Compliance Testing, LLC
Previously Flom Test Lab
EMI, EMC, RF Testing Experts Since 1963

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http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: AutoEnginuity

Model: Wireless Diagnostics

Description: Wireless diagnostics tool for auto parts stores

Serial Number: N/A

FCC ID: 2ALTV-AS12017

To

FCC Part 15.247 FHSS

Date of Issue: September 28, 2017

On the behalf of the applicant:	**AutoEnginuity** **1819 N Rosemont** **Mesa, AZ 85205**
Attention of:	**Jay Horak** **Ph: (480)840-5815** **E-mail: jayh@autoenginuity.com**

Prepared by
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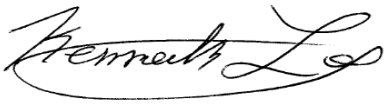
Project No: p1720024



Kenneth Lee
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	April 2, 2017	Kenneth Lee	Original Document
2.0	September 27, 2017	Kenneth Lee	Updated Test Summary Page. Removed Conducted procedure from Spurious 15.205 emissions.

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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 in the table 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 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 and Engineering Practices

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2 and the following individual Part: 15.247 Operation within bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

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

In accordance with ANSI C63.4:2014, ANSI C63.10:2013, FCC DA 00-705, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10 to 40C (50 to 104F) 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.

Environmental Conditions		
Temperature (°C)	**Humidity (%)**	**Pressure (mbar)**
25.2	37.9	968.7

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

EUT Description
Model: Wireless Diagnostics
Description: Wireless diagnostics tool for auto parts stores
Firmware: N/A
Software: N/A
Serial Number: N/A
Additional Information: The device is capable of implementing Bluetooth Classic, EDR 2MB and EDR 3MB all were fully tested. The spurious emission testing was done with the modulation that produced the highest amplitude emissions. The device was tested with a 3 dBi antenna. The hopping function was disabled for certain tests.

EUT Operation during Tests:
The device was set to transmit at the lowest, a middle and the highest channel of operation via an SSH connection with a laptop computer.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	AC Adapter	XP Power	VEL24US120-US-JA	N/A

Cables: None

Modifications: None

15.203: Antenna Requirement:

	The antenna is permanently attached to the EUT
X	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)	Occupied Bandwidth	Pass	
15.247(a)	Dwell Time	Pass	
15.247(a)	Number of Hopping Channels	Pass	
15.247(a)	Channel Separation	Pass	
15.207	A/C Powerline Conducted Emissions	Pass	

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63.10-2014	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2013	Method and Measurements of Radio-Noise Emissions from low-Voltage Electrical and Electronic Equipment in the range 9kHz to 40GHz.
ISO/IEC 17025:2005	General requirements for the Competence of Testing and Calibrations Laboratories

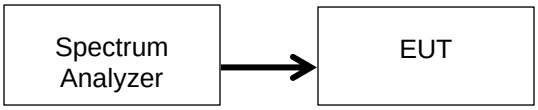
Peak Output Power
Engineer: Kenneth Lee
Test Dates: 03/31/2017

Test Procedure

The EUT was connected directly to the input of a spectrum analyzer. The peak readings were taken and the result was then compared to the limit. The spectrum analyzer was set to the following:

RBW ≥ DTS Bandwidth
VBW ≥ 3 x RBW
Span ≥ 3 x RBW
Sweep time = auto couple
Detector = peak
Trace Mode = max hold

Test Setup



Transmitter Peak Output Power - BT

Tuned Frequency (MHz)	Recorded Measurement	Specification Limit (W)	Result
2402	9.858	1	Pass
2442	10.14	1	Pass
2480	9.938	1	Pass

Transmitter Peak Output Power – EDR 2MB

Tuned Frequency (MHz)	Recorded Measurement	Specification Limit (W)	Result
2402	8.103	1	Pass
2442	7.829	1	Pass
2480	9.607	1	Pass

Transmitter Peak Output Power – EDR 3MB

Tuned Frequency (MHz)	Recorded Measurement	Specification Limit (W)	Result
2402	8.644	1	Pass
2442	8.421	1	Pass
2480	7.978	1	Pass

Conducted Spurious Emissions

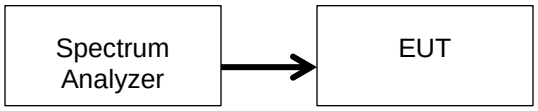
Engineer: Kenneth Lee

Test Date: 03/31/2017

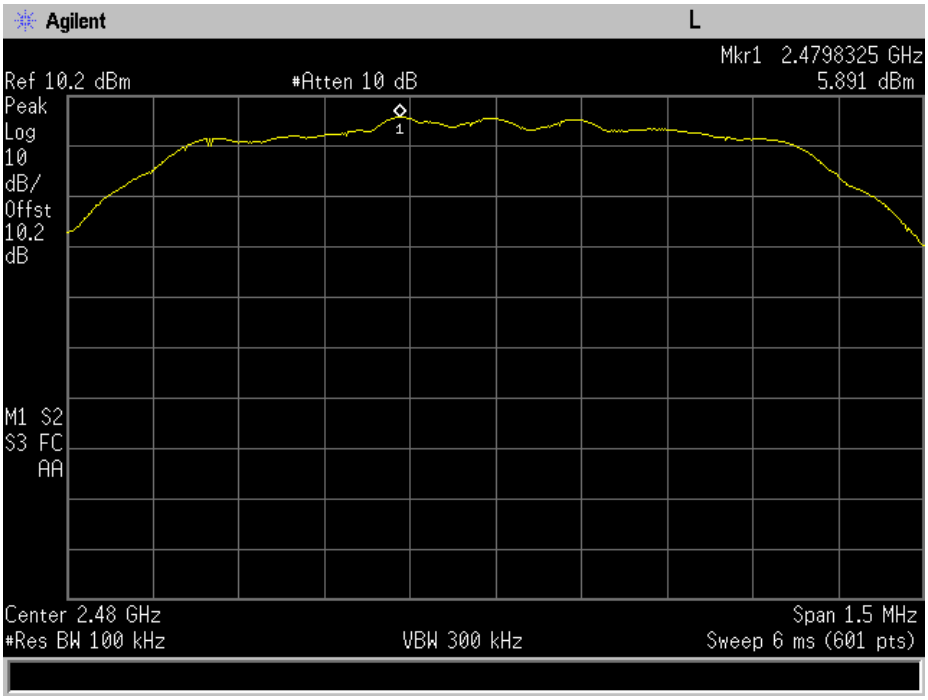
Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The reference level was offset for the peak power output with the resolution bandwidth set for 100 kHz. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. All emissions were investigated to insure they were attenuated from the peak fundamental by at least 20dB.

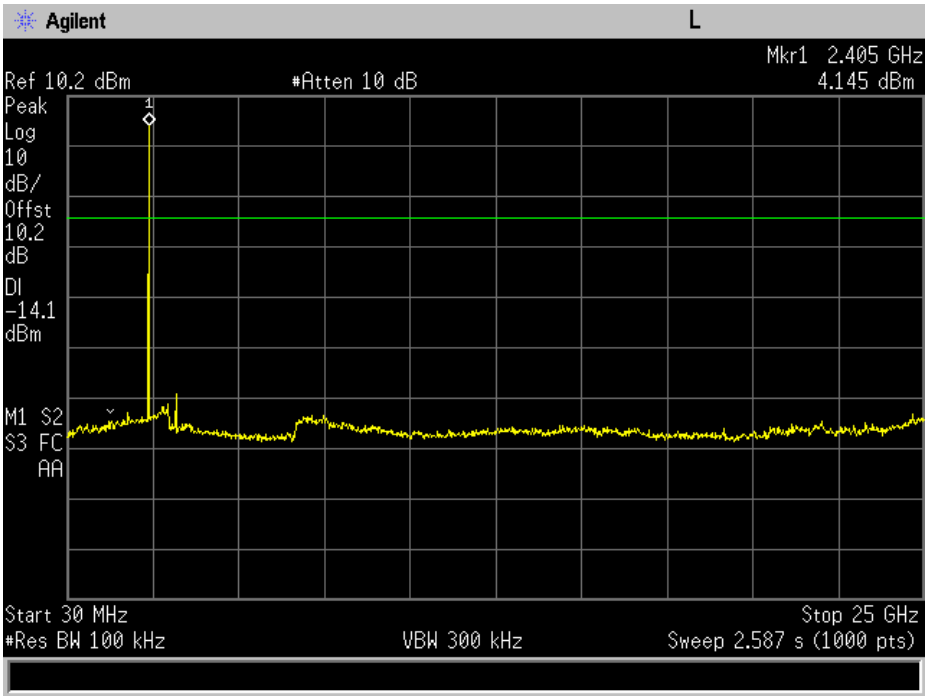
Test Setup



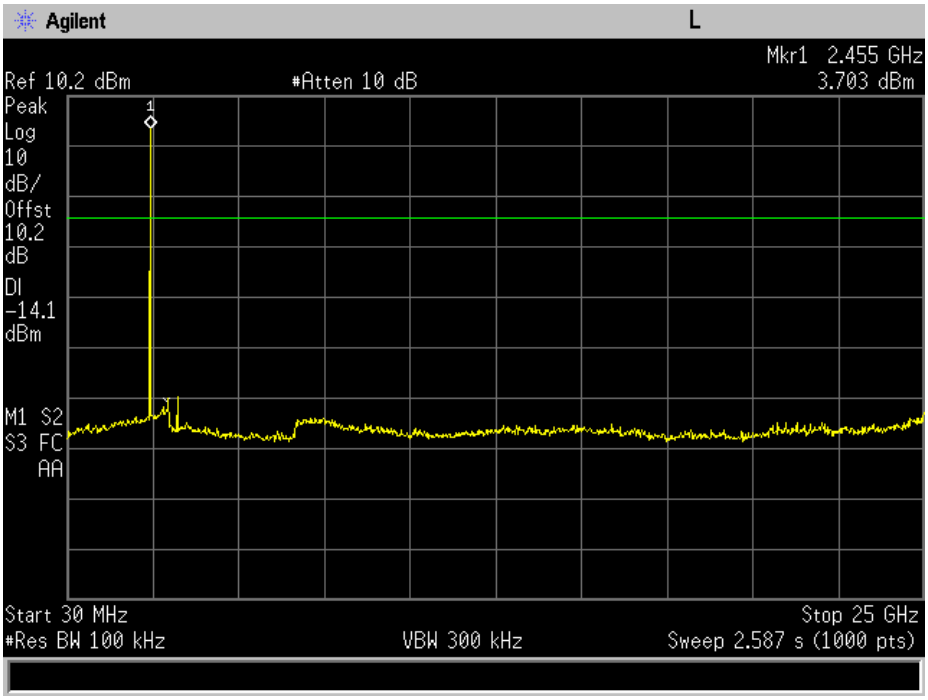
Conducted Spurious Reference Level



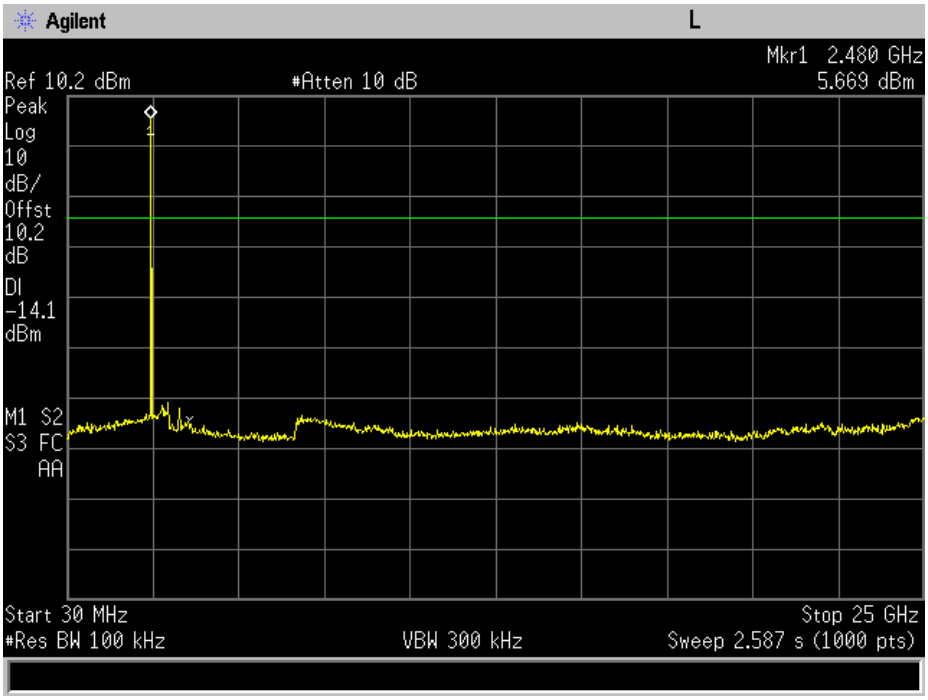
Conducted Spurious Emissions 2402 MHz



Conducted Spurious Emissions 2442 MHz



Conducted Spurious Emissions 2480 MHz



Radiated Spurious Emissions
Engineer: Kenneth Lee
Test Date: 3/31/2017

Test Procedure – (Compliance to 15.247 and 15.209)

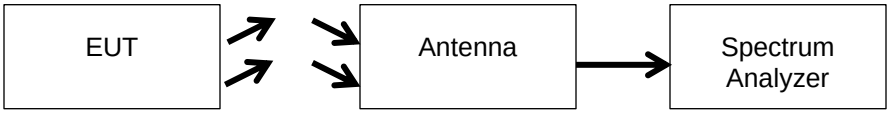
Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. 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

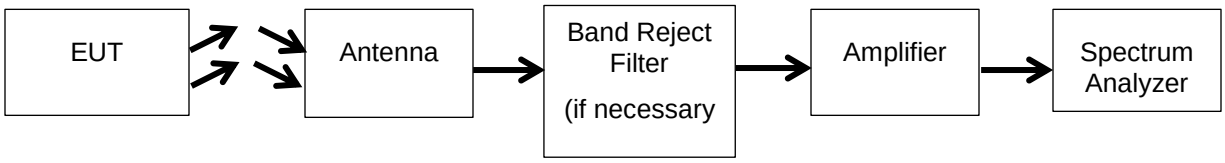


Test Procedure for
Radiated Spurious Emissions above 1 GHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The output of the transmitter was connected to a non-radiating balance load. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. 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.

RBW = 100 KHz and 1 MHz
VBW = 300 KHz and 3 MHz
Detector – Quasi Peak

Test Setup



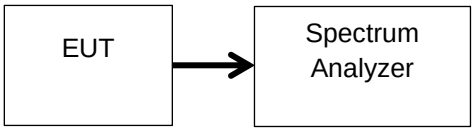
See Annex A for test data

Emissions at Band Edges
Engineer: Kenneth Lee
Test Date: 3/31/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer. The spectrum analyzer was used to verify that the EUT met the requirements for band edge with both peak and average measurements. The cable and transducer correction factors were input into the analyzer as a reference level offset to ensure accurate readings.

Test Setup



Band Edge Emissions Summary - BT

Tuned Frequency (MHz)	Emission Frequency (MHz)	Monitored Level	Detector	Limit	Result
2402	2400	-60.42	Peak	-20 dBc	Pass
2480	2483.5	-62.82	Peak	-20 dBc	Pass

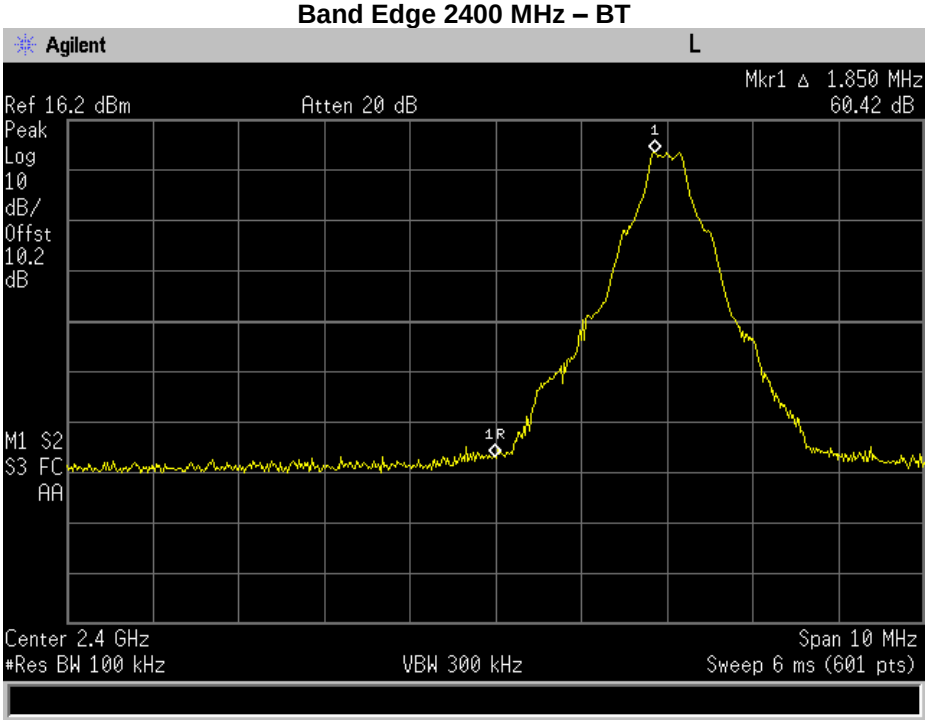
Band Edge Emissions Summary – EDR 2MB

Tuned Frequency (MHz)	Emission Frequency (MHz)	Monitored Level	Detector	Limit	Result
2402	2400	-55.2	Peak	-20 dBc	Pass
2480	2483.5	-55.7	Peak	-20 dBc	Pass

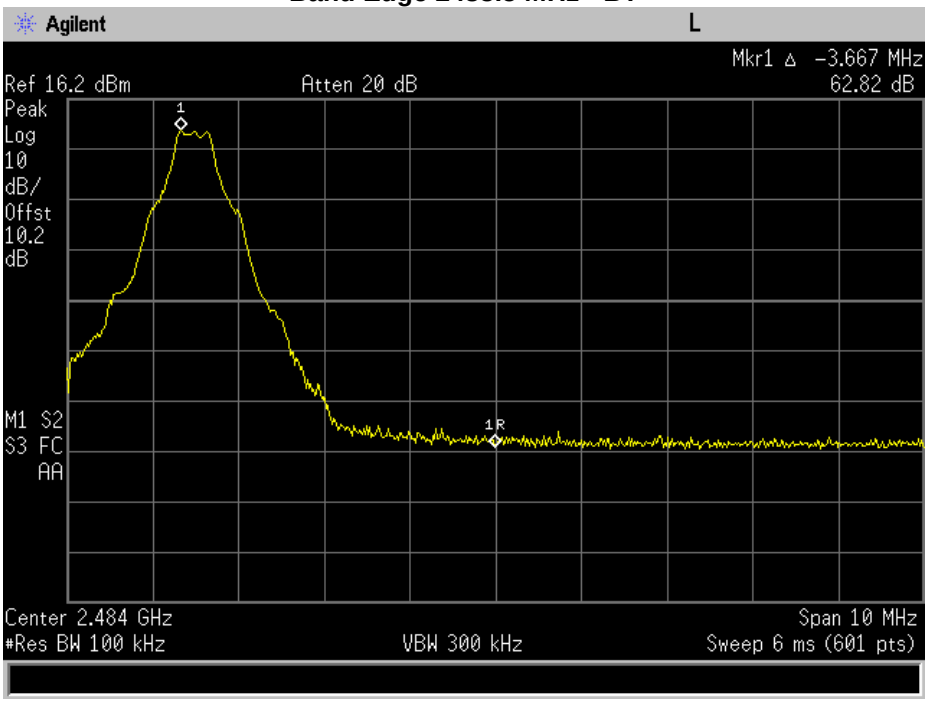
Band Edge Emissions Summary – EDR 3MB

Tuned Frequency (MHz)	Emission Frequency (MHz)	Monitored Level	Detector	Limit	Result
2402	2400	-55.13	Peak	-20 dBc	Pass
2480	2483.5	-55.83	Peak	-20 dBc	Pass

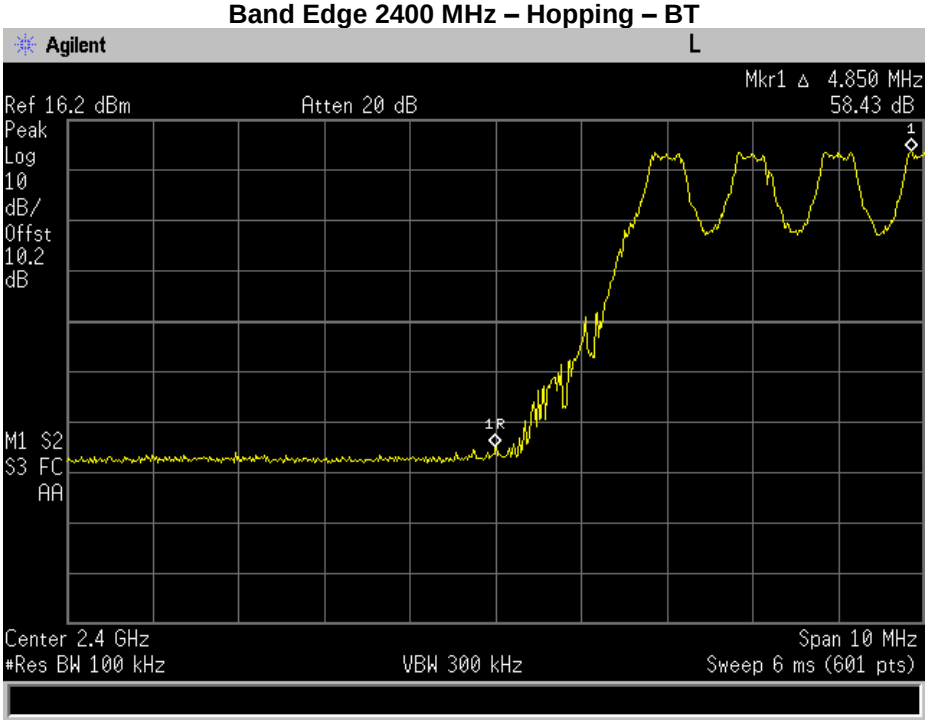
Band Edge 2400 MHz – BT



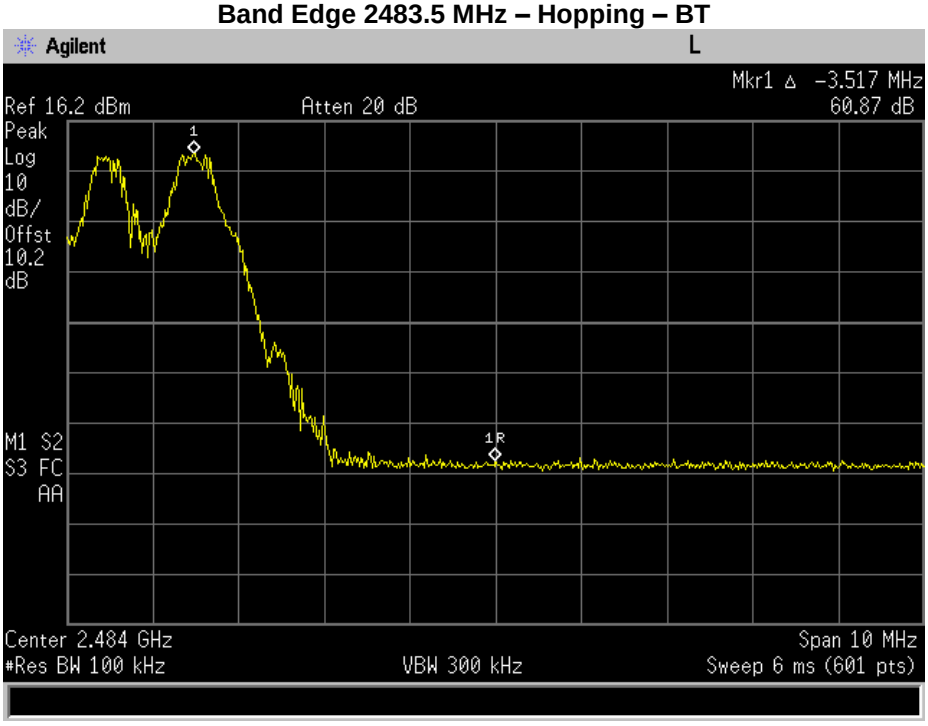
Band Edge 2483.5 MHz - BT



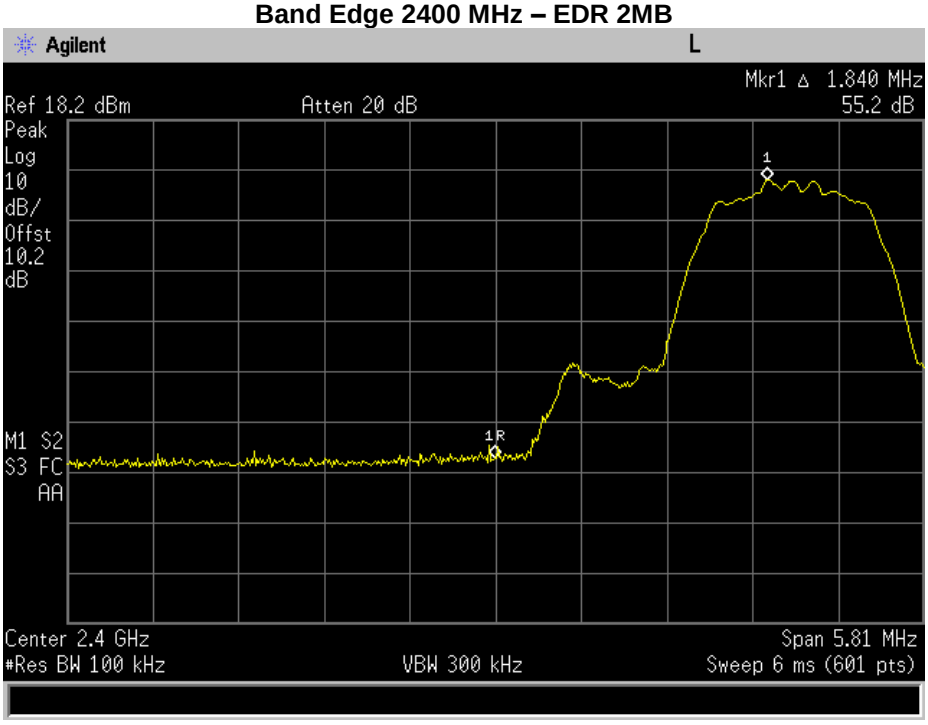
Band Edge 2400 MHz – Hopping – BT



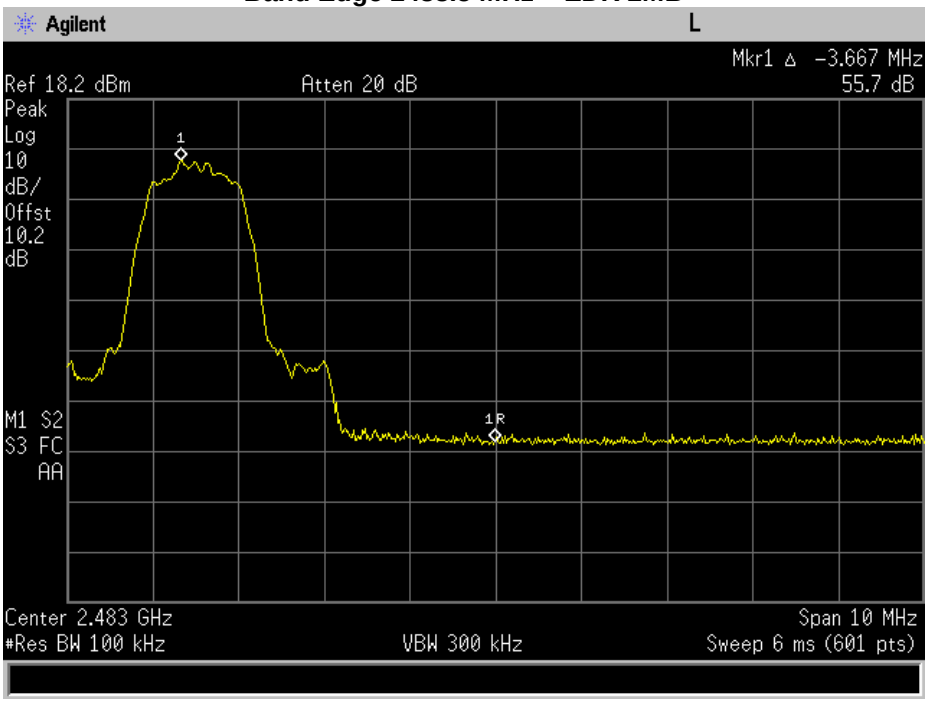
Band Edge 2483.5 MHz – Hopping – BT



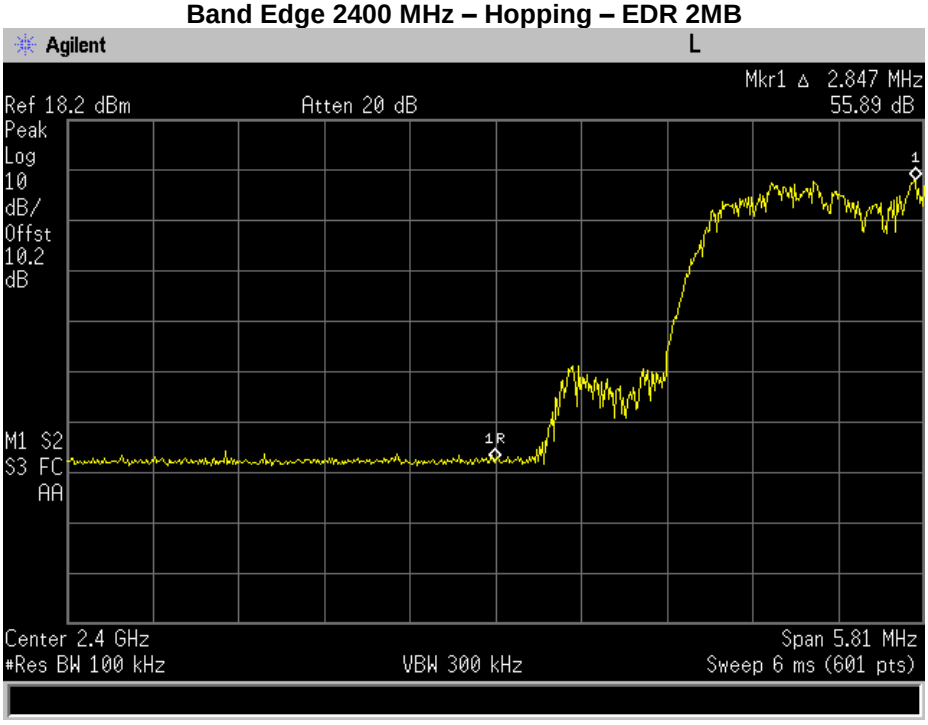
Band Edge 2400 MHz – EDR 2MB



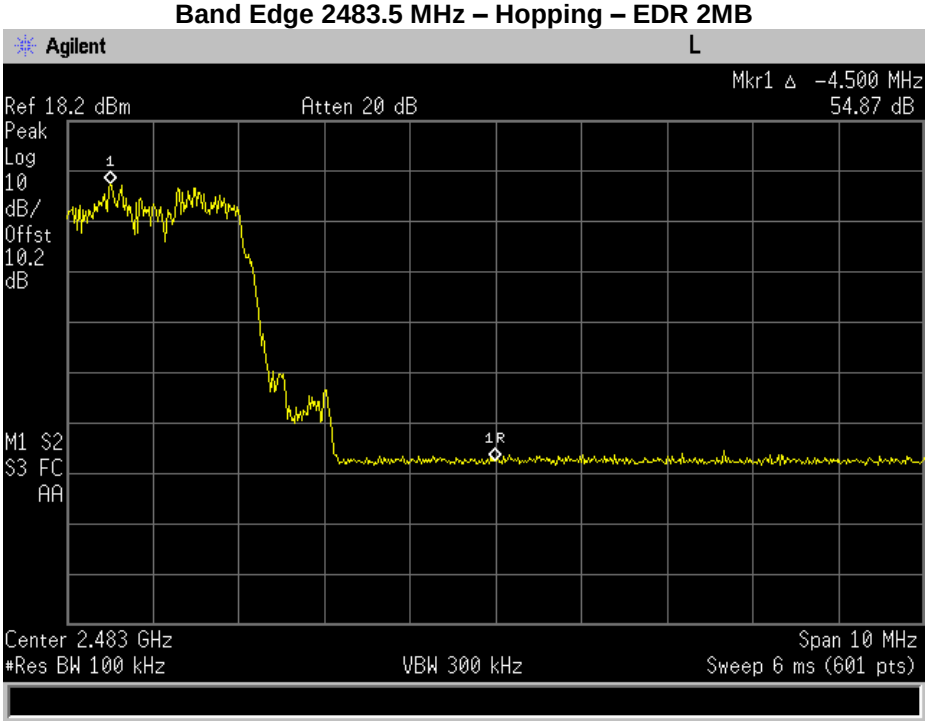
Band Edge 2483.5 MHz – EDR 2MB



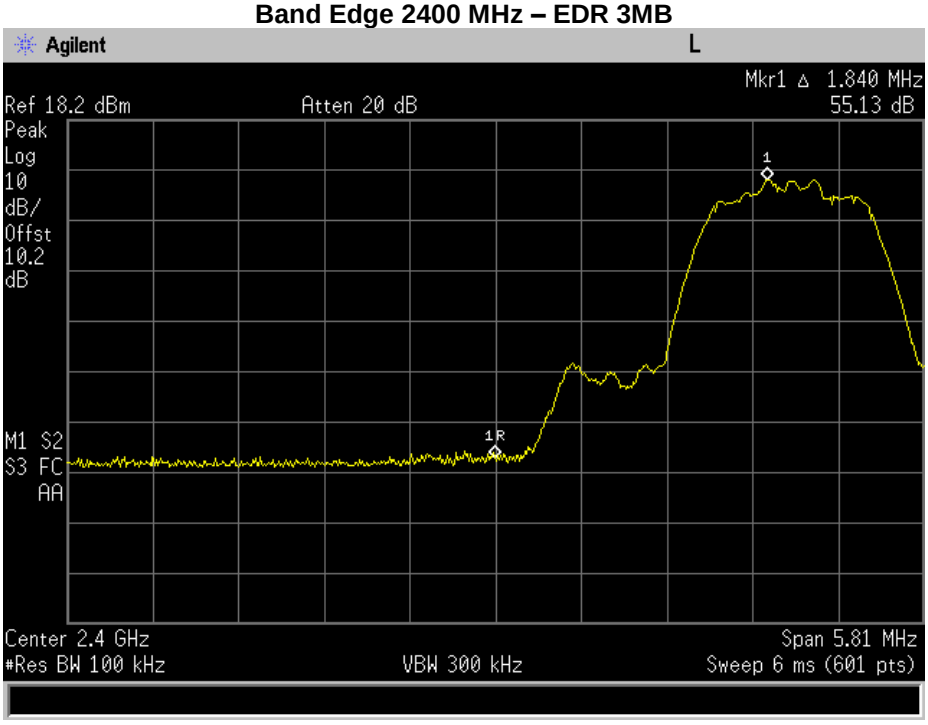
Band Edge 2400 MHz – Hopping – EDR 2MB



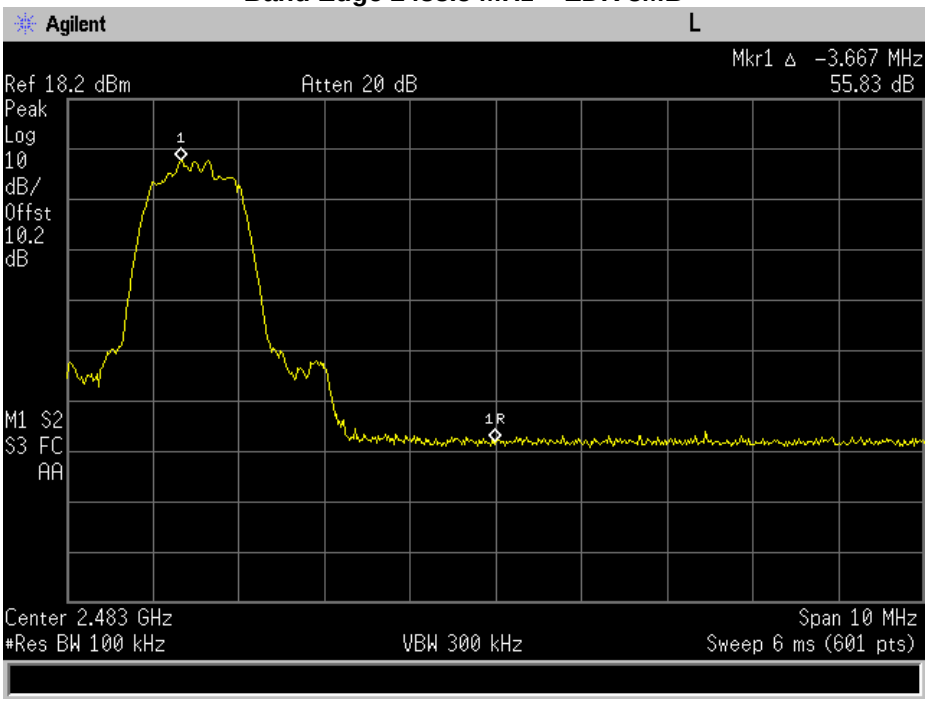
Band Edge 2483.5 MHz – Hopping – EDR 2MB



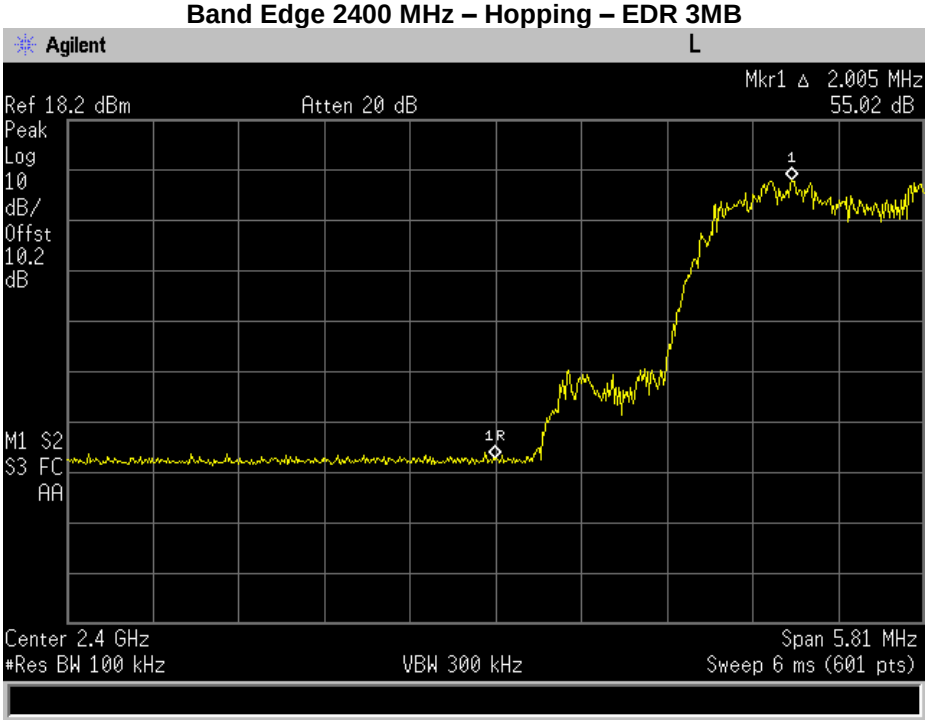
Band Edge 2400 MHz – EDR 3MB



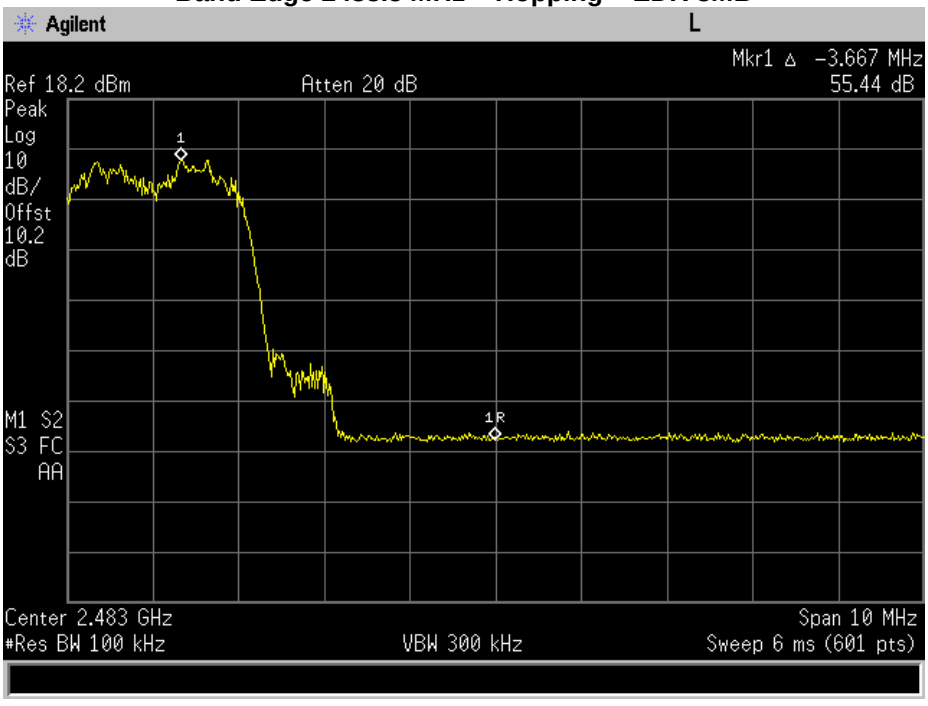
Band Edge 2483.5 MHz – EDR 3MB



Band Edge 2400 MHz – Hopping – EDR 3MB



Band Edge 2483.5 MHz – Hopping – EDR 3MB



Restricted Band Emissions Summary – BT

Tuned Frequency (MHz)	Emission Frequency (MHz)	Peak Monitored Level (dBuV/m)	Peak Limit (dBuV/m)	Average Monitored Level (dBuV/m)	Average Limit (dBuV/m)	Result
2402	2390	49.4	74.0	N/A	54.0	Pass
2480	2483.5	73.69	74.0	53.35	54.0	Pass

Restricted Band Emissions Summary – EDR 2MB

Tuned Frequency (MHz)	Emission Frequency (MHz)	Peak Monitored Level (dBuV/m)	Peak Limit (dBuV/m)	Average Monitored Level (dBuV/m)	Average Limit (dBuV/m)	Result
2402	2390	49.41	74.0	40	54.0	Pass
2480	2483.5	71.31	74.0	49.99	54.0	Pass

Restricted Band Emissions Summary – EDR 3MB

Tuned Frequency (MHz)	Emission Frequency (MHz)	Peak Monitored Level (dBuV/m)	Peak Limit (dBuV/m)	Average Monitored Level (dBuV/m)	Average Limit (dBuV/m)	Result
2402	2390	48.82	74.0	39.99	54.0	Pass
2480	2483.5	71.77	74.0	49.83	54.0	Pass

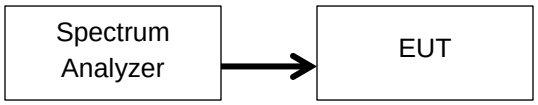
See Annex B for plot data

Occupied Bandwidth
Engineer: Kenneth Lee
Test Date: 3/31/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmitting 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 20dB and 99% bandwidths were measured to verify that the bandwidth met the specification.

Test Setup



20 dB Bandwidth Summary – BT

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.132	Pass
2442	1.138	Pass
2480	1.133	Pass

99% Bandwidth Summary – BT

Frequency (MHz)	Recorded Measurement (kHz)	Result
2402	996.7569	Pass
2442	997.1684	Pass
2480	995.3151	Pass

20 dB Bandwidth Summary – EDR 2MB

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.425	Pass
2442	1.425	Pass
2480	1.421	Pass

99% Bandwidth Summary – EDR 2MB

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.2398	Pass
2442	1.2379	Pass
2480	1.2366	Pass

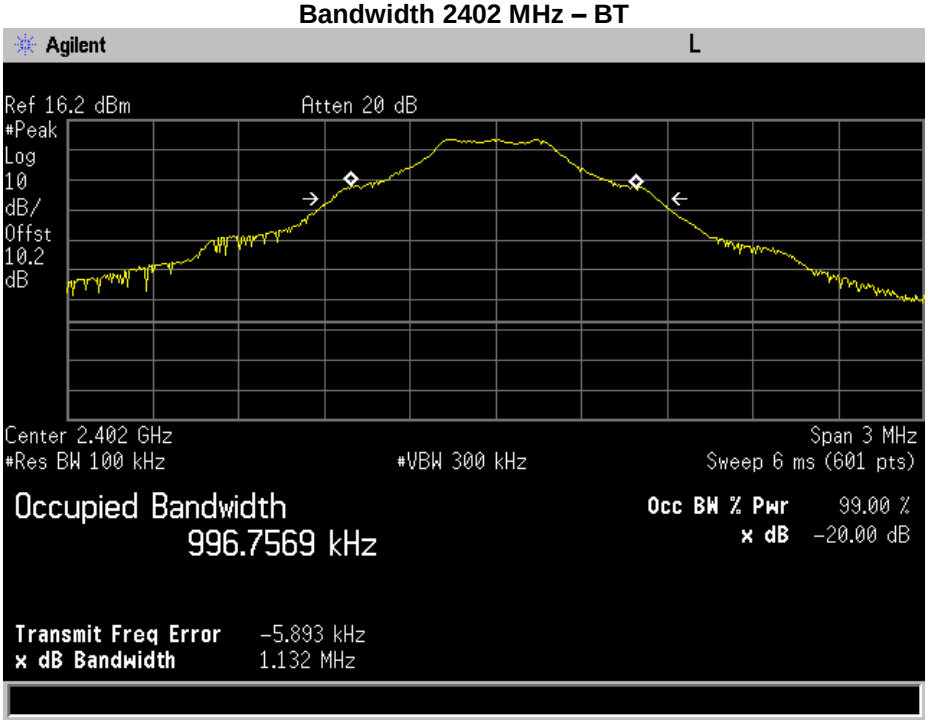
20 dB Bandwidth Summary – EDR 3MB

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.414	Pass
2442	1.411	Pass
2480	1.408	Pass

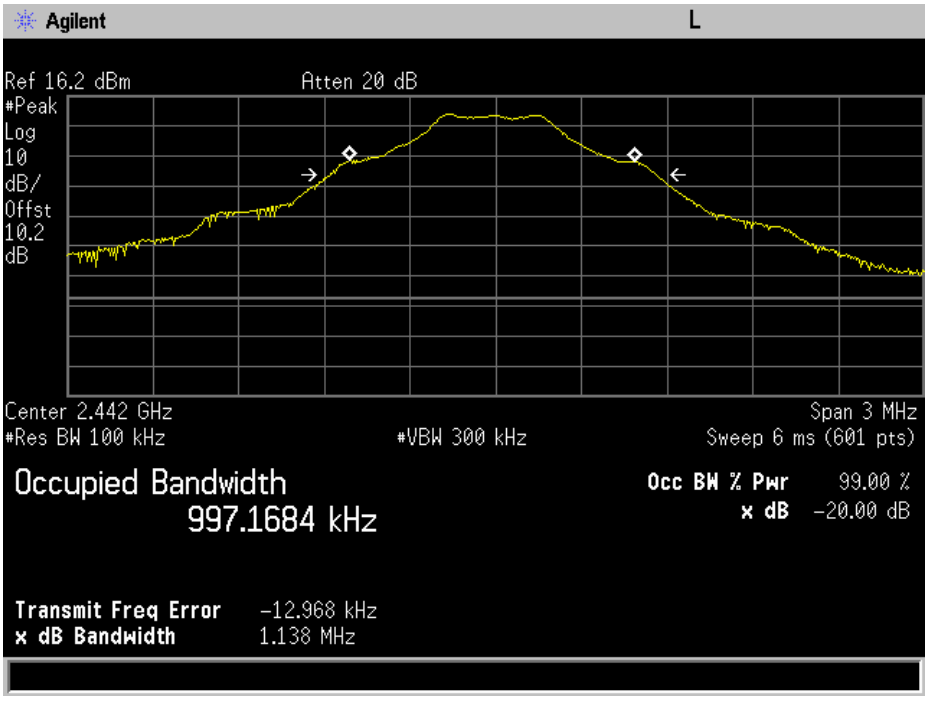
99% Bandwidth Summary – EDR 3MB

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.2346	Pass
2442	1.2331	Pass
2480	1.2296	Pass

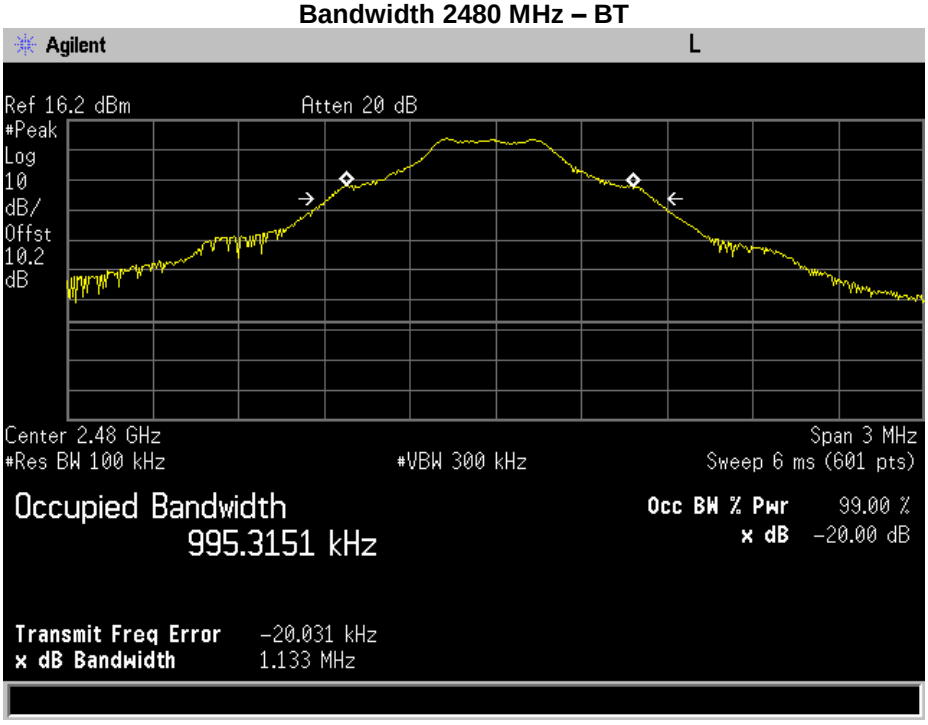
Bandwidth 2402 MHz – BT



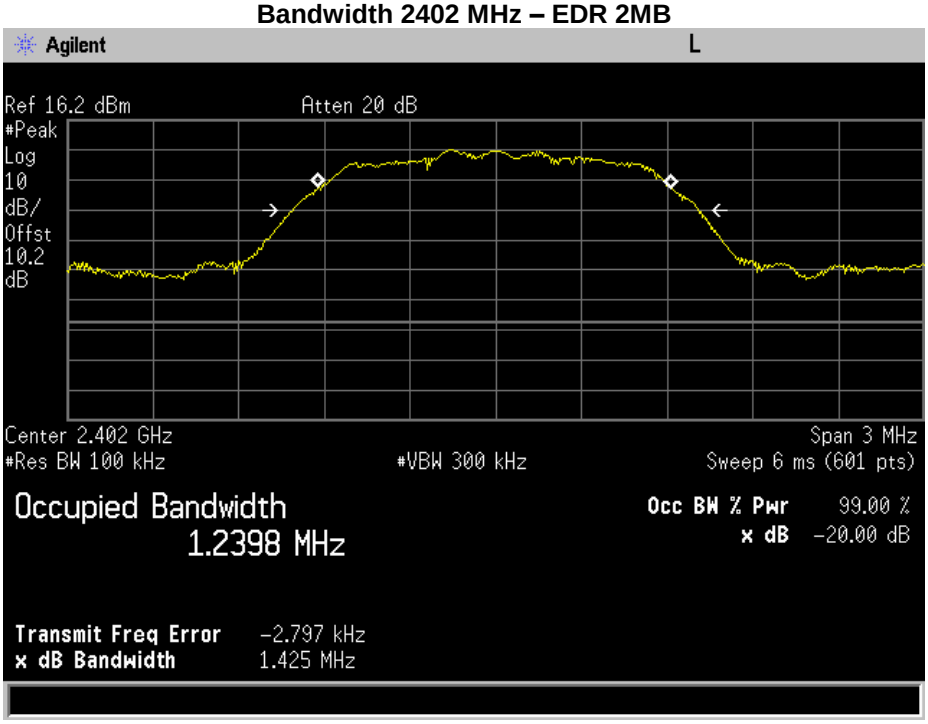
Bandwidth 2442 MHz – BT



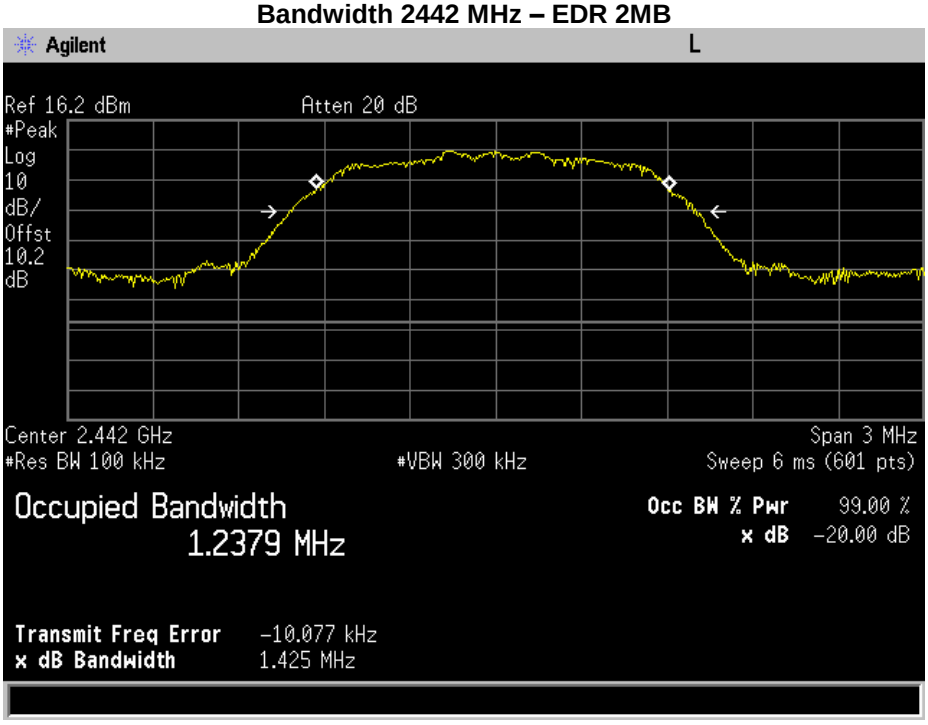
Bandwidth 2480 MHz – BT



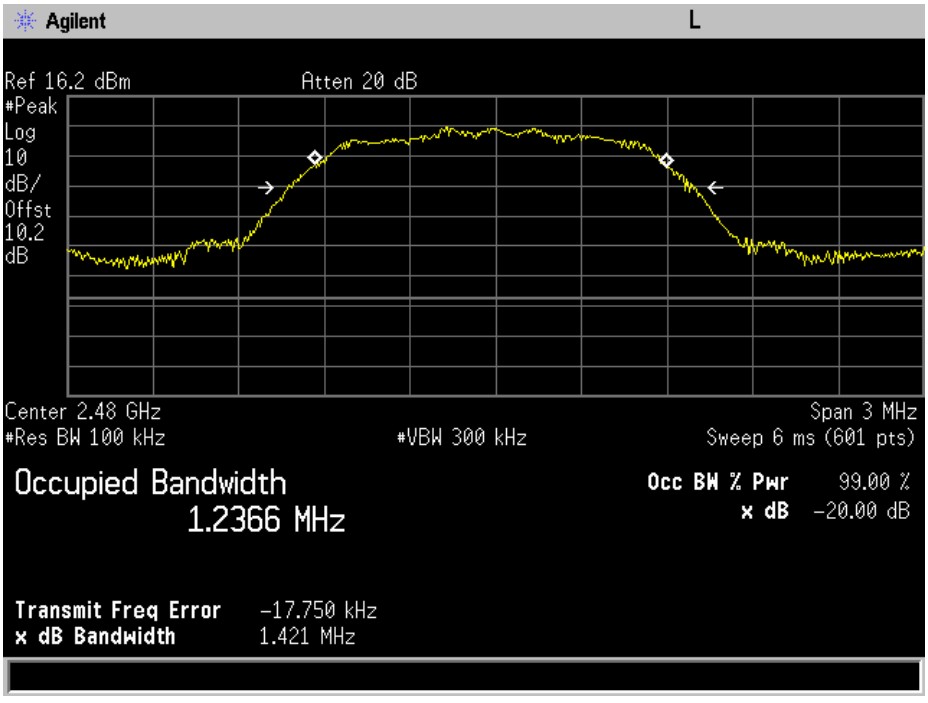
Bandwidth 2402 MHz – EDR 2MB



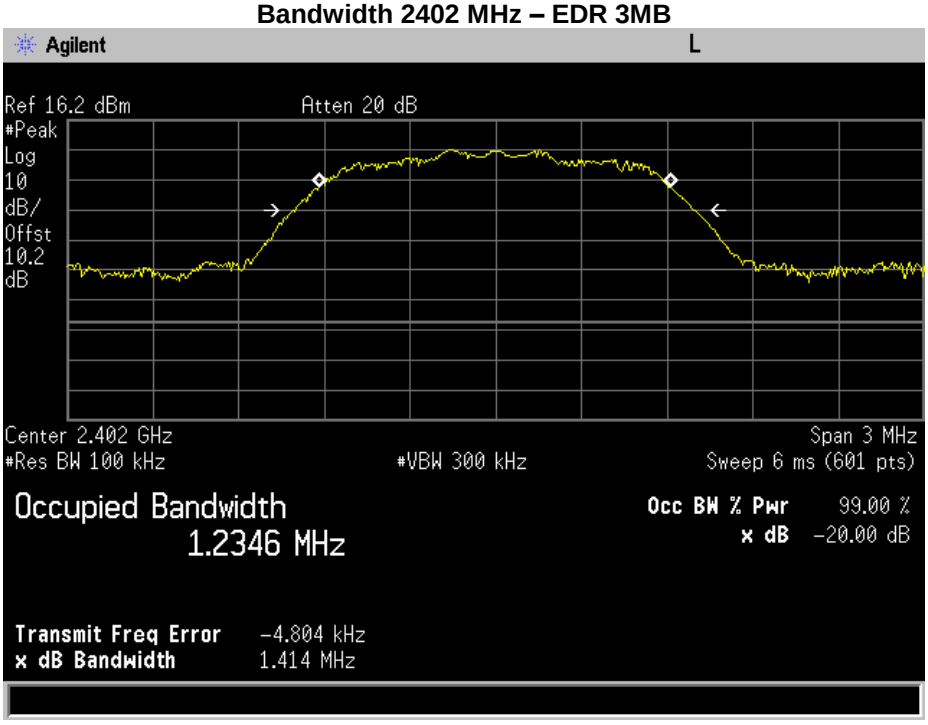
Bandwidth 2442 MHz – EDR 2MB



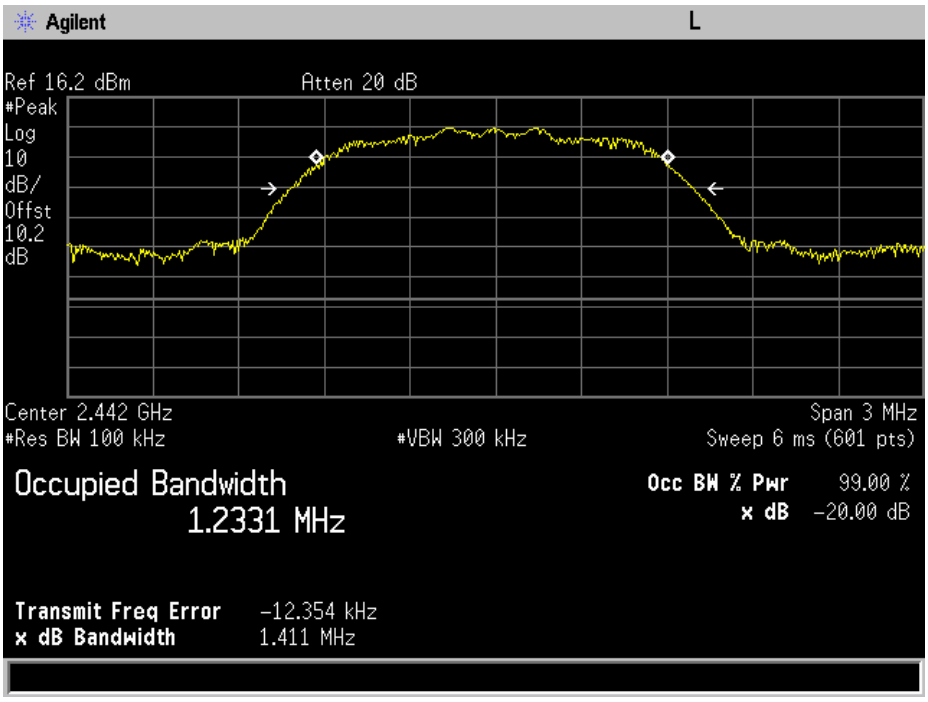
Bandwidth 2480 MHz – EDR 2MB



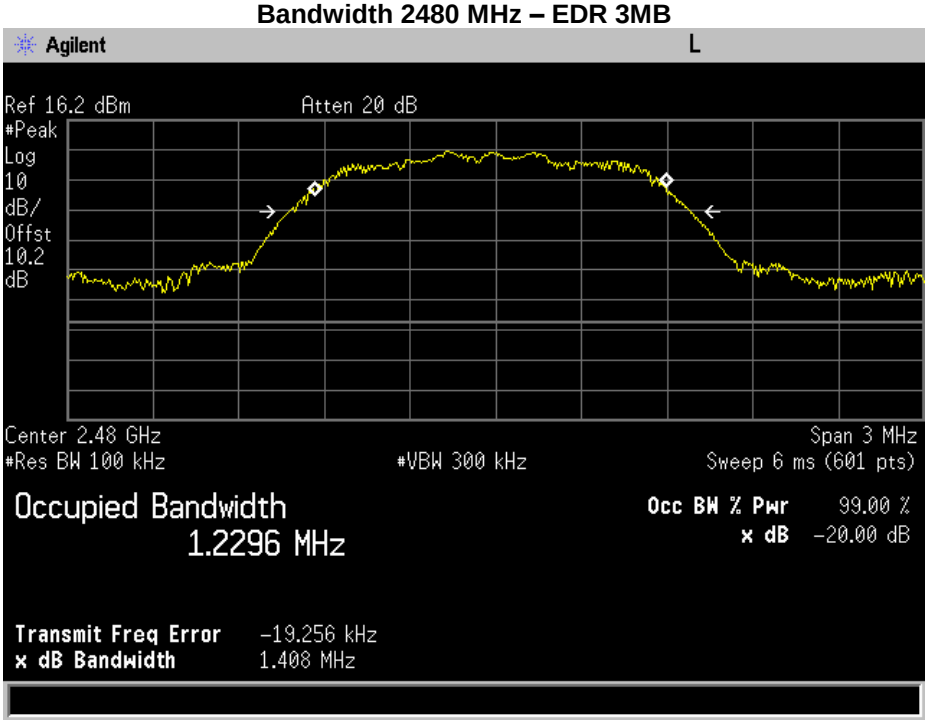
Bandwidth 2402 MHz – EDR 3MB



Bandwidth 2442 MHz – EDR 3MB



Bandwidth 2480 MHz – EDR 3MB



Dwell Time

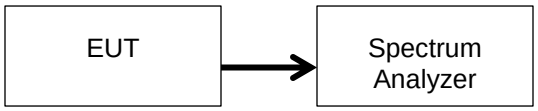
Engineer: Kenneth Lee

Test Date: 3/29/2017

Test Procedure

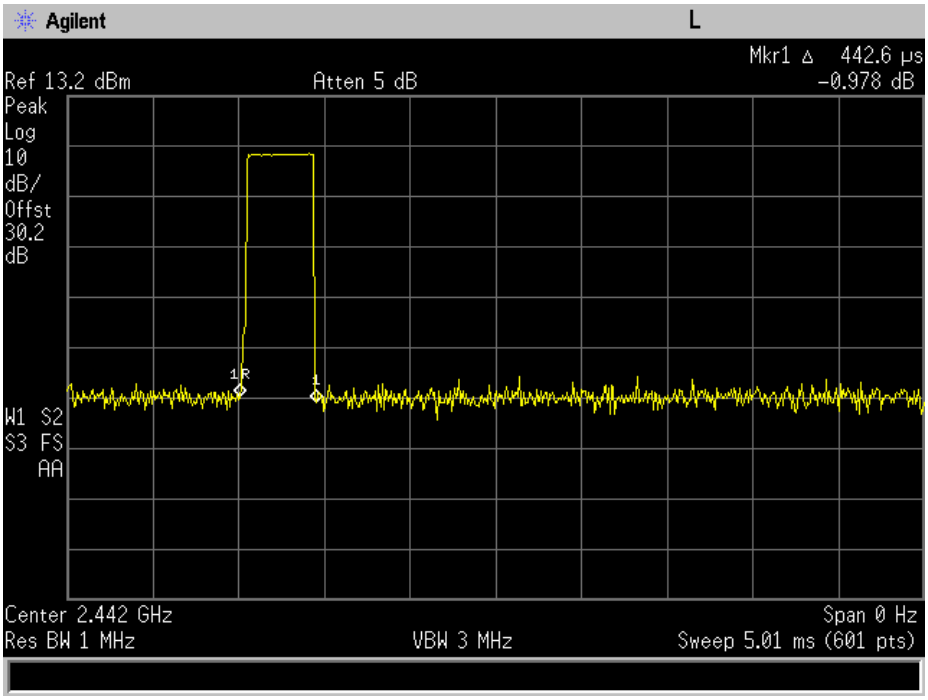
The EUT was connected directly to a spectrum analyzer. The EUT was set to hopping mode with the spectrum analyzer set to a 0 Hz span. A single transmission was captured and the dwell time was recorded.

Test Setup

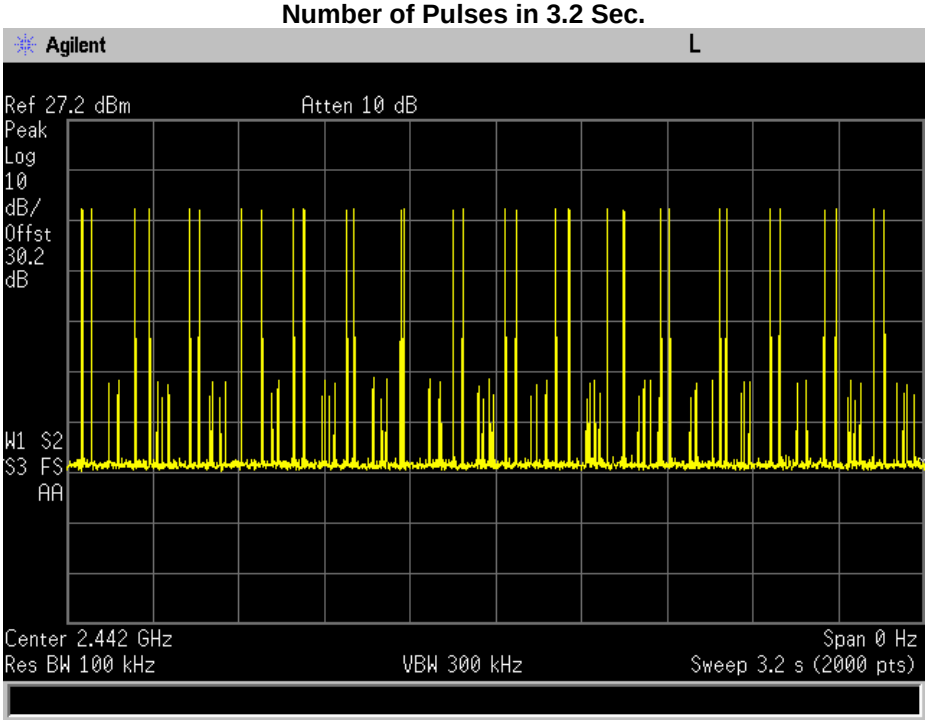


Dwell Time = 142.78 ms

Time of 1 Pulse



Number of Pulses in 3.2 Sec.



Dwell Time Limit is 400 ms within 0.4 x 79 = 31.6 seconds

Time of One Pulse = 442.6 us
Number of Pulses in 3.2 seconds = 32 pulses
442.6 us x 32 = 14.278 ms
14.278 ms x 10 = 142.78 ms

Number of Hopping Channels

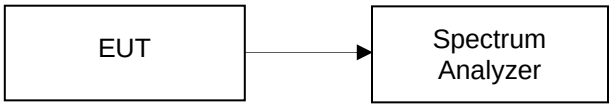
Engineer: Kenneth Lee

Test Date: 3/29/2017

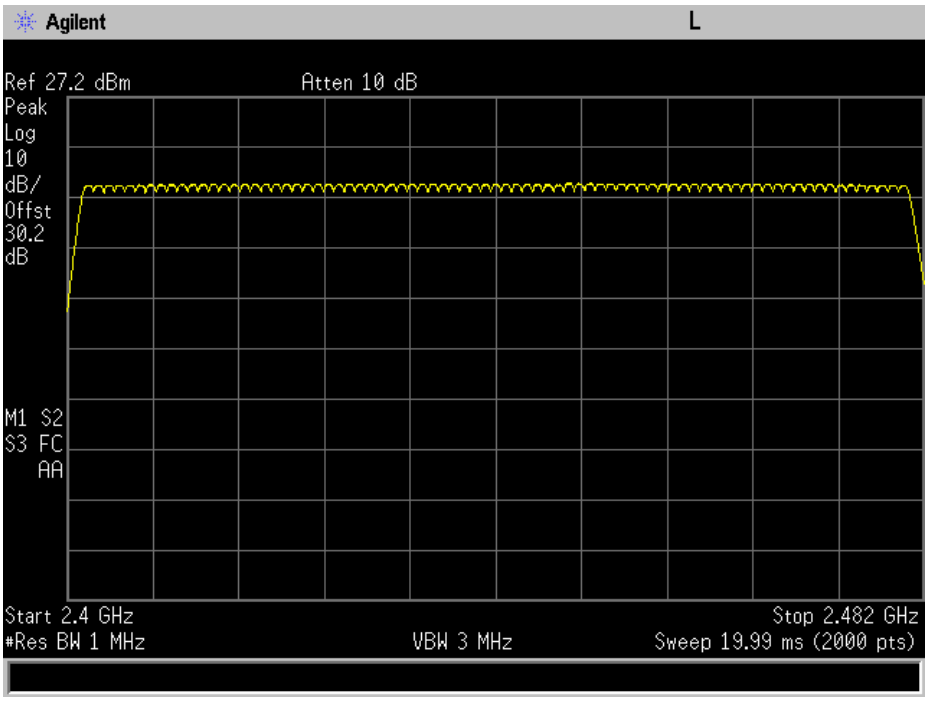
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set to the specified band end points. The EUT was then set to operate in hopping mode. The MAX HOLD function of the spectrum analyzer was utilized to verify the number of hopping cannels.

Test Setup



Number of Hopping Channels = 79



Channel Frequency Separation

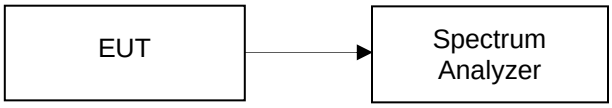
Engineer: Kenneth Lee

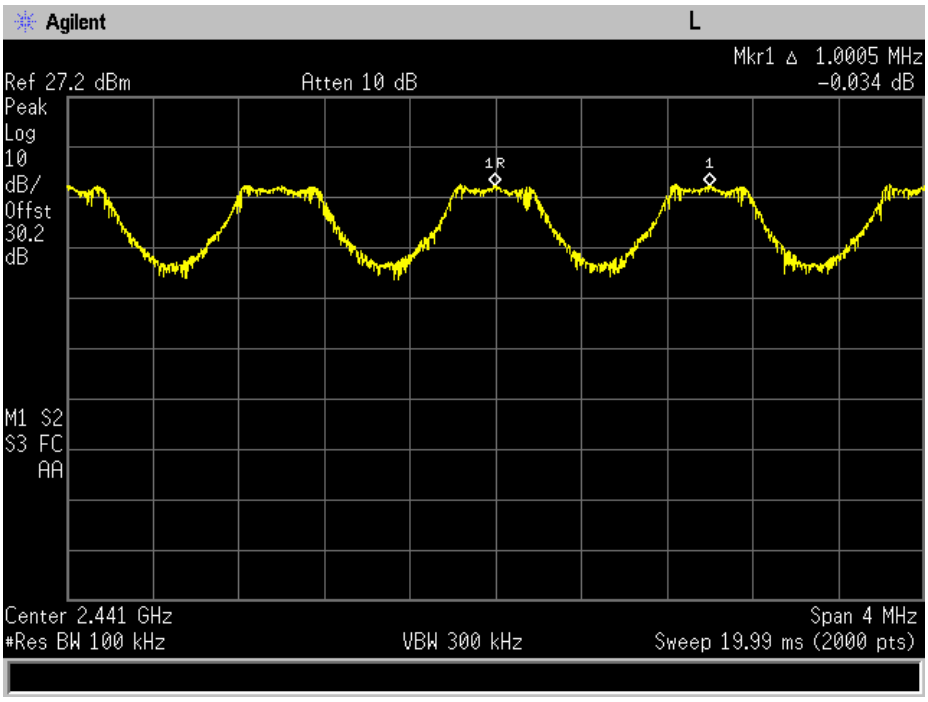
Test Date: 3/29/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set to encompass a minimum of two hopping channels. The EUT was then set to operate in hopping mode. The MAX HOLD and Marker Delta functions of the spectrum analyzer were utilized to verify the channel separation.

Test Setup





A/C Powerline Conducted Emissions

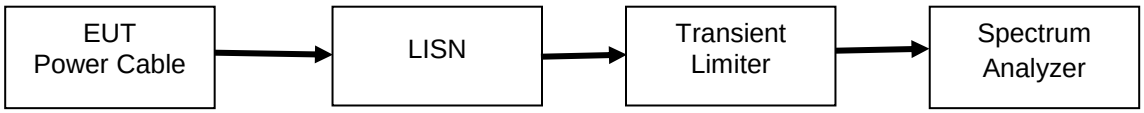
Engineer: Kenneth Lee

Test Date: 3/29/2017

Test Procedure

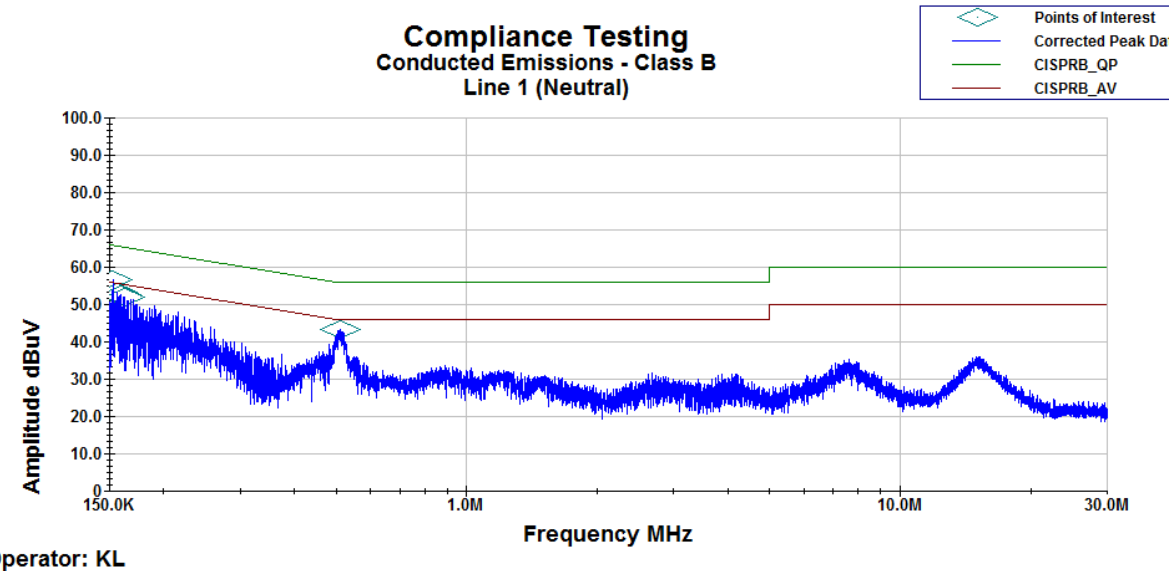
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup



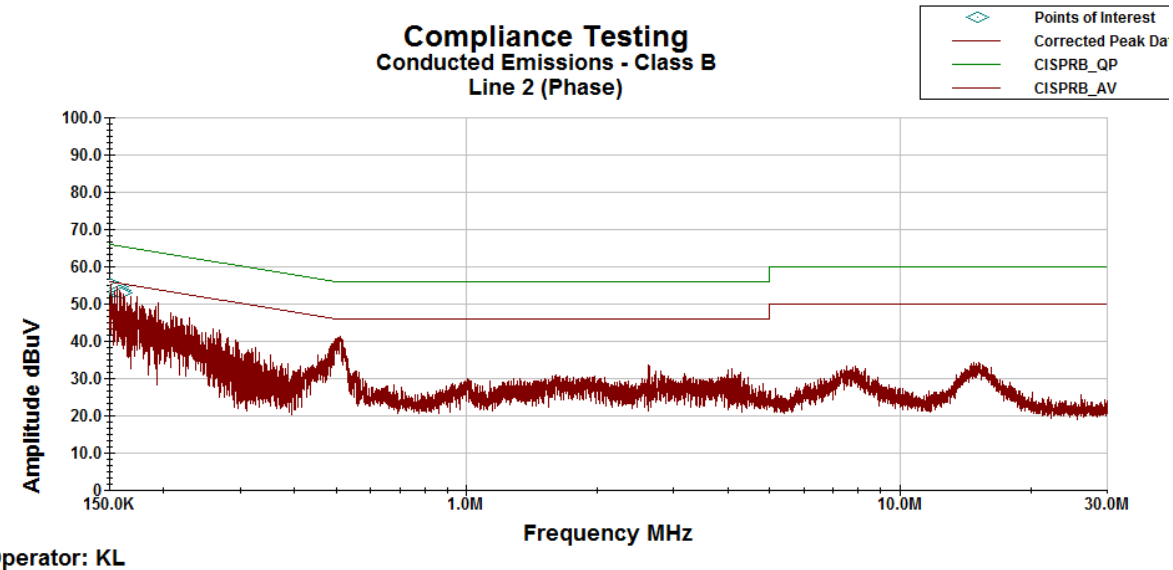
Conducted Emissions Test Results

Line 1 Peak Plot



Operator: KL
Conducted Emissions.til **Job #: p1720024**

Line 2 Peak Plot



Operator: KL
Conducted Emissions.til **Job #: p1720024**

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)
150.63 KHz	30.21	0.29	0.02	10.2	40.728	55.982	-15.254
150.63 KHz	30.21	0.29	0.02	10.2	40.728	55.982	-15.254
151.8 KHz	30.44	0.28	0.02	10.2	40.944	55.949	-15.004
151.9 KHz	30.31	0.28	0.02	10.2	40.807	55.946	-15.139
153.28 KHz	30.27	0.27	0.02	10.2	40.76	55.906	-15.146
510.93 KHz	26.46	0.1	0.03	10.1	36.695	46	-9.305

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)
150.03 KHz	29.76	0.3	0.02	10.2	40.278	55.999	-15.722
150.38 KHz	29.85	0.3	0.02	10.2	40.371	55.989	-15.619
153.8 KHz	29.68	0.26	0.02	10.2	40.16	55.891	-15.731
154.22 KHz	29.73	0.26	0.02	10.2	40.21	55.879	-15.67
156.43 KHz	29.93	0.24	0.02	10.2	40.382	55.816	-15.435
153.72 KHz	29.89	0.26	0.02	10.2	40.373	55.894	-15.52

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)
150.63 KHz	36.788	0.294	0.02	10.2	47.301	65.982	-18.681
150.63 KHz	36.788	0.294	0.02	10.2	47.301	65.982	-18.681
151.8 KHz	36.761	0.282	0.02	10.2	47.263	65.949	-18.686
151.9 KHz	36.762	0.281	0.02	10.2	47.263	65.946	-18.683
153.28 KHz	36.818	0.267	0.02	10.2	47.305	65.906	-18.601
510.93 KHz	31.335	0.1	0.03	10.1	41.565	56	-14.435

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)
150.03 KHz	36.15	0.3	0.02	10.2	46.667	65.999	-19.332
150.38 KHz	36.33	0.3	0.02	10.2	46.851	65.989	-19.138
153.8 KHz	36.21	0.26	0.02	10.2	46.697	65.891	-19.195
154.22 KHz	36.34	0.26	0.02	10.2	46.819	65.879	-19.06
156.43 KHz	36.37	0.24	0.02	10.2	46.823	65.816	-18.993
153.72 KHz	36.22	0.26	0.02	10.2	46.707	65.894	-19.186

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	3/28/17	3/28/18
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 3/29/17	
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
AC Power Source	Behlman	BL 6000	i00362	Verified on: 3/29/17	
EMI Analyzer	Agilent	E7405A	i00379	2/22/17	2/22/18
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
LISN	COM-Power	LI-125A	i00446	4/29/16	4/29/18
LISN	COM-Power	LI-125A	i00448	4/29/16	4/29/18
PSA Spectrum Analyzer	Agilent	E4445A	i00471	8/30/16	8/30/17
Spectrum Analyzer	Agilent	E4407B	i00331	10/19/16	10/19/17
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