## 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 Ω 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**

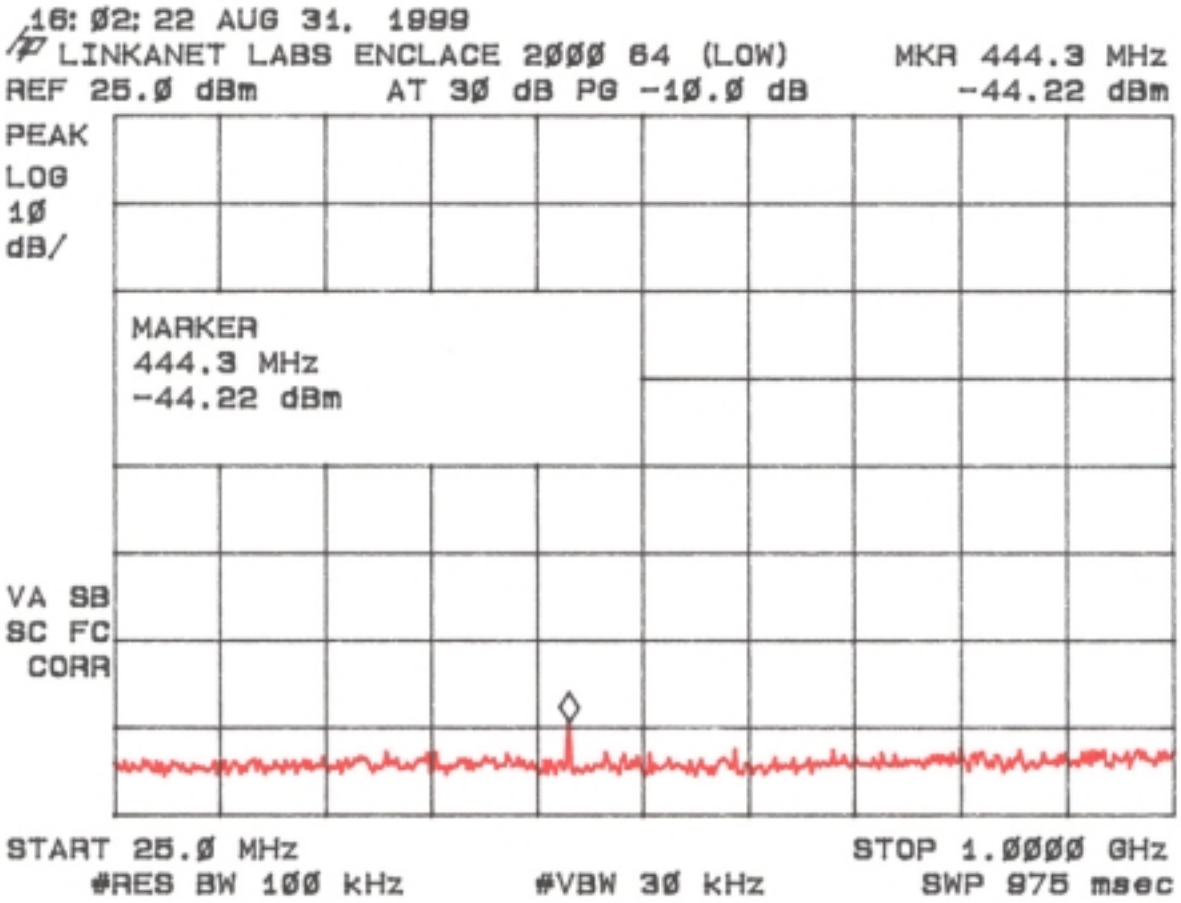


**Figure 4b**
**Antenna Conducted Spurious Emissions 5.247(c) Low**

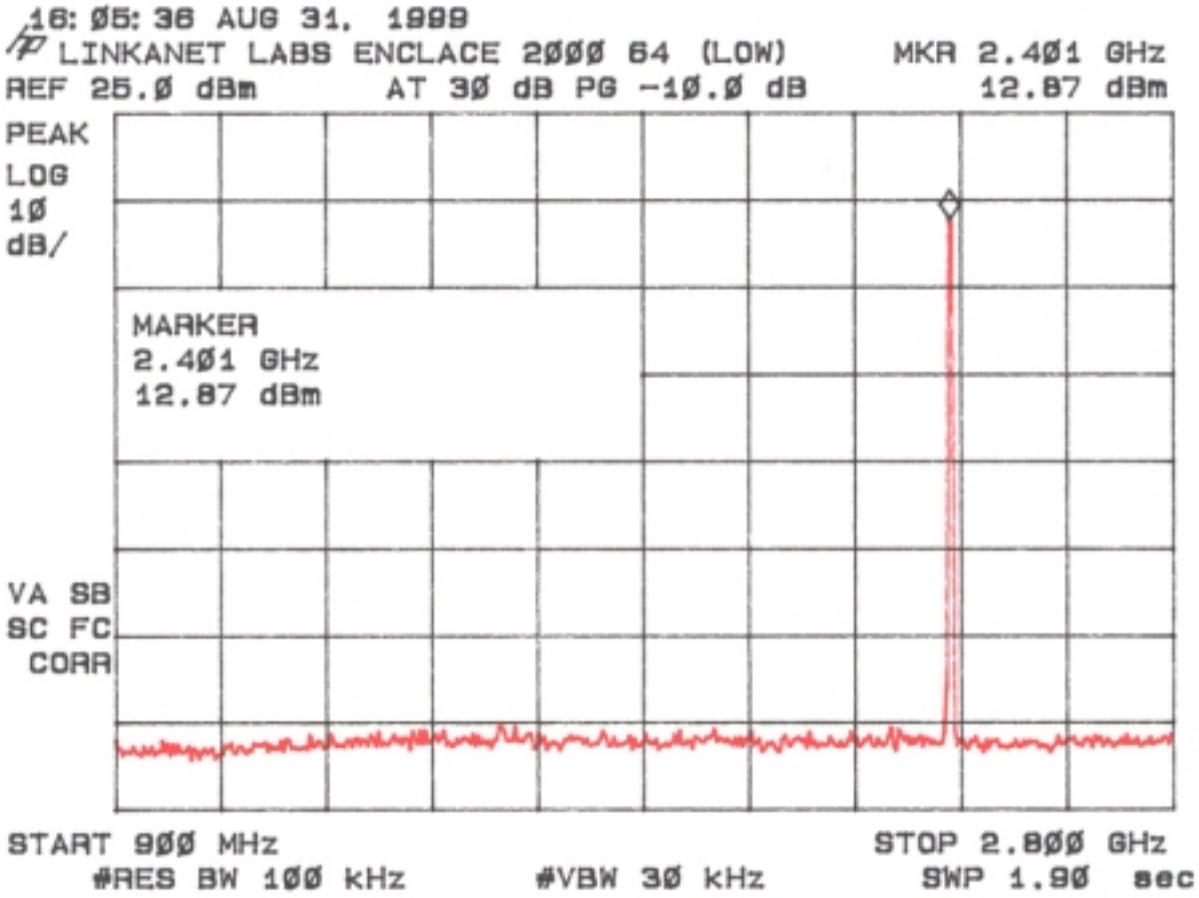


**Figure 4c**
**Antenna Conducted Spurious Emissions 15.247(c) Low**

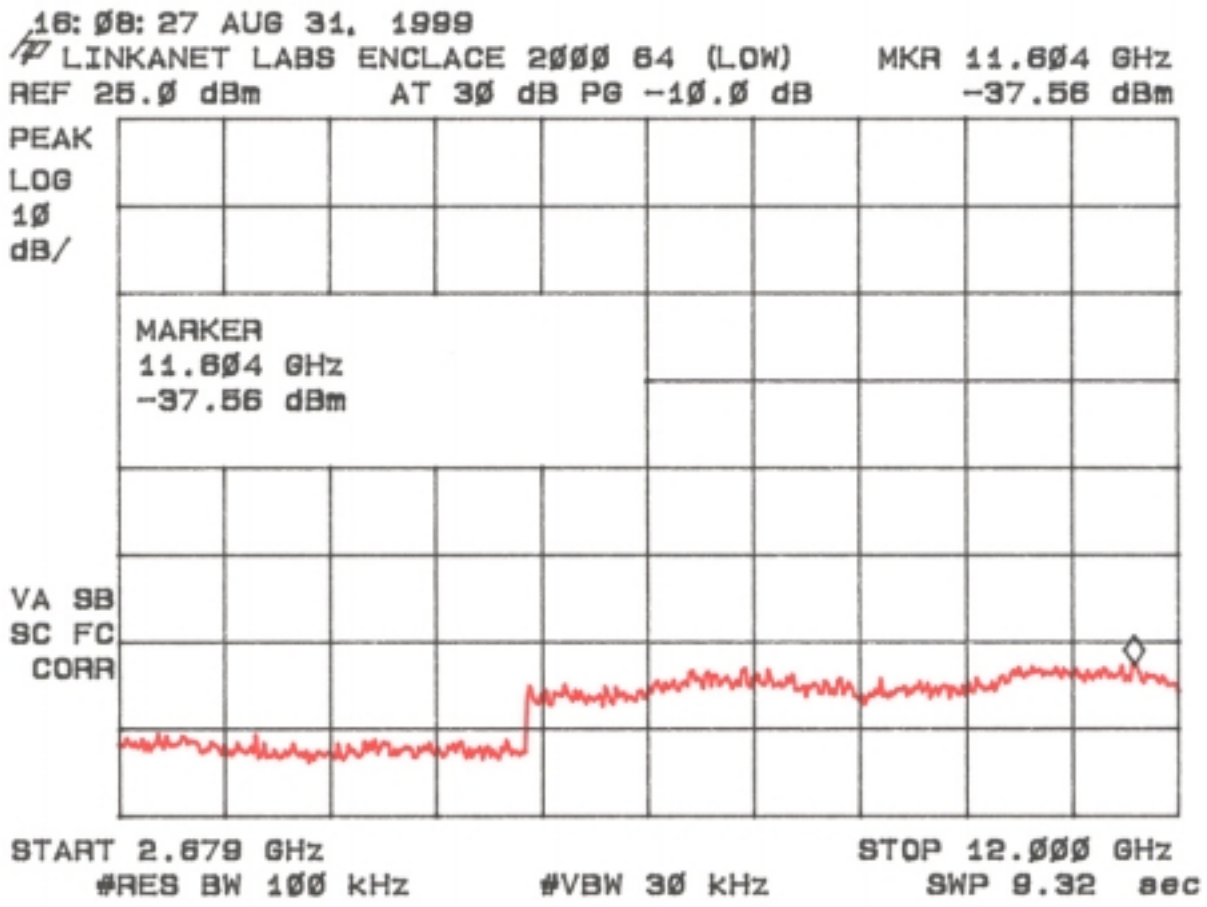


**Figure 4d**
**Antenna Conducted Spurious Emissions 15.247(c) Low**

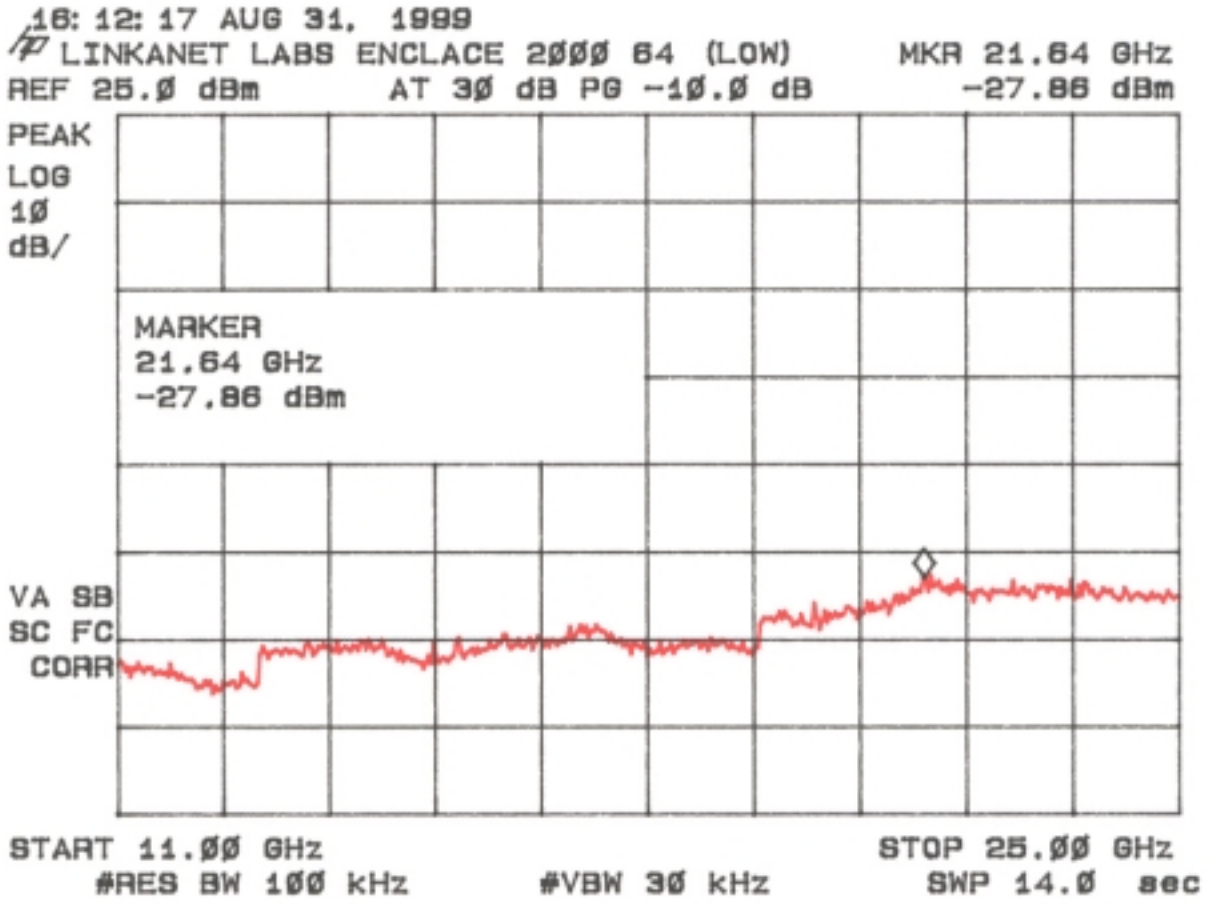


**Figure 4e**
**Antenna Conducted Spurious Emissions 15.247(c) Mid**

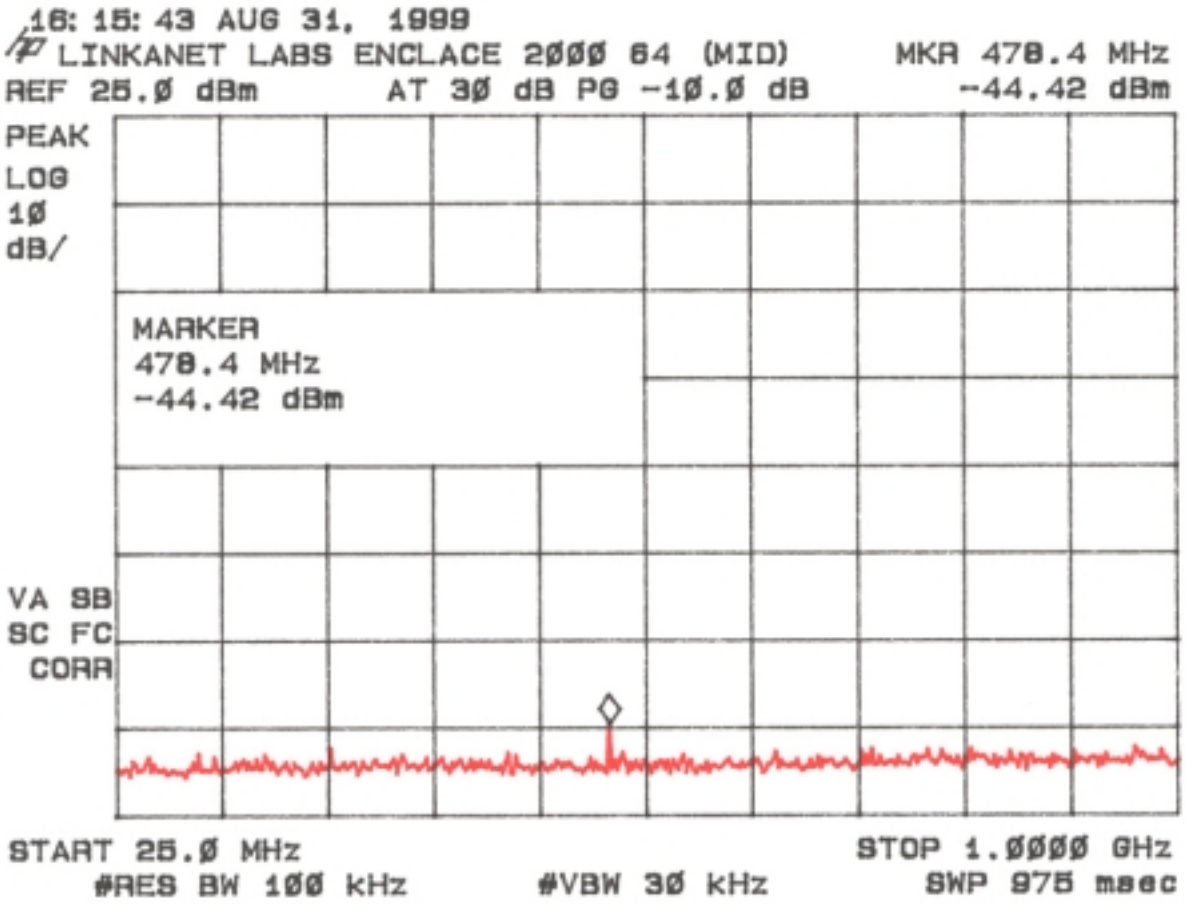


**Figure 4f**
**Antenna Conducted Spurious Emissions 15.247(c) Mid**

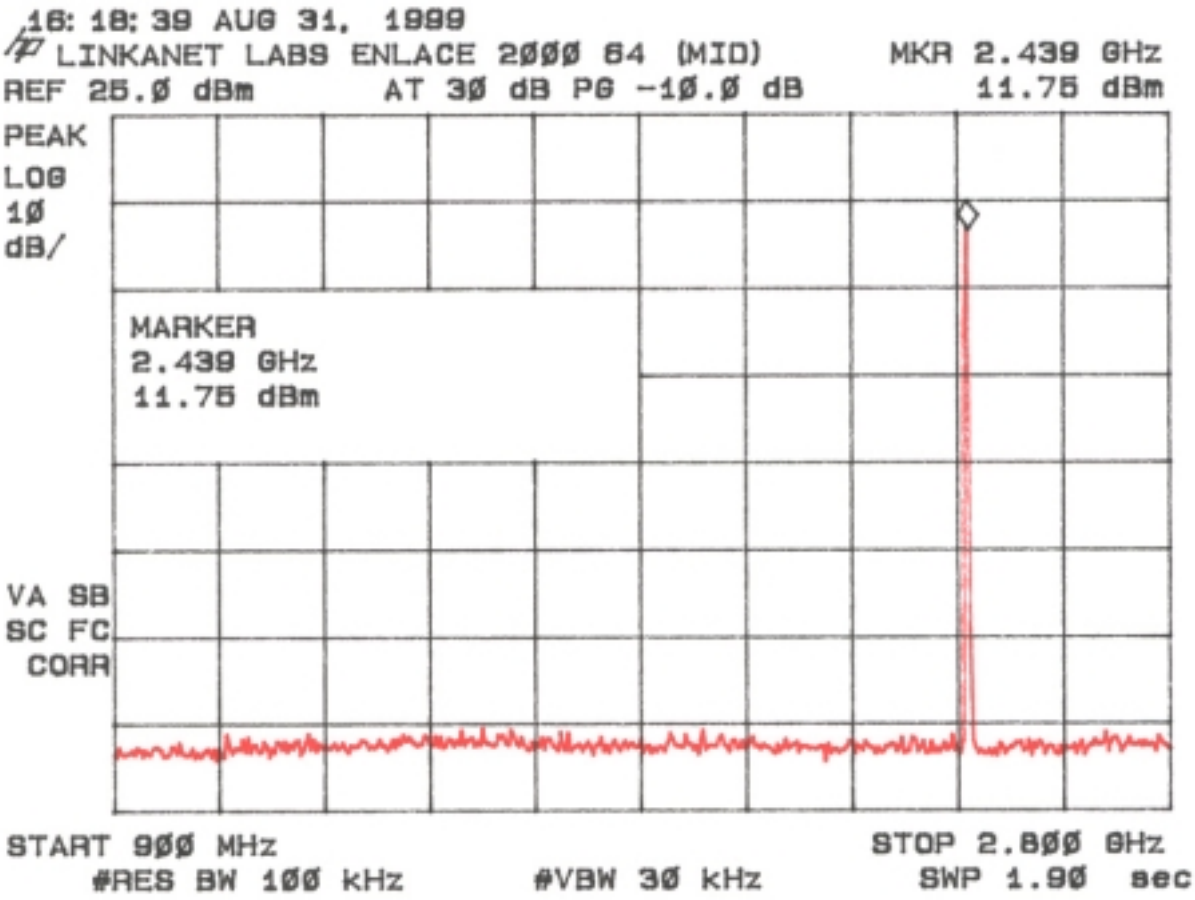


**Figure 4g**
**Antenna Conducted Spurious Emissions 15.247(c) Mid**

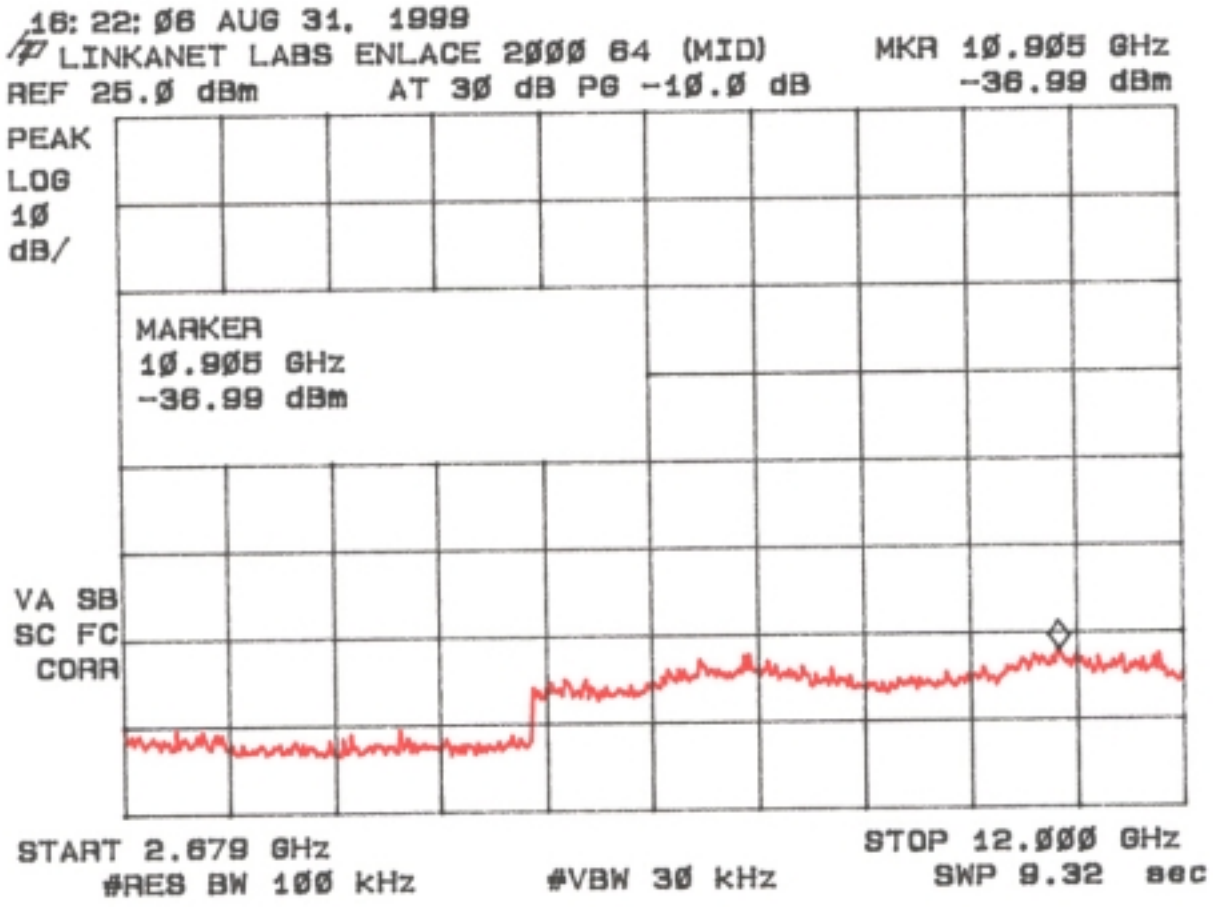


**Figure 4h**
**Antenna Conducted Spurious Emissions 15.247(c) Mid**

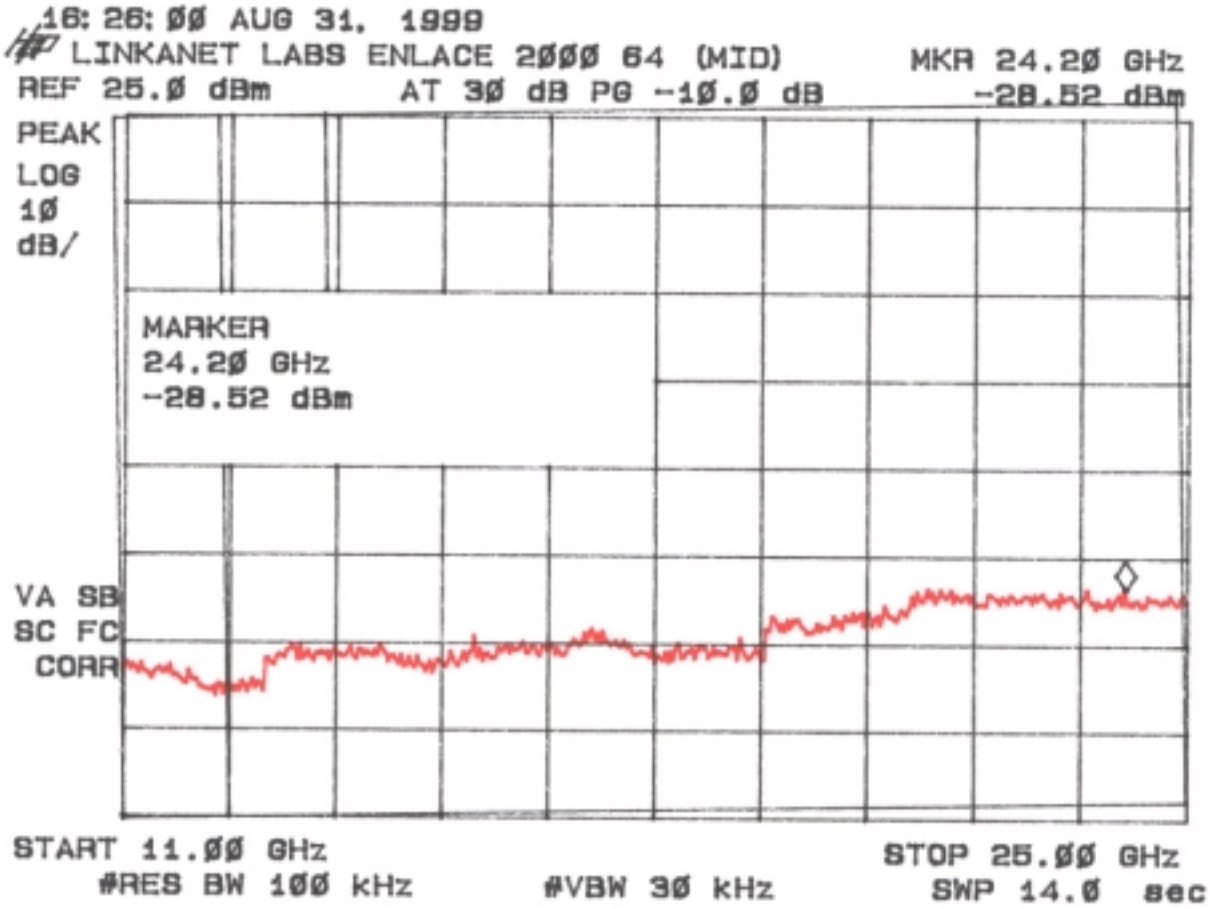


**Figure 4i**
**Antenna Conducted Spurious Emissions 15.247(c) High**

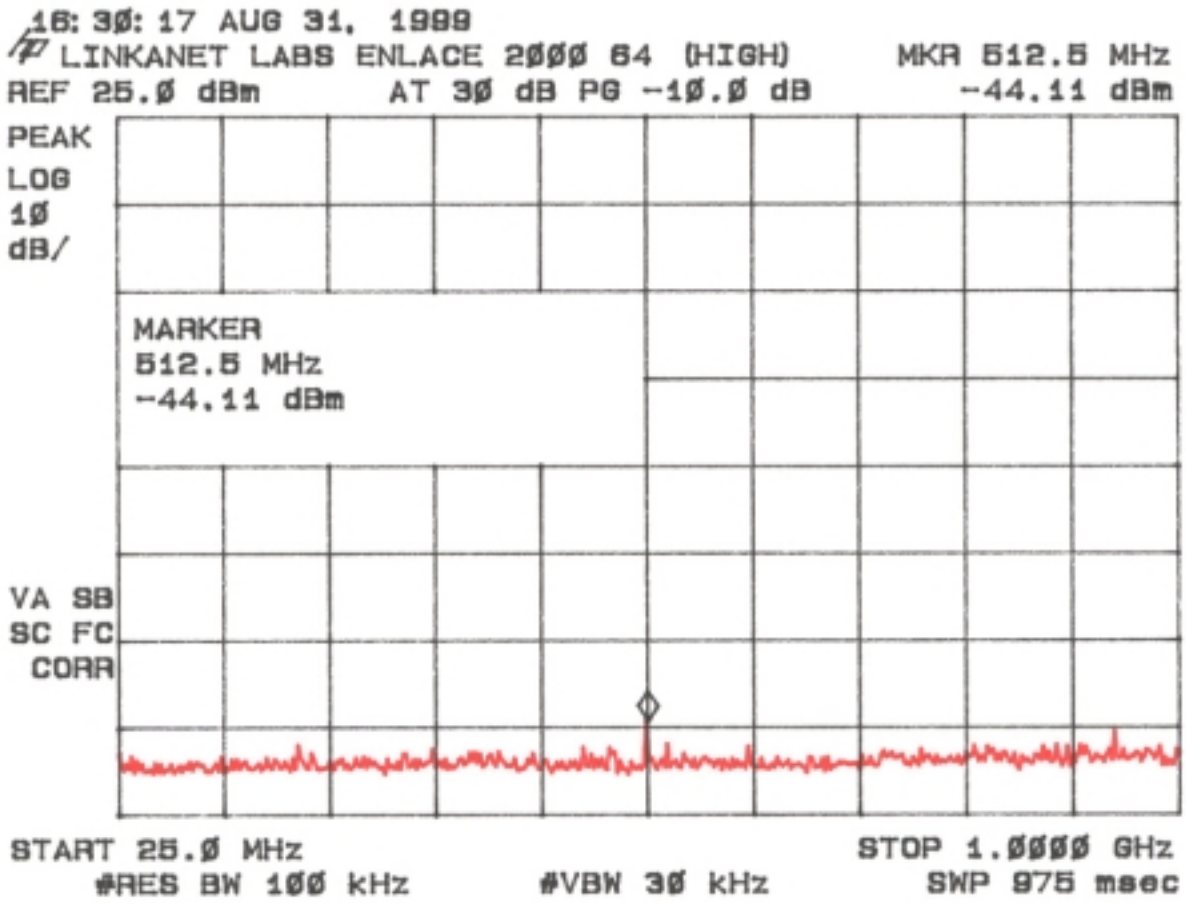


**Figure 4j**
**Antenna Conducted Spurious Emissions 15.247(c) High**

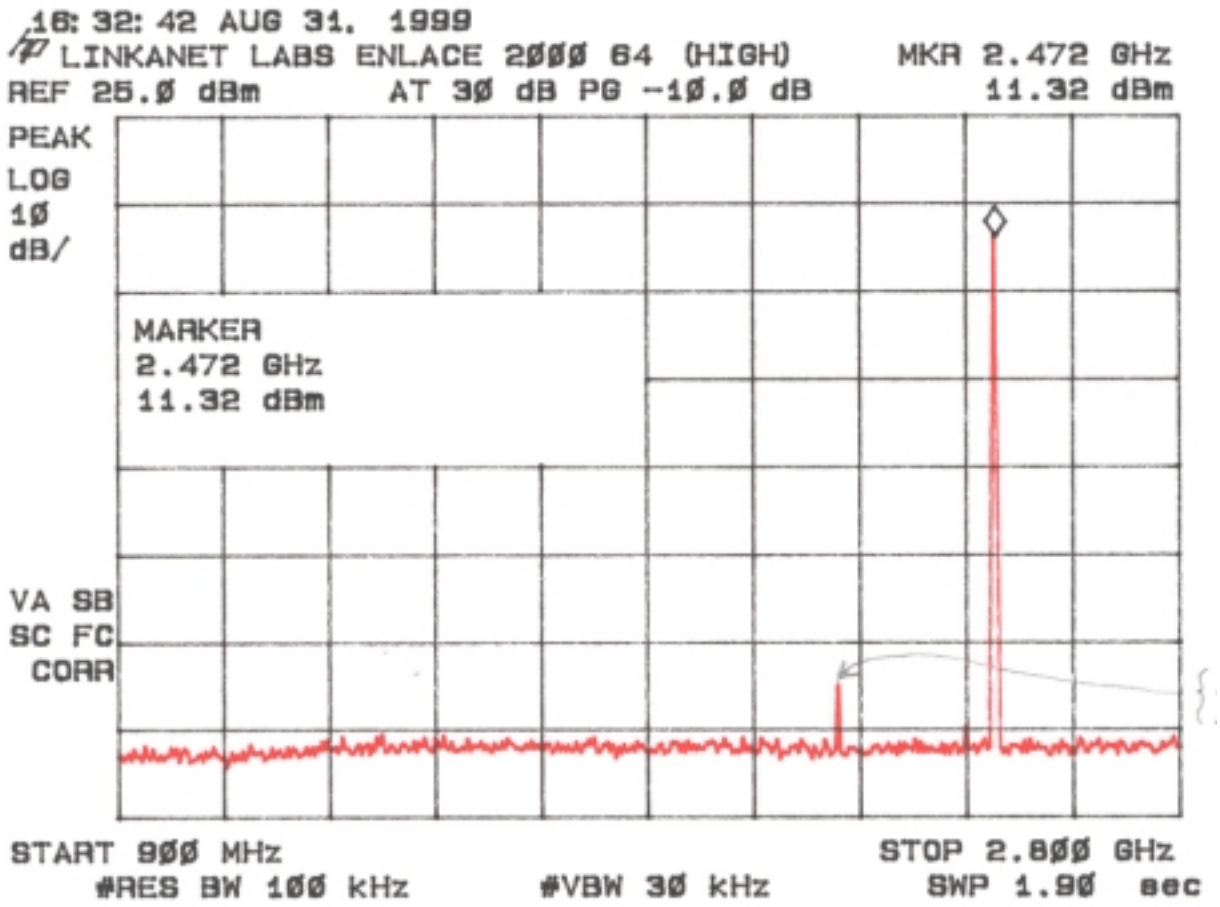


**Figure 4k**
**Antenna Conducted Spurious Emissions 15.247(c) High**

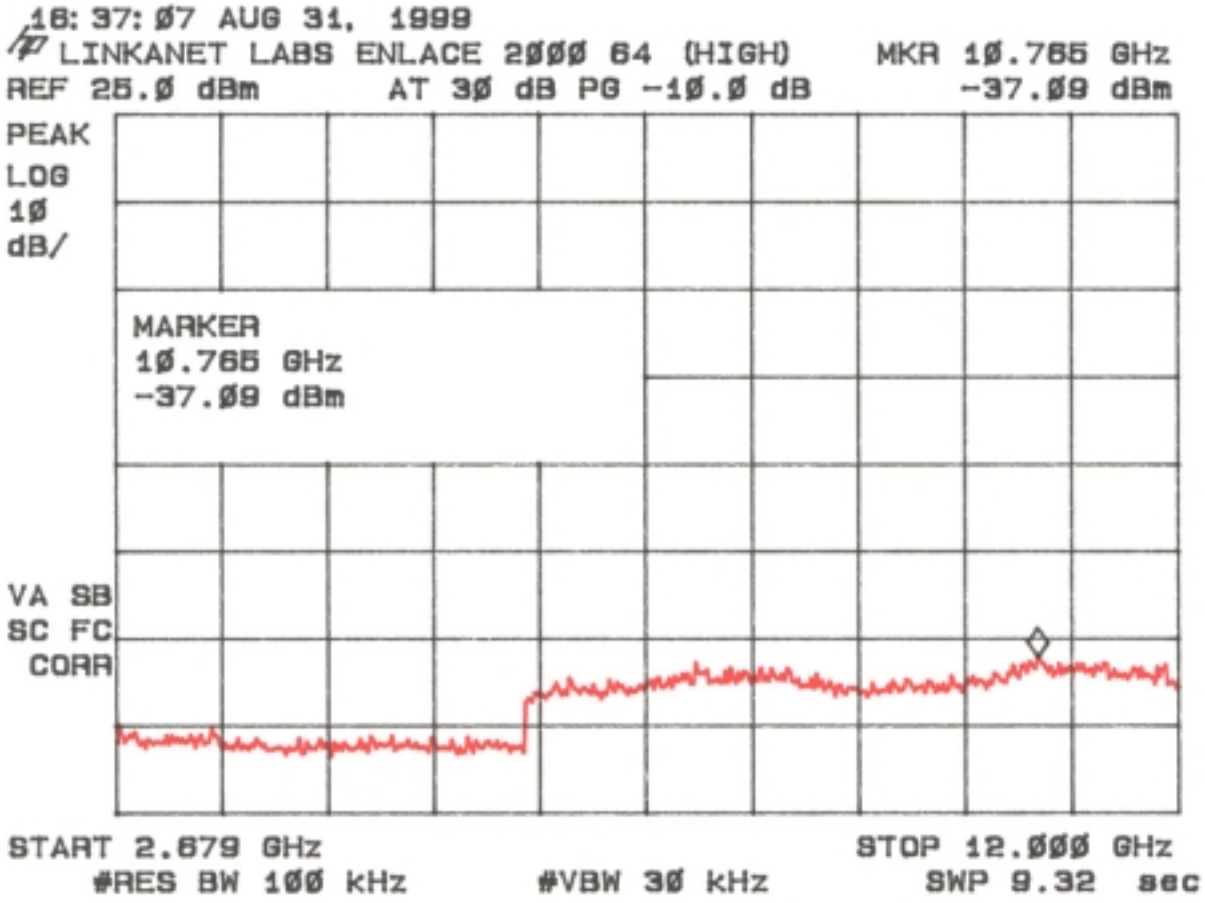
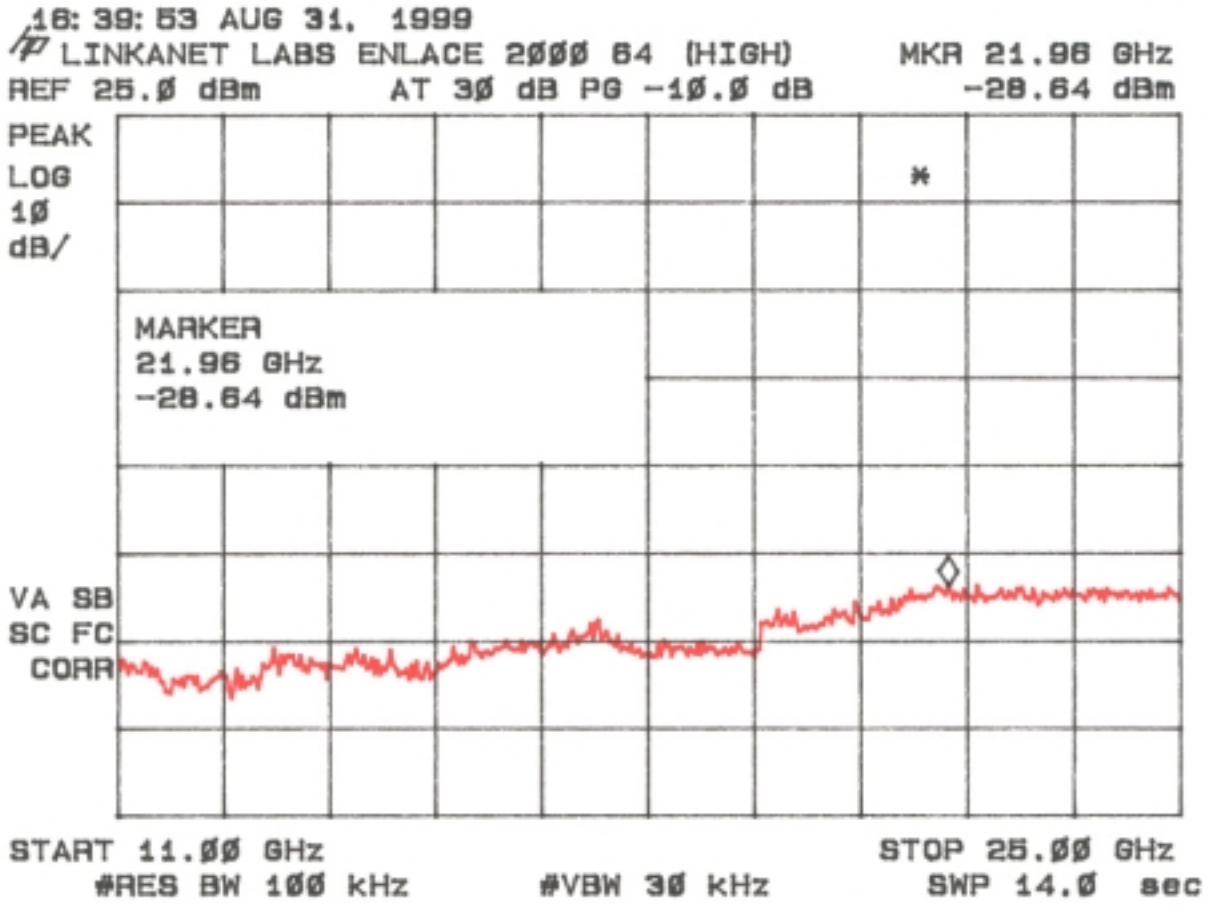


**Figure 4l**
**Antenna Conducted Spurious Emissions 15.247(c) High**



## 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**

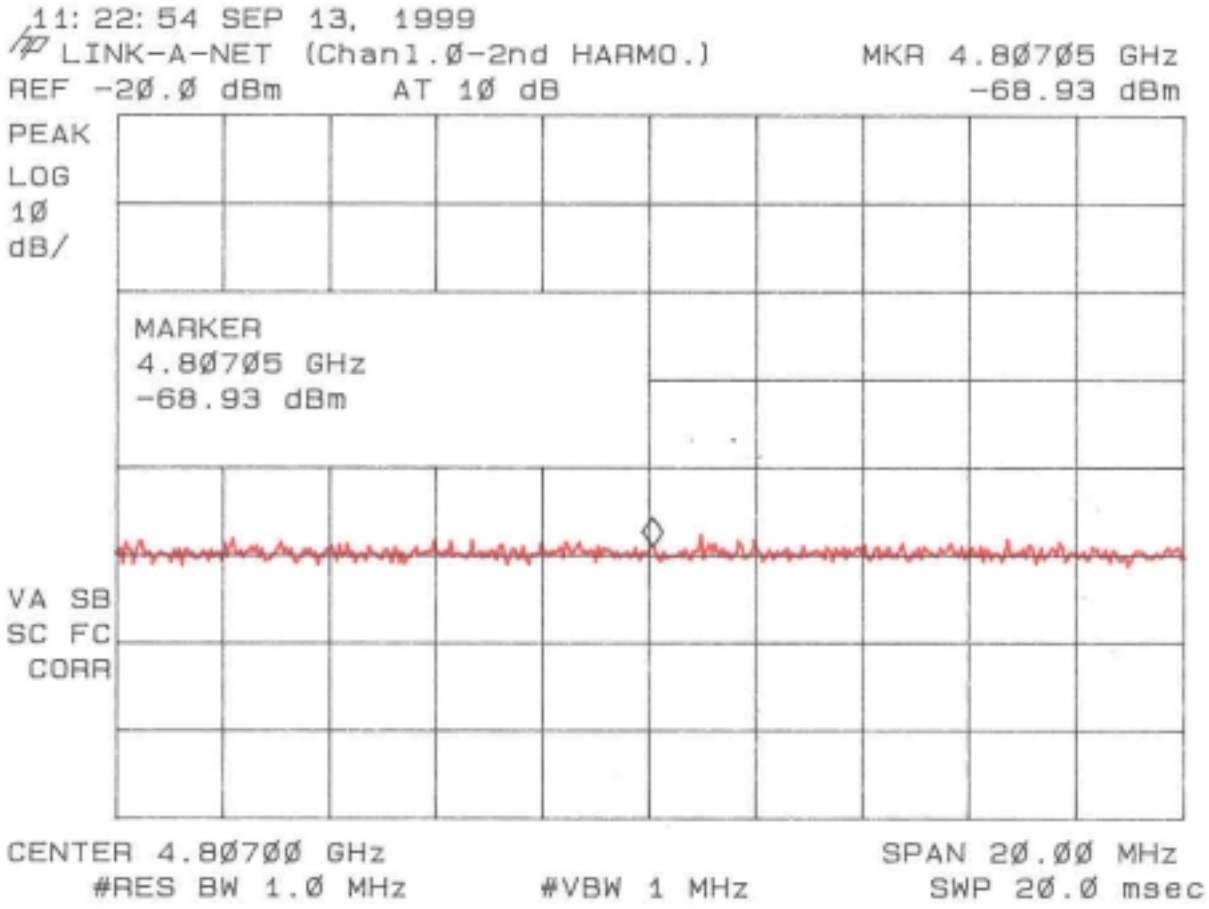


**Figure 5b**
**Peak Radiated Spurious Emission 15.247(c) Low**

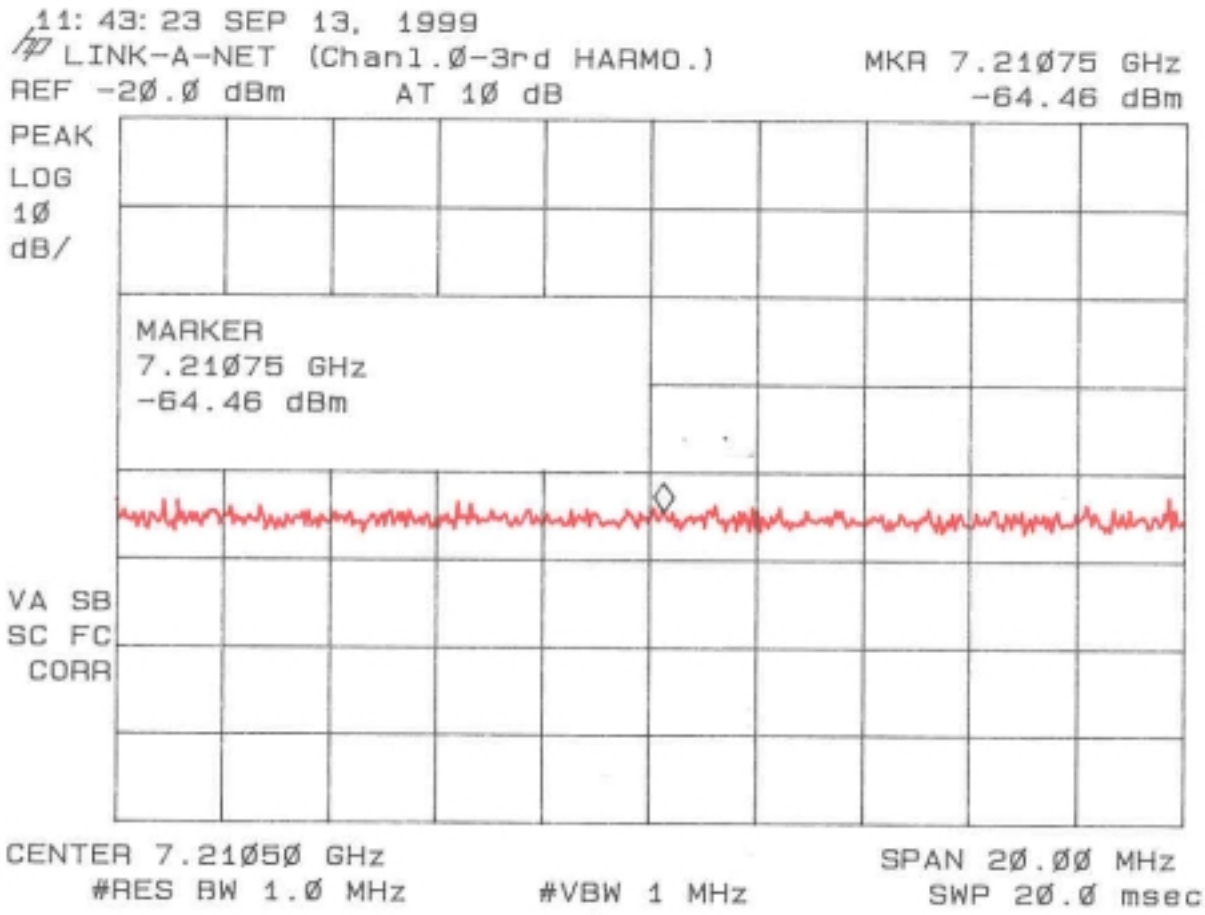


**Figure 5c**
**Peak Radiated Spurious Emission 15.247(c) Mid**

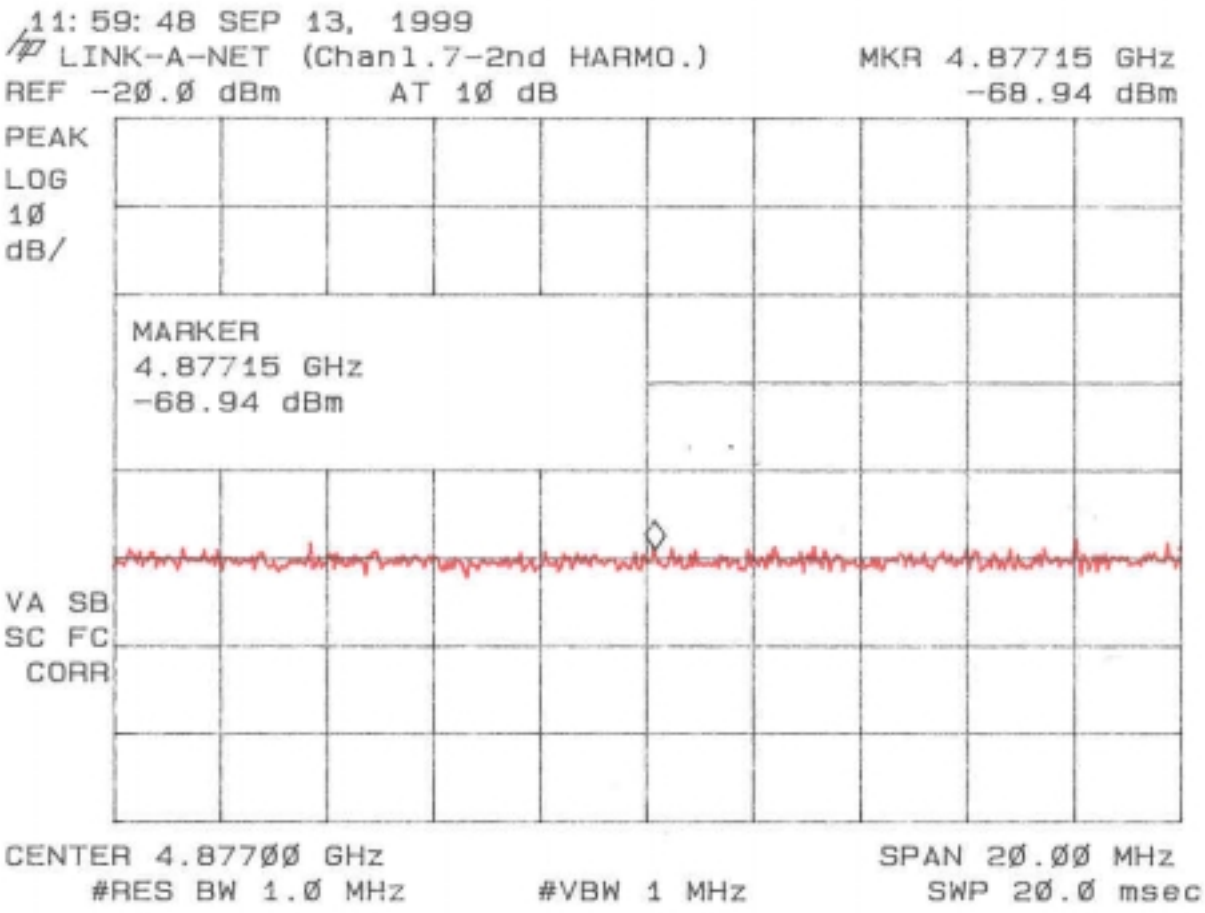


**Figure 5d**
**Peak Radiated Spurious Emission 15.247(c) Mid**

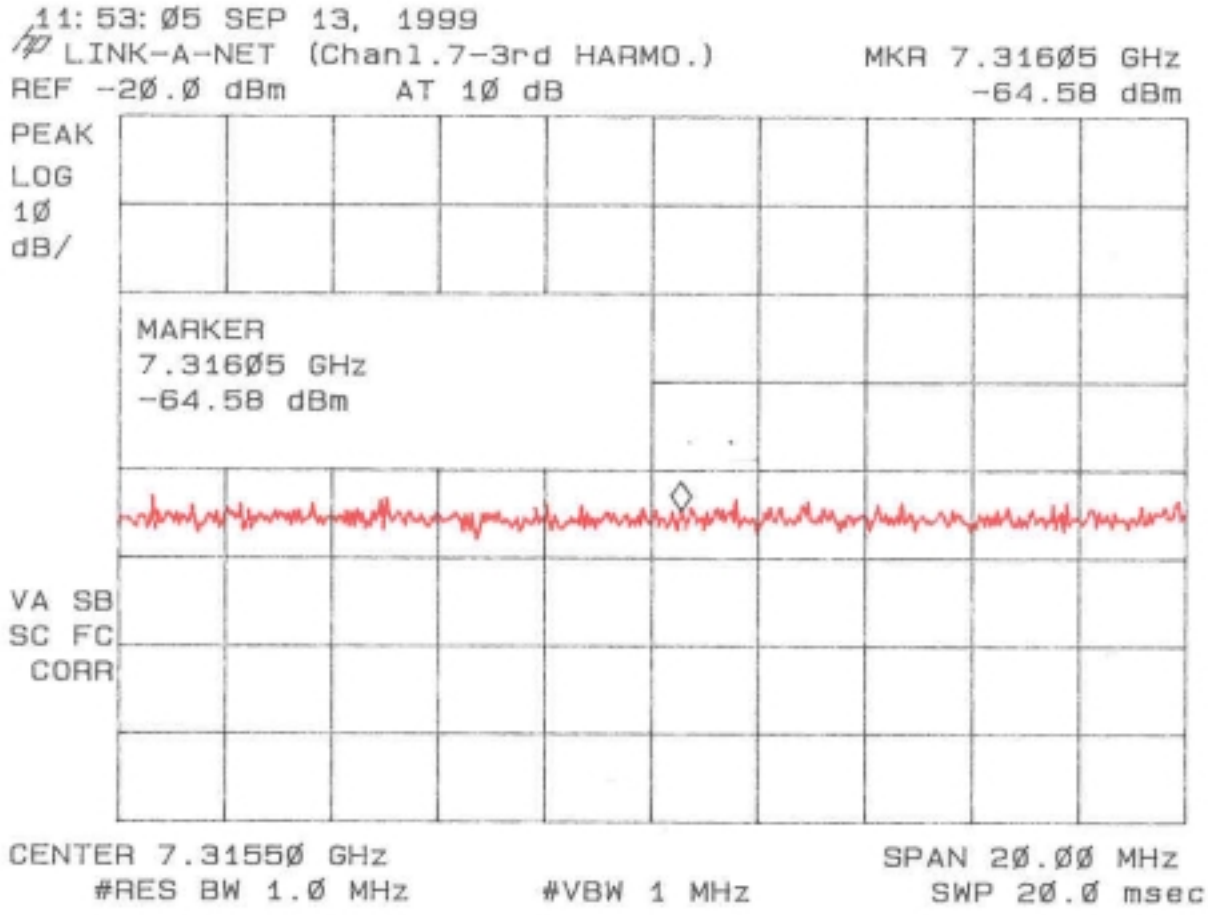


**Figure 5e**
**Peak Radiated Spurious Emission 15.247(c) High**

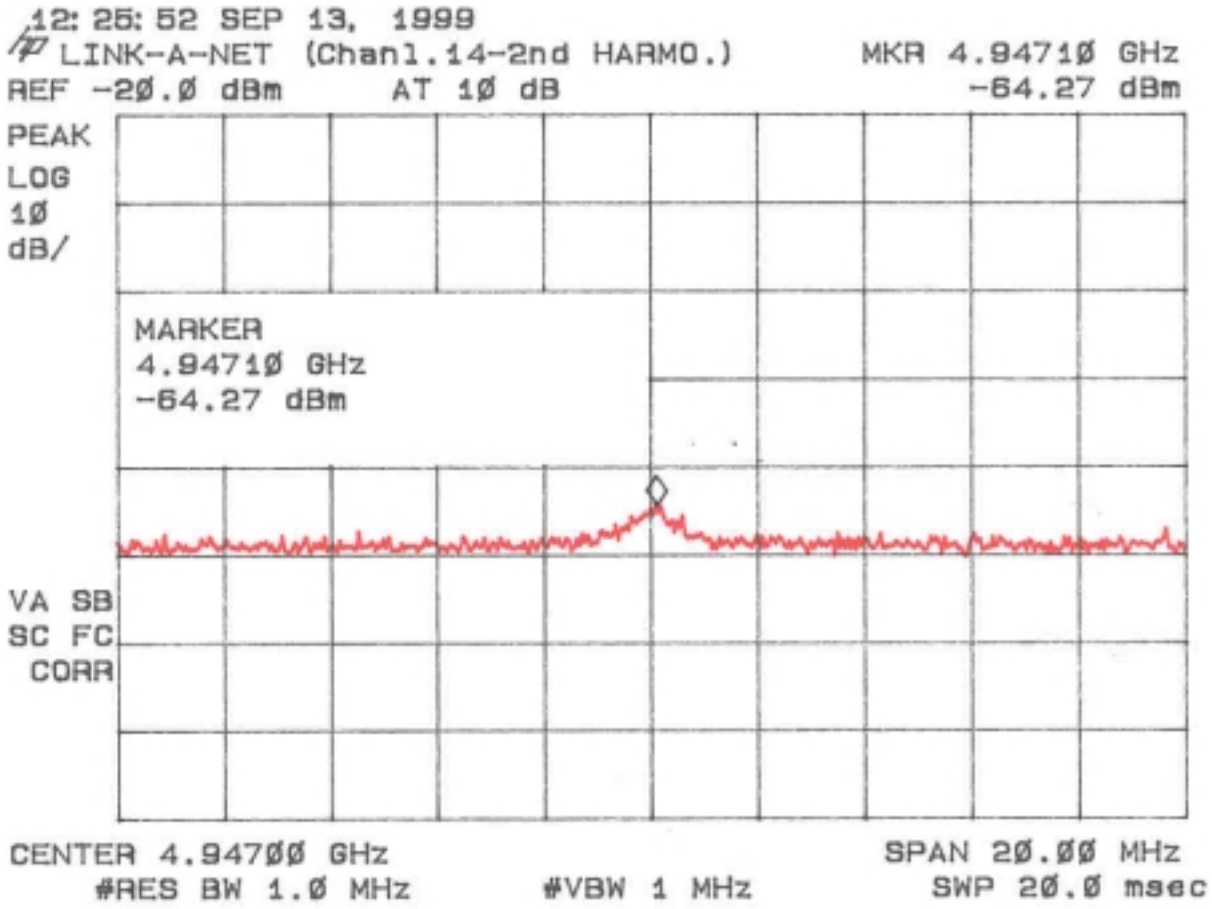


**Figure 5f**
**Peak Radiated Spurious Emission 15.247(c) High**

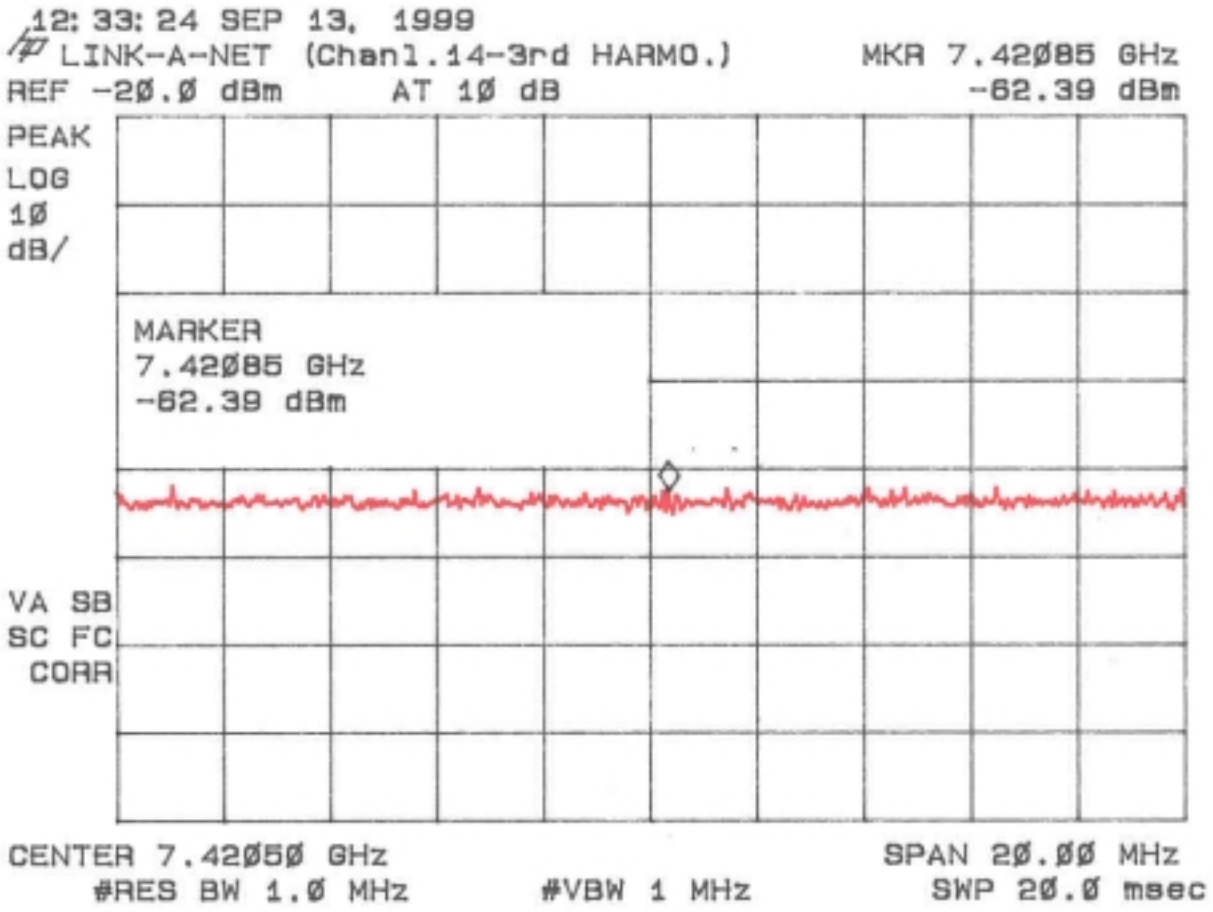


**TABLE 4a PEAK RADIATED SPURIOUS EMISSIONS (Low)**

| 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**

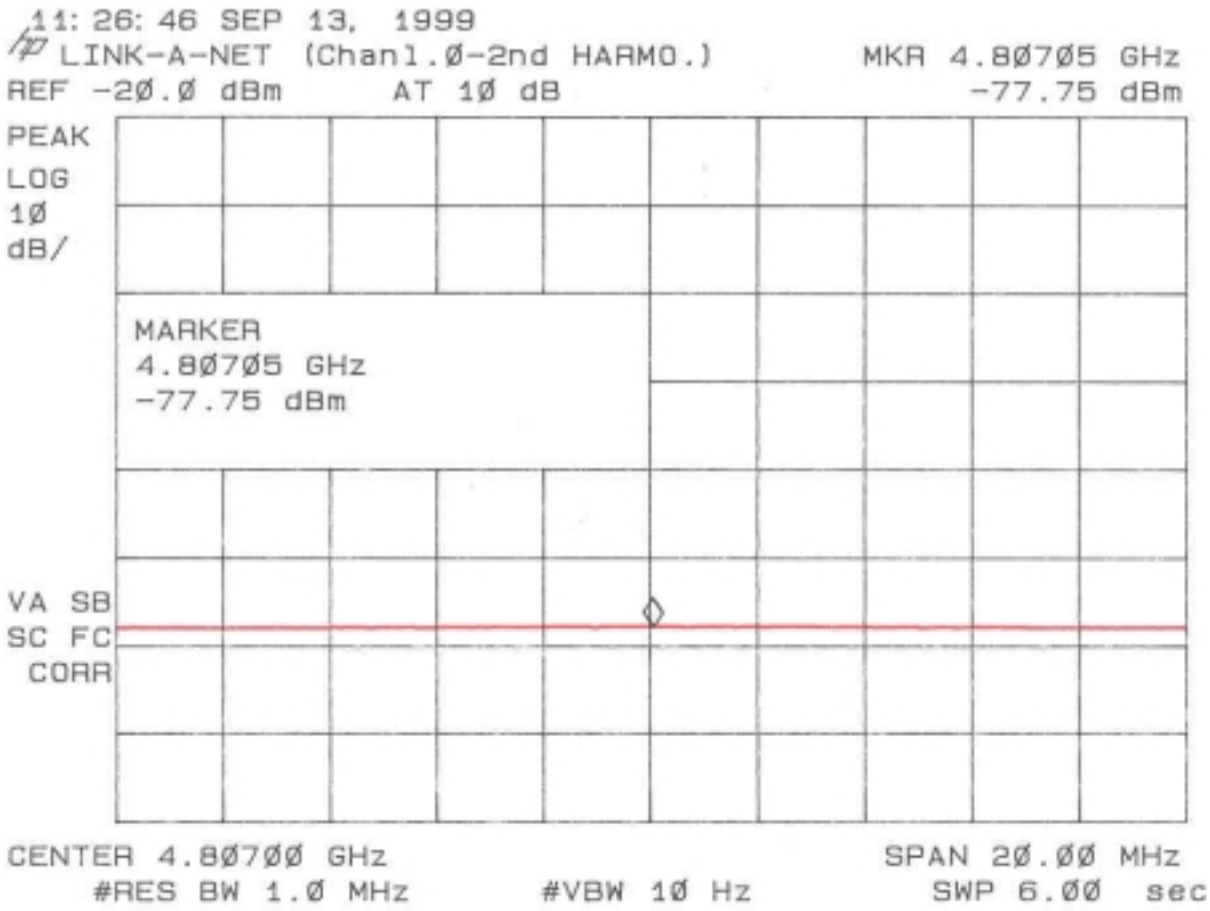


**Figure 6b**
**Average Radiated Spurious Emission 15.247(c) Low**

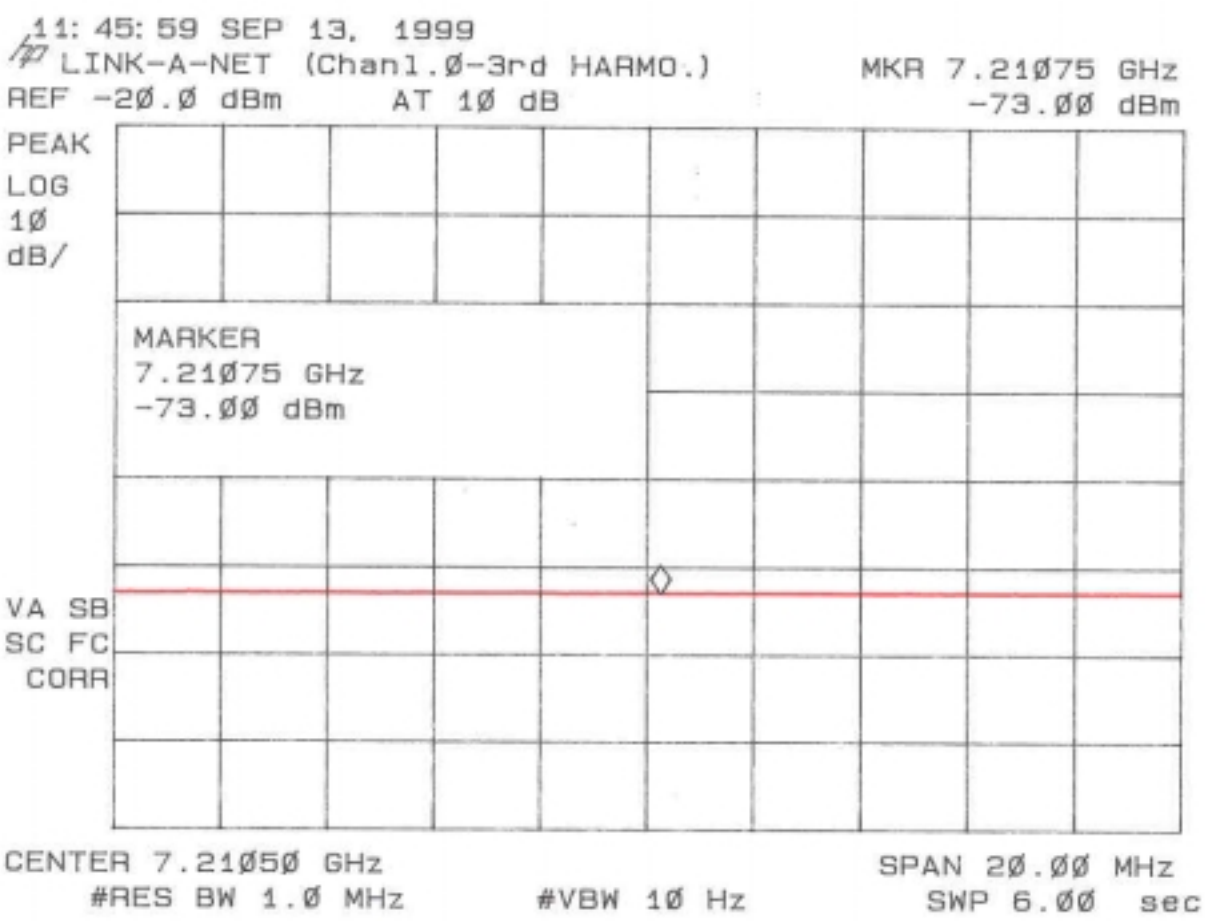


**Figure 6c**
**Average Radiated Spurious Emission 15.247(c) Mid**

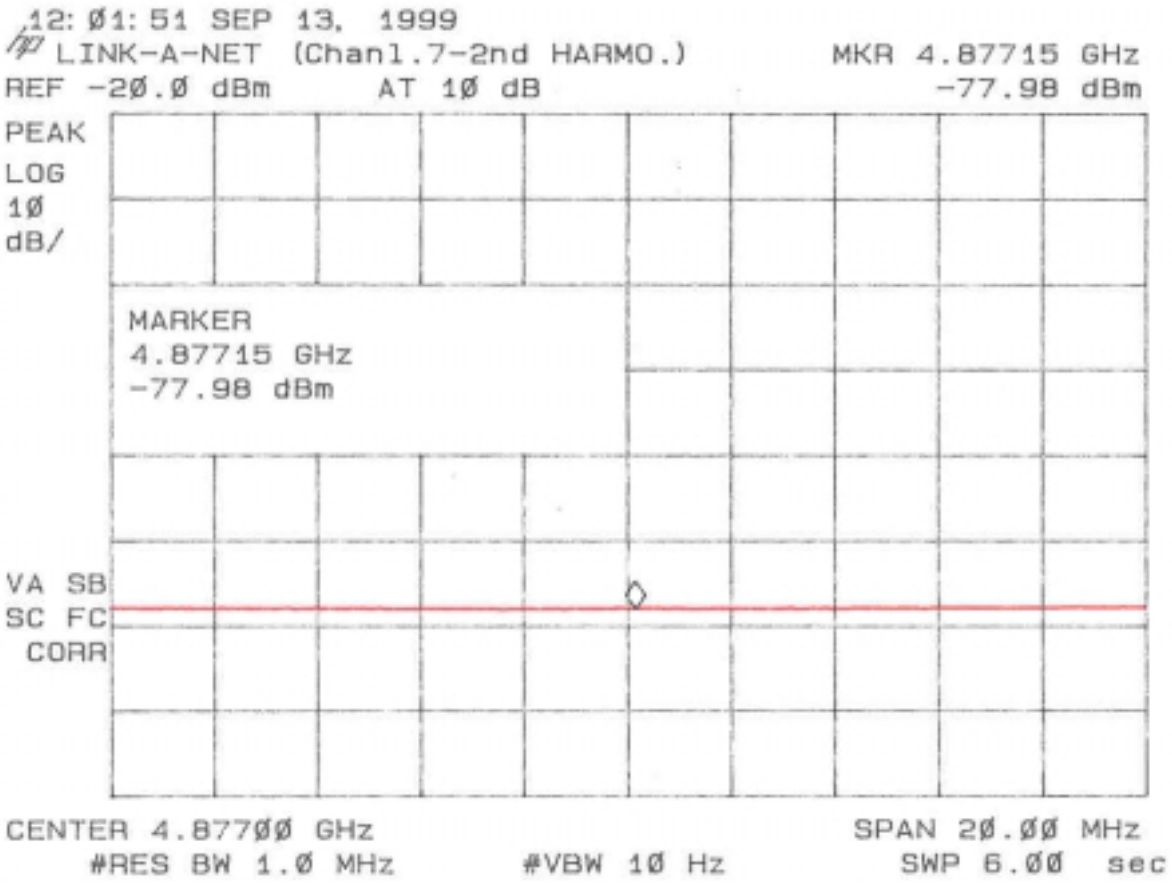


**Figure 6d**
**Average Radiated Spurious Emission 15.247(c) Mid**

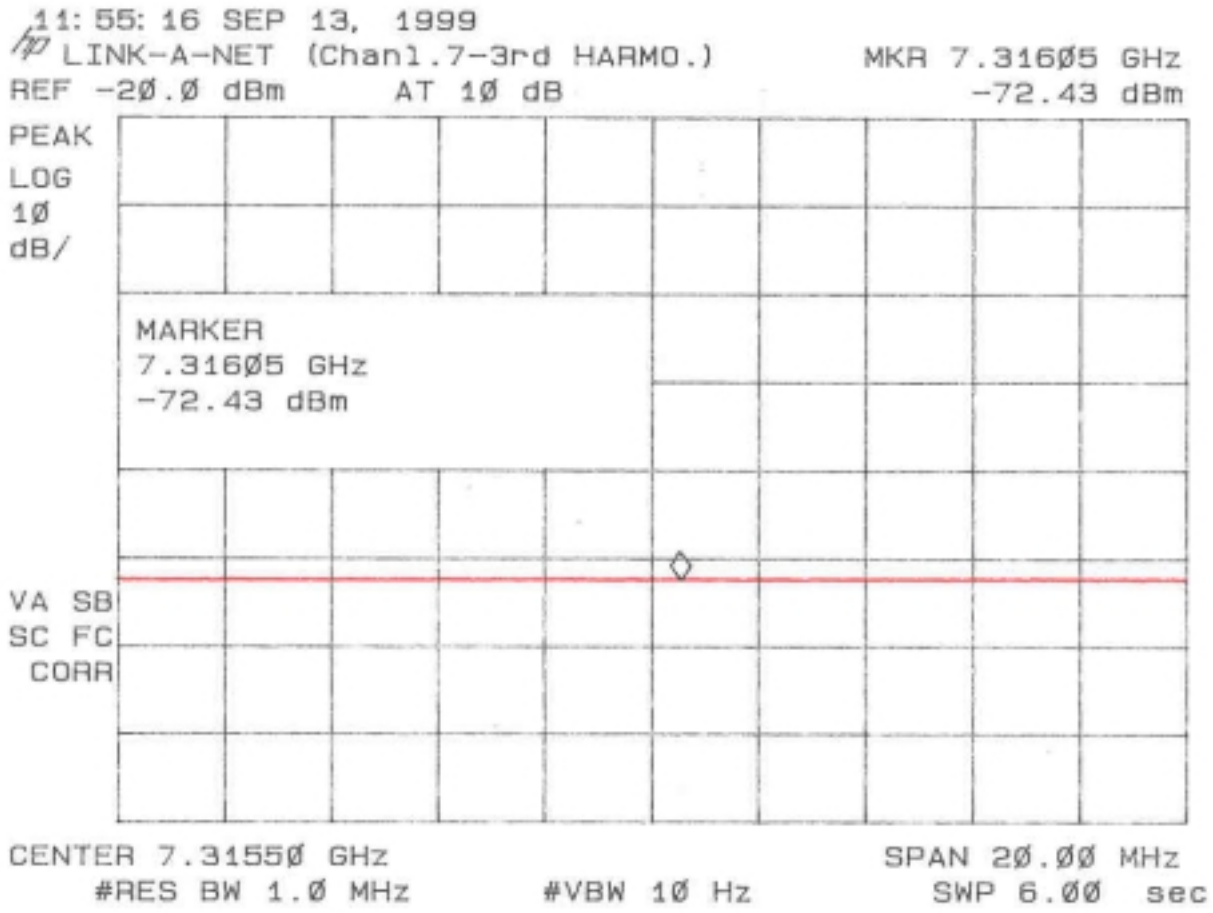


**Figure 6e**
**Average Radiated Spurious Emission 15.247(c) High**

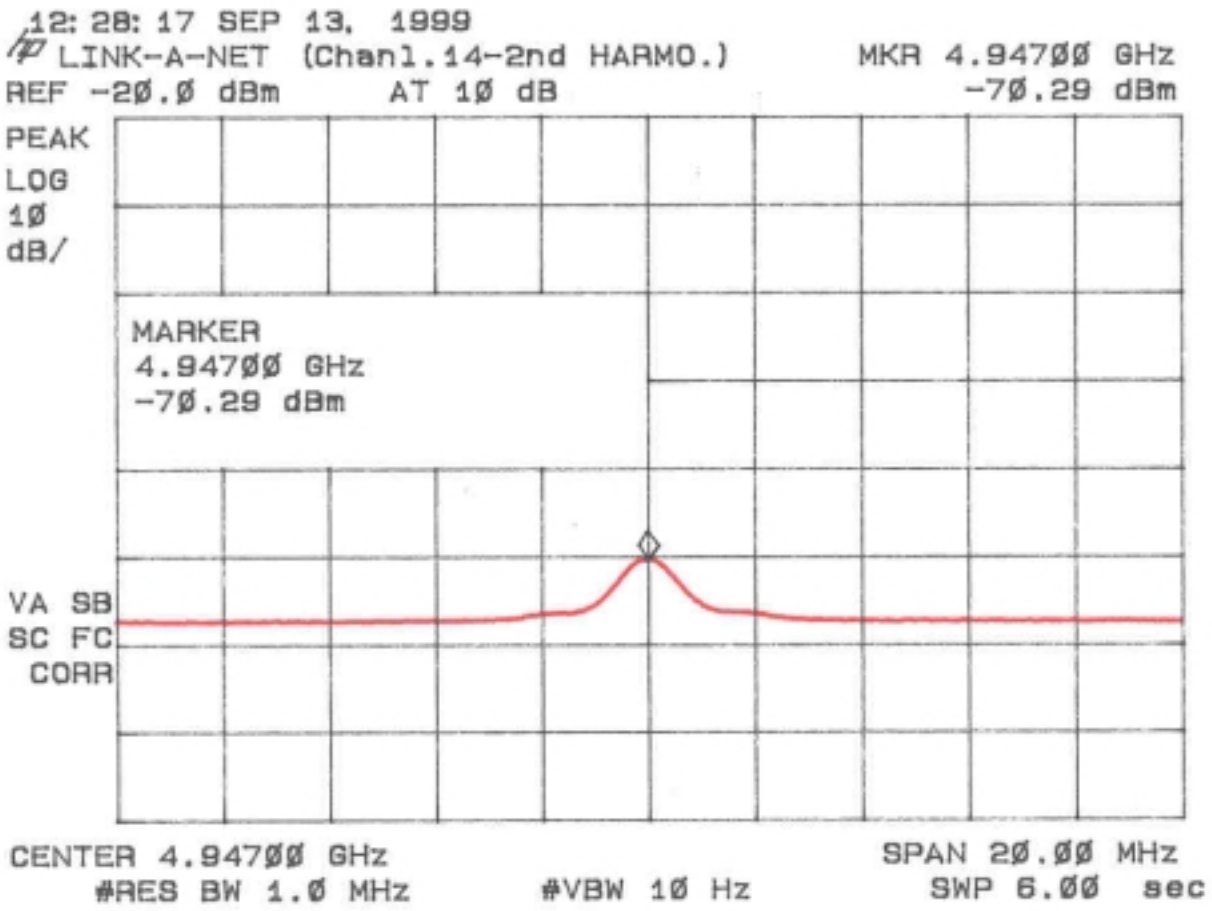


**Figure 6f**
**Average Radiated Spurious Emission 15.247(c) High**

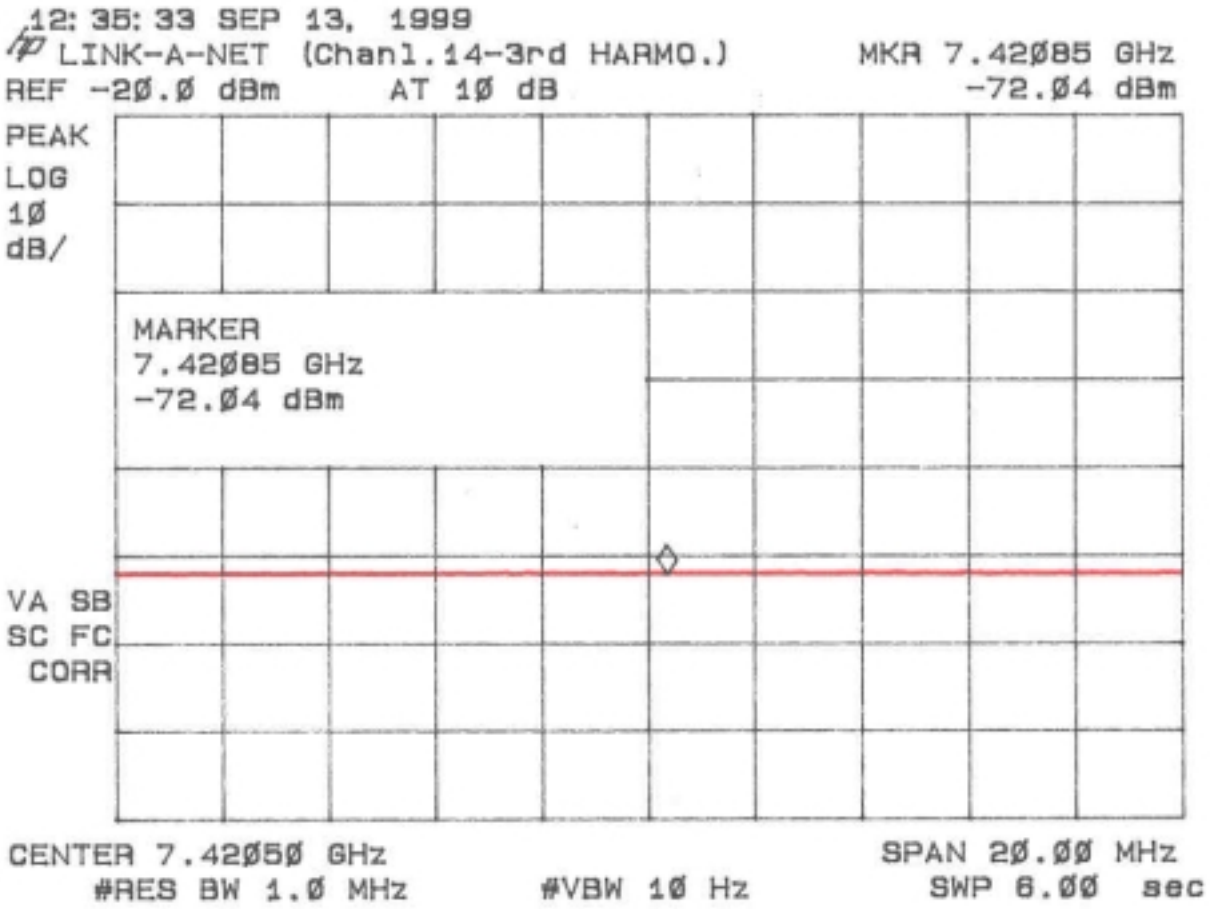


**TABLE 5a AVERAGE RADIATED SPURIOUS EMISSIONS (Low)**

| 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) =**
**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**