# FCC Testing of the Axnes Aviation AS Base Station. Model: BST50 in accordance with: FCC 47 CFR Part 90 and FCC 47 CFR Part 2

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FCC ID: 2AOHP BST50A (BST50)

Product Service

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## COMMERCIAL-IN-CONFIDENCE

Document Number: 75940027-04 | Issue: 02

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| **Project Management** | Steven White | 24 January 2019 | |
| **Authorised Signatory** | Simon Bennett | 24 January 2019 | |

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 90 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 | 24 January 2019 | |
| **Testing** | Graeme Lawler | 24 January 2019 | |

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 90: 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 | 23 April 2017 |
| 2 | Clarification on the frequency of test channels in relation to Part 90 | 24 January 2019 |

**Table 1**

## 1.2 Introduction

| | |
|---|---|
| Applicant | Axnes Aviation AS |
| Manufacturer | Axnes Aviation AS |
| Model Number(s) | BST50 |
| Serial Number(s) | 000 273 |
| Hardware Version(s) | R8 |
| Software Version(s) | AXS-SW-0311 |
| Number of Samples Tested | 1 |
| Test Specification/Issue/Date | FCC 47 CFR Part 90: 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 | 06 November 2017 |
| Finish of Test | 11 April 2018 |
| Name of Engineer(s) | Matthew Russell, Mehadi Choudhury and Graeme Lawler |
| Related Document(s) | ANSI C63.26 (2015) |

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## 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 90 and FCC 47 CFR Part 2 is shown below.

| Section | Specification Clause | | Test Description | Result | Comments/Base Standard |
|---|---|---|---|---|---|
| | Part 90 | Part 2 | | | |
| Configuration and Mode: PNG BST50 UHF Transceiver | | | | | |
| 2.1 | 90.205 | 2.1046 | Maximum Conducted Output Power | Pass | |
| 2.2 | 90.213 | 2.1055 | Frequency Stability | Pass | |
| 2.3 | 90.209 | 2.1049 | Bandwidth Limitations | Pass | |
| 2.4 | 90.207 | 2.1047 | Types of Emission | Pass | |
| 2.5 | 90.210 | 2.1051 | Spurious Emissions at Antenna Terminals | Pass | |
| 2.6 | 90.210 | 2.1053 | Radiated Spurious Emissions | Pass | |
| 2.7 | 90.221 | - | Adjacent Channel Power | Pass | |
| 2.8 | 90.214 | - | Transient Frequency Behaviour | N/A | See Note |

**Table 2**

Note: The client has declared that both the MP50 and BST50 share the same electronic parts (same Printed Board Assembles) which contain the frequency source (26 MHz TCXO), the VCO giving the RF frequency accuracy and the Radio transmitter giving the transient behavior.

Both products also transmit in bursts, which are turned on and off in the same manner.

Transient tests were limited therefore limited, to the MP50 component of the system, as detailed in TUV document (75940027-03)

Product Service

## 1.4 Application Form

| EQUIPMENT DESCRIPTION | |
|---|---|
| Model Name/Number | PNG BST50 |
| Part Number | AXS-BS-D0100-N |
| Hardware Version | R8 |
| Software Version | AXS-SW-0311 |
| FCC ID (if applicable) | FRN number: 0026666784 |
| Industry Canada ID (if applicable) | |
| 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 | 22K0D7WXT | 405.0125 | 434.9875 | 469.98750 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| 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 | |
| | 28 | 500 mA | |
| Battery | Nominal Voltage | Battery Operating End Point Voltage | |
| | | | |
| Can EUT transmit whilst being charged? | Yes ☒ No ☐ | | |

| EXTREME CONDITIONS | | | | | |
|---|---|---|---|---|---|
| Maximum temperature | 70 | °C | Minimum temperature | -45 | °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

The device under test is capable of operation between 405MHz and 470MHz, and as such it straddles several frequency ranges which are covered under Part 90.

The channels used for testing were 405.0125 MHz, 434.9875 MHz and 469.9875 MHz, and were selected to cover the full range of the device.

However, it should be noted that 405.0125 MHz and 434.9875 MHz are not allowable frequencies under Part 90.

They are however considered to be representative of all channels within this range, as all channels within the frequency range 405MHz to 470MHz have equivalent power, bandwidth and modulation.

Selection and test of other allowable part 90 channels, either higher or lower within this frequency range, is therefore not expected to have any impact on compliance.

Channels that are not allowed under Part 90, will not be accessible within the final device.

## 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: 000 273 | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |
| 1 | Firmware Update to reduce Occupied Bandwidth and Improve ACP. | 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 BST50 UHF Transceiver | | |
| Maximum Conducted Output Power | Mehadi Choudhury | UKAS |
| Frequency Stability | Mehadi Choudhury | UKAS |
| Bandwidth Limitations | Matthew Russell | UKAS |
| Spurious Emissions at Antenna Terminals | Mehadi Choudhury and Matthew Russell | UKAS |
| Radiated Spurious Emissions | Graeme Lawler | UKAS |
| Adjacent Channel Power | Matthew Russell | UKAS |

**Table 4**

Office Address:

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

# 2 Test Details

## 2.1 Maximum Conducted Output Power

### 2.1.1 Specification Reference

FCC 47 CFR Part 90 Clause 90.205
FCC 47 CFR Part 2, Clause 2.1046

### 2.1.2 Equipment Under Test and Modification State

BST50, S/N: 000 273 - Modification State 0

### 2.1.3 Date of Test

22 November 2017

### 2.1.4 Test Method

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

ERP Results = Maximum Conducted Output Power (dBm) + Antenna Gain (dBi) – 2.15.

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.1.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 22.9 °C |
| Relative Humidity | 41.7 % |

### 2.1.6 Test Results

PNG BST50 UHF Transceiver

| 405.0125 MHz | | 434.9875 MHz | | 469.9875 MHz | |
|---|---|---|---|---|---|
| Maximum Power (dBm) | Maximum Power (W) | Maximum Power (dBm) | Maximum Power (W) | Maximum Power (dBm) | Maximum Power (W) |
| 26.005 | 0.399 | 25.805 | 0.380 | 26.039 | 0.402 |

**Table 5 - Conducted Power Results**

| 405.0125 MHz | | 434.9875 MHz | | 469.9875 MHz | |
|---|---|---|---|---|---|
| Maximum Power (dBm) | Maximum Power (W) | Maximum Power (dBm) | Maximum Power (W) | Maximum Power (dBm) | Maximum Power (W) |
| 28.855 | 0.768 | 28.655 | 0.734 | 28.889 | 0.774 |

**Table 6 - ERP Results**

FCC 47 CFR Part 90, Limit Clause 90.205

| Frequency (MHz) | Limit |
|---|---|
| < 25 | 1000 W |
| 25 to 50 | 300 W |
| 72 to 76 | 300 W |
| 150 to 174 | Refer to 90.205 (d) of the specification |
| 217 to 220 | Refer to 90.259 of the specification |
| 220 to 222 | Refer to 90.729 of the specification |
| 421 to 430 (See note 1) | Refer to 90.279 of the specification |
| 450 to 470 (See note 2) | Refer to 90.205 (h) of the specification |
| 470 to 512 | Refer to 90.307 and 90.309 of the specification |
| 758 to 775 and 788 to 805 | Refer to 90.541 and 90.542 of the specification |
| 806 to 824, 851 to 869, 869 to 901 and 935 to 940 | Refer to 90.635 of the specification |
| 902 to 927.25 | LMS systems operating pursuant to subpart M of the specification: 30 W |
| 927.25 to 928 | LMS equipment: 300 W |
| 929 to 930 | Refer to 90.494 of the specification |
| 1427 to 1429.5 and 1429.5 to 1432 | Refer to 90.259 of the specification |
| 2450 to 2483.5 | 5 W |
| 4940 to 4990 | Refer to 90.1215 of the specification |
| 5850 to 5925 | Refer to subpart M of the specification |
| All other frequency bands | On a case by case basis |

**Table 7 - Specification Limits for Maximum ERP**

NOTE 1: In the 421 – 430 MHz range, an effective antenna height of less than 152 m can be assumed as worst case. The application of the EUT means it can either be used on the ground or installed in aeronautical crafts. The limit used was therefore ERP > 5 W.

NOTE 2: In the 450 – 470 MHz range, a reference HAAT of less than 15 $m^3$ can be assumed as worst case. The application of the EUT means it can either be used on the ground or installed in aeronautical crafts. The limit used was therefore ERP > 2 W.

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**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 | - | 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 | - | TU |
| 30dB Attenuator | Narda | 766-30 | 4783 | - | O/P Mon |

**Table 8**

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

## 2.2 Frequency Stability

### 2.2.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.213
FCC 47 CFR Part 2, Clause 2.1055

### 2.2.2 Equipment Under Test and Modification State

BST50, S/N: 000 273 - Modification State 0

### 2.2.3 Date of Test

08 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.

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.2.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.3 °C |
| Relative Humidity | 29.9 - 44.9 % |

### 2.2.6 Test Results

PNG BST50 UHF Transceiver

| Voltage | Frequency Error (ppm) | | |
|---|---|---|---|
| | 405.0125 MHz | 434.9875 MHz | 469.9875 MHz |
| 23.8 V DC | 0.486 | 0.336 | 0.434 |
| 32.2 V DC | 0.375 | 0.414 | 0.215 |

**Table 9 - Frequency Stability Under Voltage Variations**

| Temperature | Frequency Error (ppm) | | |
|---|---|---|---|
| | 405.0125 MHz | 434.9875 MHz | 469.9875 MHz |
| +50.0 °C | 0.109 | 0.370 | 0.294 |
| +40.0 °C | 0.146 | 0.262 | 0.251 |
| +30.0 °C | 0.269 | 0.524 | 0.555 |
| +20.0 °C | 0.491 | 0.416 | 0.198 |
| +10.0 °C | 0.348 | 0.423 | 0.730 |
| 0 °C | 0.252 | 0.462 | 0.230 |
| -10.0 °C | 0.459 | 0.326 | 0.470 |
| -20.0 °C | 0.277 | 0.372 | 0.468 |
| -30.0 °C | 0.101 | 0.276 | 0.330 |

**Table 10 - Frequency Stability Under Temperature Variations**

FCC 47 CFR Part 90, Limit Clause 90.213

421 MHz to 512 MHz: 2.5 ppm (Fixed and Base Stations)

### 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 Unit | Farnell | LB30-4 | 158 | - | O/P Mon |
| Multimeter | Iso-tech | IDM-101 | 466 | 12 | 02-Oct-2018 |
| Cable( 3m, SMA(m) - SMA(m) ) | Reynolds | 262-0248-3000 | 2402 | 12 | 19-Sep-2018 |
| Power Supply | Iso-tech | IPS 2010 | 2439 | - | O/P Mon |
| Spectrum Analyser | Rohde & Schwarz | FSU26 | 2747 | 12 | 02-Feb-2018 |
| Thermocouple Thermometer | Fluke | 51 | 3174 | 12 | 22-Dec-2017 |
| 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-2017 |
| Climatic Chamber | Aralab | FitoTerm 300E45 | 4823 | - | O/P Mon |

**Table 11**

O/P Mon – Output Monitored using calibrated equipment

## 2.3 Bandwidth Limitations

### 2.3.1 Specification Reference

FCC 47 CFR Part 87, Clause 90.209
FCC 47 CFR Part 2, Clause 2.1049

### 2.3.2 Equipment Under Test and Modification State

BST50, S/N: 000 273 - Modification State 0

### 2.3.3 Date of Test

11 April 2018

### 2.3.4 Test Method

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

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.3.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.7 °C |
| Relative Humidity | 40.1 % |

### 2.3.6 Test Results

PNG BST50 UHF Transceiver

| Occupied Bandwidth (kHz) | | |
|---|---|---|
| 405.0125 MHz | 434.9875 MHz | 469.9875 MHz |
| 21.591 | 21.892 | 21.672 |

**Table 12 - Occupied Bandwidth Results**

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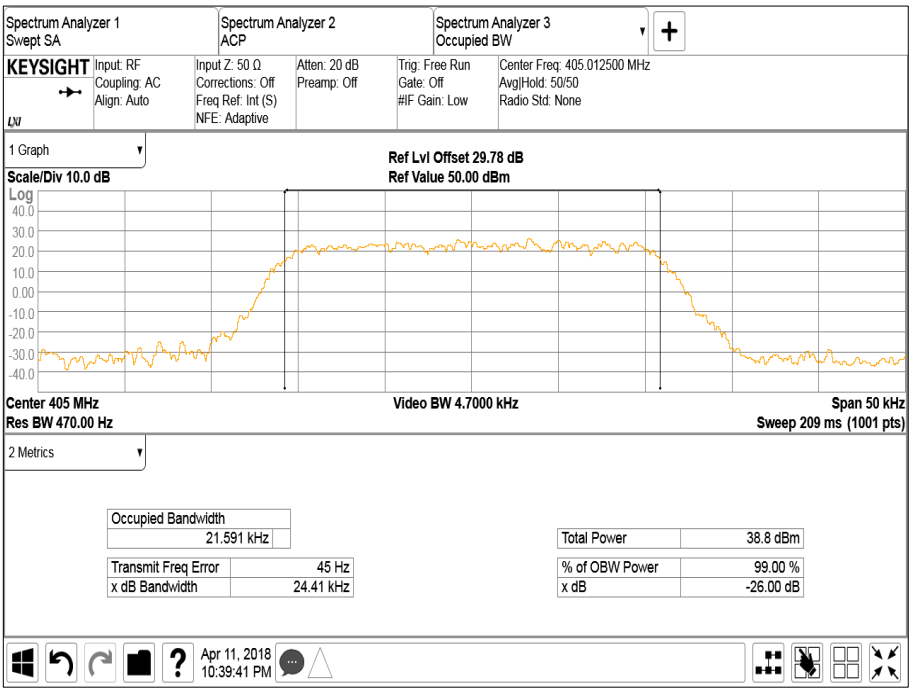


**Figure 1 - Occupied Bandwidth - 405.0125 MHz**

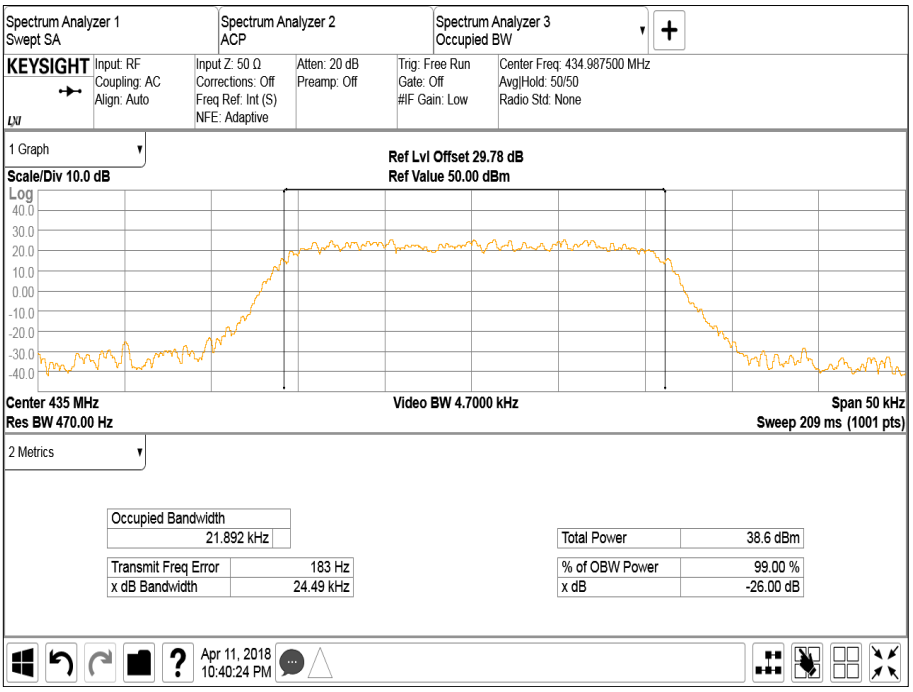


**Figure 2 - Occupied Bandwidth - 434.9875 MHz**

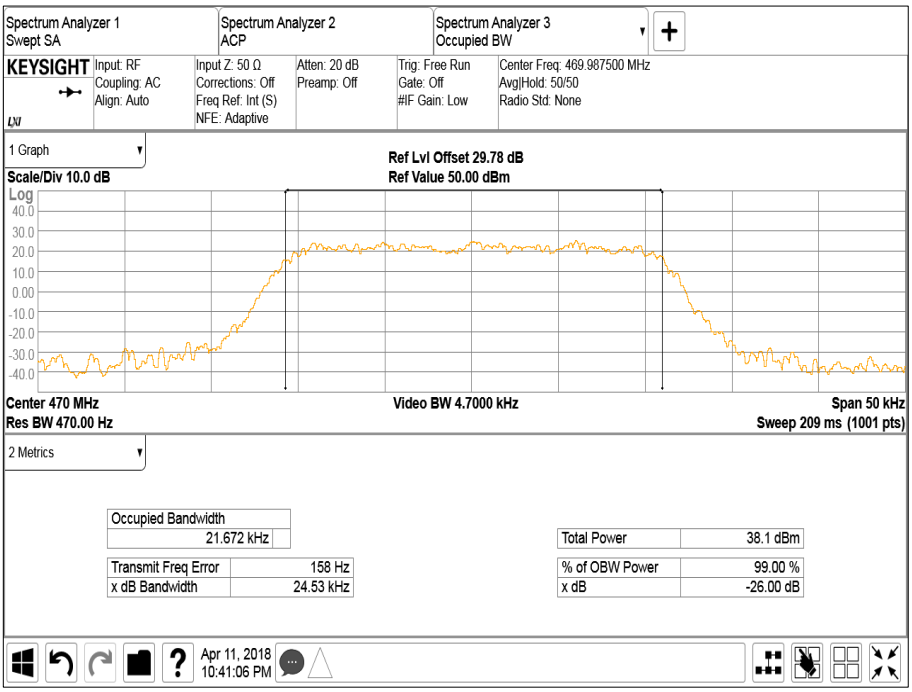


**Figure 3 - Occupied Bandwidth - 469.9875 MHz**

<u>FCC 47 CFR Part 90, Limit Clause 90.209</u>

Less than the Authorised Bandwidth (22 kHz).

### 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 |
|---|---|---|---|---|---|
| Attenuator 10dB/25W | Weinschel | 46-10-43 | 400 | 12 | 21-Jun-2018 |
| Directional Coupler | Narda | 3020A | 419 | - | O/P Mon |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 14-Sep-2018 |
| Step Attenuator | Rohde & Schwarz | DPSP | 1672 | - | O/P Mon |
| 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 |
| 1m N-Type Cable | Rhophase | - | 4233 | 12 | 14-Jun-2018 |
| 2 metre SMA Cable | Florida Labs | SMS-235SP-78.8-SMS | 4518 | 12 | 19-Sep-2018 |
| 4 Channel PSU | Rohde & Schwarz | HMP4040 | 4736 | - | O/P Mon |
| EXA | Keysight Technologies | N9010B | 4968 | 12 | 21-Dec-2018 |

**Table 13**

O/P Mon – Output Monitored using calibrated equipment

## 2.4 Types of Emission

### 2.4.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.207
FCC 47 CFR Part 2, Clause 2.1047

### 2.4.2 Equipment Under Test

BST50

### 2.4.3 Test Method

A declaration was made by the applicant.

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.4.4 Test Results

PNG BST50 UHF Transceiver

The emission designator used by the equipment was declared by the manufacturer as: 22K0D7WXT

The following information was supplied by the manufacturer:

The modulation type used is 16QAM, utilizing 22 kHz channel bandwidth, and assuming 25 kHz channel spacing. The system is time division multiplexed to allow for single frequency duplex operation. One channel allows 5 voice channels, and additional data to be transferred giving an efficient 4 kHz per voice channel utilization. The system is implemented as a software defined radio, transferring encrypted voice/data streams. Encryption ensures random bit patterns, and by that the data and modulation cannot be influenced by the content. Further the modulation envelope is controlled by steep software filters ensuring no over modulation can occur.

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 Spurious Emissions at Antenna Terminals

### 2.5.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.210
FCC 47 CFR Part 2, Clause 2.1051

### 2.5.2 Equipment Under Test and Modification State

BST50, S/N: 000 273 - Modification State 0
BST50, S/N: 000 273 - Modification State 1 (Emission Mask Only)

### 2.5.3 Date of Test

23 November 2017 to 11 April 2018

### 2.5.4 Test Method

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

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.5.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.7-24.2 °C |
| Relative Humidity | 28.4-40.1 % |

### 2.5.6 Test Results

PNG BST50 UHF Transceiver

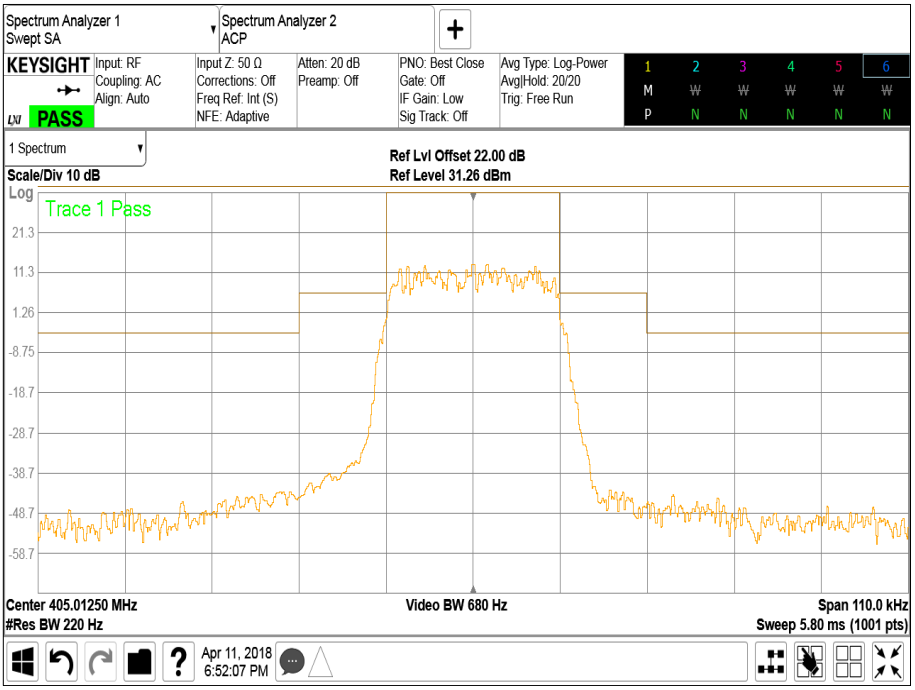

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**Figure 4 - 405.0125 MHz - Transmitter Spectrum Mask**

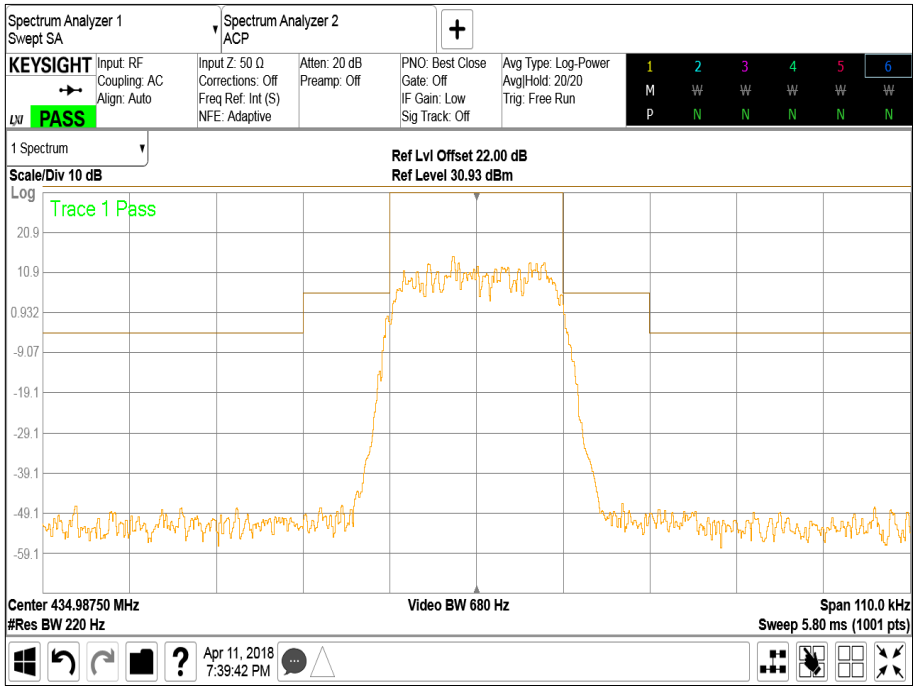


**Figure 5 - 434.9875 MHz - Transmitter Spectrum Mask**

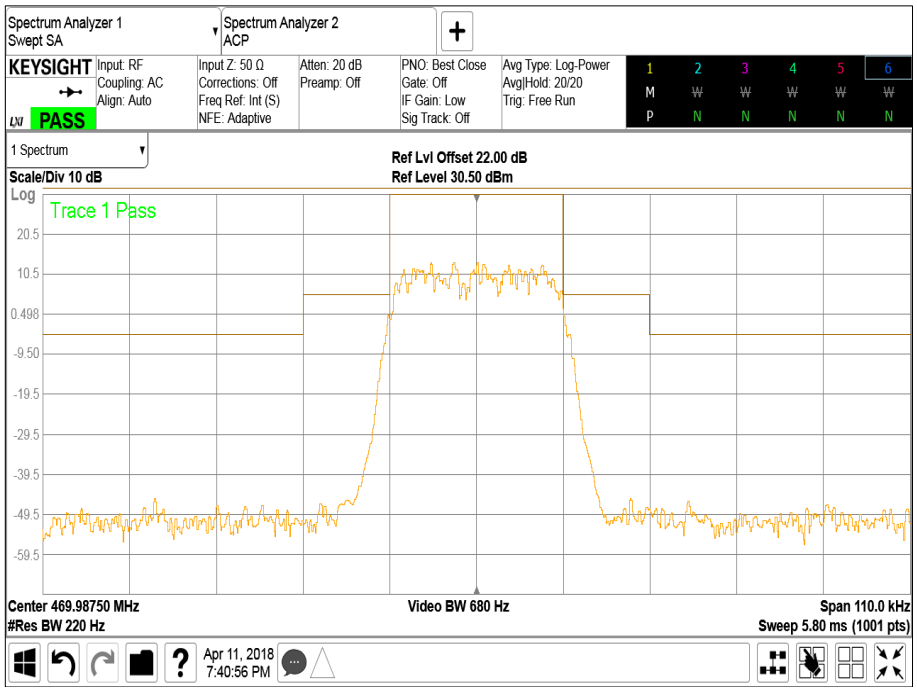


**Figure 6 - 469.9875 MHz - Transmitter Spectrum Mask**

Product Service

**Figure 7 - 405.0125 MHz - 9 kHz to 150 kHz**

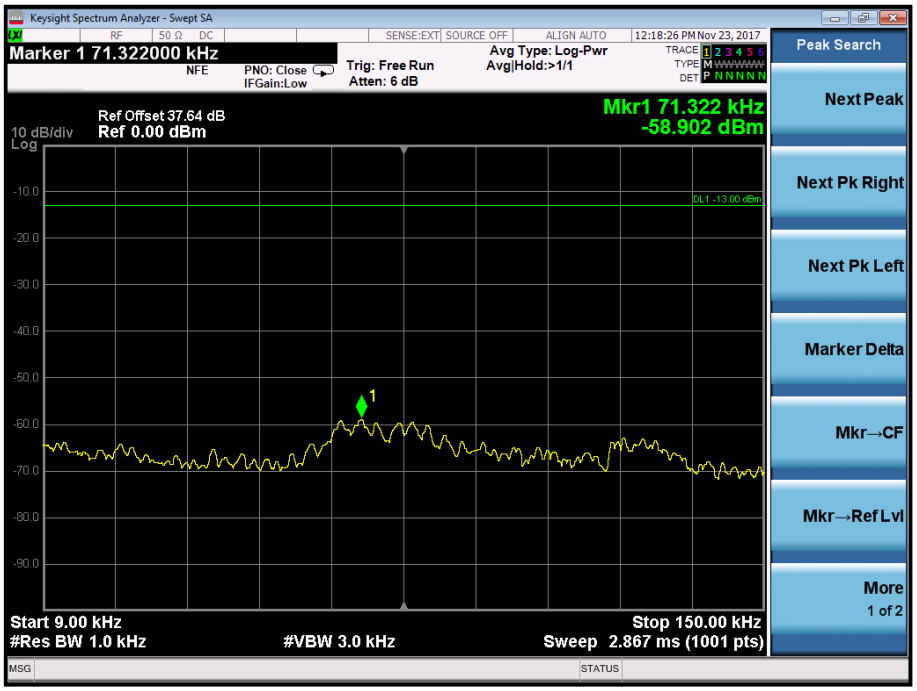


**Figure 8 - 434.9875 MHz - 9 kHz to 150 kHz**

**Figure 9 - 469.9875 MHz - 9 kHz to 150 kHz**

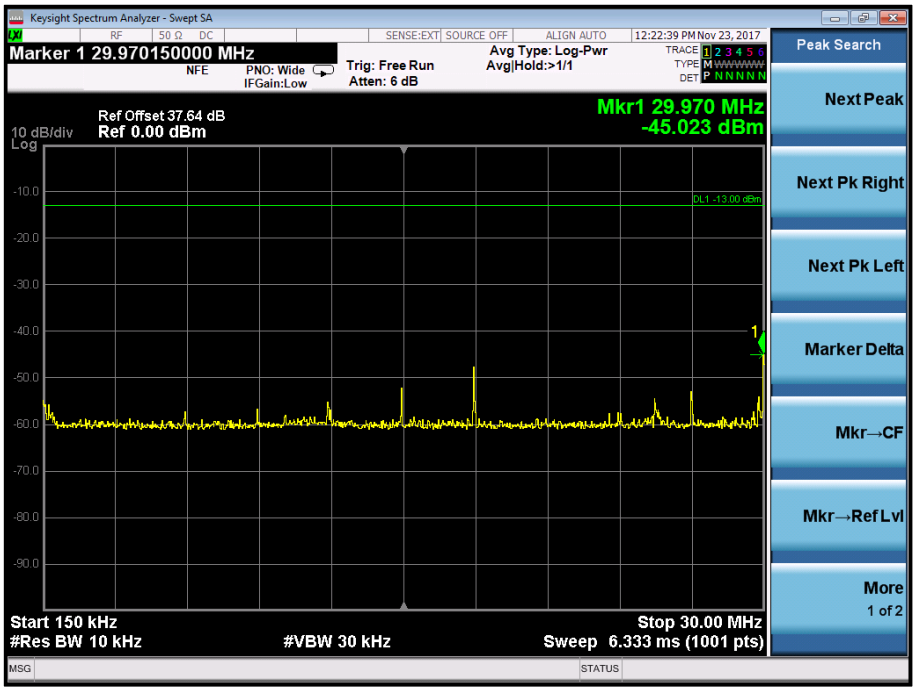


**Figure 10 - 405.0125 MHz - 150 kHz to 30 MHz**

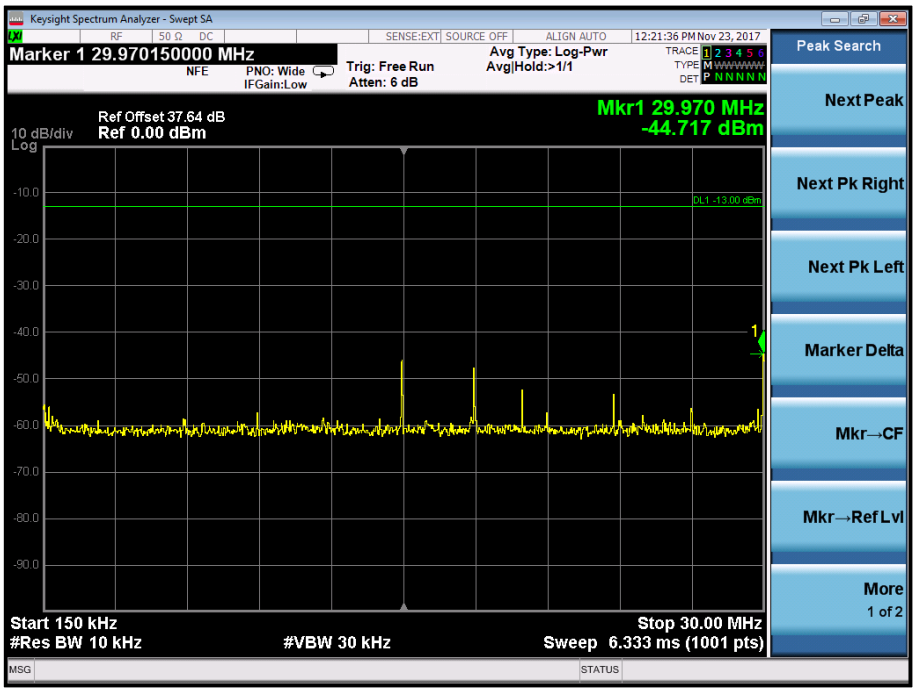


**Figure 11 - 434.9875 MHz - 150 kHz to 30 MHz**

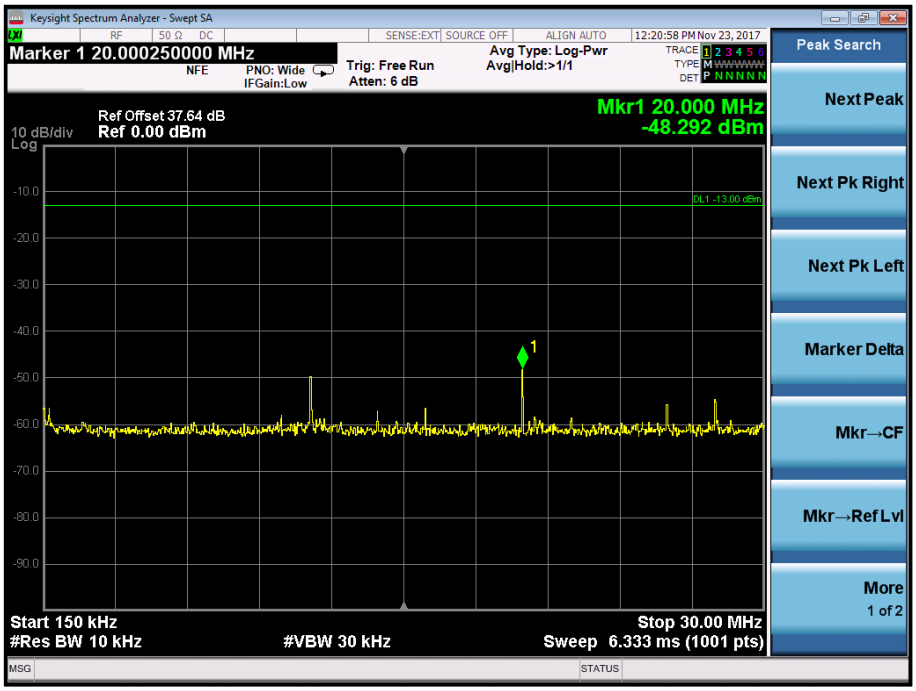


**Figure 12 - 469.9875 MHz - 150 kHz to 30 MHz**

Product Service

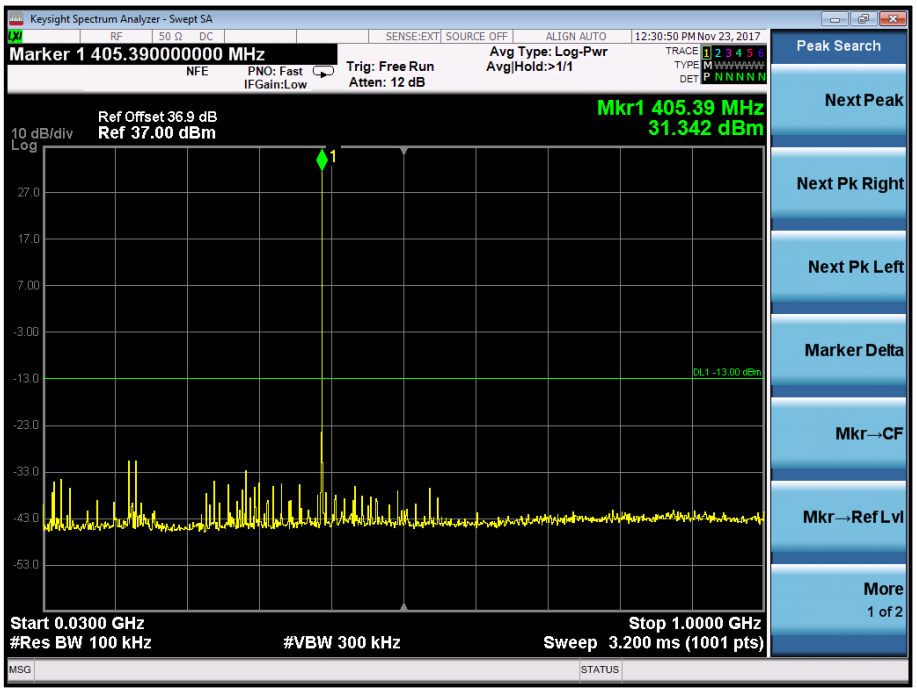


**Figure 13 - 405.0125 MHz - 30 MHz to 1 GHz**

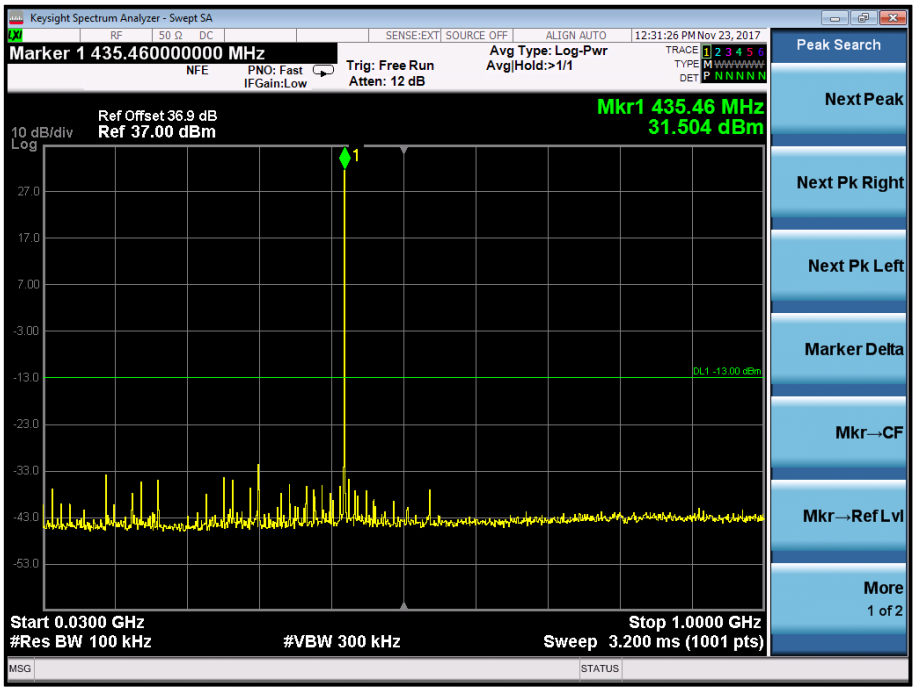


**Figure 14 - 434.9875 MHz - 30 MHz to 1 GHz**

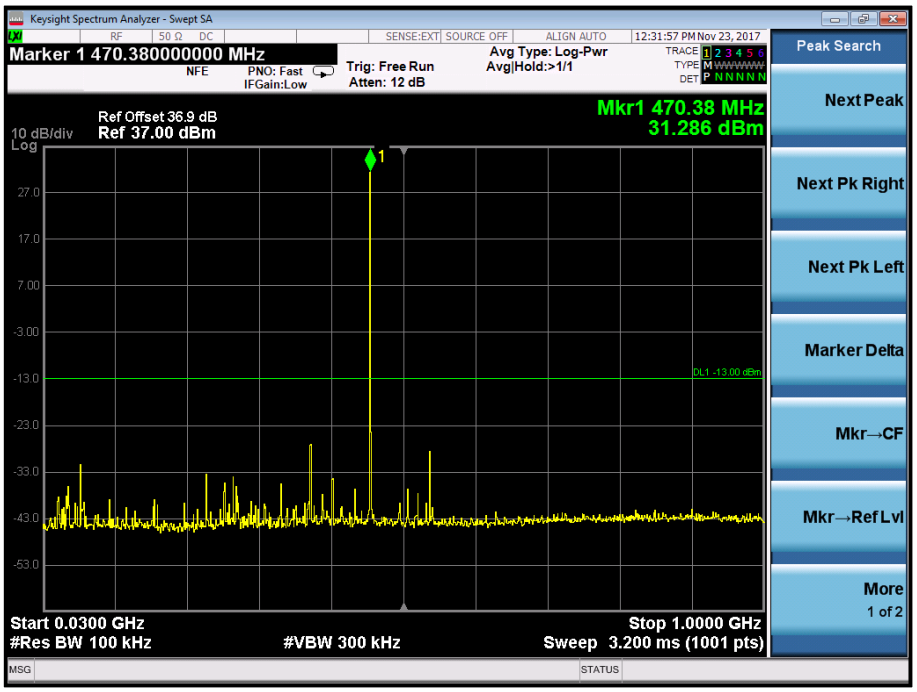


**Figure 15 - 469.9875 MHz - 30 MHz to 1 GHz**

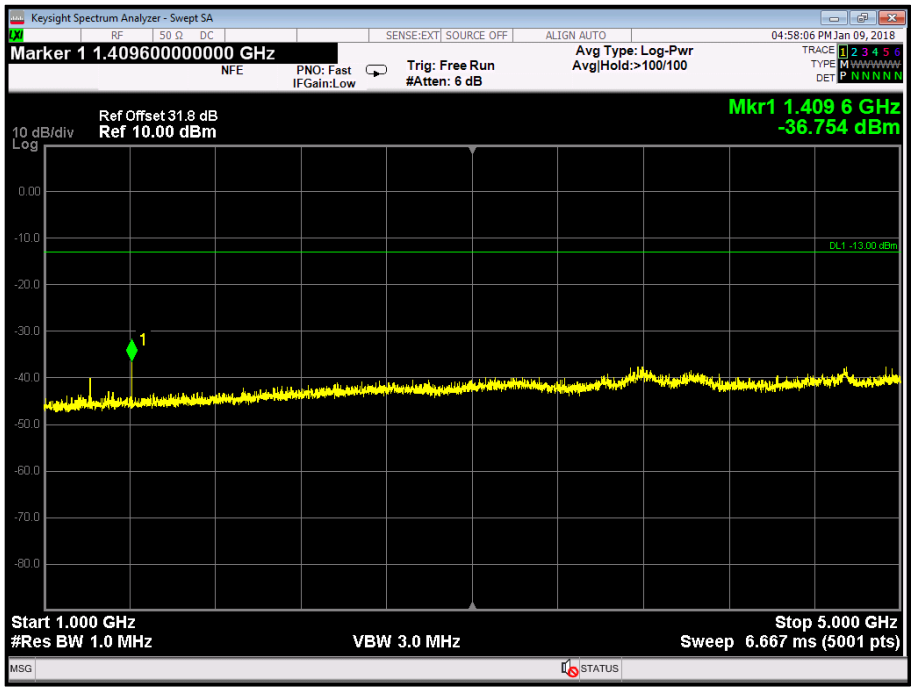


**Figure 16 - 405.0125 MHz - 1 GHz to 5 GHz**

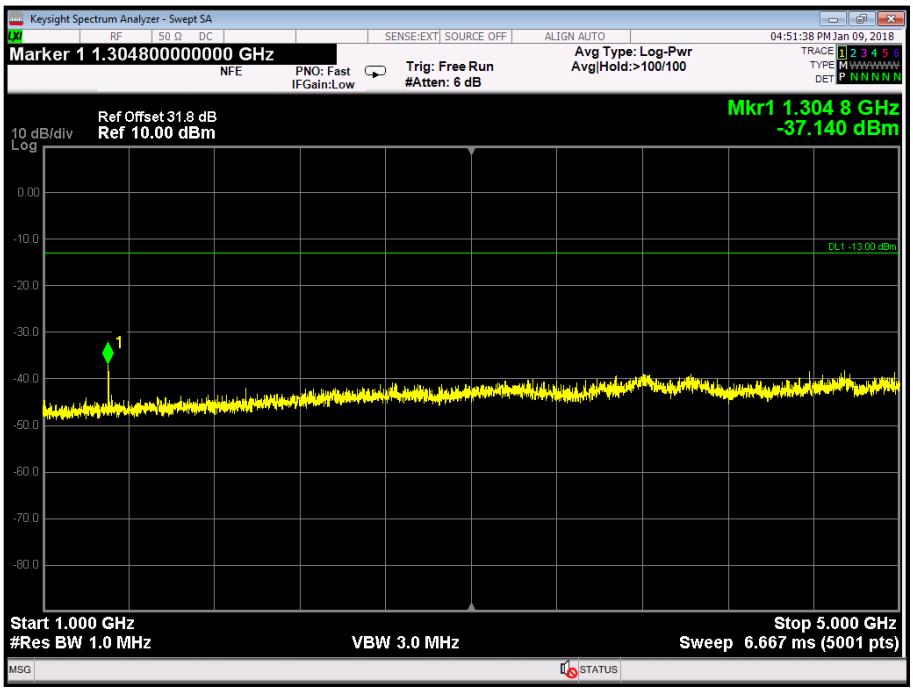


**Figure 17 - 434.9875 MHz - 1 GHz to 5 GHz**

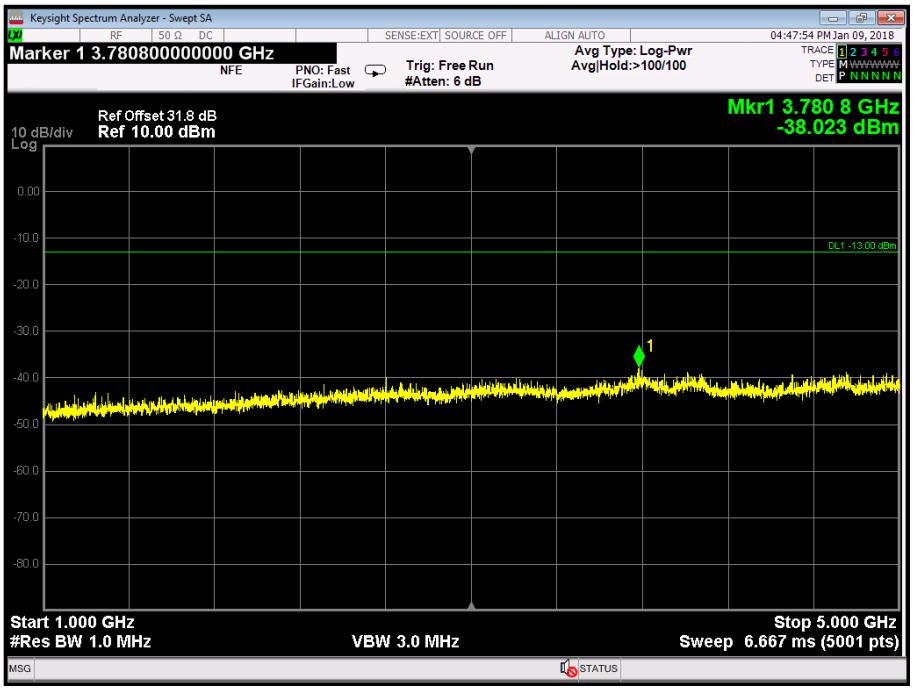


**Figure 18 - 469.9875 MHz - 1 GHz to 5 GHz**

Product Service

FCC 47 CFR Part 90, Limit Clause 90.210 (b)

For transmitters that are equipped with an audio lowpass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorised bandwidth: At least 43 + 10 log (P) dB.

### 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 |
|---|---|---|---|---|---|
| Power Supply Unit | Farnell | LB30-4 | 158 | - | O/P Mon |
| Multimeter | White Gold | WG022 | 190 | 12 | 24-Nov-2017 |
| Attenuator 10dB/25W | Weinschel | 46-10-43 | 400 | 12 | 21-Jun-2018 |
| Directional Coupler | Narda | 3020A | 419 | - | 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 |
| Attenuator (20dB, 150W) | Narda | 769-20 | 3367 | 12 | 31-May-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 |
| 1m N-Type Cable | Rhophase | - | 4233 | 12 | 14-Jun-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 |
| 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 | - | O/P Mon |
| EXA | Keysight Technologies | N9010B | 4968 | 12 | 21-Dec-2018 |

**Table 14**

O/P Mon – Output Monitored using calibrated equipment

## 2.6 Radiated Spurious Emissions

### 2.6.1 Specification Reference

FCC 47 CFR Part 87, Clause 87.139
FCC 47 CFR Part 2, Clause 2.1051

### 2.6.2 Equipment Under Test and Modification State

BST50, S/N: 000 273 - Modification State 0

### 2.6.3 Date of Test

18 November 2017 to 19 November 2017

### 2.6.4 Test Method

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

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

The limit line on the prescan plots was calculated from equation c) in clause 5.2.7

E (dBµV/m) = EIRP (dBm) – 20Log(D) + 104.8

82.2 = - 13 – 20Log (3) + 104.8

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.6.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 16.5 °C |
| Relative Humidity | 44.0 % |

### 2.6.6 Test Results

PNG BST50 UHF Transceiver

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

**Table 15 - 405.0125 MHz - Emissions Results**

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

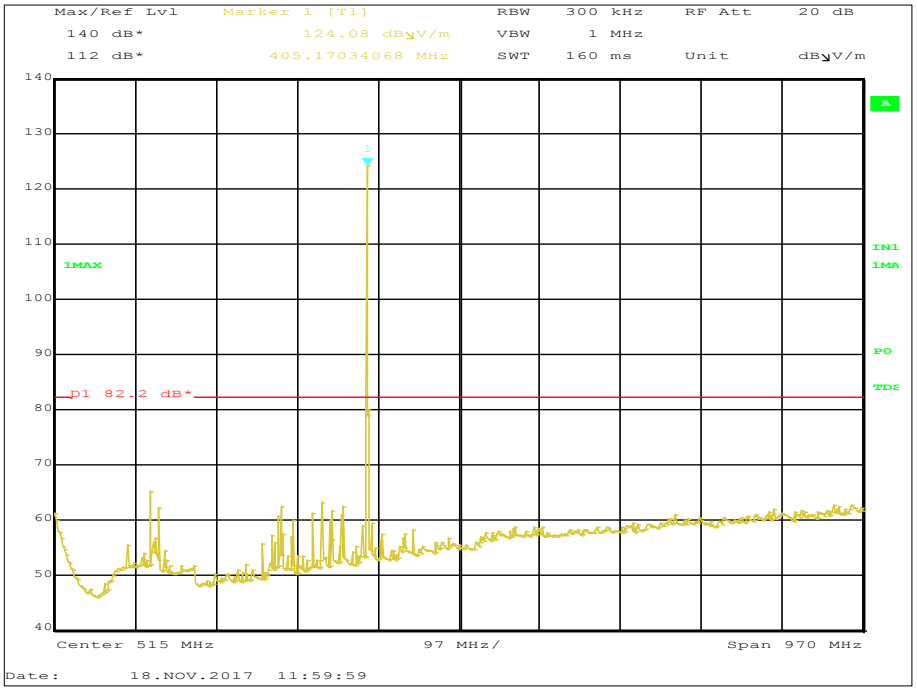


**Figure 19 - 405.0125 MHz - 30 MHz to 1 GHz**

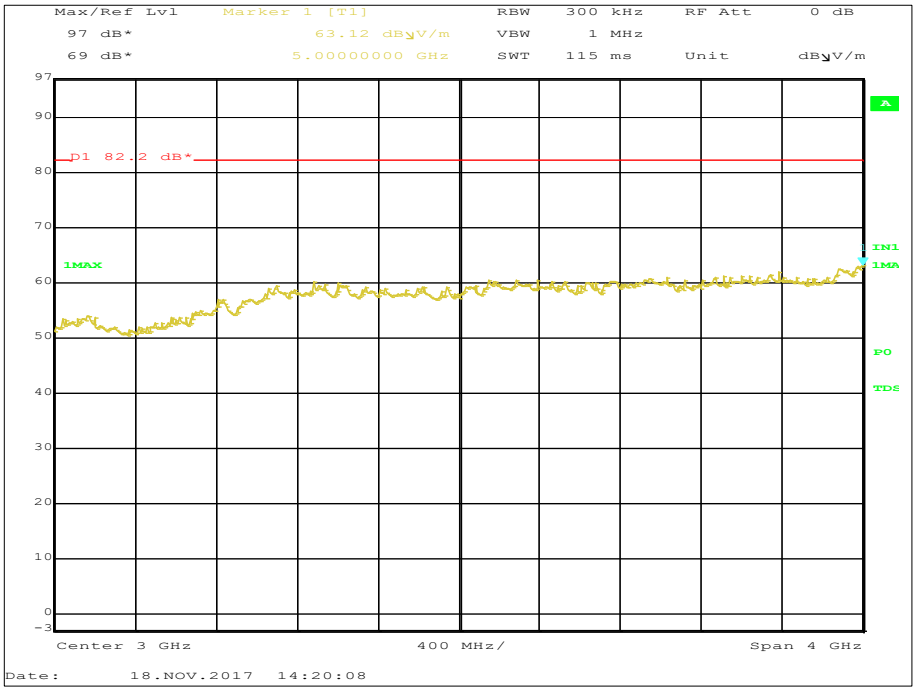


**Figure 20 - 405.0125 MHz - 1 GHz to 5 GHz**

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

**Table 16 - 434.9875 MHz - Emissions Results**

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

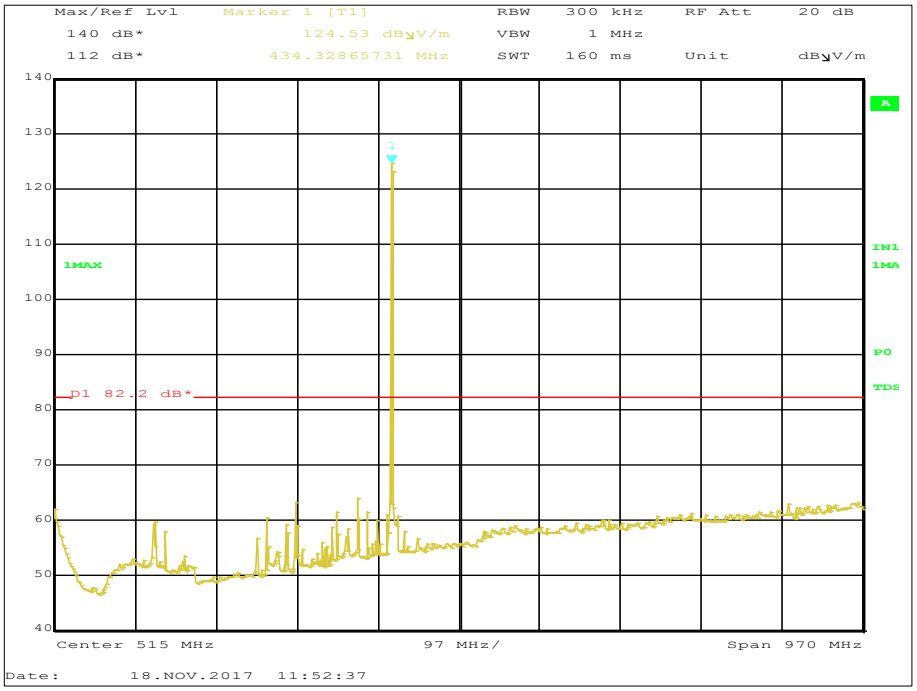


**Figure 21 - 434.9875 MHz - 30 MHz to 1 GHz**

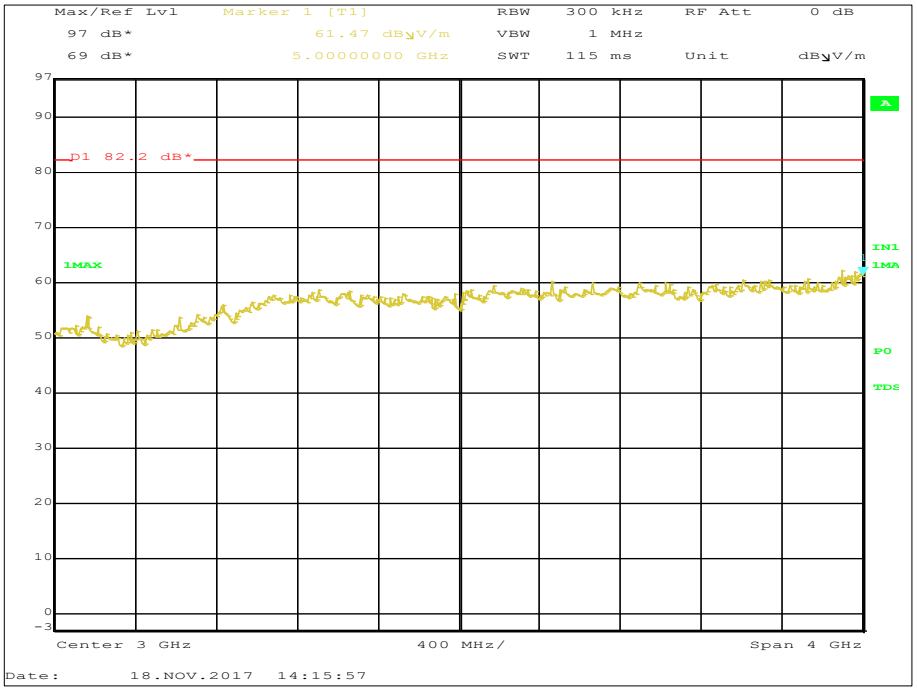


**Figure 22 - 434.9875 MHz - 1 GHz to 5 GHz**

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

**Table 17 - 434.9875 MHz - Emissions Results**

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

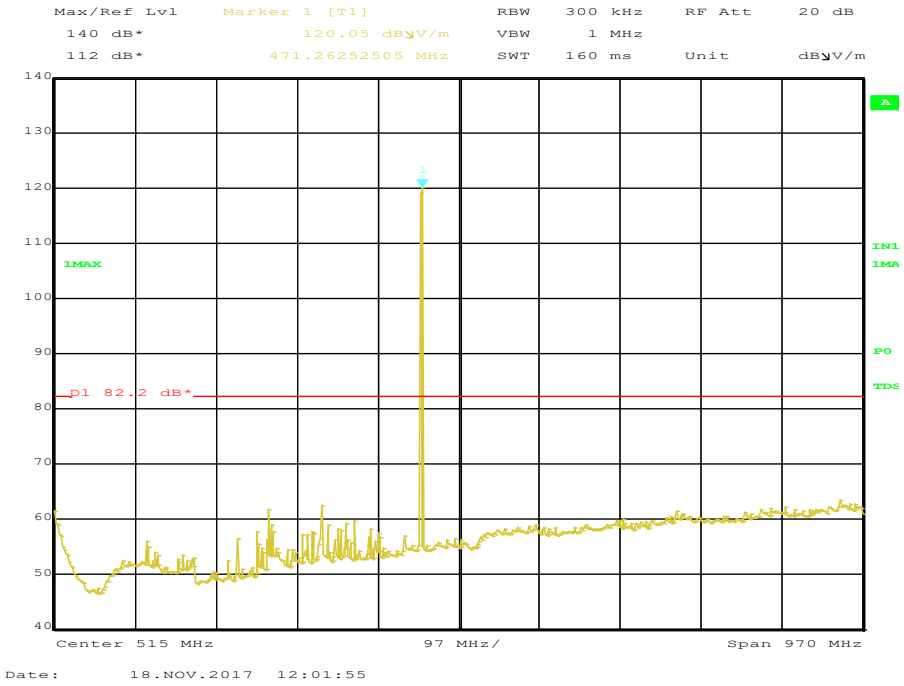


**Figure 23 - 469.9875 MHz 30 MHz to 1 GHz**

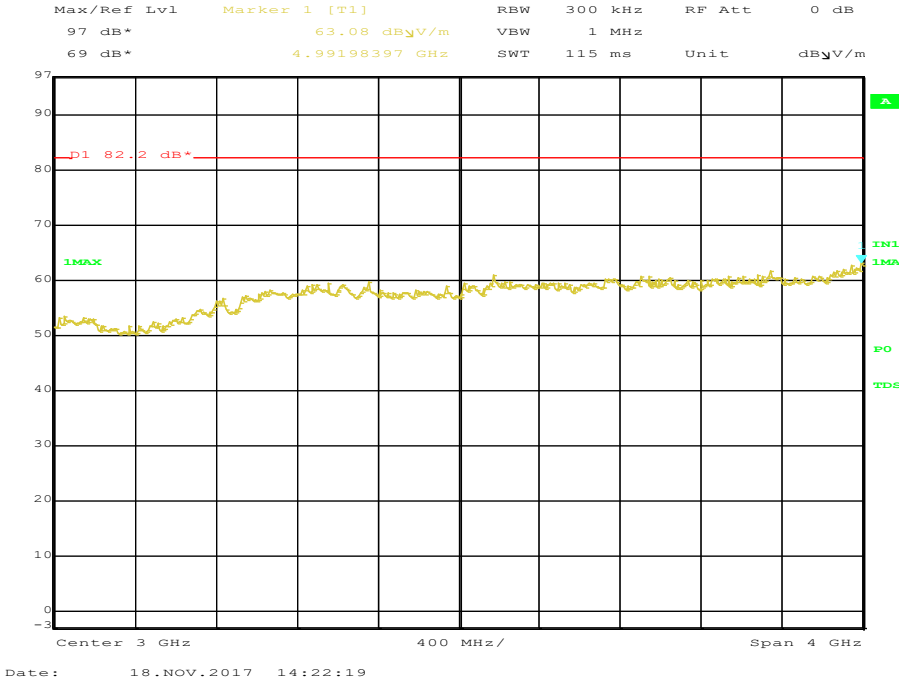


**Figure 24 - 469.9875 MHz 1 GHz to 5 GHz**

<u>FCC 47 CFR Part 90, Limit Clause 90.210 (b)</u>

For transmitters that are equipped with an audio lowpass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows

(5) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(6) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(7) On any frequency removed from the assigned frequency by more than 250 percent of the authorised bandwidth: At least 43 + 10 log (P) dB.

### 2.6.7 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 18**

TU - Traceability Unscheduled

## 2.7 Adjacent Channel Power

### 2.7.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.221

### 2.7.2 Equipment Under Test and Modification State

BST50, S/N: 000 273 - Modification State 1

### 2.7.3 Date of Test

11 April 2018

### 2.7.4 Test Method

The adjacent channel power was measured using the spectrum analyser with ACP measurement functionality. The adjacent channels were measured at a displacement frequency of ±25 kHz with a measurement bandwidth of 18 kHz.

***Note: Refer to section 1.6* for clarification on the frequency of selected test channels, in relation to Part 90**

### 2.7.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.7 °C |
| Relative Humidity | 40.1 % |

### 2.7.6 Test Results

| Adjacent Channel Power (dBc) | | | | | |
|---|---|---|---|---|---|
| 405.0125 MHz | | 434.9875 MHz | | 469.9875 MHz | |
| -25 kHz | +25 kHz | -25 kHz | +25 kHz | -25 kHz | +25 kHz |
| -56.42 | -57.54 | -59.34 | -60.69 | -58.37 | -59.61 |

**Table 19 – Adjacent Channel Power**

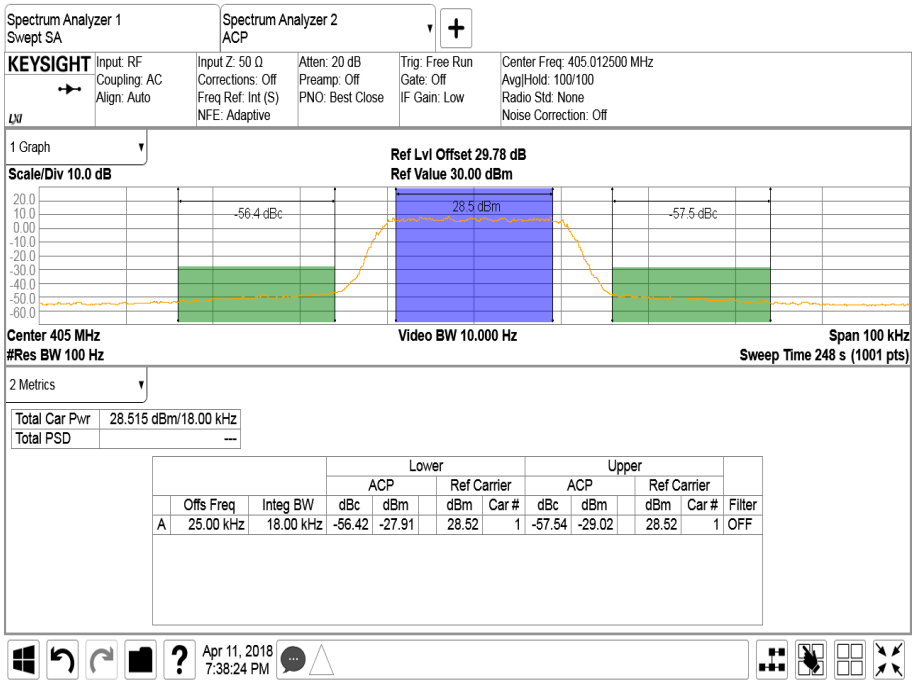


**Figure 25 - Adjacent Channel Power, 405.0125 MHz**

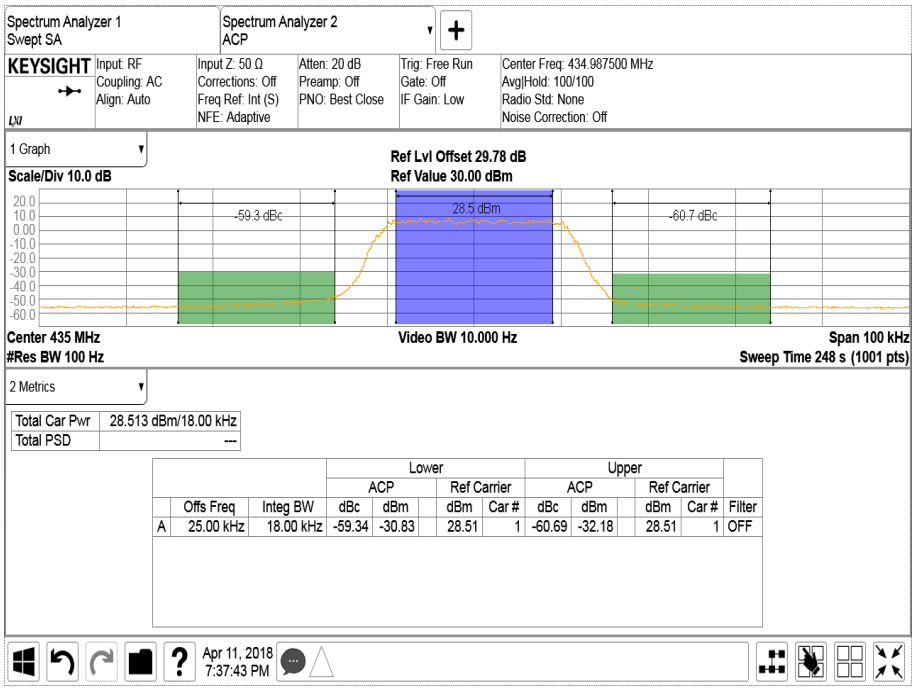


**Figure 26- Adjacent Channel Power, 434.9875 MHz**

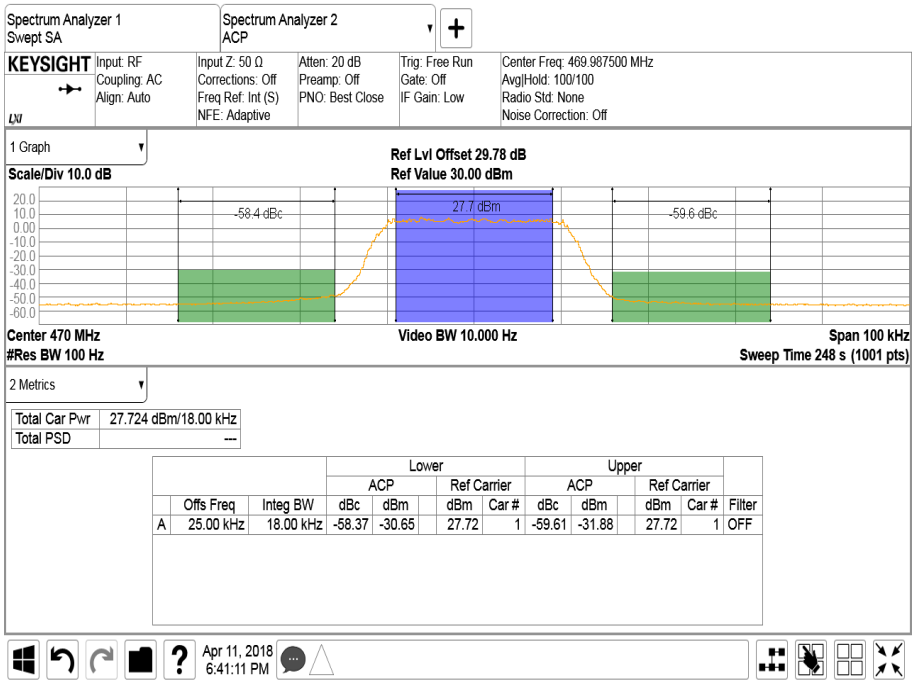


**Figure 27 - Adjacent Channel Power, 469.9875 MHz**

FCC 47 CFR Part 90 Limit Clause 90.221(b)(1)

| Frequency Offset | Maximum ACP (dBc) for devices 1 watt and less | Maximum ACP (dBc) for devices above 1 watt |
|---|---|---|
| 25 kHz | -55 dBc | -60 dBc |
| 50 kHz | -70 dBc | -70 dBc |
| 75 kHz | -70 dBc | -70 dBc |

**Table 20 - Adjacent Channel Power Limit**

### 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 |
|---|---|---|---|---|---|
| Attenuator 10dB/25W | Weinschel | 46-10-43 | 400 | 12 | 21-Jun-2018 |
| Directional Coupler | Narda | 3020A | 419 | - | O/P Mon |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 14-Sep-2018 |
| Step Attenuator | Rohde & Schwarz | DPSP | 1672 | - | O/P Mon |
| 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 |
| 1m N-Type Cable | Rhophase | | 4233 | 12 | 14-Jun-2018 |
| 2 metre SMA Cable | Florida Labs | SMS-235SP-78.8-SMS | 4518 | 12 | 19-Sep-2018 |
| 4 Channel PSU | Rohde & Schwarz | HMP4040 | 4736 | - | O/P Mon |
| EXA | Keysight Technologies | N9010B | 4968 | 12 | 21-Dec-2018 |

**Table 21**

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 |
|---|---|
| Power and Emissions | ± 3.2 dB |
| Frequency Stability | ± 8.03 Hz |
| Bandwidth of Emission | ± 58.05 Hz |
| Types of Emission | - |
| Spurious Emissions at Antenna Terminals | ± 3.45 dB |
| Radiated Spurious Emissions | 30 MHz to 1 GHz: ± 5.2 dB<br>1 GHz to 18 GHz: ± 6.3 dB |
| Modulation Requirements | - |
| Adjacent Channel Power | ±1.16 dB |

**Table 22**