# FCC PART 95

# MEASUREMENT AND TEST REPORT

For

## Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, 518057 China

## FCC ID: YAMTF-412

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | FRS/GMRS TWO-WAY RADIOS |

| | |
|---|---|
| **Report Number:** | RDG170220003-00A |
| **Report Date:** | 2017-03-22 |
| **Reviewed By:** | Oscar Ye<br>Engineer |
| **Test Laboratory:** | Bay Area Compliance Laboratories Corp. (Kunshan)<br>No.248 Chenghu Road, Kunshan, Jiangsu province, China<br>Tel: +86-0512-86175000<br>Fax: +86-0512-88934268<br>www.baclcorp.com.cn |

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# GENERAL INFORMATION

## Product Description for Equipment Under Test (EUT)

The *Hytera Communications Corporation Limited*'s product, model number: *TF-412 (FCC ID: YAMTF-412)* or the "EUT" in this report was a *FRS/GMRS TWO-WAY RADIOS*, which was measured approximately: 146.8 mm (L) x 55 mm (W) x 31.2 mm (H), rated input voltage: DC 4.5V Li-ion battery

** All measurement and test data in this report was gathered from production sample serial number: 170220003 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-02-20.*

## Objective

This report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2 and Part 95, Subpart A & Subpart B & Subpart E of the Federal Communication Commissions rules.

## Related Submittal(s)/Grant(s)

No related submittal(s).

## Test Methodology

All tests and measurements indicated in this document were performed in accordance with Part 95 Subpart A and Subpart E of the Federal Communication Commissions rules with TIA-603-D, Land Mobile FM or PM-Communications Equipment-Measurement and Performance Standards.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Measurement Uncertainty

| Item | | Uncertainty |
|---|---|---|
| RF conducted test with spectrum | | ±0.9dB |
| Radiated emission | 30MHz~1GHz | ±5.91dB |
| | Above 1G | ±4.92dB |
| Occupied Bandwidth | | ±0.5kHz |
| Temperature | | ±1.0℃ |
| Humidity | | ±6% |

## Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

# SYSTEM TEST CONFIGURATION

## Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user).

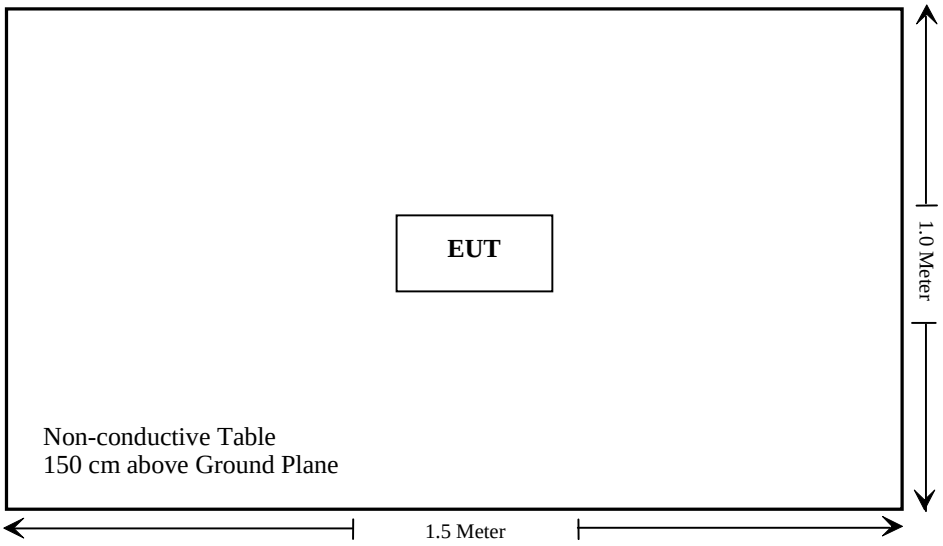
## Equipment Modifications

No modification was made to the EUT tested.

## Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| / | / | / | / |

## Block Diagram of Test Setup



# SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Results |
|---|---|---|
| §2.1093 | RF Exposure | Compliance |
| §2.1046, §95.639(a)(d) | RF Output Power | Compliance |
| §2.1047, §95.637(a) | Modulation Characteristic | Compliance |
| §2.1049, §95.633 (c), §95.635 (b) (1) (3) (7) | Authorized Bandwidth & Emission Mask | Compliance |
| §2.1053, §95.635(b) (7) | Spurious Radiated Emissions | Compliance |
| §2.1055(d), §95.626(b) | Frequency Stability | Compliance |

# TEST EQUIPMENT LIST

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| **Radiated Emission Test** | | | | | |
| Sonoma Instrunent | Amplifier | 330 | 171377 | 2016-12-12 | 2017-12-12 |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100195 | 2016-11-25 | 2017-11-25 |
| Sunol Sciences | Broadband Antenna | JB3 | A090314-2 | 2016-01-09 | 2019-01-08 |
| Sunol Sciences | Broadband Antenna | JB3 | A090314-1 | 2016-01-09 | 2019-01-08 |
| Narda | Pre-amplifier | AFS42-00101800 | 2001270 | 2016-09-08 | 2017-09-08 |
| EMCO | Horn Antenna | 3116 | 9510-2384 | 2015-11-07 | 2018-11-06 |
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 100048 | 2016-11-25 | 2017-11-25 |
| ETS | Horn Antenna | 3115 | 6229 | 2017-01-10 | 2018-01-09 |
| ETS | Horn Antenna | 3115 | 9311-4159 | 2017-01-10 | 2018-01-09 |
| R&S | Auto test Software | EMC32 | V 09.10.0 | NCR | NCR |
| haojintech | Coaxial Cable | Cable-1 | 001 | 2016-12-12 | 2017-12-12 |
| haojintech | Coaxial Cable | Cable-2 | 002 | 2016-12-12 | 2017-12-12 |
| haojintech | Coaxial Cable | Cable-3 | 003 | 2016-12-12 | 2017-12-12 |
| MICRO-COAX | Coaxial Cable | Cable-4 | 004 | 2016-12-12 | 2017-12-12 |
| MICRO-COAX | Coaxial Cable | Cable-5 | 005 | 2016-12-12 | 2017-12-12 |
| MICRO-COAX | Coaxial Cable | Cable-7 | 007 | 2016-12-12 | 2017-12-12 |
| HP | Signal Generator | 8341B | 2624A00116 | 2016-08-29 | 2017-08-29 |
| **RF Conducted test** | | | | | |
| BACL | TS 8997 Cable-01 | T-KS-EMC086 | T-KS-EMC086 | 2016-12-09 | 2017-12-08 |
| BACL | RF cable | KS-LAB-012 | KS-LAB-012 | 2016-12-15 | 2017-12-14 |
| WEINSCHEL | 3dB Attenuator | 5326 | N/A | 2016-06-18 | 2017-06-18 |
| Rohde & Schwarz | OSP120 BASE UNIT | OSP120 | 101247 | 2016-07-04 | 2017-07-03 |
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 836131/009 | 2016-09-21 | 2017-09-21 |
| HEWLETT PACKARD | RF Communications Test SET | 8920A | 3438A05201 | 2016-09-21 | 2017-09-21 |
| HONOVA | Power Splitter | ZFRSC-14-S+ | 019411452 | 2016-06-12 | 2017-06-12 |
| N/A | 30dB Attenuator | 100W 30dB | N/A | 2016-06-18 | 2017-06-18 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

# FCC §1.1307(b) & §2.1093 - RF EXPOSURE

## Applicable Standard

According to FCC §1.1307(b) and §2.1093, protable device operates Part 95 should be subjected to rountine environmental evaluation for RF exposure prior or equipment authorization or use.

**Result:** Compliance.

Please refer to SAR Report Number: RDG170220003-20.

# FCC §2.1046 & §95.639(d) - RF OUTPUT POWER

## Applicable Standard

Per FCC §2.1046, and §95.639(d), No FRS Unit, under any condition of modulation, shall exceed a 0.5 W effective radiated power (ERP).

Per FCC §95.639(a) (1), No GMRS transmitter, under any condition of modulation, shall exceed 50 W Carrier power (average TP during one unmodulated RF cycle) when transmitting emission type A1D, F1D, G1D, A3E, F3E or G3E.

## Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the emissions were measured by the substitution.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 °C |
| **Relative Humidity:** | 52 % |
| **ATM Pressure:** | 100.0 kPa |

*The testing was performed by Chris Wang on 2017-03-11.*

*Test Mode: Transmitting*

| Indicated | | Table Angle Degree | Test Ant. | | Substituted | | | Absolute Level (dBm) | FCC Part 95 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | S.A. Reading (dBµV) | | Height (m) | Polar (H/V) | Substituted Level (dBm) | Cable Loss (dB) | Ant. Gain (dB) | | ERP (mW) | Limit (Watt) |
| GMRS 462.625MHz (high power) | | | | | | | | | | |
| 462.625 | 95.05 | 155 | 2.6 | H | 14.6 | 0.23 | 4.05 | 18.42 | 69.50 | 50 |
| 462.625 | 101.18 | 343 | 2.9 | V | 24.0 | 0.23 | 4.05 | 27.82 | 605.34 | 50 |
| GMRS 462.625MHz (low power) | | | | | | | | | | |
| 462.625 | 94.38 | 299 | 2.2 | H | 13.9 | 0.23 | 4.05 | 17.72 | 59.16 | 50 |
| 462.625 | 94.82 | 335 | 1.4 | V | 17.6 | 0.23 | 4.05 | 21.42 | 138.68 | 50 |
| FRS 467.6375MHz | | | | | | | | | | |
| 467.6375 | 95.52 | 291 | 2.3 | H | 15.1 | 0.23 | 4.05 | 18.92 | 77.98 | 0.5 |
| 467.6375 | 97.45 | 42 | 1.2 | V | 20.3 | 0.23 | 4.05 | 24.12 | 258.23 | 0.5 |

**Test Result:** Compliance.

# FCC §2.1047 & §95.637(a) - MODULATION CHARACTERISTIC

## Applicable Standard

Per FCC §2.1047 and §95.637(a): A GMRS transmitter that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A FRS unit that transmits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz .

Each GMRS transmitter, except a mobile station transmitter with a power output of 2.5 W or less, must automatically prevent a greater than normal audio level from causing over-modulation. The transmitter also must include audio frequency low pass filtering, unless it complies with the applicable paragraphs of § 95.631 (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 10 (f/3) dB greater than the attenuation at 1 kHz. Above 20 kHz, it must have an attenuation of at least 50 dB greater than the attenuation at 1 kHz.

## Test Procedure

Test Method: TIA/EIA-603-D

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 °C |
| **Relative Humidity:** | 52 % |
| **ATM Pressure:** | 100.0 kPa |

*The testing was performed by Chris Wang on 2017-03-11.*

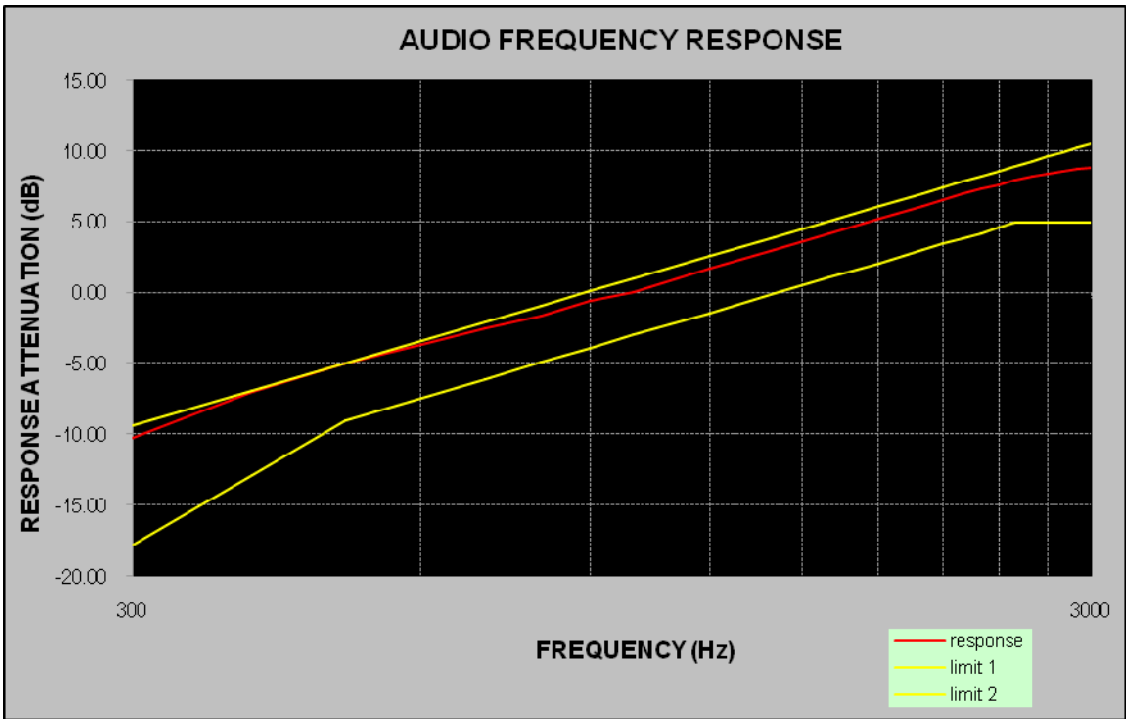
Please refer to the following tables and plots.

*Test Mode: Transmitting*

**Audio Frequency Response**

Carrier Frequency: 462.6250 MHz

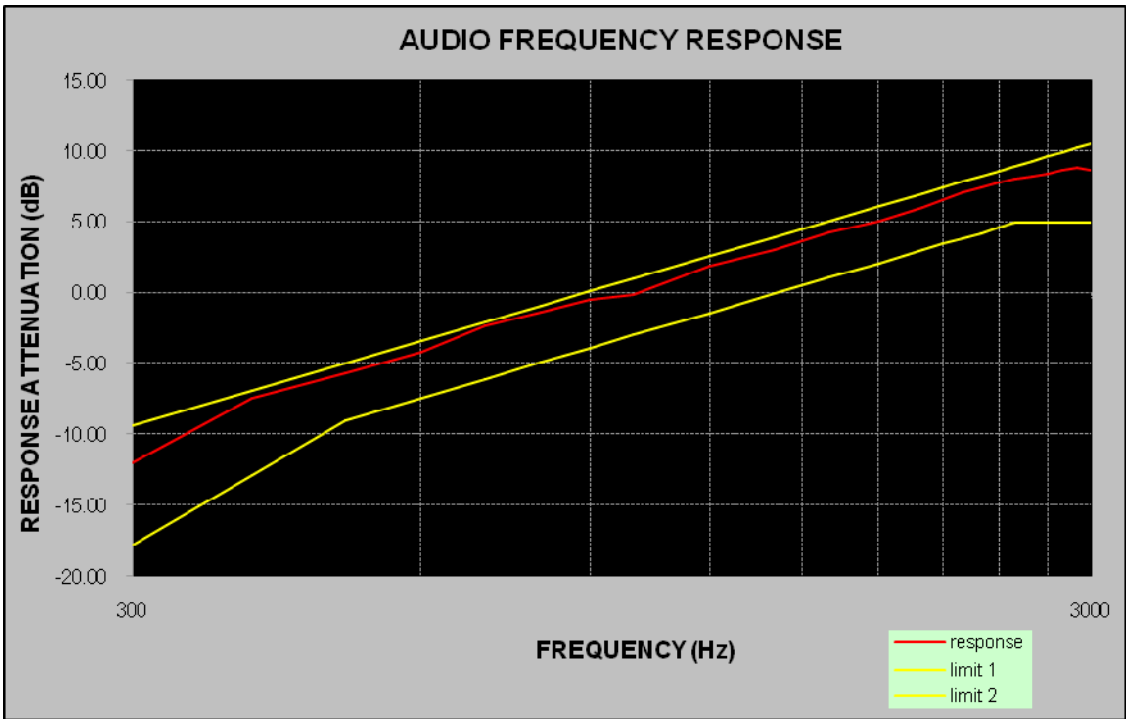
| Audio Frequency (Hz) | Response Attenuation (dB) |
|---|---|
| 300 | -10.23 |
| 400 | -6.97 |
| 500 | -5.01 |
| 600 | -3.64 |
| 700 | -2.52 |
| 800 | -1.60 |
| 900 | -0.59 |
| 1000 | 0.00 |
| 1200 | 1.67 |
| 1400 | 3.05 |
| 1600 | 4.20 |
| 1800 | 5.24 |
| 2000 | 6.12 |
| 2100 | 6.58 |
| 2200 | 7.02 |
| 2300 | 7.32 |
| 2400 | 7.62 |
| 2500 | 7.92 |
| 2600 | 8.22 |
| 2700 | 8.41 |
| 2800 | 8.56 |
| 2900 | 8.72 |
| 3000 | 8.80 |


AUDIO FREQUENCY RESPONSE
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
RESPONSE ATTENUATION (dB)
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

**Audio Frequency Response**

Carrier Frequency: 467.6375 MHz

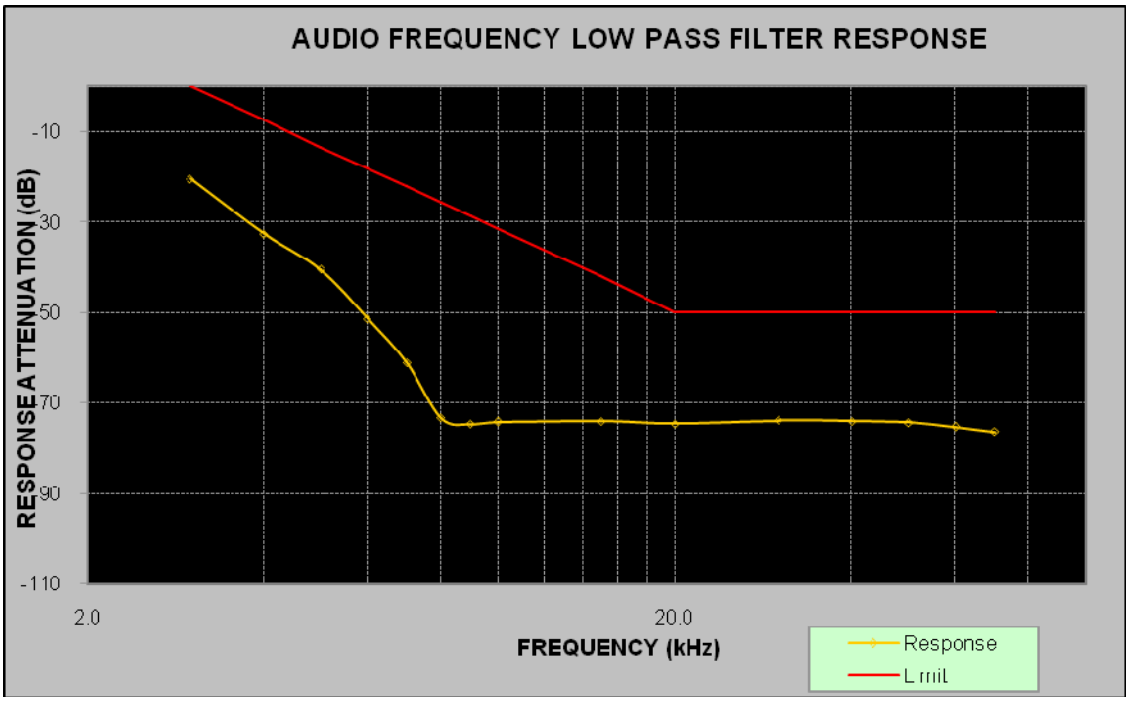
| Audio Frequency (Hz) | Response Attenuation (dB) |
|---|---|
| 300 | -12.04 |
| 400 | -7.45 |
| 500 | -5.71 |
| 600 | -4.21 |
| 700 | -2.36 |
| 800 | -1.41 |
| 900 | -0.54 |
| 1000 | -0.10 |
| 1200 | 1.90 |
| 1400 | 3.02 |
| 1600 | 4.27 |
| 1800 | 5.06 |
| 2000 | 6.06 |
| 2100 | 6.55 |
| 2200 | 7.10 |
| 2300 | 7.41 |
| 2400 | 7.75 |
| 2500 | 8.04 |
| 2600 | 8.21 |
| 2700 | 8.43 |
| 2800 | 8.62 |
| 2900 | 8.84 |
| 3000 | 8.66 |


AUDIO FREQUENCY RESPONSE
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
RESPONSE ATTENUATION (dB)
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

**Audio frequency lows pass filter response**

Carrier Frequency: 462.625 MHz, authorized bandwidth=20 kHz

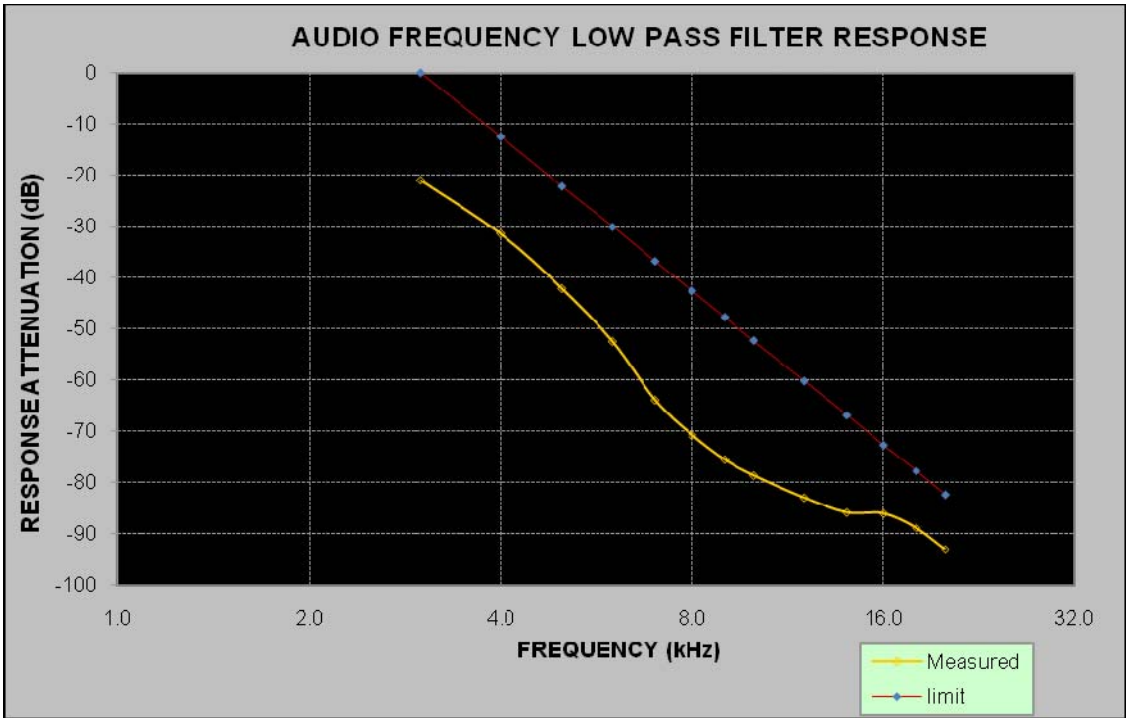
| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|---|---|---|
| 1.0 | 0.0 | / |
| 3.0 | -20.4 | 0.0 |
| 4.0 | -32.5 | -7.5 |
| 5.0 | -40.4 | -13.3 |
| 6.0 | -51.3 | -18.1 |
| 7.0 | -61.0 | -22.1 |
| 8.0 | -73.2 | -25.6 |
| 9.0 | -74.5 | -28.6 |
| 10.0 | -74.1 | -31.4 |
| 15.0 | -73.9 | -41.9 |
| 20.0 | -74.5 | -50.0 |
| 30.0 | -73.8 | -50.0 |
| 40.0 | -73.9 | -50.0 |
| 50.0 | -74.3 | -50.0 |
| 60.0 | -75.2 | -50.0 |
| 70.0 | -76.3 | -50.0 |



**Audio frequency lows pass filter response**

Carrier Frequency: 467.6375 MHz, authorized bandwidth=12.5 kHz

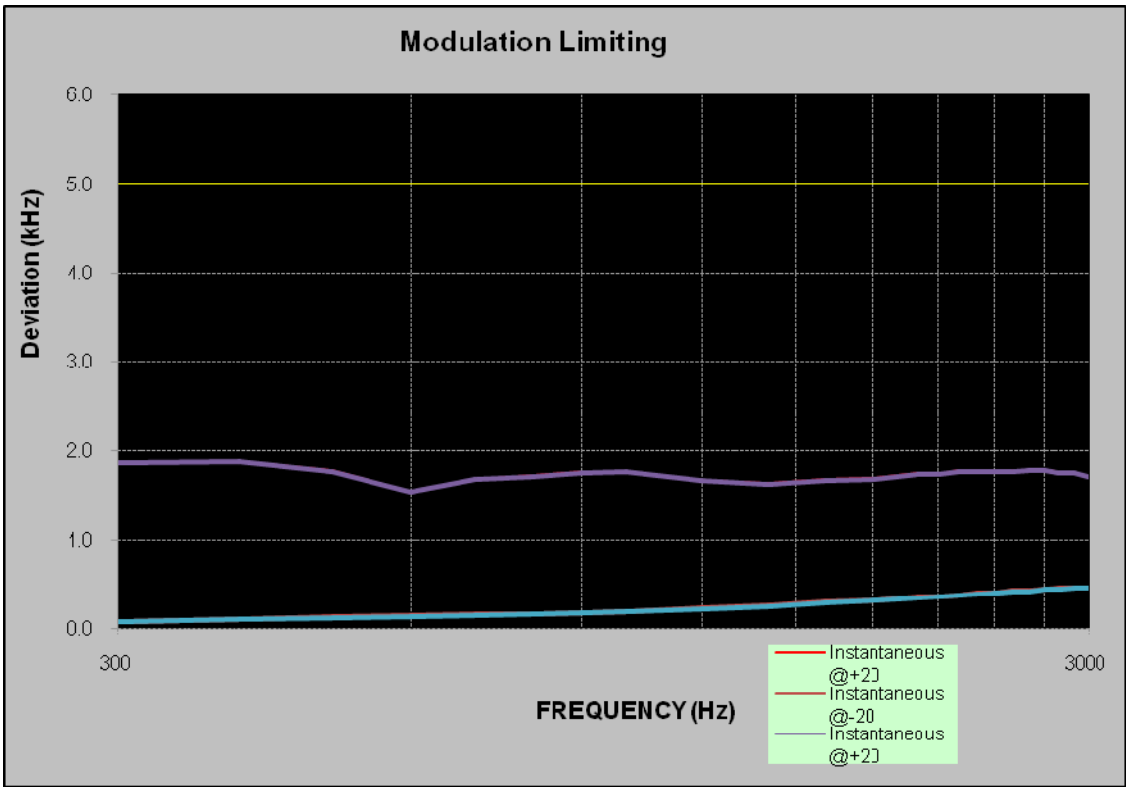
| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|---|---|---|
| 1.0 | 0.0 | / |
| 3.0 | -21.1 | 0.0 |
| 4.0 | -31.5 | -12.5 |
| 5.0 | -42.2 | -22.2 |
| 6.0 | -52.5 | -30.1 |
| 7.0 | -63.9 | -36.8 |
| 8.0 | -70.7 | -42.6 |
| 9.0 | -75.5 | -47.7 |
| 10.0 | -78.6 | -52.3 |
| 12.0 | -82.9 | -60.2 |
| 14.0 | -85.8 | -66.9 |
| 16.0 | -86 | -72.7 |
| 18.0 | -88.8 | -77.8 |
| 20.0 | -93 | -82.4 |



## MODULATION LIMITING

Carrier Frequency: 462.625 MHz

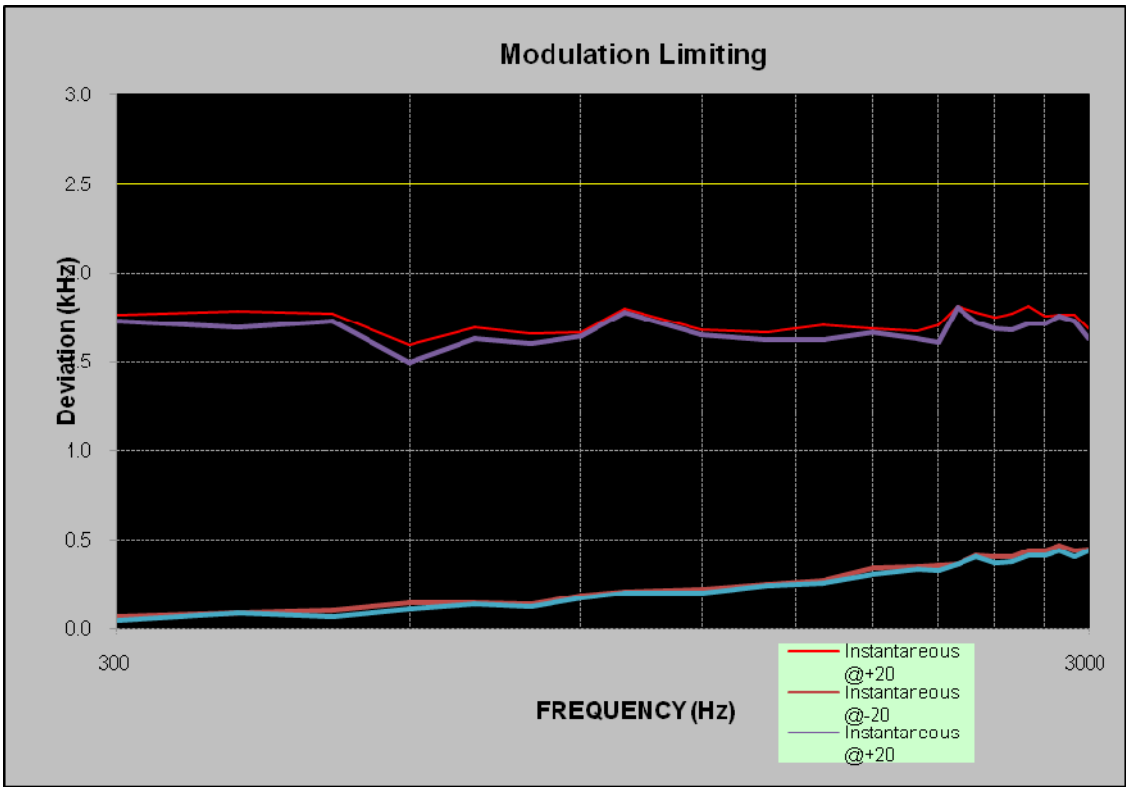
| Audio Frequency (Hz) | Instantaneous | | Steady-state | | FCC Limit [kHz] |
|---|---|---|---|---|---|
| | DEVIATION (@+20dB) [kHz] | DEVIATION (@-20dB) [kHz] | DEVIATION (@+20dB) [kHz] | DEVIATION (@-20dB) [kHz] | |
| 300 | 1.866 | 0.079 | 1.851 | 0.071 | 5 |
| 400 | 1.872 | 0.102 | 1.864 | 0.096 | 5 |
| 500 | 1.764 | 0.125 | 1.755 | 0.113 | 5 |
| 600 | 1.531 | 0.143 | 1.527 | 0.135 | 5 |
| 700 | 1.673 | 0.151 | 1.667 | 0.147 | 5 |
| 800 | 1.717 | 0.163 | 1.706 | 0.157 | 5 |
| 900 | 1.751 | 0.174 | 1.739 | 0.168 | 5 |
| 1000 | 1.760 | 0.187 | 1.751 | 0.183 | 5 |
| 1200 | 1.664 | 0.223 | 1.657 | 0.211 | 5 |
| 1400 | 1.626 | 0.257 | 1.617 | 0.244 | 5 |
| 1600 | 1.665 | 0.291 | 1.654 | 0.276 | 5 |
| 1800 | 1.687 | 0.317 | 1.676 | 0.308 | 5 |
| 2000 | 1.735 | 0.347 | 1.724 | 0.338 | 5 |
| 2100 | 1.734 | 0.356 | 1.721 | 0.348 | 5 |
| 2200 | 1.767 | 0.372 | 1.751 | 0.366 | 5 |
| 2300 | 1.760 | 0.388 | 1.756 | 0.382 | 5 |
| 2400 | 1.771 | 0.399 | 1.757 | 0.393 | 5 |
| 2500 | 1.769 | 0.420 | 1.754 | 0.415 | 5 |
| 2600 | 1.771 | 0.425 | 1.766 | 0.413 | 5 |
| 2700 | 1.770 | 0.436 | 1.763 | 0.430 | 5 |
| 2800 | 1.749 | 0.450 | 1.745 | 0.442 | 5 |
| 2900 | 1.746 | 0.452 | 1.739 | 0.447 | 5 |
| 3000 | 1.703 | 0.456 | 1.695 | 0.451 | 5 |


Modulation Limiting
Deviation (kHz)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20
Instantaneous @-20
Instantaneous @+20

## MODULATION LIMITING

Carrier Frequency: 467.6375MHz

| Audio Frequency (Hz) | Instantaneous | | Steady-state | | FCC Limit [kHz] |
|---|---|---|---|---|---|
| | DEVIATION (@+20dB) [kHz] | DEVIATION (@-20dB) [kHz] | DEVIATION (@+20dB) [kHz] | DEVIATION (@-20dB) [kHz] | |
| 300 | 1.758 | 0.062 | 1.726 | 0.041 | 2.500 |
| 400 | 1.784 | 0.085 | 1.692 | 0.084 | 2.500 |
| 500 | 1.768 | 0.102 | 1.724 | 0.066 | 2.500 |
| 600 | 1.593 | 0.139 | 1.497 | 0.107 | 2.500 |
| 700 | 1.691 | 0.141 | 1.631 | 0.137 | 2.500 |
| 800 | 1.653 | 0.136 | 1.601 | 0.117 | 2.500 |
| 900 | 1.662 | 0.186 | 1.64 | 0.167 | 2.500 |
| 1000 | 1.799 | 0.205 | 1.777 | 0.197 | 2.500 |
| 1200 | 1.678 | 0.215 | 1.649 | 0.198 | 2.500 |
| 1400 | 1.661 | 0.248 | 1.624 | 0.242 | 2.500 |
| 1600 | 1.708 | 0.266 | 1.624 | 0.252 | 2.500 |
| 1800 | 1.683 | 0.335 | 1.665 | 0.301 | 2.500 |
| 2000 | 1.671 | 0.342 | 1.626 | 0.333 | 2.500 |
| 2100 | 1.704 | 0.353 | 1.606 | 0.325 | 2.500 |
| 2200 | 1.814 | 0.361 | 1.803 | 0.357 | 2.500 |
| 2300 | 1.776 | 0.406 | 1.719 | 0.402 | 2.500 |
| 2400 | 1.746 | 0.402 | 1.682 | 0.364 | 2.500 |
| 2500 | 1.765 | 0.401 | 1.676 | 0.373 | 2.500 |
| 2600 | 1.811 | 0.433 | 1.713 | 0.409 | 2.500 |
| 2700 | 1.753 | 0.437 | 1.714 | 0.407 | 2.500 |
| 2800 | 1.759 | 0.465 | 1.753 | 0.438 | 2.500 |
| 2900 | 1.758 | 0.437 | 1.725 | 0.402 | 2.500 |
| 3000 | 1.682 | 0.443 | 1.626 | 0.439 | 2.500 |


Modulation Limiting
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Deviation (kHz)
300
3000
FREQUENCY (Hz)
Instantaneous @+20
Instantaneous @-20
Instantaneous @+20

# FCC §2.1049 & §95.633(c) & §95.635 (b) (1) (3) (7) - AUTHOURIZED BANDWIDTH AND EMISSION MASK

## Applicable Standard

According to §95.633(c), the authorized bandwidth for emission type F3E or F2D transmitted by a FRS unit is 12.5 kHz.

According to §95.635(b) (1) (3) (7), the power of each unwanted emission shall be less than TP as specified in the applicable paragraphs listed in 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.

3) 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.

7) At least 43 + 10 log $_{10}$ (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

## Test Procedure

TIA-603-D, section 2.2.11

## Test Data

### Environmental Conditions

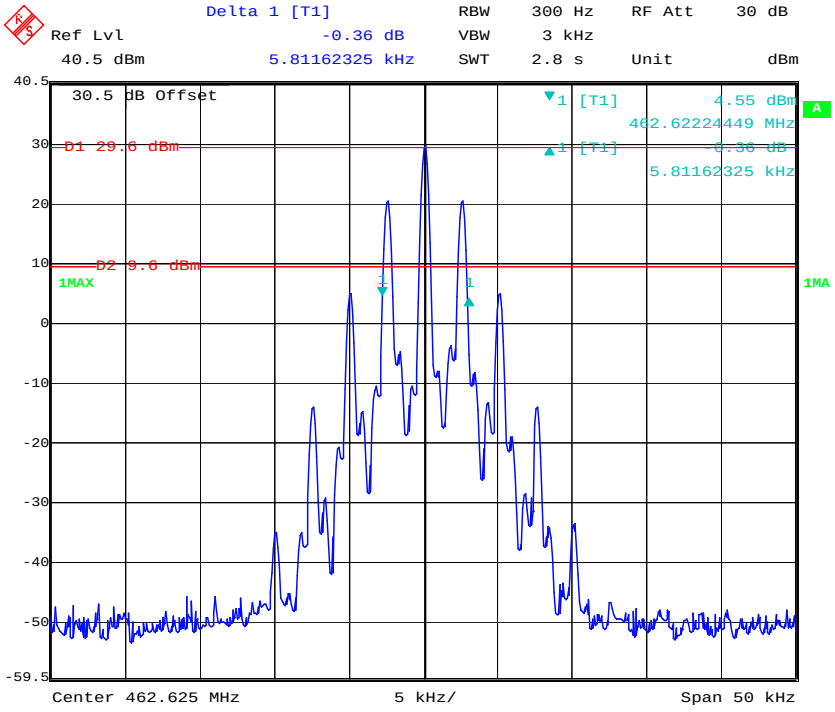
| | |
|---|---|
| **Temperature:** | 23 °C |
| **Relative Humidity:** | 52 % |
| **ATM Pressure:** | 100.0 kPa |

*The testing was performed by Chris Wang on 2017-03-11.*

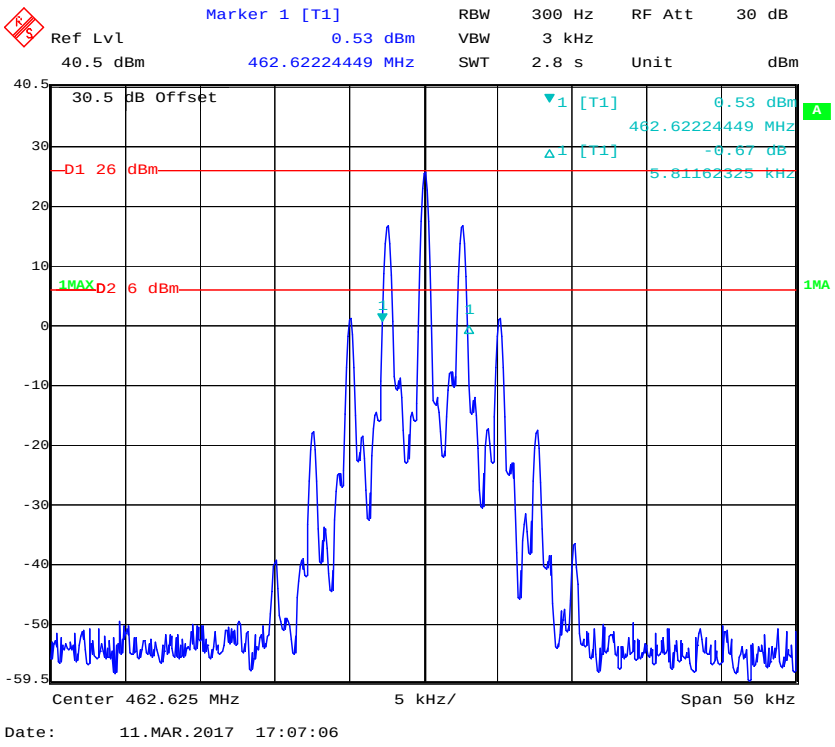
*Test Mode: Transmitting*

| Item | | Frequency (MHz) | 20dB Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|---|---|
| GMRS | PH | 462.6250 | 5.812 | 20.0 | Pass |
| | PL | | 5.812 | 20.0 | Pass |
| FRS | | 467.6375 | 5.812 | 12.5 | Pass |

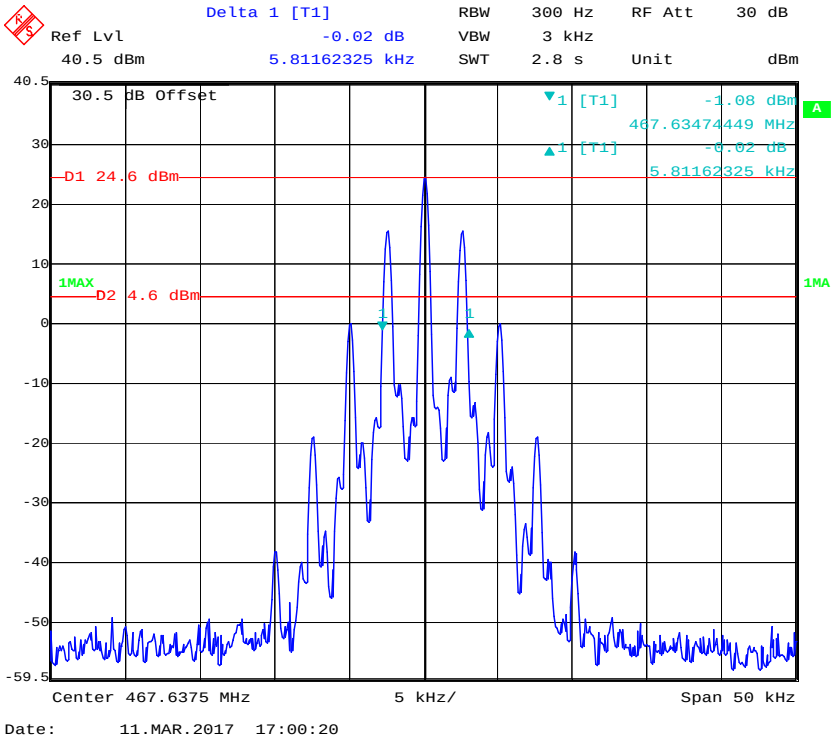
## 20dB Bandwidth, GMRS, PH



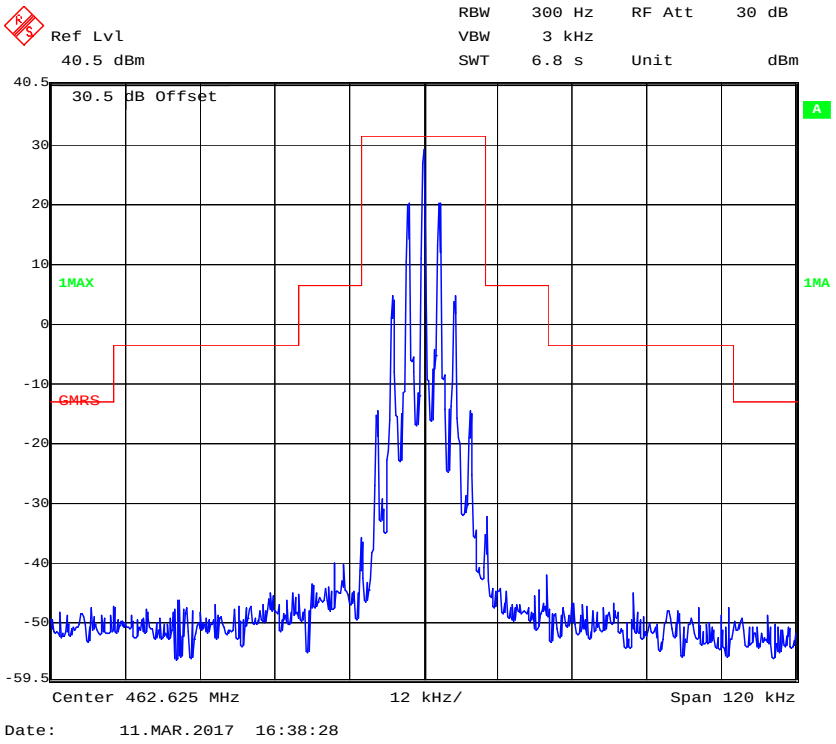

## 20dB Bandwidth, GMRS, PL



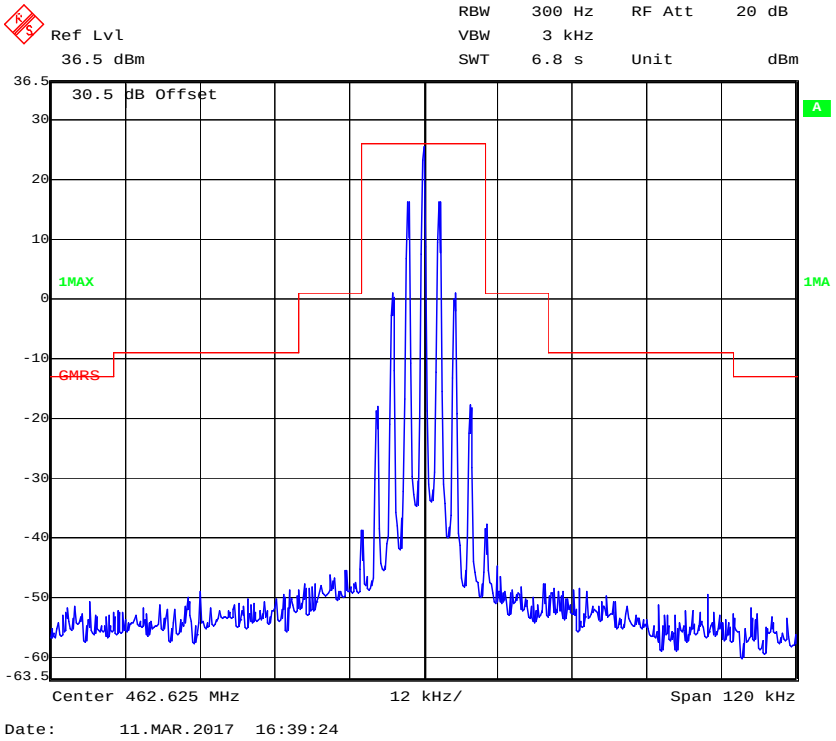
## 20dB Bandwidth, FRS



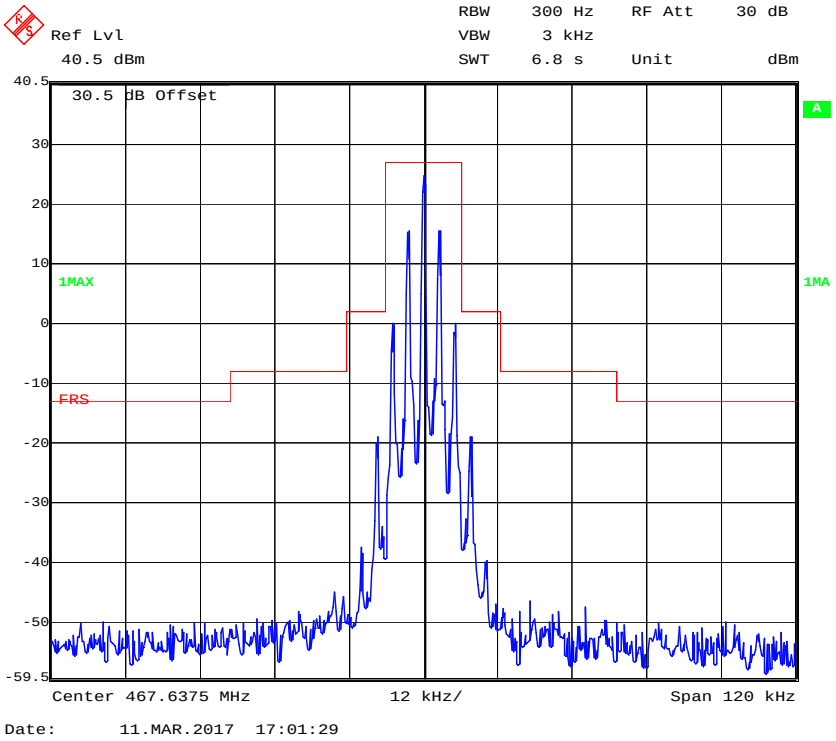

## Emission Mask
## GMRS- 462.625 MHz, PH



## GMRS- 462.625 MHz, PL




## FRS – 467.6375 MHz



# FCC §2.1053 & §95.635(b) (7) - RADIATED SPURIOUS EMISSION

## Applicable Standard

FCC §2.1053 and §95.635(b) (7)

## Test Procedure

The transmitter was placed on a wooden turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =10 1g (TXpwr in Watts/0.001)-the absolute level
Spurious attenuation limit in dB = 43+10 $\text{Log}_{10}$ (power out in Watts)

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 °C |
| **Relative Humidity:** | 52 % |
| **ATM Pressure:** | 100.0 kPa |

*The testing was performed by Layne Li on 2017-03-11.*

*Test Mode: Transmitting*

| Indicated | | Table Angle Degree | Test Antenna | | Substituted | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Receiver Reading (dBuV) | | Height (m) | Polar (H/V) | Level (dBm) | Cable Loss (dB) | Antenna Gain (dB) | | | |
| FRS 467.6375 MHz | | | | | | | | | | |
| 935.28 | 57.35 | 179 | 1.1 | H | -42.8 | 0.27 | 5.05 | -38.02 | -13 | 25.02 |
| 935.28 | 61.90 | 166 | 2.0 | V | -34.8 | 0.27 | 5.05 | -30.02 | -13 | 17.02 |
| 1402.91 | 64.97 | 36 | 1.4 | H | -39.1 | 0.34 | 7.92 | -31.52 | -13 | 18.52 |
| 1402.91 | 61.40 | 17 | 1.7 | V | -44.4 | 0.34 | 7.92 | -36.82 | -13 | 23.82 |
| 1870.55 | 61.70 | 109 | 2.1 | H | -38.2 | 0.45 | 8.84 | -29.81 | -13 | 16.81 |
| 1870.55 | 61.83 | 121 | 2.1 | V | -40.3 | 0.45 | 8.84 | -31.91 | -13 | 18.91 |
| 2338.19 | 59.00 | 227 | 1.6 | H | -41.4 | 0.48 | 9.66 | -32.22 | -13 | 19.22 |
| 2338.19 | 60.47 | 24 | 1.1 | V | -41.3 | 0.48 | 9.66 | -32.12 | -13 | 19.12 |
| GMRS 462.6250MHz | | | | | | | | | | |
| 925.25 | 55.95 | 207 | 2.4 | H | -44.2 | 0.27 | 5.05 | -39.42 | -13 | 26.42 |
| 925.25 | 65.30 | 298 | 2.0 | V | -31.4 | 0.27 | 5.05 | -26.62 | -13 | 13.62 |
| 1387.88 | 64.27 | 82 | 2.1 | H | -39.8 | 0.34 | 7.92 | -32.22 | -13 | 19.22 |
| 1387.88 | 70.90 | 123 | 1.8 | V | -34.9 | 0.34 | 7.92 | -27.32 | -13 | 14.32 |
| 1850.50 | 66.30 | 179 | 1.5 | H | -33.6 | 0.45 | 8.84 | -25.21 | -13 | 12.21 |
| 1850.50 | 70.63 | 20 | 1.3 | V | -31.5 | 0.45 | 8.84 | -23.11 | -13 | 10.11 |
| 2313.13 | 57.90 | 234 | 1.3 | H | -42.5 | 0.48 | 9.66 | -33.32 | -13 | 20.32 |
| 2313.13 | 62.97 | 48 | 1.3 | V | -38.8 | 0.48 | 9.66 | -29.62 | -13 | 16.62 |

**Note:**
1) Absolute Level = SG Level - Cable loss + Antenna Gain
2) Margin = Limit- Absolute Level

# FCC§2.1055 (d) & §95.626(b) - FREQUENCY STABILITY

## Applicable Standard

According to FCC §2.1055(a) (1), the frequency stability shall be measured with variation of ambient temperature from –30 ºC to +50 ºC, and according to FCC 2.1055(d) (2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC §95.626(b), Each FRS unit must be maintained within a frequency tolerance of 0.00025%( 2.5 ppm).

According to FCC §95.621(b) , Each GMRS transmitter for mobile station, small base station and control station operation must be maintained within a frequency tolerance of 0.0005%. Each GMRS transmitter for base station (except small base), mobile relay station or fixed station operation must be maintained within a frequency tolerance of 0.00025%.

## Test Procedure

Frequency Stability vs. Temperature: The equipment under test 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 RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Frequency Counter.

Frequency Stability vs. Voltage:

1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

The output frequency was recorded for each voltage.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 °C |
| **Relative Humidity:** | 52 % |
| **ATM Pressure:** | 100.0 kPa |

*The testing was performed by Chris Wang on 2017-03-11.*

*Test Mode: Transmitting*

**GMRS**

| Reference Frequency: 462.625 MHz, Limit: ±5 ppm | | | |
|---|---|---|---|
| **Environment Temperature (℃)** | **Power Supplied ($V_{DC}$)** | **Measurement Frequency (MHz)** | **Frequency Error (ppm)** |
| Frequency Stability Ver. Temperature | | | |
| 50 | 4.5 | 462.625012 | 0.0259 |
| 40 | 4.5 | 462.625042 | 0.0908 |
| 30 | 4.5 | 462.625020 | 0.0432 |
| 20 | 4.5 | 462.625025 | 0.0540 |
| 10 | 4.5 | 462.625047 | 0.1016 |
| 0 | 4.5 | 462.625015 | 0.0324 |
| -10 | 4.5 | 462.625046 | 0.0994 |
| -20 | 4.5 | 462.625050 | 0.1081 |
| -30 | 4.5 | 462.625003 | 0.0065 |
| Frequency Stability Ver. Input Voltage | | | |
| 20 | 3.8 | 462.625043 | 0.0929 |
| 20 | 5.2 | 462.625015 | 0.0324 |

**FRS**

| Reference Frequency: 467.6375 MHz, Limit: ±2.5 ppm | | | |
|---|---|---|---|
| **Environment Temperature (℃)** | **Power Supplied ($V_{DC}$)** | **Measurement Frequency (MHz)** | **Frequency Error (ppm)** |
| Frequency Stability Ver. Temperature | | | |
| 50 | 4.5 | 467.637538 | 0.0813 |
| 40 | 4.5 | 467.637505 | 0.0107 |
| 30 | 4.5 | 467.637540 | 0.0855 |
| 20 | 4.5 | 467.637508 | 0.0171 |
| 10 | 4.5 | 467.637523 | 0.0492 |
| 0 | 4.5 | 467.637540 | 0.0855 |
| -10 | 4.5 | 467.637548 | 0.1026 |
| -20 | 4.5 | 467.637535 | 0.0748 |
| -30 | 4.5 | 467.637537 | 0.0791 |
| Frequency Stability Ver. Input Voltage | | | |
| 20 | 3.8 | 467.637536 | 0.0770 |
| 20 | 5.2 | 467.637508 | 0.0171 |

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