REGULATORY Compliance REPORT

TITLE: Test Report for Title 47 Part 15.249 and RSS-210 for 100W/WP-phase3.3

AUTHOR: Roger Mulcahy

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

REVISION HISTORY

A		for initial upload	15jun11	Engineering	
				Regulatory	
B		updated for questions asked, just a few; 100WB nomenclature above, page 7 freq range, page 3 nomenclature, added RX and fixed rule parts.	29june11	Engineering	
				Regulatory	
C		corrected page 7 to show entire range investigated	07jul11	Engineering	
				Regulatory	

FCC Part 15.249 / IC RSS-210 Sec. 6.2.2(m2);
Field strength of Low Power Transmitters, 908 MHz
FCC ID: EWQ100WB
IC ID: 864D-100WB
IC Device Models: 100WBOATS Registration Number: FCC 90716, IC 5615

Rule	Description	Spec Limit	Max. Reading	Pass/Fail
15.31(e)	Variation of Supply Voltage	n/a	N/A (battery)	N/A
15.207/RSS-GEN 7.2.2	Power line conducted emissions	n/a	N/A (battery)	N/A
15.249(d) / RSS-210 sec. 2.7 table 2	Out of band non-harmonic radiated emissions	table	No Emissions	Pass
15.35(b)/RSS-210 sec. 6.5	duty cycle corrections	calculated	-5.65db	N/A
15.249(a) / RSS-210 A2.9	Radiated emissions of transmitter fundamental and harmonics	50,000 / 500 uV/m – 94dBuV/m	93.32dBuV/m @908 MHz average 51.99dBuV/m @ 2724MHz	Pass
15.249(d)	Band Edge, radiated	200 uV/m – 46dBuV/m	38.7 dBuV/m @902 MHz	Pass
RSS-GEN 4.6.1	99% Bandwidth	<0.5% of the center frequency	211 kHz	Pass
RSS-Gen 7.2.3	Receiver Spurious Emissions - radiated	table		Pass

Rule versions: FCC Part 1; FCC Part 2; FCC Part 15, RSS-102 Issue 4 (03-2010); RSS-210 Issue 8 (12-2010); , RSS-Gen Issue 3 (12-2010)
Reference docs: ANSI C63.4-2003; DA 00-705 (03-30-2000); OET65 (08-1997); OET65C (06-2001); IEEE C95.3-2002.

Cognizant Personnel	
Roger Mulcahy	Test Technician
Name	Title
Jason Woodruff	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: Tests shall be performed at ambient temperature

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

EQUIPMENT UNDER TEST

EUT Module

Manuf:	Itron, Inc.
Itron Model:	Itron 100W/WP (Customer nomenclature)Endpoint
FCC/IC cert #:	100WB
Serial Number(s)	**board 200063; Endpoint 200087 or** Listed Below
Power source	Fresh Batteries were used

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

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 7.2.2

Power line Conducted Emissions

Measure the AC power line conducted emissions from 150kHz to 30 MHz using a 50□H/50□ 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 (dB□V)	Average (dB□V)
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.

15.209 / RSS-210 sec.2.7 table 2

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.

DUT is endpoint 200087, battery was new.

Frequency range investigated was 9 kHz to 9.28GHz. (part 15.33 (a))

Equipment Used	Serial Number	Cal Date	Cal Due
Huber&Suhner 40 foot cable	220297001	12/3/2009	12/3/2011
filter 405735 and Huber&Suhner sucotest cable 1	405735	8/16/2010	8/16/2011
AH systems preamplifer PAM 0126	135	11/17/2010	11/17/2011
EMCO loop antenna model 6502 (9kHz to 30MHz)	9509-2970	10/7/2010	10/7/2012
EMCO 3148 Log periodic (200MHz to 1GHz)	9901-1044	9/9/2010	9/9/2012
EMCO Biconical antenna(30MHz-to 300MHz)	9203-2455	9//2010	9/9/2012
EMCO 3115 double ridge wave guide(1Ghz – 18GHz)	9508-4550	3/22/2010	3/22/2012
Agilent E7405A Spectrum Analyzer	MY45113415	8/4/2010	8/4/2011

Date	Temp/Humidity ºF / %	Tested by
5/10/2011 and 5/13/2011	75F / 25%	Roger Mulcahy

No Emissions found

15.35(b)

Pulsed Operation

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

$$\text{Duty Cycle}_{dB} = |20 * \log(\text{Duty Cycle \%})|$$

When operated under 15-249 rules, the 100W are 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 100G, all with less than 51.6 mS duration. Testing to 15.249 limits was done with special code that transmits repeated low power 100 mS bursts at 908 MHz

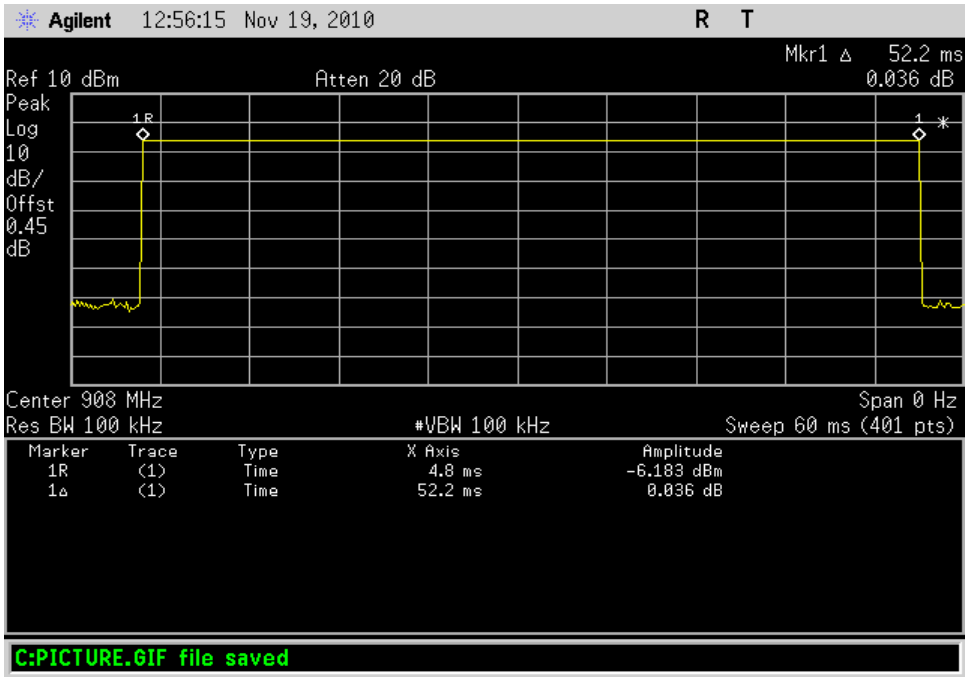
DUT was test board 200063, battery was new.

Equipment Used	Serial Number	Cal Date	Cal Due
Agilent E4402B	My44210913	10/7/2010	10/7/2012

Date	Temp/Humidity °F / %	Tested by
11/19/2010	72/50	Roger Mulcahy

$\text{Duty Cycle}_{dB} = |20*\log(\text{Duty Cycle \%})|$
$\text{Duty Cycle}_{dB} = |20*\log(52.2/100)|$
$\text{Duty Cycle}_{dB} = |20*\log(0.522)|$
$\text{Duty Cycle}_{dB} = -5.65$ db correction factor

Conducted setup: Board 200063 was connected to the Agilent E4402B analyzer.



15.249(a)/RSS-210 A2.9

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 (□V/m)	in (dBuV/m)	Harmonics (□V/m)	in (dBuV/m)
50,000	94	500	54

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

Equipment Used	Serial Number	Cal Date	Cal Due
Agilent E7405A Spectrum Analyzer	MY45113415	8/4/2010	8/4/2011
Huber&Suhner 40 foot cable	220297001	12/3/2009	12/3/2011
EMCO loop antenna model 6502 (9kHz to 30MHz)	9509-2970	10/7/2010	10/7/2012
EMCO Biconical antenna(30MHz-to 300MHz)	9203-2455	9//2010	9/9/2012
EMCO 3148 Log periodic(200MHz to 1GHz)	9901-1044	9/9/2010	9/9/2012
EMCO 3115 double ridge wave guide(1GHz – 18GHz)	9508-4550	3/22/2010	3/22/2012
microwave circuits 1.3ghz high pass filter	405735	8/16/2010	8/16/2011
Sucoflex cable 36”	104	9/17/2009	9/17/2011
AH systems preamplifer PAM 0126	135	11/17/2010	11/17/2011

Date	Temp/Humidity ºF / %	Tested by
5/10/2011 and 5/11/2011	75F / 26%	Roger Mulcahy

Frequency (Mhz)	Polarity	Peak Level (dBuV/m)	Average level with Duty Cycle Correction factor - 5.65db* (dBuV/m)	Antenna correction Factor	Coaxial cable and High pass filter loss (db)	Amplifier Gain (db)
908	Vertical	93.32		24.54	2.59	0
908	Horizontal	87.26		24.54	2.59	0
2724	Horizontal	57.64	51.99	28.9	5.28	-34.47
3632	Horizontal	55.73	50.08	31.58	6.03	-34.08
5448	Horizontal	53.77	48.12	34.18	7.43	-34.99
5448	vertical	53.3	47.65	34.18	7.43	-34.99
3632	vertical	53	47.35	31.58	6.03	-34.08
4540	Horizontal	52.72	47.07	32.4	6.84	-34.57

*For harmonics, adjust for the proper duty cycle correction in accordance with the results from pulsed operation section above.

DUT is endpoint 200087, battery was new.

Frequency range investigated was 9 kHz to 9.28GHz. (part 15.33 and RSS-GEN sec. 4.9)

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 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. Submit this plot.

Band Edge	Test Setup	Level	Pass/Fail
902 MHz	Radiated	38.7dB uV/m	Pass
928 MHz	Radiated	37.6dB uV/m	Pass

Date	Temp/Humidity ºF / %	Tested by
5/25/2011	72F / 48.7%	Roger Mulcahy

Radiated setup: Endpoint 200087 batteries were new and test was conducted at EMC.

EMC SR Scan Data.pdf

RSS-GEN 4.6.1

99% Bandwidth, conducted

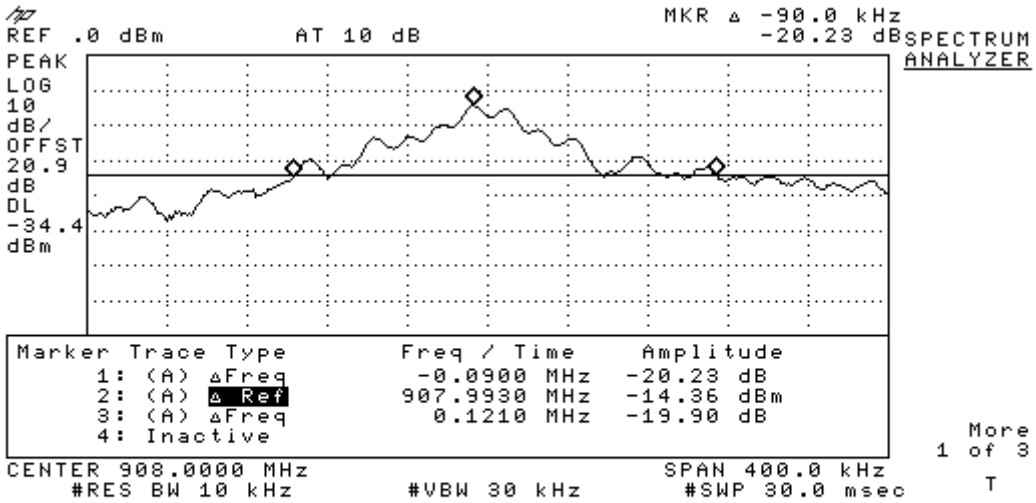
The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.
The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.
The span between the two recorded frequencies is the occupied bandwidth.

Capture a plot of the 99% bandwidth of a single transmission.
DUT was test board 200087, battery was new.

Equipment Used	Serial Number	Cal Date	Cal Due
HP 8593E	3543A02032	12/3/2010	12/3/2011

Date	Temp/Humidity ºF / %	Tested by
6/8/2011	72/50	Roger Mulcahy

Conducted setup: Board 200087 was connected to the HP 8593E analyzer.



99% BW = 121 kHz + 90 kHz = 211 kHz

RSS-Gen 7.2.3 Receiver Spurious Emission Limits and Unintentional 15.109

7.2.3.2 Radiated Measurement

All spurious emissions shall comply with the limits of Table 1.

Receiver Spurious Emissions

The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate. Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions. Radiated emission measurements are to be performed using a calibrated open-area test site. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port. If the receiver is super-regenerative, stabilize it by coupling to it an un-modulated carrier on the receiver frequency (antenna conducted measurement) or by transmitting an un-modulated carrier on the receiver frequency from an antenna in the proximity of the receiver (radiated measurement). Taking care not to overload the receiver, vary the amplitude and frequency of the stabilizing signal to obtain the highest level of the spurious emissions from the receiver. For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

Receiver Spurious Emission Standard

The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1. The resolution bandwidth of the spectrum analyzer shall be 100 kHz for spurious emission measurements below 1.0 GHz, and 1.0 MHz for measurements above 1.0 GHz.

Equipment Used	Serial Number	Cal Date	Due
Agilent E7405A Spectrum Analyzer	MY45113415	8/4/2010	8/4/2011
AH systems preamplifer PAM 0126	135	11/17/2010	11/17/2011
Huber&Suhner 40 foot cable	220297001	12/3/2009	12/3/2011
Sucoflex cable 36"	104	9/17/2009	9/17/2011
EMCO 3148 Log periodic	9901-1044	9/9/2010	9/9/2012
EMCO 3108Biconical antenna	9203-2455	9/9/2009	9/9/2012
EMCO 3115 double ridge wave guide	9508-4550	3/22/2010	3/22/2012
Date	Tested by	Temp/Humidity, ºF / %	
5/12/2011	Roger Mulcahy	78F / 25%	

Unit tested w/fresh battery: *200087*

Table 1- Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 meters)	in dBuV/m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

FS(uV/m) = 10 raised to the power of {(dBuV/m)/20}

Frequency range investigated was 30MHz to 9.28 GHz. Emissions from the Receiver were below the noise floor.

No emissions noise floor is 27dBuV/m

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.