

**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 a 50 Ohm dummy load.

The transmitter was tuned in accordance with the tune up procedure (Appendix 2), with a supply voltage of 28 VDC at the final amplifier stage.

Test Set-Up:



Test Equipment:

- |                             |         |              |
|-----------------------------|---------|--------------|
| - HP Power Meter            | Model # | EPM-441A     |
| - HP Power Sensor           | Model # | ECP-E18A     |
| - 2 Narda 30 dB Attenuators | Model # | HFP- 5100/30 |

Test condition:

Modulation type: 4QPSK Random Symbols

Test Result:

| <u>Frequency</u> | <u>Output Power</u> |
|------------------|---------------------|
| 216.01 MHz       | 39.60 dBm           |
| 217.01 MHz       | 39.50 dBm           |
| 218.01 MHz       | 39.50 dBm           |
| 219.99 MHz       | 39.40 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:

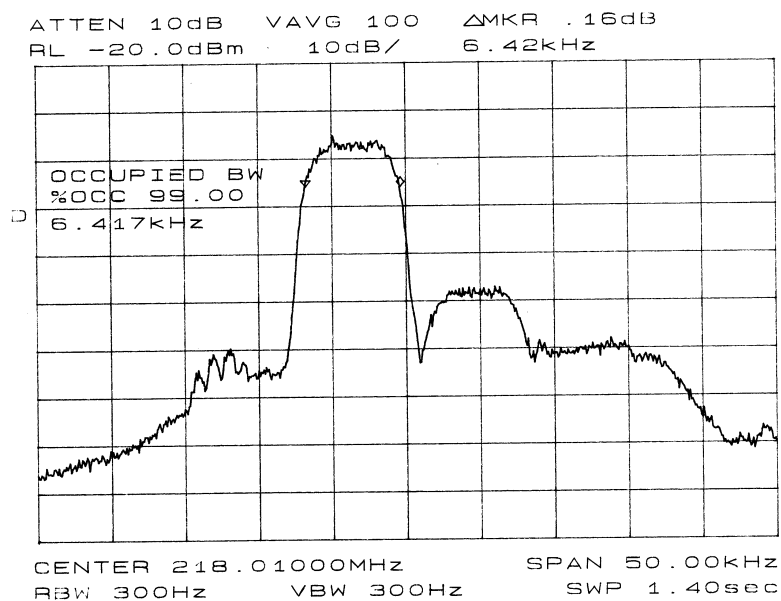
- |                             |                    |
|-----------------------------|--------------------|
| - HP Spectrum Analyzer      | Model # 8560E      |
| - 2 Narda 30 dB Attenuators | Model # MOD 766-30 |

Test condition:

Modulation: Internally generated signal corresponding to the encoded 10 kbits/s 4QPSK Random Symbols.  
Transmit frequency: 218.01 MHz.  
Transmit power: 10 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      |
| - 2 Narda 30 dB Attenuators | Model # MOD 766-30 |

Test conditions:

Modulation: Internally generated signal corresponding to the encoded 10 kbits/s 4QPSK Random symbols.  
Transmit frequency: 218.01 MHz.  
Transmit power: 10 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.

| <u>Spurious Frequency (MHz)</u> | <u>dBc below the fundamental frequency</u> |
|---------------------------------|--------------------------------------------|
| 218.025                         | 54 dBc                                     |
| 218.032                         | 40 dBc                                     |
| 436.02                          | 68 dBc                                     |
| 654.03                          | 80 dBc                                     |
| 872.04                          | 78 dBc                                     |
| 1090.05                         | 75 dBc                                     |
| 1308.06                         | > 82 dBc                                   |
| 1526.07                         | > 82 dBc                                   |
| 1744.08                         | > 82 dBc                                   |
| 1955.97                         | > 82 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 excited by 10 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.

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

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

$$\Rightarrow E = \frac{(49.2 \times 10)^{1/2}}{3}$$

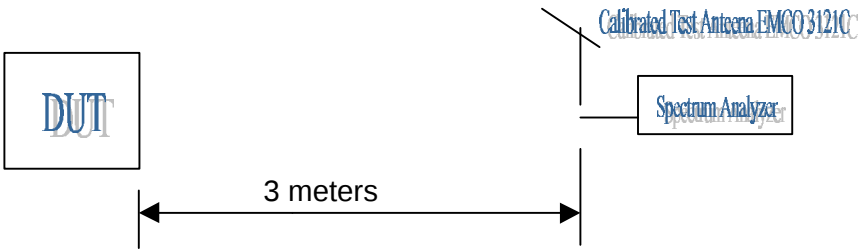
$$E = 7.40 \text{ V/m} = 7400000 \text{ } \mu\text{V/m}$$

$$E = 20\text{Log} (7400000) = 137 \text{ dB}\mu\text{/m}$$

Since  $1\mu\text{V} = -107 \text{ dBm}$ , the reference fundamental frequency becomes

$$137 - 107 = 30 \text{ dBm}$$

Test Set-Up:



Test Equipment:

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

Test condition:

Modulation:              Single Tone.  
Transmit power:        10 W  
Transmit frequency:    218.01 MHz

Test Results:

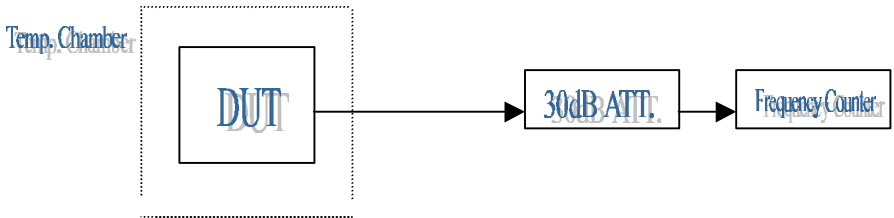
| <u>Spurious Frequency, MHz</u> | <u>dBc below the fundamental frequency</u> |
|--------------------------------|--------------------------------------------|
| 436.02                         | 112 dBc                                    |
| 654.03                         | 123 dBc                                    |
| 872.04                         | > 130 dBc                                  |
| 1090.05                        | > 130 dBc                                  |
| 1308.06                        | > 130 dBc                                  |
| 1526.07                        | > 130 dBc                                  |
| 1744.08                        | > 130 dBc                                  |
| 1955.98                        | > 130 dBc                                  |

The magnitudes of all other spurious frequencies were 20 dB or more below the fundamental frequency.

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

Test condition:

Modulation: Single Tone  
Transmit frequency: 218.003 MHz.  
Transmit power: 10 W  
Supply voltage: 220VAC

Frequency measurements were made at  $-30^{\circ}\text{C}$  and at intervals of  $10^{\circ}\text{C}$  through the range  $-30^{\circ}$  to  $+50^{\circ}\text{C}$ . At each temperature, the unit was exposed to test chamber ambient for 30 minutes. No short-term transient keying effects on the frequency of the transmitter is detected. No COLD START measurements are performed, since the unit is not designed to be used in mobile station.

Test Result:

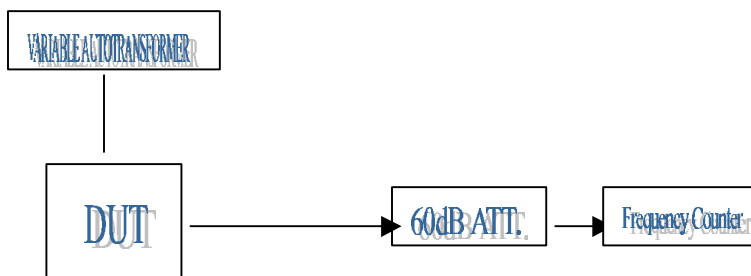
| Temperature ( $^{\circ}\text{C}$ ) | Frequency (MHz) |
|------------------------------------|-----------------|
| -30                                | 218.003012      |
| -20                                | 218.003009      |
| -10                                | 218.003015      |
| 0                                  | 218.003016      |
| 10                                 | 218.003015      |
| 20                                 | 218.003017      |
| 30                                 | 218.003004      |
| 40                                 | 218.002994      |
| 50                                 | 218.002986      |

Maximum frequency error:  $218003017 - 218002986 = 31\text{ Hz}$ .

Test results show that the frequency stability is better than 0.15 PPM with variation of temperature from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . 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     |
| - 2 Narda 30 dB Attenuators          | Model # MOD 766-30 |
| - Powerstat Variable Autotransformer | Type: 116B         |

Test condition:

Modulation: Single Tone  
Transmit frequency: 218.003 MHz.  
Transmit power: 10 W

The frequency stability as a function of primary supply voltage was measured with an HP53181A frequency counter. The nominal primary supply voltage to the unit is 220 VAC. The variable autotransformer was used to vary the primary supply voltage from 85 to 115 percent of the 220 VAC nominal value.

| <u>Supply Voltage (VAC)</u> | <u>Frequency (MHz)</u> |
|-----------------------------|------------------------|
| 187                         | 218.003000 MHz         |
| 197                         | 218.003000 MHz         |
| 207                         | 218.002999 MHz         |
| 217                         | 218.002999 MHz         |
| 227                         | 218.002999 MHz         |
| 237                         | 218.002999 MHz         |
| 247                         | 218.002999 MHz         |
| 257                         | 218.002999 MHz         |

Maximum frequency error:  $218003000 - 218002999 = 1 \text{ Hz}$ .

Test results show that the frequency stability is better than 0.005 PPM with variation of primary supply voltage from 85 to 115 percent of the nominal value.

**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 accordance with paragraph (a) of 2.2057.

**Statement of Test Data Accuracy**

Fairfield Industries, Inc. attests to the accuracy of test data presented in accordance with 2.1.046 through 2.1057.

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