Shenzhen Huatongwei International Inspection Co., Ltd.
1/F,Bldg 3,Hongfa Hi-tech Industrial Park,Genyu Road,Tianliao,Gongming,Shenzhen,China
Phone:86-755-26748019 Fax:86-755-26748089 http://www.szhtw.com.cn

# TEST REPORT

| | |
|---|---|
| **Report No. ..... :** | **CHTEW19030075** |
| **Project No. ..... :** | **SQ201811002301EW** |
| **FCC ID .....:** | **K6630653X3D** |
| **Applicant's name .....:** | **YAESU MUSEN CO., LTD.** |
| Address .....: | Tennozu Parkside Building 2-5-8 Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-0002 Japan |
| Manufacturer.....: | QUANZHOU QIXIANG ELECTRON SCIENCE & TECHNOLOGY CO., LTD. |
| Address.....: | Wan'An Tangxi Industrial Zone, Luojiang District, Quanzhou, Fujian, China |
| **Test item description .....:** | **25 Watt VHF/FM Marine Transceiver** |
| Trade Mark .....: | STANDARD HORIZON |
| Model/Type reference .....: | GX1400GPS |
| Listed Model(s).....: | GX1400 |
| **Standard.....:** | **FCC CFR Title 47 Part 2**<br>**FCC CFR Title 47 Part 80** |
| Date of receipt of test sample……...: | Mar.01, 2019 |
| Date of testing……..……: | Mar.01, 2019- Mar.13, 2019 |
| Date of issue……...: | Mar.14, 2019 |
| **Result ..... ……...:** | **PASS** |

Report verification :

| | | |
|---|---|---|
| Compiled by<br>( position+printed name+signature) . : | File administrators Fanghui Zhu | Fanghui Zhu |
| Supervised by<br>( position+printed name+signature) . : | Project Engineer Edward Pan | Edward Pan |
| Approved by<br>( position+printed name+signature) . : | RF Manager Hans Hu | Hans Hu |

| | |
|---|---|
| **Testing Laboratory Name.....:** | **Shenzhen Huatongwei International Inspection Co., Ltd.** |
| Address .....: | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China |

# Contents


| | | |
|---|---|---|
| **1** | **TEST STANDARDS AND REPORT VERSION** | **3** |
| **1.1.** | **Test Standards** | **3** |
| **1.2.** | **Report revised information** | **3** |
| **2** | **TEST DESCRIPTION** | **4** |
| **3** | **SUMMARY** | **5** |
| **3.1** | **Client Information** | **5** |
| **3.2** | **Product Description** | **5** |
| **3.3** | **Test frequency list** | **6** |
| **3.4** | **Operation mode** | **6** |
| **3.5** | **EUT configuration** | **7** |
| **4** | **TEST ENVIRONMENT** | **8** |
| **4.1** | **Address of the test laboratory** | **8** |
| **4.2** | **Test Facility** | **8** |
| **4.3** | **Environmental conditions** | **9** |
| **4.4** | **Statement of the measurement uncertainty** | **9** |
| **4.5** | **Equipments Used during the Test** | **10** |
| **5** | **TEST CONDITIONS AND RESULTS** | **12** |
| **5.1** | **Conducted Carrier Output Power** | **12** |
| **5.2** | **99% Occupied Bandwidth & 26dB Bandwidth** | **13** |
| **5.3** | **Emission Mask** | **14** |
| **5.4** | **Modulation Limit** | **15** |
| **5.5** | **Audio Frequency Response** | **16** |
| **5.6** | **Audio Low Pass Filter Response** | **18** |
| **5.7** | **Frequency stability VS Temperature** | **19** |
| **5.8** | **Frequency stability VS Voltage** | **21** |
| **5.9** | **Transmit Conducted Spurious Emission** | **23** |
| **5.10** | **Transmitter Radiated Spurious Emission** | **24** |
| **5.11** | **AC Power Line Conducted Spurious Emission** | **28** |
| **5.12** | **Radiated Emission** | **29** |
| **6** | **APPENDIX REPORT** | **32** |

# 1 TEST STANDARDS AND REPORT VERSION

## 1.1. Test Standards

The tests were performed according to following standards:
FCC Rules Part 2: Frequency allocations and radio treaty matters; General rules and regulations
FCC Rules Part 80: STATIONS IN THE MARITIME SERVICES
ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
ANSI/TIA-603-E(2016): Land Mobile FM or PM Communications Equipment and Performance Standards

## 1.2. Report revised information

| Revised No. | Date of issued | Description |
|---|---|---|
| N/A | 2019-03-14 | Original |
| | | |
| | | |
| | | |
| | | |

# 2 TEST DESCRIPTION

| Test Item | Section in CFR 47 | Result | Test Engineer |
|---|---|---|---|
| Conducted Carrier Output Power | Part 80.215<br>Part 2.1046(a) | Pass | Gaosheng Pan |
| 99% Occupied Bandwidth & 26dB bandwidth | Part 80.205<br>Part 2.1049 | Pass | Gaosheng Pan |
| Emission Mask | Part 80.211(f)<br>Part 2.1049 | Pass | Gaosheng Pan |
| Modulation Limit | Part 2.1047(b)<br>Part 80.213 | Pass | Gaosheng Pan |
| Audio Frequency Response | FCC Part 2.1047(a) | Pass | Gaosheng Pan |
| Audio Low Pass Filter Response | FCC Part 80.213,<br>Part 2.1047(a) | Pass | Gaosheng Pan |
| Frequency Stability V.S. Temperature | Part 80.209<br>Part 2.1055 | Pass | Gaosheng Pan |
| Frequency Stability V.S. Voltage | Part 80.209<br>Part 2.1055 | Pass | Gaosheng Pan |
| Transmit Conducted Spurious Emission | Part 80.211(f)(3)<br>Part 2.1051 | Pass | Gaosheng Pan |
| Transmit Radiated Spurious Emission | Part 80.211(f)(3)<br>Part 2.1053 | Pass | Baojin Ling |
| **Receiver Requirement** | | | |
| Test item | Standards requirement | Result | Test Engineer |
| AC Power Line Conducted Emission | FCC Part 15.207 | N/A | N/A |
| Radiated Emission | FCC Part 15.209 | Pass | Shower Dai |

# 3 SUMMARY

## 3.1 Client Information

| | |
|---|---|
| Applicant: | YAESU MUSEN CO., LTD. |
| Address: | Tennozu Parkside Building 2-5-8 Higashi-Shinagawa, Shinagawa-ku, Tokyo 140-0002 Japan |
| Manufacturer: | QUANZHOU QIXIANG ELECTRON SCIENCE & TECHNOLOGY CO., LTD. |
| Address: | Wan'An Tangxi Industrial Zone, Luojiang District, Quanzhou, Fujian, China |

## 3.2 Product Description

| | | | |
|---|---|---|---|
| Name of EUT: | 25 Watt VHF/FM Marine Transceiver | | |
| Trade mark: | STANDARD HORIZON | | |
| Model/Type reference: | GX1400GPS | | |
| Listed model(s): | GX1400 | | |
| Power supply: | DC 13.8V | | |
| Hardware version: | SPP01 | | |
| Software version: | SPP01 | | |
| **RF Specification** | | | |
| Operation Frequency Range: | TX:156.025MHz to 161.600MHz | | |
| | RX:156.050MHz to 162.025MHz | | |
| Rated Output Power: | ☒ High Power: 25W | ☒ Low Power: 1W | |
| Modulation Type: | Analog: | FM | |
| Channel Separation: | Analog: | ☐ 12.5kHz | ☒ 25kHz |
| Emission Designator: *[1] | Analog: | 16K0G3E | |
| Antenna Type: | External | | |

Note:

(1) *[1] According to FCC Part 2.202 requirements, the Necessary Bandwidth is calculated as follows:

- For FM Voice Modulation

  Channel Spacing = 25 KHz, D = 5 KHz max, K = 1, M = 3 KHz

  Bn = 2M + 2DK = 2*3 + 2*5*1 = **16 KHz**

  Emission designation: 16K0G3E

## 3.3 Test frequency list

According to ANSI C63.26 section 5.1.2.1:

Measurements of transmitters shall be performed and, if required, reported for each frequency band in which the EUT can be operated with the device transmitting at the number of frequencies in each band specified in Table 2.

| Frequency range over which EUT operates | Number of frequencies | Location in frequency range of operation |
|---|---|---|
| 1 MHz or less | 1 | Middle |
| 1 MHz to 10 MHz | 2 | 1 near top and 1 near bottom |
| More than 10 MHz | 3 | 1 near top, 1 near middle, and 1 near bottom |

| Frequency Bands (MHz) | Test Channel | Test Frequency(MHz) | |
|---|---|---|---|
| | | TX | RX |
| 156.025 ~ 162.025 | $CH_L$(CH1001) | 156.05MHz | 156.05MHz |
| | $CH_{M2}$(CH16) | 156.800MHz | 156.800MHz |
| | $CH_H$(CH88) | 157.425MHz | 157.425MHz |

## 3.4 Operation mode

| Test mode | Transmitting | Receiving | Power level | | Analog Voice/PM | GPS | US Weather |
|---|---|---|---|---|---|---|---|
| | | | High | Low | 25kHz | | |
| TX-AWH | √ | | √ | | √ | | |
| TX-AWL | √ | | | √ | √ | | |
| RX-AW | | √ | | | √ | | |
| RX-GPS | | √ | | | | √ | |
| RX-US Weather | | √ | | | | | √ |

Note:

√: is operation mode.

Note:

- US weather Channel:

| Channel | Frequency(MHz) | Restrictions |
|---|---|---|
| WX1 | 162.550 | RX ONLY |
| WX2 | 162.400 | RX ONLY |
| WX3 | 162.475 | RX ONLY |
| WX4 | 162.425 | RX ONLY |
| WX5 | 162.450 | RX ONLY |
| WX6 | 162.500 | RX ONLY |
| WX7 | 162.525 | RX ONLY |

| Modulation Type | Description |
|---|---|
| UM | Un-modulation |
| AM2 | Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation. |
| AM6 | Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation, then increase the level from the audio generator by 20 dB |
| AM5 | Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. |

Pre-scan above all test mode, found below test mode which it was worse case mode, so only show the test data for worse case mode on the test report.

| Test item | Modulation Type | Test mode (Worse case mode) |
|---|---|---|
| Conducted Output Power | UM | TX-AWH, TX-AWL |
| 99% Occupied Bandwidth & 26dB bandwidth | AM6 | TX-AWH, TX-AWL |
| Emission Mask | AM5 | TX-AWH, TX-AWL |
| Modulation Limit | AM6 | TX-AWH |
| Audio Frequency Response | AM2 | TX-AWH |
| Frequency Stability VS Temperature | UM | TX-AWH, TX-AWL |
| Frequency Stability VS Voltage | UM | TX-AWH, TX-AWL |
| Transmit Conducted Spurious Emission | AM5 | TX-AWH |
| Transmit Radiated Spurious Emission | AM5 | TX-AWH |
| AC Power Line Conducted Emission | - | N/A |
| Radiated Emission | - | RX-GPS |

## 3.5 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ● | Power Cable | Length (m) : | / |
| | | Shield : | Unshielded |
| | | Detachable : | Undetachable |
| ○ | Multimeter | Manufacturer : | / |
| | | Model No. : | / |

# 4 TEST ENVIRONMENT

## 4.1 Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

## 4.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

**CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

**A2LA-Lab Cert. No. 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

**FCC-Registration No.: 762235**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 762235.

**IC-Registration No.: 5377B-1**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered byCertification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B-1.

**ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

## 4.3 Environmental conditions

| Atmospheric Contions | |
|---|---|
| Temperature: | 21℃ to 25℃ |
| Relative Humidity: | 20 % to 75 %. |
| Atmospheric Pressure: | 860 mbar to 1060 mbar |
| Norminal Test Voltage: | $V_N$ = DC 13.8V |
| Extrem Test Voltage @115%$V_N$: | $V_H$ = DC 15.87V |
| Extrem Test Voltage @85%$V_N$: | $V_L$ = DC 11.73V |

## 4.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

| Test Items | Measurement Uncertainty | Notes |
|---|---|---|
| Frequency stability & Occupied Bandwidth | 18Hz for <1GHz<br>69Hz for >1GHz | (1) |
| Conducted Output Power | 0.63dB | (1) |
| ERP / EIRP / RSE | 2.38dB for <1GHz<br>3.45dB for >1GHz | (1) |
| Conducted Emission 9KHz-30MHz | 3.35 dB | (1) |
| Radiated Emission 30~1000MHz | 4.80 dB | (1) |
| Radiated Emission 1~18GHz | 5.16 dB | (1) |
| Radiated Emission 18-40GHz | 5.54 dB | (1) |
| FM deviation | 25 Hz | (1) |
| Audio level | 0.62 dB | (1) |
| Low Pass Filter Response | 0.76 dB | (1) |
| Modulation Limiting | 0.42 % | (1) |
| Transient Frequency Behavior | 6.8 % | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## 4.5 Equipments Used during the Test

| ● | Radiated Emission-6th test site | | | | | |
|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Semi-Anechoic Chamber | Albatross projects | SAC-3m-02 | N/A | 2018/09/30 | 2021/09/29 |
| ● | EMI Test Receiver | R&S | ESCI | 100900 | 2018/10/28 | 2019/10/27 |
| ○ | Loop Antenna | R&S | HFH2-Z2 | 100020 | 2017/11/20 | 2020/11/19 |
| ● | Ultra-Broadband Antenna | SCHWARZBECK | VULB9163 | 546 | 2017/04/05 | 2020/04/04 |
| ● | Pre-Amplifer | SCHWARZBECK | BBV 9742 | N/A | 2018/11/15 | 2019/11/14 |
| ● | RF Connection Cable | HUBER+SUHNER | N/A | N/A | 2018/09/28 | 2019/09/27 |
| ● | RF Connection Cable | HUBER+SUHNER | SUCOFLEX104 | 501184/4 | 2018/09/28 | 2019/09/27 |
| ● | Test Software | R&S | ES-K1 | N/A | N/A | N/A |
| ● | Turntable | Maturo Germany | TT2.0-1T | N/A | N/A | N/A |
| ● | Antenna Mast | Maturo Germany | CAM-4.0-P-12 | N/A | N/A | N/A |

| ● | Radiated emission-7th test site | | | | | |
|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Semi-Anechoic Chamber | Albatross projects | SAC-3m-01 | N/A | 2018/09/30 | 2021/09/29 |
| ● | Spectrum Analyzer | R&S | FSP40 | 100597 | 2018/10/27 | 2019/10/26 |
| ● | Horn Antenna | SCHWARZBECK | 9120D | 1011 | 2017/03/27 | 2020/03/26 |
| ○ | Pre-amplifier | BONN | BLWA0160-2M | 1811887 | 2018/11/14 | 2019/11/13 |
| ● | Pre-amplifier | CD | PAP-0102 | 12004 | 2018/11/14 | 2019/11/13 |
| ● | Broadband Pre-amplifier | SCHWARZBECK | BBV 9718 | 9718-248 | 2018/04/28 | 2019/04/27 |
| ● | RF Connection Cable | HUBER+SUHNER | RE-7-FH | N/A | 2018/11/15 | 2019/11/14 |
| ● | RF Connection Cable | HUBER+SUHNER | RE-7-FL | N/A | 2018/11/15 | 2019/11/14 |
| ● | Test Software | Audix | E3 | N/A | N/A | N/A |
| ● | Turntable | Maturo Germany | TT2.0-1T | N/A | N/A | N/A |
| ● | Antenna Mast | Maturo Germany | CAM-4.0-P-12 | N/A | N/A | N/A |

| ● | TS8613 Test system | | | | | |
|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Spectrum Analyzer | Agilent | N9020A | MY50510187 | 2018/09/29 | 2019/09/28 |
| ● | Signal & Spectrum Analyzer | R&S | FSW26 | 103440 | 2018/10/28 | 2019/10/27 |
| ● | RF Communication Test Set | HP | 8920A | 3813A10206 | 2018/10/28 | 2019/10/27 |
| ● | Digital intercom communication tester | Aeroflex | 3920B | 1001682041 | 2018/10/28 | 2019/10/27 |
| ● | Signal Generator | R&S | SML02 | 100507 | 2018/10/27 | 2019/10/26 |
| ● | Signal Generator | IFR | 2032 | 203002\100 | 2018/11/11 | 2019/11/10 |
| ● | RF Control Unit | Tonscend | JS0806-2 | N/A | N/A | N/A |
| ● | Fliter-VHF | Microwave | N26460M1 | 498702 | 2018/03/19 | 2019/03/18 |
| ○ | Fliter-UHF | Microwave | N25155M2 | 498704 | 2018/03/19 | 2019/03/18 |
| ○ | Power Divider | Microwave | OPD1040-N-4 | N/A | 2018/11/15 | 2019/11/14 |
| ○ | Attenuator | JFW | 50FH-030-100 | N/A | 2018/11/15 | 2019/11/14 |
| ○ | Attenuator | JFW | 50-A-MFN-20 | 0322 | 2018/11/15 | 2019/11/14 |
| ● | Test software | HTW | Radio ATE | N/A | N/A | N/A |

| ● | Auxiliary Equipment | | | | | |
|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Climate chamber | ESPEC | GPL-2 | N/A | 2018/11/08 | 2019/11/07 |
| ● | DC Power Supply | Gwinstek | SPS-2415 | GER835793 | 2018/10/28 | 2019/10/27 |

| ● | Radiated Spurious Emission | | | | | |
|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Semi-Anechoic Chamber | Albatross projects | SAC-3m-01 | N/A | 2018/09/30 | 2021/09/29 |
| ● | Spectrum Analyzer | R&S | FSP40 | 100597 | 2018/10/27 | 2019/10/26 |
| ● | Loop Antenna | R&S | HFH2-Z2 | 100020 | 2017/11/20 | 2020/11/19 |
| ● | Ultra-Broadband Antenna | SCHWARZBECK | VULB9163 | 538 | 2017/04/05 | 2020/04/04 |
| ● | Horn Antenna | SCHWARZBECK | 9120D | 1011 | 2017/04/01 | 2020/03/31 |
| ○ | Horn Antenna | SCHWARZBECK | BBHA9170 | 25841 | 2017/03/27 | 2020/03/26 |
| ○ | Pre-amplifier | BONN | BLWA0160-2M | 1811887 | 2018/11/14 | 2019/11/13 |
| ● | Pre-amplifier | CD | PAP-0102 | 12004 | 2018/11/14 | 2019/11/13 |
| ● | Broadband Preamplifier | SCHWARZBECK | BBV 9718 | 9718-248 | 2018/04/28 | 2019/04/27 |
| ● | RF Connection Cable | HUBER+SUHNER | RE-7-FH | N/A | 2018/11/15 | 2019/11/14 |
| ● | RF Connection Cable | HUBER+SUHNER | RE-7-FL | N/A | 2018/11/15 | 2019/11/14 |
| ● | EMI Test Software | Audix | E3 | N/A | N/A | N/A |
| ● | Turntable | MATURO | TT2.0 | N/A | N/A | N/A |
| ● | Antenna Mast | MATURO | TAM-4.0-P | N/A | N/A | N/A |

# 5 TEST CONDITIONS AND RESULTS

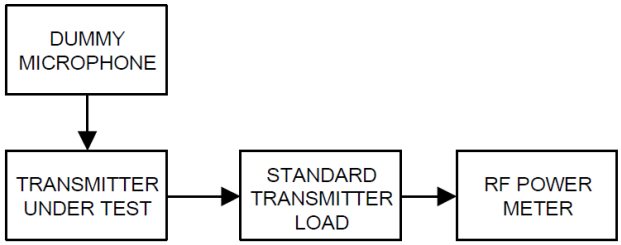
## 5.1 Conducted Carrier Output Power

**LIMIT**

FCC Part 80.215， FCC Part 2.1046

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation.

**TEST CONFIGURATION**




**TEST PROCEDURE**

(1) Connect the equipment as illustrated
(2) Correct for all losses in the RF path
(3) Measure the transmitter output power
(4) If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Please refer to appendix A on the section 6 appendix report

## 5.2 99% Occupied Bandwidth & 26dB Bandwidth

**LIMIT**

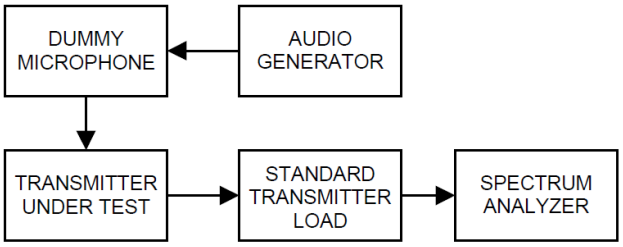
FCC Part 80.205, FCC Part 2.1049

| Class of emission | Emission designator | Authorized bandwidth (kHz) |
|---|---|---|
| A1A | 160HA1A | 0.4 |
| A1B[1] | 160HA1B | 0.4 |
| A1D[12] | 16K0A1D | 20.0 |
| A2A | 2K66A2A | 2.8 |
| A2B[1] | 2K66A2B | 2.8 |
| A2D[12] | 16K0A2D | 20.0 |
| A3E | 6K00A3E | 8.0 |
| A3N[2] | 2K66A3N | 2.8 |
| A3X[3] | 3K20A3X | 25.0 |
| F1B[4] | 280HF1B | 0.3 |
| F1B[5] | 300HF1B | 0.5 |
| F1B[6] | 16KOF1B | 20.0 |
| F1C | 2K80F1C | 3.0 |
| F1D[12] | 16K0F1D | 20.0 |
| F2B[6] | 16KOF2B | 20.0 |
| F2C[7] | 16KOF2C | 20.0 |
| F2D[12] | 16K0F2D | 20.0 |
| F3C | 2K80F3C | 3.0 |
| F3C[7] | 16KOF3C | 20.0 |
| F3E[8] | 16KOF3E | 20.0 |

[8]Applicable only when maximum frequency deviation is 5 kHz. See also paragraph (b) of this section.

**TEST CONFIGURATION**

Test setup for Analog:




**TEST PROCEDURE**

(1) Connect the equipment as illustrated

(2) Spectrum set as follow:

Centre frequency = the nominal EUT channel center frequency,

The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient)

RBW = 1% to 5% of the anticipated OBW, VBW ≥ 3 × RBW, Sweep = auto,

Detector function = peak, Trace = max hold

(3) Set 99% Occupied Bandwidth and 26dB Bandwidth

(4) Measure and record the results in the test report.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Please refer to appendix B on the section 6 appendix report

## 5.3 Emission Mask

**LIMIT**

FCC Part 80.211(f),FCC Part 2.1049

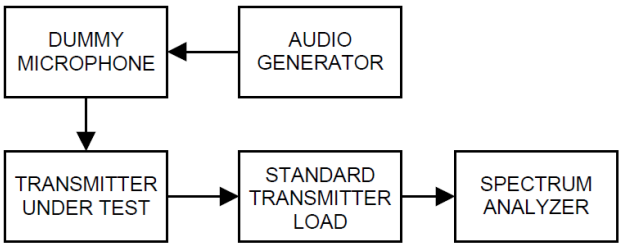
(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log10 (mean power in watts) dB.

**TEST CONFIGURATION**

Test setup for Analog:




**TEST PROCEDURE**

1) Connect the equipment as illustrated.
2) Spectrum set as follow:
   Centre frequency = fundamental frequency, span=120kHz for 12.5kHz channel spacing,
   RBW=100Hz, VBW=1000Hz, Sweep = auto,
   Detector function = peak, Trace = max hold
3) Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0dB reference for the measurement.
4) Apply Input Modulation Signal to EUT according to Section 3.4
5) Measure and record the results in the test report.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

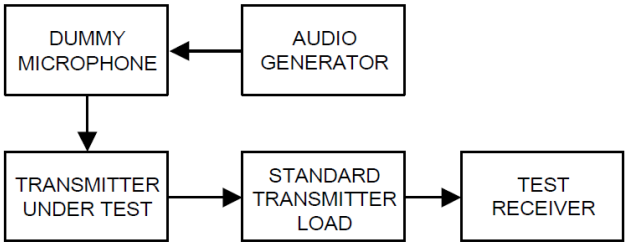
Please refer to appendix C on the section 6 appendix report

## 5.4 Modulation Limit

**LIMIT**

FCC Part 80.213,FCC Part 2.1047(b)
5kHz for 25 KHz Channel Spacing System

**TEST CONFIGURATION**




**TEST PROCEDURE**

1) Connect the equipment as illustrated.
2) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
3) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for ≤0.25 Hz to ≥15,000 Hz. Turn the de-emphasis function off.
4) Apply Input Modulation Signal to EUT according to Section 3.4 and vary the input level from –20 to +20dB.
5) Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level
6) Repeat step 4-5 with input frequency changing to 300Hz, 1004Hz, 1500Hz and 2500Hz in sequence.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

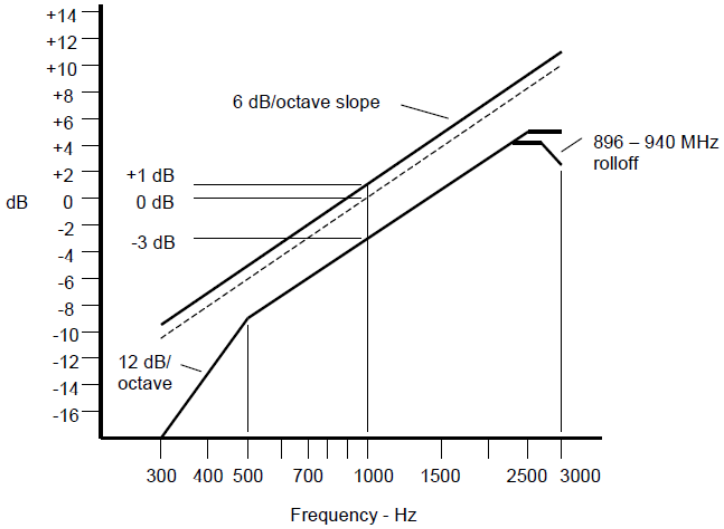
☒ **Passed** ☐ **Not Applicable**

Please refer to appendix D on the section 6 appendix report

## 5.5 Audio Frequency Response

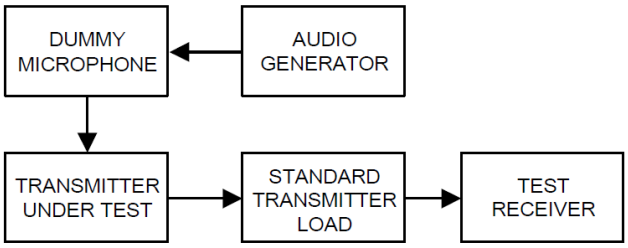
**LIMIT**

FCC Part 80.213(e) ,FCC Part 2.1047(a):
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. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.




An additional 6 dB per octave attenuation is allowed from 2500 Hz to 3000 Hz in equipment operating in the 25 MHz to 869 MHz range.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1) Connect the equipment as illustrated.
2) Set the test receiver to measure peak positive deviation. Set the audio bandwidth for 50 Hz to 15,000 Hz. Turn the de-emphasis function off.
3) Set the DMM to measure rms voltage.
4) Adjust the transmitter per the manufacturer's procedure for full rated system deviation.
5) Apply Input Modulation Signal to EUT according to Section 3.4
6) Set the test receiver to measure rms deviation and record the deviation reading.
7) Record the DMM reading as $V_{REF}$ .
8) Set the audio frequency generator to the desired test frequency between 300 Hz and 3000 Hz.
9) Vary the audio frequency generator output level until the deviation reading that was recorded in step 6) is obtained.
10) Record the DMM reading as $V_{FREQ}$
11) Calculate the audio frequency response at the present frequency as:
audio frequency response=$20\log_{10}$ ($V_{FREQ}/V_{REF}$).
12) Repeat steps 8) through 11) for all the desired test frequencies

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

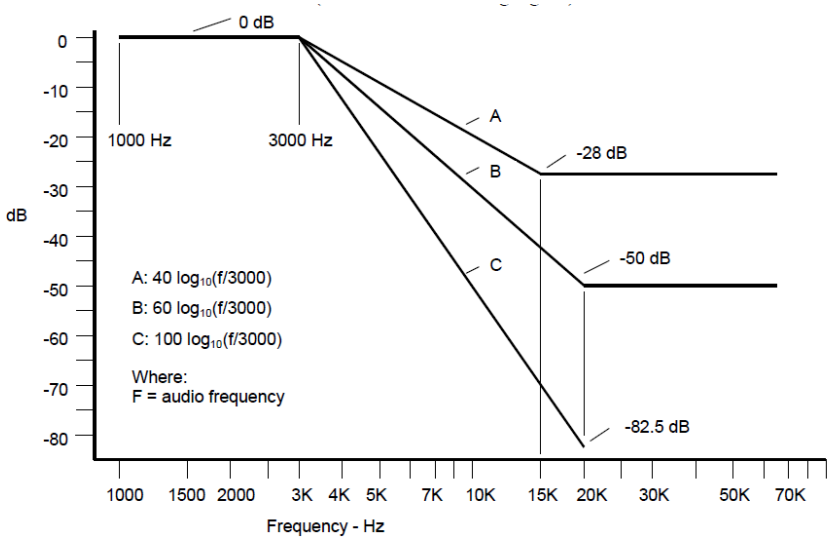
Please refer to appendix E on the section 6 appendix report

## 5.6 Audio Low Pass Filter Response

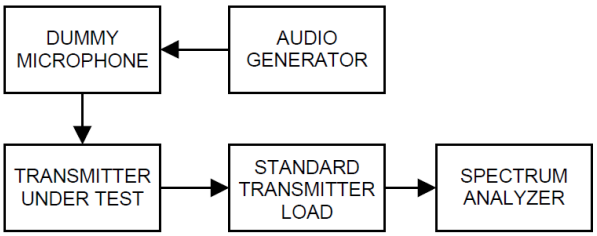
**LIMIT**

FCC Part 2.1047(b),FCC Part 80.213(e)

Coast station transmitters operated in the 156-162 MHz band must be equipped with an audio low-pass filter. The filter must be installed between the modulation limiter and the modulated radio frequency stage. At frequencies between 3 kHz and 20 kHz it must have an attenuation greater than at 1 kHz by at least 60log10(f/3) dB where “f” is the audio frequency in kilohertz. At frequencies above 20 kHz the attenuation must be at least 50 dB greater than at 1 kHz.




**TEST CONFIGURATION**




**TEST PROCEDURE**

1) Configure the EUT as shown in figure .
2) Apply a 1000 Hz tone from the audio signal generator and adjust the level per manufacturer’s specifications. Record the dB level of the 1000 Hz tone as $LEV_{REF}$.
3) Set the audio signal generator to the desired test frequency between 3000 Hz and the upper low pass filter limit. Record the dB level at the test frequency as $LEV_{FREQ.}$
4) Calculate the audio frequency response at the test frequency as:
   low pass filter response = $LEV_{FREQ}$ - $LEV_{REF}$

**TEST MODE:**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Please refer to appendix F on the section 8 appendix report

## 5.7 Frequency stability VS Temperature

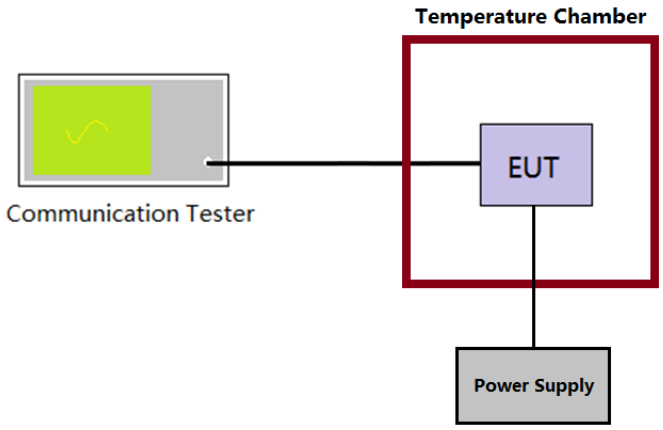
**LIMIT**

FCC Part 80.209， FCC Part 2.1055

| Frequency bands and categories of stations | Tolerances[1] |
|---|---|
| (5) Band 156-162 MHz: | |
| (i) Coast stations: | |
| For carriers licensed to operate with a carrier power: | |
| Below 3 watts | 10. |
| 3 to 100 watts | 5.[7] |
| (ii) Ship stations | 10.[4] |
| (iii) Survival craft stations operating on 121.500 MHz | 50. |
| (iv) EPIRBs: | |
| Operating on 121.500 and 243.000 MHz | 50. |
| Operating on 156.750 and 156.800 MHz.[6] | 10. |
| (6) Band 216-220 MHz: | |
| (i) Coast stations: | |
| For all emissions | 5. |
| (ii) Ship stations: | |
| For all emissions | 5. |
| (7) Band 400-466 MHz: | |
| (i) EPIRBs operating on 406-406.1 MHz | 5. |
| (ii) On-board stations | 5. |
| (iii) Radiolocation and telecommand stations. | 5. |
| (8) Band 1626.5-1646.5 MHz: | |
| (i) Ship earth stations | 5. |

[7]For transmitters operated at private coast stations with antenna heights less than 6 meters (20 feet) above ground and output power of 25 watts or less the frequency tolerance is 10 parts in $10^6$.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1) The EUT output port was connected to communication tester.

2) The EUT was placed inside the temperature chamber.

3) Turn EUT off and set the chamber temperature to –30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency as $MCF_{MHz}$.

*4)* Calculate the ppm frequency error by the following:
*ppm error=*$(MCF_{MHz}/ACF_{MHz}-1)*10^6$
*where*
$MCF_{MHz}$ *is the Measured Carrier Frequency in MHz*
$ACF_{MHz}$ *is the Assigned Carrier Frequency in MHz*

5) Repeat step 3 measure with 10°C increased per stage until the highest temperature of +50°C reached.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Please refer to appendix G on the section 6 appendix report

## 5.8 Frequency stability VS Voltage

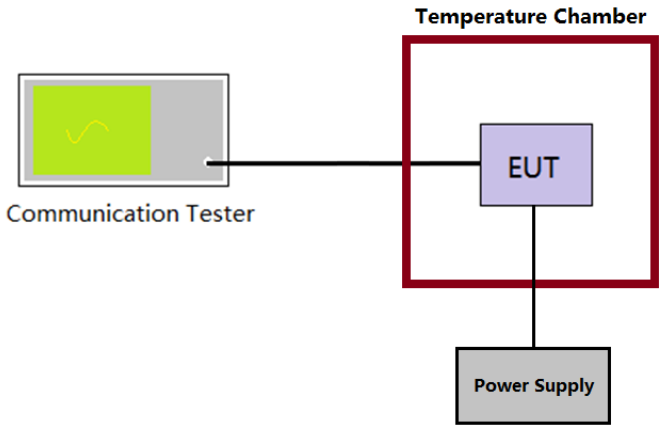
**LIMIT**

FCC Part 80.209， FCC Part 2.1055

| Frequency bands and categories of stations | Tolerances[1] |
|---|---|
| (5) Band 156-162 MHz: | |
| (i) Coast stations: | |
| For carriers licensed to operate with a carrier power: | |
| Below 3 watts | 10. |
| 3 to 100 watts | 5.[7] |
| (ii) Ship stations | 10.[4] |
| (iii) Survival craft stations operating on 121.500 MHz | 50. |
| (iv) EPIRBs: | |
| Operating on 121.500 and 243.000 MHz | 50. |
| Operating on 156.750 and 156.800 MHz.[6] | 10. |
| (6) Band 216-220 MHz: | |
| (i) Coast stations: | |
| For all emissions | 5. |
| (ii) Ship stations: | |
| For all emissions | 5. |
| (7) Band 400-466 MHz: | |
| (i) EPIRBs operating on 406-406.1 MHz | 5. |
| (ii) On-board stations | 5. |
| (iii) Radiolocation and telecommand stations. | 5. |
| (8) Band 1626.5-1646.5 MHz: | |
| (i) Ship earth stations | 5. |

[7]For transmitters operated at private coast stations with antenna heights less than 6 meters (20 feet) above ground and output power of 25 watts or less the frequency tolerance is 10 parts in $10^6$.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1) The EUT output port was connected to communication tester.

2) The EUT was placed inside the temperature chamber at 25°C

3) Record the carrier frequency of the transmitter as $MCF_{MHZ}$

*4)* Calculate the ppm frequency error by the following:
*ppm error=*$(MCF_{MHz}/ACF_{MHz}-1)*10^6$
*where*
$MCF_{MHz}$ *is the Measured Carrier Frequency in MHz*
$ACF_{MHz}$ *is the Assigned Carrier Frequency in MHz*

5) Repeat step 3 measure with varied ±15% of the nominal value measured at the input to the EUT

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Please refer to appendix H on the section 6 appendix report

## 5.9 Transmit Conducted Spurious Emission

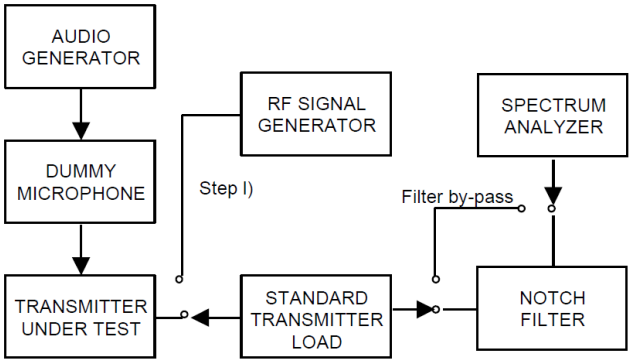
**LIMIT**

FCC Part 80.211(f)(3), FCC Part 2.1051

| FCC Rules | Attenuation Limit (dBc) |
|---|---|
| § 80.211(f)(3) | At least 43 +10log10 (mean power in watts) dB |

*43 + 10 log (Pwatts)*
*Calculation: Limit (dBm) =EL-43-10log10 (TP)*
*Notes: EL is the emission level of the Output Power expressed in dBm,*
*In this application, the EL is P( dBm).*
*Limit (dBm) = P( dBm)-43-10 log (Pwatts) = -13 dBm*

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. Connect the equipment as illustrated, with the notch filter by-passed.
2. Apply Input Modulation Signal to EUT according to Section 3.4
3. Adjust the spectrum analyzer for the following settings:
   Below 1GHz: RBW=100kHz, VBW=300kHz
   Above 1GHz: RBW=1MHz, VBW=3MHz
   Detector=Peak, Sweep time=Auto, Trace=Max hold
4. Scan frequency range up to 10$^{th}$ harmonic.
5. Record the frequencies and levels of spurious emissions

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Please refer to appendix I on the section 6 appendix report

## 5.10 Transmitter Radiated Spurious Emission

Radiated spurious emissions are emissions from the equipment when transmitting into a nonradiating load on a frequency or frequencies that are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

**LIMIT**

FCC Part 80.211(f)(3), FCC Part 2.1051

| FCC Rules | Attenuation Limit (dBc) |
|---|---|
| § 80.211(f)(3) | At least 43 +10log10 (mean power in watts) dB |

*43 + 10 log (Pwatts)*

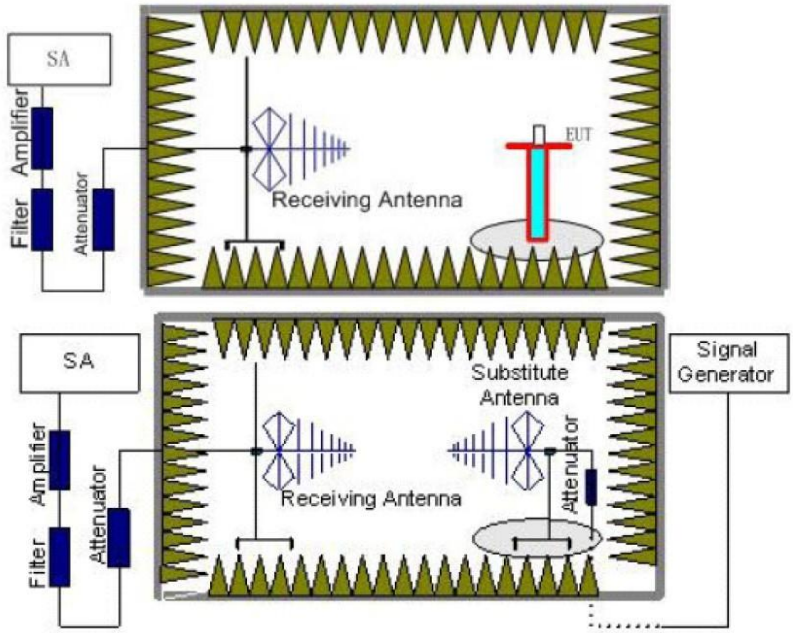
*Calculation: Limit (dBm) =EL-43-10log10 (TP)*

*Notes: EL is the emission level of the Output Power expressed in dBm,*
*In this application, the EL is P( dBm).*

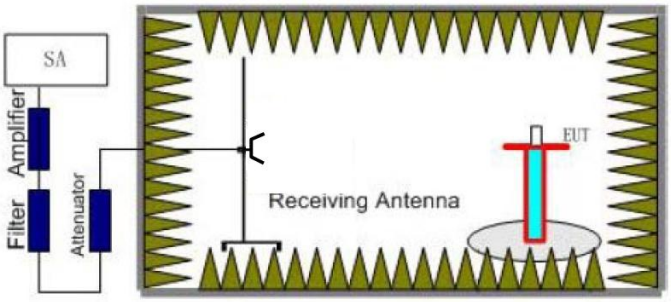
*Limit (dBm) = P( dBm)-43-10 log (Pwatts) = -13 dBm*

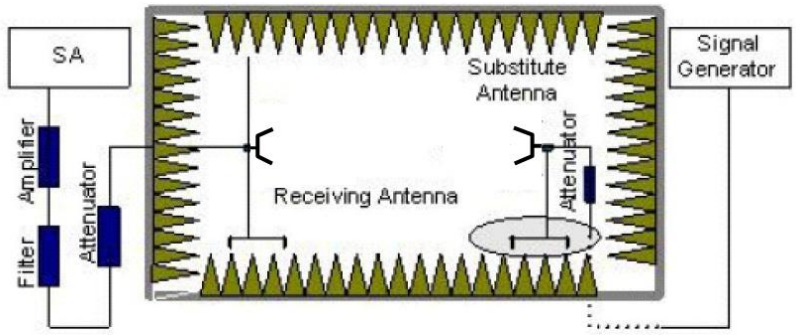
**TEST CONFIGURATION**

**Below 1GHz:**




**Above 1GHz:**






**TEST PROCEDURE**

1. Standard Transmitter Load with a 50Ω input impedance and an output impedance matched to the test equipment.
2. 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 height of receiving antenna is 1. 0 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.
3. 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.
4. 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).
5. 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.
6. 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
   We used SMF100A micowave signal generator which signal level can up to 33dBm,so we not used power Amplifier for substituation test; 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.
8. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

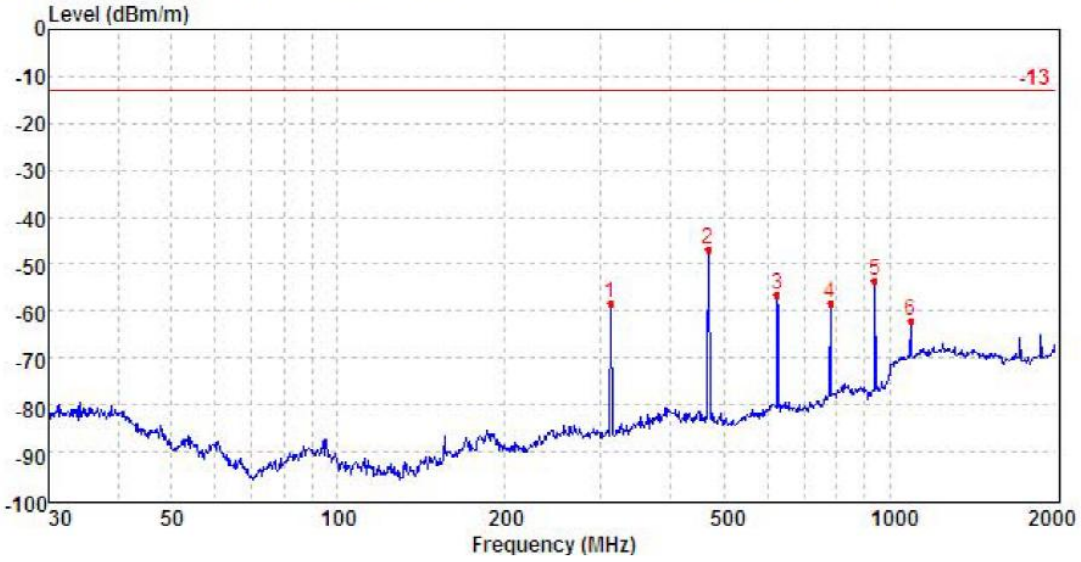
**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

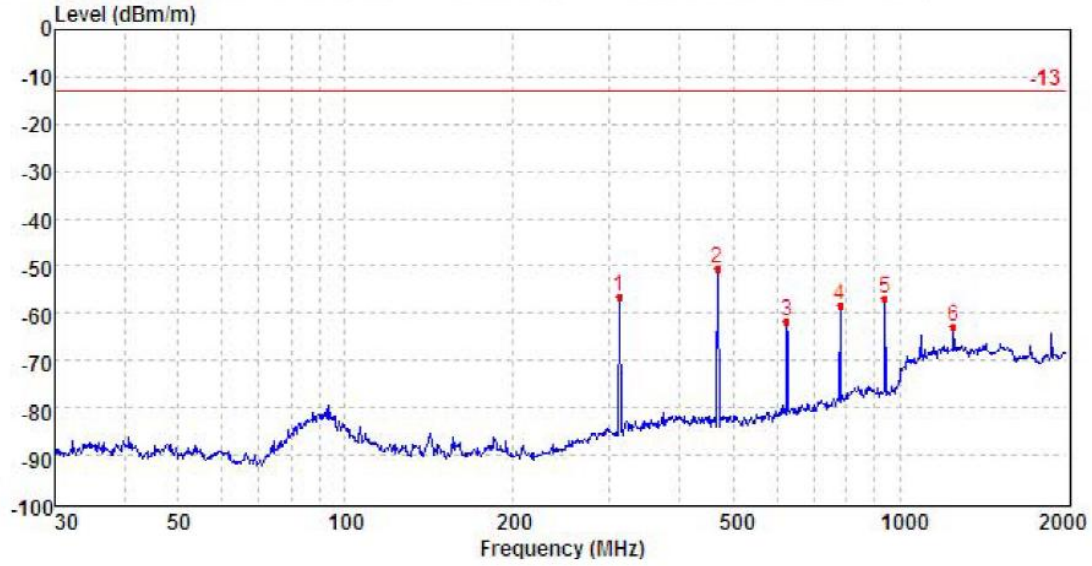
☒ **Passed** ☐ **Not Applicable**

| TEST MODE | TX-AWH | Test Channel: | $CH_L$ | Polarity: | Horizontal |
|---|---|---|---|---|---|



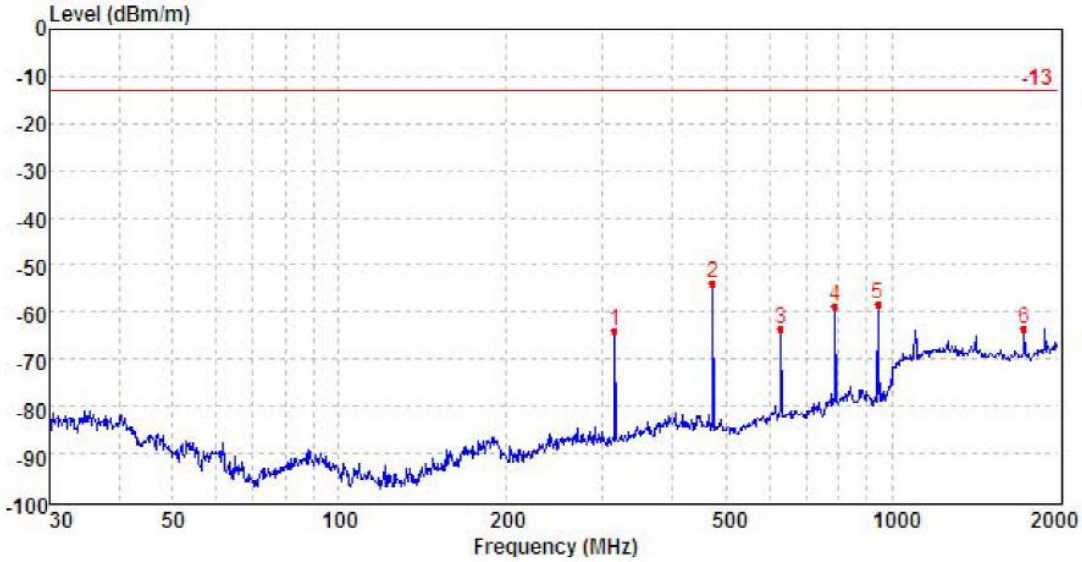

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 312.51 | -53.38 | 23.40 | 2.02 | 30.27 | -58.23 | -13.00 | -45.23 | Peak |
| 2 | 469.66 | -44.77 | 26.11 | 2.54 | 30.59 | -46.71 | -13.00 | -33.71 | Peak |
| 3 | 624.90 | -57.08 | 28.82 | 3.00 | 31.24 | -56.50 | -13.00 | -43.50 | Peak |
| 4 | 780.68 | -61.68 | 29.99 | 3.42 | 30.25 | -58.52 | -13.00 | -45.52 | Peak |
| 5 | 939.13 | -57.39 | 29.22 | 3.78 | 29.31 | -53.70 | -13.00 | -40.70 | Peak |
| 6 | 1092.41 | -71.67 | 34.94 | 4.07 | 29.40 | -62.06 | -13.00 | -49.06 | Peak |

| TEST MODE | TX-AWH | Test Channel: | $CH_L$ | Polarity: | Vertical |
|---|---|---|---|---|---|



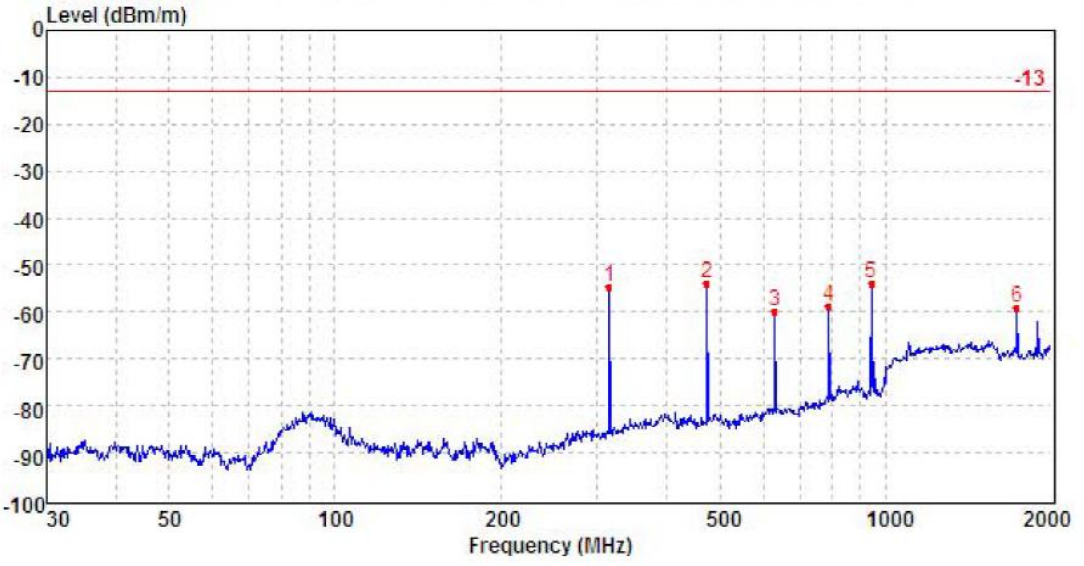

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 312.51 | -52.41 | 23.97 | 2.02 | 30.27 | -56.69 | -13.00 | -43.69 | Peak |
| 2 | 469.66 | -48.28 | 25.93 | 2.54 | 30.59 | -50.40 | -13.00 | -37.40 | Peak |
| 3 | 624.90 | -61.72 | 28.31 | 3.00 | 31.24 | -61.65 | -13.00 | -48.65 | Peak |
| 4 | 780.68 | -61.14 | 29.49 | 3.42 | 30.25 | -58.48 | -13.00 | -45.48 | Peak |
| 5 | 939.13 | -60.16 | 28.95 | 3.78 | 29.31 | -56.74 | -13.00 | -43.74 | Peak |
| 6 | 1249.55 | -75.06 | 37.08 | 4.41 | 29.39 | -62.96 | -13.00 | -49.96 | Peak |

| TEST MODE | TX-AWH | Test Channel: | $CH_H$ | Polarity: | Horizontal |
|---|---|---|---|---|---|




| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 315.14 | -59.16 | 23.45 | 2.03 | 30.26 | -63.94 | -13.00 | -50.94 | Peak |
| 2 | 473.62 | -51.89 | 26.10 | 2.55 | 30.64 | -53.88 | -13.00 | -40.88 | Peak |
| 3 | 630.17 | -64.40 | 28.97 | 3.03 | 31.26 | -63.66 | -13.00 | -50.66 | Peak |
| 4 | 790.58 | -62.24 | 29.97 | 3.46 | 29.90 | -58.71 | -13.00 | -45.71 | Peak |
| 5 | 943.08 | -62.17 | 29.37 | 3.78 | 29.29 | -58.31 | -13.00 | -45.31 | Peak |
| 6 | 1733.87 | -76.26 | 36.48 | 5.36 | 29.19 | -63.61 | -13.00 | -50.61 | Peak |

| TEST MODE | TX-AWH | Test Channel: | $CH_H$ | Polarity: | Vertical |
|---|---|---|---|---|---|




| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 315.14 | -50.63 | 24.05 | 2.03 | 30.26 | -54.81 | -13.00 | -41.81 | Peak |
| 2 | 473.62 | -52.04 | 26.20 | 2.55 | 30.64 | -53.93 | -13.00 | -40.93 | Peak |
| 3 | 630.17 | -60.13 | 28.43 | 3.03 | 31.26 | -59.93 | -13.00 | -46.93 | Peak |
| 4 | 790.58 | -61.80 | 29.48 | 3.46 | 29.90 | -58.76 | -13.00 | -45.76 | Peak |
| 5 | 943.08 | -57.64 | 29.08 | 3.78 | 29.29 | -54.07 | -13.00 | -41.07 | Peak |
| 6 | 1733.87 | -71.51 | 36.32 | 5.36 | 29.19 | -59.02 | -13.00 | -46.02 | Peak |

## 5.11 AC Power Line Conducted Spurious Emission

The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm / 50 u Henry as specified by section 5.1 of ANSI C63.4. Cables and peripherals were moved to find the maximum emission levels for each frequency.

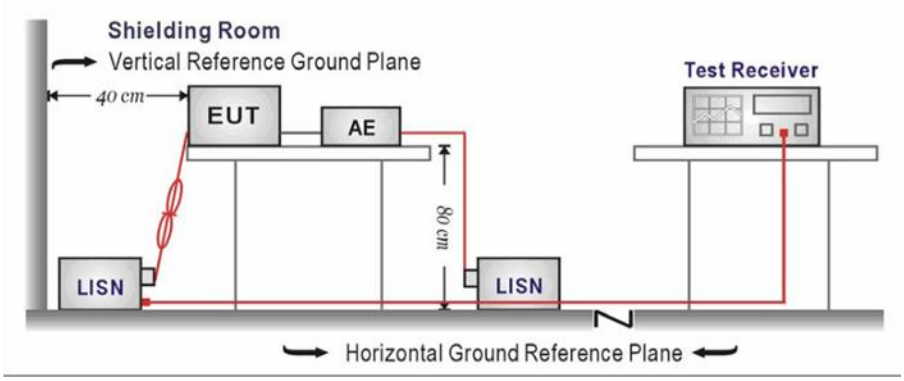
**Limit**

FCC CFR Title 47 Part 15 Subpart C Section 15.207:

| Frequency range (MHz) | Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor,was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

**TEST MODE**

Please reference to the section 3.4

**TEST RESULTS**

☐ **Passed** ☒ **Not Applicable**

## 5.12 Radiated Emission

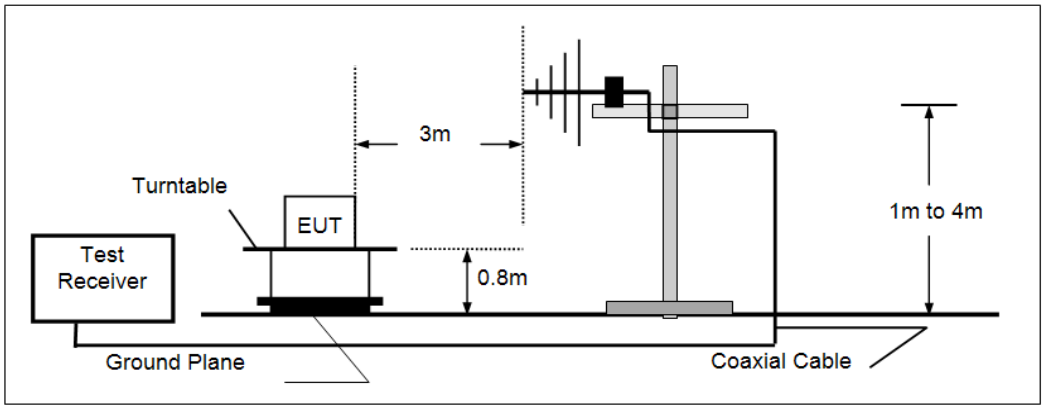
**LIMIT**

FCC CFR Title 47 Part 15 Subpart C Section 15.209

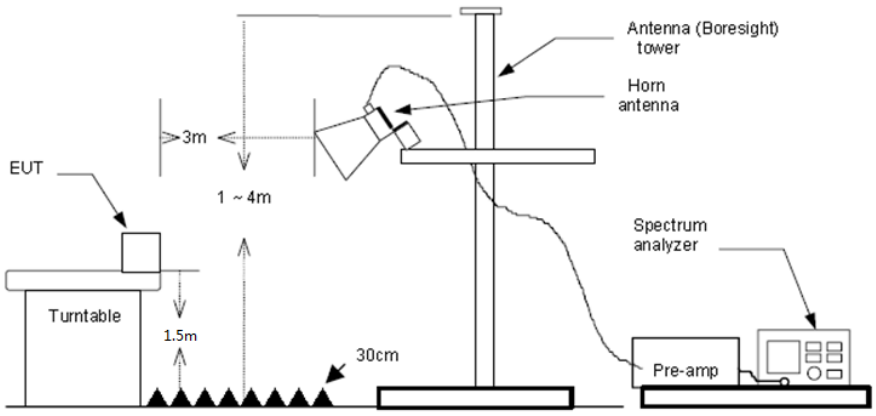
| Frequency | Limit (dBuV/m @3m) | Value |
|---|---|---|
| 30MHz-88MHz | 40.00 | Quasi-peak |
| 88MHz-216MHz | 43.50 | Quasi-peak |
| 216MHz-960MHz | 46.00 | Quasi-peak |
| 960MHz-1GHz | 54.00 | Quasi-peak |
| Above 1GHz | 54.00 | Average |
| | 74.00 | Peak |

**TEST CONFIGURATION**

- 30MHz ~ 1GHz




- Above 1GHz



**TEST PROCEDURE**

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Below 1 GHz:
   RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
   If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
   (3) From 1 GHz to $10^{th}$ harmonic:
   RBW=1MHz, VBW=3MHz Peak detector for Peak value.
   RBW=1MHz, VBW=3MHz RMS detector for Average value.

**TEST MODE**

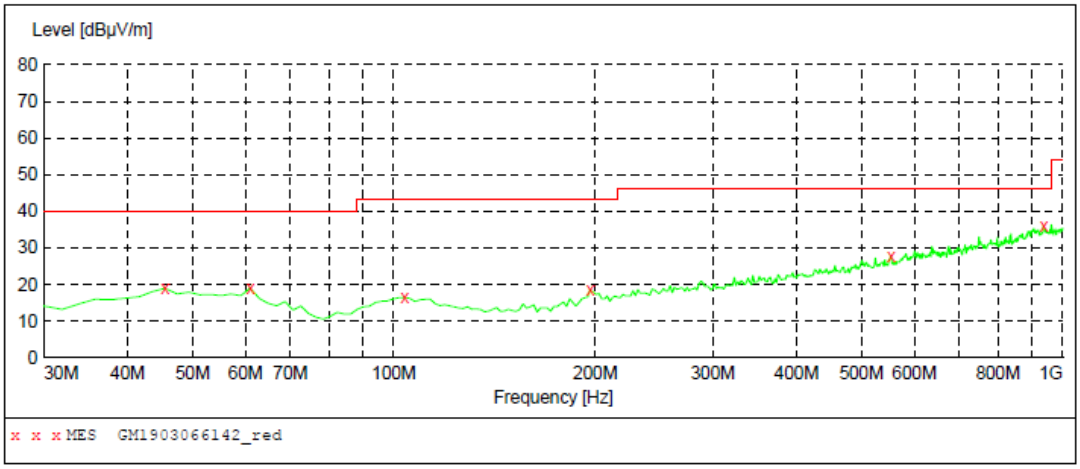
Please reference to the section 3.4

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

Note:
The EUT shall be scanned from 30 MHz to the 5th harmonic of the highest oscillator frequency in the digital devices or 1 GHz whichever is higher.

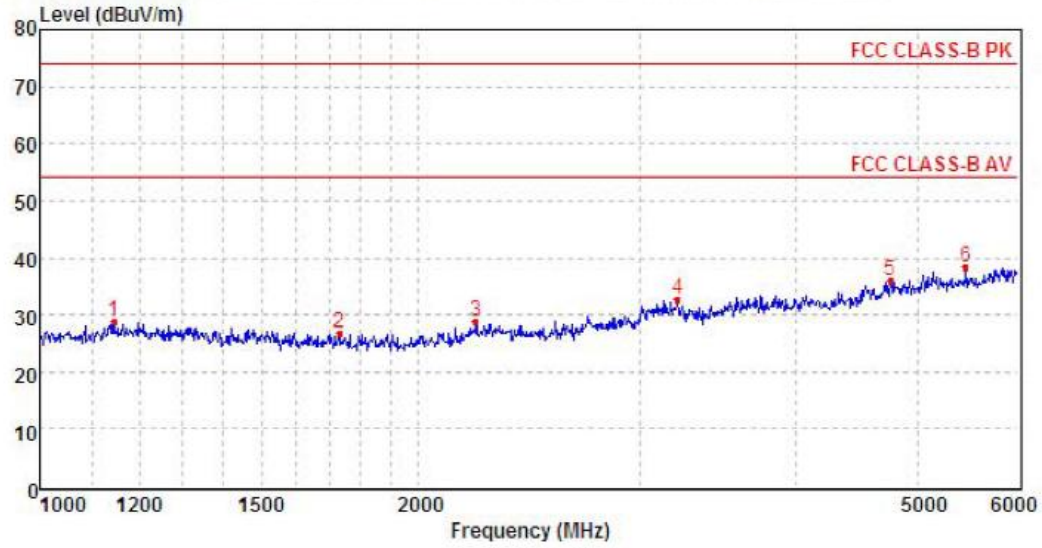
| TEST MODE | RX-GPS+US Weather Channel | Polarity: | Horizontal |
|---|---|---|---|




***MEASUREMENT RESULT: "GM1903066142_red"***

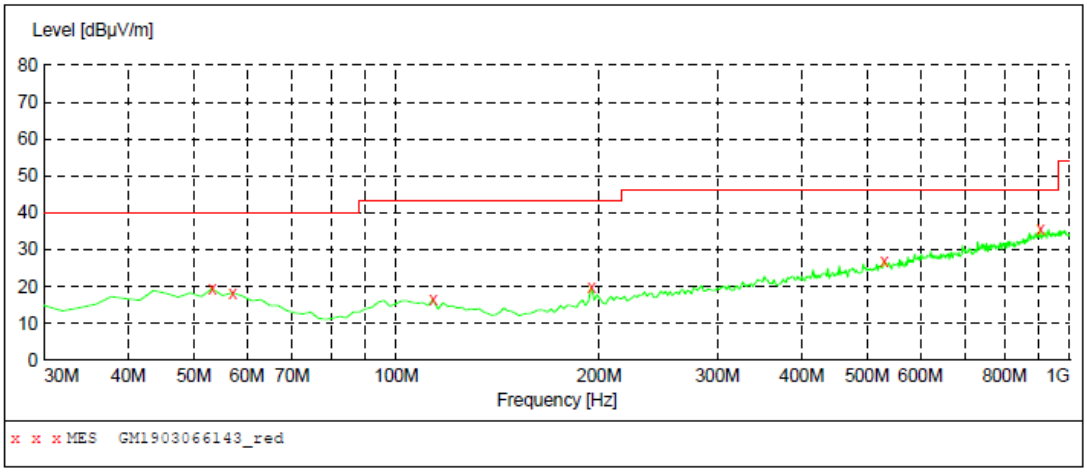
3/6/2019 10:36PM

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---|---|---|---|---|---|---|---|---|
| 45.520000 | 19.00 | -8.7 | 40.0 | 21.0 | QP | 100.0 | 171.00 | HORIZONTAL |
| 61.040000 | 19.10 | -10.2 | 40.0 | 20.9 | QP | 100.0 | 251.00 | HORIZONTAL |
| 103.720000 | 16.50 | -10.3 | 43.5 | 27.0 | QP | 100.0 | 91.00 | HORIZONTAL |
| 196.840000 | 18.50 | -9.5 | 43.5 | 25.0 | QP | 100.0 | 286.00 | HORIZONTAL |
| 553.800000 | 27.60 | 0.0 | 46.0 | 18.4 | QP | 100.0 | 359.00 | HORIZONTAL |
| 935.980000 | 35.80 | 8.1 | 46.0 | 10.2 | QP | 100.0 | 0.00 | HORIZONTAL |




| Mark | Frequency MHz | Reading dBuV/m | Antenna dB | Cable dB | Preamp dB | Level dBuV/m | Limit dBuV/m | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1145.88 | 35.56 | 25.88 | 4.54 | 37.26 | 28.72 | 74.00 | -45.28 | Peak |
| 2 | 1730.27 | 33.09 | 25.26 | 5.82 | 37.33 | 26.84 | 74.00 | -47.16 | Peak |
| 3 | 2223.59 | 32.36 | 27.64 | 6.48 | 37.60 | 28.88 | 74.00 | -45.12 | Peak |
| 4 | 3216.29 | 33.78 | 28.70 | 7.74 | 37.38 | 32.84 | 74.00 | -41.16 | Peak |
| 5 | 4753.26 | 30.77 | 31.41 | 9.52 | 35.82 | 35.88 | 74.00 | -38.12 | Peak |
| 6 | 5456.44 | 31.04 | 31.73 | 10.17 | 34.50 | 38.44 | 74.00 | -35.56 | Peak |

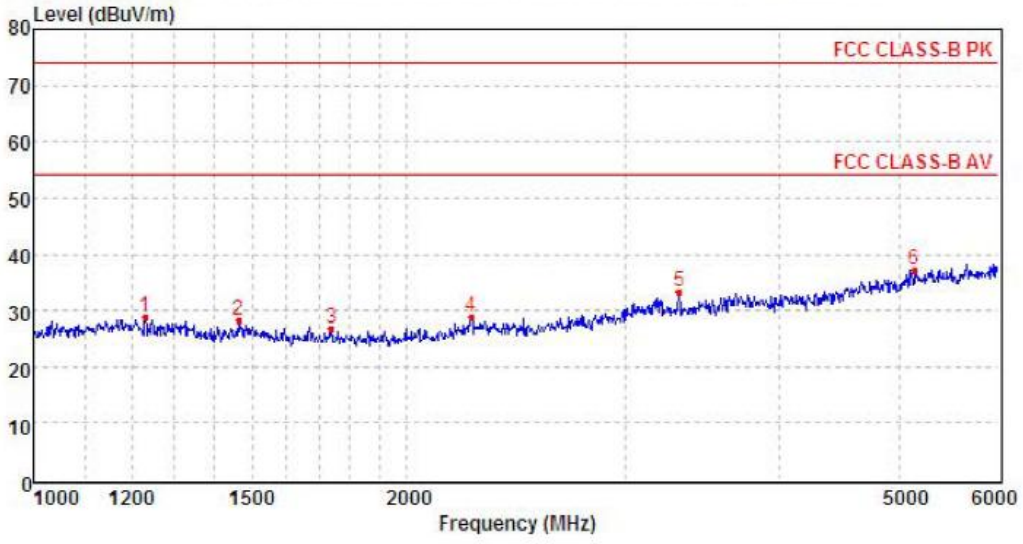
| TEST MODE | RX-GPS+US Weather Channel | Polarity: | Vertical |
|---|---|---|---|




***MEASUREMENT RESULT: "GM1903066143_red"***

3/6/2019 10:40PM

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---|---|---|---|---|---|---|---|---|
| 53.280000 | 19.40 | -9.0 | 40.0 | 20.6 | QP | 100.0 | 0.00 | VERTICAL |
| 57.160000 | 18.30 | -9.3 | 40.0 | 21.7 | QP | 100.0 | 126.00 | VERTICAL |
| 113.420000 | 16.50 | -11.1 | 43.5 | 27.0 | QP | 100.0 | 171.00 | VERTICAL |
| 194.900000 | 19.90 | -9.8 | 43.5 | 23.6 | QP | 100.0 | 136.00 | VERTICAL |
| 530.520000 | 26.80 | -0.5 | 46.0 | 19.2 | QP | 100.0 | 3.00 | VERTICAL |
| 904.940000 | 35.50 | 7.7 | 46.0 | 10.5 | QP | 100.0 | 217.00 | VERTICAL |




| Mark | Frequency MHz | Reading dBuV/m | Antenna dB | Cable dB | Preamp dB | Level dBuV/m | Limit dBuV/m | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1231.02 | 35.00 | 26.27 | 4.71 | 37.21 | 28.77 | 74.00 | -45.23 | Peak |
| 2 | 1464.69 | 34.41 | 25.83 | 5.18 | 37.09 | 28.33 | 74.00 | -45.67 | Peak |
| 3 | 1739.60 | 33.09 | 25.28 | 5.84 | 37.34 | 26.87 | 74.00 | -47.13 | Peak |
| 4 | 2255.70 | 31.93 | 27.84 | 6.53 | 37.59 | 28.71 | 74.00 | -45.29 | Peak |
| 5 | 3315.76 | 34.58 | 28.20 | 7.86 | 37.29 | 33.35 | 74.00 | -40.65 | Peak |
| 6 | 5133.96 | 30.83 | 31.76 | 9.78 | 35.11 | 37.26 | 74.00 | -36.74 | Peak |

# 6 APPENDIX REPORT

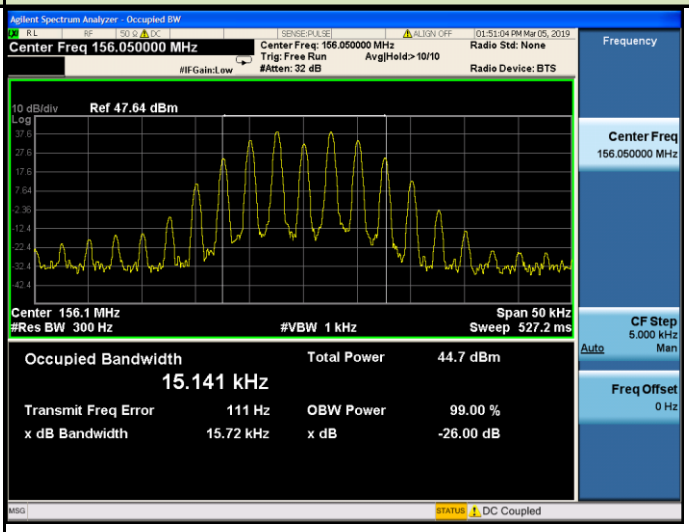
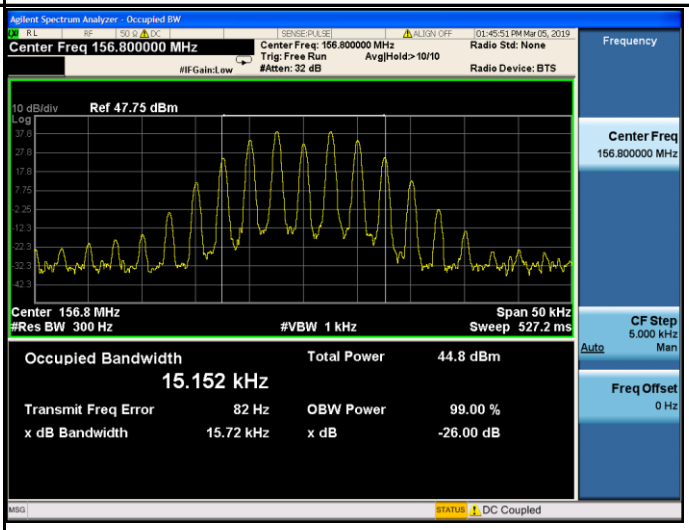
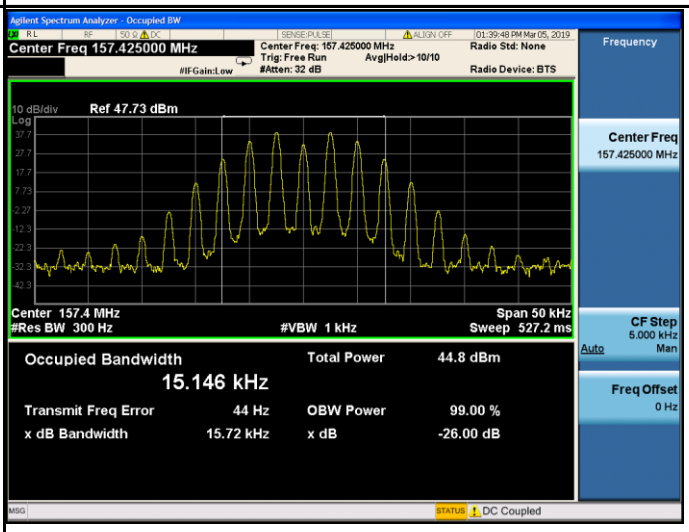
**Appendix A:Maximum Transmitter Power**

| Operation Mode | Modulation Type | Test Channel | Measured Power(dBm) | Measured Power(W) | Rated Power(W) | Percentage (%) | Limit (%) | Result |
|---|---|---|---|---|---|---|---|---|
| TX-AWH | FM | $CH_L$ | 43.9 | 24.38 | 25.00 | -2.5 | ±20 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 43.9 | 24.32 | 25.00 | -2.7 | ±20 | PASS |
| TX-AWH | FM | $CH_H$ | 43.9 | 24.27 | 25.00 | -2.9 | ±20 | PASS |
| TX-AWL | FM | $CH_L$ | 29.1 | 0.81 | 1.00 | -18.9 | ±20 | PASS |
| TX-AWL | FM | $CH_{M2}$ | 29.1 | 0.81 | 1.00 | -18.9 | ±20 | PASS |
| TX-AWL | FM | $CH_H$ | 29.1 | 0.81 | 1.00 | -19.1 | ±20 | PASS |

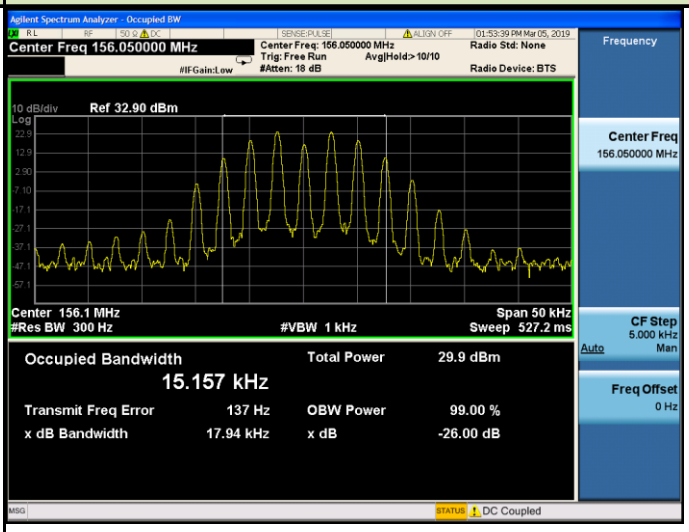
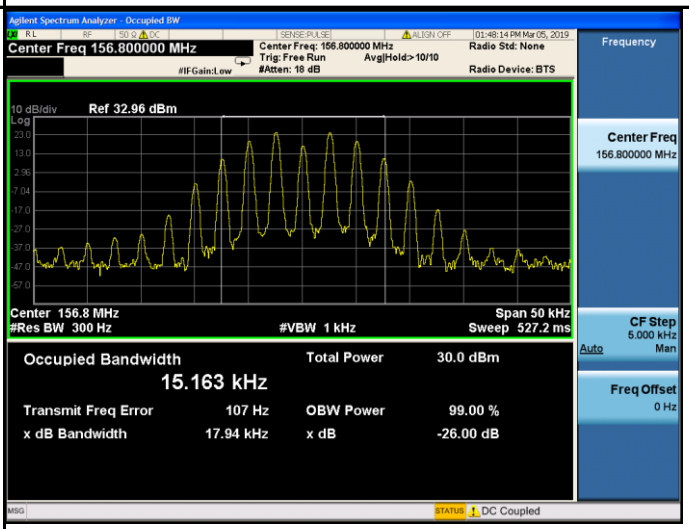
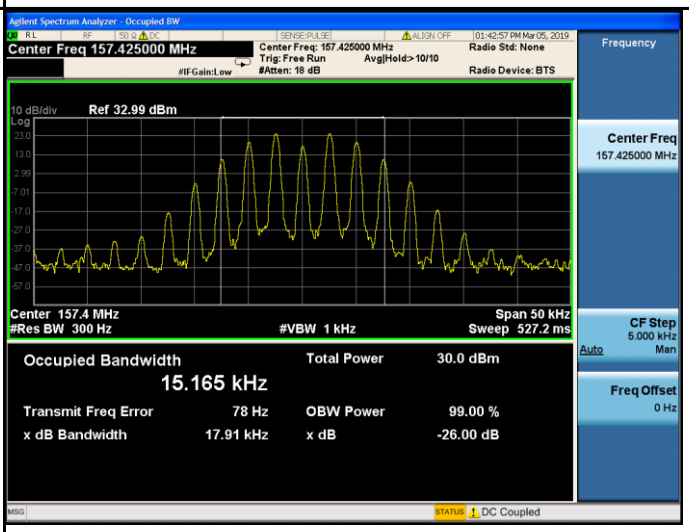
**Appendix B:Occupied Bandwidth**

| Operation Mode | Modulation Type | Test Channel | Occupied Bandwidth | | 99% Limit(kHz) | Result |
|---|---|---|---|---|---|---|
| | | | 99%(kHz) | 26dB(kHz) | | |
| TX-AWH | FM | $CH_L$ | 15.141 | 15.720 | ⩽20 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 15.152 | 15.720 | ⩽20 | PASS |
| TX-AWH | FM | $CH_H$ | 15.146 | 15.720 | ⩽20 | PASS |
| TX-AWL | FM | $CH_L$ | 15.157 | 17.940 | ⩽20 | PASS |
| TX-AWL | FM | $CH_{M2}$ | 15.163 | 17.940 | ⩽20 | PASS |
| TX-AWL | FM | $CH_H$ | 15.165 | 17.910 | ⩽20 | PASS |

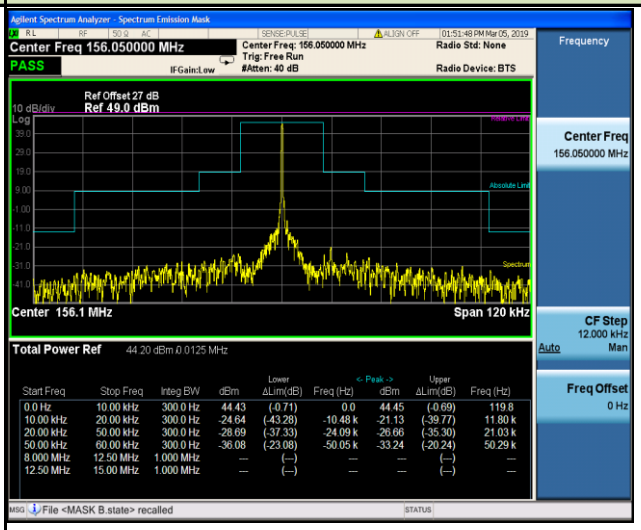
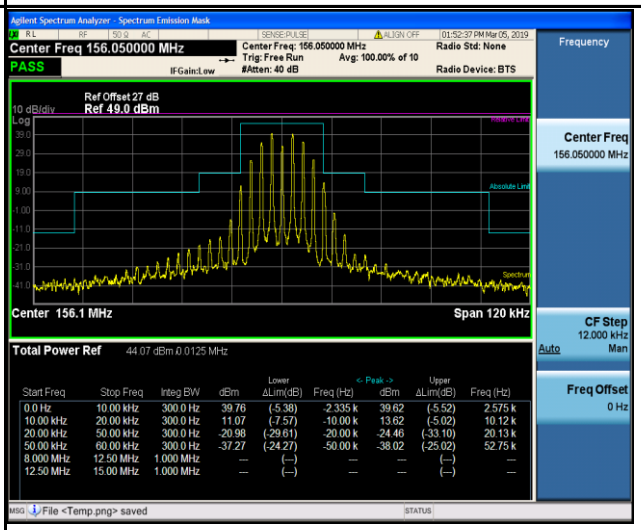
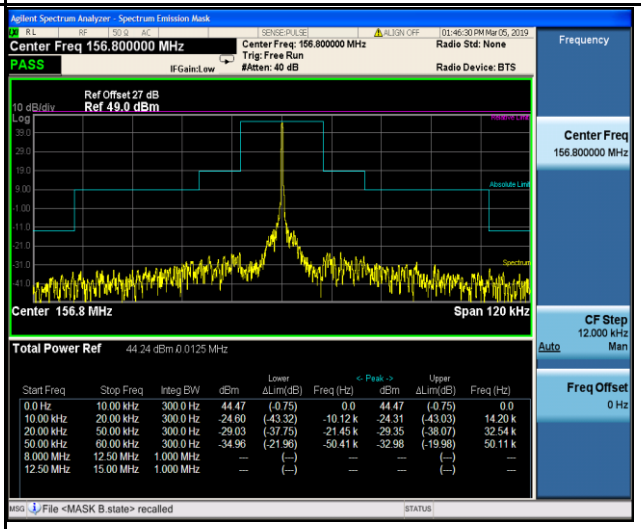
## Appendix B:Occupied Bandwidth

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWH | FM | $CH_L$ |  |
| TX-AWH | FM | $CH_{M2}$ |  |
| TX-AWH | FM | $CH_H$ |  |

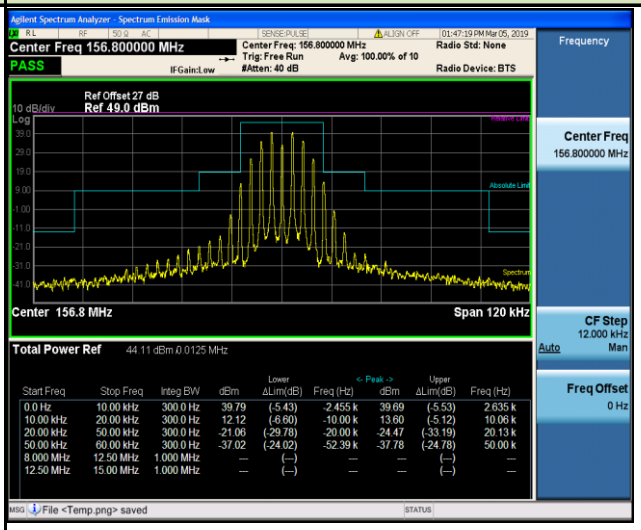
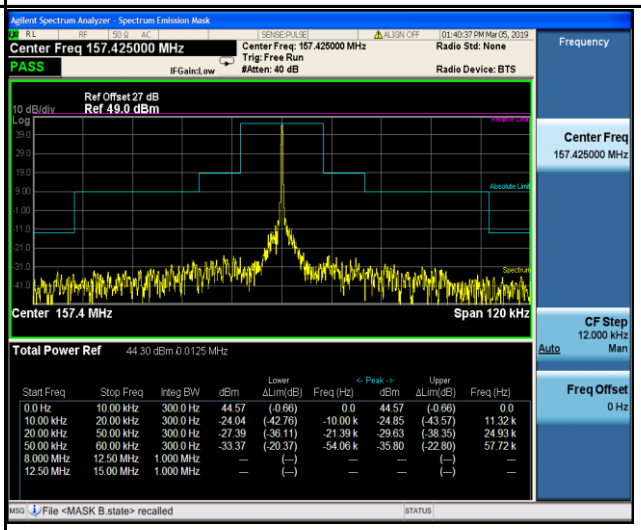
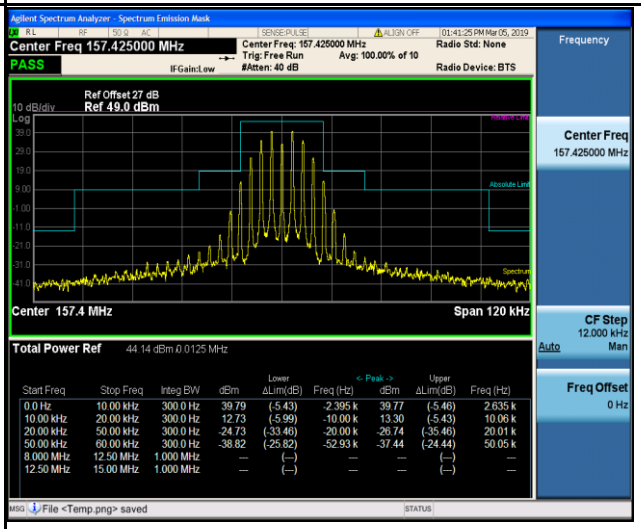
## Appendix B:Occupied Bandwidth

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWL | FM | $CH_L$ |  |
| TX-AWL | FM | $CH_{M2}$ |  |
| TX-AWL | FM | $CH_H$ |  |

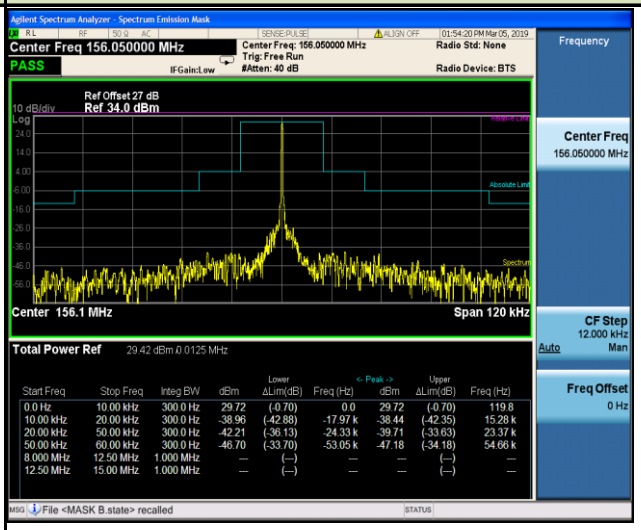
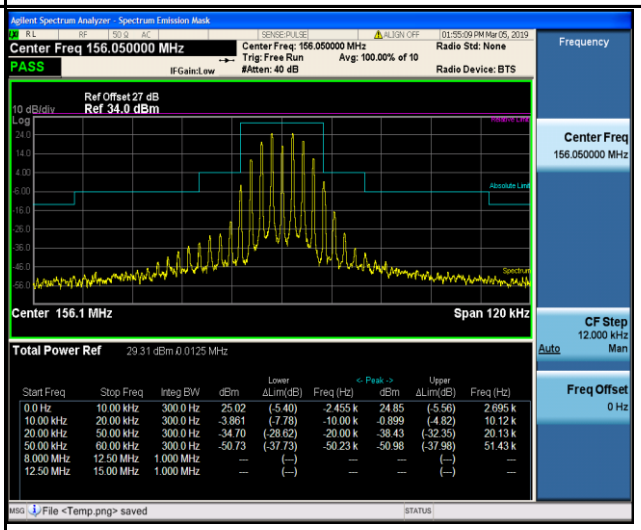
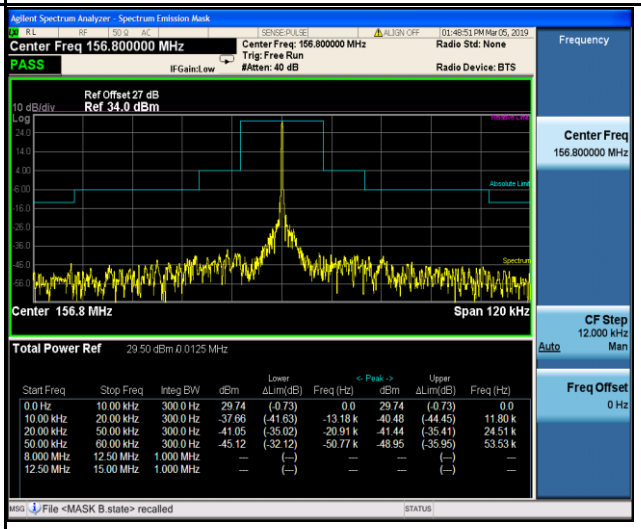
## Appendix C:Emission Mask

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWH | FM | $CH_L$ |  |
| TX-AWH | FM | $CH_L$ |  |
| TX-AWH | FM | $CH_{M2}$ |  |

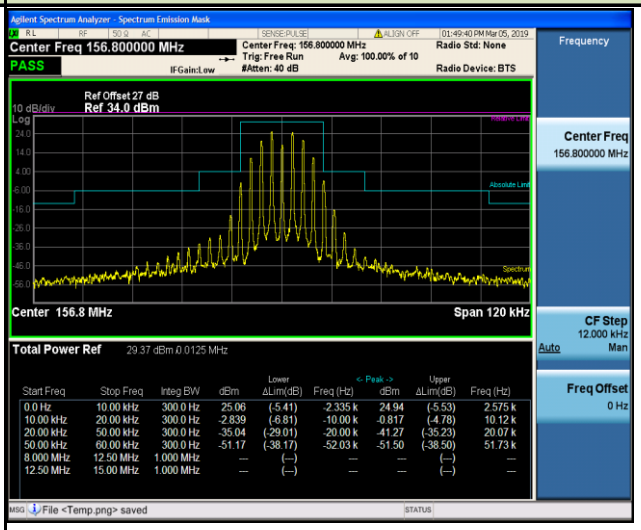
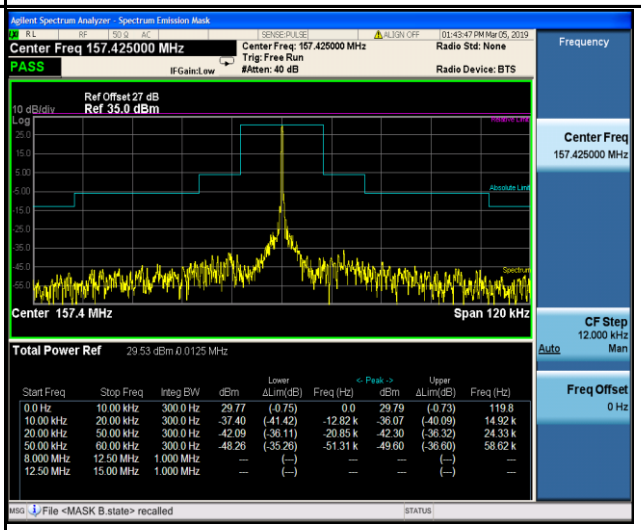
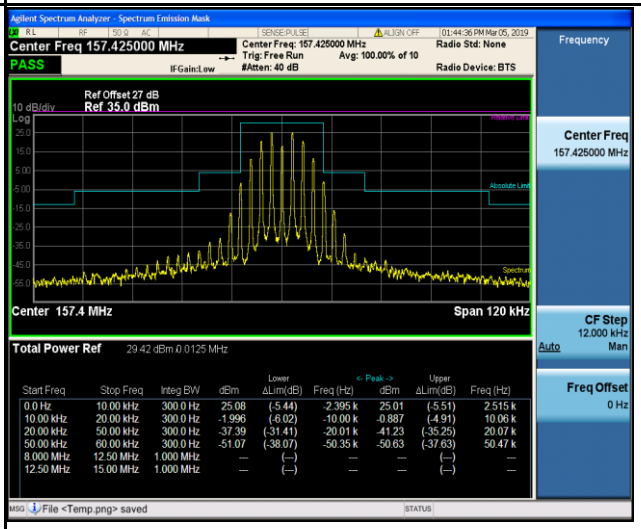
## Appendix C:Emission Mask

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWH | FM | $CH_{M2}$ |  |
| TX-AWH | FM | $CH_{H}$ |  |
| TX-AWH | FM | $CH_{H}$ |  |

## Appendix C:Emission Mask

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWL | FM | $CH_L$ |  |
| TX-AWL | FM | $CH_L$ |  |
| TX-AWL | FM | $CH_{M2}$ |  |

## Appendix C:Emission Mask

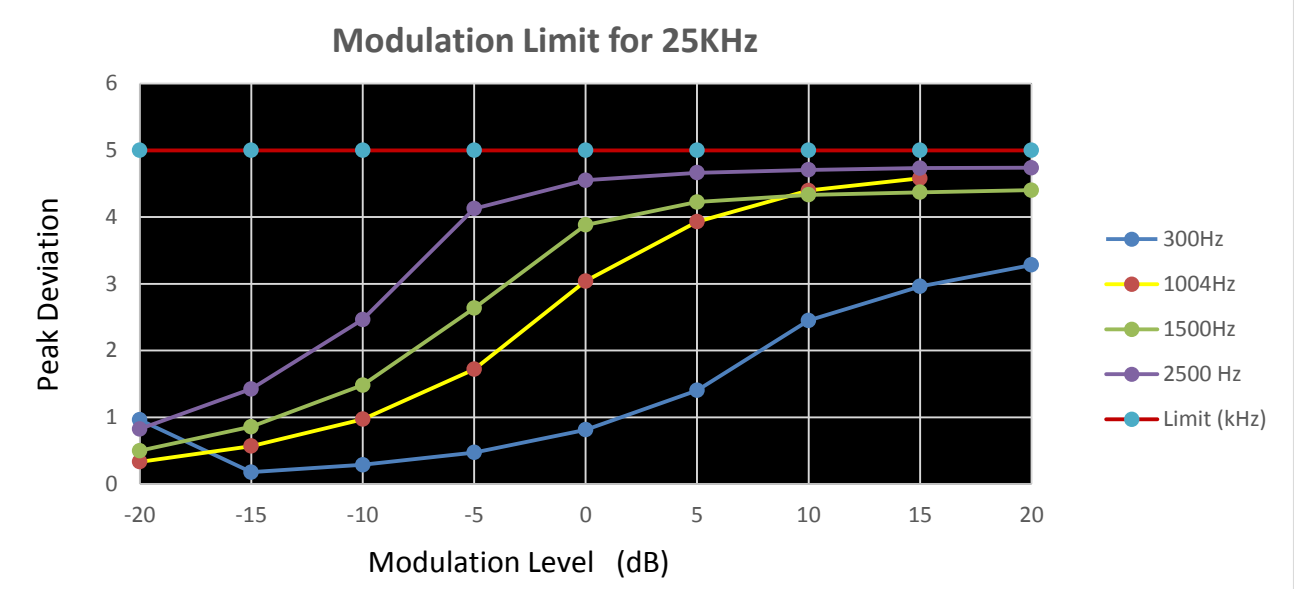
| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWL | FM | $CH_{M2}$ |  |
| TX-AWL | FM | $CH_{H}$ |  |
| TX-AWL | FM | $CH_{H}$ |  |

**Appendix D:Modulation Limit**

| Operation Mode | Modulation Type | Test Channel | Modulation Level (dB) | Peak frequency deviation (kHz) | | | | Limit (kHz) | Result |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 300Hz | 1004Hz | 1500Hz | 2500 Hz | | |
| TX-AWH | FM | $CH_{M2}$ | -20 | 0.962 | 0.334 | 0.5 | 0.825 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | -15 | 0.178 | 0.568 | 0.859 | 1.425 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | -10 | 0.287 | 0.971 | 1.483 | 2.465 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | -5 | 0.472 | 1.72 | 2.635 | 4.126 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 0 | 0.813 | 3.041 | 3.882 | 4.552 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 5 | 1.403 | 3.929 | 4.224 | 4.665 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 10 | 2.45 | 4.397 | 4.332 | 4.708 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 15 | 2.962 | 4.581 | 4.372 | 4.734 | 5 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 20 | 3.283 | 4.64 | 4.403 | 4.737 | 5 | PASS |

**Appendix D:Modulation Limit**

**TEST PLOT RESULT**

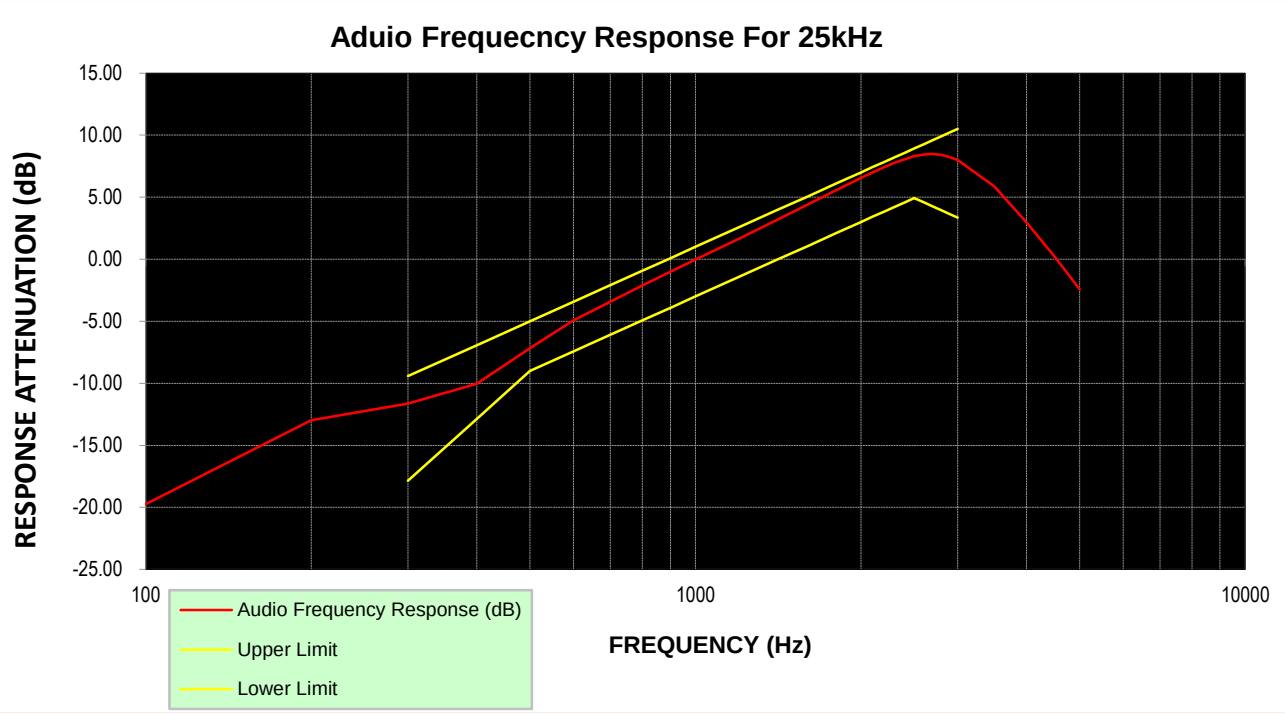


**Appendix E:Aduio Frequency Response**

| Operation Mode | Modulation Type | Test Channel | Frequency (Hz) | Audio Frequency Response (dB) | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| TX-AWH | FM | $CH_{M2}$ | 100 | -19.74 | | | PASS |
| TX-AWH | FM | $CH_{M2}$ | 200 | -12.97 | | | PASS |
| TX-AWH | FM | $CH_{M2}$ | 300 | -11.63 | -17.84 | -9.42 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 400 | -10.03 | -12.86 | -6.93 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 500 | -7.18 | -9.00 | -5.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 600 | -4.92 | -7.42 | -3.42 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 700 | -3.42 | -6.09 | -2.09 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 800 | -2.11 | -4.93 | -0.93 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 900 | -1.01 | -3.91 | 0.09 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 1000 | -0.02 | -3.00 | 1.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 1200 | 1.66 | -1.42 | 2.58 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 1400 | 3.13 | -0.09 | 3.91 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 1600 | 4.41 | 1.07 | 5.07 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 1800 | 5.54 | 2.09 | 6.09 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2000 | 6.55 | 3.00 | 7.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2100 | 7.00 | 3.42 | 7.42 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2200 | 7.40 | 3.83 | 7.83 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2300 | 7.77 | 4.21 | 8.21 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2400 | 8.06 | 4.58 | 8.58 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2500 | 8.30 | 4.93 | 8.93 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2600 | 8.45 | 4.59 | 9.27 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2700 | 8.48 | 4.27 | 9.60 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2800 | 8.40 | 3.95 | 9.91 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 2900 | 8.24 | 3.65 | 10.22 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 3000 | 8.01 | 3.35 | 10.51 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 3500 | 5.86 | | | PASS |
| TX-AWH | FM | $CH_{M2}$ | 4000 | 2.97 | | | PASS |
| TX-AWH | FM | $CH_{M2}$ | 4500 | 0.22 | | | PASS |
| TX-AWH | FM | $CH_{M2}$ | 5000 | -2.43 | | | PASS |

**Appendix E:Aduio Frequency Response**

TEST PLOT RESULT

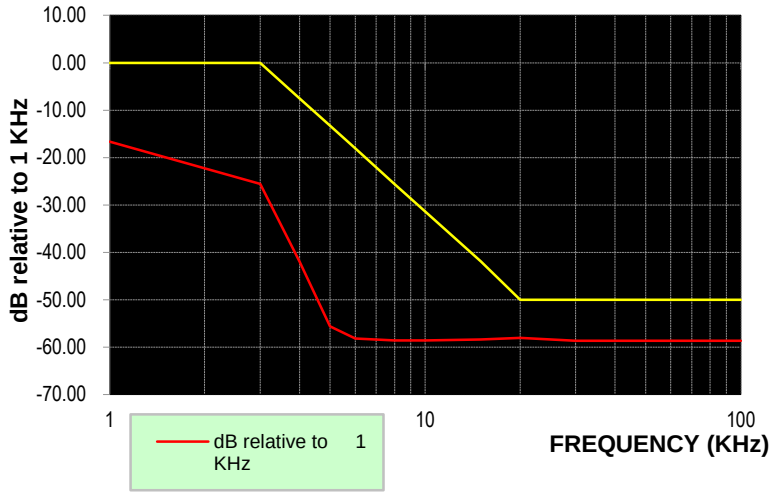



Note: The highest audio frequency response at 3kHz<3.125kHz, so meet the requirement.

**Appendix F:Audio Low Pass Filter Response**

| Operation Mode | Modulation Type | Test Channel | Frequency (KHz) | dB relative to 1 KHz | Limit | Result |
|---|---|---|---|---|---|---|
| TX-AWH | FM | $CH_{M2}$ | 1 | -16.64 | 0.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 3 | -25.58 | 0.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 4 | -41.97 | -7.50 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 5 | -55.65 | -13.30 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 6 | -58.21 | -18.10 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 8 | -58.60 | -25.60 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 10 | -58.62 | -31.40 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 15 | -58.41 | -41.90 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 20 | -58.04 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 30 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 40 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 50 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 60 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 70 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 80 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 90 | -58.66 | -50.00 | PASS |
| TX-AWH | FM | $CH_{M2}$ | 100 | -58.66 | -50.00 | PASS |

**Appendix F:Audio Low Pass Filter Response**

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWH | FM | $CH_{M2}$ |  |

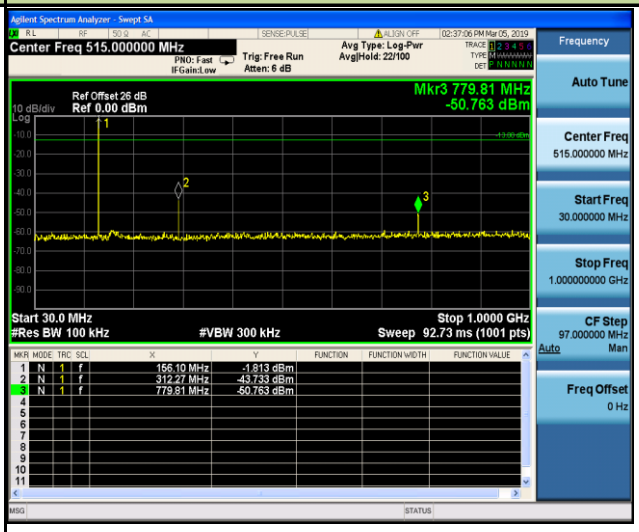
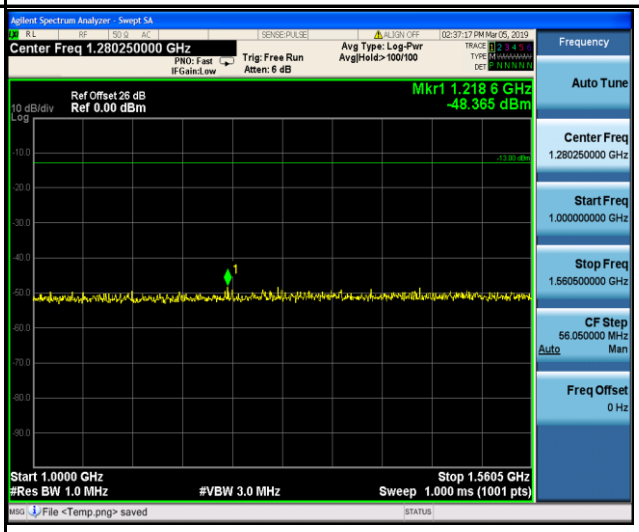
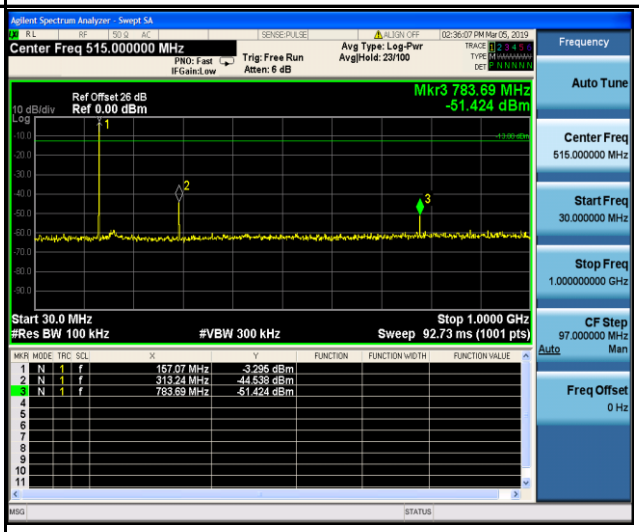
## Appendix G:Frequency Stability Test & Temperature

| Operation Mode | Modulation Type | Test Conditions | | Frequency error (ppm) | | | Limit (ppm) | Result |
|---|---|---|---|---|---|---|---|---|
| | | Voltage | Temperature | $CH_L$ | $CH_{M2}$ | $CH_H$ | | |
| TX-AWH | FM | $V_N$ | -30 | **0.140** | 0.131 | 0.129 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | -20 | 0.121 | 0.130 | 0.121 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | -10 | 0.116 | 0.112 | 0.105 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | 0 | 0.100 | 0.105 | 0.103 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | 10 | 0.092 | 0.095 | 0.090 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | 20 | 0.085 | 0.086 | 0.078 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | 30 | 0.094 | 0.100 | 0.089 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | 40 | 0.104 | 0.106 | 0.097 | ±10 | PASS |
| TX-AWH | FM | $V_N$ | 55 | 0.110 | 0.117 | 0.109 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | -30 | 0.135 | 0.131 | 0.136 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | -20 | 0.124 | 0.119 | 0.127 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | -10 | 0.105 | 0.115 | 0.111 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | 0 | 0.101 | 0.109 | 0.105 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | 10 | 0.089 | 0.099 | 0.091 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | 20 | 0.080 | 0.084 | 0.082 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | 30 | 0.092 | 0.093 | 0.094 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | 40 | 0.097 | 0.107 | 0.101 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | 55 | 0.107 | 0.110 | 0.107 | ±10 | PASS |

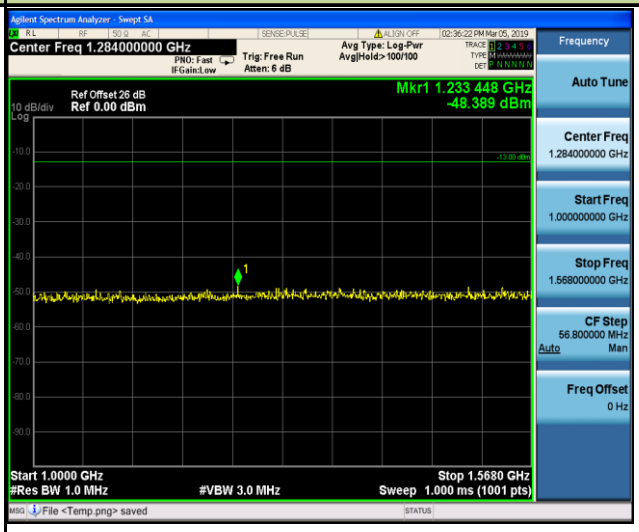
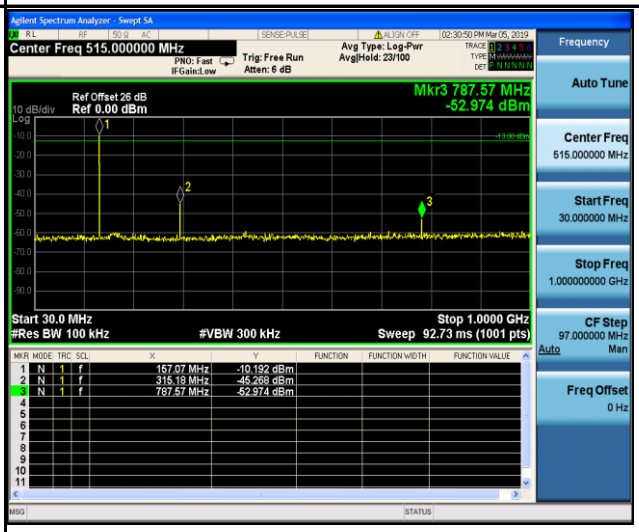
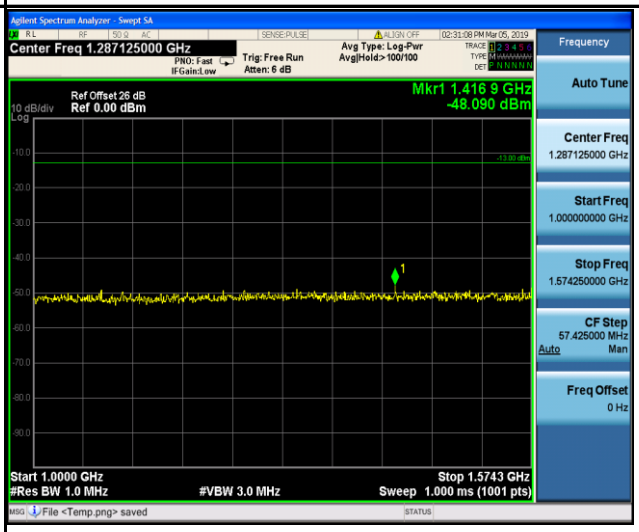
**Appendix H:Frequency Stability Test & Voltage**

| Operation Mode | Modulation Type | Test Conditions | | Frequency error (ppm) | | | Limit (ppm) | Result |
|---|---|---|---|---|---|---|---|---|
| | | Voltage | Temperature | $CH_L$ | $CH_{M2}$ | $CH_H$ | | |
| TX-AWH | FM | $V_N$ | $T_N$ | 0.085 | 0.086 | 0.078 | ±10 | PASS |
| TX-AWH | FM | $V_L$ | $T_N$ | 0.105 | **0.109** | 0.099 | ±10 | PASS |
| TX-AWH | FM | $V_H$ | $T_N$ | 0.096 | 0.099 | 0.085 | ±10 | PASS |
| TX-AWL | FM | $V_N$ | $T_N$ | 0.080 | 0.084 | 0.082 | ±10 | PASS |
| TX-AWL | FM | $V_L$ | $T_N$ | 0.102 | 0.104 | 0.108 | ±10 | PASS |
| TX-AWL | FM | $V_H$ | $T_N$ | 0.091 | 0.096 | 0.094 | ±10 | PASS |

## Appendix I:Spurious Emission On Antenna Port

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWH | FM | $CH_L$ |  <br>30MHz~1GHz |
| TX-AWH | FM | $CH_L$ |  <br>1GHz~10th Harmonic |
| TX-AWH | FM | $CH_{M2}$ |  <br>30MHz~1GHz |

## Appendix I:Spurious Emission On Antenna Port

| Operation Mode | Modulation Type | Test Channel | TEST PLOT RESULT |
|---|---|---|---|
| TX-AWH | FM | $CH_{M2}$ |  <br>1GHz~10th Harmonic |
| TX-AWH | FM | $CH_{H}$ |  <br>30MHz~1GHz |
| TX-AWH | FM | $CH_{H}$ |  <br>1GHz~10th Harmonic |

----End of Report----