REGULATORY COMPLIANCE REPORT

TITLE: FCC & IC Test Report for 15.247 & RSS-210 Frequency Hopping Device (60W)
AUTHOR: Jeff Gilbert

REV	CCO	DESCRIPTION OF CHANGE	DATE	APPROVALS	
1		INITIAL RELEASE	3-23-06	Engineering	Jeff Gilbert
				Engineering	

REVISION HISTORY

				Engineering	
				Engineering	
				Engineering	

Summary

Test Data Summary

FCC 15.247 / IC RSS-210
Frequency Hopping Transmitter (60W), 910 – 920 MHz
FCC ID: EO960W / **IC ID:** 864D-60W
Device Model: ERW-0771
Model Numbers:
ERW-0771-0201
Serial Numbers:
24033, 20446
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 - Radiated	>20 dB (200 kHz)	Pass
Part 15.247(a)(1)(i) / RSS-210 A8.1(3)	Number of Hopping Channels - Radiated	50	Pass
Part 15.247(a)(1)(i) / RSS-210 A8.1(3)	20dB Bandwidth - Radiated	167.5 kHz	Pass
Part 15.247(b) (2) / RSS-210 A8.4(1)	Power Output – Radiated (EIRP)	11.37dBm	Pass
Part 15.247(d) / RSS-210 A8.5	Spurious Emissions - Radiated	38.3 dBc	Pass
Parts 15.205 & 15.209 / RSS-210 2.2, 2.6 Tables 1 & 2	Restricted Bands / Spurious Emissions - Radiated	1.25 dB Margin@5.46GHz	Pass
Part 15.247(a)(1)(i) / RSS-210 A8.1(3)	Time of Occupancy	5.925 mS	Pass
Parts 1.1310 & 2.1091 / RSS-102	Limits for Maximum Permissible Exposure (MPE)	.00316 mW/cm^2	Pass

Rule versions: FCC Part 1 (01-2006), FCC Part 2 (01-2006), FCC Part 15 (02-01-2006), 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: Mark Kvamme	Title: Test Technician
Name: Jeff Gilbert	Title: Regulatory Engineer
Name: John Mueller	Title: Project Lead

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

Carrier Frequency Separation

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:

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

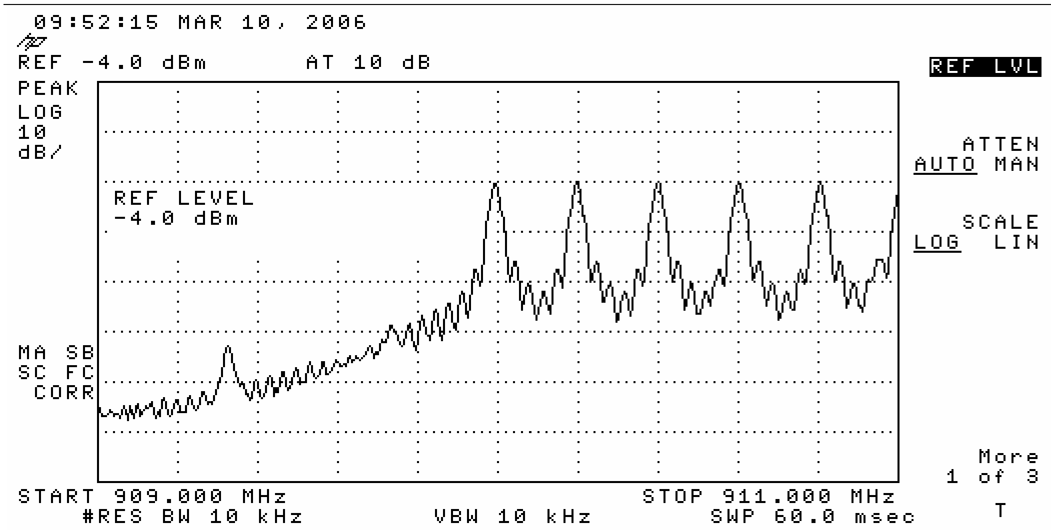
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

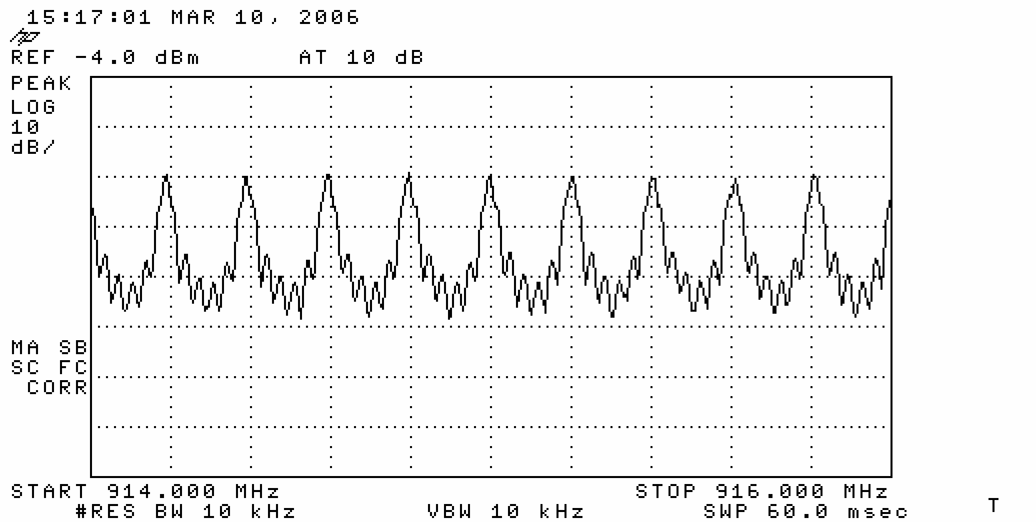
Equipment Used	Serial Number	Cal Date	Due
HP8594	3710A04999	24-FEB-05	24-FEB-07

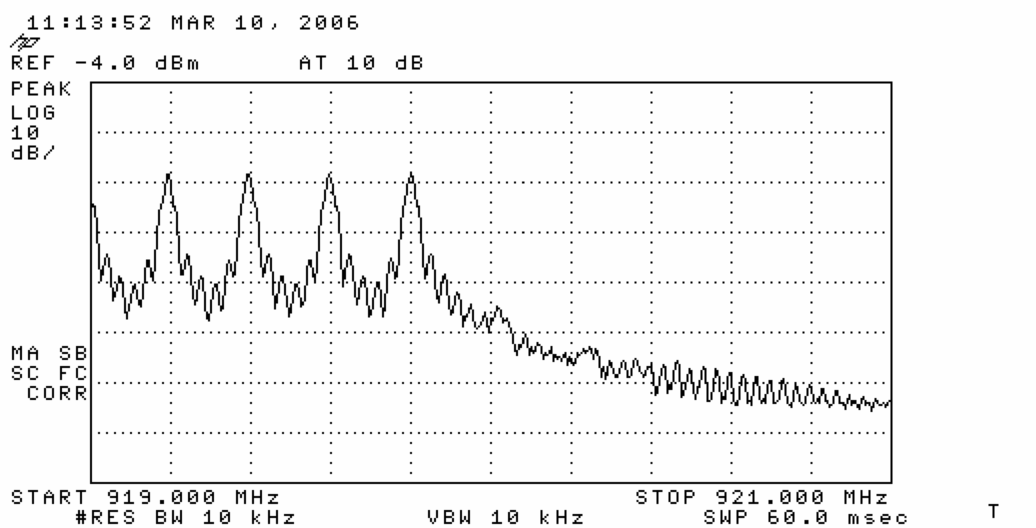
Date	Tested by
3/9/2006	Mark Kvamme

Unit tested: 24033

Carrier separation is 200 kHz.




15:17:01 MAR 10, 2006
REF -4.0 dBm
AT 10 dB
PEAK
LOG
10
dB/
MA SB
SC FC
CORR
START 914.000 MHz
STOP 916.000 MHz
#RES BW 10 kHz
VBW 10 kHz
SWP 60.0 msec
T


11:13:52 MAR 10, 2006
REF -4.0 dBm
AT 10 dB
PEAK
LOG
10
dB/
MA SB
SC FC
CORR
START 919.000 MHz
STOP 921.000 MHz
#RES BW 10 kHz
VBW 10 kHz
SWP 60.0 msec
T

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

Number of Hopping Channels

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:

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

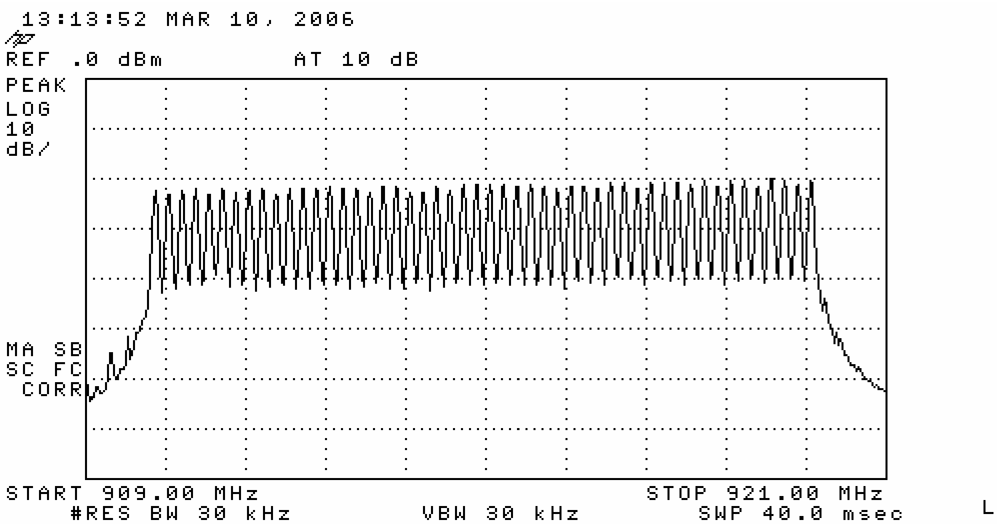
Allow the trace to stabilize. It may prove necessary to break the span up into sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

Equipment Used	Serial Number	Cal Date	Due
HP8594	3710A04999	24-FEB-05	24-FEB-07

Date	Tested by
3/10/2006	Mark Kvamme

Unit tested: 24033

There are 50 channels.



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

20 dB Bandwidth

Verify that the 20 dB bandwidth of the hopping channel is less than 250 kHz.

Use the following spectrum analyzer settings:

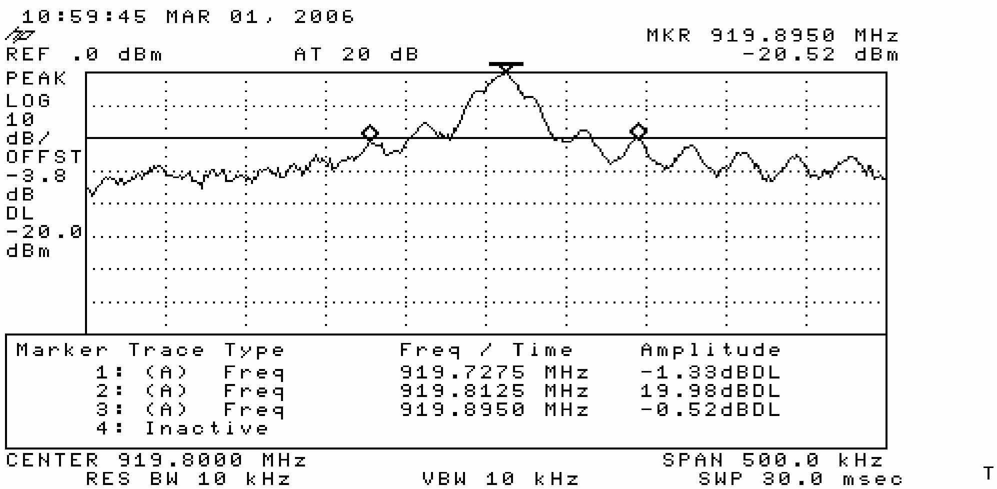
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

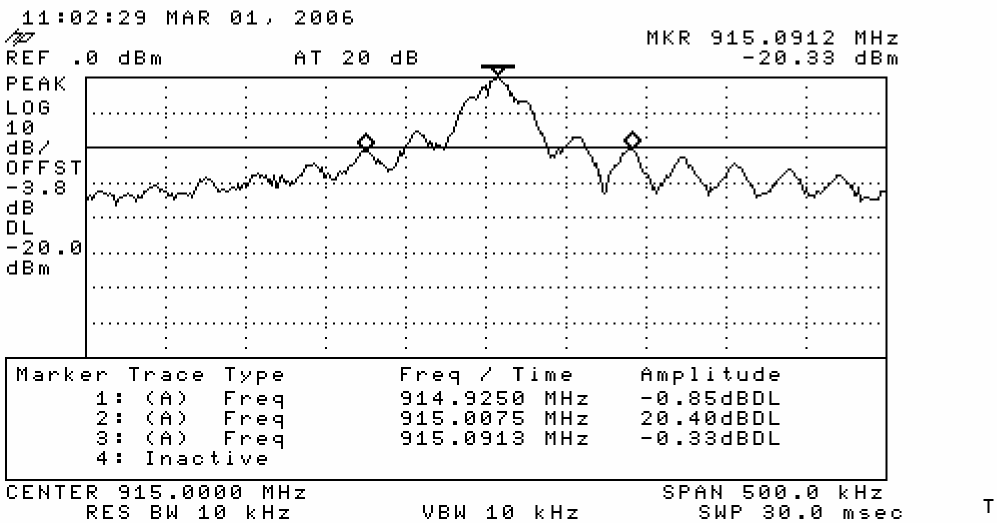
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the mission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

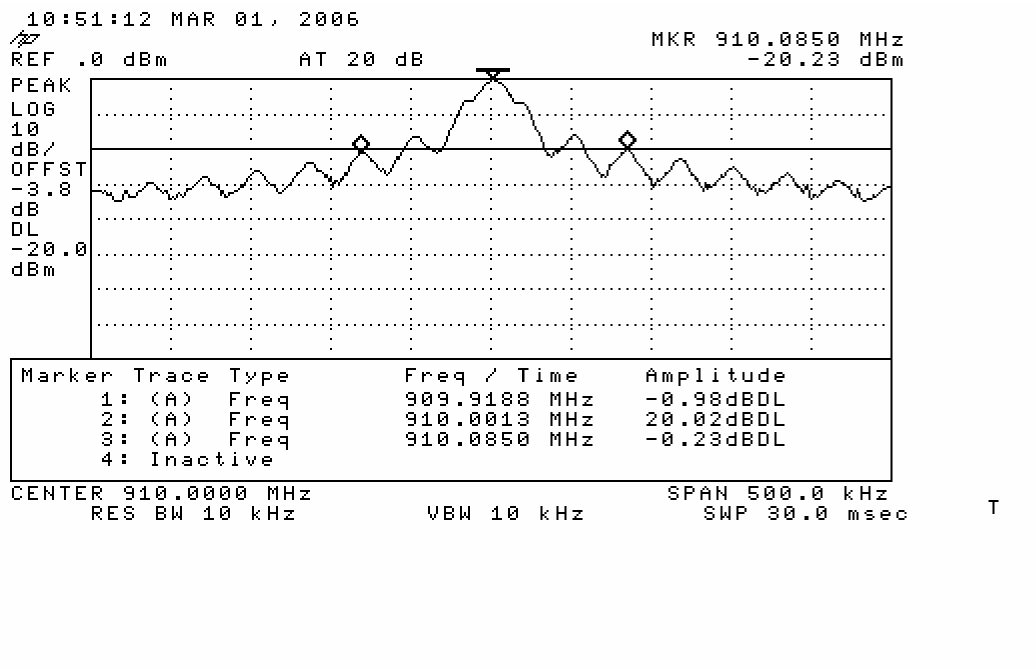
Equipment Used	Serial Number	Cal Date	Due
EMCO 3115	9205-3878	13-APR-04	13-APR-06
HP8593E	3543A02032	9-SEP-04	9-SEP-06

Date	Tested by
3/1/2006	Mark Kvamme

Unit tested: 20446
910 MHz = (82.5 kHz + 83.7 kHz) = 166.2 kHz
915 MHz = (82.5 kHz + 83.8 kHz) = 166.3 kHz
919.8 MHz = (85kHz + 82.5 kHz) = 167.5 kHz


10:59:45 MAR 01, 2006
MKR 919.8950 MHz
REF .0 dBm AT 20 dB -20.52 dBm
PEAK
LOG
10
dB/
OFFST
-3.8
dB
DL
-20.0
dBm
Marker Trace Type Freq / Time Amplitude
1: (A) Freq 919.7275 MHz -1.33dBDL
2: (A) Freq 919.8125 MHz 19.98dBDL
3: (A) Freq 919.8950 MHz -0.52dBDL
4: Inactive
CENTER 919.8000 MHz SPAN 500.0 kHz
RES BW 10 kHz VBW 10 kHz SWP 30.0 msec
T


11:02:29 MAR 01, 2006
MKR 915.0912 MHz
REF .0 dBm AT 20 dB -20.33 dBm
PEAK
LOG
10
dB/
OFFST
-3.8
dB
DL
-20.0
dBm
Marker Trace Type Freq / Time Amplitude
1: (A) Freq 914.9250 MHz -0.85dBDL
2: (A) Freq 915.0075 MHz 20.40dBDL
3: (A) Freq 915.0913 MHz -0.33dBDL
4: Inactive
CENTER 915.0000 MHz SPAN 500.0 kHz
RES BW 10 kHz VBW 10 kHz SWP 30.0 msec
T



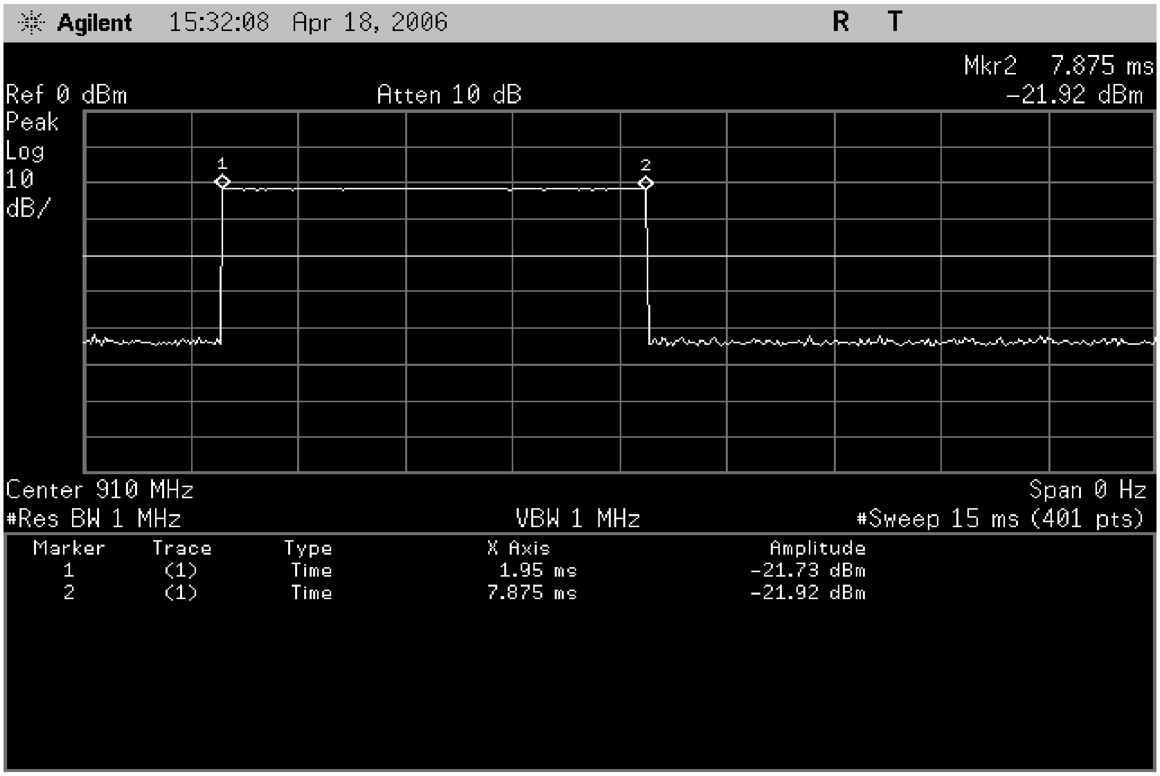
15.247(a) (1) (i) / RSS-210 A8.1 (3)

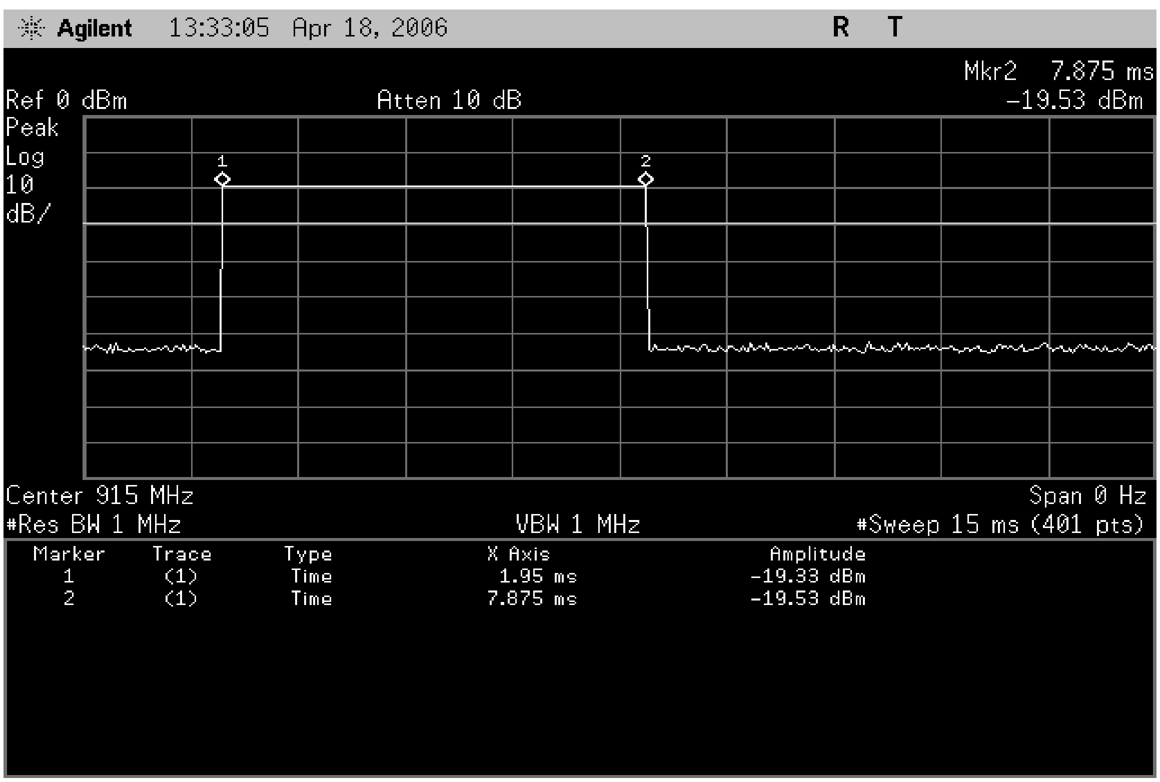
Time of Occupancy

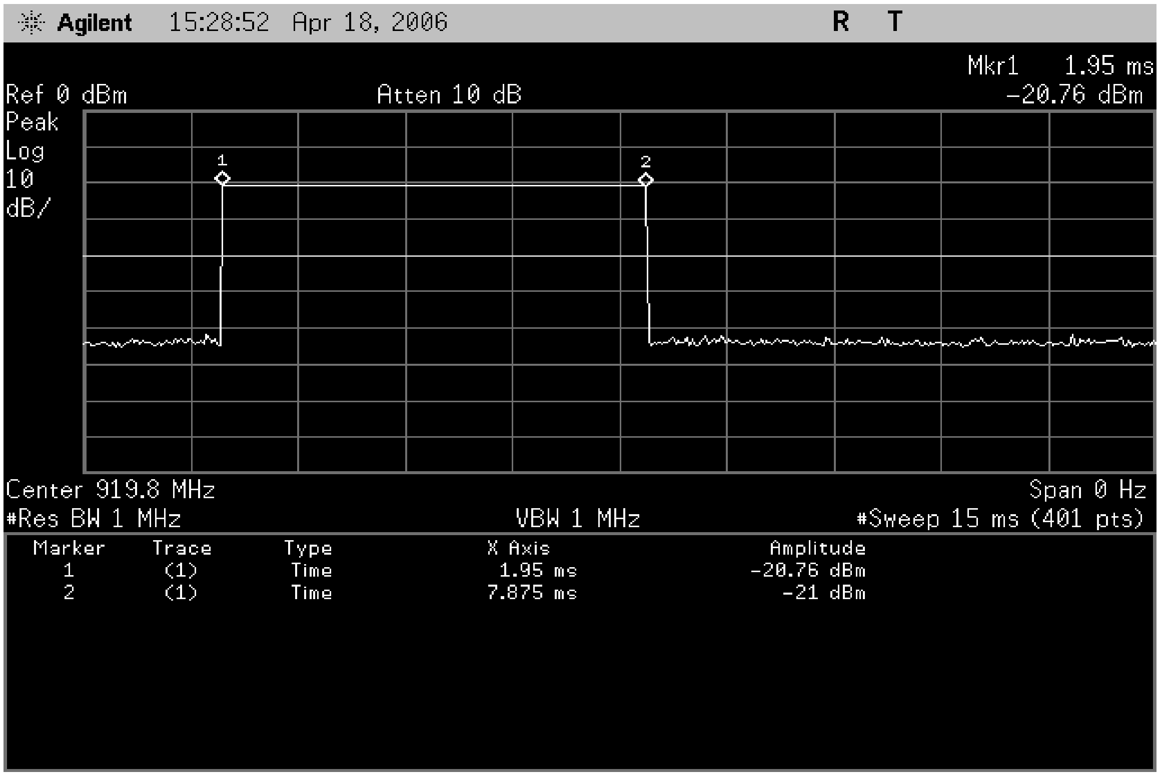
Verify that the transmitted signal does not occupy a single frequency for more than 400 mS in a 20 second period.

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).

Each transmission is 5.925 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. The maximum possible occupancy time on any one frequency is 5.925 mS within a 20 second period.


Agilent 15:32:08 Apr 18, 2006
R T
Mkr2 7.875 ms
Ref 0 dBm
Atten 10 dB
-21.92 dBm
Peak
Log
10
dB/
1
2
Center 910 MHz
Span 0 Hz
#Res BW 1 MHz
VBW 1 MHz
#Sweep 15 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Time 1.95 ms -21.73 dBm
2 (1) Time 7.875 ms -21.92 dBm


Agilent 13:33:05 Apr 18, 2006
R T
Mkr2 7.875 ms
Ref 0 dBm
Atten 10 dB
-19.53 dBm
Peak
Log
10
dB/
1
2
Center 915 MHz
Span 0 Hz
#Res BW 1 MHz
VBW 1 MHz
#Sweep 15 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Time 1.95 ms -19.33 dBm
2 (1) Time 7.875 ms -19.53 dBm


Agilent 15:28:52 Apr 18, 2006
R T
Mkr1 1.95 ms
Ref 0 dBm
Atten 10 dB
-20.76 dBm
Peak
Log
10
dB/
1
2
Center 919.8 MHz
Span 0 Hz
#Res BW 1 MHz
VBW 1 MHz
#Sweep 15 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Time 1.95 ms -20.76 dBm
2 (1) Time 7.875 ms -21 dBm

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

Power Output (EIRP)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels.

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
HP437B	3125U11553	11/10/04	11/10/06
HP8481D	3318A08626	12/1/04	12/1/06
HP E4408B	US40240538	4/3/05	4/3/06
EMCO 3115	9205-3878	4/13/04	4/13/06

Date	Tested by	Temperature/humidity
3/6/2006	Mark Kvamme	57F / 34%

Unit tested: 20446

Radiated measurement per the alternative method in Annex A (Field Strength Measurement Procedure).

Freq. MHz	Ant. Pos.	Antenna Height / Table Azimuth	spectrum analyzer reading EUT (dBm)	spectrum analyzer reading substitution antenna (dBm)	power into substitution antenna power (dBm)	substitution antenna gain (12261)	EIRP (dBm)
910.00	V	130/180	-7.63	-20.5	-1.2	0.3	11.37

15.247(d) / RSS-210 A8.5

Spurious Emissions

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.

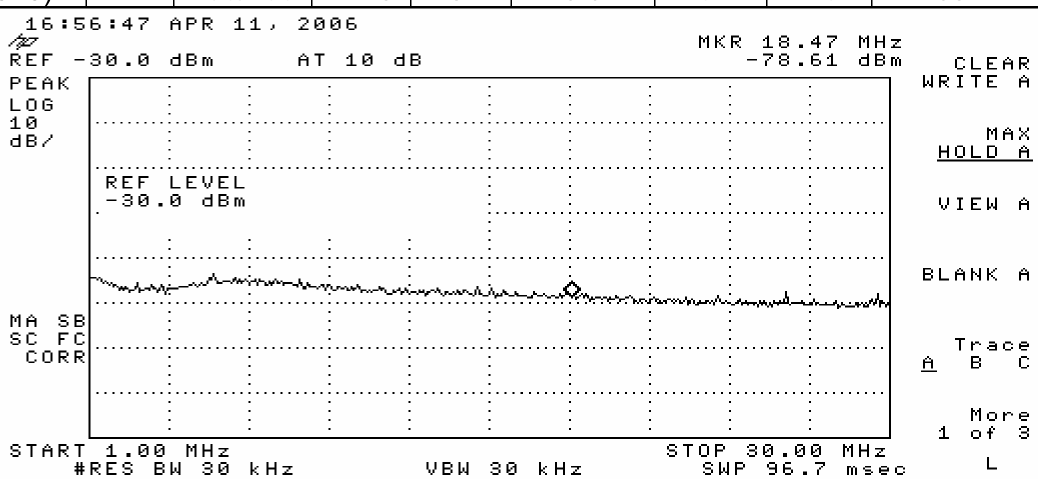
Follow the procedure outlined in Annex A of this document.

Equipment Used	Serial Number	Cal Date	Due
HP437B	3125U11553	11/10/04	11/10/06
HP8481D	3318A08626	12/1/04	12/1/06
HP E4408B	US40240538	4/3/05	4/3/06
EMCO 3115	9205-3878	4/13/04	4/13/06
Dipole	4106	9/13/04	9/13/06
EMCO 6502	2129	10/22/04	10/22/06

Date	Tested by
3/6/2006	Mark Kvamme

Unit tested: 20446; Frequency range investigated was 1 MHz to 9.2 GHz. Radiated measurement from 1 to 30 MHz was performed in a GTEM.

Freq. MHz	Ant. Pos.	Antenna Height / Table Azimuth	Level dBm	Level dBuV	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	**Corrected Level dBuV/m**	emissions dBc
1840.00	V	130/125	**-36.6**	**70.4**	**30.7**	26.8	2.2	**68.8**	41.0
6440.00	V	102/355	**-33.1**	**73.9**	**42.7**	34.6	5.6	**71.4**	38.3
Carrier (915)	V	130/180	**-27.9**	**79.1**	**0.0**	29.1	1.5	**109.7**	



15.205, 15.209 / RSS-210 2.2, 2.6

Restricted Bands & Spurious Emissions

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.

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			

Equipment Used	Serial Number	Cal Date	Due
HP437B	3125U11553	11/10/04	11/10/06
HP8481D	3318A08626	12/1/04	12/1/06
HP E4408B	US40240538	4/3/05	4/3/06
EMCO 3115	9205-3878	4/13/04	4/13/06
EMCO 6502	2129	10/22/04	10/22/06

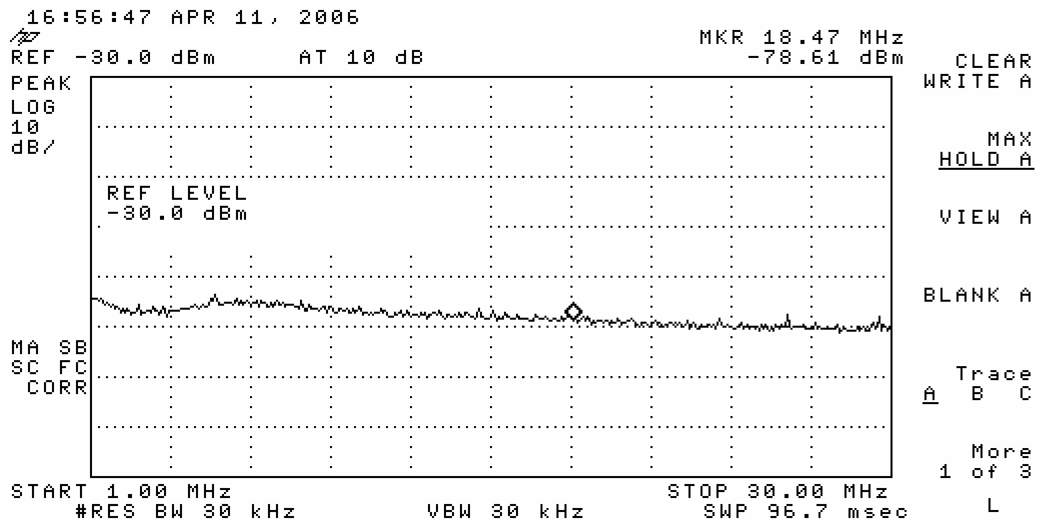
Date	Tested by	Temperature/humidity
3/6/2006	Mark Kvamme	57F / 34%

Unit tested: 20446; Frequency range investigated was 1 MHz to 9.2 GHz. Radiated measurement from 1 to 30 MHz was performed in a GTEM. A Duty Cycle Correction Factor (20log(dwell time/100mS)) was applied to show compliance to the 15.209 limit.

$$20\log\left(\frac{5.925mS}{100mS}\right) = -24.55dB$$

The maximum allowed correction factor is 20 dB.

Freq. MHz	Ant. Pos.	Antenna Height / Table Azimuth	Level dBm	Level dBuV	Amplifier Gain dB	Ant. Factor dB	Cable Loss dB	Duty Cycle Correction dB	**Corrected Level dBuV/m**	Limit dBuV/m	Margin dB
2730	H	101/5	-37.63	69.37	42.31	29.4	3.2	20	39.66	54	14.34
3640	V	101/140	-46	61	47.3	31.7	3.8	20	29.2	54	24.8
4600	V	102/100	-34.18	72.82	44.61	32.4	4.2	20	44.81	54	9.19
5460	V	107/345	-29.5	77.5	43.45	34.1	4.6	20	52.75	54	1.25
7280	V	115/340	-40.7	66.3	43.3	36.1	6.4	20	45.5	54	8.5
8190	V	141/10	-42.1	64.9	44.4	37	6.8	20	44.3	54	9.7
9100	H	100/30	-46.8	60.2	46.1	37.8	7.3	20	39.2	54	14.8



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:

$$910 \ / 1500 = 0.61 \ mW \ / cm^2 \ @ \ 20 \ cm$$

Max antenna gain = 2.0 dBi = 1.59 numeric

Max TX power = 10 dBm = 10 mW

$$P_D = \frac{10 \times 1.59}{4 \times \pi \times 20^2} = 0.00316 \ mW \ / cm^2 \ @ \ 20 \, cm$$

ANNEX A

15.247 (d)

Band-edge compliance of RF Conducted Emissions

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, 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 bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. 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.

Spurious RF Conducted Emissions

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10^{th} harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section. Submit these plots.

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.

ALTERNATIVE TEST PROCEDURES

If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the peak output power limit specified in Section 15.247(b) (2) and the spurious RF conducted emission limit specified in Section 15.247(d) are acceptable. A pre-amp, and, in the latter case, a high pass filter, are required for the following measurements.

1) Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where: E is the measured maximum fundamental field strength in V/m, utilizing a RBW ≥ the 20 dB bandwidth of the emission, VBW > RBW, peak detector function. Follow the procedures in C63.4-2003 with respect to maximizing the emission.

G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.

d is the distance in meters from which the field strength was measured.

P is the power in watts for which you are solving:

$$P = \frac{(E \times d)^2}{30G}$$

2) To demonstrate compliance with the spurious RF conducted emission requirement of Section 15.247(d), use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

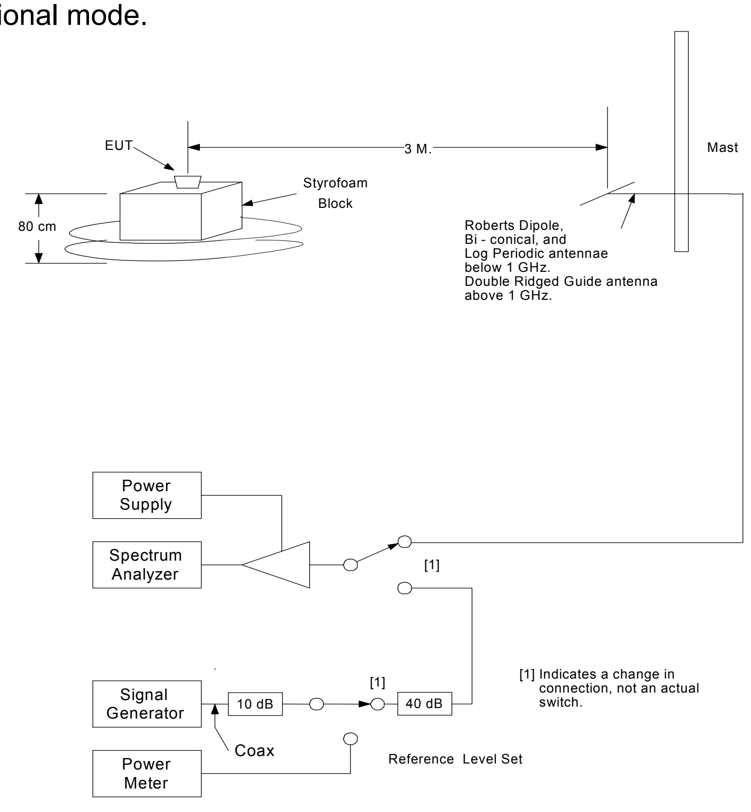
Measure the field strength of both the fundamental emission and all spurious emissions with these settings. Follow the procedures in C63.4-2003 with respect to maximizing the emissions. The measured field strength of all spurious emissions must be below the measured field strength of the fundamental 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) Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
2) 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.
3) 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 2). Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

4) 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 2) with the antenna fixed at this height. Otherwise, move the antenna to the height that repeats the highest amplitude observation and proceed.
5) Change the polarity of the antenna and repeat step 2), step 3), and step 4). Compare the resulting suspected highest amplitude signal with that found for the other polarity. Select and note the higher of the two signals.
6) The transmitter shall be replaced by a substitution antenna.
The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
The substitution antenna shall be connected to a calibrated signal generator.
If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
7) The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
8) The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
9) The input level to the substitution antenna shall be recorded as power level, corrected for any change of input attenuator setting of the measuring receiver.
10) The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
11) The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.



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.