REGULATORY COMPLIANCE REPORT

TITLEb: Test Report For title 47 Part 15.249 and RSS-210 Actaris
AUTHOR: Mark Kvamme

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

REVISION HISTORY

				Engineering	
				Engineering	
				Engineering	

FCC Part 15.249 / IC RSS-210 Sec. 6.2.2(m2);
Field strength of Low Power Transmitters,
100G DLS, 908 MHz
FCC ID: EWQ100GDLBS
IC ID: 864D-100GDLBS
IC Device Models: 10S
Part Numbers: ERG-5006-005/006
Serial Number: board 105, 18; Endpoint 115
OATS Registration Number: FCC 90716, IC 864D-1

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	-5.02db	N/A
15.249(a)/RSS-210 Sec. 6.2.2 (m2)(1)	Radiated emissions of transmitter fundamental and harmonics	Fundamental 94 dbuV/m Avg Harmonics Peak 74 dbuV/m Avg 54 dbuV/m	Fundamental 93.41dbuV/m Harmonics @ 5448 MHz Peak 55.93 dbuV/m Avg 50.91 dbuV/m	Pass
15.249(d)	Band Edge, radiated	-50dBc or 46 dbuV/m (lesser)	33.30 dbuV/m @ 902 MHz 32.55 dbuV/m @ 928 MHz	Pass
RSS-GEN 4.6.1	99% Bandwidth	<0.5% of the center frequency	108.8KHz	Pass

Cognizant Personnel	
Mark Kvamme	Test Technician
Name	Title
Johann De Jager	Project Engineer
Name	Title
Jay Holcomb	Regulatory
Name	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 +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.
Itron p/n:	ERG-5006-005, ERG-5006-006
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 50mH/50ohm 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 (dBuV)	Average (dBuV)
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. 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 114, battery was new.

Equipment Used	Serial Number	Cal Date	Due
Agilent E7405A Spectrum Analyzer	MY45113415	8/8/2011	8/8/2012
Microcoax 40 foot cable	H1G315G1	4/15/2011	4/15/2013
AH systems preamplifer model number PAM 0126	135	1/3/2012	1/3/2013
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	12/9/2011	12/9/2012
Emco 6502 Loop (9kHz to 30MHz)	9509-2970	10/7/2010	10/7/2012
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)	9205-3878	12/21/2011	12/21/2013
EMCO 3148 Log periodic (200MHz to 1GHz)	9901-1044	8/23/2011	8/23/2013
1.3GHz high pass filter	405735	6/3/2011	6/3/2013
Huber&Suhner sucotest cable	2	4/26/2011	4/26/2013
Date	Tested by		
4/26/2012	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:

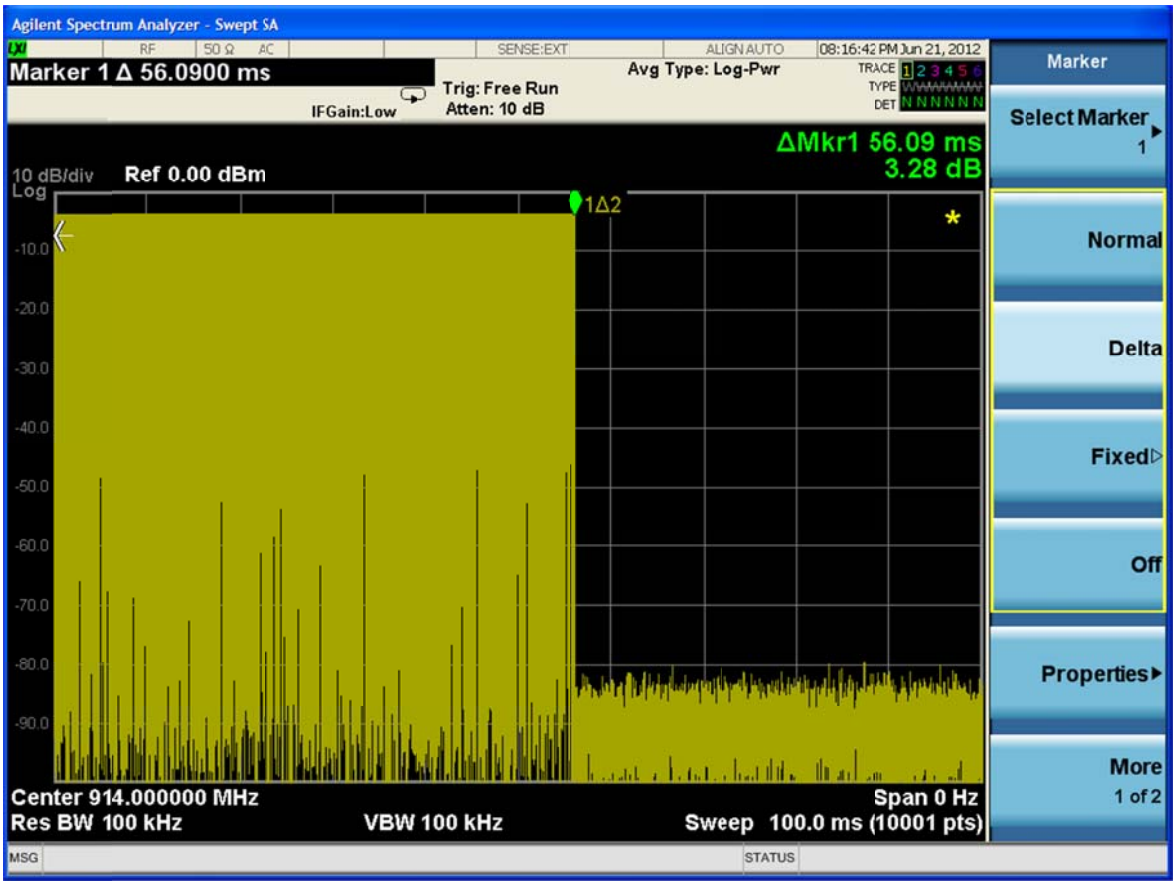
$$\text{Duty Cycle}_{dB} = |20 * \log(\text{Duty Cycle \%})|$$

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 56.09 mS duration.

Equipment Used	Serial Number	Cal Date	Due
Agilent CXA Signal Analyzer N9000A	MY51260424	7/11/2011	7/11/2012
Date	**Tested by**		
6/22/2012	Dale Carlson		

Conducted setup: Board18, with a new battery, was connected to the Agilent CXA Signal Analyzer N9000A.

$\text{Duty Cycle}_{dB} = |20*\log(\text{Duty Cycle \%})|$
$\text{Duty Cycle}_{dB} = |20*\log(56.09/100)|$
$\text{Duty Cycle}_{dB} = |20*\log(0.5609)|$
$\text{Duty Cycle}_{dB} = -5.02$ 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.

Fundamental (mV/m)	in (dBuV/m)	Harmonics (mV/m)	in (dBuV/m)
50,000	94	500	54

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

DUT is endpoint 114, battery was new.

Equipment Used	Serial Number	Cal Date	Due
Agilent E7405A Spectrum Analyzer	MY45113415	8/8/2011	8/8/2012
Microcoax 40 foot cable	H1G315G1	4/15/2011	4/15/2013
AH systems preamplifer model number PAM 0126	135	1/3/2012	1/3/2013
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	12/9/2011	12/9/2012
EMCO 3148 Log periodic (200MHz to 1GHz)	9901-1044	8/23/2011	8/23/2013
1.3GHz high pass filter	405735	6/3/2011	6/3/2013
Huber&Suhner sucotest cable	2	4/26/2011	4/26/2013
Date	Tested by		
4/26/2012	Mark Kvamme		

Freq. MHz	Peak Level dBm(3)	Peak Level dBuV(4)	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	peak Level dBuV/m(1) (3)	average Level dBuV/m(2)
908	-40.45	66.55	0	24.08	2.78	**93.41**	
5448	-57.27	49.73	35.77	34.13	7.84	**55.93**	**50.91**
3632	-56.38	50.62	34.94	31.72	6.35	53.75	48.73
4540	-62.4	44.6	35.54	32.24	7.14	48.44	43.42
1816	-58.03	48.97	34.78	27.24	4.71	46.14	41.12
2724	-61	46	34.96	28.76	5.51	45.31	40.29

(1)Level (dbuV/m)=Level (dbuV) – Amplifier Gain (db) +Ant. Factor (db/m) + Cable Loss (db)

(2)Level (dbuV/m)=Level (dbuV) – Amplifier Gain (db) +Ant. Factor (db/m) + Cable Loss (db)-5.02 db (duty cycle correction factor calculated in previous section)

(3)RBW & VBW =100KHz below 1GHz and 1MHz above 1GHz.

(4) level dbm +107 = level dbuV @ 50 ohms

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 ≥ 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.

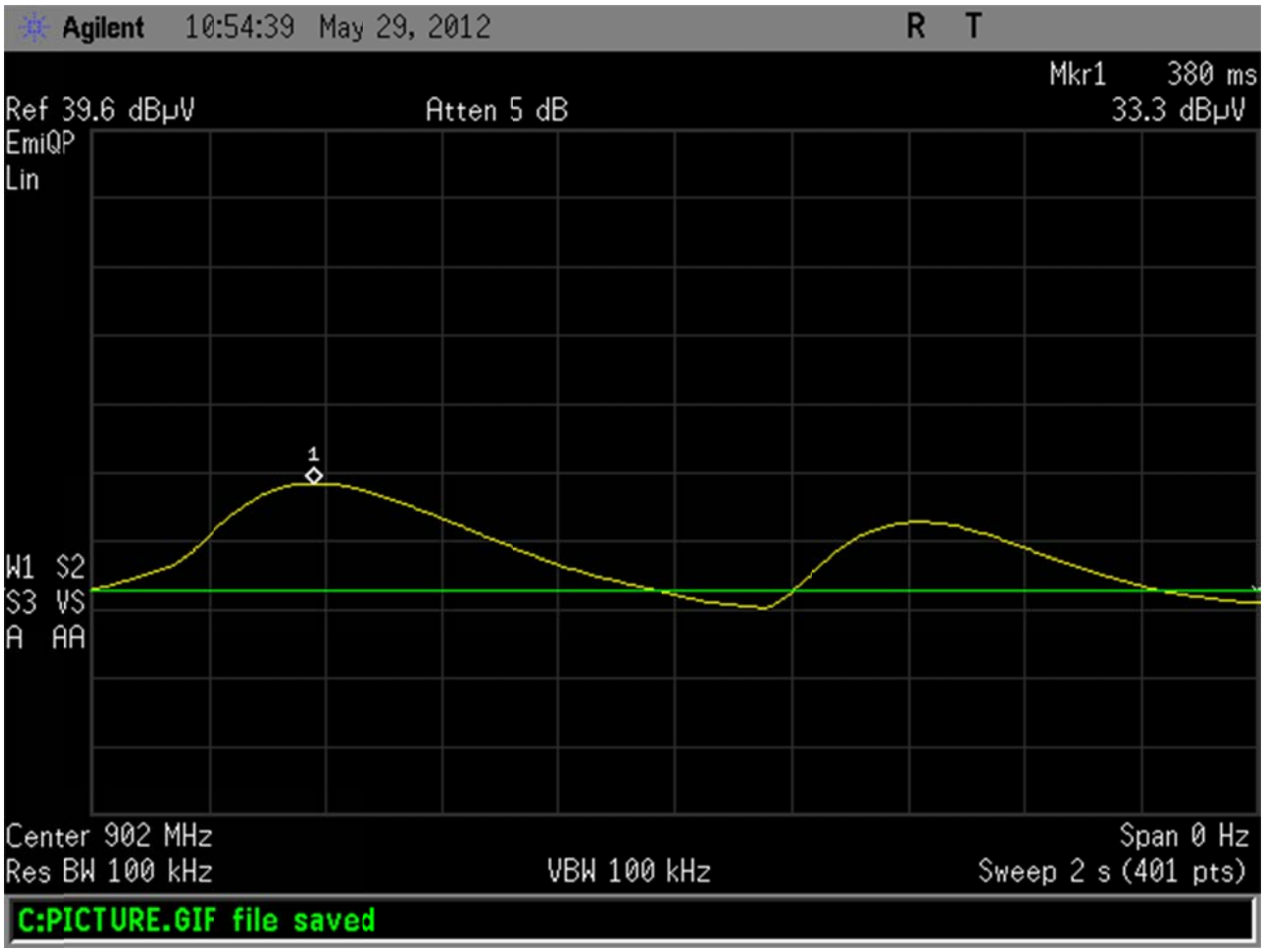
Band Edge	Test Setup	Level	Pass/Fail
902 MHz	Radiated	33.3 dbuV/m (1)(2)	Pass
928 MHz	Radiated	32.55 dbuV/m (1)(2)	Pass

(1) per the rules, radiated is allowed to show compliance.
(2) reading was obtained using a quasi peak detector.

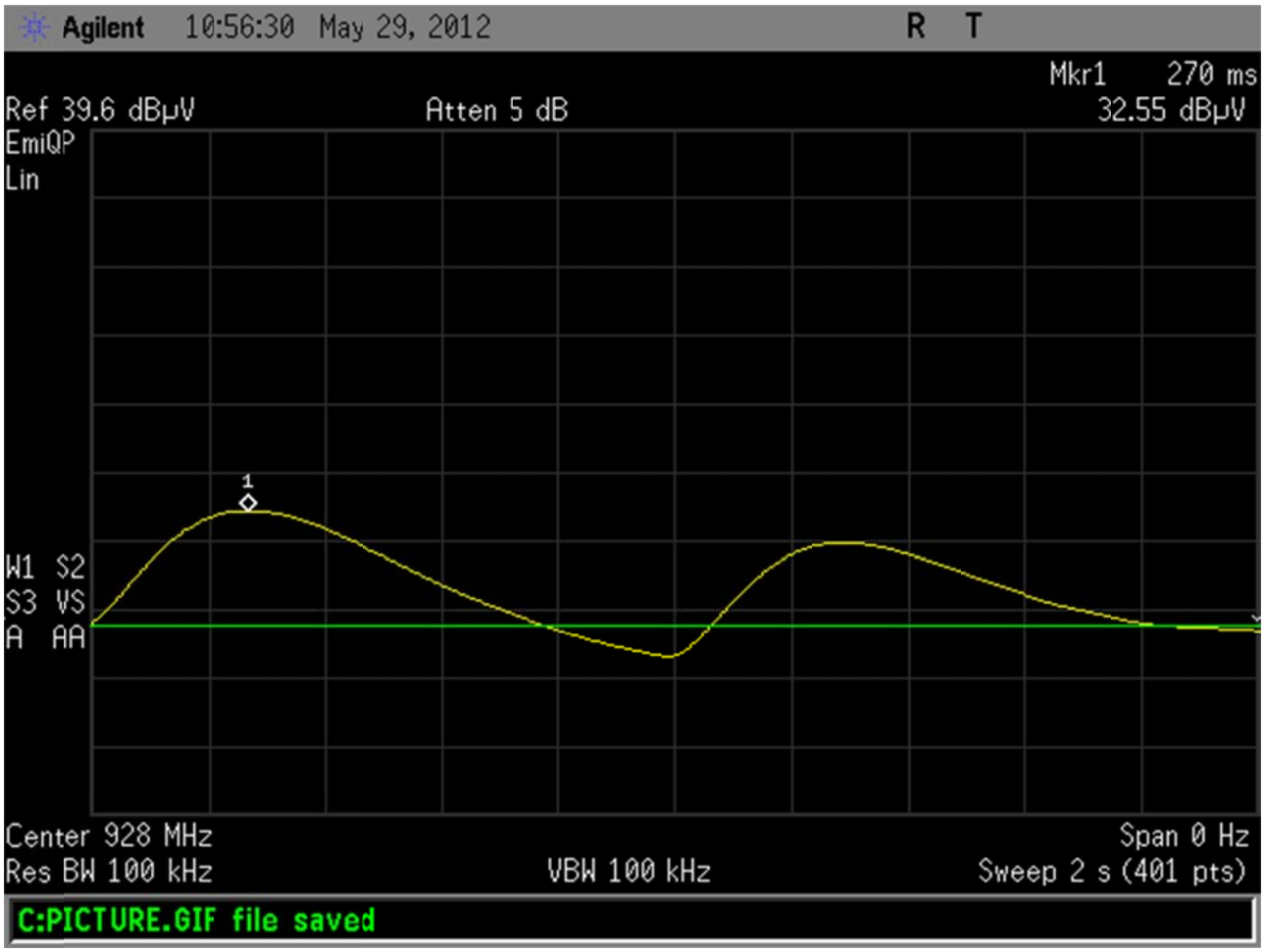
Equipment Used	Serial Number	Cal Date	Due
Agilent E7405A Spectrum Analyzer	MY45113415	8/8/2011	8/8/2012
Microcoax 40 foot cable	H1G315G1	4/15/2011	4/15/2013
AH systems preamplifer model number PAM 0126	135	1/3/2012	1/3/2013
EMCO 3148 Log periodic (200MHz to 1GHz)	9901-1044	8/23/2011	8/23/2013
Huber&Suhner sucotest cable	2	4/26/2011	4/26/2013
Date	Tested by		
5/29/2012	Mark Kvamme		

Radiated setup: Endpoint 114, with a new battery, was placed at 3 meters and the field strength was measured with the log periodic antenna, 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 114 was positioned to 245 degrees the antenna was positioned to vertical 112 cm. band edge at 902 MHz and 928 MHz was measured using a quasi peak detector.

The device was set to transmit every 1 second. At 902 MHz the band edge signal was 33.3 dbuV/m



The device was set to transmit every 1 second. At 928 MHz the band edge signal was 32.55 dbuV/m



RSS-GEN 4.6.1

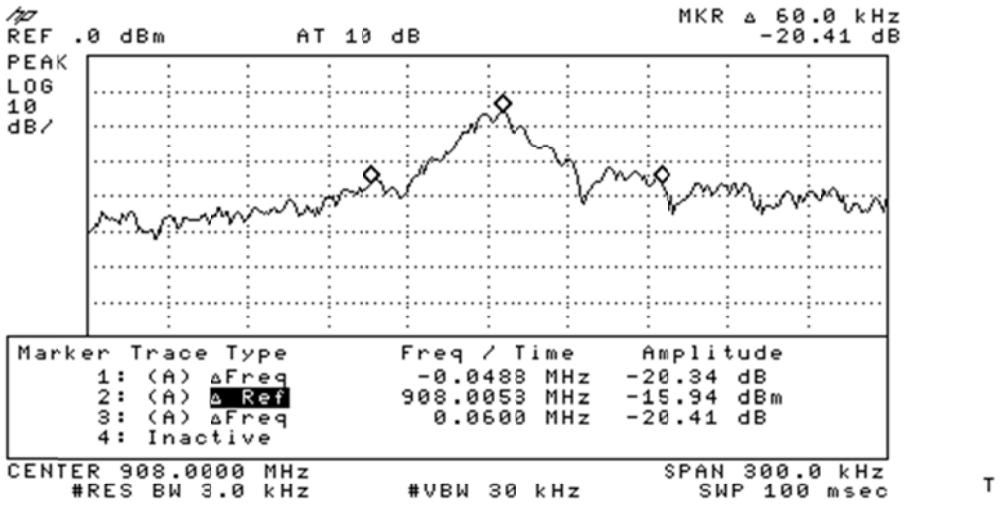
99% Bandwidth, conducted

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
HP8593E	3543A02032	12/9/2011	12/9/2012
Date	**Tested by**		
5/30/2011	Mark Kvamme		

Conducted setup: Board 105 with a new battery, was connected to the Hewlett Packard 8593E analyzer.
99% BW = 48.8kHz + 60.0kHz = 108.8 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.