



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: Packet Power, LLC

Model: P5C

Description: Wireless Smart DC Power Monitors

Serial Number: N/A

FCC ID: WCGP5C

To

FCC Part 15.249

Date of Issue: July 30, 2015

On the behalf of the applicant:

Packet Power, LLC
2716 Summer St NE
Minneapolis, MN 55413

Attention of:

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Project No: p1560010

Alex Macon
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	July 27, 2015	Alex Macon	Original Document
2.0	July 30, 2015	Alex Macon	Included 30-1000MHz radiated plot and updated band edge plots for better clarification.



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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 C63.10-2009 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)
24.6 – 25.3	34.5 – 48.2	962.5 – 966.1

EUT Description

Model: P5C

Description: Wireless Smart DC Power Monitors

Firmware: N/A

Software: N/A

Serial Number: N/A

Additional Information: EUT incorporates a 2.4 GHz radio and is powered with 5 VDC

EUT Operation during Tests

EUT was placed in test modes using the NMX PacketPower URL paired with the node configurator.



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Power Supply	Meanwell	APV-12-5	N/A
1	Node Configurator	Packet Power	63E1-0200-2014-001D	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	Power lines, twisted pair	.5	N	N	N

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)	Fundamental Field Strength	Pass	
15.249(d)	Out of Band Spurious Emissions	Pass	
15.215	99% Occupied Bandwidth	Pass	

Fundamental Field Strength

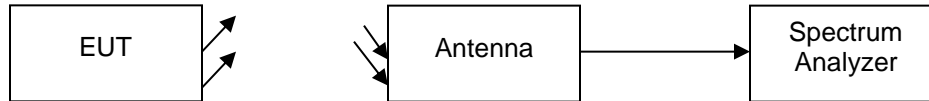
Engineer: Alex Macon

Test Date: 7/27/15

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.

Test Setup



Spectrum 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.

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)	Duty Cycle Correction (dB)	Corrected Value (dBuV)	Peak Limit (dBuV/m)	Result
2403	98.21	-13.24	84.97	114.0	Pass
2431	99.77	-13.24	86.53	114.0	Pass
2464	99.32	-13.24	86.08	114.0	Pass

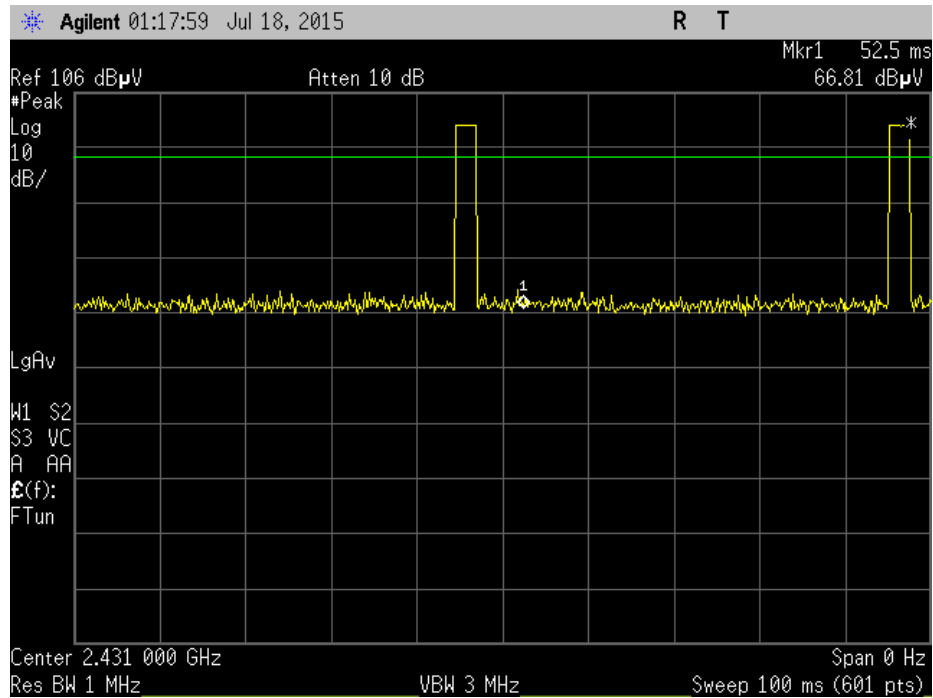
Tuned Frequency (MHz)	Average Measured Level (dBuV/m)	Duty Cycle Correction (dB)	Corrected Value (dBuV)	Avg. Limit (dBuV/m)	Result
2403	98.17	-13.24	84.93	94.0	Pass
2431	99.71	-13.24	86.47	94.0	Pass
2464	99.18	-13.24	85.94	94.0	Pass

Duty cycle correction = $10\log(4.734\text{ms}/100\text{ms})$

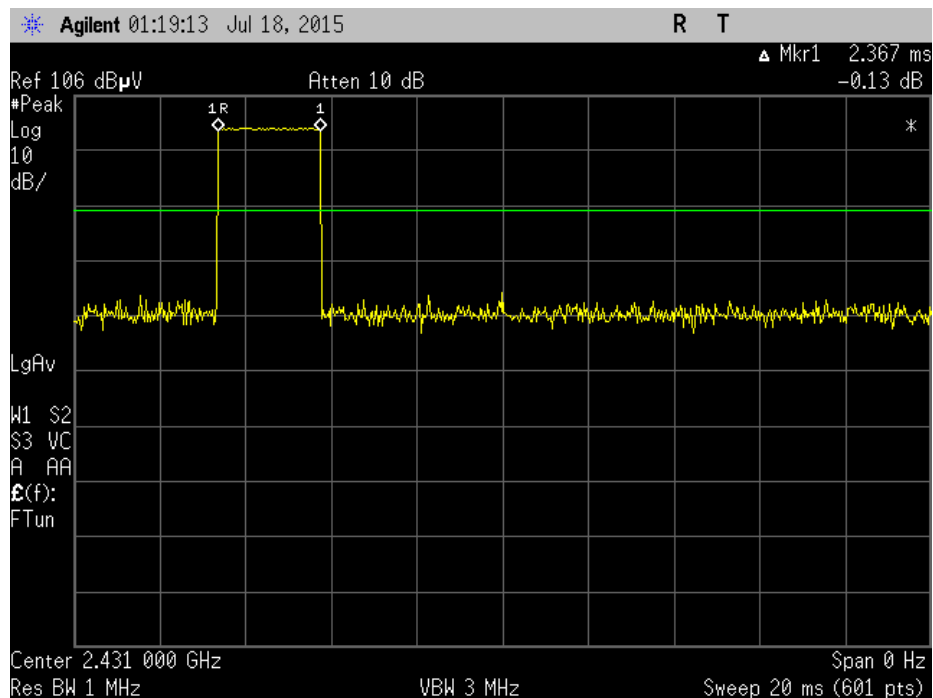
Duty cycle correction = -13.24



Duty Cycle Correction Data



Burst Width



Radiated Spurious Emissions

Engineer: Alex Macon

Test Date: 7/17/15

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the limits for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording data. The spectrum for each tuned frequency was examined to the 10th harmonic.

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:

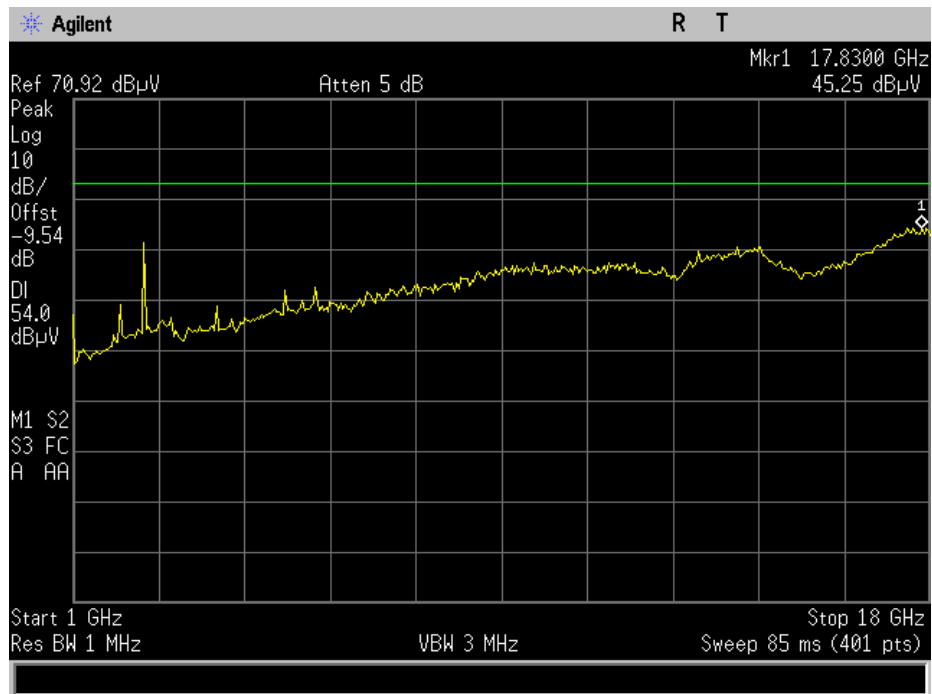
Correction Factors include Antenna and cable insertion loss correction factors.

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

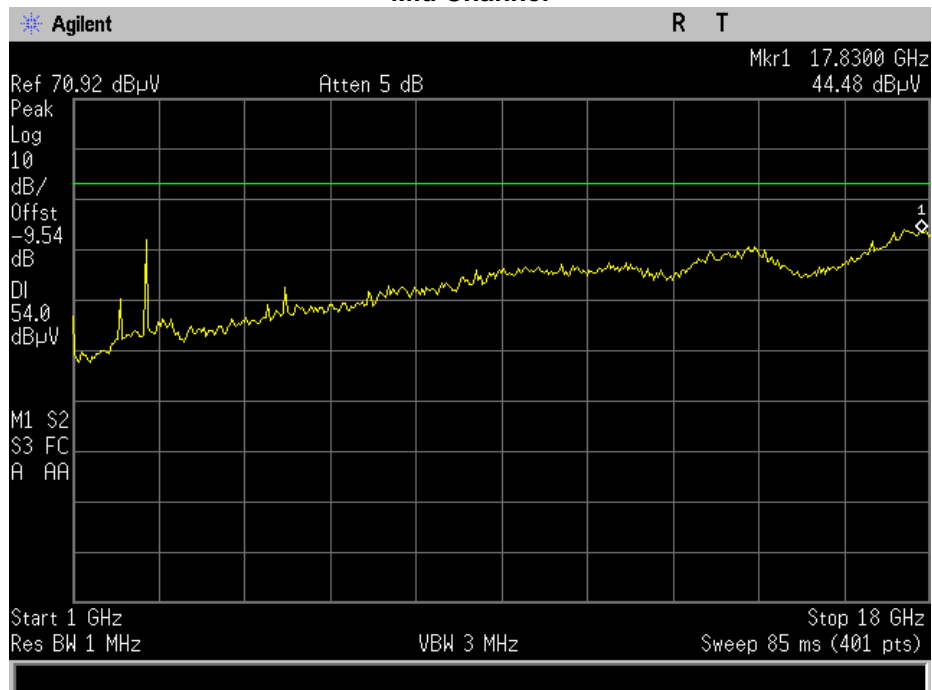


Radiated Spurious Emissions

Low Channel

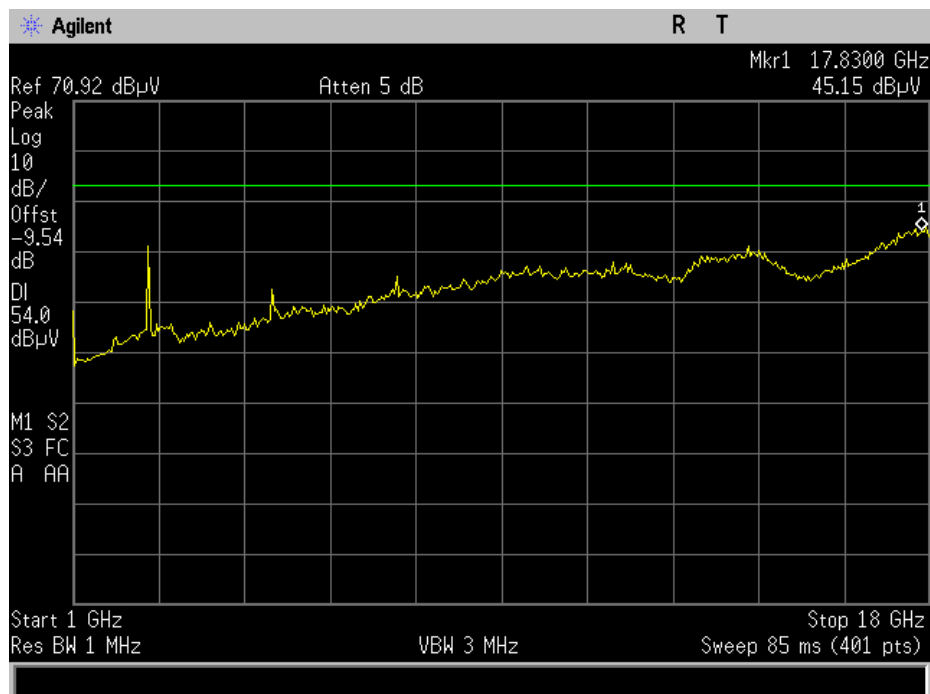


Mid Channel



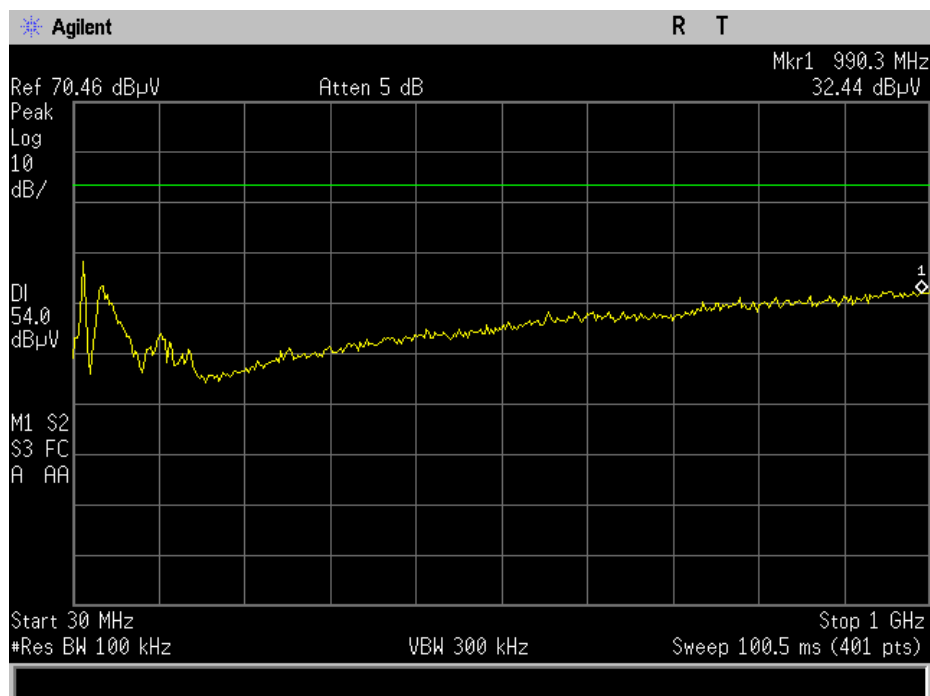


High Channel



**All peak emissions were below the average limit of 54 dBuV
Emissions were investigated up to 26.5 GHz but no emissions were found.**

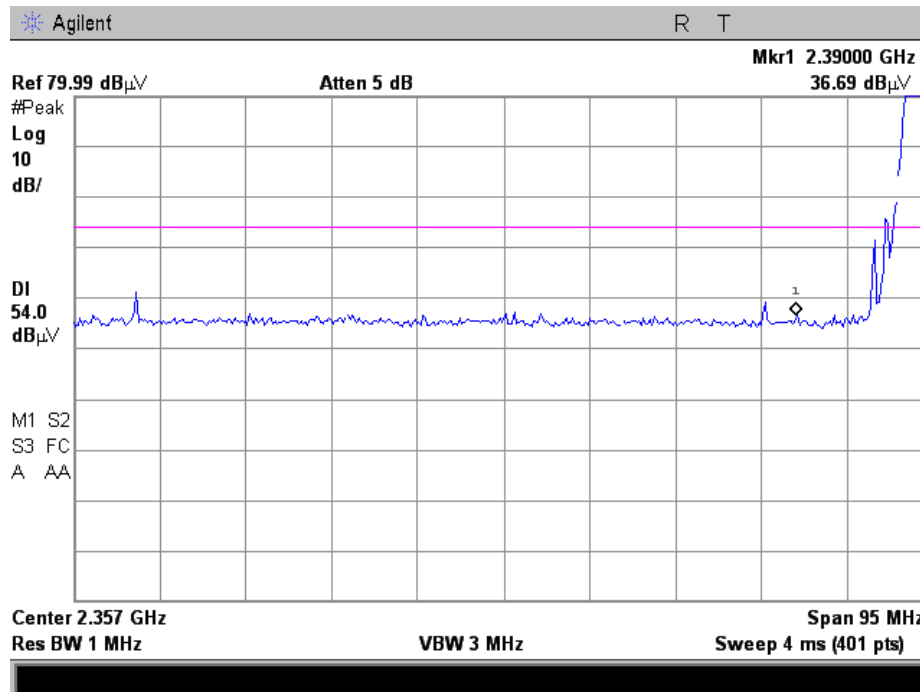
30 – 1000 MHz



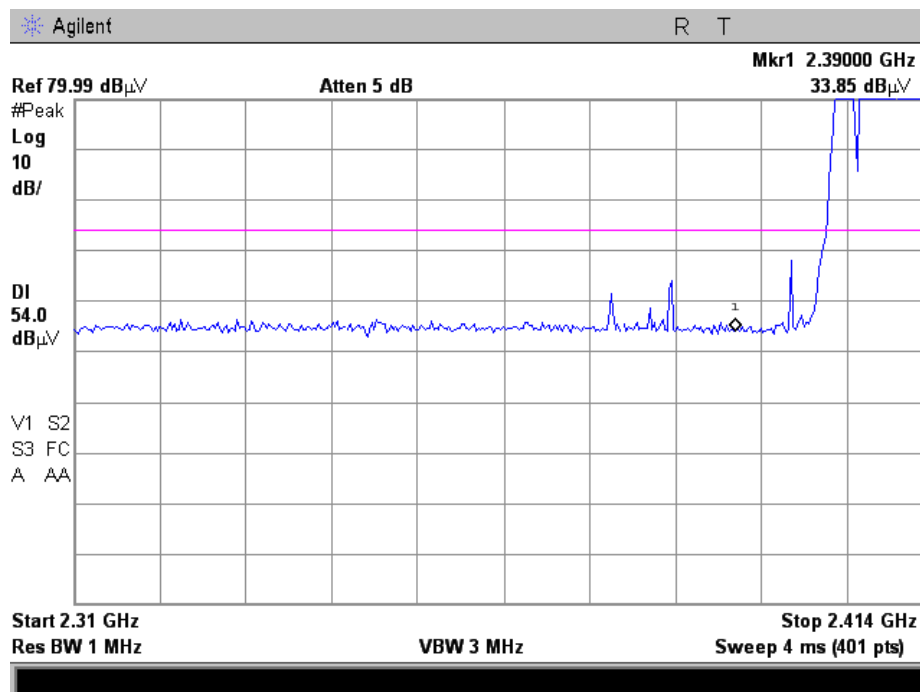
The above plot is representative of high, mid and low channels.



Lower Band Edge Plot

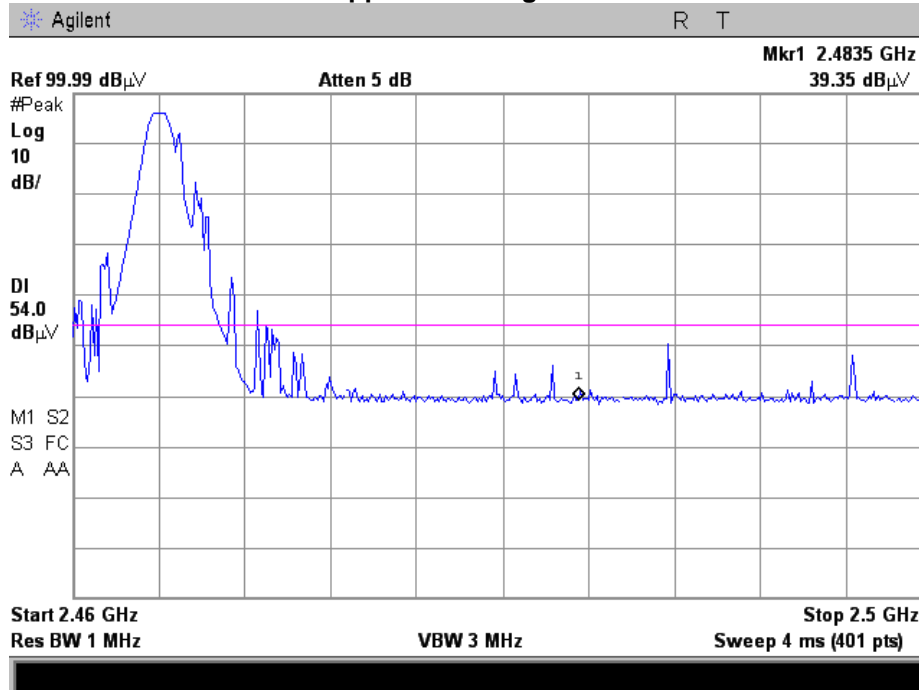


Hopping

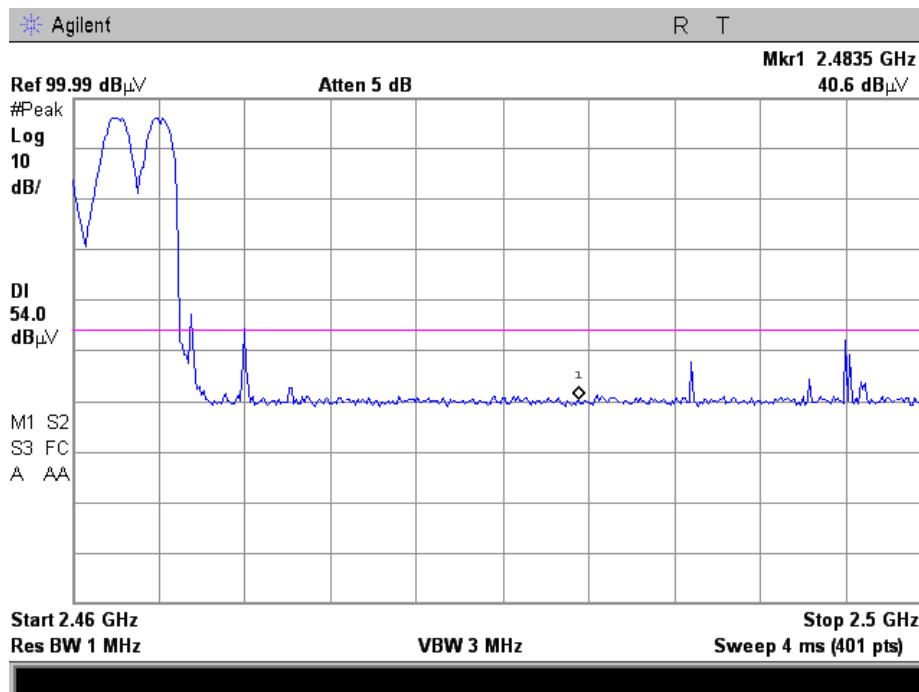




Upper Band Edge Plot



Hopping





99% Occupied Bandwidth

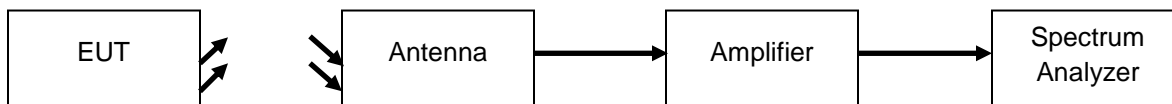
Engineer: Alex Macon

Test Date: 7/27/15

Test Procedure

The EUT was tested in a semi-anechoic chamber 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 (kHz)	Result
2403	495.3	Pass
2431	540.7	Pass
2464	532.0	Pass



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
RF Pre-Amplifier	HP	8449	i00028	Verified on: 7/17/15	
Horn Antenna	EMCO	3115	i00103	9/5/06	9/5/08
High Pass Filter	Trilithic	4HX3400-3-XX	i00177	Verified on: 7/17/15	
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	5/8/14	5/8/16
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/9/12	4/9/2015
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	4/1/15	4/1/16
Voltmeter	Fluke	75III	i00320	3/24/15	3/24/16
Spectrum Analyzer	Agilent	E4407B	i00331	6/13/14	6/13/15
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
EMI Analyzer	Agilent	E7405A	i00379	2/5/15	2/5/16
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	11/26/15

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