

FCC Test Report

Axnes Aviation AS

Transceiver, Model: MP30

In accordance with FCC 47 CFR Part 90 and
FCC 47 CFR Part 2

Prepared for: Axnes Aviation AS
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Add value.
Inspire trust.

FCC ID: 2AOHPMP30A

COMMERCIAL-IN-CONFIDENCE

Document Number: 75946122-01 | Issue: 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Simon Bennett	Innovations Manager	Authorised Signatory	09 December 2019

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD 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	Nandhini Mathivanan	09 December 2019	
Testing	Graeme Lawler	09 December 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: 2018 and FCC 47 CFR Part 2 2018 for the tests detailed in section 1.3.



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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	09 December 2019

Table 1

1.2 Introduction

Applicant	Axnes Aviation AS
Manufacturer	Axnes Aviation AS
Model Number(s)	MP30
Serial Number(s)	010 300
Hardware Version(s)	R10
Software Version(s)	AXS-SW-0511
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 90: 2018 FCC 47 CFR Part 2: 2018
Order Number	802298
Date	22-May-2019
Date of Receipt of EUT	23-May-2019
Start of Test	28-May-2019
Finish of Test	25-September-2019
Name of Engineer(s)	Nandhini Mathivanan, Graeme Lawler and Matthew Russell
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
Configuration and Mode: Battery Powered - 8PSK UHF				
2.1	90.205 and 2.1046	Maximum Conducted Output Power	Pass	
2.2	90.207 and 2.1047	Types of Emissions	Declaration	
2.3	90.209 and 2.1049	Bandwidth Limitations	Pass	
2.4	90.210 and 2.1051	Spurious Emissions at Antenna Terminals	Pass	
2.5	90.210 and 2.1055	Frequency Stability	Pass	
2.6	90.221	Adjacent Channel Power	Pass	
2.7	90.214 and N/A	Transient Frequency Behaviour	Pass	
Configuration and Mode: Battery Powered - 16QAM				
2.8	90.210 and 2.1051	Radiated Spurious Emissions	Pass	

Table 2

NOTE: Conducted tests are only documented in this report for 8PSK modulation. The manufacturer declared that the MP30 is electrically identical to the MP50 which was tested in Document 75940027 Report 03 where results for 16QAM modulation are reported.

The manufacturer declared that for Radiated Spurious Emissions, the worst case mode was 16QAM based on Conducted Output Power.



1.4 Application Form

Equipment Description

Technical Description: (Please provide a brief description of the intended use of the equipment)	Crew unit for use in the PNG wireless intercom extension family. Connects to crews helmet or headset. Relays voice and data between crew member and vehicle intercom. Operates in the UHF band.
Manufacturer:	Axnes AS
Model:	MP30
Part Number:	AXS-HH-D0200-BGN-C3
Hardware Version:	R10
Software Version:	AXS-SW-0511
FCC ID (if applicable)	2AOHPMP30A
IC ID (if applicable)	Click to edit

Intentional Radiators

Technology	UHF	UHF	Bluetooth
Frequency Band (MHz)	406.1 - 430.0	450-470	2402-2480
Conducted Declared Output Power (dBm)	26	26	7.56
Antenna Gain (dBi)	5.1	5.1	3.29
Supported Bandwidth(s) (MHz)	0.025	0.025	1 MHz
Modulation Scheme(s)	8PSK/16QAM	8PSK/16QAM	GFSK/8DPSK/π/4 DQPSK
ITU Emission Designator	20K0D7W	20K0D7W	1M00DXW
Bottom Frequency (MHz)	406.1	450	2402
Middle Frequency (MHz)	423	460	2441
Top Frequency (MHz)	430	470	2480

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	12 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒	
Class B Digital Device (Use in residential environment only) ☐	

AC Power Source

AC supply frequency: Click to edit (Hz)	
Click to edit V	Max current: Click to edit A
Single Phase ☐ Three Phase ☐	



DC Power Source

Nominal voltage: Click to edit V
Extreme upper voltage: Click to edit V
Extreme lower voltage: Click to edit V
Max current: Click to edit. A

Battery Power Source

Voltage: 3.8 V
End-point voltage: 3.6 V (Point at which the battery will terminate)
Alkaline ☐ Leclanche ☒ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ *(Vehicle regulated)
Other ☐ Please detail: Click to edit

Charging

Can the EUT transmit whilst being charged	Yes ☒ No ☐
---	---

Temperature

Minimum temperature: -20 °C	Maximum temperature: 50 °C
-----------------------------	----------------------------

Antenna Characteristics

Antenna connector ☐ State impedance Click to edit Ohm
Temporary antenna connector ☐ State impedance Click to edit Ohm
Integral antenna ☒ Type monopole State impedance 5.1 dBi
External antenna ☐ Type Click to edit State impedance Click to edit dBi

Ancillaries (if applicable)

Manufacturer: Click to edit	Part Number: Click to edit
Model: Click to edit	Country of Origin: Click to edit

I hereby declare that the information supplied is correct and complete.

Name: Petter Johnsen
Position held: CTO
Date: 09 December 2019



1.5.3 EUT Configuration and Rationale for Radiated Spurious Emissions

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. Pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4.

1.6 Deviations from the Standard

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

The channels used for testing were 406.1125 MHz, 450.0125 MHz and 469.9875 MHz, and were selected to cover the full range of the device. All channels within the frequency range 405 MHz to 470 MHz have equivalent power, bandwidth and modulation (either 8PSK or 16QAM).

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
Model: MP30: Serial Number: 010 300			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3



1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Battery Powered - 8PSK UHF		
Maximum Conducted Output Power	Nandhini Mathivanan	UKAS
Bandwidth Limitations	Nandhini Mathivanan	UKAS
Spurious Emissions at Antenna Terminals	Nandhini Mathivanan	UKAS
Frequency Stability	Nandhini Mathivanan	UKAS
Adjacent Channel Power	Matthew Russell	UKAS
Transient Frequency Behaviour	Nandhini Mathivanan	UKAS
Configuration and Mode: Battery Powered - 16QAM		
Radiated Spurious Emissions	Graeme Lawler	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

MP30, S/N: 010 300 - Modification State 0

2.1.3 Date of Test

28-May-2019

2.1.4 Test Method

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90, Clause 90.205 and FCC CFR 47 Part 2, Clause 2.1046 and ANSI C63.26, clause 5.2.4.3.

2.1.5 Environmental Conditions

Ambient Temperature 23.1 °C
Relative Humidity 35.5 %

2.1.6 Test Results

Battery Powered - 8PSK UHF

Description	406.1125 MHz		450.0125 MHz		469.9875 MHz	
	Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
Conducted Power	26.35	0.432	26.68	0.466	26.39	0.436
ERP	29.30	0.851	29.63	0.918	29.34	0.859

Table 5 - ERP



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	Refer to 90.279 of the specification
450 to 470	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 6 - Specification Limits for Maximum ERP



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
Directional Coupler	Narda	3020A	419	-	O/P Mon
Thermocouple Thermometer	Fluke	51	3174	12	07-Feb-2020
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	17-Oct-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	22-Oct-2019
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	04-Oct-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	04-Oct-2019
Attenuator 10 dB 2 W	Telegartner	J01156A0031	N/S	-	O/P Mon

Table 7

O/P Mon – Output Monitored using calibrated equipment



2.2 Types of Emissions

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test

MP30

2.2.3 Date of Test

31-May-2019

2.2.4 Test Method

The following information was provided by the manufacturer

2.2.5 Test Results

Battery Powered - 8PSK UHF

The emission designator was declared by the manufacturer as 20K0D7W.

Modulation Type: [D] Carrier is amplitude and angle modulated.

Modulation Nature: [7] Two or more digital channels

Information Type: [W] Multiple Formats of Data Transmitted.

FCC 47 CFR Part 90, Limit Clause 90.207

As per FCC Part 90.207 (b) through (n).

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.



2.3 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

MP30, S/N: 010 300 - Modification State 0

2.3.3 Date of Test

28-May-2019

2.3.4 Test Method

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90, Clause 90.209, FCC CFR 47 Part 2, Clause 2.1049 and ANSI C63.26, clause 5.4.4.

2.3.5 Environmental Conditions

Ambient Temperature 23.1 °C
Relative Humidity 36.5 %

2.3.6 Test Results

Battery Powered - 8PSK UHF

406.1125 MHz	450.0125 MHz	469.9875 MHz
21.538 kHz	21.288 kHz	21.388 kHz

Table 8 - Occupied Bandwidth Results

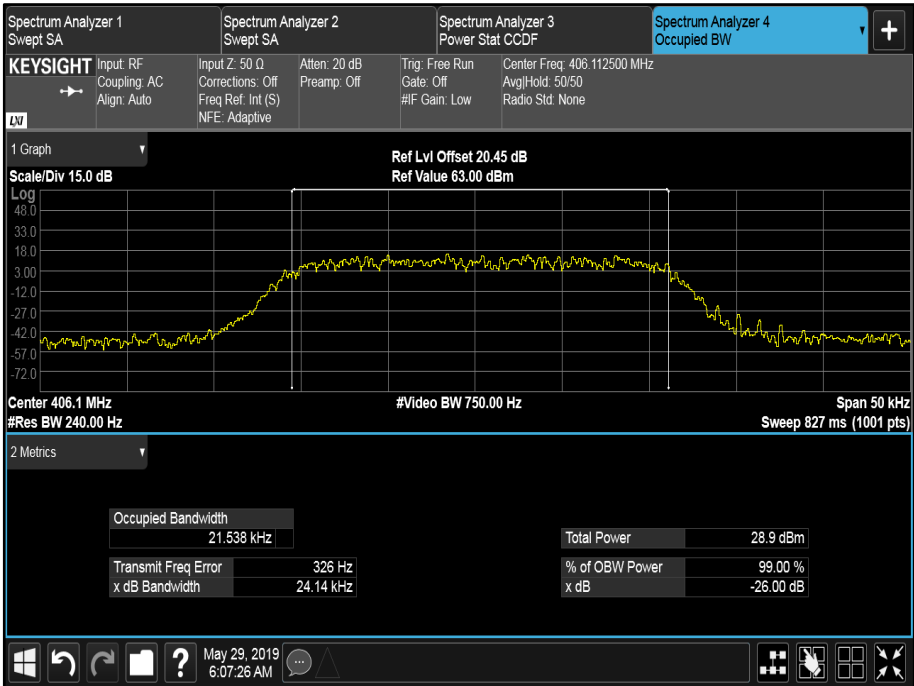


Figure 3 - 406.1125 MHz Occupied Bandwidth

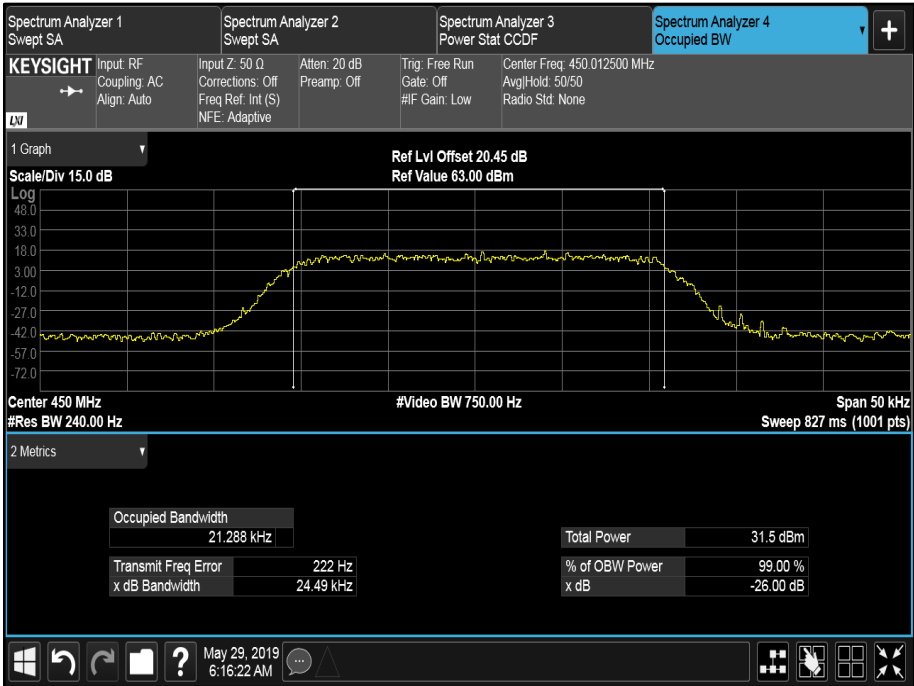


Figure 4 - 450.0125 MHz Occupied Bandwidth

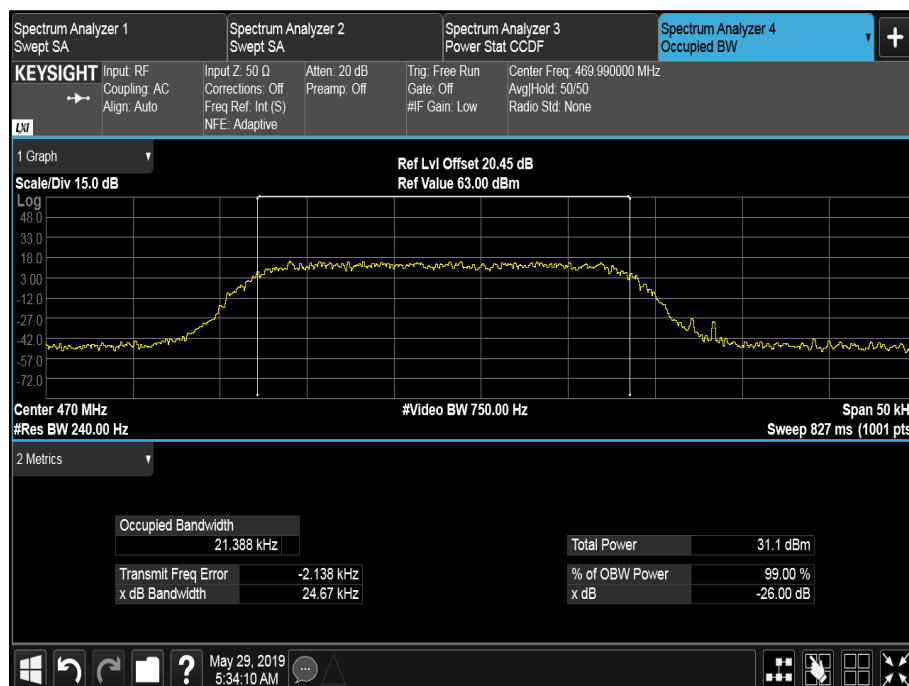


Figure 5 - 469.9875 MHz Occupied Bandwidth

FCC 47 CFR Part 90, Limit Clause 90.209

< 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
Directional Coupler	Narda	3020A	419	6	O/P Mon
Thermocouple Thermometer	Fluke	51	3174	12	07-Feb-2020
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	17-Oct-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	22-Oct-2019
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	04-Oct-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	04-Oct-2019

Table 9

O/P Mon – Output Monitored using calibrated equipment



2.4 Spurious Emissions at Antenna Terminals

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

MP30, S/N: 010 300 - Modification State 0

2.4.3 Date of Test

30-May-2019

2.4.4 Test Method

The test was performed according to FCC 47 CFR Part 90, Clause 90.210, FCC 47 CFR Part 2, Clause 2.1051 and ANSI C63.26, clause 5.7.

The centre frequency of the spectrum analyser was adjusted as required so that the 22 kHz authorized bandwidth was centered on the measured centre frequency, as opposed to the nominal centre frequency. Frequency error requirements are considered as documented in section 2.5 of the present document.

For frequencies between 9 kHz to 150 kHz and 150 kHz to 30 MHz the RBW chosen for measurement was reduced to 1 kHz and 10 kHz respectively. This is less than the 100 kHz RBW requirement for frequencies below 1000 MHz as stated in 90.210(o). These lower RBW's were chosen though to ensure that any DC leakage from the input was not measured. If $10 \cdot \log(100/\text{RBW})$ is added to the highest peak result to correct for the lower RBW used in the measurement and the corrected result compared to the limit, it can be seen that the measurements demonstrate compliance with the appropriate limit.

2.4.5 Environmental Conditions

Ambient Temperature	23.1 - 24.3 °C
Relative Humidity	36.5 - 46.4 %

2.4.6 Test Results

Battery Powered - 8PSK UHF

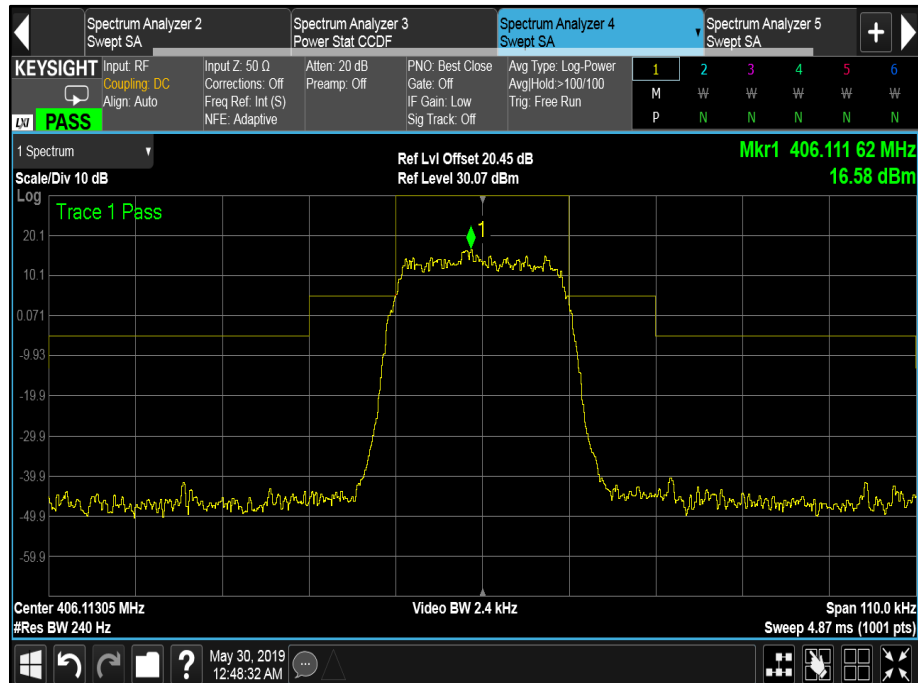


Figure 6 - 406.1125 MHz - Transmitter Spectrum Mask

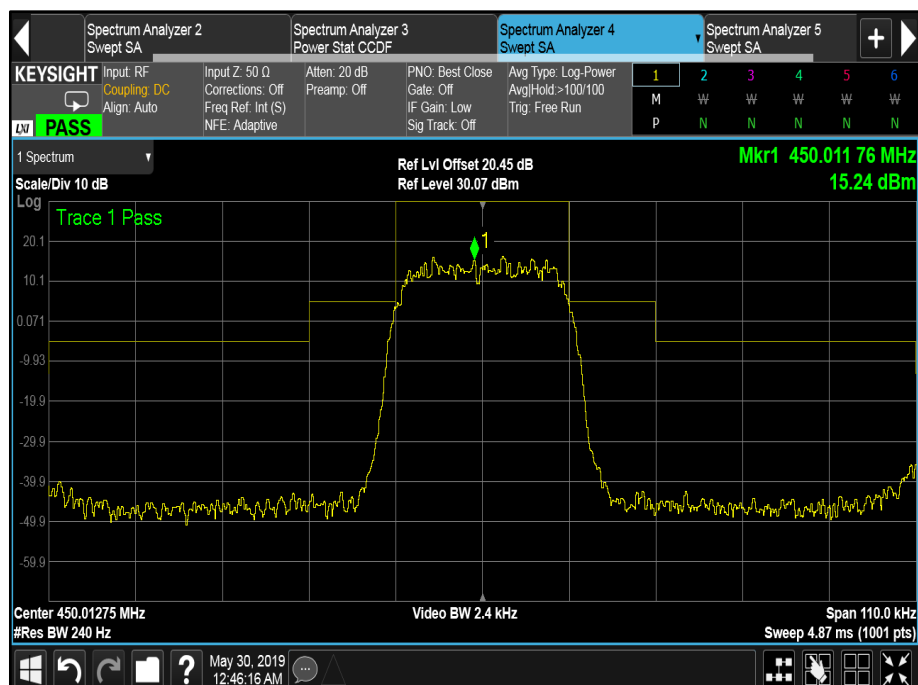


Figure 7 - 450.0125 MHz - Transmitter Spectrum Mask

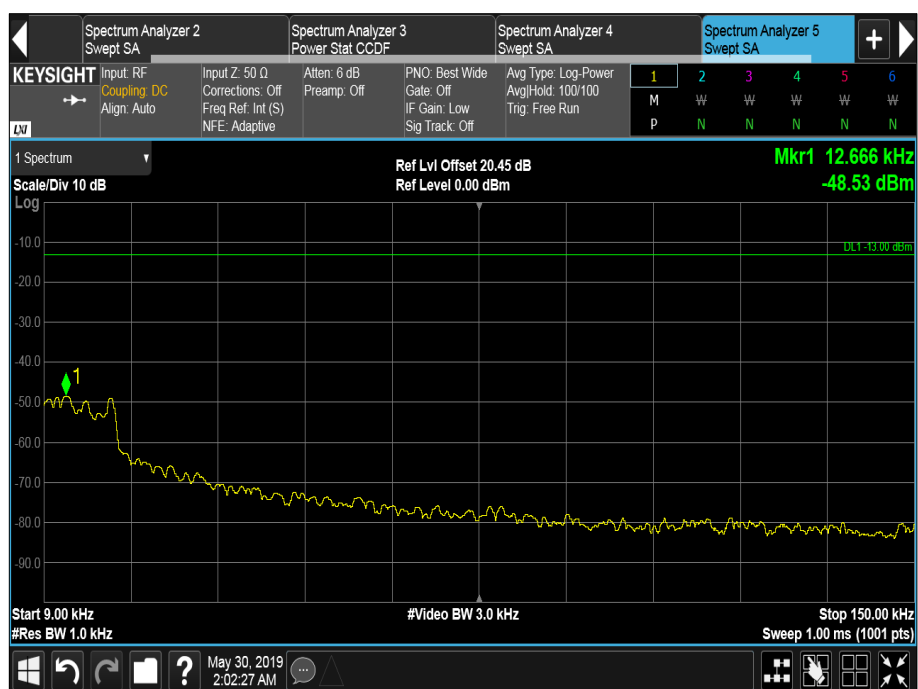
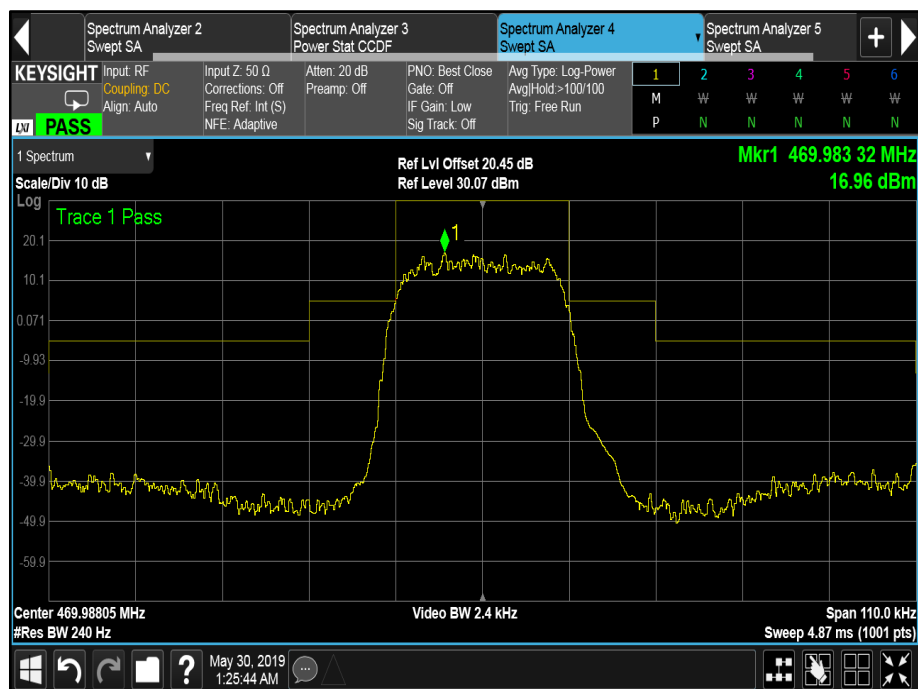




Figure 10 - 450.0125 MHz - 9 kHz to 150 kHz

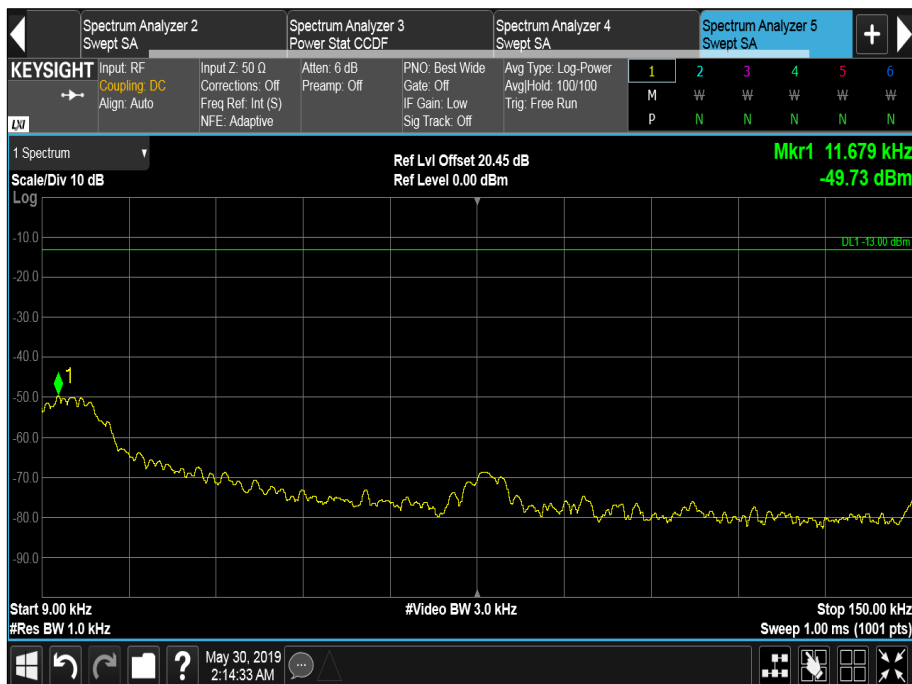


Figure 11 - 469.9875 MHz - 9 kHz to 150 kHz



Figure 12 - 406.1125 MHz - 150 kHz to 30 MHz

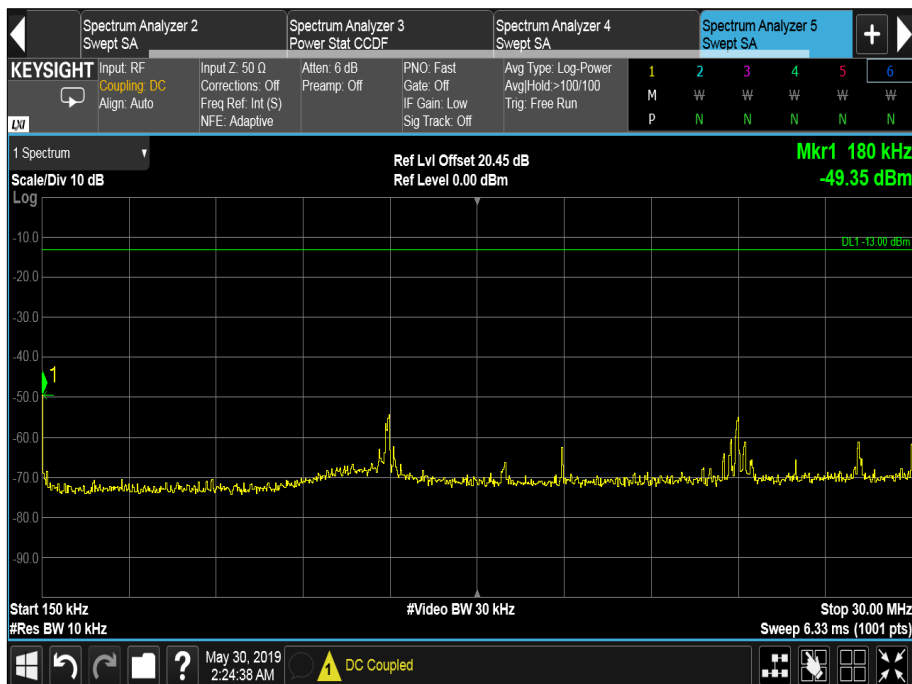


Figure 13 - 450.0125 MHz - 150 kHz to 30 MHz



Figure 14 - 469.9875 MHz - 150 kHz to 30 MHz

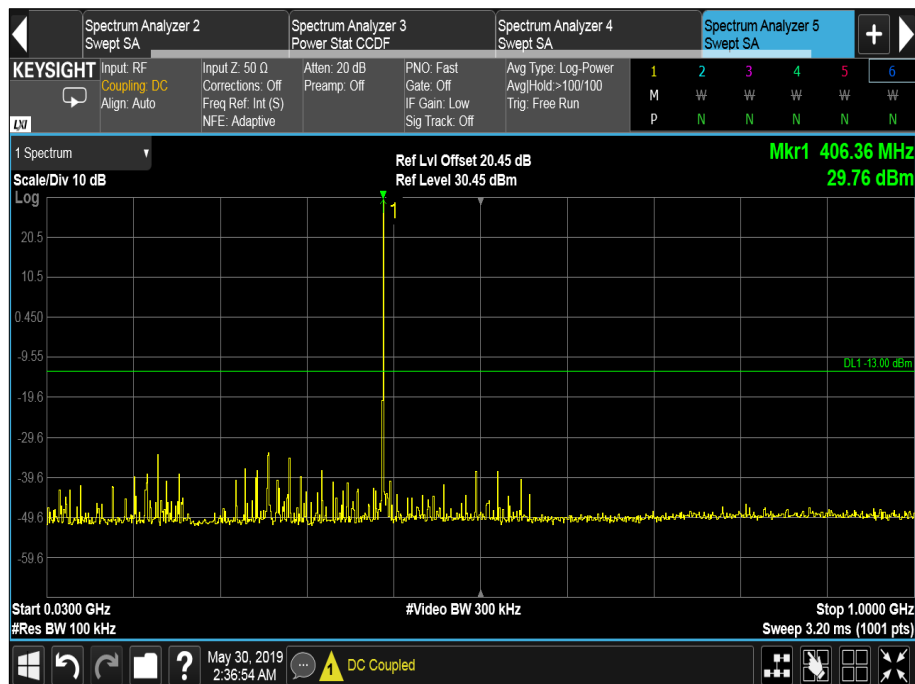


Figure 15 - 406.1125 MHz - 30 MHz to 1 GHz

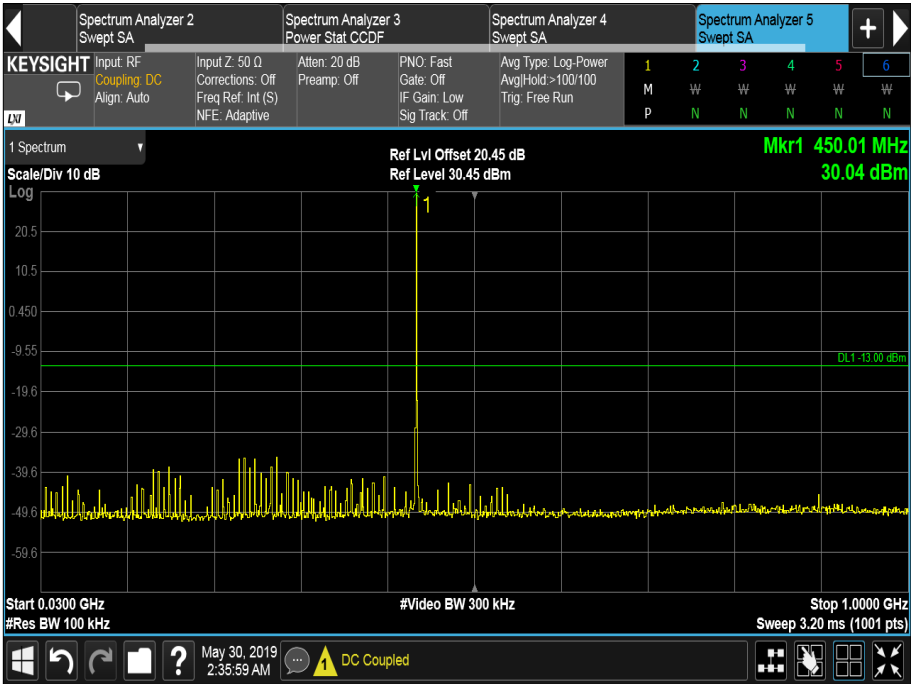


Figure 16 - 450.0125 MHz - 30 MHz to 1 GHz



Figure 17 - 469.9875 MHz - 30 MHz to 1 GHz

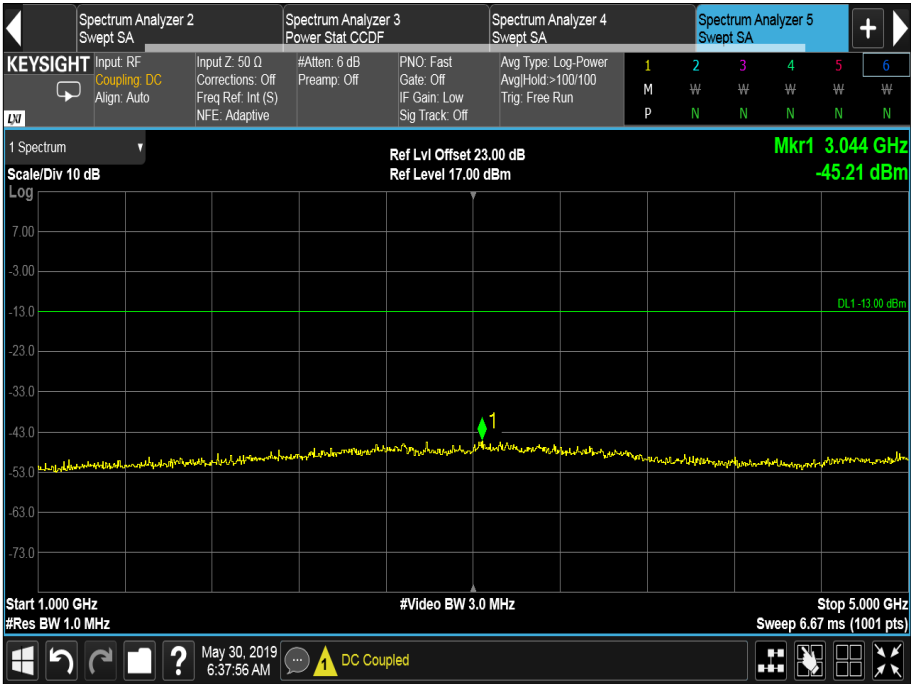


Figure 18 - 406.1125 MHz - 1 GHz to 5 GHz

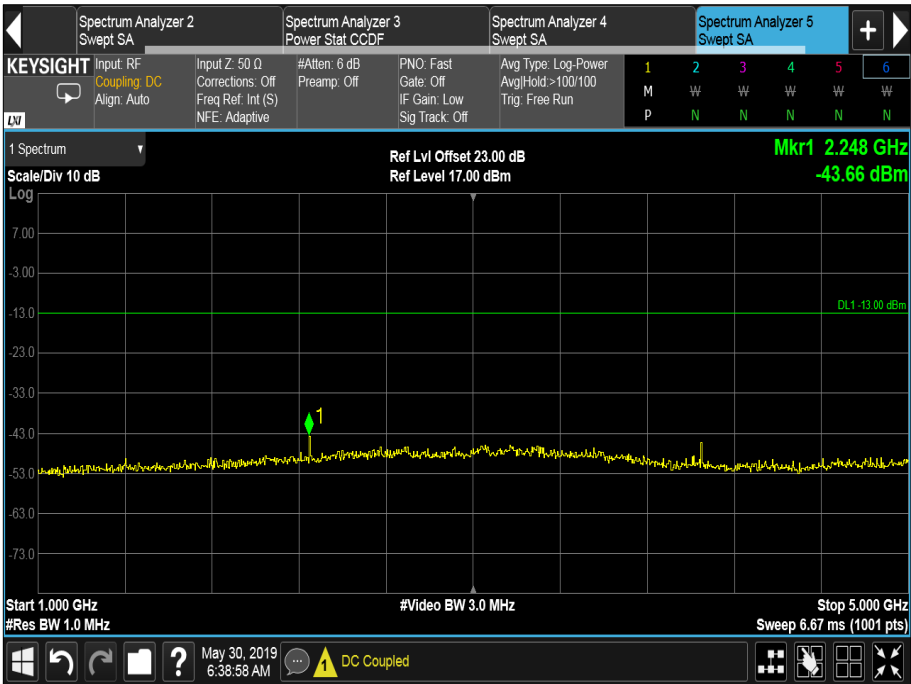


Figure 19 - 450.0125 MHz - 1 GHz to 5 GHz

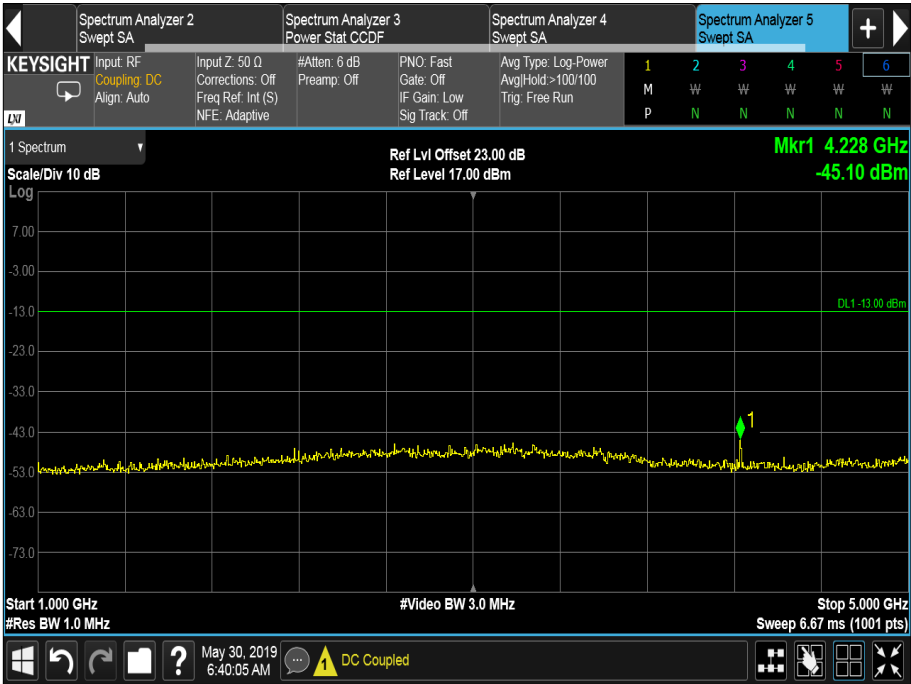


Figure 20 - 469.9875 MHz - 1 GHz to 5 GHz

FCC 47 CFR Part 90, Limit Clause 90.210

The EUT shall comply with emission mask B as per FCC 47 CFR Part 90.210.



2.4.7 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
Directional Coupler	Krytar	1850	58	-	O/P Mon
Directional Coupler	Narda	3020A	419	-	O/P Mon
Filter (Hi Pass)	Mini-Circuits	NHP-600	2834	-	O/P Mon
Thermocouple Thermometer	Fluke	51	3174	12	07-Feb-2020
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	17-Oct-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	22-Oct-2019
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	04-Oct-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	04-Oct-2019

Table 10

O/P Mon – Output Monitored using calibrated equipment



2.5 Frequency Stability

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

MP30, S/N: 010 300 - Modification State 0

2.5.3 Date of Test

24-September-2019 to 25-September-2019

2.5.4 Test Method

This test was performed in accordance with FCC 47 CFR Part 2, Clause 2.1055.

The temperature was varied from -30 °C to +50 °C in 10° steps at nominal voltage. Frequency measurements were performed at +20 °C for minimum and maximum voltages.

The peak value was determined using the marker peak function and the frequency of the points -20 dBc relative to the peak were recorded as f1 and f2. To find out the frequency error, the following formula was used. $f_c = (f1 + f2) / 2$. The frequency error is the difference between the declared transmitted frequency and calculated carrier frequency declared frequency.

2.5.5 Environmental Conditions

Ambient Temperature 22.4 °C
Relative Humidity 64.9 %

2.5.6 Test Results

Battery Powered - 8PSK UHF

Voltage	Frequency Error (ppm)		
	406.1125 MHz	450.0125 MHz	469.9875 MHz
3.4 V DC	0.677	0.667	0.798
3.8 V DC	0.862	0.778	0.745

Table 11 - Frequency Stability Under Voltage Variations



Temperature	Frequency Error (ppm)		
	406.1125 MHz	450.0125 MHz	469.9875 MHz
+50.0 °C	0.616	0.556	0.532
+40.0 °C	0.616	0.556	1.064
+30.0 °C	0.616	0.556	0.532
+20.0 °C	0.677	0.500	0.479
+10.0 °C	0.246	0.667	0.532
0.0 °C	0.923	0.500	0.585
-10.0 °C	0.616	-0.556	0.532
-20.0 °C	0.246	0.778	0.213
-30.0 °C	0.616	1.111	0.532

Table 12 - Frequency Stability Under Voltage Variations

FCC 47 CFR Part 90, Limit Clause 90.213

5 ppm

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
Combiner	Anzac	T-1000	418	-	TU
Directional Coupler	Narda	3020A	419	-	O/P Mon
Attenuator (10 dB)	Weinschel	47-10-34	481	12	18-Jul-2019
Thermometer	Digitron	T208	2340	12	22-Nov-2019
Climatic Chamber	TAS	Micro 225	2892	-	O/P Mon
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	25-Jun-2020
Attenuator (20dB, 250W)	Weinschel	45-20-43	4321	12	17-Jul-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	15-Oct-2019
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	06-Feb-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	04-Oct-2019
Cable (18 GHz)	Rosenberger	LU7-071-2000	5108	12	05-Oct-2019
Attenuator 10 dB 2 W	Telegartner	J01156A0031	N/S	-	O/P Mon

Table 13

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment



2.6 Adjacent Channel Power

2.6.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.221

2.6.2 Equipment Under Test and Modification State

MP30, S/N: 010 300 - Modification State 0

2.6.3 Date of Test

20-November-2019

2.6.4 Test Method

The antenna port of the EUT was connected to a spectrum analyser via an attenuator and bi-directional coupler. The incident port of the coupler was connected to the BST 50 Base Station which was configured to the same channel as the EUT.

The spectrum analyser adjacent channel power measurement function was configured to measure over and 18 kHz bandwidth at 25 kHz, 50 kHz and 75 kHz offsets. The gated trigger of the spectrum analyser was used as the duty cycle of the EUT was less than 98%

The results have been recorded below in dBm as it is not necessary to for the ACP to be below -36 dBm which is less stringent than the -70 dBc requirement.

2.6.5 Environmental Conditions

Ambient Temperature 23.3 °C
Relative Humidity 24.6 %

2.6.6 Test Results

Battery Powered - 8PSK UHF

Offset (kHz)	Adjacent Channel Power		
	406.1125 MHz	450.0125 MHz	469.9875 MHz
-25	-61.10 dBc	-59.95 dBc	-62.03 dBm
+25	-59.18 dBc	-59.17 dBc	-61.16 dBm
-50	-37.51 dBm	-36.37 dBm	-37.50 dBm
+50	-36.98 dBm	-36.22 dBm	-37.24 dBm
-75	-39.23 dBm	-39.07 dBm	-38.74 dBm
+75	-39.26 dBm	-39.16 dBm	-38.52 dBm

Table 14 - Adjacent Channel Power



FCC Part 90, Limit Clause 90.221(b)

Frequency Offset	Maximum ACP (dBc) for devices $\leq 1W$	Maximum ACP (dBc) for devices $> 1W$
25 kHz	-55	-60
50 kHz	-70	-70
75 kHz	-70	-70

Table 15 - Adjacent Channel Power Limits

NOTE: In any case, no requirement in excess of -36 dBm shall apply.

Industry Canada RSS-119, Limit Clause 5.8.9.1

The ACP of transmitters operating in the bands 768-776 MHz and 798-806 MHz shall comply with the requirements for various transmitter channel sizes provided in tables 13 to 16 of the specification.

2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 3.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
50ohm Load (50W)	Weinschel	M1426	361	12	15-Nov-2020
Directional Coupler	Narda	3020A	419	-	O/P Mon
Hygrometer	Rotronic	I-1000	2891	12	02-Oct-2020
Attenuator (30dB, 150W)	Narda	769-30	3369	12	17-Jul-2020
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	18-Mar-2020
True RMS Multimeter	Fluke	179	4007	12	31-Oct-2020
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4517	12	12-Nov-2020
2 metre SMA Cable	Florida Labs	SMS-235SP-78.8-SMS	4518	12	12-Nov-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4519	12	12-Nov-2020
4 Channel PSU	Rohde & Schwarz	HMP4040	4736	-	O/P Mon

Table 16

O/P Mon – Output Monitored using calibrated equipment

2.7 Transient Frequency Behaviour

2.7.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.214

2.7.2 Equipment Under Test and Modification State

MP30, S/N: 010 300 - Modification State 0

2.7.3 Date of Test

29-May-2019 to 30-May-2019

2.7.4 Test Method

The test was performed in accordance with FCC 47 CFR Part 90, Clause 90.214. The FM demod mode of a signal analyser was used to measure the frequency displacement over time.

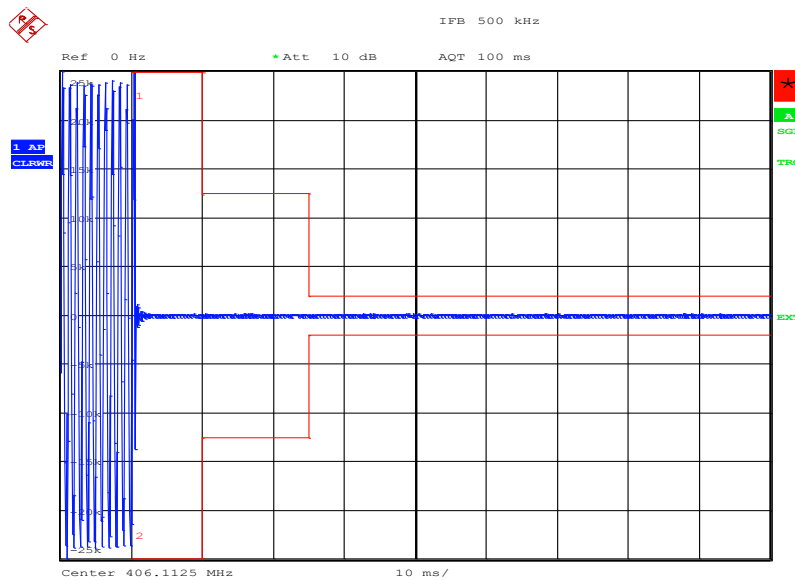
2.7.5 Environmental Conditions

Ambient Temperature 24.1 °C

Relative Humidity 50.4 %

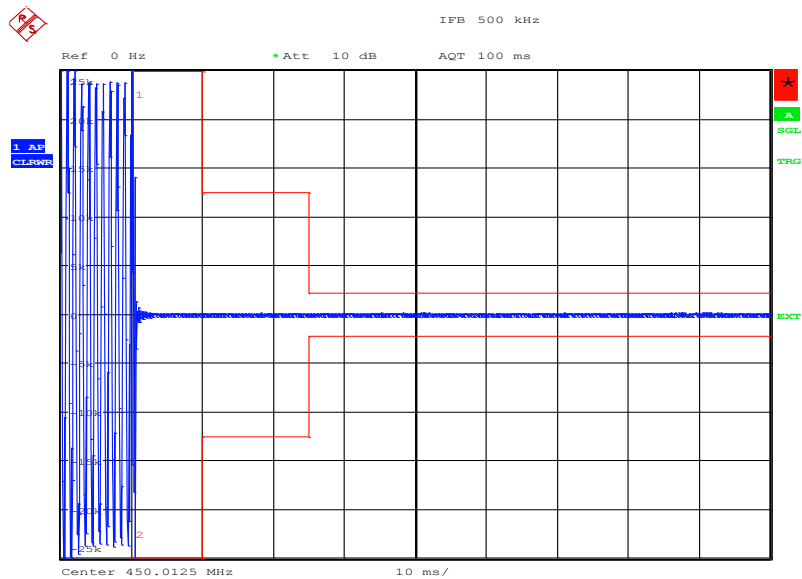
2.7.6 Test Results

Battery Powered - 8PSK UHF



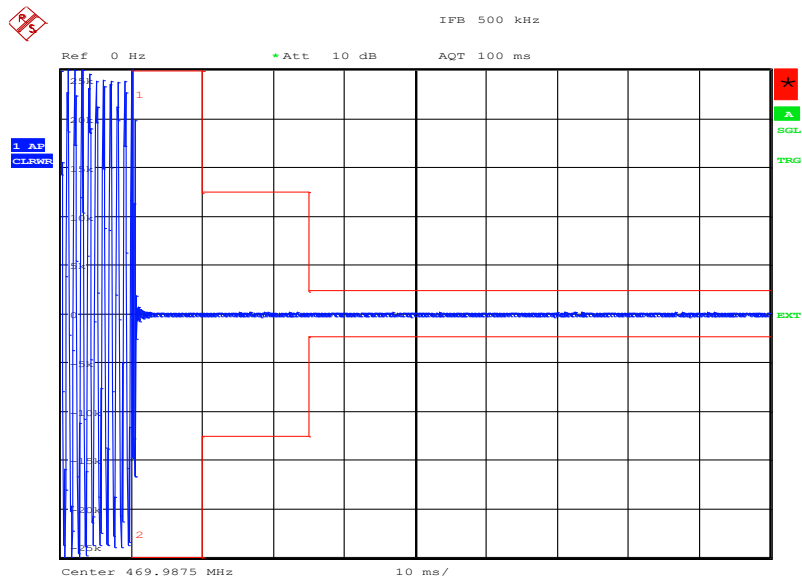
Date: 30.MAY.2019 12:41:07

Figure 21 - 406.1125 MHz, Switch On



Date: 30.MAY.2019 12:49:12

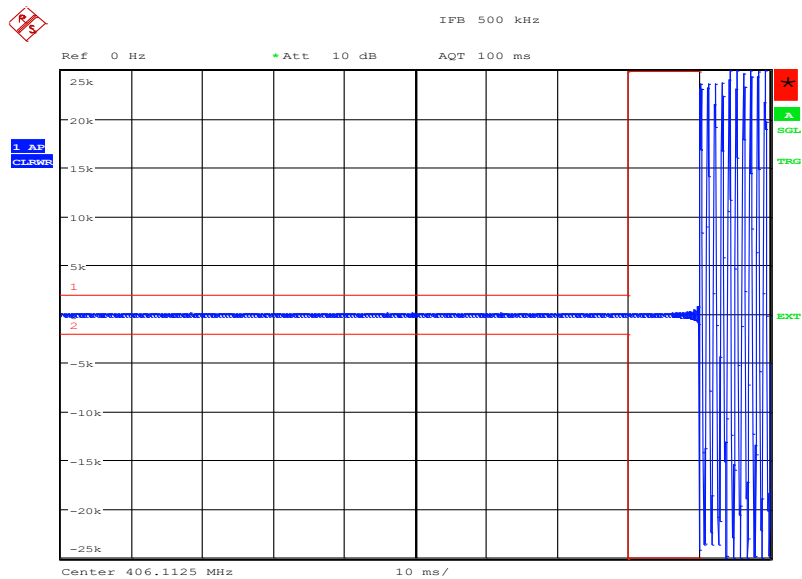
Figure 22 - 450.0125 MHz, Switch On



Date: 30.MAY.2019 12:58:12

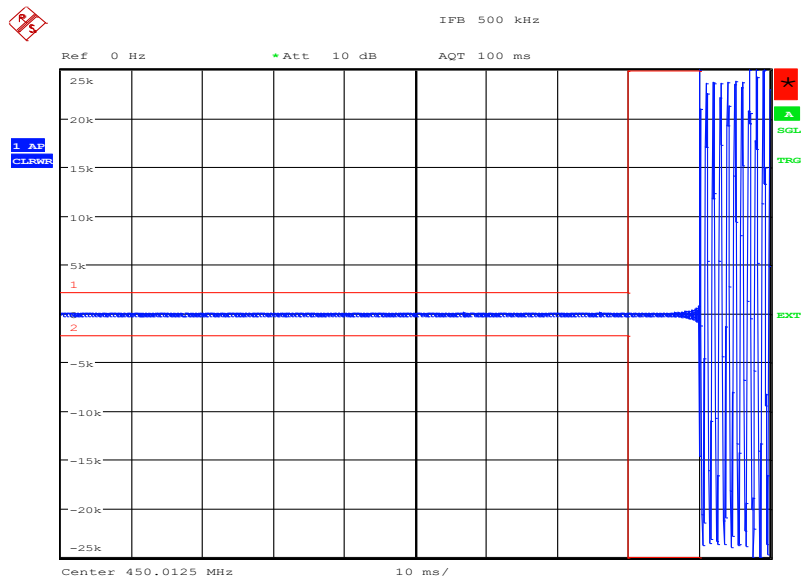
Figure 23 - 469.9875 MHz, Switch On

Note: It was noted T2 on the above limit lines should start at the period immediately after T1 and the limit shall be ± 12.5 kHz for the next 25ms. It can be determined from the data on the above plots that the EUT is compliant.



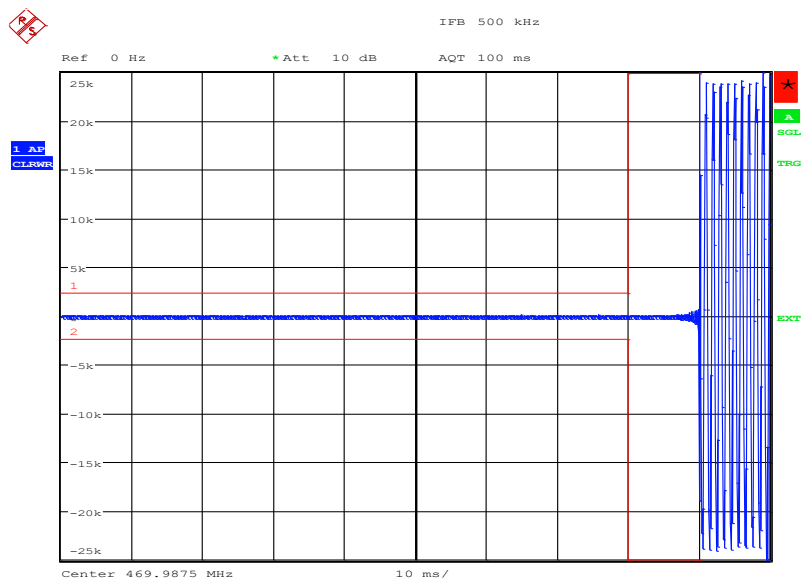
Date: 30.MAY.2019 12:29:43

Figure 24 - 406.1125 MHz, Switch On



Date: 30.MAY.2019 12:53:22

Figure 25 - 450.0125 MHz, Switch On



Date: 30.MAY.2019 13:06:17

Figure 26 - 469.9875 MHz, Switch On

FCC 47 CFR Part 90, Limit Clause 90.214

Time Interval	Maximum Frequency Difference	150 to 174 MHz	421 to 512 MHz
Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels			
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
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels			
T ₁	± 12.5 kHz	5.0 ms	10.0 ms
T ₂	± 6.25 kHz	20.0 ms	25.0 ms
T ₃	± 12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behaviour for Equipment Designed to Operate on 6.25 kHz Channels			
T ₁	± 6.25 kHz	5.0 ms	10.0 ms
T ₂	± 3.125 kHz	20.0 ms	25.0 ms
T ₃	± 6.25 kHz	5.0 ms	10.0 ms

Table 17 - Limits for Transient Frequency Behaviour



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 (Software Driver)	Hewlett Packard	11713A	116	-	TU
Directional Coupler	Narda	3020A	419	-	O/P Mon
Attenuator (Step, 11dB, 1W)	Hewlett Packard	8494H	425	-	O/P Mon
Power Divider	Weinschel	1506A	603	12	23-Apr-2020
Attenuator (Step, 12=10dB, 1W)	Hewlett Packard	8496H	2786	-	O/P Mon
Thermocouple Thermometer	Fluke	51	3174	12	07-Feb-2020
Hygrometer	Rotronic	I-1000	3220	12	13-Sep-2019
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	17-Oct-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	22-Oct-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	15-Oct-2019
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5098	12	04-Oct-2019
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	04-Oct-2019

Table 18

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated equipment



2.8 Radiated Spurious Emissions

2.8.1 Specification Reference

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

2.8.2 Equipment Under Test and Modification State

MP30, S/N: 010 300 - Modification State 0

2.8.3 Date of Test

17-July-2019

2.8.4 Test Method

Testing was performed in accordance with ANSI C63.26, Clause 5.5.

The regulatory EIRP limit of -13dBm has been converted to a Field Strength using equation c) in clause 5.2.7 of ANSI C63.26.

$$E \text{ (dBuV/m)} = \text{EIRP (dBm)} - 20 \log(D) + 104.8.$$

At a measurement distance of 3 meters:

$$E \text{ (dBuV/m)} = -13 - 20\log(3) + 104.8.$$

$$E = 82.26 \text{ dBuV/m}$$

2.8.5 Environmental Conditions

Ambient Temperature 17.0 °C
Relative Humidity 60.8 %

2.8.6 Test Results

Battery Powered - 16QAM

Frequency (MHz)	Level (dBm)
*	

Table 19 - 406.1125 MHz - Emissions Results

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

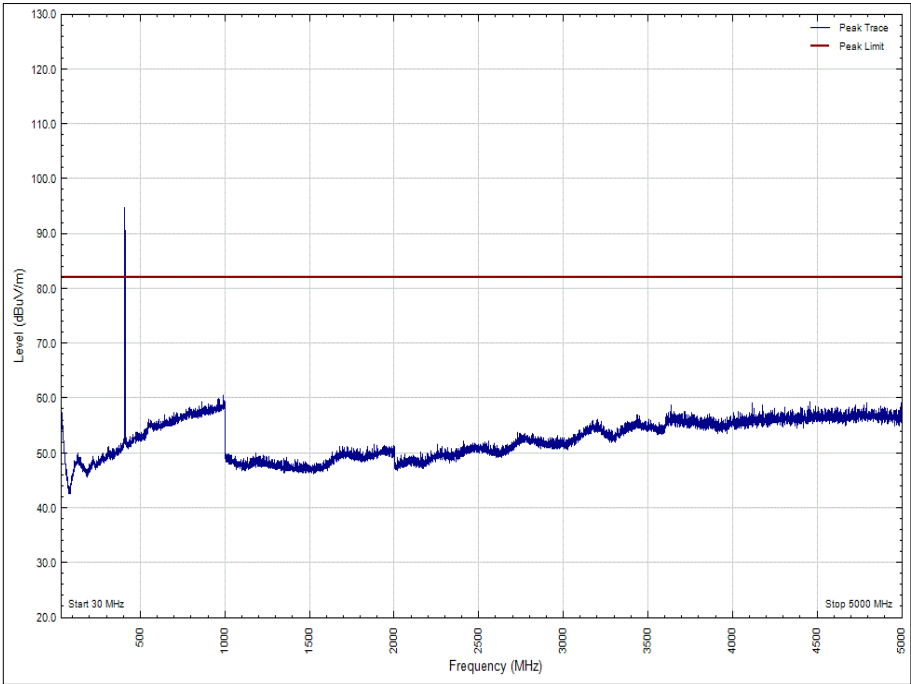


Figure 27 - 406.1125 MHz - 30 MHz to 5 GHz - X Orientation Vertical

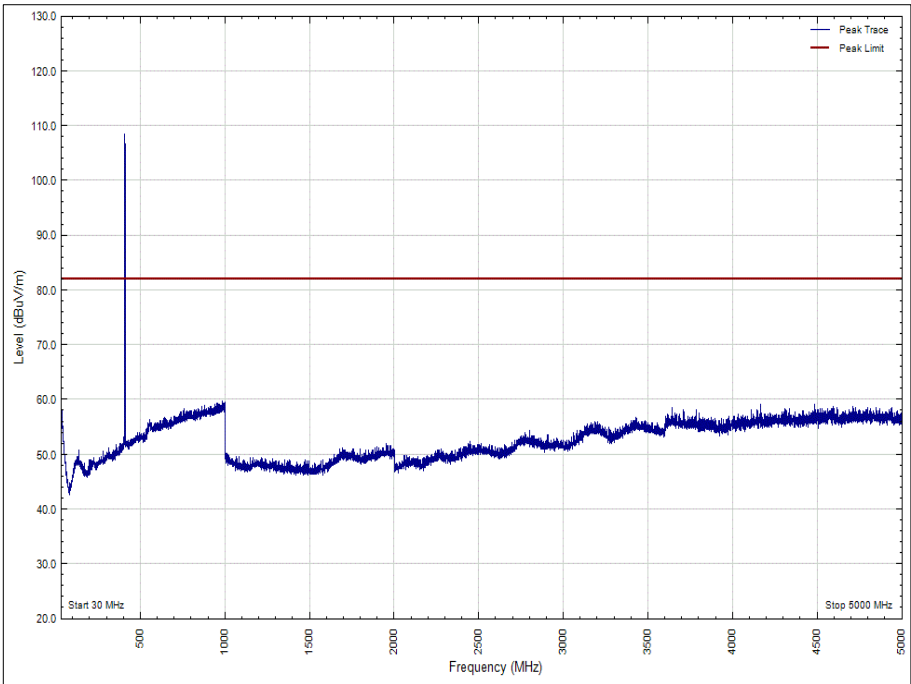


Figure 28 - 406.1125 MHz - 30 MHz to 5 GHz - X Orientation Horizontal

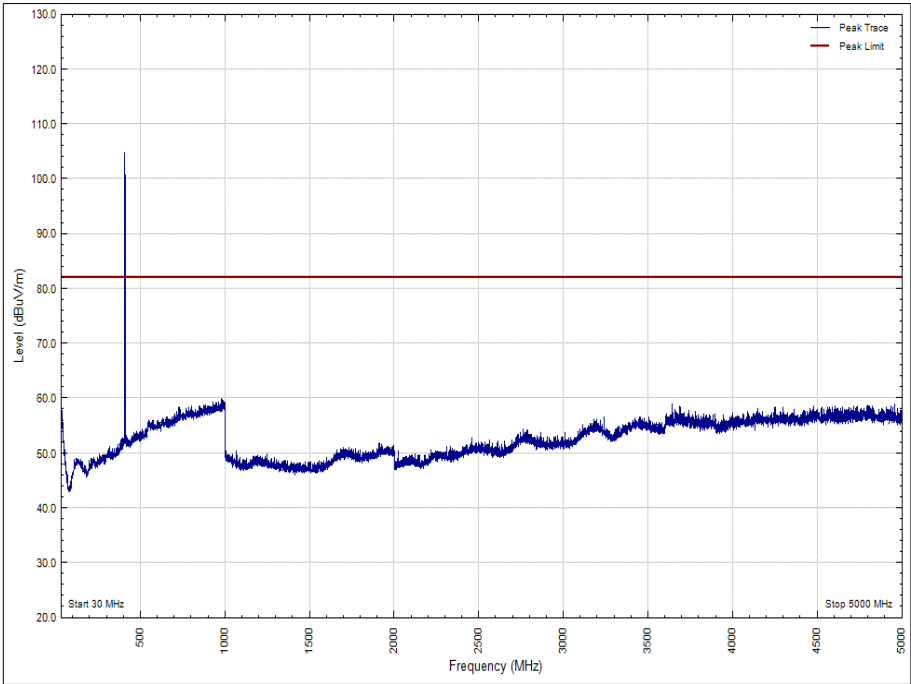


Figure 29 - 406.1125 MHz - 30 MHz to 5 GHz - Y Orientation Vertical

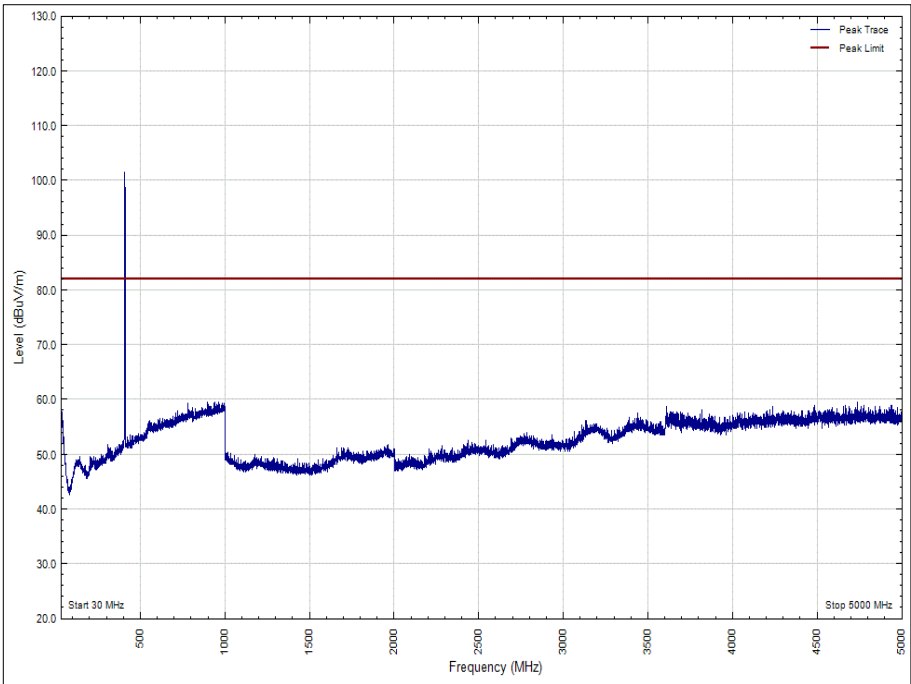


Figure 30 - 406.1125 MHz - 30 MHz to 5 GHz - Y Orientation Horizontal

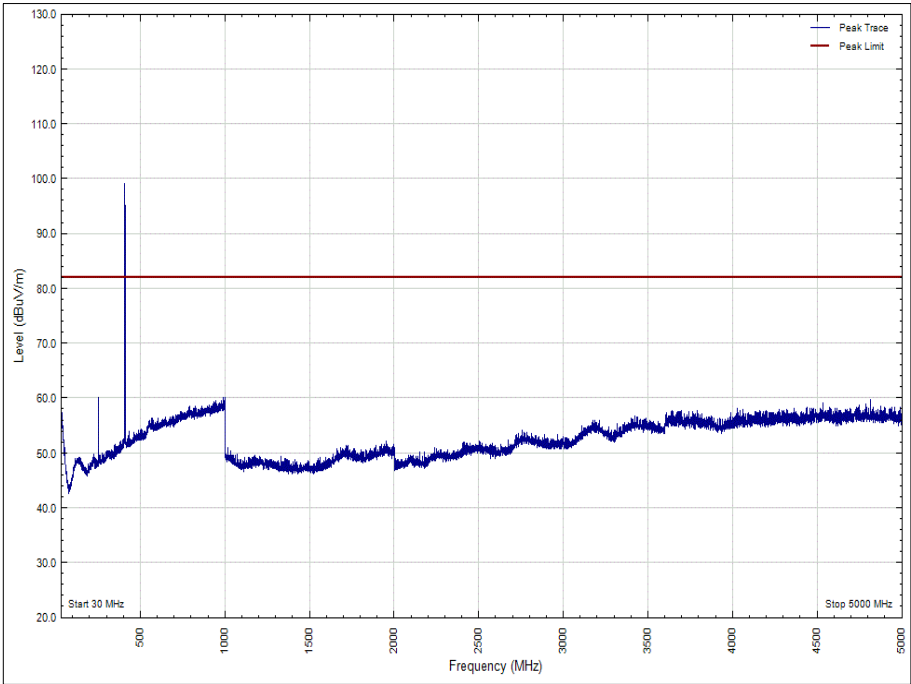


Figure 31 - 406.1125 MHz - 30 MHz to 5 GHz - Z Orientation Vertical

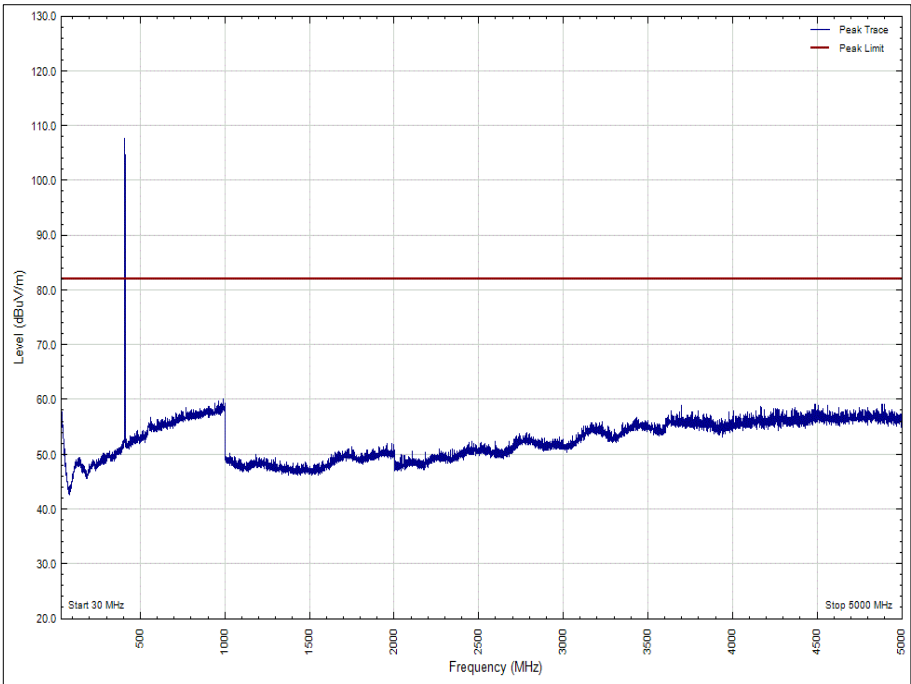


Figure 32 - 406.1125 MHz - 30 MHz to 5 GHz - Z Orientation Horizontal



Frequency (MHz)	Level (dBm)
*	

Table 20 - 450.0125 MHz - Emissions Results

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

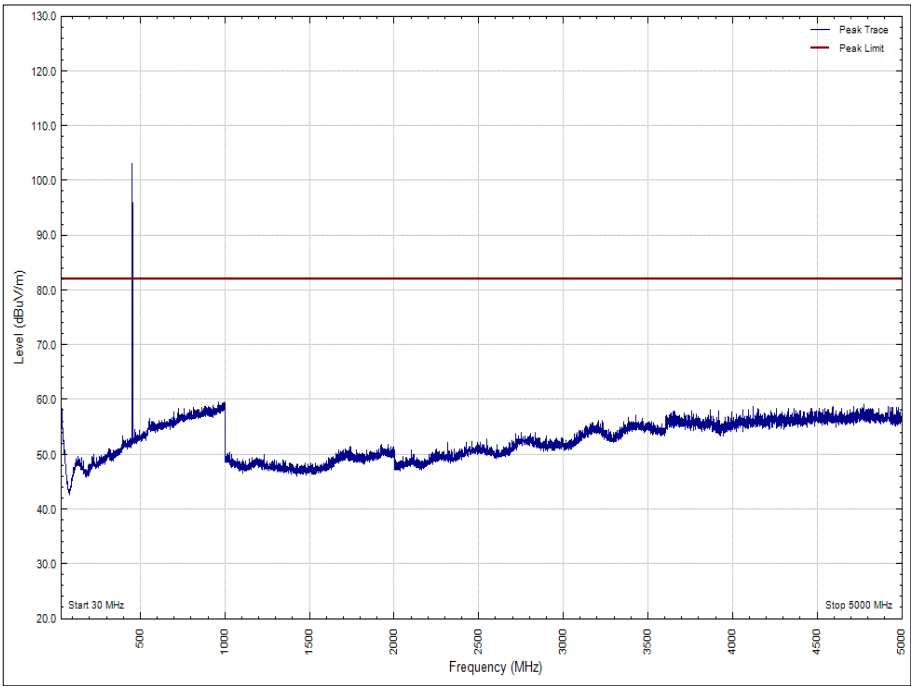


Figure 33 - 450.0125 MHz - 30 MHz to 5 GHz - X Orientation Vertical

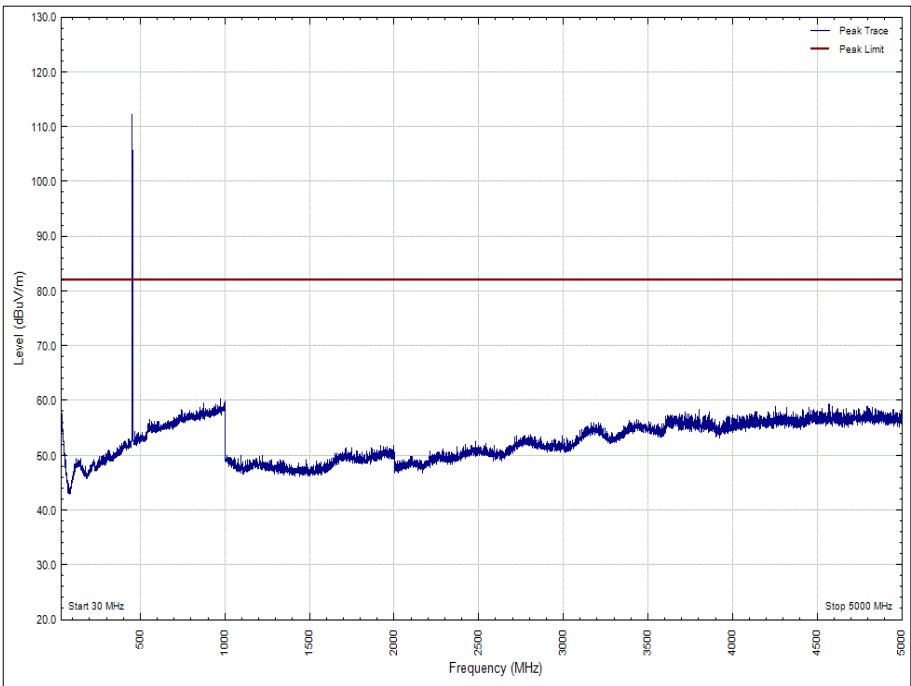


Figure 34 - 450.0125 MHz - 30 MHz to 5 GHz - X Orientation Horizontal

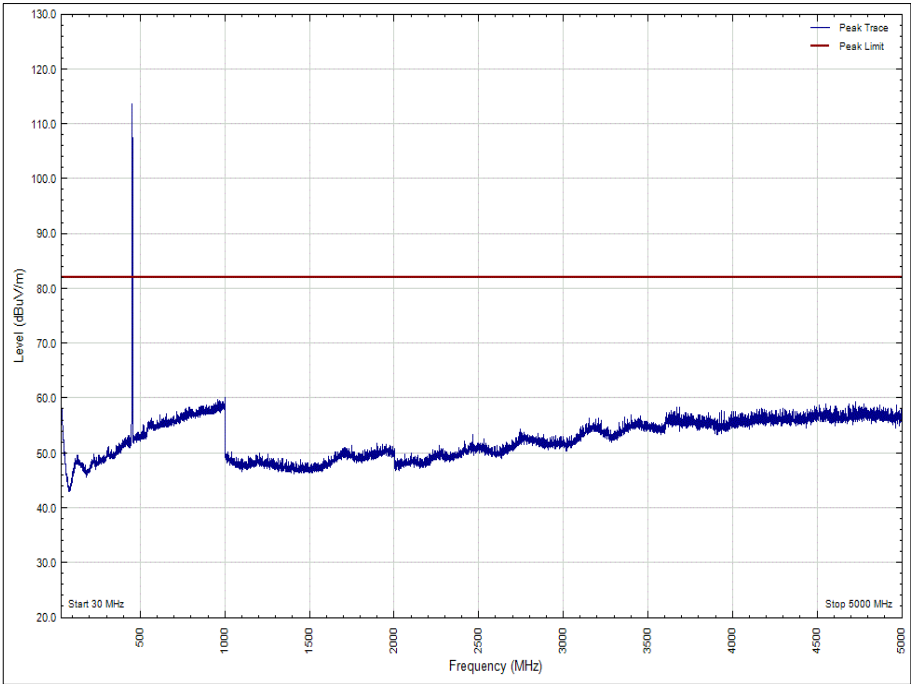


Figure 35 - 450.0125 MHz - 30 MHz to 5 GHz - Y Orientation Vertical

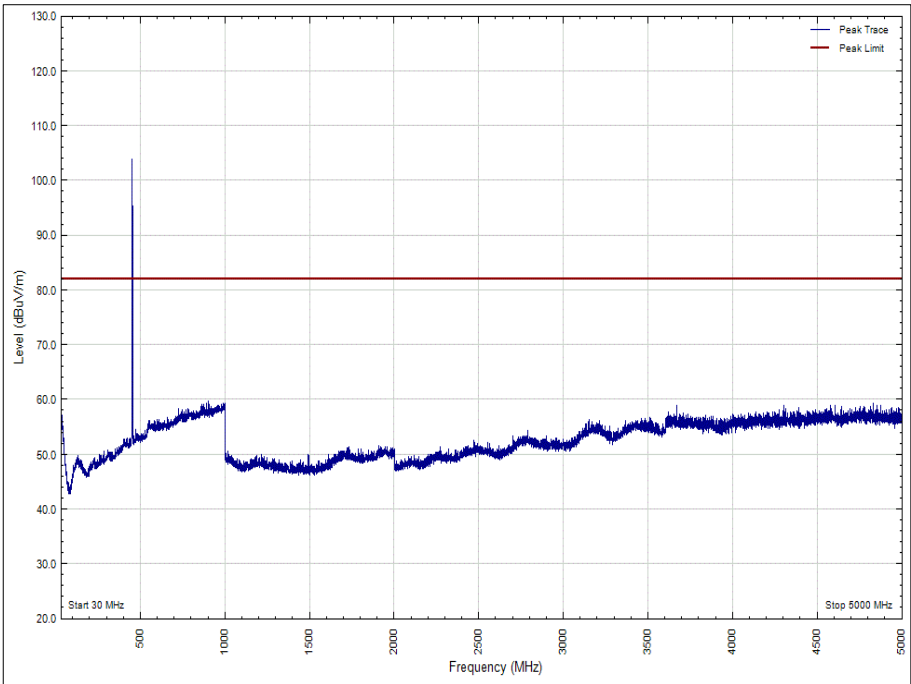


Figure 36 - 450.0125 MHz - 30 MHz to 5 GHz - Y Orientation Horizontal

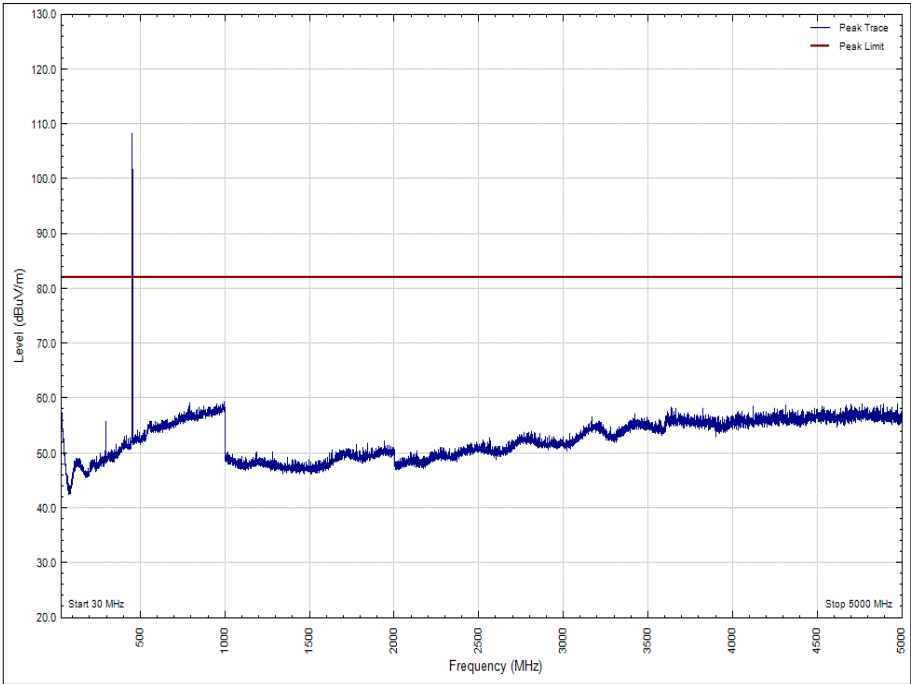


Figure 37 - 450.0125 MHz - 30 MHz to 5 GHz - Z Orientation Vertical

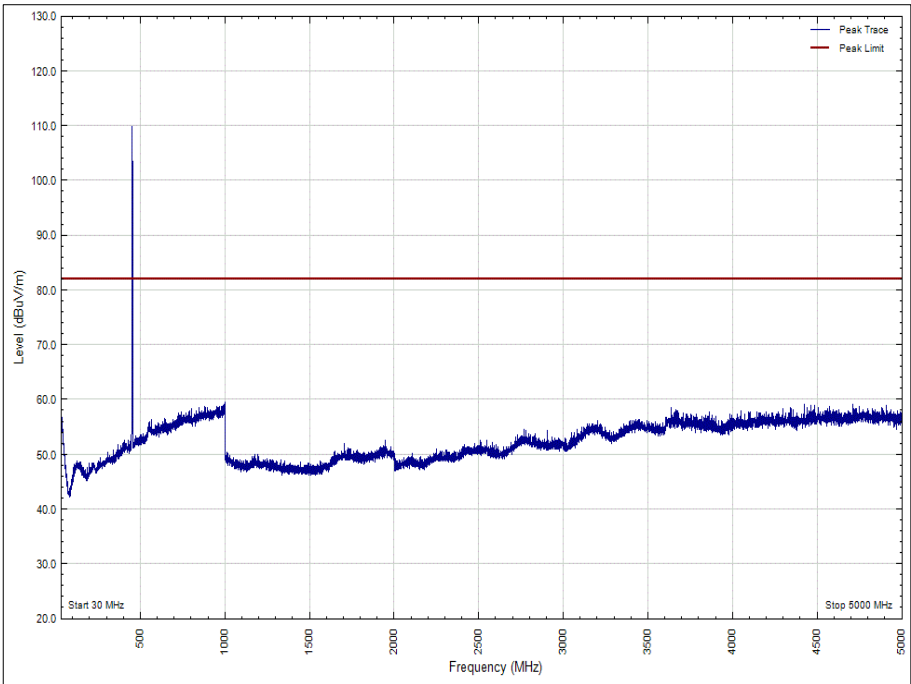


Figure 38 - 450.0125 MHz - 30 MHz to 5 GHz - Z Orientation Horizontal



Frequency (MHz)	Level (dBm)
*	

Table 21 - 450.0125 MHz - Emissions Results

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

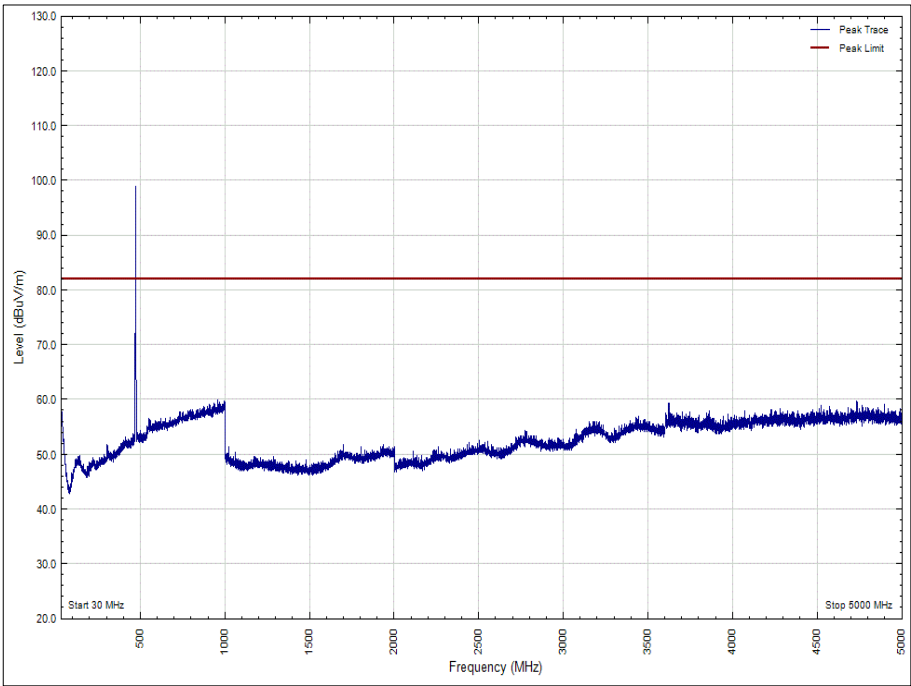


Figure 39 - 469.9875 MHz - 30 MHz to 5 GHz - X Orientation Vertical

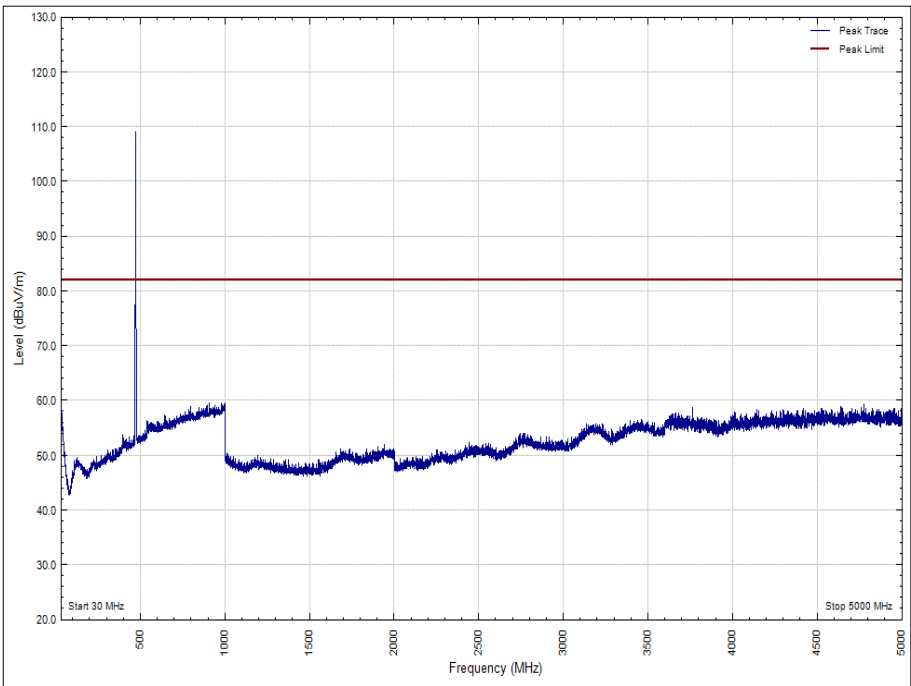


Figure 40 - 469.9875 MHz - 30 MHz to 5 GHz - X Orientation Horizontal

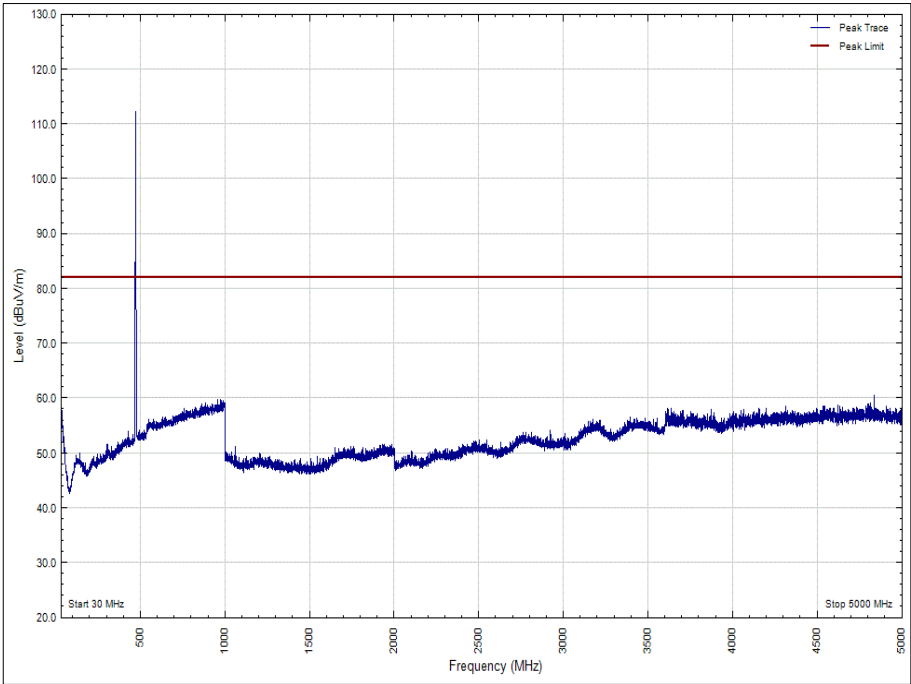


Figure 41 - 469.9875 MHz - 30 MHz to 5 GHz - Y Orientation Vertical

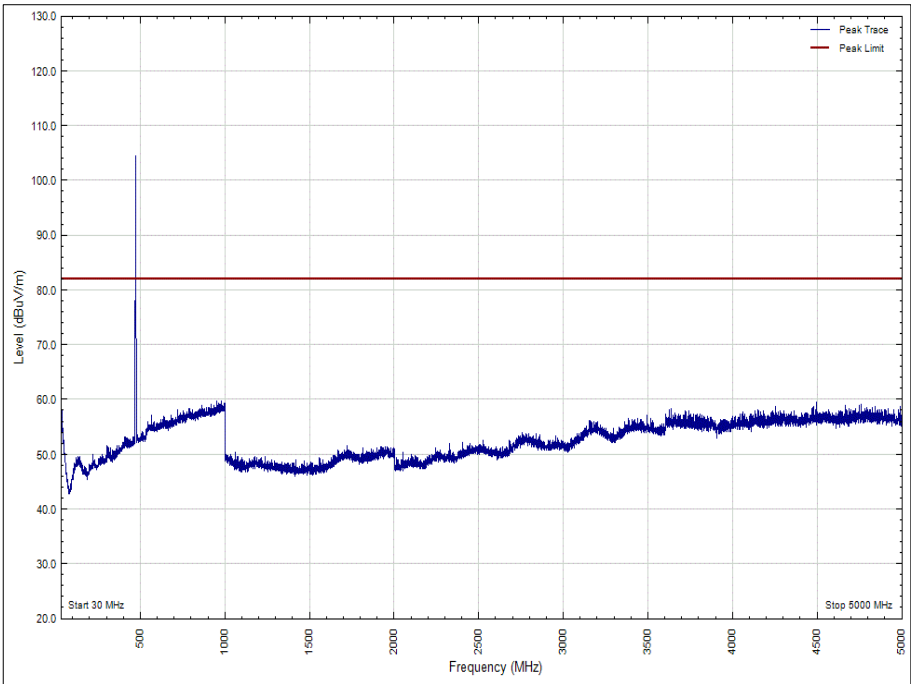


Figure 42 - 469.9875 MHz - 30 MHz to 5 GHz - Y Orientation Horizontal

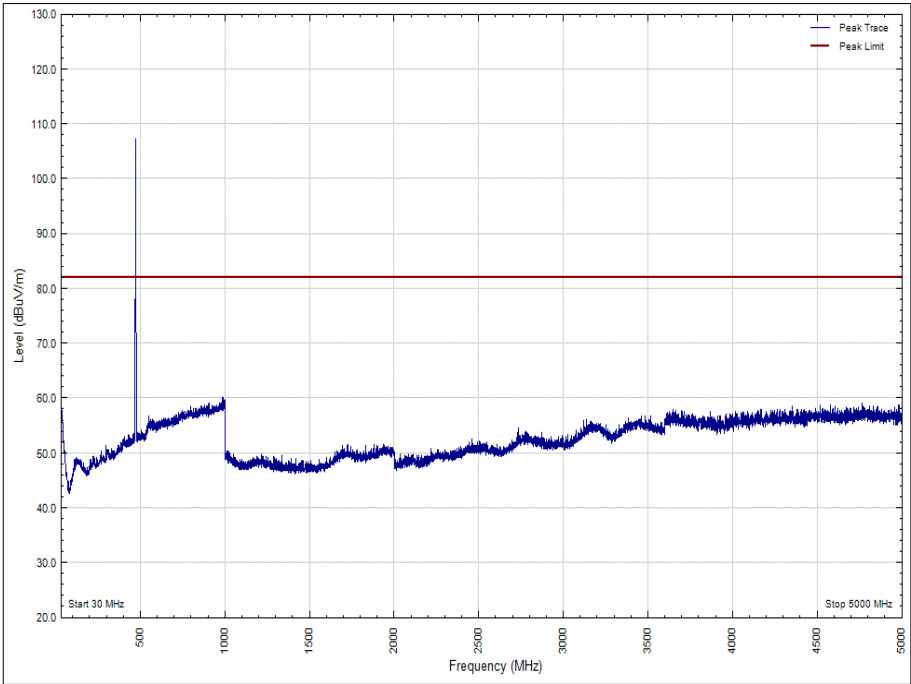


Figure 43 - 469.9875 MHz - 30 MHz to 5 GHz - Z Orientation Vertical

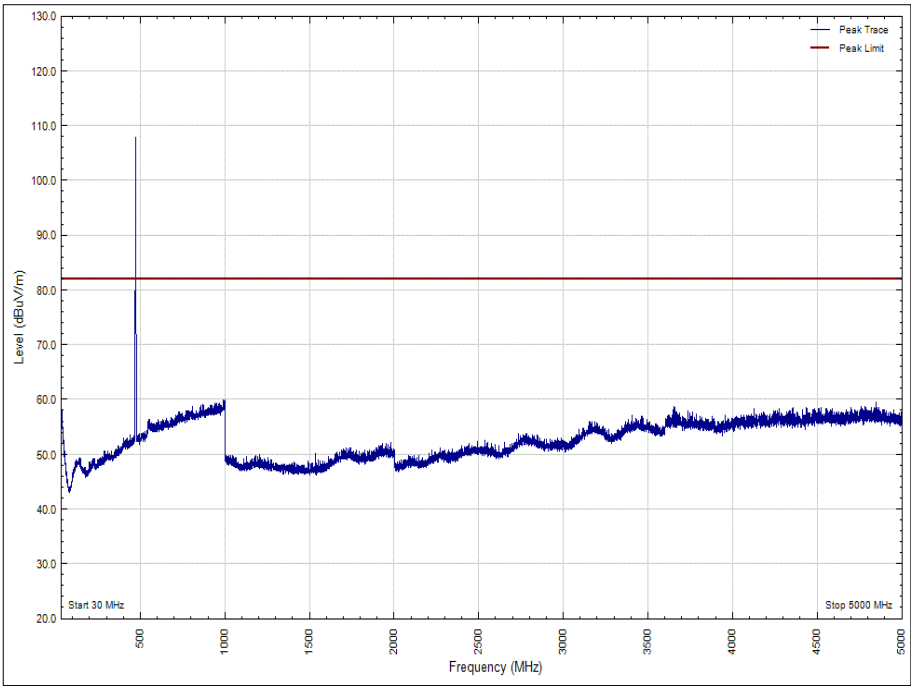


Figure 44 - 469.9875 MHz - 30 MHz to 5 GHz - Z Orientation Horizontal

FCC 47 CFR Part 90, Limit Clause 90.210

The EUT shall comply with emission mask B as per FCC 47 CFR Part 90.210.



2.8.7 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
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	A1	2677	12	20-Feb-2020
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	08-Aug-2019
Comb Generator	Schaffner	RSG1000	3034	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	17-Dec-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	11-Dec-2019
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
4dB Attenuator	Pasternack	PE7047-4	4935	24	28-Nov-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5093	12	04-Oct-2019
EmX Emissions Software	TUV SUD	EmX V.V1.4.8.3	5125	-	Software

Table 22

TU – Traceability Unscheduled.

3 Photographs

3.1 Test Setup Photographs

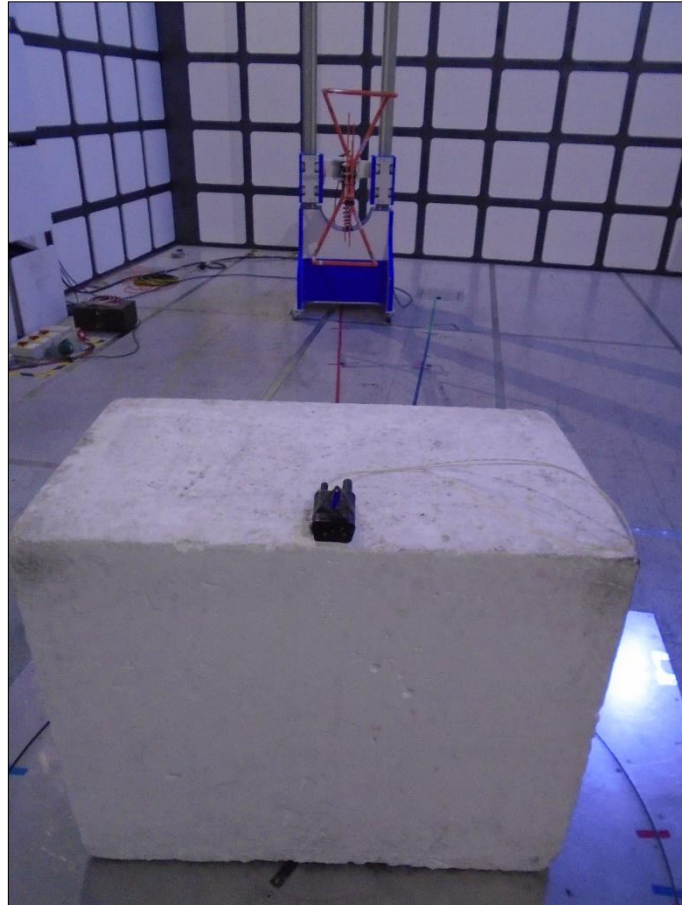


Figure 45 - 30 MHz to 1 GHz - X Orientation

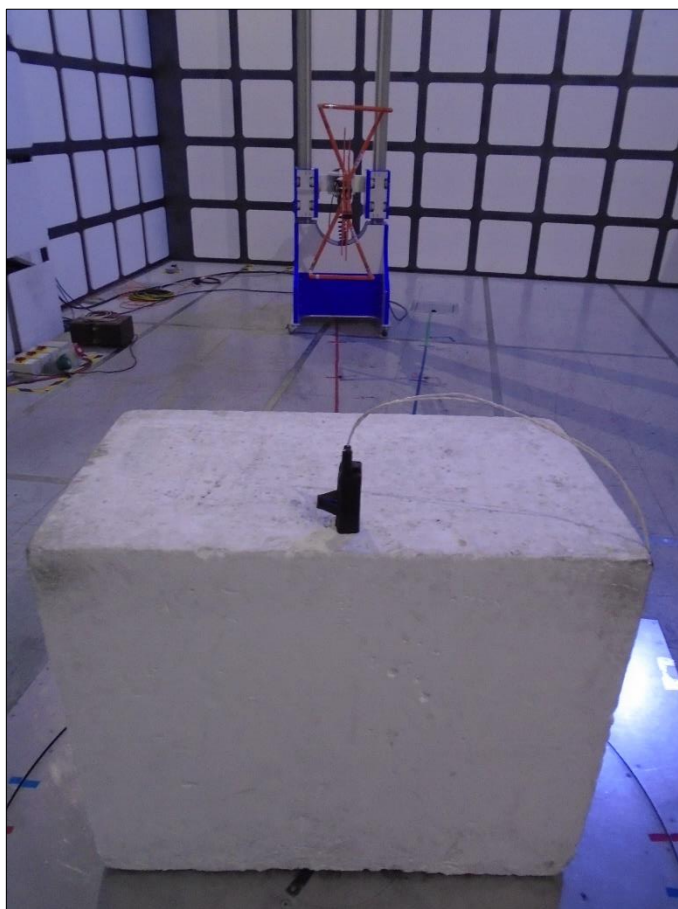


Figure 46 - 30 MHz to 1 GHz - Y Orientation

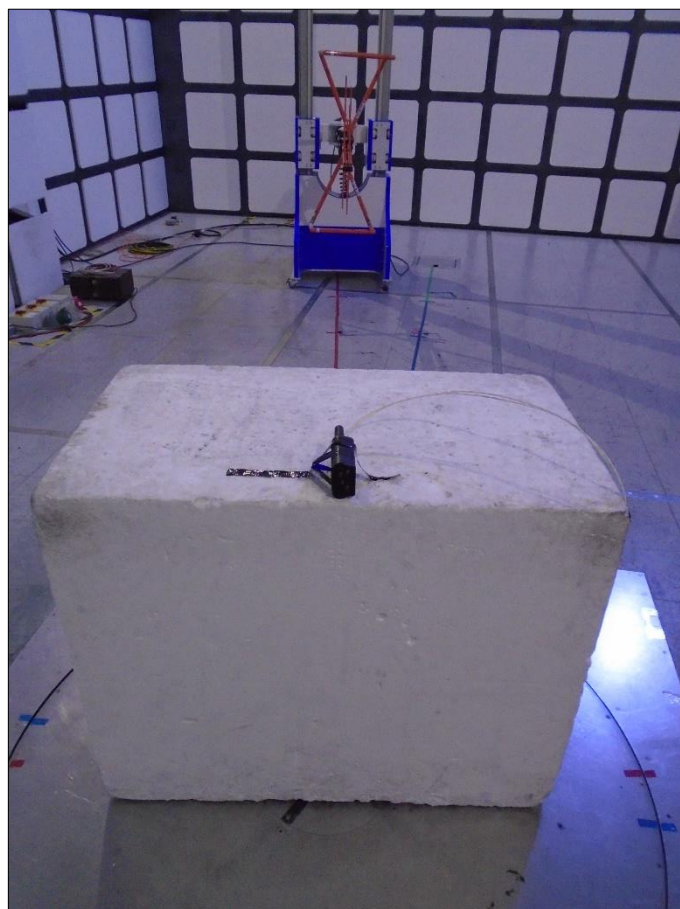


Figure 47 - 30 MHz to 1 GHz - Z Orientation



Figure 48 - 1 GHz to 5 GHz - X Orientation



Figure 49 - 1 GHz to 5 GHz - Y Orientation



Figure 50 - 1 GHz to 5 GHz - Z Orientation



4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 18 GHz: ± 6.3 dB
Transient Frequency Behaviour	± 0.2 Hz
Adjacent Channel Power	± 3.0 dB
Frequency Stability	± 463.022 Hz
Spurious Emissions at Antenna Terminals	± 3.45 dB
Bandwidth Limitations	± 58.05 Hz
Types of Emissions	-
Maximum Conducted Output Power	± 3.2 dB

Table 23

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2007, clause 4.4.3 and 4.5.1.