



Test Report

Prepared for: Emotiv Inc

Model: EPOC Flex

Description: EEG Headset

Serial Number: FLEX01

FCC ID: 2ADIH-FLEX01

To

FCC Part 15.247 DTS

Date of Issue: August 15, 2018

On the behalf of the applicant:

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Attention of:

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Poona Saber
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 9, 2018	Poona Saber	Original Document



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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)
23.3	28.9	967

EUT Description

Model: EPOC Flex

Description: EEG Headset

Firmware: N/A

Software: Emotive Pro

Serial Number: N/A

Additional Information: The EPOC Flex is a 32-channel flexible EEG system consist of a controller, universal USB receiver, cap with electrode sensors on. The controller has a Bluetooth low energy radio with mini chip antenna. Frequency of operation is 2400-2483.5 MHz and unit is a battery operated with recharging capability through mini USB cable

EUT Operation during Tests

Controller unit is put on continuous transmit mode on Low, mid and high channels controlled via Nrfgo studio software provided by the manufacturer. A sample unit with SMA connector to antenna port for conducted testing is provided. A USB receiver to pair with the controller on its normal operation mode is provided as well. For radiated testing the antenna port of the conducted sample is terminated in a 50 ohm load.



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Laptop with Nrfgo studio	DELL	Latitude	N/A
1	J-Link Lite Board			

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	Micro-B to USB	<3	N/A	N/A	N/A
1	USB to Serial Cable	<3	N/A	N/A	N/A

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	Battery operated device



Peak Output Power

Engineer: Poona Saber

Test Date: 8/3/2018

Test Procedure

The EUT was connected to Spectrum analyzer through the antenna port and procedures of KDB 558074 D01 v04 was followed to measure the Peak conducted power.

The Spectrum Analyzer was set to the following:

RBW = \geq DTS bandwidth

VBW \geq 3 x RBW

Peak Detector

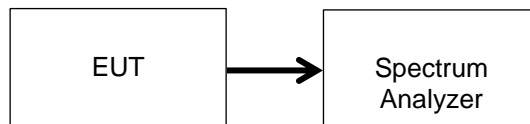
Trace mode = max hold

Sweep = auto

Span \geq 3 x RBW

The EUT was set to continuous 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 Peak Output Power

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	-5.412	1 W (30 dBm)	Pass
2440	-7.265	1 W (30 dBm)	Pass
2480	-9.76	1 W (30 dBm)	Pass



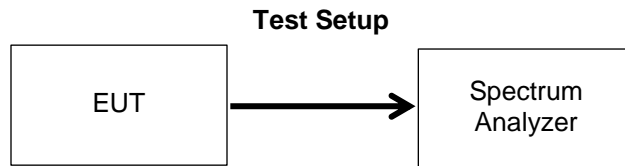
Conducted Spurious Emission and Band edge

Engineer: Poona Saber

Test Date: 8/7/2018

Test Procedure

The EUT was connected to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions of part 15.247 (d) and 15.209 for restricted band emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Band edge requirements for 15.205 and 15.247 (d) has been evaluated as well. 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.



Note: For conducted 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

Engineer: Poona Saber

Test Date: 8/8/2018

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 Antenna port on EUT got terminated into a 50 Ohms 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.

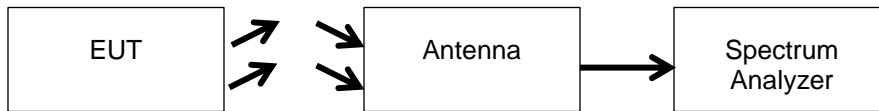
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

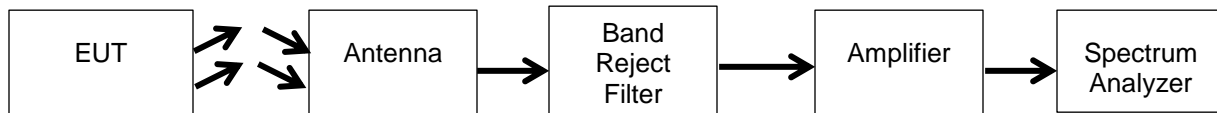
Test Setup



Test Procedure for Radiated Spurious Emissions above 1 GHz

The EUT was 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. Only noise floor was observed past 18 GHz.

Test Setup



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

EUT antenna port is terminated with a 50 Ohm load and no other emissions were detectable. All emissions were more than -20 dBc.

See Annex B for test results



Occupied Bandwidth

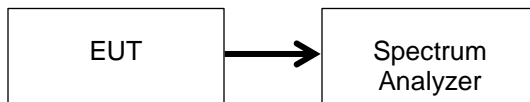
Engineer: Poona Saber

Test Date: 8/3/2018

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

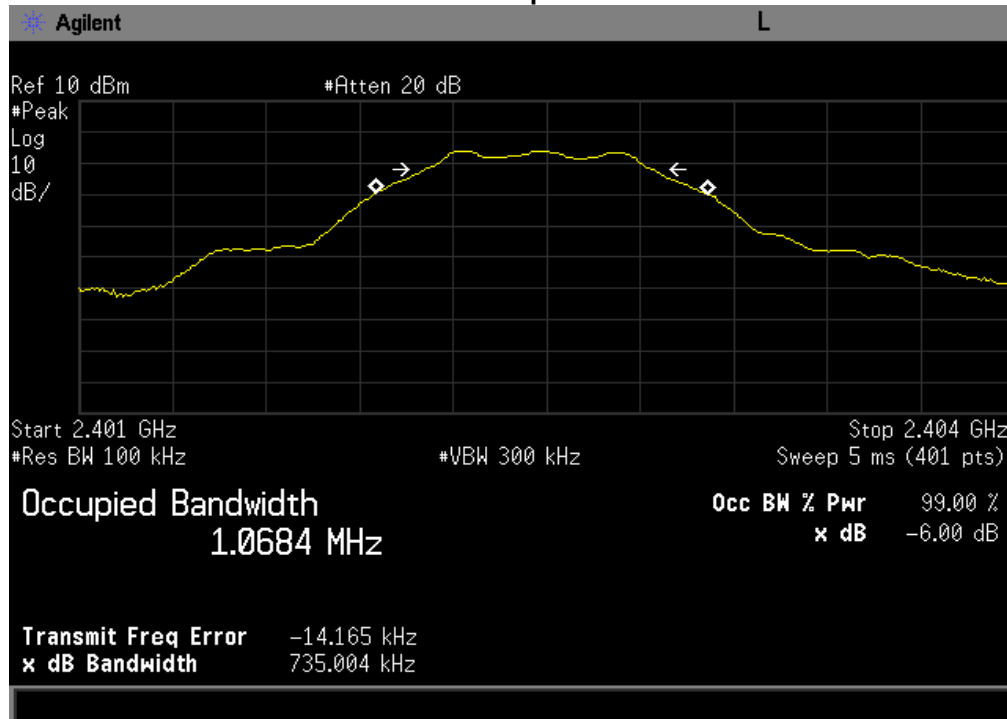
Frequency (MHz)	Measured Bandwidth (MHz)	Specification Limit (kHz)	Result
2402	0.735	≥ 500	Pass
2440	0.720	≥ 500	Pass
2480	0.718	≥ 500	Pass

99% Bandwidth Summary

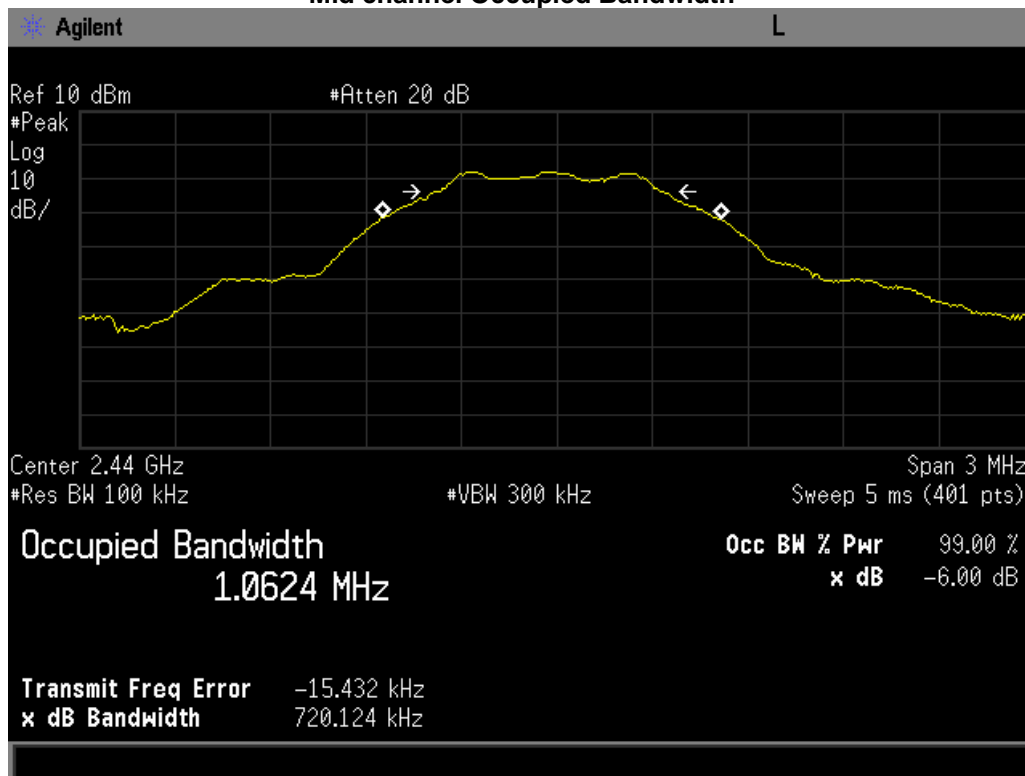
Frequency (MHz)	Measured Bandwidth (MHz)	Result
2402	1.0684	Pass
2440	1.0624	Pass
2480	1.0629	Pass



Low channel Occupied Bandwidth

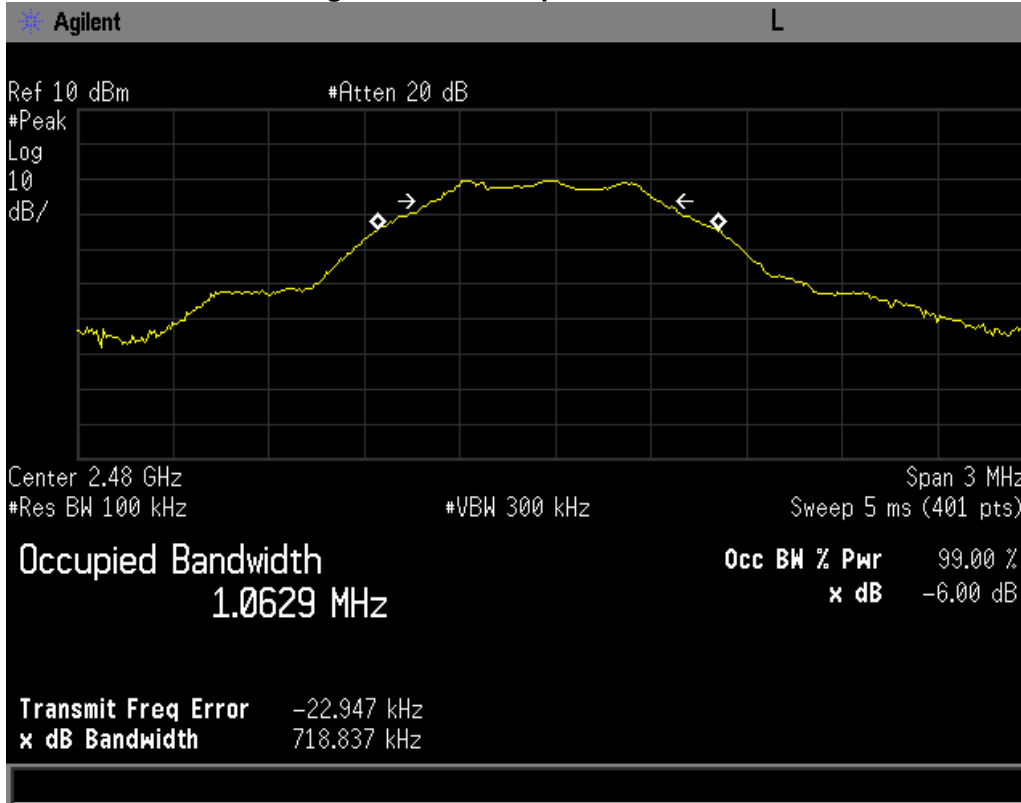


Mid channel Occupied Bandwidth





High channel Occupied Bandwidth





Transmitter Power Spectral Density (PSD)

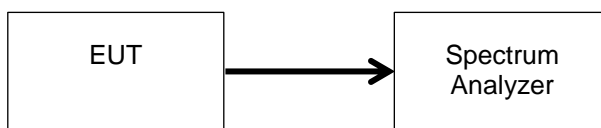
Engineer: Poona Saber

Test Date: 8/6/2018

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

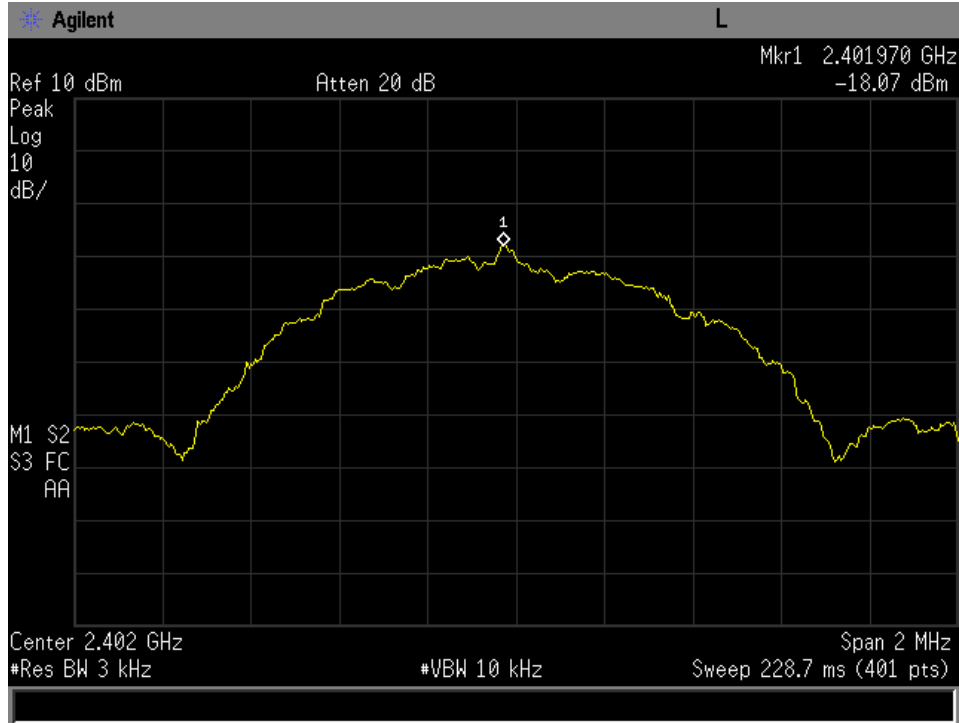


PSD Summary

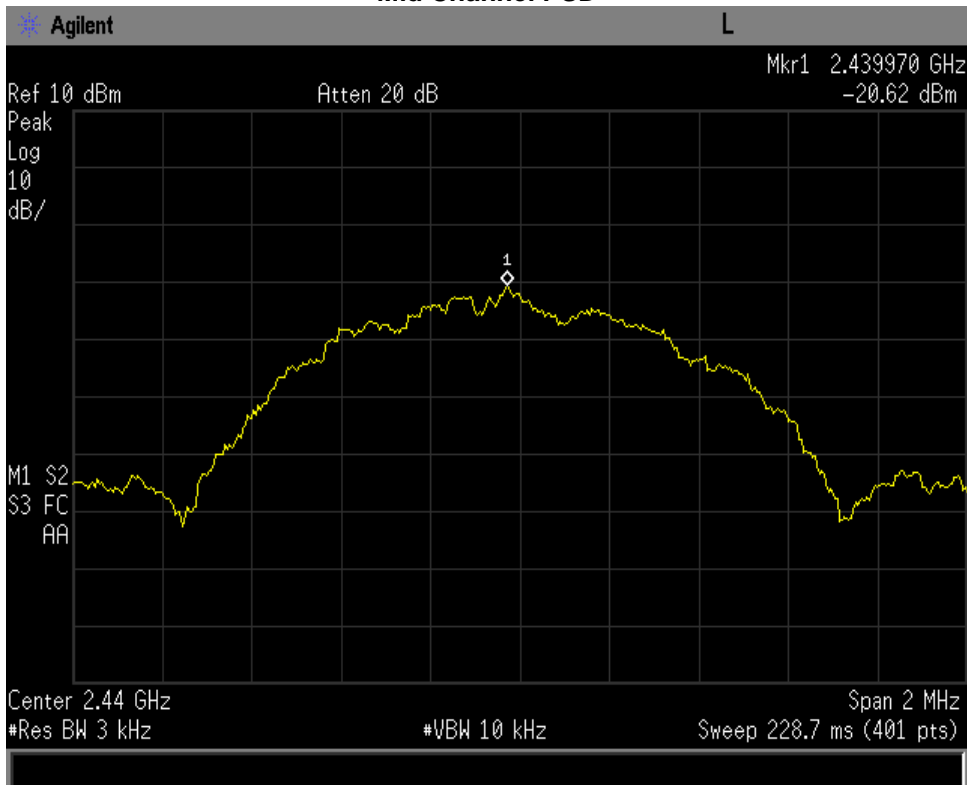
Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-18.07	8	Pass
2440	-20.62	8	Pass
2480	-22.86	8	Pass



Low Channel PSD

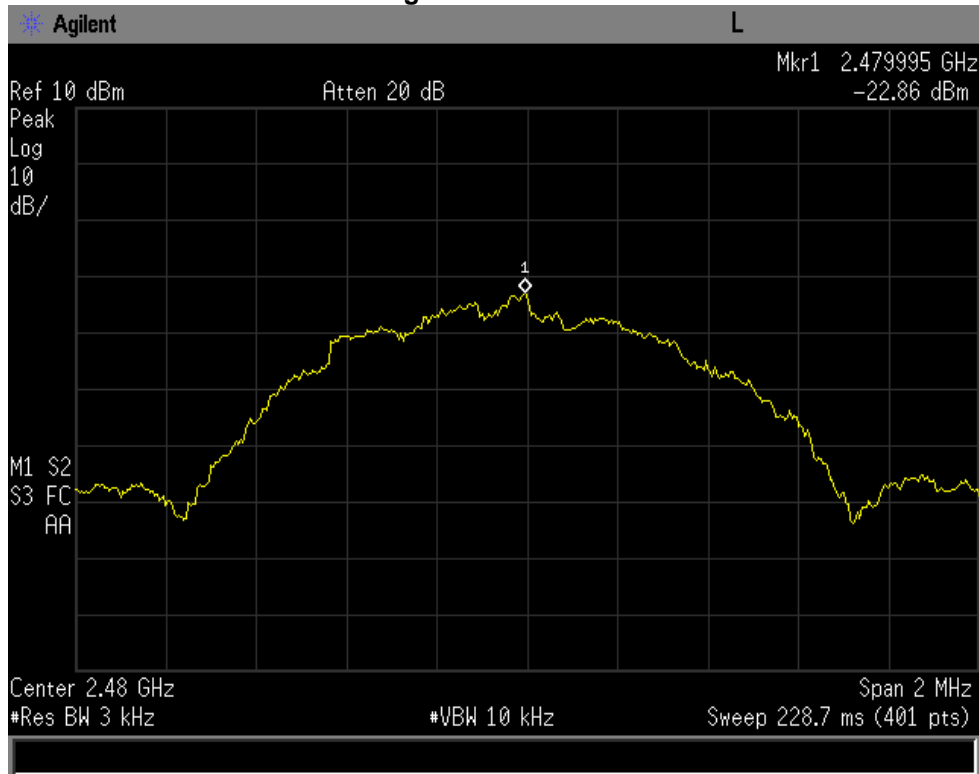


Mid Channel PSD





High Channel PSD





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	11/21/17	11/21/18
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
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

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