



Test Report

Prepared for: TimeKeeping Systems Inc.

Model: PLT-001

Description: Precision Locator Tag

Serial Number: N/A

FCC ID: MTD-0008

IC: 12375A-0008

To

FCC Part 15.247
ISED RSS-247, Issue 2

Date of Issue: February 13, 2019

On the behalf of the applicant:

TimeKeeping Systems Inc.
30700 Bainbridge Rd
Cleveland, OH 44139

Attention of:

Barry Markwitz, President
Ph: (216)595-0890
Email: bmarkwitz@guard1.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: p18b0005

Poona Saber
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	1/3/2018	Poona Saber	Original Document
2.0	1/22/2019	Poona Saber	-Revised Annex B -Revised Annex C -Added measurement uncertainty -Changes on page 6,12,13,test equipment
3.0	2/12/2019	Poona Saber	-Added RF cable to equipment list -Revised Annex B with a note on page 4



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ILAC / A2LA

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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)
19-26	31-39	960-978

EUT Description

Model: PLT-001

Description: Precision Locator Tag

Serial Number: N/A

Firmware: 20181017.1

Software: N/A

Serial Number: N/A

Additional Information:

The PLT-001 is an optional part of the Guard1 Tracking system. The PLT-001 mounts in a single gang electrical box, usually in a wall or ceiling, typically at 15-foot intervals. The PLT-001 works in conjunction with Duress Device Models DD-005 and DD-007 to provide more precise location of people carrying the Duress Device. New Battery is used during all test.

The antenna on the device is Chip antenna with 3.76 dBi gain.

EUT Operation during Tests

Device has Bluetooth low Energy wireless technology and is tested at 3 channels covering the 2400-2483.5 band by putting on continuous modulated mode. Unit is powered up with a DC power supply of 5 VDC to battery terminals on the testing samples



Accessories: None

Modifications: None

Cables

Qty	Description	Length (m)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	UFL to SMA connector	<1	N	N	N

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

FCC 15.247 Specification	RSS-247 Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Section 5.4(d)	Output Power	Pass	
15.247(d)	Section 5.5	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Section 5.5	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Section 5.5	Emissions At Band Edges	Pass	
15.247(a)(2)	Sections 5.2(a)	Occupied Bandwidth	Pass	
15.247(e)	Section 5.2(b)	Transmitter Power Spectral Density	Pass	
15.207	RSS-GEN Section 8.8	A/C Powerline Conducted Emissions	N/A	Device is battery operated

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 v05	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247



Conducted Output Power

Engineer: Poona Saber

Test Date: 12/20/18

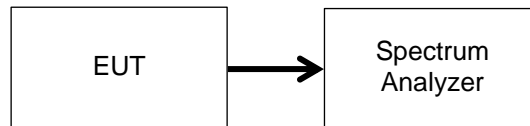
Test Procedure

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

- RBW ≥ DTS bandwidth
- VBW ≥ 3 x RBW
- Set span ≥ 3 x RBW
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold

The EUT was set to transmit on the lowest, middle and highest frequencies at the Lowest and maximum power level. The RF output power was measured using the spectrum analyzer’s marker peak function

Test Setup



Transmitter Output Power Summary Table

Tuned Frequency (MHz)	Measured Value (dBm)	Specification Limit	Result
2402	3.81	1 W (30 dBm)	Pass
2426	3.76	1 W (30 dBm)	Pass
2480	3.44	1 W (30 dBm)	Pass



Conducted Spurious Emissions in Non-Restricted Band

Engineer: Poona Saber

Test Date: 12/21/2018

Test Procedure

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

RBW = 100 kHz

VBW \geq 3 x RBW

Peak Detector

Trace mode = max hold

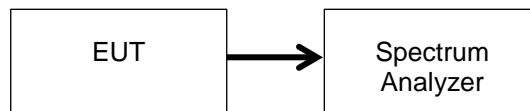
Sweep = auto couple

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 emissions were investigated to insure they were attenuated from the peak fundamental by at least 20dB. If the average power levels were measured, then the out-of-band emissions needed to be attenuated by 30dB. In addition, emissions were investigated at the band edges to insure all out-of-band emissions were attenuated 20 or 30dB as necessary.

Band Edge measurements for low and high channels were also tested and results are in the plots of Annex A.

Test Setup



See Annex A for Test Data

Conducted Spurious Emissions in Restricted Band

Engineer: Poona Saber

Test Date: 12/27/2018

Test Procedure

Radiated Emissions that fall in the restricted bands as defined in 15.205(a) must comply with the radiated emissions limits specified in 15.209(a). Conducted measurements from the antenna port is performed for the emissions coming from the radio and radiated emissions emitting from the unit with the radio port terminated are done in the next section. The EUT was connected directly to a spectrum analyzer. The Spectrum Analyzer was set to the following:

Below 1 GHz:

RBW = 100 kHz

VBW $\geq 3 \times$ RBW

Detector: quasi peak

Above 1 GHz:

RBW= 1 MHz

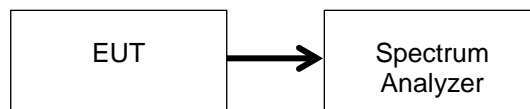
VBW= 3 MHz

Detector: Peak for peak measurements and Average for Average measurements

Band Edge measurements that fall in restricted bands for low and high channels were also tested and results are in the plots of Annex C.

For the band edge measurements that fall within 2 MHz of the authorized band edge the integration method called out in C63.10- 2013 was used.

Test Setup



See Annex B for test data



Radiated Spurious Emissions

Engineer: Poona Saber

Test Date: 12/27/2018

Test Procedure Radiated Spurious Emissions: 30 – 1000 MHz

The EUT antenna port is terminated into a 50 ohm resistor and spurious emissions coming from the other part of the device including the body and digital circuitry is investigated.

EUT was setup in a semi-anechoic test chamber 3m from the receiving antenna. The EUT was set to transmit on the lowest, middle and highest frequency of operation at the maximum power level. The EUT was tested, in 3 orthogonal axis, by rotating it 360° with the receive antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the TX signal levels were maximized. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions.

All emissions from 30 MHz to 1 GHz were examined.

Measured Level includes antenna and receiver cable correction factors.

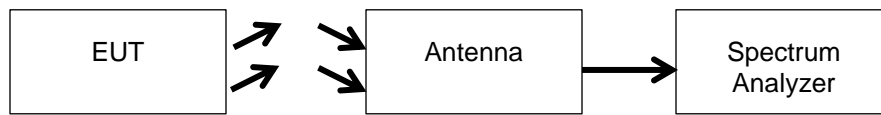
Correction factors were input into the spectrum analyzer before recording “Measured Level”.

RBW = 100 KHz

VBW = 300 KHz

Detector – Quasi Peak

Test Setup



Test Procedure for Radiated Spurious Emissions above 1 GHz

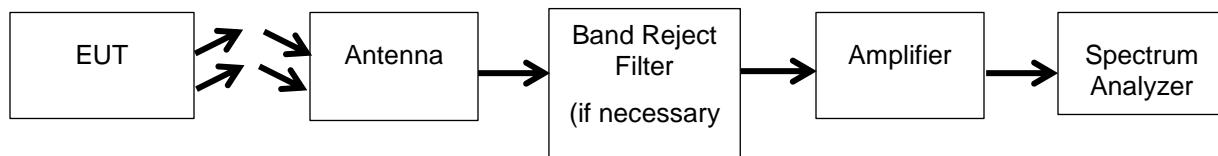
The EUT was setup in a semi-anechoic test chamber set 3m from the receiving antenna. The EUT was set to transmit on the lowest, middle and highest frequency of operation at the maximum power level. The EUT was tested, in 3 orthogonal axis, by rotating it 360° with the receive antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the TX signal levels were maximized. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions.

RBW = 1 MHz

VBW = 3 MHz

Detector – Peak

Test Setup



See Annex C for test data



DTS Bandwidth

Engineer: Poona Saber

Test Date: 12/20/2018

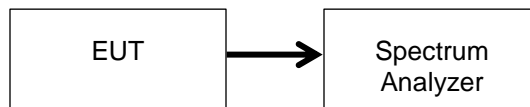
Test Procedure

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 6db and this value was used to determine the width of the carrier. Alternatively, the spectrum analyzer’s automatic bandwidth capability was used.

Test Setup



6 dB Occupied Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (kHz)	Specification Limit (kHz)	Result
2402	743	≥ 500	Pass
2426	729	≥ 500	Pass
2480	751	≥ 500	Pass

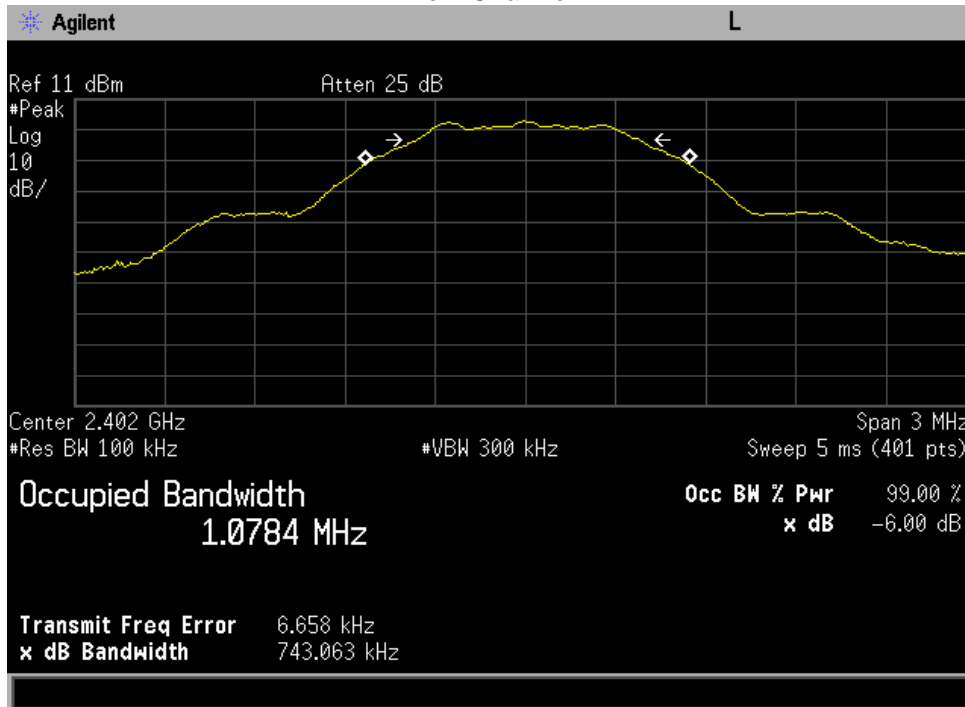
99% Bandwidth Summary

Frequency (MHz)	Measured Bandwidth (MHz)	Result
2402	1.07	Pass
2426	1.09	Pass
2480	1.09	Pass

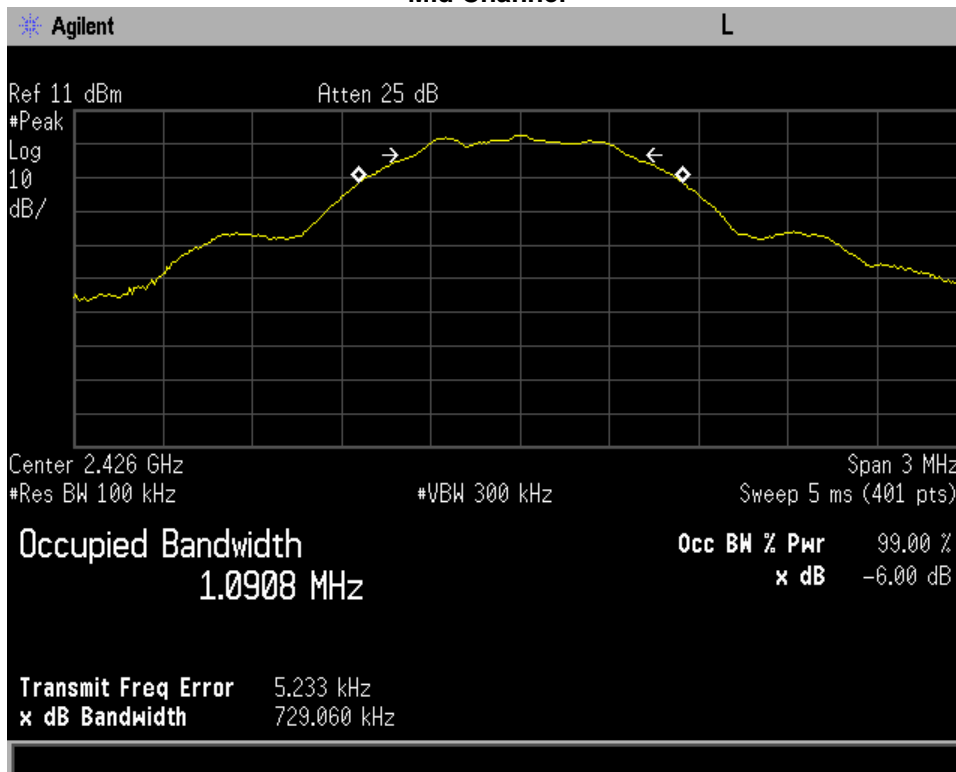


6 dB and 99% Bandwidth Plots

Low Channel

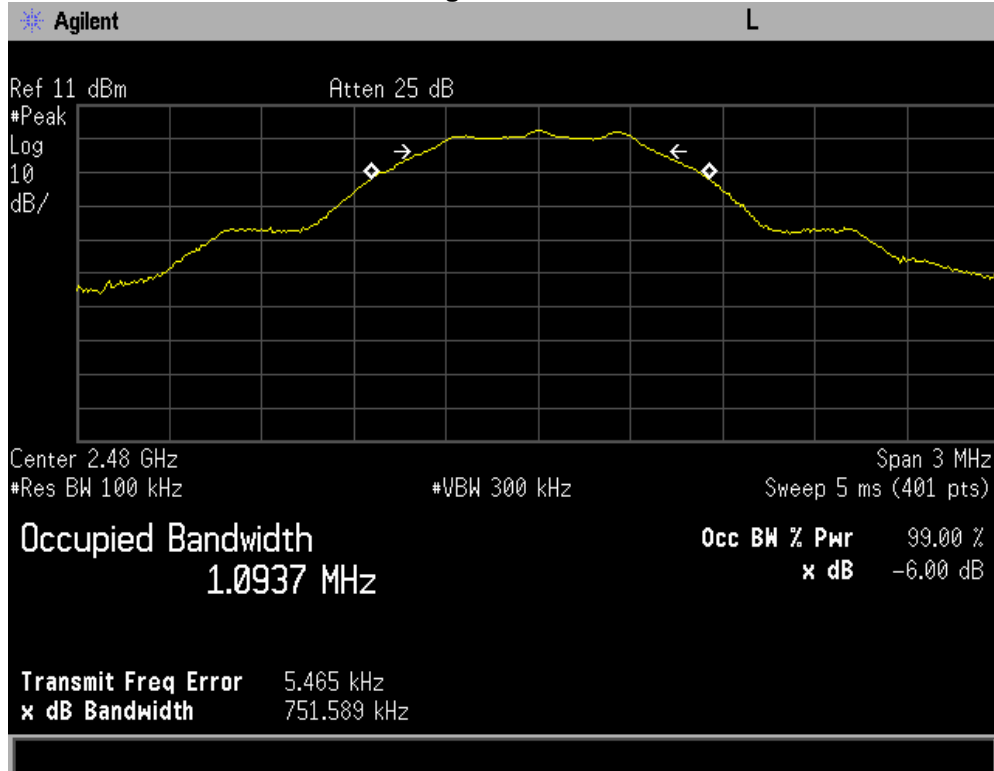


Mid Channel





High Channel





Transmitter Power Spectral Density (PSD)

Engineer: Poona Saber

Test Date: 12/20/2018

Test Procedure

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

Set analyzer center Frequency to DTS channel center frequency

Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ KHz}$

VBW $\geq 3 \times \text{RBW}$

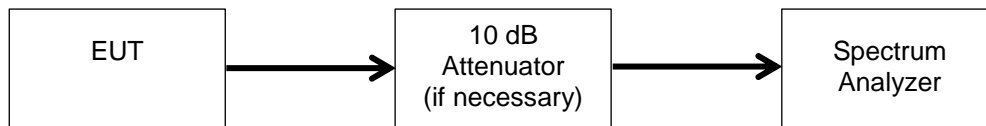
Sweep time = auto couple.

Detector = peak.

Trace mode = max hold

The EUT was set to transmit at the lowest, middle and highest channels of the band at the maximum power levels. Once the trace has stabilized the peak marker was used to determine the peak power spectral density.

Test Setup



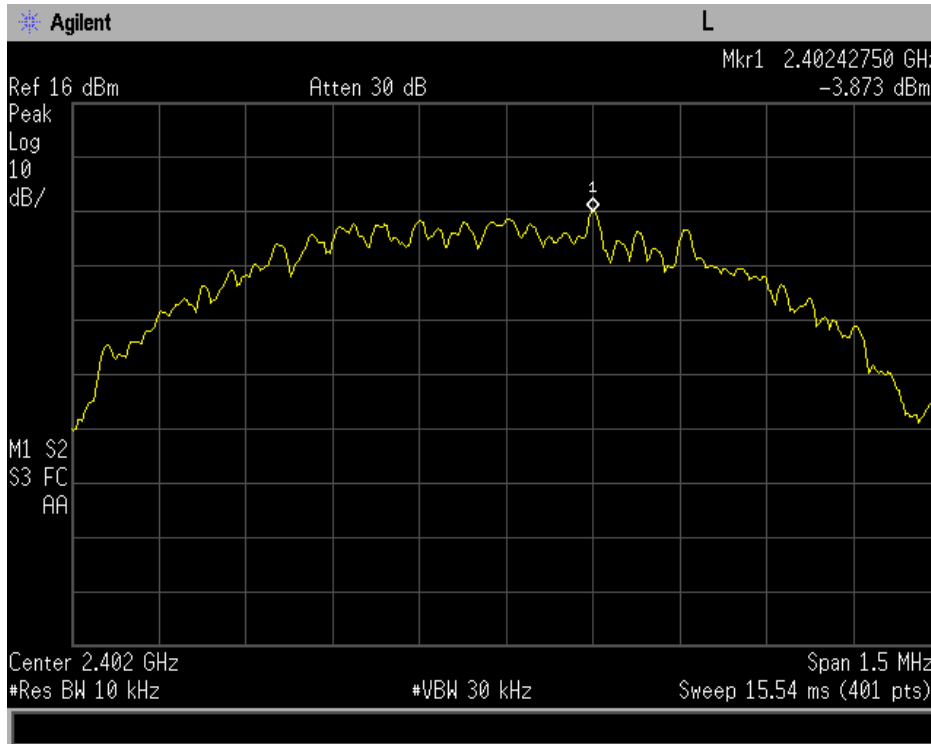
PSD Summary

Frequency (MHz)	Measured Data (dBm)	Specification Limit (dBm)	Result
2402	-3.87	8	Pass
2426	-4.48	8	Pass
2480	-3.95	8	Pass

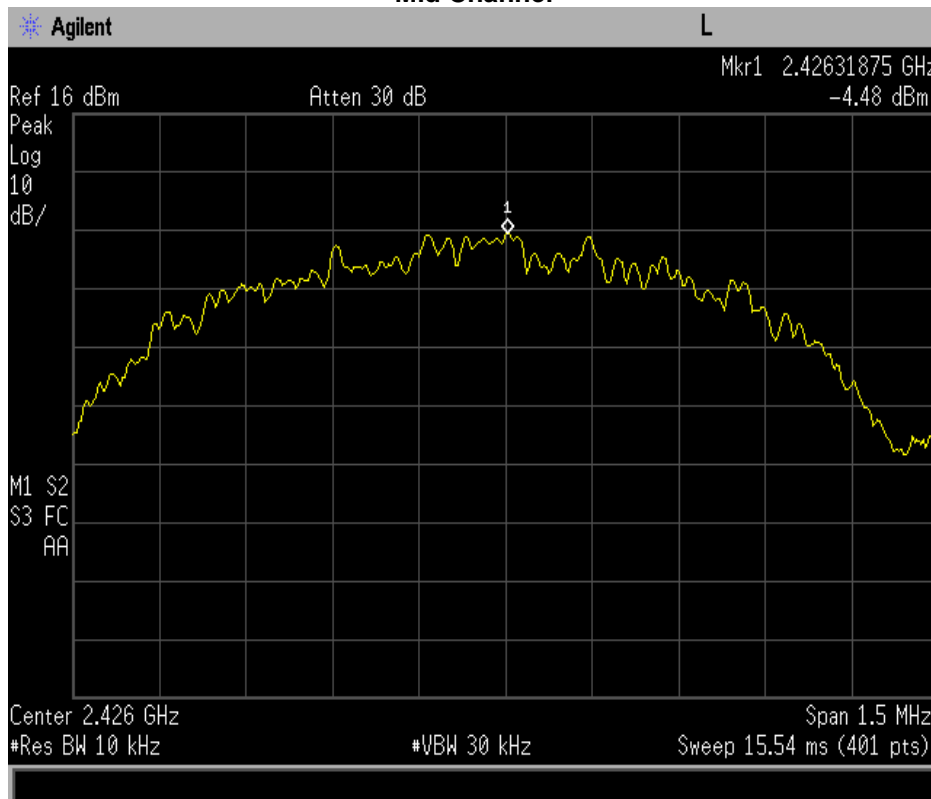


PSD Plots

Low Channel

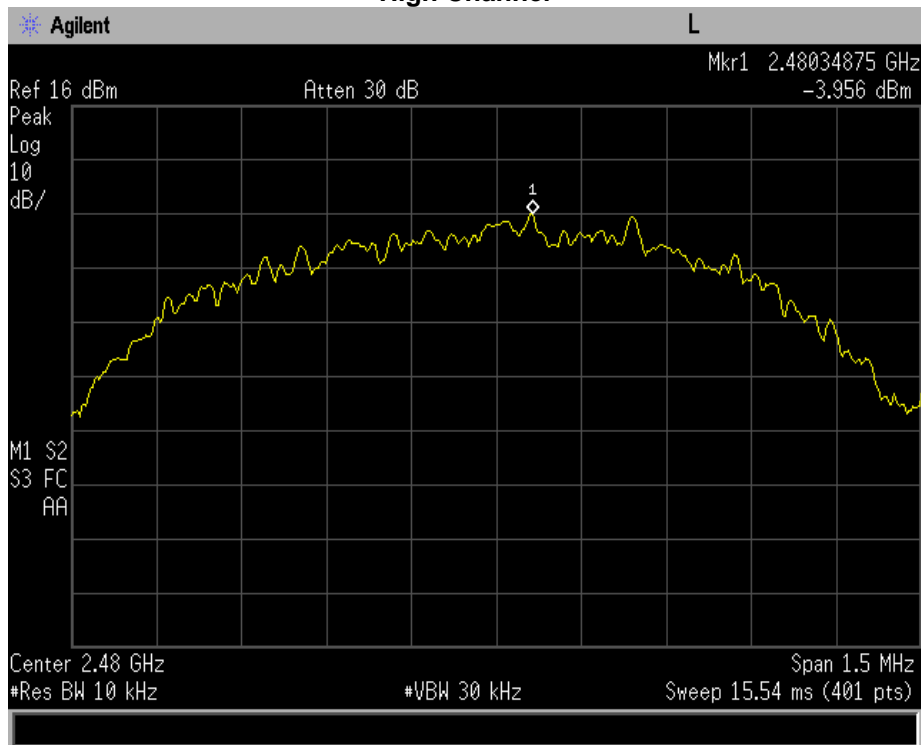


Mid Channel





High Channel





Measurement Uncertainty

Measurement Uncertainty (U_{lab}) for Compliance Testing is listed in the table below.
The reported expanded uncertainty $U_{lab}(dB)$ has been estimated at a 95% confidence level ($k=2$)

Measurement	U_{lab}
Radio Frequency	$\pm 1.0 \times 10^{-12}$
RF Power, conducted	± 0.43 dB
RF Power Density, conducted	$\pm .98$ dB
Spurious Emissions, Conducted	± 2.49 dB
All Emissions, radiated	± 5.7 dB
Temperature	± 1.0 deg C
Humidity	± 4.3 %
Dc voltage	$\pm .12$ %
Low Frequency voltages	± 2.3 %

The reported expanded uncertainty +/- $U_{lab}(dB)$ has been estimated at a 95% confidence level ($k=2$)

U_{lab} is less than or equal to U_{CISPR} therefore

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit



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	6/9/17	6/9/18
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
EMI Analyzer	Agilent	E7405A	i00379	2/13/18	2/13/19
Preamplifier	HP	8447D	i00055	NCR	NCR
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A
DC power supply	GW	GPS 3030d	I00495	Functional Verification	
RF Cable	Times Microwave systems	68999	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