



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: JAssy

Model: Visum Monitor

Description: Wireless Visum Fertilizer monitor

Serial Number: v.2.0

FCC ID: 2AD66-RF2401F20

IC ID: 21278-RF2401F20

To

FCC Part 15.249

RSS 210 Issue 8

Date of Issue: November 21, 2019

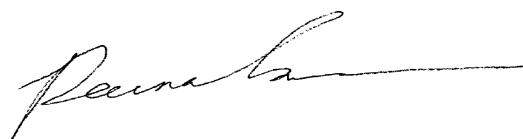
On the behalf of the applicant:

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Poona Saber
Project Test Engineer

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All results contained herein relate only to the sample tested.



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	November 21, 2019	Poona Saber	Original Document
2.0	March 25, 2020	Poona Saber	Added radiated spurious emission 18-26 GHz Added RSS 102



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Compliance Testing, LLC

Testing since 1963

ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A



The applicant has been cautioned as to the following

15.21: Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10:2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (mbar)
18-26	26-38	976.7 – 980.9

EUT Description

Model: Visum Monitor

Description: Wireless Visum fertilizer monitor

Software: v. 4.4

Additional Information:

The device is a monitor used to monitor and track the fertilizer and grains flow in agriculture lines. It communicates at 2.4 GHz with the flow sensors indicating the presence or absence of the flow. Its connected with a power cable to 12 or 24 DC voltage source.

It contains a following FCC and IC IDs respectively:

2AD66-RF2401F20 and 21278-RF2401F20.

It utilizes GFSK modulation and has an omni directional antenna of 5 dBi gain and SMA connector. Testing have been done to show compliance of the previously certified module with new antenna to the respective rule parts.

EUT Operation during Tests

Unit is put into B4 mode where it operates in Pseudo-random bit sequence mode continuously sending bursts of PRBS messages, so the product stays the maximum amount of time transmitting packages. Unit is put on low, mid and high channel from 2405-2478 MHz.



Accessories:

Qty	Description	Manufacturer	Model	S/N
	None			

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	Power Cable	<3	Y	N	DC power supply

Modifications: None

15.203: Antenna Requirement:

The antenna is permanently attached to the EUT

The antenna uses a unique coupling

The EUT must be professionally installed

The antenna requirement does not apply



Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.249(a) RSS 210 B.10	Fundamental Field Strength	Pass	
15.249(d) RSS 210 B.10	Out of Band Spurious Emissions and Band Edge	Pass	
15.249(d),15.205 RSS-Gen	Restricted out of band emissions and restricted Band Edge	Pass	
15.215 (c) RSS-GEN 6.7	Occupied Bandwidth	Pass	



Fundamental Field Strength

Engineer: Poona Saber

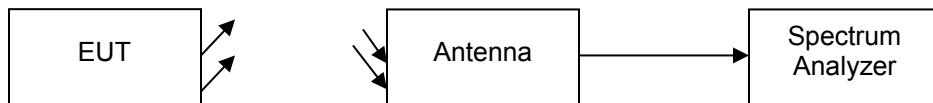
Test Date: 11/19/19

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength.

The peak of fundamental and duty cycle of the emission were measured per Ansi C63.10 6.6 and 7.5. Average measurement is calculated by adding the $20 \log(\text{duty cycle})$ to the peak measurement as shown below.

Test Setup



Spectrum Analyzer Settings

Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As Necessary
Average	1 MHz	3 Mhz	As Necessary
Quasi – Peak	120 kHz	300 kHz	As Necessary

Sample Calculations:

Correction Factors include Antenna correction factor, amplifier gain and cable insertion loss.

Measured Level includes correction factors that were entered into the spectrum analyzer before recording test data.



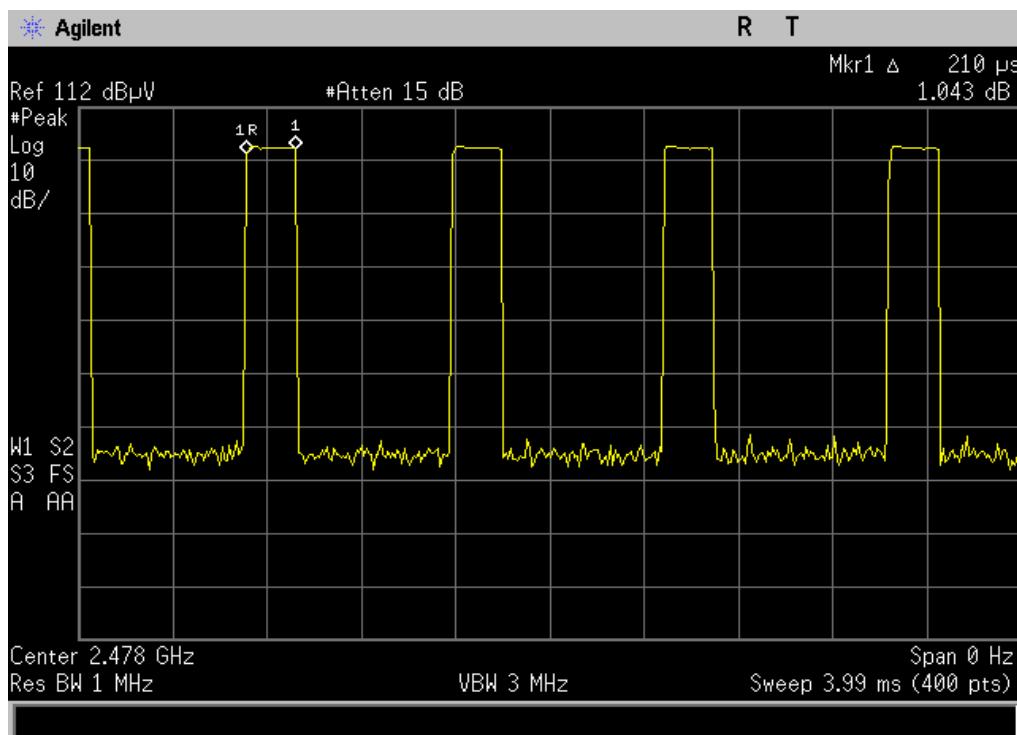
Fundamental Field Strength

Tuned Frequency (MHz)	Peak Measured Level (dBuV/m)	Peak Limit (dBuV/m)	Result
2405	104.6	114.0	Pass
2439	104.3	114.0	Pass
2478	104.7	114.0	Pass

Tuned Frequency (MHz)	Peak Measured Level (dBuV/m)	Duty Cycle (Numeric)	Duty Cycle (dB)	Average Measured Level (dBuV/m)	Average Limit (dBuV/m)	Result
2405	104.6	0.23	-12.66	91.94	94.0	Pass
2439	104.3	0.23	-12.66	91.64	94.0	Pass
2478	104.7	0.23	-12.66	92.04	94.0	Pass

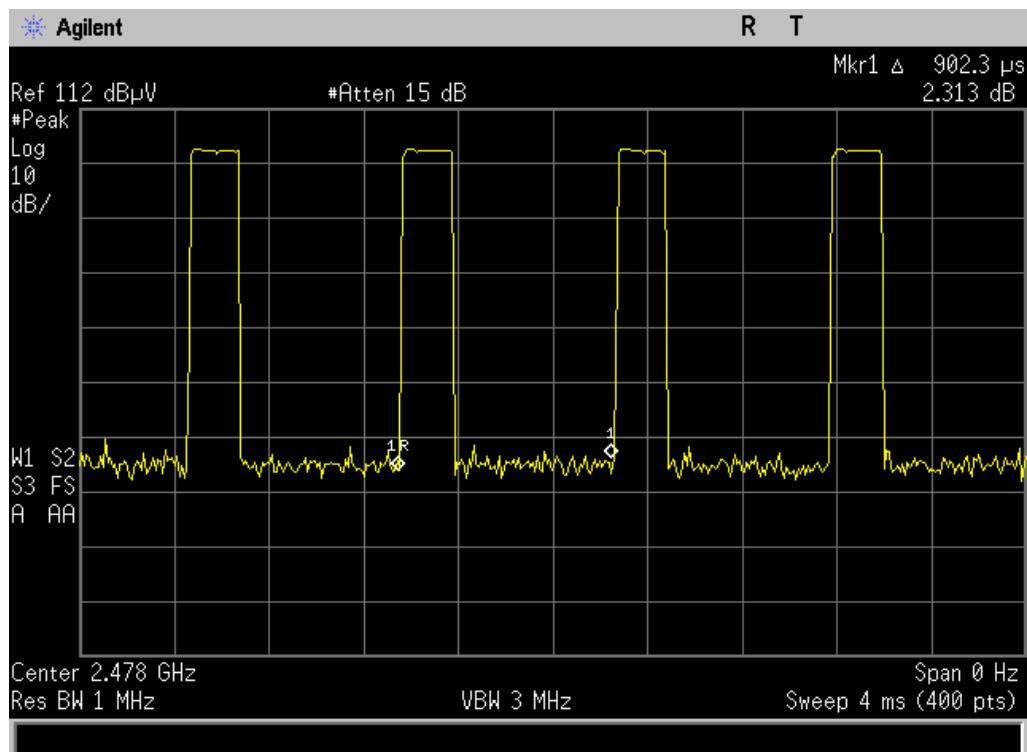
Plots

Duty Cycle On time

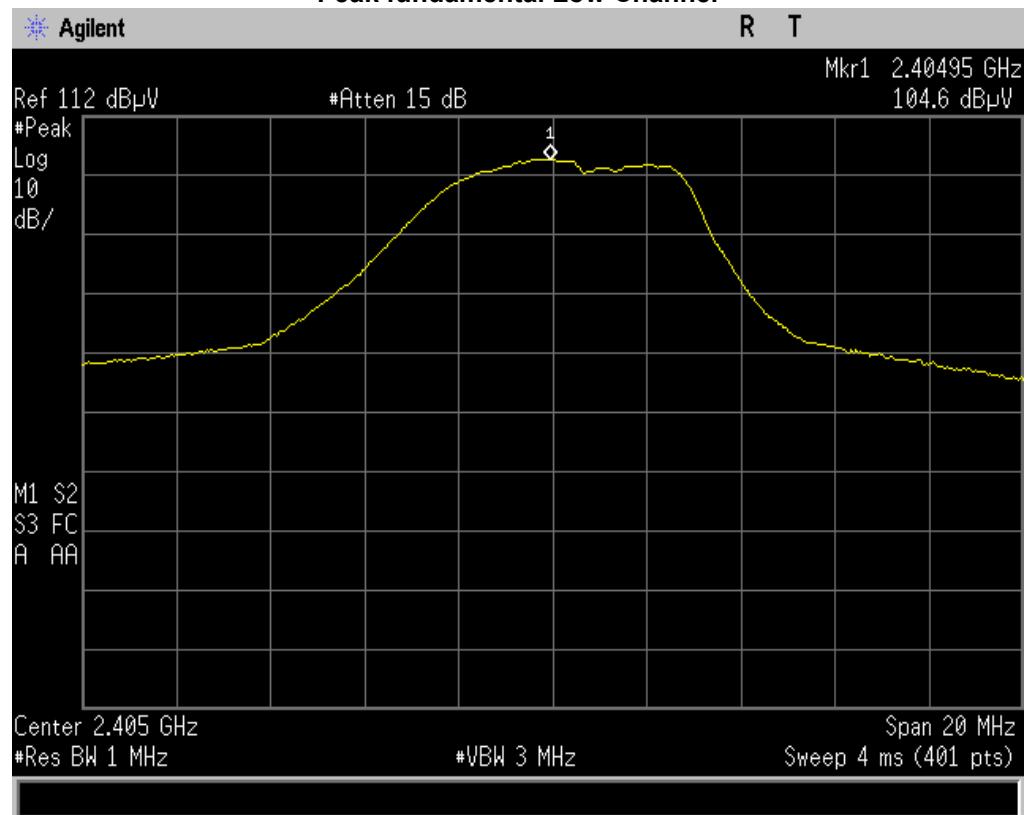




Duty Cycle On + OFF time

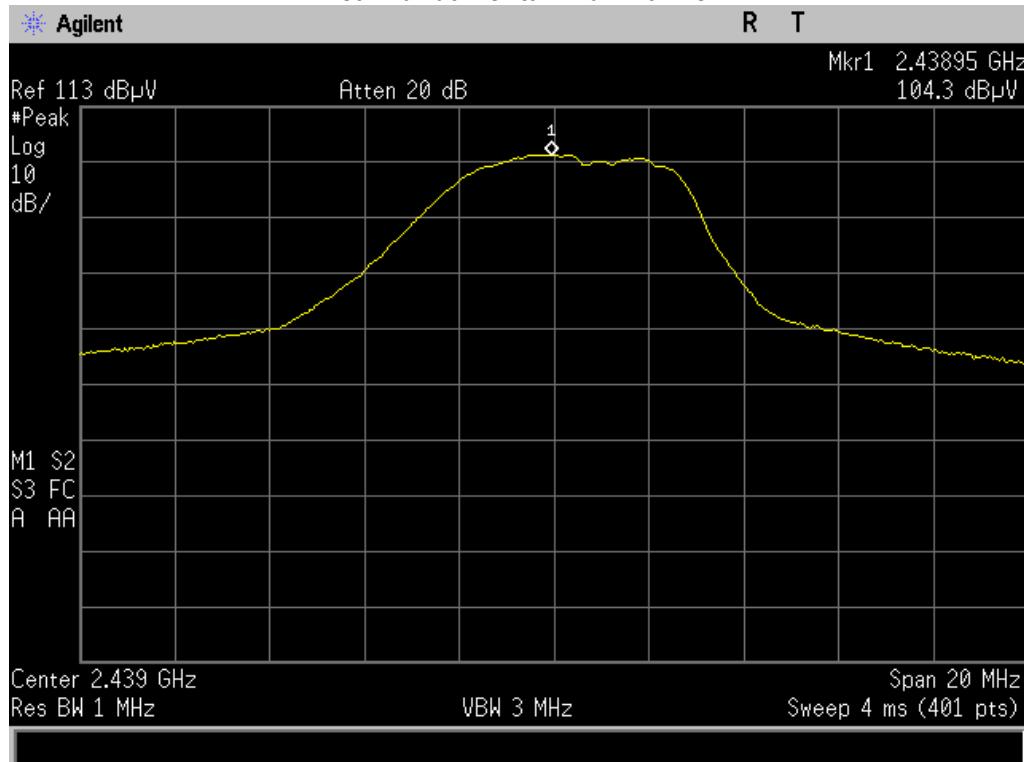


Peak fundamental Low Channel

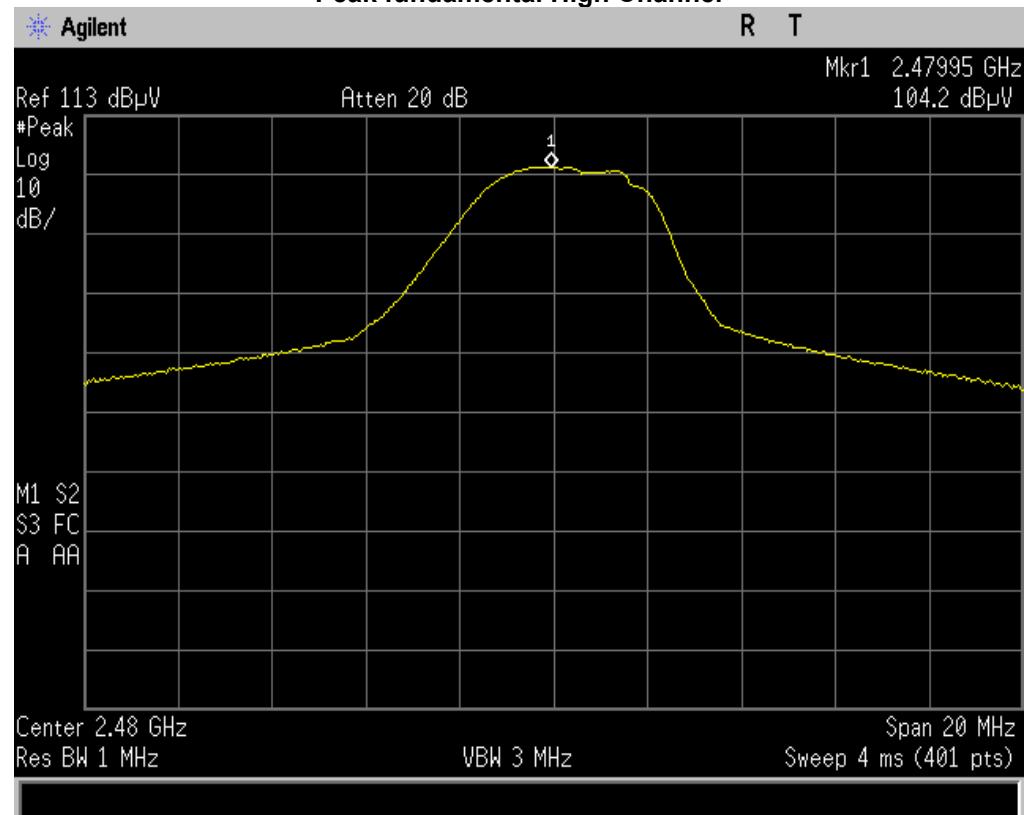




Peak fundamental Mid Channel



Peak fundamental High Channel





Radiated Spurious Emissions

Engineer: Poona Saber

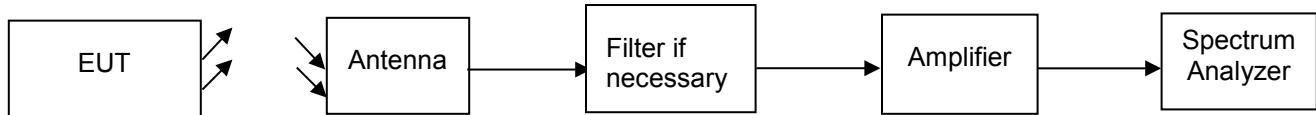
Test Date: 11/20/19

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The spectrum for each tuned frequency was examined to the 10th harmonic. In addition, plots of the radiated spurious emissions at the operating band edges are provided to verify compliance.

Field strength of Harmonics shall be 68 dBuV/m and other emissions radiated outside of the frequency band shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emissions limits in 15.209 whichever is lesser attenuation.

Test Setup



Analyzer Settings

Detector Settings	RBW	VBW	Span
Peak	1 MHz	3 MHz	As Necessary
Average	1 MHz	3 MHz	As Necessary

Sample Calculations:

Correction Factors include Antenna and cable insertion loss correction factors.

Measured Level includes correction factors that were input to the spectrum analyzer before recording test data

See Annex A for Radiated emissions Plots



Out of band and restricted band edge

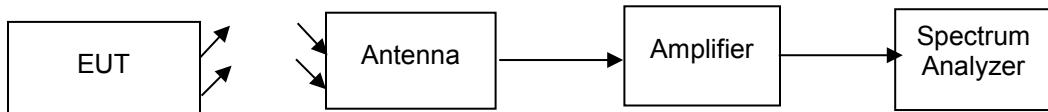
Engineer: Poona Saber

Test Date: 11/20/19

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meters from the receiving antenna. Bandedge measurements were made for both 15.205 restricted band of 2310-2390 MHz plus 2483.5-2500 MHz and band edges of the 2400-2483.5 MHz frequency band per 15.209 general limits.

Test Setup



Fundamental measurements

Tuned Frequency (MHz)	Peak Measured Level (dBuV/m)	Average Measured Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
2405	104.6	91.94	114.0	94	Pass
2478	104.7	92.04	114.0	94	Pass

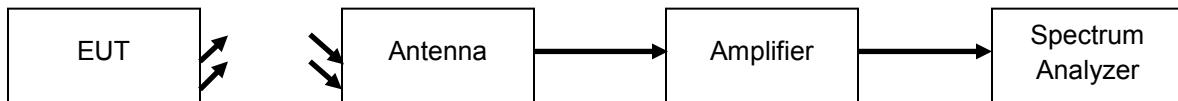
Authorized Band edge measurements

Tuned Frequency (MHz)	Peak fundamental (dBuV/m)	Average fundamental (dBuV/m)	Marker delta method	Peak band edge	Average band edge	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
2400	104.6	91.94	-38.66	65.94	53.28	74	54	Pass
2483.5	104.7	92.04	-48.05	46.37	23.97	74	54	Pass

See Annex B for Radiated emissions Band edge Plots

**99% Occupied Bandwidth****Engineer:** Poona Saber**Test Date:** 11/27/19**Test Procedure**

The EUT was tested on an Open Area Test Site (OATS) at a distance of 3 meter from the receiving antenna. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold while the 99% bandwidth was measured.

Test Setup**Occupied Bandwidth Summary**

Frequency (MHz)	Recorded Measurement MHz	Result
2405	3.76	Pass
2439	4.47	Pass
2478	4.36	Pass

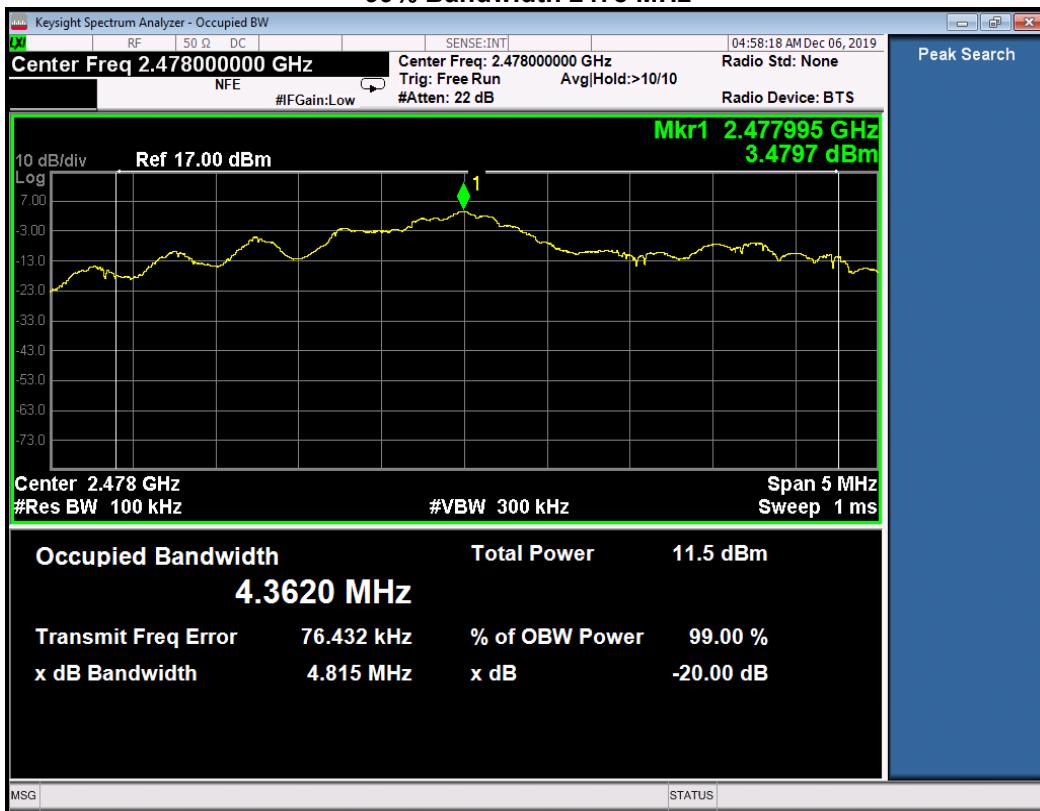
99% Bandwidth 2405 MHz



99% Bandwidth 2439 MHz



99% Bandwidth 2478 MHz





Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/18	6/16/20
Bi-Log Antenna	Chase	CBL6111C	i00267	3/8/18	3/8/20
EMI Analyzer	Agilent	E7405A	i00379	1/16/19	1/16/20
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT