REGULATORY COMPLIANCE REPORT

TITLE: FCC & IC Test Report for 15.247 & RSS-210 Frequency Hopping Device (100G)
AUTHOR: Jon Mueller

REV	CCO	DESCRIPTION OF CHANGE	DATE	APPROVALS	
1		INITIAL RELEASE		Engineering	Jon Mueller
				Engineering	

REVISION HISTORY

				Engineering	
				Engineering	
				Engineering	

Test Data Summary

FCC 15.247 / IC RSS-210
Frequency Hopping Device (100G), 908 – 924 MHz
FCC ID: EO9100G / **IC ID:** 864D-100G
Device Model: ERG-5000
Model Numbers:
ERG-5000-501, ERG-5000-502, ERG-5000-503
OATS Registration Number: FCC 90716, IC 5615

Rule	Description	Max. Reading	Pass/Fail
Part 15.31(e)	Variation of Input Voltage - Conducted	N/A (battery device)	N/A
Part 15.207 / RSS-Gen 7.2.2	AC Powerline Conducted Emissions	N/A (battery device)	N/A
Part 15.247(a)(1) / RSS-210 A8.1(2)	Carrier Frequency Separation – (Measured Conducted)	199 kHz	Pass
Part 15.247(a)(1)(i) / RSS-210 A8.1(3)	Number of Hopping Channels (Measured Conducted)	50	Pass
Part 15.247(a)(1)(i) / RSS-210 A8.1(3)	20dB Bandwidth (Measured Conducted)	131 kHz	Pass
Part 15.247(b) (2) / RSS-210 A8.4(1)	Power Output (Measured Conducted)	21.14 dBm (.130 W) @ 915 MHz	Pass
Part 15.247(d) / RSS-210 A8.5	Spurious Emissions - (Measured Radiated)	-52.34 dBc @1829 Mhz	Pass
Parts 15.205 & 15.209 / RSS-210 2.2, 2.6 Tables 1 & 2	Restricted Bands / Spurious Emissions - (Measured Radiated)	63.3dbuV/m 10.7dB Margin @ 2730 MHz	Pass
Part 15.247(a)(1)(i) / RSS-210 A8.1(3)	Time of Occupancy	5.86 mS	Pass
RSS-210 Gen 7.2.3	Receiver Spurious Emissions	Noise floor emissions below 54dbuV/m @ 908MHz	Pass
Parts 1.1310 & 2.1091 / RSS-102	Limits for Maximum Permissible Exposure (MPE)	0.0449mW/cm^2	Pass

Rule versions: FCC Part 1 (01-2006), FCC Part 2 (01-2006), FCC Part 15 (02-2006), RSS-102 (11-2005), RSS-210 Issue 6 (09-2005), 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

Name	Title
Mark Kvamme	Test Technician
Adam Wisch	Project Engineer
Jon Mueller	R&D Manager

15.247(a) (1) / RSS-210 A8.1 (2)

Carrier Frequency Separation

The measurement was performed conducted (photograph in Annex A.)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Verify that the channel separation is > the 20dB bandwidth of a single transmission. The EUT must have its hopping function enabled. Use the following analyzer settings: **EUT configuration: Programmed for field operation. Transmitting Standard Consumption Messages (SCM) on all 50 channels.**

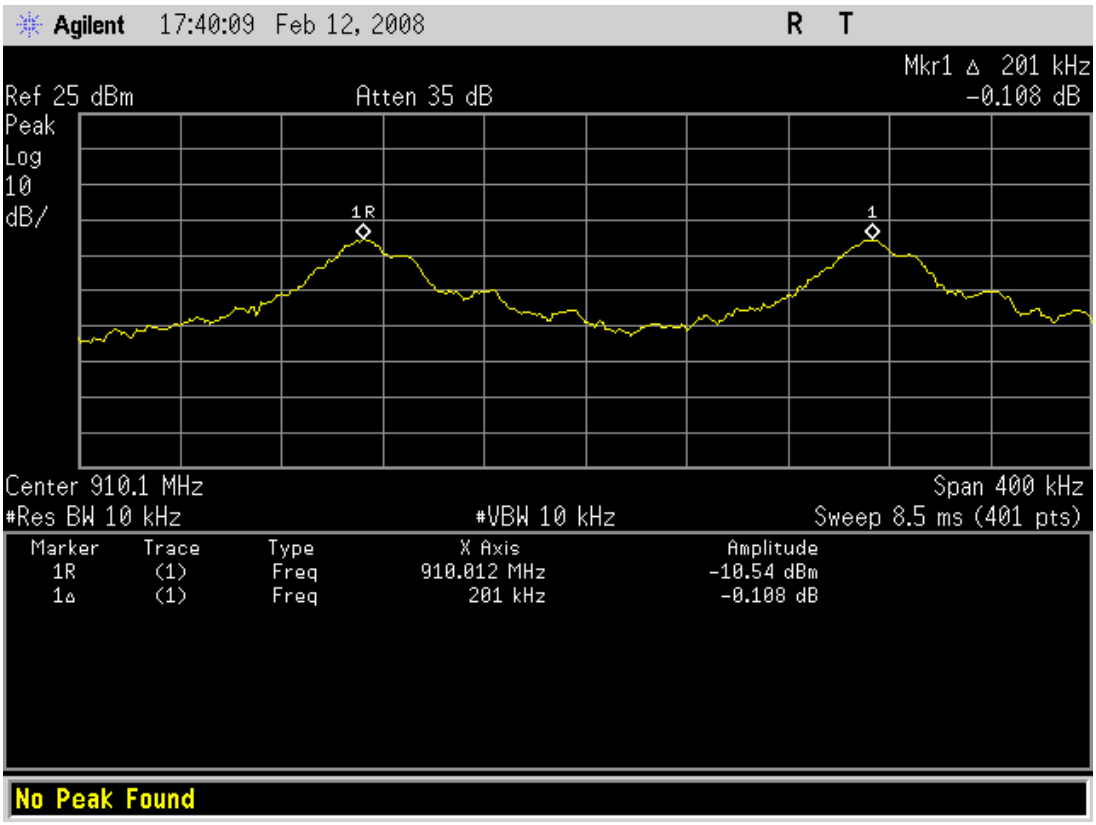
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

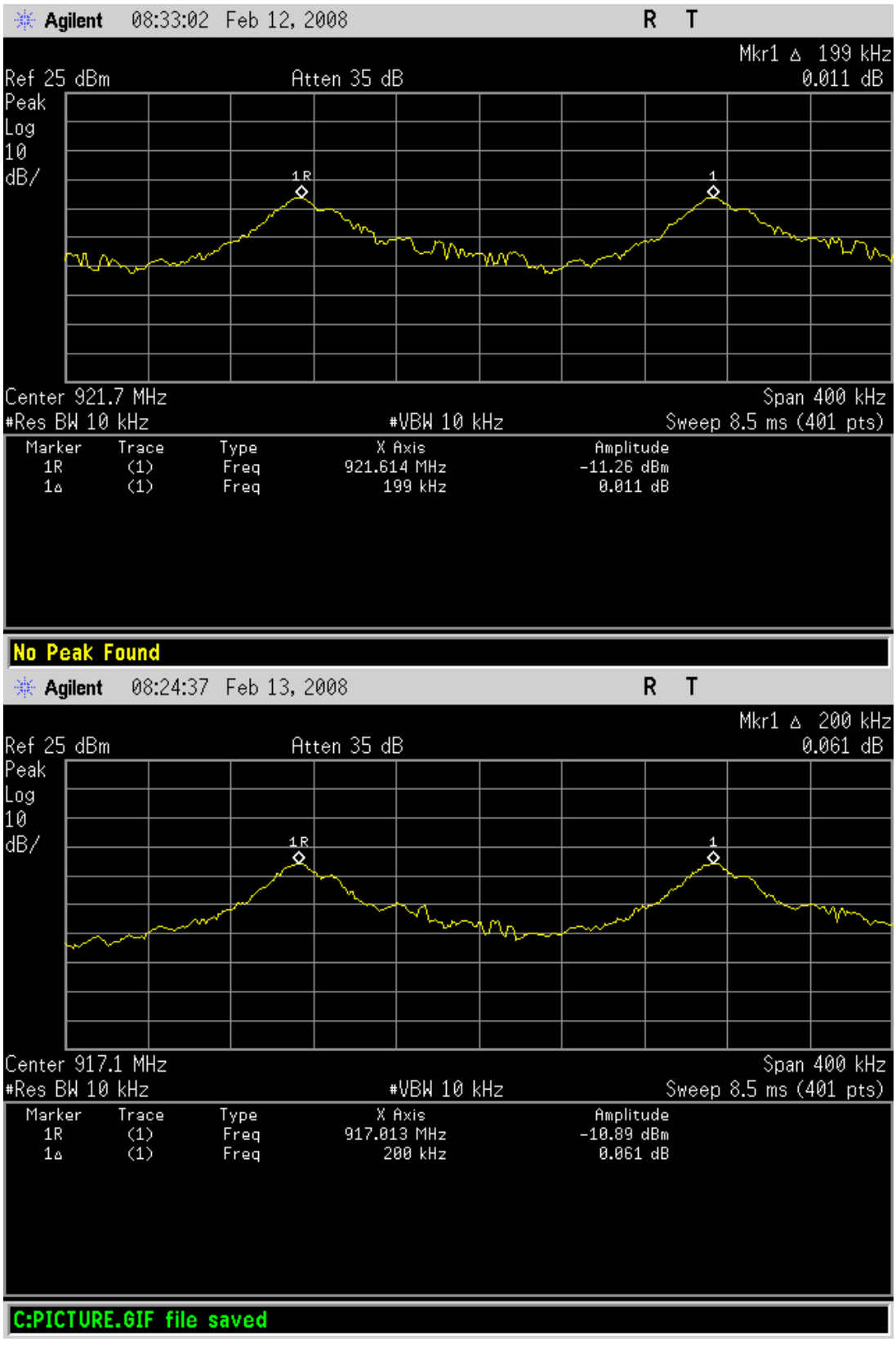
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section.

Equipment Used	Serial Number	Cal Date	Due
Spectrum Analyzer	MY45113415	7-Aug-07	8-Aug-08
Huber&Suhner Sucoflex 100 18 inch. Sma to N	220057 002	03-May-07	03-May-08

Date	Tested by
12-13-Feb-08	Mark Kvamme

Min carrier separation is 199 kHz.
Max carrier separation is 201 kHz.


Agilent 17:40:09 Feb 12, 2008
R T
Mkr1 Δ 201 kHz
-0.108 dB
Ref 25 dBm
Atten 35 dB
Peak
Log
10
dB/
1R
1
Center 910.1 MHz
Span 400 kHz
#Res BW 10 kHz
#VBW 10 kHz
Sweep 8.5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1R (1) Freq 910.012 MHz -10.54 dBm
1Δ (1) Freq 201 kHz -0.108 dB
No Peak Found


Agilent 08:33:02 Feb 12, 2008
R T
Mkr1 Δ 199 kHz
0.011 dB
Ref 25 dBm
Atten 35 dB
Peak
Log
10
dB/
1R
1
Center 921.7 MHz
Span 400 kHz
#Res BW 10 kHz
#VBW 10 kHz
Sweep 8.5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1R (1) Freq 921.614 MHz -11.26 dBm
1Δ (1) Freq 199 kHz 0.011 dB
No Peak Found
Agilent 08:24:37 Feb 13, 2008
R T
Mkr1 Δ 200 kHz
0.061 dB
Ref 25 dBm
Atten 35 dB
Peak
Log
10
dB/
1R
1
Center 917.1 MHz
Span 400 kHz
#Res BW 10 kHz
#VBW 10 kHz
Sweep 8.5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1R (1) Freq 917.013 MHz -10.89 dBm
1Δ (1) Freq 200 kHz 0.061 dB
C:PICTURE.GIF file saved

15.247(a) (1) (i) / RSS-210 A8.1 (3)

Number of Hopping Channels

The measurement was performed conducted. (photograph in Annex A.)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

EUT configuration: Programmed for field operation. Transmitting Standard Consumption Messages (SCM) on all 50 channels.

Span = the frequency band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = Peak
Trace = max hold

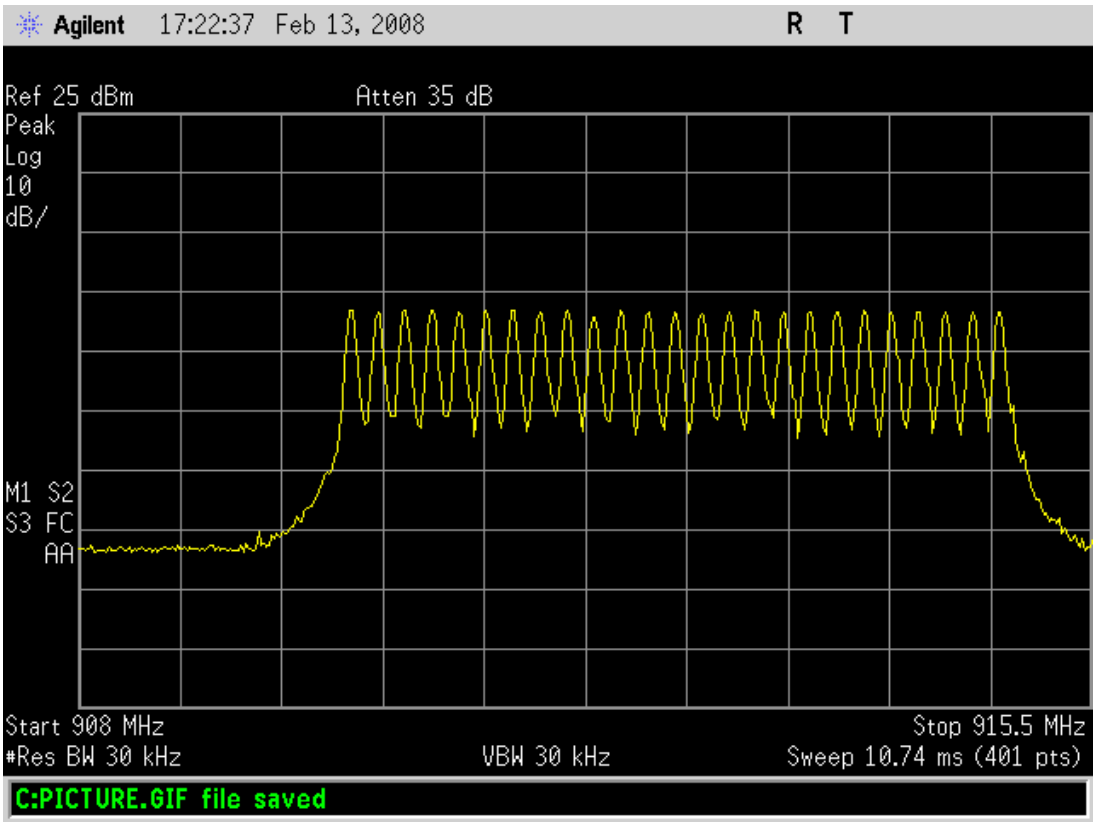
Allow the trace to stabilize. It may prove necessary to break the span up into sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). Measurements are relative to demonstrate number of channels and channel spacing.

Equipment Used	Serial Number	Cal Date	Due
Spectrum Analyzer	MY45113415	7-Aug-07	8-Aug-08
Huber&Suhner Sucoflex 100 18 inch. Sma to N	220057 002	03-May-07	03-May-08

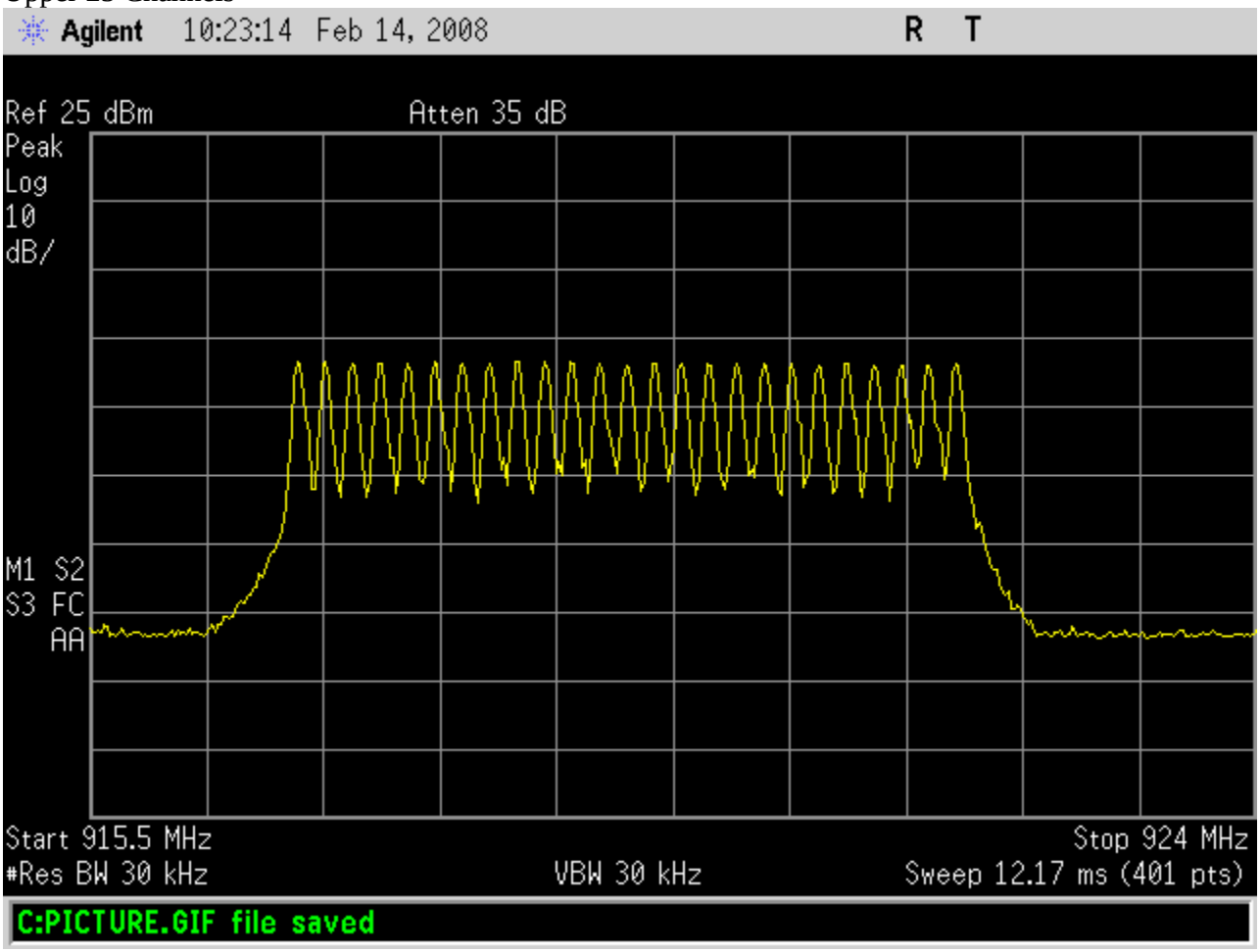
Date	Tested by
13-14-Feb-2008	Mark Kvamme

There are 50 channels. The maximum transmissions that will occur in 20 seconds is 6. The maximum number of transmission in 20 seconds that will occur on any one channel is one.

Lower 25 Channels


Agilent 17:22:37 Feb 13, 2008
R T
Ref 25 dBm
Atten 35 dB
Peak
Log
10
dB/
M1 S2
S3 FC
AA
Start 908 MHz
#Res BW 30 kHz
VBW 30 kHz
Stop 915.5 MHz
Sweep 10.74 ms (401 pts)
C:PICTURE.GIF file saved

Upper 25 Channels



15.247(a) (1) (i) / RSS-210 A8.1 (3)

20 dB Bandwidth

The measurement was performed conducted. (photograph in Annex A.)

Verify that the 20 dB bandwidth is less than the 200KHz width of the hopping channel.

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 (921.8 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. See Annex A for picture of test setup.

Use the following spectrum analyzer settings:

Span = 400 KHz centered on a hopping channel. 400 KHz is approximately 2 times the 20 dB bandwidth of the hopping channel.

RBW ≥ 1 Mhz when measuring total power.
3Khz (approximately 1% of the 20 dB bandwidth) when measuring -20 dB down relative to total power

VBW ≥ 30 KHz (1o0 times RBW)

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Set RBW to 1 MHz , select max hold, and measure total TX Power (Reference Power)

Set a reference line 20 dB below the reference power measured in the previous step. Set RBW to 3KHz. Select peak power and capture the modulated spectrum and press View B. This will take several minutes due to the occasional short transmissions.

Place a marker at the lower frequency 20 dB down point on the modulated spectrum. Press Marker Delta and mark the upper frequency 20 dB down point. The indicated delta frequency is the 20 dB bandwidth of the emission, This is also the 99% bandwidth.

In general, If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. For this product only one data rate and modulation mode is used. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

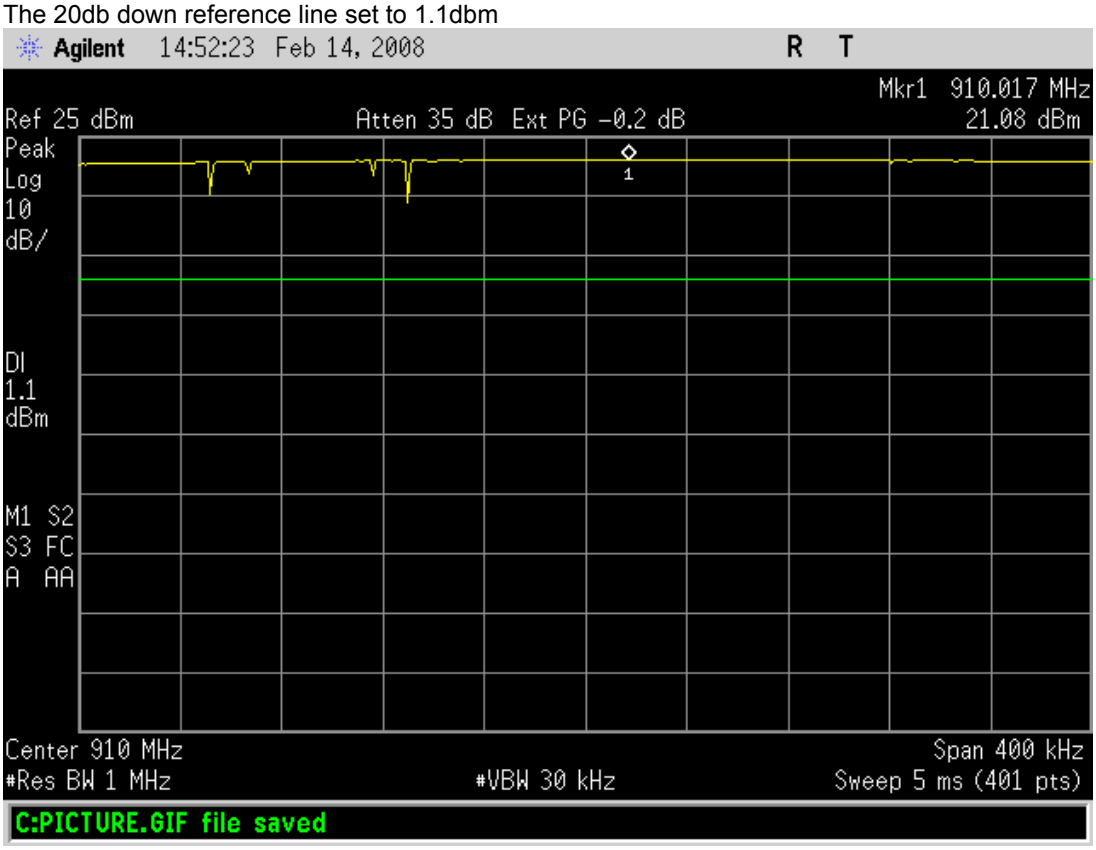
Equipment Used	Serial Number	Cal Date	Due
Spectrum Analyzer	MY45113415	7-Aug-07	8-Aug-08
Huber&Suhner Sucoflex 100 18 inch. Sma to N	220057 002	03-May-07	03-May-08

Date	Tested by
13-14-Feb-08	Mark Kvamme

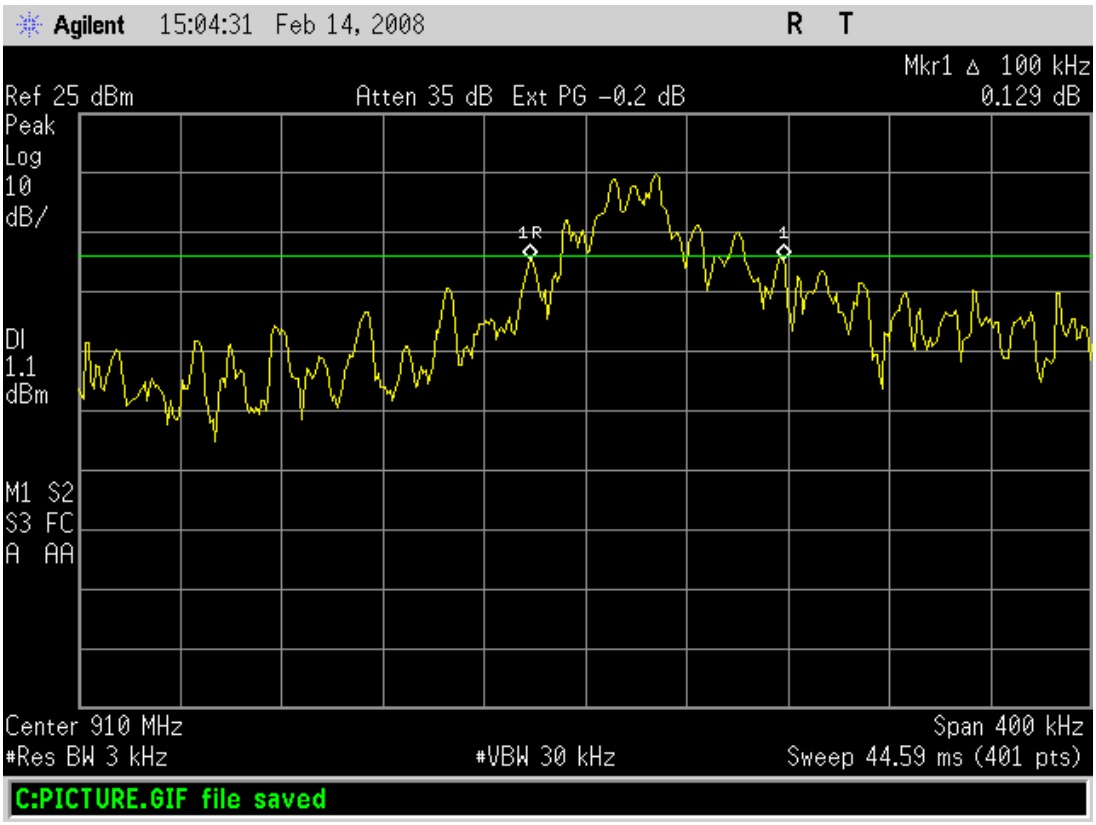
20 dB Occupied Bandwidth

910.000 MHz = 100 kHz
914.600 MHz = 100 kHz
921.800 MHz = 133 kHz

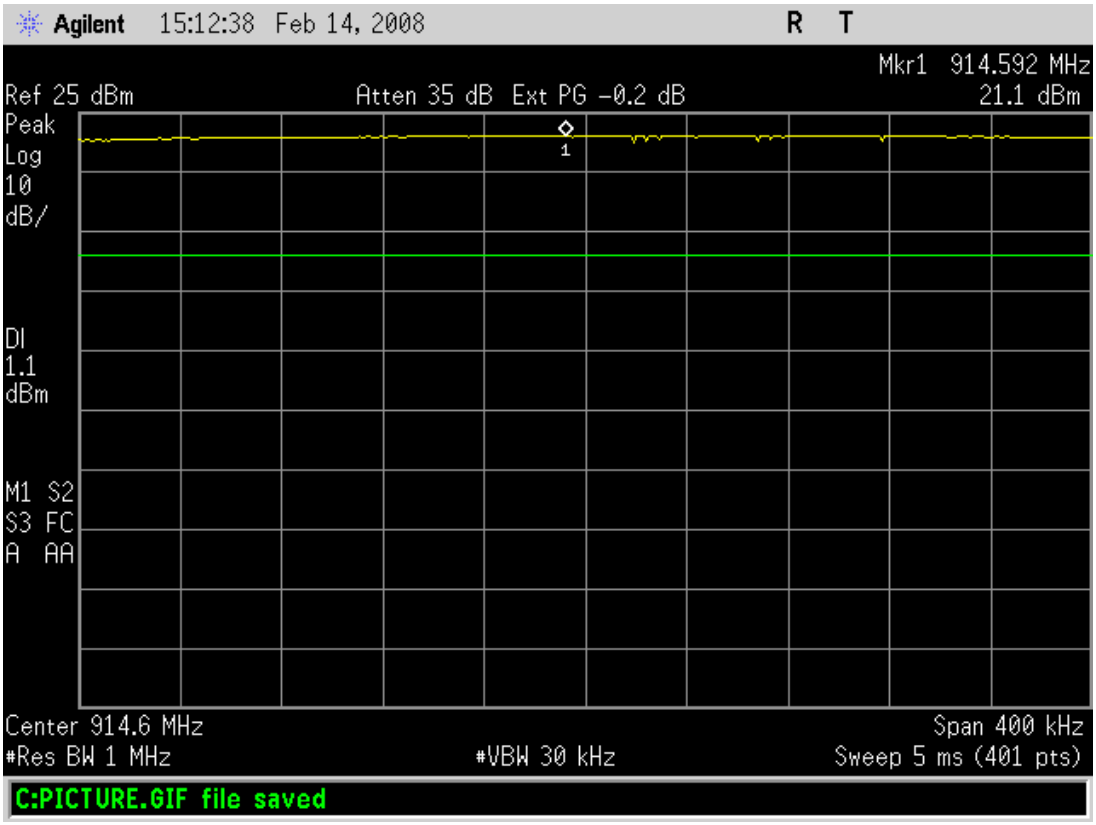
The 20db down reference line set to 1.1dbm



The 20db down points have 100khz of separation



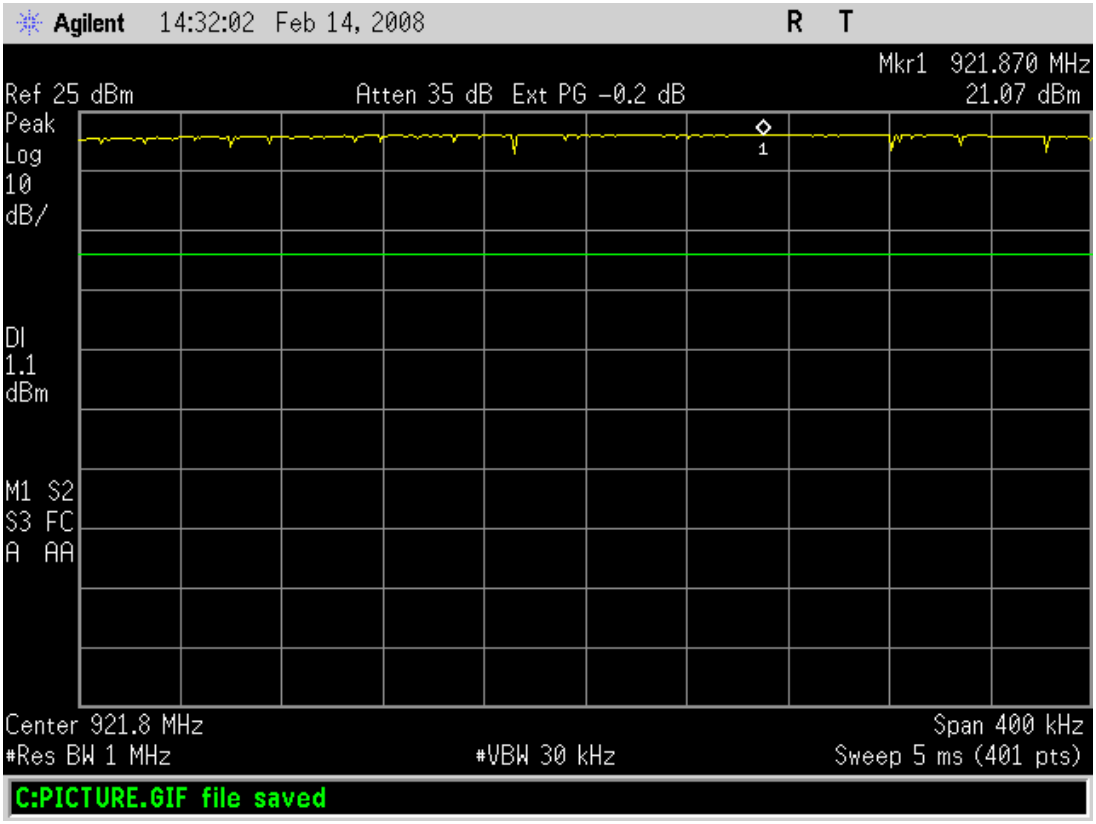
The 20db down reference line set to 1.1dbm



The 20db down points have 100khz of separation


Agilent 15:42:41 Feb 14, 2008
R T
Mkr1 Δ 100 kHz
Ref 25 dBm
Atten 35 dB Ext PG -0.2 dB
-0.813 dB
Peak
Log
10
dB/
1R
1
Dl
1.1
dBm
M1 S2
S3 FC
A AA
Center 914.6 MHz
Span 400 kHz
#Res BW 3 kHz
#VBW 30 kHz
Sweep 44.59 ms (401 pts)
C:PICTURE.GIF file saved

The 20db down reference line set to 1.1dbm



The 20db down points have 131khz of separation

15.247(a) (1) (i) / RSS-210 A8.1 (3)

Time of Occupanc

The measurement was performed conducted. (photograph in Annex A.)

Verify that the transmitted signal does not occupy a single frequency for more than 400 mS.

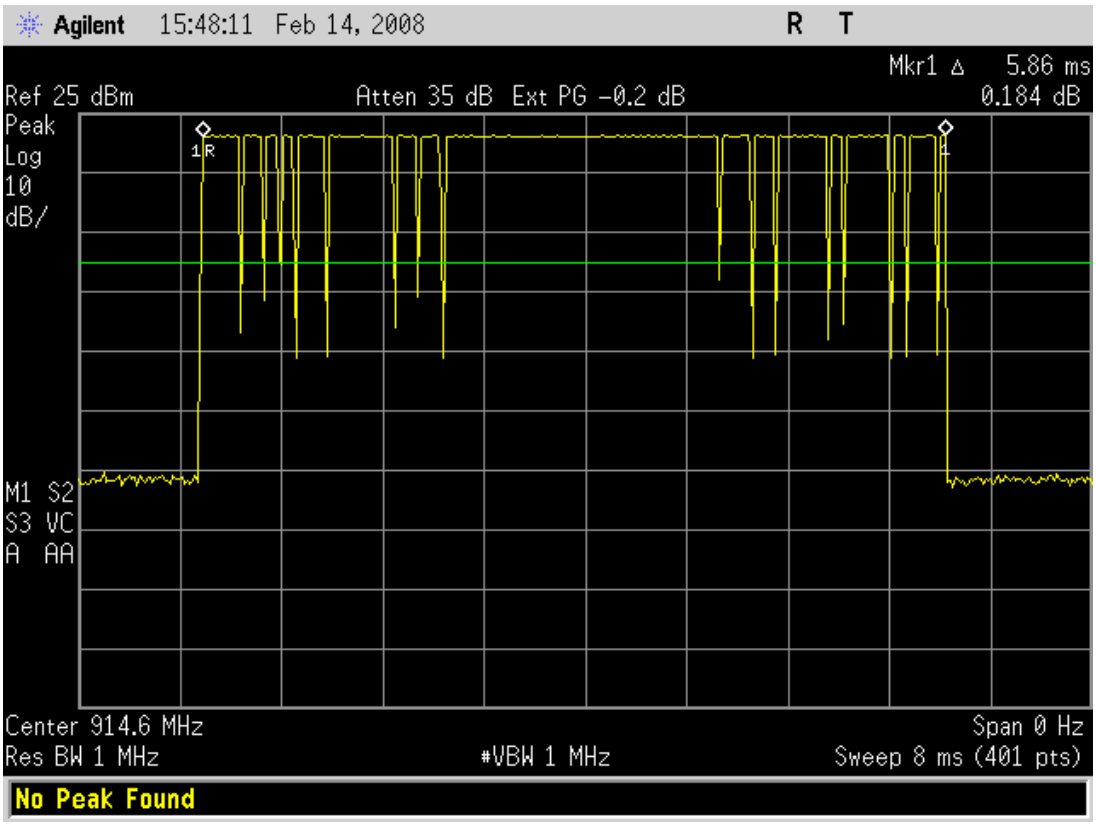
EUT Configuration: The EUT is configured to transmit (special code set) on the low channel (908 MHz), a middle channel (915 MHz), and a high channel (921.8 MHz). The EUT is also configured to transmit every 4 seconds. This configuration is transmitting Standard Consumption Messages and triggered on one specific message. See Annex A for picture of test setup.

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = zero span, centered on a hopping channel
RBW = 1 MHz
VBW ≥ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold
If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. Submit this plot(s).

Equipment Used	Serial Number	Cal Date	Due
Spectrum Analyzer	MY45113415	7-Aug-07	8-Aug-08
Huber&Suhner Sucoflex 100 18 inch. Sma to N	220057 002	03-May-07	03-May-08

Date	Tested by
14-Feb-08	Mark Kvamme

Each transmission is 5.86 mS long. Each transmission takes place on one of 50 different channels in a pseudo-random sequence. All 50 channels are used equally on the average. The algorithm that determines the pseudo-random hop sequence does not allow the device to transmit on the same channel more than once in a 20 second period.


Agilent 15:48:11 Feb 14, 2008
R T
Mkr1 Δ 5.86 ms
0.184 dB
Ref 25 dBm
Atten 35 dB Ext PG -0.2 dB
Peak
Log
10
dB/
1R
M1 S2
S3 VC
A AA
Center 914.6 MHz
Res BW 1 MHz
#VBW 1 MHz
Span 0 Hz
Sweep 8 ms (401 pts)
No Peak Found

15.247(b) (2) / RSS-210 A8.4 (1)

Power Output

The measurement was performed conducted. (photograph in Annex A.)

For frequency hopping systems operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W, if the hopset uses 50 or more hopping channels.

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 (921.8 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. See Annex A for picture of test setup.

Use the following spectrum analyzer settings:

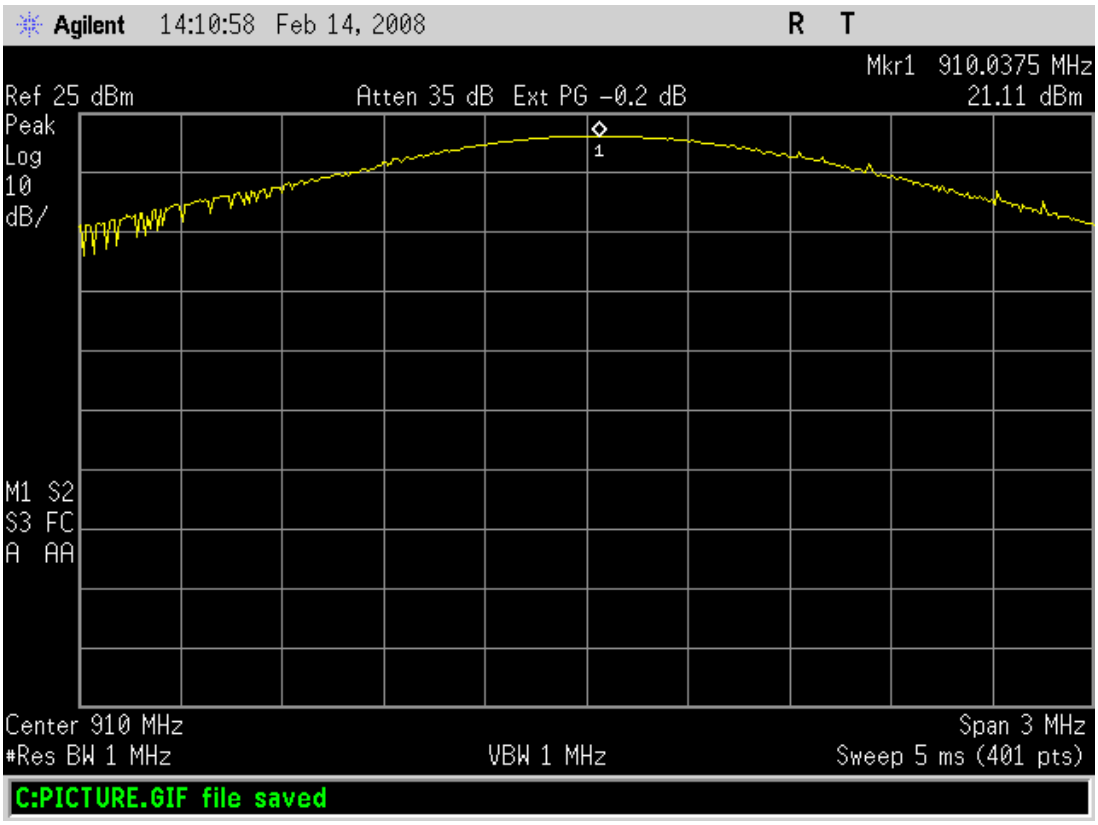
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.
RBW > the 20 dB bandwidth of the emission being measured.
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

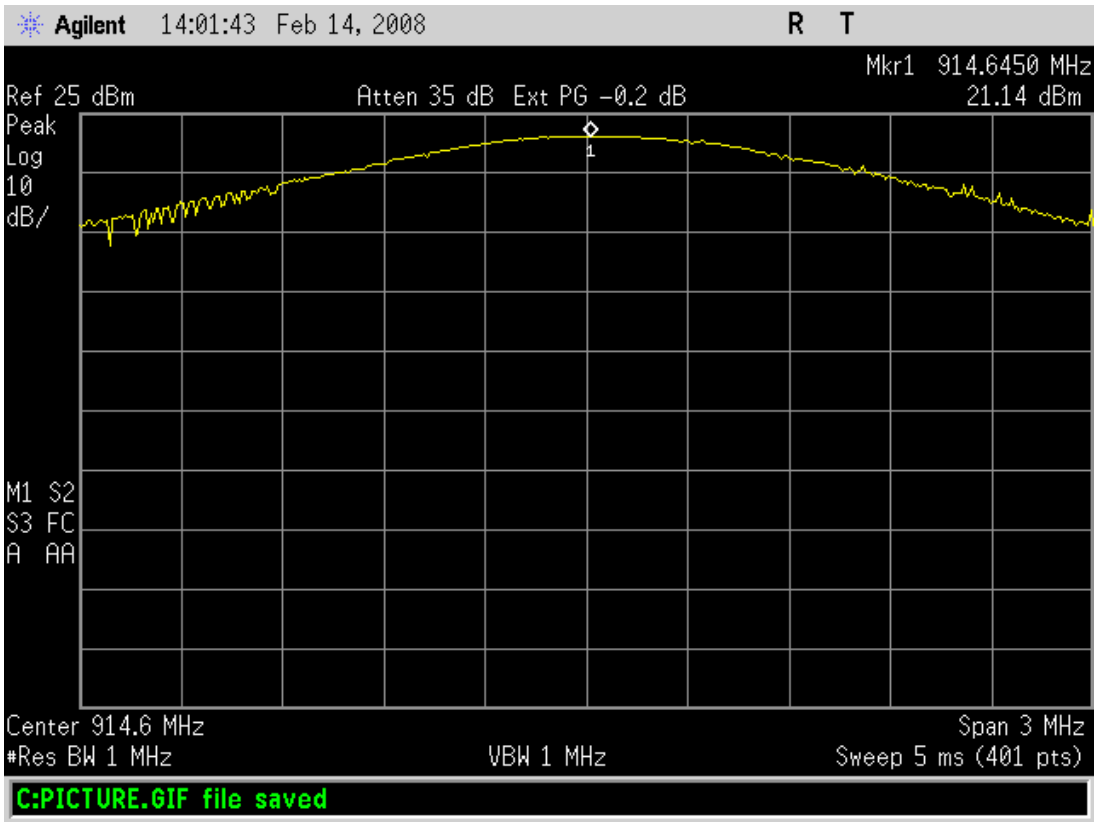
Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power. The limit is specified in one of the subparagraphs of this Section. Submit this plot. A peak responding power meter may be used instead of a spectrum analyzer.

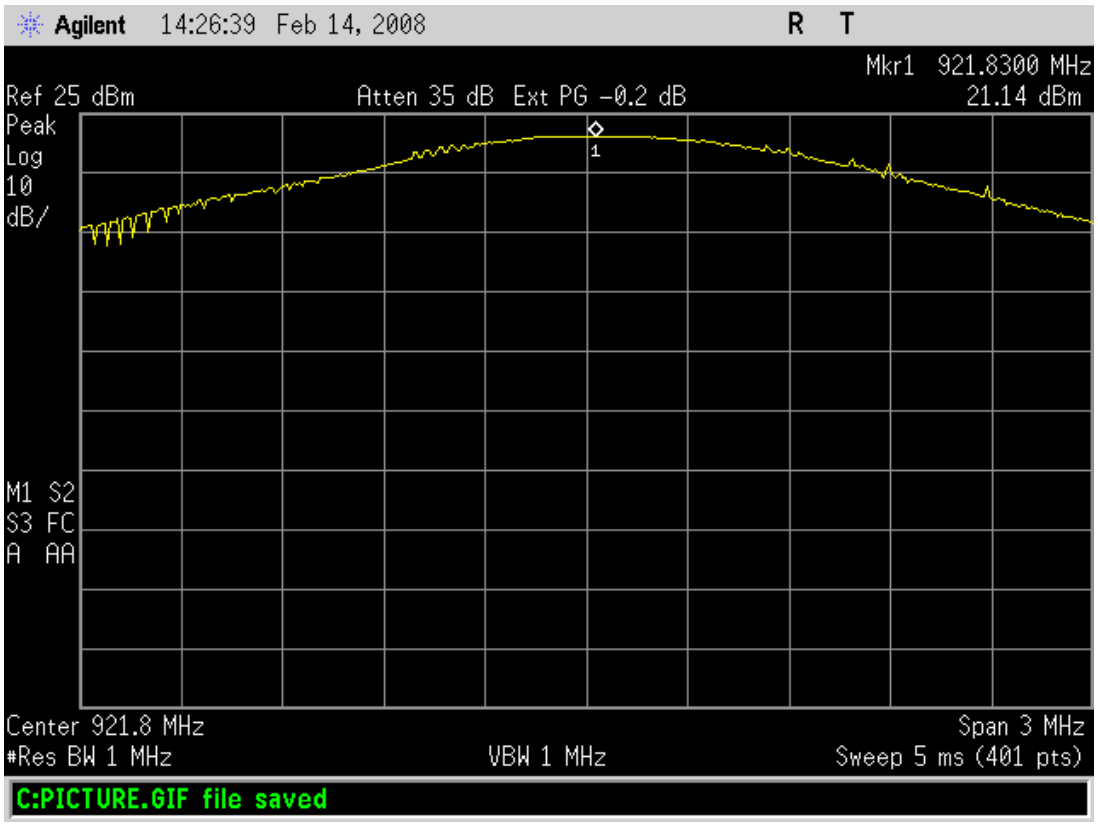
Equipment Used	Serial Number	Cal Date	Due
Spectrum Analyzer	MY45113415	7-Aug-07	8-Aug-08
Huber&Suhner Sucoflex 100 18 inch. Sma to N	220057 002	03-May-07	03-May-08

Date	Tested by	Temperature/humidity
14-Feb-08	Mark Kvamme	72/16

Power in dbm
910.000 Mhz = 21.1dbm
914.600 Mhz = 21.14
921.800 Mhz = 21.14


Agilent 14:10:58 Feb 14, 2008
R T
Mkr1 910.0375 MHz
Ref 25 dBm
Atten 35 dB Ext PG -0.2 dB
21.11 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Center 910 MHz
Span 3 MHz
#Res BW 1 MHz
VBW 1 MHz
Sweep 5 ms (401 pts)
C:PICTURE.GIF file saved


Agilent 14:01:43 Feb 14, 2008
R T
Mkr1 914.6450 MHz
Ref 25 dBm
Atten 35 dB Ext PG -0.2 dB
21.14 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Center 914.6 MHz
Span 3 MHz
#Res BW 1 MHz
VBW 1 MHz
Sweep 5 ms (401 pts)
C:PICTURE.GIF file saved


Agilent 14:26:39 Feb 14, 2008
R T
Mkr1 921.8300 MHz
Ref 25 dBm
Atten 35 dB Ext PG -0.2 dB
21.14 dBm
Peak
Log
10
dB/
1
M1 S2
S3 FC
A AA
Center 921.8 MHz
Span 3 MHz
#Res BW 1 MHz
VBW 1 MHz
Sweep 5 ms (401 pts)
C:PICTURE.GIF file saved

15.247(d) / RSS-210 A8.5

Spurious Emissions

Measured Radiated. (photograph in Annex A.)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in Section 15.209 is not required.

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 (921.8 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. See Annex A for picture of test setup.

Follow the procedure outlined in Annex A of this document.

Equipment used for the OATS measurements

Equipment Used	Serial Number	Cal Date	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-Mar-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

Equipment used for the pre scan 9Khz to 30Mhz

Equipment Used	Serial Number	Cal Date	Due
Anechoic Chamber	N/A	N/A	N/A
Pasternack RG214/U	RG214/U	N/A	N/A
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	02-Oct-07	02-Oct-08
EMCO loop antenna model 6502	EMCO 6502	9509-2970	24-Oct-08

Equipment used for the pre scan above 30Mhz

Equipment Used	Serial Number	Cal Date	Due
EMCO GTEM	5407	N/A	N/A
Andrew Heliax length 10 Ft. dia.1/2 inch	FSJ4-50B	N/A	N/A
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	02-Oct-07	02-Oct-08
EMCO loop antenna model 6502	EMCO 6502	9509-2970	24-Oct-08
Mini-circuits ZHL-1042J-SMA (black amp)	D021000-23		

Date	Tested by
5 Feb 08 ,30-31Jan 08	Mark Kvamme

Frequency range investigated was 9 kHz to 9.3 GHz. Radiated measurements were performed @ the Open Air Test Site. For the frequency range of 9Khz to 30Mhz a pre-scan was done in an anechoic chamber. For frequencies above 30Mhz a pre scan was done in a GTEM chamber. Worst case results are reported below.

Freq. MHz	Ant. Pos.	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	**Level dBuV/m**	dbc		Temperature Fahrenheit	Relative Humidity
914.63	Vertical	0	27.82	2.62	117.39		5-Feb-08	45.82	39.77
1829	Vertical	36.24	26.78	3.67	64.34	-53.05	30-Jan-08	56.71	11.61
1829	Horizontal	36.24	26.78	3.67	65.05	**-52.34**	30-Jan-08	50.41	12.61
5488	Vertical	36.89	34.5	6.73	50	-67.39	31-Jan-08	48.31	18.73
5488	Horizontal	36.89	34.5	6.73	62.05	-55.34	31-Jan-08	61.27	14.45

15.205, 15.209 / RSS-210 2.2, 2.6

Restricted Bands & Spurious Emissions

Measured Radiated. (photograph in Annex A.)

Only spurious emissions are permitted in any of the frequency bands listed below. The limits stated in 15.209 shall apply. Spurious emissions outside these bands shall also comply with the 15.209 limits.

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 (921.8 MHz). The EUT is also configured to transmit every 4 seconds. This enables measurement of peak energy to be made at each location. See Annex A for picture of test setup.

Measure the field strength of all transmitter spurious emissions in the restricted bands listed below. Follow the procedure outlined in Annex A of this document.

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505 1	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Date	Temperature Fahrenheit	Relative Humidity
30-Jan-08	48.04	12.4
31-Jan-08	50.65	15.58
1-Feb-08	37.99	24.59

Date	Tested by
2 Feb 08 ,30-31Jan 08	Mark Kvamme

A Duty Cycle Correction Factor (20log (dwell time/100mS)) was applied to show compliance to the 15.205 limit. 20log (5.86/100)= -24.61 dB . The maximum allowed correction factor is 20 dB.

Freq. MHz	Ant. Pos.	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	**PEAK Level dBuV/m**	PEAK margin relative to 74dbuV/m	**Average Level dBuV/m**	Average power margin relative to 54dbuV/m
2730	Vertical	36.02	29.29	4.64	60.03	13.97	40.03	13.97
2730	Horizontal	36.02	29.29	4.64	63.3	10.7	43.3	10.7
2744	Vertical	36.02	29.29	4.64	59.65	14.35	39.65	14.35
2744	Horizontal	36.02	29.29	4.64	62.87	11.13	42.87	11.13
2765	Vertical	36.02	29.29	4.64	57.45	16.55	37.45	16.55
2765	Horizontal	36.02	29.29	4.64	59.74	14.26	39.74	14.26
3640	Vertical	35.94	31.68	5.41	52.94	21.06	32.94	21.06
3640	Horizontal	35.94	31.68	5.41	56.52	17.48	36.52	17.48
3658	Vertical	35.94	31.68	5.41	51.19	22.81	31.19	22.81
3658	Horizontal	35.94	31.68	5.41	55.9	18.1	35.9	18.1
3687	Vertical	35.94	31.68	5.41	51.36	22.64	31.36	22.64
3687	Horizontal	35.94	31.68	5.41	53.34	20.66	33.34	20.66
4550	Vertical	36.3	32.82	6.11	58.08	15.92	38.08	15.92
4550	Horizontal	36.3	32.82	6.11	60.87	13.13	40.87	13.13
4573	Vertical	36.3	32.82	6.11	57.14	16.86	37.14	16.86
4573	Horizontal	36.3	32.82	6.11	59.49	14.51	39.49	14.51
4609	Vertical	36.3	32.82	6.11	55.5	18.5	35.5	18.5
4609	Horizontal	36.3	32.82	6.11	58.35	15.65	38.35	15.65
6402	Vertical	36.6	34.99	7.3	55.03	18.97	35.03	18.97
6402	Horizontal	36.6	34.99	7.3	55.52	18.48	35.52	18.48
7317	Vertical	36.36	36.33	7.85	54.26	19.74	34.26	19.74
7317	Horizontal	36.36	36.33	7.85	57.58	16.42	37.58	16.42
8232	Vertical	35.99	37.26	8.38	50.5	23.5	30.5	23.5
8232	Horizontal	35.99	37.26	8.38	51	23	31	23
9146	Vertical	35.29	37.98	8.89	50	24	30	24
9146	Horizontal	35.29	37.98	8.89	45	29	25	29

RSS-Gen 7.2.3 Receiver Spurious Emission Limits

7.2.3.2 Radiated Measurement

Measured Radiated. (photograph in Annex A.)

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.

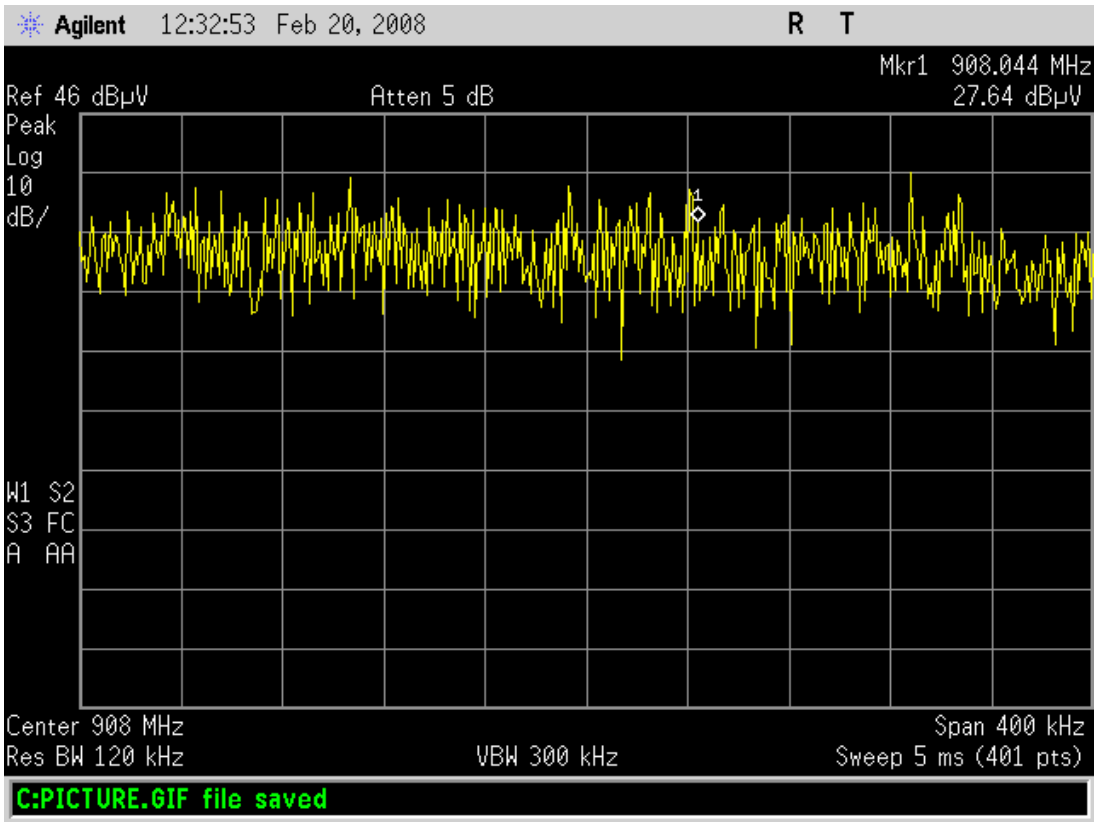
Table 1 - Spurious Emission Limits for Receivers

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

Table 1

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 meters)
30-88	100
88-216	150
216-960	200
Above 960	500

Frequency range investigated was 30Mhz to 1 GHz.
Emissions from the Receiver were below the noise floor.


Agilent 12:32:53 Feb 20, 2008
R T
Mkr1 908.044 MHz
27.64 dBµV
Ref 46 dBµV
Atten 5 dB
Peak
Log
10
dB/
W1 S2
S3 FC
A AA
Center 908 MHz
Res BW 120 kHz
VBW 300 kHz
Span 400 kHz
Sweep 5 ms (401 pts)
C:PICTURE.GIF file saved

1.1310 & 2.1091 / RSS-102

Maximum Permissible Exposure (MPE)

Determine the maximum power density for the general / uncontrolled population minimum separation distance of 20 cm. (f_{MHz} / 1500 mW/cm^2).

The power density is calculated as:

$$P_d = \frac{P_t \times G}{4 \times \pi \times r^2}$$

P_d = power density in watts
P_t = transmit power in milliwatts
G = numeric antenna gain
r = distance between body and transmitter in centimeters.]

FCC Limit:

Max antenna gain = 0.3 dBi = 1.072 numeric

Max TX power = 21.14 dBm = 211.4 mW

$$908 \ / 1500 \ = 0.61 \ mW \ / cm^2 @ \ 20 \ cm$$

$$P_D = \frac{211.4 \times 1.072}{4 \times \pi \times 20^2} = 0.0449 \ mW \ / cm^2 @ 20 cm$$

ANNEX A

Conducted measurement setup

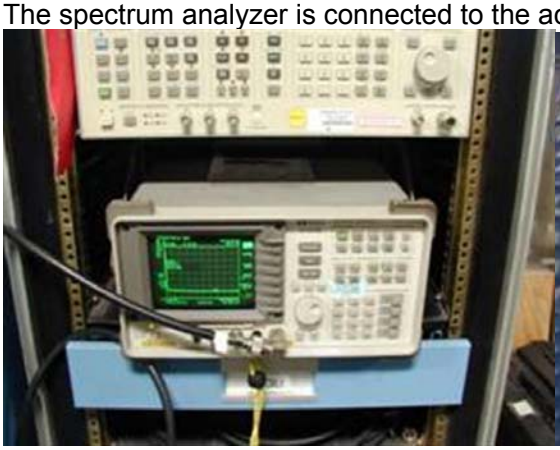
Equipment Used	Serial Number	Cal Date	Due
Spectrum Analyzer	MY45113415	7-Aug-07	8-Aug-08
Huber&Suhner Sucoflex 100 18 inch. Sma to N	220057 002	03-May-07	03-May-08

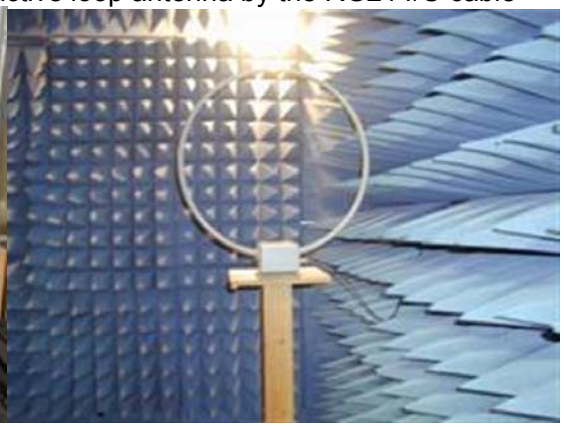
Radiated measurement pre scan setup 9Khz to 30Mhz

Equipment used for the pre scan 9Khz to 30Mhz

Equipment Used	Serial Number	Cal Date	Due
Anechoic Chamber	N/A	N/A	N/A
Pasternack RG214/U	RG214/U	N/A	N/A
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	02-Oct-07	02-Oct-08
EMCO loop antenna model 6502	EMCO 6502	9509-2970	24-Oct-08

The spectrum analyzer is connected to the active loop antenna by the RG214/U cable





Radiated measurement pre scan above 30Mhz

Equipment used for the pre scan above 30Mhz

Equipment Used	Serial Number	Cal Date	Due
EMCO GTEM 5407	24960	N/A	N/A
Andrew Heliax length 10 Ft. dia.1/2 inch	FSJ4-50B	N/A	N/A
Hewlett Packard 8593E Spectrum Analyzer	3543A02032	02-Oct-07	02-Oct-08
EMCO loop antenna model 6502	EMCO 6502	9509-2970	24-Oct-08
Mini-circuits ZHL-1042J-SMA (black amp)	D021000-23		

The EMCO 5407 GTEM is connected by a 10 foot heliax cable to a 30db pre amplifier which feeds the input to the spectrum analyzer.

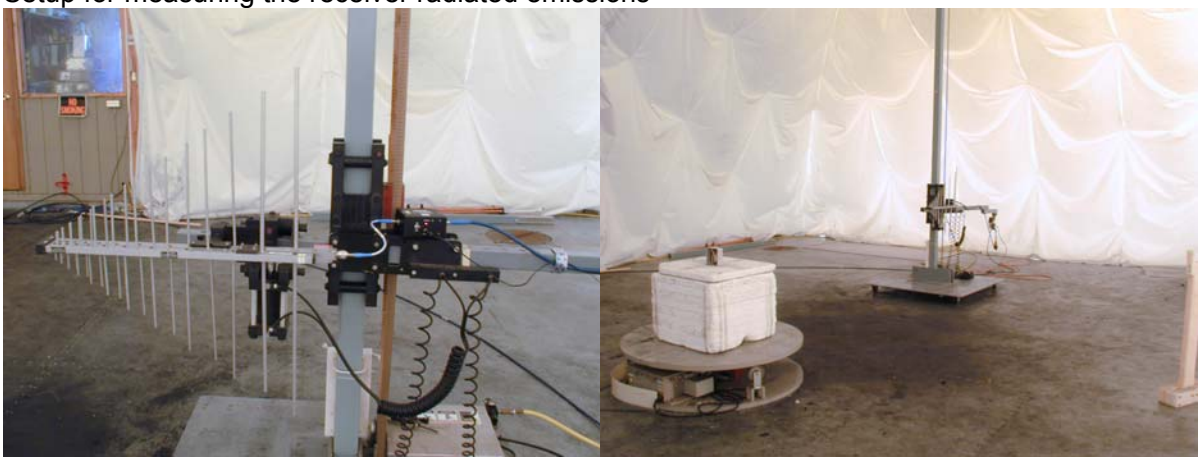
Radiated measurement setup

Equipment Used	Serial Number	Cal Date	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-Mar-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
EMCO 3148 Log periodic	9901-1044	24-Oct-06	24-Oct-08

Set up for measurements above 1Ghz with pre amplifier

Setup for measurement of the Tx fundamental without pre amplifier

Setup for measuring the receiver radiated emissions



EMC analyzer with the Antenna correction Factor, Amplifier Gain, and Coax loss programmed into internal tables.

Spurious Radiated Emissions

This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured.
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

Follow the guidelines in ANSI C63.4-2003 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 mS), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative "marker-delta" method, listed at the end of this document, may be employed.

Sweep = auto
Detector function = peak
Trace = max hold

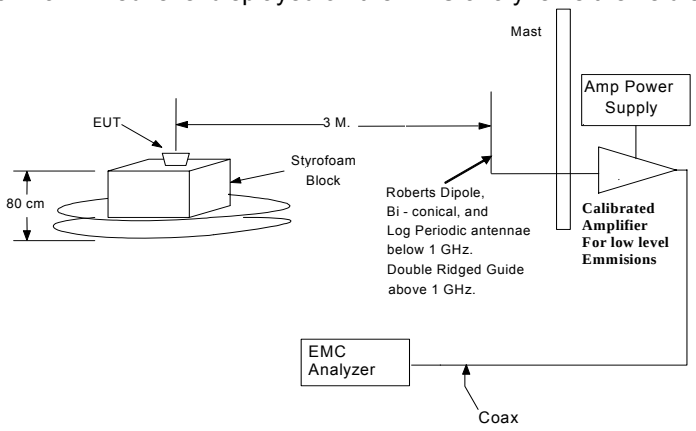
Measure the field strength of both the fundamental emission and all spurious emissions with these settings. Follow the procedures in C63.4-2003 with respect to maximizing the emissions. The measured field strength of all spurious emissions must be below the measured field strength of the fundamental emission by the amount specified in Section 15.247(d). Note that if the emission falls in a Restricted Band, as defined in Section 15.205, the procedure for measuring spurious radiated emissions, listed above, must be followed.

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.



Marker-Delta Method

In making radiated band-edge measurements, there can be a problem obtaining meaningful data since a measurement instrument that is tuned to a band-edge frequency may also capture some in-band signals when using the resolution bandwidth (RBW) required by measurement procedure ANSI C63.4-1992 (hereafter C63.4). In an effort to compensate for this problem, we have developed the following technique for determining band-edge compliance.

STEP 1) Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function required by C63.4 and our Rules for the frequency being measured. For example, for a device operating in the 902-928 MHz band under Section 15.249, use a 120 kHz RBW with a CISPR QP detector (a peak detector with 100 kHz RBW may alternatively be used). For transmitters operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector (as required by Section 15.35). Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW). Note: For pulsed emissions, other factors must be included. Please contact the FCC Lab for details if the emission under investigation is pulsed. Also, please note that radiated measurements of the fundamental emission of a transmitter operating under 15.247 are not normally required, but they are necessary in connection with this procedure.

STEP 2) Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.

STEP 3) Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.

STEP 4) The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the

"delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured in the conventional manner.