



REGULATORY Compliance REPORT

TITLE: Test Report for Title 47 Part 15.249 and RSS-210 for 100W+

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

REVISION HISTORY

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FCC Part 15.249 / IC RSS-210 Sec. 6.2.2(m2);
Field strength of Low Power Transmitters,
100WD 908 MHz
FCC ID:EWQ100WD
IC:864D-100WD
IC Device Models:100WD, 100WDR
OATS 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. 6.6.2(m2)(3)	Out of band non-harmonic radiated emissions	table	No Emissions	Pass
15.35(b)/RSS-210 sec. 6.5	duty cycle corrections	calculated	-5.02db	N/A
15.249(a)/RSS-210 Sec. 6.2.2 (m2)(1)	Radiated emissions of transmitter fundamental and harmonics	50,000 / 500 uV/m - 94dBuV/m	90.94dBuV/m @908 MHz average 47.95dBuV/m @ 7264MHz	Pass
15.249(d)	Band Edge, radiated	200 uV/m - 46dBuV/m	42.92 dBuV/m @902 MHz	
RSS-GEN 4.6.1	99% Bandwidth	<0.5% of the center frequency	166.1kHz	Pass

Cognizant Personnel	
<u>Roger Mulcahy</u> Name	<u>Test Technician</u> Title
<u>Jason Woodruff</u> Name	<u>Project Engineer</u> Title
<u>Jay Holcomb</u> Name	<u>Regulatory</u> 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 +10° C and +40° 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+ Endpoint
Serial Number(s)	board 69501228; Endpoint 69501161 are 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. THEREFORE 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 μ H/50 μ 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 μ V)	Average (dB μ 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. THEREFORE THIS TEST IS N/A.

15.209 / RSS-210 sec. 6.2(m2)(3)

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 69501161, battery was new.

Equipment Used	Serial Number	Cal Date	Cal Due
Agilent E7405A Spectrum Analyzer	MY45113415	7/19/2012	7/19/2013
Microcoax 40 foot cable	H1G315G1	4/15/2011	4/15/2013
AH systems preamplifier model number PAM 0126	146	2/6/2012	2/6/2013
Emco 6502 Loop (9kHz to 30Mhz)	9509-2970	11/5/2012	11/5/2014
Emco 3110B Biconical (30MHz-to 300MHz)	9807-3129	7/20/2011	7/20/2013
Emco 3146 Log Periodic (200Mhz to 1GHz)	9203-3358	7/20/2011	7/20/2013
Emco 3115 waveguide (1Ghz - 18GHz)	9508-4550	12/21/2011	12/21/2012
1.3Ghz high pass filter	405735	6/3/2011	6/3/2013
Huber&Suhner sucotest cable	2	4/26/2011	4/26/2013

Date	Temp/Humidity °F / %	Tested by
11/7/2012 to 11/8/2012	75F / 31%	Roger Mulcahy

No Emissions found

15.35(b) / RSS-210 sec. 6.5

Pulsed Operation

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

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

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 100w, all with less than 52.2 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 69501228, battery was new.

Equipment Used	Serial Number	Cal Date	Due
Agilent E4402B	My44210913	10/25/2012	10/25/2014
Date	Tested by		
11/6/2012	Roger Mulcahy		

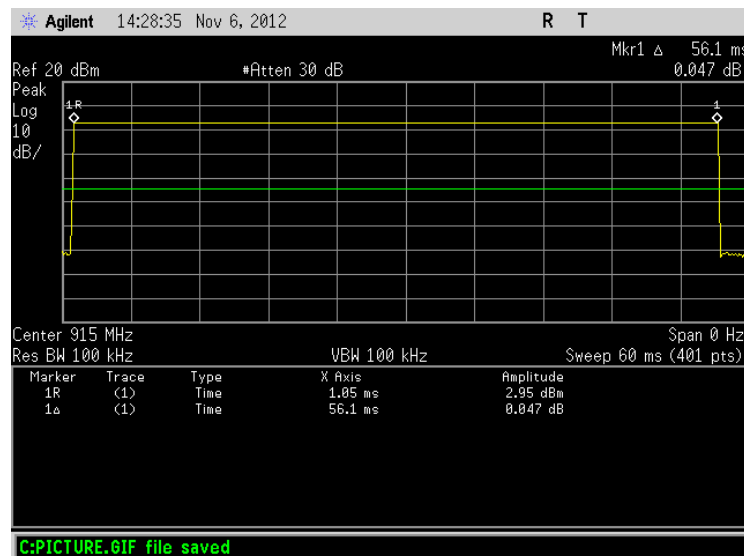
$$\text{Duty Cycle}_{\text{dB}} = |20 * \log(\text{Duty Cycle } \%)|$$

$$\text{Duty Cycle}_{\text{dB}} = |20 * \log(56.1/100)|$$

$$\text{Duty Cycle}_{\text{dB}} = |20 * \log(0.522)|$$

$$\text{Duty Cycle}_{\text{dB}} = -5.02 \text{ db correction factor}$$

Conducted setup: Board 69501228 was connected to the Agilent E4402B analyzer.



15.249(a)/RSS-210 sec. 6.2(m2)(1)

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

$$FS \text{ (dBuV/m)} = 20 * \log (FS(\mu\text{V/m}))$$

Equipment Used	Serial Number	Cal Date	Cal Due
Agilent E7405A Spectrum Analyzer	MY45113415	7/19/2012	7/19/2013
Microcoax 40 foot cable	H1G315G1	4/15/2011	4/15/2013
Emco 3110B Biconical (30MHz-to 300MHz)	9807-3129	7/20/2011	7/20/2013
Emco 3146 Log Periodic (200Mhz to 1GHz)	9203-3358	7/20/2011	7/20/2013
Emco 3115 waveguide (1Ghz - 18GHz)	9508-4550	12/21/2011	12/21/2012
AH systems preamplifier model number PAM 0126	146	2/6/2012	2/6/2013
1.3Ghz high pass filter	405735	6/3/2011	6/3/2013

Date	Temp/Humidity °F / %	Tested by
11/5/2012 to 11/6/2012	76F / 32%	Roger Mulcahy

Test unit id 69501161

Frequency (Mhz)	Polarity	Peak Level (dBuV/m)	Average level with Duty Cycle Correction factor - 5.02db* (dBuV/m)	Antenna correction Factor	Coaxial cable and High pass filter loss (db)	Amplifier Gain (db)
908	Vertical	90.94		22.18	2.78	0
908	Horizontal	82.59		22.18	2.78	0
7264	Horizontal	52.97	47.95	36.15	9.06	-33.57
6356	Vertical	52.08	47.06	34.72	8.49	-33.9
6356	Horizontal	51.6	46.58	34.72	8.49	-33.9
5448	Horizontal	48.09	43.07	34.13	7.84	-33.94
4540	Horizontal	47.06	42.04	32.24	7.14	-33.34
1816	Vertical	40.66	35.02	26.9	4.71	-36.95

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

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 \geq 1% of the span
 VBW \geq RBW
 Sweep = auto
 Detector function = peak
 Trace = max hold

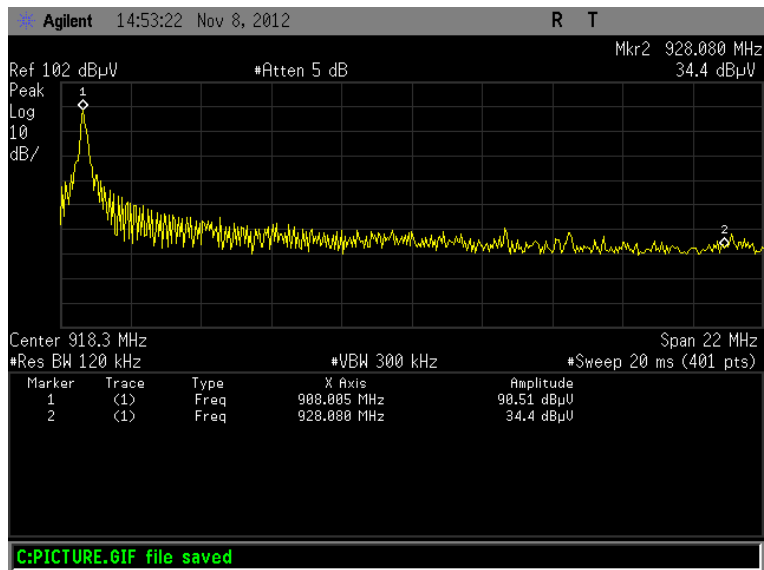
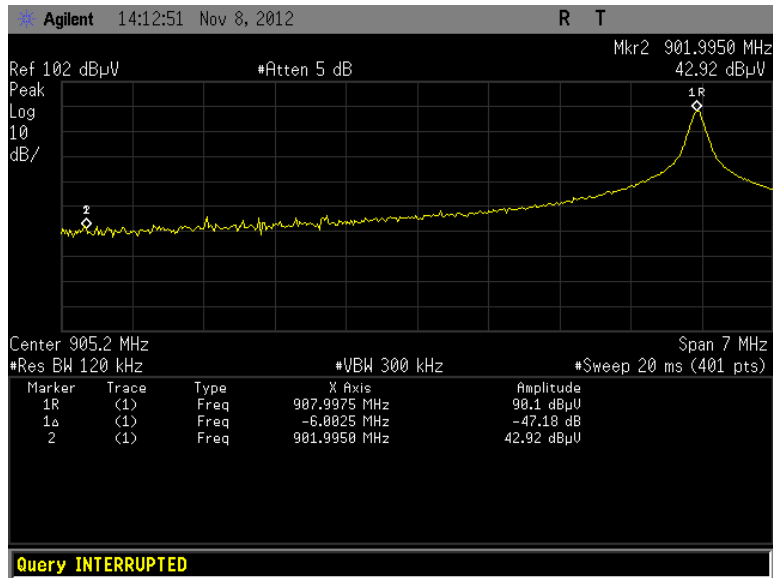
Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the 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	42.92dB uV/m	Pass
928 MHz	Radiated	34.4dB uV/m	Pass

Date	Temp/Humidity °F / %	Tested by
11/08/2011	77F / 31%	Roger Mulcahy and Mark Kvamme

Radiated setup: Endpoint 69501161batteries are new.



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.

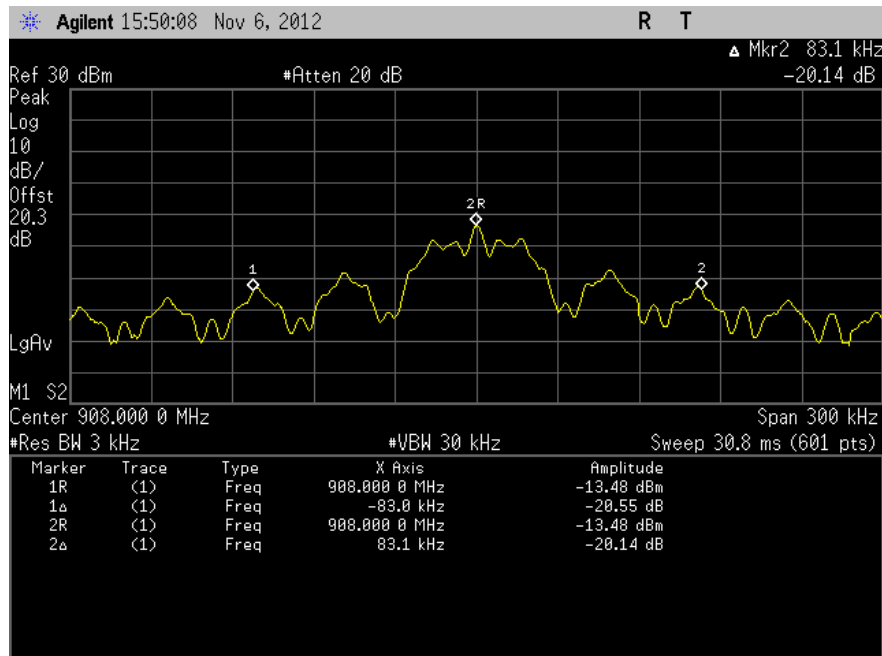
The span between the two recorded frequencies is the occupied bandwidth.

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	Due
E4440A	MY45305142	24-Apr-12	24-Apr-13
Date	Tested by		
11/6/2012	Roger Mulcahy		

Conducted setup: Board 69501228.



$$99\% \text{ BW} = 83.1 \text{ kHz} + 83 \text{ kHz} = 166.1 \text{ kHz}$$

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.

