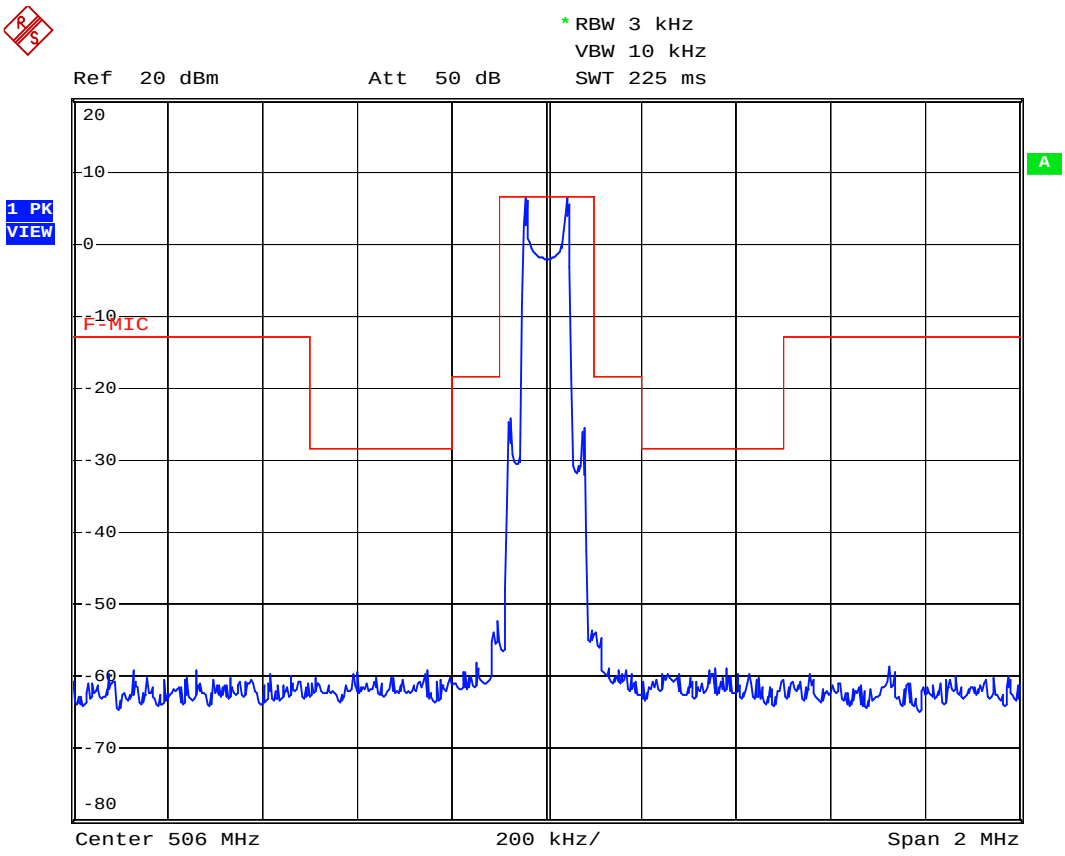


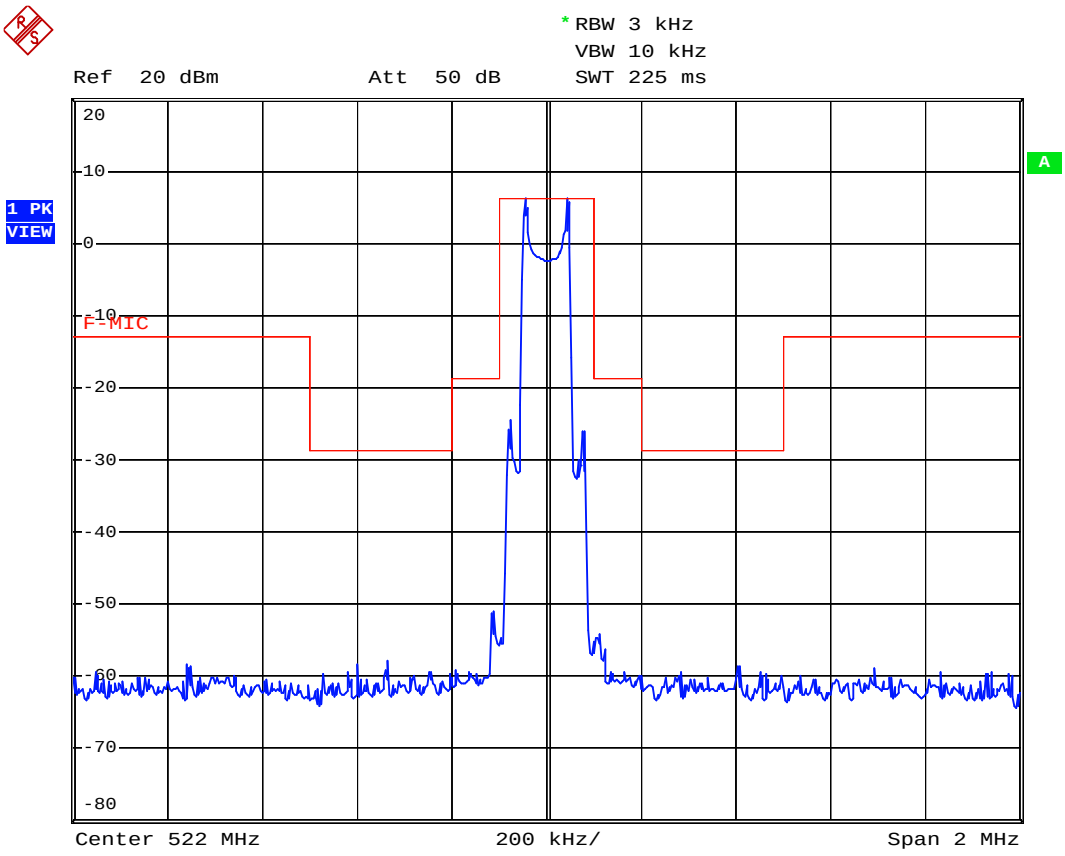
Site	:CHAMBER #2	Date	:2017-03-16
Limit	:-13 DBM	Ant. Pol.	:VERTICAL
EUT	:Wireless Microphone	Model	:WM-5225
Power Rating	:DC1.5V Battery	Temp.	:17˚C
Engineer	:Kazuma Ho	Humi.	:65 %
Test Mode	:CH Low 506MHz-Middle 522MHz-High 538MHz		

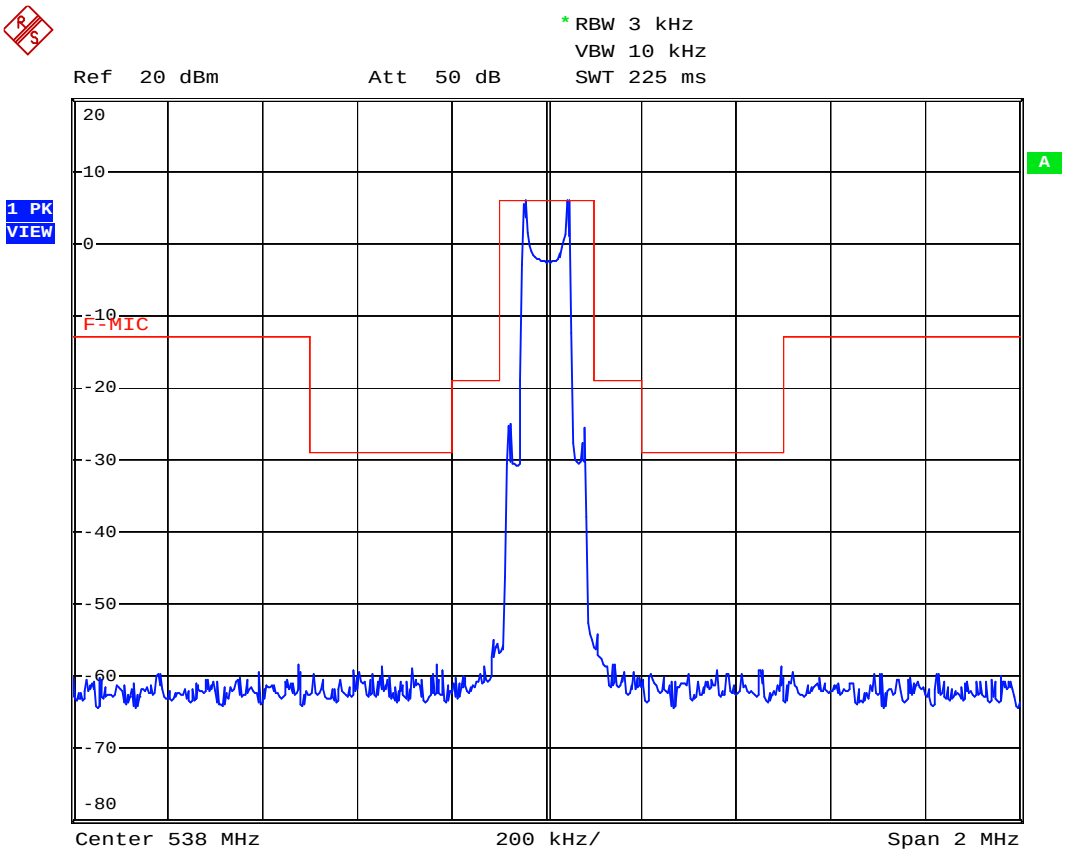
Freq MHz	Reading dBμV	Correction Factor dB	Result dBm	Limits dBm	Over limit dB	Detector
109.5400	29.28	-110.54	-81.26	-13.00	-68.26	Peak
210.4200	29.97	-108.71	-78.74	-13.00	-65.74	Peak
303.5400	29.03	-105.42	-76.39	-13.00	-63.39	Peak
406.3600	28.88	-103.44	-74.56	-13.00	-61.56	Peak
662.4400	28.57	-99.78	-71.21	-13.00	-58.21	Peak
801.1500	30.41	-97.47	-67.06	-13.00	-54.06	Peak

Note :
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)-EIRP Factor-2.15dB
   {EIRP Factor = -99.9dB (30MHz-1GHz) or -95.2dB (1GHz Above)}
   {ERP = EIRP – 2.15dB}
3. The margin value=Limit - Result

6.4.3 Emission mask plots

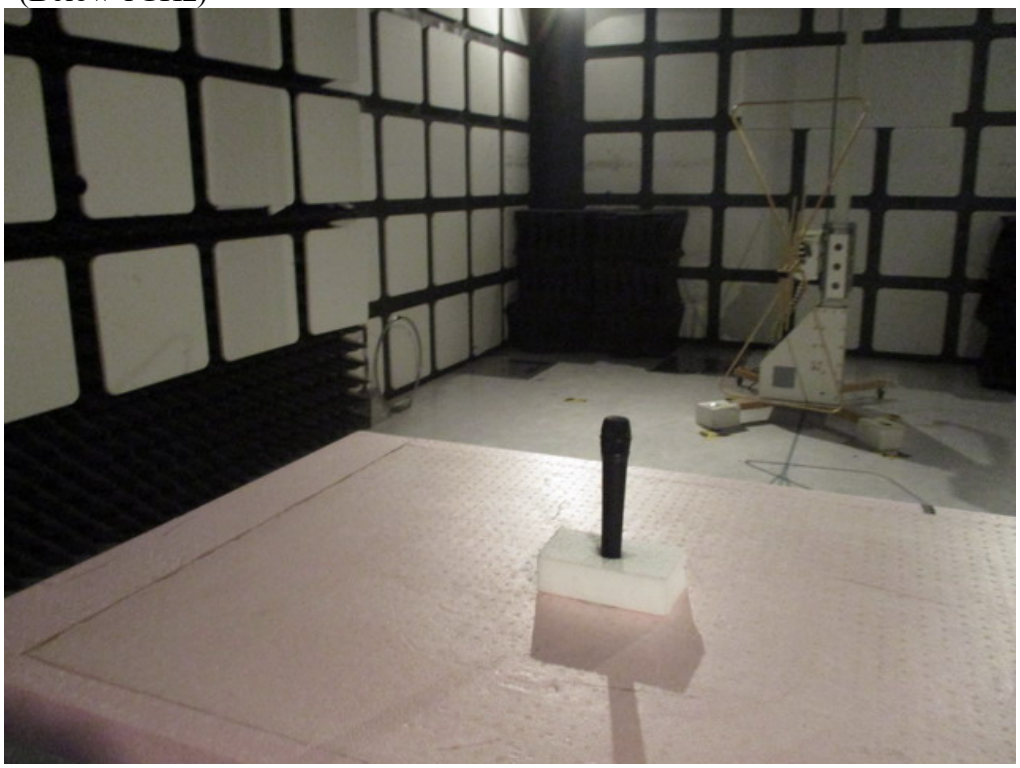


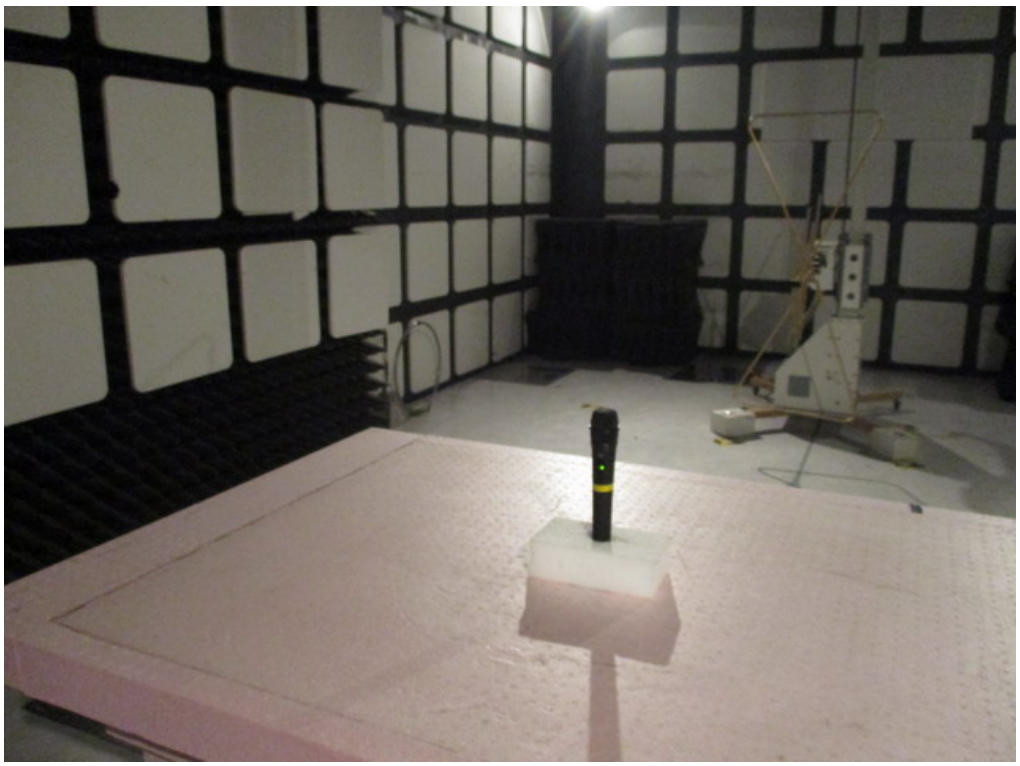

RBW 3 kHz
VBW 10 kHz
SWT 225 ms
Ref 20 dBm
Att 50 dB
1 PK
VIEW
A
F-MIC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 522 MHz
200 kHz/
Span 2 MHz


* RBW 3 kHz
VBW 10 kHz
SWT 225 ms
Ref 20 dBm
Att 50 dB
1 PK
VIEW
A
F-MIC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 538 MHz
200 kHz/
Span 2 MHz

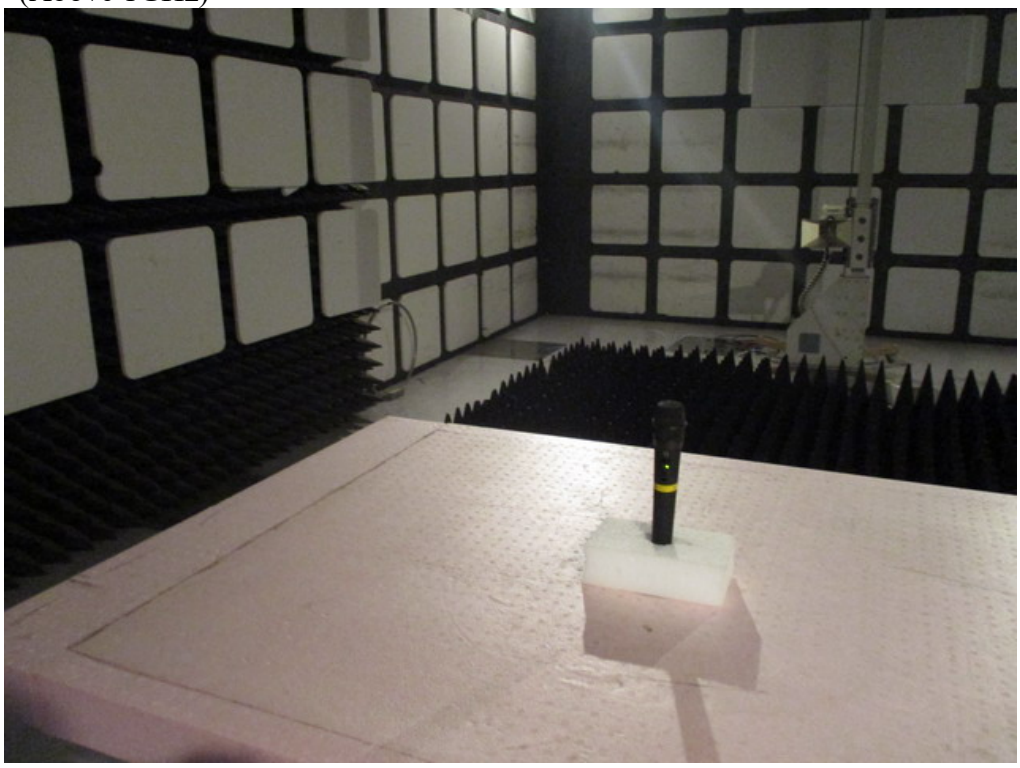
6.5 Radiated Measurement Photos

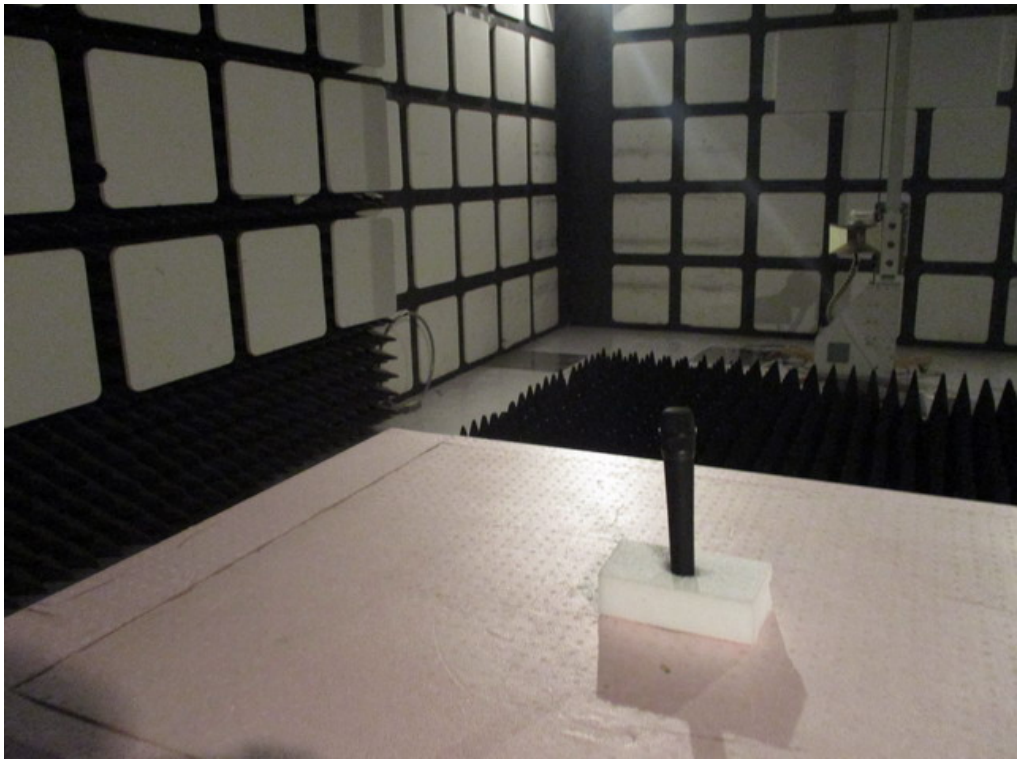
(Below 1GHz)





(Above 1GHz)





7. FREQUENCY STABILITY MEASUREMENT

7.1 Provisions Applicable

According to §2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30 to +50 centigrade.
According to §2.1055 (d)(1), the frequency stability shall be measured with variation of primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
According to §2.1055 (d)(2), for hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

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

7.2 Measurement Procedure

A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 6 for frequencies measured at an environmental chamber.

2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Then turn off the EUT.

3. Set the temperature of chamber to 50℃. Allow sufficient time 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 when the frequency has stablized.

4. Repeat step 3 with a 10℃ decreased per stage until the lowest temperature -30℃ is measured, record all measurement frequencies.

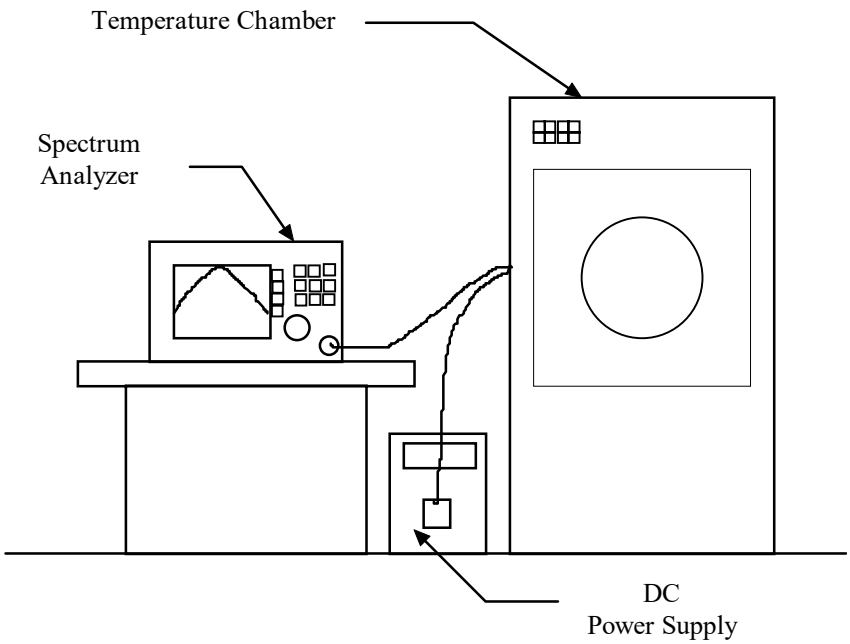
B) Frequency stability versus input voltage

1. Setup the configuration per figure 6 for frequencies measured at an environmental chamber set for a temperature of 25℃.

2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz.

3. Supply the EUT primary voltage with 85 and 115 percent of the nominal value and record the frequency.

Figure 6 : Frequency stability measurement configuration



7.3 Measurement Instrument

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2016/10/03	2017/10/02
Temperature Chamber	ESPEC	EFL-3	2016/05/10	2017/05/09

7.4 Measurement Data

Test Date : Apr. 19, 2017 Temperature : 25 °C Humidity : 55 %

A. Tx Frequency 506 MHz

A1. Frequency stability versus enviroment tempture

Reference Frequency :506 MHz			Limit：0.005%
Enviroment Tempture (℃)	Power Supplied (Vdc)	(MHz)	(%)
50	1.5	505.9979	-0.00042
40		505.9990	-0.00020
30		505.9995	-0.00010
20		506.0003	0.00006
10		506.0015	0.00030
0		506.0027	0.00053
-10		506.0044	0.00087
-20		506.0079	0.00156
-30		506.0101	0.00200

A2. Frequency stability versus supplied voltage

Reference Frequency : 470 MHz			Limit：0.005%
Enviroment Tempture (℃)	Power Supplied (Vdc)	(MHz)	(%)
25	1.3	505.9997	-0.00006
25	1.8	505.9997	-0.00006

8 CONDUCTED EMISSION MEASUREMENT

8.1 Standard Applicable

This EUT is excused from investigation of conducted emission, for it is powered by DC battery only. According to §15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.