

# 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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Grimstad  
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NORWAY



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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Contents

**1      Report Summary .....2**

1.1    Report Modification Record.....2

1.2    Introduction.....2

1.3    Brief Summary of Results .....3

1.4    Application Form .....4

1.5    Product Information .....6

1.6    Deviations from the Standard.....7

1.7    EUT Modification Record .....7

1.8    Test Location .....8

**2      Test Details .....9**

2.1    Maximum Conducted Output Power .....9

2.2    Types of Emissions .....12

2.3    Bandwidth Limitations .....13

2.4    Spurious Emissions at Antenna Terminals .....16

2.5    Frequency Stability.....26

2.6    Adjacent Channel Power.....28

2.7    Transient Frequency Behaviour .....30

2.8    Radiated Spurious Emissions .....35

**3      Photographs .....46**

3.1    Test Setup Photographs .....46

**4      Measurement Uncertainty .....52**



## 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<br>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:<br>(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) <input checked="" type="checkbox"/> |          |
| Class B Digital Device (Use in residential environment only) <input type="checkbox"/>                              |          |

### AC Power Source

|                                                                            |                              |
|----------------------------------------------------------------------------|------------------------------|
| AC supply frequency: Click to edit (Hz)                                    |                              |
| Click to edit V                                                            | Max current: Click to edit A |
| Single Phase <input type="checkbox"/> Three Phase <input type="checkbox"/> |                              |



#### 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 <input type="checkbox"/> Leclanche <input checked="" type="checkbox"/> Lithium <input type="checkbox"/> Nickel Cadmium <input type="checkbox"/> Lead Acid* <input type="checkbox"/> *(Vehicle regulated) |
| Other <input type="checkbox"/> Please detail: Click to edit                                                                                                                                                       |

#### Charging

|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| Can the EUT transmit whilst being charged | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |
|-------------------------------------------|---------------------------------------------------------------------|

#### Temperature

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

#### Antenna Characteristics

|                                                                                                |
|------------------------------------------------------------------------------------------------|
| Antenna connector <input type="checkbox"/> State impedance Click to edit Ohm                   |
| Temporary antenna connector <input type="checkbox"/> State impedance Click to edit Ohm         |
| Integral antenna <input checked="" type="checkbox"/> Type monopole State impedance 5.1 dBi     |
| External antenna <input type="checkbox"/> 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**

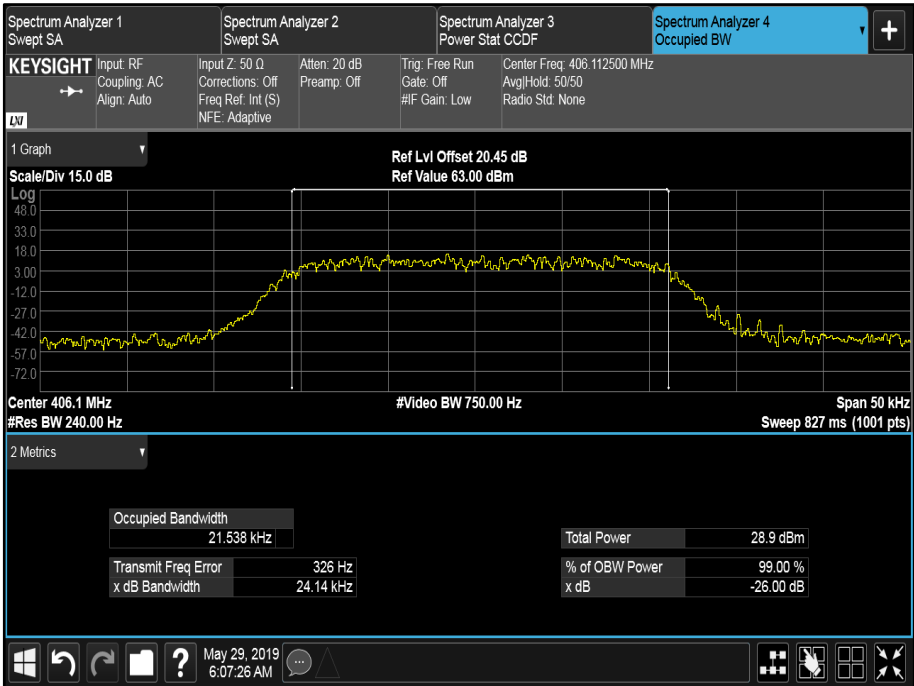


Figure 3 - 406.1125 MHz Occupied Bandwidth

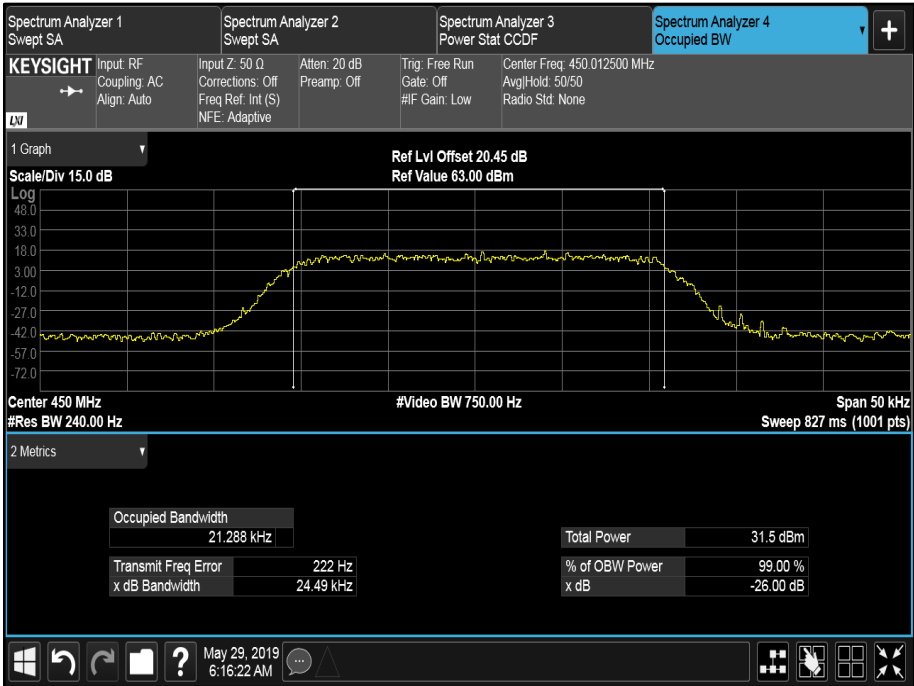
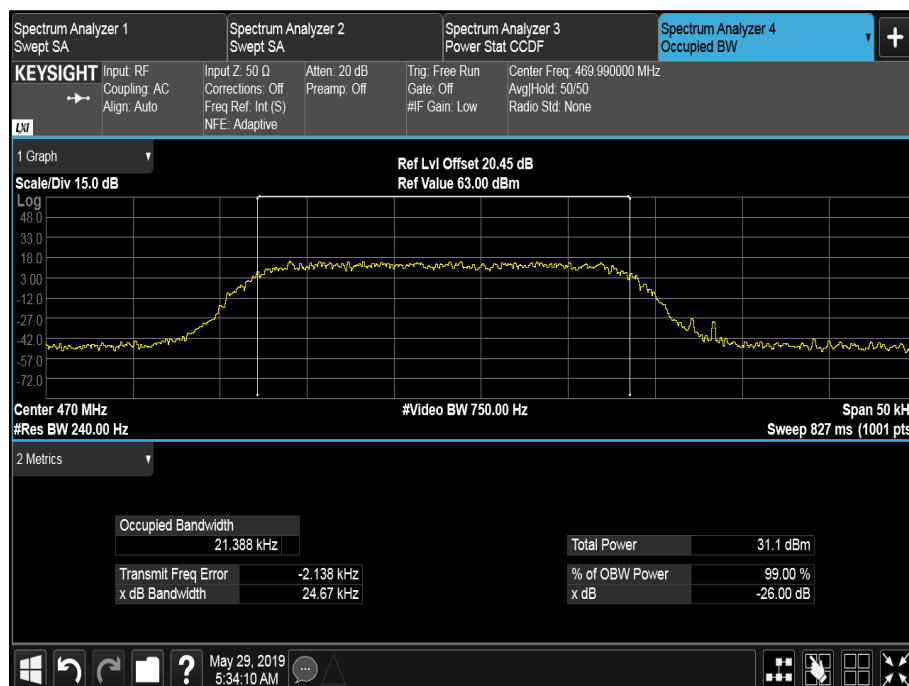


Figure 4 - 450.0125 MHz Occupied Bandwidth



**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

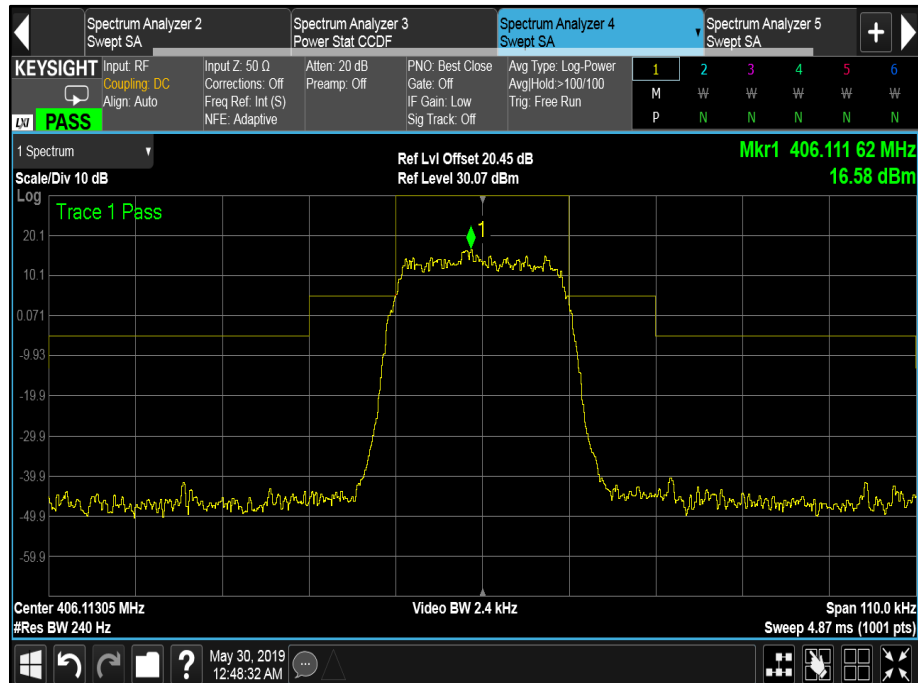


Figure 6 - 406.1125 MHz - Transmitter Spectrum Mask

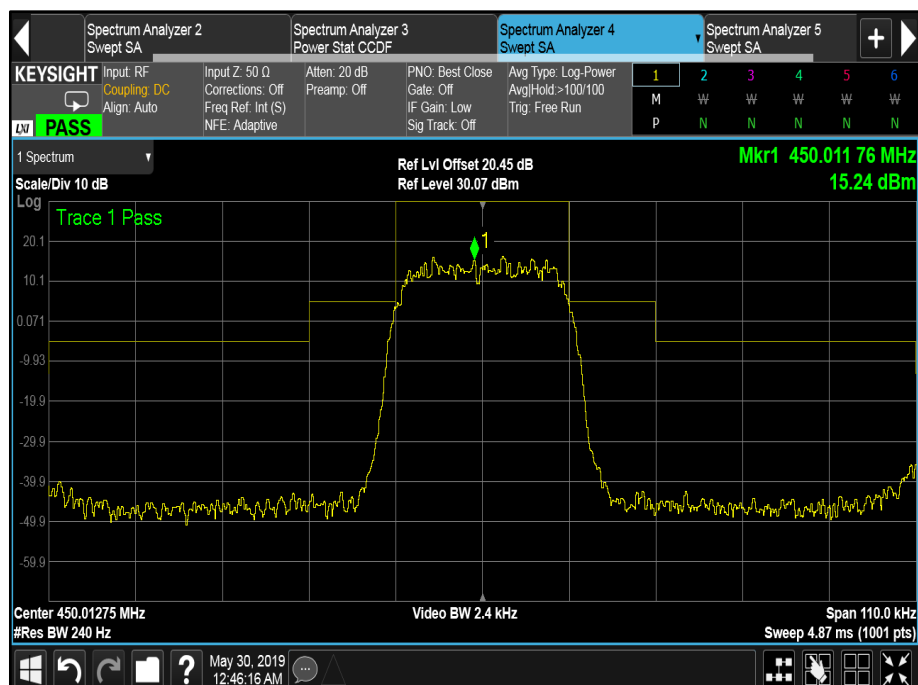


Figure 7 - 450.0125 MHz - Transmitter Spectrum Mask

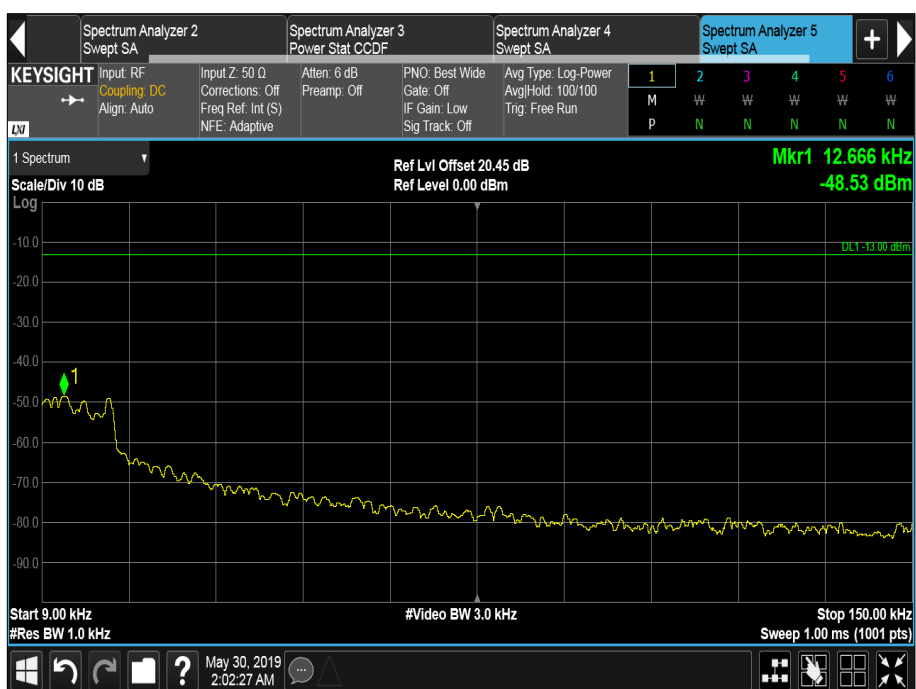
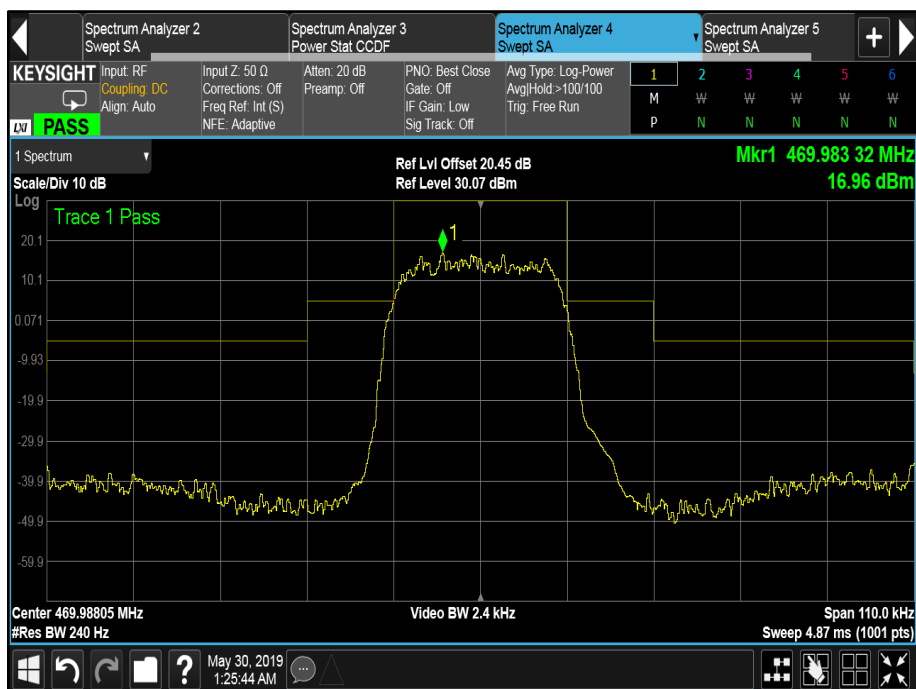




Figure 10 - 450.0125 MHz - 9 kHz to 150 kHz

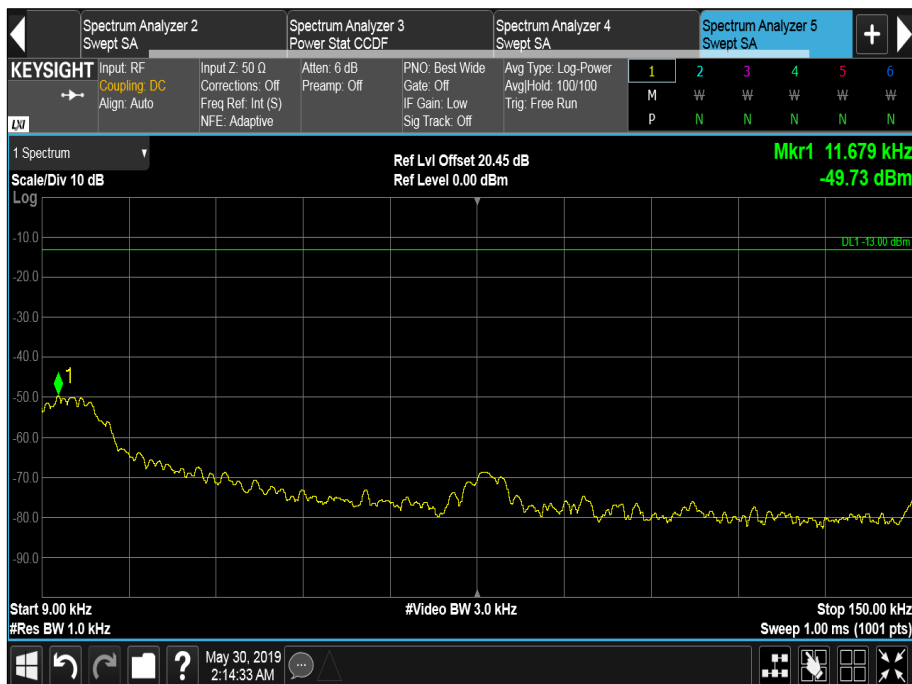


Figure 11 - 469.9875 MHz - 9 kHz to 150 kHz



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

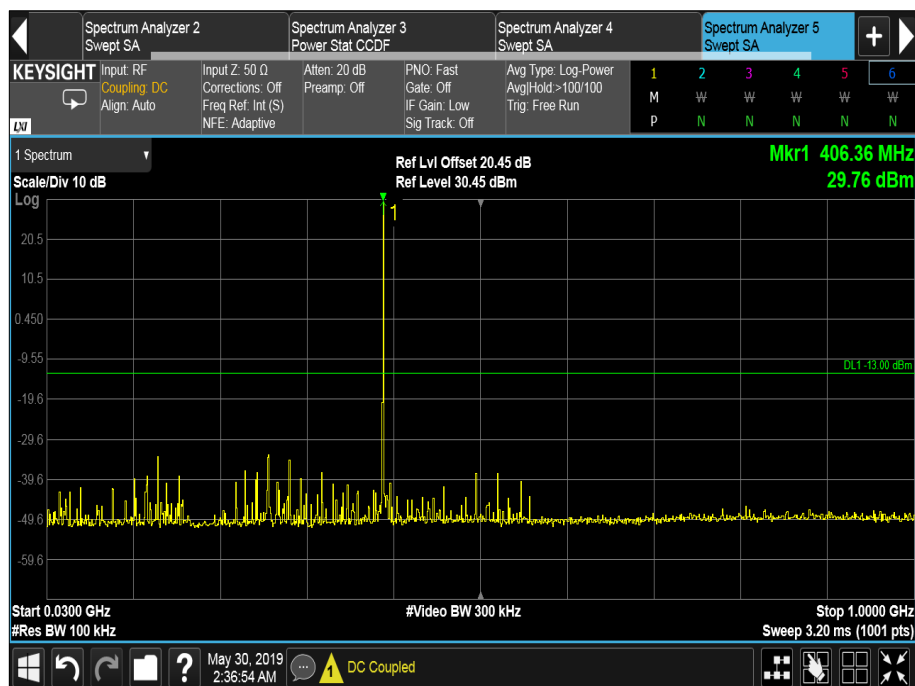


Figure 15 - 406.1125 MHz - 30 MHz to 1 GHz

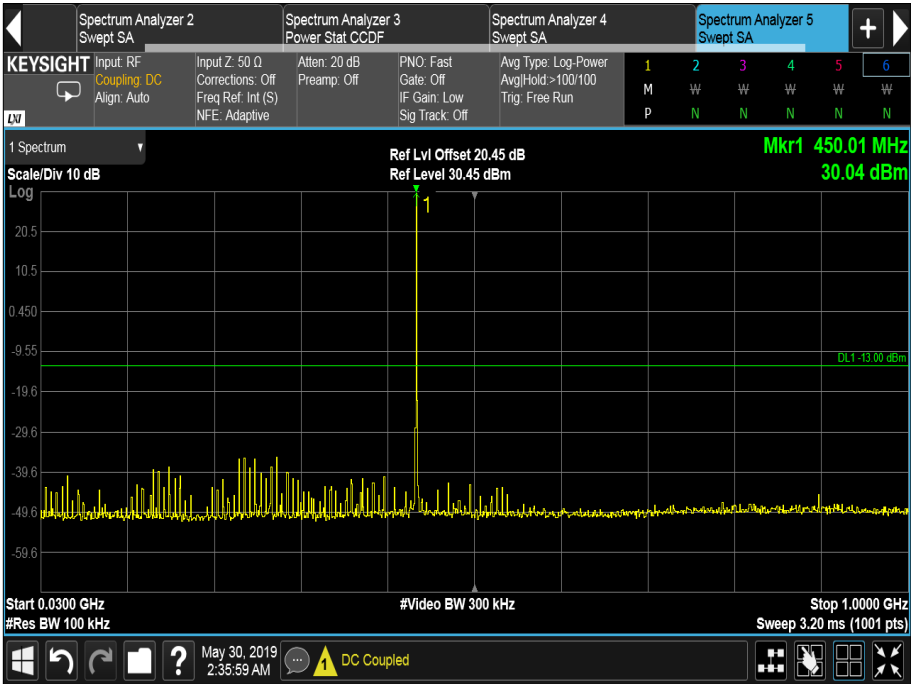


Figure 16 - 450.0125 MHz - 30 MHz to 1 GHz



Figure 17 - 469.9875 MHz - 30 MHz to 1 GHz

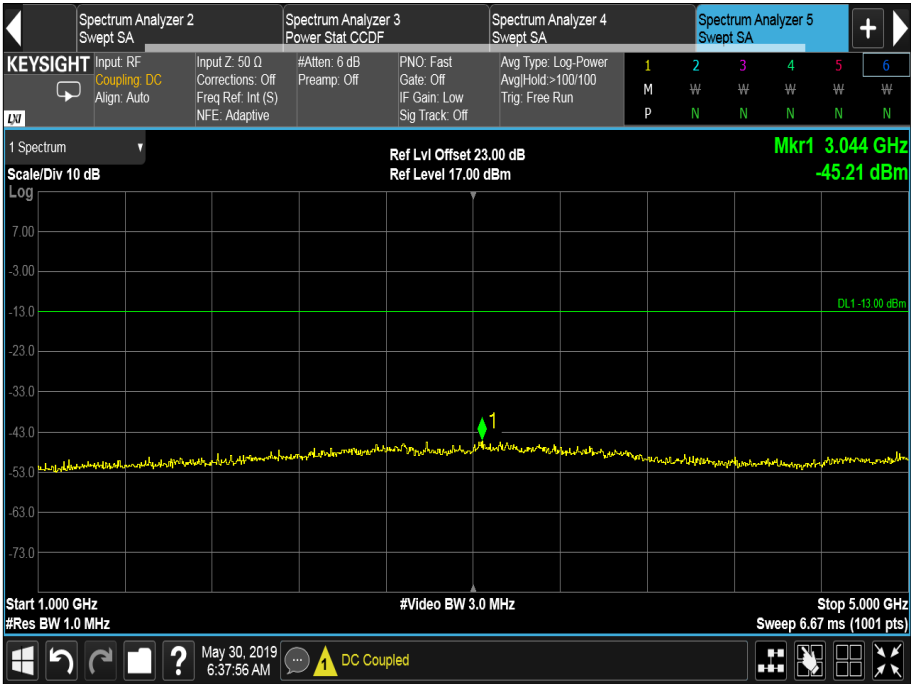


Figure 18 - 406.1125 MHz - 1 GHz to 5 GHz

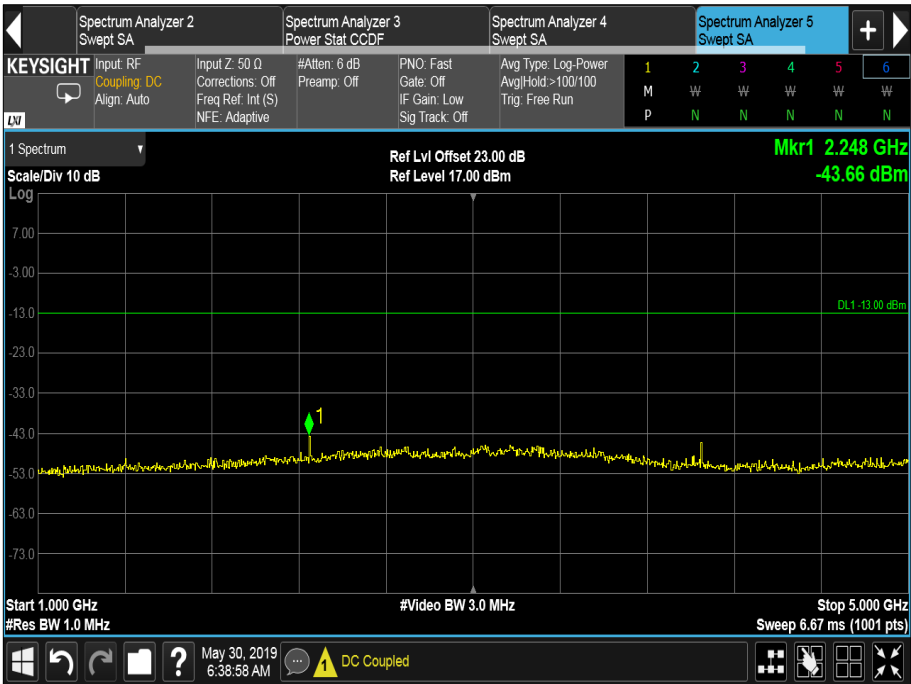


Figure 19 - 450.0125 MHz - 1 GHz to 5 GHz

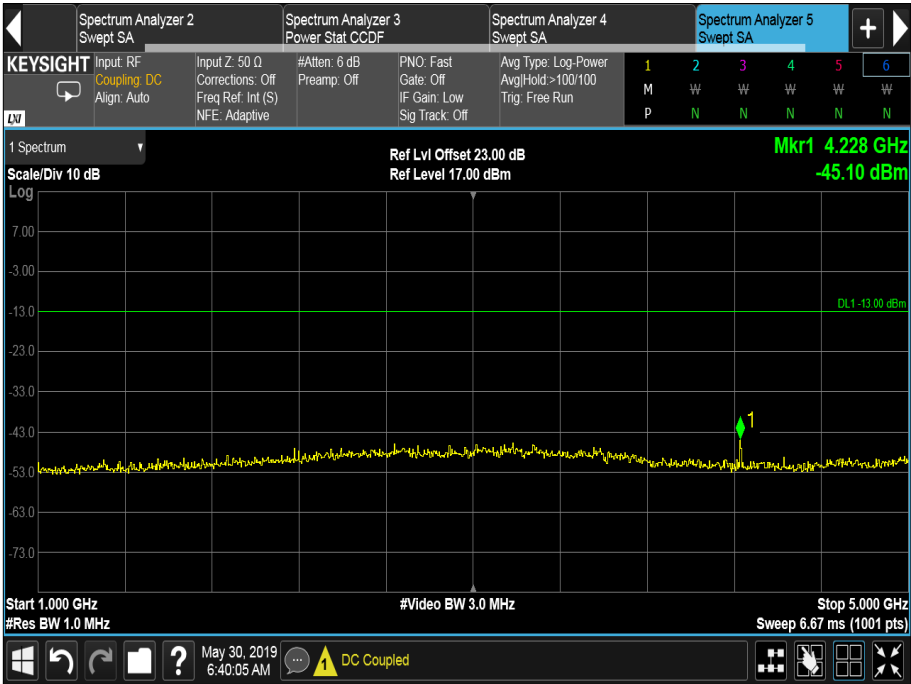


Figure 20 - 469.9875 MHz - 1 GHz to 5 GHz

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.

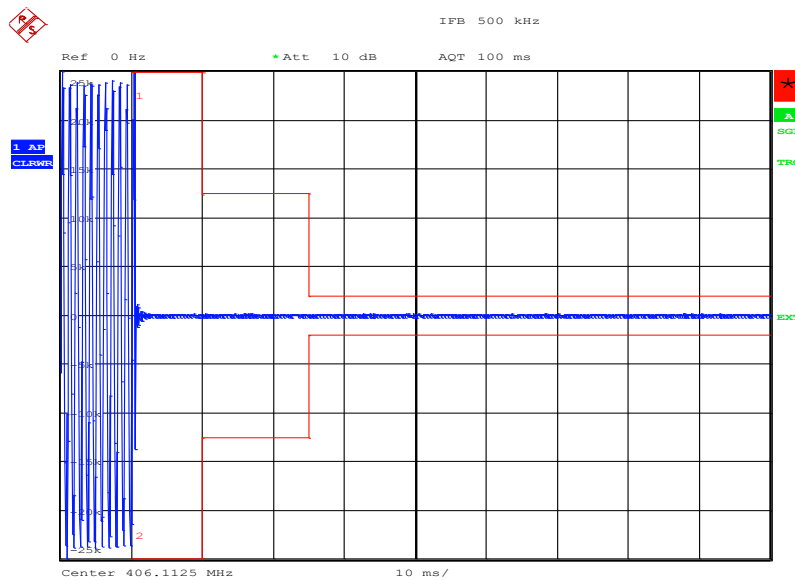
### 2.7.5 Environmental Conditions

Ambient Temperature 24.1 °C

Relative Humidity 50.4 %

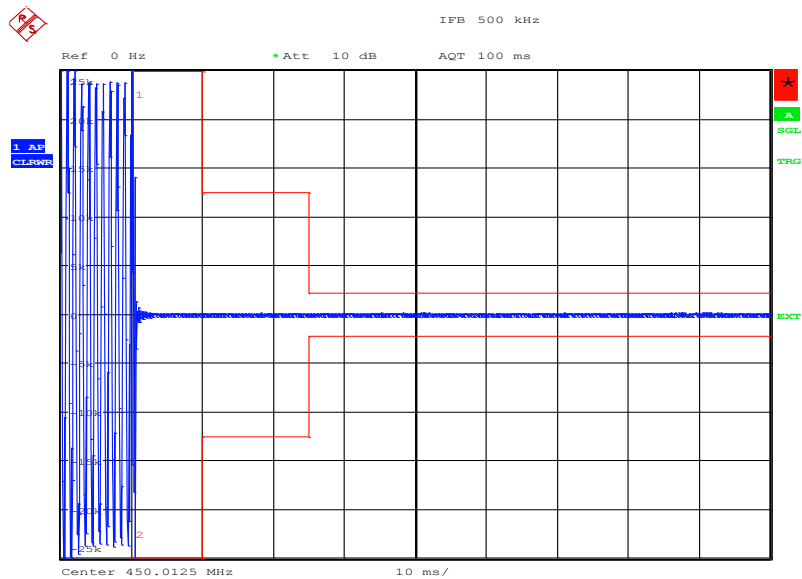
### 2.7.6 Test Results

Battery Powered - 8PSK UHF



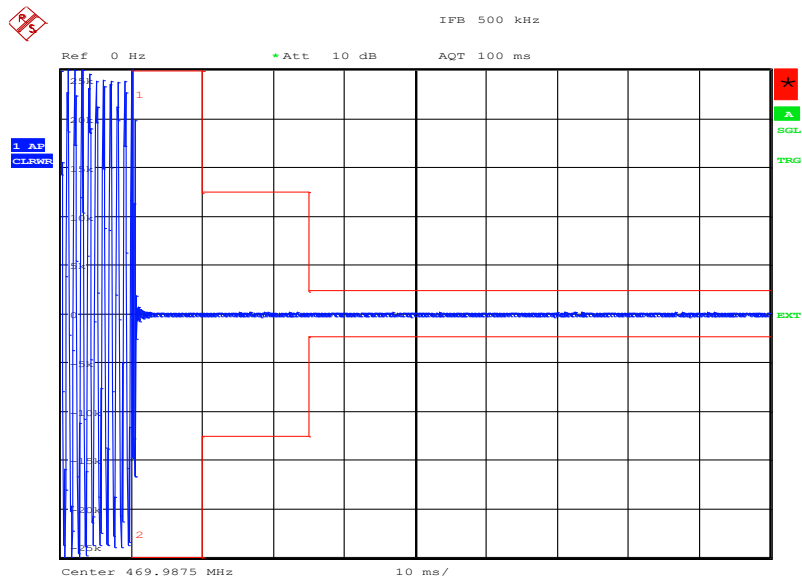
Date: 30.MAY.2019 12:41:07

Figure 21 - 406.1125 MHz, Switch On



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

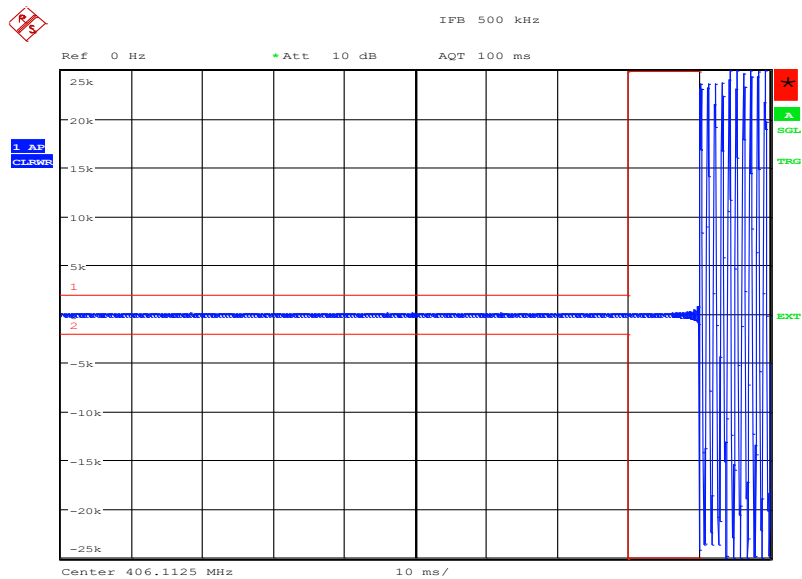
**Figure 22 - 450.0125 MHz, Switch On**



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

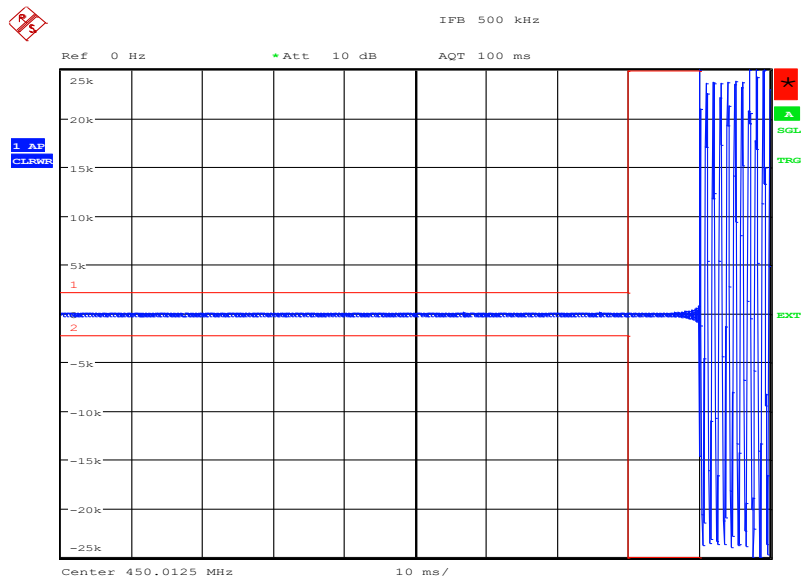
**Figure 23 - 469.9875 MHz, Switch On**

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



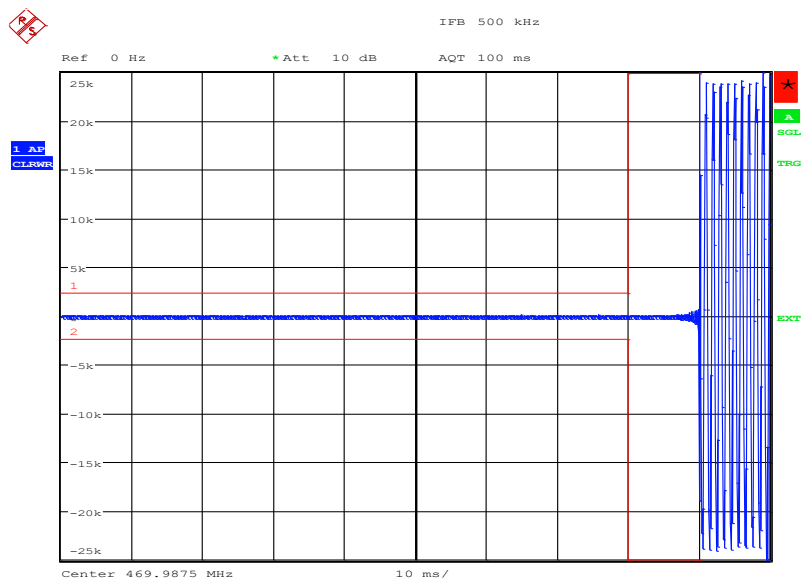
Date: 30.MAY.2019 12:29:43

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 <sub>1</sub>                                                                       | ± 25.0 kHz                   | 5.0 ms         | 10.0 ms        |
| T <sub>2</sub>                                                                       | ± 12.5 kHz                   | 20.0 ms        | 25.0 ms        |
| T <sub>3</sub>                                                                       | ± 25.0 kHz                   | 5.0 ms         | 10.0 ms        |
| Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz Channels |                              |                |                |
| T <sub>1</sub>                                                                       | ± 12.5 kHz                   | 5.0 ms         | 10.0 ms        |
| T <sub>2</sub>                                                                       | ± 6.25 kHz                   | 20.0 ms        | 25.0 ms        |
| T <sub>3</sub>                                                                       | ± 12.5 kHz                   | 5.0 ms         | 10.0 ms        |
| Transient Frequency Behaviour for Equipment Designed to Operate on 6.25 kHz Channels |                              |                |                |
| T <sub>1</sub>                                                                       | ± 6.25 kHz                   | 5.0 ms         | 10.0 ms        |
| T <sub>2</sub>                                                                       | ± 3.125 kHz                  | 20.0 ms        | 25.0 ms        |
| T <sub>3</sub>                                                                       | ± 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.

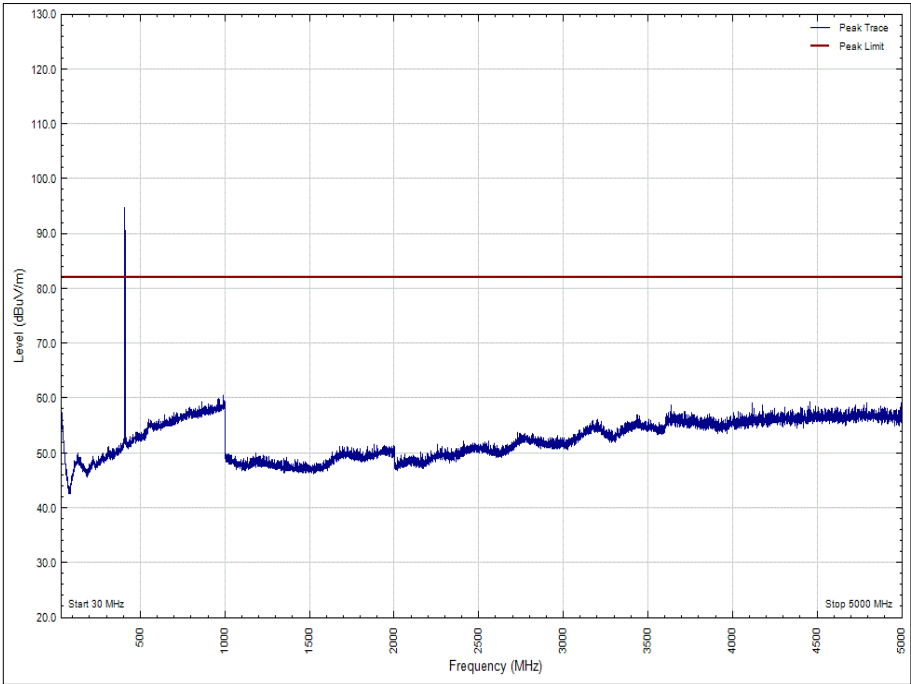


Figure 27 - 406.1125 MHz - 30 MHz to 5 GHz - X Orientation Vertical

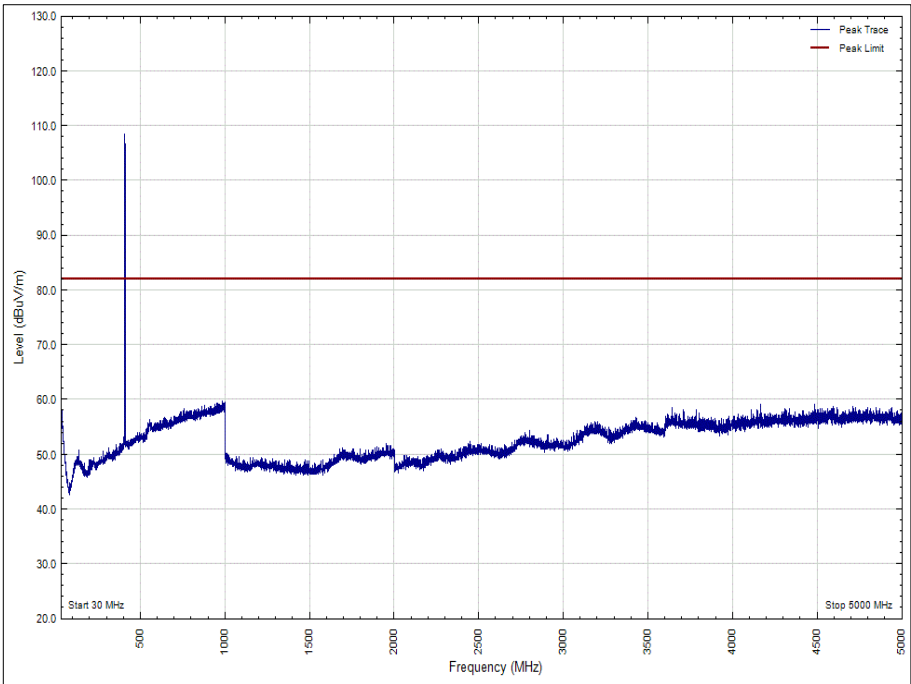


Figure 28 - 406.1125 MHz - 30 MHz to 5 GHz - X Orientation Horizontal

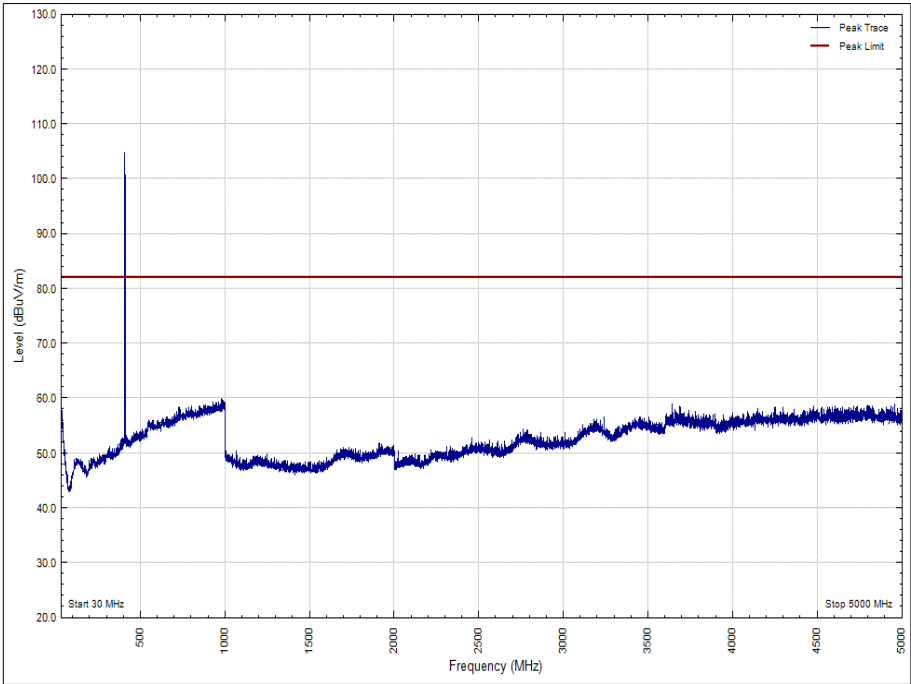


Figure 29 - 406.1125 MHz - 30 MHz to 5 GHz - Y Orientation Vertical

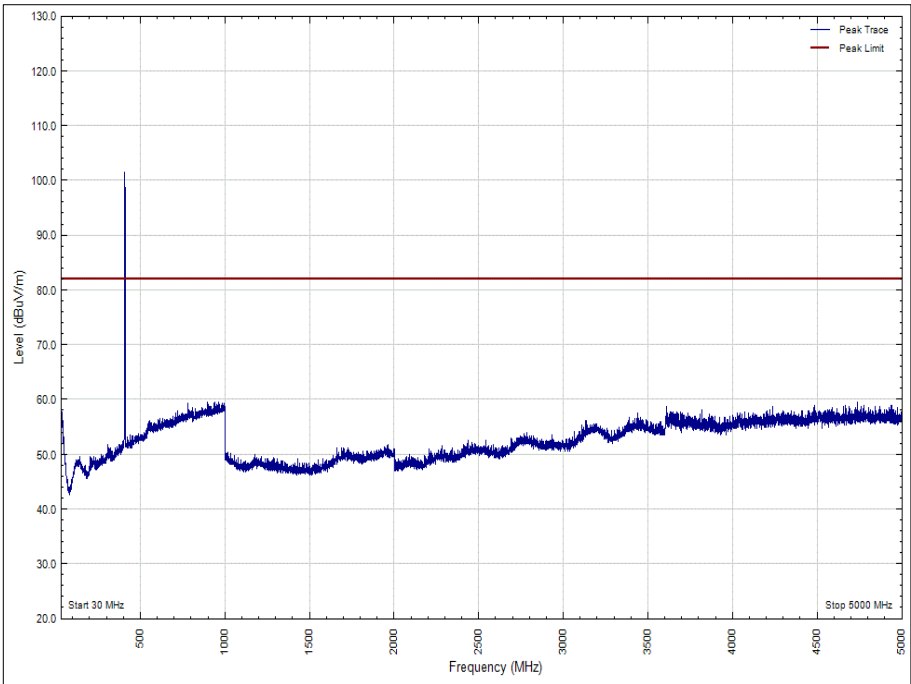


Figure 30 - 406.1125 MHz - 30 MHz to 5 GHz - Y Orientation Horizontal

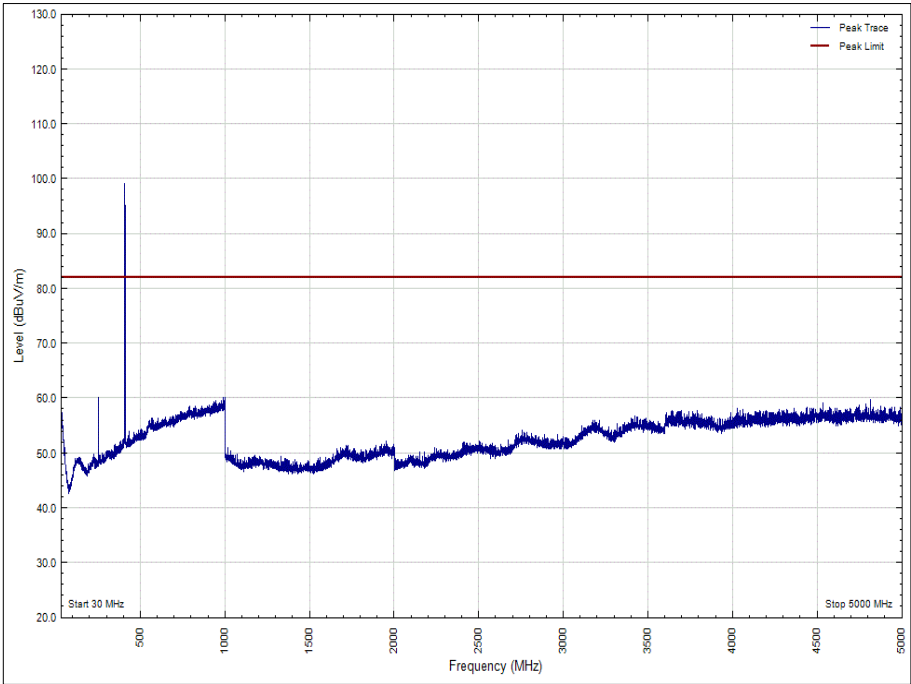


Figure 31 - 406.1125 MHz - 30 MHz to 5 GHz - Z Orientation Vertical

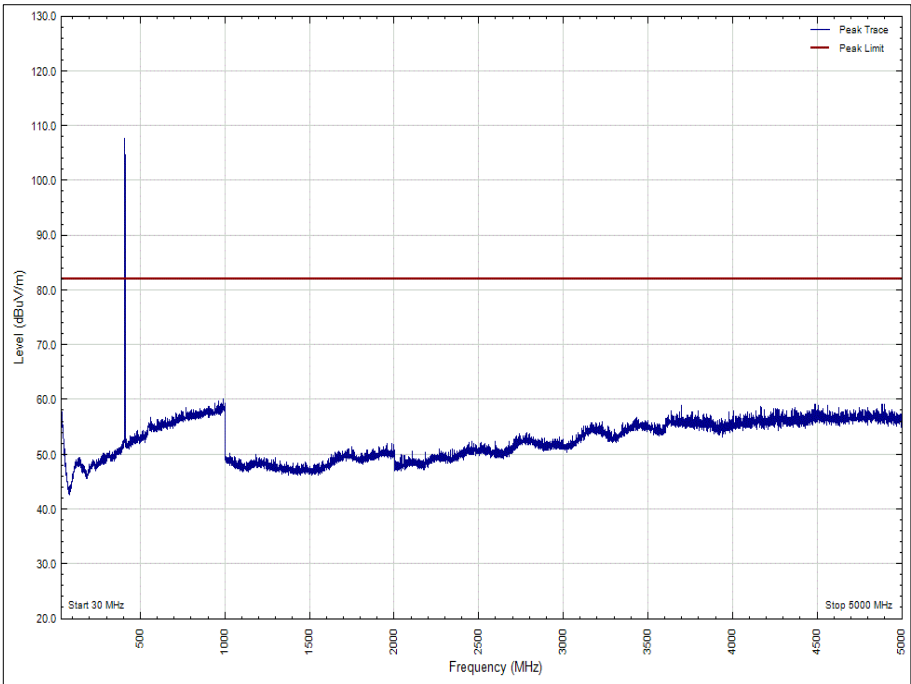


Figure 32 - 406.1125 MHz - 30 MHz to 5 GHz - Z Orientation Horizontal



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

Table 20 - 450.0125 MHz - Emissions Results

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

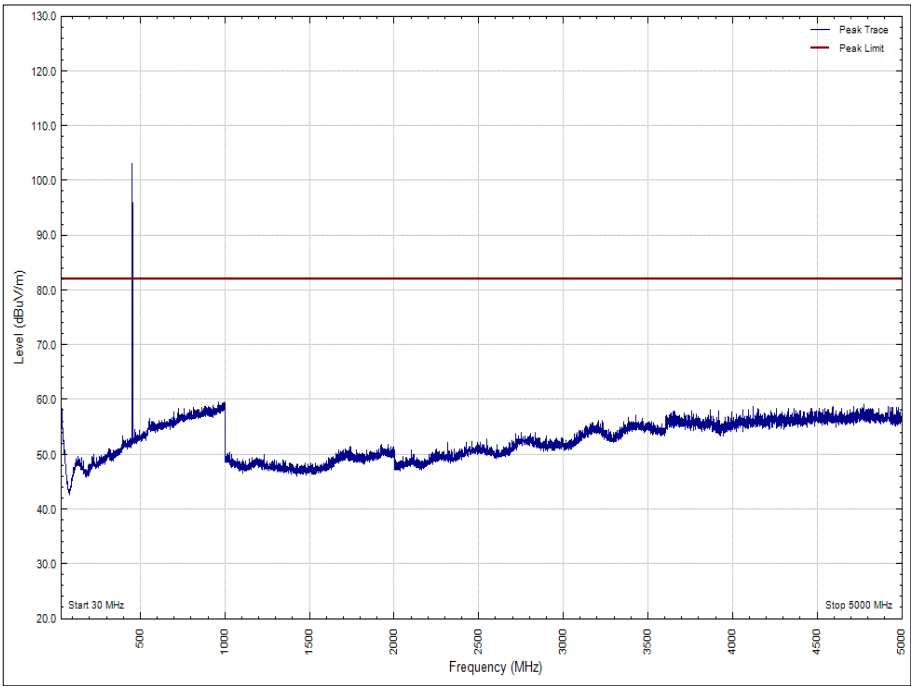


Figure 33 - 450.0125 MHz - 30 MHz to 5 GHz - X Orientation Vertical

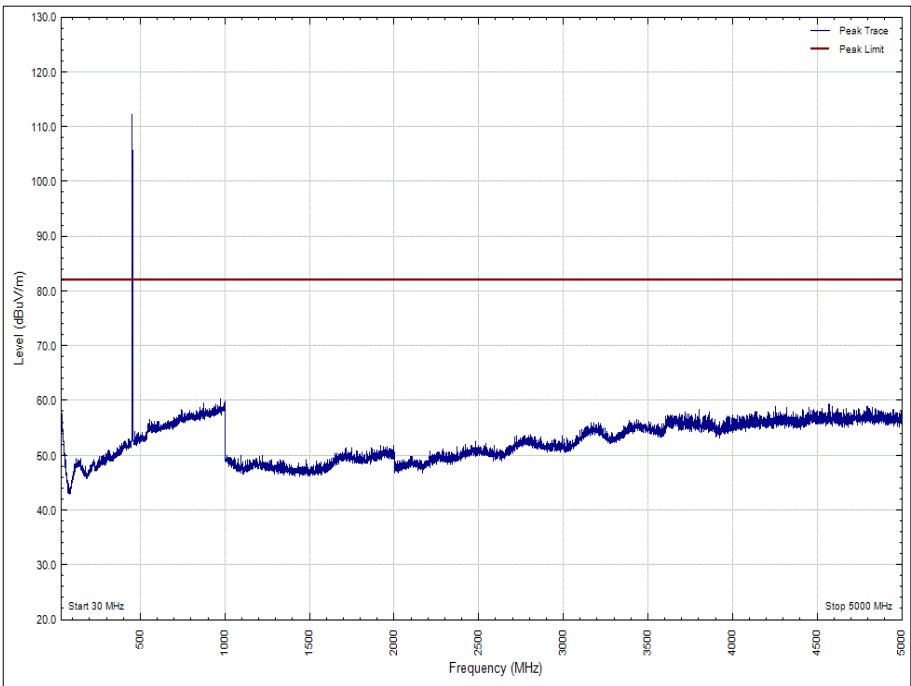


Figure 34 - 450.0125 MHz - 30 MHz to 5 GHz - X Orientation Horizontal

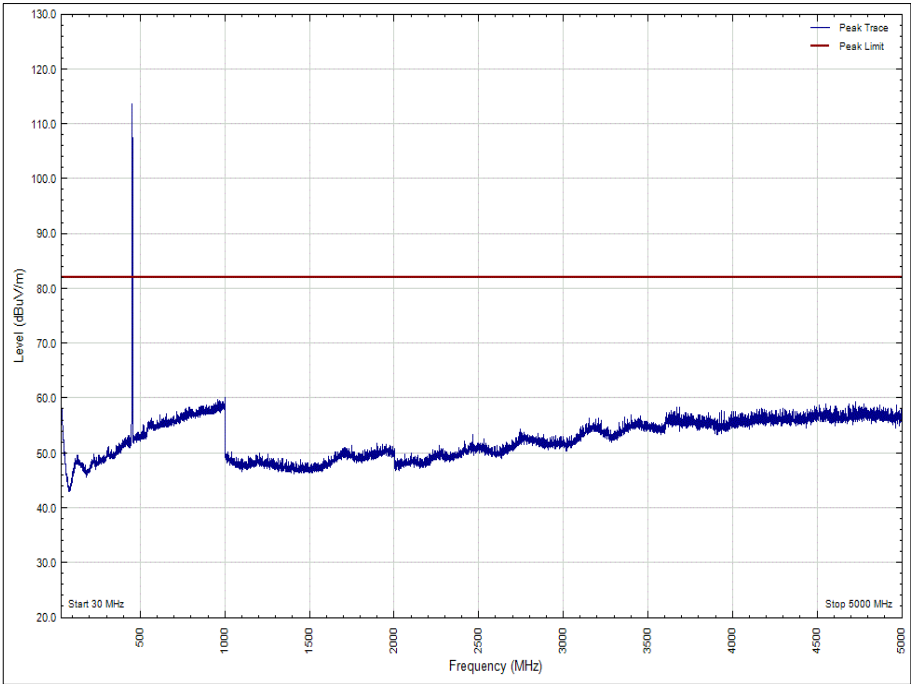


Figure 35 - 450.0125 MHz - 30 MHz to 5 GHz - Y Orientation Vertical

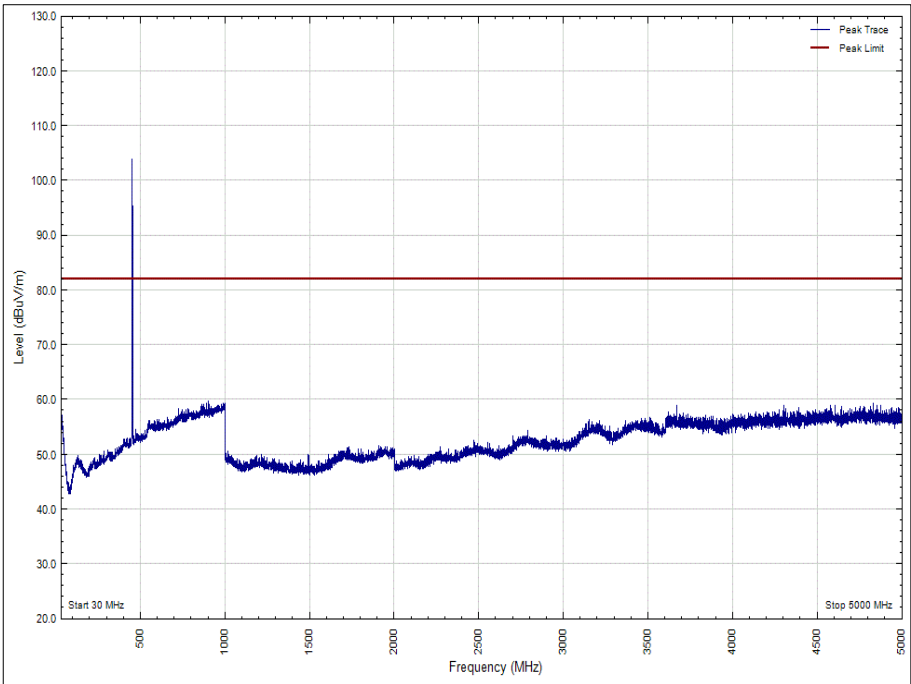


Figure 36 - 450.0125 MHz - 30 MHz to 5 GHz - Y Orientation Horizontal

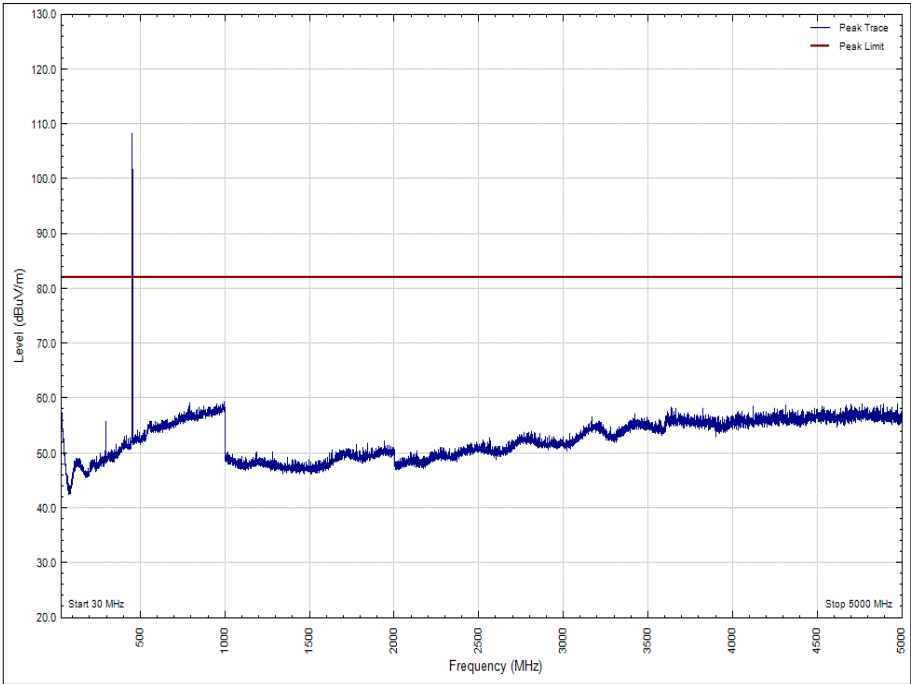


Figure 37 - 450.0125 MHz - 30 MHz to 5 GHz - Z Orientation Vertical

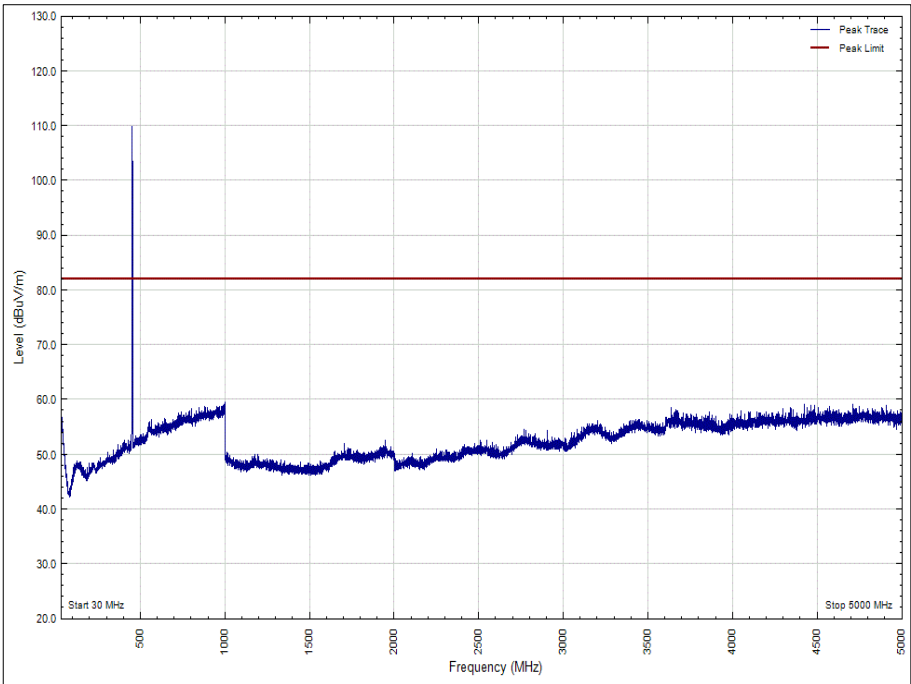


Figure 38 - 450.0125 MHz - 30 MHz to 5 GHz - Z Orientation Horizontal



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

Table 21 - 450.0125 MHz - Emissions Results

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

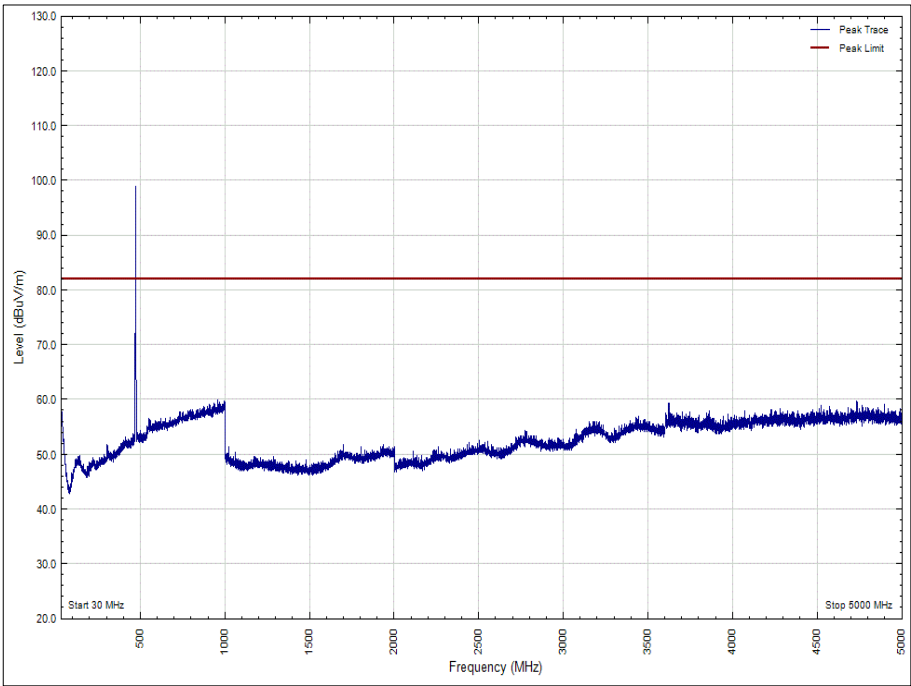


Figure 39 - 469.9875 MHz - 30 MHz to 5 GHz - X Orientation Vertical

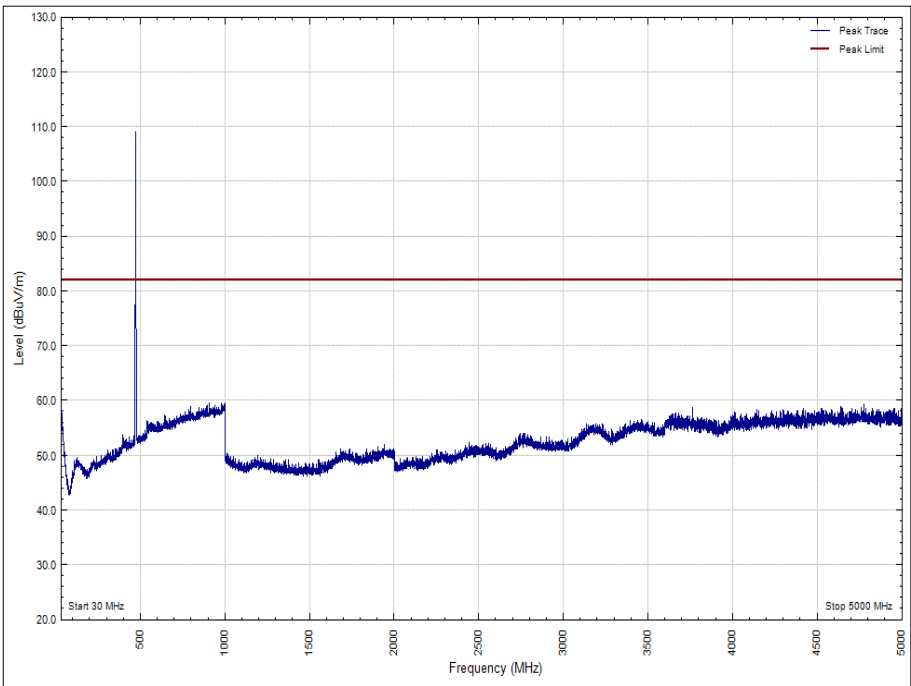


Figure 40 - 469.9875 MHz - 30 MHz to 5 GHz - X Orientation Horizontal

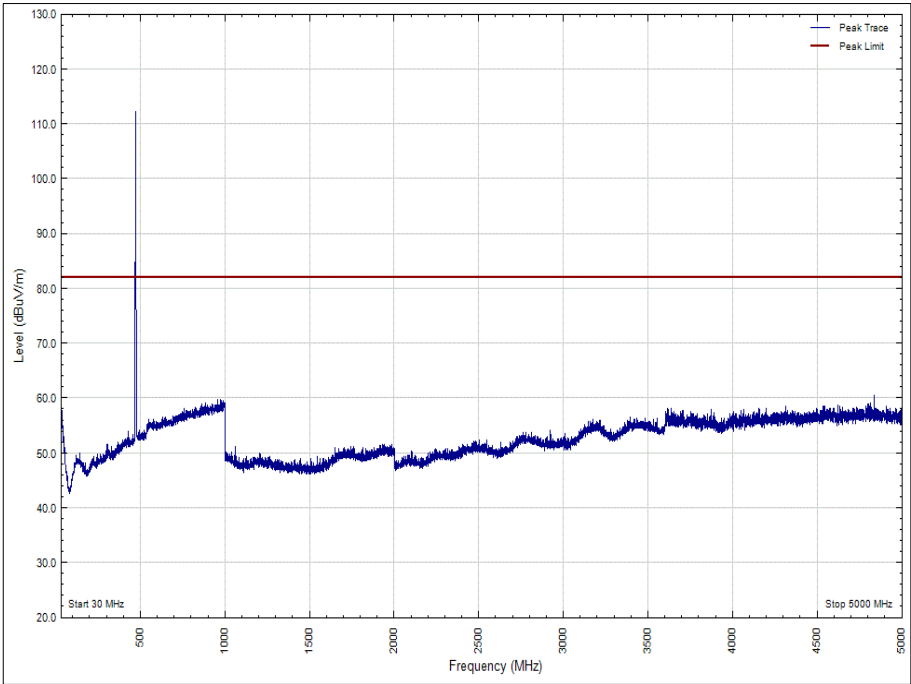


Figure 41 - 469.9875 MHz - 30 MHz to 5 GHz - Y Orientation Vertical

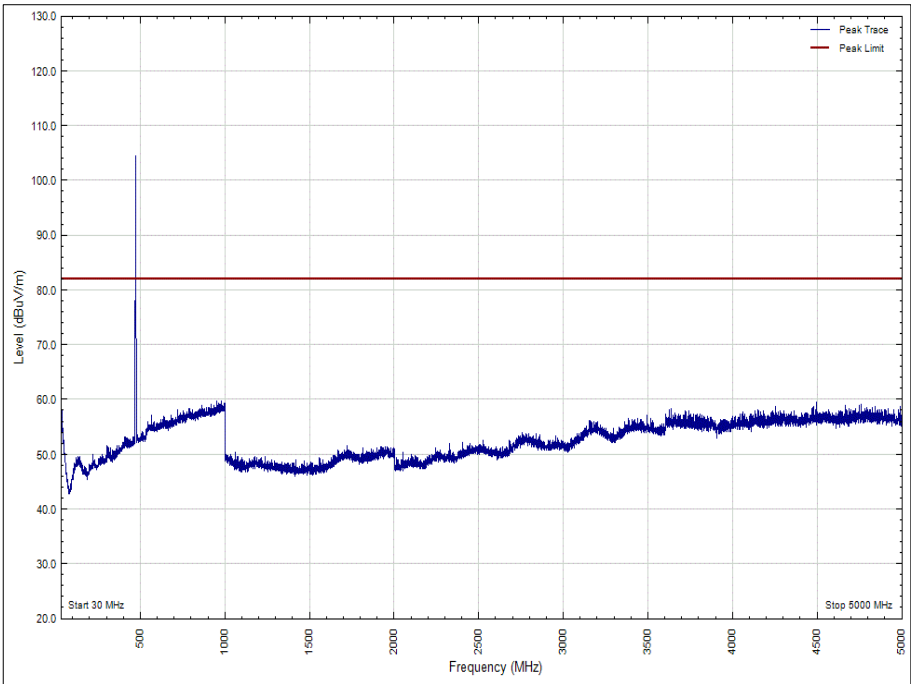


Figure 42 - 469.9875 MHz - 30 MHz to 5 GHz - Y Orientation Horizontal

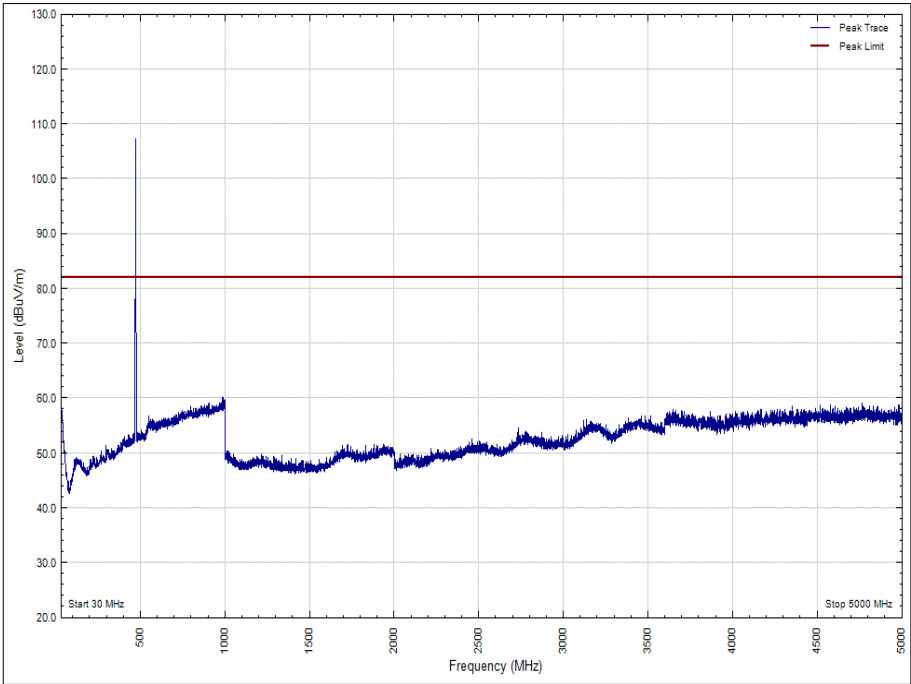


Figure 43 - 469.9875 MHz - 30 MHz to 5 GHz - Z Orientation Vertical

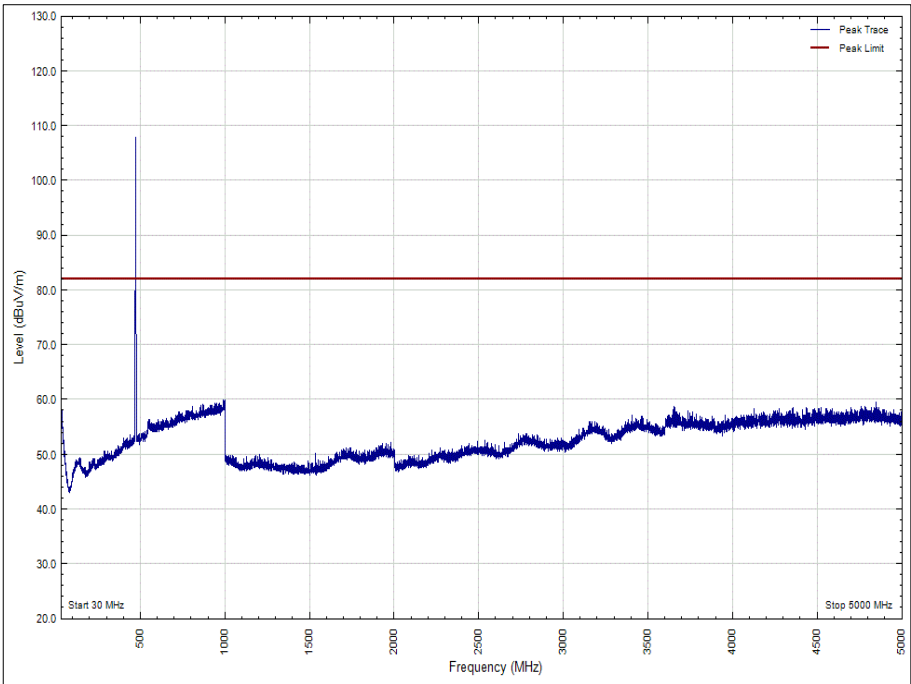


Figure 44 - 469.9875 MHz - 30 MHz to 5 GHz - Z Orientation Horizontal

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

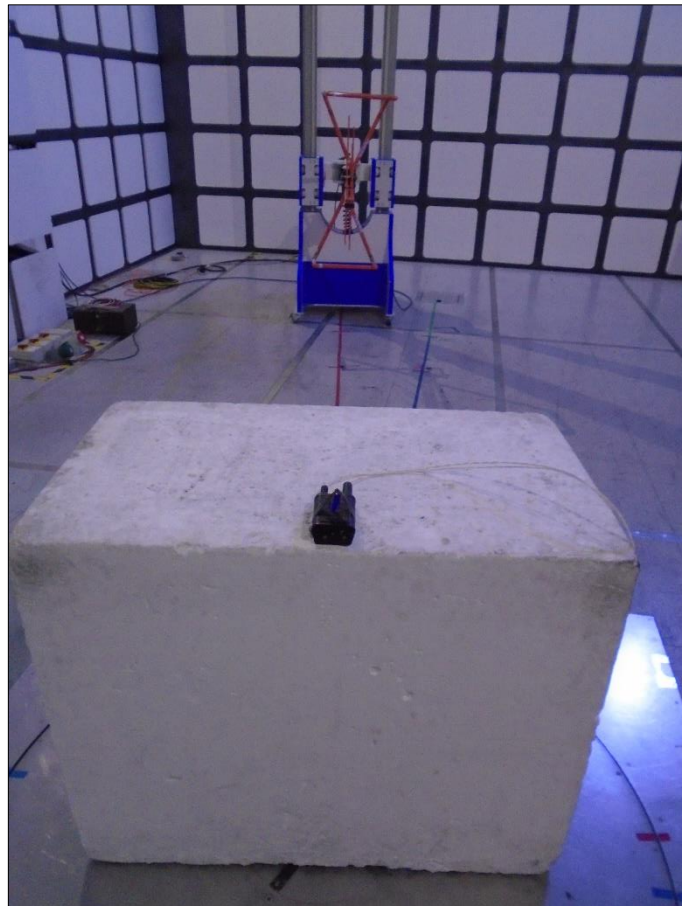
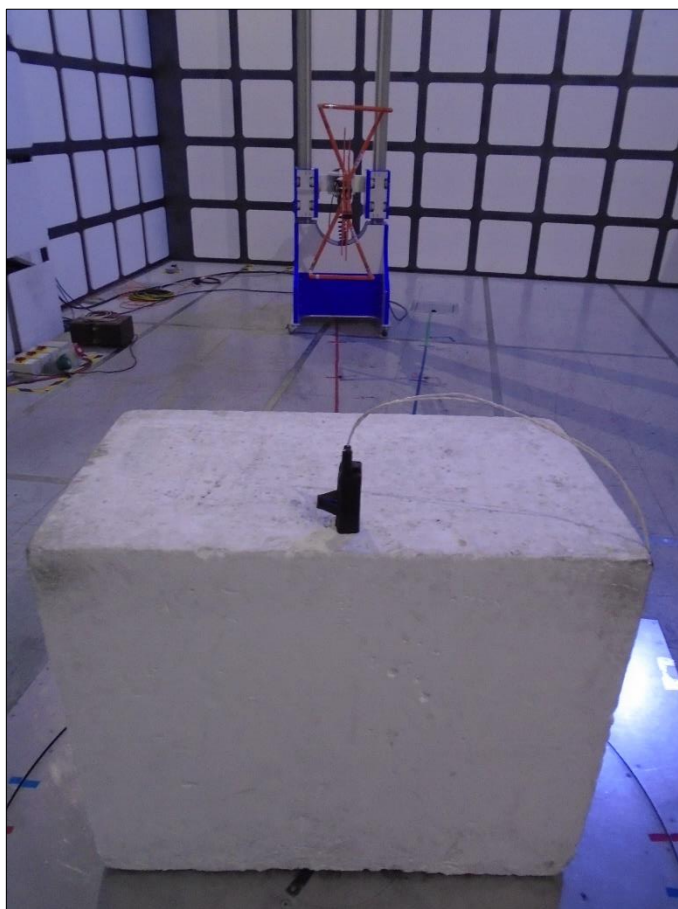
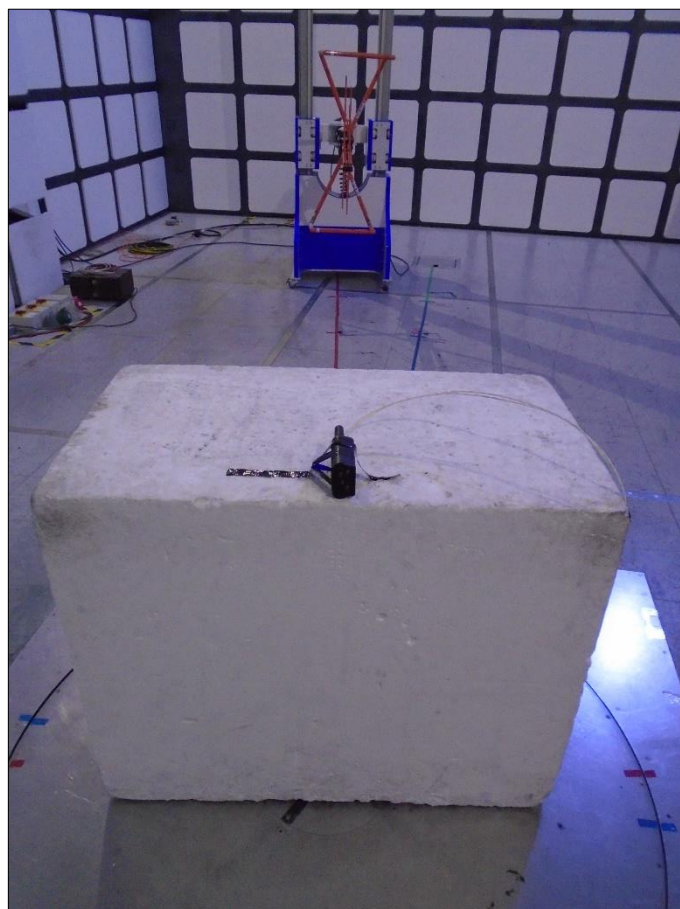


Figure 45 - 30 MHz to 1 GHz - X Orientation



**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: $\pm 5.2$ dB<br>1 GHz to 18 GHz: $\pm 6.3$ dB |
| Transient Frequency Behaviour           | $\pm 0.2$ Hz                                                   |
| Adjacent Channel Power                  | $\pm 3.0$ dB                                                   |
| Frequency Stability                     | $\pm 463.022$ Hz                                               |
| Spurious Emissions at Antenna Terminals | $\pm 3.45$ dB                                                  |
| Bandwidth Limitations                   | $\pm 58.05$ Hz                                                 |
| Types of Emissions                      | -                                                              |
| Maximum Conducted Output Power          | $\pm 3.2$ 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.