TEST SET-UP PROCEDURES AND TEST EQUIPMENT USED

Pursuant to 47 CFR 2.1041

Except where otherwise stated, all measurements are made following the Telecommunications Industries Association (TIA) “Land Mobile FM or PM Communications Equipment Measurement and Performance Standards” (TIA-603-D).

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) Transmit 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 vs. Temperature and Voltage
10) Transient Frequency Behavior

Test Equipment List

Pursuant to 47 CFR 2.1033(c)

The following test equipment was used to perform the measurements of the submitted data. The calibration of this equipment is performed at regular intervals.

Test	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Due date
RF Power Output	DC Power Supply	Agilent	6652A	MY40000291	n/a	8/31/2012	8/31/2013
	Power Meter	Gigatronics	8652A	8650734	n/a	8/29/2012	8/29/2013
	Power Sensor	Gigatronics	80301A	1825606	0.01 - 18 GHz	8/31/2012	8/31/2013
Transmit Audio Response	Modulation Analyzer	HP	HP8901B	3749A05962	.15 - 1300MHz	8/21/2012	8/21/2013
	DC Power Supply	HP	HP6652A	US36400275	0Hz (DC)	5/30/2012	5/30/2014
	Audio Analyzer	HP	8903B	3729A18323	0-250kHz	8/21/2012	8/21/2013
Low Pass (Splatter) Filter Response	UPV	Rhode and Schwartz	UPV	10068	0-250kHz	9/17/2012	9/17/2014
	Audio Analyzer	Agilent	U8903A	MY49420007	0-100kHz	9/14/2012	9/14/2013
	DC Power Supply	HP	HP6033A	3329A07464	0Hz (DC)	9/14/2012	9/14/2013
Modulation Limiting Characteristics	Audio Analyzer	HP	8903B	2922A06797	0-250kHz	9/3/2012	9/3/2013
	Modulation Analyzer	HP	HP8901B	3403A04909	.15 - 1300MHz	9/6/2012	9/6/2013
Occupied Bandwidth	DC Power Supply	HP	HP6652A	3519A02097	0 Hz (DC)	9/16/2012	9/16/2013
	Modulation Analyzer	HP	HP8901B	2414A00208	150 KHz - 1300 MHz	8/27/2012	8/27/2013
	Audio Analyzer	HP	HP8903B	3011A10310	20 KHz - 100KHz	9/1/2012	9/1/2013
	Spectrum Alayzer	Agilent	E4445A	MY45300894	3 Hz - 13.2 GHz	9/27/2012	9/27/2013

	Function / Arbitrary waveform gen	HP	HP33120A	A01629	DC - 15 MHz	Cal not Required	
	Function Generator	BK Precision	4011	A11638	DC - 5 MHz	Cal not Required	
	Universial Service Encoder	CT System	300	A11639		Cal not Required	
Transmit Conducted Spurious Emissions	Spectrum Analyzer	Agilent	PSA E4445A	MY44300631		4/1/2011	4/1/2013
	Power Meter	Agilent	E4417	G841291718		8/24/2012	8/24/2013
	Power Sensor	HP	HP8481	2702A74852		8/31/2011	8/31/2013
	Power Sensor	HP	HP8481	2349A39195		8/31/2011	8/31/2013
	Power Sensor	Agilent	E9325	US40420450		8/24/2012	8/24/2013
	Power Sensor	Agilent	E9325	US40420304		8/24/2012	8/24/2013
	DC Power Supply	Agilent	HP6652	3235A-00690		8/31/2011	8/31/2013
	DC Power Supply	Agilent	HP6652	3235A-00673		8/31/2011	8/31/2013
Transmit Radiated Spurious Emissions	**OATS TESTING**						
	Signal Generator	Rohde & Schwarz	SMP22	YYYYC836	E52848	100015	5/2/2013
	Spectrum Analyzer/ESI Test Receiver	Rhode & Schwarz	ESI 26	RRRZA002	E52456	100017	8/7/2013
	Spectrum Analyzer/ESI Test Receiver	Rhode & Schwarz	ESI 26	RRRZA001	E51508	827769/009	3/21/2013
	System controller	Sunol Sciences Corp.	SC99V	NA	NA	110901-1	No Cal. Reqired
	Turntable. Flush Mount 2M Part# 15284	Sunol Sciences Corp.	FM2011VS	NA	NA	60811	No Cal. Reqired
	Antenna Positioning Tower	Sunol Sciences Corp.	TLT2	NA	NA	042304-5	No Cal. Reqired
	Antenna Positioning Tower	Sunol Sciences Corp.	TLT2	NA	NA	091503-3	No Cal. Reqired
	OATS RF Tray	Motorola	2000	NA	NA	NA	No Cal. Reqired

	Power Supply	Hewlett Packard	6032A	PSHP-CA18	F73804	2933A-0S108	4/6/2013
	OATS ANTENNAS						
	DRG Horn Freq. 700MHZ-18GHZ	A.H. Systems Inc.	SAS-571	BBBBC698	NA	511	4/26/2013
	DRG Horn Freq. 700MHZ-18GHZ	A.H. Systems Inc.	SAS-571	AAAAY772	NA	512	8/14/2013
	Bilog Antenna 30MHz to 2GHz	TESEQ GmbH Berlin	CBL 6112D	NA	NA	30991	8/14/2013
	Bilog Antenna	Schaffner-Chase EMC Ltd.	CBL6112B	AAAAV772	NA	2839	3/9/2013
Frequency Stability	DC Power Supply	HP	HP66252A	Asset: A12582	0Hz (DC)	10-Sep-12	10-Sep-13
	Modulation Analyzer	HP	HP8901B	Asset: A12018	150KHz-1300MHz	7-Sep-12	7-Sep-13
	Temperature Chamber	Thermotron		Asset: A00477		Not Required	Not Required
Transient Freq Behavior	DC Power Supply	HP	HP6032A	3102A06888	0Hz (DC)	9/10/2012	9/10/2013
	Spectrum Analyzer	Rhode and Schwarz	FSU	100361	20 Hz to 8 GHz	9/6/2012	9/6/2013
	Power Meter	HP	HP428A	3048U02948	100KHz-26.5GHz	9/6/2012	9/6/2013

Radiated Spurious and Harmonic Emissions:

Radiated Spurious and Harmonic Emissions were performed by:

Motorola Plantation OATS (Open Area Test Site) Lab
8000 West Sunrise Blvd.
Plantation, Florida 33322

FCC Registration: 91932
Industry of Canada: IC109U-1
ISO 25 certified

Measurement Procedures Used for Submitted Data

EXHIBIT 6A - **RF Power Output vs. DC Power Input** – Pursuant to 47 CFR 2.1046

Conducted power is measured in accordance with TIA-603-D section 2.2.1.2. The transmitter under test is connected to an Gigatronics 8652A 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 voltage applied to the final stages and the current it draws are read directly from the calibrated DC Power Supply (Agilent 6652A). Remote voltage sensing is used to ensure the correct DC voltage is applied to the Final Device. 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 6B - Transmitter Audio Frequency Response – Pursuant to 47 CFR 2.1047(a)

The transmitter output is monitored with an HP 8901B Modulation Analyzer, whose FM demodulator output is fed to an HP 8903B Audio Analyzer. De-emphasis is disabled and filtering above 15 kHz, internal to the test equipment, is used. An audio oscillator signal, derived from the HP 8903B 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 range of 100 Hz to 5000 Hz. The frequency response is plotted, using a reference of 0 dB at 1 kHz.

EXHIBIT 6C - **Transmitter Audio Post Limiter Lowpass Filter Response** – Pursuant to 47 CFR 2.1047(a)

The audio oscillator portion of an HP 8903B Audio Analyzer is connected to the input of the post limiter lowpass filter. The output of the lowpass filter (OMAP TX SSI) is measured with the Rohde & Schwarz UPV Audio Analyzer. The response is swept between the limits of 100 Hz and 30 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** – Pursuant to 47 CFR 2.1047(b)

An audio oscillator is connected to the microphone audio input. The transmitter output is monitored with an HP 8901B Modulation Analyzer. The flat frequency response FM

demodulator output of the HP 8901B is fed to an HP 8903B 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 ±20 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 four times, for conditions with Tone Private Line, Digital Private Line, Trunking (these are continuous subaudible signaling formats), and without subaudible signalling (referred to as “carrier squelch mode”).

EXHIBIT 6E - **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 E4445A 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 E4445A 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 E4445A 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 E4445A 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 f_o to 5.625 kHz removed from f_o: 0 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 12.5 kHz: at least $7.27*(f_d - 2.88\ kHz)$ dB.
3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 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 6F - **Conducted Spurious Emissions** – Pursuant to 47 CFR 2.1051

The output of the transmitter is connected, via a suitable attenuator, to the input of an Agilent PSA E4445A Spectrum Analyzer. The level of spurious emissions, in dBm, is plotted. This data is measured at the lower, middle, and upper frequency limits of the frequency range. Since the transmit power is adjustable, the measurement is repeated at various power levels including minimum and maximum.

EXHIBIT 6G - **Radiated Spurious Emissions** – Pursuant to 47 CFR 2.1053

Transmitter radiated spurious emissions were measured by the Motorola Plantation OATS (Open Area Test Site) Lab, located at 8000 West Sunrise Blvd, Plantation, Florida 33322. 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 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.

EXHIBIT 6H-1 and 6H-2 - **Frequency Stability vs. Temperature and vs. Voltage** – Pursuant to 47 CFR 2.1055(a)(b) and (d)

Frequency Stability vs. Temperature data is measured in accordance with FCC Rules Part 2.1055(a)(1). A Cesium Beam Frequency Standard is used as a reference for frequency measurements. The calibration of the temperature measurements is referenced to a Thermotron 2800 Environmental Chamber.

Frequency Stability vs. Voltage data is measured in accordance with FCC Rules Part 2.1055(d). A Cesium Beam Frequency Standard is used as a reference for frequency measurements.

EXHIBIT 6I - **Transient Frequency Behavior** – Pursuant to 47 CFR 90.214

The trigger level on the Rohde & Schwartz FSU Spectrum Analyzer is set at 40 dB below rated power and the trigger sense is set to capture either the key-up or de-key event as appropriate. The center frequency and span are set to the appropriate levels. The FSU is then placed into the single-trigger mode. The radio is keyed up or dekeyed as appropriate, and the resultant captured waveform is plotted.