

6.6. Frequency Stability Data -- Pursuant 47 CFR 2.1055a(1), 2.1055(d)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, Quad-64QAM). The data shown in following tables was taken with the radio set to transmit a Quad-16QAM signal at 820.9875 MHz while locked to a R2660C service monitor.

Temperature [Celsius Degrees]	Frequency Error [Hz]	Frequency Error [PPM]
-20	-25	-0.029
-15	-30	-0.035
-10	-30	-0.035
-5	-24	-0.028
0	-23	-0.027
5	-14	-0.016
10	-25	-0.029
15	-15	-0.018
20	-18	-0.021
25	-15	-0.018
30	-18	-0.021
35	-15	-0.018
40	-15	-0.018
45	-15	-0.018
50	-19	-0.022
55	-14	-0.016
60	-9	-0.011

Figure 6-17: Transmitter Frequency Stability Data - Frequency vs. Temperature

Voltage [Volts]	Frequency Error [Hz]	Error in [PPM]
3.55	-70	-0.084
3.6	-80	-0.096
3.7	-73	-0.088
3.8	-80	-0.096
3.9	-100	-0.120
4	-90	-0.108
4.1	-89	-0.107
4.2	-100	-0.120

Figure 6-18: Transmitter Frequency Stability Data - Frequency vs. Voltage

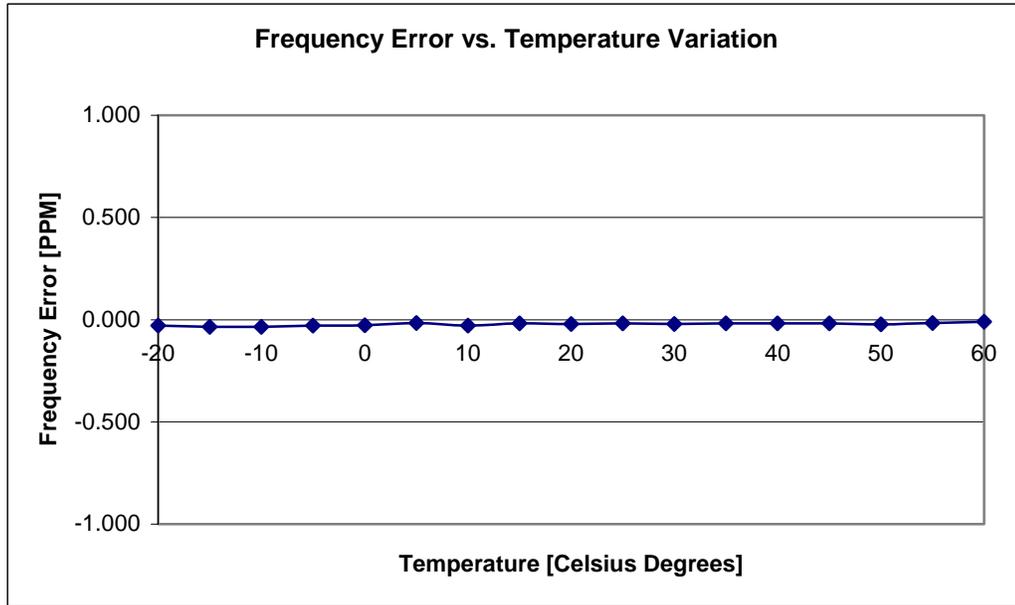


Figure 6-19: Frequency Stability vs. Temperature

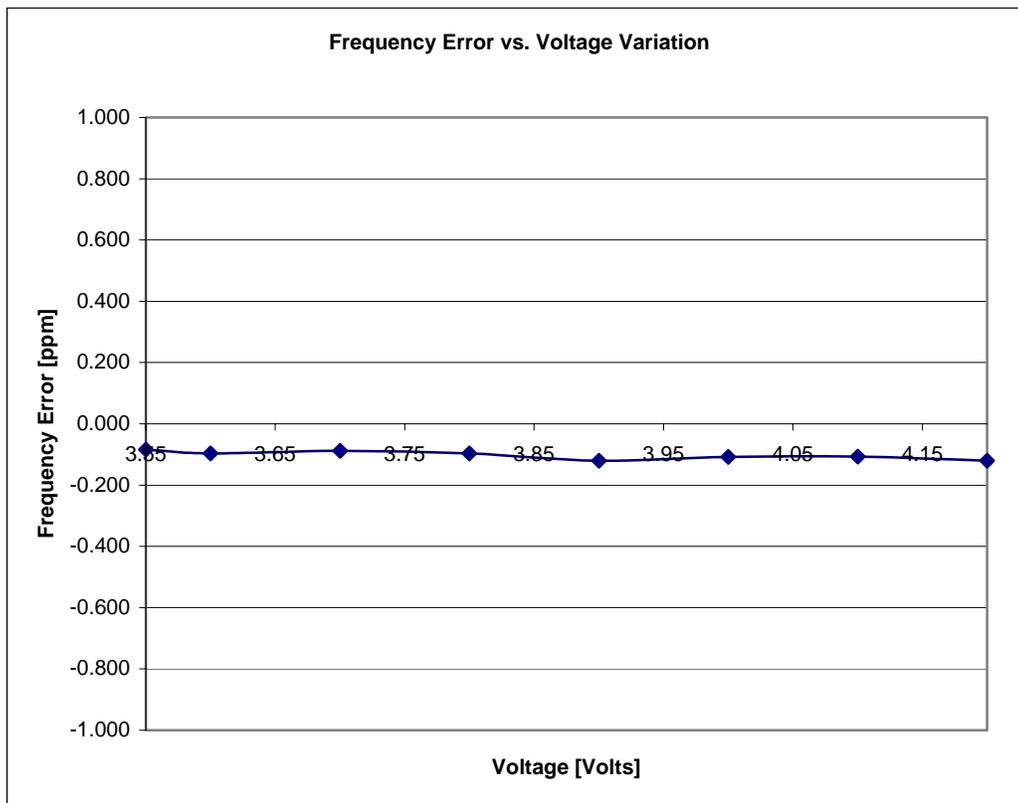


Figure 6-20: Frequency Stability vs. Voltage

6.7. Power Line Conducted Spurious Emissions -- Pursuant 47 CFR 15.207

Conducted emission limits per 47 CFR 15.207(a). For an intentional radiator, which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed 250 microvolts.

This RF device can transmit while resting in a battery charger that is connected to the AC power line. Figures 6-21 until 6-24 demonstrate compliance with the cited limit. The conducted emission was measured at two configurations:

1. Laptop configuration. The PCMCIA iDEN modem was inserted into DELL laptop model PP01L, and was configured to transmit at maximum power while it was connected to the power supply via the LISN. The laptop was connected to its charger and to the AC line source.
2. PDA configuration. The PCMCIA iDEN modem was inserted into IPAQ model H3650/70 PDA of Compaq, and was configured to transmit at maximum power while it was connected to the power supply via the LISN. The PDA was connected to its charger and to the AC line source.

Laptop configuration

Figures 6-21 and 6-22 portray the amplitude of the emissions measured with a peak detector for the iDEN modem inserted into DELL laptop. These figures provide a table contains 5 points of the maximum emissions measured by a quasi peak detector, average detector and peak detector. The margin of the peak detector to the FCC limit is also shown.



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IM 1100 COND EM FCC PHASE
Signal Freq (MHz) PK Amp QP Amp AV Amp PKΔL1
  1      0.636300    36.5  33.5  20.3  -11.5
  2      0.891353    36.9  33.1  18.1  -11.1
  3      1.196086    36.7  32.1  13.2  -11.3
  4      2.734241    37.5  31.8   7.6  -10.5
  5      5.342436    38.7  33.7  23.3  -9.3
    
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FREQ 795.7 kHz
PEAK 37.9 dBμV
QP   34.3 dBμV
AVG  20.5 dBμV
    
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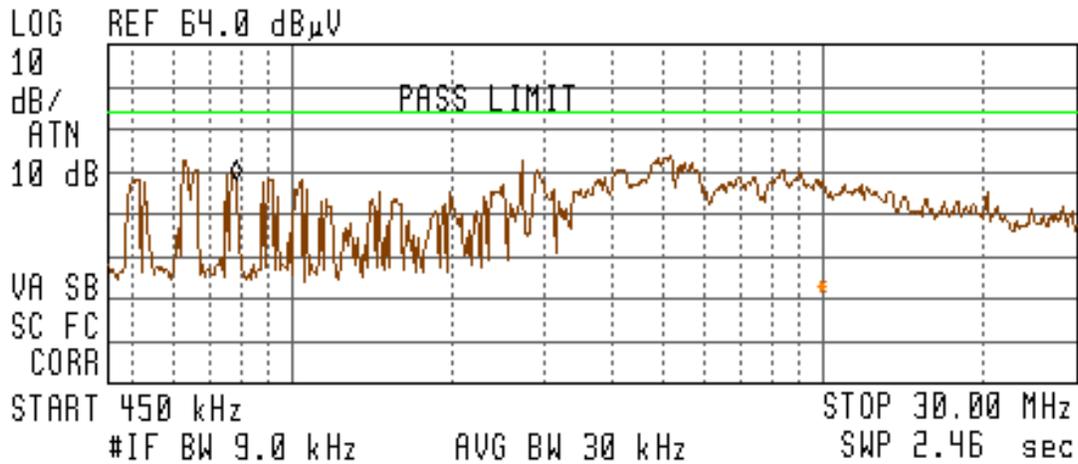


Figure 6-21: Phase Line Emission measured by peak detector while the Modem is inserted into DELL laptop and configured to transmit at 813.5625 MHz



IM 1100 COND EM FCC NEUTRAL

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	PK Δ L1
1	0.646743	36.6	33.4	19.7	-11.4
2	1.044503	36.0	31.9	17.0	-12.0
3	2.701561	37.9	32.2	8.1	-10.1
4	4.166301	36.1	30.7	14.3	-11.9
5	5.017234	38.8	33.0	20.2	-9.2

FREQ	1.032 MHz
PEAK	36.3 dB μ V
QP	32.0 dB μ V
AVG	16.8 dB μ V

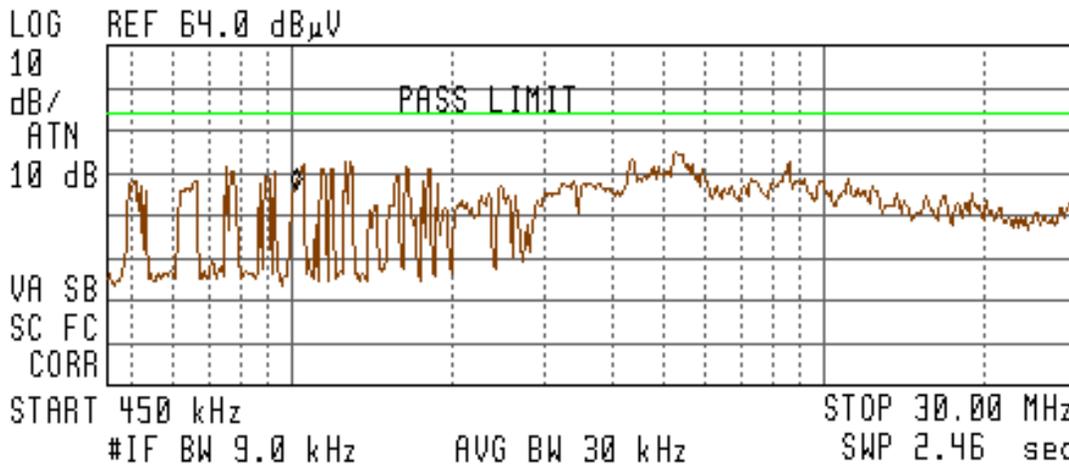


Figure 6-22: Neutral Line emission measured by peak detector while the Modem is inserted into DELL laptop and configured to transmit at 813.5625 MHz

PDA configuration

Figures 6-23 and 6-24 portray the amplitude of the emissions measured with a peak detector for the iDEN modem inserted into IPAQ PDA of Compaq. These figures provide a table contains 5 points of the maximum emissions measured by a quasi peak detector, average detector and peak detector. The margin of the peak detector to the FCC limit is also shown.



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IM 1100 COND EM FCC IPAQ PHASE
Signal Freq (MHz) PK Amp QP Amp AV Amp PKΔL1
  1 0.532109 36.9 34.5 19.8 -11.1
  2 0.644622 39.0 34.5 20.0 -9.0
  3 0.756291 39.2 36.3 20.8 -8.8
  4 1.050958 35.1 30.6 11.7 -12.9
  5 10.932407 30.9 24.5 12.3 -17.1
    
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FREQ 1.894 MHz
PEAK 33.0 dBμV
QP 26.3 dBμV
AVG 8.5 dBμV
    
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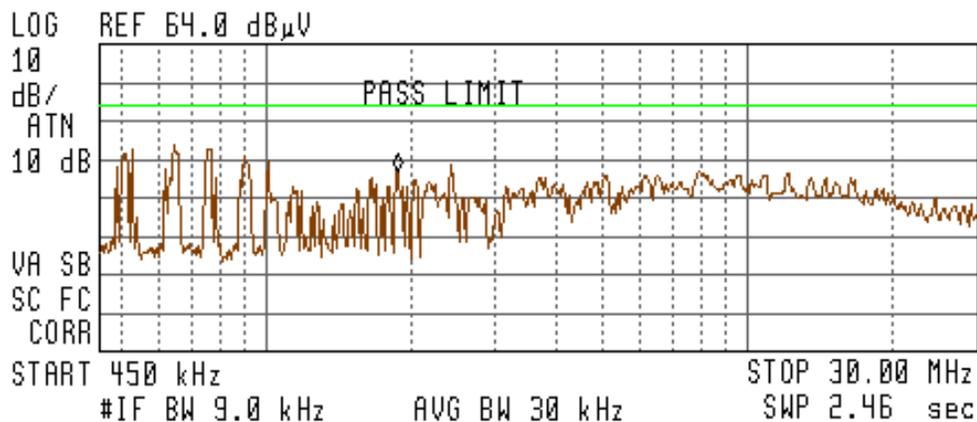


Figure 6-23: Phase Line emission measured by peak detector while the Modem is inserted into IPAQ PDA and configured to transmit at 813.5625 MHz



IM 1100 COND EM FCC IPAQ PHASE

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	PK Δ L1
1	0.532109	36.9	34.5	19.8	-11.1
2	0.644622	39.0	34.5	20.0	-9.0
3	0.756291	39.2	36.3	20.8	-8.8
4	1.050958	35.1	30.6	11.7	-12.9
5	10.932407	30.9	24.5	12.3	-17.1

FREQ	1.894 MHz
PEAK	33.0 dB μ V
QP	26.3 dB μ V
AVG	8.5 dB μ V

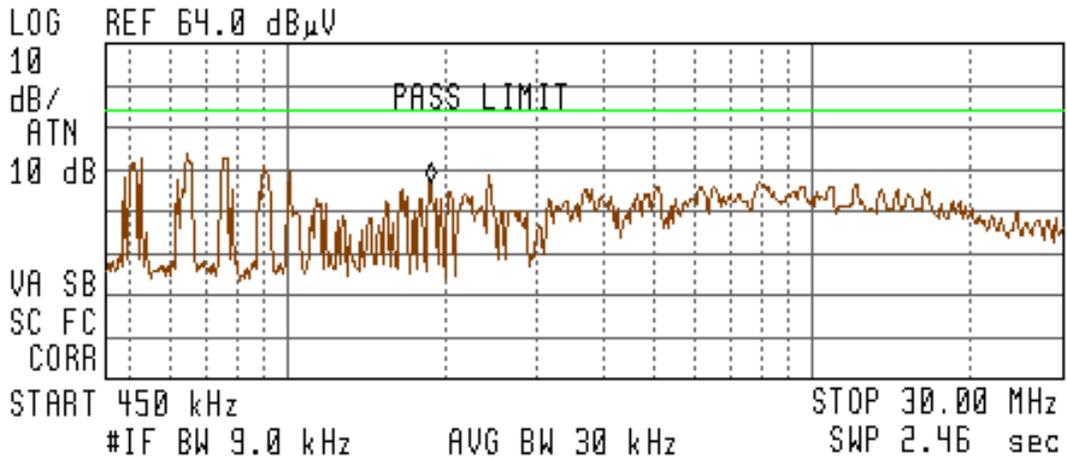


Figure 6-24: Neutral Line emission measured by peak detector while the Modem is inserted into IPAQ PDA and configured to transmit at 813.5625 MHz

6.8. Effective Radiated Power (ERP)

The method described in paragraph 7.1b was employed.

Prior to measuring ERP, the output power of the transmitter was adjusted to within 5% of the maximum power level, which is 0.7 W pulse average power. The actual measured power at each of the test frequencies after the adjustment was as follows:

F = 806.0125 MHz: Pout = 0.690 W (pulse average power)

F = 813.5125 MHz: Pout = 0.693 W (pulse average power)

F = 824.9875 MHz: Pout = 0.693 W (pulse average power)

The ERP measurement results are summarized in Tables 6.8.1 and 6.8.2 below.

Frequency (MHz):	806.0125	813.5125	824.9875
Reference field strength(dB μ V/m):	119.71	121.28	120.60
P_incident (dBm):	31.2	32.8	32.4
Cable_loss (dB):	4.6	4.6	4.6
Test_antenna_gain (dBi):	1.28	1.32	1.36
EIRP (dBm):	27.88	29.52	29.16
ERP (dBm):	25.73	27.37	27.01
EIRP (W):	0.614	0.895	0.824
ERP (W):	0.374	0.546	0.502

Table 6.8.1: ERP measurement results for iM1100 inside a PDA

Frequency (MHz):	806.0125	813.5125	824.9875
Reference field strength(dB μ V/m):	119.60	120.11	119.50
P_incident (dBm):	31.0	31.8	31.4
Cable_loss (dB):	4.6	4.6	4.6
Test_antenna_gain (dBi):	1.28	1.32	1.36
EIRP (dBm):	27.68	28.52	28.16
ERP (dBm):	25.53	26.37	26.01
EIRP (W):	0.586	0.711	0.655
ERP (W):	0.357	0.433	0.399

Table 6.8.2: ERP measurement results for iM1100 inside a laptop computer

Based on the above results, the maximum EIRP for the iM1100 is 0.895 W pulse average power, and the maximum ERP is 0.546 W pulse average power.