

**EXHIBIT 7**

**Measurement Procedure & Test Equipment Used**

Except where otherwise stated, all measurements are made following the Electronic Industries Association (EIA) Minimum Standard for Portable/Personal Land Mobile Communications FM or PM Equipment 25-1000 MHz-(EIA/TIA-603D).

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	<u>    x    </u>
2.	RF Power Output Data	<u>    x    </u>
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**Test Equipment List**

Pursuant To FCC Rules 2.947 (d)

<b>N o.</b>	<b>Equipment</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal Cycle</b>	<b>Cal Due date</b>
1	Lenovo Laptop	T400	R8-RZCLK	N/A	*Calibration not required*
2	Lenovo AC Adapter	42T4424	11S42T4424Z1ZF3 E9BV2DD	N/A	*Calibration not required*
3	Dynamic Signal Analyzer	35670A	MY42506685	3 years	28-Aug-2017
4	Power Meter	E4416A	GB41292504	3 years	3-Feb-2017
5	Power Sensor	E4412A	MY41495365	3 years	8-Jan-2017
6	Spectrum Analyzer	E4445A	MY44300503	3 years	9-Dec-2017
7	PXA Signal Analyzer	N9030A	MY51361247	3 years	31-Oct-2017
8	Audio Analyzer	8903B	3011A11370	3 years	26-Aug-2017
9	Modulation Analyzer	8901B	3005A02626	3 years	20-May-2017
10	System power supply	6033A	2642A02311	3 years	8-May-2017
11	30 dB attenuator: MCE/Weinschel	33-30-34	NA	N/A	*Calibration not required*
12	Temperature Chamber	SH-641	92008472	1 year	16-June-2015
13	Agilent Spectrum Analyzer	E7405A	MY45106084		1-Aug-2015
14	Schaffner Bilog Antenna (30MHz – 2GHz) BL4	CBL6112B	2593		13-Dec-2015
15	Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441056		15-Aug-2015
16	Toyo Preamplifier	TPA0118036	00000005		16-Oct-2015
17	EMCO Horn Antenna (1GHz-18GHz)	3115	9901-5671		13-Mar-2016
18	R&S Test Receiver – ESI1	ESI40	100010		23-Jul-2015
19	Schaffner Bilog Antenna (30MHz-2GHz) BL3	CBL6112D	2549		29-Jan-2016
20	ETS Horn Antenna (18GHz-40GHz)	3116	0004-2474		2-Oct-2015
21	TDK-RF Horn Antenna	HRN-0118	102191		13-Mar-2016
22	Agilent Preamplifier (1GHz-26.5GHz) (PA18)	8449D	3008A02305		6-Oct-2015
23	Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441096		13-Oct-2015
24	Schaffner EMI Receiver	SMR4503	040		11-Feb-2016
25	Agilent EMC Analyzer-SA7	E7403A	US41160167		28-May-2015
26	Schaffner LISN-LISN7 (Ref)	NNB42	00008		28-Jan-2016
27	Schaffner LISN-LISN7 (EUT)	NNB42	04/10055		31-Oct-2015

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) * 90.541, 90.545(b)(4) (700 MHz) * 22.565(f) (VHF & UHF), 24.132 (900 MHz) * 74.461 (VHF & UHF)	RSS-Gen Sec 6.12, RSS-119 Sec 5.4.1,  * RSS 119 Sec 5.4.5 (700 MHz) RSS 134 Sec 5.4 (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 6.6, RSS 119 Sec 5.5,  RSS 134 Sec 5.5 (900 MHz)
TX Conducted Spurious Emissions	2.1051, 90.210, * 22.359 (VHF,UHF), 24.133 (900MHz) * 80.211(c) (VHF), * 74.462(c) (VHF & UHF)	RSS GEN Sec 6.13, RSS 119 Sec 4.2, 5.8, RSS 134 Sec 6.3(ii) (900MHz) * RSS 182 (VHF)
TX Radiated Spurious Emissions	2.1053, 90.210, * 22.359 (VHF,UHF) * 74.462(c) (VHF & UHF)	RSS GEN Sec 6.13, RSS 119 Sec 4.2, 5.8
Frequency Stability (Temp / Supply Voltage)	2.1055, 90.213, * 90.539 (700 MHz) * 22.355 24.135 (900 MHz) * 74.464 (VHF & UHF)	RSS GEN Sec 6.11 RSS 119 Sec 5.3  RSS 134 Sec 7 (900MHz) Notice 2011-08 (TETRA)
Power Line Conducted Spurious Emissions	15.107	-
Adjacent Channel Power	* 90.543 (a)-(d)(700 MHz) * 90.221(b) (UHF TETRA) * 90.221(c) (8/900 TETRA) * R&O FCC 12-114, FCC 11-63 (TETRA)	* RSS 119 Sec 4.3 (700 MHz) * RSS 119 Sec 5.8.9 (700 MHz) * RSS 119 Sec 5.5 Table 3 <sup>(Note 2)</sup> (TETRA) * RSS 119 Sec 5.8.10 (TETRA)
Transient Frequency Behaviour	* 90.214 (VHF & UHF)	* RSS 119 Sec 5.9 (VHF & UHF)

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.

The transmitter is operated in test mode under normal conditions. The DC voltage applied to the transmitter are read directly from the calibrated DC Power Supply. Remote voltage sensing is used to ensure the correct DC voltage is applied to the battery terminal of DUT. This measurement is performed at the lowest, the middle, and the highest operating frequencies of the operating bandwidth of the equipment.

**Audio Frequency Response**

Pursuant FCC Rules 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.

**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 1000 Hz and level 16dB 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 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.

**Modulation Limiting**

Pursuant FCC Rules 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 between 300 and 3000 Hz in 100Hz steps. Record the system deviation obtained as a function of the input level.

**Occupied Bandwidth**

Pursuant to FCC Rules 2.1049

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, data, and TDMA, the reference line for the data plot is that of the peak value of the modulated carrier. For digital data, the Standard Transmitter Test Pattern 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.

**Radiated Spurious Emissions**

Pursuant to FCC Rules 2.1053

Testing was performed in TUV/USV/PSB test laboratory in Singapore.

**Test-Setup:**

The EUT and supporting equipment were setup as shown in the test setup photo. The test was conducted in an anechoic chamber under the normal test condition. The EUT was connected to an appropriate power source while all other supporting equipment was powered separately from another power source.

The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyzer were set accordingly as per in the test requirement. All other supporting equipment was powered separately from another filtered mains.

**Test Method:**

1. The EUT was set to transmit at the maximum power at the lower operating frequency with the modulation on at normal test condition.
2. The receiving antenna (Test antenna) was set at vertical polarization with the height of 1m.
3. With the spectrum analyzer was set to max hold enabled (peak detector mode), the emissions outside the operating frequency range (spurious emissions) that exceeded the allowable limits or come to within 6dB below the limit were searched and recorded.
4. For each spurious emission found, the test antenna was raised or lowered through the specified range of heights (1m-4m) until a maximum signal level was detected on the test receiver.
5. The EUT was then rotated through 360° in the horizontal plane until the maximum signal was received. The maximum received signal level was recorded as A (in dBm).
6. The EUT was replaced with the substitution antenna with the antenna input was connected to the signal generator via a 10dB attenuator (if required).
7. The signal generator was set to the found spurious frequency. The output level of the signal generator was adjusted until the test receiver was at least 20dB above the level when the signal generator was switched off.
8. The test antenna was raised and lowered through the specified range of heights (1m-4m) until the maximum signal level was received on the test receiver.
9. The substitution antenna was rotated until the maximum level was detected on the test receiver.
10. The output level of the signal generator was adjusted until the received signal level at the test receiver was equal to the level recorded in step 6 (A dBm). The signal generator output level was recorded as B (in dBm).
11. The spurious emission level, P (e.r.p / e.i.r.p) was computed as followed:
 

P (e.i.r.p)	=	B – C – D + E
P (e.r.p)	=	P (e.i.r.p) – 2.15
Where C	=	cable loss between the signal generator and the substitution
D	=	attenuation level if attenuator is used
E	=	substitution antenna gain
12. The steps 2 to 11 were repeated with the receiving antenna was set to horizontal polarization.
13. Comparison was made on both measured results with vertical and horizontal polarizations. The highest value out of vertical and horizontal polarizations was recorded.
14. The steps 2 to 13 were repeated until all the spurious emissions were measured.
15. The steps 1 to 14 were repeated with the EUT was set to operate at the upper operating frequency.

**Note:**

RBW setting is adjusted to 120kHz for frequency below 1GHz and 1MHz for frequency above 1GHz.

**Conducted Spurious Emissions**

Pursuant to FCC Rule 2.1051

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

Note:

RBW setting is adjusted to 100kHz for frequency below 1GHz and 1MHz for frequency above 1GHz.

**Powerline 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 is connected 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.

**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

Transient frequency behavior is a measure of the difference, as a function in time, of the actual transmitter frequency to the assigned transmitter frequency when the transmitted RF output power is switched on or off.

Setup -- Per TIA/EIA 603, Section 2.2.19

Connect the output port of the transmitter under test (TUT) to an attenuator, and this to a directional coupler. Connect an RF peak detector to the coupled output of the directional coupler, and connect the output of the RF peak detector to the external trigger on a storage oscilloscope. The output of the directional coupler is mixed, via an RF combining network, with the output of a signal generator. Verify that the TUT signal level present at the combining network output is approximately 40 dB below the maximum input level of the test receiver as per step (f). Set the signal generator at the same frequency as the TUT, modulated with a 1 kHz tone, with an FM deviation equal to the assigned channel spacing (+25 kHz). Following step (h), adjust the signal generator to provide 20 dB less power at the combiner output than the level set in step (f). Connect the output of the RF combiner to a test receiver, and the test receiver's output port to a vertical input channel of the storage scope. Adjust the horizontal sweep rate on the oscilloscope to 10 msec/div, and the vertical amplitude to display the 1 kHz tone over +/- 4 divisions centered on the display. Reduce the transmit attenuation by 30 dB as per step (l) so that the difference in the power between the reference signal and the TUT signal at the combiner is 50 dB when the TUT is turned on. Following step (k), adjust the oscilloscope to trigger on an increasing signal from the RF detector at one division from the left side of the display when the TUT is turned on. Switch on the TUT and record the display (for RF Output Power ON). Following step (q), adjust the oscilloscope trigger controls to trigger on a decreasing signal from the RF peak detector, at 1 division from the right side of the display when the TUT is turned off. Switch off the transmitter and record the display (for RF Output Power OFF).

\* Steps (f), (h), (k), (l), and (q) - section 2.2.19 of the TIA/EIA 603 were followed.

Method of Measurement -- Per TIA/EIA-603-2.2.19.

For RF Output Power ON: Turn the transmitter ON. Once the demodulator output has been captured by the transmitter power, the 1 kHz test signal will be completely suppressed. This point in time is named T-on. The display will then show the frequency difference from the assigned frequency to the actual transmitter frequency versus time. Two time intervals will be measured following T-on: T-1 and T-2.

So, the RF ON time intervals are as follows: T-on -----> T-1 -----> T-2

For RF Output Power OFF: Turn the transmitter OFF. The display will show the transmitter frequency difference versus time, and when the 1 kHz test signal starts to rise, it indicates total absence of the transmitter output at the specified frequency. This point is named T-off. Time interval T-3 precedes T-off. So, the RF OFF time intervals are as follows: T-3 -----> T-off.