1 RF POWER OUTPUT

1.1 Test Instrumentation

[X] Hewlett-Packard 437B Power Meter
[X] Hewlett-Packard 34401A Digital Multimeter
[X] Hewlett-Packard 6622A System DC Power Supply

2 MODULATION CHARACTERISTICS

2.1 Test instrumentation

[X] Hewlett-Packard 8901B Modulation Analyzer
[X] Hewlett-Packard 8903B Audio Analyzer
[X] Hewlett-Packard 6622A System DC Power Supply
[X] Hewlett-Packard 8657A Signal Generator
[X] Sierra 30 dB Attenuator, Model: 661A-30

3 OCCUPIED BANDWIDTH

3.1 Test instrumentation

[X] Hewlett-Packard 6622A System DC Power Supply
[X] Hewlett-Packard 8563E Spectrum Analyzer
[X] Computer

4 TRANSMITTER CONDUCTED SPURIOUS EMISSIONS

4.1 Test instrumentation

[X] Agilent 8595E Spectrum Analyzer
[X] Hewlett-Packard 6622A System DC Power Supply
[X] MiniCircuit NHP-700 High Pass Filter
[X] Sierra 30 dB Attenuator, Model: 661A-30

5 TRANSMITTER RADIATED SPURIOUS EMISSIONS

5.1 Test instrumentation

[X] HP 8546A EMI Receiver
[X] Pasternack 6 dB Attenuator, PE7014-6
[X] Hewlett-Packard 8491B, 20 dB Attenuator
[X] Topward Power Supply
[X] Boonton 4232 Power Meter
[X] HP 83620 B Signal Generator
[X] Roberts Tunable Dipole Antenna
[X] Roberts Tunable Dipole Antenna

6 FREQUENCY STABILITY

6.1 Test instrumentation

[X] Votsch Temperature Chamber, VT4010
[X] Hewlett-Packard 8901B Modulation Analyzer
[X] Hewlett-Packard 6622A System DC Power Supply
[X] Sierra 30 dB Attenuator, Model: 661A-30

7 TRANSIENT FREQUENCY BEHAVIOR

7.1 Test instrumentation

[X] Philips PM3392A AutoRanging CombiScope
[X] Hewlett-Packard 6622A System DC Power Supply
[X] Hewlett-Packard 8657A Signal Generator
[X] Hewlett-Packard 8901B Modulation Analyzer
[X] Narda Bi-directional Coaxial Coupler, Model: 3020A
[X] Wavetek Negative RF Detector
[X] Weinschel 50 Ohm Termination
[X] Weinschel 10 dB Attenuator
[X] Sierra 30 dB Attenuator, Model: 661A-30

8 RF POWER OUTPUT

8.1 Test Procedure

The transmitter is operated under normal conditions at the specified nominal DC input voltage. The antenna output is terminated in 50 ohms. The DC supply path to the final stage only is interrupted to allow insertion of a DC ammeter in series with the DC supply. The DC voltage drop of the ammeter is negligible. A DC voltmeter is computed as the product of the DC current (in amps) times the DC voltage (in volts). This measurement is performed at the upper and lower limits of the frequency range. At each frequency, the measurement is performed at the upper and lower limits of the specified adjustable power range.

9 MODULATION CHARACTERISTICS

9.1 Test Procedure

9.1.1 Audio Frequency Response

The RF output of the transceiver was connected to the input of a modulation analyzer through sufficient attenuation so as not to overload the analyzer or distort the readings. An audio signal generator was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone connectors.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEV_{REF}. With the audio signal generator level unchanged, set the generator frequency between 100 Hz to 100 kHz. The transmitter deviations (DEV_{FREQ}) were measured and the audio frequency response was calculated as

9.1.2 Audio Low-Pass Filter Response

An audio signal generator and an audio spectrum analyzer were connected to the input and output of the post limiter low pass filter respectively. The audio signal generator frequency was set between 1000 Hz and the upper low pass filter limit. The audio frequency response at test frequency was calculated as

$$LEV_{FREQ} - LEV_{REF}$$

9.1.3 Modulation Limiting

With the same setup as section 4.2.1 above, at three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded.

10 OCCUPIED BANDWIDTH

10.1 Test Procedure

The antenna was disconnected from the transmitter and the short cable was connected to the transmitter RF output.

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth and video bandwidth of the spectrum analyzer was set at 300 Hz. With the transmitter keyed, the level of the unmodulated carrier was set to the full scale reference line of the spectrum analyzer. This is used as a 0dB reference for emission mask measurements.

The transmitter was then modulated with a 2500 Hz tone at an input level 16 dB greater than the necessary to produce 50% of rated system deviation. The resolution bandwidth of the spectrum analyzer was set to 300 Hz and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask.

11 TRANSMITTER CONDUCTED SPURIOUS EMISSIONS

11.1 Test Procedure

The output of the transmitter is connected, via a suitable attenuator, to the input of an HP8561B spectrum analyzer. After a carrier reference level has been established, a tunable notch filter is inserted between the attenuator and the spectrum analyzer to allow suppression of the carrier level. The effect of the notch filter on other frequencies, if any, is plotted. This data is measured at the upper and lower frequency limits of the frequency range. If transmit power is adjusted, the measurement is repeated at various power levels including minimum and maximum.

FCC Limits -- Per Applicable Rule Parts
Conducted spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency in accordance with the following formula:

For 25 kHz Channel Bandwidth:
Spurious attenuation in dB =43+10 $\log_{10}$ (Power output in watts)

For 12.5 kHz Channel Bandwidth:
Spurious attenuation in dB =50+10 $\log_{10}$ (Power output in watts)

12 TRANSMITTER RADIATED SPURIOUS EMISSIONS

12.1 Test Procedure

The transmitter was placed on a wooden turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3 orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The spurious harmonic attenuation was measured as the difference between ERP in dBm at the fundamental frequency and at the spurious emission frequency.

Spurious attenuation in dB = 43 +10Log$_{10}$(power out in Watts)

13 FREQUENCY STABILITY

13.1 Test Procedure

The ppm frequency error of the transmitter was calculated by:
Where MCF is the Measured Carrier Frequency in MHz
ACF is the Assigned Carrier Frequency in MHz

13.1.1 Frequency Stability vs. Temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

13.1.2 Frequency Stability vs. Voltage

At room temperature (25 +/- 5^{o} C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured from 85% to 110% of the nominal operating input voltage.

14 TRANSIENT FREQUENCY BEHAVIOR

14.1 Test Procedure

Test setup was configured according to the paragraph 2.2.19 of the TIA/EIA 603-1. A digital oscilloscope was used to capture the transient response.

15 EMISSIONS DESIGNATOR CALCULATION

Employing Carson’s rule for the FM modulation, the required bandwidth for 5 and 2.5 kHz deviation systems is as follows.

i) For a 5 kHz Deviation System
BW = 2(M+D)= 2(3+5) = 2(8) = 16kHz.
Emission Designator 16K0F3E

ii) For a 2.5 kHz Deviation System
BW = 2(M+D) = 2(3+2.5)= 2(5.5) = 11kHz.
Emission Designator 11K0F3E