



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: Time Keeping Systems Inc.

Model: TAG-002

Description: Wearable Positioning Device

Serial Number: N/A

FCC ID: MTDTAG002

IC: 12375A-TAG002

To

FCC Part 15.247 DTS

And

IC RSS-247

Date of Issue: November 9, 2016

On the behalf of the applicant:

Time Keeping Systems Inc.
30700 Bainbridge Rd
Cleveland, OH 44139

Attention of:

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Project No: p1650004

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 15, 2016	Kenneth Lee	Original Document
2.0	November 9, 2016	Amanda Reed	Added reference to RSS-247 & IC ID



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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**



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 (°C)	Humidity (%)	Pressure (mbar)
23.4	26.1	949.8

EUT Description

Model: TAG-002

Description: Wearable positioning device

Firmware: N/A

Software: N/A

Serial Number: N/A

Additional Information: None

EUT Operation during Tests

The EUT consisted of three PCBs that were set to the high, low and middle channels. All three boards were set to transmit at max power.

Accessories: None

Cables: None

Modifications: None

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



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	N/A	EUT is battery powered



Peak Output Power

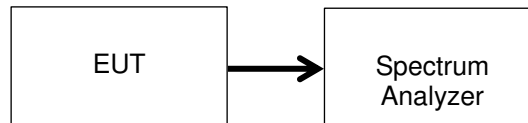
Engineer: Kenneth Lee

Test Date: 06/14/2016

Test Procedure

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

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	0.23	1 W (30 dBm)	Pass
2426	-0.48	1 W (30 dBm)	Pass
2480	-1.33	1 W (30 dBm)	Pass



Conducted Spurious Emission

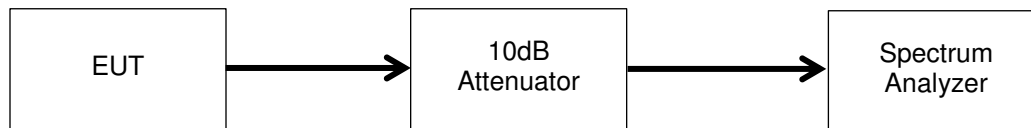
Engineer: Kenneth Lee

Test Date: 06/15/2016

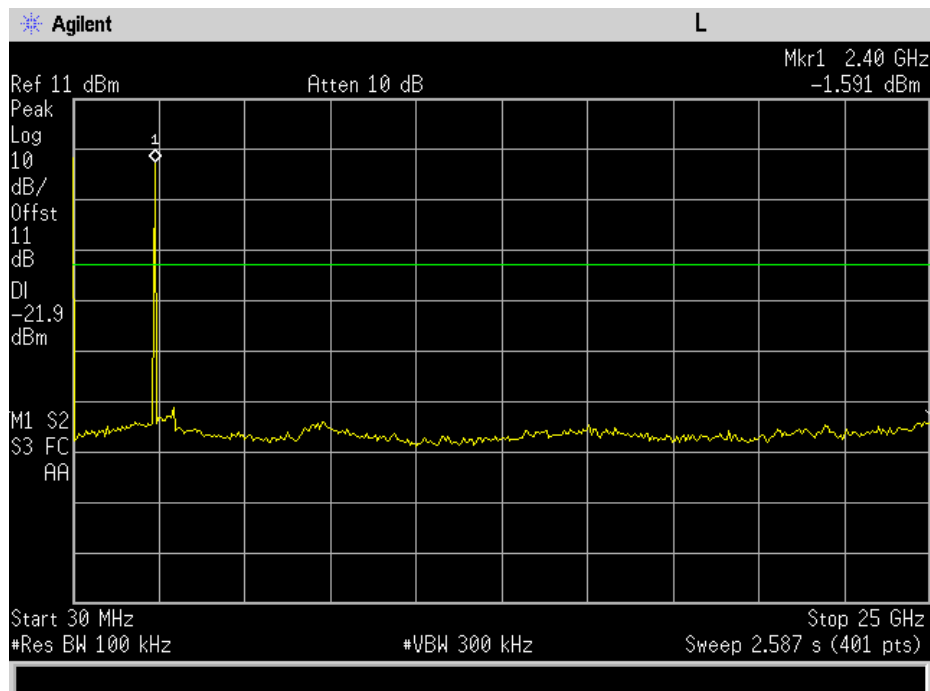
Test Procedure

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted. The peak output power is added to the recorded measurement to provide the corrected spurious level dBc.

Test Setup

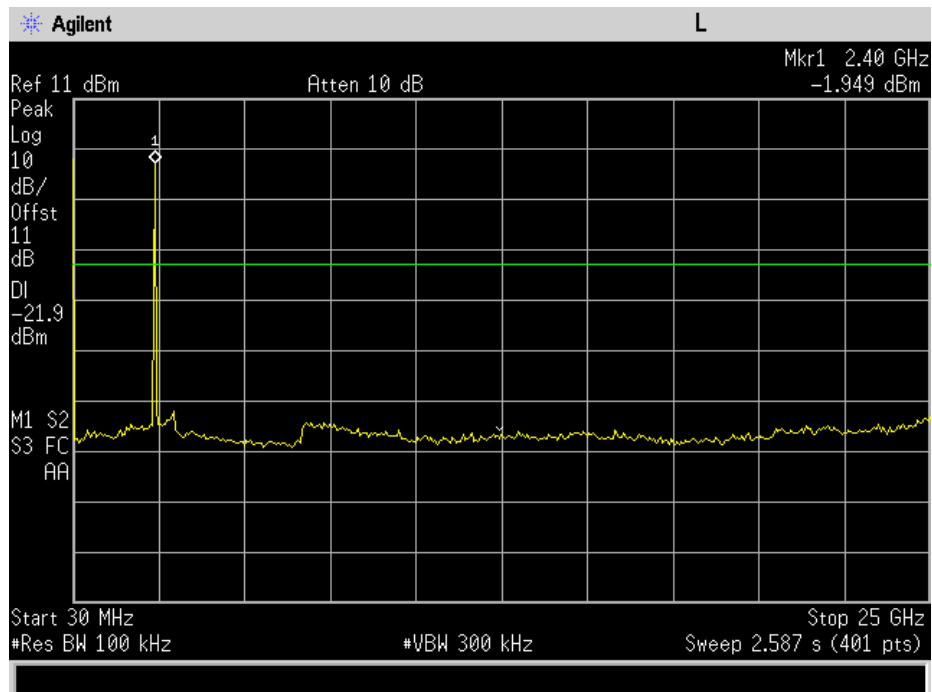


Conducted Spurious Emissions Tuned Freq=2402 MHz

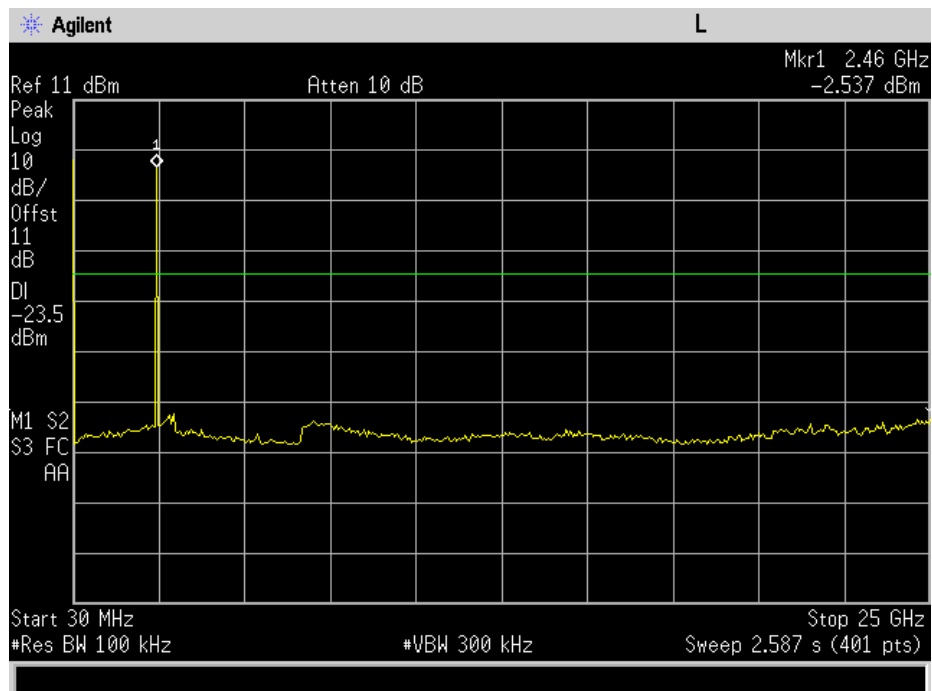




Conducted Spurious Emissions Tuned Freq=2426 MHz



Conducted Spurious Emissions Tuned Freq=2480 MHz





Radiated Spurious Emissions

Engineer: Kenneth Lee

Test Date: 06/14/2016

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 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.

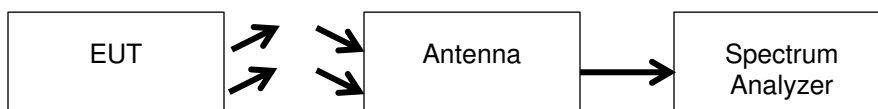
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

Test Setup



Test Procedure for Radiated Spurious Emissions above 1 GHz

The EUT was 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



See Annex A for test data



Emissions at Band Edges

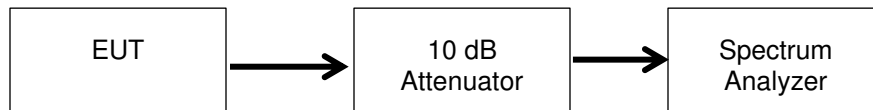
Engineer: Kenneth Lee

Test Date: 06/14/2016

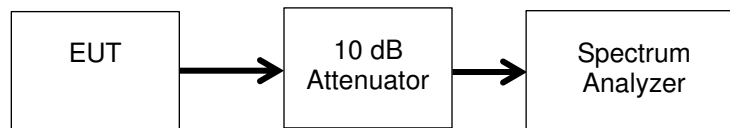
Test Procedure

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

Band Edge Test Setup

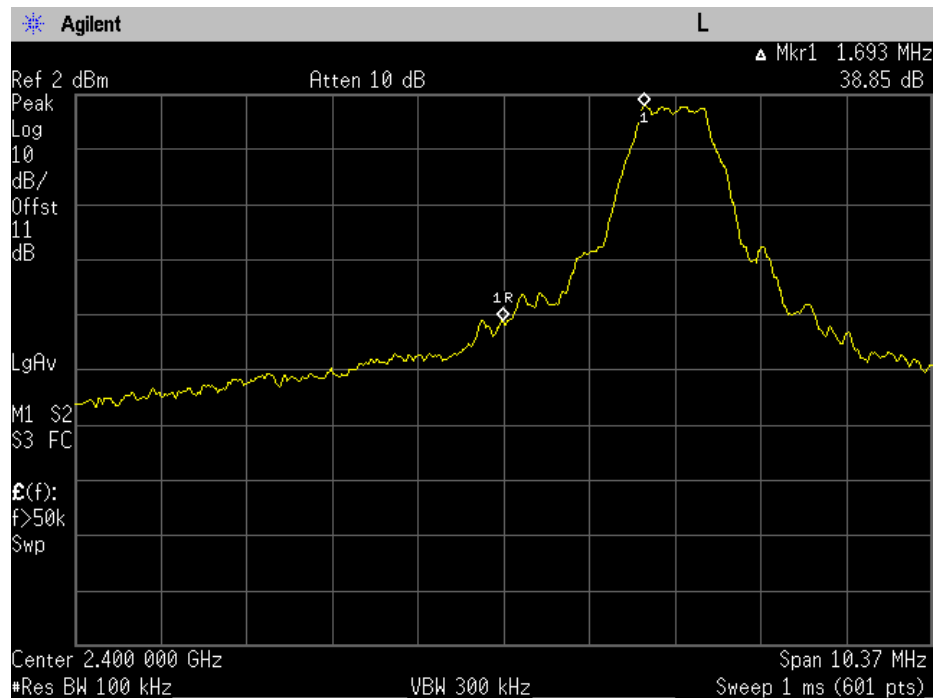


Restricted Band Test Setup

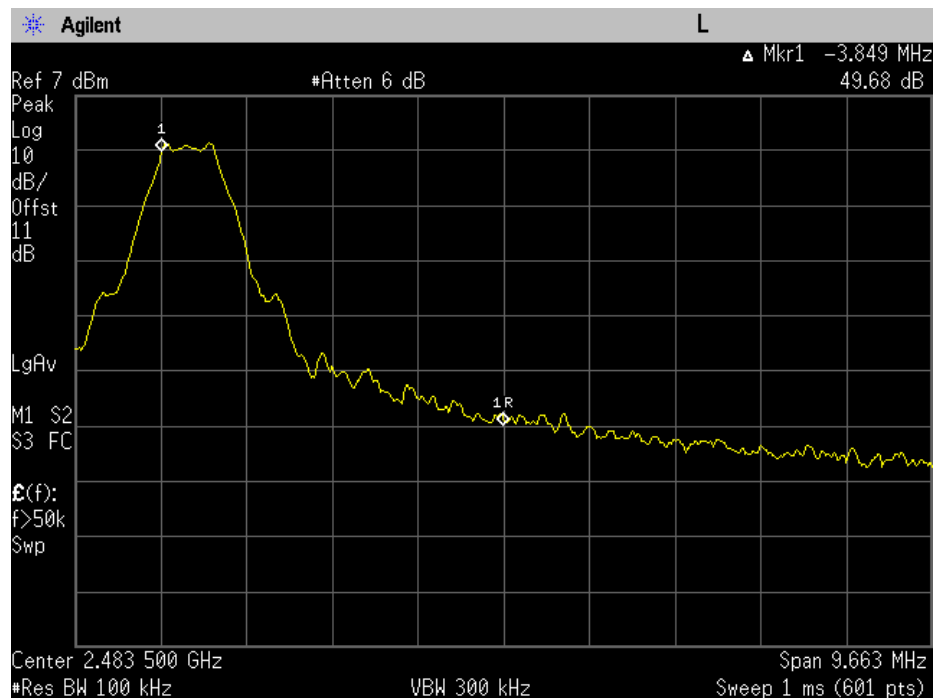




Band Edge 2400 MHz
Tuned Freq = 2402 MHz

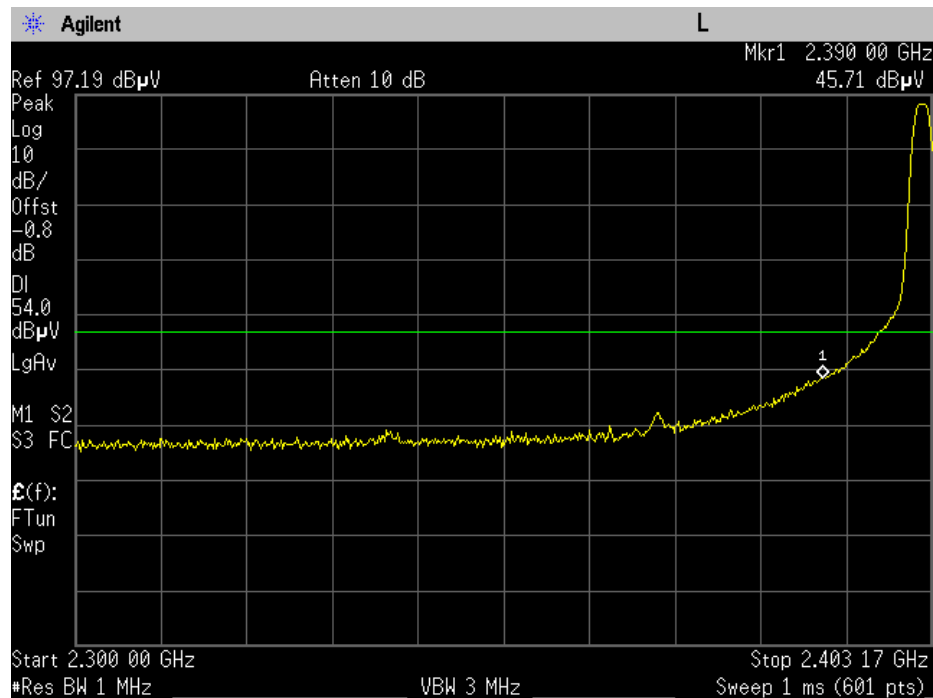


Band Edge 2483.5 MHz
Tuned Freq = 2480 MHz

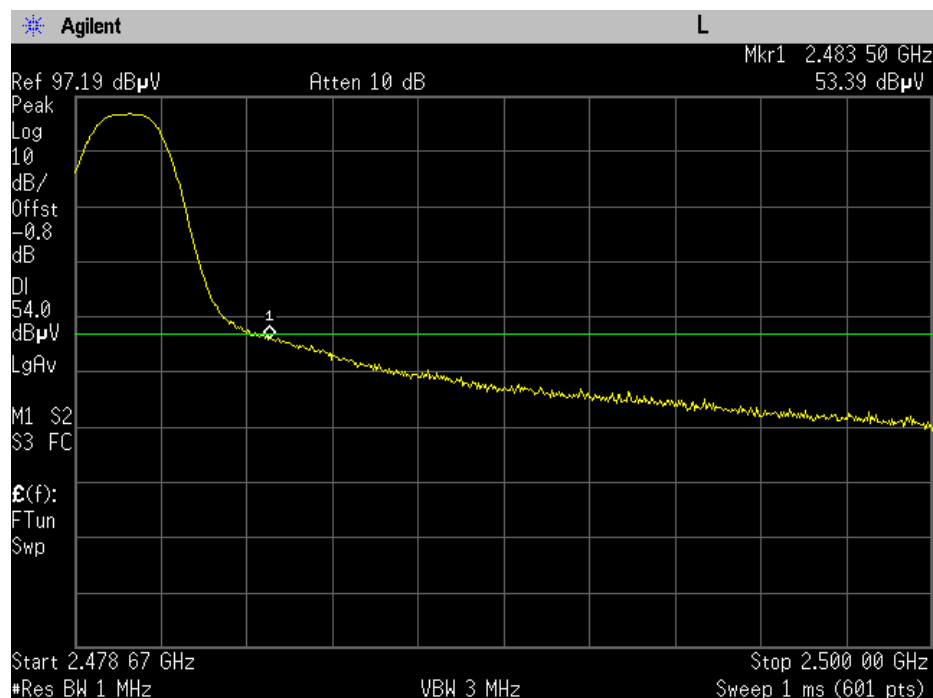




Restricted Band 2300 – 2390 MHz – Peak
Tuned Freq = 2402 MHz



Restricted Band 2483.5 – 2500 MHz – Peak
Tuned Freq = 2480 MHz





Occupied Bandwidth

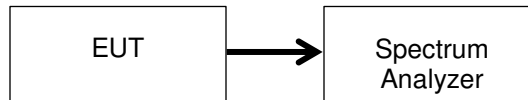
Engineer: Kenneth Lee

Test Date: 06/14/2016

Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmit 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 6dB and 99% bandwidths were measured to verify the bandwidth met the specification.

Test Setup



6 dB Occupied Bandwidth Summary

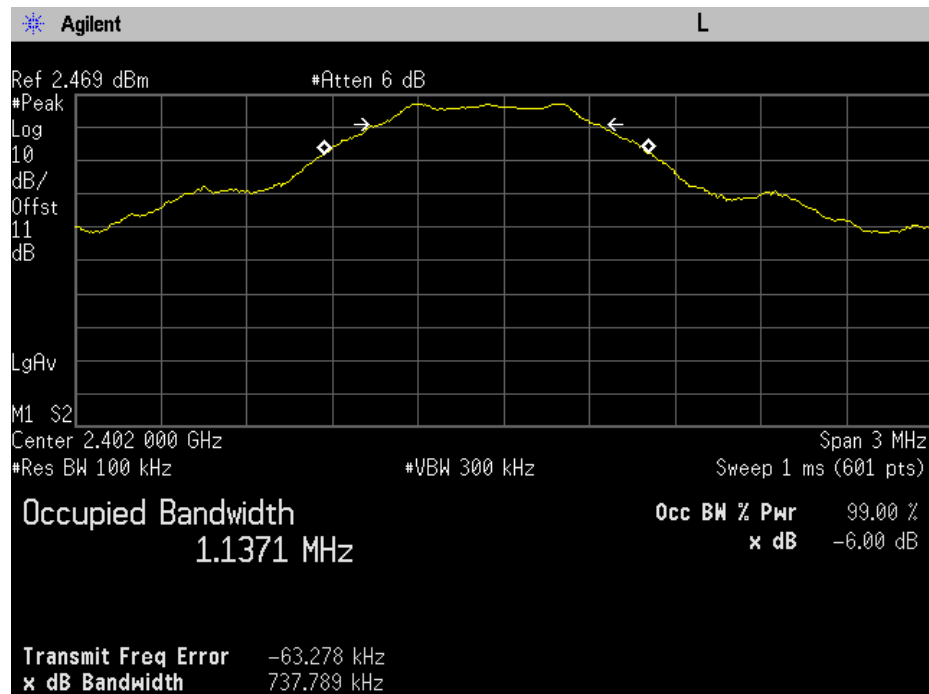
Frequency (MHz)	Measured Bandwidth (MHz)	Specification Limit (kHz)	Result
2402	737.789	≥ 500	Pass
2426	734.625	≥ 500	Pass
2480	741.615	≥ 500	Pass

99% Bandwidth Summary

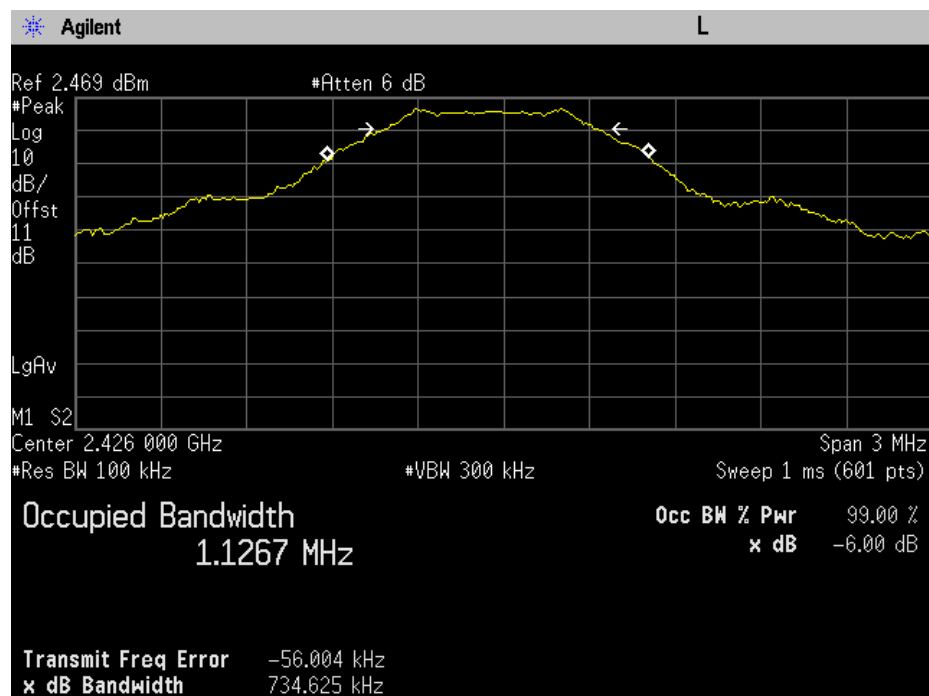
Frequency (MHz)	Measured Bandwidth (MHz)	Result
2402	1.1371	Pass
2426	1.1267	Pass
2480	1.1164	Pass



6dB and 99% Bandwidth 2402 MHz

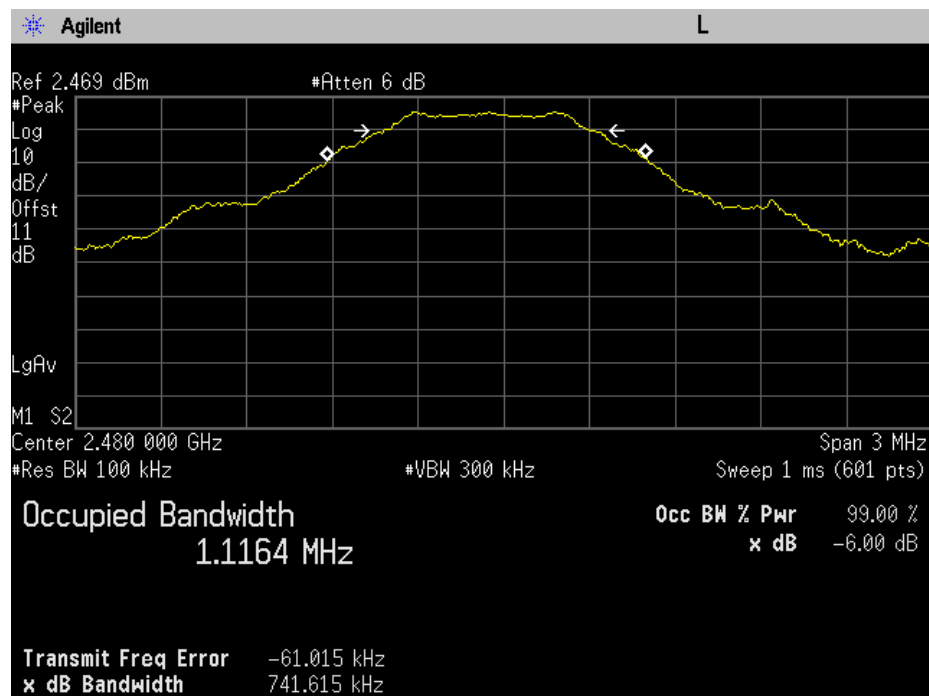


6dB and 99% Bandwidth 2426 MHz





6dB and 99% Bandwidth 2480 MHz





Transmitter Power Spectral Density (PSD)

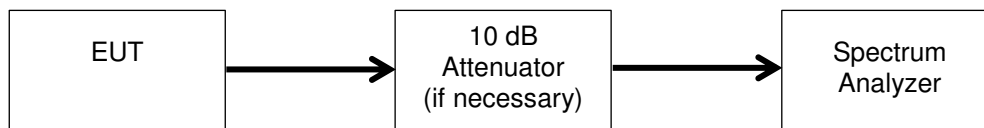
Engineer: Kenneth Lee

Test Date: 06/14/2016

Test Procedure

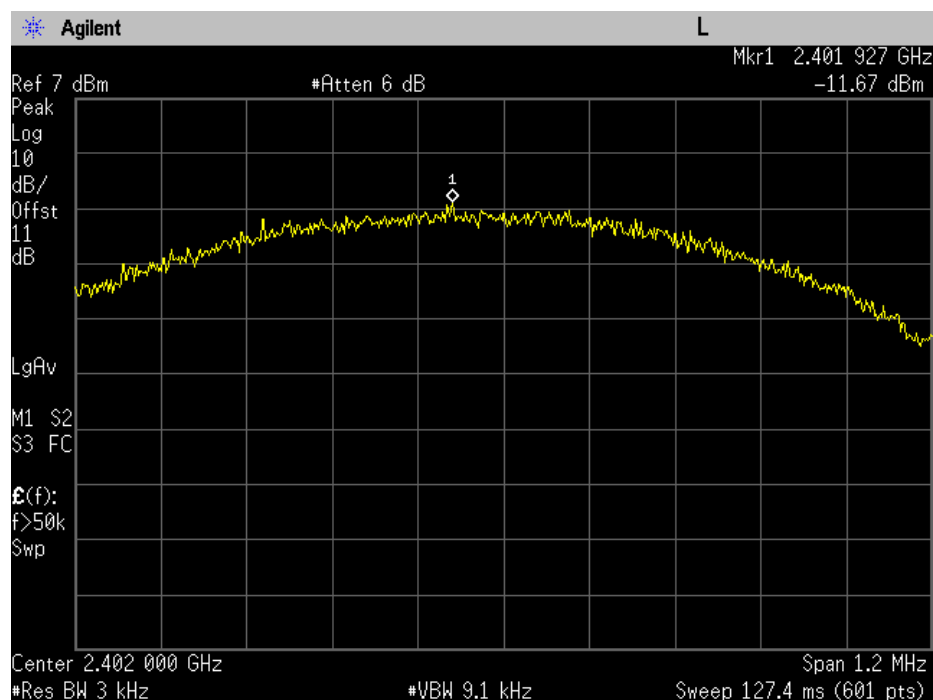
The EUT was connected directly to a spectrum analyzer. The test was performed per section 6.11.2.3 of C63.10 - 2013 "Procedure for determining PSD for DTS devices".

Test Setup



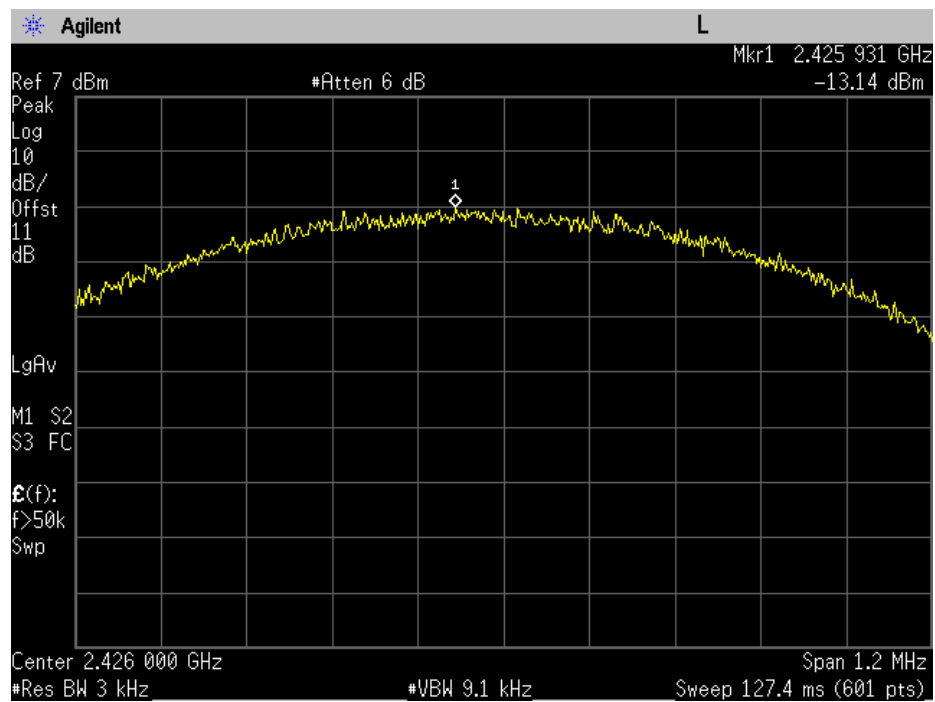
PSD Summary

PSD 2402 MHz

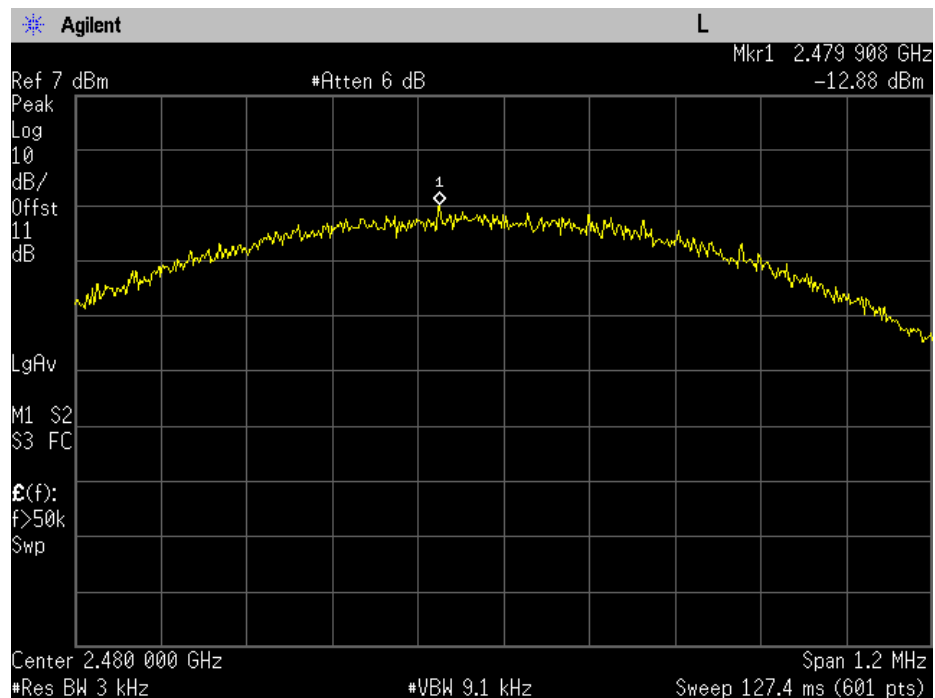




PSD 2426 MHz



PSD 2480 MHz





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
Horn Antenna	EMCO	3115	i00103	1/20/15	1/20/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/19/15	10/19/17
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
1-18 GHz Pre-Amplifier	Miteq	AFS44-00101-400-23-10P-44	i00509	Verified on: 06/14/2016	

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