Compliance Testing, LLC
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toll-free: (866) 311-3268
fax: (480) 926-3598
http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Garmin International, Inc.

Model: A03393

Description: Short Range Transceiver

Serial Number: N/A

FCC ID: IPH-03393
IC: 1792A-03393

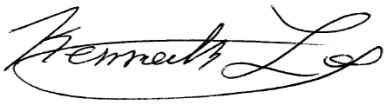
To

FCC Part 15.247
IC RSS-247

Date of Issue: December 6, 2017

On the behalf of the applicant:	**Garmin International, Inc.** **1705 S. Research Loop** **Tucson, AZ 85710**
Attention of:	**Rick Waybright, Hardware Engineer** **Ph: (520)290-6000** **E-Mail: Rick.Waybright@garmin.com**

Prepared By
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1790006



Kenneth Lee
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	September 21, 2017	Kenneth Lee	Original Document
2.0	November 15, 2017	Amanda Reed	Updated model information
3.0	December 6, 2017	Kenneth Lee	Updated KDB version number in references table, Updated section referenced for Conducted Spurious Emissions from (b) to (d) Updated ANSI date on page 6

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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**

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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 (ºC)	**Humidity (%)**	**Pressure (mbar)**
23-29	31-38	966-972

EUT Description
Model: A03393
Description: Short Range Transceiver
Firmware: N/A
Software: N/A
Serial Number: N/A
Additional Information: The EUT implements BLE and ANT protocols, but the signal outputs are identical, on only one was tested to show compliance.

EUT Operation during Tests
The EUT was set to transmit at the lowest, middle and highest frequencies of operation at the maximum available output power. The EUT was controlled through a laptop computer via client provided software.

Accessories:

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

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	USB	0.1	Y	N	N

Modifications: None

15.203: Antenna Requirement:

X	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

FCC 15.247 Specification	RSS-247 Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Section 5.4(d)	Peak Output Power	Pass	
15.247(d)	Section 5.5	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Section 5.5	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Section 5.5	Emissions At Band Edges	Pass	
15.247(a)(2)	Section 5.2(a)	Occupied Bandwidth	Pass	
15.247(e)	Section 5.2(b)	Transmitter Power Spectral Density	Pass	
15.207	RSS-GEN Section 8.8	A/C Powerline Conducted Emissions	Pass	

References	Description
CFR47, Part 15, Subpart B	Unintentional Radiators
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63.10-2013	American National standard for testing Unlicensed Wireless Devices
ANSI C63.4-2014	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
KDB 558074 D01 v04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

Conducted Output Power
Engineer: Kenneth Lee
Test Date: 9/19/2017

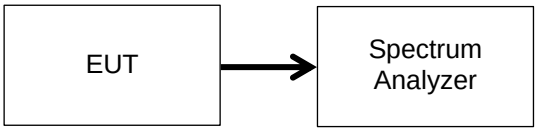
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = RBW ≥ *DTS bandwidth*
VBW ≥ 3 x RBW
Span = ≥ 3 x RBW
Detector = Peak
Sweep = auto
Trace Mode = Max Hold

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The RF output power was measured using the spectrum analyzer's marker peak function.

Test Setup



Transmitter Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	3.775	1 W (30 dBm)	Pass
2440	3.696	1 W (30 dBm)	Pass
2480	3.582	1 W (30 dBm)	Pass

Radiated Spurious Emissions
Engineer: Kenneth Lee
Test Date: 9/19/2017

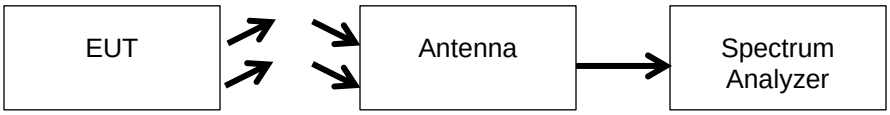
Test Procedure
Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. 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

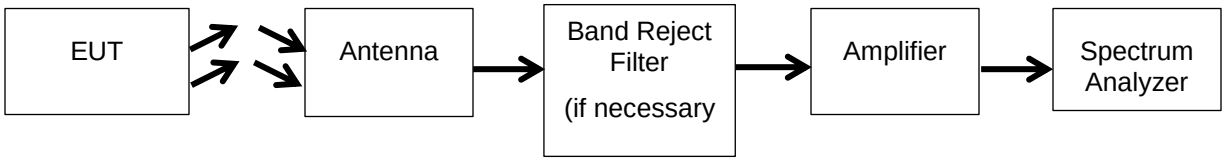
Test Setup



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 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.

Test Setup



See Annex A for Test Data

Conducted Spurious Emissions

Engineer: Kenneth Lee

Test Date: 9/19/2017

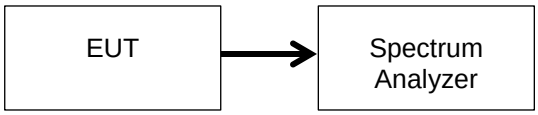
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

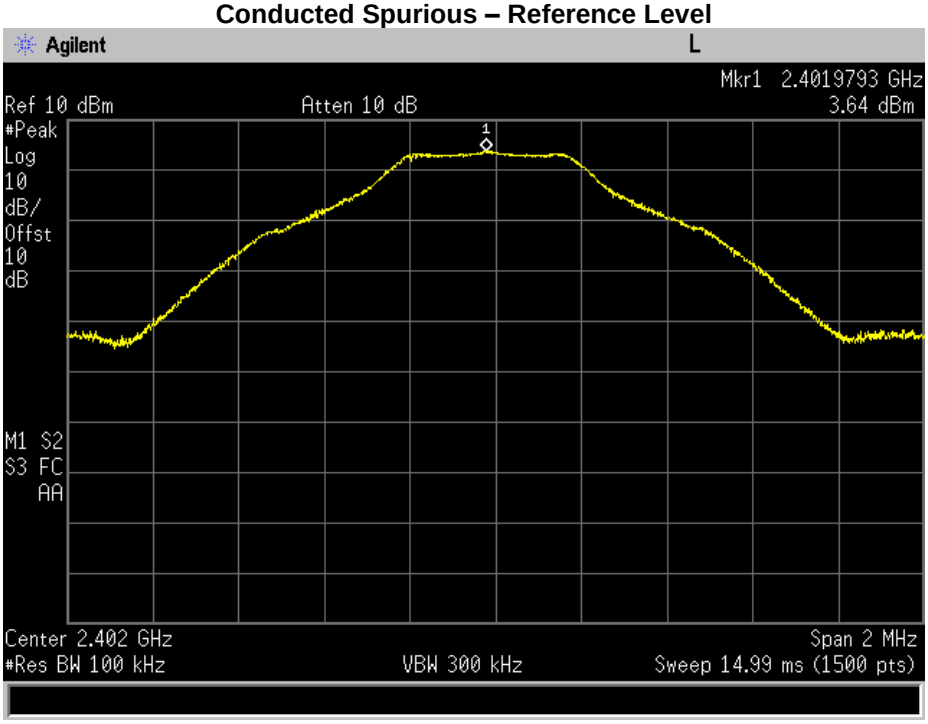
RBW = 100 kHz
VBW ≥ 3 x RBW
Peak Detector
Trace mode = max hold
Sweep = auto couple
Frequency Range = 30MHz – 10th Harmonic of the fundamental

The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The trace was allowed to stabilize. All emissions were investigated to insure they were attenuated from the peak fundamental by at least 20dB. In addition, the emissions at the band edges were measured to ensure they were at least 20 dBc.

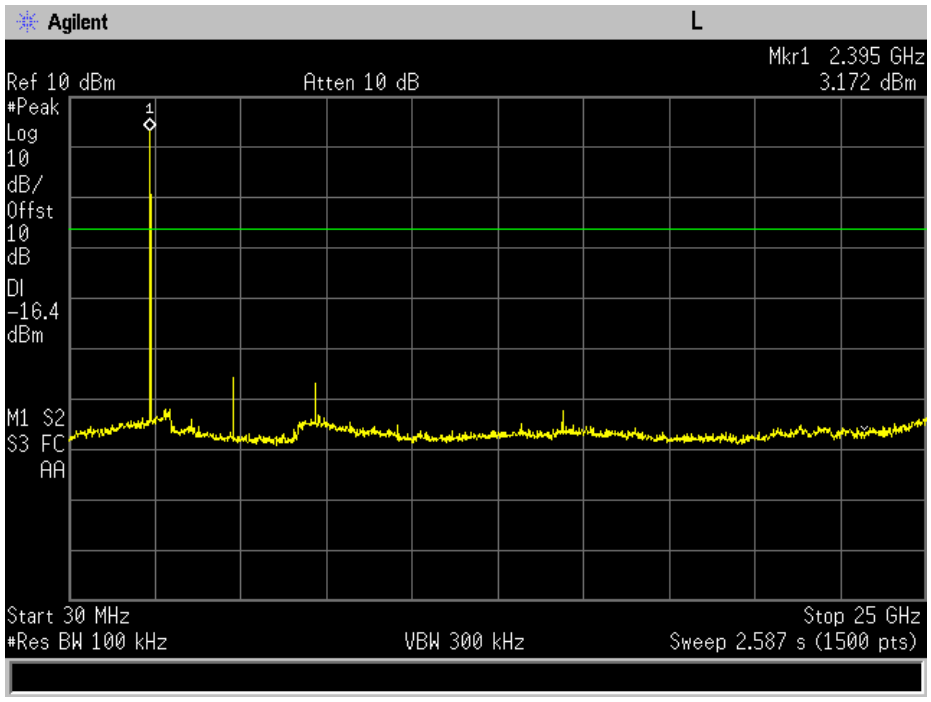
Test Setup



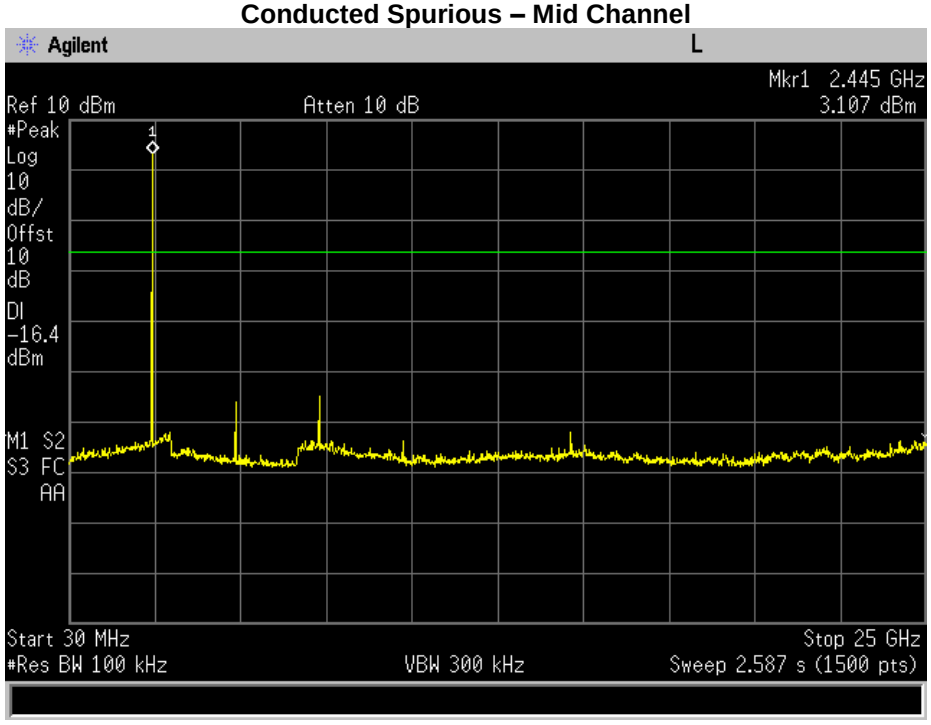
Conducted Spurious – Reference Level



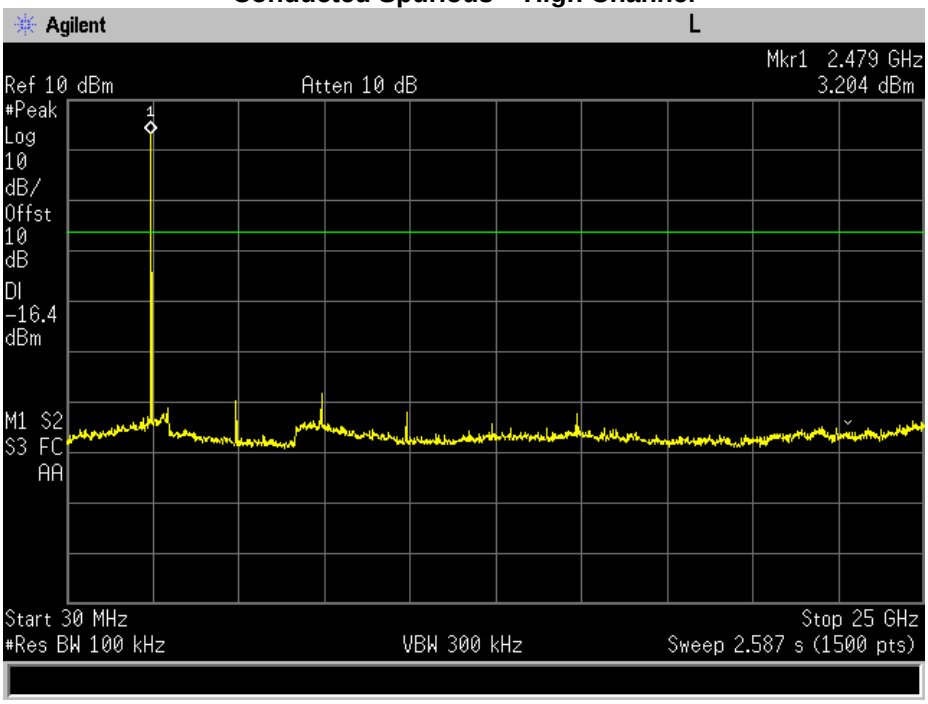
Conducted Spurious – Low Channel



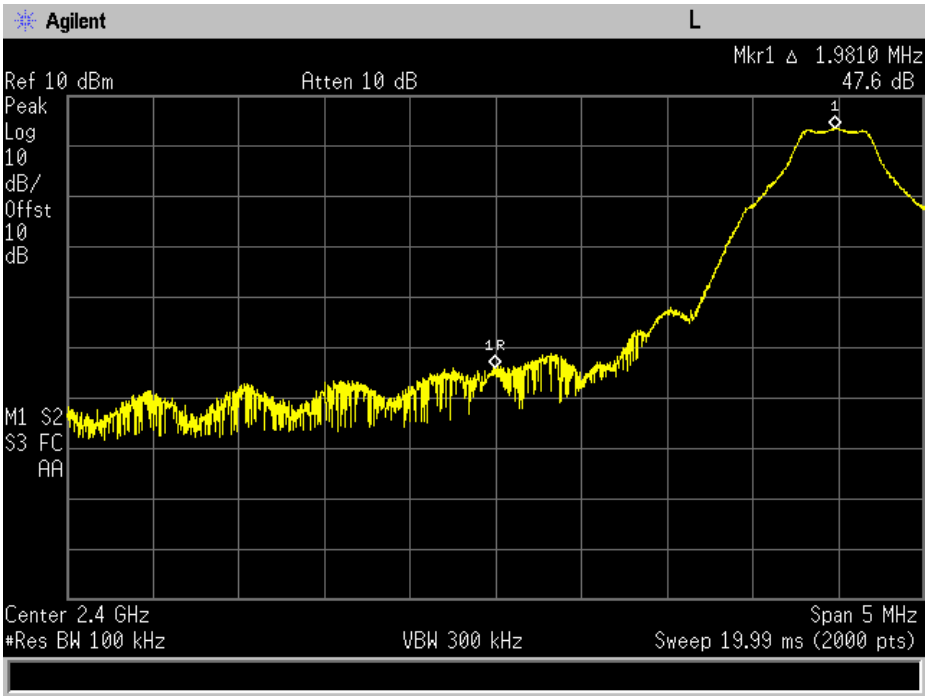
Conducted Spurious – Mid Channel



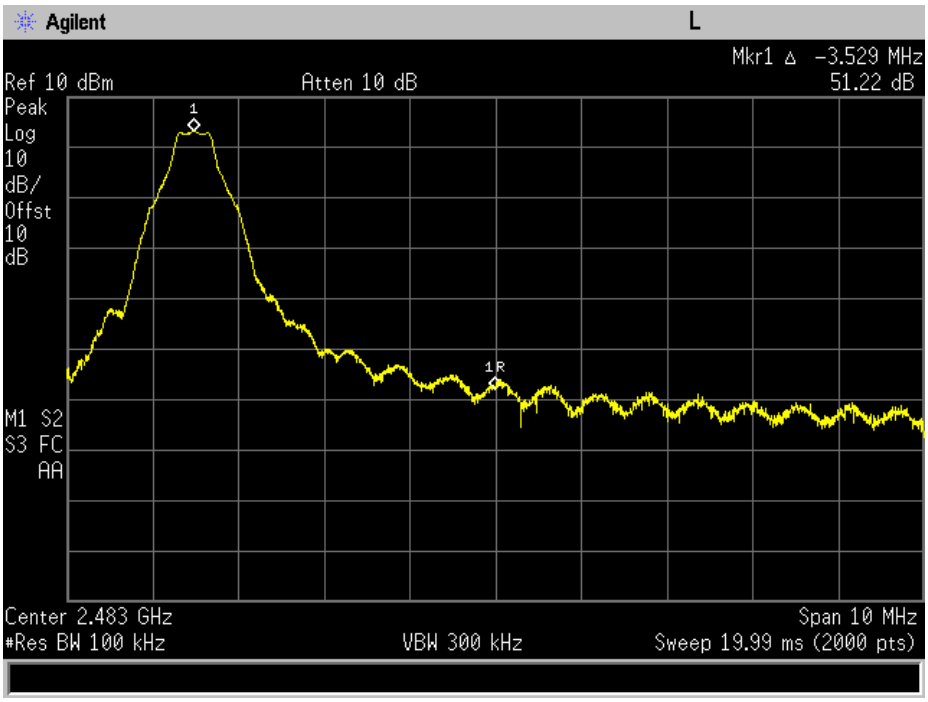
Conducted Spurious – High Channel



Low Channel Band Edge



High Channel Band Edge



DTS Bandwidth
Engineer: Kenneth Lee
Test Date: 9/19/2017

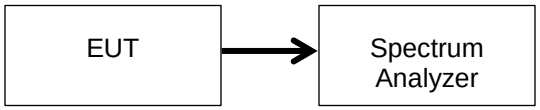
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

RBW = 100 kHz
VBW ≥ 3 x RBW
Peak Detector
Trace mode = max hold
Sweep = auto couple

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. The maximum width of the emission that was determined by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that were attenuated by 6db and this value was used to determine the width of the carrier. Alternatively, the spectrum analyzer's automatic bandwidth capability was used.

Test Setup



6 dB Occupied Bandwidth Summary

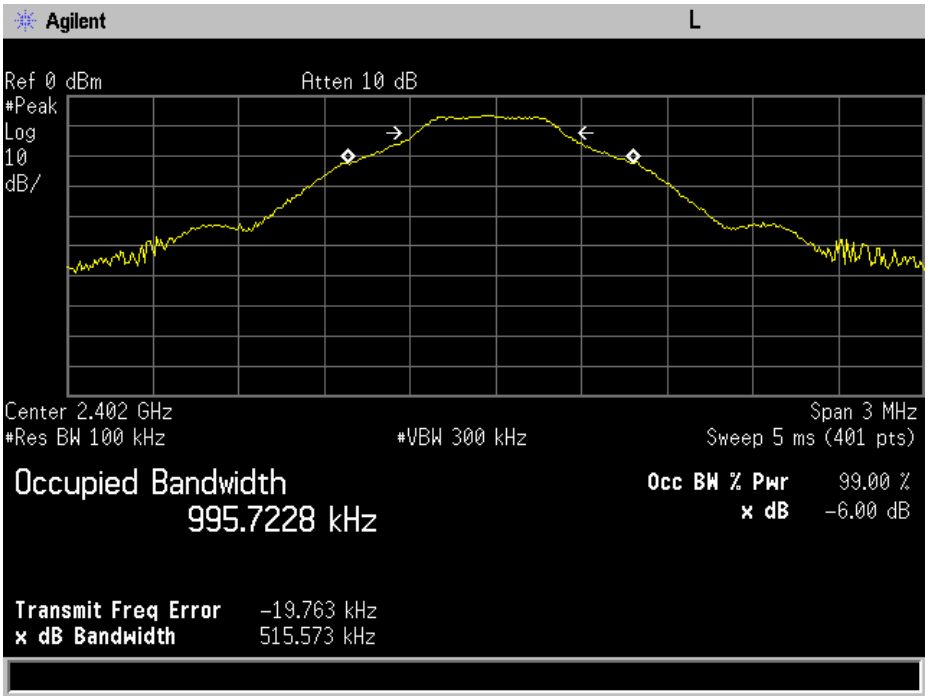
Frequency (MHz)	Measured Bandwidth (MHz)	Specification Limit (kHz)	Result
2402	515.573	≥ 500	Pass
2440	524.749	≥ 500	Pass
2480	527.437	≥ 500	Pass

99% Bandwidth Summary

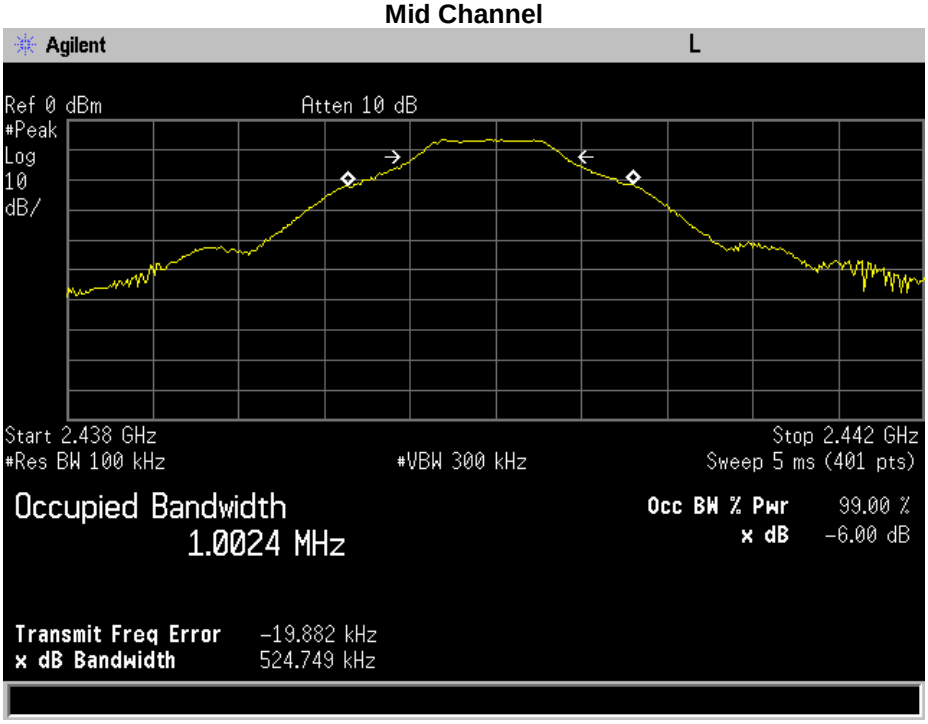
Frequency (MHz)	Measured Bandwidth (MHz)	Result
2402	0.9957228	Pass
2440	1.0024	Pass
2480	1.0028	Pass

99% and 6dB Bandwidth Plots

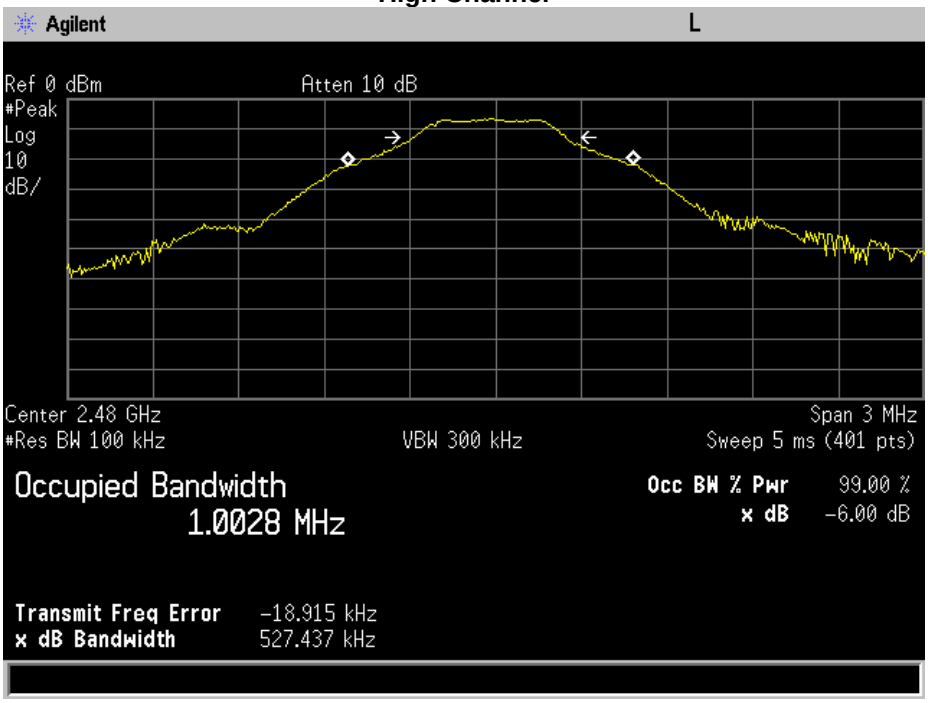
Low Channel



Mid Channel



High Channel



Transmitter Power Spectral Density (PSD)

Engineer: Kenneth Lee

Test Date: 9/19/2017

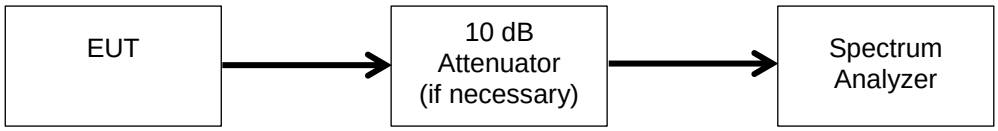
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

DTS channel center frequency
Span 1.5 x DTS bandwidth
RBW =3 kHz ≤ RBW ≤ 100 kHz
VBW ≥ 3 x RBW
Peak Detector
Sweep time = auto couple
Trace mode = max hold

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. Once the trace was stabilized the peak marker was used to determine the peak power spectral density.

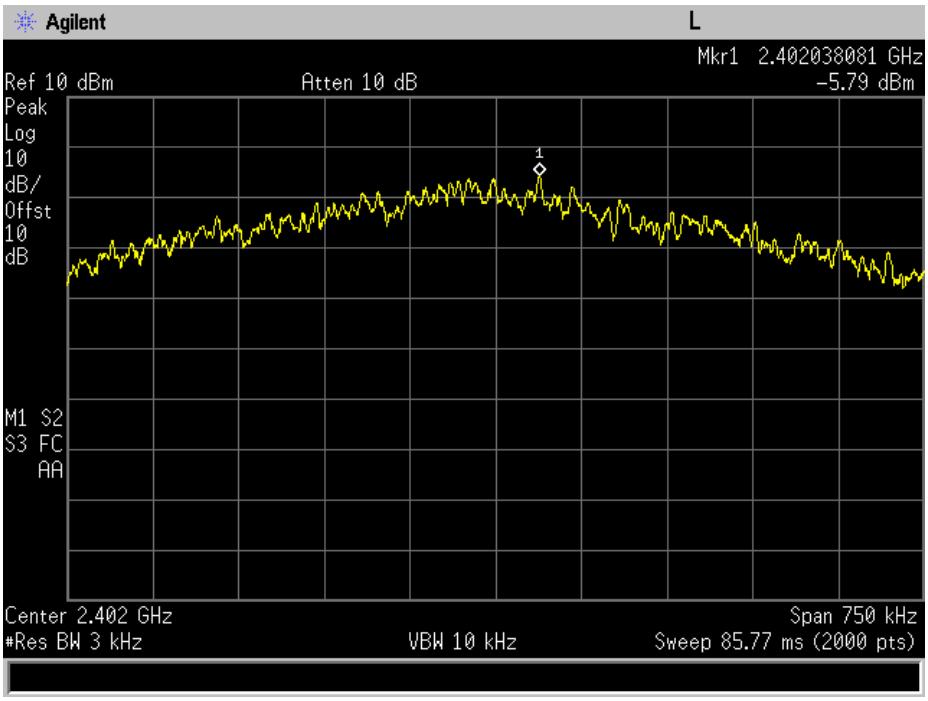
Test Setup



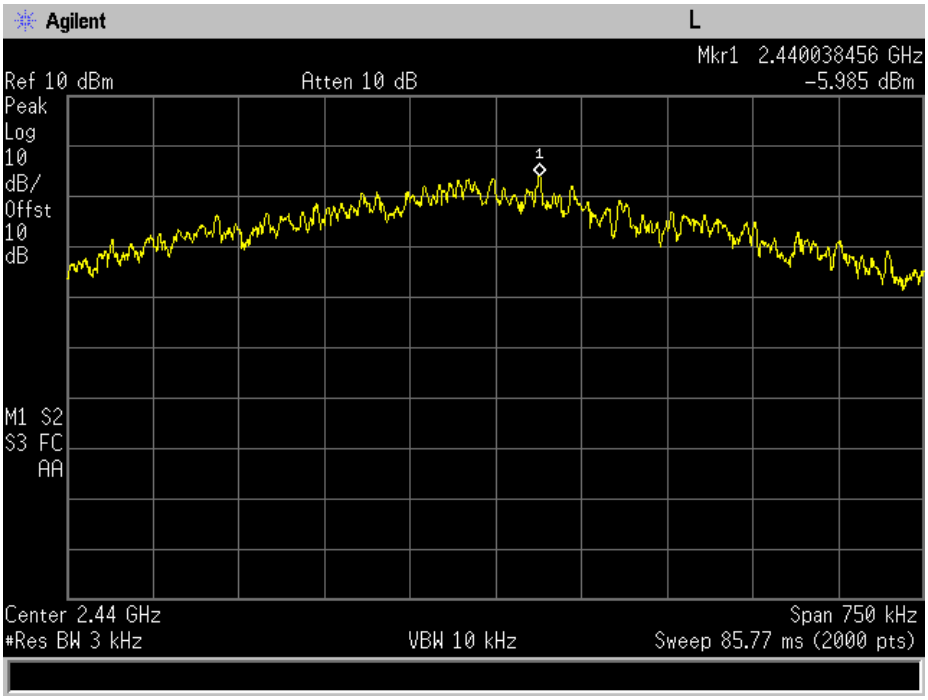
PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-5.79	8	Pass
2440	-5.985	8	Pass
2480	-6.176	8	Pass

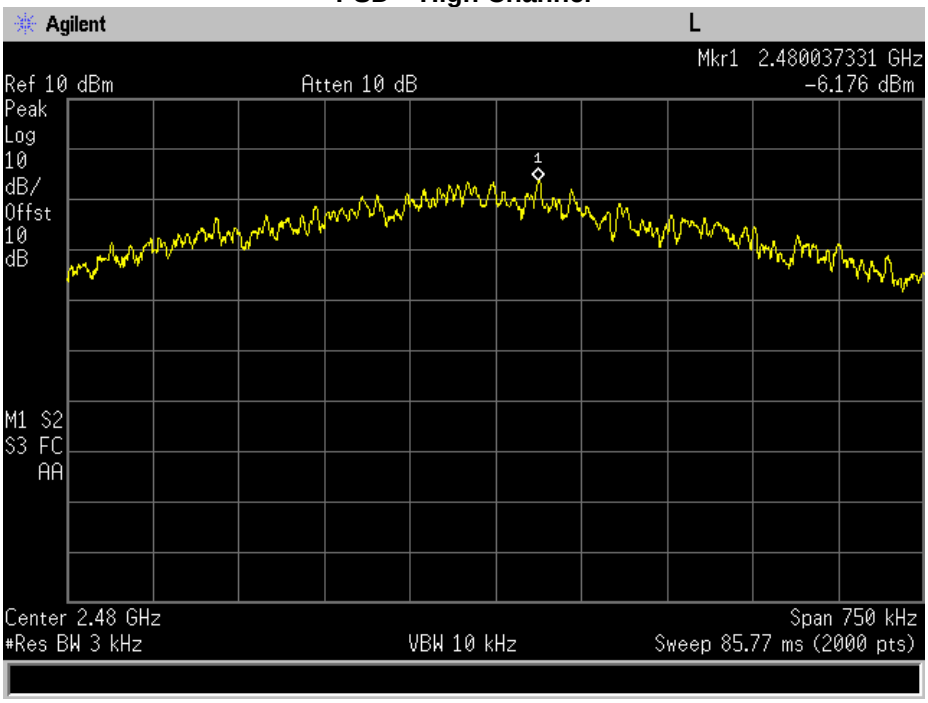
PSD – Low Channel



PSD – Mid Channel



PSD – High Channel



A/C Powerline Conducted Emission

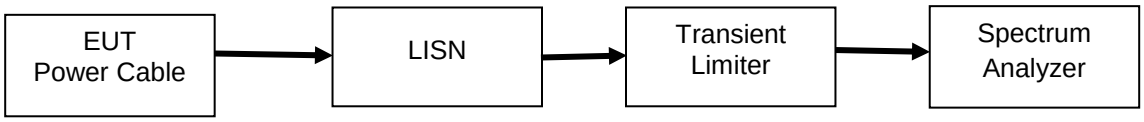
Engineer: Kenneth Lee

Test Date: 9/20/2017

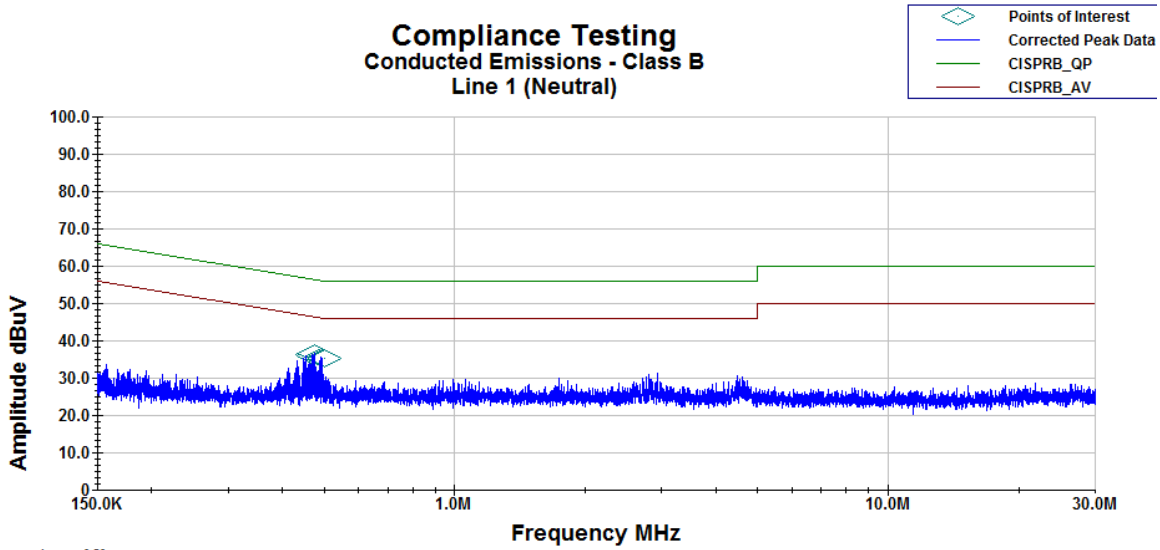
Test Procedure

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

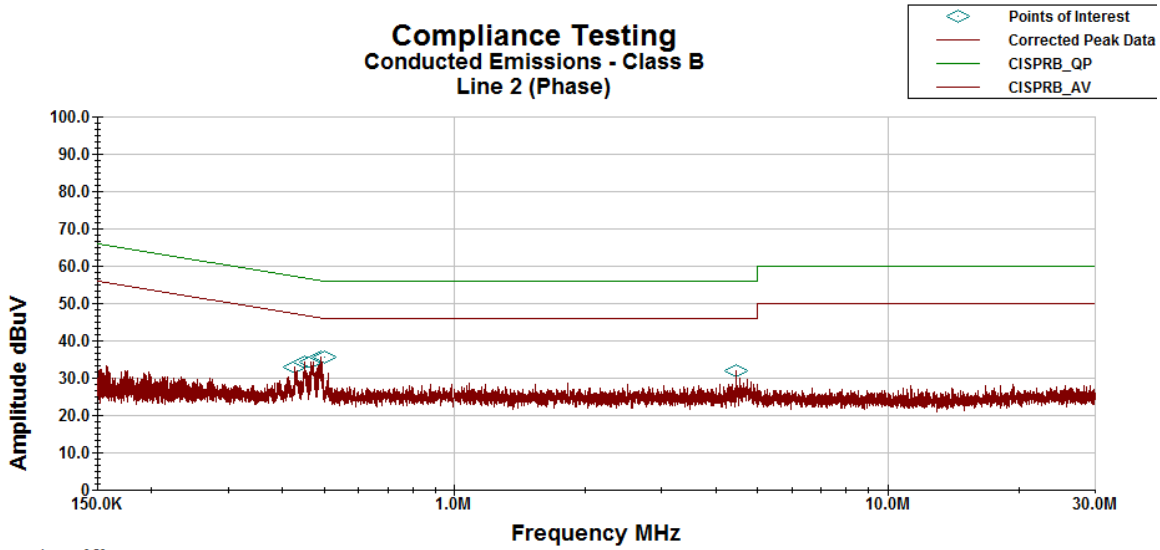


Conducted Emissions Test Results



Operator: KL

Conducted Emissions - FCC 207.til **Job #: p1790006**



Operator: KL

Conducted Emissions - FCC 207.til **Job #: p1790006**

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)
470.4 KHz	10.25	0.1	0.03	10.1	20.477	46.846	-26.369
470.51 KHz	10.2	0.1	0.03	10.1	20.427	46.843	-26.416
470.61 KHz	10.24	0.1	0.03	10.1	20.47	46.84	-26.37
488.15 KHz	9.97	0.1	0.03	10.1	20.197	46.339	-26.142
490.26 KHz	10.49	0.1	0.03	10.1	20.723	46.278	-25.555
493.8 KHz	7.93	0.1	0.03	10.1	18.157	46.177	-28.02

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)
432.08 KHz	12.13	0.1	0.03	10.1	22.357	47.941	-25.584
447.21 KHz	9.94	0.1	0.03	10.1	20.173	47.508	-27.335
477.47 KHz	7.34	0.1	0.03	10.1	17.57	46.644	-29.074
488.8 KHz	14.43	0.1	0.03	10.1	24.657	46.32	-21.663
490.2 KHz	14.86	0.1	0.03	10.1	25.093	46.28	-21.187
4.4591 MHz	9.72	0	0.093	10.2	20.016	46	-25.984

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)
470.4 KHz	21.36	0.1	0.03	10.1	31.59	56.846	-25.256
470.51 KHz	21.4	0.1	0.03	10.1	31.63	56.843	-25.213
470.61 KHz	21.5	0.1	0.03	10.1	31.73	56.84	-25.11
488.15 KHz	20.28	0.1	0.03	10.1	30.51	56.339	-25.829
490.26 KHz	21.14	0.1	0.03	10.1	31.37	56.278	-24.908
493.8 KHz	17.77	0.1	0.03	10.1	28	56.177	-28.177

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)
432.08 KHz	17.49	0.1	0.03	10.1	27.72	57.941	-30.221
447.21 KHz	15.81	0.1	0.03	10.1	26.04	57.508	-31.468
477.47 KHz	14.28	0.1	0.03	10.1	24.51	56.644	-32.134
488.8 KHz	21.25	0.1	0.03	10.1	31.48	56.32	-24.84
490.2 KHz	21.55	0.1	0.03	10.1	31.78	56.28	-24.5
4.4591 MHz	15.67	0	0.093	10.2	25.963	56	-30.037

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: 9/20/17	
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/9/17	6/9/18
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
AC Power Source	Behlman	BL 6000	i00362	Verified on: 9/20/17	
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
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