REGULATORY TEST REPORT

TITLE: FCC & IC Test Report for 15.249 & RSS-210 Frequency single channel programming (100G)
AUTHOR: Mark Kvamme

REV	CCO	*DESCRIPTION OF CHANGE*	DATE	*APPROVALS*	
		INITIAL RELEASE		Engineering	
				Engineering	

REVISION HISTORY

				Engineering	
				Engineering	
				Engineering	

Summary

Test Data Summary

FCC Part 15.249 / IC RSS-210 Sec. 6.2.2(m2)
Field strength of low power Transmitters
902-928MHz Band

908Mhz programming

FCC ID: **EO9100G /** IC ID: **864D-100G**

Device Model: ERG-5000

Model Numbers:

ERG-5000-501, ERG-5000-502, ERG-5000-503, ERRG-5000-504

OATS Registration Number: FCC 90716, IC 5615

Rule	Description	Max. Reading	Pass/Fail
15.31(e)	Variation of Supply Voltage	N/A battery	N/A
15.207/RSS-210 Annex 2	Powerline conducted emissions	N/A battery	N/A
15.249(d)/RSS-210 sec. 6.6.2(m2)(3)	Out of band non-harmonic radiated emissions	28dbuV/m @908 Mhz	Pass
15.35(b)/RSS-210 sec. 6.5	duty cycle corrections	Wrong Message	N/A
15.249(a)/RSS-210 Sec. 6.2.2 (m2)(1)	Radiated emissions of transmitter fundamental and harmonics	86.46dbuV/m @908 Mhz 38.9dbuV/m @1816 Mhz	Pass
15.31(m)	Relative field intensities at high and low frequencies of transmitter	Single channel max reading of 86.46 dbuV/m @908 Mhz	Pass
15.249(d)	Band Edge	116.3uV/m @902 Mhz	Pass
RSP-100 Appendix II	99% Bandwidth	115Khz @ 908 Mhz	Pass

Cognizant Personnel	
Mark Kvamme	Test Technician
Name	Title
Name	Title
Name	Title

TCB Submittal Checklist

Item list for TCB evaluation

Item	Completed	Confidential

Test Report		No
Test Setup Photos – Powerline Conducted Emissions		No
Test Setup Photos – Radiated Emissions		No
Internal Pictures		Yes
External Pictures		No
Schematics		Yes
Block Diagram		Yes
Operational Description		Yes
Users Manual		
Label Drawings		No
Request for Confidentiality		No
Industry Canada RSP-100 Appendices I and II		No

Test 1: 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. BATTER IS NOT RECHARGABLE.

Test 2: 15.207 / RSS-210 Annex 2

Powerline Conducted Emissions

Measure the AC powerline conducted emissions from 150kHz to 30 MHz using a 50μH/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. BATTER IS NOT RECHARGABLE.

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

Out of band non-harmonic emissions

Measure the field strength of all spurious emissions that are not harmonics according to the procedure in Appendix A. The maximum field strength shall not exceed:

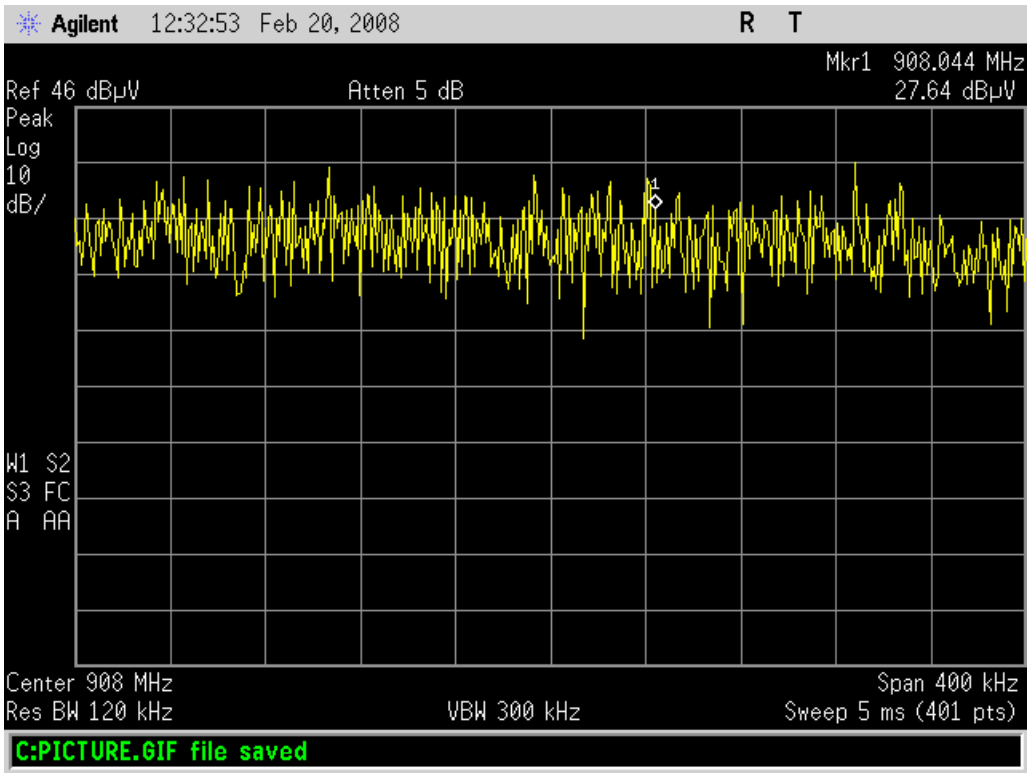
Frequency (MHz)	Field Strength (µV/m)	Distance (meters)
1.705-30	30*	30*
30-88	100	3
88-216	150	3
216-960	200	3
>960	500	3

* Adjust 40dB/decade when measuring at different distances than specified.

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

Equipment Used	Serial Number	Cal Date	Cal Due
Spectrum Analyzer	MY45113415	07-Aug-07	07-Aug-09
Huber&Suhner 18 inch. Sma to Sma	220060 002	03-May-07	03-May-08
Huber&Suhner 40 foot cable	220297 001	09-Apr-07	09-Apr-08
EMCO loop antenna model 6502	9509-2970	24-Oct-07	24-Oct-08
EMCO biconical	9807-3129	10/4/2007	10/4/2009
EMCO Log periodic	9901-1044	10/24/2007	10/24/2008

Date	Temp/Humidity ºF / %	Tested by
20 Feb 08	55 / 11	Mark Kvamme



Test 4: 15.35(b) / RSS-210 sec. 6.5

Pulsed Operation

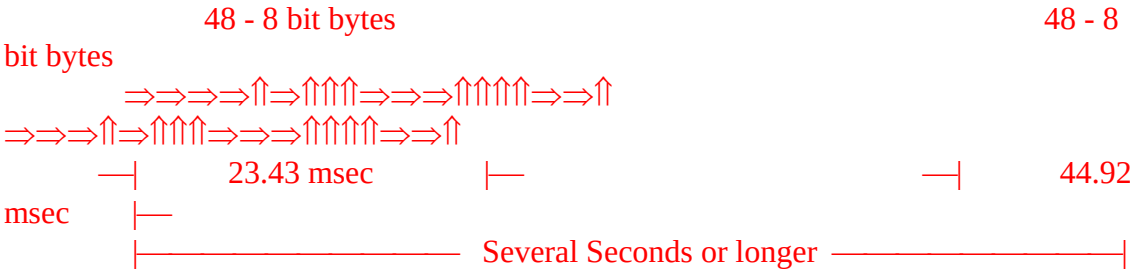
Calculate the maximum duty cycle of the transmitter that will occur in any 100ms. Perform the following calculation:

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

If the calculated result is less than 20dB, use that number as the relaxation factor for test 4 of this report. Otherwise, use 20dB.

When programmed the Unit Transmits a Manchester Encoded Message. Depending on programming details message length will vary, however the longest message is 48 bytes (384 bits). Programming will typically occur once in the product life, at installation.

Zooming in on a message length:



Bit rate is: 16.384 Kbits/Second.
Message Period is: 384/16.384 Kbits / sec = 23.43 msec

During the transmission of messages, the Transmit Duty Cycle can be computed.

% Duty Cycle Transmit = (384 bits) (1/16.384 Kbits/Sec) (.5) (100%) / (100 msec)

% Duty Cycle Transmit =11.7 %

Note: The .5 factor is a result of Manchester Encoded Data.

Expressing the correction factor for Duty Cycle in dB:

dB Duty Cycle Transmit = 20 Log (Duty Cycle)
dB Duty Cycle Transmit = 20 Log (.117)
dB Duty Cycle Transmit = -18.63dB

Test 5: 15.249(a)/RSS-210 sec. 6.2(m2)(1)

Transmitter Fundamental and Harmonics

EUT Configuration: The EUT is configured to transmit (special code set) on the low channel (908 MHz), a middle channel (915 MHz), and a high channel (924 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. .

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 highiest frequencies. The maximum field strength of emissions may not exceed:

Fundamental (μV/m)	Harmonics (μV/m)
50,000	500

For harmonics, adjust for the proper duty cycle correction of up to 20dB in accordance with the results from test 3.

Equipment Used	Serial Number	Cal Date	Cal Due
Spectrum Analyzer	MY45113415	07-Aug-07	07-Aug-09
Huber&Suhner 18 inch. Sma to Sma	220060 002	03-May-07	03-May-08
Huber&Suhner 40 foot cable	220297 001	09-Apr-07	09-Apr-08
EMCO 3115 double ridge wave guide	9508-4550	15-Mar-06	15-Apr-08
ETS lindgren dipole antenna	00078573	02-Sep-06	02-Sep-08
AH systems preamplifer model number PAM 0126	135	12/8/2007	12/8/2008

Date	Temp/Humidity ºF / %	Tested by
3/31/2008	50/50	Mark Kvamme

Frequency (Mhz)	Polarity	Height	Angle	Reading dbuV/m	Ant #	ACF	Coax #	Coax corr.	Amp #	Amp corr.
908	Vertical	124	0	86.46	36982077	27.82	220297001	2.63	not selected	0

Frequency (Mhz)	Polarity	Height	Angle	Reading dbuV/m	margin relative to 54dbuV/m	Ant #	ACF	Coax #	Coax corr.	Amp #	Amp corr.
1816	Vertical	101	305	38.9	15.1	16256	26.58	220297001	3.67	135	-36.24
1816	Horizontal	112	230	37.1	16.9	16256	26.58	220297001	3.67	135	-36.24
2724	Vertical	NF	NF	34	20	16256	29.43	220297001	4.64	135	-36.02
2724	Horizontal	NF	NF	34	20	16256	29.43	220297001	4.64	135	-36.02

All frequencies above the third harmonic are below the noise floor

Test 6: FCC Part 15.31(m)

Relative Field Intensities over frequency

Use the max hold feature of the analyzer to capture the full bandwidth of transmissions. Place markers near the highest and lowest transmission frequencies to demonstrate the relative field strengths of each.

Equipment Used	Serial Number	Cal Date	Cal Due
Spectrum Analyzer	MY45113415	07-Aug-07	07-Aug-09
Huber&Suhner 40 foot cable	220297 001	09-Apr-07	09-Apr-08
ETS lindgren dipole antenna	00078573	02-Sep-06	02-Sep-08

Date	Temp/Humidity ºF / %	Tested by
3/31/2008	50/50	Mark Kvamme

Frequency (Mhz)	Polarity	Height	Angle	Reading dbuV/m	Ant #	ACF	Coax #	Coax corr.	Amp #	Amp corr.
908	Vertical	124	0	86.46	36982077	27.82	220297001	2.63	not selected	0

Test 7: FCC Part 15.249(d)

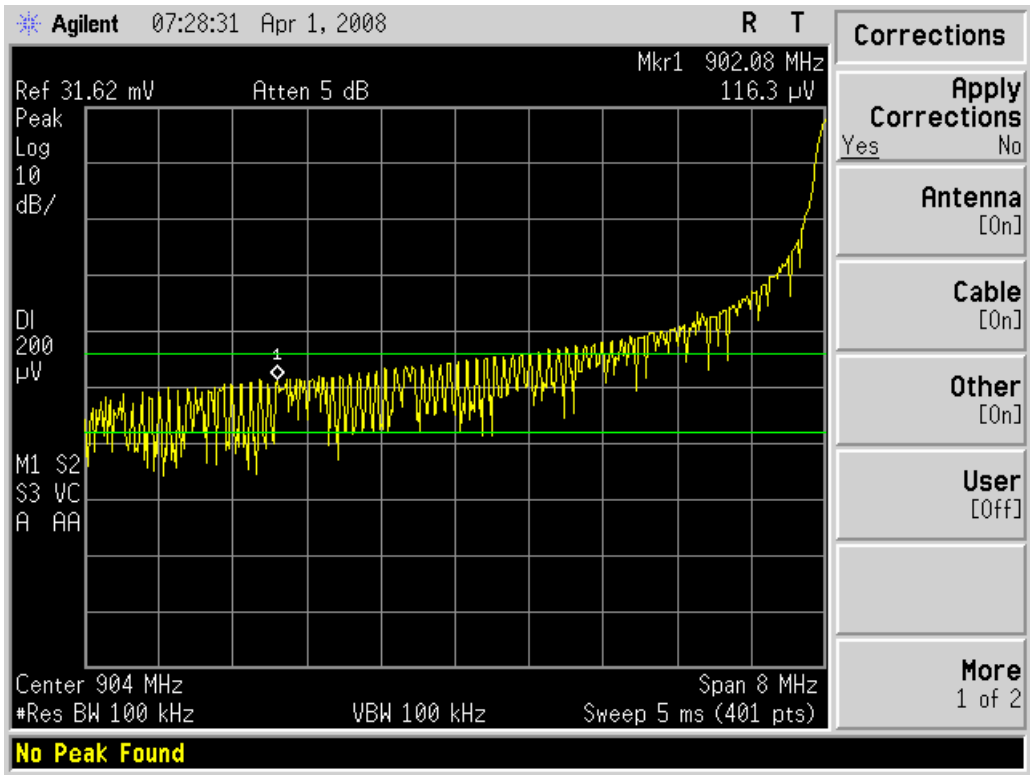
Band Edge

EUT Configuration: The EUT is configured to transmit (special code set) on the low channel (908 MHz), a middle channel (915 MHz), and a high channel (924 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. .

Demonstrate that the transmitter's emissions at the 902-928MHz band edge are at least 50dB below the carrier or less than 200uV/m at 3 meters, whichever is the lesser attenuation.

Equipment Used	Serial Number	Cal Date	Cal Due
Spectrum Analyzer	MY45113415	07-Aug-07	07-Aug-09
Huber&Suhner 40 foot cable	220297 001	09-Apr-07	09-Apr-08
EMCO Log periodic	9901-1044	10/24/2007	10/24/2008
AH systems preamplifer model number PAM 0126	135	12/8/2007	12/8/2008

Date	Temp/Humidity ºF / %	Tested by
3/31/2008	72/30	Mark Kvamme



Test 8: RSP-100 Appendix II

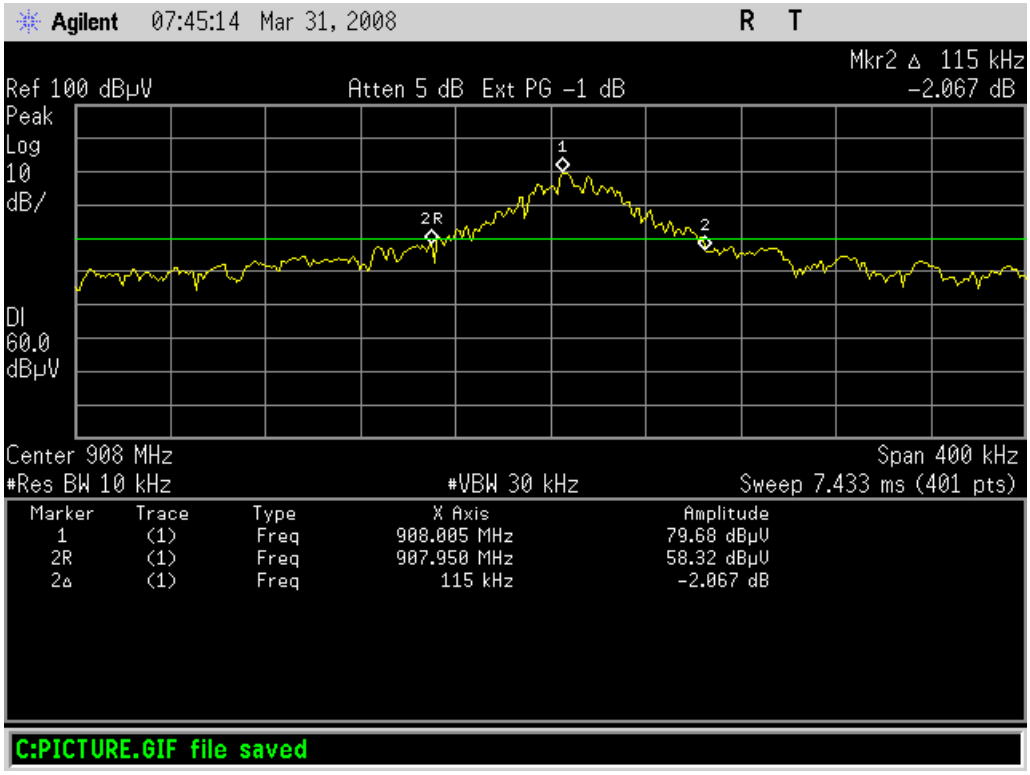
99% Bandwidth

EUT Configuration: The EUT is configured to transmit (special code set) on the low channel (908 MHz), a middle channel (915 MHz), and a high channel (924 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. .

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

Equipment Used	Serial Number	Cal Date	Cal Due
Spectrum Analyzer	MY45113415	07-Aug-07	07-Aug-09
Huber&Suhner 40 foot cable	220297 001	09-Apr-07	09-Apr-08
ETS lindgren dipole antenna	00078573	02-Sep-06	02-Sep-08

Date	Temp/Humidity ºF / %	Tested by
3/31/2008	50/50	Mark Kvamme



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. Levels below 1 GHz are to be measured with the spectrum analyzer resolution bandwidth at 120 kHz and levels at or above 1 GHz are to be measured with the spectrum analyzer resolution bandwidth at 1 MHz.

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.