FCC Testing of the Axnes Aviation AS Transceiver. Model: MP50. In accordance with: FCC 47 CFR Part 90 and FCC 47 CFR Part 2

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

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Document Number: 75940027-03 | 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 2018
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)	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 90: 2016 and FCC 47 CFR Part 2: 2016
Order Number Date	801584 10 August 2017
Date of Receipt of EUT	11 August 2017 and 31 October 2017
Start of Test	16 November 2017
Finish of Test	30 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 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 MP50 (Stand Alone) 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	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)	
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	16K0F3E	156.0125	159.000	161.9875

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

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: 000 451			
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) 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
Transient Frequency Behaviour	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

MP50, S/N: 000 452 - 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 MP50 (Stand Alone) 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)
25.244	0.335	25.608	0.364	25.755	0.376

Table 5 - Conducted Power Results

405.0125 MHz		434.9875 MHz		469.9875 MHz	
ERP (dBm)	ERP (W)	ERP (dBm)	ERP (W)	ERP (dBm)	ERP (W)
28.094	0.645	28.458	0.701	28.605	0.725

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.

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
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

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

2.2.3 Date of Test

20 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	20.4 - 22.2 °C
Relative Humidity	32.5 - 43.2 %

2.2.6 Test Results

PNG MP50 (Stand Alone) UHF Transceiver

Voltage	Frequency Error (ppm)		
	405.0125 MHz	434.9875 MHz	469.9875 MHz
3.2 V DC	0.627	0.425	0.279
3.6 V DC	0.267	0.706	0.438

Table 9 - Frequency Stability Under Voltage Variations

Temperature	Frequency Error (ppm)		
	405.0125 MHz	434.9875 MHz	469.9875 MHz
+50.0 °C	0.247	0.375	0.434
+40.0 °C	0.316	0.437	0.564
+30.0 °C	0.598	0.522	0.204
+20.0 °C	0.188	0.667	0.489
+10.0 °C	0.346	0.274	0.423
0 °C	0.556	0.359	0.581
-10.0 °C	0.884	0.570	0.443
-20.0 °C	0.104	0.306	0.413
-30.0 °C	0.232	0.310	0.715

Table 10 - Frequency Stability Under Temperature Variation

FCC 47 CFR Part 90, Limit Clause 90.213

421 MHz to 512 MHz: 5 ppm (Mobile Stations less than 2 W)

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
Directional Coupler	Narda	3020A	419	-	O/P Mon
Multimeter	Iso-tech	IDM-101	466	12	02-Oct-2018
Step Attenuator	Rohde & Schwarz	DPSP	1672	-	O/P Mon
Cable (3m, SMA (m) – SMA (m)	Reynolds	262-0248-3000	2402	12	19-Sep-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
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4514	12	19-Sep-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
Climatic Chamber	Aralab	FitoTerm 300E45	4823	-	O/P Mon

Table 11

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

2.3 Bandwidth Limitations

2.3.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.209
FCC 47 CFR Part 2, Clause 2.1049

2.3.2 Equipment Under Test and Modification State

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

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	23.0-23.7 °C
Relative Humidity	40.1-46.7 %

2.3.6 Test Results

PNG MP50 (Stand Alone) UHF Transceiver

Occupied Bandwidth (kHz)		
405.0125 MHz	434.9875 MHz	469.9875 MHz
21.383	21.465	21.723

Table 12 - Occupied Bandwidth Results

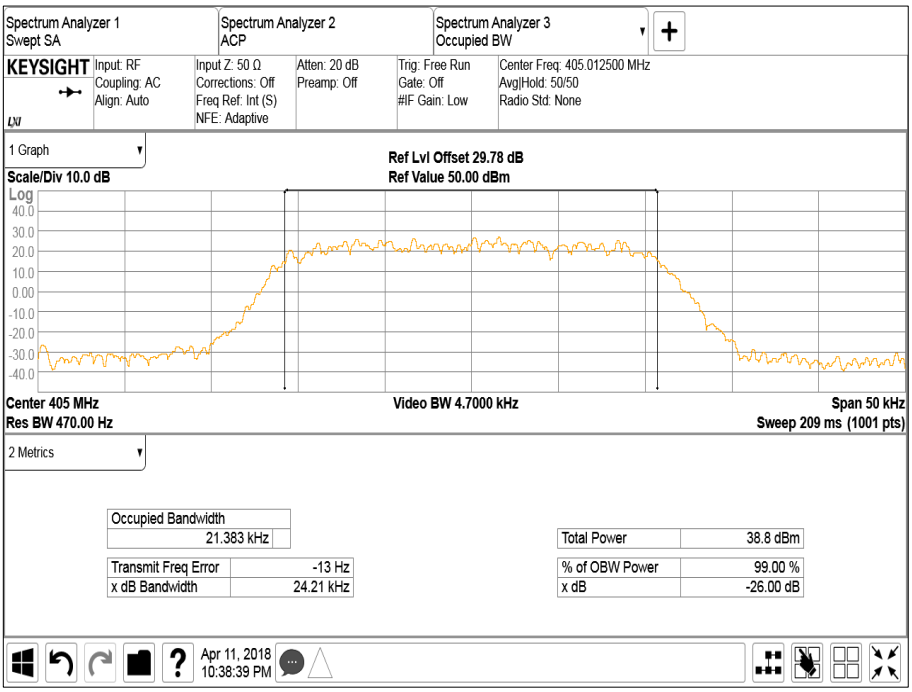

Figure 1 - Occupied Bandwidth - 405.0125 MHz

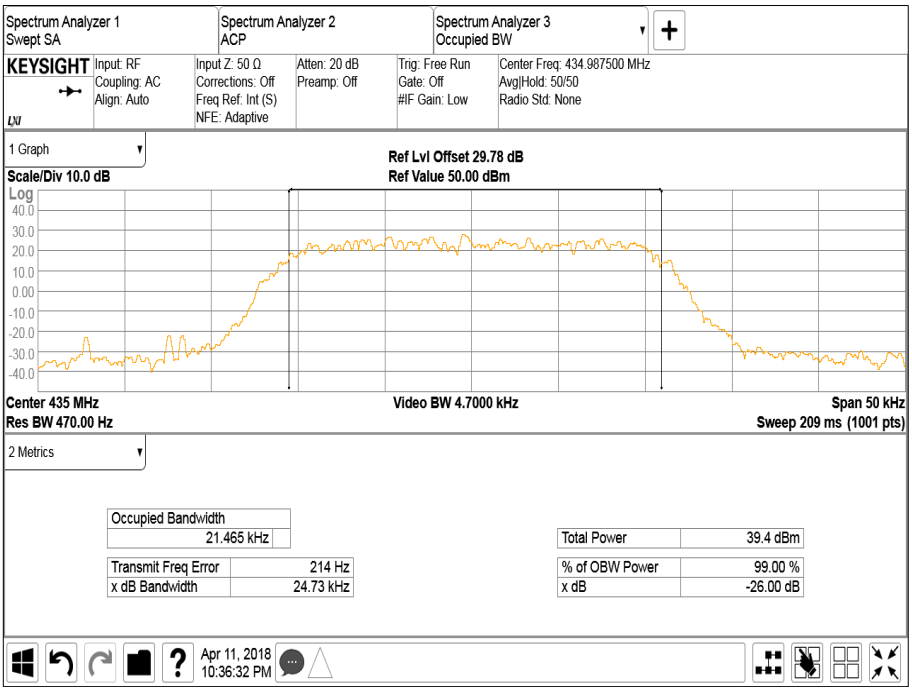

Figure 2 - Occupied Bandwidth - 434.9875 MHz

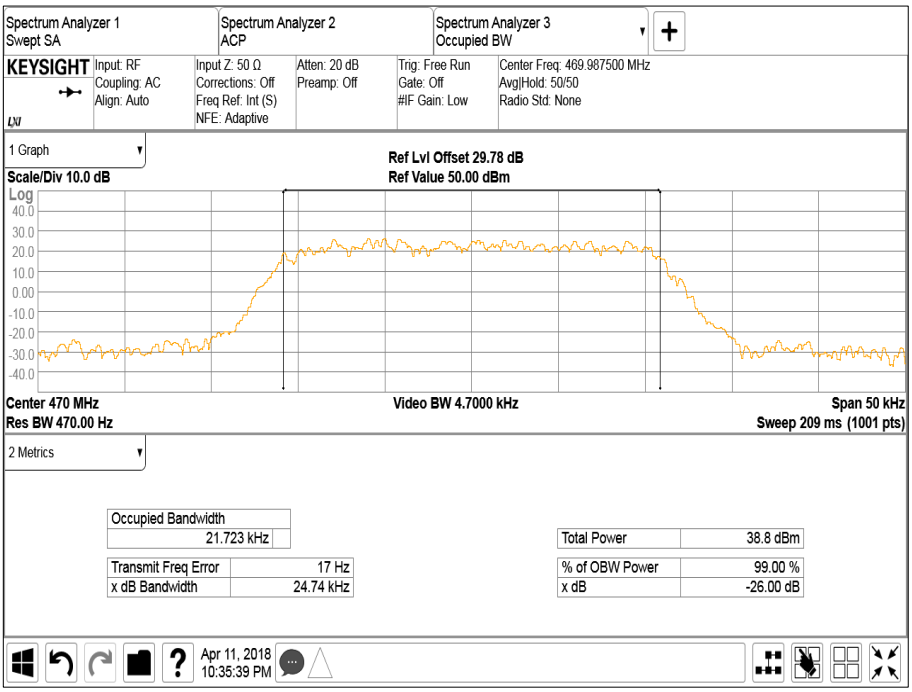

Figure 3 - Occupied Bandwidth - 469.9875 MHz

<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

MP50

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 MP50 (Stand Alone) 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

MP50, S/N: 000 452 - Modification State 0
MP50, S/N: 000 452 - 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 MP50 (Stand Alone) UHF Transceiver

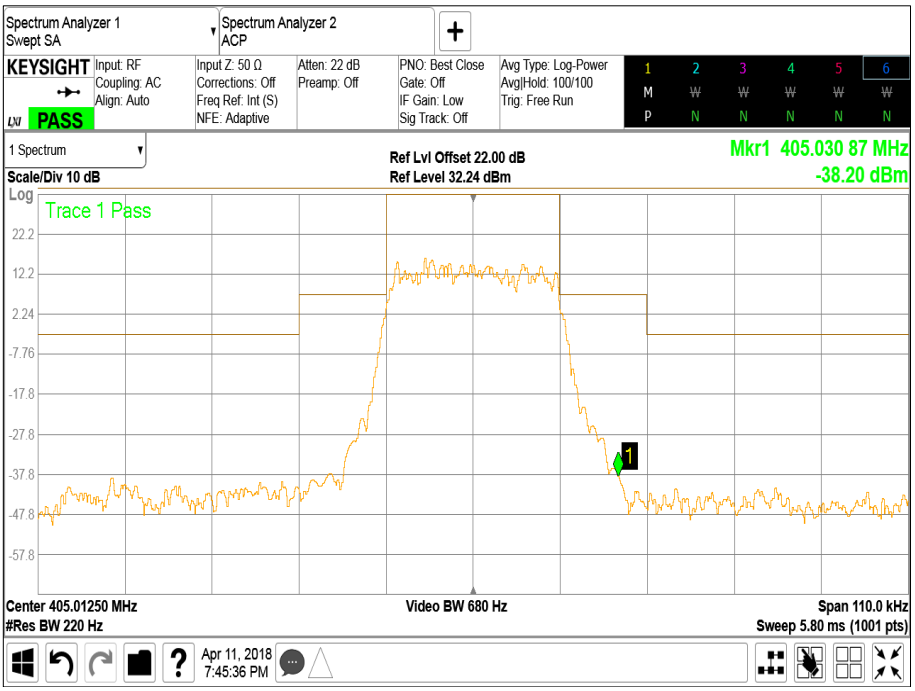

Figure 4 - 405.0125 MHz - Transmitter Spectrum Mask

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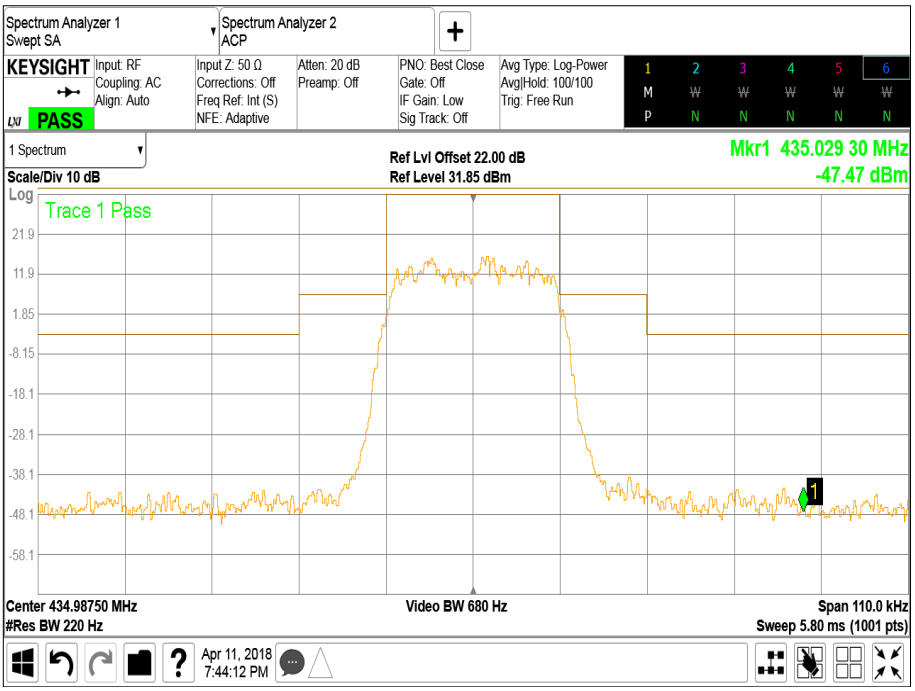

Figure 5 - 434.9875 MHz - Transmitter Spectrum Mask

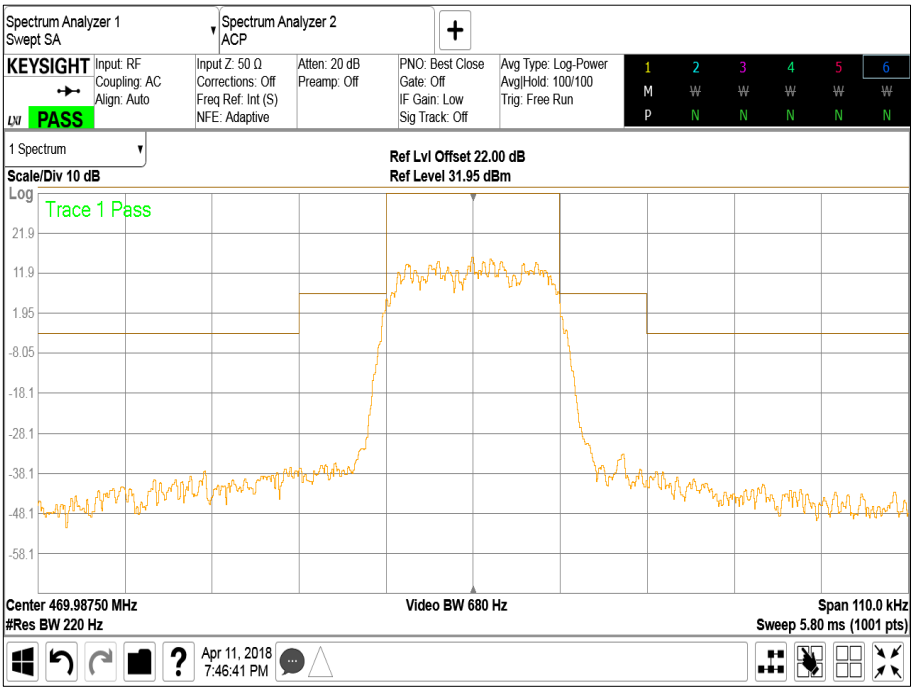

Figure 6 - 469.9875 MHz - Transmitter Spectrum Mask

Figure 7 - 405.0125 MHz - 9 kHz to 150 kHz

Figure 8 - 434.9875 MHz - 9 kHz to 150 kHz

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Figure 9 - 469.9875 MHz - 9 kHz to 150 kHz

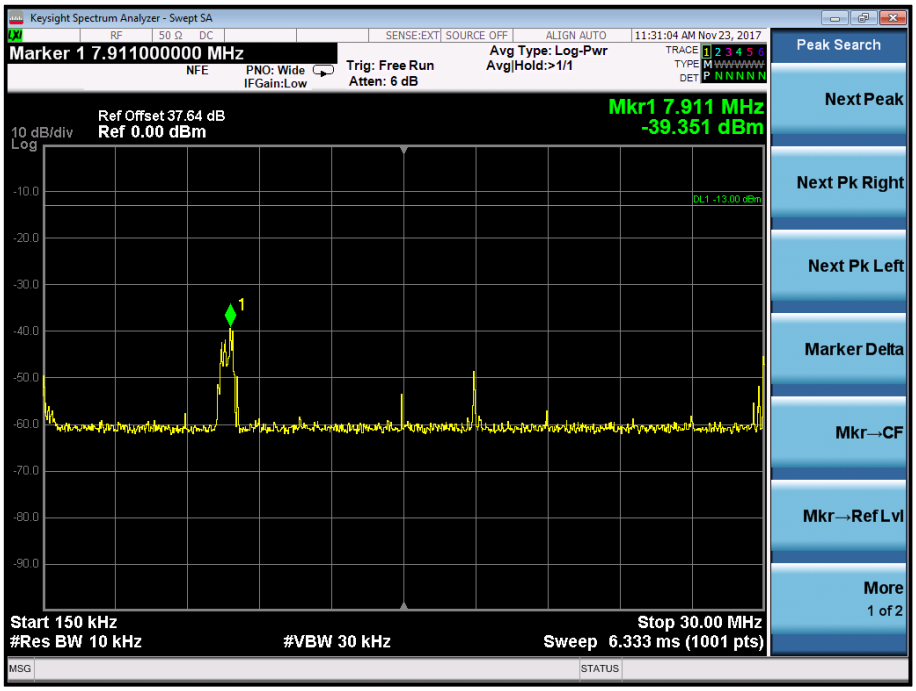

Figure 10 - 405.0125 MHz - 150 kHz to 30 MHz

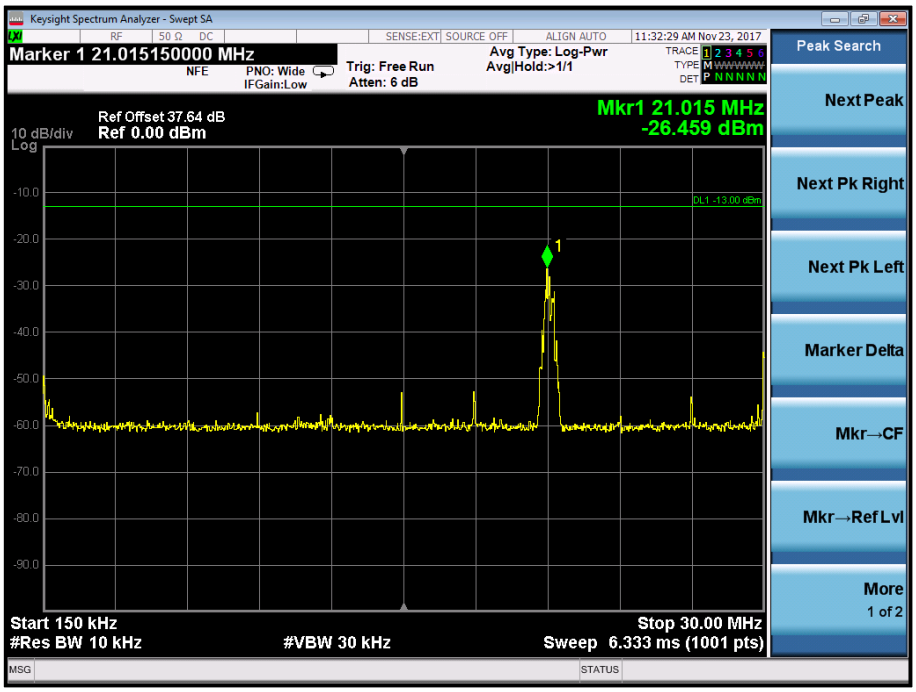

Figure 11 - 434.9875 MHz - 150 kHz to 30 MHz

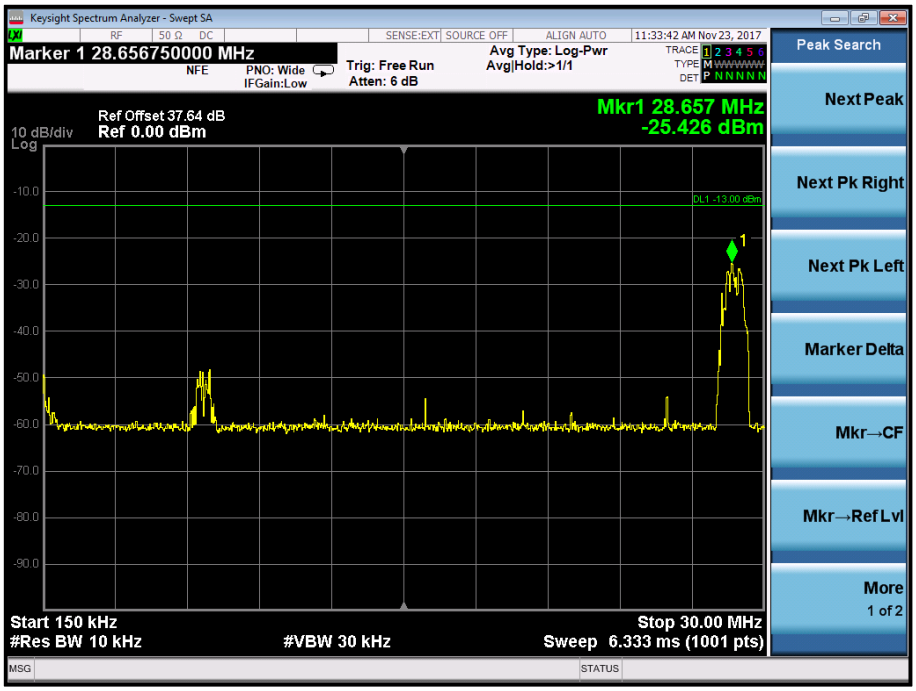

Figure 12 - 469.9875 MHz - 150 kHz to 30 MHz

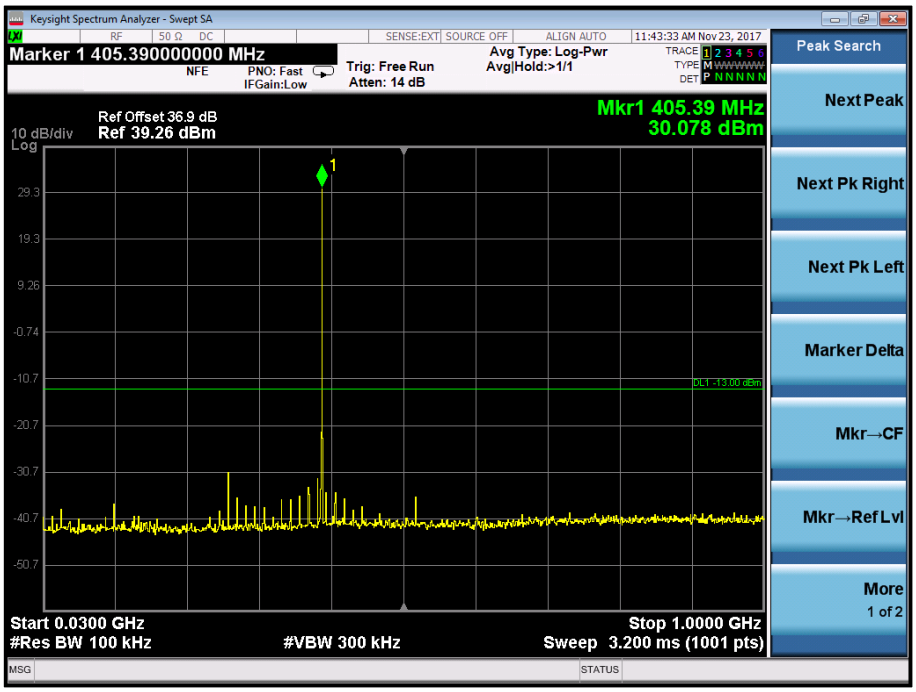

Figure 13 - 405.0125 MHz - 30 MHz to 1 GHz

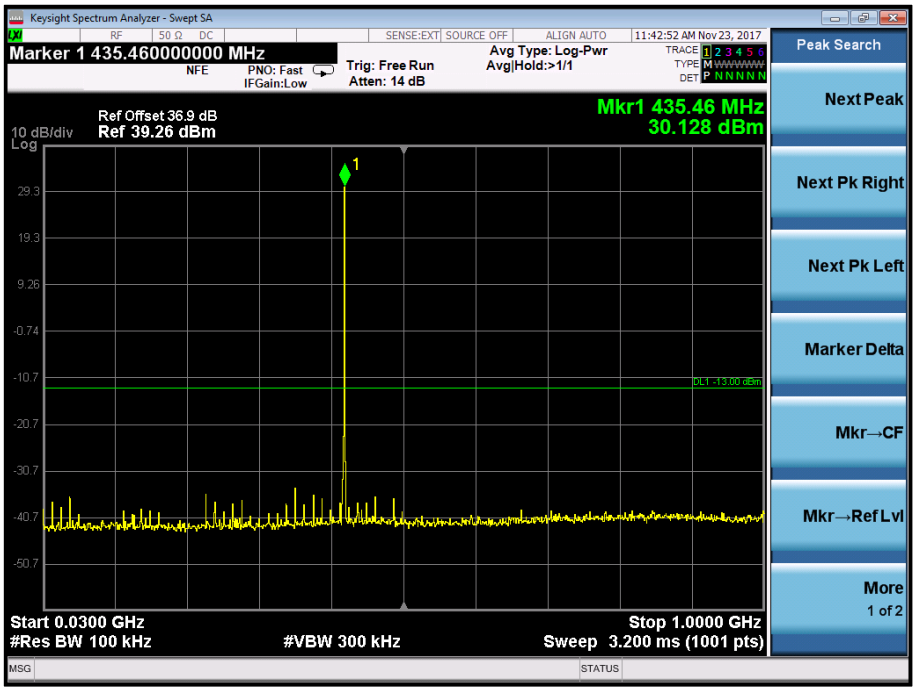

Figure 14 - 434.9875 MHz - 30 MHz to 1 GHz

Product Service

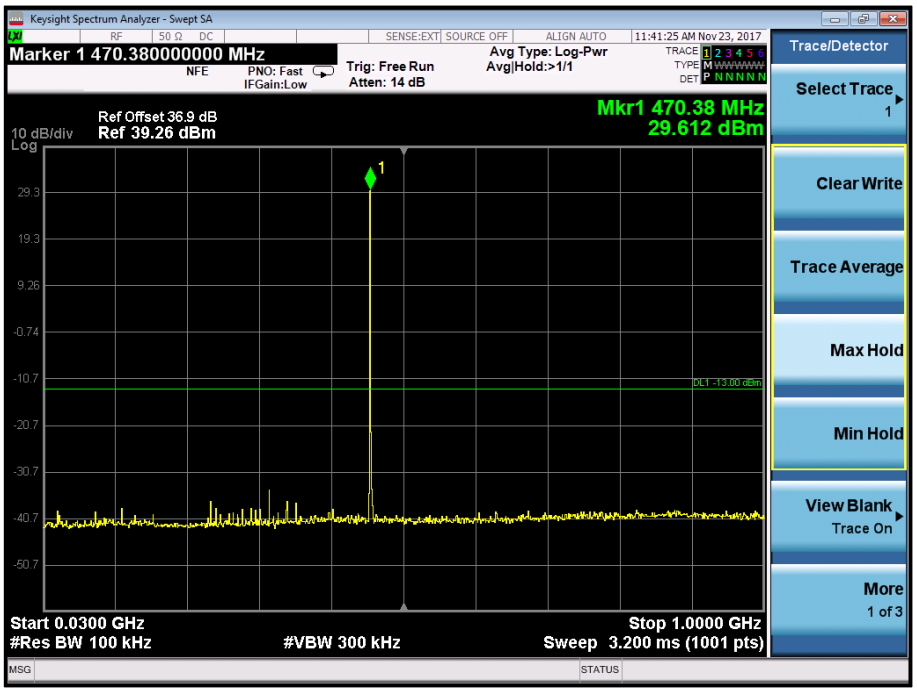

Figure 15 - 469.9875 MHz - 30 MHz to 1 GHz

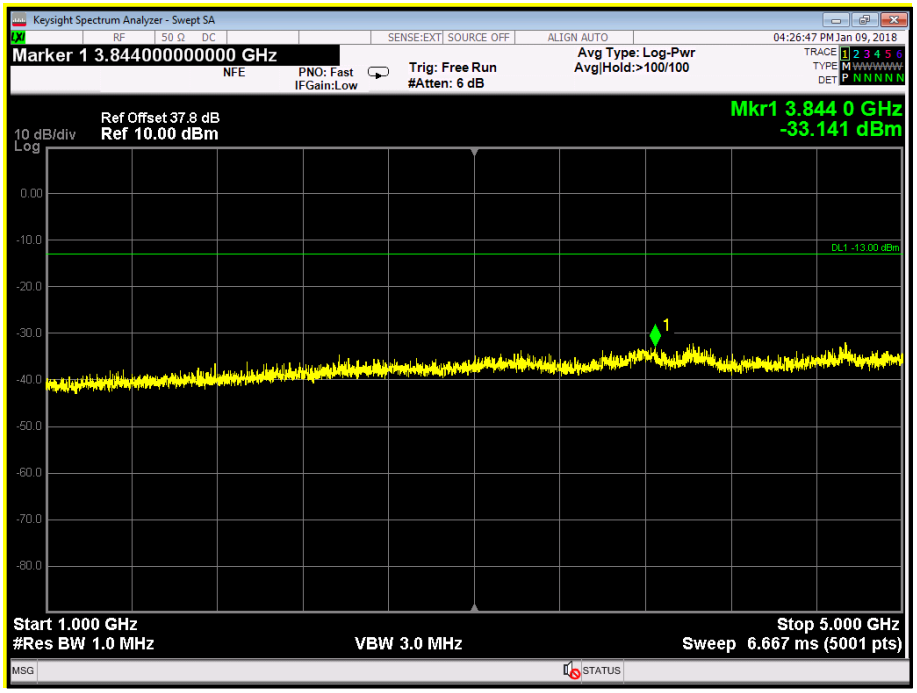

Figure 16 - 405.0125 MHz - 1 GHz to 5 GHz

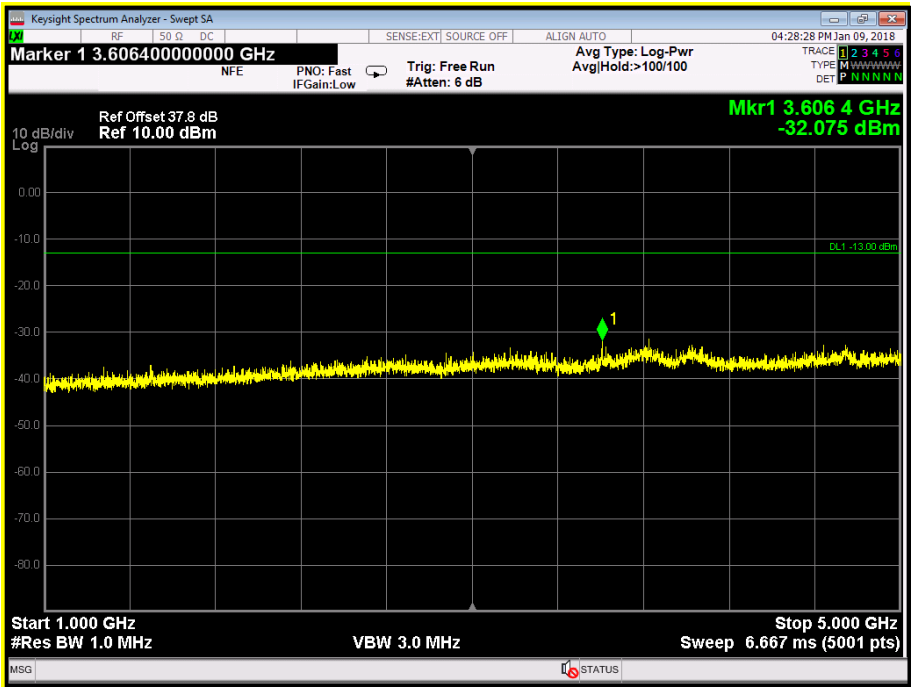

Figure 17 - 434.9875 MHz - 1 GHz to 5 GHz

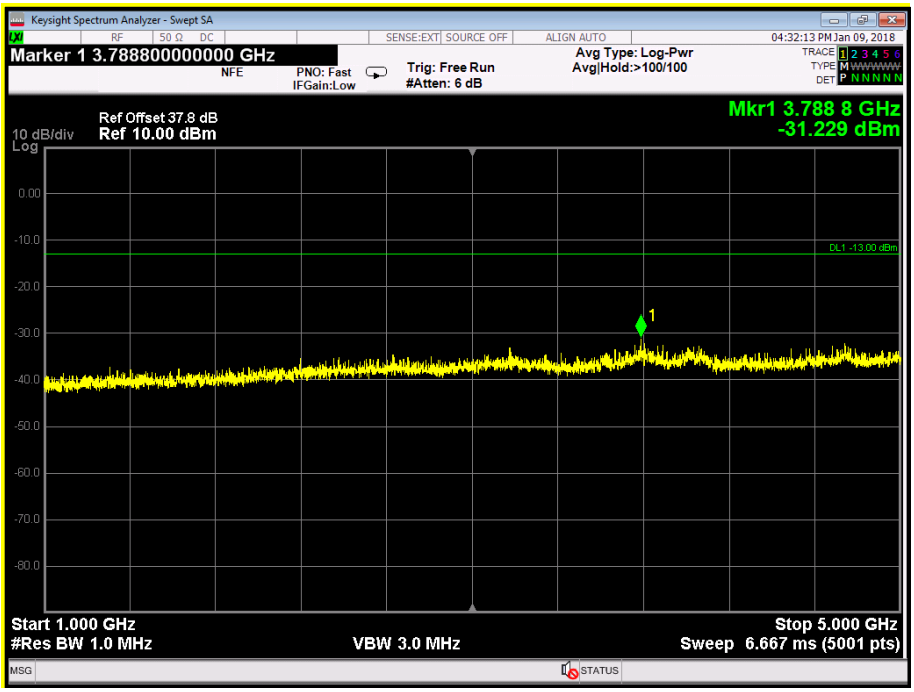

Figure 18 - 469.9875 MHz - 1 GHz to 5 GHz

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 90.210
FCC 47 CFR Part 2, Clause 2.1051

2.6.2 Equipment Under Test and Modification State

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

2.6.3 Date of Test

18 November 2017 to 06 December 2017

2.6.4 Test Method

Testing was performed in accordance with ANSI C63.26, 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.

For 30 MHz to 1 GHz testing, the antenna port was extended to outside the test chamber and terminated with a 50 Ohm load. This provided sufficient loss between EUT and Base Station to ensure EUT was transmitting at maximum power (A2).

***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 - 20.3 °C
Relative Humidity	34.0 - 44.0 %

2.6.6 Test Results

PNG MP50 (Stand Alone) UHF Transceiver

Frequency (MHz)	Level (dBm)
*	

Table 15 - 405.0125 MHz - Emissions Results

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

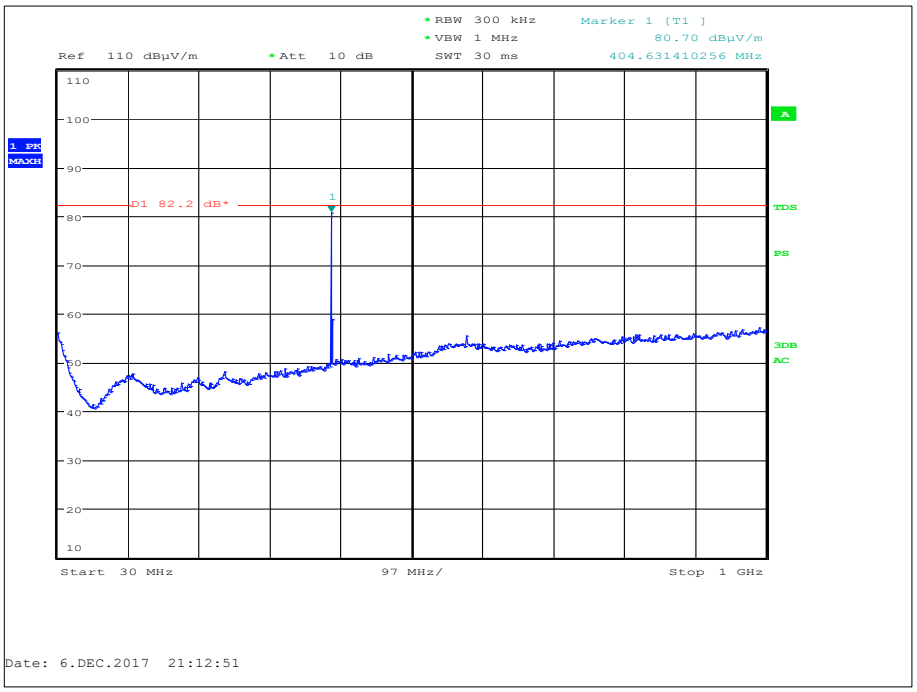

Figure 19 - 405.0125 MHz - 30 MHz to 1 GHz

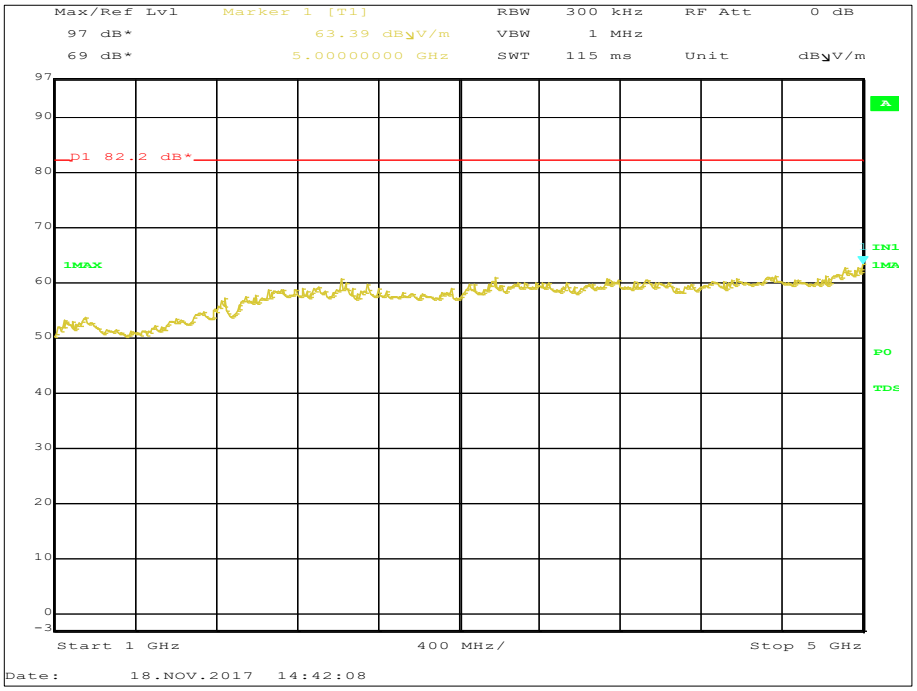

Figure 20 - 405.0125 MHz - 1 GHz to 5 GHz

Frequency (MHz)	Level (dBm)
*	

Table 16 - 434.9875 MHz - Emissions Results

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

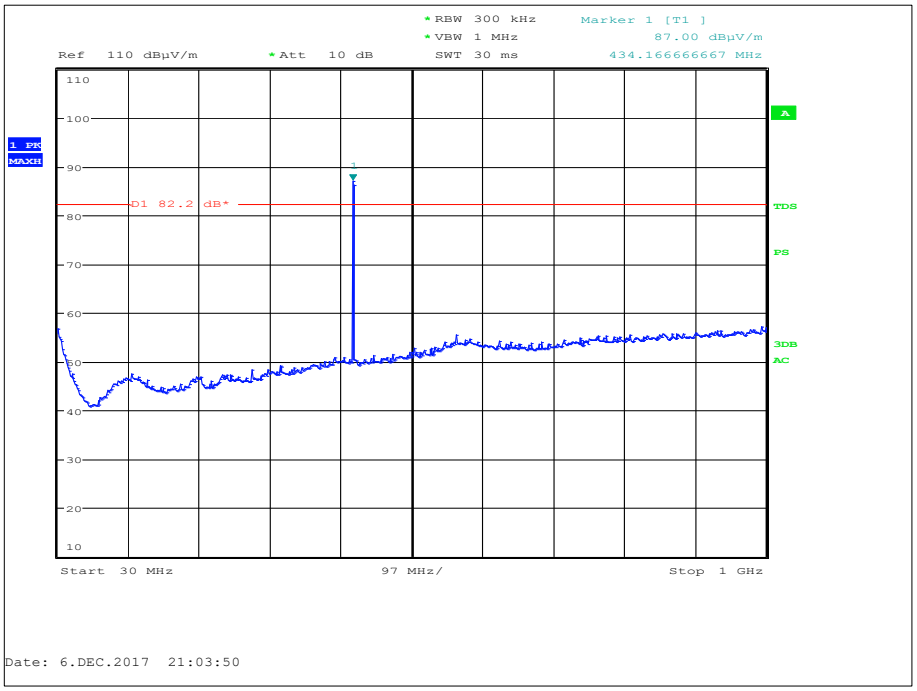

Figure 21 - 434.9875 MHz - 30 MHz to 1 GHz

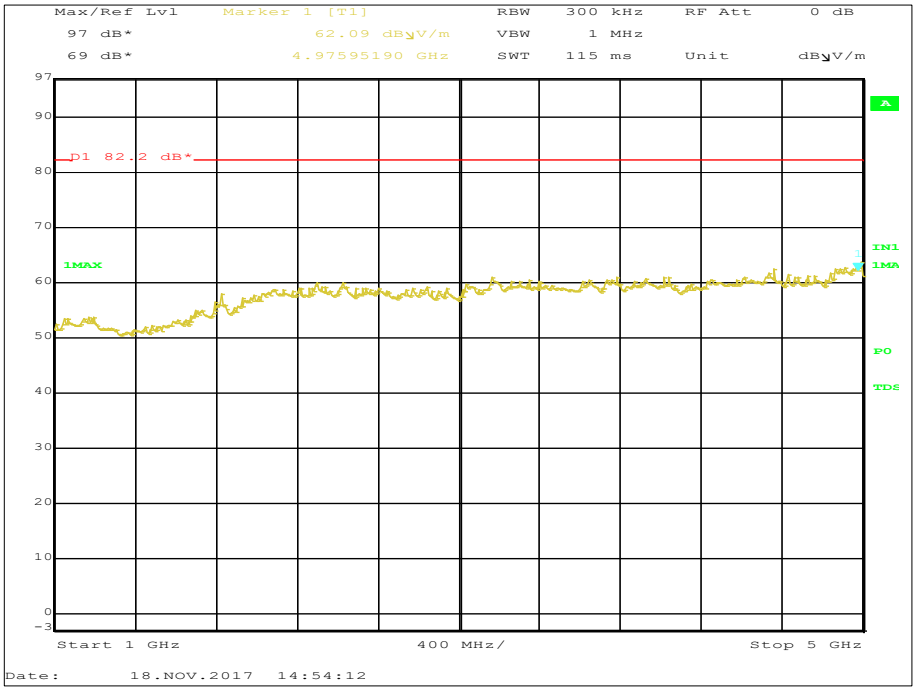

Figure 22 - 434.9875 MHz - 1 GHz to 5 GHz

Frequency (MHz)	Level (dBm)
*	

Table 17 - 434.9875 MHz - Emissions Results

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

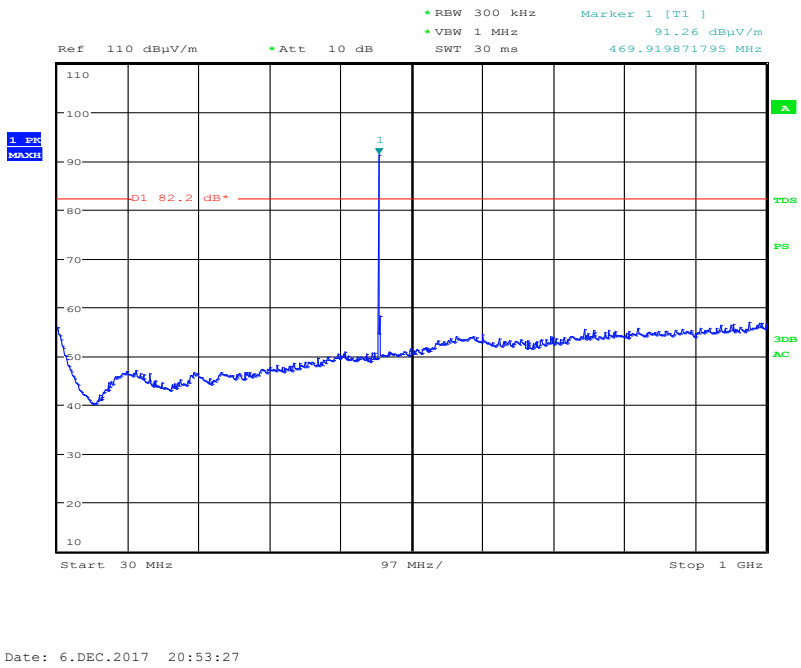

Figure 23 - 469.9875 MHz 30 MHz to 1 GHz

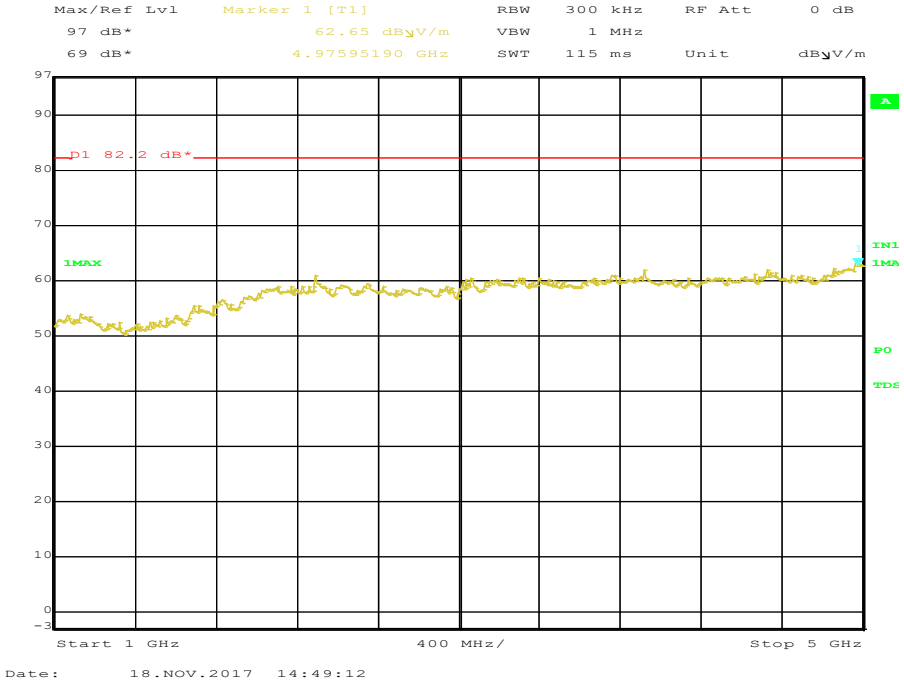

Figure 24 - 469.9875 MHz 1 GHz to 5 GHz

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

(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 87, Clause 90.221

2.7.2 Equipment Under Test and Modification State

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

2.7.3 Date of Test

12 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.

The EUT was powered using an external DC power supply in place of the batteries. Due to the voltage drop that occurs during a transmit burst, it was necessary to measure the peak voltage drop using an oscilloscope. The voltage on the external DC power supply increased by the value measured to ensure that during a transmit burst the voltage did not fall below 3.6 V DC.

***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	22.6 °C
Relative Humidity	39.6 %

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
-55.51	-57.65	-57.40	-56.90	-55.99	-55.52

Table 19 – Adjacent Channel Power

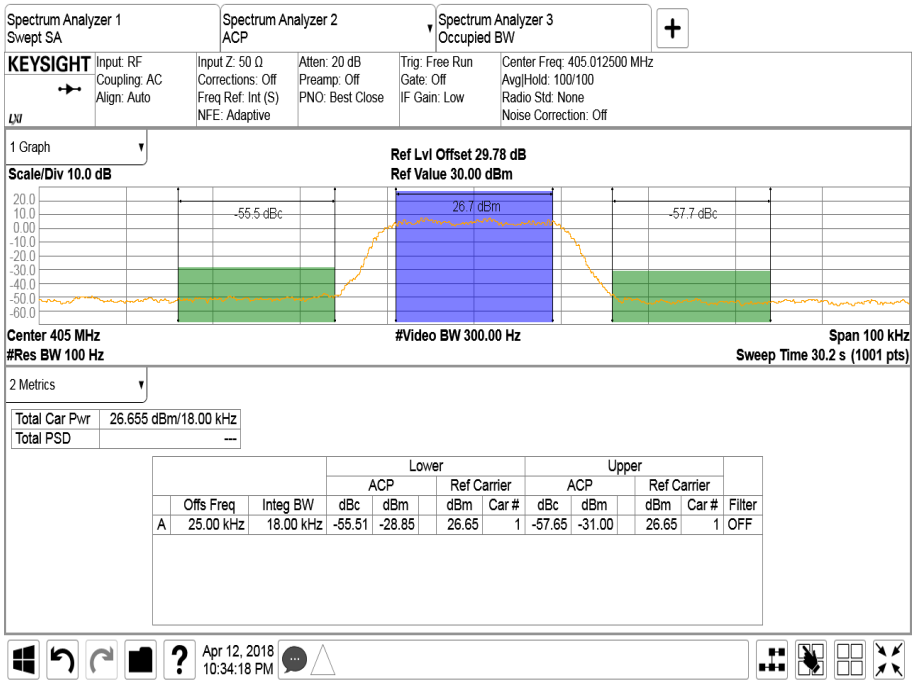

Figure 25 - Adjacent Channel Power, 405.0125 MHz

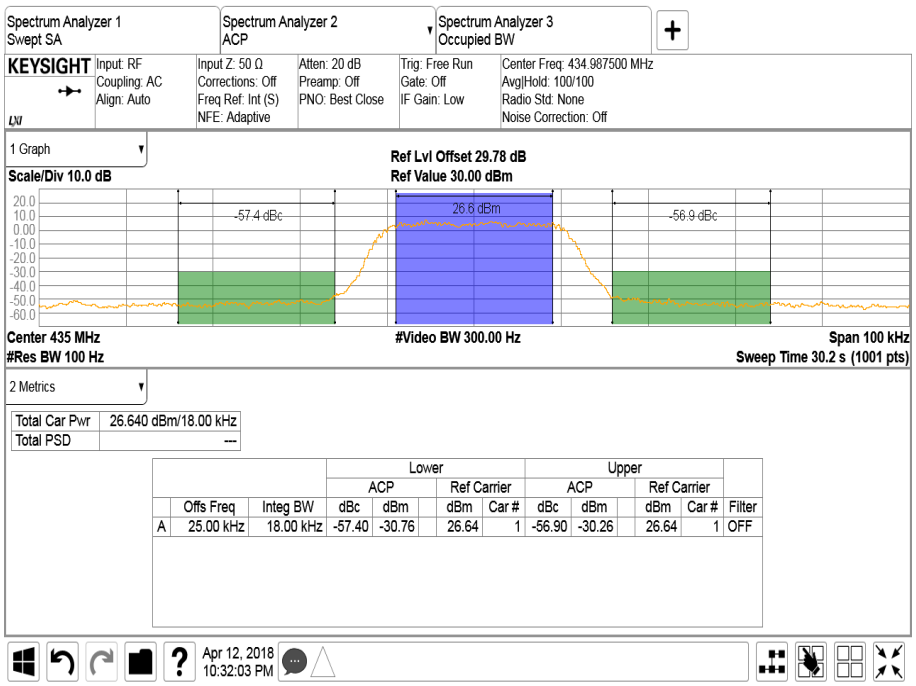

Figure 26- Adjacent Channel Power, 434.9875 MHz

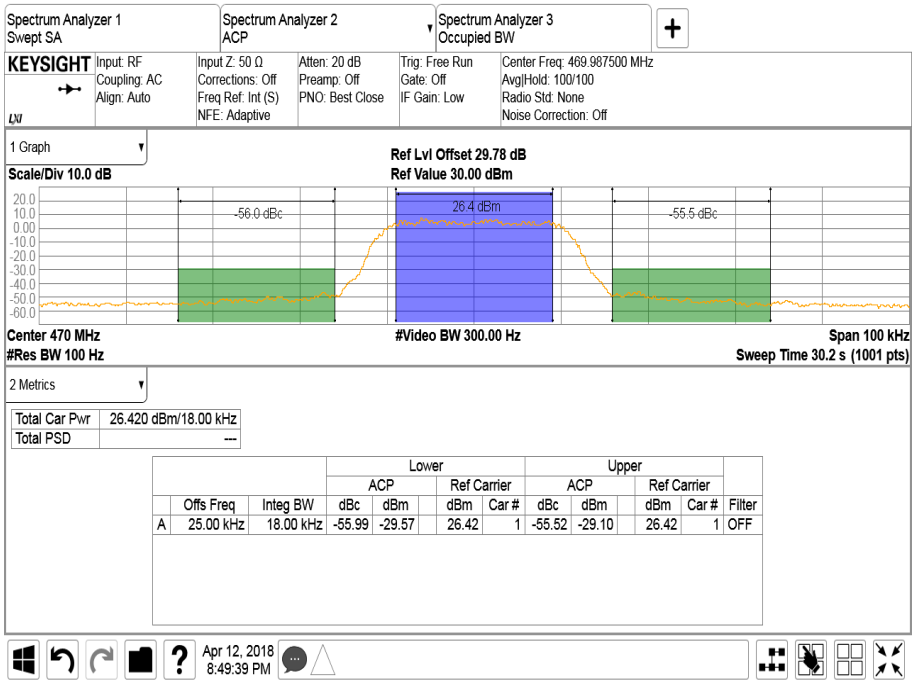

Figure 27 - Adjacent Channel Power, 469.9875 MHz

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
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	19-Jun-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

2.8 Transient Frequency Behaviour

2.8.1 Specification Reference

FCC 47 CFR Part 87, Clause 90.214

2.8.2 Equipment Under Test and Modification State

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

2.8.3 Date of Test

30 April 2018

2.8.4 Test Method

The transient frequency behavior was measured using the spectrum analyser with FM demod measurement functionality. The EUT was connected to the spectrum analyser via an attenuator, combiner and cable. Connected to the other port of the combiner was a signal generator which was set to produce a 1 kHz tone with 25 kHz deviation. The amplitude of this signal was -20 dBc. The trigger point for the spectrum analyser was the moment the power of the EUT was greater than/less than for the switch on/switch off.

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

2.8.5 Environmental Conditions

Ambient Temperature	22.6 °C
Relative Humidity	39.6 %

2.8.6 Test Results

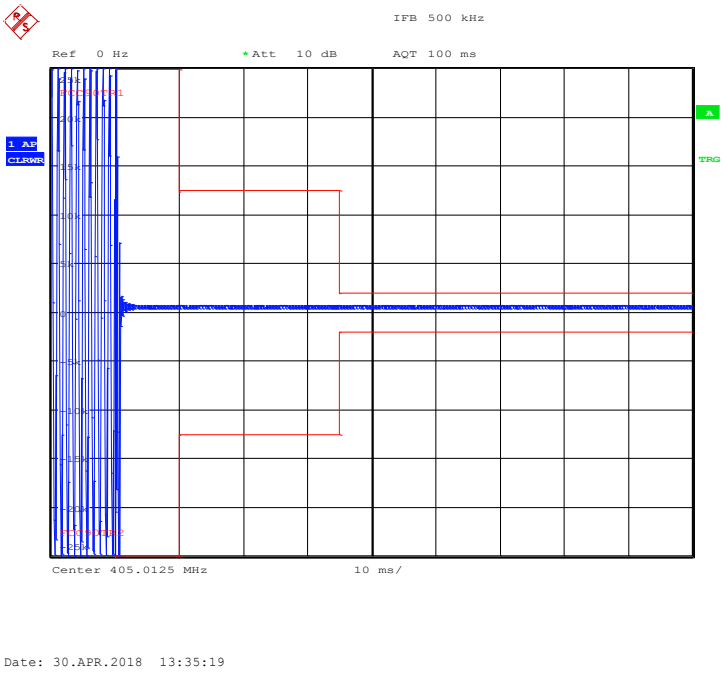

Figure 28 - Switch On Transient, 405.0125 MHz

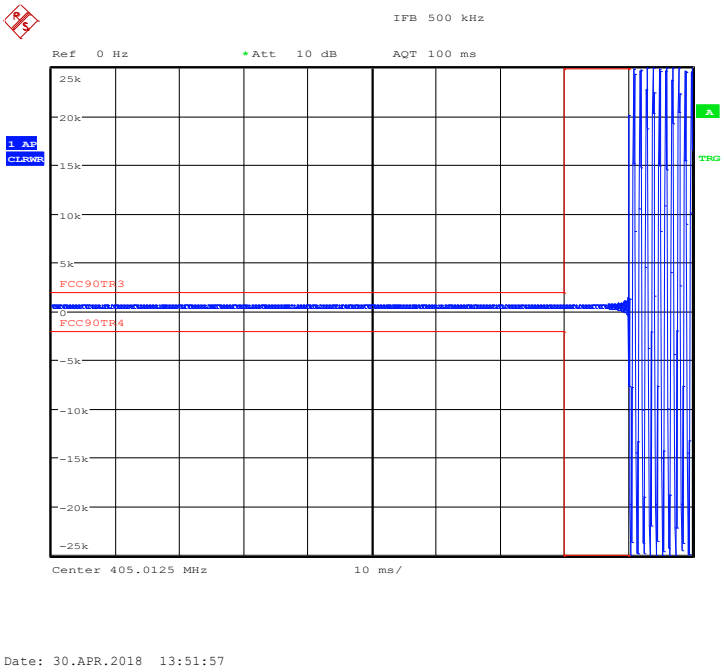

Figure 29 - Switch Off Transient, 405.0125 MHz

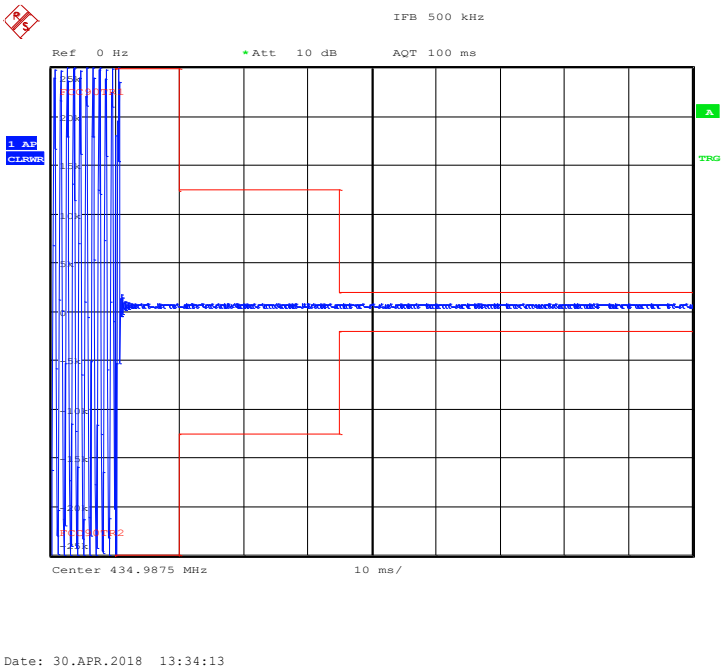

Figure 30- Switch On Transient, 434.9875 MHz

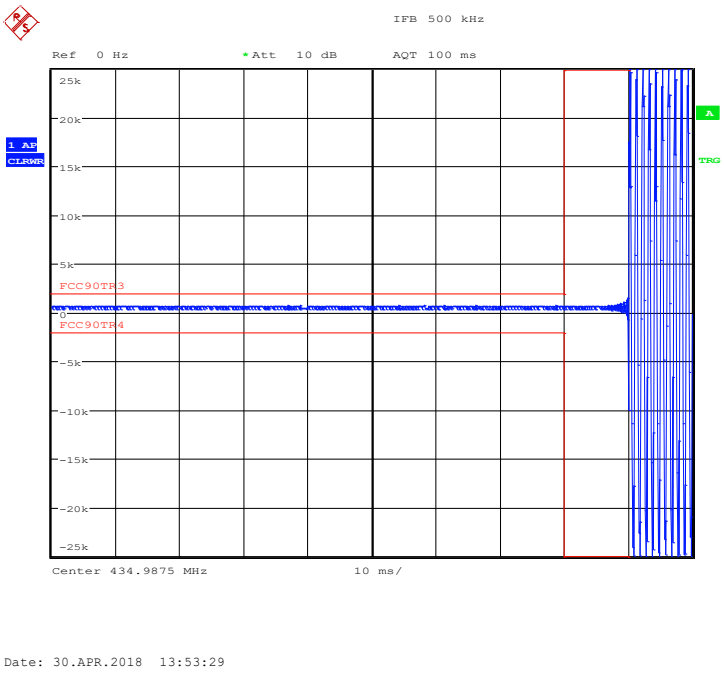

Figure 31- Switch Off Transient, 434.9875 MHz

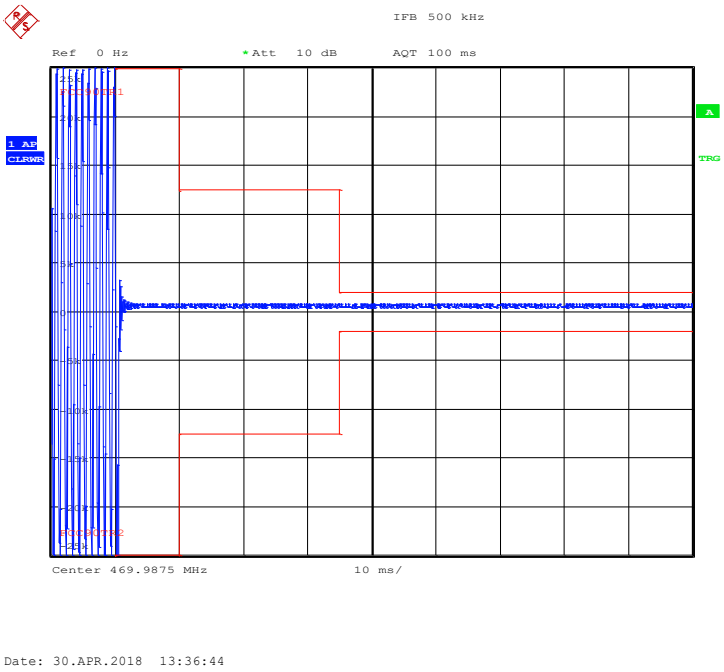

Figure 32 - Switch On Transient, 469.9875 MHz

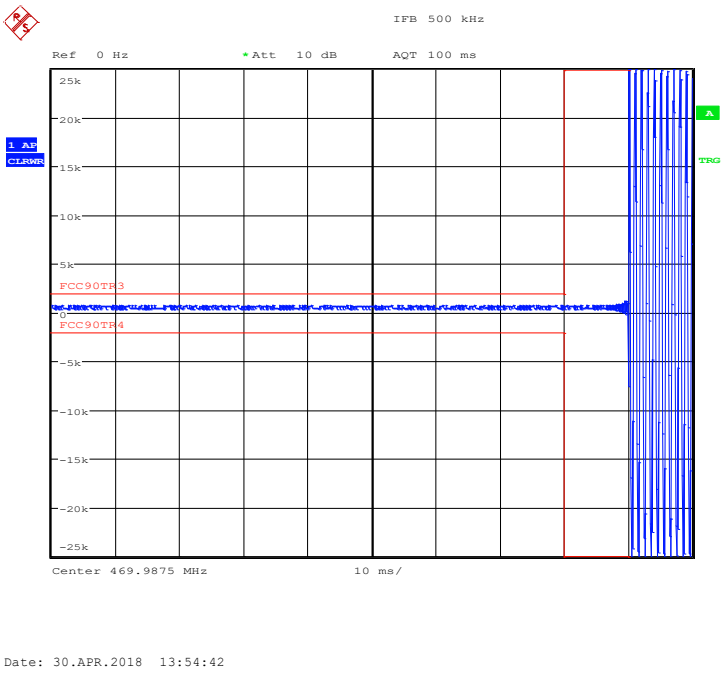

Figure 33 - Switch Off Transient, 469.9875 MHz

FCC 47 CFR Part 90 Limit Clause 90.214

Time Intervals	Maximum frequency difference	All Equipment	
		150 MHz to 174 MHz	421 MHz to 512 MHz
T_1	±25.0 kHz	5.0 ms	10.0 ms
T_2	±12.5 kHz	20.0 ms	25.0 ms
T_3	±25.0 kHz	5.0 ms	10.0 ms

Table 22 – Transient Frequency Behavior Limit

2.8.7 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	White Gold	WG022	190	12	24-Nov-2018
Power Divider	Weinschel	1506A	603	12	19-Jan-2019
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	20-Oct-2018
Hygrometer	Rotronic	I-1000	2891	12	30-Aug-2018
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	02-May-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
1m N-Type Cable	Rhophase		4233	12	14-Jun-2018
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	20-Oct-2018
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon

Table 23

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
Maximum Conducted Output Power	± 3.2 dB
Frequency Stability	± 8.03 Hz
Bandwidth Limitations	± 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 1 GHz to 18 GHz: ± 6.3 dB
Adjacent Channel Power	±1.16 dB

Table 24