



H.B. Compliance Solutions

Intentional Radiator Test Report

For the

Raveon Technologies Corporation

Pro Max Transmitter II Model # RV-PMTII

Tested under

The FCC Rules contained in Title 47 of the CFR, Part 95 Subpart J for

Personal Radio Services - MURS

June 24, 2016

Prepared for:

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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 95 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	June 10, 2016	Initial Issue
1	June 22, 2016	TCB Comments
2	June 24, 2016	Correction to FCC ID

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EXECUTIVE SUMMARY

1. Testing Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 95 Subpart J. All tests were conducted using measurement procedure from ANSI TIA/EIA-603-D-2010 as appropriate.

Test Name	Test Method/Standard	Result	Comments
RF Output Power	2.1046; 95.639(h)	Pass	
Modulation Characteristics	2.1047(a)	Pass	The EUT does not transmit voice. The device transmit data signal only
Occupied Bandwidth	2.1049; 95.635(e)	Pass	
Spurious Emissions at Antenna Terminals	2.1051; 95.635(e)	Pass	
Radiated Spurious Emissions	2.1053; 95.635(e)	Pass	
Frequency Stability over Temperature Variations	2.1055(a)(1); 95.632	Pass	
Frequency Stability over Voltage Variations	2.1055(d)	Pass	

EQUIPMENT CONFIGURATION

1. Overview

H.B Compliance Solutions was contracted by Raveon Technologies Corporation to perform testing on the Pro Max Transmitter II under the purchase order number 7751.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Raveon Technologies Corporation, Pro Max Transmitter II.

The tests were based on FCC Part 95 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. Raveon Technologies Corporation 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.

Product Name:	Pro Max Transmitter II
Model(s) Tested:	RV-PMTII
FCC ID:	SRS-PMTII
Supply Voltage Input:	Primary Power : 6 Vdc
Frequency Range:	154.6MHz
No. of Channels:	Single Channel
Necessary Bandwidth	20kHz
Type(s) of Modulation:	DTMF
Range of Operation Power:	0.827 W
Voltage into final Transistor	6 volts
Current into final Transistor	2.5 amps
Emission Designator:	6K00F3D
Channel Spacing(s)	None
Test Item:	Pre-Production
Type of Equipment :	Fixed
Antenna:	O
Environmental Test Conditions:	Temperature: 15-35°C Humidity: 30-60% Barometric Pressure: 860-1060 mbar
Modification to the EUT:	None
Evaluated By:	Staff at Artesyn Embedded & H.B. Compliance Solutions
Test Date(s):	05/02/16 till 06/07/16

2. Test Facility

Radiated Emission testing was performed at Artesyn Embedded Technologies. This facility is located at 2900 S. Diablo Way, Suite 190, Tempe, AZ 85282. All equipment used in making physical determination is accurate and bears recent traceability to the National Institute of Standards and Technology.

Test facility at Artesyn Embedded Technologies is an A2LA accredited test site. The A2LA certificate number is 2716.01. The scope of accreditation covers the FCC Method - 47 CFR Part 15, ICES-003, CISPR 22, AS/NZS 3548 and VCCI

Conducted testing was performed at H.B. Compliance Solutions. This facility is located at 5005 S. Ash Avenue, Suite # A-10, Tempe AZ 85282.

Radiated Emissions measurements were performed in a semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at Emerson Network Power.

3. Description of Test Sample

The Raveon Technologies, RV-PMTII Data radio modem, is a high-speed wide-band data communications device. It contains a transmitter and a modem, creating an easy to use transparent data radio link. The built in DTMF protocol is compatible with many legacy systems. The components are contained in a metal enclosure. It runs off 6 Vdc via a 2 wire cord. This model transmit data at 154.6MHz range.

4. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number
# 1	Pro Max Transmitter II	RV-PMTII	N/A

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 #
#2	DC Power Supply	Lambda	LA-200	LA2-AA20-1433535
#3	Laptop	Dell	Inspiron 1545	17934612445

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
#4	Power	2 wire	1	2	N	DC Power Supply

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 software. This software programmed the transmitter from three frequencies modulated and the other three in CW mode. 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 Raveon Technologies Corporation upon completion of testing & certification

Criteria for Intentional Radiators

1. RF Power Output

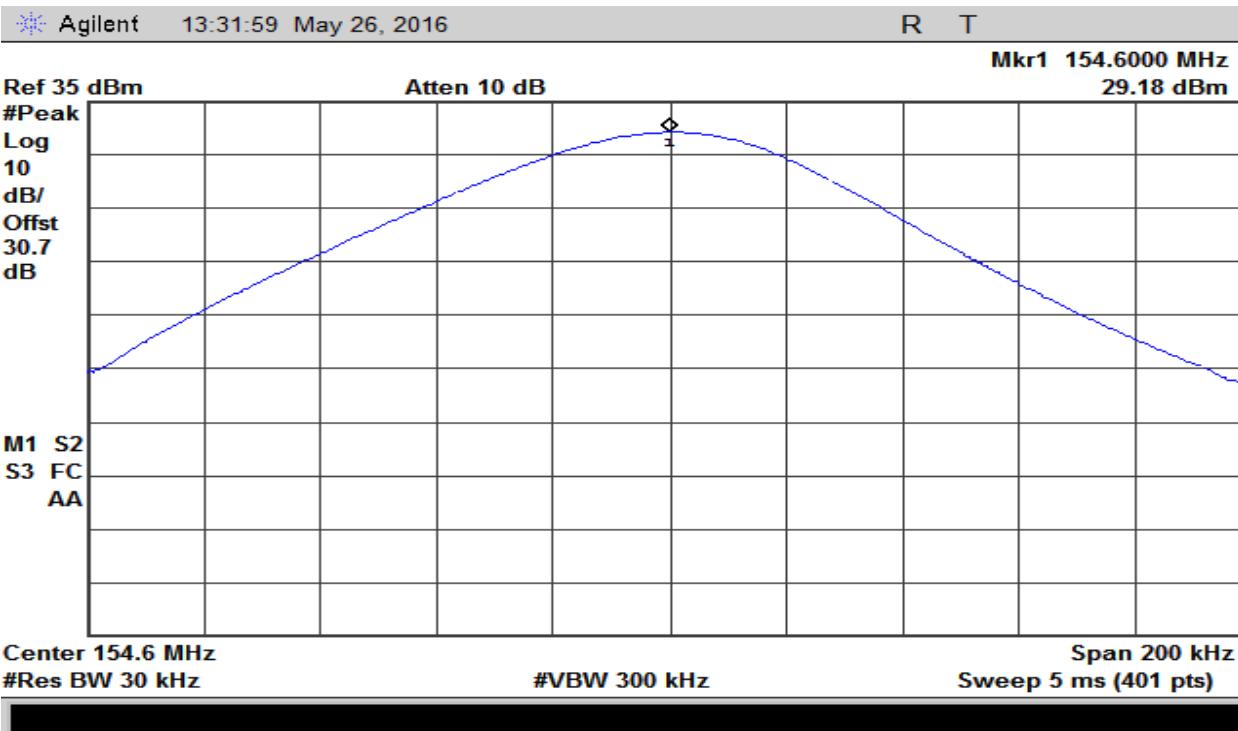
Test Requirement(s):	§2.1046 and §95.639(h)	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	05/02/2016

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 maximum output power.

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)	Limit (W)
154.6	29.18	0.827	2.0

Table 4. RF Power Output, Test Results



Plot 1 – Output Power

2. Modulation Characteristics

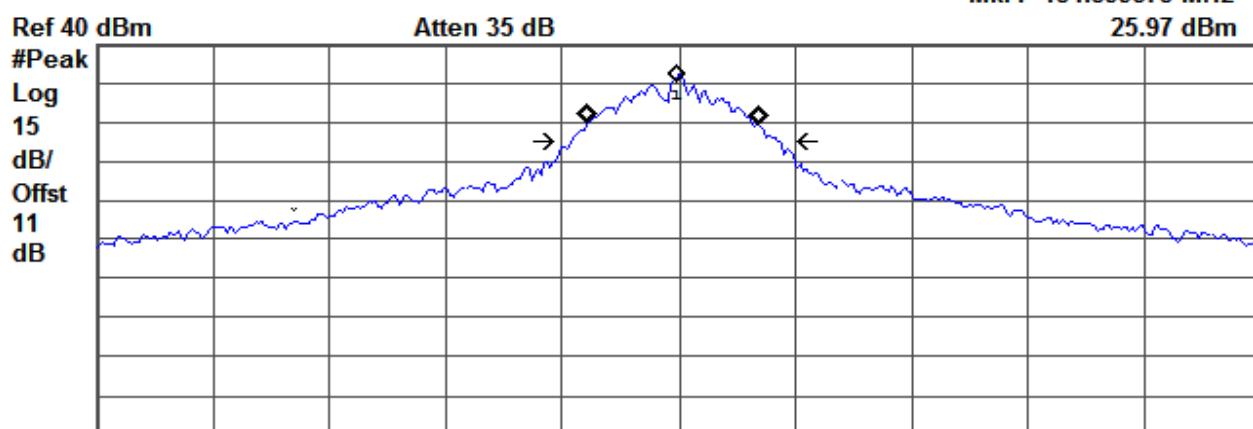
Test Requirement(s):	2.1047	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	05/26/2016

Test Procedure: As required by 47 CFR 2.1047, Modulation characteristics 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.

As per standard a curve or equivalent data of the EUT is shown

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



Occupied Bandwidth
7.1902 kHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -224.992 Hz
x dB Bandwidth 8.765 kHz

Plot 4 – Modulation Characteristics

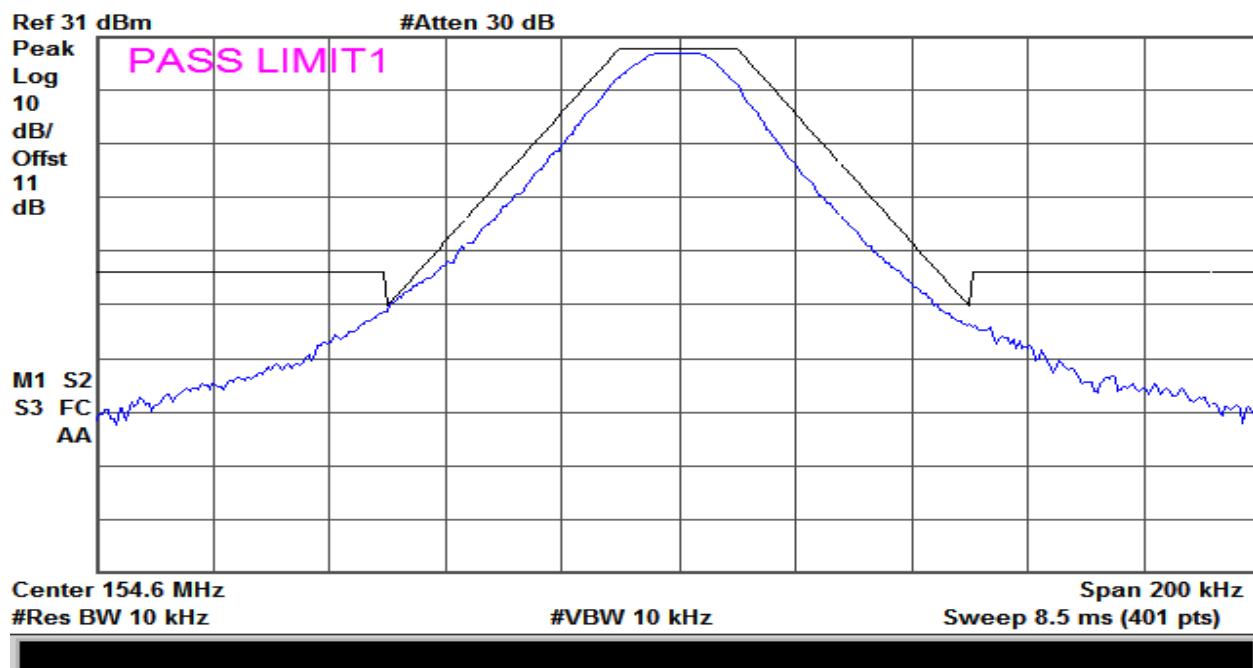
3. Occupied Bandwidth (Emission Mask)

Test Requirement(s):	2.1049 and §95.635(e)(3) with FCC (Emission Mask 3)	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	05/02/2016

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.

The following pages show measurements of Emission Mask plots:



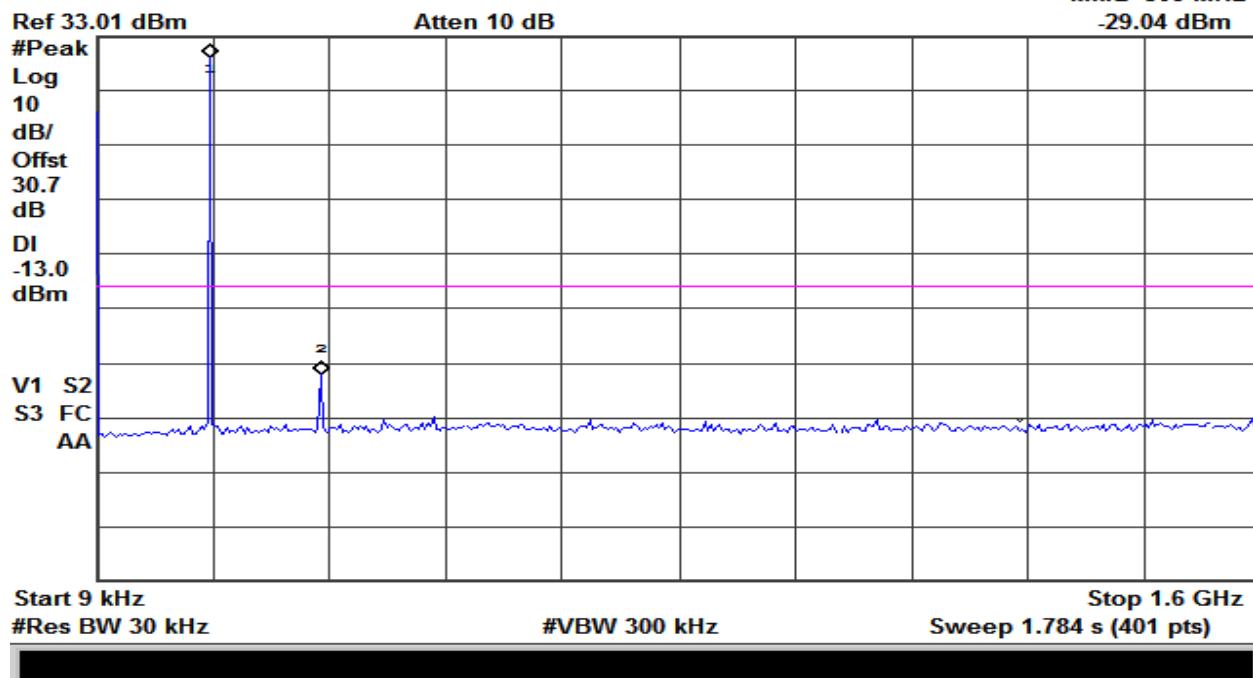
Plot 6 – 20 kHz Spacing – Mask 3

4. Spurious Emissions at Antenna Terminals

Test Requirement(s):	§2.1051 and 95.635(e)	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	05/02/2016

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 30MHz up to 10th harmonic of the fundamental or 40GHz whichever is the lesser. Measurements were made at the low, mid and high frequency of the transmit band.



Plot 12 – Conducted Spurious – 9 kHz to 1.6GHz

5. Radiated Spurious Emissions

Test Requirement(s):	§2.1053 and 90.210(j)	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	05/04/2016

Test Procedures: As required by 47 CFR 2.1053, field strength of radiated spurious measurements were made in accordance with the procedures of the TIA/EIA-603-D-2010.

The EUT was placed on a wooden table inside a 3 meter semi-anechoic chamber. The EUT was transmitting into a non-radiating load which was directly connected to the EUT antenna port.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as 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 10th harmonic was investigated.

The EUT is removed and replaced with a substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \log (\text{Txpwr in Watts}/0.001)$ -the absolute level

Spurious attenuation limit in dB = $50 + 10 \log_{10} (P)$ dB or 70dB whichever is the lesser attenuation

Frequency (MHZ)	Amplitude (dbuV)	Antenna Polarity	Cable Loss	Substitution Generator Level (dbm)	Transmit Antenna Gain	Corrected Amplitude (dBm)	Limit (dBm)
309.14	65.01	Vert	0.1	-26.0	4.6	-21.5	-20
463.91	58.98	Vert	0.3	-44.0	4.6	-39.7	-20
618.35	63.89	Horz	0.4	-42.0	5.2	-37.2	-20
773.02	60.48	Vert	0.2	-42.0	5.4	-36.8	-20

Table 5 - Spurious Radiated Emission Data –

6. Frequency Stability vs Temperature

Test Requirement(s):	§2.1055 and 95.632	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	06/07/2016

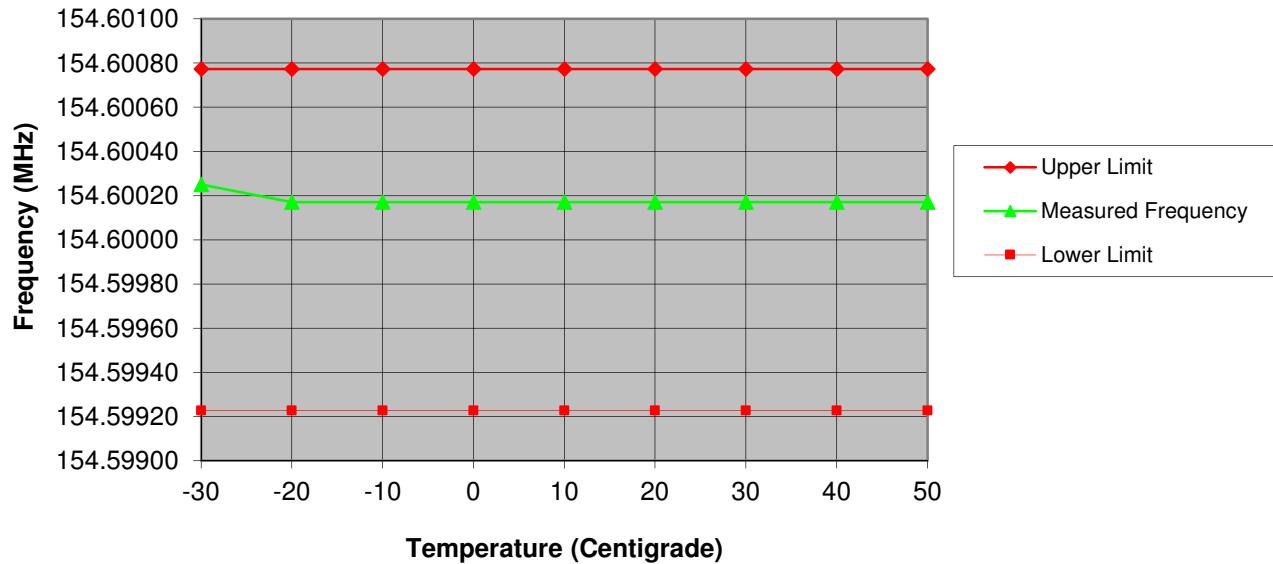
Test Procedures: As required by 47 CFR 2.0155, Frequency Stability measurements were made at the RF antenna output terminals of the EUT.

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.

Temperature centigrade	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
-30	154.60025	-0.00052	0.00102
-20	154.60017	-0.00060	0.00094
-10	154.60017	-0.00060	0.00094
0	154.60017	-0.00060	0.00094
10	154.60017	-0.00060	0.00094
20	154.60017	-0.00060	0.00094
30	154.60017	-0.00060	0.00094
40	154.60017	-0.00060	0.00094
50	154.60017	-0.00060	0.00094

Table 8 – Temperature vs Frequency Test Result

Frequency Stability vs. Temperature



Plot 18 – Temperature vs Frequency

7. Frequency Stability vs Voltage

Test Requirement(s):	§2.1055	Test Engineer(s):	Keith T.
Test Results:	Pass	Test Date(s):	06/07/2016

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

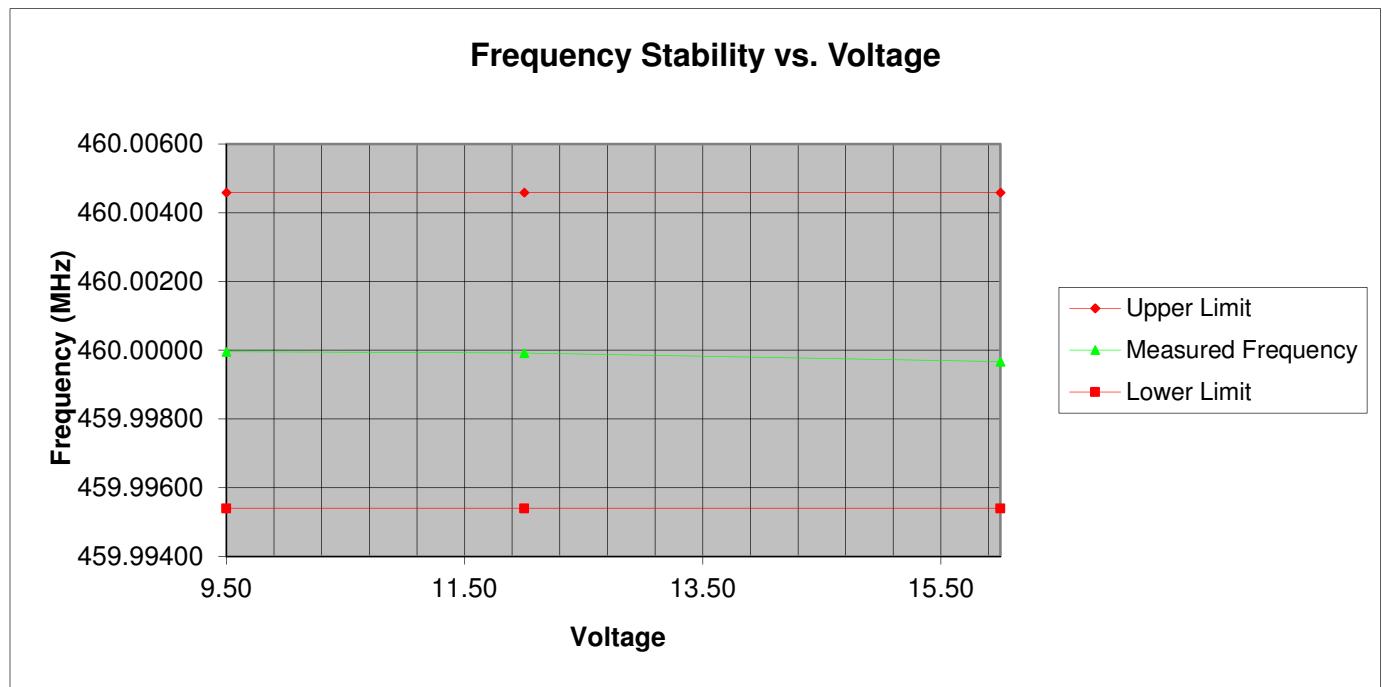
The EUT was connected to a variable DC source. The frequency was measured at both the nominal 5.5 Vdc of the EUT and at the extreme lower and upper voltages.

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: 154.6MHz at 5.5Vdc at 20°C

Input Voltage (Vdc)	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
4.68	154.60000	-0.00077	0.00077
5.50	154.60000	-0.00077	0.00077
6.33	154.60000	-0.00077	0.00077

Table 9. Temperature vs. Voltage Test Result



Plot 19 – 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

$$B = 2M + 2DK$$

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

Digital Data: DTMF; 1600 bps; Narrow Band; 25 KHz Channel Spacing

Calculation

Data Rate in bps (R) = 1600

Peak Deviation of Carrier (D) = +-2.2KHz

Number of States in Each Symbol = 2

$$BN = 1600 + 2(2200) = 6.0 \text{ KHz}$$

Emission Designator: 6K00F3D

I. Test Equipment

Equipment	Manufacturer	Model	Serial #	Last Cal Date	Cal Due Date
Power Supply	Lambda	LA-200	LA2AA201433535	Verified	
Digital Multimeter	Fluke	77 III	72550270	Nov/20/15	Nov/30/16
Spectrum Analyzer	Agilent	E4402B	US41192757	Feb/15/16	Feb/15/17
Temperature Chamber	Thermotron	SM-3.5S	12817	Sep/18/15	Sep/18/16
Spectrum Analyzer	Hewlett Packard	8563E	3821A09316	Oct/03/15	Oct/03/16
Temperature Meter	Control Company	6066N53	140536623	Aug/08/14	Aug/08/16
Attenuator 10dB	Huber+Suhner	6810.17.A	757300	Verified	
High Pass Filter	Mini-Circuits	VHF-3100+	1023	Verified	
Variable Attenuator	Hewlett Packard	None	None	NCR	None
EMI Receiver	R&S	ESCS-30	825788/008	Dec/02/15	Dec/02/1
Signal Generator	R&S	SMY02	1062.5502.12	NCR	None
Attenuator 20dB	Weinschel	41-20-12	86332	Verified	
Horn Antenna	Com-Power	AHA-118	711150	May/10/16	May/10/18
Bilog Antenna	Chase	CBL6140	1040	Mar/30/16	Mar/30/17
Diode/Crystal Detector	H.P.	8470B	None	Verified	
Combiner/Splitter	MiniCircuits	ZFSC-2-2	None	Verified	
Oscilloscope	Tektronix	TDS 3052	B013389	Jun/03/15	Jun/03/16

Table 10 – 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)

END OF TEST REPORT