



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: Mark A. Davis

Model: HH021

Description: Wireless Helmet Headset

Serial Number: N/A

FCC ID: 2AKXKHH021

To

FCC Part 15.247 DTS

Date of Issue: April 14, 2017

On the behalf of the applicant:

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Attention of:

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Project No: p1720025

Kenneth Lee
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	March 21, 2017	Kenneth Lee	Original Document
2.0	April 14, 2017	Kenneth Lee	Updated Conducted Spurious Emissions Specification reference in Test Summary Table Removed settings table from Radiated Spurious Emissions Procedure Updated Test Procedure for Peak Power Output



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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)
24.5	36.1	970.7

EUT Description

Model: HH021

Description: Wireless Helmet Headset

Firmware: PurePath Wireless Configurator 1.4.2.38775 – Texas Instruments

Software: N/A

Serial Number: N/A

Additional Information: This device incorporates the TI PurePath protocol.

EUT Operation during Tests

The EUT was set to transmit at the lowest, middle and the highest channel of operation via computer software provided by Texas Instruments.

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(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(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: 3/21/2017

Test Procedure

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

RBW = RBW $\geq$ DTS bandwidth

VBW $\geq$ 3 x RBW

Span = $\geq$ 3 x RBW

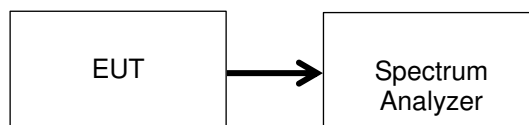
Detector = Peak

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 peak marker function.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2406	-3.237	1 W (30 dBm)	Pass
2442	-3.475	1 W (30 dBm)	Pass
2474	-3.746	1 W (30 dBm)	Pass



Conducted Spurious Emission

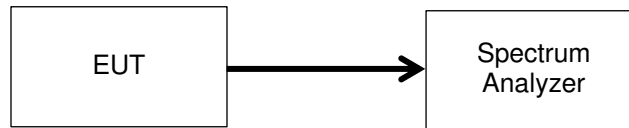
Engineer: Kenneth Lee

Test Date: 3/21/2017

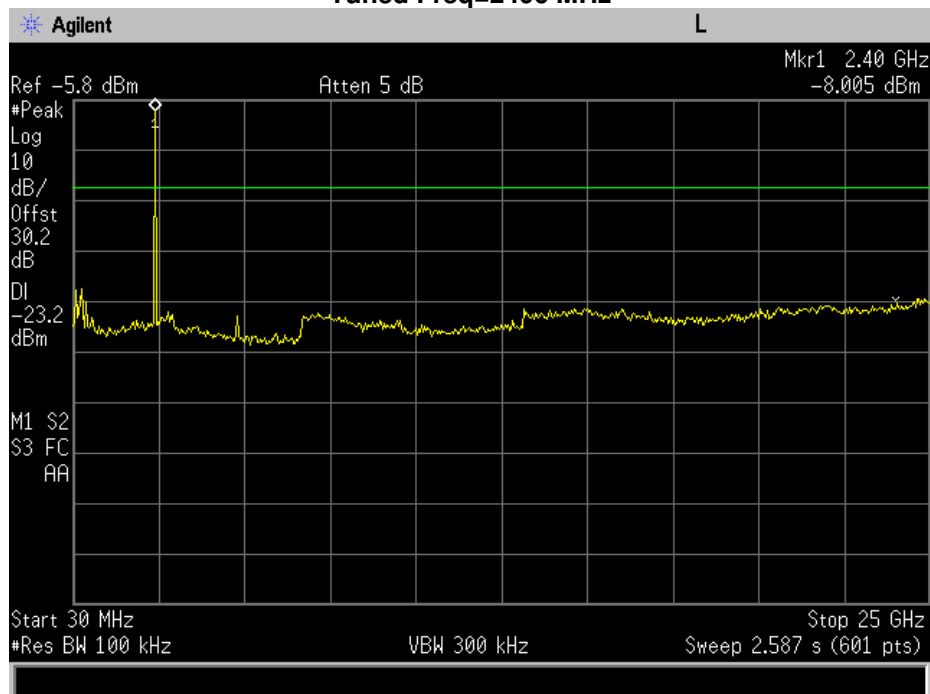
Test Procedure

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

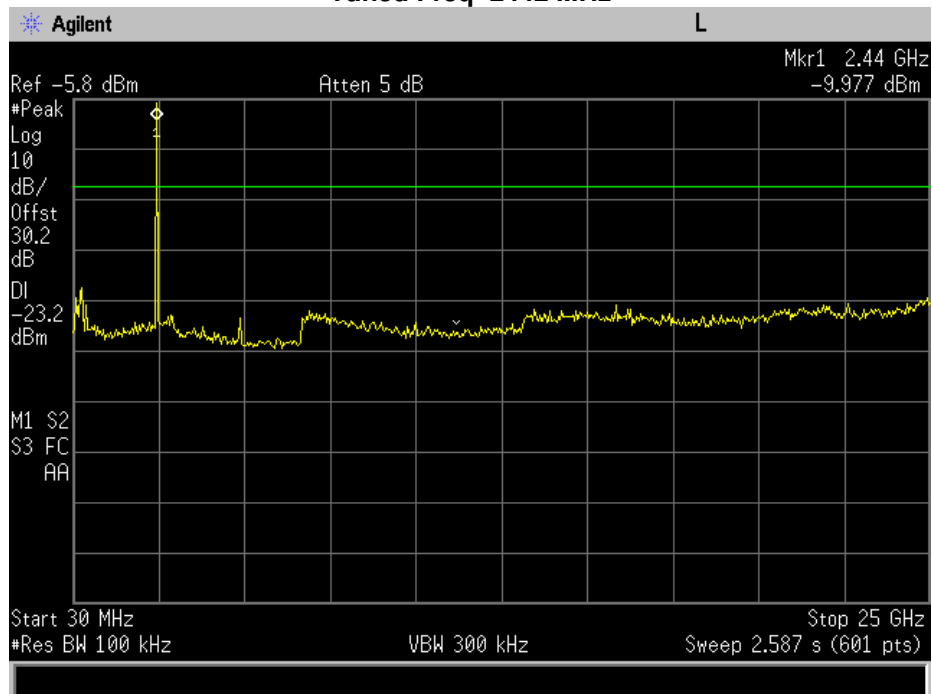


Conducted Spurious Emissions Tuned Freq=2406 MHz

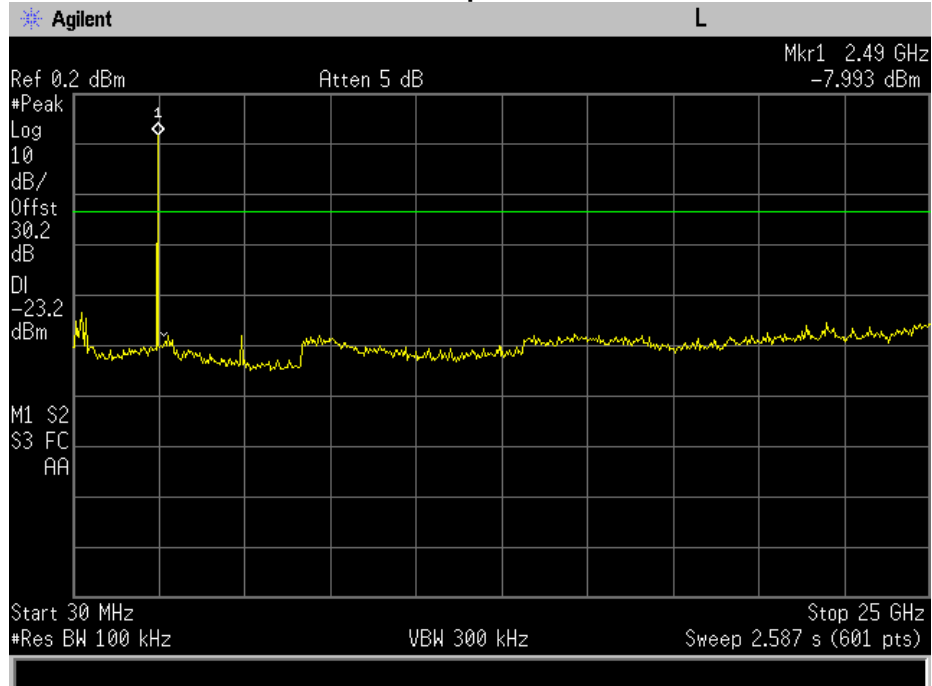




Conducted Spurious Emissions Tuned Freq=2442 MHz



Conducted Spurious Emissions Tuned Freq=2474 MHz





Radiated Spurious Emissions

Engineer: Kenneth Lee

Test Date: 3/21/2017

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.

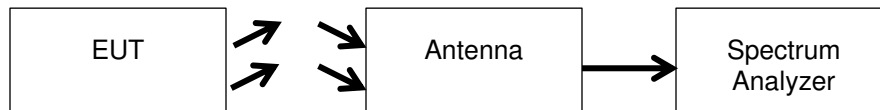
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

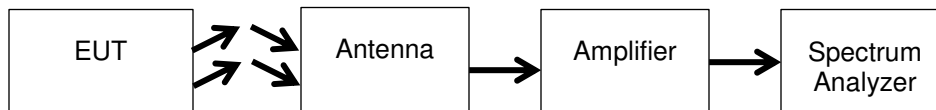
Test Setup



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

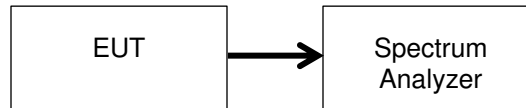
Engineer: Kenneth Lee

Test Date: 3/21/2017

Test Procedure

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

Band Edge Test Setup



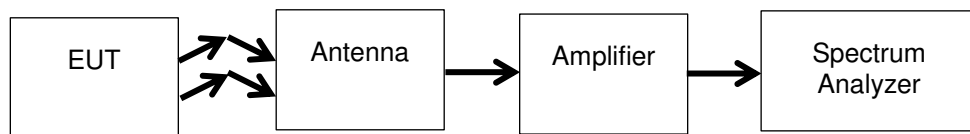
Band Edge Emissions Summary

Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBc)	Detector	Limit (dBc)	Result
2406	2400	-37.93	Peak	-20 dBc	Pass
2474	2483.5	-45.66	Peak	-20dBc	Pass

Restricted Band Test Procedure

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 restricted band for both peak and average measurements. The cable and antenna correction factors were input into the analyzer as a reference level offset to ensure accurate readings. The amplifier and band reject filter correction factors were also input to the spectrum analyzer.

Restricted Band Test Setup



Restricted Band Emissions Summary

Restricted Band (MHz)	Tuned Frequency (MHz)	Emission Frequency (MHz)	Measured Value (dBuV/m)	Detector	Limit (dBuV/m)	Result
2300 – 2390	2406	2390	39	Peak	54*	Pass
2483.5 - 2500	2474	2483.5	52.38	Peak	74	Pass
2483.5 - 2500	2474	2483.5	36.84	Average	54	Pass

* The EUT met the Avg limits using the Peak detector

Agilent

Ref 0.2 dBm

Atten 5 dB

Mkr1 Δ 6.179 MHz

37.93 dB

#Peak

Log

10

dB/

Offst

30.2

dB

M1 S2

S3 FC

AA

Center 2.4 GHz

Span 16.7 MHz

#Res BW 100 kHz

VBW 300 kHz

Sweep 6 ms (601 pts)

Agilent

Ref 0.2 dBm Atten 5 dB

Mkr1 Δ -9.36 MHz
45.66 dB

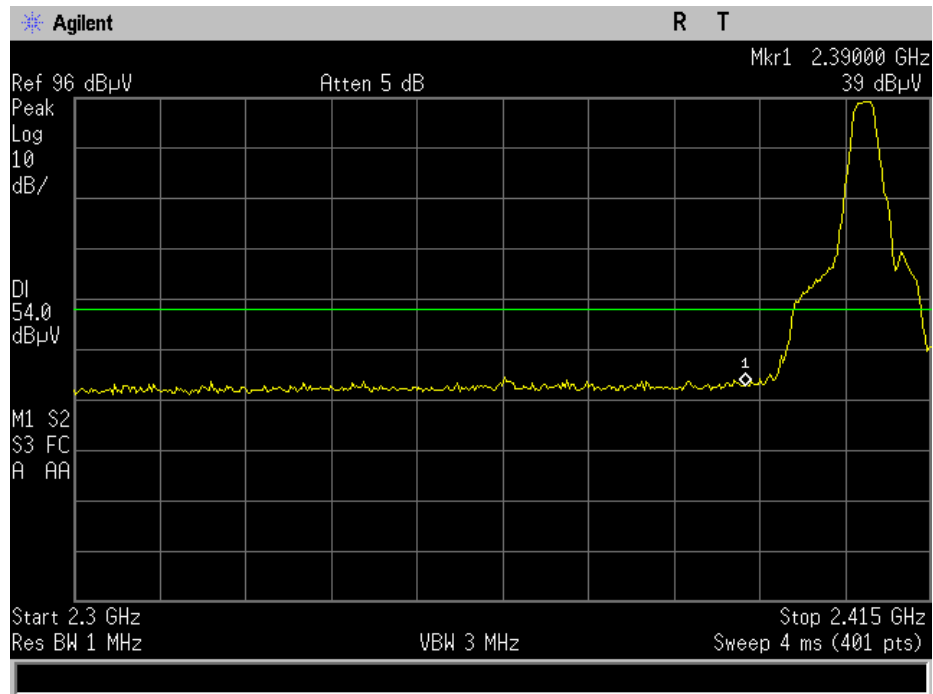
#Peak
Log
10
dB/
Offset
30.2
dB

M1 S2
S3 FC
AA

Center 2.483 GHz Span 35.98 MHz
#Res BW 100 kHz VBW 300 kHz Sweep 6 ms (601 pts)

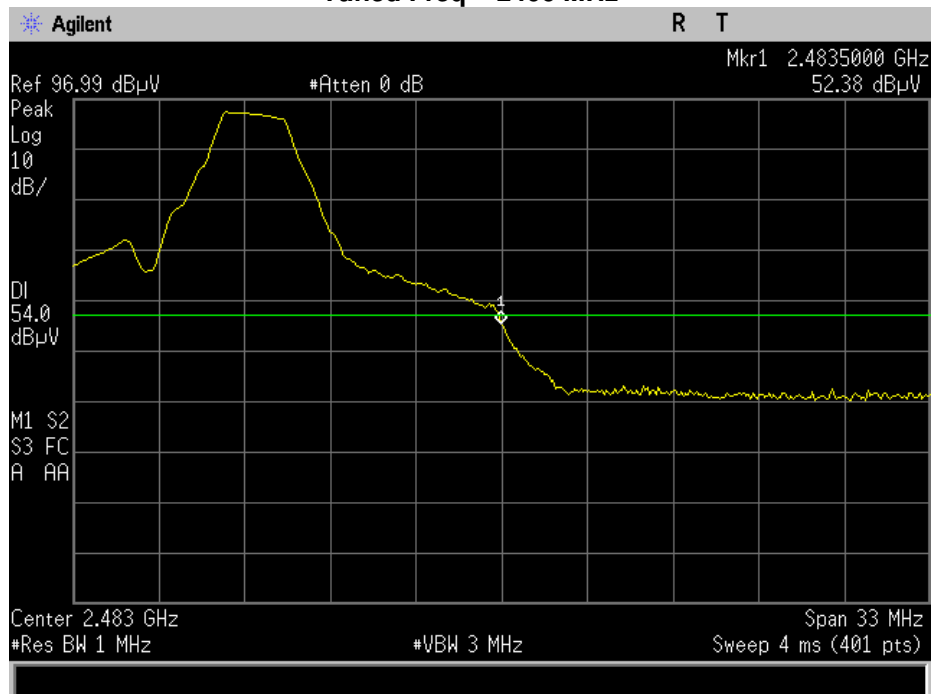


Restricted Band 2300 – 2390 MHz – Peak
Tuned Freq = 2406 MHz

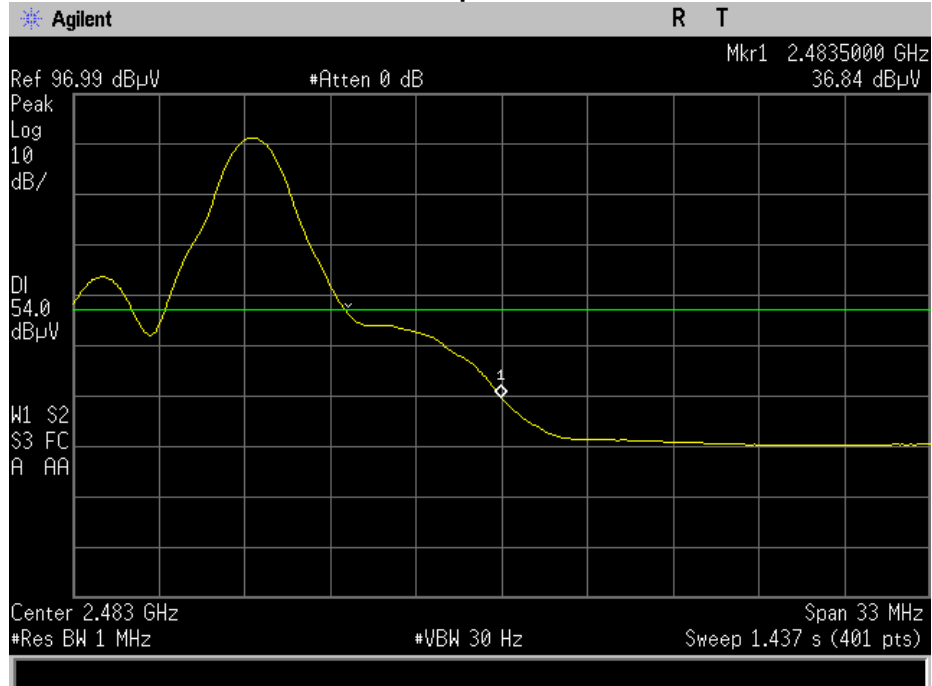




Restricted Band 2483.5 – 2500 MHz – Peak
Tuned Freq = 2406 MHz



Restricted Band 2483.5 – 2500 MHz – Avg
Tuned Freq = 2474 MHz





Occupied Bandwidth

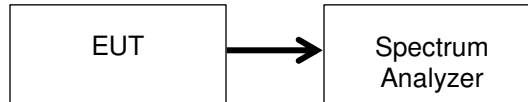
Engineer: Kenneth Lee

Test Date: 3/21/2017

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



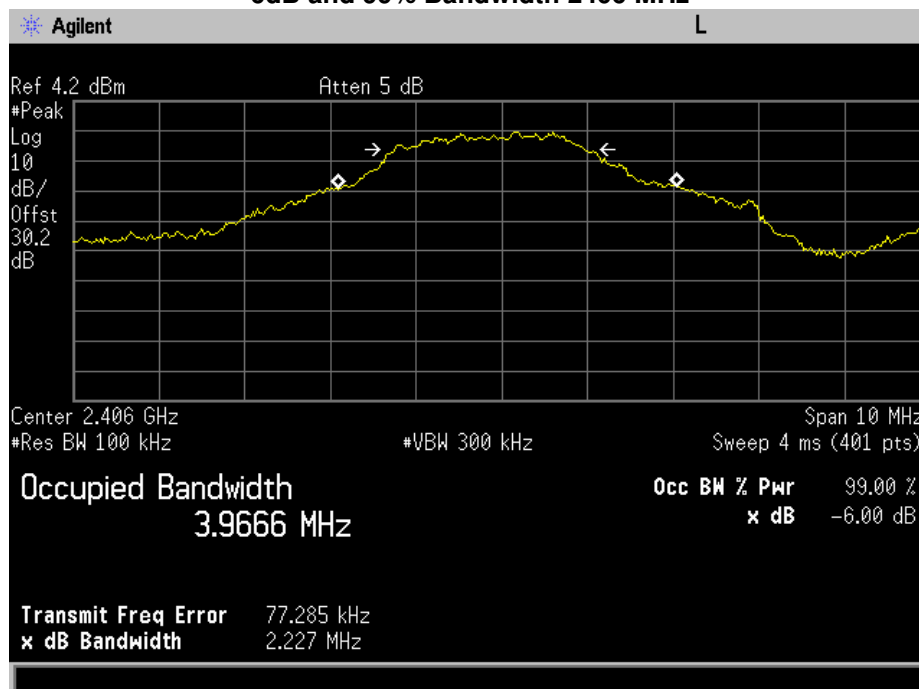
6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (MHz)	Specification Limit (kHz)	Result
2406	2.227	≥ 500	Pass
2442	2.236	≥ 500	Pass
2474	2.194	≥ 500	Pass

99% Bandwidth Summary

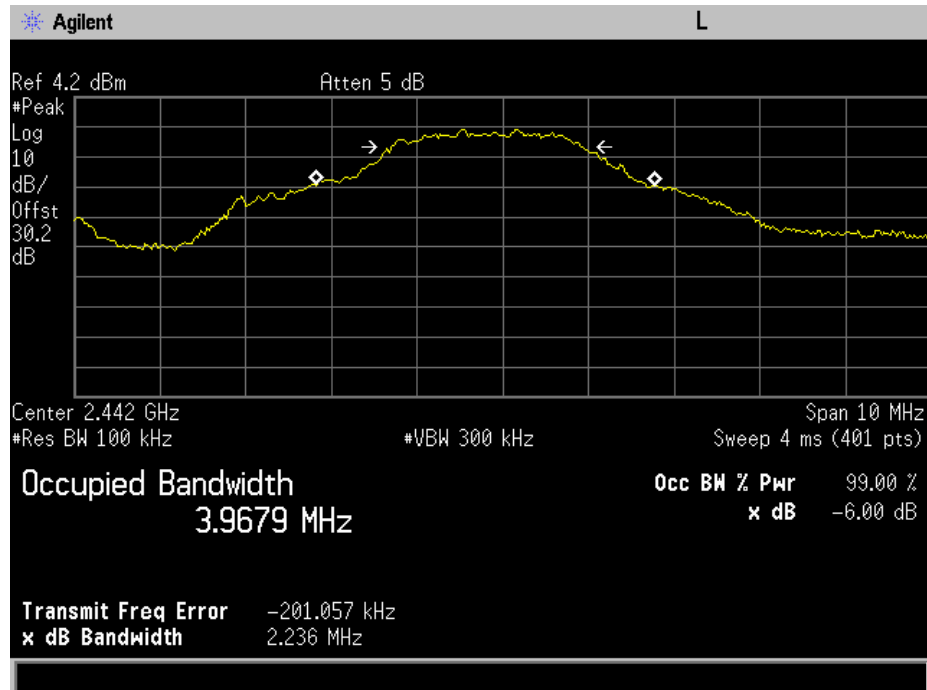
Frequency (MHz)	Measured Bandwidth (MHz)	Result
2406	3.966	Pass
2442	3.967	Pass
2474	3.954	Pass

6dB and 99% Bandwidth 2406 MHz

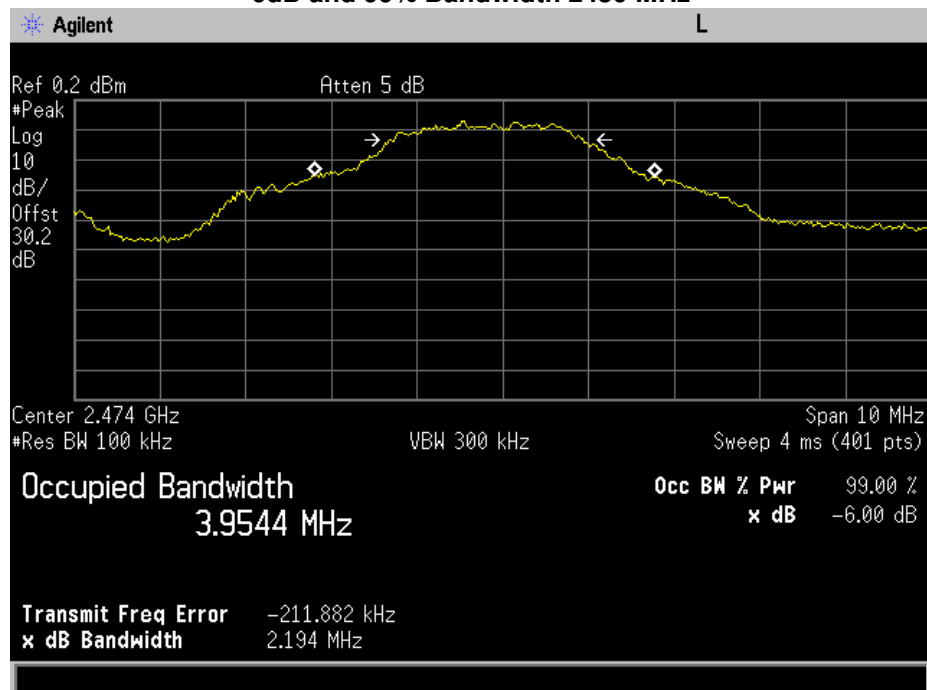




6dB and 99% Bandwidth 2442 MHz



6dB and 99% Bandwidth 2480 MHz





Transmitter Power Spectral Density (PSD)

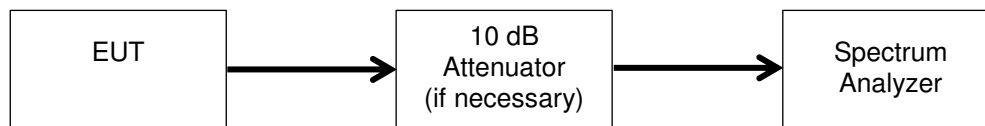
Engineer: Kenneth Lee

Test Date: 3/21/2017

Test Procedure

The EUT was connected directly to a spectrum analyzer. The test was performed per section 11.10 of C63.10:2013 "Procedure for determining PSD for DTS devices".

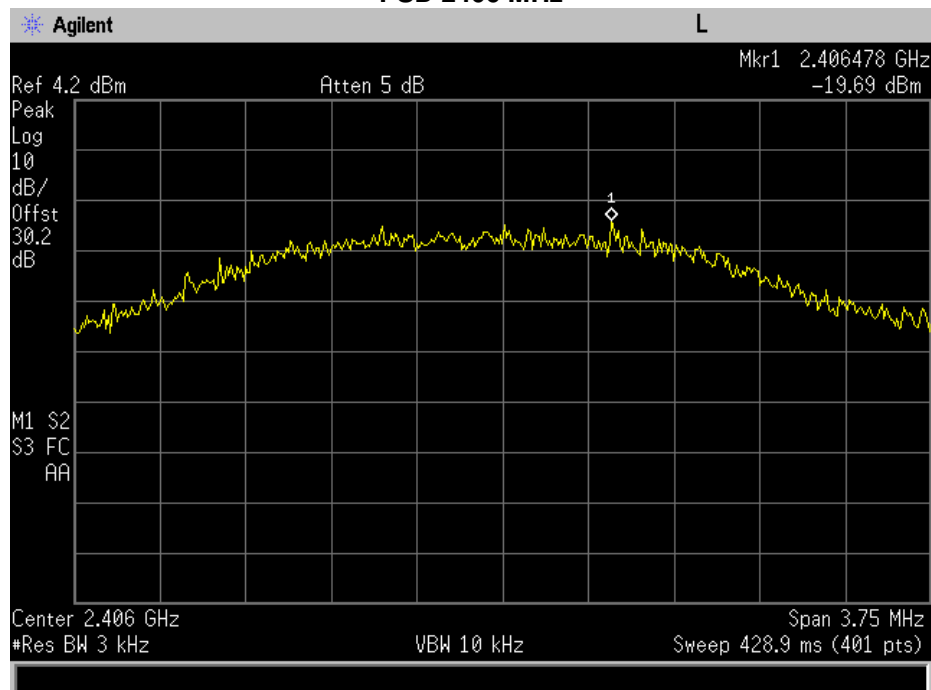
Test Setup



PSD Summary

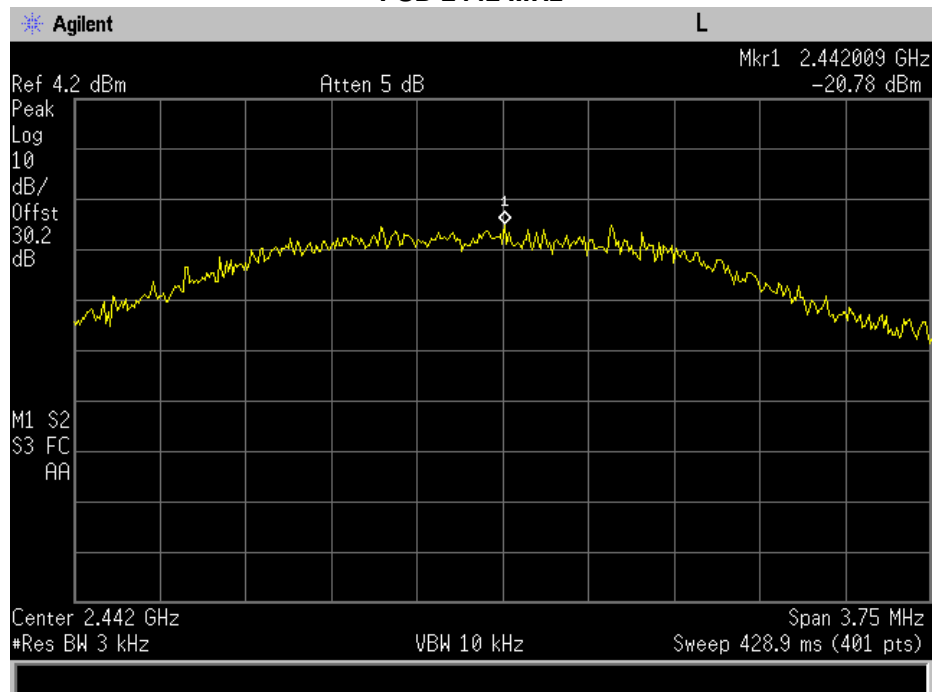
Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2406	-19.69	8	Pass
2442	-20.78	8	Pass
2474	-20.87	8	Pass

PSD 2406 MHz

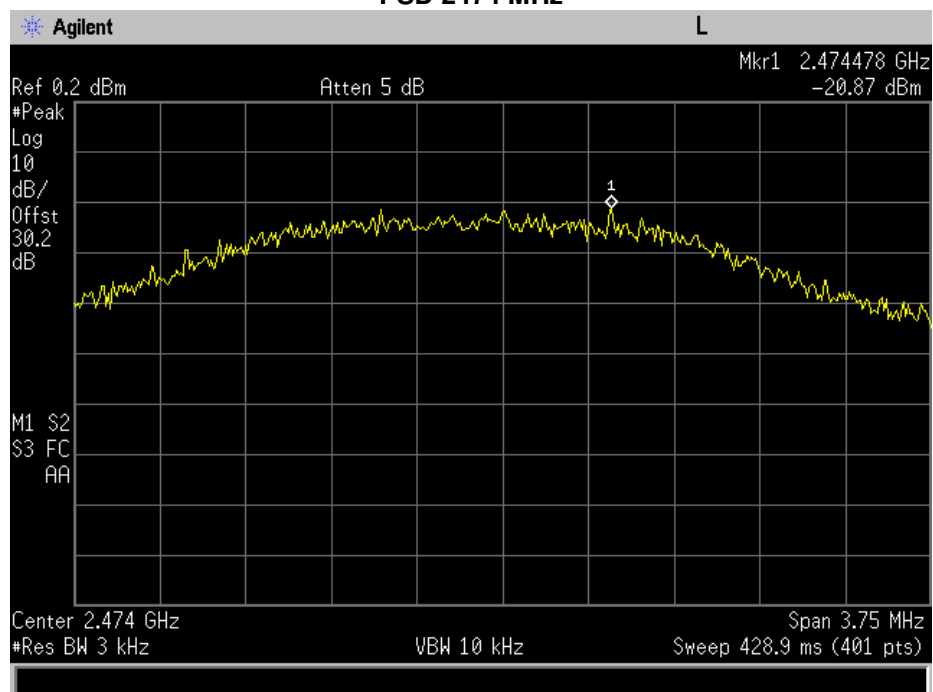




PSD 2442 MHz



PSD 2474 MHz





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
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
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
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
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/22/15	4/22/18

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