

## 6.5. Frequency Stability Data -- Pursuant 47 CFR 2.1055a(1), 2.1055d(2)

Measurements were made per method described in paragraph 7.4. Because of the transmitter's dependence on the stability of the base station oscillator, it is not possible to provide stability data for this transmitter as is commonly supplied for certification per 47 CFR 2.1055 for a radio with a locally stabilized oscillator.

The following information is provided to clarify how the transmitter attains the necessary accuracy of 2.5 PPM or better. The transmitter's suppressed carrier emission is produced by mixing of a modulated intermediate frequency with a higher, digitally synthesized injection frequency with a resolution of 12.5 kHz. Both of these frequencies are derived from a temperature compensated crystal oscillator (Y300 in Figure 4-1). Transmission frequency accuracy is enhanced by the radio receiver circuitry which causes the radio operating frequency to become locked to within 0.4 PPM of the base station once it has acquired the primary control channel. Thus the temperature and voltage frequency stability of the transmitter is within 0.4 PPM accuracy of the higher stability base station oscillator.

The AFC routine and frequency locking mechanism are implemented using both hardware and software. The hardware and software combined provide an automatic frequency control function, which locks the receiver to within 0.4 PPM of the control channel oscillator. Since the base station stability is FCC regulated to be 1.5 PPM or better, the absolute accuracy of the transmitter is inherently better than 1.9 PPM. This is accomplished by programming U601 while the radio is in operation.

Transmitter frequency stability is guaranteed over all specified environmental operating conditions (battery voltage, temperature, humidity, etc.), because of the nature of the base station frequency locking mechanism. The frequency stability of the transmitter is maintained until the battery voltage drops below 3.55 volts. Any voltage below 3.55 volts is outside the specified operating range of the transmitter and linearity is degraded below 3.55 volts. For this reason, the radio shuts down (while in transmit mode) when the voltage drops below 3.55 volts.

### Note:

Frequency stability is independent of modulation scheme (Quad-QPSK, Quad-16QAM and Quad-64QAM). The data shown in following tables was taken with the radio set to transmit a Quad-16QAM signal at 811.7000 MHz while locked to a R2660C service monitor.

Temperature (°Centigrade)	Frequency Error (Hz)	Frequency Error (PPM)
-30	17.46	0.022
-20	11.58	0.014
-10	12.06	0.015
0	19.44	0.024
10	10.37	0.013
20	21.91	0.027
30	18.81	0.023
40	27.81	0.034
50	14.47	0.018
60	21.01	0.026

Figure 6-37: Transmitter Frequency Stability Data - Frequency vs. Temperature

Voltage (Volts)	Error in (Hz)	Error in (PPM)
3.55	15.10	0.019
3.60	13.09	0.016
3.70	17.10	0.021
3.80	15.32	0.019
3.90	22.73	0.028
4.00	-1.87	-0.002
4.10	6.15	0.008
4.20	11.09	0.014

Figure 6-38: Transmitter Frequency Stability Data - Frequency vs. Voltage

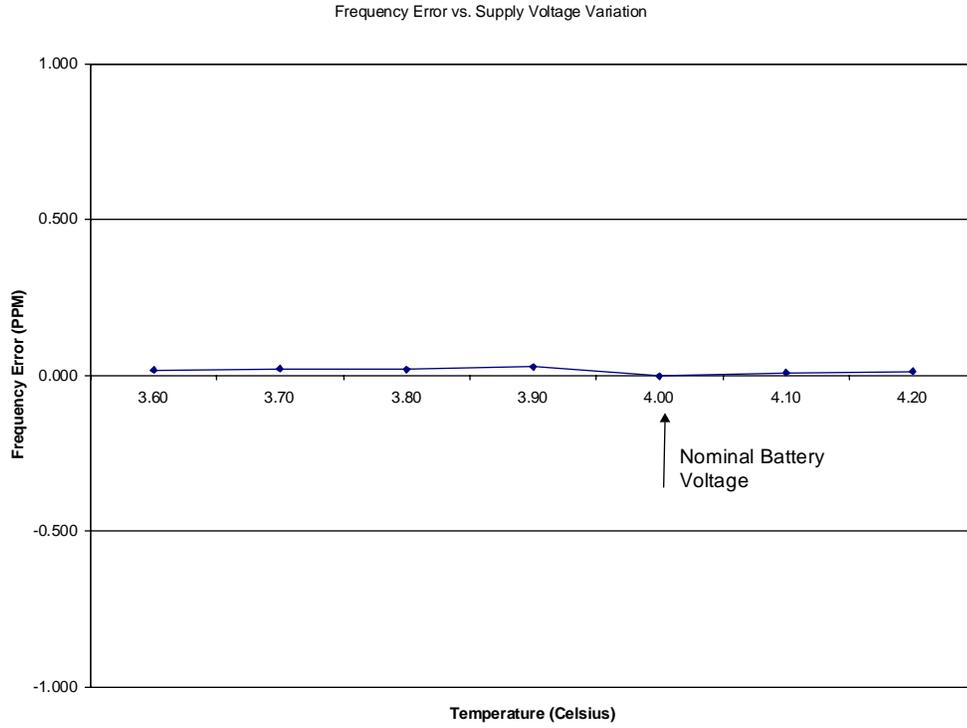


Figure 6-39: Frequency Stability vs. Voltage

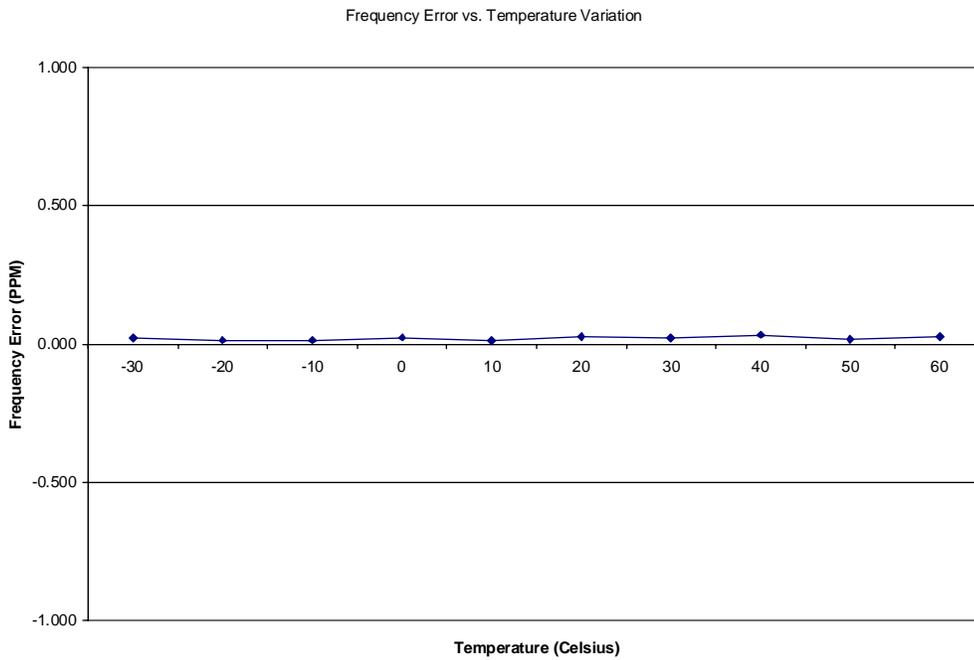


Figure 6-40: Frequency Stability vs. Temperature

---

**6.6. Conducted Spurious Emissions – Pursuant 47 CFR 2.1053 and 2.1057**

The conducted spurious emissions were measured according to the method described in paragraph 7.6.

Conducted spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB =  $43 + 10 \log_{10} (P)$   
(Thus the effective limit is -13 dBm for any transmitter power level).

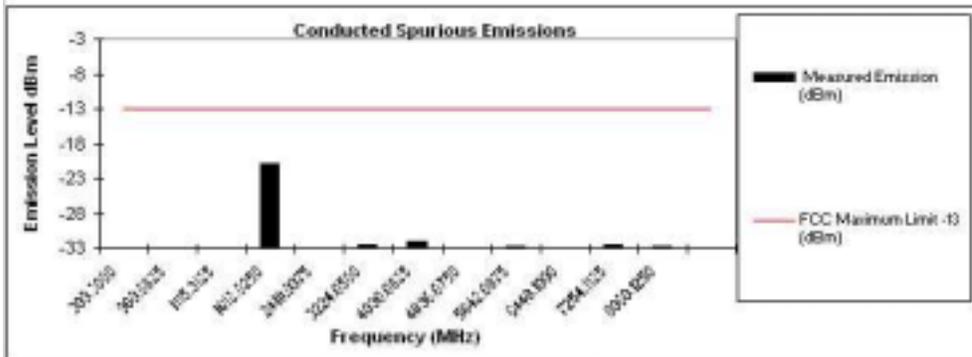
NOTE 1: Spurious emissions are independent of modulation type. Quad-16QAM was used to obtain the results reported.

NOTE 2: Emissions more than 20dB below the limit are not reported.

**Transmitter Conducted Spurious Emissions**

**806.0125 MHz**

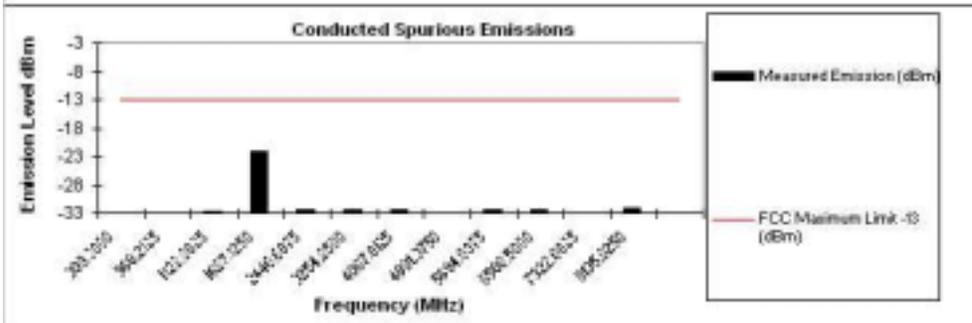
Spur	Frequency (MHz)	FCC Maximum Limit -13 (dBm)	Measured Emission (dBm)
2XIF	309.3000	-13	
LO	960.6625	-13	
IF+LO	1115.3125	-13	
2X FUND	1612.0250	-13	-20.87
3X FUND	2418.0375	-13	
4X FUND	3224.0500	-13	-32.53
5X FUND	4030.0625	-13	-32.03
6X FUND	4836.0750	-13	
7X FUND	5642.0875	-13	-32.87
8X FUND	6448.1000	-13	
9X FUND	7254.1125	-13	-32.58
10XFUND	8060.1250	-13	-32.71



**Transmitter Conducted Spurious Emissions**

**813.5625 MHz**

Spur	Frequency (MHz)	FCC Maximum Limit -13 (dBm)	Measured Emission (dBm)
2XIF	309.3000	-13	
LO	960.2125	-13	
IF+LO	1122.8625	-13	-32.76
2X FUND	1627.1250	-13	-22.21
3X FUND	2440.6875	-13	-32.45
4X FUND	3254.2500	-13	-32.43
5X FUND	4067.8125	-13	-32.34
6X FUND	4881.3750	-13	
7X FUND	5694.9375	-13	-32.45
8X FUND	6508.5000	-13	-32.58
9X FUND	7322.0625	-13	
10XFUND	8135.6250	-13	-32.24



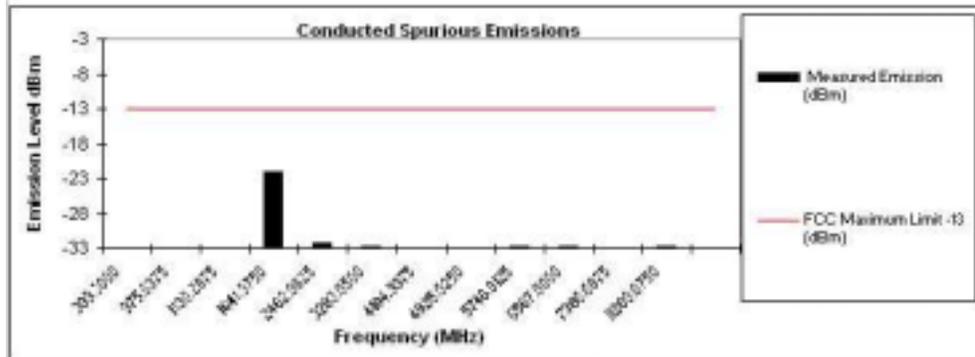
No data indicates the spurious emission was less than -33 dBm or could not be detected due to noise limitations or ambients.

**Figure 6-41: TX Conducted Spurious Emissions (Radio Set to Transmit at max power setting at 806.0125 MHz and 813.5625 MHz) (Primary U500)**

**Transmitter Conducted Spurious Emissions**

**820.9875 MHz**

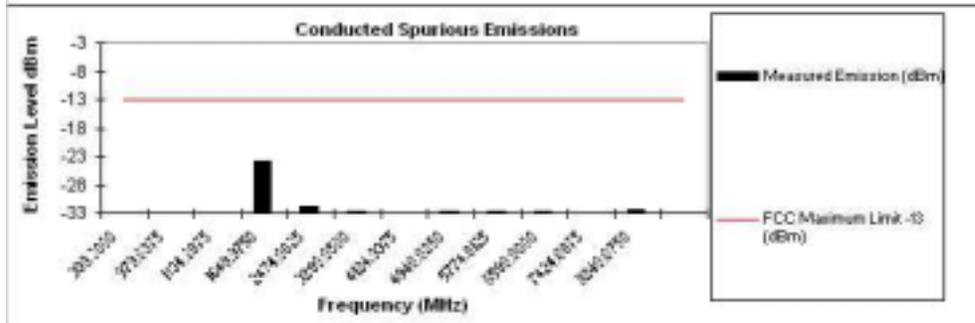
Spur	Frequency (MHz)	FCC Maximum Limit -13 (dBm)	Measured Emission (dBm)
2XIF	309.3000	-13	
LO	975.6375	-13	
IF+LO	1130.2875	-13	
2X FUND	1641.9750	-13	-22.03
3X FUND	2462.9625	-13	-32.37
4X FUND	3283.9500	-13	-32.71
5X FUND	4104.9375	-13	
6X FUND	4925.9250	-13	
7X FUND	5746.9125	-13	-32.87
8X FUND	6567.9000	-13	-32.77
9X FUND	7388.8875	-13	
10XFUND	8209.8750	-13	-32.67



**Transmitter Conducted Spurious Emissions**

**824.9875 MHz**

Spur	Frequency (MHz)	FCC Maximum Limit -13 (dBm)	Measured Emission (dBm)
2XIF	309.3000	-13	
LO	979.6375	-13	
IF+LO	1134.2875	-13	
2X FUND	1649.9750	-13	-23.74
3X FUND	2474.9625	-13	-31.89
4X FUND	3299.9500	-13	-32.71
5X FUND	4124.9375	-13	
6X FUND	4949.9250	-13	-32.78
7X FUND	5774.9125	-13	-32.67
8X FUND	6599.9000	-13	-32.78
9X FUND	7424.8875	-13	
10XFUND	8249.8750	-13	-32.54



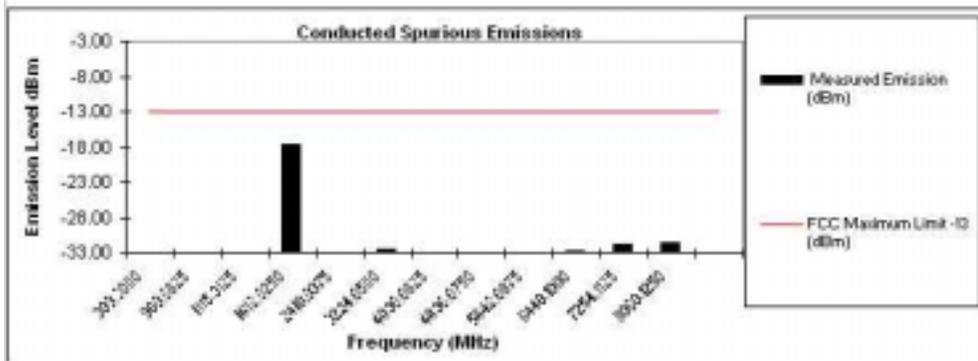
No data indicates the spurious emission was less than -33 dBm or could not be detected due to noise limitations or ambients.

**Figure 6-42: TX Conducted Spurious Emissions (Radio Set to Transmit at max power setting at 820.9875 MHz and 824.9875 MHz) (Primary U500)**

### Transmitter Conducted Spurious Emissions

#### 806.0125 MHz

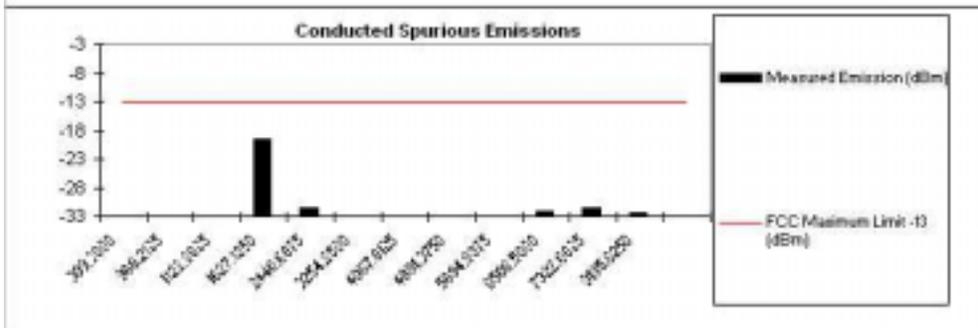
Spur	Frequency (MHz)	FCC Maximum Limit -13 (dBm)	Measured Emission (dBm)
2XIF	309.3000	-13	
LO	960.6625	-13	
IF+LO	1115.3125	-13	
2X FUND	1612.0250	-13	-17.73
3X FUND	2418.0375	-13	
4X FUND	3224.0500	-13	-32.57
5X FUND	4030.0625	-13	-32.90
6X FUND	4836.0750	-13	
7X FUND	5642.0875	-13	
8X FUND	6448.1000	-13	-32.75
9X FUND	7254.1125	-13	-31.90
10X FUND	8060.1250	-13	-31.57



### Transmitter Conducted Spurious Emissions

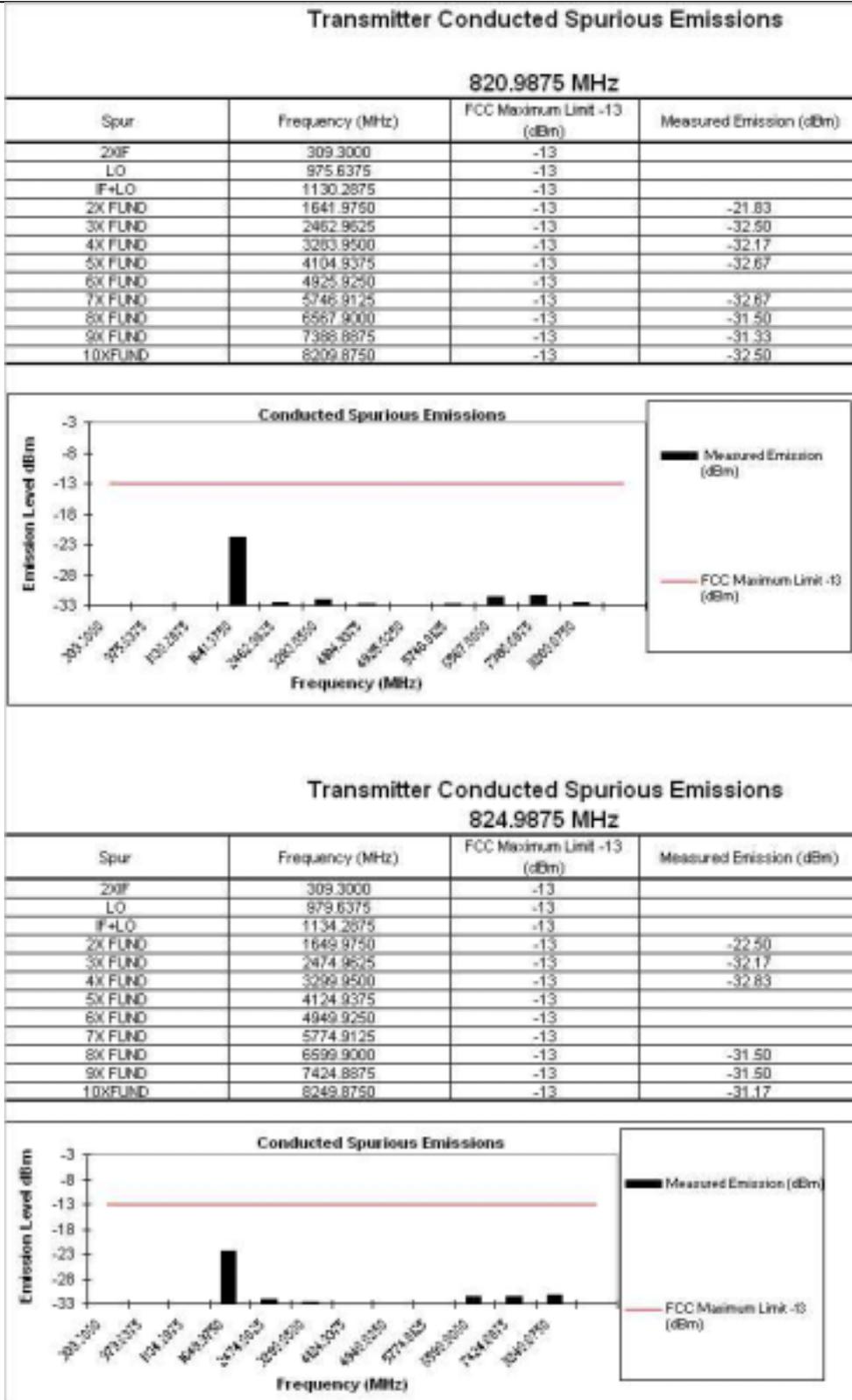
#### 813.5625 MHz

Spur	Frequency (MHz)	FCC Maximum Limit -13 (dBm)	Measured Emission (dBm)
2XIF	309.3000	-13	
LO	968.2125	-13	
IF+LO	1122.8625	-13	
2X FUND	1627.1250	-13	-19.47
3X FUND	2440.6875	-13	-31.47
4X FUND	3254.2500	-13	-32.97
5X FUND	4067.8125	-13	-32.97
6X FUND	4881.3750	-13	
7X FUND	5694.9375	-13	
8X FUND	6508.5000	-13	-32.13
9X FUND	7322.0625	-13	-31.63
10X FUND	8135.6250	-13	-32.30



No data indicates the spurious emission was less than -33 dBm or could not be detected due to noise limitations or ambients.

**Figure 6-43: TX Conducted Spurious Emissions (Radio Set to Transmit at max power setting at 806.0125 MHz and 813.5625 MHz) (Alternate U500)**



No data indicates the spurious emission was less than -33 dBm or could not be detected due to noise limitations or ambients.

**Figure 6-44: TX Conducted Spurious Emissions (Radio Set to Transmit at max power setting at 820.9875 MHz and 824.9875 MHz) (Alternate U500)**

## 6.7. Power Line Conducted Spurious Voltage -- Pursuant 47 CFR 15.207

### Conducted emission limits per 47 CFR 15.207(a).

The conducted emissions shall not exceed 250  $\mu\text{V}$  (48  $\text{dB}\mu\text{V}$ ) when measured with a quasi-peak detector over the frequency range 450 kHz to 30 MHz.

This portable RF device can transmit while resting in a battery charger that is connected to the AC power line. Figure 6-45 contains two measurement traces in addition to the applicable limit line (FCCBCN). The upper trace portrays the amplitude of the emissions measured during sweeping with a peak detector, while the lower trace represents the amplitude of the emissions measured using an average detector. These detectors facilitated the measurement process. Measurements with a quasi-peak detector lie between these bounds.

To assure compliance the maximum emission at 658 kHz (Marker 2) apparent in Figure 6-45 of 54.54  $\text{dB}\mu\text{V}$  measured with a peak detector was only 51.79  $\text{dB}\mu\text{V}$  when measured using a quasi-peak detector. Furthermore per FCC 15.107d, if the level of an emission measured using the quasi-peak instrumentation is 6dB, or more, higher than the level of the same emission measured with instrumentation having an average detector and a 9kHz minimum bandwidth, that emission is considered broadband and the level obtained with the quasi-peak detector may be reduced by 13 dB for comparison to the limits. Then the result for this frequency would be 51.79  $\text{dB}\mu\text{V}$  – 13dB = 38.79  $\text{dB}\mu\text{V}$ . The same procedure was used for 510 kHz (Marker 1), 750 kHz (Marker 3), 1.314 MHz (Marker 4) and their corresponding results are shown in Figure 6-46. Similarly, in Figure 6-47, the maximum emission of 54.55  $\text{dB}\mu\text{V}$  at 658kHz (Marker 2) measured with a peak detector was only 38.38  $\text{dB}\mu\text{V}$  with quasi-peak per FCC 15.107d in Figure 6-47. The same procedure was used for 514 kHz (Marker 1), 750 kHz (Marker 3), 1.618 MHz (Marker 4) and their corresponding results are shown in Figure 6-48.

### Tests Performed By:

Curt McLennan  
Motorola EMC Laboratory (FCC Registration: 91932 / Industry of Canada: IC 3679)  
8000 West Sunrise Blvd.  
Plantation, FL 33322

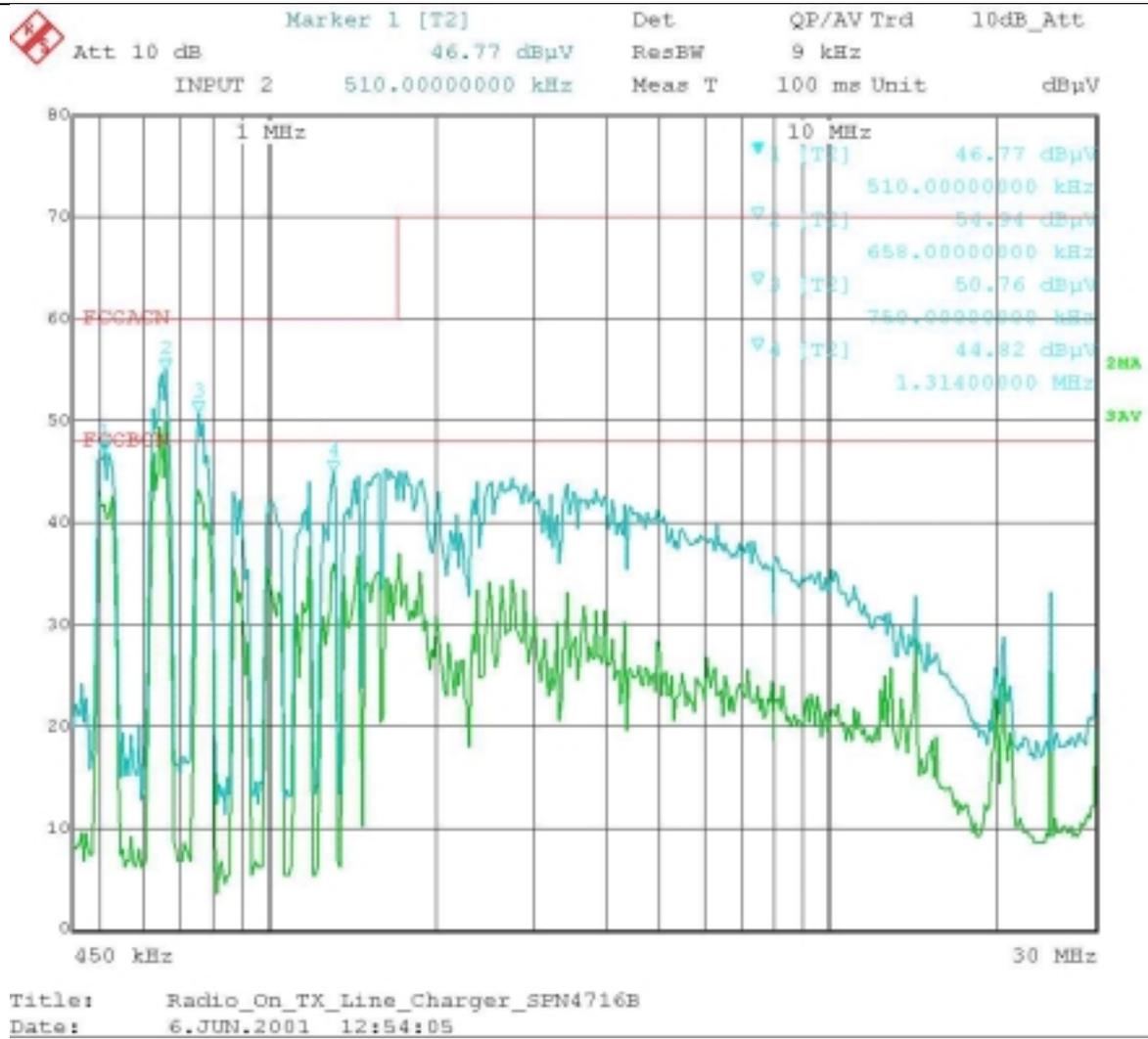


Figure 6-45: Phase Line (Radio in transmit mode at 820.9875 MHz)

Frequency (MHz)	Quasi-Peak (dBμV)	Average (dBμV)	Quasi-Peak Adjusted Per FCC 15.107d (dBμV)	FCC Limit (dBμV)
0.510	43.89	33.06	30.89	48
0.658	51.79	36.14	38.79	
0.750	48.13	32.37	35.13	
1.314	39.51	20.13	26.51	

Figure 6-46: Phase Line Data -Quasi-peak and Average - (Radio in transmit mode at 820.9875 MHz)

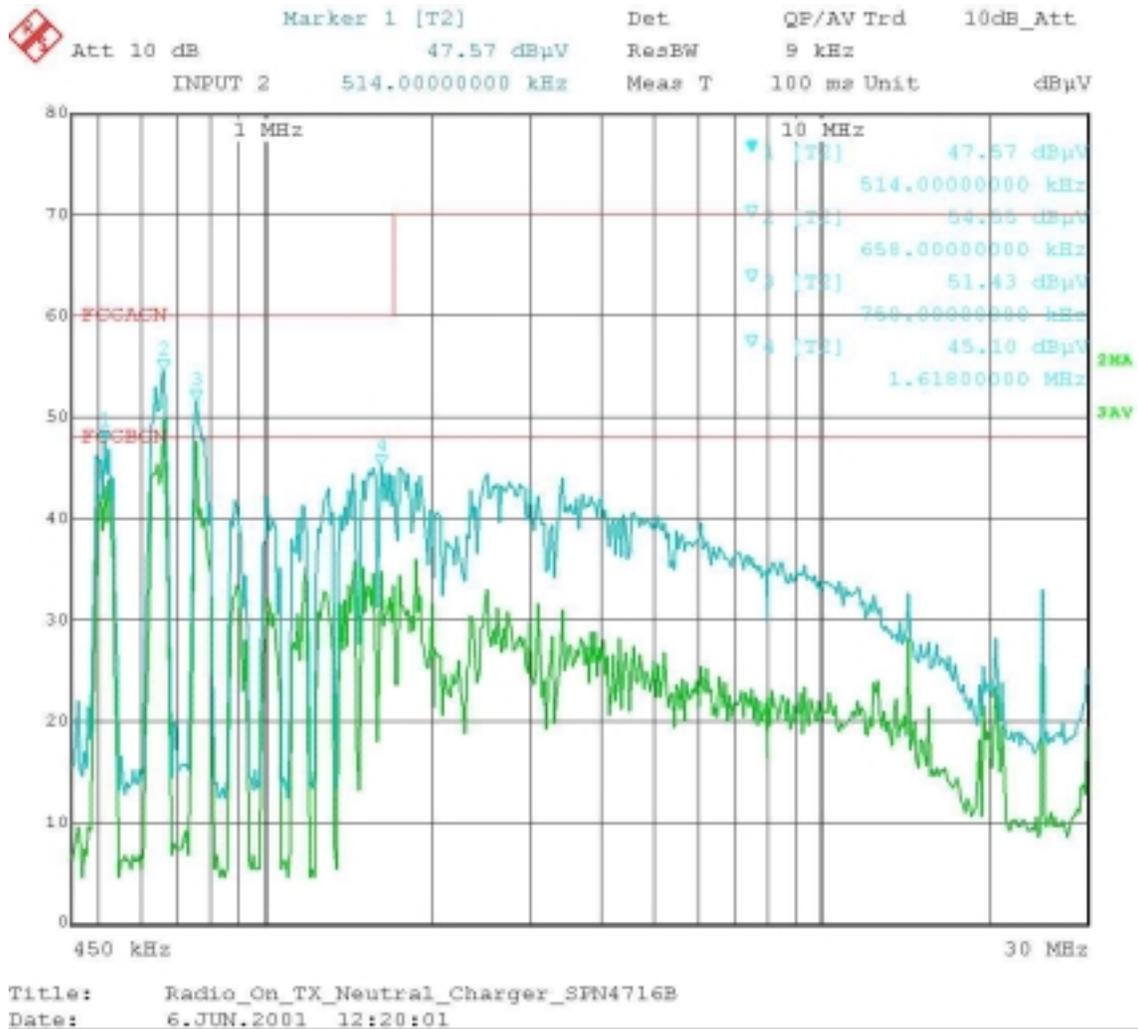


Figure 6-47: Neutral Line (Radio in transmit mode at 820.9875 MHz)

Frequency (MHz)	Quasi-Peak (dBµV)	Average (dBµV)	Quasi-Peak Adjusted Per FCC 15.107d (dBµV)	FCC Limit (dBµV)
0.514	44.43	33.60	31.43	48
0.658	51.38	35.36	38.38	
0.750	48.17	32.99	35.17	
1.618	40.24	19.42	27.24	

Figure 6-48: Neutral Line Data -Quasi-peak and Average - (Radio in transmit mode at 820.9875 MHz)