

INTRODUCTION:

Application for Original Equipment Certification under FCC ID: AS5BBTRX-23 for Alcatel-Lucent Remote Radio Head (RRH) 4x30W Base Station, Operating in the Miscellaneous Wireless Communications Services, 746 - 756 MHz, with LTE Technology.

In accordance with Parts 2 and 27 of the Commission's Rules and Regulations, we are submitting data to show compliance with the requirements of the Commission for the certification of the Alcatel-Lucent B13 RRH 4X30, henceforth RRH 4x30, under FCC ID AS5BBTRX-23, for operation in the domestic 700 Upper band C (Tx: 746-756 MHz and Rx 777-787 MHz), i.e., E-UTRAN band 13, with Long Term Evolution (LTE) technology.

The RRH 4x30 has four antenna ports. The RRH 4x30 supports 2x60W MIMO with 2 transmit and 2 receive streams or 4x30W MIMO with 4 transmit and 4 receive streams. The maximum output power of the 2x60 or 4x30 configurations is 120 watts or 50.8dBm per unit. The RRH 4X30 was powered by a DC power supply with -48VDC. **This product is configured to operate with 2x60W MIMO.**

The RRH 4x30 consists of a Control Unit board (CU), Power Amplifier Board (PA), Power Module and RF Filter.

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-23**

TEST REPORT

SUB-EXHIBIT 11.1**MEASUREMENT PER SECTION 2.1033 (C) (14) OF THE RULES****SECTION 2.1033 (c) (14)**

The data required by Section 2.1046 through 2.1057, inclusive, measured in accordance with the procedures set out in Section 2.1041.

RESPONSE:

The following pages include the data required for the **AS5BBTRX-23**, measured in accordance with the procedures set out in Section 2.1033(c)(14) of the Rules.

Each required measurement and its corresponding exhibit number are:

Sub-Exhibit 11.2	Section 2.1046	RF Power Output - See Sub-Exhibit 4
Sub-Exhibit 11.3	Section 2.1047	Modulation Characteristics Peak-to-Average ratio (PAR)
Sub-Exhibit 11.4	Section 2.1049 27.53(c)	(a) Emissions Bandwidth (b) Occupied Bandwidth/Band Edge spurious Emissions
Sub-Exhibit 11.5	Section 2.1051 27.53(c)	Spurious Emissions at Antenna Terminals
Sub-Exhibit 11.6	Section 2.1053, 27.53 (c) (f)	Field Strength of Spurious Radiation
Sub-Exhibit 11.7	Section 2.1055, 27.54	Measurement of Frequency Stability
Sub-Exhibit 11.8	Section 2.947 (d)	Test Instruments Used for Test – See Test Report

Sub-Exhibit 11.2

FCC Section 2.1046
RF Power output

Refer to **Sub-Exhibit 11.4** Occupied Bandwidth Measurements. During that measurement RF Output was continuously monitored.

Sub-Exhibit 11.3

FCC Section 2.1047
Modulation Characteristics
&
Measurement of Peak-to-Average ratio (PAR)

Section 2.1047

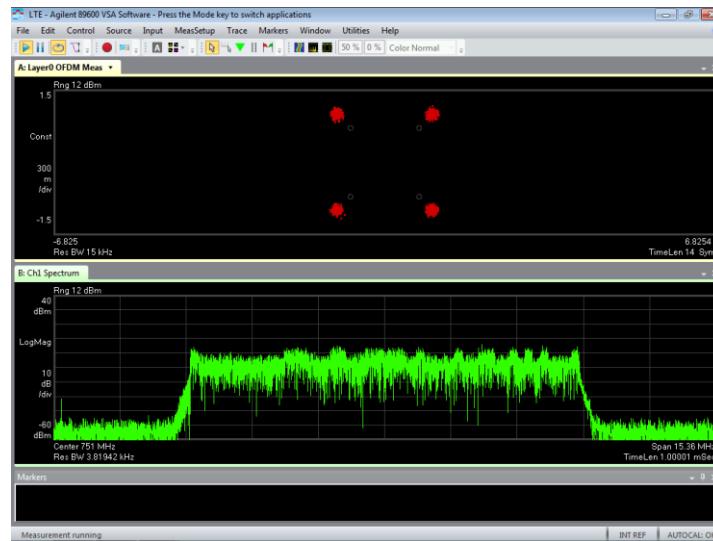
Modulation Characteristics

The modulation techniques used are explained in the submission as part section 2.1033 (c) (13). The RF signal at the antenna port was demodulated and verified for correctness of modulation signal used before each test was performed. The attached plots of graphs show the modulation components: In phase (I) and Quadrature (Q) components.

- (1) Quadrature Phase Shift Keying (QPSK) modulation scheme uses 2 bits are transmitted simultaneously (one per channel) and a symbol can be represented by 2 bits. Therefore there are $2^2 = 4$ states (Binary 00 to 11). The theoretical bandwidth is 2bits/second/Hz.
- (2) 16 Quadrature amplitude modulation (QAM): In 16QAM, there are 16-states. There are four I values and four Q values, therefore 4 bits are available for represent a symbol. Therefore there are $2^4 = 16$ states (Binary 0000 to 1111). The theoretical bandwidth is 4bits/second/Hz.
- (3) 64 Quadrature amplitude modulation (QAM): 64QAM is similar to 16QAM, there will be 64 states and 6 bits are available to represent a symbol.

Measurement of Peak-to-Average ratio (PAR)

The peak-to-average (PAR) has been verified per KDB 971168 procedures for the peak-to-averages ratio at 0.1% probability. The PAR does not exceed 13 dB.

**B13 RRH 4X30**

FCC Part 27

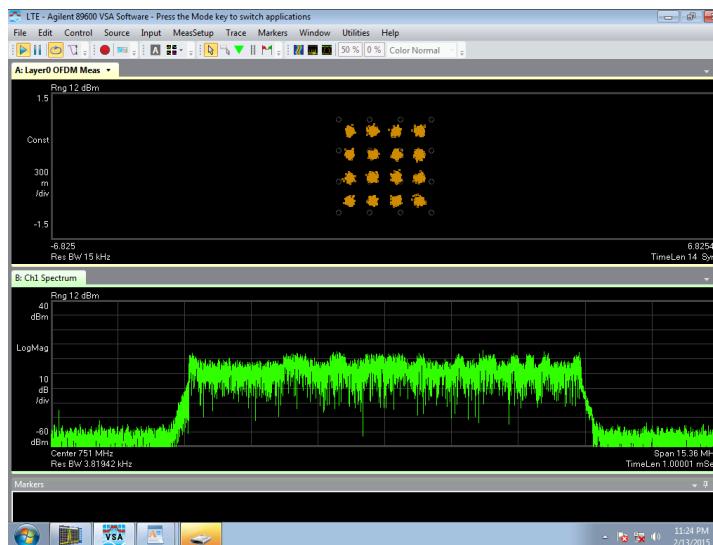
Block: C (746 - 756 MHz)

Modulation: QPSK

PWR: 60W (2x60W MIMO)

FCCID: AS5BBTRX-23

TEST ENGINEER: SEG

**B13 RRH 4X30**

FCC Part 27

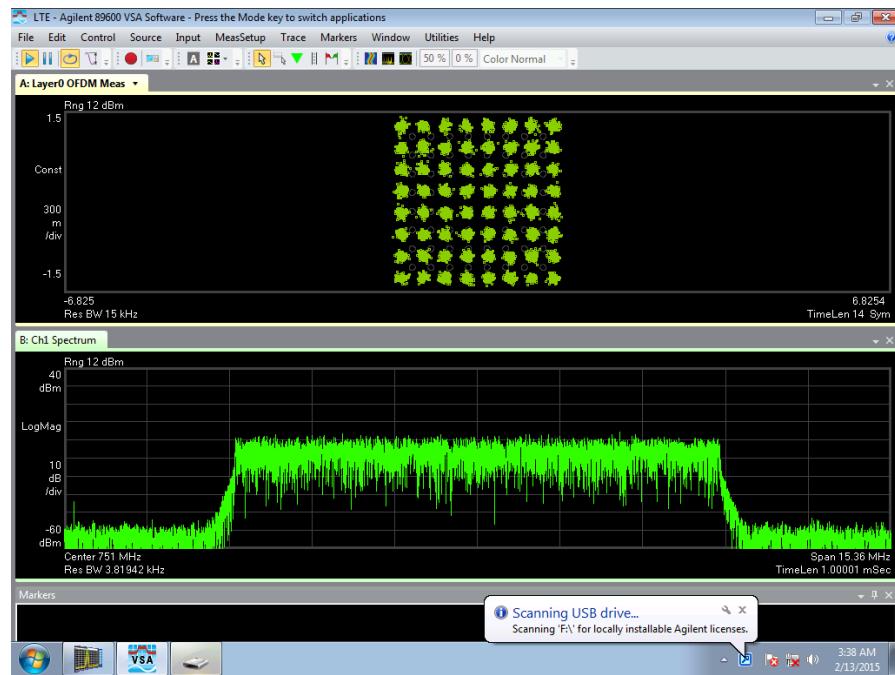
Block: C (746 - 756 MHz)

Modulation: 16QAM

PWR: 60W (2x60W MIMO)

FCCID: AS5BBTRX-23

TEST ENGINEER: SEG

**B13 RRH 4X30**

FCC Part 27

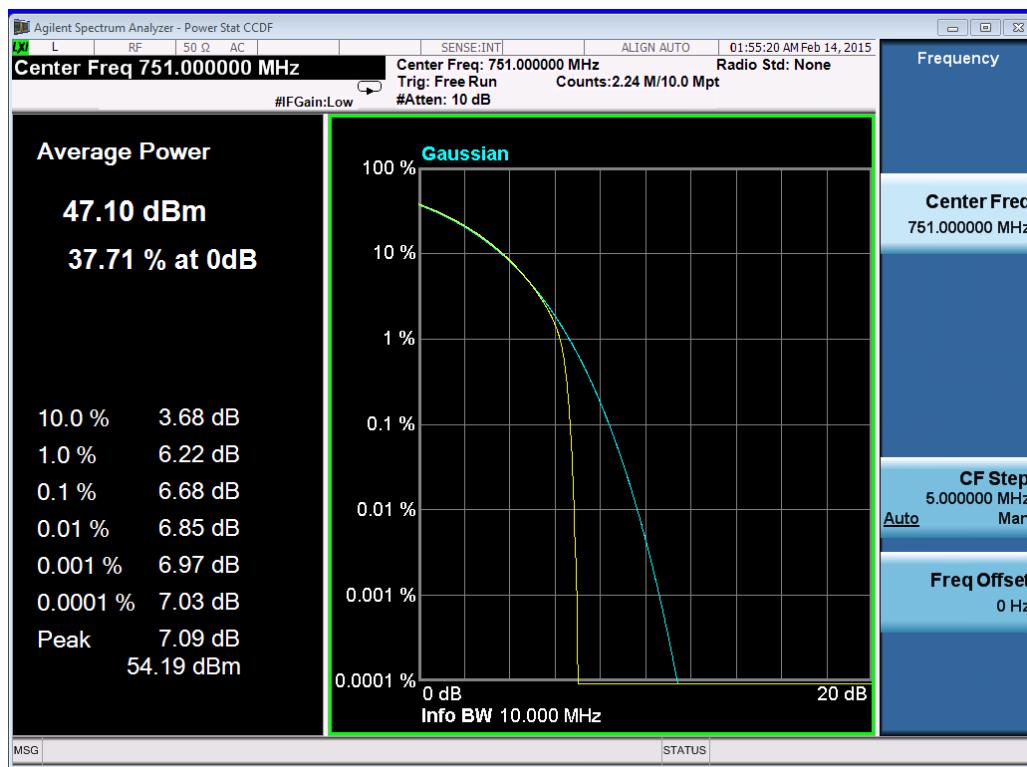
Block: C (746 - 756 MHz)

Modulation: 64QAM

PWR: 60W (2x60W MIMO)

FCCID: AS5BBTRX-23

TEST ENGINEER: SEG



B13 RRH 4X30

Modulation: QPSK

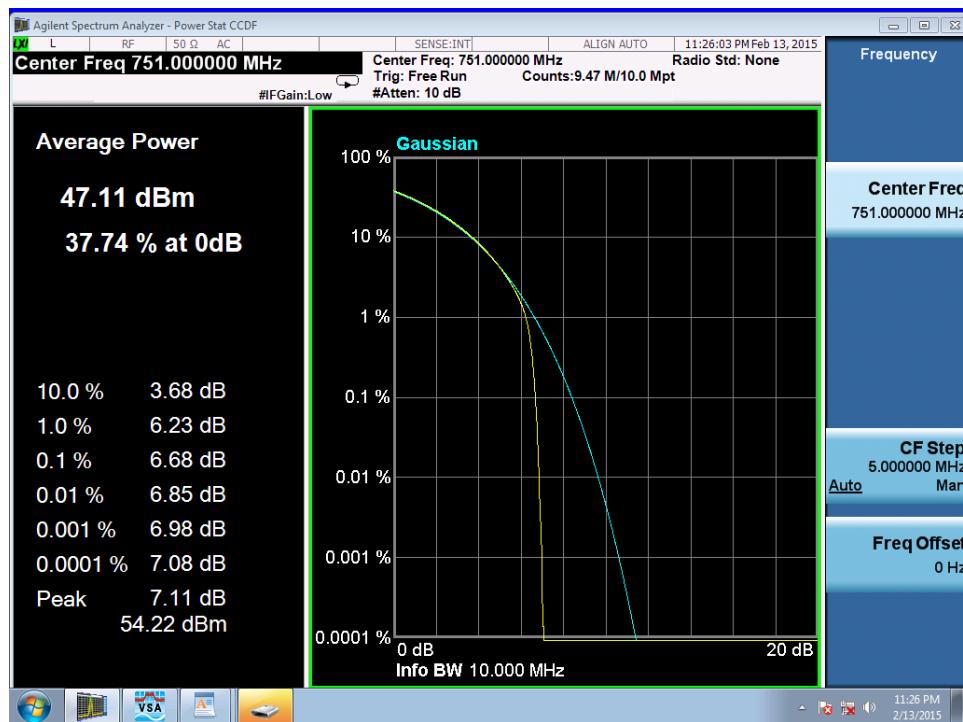
FCC Part 27

Block: C (746 - 756 MHz)

PWR: 60W (2x60W MIMO)

FCCID: AS5BBTRX-23

TEST ENGINEER: SEG

**B13 RRH 4X30**

Modulation: 16QAM

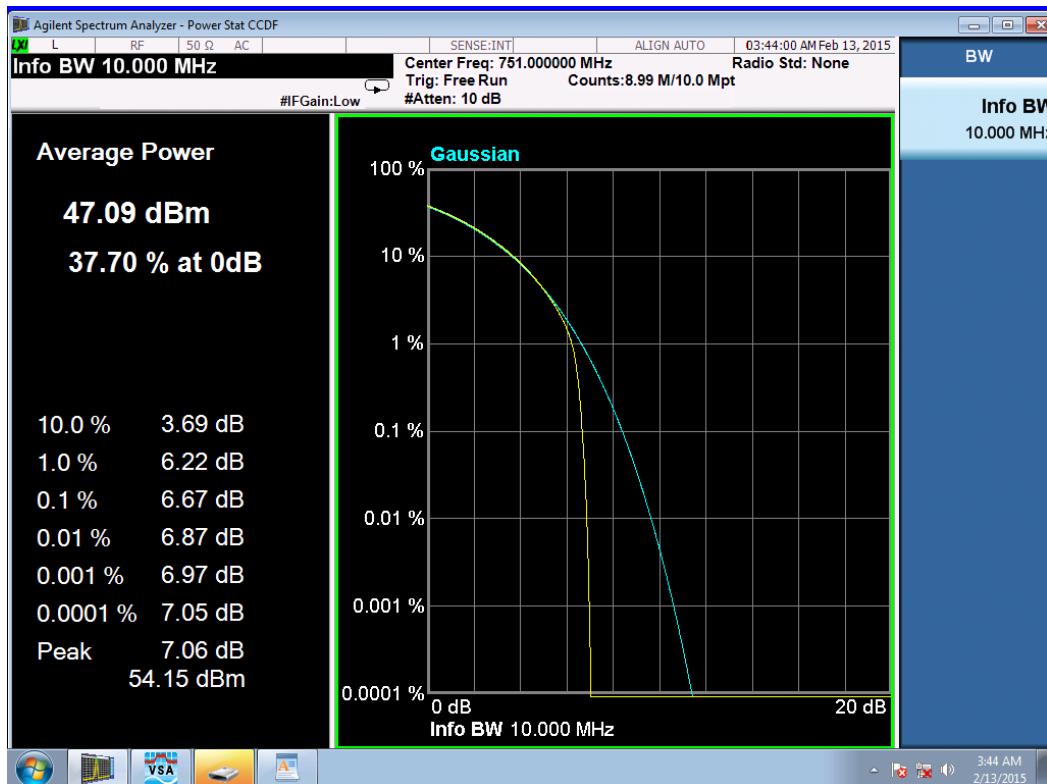
FCC Part 27

Block: C (746 - 756 MHz)

PWR: 60W (2x60W MIMO)

FCCID: AS5BBTRX-23

TEST ENGINEER: SEG

**B13 RRH 4X30**

Modulation: 64QAM

FCC Part 27

Block: C (746 - 756 MHz)

PWR: 60W (2x60W MIMO)

FCCID: AS5BBTRX-23

TEST ENGINEER: SEG

Sub-Exhibit 11.4

FCC Section 2.1049

- (a) Emissions Bandwidth Measurement
- (b) Occupied Bandwidth Measurement showing spurious Emissions **close to Block edges.**

Emissions Bandwidth Measurement

FCC approved two (2) measurement methods for Emissions Bandwidth.

- (A) 99% Power Bandwidth.
- (B) 26dB Bandwidth

The 99% power bandwidth method was used to measure the bandwidth at different modulations and highest is recorded. The modulations used are:

- 1. QPSK
- 2. 16 QAM
- 3. 64 QAM

The Highest measured 99% Power Bandwidth was used for Emissions type designation. The measured bandwidth was 9.00 MHz for a 10 MHz Bandwidth carrier.

Therefore, Emission designator is: 9M00F9W for 10 MHz Bandwidth.

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-23**

**MEASUREMENT OF EMISSIONS BANDWIDTH
99% POWER BANDWIDTH**

**(b) MEASUREMENT OF
EMISSIONS BANDWIDTH**

The occupied bandwidth of the Long Term Evolution (LTE) is measured using a Rohde & Schwarz ESU Spectrum Analyzer/Receiver. The emissions bandwidth is specified in FCC Part 27.53.

The measurements were made on a “**B13 RRH 4X30**” for 10 MHz bandwidth in the following modulations:

1. QPSK
2. 16 QAM
3. 64 QAM

Results:

The plots are provided for following bandwidths: 10 MHz

The measured 99% Power Bandwidth is:

Nominal BW	Maximum BW Measured (MHz)
10 MHz 60 Watts	9.00 MHz

Channel Lists

Block	Frequency (MHz)	Bandwidth (MHz)
C	751	10

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-23**

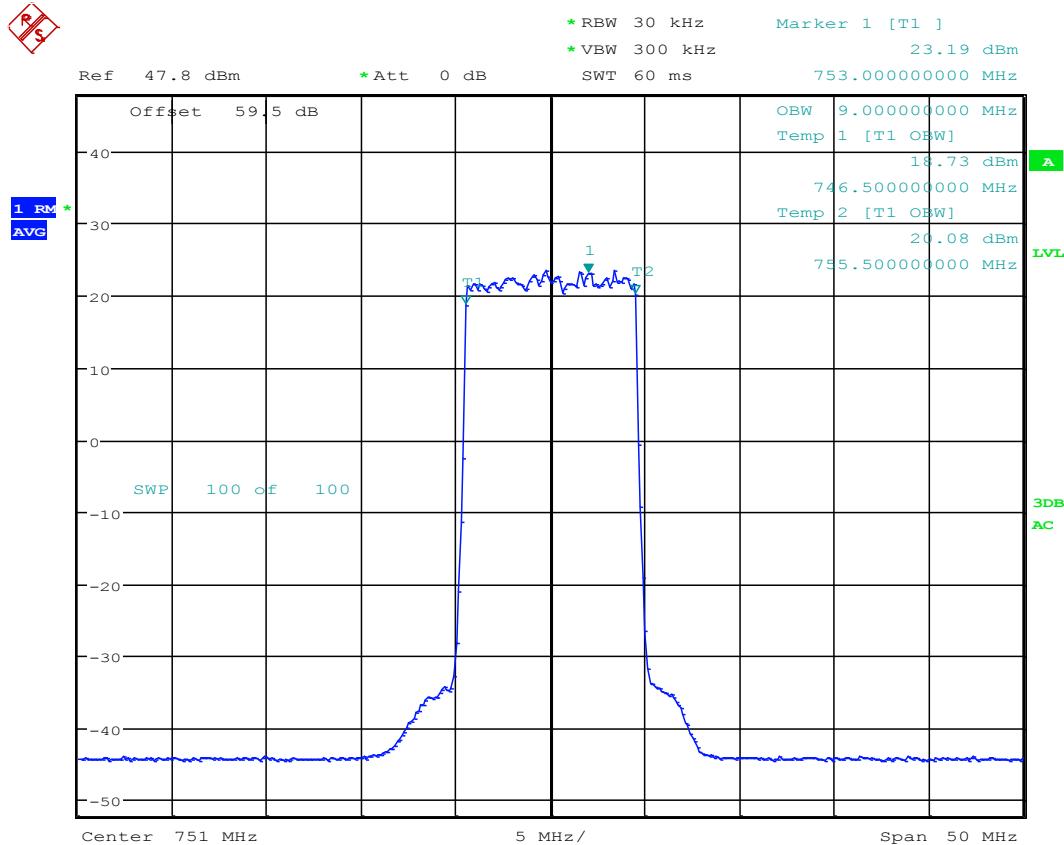
**99% POWER BANDWIDTH DATA
2x60W MIMO CONFIGURATION**

Block: C

10 MHz Bandwidth (746 - 756 MHz)

2x60 watts (MIMO)

(99% Power Bandwidth)



99% POWER BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

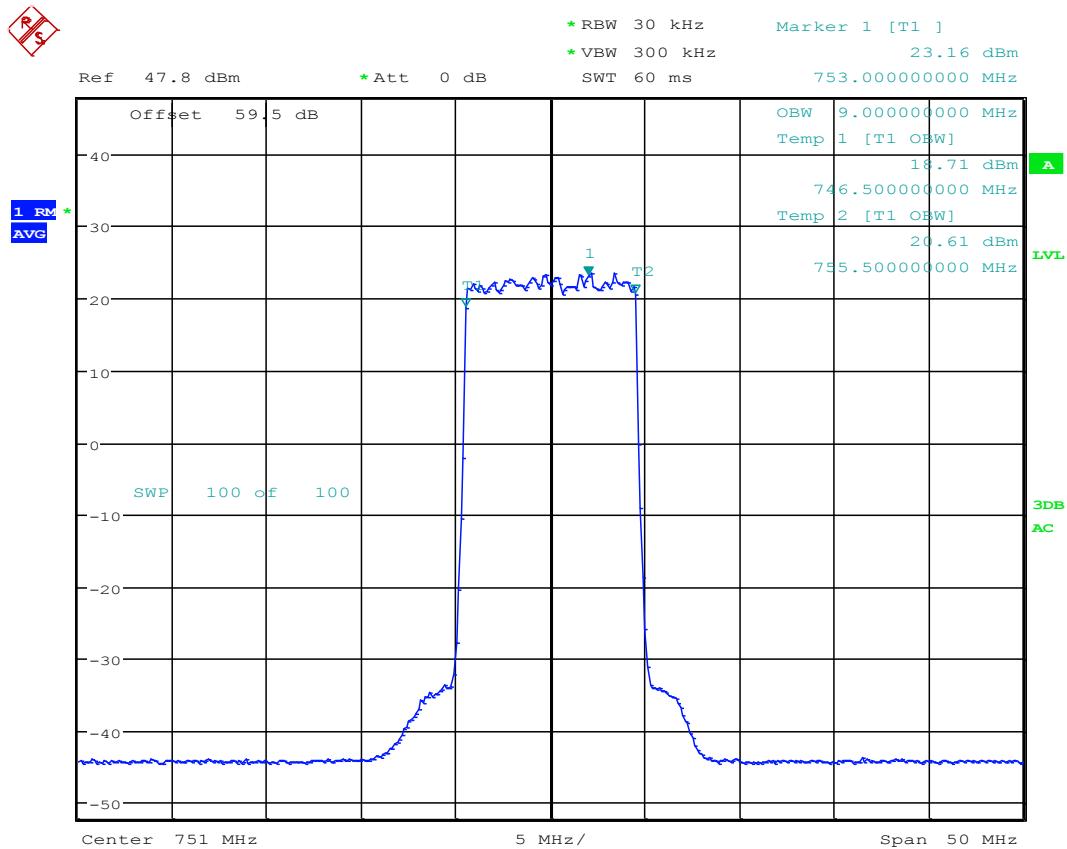
Date: 13.FEB.2015 13:22:11

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-23



99% POWER BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

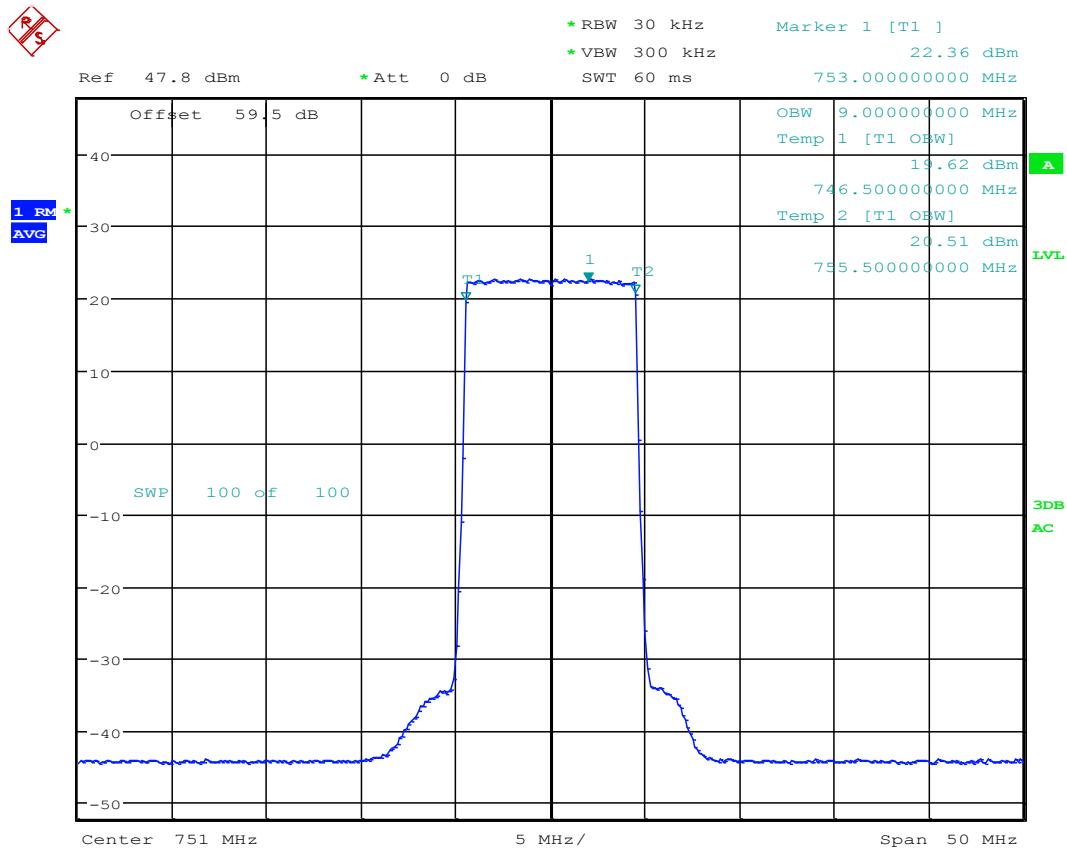
Date: 13.FEB.2015 11:17:54

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-23



99% POWER BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

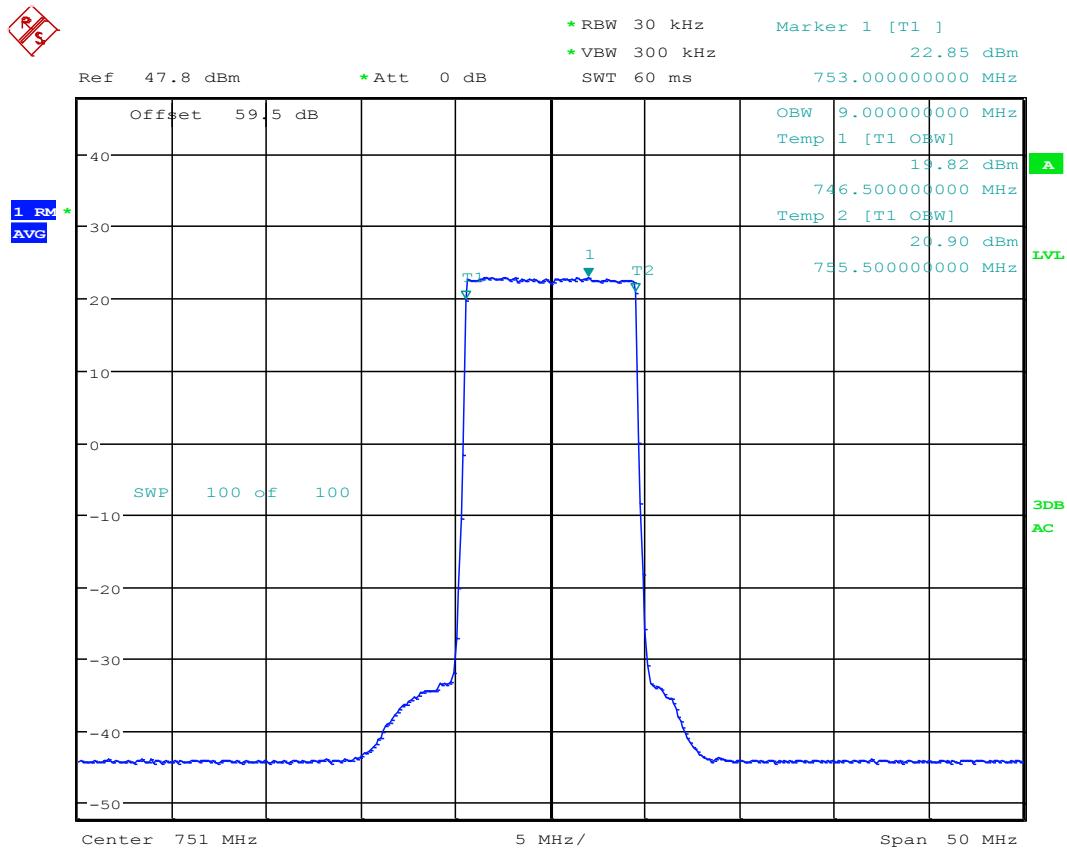
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Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-23



99% POWER BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

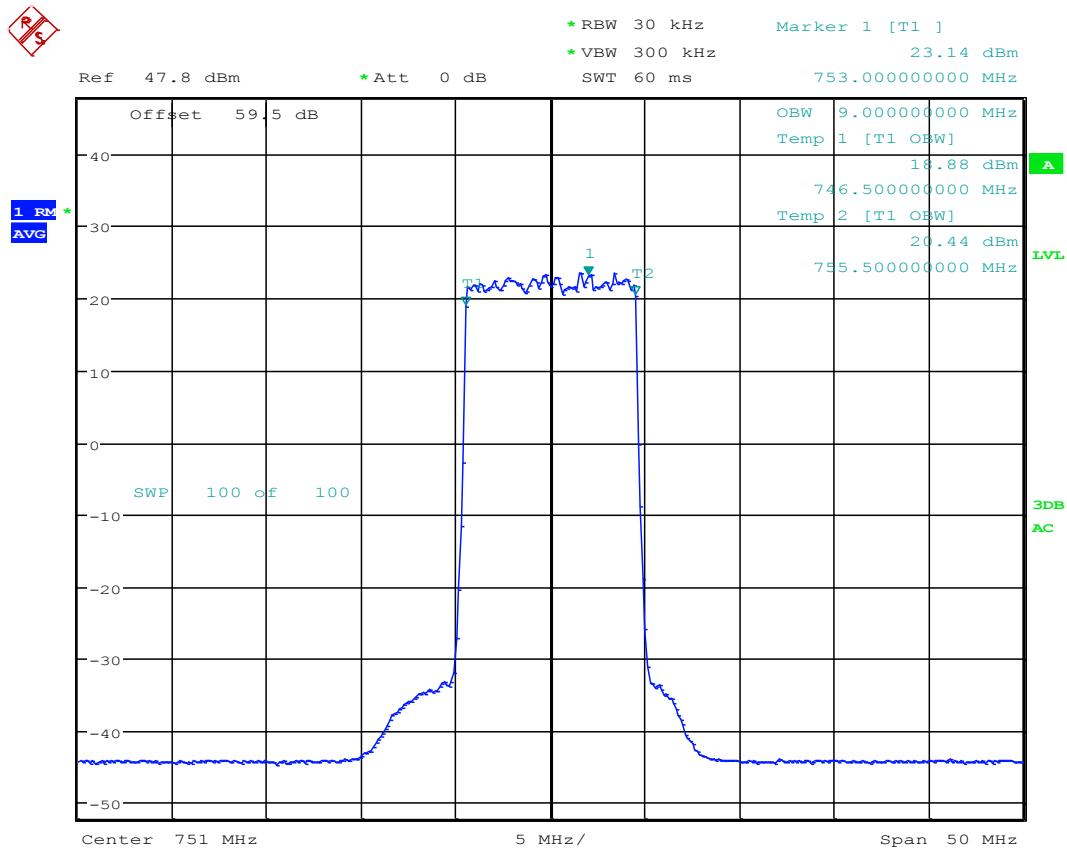
Date: 18.FEB.2015 09:29:47

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-23



99% POWER BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

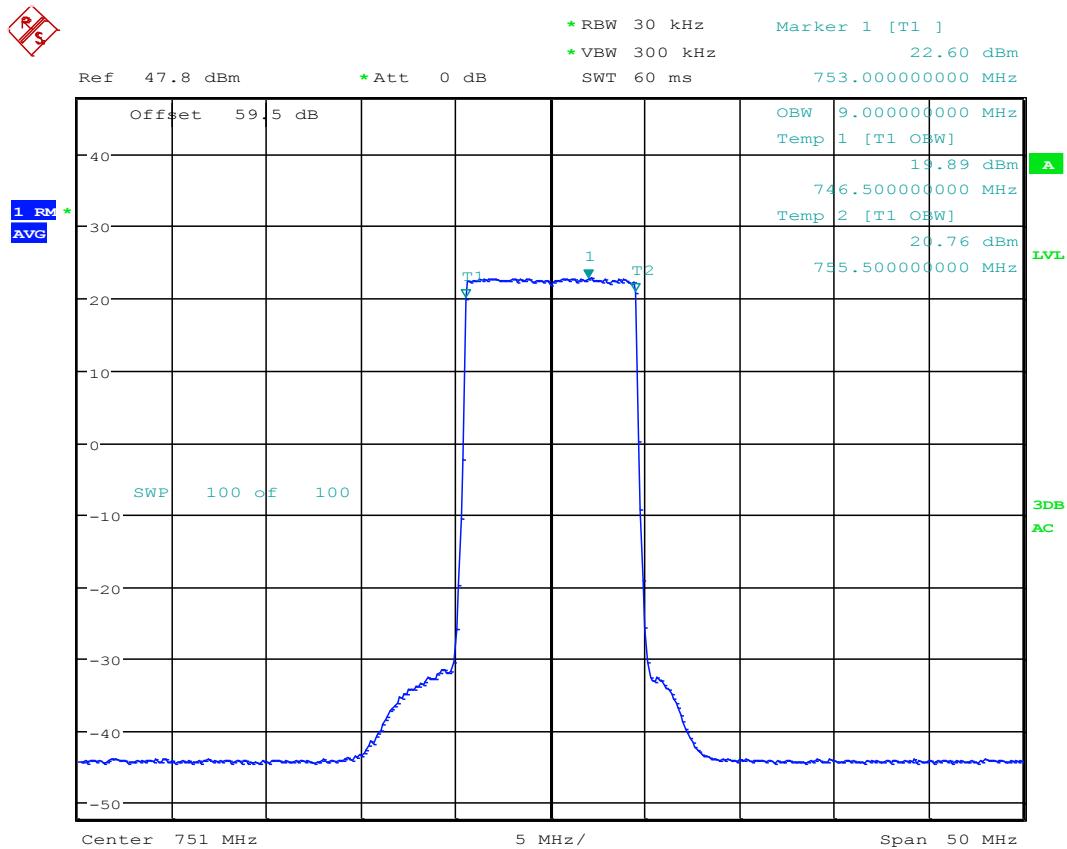
Date: 18.FEB.2015 09:52:58

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-23



99% POWER BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:49:37

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

**MEASUREMENT OF
SPECTRUM MASK/OCCUPIED BANDWIDTH
(100 kHz ADJACENT TO CHANNEL EDGE)**

Section 2.1049 & 27.53 (c)

MEASUREMENT OF SPECTRUM MASK OCCUPIED BANDWIDTH

The Spectrum mask close to the center of the carrier frequency (Occupied bandwidth) of the Long Term Evolution (LTE) was measured using a Rohde & Schwarz ESI Spectrum Analyzer/Receiver. The RF power level was measured using RF power meter as shown in the test setup in Figure A. The RF output from the LTE EAC port to spectrum analyzer was reduced (to an amplitude usable by the spectrum analyzer) by using calibrated attenuator(s) and RF directional coupler. This combined attenuation was offset on the display, and the signal for single carrier was adjusted to the corrected RF power level using 100 kHz Resolution Bandwidth for 10 MHz wide transmit signals. While adjusting the corrected RF power level in the spectrum analyzer, the attenuator and resolution BW of spectrum analyzer were considered.

The measurements were made on a **“B13 RRH 4x30”**.

The reference line on the spectrum analyzer display corresponds to level measured by the RF power meter. Occupied Bandwidth plots were made at antenna terminals for an output of 60 Watts (47.8 dBm)/carrier.

The carrier frequencies and blocks measured were provided at the bottom of each plot. The output signals at the antenna terminal were plotted for each frequency/block. The B13 4x30 RRHs are capable of operating in the band of 746 MHz to 756 MHz (Blocks C). The Base station presently tested was configured to operate at 10 MHz Bandwidth. The carrier frequency, Block and bandwidth evaluated for a single carrier were listed in the Table below. The tests were performed for QPSK, 16QAM and 64QAM modulations.

Block edge requirements:

FCC Section 27.53(c) 5: 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.

Pursuant to FCC KDB 662911 D01 and D02 for MIMO mode of operations, the FCC limit of -13 dBm shall be 3 dB more stringent for two antennas. Therefore the limits for all channel edge and out of band spurious emissions shall be -16dBm for 2x60W configuration.

Results:

The measurement results demonstrate the full compliance with the Rules of the Commission at **FCC Part 27.53 (c)**

The FCC requirements are tabulated in the following table, where MIMO requirement/margin is not included.

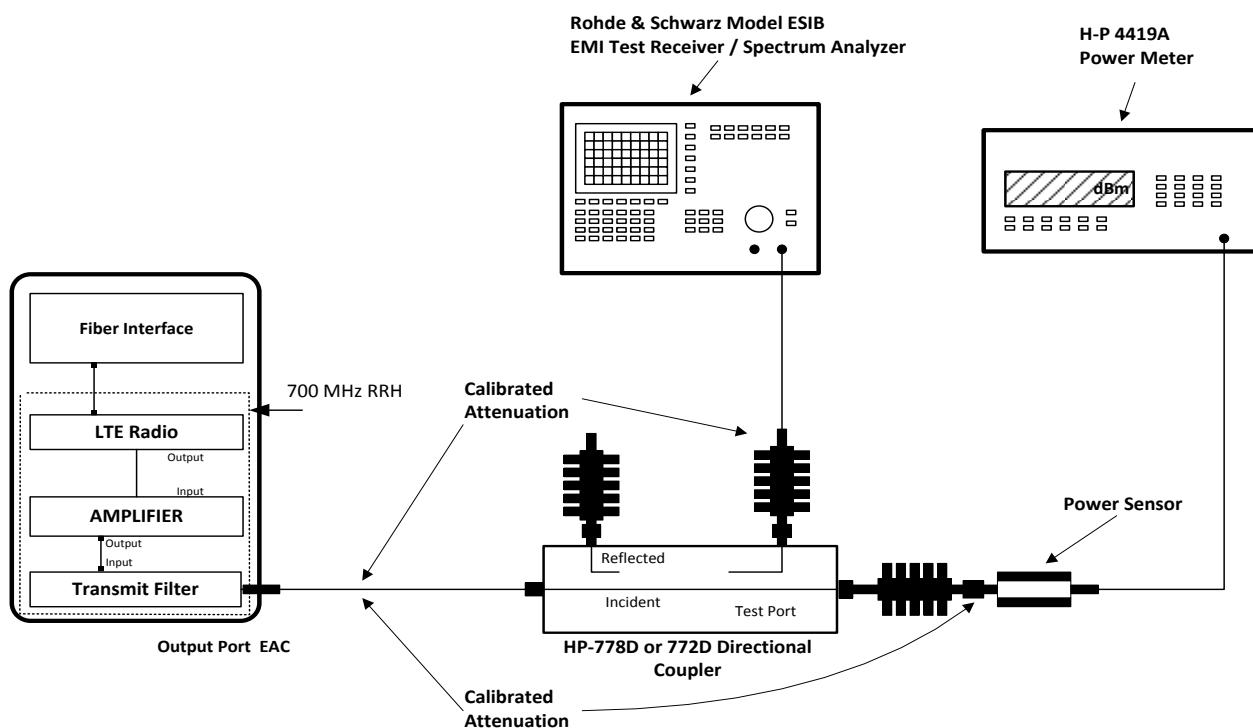
FCC Part 27.53 (c) Transmitter Unwanted Emission Limits

Frequency	Required Minimum Attenuation below the Mean Carrier Power P	Minimum Resolution Bandwidth of Spectrum Analyzer
100kHz Immediately Outside and Adjacent to 746-758 and 776-788 MHz	(43 + P dBW) dBc	30 kHz
Outside the above Frequency Range	(43 + P dBW) dBc	100 kHz
763-775, 793-805 MHz	(76 + P dBW) dBc	6.25 kHz

Channel List

Block	Frequency (MHz)	Bandwidth (MHz)
C	751	10

**Figure A. TEST CONFIGURATION FOR SPECTRUM MASK
(OCCUPIED BANDWIDTH)**



All components are calibrated over the frequency range of interest

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-23**

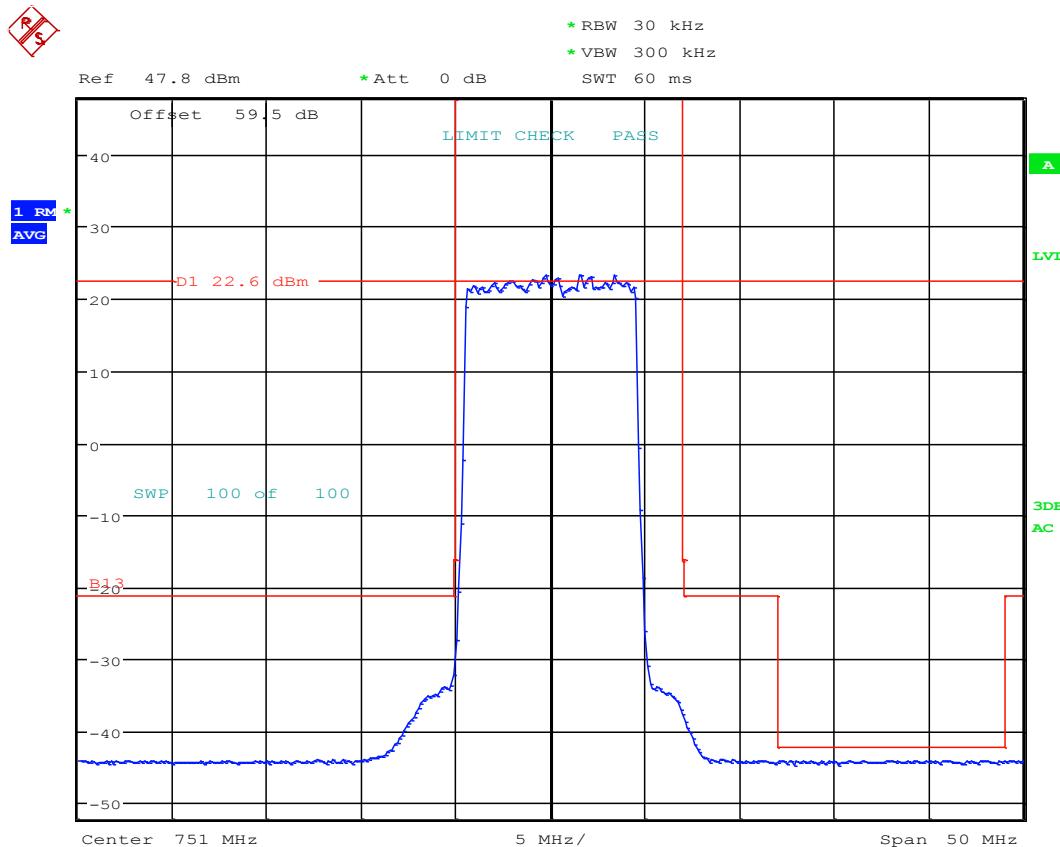
**OCCUPIED BANDWIDTH DATA
2x60W MIMO CONFIGURATION**

Block: C

10 MHz Bandwidth (746 - 756 MHz)

2x60 watts (MIMO)

SPECTRUM MASK/OCCUPIED BANDWIDTH



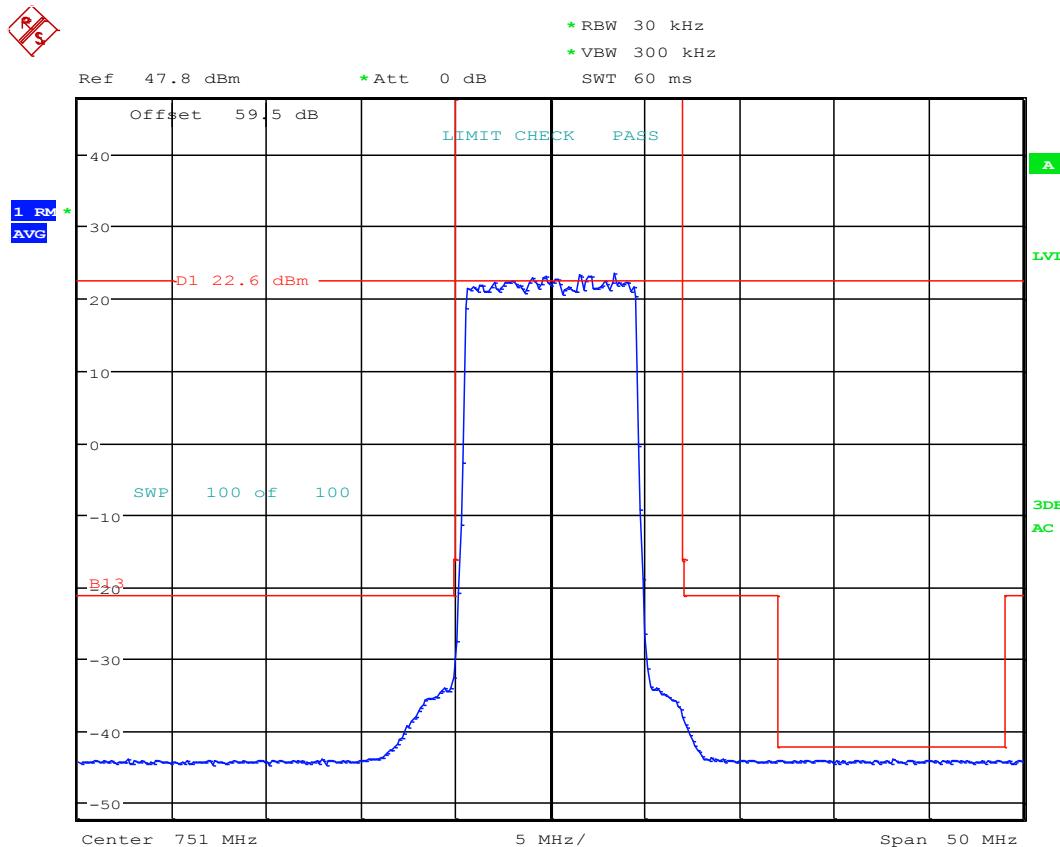
OCCUPIED BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 13:25:02

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



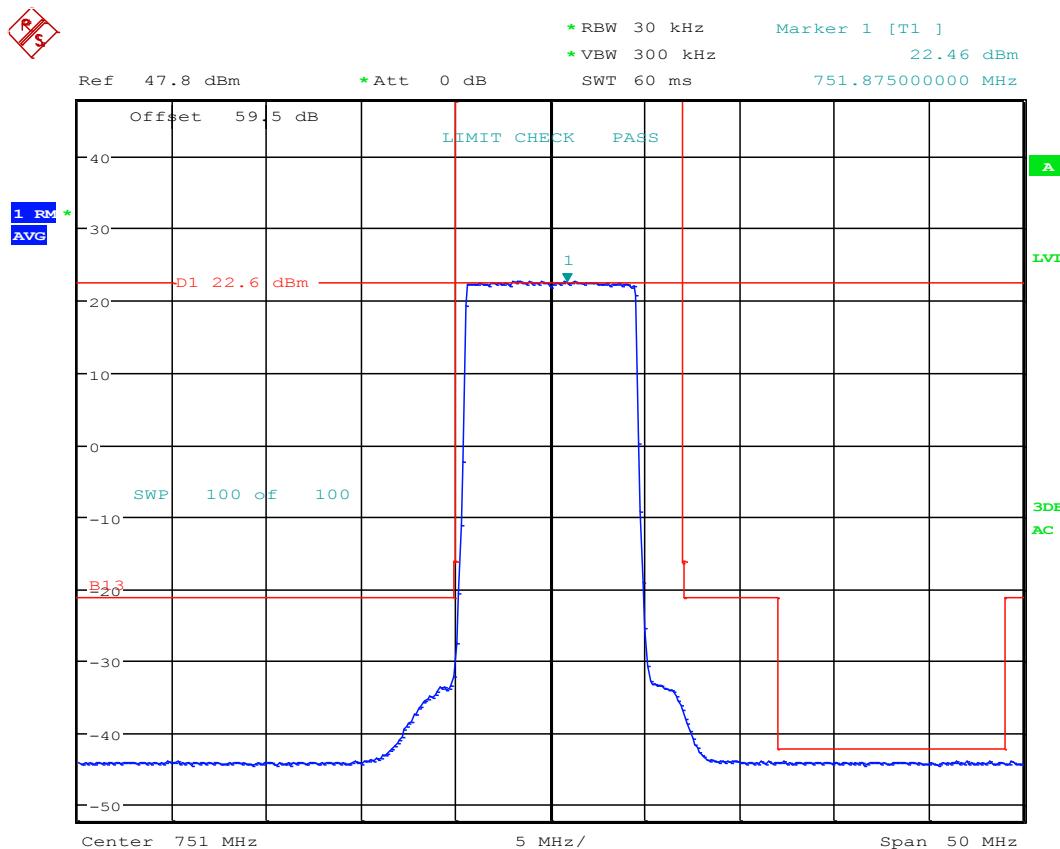
OCCUPIED BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 11:14:00

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



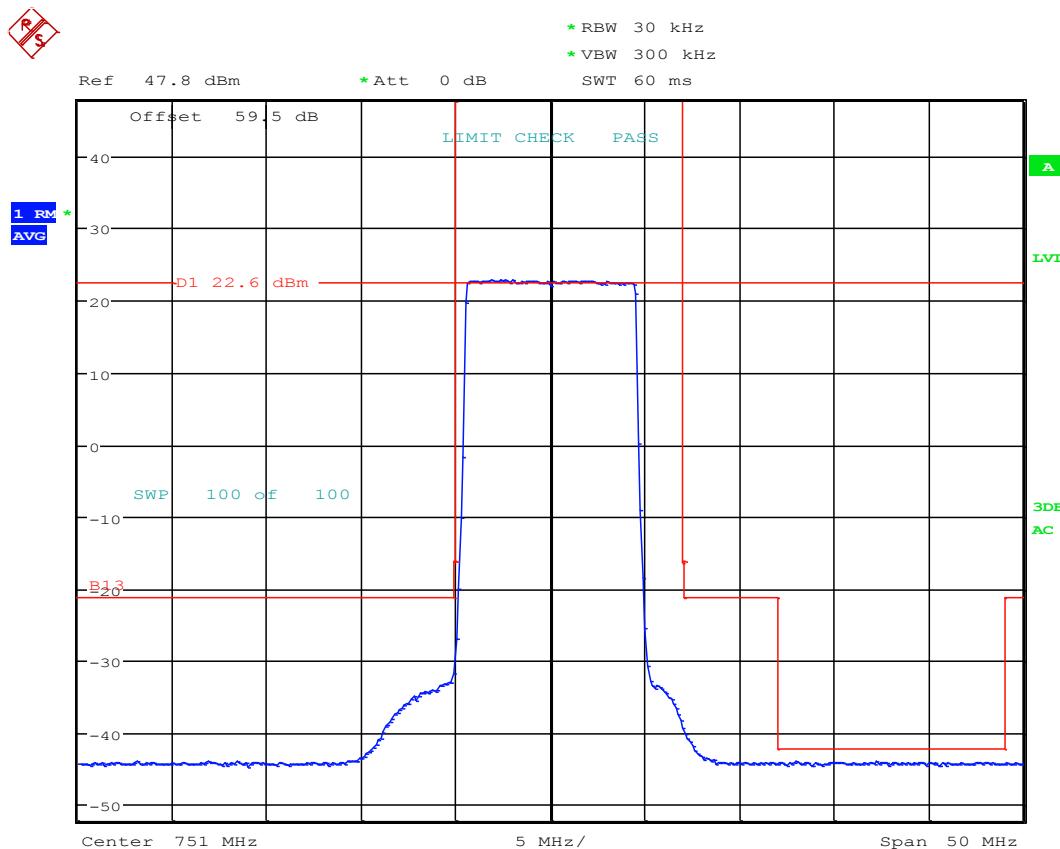
OCCUPIED BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 12.FEB.2015 14:46:43

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



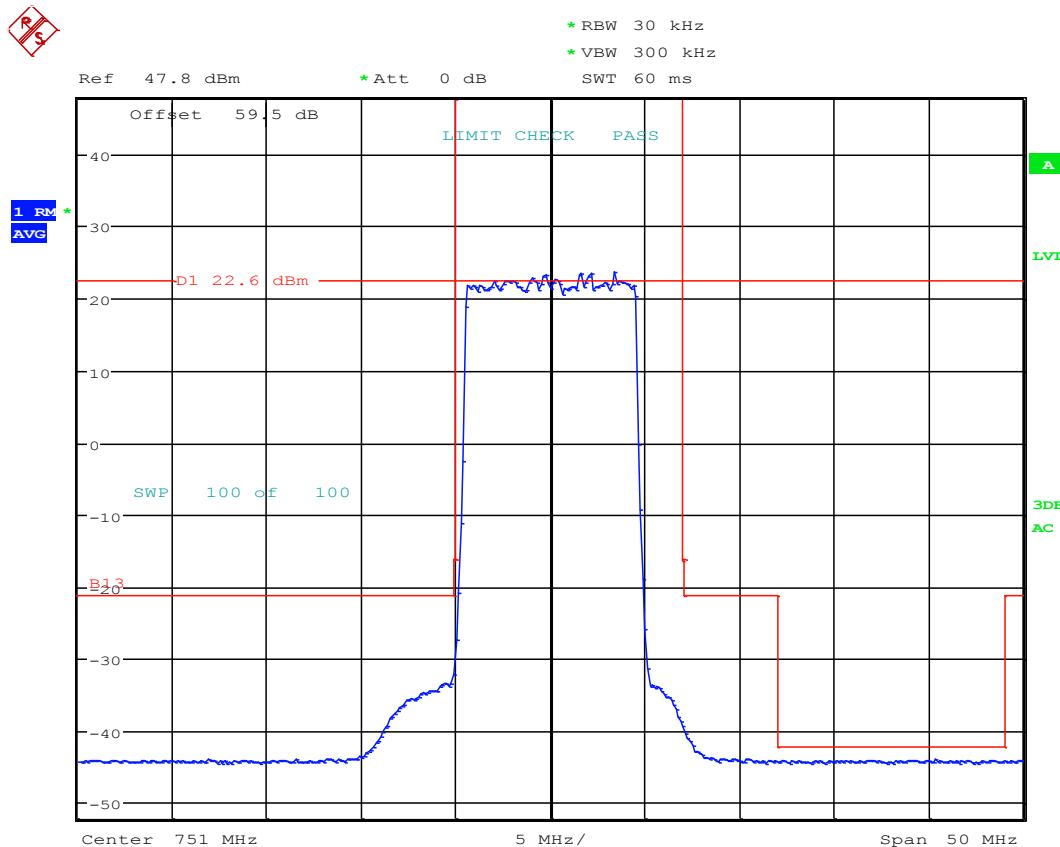
OCCUPIED BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 09:26:52

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



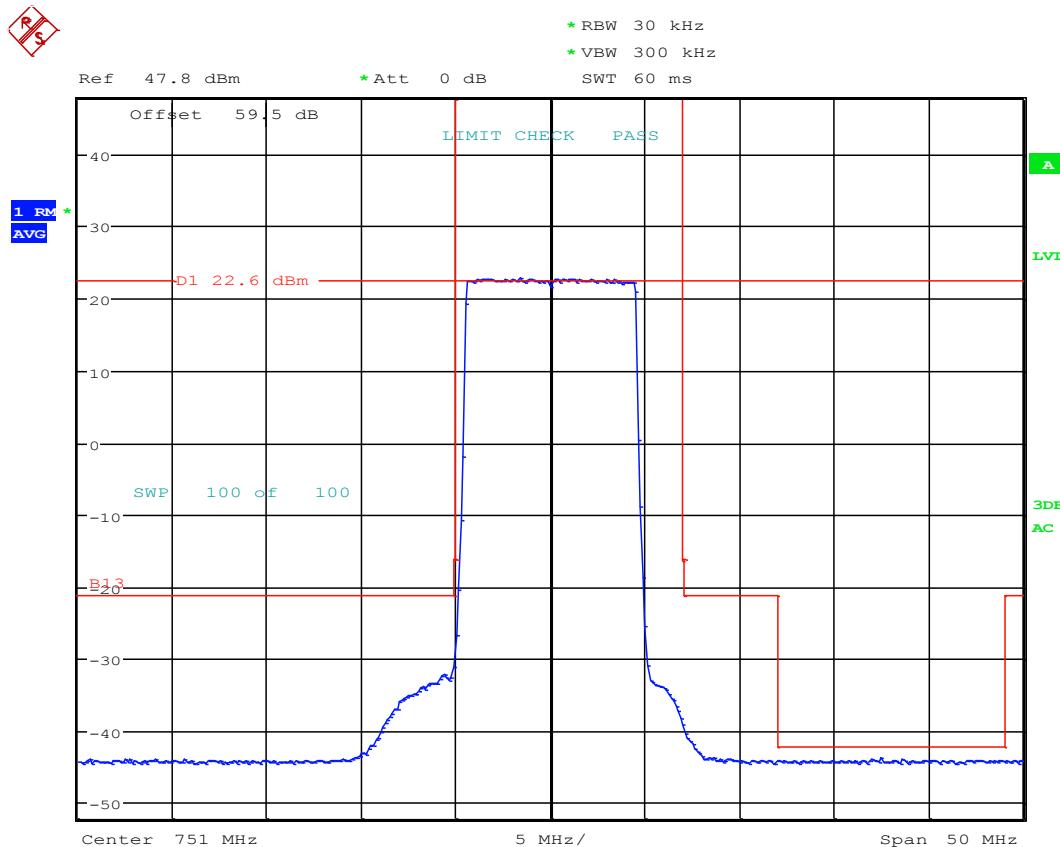
OCCUPIED BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:01:01

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



OCCUPIED BANDWIDTH: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:47:35

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

Sub-Exhibit 11.5

**FCC Section 2.1051 and 27.53 (c)
Spurious Emissions at Antenna Transmit Terminals**

**MEASUREMENT OF
SPURIOUS EMISSIONS
AT TRANSMIT ANTENNA PORT
FCC 27.53 (c)**

Spurious Emissions at Transmit Antenna Terminals

Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 kHz to the 13 GHz. The test setup is as described in Figure B. Measurements were made using a Rohde & Schwarz ESU (10 kHz to 40 GHz) EMI Test receiver. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators. The RF power level was continuously monitored via RF Power Meter as shown in the test setup in Figure B. The required emission limitation is specified in 27.53(c). Measurements were made at 60W per carrier for 10 MHz bandwidth at antenna terminals. The measured spurious emission levels were plotted for the frequency range 10 kHz to 13 GHz. The measurements were made using following receiver parameters:

Frequency Range	Resolution Bandwidth
10 kHz to 30 MHz	10 kHz
30 MHz to 1 GHz	100 kHz
1 GHz to 13 GHz	1 MHz

Channel Lists

Block	Frequency (MHz)	Bandwidth (MHz)
C	751	10

FCC Section 27.53(c)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.*

FCC Section 27.53(c)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*

Pursuant to FCC KDB 662911 D01 and D02 for MIMO mode of operations, the FCC limit of -13dBm shall be 3dB more stringent for two antennas. Therefore the out of band spurious emissions limits shall be -16dBm for 2x60W configuration.

The tests were performed for 10 MHz bandwidth with the following modulations:

- A. QPSK
- B. 16 QAM
- C. 64 QAM

RESULTS:

The plots are provided for following bandwidth: 10 MHz

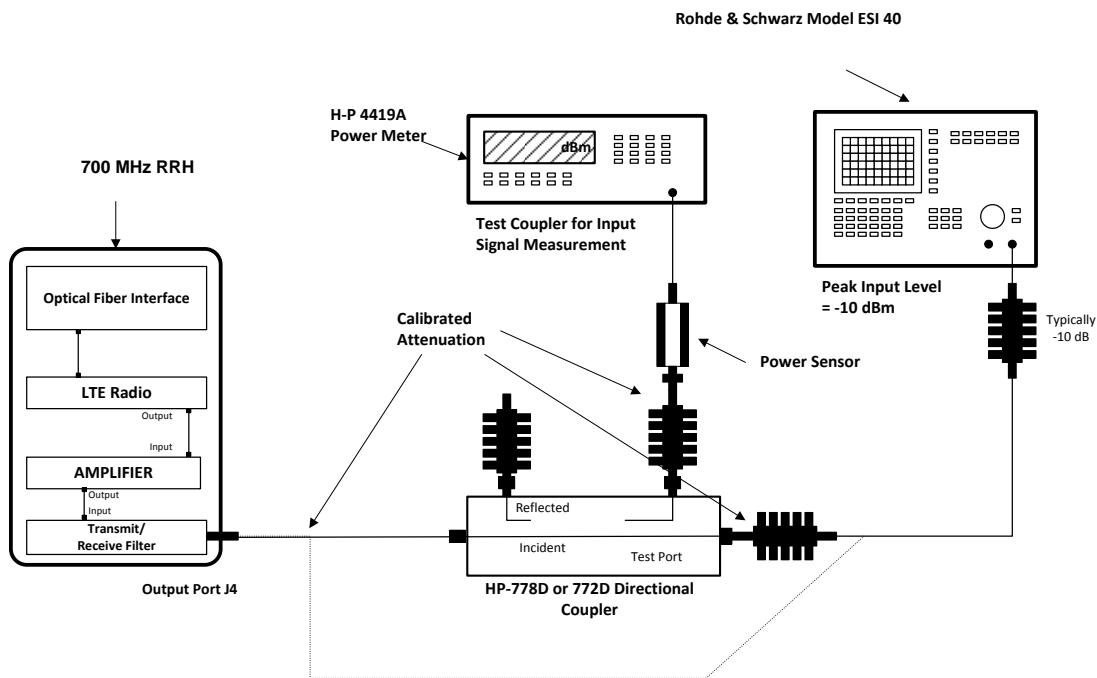
The magnitude of spurious emissions is within the specification limits of FCC Part 27.53 (c).

Measurement uncertainty:

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

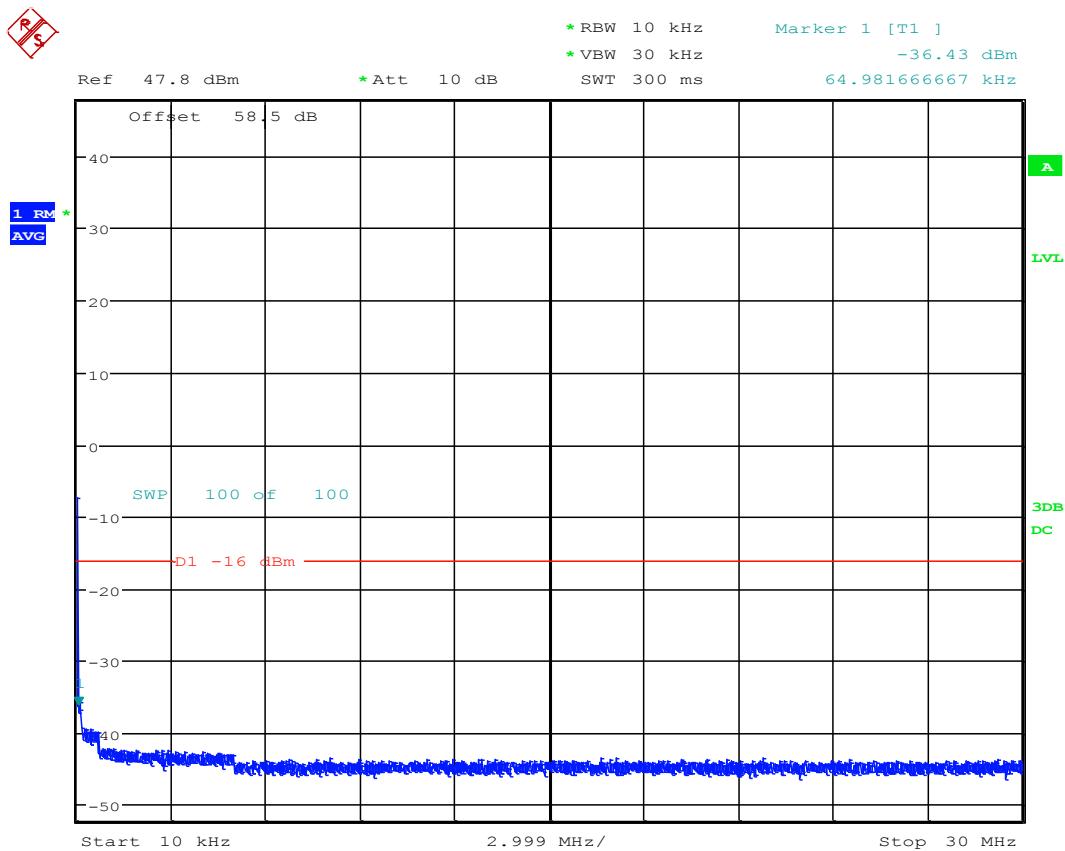
Figure B. TEST CONFIGURATION FOR CONDUCTED SPURIOUS

**SPURIOUS EMISSIONS DATA
2x60W MIMO CONFIGURATION**

**Transmit Port
Antenna Conducted Spurious Emissions**

**Block: C
10 MHz Bandwidth (746 - 756 MHz)**

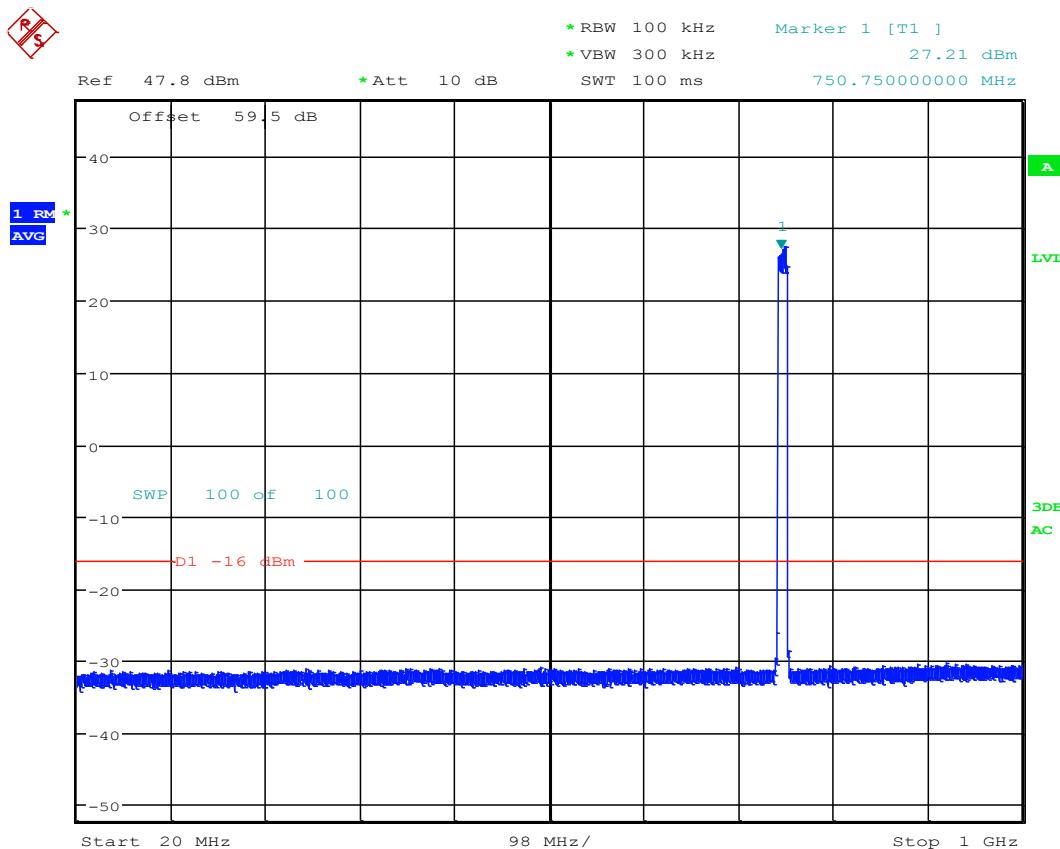
**2x60 watts (MIMO)
Port #1**



TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG
 RRH 4X30 B13; 751 MHz; 10 MHz BW
 Date: 13.FEB.2015 13:47:31

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



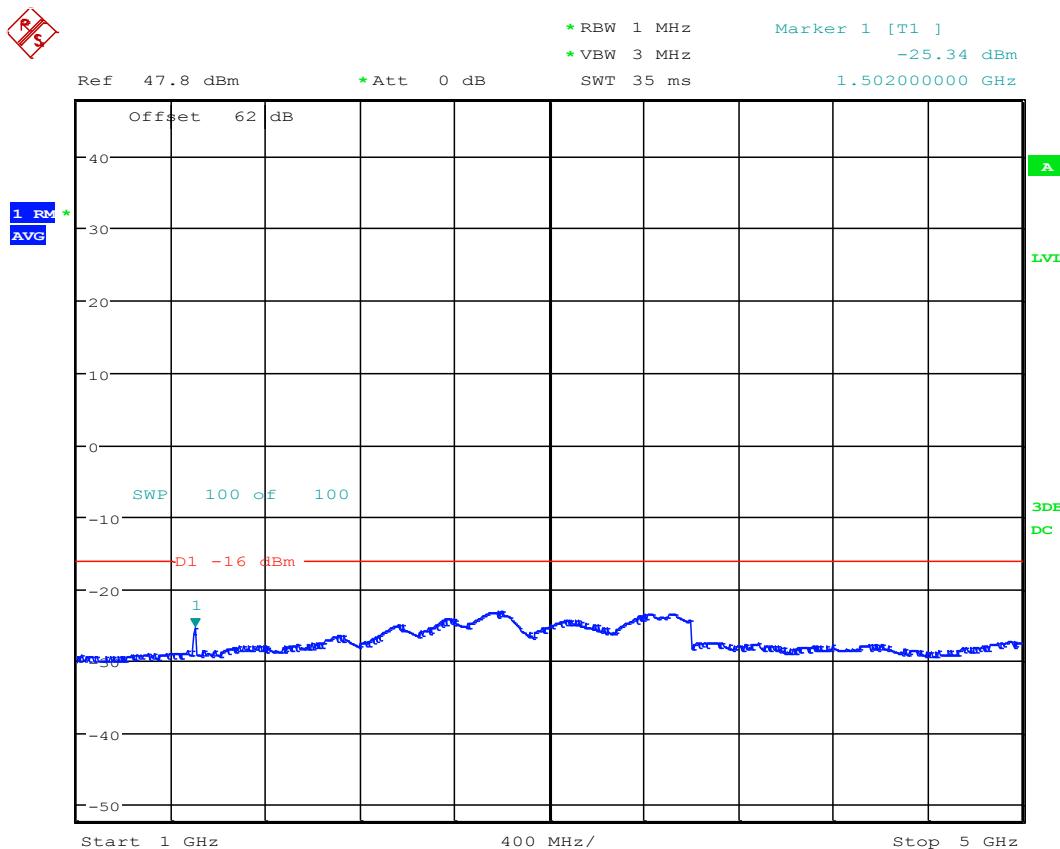
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

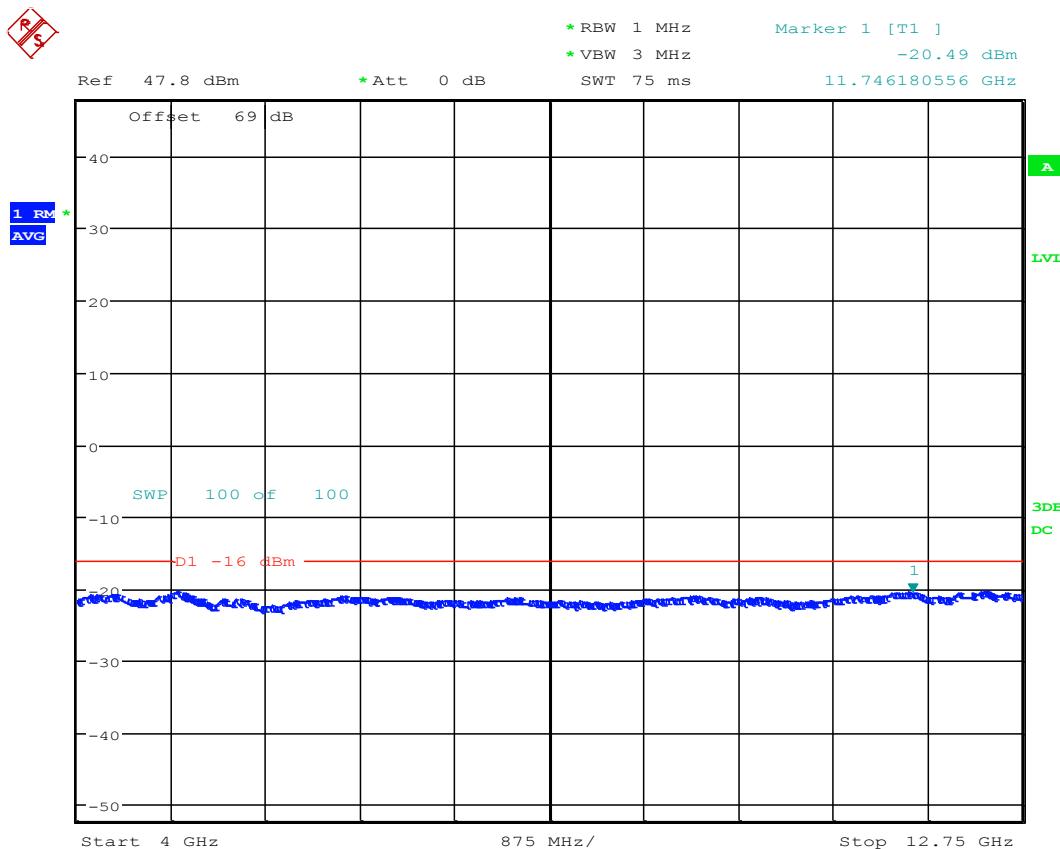
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 13:49:26

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1





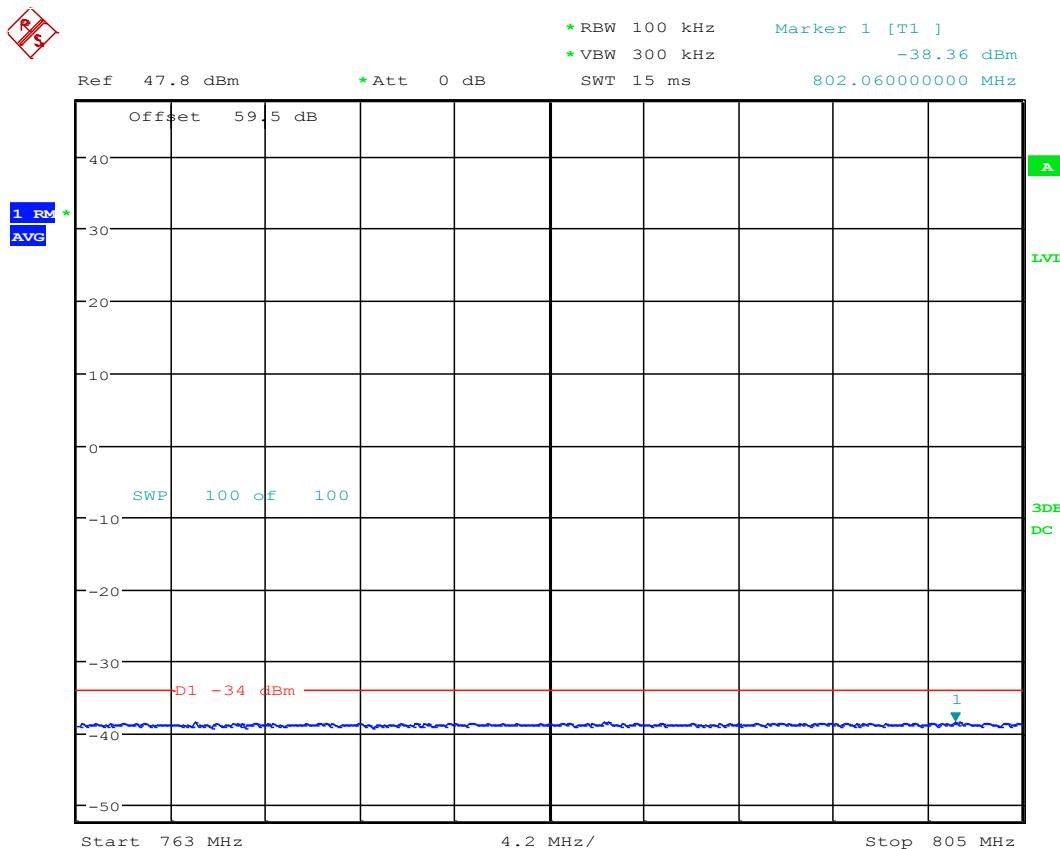
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 13:52:39

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

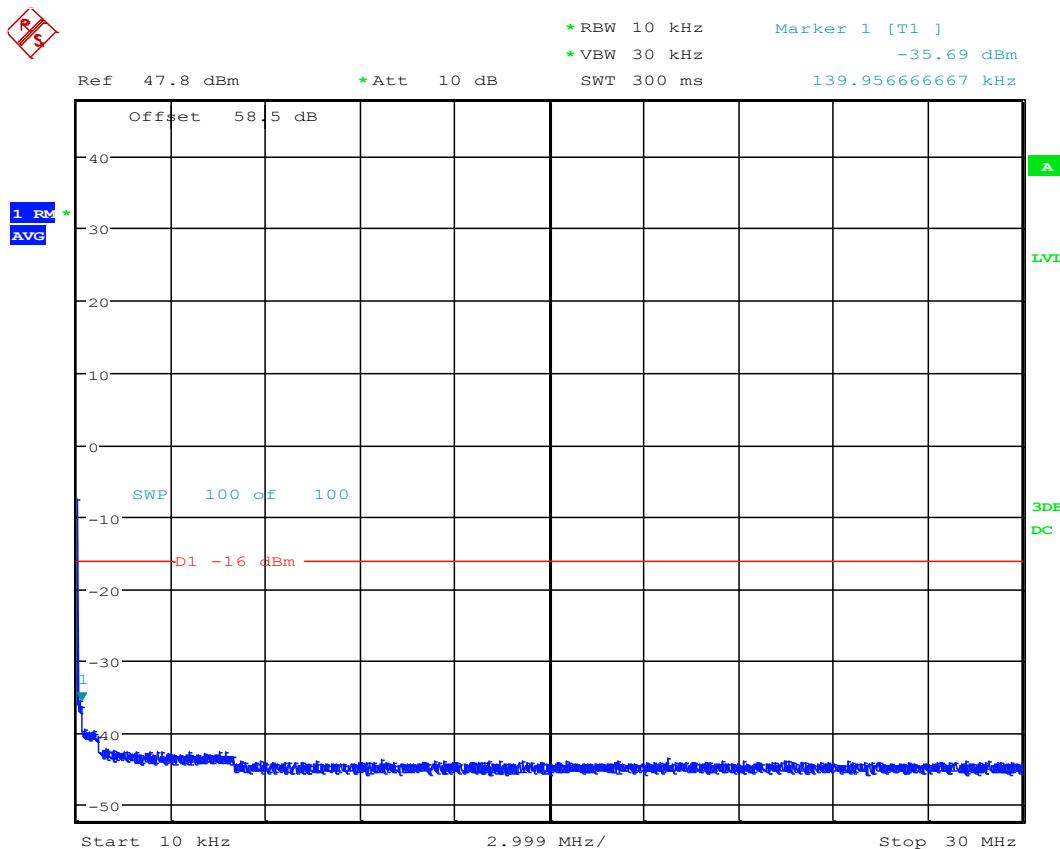
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 13:53:51

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1

After adding 3 dB for MIMO, the limit for this range is -37 dBm



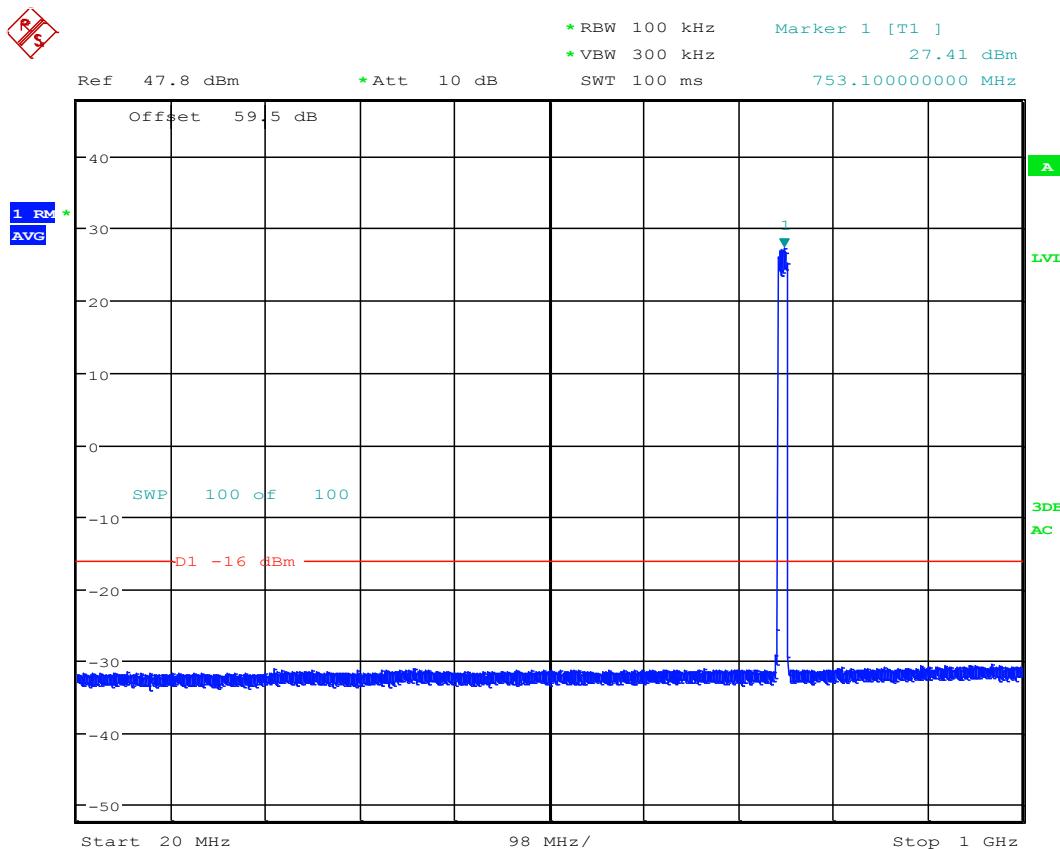
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 11:03:07

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



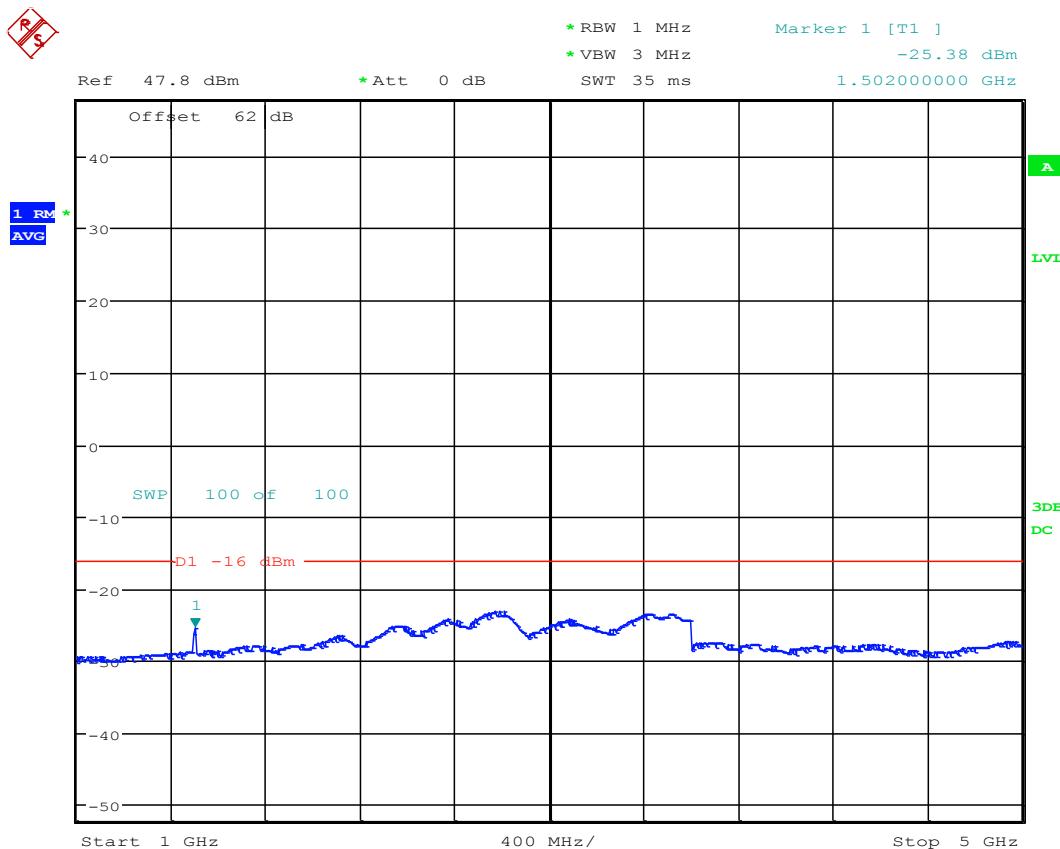
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

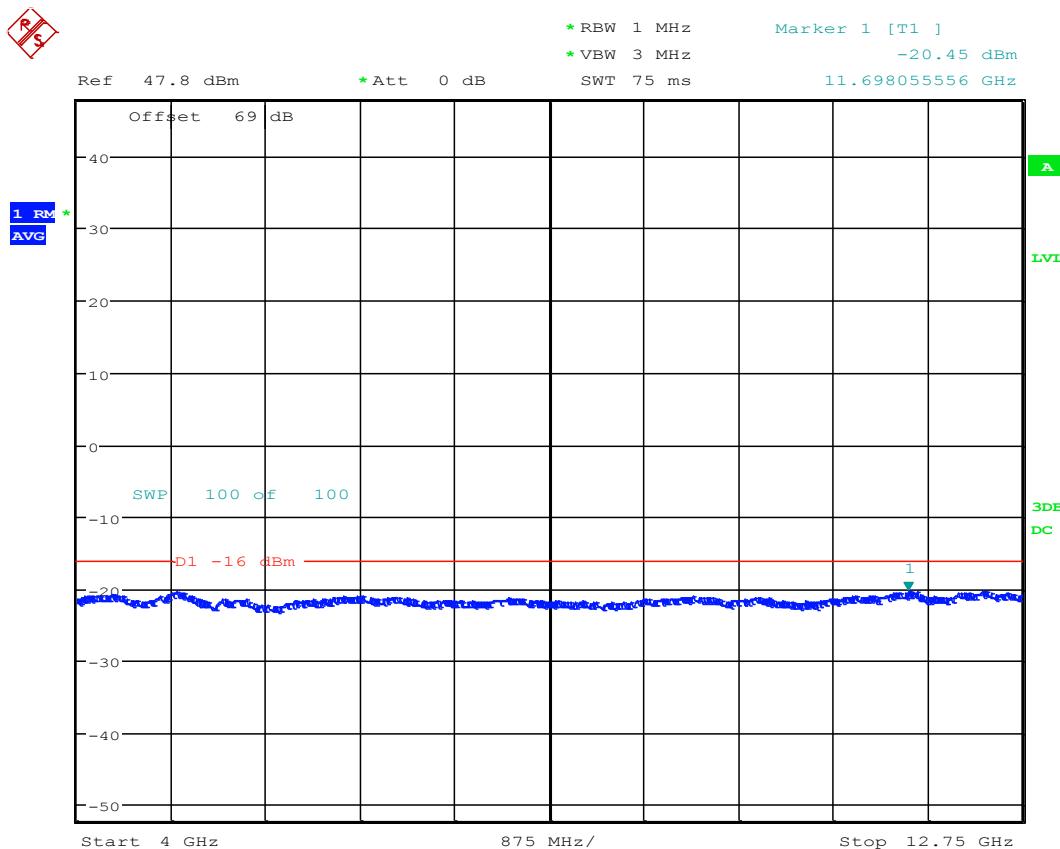
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 10:58:57

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1





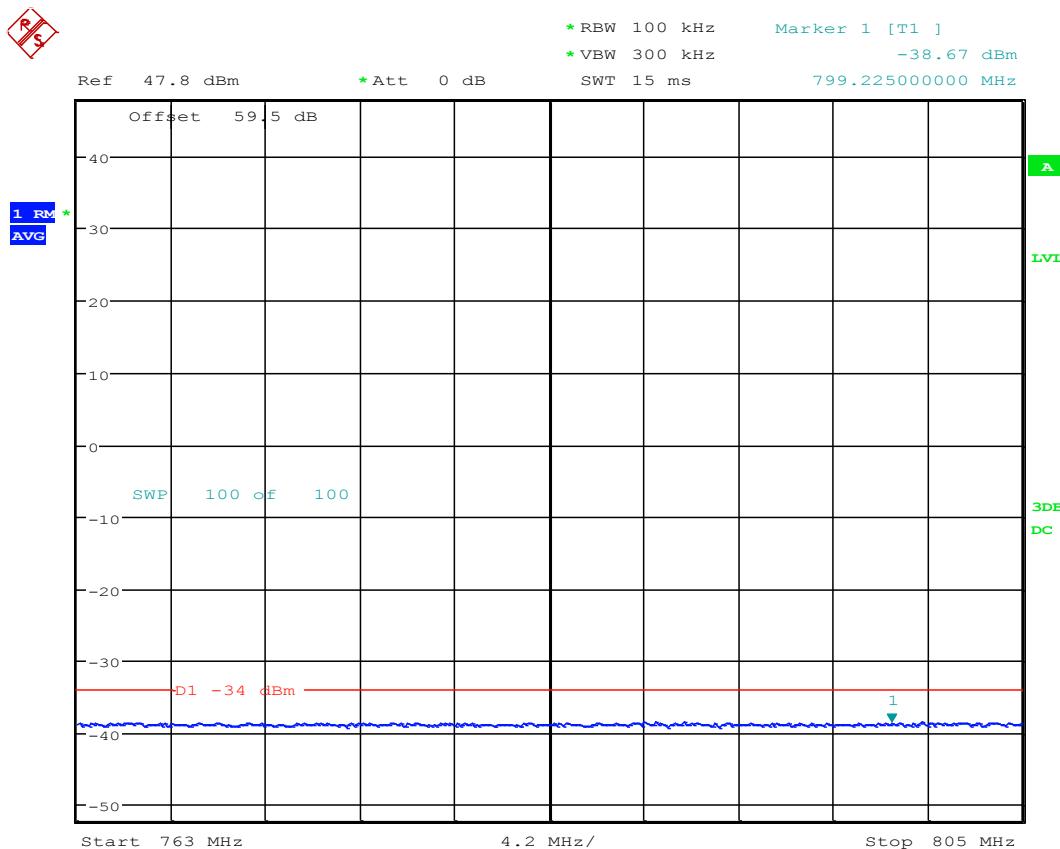
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 10:54:23

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

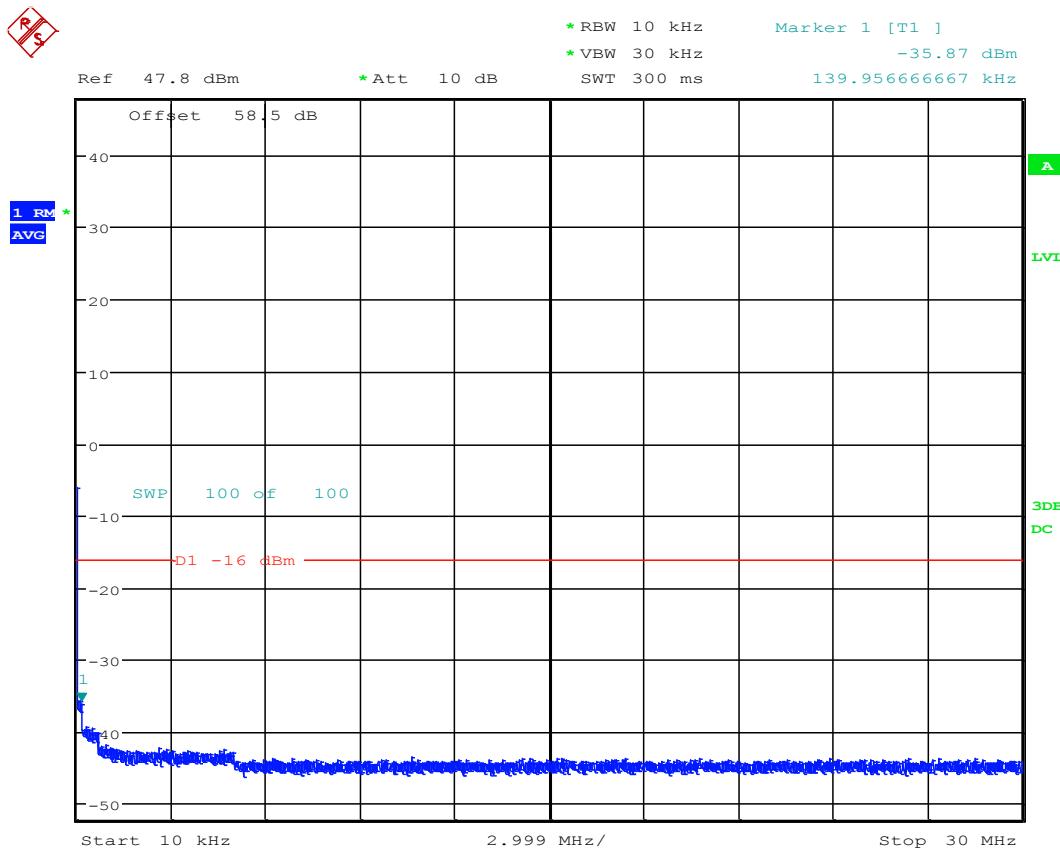
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 10:52:37

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1

After adding 3 dB for MIMO, the limit for this range is -37 dBm



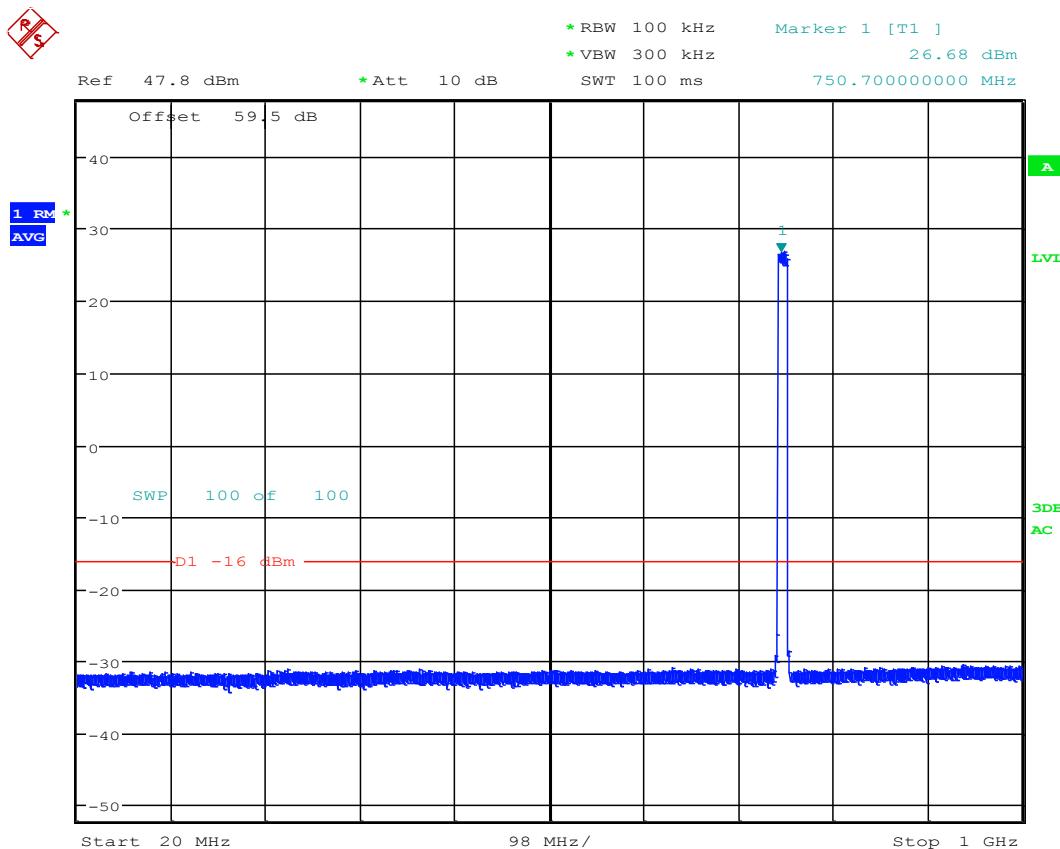
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 08:59:21

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



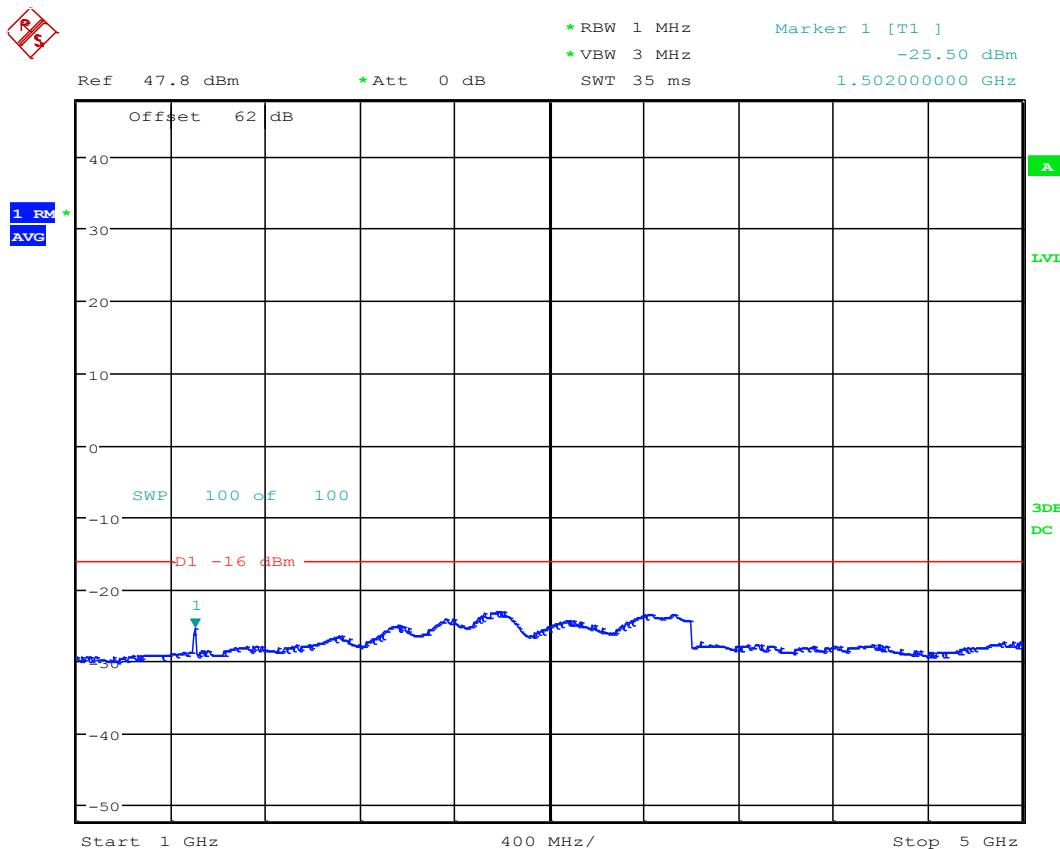
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 09:03:13

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



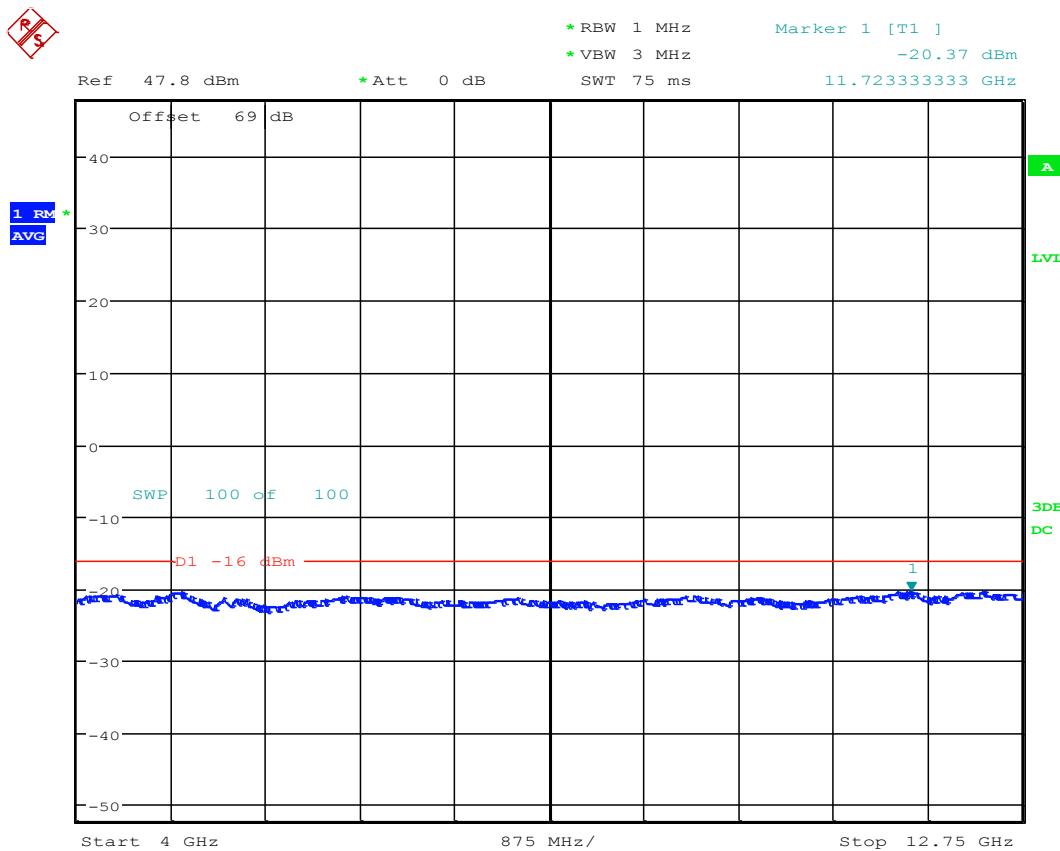
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 09:13:56

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #1



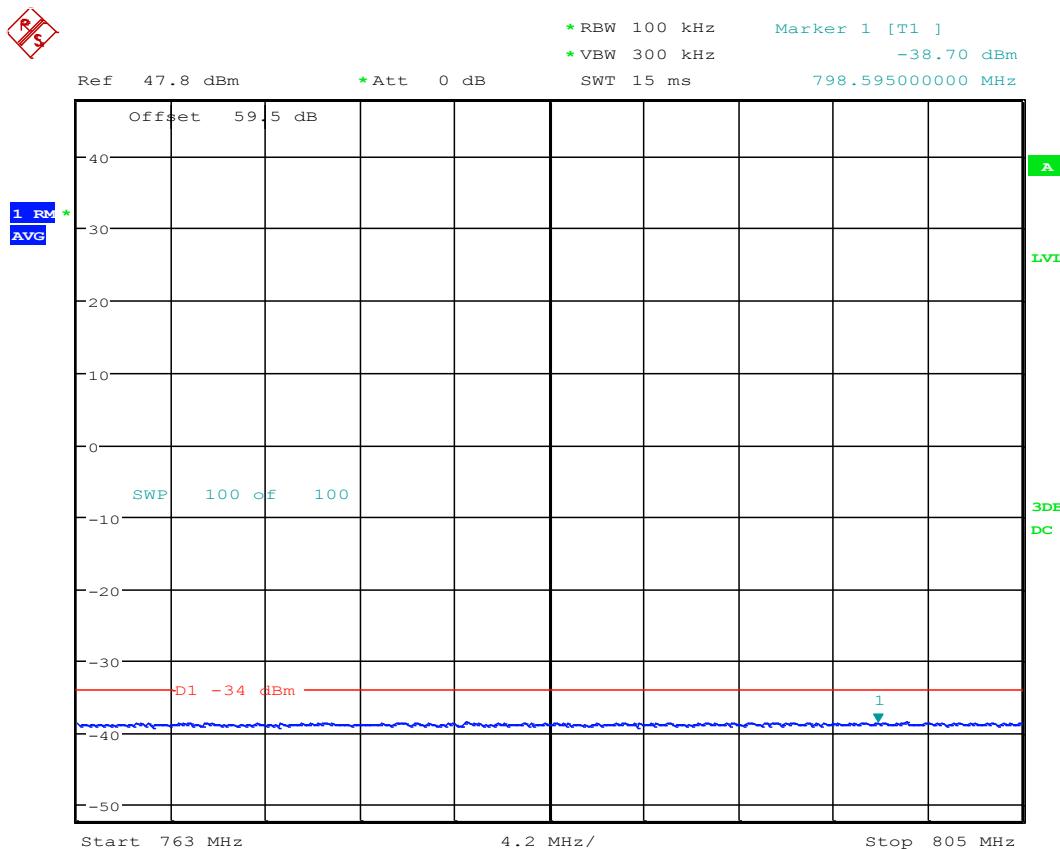
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 13.FEB.2015 09:21:00

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

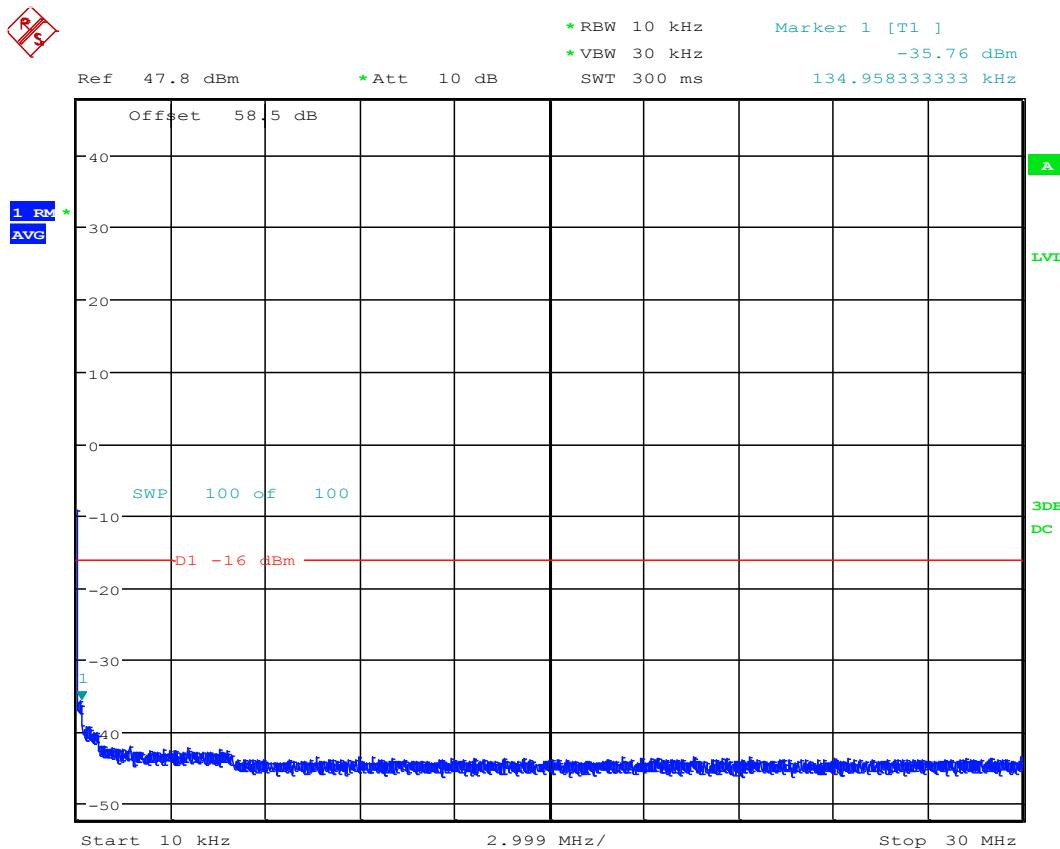
Port #1



**Transmit Port
Antenna Conducted Spurious Emissions**

**Block: C
10 MHz Bandwidth (746 - 756 MHz)**

**2x60 watts (MIMO)
Port #2**



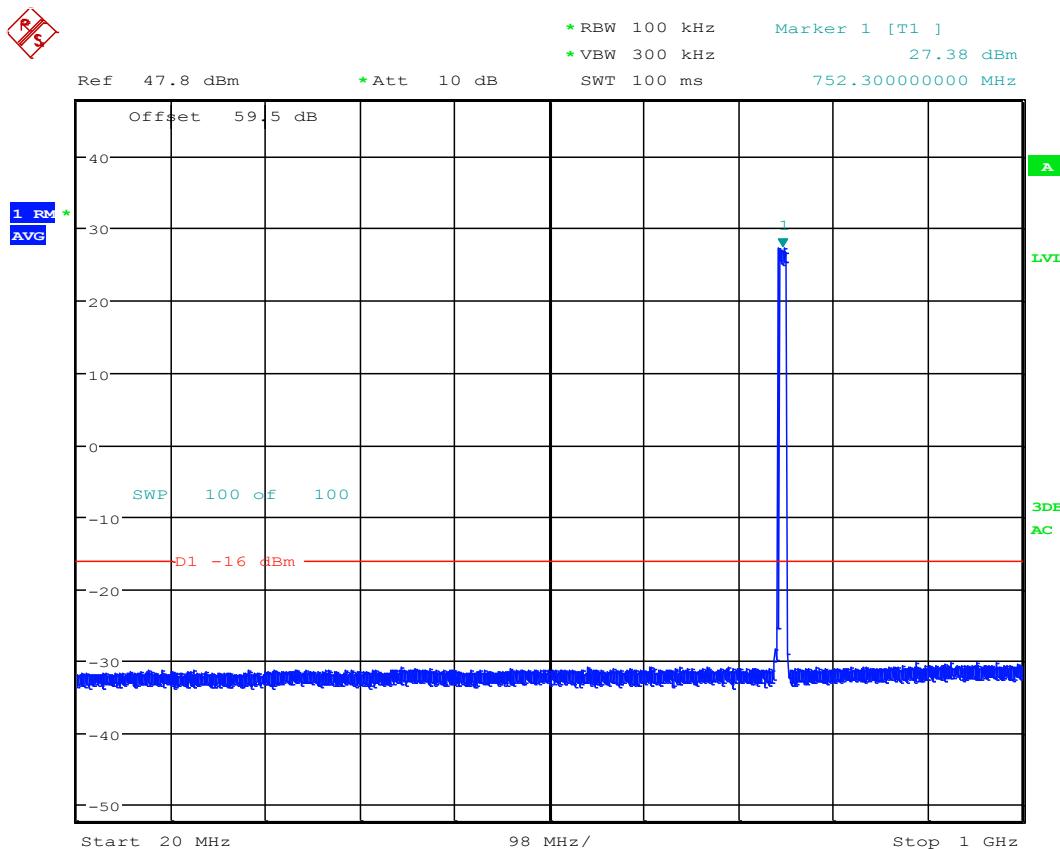
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 09:16:55

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



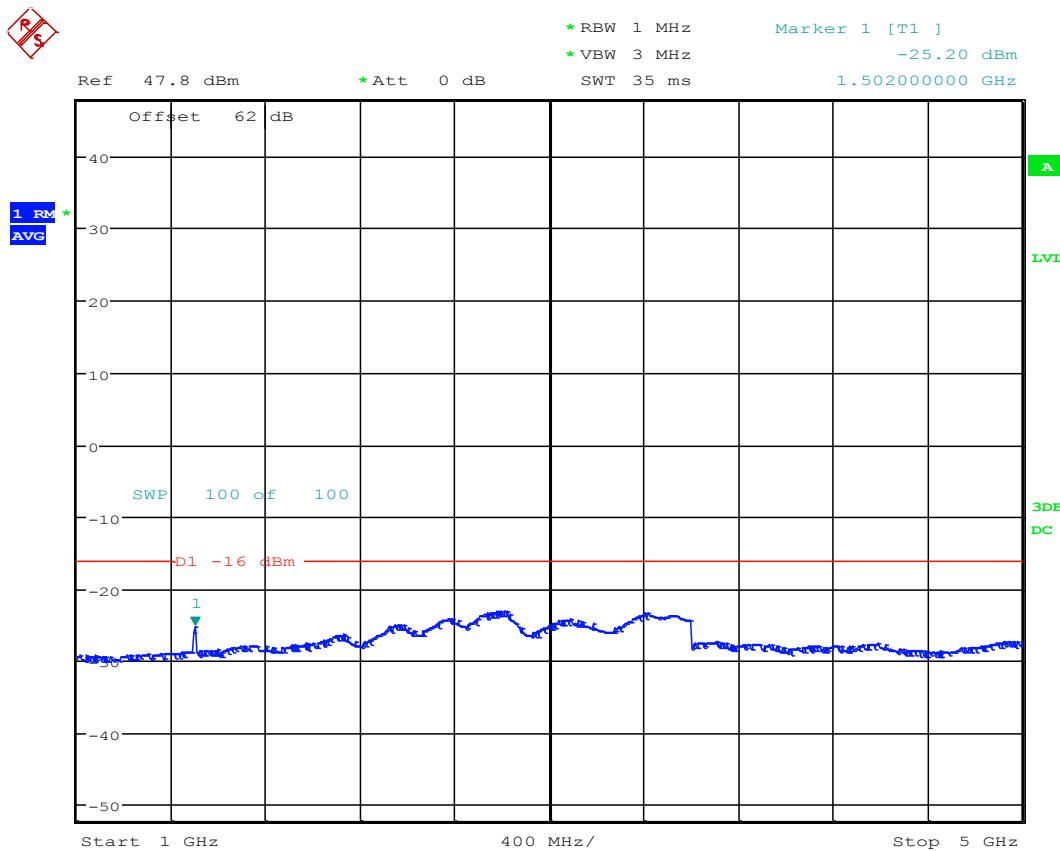
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

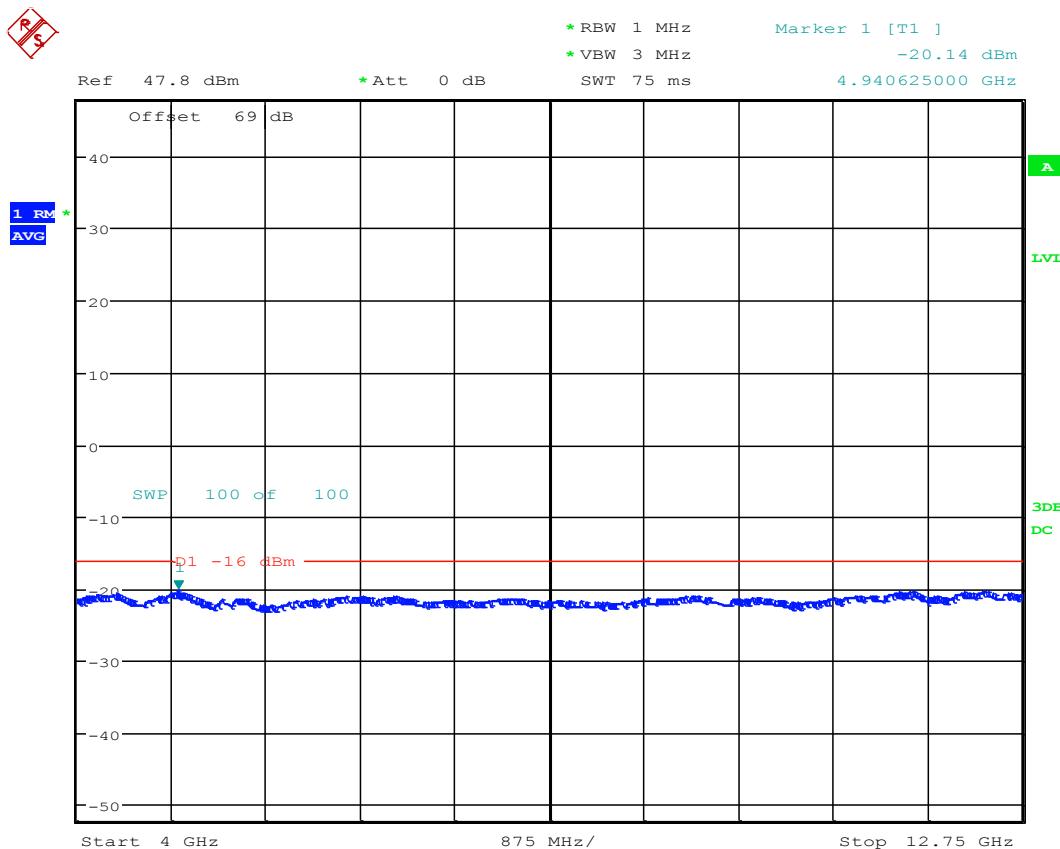
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 09:15:26

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2





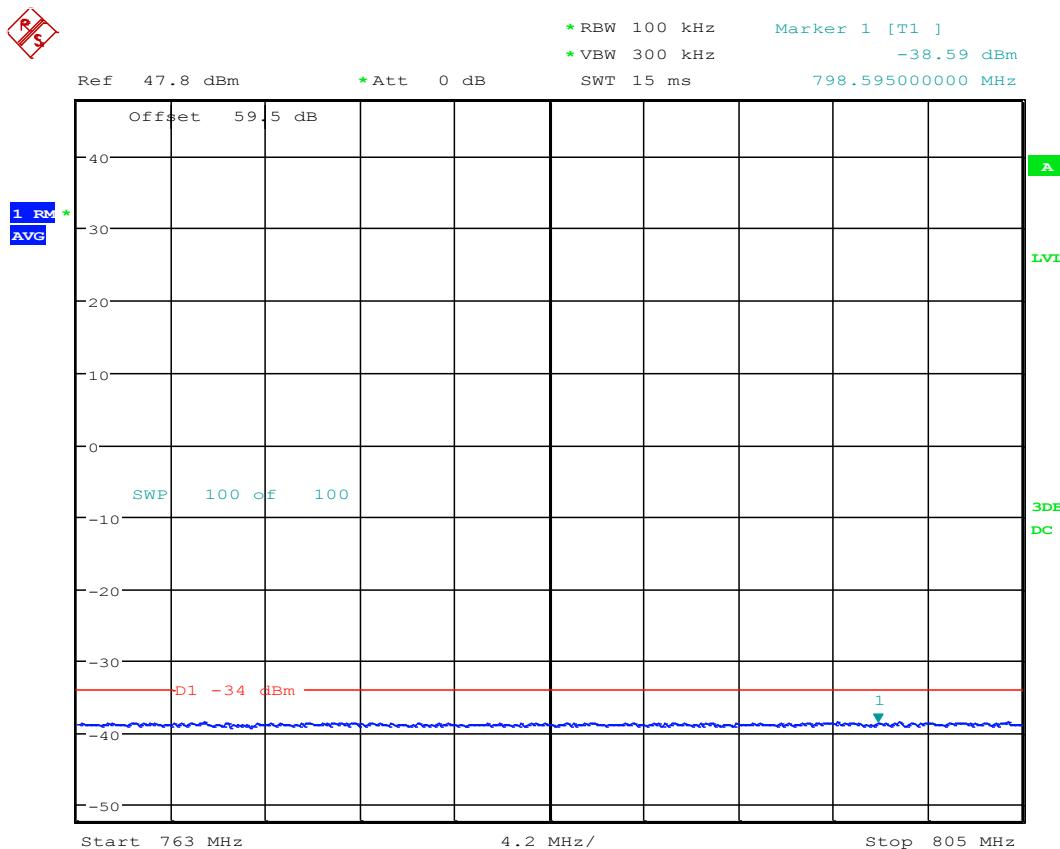
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 09:12:45

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

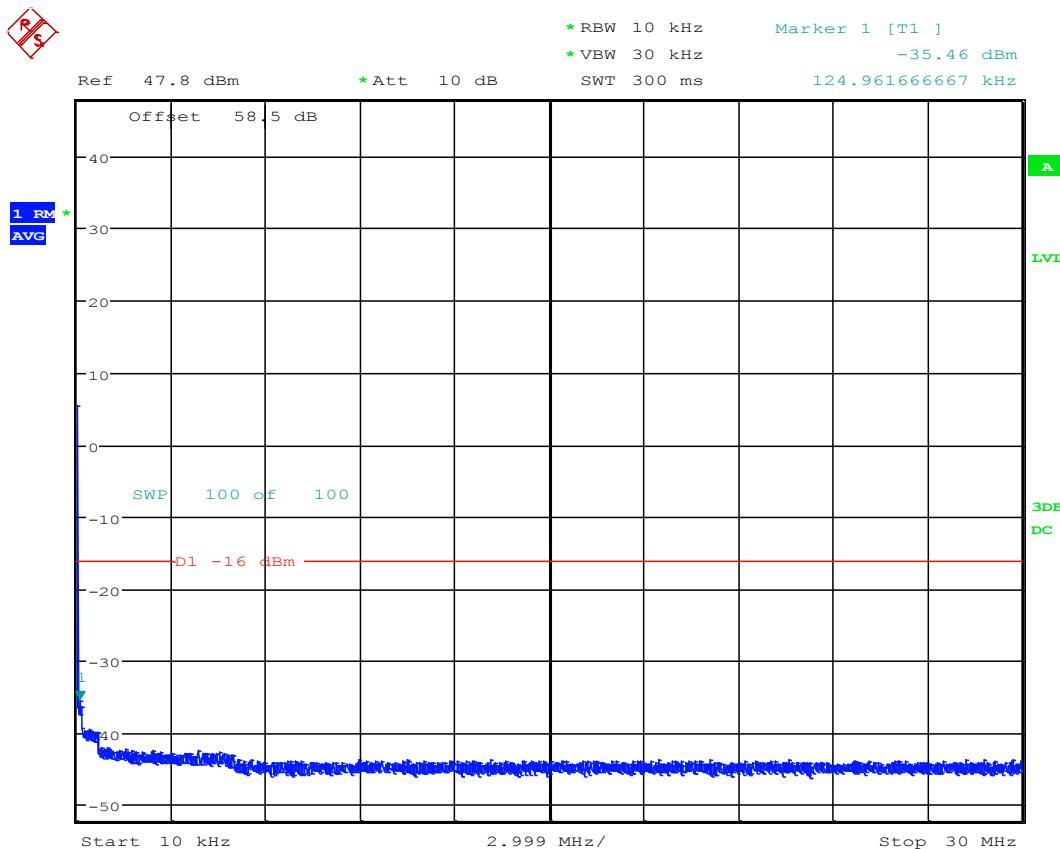
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 09:08:03

Tatfook Filter; QPSK Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

After adding 3 dB for MIMO, the limit for this range is -37 dBm



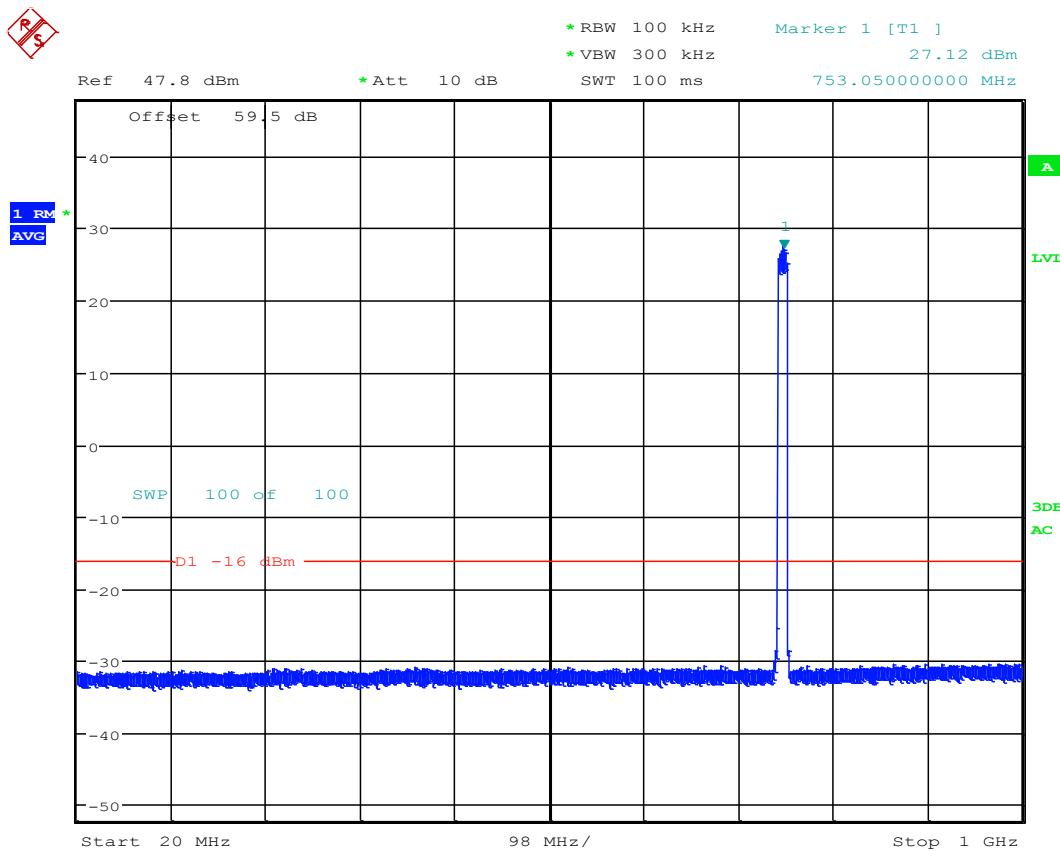
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:12:27

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



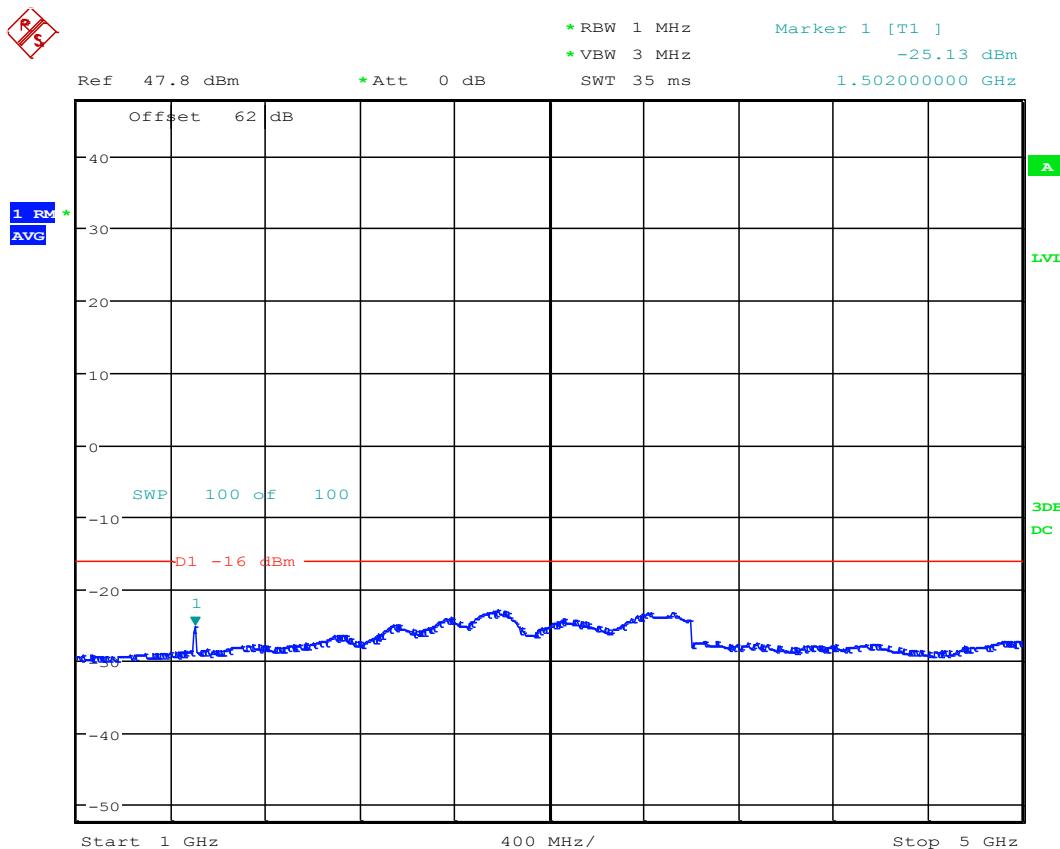
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

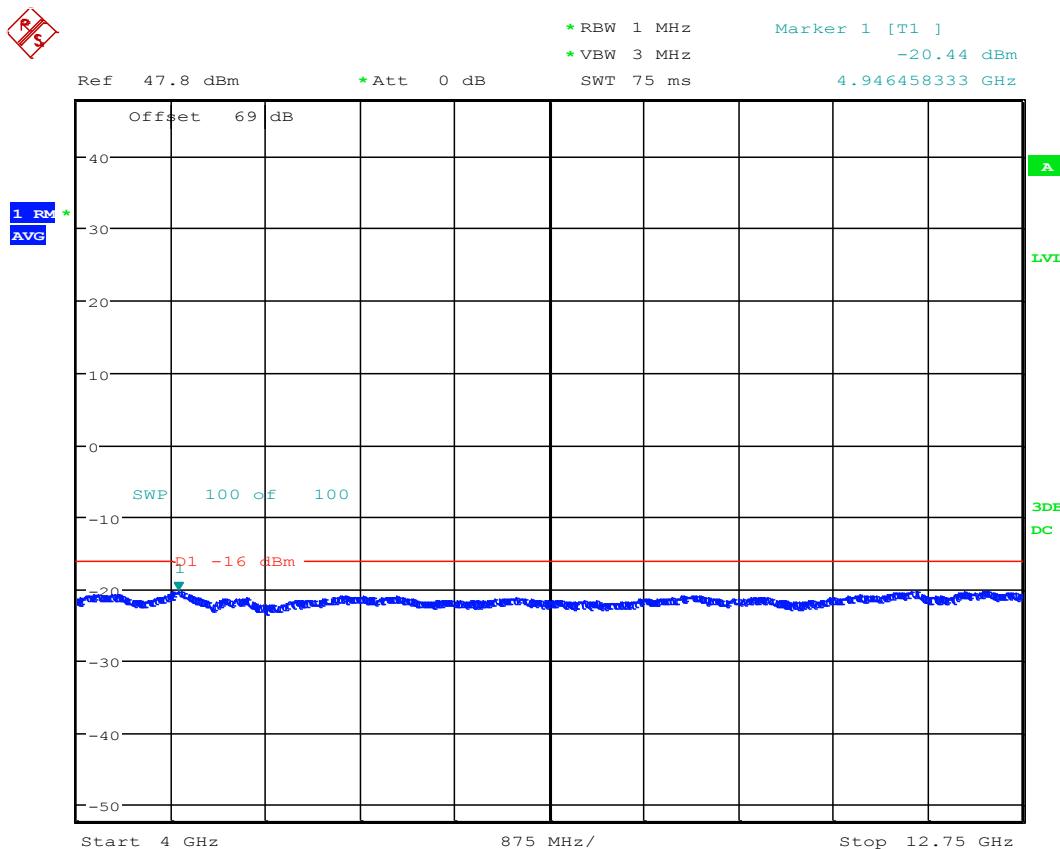
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:13:44

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2





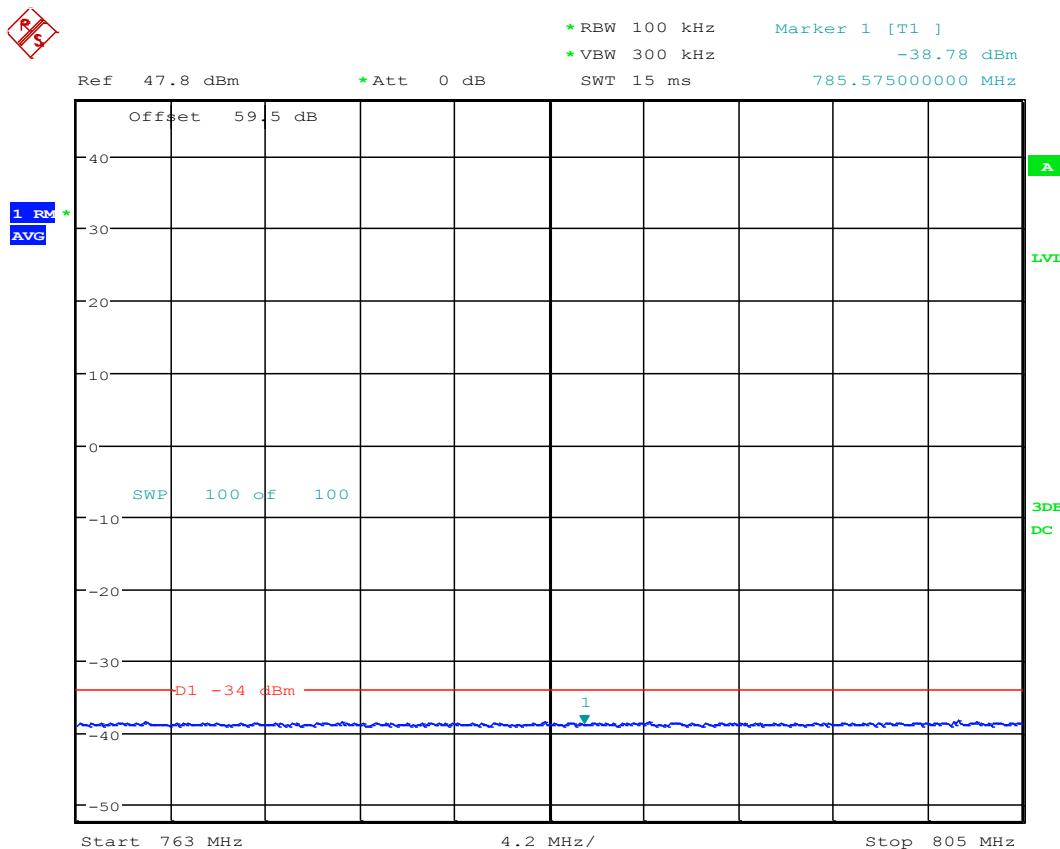
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:16:17

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

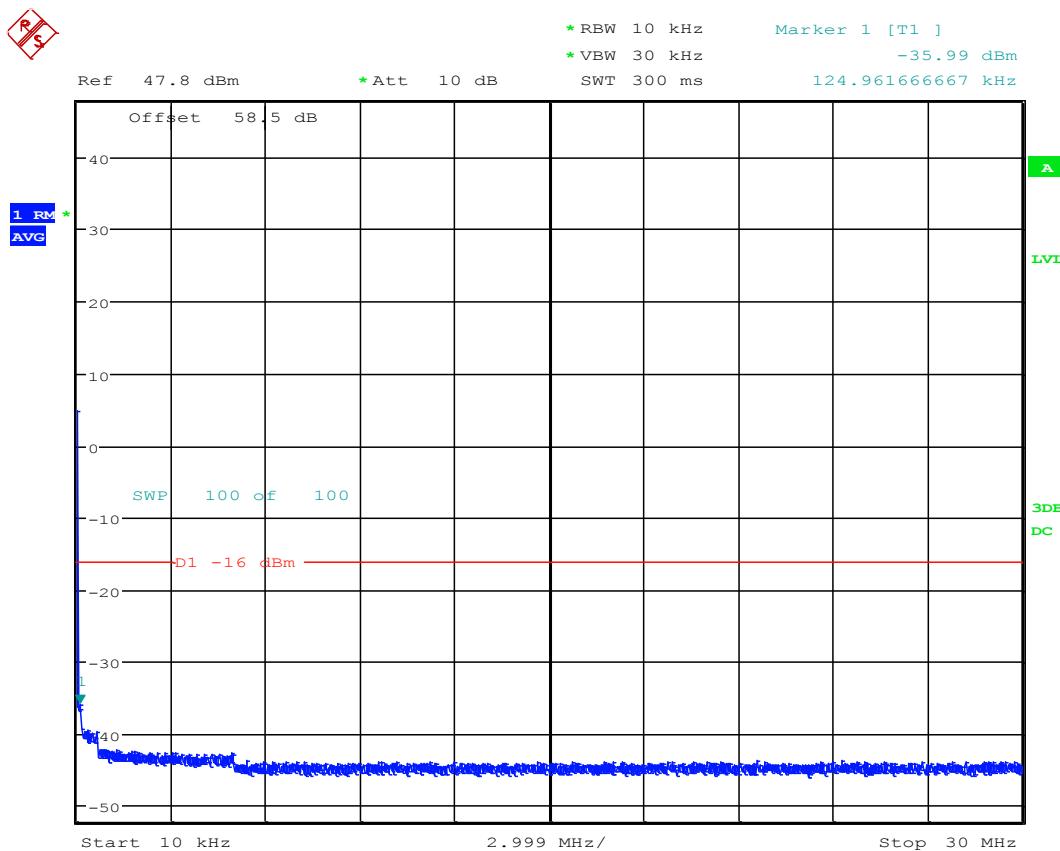
RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:17:54

Tatfook Filter; 16QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

After adding 3 dB for MIMO, the limit for this range is -37 dBm



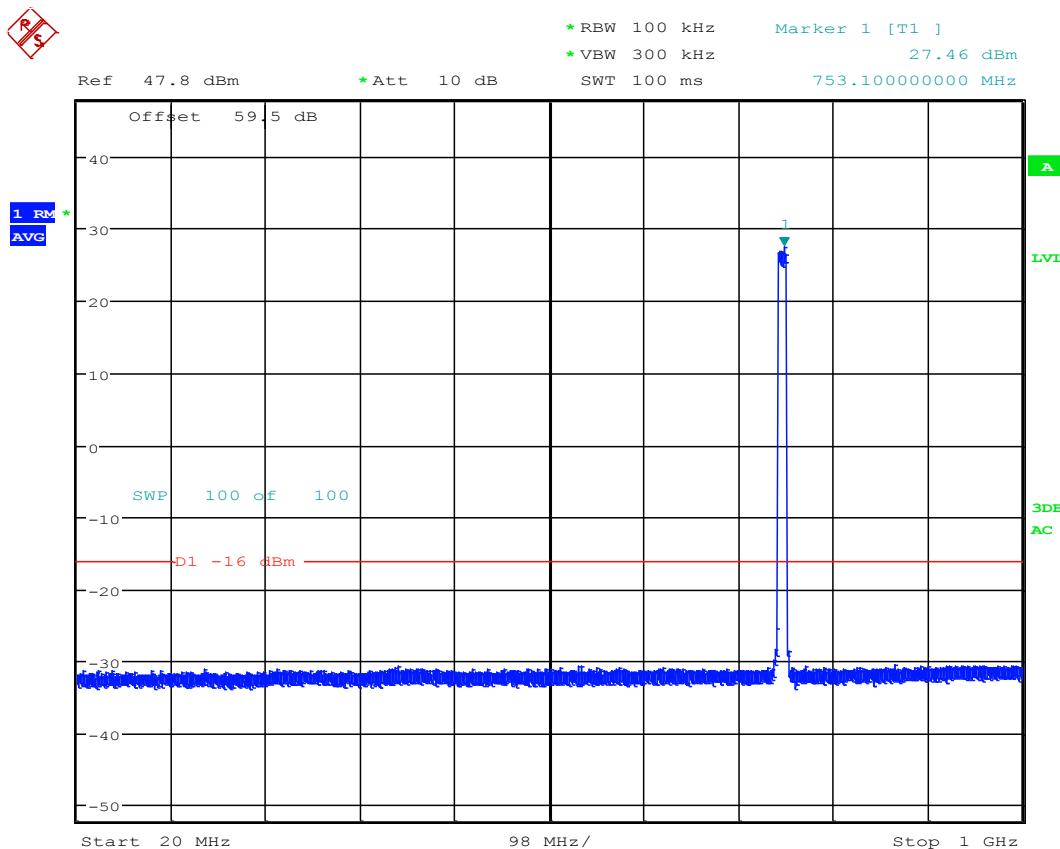
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:38:04

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



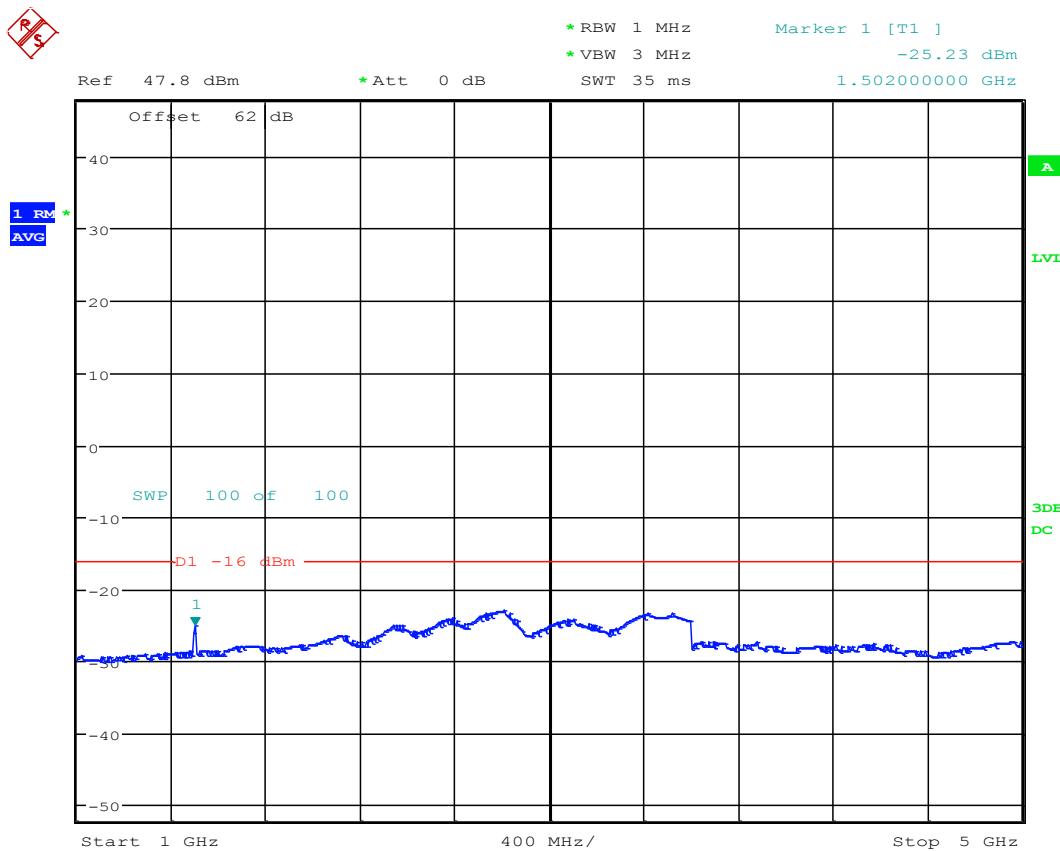
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:35:40

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



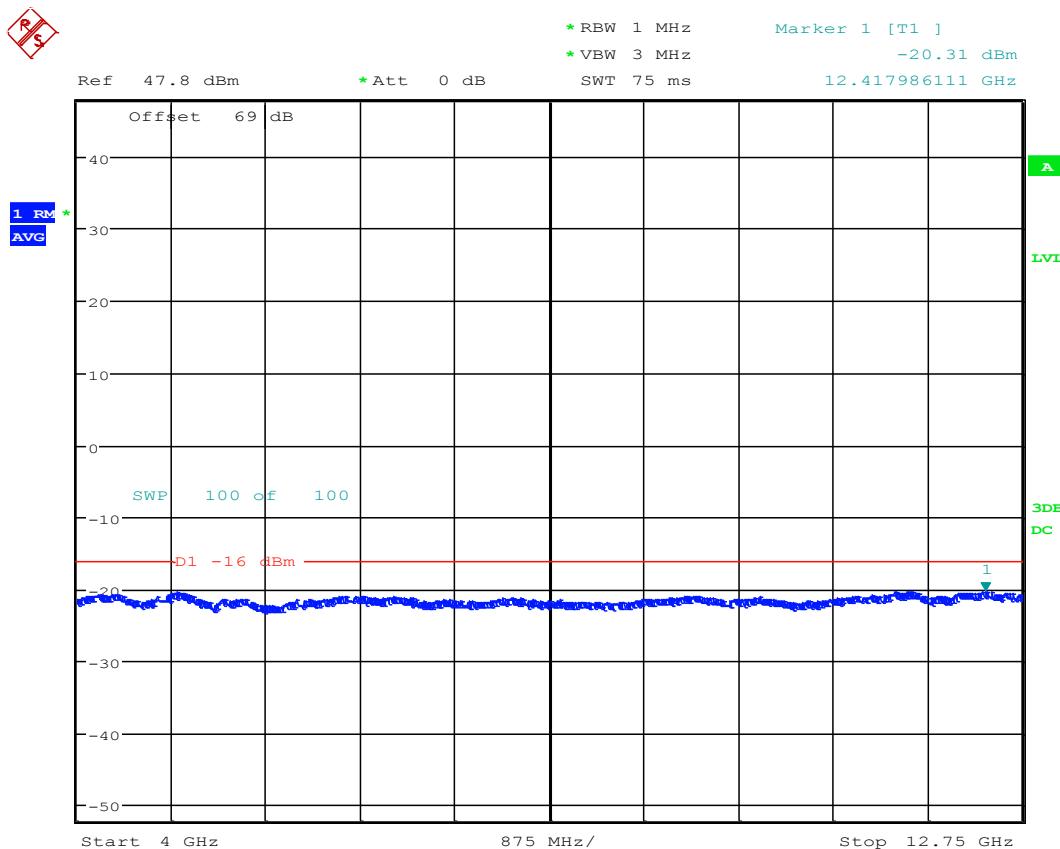
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:34:17

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



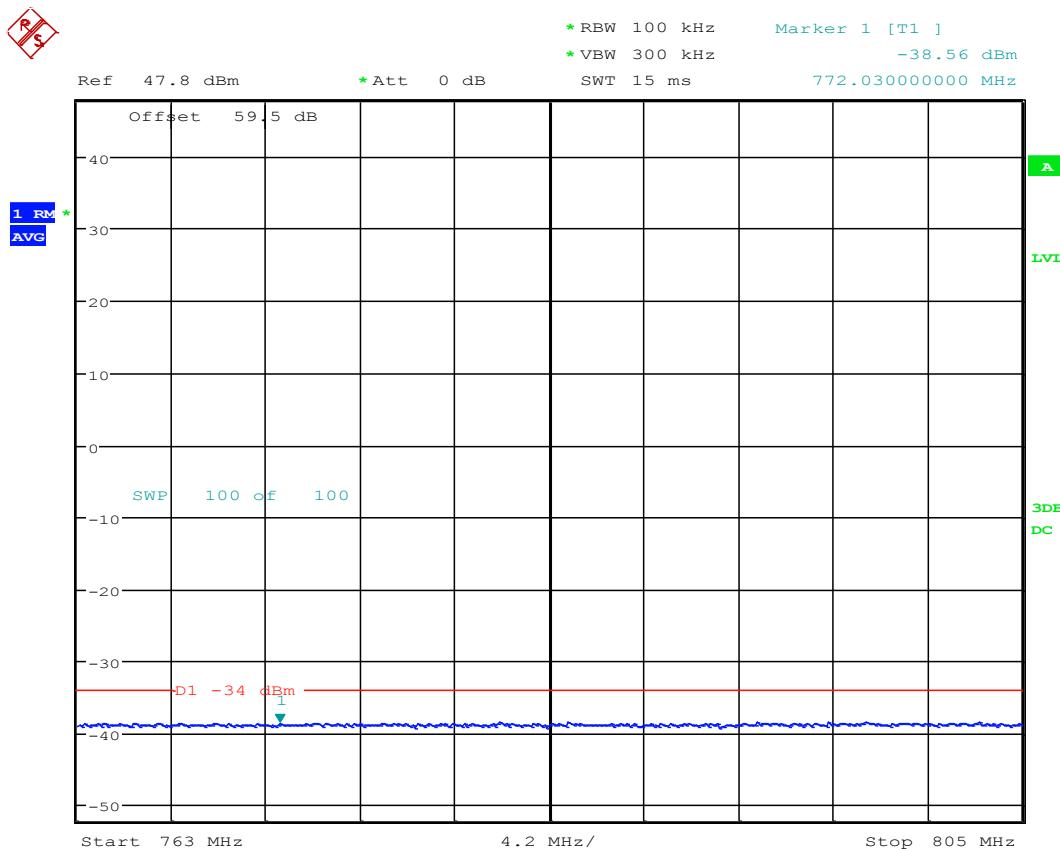
TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:33:00

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2



TX SPURIOUS EMISSIONS: TEST ENGINEER: SEG

RRH 4X30 B13; 751 MHz; 10 MHz BW

Date: 18.FEB.2015 10:31:35

Tatfook Filter; 64QAM Modulation; Carrier Power: 60W; 2x2 MIMO; FCC Part 27.53; FCCID: AS5BBTRX-23

Port #2

After adding 3 dB for MIMO, the limit for this range is -37 dBm

Sub-Exhibit 11.6

FIELD STRENGTH OF SPURIOUS RADIATION

SECTION 2.1053 and 27.53 (c) (f)

SECTION 2.1053**FIELD STRENGTH OF SPURIOUS RADIATION**

Field strength measurements of radiated spurious emissions were made at 3 m semi anechoic room of Global Product Compliance Laboratory of Alcatel-Lucent Murray Hill. A complete description and full measurement data for the site is on file with the Commission (FCC Site Registration #995653).

The “**B13 RRH 4x30**” with FCCID: AS5BBTRX-23” was tested with an RF output of **60W each for 2x60W configuration**. The radiated emissions tests were performed with the B13 4x30 RRH operating with 10 MHz bandwidth in the frequency block listed for Antenna terminal Conducted spurious emissions measurement. All tests were performed with the RRH operating in QPSK and 64QAM modulations, respectively. During testing, the RRH AICs were terminated with 50 ohm loads. The spectrum from 10 MHz to the 10th harmonic (13 GHz) of the carrier was searched for spurious radiation. Measurements were made according to ANSI C63.4.

All emissions more than 20 dB below the specification limit were considered not reportable (Section 2.1057(c)).

The calculated emission levels were found by:

$$\text{Measured level (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB)} = \text{Field Strength (dB}\mu\text{V/m)}$$

Section 2.1053 contains the requirements for the levels of spurious radiation as a function of frequency.

FCC Section 27.53(c 1): the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB or -13dBm. Pursuant to FCC OET RULESKDB 662911 D01 and D02 for two antenna MIMO mode of operations, the FCC limit of -13dBm shall be 3dB more stringent for two antennas. Therefore all channel edge and out of band spurious emissions limits shall be -16dBm for 2x60W configuration.

The reference level for the un-modulated carriers is calculated as the field produced by an ideal isotropic antenna excited by the transmitter output power according to the following relation taken from Recommendation ITU-R, SM.329-11, “*Unwanted emissions in the spurious domain*” January 2011.

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

$$20 \log (E*10^6) - (46 + 10 \log P) = 79.2 \text{ dB }\mu\text{V/meter}$$

E = Field Intensity in Volts/meter

P = Transmitted Power in Watts

R = Distance from the ideal isotropic antenna in meters = 3 m

RESULTS:

For this particular test, the field strength of any spurious radiation is required to be less than 79.2dB μ V/meter. Reportable measurements are equal to or greater than 59.2dB μ V/meter. Over the spectrum investigated, 10 MHz to 10th of the carrier (13 GHz), no reportable spurious emissions were detected. This demonstrates that the “**B13 RRH 4X30**” the subject of this application, complies with Sections 2.1053, 27.53 (c), (f) and 2.1057 of the Rules.

Sub-Exhibit 11.7

MEASUREMENT OF FREQUENCY STABILITY

SECTION 2.1055 and 27.54

Frequency Stability Testing was evaluated on the B25 RRH 4X30 with carrier frequency at 751 MHz. The testing was performed from 02/26/2015 through 02/27/2015 on the 700U B13 RRH4x30 P2, in the T-16 Thermal chamber of the GPCL test facility located in Bldg 4, Room 4-280, Murray Hill, NJ. The temperatures to which the UUT were subjected comprised high temperature (+50°C, system ambient) and low temperature (-30°C system ambient). The system level Frequency Stability testing of the UUT yielded results in compliance with established design criteria.

Frequency Stability performance was verified by measuring Frequency Tolerance at EAC using an MXA Signal Analyzer. Frequency Tolerance is a measurement of the difference between the actual transmit frequency and the assigned frequency (751MHz).

UUT: PRI04283 - 700U B13 RRH4x30, SN: LBALLU-YD1448001NA.

Frequency Block Tested: **PRI04283 - Asset 1.0 - RRH 4x30 B13 (CF =751MHz)**

1. (a) Set the power supply to nominal Voltage. (b) Record the frequency at $\sim 25^{\circ}\text{C}$. (c) Raise EUT operating temperature to 50°C . (d) Record the frequency difference. (e) Repeat step (d) at each 10°C step down to -30°C . Result will be 10 readings and take temperature readings to establish thermal stability at each point.

Baseline Measurement at $+25^{\circ}\text{C}$

Transmit Frequency Deviation at $+25^{\circ}\text{C}$ at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.786
0.5	1.048
1.0	0.633
1.5	1.506
2.0	0.752
2.5	1.544
3.0	1.833
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at $+50^{\circ}\text{C}$ at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.532
0.5	0.783
1.0	1.175
1.5	1.747
2.0	1.941
2.5	1.653
3.0	1.861
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at $+40^{\circ}\text{C}$ at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.743
0.5	0.996
1.0	1.091
1.5	1.816
2.0	0.307
2.5	0.841
3.0	1.463
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +30°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.261
0.5	1.503
1.0	1.072
1.5	0.846
2.0	1.149
2.5	1.887
3.0	0.962
FCC SPECIFICATION	±751 MHz (±0.05ppm) ±0.05ppm = ±37.55Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +20°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.607
0.5	1.579
1.0	1.411
1.5	0.798
2.0	0.703
2.5	0.886
3.0	1.792
FCC SPECIFICATION	±751 MHz (±0.05ppm) ±0.05ppm = ±37.55Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +10°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.921
0.5	1.818
1.0	0.736
1.5	1.614
2.0	0.958
2.5	1.044
3.0	1.421
FCC SPECIFICATION	±751 MHz (±0.05ppm) ±0.05ppm = ±37.55Hz
FCC RESULT	PASS

Transmit Frequency Deviation at 0°C at 100% of Nominal Voltage, -48VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.932
0.5	1.637
1.0	0.845
1.5	1.002
2.0	1.721
2.5	0.886
3.0	1.674
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at -10°C at 100% of Nominal Voltage, -48VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.958
0.5	1.133
1.0	0.786
1.5	1.033
2.0	0.682
2.5	1.136
3.0	1.649
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at -20°C at 100% of Nominal Voltage, -48VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.979
0.5	0.827
1.0	0.522
1.5	1.589
2.0	0.997
2.5	1.379
3.0	1.851
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at -30°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.766
0.5	1.991
1.0	1.003
1.5	1.405
2.0	1.841
2.5	0.905
3.0	1.922
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Upon return to +25°C.

2. At ambient, vary voltage to +15% and -15% of nominal and record frequency difference. Result will be 12 readings for each voltage (nominal, ~+ 3%, ~+6%, ~+9%, ~+12%, +15%, and nominal, ~- 3%, ~-6%, ~-9%, ~-12%, -15%).

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.241
0.5	1.083
1.0	1.998
1.5	0.574
2.0	0.946
2.5	1.263
3.0	0.745
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 103% of Nominal Voltage, -49.44VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.311
0.5	0.810
1.0	1.715
1.5	1.596
2.0	0.968
2.5	1.323
3.0	0.873
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 106% of Nominal Voltage, -50.88VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.257
0.5	0.823
1.0	0.499
1.5	1.522
2.0	1.954
2.5	1.401
3.0	0.968
FCC SPECIFICATION	±751 MHz (±0.05ppm) ±0.05ppm = ±37.55Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 109% of Nominal Voltage, -52.32VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.389
0.5	0.757
1.0	1.013
1.5	1.185
2.0	1.225
2.5	1.642
3.0	0.961
FCC SPECIFICATION	±751 MHz (±0.05ppm) ±0.05ppm = ±37.55Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 112% of Nominal Voltage, -53.76VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.019
0.5	0.972
1.0	0.687
1.5	1.002
2.0	1.165
2.5	0.650
3.0	1.611
FCC SPECIFICATION	±751 MHz (±0.05ppm) ±0.05ppm = ±37.55Hz
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 115% of Nominal Voltage, -55.20VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.183
0.5	1.216
1.0	0.749
1.5	1.128
2.0	1.652
2.5	1.177
3.0	0.598
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at 100% of Nominal Voltage, -48.0VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.251
0.5	0.784
1.0	1.843
1.5	1.581
2.0	1.064
2.5	0.906
3.0	1.318
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -3% of Nominal Voltage, -46.56VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.687
0.5	0.799
1.0	1.094
1.5	1.051
2.0	1.196
2.5	0.581
3.0	1.097
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -6% of Nominal Voltage, -45.12VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.765
0.5	1.104
1.0	0.887
1.5	1.492
2.0	1.311
2.5	1.705
3.0	1.035
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

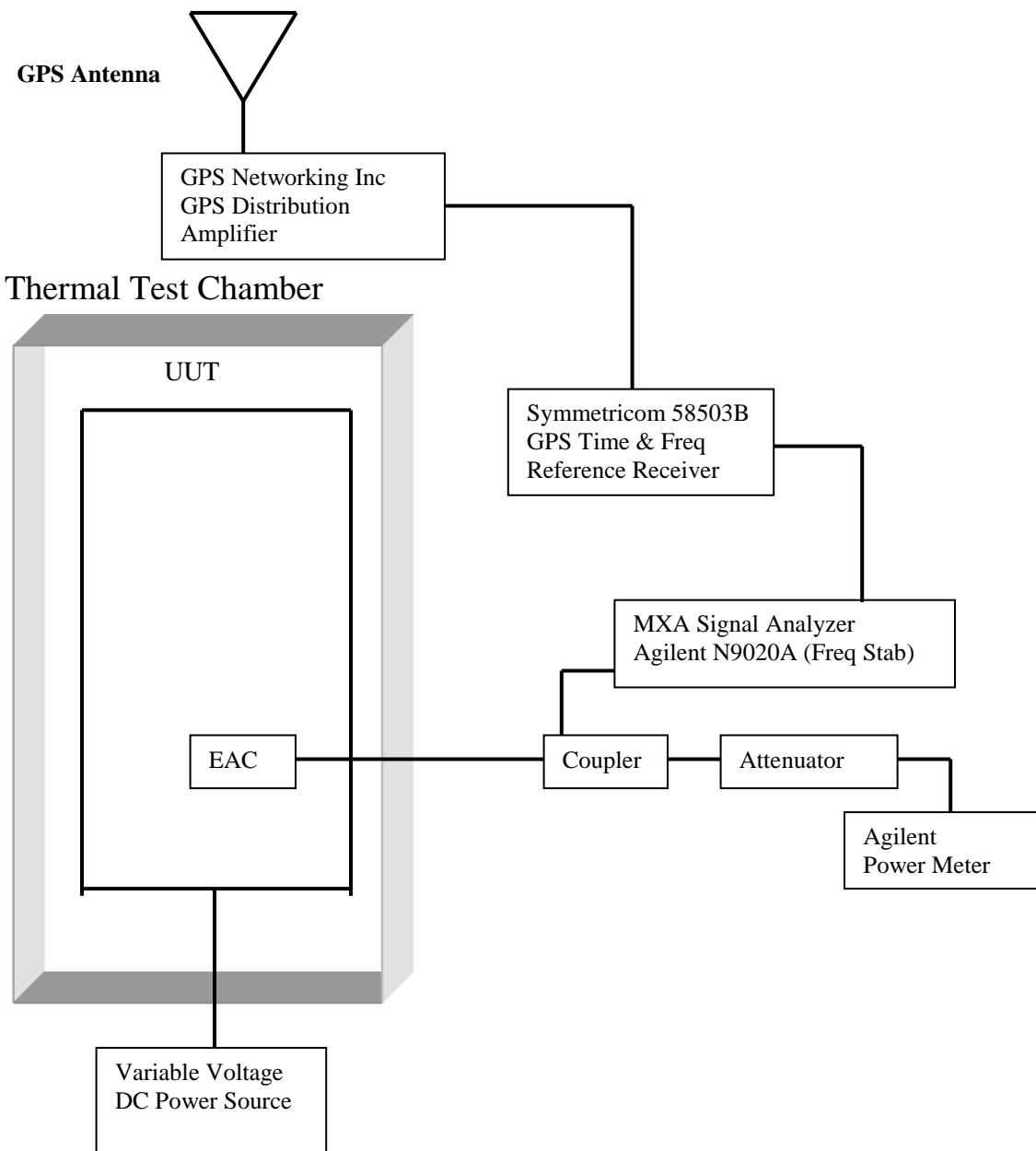
Transmit Frequency Deviation at +25°C at -9% of Nominal Voltage, -43.68VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	0.836
0.5	1.012
1.0	1.157
1.5	0.583
2.0	1.131
2.5	0.814
3.0	0.966
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -12% of Nominal Voltage, -42.24VDC

Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.108
0.5	1.371
1.0	0.736
1.5	1.152
2.0	0.627
2.5	1.101
3.0	1.283
FCC SPECIFICATION	$\pm 751 \text{ MHz} (\pm 0.05\text{ppm})$ $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

Transmit Frequency Deviation at +25°C at -15% of Nominal Voltage, -40.80VDC	
Time (minutes)	Transmit Carrier Deviation (Hz)
0	1.221
0.5	0.989
1.0	0.854
1.5	1.043
2.0	1.061
2.5	1.622
3.0	1.747
FCC SPECIFICATION	±751 MHz ($\pm 0.05\text{ppm}$) $\pm 0.05\text{ppm} = \pm 37.55\text{Hz}$
FCC RESULT	PASS

FIGURE 1: TEST SET-UP

Sub-Exhibit 11.8

Measurement Instrumentation and Antennas

SECTION 2.947 (d)

All instrumentations, antennas and test Chamber used for the purpose of tests contained in the report were in calibration and calibrations are traceable to NIST

TEST INSTRUMENTATION

OCCUPIED BANDWIDTH/SPURIOUS EMISSIONS

Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
Weinschel	48-30-33	AY8323	Attenuator	DC-18GHz 100 Watt	E961	N/A	N/A	Active
Hewlett Packard	8481A	US372900 01	Power Sensor	10MHz-18GHz	E267	6/30/2014	12	Active
Hewlett Packard	778D	18655	Directional Coupler	Dual 0.1-2.0GHz 20dB	E1122	N/A	N/A	Active
Rohde & Schwarz	ESU40	100246	Test Receiver	EMI 20Hz-40GHz -155 to +30dBm	E954	7/10/2014	24	Active
Hewlett Packard	437B	3110A037 95	RF Power Meter		E206	6/17/2014	24	Active
Weinschel	47-10-34	BX8022	Attenuator	10dB, 50 Watt	E820	1/24/2014	24	Active
Weinschel	66-20-34	BW7319	Attenuator	20dB 150W DC-18GHz	E816	1/13/2014	24	Active
Agilent	N9020A	MY52091 829	MXA Signal Analyzer	20Hz-26.5GHz Analyzer	Customer Equipment	7/21/2013	24	Active

SPURIOUS RADIATION

Manufacturer	Model	Serial Number	Type	Description	GPCL ID	Last Cal	Interval	Status
A.H. Systems Inc.	SAS-521-2	457	Biological Antenna	25 - 2000 MHz	E766	12/29/2014	24	Active
Weinschel	2-6	BX3433	Attenuator	6 dB DC-18GHz 5 Watt	E888	3/5/2014	24	Active
Sonoma Instrument Co.	310	185794	Amplifier	9 KHz-1GHz	E507	6/17/2014	24	Active
Hewlett Packard	8593E	3926A04192	Spectrum Analyzer	9 KHz-22 GHz	E454	4/17/2014	24	Active
Rohde & Schwarz	ESIB40	100044	Test Receiver	EMI (20Hz to 40 GHz)-150 +30dBm	E567	2/7/2014	24	Active
Agilent	8449B	3008A01740	Amplifier	Pre-Amplifier 1-26.5GHz	E1166	1/17/2014	24	Active
ETS Lindgren	3117	00135194	Horn Antenna	Double-Ridged Waveguide Horn 1-18 GHz	E1074	11/25/2014	24	Active

FREQUENCY STABILITY

Instrument Type	Serial Number	Vendor	Cal Due Date
MXA	MY52091035	AGILENT N9020A Signal Analyzer	10/30/2016
Power Meter	MY40511034	AGILENT E4419B	03/12/2015
Power Sensor	US39211924	AGILENT E9300A	09/17/2015
Multimeter	JP35001820	HP 971A	06/10/2015
Power Supply	10C4316B	TDK LAMBDA, MODEL GEN 60-250	N/A