

## ELECTROMAGNETIC COMPATIBILITY TEST REPORT

PREPARED FOR FATIGUE SCIENCE  
BY QAI LABORATORIES



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**Laboratory Accreditations (per ISO/IEC 17025:2005):**



**American Association for Laboratory Accreditation Certificate Number: 3657.02**

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**Applicable Test Standards:** FCC CFR Title 47 Part 15: Subpart B  
ICES-003 Issue 6  
FCC CFR Title 47 Part 15: Subpart C  
RSS-210 Issue 9  
RSS-Gen Issue 4

**Equipment Tested:** Fatigue Science Readiband 4  
**Model Number:** FSRB4C  
**FCC ID:** XVL-FSRB4C  
**IC Certification Number:** 8707A-RB4C  
**Manufacturer:** Fatigue Science

## REVISION HISTORY

Date	Report Number	Rev #	Details	Author's Initials
Feb 21, 2017	E10699-1605_FatigueSci	0.0	Draft Test Report	HZ
Feb 21, 2017	E10699-1605_FatigueSci	1.0	Final Test Report	HZ

*All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.*

## REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by Fatigue Science. Tests were conducted on the sample equipment as requested by Fatigue Science for the purpose of demonstrating compliance with FCC CFR Title 47 Part 15: Subpart B, ICES-003 Issue 6, FCC CFR Title 47 Part 15: Subpart C, RSS-210 Issue 9, and RSS-Gen Issue 4 as agreed upon by Fatigue Science as per Quote 16SH11041.

Fatigue Science is responsible for the tested product configuration, continued product compliance, and for the appropriate auditing of subsequent products as required. This report may comprise partial list of tests that are required for FCC or IC Declaration of Conformity and can only be produced by the manufacturer.

This is to certify that the following report is true and correct to the best of our knowledge.




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## QAI FACILITIES

Founded in 1994 by a group of experienced certification and testing experts, QAI is an independent third-party testing, inspection and certification organization which serves the building industry, government and individuals with cost effective solutions through our in-house capabilities / services, and an established world-wide network of qualified affiliates. To help get your product to market, trust the provider that many leading global manufacturers do: QAI.

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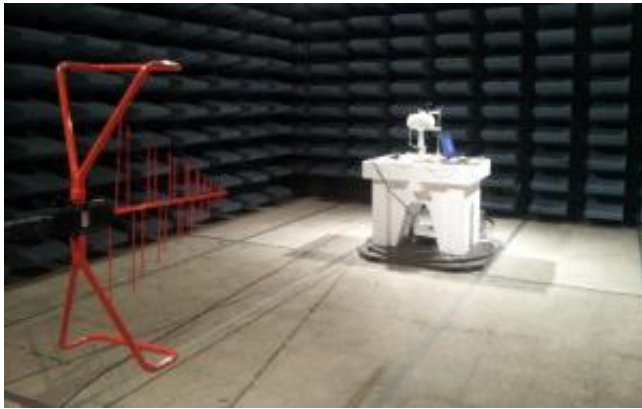
## QAI EMC ACCREDITATION

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). Products are tested to the latest and applicable EMC/EMI requirements for domestic and international markets. QAI EMC goes above and beyond being a testing facility—we are your regulatory compliance partner. QAI EMC has the capability to perform RF Emissions and Immunity for all types of electronics manufacturing including Industrial, Scientific, Medical, Information Technology, Telecom, Wireless, Automotive, Marine and Avionics.

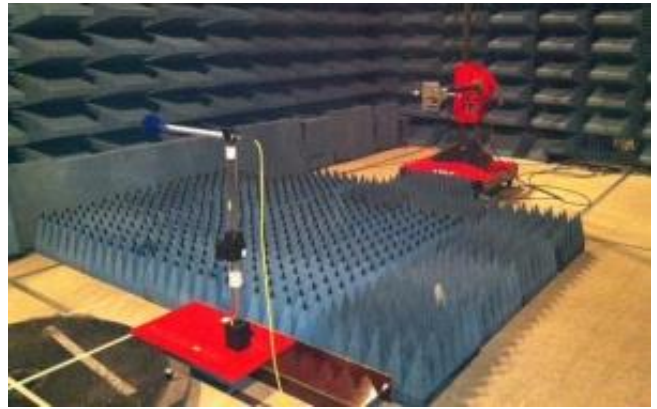
EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC Canada	CA9543	21146-1	3657.02



**Headquarters & EMC Laboratory in Burnaby, BC**



**Chamber 1- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**Chamber 1- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**Chamber 2- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**Chamber 2- 3m Semi-Anechoic Chamber (SAC) in Burnaby, BC**



**10m Open Area Test Site (OATS) in British Columbia, Canada**

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## Section I: EXECUTIVE SUMMARY

### 1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of “Fatigue Science Readiband 4” as per Sections 1.2 & 1.3.

### 1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 16SH11041:

- **FCC CFR 47 Part 15** – Radio Frequency Devices, Subpart B – Unintentional Radiators
- **ICES-003 Issue 6** – Information Technology Equipment (Including Digital Apparatus) - Limits and Methods of Measurement
- **FCC CFR 47 Part 15** – Radio Frequency Devices, Subpart C – Intentional Radiators
  - o 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5875 MHz
- **RSS-210 Issue 9** – Licence-Exempt Apparatus: Category I Equipment
- **RSS-Gen Issue 4** – General Requirements and Information for the Certification of Radio Apparatus

The tests documented in this report were performed in accordance with ANSI C63.4-2014, ANSI C63.10-2013, and RSS-Gen Issue 4.

### 1.3 Summary of Results

The following tests demonstrate the testimony to “FCC and IC” Mark Electromagnetic compatibility testing for “Fatigue Science Readiband 4” manufactured by Misty West.

The following testing was performed pursuant to the FCC and IC Radio and RF Emissions Standards:

Test or Measurement	Applicable FCC and IC Standard	Performance Criteria
Antenna Requirement	FCC CFR 47 Part 15.203	Complies
	RSS-Gen Issue 4	
Intentional Radiated Emissions	FCC CFR 47 Part 15.249 FCC CFR 47 Part 15.209 FCC CFR 47 Part 15.205	Complies
	RSS-210 Issue 9 RSS-Gen Issue 4	
20dB Occupied Bandwidth	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 1 RSS-Gen Issue 4	
99% Occupied Bandwidth	FCC CFR 47 Part 15.247	Complies
	RSS-247 Issue 1 RSS-Gen Issue 4	
Band Edge	FCC CFR 47 Part 15.249	Complies
	RSS-210 Issue 9	
Unintentional Radiated Emissions	FCC CFR 47 Part 15.209 (a)	Complies
	ICES-003 Issue 6 RSS-Gen Issue 4	
AC Mains Conducted Emissions	FCC CFR 47 Part 15.207	Complies
	ICES-003 Issue 6 RSS-Gen Issue 4	
Frequency Stability	FCC CFR 47 Part 15.215(c)	Complies
	RSS-Gen Issue 4	
RF Exposure	FCC KDB 447498 D01 Clause 4.3.1	Complies
	RSS-102 Section 2.5.1	

## Section II: GENERAL INFORMATION

### 2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Ancillary Equipment needed to perform the tests as complete system.

#### Equipment Under Test (EUT) Information

<b>EUT</b>	Fatigue Science Readiband 4
<b>Functional Description</b>	A wrist-worn band with integrated Bluetooth 4.0 Low Energy radio for monitoring and recording sleep and other related activities
<b>FRN</b>	0018991455
<b>FCC ID</b>	XVL-FSRB4C
<b>IC Number</b>	8707A-RB4C
<b>Manufacturer</b>	Misty West
<b>Model No.</b>	FSRB4C

<b>Frequency Band</b>	Low - - 2402MHz Mid - - 2446MHz High - - 2480MHz
<b>Transmit Power</b>	4dBm
<b>Test Channels</b>	40 2MHz channels
<b>Antenna Type and Gain</b>	PCB antenna – 0.07dBi PCB monopole



**EUT – Fatigue Science Readiband 4**



## 2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	22-28°C
Relative Humidity	39.7 - 54.4%

## 2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1,5 x 10 <sup>-5</sup> MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

## 2.4 Worst Test Case

Worst-case orientation was determined during the preliminary testing. The final radiated emissions were performed in the worst-case orientation.

## 2.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	Quasi-Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Quasi Peak reading shown in the table above is already corrected by the software using correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

Or

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable Loss} - \text{Amp gain (if pre-amplifier was used)}$$

The final Quasi peak reading shown in the data is calculated by the software using following equation:

$$\text{Corrected Quasi Peak (dBµV/m)} = \text{Raw Quasi Peak Reading} + \text{Antenna factor} + \text{Cable loss}$$

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	0.6	21.7	66.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	0.6	28.8	56.0

*Note: Data shown above are sample data and are not relevant to the EUT's actual data.*

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

The final Quasi peak or Average reading shown in the data is calculated by the software using following equation:

$$\text{Corr. Quasi Peak/Average Reading (dBµV)} = \text{Raw Quasi Peak/Average Reading} + \text{Antenna factor} + \text{Cable loss}$$

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

$$\text{Margin (dB)} = \text{Limit} - \text{Quasi-Peak or Average reading}$$

## 2.6 Test Equipment List

The tables below contain all the equipment used by QAI Laboratories in conducting all tests on the Equipment Under Test (EUT) as per Section 1.3.

### Emissions Test Equipment

Manufacturer	Model	Description	Serial No.	Calibration Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A120106	24-Sep-2017
Sunol Sciences	DRH-118	Horn Antenna 1GHz-18GHz	A050905	10-Mar-2019
ETS Lindgren	3160-09	Horn Antenna 18GHz-26.5GHz	9701-1071	30-Aug-2017
ETS Lindgren	3160-10	Horn Antenna 26.5GHz-40.0GHz	9708-1075	30-Aug-2017
ETS Lindgren	6502	Active Loop Antenna 10kHz – 30MHz	2178	21-Aug-2017
ETS Lindgren	2165	Turntable	00043677	N/A
ETS Lindgren	2125	Mast	00077487	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	20-Nov-2017
Fischer	FCC-LISN-50-25-2-08	LISN (150kHz-30MHz)	2041	19-Nov-2018
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	Conditional Use
California Instruments	PACS-1	Harmonics and flicker analyzer	72569	18 July 2018
California Instruments	OMNI 1-18 I	Programmable Impedance Flicker test	-	18 July 2018
California Instruments	3001ix	Power supply	HK52117	18 July 2018

*Note: Equipment listed above have a 3 years calibration interval.*

### Measurement Software List

Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	6.20.0	Emissions Test Software
ETS-Lindgren	Tile7	7.3.15	Emissions Test Software

## Section III: REQUIREMENTS FOR THE US MARKET (FCC) & THE CANADIAN MARKET (IC) - Exigences pour le Marché Canadien

### 3.1 Antenna Requirements

**Date Performed:**

January 25, 2017

**Test Standard:**

- FCC CFR 47 Part 15.203
- RSS-Gen Issue 4

**Applicable Regulation:**

The purpose of this requirement is to make certain that no other antenna, except for that provided by the responsible party, shall be used with the Equipment-Under-Test (EUT) as defined in FCC CFR 47 Part 15.203 & RSS-Gen Issue 4:

“An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.” ... “the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.”

**Modifications:**

No modification was required to comply for this test.

**Final Result:**

The EUT has a PCB monopole antenna. EUT meets antenna requirement.

### 3.2 Intentional Radiated Emissions

**Date Performed:**

January 20, 2017

**Test Standard:**

- FCC CFR 47 Part 15.249
- FCC CFR 47 Part 15.209
- FCC CFR 47 Part 15.205
- RSS-210 Issue 9
- RSS-Gen Issue 4

**Test Method:**

- ANSI C63.10:2013

**Test Requirement:**

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	dBµV/m	µV/m	dBµV/m
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54
24.0-24.25	250	108	2500	68

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in Rss-Gen Issue 4, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

**Unwanted emissions falling into restricted bands of shall comply with the limits specified below**

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

**FCC PART 15.205-RESTRICTED BANDS OF OPERATION**

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110		16.42-16.423	399.9-410
<sup>1</sup> 0.495-0.505		16.69475-16.69525	608-614
2.1735-2.1905		16.80425-16.80475	960-1240
4.125-4.128		25.5-25.67	1300-1427
4.17725-4.17775		37.5-38.25	1435-1626.5
4.20725-4.20775		73-74.6	1645.5-1646.5
6.215-6.218		74.8-75.2	1660-1710
6.26775-6.26825		108-121.94	1718.8-1722.2
6.31175-6.31225		123-138	2200-2300
8.291-8.294		149.9-150.05	2310-2390
8.362-8.366		156.52475-156.52525	2483.5-2500
8.37625-8.38675		156.7-156.9	2690-2900
8.41425-8.41475		162.0125-167.17	3260-3267
12.29-12.293		167.72-173.2	3332-3339
12.51975-12.52025		240-285	3345.8-3358
12.57675-12.57725		322-335.4	3600-4400
13.36-13.41			( <sup>2</sup> )

\* - note FCC-specific .

Canada-specific frequency ranges in MHz – 3.020-3.026, 5.677–5.683, 121.94-123.0. 149.9-150.05, 162.0125-167.17, 167.72-173.2, 1300-1427, 2483.5-2500, 3500-3600,

**(2) Above 38,6 GHz**

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

**RESTRICTED FREQUENCY BANDS (RSS-GEN ISSUE 4)**

MHz	MHz	GHz
0.090-0.110	240-285	9.0-9.2
2.1735-2.1905	322-335.4	9.3-9.5
3.020-3.026	399.9-410	10.6-12.7
4.125-4.128	608-614	13.25-13.4
4.17725-4.17775	960-1427	14.47-14.5
4.20725-4.20775	1435-1626.5	15.35-16.2
5.677-5.683	1645.5-1646.5	17.7-21.4
6.215-6.218	1660-1710	22.01-23.12
6.26775-6.26825	1718.8-1722.2	23.6-24.0
6.31175-6.31225	2200-2300	31.2-31.8
8.291-8.294	2310-2390	36.43-36.5
8.362-8.366	2655-2900	Above 38.6
8.37625-8.38675	3260-3267	
8.41425-8.41475	3332-3339	
12.29-12.293	3345.8-3358	
12.51975-12.52025	3500-4400	
12.57675-12.57725	4500-5150	
13.36-13.41	5350-5460	
16.42-16.423	7250-7750	
16.69475-16.69525	8025-8500	
16.80425-16.80475		
25.5-25.67		
37.5-38.25		
73-74.6		
74.8-75.2		
108-138		
156.52475-156.52525		
156.7-156.9		

Note: Certain frequency bands listed in Table 3 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200- and 300- series RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

**Test Setup:**

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 902-928 MHz and 2400-2483.5 MHz bands were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

**Measurement Method:**

ANSI C63.10:2013 radiated emissions procedure was followed to demonstrate the compliance of Bluetooth low energy.

**Modifications:**

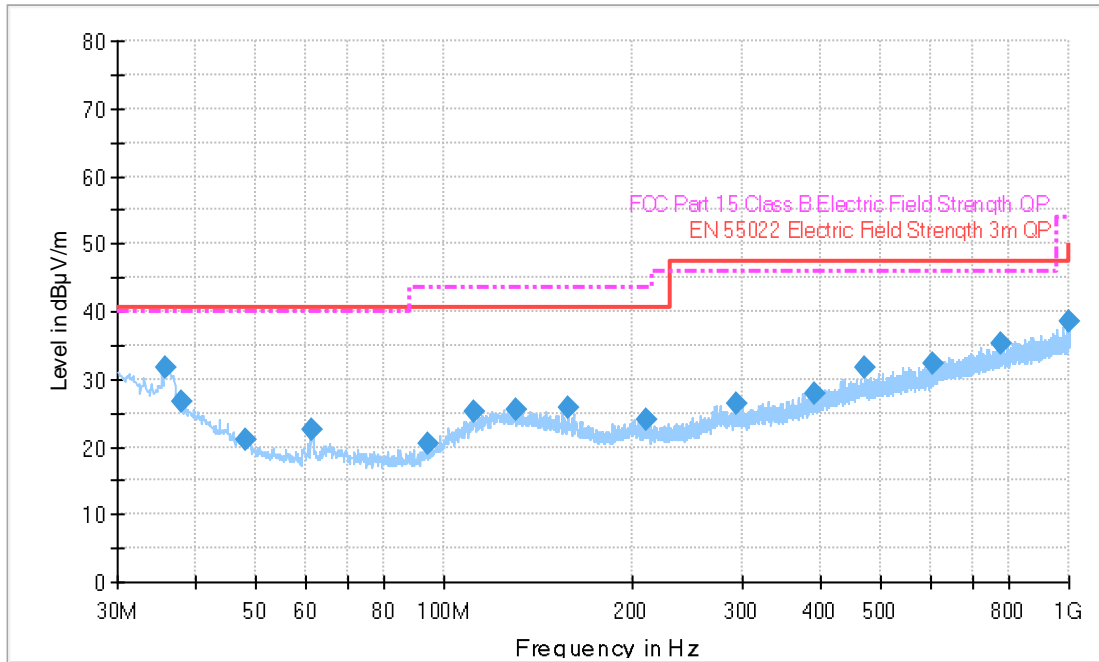
No modification was required to comply for this test.

**Final Result:**

Harmonics field strength were below the noise floor and were not included in this report.

The EUT complies with the applicable standard.

**Measurement Data and Plot:**



**Plot 1: TX Mode (High Channel) – Radiated Emissions: 30-1000MHz**

*Note: Quasi-peaks were 20dB or greater below the limit line and were not included in this report.*



**Table 1: TX Mode (Low Channel) – Field Strength of Fundamental**

Freq. (MHz)	Raw Pk (dBuV/m)	Raw Ave. (dBuV/m)	Ant. Pol. (V/H)	Turn-table (degree)	Ant Ht (cm)	Ant factor (dB/m)	System Loss/Gain (dB)	Corr. Pk (dBuV/m)	Corr. Ave. (dBuV/m)	Peak Limit (dBuV/m)	Ave Limit (dBuV/m)	Peak Margin (dB)	Ave. Margin (dB)
2402	46	31.9	V	80	200	32.5	3.4	81.9	67.8	114	94	32.1	26.2
2402	52.7	38.2	H	100	174	32.5	3.4	88.6	74.1	114	94	25.4	19.9

**Table 2: TX Mode (Mid Channel) – Field Strength of Fundamental**

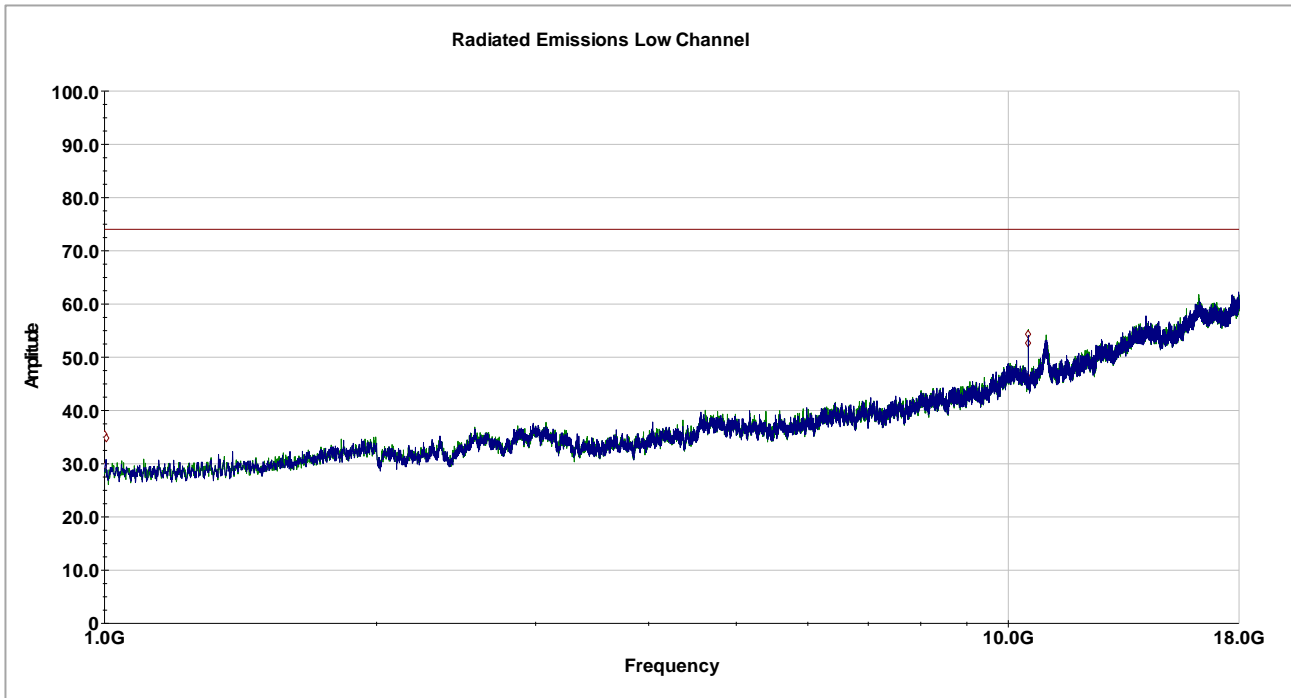
Freq. (MHz)	Raw Pk (dBuV/m)	Raw Ave. (dBuV/m)	Ant. Pol. (V/H)	Turn-table (degree)	Ant Ht (cm)	Ant factor (dB/m)	System Loss/Gain (dB)	Corr. Pk (dBuV/m)	Corr. Ave. (dBuV/m)	Peak Limit (dBuV/m)	Ave Limit (dBuV/m)	Peak Margin (dB)	Ave. Margin (dB)
2440	47.6	33.3	V	230	320	32.5	3.3	83.4	69.1	114	94	30.6	24.9
2440	51.8	37.4	H	200	220	32.5	3.3	87.6	73.2	114	94	26.4	20.8

**Table 3: TX Mode (High Channel) – Field Strength of Fundamental**

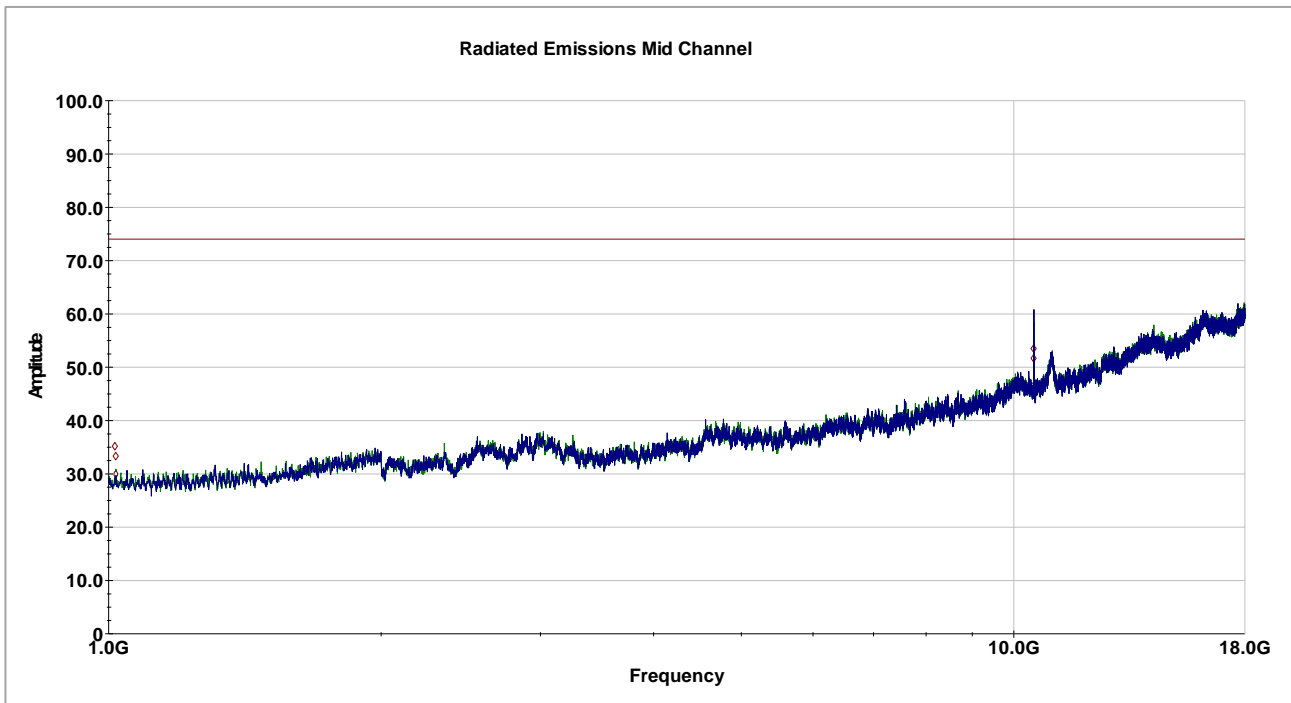
Freq. (MHz)	Raw Pk (dBuV/m)	Raw Ave. (dBuV/m)	Ant. Pol. (V/H)	Turn-table (degree)	Ant Ht (cm)	Ant factor (dB/m)	System Loss/Gain (dB)	Corr. Pk (dBuV/m)	Corr. Ave. (dBuV/m)	Peak Limit (dBuV/m)	Ave Limit (dBuV/m)	Peak Margin (dB)	Ave. Margin (dB)
2480	47.7	33.7	V	200	320	32.5	3.5	83.7	69.7	114	94	30.3	24.3
2480	52.4	38.1	H	200	220	32.5	3.5	88.4	74.1	114	94	25.6	19.9

**Table 4: Peak Power Measurement**

Channel	Freq. (MHz)	Peak Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
Low	2402	-0.18	0.07	-0.11
Mid	2446	-0.36	0.07	-0.29
High	2480	-0.48	0.07	-0.41



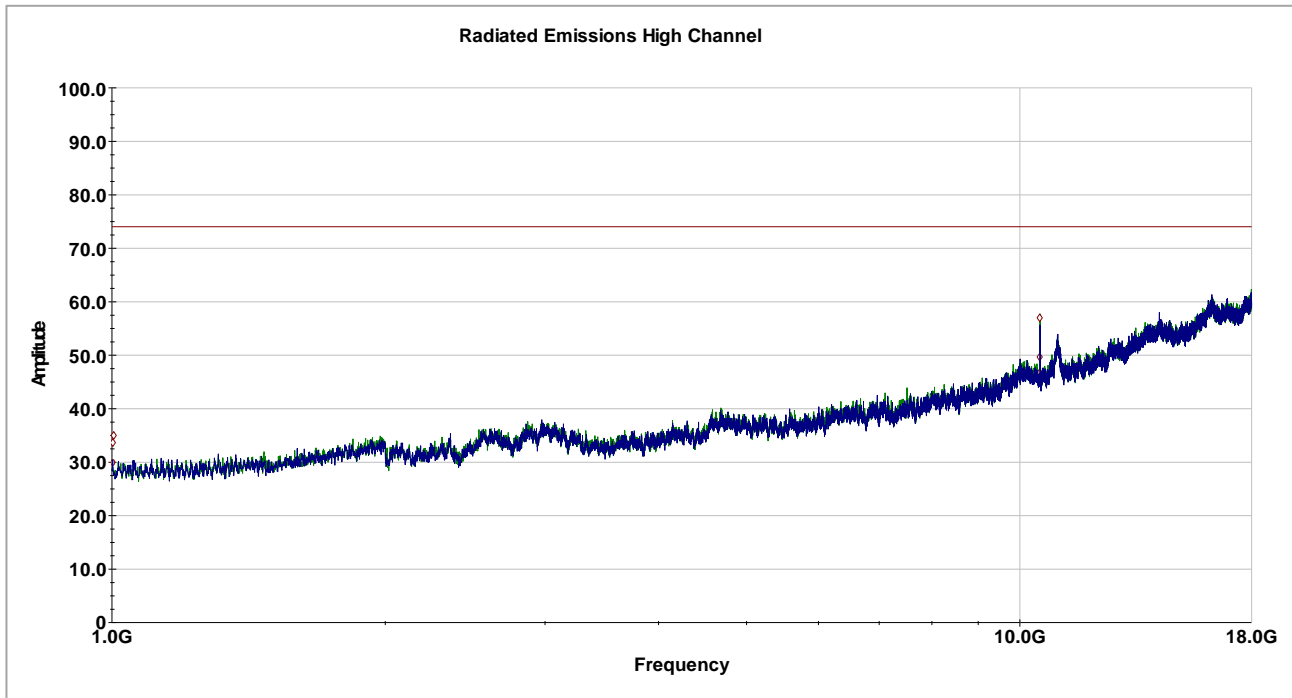
**Plot 2: TX Mode (Low Channel) – Radiated Emissions**



**Plot 3: TX Mode (Mid Channel) – Radiated Emissions**

*Note 1: Notch filter was used to suppress fundamental frequency.*

*Note 2: Harmonic emissions data were 20dB or greater below the limit line and were not included in this report.*



**Plot 4: TX Mode (High Channel) – Radiated Emissions**

*Note 1: Notch filter was used to suppress fundamental frequency.*

*Note 2: Harmonic emissions data were 20dB or greater below the limit line and were not included in this report.*

### 3.3 20dB Occupied Bandwidth

**Date Performed:**

January 25, 2017

**Test Standard:**

- FCC CFR 47 Part 15.247
- RSS-247 Issue 1
- RSS-Gen Issue 4

**Test Method:**

- ANSI C63.10-2013

**Test Requirement:**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, 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 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW.

**Test Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

**Measurement Method:**

As called in ANSI C63.10-2013.

**Modifications:**

No modification was required to comply for this test.

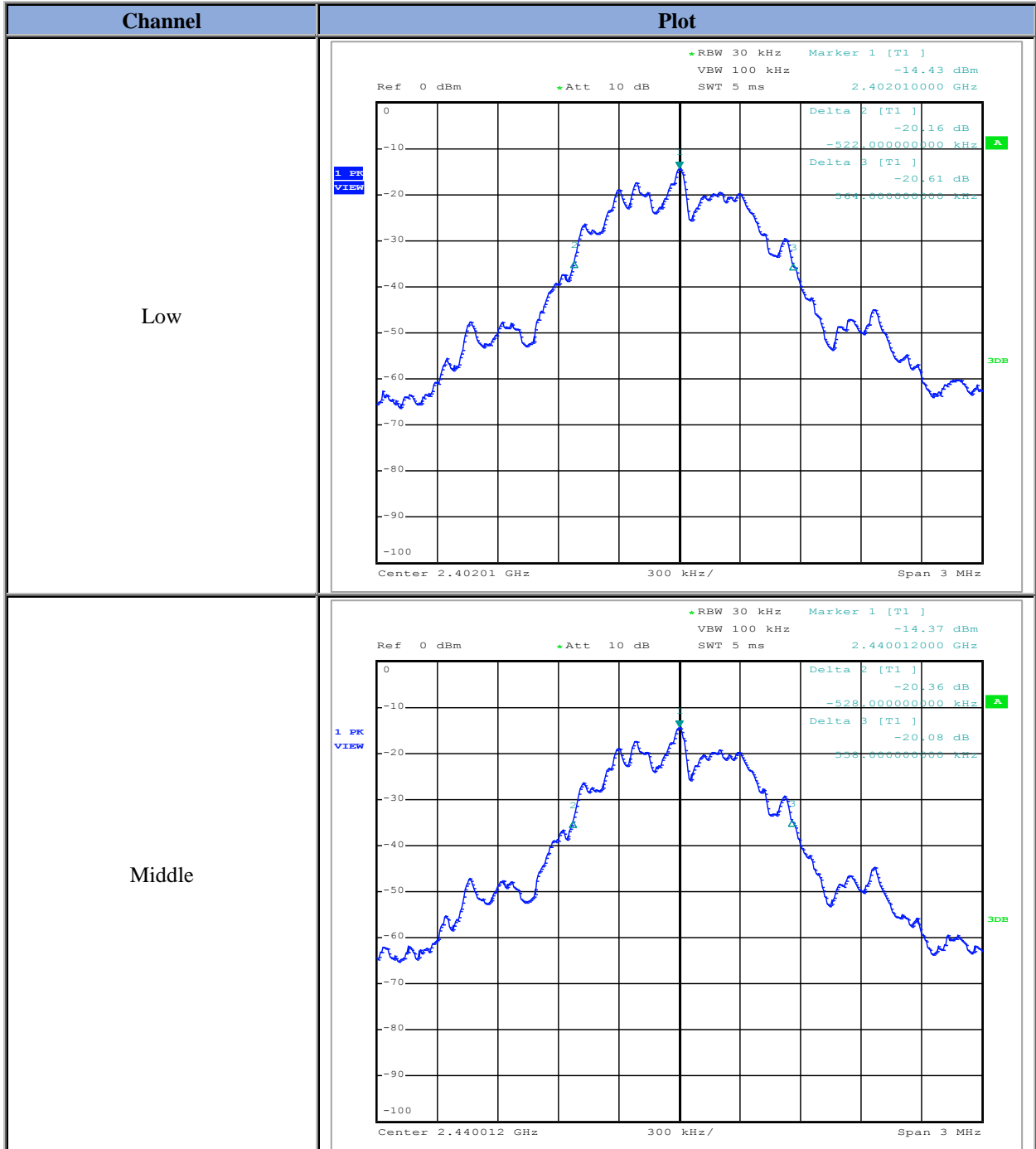
**Final Result:**

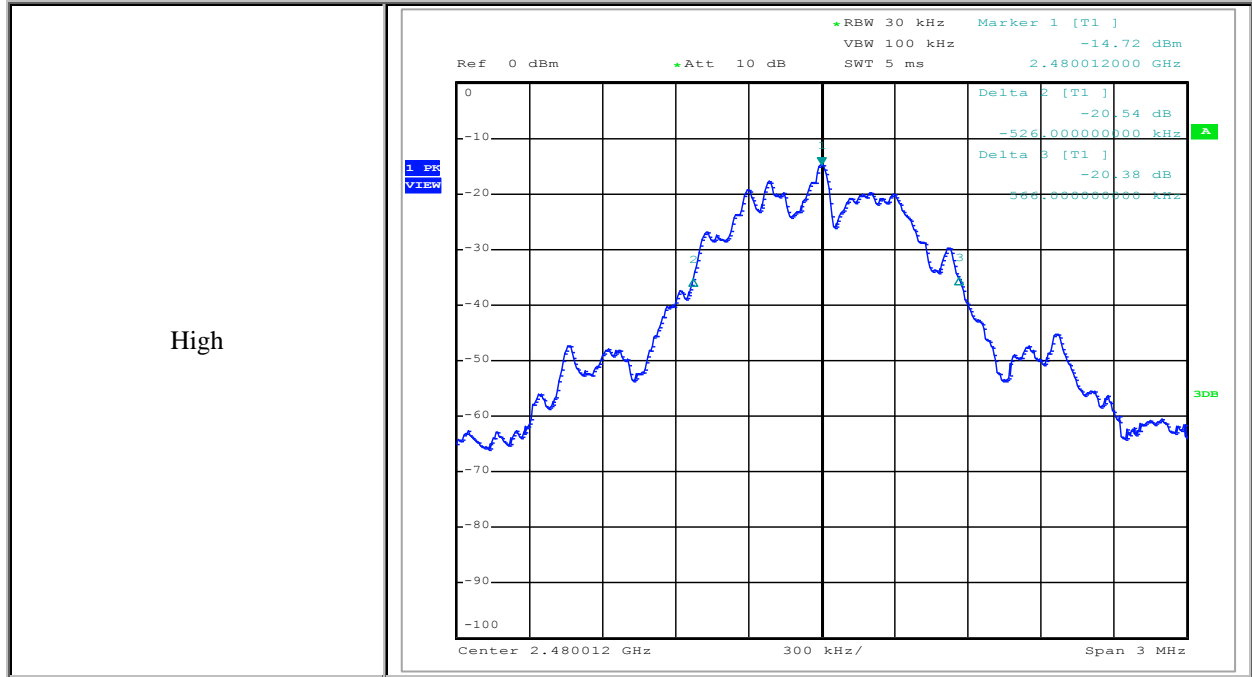
The EUT complies with the applicable standard.

**Measurement Data and Plot:**

**Table 5: 20dB Occupied Bandwidth Data**

Channel	Frequency (MHz)	20dB OBW (kHz)
Low	2402	686
Middle	2440	658
High	2480	692





**Plot 5: 20dB Occupied Bandwidth Plot**

## 3.4 99% Occupied Bandwidth

### Date Performed:

January 25, 2017

### Test Standard:

- FCC CFR 47 Part 15.247
- RSS-247 Issue 1
- RSS-Gen Issue 4

### Test Method:

- ANSI C63.10-2013

### Test Setup:

**RSS-Gen Issue 4: Section 6.6** – A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

### Measurement Method:

As called in ANSI C63.10-2013.

### Modifications:

No modification was required to comply for this test.

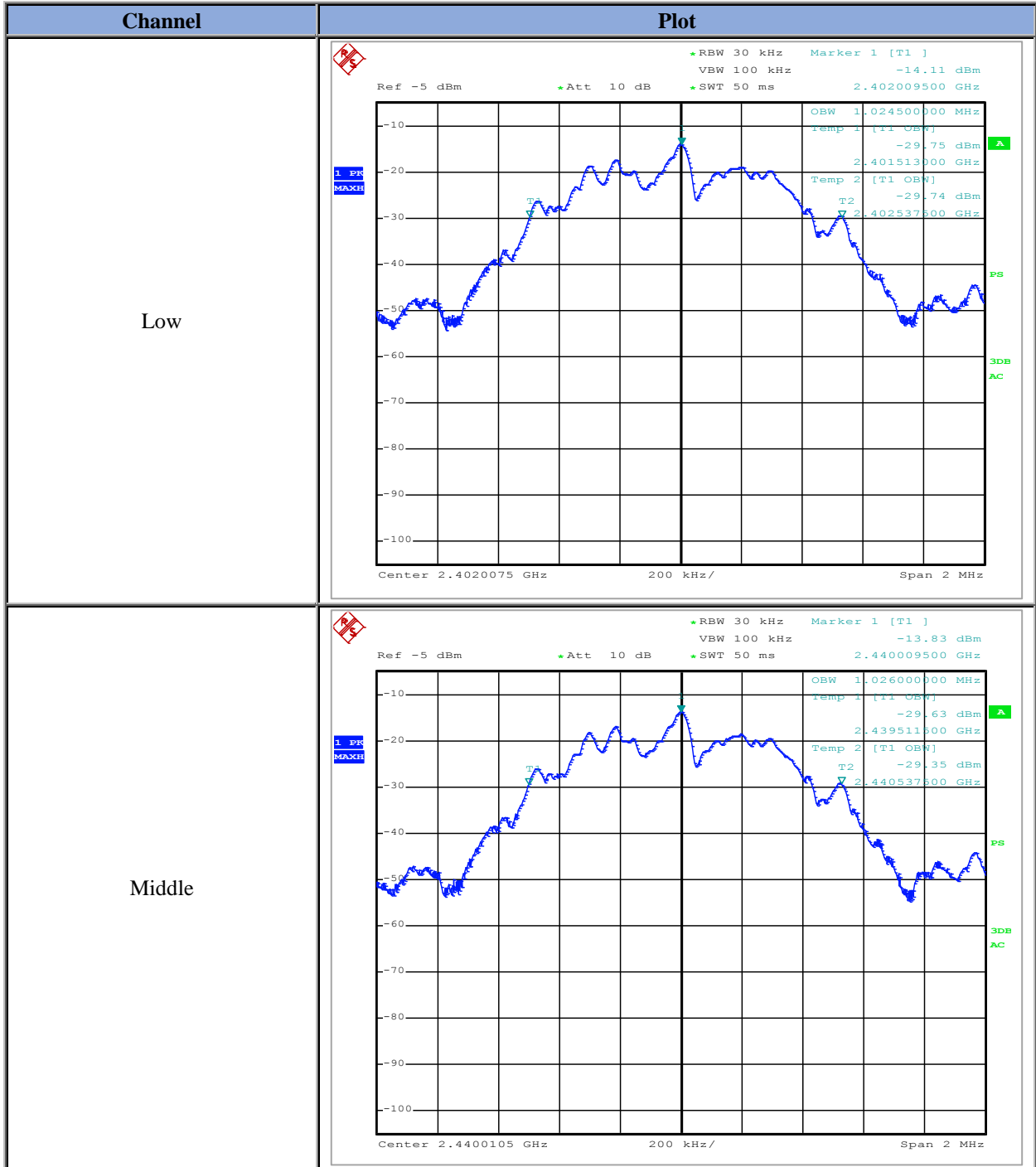
### Final Result:

The EUT complies with the applicable standard.

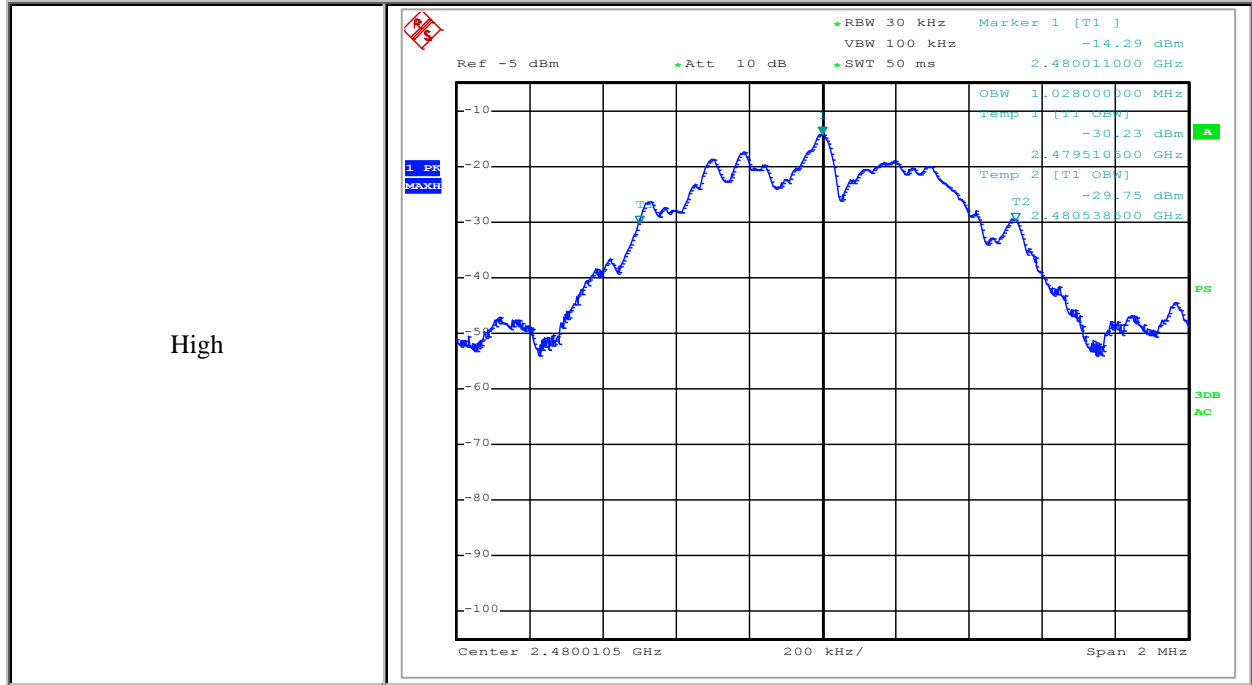
**Measurement Data and Plot:**

**Table 6: 99% Occupied Bandwidth Data**

Channel	Frequency (MHz)	99% OBW (MHz)
Low	2402	1.024
Middle	2440	1.026
High	2480	1.028







**Plot 6: 99% Occupied Bandwidth Plot**

## 3.5 Band Edge

### **Date Performed:**

January 25, 2017

### **Test Standard:**

- FCC CFR 47 Part 15.249
- RSS-210 Issue 9

### **Test Method:**

- ANSI C63.10-2013

### **Test Requirement:**

As per §15.249(d):

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

As per RSS-210 F.1(e):

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

### **Test Setup:**

The antenna port of EUT was directly connected to a spectrum analyzer.

### **Measurement Method:**

The measurement method used was Section 6.10.6.2 Marker-delta Method of ANSI C63.10-2013 standard.

### **Modifications:**

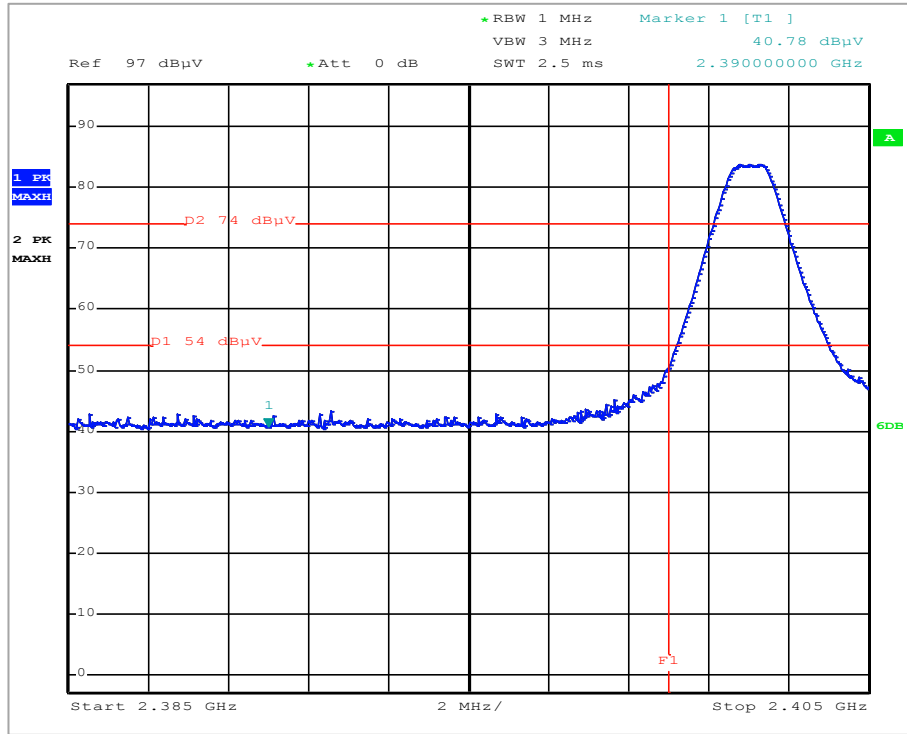
No modification was required to comply for this test.

### **Final Result:**

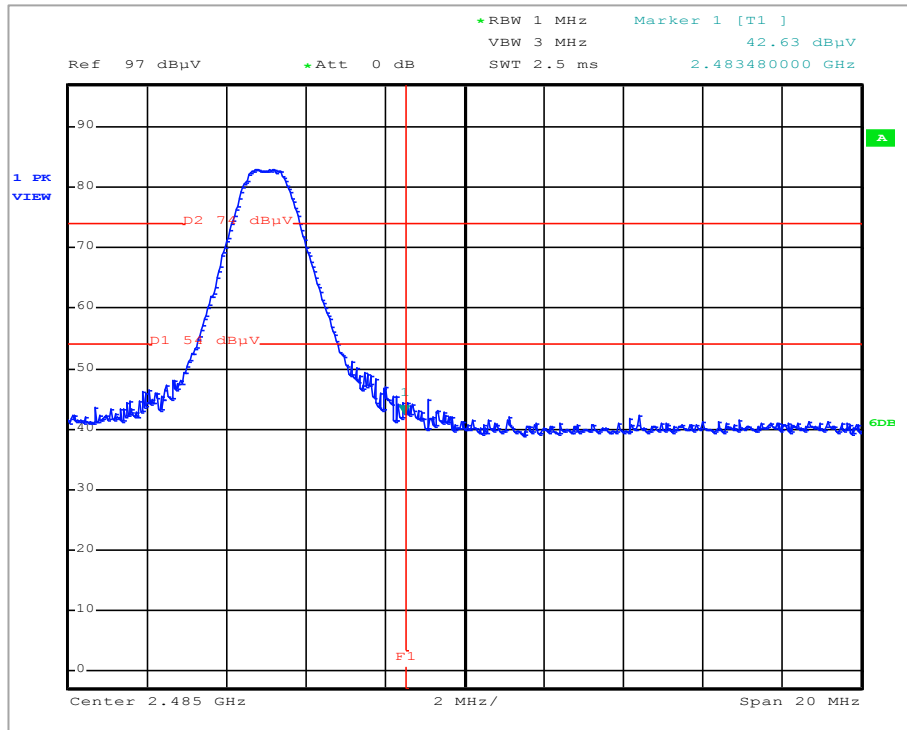
The EUT complies with the applicable standard.

**Measurement Data and Plot:**

**Radiated Band Edge 3m:**



**Plot 7: Radiated Band Edge Plot – Low Side**



**Plot 8: Radiated Band Edge Plot – High Side**

### 3.6 Unintentional Radiated Emissions

**Date Performed:**

December 20, 2016

**Test Standard:**

- FCC CFR 47 Part 15.209
- ICES-003 Issue 6
- RSS-Gen Issue 4

**Test Method:**

- ANSI C63.4-2014

**Test Requirement:**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in Rss-Gen Issue 4, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Unwanted emissions falling into restricted bands of shall comply with the limits specified below

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

**Test Setup:**

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

**Measurement Method:**

Measurements were made using spectrum analyser and receiver, 200Hz RBW average detector for the frequency range 9-150KHz; 9kHz RBW average detector for the Frequency range 150kHz to 30MHz; 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters.

The measurement results are obtained as described below:

$$E \text{ [dB}\mu\text{V/m]} = \text{Un-Corrected Value} + \text{ATOT}$$

Where ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

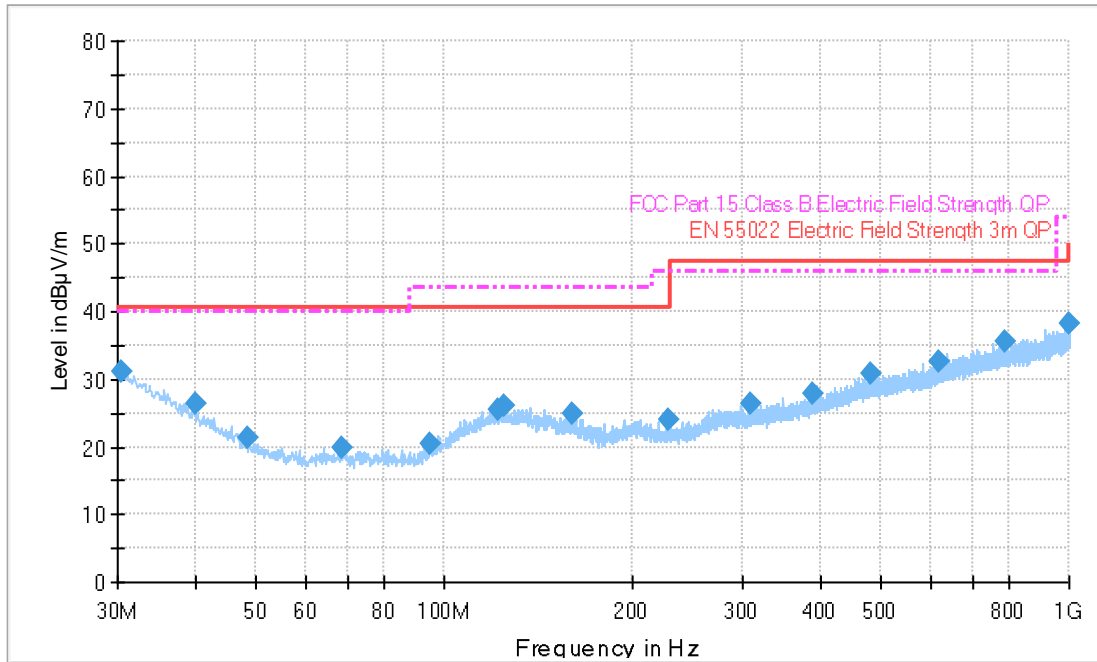
**Modifications:**

No modification was required to comply for this test.

**Final Result:**

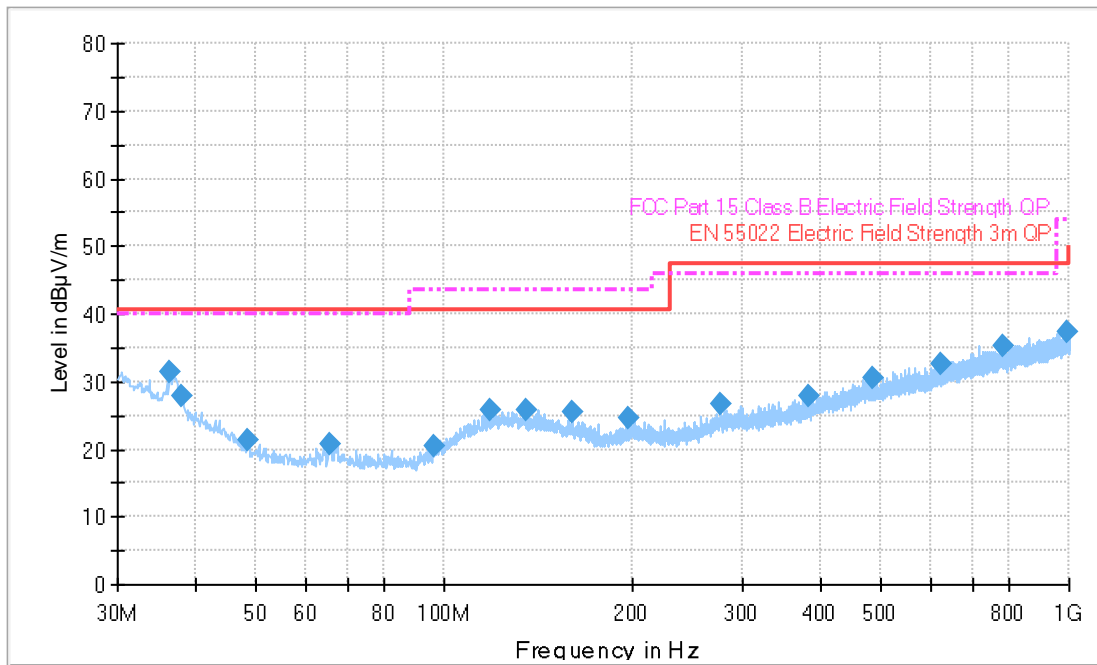
The EUT complies with the applicable standard.

**Measurement Data and Plot:**



**Plot 9: Radiated Spurious Emissions: 30-1000MHz (Standby Mode)**

*Note: Quasi-peaks were 20dB or greater below the limit line and were not included in this report.*



**Plot 10: Radiated Spurious Emissions: 30-1000MHz (Charge Mode)**

*Note: Quasi-peaks were 20dB or greater below the limit line and were not included in this report.*

### 3.7 AC Mains Conducted Emissions

**Date Performed:**

January 20, 2017

**Test Standard:**

- FCC CFR 47 Part 15.207
- ICES-003 Issue 6
- RSS-Gen Issue 4

**Test Method:**

- ANSI C63.4-2014

**Test Requirement:**

Class B Limit:

Frequency (MHz)	Conducted Limit	
	(dBµV)	
	Quasi-Peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30	60	50

*Note 1: The lower limit shall apply at the transition frequencies*  
*Note 2: The limit decreases linearly with the logarithm of the frequency in the 0.15 to 30 MHz*

**Test Setup:**

The EUT was connected to the conducted emissions LISN apparatus.

**Measurement Method:**

Measurements were made using a test receiver with 9 kHz bandwidth, CISPR Quasi-Peak and Average detector.

**Modifications:**

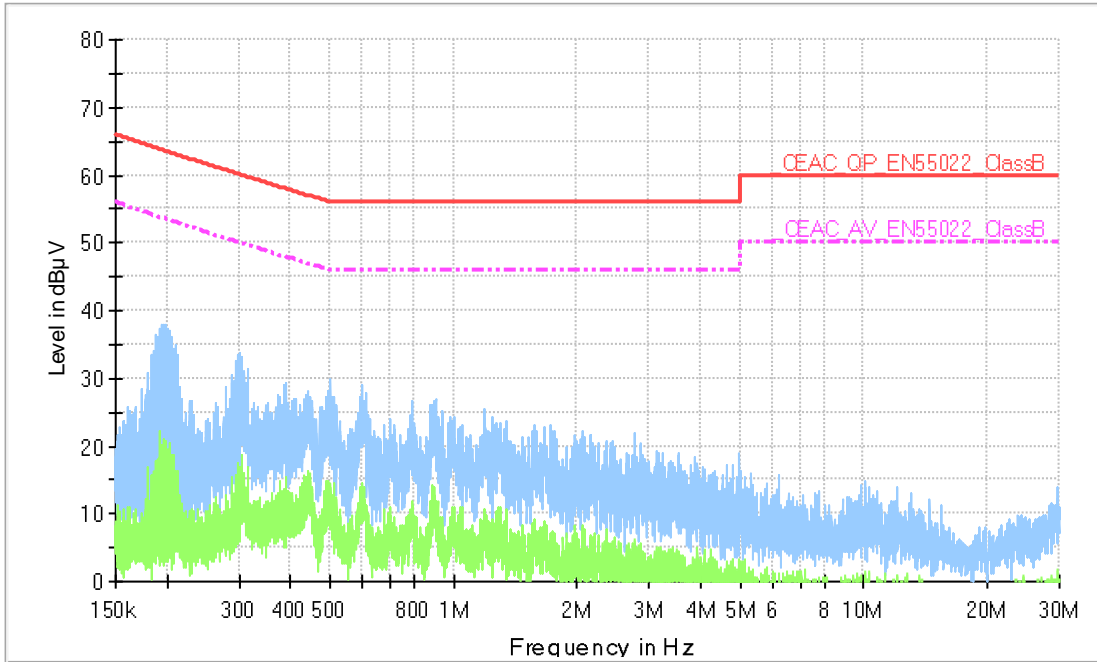
No modification was required to comply for this test.

**Final Result:**

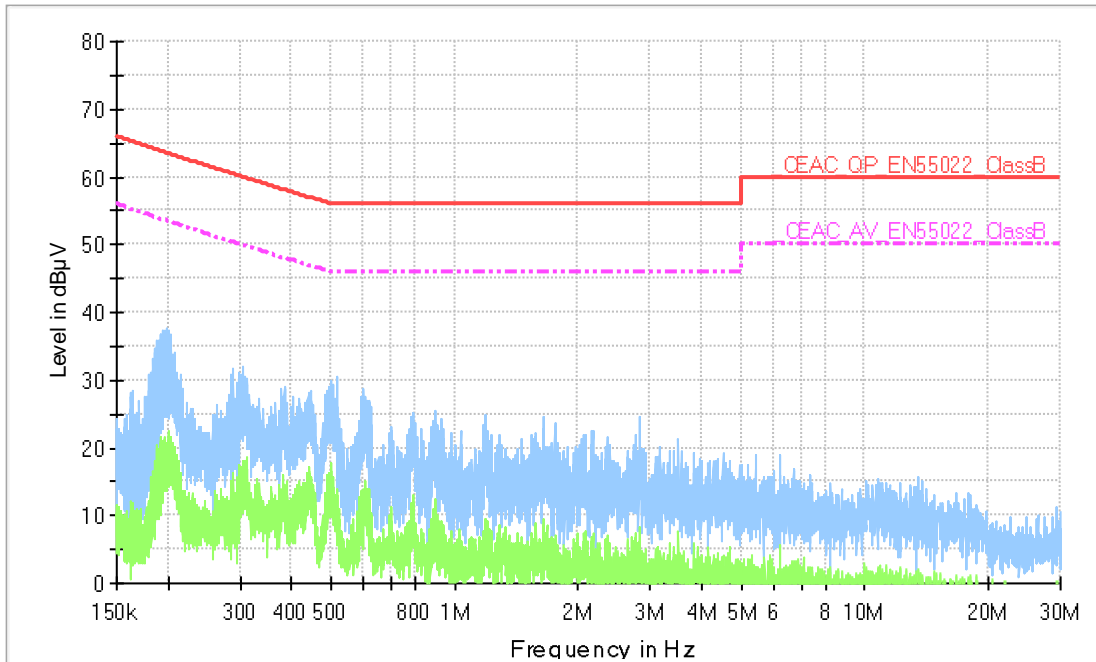
The EUT complies with the applicable standard.



**Measurement Data and Plot:**

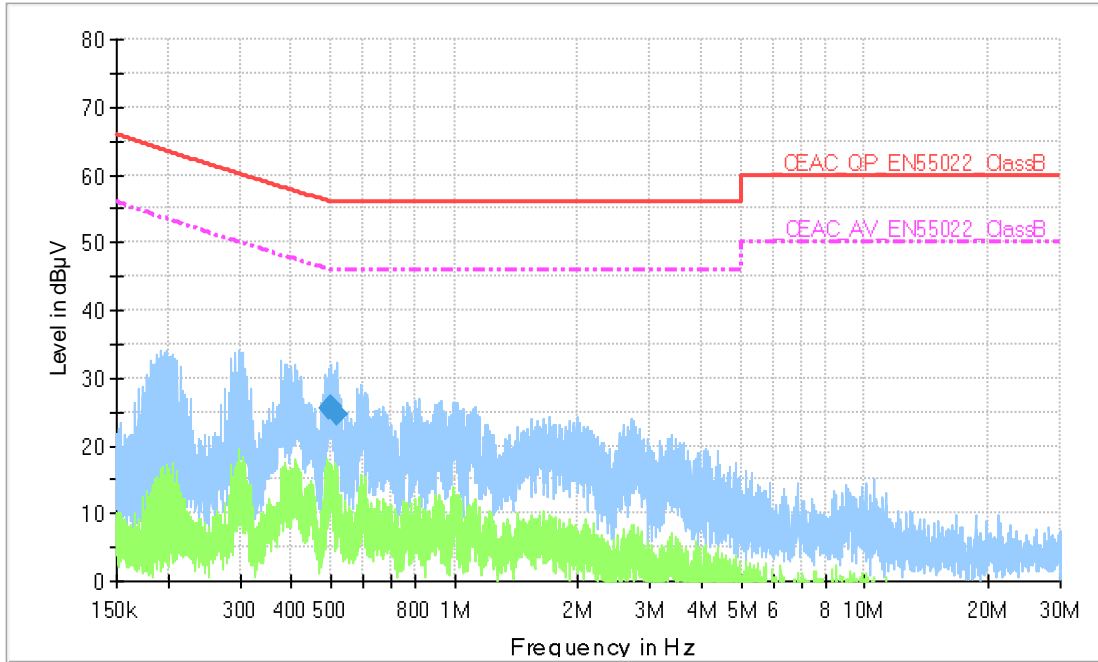


**Plot 11: AC Mains Conducted Emissions – Line 1, 120Vac/60Hz**

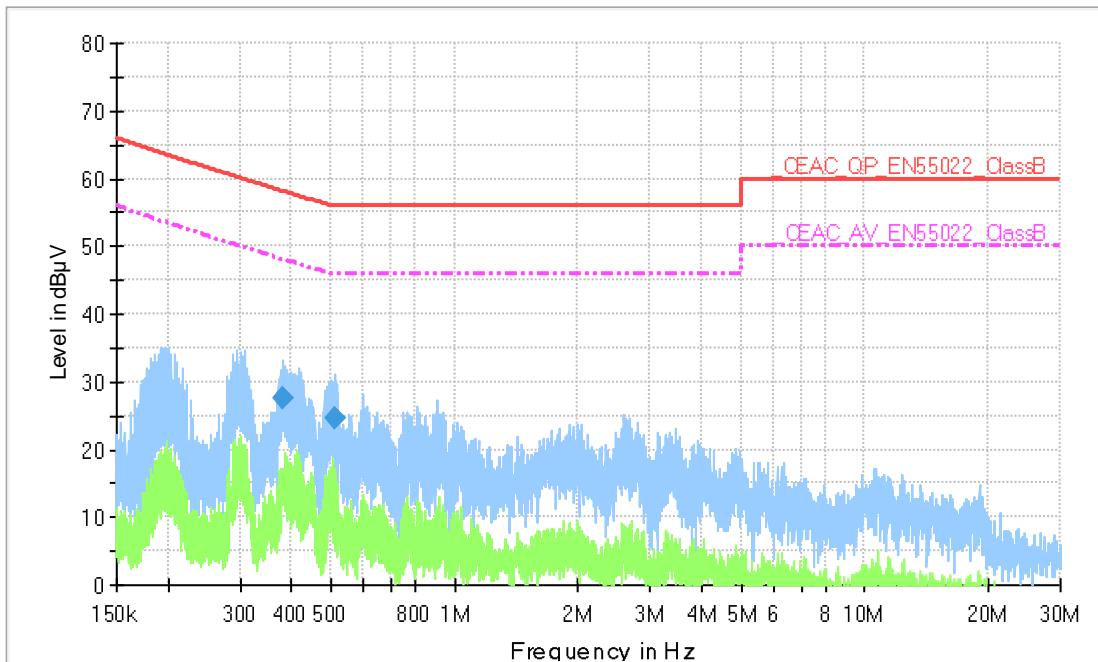


**Plot 12: AC Mains Conducted Emissions – Line 2, 120Vac/60Hz**

*Note: Emissions data were below the limit line by 20dB or greater and were not included in this report.*



**Plot 13: AC Mains Conducted Emissions – Line 1, 230Vac/50Hz**



**Plot 14: AC Mains Conducted Emissions – Line 2, 230Vac/50Hz**

*Note: Emissions data were below the limit line by 20dB or greater and were not included in this report.*

### 3.8 Frequency Stability

**Date Performed:**

January 27, 2017

**Test Standard:**

- FCC CFR 47 Part 15.215
- RSS-Gen Issue 4

**Test Method:**

- ANSI C63.10-2013

**Test Setup:**

**FCC (15.215(c)):** The 20dB bandwidth must remain within the designated frequency band over the expected variations in temperature and voltage range.

**Rss-Gen Issue 4 (8.8):** Transmitter frequency stability for licence-exempt radio apparatus shall be measured in accordance with Section 6.11. For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F) instead of at the temperatures specified in Section 6.11. If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz.

**Modifications:**

No modification was required to comply for this test.

**Performance:**

Complies with the applicable standard.

**Measurement Data and Plot:**

**Table 7: Frequency Stability Data**

Temperature (°C)	Channel	Frequency (MHz)	Offset (MHz)	PPM
20	Low	2402.080	-	-
	Mid	2440.000	-	-
	High	2480.000	-	-
-40	Low	2402.040	-0.040	-40000
	Mid	2440.040	0.040	40000
	High	2480.040	0.040	40000
85	Low	2402.040	-0.040	-40000
	Mid	2440.040	0.040	40000
	High	2480.040	0.040	40000

### 3.9 RF Exposure Evaluation

**Date Performed:**

February 17, 2017

**Test Standard:**

- FCC KDB 447498 D01 Clause 4.3.1
- RSS-102 Section 2.5.1

**Host Product:**

Internal Product Name: Readiband 4C  
Model: FSRB4C

**EUT Identifier:**

The host product contains information:

Product	FCC ID	IC ID	Model #	Manufacturer
Readiband 4C	XVL-FSRB4C	8707A-RB4C	FSRB4C	Fatigue Science

**Antenna Description:**

Description	Manufacturer	Model #	Antenna Gain	Type
On board antenna	Fatigue Science	FSRB4C	0.07dBi	On board antenna PCB monopole

**Bluetooth Low Energy (BLE) RF Exposure Evaluation:**

As per RSS-102 Section 2.5.1, SAR Evaluation is exempted if minimum distance is  $\leq 5$  mm and the output power is less than 4mW at frequencies below 2450MHz to 1900 MHz

Frequency (MHz)	Peak Output Power (dBm)	Max Gain (dBi)	EIRP (dBm)	EIRP (mW)
2402	-0.18	0.07	-0.11	0.975

Device EIRP is less than 4mW and is exempted from SARS evaluation as required by RSS-102.

As per FCC KDB 447498 D01 General RF Exposure Guidance v06(Clause 4.3.1) for 100 MHz to 6 GHz and test separation distances  $\leq 50$  mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR, and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz

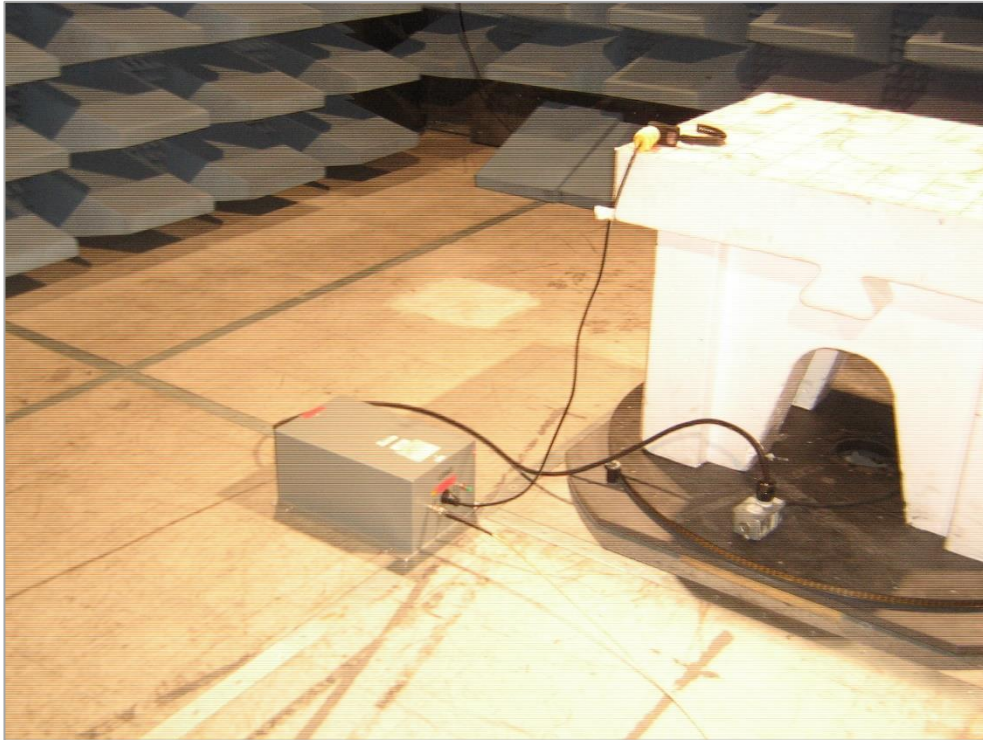
The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

The device is normally worn on the wrist where the separation distance is less than 5mm

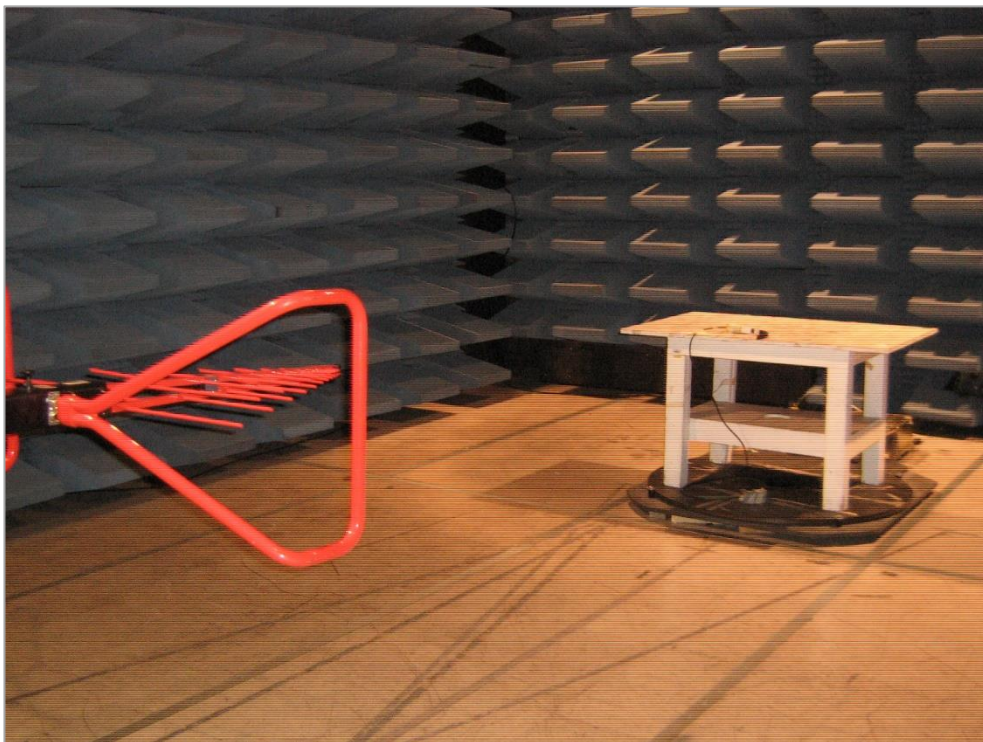
As per above equation:  $\left(\frac{0.975 \text{ mW}}{5 \text{ mm}}\right) * (\sqrt{2.402 \text{ GHz}}) = 0.302$  which less than 3.0.

This unit meets the SARS exclusion as defined in FCC KDB 447498 D01.

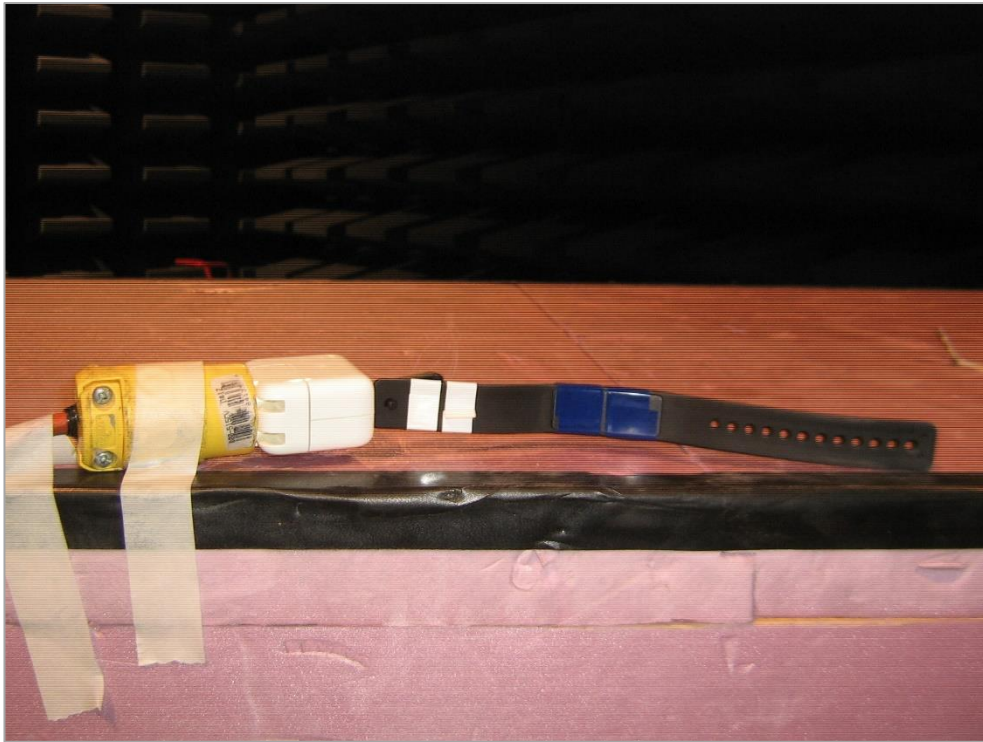
## Appendix A: TEST SETUP PICTURES



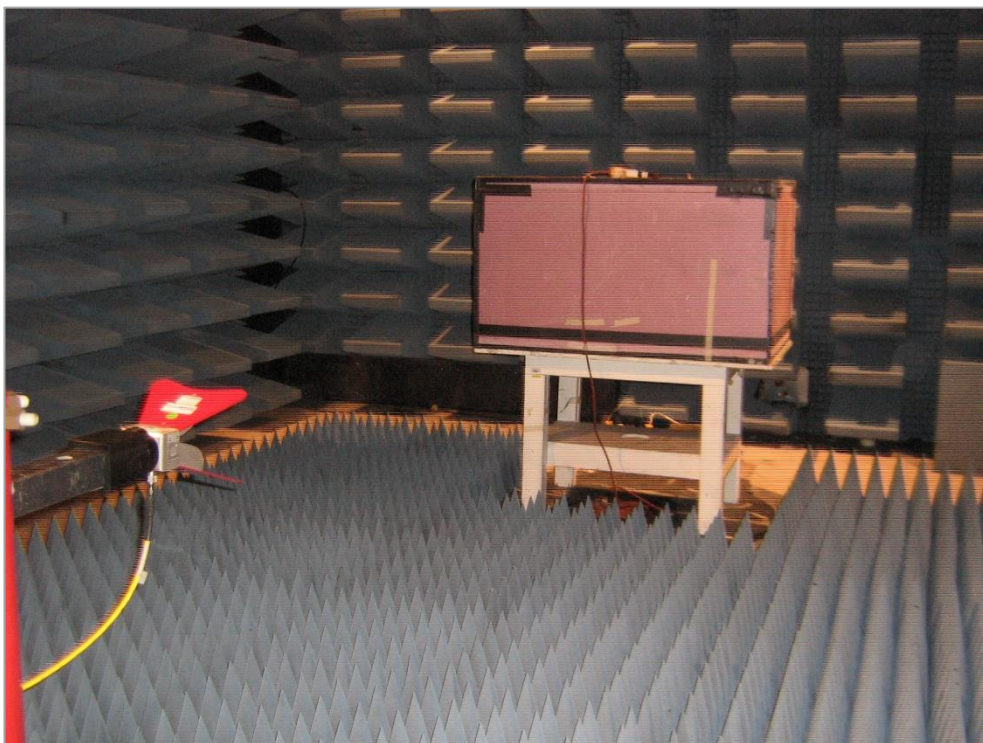
**Figure 1: Conducted Emissions Test Setup**



**Figure 2: Radiated Emissions (below 1GHz) Test Setup**



**Figure 3: Radiated Emissions (above 1GHz close-up view) Test Setup**



**Figure 4: Radiated Emissions (above 1GHz) Test Setup**

## Appendix B: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
DC	Direct Current
E.I.R.P.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EUT	Equipment Under Test
FCC	Federal Communications Commission
IC	Industry Canada
ICES	Interference-Causing Equipment Standard
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
RSS	Radio Standards Specifications
SAC	Semi-Anechoic Chamber



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**END OF REPORT**