TEST SET-UP PROCUDURES

Equipment Used for Submitted Data

Pursuant To FCC Rules 2.999. The calibration of this equipment is performed at regular intervals.

Transmitter Frequency:
HP8901B Modulation Analyzer

Temperature Measurement:
HP8901B Modulation Analyzer
HP8482B Power Sensor and 30dB Attenuator (High Power 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:
Hewlett Packard model 8566A spectrum analyzer
Hewlett Packard model 8350B sweep oscillator
Empire Devices DM-105/T3 tuned dipole antenna (400-1000 MHz)
EMCO 3121C-DB4 tuned dipole antenna (400-1000 MHz)
EMCO 3105 ridged W.G. antennas (1-12.4 GHz)
Bird model 8130 50 □, 50 Watt load

TEST SET-UP PROCUDURES

Measurement Procedures Used for Submitted Data

1) **RF Power Vs. DC Power Input (FCC Rules Part 2.993)**
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 the 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))**
The transmitter output is monitored with an HP8901B Modulation Analyzer, whose FM demodulator output is fed to an HP8903B Audio Analyzer. De-emphasis or filtering within the test equipment is not used. An audio oscillator signal, derived from the HP8903B Audio Analyzer, is connected to the microphone audio input of the transmitter. At a frequency of 1 kHz, the level is adjusted to obtain 20% of full system deviation, to ensure that limiting does not occur at any frequency in the range of 300 - 3000 Hz. A constant input level is then maintained and the oscillator frequency is varied between the range of 100 Hz to 3000 Hz. The frequency response is plotted, using a reference of 0 dB at 1 kHz. The audio oscillator signal is then increase to a level 20 dB greater than that required for standard test modulation at 1 kHz. The oscillator frequency is varied from 3 kHz to at least 30 kHz. The frequency response is plotted, using a reference of 0 dB at 1 kHz.

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 1kHz by 40 log10 (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 in 5 dB increments and the resulting deviation is plotted. This measurement is repeated at 300 Hz and 3 kHz. The above procedure is performed three times, for conditions with and without TPL and DPL (continuous sub-audible signaling formats).

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)**

Procedure for Occupied Bandwidth for Voice Transmission.

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. This measurement is repeated with TPL continuous sub-audible signaling added (250.3 Hz at 15% full system deviation) and again with DPL (code131 at 15% of full system deviation). These measurements are then repeated for all types of signaling or data transmission that are not used simultaneously with voice. In these cases, the signaling or data modulation replaces the 2500 Hz tone modulation. The measurement is performed separately for conditions with TPL, DPL and without sub-audible signaling.

Procedure for Occupied Bandwidth for Data Transmission.

An audio function generator capable of voltage control of frequency is connected to the Flat (non pre-emphasized) Transmit Audio Input of the transmitter under test. A second function generator producing a square wave output at a frequency of 1200 Hz is connected to the voltage control input of the first generator. The first generator is set to produce a sine wave signal at a center frequency of 2500 Hz, and the amplitude of the square wave from the second generator is adjusted so that the frequency of the first generator is varied ±500 Hz. The resulting output of the first generator is an AFSK sine wave signal that shifts between two discrete frequencies, 2000 Hz and 3000 Hz, at a rate of 1200 Hz. The amplitude of the first generator, which modulates the transmitter, is adjusted for full system deviation.

The transmitter output is connected, via a suitable attenuator, to an HP8593A Spectrum Analyzer that outputs to an HP7470A plotter. Spectrum analysis of the transmitter output is performed to at least ±2.5 times the channel spacing. The unmodulated carrier is used to establish a 0-dB reference, and then the modulating signal is applied. This measurement is repeated with Tone Private Line continuous sub-audible signaling added (250.3 Hz at 15% full system deviation) and again with Digital Private Line (code 131 at 15% of full system deviation). In each case, the amplitude of the modulating signal is adjusted so that the total deviation level, including the TPL or DPL modulation, is the full system deviation.

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 fo : 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 - 2.88Khz) 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.

TEST SET-UP PROCUDURES

Measurement Procedures Used for Submitted Data

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 watt)

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

Radiated Spurious and Harmonic Emissions were performed by:

Motorola Plantation EMC Lab
8000 West Sunrise Blvd.
Fort Lauderdale, FL 33322
USA.

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 80).

TEST SET-UP PROCUDURES

Measurement Procedures Used for Submitted Data

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 (FCC Rules Part 90.214)**
This data measured in accordance with FCC Rules. Applicable method of measurement and definition in Section 2.2.19 of the TIA/EIA 603. Specifically, the triggering level was set in the following manner.

1) The radio (11W) was keyed into a HP438A Power Meter in order to set -10 dBm level. This level is 40 dB lower than the maximum input level of the HP8901B.

2) A HP8657A Signal Generator modulated with a 1 kHz tone and (12.5 kHz or 25 kHz) of deviation was then input to the Power Meter and the output adjusted to achieve a -10 dBm level. This level was then lowered by 20 dB, and maintained for the balance of the testing.

3) The 30 dB attenuator was then removed from the radio output path, thus creating a 40 dB difference between the Generator level and the transmitter level.

All other measurements were completed per the procedure outlined in part 2.2.19 of TIA/EIA-603 and the results saved and plotted.

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 with **FCC ID: AZ492FT4835**

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) = 16 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 kHz.
Emission Designator 11K0F3E (Voice)