

**EXHIBIT 9**

**TEST REPORT**

This test report presents the measurement data required by the Commission for certifying the Alcatel-Lucent 9768 LightRadio™ AWS MRO 2x1W, subject of this application, for operation in the AWS with LTE technology.

As stated before, the MRO 2x1W consists of a Digital/RF Analog board (DA), Power Amplifier Board (PA), and RF dual-duplex Filter. The MRO 2x1W has two antenna ports and supports MIMO with 2 transmit and 2 receive streams. The maximum output power is 30dBm (1W) per LTE carrier and per port and 2W per unit.

<b>Applicant</b>	Alcatel-Lucent USA Inc. 600-700 Mountain Ave Murray Hill, New Jersey 07974
<b>FCC ID</b>	AS5BBTRX-18
<b>Model Name</b>	9768 Metro Radio Outdoor B4 LTE 2x1W
<b>Test Standard(s)</b>	47 CFR FCC Part 27
<b>Technology</b>	LTE
<b>Operation Frequency Band</b>	AWS (Tx: 2110-2155MHz and Rx: 1710-1755MHz), E-UTRAN Band 4
<b>Test Date</b>	February 4 – March 17, 2014
<b>Submission Type</b>	Original Equipment
<b>FCC Part 15 Class A Compliance</b>	Yes (Evaluated on -48VDC Version)
<b>Test Report Number</b>	2014-0040
<b>Test Laboratory</b>	Global Product Compliance Laboratory 600-700 Mountain Avenue Room 5B-108 Murray Hill, New Jersey 07974-0636 USA

Per the requirement of Section 2.911(d) Certification of Technical Test Data, I hereby certify that the technical test data are the results of tests supervised by me.



Qin Yu, Ph.D.  
Member of Technical Staff  
Global Product Compliance Laboratory  
Alcatel-Lucent USA, Inc

## SUBEXHIBIT 9.1

### Section 2.1033 (c)(14) REQUIRED MEASUREMENT DATA

The required measurement data is presented in the following exhibits as follows:

SUBEXHIBIT 9.2	Section 2.1046	Measurements Required: RF Power Output
SUBEXHIBIT 9.3	Section 2.1047	Modulation Characteristics
SUBEXHIBIT 9.4	Section 2.1049, 27.53(g)	Measurements Required: Occupied Bandwidth and Out-of-Band Emissions
SUBEXHIBIT 9.5	Sections 2.1051, 27.53(g)	Measurements Required: Spurious Emissions at Antenna Terminals
SUBEXHIBIT 9.6	Sections 2.1053, 27.53(g)	Measurements Required: Field Strength of Spurious Radiation
SUBEXHIBIT 9.7	Sections 2.1055, 27.54	Measurements Required: Frequency Stability
SUBEXHIBIT 9.8	Section 2.947	List of Test Equipment Used
SUBEXHIBIT 9.9	Section 2.1033 (6)	Test Facilities

I hereby to certify that the evaluation of the subject product has been either performed or led by me in accordance with the Commission's Rules and Regulations set forth in the above standards. The data and the descriptions about the test setup, procedures and configuration presented in this report are accurate.



Steve E. Gordon

Lead Test Engineer  
Member of Technical Staff  
Global Product Compliance Laboratory  
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## SUBEXHIBIT 9.2

### Section 2.1046 MEASUREMENT REQUIRED: RF POWER OUTPUT

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal (J4), as shown in the accompanying test set-up diagram. The radio was tuned to a channel which is transmitting in the 2110-2155MHz frequency band. The power level of the base station was calibrated to allow the base station to operate at the manufacturer's maximum rated mean power level, i.e., +30dBm (1W) per LTE carrier at the antenna-transmitting terminal.

Power measurements were made with a Hewlett-Packard Power Meter with 8481A Power Sensor (0.01 – 18 GHz) in the average mode. The test set-up for conducting the RF power output measurement is shown in the following figure. Before the testing was started, the Base Station was given a sufficient "warm-up" period as required.

The maximum rated mean power at the antenna transmitting terminal was measured for a single LTE carrier (10MHz or 20MHz carrier) with QPSK, 16QAM and 64QAM modulation across the entire AWS band, respectively.

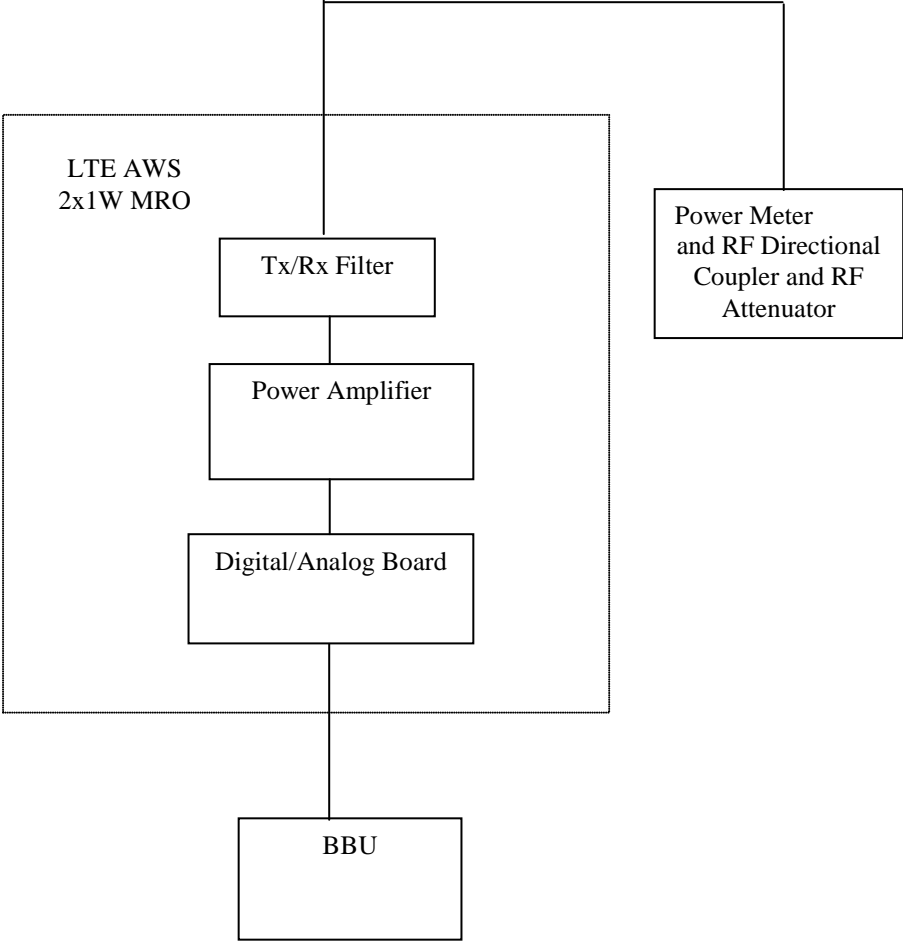
The RF power output measured for each configuration was shown as "Ref Lvl" in the plots provided in SubExhibit 9.4.

The Peak-to-Average Power Ratio (PAPR) of AWS MRO has also been measured per KDB 971168 procedures for both 10MHz and 20MHz carriers at the lowest, middle and highest available channels of the AWS band for QPSK, 16QAM and 64QAM, respectively. The PAPR values (0.1% probability) of AWS MRO measured are all below 13dB with a maximum value of 6.28 dB.

### **Results:**

The maximum rated mean RF power outputs of the Alcatel-Lucent AWS LTE 2x1W MRO at its antenna transmitting terminals is 1W (+30 dBm) per 10MHz or 20MHz LTE carrier per port and 2 W (+33 dBm) per MRO, within  $\pm 1$ dB derivation, and are in full compliance with the Rules of the Commission.

**FIGURE 9.2.1 TEST SET-UP FOR MEASUREMENT OF RADIO FREQUENCY POWER OUTPUT**



## SUBEXHIBIT 9.3

### Section 2.1047 MEASUREMENT REQUIRED: MODULATION CHARACTERISTICS

The ALU AWS 2x1W MRO supports LTE technology. The LTE utilizes Orthogonal Frequency Division Multiplex (OFDM) modulation techniques, where the data is distributed over a large number of closely spaced orthogonal subcarriers. The subcarriers are modulated with conventional modulation scheme, such as QPSK, 16QAM and 64QAM.

The modulation accuracy measures the ability of the transmitter to generate the ideal signal.

In LTE, the modulation characteristics measurement measure the difference between the ideal symbols and the measured symbols after the equalization. The measurement was performed for QPSK, 16QAM and 64QAM, respectively, where the carrier power level was adjusted to the rated maximum mean power +30dBm (1W) at the output terminal.

The measurements were performed at the antenna transmitting terminal of the base station system with an Agilent 89601 Vector Signal Analyzer which was calibrated in accordance with ISO 9001 process.

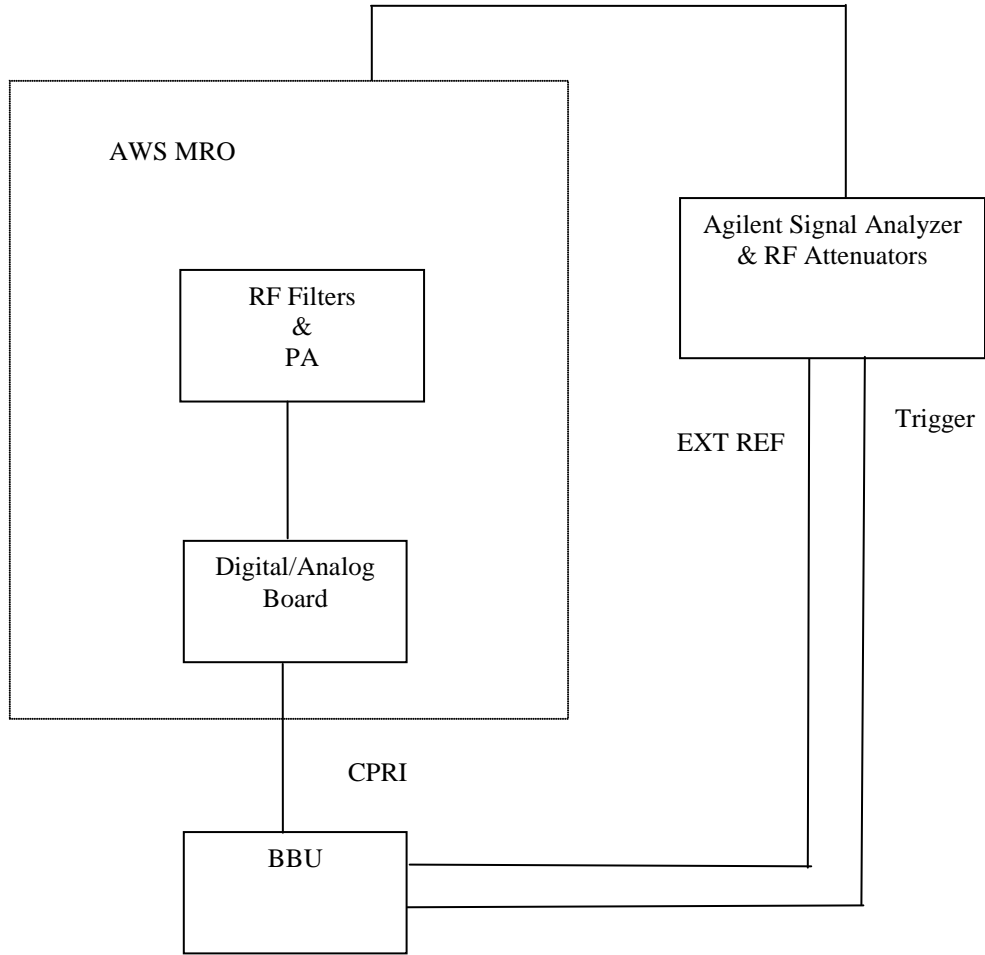
The test set-up diagram is given in the Figure 9.3.1, where the Agilent 89601 VSA used the external signals from the base station as its trigger source and time reference.

Figure 9.3.2 shows three representative screen plots of the modulation measurement at 2115 MHz for a 10MHz bandwidth LTE carrier in QPSK, 16QAM and 64QAM modulations, respectively.

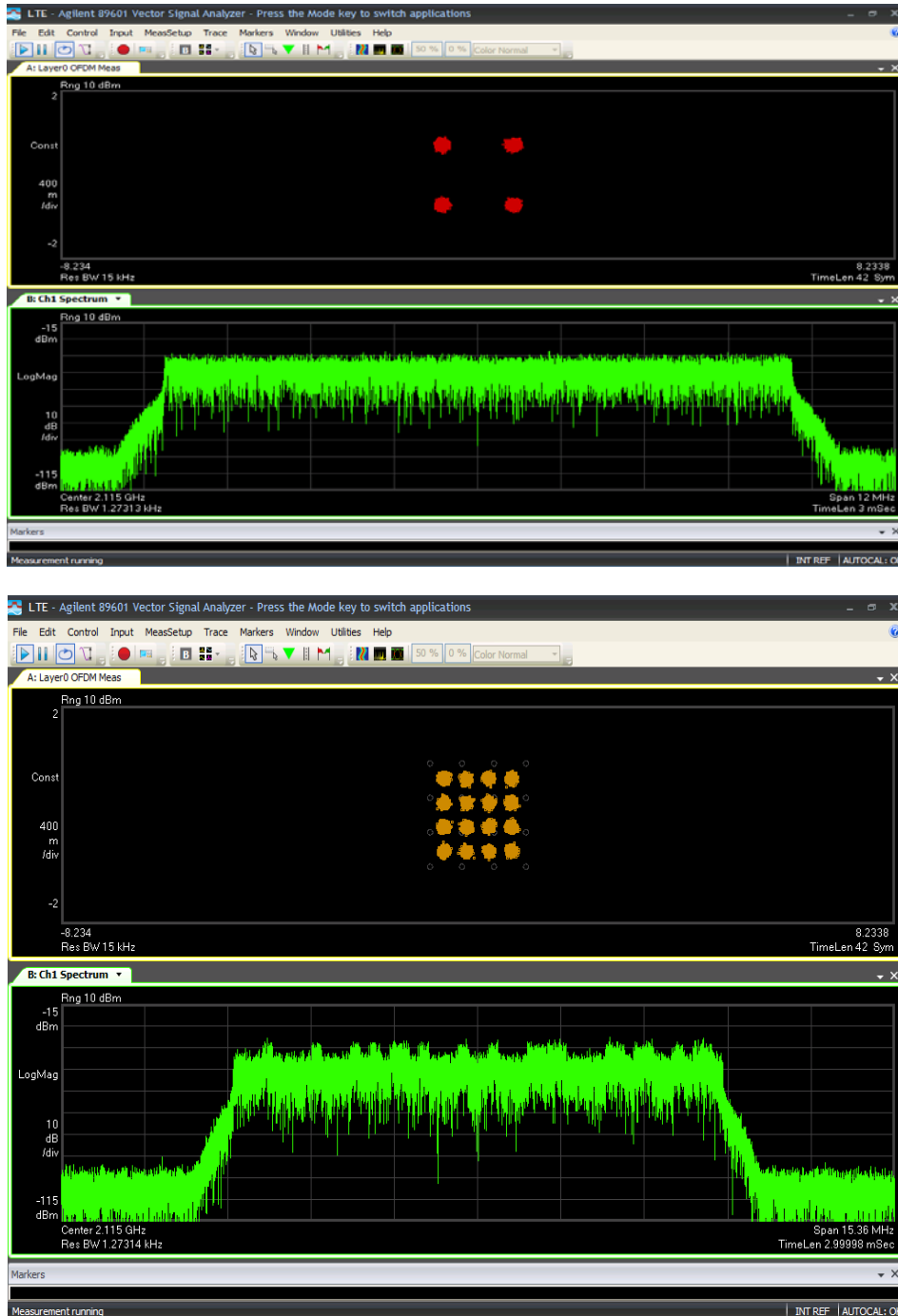
#### **Results:**

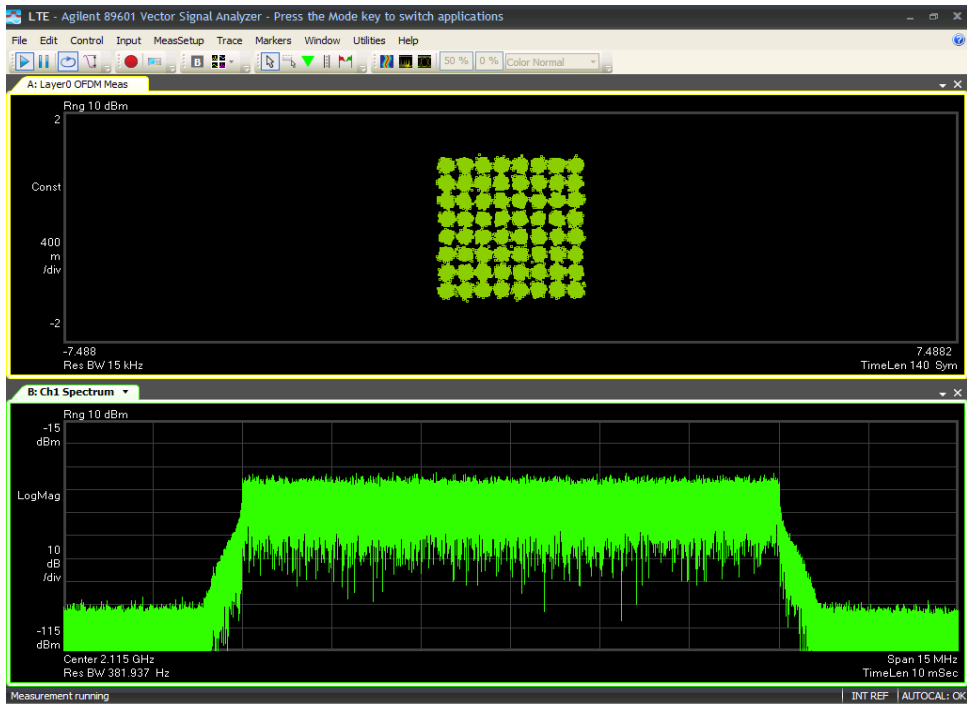
The modulation characteristics of the LTE AWS 2x1W MRO is in full compliance with the Rules of the Commission across the AWS Frequency Band.

**FIGURE 9.3.1 TEST SET-UP FOR MEASUREMENT OF MODULATION ACCURACY, OCCUPIED BANDWIDTH AND OUT-OF-BAND EMISSIONS**



**FIGURE 9.3.2 SCREEN PLOTS OF MODULATION MEASUREMENT AT 2115 MHZ, 10MHZ LTE WITH QPSK, 16QAM AND 64QAM MODULATIONS**







SUBEXHIBIT 9.4

**Section 2.1049 MEASUREMENT REQUIRED: OCCUPIED BANDWIDTH AND OUT-OF-BAND EMISSIONS**

In compliance with Section 2.1049, the appropriate E-UTRA test model specified in 3GPP TS 36.141 was used for LTE carrier.

The EUT (equipment under test) supports a single LTE carrier of either 10MHz or 20MHz in AWS band, 2110-2155 MHz (45MHz) per transmitting path (see Table 9.4.1). The occupied bandwidth and out-of-band emissions measurements were made at the antenna transmitting terminal (J4) for QPSK, 16QAM and 64QAM modulations, respectively.

**9.4.1 EUTRAN IV, AWS Band**

<b>AWS Blocks</b>	<b>Tx Frequency (MHz)</b>	<b>Rx Frequency (MHz)</b>	<b>Bandwidth (MHz)</b>
A	2110 - 2120	1710 - 1720	10
B	2120 - 2130	1720 - 1730	10
C	2130 - 2135	1730 - 1735	5
D	2135 - 2140	1735 - 1740	5
E	2140 - 2145	1740 - 1745	5
F	2145 - 2155	1745 - 1755	10

The 2110-2155 MHz transmitting band for wireless communication is governed by the FCC rules in CFR 47, Part 27, Subpart C. The minimum emission requirements and the setting of measurement equipment for the occupied bandwidth measurement of an AWS carrier were specified in FCC Part 27.53(g). The FCC’s requirements are tabulated in the following table:

**Table 9.4.2 FCC Part 27.53(g) Transmitter Unwanted Emission Limits**

Frequency	Required Minimum Attenuation below the Mean Carrier Power <i>P</i>	Minimum Resolution Bandwidth of Spectrum Analyzer
1MHz Bands Immediately Outside the Transmitting Frequency Band	(43 + <i>P</i> dBW) dBc	100kHz for 10MHz carrier and 200kHz for 20MHz carrier
Outside the above Frequency Range	(43 + <i>P</i> dBW) dBc	1MHz

The requirement of FCC Part 27.53(g) was used as the required emission limit mask in the LTE measurement.

The measurements were performed with a Rohde & Schwarz EMI Receiver, which was calibrated in accordance with ISO 9001 process. The test set-up diagram is same as the one shown in the Figure 9.3.1.

The 99% occupied bandwidth measurement of an LTE carrier was measured per FCC KDB 971168.

For the out-of-band measurement, the spectrum analyzer was set with a resolution bandwidth which is equal to 1% of carrier bandwidth, a video bandwidth which is equal to at least 3xRBW and a 30 MHz span, as shown in the plots of the occupied bandwidth measurement attached in the following pages. The emissions outside the above spans were evaluated in Measurement Required: Out-of-block Spurious Conducted Emissions. The top of the carrier measured with a resolution bandwidth which is equal to 1% of carrier bandwidth was 20 dB below the LTE carrier power measured with a resolution bandwidth greater than the carrier bandwidth (if available) or a wideband power meter. This 20dB offset was due to the fact that  $10 \log (BW/1\% * BW) = 20 \text{ dB}$ .

The RMS average detector was used in all above measurement.

For 10MHz LTE carrier, the measurements were made at the antenna transmitting terminal (J4) on one channel in each of AWS A, B and F frequency blocks. For 20MHz LTE carrier, the measurements were made at the antenna transmitting terminal (J4) at the lowest, middle and highest available channels in AWS band. The measurement was performed for QPSK, 16QAM and 64QAM modulations, respectively. At the carrier frequency, the carrier power level at the antenna terminal was adjusted to the maximum rated mean power +30 dBm (1W).

The two 99% Occupied Bandwidth plots which gave the widest occupied bandwidth for one 10MHz and one 20MHz LTE carrier with QPSK, 16QAM and 64 QAM were submitted, respectively.

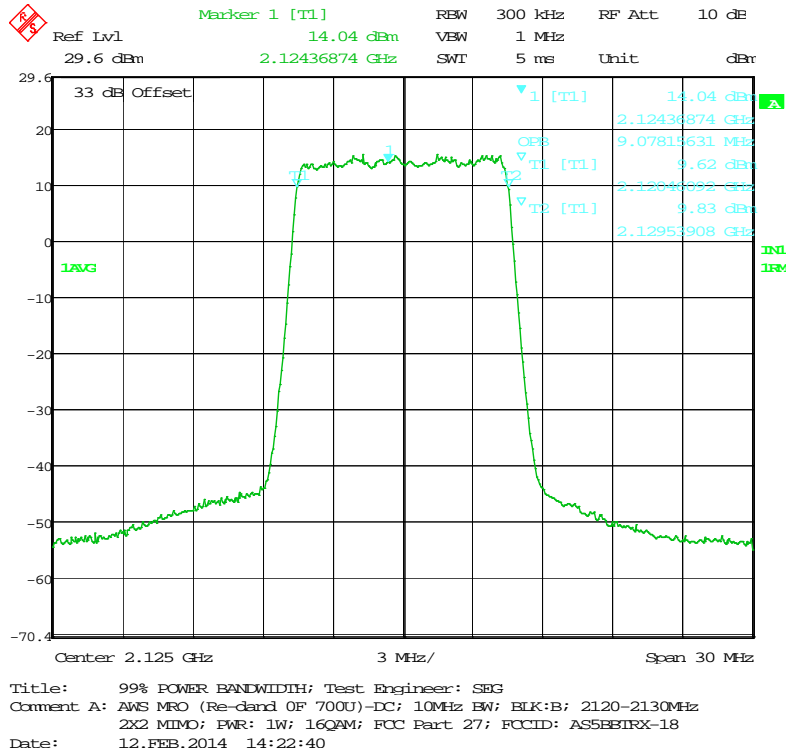
For one LTE carrier configuration, one emission plot for each carrier bandwidth is submitted which has the least margin among all AWS blocks evaluated for each QPSK, 16QAM and 64QAM modulation. The limits specified in FCC Part 27.53(g) are displayed in the plots where 3dB margin for 2x2 MIMO is included.

### **Results:**

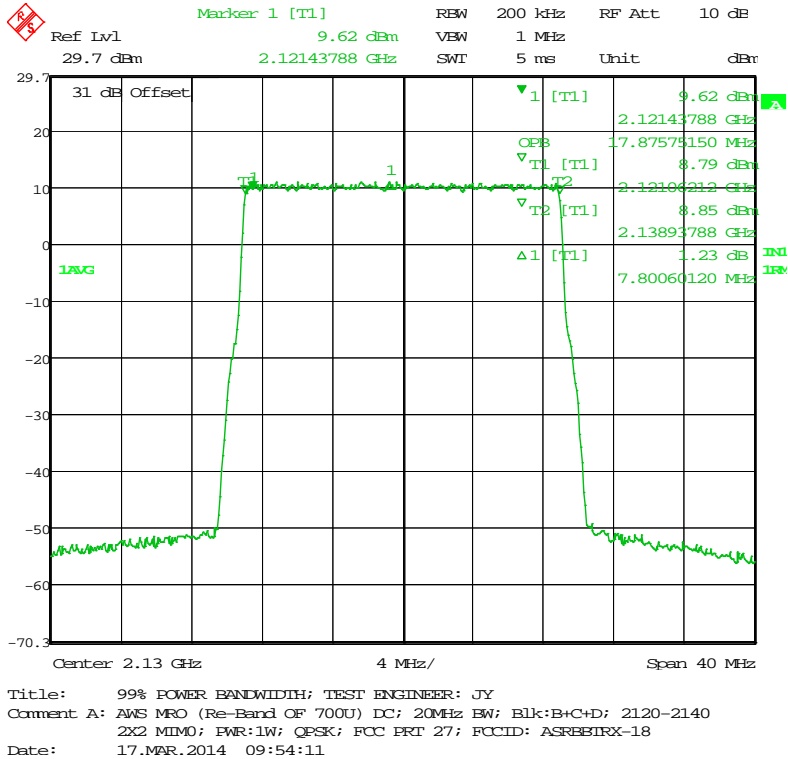
The 99% Occupied Bandwidth plots showed a bandwidth of 9.02~9.06 MHz for a 10MHz carrier and 17.80-17.88MHz for a 20MHz carrier, respectively. From the occupied bandwidth and out-of-band plots attached in the following, it can be seen that all the waveforms are under the required FCC emission masks for MIMO operation. The measurement results demonstrate the full compliance with the Rules of the Commission for AWS band.

**FIGURE 9.4.1 99% OCCUPIED BANDWIDTH PLOTS**

**(a) 10MHZ LTE CHANNEL 2125 MHz WITH 16QAM MODULATION — 9.08MHz**

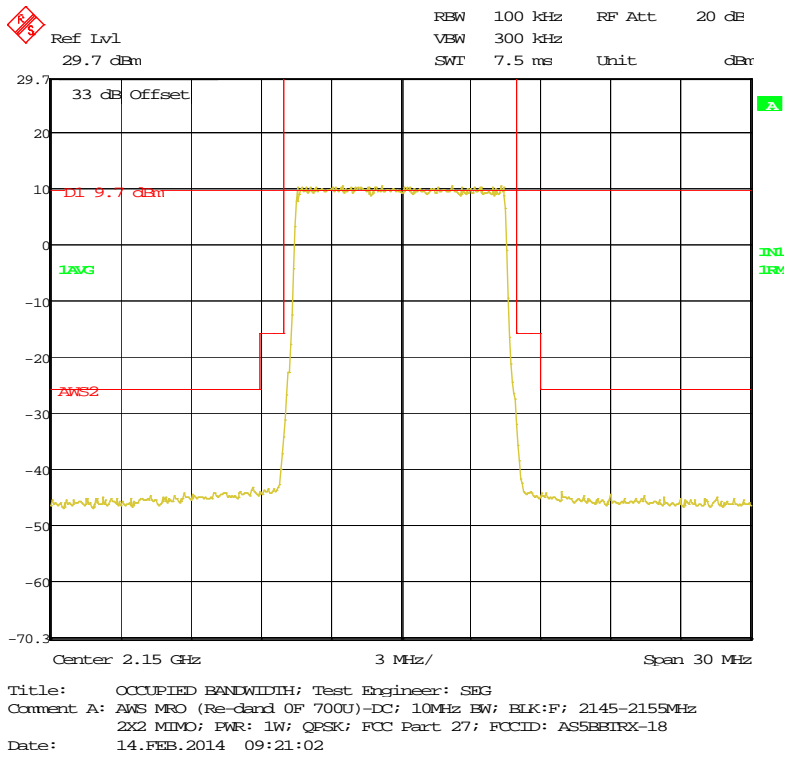


**(b) 20MHZ LTE CHANNEL 2130MHz WITH 64QAM MODULATION — 17.88 MHz**

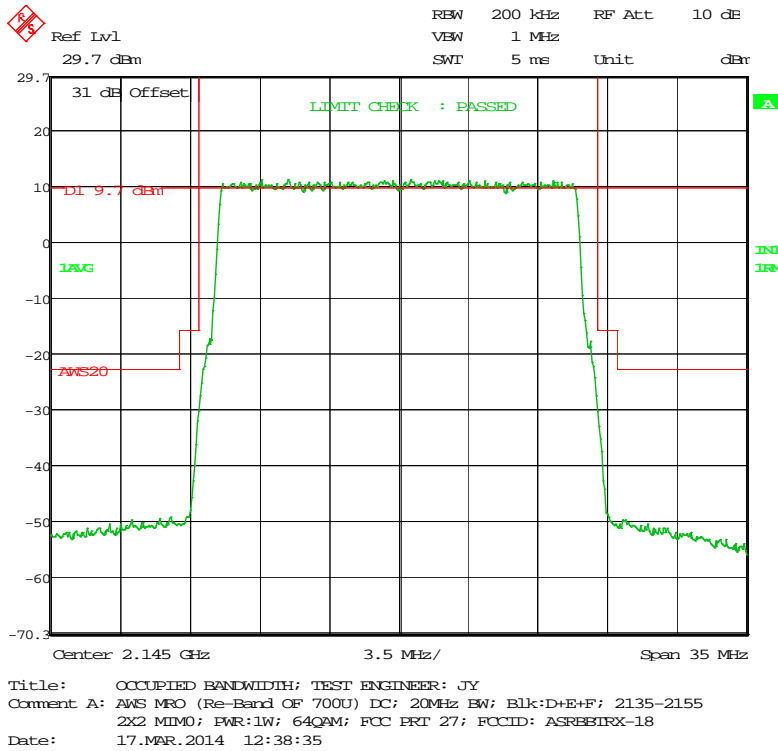


**FIGURE 9.4.2 OCCUPIED BANDWIDTH AND OUT-OF-BAND EMISSIONS PLOTS**

**(a) 10MHz LTE at 2150MHz, 1W, QPSK**



**(b) 20MHz LTE at 2145MHz, 1W, 64QAM**



## SUBEXHIBIT 9.5

### **Section 2.1051 MEASUREMENT REQUIRED: SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS**

The out-of-block spurious emissions at the antenna transmitting terminal were investigated from 10 MHz to the 10<sup>th</sup> harmonic of the carrier or 22 GHz, per Section 2.1057(a)(1).

The carrier setup and configurations were same as in Sub-exhibit 9.4.

The emission limitations and the setting of measurement equipment for the unwanted emissions measurement of LTE carriers were specified in 27.53(g) and shown in Sub-exhibit 9.4.

For the mean output power of +30 dBm (1 W) at J4, the required spurious emissions attenuation per  $(43 + P)$  dBW dBc is 43dBc per 27.53(g). FCC CFR 47, Sections 2.1051 and 2.1057(c) specify that the spurious emissions attenuated more than 20 dB below the permissible value need not be reported. There the reportable limit is -66 dBc for 2x2MIMO.

The measurements were performed with a Rohde & Schwarz EMI Receiver, which was calibrated in accordance with ISO 9001 process. The test set-up diagram is given in the Figure 9.3.1.

The carrier power level at the antenna transmitting terminal was calibrated before the conducted spurious emissions testing for each test.

The spectrum analyzer was set to a 1MHz resolution bandwidth. The RMS detector was used.

The spurious emissions in the frequency range of 10MHz to 22GHz are well under the required reportable emission limit for all carrier bandwidth with QPSK, 16QAM and 64QAM modulations evaluated. Therefore, there are no reportable emissions.

#### **Results:**

Over the frequency spectrum investigated, 10MHz to 22GHz, for Alcatel-Lucent LTE AWS 2x1W, no reportable out-of-block spurious emissions were detected. The out-of-block spurious emissions in the entire spectrum investigated are under the required reportable emission limit. The measurement results demonstrate that the subject of the application is in full compliance with the Rules of the Commission.

## SUBEXHIBIT 9.6

### Section 2.1053 MEASUREMENT REQUIRED: FIELD STRENGTH OF SPURIOUS RADIATION

The EUT transmits 2x1W in the domestic AWS Band with LTE technology. The -48VDC LTE 2x1W MRO outdoor was investigated from 30 MHz to the 10<sup>th</sup> harmonic of the carrier or 22 GHz, per Section 2.1057(a)(1). The EUT was configured as in the normal mode of the installation and operation. The recommendations of ANSI C63.4–2009 and ANSI/TIA-603-C 2004 were followed for EUT testing setup, cabling and measurement.

The base station was configured to transmit one LTE carrier (10MHz carrier at 2150 MHz and 20MHz carrier at 2145MHz) with the maximum mean power of 1W (30dBm) at each antenna port of TX1 and TX2, respectively. The test model used for configuring the LTE carrier was described in Sub-exhibit 9.4. All carriers were transmitting to non-radiating 50 Ω resistive loads. Both 10MHz bandwidth carrier and 20MHz bandwidth carrier with QPSK and 64QAM were evaluated, respectively.

The emission limitations and the setting of measurement equipment for the conducted spurious emissions measurement were specified in 27.53(g) and shown in Sub-Exhibit 9.4.

By using the relation between the electric field strength of an ideal dipole and its excitation power given in Reference Data for Radio Engineers, page 676, 4<sup>th</sup> edition, ITT Corp., the emission limit calculated for equals

**Table 9.6.1. FCC Part 27.53 Radiated Spurious Emission Limit in Electrical Field Strength at 3m Separation Distance**

Frequency of Emission (MHz)	Separation Distance (m)	E (dBμV/m)	Detector/RBW
10-22,000	3	84.1	Average/1MHz

The field strength of radiated spurious emissions measured was determined by

$$E \text{ (dB}\mu\text{V/m)} = V_{\text{meas}} \text{ (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB1/m)}.$$

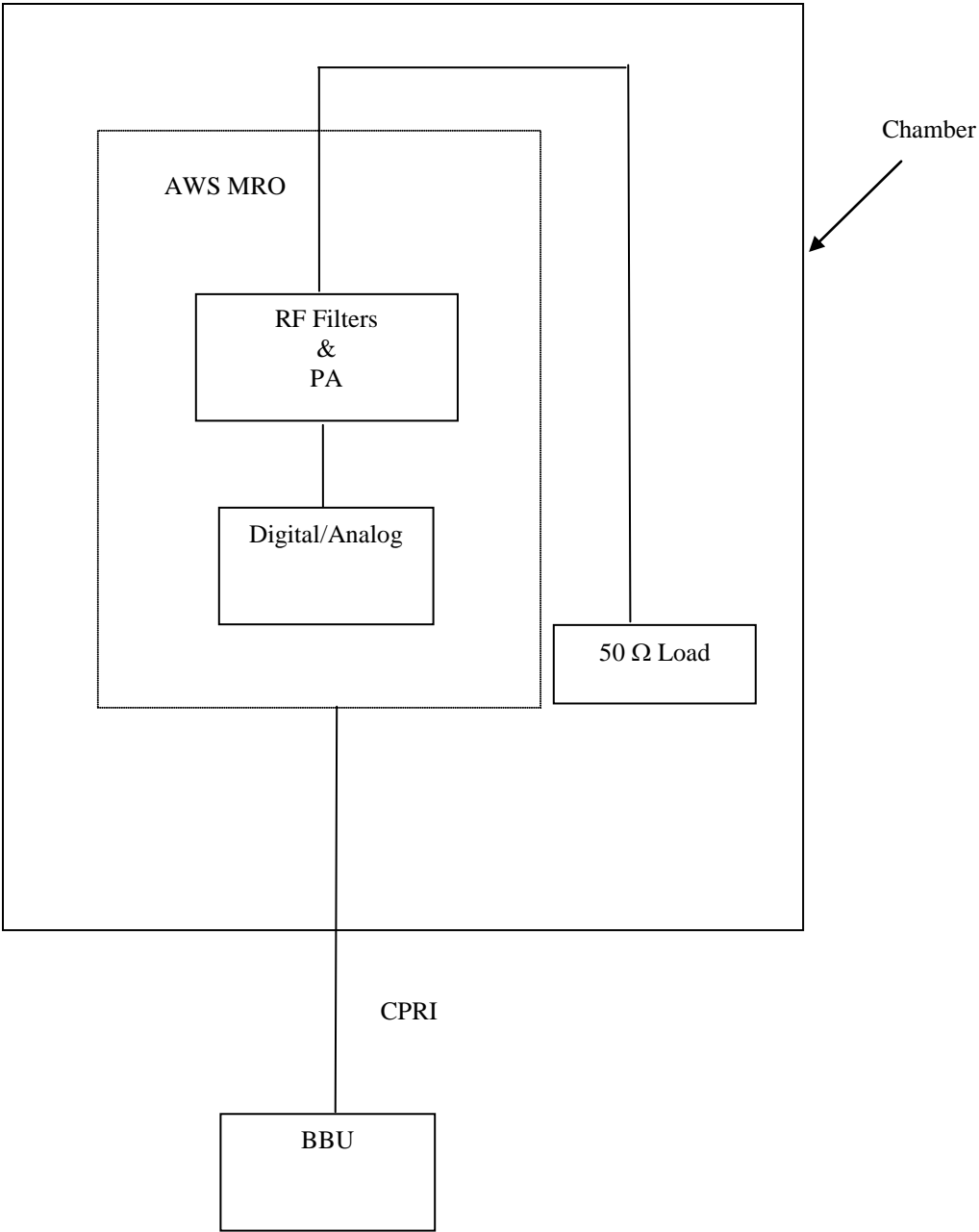
Sections 2.1051 and 2.1057(c) specify that the spurious emissions attenuated more than 20 dB below the permissible value need not be reported. Therefore, the reportable limits at 3 meter are 20dB below the above limits plus 3dB for 2x2 MIMO, i.e., 61 dBμV/m.

All the measurement equipment used, including antennas, was calibrated in accordance with ISO 9001 process. The EUT setup diagram is given in the Figure 9.6.1.

#### **Results:**

Over the frequency spectrum investigated no reportable radiated spurious emissions were detected. The measurement results of the Alcatel-Lucent AWS LTE MRO 2x1W, subject of this application, demonstrate the full compliance with the Rules of the Commission.

**FIGURE 9.6.1 EUT FOR MEASUREMENT OF RADIATED SPURIOUS EMISSIONS**



## SUBEXHIBIT 9.7

### Section 2.1055 MEASUREMENT REQUIRED: FREQUENCY STABILITY

This test evaluates the frequency difference between the actual transmit carrier frequency and the specified transmit frequency assignment.

The Alcatel-Lucent LTE AWS MRO 2x1W, a small cell, was designed to transmit an LTE carrier in the frequency spectrum 2110-2155MHz. The AWS MRO 2x1W supports 2x2 MIMO with 2 antenna ports with the maximum output power of 30dBm per port. The MRO 2x1W consists of RF boards. The baseband signals and timing signals were provided by the BBU through CPRI link.

The frequency stability testing was conducted on the -48VDC LTE AWS 2x1W MRO. The outdoor system was designed for a wider temperature range than the indoor frame. The primary power supplier is -48VDC. The stability of the output frequency of the AWS MRO was measured at its antenna transmitting terminal 1) from -30 °C to +50 °C in 10 °C steps at the rated supply voltage; and 2) at 85% and 115% of the nominal supply voltage, per Section 2.1055. The primary supply voltage, -48VDC, was varied from 85% to 115%. The 85% of -48 VDC is -40.8 VDC and 115% is -55.2 VDC. The MRO was set to transmit two 10MHz LTE carriers at 2132.5 MHz at the rated RF power. The carrier frequency at 2132.5 MHz was measured at the antenna terminal (J4) at each temperature and each supply voltage by an Agilent MXA Signal Analyzer, respectively. In addition, the transmit power was monitored by the power meter to ensure proper cell performance throughout the test interval.

The above AWS 2x1W MRO was installed in an environmental chamber and the BBU was outside the chamber. At each temperature and each supply voltage, the EUT was given sufficient time for its thermal stabilization. The testing was performed during the period of February 4~6, 2014.

FCC Section 27.54 specifies that the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation. The 3GPP TS 36.104 specify the minimum standard is  $\pm 0.050$  ppm for LTE (observed over one period of one subframe (1 ms)) carriers.

The maximum frequency derivations ( $\Delta f$ ) at the antenna terminal from the assigned carrier frequency at each temperature and supply voltage are summarized in the following tables. The  $\pm 0.05$ ppm of 2132.5MHz is  $\pm 106.625$ Hz.

**TABLE 9.7.1 FREQUENCY DERIVATION FOR LTE CARRIER AT 2132.5MHZ  
FROM -30°C TO +50°C**

Stabilized Temp. (°C)	$\Delta f$ 100% $V_{norm}$ (Hz)
-30	1.01
-20	1.03
-10	0.97
0	1.02
+10	1.25
+20	1.50
+30	1.37
+40	1.44
+50	0.73

The maximum frequency derivations ( $\Delta f$ ) at +25°C and 85% -115% of the supply voltage from the assigned carrier frequency are summarized in the following tables.



**TABLE 9.7.2 FREQUENCY DERIVATION FOR LTE CARRIER  
AT 2132.5 MHZ FROM 85% V<sub>norm</sub> TO 115% V<sub>norm</sub> AT +25°C**

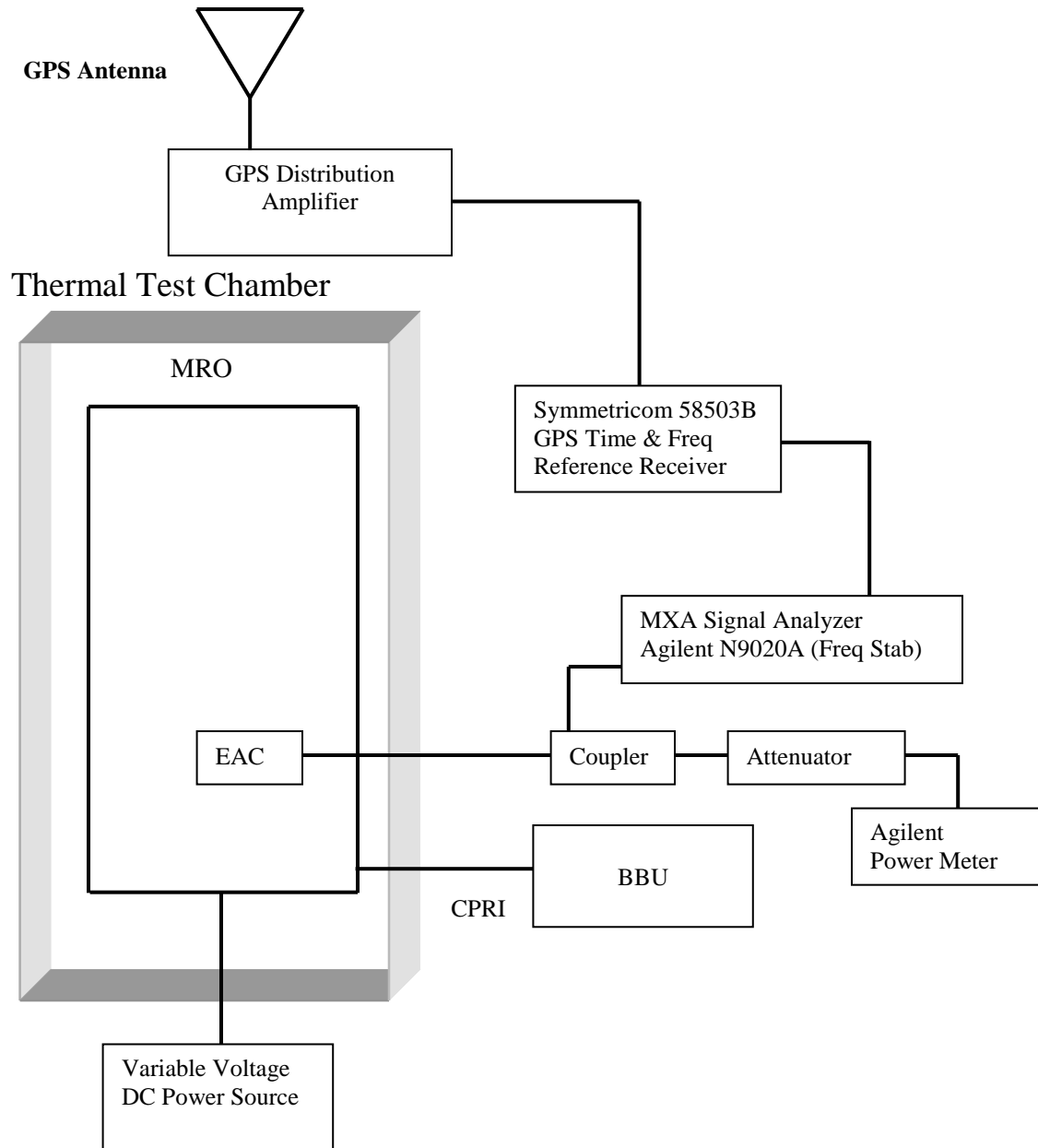
<b>Voltage Derivation (%V<sub>norm</sub>/VDC)</b>	<b><math>\Delta f</math> (Hz)</b>
85/-40.80	0.96
88/-42.20	0.99
91/-43.68	0.98
94/-45.12	0.99
97/-46.56	1.00
100/-48.00	0.95
103/-49.44	0.99
106/-50.88	0.91
109/-52.32	0.96
112/-53.76	0.91
115/-55.20	0.83

All the measurement equipment was calibrated in accordance with ISO 9001 process. The test set-up diagram is given in the Figure 9.7.1

**Results:**

The maximum frequency drifts at the antenna terminal of the AWS 2x1W MRO at the 2132.5MHz LTE carrier frequency due to temperature and supply voltage changes are below  $\pm 0.05$ ppm requirement. The Alcatel-Lucent LTE AWS 2x1W MRO demonstrated full compliance with the Rules of the Commission.

FIGURE 9.7.1 SET-UP FOR MEASUREMENT OF FREQUENCY STABILITY



**SUBEXHIBIT 9.8****Section 2.947 LISTING OF TEST EQUIPMENT USED**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Calibrated Date</b>	<b>Due Cal. Date</b>
Power Meter	Hewlett-Packard	437B	3125U21137	12/5/2013	12/5/2014
Power Sensor (10MHz-18GHz)	Hewlett-Packard	8481A	US37294629	9/16/2013	9/16/2014
Power Meter	Agilent	E4419B	MY40511034	1/07/2013	1/07/2015
Power Sensor	Agilent	E9301A	MY52280001	1/06/2014	1/06/2015
EMI Test Receiver (20Hz to 40 GHz)	Rohde & Schwarz	ESIB40	100044	7/2/2013	7/2/2015
Signal Analyzer, MXA, 10Hz-3.6GHz	Agilent	N9020A	MY52090740	7/13/2012	7/13/2015
MXA Signal Analyzer	Agilent	N9020A	MY49060086	10/10/2012	10/10/2014
Spectrum Analyzer 9kHz-22GHz	Hewlett-Packard	8593E	3911A04003	5/22/2013	5/22/2014
Attenuator 5dB DC-18GHz (5W)	Weinschel	2-6	BC0255	10/8/2013	10/8/2015
Attenuator (100 W)	Weinschel	48-30-33, E961	AY8323	N/A	N/A
Biological Antenna 25-2000MHz	A.H. Systems	SAS-521-2	408	2/15/2013	2/15/2015
Double Ridged Horn Ant. 1-18GHz	ETS Lindgren	3115	9903-5769	1/30/2013	1/30/2015
Double Ridged Horn Ant. 18-40GHz	ETS Lindgren	3116	2539	3/22/2013	3/22/2014
Pre-amplifier 1-26.5GHz	Hewlett-Packard	8449B	3008A01384	9/28/2012	9/28/2014
Pre-amplifier 9kHz-1GHz	Sonoma Instrument Co.	310N	185785	11/26/2013	11/26/2015
Multimeter	Hewlett-Packard	971A	JP35001820	02/28/2013	02/28/2014

**SUBEXHIBIT 9.9****Section 2.1033 (6) TEST FACILITIES**

All measurement facilities used to collect the measurement data under normal condition are located at 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 USA. The field strength measurements of radiated spurious emissions are made in a FCC and IC registered three meter semi-anechoic chamber AR7 (FCC Site Registration Number: 995653, IC Filing Number: 6933F-7) which is maintained by Alcatel-Lucent in Murray Hill, New Jersey. The sites were constructed and are continuously in conformance with the requirements of ANSI C63.4 and CISPR Publication 22.