

## **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 50  $\Omega$  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

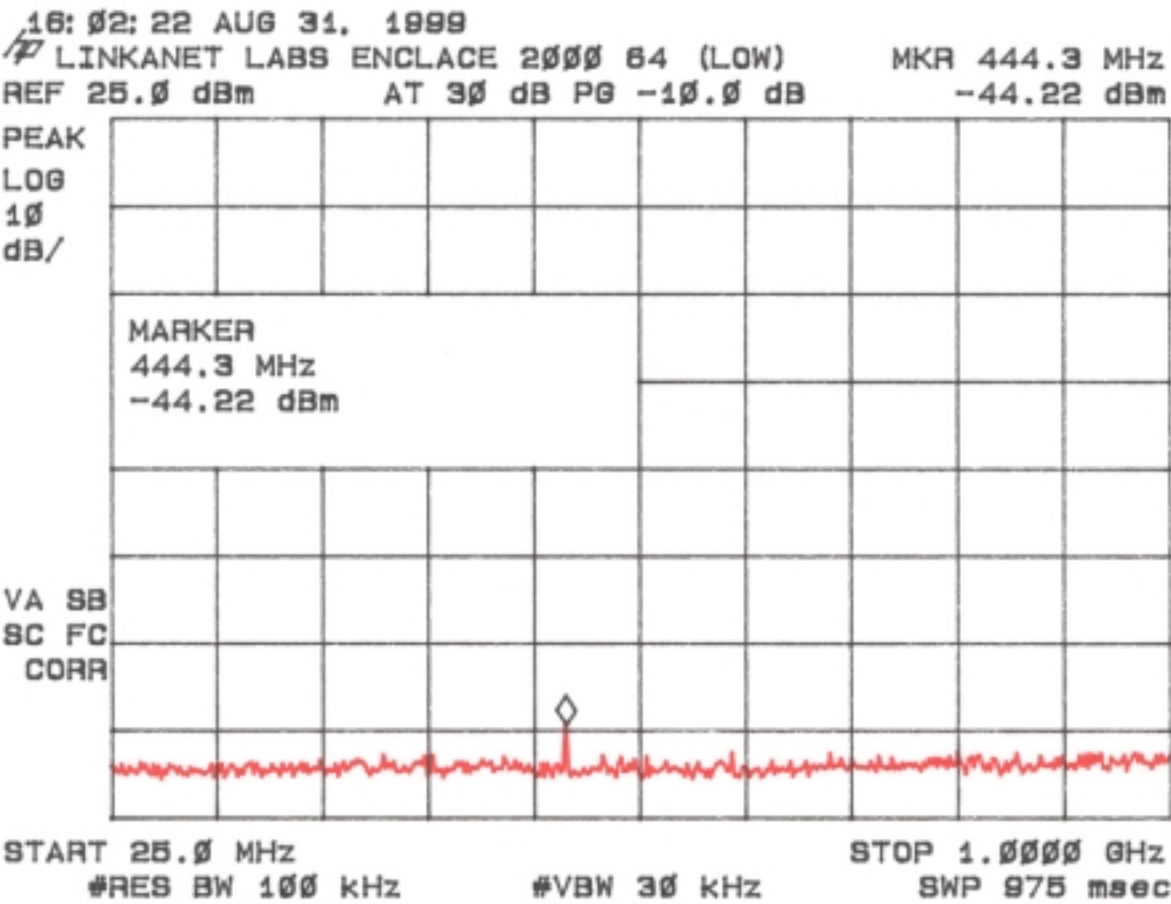


Figure 4b  
Antenna Conducted Spurious Emissions 5.247(c) Low

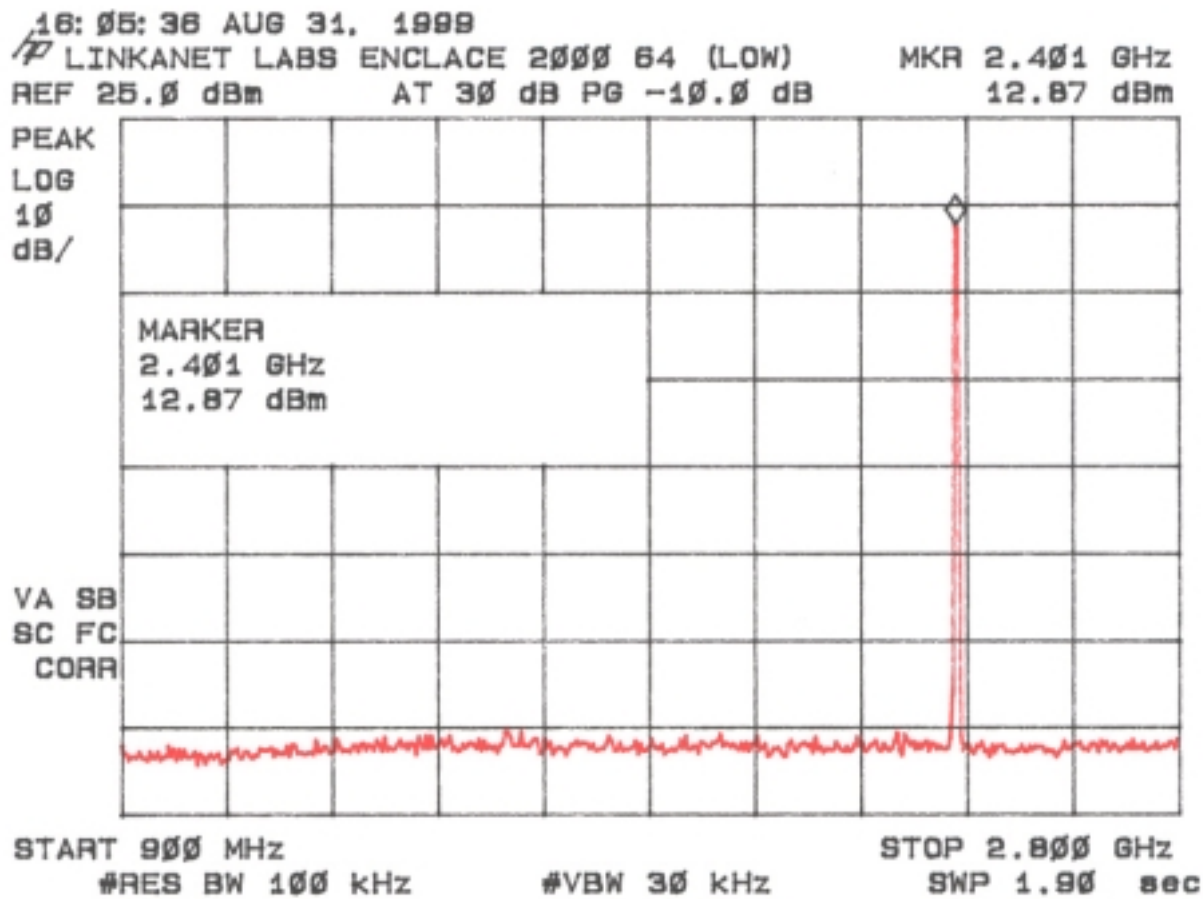


Figure 4c  
Antenna Conducted Spurious Emissions 15.247(c) Low

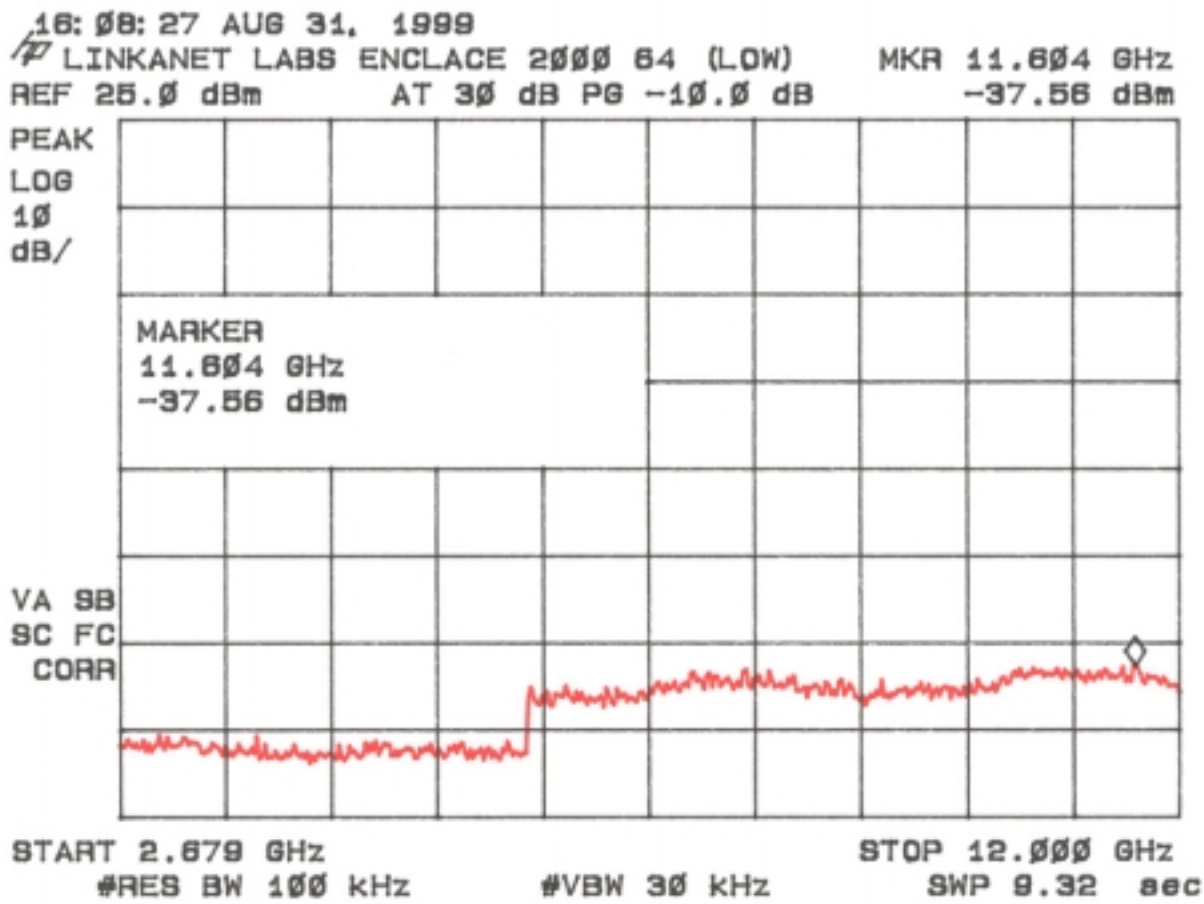


Figure 4d  
Antenna Conducted Spurious Emissions 15.247(c) Low

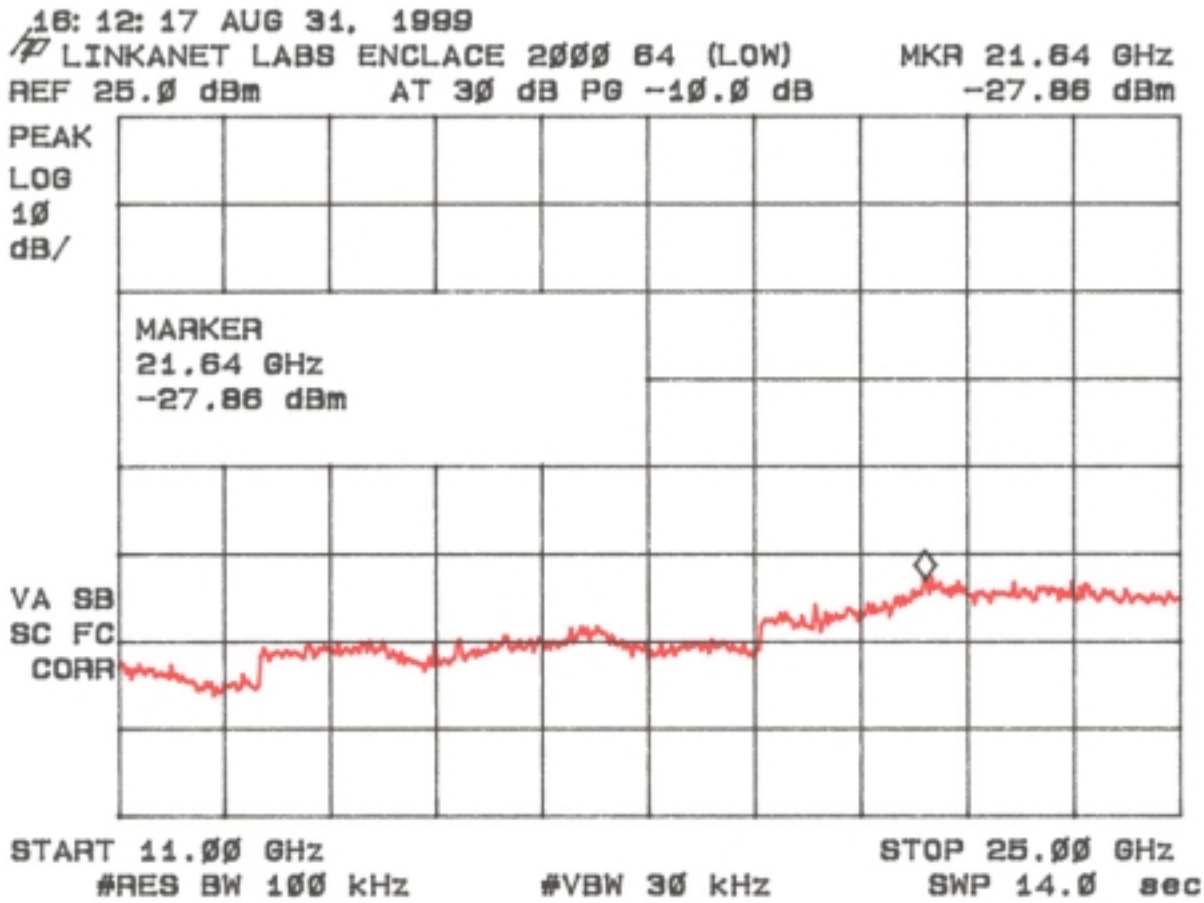


Figure 4e  
Antenna Conducted Spurious Emissions 15.247(c) Mid

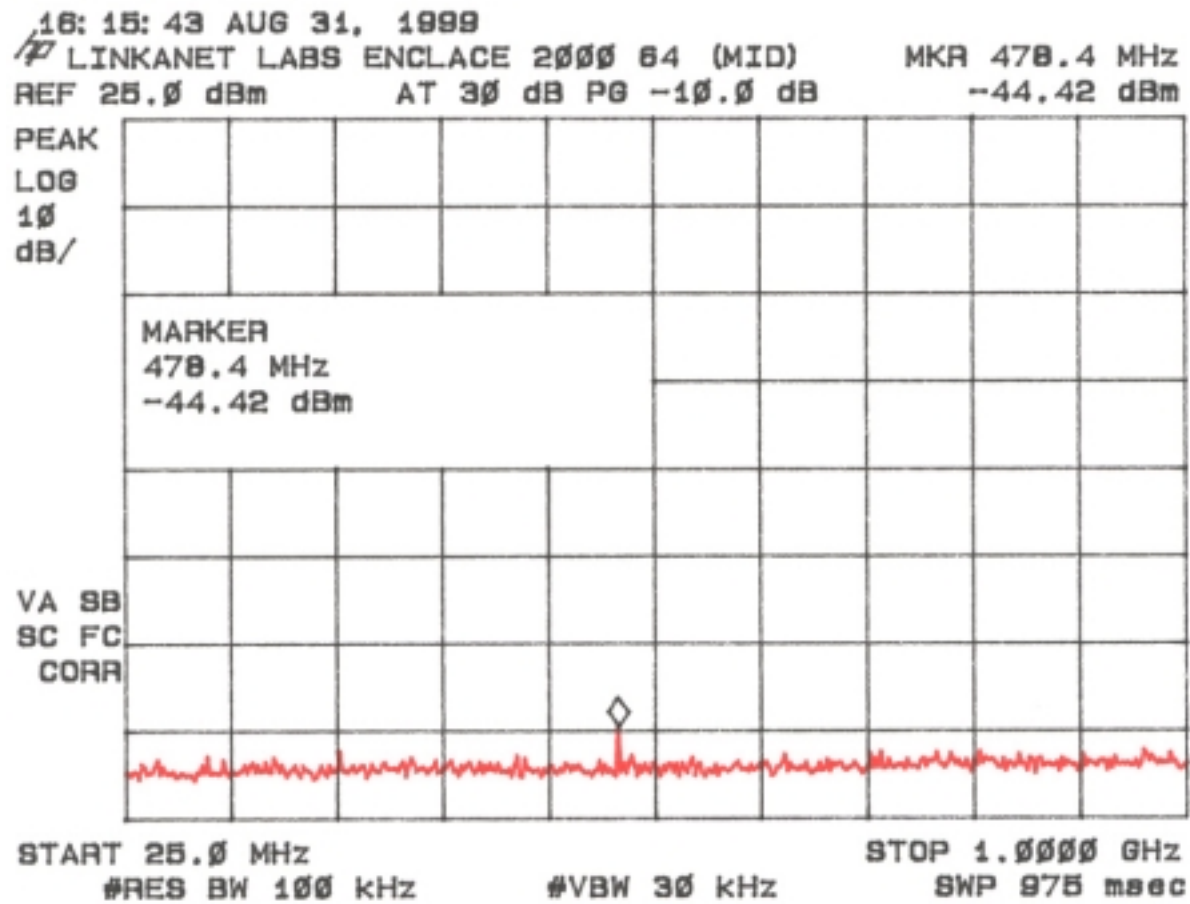


Figure 4f  
Antenna Conducted Spurious Emissions 15.247(c) Mid

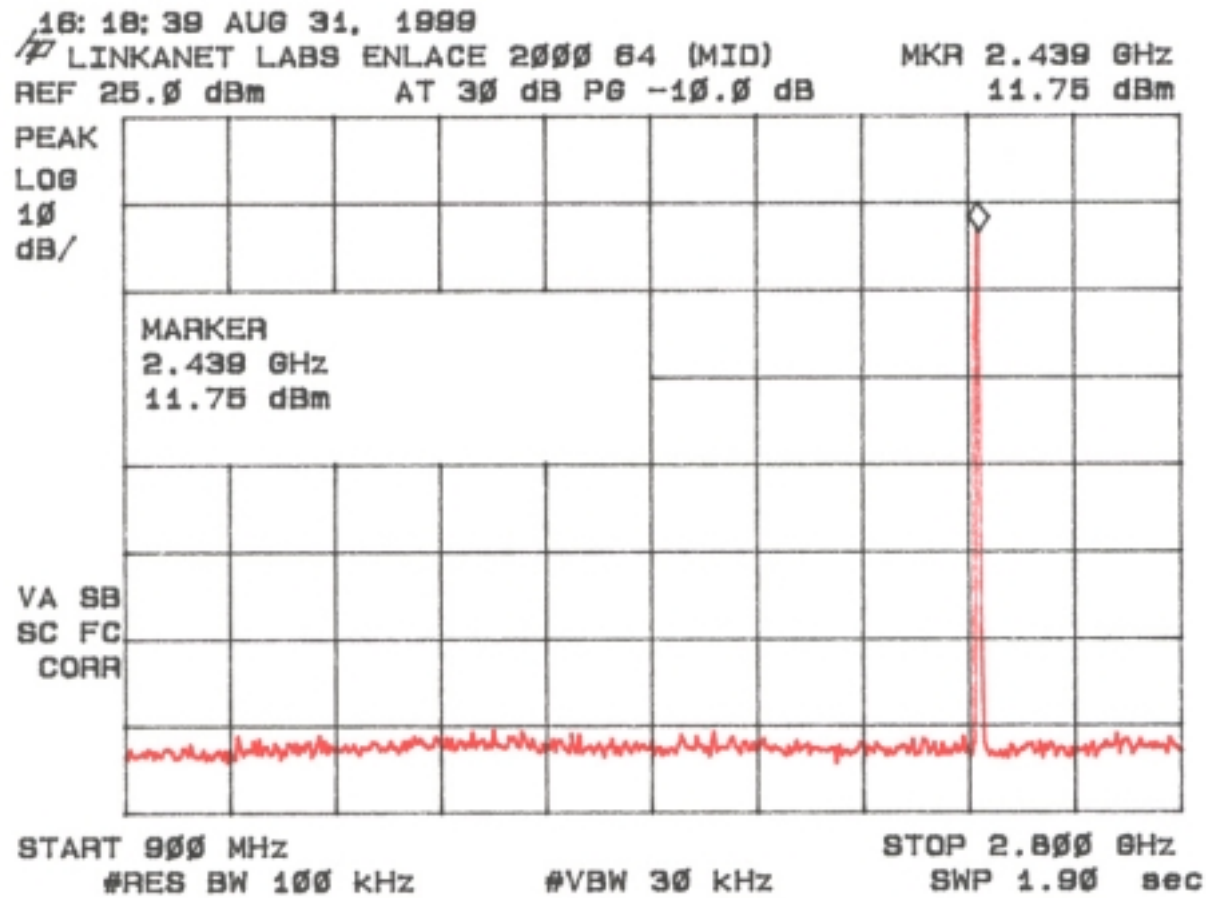


Figure 4g  
Antenna Conducted Spurious Emissions 15.247(c) Mid

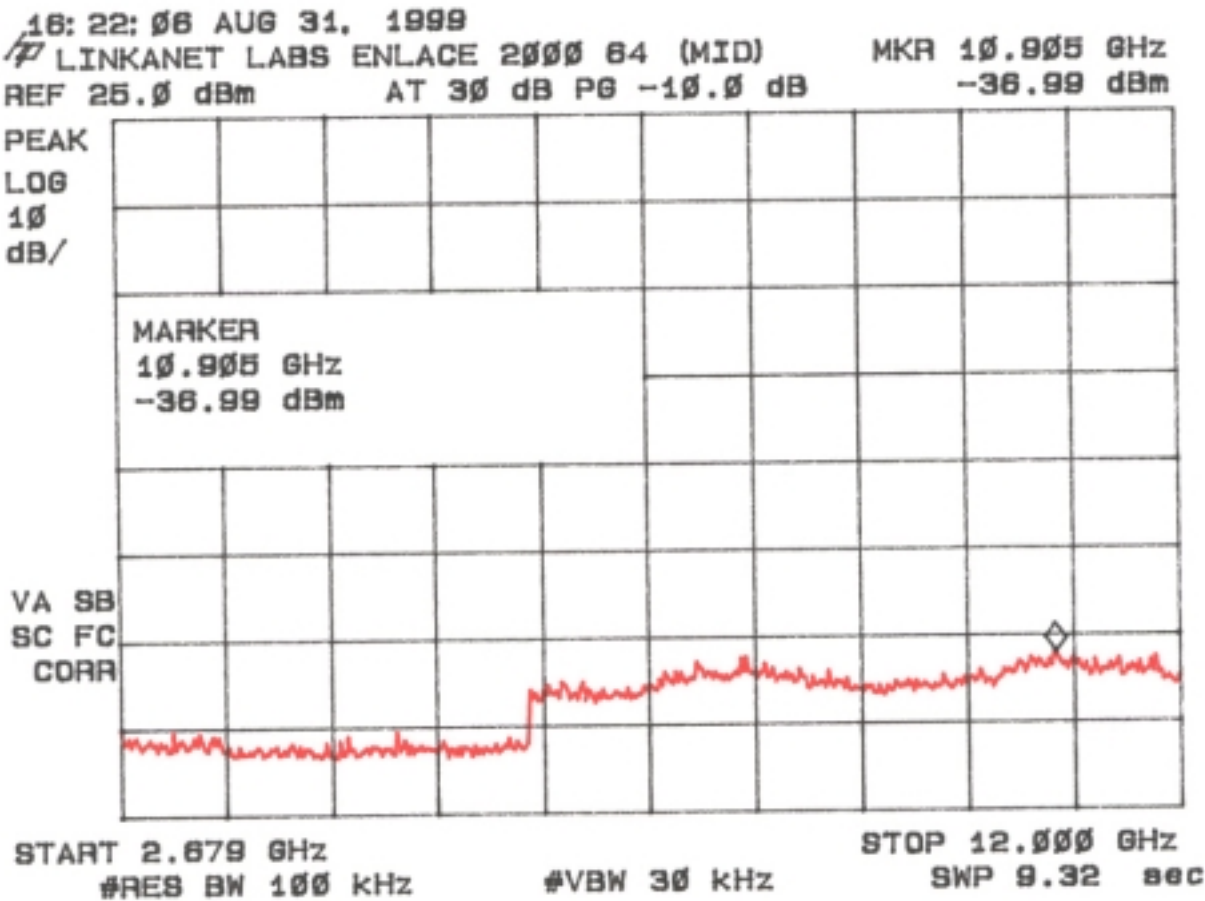




Figure 4h  
Antenna Conducted Spurious Emissions 15.247(c) Mid

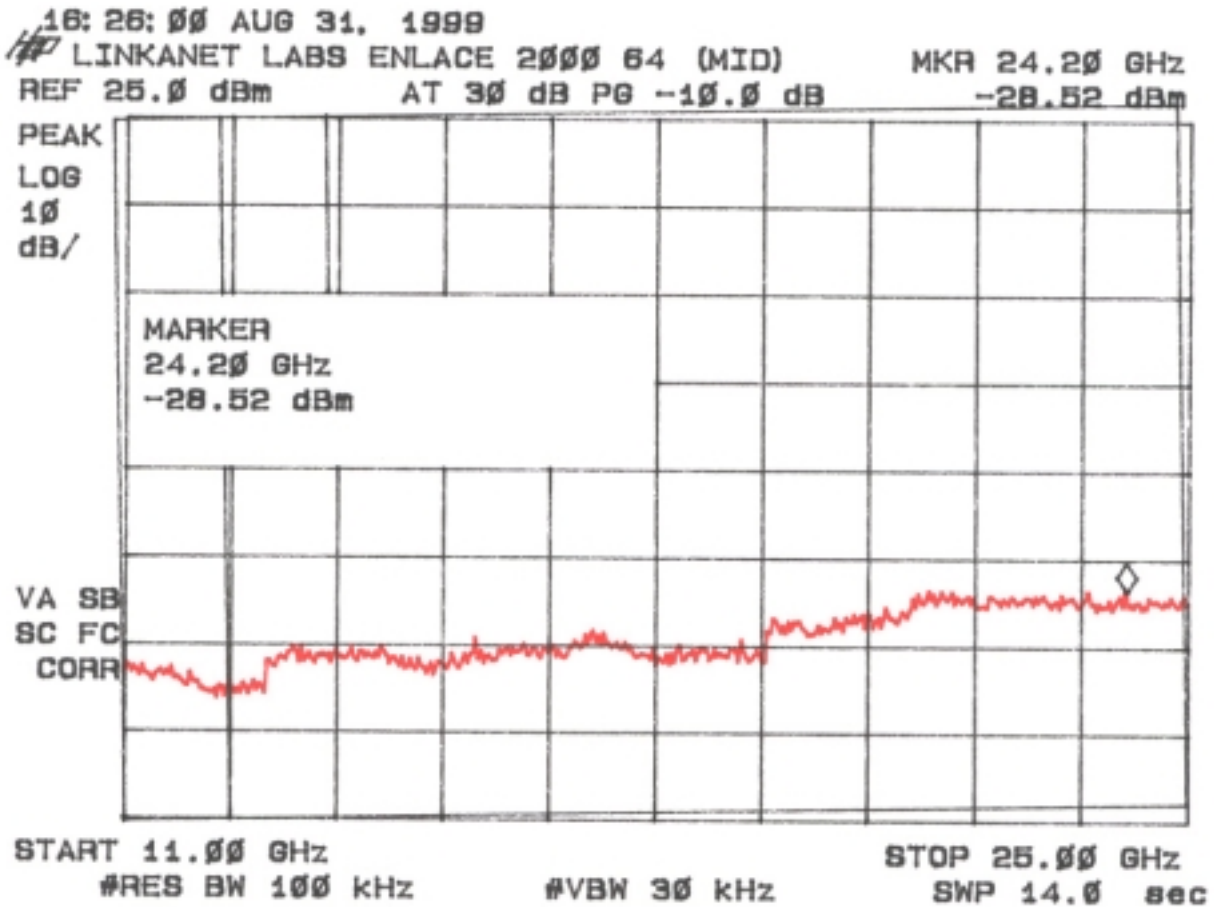


Figure 4i  
Antenna Conducted Spurious Emissions 15.247(c) High

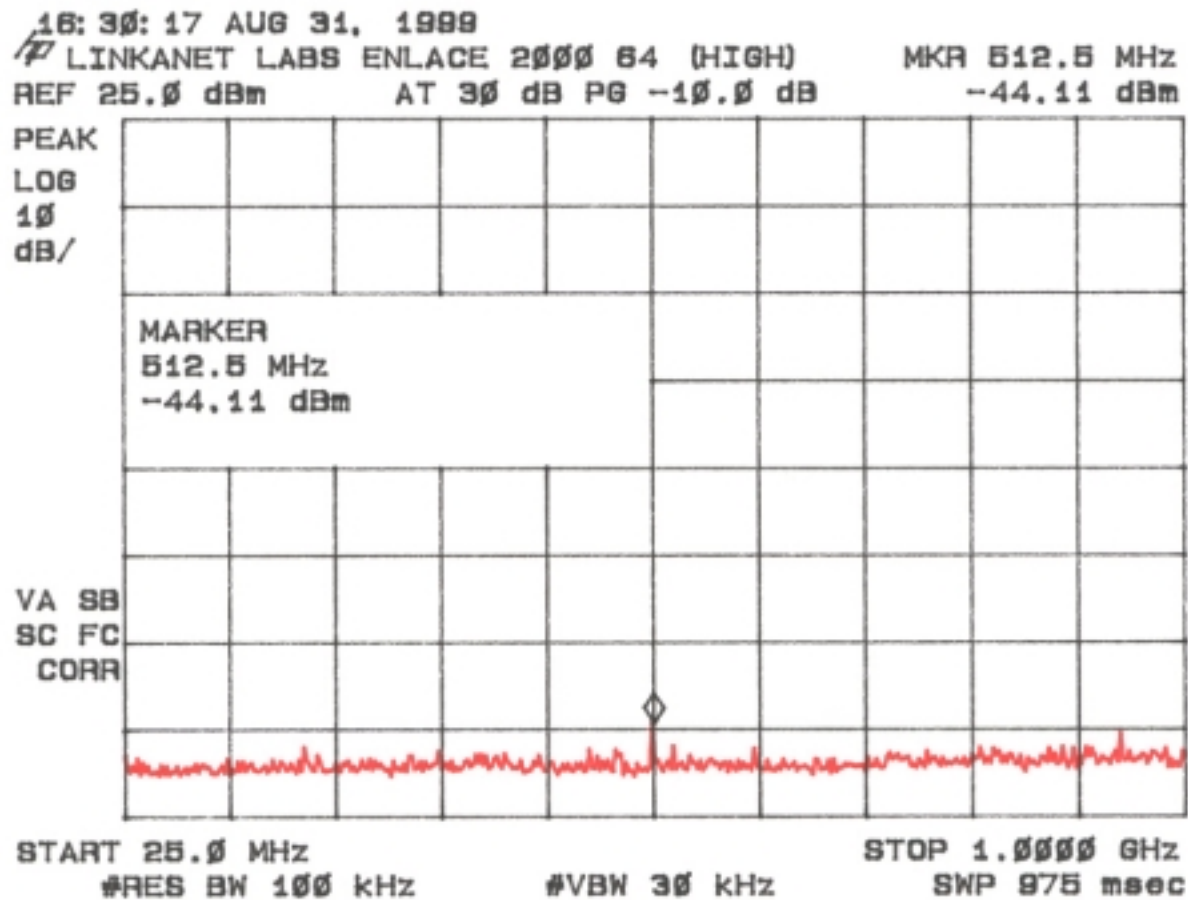


Figure 4j  
Antenna Conducted Spurious Emissions 15.247(c) High

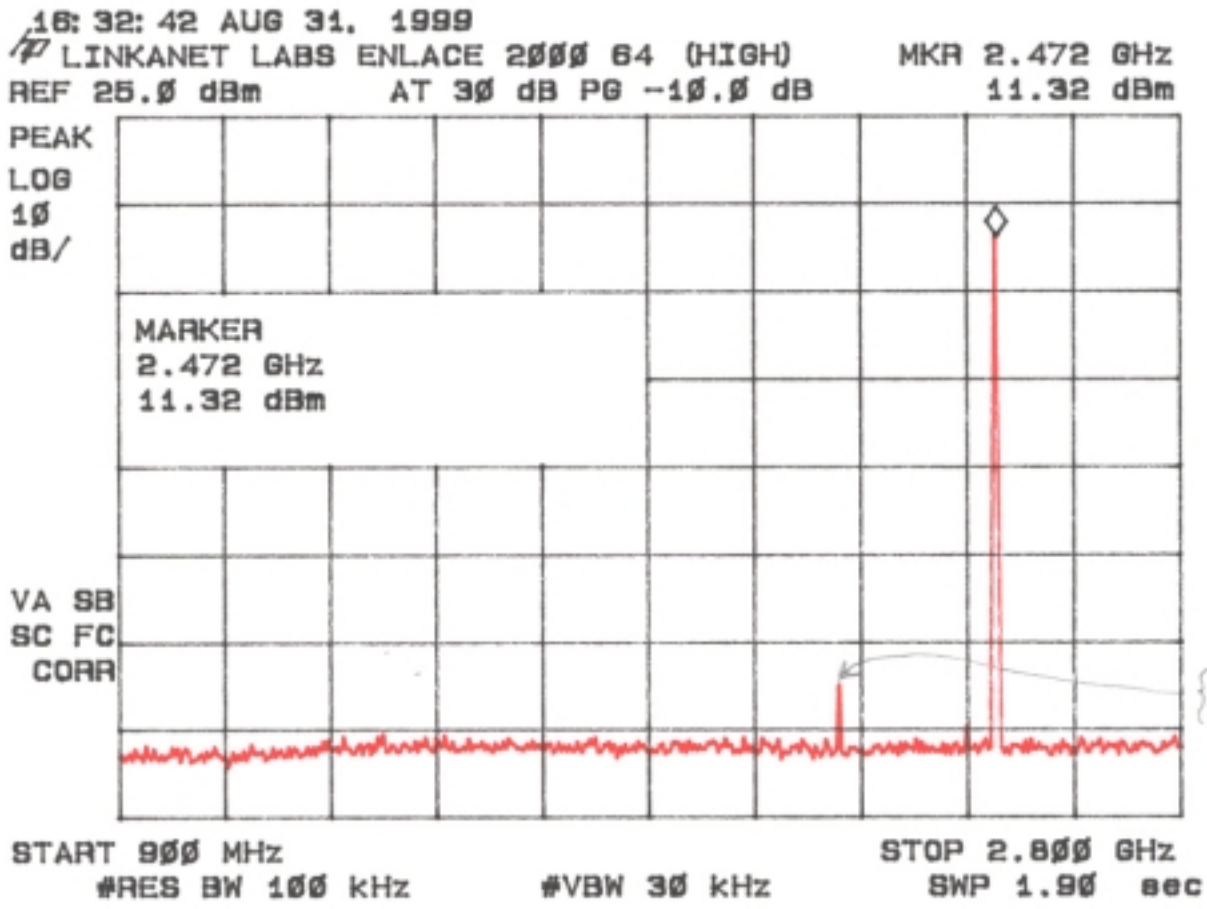


Figure 4k  
Antenna Conducted Spurious Emissions 15.247(c) High

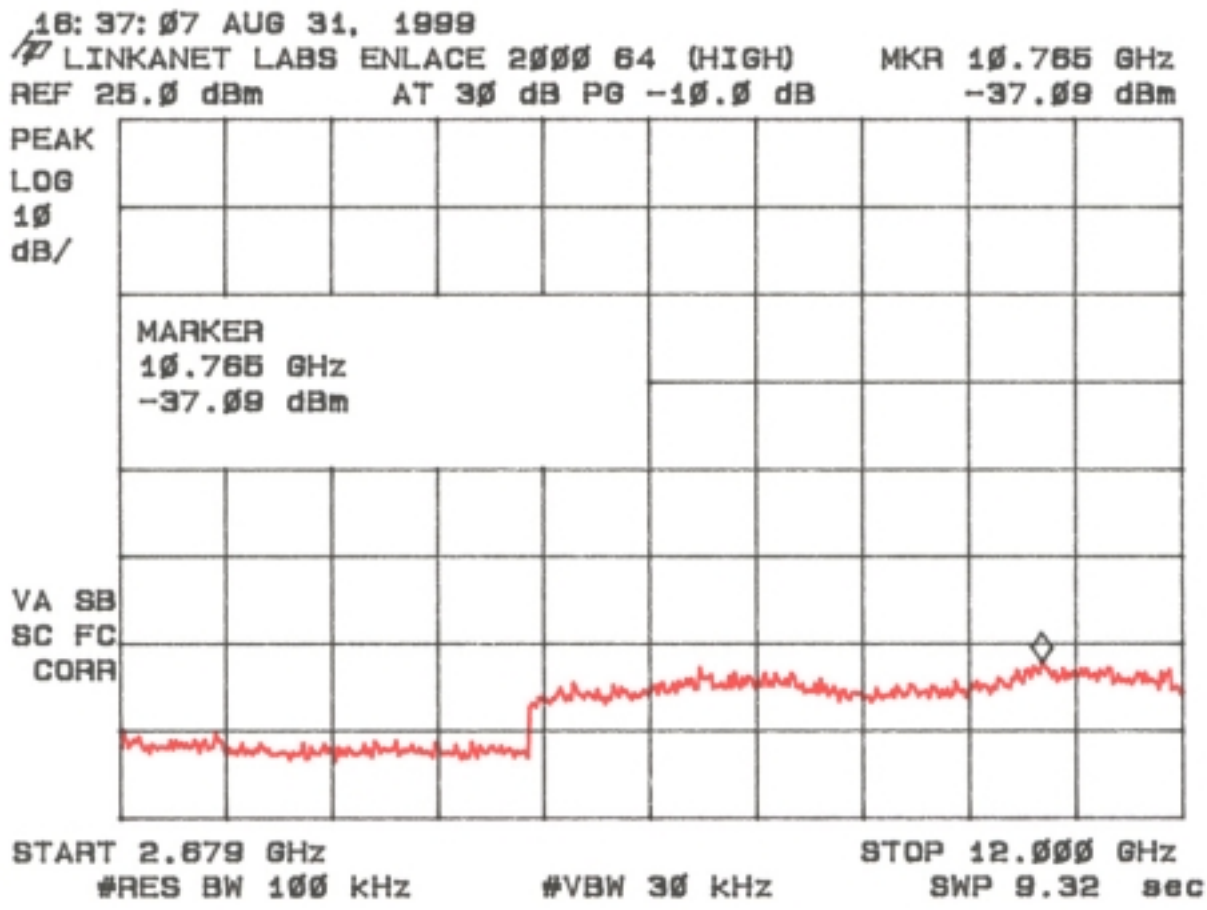
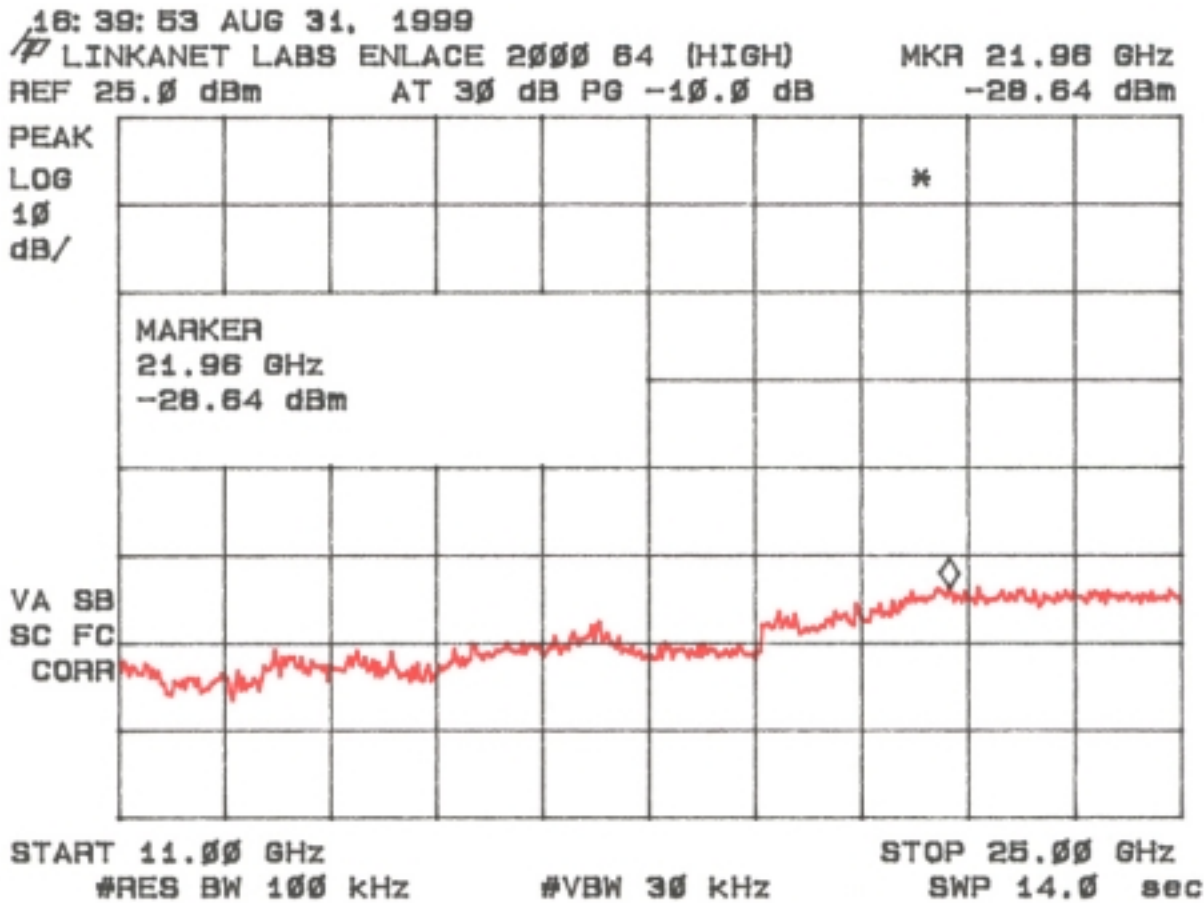


Figure 4l  
Antenna Conducted Spurious Emissions 15.247(c) High



## **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

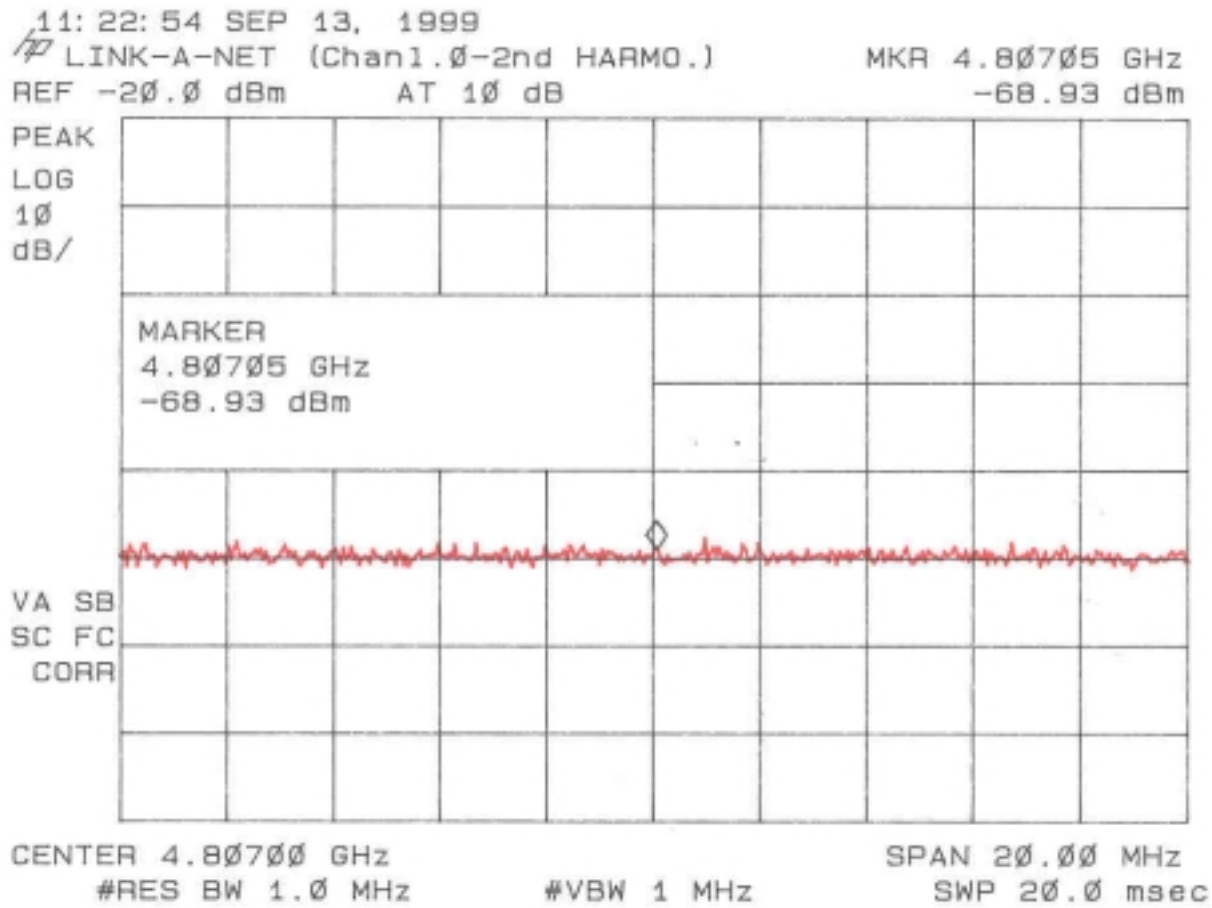
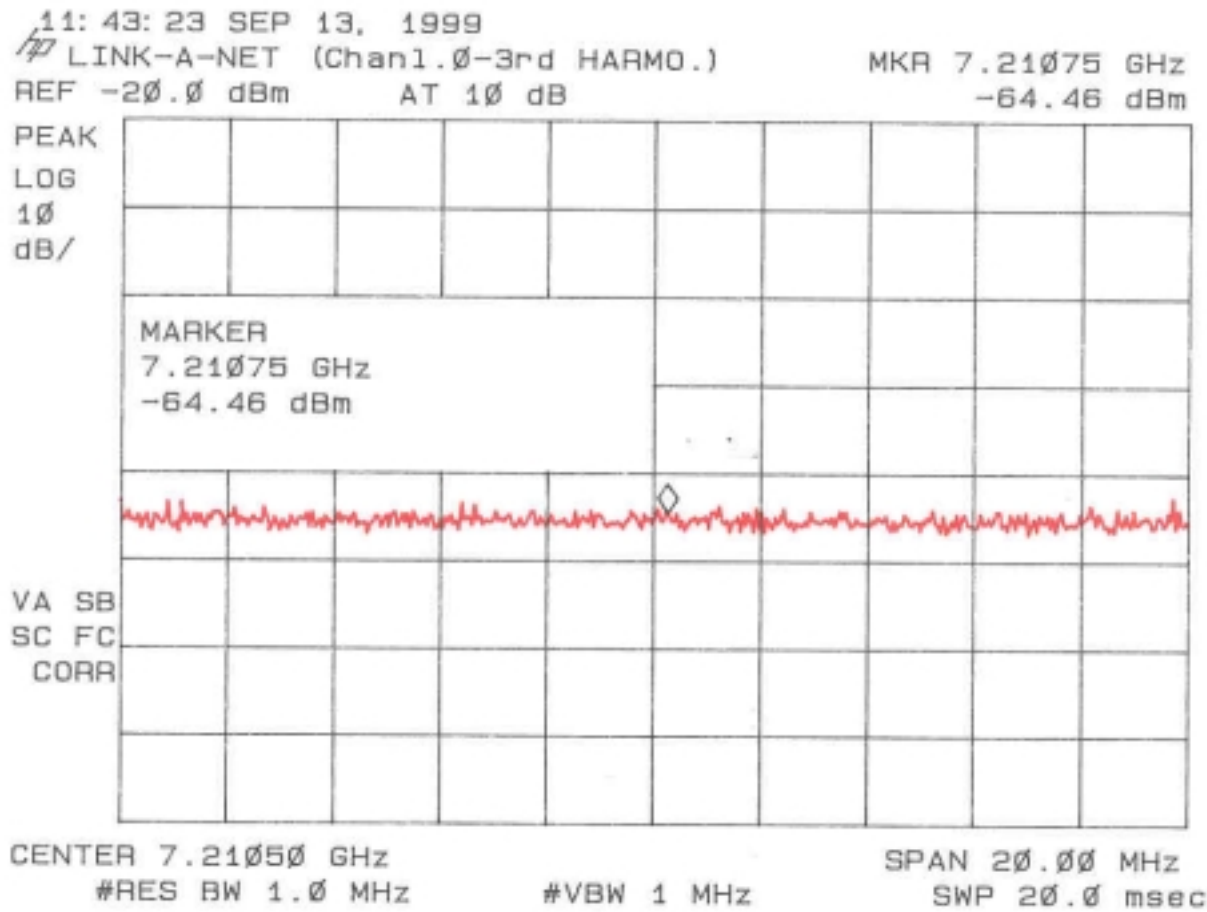


Figure 5b  
Peak Radiated Spurious Emission 15.247(c) Low





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

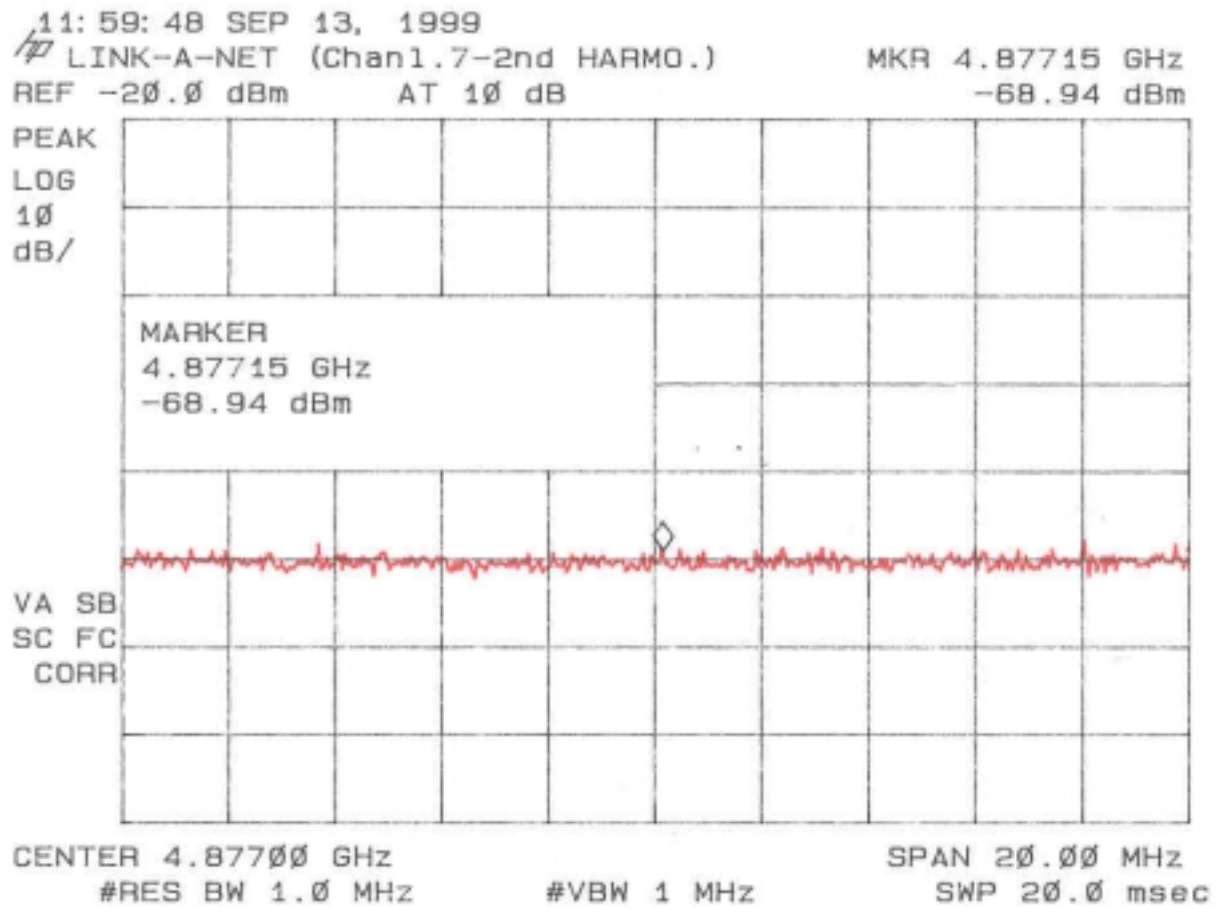


Figure 5d  
Peak Radiated Spurious Emission 15.247(c) Mid

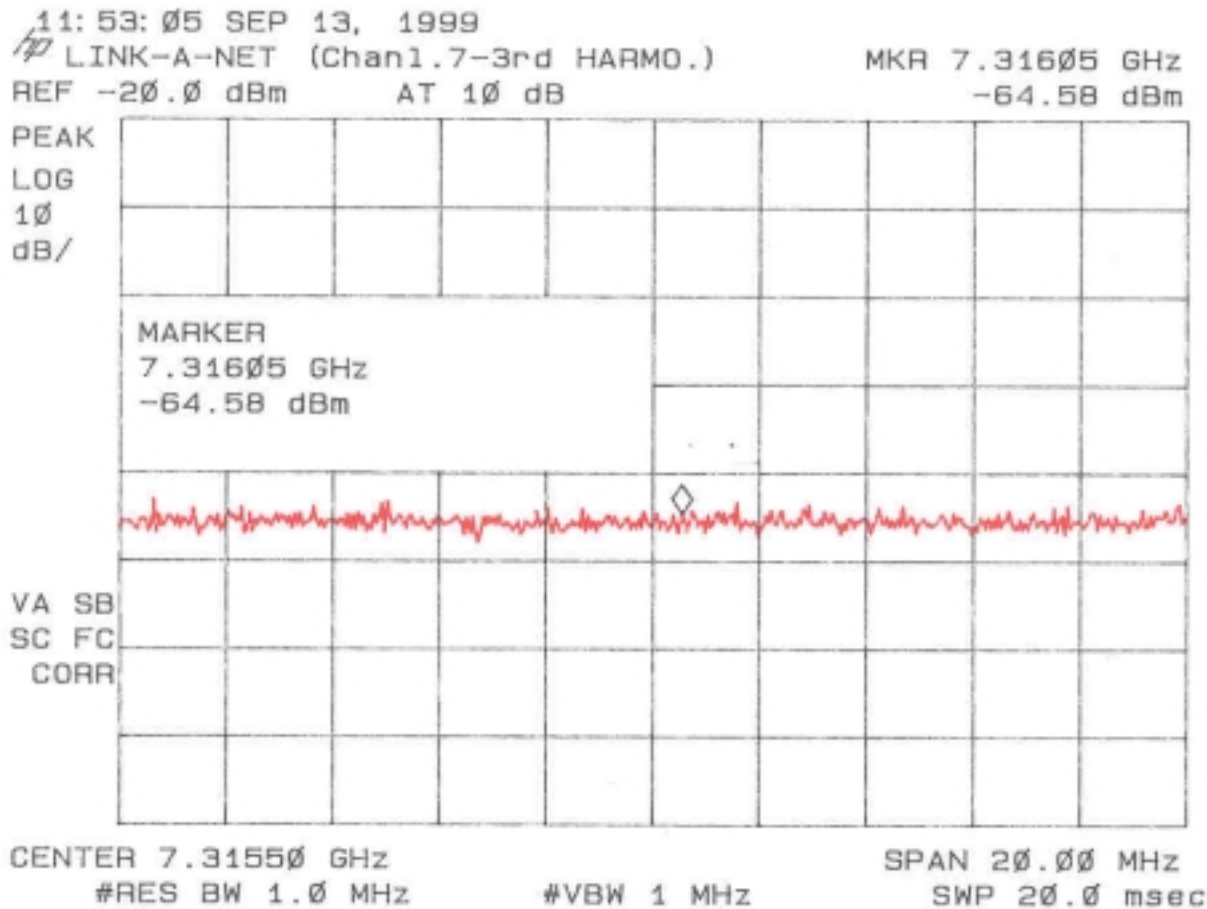


Figure 5e  
Peak Radiated Spurious Emission 15.247(c) High

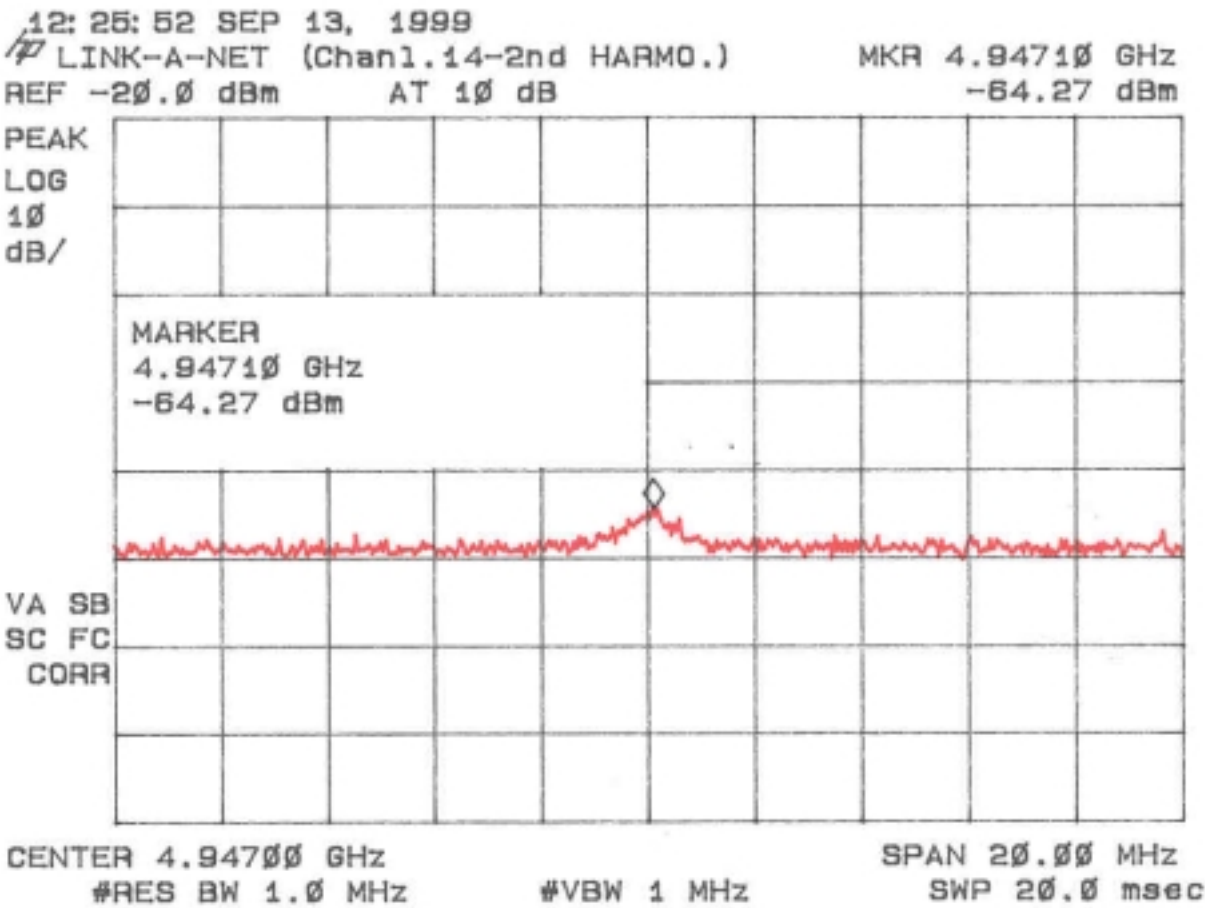
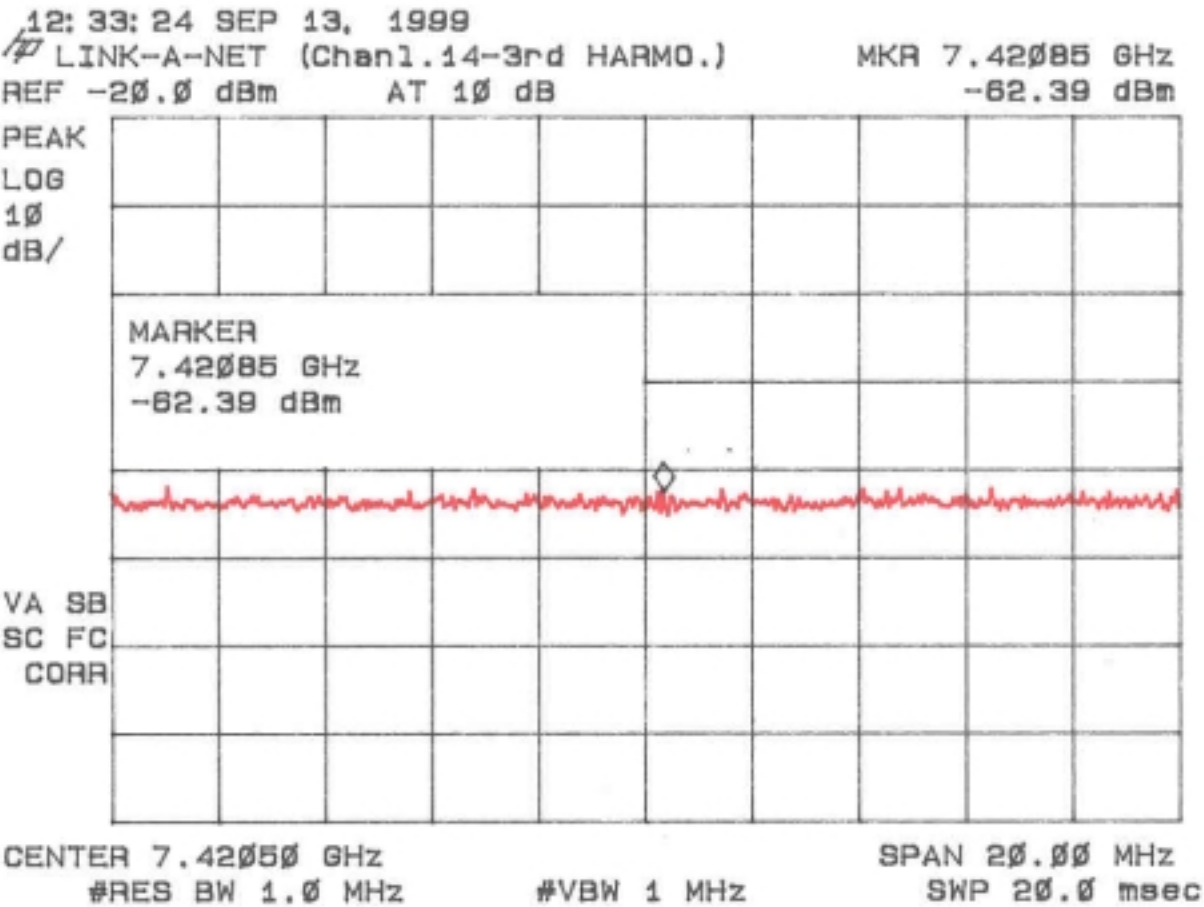


Figure 5f  
Peak Radiated Spurious Emission 15.247(c) High



**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	Mclk (Hz)	Chip rate (MHz)	TX burst (ms)	TDD (ms)	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

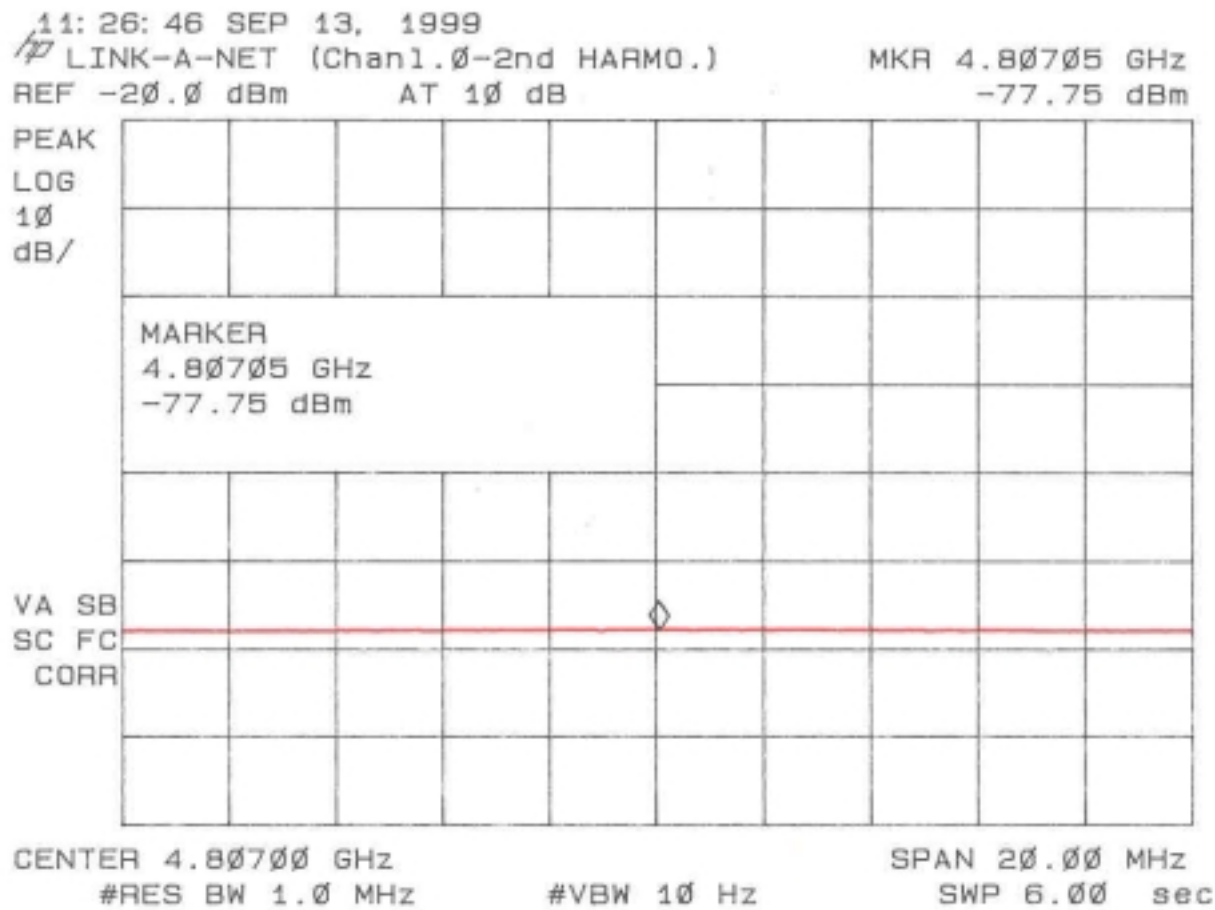


Figure 6b  
Average Radiated Spurious Emission 15.247(c) Low

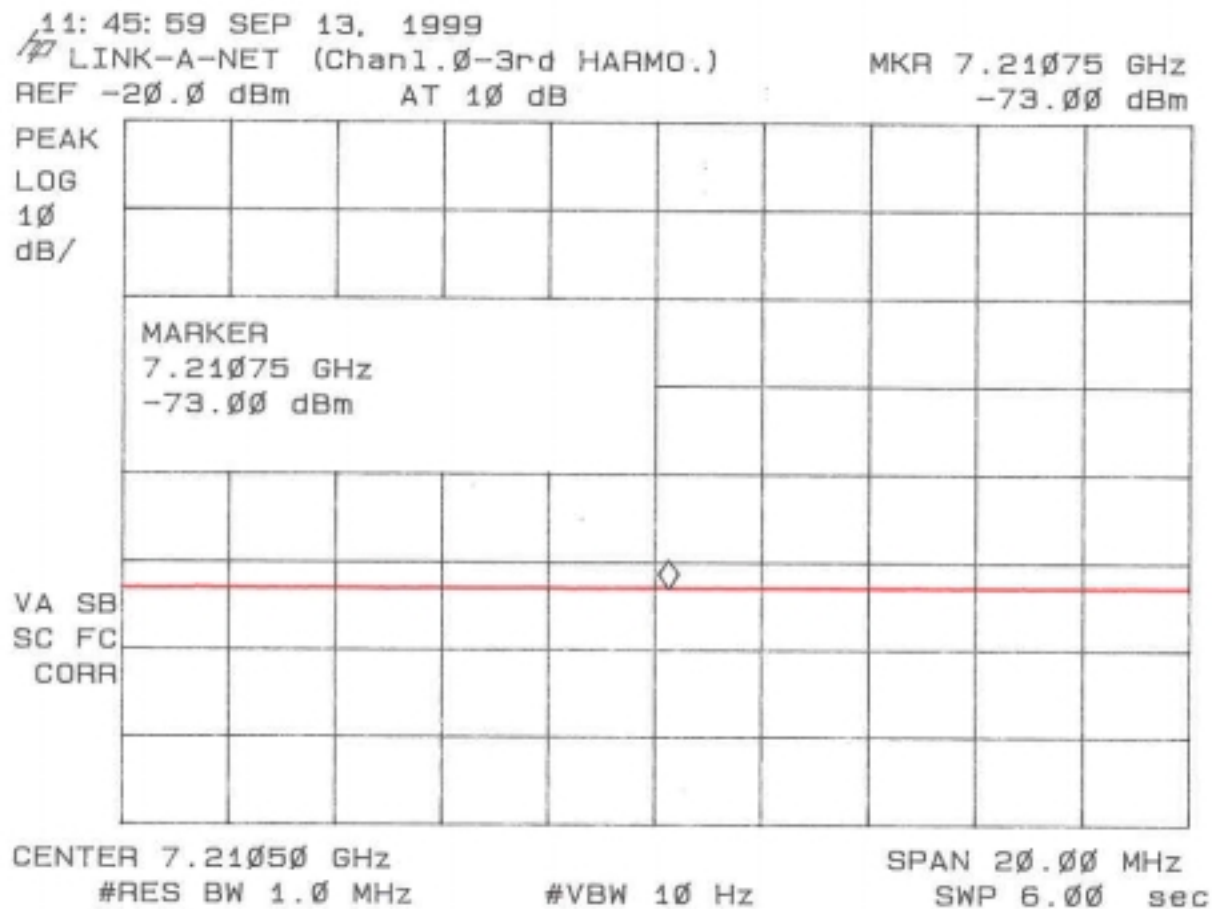




Figure 6c  
Average Radiated Spurious Emission 15.247(c) Mid

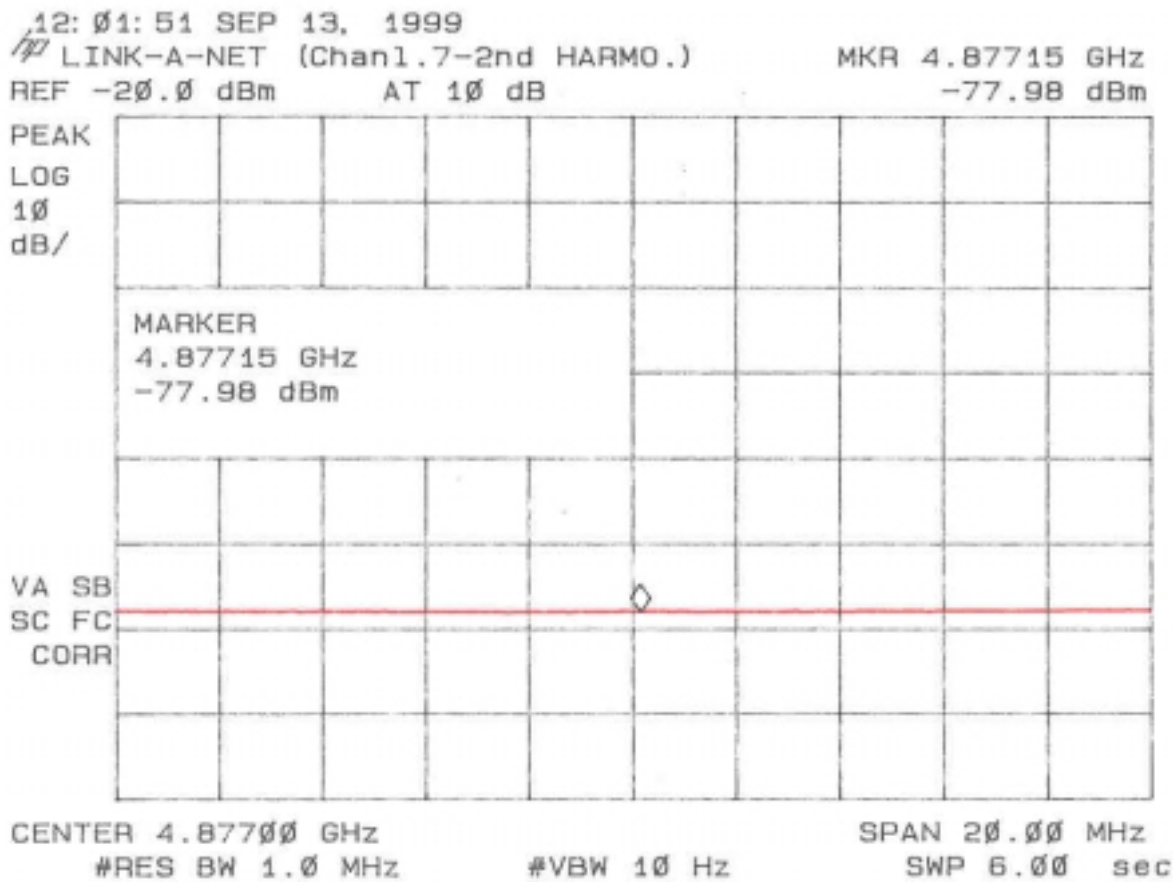


Figure 6d  
Average Radiated Spurious Emission 15.247(c) Mid

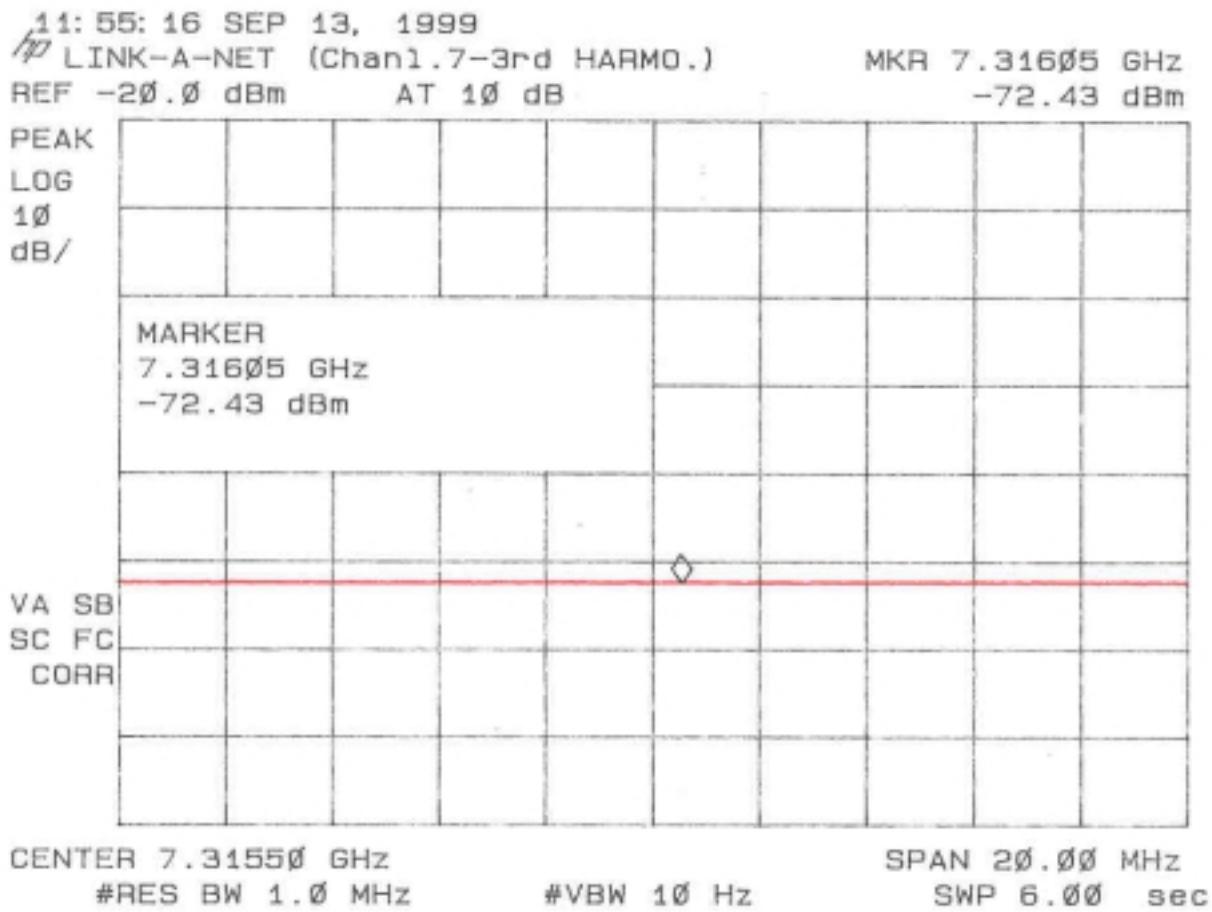


Figure 6e  
Average Radiated Spurious Emission 15.247(c) High

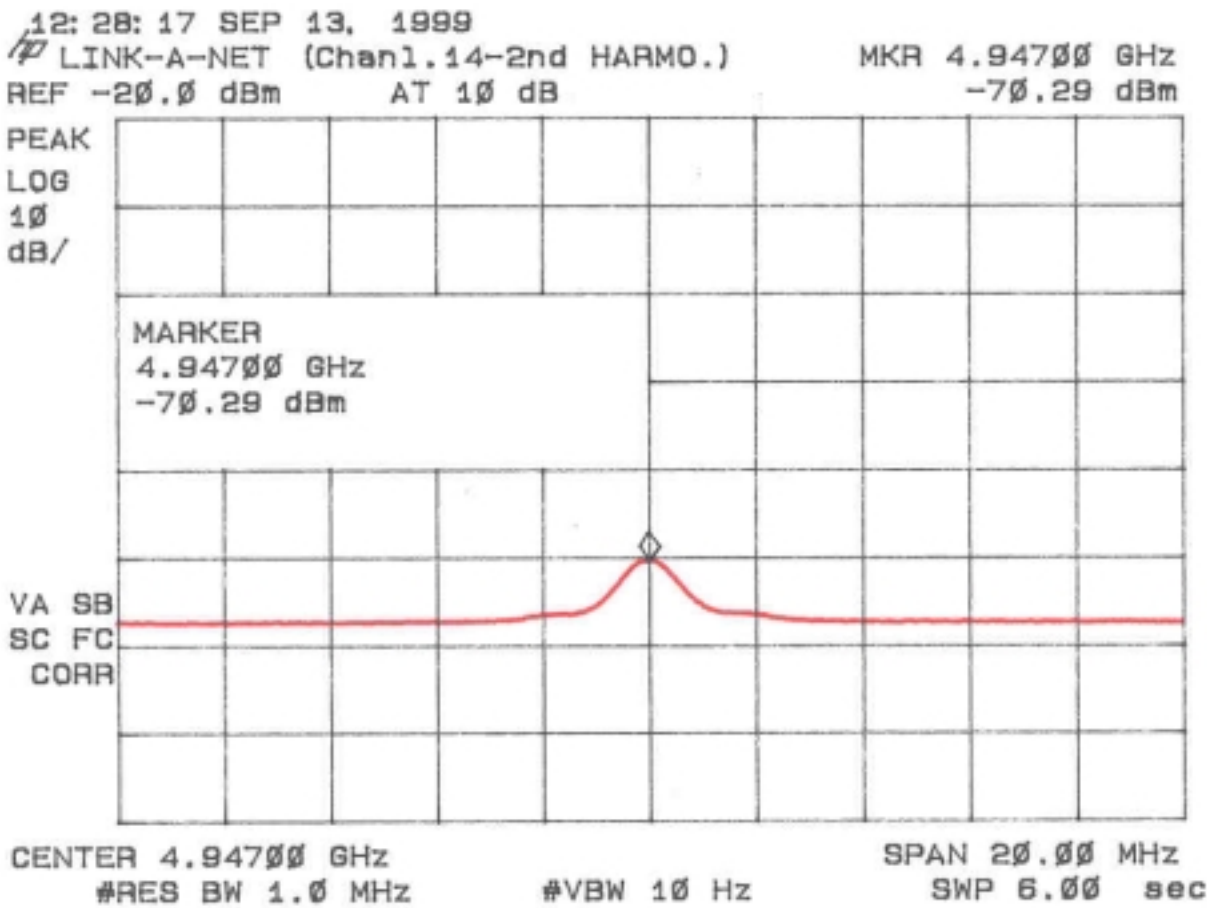
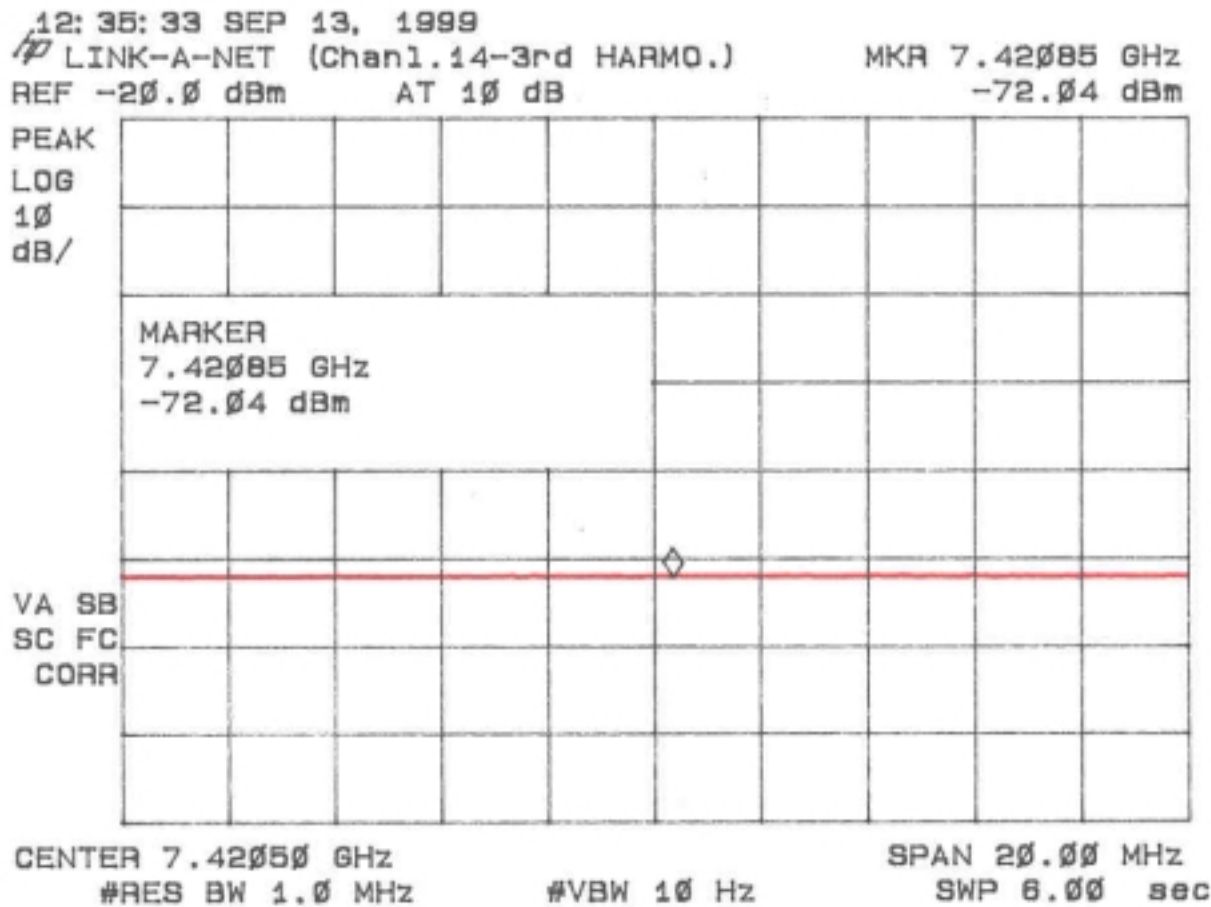


Figure 6f  
Average Radiated Spurious Emission 15.247(c) High



**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