Compliance Testing, LLC
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Test Report

Prepared for: Core Kinect

Model: OBDLRA1 & GENLRA3

Description: Vehicle Tracking and Diagnostic System

Serial Number: N/A

FCC ID: 2ARKMOBDLRA1

IC: 24436-OBDLRA1

To

FCC Part 15.247 DTS
ISED RSS-247 Issue 2

Date of Issue: March 21, 2019

On the behalf of the applicant:	**Core Kinect** **2800S. Rural Road** **Suite 103** **Tempe, AZ 85282**
Attention of:	**Assar Badri, Engineer** **Ph: (602)684-5484** **E-mail: assar@corekinect.com**

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Project No: p1830020

Poona Saber
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	February 11, 2019	Poona Saber	Original Document
2.0	March 21, 2019	Amanda Reed	Updated FCC ID
3.0	August 15, 2019	Poona Saber	Added model numbers and HVIN Added conducted output powers Revised 20 dB, 6 dB and 99% OBW for 900 MHz Revised frequency hopping occupancy measurement and result Added number of hopping channels Revised Annex A Revised Annex B
4.0	August 27,2019	Poona Saber	Revised Test setup photos

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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**

ilac-MRA

A2LA ACCREDITED
TESTING CERT
#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 (ºC)	**Humidity (%)**	**Pressure (mbar)**
23.3	28.9	967

EUT Description
Model: OBDLRA1 & GENLRA3
Description: Vehicle Tracking and Diagnostic System
Firmware: N/A
Software: N/A
Serial Number: N/A
Additional Information:
Unit has two transmitters which operate in two bands of 902-928 MHz for Lora and 2402-2480 MHz for BLE. It is a FHSS system on 900 MHz band and DTS on 2.4 GHz band. It was tested on continuous operation mode on three channels of low, mid and high on both bands of operation.
Manufacture has software control to make sure both transmitters would never transmit at the same time.

Antenna peak gain for 900 MHz LoRa is 2 dBi and 0 dBi for 2.4 GHz BLE.

A DC power supply has been provided by manufacturer which gets power from AC main and provide DC voltage to recharge the batteries of the unit. Manufacturer declares that this power supply is not sold with the unit hence the radiated testing has been done without the power supply attached to unit for restricted band testing.

Accessories: DC power supply
AC to DC adaptor- model WT24-1202000-U

Cables: Can bus cable connecting DC power supply to Unit

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

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(b)	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	
15.247(a)	Carrier separation Frequency	Pass	
15.247(a)	Dwell Time	Pass	
15.247(a)	Number of Hopping Channels	Pass	

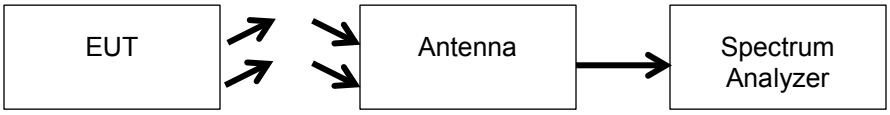
Peak Output Power

Engineer: Poona Saber
Test Date: 12/24/18

Test Procedure

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was maximized for highest emission per X,Y,Z axes and set to transmit on the lowest, middle and highest frequencies at the maximum power level. The peak readings were taken, and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

900 MHz

Tuned Frequency (MHz)	Measured Value EIRP (dBm)	Antenna Gain (dBi)	Conducted power (dBm)	Specification Limit	Result
902.3	3.51	2	1.51	1 W (30 dBm)	Pass
915	5.6	2	3.6	1 W (30 dBm)	Pass
927.7	5.12	2	3.12	1 W (30 dBm)	Pass

2.4 GHz

Tuned Frequency (MHz)	Measured Value (dBm)	Antenna Gain (dBi)	Conducted power (dBm)	Specification Limit	Result
2402	-1.98	0	-1.98	1 W (30 dBm)	Pass
2440	-7.097	0	-7.097	1 W (30 dBm)	Pass
2480	-2.224	0	-2.224	1 W (30 dBm)	Pass

Radiated Spurious Emission in Non-Restricted Frequency Bands

Engineer: Poona Saber

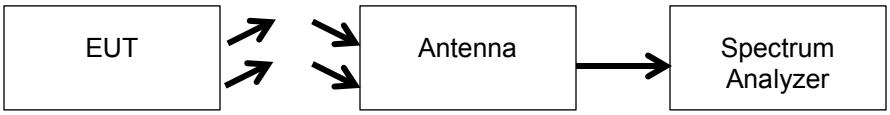
Test Date: 12/25/18

Test Procedure

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was maximized for highest emission per X, Y, Z axes and set to transmit on the lowest, middle and highest frequencies at the maximum power level.

The EUT was verified for spurious emissions of part 15.247 (d) and the frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed.
If the maximum peak conducted output power procedure was used to determine compliance, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc) which is done by reference level measurements per 11.11.2 of C63.10-2013 and emission level measurement of 11.11.3.

Test Setup



Note: For measurements in restricted bands per KDB 558074 a maximum ground reflection factor of 4.7 dB shall be added to EIRP level for frequencies between 30 MHz and 1000 MHz.

See Annex A for test results

Radiated Spurious Emissions in Restricted Frequency Bands

Engineer: Poona Saber
Test Date: 1/23/18

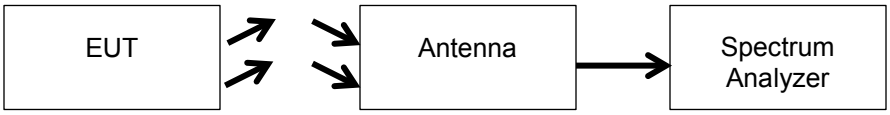
Test Procedure
Radiated Spurious Emissions: 30 – 1000 MHz

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 general Radiated Emissions limits of 15.209 if emissions fall in 15.205 restricted band. 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

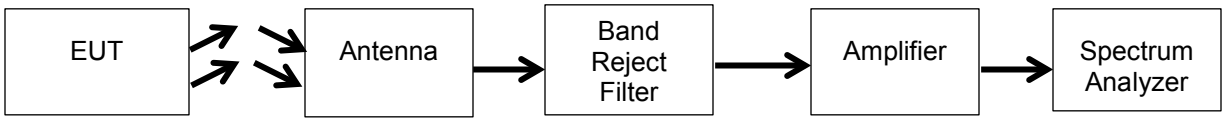
Test Setup



Test Procedure for
Radiated Spurious Emissions above 1 GHz

The EUT was 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



Detector Settings	RBW (MHz)	VBW (MHz)	Span
Peak	1	3	As Necessary
Average	1	3	As Necessary

See Annex B for test results

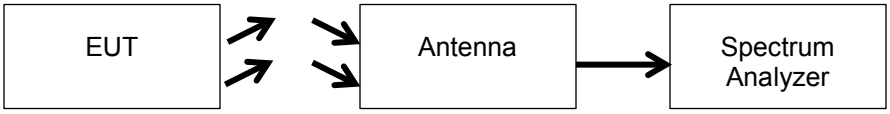
DTS Bandwidth

Engineer: Poona Saber
Test Date: 12/25/18

Test Procedure

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. Procedures on ANSI C63.10 subclause 11.8 were followed. 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 for 2.4 GHz

Frequency (MHz)	Measured Bandwidth (KHz)	Specification Limit (kHz)	Result
2402	899.72	≥ 500	Pass
2440	900.15	≥ 500	Pass
2480	842.03	≥ 500	Pass

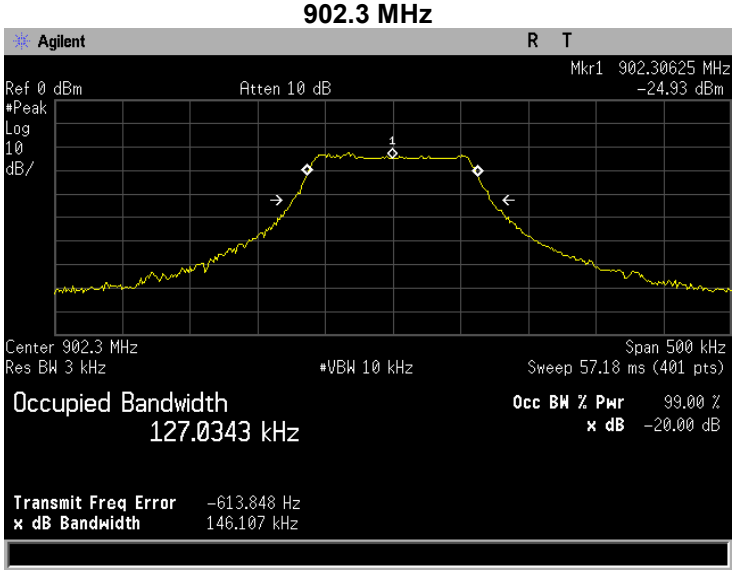
20 dB Occupied Bandwidth for 900 MHz Lora

Frequency (MHz)	Measured Bandwidth (KHz)	Specification Limit (kHz)	Result
902.3	146.107	≤ 500	Pass
915	143.66	≤ 500	Pass
927.7	145.18	≤ 500	Pass

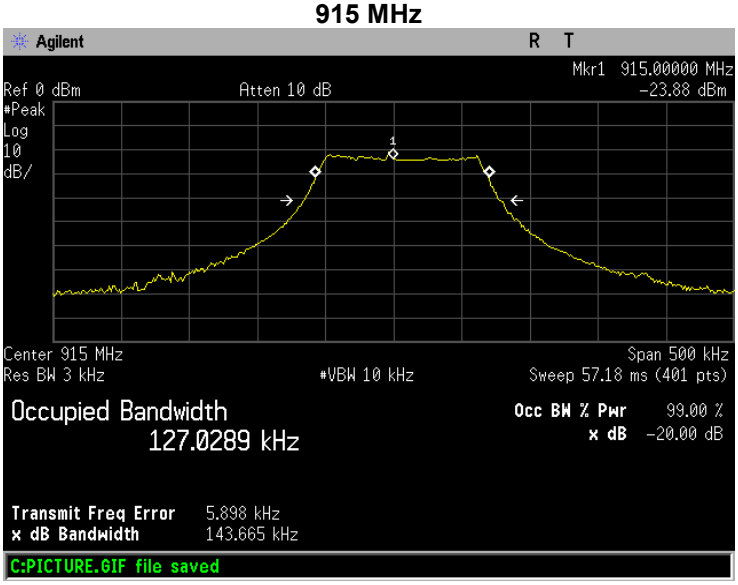
99% Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (KHz)	Result
902.3	127.03	Pass
915	127.02	Pass
927.7	127.17	Pass
2402	1814.1	Pass
2440	1786.5	Pass
2480	1842.4	Pass

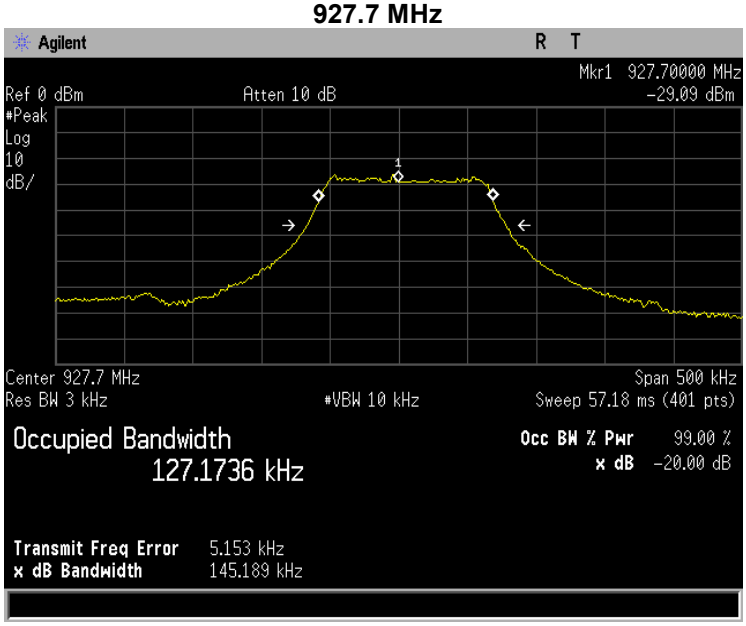
902.3 MHz



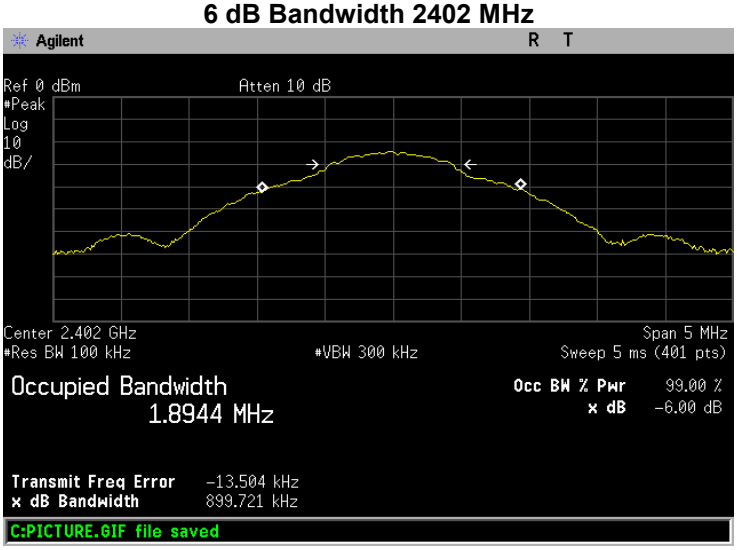
915 MHz



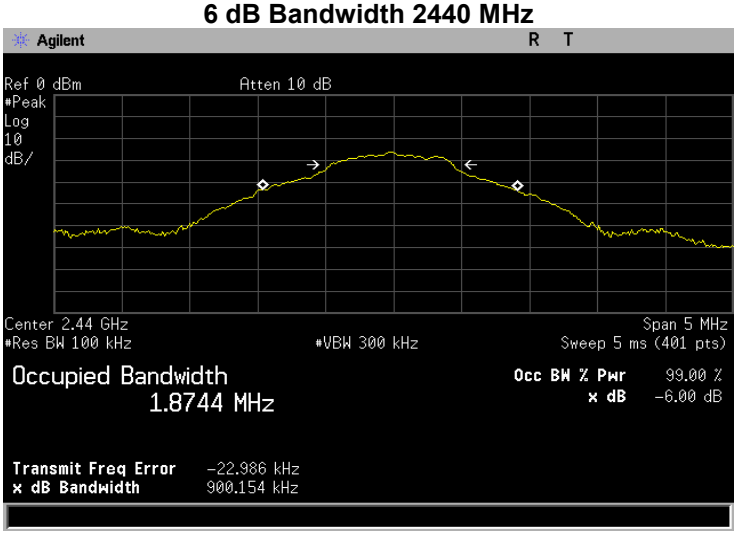
927.7 MHz



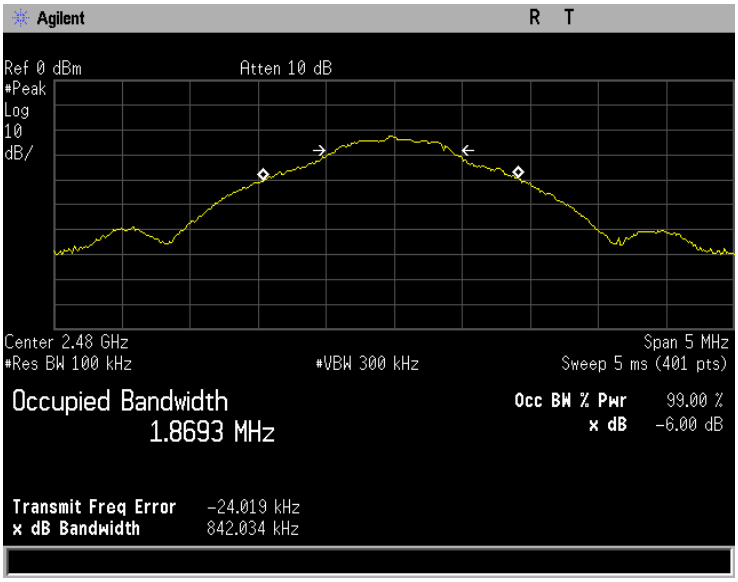
6 dB Bandwidth 2402 MHz



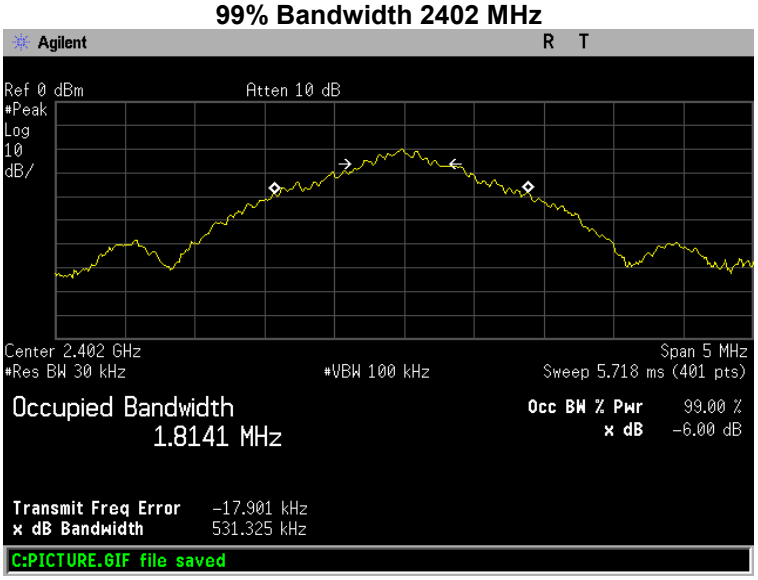
6 dB Bandwidth 2440 MHz



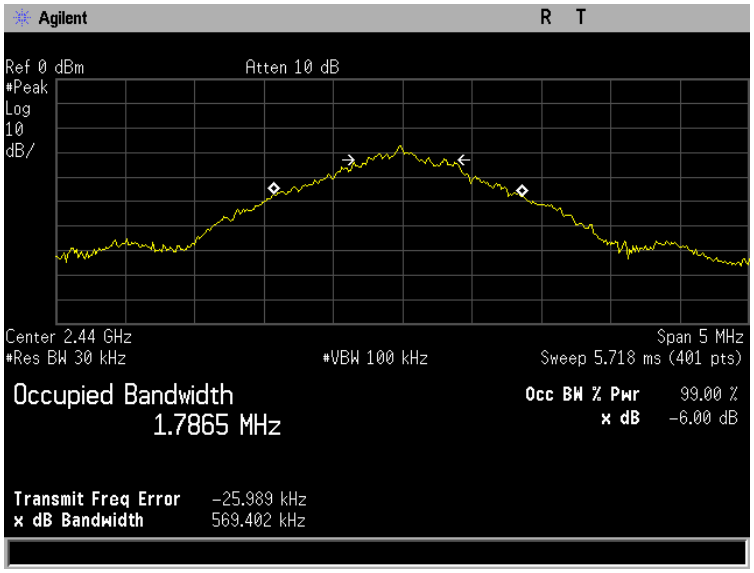
6 dB Bandwidth 2480 MHz



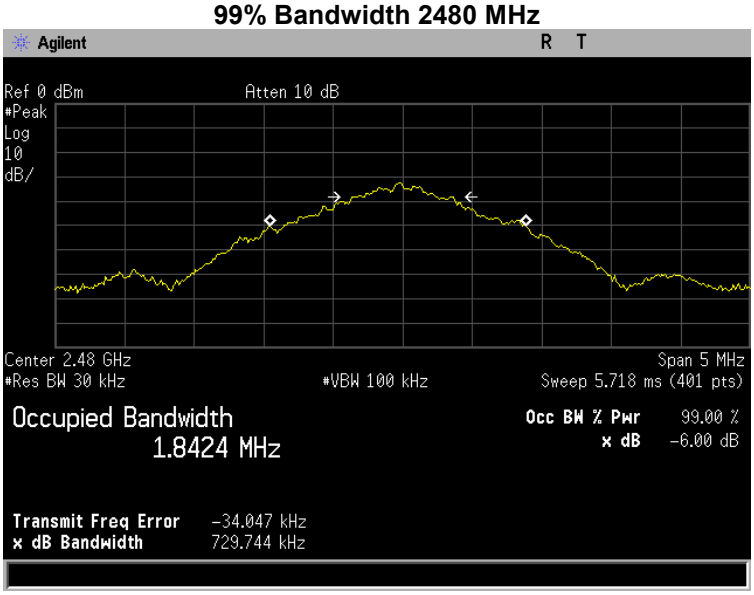
99% Bandwidth 2402 MHz



99% Bandwidth 2440 MHz



99% Bandwidth 2480 MHz



Transmitter Power Spectral Density (PSD)

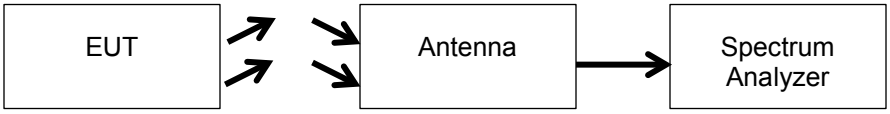
Engineer: Poona Saber

Test Date: 1/25/19

Test Procedure

The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The test was performed per section 11.10 of C63.10:2013 "Procedure for determining PSD for DTS devices"

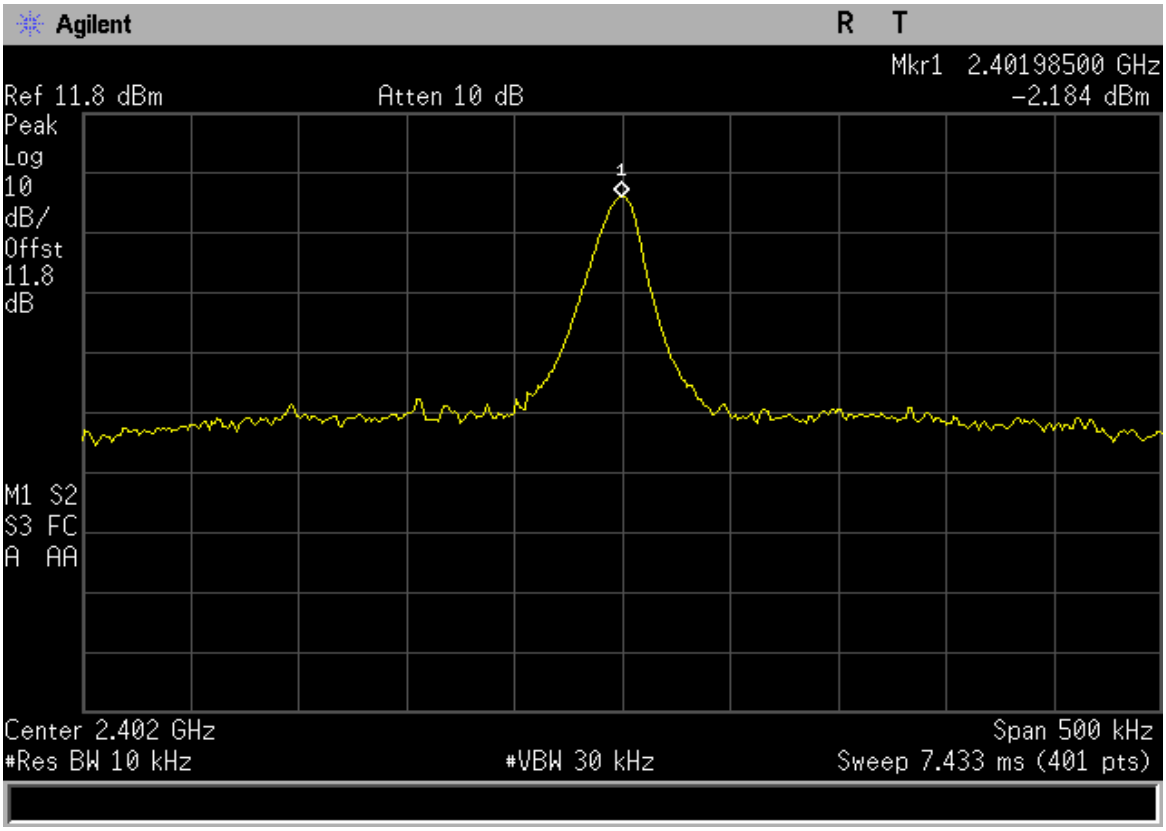
Test Setup



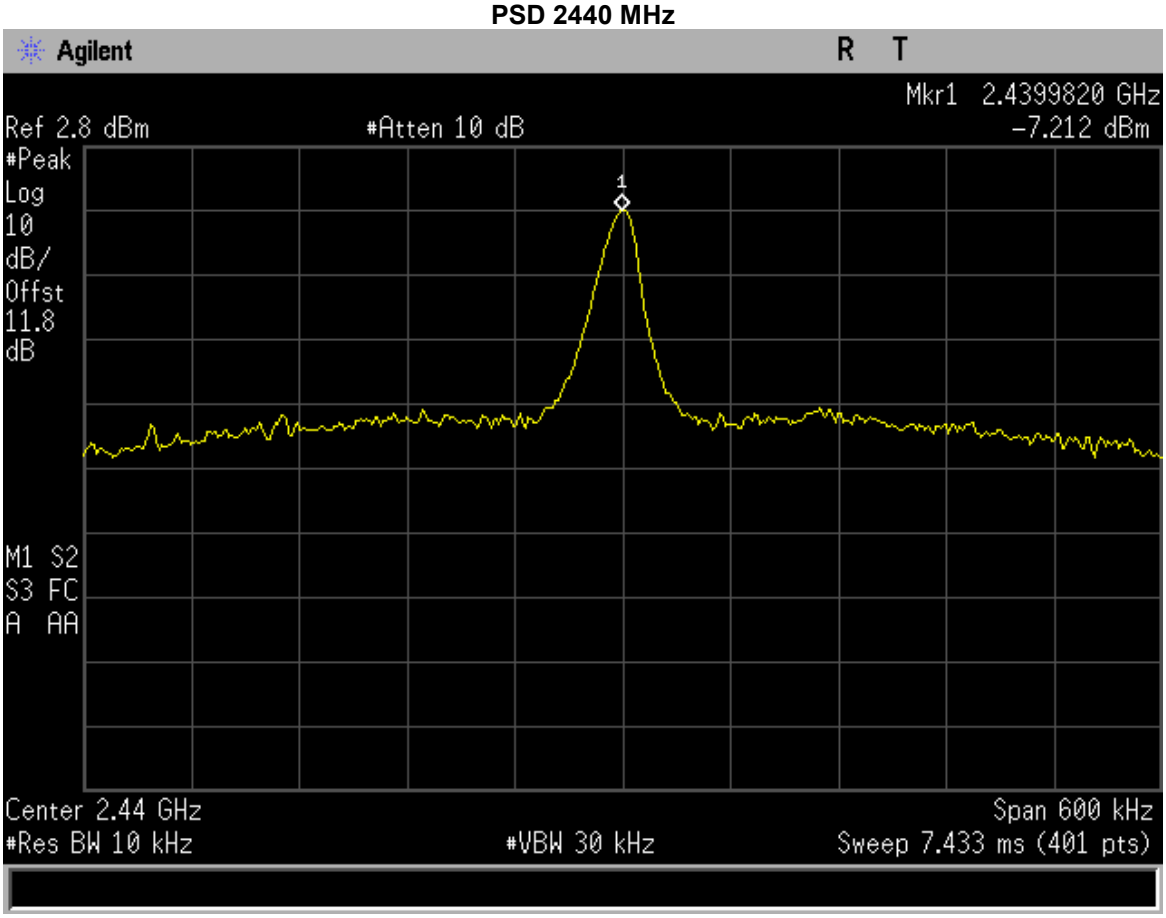
PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-2.184	8	Pass
2440	-7.212	8	Pass
2480	-2.276	8	Pass

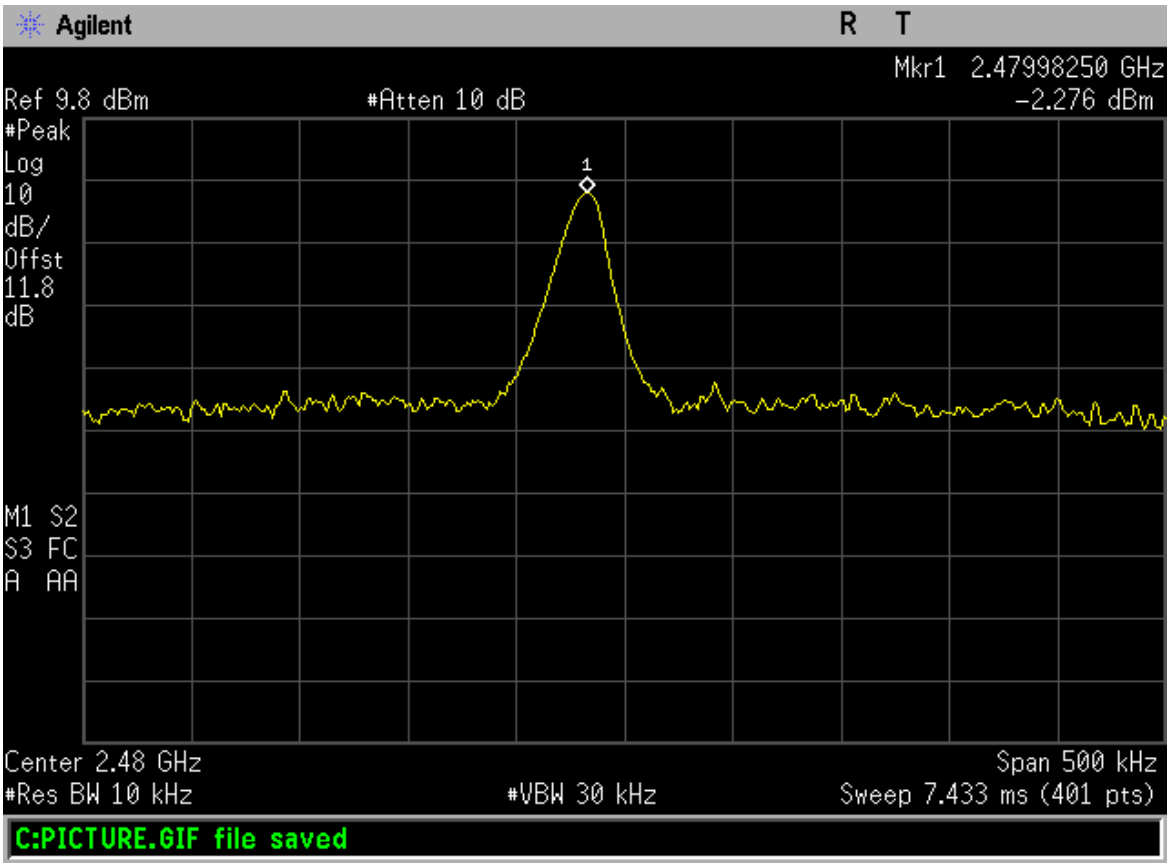
PSD 2402 MHz



PSD 2440 MHz



PSD 2480 MHz



A/C Powerline Conducted Emission

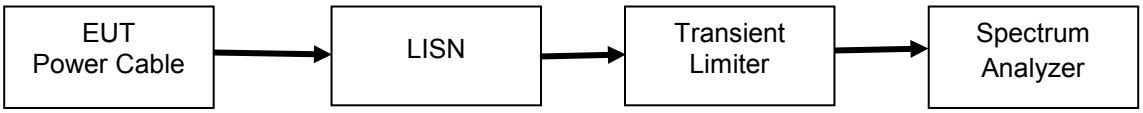
Engineer: Poona Saber

Test Date: 1/21/19

Test Procedure

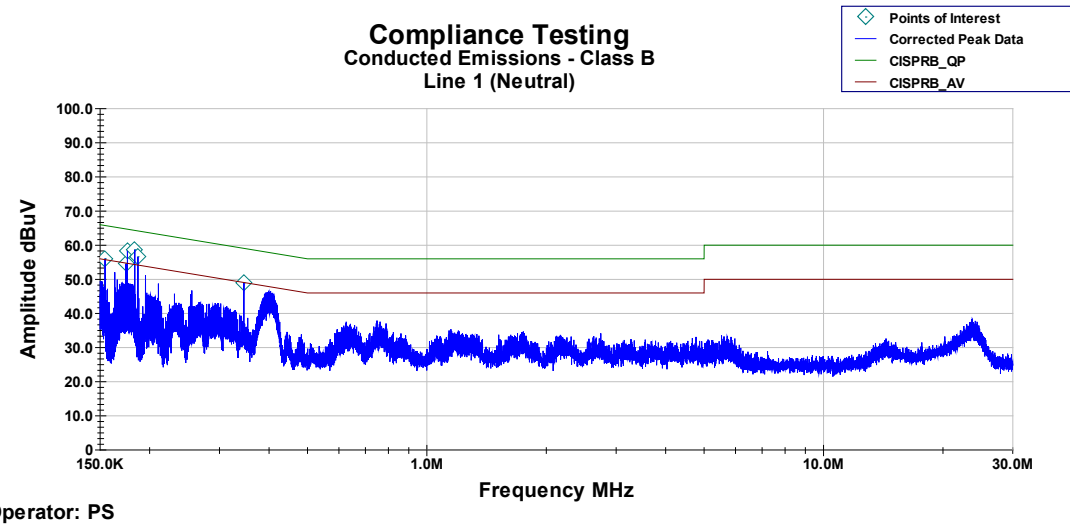
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup



Conducted Emission Test Results

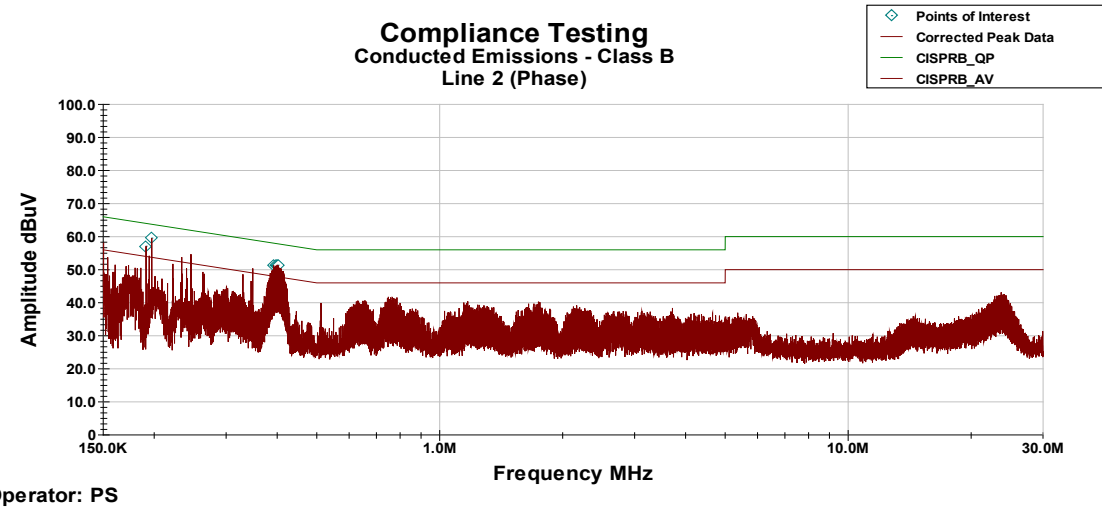
Line 1 Peak Plot



Operator: PS

EN55032 Class B_85462 EMI Rec_V7_ACTIVE_ Round 2.til **Job #:**

Line 2 Peak Plot



Operator: PS

EN55032 Class B_85462 EMI Rec_V7_ACTIVE_ Round 2.til **Job #:**

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)
150.03 KHz	13.1	0.3	0.02	10.2	23.616	55.999	-32.383
162.85 KHz	-13.44	0.2	0.02	10.171	-3.049	55.633	-58.681
171.79 KHz	17.65	0.2	0.02	10.1	27.97	55.377	-27.407
176.37 KHz	17.72	0.2	0.02	10.1	28.037	55.247	-27.21
192.61 KHz	8.99	0.2	0.02	10.1	19.307	54.783	-35.476
337.88 KHz	10.16	0.13	0.027	10.1	20.421	50.632	-30.211

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)
185.21 KHz	14.97	0.2	0.02	10.1	25.29	54.994	-29.704
192.55 KHz	9.36	0.2	0.02	10.1	19.68	54.784	-35.104
396.48 KHz	22.69	0.1	0.03	10.1	32.922	48.958	-16.036
401.15 KHz	23.42	0.1	0.03	10.1	33.647	48.824	-15.178
401.87 KHz	23.46	0.1	0.03	10.1	33.693	48.804	-15.11
398.04 KHz	23.07	0.1	0.03	10.1	33.298	48.913	-15.616

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)
150.03 KHz	30.52	0.3	0.02	10.2	41.04	65.999	-24.959
162.85 KHz	29.05	0.2	0.02	10.171	39.441	65.633	-26.191
171.79 KHz	35.88	0.2	0.02	10.1	46.2	65.377	-19.177
176.37 KHz	35.35	0.2	0.02	10.1	45.67	65.247	-19.577
192.61 KHz	27.4	0.2	0.02	10.1	37.72	64.783	-27.063
337.88 KHz	24.14	0.131	0.027	10.1	34.398	60.632	-26.234

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)
185.21 KHz	29.86	0.2	0.02	10.1	40.18	64.994	-24.814
192.55 KHz	27.81	0.2	0.02	10.1	38.13	64.784	-26.654
396.48 KHz	37.57	0.1	0.03	10.1	47.802	58.958	-11.156
401.15 KHz	37.6	0.1	0.03	10.1	47.83	58.824	-10.994
401.87 KHz	37.74	0.1	0.03	10.1	47.97	58.804	-10.834
398.04 KHz	37.68	0.1	0.03	10.1	47.911	58.913	-11.002

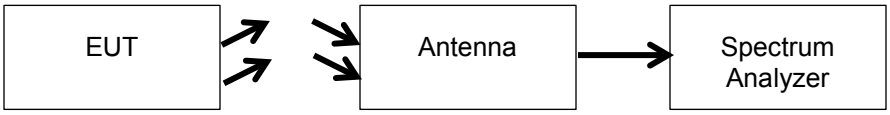
Carrier Frequency Separation

Engineer: Poona Saber
Test Date: 12/25/2018

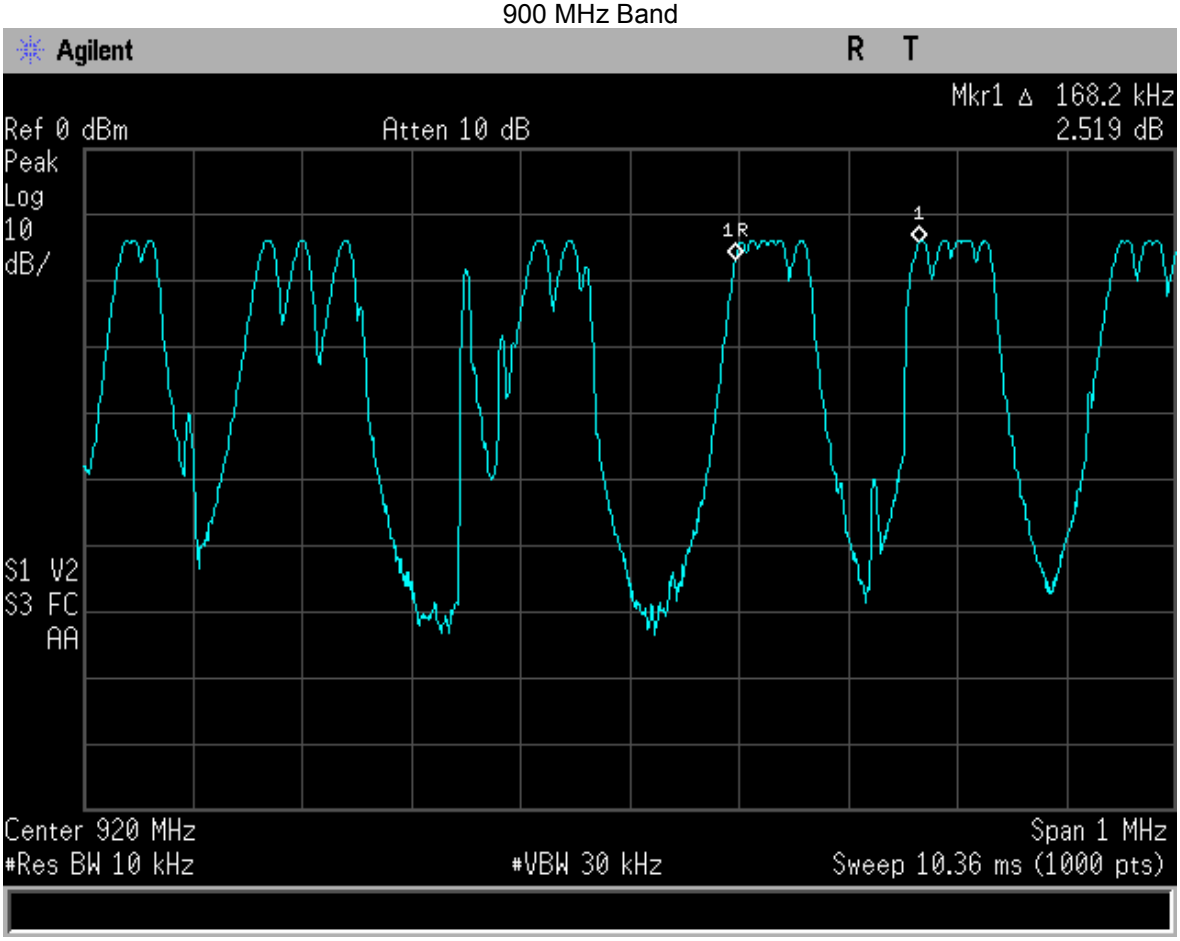
Test Procedure

Per 15.247 (a) requirements the frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Setup



Test Results
900 MHz Band



Dwell Time

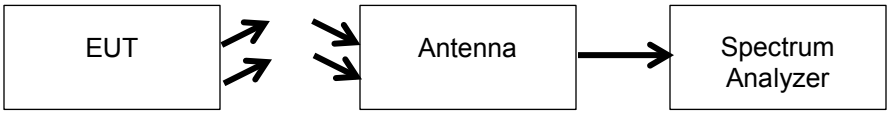
Engineer: Poona Saber
Test Date: 12/25/18

Test Procedure

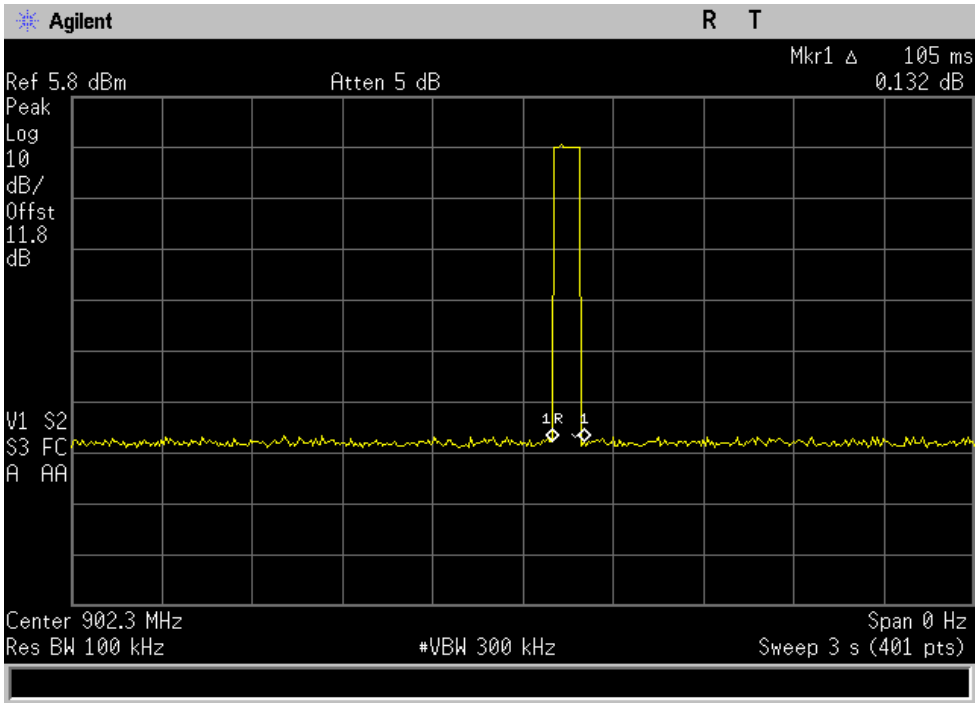
The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna.
The EUT was set to hopping mode with the spectrum analyzer set to a 0 Hz span. A single transmission was captured and the dwell time was recorded.
For frequency hopping systems operating in the 902-928 MHz band:
if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period. if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period

For frequency hopping systems operating in the 2400-2483.5 MHz band:
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

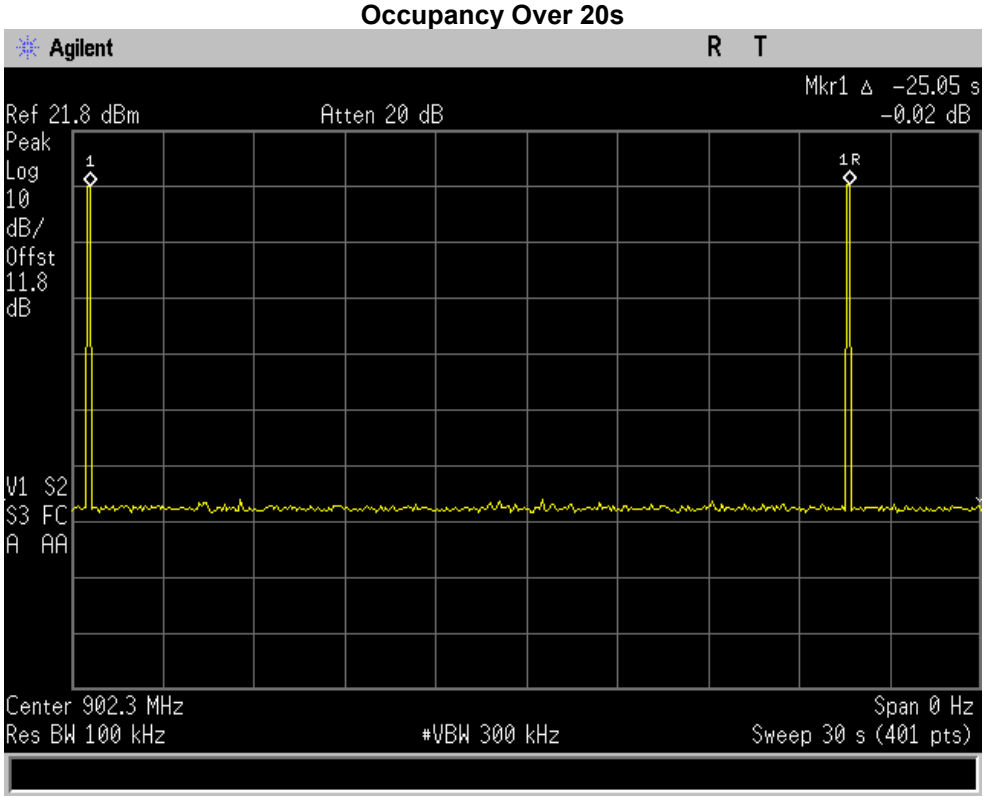
Test Setup



Dwell Time 1
900 MHz



Occupancy Over 20s



The average time of occupancy is not greater than 0.4 seconds within a 20 second period

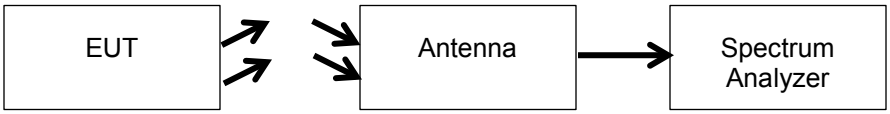
Number of Hopping Channels

Engineer: Poona Saber
Test Date: 12/25/18

Test Procedure

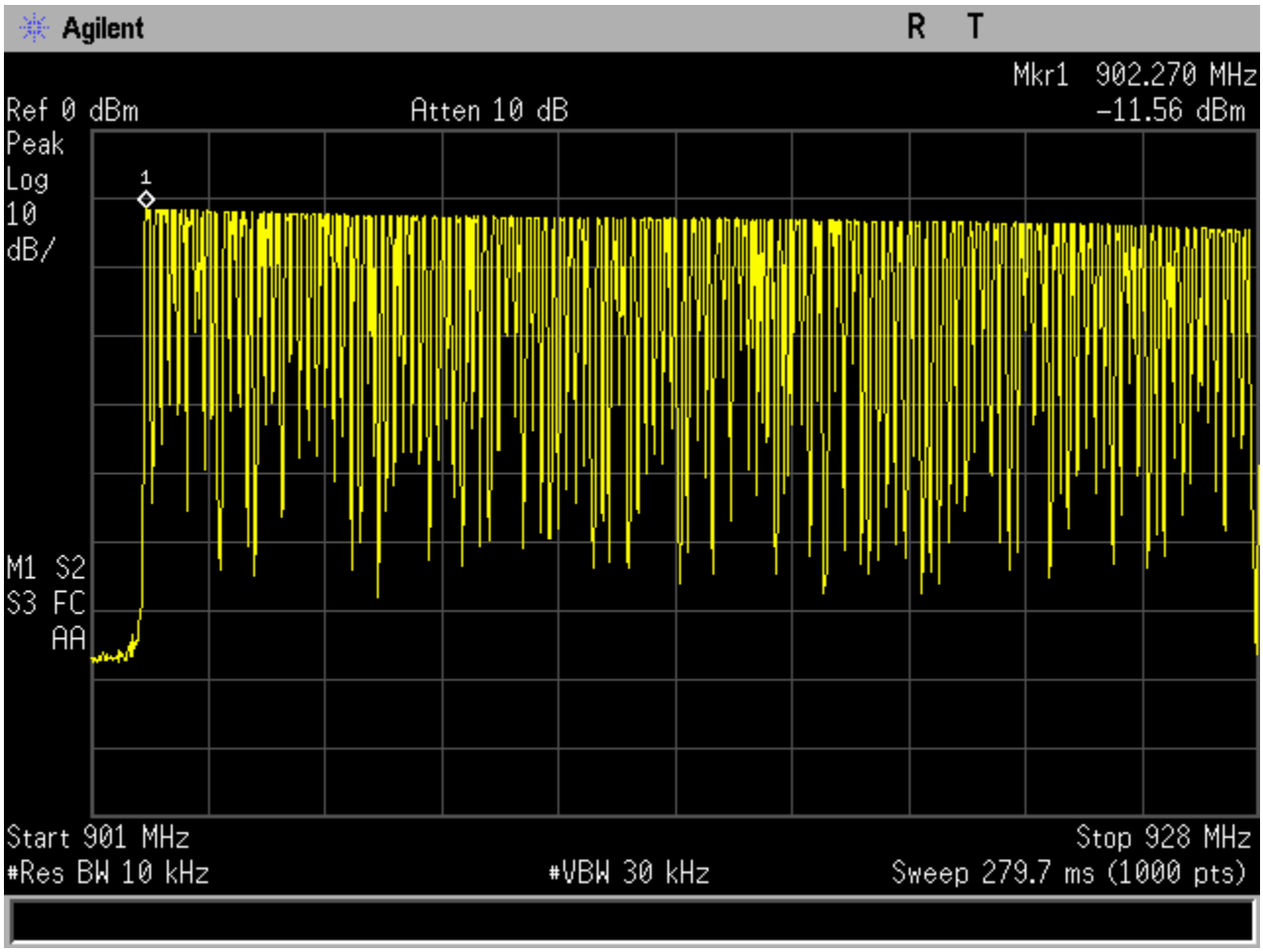
The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The Span was set to the specified band end points. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies. The EUT was then set to operate in hopping mode. The MAX HOLD function of the spectrum analyzer was utilized to verify the number of hopping cannels.

Test Setup



Number of Hopping Channels

There are 127 Hopping channels available



Measurement Uncertainty

RF 15.247			
Test Item	**Frequency Range**	**Description**	**Uncertainty**
Conducted Emissions (AC Line)	150KHz – 30MHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2	±3.5dB
Radiated Spurious Emissions	30MHz – 1GHz		+5.6dB/-4.5dB
Radiated Spurious Emissions	1GHz – 18Ghz		+4.3dB/-4.1dB
Radiated Spurious Emissions	18GHz – 40Ghz		+5.3dB/-5.6dB
RF Power, Conducted	800-6000MHz		±1.2dB
Power Spectral Density	800-6000MHz		±2.3dB
DTS Bandwidth	800-6000MHz		±3%
Emissions at Band Edge	800-6000MHz		±5%

Test Equipment Utilized

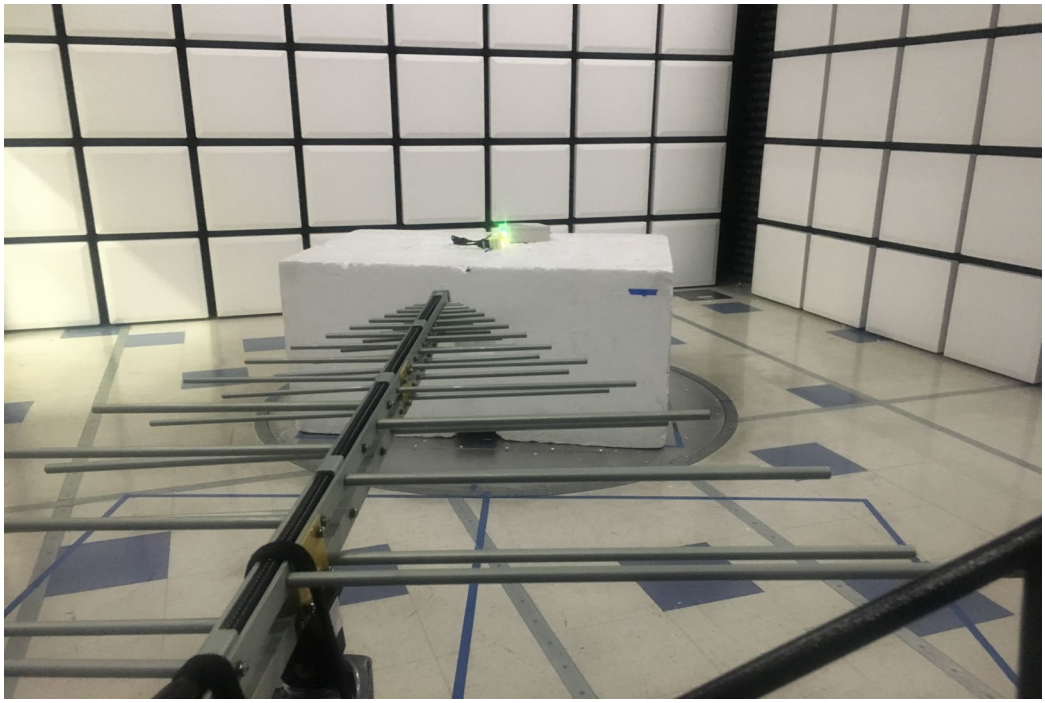
Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/18	6/16/20
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	5/22/18	5/22/21
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/29/18	6/29/19
Spectrum Analyzer	Agilent	E4407B	i00331	12/4/19	12/4/20
Bi-Log antenna	Chase	CBL6111C	i00267	3/8/18	3/8/20
EMI Analyzer	Agilent	E7405A	i00379	2/13/18	2/13/19
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
Preamplifier	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A
EMI Receiver	HP	8546A	i00033	3/26/18	3/26/19
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 1/21/19	
AC Power Source	Behlman	BL 6000	i00362	Verified on: 1/21/19	
LISN	COM-Power	LI-125A	i00447	9/11/17	9/11/19
LISN	COM-Power	LI-125A	i00449	9/11/17	9/11/19

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.

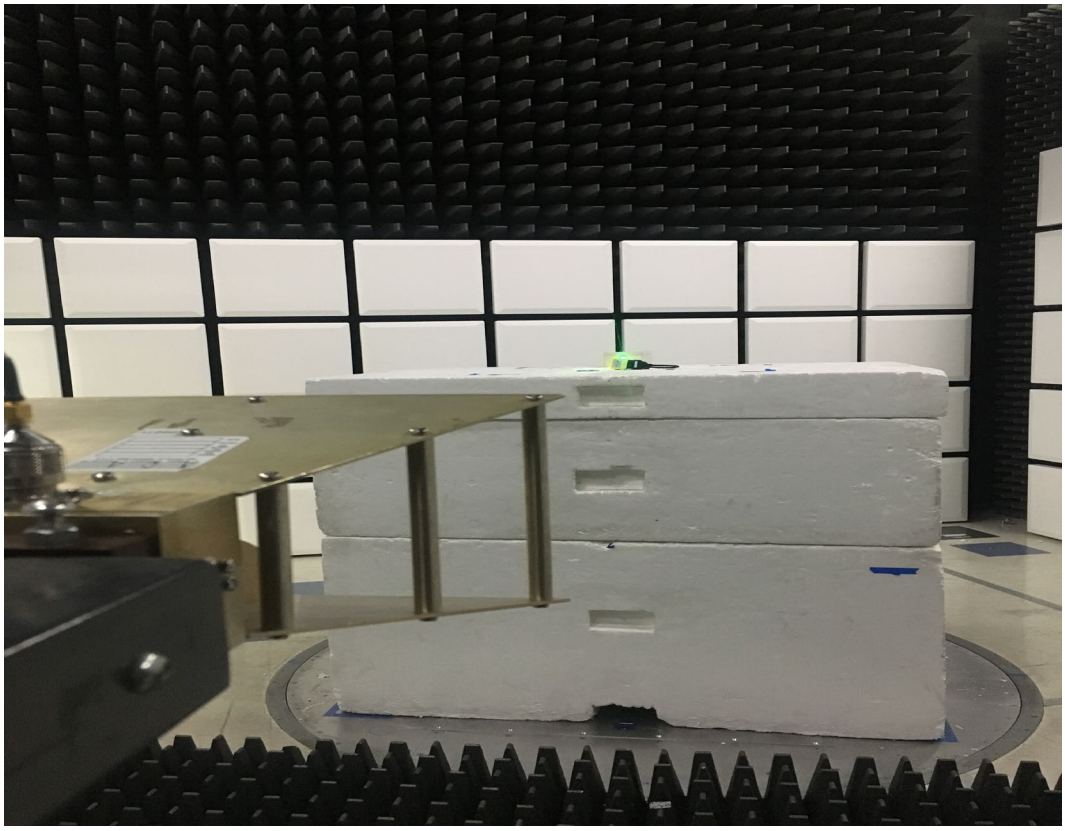
END OF TEST REPORT

Test Setup Photos
FCC ID: 2ARKMOBDLRA1
IC: 24436-OBDLRA1

RF Radiated Below 1 GHz



RF Radiated Above 1 GHz



Conducted Emissions