# FCC Testing of the Axnes Aviation AS Transceiver. Model: MP50 In accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2

Prepared for: Axnes Aviation AS
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FCC ID: 2AOHP MP50A (MP50)

## COMMERCIAL-IN-CONFIDENCE

Date: May 2018
Document Number: 75940027-02 | Issue: 01

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Project Management | Steven White | 15 May 2018 | |
| Authorised Signatory | Simon Bennett | 15 May 2018 | |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2. The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Testing | Mehadi Choudhury | 15 May 2018 | |
| Testing | Graeme Lawler | 15 May 2018 | |

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 80: 2016 and FCC 47 CFR Part 2: 2016.

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# 1 Report Summary

## 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue |
|---|---|---|
| 1 | First Issue | 15 May 2018 |

**Table 1**

## 1.2 Introduction

| | |
|---|---|
| Applicant | Axnes Aviation AS |
| Manufacturer | Axnes Aviation AS |
| Model Number(s) | MP50 |
| Serial Number(s) | 000 451 and 000 452 |
| Hardware Version(s) | R13 |
| Software Version(s) | AXS-SW-0221 |
| Number of Samples Tested | 2 |
| Test Specification/Issue/Date | FCC 47 CFR Part 80: 2016 and FCC 47 CFR Part 2: 2016 |
| Order Number<br>Date | 801584<br>10-August-2017 |
| Date of Receipt of EUT | 11-August-2017 |
| Start of Test | 31-October-2017 |
| Finish of Test | 12-April-2018 |
| Name of Engineer(s) | Matthew Russell, Mehadi Choudhury and Graeme Lawler |
| Related Document(s) | ANSI C63.26 (2015) |

## 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 80 and FCC 47 CFR Part 2 is shown below.

| Section | Specification Clause | | Test Description | Result | Comments/Base Standard |
|---|---|---|---|---|---|
| | Part 80 | Part 2 | | | |
| Configuration and Mode: PNG MP50 (Stand Alone) VHF Transceiver | | | | | |
| 2.1 | 80.205 | 2.1049 | Bandwidths | Pass | |
| 2.2 | 80.209 | 2.1055 | Transmitter Frequency Tolerances | Pass | |
| 2.3 | 80.211 | 2.1051 | Spurious Emissions at Antenna Terminals | Pass | |
| 2.4 | 80.211 | 2.1051 | Radiated Spurious Emissions | Pass | |
| 2.5 | 80.213 | 2.1047 | Modulation Requirements | Pass | |
| 2.6 | 80.215 | 2.1046 | Transmitter Power | Pass | |
| 2.7 | 80.217(b) | - | Suppression of Interference Aboard Ships | Pass | |

**Table 2**

## 1.4 Application Form

| EQUIPMENT DESCRIPTION | |
|---|---|
| Model Name/Number | PNG MP50 |
| Part Number | AXS-HH-D0100-N-C0 |
| Hardware Version | R13 |
| Software Version | AXS-SW-0221 |
| FCC ID (if applicable) | 2AOHPMP50A |
| Industry Canada ID (if applicable) | n/a |
| Technical Description (Please provide a brief description of the intended use of the equipment) | PNG system is a wireless intercom extention, for use in demanding high noise environments as tracked vehicles, around helicopters and aircrafts and similar. The base station (BST50) and control panel (CP50) is mounted in the vehicle, while the crew is equiped with MP50 connected to a helmet or headset. Two alternative charging sations are available CHG50 and CHG55. |

| INTENTIONAL RADIATORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Technology | Frequency Band (MHz) | Conducted Declared Output Power (dBm) | Antenna Gain (dBi) | Supported Bandwidth (s) (MHz) | Modulation Scheme(s) | ITU Emission Designator | Test Channels (MHz) | | |
| | | | | | | | Bottom | Middle | Top |
| UHF 16QAM | 405-470 | 26 | 5 | 0.025 | 16QAM | 22K0 D7WXT | 405.0125 | 434.9875 | 469.98750 |
| VHF FM | 156-162 | 26 | 5 | 0.025 | FM | 16KOG3E | 156.025 | 159.025 | 162.025 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| UN-INTENTIONAL RADIATOR | |
|---|---|
| Highest frequency generated or used in the device or on which the device operates or tunes | 1880 MHz used in VCO Divide by for before distribution |

| Power Source | | | |
|---|---|---|---|
| AC | Single Phase | Three Phase | Nominal Voltage |
| | | | |
| External DC | Nominal Voltage | Maximum Current | |
| | | | |
| Battery | Nominal Voltage | Battery Operating End Point Voltage | |
| | 3.6 | 3.2 | |
| Can EUT transmit whilst being charged? | | Yes ☒ No ☐ | |

| EXTREME CONDITIONS | | | | | |
|---|---|---|---|---|---|
| Maximum temperature | 50 | °C | Minimum temperature | -20 | °C |

| Ancillaries |
|---|
| Please list all ancillaries which will be used with the device. |
| |

| ANTENNA CHARACTERISTICS | | | | |
|---|---|---|---|---|
| ☐ | Antenna connector | | State impedance | Ohm |
| ☐ | Temporary antenna connector | | State impedance | Ohm |
| ☒ | Integral antenna | Type Monopole | | |
| ☐ | External antenna | Type | | |

I hereby declare that the information supplied is correct and complete

Name: Petter Johnsen
Position held: CTO Date: 5 Sep 2017

## 1.5 Product Information

### 1.5.1 Technical Description

PNG system is a wireless intercom extension, for use in demanding high noise environments as tracked vehicles, around helicopters and aircrafts and similar. The base station (BST50) and control panel (CP50) is mounted in the vehicle, while the crew is equipped with MP50 connected to a helmet or headset. Two alternative charging stations are available CHG50 and CHG55.

## 1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

## 1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

| Modification State | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|---|---|---|---|
| Serial Number: 000 451 | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |
| Serial Number: 000 452 | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |
| 1 | Firmware Update to reduce Occupied Bandwidth and Improve ACP for UHF. | Axnes Aviation AS | 04 April 2018 |

**Table 3**

## 1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

| Test Name | Name of Engineer(s) | Accreditation |
|---|---|---|
| Configuration and Mode: PNG MP50 (Stand Alone) VHF Transceiver | | |
| Bandwidths | Matthew Russell | UKAS |
| Transmitter Frequency Tolerances | Mehadi Choudhury | UKAS |
| Spurious Emissions at Antenna Terminals | Matthew Russell and Mehadi Choudhury | UKAS |
| Radiated Spurious Emissions | Graeme Lawler | UKAS |
| Modulation Requirements | Mehadi Choudhury | UKAS |
| Transmitter Power | Mehadi Choudhury | UKAS |
| Suppression of Interferance Aboard Ships | Mehadi Choudhury | UKAS |

**Table 4**

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

# 2 Test Details

## 2.1 Bandwidths

### 2.1.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.205 and 2.1049

### 2.1.2 Equipment Under Test and Modification State

MP50, S/N: 000 452 - Modification State 1

### 2.1.3 Date of Test

12 April 2017

### 2.1.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.4.4.

The EUT was modulated using an internally generated test tone provided by the manufacturer.

### 2.1.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 22.6 °C |
| Relative Humidity | 39.6 % |

### 2.1.6 Test Results

PNG MP50 (Stand Alone) VHF Transceiver

| Occupied Bandwidth (kHz) | | |
|---|---|---|
| 156.0125 MHz | 159.0000 MHz | 161.9875 MHz |
| 13.690 | 14.319 | 10.797 |

**Table 5 - Occupied Bandwidth Results**

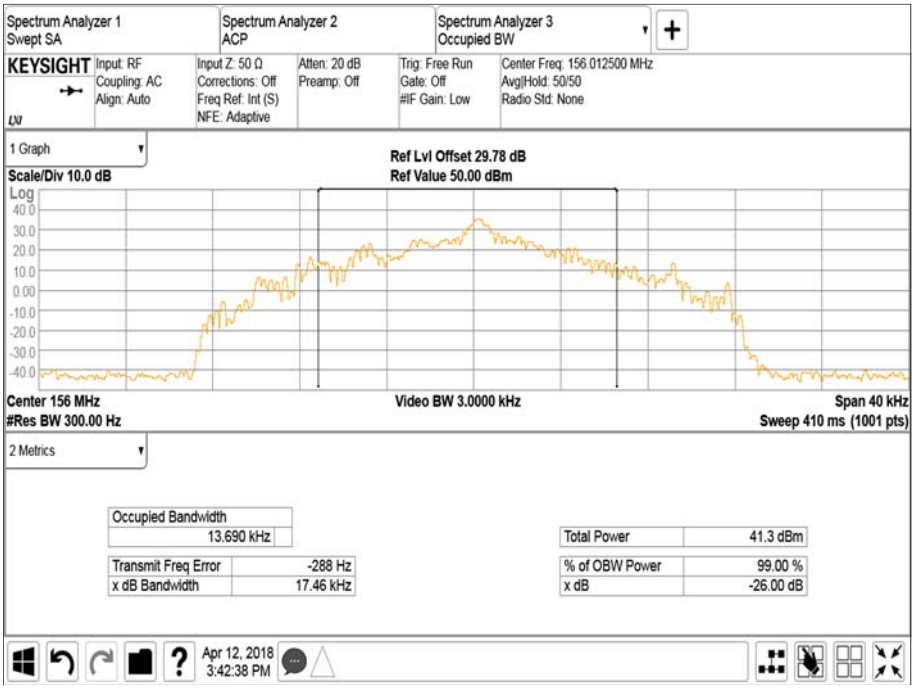


**Figure 1 - 156.0125 MHz Occupied Bandwidth**

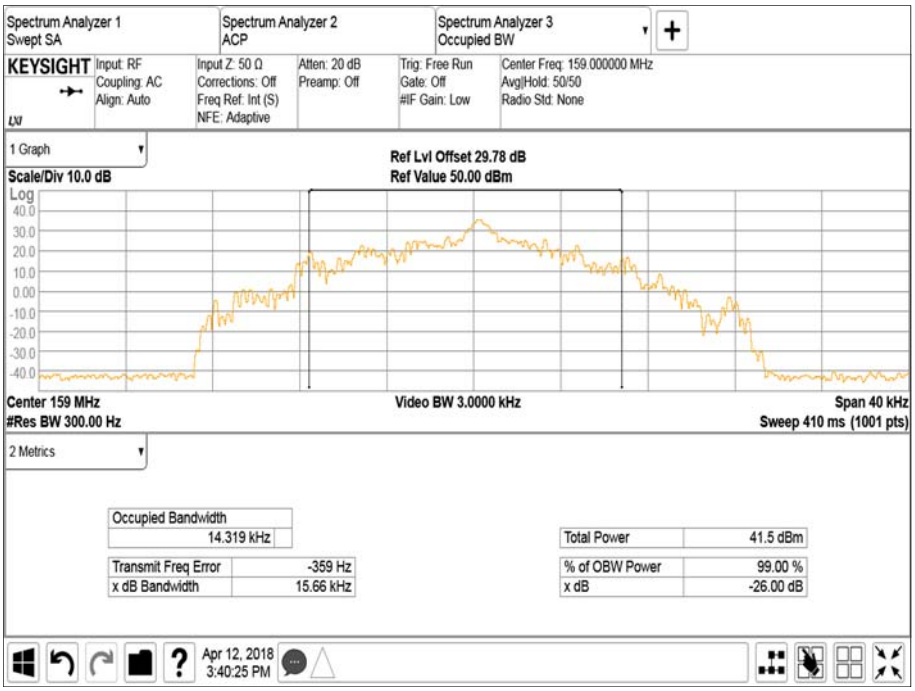


**Figure 2 - 159.0000 MHz Occupied Bandwidth**

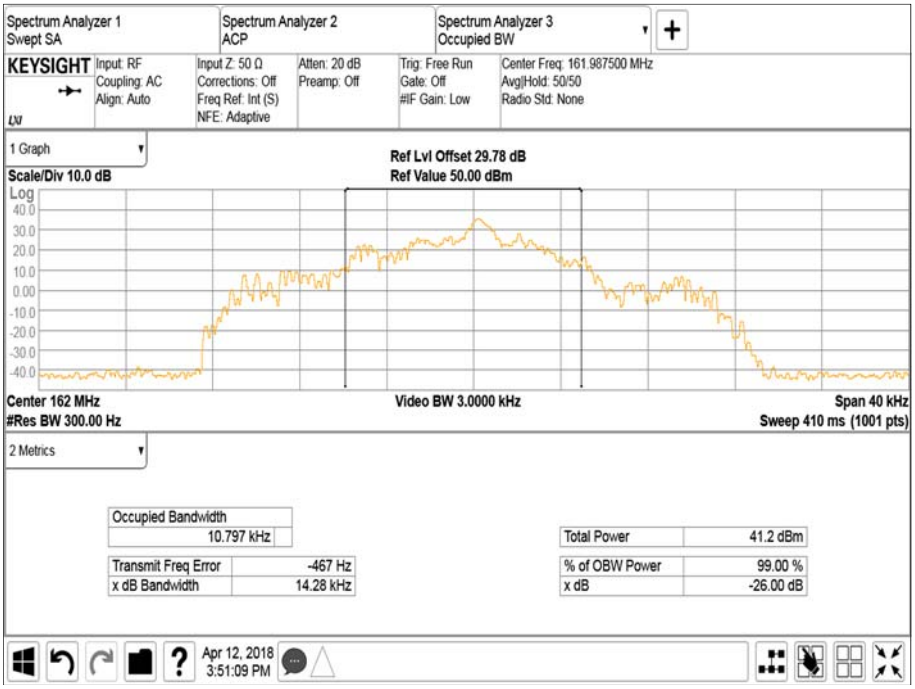


**Figure 3 - 161.9875 MHz Occupied Bandwidth**

<u>FCC 47 CFR Part 80, Limit Clause 80.205(a)</u>

Authorized Bandwidth 20 kHz
(Emissions Designator, 16K0G3E)

### 2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 14-Sep-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Attenuator (20dB, 150W) | Narda | 769-20 | 3367 | 12 | 31-May-2018 |
| 1 Metre SMA Cable | Rhophase | 3PS-1801A-1000-3PS | 4099 | 12 | 19-Sep-2018 |
| 2 metre SMA Cable | Florida Labs | SMS-235SP-78.8-SMS | 4518 | 12 | 19-Sep-2018 |
| 4 Channel PSU | Rohde & Schwarz | HMP4040 | 4736 | - | TU |
| EXA | Keysight Technologies | N9010B | 4968 | 12 | 21-Dec-2018 |

**Table 6**

TU - Traceability Unscheduled

## 2.2 Transmitter Frequency Tolerances

### 2.2.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.209 and 2.1055

### 2.2.2 Equipment Under Test and Modification State

MP50, S/N: 000 452 - Modification State 0

### 2.2.3 Date of Test

01 November 2017

### 2.2.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.6. A spectrum analyser was used to measure the unmodulated carrier frequency.

### 2.2.5 Environmental Conditions

Ambient Temperature 23.4 °C
Relative Humidity 43.1 %

### 2.2.6 Test Results

PNG MP50 (Stand Alone) VHF Transceiver

| Voltage | Frequency Error (ppm) | |
|---|---|---|
| | 156.0125 MHz | 161.9875 MHz |
| 3.2 V DC | 0.462 | 0.475 |
| 3.6 V DC | 0.668 | 0.681 |

**Table 7 - Frequency Stability Under Voltage Variations**

| Temperature | Frequency Error (ppm) | |
|---|---|---|
| | 156.0125 MHz | 161.9875 MHz |
| +50.0 °C | 0.575 | 0.574 |
| +40.0 °C | 0.462 | 0.455 |
| +30.0 °C | 0.586 | 0.584 |
| +20.0 °C | 0.729 | 0.722 |
| +10.0 °C | 0.883 | 0.861 |
| 0 °C | 0.770 | 0.772 |
| -10.0 °C | 0.534 | 0.554 |
| -20.0 °C | 0.606 | 0.613 |

**Table 8 - Frequency Stability Under Temperature Variations**

FCC 47 CFR Part 80, Limit Clause 80.209(a)

± 10 ppm.

### 2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Power Supply | Hewlett Packard | 6267B | 21 | - | O/P Mon |
| Climatic Chamber | Votsch | VT4002 | 161 | 12 | O/P Mon |
| Multimeter | Iso-tech | IDM-101 | 466 | 12 | 02-Oct-2018 |
| Digital Temperature Indicator | Fluke | 51 | 2267 | 12 | 05-Jul-2018 |
| Cable( 3m, SMA(m) - SMA(m) ) | Reynolds | 262-0248-3000 | 2402 | 12 | 19-Sep-2018 |
| Spectrum Analyser | Rohde & Schwarz | FSU26 | 2747 | 12 | 02-Feb-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 02-Oct-2018 |
| Calibration Unit | Rohde & Schwarz | ZV-Z54 | 4368 | 12 | 19-Sep-2018 |
| Frequency Standard | Spectracom | Secure Sync 1200-0408-0601 | 4393 | 6 | 12-Mar-2018 |
| 30dB Attenuator | Narda | 766-30 | 4783 | 12 | 03-Oct-2018 |

**Table 9**

O/P Mon – Output Monitored using calibrated equipment

## 2.3 Spurious Emissions at Antenna Terminals

### 2.3.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.211 and 2.1051

### 2.3.2 Equipment Under Test and Modification State

MP50, S/N: 000 452 - Modification State 0
MP50, S/N: 000 452 - Modification State 1 (Emission Mask Only)

### 2.3.3 Date of Test

21 November 2017 and 12 April 2018

### 2.3.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.7.

The EUT was modulated using an internally generated test tone provided by the manufacturer.

### 2.3.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 22.6-24.1 °C |
| Relative Humidity | 39.6-40.3 % |

### 2.3.6 Test Results

PNG MP50 (Stand Alone) VHF Transceiver

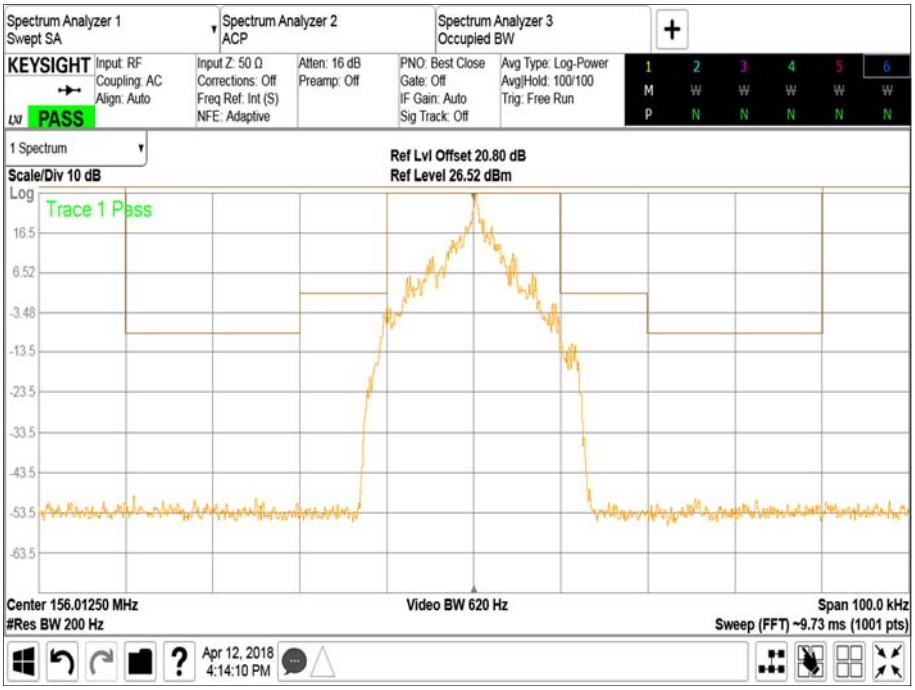


**Figure 4 - 156.0125 MHz - Transmitter Spectrum Mask**

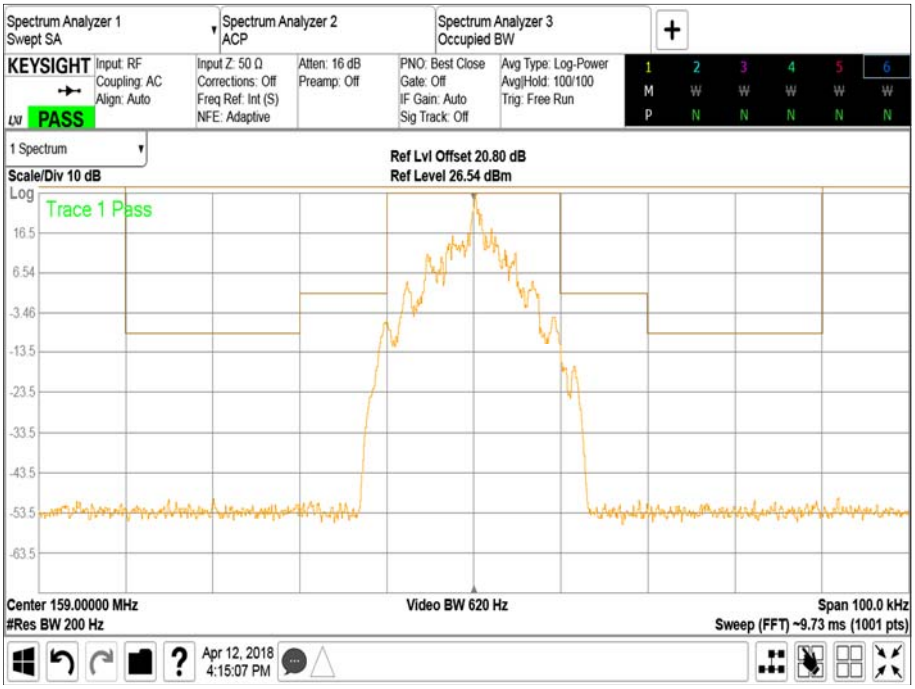


**Figure 5 - 159.0000 MHz - Transmitter Spectrum Mask**

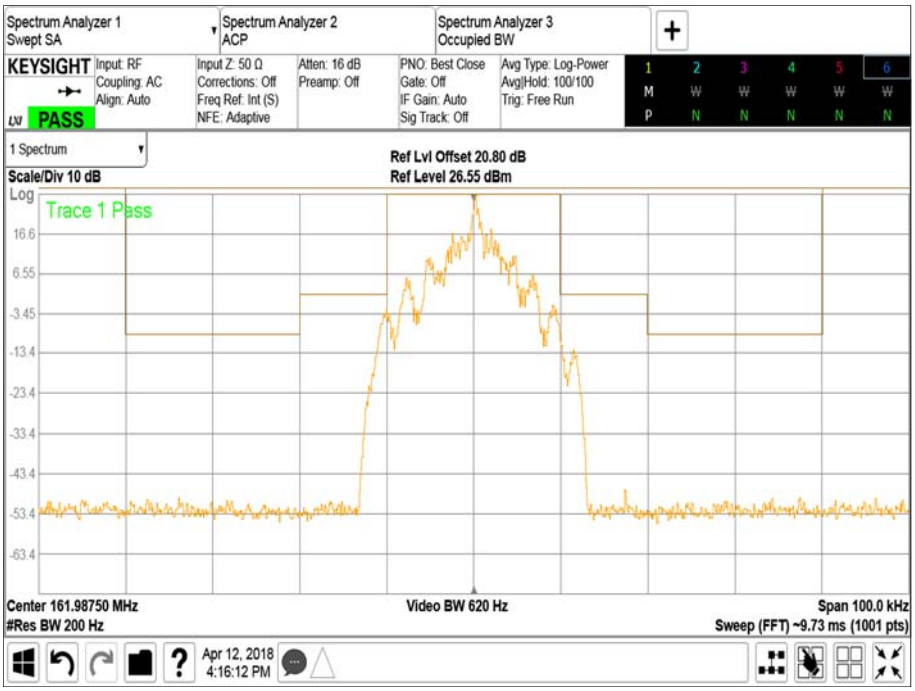


**Figure 6 - 161.9875 MHz - Transmitter Spectrum Mask**

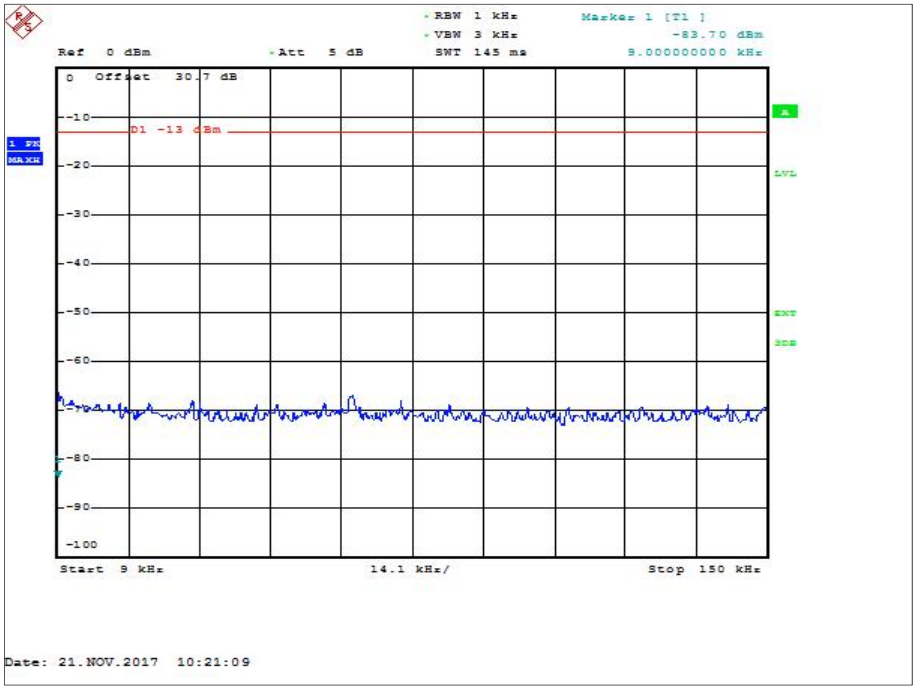


**Figure 7 - 156.0125 MHz - 9 kHz to 150 kHz**

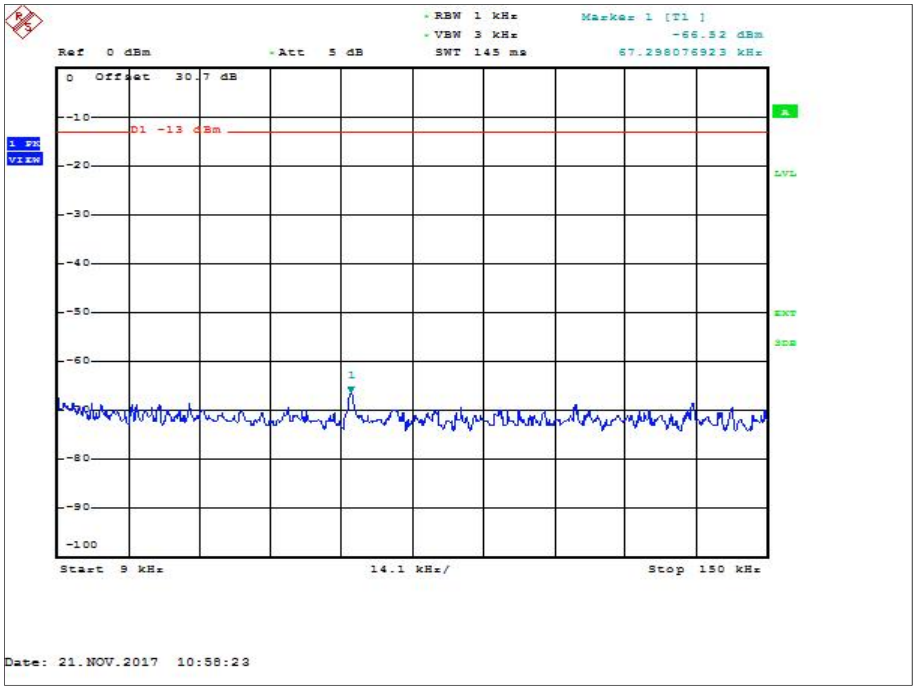


**Figure 8 - 159.0000 MHz - 9 kHz to 150 kHz**

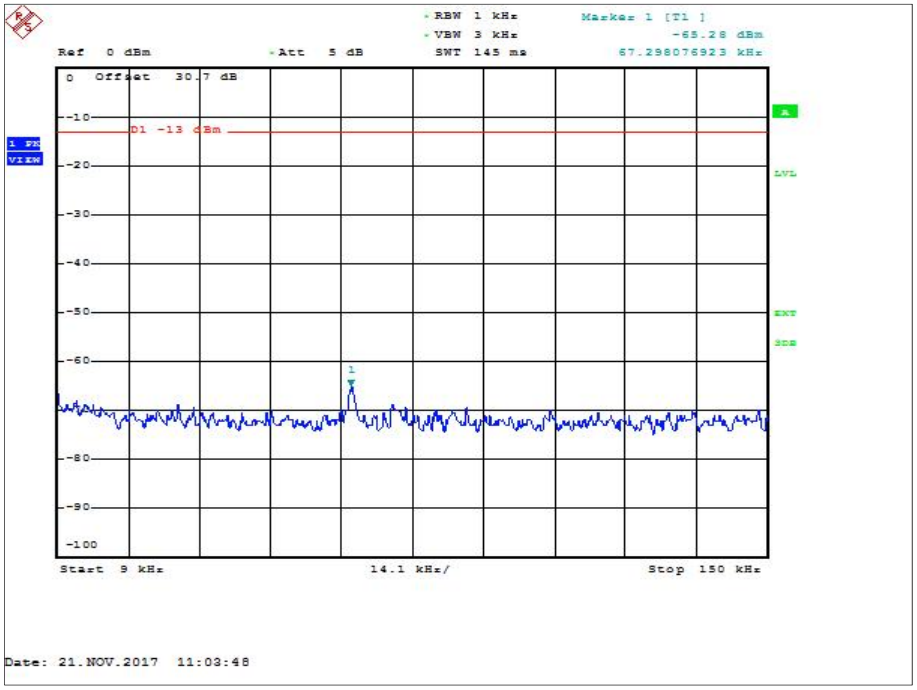


**Figure 9 - 161.9875 MHz - 9 kHz to 150 kHz**

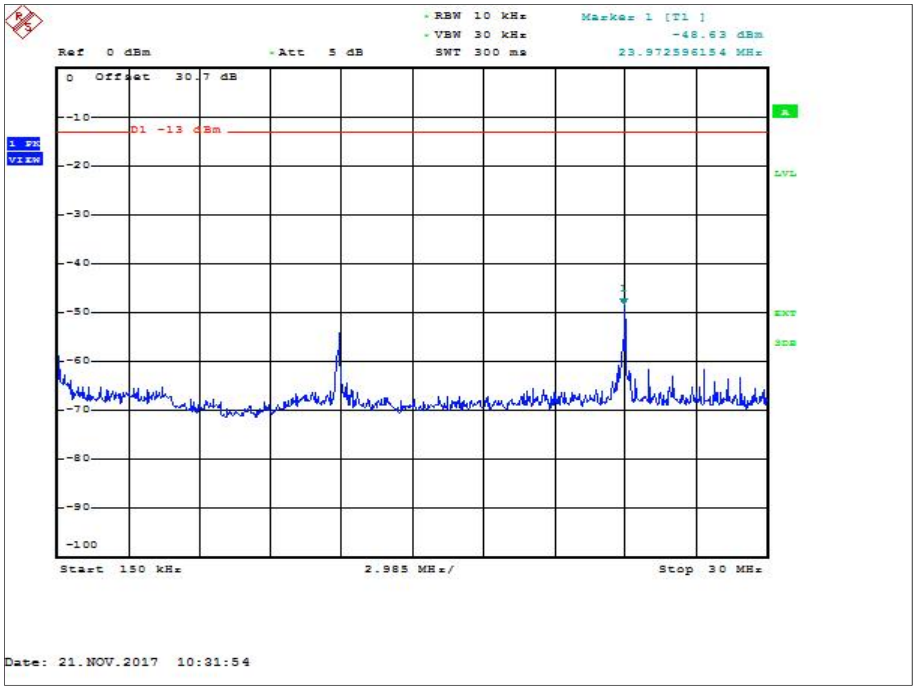


**Figure 10 - 156.0125 MHz - 150 kHz to 30 MHz**

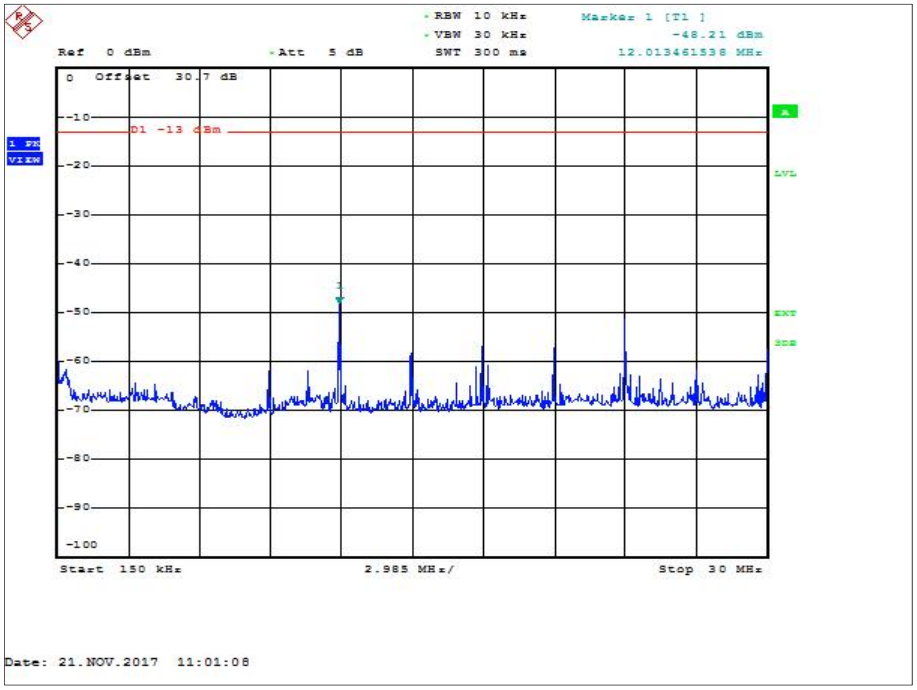


**Figure 11 - 159.0000 MHz - 150 kHz to 30 MHz**

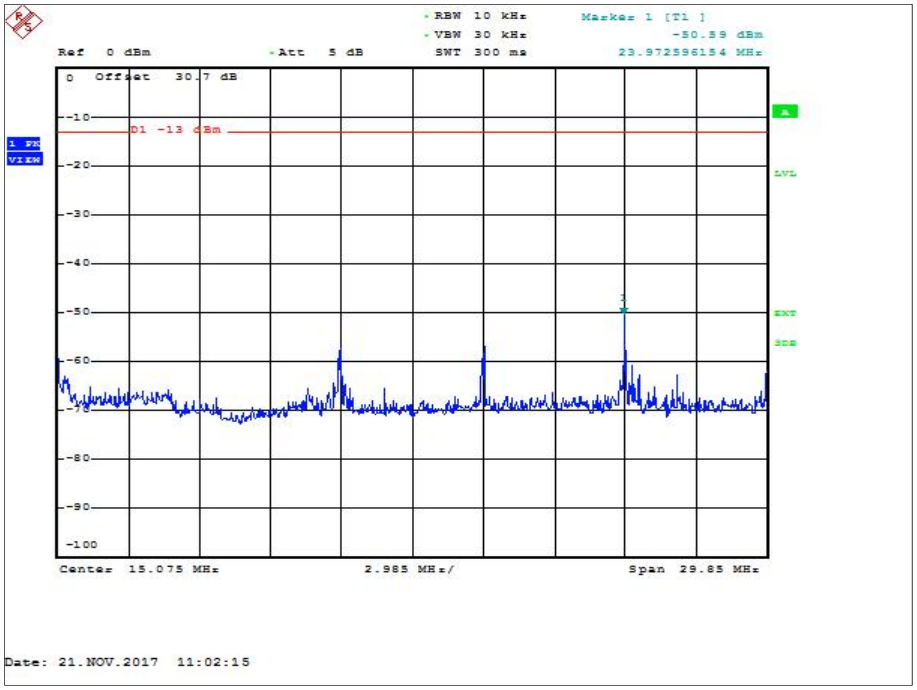


**Figure 12 - 161.9875 MHz - 150 kHz to 30 MHz**

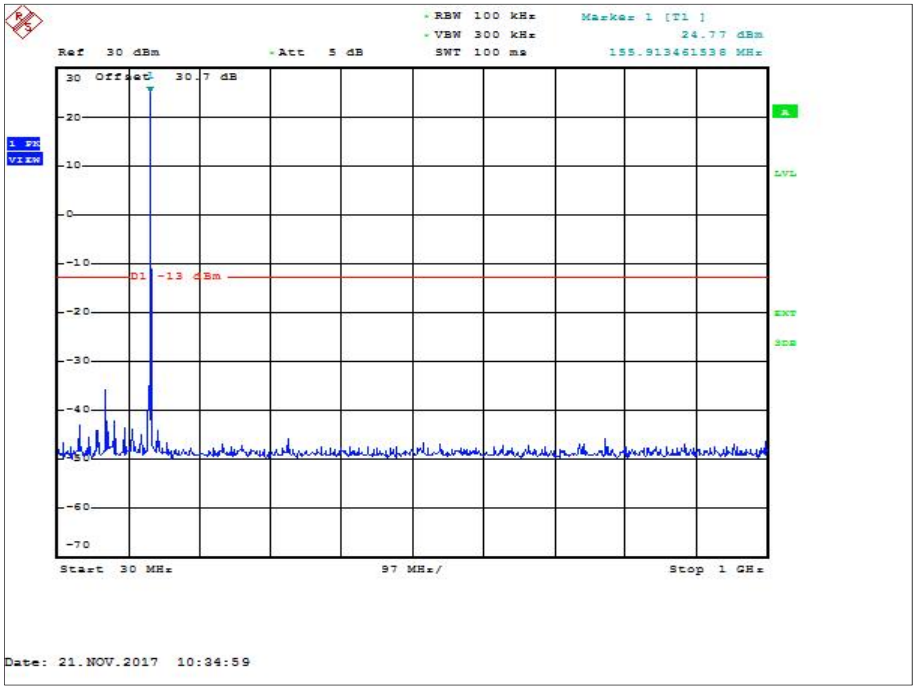


**Figure 7 - 156.0125 MHz - 30 MHz to 1 GHz**

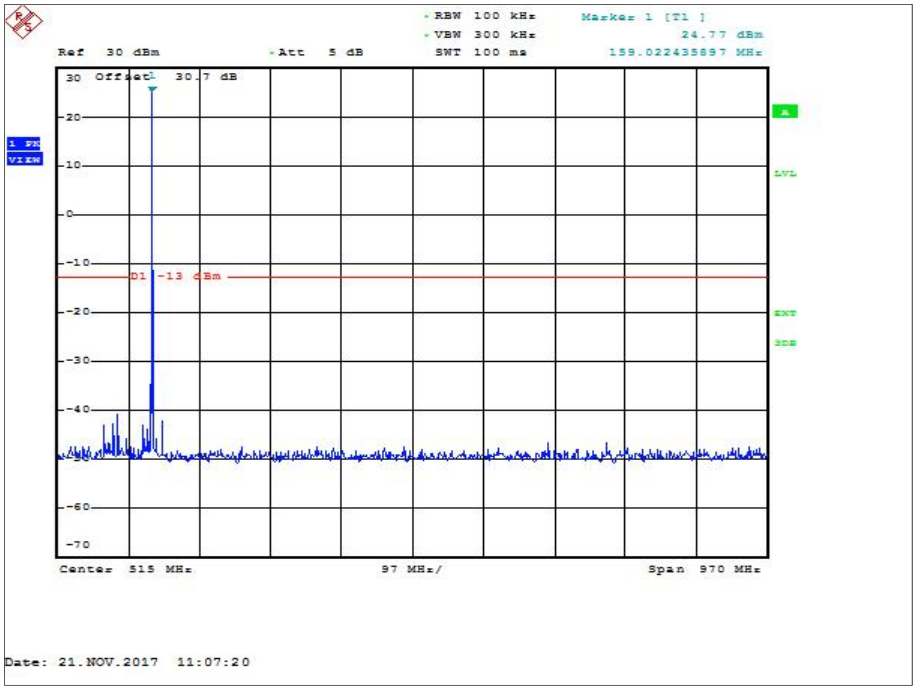


**Figure 8 - 159.0000 MHz - 30 MHz to 1 GHz**

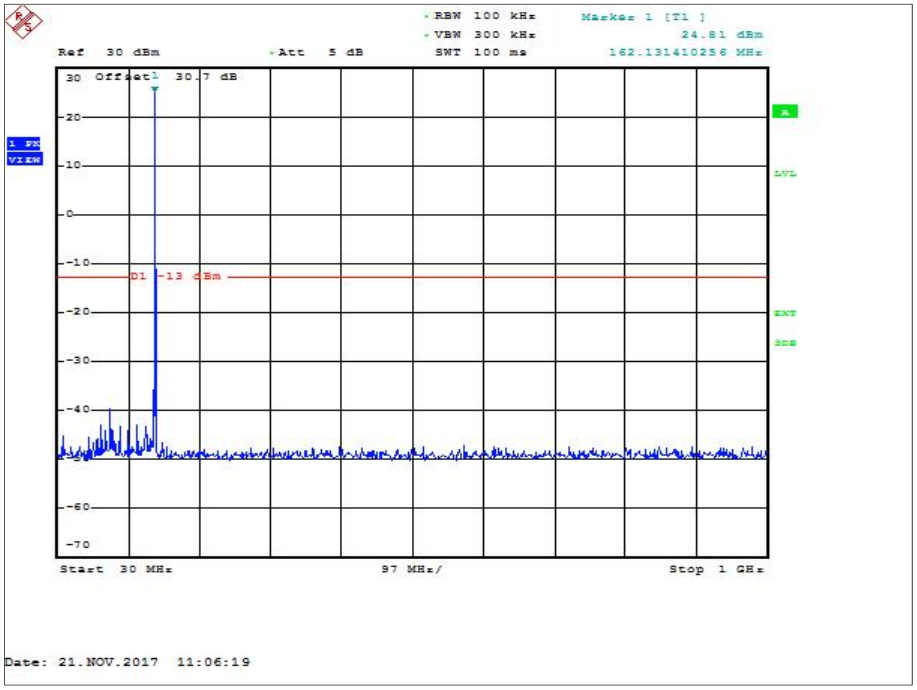


**Figure 9 - 161.9875 MHz - 30 MHz to 1 GHz**

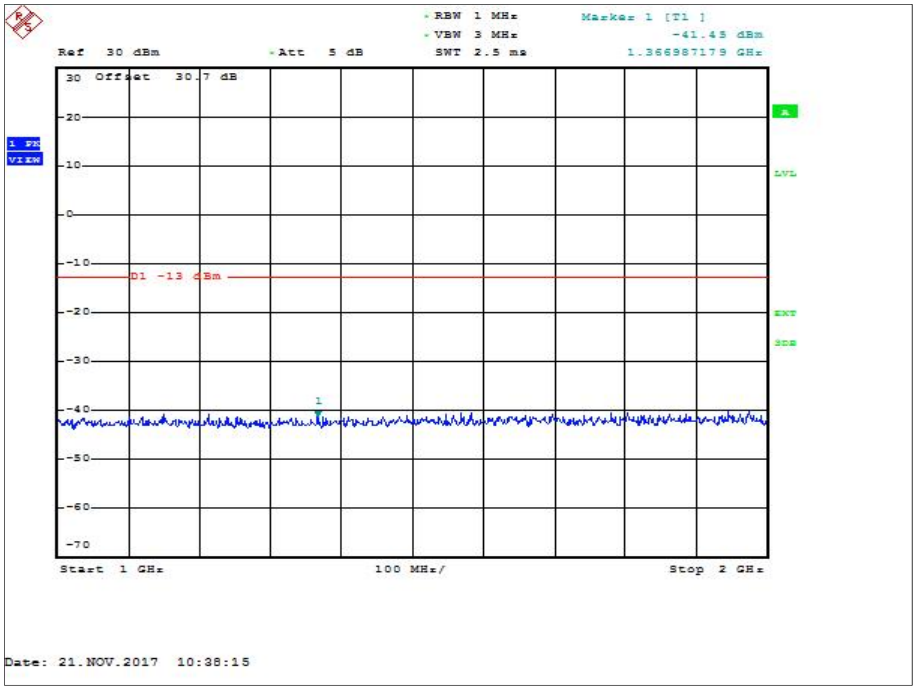


**Figure 10 - 156.0125 MHz - 1 GHz to 2 GHz**

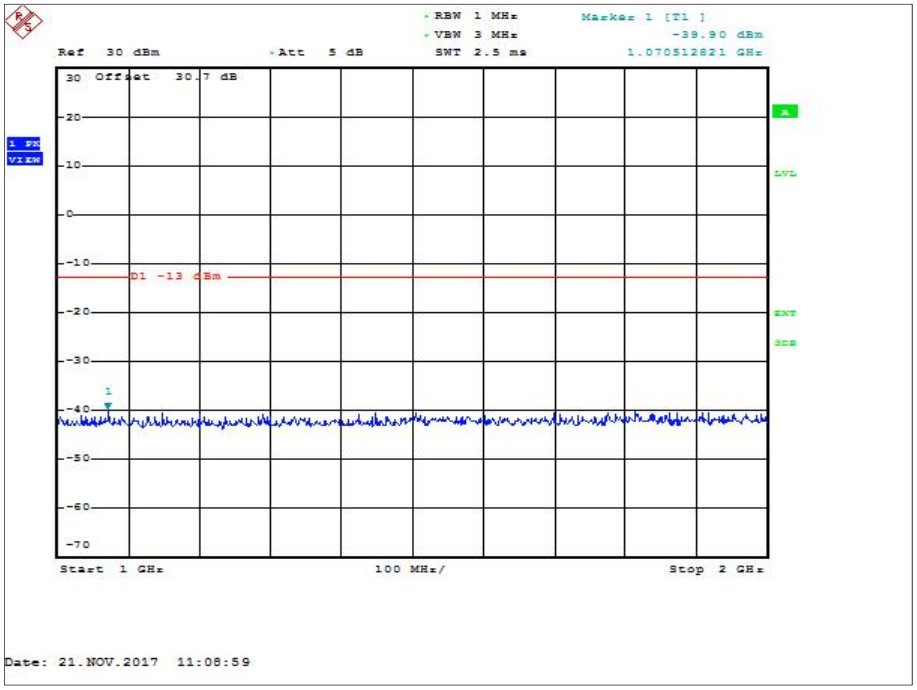


**Figure 11 - 159.0000 MHz - 1 GHz to 2 GHz**

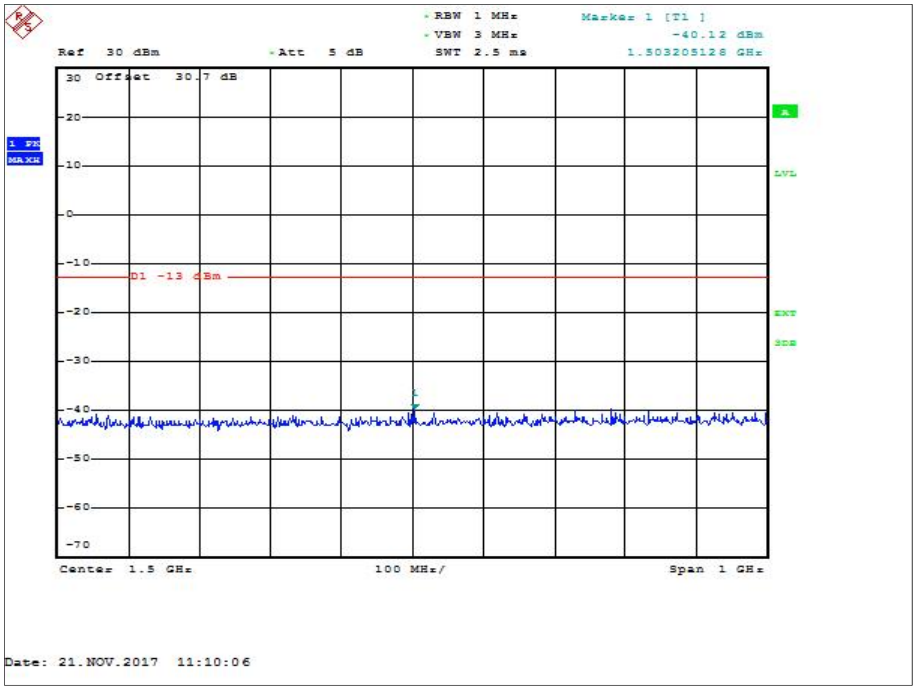


**Figure 12 - 161.9875 MHz - 1 GHz to 2 GHz**

FCC 47 CFR Part 80, Limit Clause 80.211(a)

Within 250% of the Authorised Bandwidth:

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;

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

More than 250% of the Authorised Bandwidth:

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.

### 2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Power Supply Unit | Farnell | LB30-4 | 158 | 12 | O/P Mon |
| Multimeter | White Gold | WG022 | 190 | 12 | 24-Nov-2017 |
| Directional Coupler | Narda | 3020A | 419 | 6 | O/P Mon |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 14-Sep-2018 |
| Step Attenuator | Rohde & Schwarz | DPSP | 1672 | - | O/P Mon |
| Audio Analyser | Hewlett Packard | 8903B | 2212 | 12 | 11-Aug-2018 |
| Cable( 3m, SMA(m) - SMA(m) ) | Reynolds | 262-0248-3000 | 2402 | 12 | 19-Sep-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Signal Analyser | Rohde & Schwarz | FSQ 26 | 3545 | 12 | 23-Oct-2018 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 02-Oct-2018 |
| 1 Metre SMA Cable | Rhophase | 3PS-1801A-1000-3PS | 4099 | 12 | 19-Sep-2018 |
| Calibration Unit | Rohde & Schwarz | ZV-Z54 | 4368 | 12 | 19-Sep-2018 |
| Frequency Standard | Spectracom | Secure Sync 1200-0408-0601 | 4393 | 6 | 12-Mar-2018 |
| 1 metre SMA Cable | Florida Labs | SMS-235SP-39.4-SMS | 4514 | 12 | 19-Sep-2018 |
| 2 metre SMA Cable | Florida Labs | SMS-235SP-78.8-SMS | 4518 | 12 | 19-Sep-2018 |
| 4 Channel PSU | Rohde & Schwarz | HMP4040 | 4736 | - | TU |
| 30dB Attenuator | Narda | 766-30 | 4783 | 12 | 19-Dec-2018 |
| EXA | Keysight Technologies | N9010B | 4968 | 12 | 21-Dec-2018 |

**Table 10**

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

## 2.4 Radiated Spurious Emissions

### 2.4.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.211 and 2.1051

### 2.4.2 Equipment Under Test and Modification State

MP50, S/N: 000 451 - Modification State 0

### 2.4.3 Date of Test

18 November 2017 to 19 November 2017

### 2.4.4 Test Method

Testing was performed in accordance with ANSI C63.26-2015 clause 5.5.

Pre-scans were performed using the direct field strength method. Any emissions found within 10dB of the specification limit were formally measured using the substitution method.

The limit line on the pre-scan plots was calculated using the equation c) in clause 5.2.7.

E (dBµV/m) = EIRP (dBm) − 20log(D) + 104.8; where D is the measurement distance (in the far field region) in m.

82.2 dBµV/m = -13 dBm – 20log(3) + 104.8

### 2.4.5 Environmental Conditions

Ambient Temperature 16.5 °C
Relative Humidity 44.0 %

### 2.4.6 Test Results

PNG MP50 (Stand Alone) VHF Transceiver

| Frequency (MHz) | Level (dBm) |
|---|---|
| * | |

**Table 11 - 156.0125 MHz - Emissions Results**

*No emissions were detected within 10 dB of the limit.

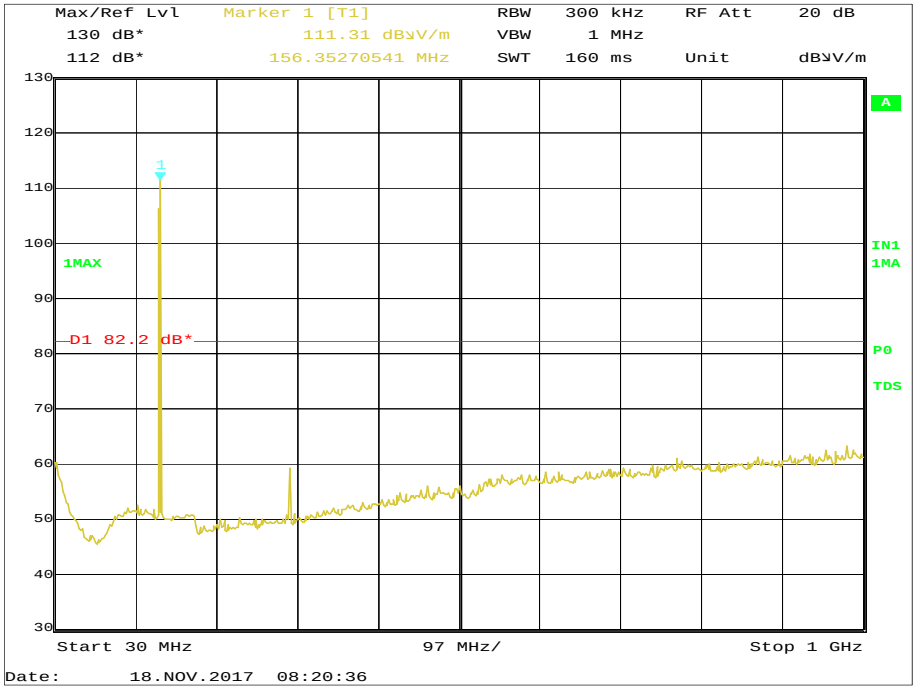


**Figure 13 - 156.0125 MHz - 30 MHz to 1 GHz**

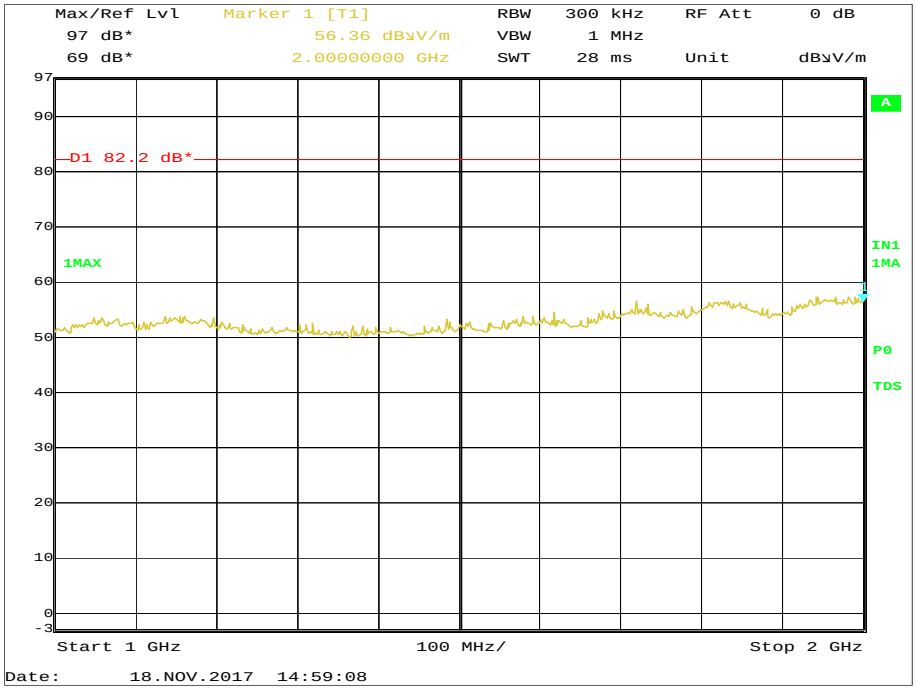


**Figure 14 - 156.0125 MHz - 1 GHz to 2 GHz**

| Frequency (MHz) | Level (dBm) |
|---|---|
| * | |

**Table 12 - 159.0000 MHz - Emissions Results**

*No emissions were detected within 10 dB of the limit.

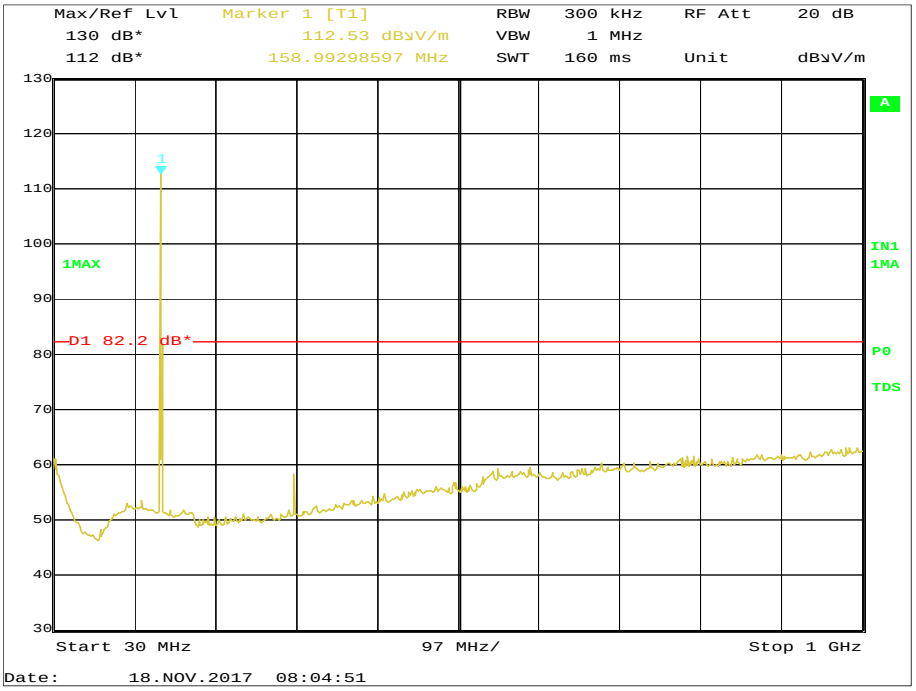


**Figure 15 - 159.0000 MHz - 30 MHz to 1 GHz**

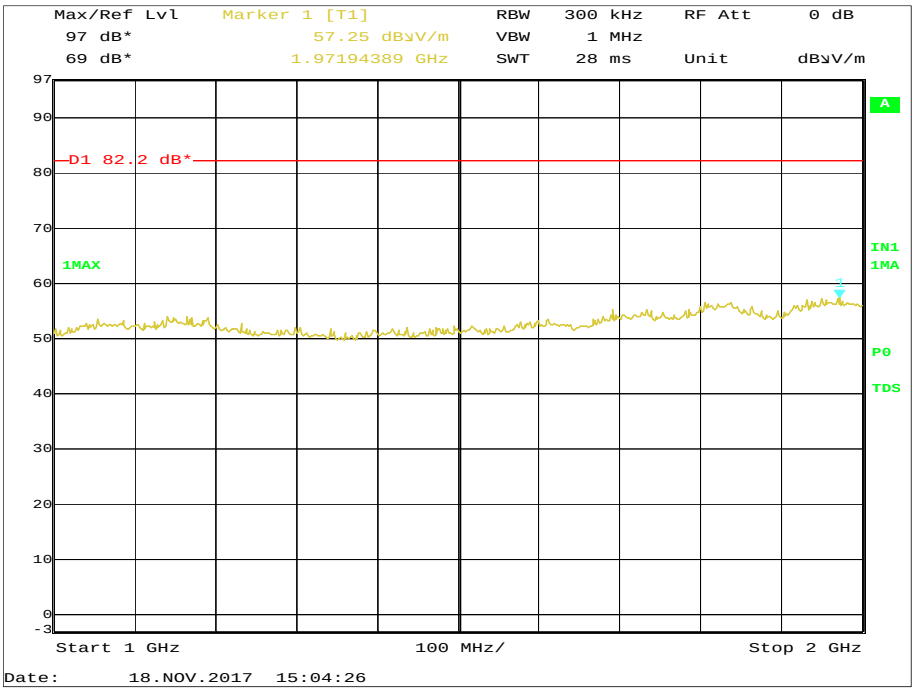


**Figure 16 - 159.0000 MHz - 1 GHz to 2 GHz**

| Frequency (MHz) | Level (dBm) |
|---|---|
| * | |

**Table 13 - 159.0000 MHz - Emissions Results**

*No emissions were detected within 10 dB of the limit.

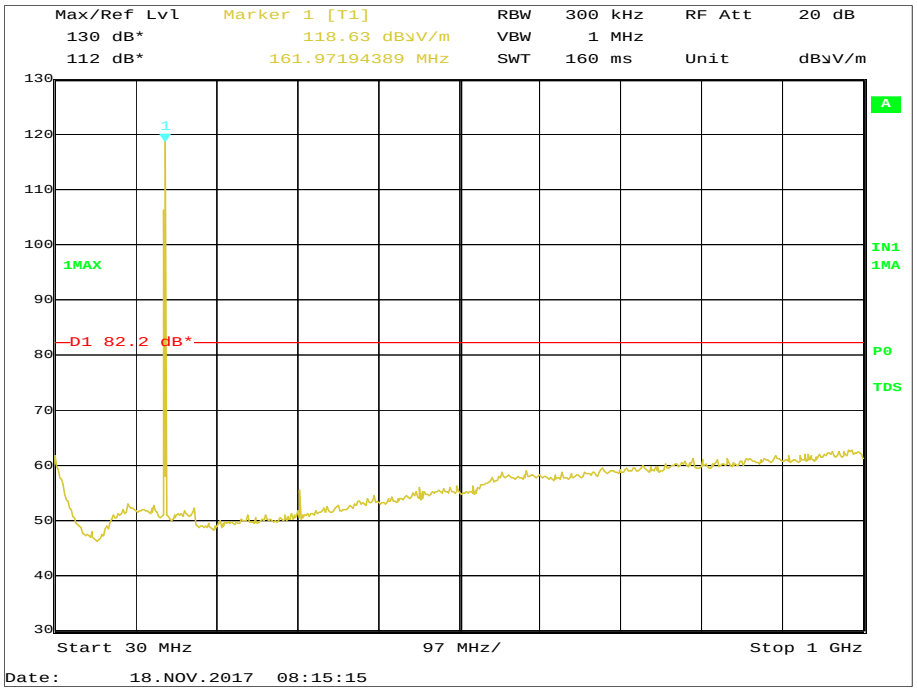


**Figure 17 - 161.9875 MHz - 30 MHz to 1 GHz**

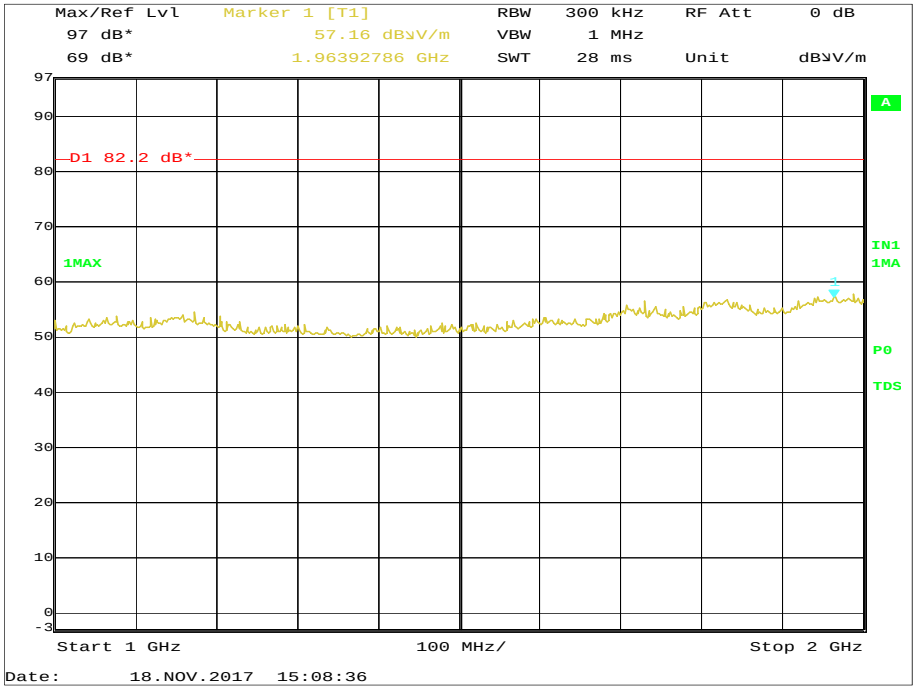


**Figure 18 - 161.9875 MHz - 1 GHz to 2 GHz**

<u>FCC 47 CFR Part 80, Limit Clause 80.211(a)</u>

More than 250% of the Authorised Bandwidth:

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.

### 2.4.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Test Receiver | Rohde & Schwarz | ESIB26 | 242 | 12 | 19-Jun-2018 |
| Antenna (Bilog) | Schaffner | CBL6143 | 287 | 24 | 18-Apr-2018 |
| Signal Generator (10MHz to 40GHz) | Rohde & Schwarz | SMR40 | 1002 | 12 | 20-Oct-2018 |
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 20-Dec-2017 |
| Turntable Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Hygrometer | Rotronic | HYGROPALM 1 | 2338 | 12 | 24-Oct-2018 |
| Digital Multimeter | Iso-tech | IDM-101 | 2895 | 12 | 20-Jul-2018 |
| Antenna (Log Periodic) | Schaffner | UPA6108 | 3109 | 12 | 16-Jun-2018 |
| Cable (N-N, 8m) | Rhophase | NPS-2302-8000-NPS | 3248 | 12 | 02-May-2018 |
| EMI Test Receiver | Rohde & Schwarz | ESU40 | 3506 | 12 | 22-Nov-2018 |
| Tilt Antenna Mast | maturo Gmbh | TAM 4.0-P | 3916 | - | TU |
| Mast Controller | maturo Gmbh | NCD | 3917 | - | TU |
| TRUE RMS MULTIMETER | Fluke | 179 | 4006 | 12 | 13-Dec-2017 |
| Cable (Rx, Km-Km 2m) | Scott Cables | KPS-1501-2000-KPS | 4526 | 6 | 22-May-2018 |
| Cable (Yellow, Rx, Km-Km 2m) | Scott Cables | KPS-1501-2000-KPS | 4527 | 6 | 04-Dec-2017 |
| Double Ridge Broadband Horn Antenna | Schwarzbeck | BBHA 9120 B | 4848 | 12 | 17-Feb-2018 |

**Table 14**

TU - Traceability Unscheduled

## 2.5 Modulation Requirements

### 2.5.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.213 and 2.1047

### 2.5.2 Equipment Under Test and Modification State

MP50, S/N: 000 452 - Modification State 0

### 2.5.3 Date of Test

03 November 2017

### 2.5.4 Test Method

The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was configured to transmit at maximum power. The audio input was initially set at a level of 50 mV and the audio frequency varied between 100 Hz and 5 kHz to show the audio frequency response.

At frequencies of 100 Hz, 1 kHz and 5 kHz, the audio input voltage was varied between 1 mV and 1000 mV to show the EUT's capability to limit the level of modulation for different input signal levels and frequencies. The results are shown on the graph below.

### 2.5.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 22.6 °C |
| Relative Humidity | 42.6 % |

### 2.5.6 Test Results

PNG MP50 (Stand Alone) VHF Transceiver

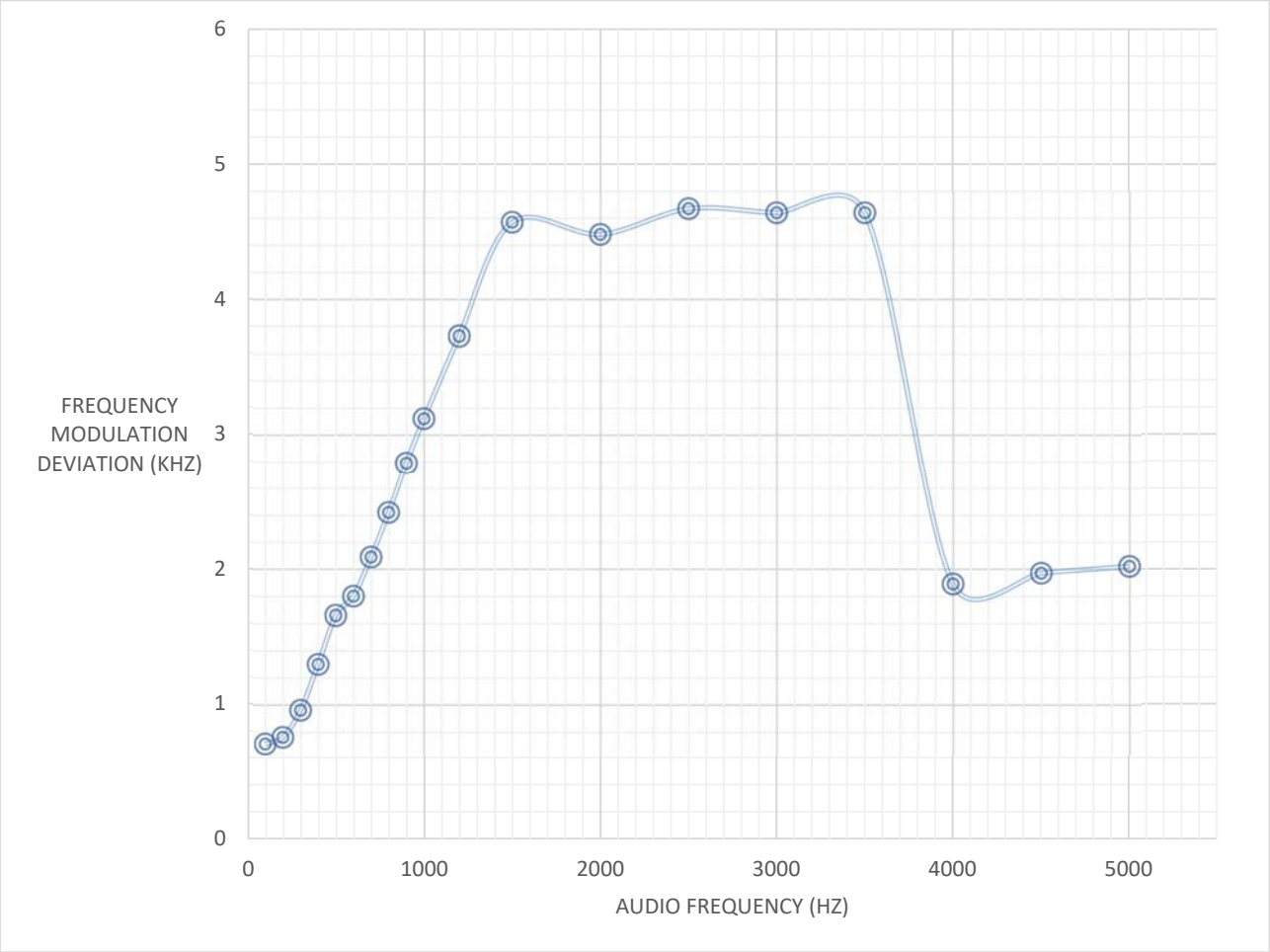


**Figure 19 – Audio Frequency Response**

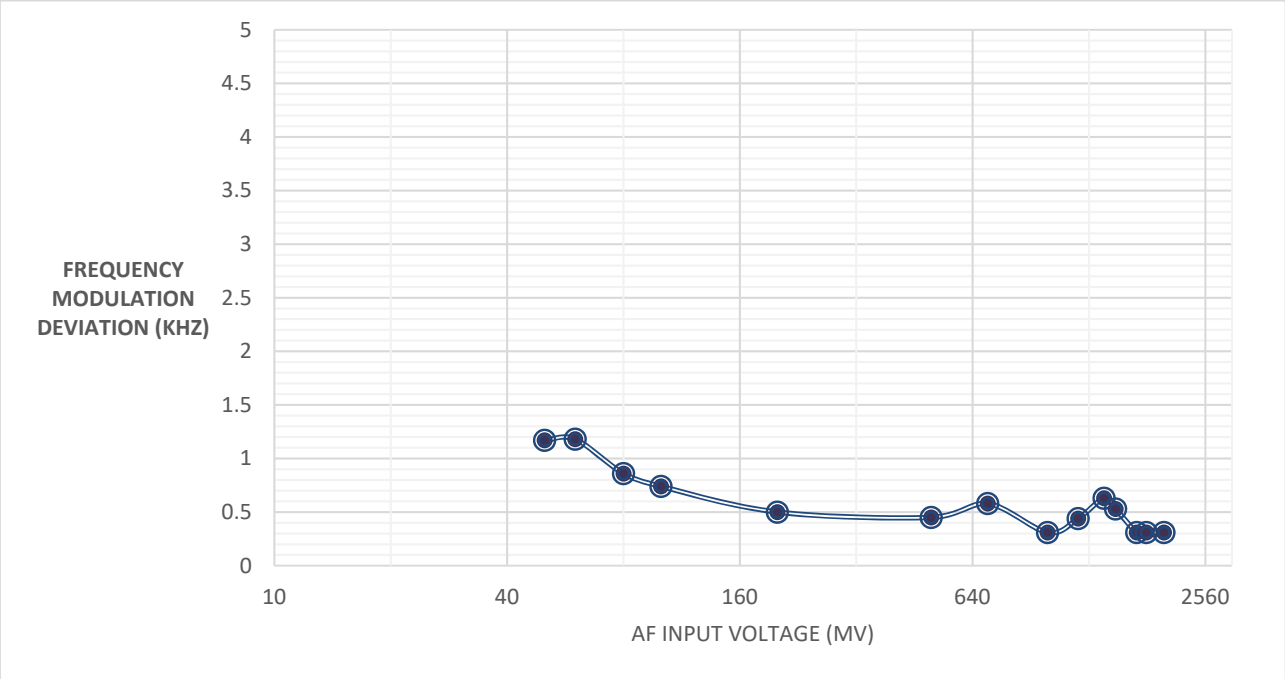


**Figure 20 - Modulation Limiting Capability -100 Hz AF**

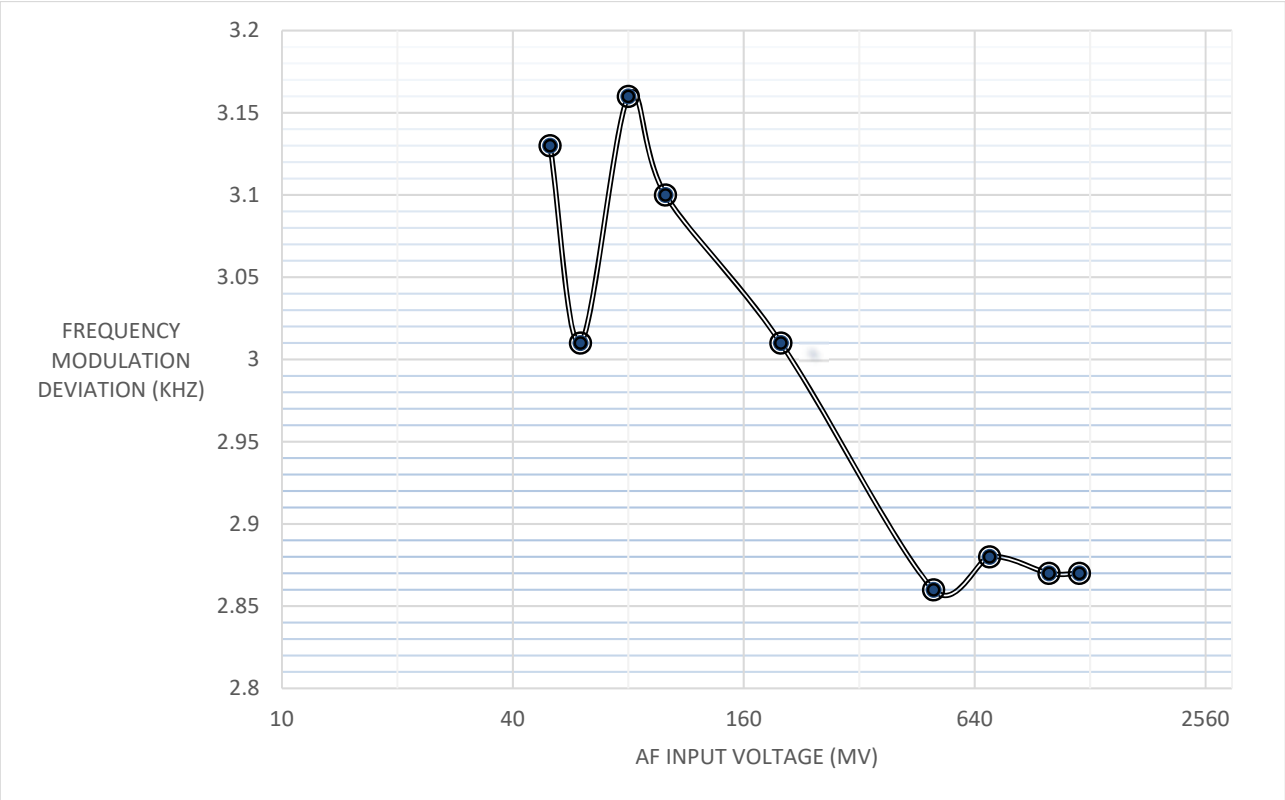


**Figure 21 - Modulation Limiting Capability - 1 kHz AF**

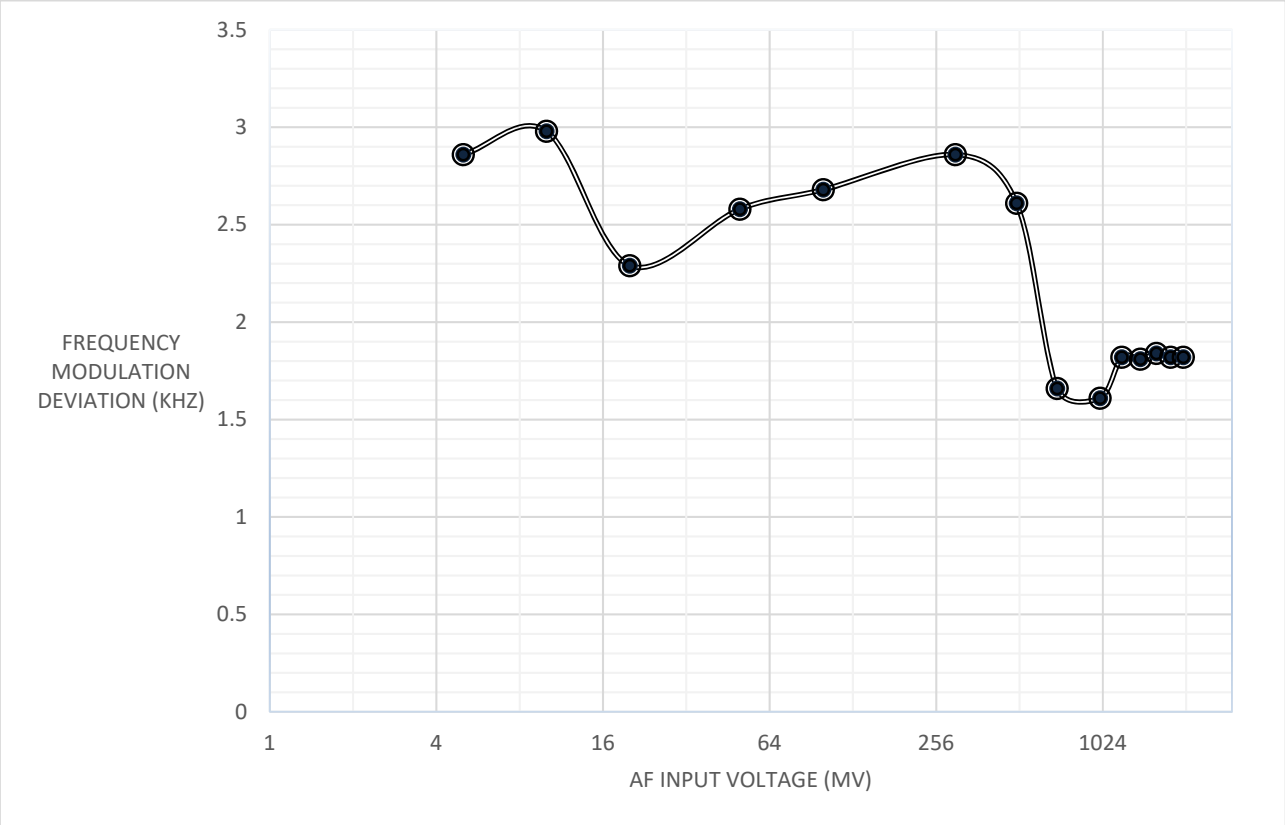


**Figure 22 - Modulation Limiting Capability - 5 kHz AF**

FCC 47 CFR Part 80, Limit Clause 80.213

Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent.

FCC 47 CFR Part 2, Limit Clause 2.1047

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.

Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

### 2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Multimeter | Iso-tech | IDM-101 | 466 | 12 | 02-Oct-2018 |
| Audio Analyser | Hewlett Packard | 8903B | 1350 | 12 | 16-Nov-2017 |
| Power Supply Unit | Farnell | TSV-70 | 2043 | - | O/P Mon |
| Cable( 3m, SMA(m) - SMA(m) ) | Reynolds | 262-0248-3000 | 2402 | 12 | 19-Sep-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Signal Analyser | Rohde & Schwarz | FSQ 26 | 3545 | 12 | 23-Oct-2018 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 02-Oct-2018 |
| Calibration Unit | Rohde & Schwarz | ZV-Z54 | 4368 | 12 | 19-Sep-2018 |
| Frequency Standard | Spectracom | Secure Sync 1200-0408-0601 | 4393 | 6 | 12-Mar-2018 |
| 30dB Attenuator | Narda | 766-30 | 4783 | 12 | 19-Dec-2018 |

**Table 15**

O/P Mon – Output Monitored using calibrated equipment

## 2.6 Transmitter Power

### 2.6.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.215 and 2.1046

### 2.6.2 Equipment Under Test and Modification State

MP50, S/N: 000 452 - Modification State 0

### 2.6.3 Date of Test

31 October 2017

### 2.6.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.2.3.3.

The peak power was measured as this was considered worst case.

### 2.6.5 Environmental Conditions

Ambient Temperature 22.2 °C
Relative Humidity 44.7 %

### 2.6.6 Test Results

PNG MP50 (Stand Alone) VHF Transceiver

| 156.0125 MHz | | 159.0000 MHz | | 161.9875 MHz | |
|---|---|---|---|---|---|
| Result (dBm) | Result (W) | Result (dBm) | Result (W) | Result (dBm) | Result (W) |
| 26.67 | 0.46 | 26.76 | 0.47 | 26.74 | 0.47 |

**Table 16 - Transmitter Power Results**

FCC 47 CFR Part 80, Limit Clause 80.215 (d)

Ship station frequencies above 27500 kHz. The maximum power must not exceed the values listed below:

- Ships Stations: 156 to 162 MHz - 25 W
- Marine Utility Stations and Handheld Portable Transmitters: 156 to 162 MHz - 10 W

### 2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Power Supply Unit | Hewlett Packard | 6267B | 21 | - | TU |
| Signal Generator | Hewlett Packard | ESG4000A | 38 | 12 | 31-May-2018 |
| Multimeter | Iso-tech | IDM-101 | 466 | 12 | 02-Oct-2018 |
| Power Supply Unit | Farnell | TSV-70 | 2043 | - | O/P Mon |
| Cable( 3m, SMA(m) - SMA(m) ) | Reynolds | 262-0248-3000 | 2402 | 12 | 19-Sep-2018 |
| Spectrum Analyser | Rohde & Schwarz | FSU26 | 2747 | 12 | 02-Feb-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 02-Oct-2018 |
| Calibration Unit | Rohde & Schwarz | ZV-Z54 | 4368 | 12 | 19-Sep-2018 |
| Frequency Standard | Spectracom | Secure Sync 1200-0408-0601 | 4393 | 6 | 12-Mar-2018 |
| 30dB Attenuator | Narda | 766-30 | 4783 | 12 | 12-Dec-2018 |

**Table 17**

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

## 2.7 Suppression of Interference Aboard Ships

### 2.7.1 Specification Reference

FCC 47 CFR Part 80 and FCC 47 CFR Part 2, Clause 80.217(b)

### 2.7.2 Equipment Under Test and Modification State

MP50, S/N: 000 452 - Modification State 0

### 2.7.3 Date of Test

23 November 2017

### 2.7.4 Test Method

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 80.217 (b) and KDB 971168.

A network analyser was used to measure the path loss and the worst case was entered as a reference level offset in to the spectrum analyser for each frequency range of interest. The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was configured in a receive only state. The spectrum analyser settings were configured with an RBW of 100 kHz below 1 GHz and 1 MHz for frequencies greater than 1 GHz using a VBW of 3 times the RBW. The trace set to max hold using a peak detector and the plots recorded as shown.

### 2.7.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 24.2 °C |
| Relative Humidity | 28.4 % |

### 2.7.6 Test Results

PNG MP50 (Stand Alone)

| Frequency of Interfering Emissions | Maximum Power delivered to Artificial Antenna (dBm) | Maximum Power delivered to Artificial Antenna (µW) |
|---|---|---|
| 9 kHz to 150 kHz | -48.220 | 0.020 |
| 150 kHz to 30 MHz | -50.052 | 0.010 |
| 30 MHz to 100 MHz | -50.426 | 0.010 |
| 100 MHz to 300 MHz | -49.455 | 0.010 |
| 300 MHz to 1 GHz | -47.590 | 0.020 |
| 1 GHz to 2 GHz | -37.399 | 0.180 |

**Table 18 - Receive Mode Spurious Emissions Results**

**Figure 23 - 9 kHz to 150 kHz**

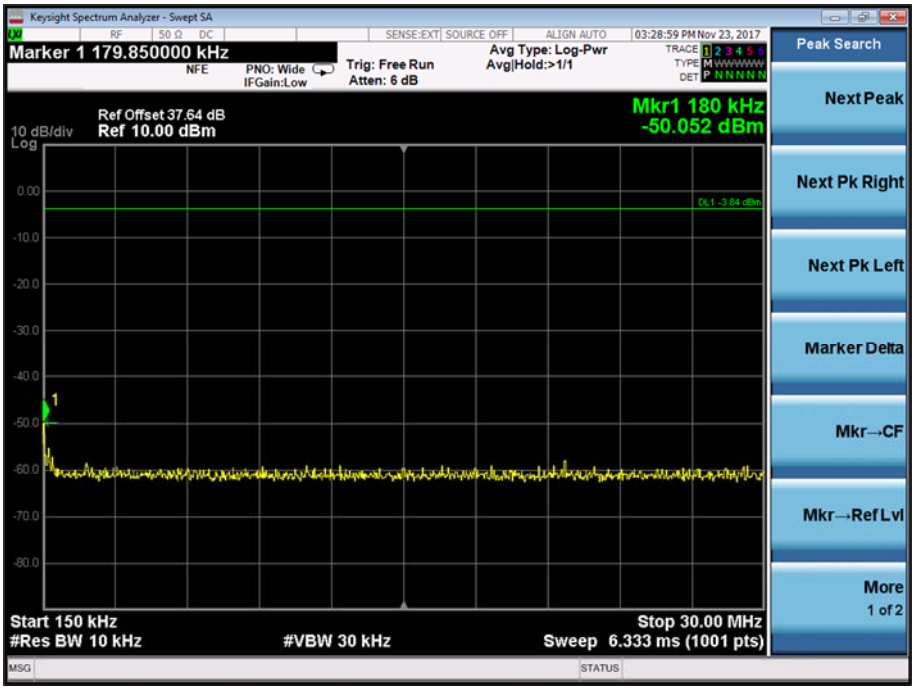


**Figure 24 - 150 kHz to 30 MHz**

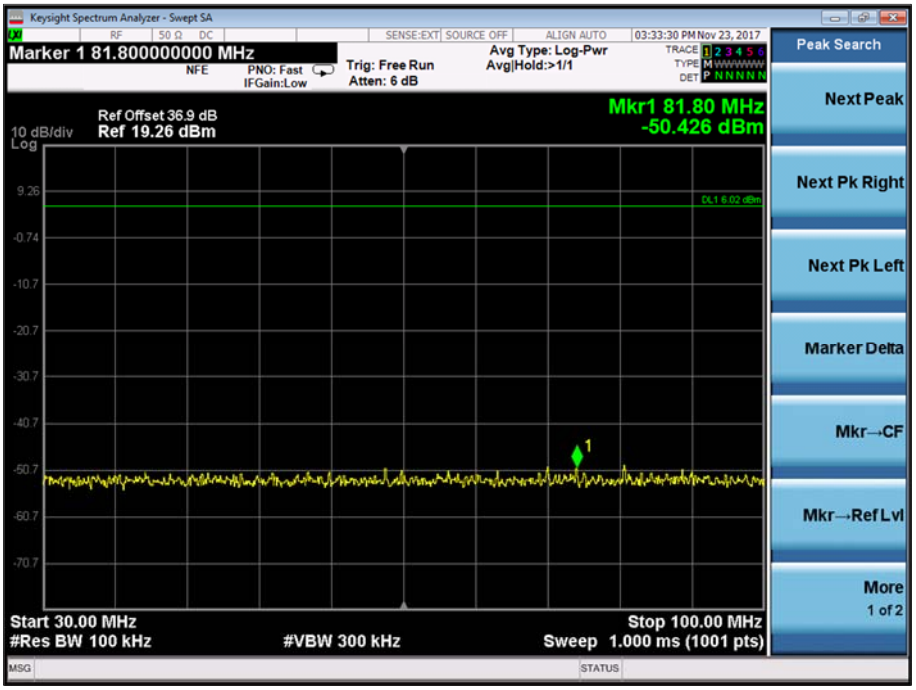


**Figure 25 - 30 MHz to 100 MHz**

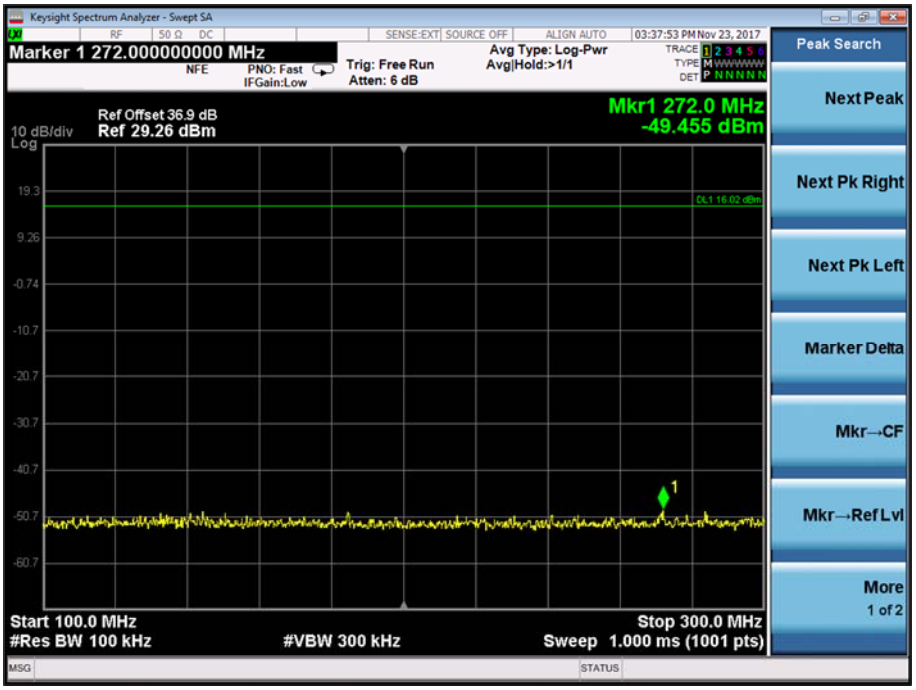


**Figure 26 - 100 MHz to 300 MHz**

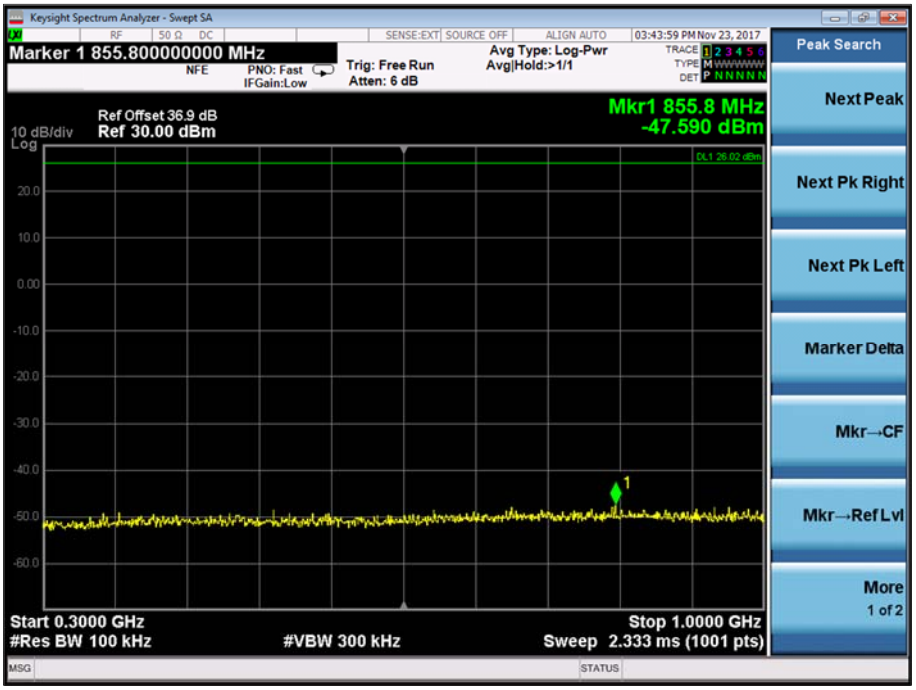


**Figure 27 - 300 MHz to 1 GHz**

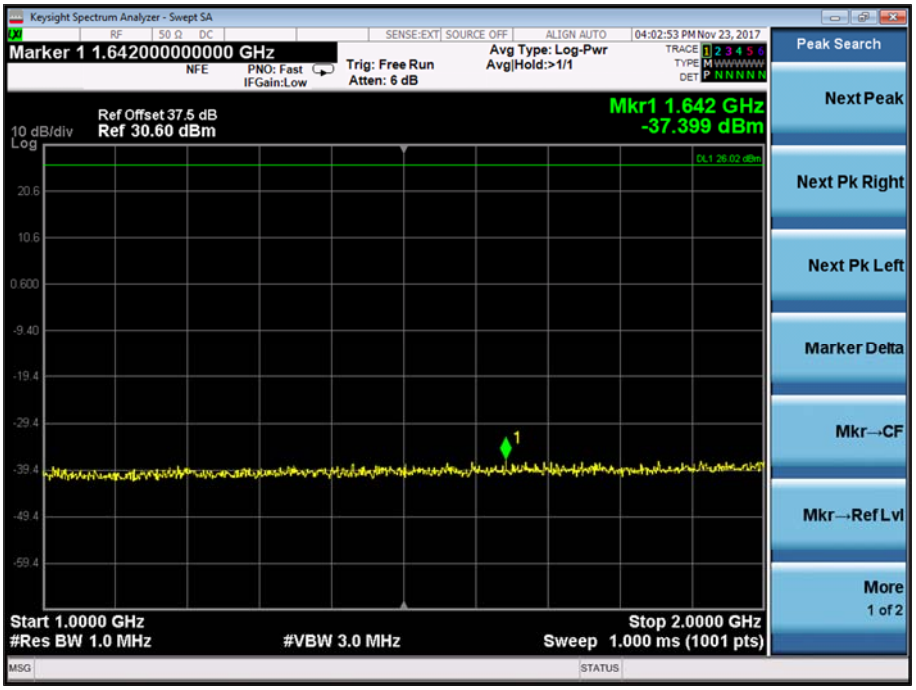


**Figure 28 - 1 GHz to 2 GHz**

FCC 47 CFR Part 80, Limit Clause 80.217 (b)

The EUT shall deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

| Frequency of interfering emissions | Power to artificial antenna in µW |
|---|---|
| Below 30 MHz | 400 |
| 30 to 100 MHz | 4,000 |
| 100 to 300 MHz | 40,000 |
| Over 300 MHz | 400,000 |

**Table 19**

### 2.7.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Power Supply Unit | Farnell | LB30-4 | 158 | 12 | O/P Mon |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 14-Sep-2018 |
| Cable( 3m, SMA(m) - SMA(m) ) | Reynolds | 262-0248-3000 | 2402 | 12 | 19-Sep-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 02-Oct-2018 |
| Calibration Unit | Rohde & Schwarz | ZV-Z54 | 4368 | 12 | 19-Sep-2018 |
| Frequency Standard | Spectracom | Secure Sync 1200-0408-0601 | 4393 | 6 | 12-Mar-2018 |
| PXA Signal Analyser | Keysight Technologies | N9030A | 4653 | 12 | 12-Jan-2018 |
| 4 Channel PSU | Rohde & Schwarz | HMP4040 | 4736 | - | O/P Mon |
| 30dB Attenuator | Narda | 766-30 | 4783 | 12 | 12-Dec-2018 |

**Table 20**

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment

# 3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

| Test Name | Measurement Uncertainty |
|---|---|
| Authorisation of Transmitters for Licensing | - |
| Bandwidths | ± 58.05 Hz |
| Transmitter Frequency Tolerances | ± 11 Hz |
| Spurious Emissions at Antenna Terminals | ± 3.45 dB |
| Radiated Spurious Emissions | ± 3.08 dB |
| Modulation Requirements | - |
| Transmitter Power | ± 3.2 dB |
| Suppression of Interference Aboard Ships | ±3.45 dB |
| Requirements for Selective Calling Equipment | - |

**Table 21**