APPENDIX 8
DATA REQUIRED BY 2.1046 THROUGH 2.1057*:*

2.1046 **RF Power Output**.

Power output is measured at the RF output terminal with . a Narda 30dB attenuator used as an 50 Ohms dummy load.

The transmitter was tuned in accordance with the tune up procedure (Appendix 2) with a supply voltage of 12 VDC.

Test Set-Up:

Test Equipment:

- HP Power Meter	Model # EPM-441A
- HP Power Sensor	Model # ECP-E18A
- Narda 30 dB Attenuator	Model # MOD 766-30

Test condition:

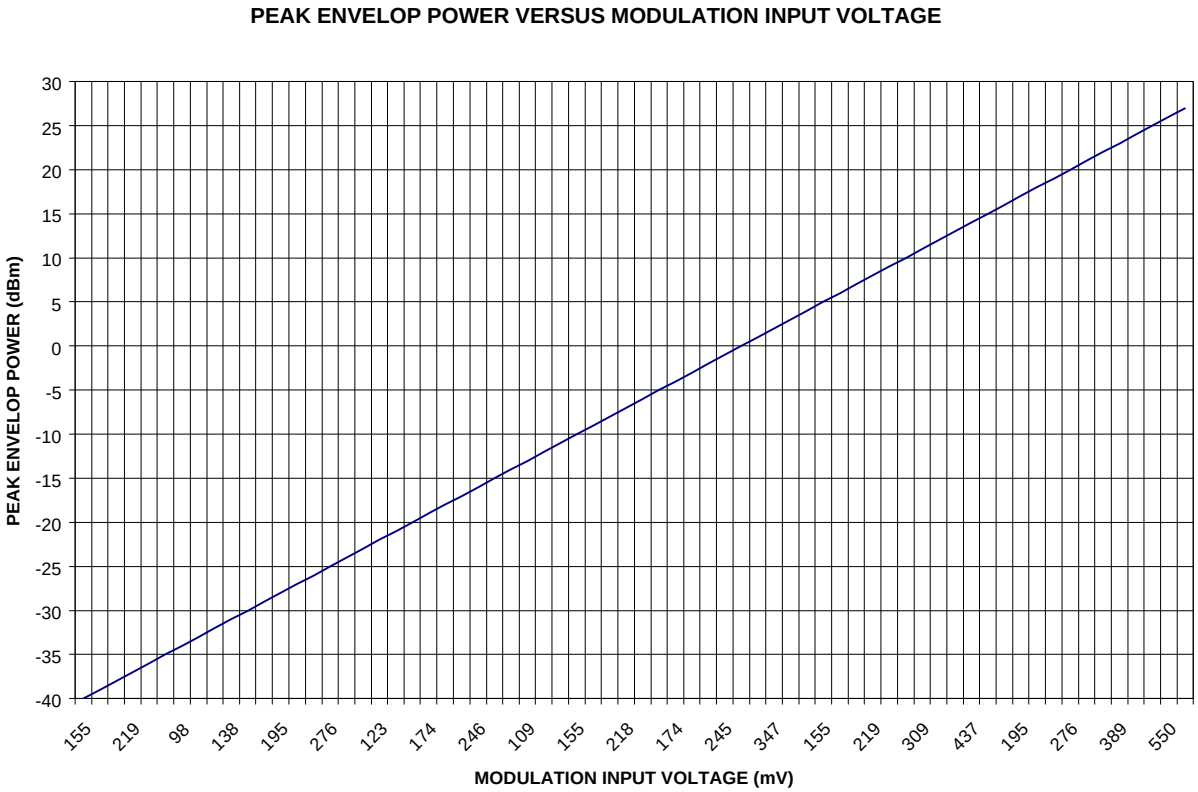
Modulation type: 16QAM Random Symbols

Test Result:

Frequency	Output Power
216.01 MHz	27.02 dBm
217.01 MHz	27.01 dBm
218.01 MHz	27.03 dBm
219.99 MHz	27.00 dBm

2.1047 **Modulation characteristics**.

A curve showing the peak envelope power versus the modulation input voltage is shown in figure 1



2.1049 **Occupied Bandwidth**

Test Set-Up:

Test Equipment:

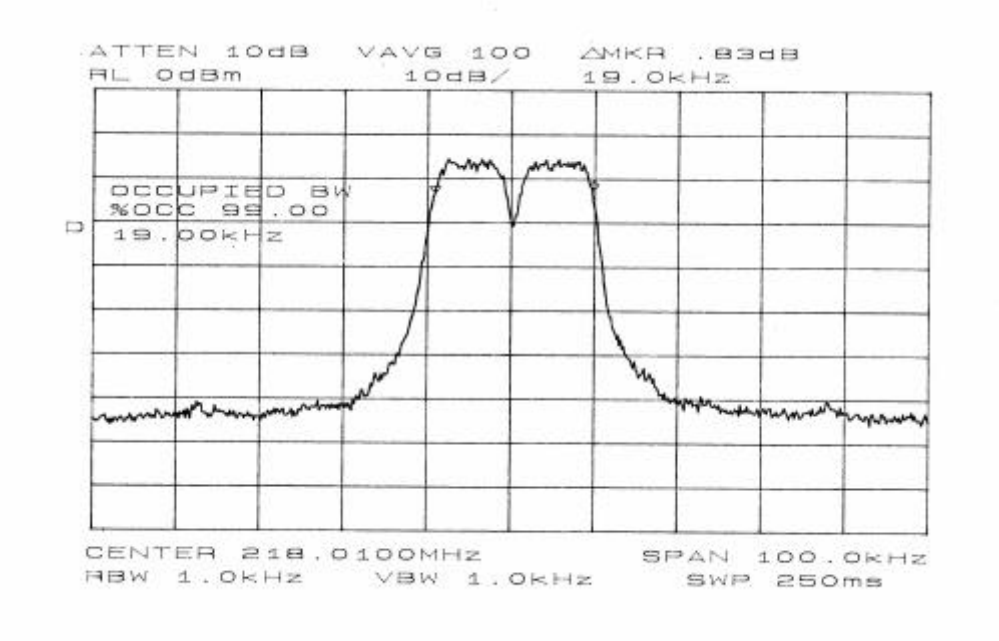
- HP Spectrum Analyzer	Model # 8560E
- Narda 30 dB Attenuator	Model # MOD 766-30

Test condition:

Modulation: Internally generated signal corresponding to the encoded 60 kbits/s 16QAM Random symbols.
Transmit frequency: 218.01 MHz.
Transmit power: 0.5 W.

Test Result:

Figure 2 is a plot of a 99% occupied bandwidth measured with a HP 8560E spectrum analyzer. The plot shows that the total mean power is well within the 20 kHz bandwidth.



2.1051 **Spurious emissions at antenna terminal.**

Test Set-Up:

Test Equipment:

- HP Spectrum Analyzer Model # 8560E
- Narda 30 dB Attenuator Model # MOD 766-30

Test conditions:

Modulation: Internally generated signal corresponding to the encoded 60 kbits/s 16QAM Random symbols.
Transmit frequency: 218.01 MHz.
Transmit power: 0.5 W

Test Result:

Spurious emissions were measured throughout the RF spectrum from 10 kHz to 2 GHz. Any emissions that were between the required attenuation and the noise floor of the spectrum analyzer were recorded.

Spurious Frequency (MHz)	dBc below the fundamental frequency
436.02	67 dBc
654.03	73 dBc
872.04	> 90 dBc
1090.05	> 90 dBc
1308.06	> 90 dBc
1526.07	> 90 dBc
1744.08	> 90 dBc
1955.97	> 90 dBc

2.1053 **Field strength of spurious radiation**.

A. The following tests were performed at an open-field test site, with the measurement instrument antenna located in the far field (3 meters) from the test antenna. The test result shows the relative radiated power of each spurious emission with reference to the rated power output of the transmitter.

Reference level calculation:

Reference level for the spurious radiation was taken as an ideal dipole exited by 0.5 watt. First, the magnitude of the fundamental frequency when radiated from an ideal dipole is calculated in V/m and then it is changed to dBm, since the spectrum analyzer measures the magnitude of the harmonic and spurious emission in dBm.

$$E = \frac{(49.2\ Pt)^{1/2}}{R}$$

Where: E= electric field intensity V/m
Pt= transmitter power in watts
R= distance in meters

$$\Rightarrow E = \frac{(49.2 \times 0.5)^{1/2}}{3}$$

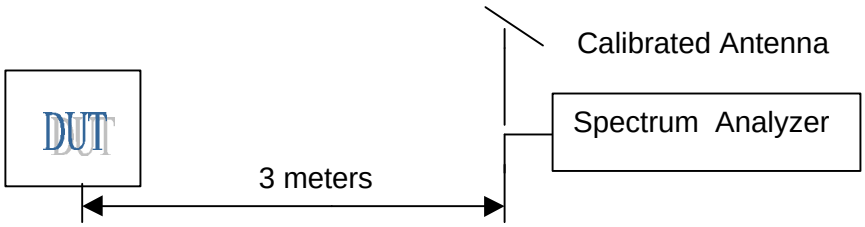
E= 1.65 V/m =1650000 μV/m

E= 20Log (1650000) = 124 dB μ/m

Since 1μV= -107 dBm, the reference fundamental frequency becomes

124 – 107 = 17 dBm

Test Set-Up:



Test Equipment:

- HP Spectrum Analyzer Model # 8560E
- Calibrated test Antenna EMCO Model 3121C

Test condition:

Modulation: Single Tone.
Transmit power: 0.5 W
Transmit frequency: 218.01 MHz

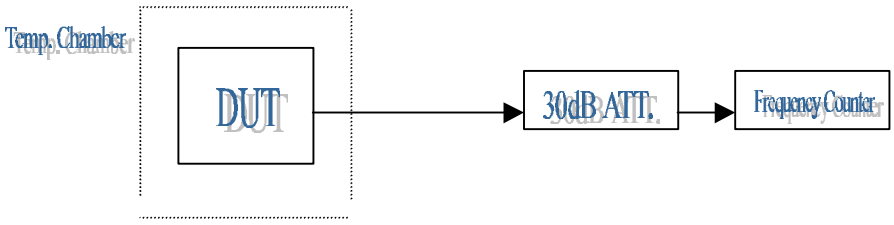
Test Result:

Spurious Frequency, MHz	dBc below the fundamental frequency
436.02	> 120 dBc
654.03	> 120 dBc
872.04	> 120 dBc
1090.05	> 120 dBc
1308.06	> 120 dBc
1526.07	> 120 dBc
1744.08	> 120 dBc
1955.98	> 120 dBc

2.1055 **Frequency stability.**

a. Frequency Stability as a function of temperature.

Test Set-Up:



Test Equipment:

- HP Frequency Counter Model # 53181A
- Narda 30 dB Attenuator Model # MOD 766-30
- Associated Environmental System Temperature Chamber
- HP Power supply Model # HP6632A

Test condition:

Modulation: Single Tone
Transmit frequency: 218.003 MHz.
Transmit power: 0.5 W
Supply voltage: 12V

Frequency measurements were made at –30 º C and at intervals of 10 º C through the range –30º to +50º C. At each temperature, the unit was exposed to test chamber ambient for 30 minutes. No COLD START measurements are performed, since the unit is designed for battery powered and having less than 3 watts mean output power.

Test Result:

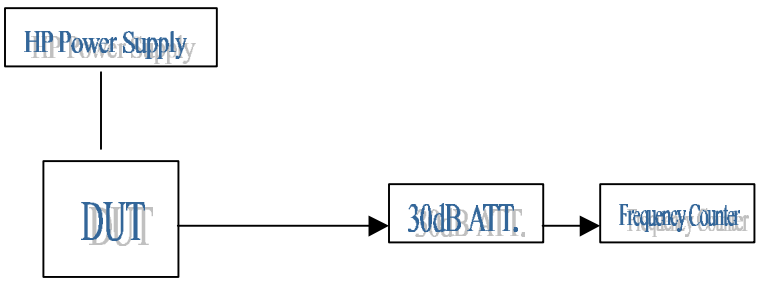
Temperature (ºC)	Frequency (MHz)
-30	218.003490
-20	218.003473
-10	218.003461
0	218.003410
10	218.003340
20	218.003223
30	218.003177
40	218.003136
50	218.003120

Maximum frequency error: 218003490 – 218003000 = 490 Hz

Test results show that the frequency stability is better than 2.5 PPM with variation of temperature from -30° C to +50° C. No short-term transient keying effects on the frequency of the transmitter is detected.

a. Frequency stability as a function of primary supply voltage.

Test Set-Up:



Test Equipment:

- HP Frequency Counter	Model # 53181A
- Narda 30 dB Attenuator	Model # MOD 766-30
- HP Power supply	Model # HP6632A

Test condition:

Modulation:	Single Tone
Transmit frequency:	218.003 MHz.
Transmit power:	0.5 W

The unit is a hand-carried, battery-powered equipment with a specified operating voltage range from 11 V to 14 V (nominal voltage: 12 V; Battery operating end point = 11 V). The HP6632A variable dc power supply was used in these tests to vary the supply voltage to the unit.

Supply Voltage (V)	Frequency (MHz)
10.5	218.002863 MHz
11.0	218.002863 MHz
11.5	218.002863 MHz
12.0	218.002864 MHz
12.5	218.002864 MHz
13.0	218.002864 MHz
13.5	218.002863 MHz
14.0	218.002862 MHz

Test results show that the frequency stability is better than 1PPM with variation of supply voltage from 10.5V to 14V. No transient keying effects on the frequency of the transmitter is detected at 12V, 10.5V and 14V supply voltage.

2.1057 **Frequency Range of Measurements**

The measurements for 2.1051 and 2.1053 were conducted over the frequency range 10 kHz to 2 GHz in acordance with paragraph (a) of 2.1057.

Statement of Test Data Accuracy

Fairfield Industries, Inc attests to the accuracy of test data presented in accordance with 2.1046 through 2.1057.

Tests performed by:
Thinh Vu
Associate Engineer
Fairfield Industries, Inc.

Tests supervised by:
Phil Richards
Sr. Project Engineer
Fairfield Industries, Inc.