

# ReelSonar

## TEST REPORT FOR

**iBobber Bluetooth Scale  
Model: RS115**

**Tested to The Following Standards:**

**FCC Part 15 Subpart C Section: 15.249**

**Report No.: 100524-5**

**Date of issue: January 16, 2018**



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

## TABLE OF CONTENTS

|   |    |
|---|----|
| Administrative Information .....                    | 3  |
| Test Report Information .....                       | 3  |
| Report Authorization .....                          | 3  |
| Test Facility Information .....                     | 4  |
| Software Versions .....                             | 4  |
| Site Registration & Accreditation Information ..... | 4  |
| Summary of Results .....                            | 5  |
| Modifications During Testing.....                   | 5  |
| Conditions During Testing.....                      | 5  |
| Equipment Under Test.....                           | 6  |
| General Product Information.....                    | 6  |
| FCC Part 15 Subpart C .....                         | 7  |
| 15.215(c) Occupied Bandwidth (20dB BW) .....        | 7  |
| 15.249(a) Field Strength of Fundamental .....       | 10 |
| 15.249(a) Radiated Emissions and Band Edge .....    | 17 |
| Supplemental Information .....                      | 34 |
| Measurement Uncertainty .....                       | 34 |
| Emissions Test Details.....                         | 34 |

## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

ReelSonar  
2316 Eastlake Ave E  
Seattle, WA 98102

Representative: Alex Lebedev  
Customer Reference Number: 17-027

**DATE OF EQUIPMENT RECEIPT:****DATE(S) OF TESTING:****REPORT PREPARED BY:**

Dianne Dudley  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 100524

December 29, 2017

December 29, 2017

January 4-5, 2018

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink, reading "Steve Behm", is written over a horizontal line.

**Steve Behm**  
**Director of Quality Assurance & Engineering Services**  
**CKC Laboratories, Inc.**

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
Canyon Park  
22116 23rd Drive SE, Suite A  
Bothell, WA 98021

## Software Versions

| CKC Laboratories Proprietary Software | Version |
|---------------------------------------|---------|
| EMITest Emissions                     | 5.03.02 |
| EMITest Emissions                     | 5.03.11 |

## Site Registration & Accreditation Information

| Location                   | NIST CB # | TAIWAN         | CANADA  | FCC    | JAPAN  |
|----------------------------|-----------|----------------|---------|--------|--------|
| Canyon Park<br>Bothell, WA | US0081    | SL2-IN-E-1145R | 3082C-1 | US1022 | A-0148 |

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 15 Subpart C - 15.249

| Test Procedure | Description                               | Modifications | Results         |
|----------------|---|---------------|-----------------|
| 15.215(c)      | Occupied Bandwidth                        | NA            | PASS            |
| 15.249(a)      | Field Strength of Fundamental             | NA            | PASS            |
| 15.249(a)      | Radiated Spurious Emissions and Band Edge | NA            | PASS            |
| 15.207         | AC Conducted Emissions                    | NA            | NA <sup>1</sup> |

NA = Not Applicable

NA<sup>1</sup> = Not Applicable because the EUT is battery powered.

## Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

| Summary of Conditions                      |
|--|
| No modifications were made during testing. |
|  |

Modifications listed above must be incorporated into all production units.

## Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

| Summary of Conditions |
|-----------------------|
| None                  |
|                       |

## EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 1

#### *Equipment Tested:*

| Device                  | Manufacturer | Model # | S/N |
|-------------------------|--------------|---------|-----|
| iBobber Bluetooth Scale | ReelSonar    | RS115   | 6   |

#### *Support Equipment:*

| Device | Manufacturer | Model # | S/N |
|--------|--------------|---------|-----|
| NA     |              |         |     |

## General Product Information:

| Product Information                | Manufacturer-Provided Details |
|------------------------------------|-------------------------------|
| Equipment Type:                    | Stand-Alone Equipment         |
| Modulation Type(s):                | GFSK                          |
| Maximum Duty Cycle:                | 100%                          |
| Antenna Type(s) and Gain:          | Trace, -6 dBi                 |
| Antenna Connection Type:           | Integral                      |
| Nominal Input Voltage:             | Battery Powered (3V)          |
| Firmware / Software used for Test: | TI Btool v1.40.15             |

## FCC Part 15 Subpart C

### 15.215(c) Occupied Bandwidth (20dB BW)

#### Test Setup/Conditions

|                |                    |                |                 |
|----------------|--------------------|----------------|-----------------|
| Test Location: | Canyon Park Lab C2 | Test Engineer: | Steve Pittsford |
| Test Method:   | ANSI C63.10 (2013) | Test Date(s):  | 1/5/2018        |
| Configuration: | 1                  |                |                 |

#### Environmental Conditions

|                  |    |                        |    |
|------------------|----|------------------------|----|
| Temperature (°C) | 22 | Relative Humidity (%): | 30 |
|------------------|----|------------------------|----|

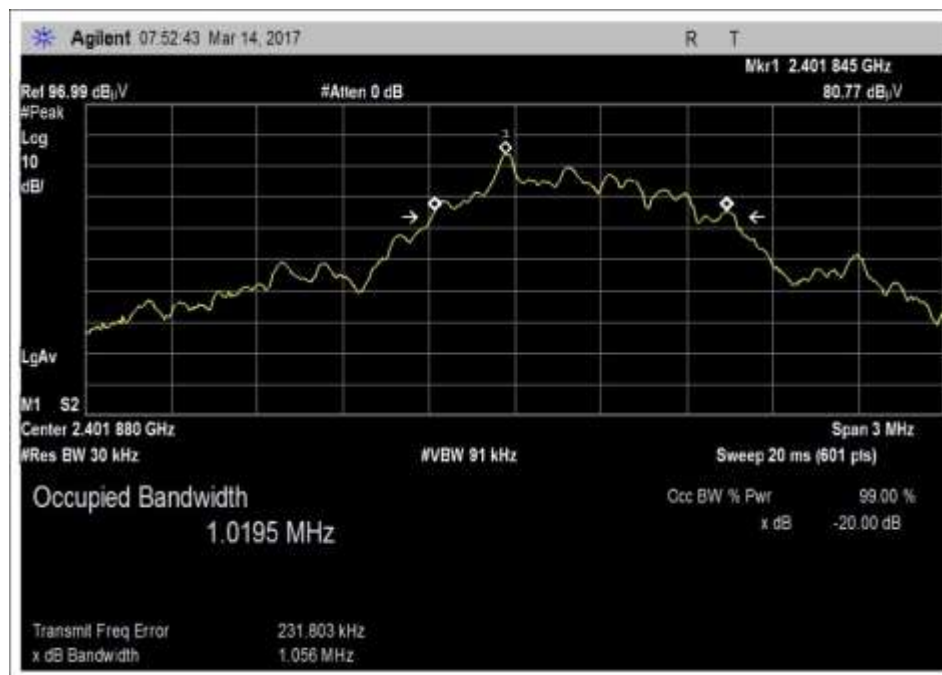
#### Test Equipment

| Asset# | Description                        | Manufacturer   | Model   | Cal Date   | Cal Due    |
|--------|------------------------------------|----------------|---------|------------|------------|
| P05464 | Cable                              | Andrews        | Heliast | 11/22/2017 | 11/22/2019 |
| 02872  | Spectrum Analyzer                  | Agilent        | E4440A  | 11/3/2017  | 11/3/2019  |
| 00966A | Near Field Probe Set - Sniffer Kit | Electrometrics | EHFP-30 | 3/30/2016  | 3/30/2018  |

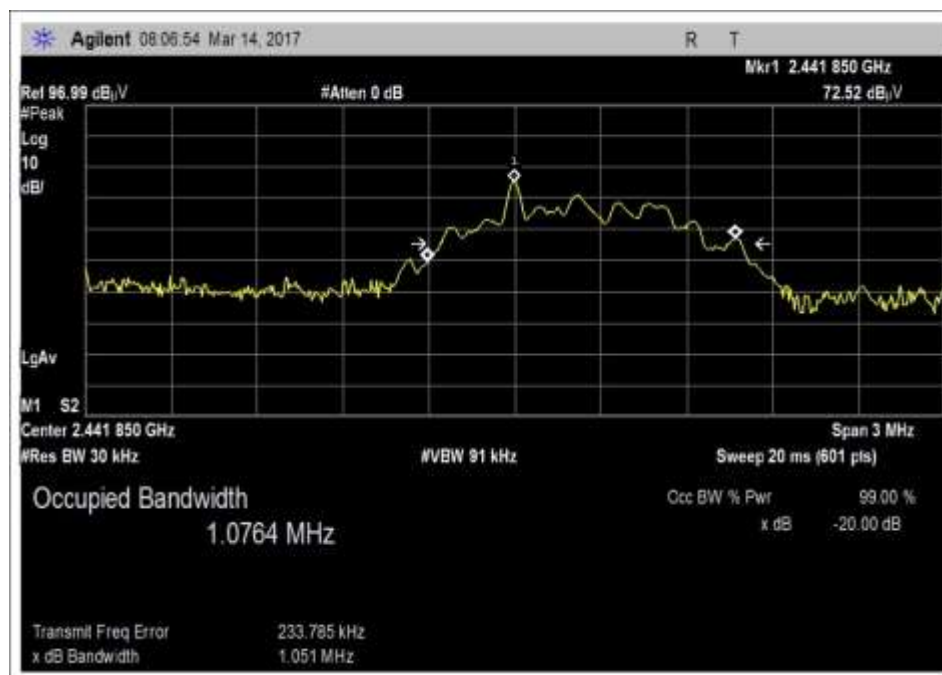
#### Test Data Summary

| Frequency (MHz) | Antenna Port | Modulation | Measured (kHz) | Limit (kHz)      | Results |
|-----------------|--------------|------------|----------------|------------------|---------|
| 2402            | 1            | GFSK       | 1.056          | Stay within band | Pass    |
| 2442            | 1            | GFSK       | 1.051          | Stay within band | Pass    |
| 2480            | 1            | GFSK       | 1.043          | Stay within band | Pass    |

Plot(s)

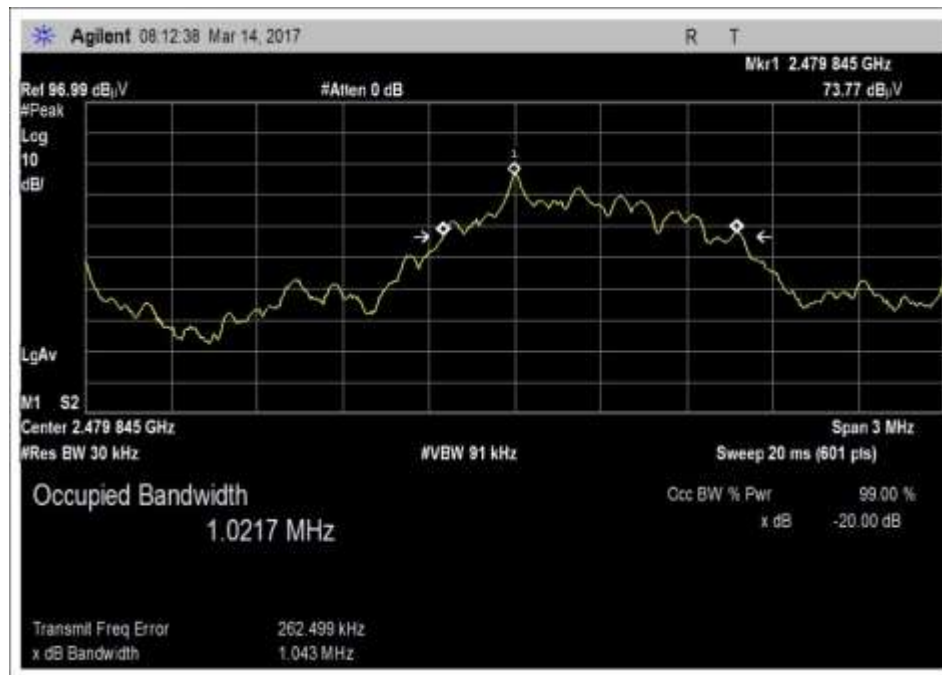


OBW Low



OBW Middle





OBW High

### Test Setup Photo(s)



## 15.249(a) Field Strength of Fundamental

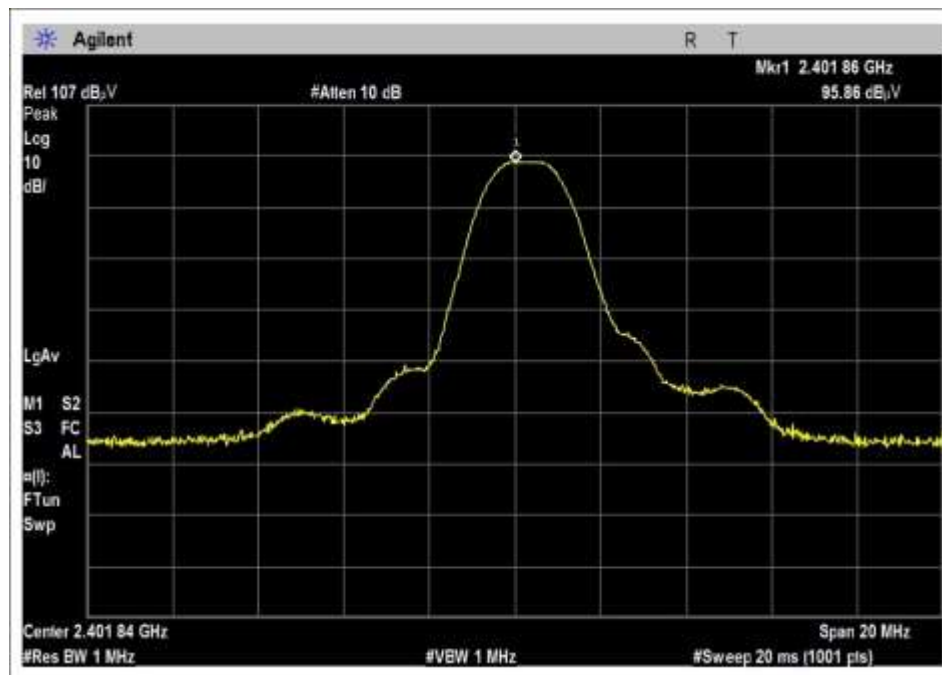
### Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

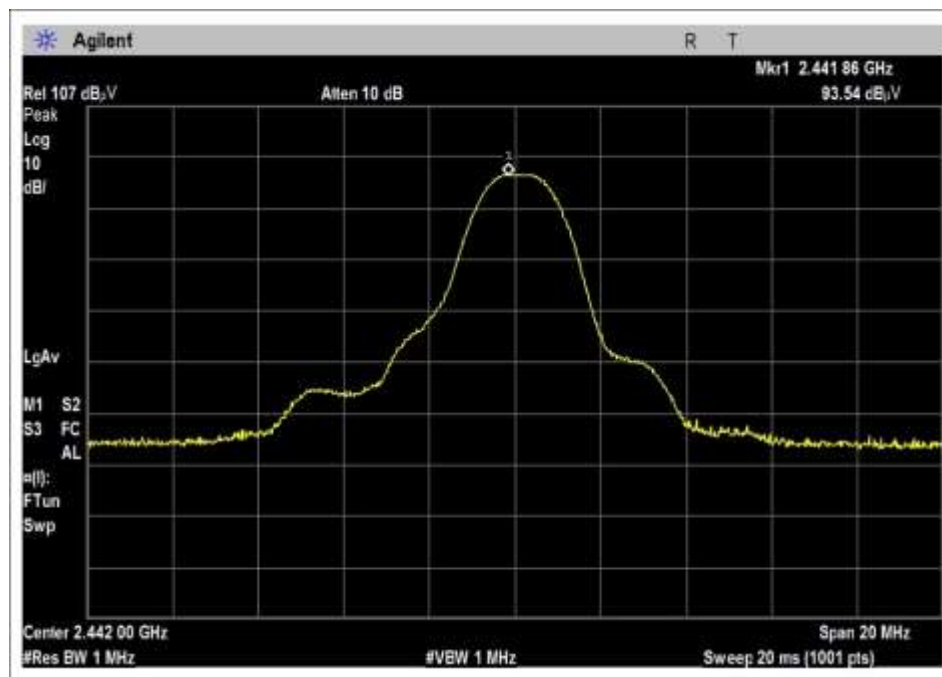
### Test Data Summary – Radiated Field Strength Measurement

| Frequency (MHz) | Modulation | Ant. Type | Measured (dBuV/m @ 3m) | Limit (dBuV/m @ 3m) | Results |
|-----------------|------------|-----------|------------------------|---------------------|---------|
| 2402            | GFSK       | Trace     | 93.4                   | ≤94                 | Pass    |
| 2442            | GFSK       | Trace     | 91.0                   | ≤94                 | Pass    |
| 2480            | GFSK       | Trace     | 88.8                   | ≤94                 | Pass    |

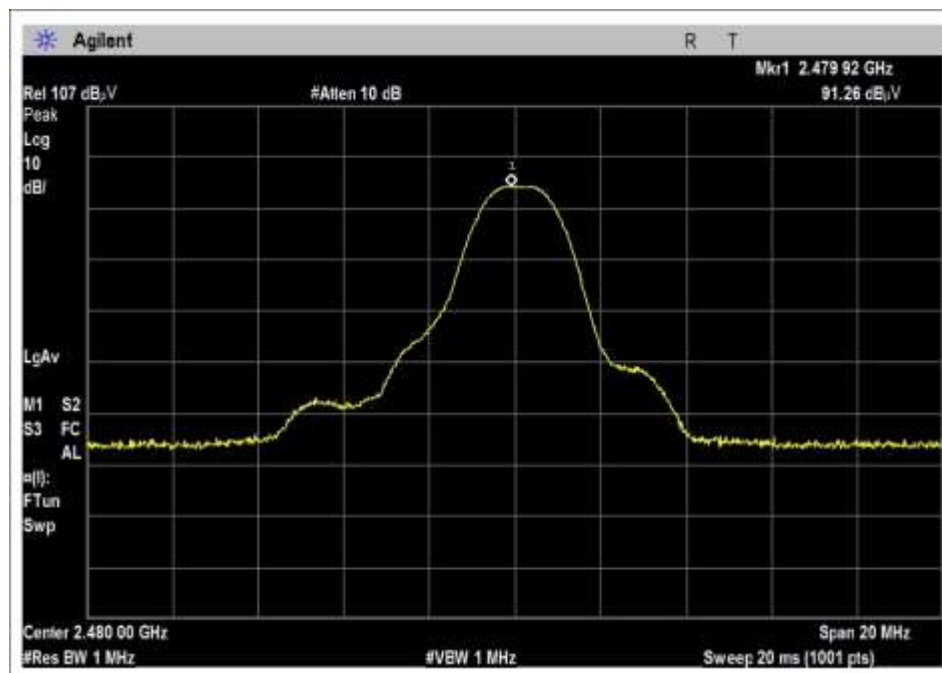
### Plot(s)



Max Power Low Channel



Max Power Middle Channel



Max Power High Channel

### Test Setup / Conditions / Data

Place content into folder

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **ReelSonar**  
 Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**  
 Work Order #: **100524** Date: 12/29/2017  
 Test Type: **Maximized Emissions** Time: 11:15:29  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.11

#### *Equipment Tested:*

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

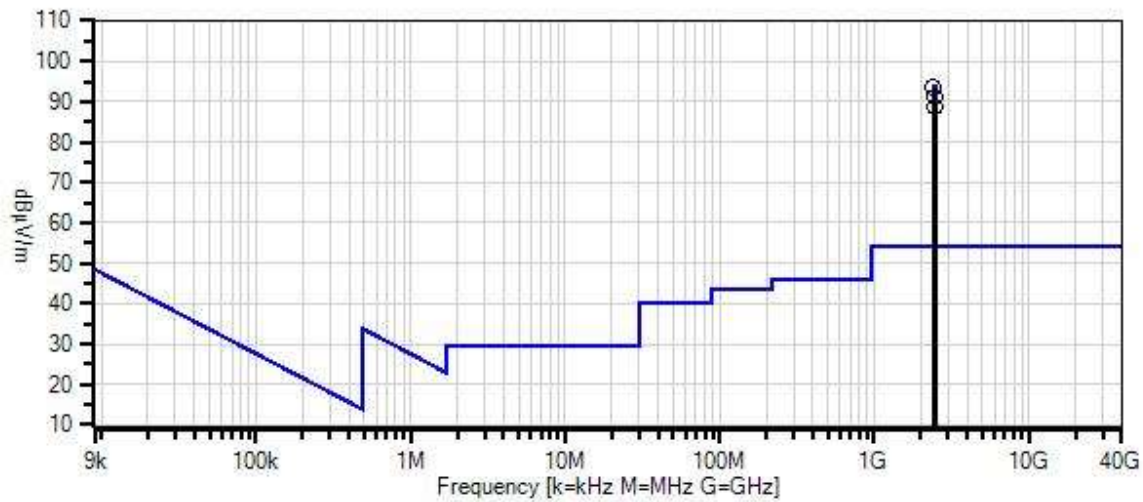
#### *Support Equipment:*

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### *Test Conditions / Notes:*

|  |
|--|
| ANSI C63.10 (2013)<br><br>Temperature: 20-21°C<br>Relative Humidity: 32.33%<br>Pressure: 101.7kPa<br><br>Setup: The EUT is continuously transmitting modulated data. Low, Mid, and High channels investigated, only worst case reported. X, Y, Z EUT axes investigated, only worst case reported. Horizontal and Vertical antenna polarities investigated, worst case reported. EUT is battery powered with a fresh battery installed. |
|--|

ReelSonar WO#: 100524 Sequence#: 4 Date: 12/29/2017  
 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Horiz



- Readings
- Peak Readings
- × QP Readings
- \* Average Readings
- ▼ Ambient
- Software Version: 5.03.11
- 1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

**Test Equipment:**

| ID | Asset #  | Description                                | Model                    | Calibration Date | Cal Due Date |
|----|----------|--|--------------------------|------------------|--------------|
| T1 | AN02871  | Spectrum Analyzer                          | E4440A                   | 2/24/2017        | 2/24/2019    |
| T2 | ANP06540 | Cable                                      | Heliac                   | 10/30/2017       | 10/30/2019   |
| T3 | ANP06515 | Cable                                      | Heliac                   | 1/21/2016        | 1/21/2018    |
| T4 | AN03540  | Preamp                                     | 83017A                   | 5/2/2017         | 5/2/2019     |
| T5 | AN01467  | Horn Antenna-<br>ANSI C63.5<br>Calibration | 3115                     | 7/21/2017        | 7/21/2019    |
| T6 | ANP06934 | Cable                                      | 32026-29801-<br>29801-18 | 3/11/2016        | 3/11/2018    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq      | Rdng       | T1<br>T5      | T2<br>T6     | T3   | T4    | Dist  | Corr         | Spec         | Margin | Polar |
|---|-----------|------------|---------------|--------------|------|-------|-------|--------------|--------------|--------|-------|
|   | MHz       | dB $\mu$ V | dB            | dB           | dB   | dB    | Table | dB $\mu$ V/m | dB $\mu$ V/m | dB     | Ant   |
| 1 | 2401.860M | 95.9       | +0.0<br>+28.1 | +0.4<br>+0.4 | +2.6 | -34.0 | +0.0  | 93.4         | 94.0         | -0.6   | Horiz |
| 2 | 2441.860M | 93.5       | +0.0<br>+28.1 | +0.4<br>+0.4 | +2.6 | -34.0 | +0.0  | 91.0         | 94.0         | -3.0   | Horiz |
| 3 | 2479.920M | 91.3       | +0.0<br>+28.1 | +0.4<br>+0.4 | +2.6 | -34.0 | +0.0  | 88.8         | 94.0         | -5.2   | Horiz |

Test Setup Photo(s)



X Axis



Y Axis



Z Axis



Above 1GHz, Cone Placement



## 15.249(a) Radiated Emissions and Band Edge

See data sheets for test setup and test equipment.

### Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **ReelSonar**  
 Specification: **15.209 Radiated Emissions**  
 Work Order #: **100524** Date: 1/4/2018  
 Test Type: **Maximized Emissions** Time: 16:24:05  
 Tested By: Michael Atkinson Sequence#: 3  
 Software: EMITest 5.03.11

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

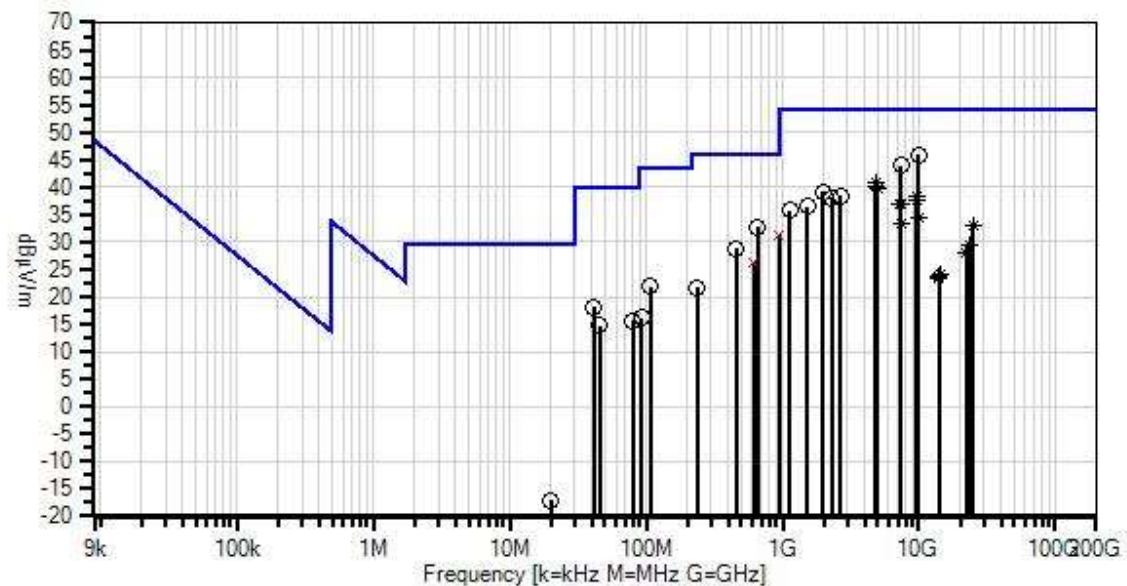
ANSI C63.10 (2013)

Temperature: 20-22°C  
 Relative Humidity: 32-35%  
 Pressure: 101.7kPa

Frequency: 9k-25GHz

Setup: The EUT is continuously transmitting modulated data. Low, Mid, and High channels investigated, only worst case reported. X, Y, Z EUT axes investigated, only worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, three orthogonal antenna polarities investigated below 30MHz, worst case reported. EUT is battery powered with a fresh battery installed.

ReelSonar WO#: 100524 Sequence#: 3 Date: 1/4/2018  
 15.209 Radiated Emissions Test Distance: 3 Meters Various



— Readings  
 \* Average Readings  
 — 1 - 15.209 Radiated Emissions

○ Peak Readings  
 ▼ Ambient

× QP Readings  
 Software Version: 5.03.11

**Test Equipment:**

| ID  | Asset #    | Description                                | Model                           | Calibration Date | Cal Due Date |
|-----|------------|--|---------------------------------|------------------|--------------|
| T1  | AN02871    | Spectrum Analyzer                          | E4440A                          | 2/24/2017        | 2/24/2019    |
| T2  | ANP06540   | Cable                                      | Heliac                          | 10/30/2017       | 10/30/2019   |
| T3  | ANP05963   | Cable                                      | RG-214                          | 2/15/2016        | 2/15/2018    |
| T4  | ANP05360   | Cable                                      | RG214                           | 11/30/2016       | 11/30/2018   |
| T5  | AN02307    | Preamp                                     | 8447D                           | 2/15/2016        | 2/15/2018    |
| T6  | ANP06123   | Attenuator                                 | 18N-6                           | 5/5/2017         | 5/5/2019     |
| T7  | AN03628    | Biconilog Antenna                          | 3142E                           | 6/7/2017         | 6/7/2019     |
| T8  | ANP06515   | Cable                                      | Heliac                          | 1/21/2016        | 1/21/2018    |
| T9  | AN03540    | Preamp                                     | 83017A                          | 5/2/2017         | 5/2/2019     |
| T10 | AN01467    | Horn Antenna-<br>ANSI C63.5<br>Calibration | 3115                            | 7/21/2017        | 7/21/2019    |
| T11 | ANP06934   | Cable                                      | 32026-29801-<br>29801-18        | 3/11/2016        | 3/11/2018    |
| T12 | AN02673    | Spectrum Analyzer                          | E4446A                          | 2/3/2017         | 2/3/2019     |
| T13 | AN02742    | Active Horn<br>Antenna                     | AMFW-5F-<br>18002650-20-<br>10P | 10/7/2016        | 10/7/2018    |
| T14 | AN02763-69 | Waveguide                                  | Multiple                        | 7/14/2017        | 7/14/2019    |
| T15 | ANP06503   | Cable                                      | 32026-29801-<br>29801-36        | 4/28/2016        | 4/28/2018    |
| T16 | ANP06678   | Cable                                      | 32026-29801-<br>29801-144       | 9/19/2016        | 9/19/2018    |
| T17 | AN02741    | Active Horn<br>Antenna                     | AMFW-5F-<br>12001800-20-<br>10P | 3/30/2017        | 3/30/2019    |
| T18 | AN00052    | Loop Antenna                               | 6502                            | 4/8/2016         | 4/8/2018     |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq      | Rdng       | T1    | T2    | T3   | T4   | Dist  | Corr         | Spec         | Margin | Polar |
|---|-----------|------------|-------|-------|------|------|-------|--------------|--------------|--------|-------|
|   |           |            | T5    | T6    | T7   | T8   |       |              |              |        |       |
|   |           |            | T9    | T10   | T11  | T12  |       |              |              |        |       |
|   |           |            | T13   | T14   | T15  | T16  |       |              |              |        |       |
|   |           |            | T17   | T18   |      |      |       |              |              |        |       |
|   | MHz       | dB $\mu$ V | dB    | dB    | dB   | dB   | Table | dB $\mu$ V/m | dB $\mu$ V/m | dB     | Ant   |
| 1 | 9916.291M | 34.8       | +0.0  | +0.4  | +0.0 | +0.0 | +0.0  | 46.0         | 54.0         | -8.0   | Vert  |
|   |           |            | +0.0  | +0.0  | +0.0 | +6.1 | 360   |              | High Band    |        | 149   |
|   |           |            | -33.7 | +37.7 | +0.7 | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +0.0  | +0.0 | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +0.0  |      |      |       |              |              |        |       |
| 2 | 7437.291M | 34.5       | +0.0  | +1.1  | +0.0 | +0.0 | +0.0  | 44.0         | 54.0         | -10.0  | Vert  |
|   |           |            | +0.0  | +0.0  | +0.0 | +5.4 |       |              | High Band    |        | 200   |
|   |           |            | -34.4 | +36.8 | +0.6 | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +0.0  | +0.0 | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +0.0  |      |      |       |              |              |        |       |

|    |           |      |       |       |       |      |      |      |           |       |       |
|----|-----------|------|-------|-------|-------|------|------|------|-----------|-------|-------|
| 3  | 4882.190M | 36.6 | +0.0  | +0.5  | +0.0  | +0.0 | +0.0 | 40.8 | 54.0      | -13.2 | Vert  |
|    | Ave       |      | +0.0  | +0.0  | +0.0  | +4.0 | 319  |      | Mid Band  |       | 165   |
|    |           |      | -33.2 | +32.4 | +0.5  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| ^  | 4882.139M | 43.8 | +0.0  | +0.5  | +0.0  | +0.0 | +0.0 | 48.0 | 54.0      | -6.0  | Vert  |
|    |           |      | +0.0  | +0.0  | +0.0  | +4.0 | 319  |      | Mid Band  |       | 165   |
|    |           |      | -33.2 | +32.4 | +0.5  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 5  | 658.600M  | 29.3 | +0.0  | +0.3  | +2.1  | +1.7 | +0.0 | 32.7 | 46.0      | -13.3 | Vert  |
|    |           |      | -28.1 | +5.9  | +21.5 | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 6  | 4806.158M | 36.1 | +0.0  | +0.5  | +0.0  | +0.0 | +0.0 | 40.1 | 54.0      | -13.9 | Horiz |
|    | Ave       |      | +0.0  | +0.0  | +0.0  | +3.9 | 216  |      | Low Band  |       | 160   |
|    |           |      | -33.2 | +32.3 | +0.5  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| ^  | 4806.158M | 44.5 | +0.0  | +0.5  | +0.0  | +0.0 | +0.0 | 48.5 | 54.0      | -5.5  | Horiz |
|    |           |      | +0.0  | +0.0  | +0.0  | +3.9 | 219  |      | Low Band  |       | 151   |
|    |           |      | -33.2 | +32.3 | +0.5  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 8  | 4958.184M | 35.3 | +0.0  | +0.5  | +0.0  | +0.0 | +0.0 | 39.7 | 54.0      | -14.3 | Vert  |
|    | Ave       |      | +0.0  | +0.0  | +0.0  | +4.1 |      |      | High Band |       | 200   |
|    |           |      | -33.2 | +32.5 | +0.5  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| ^  | 4958.184M | 42.1 | +0.0  | +0.5  | +0.0  | +0.0 | +0.0 | 46.5 | 54.0      | -7.5  | Vert  |
|    |           |      | +0.0  | +0.0  | +0.0  | +4.1 | 289  |      | High Band |       | 99    |
|    |           |      | -33.2 | +32.5 | +0.5  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 10 | 939.900M  | 22.8 | +0.0  | +0.4  | +2.4  | +2.2 | +0.0 | 31.4 | 46.0      | -14.6 | Vert  |
|    | QP        |      | -27.2 | +5.9  | +24.9 | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| ^  | 939.900M  | 27.3 | +0.0  | +0.4  | +2.4  | +2.2 | +0.0 | 35.9 | 46.0      | -10.1 | Vert  |
|    |           |      | -27.2 | +5.9  | +24.9 | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 12 | 1966.000M | 42.5 | +0.0  | +0.3  | +0.0  | +0.0 | +0.0 | 39.1 | 54.0      | -14.9 | Horiz |
|    |           |      | +0.0  | +0.0  | +0.0  | +2.4 |      |      |           |       |       |
|    |           |      | -34.3 | +27.9 | +0.3  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |           |      | +0.0  | +0.0  |       |      |      |      |           |       |       |

|    |           |      |       |       |      |      |      |      |          |       |       |
|----|-----------|------|-------|-------|------|------|------|------|----------|-------|-------|
| 13 | 2670.000M | 40.2 | +0.0  | +0.5  | +0.0 | +0.0 | +0.0 | 38.5 | 54.0     | -15.5 | Vert  |
|    |           |      | +0.0  | +0.0  | +0.0 | +2.7 |      |      |          |       |       |
|    |           |      | -33.9 | +28.6 | +0.4 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| 14 | 9607.530M | 26.9 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0 | 38.2 | 54.0     | -15.8 | Horiz |
|    | Ave       |      | +0.0  | +0.0  | +0.0 | +5.8 | 311  |      | Low Band |       | 140   |
|    |           |      | -33.5 | +37.5 | +0.8 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| ^  | 9607.530M | 40.0 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0 | 51.3 | 54.0     | -2.7  | Horiz |
|    |           |      | +0.0  | +0.0  | +0.0 | +5.8 | 175  |      | Low Band |       | 134   |
|    |           |      | -33.5 | +37.5 | +0.8 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| 16 | 2306.000M | 40.9 | +0.0  | +0.4  | +0.0 | +0.0 | +0.0 | 38.1 | 54.0     | -15.9 | Horiz |
|    |           |      | +0.0  | +0.0  | +0.0 | +2.5 |      |      |          |       |       |
|    |           |      | -34.1 | +28.1 | +0.3 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| 17 | 9764.139M | 26.6 | +0.0  | +0.5  | +0.0 | +0.0 | +0.0 | 37.7 | 54.0     | -16.3 | Horiz |
|    | Ave       |      | +0.0  | +0.0  | +0.0 | +5.9 | 360  |      | Mid Band |       | 165   |
|    |           |      | -33.6 | +37.6 | +0.7 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| ^  | 9764.139M | 38.6 | +0.0  | +0.5  | +0.0 | +0.0 | +0.0 | 49.7 | 54.0     | -4.3  | Horiz |
|    |           |      | +0.0  | +0.0  | +0.0 | +5.9 |      |      | Mid Band |       | 165   |
|    |           |      | -33.6 | +37.6 | +0.7 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| 19 | 7205.530M | 28.1 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0 | 37.0 | 54.0     | -17.0 | Vert  |
|    | Ave       |      | +0.0  | +0.0  | +0.0 | +5.3 | 360  |      | Low Band |       | 170   |
|    |           |      | -33.9 | +36.2 | +0.6 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| ^  | 7205.530M | 40.8 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0 | 49.7 | 54.0     | -4.3  | Vert  |
|    |           |      | +0.0  | +0.0  | +0.0 | +5.3 |      |      | Low Band |       | 175   |
|    |           |      | -33.9 | +36.2 | +0.6 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| 21 | 7323.139M | 27.6 | +0.0  | +0.9  | +0.0 | +0.0 | +0.0 | 36.8 | 54.0     | -17.2 | Vert  |
|    | Ave       |      | +0.0  | +0.0  | +0.0 | +5.3 | 360  |      | Mid Band |       | 165   |
|    |           |      | -34.1 | +36.5 | +0.6 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |
| ^  | 7323.139M | 34.6 | +0.0  | +0.9  | +0.0 | +0.0 | +0.0 | 43.8 | 54.0     | -10.2 | Vert  |
|    |           |      | +0.0  | +0.0  | +0.0 | +5.3 | 9    |      | Mid Band |       | 165   |
|    |           |      | -34.1 | +36.5 | +0.6 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  | +0.0 | +0.0 |      |      |          |       |       |
|    |           |      | +0.0  | +0.0  |      |      |      |      |          |       |       |

|    |                       |      |       |       |       |      |      |      |           |       |       |
|----|-----------------------|------|-------|-------|-------|------|------|------|-----------|-------|-------|
| 23 | 460.700M              | 29.5 | +0.0  | +0.2  | +1.9  | +1.4 | +0.0 | 28.8 | 46.0      | -17.2 | Horiz |
|    |                       |      | -27.9 | +5.9  | +17.8 | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 24 | 1512.000M             | 43.0 | +0.0  | +0.4  | +0.0  | +0.0 | +0.0 | 36.4 | 54.0      | -17.6 | Horiz |
|    |                       |      | +0.0  | +0.0  | +0.0  | +2.0 |      |      |           |       |       |
|    |                       |      | -34.9 | +25.6 | +0.3  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 25 | 1128.000M             | 45.1 | +0.0  | +0.4  | +0.0  | +0.0 | +0.0 | 35.7 | 54.0      | -18.3 | Horiz |
|    |                       |      | +0.0  | +0.0  | +0.0  | +1.8 |      |      |           |       |       |
|    |                       |      | -36.2 | +24.3 | +0.3  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 26 | 9916.184M<br>Ave      | 23.1 | +0.0  | +0.4  | +0.0  | +0.0 | +0.0 | 34.3 | 54.0      | -19.7 | Vert  |
|    |                       |      | +0.0  | +0.0  | +0.0  | +6.1 | 163  |      | High Band |       | 144   |
|    |                       |      | -33.7 | +37.7 | +0.7  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 27 | 613.000M<br>QP        | 23.4 | +0.0  | +0.3  | +2.1  | +1.6 | +0.0 | 26.3 | 46.0      | -19.7 | Horiz |
|    |                       |      | -28.1 | +5.9  | +21.1 | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| ^  | 613.000M              | 29.3 | +0.0  | +0.3  | +2.1  | +1.6 | +0.0 | 32.2 | 46.0      | -13.8 | Horiz |
|    |                       |      | -28.1 | +5.9  | +21.1 | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 29 | 7437.184M<br>Ave      | 23.7 | +0.0  | +1.1  | +0.0  | +0.0 | +0.0 | 33.2 | 54.0      | -20.8 | Vert  |
|    |                       |      | +0.0  | +0.0  | +0.0  | +5.4 | 360  |      | High Band |       | 149   |
|    |                       |      | -34.4 | +36.8 | +0.6  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 30 | 24963.000<br>M<br>Ave | 32.6 | +0.0  | +0.0  | +0.0  | +0.0 | +0.0 | 33.0 | 54.0      | -21.0 | Horiz |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 | 360  |      | Mid Band  |       | 111   |
|    |                       |      | -11.7 | +1.1  | +2.4  | +8.6 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| ^  | 24963.000<br>M        | 45.2 | +0.0  | +0.0  | +0.0  | +0.0 | +0.0 | 45.6 | 54.0      | -8.4  | Horiz |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      | Mid Band  |       | 111   |
|    |                       |      | -11.7 | +1.1  | +2.4  | +8.6 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |
| 32 | 107.600M              | 33.6 | +0.0  | +0.1  | +1.2  | +0.6 | +0.0 | 21.9 | 43.5      | -21.6 | Horiz |
|    |                       |      | -27.7 | +5.9  | +8.2  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0  |       |      |      |      |           |       |       |

|    |                       |      |       |      |       |      |      |      |           |       |       |
|----|-----------------------|------|-------|------|-------|------|------|------|-----------|-------|-------|
| 33 | 41.600M               | 29.6 | +0.0  | +0.1 | +0.5  | +0.4 | +0.0 | 18.2 | 40.0      | -21.8 | Horiz |
|    |                       |      | -27.9 | +5.9 | +9.6  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 34 | 237.600M              | 28.1 | +0.0  | +0.2 | +1.5  | +0.9 | +0.0 | 21.7 | 46.0      | -24.3 | Horiz |
|    |                       |      | -27.1 | +5.9 | +12.2 | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 35 | 80.400M               | 29.6 | +0.0  | +0.1 | +0.8  | +0.5 | +0.0 | 15.7 | 40.0      | -24.3 | Vert  |
|    |                       |      | -27.8 | +5.9 | +6.6  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 36 | 23380.000<br>M<br>Ave | 31.6 | +0.0  | +0.0 | +0.0  | +0.0 | +0.0 | 29.4 | 54.0      | -24.6 | Horiz |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 | 284  |      | Low Band  |       | 99    |
|    |                       |      | -14.2 | +1.4 | +2.2  | +8.4 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| ^  | 23380.000<br>M        | 31.8 | +0.0  | +0.0 | +0.0  | +0.0 | +0.0 | 29.6 | 54.0      | -24.4 | Horiz |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 | 360  |      | Low Band  |       | 99    |
|    |                       |      | -14.2 | +1.4 | +2.2  | +8.4 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 38 | 45.500M               | 27.8 | +0.0  | +0.1 | +0.5  | +0.4 | +0.0 | 14.7 | 40.0      | -25.3 | Vert  |
|    |                       |      | -27.9 | +5.9 | +7.9  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 39 | 22242.000<br>M<br>Ave | 30.6 | +0.0  | +0.0 | +0.0  | +0.0 | +0.0 | 28.1 | 54.0      | -25.9 | Vert  |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      | High Band |       | 144   |
|    |                       |      | -14.4 | +1.5 | +2.1  | +8.3 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| ^  | 22242.000<br>M        | 39.6 | +0.0  | +0.0 | +0.0  | +0.0 | +0.0 | 37.1 | 54.0      | -16.9 | Vert  |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 | 360  |      | High Band |       | 164   |
|    |                       |      | -14.4 | +1.5 | +2.1  | +8.3 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 41 | 92.100M               | 29.2 | +0.0  | +0.1 | +1.0  | +0.5 | +0.0 | 16.2 | 43.5      | -27.3 | Vert  |
|    |                       |      | -27.7 | +5.9 | +7.2  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 |       |      |      |      |           |       |       |
| 42 | 14256.000<br>M<br>Ave | 30.5 | +0.0  | +0.8 | +0.0  | +0.0 | +0.0 | 24.1 | 54.0      | -29.9 | Vert  |
|    |                       |      | +0.0  | +0.0 | +0.0  | +7.4 |      |      |           |       |       |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 | 213  |      | High Band |       | 109   |
|    |                       |      | +0.0  | +0.0 | +0.0  | +0.0 |      |      |           |       |       |
|    |                       |      | -14.6 | +0.0 |       |      |      |      |           |       |       |

|    |                       |      |       |       |      |      |       |       |      |       |              |
|----|-----------------------|------|-------|-------|------|------|-------|-------|------|-------|--------------|
| ^  | 14256.000<br>M        | 37.8 | +0.0  | +0.8  | +0.0 | +0.0 | +0.0  | 31.4  | 54.0 | -22.6 | Vert         |
|    |                       |      | +0.0  | +0.0  | +0.0 | +7.4 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | -14.6 | +0.0  |      |      |       |       |      |       |              |
| 44 | 14120.000<br>M<br>Ave | 30.3 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0  | 23.7  | 54.0 | -30.3 | Horiz        |
|    |                       |      | +0.0  | +0.0  | +0.0 | +7.3 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 | 360   |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | -14.6 | +0.0  |      |      |       |       |      |       |              |
| ^  | 14120.000<br>M        | 37.0 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0  | 30.4  | 54.0 | -23.6 | Horiz        |
|    |                       |      | +0.0  | +0.0  | +0.0 | +7.3 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 | 71    |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | -14.6 | +0.0  |      |      |       |       |      |       |              |
| 46 | 14072.000<br>M<br>Ave | 30.0 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0  | 23.4  | 54.0 | -30.6 | Vert         |
|    |                       |      | +0.0  | +0.0  | +0.0 | +7.3 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 | 271   |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | -14.6 | +0.0  |      |      |       |       |      |       |              |
| ^  | 14072.000<br>M        | 43.2 | +0.0  | +0.7  | +0.0 | +0.0 | +0.0  | 36.6  | 54.0 | -17.4 | Vert         |
|    |                       |      | +0.0  | +0.0  | +0.0 | +7.3 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | -14.6 | +0.0  |      |      |       |       |      |       |              |
| 48 | 240.000k              | 45.9 | +0.0  | +0.0  | +0.0 | +0.0 | -80.0 | -24.4 | 20.0 | -44.4 | Vario<br>144 |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +9.7  |      |      |       |       |      |       |              |
| 49 | 20.090M               | 14.3 | +0.0  | +0.0  | +0.0 | +0.0 | -40.0 | -17.1 | 29.5 | -46.6 | Vario<br>144 |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.3 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +8.3  |      |      |       |       |      |       |              |
| 50 | 17.673k               | 44.7 | +0.0  | +0.0  | +0.0 | +0.0 | -80.0 | -20.9 | 42.6 | -63.5 | Vario<br>144 |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +0.0  | +0.0 | +0.0 |       |       |      |       |              |
|    |                       |      | +0.0  | +14.4 |      |      |       |       |      |       |              |

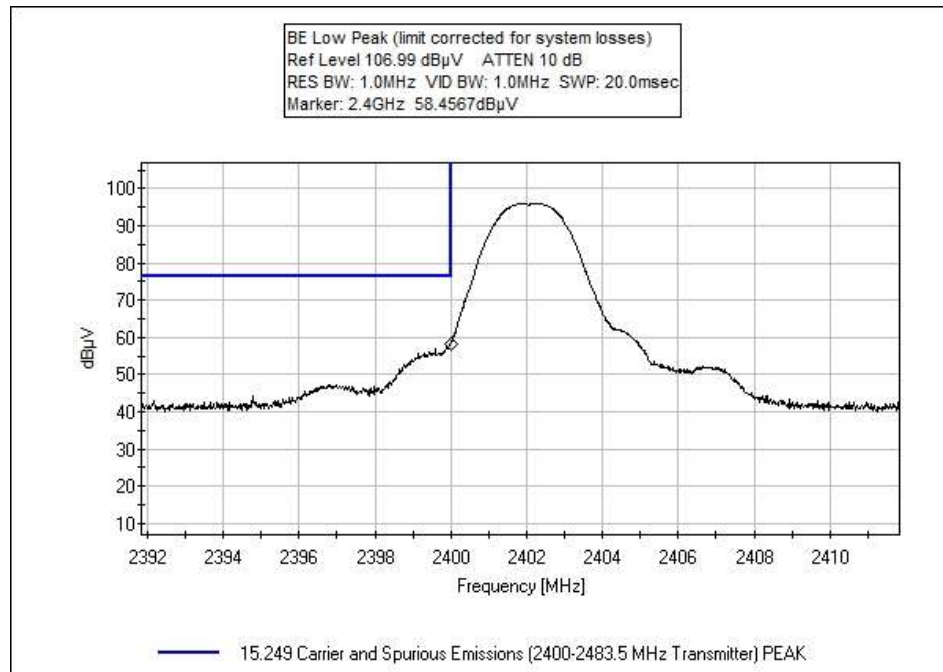


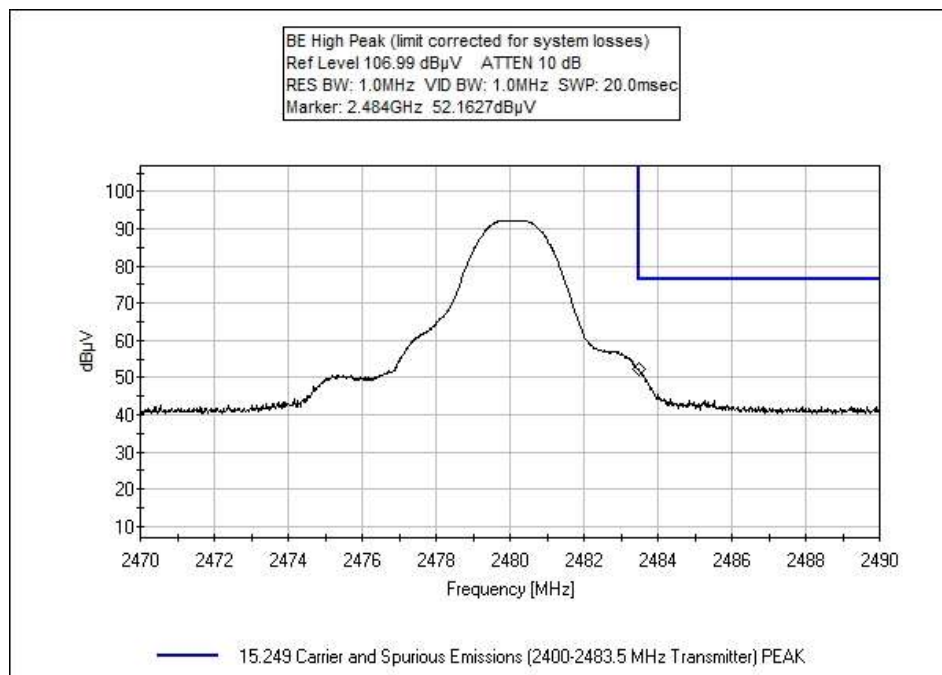
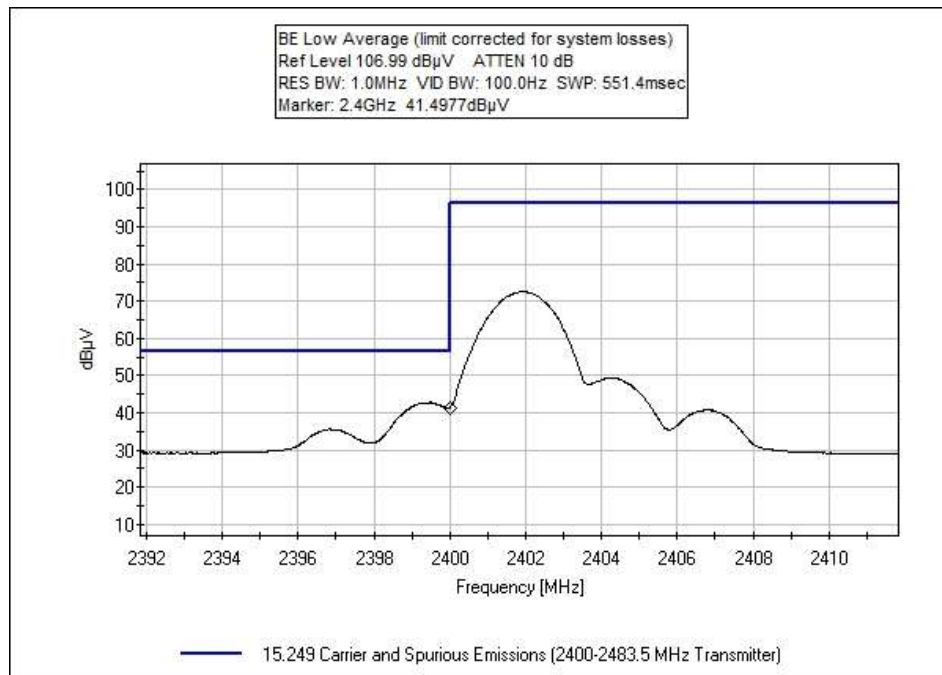
## Band Edge

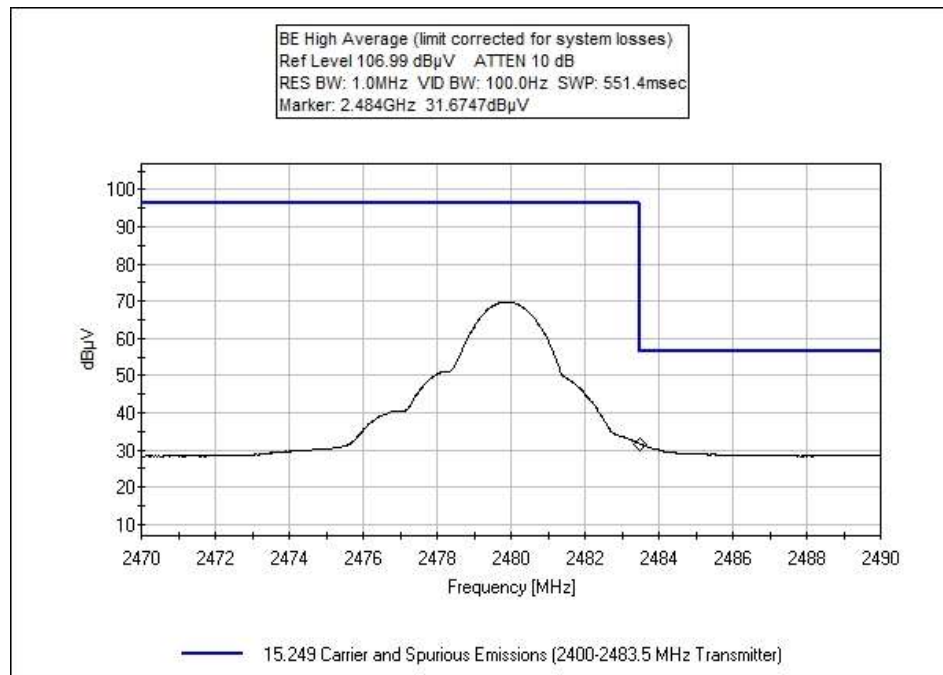
| Band Edge Summary |            |           |                             |                    |         |
|-------------------|------------|-----------|-----------------------------|--------------------|---------|
| Frequency (MHz)   | Modulation | Ant. Type | Field Strength (dBuV/m @3m) | Limit (dBuV/m @3m) | Results |
| 2400 (Peak)       | GFSK       | Trace     | 56.0                        | <74                | Pass    |
| 2400 (Average)    | GFSK       | Trace     | 39.0                        | <54                | Pass    |
| 2483.5 (Peak)     | GFSK       | Trace     | 49.7                        | <74                | Pass    |
| 2483.5 (Average)  | GFSK       | Trace     | 29.2                        | <54                | Pass    |

Test performed using operational mode with the highest output power, representing worst case

## Band Edge Plots







### Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **ReelSonar**  
 Specification: **15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**  
 Work Order #: **100524** Date: 12/29/2017  
 Test Type: **Maximized Emissions** Time: 11:53:54  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.11

#### *Equipment Tested:*

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

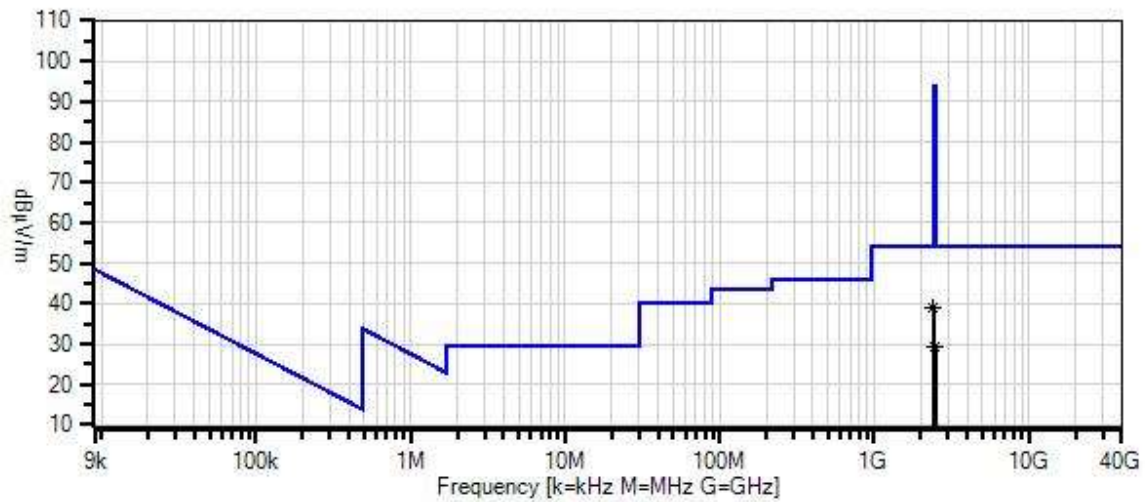
#### *Support Equipment:*

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### *Test Conditions / Notes:*

|   |
|---|
| ANSI C63.10 (2013)<br><br>Temperature: 20°C<br>Humidity: 33%<br>Pressure: 101.7kPa<br><br>Setup: The EUT is continuously transmitting modulated data. Low and High channels investigated for Band Edge. X, Y, Z EUT axes investigated, only worst case reported. Horizontal and Vertical antenna polarities investigated, worst case reported. EUT is battery powered with a fresh battery installed. |
|---|

ReelSonar W/O#: 100524 Sequence#: 4 Date: 12/29/2017  
 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Horiz



- Readings
- Peak Readings
- × QP Readings
- \* Average Readings
- ▼ Ambient
- Software Version: 5.03.11
- 1 - 15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

**Test Equipment:**

| ID | Asset #  | Description                                | Model                    | Calibration Date | Cal Due Date |
|----|----------|--|--------------------------|------------------|--------------|
| T1 | AN02871  | Spectrum Analyzer                          | E4440A                   | 2/24/2017        | 2/24/2019    |
| T2 | ANP06540 | Cable                                      | Heliac                   | 10/30/2017       | 10/30/2019   |
| T3 | ANP06515 | Cable                                      | Heliac                   | 1/21/2016        | 1/21/2018    |
| T4 | AN03540  | Preamp                                     | 83017A                   | 5/2/2017         | 5/2/2019     |
| T5 | AN01467  | Horn Antenna-<br>ANSI C63.5<br>Calibration | 3115                     | 7/21/2017        | 7/21/2019    |
| T6 | ANP06934 | Cable                                      | 32026-29801-<br>29801-18 | 3/11/2016        | 3/11/2018    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq      | Rdng | T1<br>T5 | T2<br>T6 | T3   | T4    | Dist  | Corr   | Spec   | Margin | Polar |
|---|-----------|------|----------|----------|------|-------|-------|--------|--------|--------|-------|
|   | MHz       | dBμV | dB       | dB       | dB   | dB    | Table | dBμV/m | dBμV/m | dB     | Ant   |
| 1 | 2400.000M | 41.5 | +0.0     | +0.4     | +2.6 | -34.0 | +0.0  | 39.0   | 54.0   | -15.0  | Horiz |
|   | Ave       |      | +28.1    | +0.4     |      |       |       |        |        |        |       |
| ^ | 2400.000M | 58.5 | +0.0     | +0.4     | +2.6 | -34.0 | +0.0  | 56.0   | 74.0   | -18.0  | Horiz |
|   |           |      | +28.1    | +0.4     |      |       |       |        |        |        |       |
| 3 | 2483.500M | 31.7 | +0.0     | +0.4     | +2.6 | -34.0 | +0.0  | 29.2   | 54.0   | -24.8  | Horiz |
|   | Ave       |      | +28.1    | +0.4     |      |       |       |        |        |        |       |
| ^ | 2483.500M | 52.2 | +0.0     | +0.4     | +2.6 | -34.0 | +0.0  | 49.7   | 74.0   | -24.3  | Horiz |
|   |           |      | +28.1    | +0.4     |      |       |       |        |        |        |       |

Test Setup Photo(s)



X Axis



Y Axis



Z Axis



Below 1GHz





Above 1GHz, Cone Placement

## SUPPLEMENTAL INFORMATION

### Measurement Uncertainty

| Uncertainty Value | Parameter                 |
|-------------------|---------------------------|
| 4.73 dB           | Radiated Emissions        |
| 3.34 dB           | Mains Conducted Emissions |
| 3.30 dB           | Disturbance Power         |

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ . Compliance is deemed to occur provided measurements are below the specified limits.

### Emissions Test Details

#### TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

#### CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in  $\text{dB}\mu\text{V}/\text{m}$ , the spectrum analyzer reading in  $\text{dB}\mu\text{V}$  was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

| SAMPLE CALCULATIONS |                     |                                     |
|---------------------|---------------------|-------------------------------------|
|                     | Meter reading       | ( $\text{dB}\mu\text{V}$ )          |
| +                   | Antenna Factor      | ( $\text{dB}/\text{m}$ )            |
| +                   | Cable Loss          | ( $\text{dB}$ )                     |
| -                   | Distance Correction | ( $\text{dB}$ )                     |
| -                   | Preamplifier Gain   | ( $\text{dB}$ )                     |
| =                   | Corrected Reading   | ( $\text{dB}\mu\text{V}/\text{m}$ ) |

## TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE |                     |                  |                   |
|--|---------------------|------------------|-------------------|
| TEST   | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS  | 150 kHz             | 30 MHz           | 9 kHz             |
| RADIATED EMISSIONS   | 9 kHz               | 150 kHz          | 200 Hz            |
| RADIATED EMISSIONS   | 150 kHz             | 30 MHz           | 9 kHz             |
| RADIATED EMISSIONS   | 30 MHz              | 1000 MHz         | 120 kHz           |
| RADIATED EMISSIONS   | 1000 MHz            | >1 GHz           | 1 MHz             |

## SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

### Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

### Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

### Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.