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.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

ReelSonar
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Representative: Alex Lebedev
Customer Reference Number: 17-027

REPORT PREPARED BY:

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Project Number: 100524

DATE OF EQUIPMENT RECEIPT: December 29, 2017
DATE(S) OF TESTING: 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.

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 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[1]

NA = Not Applicable
NA[1] = 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 (ºC)	22	Relative Humidity (%):	30

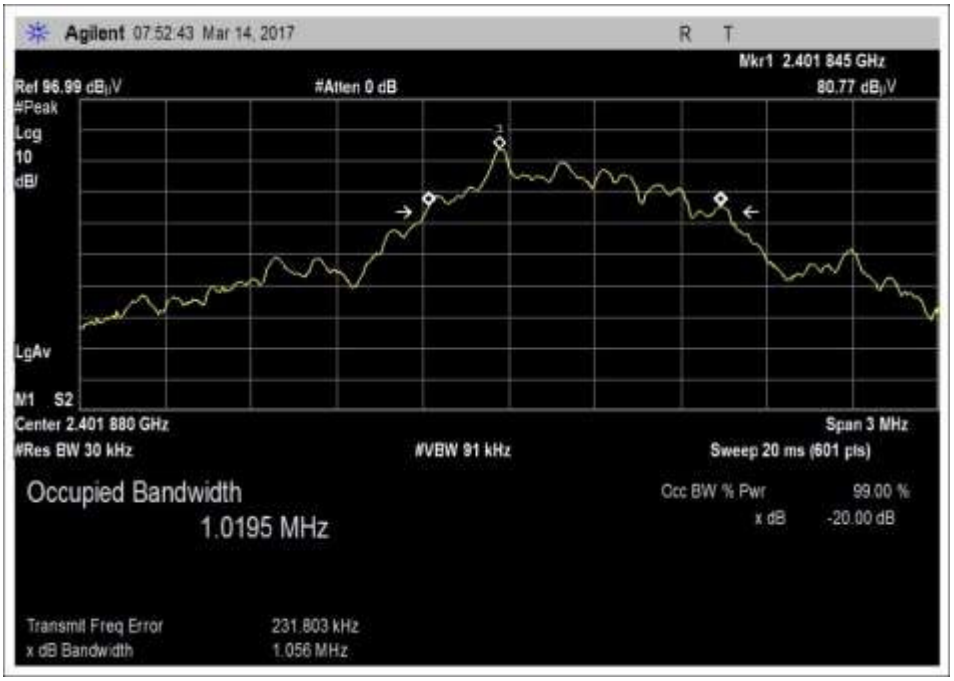
Test Equipment

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P05464	Cable	Andrews	Heliax	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

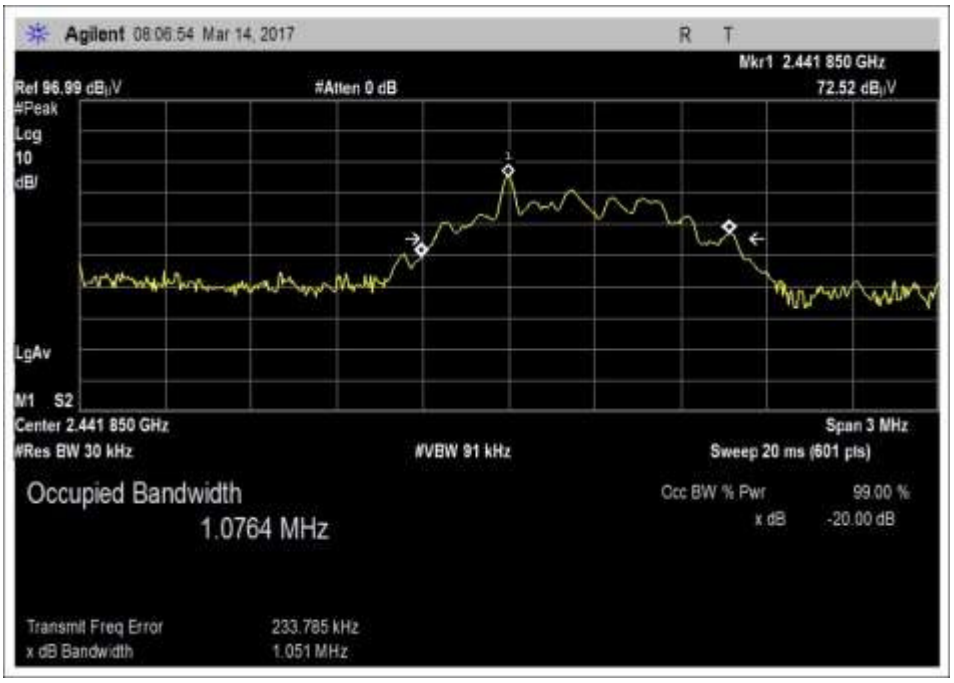
Test Data Summary

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

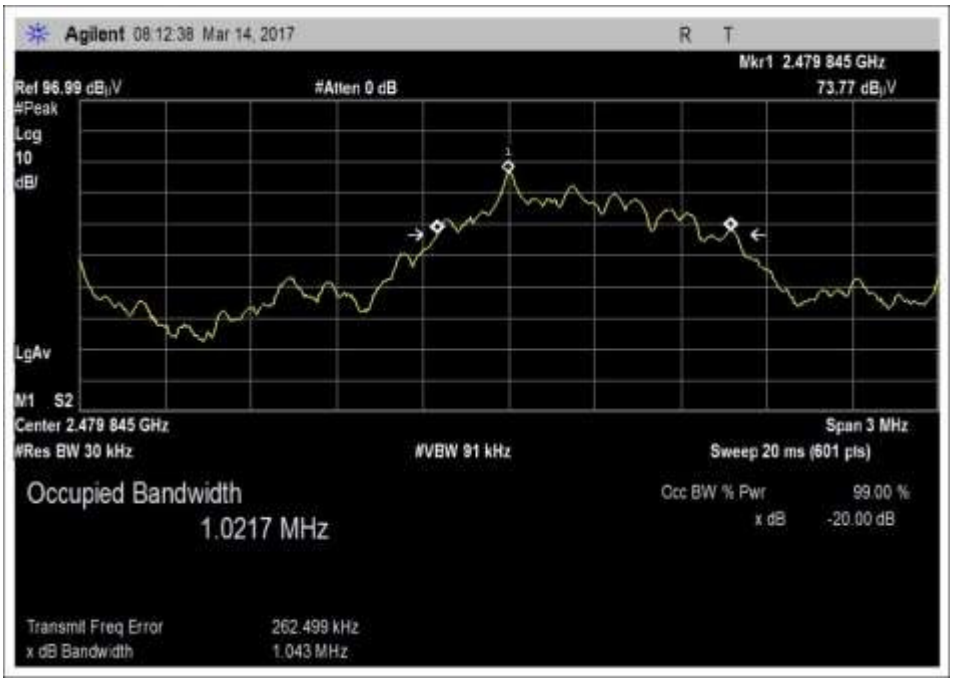
Plot(s)



OBW Low



OBW Middle



OBW High

Test Setup Photo(s)

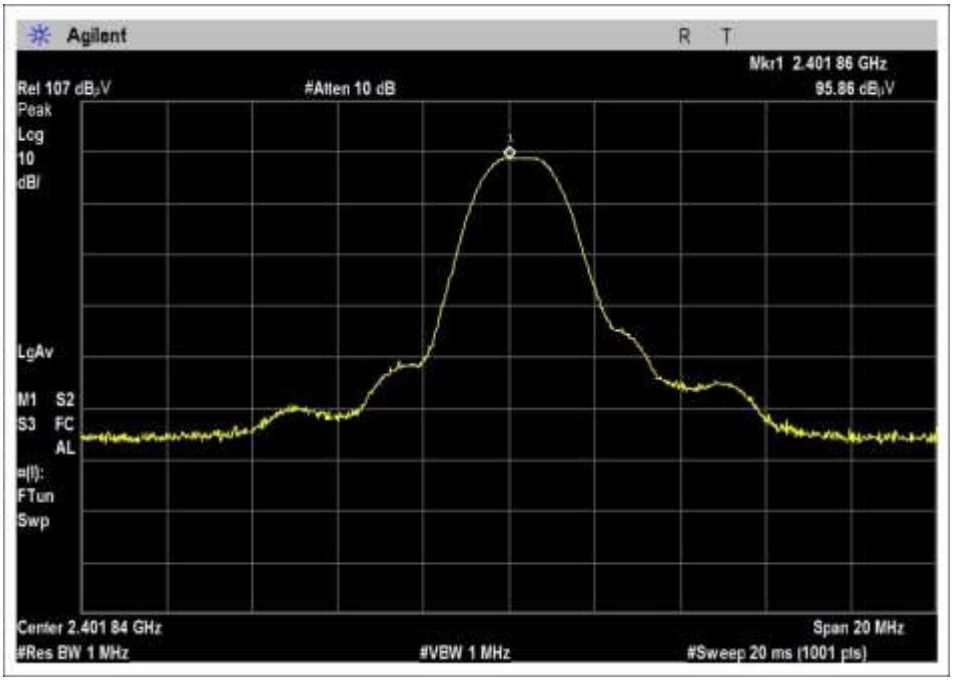
15.249(a) Field Strength of Fundamental

Test Data Summary - Voltage Variations

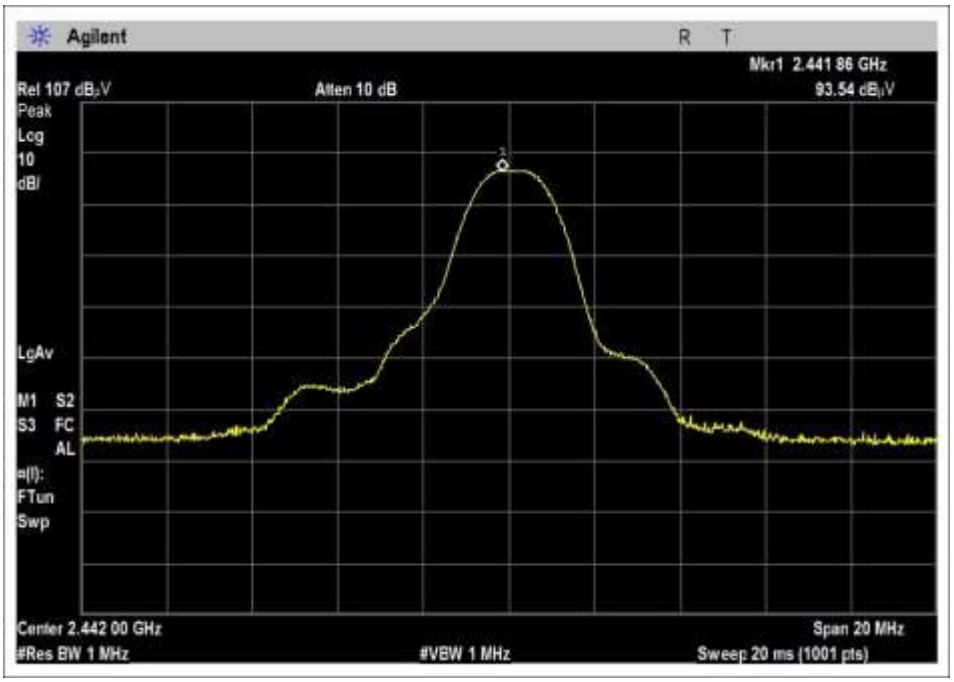
This equipment is battery powered. Power output tests were performed using a fresh battery.

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

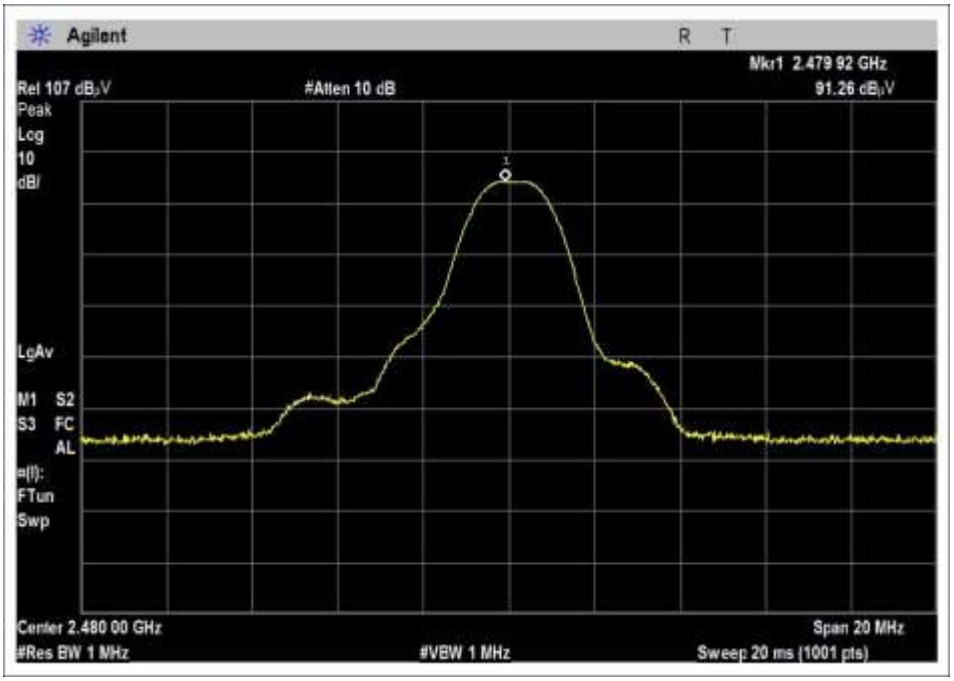
Plot(s)



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			

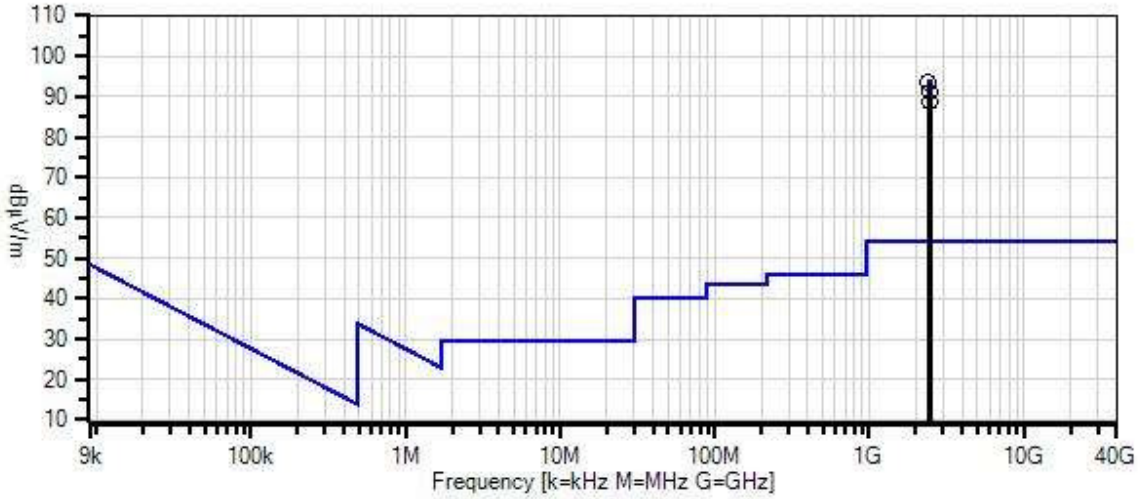
Test Conditions / Notes:

ANSI C63.10 (2013)

Temperature: 20-21°C
Relative Humidity: 32.33%
Pressure: 101.7kPa

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	Heliax	10/30/2017	10/30/2019
T3	ANP06515	Cable	Heliax	1/21/2016	1/21/2018
T4	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	ANP06934	Cable	32026-29801-29801-18	3/11/2016	3/11/2018

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2401.860M	95.9	+0.0 +28.1	+0.4 +0.4	+2.6	-34.0	+0.0	93.4	94.0	-0.6	Horiz
2	2441.860M	93.5	+0.0 +28.1	+0.4 +0.4	+2.6	-34.0	+0.0	91.0	94.0	-3.0	Horiz
3	2479.920M	91.3	+0.0 +28.1	+0.4 +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:

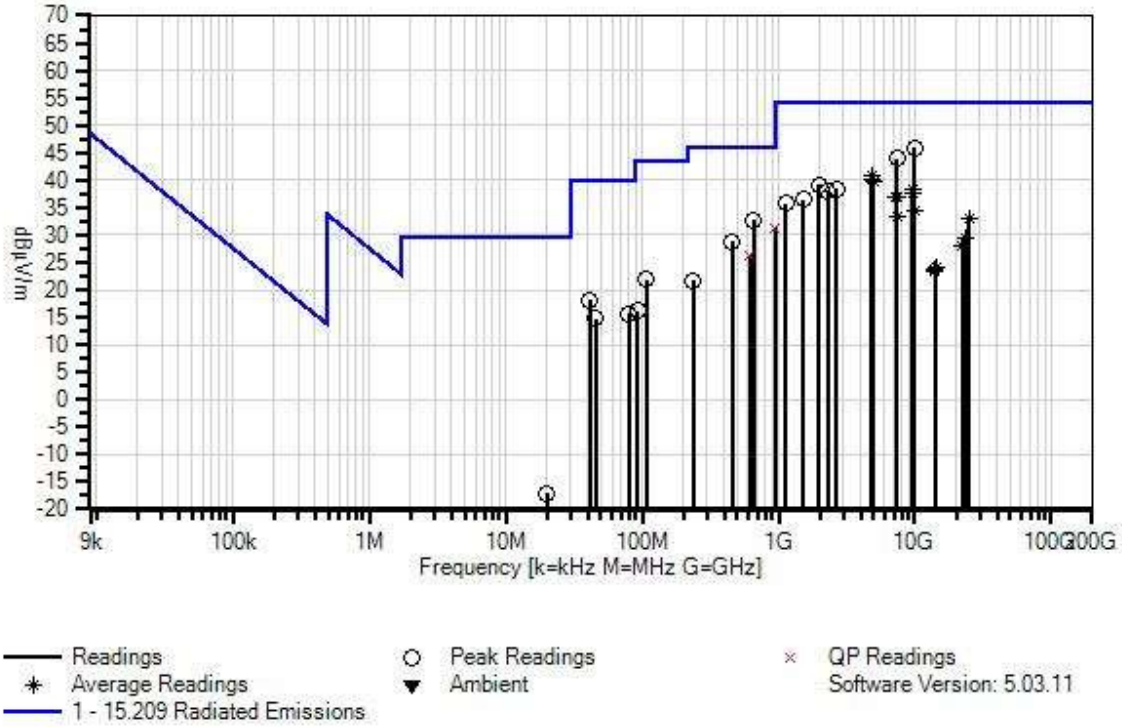
ANSI C63.10 (2013)

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



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	Heliax	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	Heliax	1/21/2016	1/21/2018
T9	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T10	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T11	ANP06934	Cable	32026-29801-29801-18	3/11/2016	3/11/2018
T12	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T13	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	10/7/2016	10/7/2018
T14	AN02763-69	Waveguide	Multiple	7/14/2017	7/14/2019
T15	ANP06503	Cable	32026-29801-29801-36	4/28/2016	4/28/2018
T16	ANP06678	Cable	32026-29801-29801-144	9/19/2016	9/19/2018
T17	AN02741	Active Horn Antenna	AMFW-5F-12001800-20-10P	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 T5 T9 T13 T17	T2 T6 T10 T14 T18	T3 T7 T11 T15	T4 T8 T12 T16	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	9916.291M	34.8	+0.0 +0.0 -33.7 +0.0 +0.0	+0.4 +0.0 +37.7 +0.0 +0.0	+0.0 +0.0 +0.7 +0.0	+0.0 +6.1 +0.0 +0.0	+0.0 360	46.0	54.0 High Band	-8.0	Vert 149
2	7437.291M	34.5	+0.0 +0.0 -34.4 +0.0 +0.0	+1.1 +0.0 +36.8 +0.0 +0.0	+0.0 +0.0 +0.6 +0.0	+0.0 +5.4 +0.0 +0.0	+0.0	44.0	54.0 High Band	-10.0	Vert 200

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

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

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

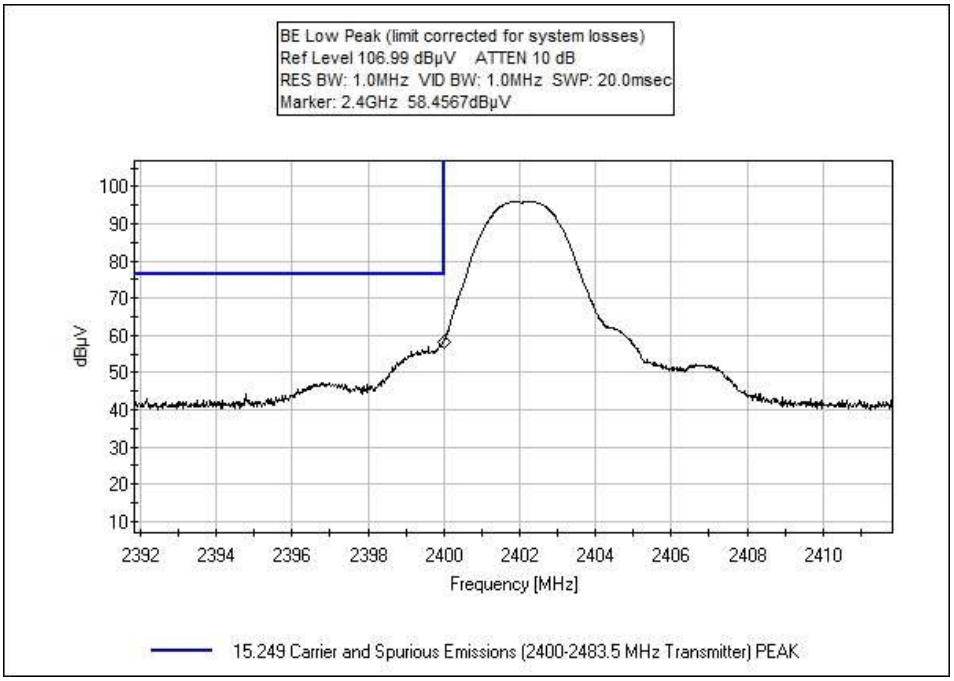
^	14256.000	37.8	+0.0	+0.8	+0.0	+0.0	+0.0	31.4	54.0	-22.6	Vert
	M		+0.0	+0.0	+0.0	+7.4					
			+0.0	+0.0	+0.0	+0.0			High Band		109
			+0.0	+0.0	+0.0	+0.0					
			-14.6	+0.0							
44	14120.000	30.3	+0.0	+0.7	+0.0	+0.0	+0.0	23.7	54.0	-30.3	Horiz
	M		+0.0	+0.0	+0.0	+7.3					
	Ave		+0.0	+0.0	+0.0	+0.0	360		Low Band		99
			+0.0	+0.0	+0.0	+0.0					
			-14.6	+0.0							
^	14120.000	37.0	+0.0	+0.7	+0.0	+0.0	+0.0	30.4	54.0	-23.6	Horiz
	M		+0.0	+0.0	+0.0	+7.3					
			+0.0	+0.0	+0.0	+0.0	71		Low Band		99
			+0.0	+0.0	+0.0	+0.0					
			-14.6	+0.0							
46	14072.000	30.0	+0.0	+0.7	+0.0	+0.0	+0.0	23.4	54.0	-30.6	Vert
	M		+0.0	+0.0	+0.0	+7.3					
	Ave		+0.0	+0.0	+0.0	+0.0	271		Mid Band		111
			+0.0	+0.0	+0.0	+0.0					
			-14.6	+0.0							
^	14072.000	43.2	+0.0	+0.7	+0.0	+0.0	+0.0	36.6	54.0	-17.4	Vert
	M		+0.0	+0.0	+0.0	+7.3					
			+0.0	+0.0	+0.0	+0.0			Mid Band		111
			+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
			+0.0	+0.0	+0.0	+0.0					144
			+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
			+0.0	+0.0	+0.0	+0.3					144
			+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
			+0.0	+0.0	+0.0	+0.0					144
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+14.4							

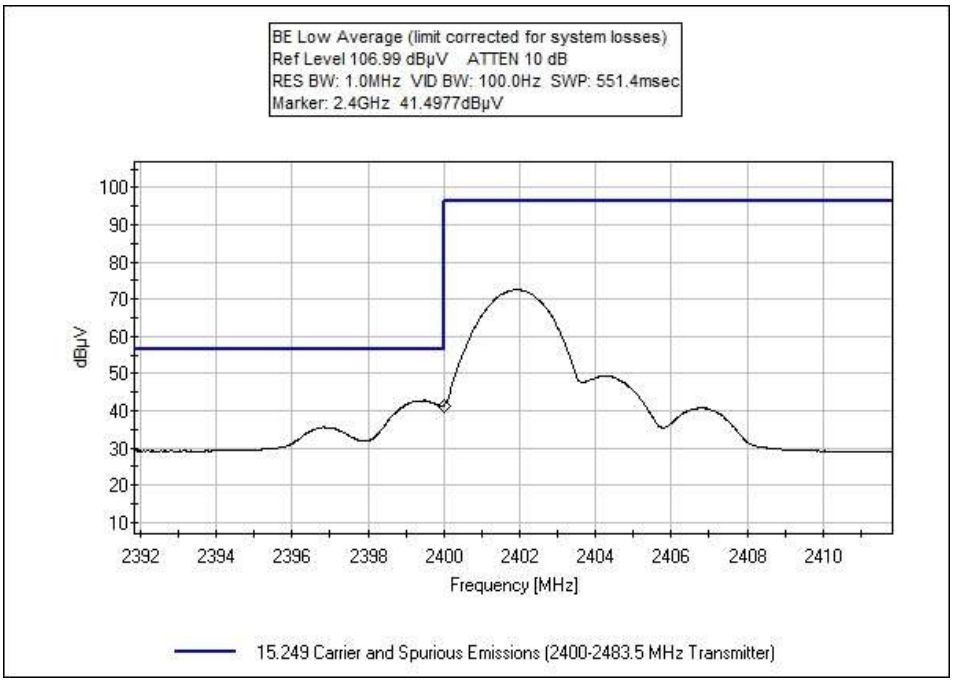
Band Edge

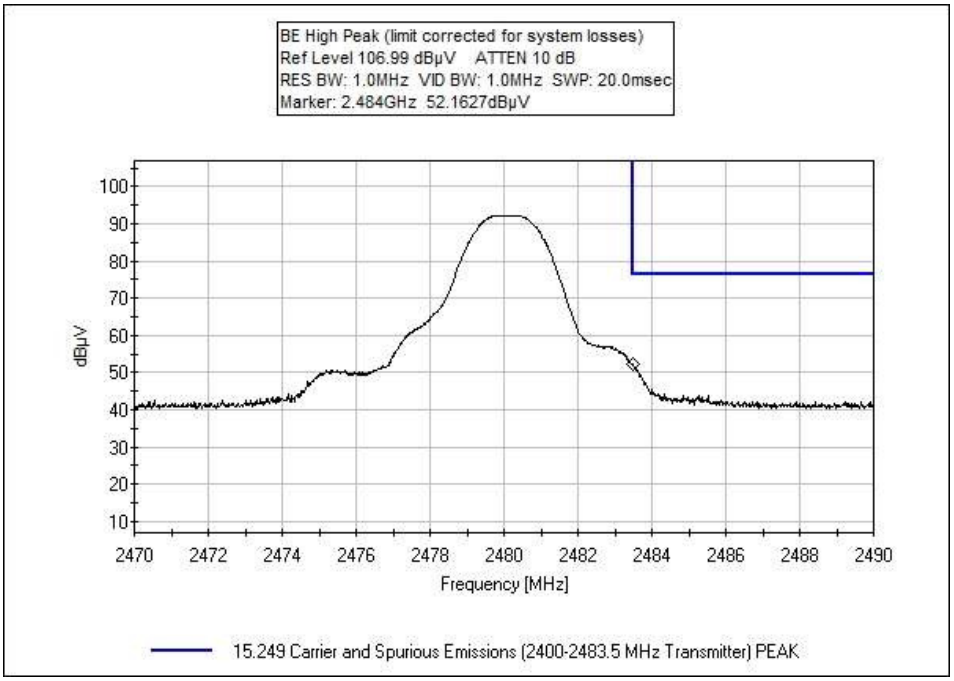
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2400 (Peak)	GFSK	Trace	56.0	<74	Pass
2400 (Average)	GFSK	Trace	39.0	<54	Pass
2483.5 (Peak)	GFSK	Trace	49.7	<74	Pass
2483.5 (Average)	GFSK	Trace	29.2	<54	Pass

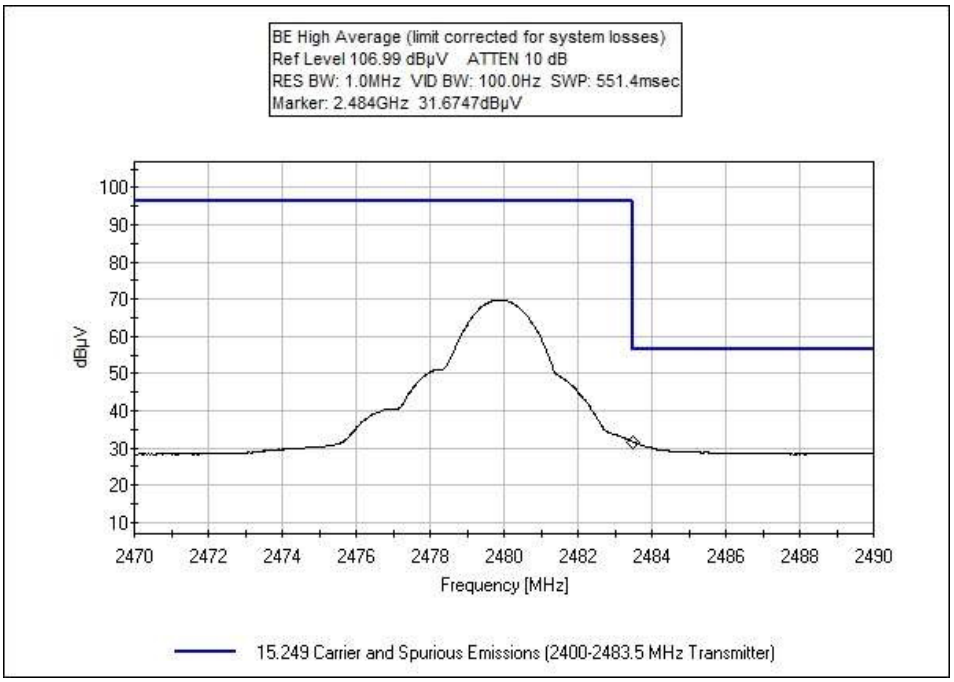
Test performed using operational mode with the highest output power, representing worst case

Band Edge Plots




BE Low Average (limit corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 100.0Hz SWP: 551.4msec
Marker: 2.4GHz 41.4977dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2392
2394
2396
2398
2400
2402
2404
2406
2408
2410
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)


BE High Peak (limit corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 2.484GHz 52.1627dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2470
2472
2474
2476
2478
2480
2482
2484
2486
2488
2490
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) PEAK


BE High Average (limit corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 100.0Hz SWP: 551.4msec
Marker: 2.484GHz 31.6747dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2470
2472
2474
2476
2478
2480
2482
2484
2486
2488
2490
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

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			

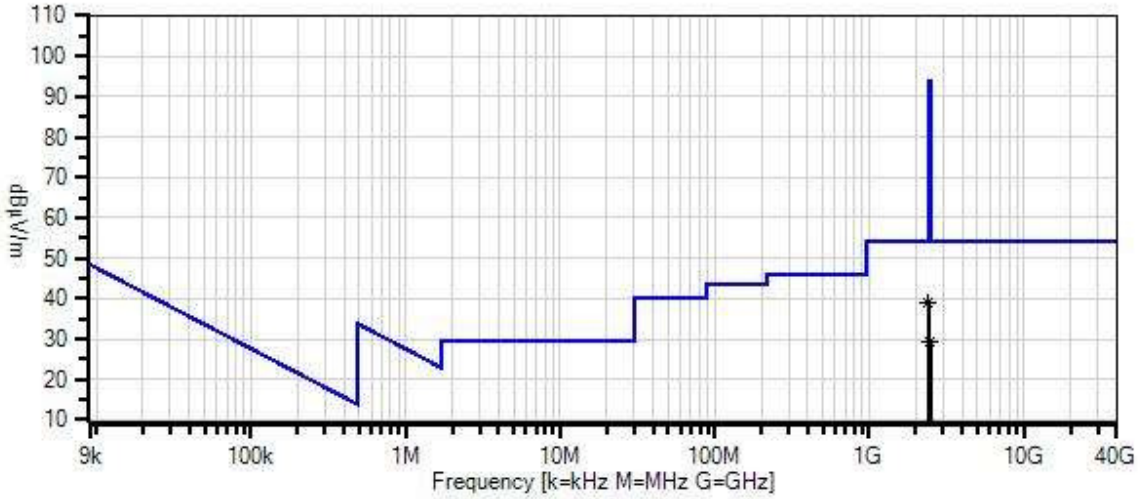
Test Conditions / Notes:

ANSI C63.10 (2013)

Temperature: 20°C
Humidity: 33%
Pressure: 101.7kPa

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 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	Heliax	10/30/2017	10/30/2019
T3	ANP06515	Cable	Heliax	1/21/2016	1/21/2018
T4	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	ANP06934	Cable	32026-29801-29801-18	3/11/2016	3/11/2018

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

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

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 dBµV/m, the spectrum analyzer reading in dBµV 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	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/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.