

REGULATORY Compliance REPORT

TITLE: Test Report For Title 47 Part 15.249 and RSS-210
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REV	CCO	DESCRIPTION OF CHANGE	DATE	APPROVALS
		INITIAL RELEASE		Engineering
				Engineering

REVISION HISTORY

A	n/a	ready for uploading	05oct10	Engineering
B	n/a	clarified x/decade note on page 5 and put full radiated for band edge.		Engineering
				Engineering

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**FCC Part 15.249 / IC RSS-210 Sec. 6.2.2(m2);
Field strength of Low Power Transmitters,
100GDL with remote disconnect, 908 MHz
FCC ID: EWQ100GDLCN
IC ID: 864D-100GDLCN
IC Device Models: 5N, 6N
Part Numbers: ERG-5003-007; -008
.Serial Number: board 2072; Endpoint 9570
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	Powerline 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	-5.75db	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	92.05dbuV/m @908 MHz average 52.66dbuV/m @ 2724MHz	Pass
15.249(d)	Band Edge, radiated	200 uV/m	38.52 uV/m @902 MHz	Pass
RSS-GEN 4.6.1	99% Bandwidth	<0.5% of the center frequency	174kHz	Pass

Cognizant Personnel	
Mark Kvamme Name	Test Technician Title
Johann De Jager Name	Project Engineer Title
Jay Holcomb Name	Regulatory 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 100GDL FN Endpoint
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.

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 50ΩH/50Ω 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 (dBμV)	Average (dBμV)
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 9570, battery was new.

Equipment Used	Serial Number	Cal Date	Cal Due
Micro Coax 40 foot cable	214970001	4/7/2009	4/7/2011
Roberts Dipole 400-1000 MHz	4106	14-Sep-10	14-Sep-12
EMCO 3115 double ridge wave guide	9508-4550	3/22/2010	3/22/2012
filter 405735 and Huber&Suhner sucotest cable 1	405735	8/16/2010	8/16/2011
AH systems preamplifier	146	12/3/2009	12/3/2010
EMCO 3146 Log periodic	9203-3358	10/12/2009	10/12/2011
EMCO Biconical antenna	9807-3129	10/2/2009	10/2/2011
EMCO loop antenna model 6502	9509-2970	10/15/2008	10/15/2010
Agilent E7405A Spectrum Analyzer	MY45113415	8/4/2010	8/4/2011

Date	Temp/Humidity °F / %	Tested by
9/30/2010	70F / 70%	Mark Kvamme

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:

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

When operated under 15-249 rules, the 100G is 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.

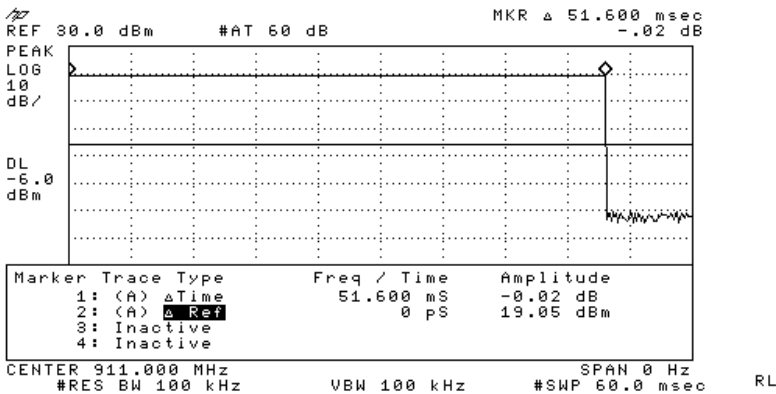
DUT was test board 9081, battery was new.

Equipment Used	Serial Number	Cal Date	Cal Due
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	8 Dec 09	8 Dec 10
Huber & Suhner Suco flex 104	220058002	8 Sept 10	8 Sept 11

Date	Temp/Humidity °F / %	Tested by
9/14/2010	72/50	Mark Kvamme

Conducted setup: Board 9081, with a new battery, was connected to the Hewlett Packard 8593E analyzer with the cable listed in the table above.

Duty Cycle_{dB} = |20*log(Duty Cycle %)|
 Duty Cycle_{dB} = |20*log(51.6/100)|
 Duty Cycle_{dB} = |20*log(0.156)|
 Duty Cycle_{dB} = -5.75 db correction factor



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

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

Equipment Used	Serial Number	Cal Date	Cal Due
Micro Coax 40 foot cable	214970001	4/7/2009	4/7/2011
ETS Lindgren Dipole antenna	78573	9/18/2008	9/18/2010
EMCO 3115 double ridge wave guide	9508-4550	3/22/2010	3/22/2012
filter 405735 and Huber&Suhner sucotest cable 1	405735	8/16/2010	8/16/2011
AH systems preamplifier	146	12/3/2009	12/3/2010

Date	Temp/Humidity °F / %	Tested by
9/11/2010	60F / 73%	Mark Kvamme

Frequency (MHz)	Polarity	Peak Level (dbuV/m)	Average level with Duty Cycle Correction factor - 5.75db* (dbuV/m)	Antenna correction Factor	Coaxial cable and High pass filter loss (db)	Amplifier Gain (db)
908	Horizontal	92.05		27.93	2.59	0
908	Vertical	83.38		27.93	2.59	0
2724	Horizontal	58.41	52.66	28.9	5.28	34.47
2724	Vertical	51.98	46.23	28.9	5.28	34.47
5448	Vertical	50.76	45.01	34.18	7.43	34.99
4540	Vertical	49.67	43.92	32.4	6.84	34.57
4540	Horizontal	49.67	43.92	32.4	6.84	34.57
3632	Vertical	49.44	43.69	31.58	6.03	34.08
3632	Horizontal	48.53	42.78	31.58	6.03	34.08
1816	Vertical	43.88	38.13	26.9	4.76	34.52
1816	Horizontal	42.98	37.23	26.9	4.76	34.52
5448	Horizontal	49.62	43.87	34.18	7.43	34.99

*For harmonics, adjust for the proper duty cycle correction in accordance with the results from test 3.

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.

Comment [jrh1]: need radiated for low and high, and conducted is not needed.

Band Edge	Test Setup	Level	Pass/Fail
902 MHz	Radiated	38.52 uV/m(2)	Pass
928 MHz	Radiated	78.25 uV/m(3)(4)	Pass

(2) reading was obtained using a quasi peak detector. The peak reading was greater than 200uV/m

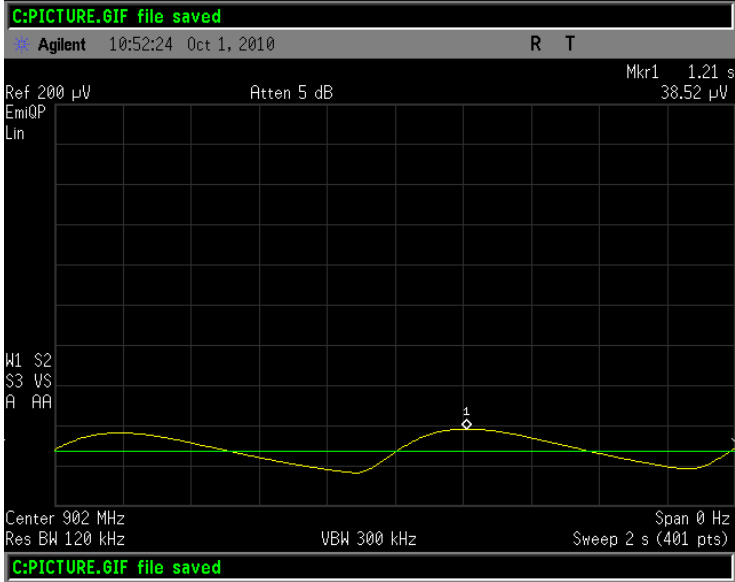
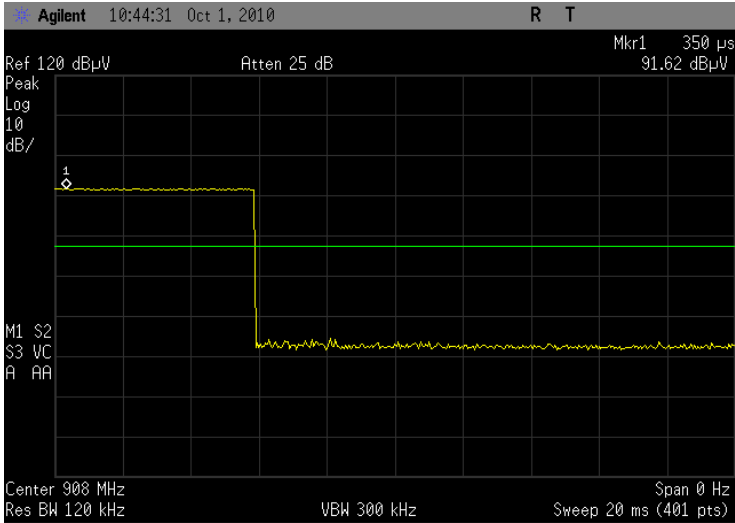
(3) reading was obtained using a peak detector

(4) Measurement made @TUV SUD American OATS - Taylors Falls location (test data attached)

Equipment Used radiated	Serial Number	Cal Date	Cal Due
Micro Coax 40 foot cable	214970001	7-Apr-09	7-Apr-11
Roberts Dipole 400-1000 MHz	4106	14-Sep-10	14-Sep-12
AH systems preamplifier	146	3-Dec-09	3-Dec-10
Agilent E7405A Spectrum Analyzer	MY45113415	4-Aug-10	4-Aug-11

Date	Temp/Humidity °F / %	Tested by
9/30/2010	70F / 70%	Mark Kvamme

Radiated setup: Endpoint 9570, with a new battery, was placed at 3 meters and the field strength was measured with the Roberts Dipole, connected to the E7405A analyzer through the amplifier and 40 foot cable. The Antenna correction factor, Cable loss, and amplifier gain were loaded into the analyzer, so the analyzer displayed the corrected level. Endpoint 9570 was positioned to 295 degrees the antenna was positioned to horizontal 182 cm. The peak of the transmission @ 908 MHz was measured. Then, the band edge at 902 MHz was measured using a quasi peak detector.



TUV SUD America Test data



9507.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.

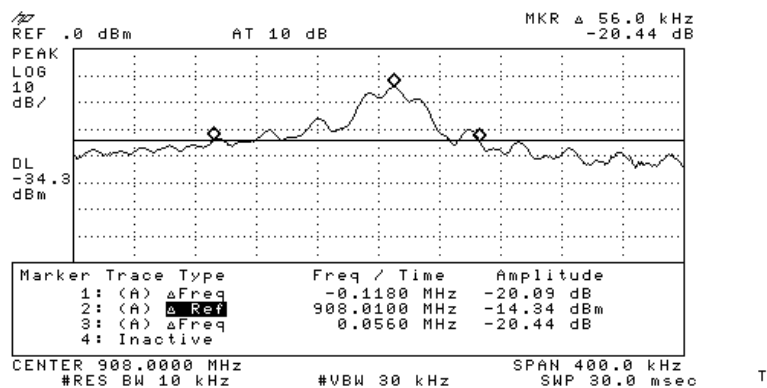
Capture a plot of the 99% bandwidth of a single transmission.

DUT was test board 2072, battery was new.

Equipment Used	Serial Number	Cal Date	Cal Due
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	8 Dec 09	8 Dec 10
Huber & Suhner Suco flex 104	220058002	8 Sept 10	8 Sept 11

Date	Temp/Humidity °F / %	Tested by
9/14/2010	72/50	Mark Kvamme

Conducted setup: Board 2072, with a new battery, was connected to the Hewlett Packard 8593E analyzer with the cable listed in the table above.



99% BW = 118 kHz + 56 kHz = 174 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.

