

**EXHIBIT 7****MEASUREMENT PROCEDURES USED FOR SUBMITTED DATA****EXHIBIT 7A - RF Output Power** - Pursuant to 47 CFR 2.1046

The RF power output is measured with the transmitter adjusted in accordance with the tune-up procedure outlined in Exhibit 7 to give the value of voltage and current as specified in Exhibit 4 as required by 2.1033(c)(8). A 50-ohm RF attenuator of proper power rating was used as a load for making these measurements. The power measurements were made using an Agilent series E4416 power meter with E9301B power sensor and 30dB attenuator.

**EXHIBIT 7B - Transmit Audio Frequency Response** – Pursuant to 47 CFR 2.1047(a)

Operate the transmitter under standard test conditions and monitor the output with a frequency deviation meter or calibrated test receiver. With 1000 Hz sine wave audio input applied through a dummy microphone circuit, adjust the audio input to give 20% of full rated system deviation maintaining a constant input voltage, vary the input frequency from 300 to 3000 Hz, and observe the deviation.

Minimum Standard

The audio frequency response shall not vary more than +1 or -3 dB from 300 to 3000 Hz from a true 6 dB per octave pre-emphasis characteristic as referenced to 1000 Hz level, with the exception of a permissible 6 dB/octave roll off below 500 Hz.

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

Operate the transmitter under standard test conditions and monitor the output of the post limiter low-pass filter with an audio spectrum analyzer or AC voltmeter. 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 audio spectrum analyzer or AC voltmeter. Use this output dB level as reference (LEVREF), vary the modulating frequency from 3000 Hz to the upper low pass filter limit and record the dB level on the audio spectrum analyzer or AC voltmeter as LEVFRE while maintaining a constant input level. The audio frequency response of the low-pass filter in accordance with the following formula:

$$\text{Low-Pass Filter Response} = \text{LEVREF} - \text{LEVREQ}$$

FCC Limits -- Per applicable rule parts.

- 450 to 869 MHz & VHF Marine.
- Frequencies between 3 kHz and 20 kHz shall be attenuated greater than the attenuation at 1 kHz by  $60 \log_{10}(f/3)$  dB.
- Frequencies above 20 kHz shall be attenuated at least 50 dB.

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

The transmitter shall be adjusted for full rated system deviation. Adjust the audio input for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0 dB) vary the audio input level from the reference to a level 20 dB above it for modulation frequencies of 300, 1000 and 3000 Hz. Record the system deviation obtained as a function of the input level.

FCC Limits

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

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

Data on occupied bandwidth is presented in the form of a spectrum analyzer photograph, which illustrates the transmitter sidebands. For analog signals, the reference line for the data plot is taken of the unmodulated carrier, to which is superimposed the sideband display generated by modulating the carrier with a 2500 Hz tone at a level 16 dB greater than that required to produce 50 percent modulation. For digital voice and data, the reference line for the data plot is that of the peak value of the modulated carrier. For digital voice, the carrier with a 2500 Hz tone at a level 16 dB greater than that required to produce 50 percent modulation. For digital data, the carrier is modulated with a Standard Transmitter Test Pattern, which is a continuously repeating 511 bit pseudo-random bit sequence based on ITU-T 0.153. If tone or digital coded squelch is indicated, photographs using both the 2500 Hz tone and the indicated squelch signal are used to modulate the transmitter. During these measurements, the instantaneous Deviation Control is set for a maximum of +5 kHz.

FCC Limits - Per Applicable Rule Parts.

Measured Data: At least +25 dB down on any frequency removed from the assigned frequency by more than 50 % and up to and including 100% of the authorized bandwidth. At least +35 dB down on any frequency removed from the assigned frequency by more than 100% up to and including 250% of the authorized bandwidth; at least 43 plus 10 log 10 (mean output power in watts) decibels or 70 decibels, whichever is the lesser attenuation.

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

The transmitter is terminated into a 50 ohm load and interfaced with a spectrum analyzer which allows the spurious emission level relative to the carrier level to be measured directly. Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of rated system deviation at 1000 Hz. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier or as high as the state of the art permits except for that region close to the carrier equal to + 250% of the authorized bandwidth.

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:

Spurious attenuation in dB =  $43 + 10 \log_{10}$  (Power output in watts) for 25 kHz Channelization. Spurious attenuation in dB =  $50 + 10 \log_{10}$  (Power output in watts) for 12.5 kHz Channelization.

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

Test Site:

The site, located at Plantation, Florida, is in a region, which is reasonably free from RF interference and has been approved by the Commission for Spurious Measurements.

The equipment is placed on the turntable, connected to a dummy RF load and then placed in normal operation using the intended power source. A broadband receiving antenna, located 10 meters from the transmitter-under-test (TUT), picks up any signals radiated from the transmitter and its operation accessories. The antenna is adjustable in height and can be horizontally and vertically polarized. A spectrum analyzer covering the necessary frequency range is used to detect and measure any radiation picked up by the above mentioned receiving antenna.

Method of Measurement:

The equipment is adjusted to obtain peak reading of received signals wherever they occur in the spectrum by:

1. Rotating the transmitter under test.
2. Adjusting the antenna height.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. Relative signal strength is indicated on the spectrum analyzer connected to the receiving antenna. To obtain actual radiated signal strength for each spurious and harmonic frequency observed, a standard signal generator with calibrated output is connected to a dipole antenna adjusted to that particular frequency. This dipole antenna is substituted for the transmitter under test. The signal generator is adjusted in output level until a reading identical to that obtained with the actual transmitter is observed on the spectrum analyzer. Signal strength is then read directly from the generator. Actual measurements are recorded on the attached graphs.

FCC Limits -- Per Applicable Rule Parts.

Radiated spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency in accordance with the following formula:

$$\text{Spurious attenuation in dB} = 43 + 10 \log_{10}(\text{Power output in watts}).$$

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

A. Temperature (Non-heated type crystal oscillators): Frequency measurements are made at the extremes of the temperature range -30 to +60 degrees centigrade and at intervals of not more than 10 degrees centigrade throughout the range. Sufficient time is allowed prior to each measurement for the circuit components to stabilize.

B. Power Supply Voltage: The primary voltage was varied from 85% to 115% of the nominal supply voltage. Voltage is measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. In addition, the primary voltage will be reduced to the point where the radio performs a reset (battery operating end point).

FCC Limits -- Per FCC Rule 90.213

Temperature - Frequency Stability of  $\pm 1.5$  ppm from -30 to +60 degrees centigrade. Power Supply Voltage - Frequency Stability of  $\pm 1.5$  ppm from 85% to 115% of nominal voltage.

**EXHIBIT 7I - Measurement Equipment List** – Pursuant to FCC Rules 2.947(d), 47 CFR 2.1033(c)

- 1) Computer: HP Pentium PC, Window 2000.
- 2) Spectrum Analyzer: HP 8563E, 9 kHz-26.5 GHz.
- 3) Spectrum Analyzer: HP 8560E, 30 Hz-2.9 GHz.
- 4) RF Signal Generator: HP 8657B, 0.1 - 2060 MHz RF Signal Generator.
- 5) Modulation Analyzer. HP 8901B.
- 6) Audio Analyzer .HP 8903B.
- 7) Dynamic Signal Analyzer: HP 35665A
- 8) Power Meter. E4416. Sensor E9301B
- 9) Oscilloscope. Phillips PM3392.
- 10) Multimeter: Hewlett Packard 34401A.
- 11) DC Power Supply: Hewlett Packard 6033A
- 12) Directional Coupler: Hewlett Packard 778D, Dual Directional Coupler.
- 13) Temperature Chamber: Votsch, model VT4010.
- 14) 30dB Attenuator: Weinschell, model 493043LIM

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
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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
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OATS Antennas

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

AC Line Conducted

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

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