REGULATORY COMPLIANCE REPORT

TITLE: FCC & IC Test Report for 15.249 & RSS-210 Low Power Transmitter, 100GDLR

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

REVISION HISTORY

				Engineering	
				Engineering	
				Engineering	

Test Data Summary

FCC Part 15.249 / IC RSS-210 Sec. 6.2.2(m2)

Field strength of Low Power Transmitters, 908 MHz

FCC ID: EO9100GDLR
IC ID: 864D-100GDLR
Device Model:
Model 7
Model Numbers:
ERG-5002-501, 502, 503
Serial Number:
7015 (radiated) 7014(conducted), with fresh batteries

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 Sec. 6.6(a)	Power line 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	No Emissions	Pass
15.35(b) / RSS-210 sec. 6.5	Pulsed Operation	100%	Pass
15.249(a)/RSS-210 Sec. 6.2.2 (m2)(1)	Transmitter fundamental and harmonics radiated emissions.	93.96dbuV/m @908 MHz and *Peak 53.6 dbuV/m @ 2724 MHz*	Pass
15.249(d)	Band Edge	94.11 uV/m quasi peak @902 MHz 55.99 dbc @ 902 MHz and 67.87dbc @ 928 MHz	Pass
RSP-100 Appendix II	99% Bandwidth	139Khz @ 908 MHz	Pass

Rule versions: FCC Part 1 (01-2006), FCC Part 2 (01-2006), FCC Part 15 (02-01-2006), RSS-102 Issue 2 (11-2005), RSS-210 Issue 7 (June 2007), RSS-Gen Issue 1 (09-2005).
Reference docs: ANSI C63.4-2003, DA 00-705 (03-30-2000), OET65 (08-1997), OET65C (06-2001), IEEE C95.3-2002.

Cognizant Personnel

Mark Kvamme	Test Technician
Name	Title
Jon Mueller	R&D Manager
Name	Title
Jay Holcomb	R&D Regulatory Manager
Name	Title

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. THERFORE THIS TEST IS N/A.

Test 2: 15.207 / RSS-210 Sec. 6.6(a)

Power line Conducted Emissions

Measure the AC power line 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. THERFORE THIS TEST IS N/A.

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)	in dBuV/m	Distance (meters)
1.705-30	30*	29.5	30*
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
>960	500	54	3

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

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	Due
Agilent E7405A Spectrum Analyzer	MY45113415	7-Aug-07	7-Aug-09
Huber&Suhner 18 inch. Sma to Sma	220060 002	3-Dec-07	3-Dec-09
Huber&Suhner 40 foot cable	220297 001	1-Dec-07	1-Dec-09
AH systems preamplifer model number PAM 0126	146	3/13/2009	3/13/2010
Emco 6502 Loop (9kHz to 30MHz)	9509-2970	01oct08	01oct09
Emco 3110B Biconical (30MHz-to 300MHz)	9807-3129	04oct07	04oct09
Emco 3146 Log Periodic (200MHz to 1GHz)	9203-3358	03oct07	03oct09
Emco 3115 waveguide (1Ghz – 18GHz)	9205-3878	17mar08	17mar10
Date	Tested by	Temp/Humidity, ºF / %	
4/27/2009	Mark Kvamme	53F/54%	

Frequency range investigated was 9kHz to 9.08GHz.

No emissions were found

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:

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

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

Test 5: 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 (μV/m)	in (dBuV/m)	Harmonics (μV/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	146	3/13/2009	3/13/2010
Huber&Suhner 18 inch. Sma to Sma	220060 002	3-Dec-07	3-Dec-09
Huber&Suhner 40 foot cable	220297 001	1-Dec-07	1-Dec-09
Agilent E7405A Spectrum Analyzer	MY45113415	8/7/07	8/7/09
Hewlett Packard HP8596E Spectrum Analyzer	3528U00340	04apr08	04apr10
Emco 3115 wave guide (1GHz-18GHz)	9205-3878	3/17/08	3/17/10
Lindgren DB-4 Dipole (400MHz-1GHz)	78573	9/18/2008	9/18/2010
Date	Tested by	Temperature/humidity	
4/27/2009	Mark Kvamme	53F/54%	

EUT Configuration: A new battery was used to power the device. The EUT is configured to transmit (special code set) on the low channel (908 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. .
For harmonics, adjust for the proper duty cycle correction of up to 20dB in accordance with the results from test 4.

		1 MHz RBW 1 MHz VBW					1 MHz RBW 1 MHz VBW	
Freq. MHz	Ant. Pos.	peak Level dBm		Amplifier Gain dB	Ant. Factor dB/m	Cable Loss dB	peak Level dBuV/m	Peak Power Margin (db) Limit (94 dbuV/m)
908	Vertical	-43.58		0	27.9	2.6	93.96	0.04

`		1 MHz RBW 1 MHz VBW	1 MHz RBW 10hz VBW				1 MHz RBW 1 MHz VBW		1 MHz RBW 10hz VBW	
Freq. MHz	Ant. Pos.	peak Level dBm	Average Level dBm	Amplifier Gain dB	Ant. Factor dB/m	Cable Loss dB	peak Level dBuV/m	Peak Power Margin (db) Limit (54 dbuV/m)	Average Level dBuV/m	Avg Power Margin (db) Limit (54 dbuV/m)
2724	Horizontal	-53.32		34.66	29.36	5.22	53.6	0.4		
5448	Horizontal	-61.36		35.07	34.09	7.46	52.12	1.88		
1816	Vertical	-51.64		34.29	26.52	4.44	52.03	1.97		
3632	Horizontal	-60.52		33.98	31.54	6.14	50.18	3.82		
3632	Vertical	-61.07		33.98	31.54	6.14	49.63	4.37		
2724	Vertical	-57.31		34.66	29.36	5.22	49.61	4.39		
1816	Horizontal	-55.39		34.29	26.52	4.44	48.28	5.72		

dbuV/m = 107 + reading + ACF + coax + Amp. Corr.
All peak measurement were below the average spec limits, therefore average not reported.
All frequencies above the sixth harmonic are below the noise floor

Test 7: FCC Part 15.249(d)

Band Edge

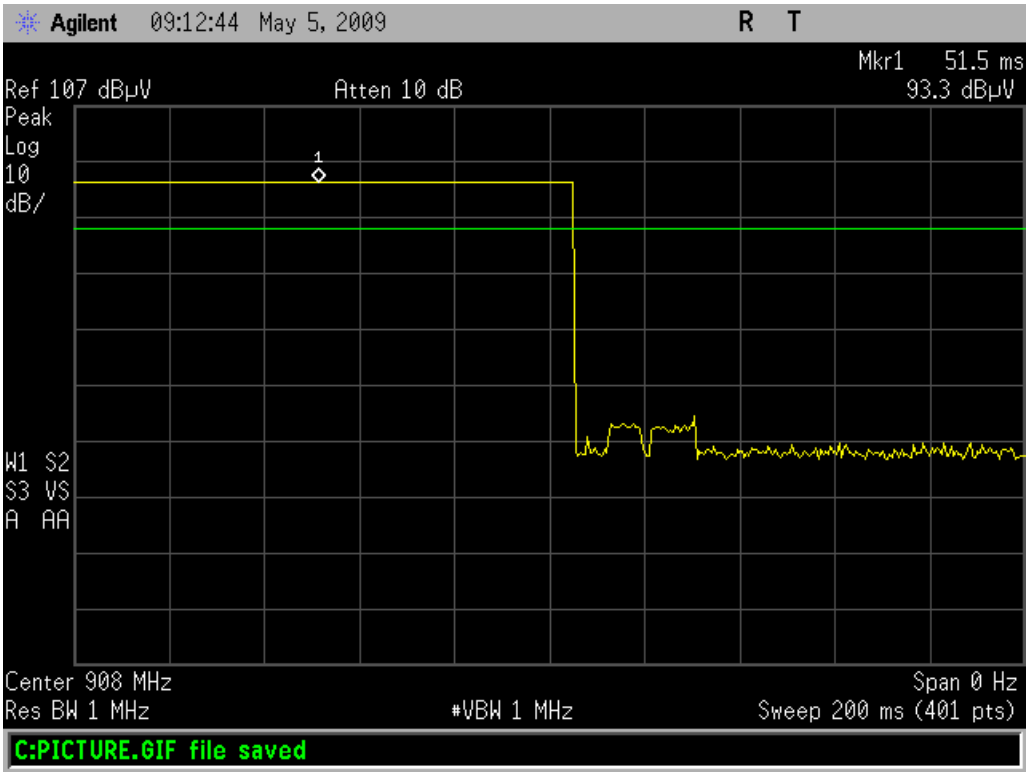
Demonstrate that the transmitter's emissions at the 902-928MHz band edge are at least 50dB below the carrier or less than 200uV/m at 3 meters, whichever is the lesser attenuation.

Equipment Used	Serial Number	Cal Date	Cal Due
H/S Sucoflex 40ft cable	220297001	12/3/07	12/3/09
Huber&Suhner 18 inch. Sma to Sma	220060 002	3-Dec-07	3-Dec-09
HP 8593E	3523A01770	30 JAN 09	30 JAN 11
Agilent E7405A Spectrum Analyzer	MY45113415	8/7/07	8/7/09
Lindgren DB-4 Dipole (400MHz-1GHz)	78573	9/18/2008	9/18/2010
AH systems preamplifer model number PAM 0126	146	3/13/2009	3/13/2010

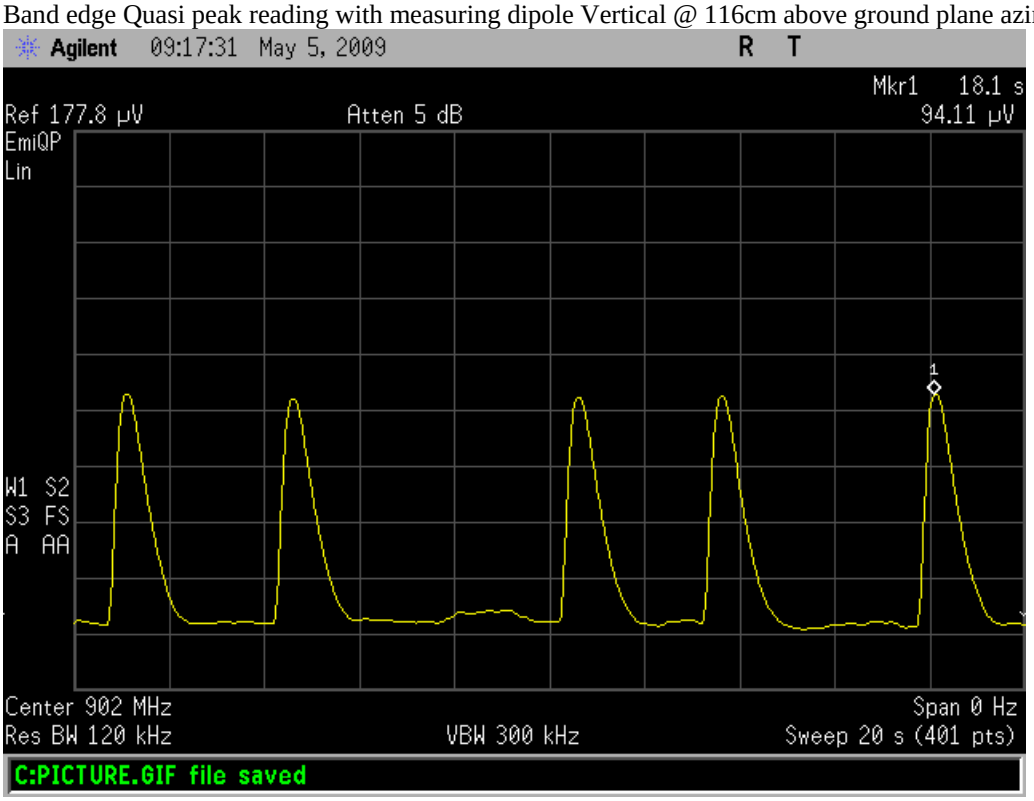
Date	Temp/Humidity ºF / %	Tested by
5/5/2009	Mark Kvamme	53F/54%

EUT Configuration: A new battery was used to power the device. The EUT is configured to transmit (special code set) on the low channel (908 MHz. The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made.

Fundamental peak reading with measuring dipole Vertical @ 116cm above ground plane azimuth 35 degrees

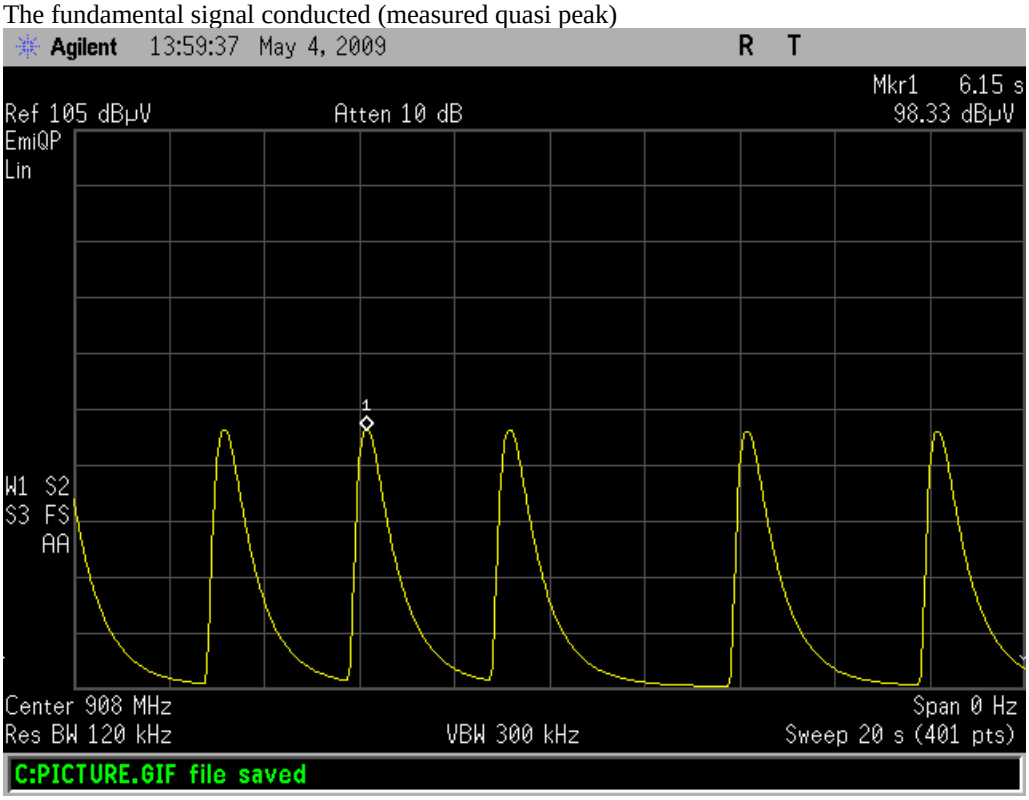


Band edge Quasi peak reading with measuring dipole Vertical @ 116cm above ground plane azimuth 35 degrees

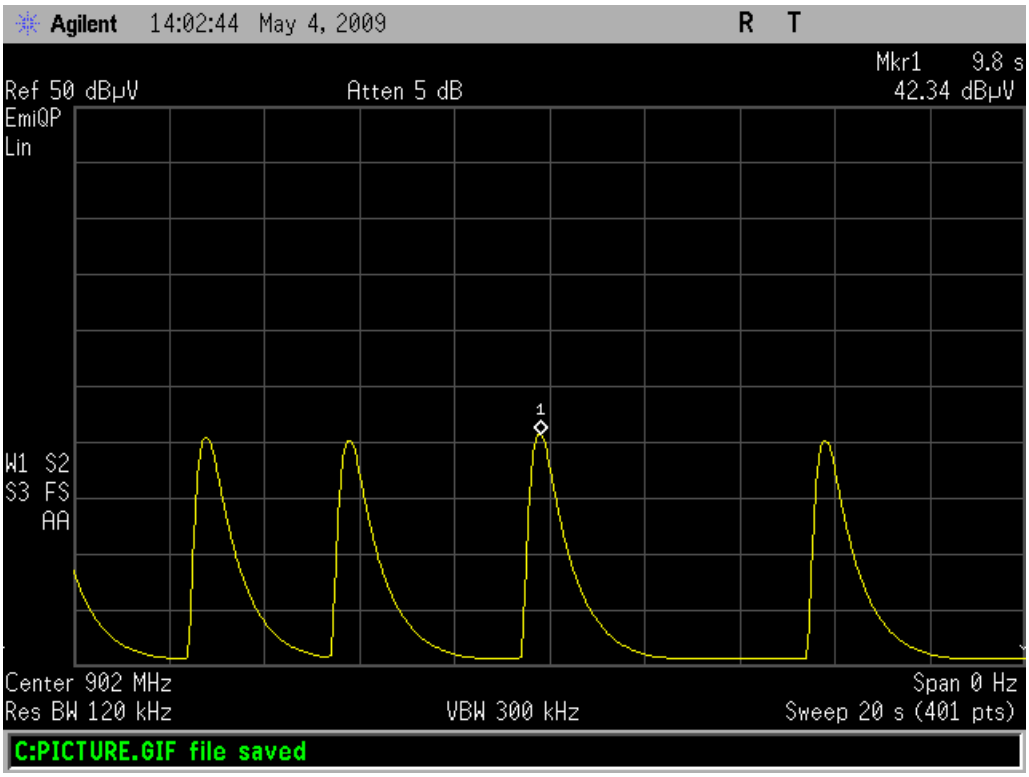


Band edge measured conducted is greater than 50dbc

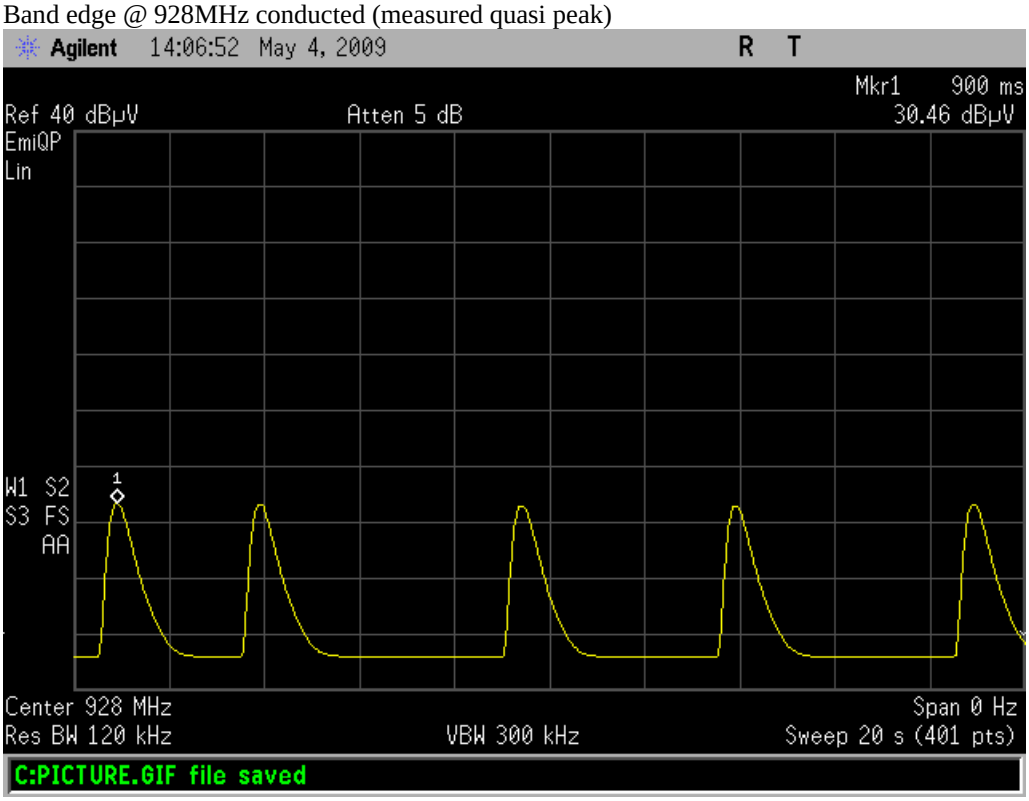
The fundamental signal conducted (measured quasi peak)



Band edge @ 902MHz conducted (measured quasi peak)



Band edge @ 928MHz conducted (measured quasi peak)



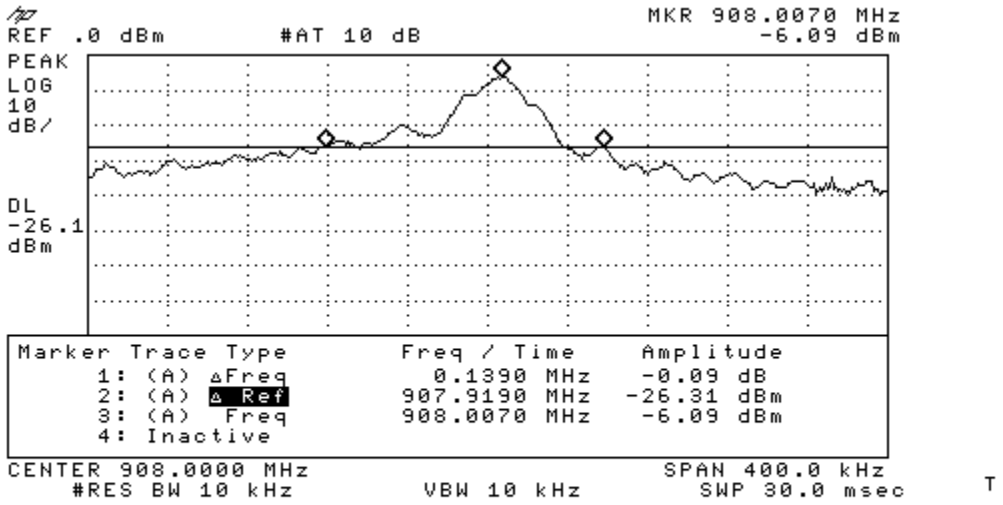
Test 8: RSP-100 Appendix II

99% Bandwidth

Equipment Used	Serial Number	Cal Date	Cal Due
HP 8593E	3523A01770	30 JAN 09	30 JAN 11

Date	Temp/Humidity ºF / %	Tested by
4/27/2009	Mark Kvamme	53F/54%

EUT Configuration: Conducted measurement with a new battery used to power the device. The EUT is configured to transmit (special code set) on the low channel (908 MHz) every 4 seconds. This enables measurement of peak energy to be made.



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.