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: Noraxon USA

Model: NAS8001-G

Description: 800 Radio

Serial Number: N/A

FCC ID: IWC-800
IC: 9113A-800

To

FCC Part 15.247
And
RSS-247

Date of Issue: April 17, 2017

On the behalf of the applicant:	**Noraxon USA** **15770 N Greenway Hayden Loop** **# 100** **Scottsdale, AZ 85260**
Attention of:	**Dave Byman, Director of Technology** **Ph: (480)443-3413** **E-Mail: dave.byman@noraxon.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: p1720003

Alex Macon
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	March 14, 2017	Alex Macon	Original Document
2.0	April 11, 2017	Alex Macon	Added emission designator and frequency range to page 6. Added clarification on channel separation and number of hopping channels section on page 18

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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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#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)**
21 - 23	29 - 32	968 - 971

EUT Description
Model: NAS8001-G
Description: 800 Radio
Firmware: N/A
Software: N/A
Serial Number: N/A
Additional Information:
The EUT is intended to be incorporated into body wearable devices.
Emission designator : 1M11F7D

EUT Operation during Tests
The EUT was controlled using manufacturer supplied software.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Laptop	Lenovo	Yoga	N/A

Cables: None

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 Summary

FCC 15.247 Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	Pass	
15.247(a)	Dwell Time	Pass	
15.247(a)	Number of Hopping Channels	Pass	
15.207	A/C Powerline Conducted Emissions	N/A	The EUT is a battery operated module

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 v03r05	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

Conducted Output Power
Engineer: Alex Macon
Test Date: 2/23/17

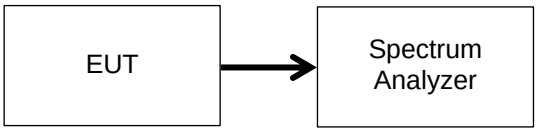
Test Procedure

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

RBW = 1-5% of the OBW, not to exceed 1MHz
VBW ≥ 3 x RBW
Peak Detector
Sweep = auto
Span = 1.5 x EBW

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 channel power function

Test Setup



Transmitter Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	15.93	1 W (30 dBm)	Pass
2441	14.98	1 W (30 dBm)	Pass
2480	13.59	1 W (30 dBm)	Pass

Conducted RF Measurements (15.209)
Engineer: Alex Macon
Test Date: 2/23/17

Test Procedure

Antenna-port conducted measurements were performed as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands for 15.209.

The following offsets were added to the measurements:
The maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level
A maximum ground reflection factor to the EIRP level, 6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000MHz.

The following equations were used to determine the field strength from the conducted values.
E[dBµV/m] = EIRP[dBm] - 20 log(d[meters]) + 104.77, where E = field strength and d = 3m
E[dBµV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

The Spectrum Analyzer was set to the following:

The Spectrum Analyzer was set to the following for emissions > 1000MHz:

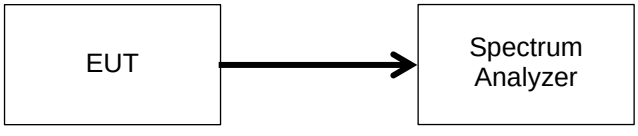
a. RBW = 1 MHz
b. VBW ≥ 3 MHz
c. Detector = Peak.
d. Sweep time = auto
e. Trace mode = max hold
    1. Note: For emissions where the peak exceeded that of the average 15.209 emission limit the following was performed.
f. RBW = 1 MHz
g. VBW ≤ RBW/100 (i.e., 10 kHz) but not less than 10 Hz

For emissions below 1000MHz the Spectrum Analyzer settings were as follows:

a. RBW = 100 kHz
b. VBW ≥ 300 kHz
c. Detector = Peak
d. Sweep time = auto
e. Trace mode = max hold

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The EUT was set to transmit on the lowest, middle and highest frequencies at the maximum power level. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was investigated.

Test Setup



See Annex A for test data

Radiated Spurious Emissions
Engineer: Alex Macon
Test Date: 2/23/17

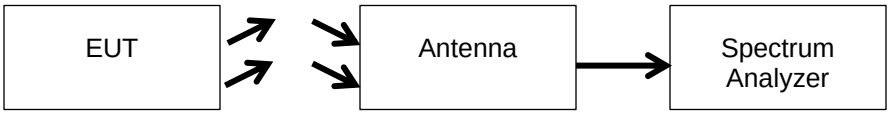
Test Procedure
Radiated Spurious Emissions: 30 – 1000 MHz

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

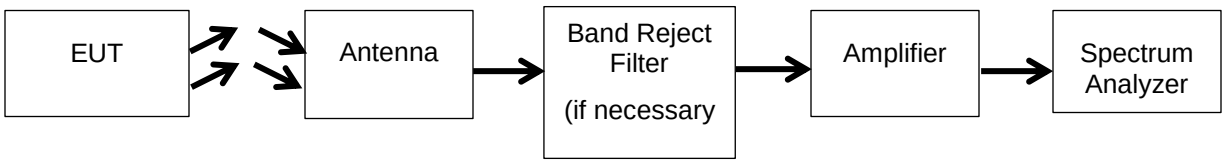
Test Setup



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. Emissions were investigated up to the 10th harmonic of the EUT but only noise floor was observed past 18 GHz.
RBW = 1 MHz
VBW = ≥ 3MHz
Detector – AVG

Test Setup



See Annex B for test data

Conducted Spurious Emissions
Engineer: Alex Macon
Test Date: 2/23/17

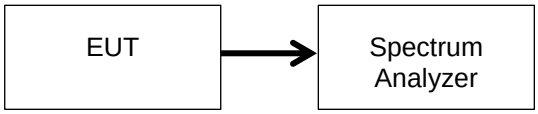
Test Procedure

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 emission were investigated to insure they were attenuated from the peak fundamental by at least 20dB. In addition emissions were investigated at the band edges to insure all out-of-band emissions were attenuated 20 as necessary.

Test Setup



See Annex A for test results

DTS Bandwidth
Engineer: Alex Macon
Test Date: 2/23/17

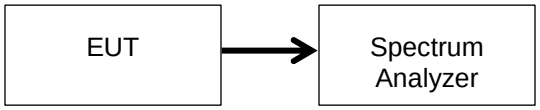
Test Procedure

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
Span = 1.5 x EBW

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 20db and this value was used to determine the width of the carrier. Alternatively the spectrum analyzer's automatic bandwidth capability was used.

Test Setup



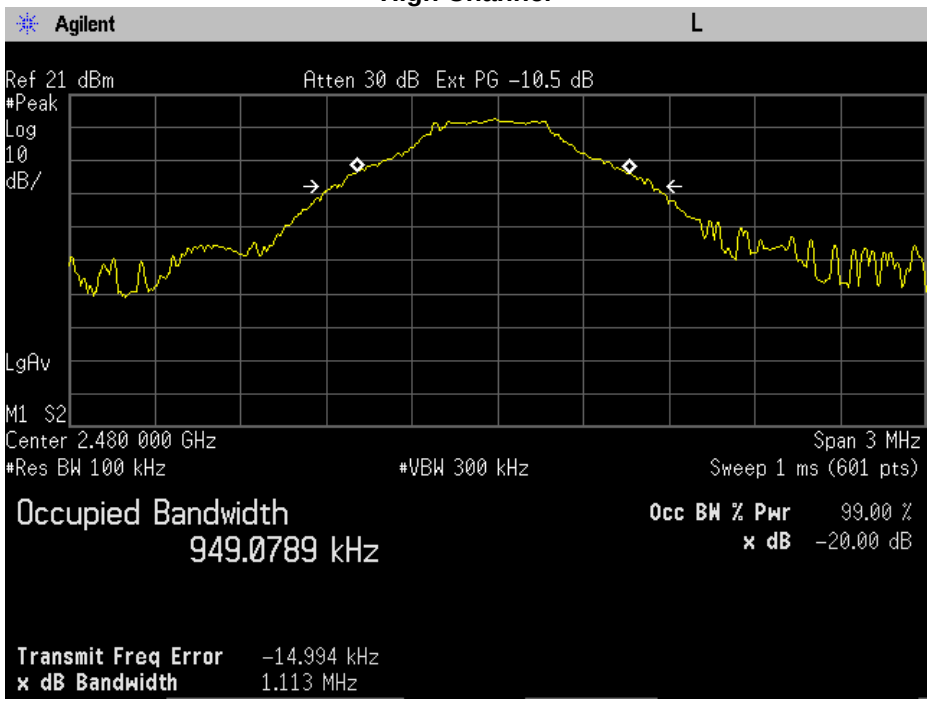
20 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (MHz)	Specification Limit (kHz)	Result
2402	1.109	≥ 500	Pass
2441	1.097	≥ 500	Pass
2480	1.113	≥ 500	Pass

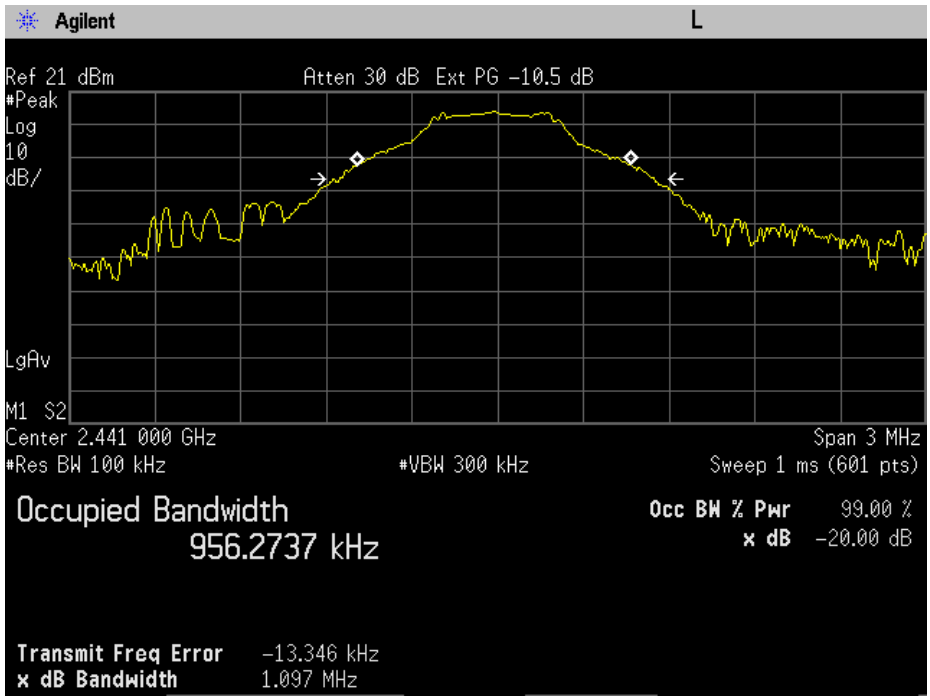
99% Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (MHz)	Result
2402	0.956	Pass
2441	0.956	Pass
2480	0.949	Pass

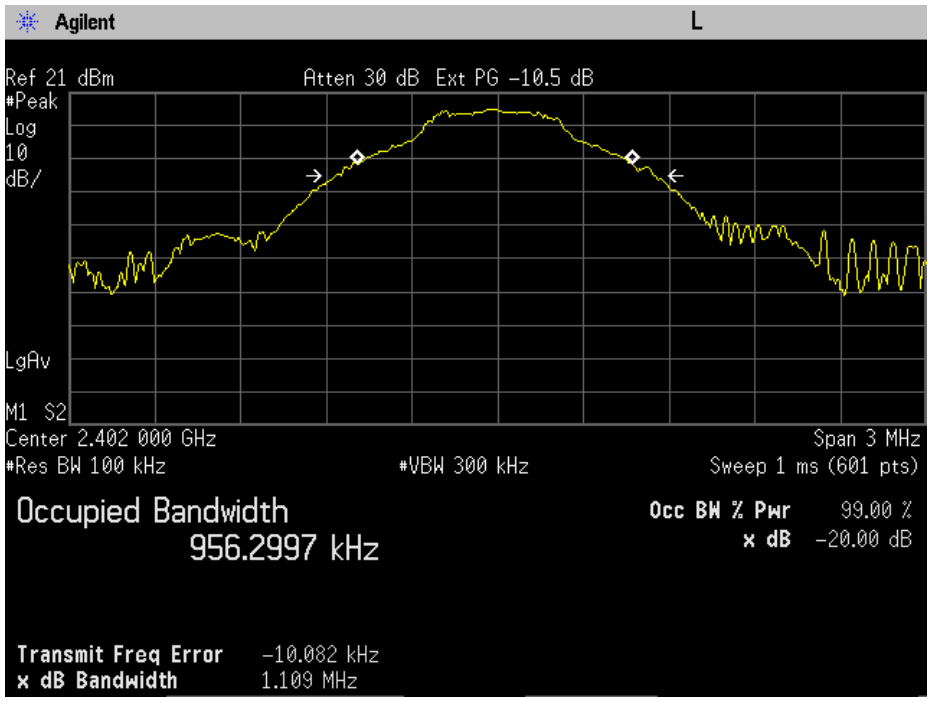
High Channel



Mid Channel



Low Channel


Agilent
L
Ref 21 dBm
Atten 30 dB Ext PG -10.5 dB
#Peak
Log
10
dB/
LgAv
M1 S2
Center 2.402 000 GHz
Span 3 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 1 ms (601 pts)
Occupied Bandwidth
956.2997 kHz
Occ BW % Pwr 99.00 %
x dB -20.00 dB
Transmit Freq Error -10.082 kHz
x dB Bandwidth 1.109 MHz

Dwell Time

Engineer: Alex Macon

Test Date: 2/23/17

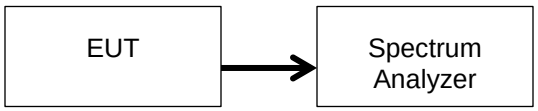
Test Procedure

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.

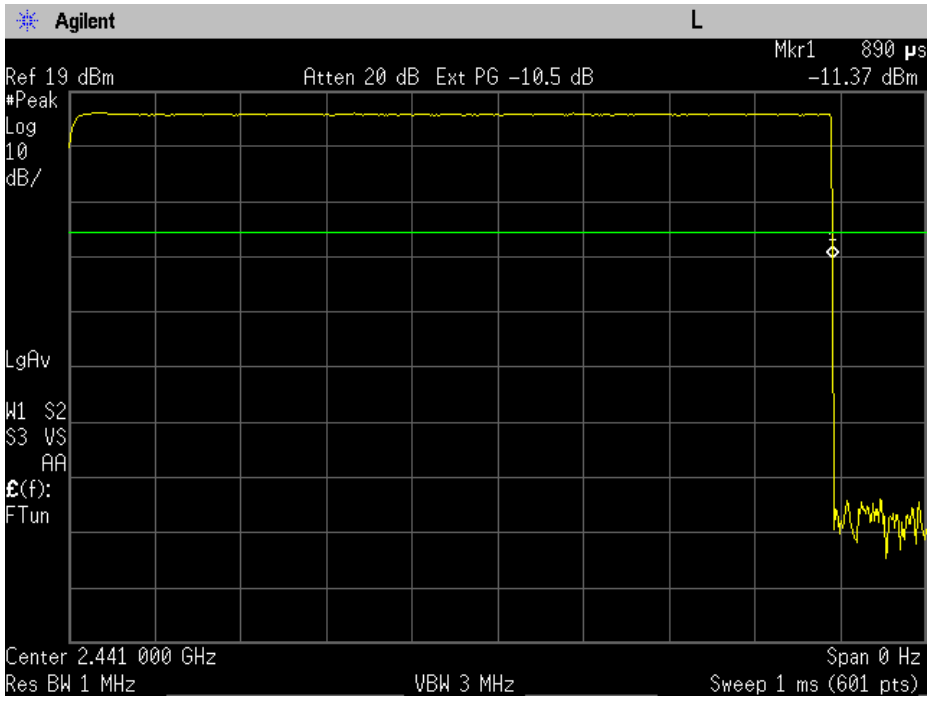
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

0.4 * 79 = 31.6 seconds

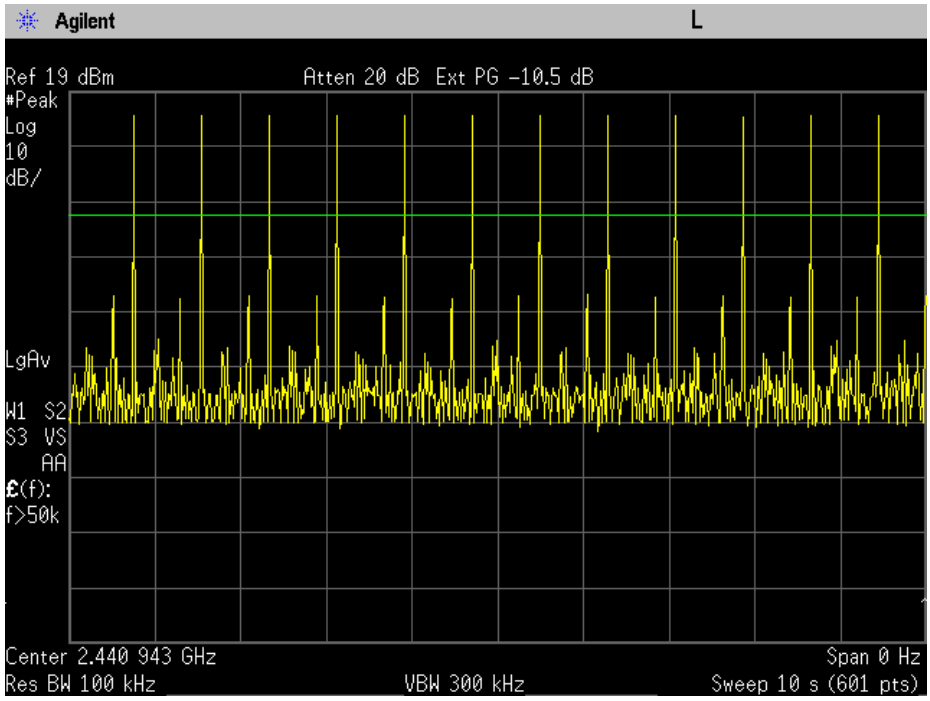
Test Setup



Dwell Time Burst



Burst in a 10 second span



890 us * 12 = 10.68ms in 10 seconds

10.68 * 3.16 =33.75ms in 31.6 seconds

Number of Hopping Channels

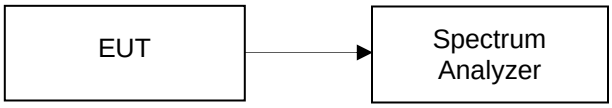
Engineer: Alex Macon

Test Date: 2/23/17

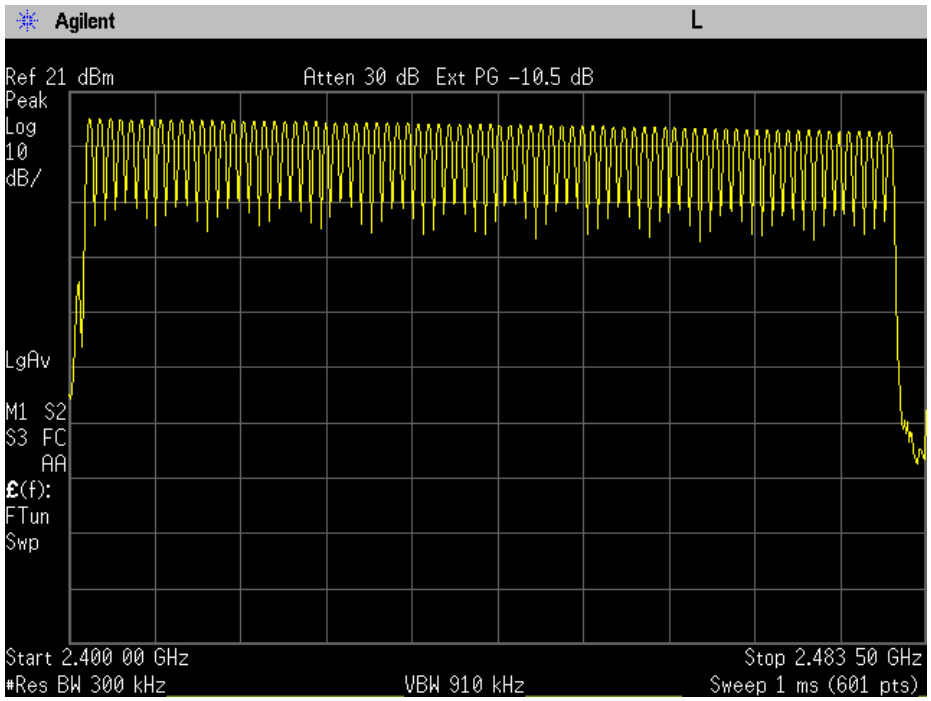
Test Procedure

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. A frequency between 2 channels was then chosen and the span decreased to fully view the adjacent hopping channels. Channel separation was then verified to be compliant.

Test Setup



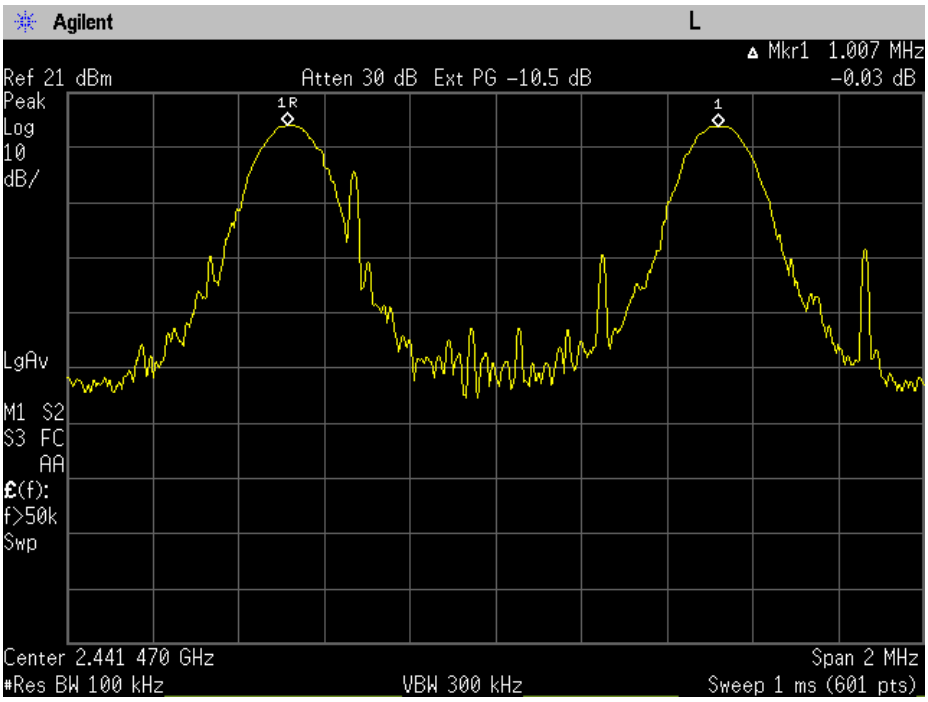
Number of Hopping Channels



79 channels

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Channel Separation



Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

(1.11 MHz)*(2/3)=0.74MHz

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/22/15	4/22/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
Spectrum Analyzer	Agilent	E4407B	i00331	10/19/16	10/19/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
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
PSA Spectrum Analyzer	Agilent	E4445A	i00471	8/30/16	8/30/17

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