EXHIBIT 7

MEASUREMENT PROCEDURES USED FOR SUBMITTED DATA

EXHIBIT 7A - RF Output Power vs. DC Power Input - Pursuant to 47 CFR 2.1046

Conducted power is measured in accordance with TIA/EIA-603 section 2.2.1.2. The transmitter under test is connected to an HP 438A Power Meter using the forward port of a directional coupler and a 20 dB pad. Appropriate calibration offsets, derived from a traceable RF attenuator, which has been precision characterized by an outside testing laboratory, are entered into the wattmeter to calibrate for the use of the coupler.

The transmitter is operated under normal conditions at the specified nominal DC input voltage. The DC supply path to the final stage only (or to the RF power amplifier module, if the final stage only is not accessible) 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 middle, and the highest operating frequencies of the operating bandwidth of the equipment.

The calibration of the power meter, detector, and attenuator pads is verified on an annual basis. Other power measurement systems that may be used are correlated with this calibrated reference system before measurements are performed, and calibration factors are adjusted as necessary to obtain precise correlation.

EXHIBIT 7B - Transmit Audio Frequency Response – Pursuant to 47 CFR 2.1047 (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 Hz – 3000 Hz. A constant input level is then maintained and the oscillator frequency is varied between the ranges of 100 Hz to 5000 Hz. The frequency response is plotted, using a reference of 0 dB at 1 kHz.

EXHIBIT 7C - Transmit Audio Post Limiter Low Pass Filter Response – Pursuant to 47 CFR 2.1047 (a)

The audio oscillator portion of an HP8903B audio analyzer is connected to the input of the post limiter low pass filter. The oscillator is adjusted, at 1000 Hz and level 16 dB greater than that required to produce standard test modulation. The output of the low pass filter is measured with an Agilent 35670A dynamic signal analyzer. The response is swept between the limits of 1000 Hz - 30000 Hz. Oscillator level is chosen to be as high as possible and that will not cause limiting at any frequency, and maintaining a constant input level versus frequency.

EXHIBIT 7D – Modulation Limiting Characteristic – Pursuant to 47 CFR 2.1047 (b)

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 low pass 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 +/-20dB 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 Tone Private Line, Digital Private Line, and Carrier Squelch Mode (without sub-audible signaling).

EXHIBIT 7E - Occupied Bandwidth - Pursuant to 47 CFR 2.1049 (c) (1)

Procedure for Occupied Bandwidth Measurement for Voice Transmission

The transmitter is connected, via a suitable attenuator, to the Agilent E4445B Spectrum Analyzer. The spectrum analyzer settings for the reference calibration are in accordance with 47 CFR 90.210 (d) (4). The unmodulated carrier's emission spectrum is captured on the spectrum analyzer and then used to establish a 0 dB reference plot for exhibits.

The HP 8903B audio source is connected to the microphone audio input of the transmitter. The audio source 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 47 CFR Part 2.1049(c)(1). The spectrum analyzer settings are adjusted in accordance with 47 CFR 90.210(d)(4) and the analyzer is swept to record the resultant emission levels using the appropriate emission mask.

This measurement is repeated with Tone Private Line (TPL) sub-audible signaling and audio by adding a 250.3 Hz TPL tone at 15% full system deviation with the previously defined 2500 Hz tone. The amplitude of the modulating signal is adjusted so that the total deviation, which includes the TPL deviation, is the full system deviation. An additional measurement is made with Digital Private Line (DPL) sub-audible signaling and audio by adding a DPL code 131 at 15% full system deviation with the previously defined 2500 Hz tone. The amplitude of the modulating signal is adjusted so that the total deviation, which includes the DPL deviation, is the full system deviation.

Procedure for Occupied Bandwidth Measurement for 2000/3000 Hz FSK Data

The transmitter is connected, via a suitable attenuator, to the Agilent E4445B Spectrum Analyzer. The spectrum analyzer settings for the reference calibration are in accordance with 47 CFR 90.210 (d) (4). The unmodulated carrier's emission spectrum is captured on the spectrum analyzer and then used to establish a 0 dB reference plot for exhibits.

The audio function generator is connected to the flat (non-pre-emphasized) transmit audio input of the radio 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 spectrum analyzer settings are adjusted in accordance with 47 CFR 90.210 (d) (4) and the analyzer is swept to record the resultant emission levels using the appropriate emission mask.

This measurement is repeated with Tone Private Line (TPL) sub-audible signaling and 2000/3000 Hz FSK data by adding a 250.3 Hz TPL tone at 15% full system deviation with the previously defined data signal. The amplitude of the modulating signal is adjusted so that the total deviation, which includes the TPL deviation, is the full system deviation. An additional measurement is made with Digital Private Line (DPL) sub-audible signaling and 2000/300 Hz FSK data by adding a DPL code 131 at 15% full system deviation with the previously defined 2500 Hz tone. The amplitude of the modulating signal is adjusted so that the total deviation, which includes the DPL deviation, is the full system deviation.

Procedure for Occupied Bandwidth Measurement for DTMF

The transmitter is connected, via a suitable attenuator, to the Agilent E4445B Spectrum Analyzer. The spectrum analyzer settings for the reference calibration are in accordance with 47 CFR 90.210 (d) (4). The unmodulated carrier's emission spectrum is captured on the spectrum analyzer and then used to establish a 0 dB reference plot for exhibits.

The transmitter is keyed up and the "#" key pressed to generate the worst-case DTMF tones (941 Hz and 1633 Hz). The spectrum analyzer settings are adjusted in accordance with 47 CFR 90.210 (d) (4) and the analyzer is swept to record the resultant emission levels using the appropriate emission mask.

This measurement is repeated with Tone Private Line (TPL) sub-audible signaling and
DTMF by adding a 250.3 Hz TPL tone at 15% full system deviation with the previously defined DTMF signal. An additional measurement is made with Digital Private Line (DPL) sub-audible signaling and DTMF by adding a DPL code 131 at 15% full system deviation with the previously defined DTMF signal.

Procedure for Occupied Bandwidth Measurement for 4-Level FSK Data

The transmitter is connected, via a suitable attenuator, to the Agilent E4445B Spectrum Analyzer. The spectrum analyzer settings for the reference calibration are in accordance with 47 CFR 90.210 (d) (4). The unmodulated carrier's emission spectrum is captured on the spectrum analyzer and then used to establish a 0 dB reference plot for exhibits.

The radio is placed in test mode such that it transmits a 511-bit pseudo-random bit sequence based on ITU-T O.153 in the 2:1 TDMA protocol's payload, which is in accordance to 47 CFR 2.1049 (h). The spectrum analyzer settings are adjusted in accordance with 47 CFR 90.210 (d) (4) and the analyzer is swept to record the resultant emission levels using the appropriate emission mask.

FCC Limits for 12.5 kHz Channel: 47 CFR 90.210 (d)

For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1. On any frequency from the center of the authorized bandwidth fo to 5.625 kHz removed from fo: 0 dB.
2. On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: at least 7.27*(fd – 2.88 kHz) dB.
3. On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: at least 50 + 10*log(P) dB or 70 dB (whichever is the lesser attenuation).

Note: The occupied bandwidth plot exhibits cover a ± 100 kHz frequency range that is centered on the assigned frequency. The radiated and conducted spurious emissions exhibits cover emissions at frequency offsets greater than ± 100 kHz.

EXHIBIT 7F - Conducted Spurious Emissions - Pursuant to FCC Rule 2.1051

The output of the transmitter is connected, via a suitable attenuator, to the input of an Agilent E4404B spectrum analyzer. 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.

EXHIBIT 7G - Radiated Spurious Emissions - Pursuant to 47 CFR 2.1053

Transmitter radiated spurious emissions were measured by Motorola Plantation EMC Lab. 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 2.1053. The data is plotted as "Radiated Spurious Emissions" on the graphs comprising EXHIBIT 6G. The specification limit corresponding to a level of 43 dB + 10log (Pout) for 25 kHz Channel Spacing and 50 dB + 10log (Pout) for 12.5

kHz Channel Spacing below the fundamental carrier power of the transmitter as indicated on each graph for reference.

EXHIBIT 7H – Frequency Stability vs. Temperature and vs. Voltage - Pursuant to 47 CFR 2.1055(a) (b) (d)

Frequency Stability vs. Temperature data is measured in accordance with FCC Rules Part 2.1055 (a) (1). A HP8901B modulation analyzer is used to measure the frequency of the signal transmitted by the radio by way of a 20dB attenuator.. The radio is placed in a Votsch, model VT4010 Temperature Chamber, and the frequency is measured as the temperature is incremented from –30 to +60 degrees C in 10 degrees increments.

Frequency Stability versus Voltage data is measured in accordance with FCC Rules Part 2.1055 (d). A HP8901B modulation analyzer is used to measure the frequency of the signal transmitted by the radio by way of a 20dB attenuator. The supply voltage of the radio is swept +30% and –23% of 7.5Vdc.

EXHIBIT 7J - Power Line Conducted Spurious Emissions - Pursuant to FCC Rule 15.107

This data measured in accordance with FCC Rules 15.107. The equipment is connected to the power line through a line stabilization network. A spectrum analyzer of nominal 50Ω impedance to one terminal of the line stabilization network. The spectrum analyzer is then tuned to search for spurious outputs from 150 kHz to 30 MHz. Record all spurious outputs found. The spectrum analyzer is then connected to the other terminal of the line stabilization network and record all spurious outputs found. The power line conducted spurious emissions is the largest reading obtained. The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the Table: 1.

Table: 1

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

EXHIBIT 7K – Transient Frequency Behavior – Pursuant to FCC Rule 90.214

This data measured in accordance with FCC Rules. Applicable method of measurement and definition can be found in Section 2.2.19 of the TIA/EIA 603. Specifically, the triggering level was set in the following manner.

The output of the radio is connected to an HP8901B modulation analyzer by way of a directional coupler, 30dB attenuator, and 2:1 combining network. This output is first measured with an Agilent E4416A power meter and then the power meter is replaced by the HP8901B modulation analyzer, and the RF output of an Agilent E4420B signal generator is connected to the second port of the combining network at a level of 30dB less than the output level of the radio measured after the attenuator. The RF output of the Agilent E4420B signal generator is modulated with a 1 kHz tone and deviation of 12.5 kHz or 25 kHz depending on the channel spacing. The modulation output of the HP8901B modulation analyzer is connected to a digital storage oscilloscope, Agilent Infiniium 54831DMSO. The signal generator is turned on first, and then the radio keyed or de-keyed depending on the particular test. The oscilloscope is triggered by way of a RF peak detector that detects the RF output of the radio by way of the directional coupler.

The picture of the oscilloscope display is stored on a floppy disk and transferred to a computer. The key up attack time plot shows the 1 kHz from the RF signal generator signal from the modulation output of the HP8901B modulation analyzer, and when the radio is keyed, the output signal from the radio captures the receiver of the HP8901B modulation analyzer, resulting in the carrier only signal. The de-key decay time plots show the unmodulated signal from the radio and when the radio is de-keyed, the 1 kHz from the RF signal generator signal captures the receiver of the HP8901B modulation analyzer, resulting in the 1 kHz signal shown in the plots.

Measurement Equipment List – Pursuant to FCC Rules 2.947 (d), 47 CFR 2.1033 (c)

1) Computer : DELL Latitude D600 Notebook, Window 2000.
2) Spectrum Analyzer : Agilent E4404B, 9 kHz – 6.7 GHz
3) Spectrum Analyzer : Agilent E4445A, 3 Hz – 13.2 GHz
4) Dynamic Signal Analyzer : Agilent 35670A
5) RF Signal Generator : Agilent E4420B, 250 kHz – 2 GHz
6) Modulation Analyzer : HP 8901B
7) Audio Analyzer : HP 8903B
8) Power Meter : Agilent E4416A
9) Power Sensor : Agilent E9301B
10) Oscilloscope : Agilent Infiniium 54831DMSO.
11) Multimeter : HP 34401A.
12) DC Power Supply : HP 6623A
13) Directional Coupler : HP 778D, Dual Directional Coupler.
14) Temperature Chamber : VOTSCH, VT4010.
15) 30 dB attenuator : Weinschel, model 24-30-34-LIM
16) High Pass Filter : Mini-Circuit NHP 300
17) 50 ohms terminating load : MCE/Weinschel 1429-4

Additional equipment used by EMC Test Laboratory

Manufacturer	Item	Item Version/	Serial
Name	Name	Model #	Number
	Description		

OATS Test Equipment

Rohde & Schwarz	Signal Generator	SMP22	DE21162
Rhode & Schwarz	Spectrum Analyzer/ESI Test Receiver	ESI 26	8277691009
Hewlett Packard	Power Supply	6032A	3542A12712
Sunol Sciences Corp.	System controller	SC98V	213981
Sunol Sciences Corp.	System controller	SC98V	313981
Sunol Sciences Corp.	Turntable. Flush Mount 2M	FM2011	NA
Sunol Sciences Corp.	Antenna Positioning Tower	TLT95/TWR95	NA
Motorola	OATS RF Tray	2000	NA

High Pass Filter

Trilithic	High Pass Filter	X5HX1612-0-75-AA	9811186

OATS Antennas

Watkins- Johnson	L.P. Antenna. Freq. 0.5 - 12.4 GHz	WJ-48010	234
Watkins- Johnson	L.P. Antenna. Freq. 0.5 - 12.4 GHz	WJ-48010	173
A.H. Systems Inc.	DRG Horn Freq. 700 MHz - 18 GHz	SAS-200/571	272
A.H. Systems Inc.	DRG Horn Freq. 700 MHz - 18 GHz	SAS-200/571	271
EMCO	Biconilog. Freq. 20 MHz – 1 GHz	3143	9403-1019
EMCO	Biconilog. Freq. 20 MHz – 1 GHz	3141	9703-1047
Schaffner-Chase EMC Ltd.	Bilog Antenna	CBL6112B	2660

AC Line Conducted

EMCO	Line Impedance Stabilization Network	3810/2NM LISN	9612-1740

OATS PreAmplifier

MITEQ	25dB Gain Amplifier 1 – 18 GHz	AFS5-00101800-25-ULN	