

**TEST SET-UP PROCUDURES**

**Equipment Used for Submitted Data**

**Transmitter Frequency:**

HP8901B Modulation Analyzer

**Temperature Measurement:**

HP8901B Modulation Analyzer

HP8482B Power Sensor and 30dB Attenuator

**DC Voltage and Currents:**

HP6623A Power Supply

HP34401A Digital Multimeter

**Deviation:**

HP8901B Modulation Analyzer

**Transmitter Conducted Spurious and Harmonic Emissions:**

HP8561B Spectrum Analyzer

MiniCircuit NHP-300 High Pass Filter

**Transmitter Occupied Bandwidth:**

HP8561A Spectrum Analyzer

**Transient Frequency Behavior:**

PHILIPS PM3382 Digital Storage Oscilloscope

NADAR Bi-Directional Coaxial Coupler

HP8657A Signal Generator

HP8901B Modulation Analyzer

WAVETEK Negative RF Detector

30dB Attenuator

MEASUREMENT DIV. Combiner

PANASONIC KX-P1124 Printer

**Radiated Spurious and Harmonic Emissions:**

HP 8566A Spectrum Analyzer

HP8665B Sweep Oscillator

EMCO 3121C-DB4 Tuned Dipole Antenna (400 - 1000 MHz)

EMCO 3147 Log Periodic Antenna (200 - 5000 MHz)

EMCO 3104C Biconical Antenna (20 - 200 MHz)

Weinschel Engineering 50-ohms, 20 - Watt load

The calibration of this equipment is performed at regular intervals.

## TEST SET-UP PROCEDURES

### Measurement Procedures Used for Submitted Data

#### 1) RF Power Vs. DC Power Input (FCC Rules Part 2.985)

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.

#### 2) Transmitter Audio Frequency Response (FCC Rules Part 2.987(a))

An audio oscillator is connected to the microphone audio input of the transmitter. At a frequency of 1kHz, the level is adjusted to obtain 20% of full system deviation, to ensure that limiting does not occur at any frequency in the 300 - 3000 Hz range. A constant input level is then maintained and the oscillator frequency is varied between the range of 100 Hz to 100 kHz. The transmitter output is monitored with an HP8901B modulation analyzer, whose FM demodulator output is monitored with an audio analyzer. De-emphasis or filtering within the test equipment is not used. The audio oscillator signal is derived from the HP8903B audio analyzer. This response measurements is linear at all frequencies, therefore the response above 3000 Hz is not attenuated as rapidly as would be the case with an in-limit response above 3000 Hz as used in EIA - 152C section 7.3. However, this method does not produce a response discontinuity at 3000 Hz.

#### FCC Limits:

Minimum Standard - The audio frequency response shall not vary more than +1 or -3 dB from 300 to 3000 Hz as referenced to 1000 Hz level (with the exception of a permissible 6 dB/octave roll off from 2500 to 3000 Hz).

#### 3) Transmitter Audio Post - Limiter Low Pass Filter Response (FCC Rules Part 2.987(a))

Operate the transmitter under standard test conditions and monitor the output with a modulation or calibrated test receiver. Adjust the audio input frequency to 1000 Hz and the input level to 20 dB greater than that required to produce standard test modulation. Note the output level on the frequency deviation meter or calibrated test receiver. Use this output level as a reference (0 dB), vary the modulating frequency from 1000 Hz to 30000 Hz and observe the change in output while maintaining a constant input level.

#### FCC Limits -- Per Applicable Rule Parts

Frequencies between 3 kHz. and 15 kHz. shall be attenuated greater than the attenuation at 1Kz by  $40 \log_{10}(f/3)$  dB. Frequencies above 15 kHz shall be attenuated 28 dB.

#### 4) Modulation Limiting Characteristic (FCC Rules Part 2.987(a))

An audio oscillator is connected to the microphone audio input. The transmitter output is monitored with an HP8901B modulation analyzer, whose non-de-emphasized FM demodulator output is fed to an HP8903B audio analyzer. The modulation analyzer's 20 kHz low pass filter is used to reduce the level of residual high frequency noise. The oscillator level is adjusted, at 1 kHz, to obtain 60% of full system deviation. The oscillator level is then varied over a range of +/- 25 dB increments and the resulting deviation is plotted. This measurement is repeated at 300 Hz and 3 kHz.

#### FCC Limits:

Minimum Standard - The transmitter modulation must not exceed rated system deviation at any frequency input or reasonable change in input level.

## TEST SET-UP PROCUDURES

### Measurement Procedures Used for Submitted Data

#### 5) Occupied Bandwidth (FCC Rules Part 2.989)

An audio oscillator is connected to the microphone input. The frequency is set to 2500 Hz and the amplitude is adjusted to a level 16 dB above that required to produce 50% of full system deviation at the frequency of maximum response of the audio modulating circuit, in accordance with FCC rules Part 2.989(a)(1). The transmitter output is connected, via a suitable attenuator, to an HP8568A spectrum analyzer. Spectrum analysis of the transmitter output is performed to at least +/- 2.5 times the channel spacing, first of the unmodulated carrier to establish a 0 dB reference, then with the modulated signal applied.

**FCC Limits** -- Per 90.210 (a) (1), (2), (3)

**Emission Mask B – 25 kHz channel bandwidth.** For transmitters that are equipped with an audio low-pass filter.

- Measured Data: (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least  $43+10 \log_{10}(P)$  dB.

**Emission Mask D - 12.5 kHz channel bandwidth.** For Transmitters that designed to operate with 12.5Khz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- Measured Data: (1) On any frequency from the center of the authorized bandwidth  $f_o$  to 5.625Khz removed from  $f_o$  : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz.) of more than 5.625 kHz. but no more than 12.5Khz. At least  $7.27 (f_d - 2.88 \text{ kHz.})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz.) of more than 12.5Khz: At least  $50+10 \log_{10}(P)$  dB or 70 dB, whichever is the lesser attenuation

#### 6) Conducted Spurious Emissions (FCC rules Part 2.991)

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)

## TEST SET-UP PROCEDURES

### Measurement Procedures Used for Submitted Data

#### 7) Radiated Spurious Emissions (FCC Rules Part 2.993)

Transmitter radiated spurious emissions were measured using at an open field test site constructed in accordance with Appendix B, FCC/OST 55 (1982). The measurement performed is the equivalent of the FCC Code of Federal Regulations, Title 47, Part 2, paragraph 2.993.

#### FCC Limits -- Per Applicable Rule Parts

Radiated Spurious emissions shall be attenuated below the maximum level of the 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)

#### 8) Frequency Stability Vs Temperature (FCC Rules Part 2.995)

This data was measured in accordance with FCC Rules Part 2.995 (a)(1). An HP8901B modulation analyzer is used as a reference for frequency measurements. The Tenney Jr. Chamber is used for temperature measurements of the environmental.

#### FCC Limits -- Per 90.213 and Applicable Rule Parts

Temperature - Frequency Stability of +/- .0005% from -30 to +60 degrees centigrade (-20 to +50 degrees centigrade Maritime parts 81 & 83).

#### 9) Frequency Stability Vs. Voltage (FCC Rules Part 2.995)

This data measured in accordance with FCC Rules Part 2.995 (d). An HP8901B is used as a reference for frequency measurements.

#### FCC Limits -- Per 90.213 and Applicable Rule Parts

Power Supply Voltage - Frequency Stability of +/- .0005% from 85% to 115% of nominal voltage. (See CRF Rule Part 90.213)

#### 10) Transient Frequency Behavior

This data measured in accordance with FCC Rules. Applicable method of measurement and definition in Section 2.2.19 of the TIA/EIA SP-2218.

#### FCC Limits -- Per Applicable Rule Parts

During the period  $t_1$  and  $t_3$  the frequency difference shall not exceed +/- 25 kHz.

During the period  $t_2$  the frequency difference shall not exceed +/- 12.5 kHz.

If the transmitter carrier output power rating is 6 Watts or less, the frequency deviation during  $t_1$  and  $t_3$  may be greater than +/- 25kHz. The corresponding plot of frequency versus time during  $t_1$  and  $t_3$  shall be recorded in the test data.

**TEST SET-UP PROCUDURES**

**Emission Designator Information**

Emission Designator for equipment: **FCC ID: AZ489FT4837**

Employing Carsons 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**

$$BW = 2(M+D) = 2(3 +5) = 2(8) = 16 \text{ kHz.}$$

Emission Designator 16K0F3E (Voice)

**ii) For a 2.5 kHz Deviation System**

$$BW = 2(M+D) = 2(3 +2.5) = 2(5.5) = 11 \text{ kHz.}$$

Emission Designator 11K0F3E (Voice)