



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: A02777

Description: Camera

Serial Number: N/A

FCC ID: IPH-02777

IC: 1792A-02777

To

FCC Part 15.247 FHSS

Date of Issue: August 4, 2016

On the behalf of the applicant:

Garmin International Inc
1200 E. 151st. Street
Olathe, KS 66062

Attention of:

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Project No: p1660026

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	June 27, 2016	Kenneth Lee	Original Document
2.0	July 23, 2016	Amanda Reed	Updated model & description
3.0	August 4, 2016	Kenneth Lee	Updated Additional Information

Table of Contents

<u>Description</u>	<u>Page</u>
Standard Test Conditions and Engineering Practices.....	6
Test Results Summary	8
Peak Output Power.....	9
Conducted Spurious Emissions.....	10
Radiated Spurious Emissions.....	15
Emissions at Band Edges.....	16
Occupied Bandwidth.....	23
Dwell Time	30
Number of Hopping Channels	32
A/C Powerline Conducted Emission.....	33
Test Equipment Utilized.....	35

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)
25.6	26.8	946.7

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

EUT Description

Model: A02777

Description: Camera

Firmware: N/A

Software: N/A

Serial Number: N/A

Additional Information: During the Dwell Time testing the device was set to the maximum data rate allowed by the radio.

EUT Operation during Tests

The EUT was put into a test mode that allowed the selection of channels and modulation. The EUT was fully tested while in BR, BT EDR 2MB and BT EDR 3MB modulations.

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



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Switching Power Supply	Garmin	PSM10R-050	N/A

Cables: None

Modifications: None

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	
15.207	A/C Powerline Conducted Emissions	Pass	

Peak Output Power

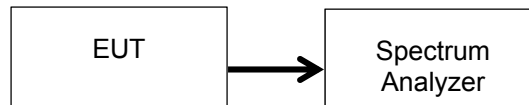
Engineer: Kenneth Lee

Test Date: 06/23/2016

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.

Test Setup



Transmitter Peak Output Power

BR

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Specification Limit (W)	Result
2402	0.88	1	Pass
2441	0.17	1	Pass
2480	-0.52	1	Pass

BT EDR 2MB

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Specification Limit (W)	Result
2402	3	1	Pass
2441	2.34	1	Pass
2480	1.69	1	Pass

BT EDR 3MB

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Specification Limit (W)	Result
2402	3.48	1	Pass
2441	2.83	1	Pass
2480	2.17	1	Pass

Conducted Spurious Emissions

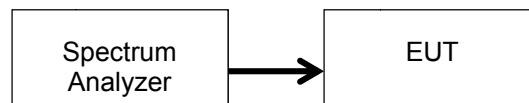
Engineer: Kenneth Lee

Test Date: 06/23/2016

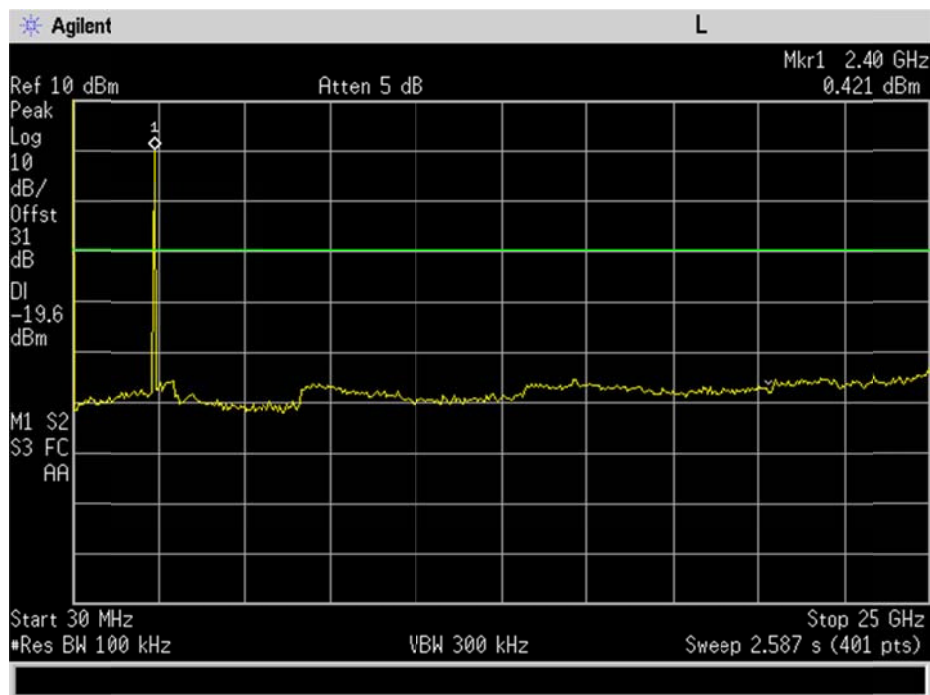
Test Procedure

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. Only detectable spurious emissions were recorded and plotted.

Test Setup

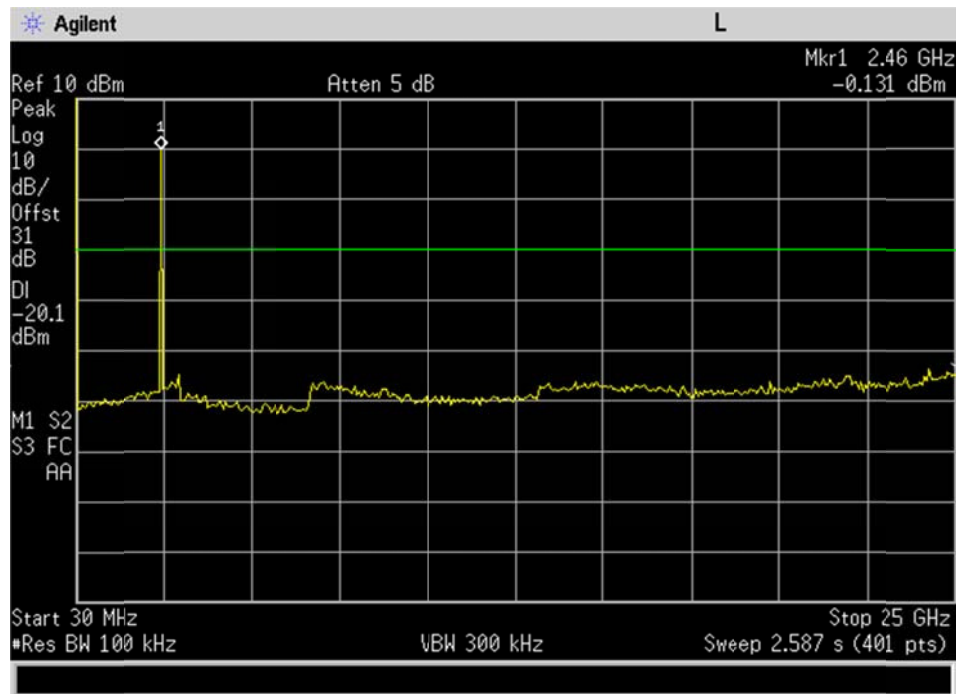


BR - Conducted Spurious Emissions 2402 MHz

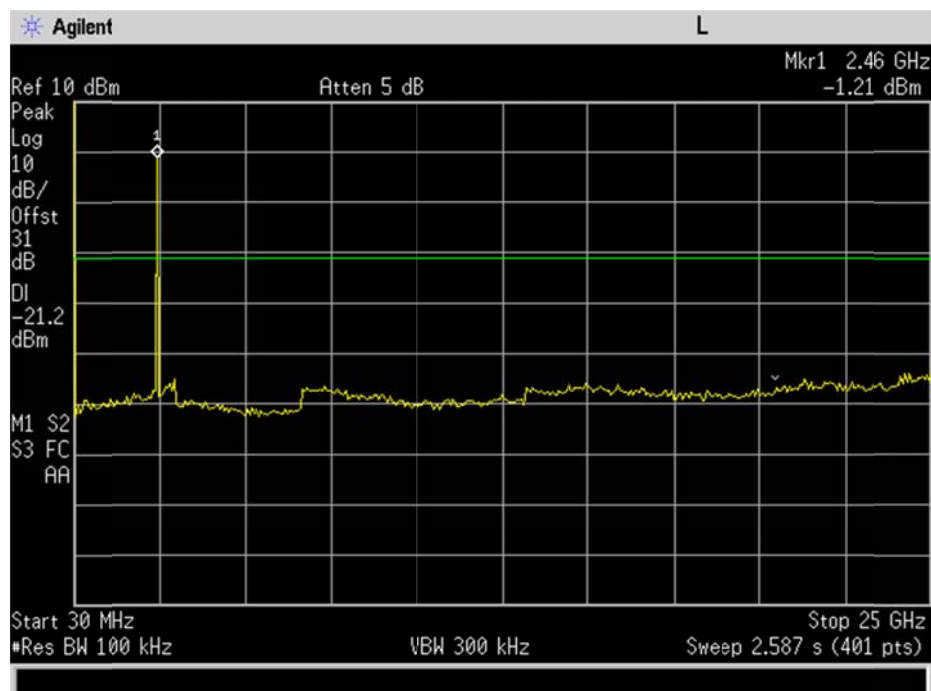




BR - Conducted Spurious Emissions 2441 MHz

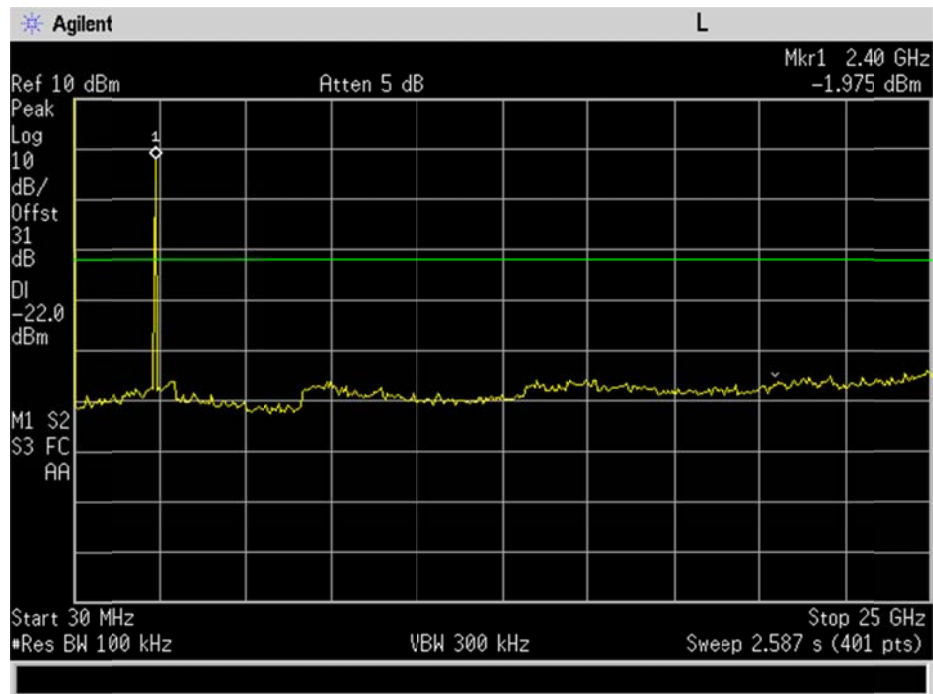


BR - Conducted Spurious Emissions 2480 MHz

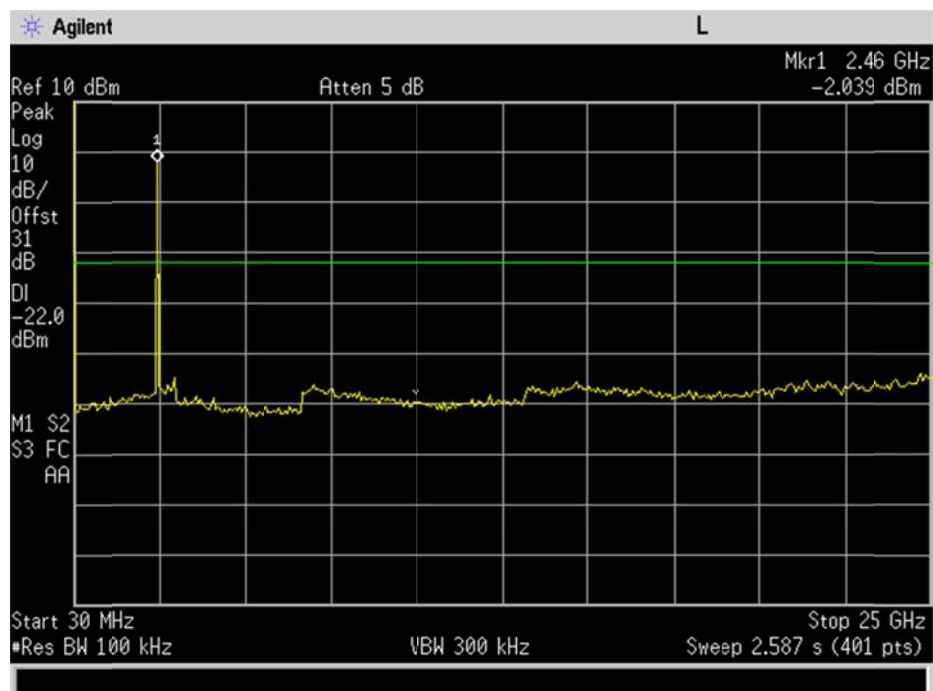




BT EDR 2MB - Conducted Spurious Emissions 2402 MHz

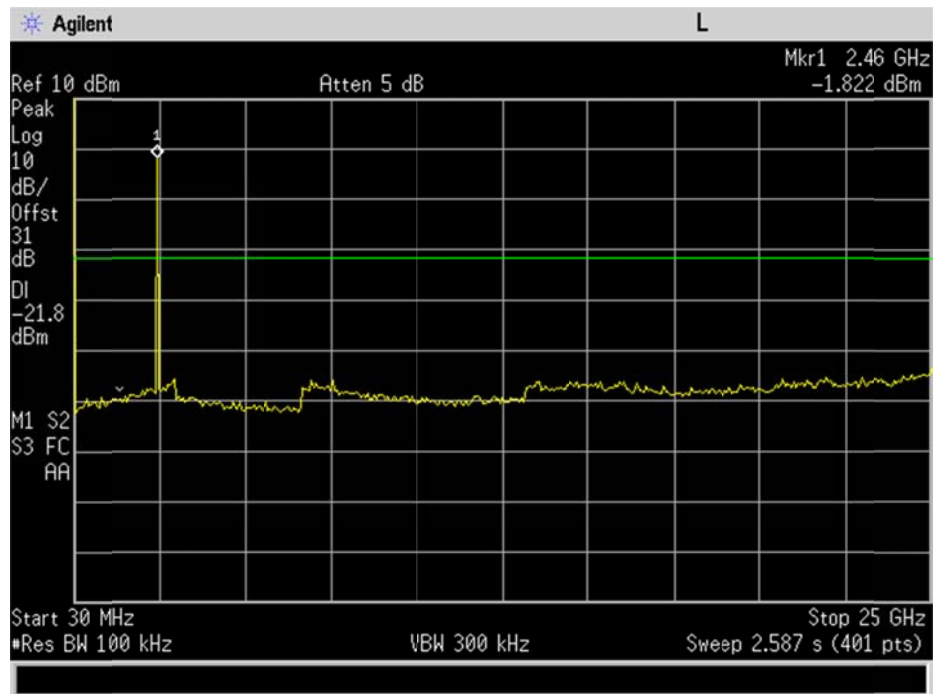


BT EDR 2MB - Conducted Spurious Emissions 2441 MHz

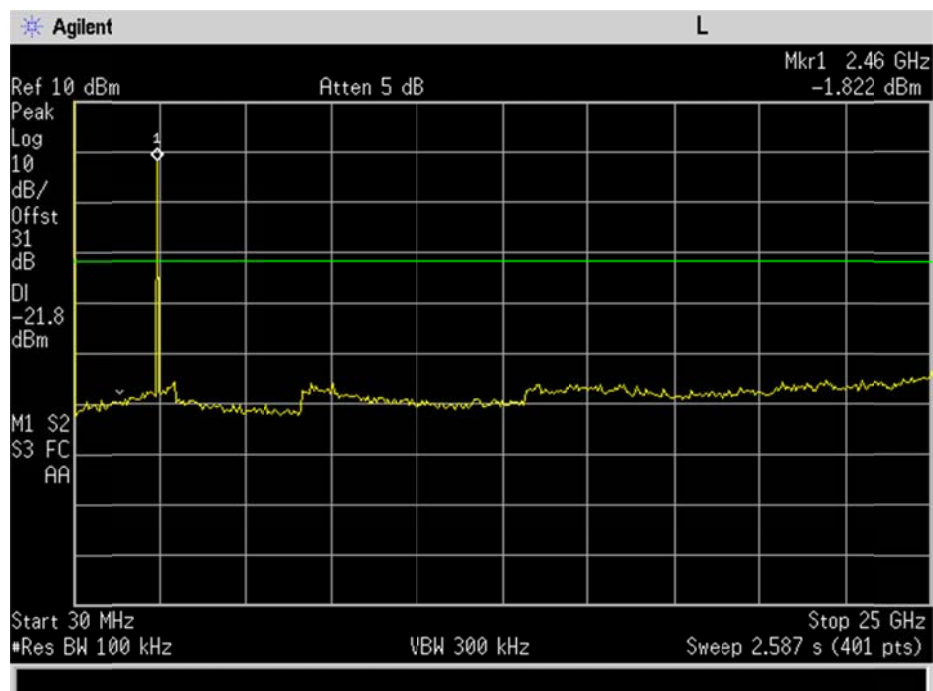




BT EDR 2MB - Conducted Spurious Emissions 2480 MHz

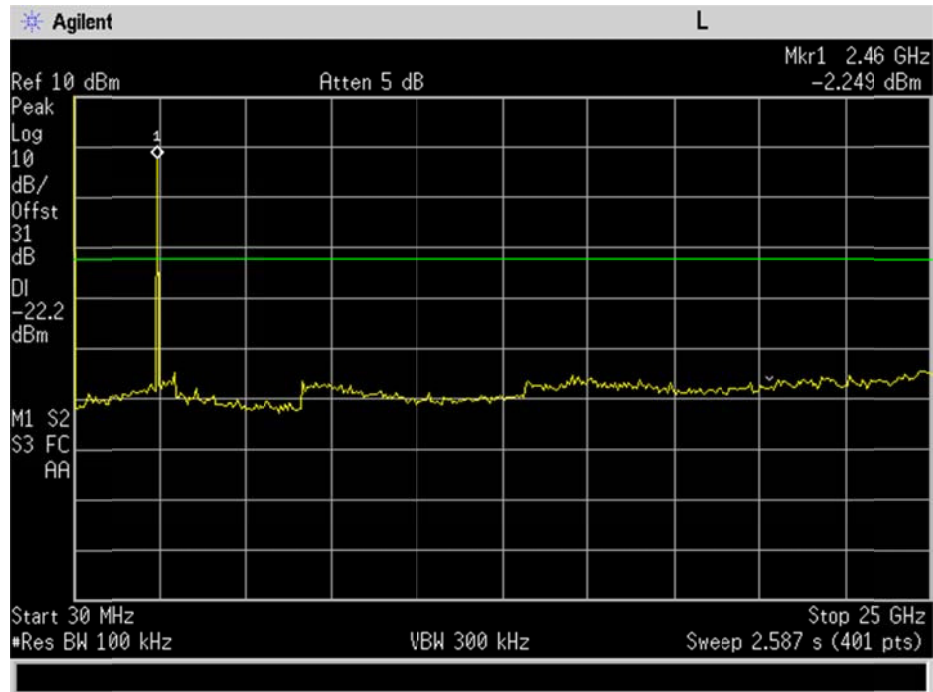


BT EDR 3MB - Conducted Spurious Emissions 2402 MHz

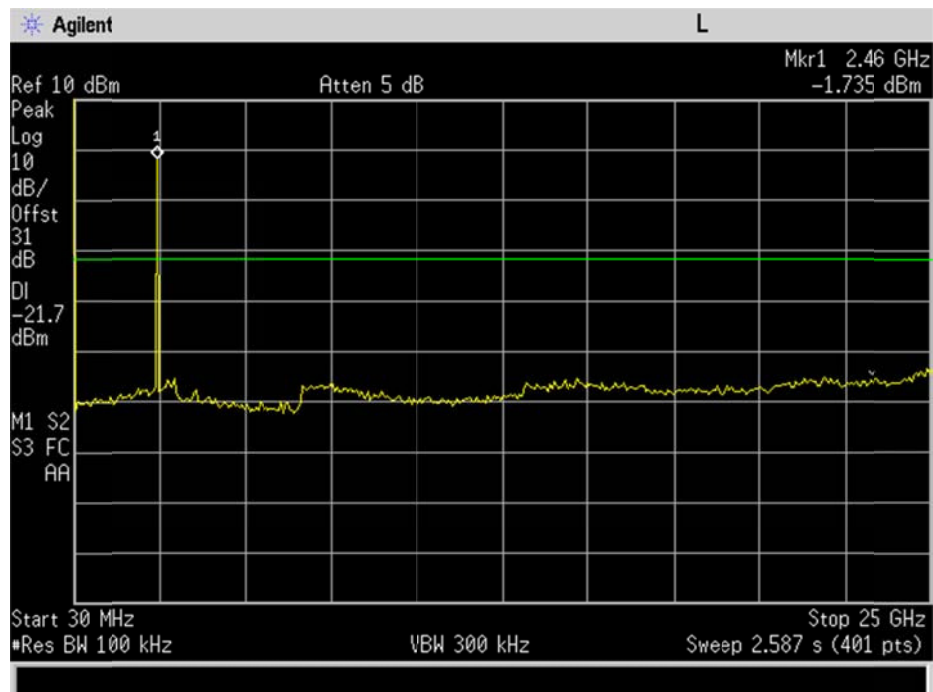




BT EDR 3MB - Conducted Spurious Emissions 2441 MHz



BT EDR 3MB - Conducted Spurious Emissions 2480 MHz



Radiated Spurious Emissions

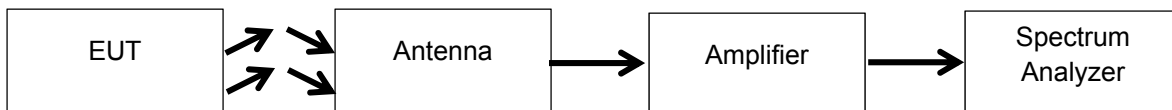
Engineer: Kenneth Lee

Test Date: 06/28/2016

Test Procedure

The EUT was tested in a semi-anechoic chamber set 1m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions. The antenna and cable correction factors were summed with the amplifier gain and entered into the spectrum analyzer as an offset to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



See Annex A for test data

Emissions at Band Edges

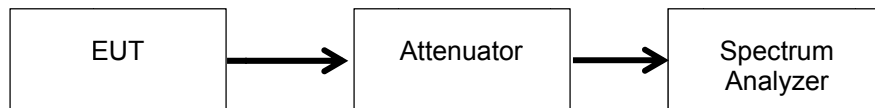
Engineer: Kenneth Lee

Test Date: 06/23/2016

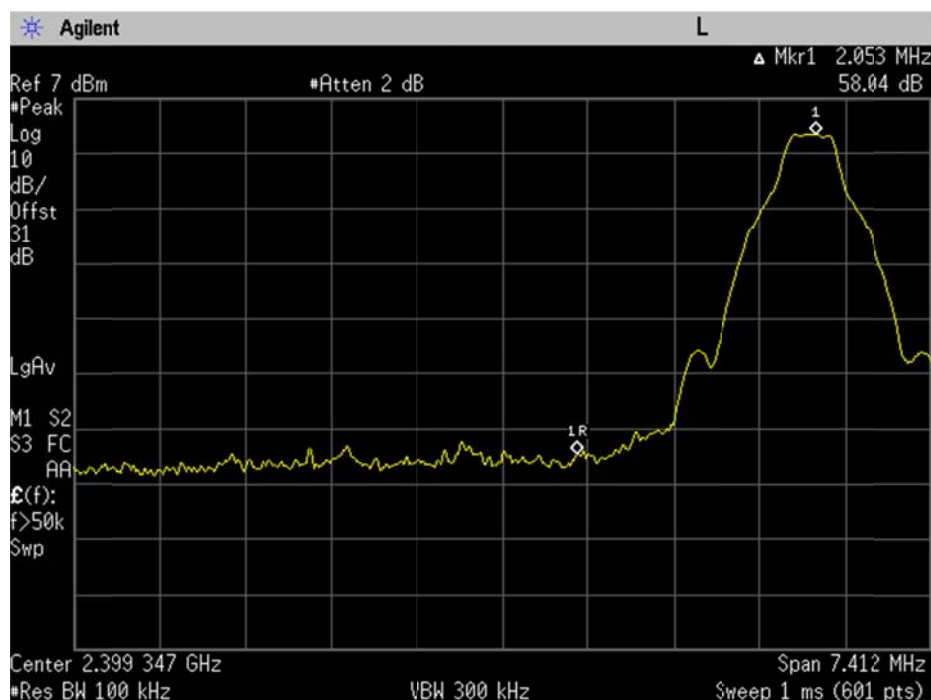
Test Procedure

The EUT was connected to a spectrum analyzer which 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

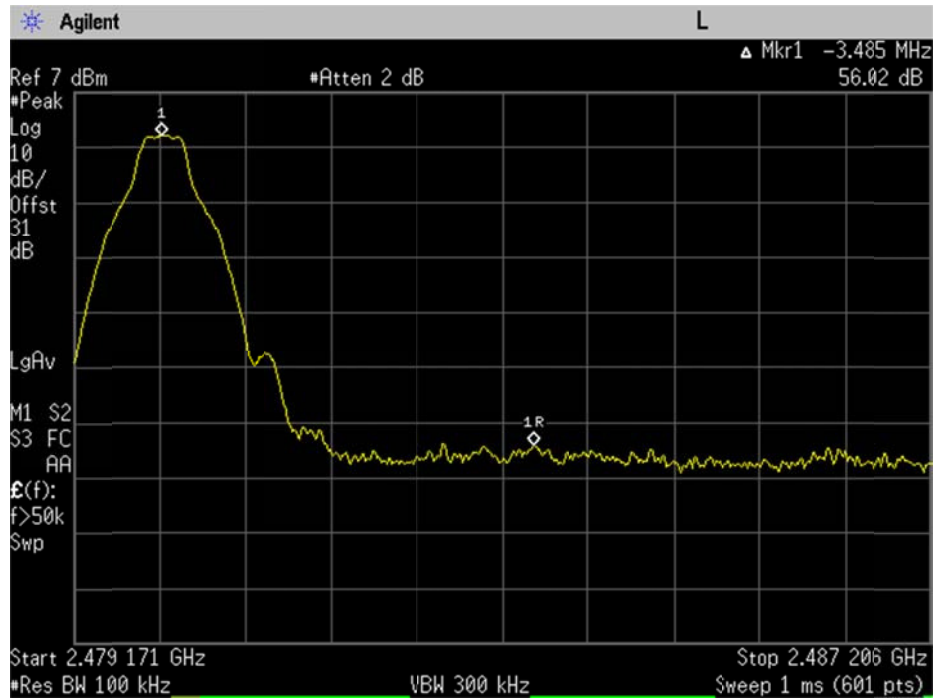


BR - Band Edge 2400 MHz

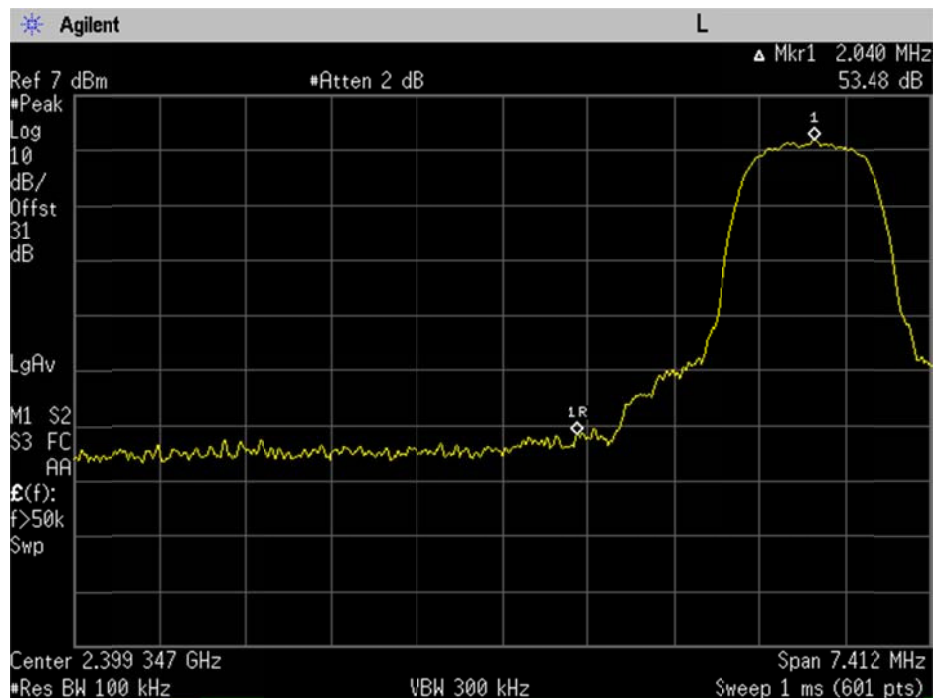




BR - Band Edge 2483.5 MHz

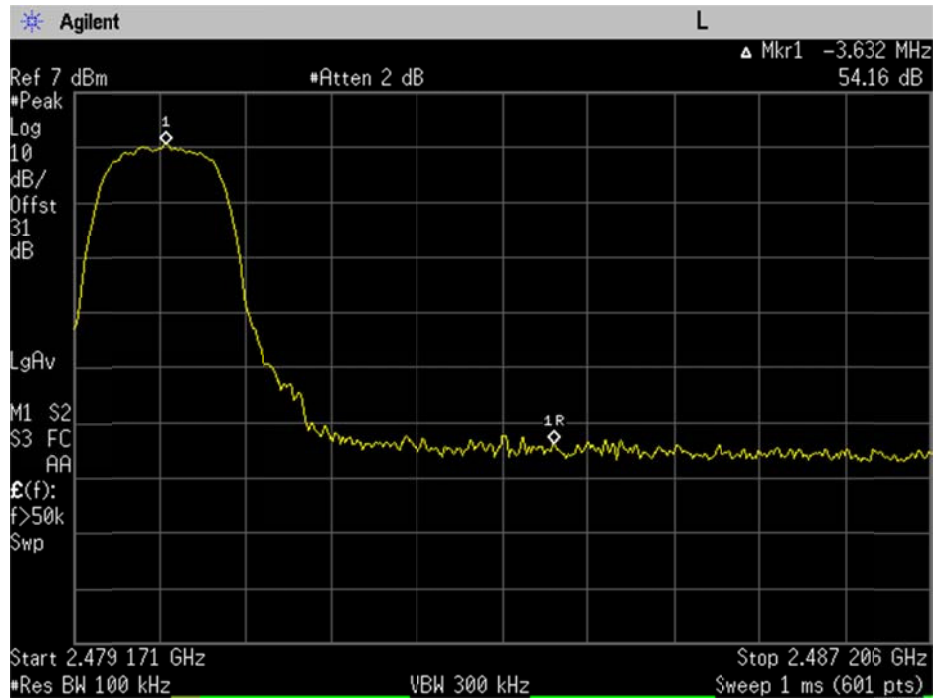


BT EDR 2MB - Band Edge 2400 MHz

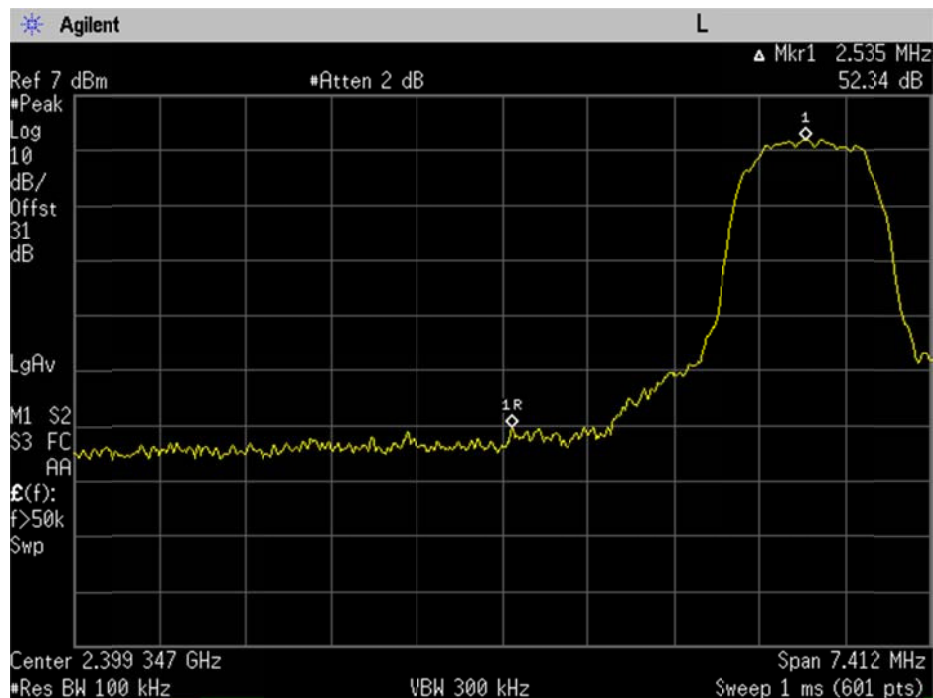




BT EDR 2MB - Band Edge 2483.5 MHz

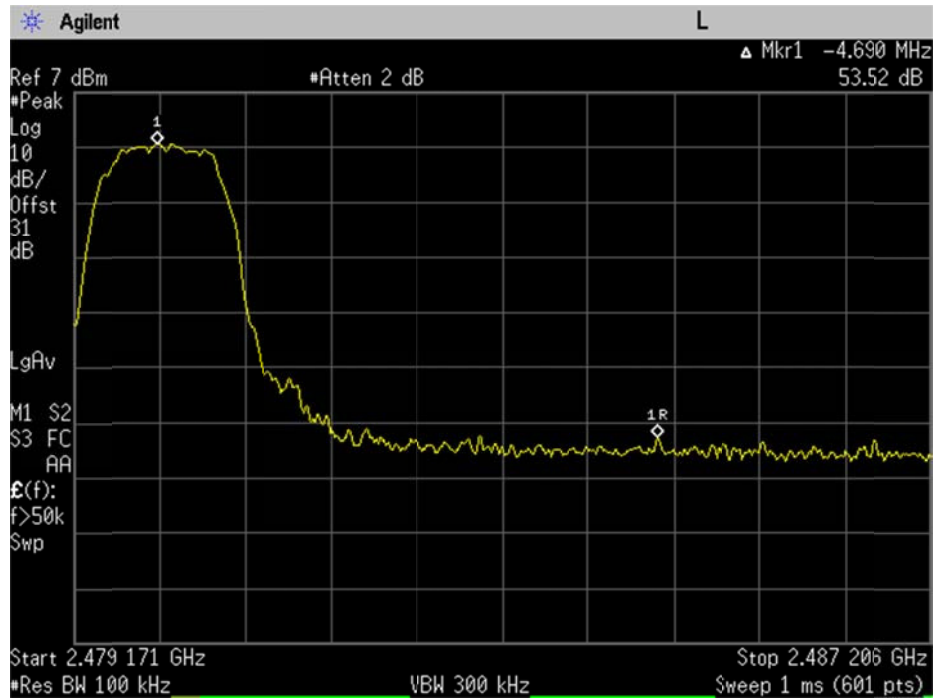


BT EDR 3MB - Band Edge 2400 MHz



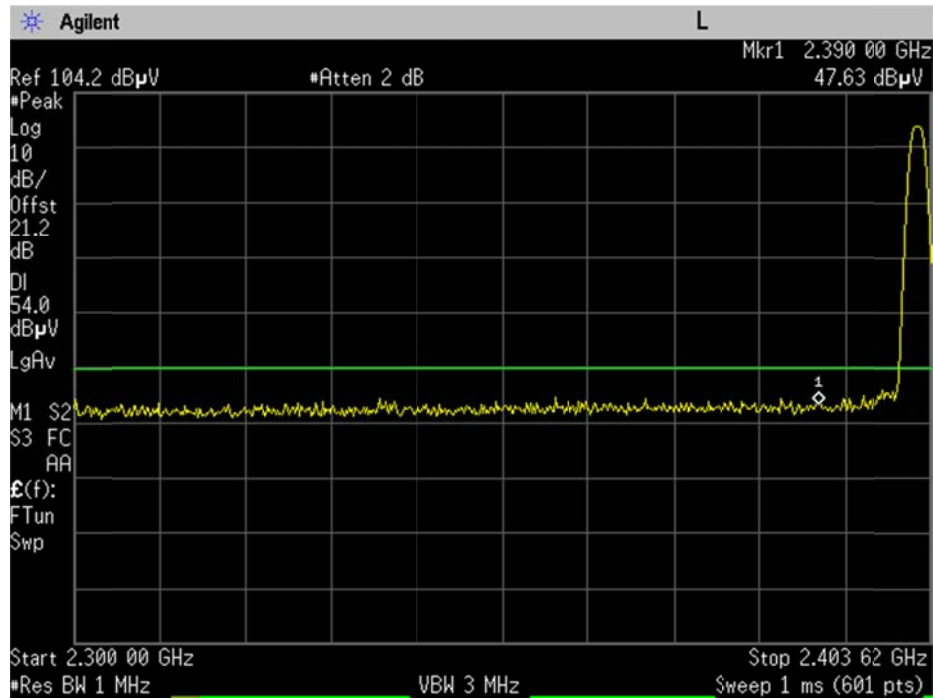


BT EDR 3MB - Band Edge 2483.5 MHz

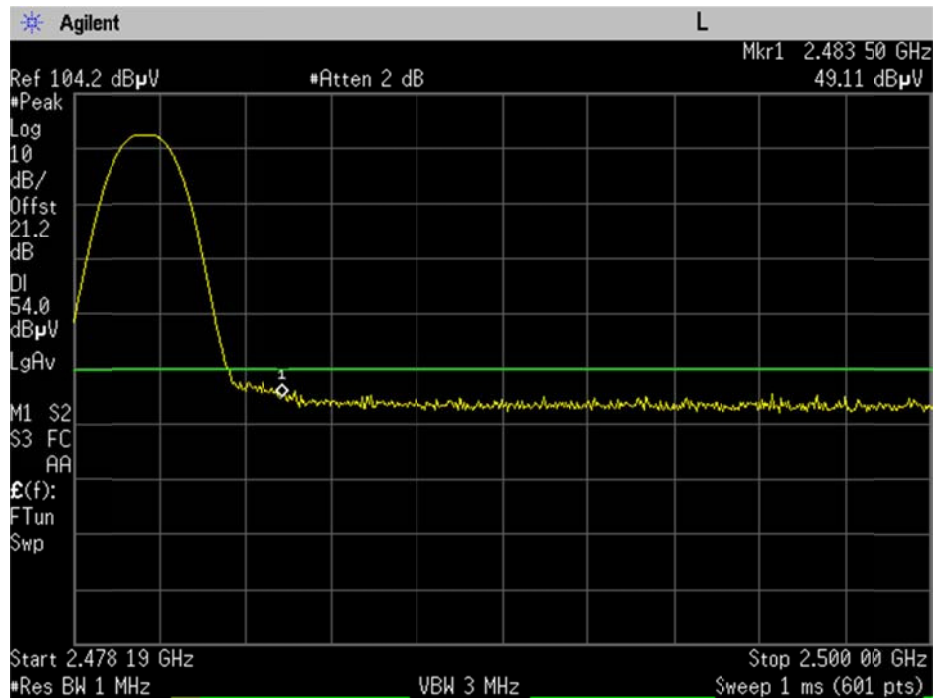




BR - Restricted Band 2390 MHz

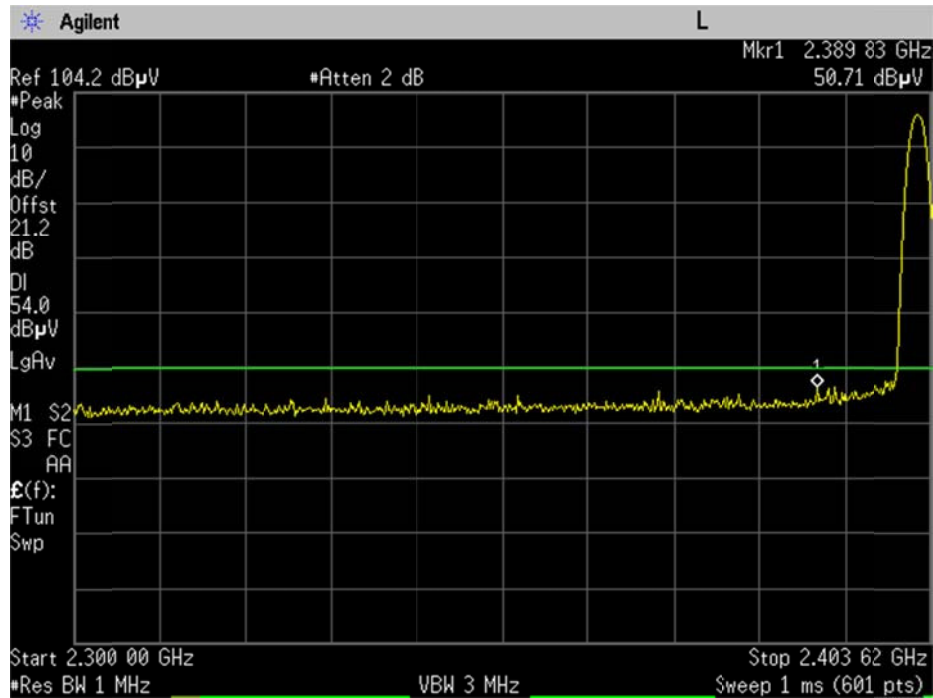


BR - Restricted Band 2483.5 MHz

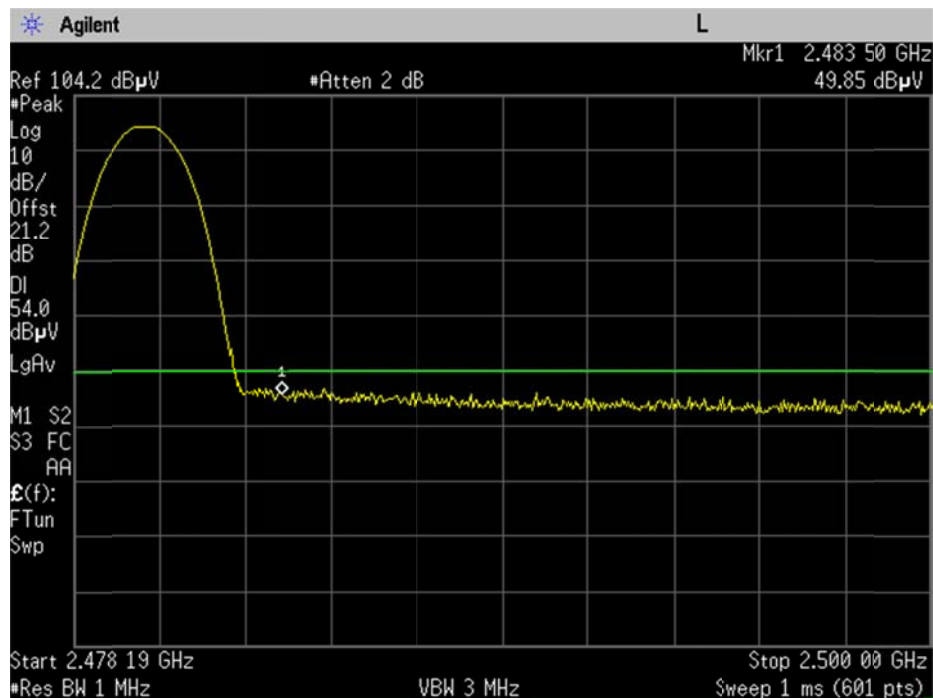




BT EDR 2MB - Restricted Band 2390 MHz

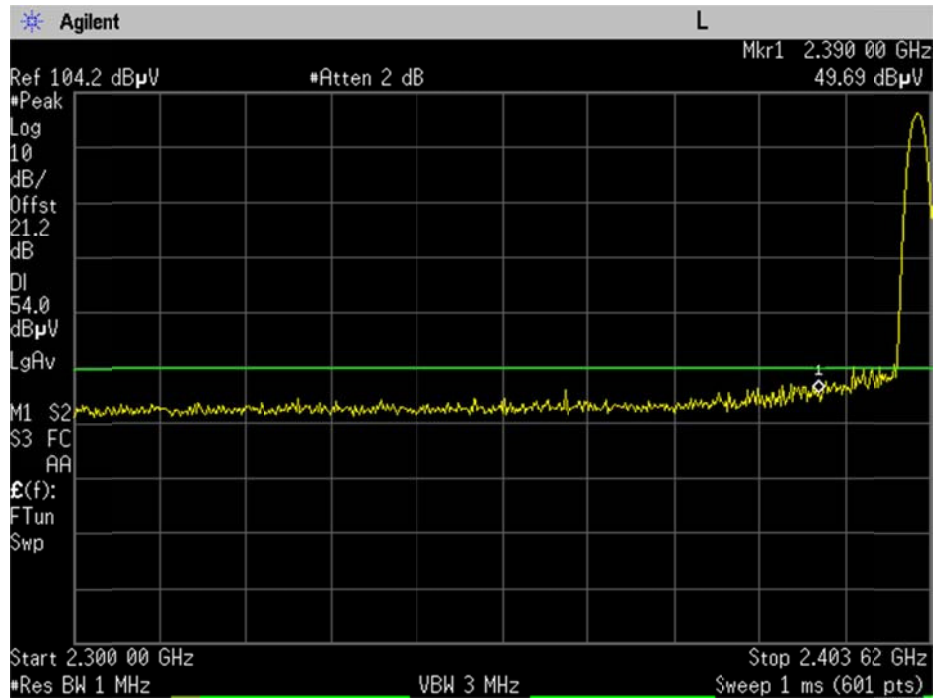


BT EDR 2MB - Restricted Band 2483.5 MHz

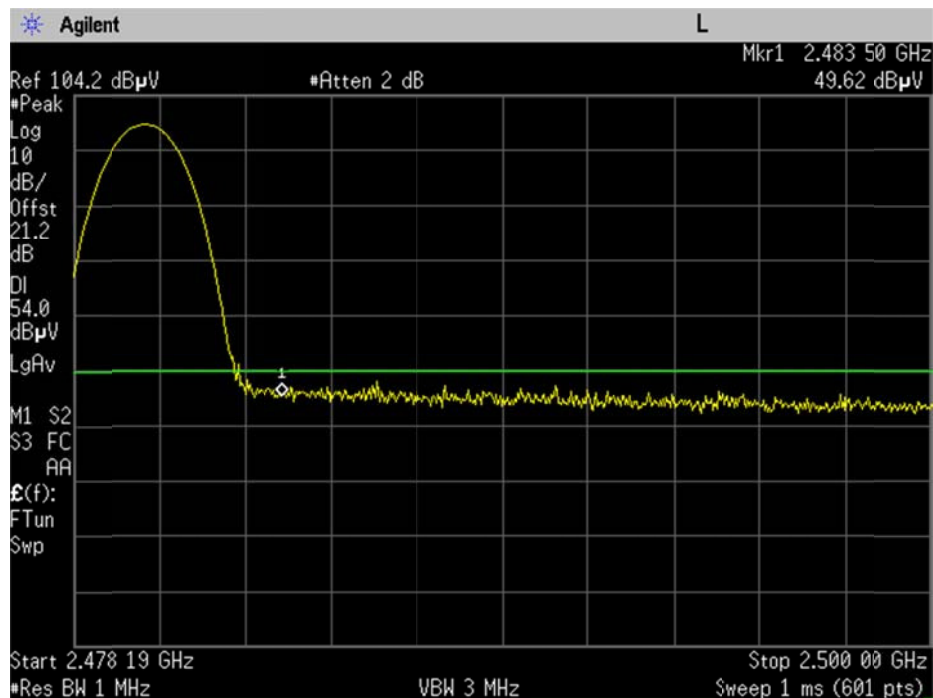




BT EDR 3MB - Restricted Band 2390 MHz



BT EDR 3MB - Restricted Band 2483.5 MHz



Occupied Bandwidth

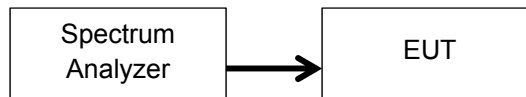
Engineer: Kenneth Lee

Test Date: 06/23/2016

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



BR - 20 dB Bandwidth Summary

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.117	Pass
2441	1.108	Pass
2480	1.106	Pass

BR - 99% Bandwidth Summary

Frequency (MHz)	Recorded Measurement (kHz)	Result
2402	941.194	Pass
2441	934.546	Pass
2480	928.34	Pass



BT EDR 2MB - 20 dB Bandwidth Summary

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.431	Pass
2441	1.432	Pass
2480	1.426	Pass

BT EDR 2MB - 99% Bandwidth Summary

Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.237	Pass
2441	1.237	Pass
2480	1.248	Pass

BT EDR 3MB - 20 dB Bandwidth Summary

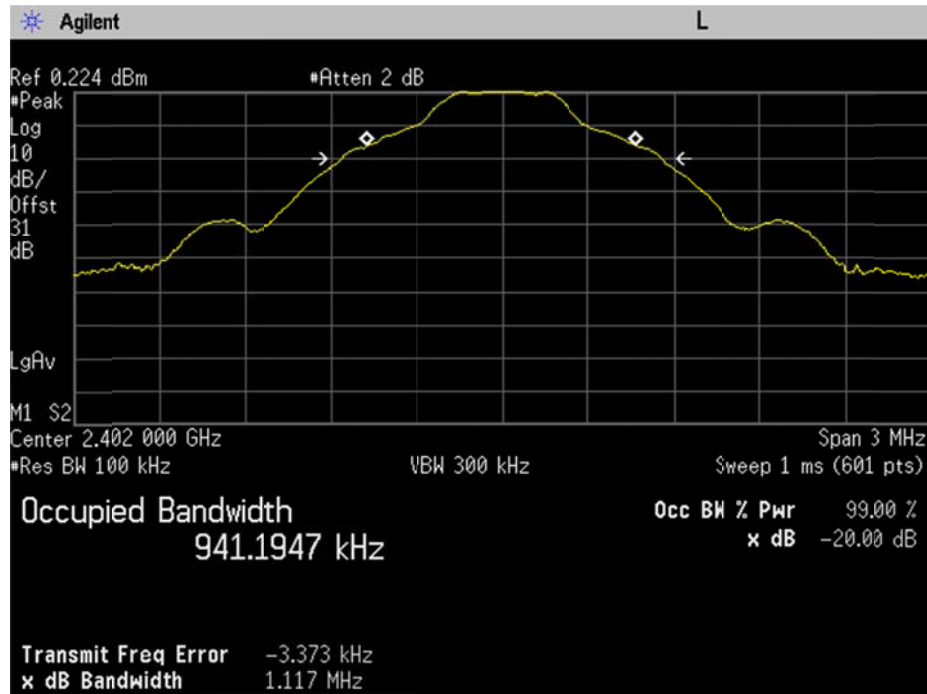
Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.424	Pass
2441	1.424	Pass
2480	1.431	Pass

BT EDR 3MB - 99% Bandwidth Summary

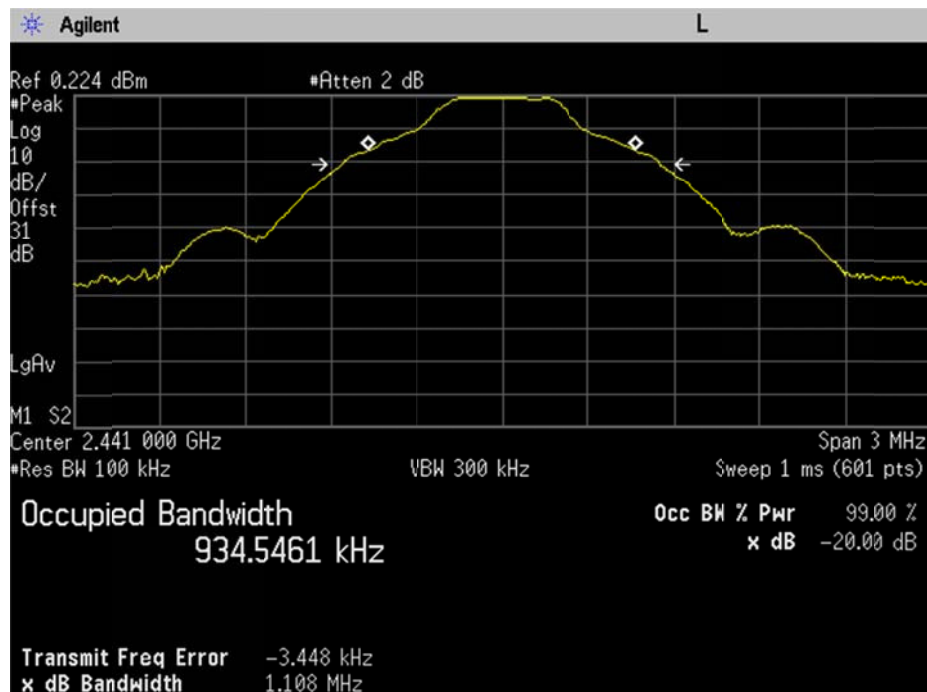
Frequency (MHz)	Recorded Measurement (MHz)	Result
2402	1.249	Pass
2441	1.245	Pass
2480	1.237	Pass



BR - 20 dB and 99% Bandwidth 2402 MHz

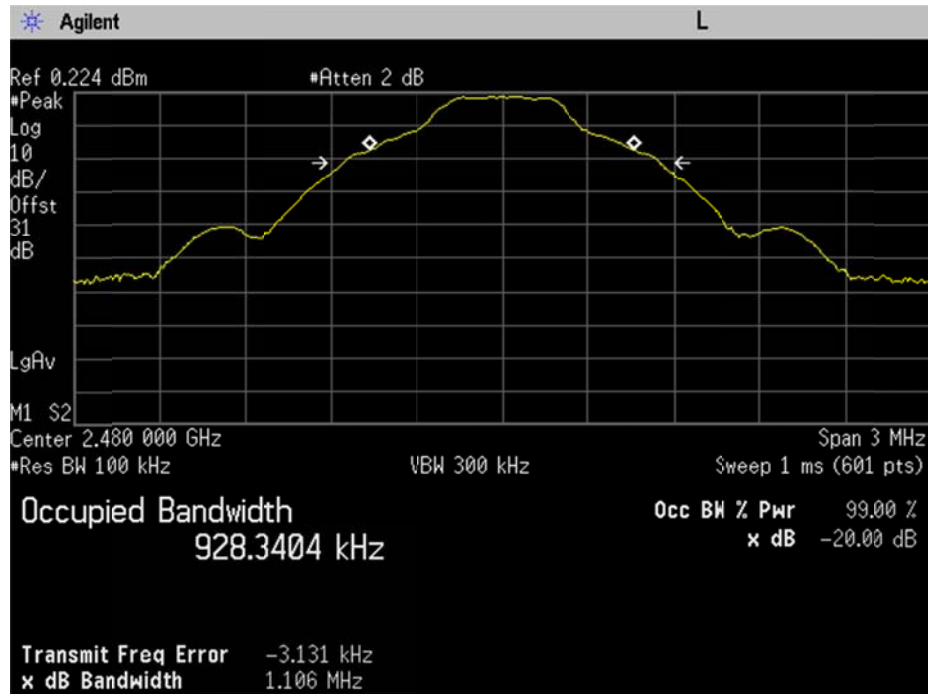


BR - 20 dB and 99% Bandwidth 2441 MHz

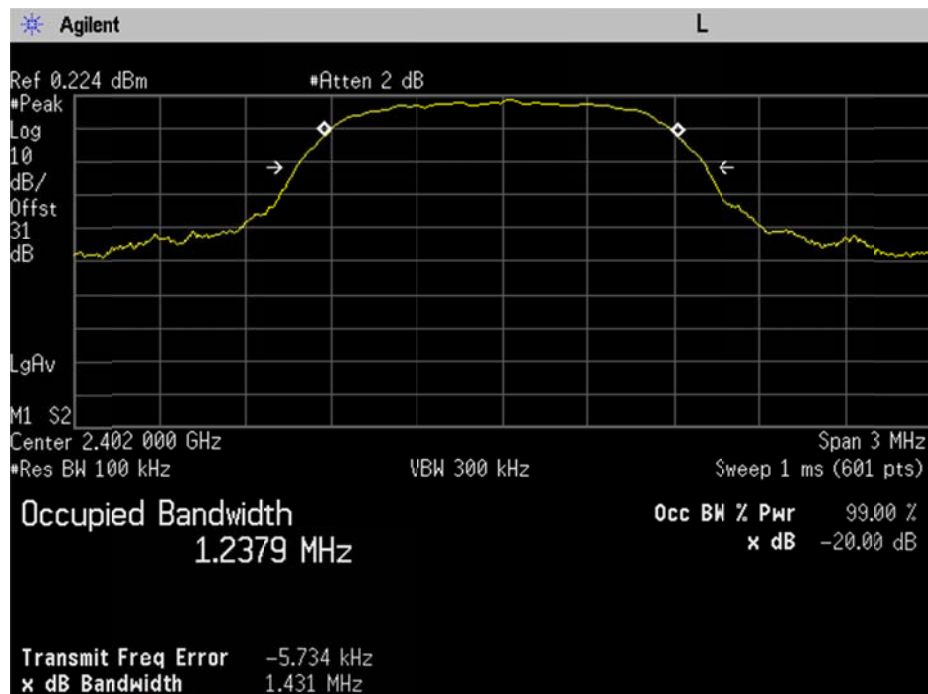




BR - 20 dB and 99% Bandwidth 2480 MHz

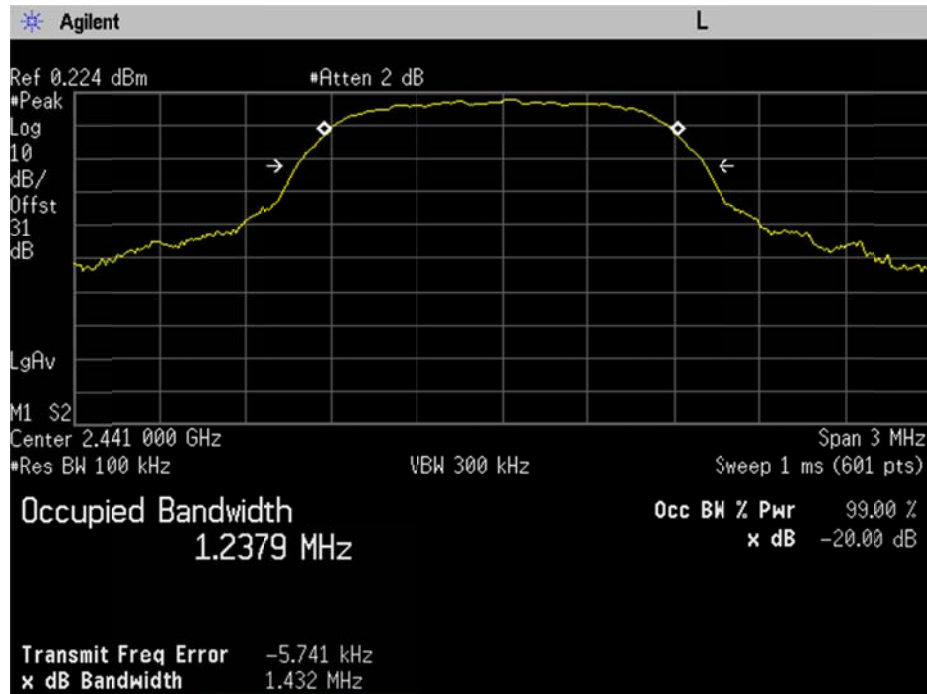


BT EDR 2MB - 20 dB and 99% Bandwidth 2402 MHz

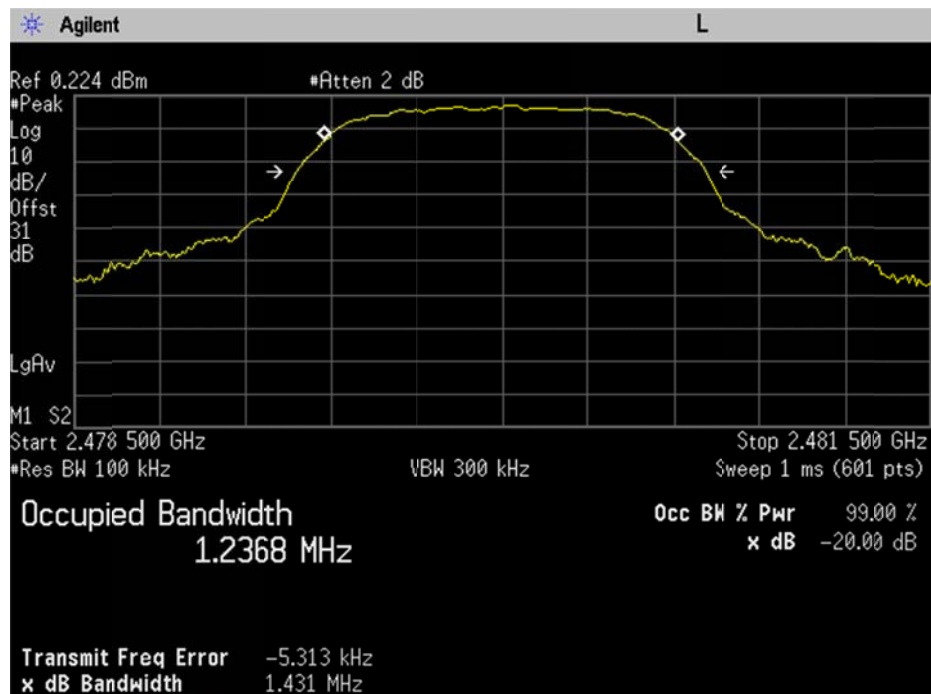




BT EDR 2MB - 20 dB and 99% Bandwidth 2441 MHz

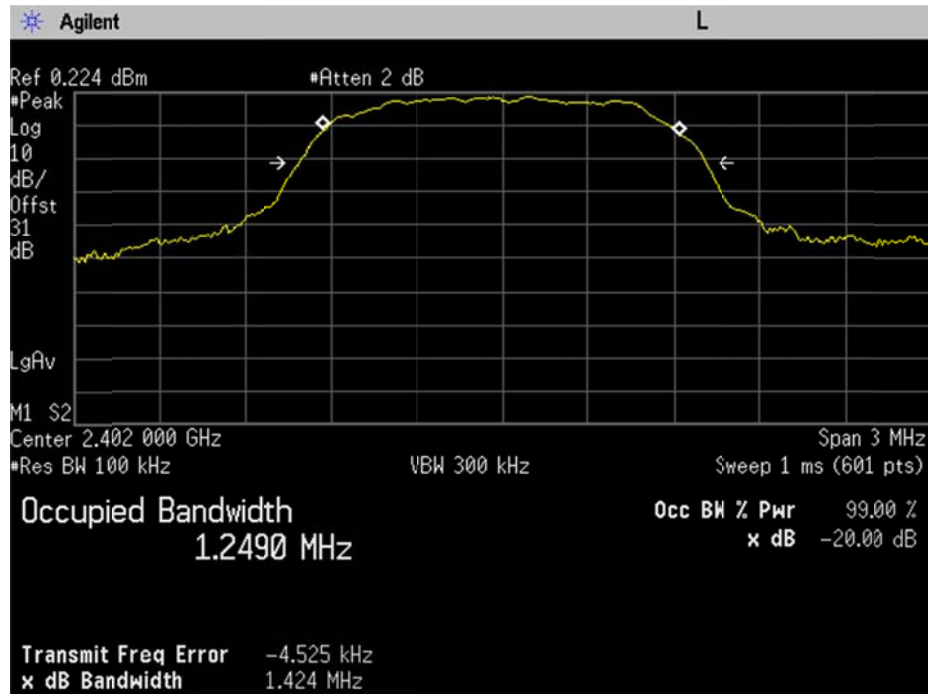


BT EDR 2MB - 20 dB and 99% Bandwidth 2480 MHz

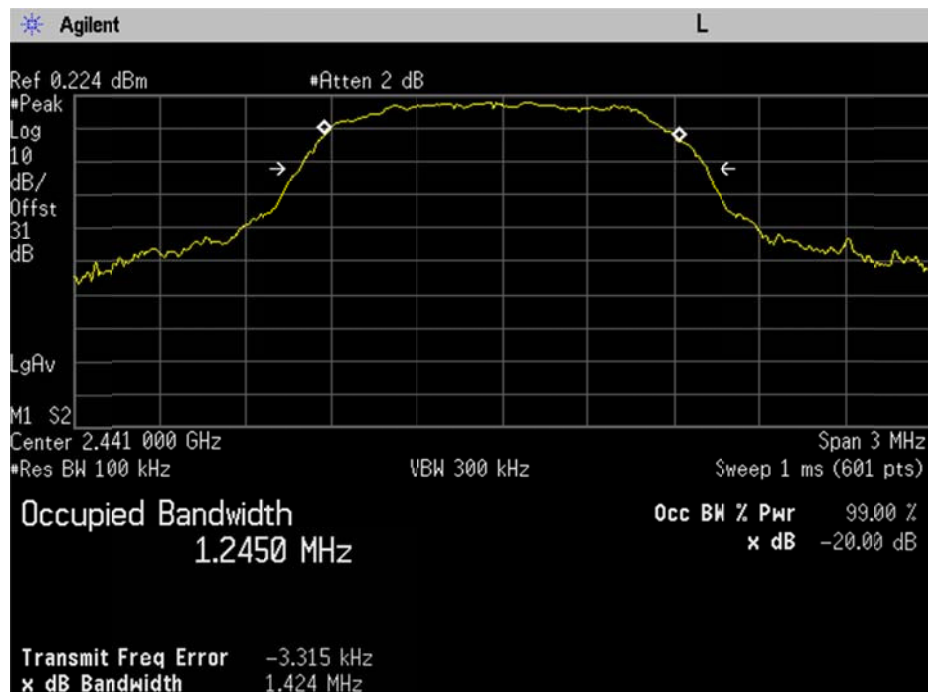




BT EDR 3MB - 20 dB and 99% Bandwidth 2402 MHz

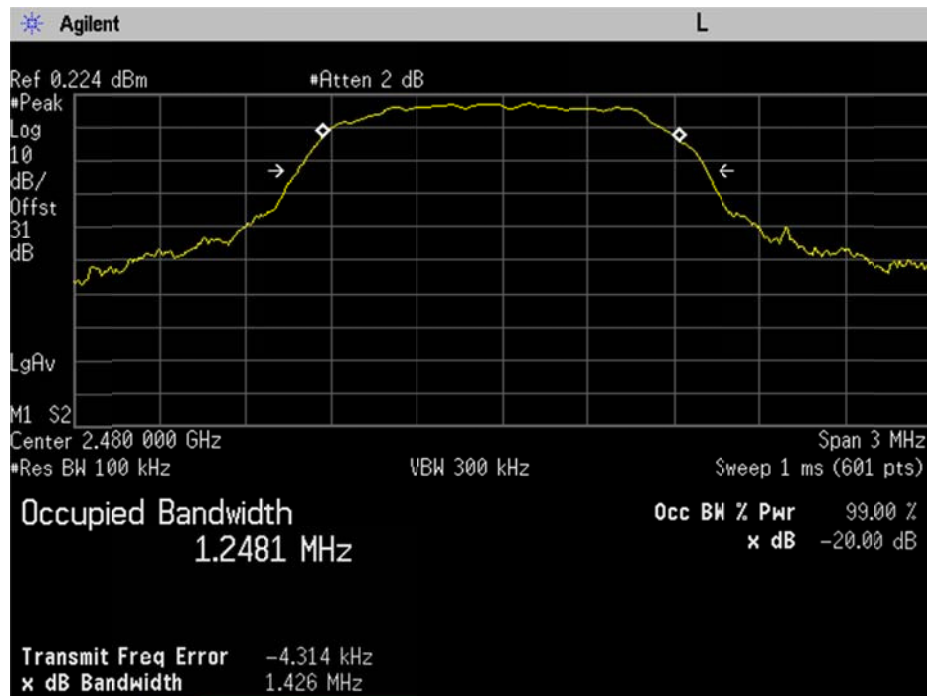


BT EDR 3MB - 20 dB and 99% Bandwidth 2441 MHz





BT EDR 3MB - 20 dB and 99% Bandwidth 2480 MHz



Dwell Time

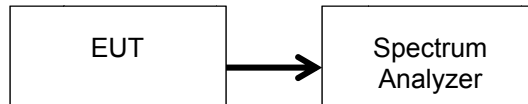
Engineer: Kenneth Lee

Test Date: 06/23/2016

Test Procedure

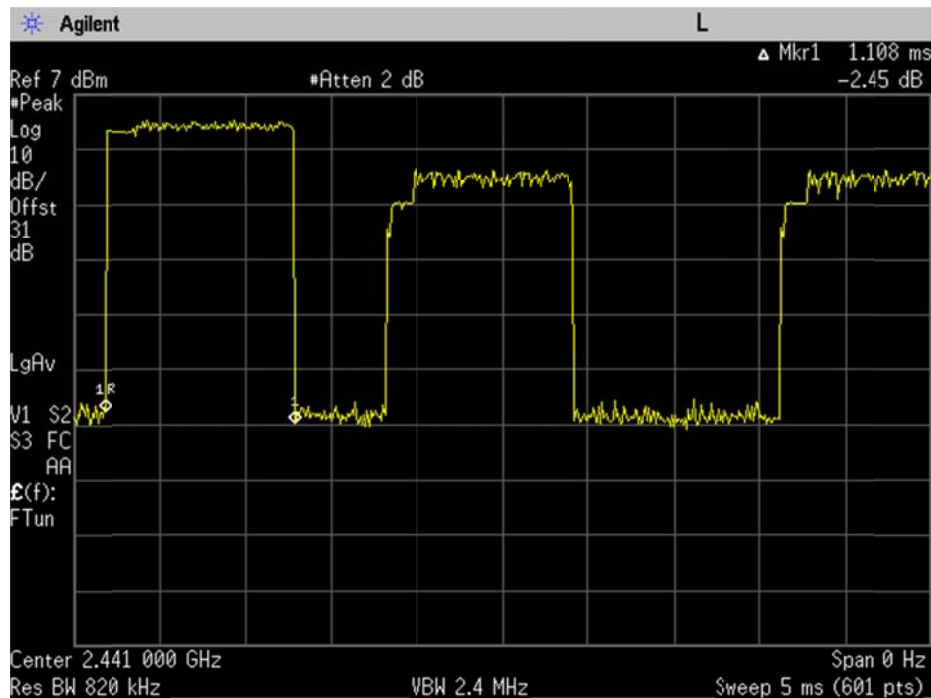
The EUT was connected directly to a spectrum analyzer. The EUT was set to hopping mode with the spectrum analyzer set to a 0 Hz span. A single transmission was captured and the dwell time was recorded.

Test Setup



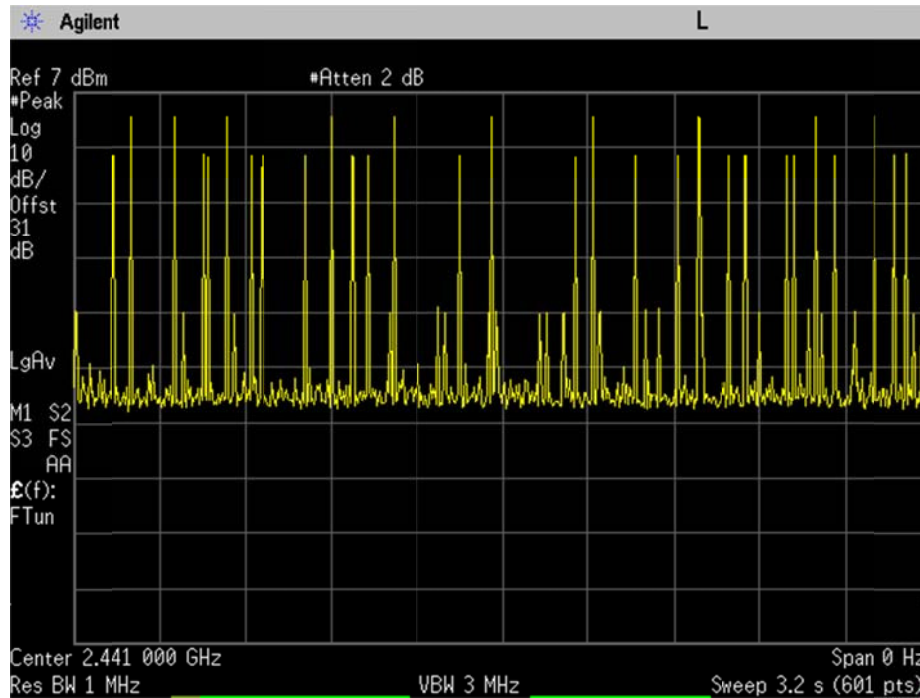
Dwell Time = 321.32 ms

Time of Single Pulse = 1.108 ms





Number of Pulses in 3.2 seconds = 29



Time of One Pulse = 1.108 ms
Number of Pulses in 3.2 seconds = 29
 $1.108 \text{ ms} \times 29 = 32.132$
 $32.132 \times 10 = 321.32 \text{ ms}$

Number of Hopping Channels

Engineer: Kenneth Lee

Test Date: 06/23/2016

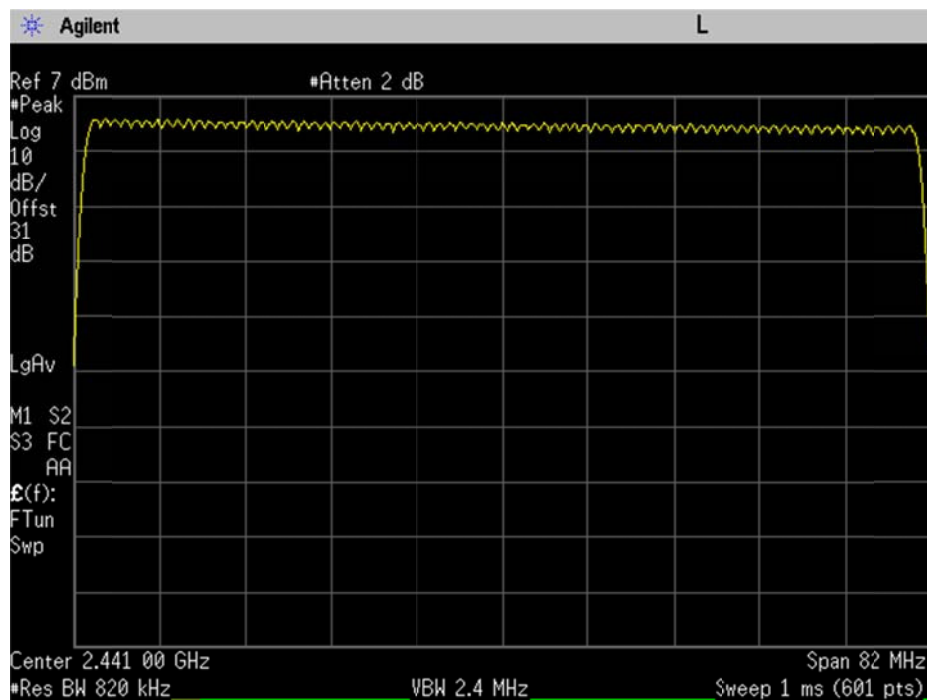
Test Procedure

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 channels.

Test Setup



Number of Hopping Channels = 79



A/C Powerline Conducted Emission

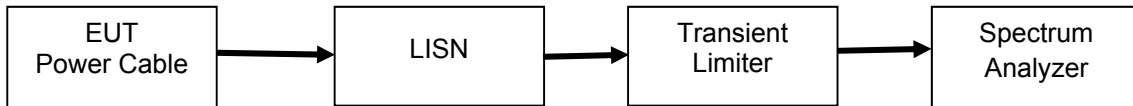
Engineer: Kenneth Lee

Test Date: 06/23/2016

Test Procedure

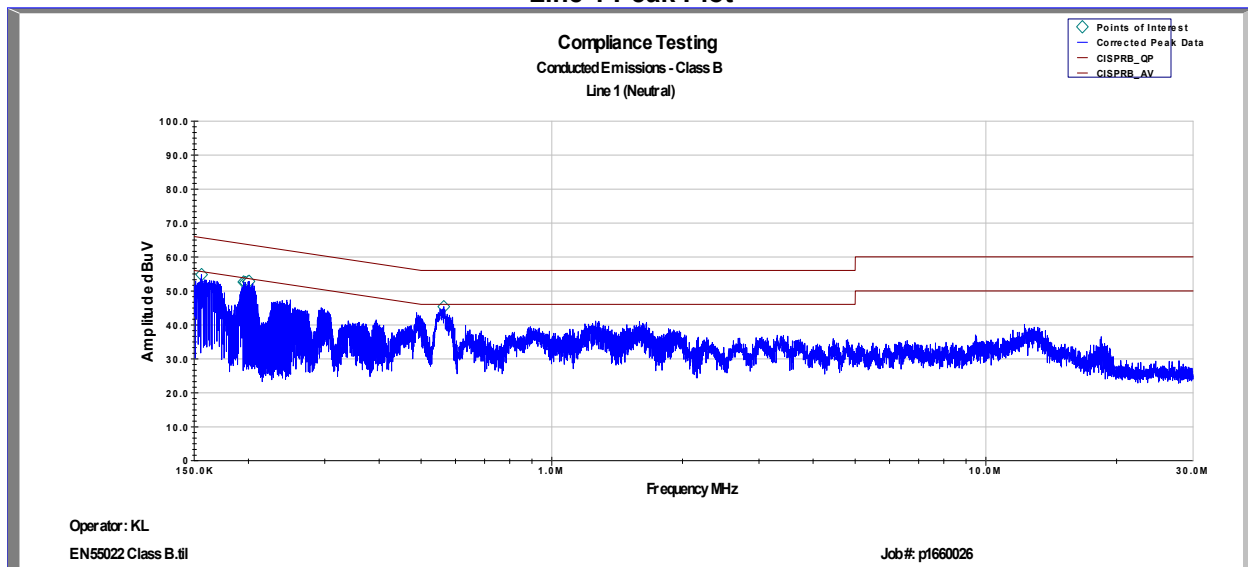
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup

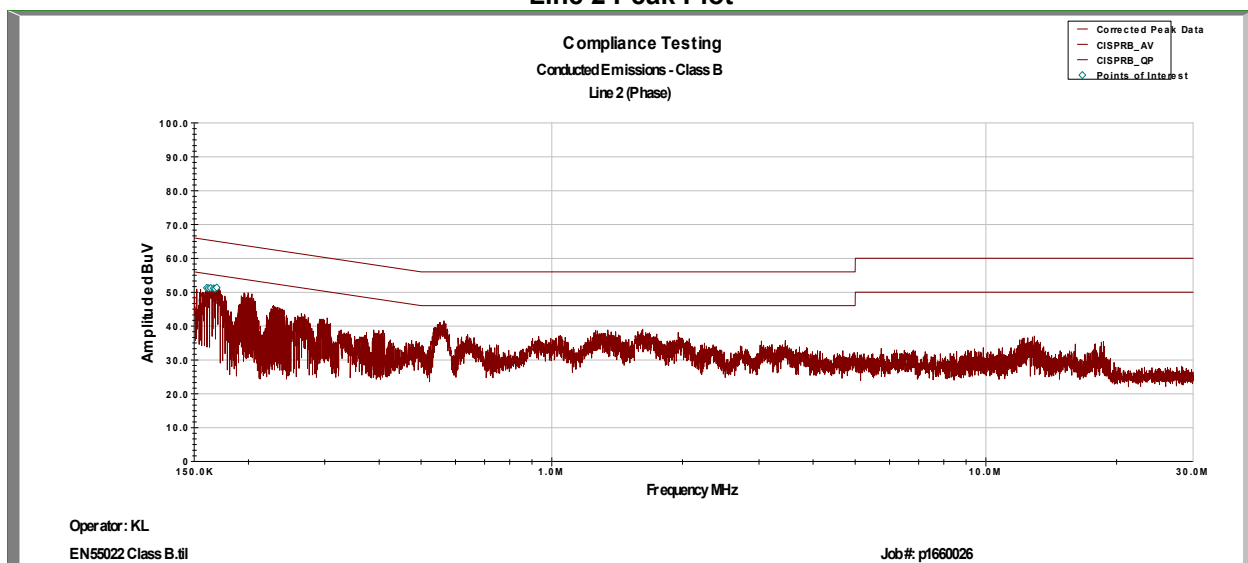


Conducted Emission Test Results

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)
158.9 KHz	19.26	0.21	0.073	10.2	29.741	55.746	-26.005
196.55 KHz	20.98	0.2	0.075	10.1	31.358	54.67	-23.312
196.64 KHz	21.45	0.2	0.075	10.1	31.825	54.667	-22.843
197.4 KHz	22.15	0.2	0.075	10.1	32.521	54.646	-22.124
197.7 KHz	22.04	0.2	0.075	10.1	32.415	54.637	-22.222
559.03 KHz	18.58	0.1	0.071	10.1	28.854	46	-17.146

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)
150.5 KHz	16.83	0.3	0.073	10.2	27.394	55.986	-28.592
156.88 KHz	16.13	0.23	0.073	10.2	26.637	55.803	-29.166
160.43 KHz	17.87	0.2	0.073	10.196	28.339	55.702	-27.363
162.95 KHz	20.5	0.2	0.073	10.17	30.944	55.63	-24.686
165.7 KHz	17.93	0.2	0.073	10.143	28.35	55.551	-27.202
167.52 KHz	20.91	0.2	0.073	10.125	31.308	55.499	-24.191

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)
158.9 KHz	39.1	0.211	0.073	10.2	49.584	65.746	-16.162
196.55 KHz	38.8	0.2	0.075	10.1	49.175	64.67	-15.495
196.64 KHz	38.79	0.2	0.075	10.1	49.165	64.667	-15.503
197.4 KHz	38.8	0.2	0.075	10.1	49.175	64.646	-15.471
197.7 KHz	38.48	0.2	0.075	10.1	48.855	64.637	-15.782
559.03 KHz	31.72	0.1	0.071	10.1	41.991	56	-14.009

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)
150.5 KHz	35.42	0.3	0.073	10.2	45.988	65.986	-19.998
156.88 KHz	36.09	0.23	0.073	10.2	46.594	65.803	-19.209
160.43 KHz	36.3	0.2	0.073	10.196	46.769	65.702	-18.933
162.95 KHz	38.46	0.2	0.073	10.17	48.904	65.63	-16.726
165.7 KHz	36.07	0.2	0.073	10.143	46.486	65.551	-19.065
167.52 KHz	38	0.2	0.073	10.125	48.398	65.499	-17.101

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
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
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/19/15	10/19/17
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	Verified on: 06/28/16	
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
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