



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: Garmin International Inc

Model: A03063

Description: Handheld GPS

Serial Number: N/A

FCC ID: IPH-03063

IC: 1792A-03063

To

FCC Part 15.247 DTS

IC RSS 247

Date of Issue: May 10, 2016

On the behalf of the applicant:

Garmin International Inc

1200 E. 151st. Street

Olathe, KS 66062

Attention of:

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Prepared By

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Project No: p1630046

Kenneth Lee

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	April 12, 2016	Kenneth Lee	Original Document



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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 marked 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 party 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)
23.7	30.6	941.3

EUT Description

Model: A03063

Description: Handheld GPS

Firmware: N/A

Software: N/A

Serial Number: N/A

The EUT incorporates BLE, and WiFi modulations

EUT Operation during Tests

EUT was placed in a test mode enabling continuous transmission of modulated and CW signals.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Switching Power Supply	Garmin	PSA105R-050QL6	N/A

Cables: None

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
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(e)	Transmitter Power Spectral Density	Pass	
15.207	A/C Powerline Conducted Emissions	Pass	

Peak Output Power

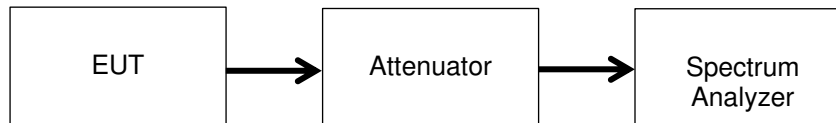
Engineer: Kenneth Lee

Test Date: 04/05/2016

Test Procedure

The EUT was connected to a spectrum analyzer. The peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

BT LE Modulation

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	1.85	1 W (30 dBm)	Pass
2440	2.18	1 W (30 dBm)	Pass
2480	2.51	1 W (30 dBm)	Pass

WiFi .11B Modulation

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2412	14.63	1 W (30 dBm)	Pass
2437	15.00	1 W (30 dBm)	Pass
2462	15.22	1 W (30 dBm)	Pass

WiFi .11G Modulation

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2412	10.62	1 W (30 dBm)	Pass
2437	13.73	1 W (30 dBm)	Pass
2462	10.78	1 W (30 dBm)	Pass



Conducted Spurious Emission

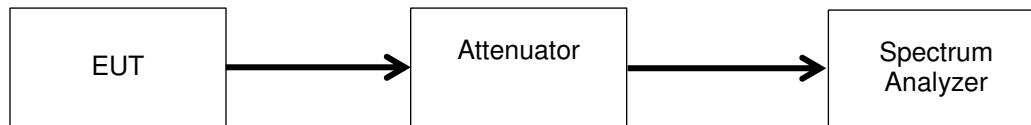
Engineer: Kenneth Lee

Test Date: 04/06/2016

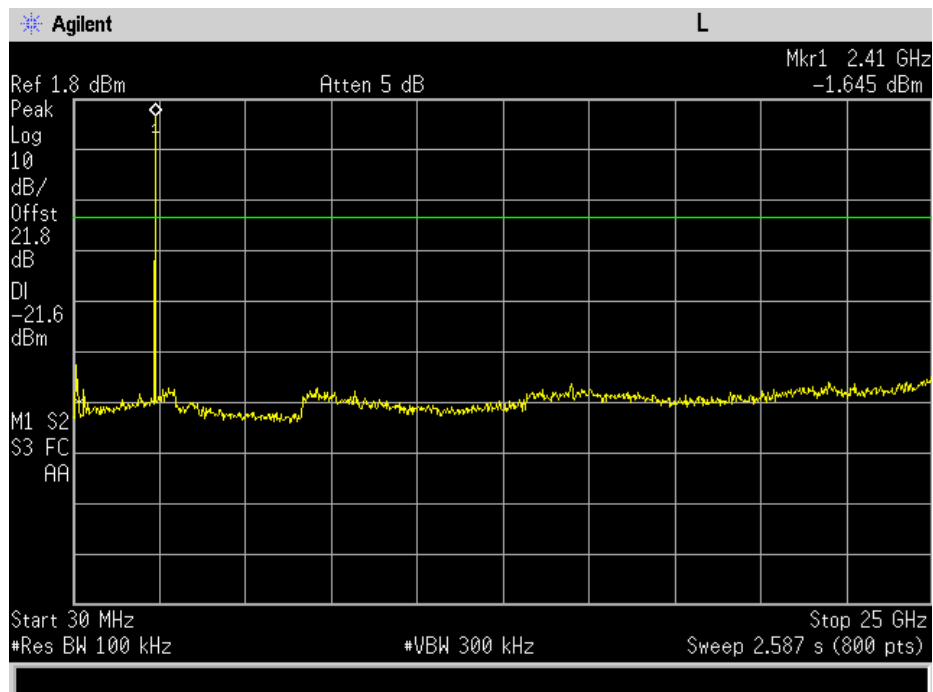
Test Procedure

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted.

Test Setup

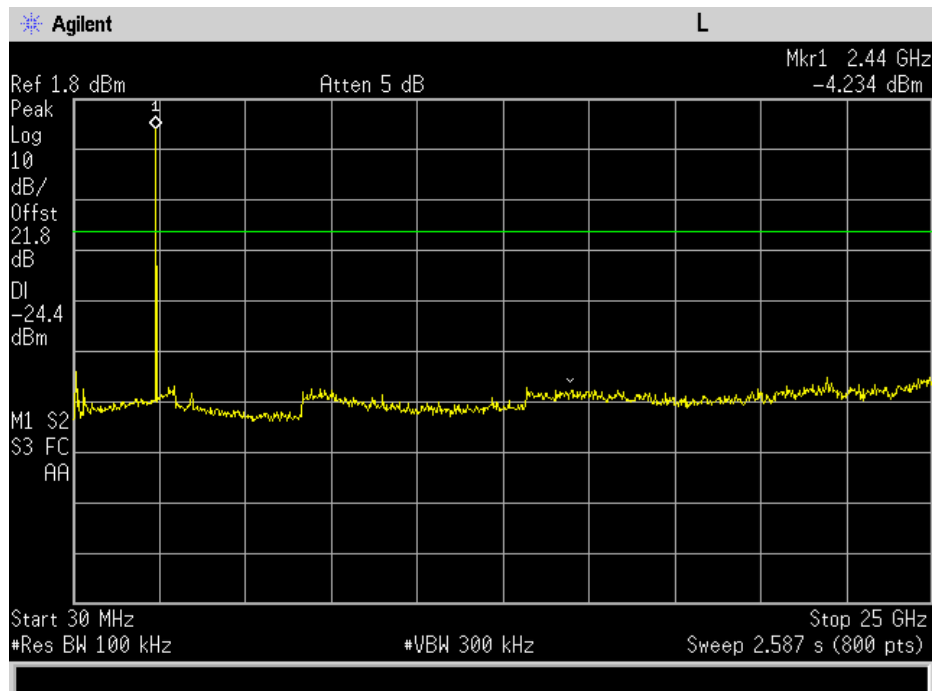


Low Ch – 30 MHz to 25 GHz

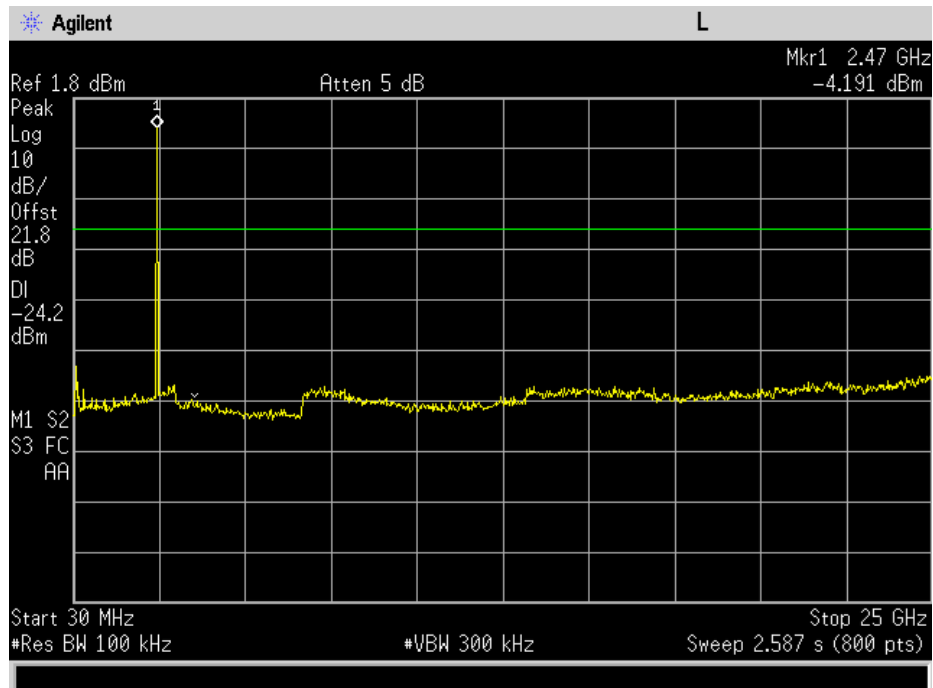




Mid Ch – 30 MHz to 25 GHz



High Ch – 30 MHz to 25 GHz





Radiated Spurious Emissions

Engineer: Kenneth Lee

Test Date: 04/06/2016

Test Procedure **Radiated Spurious Emissions: 30 – 1000 MHz**

The EUT was tested in a semi-anechoic test chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

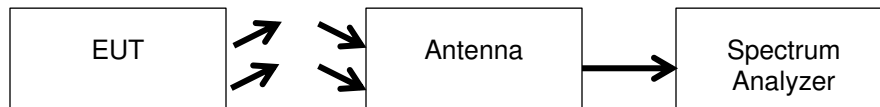
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

Test Setup



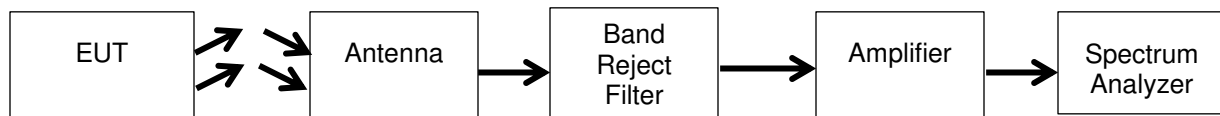
All emissions were more than -20 dBc.

See Annex A for test data

Test Procedure for Radiated Spurious Emissions above 1 GHz

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 requirements for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording the Measured Level to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



All emissions were more than -20 dBc.

See Annex A for test data

Emissions at Band Edges

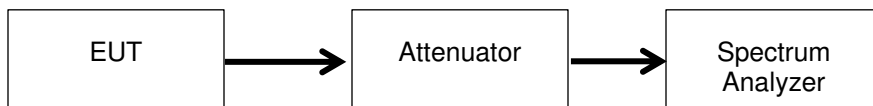
Engineer: Kenneth Lee

Test Date: 04/05/2016 and 04/13/2016

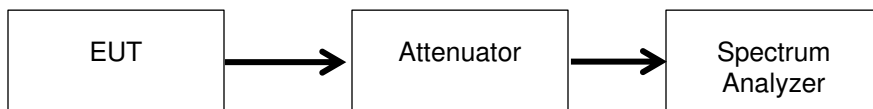
Test Procedure

The EUT was connected to a spectrum analyzer, through an attenuator, which was used to verify that the EUT met the requirements for band edge and restricted band for both peak and average measurements. The cable and attenuator correction factors were input into the analyzer as a reference level offset to ensure accurate readings. For the restricted band the amplifier and band reject filter correction factors were also input to the spectrum analyzer.

Band Edge Test Setup



Restricted Band Test Setup



BT LE Modulation

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
2402	2400	-56.93	Peak	-20 dBc	Pass
2480	2483.5	-56.48	Peak	-20 dBc	Pass

WiFi .11B Modulation

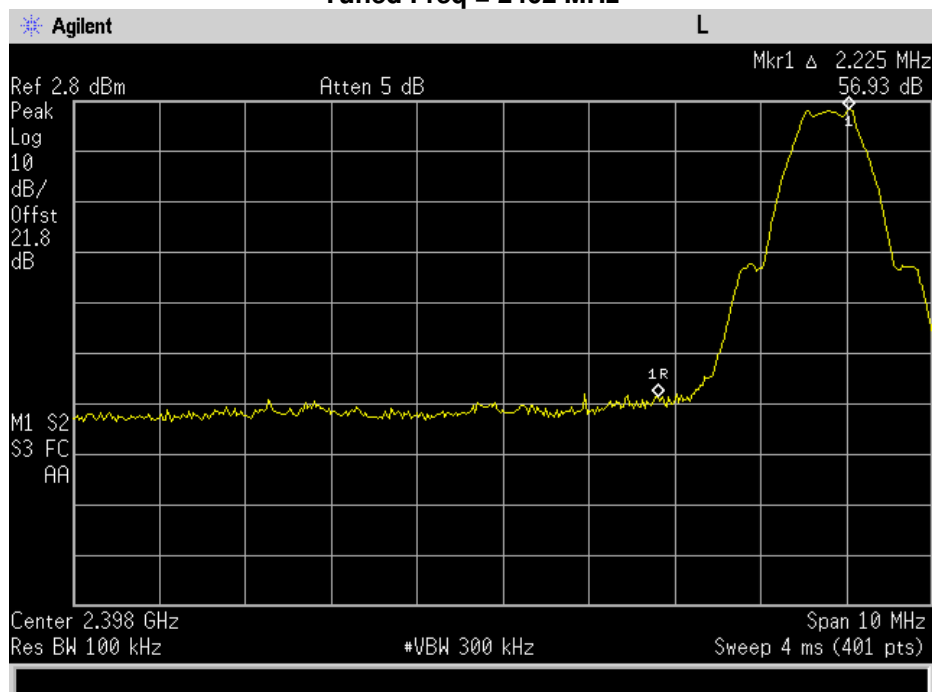
Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
2412	2400	-39.78	Peak	-20 dBc	Pass
2462	2483.5	-56.26	Peak	-20 dBc	Pass

WiFi .11G Modulation

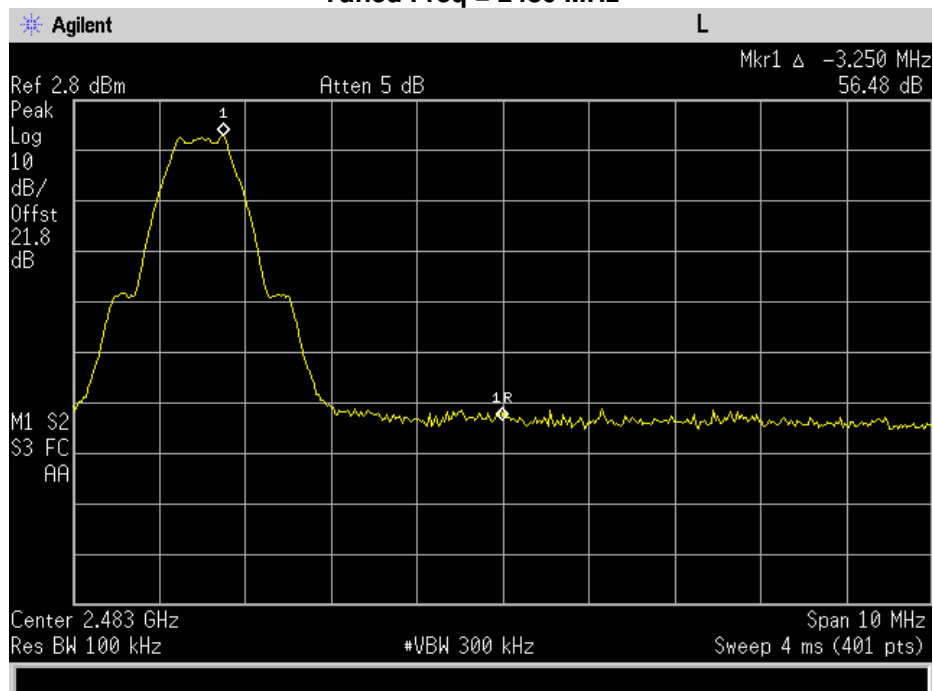
Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
2412	2400	-30.52	Peak	-20 dBc	Pass
2462	2483.5	-44.74	Peak	-20 dBc	Pass



Band Edge 2400 MHz – BT LE Modulation
Tuned Freq = 2402 MHz

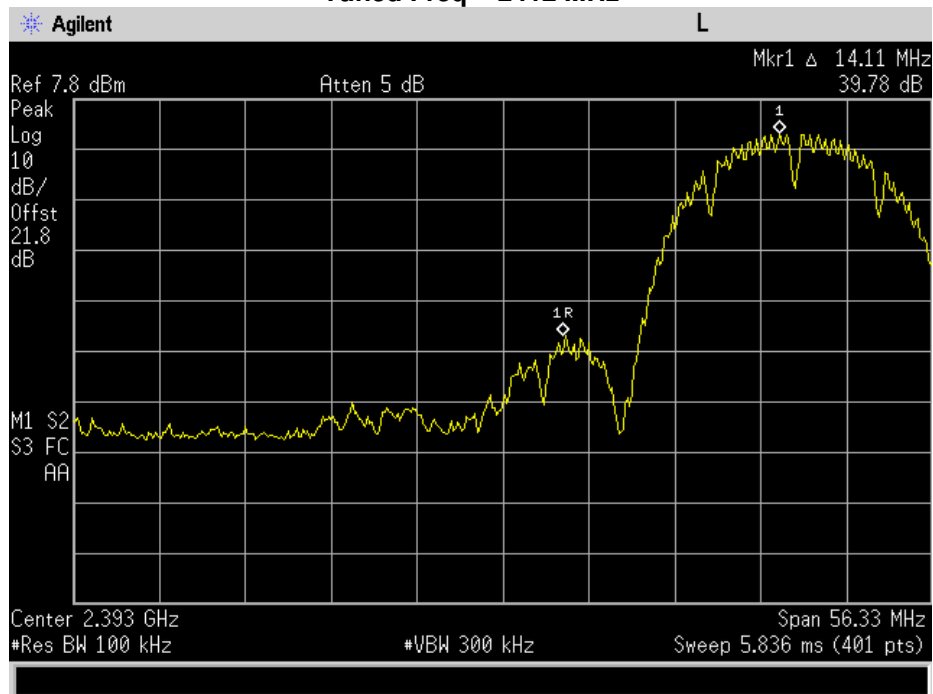


Band Edge 2483.5 MHz – BT LE Modulation
Tuned Freq = 2480 MHz

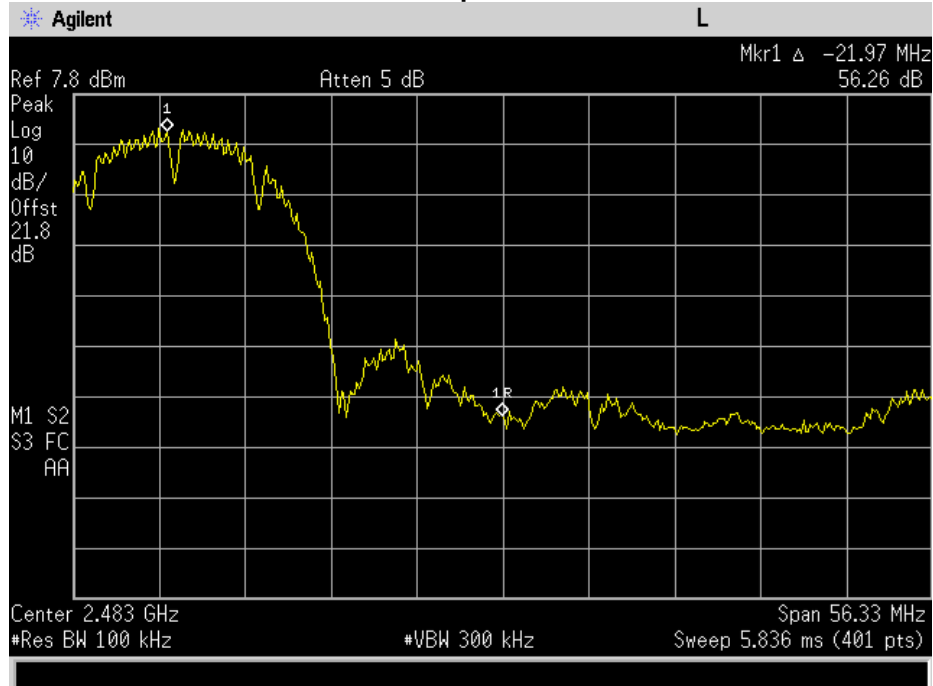




Band Edge 2400 MHz – WiFi .11B Modulation
Tuned Freq = 2412 MHz

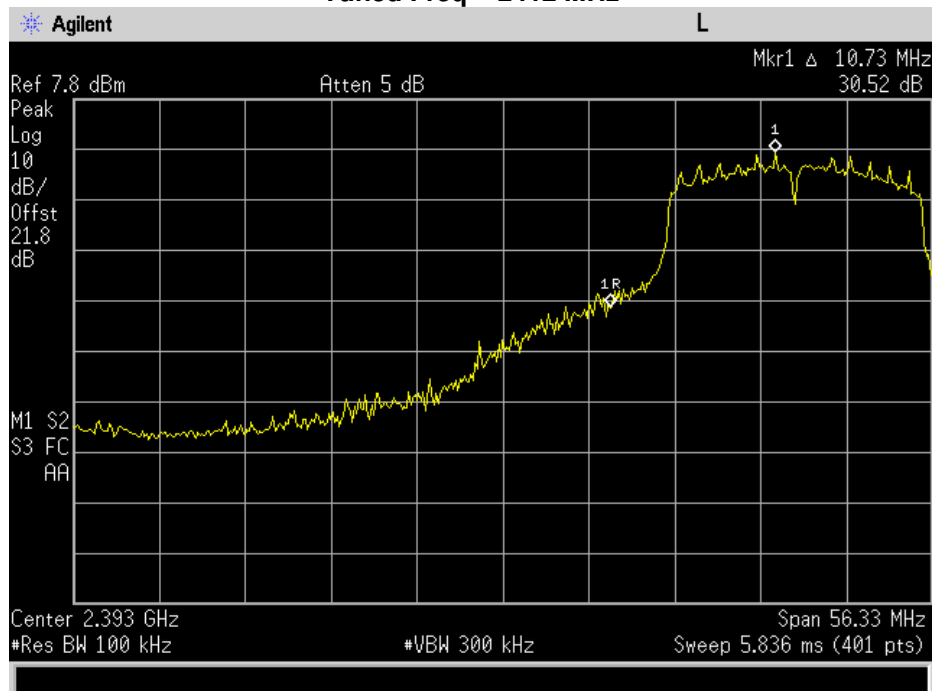


Band Edge 2483.5 MHz – WiFi .11B Modulation
Tuned Freq = 2462 MHz

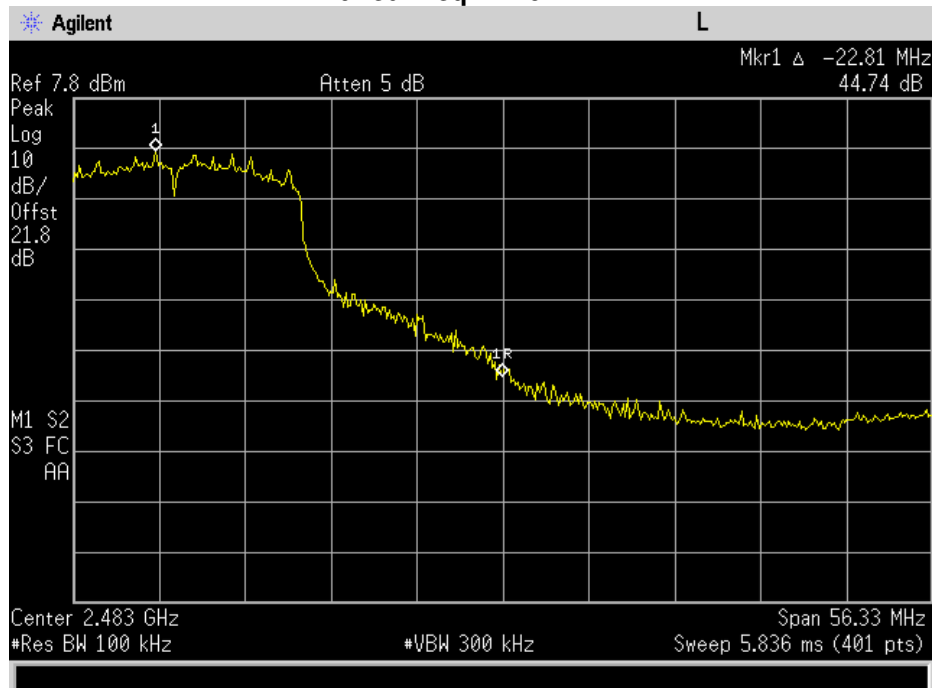




Band Edge 2400 MHz – WiFi .11G Modulation
Tuned Freq = 2412 MHz

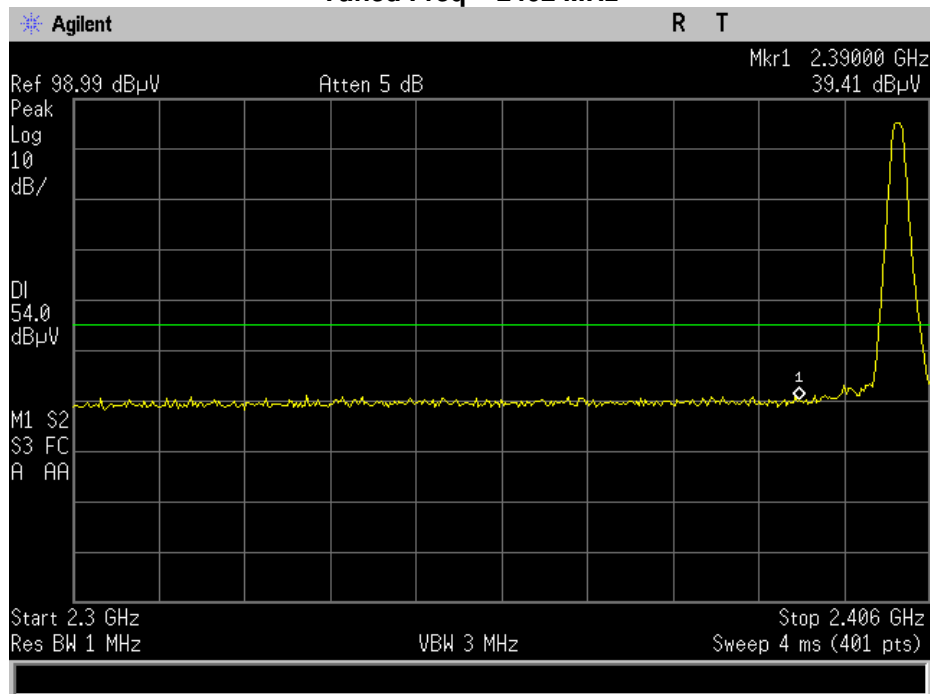


Band Edge 2483.5 MHz – WiFi .11G Modulation
Tuned Freq = 2462 MHz

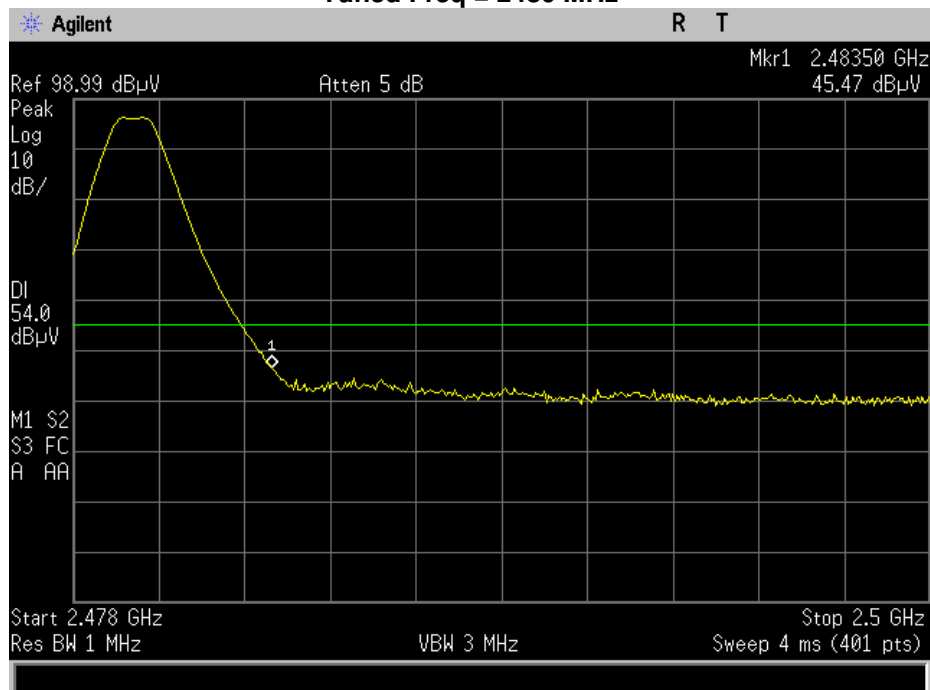




Restricted Band 2310 – 2390 MHz – BT LE Modulation
Tuned Freq = 2402 MHz

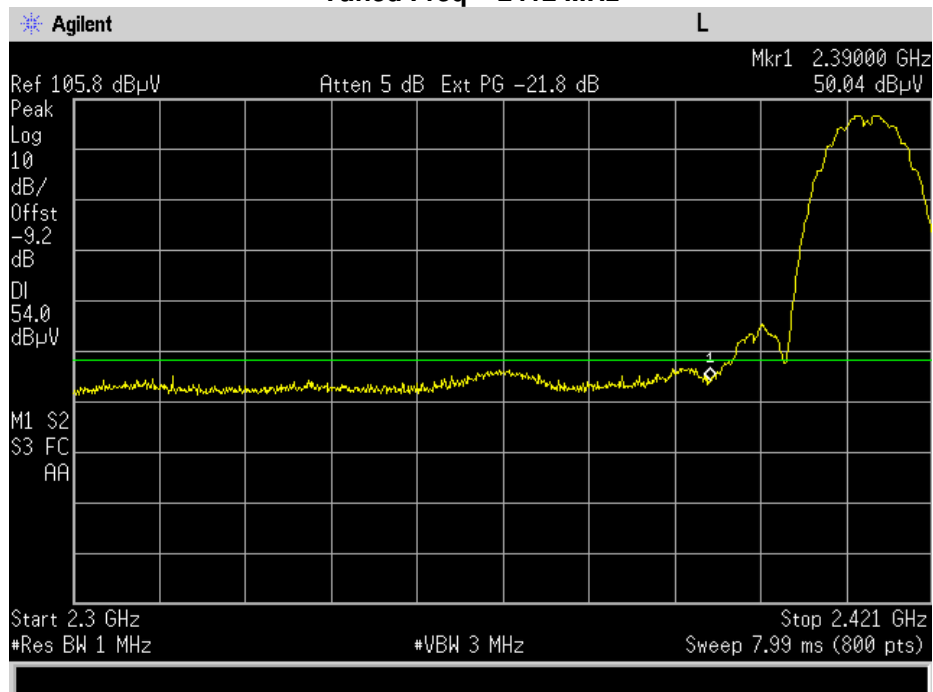


Restricted Band 2483.5 – 2500 MHz – BT LE Modulation
Tuned Freq = 2480 MHz

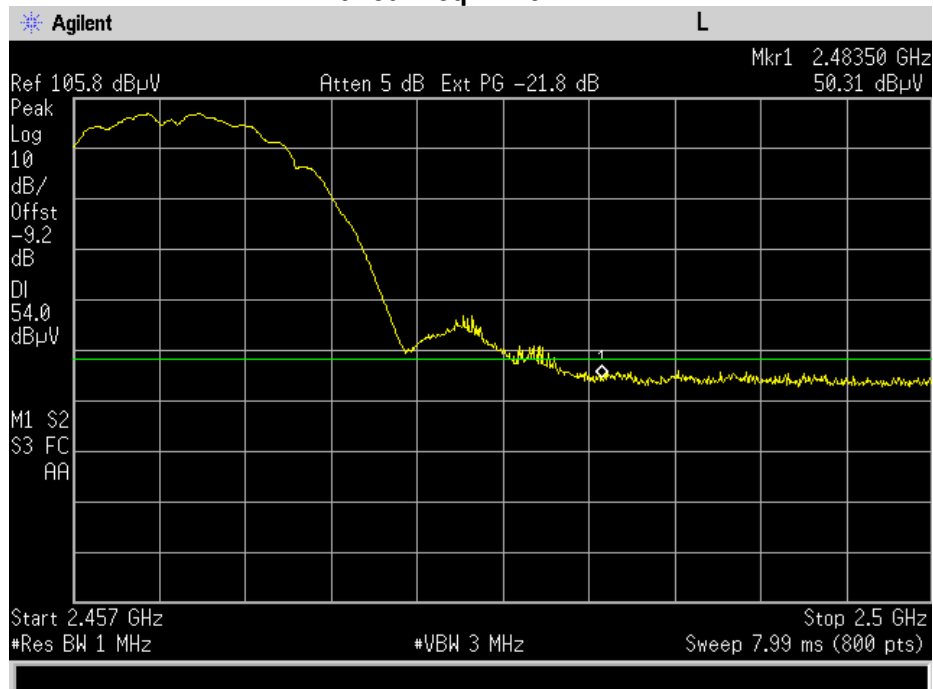




Restricted Band 2310 – 2390 MHz – WiFi .11B Modulation
Tuned Freq = 2412 MHz

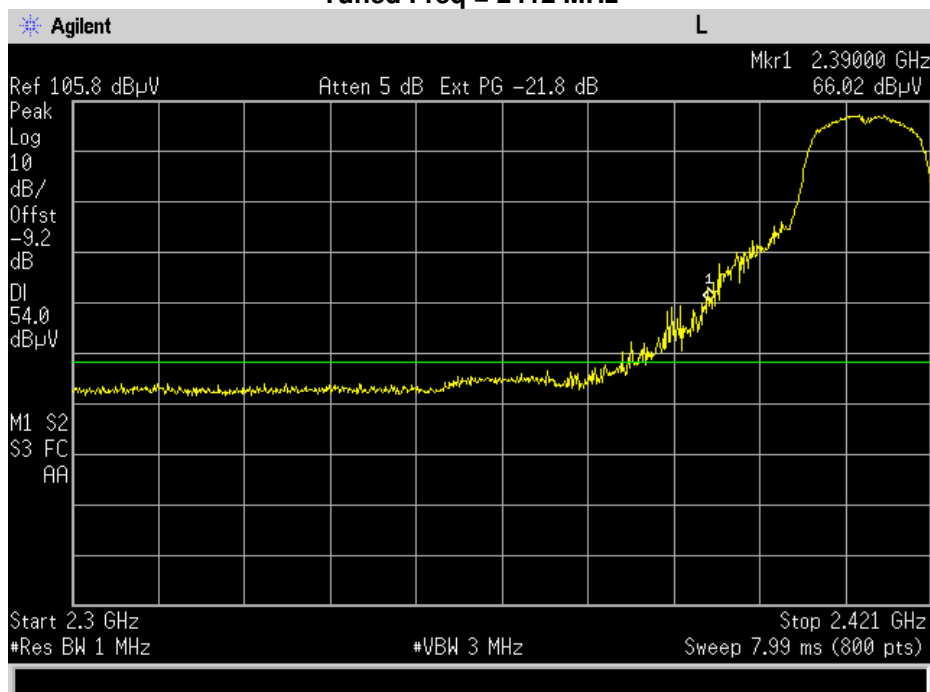


Restricted Band 2483.5 – 2500 MHz – WiFi .11B Modulation
Tuned Freq = 2462 MHz

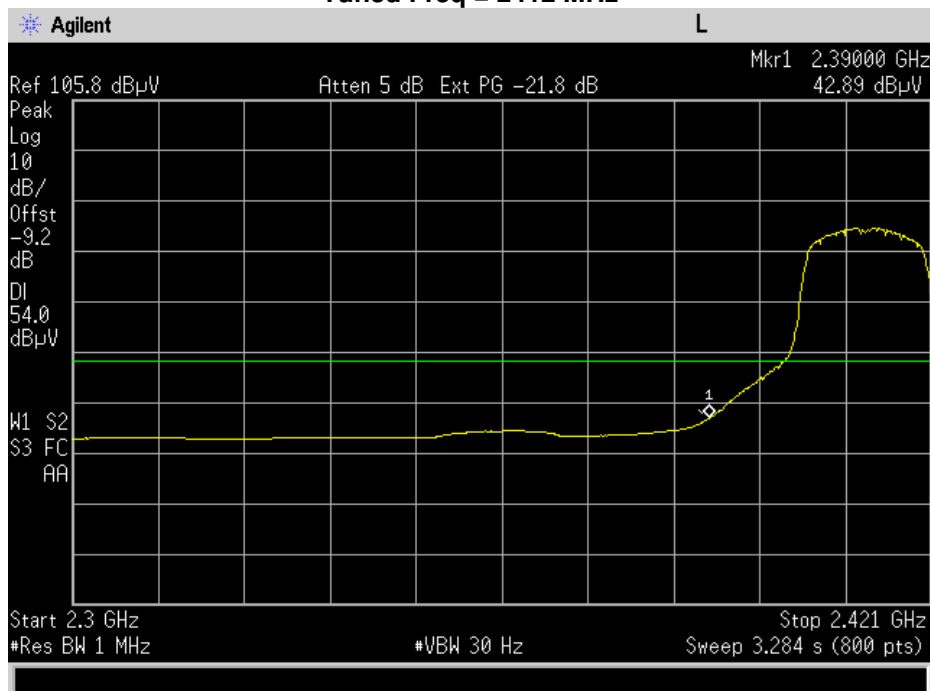




Restricted Band 2310 – 2390 MHz – Peak – WiFi .11G Modulation
Tuned Freq = 2412 MHz

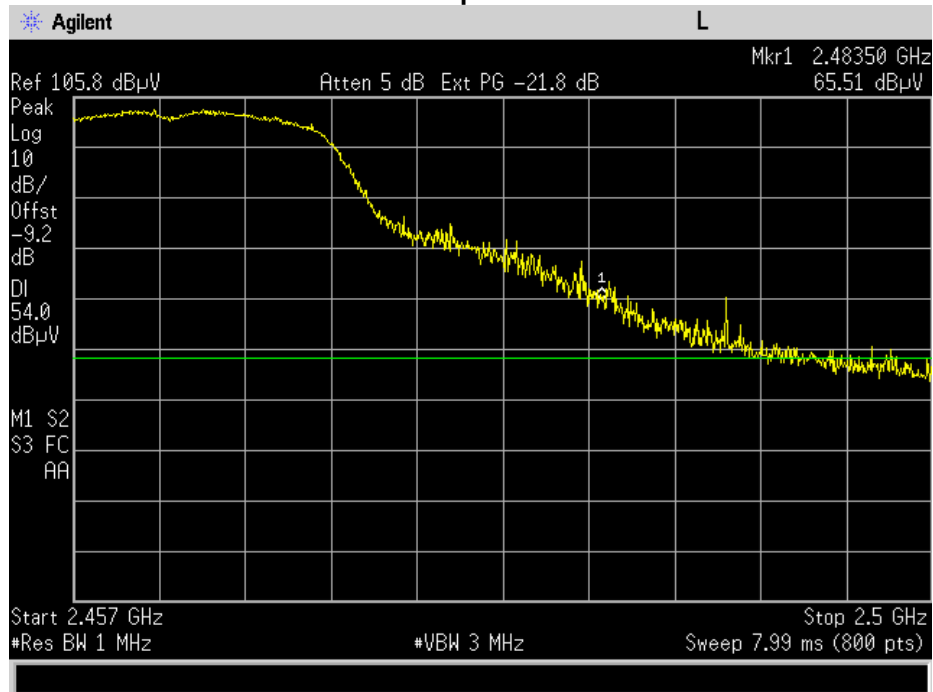


Restricted Band 2310 – 2390 MHz – Avg – WiFi .11G Modulation
Tuned Freq = 2412 MHz

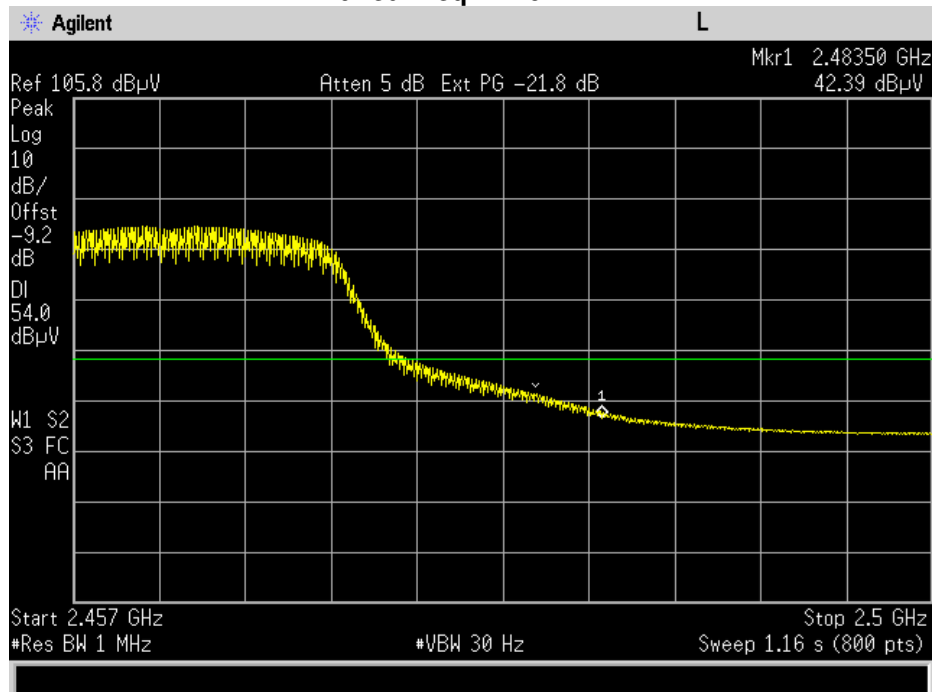




Restricted Band 2483.5 – 2500 MHz – Peak – WiFi .11G Modulation
Tuned Freq = 2462 MHz



Restricted Band 2483.5 – 2500 MHz – Avg – WiFi .11G Modulation
Tuned Freq = 2462 MHz





Occupied Bandwidth

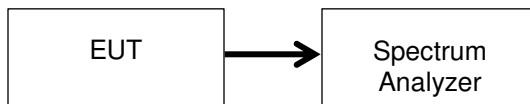
Engineer: Kenneth Lee

Test Date: 04/05/2016

Test Procedure

The EUT was connected directly to a spectrum analyzer. 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 and when the entire spectrum was captured the 6dB and 99% bandwidths were measured to verify the bandwidth met the specification.

Test Setup



6 dB Occupied Bandwidth Summary

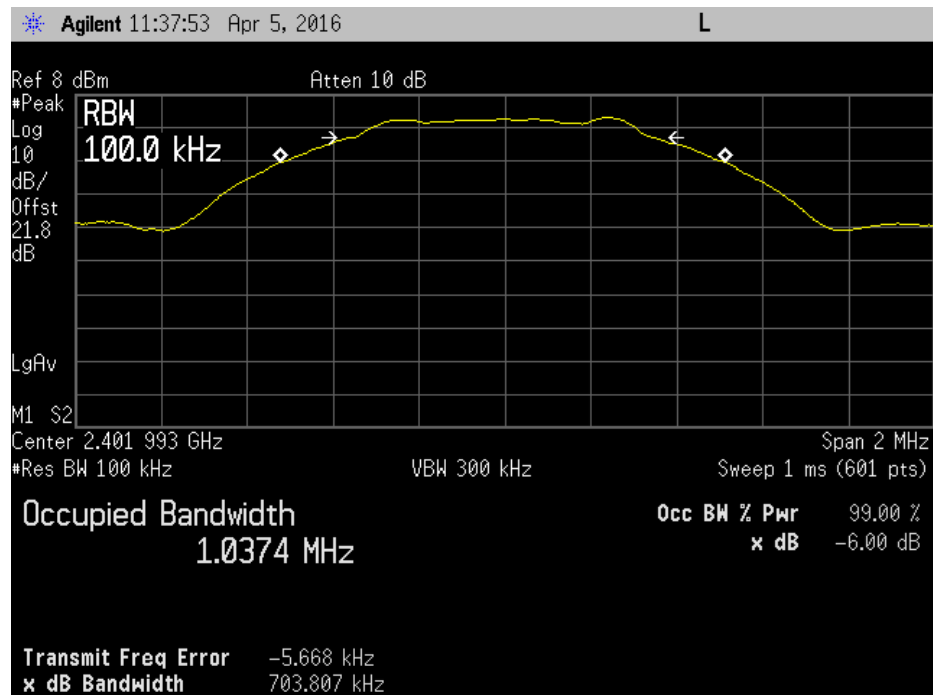
Modulation	Frequency (MHz)	Measured Bandwidth	Specification Limit (kHz)	Result
BT LE	2402	703.807 kHz	≥ 500	Pass
BT LE	2440	726.722 kHz	≥ 500	Pass
BT LE	2480	697.805 kHz	≥ 500	Pass
WiFi .11B	2412	10.115 MHz	≥ 500	Pass
WiFi .11B	2437	10.116 MHz	≥ 500	Pass
WiFi .11B	2462	10.089 MHz	≥ 500	Pass
WiFi .11G	2412	13.430 MHz	≥ 500	Pass
WiFi .11G	2437	14.140 MHz	≥ 500	Pass
WiFi .11G	2462	12.308 MHz	≥ 500	Pass

99% Bandwidth Summary

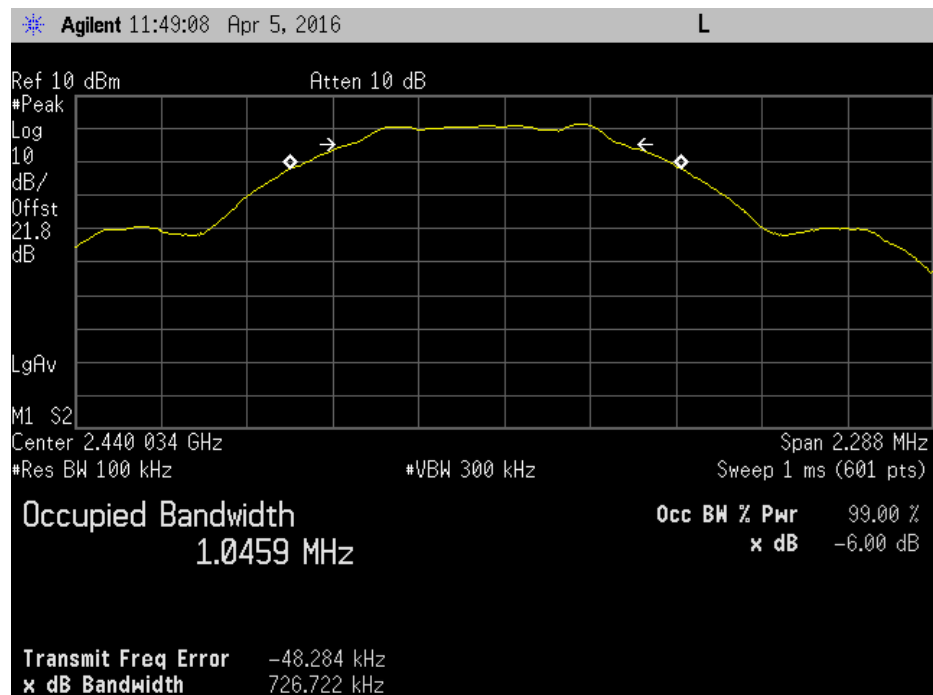
Modulation	Frequency (MHz)	Measured Bandwidth (MHz)	Result
BT LE	2402	1.037	Pass
BT LE	2440	1.045	Pass
BT LE	2480	1.043	Pass
WiFi .11B	2412	14.596	Pass
WiFi .11B	2437	14.628	Pass
WiFi .11B	2462	14.593	Pass
WiFi .11G	2412	16.320	Pass
WiFi .11G	2437	18.065	Pass
WiFi .11G	2462	16.289	Pass



99% Bandwidth 2402 MHz – BT LE Modulation

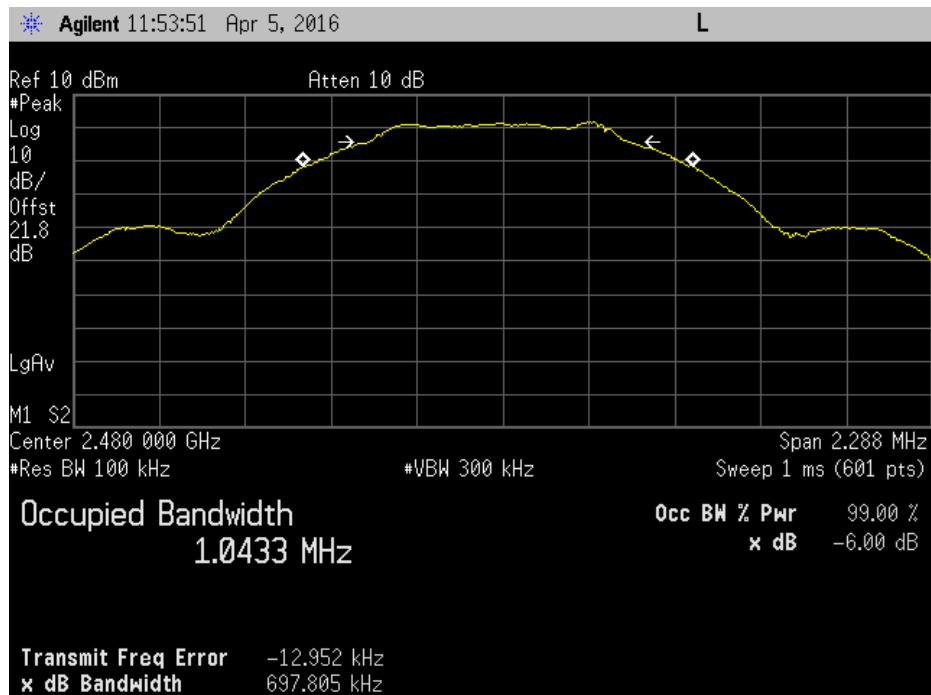


99% Bandwidth 2440 MHz – BT LE Modulation

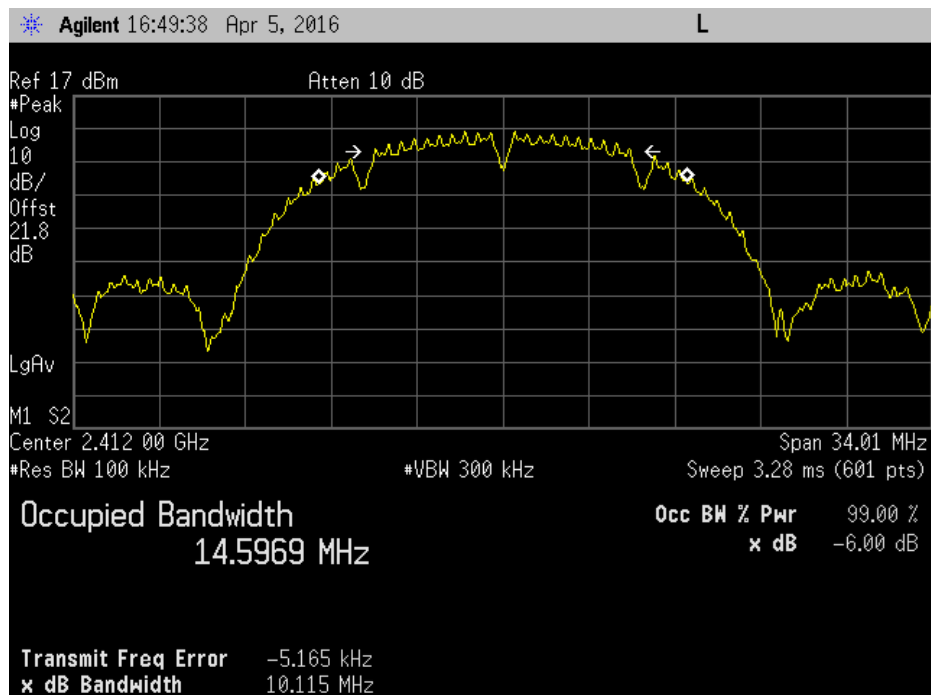




99% Bandwidth 2480 MHz – BT LE Modulation

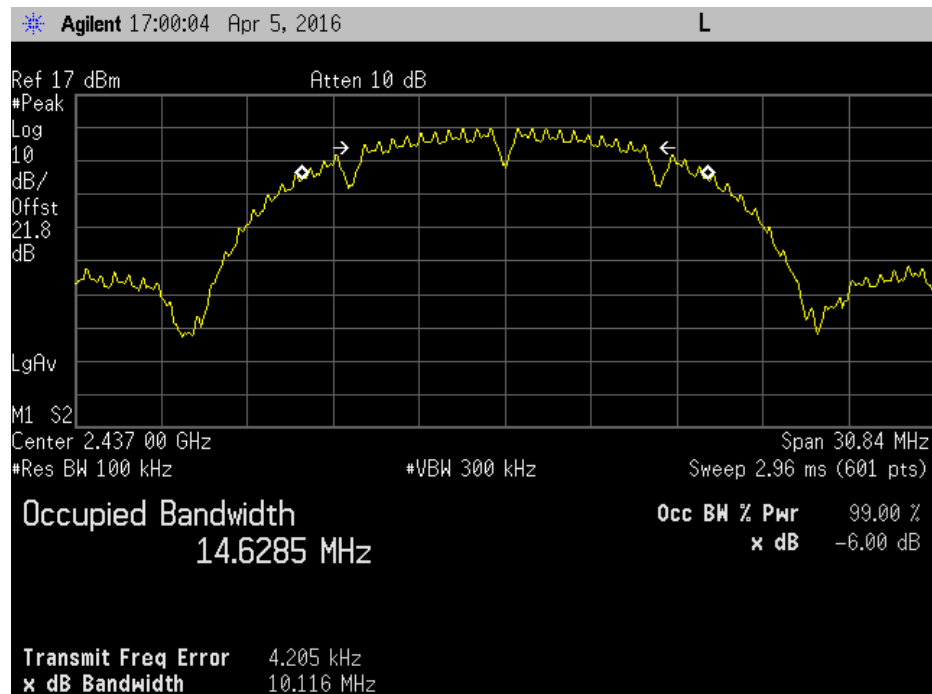


99% Bandwidth 2412 MHz – WiFi .11B Modulation

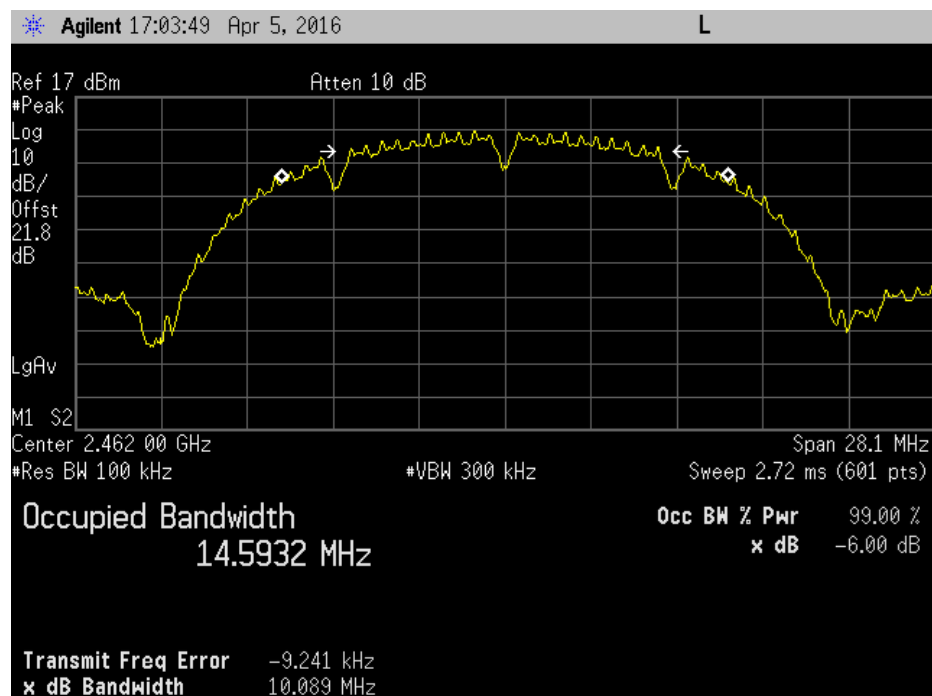




99% Bandwidth 2437 MHz – WiFi .11B Modulation

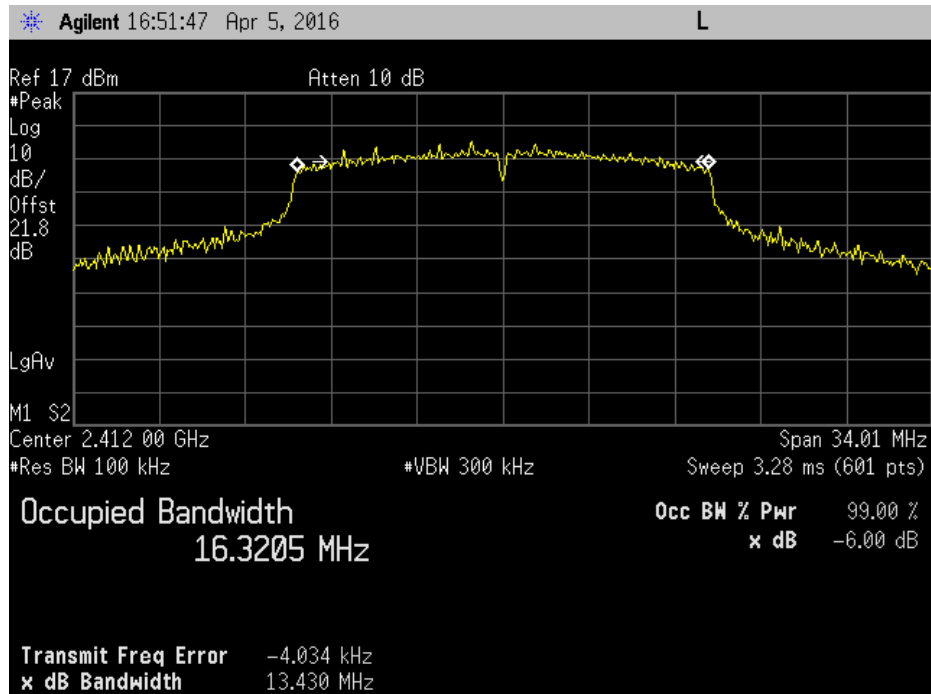


99% Bandwidth 2462 MHz – WiFi .11B Modulation

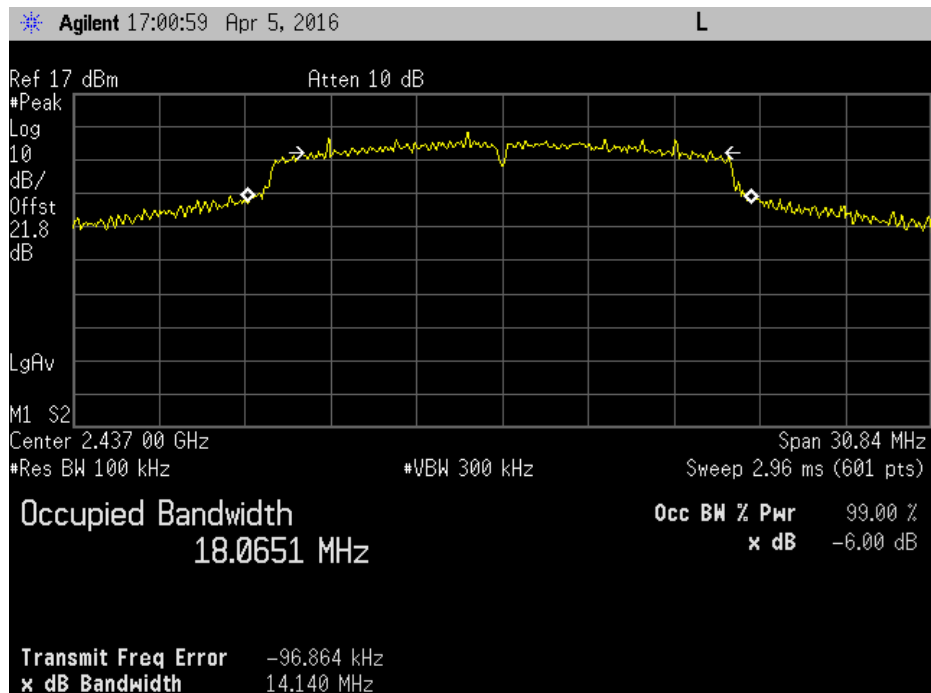




99% Bandwidth 2412 MHz – WiFi .11G Modulation

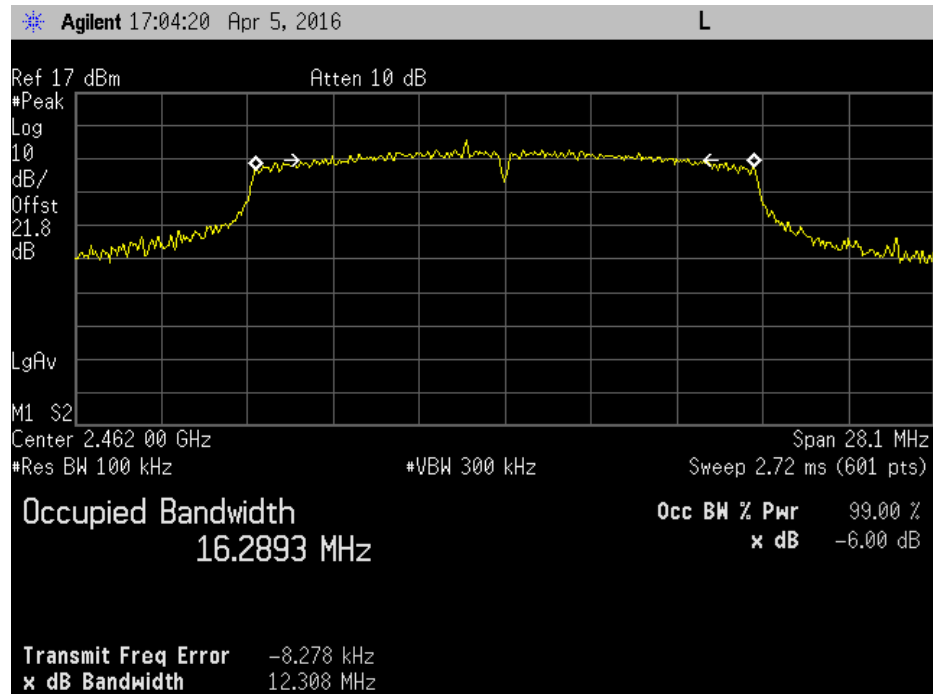


99% Bandwidth 2437 MHz – WiFi .11G Modulation





99% Bandwidth 2462 MHz – WiFi .11G Modulation



Transmitter Power Spectral Density (PSD)

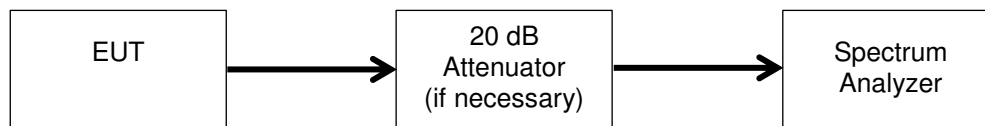
Engineer: Kenneth Lee

Test Date: 04/06/2016

Test Procedure

The EUT was connected directly to a spectrum analyzer. The test was performed per section 11.10.2 of C63.10 - 2013 "Procedure for determining PSD for DTS devices".

Test Setup



PSD Summary

BT LE Modulation

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-14.48	8	Pass
2440	-14.18	8	Pass
2480	-13.78	8	Pass

WiFi .11B Modulation

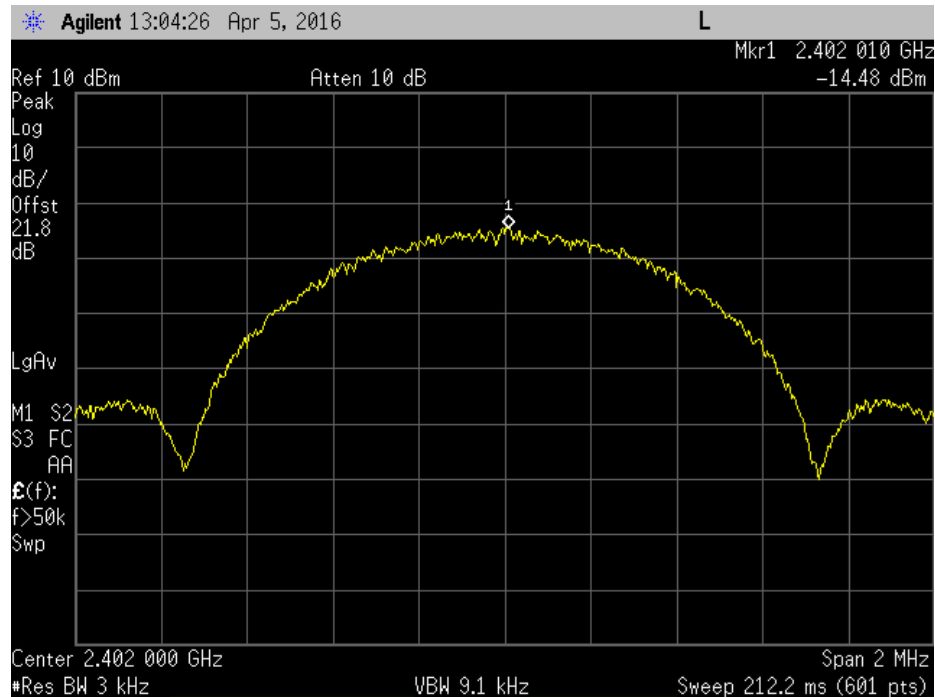
Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2412	-2.481	8	Pass
2437	-2.554	8	Pass
2462	-2.061	8	Pass

WiFi .11G Modulation

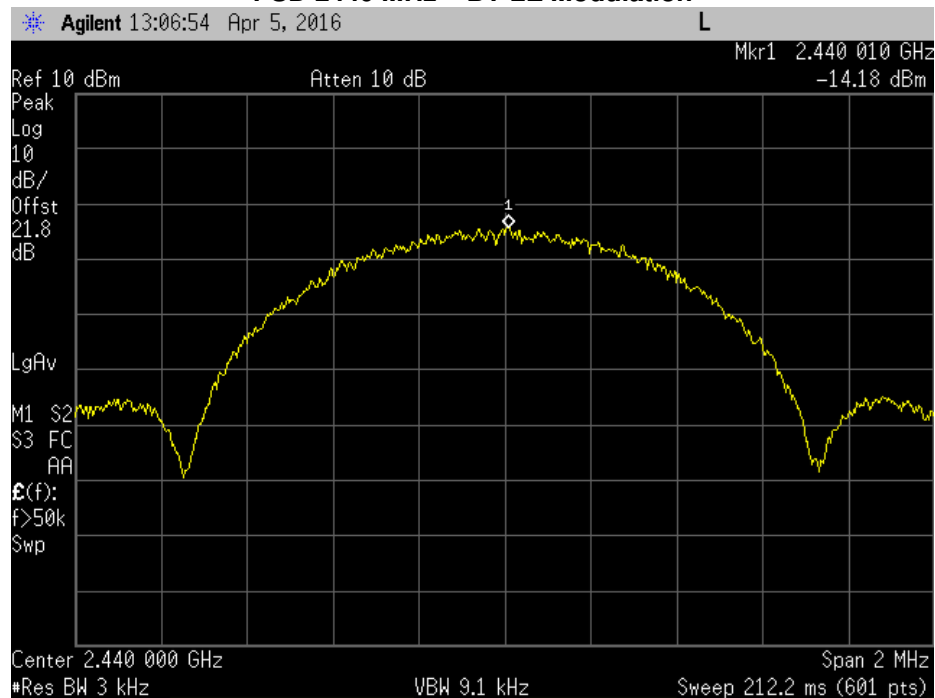
Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2412	-9.059	8	Pass
2437	-5.802	8	Pass
2462	-7.731	8	Pass



PSD 2402 MHz – BT LE Modulation

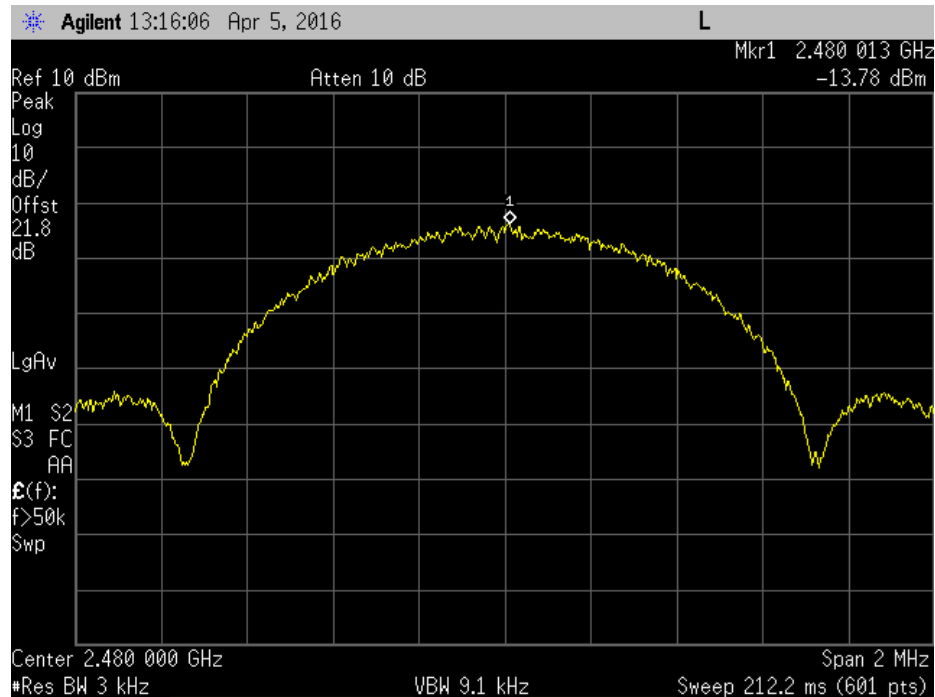


PSD 2440 MHz – BT LE Modulation

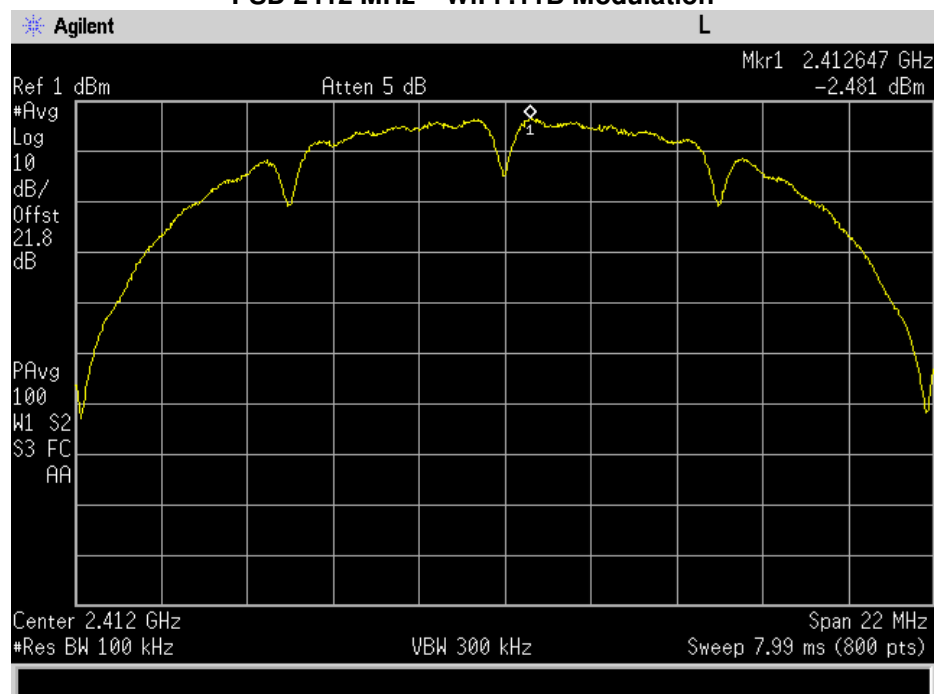




PSD 2480 MHz – BT LE Modulation

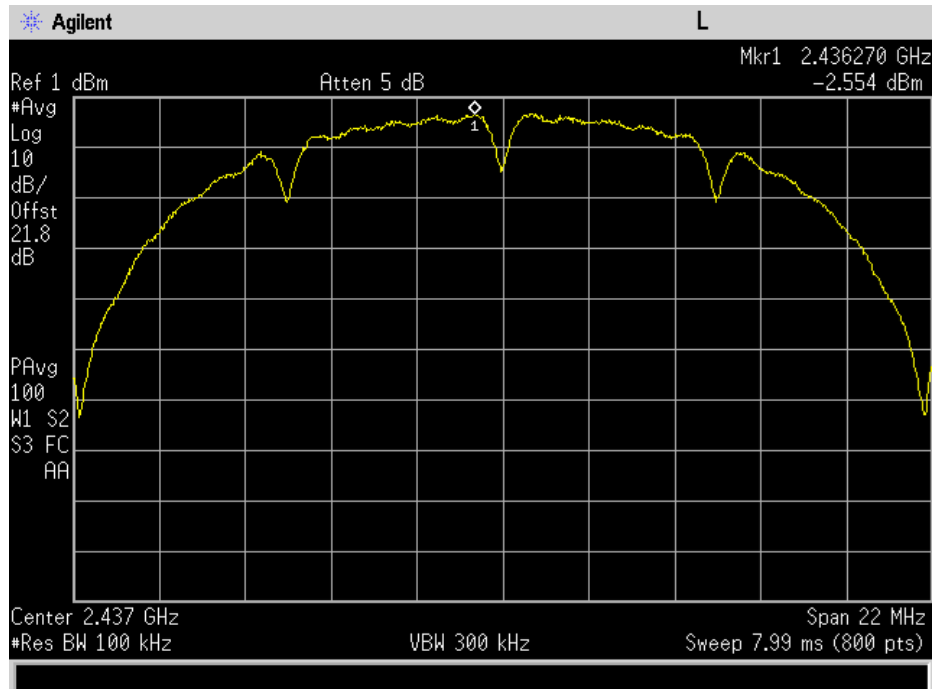


PSD 2412 MHz – WiFi .11B Modulation

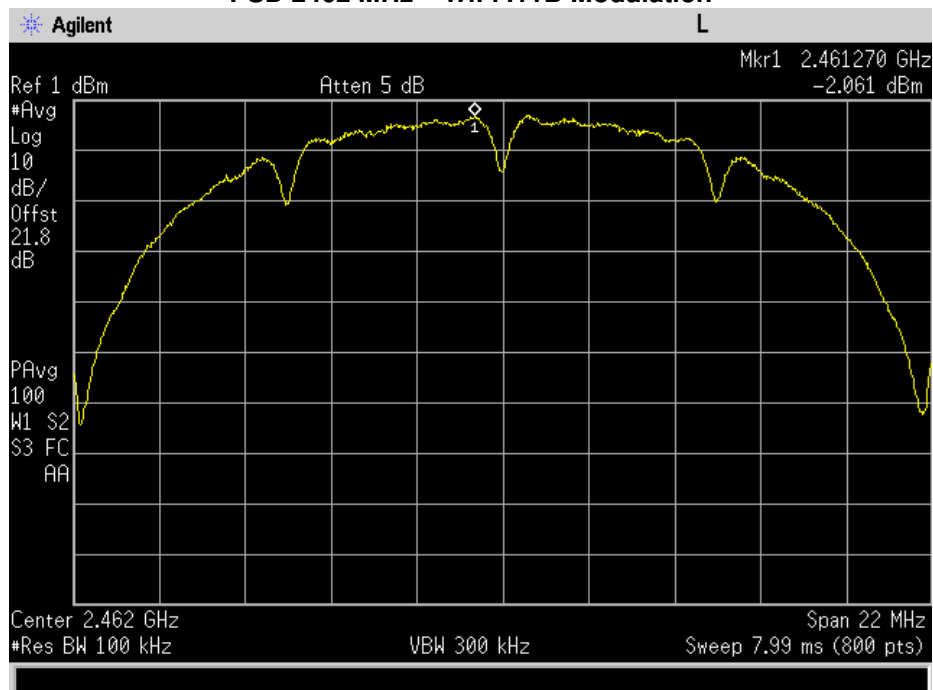




PSD 2437 MHz – WiFi .11B Modulation

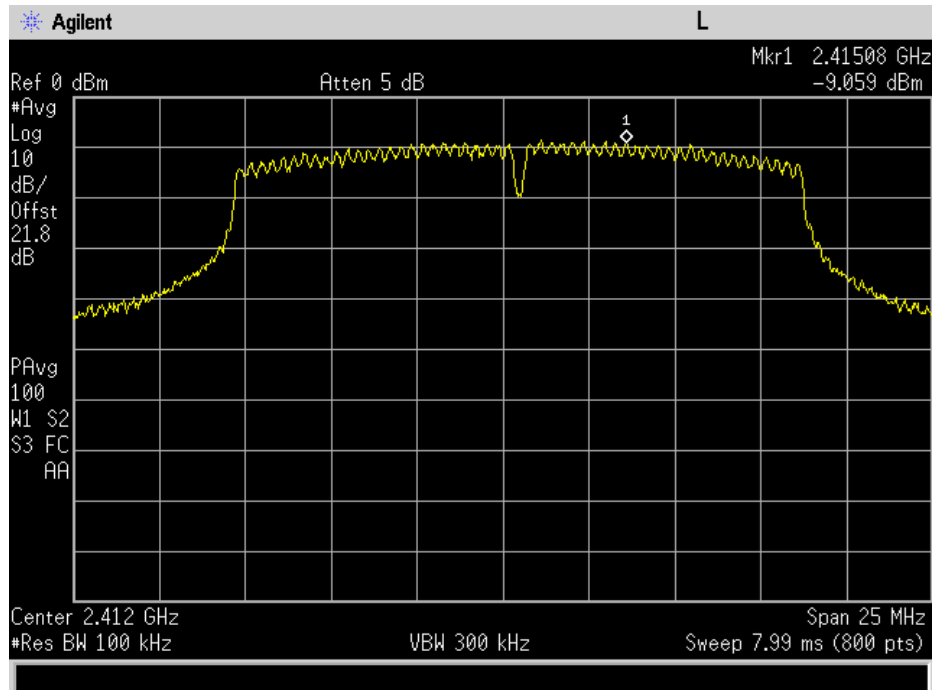


PSD 2462 MHz – WiFi .11B Modulation

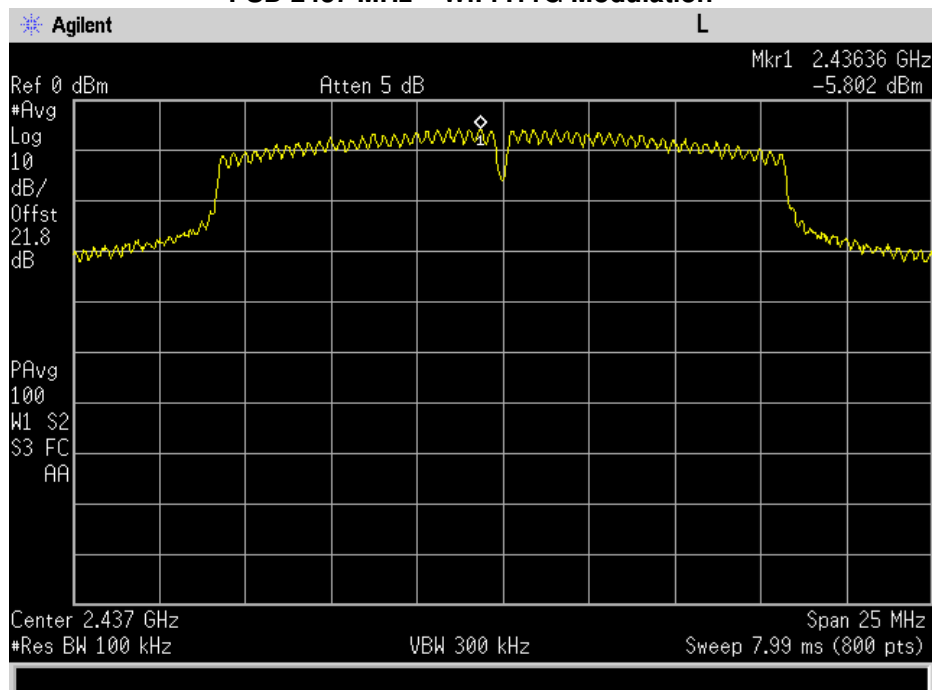




PSD 2412 MHz – WiFi .11G Modulation

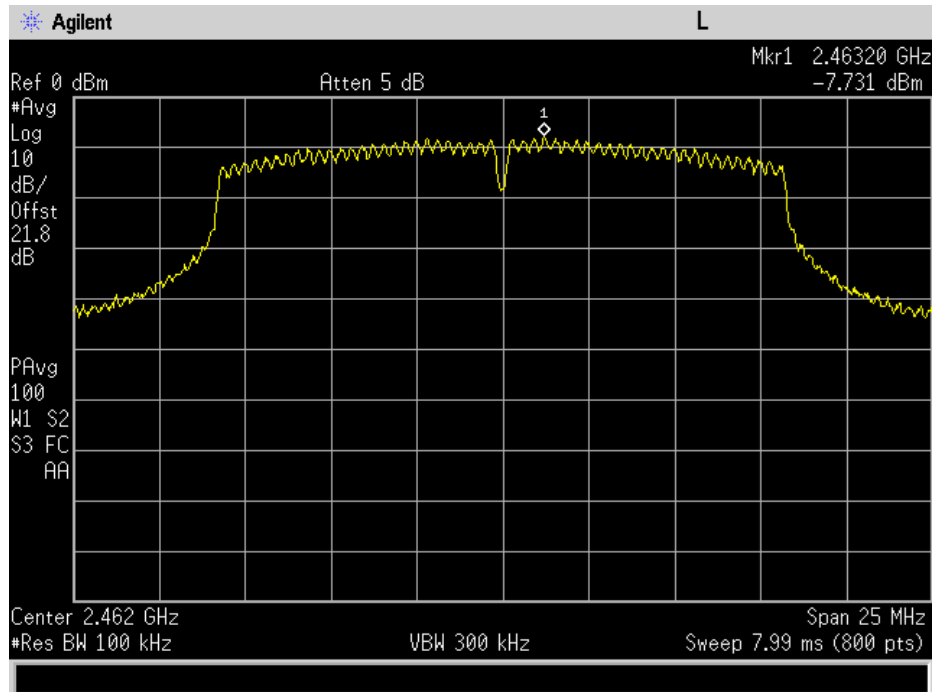


PSD 2437 MHz – WiFi .11G Modulation





PSD 2462 MHz – WiFi .11G Modulation





A/C Powerline Conducted Emission

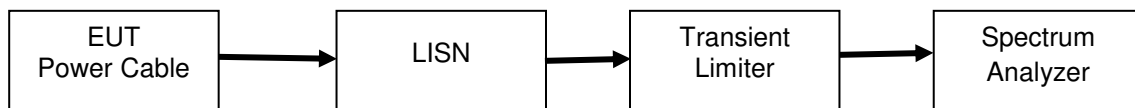
Engineer: Kenneth Lee

Test Date: 04/12/2016

Test Procedure

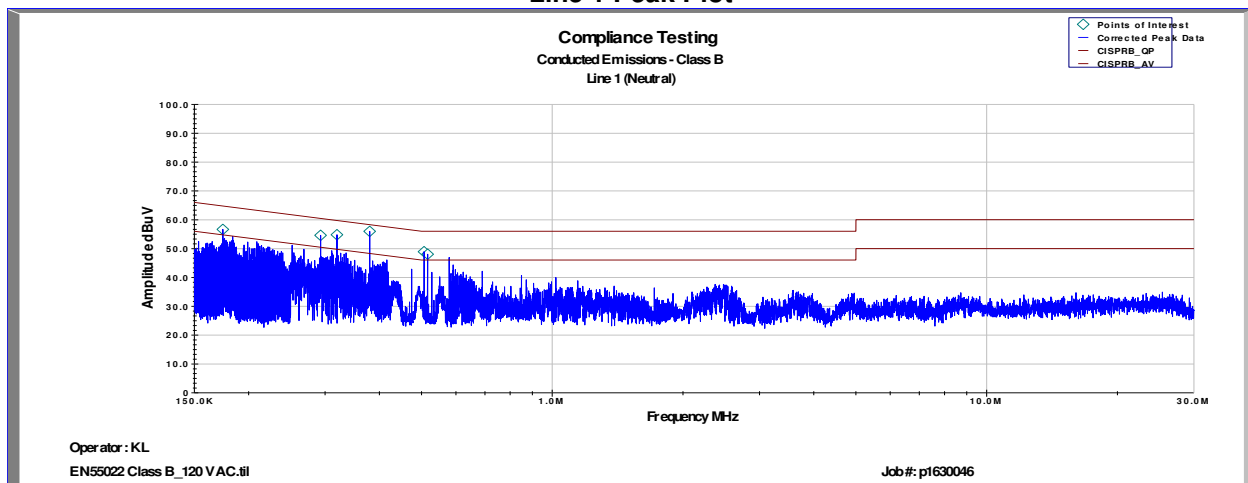
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup

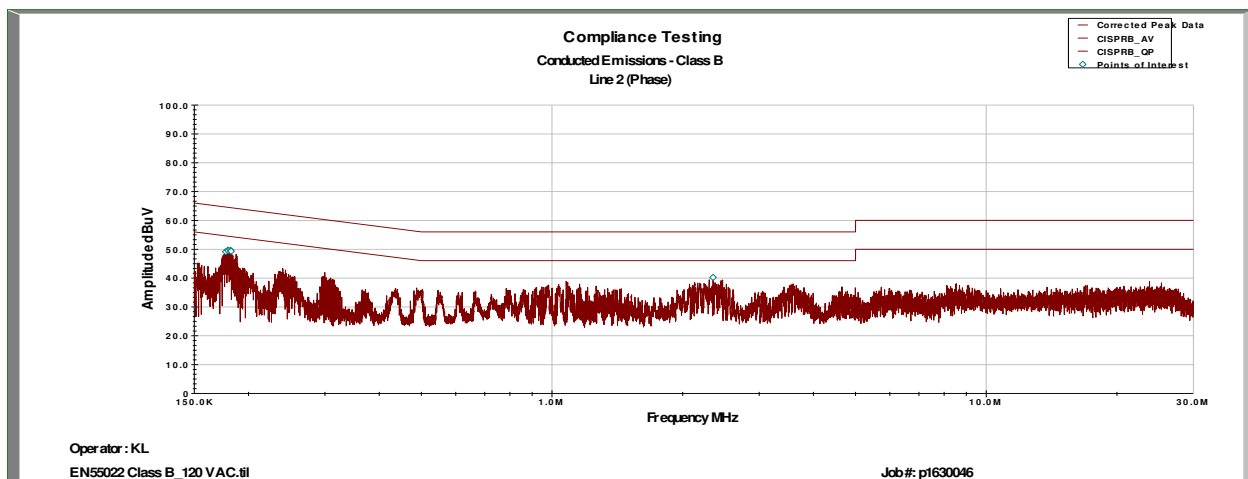


Conducted Emission Test Results

Line 1 Peak Plot



Line 2 Peak Plot





Line 1 Neutral Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
178.89 KHz	20.9	0.2	0.02	10.1	31.223	55.175	-23.951
301.89 KHz	8.89	0.15	0.025	10.1	19.167	51.66	-32.493
309.69 KHz	7.96	0.15	0.025	10.1	18.234	51.437	-33.203
371.13 KHz	7.82	0.11	0.029	10.1	18.063	49.682	-31.619
500.11 KHz	7.28	0.1	0.03	10.1	17.507	46	-28.493
505.42 KHz	5.88	0.1	0.03	10.1	16.107	46	-29.893

Line 2 Phase Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
179.97 KHz	19.37	0.2	0.02	10.1	29.687	55.144	-25.457
180.01 KHz	19.59	0.2	0.02	10.1	29.91	55.143	-25.233
180.47 KHz	19.12	0.2	0.02	10.1	29.443	55.129	-25.686
180.78 KHz	18.65	0.2	0.02	10.1	28.97	55.121	-26.151
184.51 KHz	17.8	0.2	0.02	10.1	28.117	55.014	-26.897
2.3512 MHz	9.37	0	0.068	10.1	19.541	46	-26.459

Line 1 Neutral QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
178.89 KHz	37	0.2	0.02	10.1	47.32	65.175	-17.855
301.89 KHz	23.2	0.149	0.025	10.1	33.474	61.66	-28.186
309.69 KHz	23.58	0.145	0.025	10.1	33.851	61.437	-27.587
371.13 KHz	21.77	0.114	0.029	10.1	32.013	59.682	-27.669
500.11 KHz	19.94	0.1	0.03	10.1	30.17	56	-25.83
505.42 KHz	17.13	0.1	0.03	10.1	27.36	56	-28.64

Line 2 Phase QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
179.97 KHz	35.32	0.2	0.02	10.1	45.64	65.144	-19.504
180.01 KHz	35.25	0.2	0.02	10.1	45.57	65.143	-19.573
180.47 KHz	35.07	0.2	0.02	10.1	45.39	65.129	-19.739
180.78 KHz	34.87	0.2	0.02	10.1	45.19	65.121	-19.931
184.51 KHz	32.35	0.2	0.02	10.1	42.67	65.014	-22.344
2.3512 MHz	21.99	0	0.068	10.1	32.158	56	-23.842



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	3/29/16	3/29/17
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 04/11/2016	
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	5/8/14	5/8/16
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/22/15	4/22/18
Spectrum Analyzer	Agilent	E4407B	i00331	9/18/15	9/18/16
Horn Antenna	EMCO	3115	i00103	1/20/15	1/20/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/19/15	10/19/17
EMI Analyzer	Agilent	E7405A	i00379	2/11/16	2/11/17
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/27/14	7/27/16
LISN	COM-Power	LI-125A	i00447	7/25/14	7/25/16
LISN	COM-Power	LI-125A	i00449	8/28/15	8/28/17
PSA Spectrum Analyzer	Agilent	E4445A	i00471	8/26/15	8/26/16

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