



TEST REPORT

Report No. : **CHEW22060067** Report verification : 

Project No. : **SHT2205110601EW**

FCC ID : **2A3OORM01**

Applicant's name : **Shenzhen Ysair Technology Co., LTD**

Address : 6/F, building 6, Yunli intelligent park, No. 3, Changfa Middle Road, Yangmei community, Bantian street, Longgang District, Shenzhen, Guangdong, China

Test item description : **Two Way Radio**

Trade Mark : RETEVIS

Model/Type reference : RM01

Listed Model(s) : -

Standard : **FCC CFR Title 47 Part 2**
FCC CFR Title 47 Part 80

Date of receipt of test sample : May.31, 2022

Date of testing : May.31, 2022-Jun.09, 2022

Date of issue : Jun.10, 2022

Result : **PASS**

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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

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The test report merely correspond to the test sample.

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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 | 2022-06-10 | Original |
| | | |
| | | |
| | | |
| | | |

2 TEST DESCRIPTION

| Test Item | Section in CFR 47 | Result | Test Engineer |
|---|----------------------------------|---------------|----------------------|
| Conducted Carrier Output Power | Part 80.215 Part 2.1046(a) | Pass | Caspar Chen |
| 99% Occupied Bandwidth & 26dB bandwidth | Part 80.205 Part 2.1049 | Pass | Caspar Chen |
| Emission Mask | Part 80.211(f) Part 2.1049 | Pass | Caspar Chen |
| Modulation Limit | Part 2.1047(b) Part 80.213 | Pass | Caspar Chen |
| Audio Frequency Response | Part 2.1047(a) Part 80.213(e) | Pass | Caspar Chen |
| Frequency Stability V.S. Temperature | Part 80.209 Part 2.1055 | Pass | Caspar Chen |
| Frequency Stability V.S. Voltage | Part 80.209 Part 2.1055 | Pass | Caspar Chen |
| Transmit Conducted Spurious Emission | Part 80.211(f)(3) Part 2.1051 | Pass | Caspar Chen |
| Transmit Radiated Spurious Emission | Part 80.211(f)(3) Part 2.1053 | Pass | Quanhai Deng |

3 SUMMARY

3.1 Client Information

| | |
|---------------|---|
| Applicant: | Shenzhen Ysair Technology Co., LTD |
| Address: | 6/F, building 6, Yunli intelligent park, No. 3, Changfa Middle Road, Yangmei community, Bantian street, Longgang District, Shenzhen,Guangdong,China |
| Manufacturer: | Shenzhen Ysair Technology Co., LTD |
| Address: | 6/F, building 6, Yunli intelligent park, No. 3, Changfa Middle Road, Yangmei community, Bantian street, Longgang District, Shenzhen,Guangdong,China |

3.2 Product Description

| Main unit | |
|-------------------------------------|--|
| Name of EUT: | Two Way Radio |
| Trade Mark: | RETEVIS |
| Model/Type reference: | RM01 |
| Listed Model(s) | - |
| Power supply: | DC1.2V*5 from battery AC 120V from adapter |
| Hardware version: | 6PM7-5841-HMB |
| Software version: | V1.01 |
| Ancillary unit | |
| Adapter information: | Model: SJ-12005001 Input: 100-240Va.c., 50/60Hz 0.2A Output: 12Vd.c., 0.5A |
| Charge information: | Input: 13.8V DC Output: 13.8V DC |
| RF Specification | |
| Support Frequency Range: | 156.025~163.275MHz |
| Permitted frequency range: | TX:156.025MHz to 157.425MHz RX:156.050MHz to 163.275MHz |
| Rated Output Power: | <input checked="" type="checkbox"/> High Power: 3W <input checked="" type="checkbox"/> Low Power: 1W |
| Modulation Type: | Analog: FM |
| Channel Separation: | Analog: <input checked="" type="checkbox"/> 25kHz |
| Emission Designator: * ¹ | Analog: 16K0F3E |
| Antenna Type: | Detachable antenna |

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 = 5KHz max, K = 1, M = 3KHz

$B_n = 2M + 2DK = 2*3 + 2*5*1 = 16 \text{ KHz}$

Emission designation: 16K0F3E

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 (CH60) | 156.025 | 160.625 |
| | CH _M (CH16) | 156.800 | 156.800 |
| | CH _H (CH88) | 157.425 | 162.025 |

VHF MARINE CHANNEL LIST USA - USA Channel Group , INT - International Channel Group , CAN - Canadian Channel Group

| Channel Number | | | | | Frequency (MHz) | | | | | Channel Number | | | | | Frequency (MHz) | | | | | | | | | |
|------------------|------------------|------------------|----------|---------|------------------|-----|-------------------|----------|---------|------------------|------------------|------------------|----------|---------|-----------------|-----|-----------------|-----------------|---------|-----|-----|-----|----------|---------|
| USA | INT | CAN | Transmit | Receive | USA | INT | CAN | Transmit | Receive | USA | INT | CAN | Transmit | Receive | USA | INT | CAN | Transmit | Receive | USA | INT | CAN | Transmit | Receive |
| | 01 | 01 | 156.050 | 160.060 | | 21 | 21 | 157.050 | 161.650 | 68 | 68 | 68 | 156.425 | 156.425 | 86A | | | 157.325 | 157.325 | | | | | |
| 01A | | | 156.050 | 156.050 | 21A | | 21A | 157.050 | 157.050 | 69 | 69 | 69 | 156.475 | 156.475 | 87 | 87 | 87 | 157.375 | 161.975 | | | | | |
| | 02 | 02 | 156.100 | 160.700 | | | 21b | RX Only | 161.650 | 70 | 70 | 70 | RX Only | 156.525 | 87A | | | 157.375 | 157.375 | | | | | |
| | 03 | 03 | 156.150 | 160.750 | | 22 | | 157.100 | 161.700 | 71 | 71 | 71 | 156.575 | 156.575 | 88 | 88 | 88 | 157.425 | 162.025 | | | | | |
| 03A | | | 156.150 | 156.150 | 22A | | 22A | 157.100 | 157.100 | 72 | 72 | 72 | 156.625 | 156.625 | 88A | | | 157.425 | 157.425 | | | | | |
| | 04 | | 156.200 | 160.800 | | 23 | 23 | 157.150 | 161.750 | 73 | 73 | 73 | 156.675 | 156.675 | | | A1 ² | 161.975 | 161.975 | | | | | |
| | | 04A | 156.200 | 156.200 | 23A | | | 157.150 | 157.150 | 74 | 74 | 74 | 156.725 | 156.725 | | | A2 ² | 162.025 | 162.025 | | | | | |
| | 05 | | 156.250 | 160.850 | 24 | 24 | 24 | 157.200 | 161.800 | 75 ^{*1} | 75 ^{*1} | 75 ^{*1} | 156.775 | 156.775 | | | | | | | | | | |
| 05A | | 05A | 156.250 | 156.250 | 25 | 25 | 25 | 157.250 | 161.850 | 76 ^{*1} | 76 ^{*1} | 76 ^{*1} | 156.825 | 156.825 | | | | | | | | | | |
| 06 | 06 | 06 | 156.300 | 156.300 | | | 25b | RX Only | 161.850 | 77 ^{*1} | 77 | 77 ^{*1} | 156.875 | 156.875 | | | | | | | | | | |
| | 07 | | 156.350 | 160.950 | 26 | 26 | 26 | 157.300 | 161.900 | | 78 | | 156.925 | 161.525 | | | | | | | | | | |
| 07A | | 07A | 156.350 | 156.350 | 27 | 27 | 27 | 157.350 | 161.950 | 78A | | 78A | 156.925 | 156.925 | | | | | | | | | | |
| 08 | 08 | 08 | 156.400 | 156.400 | 28 | 28 | 28 | 157.400 | 162.000 | | 79 | | 156.975 | 161.575 | | | | | | | | | | |
| 09 | 09 | 09 | 156.450 | 156.450 | | | 28b | RX Only | 162.000 | 79A | | 79A | 156.975 | 156.975 | | | | | | | | | | |
| 10 | 10 | 10 | 156.500 | 156.500 | | 60 | 60 | 156.025 | 160.625 | | 80 | | 157.025 | 161.625 | | | | | | | | | | |
| 11 | 11 | 11 | 156.550 | 156.550 | | 61 | | 156.075 | 160.675 | 80A | | 80A | 157.025 | 157.025 | | | | | | | | | | |
| 12 | 12 | 12 | 156.600 | 156.600 | 61A | | 61A | 156.075 | 156.075 | | 81 | | 157.075 | 161.675 | | | | | | | | | | |
| 13 ^{*1} | 13 | 13 ^{*1} | 156.650 | 156.650 | | 62 | | 156.125 | 160.725 | 81A | | 81A | 157.075 | 157.075 | Weather Channel | | | Frequency (MHz) | | | | | | |
| 14 | 14 | 14 | 156.700 | 156.700 | | | 62A | 156.125 | 156.125 | | 82 | | 157.125 | 161.725 | 1 | | | RX Only | 162.550 | | | | | |
| 15 ^{*1} | 15 ^{*1} | 15 ^{*1} | 156.750 | 156.750 | | 63 | | 156.175 | 160.775 | 82A | | 82A | 157.125 | 157.125 | 2 | | | RX Only | 162.400 | | | | | |
| 16 | 16 | 16 | 156.800 | 156.800 | 63A | | | 156.175 | 156.175 | | 83 | 83 | 157.175 | 161.775 | 3 | | | RX Only | 162.475 | | | | | |
| 17 ^{*1} | 17 | 17 ^{*1} | 156.850 | 156.850 | | 64 | 64 | 156.225 | 160.825 | 83A | | 83A | 157.175 | 157.175 | 4 | | | RX Only | 162.425 | | | | | |
| 18 | | | 156.900 | 161.500 | 64A | | 64A | 156.225 | 156.225 | | | 83b | RX Only | 161.775 | 5 | | | RX Only | 162.450 | | | | | |
| 18A | | 18A | 156.900 | 156.900 | | 65 | | 156.275 | 160.875 | 84 | 84 | 84 | 157.225 | 161.825 | 6 | | | RX Only | 162.500 | | | | | |
| | 19 | | 156.950 | 161.550 | 65A | 65A | 65A | 156.275 | 156.275 | 84A | | | 157.225 | 157.225 | 7 | | | RX Only | 162.525 | | | | | |
| 19A | | 19A | 156.950 | 156.950 | | 66 | | 156.325 | 160.925 | 85 | 85 | 85 | 157.275 | 161.875 | 8 | | | RX Only | 161.650 | | | | | |
| 20 | 20 | 20 ^{*1} | 157.000 | 161.600 | 66A | 66A | 66A ^{*1} | 156.325 | 156.325 | 85A | | | 157.275 | 157.275 | 9 | | | RX Only | 161.775 | | | | | |
| 20A | | | 157.000 | 157.000 | 67 ^{*1} | 67 | 67 | 156.375 | 156.375 | 86 | 86 | 86 | 157.325 | 161.925 | 10 | | | RX Only | 163.275 | | | | | |

^{*1} Low power only. ^{*2} Australian version only.

3.4 Operation mode

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

Note:

√: is operation mode.

| 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 |

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

| Laboratory Name | Shenzhen Huatongwei International Inspection Co., Ltd. | |
|----------------------|---|----------------------|
| Laboratory Location | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China | |
| Connect information: | Tel: 86-755-26715499 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn | |
| Qualifications | Type | Accreditation Number |
| | FCC | 762235 |

4.3 Environmental conditions

| Atmospheric Contions | |
|-----------------------------------|-----------------------|
| Temperature: | 21°C to 25°C |
| Relative Humidity: | 20 % to 75 %. |
| Atmospheric Pressure: | 860 mbar to 1060 mbar |
| Norminal Test Voltage: | $V_N = DC 6V$ |
| Extrem Test Voltage @115% V_N : | $V_H = DC 8.51V$ |
| Extrem Test Voltage @85% V_N : | $V_L = DC 6.29V$ |

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 | 15Hz for <1GHz 70Hz for >1GHz | (1) |
| Conducted Output Power | 0.51dB | (1) |
| ERP / EIRP / RSE | 2.66dB for <1GHz 3.44dB for >1GHz | (1) |
| Conducted Emission 9KHz-30MHz | 3.02dB | (1) |
| Radiated Emission 30~1000MHz | 4.90dB | (1) |
| Radiated Emission 1~18GHz | 4.96dB | (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

| ● TS8613 Test system | | | | | | | |
|----------------------|---------------------------------------|--------------|---------------|--------------|------------|---------------------------|---------------------------|
| Used | Test Equipment | Manufacturer | Equipment No. | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Spectrum Analyzer | Agilent | HTWE0286 | N9020A | MY50510187 | 2021/09/13 | 2022/09/12 |
| ● | Signal & Spectrum Analyzer | R&S | HTWE0262 | FSW26 | 103440 | 2021/09/13 | 2022/09/12 |
| ● | RF Communication Test Set | HP | HTWE0038 | 8920A | 3813A10206 | 2021/09/13 | 2022/09/12 |
| ○ | Digital intercom communication tester | Aeroflex | HTWE0255 | 3920B | 1001682041 | 2021/09/13 | 2022/09/12 |
| ● | Signal Generator | R&S | HTWE0191 | SML02 | 100507 | 2021/09/13 | 2022/09/12 |
| ● | Signal Generator | R&S | HTWE0337 | SMC100A | 107268 | 2021/09/13 | 2022/09/12 |
| ● | RF Control Unit | Tonscend | HTWE0294 | JS0806-2 | N/A | N/A | N/A |
| ● | Filter-VHF | Microwave | HTWE0309 | N26460M1 | 498702 | N/A | N/A |
| ○ | Filter-UHF | Microwave | HTWE0311 | N25155M2 | 498704 | N/A | N/A |
| ● | Power Divider | Microwave | HTWE0043 | OPD1040-N-4 | N/A | 2022/05/16 | 2023/05/15 |
| ● | Attenuator | JFW | HTWE0292 | 50FH-030-100 | N/A | 2022/05/16 | 2023/05/15 |
| ● | Attenuator | JFW | HTWE0293 | 50-A-MFN-20 | 0322 | 2022/05/16 | 2023/05/15 |
| ● | Test software | HTW | N/A | Radio ATE | N/A | N/A | N/A |

| ● Auxiliary Equipment | | | | | | | |
|-----------------------|-----------------|--------------|---------------|-----------|------------|---------------------------|---------------------------|
| Used | Test Equipment | Manufacturer | Equipment No. | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Climate chamber | ESPEC | HTWE0254 | GPL-2 | N/A | 2021/09/14 | 2022/09/13 |
| ● | DC Power Supply | Gwinstek | HTWE0274 | SPS-2415 | GER835793 | N/A | N/A |

| ● Radiated Spurious Emission | | | | | | | |
|------------------------------|-------------------------|--------------------|---------------|-------------------|-------------|---------------------------|---------------------------|
| Used | Test Equipment | Manufacturer | Equipment No. | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Semi-Anechoic Chamber | Albatross projects | HTWE0122 | SAC-3m-01 | C11121 | 2018/09/27 | 2022/09/26 |
| ● | Spectrum Analyzer | R&S | HTWE0098 | FSP40 | 100597 | 2021/09/13 | 2022/09/12 |
| ● | Loop Antenna | R&S | HTWE0170 | HFH2-Z2 | 100020 | 2021/04/06 | 2024/04/05 |
| ● | Broadband Horn Antenna | SCHWARZBECK | HTWE0103 | BBHA9170 | BBHA9170472 | 2020/04/27 | 2023/04/26 |
| ● | Ultra-Broadband Antenna | SCHWARZBECK | HTWE0123 | VULB9163 | 538 | 2021/04/06 | 2024/04/05 |
| ● | Horn Antenna | SCHWARZBECK | HTWE0126 | 9120D | 1011 | 2020/04/01 | 2023/03/31 |
| ● | Pre-amplifier | CD | HTWE0071 | PAP-0102 | 12004 | 2021/11/05 | 2022/11/04 |
| ● | Broadband Preamplifier | SCHWARZBECK | HTWE0201 | BBV 9718 | 9718-248 | 2022/02/28 | 2023/02/27 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0120-01 | 6m 18GHz S Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0120-02 | 6m 3GHz RG Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0119-05 | 6m 3GHz RG Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0120-04 | 6m 3GHz RG Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | EMI Test Software | Audix | N/A | E3 | N/A | N/A | N/A |

5 TEST CONDITIONS AND RESULTS

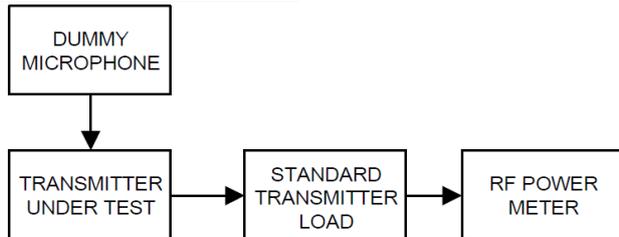
5.1 Conducted Carrier Output Power

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 8 appendix report

5.2 99% Occupied Bandwidth & 26dB Bandwidth

LIMIT

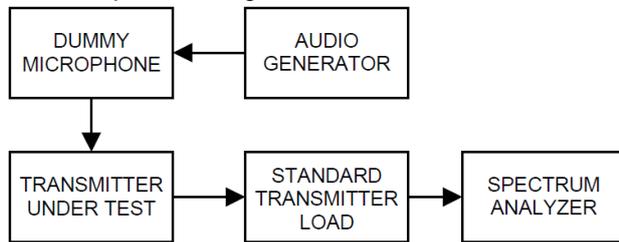
FCC Part 80.205, FCC Part 2.1049

| 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 | 16K0F1B | 20.0 |
| F1C | 2K80F1C | 3.0 |
| F1D ¹² | 16K0F1D | 20.0 |
| F2B ⁶ | 16K0F2B | 20.0 |
| F2C ⁷ | 16K0F2C | 20.0 |
| F2D ¹² | 16K0F2D | 20.0 |
| F3C | 2K80F3C | 3.0 |
| F3C ⁷ | 16K0F3C | 20.0 |
| F3E ⁸ | 16K0F3E | 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 8 appendix report

5.3 Emission Mask

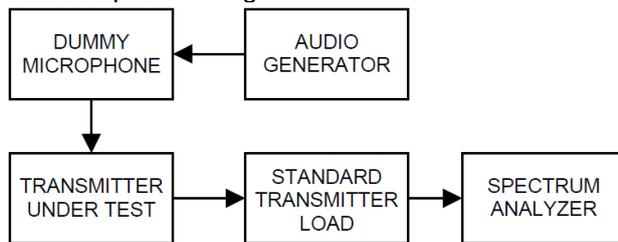
LIMIT

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 $10\log_{10}$ (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

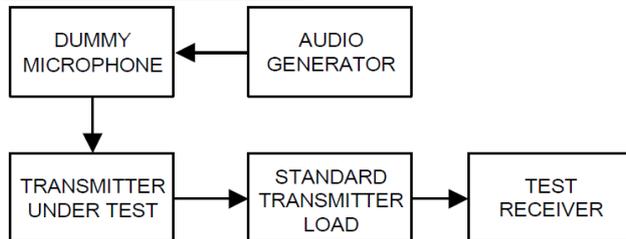
Please refer to appendix C on the section 8 appendix report

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 $\geq 15,000$ 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 $+20$ dB.
- 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

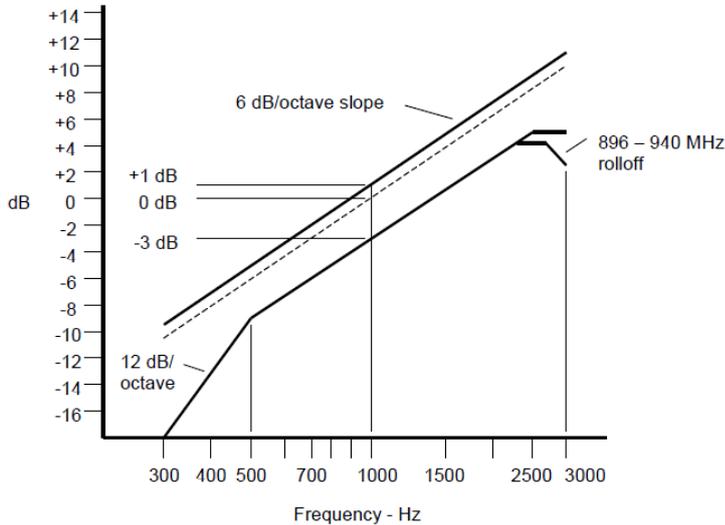
Please refer to appendix D on the section 8 appendix report

5.5 Audio Frequency Response

LIMIT

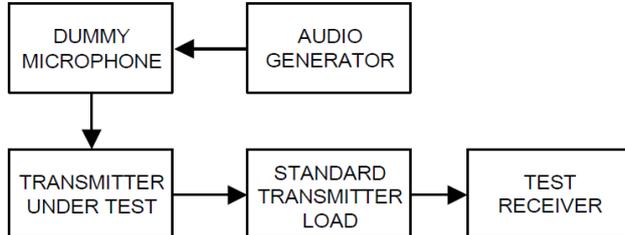
FCC Part 80.213(e) ,FCC Part 2.1047(a):

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**

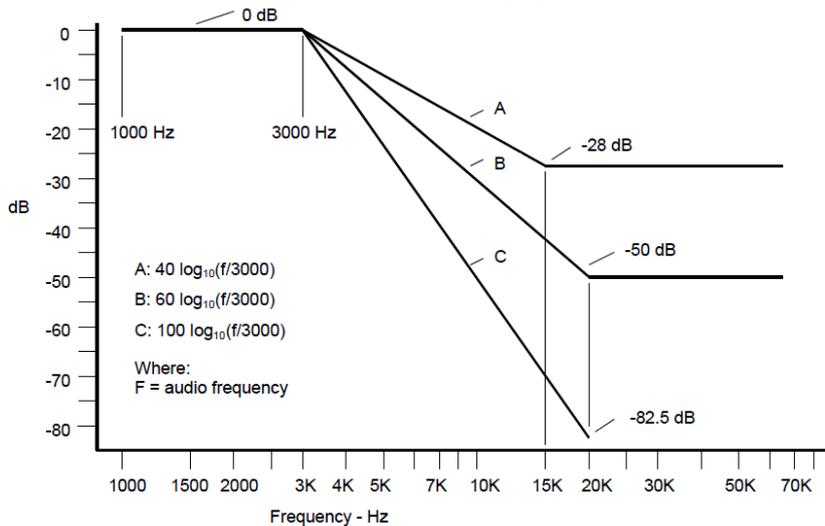
Please refer to appendix E on the section 8 appendix report

5.6 Audio Low Pass Filter Response

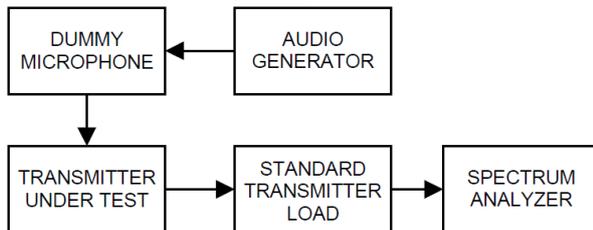
LIMIT

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 $60\log_{10}(f/3)$ 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

TEST DATA

Please refer to appendix F on the appendix report

5.7 Frequency stability VS Temperature

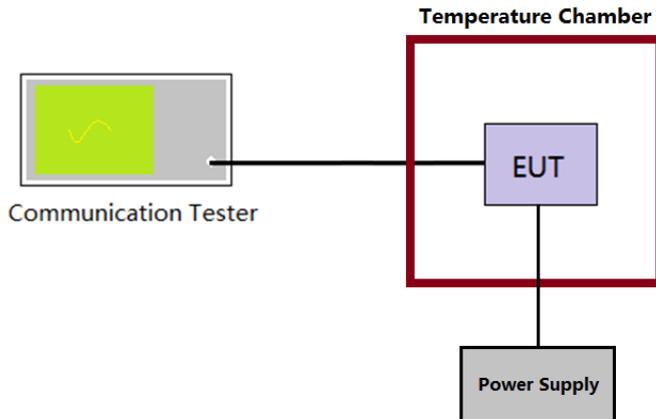
LIMIT

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. |

⁷For 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 10⁶.

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 8 appendix report

5.8 Frequency stability VS Voltage

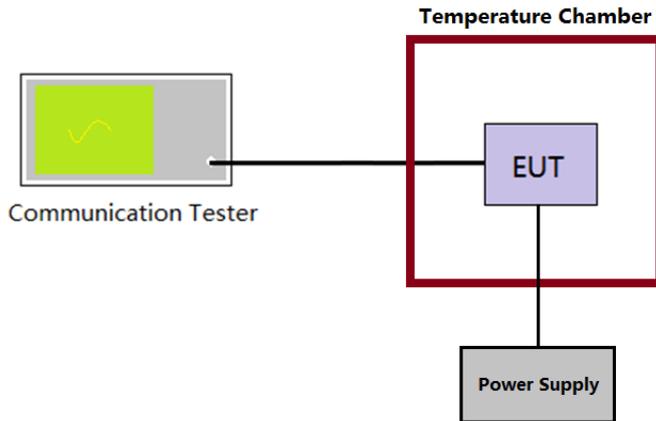
LIMIT

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. |

⁷For 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 10⁶.

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 $\pm 15\%$ 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 8 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 |

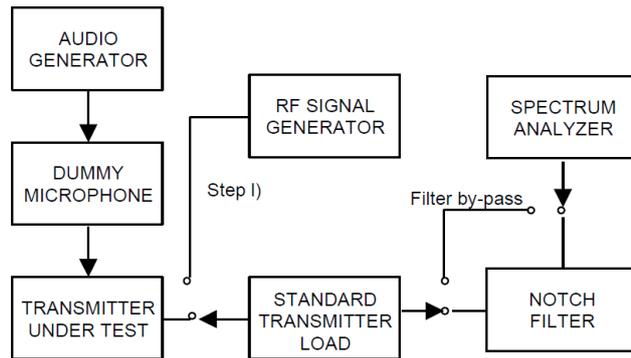
$43 + 10 \log (P_{watts})$

Calculation: $Limit (dBm) = EL - 43 - 10 \log_{10} (TP)$

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

$Limit (dBm) = P (dBm) - 43 - 10 \log (P_{watts}) = -13 \text{ dBm}$

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 10th 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 8 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 |

$$43 + 10 \log (P_{\text{watts}})$$

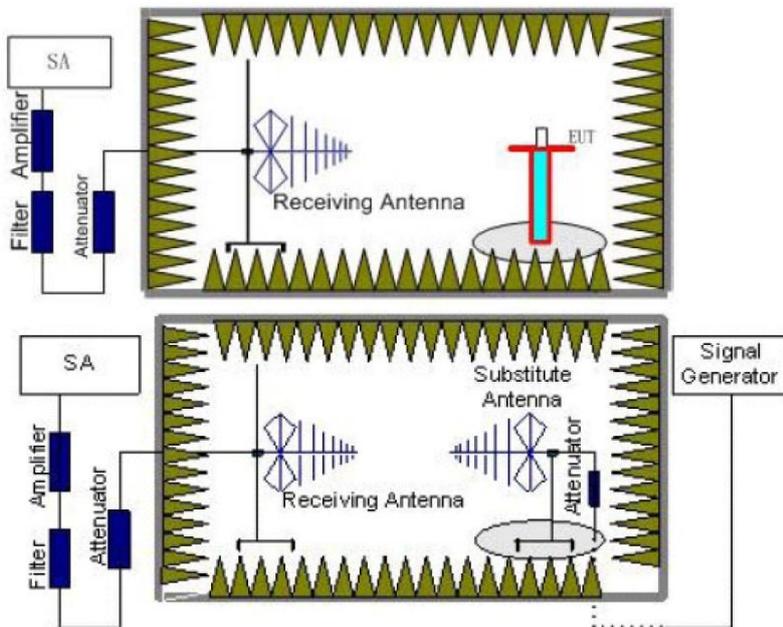
$$\text{Calculation: Limit (dBm)} = EL - 43 - 10 \log_{10} (TP)$$

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

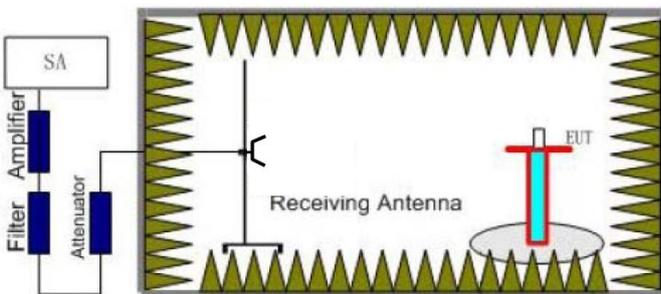
$$\text{Limit (dBm)} = P (\text{dBm}) - 43 - 10 \log (P_{\text{watts}}) = -13 \text{ dBm}$$

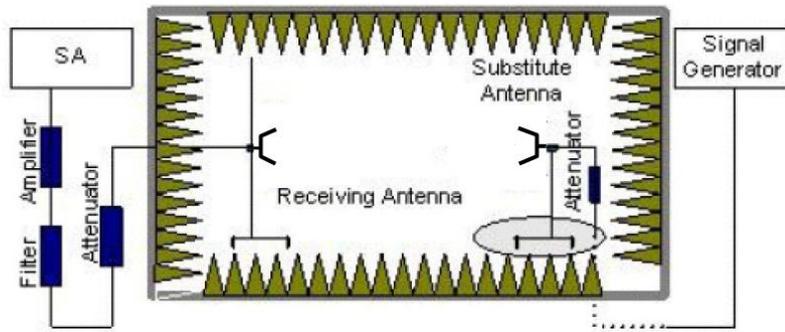
TEST CONFIGURATION

Below 1GHz:



Above 1GHz:





TEST PROCEDURE

1. Place the EUT in the center of the turntable.
 - a) For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table at a nominal height of 80 cm above the reference ground plane
 - b) For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table at a nominal height of 1.5 m above the ground plane.
2. Unless the EUT uses an integral antenna, the EUT shall be terminated with a non-radiating transmitter load. In cases where the EUT uses an adjustable antenna, the antenna shall be adjusted through typical positions and lengths to maximize emissions levels.
3. The EUT shall be tested while operating on the frequency per manufacturer specification. Set the transmitter to operate in continuous transmit mode.
4. Receiver or Spectrum set as follow:
 - Below 1GHz, RBW=100kHz, VBW=300kHz, Detector=Peak, Sweep time=Auto
 - Above 1GHz, RBW=1MHz, VBW=3MHz, Detector=Peck, Sweep time=Auto
5. Each emission under consideration shall be evaluated:
 - a) Raise and lower the measurement antenna from 1 m to 4 m, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
 - b) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
 - c) Return the turntable to the azimuth where the highest emission amplitude level was observed.
 - d) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
 - e) Record the measured emission amplitude level and frequency
6. Repeat step 5 for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.
7. Set-up the substitution measurement with the reference point of the substitution antenna located as near as possible to where the center of the EUT radiating element was located during the initial EUT measurement.
8. Maintain the previous measurement instrument settings and test set-up, with the exception that the EUT is removed and replaced by the substitution antenna.
9. Connect a signal generator to the substitution antenna; locate the signal generator so as to minimize any potential influences on the measurement results. Set the signal generator to the frequency where emissions are detected, and set an output power level such that the radiated signal can be detected by the measurement instrument, with sufficient dynamic range relative to the noise floor.
10. For each emission that was detected and measured in the initial test
 - a) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude.
 - b) Adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the amplitude level of the emission previously measured directly in step 5 and step 6.
 - c) Record the output power level of the signal generator when equivalence is achieved in step b).
11. Repeat step 8 through step 10 with the measurement antenna oriented in the opposite polarization.
12. Calculate the emission power in dBm referenced to a half-wave dipole using the following equation:

$$P_e = P_s(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$
 where
 - P_e = equivalent emission power in dBm
 - P_s = source (signal generator) power in dBm
 NOTE—dBd refers to the measured antenna gain in decibels relative to a half-wave dipole.
13. Correct the antenna gain of the substitution antenna if necessary to reference the emission power to a half-wave dipole. When using measurement antennas with the gain specified in dBi, the equivalent dipole-referenced gain can be determined from:

$$\text{gain (dBd)} = \text{gain (dBi)} - 2.15 \text{ dB.}$$
 If necessary, the antenna gain can be calculated from calibrated antenna factor information

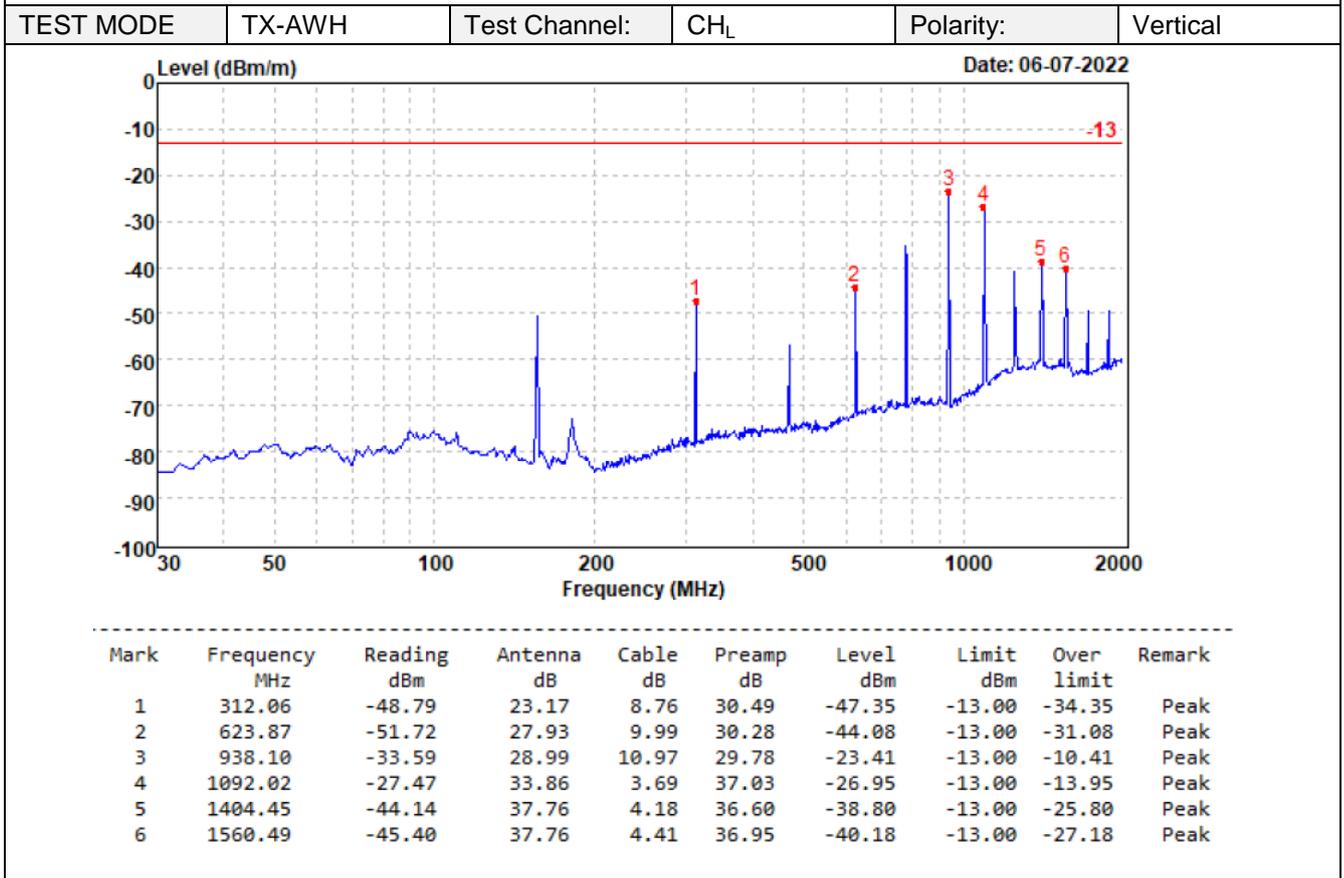
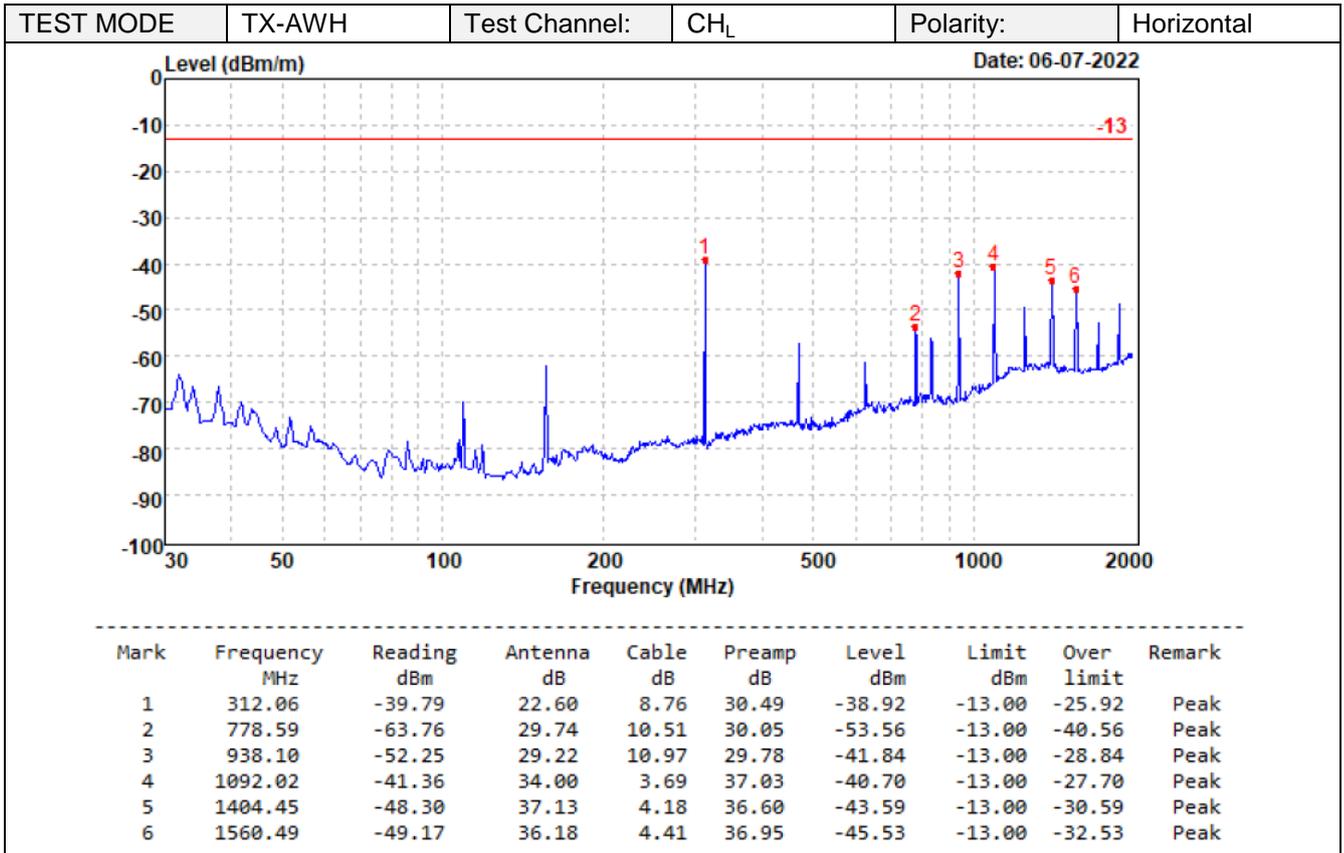
14. Provide the complete measurement results as a part of the test report.

TEST MODE

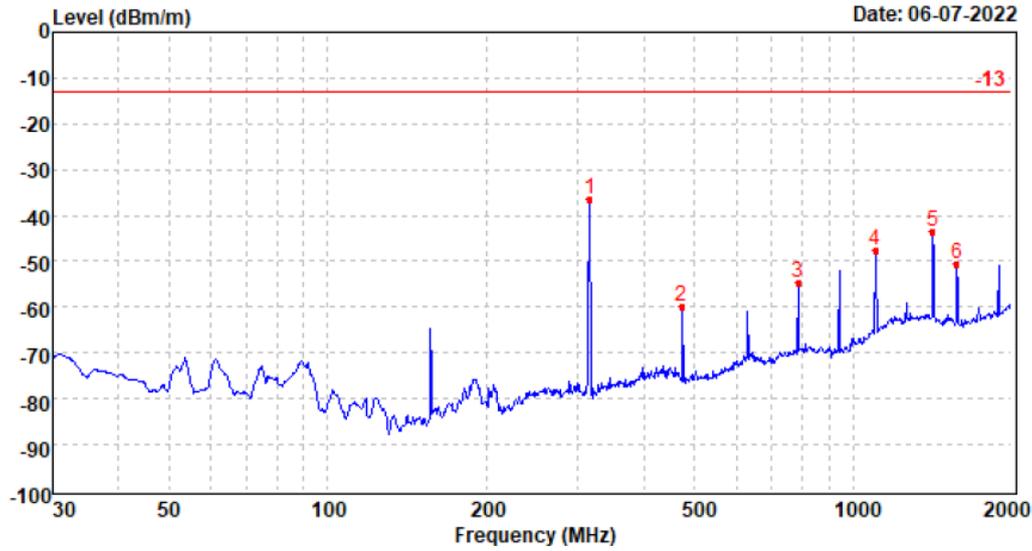
Please reference to the section 3.4

TEST RESULTS

Passed **Not Applicable**

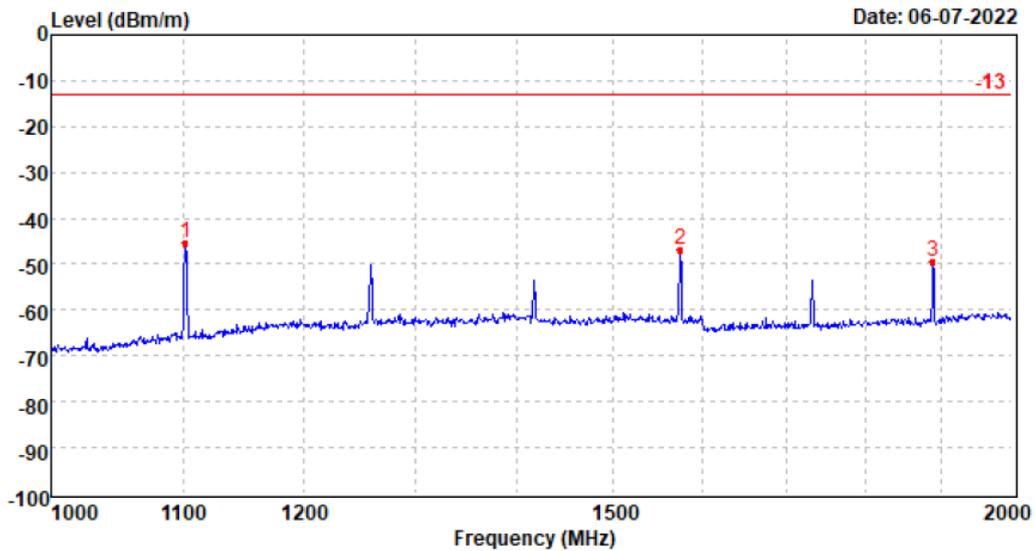


| | | | | | |
|-----------|--------|---------------|-----------------|-----------|------------|
| TEST MODE | TX-AWH | Test Channel: | CH _M | Polarity: | Horizontal |
|-----------|--------|---------------|-----------------|-----------|------------|

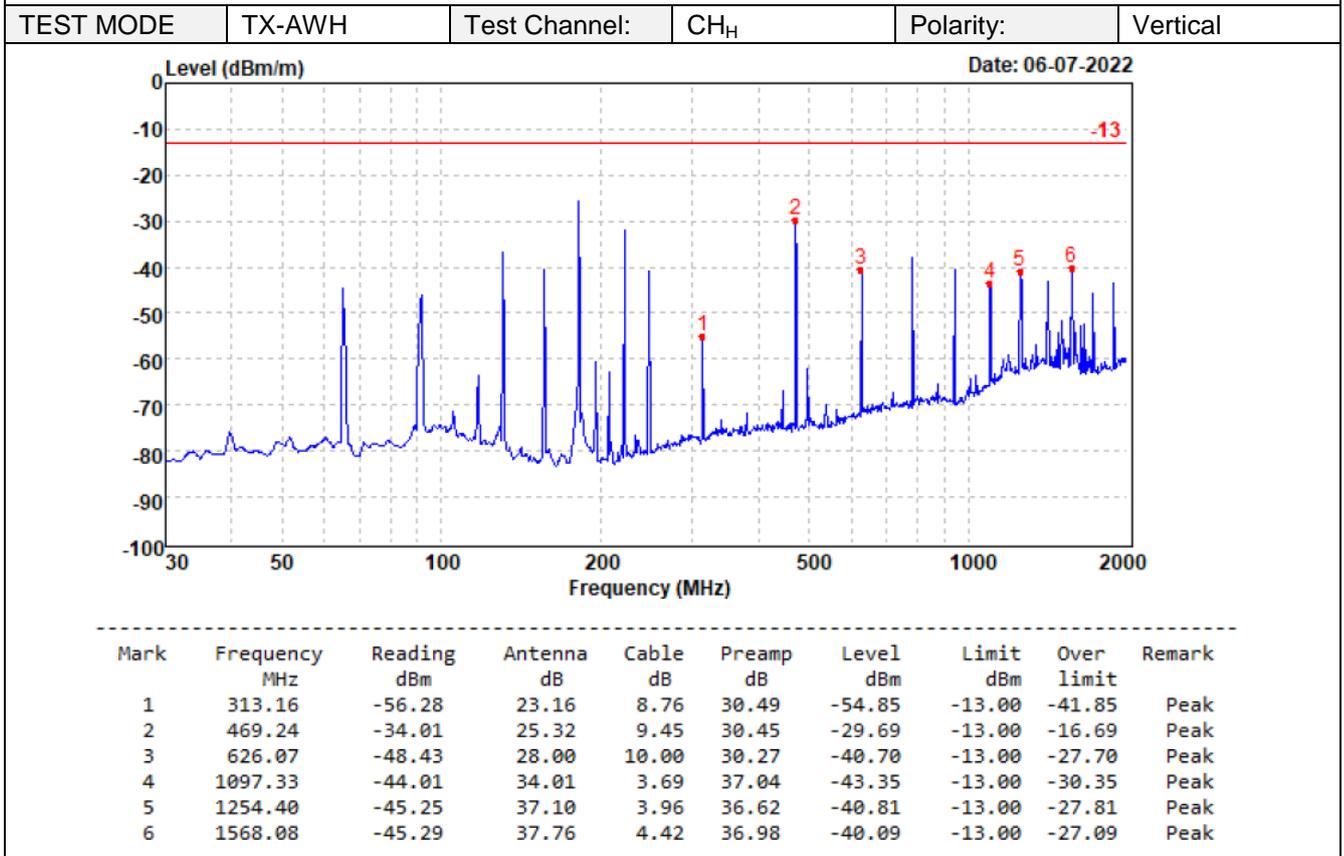
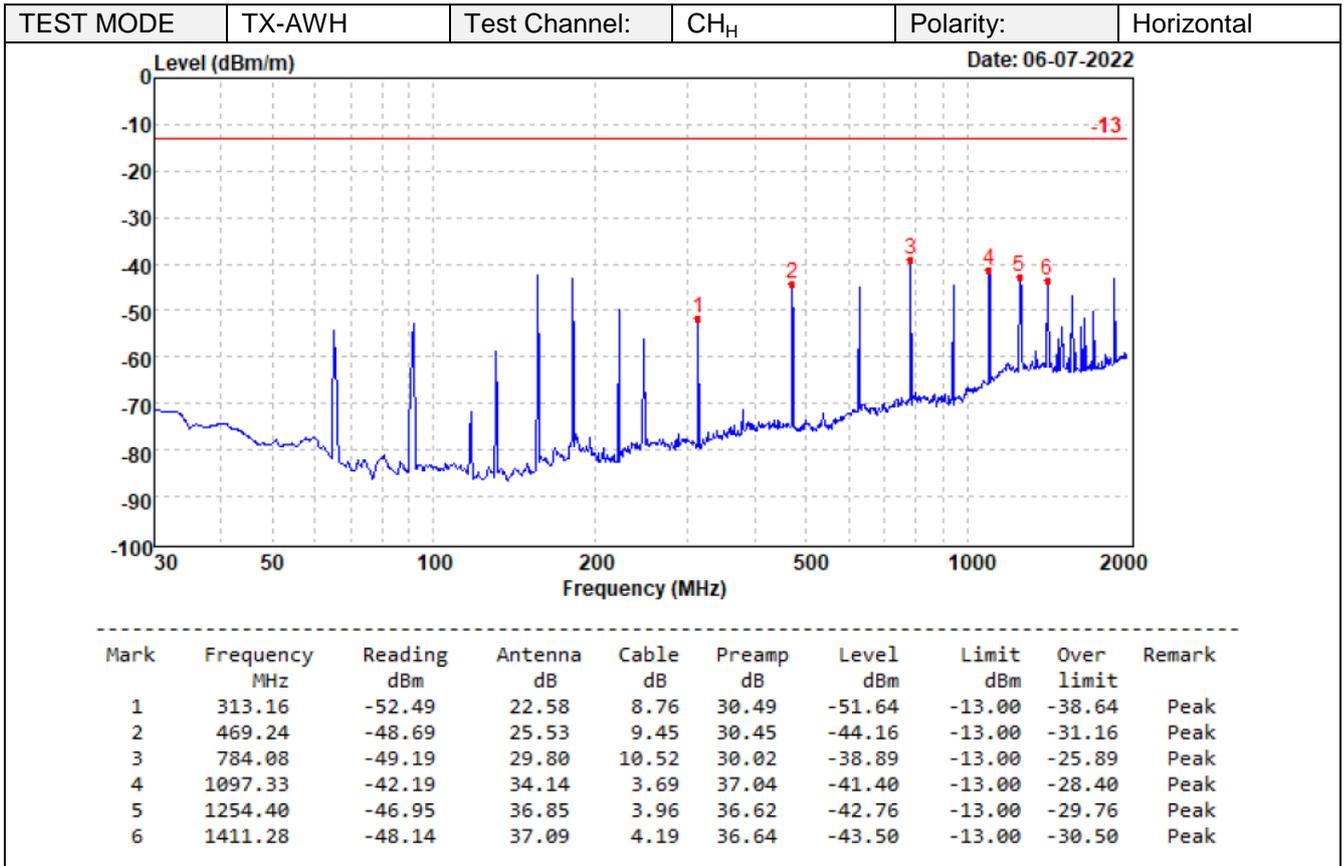


| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|------|---------------|-------------|------------|----------|-----------|-----------|-----------|------------|--------|
| 1 | 315.37 | -37.33 | 22.54 | 8.77 | 30.48 | -36.50 | -13.00 | -23.50 | Peak |
| 2 | 472.55 | -64.46 | 25.42 | 9.47 | 30.45 | -60.02 | -13.00 | -47.02 | Peak |
| 3 | 786.85 | -64.79 | 29.81 | 10.52 | 30.01 | -54.47 | -13.00 | -41.47 | Peak |
| 4 | 1101.91 | -48.50 | 34.26 | 3.70 | 37.05 | -47.59 | -13.00 | -34.59 | Peak |
| 5 | 1417.16 | -48.05 | 37.05 | 4.20 | 36.64 | -43.44 | -13.00 | -30.44 | Peak |
| 6 | 1574.62 | -54.25 | 36.10 | 4.43 | 37.02 | -50.74 | -13.00 | -37.74 | Peak |

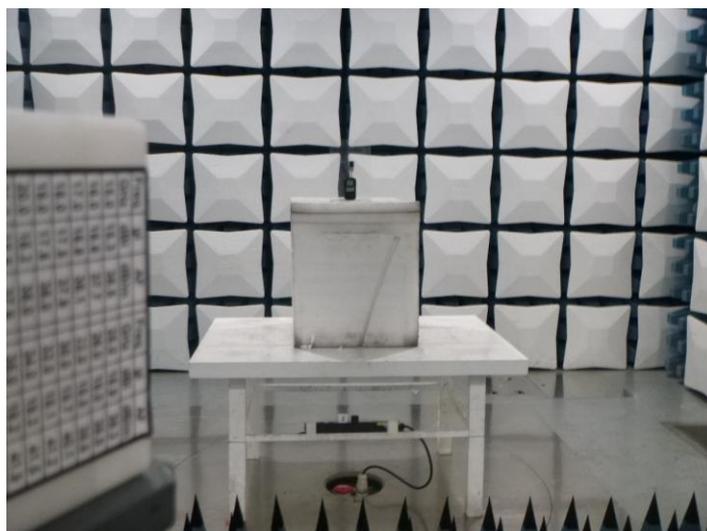
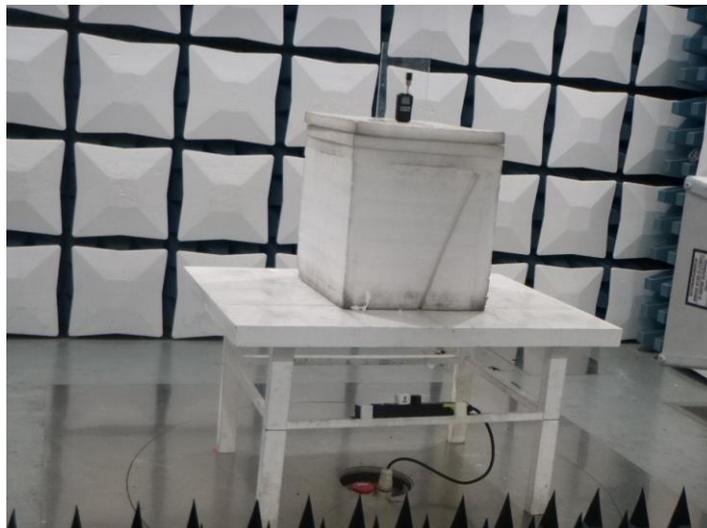
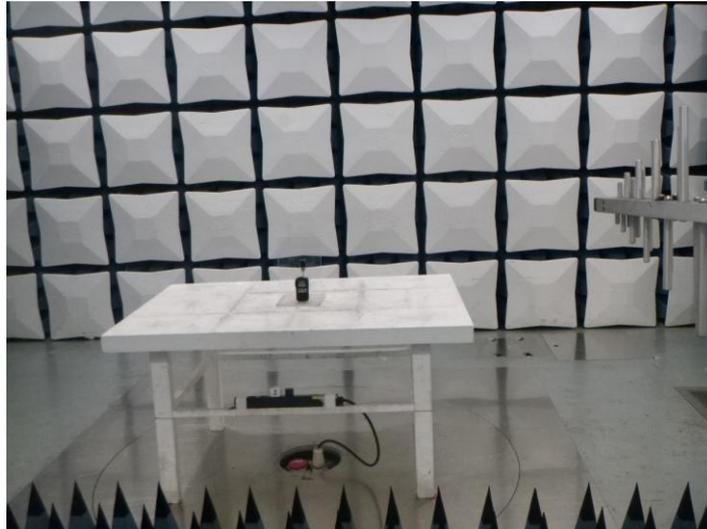
| | | | | | |
|-----------|--------|---------------|-----------------|-----------|----------|
| TEST MODE | TX-AWH | Test Channel: | CH _M | Polarity: | Vertical |
|-----------|--------|---------------|-----------------|-----------|----------|



| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|------|---------------|-------------|------------|----------|-----------|-----------|-----------|------------|--------|
| 1 | 1101.91 | -46.09 | 34.15 | 3.70 | 37.05 | -45.29 | -13.00 | -32.29 | Peak |
| 2 | 1574.62 | -52.12 | 37.76 | 4.43 | 37.02 | -46.95 | -13.00 | -33.95 | Peak |
| 3 | 1889.49 | -54.61 | 37.32 | 4.88 | 37.20 | -49.61 | -13.00 | -36.61 | Peak |

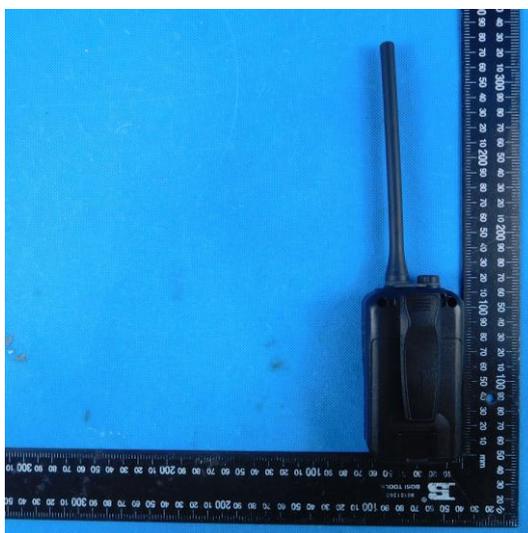


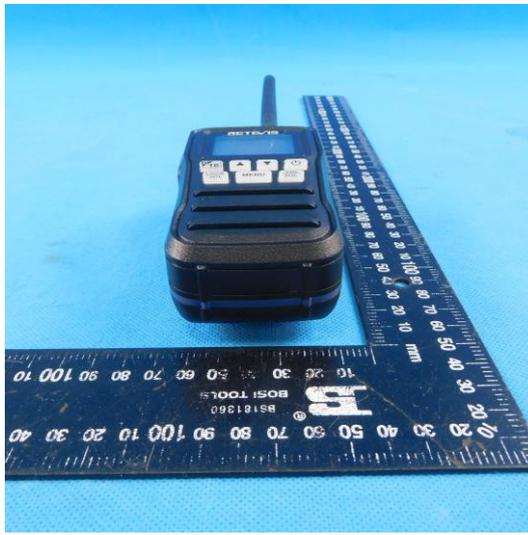
6 TEST SETUP PHOTOS OF THE EUT



7 EXTERNAL AND INTERNAL PHOTOS OF THE EUT

External Photos

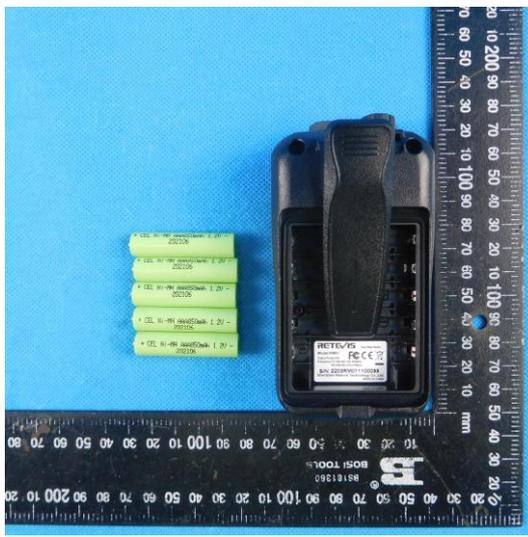


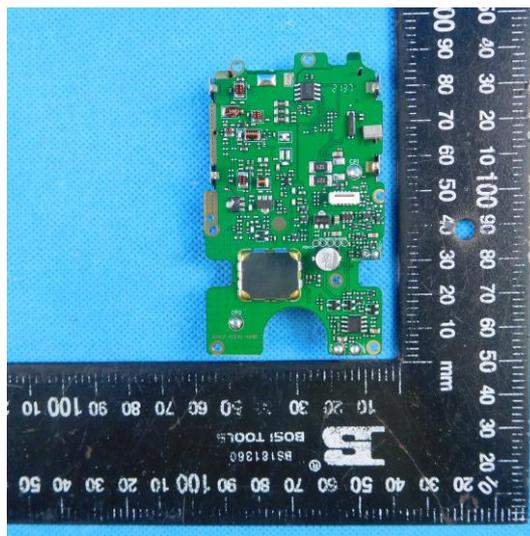
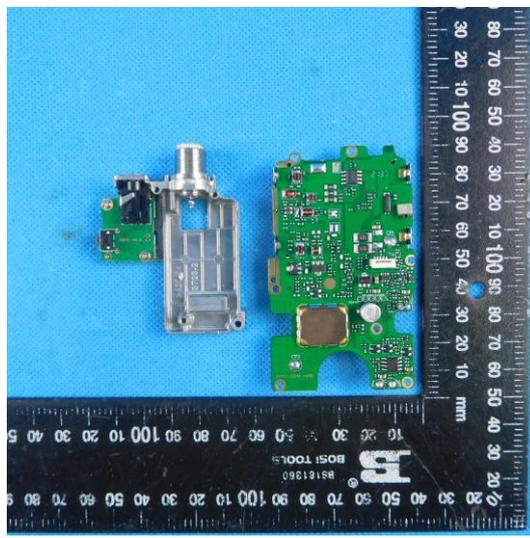


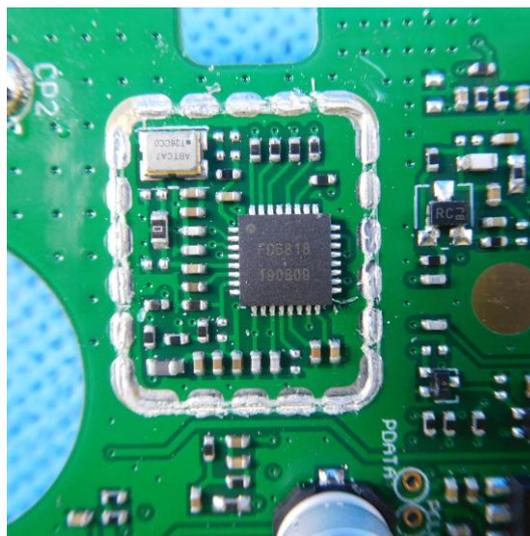
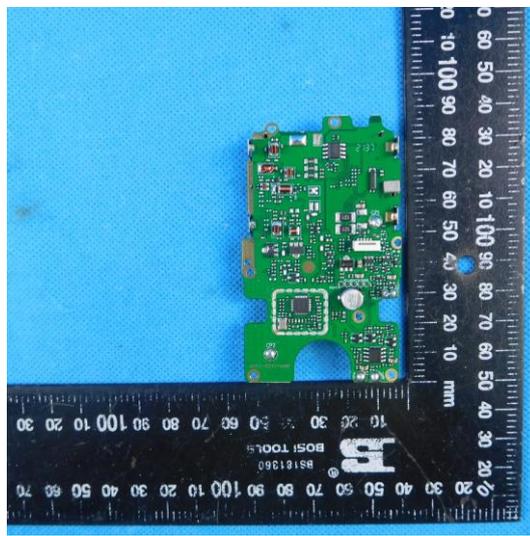
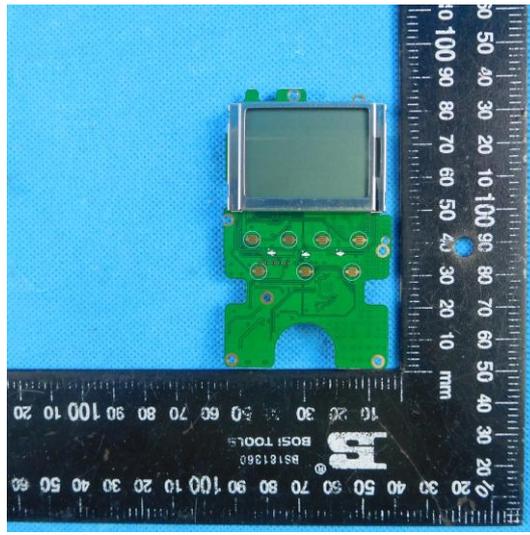




Internal Photos







8 APPENDIX REPORT