MEASUREMENT PROCEDURE AND TEST EQUIPMENT USED

Except where otherwise stated, all measurements are made following the Telecommunications Industries Association/Electronic Industries Association (TIA/EIA) "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards" (TIA/EIA-603-1992).

This exhibit presents a brief summary of how the measurements were made, the required limits, and the test equipment used.

The following procedures are presented with this application.

1) Test Equipment List
2) RF Power Output
3) Audio Frequency Response (*)
4) Post Limiter Lowpass Filter Response (*)
5) Modulation Limiting Characteristic (*)
6) Occupied Bandwidth (*)
7) Conducted Spurious Emissions
8) Radiated Spurious Emissions
9) Frequency Stability (*)
10) Transient Frequency Behavior (*)
11) Line Conducted Spurious Emissions (*)

NOTE: Items marked with (*) have data from FCC filing ID ABZ99FT4023.

Test Equipment List

Pursuant To FCC Rules 2.999

Transmitter Frequency:
HP 5385A Frequency Counter with High-Stability Reference

Temperature Measurement:
HP 2804A Quartz Thermometer

Transmitter RF Power:
HP 435A Power Meter with HP 8482A Power Sensor

DC Voltages and Currents:
Fluke 8010A Digital Voltmeter

Audio Responses:
HP 8903B Audio Analyzer

Deviation:
HP 8901B Modulation Analyzer

Transmitter Conducted Spurious and Harmonic Emissions:
HP 8566B Spectrum Analyzer with HP 85685A Preselector

Transmitter Occupied Bandwidth:
HP 8566B Spectrum Analyzer with HP 8565A Preselector using an HP 7550A Graphics Plotter

The calibration of this equipment is performed at regular intervals.

Radiated Spurious and Harmonic Emissions
Radiated Spurious and Harmonic Emissions were performed by:

Elite Electronic Engineering Company
1516 Centre Circle
Downers Grove, Illinois 60515-1082

Measurement Procedures Used for Submitted Data

EXHIBIT 6A - RF Power Output 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 Ω. 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 used to measure the dc voltage applied to the final stage. The dc input power to the final stage, in Watts, is computed as the product of the dc current (in Amperes) times the dc voltage (in Volts). This measurement is performed at the lowest, the center and the highest operating frequencies of the frequency range

EXHIBIT 6B - Transmitter Audio Frequency Response (FCC Rules Part 2.987)

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 increased 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.

EXHIBIT 6C - Transmitter Audio Post Limiter Lowpass Filter Response (FCC Rules Part 2.987)

The audio oscillator portion of an HP8903B Audio Analyzer is connected to the input of the post limiter lowpass filter. The output of the lowpass filter is measured with the HP8903B Audio Analyzer. The response is swept between the limits of 100 Hz and 100 kHz. Oscillator level is chosen to be the as high as possible that will not cause limiting at any frequency, and is maintained constant vs. frequency.

EXHIBIT 6D - Modulation Limiting Characteristic (FCC Rules Part 2.987)

An audio oscillator is connected to the microphone audio input. The transmitter output is monitored with an HP8901B Modulation Analyzer. The flat frequency response FM demodulator output of the HP8901B is fed to an HP8903B Audio Analyzer. The 20 kHz lowpass filter of the Modulation Analyzer 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 Tone Private Line and Digital Private Line (continuous subaudible signaling formats).

Measurement Procedures Used for Submitted Data (continued)

EXHIBIT 6E - Occupied Bandwidth (FCC Rules Part 2.989)

Procedure for Occupied Bandwidth for Voice Transmission

An audio oscillator is connected to the microphone audio 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 modulation circuit, in accordance with FCC rules Part 2.989(a)(1).

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, then with the modulating signal is applied. This measurement is repeated with Tone Private Line continuous subaudible signaling added (250.3 Hz at 15% full system deviation) and again with Digital Private Line (code 131 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 Tone Private Line, Digital Private Line, and without subaudible 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, then the modulating signal is applied. This measurement is repeated with Tone Private Line continuous subaudible 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.

EXHIBIT 6F - Conducted Spurious Emissions (FCC Rules Part 2.991)

The output of the transmitter is connected, via a suitable attenuator, to the input of an HP8593A 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,

Measurement Procedures Used for Submitted Data (continued)

is taken into account. The level of spurious emissions, in dB relative to the carrier, is plotted. This data is measured at the upper and lower frequency limits of the frequency range. If transmit power is adjustable, the measurement is repeated at various power levels including minimum and maximum.

EXHIBIT 6G - Radiated Spurious Emissions (FCC Rules Part 2.993)

Transmitter radiated spurious emissions were measured by Elite Electronic Engineering Company, 1516 Centre Circle, Downers Grove, Illinois 60515. Measurements were made at an approved open field test site constructed in accordance with Appendix B, FCC/OST 55 (1982), and were performed in accordance with the Code of Federal Regulations, Title 47, Part 2, paragraph 2.993. The data is plotted as “Radiated Spurious and Harmonic Emissions (Horizontal and Vertical)” on the graphs comprising Exhibit 6G. The specification limit corresponding to a level of 43 dB + 10 log (Pout) below the fundamental carrier power of the transmitter is indicated on each graph for reference.

The following additional instruments are used in performing the radiated field strength measurements:

- 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 Ω, 50 Watt load

EXHIBIT 6H and 6J - Frequency Stability vs. Temperature and vs. Voltage (FCC Rules Part 2.995)

Frequency Stability vs. Temperature data is measured in accordance with FCC Rules Part 2.995(a)(1). An HP5061A Cesium Beam Frequency Standard is used as a reference for frequency measurements. The calibration of the temperature measurements of the environmental chamber is referenced to an HP2804A Quartz Thermometer.

Frequency Stability vs. Voltage data is measured in accordance with FCC Rules Part 2.995(d). An HP5061A Cesium Beam Frequency Standard is used as a reference for frequency measurements.

EXHIBIT 6K - Transient Frequency Behavior (FCC Rules Part 90.214)

The testing was performed per the method outlined in part 2.2.19 of 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.

Measurement Procedures Used for Submitted Data (continued)

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.

EXHIBIT 6L - Line Conducted Spurious Emissions (FCC Rules Part 15.107(a))

This data is measured in accordance with FCC Rules Part 15.107(a). The measurement is performed to the method described in TIA/EIA - 603, paragraph 2.1.3. The Line Stabilization Network (LiSN) is a Rohde and Schwarz ESH 2-Z5 “Artificial Mains Network”. The monitor receiver is a Rohde and Schwarz ESH 3 with a receive range from 9 kHz to 30 MHz.