NVLAP LAB CODE: 100275-0

FCC Certification Test Report

Class II Permissive Change

Product Evaluated

B13 RRH 4X30

(FCC ID: AS5BBTRX-23)

Customer

Alcatel-Lucent USA, Inc

600-700 Mountain Avenue
Murray Hill, New Jersey 07974-0636 USA

Test Laboratory

Global Product Compliance Laboratory

Alcatel-Lucent USA, Inc
600-700 Mountain Avenue, Rm 5B-108
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Date: May 10, 2017

Revisions

Date	Revision	Section	Change
5/8/2017	0		Initial Release
5/10/2017	0		Rev1

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Prepared By: W. Steve Majkowski NCE

Signed: _____ 5/10/2017
Compliance Engineer

Approved By: Ray Johnson

Signed: _____ 5/10/2017
Technical Manager

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1. ATTESTATION OF TEST RESULTS

Company Name	Alcatel-Lucent USA, Inc.
Company:	Alcatel-Lucent USA, Inc 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636
Manufacturer:	Alcatel-Lucent USA, Inc 600-700 Mountain Ave. P.O. Box 636 Murray Hill, NJ 07974-0636
FCC ID	AS5BBTRX-23
Product Name	B13 RRH 4X30
Model Name	B13 RRH 4X30
Part No	3JR53386AAAD
Serial Number(s)	LBALLU-YD152000FF3
Test Standard(s)	47 CFR FCC Part 27
Reference(s)	47 CFR FCC Part 2 and Part 27 FCC KDB 971168 D01 ANSI C63.26 (2015)
Operating Frequency Band	700 Upper band C (Tx: 746-756 MHz, Rx: 777-787 MHz), E-UTRAN, Band 13
Technology	LTE
Test Frequency Range	10MHz – 12.7 GHz
Operation Mode(s)	4x30W MIMO
Submission Type	Class II Change
FCC Part 15 Subpart B Compliance	Compliance with Class B
Test Date	April 10 – May 8, 2017
Test Laboratory	Global Product Compliance Laboratory 600-700 Mountain Avenue, Rm 5B-108 Murray Hill, New Jersey 07974-0636 USA

This is to certify that the above product has been evaluated and is in compliance with the Rules and Regulations set forth in the above standard(s). The data and the descriptions about the test setup, procedures and configuration presented in this report are accurate. The results of testing in this report apply only to the product/system which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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 either performed or supervised by me.

W. Steve Majkowski NCE
Member of Technical Staff
Global Product Compliance Laboratory
Alcatel-Lucent USA, Inc.

2. SUMMARY OF THE TEST RESULTS

47 CFR FCC Sections	Description of Tests	Compliance Results	Notes
2.1046	**RF Power Output**	**Yes**	
2.1047	**Modulation Characteristics**	**Yes**	
2.1049, 27.53(c)	**(a) Occupied Bandwidth** **(b) Out-of-Band Emissions**	**Yes**	
2.1051, 27.53(c)	**Spurious Emissions at Antenna Terminals**	**Yes**	
2.1053, 27.53(c)	**Field Strength of Spurious Radiation**	**Yes**	
2.1055, 27.53(c)	**Measurement of Frequency Stability**	**NR**	

NR: Not Required
NA: Not Applicable

2.1 Measurement Uncertainty

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

Worst-Case Estimated Measurement Uncertainties

Standard, Method or Procedure	Condition	Frequency MHz	Expanded Uncertainty (k=2)
a. Classical Emissions, (*e.g.*, ANSI C63.4, CISPR 11, 14, 22, *etc.*, using ESHS 30,	Conducted Emissions	0.009 - 30	±3.5 dB
	Radiated Emissions (AR-6 Semi-Anechoic Chamber)	30 MHz – 200MHz H 30 MHz – 200 MHz V 200 MHz – 1000 MHz H 200 MHz – 1000 MHz V	±5.1 dB ±5.1 dB ±4.7 dB ±4.7 dB
		1 GHz- 18 GHz	±3.3 dB

2.2 Measurement uncertainty for Antenna Port Testing:

- 9 kHz to 20 MHz: Frequency = 10 Hz, Amplitude = 0.5 dB
- 20 MHz to 1 GHz: Frequency = 100Hz, Amplitude = 0.5 dB
- 1 GHz to 10 GHz: Frequency = 10 kHz, Amplitude = 0.5 dB

3. GENERAL INFORMATION

3.1 Product Descriptions

The equipment under test (EUT) has the following specifications.

Table 3.1.1 Product Specifications

Specification Items	Description
Product Type	Remote Radio Head (Tx, 4Rx), 4x4 MIMO & (2Tx2Rx) 2x2MIMO
Radio Type	TNB Licensed Non-Broadcast Station Transmitter Part27
Power Type	-48VDC
Modulation	QPSK, 16QAM, 64QAM
Operating Frequency Range	Tx: 746-756 MHz, Rx: 777-787 MHz
Channel Bandwidth	10 MHz
Max Conducted Power (Rated)	60W / 47.8 dBm per port for 2xMIMO , 30W / 44.8 dBm per port for 4xMIMO
Software Version	NEM LR16.2.2 Macro FDD CL1
Hardware Version	RRH 4x30 MIMO Version AD03
Antenna(s)	Refer to Section 3.2

The EUT supports the following carrier configurations:

Table 3.1.2 EUT Supported Configurations

Carrier Bandwidth (MHz)	Maximum No of Carriers per Path	Technology	Supported?
10	1	LTE	√

The operating band consists of the following blocks and spectrum:

Table 3.1.3 EUTRAN Band 13

Blocks	Tx Downlink Frequency Range (MHz)	Rx Uplink Frequency Range (MHz)	Width of Block (MHz)
C	746-756	777-787	10

3.2 Antenna Information

The product does not incorporate integrated antennas.

4. REQUIRED MEASUREMENTS AND RESULTS

The EUT is a Class II Permissive Change. Per 47CFR FCC Section 2.1033(c)(14), the following certification tests are required by Section 2.1046 through Section 2.1057. The measurement was conducted in accordance with the procedures set out in Section 2.1041.

47 CFR FCC Sections	Description of Tests	Required	Notes
2.1046	**RF Power Output**	**Yes**	
2.1047	**Modulation Characteristics**	**Yes**	
2.1049, 27.53(c)	**(a) Occupied Bandwidth** **(b) Out-of-Band Emissions**	**Yes**	
2.1051, 27.53(c)	**Spurious Emissions at Antenna Terminals**	**Yes**	
2.1053, 27.53(c)	**Field Strength of Spurious Radiation**	**Yes**	
2.1055, 27.53(c)	**Measurement of Frequency Stability**	**NR**	**(1), (2)**

Note (1) There were no changes to the Frequency generating or stabilizing sections of the product.
Note (2) There were no hardware changes to the product.

4.1 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. The product was configured for test as shown in Figure 4.1.1 below and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

For LTE transmit carrier operation, the **B13 RRH 4x30 Outdoor Transceiver System** is specified to provide a continuous maximum power output of 120 Watts as the sum total of RF output power of its Transmit antenna terminals. It does this by either providing 60W (47.78 dBm +/- 1 dB) for all of the carriers at either its Tx1 / Tx2 transmit antenna terminals or by providing 30W (44.77 dBm +/- 1 dB) for all of the carriers at the Tx1, Tx2, Tx3 & Tx4 transmit antenna terminals.

For this Class II Change, the operation of the 4x30W MIMO mode was evaluated with a single nominal 10 MHz carrier, Emissions Designator 9M00F9W as previously filed.

4.1.1 RF Power Output Measurement

Power measurements were conducted with a broadband Power Meter in the average mode per KDB 971168 D01. The applied signal from an **PCS LTE RRH 4x30 Band 25 Outdoor Transceiver System / AS5BBTRX-23**, met the recommended characteristics as defined in **3GPP TS 36.211 V9.1.0 (2010-03) titled:** 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 9).

The maximum rated mean power at the antenna transmitting terminal was measured with combined QPSK +-16QAM and with 64QAM modulation respectively. This power level is documented on each data sheet for Occupied bandwidth and Conducted spurious emissions.

4.1.2 RF Power Output Results

The measured RF power outputs of the EUT are given in Table 4.1.2 The RF power output was measured for the 4x30W MIMO configuration as addressed by this Class II Change. The measured performance was in full compliance with the Rules of the Commission and are detailed on each of the plots comments in Sections 4.3 and 4.4.

Table 4.1.2 Measured Maximum Average RF Output Power of the EUT

Port	Carrier Center Frequency, MHz	Carrier and Transmit MIMO Configuration	Modulation	Measured Transmit Power Watts	Measured Transmit Power dBm	RF Power Compliance Status Pass/Fail
Tx1	751.0	9M00F9W 4x30W	64QAM	30	44.77	Pass
Tx2	751.0	9M00F9W 4x30W	64QAM	30	44.77	Pass
Tx3	751.0	9M00F9W 4x30W	QPSK+16QAM &64QAM	30	44.77	Pass
Tx4	751.0	9M00F9W 4x30W	64QAM	30	44.77	Pass

4.1.3 Peak-to-Average Power Ratio Measurement

The Peak-to-Average Power Ratio (PAPR) of the EUT has also been measured per KDB 971168 D01 using the setup in Figure 4.1.1 below. These measurements were made for the 9M00F9W MHz 4x30W carriers as tabulated in Table 4.1.2.

For either the combined QPSK+16QAM modulation or for 64QAM the PAPR values (0.1% probability) of the EUT were measured to be below the 13dB requirement. The maximum PAPR value for each measured configuration is given in Table 4.1.3. Sample measurements are shown in the plots in Figures 4.1.2- A through E below.

Table 4.1.3 The Maximum PAPR Value at 0.0001% probability of the EUT

Transmit Port	Frequency, MHz	Emissions Designator	Modulation	Maximum PAPR Value at 0.1% probability (dB)
Tx 1	751.0	9M00F9W	64QAM	7.30
Tx 1	751.0	9M00F9W	QPSK-16QAM	7.14
Tx 2	751.0	9M00F9W	QPSK-16QAM	7.11
Tx 3	751.0	9M00F9W	64QAM	7.22
Tx 4	751.0	9M00F9W	64QAM	7.24

4.1.3.1 Peak-to-Average Power Ratio Results:

The maximum Peak-to-Average Power Ratio (PAPR) of the EUT measured at its antenna transmitting terminals were measured to be in full compliance with the ≤ 13 dB Rules of the Commission and are listed above.

Figure 4.1.1 Test Set-Up for Measurement of Radio Frequency Power Output

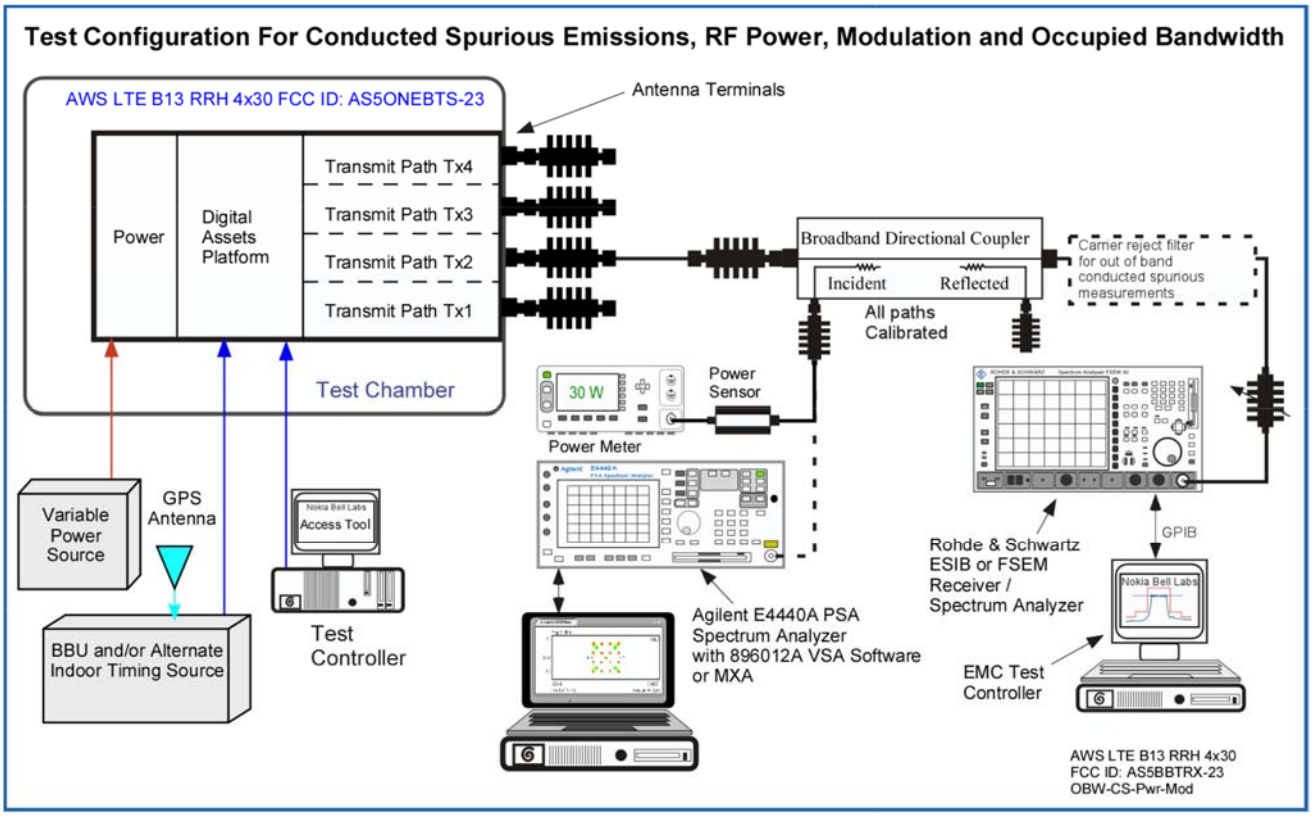


Figure 4.1.2 A through E PAPR Plots Measured with the Maximum Value

Figure 4.1.2 A PAR for Tx1 10 MHz Bandwidth 751 QPSK-16QAM

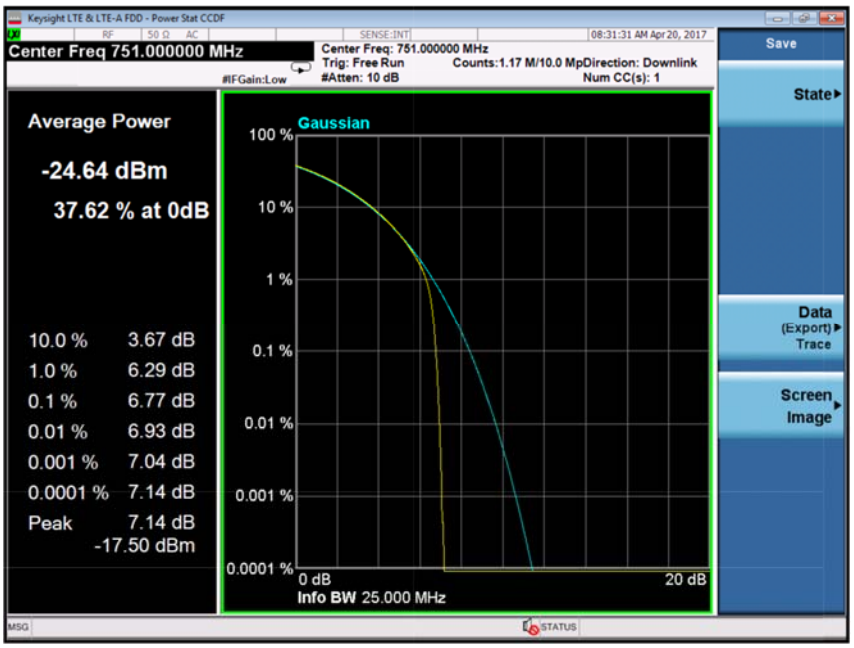


Figure 4.1.2 PAPR Plots Measured with the Maximum Value

Figure 4.1.2 B PAR for Tx1 10 MHz Bandwidth 751.0 MHz 64QAM

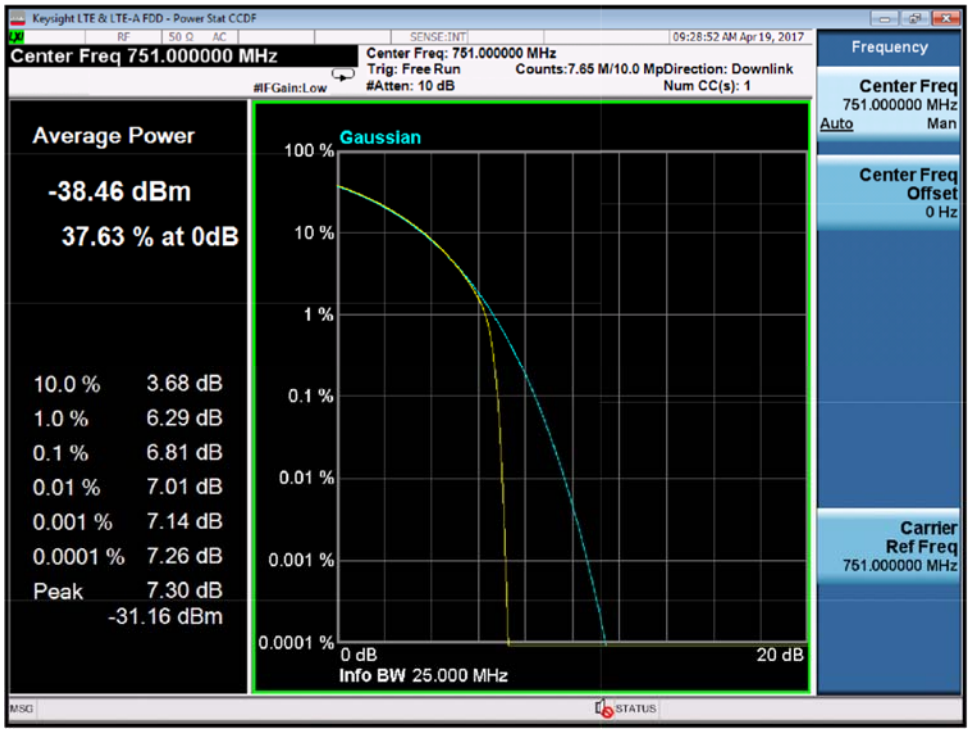


Figure 4.1.2 C PAR for Tx2 10 MHz Bandwidth 751.0 MHz 64QAM

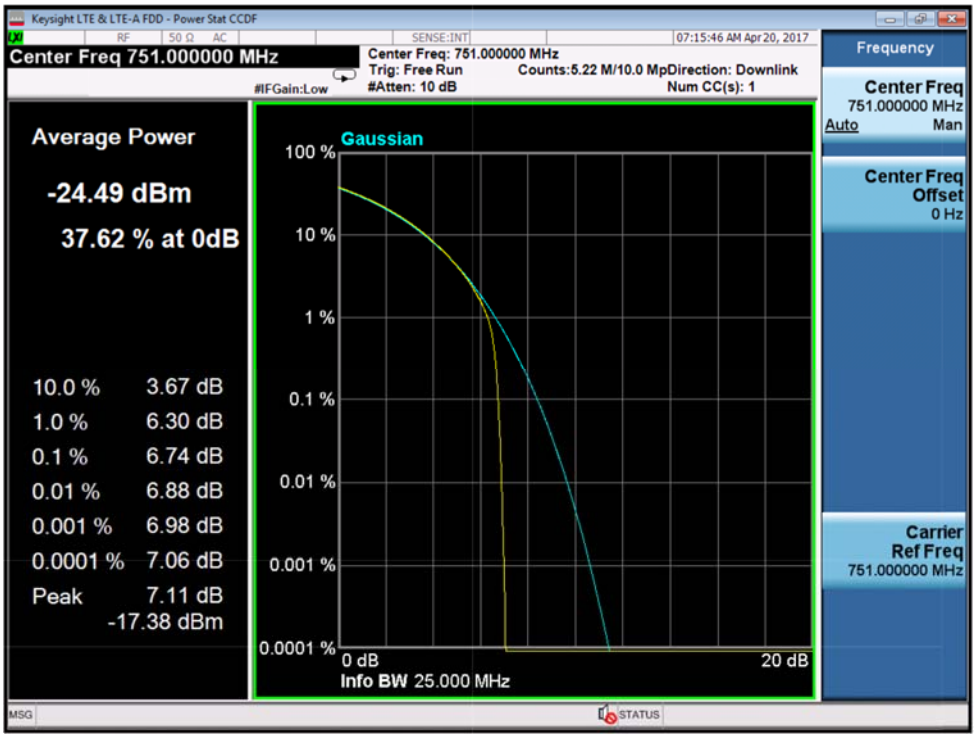


Figure 4.1.2 D PAR for Tx3 10 MHz Bandwidth 751.0 MHz 64QAM

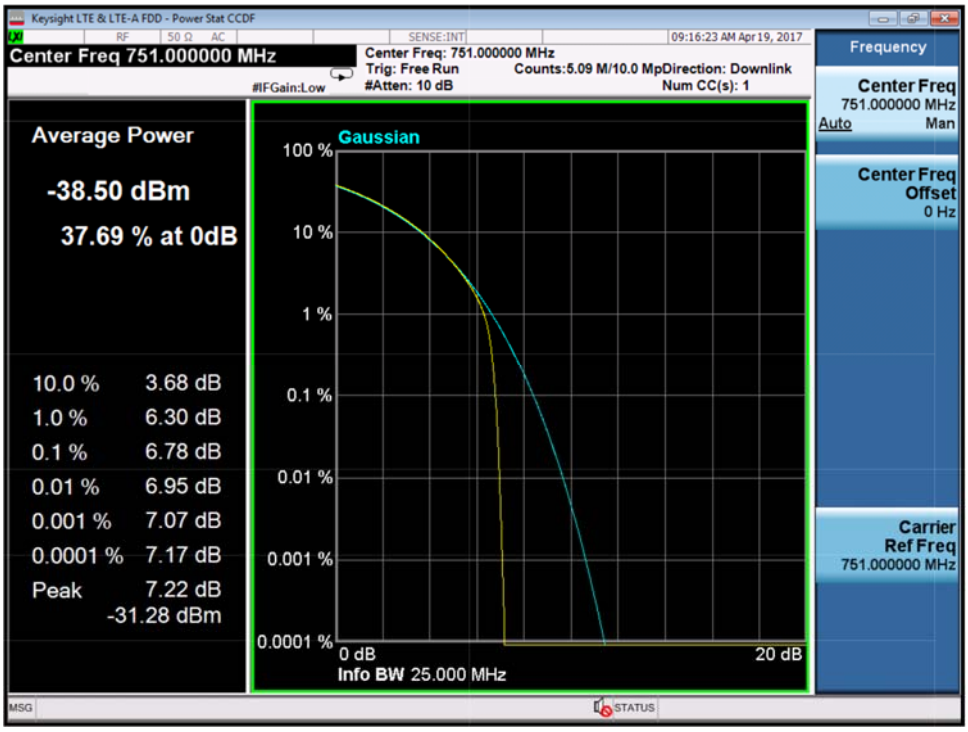
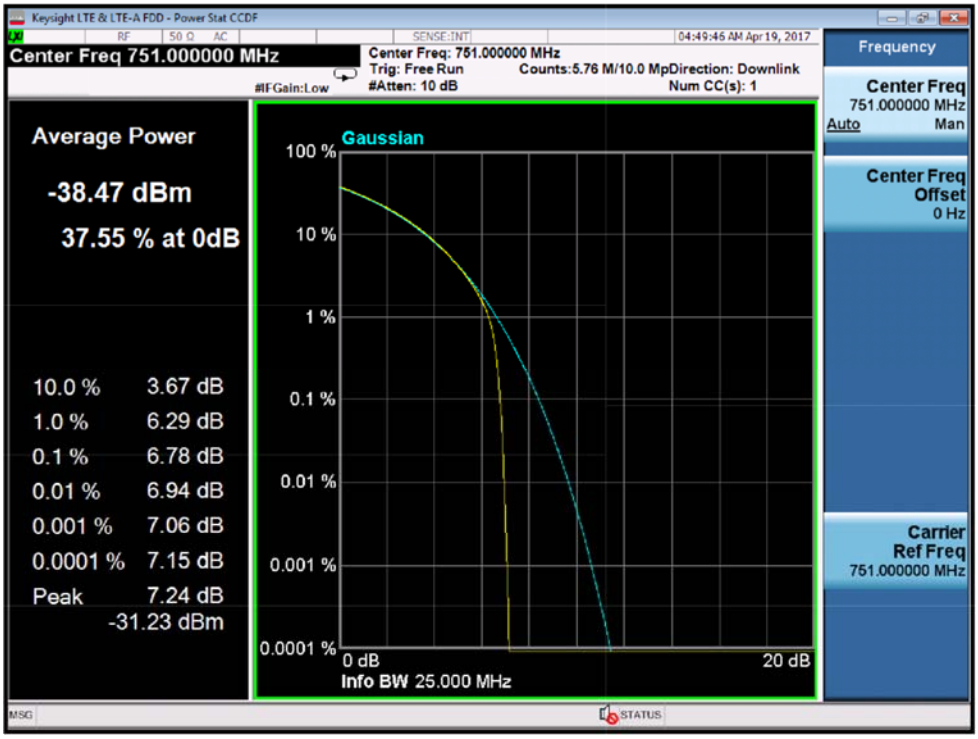


Figure 4.1.2 E PAR for Tx4 10 MHz Bandwidth 751.0 MHz 64QAM



4.2 Section 2.1047 MEASUREMENT REQUIRED: MODULATION CHARACTERISTICS

The **B13 RRH 4X30** supports LTE technologies. LTE utilizes Orthogonal Frequency Division Multiplexing (OFDM) which splits the carrier frequency bandwidth into many small subcarriers. Each individual subcarrier is modulated with QPSK, 16QAM or 64QAM digital modulation formats.

In QPSK, there are 4 possible symbol states and each symbol carries 2 bits of information. In 16QAM, there are 16 possible symbol states and each 16-QAM symbol carries 4 bits of information. While in 64QAM, there are 64 possible symbol states and each 64-QAM symbol carries 6 bits of information. Higher-order modulation, where the constellations become more dense, is more sensitive to poor channel conditions than the lower-order modulation.

The modulation characteristics measurement of LTE carriers measures the difference between the ideal symbols and the measured symbols after the equalization. The measurement was performed for the combined QPSK + 16QAM configuration and for the 64QAM configuration for Ports TX-1 and TX-4. Ports Tx-2 and Tx-3 were evaluated for the 64QAM configuration. Tests were as documented in Table 4.2 below.

Table 4.2 Modulation Results

Port	Transmit Power, Watts	Emissions Designator	Modulation	Carrier Center Frequency, MHz	Modulation, Pass/ Fail	PAR Pass/ Fail
Tx1	30	9M00F9W	QPSK +16QAM	751.0	Pass	Pass
Tx1	30	9M00F9W	64QAM	751.0	Pass	Pass
Tx2	30	9M00F9W	64QAM	751.0	Pass	Pass
Tx3	30	9M00F9W	64QAM	751.0	Pass	Pass
Tx4	30	9M00F9W	64QAM	751.0	Pass	Pass
Tx4	30	9M00F9W	QPSK +16QAM	751.0	Pass	Pass

4.2.1 Modulation Characteristics Measurement

The measurements were performed at the antenna transmitting terminals of the base station system with a signal analyzer which was calibrated in accordance with ISO 9001 process.
The test set-up diagram is given in the Figure 4.2.1, where the signal analyzer used the external signals from the base station as its trigger source and time reference.
Figure 4.2.2 shows two representative screen plots of the modulation measurement for an LTE carrier in QPSK +16QAM and 64QAM modulations, respectively.

4.2.1.1 Modulation Measurements Results:

The modulation characteristics of the EUT measured are in full compliance with the Rules of the Commission.

Figure 4.2.1 Test Set-Up for Measurement of Modulation, Occupied Bandwidth and Out-of-Band Emissions

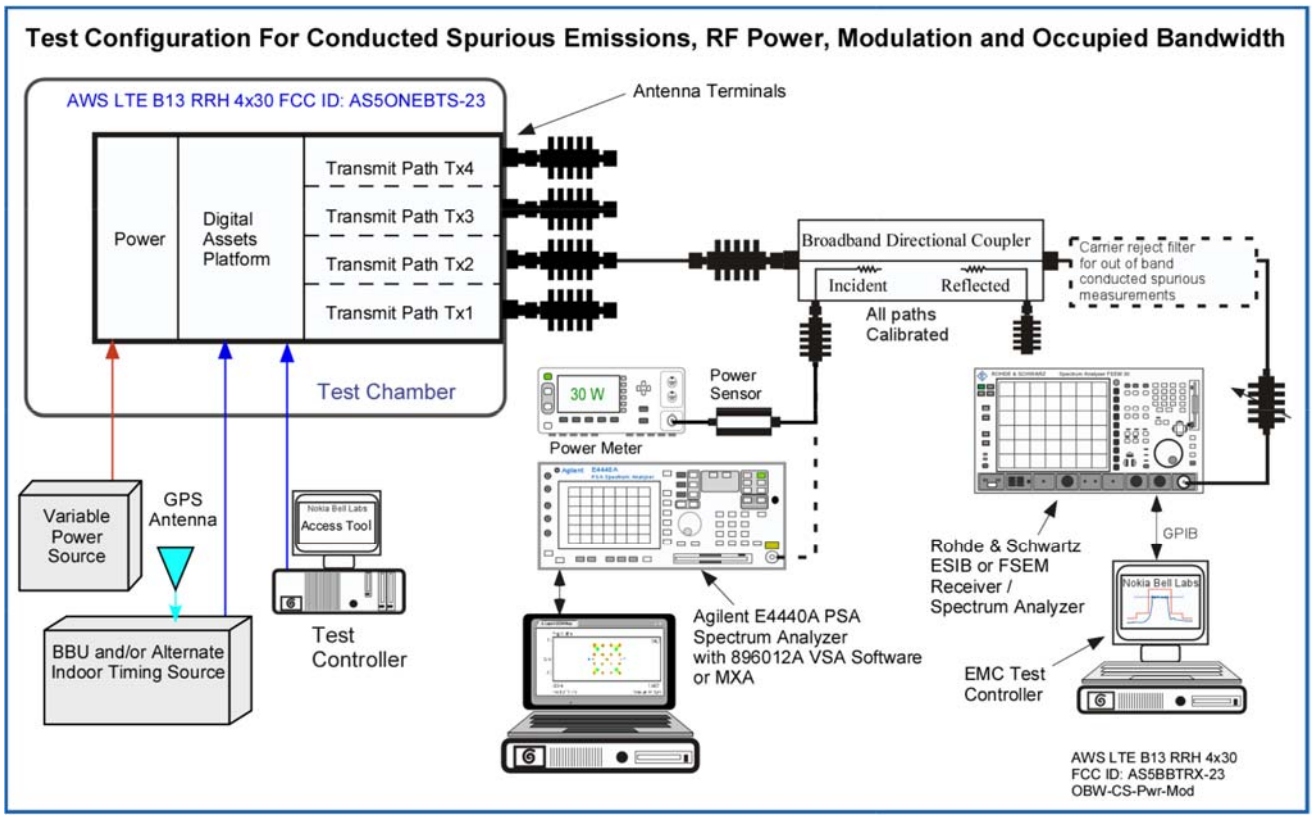
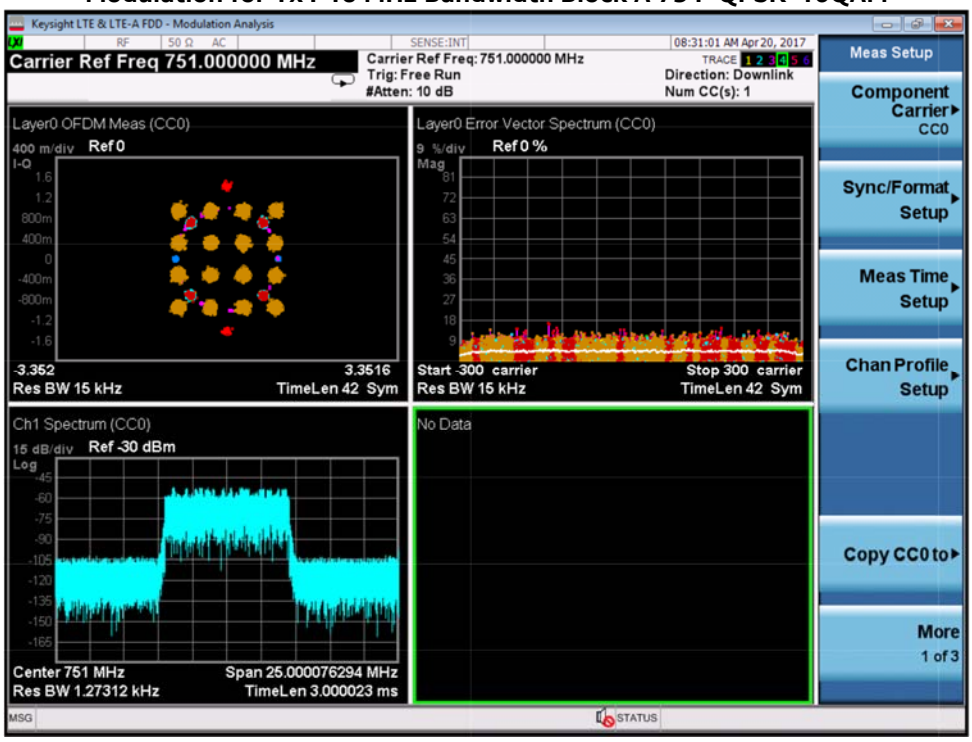
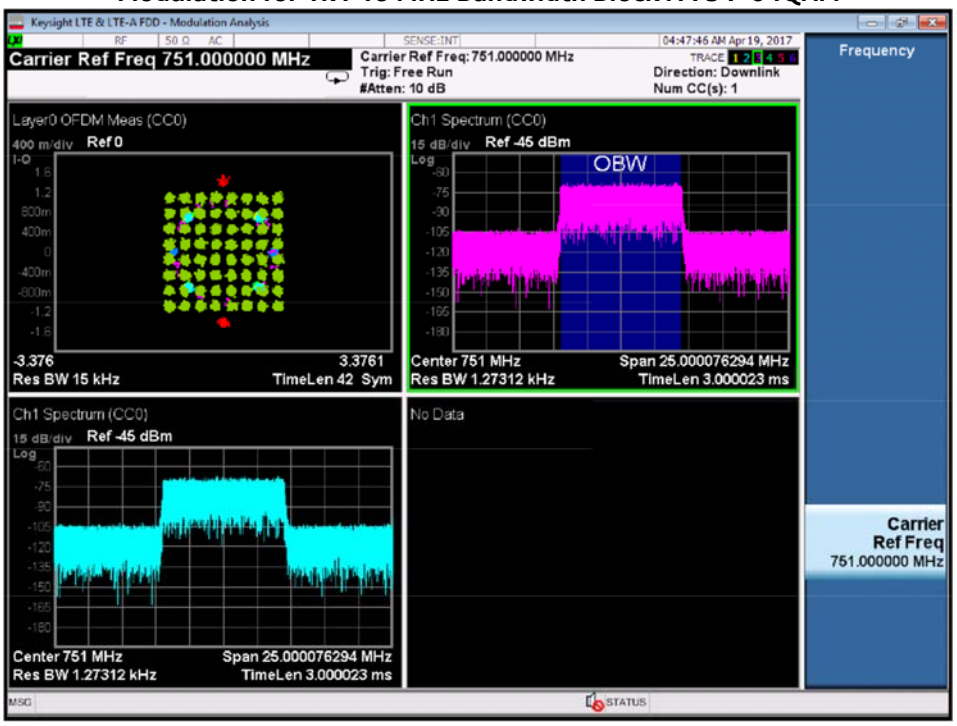


FIGURE 4.2.2 Modulation Measurements 10 MHz Bandwidth QPSK + 16QAM

Modulation for Tx1 10 MHz Bandwidth Block A 751 QPSK-16QAM



Modulation for Tx1 10 MHz Bandwidth Block A 751 64QAM



4.3 Section 2.1049 MEASUREMENT REQUIRED: OCCUPIED BANDWIDTH AND EDGE of BLOCK EMISSIONS

This test measures the Occupied Bandwidth of the transmitting carrier and the Edge of-Block Emissions in the frequency spectrum immediately outside and adjacent to the transmitting carrier(s).

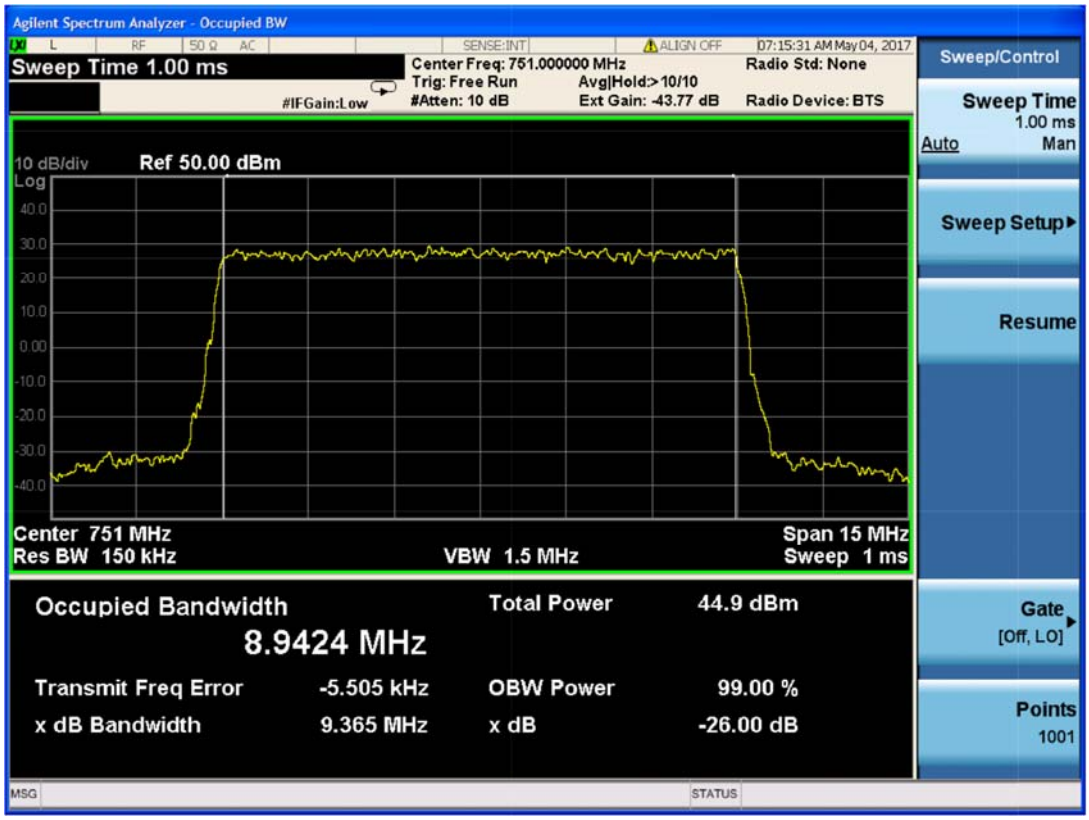
The occupied bandwidth (OBW) is usually defined either as the 99% power OBW or a relative OBW. The 99% OBW is the signal bandwidth such that, below its lower and above its upper frequency limits, the mean power radiated or conducted are each equal to 0.5 percent of the total mean power radiated or conducted by a given emission. The relative OBW is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated by at least X dB below the transmitter power, where the value of X is typically specified as 26.

Per KDB 971168 D01 v02r02, the relative OBW must be measured and reported when it is specified in the applicable rule part; otherwise, the 99% OBW shall be measured and reported. The OBW shall be measured when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment is operated.

4.3.1 Results Occupied Bandwidth (Signal Bandwidth)

The measured 99% occupied bandwidth and -26 dB relative bandwidth was measured with a Keysight MXA signal analyzer. The results are in Figure 4.3 .1 below and shows that the measured signal is within the parameters of the 9M00F9W emissions designator.

FIGURE 4.3.1- Occupied Bandwidth –9M00F9W -LTE 64QAM



4.3.2 Occupied Bandwidth-Edge of Band Emissions

Classical Occupied Bandwidth – Edge of Band Emissions is an evaluation of the transmit carrier compliance with edge of block/edge of band requirements. This measurement documents the product's ability to maintain compliance with FCC Parts 2 and 27.53 limitations on emissions outside the block of operation.

The **B13 RRH 4X30** Distributed Base station system supports single-carrier and multiple-carrier configurations with CDMA and LTE technologies. This evaluation only addresses 9M00F9W 4x30W operation.
All power adjustments were performed prior to other measurements and for this test all carriers were set to 30W. The measurements are described below.

The occupied bandwidth of each of the signals identified in Table 4.3.2 was measured using a Rohde & Schwarz ESIB-40 EMI Receiver/ Spectrum Analyzer, a PC based instrumentation controller using TILE™ software and calibrated RF attenuation and coupled signal path. The measurement process meets the requirements of ANSI C63.26 and ISO17025. The RF power level was measured and adjusted via the test setup in Figure 4.3. The set RF output from the transmitter was reduced by calibrated broadband attenuators to amplitudes usable by the spectrum analyzer and power meter. The attenuation factors are reflected in the displayed values of the charts. The typical occupied bandwidth measurement displays the signal adjusted to the reference level corresponding to the corrected RF power level for the signal bandwidth and given resolution bandwidth (RBW). This set-point was performed as follows:

For each test the power calibration was individually verified at the transmitter antenna connection (J4) with a power meter by using the test setup depicted in Figure 4.3. The power calibration was performed to calibrate the spectrum analyzers power measurement against the more accurate power meter measurement. This provides a specific reference for both the measured 30kHz RBW Occupied Bandwidth signal at the signal reference line and the 3 MHz RBW measurement against the power calibration line which is the below the "Top of Mask" limit. The "Top of Mask" limit corresponds to a single carrier signal at the specified power level of 30W / 44.77 dBm if measured with an RBW greater than the emissions bandwidth. Since the power calibration measurements was performed with a 3 MHz RBW a power calibration line equal to 10 log(3MHz/Emissions Bandwidth). The specific levels are specified in Table 4.3.2.3 which has limits for all of the measurements.

The transmitter output was configured to provide a 30W / 44.77 dBm LTE carriers. In each occupied bandwidth measurement there are two traces which track each other a given distance apart in amplitude. The top trace is the power calibration trace and this carrier is set to the power calibration line. The second trace is the occupied bandwidth measurement. The power calibration measurements is performed along with each Occupied Bandwidth measurement. The signals measured at RBW's of 3 MHz and 100 kHz were corrected for path loss and were plotted against the mask limit. As part of the calibration between the power meter measurement and the test analyzer, software was used to place the 3 MHz RBW signal at the carrier power calibration line for the specific carriers signal. The carrier as measured with 3 MHz and 100kHz RBW were corrected with the same attenuation factors. The two measurements are co-plotted on the same graph. A typical single carrier example is shown in Figure 4.3.2.3 which depicts a single 9M00F9W carrier inside the Band 13mask.

The test procedure above, calibrates the carrier power against the Mask and accurately places the measured occupied bandwidth carrier at the -20.0 dBm reference line. All of the plots are presented with a sufficiently wide frequency span for the specific signals or Block of interest. This allows for ease of comparison of the multi-carrier performance. This data was electronically recorded using the TILE™ software and electronically placed in the Occupied Bandwidth Data Sheets. These sheets contain data for multiple mixed carrier configurations for "Left Edge of Block", and "Right Edge of Block" across the PCS Band.

4.3.2.1 Requirements

The applicable requirements in 47 CFR Part 27.53(c) are as follows:
(1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

(6) Compliance with the provisions of paragraphs (c)(3) and (c)(4) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

The use of a minimum 25 sampling average was used in all measurement.

4.3.2.2 Measurement Offset and MIMO

The spectrum analysis output plots shows the peak of the LTE channel signal at the reference line that is 20.0 dB below the top of Mask reference of the spectrum analyzer. For the LTE system there is no carrier without modulation. Since the LTE signal is broadband and 10 MHz wide, all measurements performed at narrower resolution bandwidths needs to be evaluated with limits adjusted for the reduction in signal energy. The following relationship was used to provide the correct level for an unmodulated carrier vs. the modulated signal.

10*log (Resolution Bandwidth/ Transmit Bandwidth) = Signal Offset (1)

For the peak of the 10 MHz LTE signal measured with a RBW of 100 kHz the signal offset is:

Signal Offset = 10*log (100 kHz /10 MHz) = -20.00 dB

Since the 10 MHz LTE signal is wider than the 3 MHz spectrum analyzer setting used for power calibration a power calibration line must be placed below the top of mask. The offset for the power calibration line is:

Power Calibration Offset = 10*log (3 MHz /10 MHz) = -2.218 dB

For MIMO operation the limits must be adjusted per the equation:

MIMO Offset = 10LOG(n) where n= MIMO Value
For 4x MIMO = 10LOG(n)= 6.02 dB

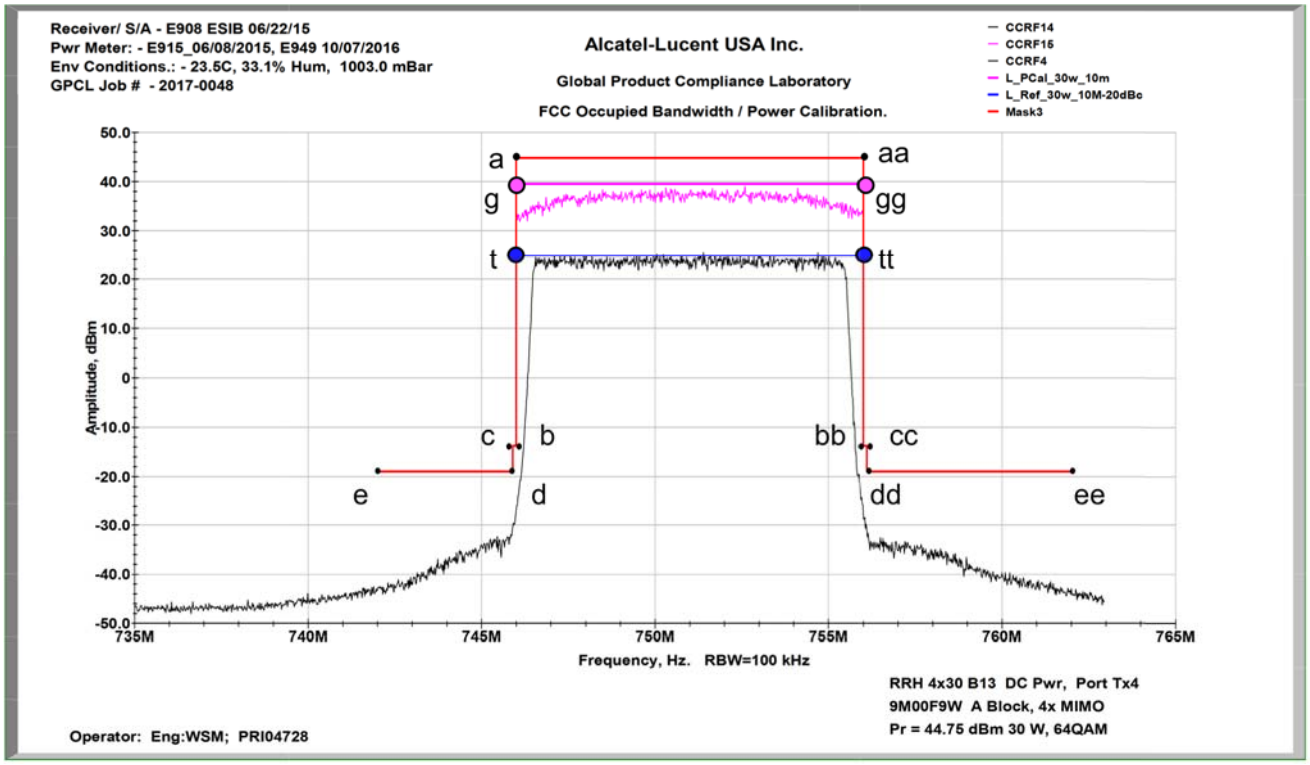
4.3.2.3 Mask Parameters

Limits which are specified as appropriate at a given RBW can be measured and evaluated at other RBW's if the limit is adjusted per equation (1). Table 4.3.2.3, below, identifies all of the limits and calibrations line levels used on the Occupied Bandwidth Masks to evaluate Out of Band Emissions. The line designations are as identified on the sample OBW chart Figure 4.3.2.3

Table 4.3.2.3 Mask Parameters

Carrier Power line a-aa		Signal BW	Measurement RBW		Power Calibration Line g-gg		Signal Offset Reference level Line t-tt		"n" x MIMO	MIMO Factor	Limit for just Outside the Block Lines c-b & bb-cc		Limit Beyond the 1st MHz outside the Block Lines e-d & dd-ee	
			OBW	RF Power	Offset	Level								
W	dBm	MHz	MHz	MHz	dB	dBm	dBc	dBm	n	dB	dBm	dBc	dBm	dBc
30	44.77	10	0.1	3	-5.23	39.54	-20.00	24.77	4	6.02	-13.79	-58.56	-19.02	-63.79

Figure 4.3.2.3 Mask Parameters



The occupied bandwidth and out-of-band emissions measurements were made at the antenna transmitting terminal for QPSK, 16QAM and 64QAM modulations, respectively. The appropriate E-UTRA test model specified in 3GPP TS 36.141 was used for LTE carriers.

The measurements were performed with a spectrum analyzer and in compliance with the procedure and requirements of ANSI C63.26. The test set-up diagram is same as the one shown in the Figure 4.3.1.

Testing was performed for the combined QPSK+16QAM and for the 64QAM modulations, respectively. The total carrier power level at the antenna terminal was adjusted to the maximum rated mean power 47.8 dBm (60W) for 2xMIMO configurations.

4.3.2.4 Results Occupied Bandwidth-Edge of Band Emissions

The Occupied Bandwidth plots with Edge-of-Band limits for the frequencies between 763-775 MHz and 793-805 MHz are below. The mask accurately depicts the limits for the specific blocks to determine compliance with FCC 47 CFR Part 27.53(c)(3)(6). The mask limits include the appropriate considerations for 4x30W MIMO operation. The plots contain data for both modulation configurations, QPSK+16QAM and 64QAM respectively.

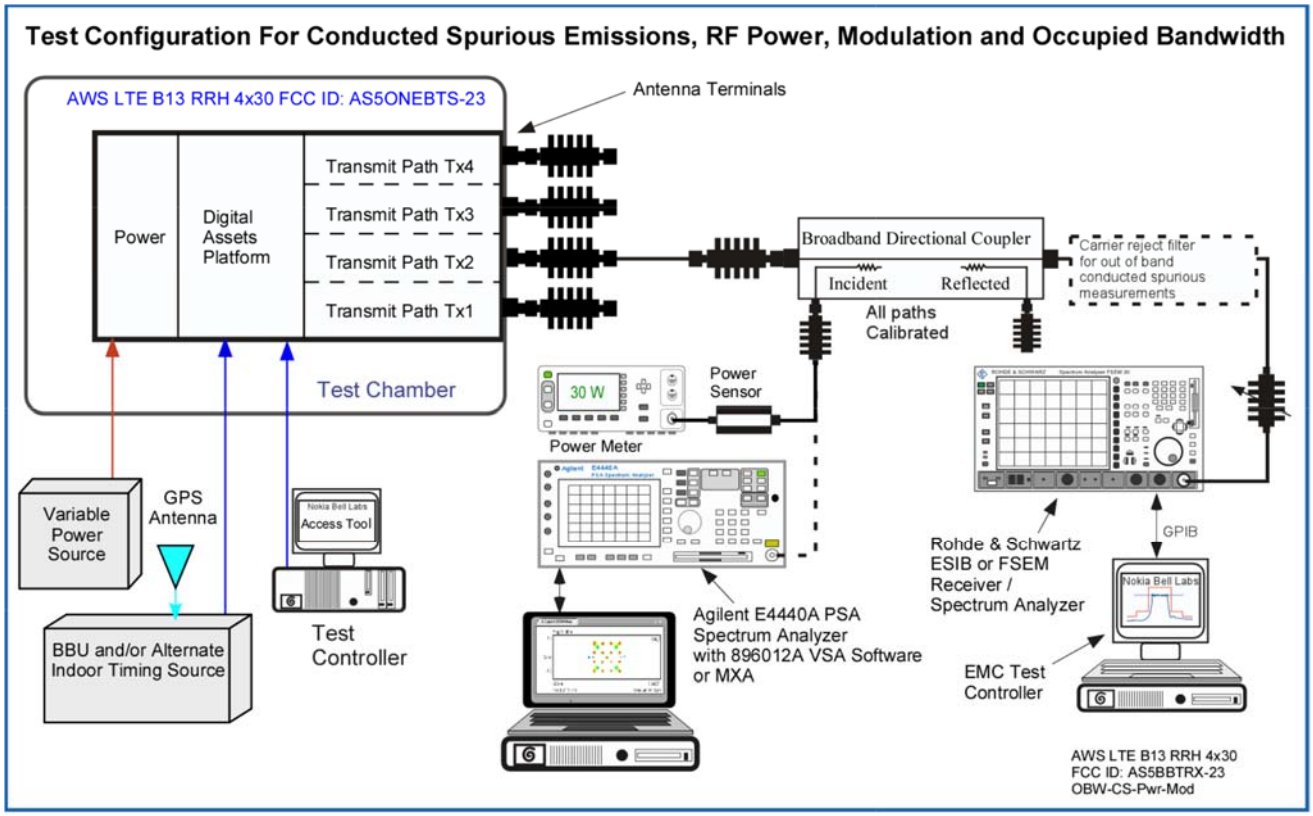
From the out-of-band emissions plots attached below, it can be seen that all the emissions are under the required FCC emission masks for MIMO operation.

The measurement results of the Occupied Bandwidth and the Edge-of-Band emissions as documented in the plots and Table 4.3.2.4 demonstrate the full compliance with the Rules of the Commission for the operating band.

Table 4.3.2.4 Compliance Tabulation of Occupied Bandwidth-Edge of Block Measurements

Port Tested	Transmit Power Watts	Modulation	Carrier Center Frequency MHz	Signal Bandwidth 9M00F9W Compliance Status	Occupied Bandwidth Compliance Status	Out of Band Emissions Compliance Status
Tx1	30	QPSK +16QAM	751.0	Pass	Pass	Pass
Tx1	30	64QAM	751.0	Pass	Pass	Pass
Tx2	30	64QAM	751.0	Pass	Pass	Pass
Tx3	30	64QAM	751.0	Pass	Pass	Pass
Tx4	30	64QAM	751.0	Pass	Pass	Pass
Tx4	30	QPSK +16QAM	751.0	Pass	Pass	Pass

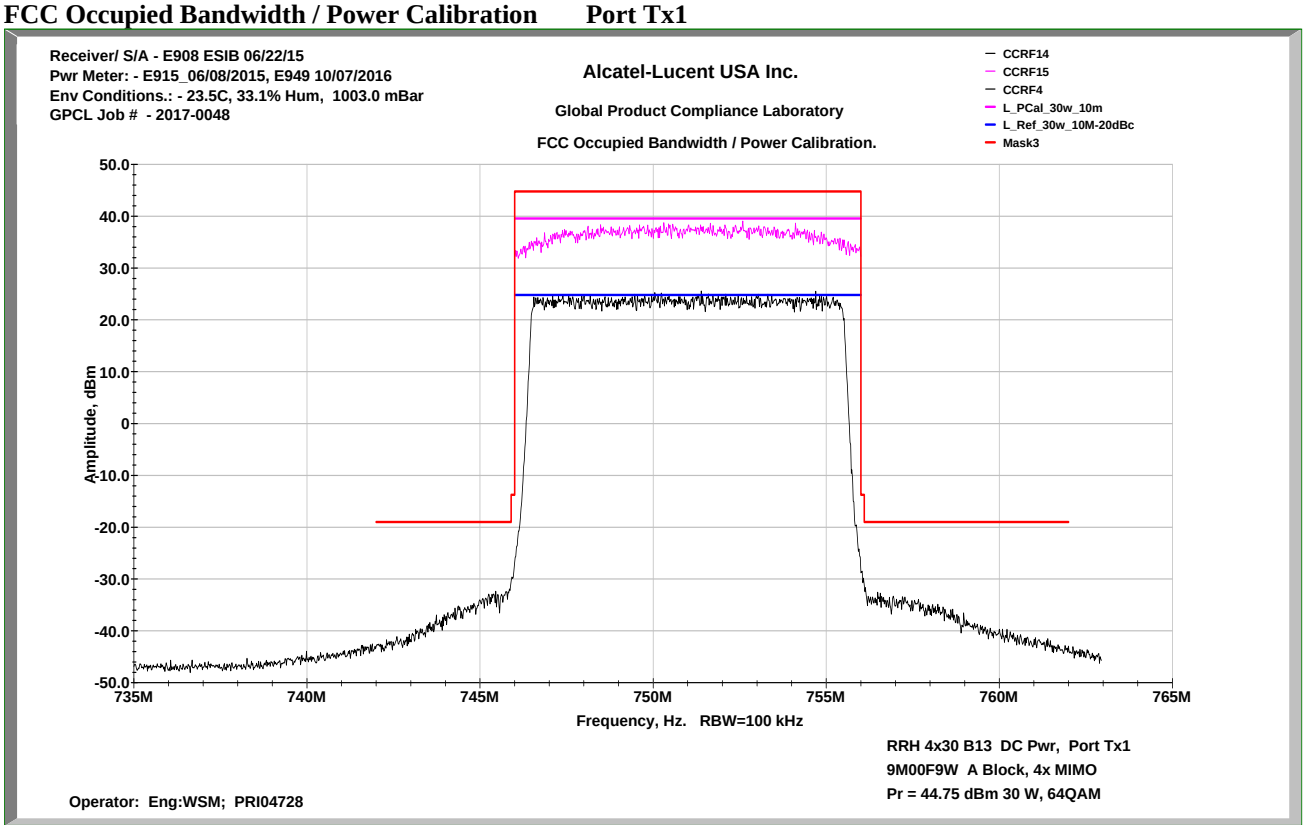
Figure 4.3.2 Test Set-Up for Measurement of Occupied Bandwidth and Out-of-Band Emissions



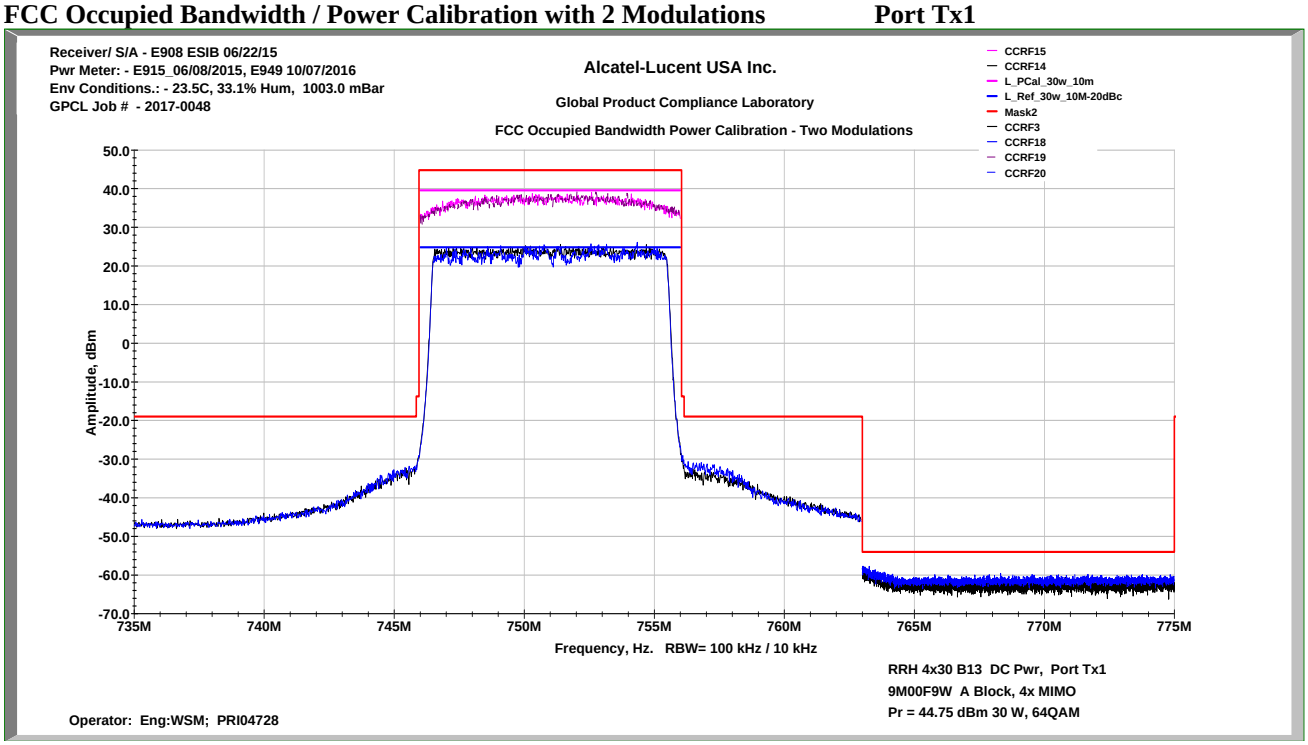
Transmitter Measurements
of
Occupied Bandwidth
and
Edge of Band Emissions
for
Alcatel-Lucent USA Inc.

AWS LTE B13 RRH 4x30
Outdoor Transceiver System
FCC ID: AS5BBTRX-23

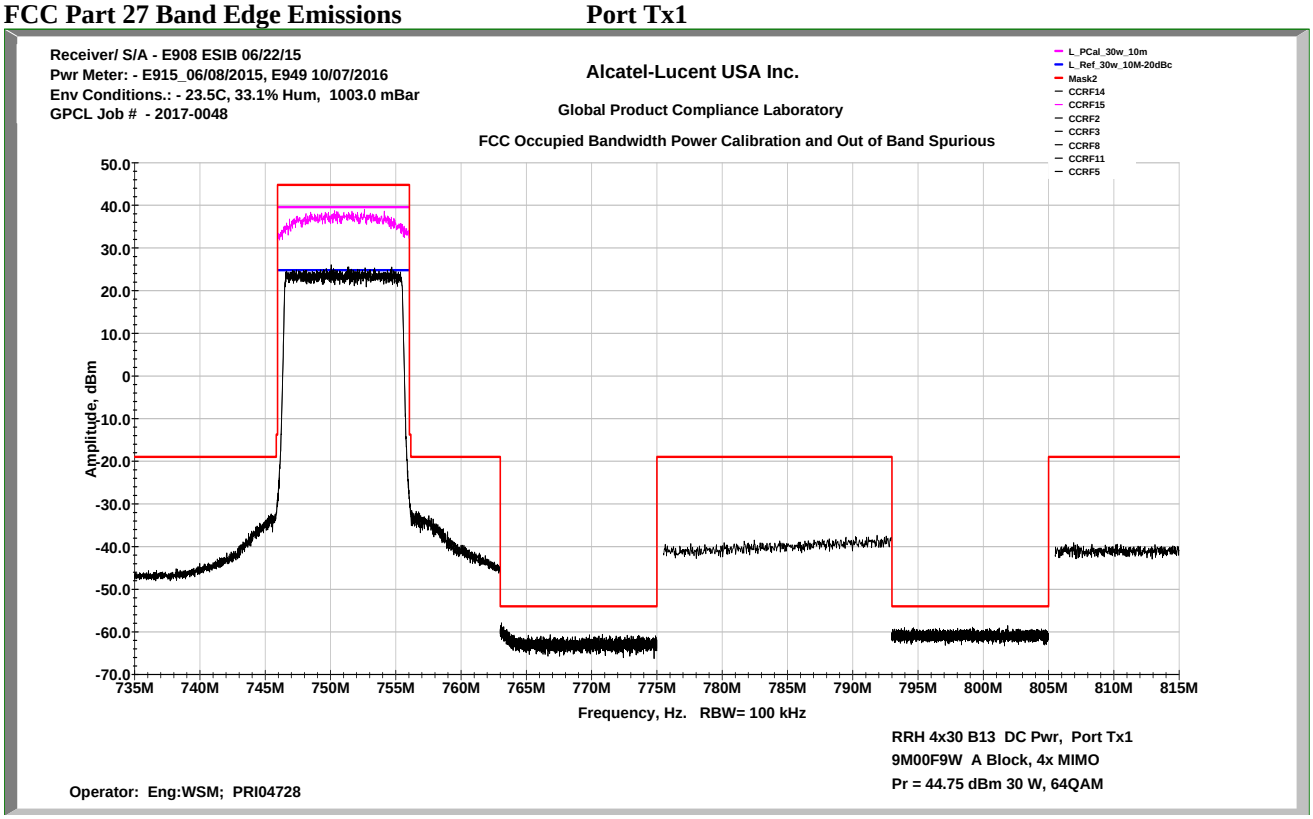
FCC Occupied Bandwidth / Power Calibration Port Tx1



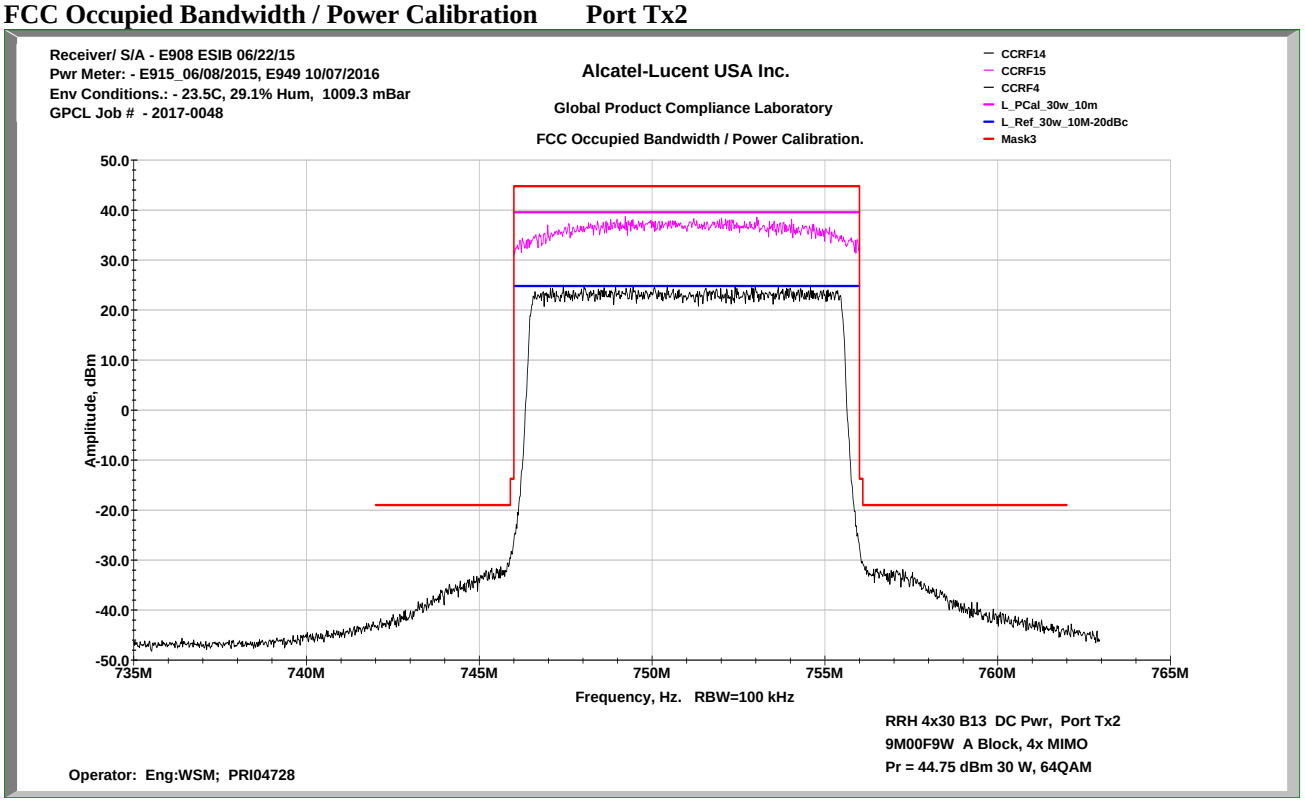
FCC Occupied Bandwidth / Power Calibration with 2 Modulations Port Tx1



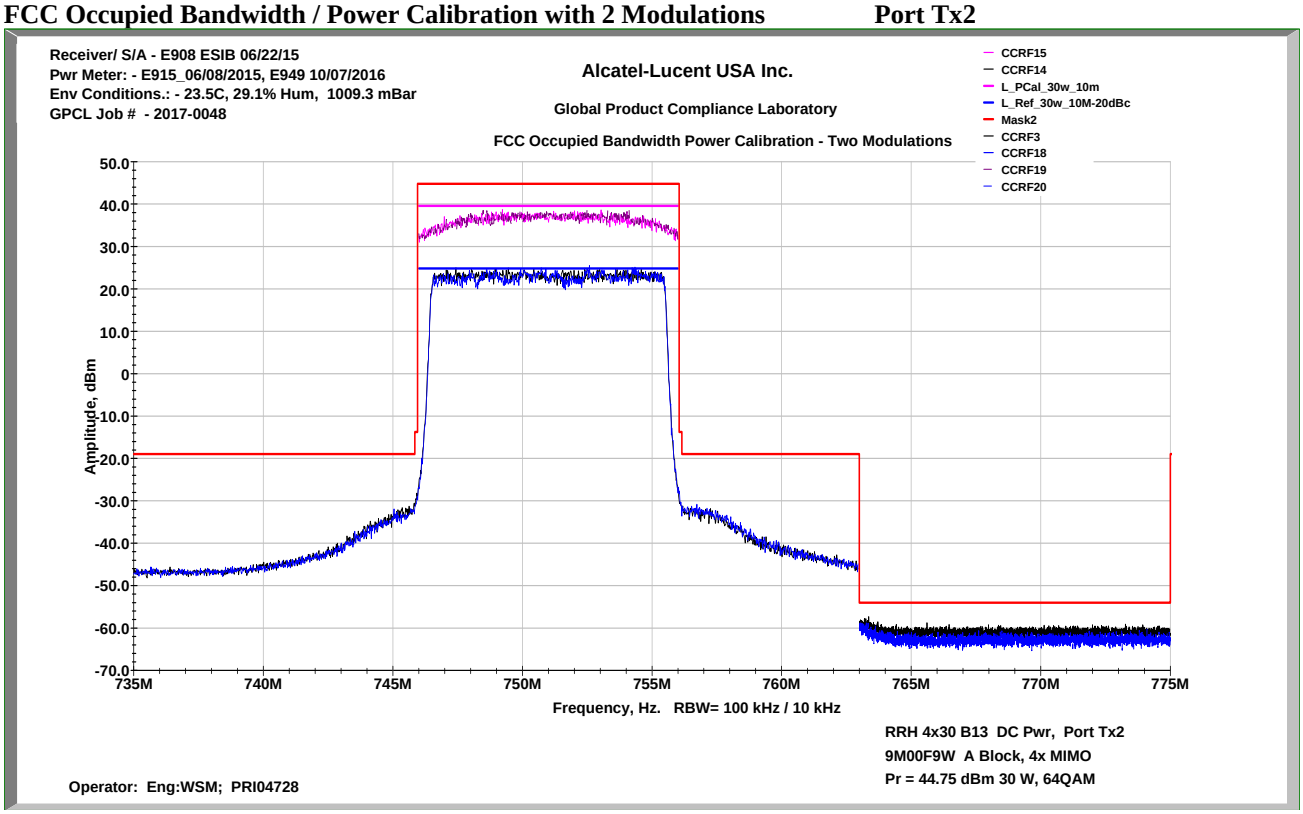
FCC Part 27 Band Edge Emissions Port Tx1



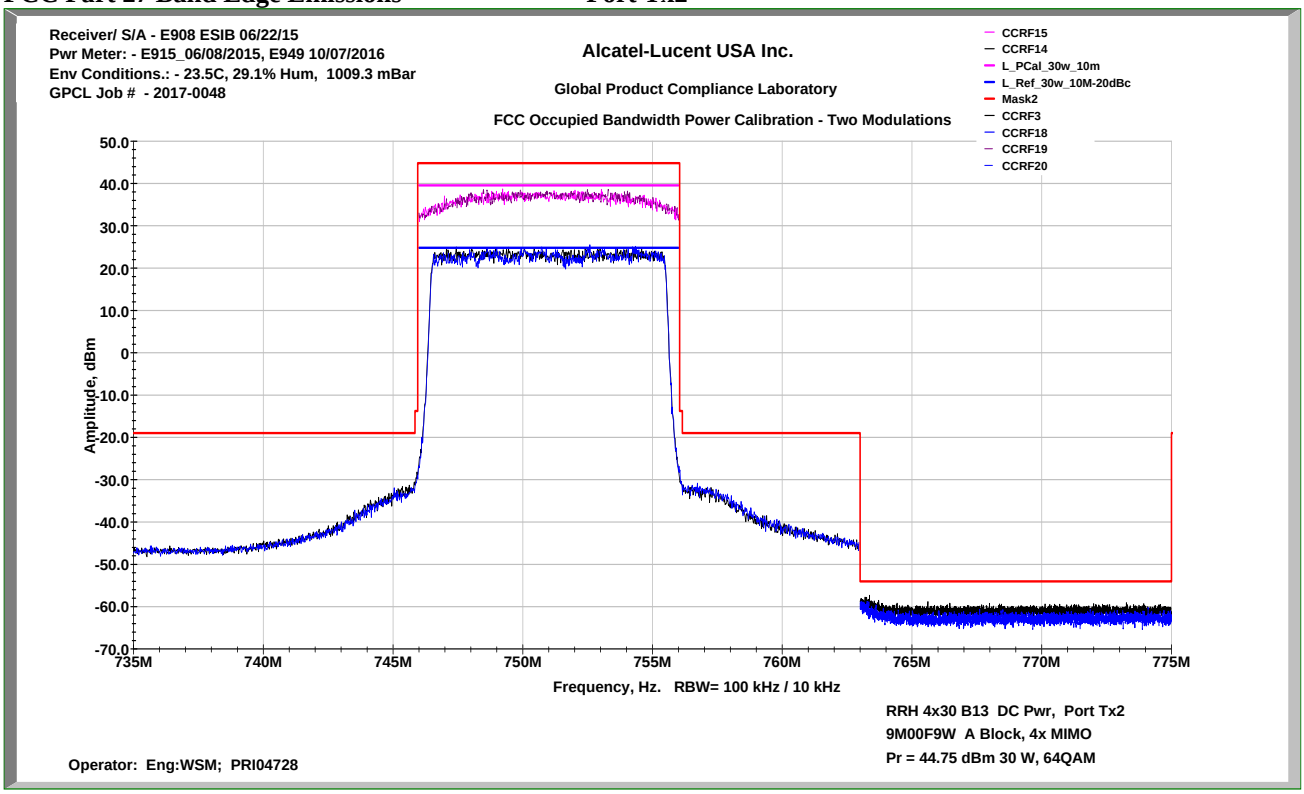
FCC Occupied Bandwidth / Power Calibration Port Tx2



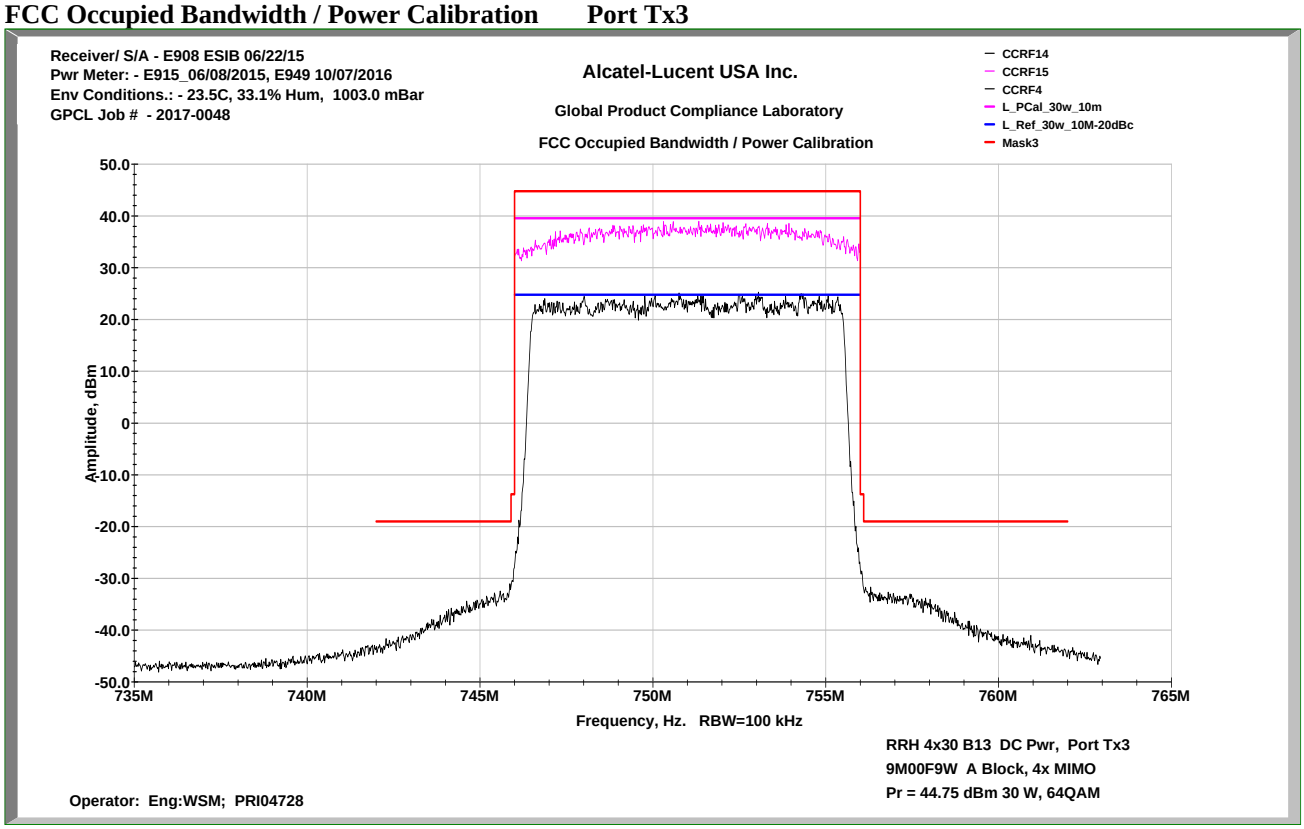
FCC Occupied Bandwidth / Power Calibration with 2 Modulations **Port Tx2**



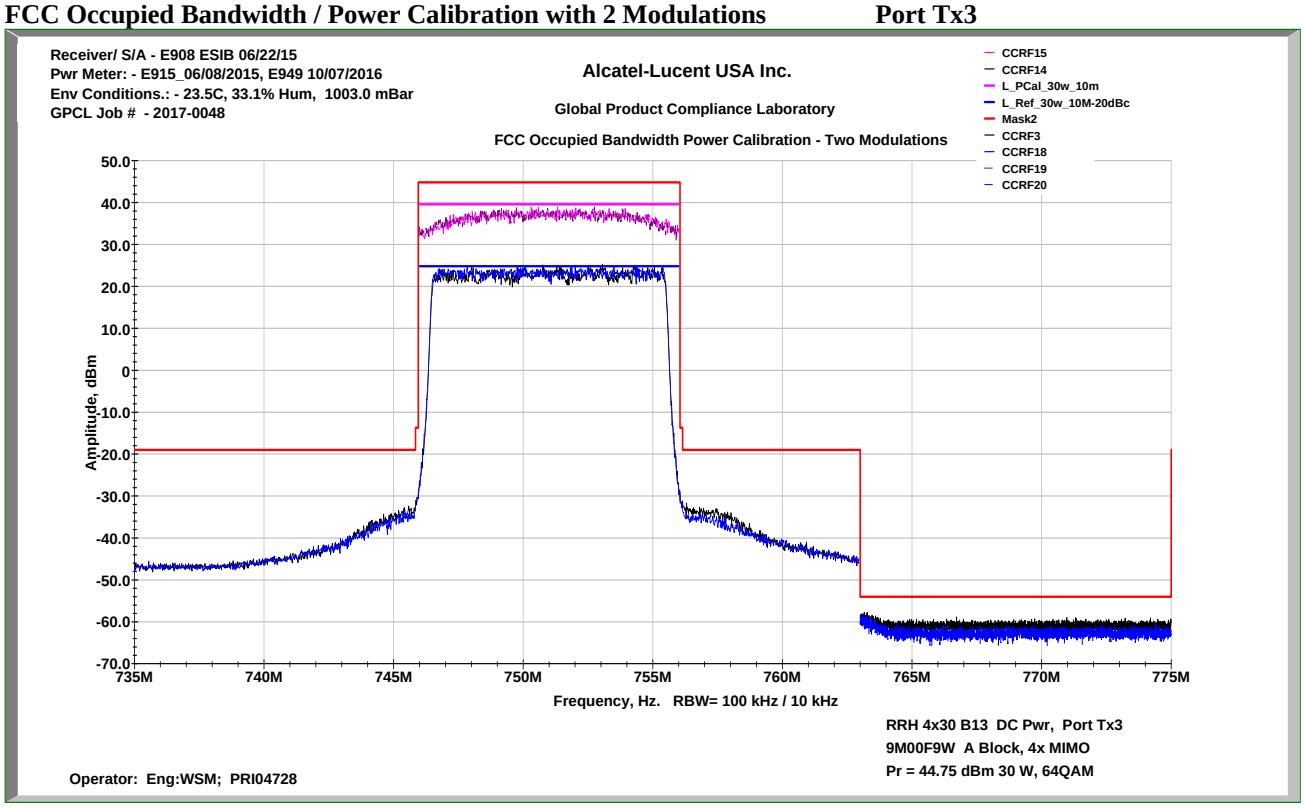
FCC Part 27 Band Edge Emissions **Port Tx2**



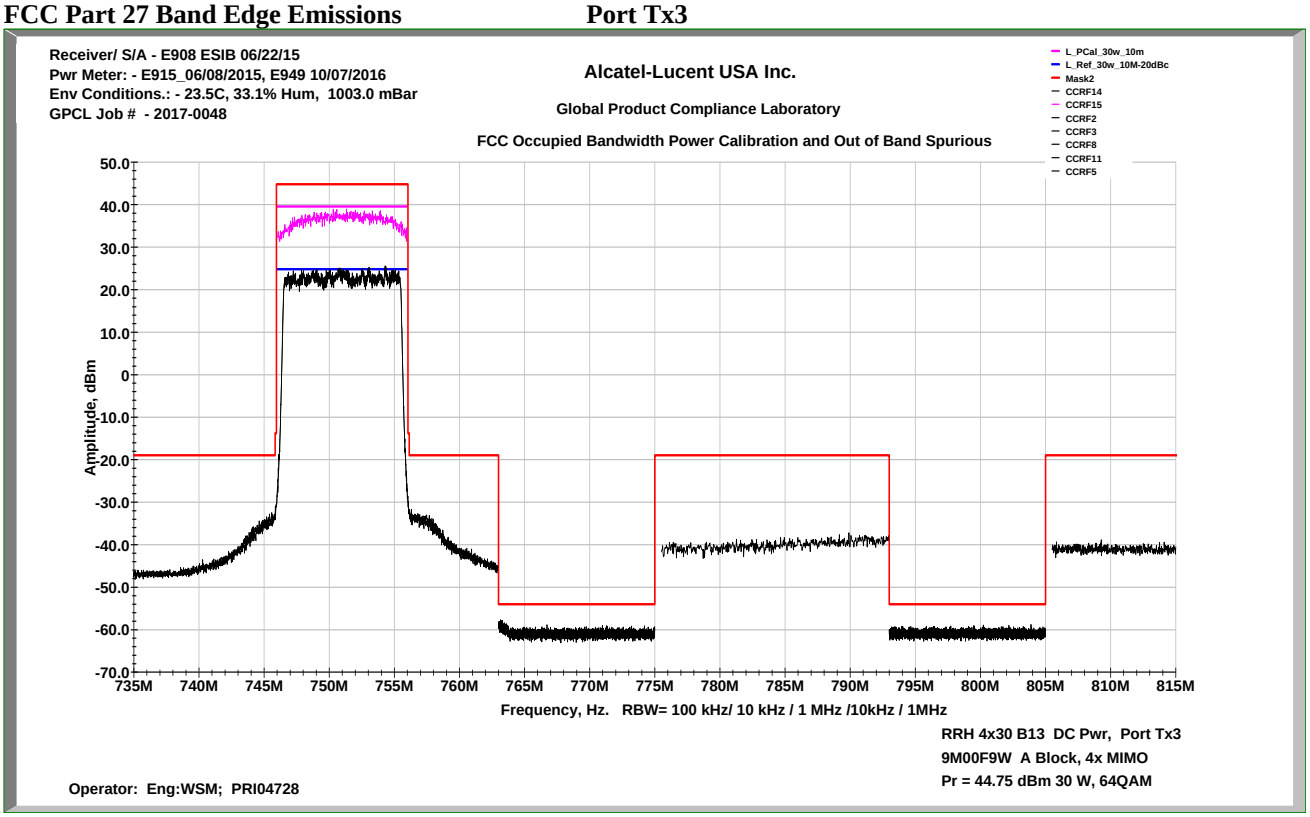
FCC Occupied Bandwidth / Power Calibration Port Tx3



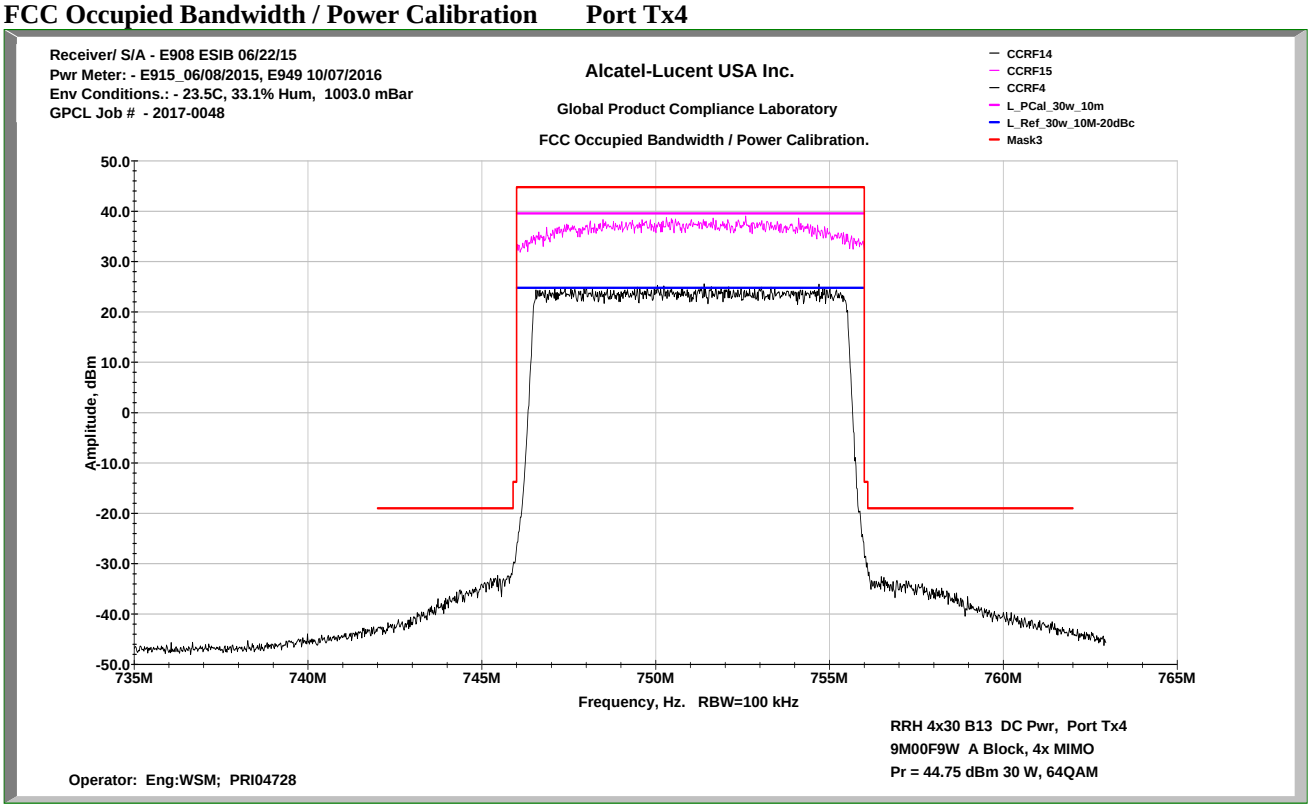
FCC Occupied Bandwidth / Power Calibration with 2 Modulations Port Tx3



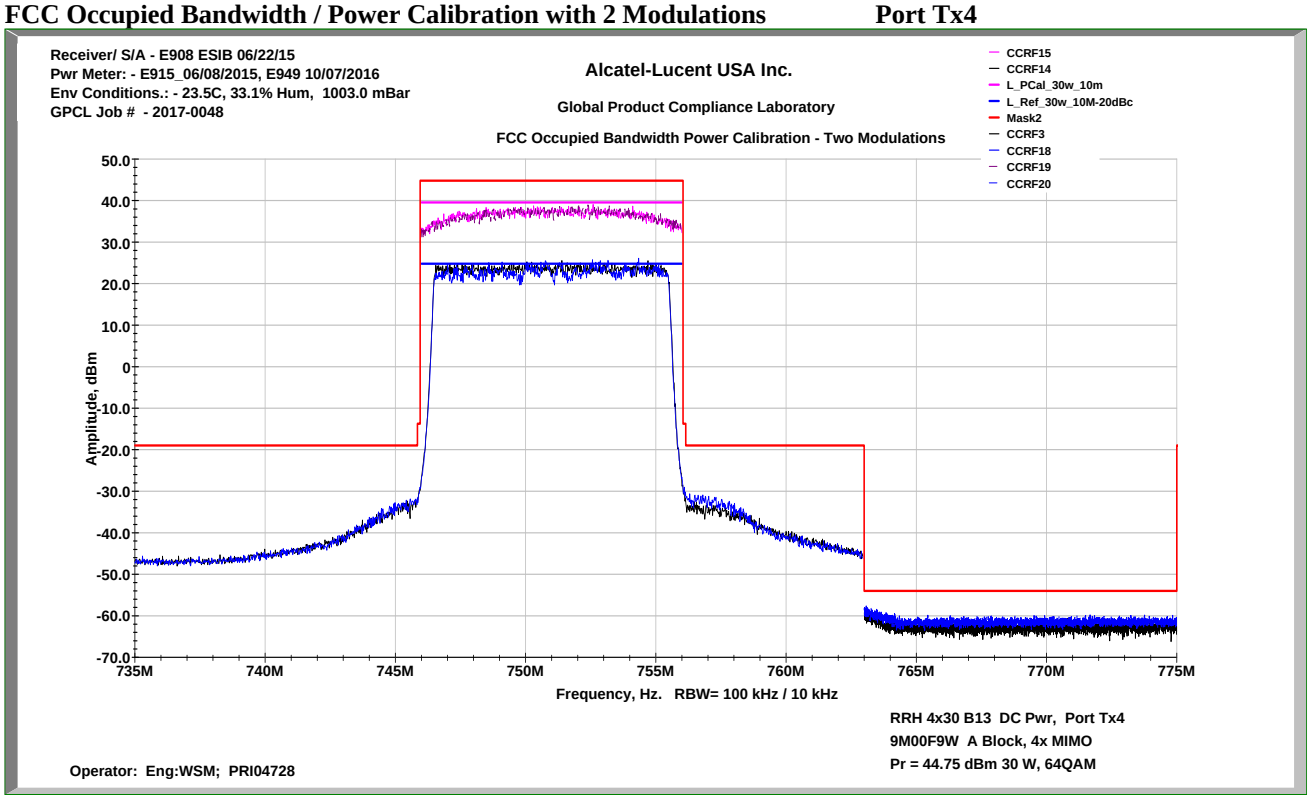
FCC Part 27 Band Edge Emissions Port Tx3



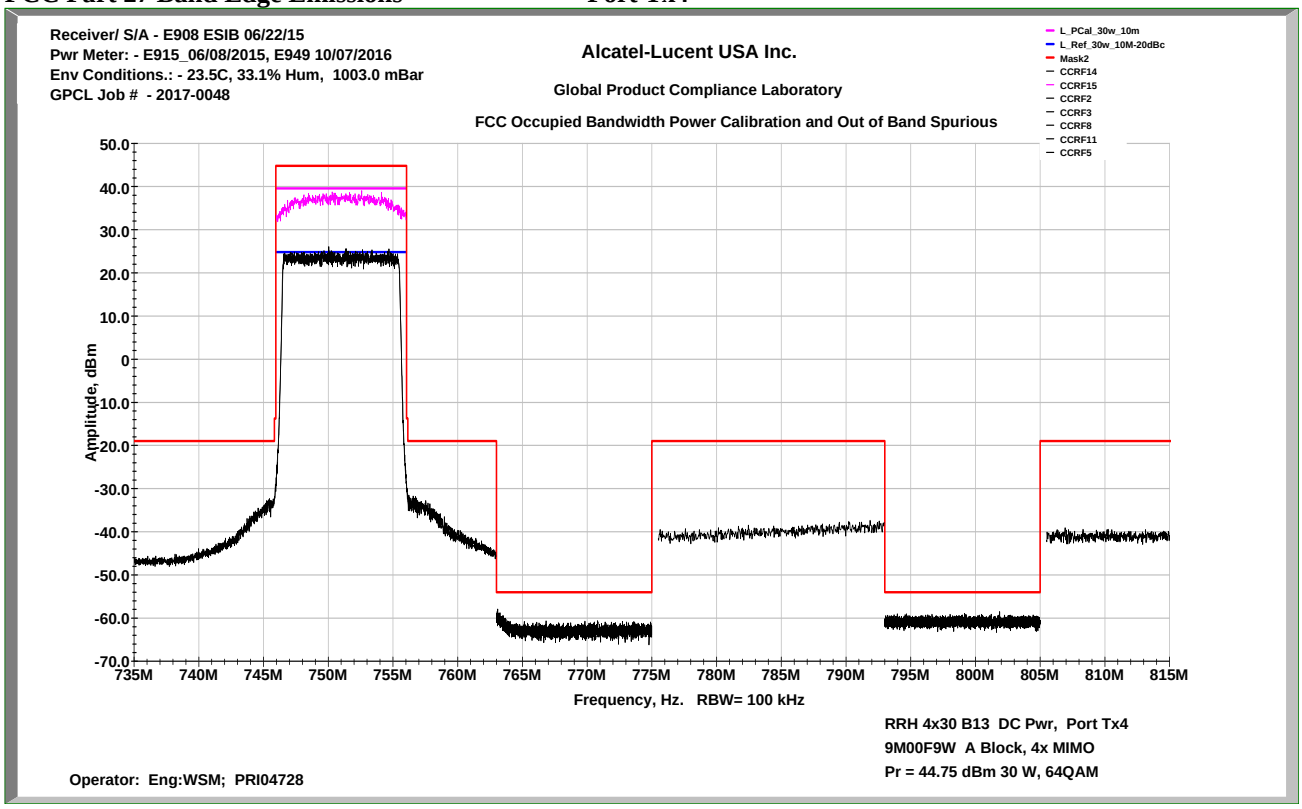
FCC Occupied Bandwidth / Power Calibration Port Tx4



FCC Occupied Bandwidth / Power Calibration with 2 Modulations Port Tx4



FCC Part 27 Band Edge Emissions Port Tx4



4.4 Section 2.1051 MEASUREMENT REQUIRED: SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

This test measures the emissions of spurious signals which may come from harmonic, parasitic, intermodulation and frequency conversion products and are outside the necessary bandwidth but exclude out-of-band emissions.

4.4.1 Section 2.1051 Spurious Emissions at Antenna Terminals

Spurious Emissions at the antenna terminals were investigated per Section 2.1057(a)(1) over the frequency range of 10 MHz to 12.7 GHz which is beyond the 10th harmonic of the carrier frequency. A test coupler which incorporates a low inter-mod broadband RF attenuator was used to reduce the transceiver's amplitude to a level usable by the spectrum analyzer. The test configuration is shown in Figure 4.4.1 which documents the test set up used for the measurements. In this set up the complete RF test path was calibrated over the 10 MHz-12.7 GHz range and it allows for RF power to be measured and monitored during the test.

The spurious measurements were made using an automated test system. The test system consists of a Rohde & Schwarz ESIB-40 Test Receiver/ Spectrum Analyzer, a PC based computer test controller, calibrated test hardware and a TILE ™ software program to acquire the test data. This system provides for measurements to be performed in compliance with ANSI C63.26 and our ISO17025 process. The measurement meets the ANSI C63.26 requirements in paragraphs 5.2.4.4.1 and 5.7 which requires that the number of points in the sweep be > 2 × Span/RBW. The volume of collected data is greater than 1 $x10^5$ data points over the frequency range of 10 MHz to 12.7 GHz. The automated test system provides for a presentation of the data in an accurate and compact form for FCC review.
Measurements were performed for all of the test configurations in Table 4.4.4 and these match the test configurations used for Occupied Bandwidth / Edge of Band Emissions, RF Power and modulation.

4.4.2 Required Limit

The required emission limitation specified in **47CFR 27.53(c)(1)(3)(5)(6) 1-Oct-2010** was applied to these tests. Based upon the criterion given in Section 27.53 of the Code and as developed in Exhibit 4.3, the required emission limit in 47 CFR 27.53(c) for emissions outside a licensees frequency block is:
Emissions >1 MHz outside the Block, *when measured with a RBW of 100 kHz or greater*, shall be attenuated by :

-{43+10log (mean power output in watts)} = -13 dBm.

In order to account for the spectral adding of identical signals from the primary and diversity ports, per KDB 662911 D01 Multiple Transmitter Output v01r01, the level needs be adjusted by 10LOG(n) where n= number of outputs.

The adjustment for n=4 is: 6.02 dB = 10LOG(4)

Therefore the limit for emissions >1 MHz outside a licensees frequency block when measured with *when measured with a RBW of 100 kHz or greater* is:

-13 dBm – 6.02 dB = -19.02 dBm

The emissions for the edge of band requirements in 47 CFR Part 27.53 (c)(3)

> *(3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;*

Compliance with the above requirement are appropriately documented in the Occupied Bandwidth exhibits as an Edge-of-Band requirement. The performance was compliant.

4.4.3 Operational Configuration

The modulation used in this evaluation are described in the pertinent standards documents which include **3GPP TS 36.211 V9.1.0 (2010-03) titled:** 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation (Release 9). The modulation is Orthogonal Frequency Division Multiple Access (OFDMA) which is processed into an uplink IF signal. The input data stream is divided into several parallel sub-streams of reduced data rate and each sub-stream is transmitted on a separate orthogonal sub-carrier. The sub-carriers are modulated using either QPSK, or 64QAM. There is no single measure of the modulation quality other than to verify that the subcarrier modulation constellations visual orientation match the symbol and amplitude criteria is consistent with QPSK and 64QAM.

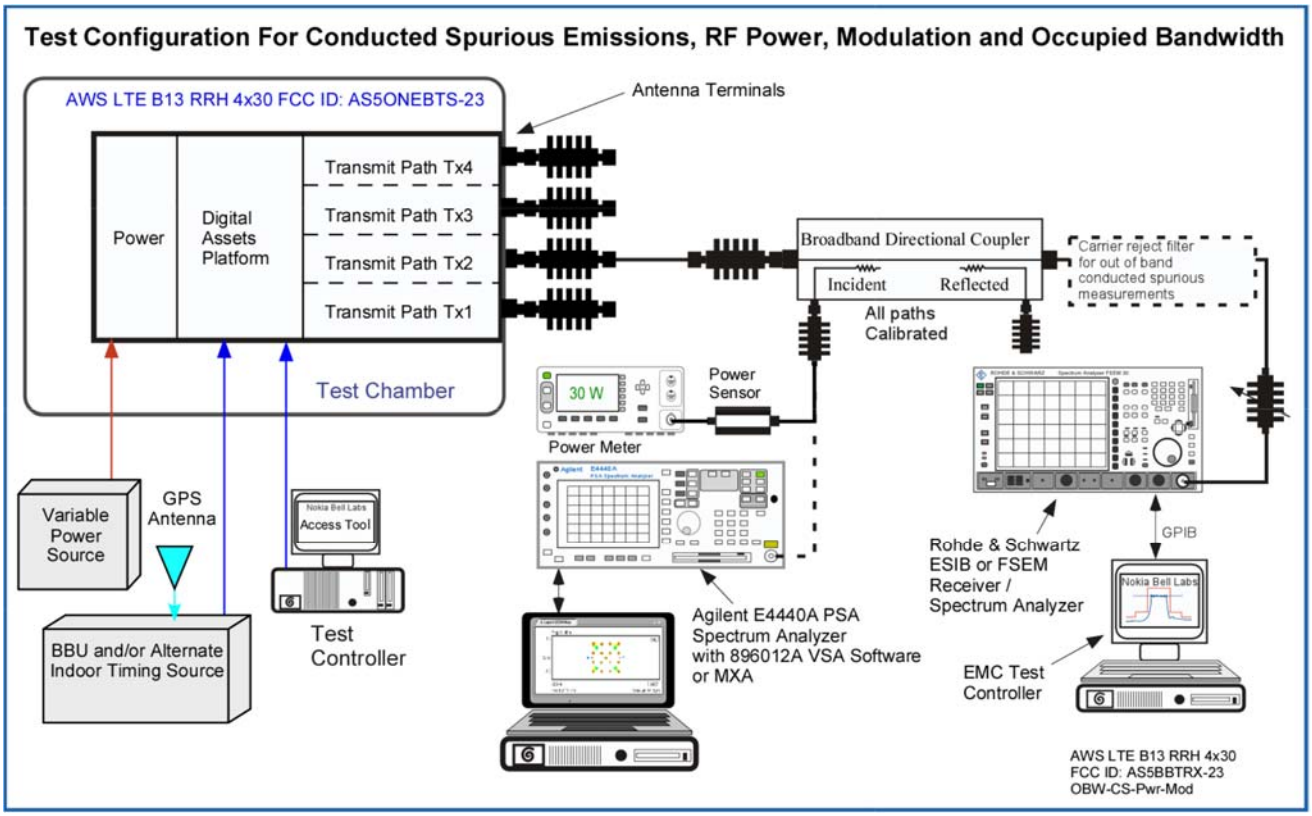
4.4.4 Results:

Over the required frequency spectrum investigated for the EUT, 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. Results are tabulated in Table 4.5.4 below. Example measurements for Port Tx1 Port Tx4 are below. The measurement results demonstrate that the subject of this application is in full compliance with the Rules of the Commission.

Table 4.5.4 Compliance Tabulation of Conducted Spurious Emissions Measurements

Port Tested	Transmit Power Watts	Modulation	Carrier Center Frequency MHz	Conducted Spurious Emissions Compliance Status	Out of Band Emissions Compliance Status
Tx1	30	QPSK +16QAM	751.0	Pass	Pass
Tx1	30	64QAM	751.0	Pass	Pass
Tx2	30	64QAM	751.0	Pass	Pass
Tx3	30	64QAM	751.0	Pass	Pass
Tx4	30	64QAM	751.0	Pass	Pass
Tx4	30	QPSK +16QAM	751.0	Pass	Pass

Figure 4.4.1 Test Set-Up for Measurement of Conducted Spurious Emissions

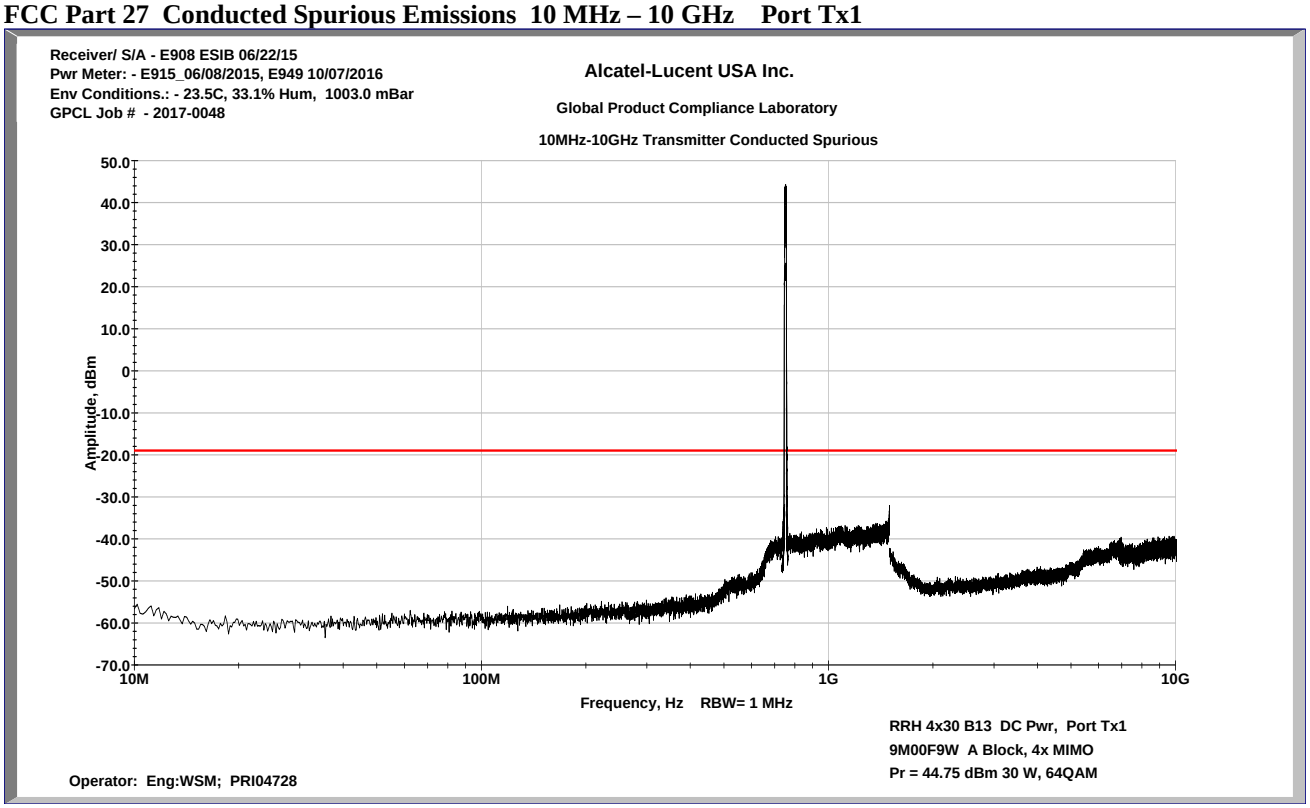


Transmitter Measurements
of
Conducted Spurious Emissions
for
Alcatel-Lucent USA Inc.

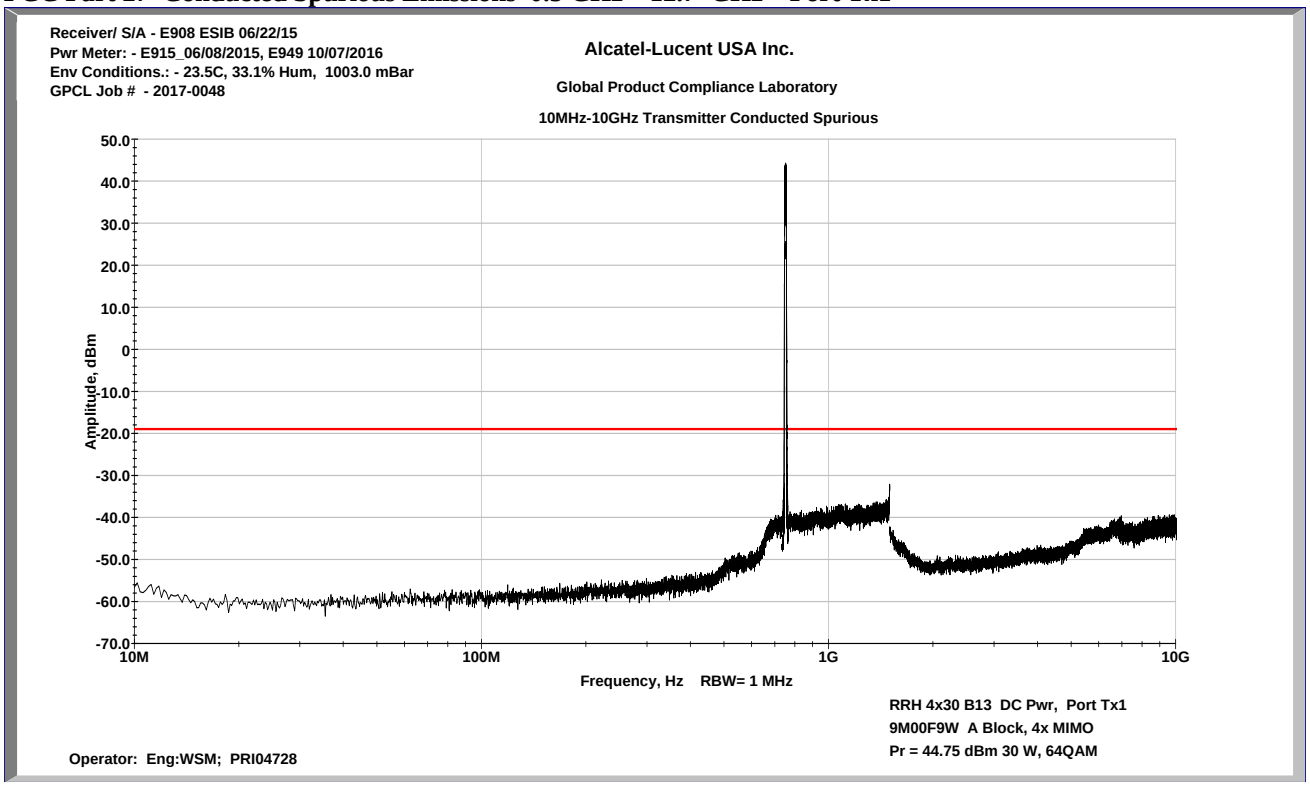
AWS LTE B13 RRH 4x30
Outdoor Transceiver System

FCC ID: AS5BBTRX-23

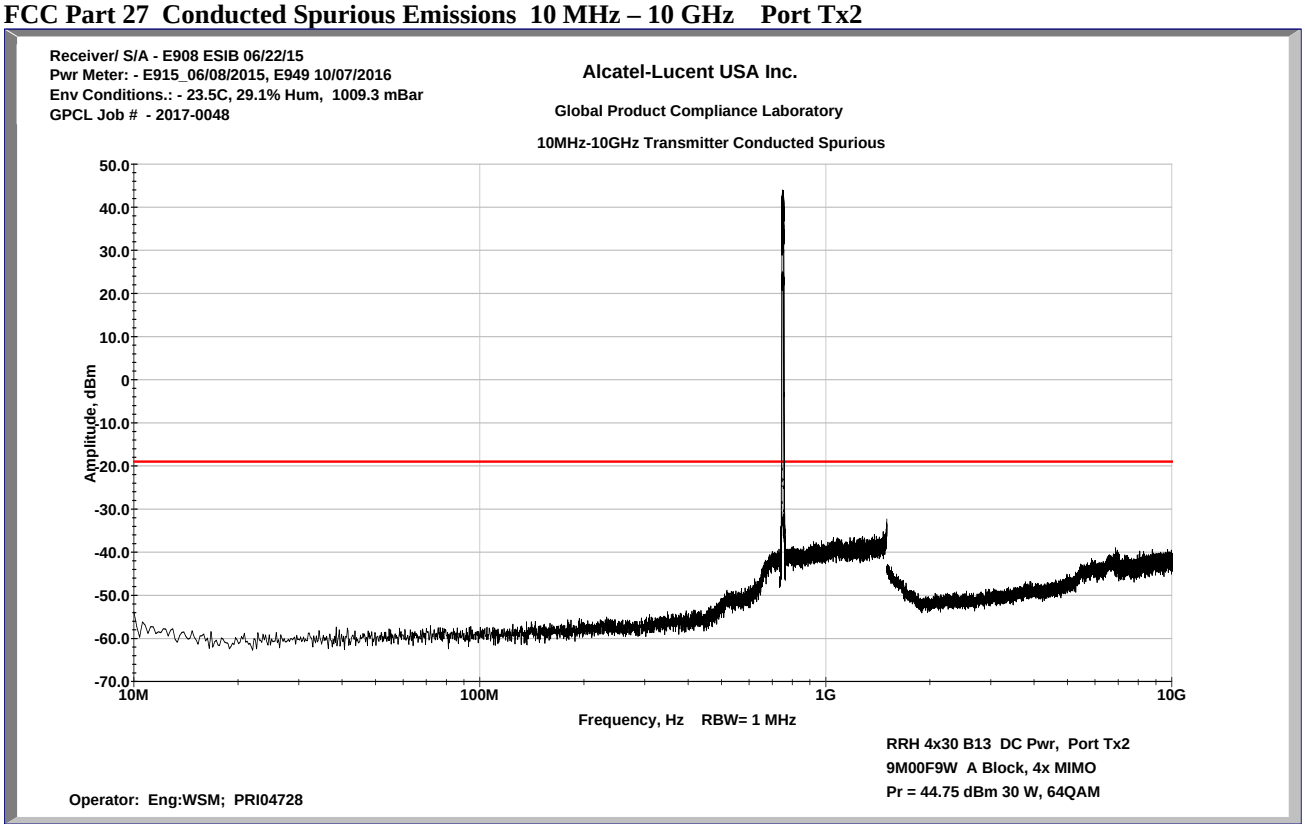
FCC Part 27 Conducted Spurious Emissions 10 MHz – 10 GHz Port Tx1



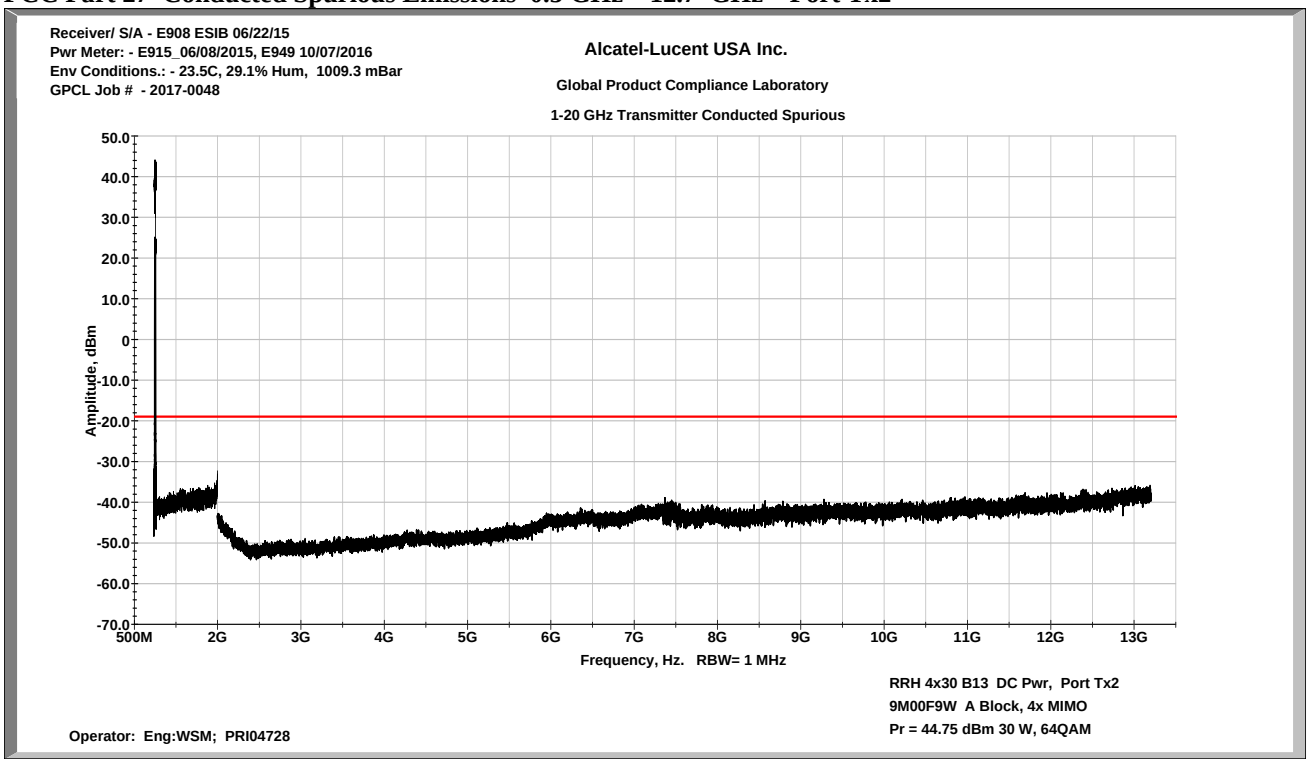
FCC Part 27 Conducted Spurious Emissions 0.5 GHz – 12.7 GHz Port Tx1



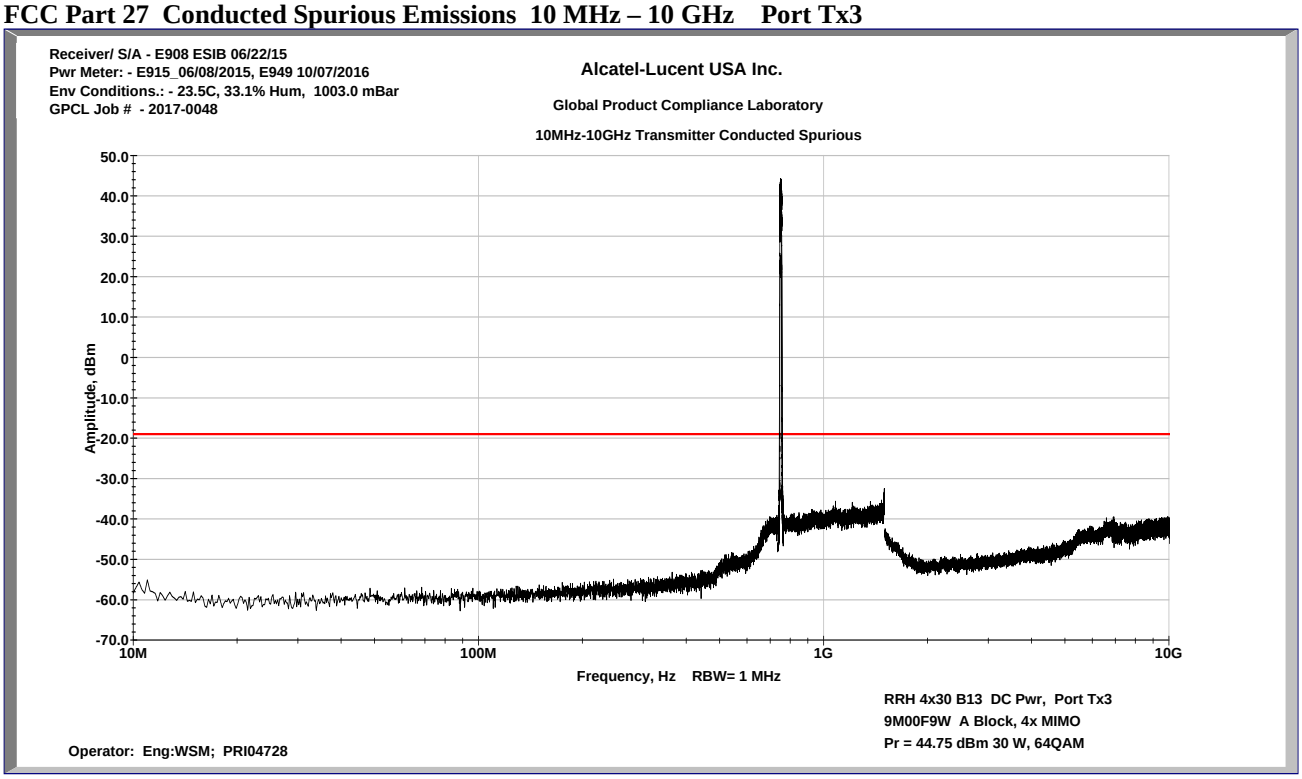
FCC Part 27 Conducted Spurious Emissions 10 MHz – 10 GHz Port Tx2



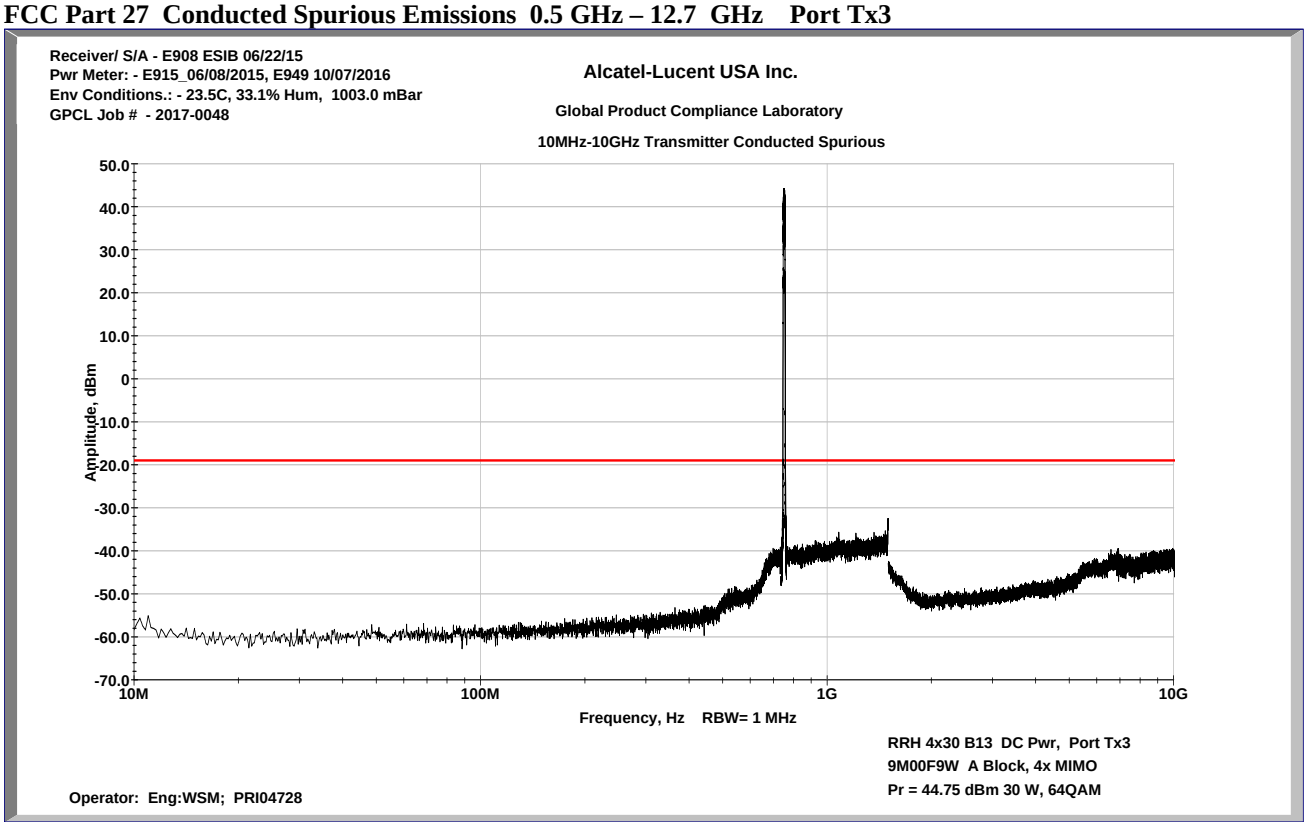
FCC Part 27 Conducted Spurious Emissions 0.5 GHz – 12.7 GHz Port Tx2



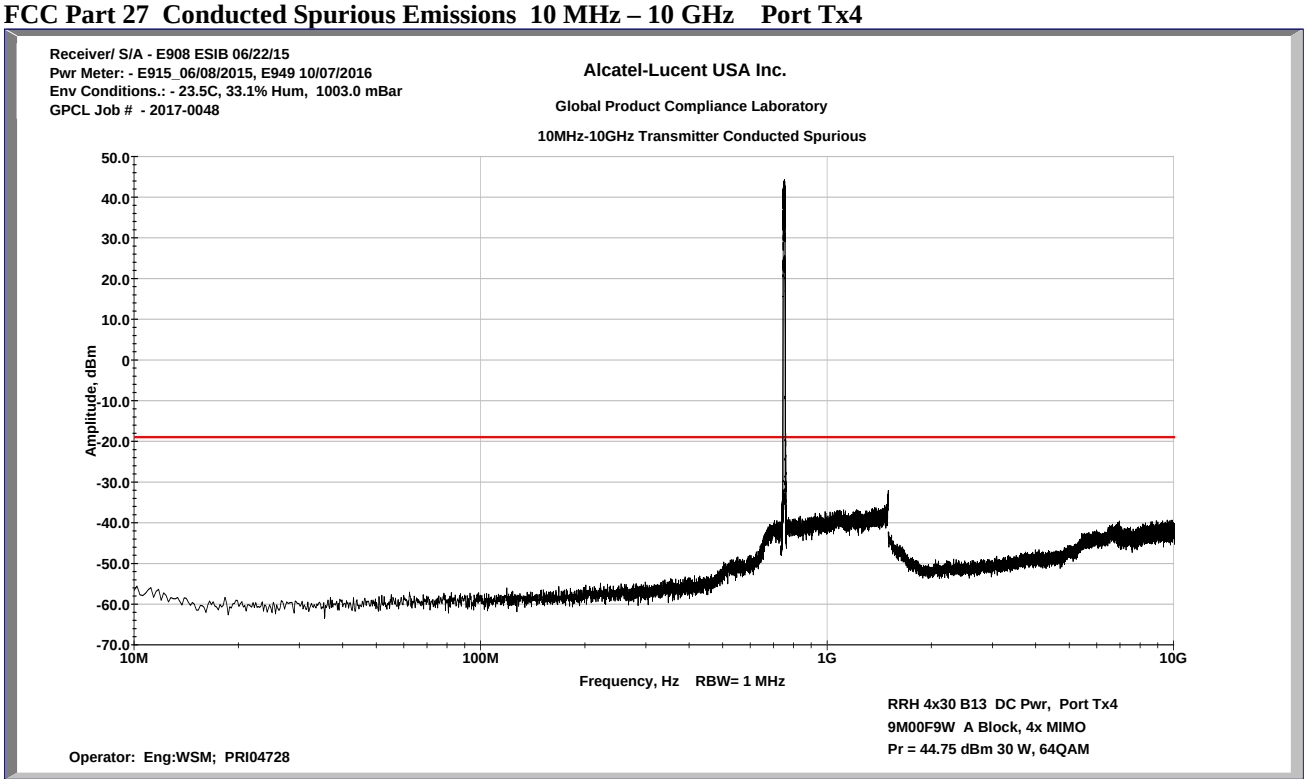
FCC Part 27 Conducted Spurious Emissions 10 MHz – 10 GHz Port Tx3



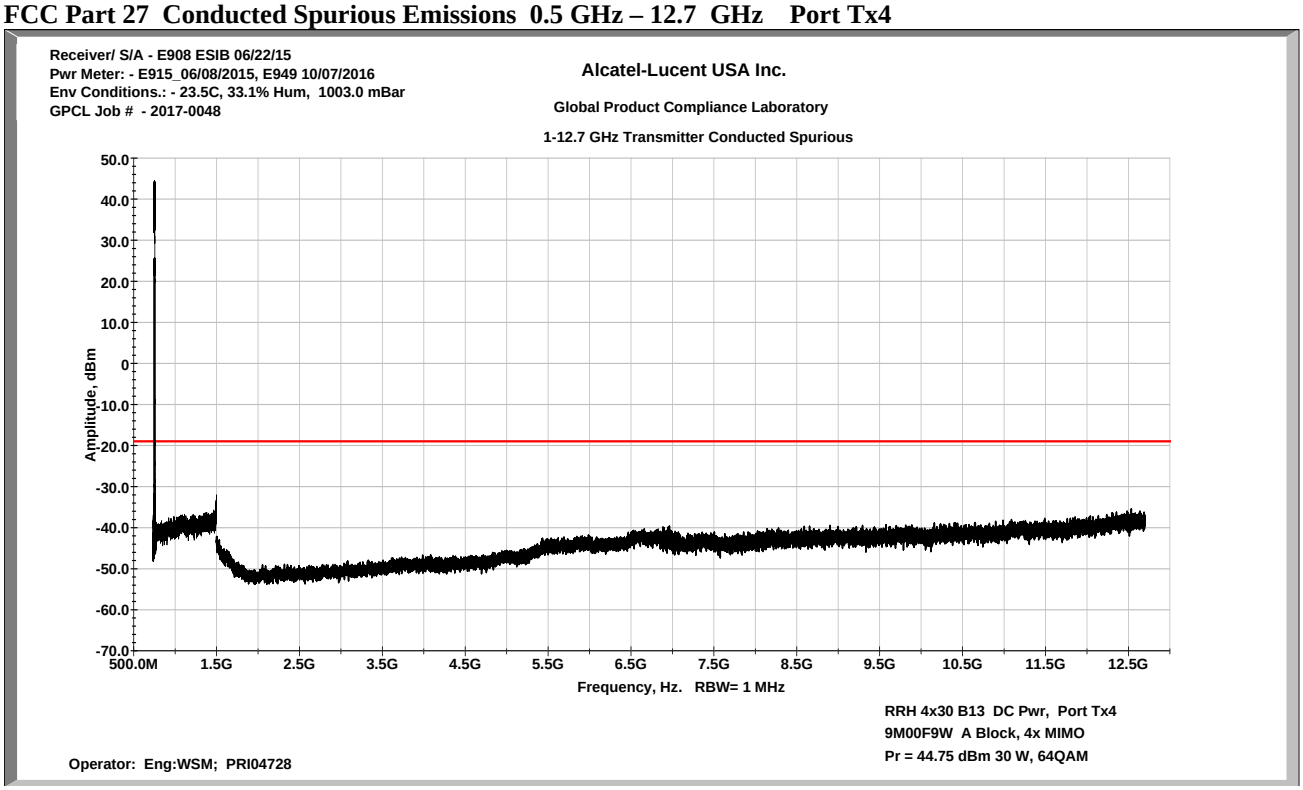
FCC Part 27 Conducted Spurious Emissions 0.5 GHz – 12.7 GHz Port Tx3



FCC Part 27 Conducted Spurious Emissions 10 MHz – 10 GHz Port Tx4



FCC Part 27 Conducted Spurious Emissions 0.5 GHz – 12.7 GHz Port Tx4



4.5 Section 2.1055: FREQUENCY STABILITY

This measurement evaluates the frequency difference between the actual transmit carrier frequency and the specified transmit frequency assignment. Only the portion of the transmitter system containing the frequency determining and stabilizing circuitry need be put in an environmental chamber and subjected to the temperature variation test per FCC Section 2.1055. The unit which provides baseband signals, such as BBU (baseband unit), can be located outside the chamber if it is a separated unit.

4.5.1 Frequency Stability Results:

This EUT was previously tested during the original filing process. There were no changes to the frequency generating or stabilizing circuitry of this product.
For this Class II Permissive Change, new data is not required.

4.6 Section 2.1053 MEASUREMENT REQUIRED: FIELD STRENGTH OF SPURIOUS RADIATION

The field strength measurements of radiated spurious emissions were made at the Nokia Bell Labs FCC Registered Test Site, ID Number US5302, using the three meter semi-anechoic chamber AR-7, (formally registered as Site Registration Number: 995653) and IC (Filing Number: 6933F-7) which is maintained by Nokia Bell Labs in Murray Hill, New Jersey.

The **B13 RRH 4X30** (EUT) was configured in semi-anechoic chamber AR-7 as in the normal field installation and the recommendations of ANSI C63.4–2009 were followed for EUT testing setup and cabling. The EUT was configured to operate per the E-UTRA test model specified in 3GPP TS 36.141.

The base station was configured to transmit a 4x30W MIMO 9M00F9W LTE carrier at 751.0 MHz with the total sum of the transmit power for all 4 ports equal to 120W (50.79 dBm). All carriers were transmitting to non-radiating 50 Ω resistive loads.

Table 4.5.1 EUT Configurations

Number of Active Transmitting Ports	Transmit Frequency, MHz	Emissions Designator	Sum Total of Transmit Power for All Ports (W/dBm)	Modulations
4 (All)	751.0	9M00F9W	120W / 50.79 dBm	64QAM and QPSK+16QAM

Section 27.53(c) and 2.1053 contains the requirements for the levels of spurious radiation as a function of the EIRP of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an isotropic radiator excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 27-7, 6th edition, IT&T Corp.

$$E = (120\pi P)^{½} = [(30*P)^{1/2}] / R$$

$$20 \log (E*10^{6}) - (43 + 10 \log P) = 82.23 \text{ dB } \mu\text{V/meter}$$

Where: E = Field Intensity in Volts/ meter R = Distance in meters = 3 m

P = Transmitted Power in watts = 120 W

The field strength of radiated spurious emissions measured was determined by

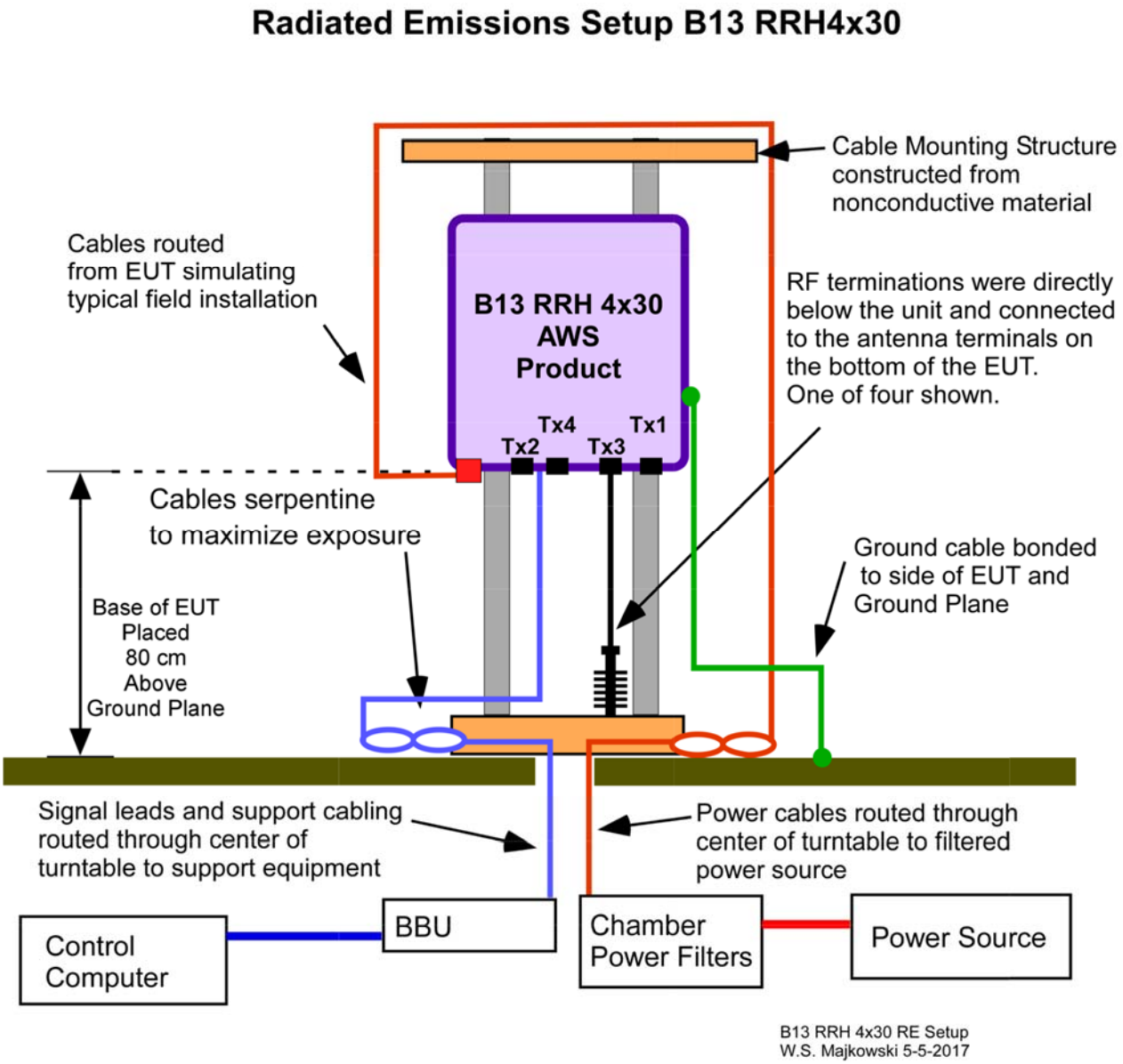
$$E(\text{dB}\mu\text{V/m}) = V_{meas}(\text{dB}\mu\text{V}) + \text{Cable Loss (dB)} + \text{Antenna Factor (dBi/m)}.$$

Field strength measurements of radiated spurious emissions were made at a semi anechoic room of Global Product Compliance Laboratories of Nokia Bell Laboratories in Murray Hill NJ which was detailed in Section 6. The recommendations of ANSI C63.4 and ANSI C63.26 were followed for EUT testing setup, cabling, and measurement approach and procedures. All the measurement equipment used, including antennas, was calibrated in accordance with ISO 9001 process. The EUT setup diagram is given in the Figure 4.6.1. The minimum margin measured per Table 4.6.2 is more than 20dB.

4.6.1 Field Strength of Radiated Emissions Results:

For this particular test, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dBμV/meter. Emissions equal to or less than 62.23 dBμV/meter are not reportable and may be verified using field strength measurements and broadband antennas. Over the out of band spectrum investigated from 10 MHz to beyond the tenth harmonic of the carrier (10GHz), no reportable spurious emissions were detected. This demonstrates that the B13 RRH 4X30 / FCC ID: AS5BBTRX-23, the subject of this application, complies with Sections 2.1053, 27.53(c) and 2.1057 of the Rules. The product except at the authorized transmit frequency is also compliant to FCC Part 15 Class B (residential) requirements.

Figure 4.6.1 Test Set-Up for Measurement of Radiated Spurious Emissions

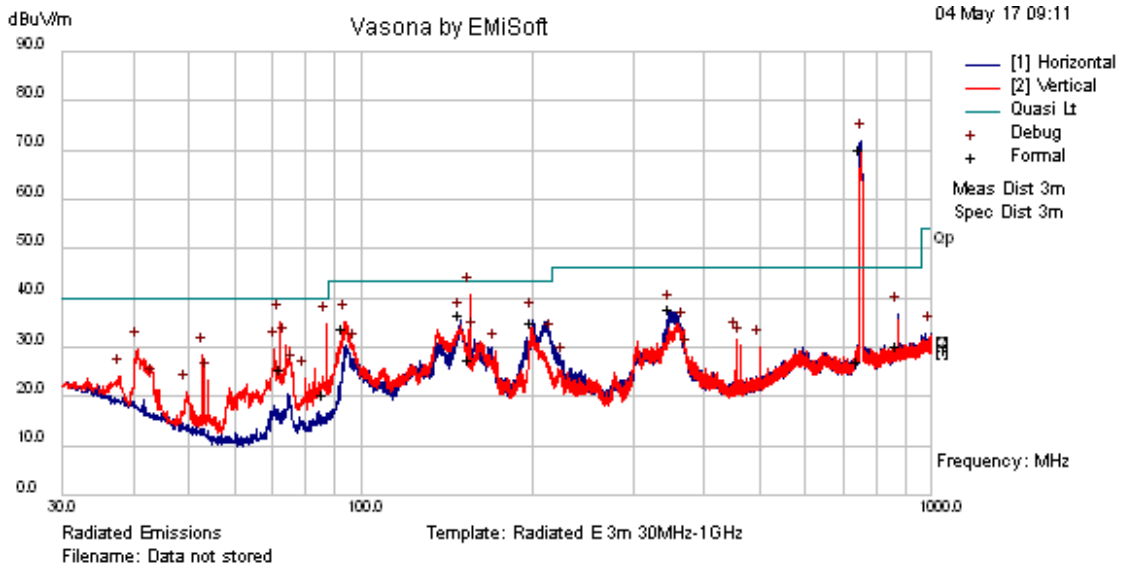


Radiated Emissions Measurements of Alcatel-Lucent USA Inc.

AWS LTE B13 RRH 4x30 Outdoor Transceiver System

FCC ID: AS5BBTRX-23

FCC Part 15B Class B : 30 MHz - 1GHz 64QAM, 9M00F9W

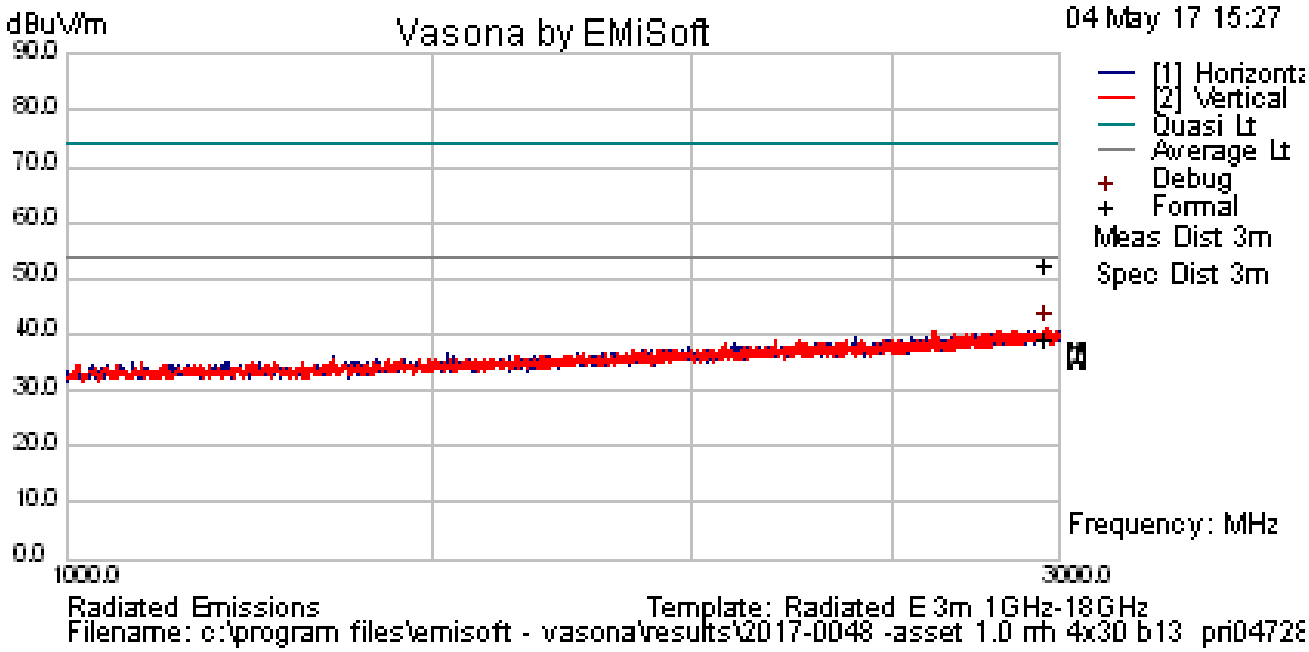


Results Title:	Radiated Emissions d= 3m; Frequency= 30 MHz - 1 GHz
File Name:	c:\program files\emisoft - vasona\results\2017-0048 -asset 1.0 rrh 4x30 b13 pri04728\T1A RE30-1GHz 64QAM.emi
Test Laboratory:	GPCL AR7-MH 23.C, 2%RH, 999mB
Test Engineer:	EEM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Asset 1.0 RRH 4x30 Band Class 13 [AWS 700 MHz Upper Band] Technology Type: LTE-FDD Frequency Band: 746 - 758 MHz [PRI04728]
Configuration:	Modulation/ Channel / Bandwidth: 64QAM, 10 MHz BW, Frequency: 751 MHz.; 4X MIMO Operation . TX Power Output: 44.77 dBm per Tx Port. EUT Operational Voltage: -48 VDC. EUT installed w/ Alarm Interface Cable Shield bonded to the ground reference plane; EUT AISG port was terminated into a BIAS-T Network w/ BIAS-T Network tied to ground reference plane. All 4 RF Ports are terminated 50 W RF loads via RF Cables. One TX Port was remotely monitored with an MXA. CPRI Fiber-Optic Interface is interconnected to a remote 9926 BBU Controller with PC Unit [located outside the test area]. Radiated Emission Test Specification: FCC Part 15B Class B. (RBW 100kHz, VBW 300 kHz) E1190 ESI Receiver, E814 Preamp, E602 Bilog. E260 EMCO 2090, E888: 6dB Pad.
Date:	2017-05-04 09:40:43

FORMAL DATA

Freq. (MHz)	Raw (dBuV)	Cable (dB)	Factor (dB)	Level (dBuV/m)	Emission Type	Pol (H/V)	Ht (cm)	Az (deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail	Comments
751.748	67	8.23	-8.9	66.33	Quasi Max	H	117	122	46	20.33	N/A	Authorized Tx
149.036	38.69	6.95	-13	32.66	Quasi Max	H	100	69	43.5	-10.84	Pass	
348.559	43.76	7.52	-17.2	34.05	Quasi Max	H	288	196	46	-11.95	Pass	
200.173	45.17	7.14	-21	31.27	Quasi Max	H	223	40	43.5	-12.23	Pass	
93.6393	42.65	6.69	-19.4	29.91	Quasi Max	V	100	127	43.5	-13.59	Pass	
72.4027	39.05	6.66	-24	21.68	Quasi Max	V	130	181	40	-18.32	Pass	
874.996	27.54	8.43	-9.37	26.6	Quasi Max	H	164	0	46	-19.4	Pass	
154.972	30.71	6.98	-13.9	23.77	Quasi Max	V	333	227	43.5	-19.73	Pass	
746.627	24.43	8.22	-9.2	23.46	Quasi Max	H	111	252	46	-22.54	Pass	
85.9897	30.92	6.68	-21	16.64	Quasi Max	V	131	176	40	-23.36	Pass	

T2 Radiated Emissions FCC Class B Limit **1GHz - 3GHz FCC B , QPSK+16QAM, 9M00F9W**

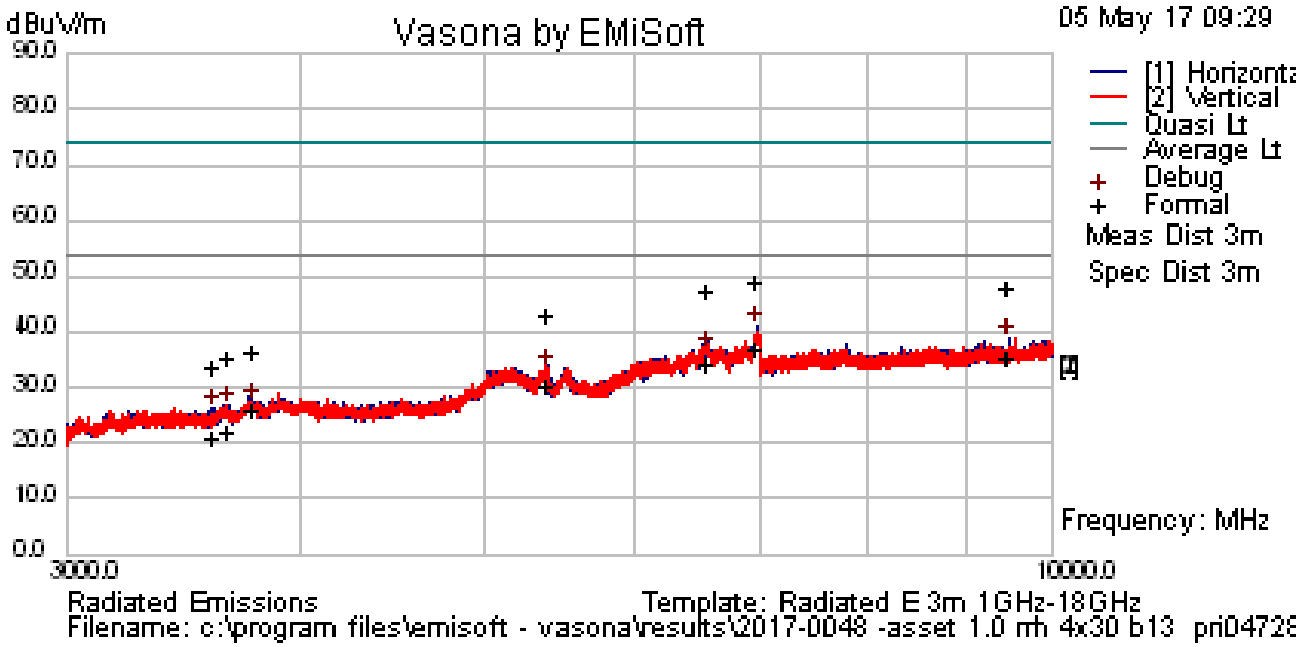


Results Title:	Radiated Emissions d= 3m; Frequency= 1 GHz-3 GHz
File Name:	c:\program files\emisoft - vasona\results\2017-0048 -asset 1.0 rrh 4x30 b13 pri04728\T2A re 1GHz - 3 GHz 16QAM.emi
Test Laboratory:	GPCL AR7-MH 23.C, 2%RH, 999mB
Test Engineer:	EEM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Asset 1.0 RRH 4x30 Band Class 13 [AWS 700 MHz Upper Band] Technology Type: LTE-FDD Frequency Band: 746 - 758 MHz [PRI04728]
Configuration:	Modulation/ Channel / Bandwidth: 16QAM, 10 MHz BW, Block C, Frequency: 751 MHz.; 4X MIMO Operation . TX Power Output: 44.77 dBm per Tx Port. EUT Operational Voltage: -48 VDC. EUT was installed with Alarm Interface Cable [with the far end of the Cable (Shield) bonded to the ground reference plane;] EUT AISG port was terminated into a BIAS-T Network [with the BIAS-T Network tied to ground reference plane. All 4 RF Ports are connected to 50 Ohm RF Attenuators via RF Cables. One TX Port was remotely monitored with an MXA. CPRI Fiber-Optic Interface is interconnected to a remote 9926 BBU Controller with PC Unit [located outside the test area]. Radiated Emission Test Specification: FCC Part 15B Class B. [Freq. Range= 1GHz - 3GHz). Preview RBW = 100 KHz, VBW= 300 KHz. Final Rec. Mea : RBW = 1 MHz E444: Horn, E1096: 10 dB Pad, E1190: ESI Rec. : E260: 2090 Cont.: E1166 : Preamp
Date:	2017-05-05 09:36:30

FORMAL DATA

Freq. MHz	Raw dBuV	Cable dB	Factor dB	Level dBuV/m	Emission Type	Pol H/V	Ht cm	Az deg	Limit dBuV/m	Margin dB)	Pass /Fail	Comments
2961.93	44.63	13.1	-8.11	49.62	Quasi Max	V	339	140	74	-24.38	Pass	
2961.93	31.28	13.1	-8.11	36.27	AvgMax	V	339	140	54	-17.73	Pass	

T3 Radiated Emissions FCC Class B Limit **3GHz – 18 GHz FCC B , QPSK+16QAM, 9M00F9W**



Results Title:	Radiated Emissions d= 3m; Frequency= 3 GHz-10 GHz
File Name:	c:\program files\emisoft - vasona\results\2017-0048 -asset 1.0 rrh 4x30 b13 pri04728\T3 re 3GHz - 10 GHz 16 QAM.emi
Test Laboratory:	GPCL AR7-MH 23.C, 2%RH, 999mB
Test Engineer:	EEM
Test Software:	Vasona by EMISoft, version 2.161
Equipment:	Nokia
EUT Details:	Asset 1.0 RRH 4x30 Band Class 13 [AWS 700 MHz Upper Band] Technology Type: LTE-FDD Frequency Band: 746 - 758 MHz [PRI04728]
Configuration:	Modulation/ Channel / Bandwidth: QPSK + 16QAM, 9M00F9W, Block C, Frequency: 751 MHz.; 4X MIMO Operation . TX Power Output: 44.77 dBm per Tx Port. EUT Operational Voltage: -48 VDC. EUT was installed with Alarm Interface Cable [with the far end of the Cable (Shield) bonded to the ground reference plane;] EUT AISG port was terminated into a BIAS-T Network [with the BIAS-T Network tied to ground reference plane. All 4 RF Ports are connected to 50 Ohm RF Attenuators via RF Cables. One TX Port was remotely monitored with an MXA. CPRI Fiber-Optic Interface is interconnected to a remote 9926 BBU Controller with PC Unit [located outside the test area]. Radiated Emission Test Specification: FCC Part 15B Class B. [Freq. Range= 3 GHz - 10 GHz). E444 Horn , E936 ESI Receiver, E 1166 Preamp
Date:	2017-05-05 09:29:08

FORMAL DATA

Freq. MHz	Raw dBuV	Cable dB	Factor dB	Level dBuV/m	Emission Type	Pol H/V	Ht cm	Az deg	Limit dBuV/m	Margin dB)	Pass /Fail	Comments
6974.18	25.72	10.92	-2.56	34.09	AvgMax	H	366	70	54	-19.91	Pass	
9501.7	20.28	13	-0.45	32.83	AvgMax	H	117	268	54	-21.17	Pass	
6578.18	23.99	10.99	-3.19	31.79	AvgMax	H	137	107	54	-22.21	Pass	
5411.92	20.28	10.82	-3.64	27.46	AvgMax	H	350	250	54	-26.54	Pass	
6974.18	37.99	10.92	-2.56	46.35	Quasi Max	H	366	70	74	-27.65	Pass	
9501.7	32.57	13	-0.45	45.12	Quasi Max	H	117	268	74	-28.88	Pass	
6578.18	36.94	10.99	-3.19	44.74	Quasi Max	H	137	107	74	-29.26	Pass	
3770.71	18.41	10.36	-5.67	23.1	AvgMax	H	231	89	54	-30.9	Pass	
5411.92	32.97	10.82	-3.64	40.15	Quasi Max	H	350	250	74	-33.85	Pass	
3659.68	15.32	10.24	-6.01	19.54	AvgMax	H	302	115	54	-34.46	Pass	
3587.92	14.54	10.16	-6.24	18.46	AvgMax	H	292	33	54	-35.54	Pass	
3770.71	29.15	10.36	-5.67	33.84	Quasi Max	H	231	89	74	-40.16	Pass	
3659.68	28.28	10.24	-6.01	32.51	Quasi Max	H	302	115	74	-41.49	Pass	
3587.92	27.3	10.16	-6.24	31.22	Quasi Max	H	292	33	74	-42.78	Pass	

4.7 LIST OF TEST EQUIPMENT

The following test equipment was used for RF Power, Modulation, Occupied Bandwidth and Conducted Spurious Emissions and Radiated Spurious Emissions Measurements.

4.7.1 Antenna Port Measurements Test Equipment

The following test equipment, In Table 4.7.1, was used for RF Power, Modulation, Occupied Bandwidth and Conducted Spurious Emissions measurements.

Table 4.7.1 Antenna Port Measurements Test Equipment List

Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
Agilent Technologies	N1921A	MY45242502	Power Sensor	-35 - +20 dBm 50 MHz -18 GHz	E949	10/7/2016	12	Active
Agilent Technologies	N1912A	GB44440226	Power Meter	P-Series Dual Channel	E915	6/08/2016	24	Active
Rohde & Schwarz	ESIB40	100100	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBM	E908	6/22/2015	24	Active
Agilent Technologies	N9020A	MY52420147	Signal Analyzer	MXA Signal Analyzer	E1152	3/13/2017	24	Active
Agilent Technologies	N9020A	MY48011791	Signal Analyzer	MXA Signal Analyzer	E831	2/23/2016	24	Active
Fluke	87V	95340316	Voltmeter	True RMS Voltmeter	P268	4/13/2016	12	Active
RLC Electronics	F-19391	1440-003	High Pass Filter	2.5GHz-26GHz High Pass Filter	E1210	2/11/2017	12	Active
Trilithic	4HC1400/8000-1-KK	850-HPF-16	High Pass Filter	1.4-8 GHz High Pass Filter	E903	3/15/2017	12	Active
Trilithic	10LC1790-3-AA	850-LPF-11	Low Pass Filter	Low Pass filter	E974	2/11/2017	12	Active
Trilithic	5HC2850/18050-1.8-KK	PCS-HPF-11	High Pass Filter	2.4 GHz -20GHz High Pass Filter	E988	2/11/2017	12	Active

4.7.2 Antenna Port Measurements Test Coupler

The RF Antenna Port Test coupler, attenuators, components and cables used for antenna port conducted testing are maintained and its calibration verified as a unit. The individual components are listed below. It is identified as **White LP 150W-Mule-Lim** for White-Low Power-150W- Multi Use Laboratory Equipment **(MULE)**-Low Intermod. The components are identified in Table 4.7.2.

4.7.3 Radiated Spurious Emissions Measurements Test Equipment

The test equipment listed In Table 4.7.3 was used for Radiated Spurious Emissions measurements.

Table 4.7.2 Antenna Port Measurements Test Coupler

Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
Hewlett Packard	772D	02839A0073	Directional Coupler	Dual directional coupler 2-18GHz	E1222	2/11/2017	12	Active
Hewlett Packard	8495B	157170	Attenuator	70dB Digital Attenuator	E1220	2/11/2017	12	Active
Hewlett Packard	8494B	157171	Attenuator	11 dB Digital Attenuator	E1221	2/11/2017	12	Active
Weinschel	6528-30-34-LIM	BN4170	Attenuator	DC-18GHz 30dB 150W	E1223	2/11/2017	12	Active
Weinschel	46-6-34	BH9330	Attenuator	6dB Attenuator 25W	E1229	2/11/2017	12	Active
Weinschel	7003	G3831	DC Block	Type N DC Block 9 kHz to 18 GHz	E1257	2/11/2017	12	Active
Weinschel	154DR-10	1027	Directional Coupler	Directional Coupler 1-4 GHz	E1258	2/11/2017	12	Active
Circulator	SFC6996N	1402	Passive Circulator	3 Port Passive Circulator	E1266	3/15/2017	12	Active
Micro-Coax	UFB197C-1-0960-50U5GL	210525-009	Test Cable	Low Loss Precision N Test Cable	N/A	2/11/2017	12	Active
Micro-Coax	UFB197C-1-0240-50U5GL	210524-008	Test Cable	Low Loss Precision N Test Cable	N/A	2/11/2017	12	Active

Table 4.7.2 Radiated Emissions Measurements Test Equipment

Asset ID	Manufacturer	Type	Details	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E602	A.H. Systems Inc.	Bilogical Antenna	25 - 2000 MHz	SAS-521-2	410	12/8/2016	12/8/2018	Requires Calibration	Active
E1166	Agilent Technologies	Amplifier	Pre-Amplifier 1-26.5GHz	8449B	3008A01740	2/25/2016	2/25/2018	Requires Calibration	Active
E260	EMC Test Systems	Multi-Device Controller		2090	9605-1139			Calibration Not Required	Active
E936	Rohde & Schwarz	Test Receiver	EMI (20Hz to 40 GHz) -150 +30dBM	ESIB40	100119	6/2/2015	6/2/2017	Requires Calibration	Active
E1190	Rohde & Schwarz	Test Receiver	EMI Test Receiver 20Hz-26.5GHz	ESI	832692/005	6/29/2016	6/29/2018	Requires Calibration	Active
E814	Sonoma Instrument Co.	Amplifier	9kHz-1GHz	310N	186747	8/10/2016	8/10/2018	Requires Calibration	Active
E1096	Weinschel	Attenuator	10 dB , 25 Watt	46-10-34	CB9725	7/13/2015	7/13/2017	Requires Calibration	Active
E888	Weinschel	Attenuator	6 dB DC-18GHz 5 Watt	6-Feb	BX3433	3/11/2016	3/11/2018	Requires Calibration	Active
E444	EMCO	Horn Antenna	Double Ridged Horn 1-18 GHz	3115	0001-6008	10/26/2016	10/26/2018	Requires Calibration	Active

4.8 PHOTOGRAPHS OF THE TEST SETUPS

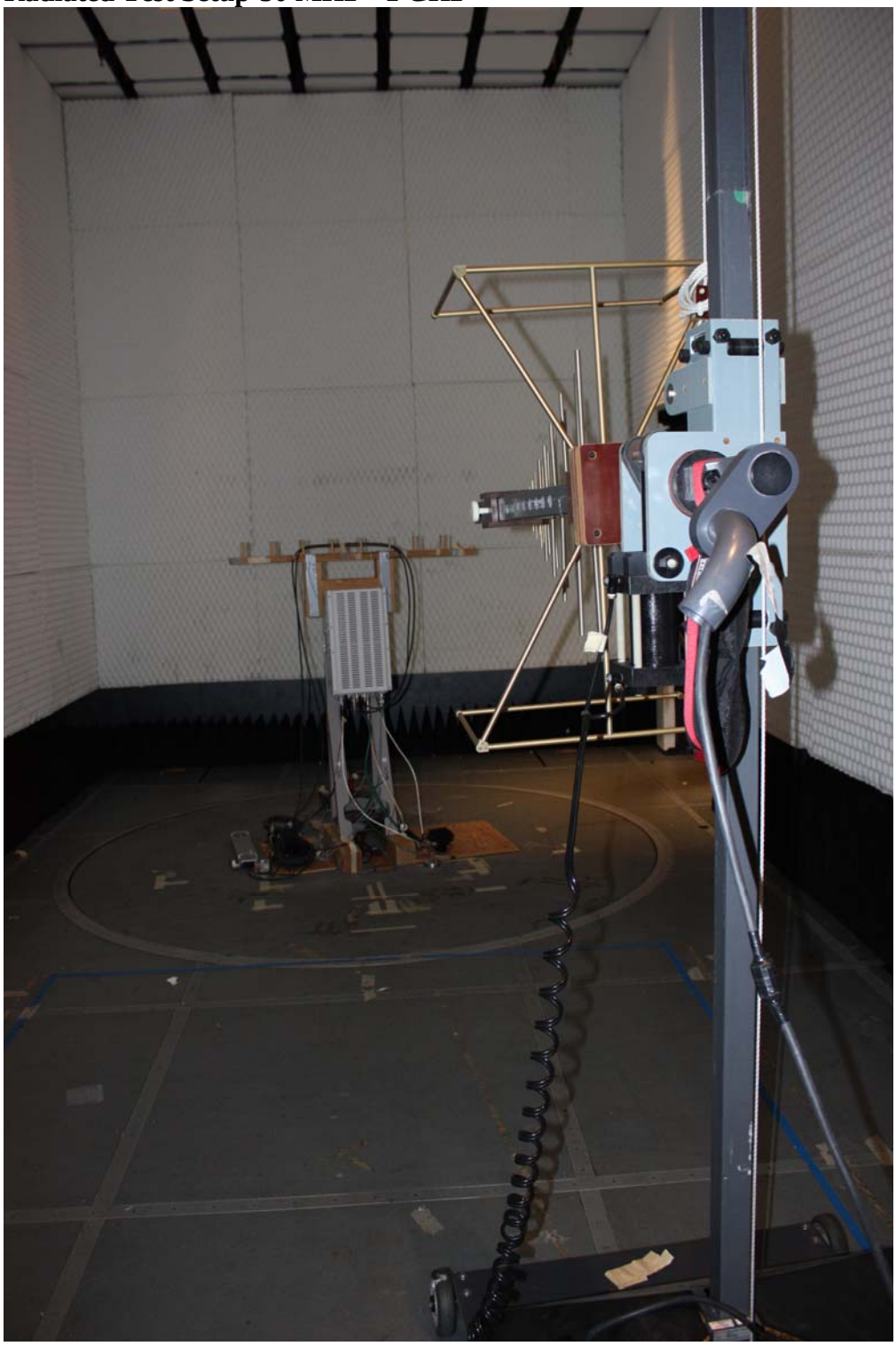
Response:
The photographs of the test setups for **PCS RRH 4x30W B25, FCC ID; FCC ID: AS5BBTRX-23** are attached and are enclosed in the Test Report.

4.8.1 Transmitter Antenna Port Measurements

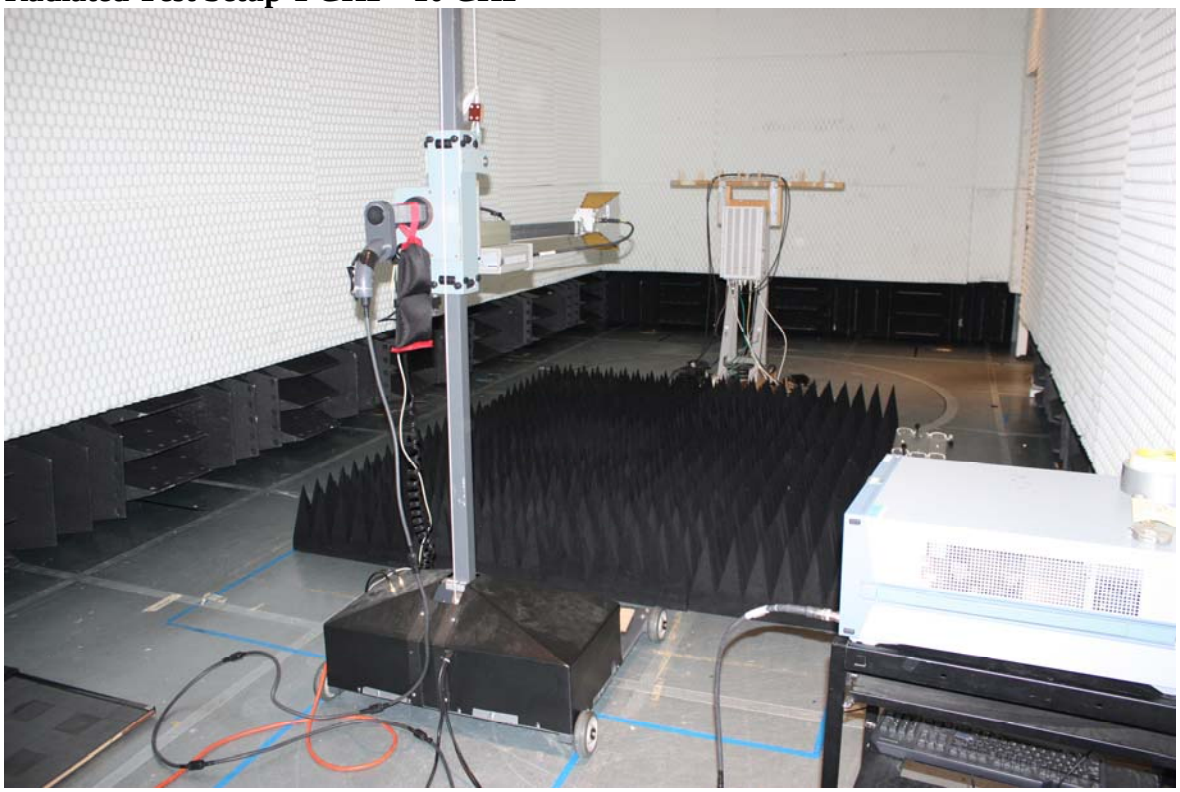
Test Setup for RF Power, Modulation, PAR, Occupied Bandwidth and Conducted Spurious Emissions.

4.8.2 Radiated Test Setup Photographs

Radiated Test Setup 30 MHz – 1 GHz



Radiated Test Setup 1 GHz – 10 GHz



4.8.3 Radiated Test Setup -Product Configuration

4.9 FACILITIES AND ACCREDITATION

The measurement facilities used to collect the measurement data in the test report are the Alcatel-Lucent Global Product Compliance Laboratory (GPCL), A member of the Nokia family of companies, and are located at 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 USA.

The field strength measurements of radiated spurious emissions were made at the Nokia Bell Labs FCC Registered Test Site, ID Number US5302, using the three meter semi-anechoic chamber AR-7, (formally registered as Site Registration Number: 995653) and IC (Filing Number: 6933F-7) which is maintained by Nokia Bell Labs 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.

Alcatel-Lucent Global Product Compliance Laboratory is accredited with the US Department of Commerce National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 7 Code of Federal Regulations for offering test services for selected test methods in Electromagnetic Compatibility; Voluntary Control Council for Interference (VCCI), Japan; Australian Communications and Media Authority (ACMA). The laboratory is ISO 9001:2008 Certified.

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100275-0

Nokia, Global Product Compliance Lab
Murray Hill, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2016-09-09 through 2017-09-30
Effective Dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Voluntary Laboratory Accreditation Program