2.11 Minimum 6 dB Bandwidth per FCC Section 15.247(a)(2)

The minimum requirement is given in Figure 7a through 7c. If the EUT incorporates different spreading codes or data rates these were each investigated and the one which produced the smallest 6 dB bandwidth was selected for test.

Figure 7a.
6 dB Bandwidth per FCC Section 15.247(a)(2) (Low)

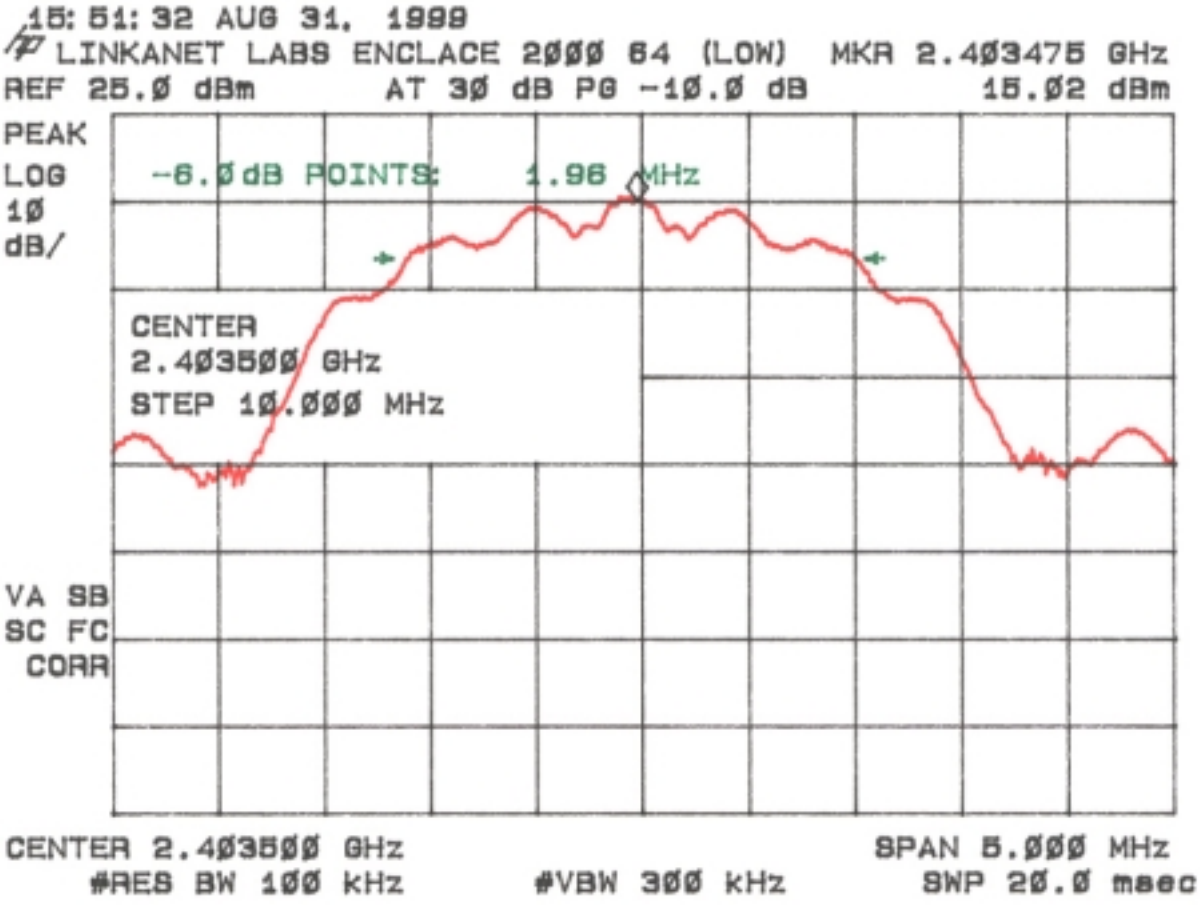


Figure 7b.
6 dB Bandwidth per FCC Section 15.247(a)(2) (Mid)

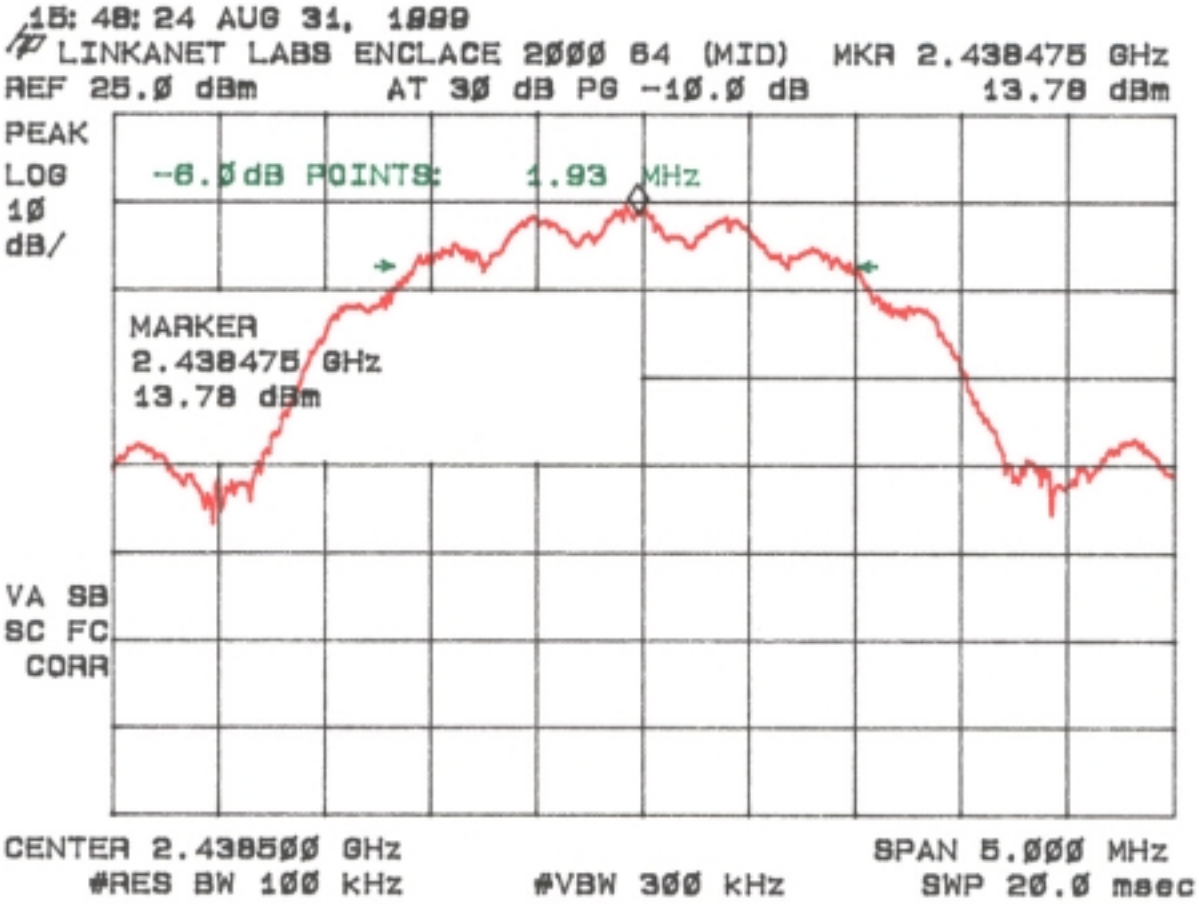
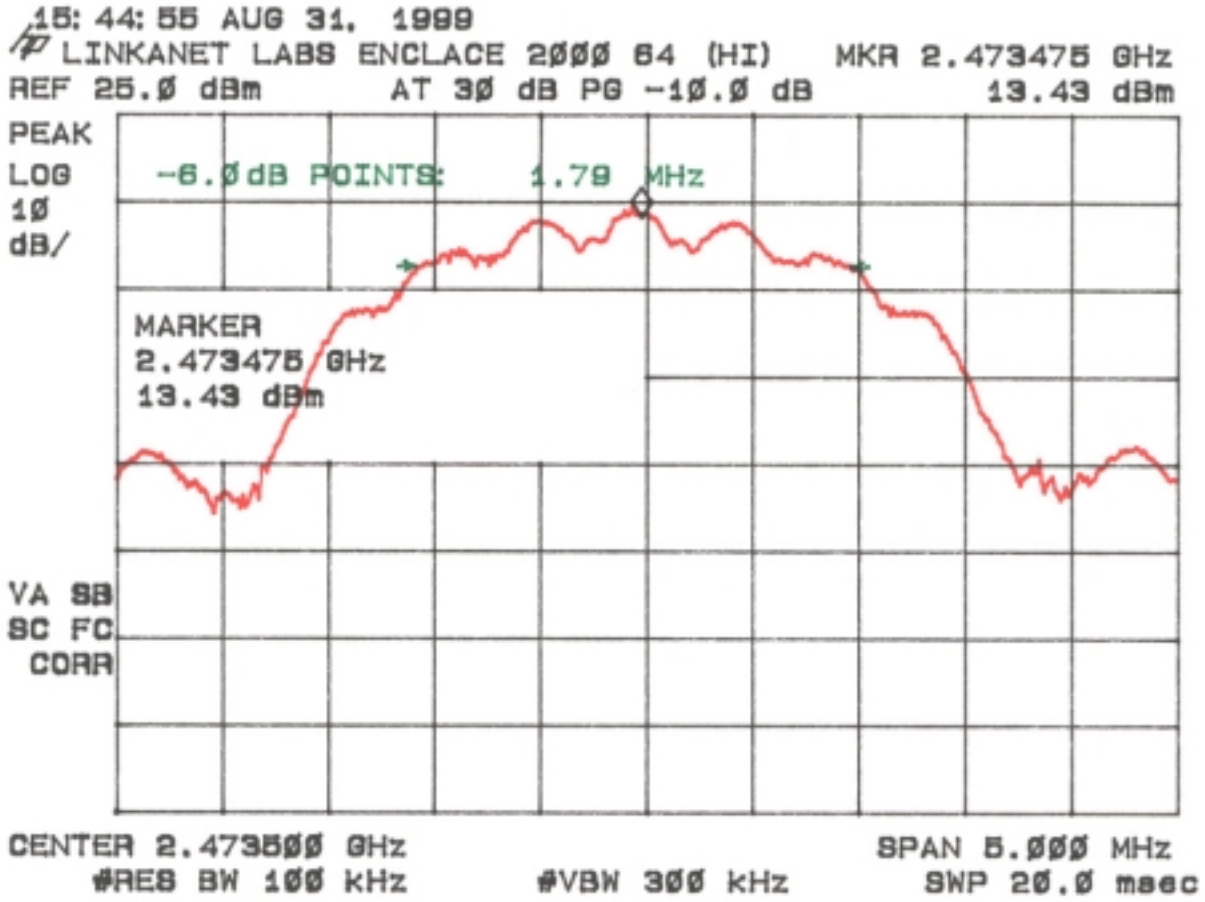


Figure 7c.
6 dB Bandwidth per FCC Section 15.247(a)(2) (High)



2.12 Power Spectral Density FCC Section 15.247(b) and 15.247(d)

The transmitter power spectral density averaged over any 1 second interval is given in Table 7 and Figure 8a through Figure 8c. If the EUT incorporates different spreading codes or data rates these were each investigated and the one which produced the smallest 6 dB bandwidth was selected for test. The measurement was made using a spectrum analyzer utilizing noise marker mode. A 34.8 dBm adjustment has been added to the measurement to correct from 1 Hz to 3 kHz measurement.

TABLE 6
POWER SPECTRAL DENSITY

Test Date: **August 31, 1999**
UST Project: **99-723**
Customer: **LinkaNet Labs**
Model: **FIRELINK 2000**

Frequency (GHz)	Test Data (dBm) Normalized to 1 Hz	Results (dBm)	FCC Limit (dBm)
2.40345	-40.8	-6.0	8.0
2.43848	-40.9	-6.1	8.0
2.47450	-42.4	-7.6	8.0

Note: 34.8 dBm has been added to correct from 1 Hz to 3 kHz

Tester
Signature: _____ Name: Tim R. Johnson

Figure 8a
Power Spectral Density 15.247(b) and 15.247(d) Low

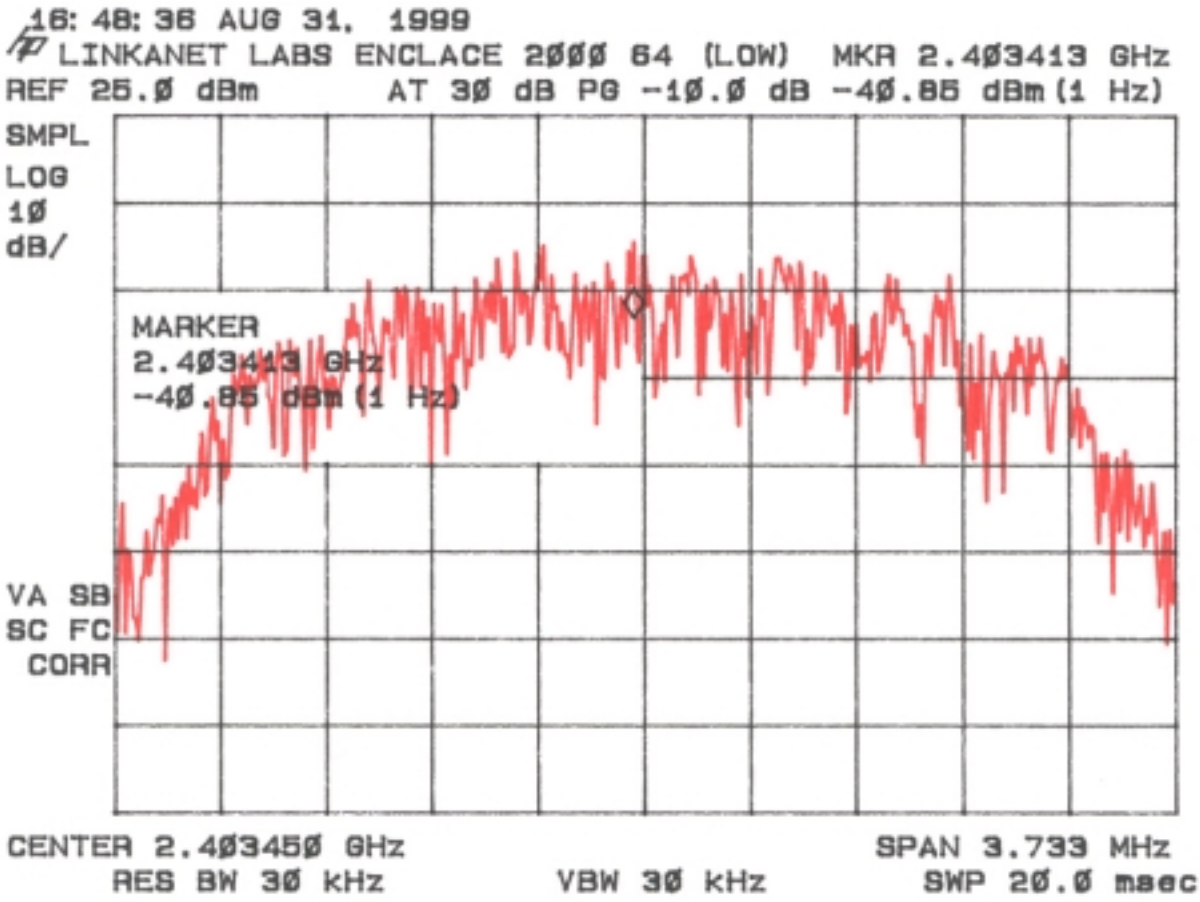


Figure 8b
Power Spectral Density 15.247(b) and 15.247(d) Mid

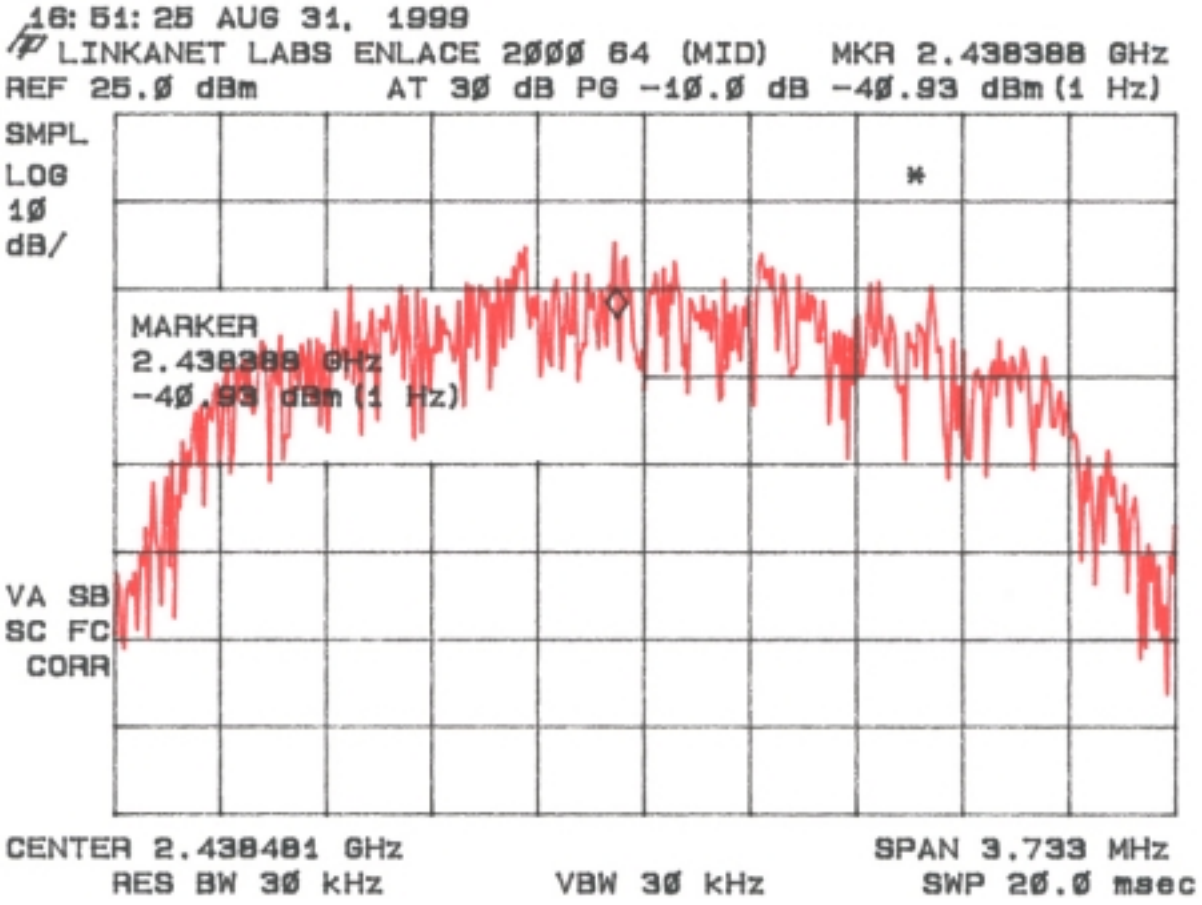
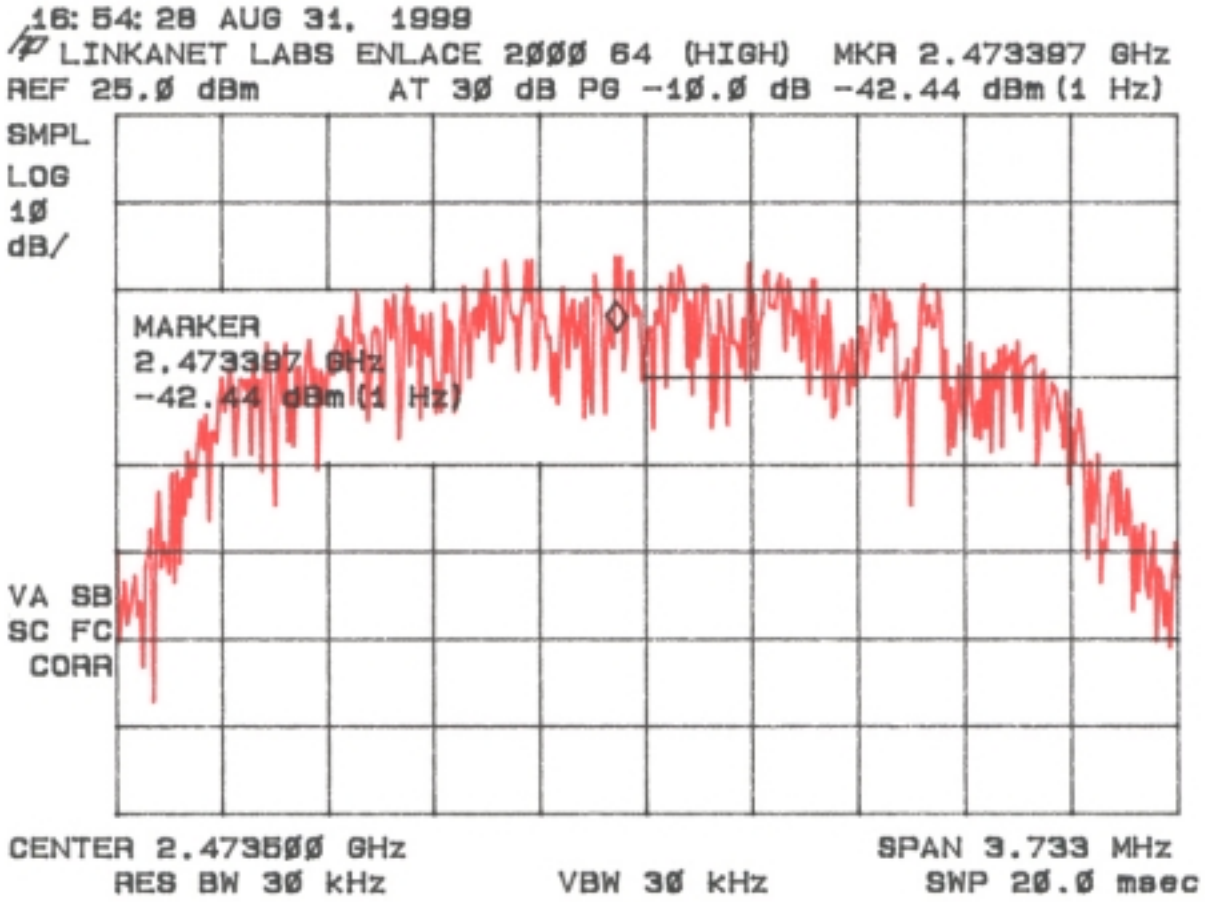


Figure 8c
Power Spectral Density 15.247(b) and 15.247(d) High



2.13 Processing Gain

Data regarding processing gain has been provided on the following page from LinkaNet Labs.

9/15/99

Processing Gain Calculation

The spread engine uses 15 chips per symbol. The processing gain calculation was made using the CW jamming margin method.

$Gp = (S/N)_0 + Mj + Lsys$

For DQPSK - $(S/N)_0 = 12dB$ at BER = $1x10^{-5}$

Lsys = 2 dB

After measuring the J/S ratio required to achieve a BER of $1x10^{-5}$ at 50 kHz increments across the passband (main lobe null to null bandwidth), the worst 20% were discarded. This left the following worst case jamming margin:

Mj = -1.6 dB

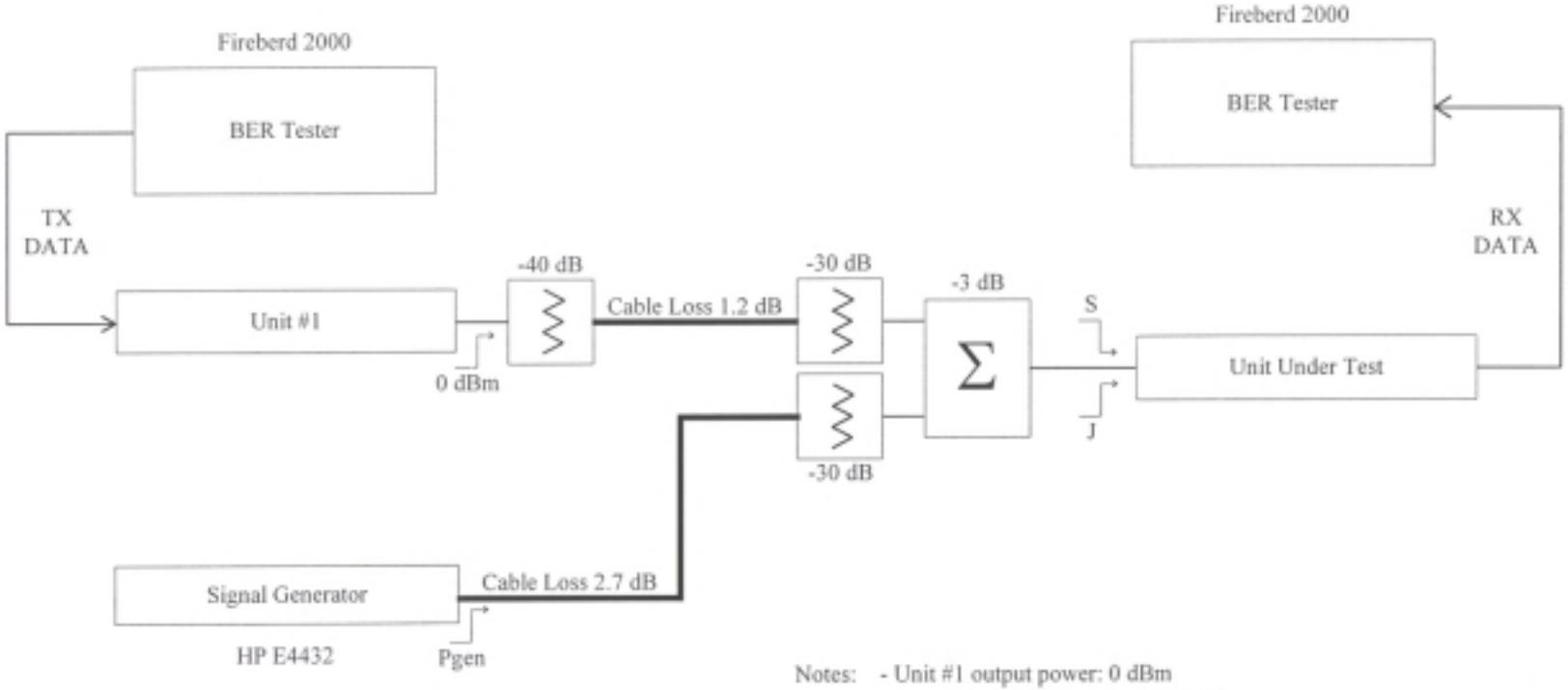
So,

Gp = 12 -1.6 + 2

Gp = 12.4 dB

LinkaNet Labs

CW Jamming
Margin Test Setup



Notes:
- Unit #1 output power: 0 dBm
- Total loss in the signal path: 74.2 dB
- Received signal level at UUT: S=-74.2 dBm
- Signal Generator output power: Pgen at 10E-5 BER
- Total loss in the jammer path: 35.7 dB
- Received jammer level at UUT: J=Pgen-35.7dBm

FCC ID: OO8LNL001

	Jammer loss (dB)		35.7		Lsys (dB)	2			
	Received Signal Level (dBm)		-74.2		Eb/No (dB)	12			
	Frequency (MHz)	Gen. (dBm)	Jammer (dBm)	J/S (dB)					
1	2436.55	-36.6	-72.3	1.9					
2	2436.6	-36.9	-72.6	1.6					
3	2436.65	-37.2	-72.9	1.3					
4	2436.7	-37.8	-73.5	0.7					
5	2436.75	-37.6	-73.3	0.9					
6	2436.8	-36.2	-71.9	2.3					
7	2436.85	-36.3	-72	2.2			Processing Gain (dB):	12.4	
8	2436.9	-36.6	-72.3	1.9					
9	2436.95	-38.2	-73.9	0.3					
10	2437	-39.4	-75.1	-0.9					
11	2437.05	-38.7	-74.4	-0.2					
12	2437.1	-39	-74.7	-0.5					
13	2437.15	-38.9	-74.6	-0.4					
14	2437.2	-38.8	-74.5	-0.3					
15	2437.25	-38.9	-74.6	-0.4					
16	2437.3	-37.5	-73.2	1					
17	2437.35	-37.9	-73.6	0.6					
18	2437.4	-38.6	-74.3	-0.1					
19	2437.45	-39.1	-74.8	-0.6					
20	2437.5	-40.5	-76.2	-2					
21	2437.55	-40.1	-75.8	-1.6					
22	2437.6	-41	-76.7	-2.5					
23	2437.65	-40.9	-76.6	-2.4					
24	2437.7	-39	-74.7	-0.5					
25	2437.75	-39	-74.7	-0.5					
26	2437.8	-38.6	-74.3	-0.1					
27	2437.85	-38.6	-74.3	-0.1					
28	2437.9	-39.7	-75.4	-1.2					
29	2437.95	-40.3	-76	-1.8					
30	2438	-42.8	-78.5	-4.3					
31	2438.05	-40.1	-75.8	-1.6					
32	2438.1	-40.2	-75.9	-1.7					
33	2438.15	-39.7	-75.4	-1.2					
34	2438.2	-39.1	-74.8	-0.6					
35	2438.25	-39.6	-75.3	-1.1					
36	2438.3	-39	-74.7	-0.5					
37	2438.35	-39.6	-75.3	-1.1					
38	2438.4	-40.5	-76.2	-2					
39	2438.45	-40.7	-76.4	-2.2					
40	2438.5	-43.3	-79	-4.8					
41	2438.55	-41	-76.7	-2.5					
42	2438.6	-41	-76.7	-2.5					
43	2438.65	-40.2	-75.9	-1.7					
44	2438.7	-39	-74.7	-0.5					
45	2438.75	-39.5	-75.2	-1					

46	2438.8	-38.9	-74.6	-0.4					
47	2438.85	-39.8	-75.5	-1.3					
48	2438.9	-40.7	-76.4	-2.2					
49	2438.95	-39.7	-75.4	-1.2					
50	2439	-41.6	-77.3	-3.1					
51	2439.05	-39.5	-75.2	-1					
52	2439.1	-39.3	-75	-0.8					
53	2439.15	-38.2	-73.9	0.3					
54	2439.2	-38.4	-74.1	0.1					
55	2439.25	-39	-74.7	-0.5					
56	2439.3	-39.2	-74.9	-0.7					
57	2439.35	-40.6	-76.3	-2.1					
58	2439.4	-39.9	-75.6	-1.4					
59	2439.45	-39.7	-75.4	-1.2					
60	2439.5	-40.4	-76.1	-1.9					
61	2439.55	-39.4	-75.1	-0.9					
62	2439.6	-38.8	-74.5	-0.3					
63	2439.65	-38.5	-74.2	0					
64	2439.7	-37.5	-73.2	1					
65	2439.75	-38.6	-74.3	-0.1					
66	2439.8	-38.6	-74.3	-0.1					
67	2439.85	-39.1	-74.8	-0.6					
68	2439.9	-39.3	-75	-0.8					
69	2439.95	-39.1	-74.8	-0.6					
70	2440	-39.3	-75	-0.8					
71	2440.05	-38.3	-74	0.2					
72	2440.1	-35.9	-71.6	2.6					
73	2440.15	-35.8	-71.5	2.7					
74	2440.2	-36.2	-71.9	2.3					
75	2440.25	-37.9	-73.6	0.6					
76	2440.3	-38	-73.7	0.5					
77	2440.35	-36.7	-72.4	1.8					
78	2440.4	-36.2	-71.9	2.3					
79	2440.45	-36.1	-71.8	2.4					
80	2440.5	-35.5	-71.2	3					

2.14 Power Line Conducted Emissions for Transmitter FCC Section 15.207

The conducted voltage measurements have been carried out in accordance with FCC Section 15.207, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Table 7.

TABLE 7. CONDUCTED EMISSIONS DATA
CLASS B

Test Date: August 31, 1999
UST Project: 99-723
Customer: LinkaNet Labs
Product: FIRELINK 2000

120 VAC

Frequency (MHz)	Test Data (dBm)		Results (uV)		FCC Limits (uV)
	Phase	Neutral	Phase	Neutral	
0.52	-72.0	-79.2	56.2	24.5	250
6.1	-67.4	-68.9	95.5	80.4	250
9.1	-69.9	-69.8	71.6	72.4	250
14.2	-70.7	-70.1	65.3	69.9	250
15.9	-66.8	-65.6	102.3	117.4	250
18.7	-65.7	-67.5	116.1	94.4	250

SAMPLE CALCULATIONS:

RESULTS uV = ANTILOG ((-72.0 + 107)/20) = 56.2
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: _____ **Name:** Tim R. Johnson

2.15 Radiated Emissions (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 1000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz for measurements made less than 1 GHz and 1 MHz for measurements over 1 GHz (if applicable). Results of these measurements are shown in Table 8.

The EUT was tested with both a 120 VAC input and –48VDC inputs. The –48 VDC supply yielded the worse case measurements.

TABLE 8. RADIATED EMISSIONS DATA

CLASS A

Test Date: **September 11, 1999**
UST Project: **99-723**
Customer: **LinkaNet Labs**
Product: **FIRELINK 2000**

Worse Case with –48VDC Power Source

Frequency (MHz)	Receiver Reading (dBm) @3m	Correction Factor (dB)	Corrected Reading (uV/m)	FCC Limit (uV/m) @3m
30.8	-85.0*	14.6	67.9	90.0
55.0	-83.0*	11.6	60.3	90.0
127.0	-83.0	14.2	80.9	150.0
131.8	-83.0	14.5	83.9	150.0
138.3	-83.0*	14.7	86.4	150.0
182.1	-85.0*	17.0	89.4	150.0
215.0	-82.0*	14.2	91.0	150.0
698.0	-93.0*	27.2	121.2	210.0

***= Quasi Peak**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-85.0 + 14.6 + 107)/20) = 67.9
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: _____ **Name: __Tim R. Johnson_____**

2.16 Power Line Conducted Emissions for Digital Device FCC Section 15.107

The conducted voltage measurements have been carried out in accordance with FCC Section 15.107, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Table 9.

TABLE 9. CONDUCTED EMISSIONS DATA – DIGITAL DEVICE CLASS A

Test Date: August 31, 1999
UST Project: 99-723
Customer: LinkaNet Labs
Product: FIRELINK 2000

120 VAC

Frequency (MHz)	Test Data (dBm)		Results (uV)		FCC Limits (uV)
	Phase	Neutral	Phase	Neutral	
0.52	-75.2	-80.5	38.9	21.1	1000
6.1	-69.4	-68.5	75.9	84.1	3000
9.1	-73.7	-73.5	46.2	47.3	3000
14.2	-70.6	-69.9	66.1	71.6	3000
15.9	-65.9	-65.4	113.5	120.2	3000
18.7	-68.6	-68.8	83.2	81.3	3000

Tester
Signature: _____ **Name:** Tim R. Johnson