6.4. **Radiated Spurious Emissions Data** -- Pursuant 47 CFR 2.1053, 2.1057, 90.210(g) and 90.691(a).

FCC Limits

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

Spurious attenuation (dB) = 43 + 10 $\log_{10}$ (P), P = Maximum Power output power setting in Watts.

NOTE 1: The following data reflects worst-case measurements taken on the unit, side orientation in this case.
NOTE 2: Spurious emissions are independent of modulation type. M-16QAM was used to obtain the results reported.

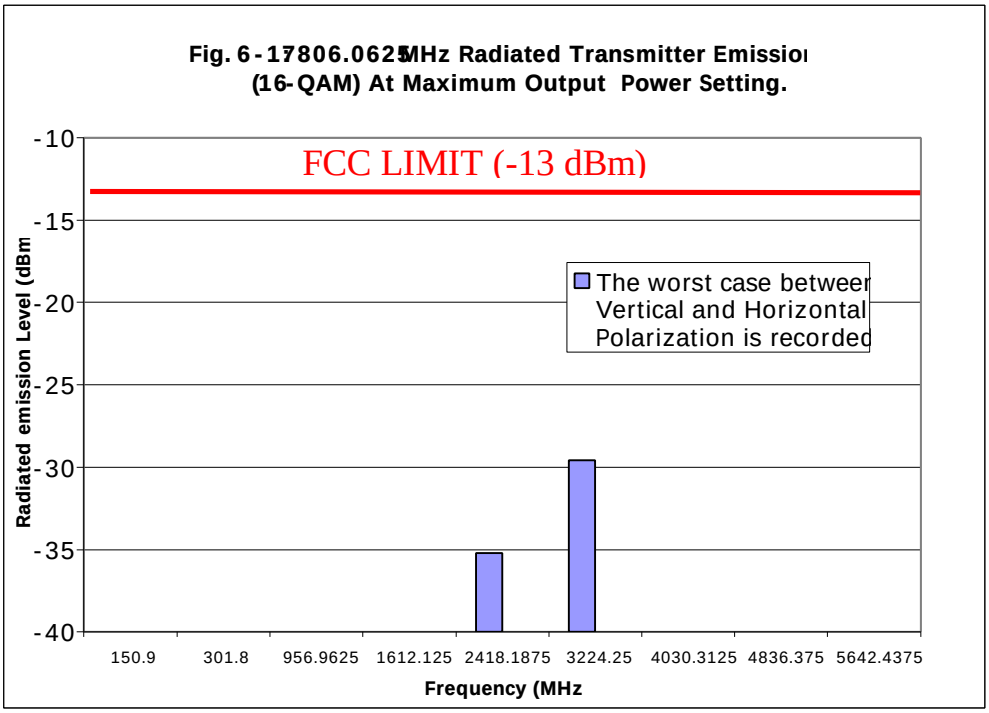

Table 6-1: 806.0625 MHz Radiated Transmitter Emissions (16QAM) At Maximum Output Power Setting.

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	956.9625	-13	< -40
2X FUND	1612.125	-13	-35.2
3X FUND	2418.1875	-13	-29.6
4X FUND	3224.25	-13	< -40
5X FUND	4030.3125	-13	< -40
6X FUND	4836.375	-13	< -40
7X FUND	5642.4375	-13	< -40
8X FUND	6448.5	-13	< -40
9X FUND	7254.5625	-13	< -40
10XFUND	8060.625	-13	< -40

* Note: Measured noise floor (-40 dBm), limited by test setup and equipment.

Table 6-2: 806.0625 MHz Radiated Transmitter Emissions (16QAM)
At Minimum Output Power Setting

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	956.9625	-13	< -40
2X FUND	1612.125	-13	< -40
3X FUND	2418.1875	-13	< -40
4X FUND	3224.25	-13	< -40
5X FUND	4030.3125	-13	< -40
6X FUND	4836.375	-13	< -40
7X FUND	5642.4375	-13	< -40
8X FUND	6448.5	-13	< -40
9X FUND	7254.5625	-13	< -40
10XFUND	8060.625	-13	< -40

Note: All the results in the above table represent the lowest measurable level, limited by the test setup and equipment; therefore, no radiation plots are shown.

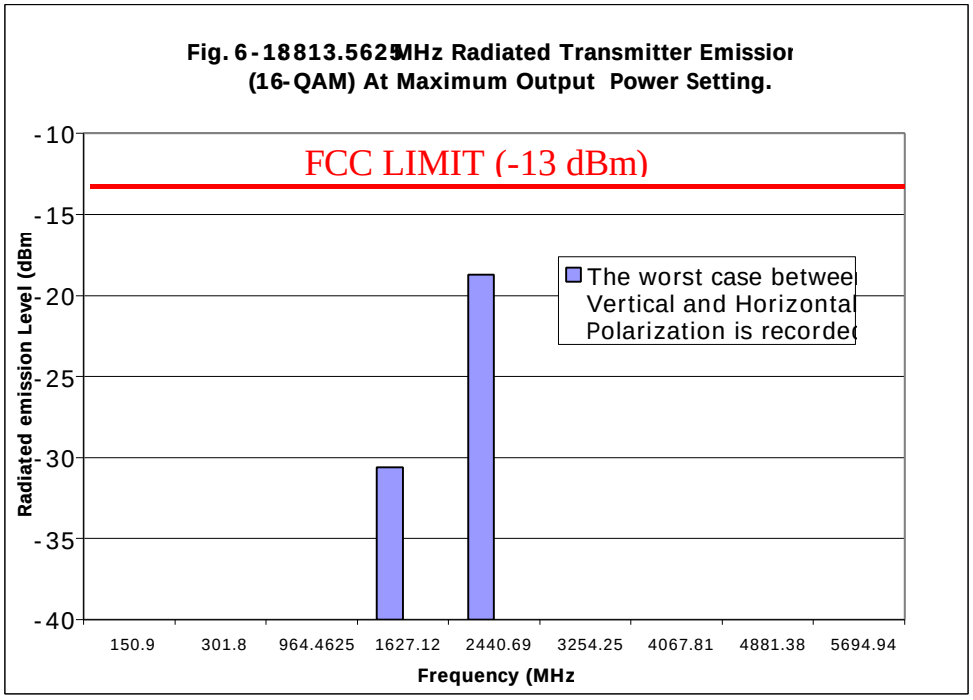

Table 6-3: 813.5625 MHz Radiated Transmitter Emissions (16QAM) At Maximum Output Power Setting.

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	964.4625	-13	< -40
2X FUND	1627.12	-13	-30.6
3X FUND	2440.69	-13	-18.7
4X FUND	3254.25	-13	-41.7
5X FUND	4067.81	-13	< -40
6X FUND	4881.38	-13	< -40
7X FUND	5694.94	-13	< -40
8X FUND	6508.50	-13	< -40
9X FUND	7322.06	-13	< -40
10XFUND	8135.62	-13	< -40

- Note: Measured noise floor (-40 dBm), limited by test setup and equipment.

Table 6-4: 813.5625 MHz Radiated Transmitter Emissions (16QAM)
At Minimum Output Power Setting

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	964.4625	-13	< -40
IF + LO	1115.3625	-13	< -40
2X FUND	1627.12	-13	< -40
3X FUND	2440.69	-13	< -40
4X FUND	3254.25	-13	< -40
5X FUND	4067.81	-13	< -40
6X FUND	4881.38	-13	< -40
7X FUND	5694.94	-13	< -40
8X FUND	6508.50	-13	< -40
9X FUND	7322.06	-13	< -40
10XFUND	8135.62	-13	< -40

Note: All the results in the above table represent the lowest measurable level, limited by the test setup and equipment; therefore, no radiation plots are shown.

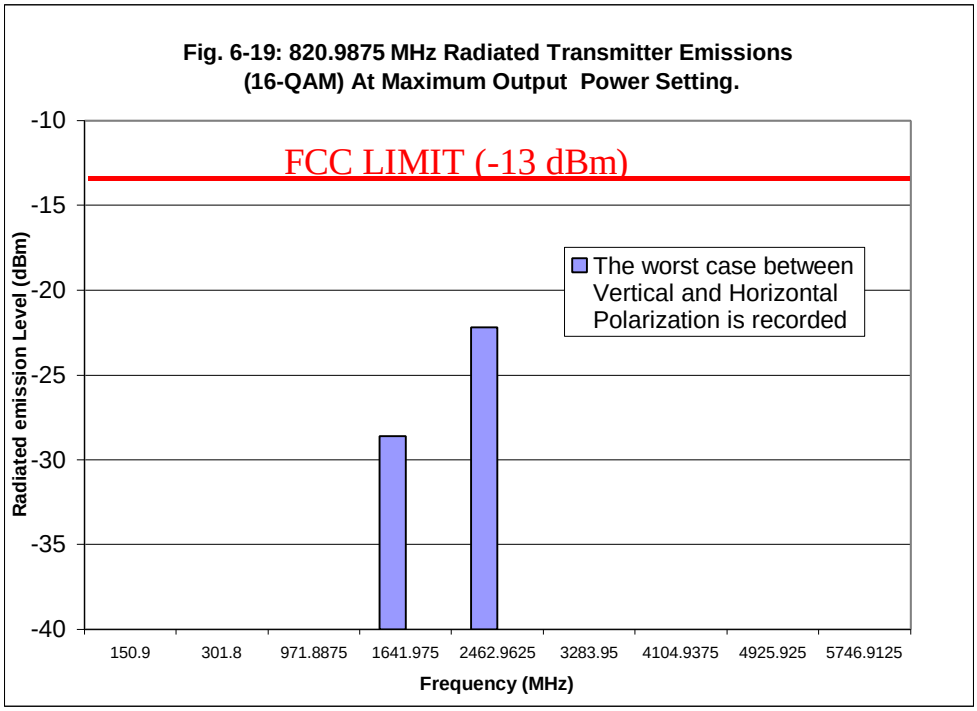

Table 6-5: 820.9875 MHz Radiated Transmitter Emissions (16QAM) At Maximum Output Power Setting.

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	971.8875	-13	< -40
2X FUND	1641.975	-13	-28.6
3X FUND	2462.9625	-13	-22.2
4X FUND	3283.95	-13	< -40
5X FUND	4104.9375	-13	< -40
6X FUND	4925.925	-13	< -40
7X FUND	5746.9125	-13	< -40
8X FUND	6567.9	-13	< -40
9X FUND	7388.8875	-13	< -40
10XFUND	8209.875	-13	< -40

* Note: Measured noise floor (-40 dBm), limited by test setup and equipment.

Table 6-6: 820.9875 MHz Radiated Transmitter Emissions (16QAM)
At Minimum Output Power Setting

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	971.8875	-13	< -40
2X FUND	1641.975	-13	< -40
3X FUND	2462.9625	-13	< -40
4X FUND	3283.95	-13	< -40
5X FUND	4104.9375	-13	< -40
6X FUND	4925.925	-13	< -40
7X FUND	5746.9125	-13	< -40
8X FUND	6567.9	-13	< -40
9X FUND	7388.8875	-13	< -40
10XFUND	8209.875	-13	< -40

Note: All the results in the above table represent the lowest measurable level, limited by the test setup and equipment; therefore, no radiation plots are shown.

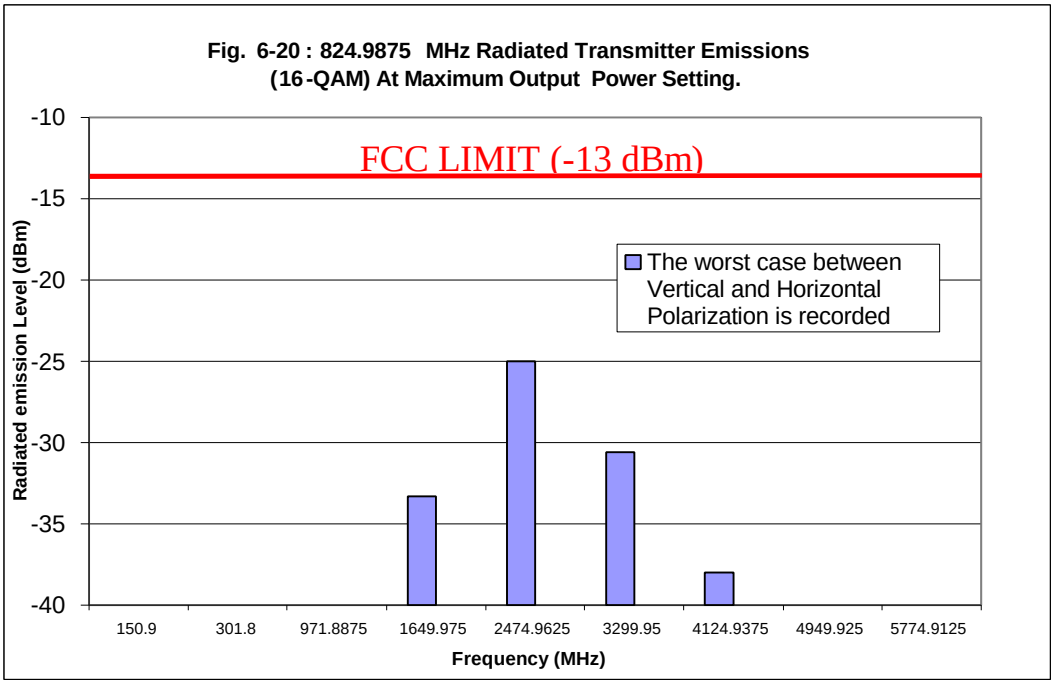

Table 6-7: 824.9875 MHz Radiated Transmitter Emissions (16QAM) At Maximum Output Power Setting.

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Recorded
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	971.8875	-13	< -40
2X FUND	1649.975	-13	-33.3
3X FUND	2474.9625	-13	-25.0
4X FUND	3299.95	-13	-30.6
5X FUND	4124.9375	-13	-38.0
6X FUND	4949.925	-13	< -40
7X FUND	5774.9125	-13	< -40
8X FUND	6599.9	-13	< -40
9X FUND	7424.8875	-13	< -40
10XFUND	8249.875	-13	< -40

* Note: Measured noise floor (-40 dBm), limited by test setup and equipment.

Table 6-8: 824.9875 MHz Radiated Transmitter Emissions (16QAM)
At Minimum Output Power Setting

Title	Frequency (MHz)	FCC Maximum Emission Limit (dBm)	Measured Emission Equivalent Power Into an Ideal Dipole (dBm) The Worst Case of Horizontal and Vertical Polarization is Registered
IF	150.9000	-13	< -40
2X IF	301.8000	-13	< -40
LO	971.8875	-13	< -40
2X FUND	1649.975	-13	< -40
3X FUND	2474.9625	-13	< -40
4X FUND	3299.95	-13	< -40
5X FUND	4124.9375	-13	< -40
6X FUND	4949.925	-13	< -40
7X FUND	5774.9125	-13	< -40
8X FUND	6599.9	-13	< -40
9X FUND	7424.8875	-13	< -40
10XFUND	8249.875	-13	< -40

Note: All the results in the above table represent the lowest measurable level, limited by the test setup and equipment; therefore, no radiation plots are shown.

6.5. **Conducted Spurious Emissions Data** -- Pursuant 47 CFR 2.1051, 2.1057, 90.210 (g) and 90.691.

Conducted Path: 50 Connector
FCC Emission Limit: less than -13 dBm

Table 6-9: Transmitter Conducted Spurious Emissions Data. Maximum Output Power Setting, Fundamental Frequency 813.5625 MHz

Description	Frequency (MHz)	Measured Power (dBm) (highest level of all modulation schemes)	Minimum Margin to FCC Spec (dB) (at all modulation schemes)
IF	150.9000	<-40 dBm	> 27
2*IF	301.8000	<-40 dBm	> 27
LO	964.4625	<-40 dBm	> 27
IF + LO	1115.3625	<-40 dBm	> 27
2*FUND	1627.1250	-19.4 dBm	6.4
3*FUND	2440.6875	-31.8 dBm	18.8
4*FUND	3254.2500	<-40 dBm	> 27
5*FUND	4067.8125	<-40 dBm	> 27
6*FUND	4881.3750	<-40 dBm	> 27
7*FUND	5694.9375	<-40 dBm	> 27
8*FUND	6508.5000	<-40 dBm	> 27
9*FUND	7322.0625	<-40 dBm	> 27
10*FUND	8135.6250	<-40 dBm	> 27

Table 6-10: Transmitter Conducted Spurious Emissions Data. Fundamental Frequency 813.5625 MHz, Minimum Power Setting

Description	Frequency (MHz)	Measured Power (dBm) (highest level of all modulation schemes)	Minimum Margin to FCC Spec (dB) (at all modulation schemes)
IF	150.9000	<-40 dBm	> 27
2*IF	301.8000	<-40 dBm	> 27
LO	964.4625	<-40 dBm	> 27
IF + LO	1115.3625	<-40 dBm	> 27
2*FUND	1627.1250	<-40 dBm	> 27
3*FUND	2440.6875	<-40 dBm	> 27
4*FUND	3254.2500	<-40 dBm	> 27
5*FUND	4067.8125	<-40 dBm	> 27
6*FUND	4881.3750	<-40 dBm	> 27
7*FUND	5694.9375	<-40 dBm	> 27
8*FUND	6508.5000	<-40 dBm	> 27
9*FUND	7322.0625	<-40 dBm	> 27
10*FUND	8135.6250	<-40 dBm	> 27

Table 6-11: Transmitter Conducted Spurious Emissions Data. Maximum Output Power Setting, Fundamental Frequency 820.9875 MHz

Description	Frequency (MHz)	Measured Power (dBm) (highest level of all modulation schemes)	Minimum Margin to FCC Spec (dB) (at all modulation schemes)
IF	150.9000	<-40 dBm	> 27
2*IF	301.8000	<-40 dBm	> 27
LO	971.8875	<-40 dBm	> 27
IF + LO	1122.7875	<-40 dBm	> 27
2*FUND	1641.975	-20.5 dBm	7.5
3*FUND	2462.9625	-26.3 dBm	13.3
4*FUND	3283.95	<-40 dBm	> 27
5*FUND	4104.9375	<-40 dBm	> 27
6*FUND	4925.925	<-40 dBm	> 27
7*FUND	5746.9125	<-40 dBm	> 27
8*FUND	6567.9	<-40 dBm	> 27
9*FUND	7388.8875	<-40 dBm	> 27
10*FUND	8209.875	<-40 dBm	> 27

Table 6-12: Transmitter Conducted Spurious Emissions Data. Fundamental frequency 820.9875 MHz, Minimum Power Setting

Description	Frequency (MHz)	Measured Power (dBm) (highest level of all modulation schemes)	Minimum Margin to FCC Spec (dB) (at all modulation schemes)
IF	150.9000	<-40 dBm	> 27
2*IF	301.8000	<-40 dBm	> 27
LO	971.8875	<-40 dBm	> 27
IF + LO	1122.7875	<-40 dBm	> 27
2*FUND	1641.975	<-40 dBm	> 27
3*FUND	2462.9625	<-40 dBm	> 27
4*FUND	3283.95	<-40 dBm	> 27
5*FUND	4104.9375	<-40 dBm	> 27
6*FUND	4925.925	<-40 dBm	> 27
7*FUND	5746.9125	<-40 dBm	> 27
8*FUND	6567.9	<-40 dBm	> 27
9*FUND	7388.8875	<-40 dBm	> 27
10*FUND	8209.875	<-40 dBm	> 27

6.6. **Frequency Stability Data** -- Pursuant 47 CFR 2.1055

Measurements were made per method described in paragraph 7.5.

Because of its 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 type acceptance per 47 CFR 2.055 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 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 and 4.2).

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 performance of the transmitter is within 0.4PPM 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. This degree of AFC accuracy is determined by the bandwidth of the phase locked loop within the IC. Since the base station stability is FCC regulated to be 1.5 PPM or better, the absolute accuracy of the transmitter is □1.9 PPM. Transmitter frequency stability is guaranteed over all specified environmental operating conditions (supply voltage, temperature, humidity, etc), because of the nature of the base station frequency locking mechanism.

Due to the fact that the frequency generation circuitry is fed from a voltage regulator, the frequency stability of the transmitter is maintained for the entire range of battery voltages at which the radio can operate. The radio samples the battery voltage during transmit mode, and if the voltage drops below 4.0 volts, the radio shuts down. This occurs when the unloaded battery voltage is 4.6 volts or lower. When connected to an external charger, the battery voltage may rise to 6 volts. The frequency stability of the transmitter vs. temperature is reported in Table 6-13 and Figure 6-21, and vs. supply voltage for battery voltages ranging from 4.6 to 6.2 volts in Table 6-14 and Figure 6-22.

Frequency stability is independent of modulation scheme (QPSK, Quad-16QAM, Quad-64QAM) and the chosen scheme for the report data is: Quad-16QAM. The data shown in Tables 12-13 and 14-15 were taken with the radio set to transmit at 820.4625 MHz while locked to a R2660C service monitor.

Table 6-13: Transmitter Frequency Stability Data - Frequency vs. Temperature

Temperature (□Centigrade)	Frequency Error (Hz)	Frequency Error (ppm)
-30	125	0.16
-20	93.7	0.11
-10	93.7	0.11
0	187.5	0.23
10	187.5	0.23
20	156.2	0.19
30	156.2	0.19
40	125	0.16
50	156.2	0.19
60	156.2	0.19

Table 6-14: Transmitter Frequency Stability at 30º Centigrade - Frequency Vs. Supply Voltage.

Supply Voltage (Volts)	Error (Hz)	Error (ppm)
4.6	152.5	0.19
4.7	156	0.19
4.8	156	0.19
4.9	162.5	0.19
5.0	156	0.19
5.1	156	0.19
5.2	156	0.19
5.3	156	0.19
5.4	156	0.19
5.5	156	0.19
5.6	156	0.19
5.7	156	0.19
5.8	156	0.19
5.9	156	0.19
6.0	156	0.19
6.1	156	0.19
6.2	156	0.19

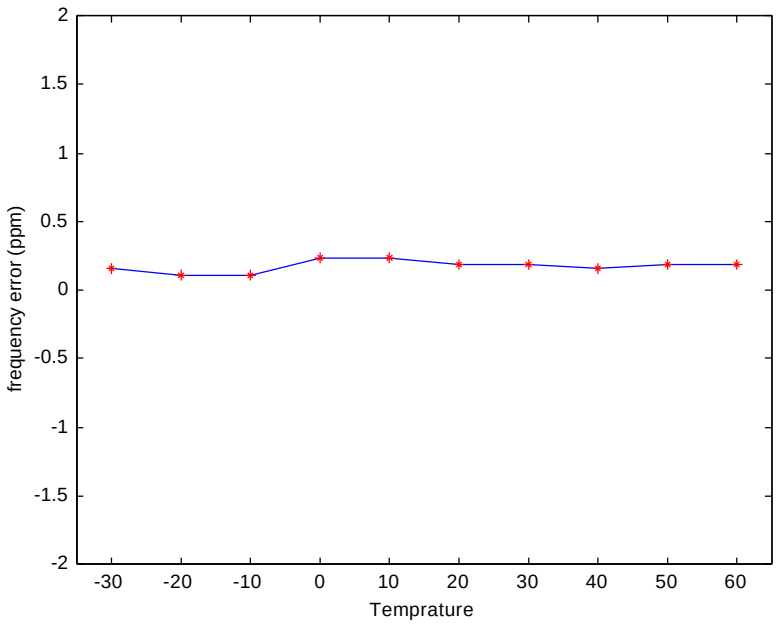

Figure 6-21: Frequency Stability vs. Temperature

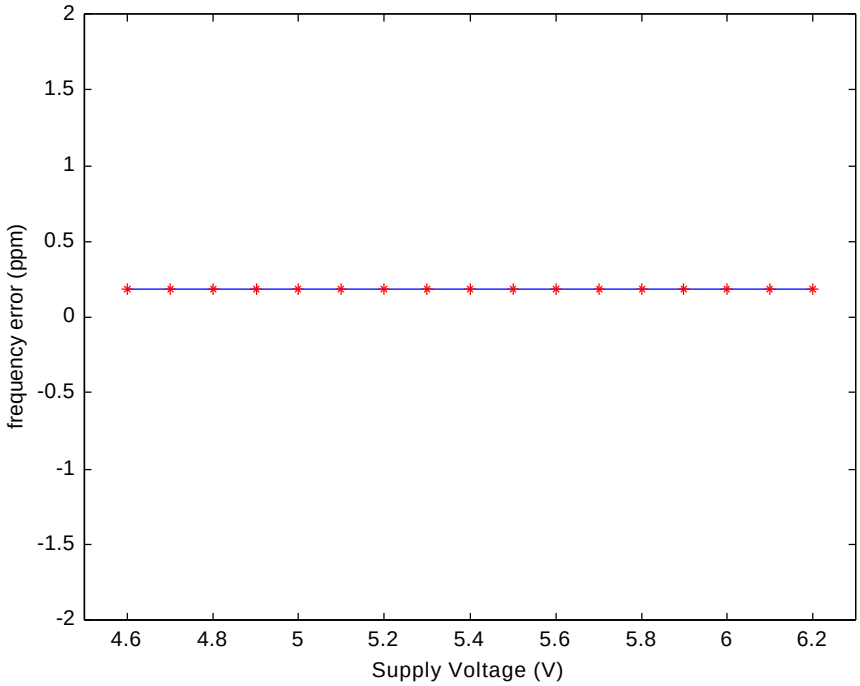

Figure 6-22: Transmitter Frequency Stability at 30º Centigrade - Frequency Vs. Supply Voltage

6.7. **Power Line Conducted Spurious Emissions** -- Pursuant 47 CFR 15.107

The portable RF device can transmit and receive while resting in a battery charger that is connected to the AC power line. The maximum emissions Measurements were made per method described in paragraph 7.5 shown in Figures 6-22 to 6-27.

The maximum permitted emission according to Pursuant 47 CFR 15.107 is 250 microvolts over the frequency range 450 kHz to 30 MHz.

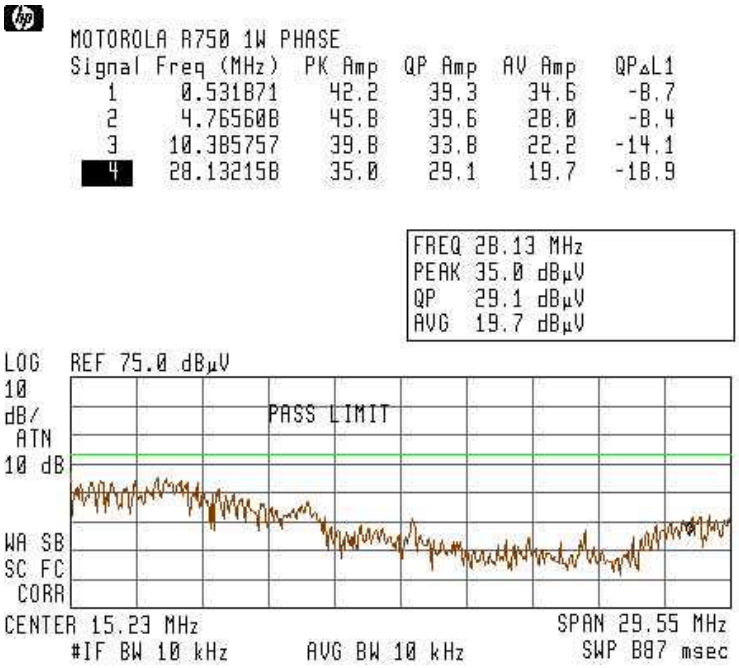

Figure 6-23: Charger AC Line At Maximum Output Power Setting.

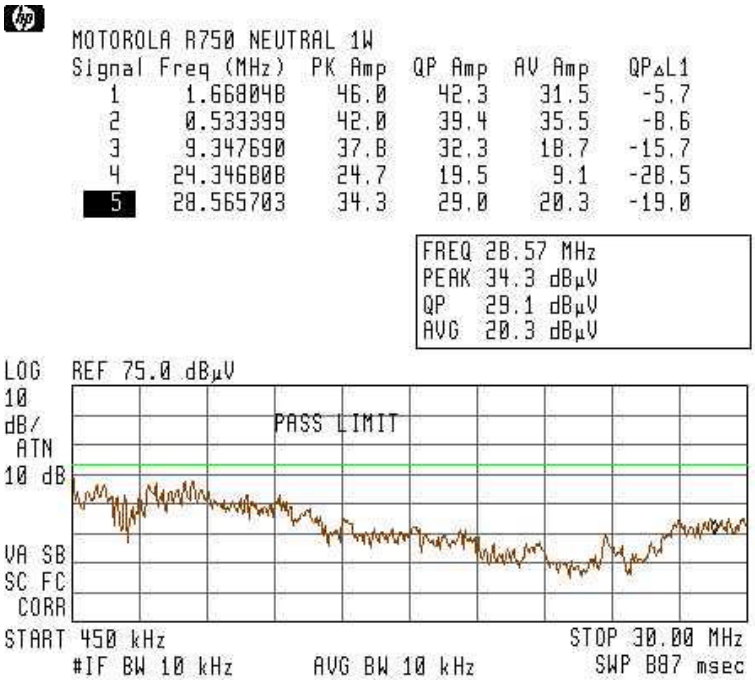

Figure 6-24: Charger Neutral Line At Maximum Output Power Setting

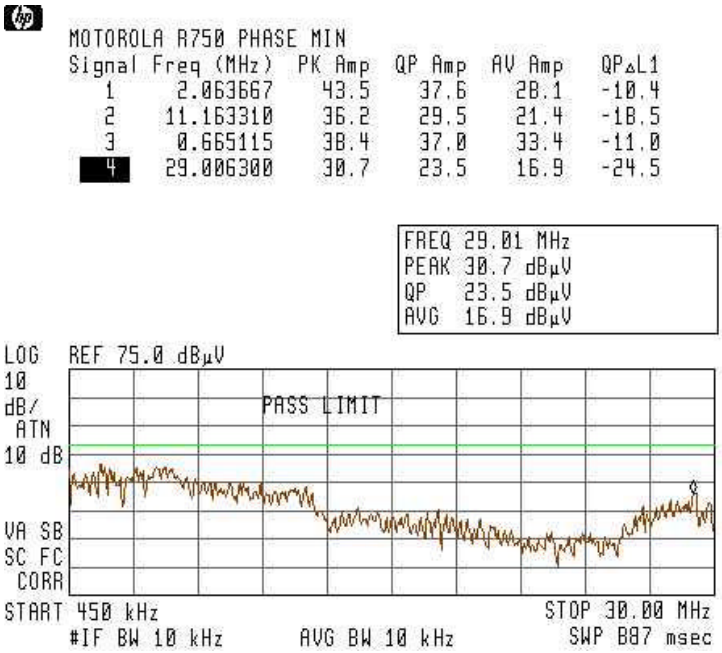

Figure 6-25: Charger AC Line At Minimum Output Power Setting.

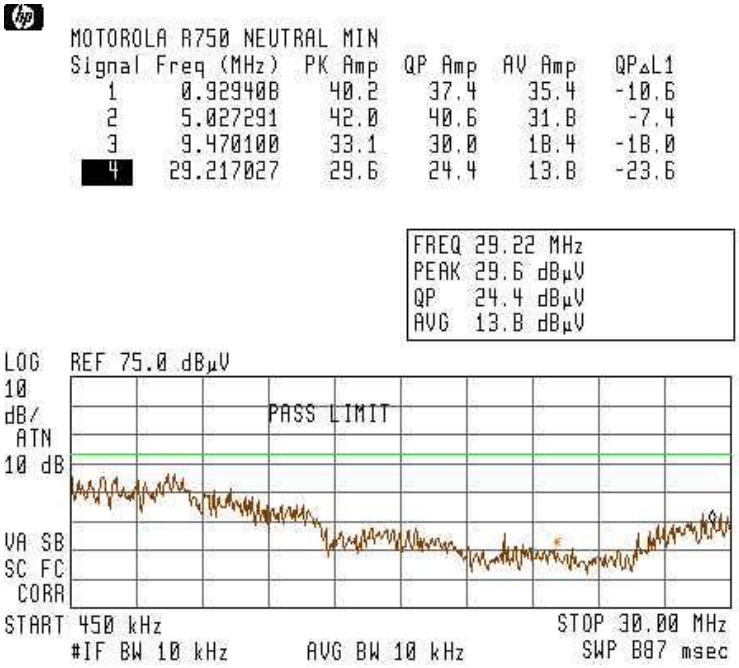

Figure 6-26: Charger Neutral Line At Minimum Output Power Setting.

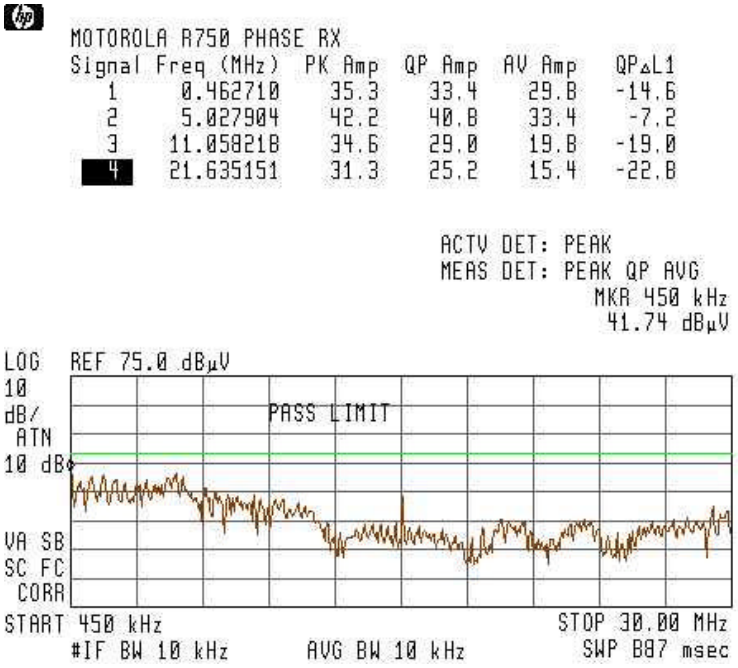

Figure 6-27: Charger AC Line in Receive Mode.

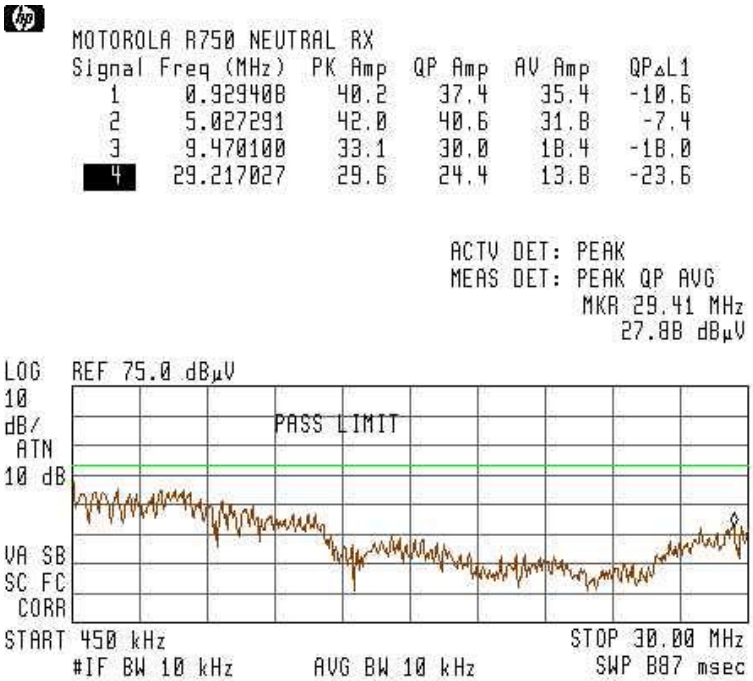

Figure 6-28: Charger Neutral Line in Receive Mode.