REGULATORY COMPLIANCE REPORT

TITLE: Test Report for title 47 Part 15.249 and RSS-210 Low Power Devices for RIVAW
AUTHOR: Mark Kvamme / Roger Mulcahy

REV	CCO	DESCRIPTION OF CHANGE	DATE	APPROVALS	
001		INITIAL RELEASE		Engineering	
				Regulatory	

REVISION HISTORY

002		update 20dB BW conducted test		Engineering	
				Regulatory	
				Engineering	
				Regulatory	
				Engineering	
				Regulatory	

Test Data Summary
FCC Part 15.249 / ISED RSS-210 Annex 2 / ISED RSS GEN
Field strength of Low Power Transmitters,
RIVAW Water, 908 MHz

Rule	Description	Spec Limit	Max. Reading	Pass/Fail
15.31(e)	Variation of Supply Voltage	n/a	N/A (battery)	N/A
Part 15.207 / RSS-Gen 8.8	Powerline conducted emissions	n/a	N/A (battery)	N/A
15.249(d) / RSS Gen 8.9, 8.10 and RSS 210 A2.9(b)	Out of band non-harmonic radiated emissions	table	36.5 dBuV/m @ 195.6 MHz	Pass
15.35(b) / RSS Gen 6.10	duty cycle corrections	calculated	-5.02dB	--
15.249(a) / RSS-210 A2.9(a)	Radiated emissions of transmitter fundamental and harmonics	**Fundamental ;** 94 dbuV/m Avg **Harmonics ;** Peak 74 dbuV/m Avg 54 dbuV/m	**Fundamental:** Peak level = 90.9dbuV/m @ 908MHz **Harmonics:** Peak level= 50.3dbuV/m @ 5448MHz Average level= 49.8dbuV/m @ 5448MHz	Pass
15.249(d)	Band Edge, radiated	-50dBc or 46 dbuV/m (lesser)	40.8 dbuV/m @ 902 MHz <36 dbuV/m @ 928 MHz	Pass
RSS Gen 6.6	20dB Bandwidth	<0.5% of the center frequency	167kHz	Pass

Rule versions: FCC Part 1; FCC Part 2; FCC Part 15; RSS-102 Issue 5 (03-2015); RSS-210 Issue 8en (05-2015); RSS 247 Issue 1 (05-2015); RSS-Gen Issue 4 (12-2014).
Reference docs: ANSI C63.4-2003(2009,2014); ANSI C63.10-2003(2009,2013); DA 00-705 (03-30-2000); OET65 (08-1997); OET65C (06-2001); IEEE C95.3-2002.(2003, 2010); RSP100 issue11; SDR KDB 442812 D01 (07-2014); Exposure KDB 227498D01 (02-2014)

Cognizant Personnel	
Mark Kvamme / Roger Mulcahy	Test Technician
Name	Title
Johann De Jager	Project Engineer
Name	Title
Jay Holcomb	Regulatory
Name	Title

CONDITIONS DURING TESTING

No Modifications to the EUT were necessary during the testing.

FCC 15.31(m) – IC _n/a_; Number of Channel
This device operates and was tested on one channel.

ANSI C63.4 - Temperature and Humidity during Testing
The temperature during testing was within +10º C and +40º C.
The Relative humidity was between 10% and 90%.
RSS-Gen 4.3 (g): Tests shall be performed at ambient temperature

EQUIPMENT UNDER TEST (EUT) DESCRIPTION
Itron declares that the EUT tested was representative of a production unit.

EUT Module

Manuf:	Itron, Inc.
Part Number(s)	ERW-1601-001
Serial Number(s)	Listed Below
Power source	Fresh Batteries were used

Plot Information
In the zero span measurements, the line in the display is the trigger level.

Peripheral Devices
None

15.31(e)

Variation of Supply Voltage

Vary the supply voltage from 85% to 115% of the nominal voltage. If the power level of the fundamental signal varies with supply voltage, record the voltage level at which the fundamental signal is at its highest and use that voltage level for all further testing.

DEVICE IS BATTERY OPERATED NOT CONNECTED TO THE POWER LINE. BATTERY IS NOT RECHARGABLE. THERFORE THIS TEST IS N/A.

15.207 / RSS-GEN 8.8

Power line Conducted Emissions

Measure the AC power line conducted emissions from 150 kHz to 30 MHz using a 50mH/50ohm line impedance stabilization network (LISN) according to the procedure specified in ANSI C63.4. Verify that no emissions exceed the following limits:

Frequency (MHz)	Quasi-Peak (dBuV)	Average (dBuV)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of frequency

DEVICE IS BATTERY OPERATED NOT CONNECTED TO THE POWER LINE. BATTERY IS NOT RECHARGABLE. THERFORE THIS TEST IS N/A.

15.249(d)/ RSS Gen 8.9, 8.10 and RSS 210 A2.9 (b)

Out of band non-harmonic emissions

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (microvolts/meter)	in dBuV/m	Measurement Distance (meters)*
0.009-0.490	2440F (kHz)		300
0.490-1.705	2400F (kHz)		30
1.705-30.0	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

FS (dBuV/) = 20 * log (FS (uV/m))

* Adjust when measuring at different distances than specified; 40dB/decade <30MHz and 20dB/decade >=30MHz. (at 30MHz depends on the antenna used)

note: 15.249(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Measure the field strength of all spurious emissions that are not harmonics according to the procedure in Appendix A.

For emissions measurements below 30MHz, rotate the loop antenna about its horizontal and vertical positions to maximize emissions.

Frequency range investigated 9 kHz to 9.08 GHz

For out of band non-harmonic emissions see CKC FCC report 98804-15 pages 13 to 16, and CKC ISED report 98804-16 pages 12 to 15.

15.35(b)/ RSS Gen 6.10

Pulsed Operation

Calculate the maximum duty cycle of the transmitter that will occur in any 100ms. Perform the following calculation:

Duty Cycle $_{dB}$ = |20 * log(Duty Cycle %)|
Duty Cycle $_{dB}$ = |20 * log (56.1/100)
Duty Cycle $_{dB}$ = 5.02 db

When operated under 15-249 rules, the RIVAW typically transmits a low power message at 908 MHz in response to a received request transmitted at 908 MHz from an external device. There are a variety of responses that can be transmitted by the 500w, all with less than 56.1 mS duration. Testing to 15.249 limits was done with special code that transmits repeated low power 100 mS bursts at 908 MHz

15.249(a)/RSS-210 Sec. A2.9,(a)

Transmitter Fundamental and Harmonics

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following: (table below)
(c) Field strength limits are specified at a distance of 3 meters.
(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Measure the field strength of the transmitter fundamental and harmonic emissions at three meters according to the procedure in Appendix A. Record emissions levels with the transmitter near its lowest, middle, and highest frequencies. The maximum field strength of emissions may not exceed:

Fundamental (mV/m)	in (dBuV/m)	Harmonics (mV/m)	in (dBuV/m)
50,000	94	500	54

FS (dBuV/m) = 20 * log (FS(uV/m))

For transmitter fundamental and harmonic emissions see CKC FCC report 98804-15 pages 8 to 16, and ISED report 98804-16 pages 9 to 15.

Equipment Used	Serial Number	Cal Date	Due
Agilent E7405A	MY45113415	4/21/2016	4/21/2017
Date	Tested by		
October/2016	Roger Mulcahy		

Unit tested with a fresh Battery: **07**

Transmitter power @ 908 MHz conducted. (Measured for MPE calculations)

FCC Part 15.249(d)

Band Edge, radiated

(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 (200uV/m(46dbuV/m) at 3 meters), whichever is the lesser attenuation.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section. Submit this plot.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

For radiated band edge emissions see CKC FCC report 98804-15 pages 17 to 20, and ISED report 98804-16 pages 16 to 20.

RSS-GEN 6.6

20 dB Bandwidth, conducted

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth. General Requirements for Compliance of Radio Apparatus RSS-Gen 10

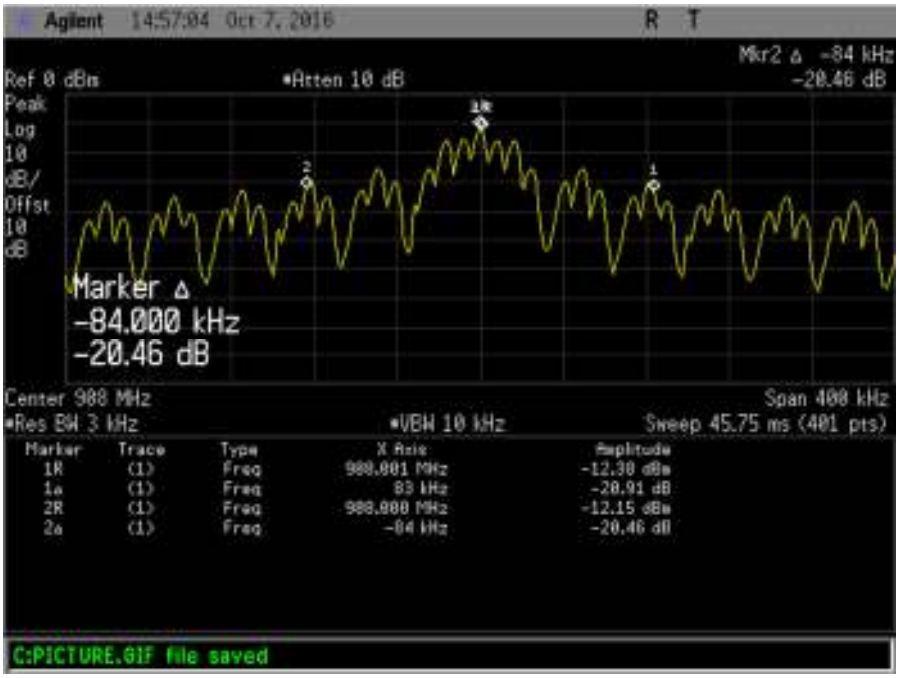
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
• The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.
Note: Video averaging is not permitted.

DUT is endpoint 07, battery was new.

Equipment Used	Serial Number	Cal Date	Due
Agilent E7405A	MY45113415	4/21/2016	4/21/2017
Date	Tested by		
October/2016	Roger Mulcahy		

Conducted setup: Board 07 with a fresh battery, was connected to the Agilent E7405E analyzer.
20 dB BW = 167 kHz



Appendix A

Field Strength Measurement Procedure

This test measures the field strength of radiated emissions using a spectrum analyzer and a receiving antenna in accordance with ANSI C63.4-2003. During the test, the EUT is to be placed on a non-conducting support at 80 cm above the horizontal ground plane of the OATS. The horizontal distance between the antenna and the EUT is to be exactly 3 meters. The bandwidths used shall be per ANSI C63.4-2003; 200 Hz from 9 kHz to 150 kHz, 9 kHz from 150 kHz to 30 MHz, 100 kHz from 30 MHz to 1000 MHz, and 1 MHz from 1 GHz to 40 GHz, with the detector set to peak hold or quasi peak .

1) The antenna correction factor, preamplifier gain (if the preamplifier is installed), and cable loss are stored in tables in the EMC analyzer and the level at the analyzer is the corrected level in dbuV/m.
2) Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
3) If appropriate, manipulate the system cables to produce the highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
4) Rotate the EUT 360° to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat step 3). Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.
5) Move the antenna over its fully allowed range of travel to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to step 3) with the antenna fixed at this height. Otherwise, move the antenna to the height that repeats the highest amplitude observation and proceed.
6) Change the polarity of the antenna and repeat step 3), step 4), and step 5). Compare the resulting suspected highest amplitude signal with that found for the other polarity. Select and note the higher of the two signals.
7) The final maximized level displayed on the EMC analyzer is the field strength.