# FCC Part 95 Rules
# Test Report

Report No.:AGC02294200402FE10

| | | |
|---|---|---|
| **FCC ID** | : | 2AJGM-P53U |
| **PRODUCT DESIGNATION** | : | TWO WAY RADIO |
| **BRAND NAME** | : | BAOFENG, POFUNG |
| **MODEL NAME** | : | P53U, BF-1903, P53UH, P53UL, 53X |
| **APPLICANT** | : | PO FUNG ELECTRONIC(HK) INTERNATIOANL GROUP COMPANY |
| **DATE OF ISSUE** | : | Jun. 23, 2020 |
| **STANDARD(S)** | : | FCC Part 95 Rules |
| **REPORT VERSION** | : | V 1.0 |

***A**ttestation of **G**lobal Compliance (Shenzhen) Co., Ltd*

## Report Revise Record

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|---|---|---|---|---|
| V1.0 | / | Jun. 23, 2020 | Valid | Initial release |

## VERIFICATION OF COMPLIANCE

| | |
|---|---|
| **Applicant** | PO FUNG ELECTRONIC(HK) INTERNATIOANL GROUP COMPANY |
| **Address** | 3/F FULOK BLDG 131-133 WING LOK ST SHEUNG WAN, Hong Kong |
| **manufacturer** | PO FUNG ELECTRONIC(HK) INTERNATIOANL GROUP COMPANY |
| **Address** | 3/F FULOK BLDG 131-133 WING LOK ST SHEUNG WAN, Hong Kong |
| **Factory** | PO FUNG ELECTRONIC(HK) INTERNATIOANL GROUP COMPANY |
| **Address** | 3/F FULOK BLDG 131-133 WING LOK ST SHEUNG WAN, Hong Kong |
| **Product Designation:** | TWO WAY RADIO |
| **Brand Name:** | BAOFENG,POFUNG |
| **Test Model** | P53U |
| **Serial Model** | BF-1903, P53UH, P53UL, 53X |
| **Difference Description** | The same motherboard and specifications, only the shell design differences & models, trademarks are different |
| **Date of Test:** | Apr. 30, 2020~Jun. 23, 2020 |

## WE HEREBY CERTIFY THAT:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in TIA/EIA 603. The sample tested as described in this report is in compliance with the FCC Rules Part 95 requirements. The test results of this report relate only to the tested sample identified in this report.

Prepared By — Calvin Liu
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Jun. 23, 2020

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Jun. 23, 2020

Approved By — Forrest Lei
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Authorized Officer
Jun. 23, 2020

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# 1. GENERAL INFORMATION

## 1.1 PRODUCT DESCRIPTION

The EUT is a **TWO WAY RADIO** designed for voice communication. It is designed by way of utilizing the FM modulation achieves the system operating.

A major technical description of EUT is described as following:

| | |
|---|---|
| Product Designation | TWO WAY RADIO |
| Test Model | P53U |
| Hardware Version | BF_1903_A21 |
| Software Version | BF_1903_A21 |
| Modulation | FM |
| Channel Separation | 12.5KHz |
| Emission Type | F3E |
| Emission Bandwidth | 10.64KHz |
| Maximum Transmitter Power | 36.95dBm |
| Rated Output power | 5W<br>(It was fixed by the manufacturer, any individual can't arbitrarily change it.) |
| Antenna Designation | Inseparable |
| Antenna Type | Integral Antenna |
| Antenna Gain | 1.50dBi |
| Power Supply | DC 7.40V |
| Limiting Voltage | DC 6.29V~ 8.51V |
| Operation Frequency Range and Channel | GMRS: 462.5625MHz -462.7125MHz(5W)<br>462.5500MHz -462.7250MHz(5W)<br>467.6500MHz(5W)<br>Test Channel :4, 12 and 16 channel |
| Frequency Tolerance | 1.087ppm |

**Channel List:**

| CH. No | CH. Freq | Power | CH. No | CH. Freq | Power |
|---|---|---|---|---|---|
| 1 | 462.5625 | 5W | 16 | 467.6500 | 5W |
| 2 | 462.5875 | | 17 | / | |
| 3 | 462.6125 | | 18 | / | |
| 4 | 462.6375 | | 19 | / | |
| 5 | 462.6625 | | 20 | / | |
| 6 | 462.6875 | | 21 | / | |
| 7 | 462.7125 | | 22 | / | |
| 8 | 462.5500 | | 23 | / | |
| 9 | 462.5750 | | 24 | / | / |
| 10 | 462.6000 | | 25 | / | |
| 11 | 462.6250 | | 26 | / | |
| 12 | 462.6500 | | 27 | / | |
| 13 | 462.6750 | | 28 | / | |
| 14 | 462.7000 | | 29 | / | |
| 15 | 462.7250 | | 30 | / | |

## 1.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for FCC ID: **2AJGM-P53U**, filing to comply with the FCC Part 95 requirements.

## 1.3 TEST METHODOLOGY.

The radiated emission testing was performed according to the procedures of TIA/EIA 603.

## 1.4 TEST FACILITY

| | |
|---|---|
| **Test Site** | Attestation of Global Compliance (Shenzhen) Co., Ltd |
| **Location** | 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong,China |
| **Designation Number** | CN1259 |
| **FCC Test Firm Registration Number** | 975832 |
| **A2LA Cert. No.** | 5054.02 |
| **Description** | Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA |

## 1.5 SPECIAL ACCESSORIES

Not available for this EUT intended for grant.

## 1.6 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

# 2. SYSTEM TEST CONFIGURATION

## 2.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

## 2.2 EUT EXERCISE

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

## 2.3 CONFIGURATION OF TESTED SYSTEM

Fig. 2-1 Configuration of Tested System


Table 2-1 Equipment Used in Tested System

| Item | Equipment | Model No. | Identifier | Note |
|---|---|---|---|---|
| 1 | TWO WAY RADIO | P53U | FCC ID: 2AJGM-P53U | EUT |
| 2 | Battery | N/A | DC 7.4V 2200mAh | AE |
| 3 | Adapter | N/A | Input: AC 100-240V 50/60Hz, 0.25A<br>Output: DC 10V 0.5A | AE |
| 4 | Charger | CH-1904 | Input: DC 10V<br>Output: DC 8.4V 500mA | AE |
| 5 | Back clip | N/A | N/A | AE |
| 6 | Lanyard | N/A | N/A | AE |

Note：The battery is full-charged during the test

## 3. SUMMARY OF TEST RESULTS

| FCC 47 CFR Part 95 Test Cases | | | |
|---|---|---|---|
| **Test Item** | **Test Requirement** | **Test Method** | **Result** |
| **Maximum Transmitter Power** | FCC CFR Part 95.1767<br>FCC 47 CFR Part 2.1046(a) | ANSI/TIA-603-E-2016 | PASS |
| **Modulation Limit** | FCC CFR Part 95.1775<br>FCC 47 CFR Part 2.1047(a)(b) | ANSI/TIA-603-E-2016 | PASS |
| **Audio Frequency Response** | FCC CFR Part 95.1775<br>FCC 47 CFR Part 2.1047(a) | ANSI/TIA-603-E-2016 | PASS |
| **Audio Low Pass Filter Response** | FCC 47 CFR Part 95.1775(e) | ANSI/TIA-603-E-2016 | PASS |
| **Emission Bandwidth** | FCC CFR Part 95.1773 | ANSI/TIA-603-E-2016 | PASS |
| **Emission Mask** | FCC CFR Part 95.1779 | ANSI/TIA-603-E-2016 | PASS |
| **Transmitter Radiated Spurious Emission** | FCC CFR Part 95.1779 | ANSI/TIA-603-E-2016 | PASS |
| **Frequency Stability** | FCC CFR Part 95.1765<br>FCC 47 CFR Part 2.1055 (a)(1) | ANSI/TIA-603-E-2016 | PASS |

**LIST OF EQUIPMENTS USED**

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| TEST RECEIVER | R&S | ESCI | 10096 | Jun. 12, 2019 | Jun. 11, 2020 |
| TEST RECEIVER | R&S | ESCI | 10096 | Jun. 09, 2020 | Jun. 08, 2021 |
| EXA Signal Analyzer | Aglient | N9020A | W1312-60196 | Oct. 08, 2019 | Oct. 07, 2020 |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep.18, 2018 | Sep.17, 2020 |
| preamplifier | ChengYi | EMC184045SE | 980508 | Sep. 23, 2019 | Sep. 22, 2020 |
| Double-Ridged Waveguide Horn | ETS LINDGREN | 3117 | 00034609 | May. 17, 2019 | May. 16, 2021 |
| Broadband Preamplifier | SCHWARZBECK | BBV 9718 | 9718-205 | Jun. 12, 2019 | Jun. 11, 2020 |
| Broadband Preamplifier | SCHWARZBECK | BBV 9718 | 9718-205 | Jun. 09, 2020 | Jun. 08, 2021 |
| Double-Ridged Waveguide Horn | ETS | 3117 | 00154520 | Oct. 26, 2019 | Oct. 25, 2021 |
| SIGNAL GENERATOR | AGILENT | E4421B | MY43351603 | Jun. 12, 2019 | Jun. 11, 2020 |
| SIGNAL GENERATOR | AGILENT | E4421B | MY43351603 | Jun. 09, 2020 | Jun. 08, 2021 |
| SIGNAL GENERATOR | R&S | SMT03 | A0304261 | Jun. 12, 2019 | Jun. 11, 2020 |
| SIGNAL GENERATOR | R&S | SMT03 | A0304261 | Jun. 09, 2020 | Jun. 08, 2021 |
| ANTENNA | SCHWARZBECK | VULB9168 | VULB9168-494 | Jan. 09, 2019 | Jan. 08, 2021 |
| ANTENNA | SCHWARZBECK | VULB9168 | D69250 | Sep.26, 2018 | Sep.25, 2020 |
| Modulation Domain Analyzer | HP | 53310A | 3121A02467 | Oct. 30, 2019 | Oct. 29, 2020 |
| Small environmental tester | ESPEC | SH-242 | -- | Oct. 08, 2019 | Oct. 07, 2020 |
| RF Communication Test Set | HP | 8920B | -- | Jun. 12, 2019 | Jun. 11, 2020 |
| RF Communication | HP | 8920B | -- | Jun. 09, 2020 | Jun. 08, 2021 |

| | | | | | |
|---|---|---|---|---|---|
| Test Set | | | | | |
| Active loop antenna (9K-30MHz) | ZHINAN | ZN30900C | 18051 | Jun. 13, 2019 | Jun. 12, 2020 |
| Active loop antenna (9K-30MHz) | ZHINAN | ZN30900C | 18051 | Jun. 11, 2020 | Jun. 10, 2021 |
| Attenuator | Schaffner | 58-30-33 | ML030 | Oct. 28, 2019 | Oct. 27, 2020 |
| Vector Analyzer | Agilent | E4440A | US40420298 | July 02, 2019 | July 01, 2020 |
| RF Cable | R&S | 1# | -- | Each time | N/A |
| Fliter-UHF | Microwave | N25155M2 | 498705 | May. 13, 2019 | May. 12, 2020 |
| Fliter-UHF | Microwave | N25155M2 | 498705 | May. 11, 2020 | May. 10, 2021 |

Note: 8920B can generate audio modulation frequency.

## 4. DESCRIPTION OF TEST MODES

### RF TEST MODES

The EUT (**TWO WAY RADIO**) has been tested under normal operating condition. (GMRS TX) are chosen for testing at each channel separation.

| No. | TEST MODES | CHANNEL SEPARATION |
|---|---|---|
| 1 | GMRS TX | 12.5KHz |

**Note:1.** Only the result of the worst case was recorded in the report.

# 5. FREQUENCY TOLERANCE

## 5.1 PROVISIONS APPLICABLE

Standard Applicable [Part 95.1765]The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.
FCC Part 95.1765,
GMRS: The carrier frequency of each GMRS transmitter transmitting an emission with an occupied bandwidth of 12.5 kHz or less must remain within 2.5 ppm
The carrier frequency of each GMRS transmitter transmitting an emission with an occupied bandwidth greater than 12.5 kHz must remain within 5 ppm

## 5.2 MEASUREMENT PROCEDURE

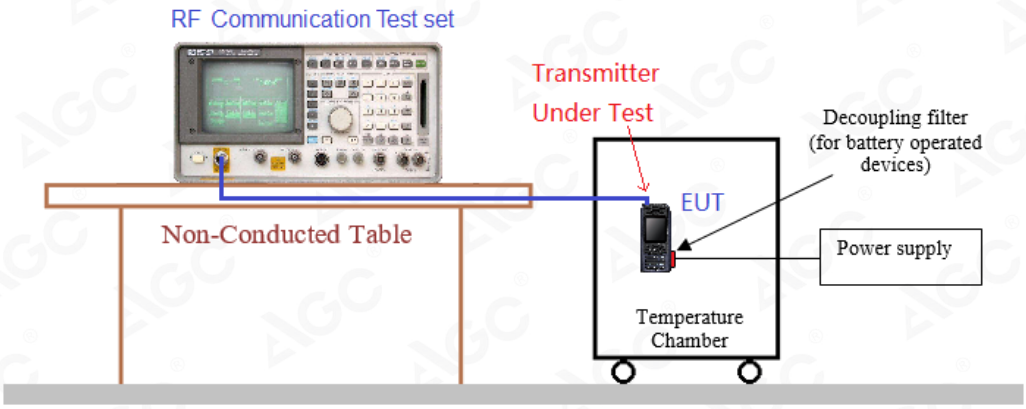
### 5.2.1 Frequency stability versus environmental temperature

1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1KHz and Video Resolution Bandwidth to 1KHz and Frequency Span to 50KHz.Record this frequency as reference frequency.
3. Set the temperature of chamber to 50℃. 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℃ decreased per stage until the lowest temperature -30℃ is measured, record all measured frequencies on each temperature step.

### 5.2.2 Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15℃ to 25℃. Otherwise, an environment chamber set for a temperature of 20℃ shall be used. The EUT shall be powered by DC 7.40V.
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1KHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

## 5.3 TEST SETUP BLOCK DIAGRAM



**5.4TEST RESULT**

(1) Frequency stability versus input voltage (Supply nominal voltage is 7.40V)

| Environment Temperature (℃) | Power Supply | Reference Frequency | | | Limit: |
|---|---|---|---|---|---|
| | (V) | 462.6375MHz | 462.6500MHz | 467.6500MHz | ppm |
| 50 | DC 7.40V | 0.728 | 0.653 | 1.021 | ±2.5for GMRS |
| 40 | DC 7.40V | 0.852 | 1.074 | 0.519 | |
| 30 | DC 7.40V | 0.875 | 0.534 | 0.614 | |
| 20 | DC 7.40V | 0.749 | 0.617 | 0.809 | |
| 10 | DC 7.40V | 1.087 | 0.688 | 0.849 | |
| 0 | DC 7.40V | 0.607 | 0.963 | 0.627 | |
| -10 | DC 7.40V | 0.700 | 0.994 | 0.605 | |
| -20 | DC 7.40V | 0.567 | 0.591 | 0.692 | |
| -30 | DC 7.40V | 0.824 | 0.738 | 0.822 | |
| Result | Pass | | | | |

(2) Frequency stability versus input voltage (Battery limiting voltage is 6.29V)

| Environment Temperature (℃) | Power Supply | Reference Frequency | | | Limit: |
|---|---|---|---|---|---|
| | (V) | 462.6375MHz | 462.6500MHz | 467.6500MHz | ppm |
| 50 | DC 6.29V | 0.817 | 0.653 | 0.696 | ±2.5for GMRS |
| 40 | DC 6.29V | 0.877 | 0.755 | 0.747 | |
| 30 | DC 6.29V | 0.768 | 0.654 | 1.025 | |
| 20 | DC 6.29V | 0.561 | 0.973 | 1.035 | |
| 10 | DC 6.29V | 0.837 | 0.780 | 0.723 | |
| 0 | DC 6.29V | 0.802 | 0.597 | 0.926 | |
| -10 | DC 6.29V | 1.056 | 0.990 | 0.600 | |
| -20 | DC 6.29V | 0.971 | 0.883 | 0.880 | |
| -30 | DC 6.29V | 0.979 | 0.930 | 1.060 | |
| Result | Pass | | | | |

(3) Frequency stability versus input voltage (Battery Fully Charged voltage is 8.51V)

| Environment Temperature (℃) | Power Supply (V) | Reference Frequency 462.6375MHz | Reference Frequency 462.6500MHz | Reference Frequency 467.6500MHz | Limit: ppm |
|---|---|---|---|---|---|
| 50 | DC 8.51V | 0.434 | 0.653 | 0.733 | ±2.5for GMRS |
| 40 | DC 8.51V | 0.694 | 0.637 | 0.723 | |
| 30 | DC 8.51V | 0.943 | 0.547 | 0.937 | |
| 20 | DC 8.51V | 1.050 | 0.668 | 0.688 | |
| 10 | DC 8.51V | 0.972 | 0.984 | 1.041 | |
| 0 | DC 8.51V | 0.833 | 0.906 | 0.846 | |
| -10 | DC 8.51V | 0.865 | 1.028 | 0.763 | |
| -20 | DC 8.51V | 0.512 | 0.809 | 0.520 | |
| -30 | DC 8.51V | 0.878 | 0.704 | 0.615 | |
| Result | Pass | | | | |

**Note**: 1.Battery terminal voltage is declared and specified by the manufacturer.
2. All test values are in "ppm"

# 6. EMISSION BANDWIDTH

## 6.1 PROVISIONS APPLICABLE

FCC Part 95.1773: GMRS:

(a) Main channels. The authorized bandwidth is 20 kHz for GMRS transmitters operating on any of the 462 MHz main channels, or any of the 467 MHz main channels.

(b) Interstitial channels. The authorized bandwidth is 20 kHz for GMRS transmitters operating on any of the 462 MHz interstitial channels, and is 12.5 kHz for GMRS transmitters operating on any of the 467 MHz interstitial channels.

Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyzer via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyzer.

## 6.2 MEASUREMENT PROCEDURE

1). The EUT was modulated by 2.5 KHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz (12.5 kHz channel spacing).

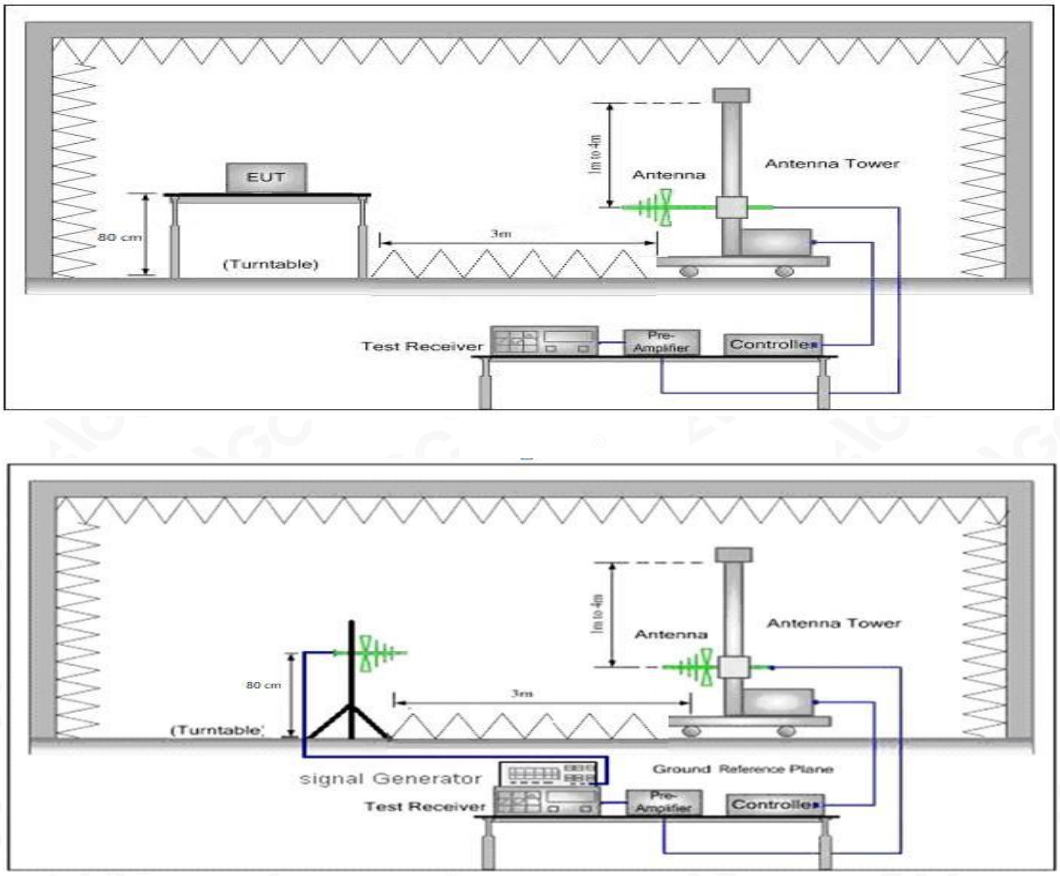
2). Set SPA Center Frequency = fundamental frequency, RBW=300Hz.VBW= 1KHz, Span =50 KHz.

3). Set SPA Max hold. Mark peak, -26 dB.

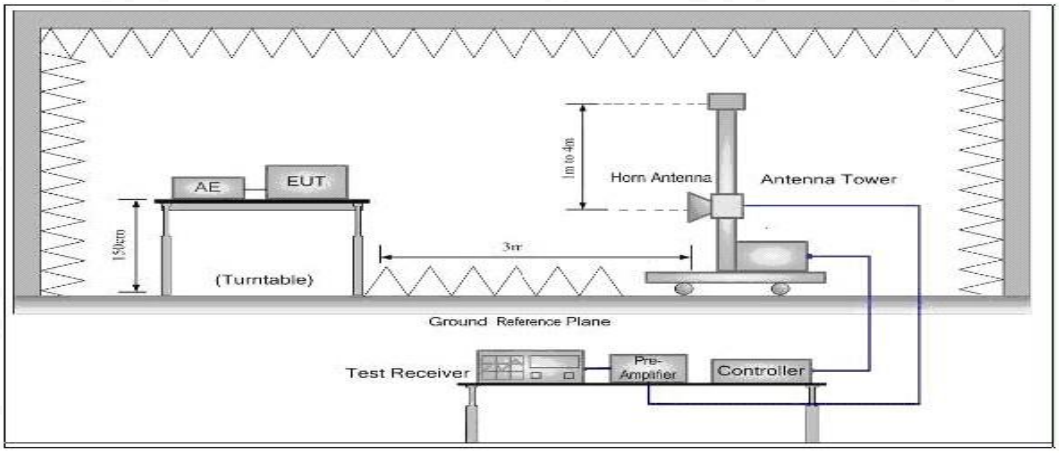
## 6.3 TEST SETUP BLOCK DIAGRAM

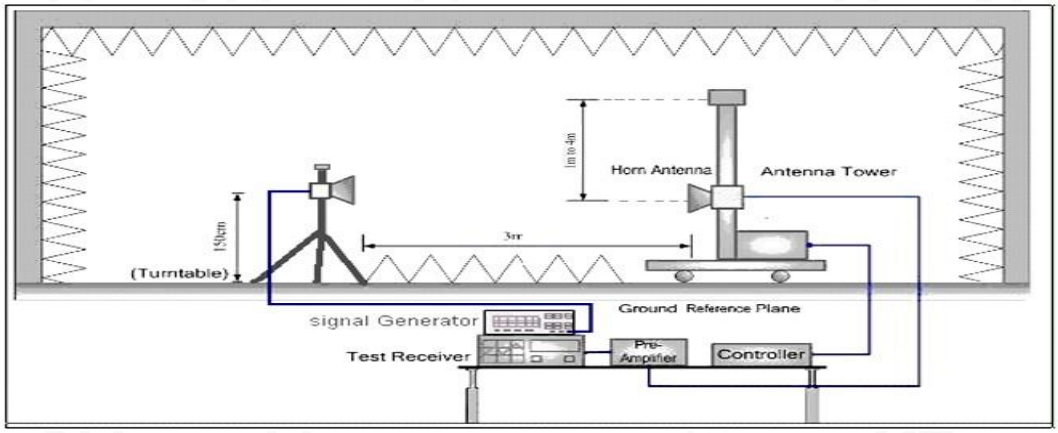
**Radiation method:**

**Radiated Below1GHz**

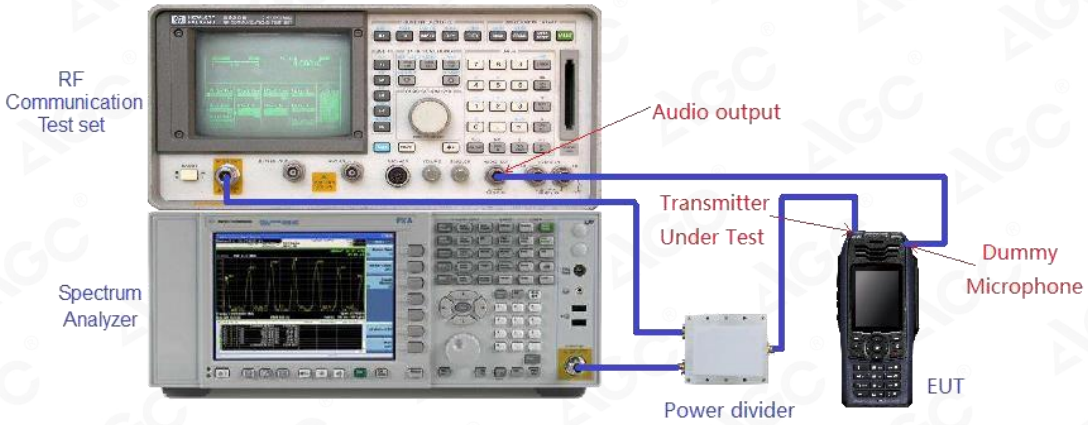


**Radiated Above 1 GHz**



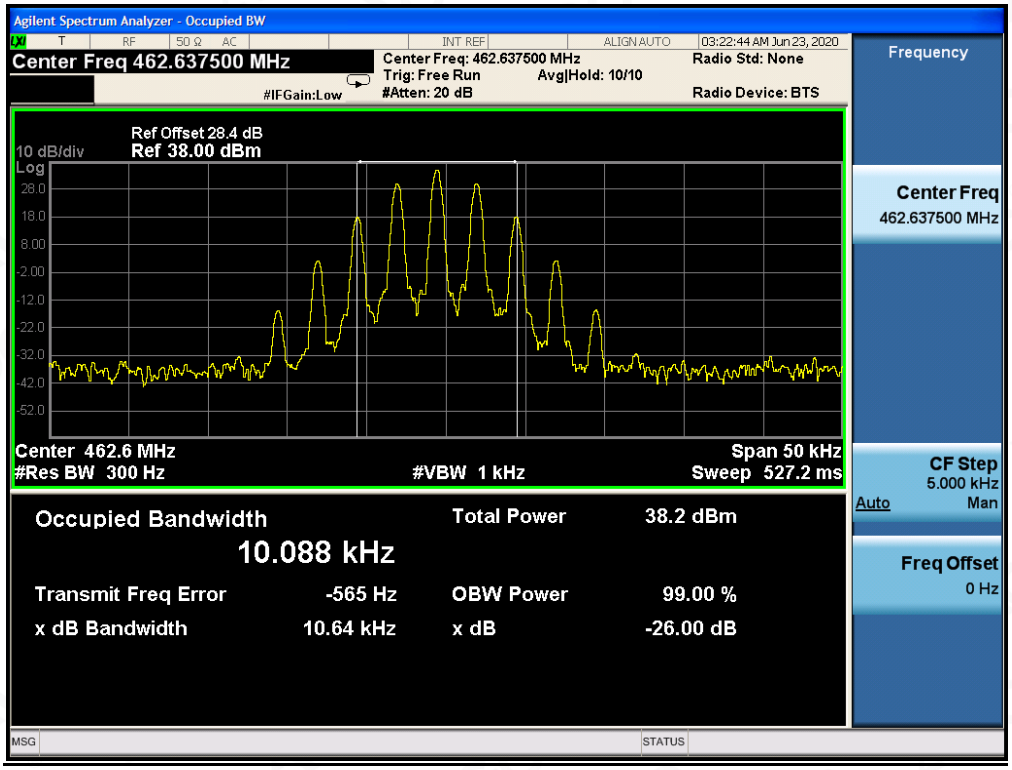
**Conduction method:**



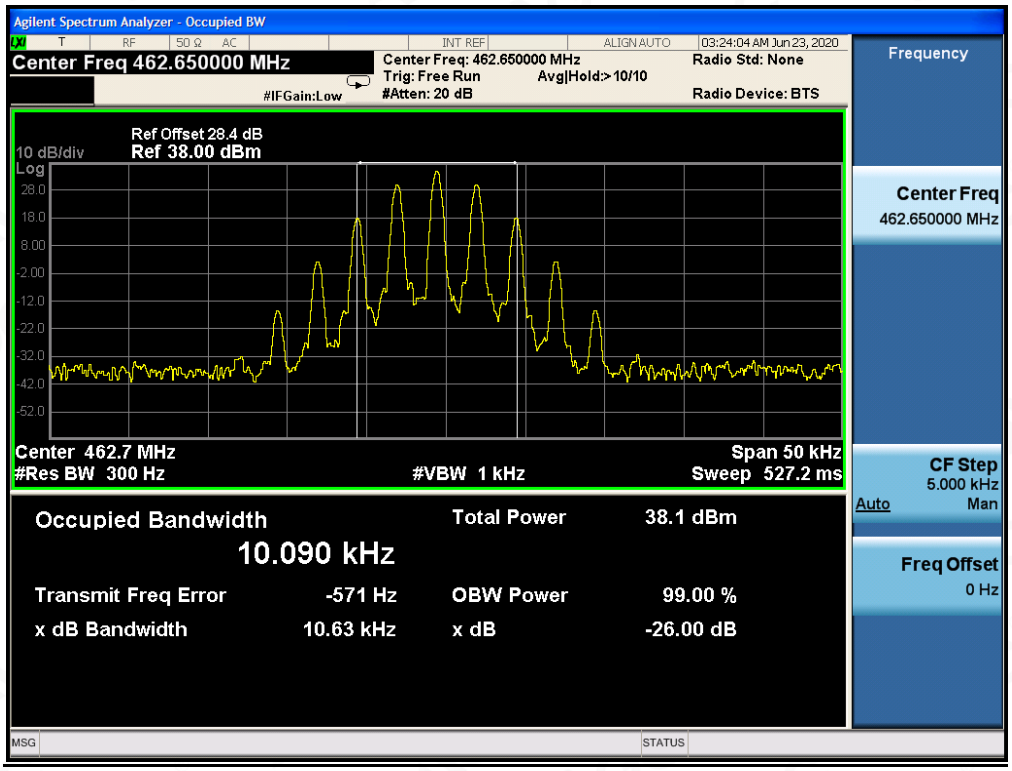
## 6.4 MEASUREMENT RESULT

| 26dB &99% Bandwidth Measurement Result | | | | |
|---|---|---|---|---|
| Operating Frequency | 12.5 KHz Channel Separation | | | |
| | 26dB Bandwidth | 99% Bandwidth | Limits | Result |
| 462.6375MHz | 10.64 KHz | 10.088 KHz | 20 KHz | Pass |
| 462.6500MHz | 10.63 KHz | 10.090 KHz | 20 KHz | Pass |
| 467.6500MHz | 10.63 KHz | 10.091 KHz | 20 KHz | Pass |

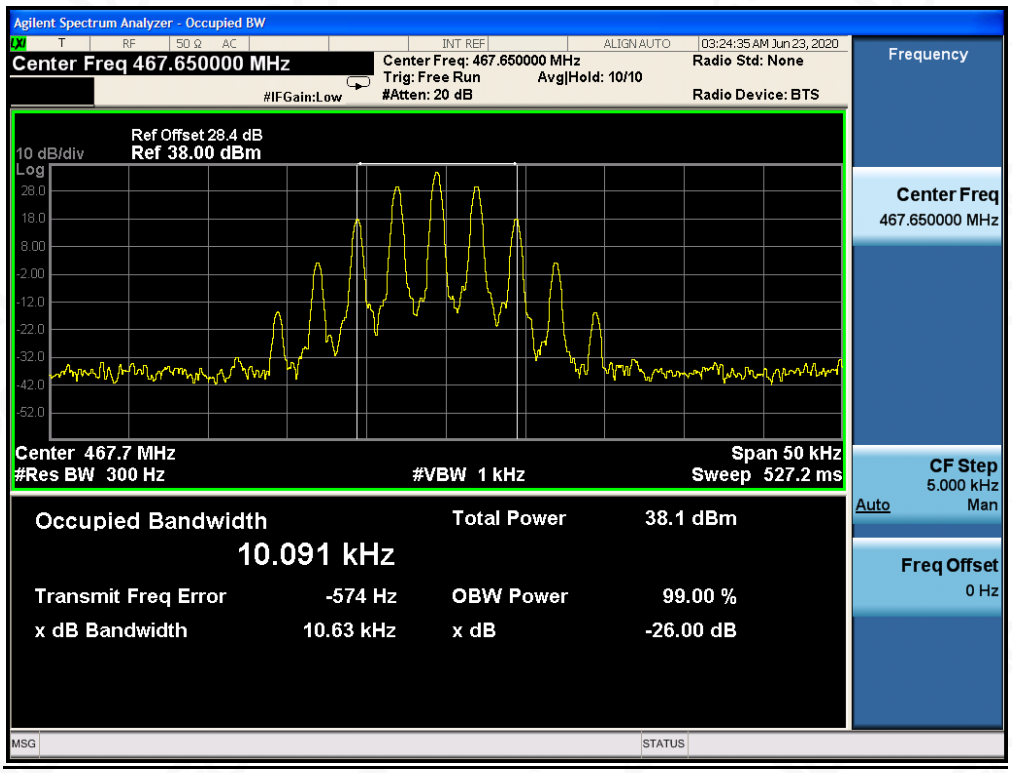
**Occupied bandwidth of 462.6375MHz**



## Occupied bandwidth of 462.6500MHz




## Occupied bandwidth of 467.6500MHz



# 7. UNWANTED RADIATION

## 7.1 PROVISIONS APPLICABLE

Standard Applicable [FCC Part 95.1779]

According to FCC section 95.1779, the unwanted emission should be attenuated below TP by at least 43+10 log(Transmit Power) dB.

## 7.2 MEASUREMENT PROCEDURE

Each GMRS transmitter type must be designed to comply with the applicable unwanted emissions limits in this section.

(a)Emission masks. Emission masks applicable to transmitting equipment in the GMRS are defined by the requirements in the following table. The numbers in the attenuation requirements column refer to rule paragraph numbers under paragraph (b) of this section.

| Emission types filter | Attenuation requirements |
|---|---|
| A1D, A3E, F1D, G1D, F2D, F3E, G3E with audio filter | (1), (2), (7) |
| A1D, A3E, F1D, G1D, F3E, G3E without audio filter | (3), (4), (7) |
| H1D, J1D, R1D, H3E, J3E, R2E | (5), (6), (7) |

(1) Filtering noted for GMRS transmitters refers to the requirement in §95.1775(e).

(2) Unwanted emission power may be measured as either mean power or peak envelope power, provided that the transmitter output power is measured the same way.

(b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

(2) 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

(3) 83 log (fd ÷ 5) dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz up to and including 10 kHz.

(4) 116 log (fd ÷ 6.1) dB or 50 + 10 log (P) dB, whichever is the lesser attenuation, on any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz), of more than 10 kHz up to and including 250% of the authorized bandwidth.

(5) 25 dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 150% of the authorized bandwidth.

(6) 35 dB on any frequency removed from the center of the authorized bandwidth by more than 150% up to and including 250% of the authorized bandwidth.

(7) 43 + 10 log (P) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

(1) EUT was placed on a 0.8 or 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. The radiated emission measurements of all transmit frequencies in all channels were measured with peak detector.

(2) A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

(3)The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100kHz,VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).

(4)The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

(5)A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.

(6)The measurement results are obtained as described below: Power(EIRP)=PMea- PAg - Pcl - Ga The measurement results are amend as described below:
Power(EIRP)=PMea- Pcl - Ga

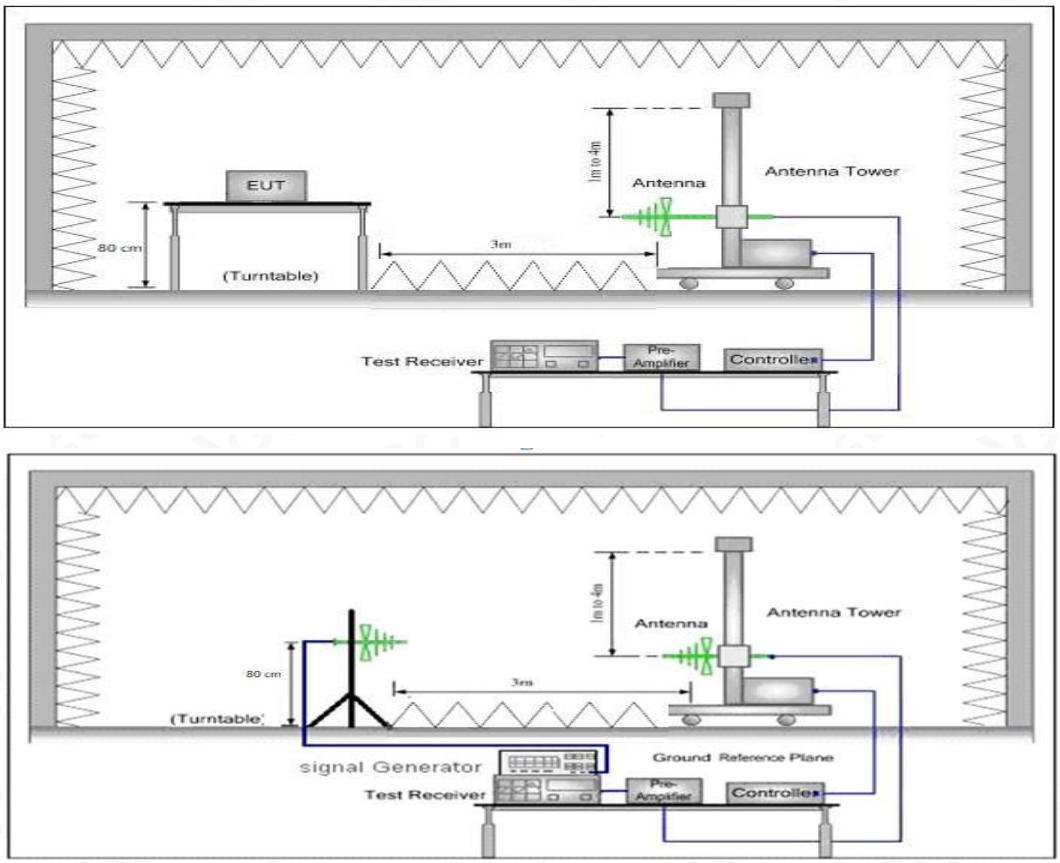
(7)This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

(8)Test the EUT in the lowest channel, the middle channel the Highest channel

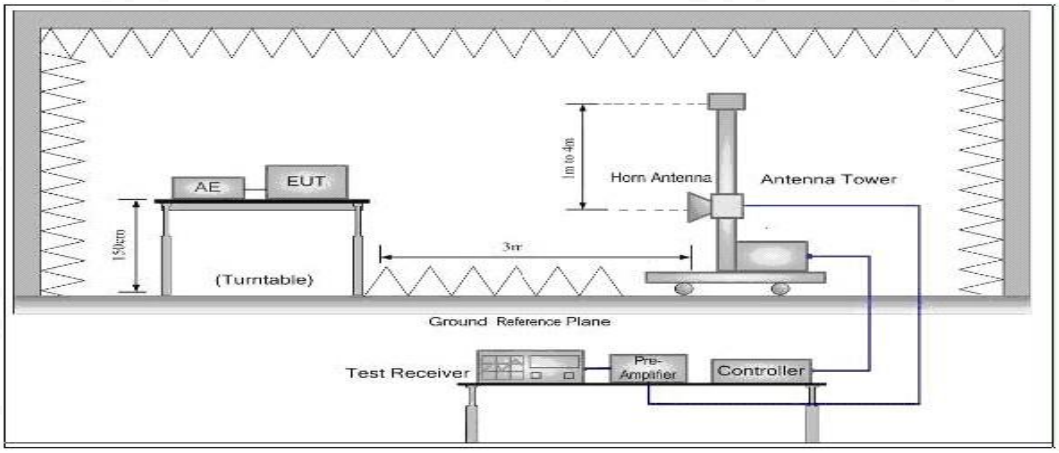
## 7.3 TEST SETUP BLOCK DIAGRAM

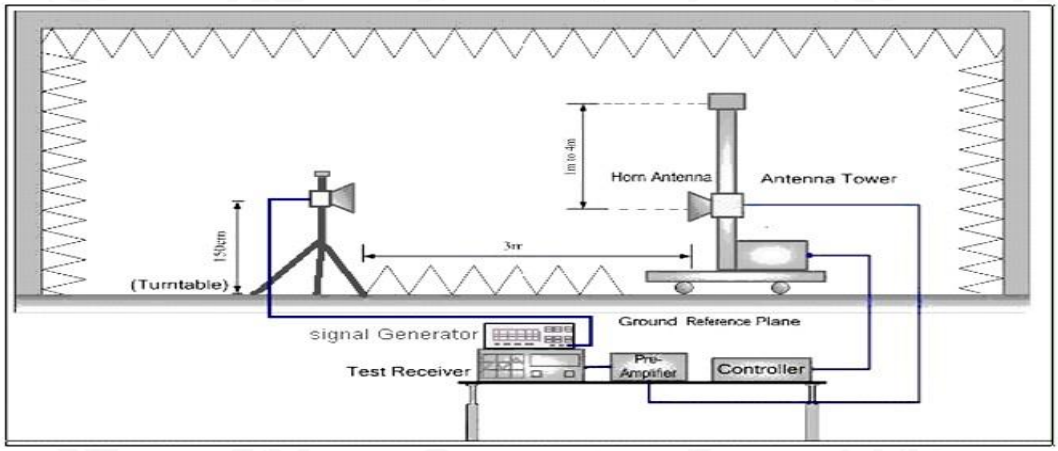
**SUBSTITUTION METHOD: (Radiated Emissions)**

**Radiated Below1GHz**



**Radiated Above 1 GHz**



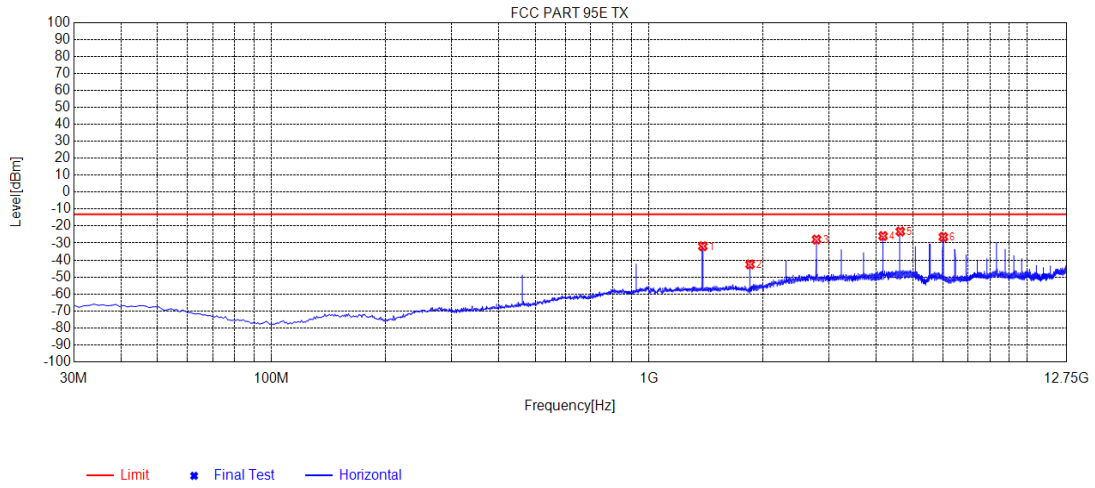



## 7.4 MEASUREMENT RESULTS:

the unwanted emission should be attenuated below TP by at least 43+10 log(Transmit Power) dB

**Limit: At least 43+10 log (P) =43+10log (5) =49.99 (dBc)  36.99-49.99=-13dBm**

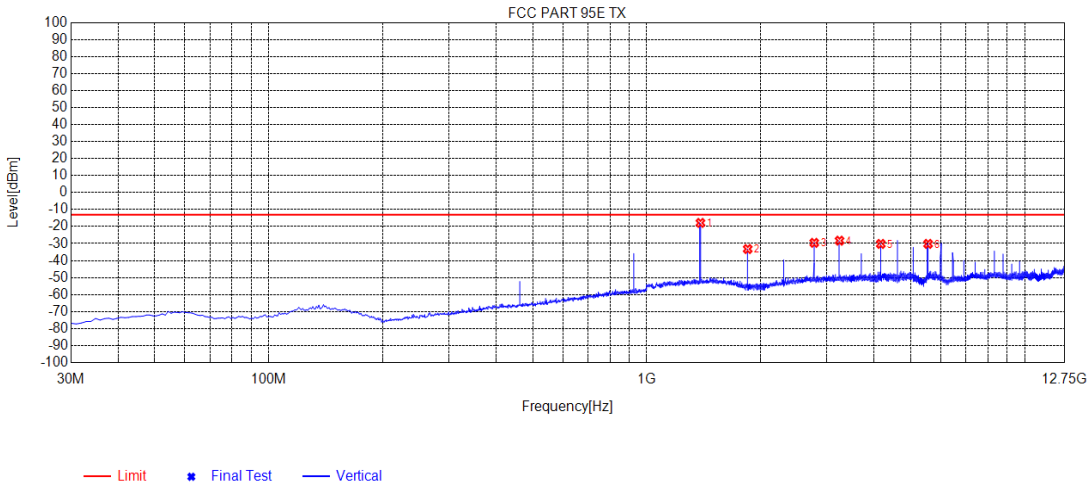
**Measurement Result for 12.5 KHz Channel Separation @ 462.6375MHz-5W-Horizontal**




| NO. | Freq. [MHz] | Reading [dBm] | Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Angle [°] | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1 | 1387.7888 | -28.43 | -31.88 | -13.00 | 18.88 | -3.45 | 268 | Horizontal |
| 2 | 1850.7851 | -42.01 | -42.60 | -13.00 | 29.60 | -0.59 | 314 | Horizontal |
| 3 | 2775.6026 | -32.81 | -27.90 | -13.00 | 14.90 | 4.91 | 19 | Horizontal |
| 4 | 4163.4163 | -34.17 | -25.85 | -13.00 | 12.85 | 8.32 | 10 | Horizontal |
| 5 | 4626.4126 | -32.74 | -23.19 | -13.00 | 10.19 | 9.55 | 28 | Horizontal |
| 6 | 6014.2264 | -37.25 | -26.43 | -13.00 | 13.43 | 10.82 | 110 | Horizontal |

**Note:**
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss-Pre-amplifier.(Above 1 GHz)
3. Margin=Limit- Level

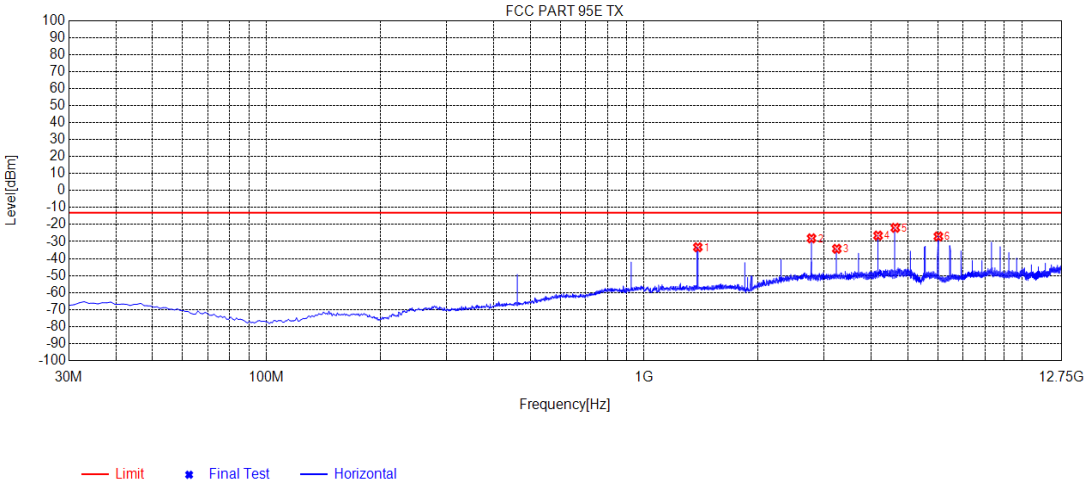
**Measurement Result for 12.5 KHz Channel Separation @ 462.6375MHz-5W-Vertical**




| NO. | Freq. [MHz] | Reading [dBm] | Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Angle [°] | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1 | 1387.7888 | -19.27 | -17.86 | -13.00 | 4.86 | 1.41 | 165 | Vertical |
| 2 | 1850.7851 | -34.14 | -33.21 | -13.00 | 20.21 | 0.93 | 330 | Vertical |
| 3 | 2775.6026 | -34.05 | -29.58 | -13.00 | 16.58 | 4.47 | 92 | Vertical |
| 4 | 3238.5989 | -33.94 | -28.32 | -13.00 | 15.32 | 5.62 | 155 | Vertical |
| 5 | 4163.4163 | -37.75 | -30.21 | -13.00 | 17.21 | 7.54 | 303 | Vertical |
| 6 | 5552.4052 | -40.34 | -30.17 | -13.00 | 17.17 | 10.17 | 10 | Vertical |

**Note:**
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss-Pre-amplifier.(Above 1 GHz)
3. Margin=Limit- Level

**Measurement Result for 12.5 KHz Channel Separation @ 462.6500MHz-5W-Horizontal**

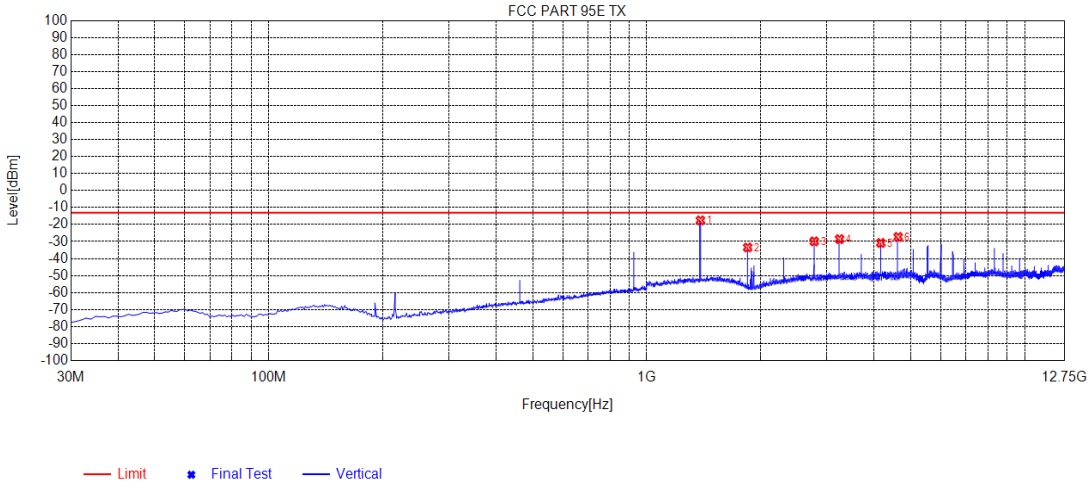



| NO. | Freq. [MHz] | Reading [dBm] | Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Angle [°] | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1 | 1387.7888 | -29.90 | -33.35 | -13.00 | 20.35 | -3.45 | 120 | Horizontal |
| 2 | 2775.6026 | -33.02 | -28.11 | -13.00 | 15.11 | 4.91 | 21 | Horizontal |
| 3 | 3238.5989 | -39.97 | -34.26 | -13.00 | 21.26 | 5.71 | 351 | Horizontal |
| 4 | 4164.5915 | -34.81 | -26.49 | -13.00 | 13.49 | 8.32 | 286 | Horizontal |
| 5 | 4626.4126 | -31.48 | -21.93 | -13.00 | 8.93 | 9.55 | 39 | Horizontal |
| 6 | 6014.2264 | -37.81 | -26.99 | -13.00 | 13.99 | 10.82 | 102 | Horizontal |

**Note:**

1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss-Pre-amplifier.(Above 1 GHz)
3. Margin=Limit- Level

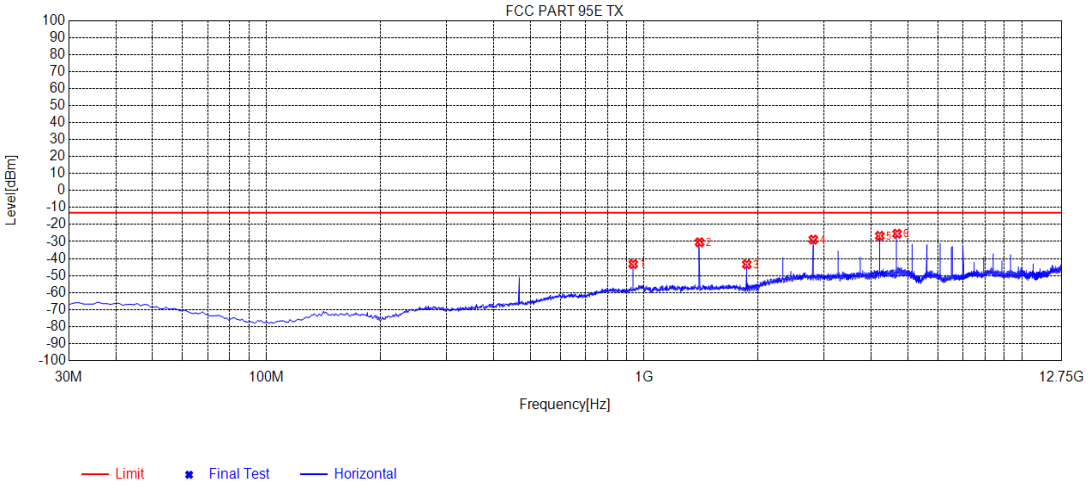
**Measurement Result for 12.5 KHz Channel Separation @ 462.6500MHz-5W-Vertical**




| NO. | Freq. [MHz] | Reading [dBm] | Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Angle [°] | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1 | 1387.7888 | -18.96 | -17.55 | -13.00 | 4.55 | 1.41 | 165 | Vertical |
| 2 | 1850.7851 | -34.39 | -33.46 | -13.00 | 20.46 | 0.93 | 330 | Vertical |
| 3 | 2775.6026 | -34.36 | -29.89 | -13.00 | 16.89 | 4.47 | 82 | Vertical |
| 4 | 3238.5989 | -34.19 | -28.57 | -13.00 | 15.57 | 5.62 | 156 | Vertical |
| 5 | 4164.5915 | -38.36 | -30.82 | -13.00 | 17.82 | 7.54 | 284 | Vertical |
| 6 | 4626.4126 | -35.56 | -27.29 | -13.00 | 14.29 | 8.27 | 146 | Vertical |

**Note:**
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss-Pre-amplifier.(Above 1 GHz)
3. Margin=Limit- Level

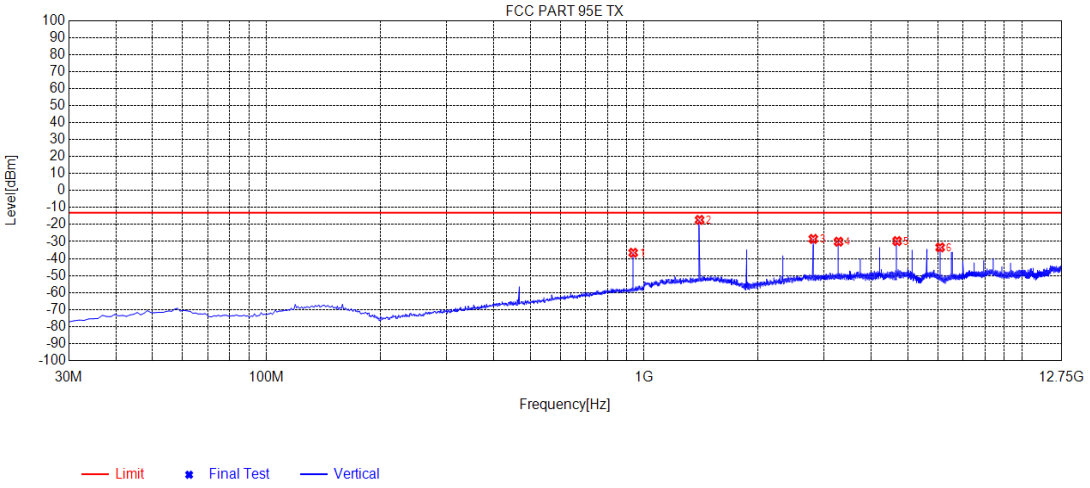
**Measurement Result for 12.5 KHz Channel Separation @ 467.6500MHz-5W-Horizontal**




| NO. | Freq. [MHz] | Reading [dBm] | Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Angle [°] | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1 | 935.9800 | -86.94 | -43.22 | -13.00 | 30.22 | 43.72 | 278 | Horizontal |
| 2 | 1403.0653 | -27.04 | -30.45 | -13.00 | 17.45 | -3.41 | 314 | Horizontal |
| 3 | 1870.7621 | -42.93 | -43.37 | -13.00 | 30.37 | -0.44 | 314 | Horizontal |
| 4 | 2806.1556 | -33.80 | -28.84 | -13.00 | 15.84 | 4.96 | 28 | Horizontal |
| 5 | 4209.2459 | -35.12 | -26.65 | -13.00 | 13.65 | 8.47 | 2 | Horizontal |
| 6 | 4676.9427 | -34.97 | -25.40 | -13.00 | 12.40 | 9.57 | 28 | Horizontal |

**Note:**
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss-Pre-amplifier.(Above 1 GHz)
3. Margin=Limit- Level

**Measurement Result for 12.5 KHz Channel Separation @ 467.6500MHz-5W -Vertical**




| NO. | Freq. [MHz] | Reading [dBm] | Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Angle [°] | Polarity |
|---|---|---|---|---|---|---|---|---|
| 1 | 935.9800 | -80.27 | -36.59 | -13.00 | 23.59 | 43.68 | 27 | Vertical |
| 2 | 1403.0653 | -18.80 | -17.28 | -13.00 | 4.28 | 1.52 | 165 | Vertical |
| 3 | 2806.1556 | -33.04 | -28.47 | -13.00 | 15.47 | 4.57 | 165 | Vertical |
| 4 | 3273.8524 | -35.76 | -30.08 | -13.00 | 17.08 | 5.68 | 165 | Vertical |
| 5 | 4676.9427 | -38.09 | -29.73 | -13.00 | 16.73 | 8.36 | 321 | Vertical |
| 6 | 6080.0330 | -44.50 | -33.45 | -13.00 | 20.45 | 11.05 | 293 | Vertical |

**Note:**
1. Factor=Antenna Factor + Cable loss. (Below 1GHz)
2. Factor=Antenna Factor+ Cable loss-Pre-amplifier.(Above 1 GHz)
3. Margin=Limit- Level

## 7.5 EMISSION MASK PLOT

Standard Applicable [FCC Part 95.1779] GMRS: Unwanted emissions shall be attenuated below the unmodulated carrier power in accordance with the following:

(1) At least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50 %up to and including 100% of the authorized bandwidth.

(2) At least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100 % up to and including 250 % of the authorized bandwidth.

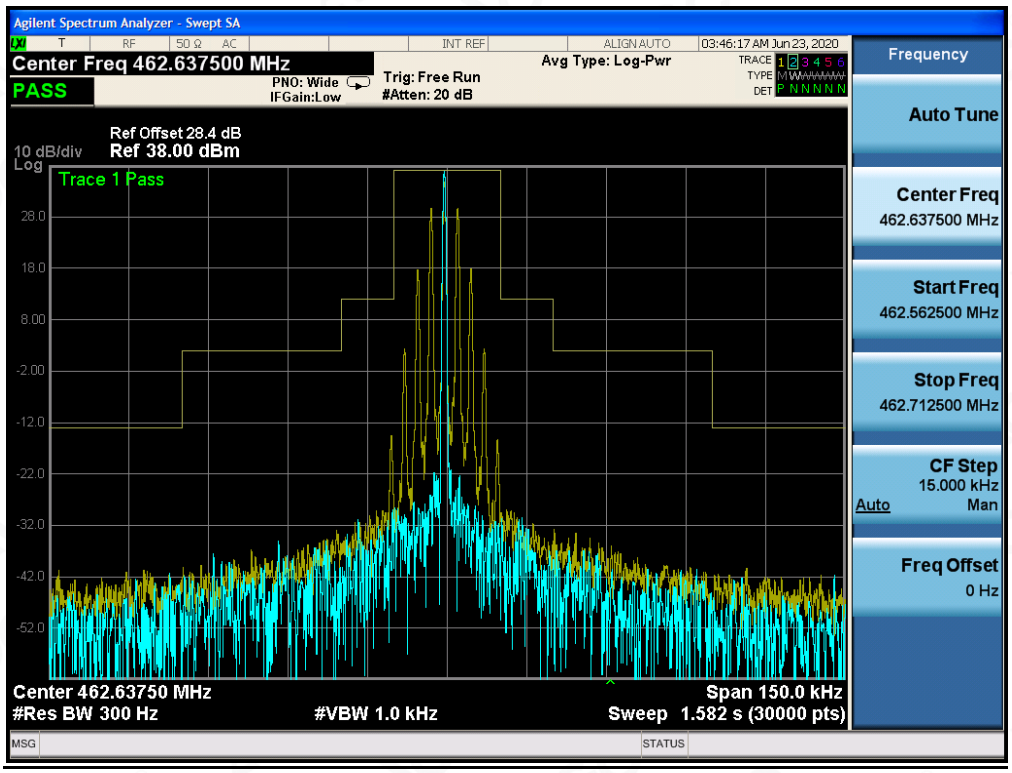
(3) At least 43 + 10 log10 (T) dB on any frequency removed from the center of the authorized bandwidth by more than250 %.

The detailed procedure employed for Emission Mask measurements are specified as following:

- The transmitter shall be modulated by a 2.5 kHz audio signal,
- The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz.

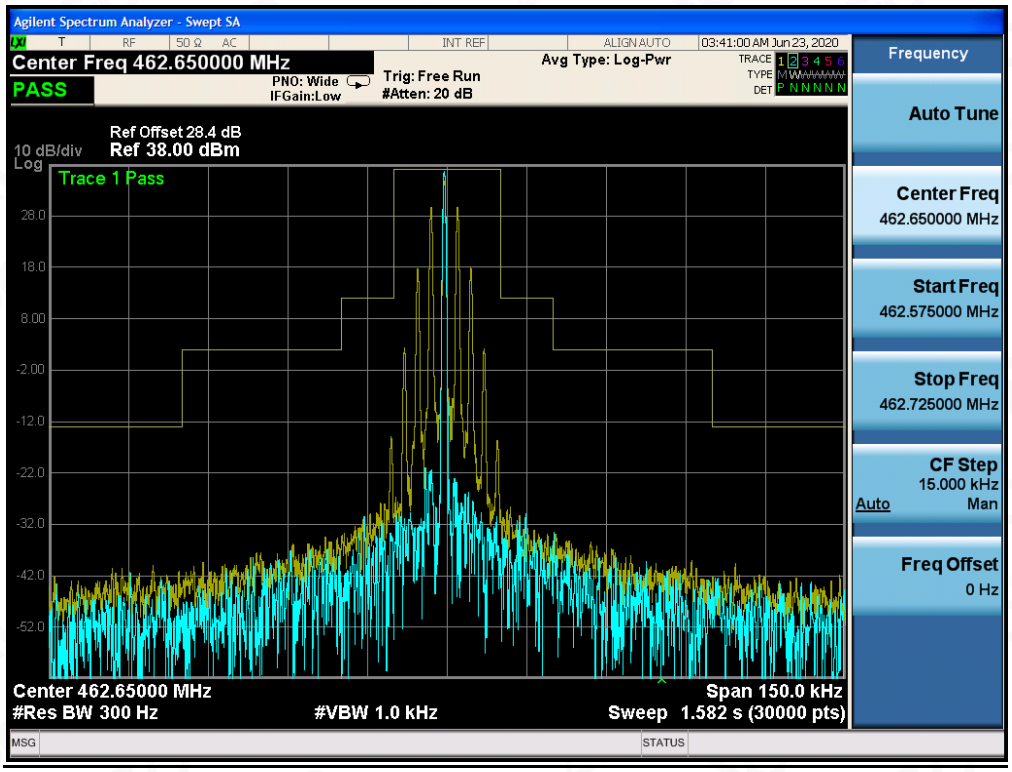
**CHANNEL 4:**

**The Worst Emission Mask for channel 4 -5W-12.5K**



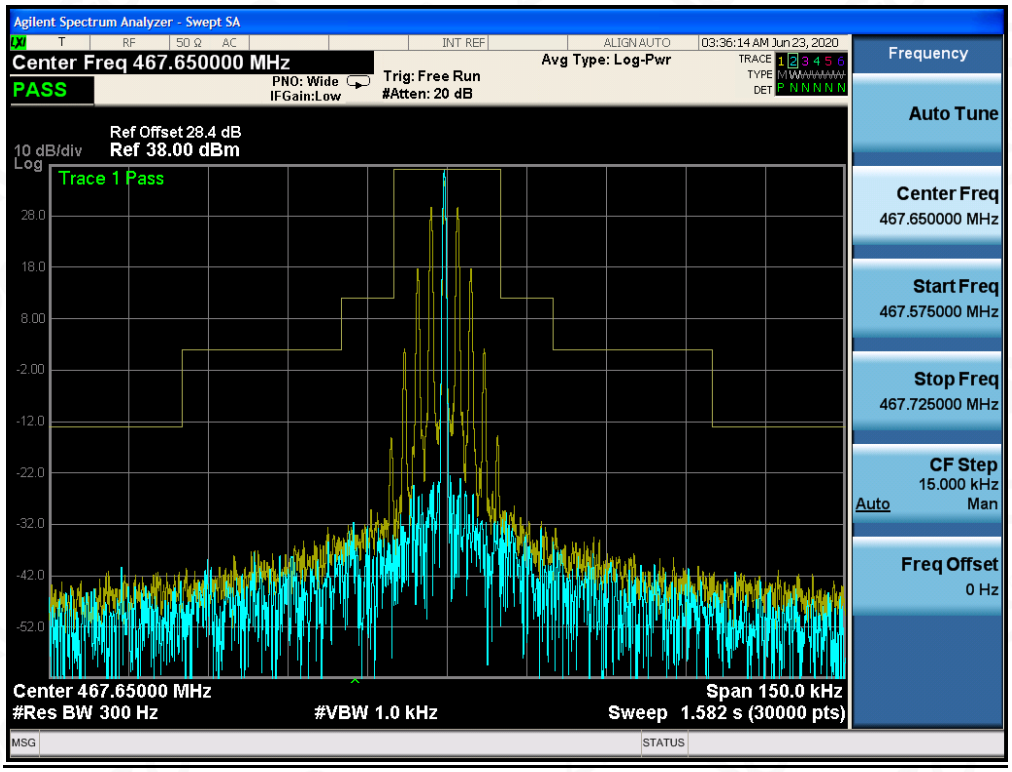
**CHANNEL 12:**

**The Worst Emission Mask for channel 12-5W-12.5K**



**CHANNEL 16:**

**The Worst Emission Mask for channel 16-5W-12.5K**



# 8. AUDIO LOW PASS FILTER RESPONSE

## 8.1.PROVISIONS APPLICABLE

§95.1775 GMRS modulation requirements

Audio filter. Each GMRS transmitter type must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of §95.1779 (without filtering).

The filter must be between the modulation limiter and the modulated stage of the transmitter.

At any frequency (f in kHz) between 3 and 20 kHz, the filter must have an attenuation of at least 60 log (f/3) dB more than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB more than the attenuation at 1 kHz

## 8.2.TEST PROCEDURE

(1) The DUT transmitter output port was connected to Modulation Analyzer.

(2) Path loss for the measurement included.

(3) Press 23.1SPCL on modulation analyzer to enable the external LO from SIgen.

(4) Set the Sigen frequency to Fc + 1.5MHz, RF output level to 0dBm without modulation.

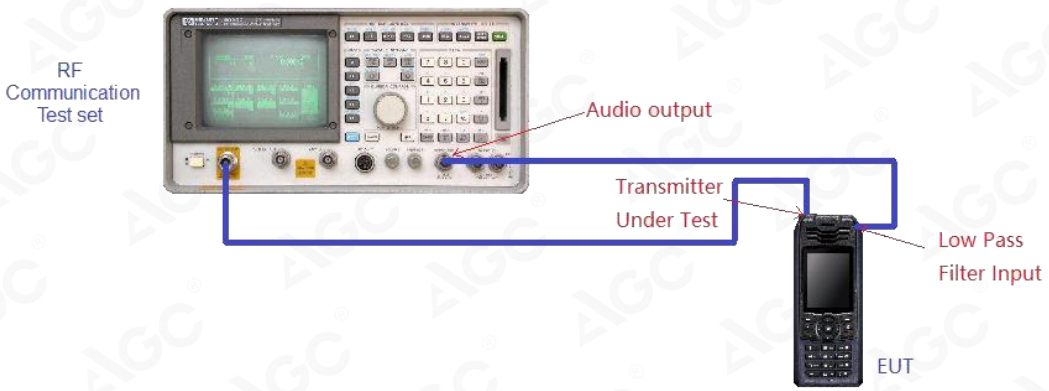
(5) Transmit the radio and set the audio analyzer to 1 kHz audio frequency and 60% of the maximum deviation.

(6) Up the amplitude by 20dB.

(7) On DSA, get the reference point to 0dB.

(8) Vary the frequency on audio analyzer from 3 kHz to 30 kHz, record the audio tone from DSA.

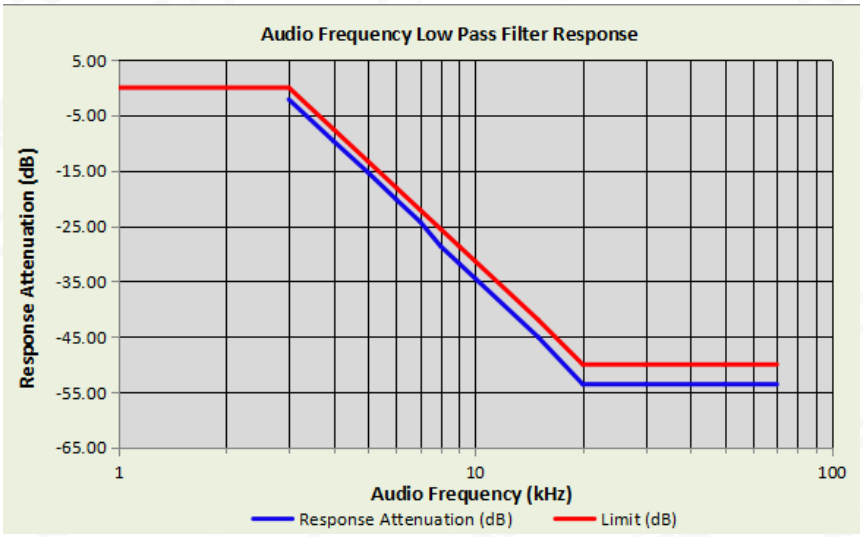
## 8.3 TEST CONFIGURATION



## 8.4 TEST RESULT

**TEST CHANNEL: 4**

| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|---|---|---|
| 1 | 0 | / |
| 3 | -2.14 | 0.00 |
| 4 | -9.64 | -7.50 |
| 5 | -15.31 | -13.31 |
| 6 | -20.20 | -18.06 |
| 7 | -24.22 | -22.08 |
| 8 | -28.68 | -25.56 |
| 9 | -31.75 | -28.63 |
| 10 | -34.49 | -31.37 |
| 15 | -45.06 | -41.94 |
| 20 | -53.57 | -50.00 |
| 30 | -53.57 | -50.00 |
| 50 | -53.57 | -50.00 |
| 70 | -53.57 | -50.00 |




Note: All the modes had been tested, but only the worst data recorded in the report.

# 9. MAXIMUMN TRANSMITTER POWER

## 9.1 PROVISIONS APPLICABLE

FCC Part 95.1767 For GMRS, the maximum permissible transmitter output power effective radiated power (e.r.p.) as follows.

This section contains transmitting power limits for GMRS stations. The maximum transmitting power depends on which channels are being used and the type of station.

(a)462/467 MHz main channels. The limits in this paragraph apply to stations transmitting on any of the 462 MHz main channels or any of the 467 MHz main channels. Each GMRS transmitter type must be capable of operating within the allowable power range. GMRS licensees are responsible for ensuring that their GMRS stations operate in compliance with these limits.

(1)The transmitter output power of mobile, repeater and base stations must not exceed 50 Watts.

(2)The transmitter output power of fixed stations must not exceed 15 Watts.

(b)462 MHz interstitial channels. The effective radiated power (ERP) of mobile, hand-held portable and base stations transmitting on the 462 MHz interstitial channels must not exceed 5 Watts.

(c)467 MHz interstitial channels. The effective radiated power (ERP) of hand-held portable units transmitting on the 467 MHz interstitial channels must not exceed 0.5 Watt. Each GMRS transmitter type capable of transmitting on these channels must be designed such that the ERP does not exceed 0.5 Watt.

**9.2 TEST PROCEDURE**

(1)EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made. The radiated emission measurements of all transmit frequencies in all channels were measured with peak detector

(2)A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver

(3)The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=100kHz,VBW=300kHz for 30MHz to 1GHz, And the maximum value of the receiver should be recorded as (Pr).

(4)The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

(5)A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should be recorded after test.

The measurement results are obtained as described below: Power(EIRP)=PMea- PAg - Pcl - Ga The measurement results are amend as described below:

Power(EIRP)=PMea- Pcl - Ga

(6)This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

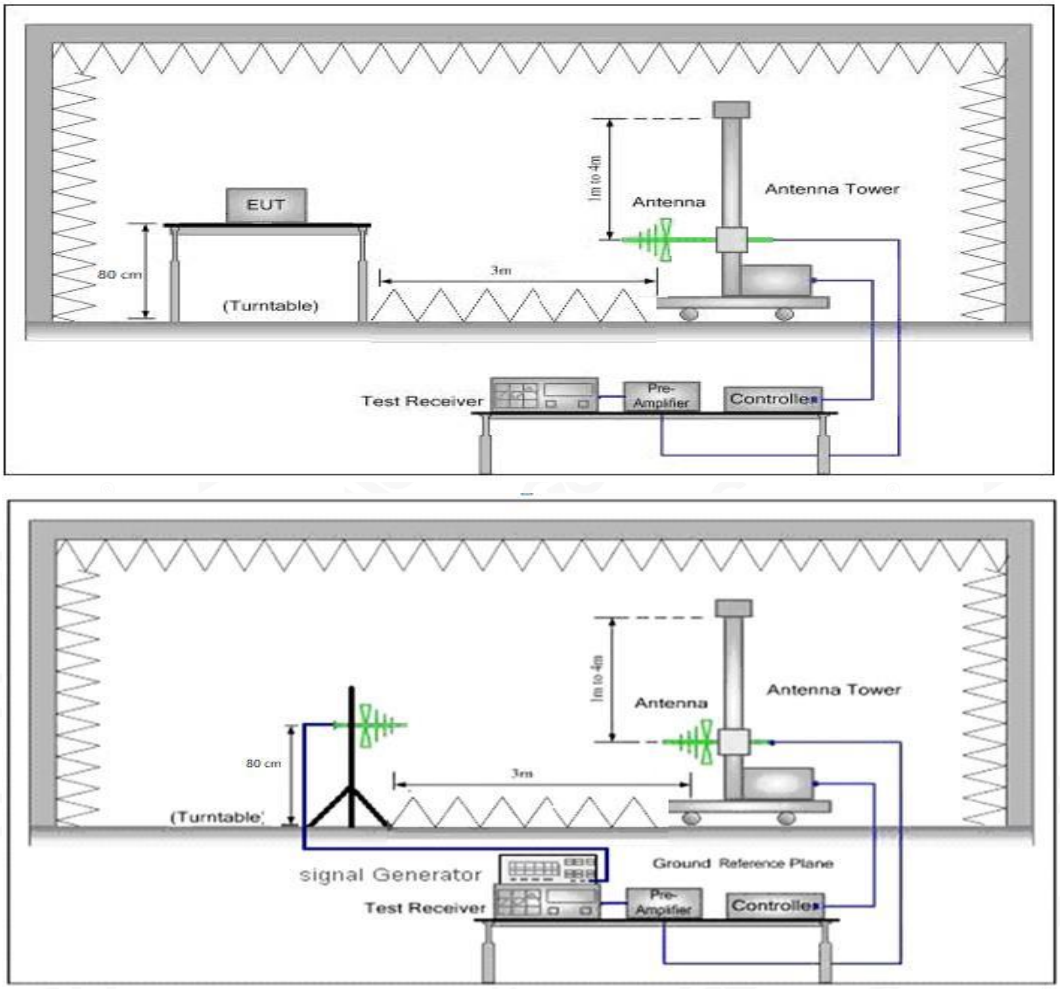
(7)ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

(8)Test the EUT in the lowest channel, the middle channel the Highest channel

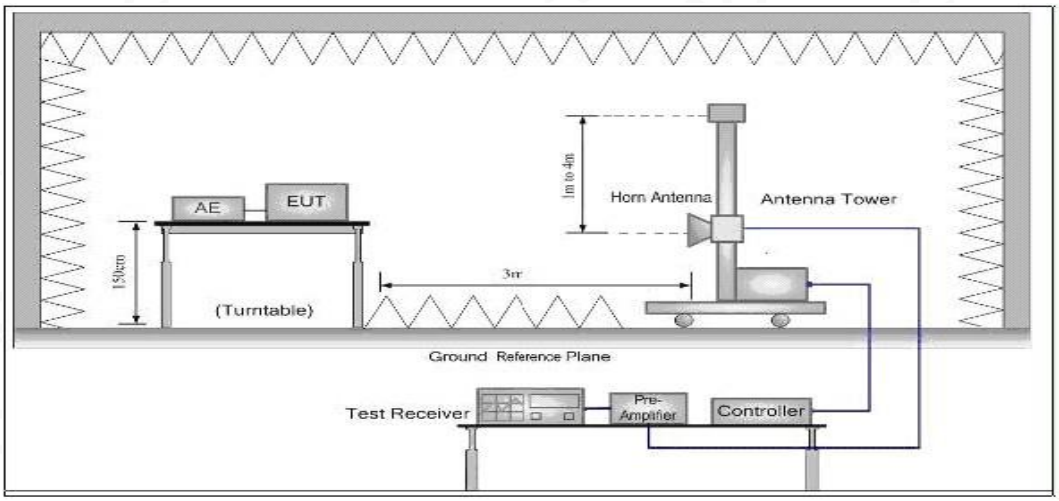
## 9.3 TEST CONFIGURATION

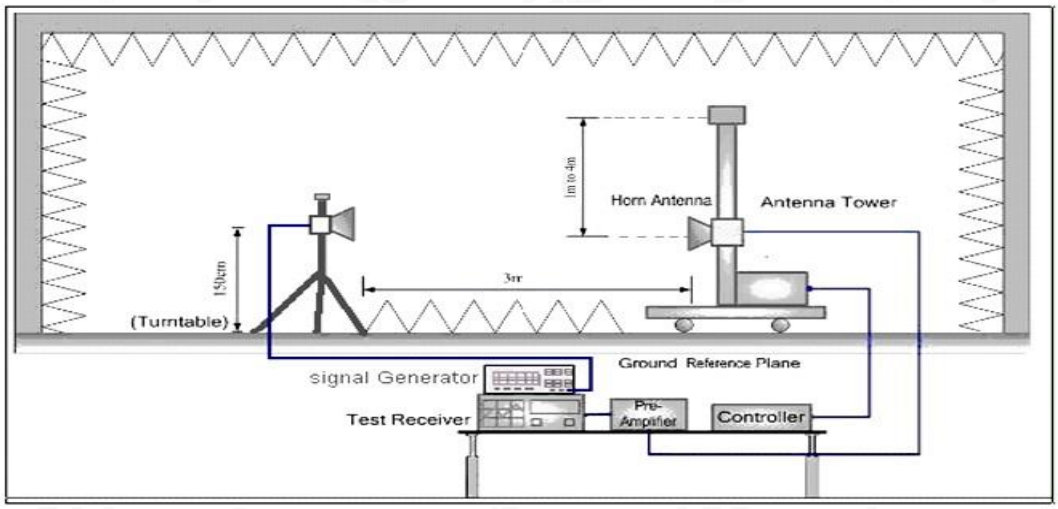
**Effective Radiated Power**

**Radiated Below1GHz**



**Radiated Above 1 GHz**



**9.4 TEST RESULT**

The maximum Power (CP) for UHF is

Analog: 5W for 12.5 KHz Channel Separation

Calculation Formula: CP = R + A + L

***** Note:

CP: The final Conducted Power

R : The reading value from spectrum analyzer

A : The attenuation value of the used attenuator

L : The loss of all connection cables

**ERP RESULT:**

| Frequency | Reading Level | Antenna | S.G. | Cable Loss | Ant.Gain | Emission Level | Emission Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuv/m) | Polarization | (dBm) | (dB) | (dBi) | (dBm) | (W) | (W) | (W) |
| ChannelSeparation:12.5KHz | | | | | | | | | |
| 462.6375 | 105.92 | V | 30.69 | 0.38 | 6.6 | 36.91 | 4.91 | 5 | 0.09 |
| 462.6375 | 105.88 | H | 30.65 | 0.38 | 6.6 | 36.87 | 4.86 | 5 | 0.14 |
| 462.6500 | 105.96 | V | 30.73 | 0.38 | 6.6 | 36.95 | 4.95 | 50 | 45.05 |
| 462.6500 | 105.86 | H | 30.63 | 0.38 | 6.6 | 36.85 | 4.84 | 50 | 45.16 |
| 467.6500 | 105.88 | V | 30.65 | 0.38 | 6.6 | 36.87 | 4.86 | 50 | 45.14 |
| 467.6500 | 105.73 | H | 30.50 | 0.38 | 6.6 | 36.72 | 4.70 | 50 | 45.30 |

**NOTE:**

Calculation Formula:

Emission Level(dBm) = S.G.(dBm)- Cable Loss(dB)+ Ant.Gain(dBi)

The Ant. Gain including the correct factor 2.15.

Margin(dB) = Limit(dBm)- Emission Level(dBm)

# 10. MODULATION CHARACTERISTICS

## 10.1 PROVISIONS APPLICABLE

According to [FCC Part 95.1775, Part 2.1047(a)], for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

Part 95.1775(a) A GMRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus orminus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz.

Part 2.1047(a) A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of100 to 5000Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing thefrequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shallbe submitted.

## 10.2 MEASUREMENT METHOD

### 10.2.1 Modulation Limit

(1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1KHz using this level as a reference (0dB) and vary the input level from –20 to +20dB. Record the frequency deviation obtained as a function of the input level.

(2). Repeat step 1 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

### 10.2.2 Audio Frequency Response

Personal Radio Service stations that transmit voice emissions may also transmit audible or subaudible tones or other signals for the purpose of selective calling and/or receiver squelch activation. These tones and signals are ancillary to voice communications and are considered to be included within the voice emission types, e.g., A3E, F3E, and G3E.

(a) Tones that are audible (having a frequency higher than 300 Hertz), must last no longer than 15 seconds at one time.

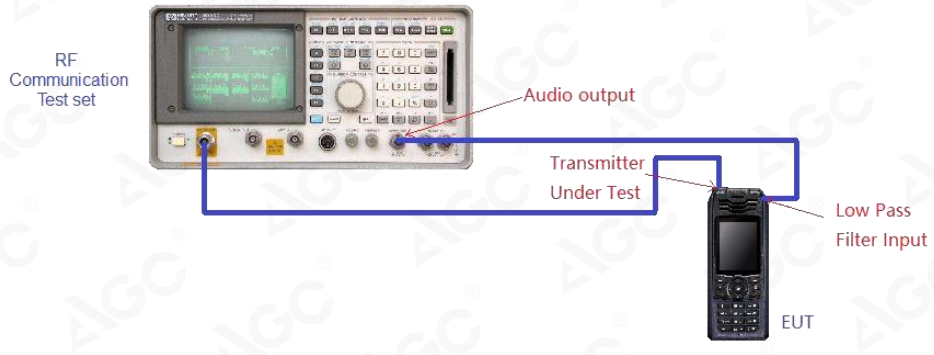
(b) Tones that are subaudible (having a frequency of 300 Hertz or less), may be transmitted continuously during a communication session.

(1). Configure the EUT as shown in figure 1.

(2). Adjust the audio input for 20% of rated system deviation at 1 KHz using this level as a reference (0 dB).

(3). Vary the Audio frequency from 100 Hz to 10 KHz and record the frequency deviation.

(4). Audio Frequency Response = 20log10 (Deviation of test frequency/Deviation of 1 KHz reference).



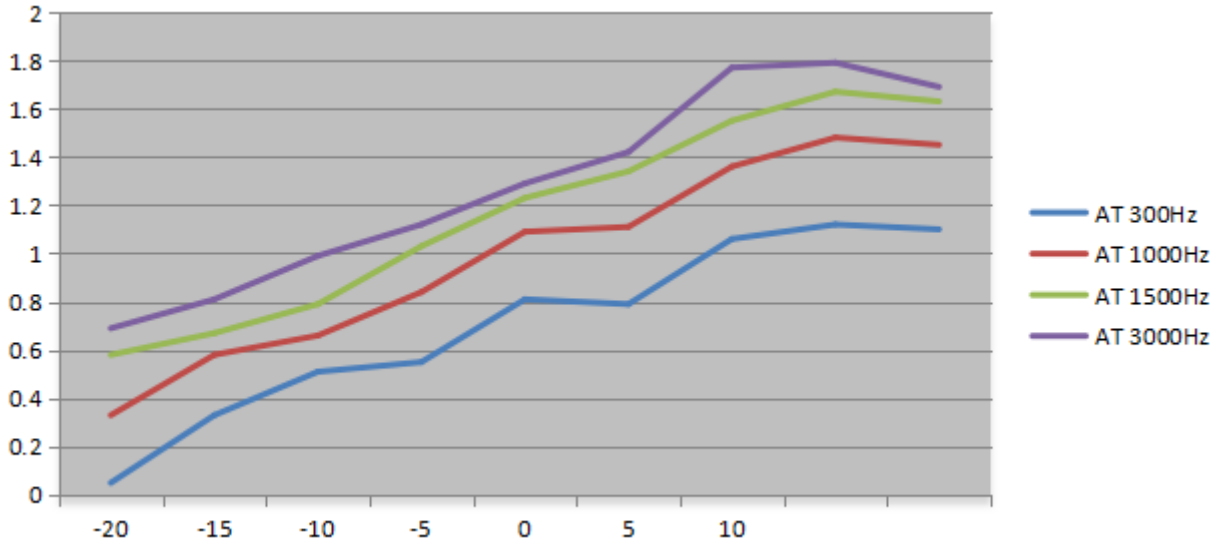
## 10.3 MEASUREMENT RESULT

**TEST CHANNEL: 4**

**(A). MODULATION LIMIT:**

**462.6375MHz @ 12.5KHz Channel Separations-5W**

| Modulation Level (dB) | Peak Freq. Deviation At 300 Hz | Peak Freq. Deviation At 1000 Hz | Peak Freq. Deviation At 1500 Hz | Peak Freq. Deviation At 3000 Hz |
|---|---|---|---|---|
| -20 | 0.05 | 0.33 | 0.58 | 0.69 |
| -15 | 0.33 | 0.58 | 0.67 | 0.81 |
| -10 | 0.51 | 0.66 | 0.79 | 0.99 |
| -5 | 0.55 | 0.84 | 1.03 | 1.12 |
| 0 | 0.81 | 1.09 | 1.23 | 1.29 |
| +5 | 0.79 | 1.11 | 1.34 | 1.42 |
| +10 | 1.06 | 1.36 | 1.55 | 1.77 |
| +15 | 1.12 | 1.48 | 1.67 | 1.79 |
| +20 | 1.10 | 1.45 | 1.63 | 1.69 |



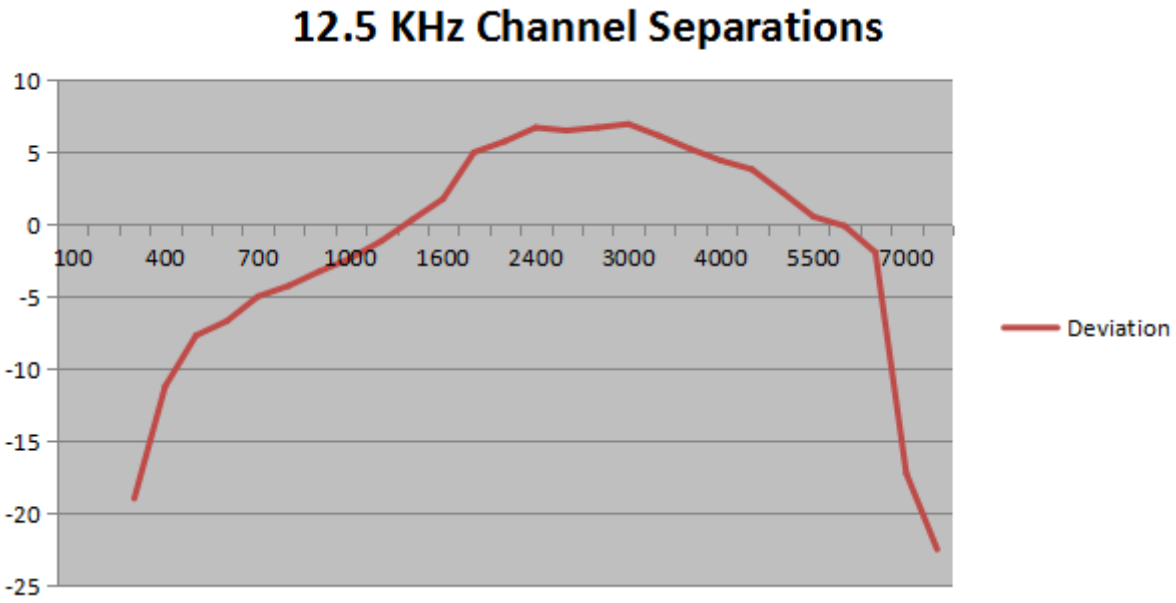

Note: All the modes had been tested, but only the worst data recorded in the report.

**(B). AUDIO FREQUENCY RESPONSE:**

**462.6375MHz @ 12.5 KHz Channel Separations-5W**

| Frequency (Hz) | Deviation (KHz) | Audio Frequency Response(dB) |
|---|---|---|
| 100 | -- | -- |
| 200 | -- | -- |
| 300 | 0.09 | -18.98 |
| 400 | 0.22 | -11.21 |
| 500 | 0.33 | -7.69 |
| 600 | 0.37 | -6.70 |
| 700 | 0.45 | -5.00 |
| 800 | 0.49 | -4.26 |
| 900 | 0.55 | -3.25 |
| 1000 | 0.61 | -2.36 |
| 1200 | 0.70 | -1.16 |
| 1400 | 0.83 | 0.32 |
| 1600 | 0.98 | 1.76 |
| 1800 | 1.42 | 4.98 |
| 2000 | 1.55 | 5.74 |
| 2400 | 1.73 | 6.70 |
| 2500 | 1.69 | 6.50 |
| 2800 | 1.73 | 6.70 |
| 3000 | 1.78 | 6.95 |
| 3200 | 1.62 | 6.13 |
| 3600 | 1.46 | 5.23 |
| 4000 | 1.33 | 4.42 |
| 4500 | 1.24 | 3.81 |
| 5000 | 1.03 | 2.19 |
| 5500 | 0.85 | 0.53 |
| 6000 | 0.79 | -0.11 |
| 6500 | 0.64 | -1.94 |
| 7000 | 0.11 | -17.23 |
| 7500 | 0.06 | -22.50 |
| 9000 | -- | -- |
| 10000 | -- | -- |
| 14000 | -- | -- |
| 18000 | -- | -- |
| 20000 | -- | -- |
| 30000 | -- | -- |

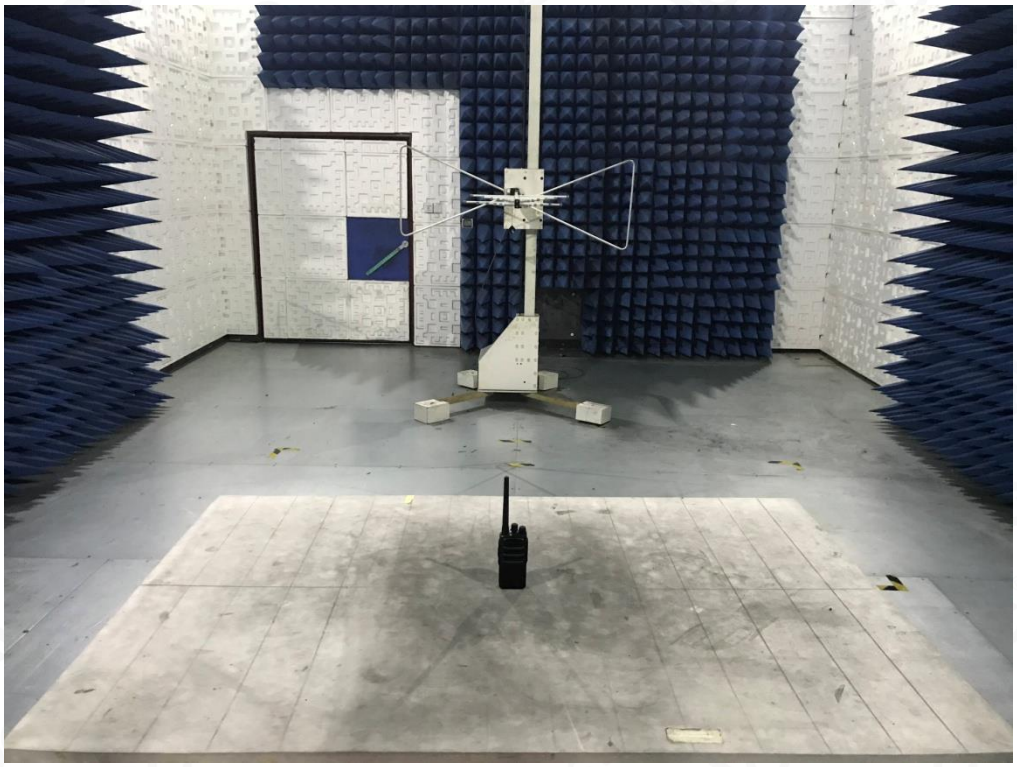
**Frequency Response Result**




Note: All the modes had been tested, but only the worst data recorded in the report.

# APPENDIX I: PHOTOGRAPHS OF SETUP

RADIATED EMISSION TEST SETUP



**----END OF REPORT----**