Measurement Procedure & Test Equipment Used

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	x
2.	RF Power Output Data	x
3.	Audio Frequency Response	x
4.	Audio Low Pass Filter Response	x
5.	Modulation Limiting	x
6.	Occupied Bandwidth	x
7.	Radiated Spurious Emissions	x
8.	Conducted Spurious Emissions	x
9.	Frequency Stability (Volt/Temp)	x
10.	Transient Frequency Behavior	x
11.	Power Line Conducted Spurious Emissions	x

Test Equipment List

Pursuant To FCC Rules 2.947 (d)

Equipment	Model No.	Serial No.	Cal Due date
HP DC Power Supply	6033A	2642A02483	6/1/2014
Agilent Power Meter	E4416A	GB41292919	7/4/2014
Agilent Power Sensor (with 30dB Pad)	E9301A	MY41495370	7/4/2014
HP Modulation Analyzer	8901B	2920A02230	11/15/2014
HP Audio Analyzer	8903B	2922A07025	11/12/2014
Agilent Dynamic Signal Analyzer	35670A	MY42507095	10/5/2014
PSA Spectrum Alayzer	E4445A	MY45300745	8/28/2014
Function Generator	33120A	US36005090	6/1/2014
Rohde & Schwarz Signal Generator	SMP22	YYYYC836	5/2/2013
Rohde & Schwarz Spectrum Analyzer/ESI Test Receiver	ESI 26	RRRZA002	8/7/2013
Rohde & Schwarz EM1 Test Receiver	ESIB 40	BBBBD750	9/19/2013
Sunol Sciences System controller	SC99V	NA	No Cal. Reqired
Sunol Sciences Turntable. Flush Mount 2M Part# 15284	FM2011VS	NA	No Cal. Reqired
Sunol Sciences Antenna Positioning Tower	TLT2	NA	No Cal. Reqired
Sunol Sciences Antenna Positioning Tower	TLT2	NA	No Cal. Reqired
Motorola OATS RF Tray	2000	NA	No Cal. Reqired
HP Power Supply	6032A	PSHP-DD17	12/19/2014
A.H. Systems Inc. DRG Horn Freq. 700MHZ-18GHZ	SAS-571	BBBBC698	4/26/2013
A.H. Systems Inc. DRG Horn Freq. 700MHZ-18GHZ	SAS-571	AAAAY772	8/14/2013
TESEQ GmbH Berlin Bilog Antenna 30MHz to 2GHz	CBL 6112D	NA	8/14/2013
EMCO Bilog Antenna	3141	AAAAV771	4/30/2013
ESPEC Temperature Chamber	SH-241	920008993	11/9/2014
Oscilloscope	54833A DSO	MY43000202	11/13/2014
RF Signal Generator	E4413B	US40050566	3/22/2014
EMI Test Receiver 20Hz – 26.5GHz	ESM1-1032	849152/002	4/3/2014
EMI Test Receiver Display	ESAI-D-804	849182/012	4/3/2014
Line Impedanace Stab. Network	3816/2NM	133386	2/27/2014

Table 1: List of equipments used

Test Name	FCC Rules Part (47 CFR)	IC Rules
RF Power Output Data	2.1046(a), 2.1033(c)(6), 2.1033(c)(7) and 2.1033(c)(8) * 90.545(b)(4) (700 MHz) 22.565(f) (VHF & UHF), * 24.132 (900 MHz) 74.461 (VHF & UHF)	RSS-Gen Sec 4.8, RSS-119 Sec 5.4.1, * RSS 134 (900 MHz)
TX Audio Frequency Response	2.1047 and 2.1033(c)(13)	-
TX Audio Low Pass Filter Response	2.1047	-
Modulation Limiting	2.1047 74.463 (VHF & UHF)	-
Occupied Bandwidth	2.1049, 90.210, 90.691 (800 MHz), 22.359 (VHF,UHF), * 24.133 (900 MHz), 74.462(b) (VHF & UHF)	RSS GEN Sec 4.6, RSS 119 Sec 5.5, * RSS 134 (900 MHz)
TX Conducted Spurious Emissions	2.1051, 90.210, 22.359 (VHF,UHF), * 80.211(c) (VHF), 74.462(c) (VHF & UHF)	RSS GEN Sec 6.2, RSS 119, * RSS 182 (VHF)
TX Radiated Spurious Emissions	2.1053, 90.210, 22.359 (VHF,UHF) 74.462(c) (VHF & UHF)	RSS GEN Sec 4.9, RSS 119 Sec 4.2, 5.8
Frequency Stability (Temp / Supply Voltage)	2.1055, 90.213, 22.355, 74.464 (VHF & UHF)	RSS GEN Sec 4.7 RSS 119 Sec 5.3
Power Line Conducted Spurious Emissions	15.107	-

Table 2: List of FCC and IC reference

** Note: Not Applicable for this filing*

Measurement Procedures Used for Submitted Data

RF Power Output

Pursuant to FCC Rules 2.1046 (a)

Conducted power is measured in accordance with TIA-603-D section 2.2.1.2. The transmitter under test is connected to an Power Meter using the forward port of a 30 dB attenuator pad and power sensor. 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 transmitter and the current it draws are read directly from the calibrated DC Power Supply. Remote voltage sensing is used to ensure the correct DC voltage is applied to the final PA 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.

Audio Frequency Response

Pursuant FCC Rules 2.1047 (a)

The transmitter output is monitored with an modulation analyzer, whose FM demodulator output is fed to an audio analyzer. De-emphasis or filtering within the test equipment is not used. An audio oscillator signal, derived from the audio analyzer, is connected to the microphone audio input of the transmitter. At a frequency of 1kHz, 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 300Hz – 3000Hz. A constant input level is then maintained and the oscillator frequency is varied between the ranges of 100Hz to 5000Hz. The frequency response is plotted, using a reference of 0 dB at 1kHz.

Audio Low Pass Filter Response

Pursuant FCC Rules 2.1047 (a)

The audio oscillator portion of an audio analyzer is connected to the input of the post limiter low pass filter. The oscillator is adjusted, at 1000Hz and level 16 dB greater than that required to produce standard test modulation. The output of the low pass filter is measured with an dynamic signal analyzer. The response is swept between the limits of 1000Hz - 30000Hz. 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.

Modulation Limiting

Pursuant FCC Rules 2.1047 (b)

An audio oscillator is connected to the microphone audio input. The transmitter output is monitored with an modulation analyzer. The flat frequency response FM demodulator output of the modulation analyzer is fed to an 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”).

Occupied Bandwidth

Pursuant to FCC Rules 2.1049

Procedure for Occupied Bandwidth Measurement for Voice Transmission

The transmitter is connected, via a suitable attenuator, to the 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 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 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 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 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.

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 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.

Note:
RBW setting is adjusted to 100kHz for both Part 22 and RSS 119.

Radiated Spurious Emissions

Pursuant to FCC Rules 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.

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: 0013253380
Industry of Canada: IC109U-1
ISO 25 certified

Note:
RBW setting is adjusted to 100kHz for both Part 22 and RSS 119.

Frequency Stability

Pursuant to FCC Rule 2.1055

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.

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 603D. Specifically, the triggering level was set in the following manner.

The output of the radio is connected to an modulation analyzer by way of a directional coupler, 30dB attenuator, and 2:1 combining network. This output is first measured with an power meter and then the power meter is replaced by the modulation analyzer, and the RF output of a 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 signal generator is modulated with a 1kHz tone and deviation of 12.5kHz or 25kHz depending on the channel spacing. The modulation output of the modulation analyzer is connected to a digital storage oscilloscope. 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 1kHz from the RF signal generator signal from the modulation output of the modulation analyzer, and when the radio is keyed, the output signal from the radio captures the receiver of the 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 1kHz from the RF signal generator signal captures the receiver of the modulation analyzer, resulting in the 1kHz signal shown in the plots.

Powerline Conducted Spurious Emissions

Pursuant to FCC Rule 15.107

Power line conducted 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 a shielded conducted room were performed in accordance with the ANSI C63.4 2003 requirements. The data is plotted as “EMI Conducted Scan” on the graphs comprising in Exhibit 6 test report.