

2.8 Antenna Conducted Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC Section 15.247(c))

Antenna Conducted spurious emissions in the frequency range 30 - 25000 MHz have been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a 50Ω impedance with the RBW = 100 kHz & VBW > RBW. All spurious emissions were measured to be greater than 20 dB down from the fundamental. The results of conducted spurious emissions are given in Figure 4a through Figure 4l.

Figure 4a
Antenna Conducted Spurious Emissions 15.247(c) Low

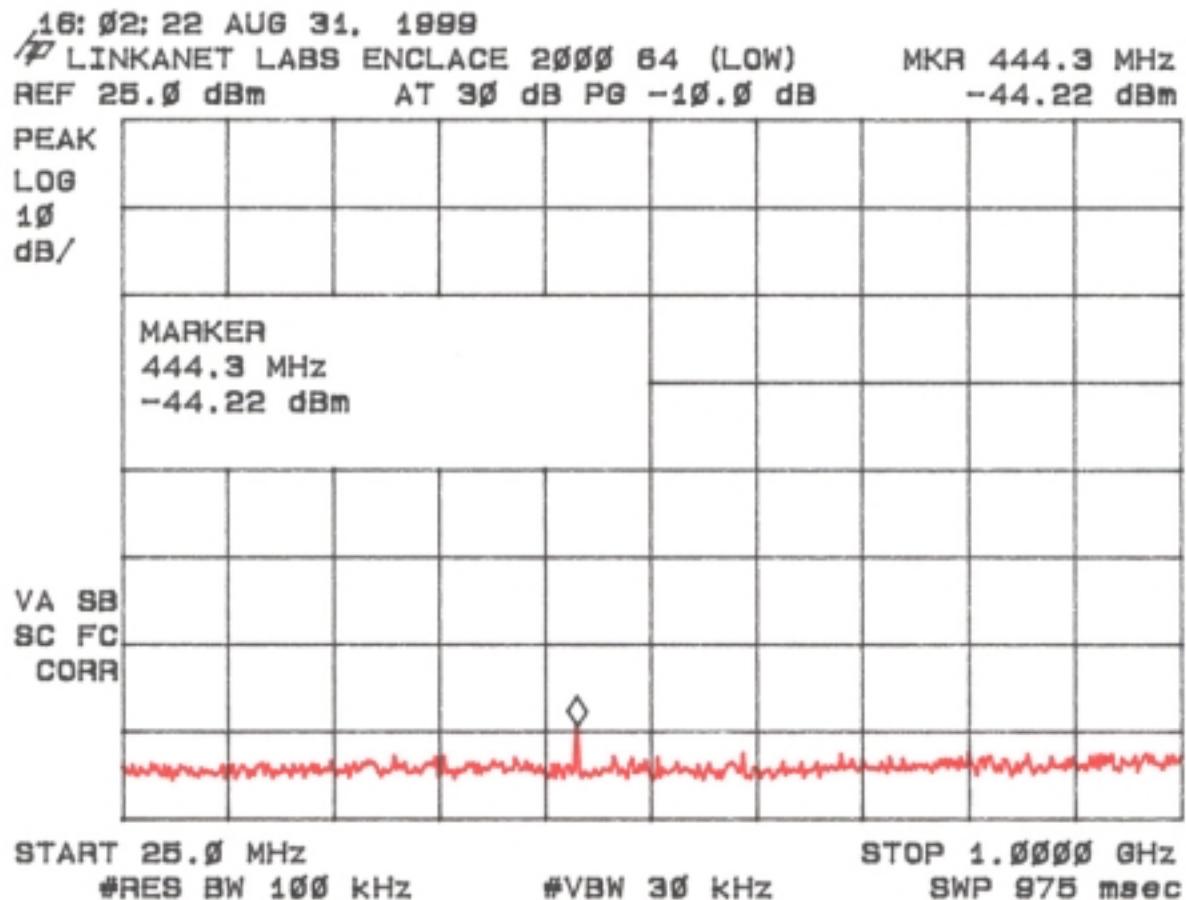


Figure 4b
Antenna Conducted Spurious Emissions 5.247(c) Low

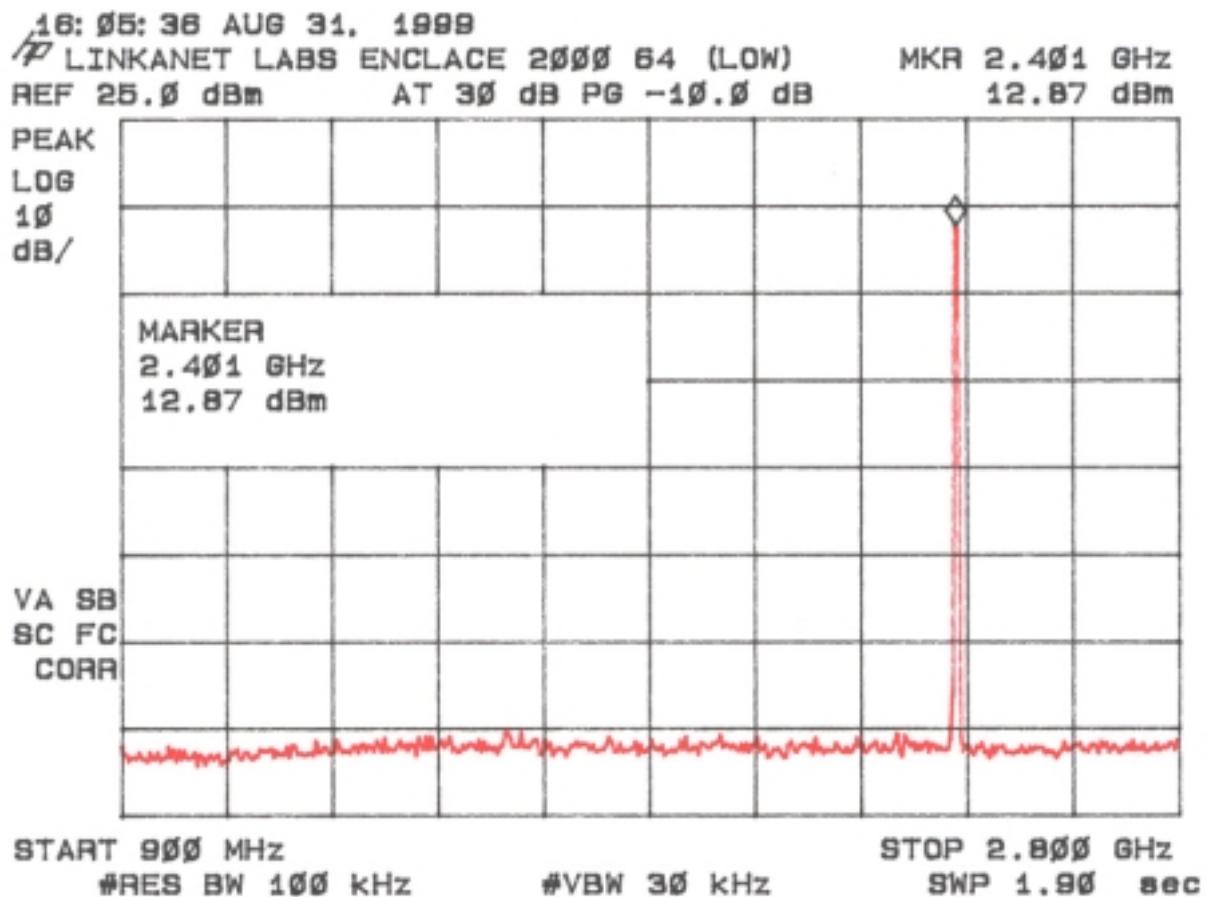


Figure 4c
Antenna Conducted Spurious Emissions 15.247(c) Low

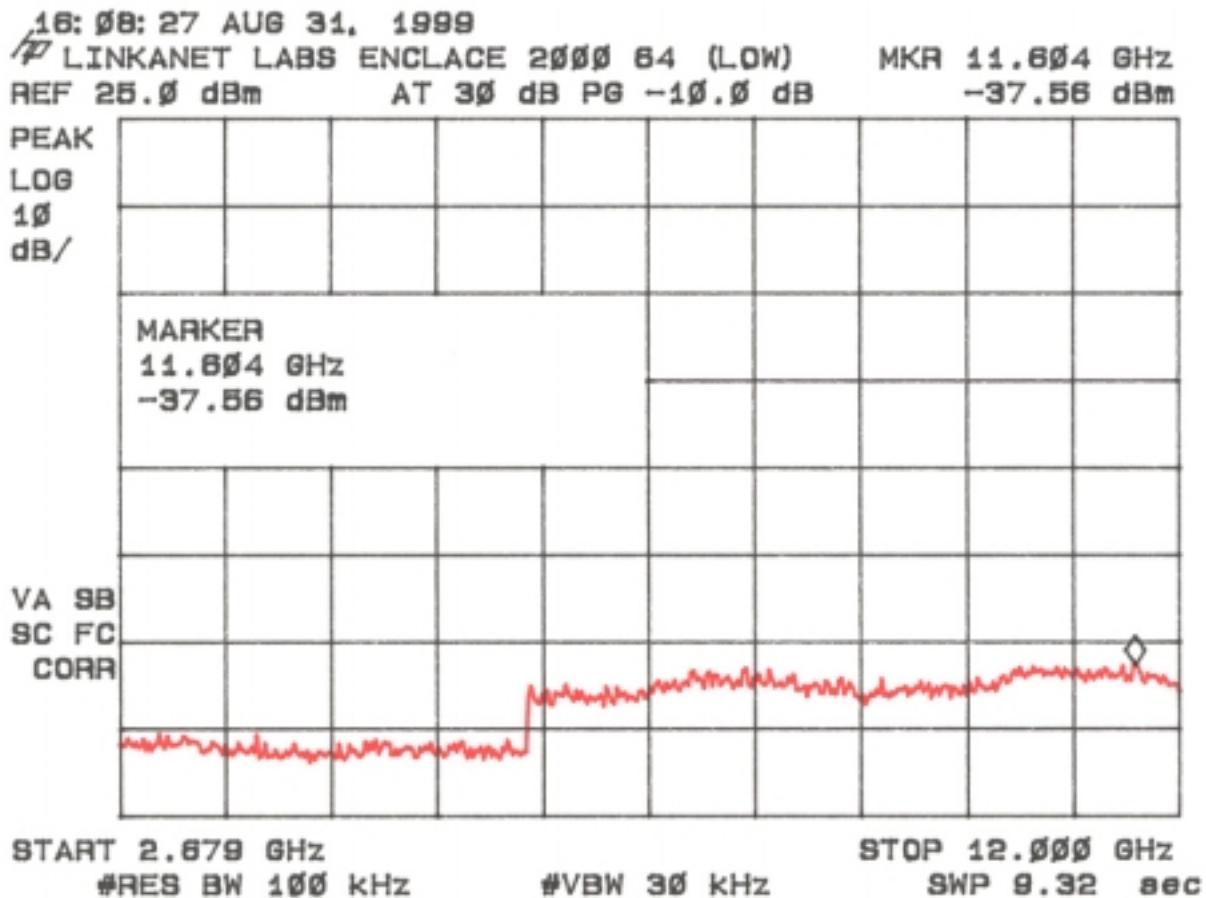


Figure 4d
Antenna Conducted Spurious Emissions 15.247(c) Low

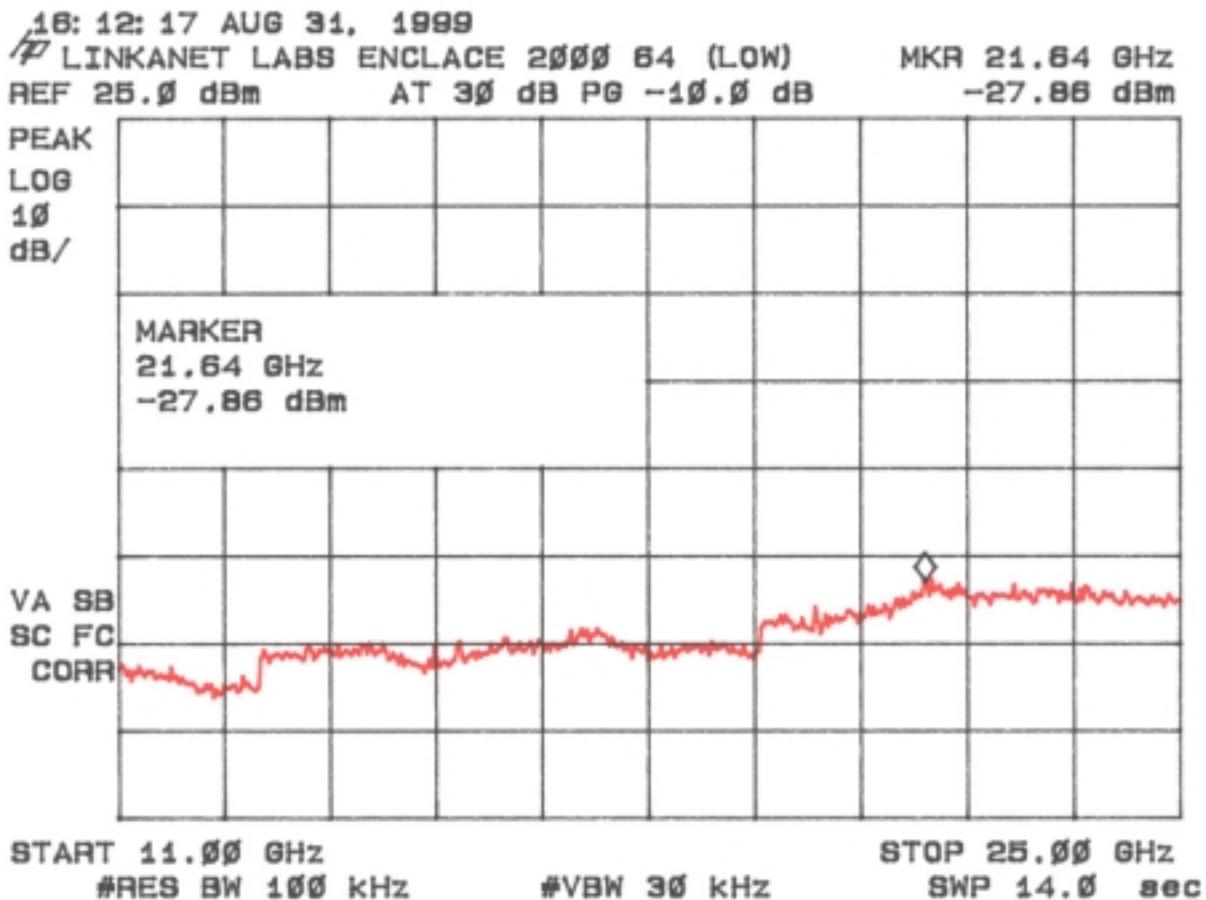


Figure 4e
Antenna Conducted Spurious Emissions 15.247(c) Mid

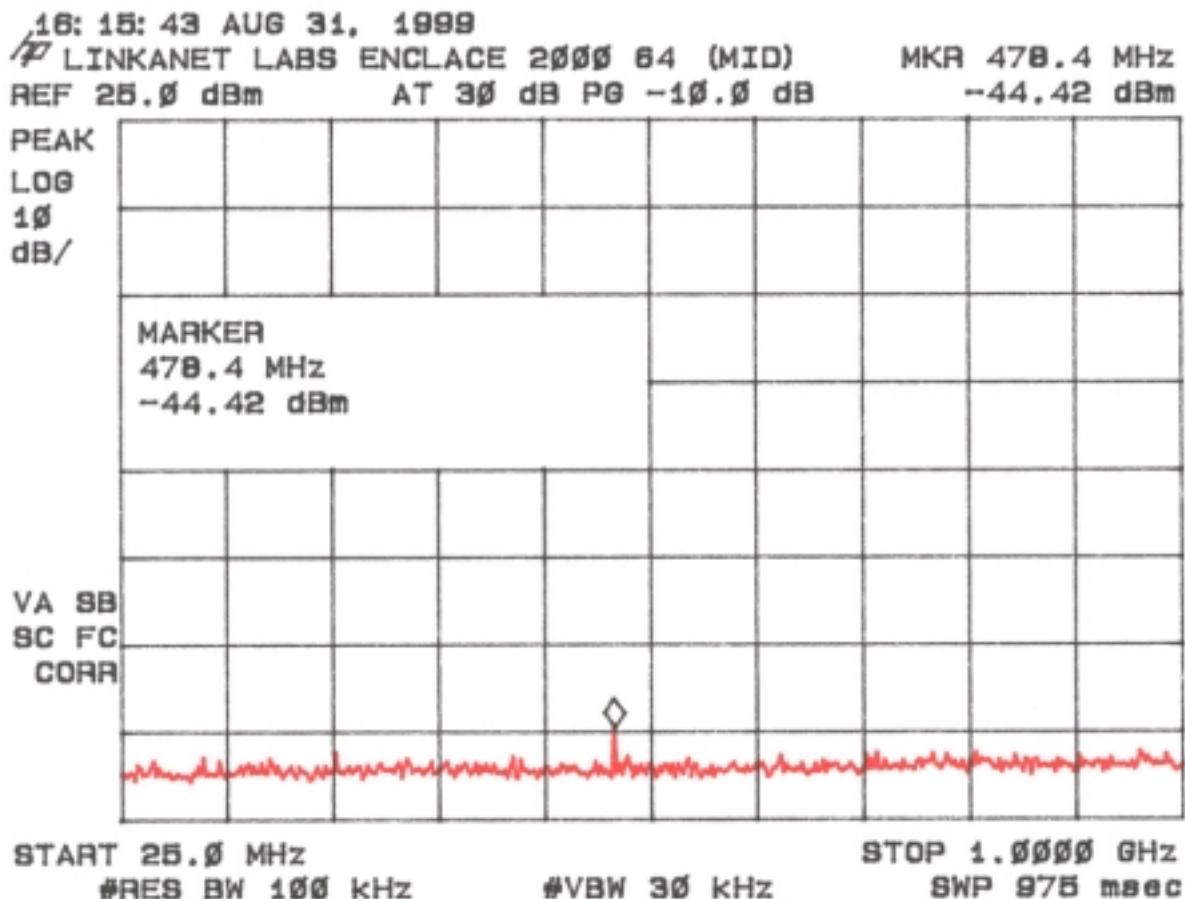


Figure 4f
Antenna Conducted Spurious Emissions 15.247(c) Mid

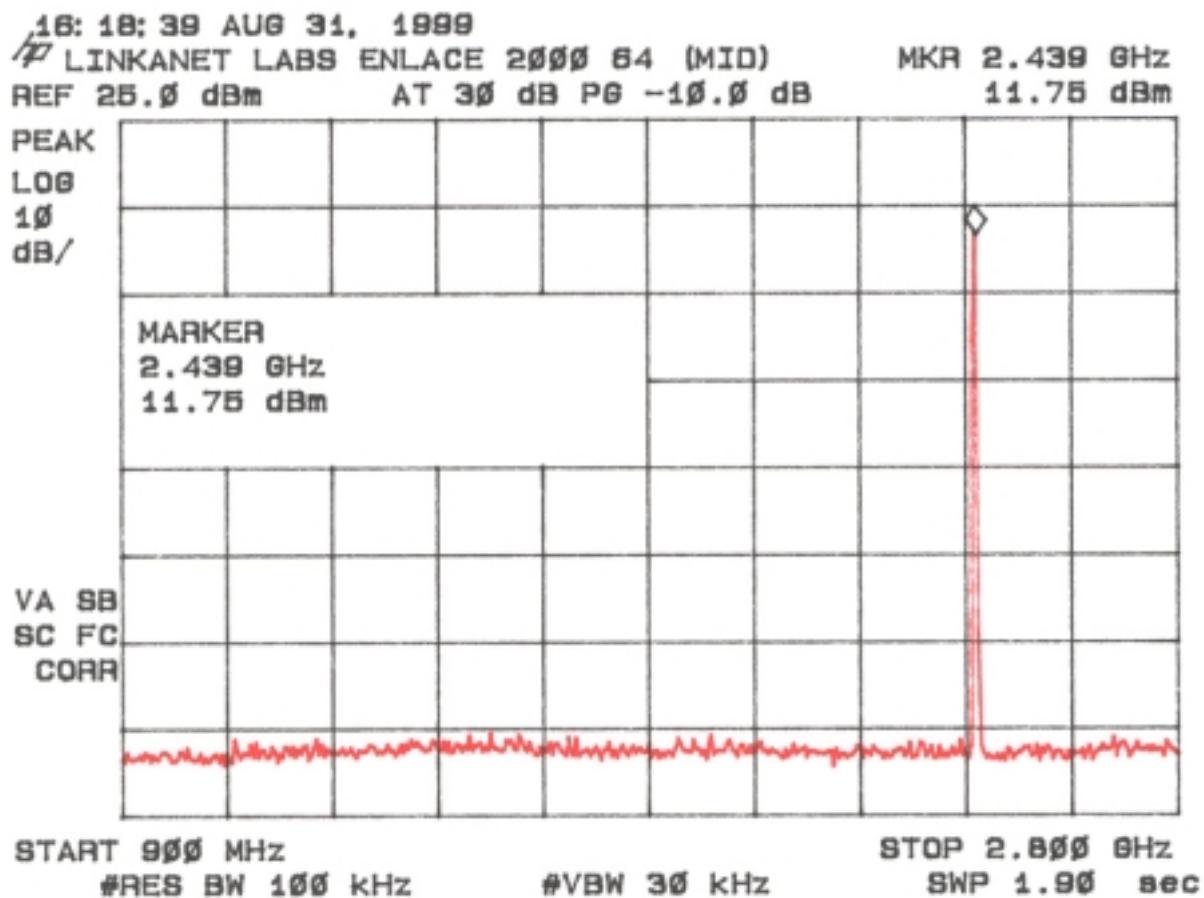


Figure 4g
Antenna Conducted Spurious Emissions 15.247(c) Mid

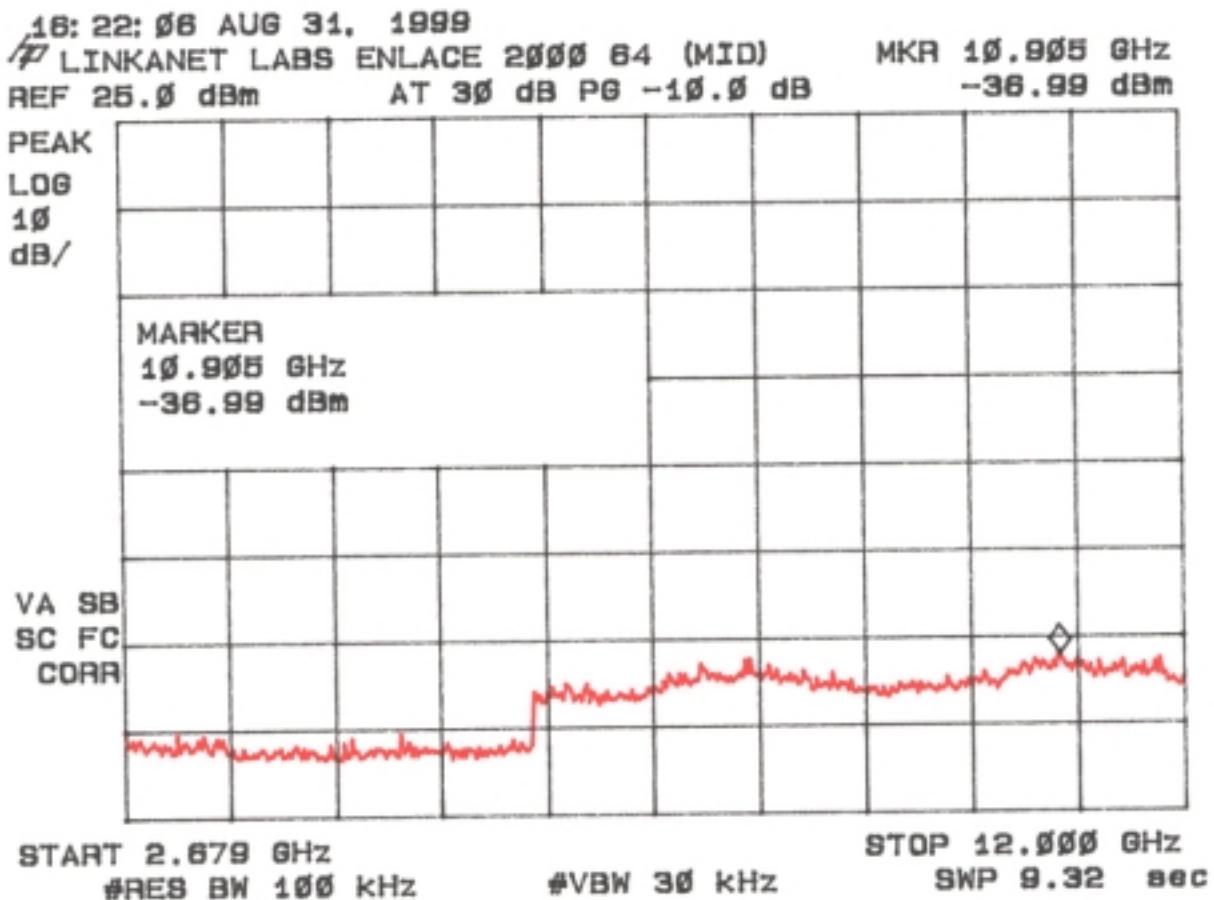


Figure 4h
Antenna Conducted Spurious Emissions 15.247(c) Mid

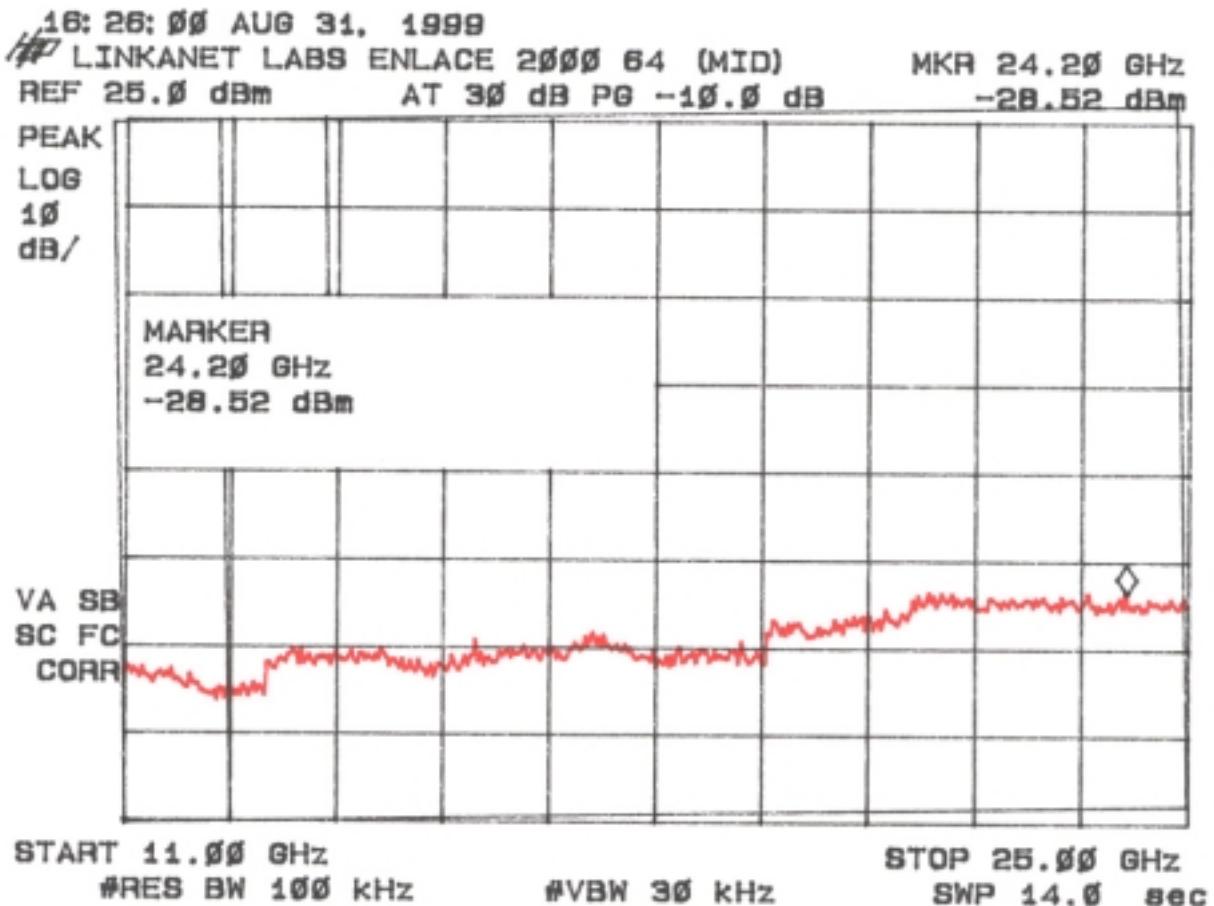


Figure 4i
Antenna Conducted Spurious Emissions 15.247(c) High

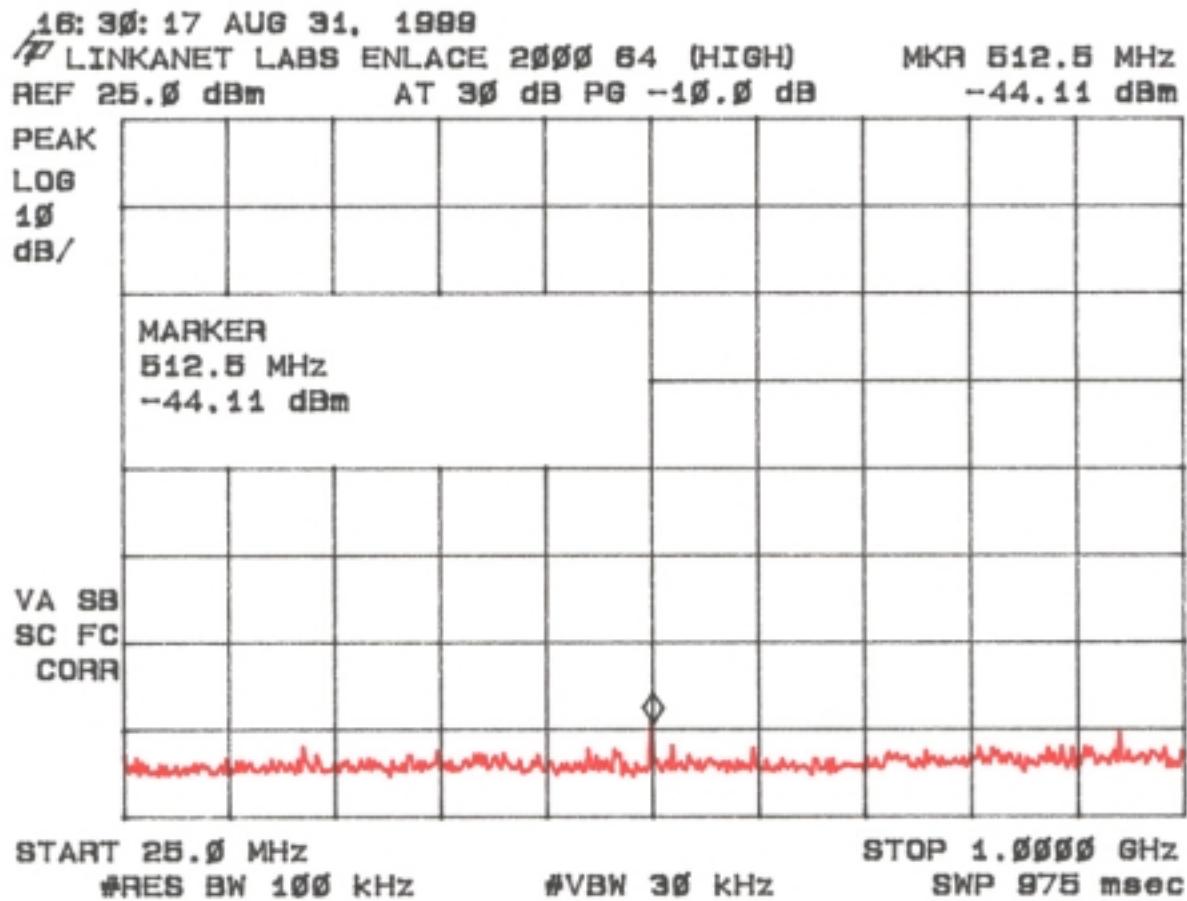


Figure 4j
Antenna Conducted Spurious Emissions 15.247(c) High

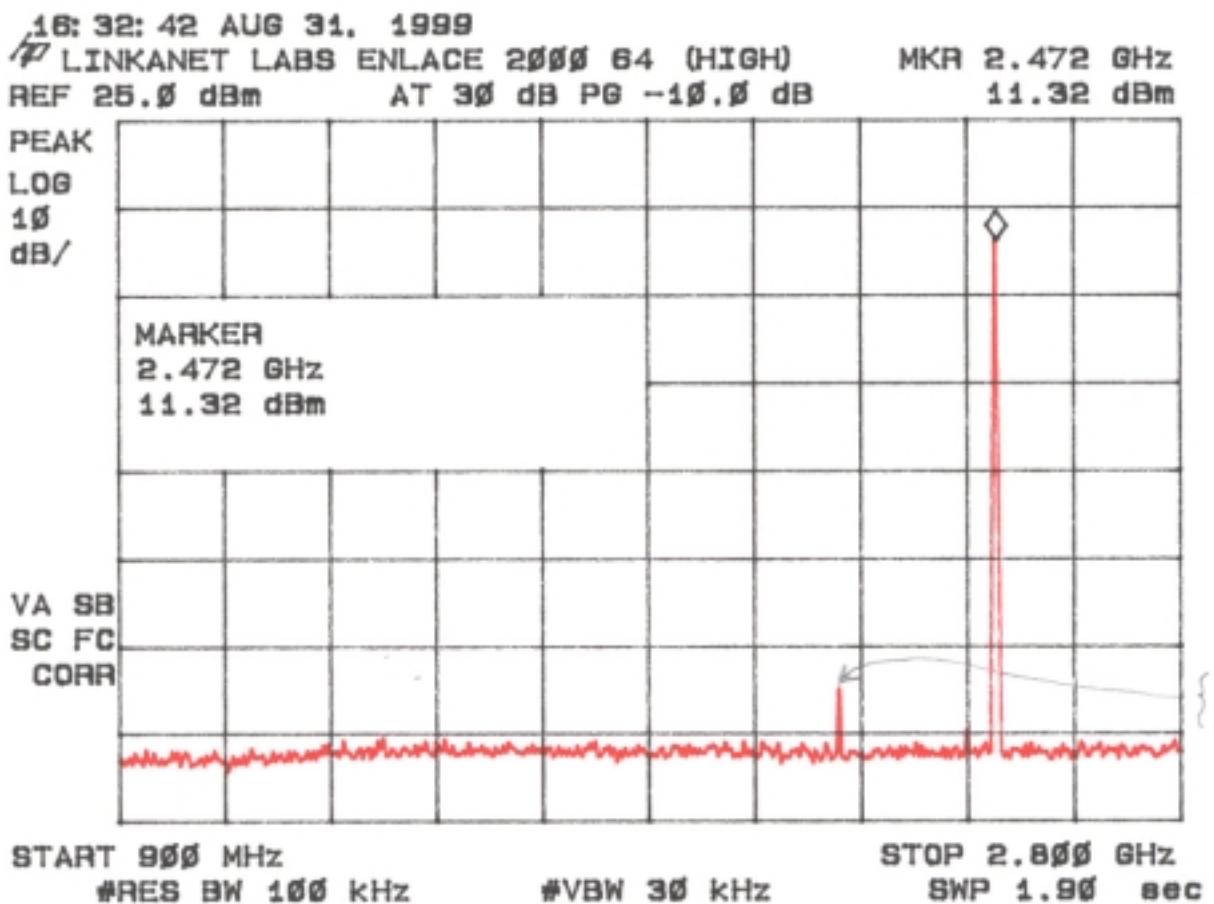


Figure 4k
Antenna Conducted Spurious Emissions 15.247(c) High

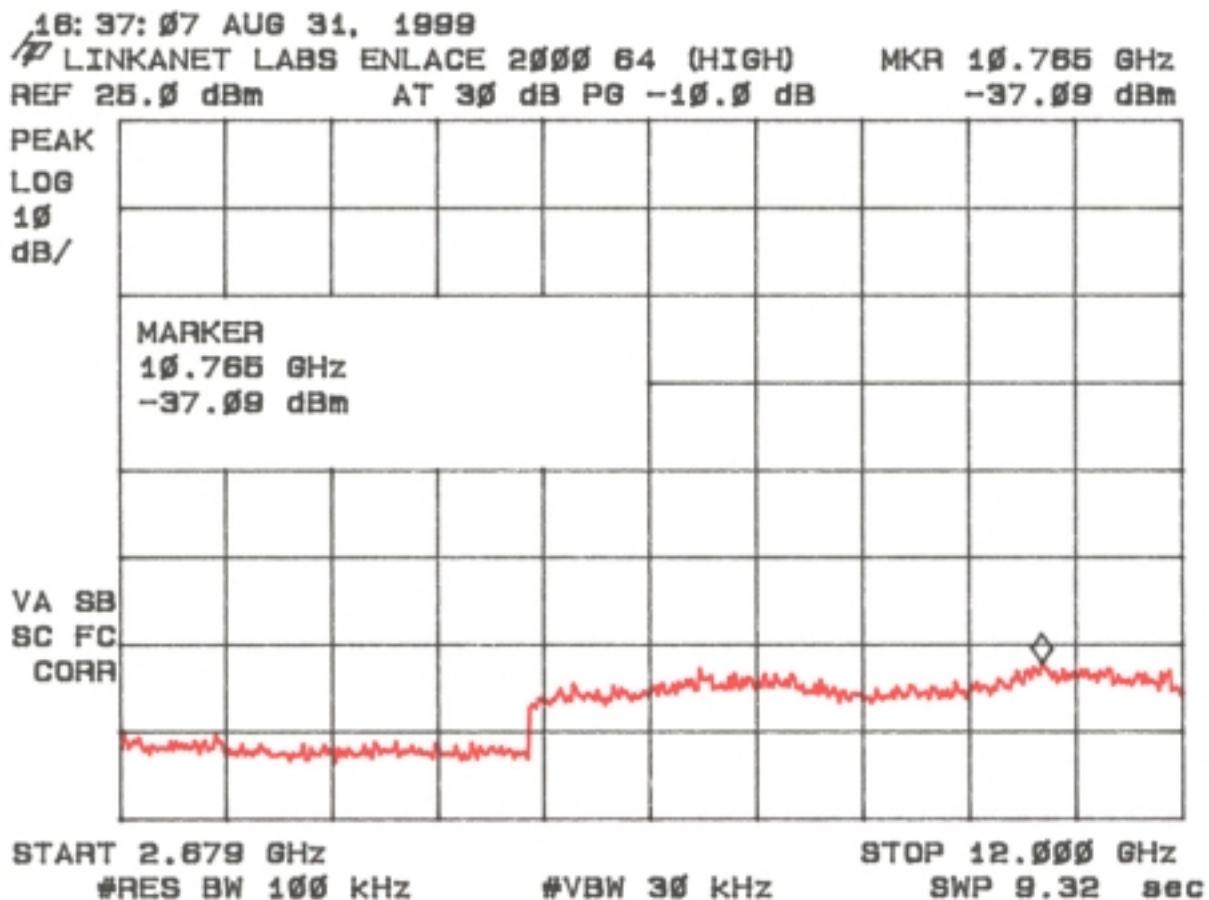
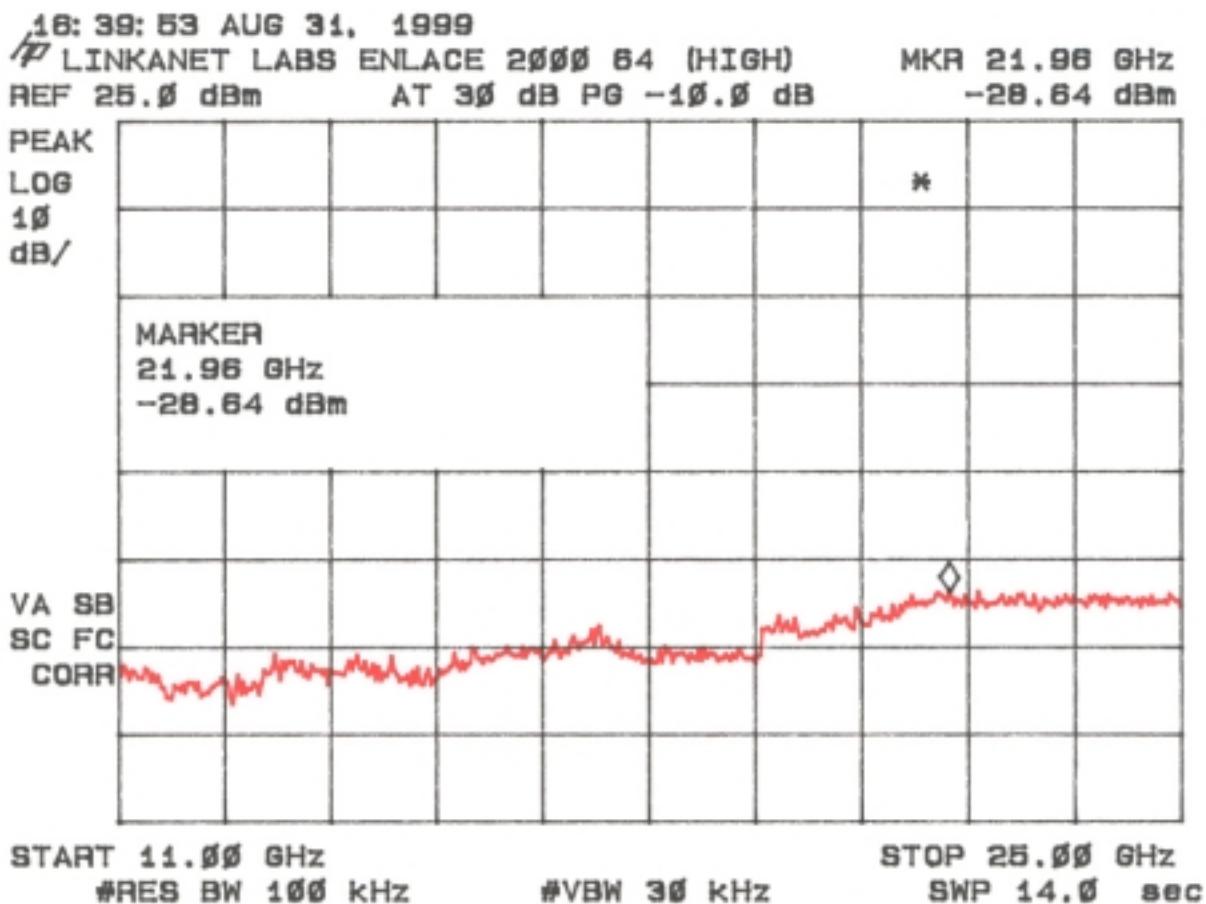


Figure 4I
Antenna Conducted Spurious Emissions 15.247(c) High



2.9 Peak Radiated Spurious Emission in the Frequency Range 30 -25000 MHz (FCC Section 15.247(c))

A preliminary scan was performed on the EUT to determine frequencies that were caused by the transmitter portion of the product. Significant emissions that fell within restricted bands were then measured on an OAT's site. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW = VBW = 1 MHz. The results of peak radiated spurious emissions falling within restricted bands are given in Table 4a (low), Table 4b, (mid), Table 4c (high) and Figure 5a – 5b(low), Figure 5c – 5d (mid) and Figure 5e –5f (high).

Figure 5a
Peak Radiated Spurious Emission 15.247(c) Low

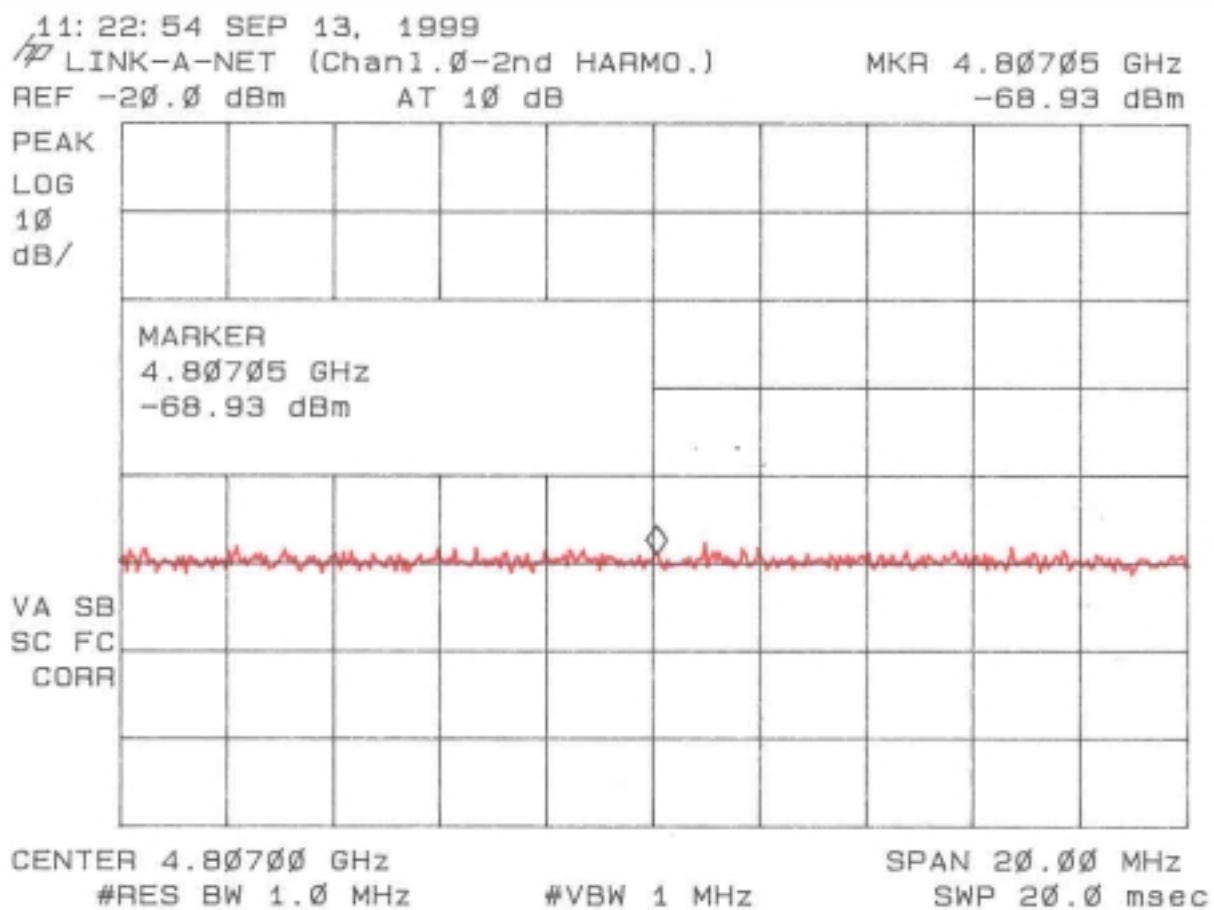


Figure 5b
Peak Radiated Spurious Emission 15.247(c) Low

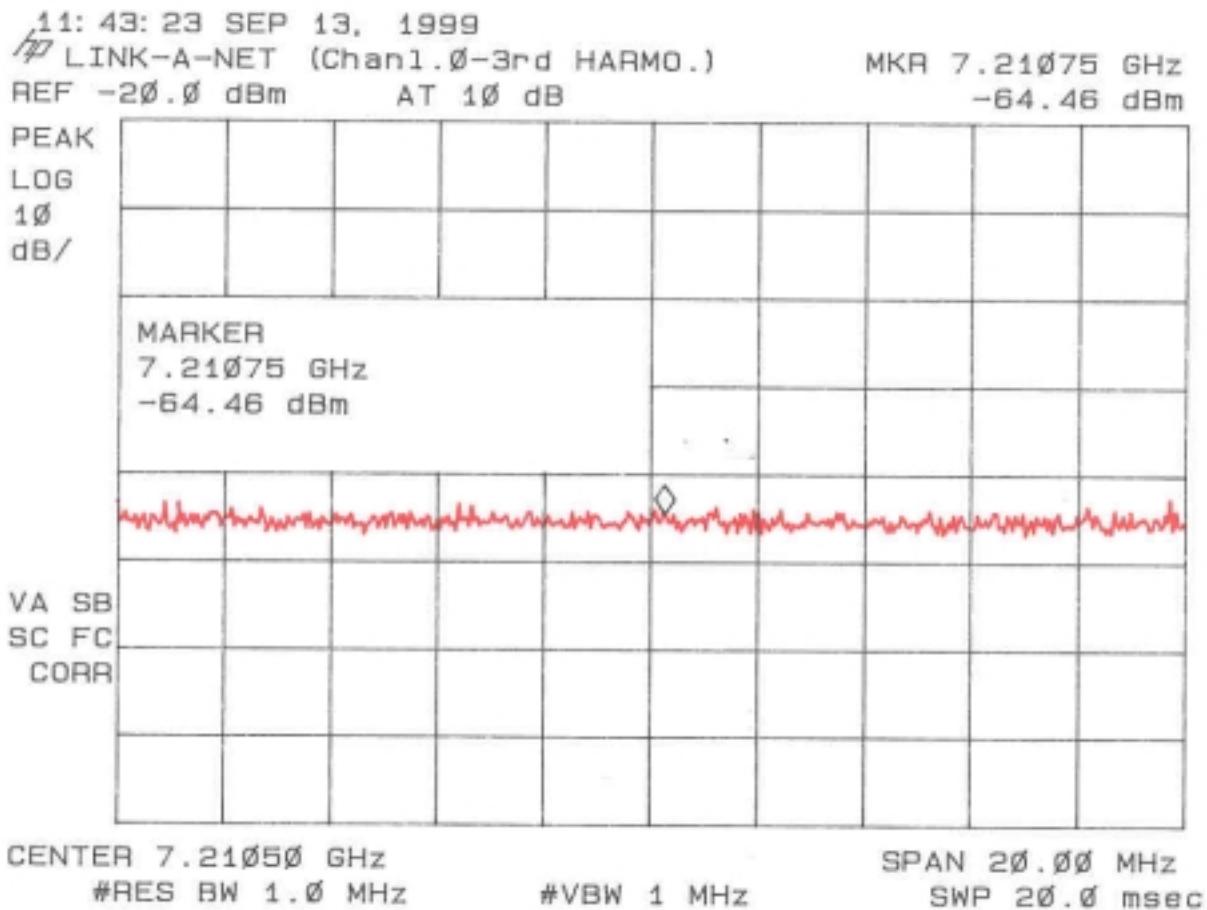


Figure 5c
Peak Radiated Spurious Emission 15.247(c) Mid

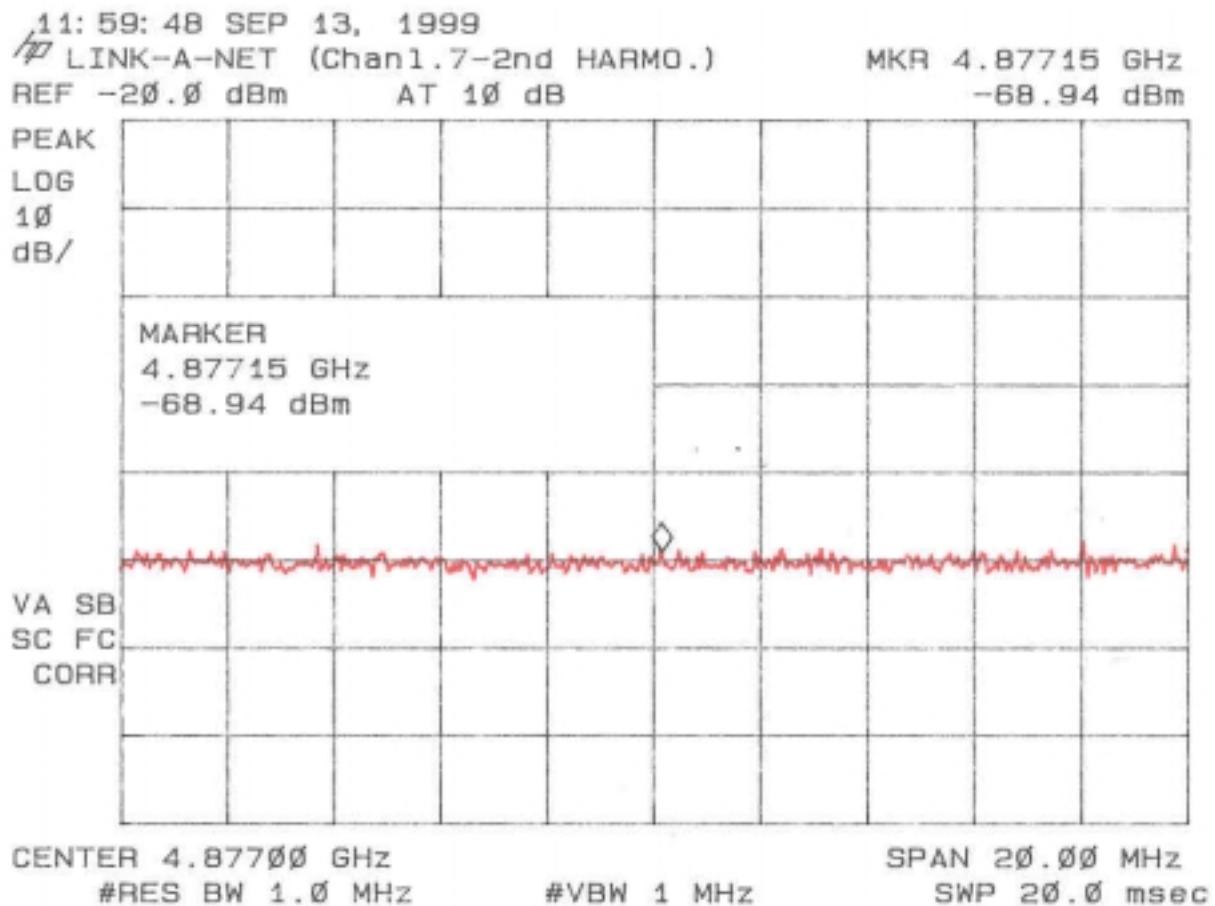


Figure 5d
Peak Radiated Spurious Emission 15.247(c) Mid

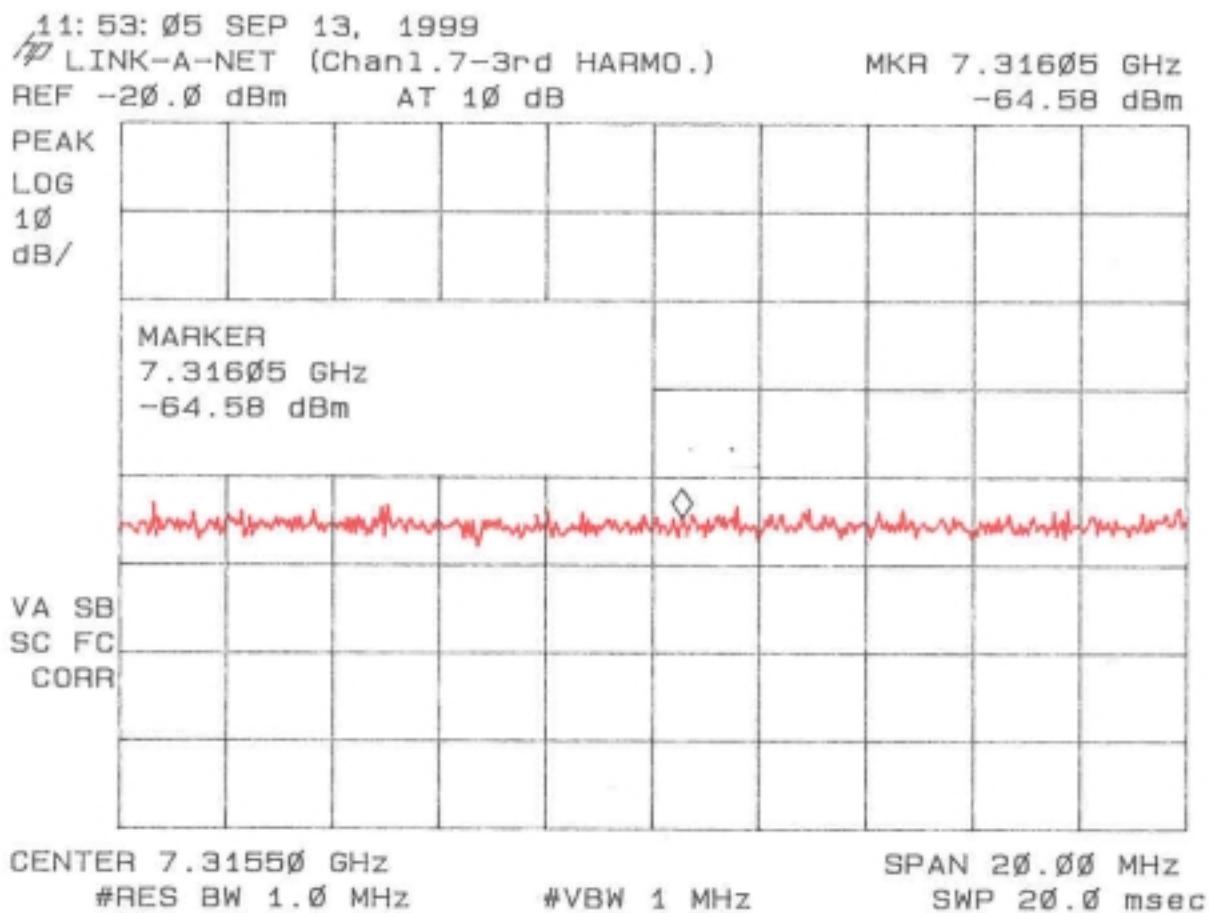


Figure 5e
Peak Radiated Spurious Emission 15.247(c) High

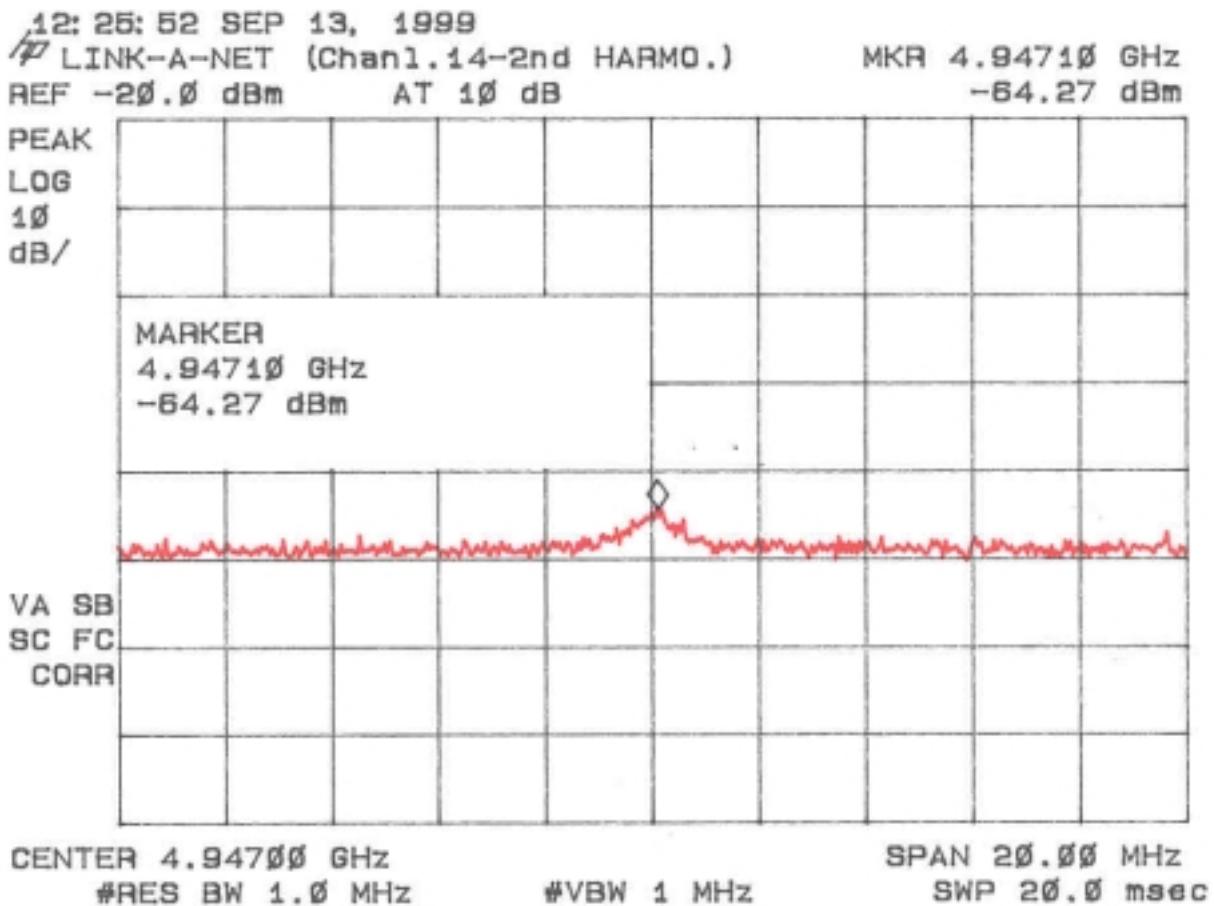


Figure 5
Peak Radiated Spurious Emission 15.247(c) High

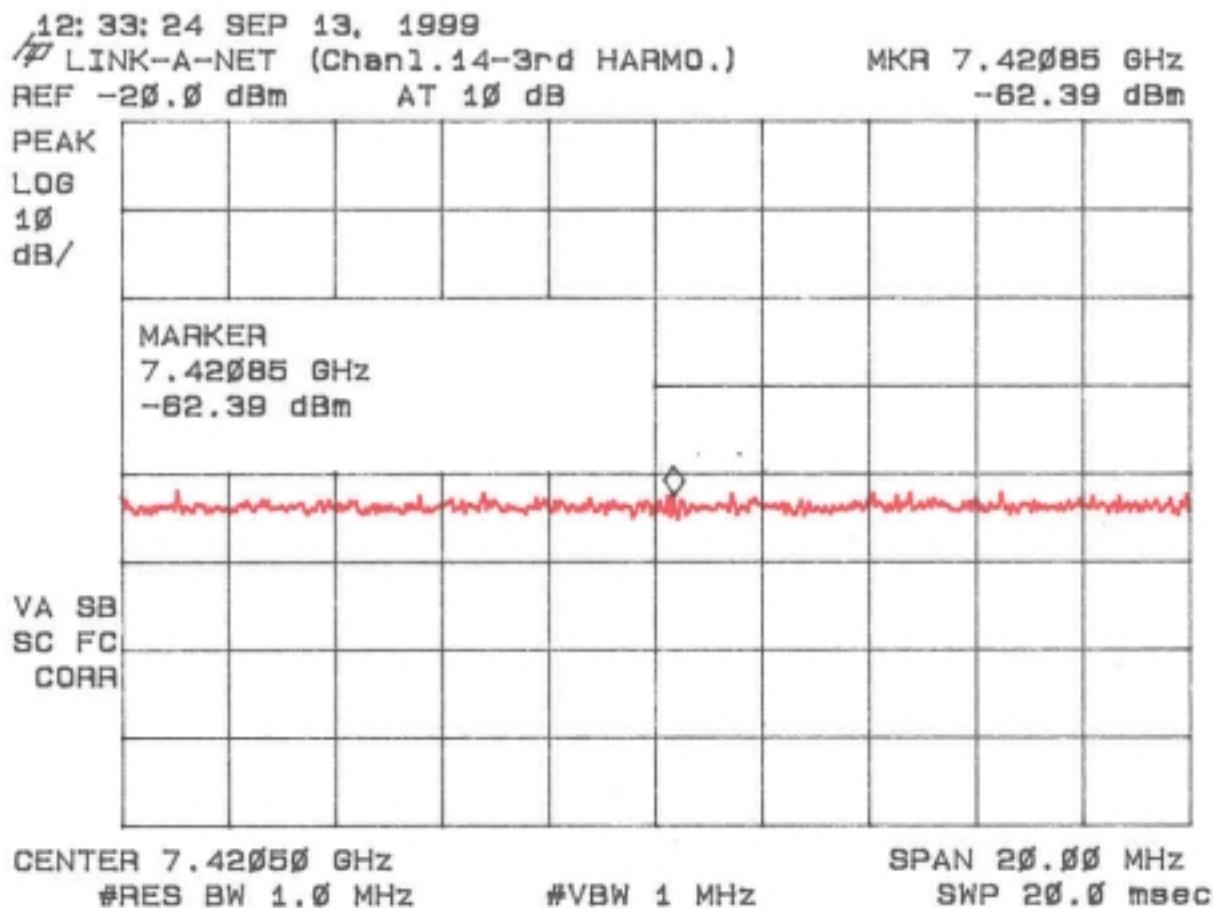


TABLE 4a PEAK RADIATED SPURIOUS EMISSIONS (Low)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.807	-67.9	34.3	34.6	7.9	231.7	5000
7.211	-63.5	34.5	37.1	7.8	495.2	5000

TABLE 4b PEAK RADIATED SPURIOUS EMISSIONS (Mid)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.877	-67.9	34.3	34.8	8.1	241.6	5000
7.316	-63.6	34.6	37.2	7.9	497.9	5000

TABLE 4c PEAK RADIATED SPURIOUS EMISSIONS (High)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.947	-63.3	34.3	35.0	8.3	427.8	5000
7.421	-61.4	34.6	37.4	7.9	652.3	5000

* = Data adjusted by + 1 dB for high pass filter

** = Instrumentation ground floor

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog ((-67.9 - 34.3 + 34.6 + 7.9 + 107)/20) = 231.7

CONVERSION FROM dBm TO dBuV = 107 dB

Tester

Signature: _____ Name: Tim R. Johnson

2.10 Average Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC Section 15.247(c))

The results of average radiated spurious emissions falling within restricted bands are given in Table 5a (low), Table 5b, (mid), Table 5c (high) and Figure 6a-6b (low), Figure 6c-6d (mid) and Figure 6e-6f (high).

Duty Cycle:

The duty cycle varies depending on the data rate being used. The following information was provided by LinkaNet labs regarding transmit cycles.

Data rate	McIk (Hz)	Chip rate (MHz)	TX burst (ms)	TDD (μs)	Duty cycle factor (dB)
64k	3731765	1.865882364	3.653767	8.497	-7.33
128k	5864202	2.932100857	3.765218	8.501	-7.07
256k	10262353	5.1311765	3.781297	8.501	-7.04
384k	20524706	10.262353	2.707712	8.5	-9.94
512k	20524706	10.262353	3.523315	8.496	-7.65

Figure 6a
Average Radiated Spurious Emission 15.247(c) Low

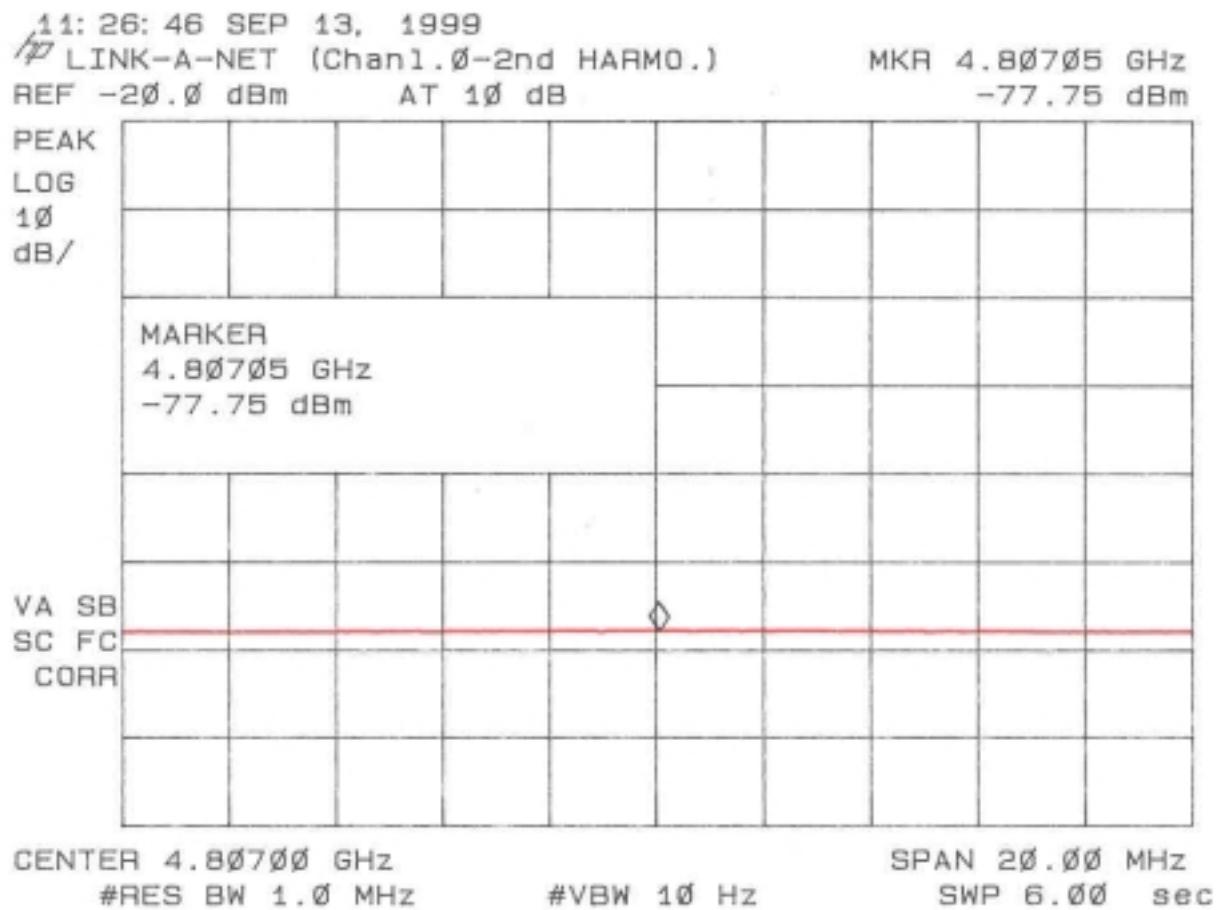


Figure 6b
Average Radiated Spurious Emission 15.247(c) Low

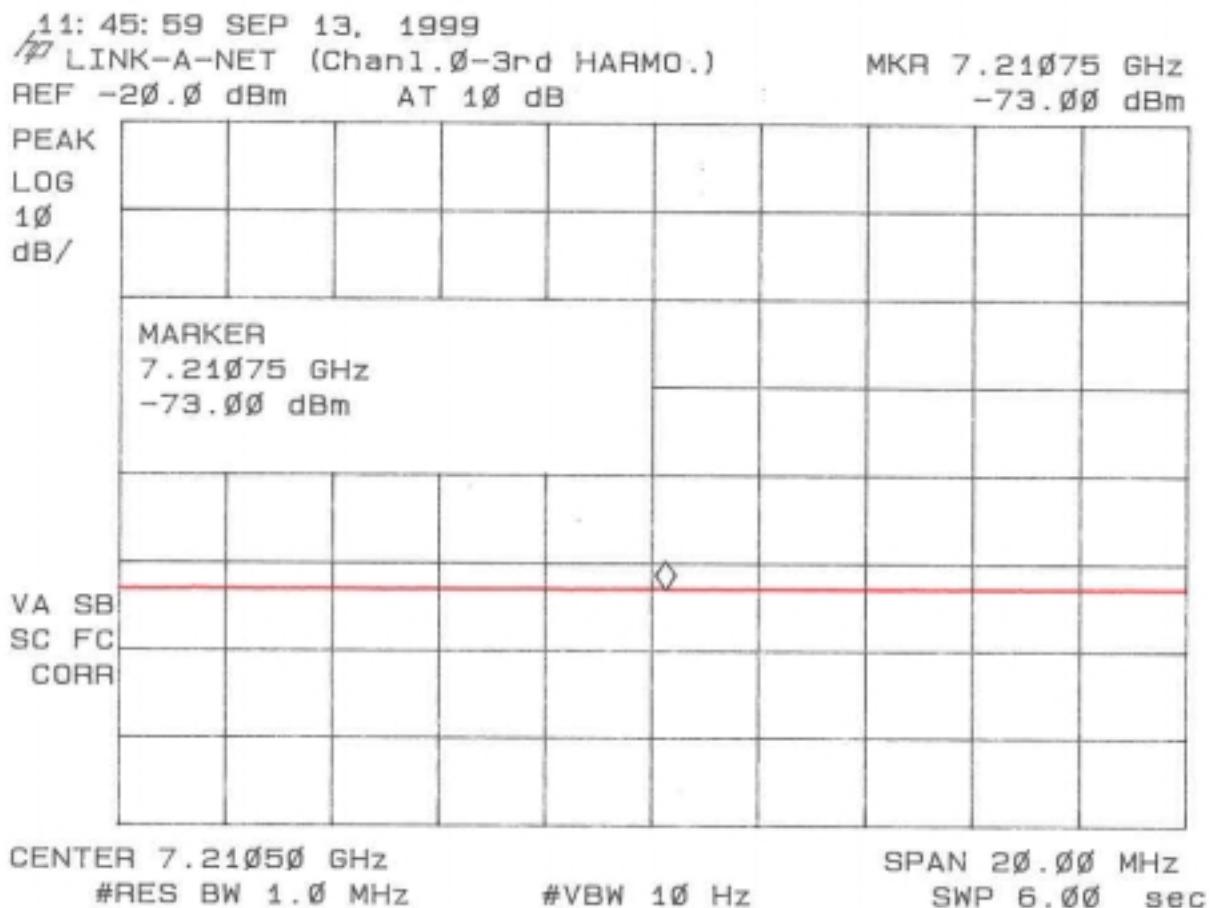


Figure 6c
Average Radiated Spurious Emission 15.247(c) Mid

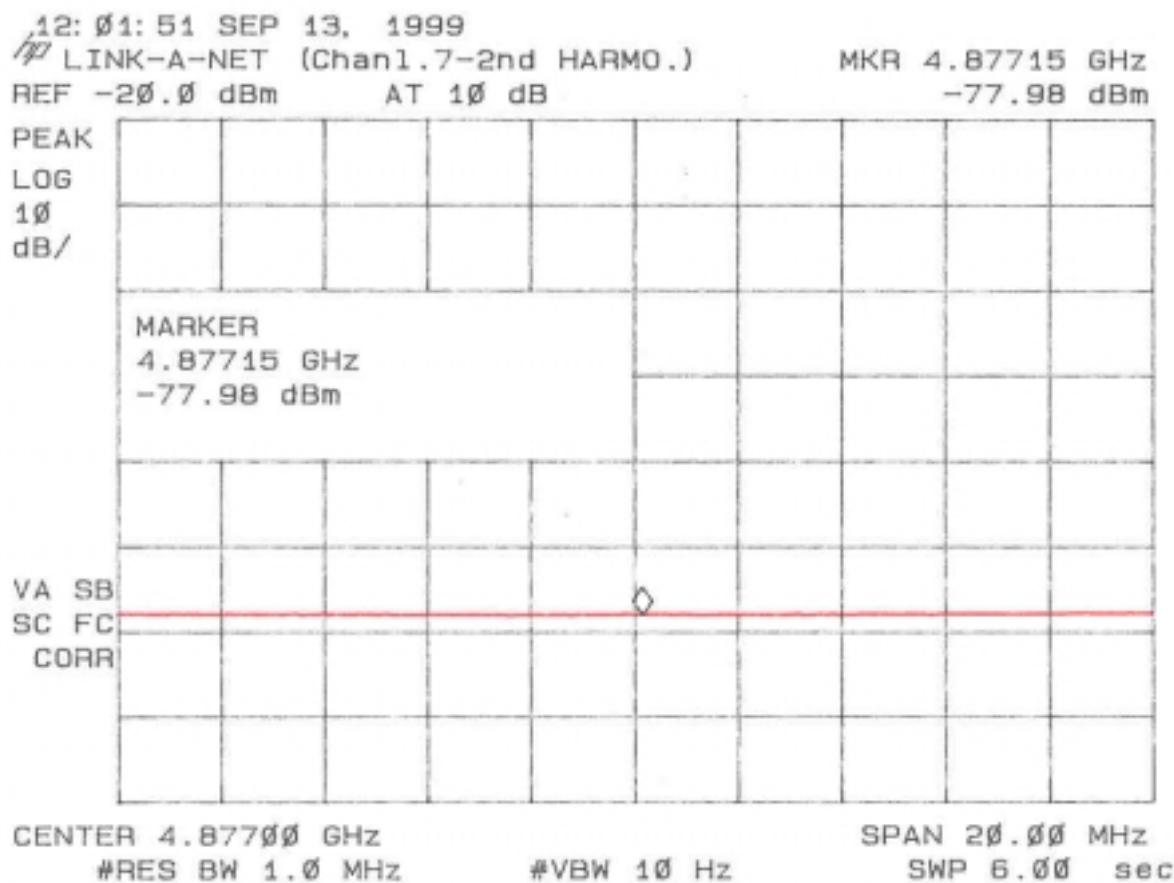


Figure 6d
Average Radiated Spurious Emission 15.247(c) Mid

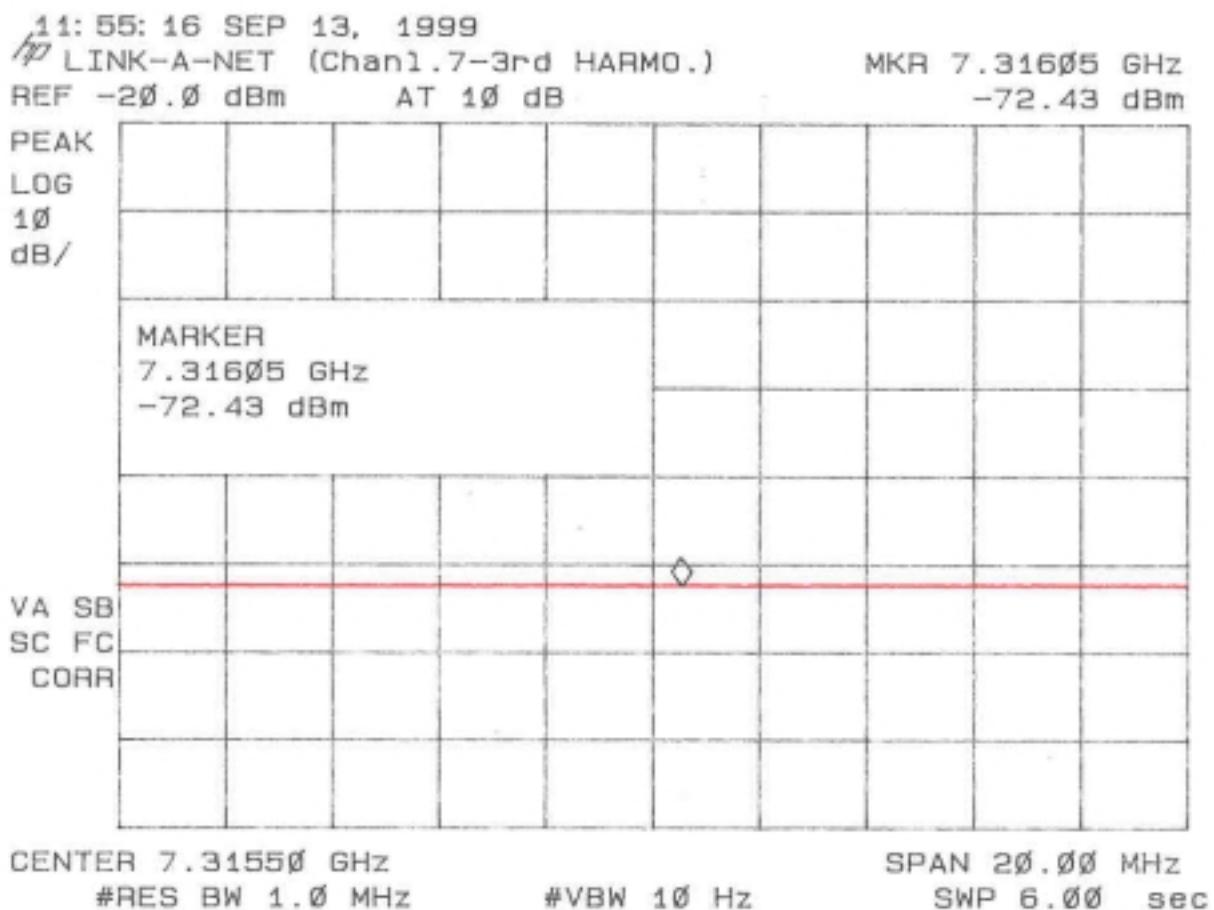


Figure 6e
Average Radiated Spurious Emission 15.247(c) High

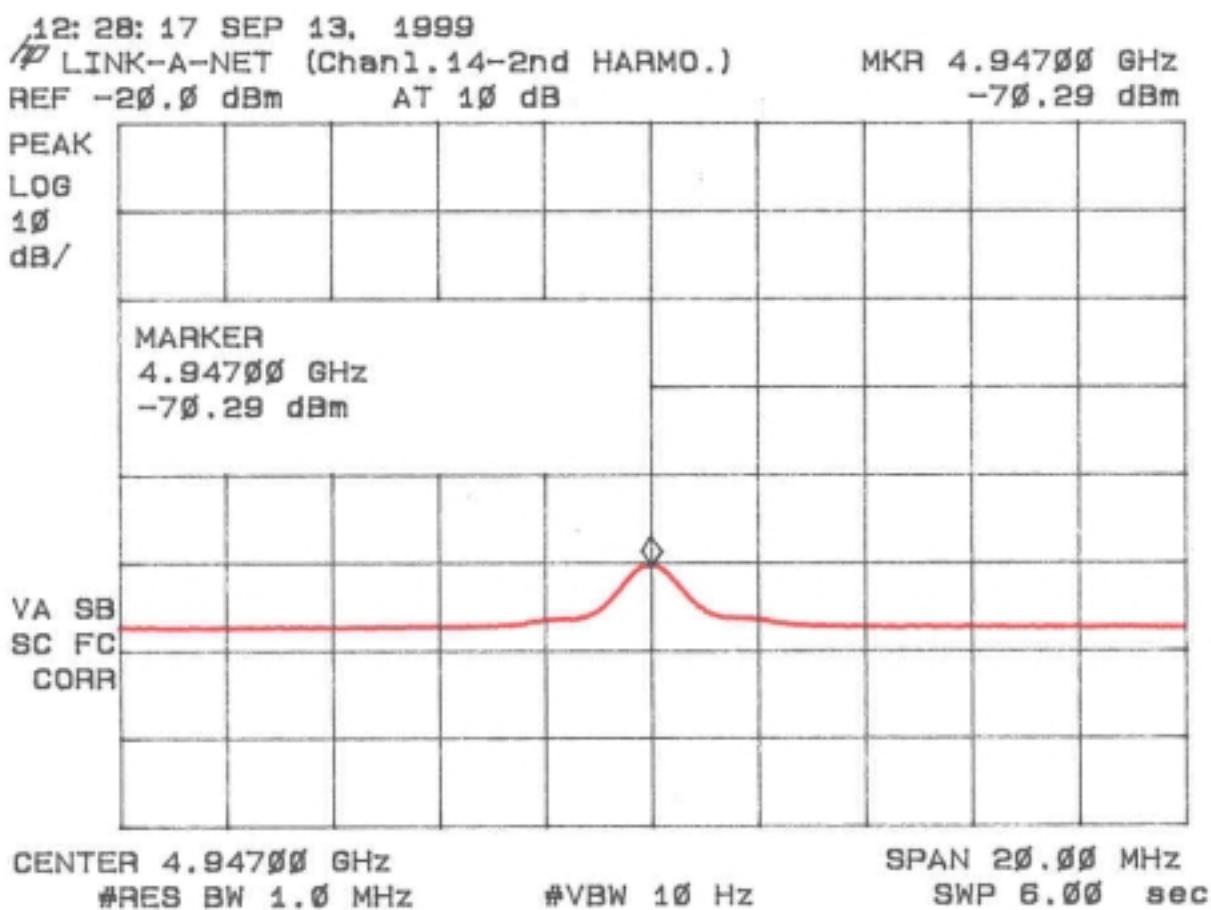


Figure 6f
Average Radiated Spurious Emission 15.247(c) High

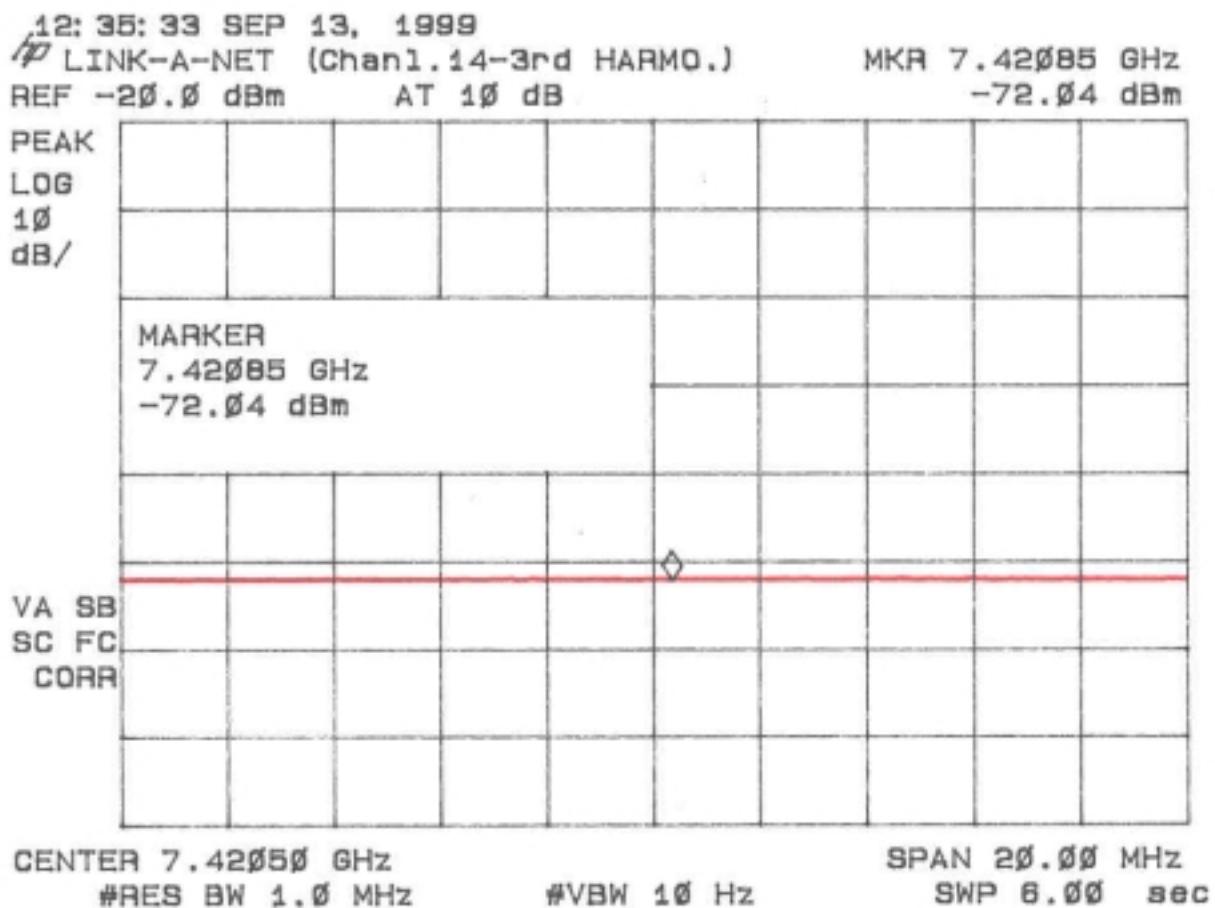


TABLE 5a AVERAGE RADIATED SPURIOUS EMISSIONS (Low)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.807	-83.8	34.3	34.6	7.9	37.1	500
7.211	-79.0	34.5	37.1	7.8	83.1	500

TABLE 5b AVERAGE RADIATED SPURIOUS EMISSIONS (Mid)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.877	-83.9	34.3	34.8	8.1	38.3	500
7.316	-72.4	34.6	37.2	7.9	180.8	500

TABLE 5c AVERAGE RADIATED SPURIOUS EMISSIONS (High)

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.947	-76.3	34.3	35.0	8.3	95.8	500
7.421	-78.0	34.6	34.7	7.9	96.5	500

* = Data adjusted by + 1dB for high pass filter and -7.0 dB for worse case duty cycle.

** = Instrumentation ground floor.

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) =

$$\text{Antilog } ((-83.8 - 34.3 + 34.6 + 7.9 + 107)/20) = 37.1$$

CONVERSION FROM dBm TO dBuV = 107 dB

Tester

Signature: _____ Name: Tim R. Johnson