



# H.B. Compliance Solutions

## Intentional Radiator Test Report

For the

**Nautel Limited**

**FM Broadcast Transmitter Model VS300HD**

Tested under

The FCC Rules contained in Title 47 of the CFR, Part 73 Subpart G and Part 74 Subpart L for

Radio Broadcast Services

February 26, 2021

**Prepared for:**

Nautel Limited

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**Prepared By:**

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**Reviewed By:**

A handwritten signature in black ink, appearing to read 'Hoosamuddin Bandukwala'.

Hoosamuddin Bandukwala



Cert # ATL-0062-E

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedure indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurement made, the equipment tested is capable of operation in accordance with the requirements of Part 74 of the FCC Rules under normal use and maintenance. All results contained herein relate only to the sample tested.

## Report Status Sheet

| Revision # | Report Date       | Reason for Revision                 |
|------------|-------------------|-------------------------------------|
| Ø          | January 12, 2021  | Initial Issue                       |
| 1          | February 26, 2021 | Corrected low band channel to 88MHz |

## Table of Contents

|                                                  |    |
|--------------------------------------------------|----|
| EXECUTIVE SUMMARY .....                          | 4  |
| 1. Testing Summary .....                         | 4  |
| EQUIPMENT CONFIGURATION .....                    | 5  |
| 1. Overview .....                                | 5  |
| 2. Test Facility .....                           | 6  |
| 3. Description of Test Sample .....              | 7  |
| 4. Equipment Configuration .....                 | 7  |
| 5. Support Equipment .....                       | 7  |
| 6. Ports and Cabling Information .....           | 8  |
| 7. Method of Monitoring EUT Operation .....      | 8  |
| 8. Mode of Operation .....                       | 8  |
| 9. Modifications .....                           | 9  |
| 10. Disposition of EUT .....                     | 9  |
| Criteria for Intentional Radiators .....         | 10 |
| 1. RF Power Output .....                         | 10 |
| 2. Modulation Characteristics .....              | 13 |
| 3. Occupied Bandwidth (Emission Mask) .....      | 16 |
| 4. Spurious Emissions at Antenna Terminals ..... | 20 |
| 5. Radiated Spurious Emissions .....             | 24 |
| 6. Frequency Stability vs Temperature .....      | 28 |
| 7. Frequency Stability vs Voltage .....          | 30 |
| 8. Necessary Bandwidth .....                     | 32 |
| 9. Test Equipment .....                          | 33 |
| 10. Measurement Uncertainty .....                | 34 |

## EXECUTIVE SUMMARY

### 1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with CFR 47 FCC Part 73 and 74. All tests were conducted using measurement procedure from ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9kHz to 40GHz and ANSI C63.26-2015 Procedures for Compliance Testing of Transmitters Used in Licensed Radio Services as appropriate.

| Test Name                                       | Test Method/Standard                 | Result | Comments |
|-------------------------------------------------|--------------------------------------|--------|----------|
| RF Output Power                                 | §2.1046; §73.811, §74.1235           | Pass   |          |
| Modulation Characteristics                      | §2.1047(a); §73.1590                 | Pass   |          |
| Occupied Bandwidth                              | §2.1049; §73.317, §74.1236           | Pass   |          |
| Spurious Emissions at Antenna Terminals         | §2.1051; §73.317; §74.1236           | Pass   |          |
| Radiated Spurious Emissions                     | §2.1053                              | Pass   |          |
| Frequency Stability over Temperature Variations | §2.1055(a)(1); §73.1545(b); §74.1261 | Pass   |          |
| Frequency Stability over Voltage Variations     | §2.1055(d); §73.1545(b); §74.1261    | Pass   |          |

## EQUIPMENT CONFIGURATION

### 1. Overview

H.B Compliance Solutions was contracted by Nautel Limited to perform testing on the FM Broadcast Transmitter VS300HD under the quotation number Q20121005.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Nautel Limited, FM Broadcast Transmitter VS300HD.

The tests were based on FCC Part 90 Rules. The tests described in this document were formal tests as described with the objective of the testing was to evaluate compliance of the Equipment Under Test (EUT) to the requirements of the aforementioned specifications. Nautel Limited should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been permanently discontinued. The results obtained relate only to the item(s) tested.

|                                       |                                                                                |
|---------------------------------------|--------------------------------------------------------------------------------|
| <b>Product Name:</b>                  | FM Broadcast Transmitter                                                       |
| <b>Model(s) Tested:</b>               | VS300HD                                                                        |
| <b>FCC ID:</b>                        | B3W-VS300HD                                                                    |
| <b>Supply Voltage Input:</b>          | Primary Power: 110 Vac                                                         |
| <b>Frequency Range:</b>               | 88MHz to 108MHz                                                                |
| <b>No. of Channels:</b>               | N/A                                                                            |
| <b>Necessary Bandwidth</b>            | 390kHz                                                                         |
| <b>Type(s) of Modulation:</b>         | FM                                                                             |
| <b>Range of Operation Power:</b>      | 15W to 150W                                                                    |
| <b>Voltage into final Transistor</b>  | 43.2 volts                                                                     |
| <b>Current into final Transistor</b>  | 7.45 amps                                                                      |
| <b>Emission Designator:</b>           | 390KF3E                                                                        |
| <b>Channel Spacing(s)</b>             | None                                                                           |
| <b>Test Item:</b>                     | Pre-Production                                                                 |
| <b>Type of Equipment:</b>             | Fixed                                                                          |
| <b>Antenna:</b>                       | External N Connector – Device is not sold with antenna                         |
| <b>Environmental Test Conditions:</b> | Temperature: 15-35°C<br>Humidity: 30-60%<br>Barometric Pressure: 860-1060 mbar |
| <b>Modification to the EUT:</b>       | None                                                                           |
| <b>Evaluated By:</b>                  | Staff at H.B. Compliance Solutions                                             |
| <b>Test Date(s):</b>                  | 12/29/2020 till 01/11/2021                                                     |
| <b>Firmware Number</b>                | 0.0.0.3                                                                        |
| <b>PCBA Version</b>                   | C                                                                              |

## 2. Test Facility

All testing was performed at H.B. Compliance Solutions. This facility is located at 5005 S. Ash Avenue, Suite # A-10, Tempe AZ-85282. All equipment used in making physical determination is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements from 30MHz to 1GHz were performed in a GTEM chamber (equivalent to an Open Area Test Site). Radiated Emission above 1GHz were performed on an Open Area Test Site (OATS). In accordance with §2.948(a)(3), a complete site description is contained at H.B. Compliance Solutions.

Test facility H.B. Compliance Solutions is an ANAB accredited test site. The ANAB certificate number is L2458. The scope of accreditation can be found on ANAB website [www.anab.org](http://www.anab.org)

ISED Test Site Registration number is 9481A



### 3. Description of Test Sample

The Nautel, VS300HD is digital radio, 150-watt FM transmitter which includes the VSHD (HD digital radio) exciter which provide an RF signal source with modulation.

This transmitter is intended to be used by licensed FM broadcasting services and have been designed for use in a traditional transmission sites with controlled access and adequate services for transmitter operation.

### 4. Equipment Configuration

| Ref. ID | Name / Description | Model Number | Serial Number |
|---------|--------------------|--------------|---------------|
| # 1     | FM Transmitter     | VS300        | 10015424      |
| # 2     | HD Radio Exciter   | VSHD         | 10010576      |

Table 1. Equipment Configuration

### 5. Support Equipment

All support equipment supplied is listed in the following Support Equipment List.

| Ref ID | Name / Description | Manufacturer | Model #       | Serial #  |
|--------|--------------------|--------------|---------------|-----------|
| # 3    | 2kW 30dB RF Load   | Bird         | 8329          | 120501251 |
| # 4    | HD Radio Exporter  | Nautel       | Exporter Plus | H 224     |
| # 5    | Laptop Computer    | Dell         | P05G          | 2956677   |

Table 2. Support Equipment

## 6. Ports and Cabling Information

| Ref ID | Port name on the EUT | Cable Description    | Qty. | Length (m) | Shielded? (Y/N) | Termination Box ID & Port ID |
|--------|----------------------|----------------------|------|------------|-----------------|------------------------------|
| # 6    | RF Out               | RG 393 with 7/16 DIN | 1    | 1.5        | Y               | # 3                          |
| # 7    | AC In                | C19                  | 3    | 2.5        | N               | AC Power                     |
| # 8    | #1 VSHD Interface    | CAT 5E               | 1    | 0.6        | N               | # 2 XTMR LINK                |
| # 9    | #1 LAN               | CAT 5E               | 1    | 3          | N               | Laptop                       |
| # 10   | #2 LAN               | CAT 5E               | 1    | 3          | N               | # 4 ETH0                     |
| # 11   | #2 RF OUT            | BNC                  | 1    | 0.3        | N               | #1 RF DRIVE IN               |
| # 12   | #1 RF SAMPLE OUT     | BNC                  | 1    | 0.3        | N               | #2 XTMR SAMPLE IN            |
| # 13   | # 1 Analog Audio     | 9 Pin DSUB to XLR3   | 1    | 0.3        | N               | # 14                         |
| # 14   | # 13 Analog L / R    | XLR3                 | 2    | 1.5        | Y               | Audio Source                 |

Table 3. Ports and Cabling Information

## 7. Method of Monitoring EUT Operation

A test receiver will be used to monitor the data transmission from the EUT.

## 8. Mode of Operation

The EUT will be configured to transmit at maximum power level. Test mode was provided to select the lower, middle and upper band of the transmitter by customer provided front panel access to the software. These settings were created for testing purpose only.

## **9. Modifications**

### **9.1 Modifications to EUT**

No modifications were made to the EUT

### **9.2 Modifications to Test Standard**

No Modifications were made to the test standard.

## **10. Disposition of EUT**

The test sample including all support equipment submitted to H.B Compliance Solutions for testing will be returned to Nautel Limited upon completion of testing & certification.

## Criteria for Intentional Radiators

### 1. RF Power Output

|                             |                               |                          |            |
|-----------------------------|-------------------------------|--------------------------|------------|
| <b>Test Requirement(s):</b> | §2.1046; §73.811 and §74.1235 | <b>Test Engineer(s):</b> | Sean E.    |
| <b>Test Results:</b>        | Pass                          | <b>Test Date(s):</b>     | 02/26/2021 |

**Test Procedures:** As required by 47 CFR 2.1046, RF Power output measurements were made at the RF output terminals of the EUT.

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer capable of making power measurements. Measurements were made at the low, mid, and high channels of the entire frequency band.

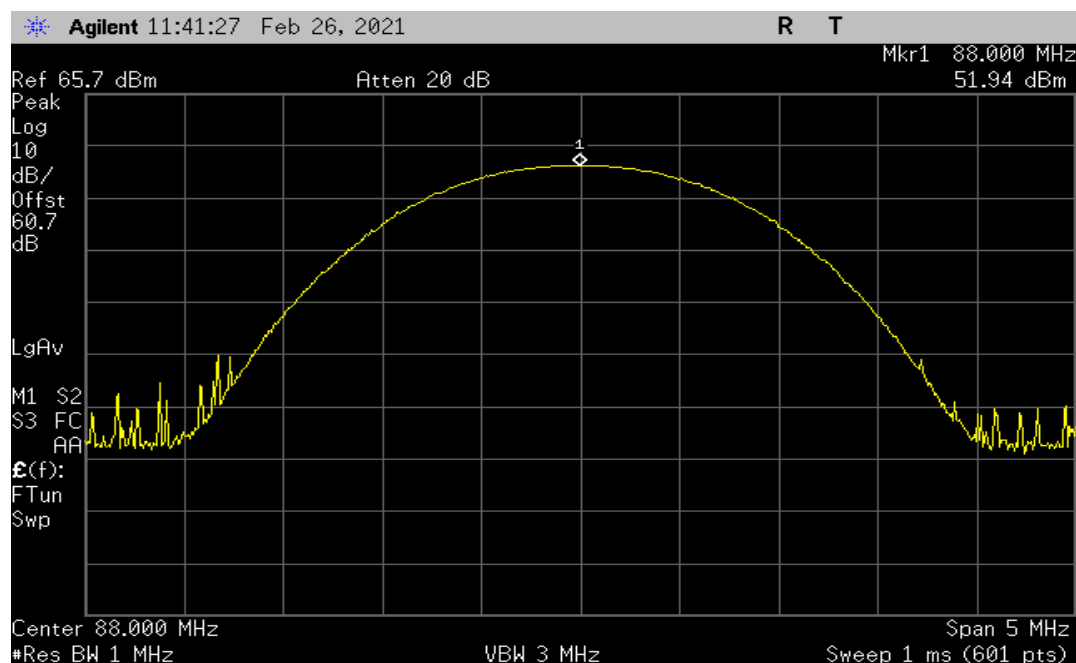
| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) | Rated Output Power (W) |
|-----------------|-----------------------|---------------------|------------------------|
| 88              | 51.94                 | 156.3               | 150                    |
| 98.1            | 51.87                 | 153.8               | 150                    |
| 107.9           | 51.85                 | 153.1               | 150                    |

Table 4. RF Power Output, Test Results

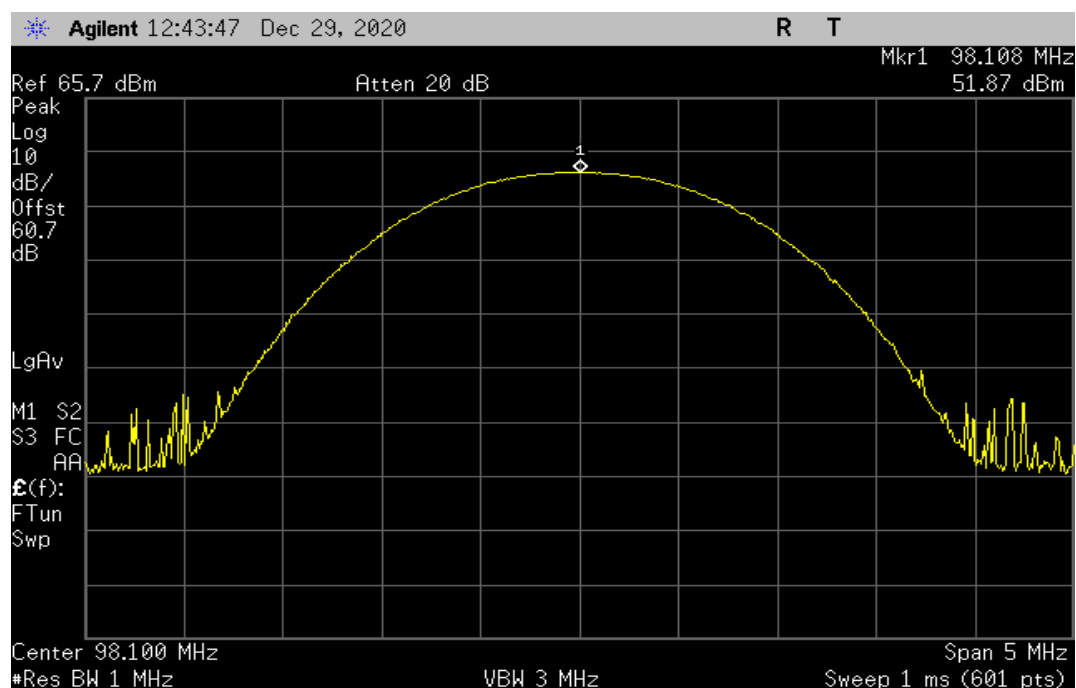
**Test Setup:**



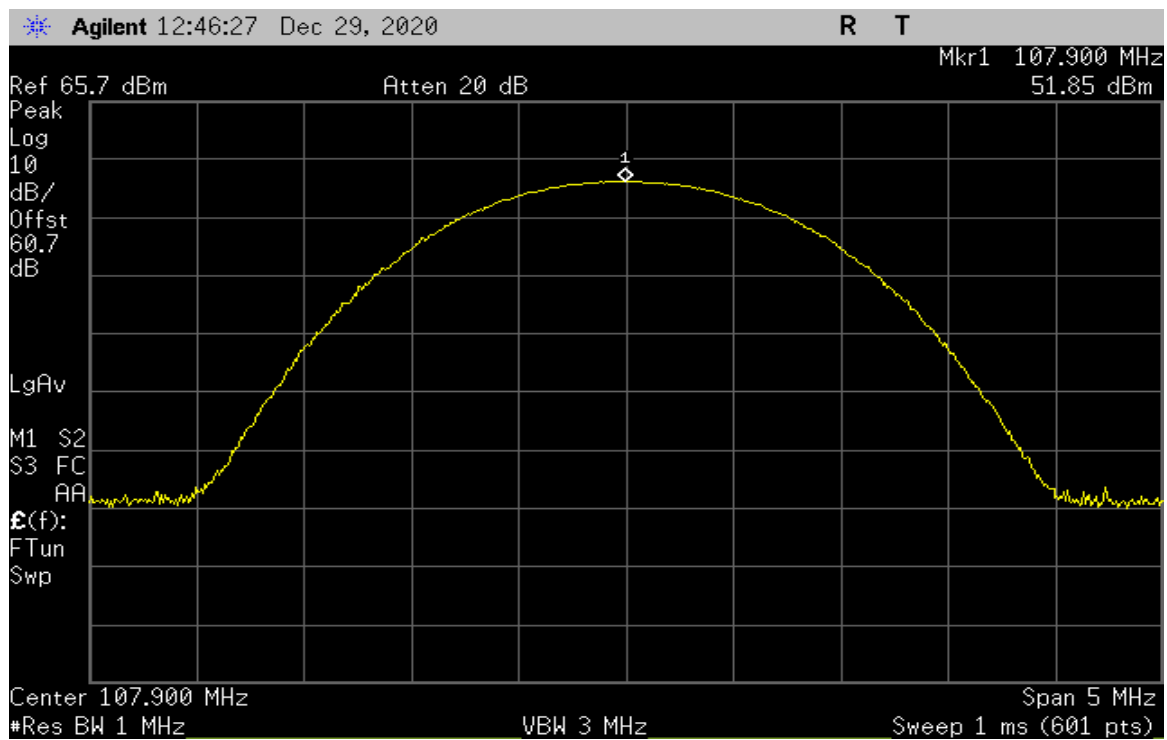
Figure 1 Output RF power Test Setup



**Plot 1 – Output Power – Low**



**Plot 2 – Output Power – Mid**



**Plot 3 – Output Power – High**

## 2. Modulation Characteristics

|                             |                      |                          |            |
|-----------------------------|----------------------|--------------------------|------------|
| <b>Test Requirement(s):</b> | §2.1047 and §73.1590 | <b>Test Engineer(s):</b> | Sean E.    |
| <b>Test Results:</b>        | Pass                 | <b>Test Date(s):</b>     | 01/06/2021 |

**Test Procedure:** As required by 47 CFR 2.1047, Modulation characteristics measurements were made at the RF output terminals of the EUT. Measurements were made in accordance with the procedures of the ANSI C63.26-2015

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer.

**For Modulating Limiting** – Data was plotted as a percentage of deviation relative to the 0 dB reference point versus input voltage.

**For Audio Response** – As per standard a curve or equivalent data showing frequency response of the audio modulating circuit shall be submitted.

The plot(s) of the modulation characteristic is presented hereinafter as reference.

### Test Setup:

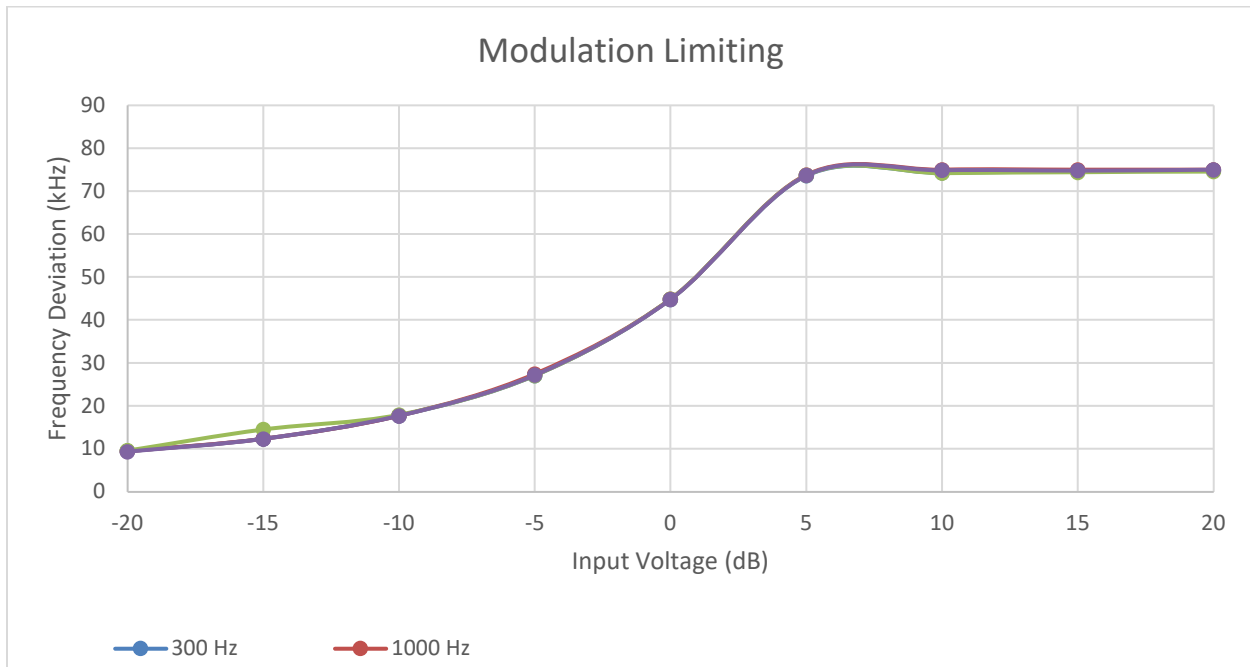


**Figure 2: Modulation Characteristics Bandwidth Test Setup**

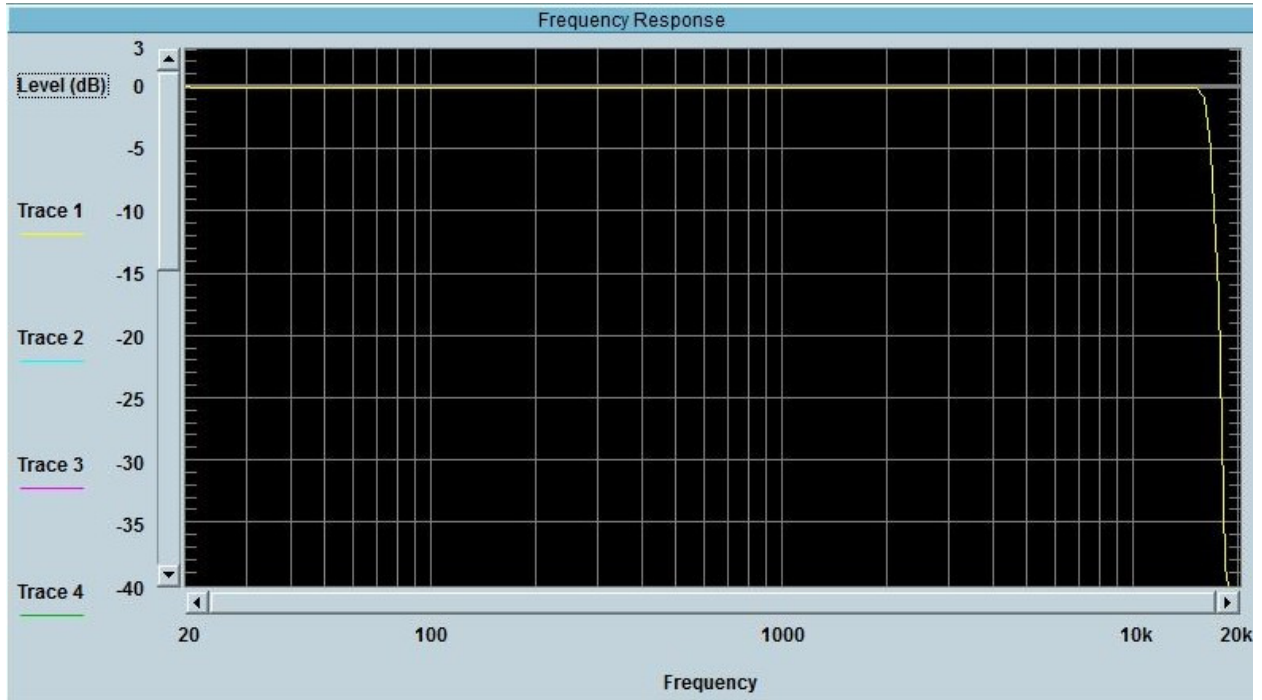
## Test Results:

| Modulation Level (dB) | Peak Frequency Deviation @300Hz | Peak Frequency Deviation @1000Hz | Peak Frequency Deviation @2500Hz | Peak Frequency Deviation @3000Hz |
|-----------------------|---------------------------------|----------------------------------|----------------------------------|----------------------------------|
| 20                    | 74.9                            | 75                               | 74.6                             | 75                               |
| 15                    | 74.6                            | 75                               | 74.4                             | 74.8                             |
| 10                    | 74.3                            | 75                               | 74.2                             | 74.9                             |
| 5                     | 73.6                            | 73.8                             | 73.7                             | 73.7                             |
| 0                     | 44.8                            | 44.9                             | 44.9                             | 44.8                             |
| -5                    | 27.1                            | 27.47                            | 27.1                             | 27.19                            |
| -10                   | 17.68                           | 17.72                            | 17.91                            | 17.7                             |
| -15                   | 12.33                           | 12.35                            | 14.52                            | 12.33                            |
| -20                   | 9.44                            | 9.47                             | 9.61                             | 9.33                             |

Table 5. Modulating Limiting, Test Results



Plot 4 – Modulating Limiting



**Plot 5 – Audio Frequency Response**

### 3. Occupied Bandwidth (Emission Mask)

|                             |                               |                          |            |
|-----------------------------|-------------------------------|--------------------------|------------|
| <b>Test Requirement(s):</b> | §2.1049; §73.317 and §74.1236 | <b>Test Engineer(s):</b> | Sean E.    |
| <b>Test Results:</b>        | Pass                          | <b>Test Date(s):</b>     | 02/26/2021 |

**Test Procedure:** As required by 47 CFR 2.1049, occupied bandwidth measurements were made at the output terminals of the EUT.

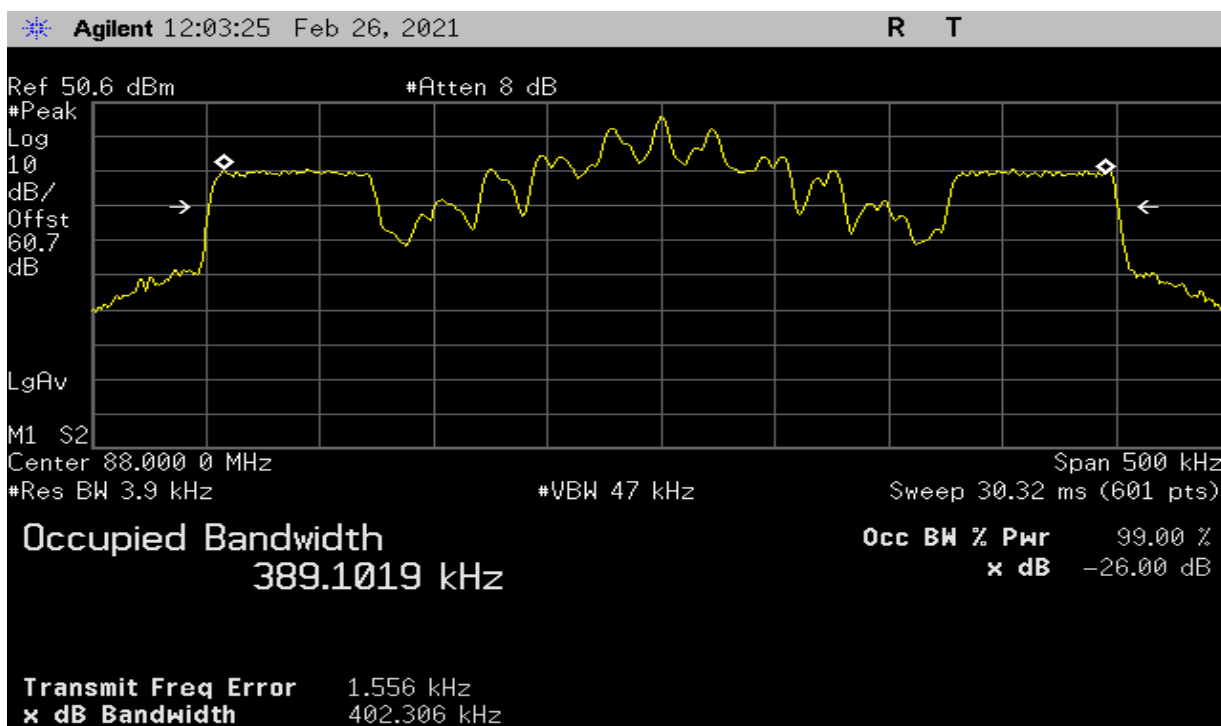
Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer. The measured highest peak power was set relative to zero dB reference. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. Measurements were carried out at the low, mid and high channels of the TX band.

#### Test Setup:

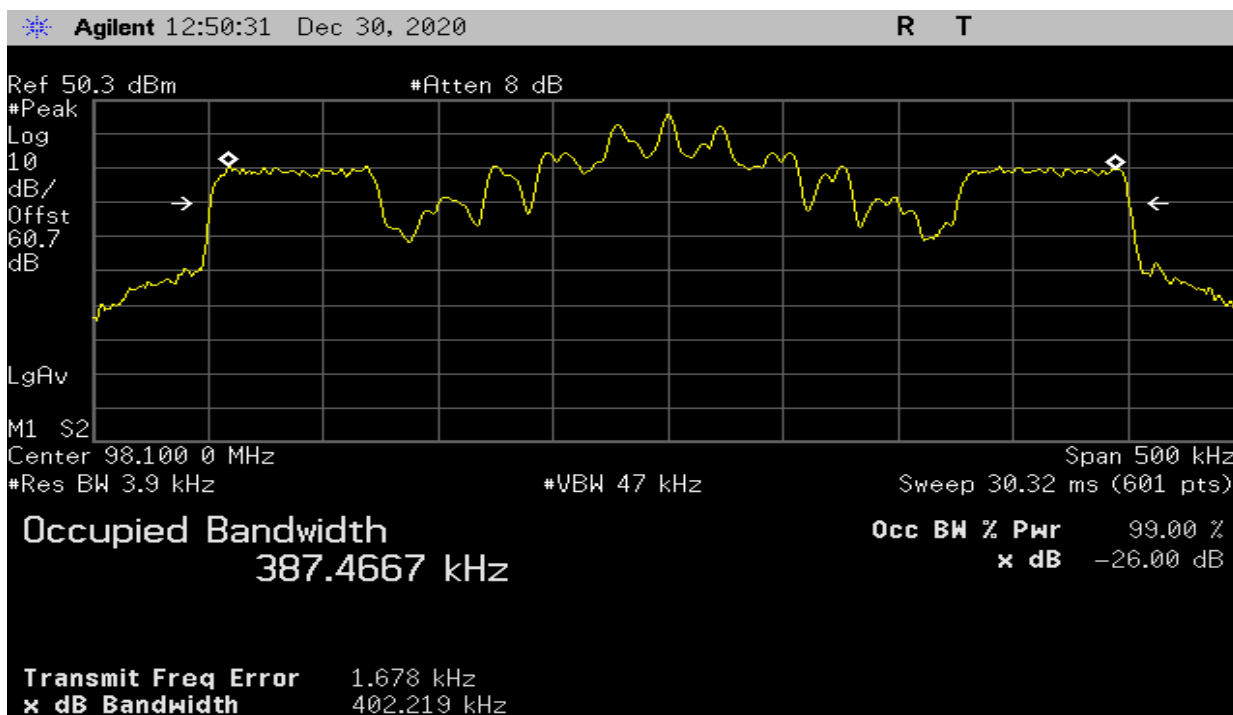


**Figure 3: Occupied Bandwidth Test Setup**

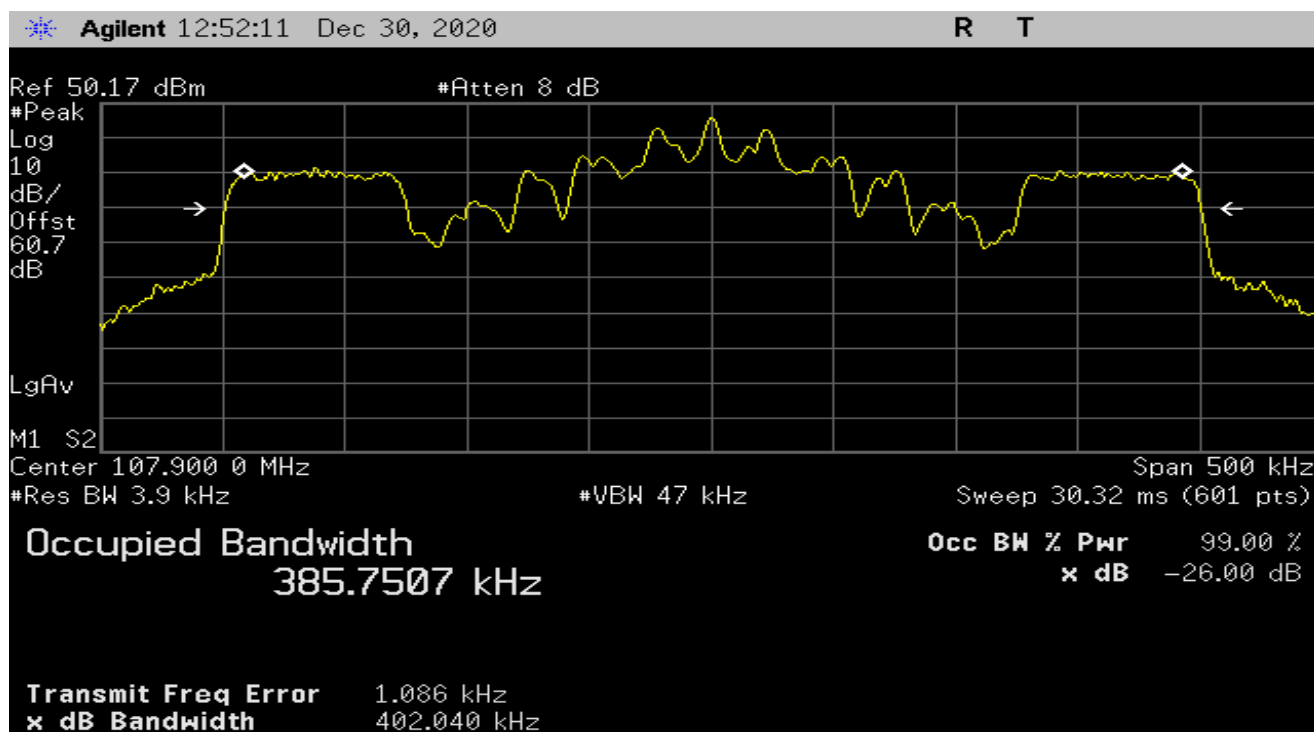
The following pages show measurements of Emission Mask plots:



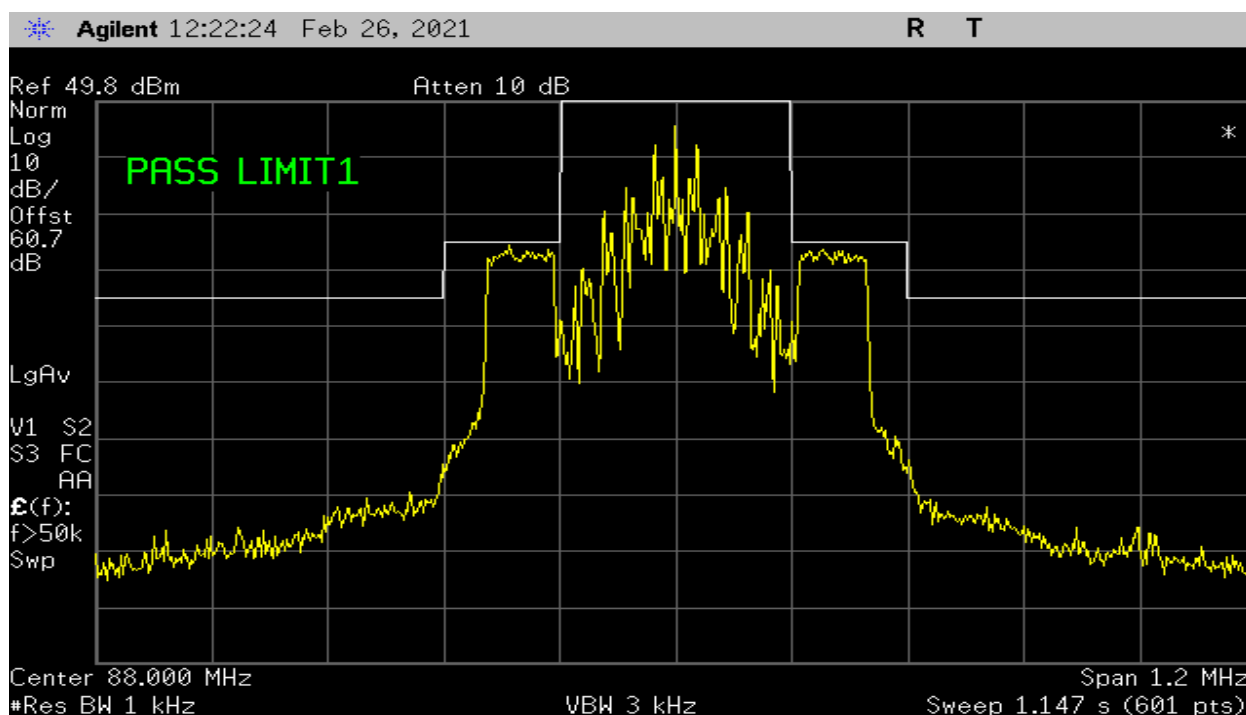
Plot 6 – Low Channel 15 kHz @ 85%



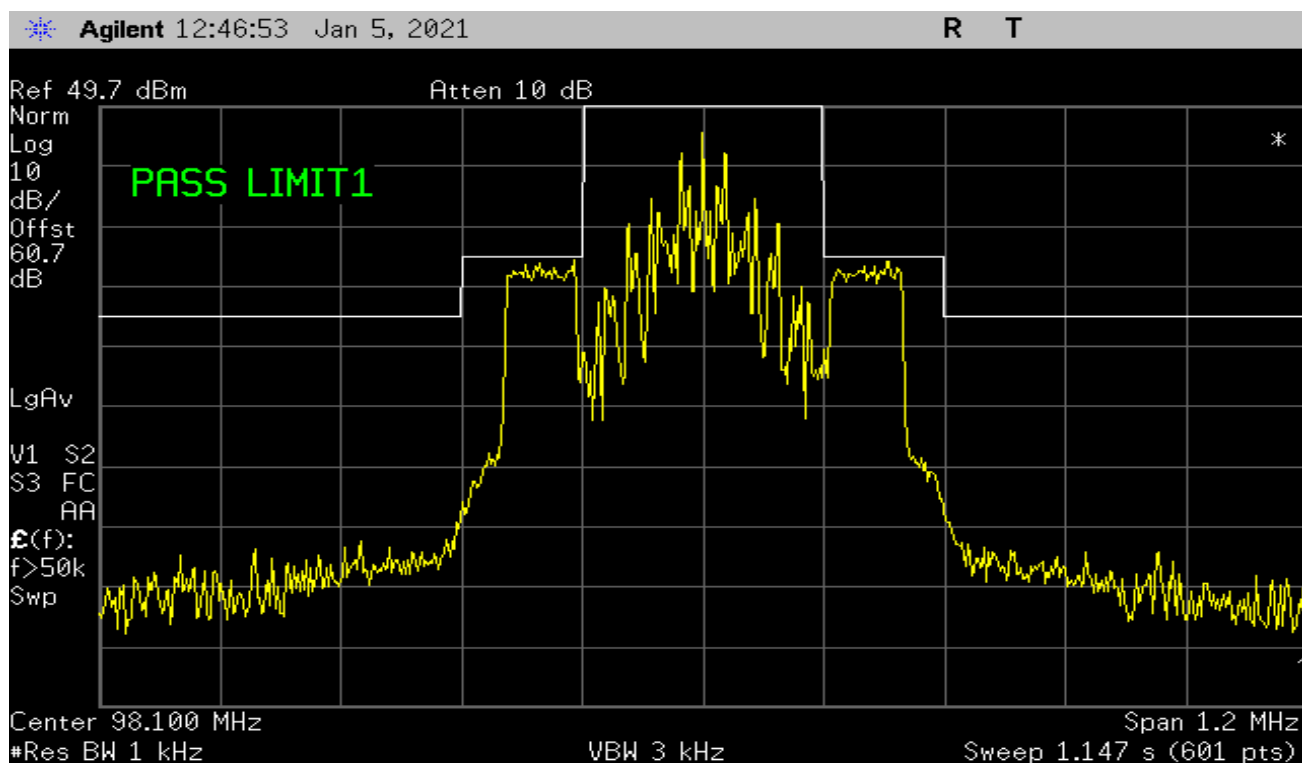
Plot 7 – Mid Channel 15 kHz @ 85%



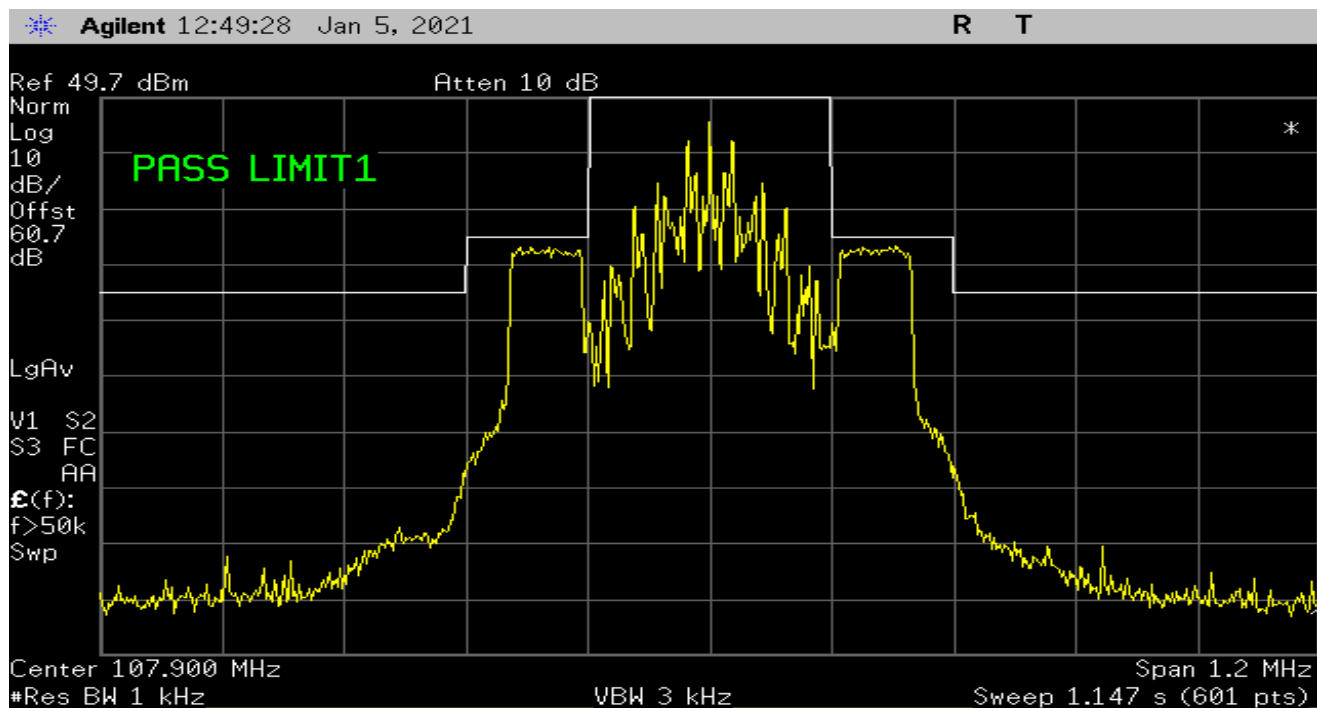
Plot 8 – High Channel 15 kHz @85%



Plot 9 – Low Channel



Plot 10 – Mid Channel



Plot 11 – High Channel

#### 4. Spurious Emissions at Antenna Terminals

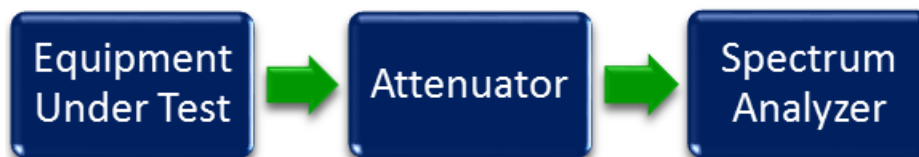
|                             |                               |                          |            |
|-----------------------------|-------------------------------|--------------------------|------------|
| <b>Test Requirement(s):</b> | §2.1051; §73.317 and §74.1236 | <b>Test Engineer(s):</b> | Sean E.    |
| <b>Test Results:</b>        | Pass                          | <b>Test Date(s):</b>     | 12/29/2020 |

##### Test Procedures:

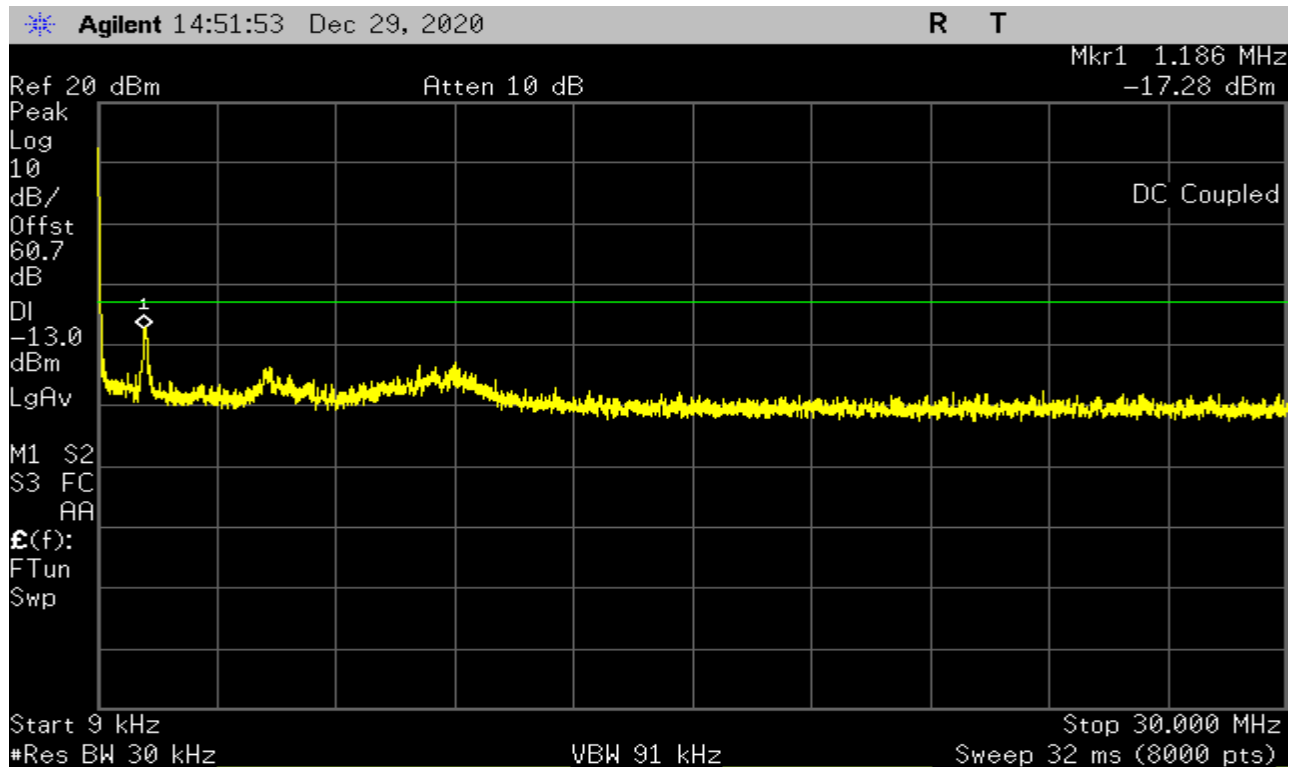
As required by 47 CFR 2.1051, spurious emissions at antenna terminal measurements were made at the RF output antenna terminal of the EUT.

Customer provided a test mode internal to the EUT to control the RF modulation, and frequency channel. The EUT was connected through an attenuator to a Spectrum Analyzer. The Spectrum Analyzer was set to sweep from 9kHz up to 10<sup>th</sup> harmonic of the fundamental or 40GHz whichever is the lesser. Measurements were made at the low, mid and high frequency of the transmit band.

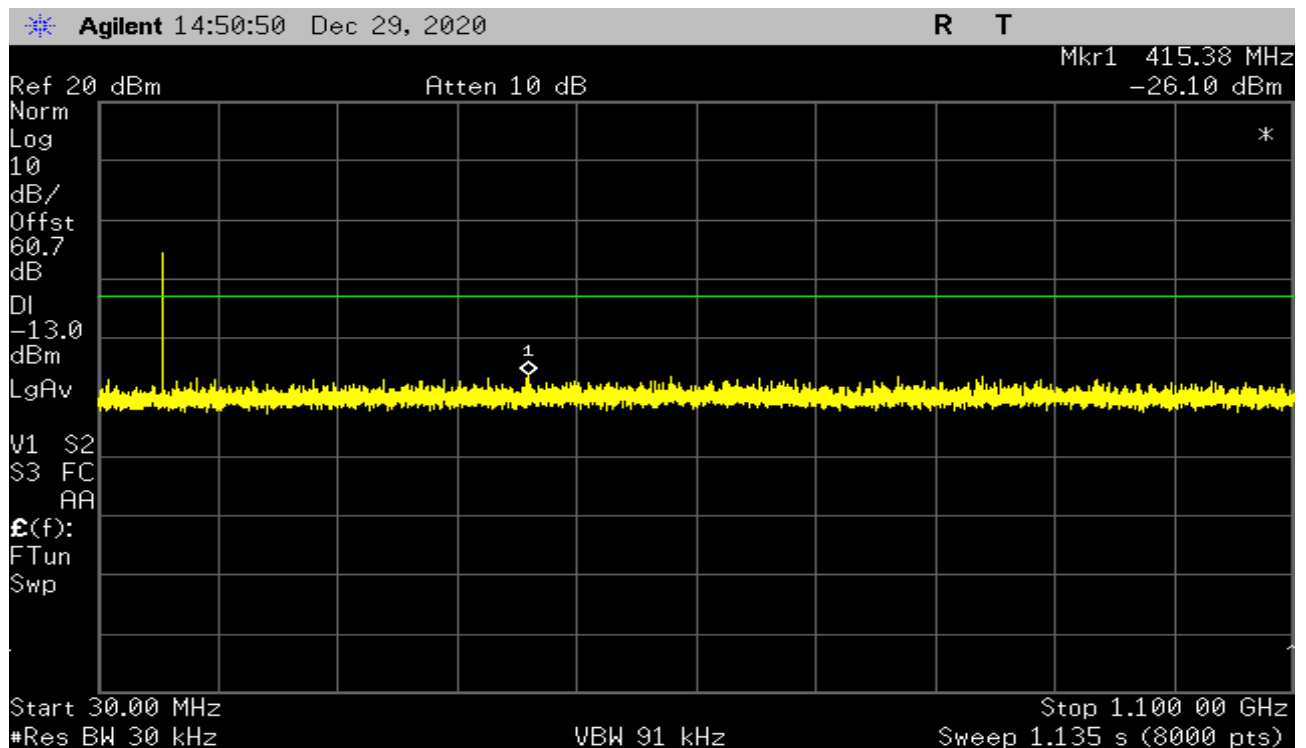
##### Test Setup:



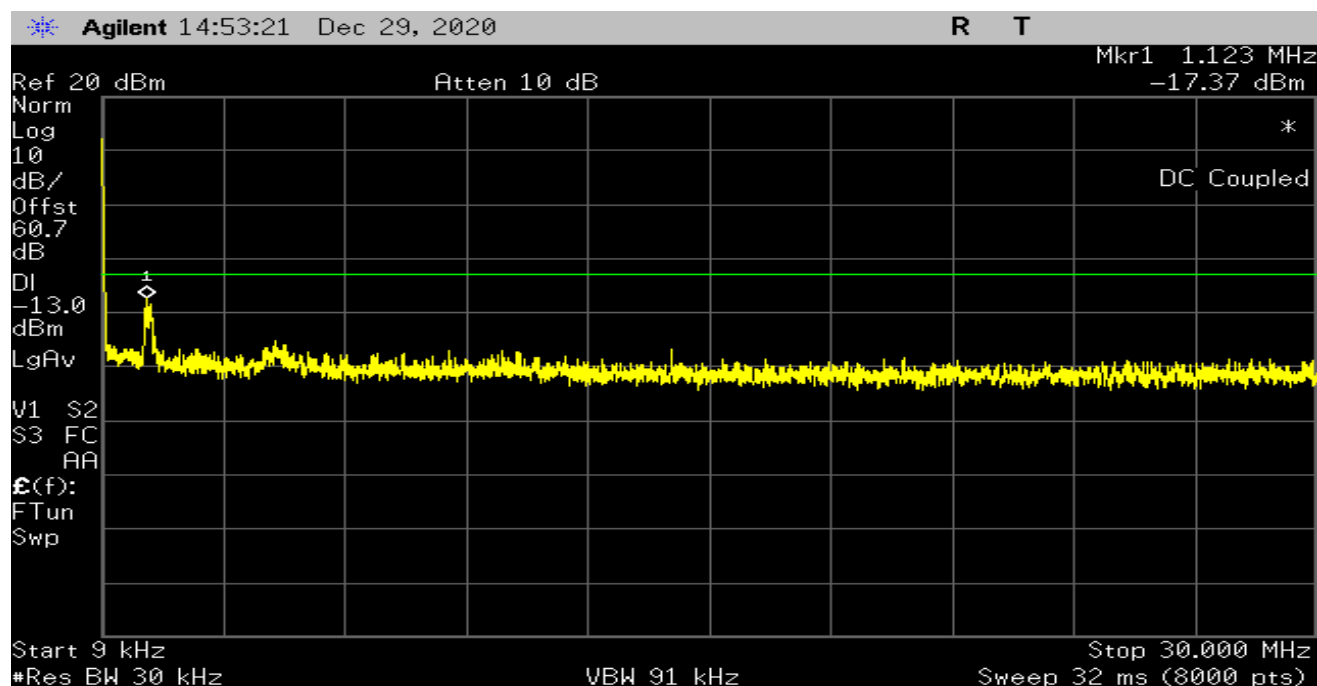
**Figure 4: Spurious Emission at Antenna Terminal Test setup**



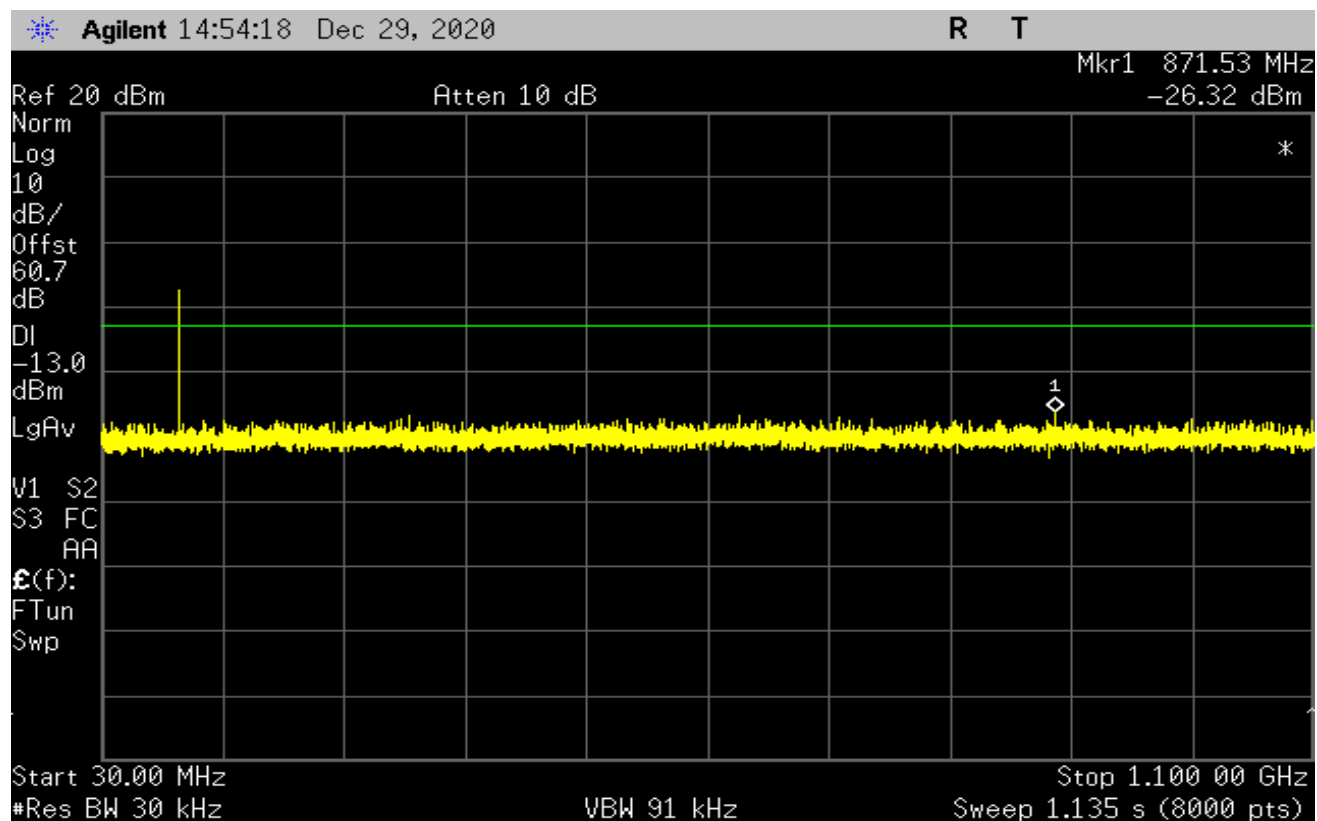
Plot 12 – Low Band



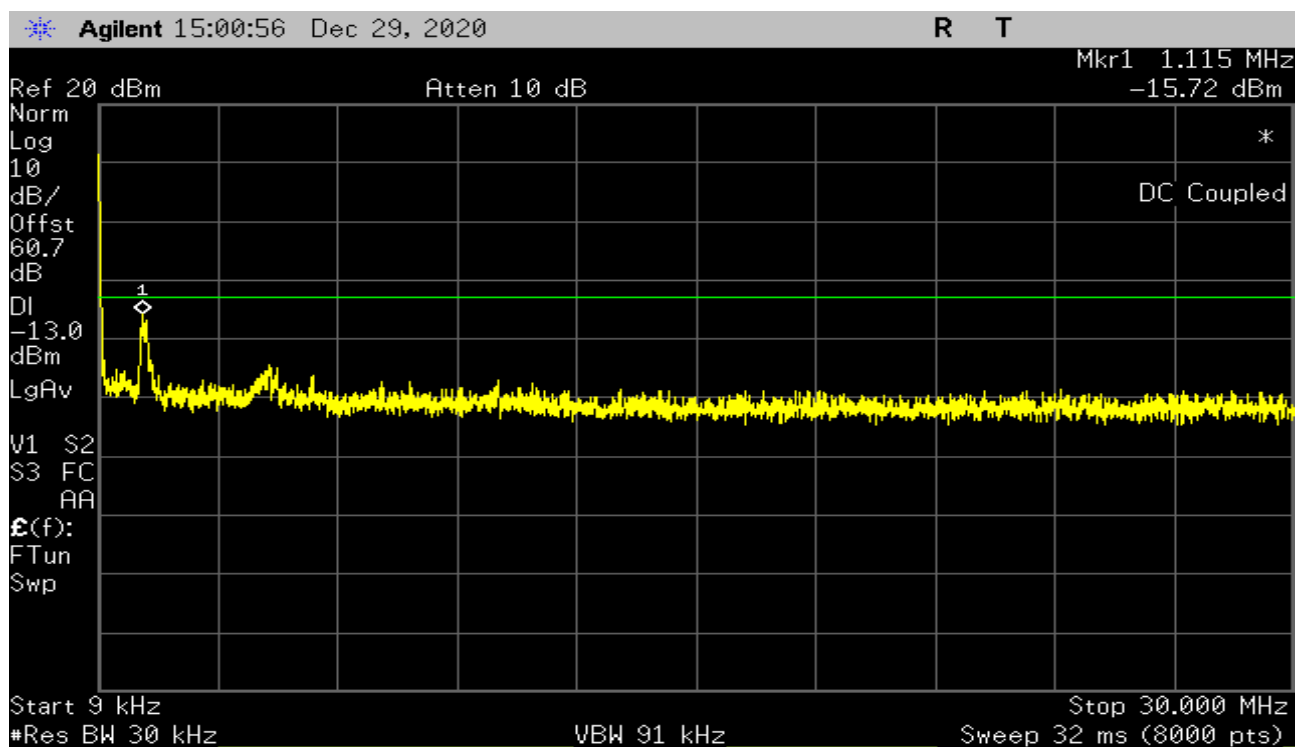
Plot 13 – Low Band



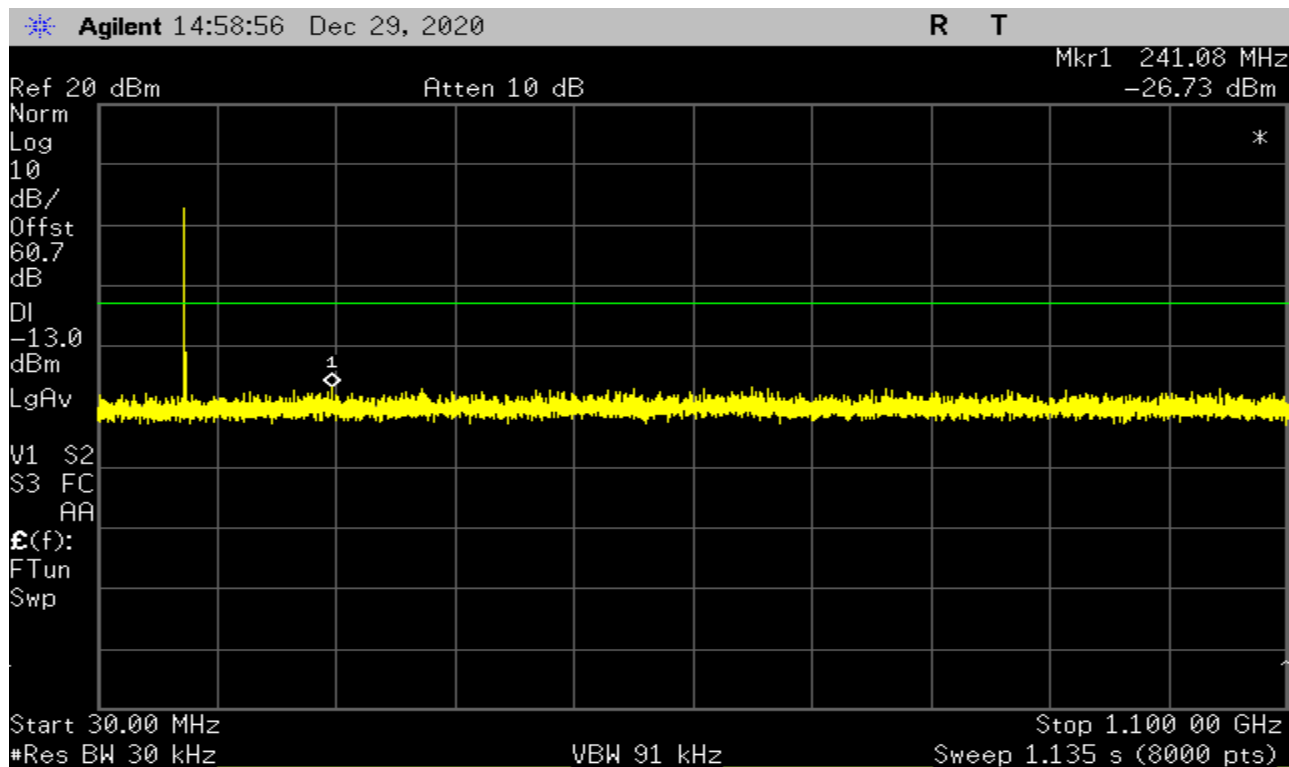
Plot 14 – Mid Band



Plot 15 – Mid Band



Plot 16 – High Band



Plot 17 – High Band

## 5. Radiated Spurious Emissions

|                             |                      |                          |            |
|-----------------------------|----------------------|--------------------------|------------|
| <b>Test Requirement(s):</b> | §2.1053 and §74.1236 | <b>Test Engineer(s):</b> | Sean E.    |
| <b>Test Results:</b>        | Pass                 | <b>Test Date(s):</b>     | 01/06/2021 |

**Test Procedures:** As required by 47 CFR 2.1053, field strength of radiated spurious measurements was made in accordance with the procedures of the ANSI C63.26-2015.

The EUT was placed on a wooden table inside a GTEM chamber. The EUT was transmitting into a 50Ω non-radiating load which was directly connected to the EUT antenna port.

The measurement antenna was set at 3 meters from the EUT. During the tests, EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3 orthogonal axis. The frequency range up to the 10<sup>th</sup> harmonic was investigated.

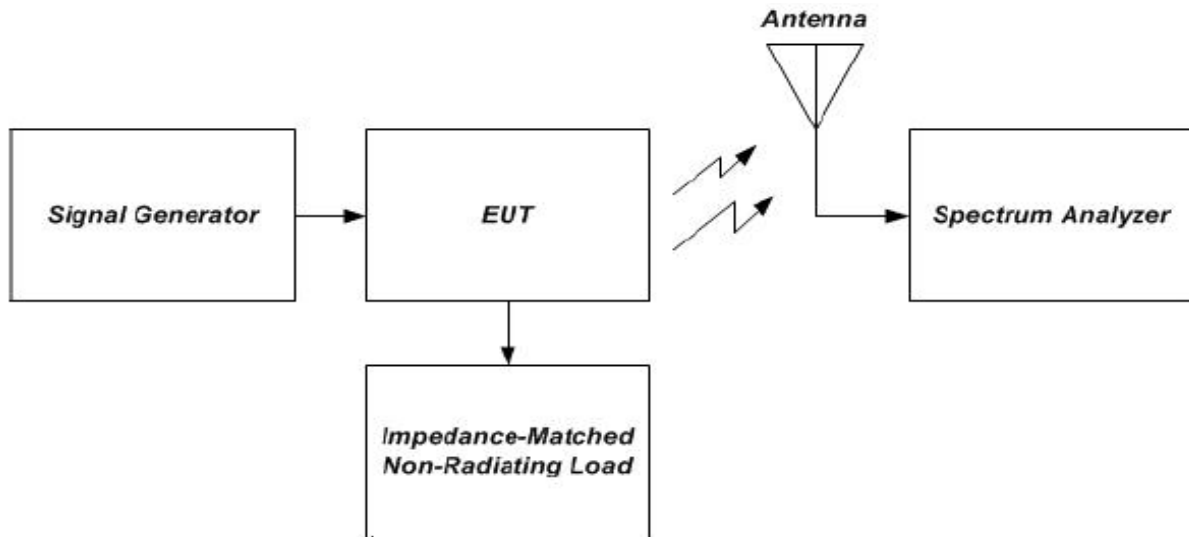
To get a maximum emissions level from the EUT, the EUT was rotated throughout the X-axis, Y-axis and Z-Axis. Worst case is X-

| Frequency Range  | Detector Setting | Resolution Bandwidth | Video Bandwidth           | Span         |
|------------------|------------------|----------------------|---------------------------|--------------|
| 30MHz – 1000 MHz | Peak             | 120kHz               | As Specified in §15.35(c) | Zero         |
| 1000 MHz – 5GHz  | Peak             | 1MHz                 | 1MHz                      | As necessary |
| 1000 MHz – 5GHz  | Average          | 1MHz                 | 10Hz                      | 0 Hz         |

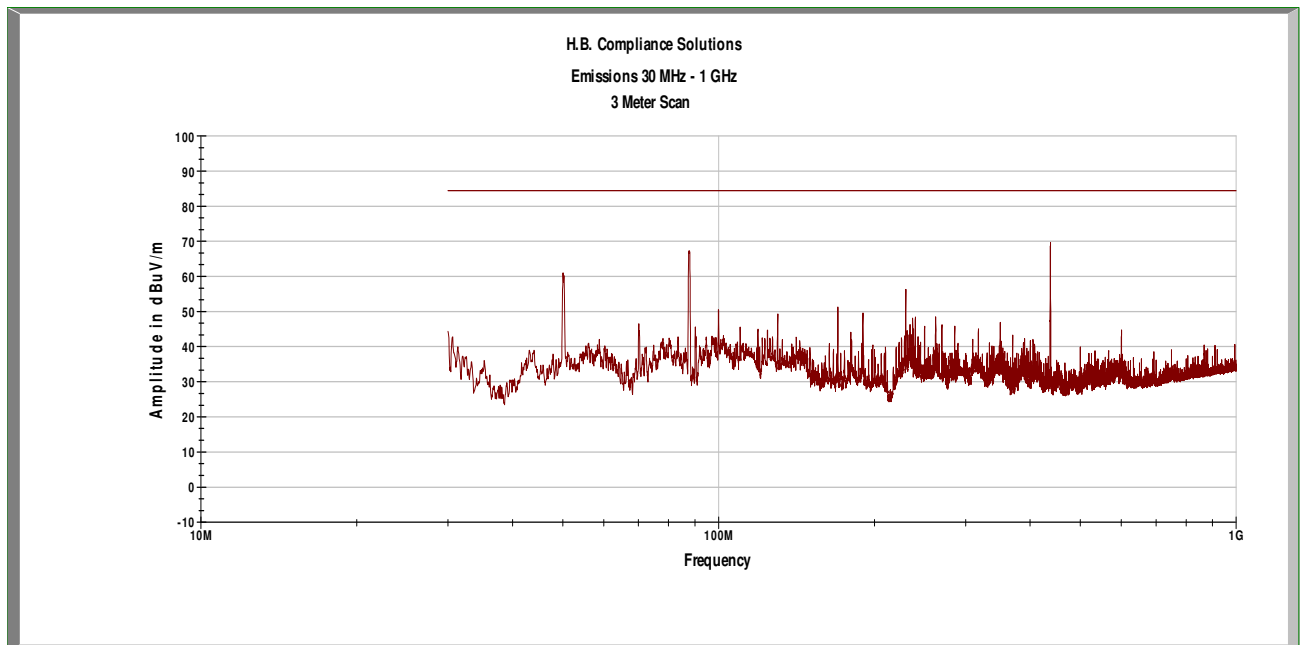
**Table 5. Analyzer Settings**

**Limit:** Any emissions appearing on a frequency removed from the carrier by more than 600kHz must be attenuated at least  $43 + 10\log_{10}$  (Power, in watts) dB below the level of the unmodulated carrier, or 80dB, whichever is the lesser attenuation.

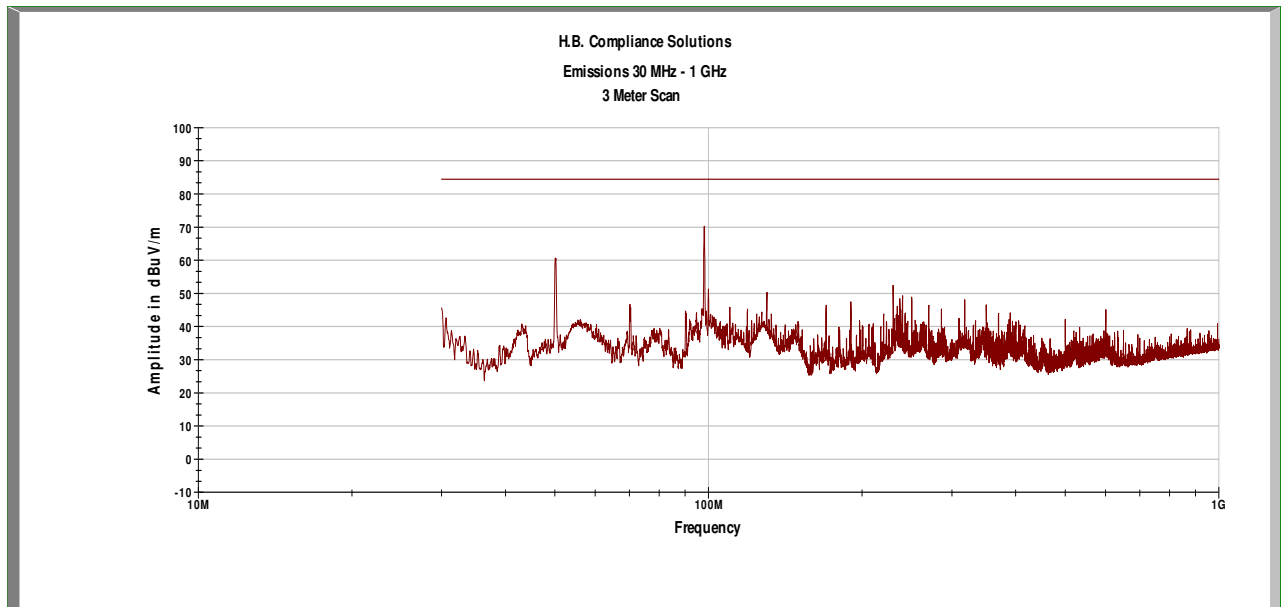
**Test Setup:**



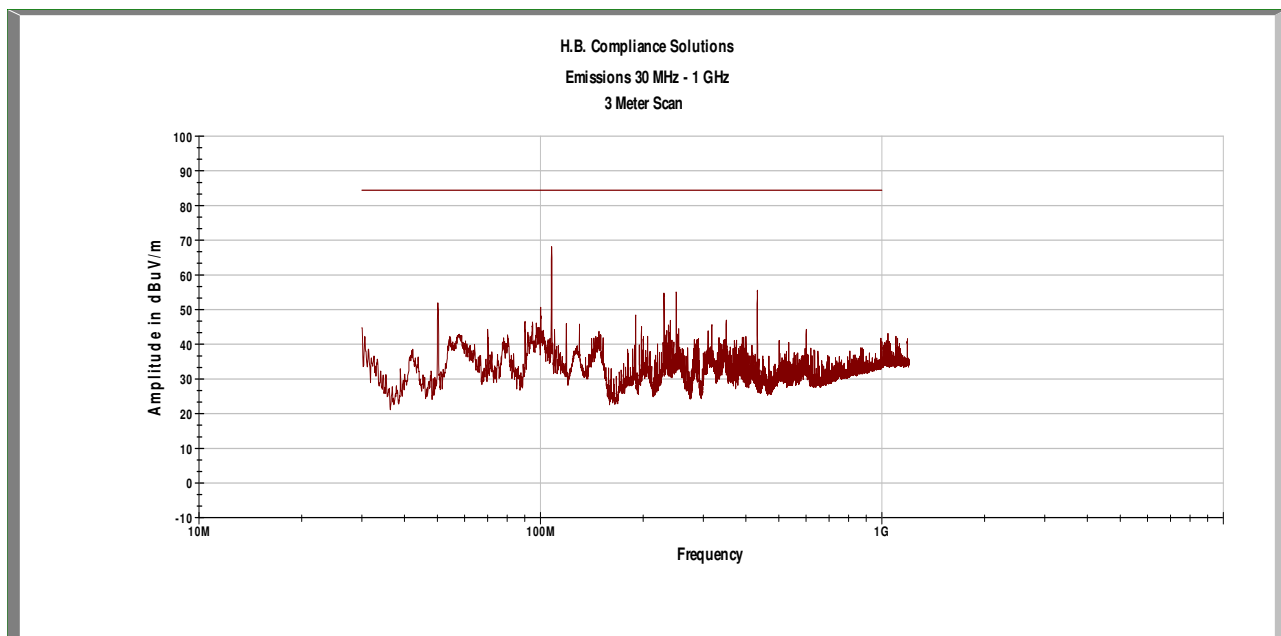
**Figure 5 – Radiated Spurious Emissions**



**Plot 18 – Low Band**



**Plot 19 – Mid Band**



**Plot 20 – High Band**

## Test Results:

| Frequency (MHZ) | Peak Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------------------|----------------|-------------|
| 50.11           | 61.0                    | 84.38          | -23.38      |
| 175.04          | 38.8                    | 84.38          | -45.58      |
| 230.01          | 56.3                    | 84.38          | -28.08      |
| 262.67          | 48.4                    | 84.38          | -35.98      |
| 350.1           | 46.8                    | 84.38          | -37.58      |
| 437.59          | 69.7                    | 84.38          | -14.68      |

Table 5 - Spurious Radiated Emission Data – Low Band

| Frequency (MHZ) | Peak Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------------------|----------------|-------------|
| 50.24           | 60.6                    | 84.38          | -23.78      |
| 130.10          | 50.1                    | 84.38          | -34.28      |
| 190.18          | 47.4                    | 84.38          | -36.98      |
| 230.01          | 52.3                    | 84.38          | -32.08      |
| 390.13          | 44.0                    | 84.38          | -40.38      |
| 586.84          | 37.0                    | 84.38          | -47.38      |

Table 6 – Spurious Radiated Emission Data – Mid Band

| Frequency (MHZ) | Peak Amplitude (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------------------|----------------|-------------|
| 50.03           | 51.9                    | 84.38          | -32.48      |
| 230.07          | 54.1                    | 84.38          | -30.28      |
| 249.96          | 55.2                    | 84.38          | -29.18      |
| 431.82          | 55.4                    | 84.38          | -28.98      |
| 533.61          | 40.4                    | 84.38          | -43.98      |
| 600.3           | 44.2                    | 84.38          | -40.18      |

Table 7 – Spurious Radiated Emission Data – High Band

**Note:** ERP Limit = -13dBm which converts to 84.38dBuV/m @ 3meter

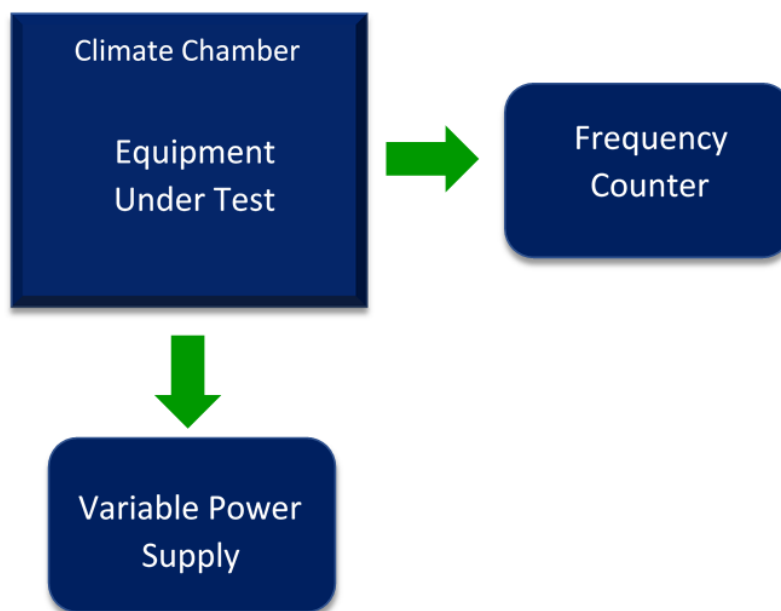
## 6. Frequency Stability vs Temperature

|                             |                                   |                          |            |
|-----------------------------|-----------------------------------|--------------------------|------------|
| <b>Test Requirement(s):</b> | §2.1055; §73.1545(b) and §74.1261 | <b>Test Engineer(s):</b> | Jerry M.   |
| <b>Test Results:</b>        | Pass                              | <b>Test Date(s):</b>     | 01/11/2021 |

**Test Procedures:** As required by 47 CFR 2.0155, Frequency Stability measurements were made at the RF antenna output terminals of the EUT.

The EUT was placed in an Environmental Chamber with all the support equipment outside the chamber. The EUT was set to transmit a modulated carrier. The reference frequency at 20°C was observed and noted down. The frequency drift was investigated for every 10°C increment until the unit was stabilized then recorded the reading in tabular format with the temperature range of -30°C to 50°C.

### Test Setup:

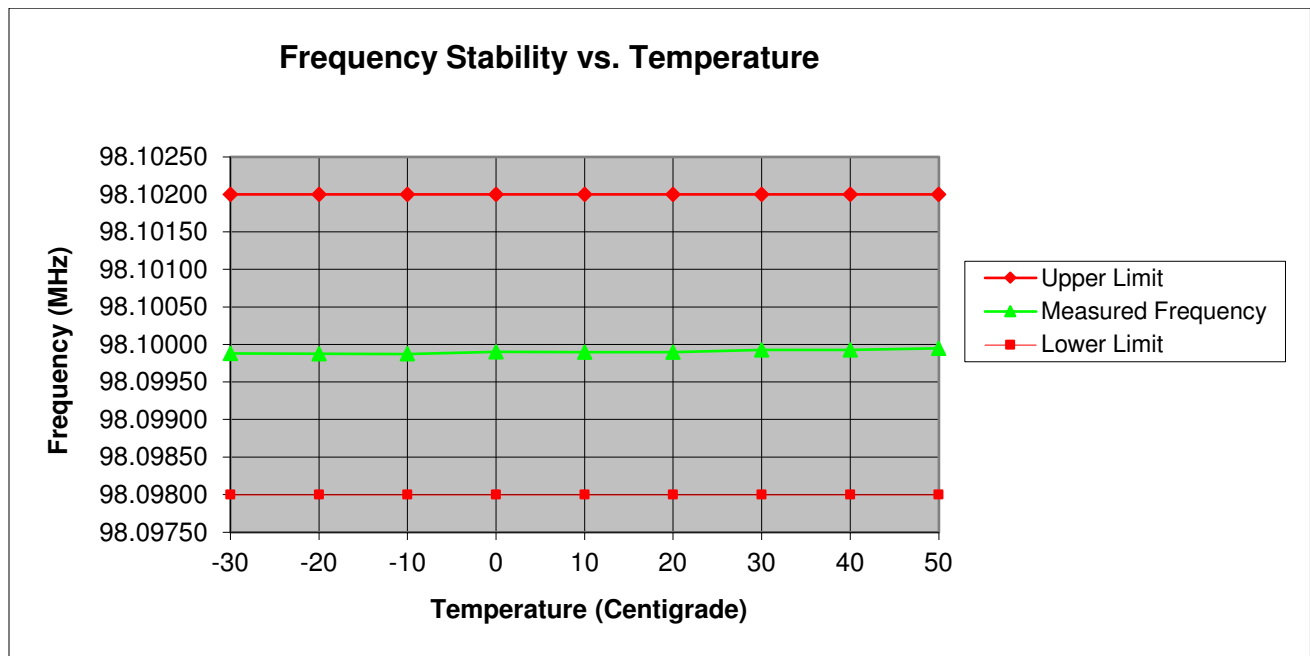


**Figure 6 – Frequency Stability Test Setup**

## Test Results:

| Temperature centigrade | Measured Frequency (MHz) | Upper Margin (MHz) | Lower Margin (MHz) | Limit |
|------------------------|--------------------------|--------------------|--------------------|-------|
| -30                    | 98.0998800               | -0.00212           | 0.00188            | ±2kHz |
| -20                    | 98.0998770               | -0.00212           | 0.00188            | ±2kHz |
| -10                    | 98.0998740               | -0.00213           | 0.00187            | ±2kHz |
| 0                      | 98.0999030               | -0.00210           | 0.00190            | ±2kHz |
| 10                     | 98.0998970               | -0.00210           | 0.00190            | ±2kHz |
| 20                     | 98.0998990               | -0.00210           | 0.00190            | ±2kHz |
| 30                     | 98.0999250               | -0.00207           | 0.00192            | ±2kHz |
| 40                     | 98.0999260               | -0.00207           | 0.00193            | ±2kHz |
| 50                     | 98.0999490               | -0.00205           | 0.00195            | ±2kHz |

**Table 8 – Temperature vs Frequency Test Result**



**Plot 21 – Temperature vs Frequency**

## 7. Frequency Stability vs Voltage

|                             |                                   |                          |             |
|-----------------------------|-----------------------------------|--------------------------|-------------|
| <b>Test Requirement(s):</b> | §2.1055; §73.1545(b) and §74.1261 | <b>Test Engineer(s):</b> | Jerry Mejak |
| <b>Test Results:</b>        | Pass                              | <b>Test Date(s):</b>     | 01/11/2021  |

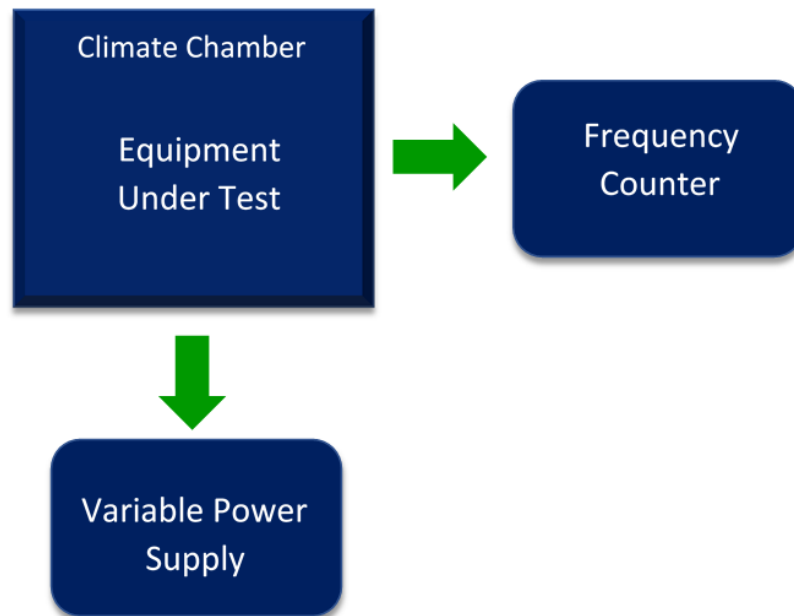
**Test Procedures:** As required by 47 CFR 2.0155, Frequency Stability measurements were made at the RF antenna output terminals of the EUT.

The EUT was connected to a variable AC source. The frequency was measured at both the nominal 230Vac of the EUT and at the extreme lower and upper voltages.

With the voltage set to a measurement point, the transmitted signal was captured by the spectrum analyzer and the frequency value determined. The frequencies are compared to the tuned frequency. All data for these measurements are found in the table 9.

**Reference Frequency: 98.1MHz at 230Vac at 20°C**

**Test Setup:**

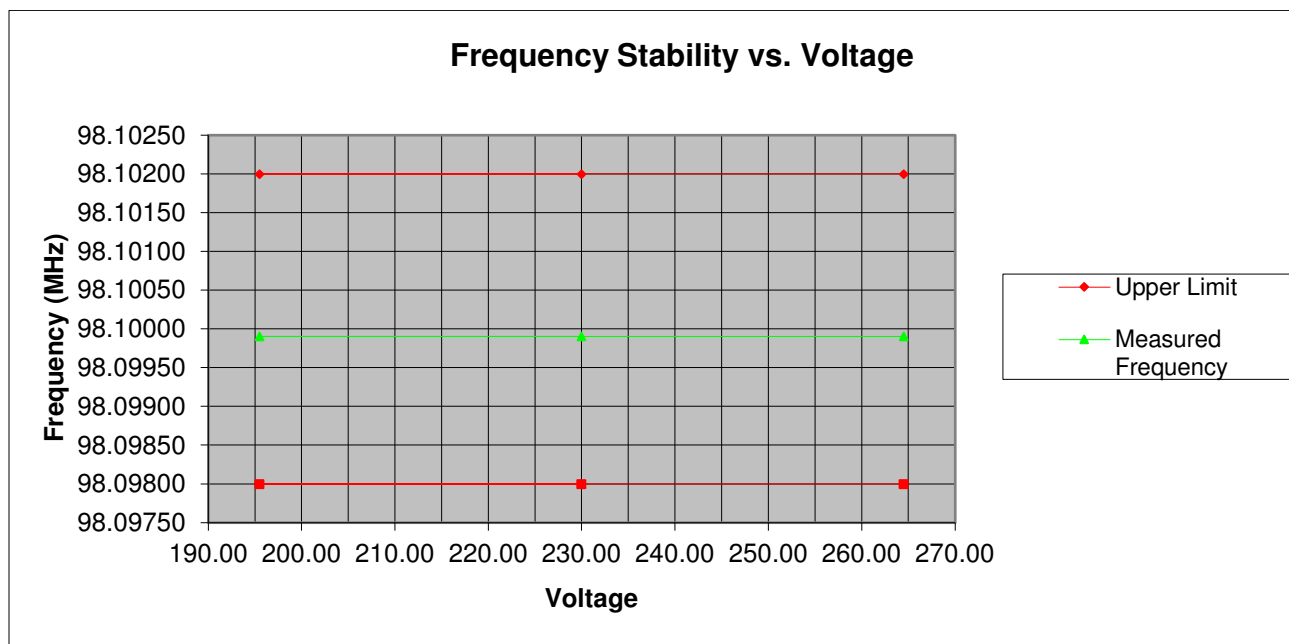


**Figure 7 – Frequency Stability Test Setup**

## Test Results:

| Input Voltage (Vdc) | Measured Frequency (MHz) | Upper Margin (MHz) | Lower Margin (MHz) |
|---------------------|--------------------------|--------------------|--------------------|
| 230.00              | 98.099905                | -0.00209           | 0.00191            |
| 195.50              | 98.099905                | -0.00209           | 0.00191            |
| 264.50              | 98.099904                | -0.00210           | 0.00190            |

**Table 9. Temperature vs. Voltage Test Result**



**Plot 22 – Temperature vs Voltage**

## 8. Necessary Bandwidth

Referencing Part 2.202 of the FCC Rules and Regulation and using the following formula for calculating the Necessary Bandwidth for Sound broadcasting

$$B = 2M + 2DK$$

Where M = Baud Rate, D = Deviation and K= Constant

### Calculation

$$M = 15K$$

$$\text{Peak Deviation of Carrier (D)} = 75\text{kHz}$$

$$K = 1$$

$$B_n = 2(15\text{kHz}) + 2(75\text{kHz}) (1) = 390\text{kHz}$$

**Emission Designator: 390KF3E**

## 9. Test Equipment

| Equipment              | Manufacturer    | Model         | Serial #   | Last Cal Date | Cal Due Date |
|------------------------|-----------------|---------------|------------|---------------|--------------|
| Digital Multimeter     | Fluke           | 77 III        | 72550270   | Apr-10-20     | Apr-10-21    |
| Spectrum Analyzer      | Agilent         | E4443A        | US41420164 | Jan/03/20     | Feb/03/21    |
| Temperature Chamber    | Test Equity     | 1207C         | 60161      | Aug/31/20     | Aug/31/21    |
| Antenna                | EMCO            | GTEM 5417     | 1063       | Verified      |              |
| Spectrum Analyzer      | Hewlett Packard | 8563E         | 3821A09316 | May/01/20     | May/01/21    |
| Modulation Analyzer    | Hewlett Packard | 8901B         | 2806A01528 | Aug/24/20     | Aug/24/21    |
| Function Generator     | Wavetek         | 145           | L6610707   | Verified      |              |
| Band Stop Filter       | Mini-Circuits   | ZX7BS-88108S+ | None       | Verified      |              |
| EMI Receiver           | Hewlett Packard | 8566B         | 2747A05264 | Nov/20/21     | Nov/20/21    |
| Attenuator 30dB        | Weinschel       | 33-30-34      | 8F1679     | Verified      |              |
| Diode/Crystal Detector | H.P.            | 8470B         | None       | Verified      |              |
| Combiner/Splitter      | Mini-Circuits   | ZFSC-2-2      | None       | Verified      |              |

**Table 11 – Test Equipment List**

**\*Statement of Traceability:** Test equipment is maintained and calibrated on a regular basis. All calibrations have been performed by a 17025 accredited test facility, traceable to National Institute of Standards and Technology (NIST)

## 10. Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. These measurements figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2. Instrumentation measurement uncertainty has **not** been taken into account to determine compliance.

The following measurement uncertainty values have been calculated as show in the table below:

| Measured Parameter             | Measurement Unit | Frequency Range | Expanded Uncertainty |
|--------------------------------|------------------|-----------------|----------------------|
| Conducted Emissions (AC Power) | dBuV or dBuA     | 150kHz – 30MHz  | ± 4.3dB              |
| RF Power, Conducted            | dBm              | 150kHz – 18GHz  | ± 0.2dB              |
| Radiated Emissions below 1GHz  | dBuV/m           | 30 – 1000MHz    | ± 5.6dB              |
| Radiated Emissions above 1GHz  | dBuV/m           | 1 – 26.5GHz     | ± 4.1dB              |

The reported expanded uncertainty has been estimated at a 95% confidence level (k=2)

## **END OF TEST REPORT**