REGULATORY COMPLIANCE REPORT

TITLE: FCC & IC Test Report for 15.249 & RSS-210 Low Power Transmitter, 100W.
AUTHOR: Roger Mulcahy

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

REVISION HISTORY

A		initial release for certification	24apr10	Engineering	
				Regulatory	
				Engineering	
				Regulatory	
				Engineering	
				Regulatory	

Test Data Summary

FCC Part 15.249 / IC RSS-210 Annex 2
Field strength of Low Power Transmitters, **100W,** 908 MHz

FCC ID: EWQ100W
IC: 864D-100W
Device Model (for IC): 100W

Part Numbers: ERW-1300-XXX
Serial Number: see below
OATS Registration Number: FCC 90716, IC 864D-1

Rule	Description	Spec Limit	Max. Reading	Pass/Fail
Part 15.31(e)	Variation of Supply Voltage	n/a	N/A battery	N/A
Part 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	26 dBuV/m peak @ 396.7MHz	Pass
15.35(b)	Pulsed Operation; duty cycle corrections	calculated	100%	N/A
15.249(a) / RSS-210 A2.9	Radiated emissions of transmitter fundamental and harmonics	50,000 / 500 uV/m	*93dbuV/m @ 908 MHz and Peak 55.86 dbuV/m @ 3632MHz Average 44.38dbuV/m @ 3632MHz*	Pass
15.249(d)	Band Edge – conducted	-50dBc or 200 uV/m (lesser)	-56.81dBc	Pass
RSS-GEN 4.6.1	99% Bandwidth – conducted	<0.5% of the center frequency	277KHz	Pass
RSS-Gen 7.2.3	Receiver Spurious Emissions	table	27 dbuV/m	Pass

Rule versions: FCC Part 1; FCC Part 2; FCC Part 15, RSS-102 Issue 2 (11-2005; RSS-210 Issue 7 (June 2007; , RSS-Gen Issue 2 (June 2007)
Reference docs: ANSI C63.4-2003; DA 00-705 (03-30-2000); OET65 (08-1997); OET65C (06-2001); IEEE C95.3-2002.

Cognizant Personnel

Name	Title
Roger Mulcahy	Test Technician
Steve Ivanca	R&D Manager
Jay Holcomb	Regulatory Manager
Aaron Fitzgerald	Project Lead

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.
Model:	Itron 100W Water Datalogging 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. 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	2400/F (kHz)		300
0.490-1.705	24000/F (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 40dB/decade when measuring at different distances than specified.

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.

Equipment Used	Serial Number	Cal Date	Due
AH systems preamplifer model number PAM 0126	135	12/01/09	12/01/10
Micro-Coax 40 foot cable	UFB505A	1/22/10	1/22/11
Agilent E7405A Spectrum Analyzer	MY45113415	7/31/09	7/31/11
Emco 6502 Loop (9kHz to 30Mhz)	9509-2970	10/15/08	10/15/10
Emco 3108B Biconical (30MHz-to 300MHz)	9203-2455	9/30/08	9/30/10
Emco 3146 Log Periodic (200Mhz to 1GHz)	9203-3358	10/12/09	10/12/11
Emco 3115 waveguide (1Ghz - 18GHz)	9208-4550	3/22/10	3/22/12
Lindgren DB-4 Dipole (400Mhz-1GHz)	78573	9/18/08	9/18/10
Huber&Suhner 36 inch. SMA to N	214970001	1/22/10	1/22/11
Date	Tested by		
4/21/2010	Roger Mulcahy		

Unit tested: 46001009;

Frequency range investigated was 9 kHz to 9.08GHz. (part 15.33 (a))

Freq. MHz	Ant. Pos.	Peak Level dBuV/m	Average Level dBuV/m	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	Corrected Level dBuV/m	Margin dBuV
396.7	Vertical	**26	21	35.4	16.4	1.7	**26	20

Note: ** Corrections were preloaded into Analyzer.

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 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 100W, all with less than 53 mS duration. Testing to 15.249 limits was done with special code that transmits repeated low power 100 mS bursts at 908 MHz. Duty cycle averaging is not needed to demonstrate compliance with 15.249 rules, and is not employed.

$$\text{Duty Cycle}_{dB} = 100\ \%|$$

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	Due
AH systems preamplifer model number PAM 0126	135	12/01/09	12/01/10
Micro-Coax 40 foot cable	UFB505A	1/22/10	1/22/11
Agilent E7405A Spectrum Analyzer	MY45113415	7/31/09	7/31/11
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	7/31/09	7/31/10
Emco 3115 waveguide (1Ghz - 18GHz)	9208-4550	3/22/10	3/22/12
Huber&Suhner 36 inch. SMA to N	214970001	1/22/10	1/22/11
Microwave Circuits 1.3 Ghz High Pass Filter	405734	5/27/09	2/27/11
Lindgren DB-4 Dipole (400Mhz-1GHz)	78573	9/18/08	9/18/10
Date	Tested by		
4/21/2010	Roger Mulcahy		

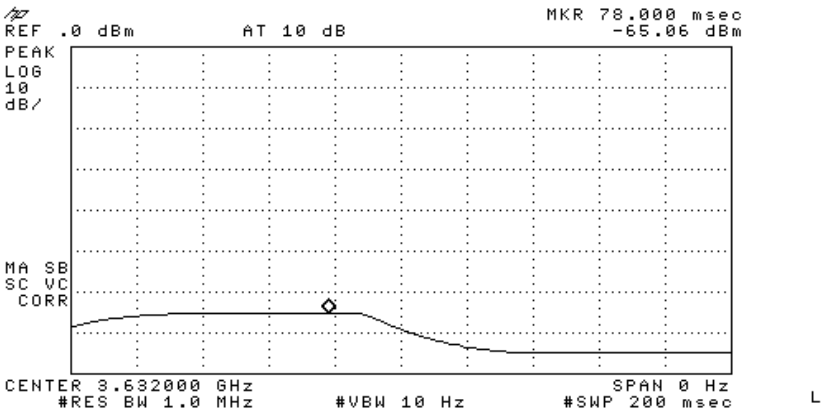
Unit tested: 46001009 with Standard Code 1.4, a new battery was installed for testing.

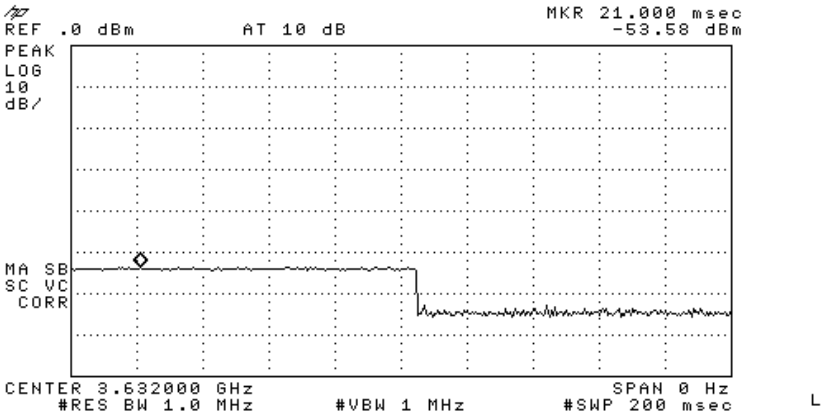
For harmonics, adjust for the proper duty cycle correction in accordance with the results from pulsed operation test above.
From the pulsed operation test above, there is no duty cycle correction for this case.

Freq. MHz	Ant. Pos.	Peak Level dBm	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	Peak Level dBuV/m	Peak Power Margin dB
908	Vertical	-44.52	0	27.93	2.59	93	1
908	Horizontal	-48.97	0	27.93	2.59	88.55	5.44

Freq. MHz	Ant. Pos.	Peak Level dBm	1MHz RBW 10Hz VBW Average Level dBuV	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	1MHz RBW 1MHz VBW Peak Level dBuV/m	1MHz RBW 10Hz VBW Average Level dBuV/m	Avg Power Margin dB Limit 54 dBuV/m
3632	Horizontal	-53.58	-65.06	35.13	31.58	5.99	55.86	44.38	9.62
1816	Vertical	-55.67	**	35.7	26.9	4.57	47.1		
1816	Horizontal	-58.76	**	35.7	26.9	4.57	44.01		
2724	Vertical	-52.4	**	35.41	28.9	5.3	53.39		
2724	Horizontal	-53.81	**	35.41	28.9	5.3	51.98		
3632	Vertical	-56.7	**	35.13	31.58	5.99	52.74		
4540	Vertical	-61.07	**	35.59	32.4	6.77	49.51		
4540	Horizontal	-58.23	**	35.59	32.4	6.77	52.35		
5448	Vertical	-59.16	**	36.04	34.18	7.38	53.36		
5448	Horizontal	-59.93	**	36.04	34.18	7.38	52.59		
6356	Vertical	-63.42	**	35.91	34.76	8.22	50.65		
6356	Horizontal	-60.92	**	35.91	34.76	8.22	53.15		

****Peak measurement were below the average spec limits, therefore average not reported.**





All frequencies above the Seventh harmonic are below the noise floor

FCC Part 15.249(d)

Band Edge, conducted

(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:

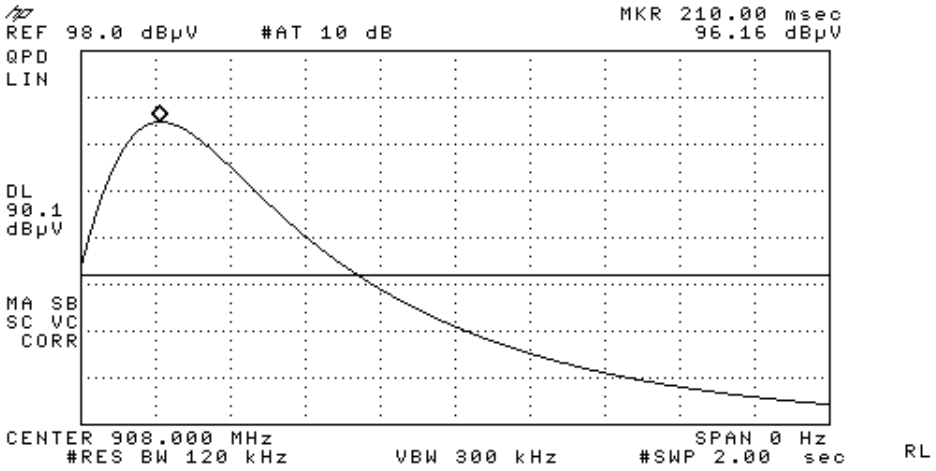
Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

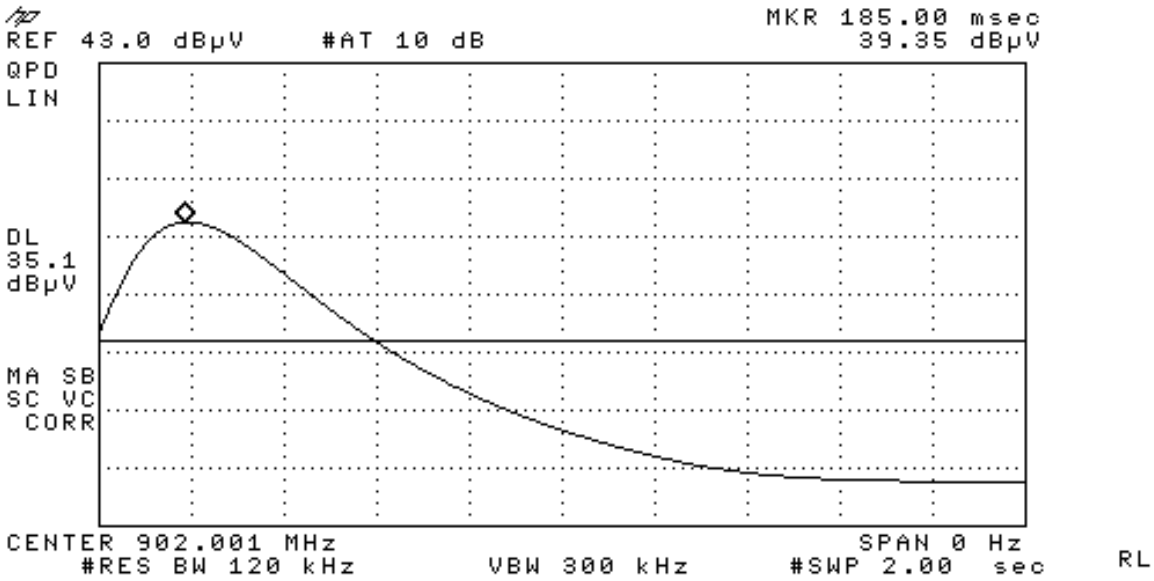
Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the 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.

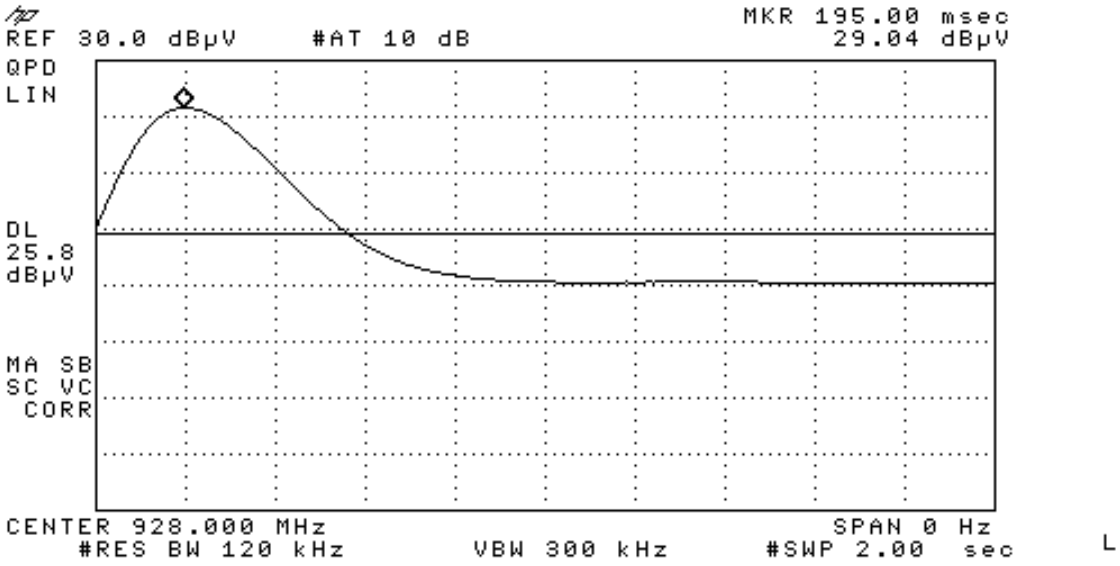
Equipment Used	Serial Number	Cal Date	Due
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	7/31/09	7/31/10
Date	Tested by		
4-20-2010	Roger Mulcahy		

Unit tested: 46001051 with Standard Code 1.4.





Level at low band edge: 96.16dBuV – 39.35dBuV = 56.81dBc



Level at high band edge: 96.16dBuV – 29.04dBuV = 67.12 dBc

RSS-GEN 4.6.1

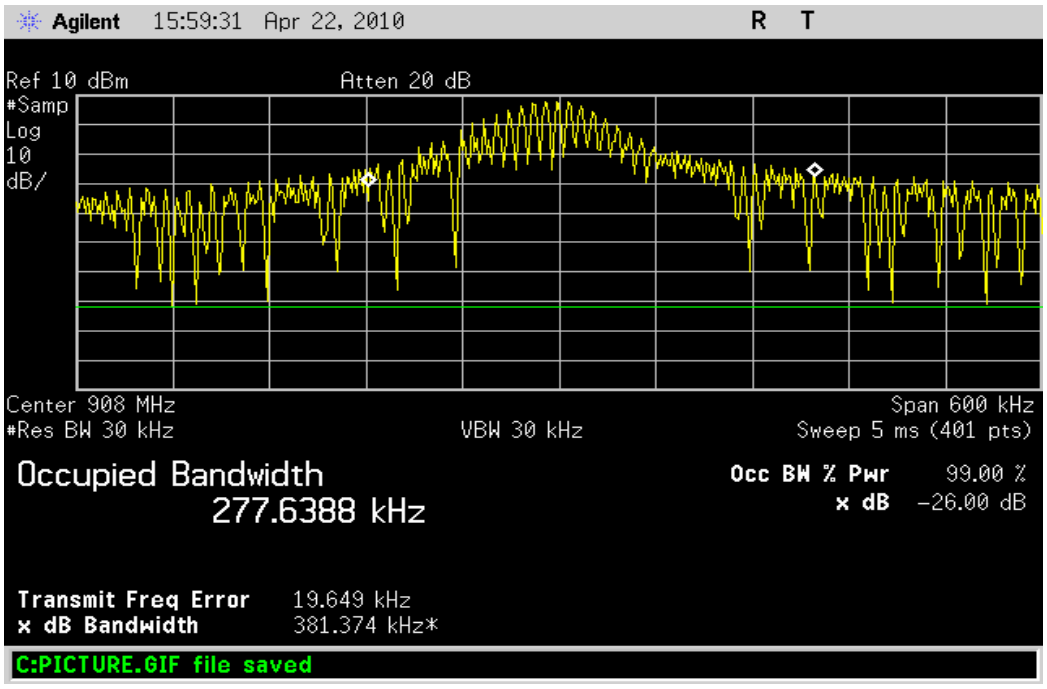
99% Bandwidth, conducted

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.

Equipment Used	Serial Number	Cal Date	Due
Agilent E4402B Spectrum Analyzer	MY44210913	16-Sept-09	16-Sept-10
Date	Tested by		
4-22-2010	Roger Mulcahy		

Unit tested: 46001051 with Standard Code 1.4.



RSS-Gen 7.2.3 (RSS-GEN 4.10) Receiver Spurious Emission Limits

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	7/31/09	7/31/11
Micro-Coax 40 foot cable	UFB505A	1/22/10	1/22/11
Emco 3108B Biconical (30MHz-to 300MHz)	9203-2455	9/30/08	9/30/10
Emco 3146 Log Periodic (200Mhz to 1GHz)	9203-3358	10/12/09	10/12/11
Emco 3115 waveguide (1Ghz - 18GHz)	9208-4550	3/22/10	3/22/12
AH systems preamplifer model number PAM 0126	135	12/01/09	12/01/10
Date	Tested by		
4/22/10	Roger Mulcahy		

Unit tested: *46001009 in factory mode*

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 9 kHz to 9.28 GHz. Emissions from the Receiver were below the noise floor.

Freq. MHz	Level dBm	Level dBuV	Pre Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	Peak Level (noise floor) dBuV/m	Peak Level (noise floor) uV/m	Margin dB
908	-69.97	37.03	35.84	23.2	2.61	27	22.39	19

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.