

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

## **TEST REPORT**

**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-01**, 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:

Measurement: 1	Section 2.1046	RF Power Output - See Measurement 3
Measurement: 2	Section 2.1047	Modulation Characteristics
Measurement: 3	Section 2.1049	(a) Emissions Bandwidth (b) Occupied Bandwidth
Measurement: 4	Section 2.1051	Spurious Emissions at Antenna Terminals
Measurement: 5	Section 2.1053	Field Strength of Spurious Radiation
Measurement: 6	Section 2.1055	Measurement of Frequency Stability
	Section 2.1057	Frequency Spectrum to be Investigated

## **Measurement 1**

### **FCC Section 2.1046**

#### **RF Power output**

Refer to Measurement 3 Occupied Bandwidth Measurement during that measurement RF Output was continuously monitored.

## **Measurement 2**

### **FCC 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 plot 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 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) 16 Quadrature amplitude modulation (QAM): In 64QAM: The 64QAM is similar to 16QAM and there will be 64 states and 6 bits are available to represent a symbol.

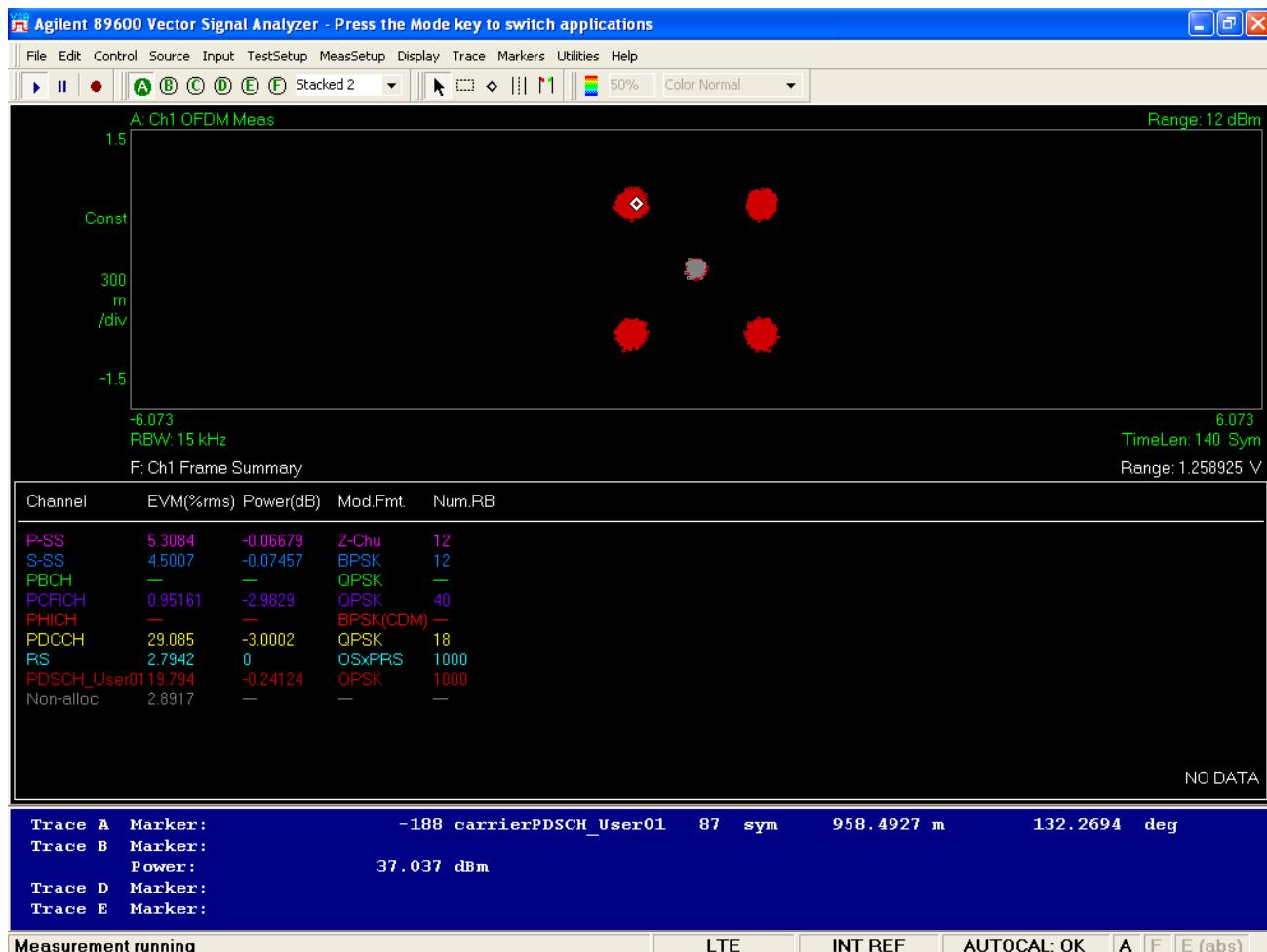
APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

QPSK MODULATION

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



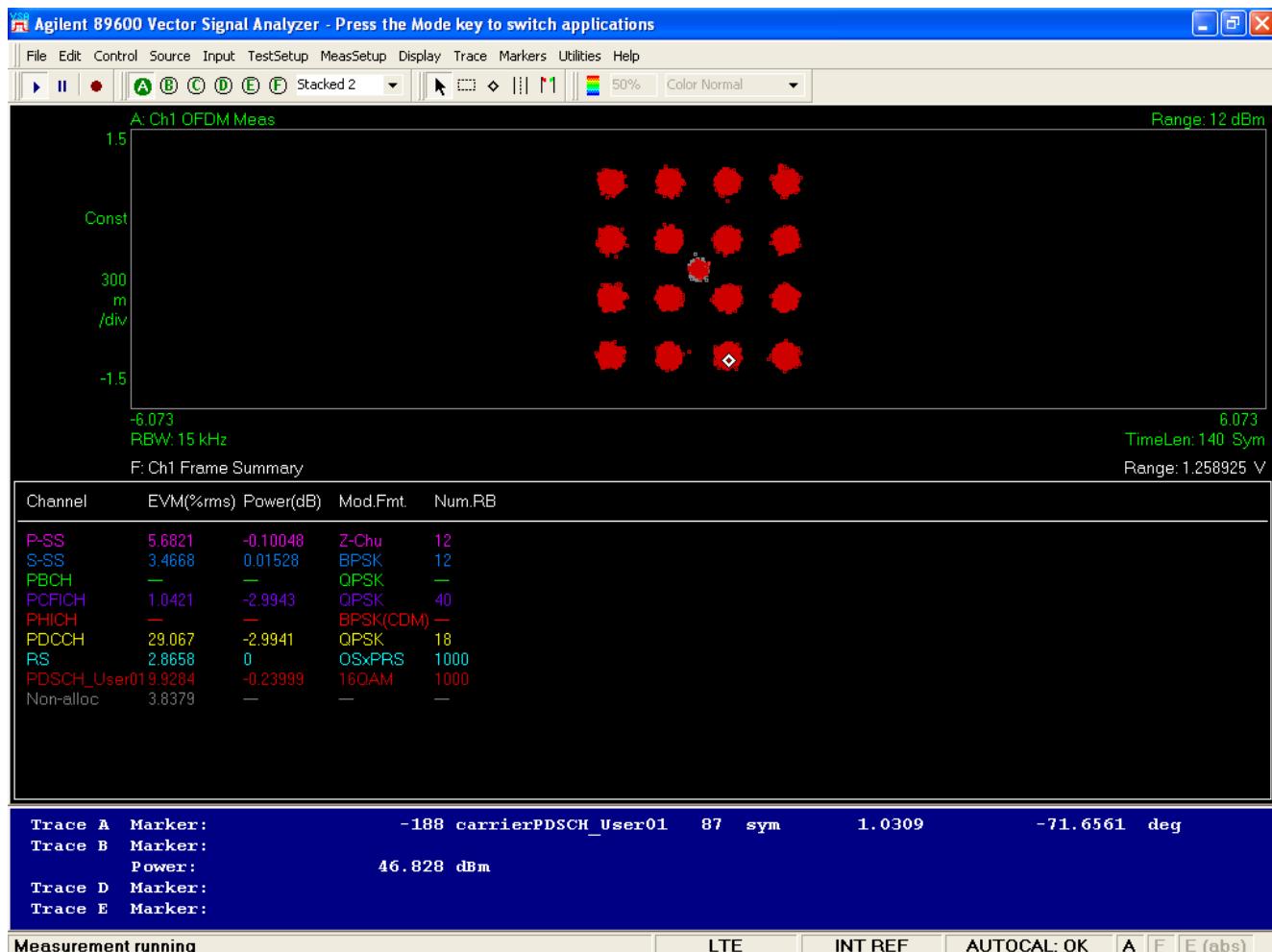
APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

16QAM MODULATION

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



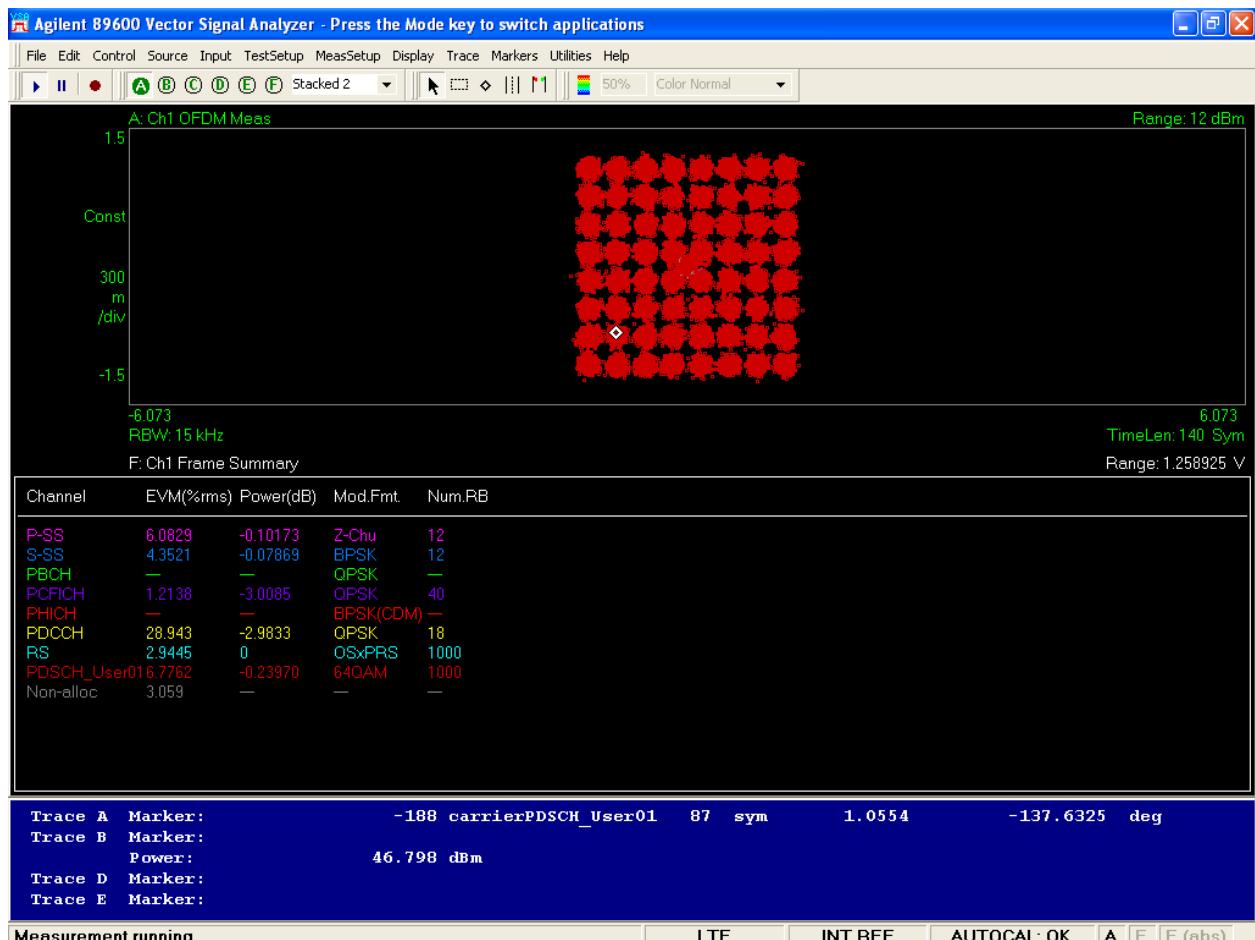
APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

**64QAM MODULATION**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



LTE

FCC Part 27.53 Block C; 64QAM Modulation; TDRU PWR: 40 (2x40W MIMO)

FCCID: AS5BBTRX-01

TEST ENGINEER: SEG

## **Measurement 3**

### **FCC Section 2.1049**

- (a) Emissions Bandwidth Measurement
- (b) Occupied Bandwidth Measurement showing spurious Emissions 100 kHz close to Block edges.

# **Spectrum Bandwidth Measurement For Emissions Type**

**FCC approves two measurement methods for Spectrum Bandwidth.**

- (A) 99% Bandwidth
- (B) 26 dB Band width.

**Both methods were used to measure the bandwidth at modulations and highest is recorded. The modulations used are:**

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

Highest Bandwidth is used for Emissions type designation: 9.38 MHz

Therefore Emissions Type: **9M38F9W**

**(a) MEASUREMENT OF SPECTRUM BANDWIDTH  
(99% POWER BANDWIDTH)**

**(a) MEASUREMENT OF  
SPECTRUM BANDWIDTH  
For Emissions Type**

The emissions bandwidth is not provided in the section 27.53 for 700 MHz bands. The spectrum bandwidth of the Long Term Evolution (LTE) were measured using 8563E Spectrum Analyzer is designed to measure 99% power bandwidth. The measurements were made for the channel center frequency of 751 MHz with 10 MHz bandwidth.

The measurements were made on a “**9412 eNodeB Compact**” indoor cabinet in following modulation configurations:

1. QPSK
2. 16 QAM
3. 64 QAM

This measurement also determines emission type.

**Results:**

The plots are provided for QPSK, 16QAM and 64QAM modulations for 10 MHz band.

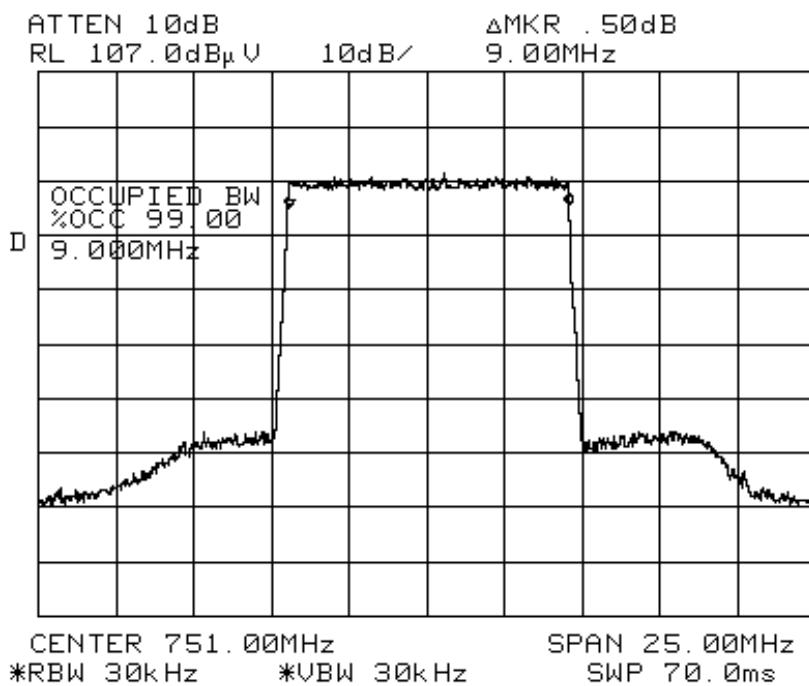
The Measured 99% power bandwidth is 9.37 MHz for Block C 10 MHz band.

**Block: C**

**10 MHz Bandwidth**

**QPSK Modulation**

**(99% Power Bandwidth)**



Test: 99% OCC-BW  
EUT: LTE Phase IV  
FCCID: AS5BBTRX-01  
RF Power: 40.0 Watts  
Modulation: QPSK  
CF: 751 MHz  
Engineer: SEG  
Date: 4/22/09

**Block: C**

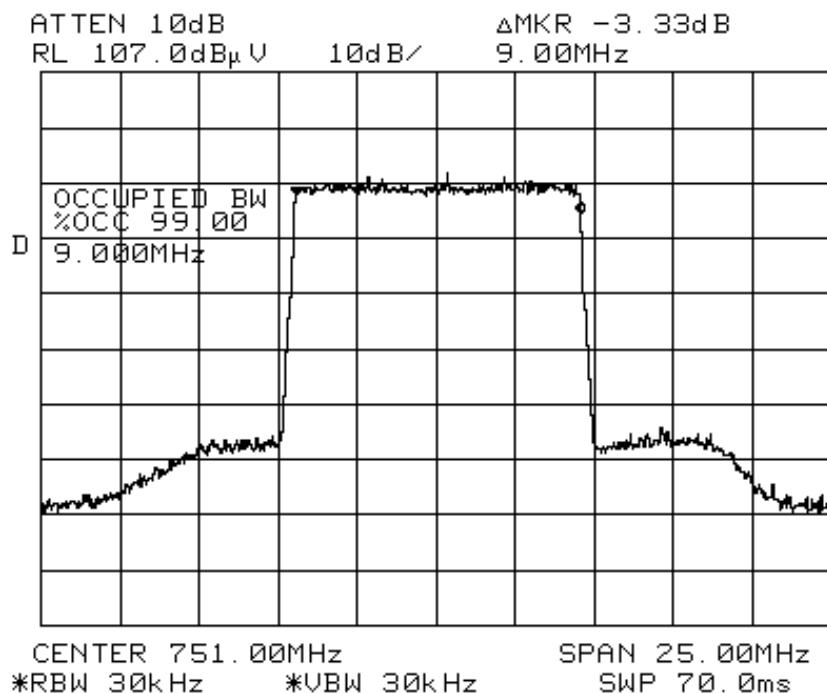
**10 MHz Bandwidth**

**16 QAM Modulation**

**(99% Power Bandwidth)**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



Test: 99% OCC-BW  
EUT: LTE Phase IV  
FCCID: AS5BBTRX-01  
RF Power: 40.0 Watts  
Modulation: 16QAM  
CF: 751 MHz  
Engineer: SEG  
Date: 4/22/09

**Block: C**

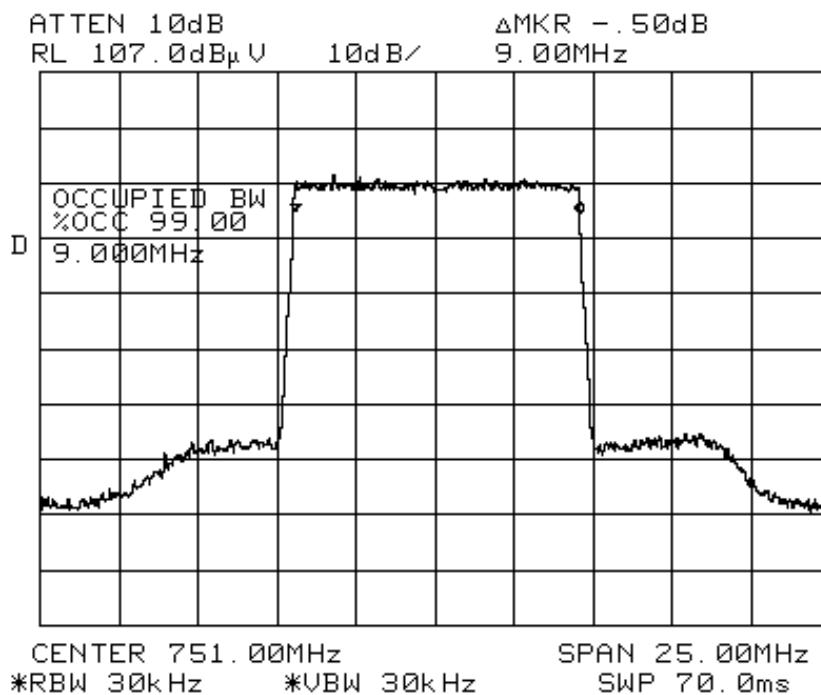
**10 MHz Bandwidth**

**64 QAM Modulation**

**(99% Power Bandwidth)**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



Test: 99% OCC-BW  
EUT: LTE Phase IV  
FCCID: AS5BBTRX-01  
RF Power: 40.0 Watts  
Modulation: 64QAM  
CF: 751 MHz  
Engineer: SEG  
Date: 4/22/09

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

**MEASUREMENT OF SPECTRUM BANDWIDTH  
26 dB POWER BANDWIDTH**

**(b) MEASUREMENT OF  
SPECTRUM BANDWIDTH  
For Emissions Type**

The occupied bandwidth of the Long Term Evolution (LTE) is measured using a Rohde & Schwarz ESI Spectrum Analyzer/Receiver and an HP Model 520 DeskJet Printer. The emissions bandwidth is not provided in the section 27.53 for 700 MHz bands. Therefore emissions band width provided in section 27.53 (g) (1) is used. Accordingly “The emissions bandwidth 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 at least 26dB below the transmitter power.”

The measurements were made on a “**9412 eNodeB Compact**” indoor cabinet in following configurations:

1. QPSK
2. 16 QAM
3. 64 QAM

**Results:**

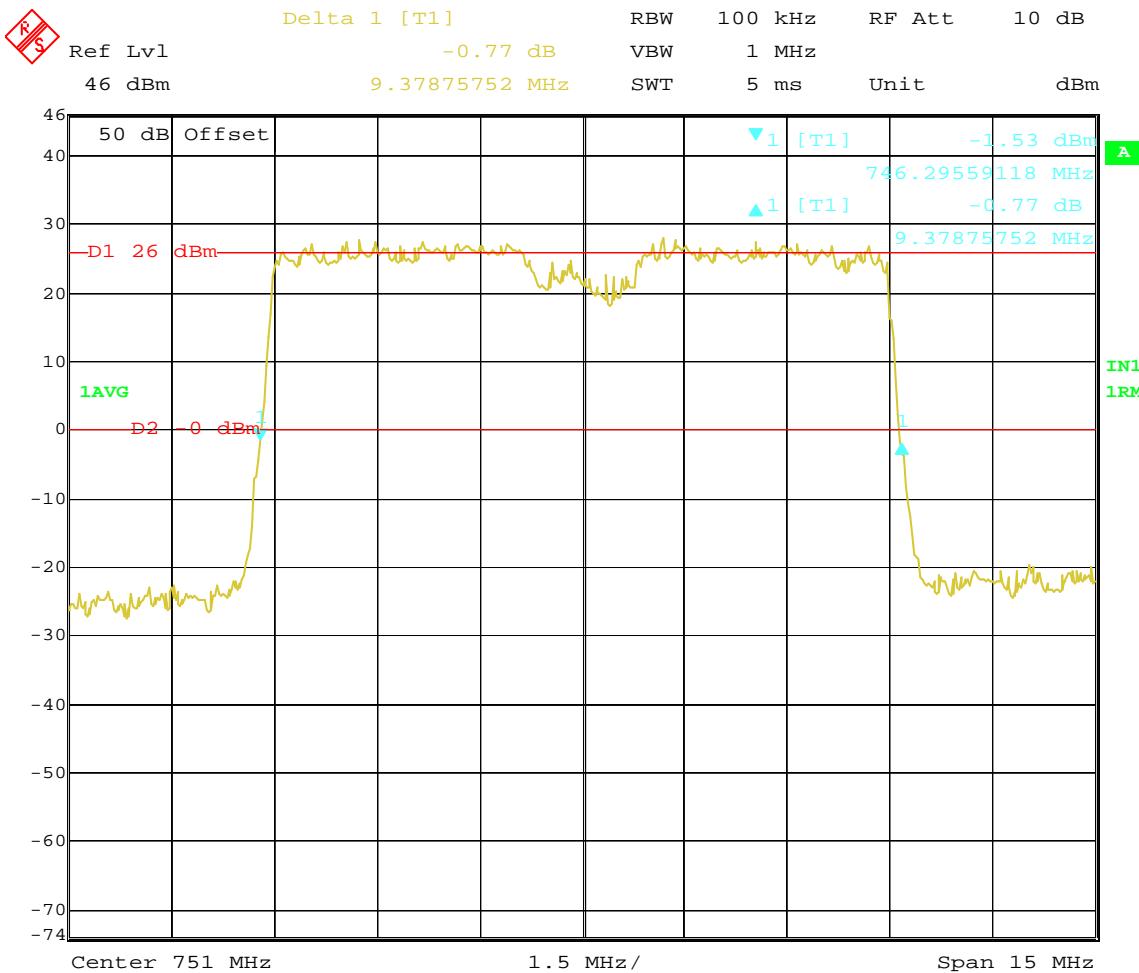
The plots are provided for QPSK, 16QAM and 64QAM modulations for 10 MHz band.  
The Measured 26dB emissions bandwidth is 9.38 MHz for Block C 10 MHz band.

**Block: C**

**10 MHz Bandwidth**

**QPSK Modulation**

**(26dB Bandwidth)**



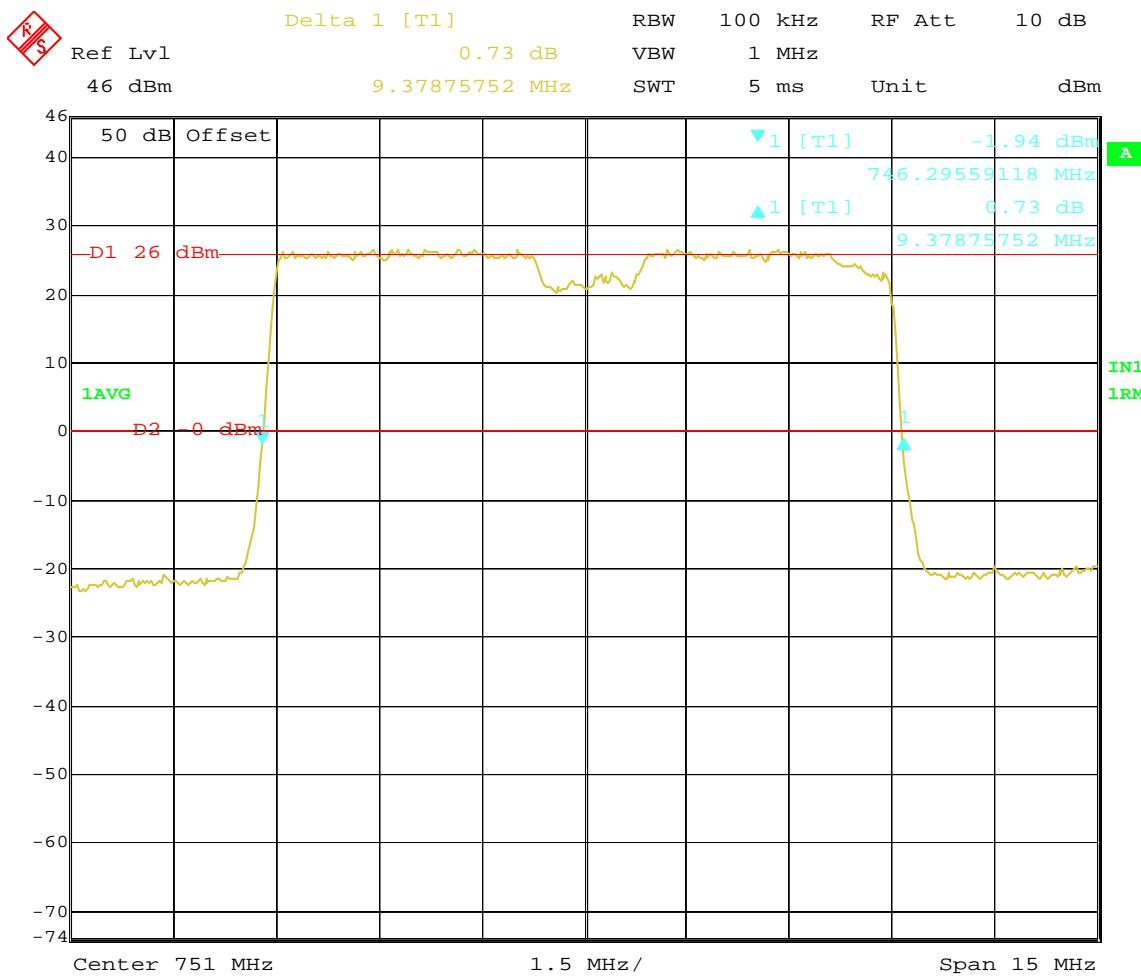
Title: 26dB BANDWIDTH; Test Engineer: SEG  
 Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40  
 (2x40W MIMO); FCCID: AS5BBTRX-01  
 Date: 24.APR.2009 08:02:26

**Block: C**

**10 MHz Bandwidth**

**16 QAM Modulation**

**(26dB Bandwidth)**



**Block: C**

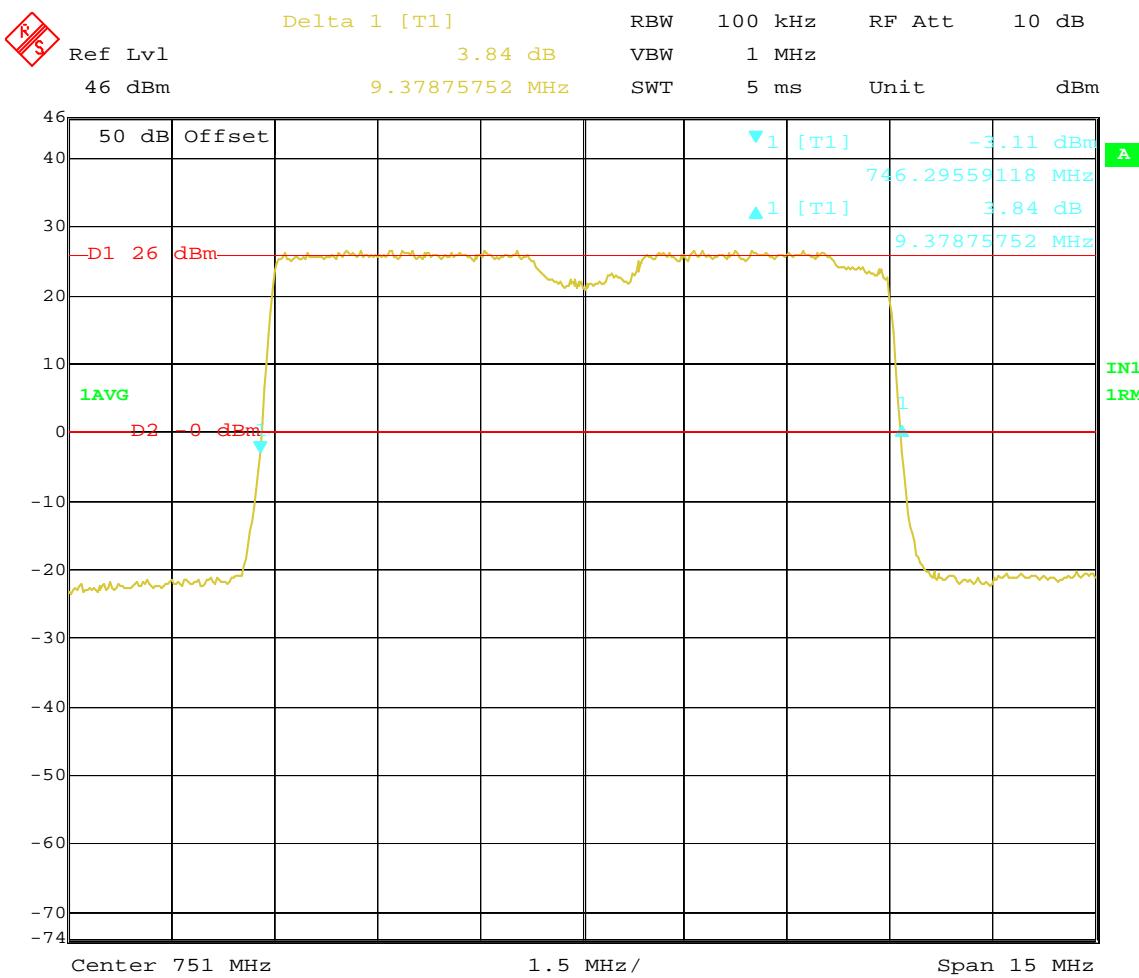
**10 MHz Bandwidth**

**64 QAM Modulation**

**(26dB Bandwidth)**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



Title: 26dB BANDWIDTH; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 11:41:23

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

**Section 27.53 (C) (5)**

## **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) 700 MHz TRDU was measured using a Rohde & Schwarz ESI Spectrum Analyzer/Receiver and an HP Model 520 DeskJet Printer. The RF power level was continuously measured using RF power meter as shown in the test setup in Figure A. The RF output from the EAC port to spectrum analyzer was reduced (to an amplitude usable by the spectrum analyzer) by using a calibrated attenuator. This attenuation was offset on the display and the signal for single carrier was adjusted to the corrected RF power level for a 100 kHz resolution bandwidth for 10 MHz wide transmit signal. 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 “**9412 eNodeB Compact**” indoor cabinet.

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 40 Watts (46.0 dBm)/carrier.

*The frequencies and blocks used were tabulated on the bottom of each plot. The output signals at RF filter (EAC) were plotted at each frequency/block. The LTE 700 MHz TRDU is capable of operating in the band of 746 to 756 MHz (Block C). The TRDU presently tested was configured to operate in Block C only. Plots were provided for a single carrier. These frequencies were chosen to show the occupied bandwidth in the block in the frequency band in which this radio can be operated.*

**Block edge requirements:**

*FCC Section 27.53(c)(5): Based on measurement instrument employing resolution bandwidth of 100 kHz bands or greater out band shall be attenuated at least  $43+10\log(P)$  dB or -13dBm. However in 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.*

**Note:** Since the LTE frame passes with 100 kHz resolution bandwidth 30 kHz resolution bandwidth was not used.

The list of band, channels, RF filters (EAC) and Amplifiers tested are listed below:

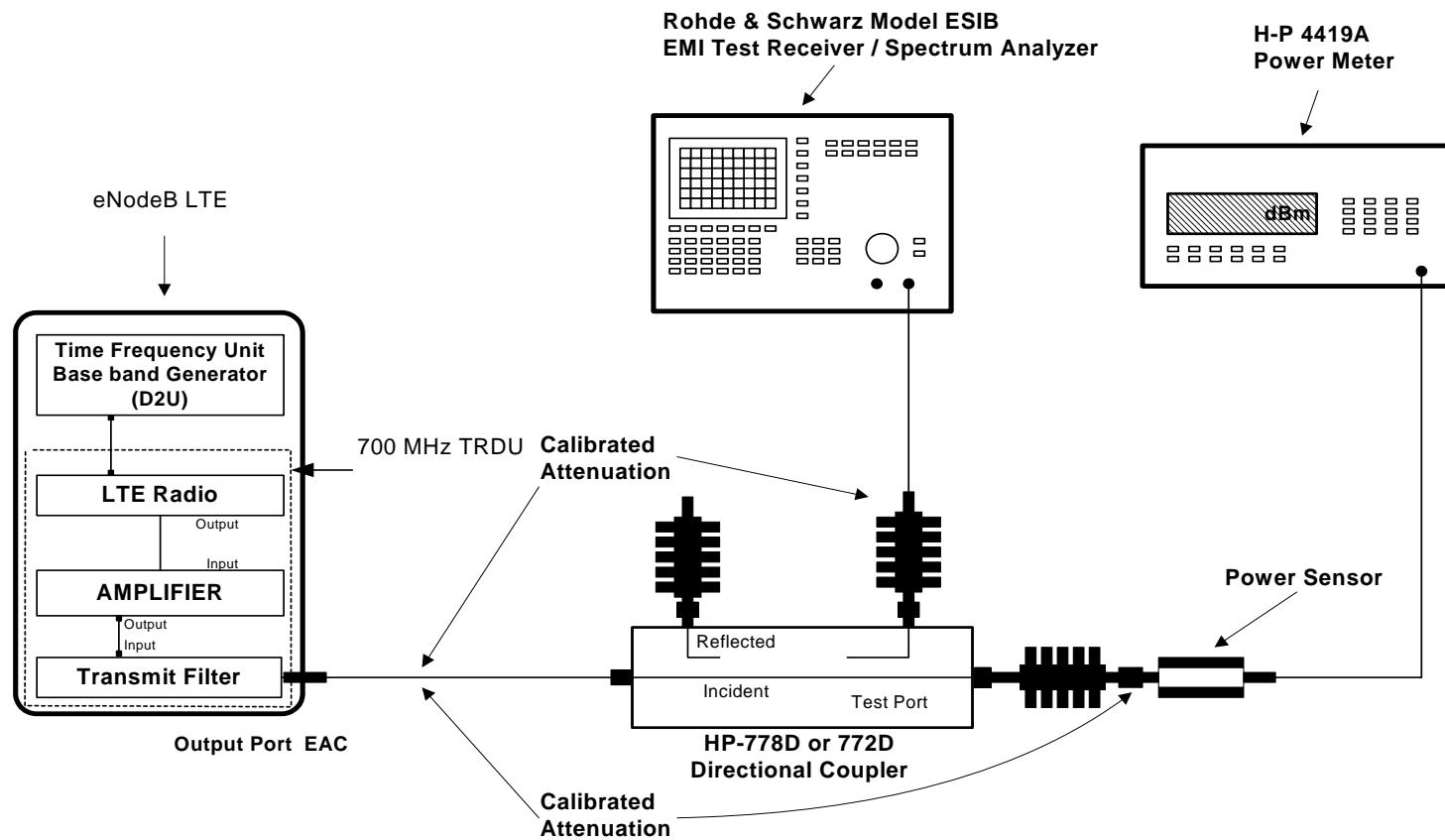
Band	Block	Frequency (MHz)	Mode	RF Filter Manufacturer	Amplifier	Power (Watts)
	FCC Block C	746-756	eNodeB	Andrews	Andrews	40

**Measurement uncertainty:**

Frequency: 100 Hz

Amplitude: 0.5 dB

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

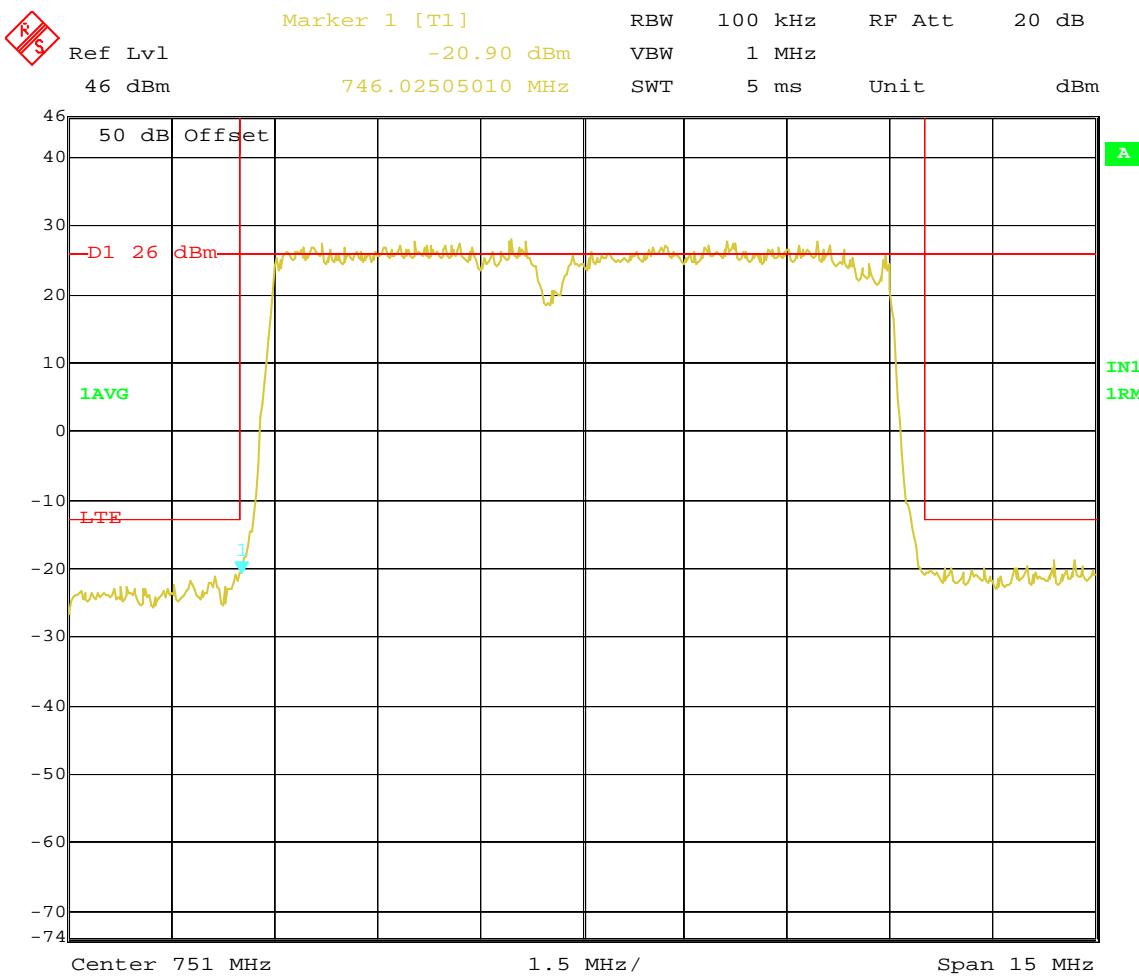


All components are calibrated over the frequency range of interest

**Block: C**

**QPSK Modulation**

**SPECTRUM MASK/OCCUPIED BANDWIDTH**



Title: OCCUPIED BANDWIDTH; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W (2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 07:57:39

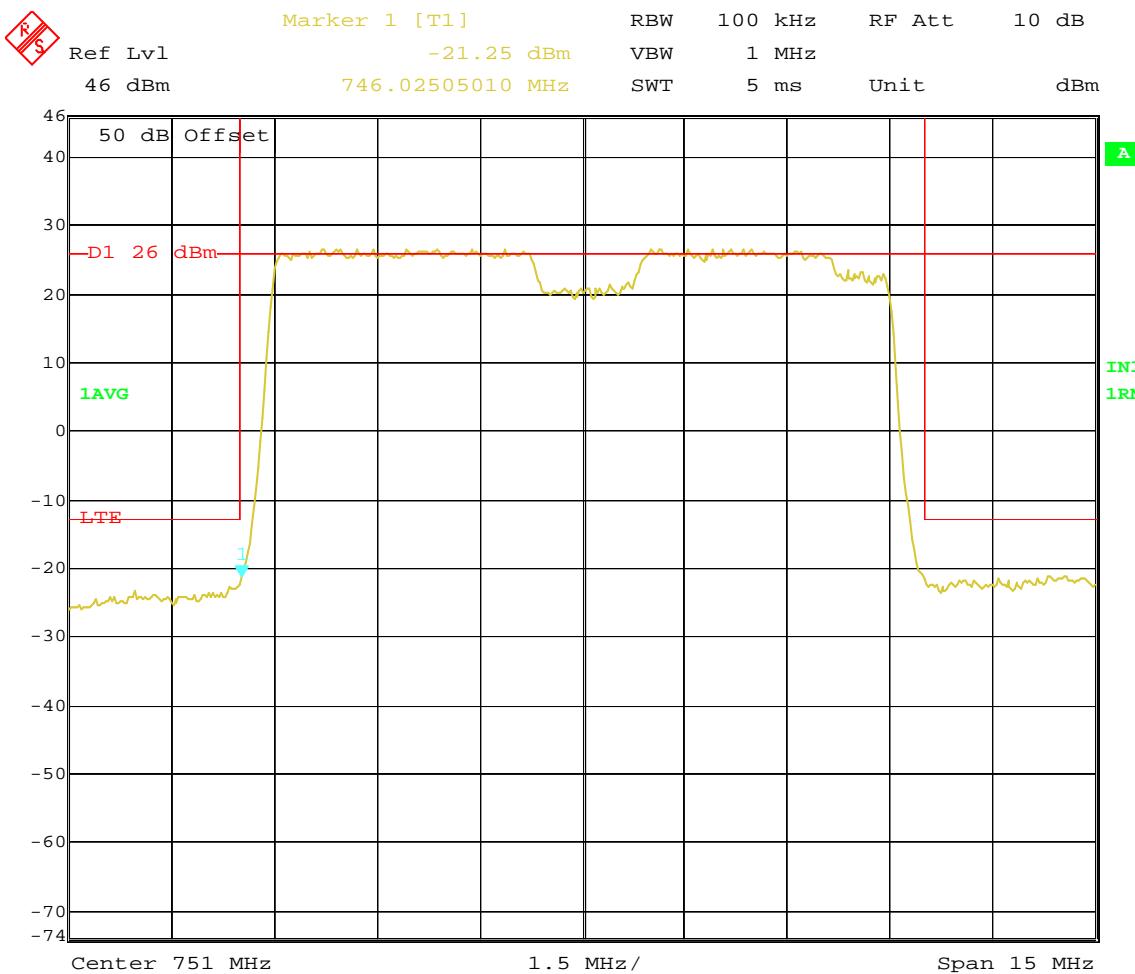
**Block: C**

**16 QAM Modulation**

**SPECTRUM MASK/OCCUPIED BANDWIDTH**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



Title: OCCUPIED BANDWIDTH; Test Engineer: SEG

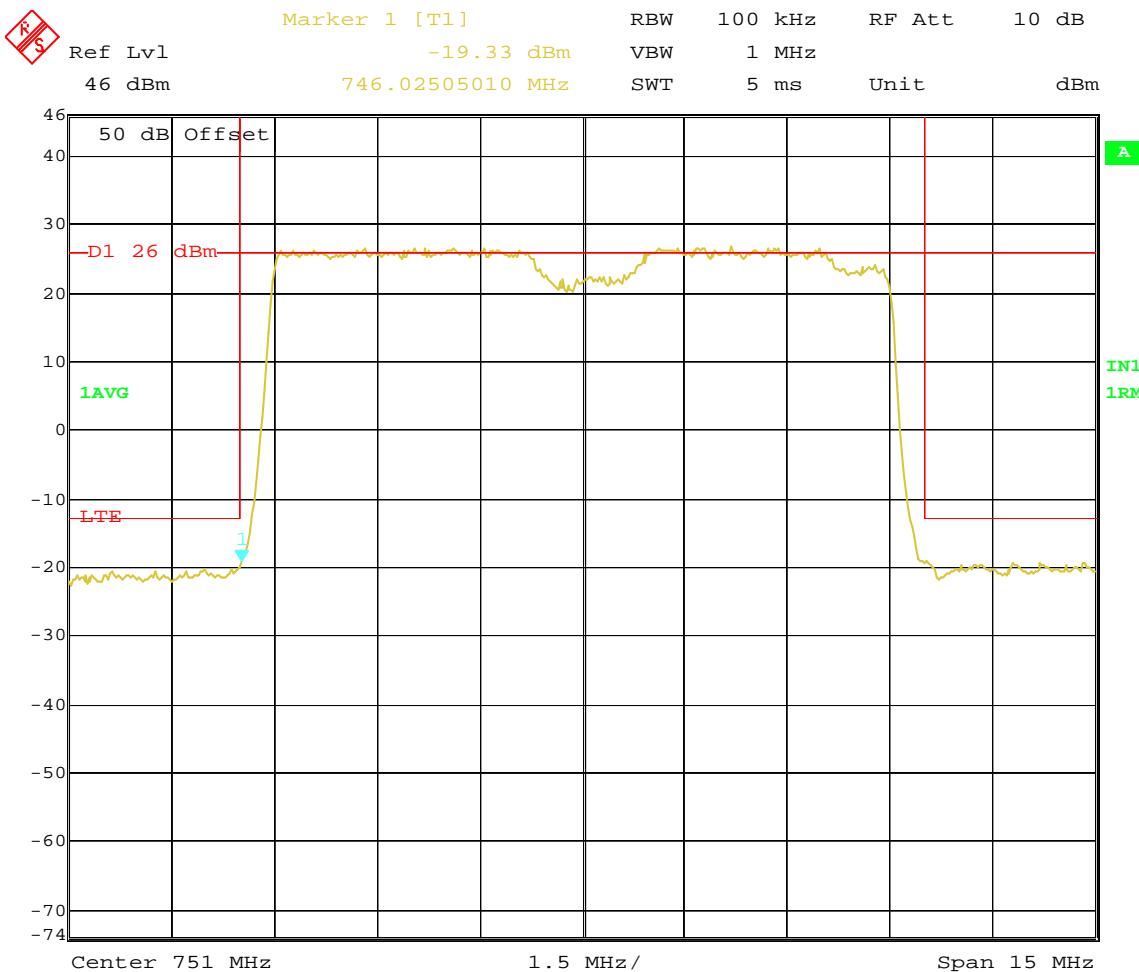
Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 10:38:27

**Block: C**

**64 QAM Modulation**

**SPECTRUM MASK/OCCUPIED BANDWIDTH**



Title: OCCUPIED BANDWIDTH; Test Engineer: SEG  
 Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
 (2X40W MIMO); FCCID: AS5BBTRX-01  
 Date: 24.APR.2009 11:54:57

## **Measurement 4**

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

## **Measurement -4**

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

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

### Spurious Emissions at Transmit Antenna Terminals

Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 9 kHz to the 12.5 GHz. The test setup is as described in Figure A. Measurements were made using a Rohde & Schwarz ESI 40 (9 kHz to 40 GHz) EMI Test receiver and a HP Model 520 DeskJet Printer. 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 A. The required emission limitation is specified in 27.53(c). All measurements were made for 40W per carrier, at external antenna connector (EAC) terminals. The measured spurious emission levels were plotted for the frequency range 9 kHz to 12.5 GHz. The measurements were made using following receiver parameters:

Frequency Range	Resolution Bandwidth	Detector Function
9 kHz to 150 kHz	1 kHz	Peak
150 kHz to 30 MHz	10 kHz	Peak
30 MHz to 1 GHz	100 kHz	Peak
1 GHz to 12.5 GHz	1 MHz	Peak

The list of band, channels, RF filters and Amplifiers tested are listed below:

Band	Block	Frequency (MHz)	Mode	RF Filter Manufacturer	Amplifier	Power (Watts)
	C	746-756	eNodeB	Andrews	Andrews	40

**FCC Section 27.53(c)(1) and (5): Based on measurement instrument employing resolution bandwidth of 100 kHz bands or greater out band emissions shall be attenuated at least  $43 + 10\log(P)$  dB or -13dBm. However in 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.**

**47CFR Ch1 (10-1-08) Edition): FCC Section 27.53(c)(3) and (5): Based on measurement instrument employing resolution bandwidth of 6.25 kHz bands or greater on all frequencies 763 to 775 MHz and 793 to 805 MHz shall be attenuated at least  $76 + 10\log(P)$  dB or -46 dBm/6.25 kHz or -44dBm/10kHz.**

The tests were performed in following modulation configurations:

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

### RESULTS:

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

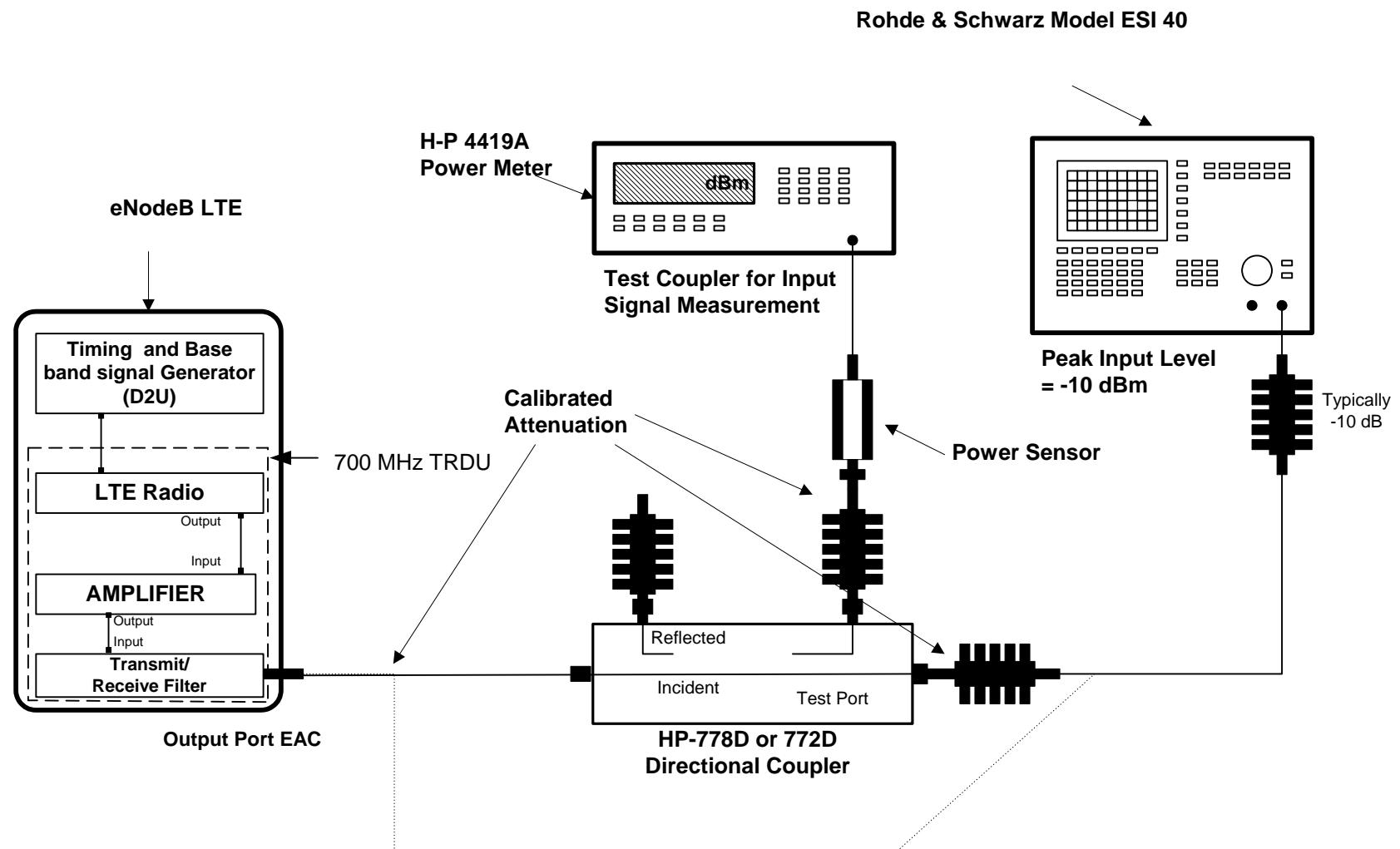
20 MHz to 1 GHz: Frequency = 100Hz, Amplitude = 0.5 dB

1 GHz to 10 GHz: Frequency = 10 kHz, Amplitude = 0.5 dB

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

## Figure A. TEST CONFIGURATION FOR CONDUCTED SPURIOUS



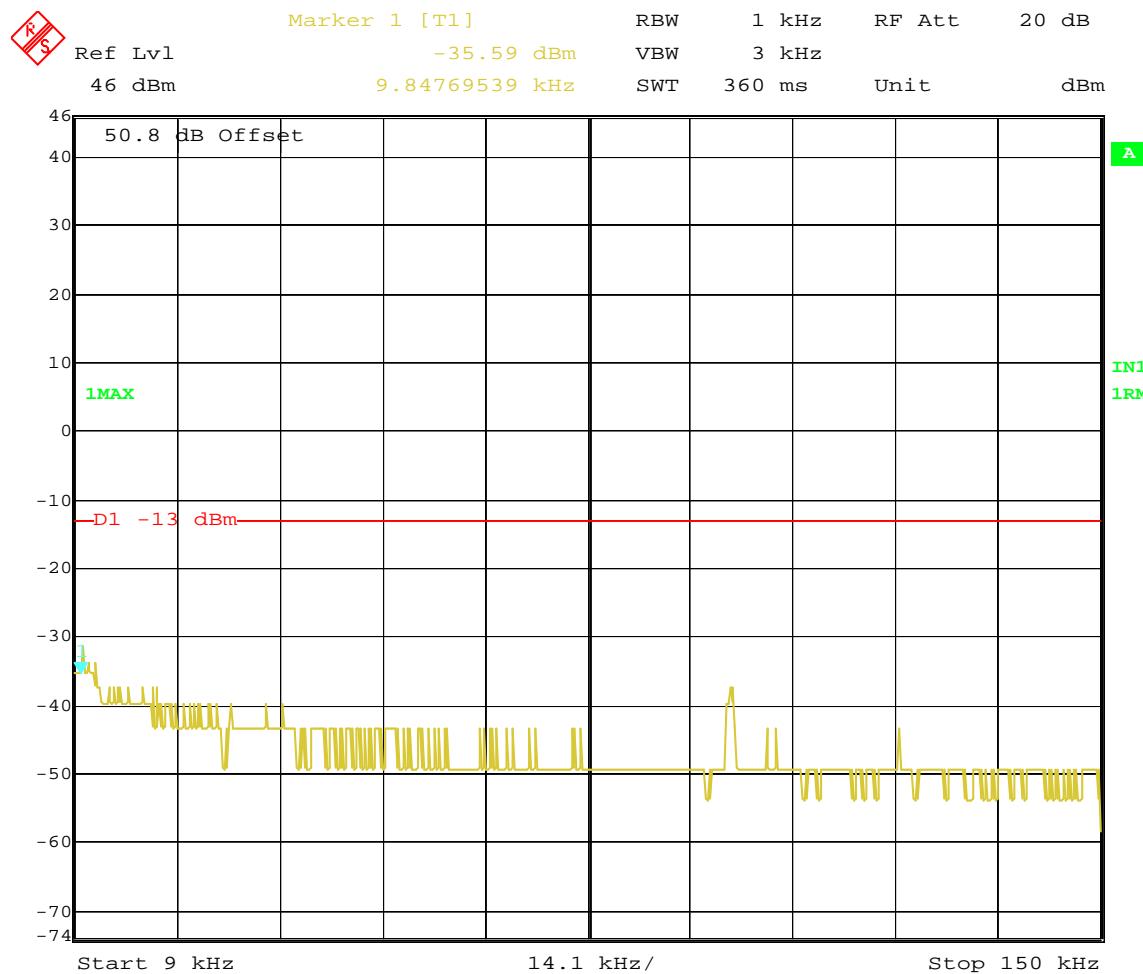
**Transmit Port  
Antenna Conducted Spurious Emissions**

**Block: C**

**QPSK**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



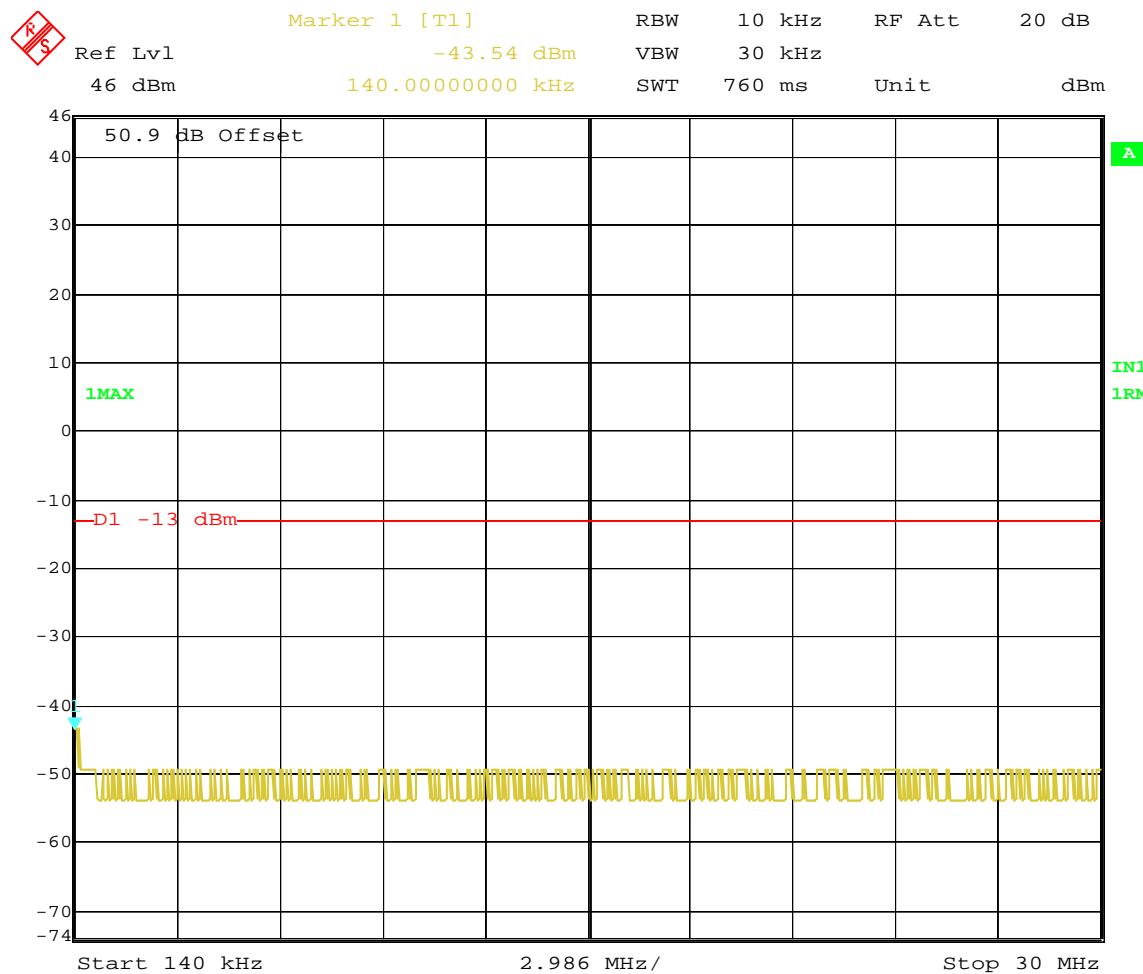
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 08:30:41

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



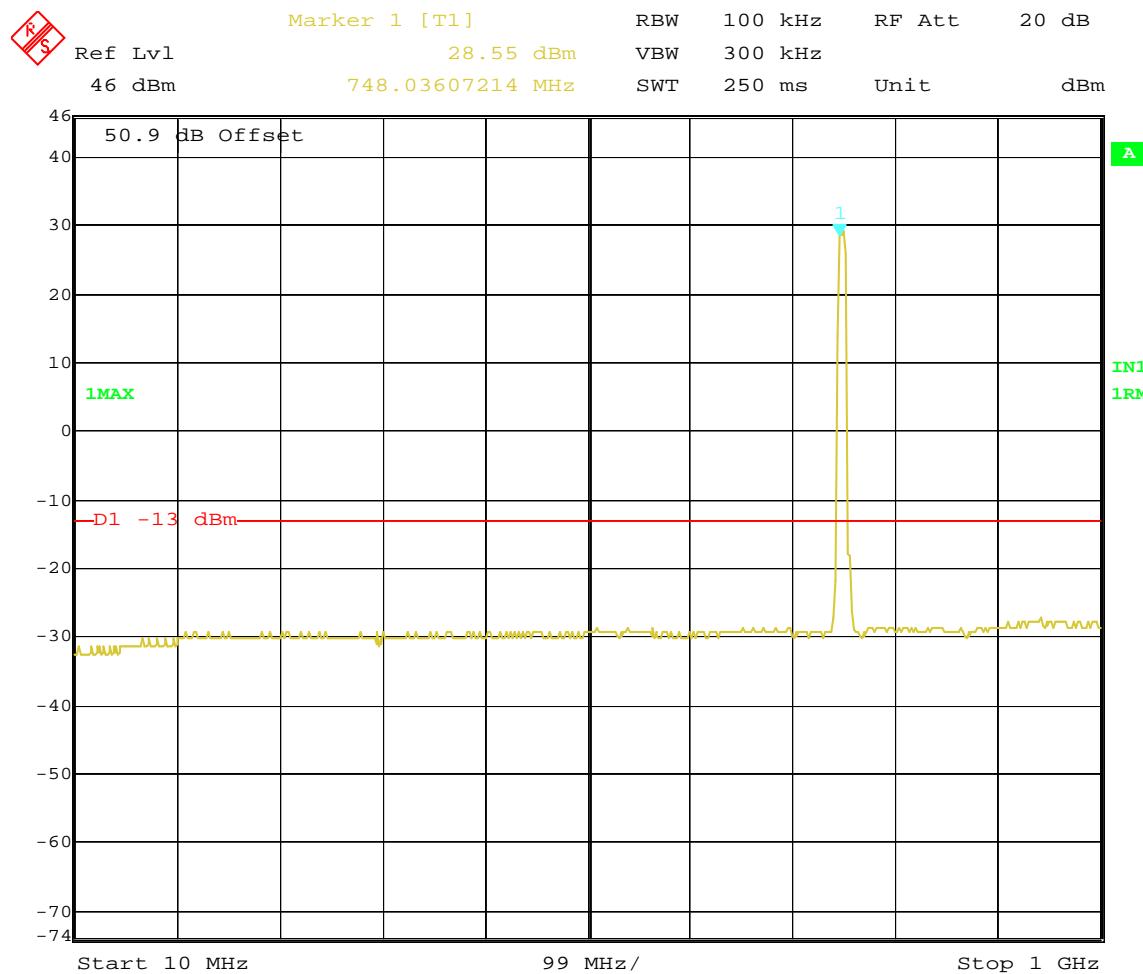
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 08:32:41

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



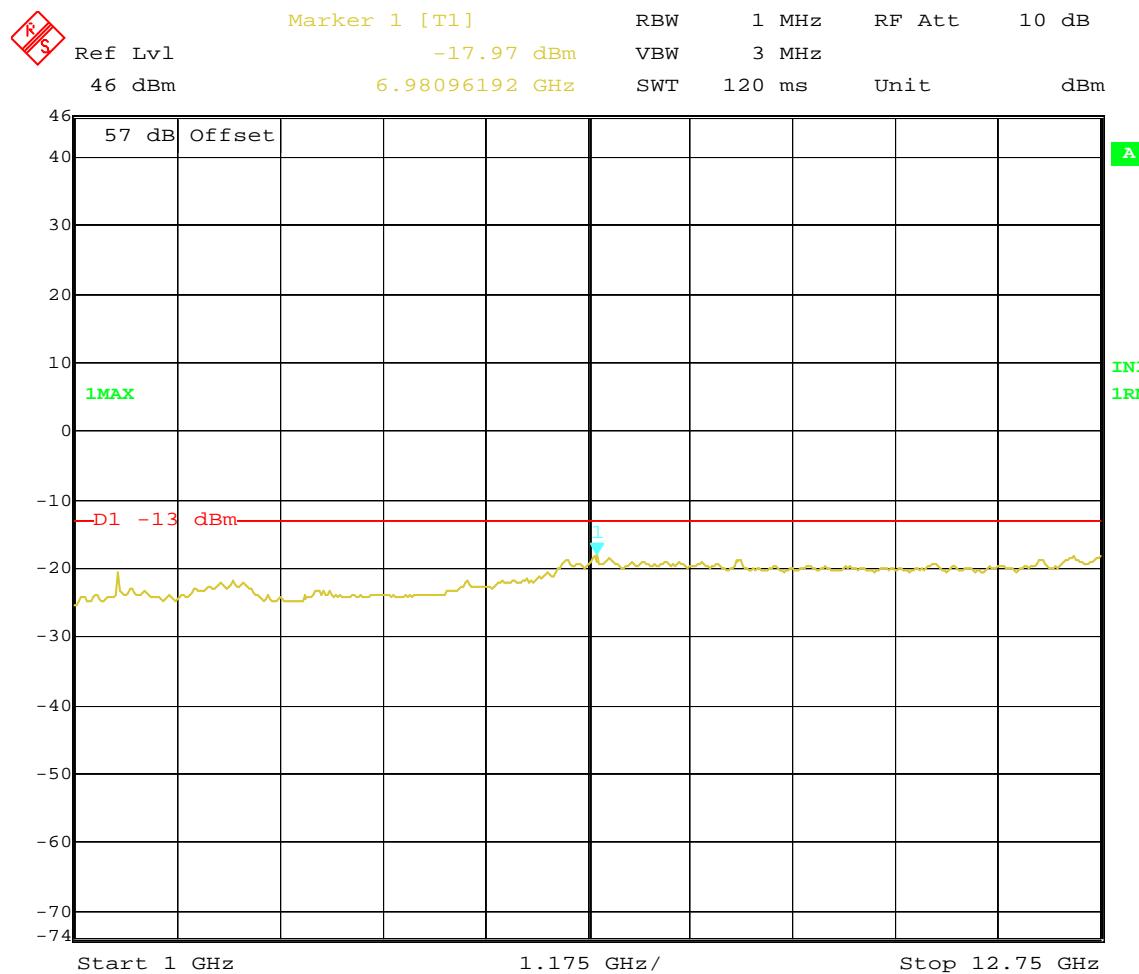
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 08:35:09

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



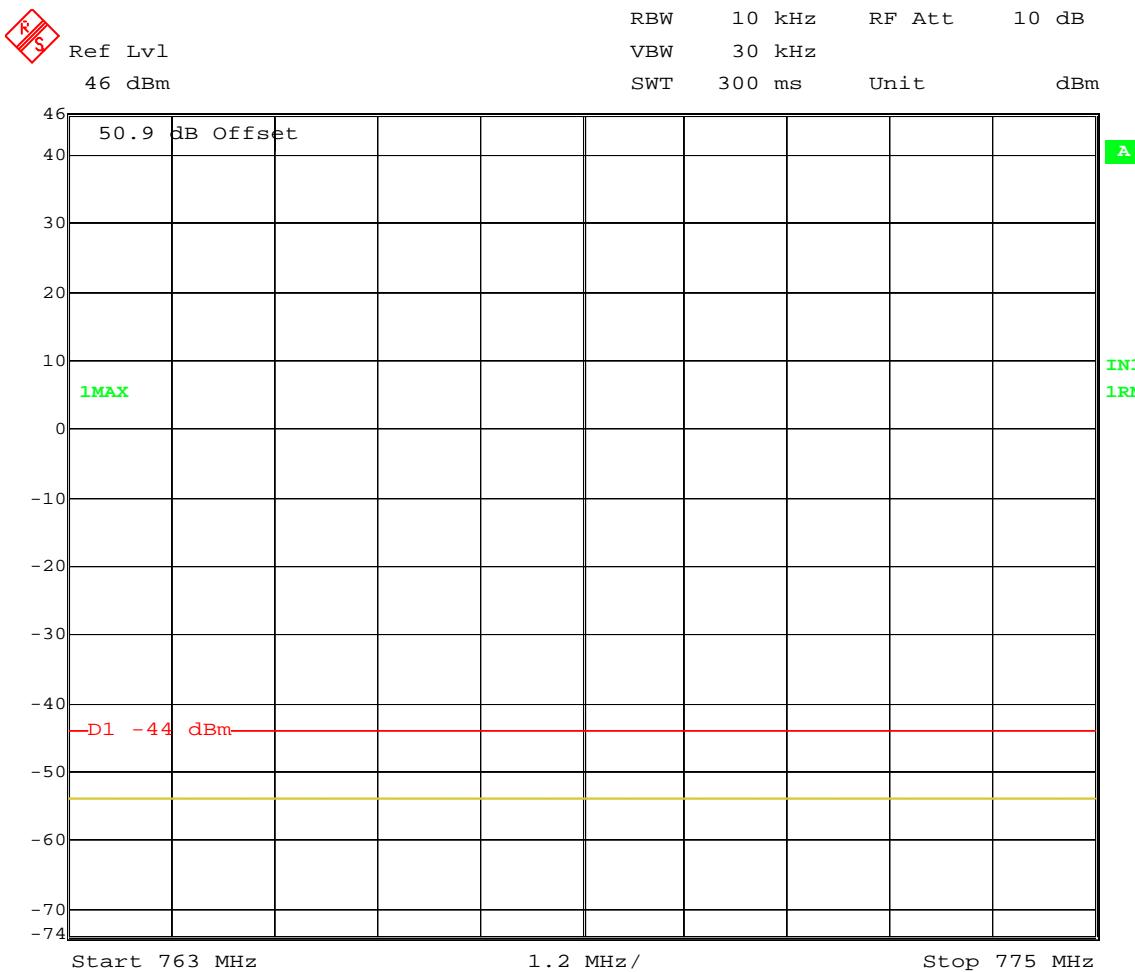
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 10:08:19

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



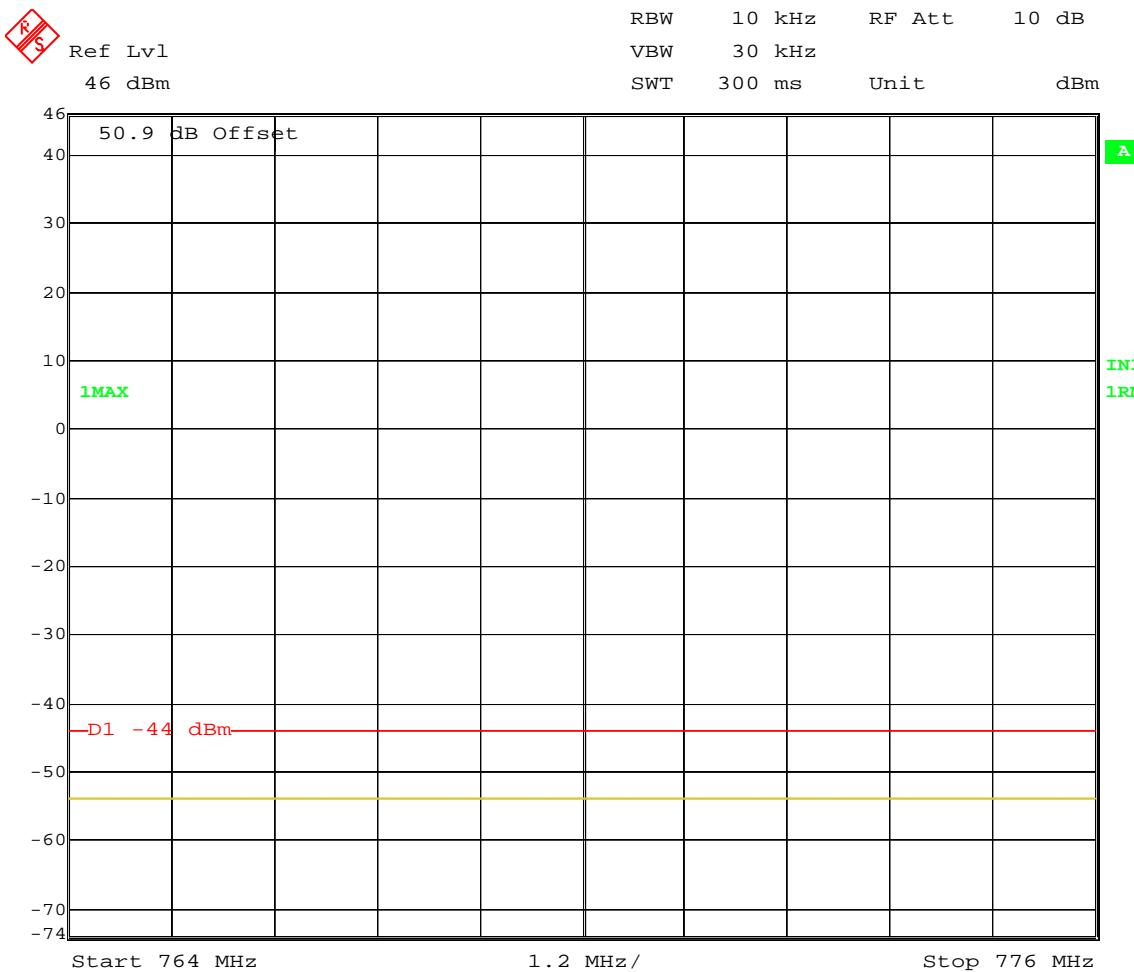
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 12:19:25

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



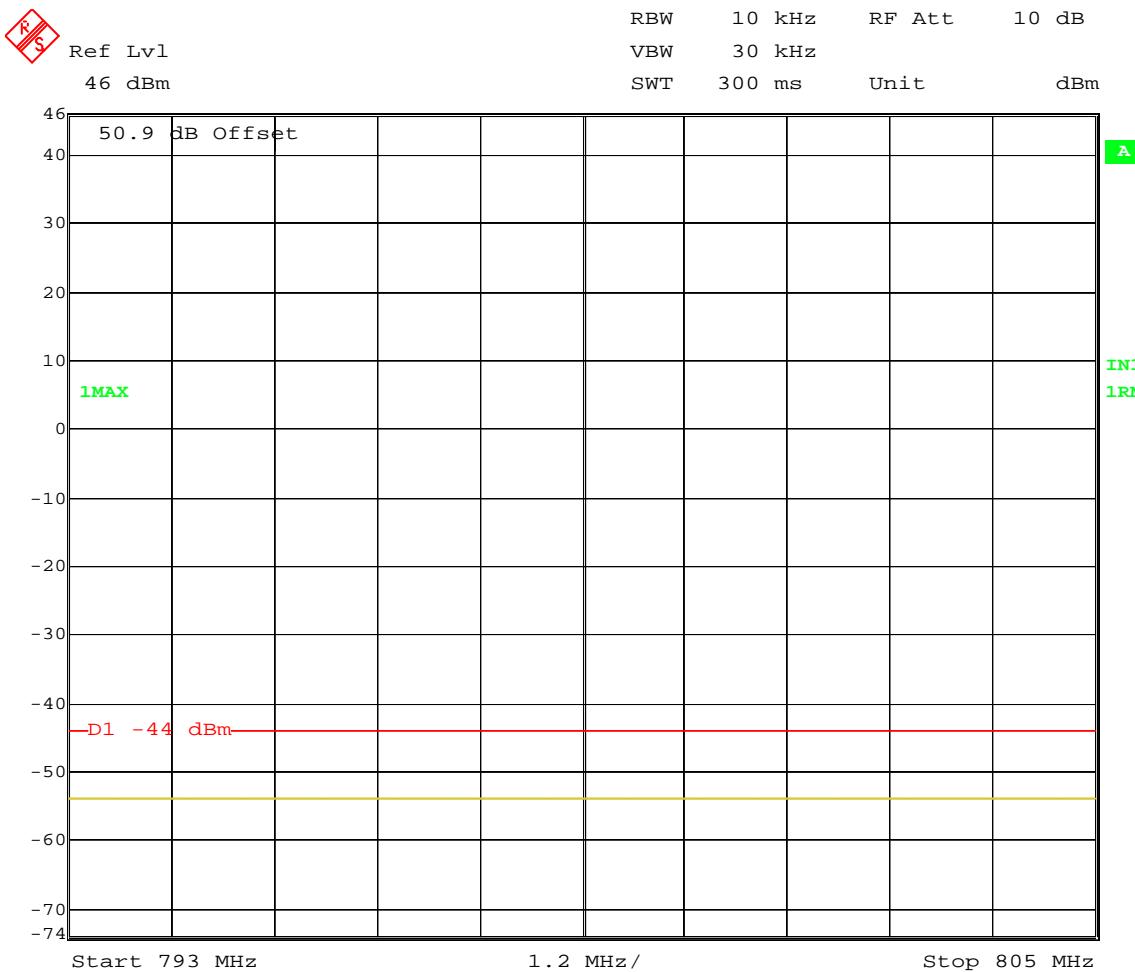
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 12:21:02

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; QPSK Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 12:25:52

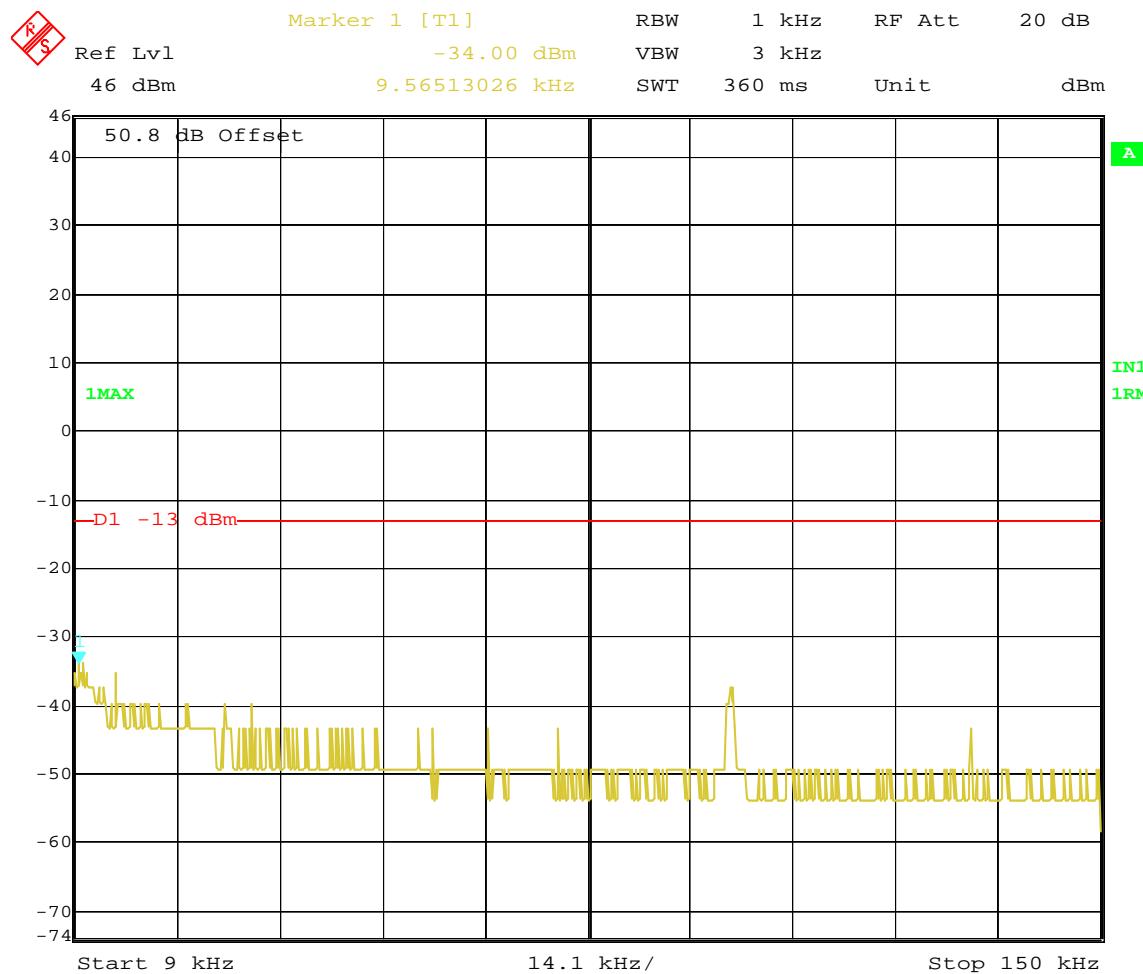
**Transmit Port**  
**Antenna Conducted Spurious Emissions**

**Block: C**

**16 QAM**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



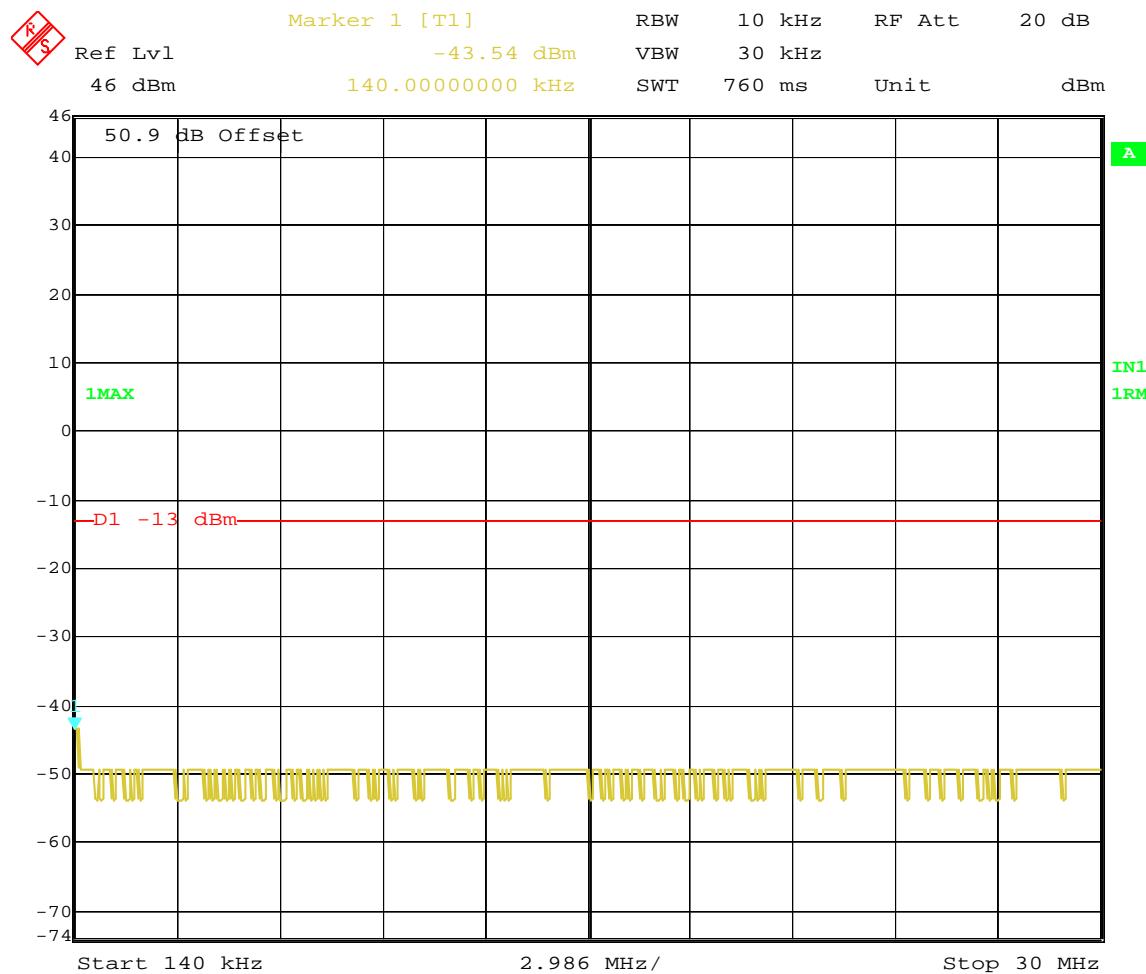
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 09:51:31

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



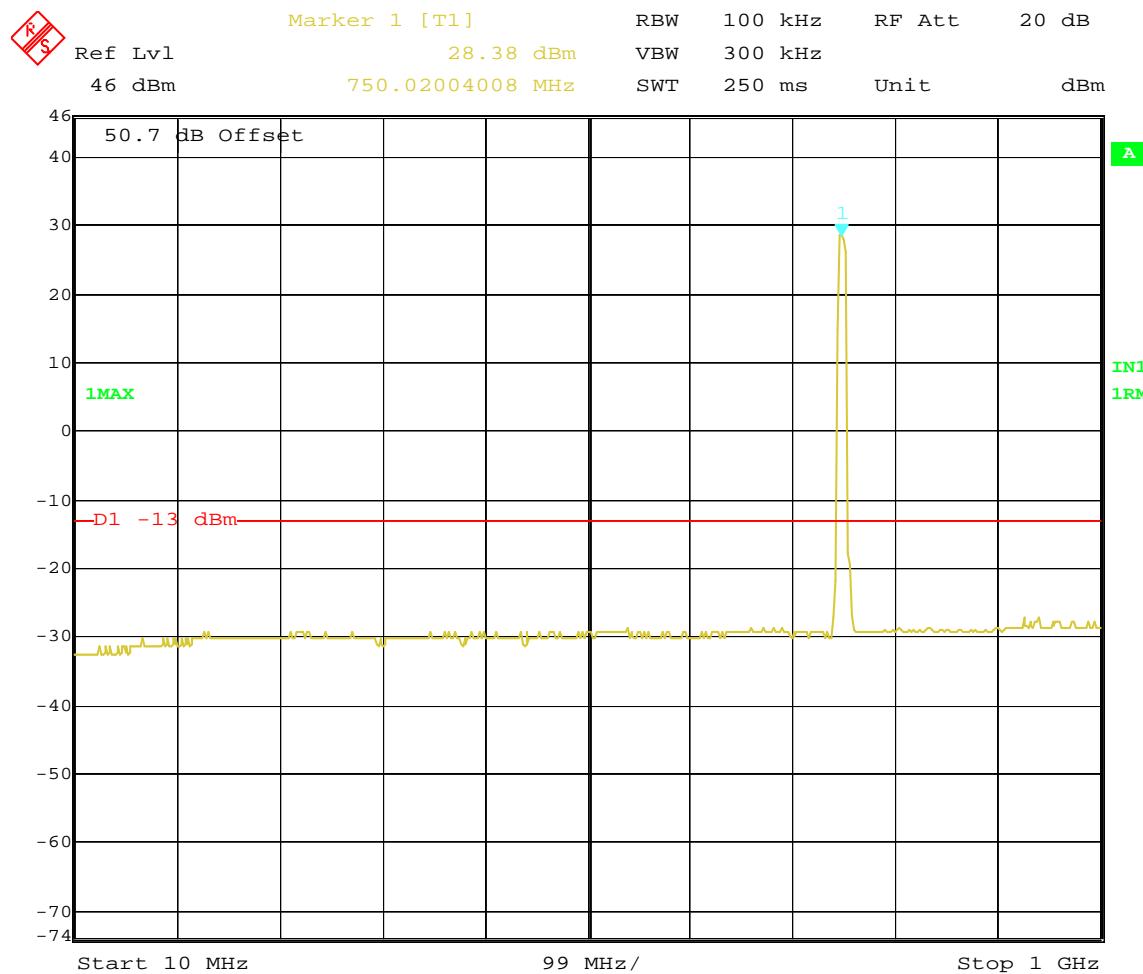
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W (2x40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 09:53:23

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



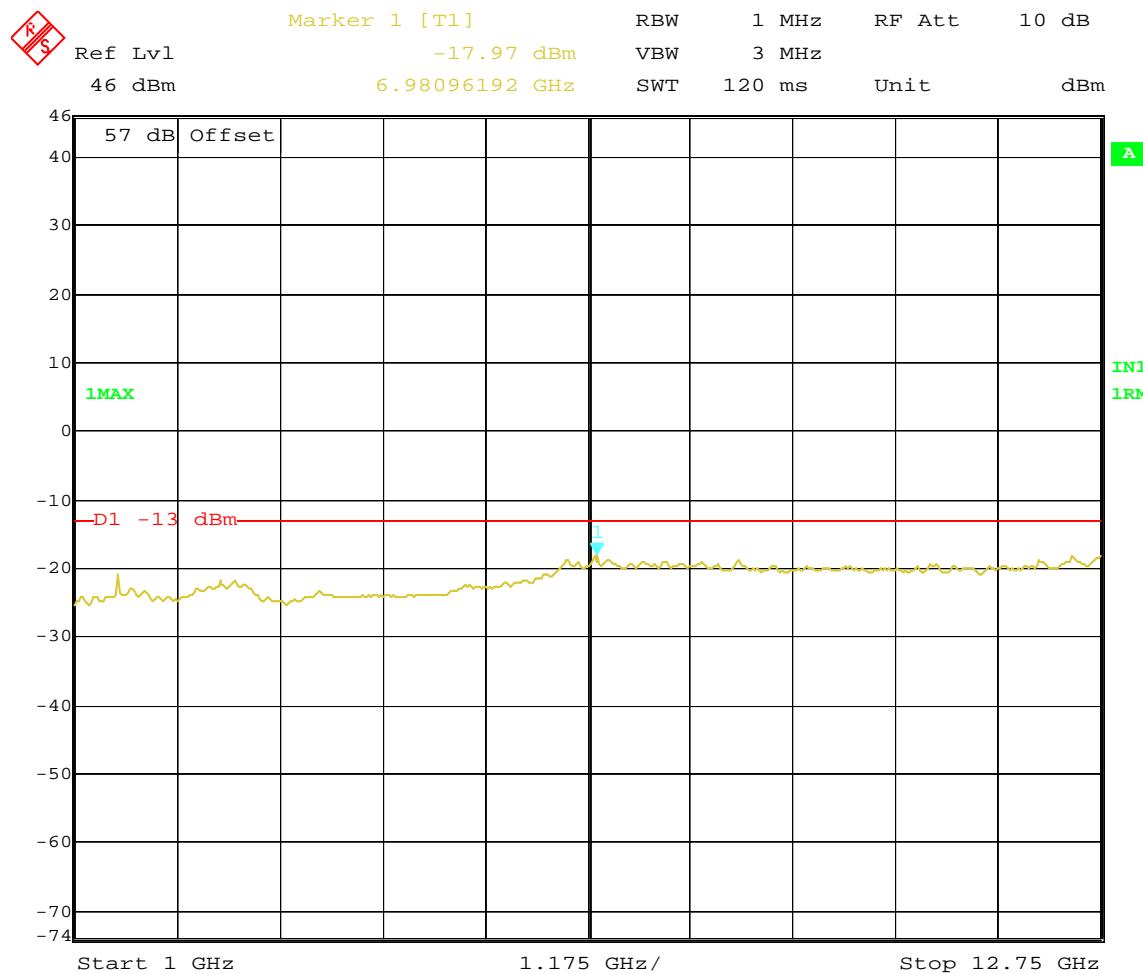
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 09:56:45

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



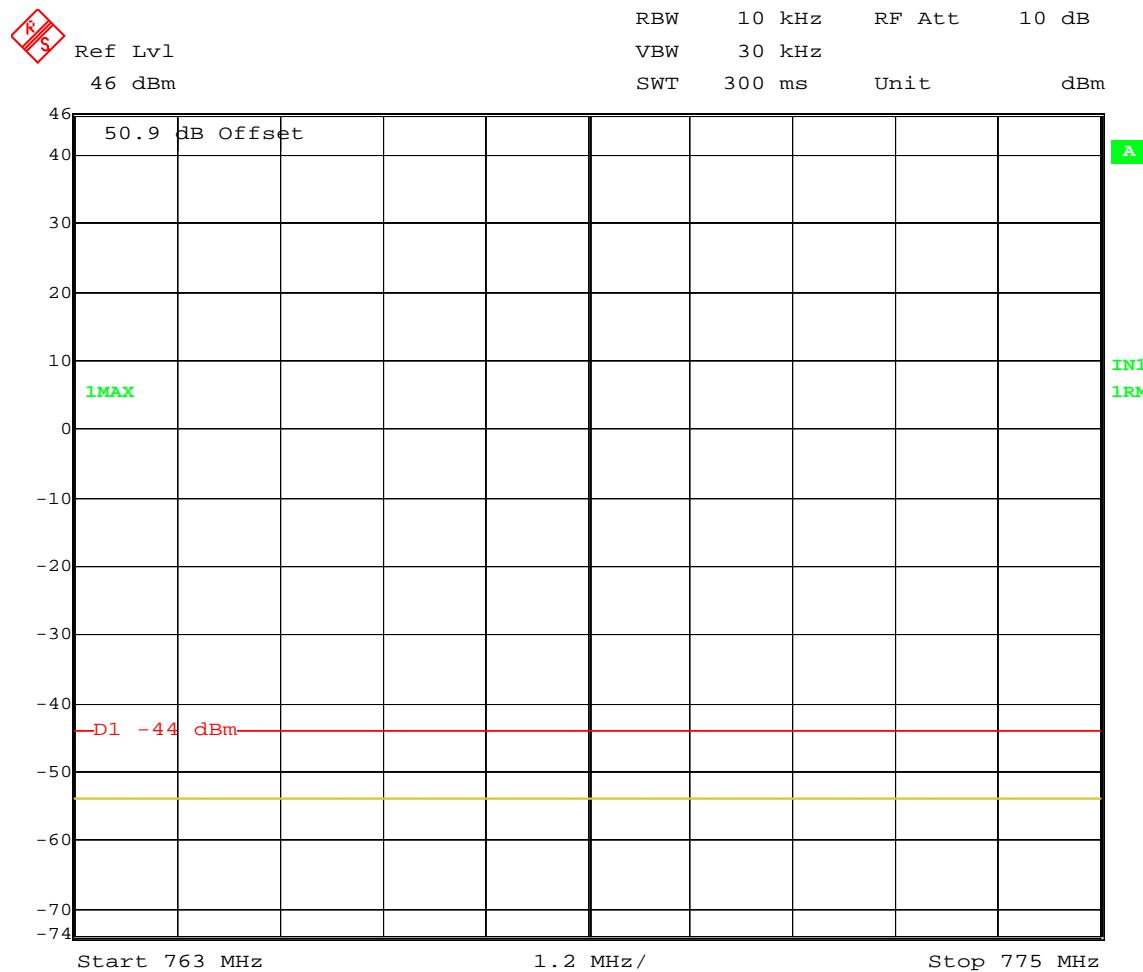
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 10:00:47

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



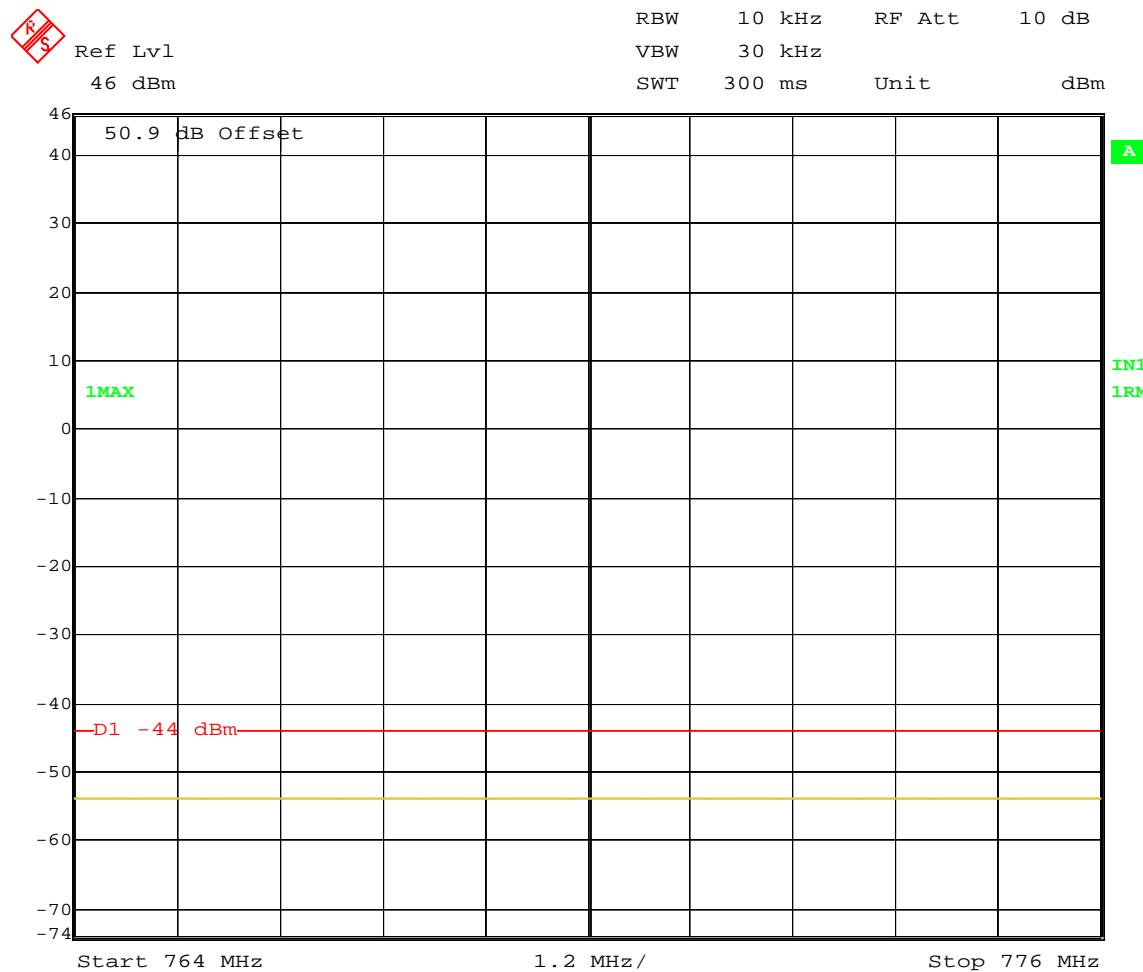
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 12:03:49

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



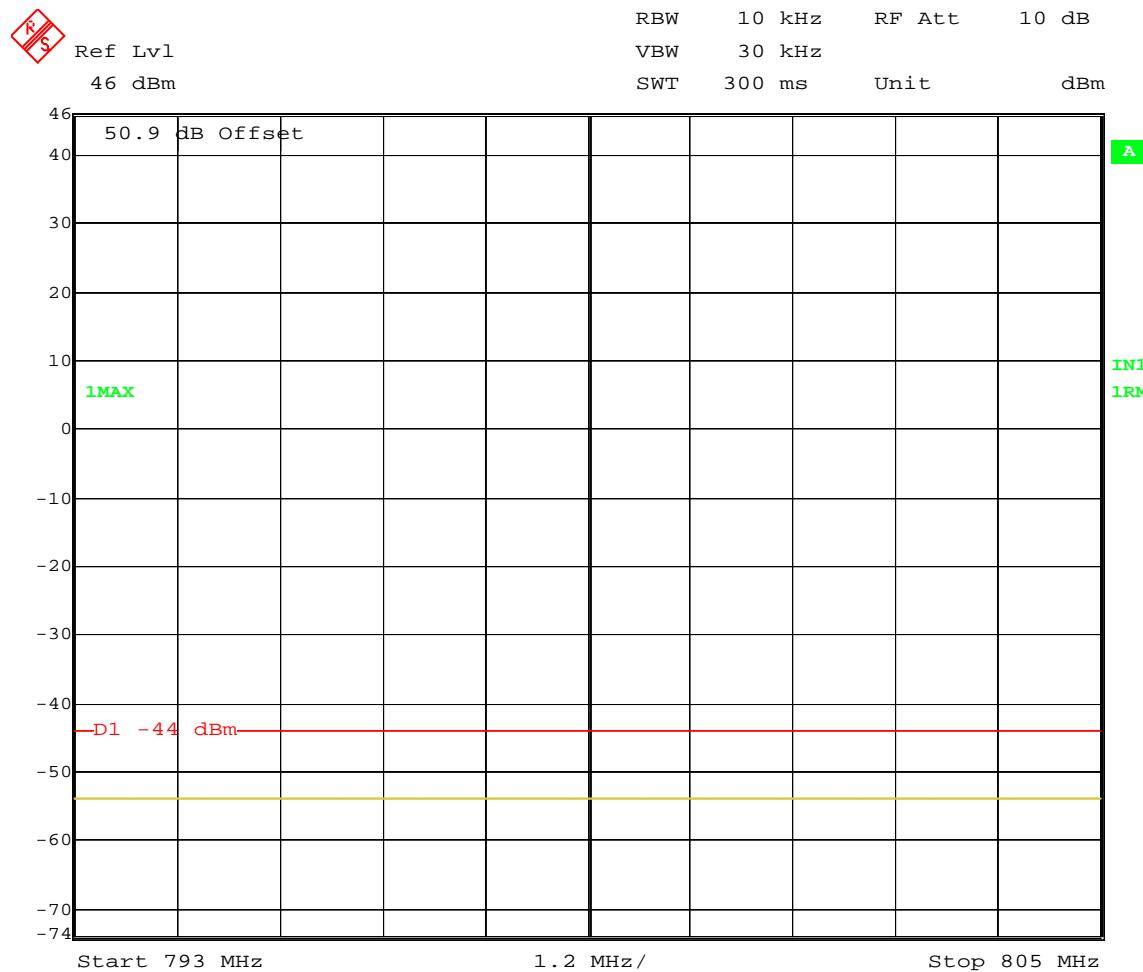
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 11:59:57

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 16QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 11:56:00

**Transmit Port  
Antenna Conducted Spurious Emissions**

**Block: C**

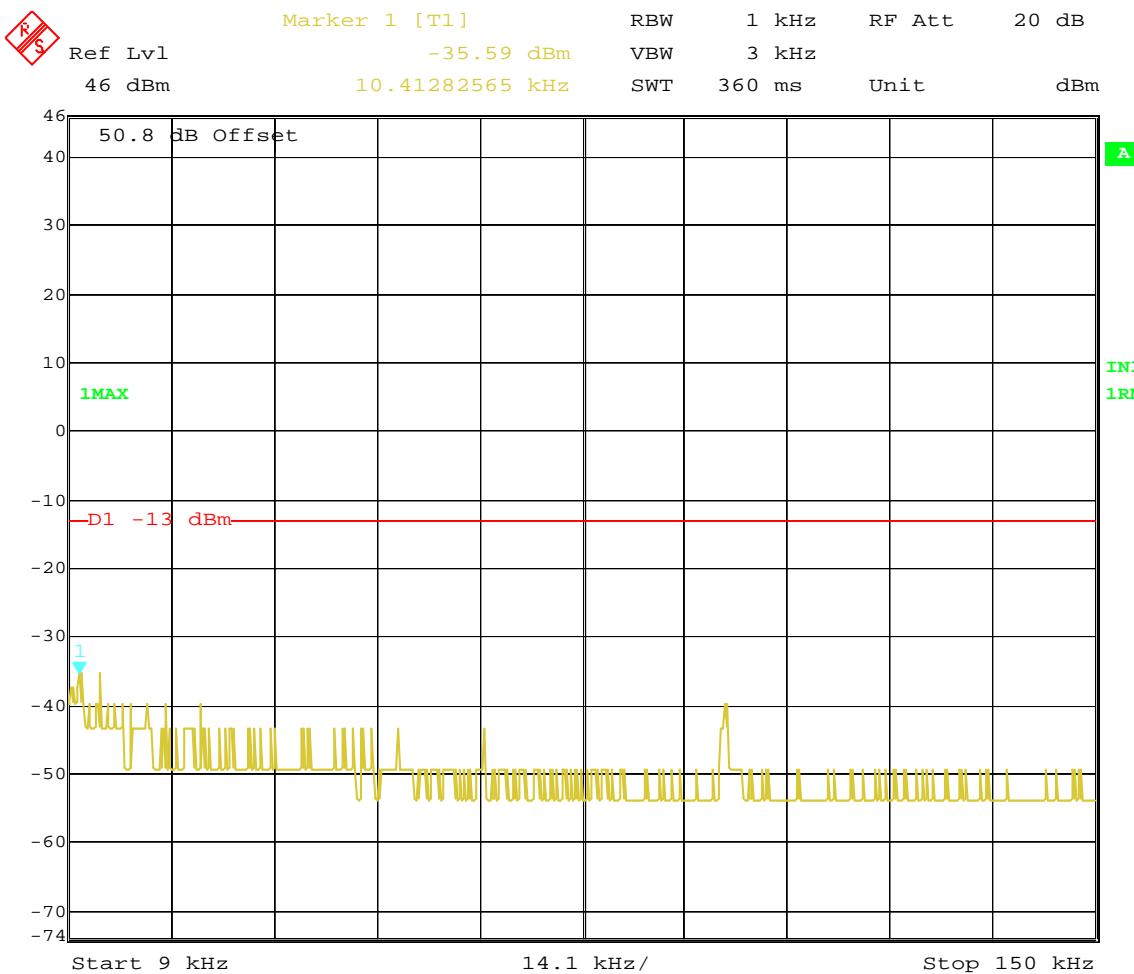
**64 QAM**

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



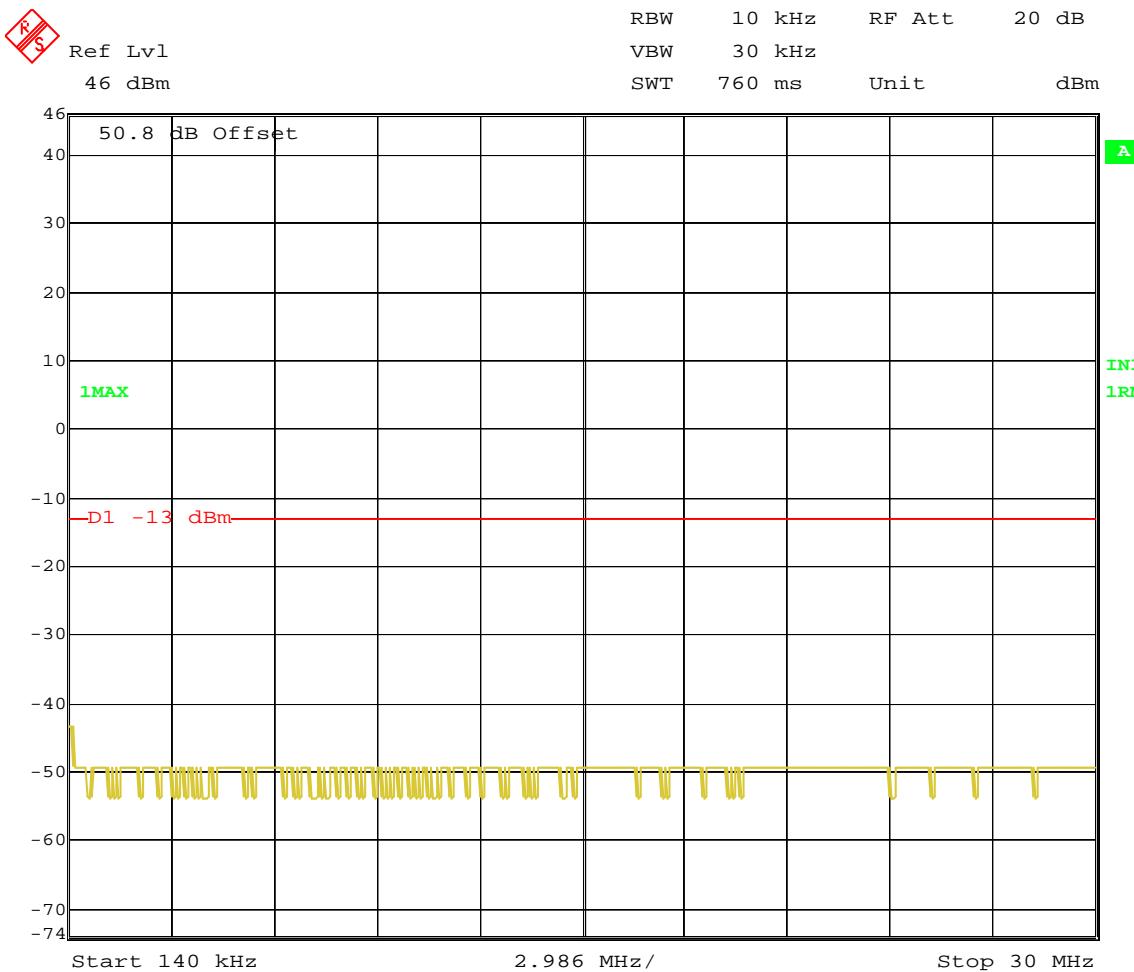
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 11:59:37

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



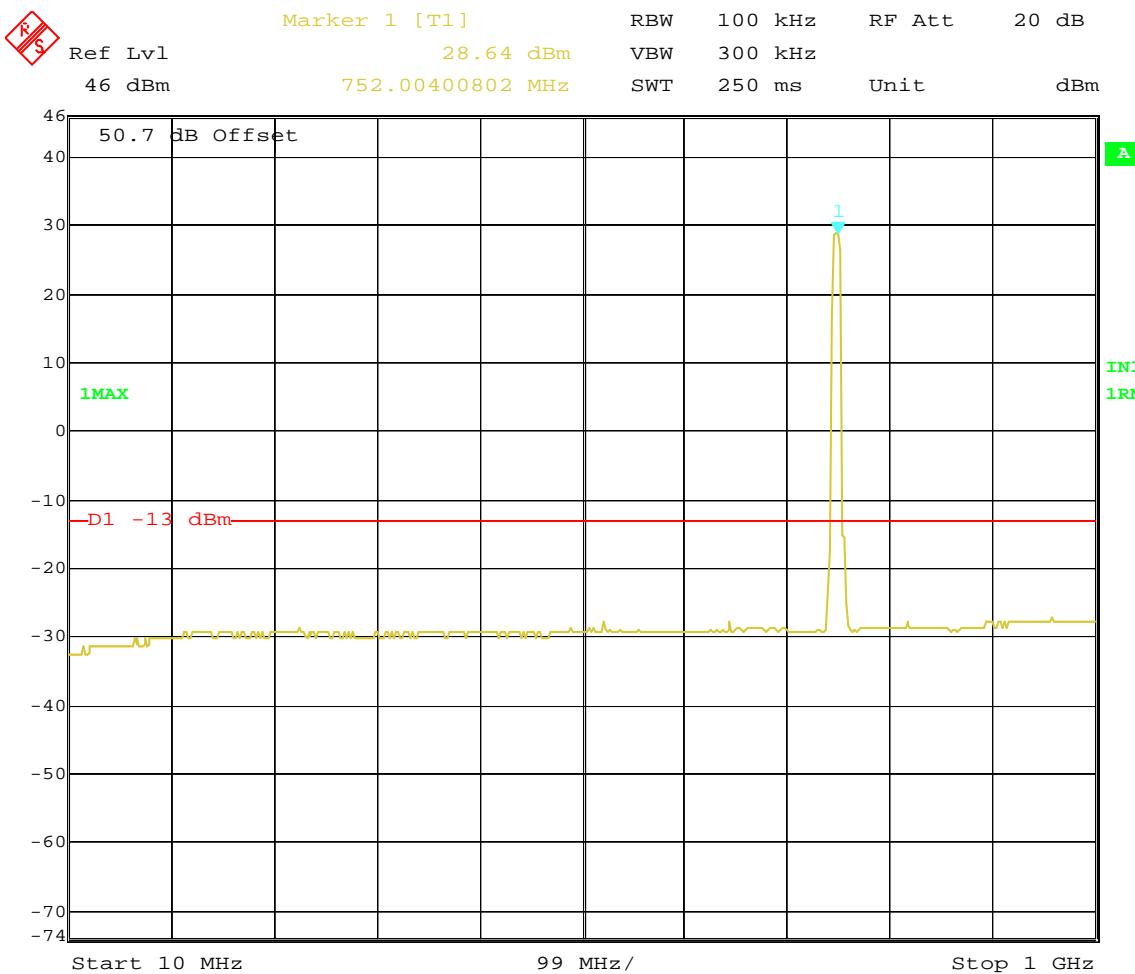
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 12:01:49

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



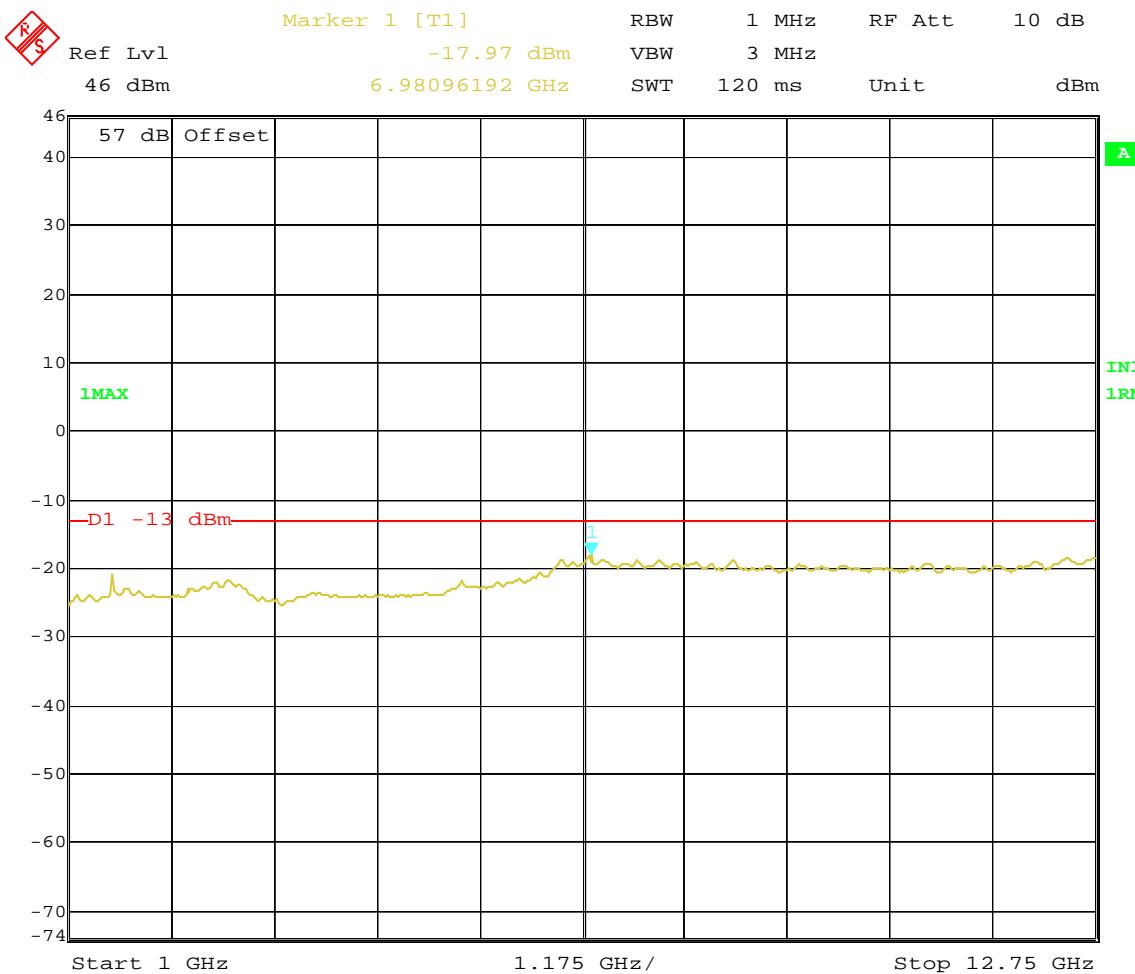
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
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Date: 24.APR.2009 12:07:03

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



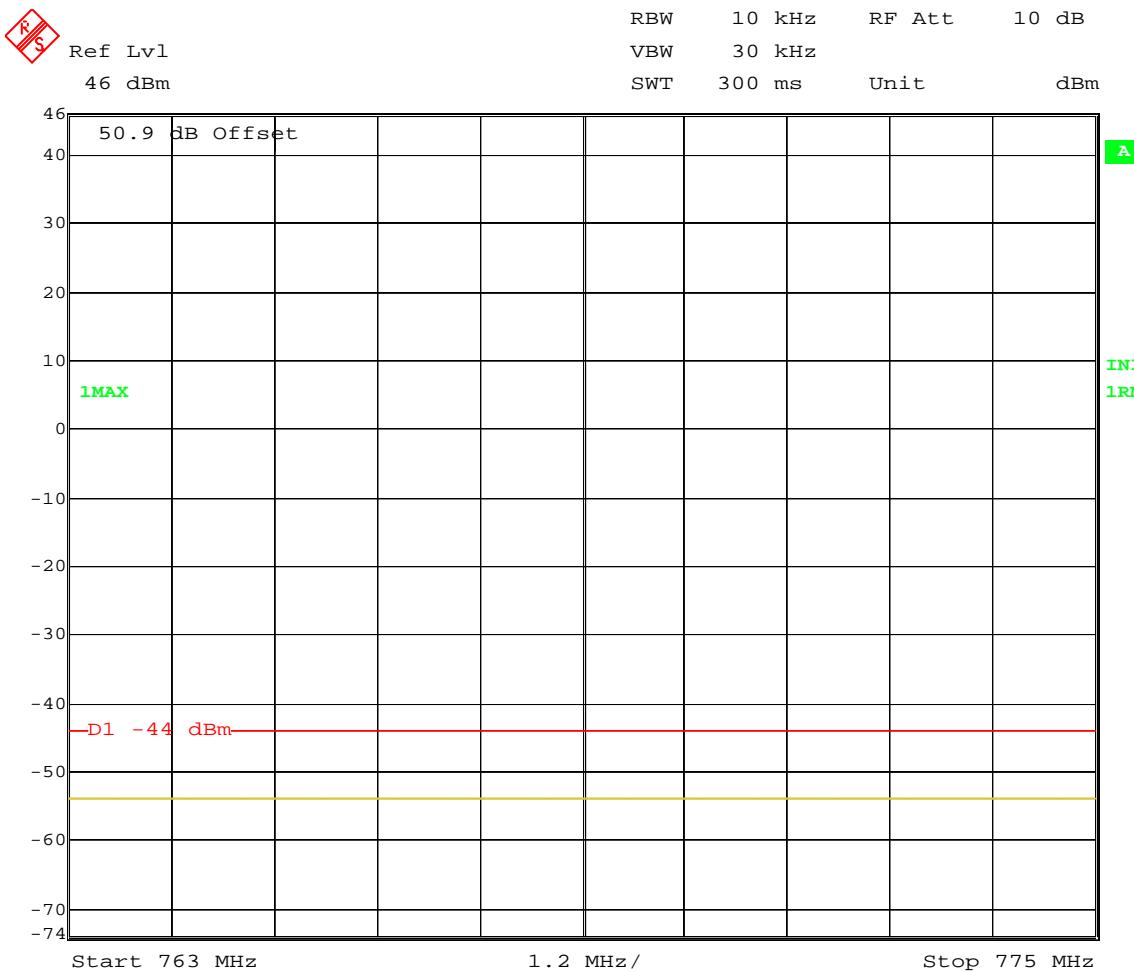
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 24.APR.2009 12:10:08

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



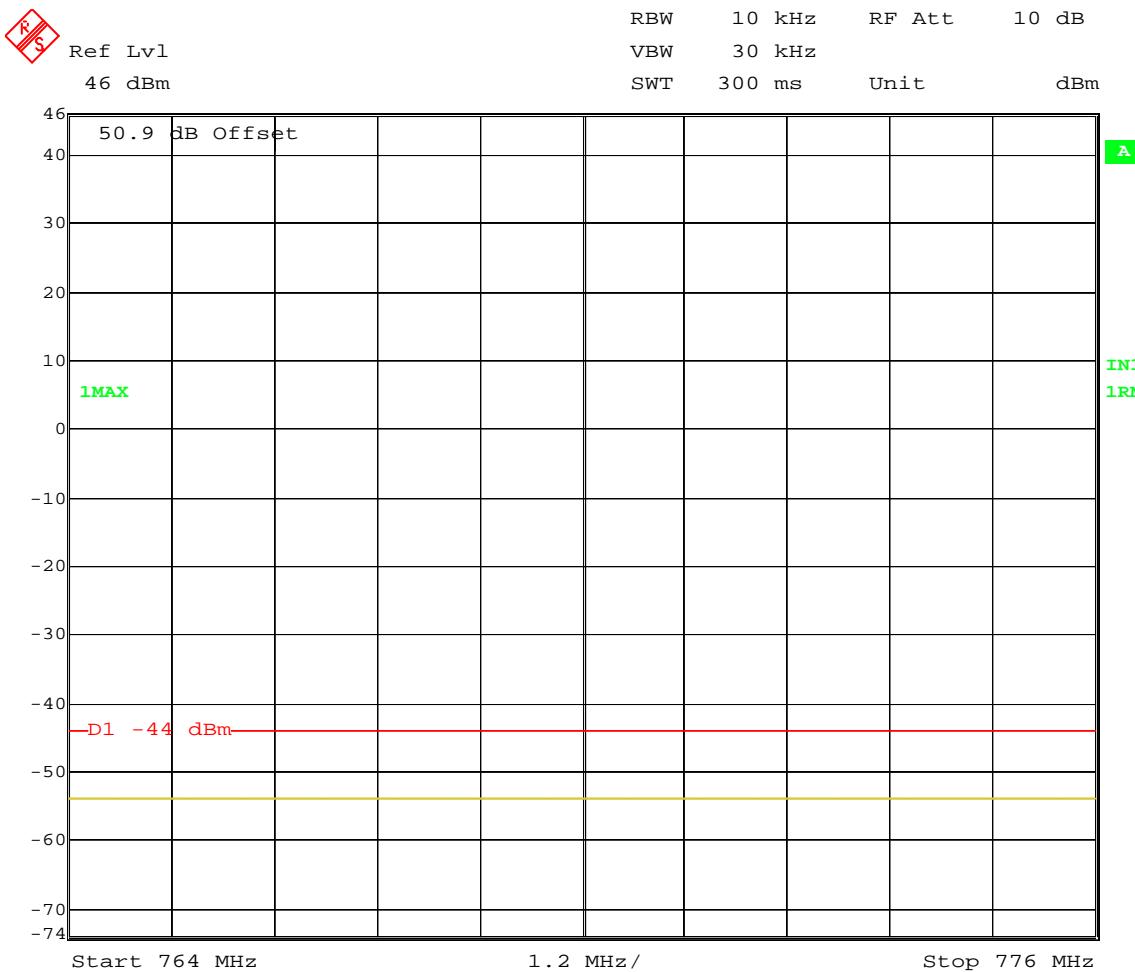
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 09:38:14

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**



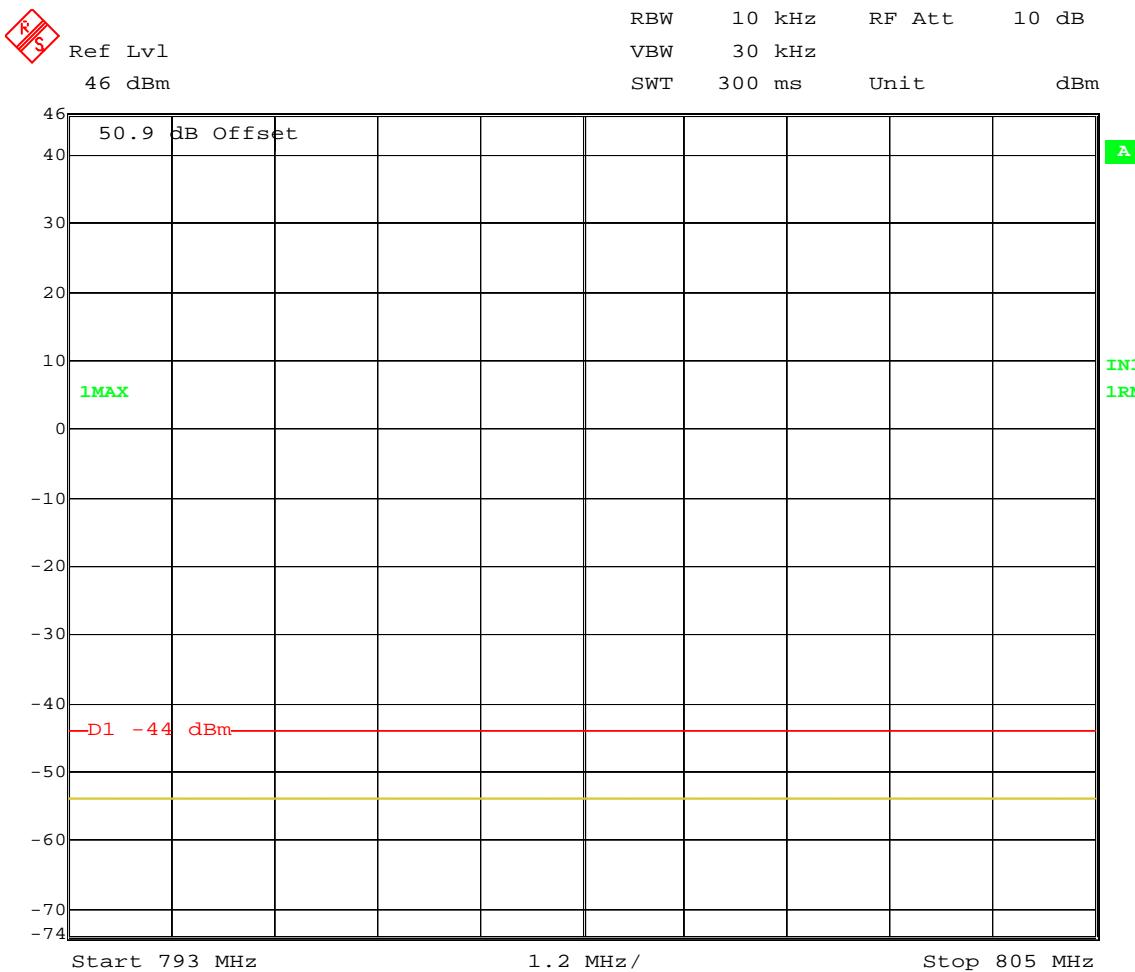
Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 09:40:40

APPLICANT: Alcatel-Lucent

FCC ID: AS5BBTRX-01



Title: SPURIOUS EMISSIONS AT TX ANTENNA PORT; Test Engineer: SEG

Comment A: LTE; FCC Part 27.53 Block C; 64QAM Modulation; TRDU PWR:40W  
(2X40W MIMO); FCCID: AS5BBTRX-01

Date: 4.MAY.2009 09:43:11

**Measurement -5**

**FIELD STRENGTH OF SPURIOUS RADIATION**  
**SECTION 2.1053 and 27.53**

**MEASUREMENT: 5****SECTION 2.1053****FIELD STRENGTH OF SPURIOUS RADIATION**

Field strength measurements of radiated spurious emissions were made at 10 m semi anechoic room of Global Product Compliance Laboratories of Alcatel-Lucent Whippany. A complete description and full measurement data for the site is on file with the Commission (FCC File 263912).

The “**9412 eNodeB Compact**” was tested with 700 MHz TRDU operating with a RF output of 40Wx2 in MIMO mode at EAC. The operation of “**9412 eNodeB Compact**” was simulated using Base Band Unit called D2U which is part of the cabinet circuit packs. The test cabinet was equipped with three 700 MHz TRDUs and 3 D2Us. The tests were performed “**9412 eNodeB Compact**” which is a indoor cabinet. The radiated emissions tests were performed with amplifiers operating with 10 MHz band width. The External Antenna Connector (EAC) of RF filters that were connected to amplifiers were terminated with 50 ohm loads. The spectrum from 10 MHz to the 10 GHz (more than 10th harmonic of the carrier) was searched for spurious radiation. Measurements were made according to ANSI C63.4. A special attention was taken for measuring in the frequency range 763 to 775 MHz and 793 to 805 MHz. In these bands there were no measurable radiated emissions were observed.

Measurements were made in following modulations.

1. Three 700 MHz TRDUs operating QPSK mode
2. Three 700 MHz TRDUs operating in 16 QAM mode
3. Three 700 MHz TRDUs operating in 64 QAM mode
4. Each of the 700 MHz TRDUs operating in QPSK, 16 QAM and 64 QAM modes respectively.

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 27.53 and 2.1053 contains the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4<sup>th</sup> edition, IT&T Corp.

$$\begin{aligned} E &= [(49.2 \cdot P)^{1/2}] / R \\ 20 \log (E \cdot 10^6) - (43 + 10 \log P) &= 84.4 \text{ dB}\mu\text{V/meter} \end{aligned}$$

E = Field Intensity in Volts/meter

P = Transmitted Power in Watts = 40 W

R = Distance in meters = 10 m

**RESULTS:**

For this particular test, the field strength of any spurious radiation is required to be less than 84.4 dB $\mu$ V/meter. Reportable measurements are equal to or greater than 64.4 dB $\mu$ V/meter. Over the spectrum investigated, 10 MHz to 10th of the carrier, no reportable spurious emissions were detected. This demonstrates that the “**9412 eNodeB Compact**” the subject of this application, complies with Sections 2.1053, 27.53 and 2.1057 of the Rules.

A special attention was taken for measuring in the frequency range 763 to 775 MHz and 793 to 805 MHz. In these bands there were no measurable radiated emissions were observed.

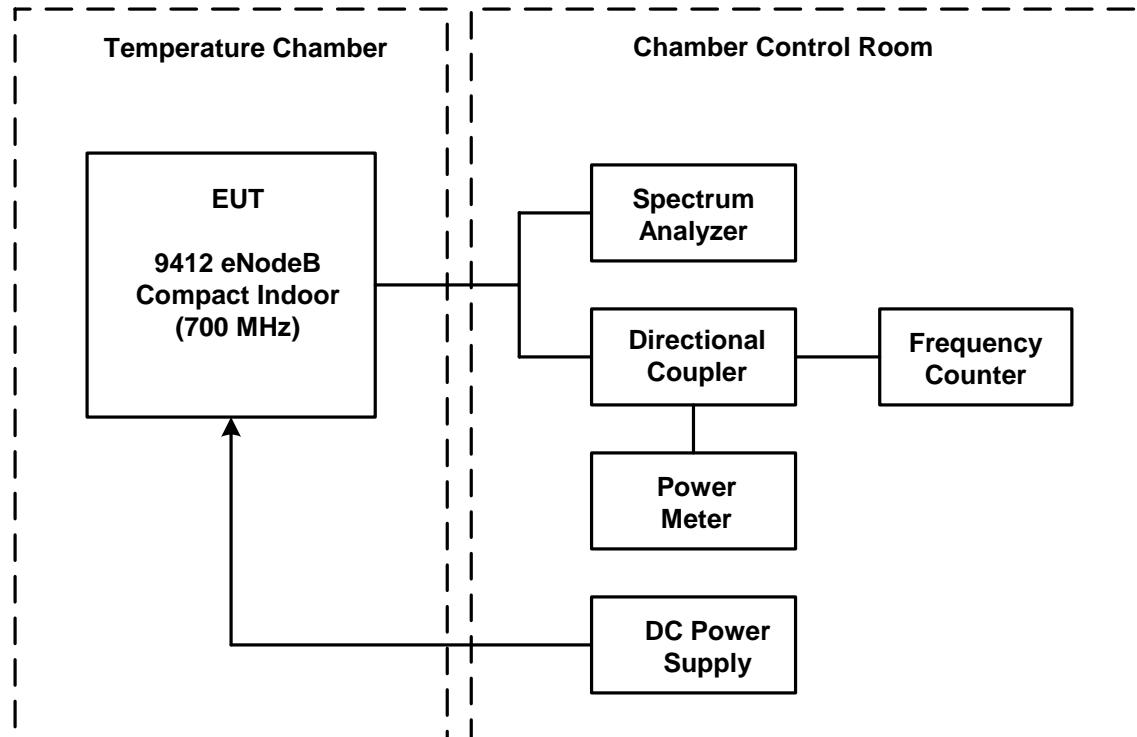
## **Measurement -6**

### **MEASUREMENT OF FREQUENCY STABILITY**

## MEASUREMENT OF FREQUENCY STABILITY

The frequency stabilization and accuracy of the LTE signals modulated and amplified by the 700 MHz Transmit and Receive Duplexer Unit (700 MHz TRDU) is a function of the input signal which is derived from GPS signals. The system provide for automatic timing synchronization upon reacquisition of GPS lock.

The 9412 eNodeB Compact indoor cube was subjected to the FCC specified environments while operating at full rated power of 2x40W at External Antenna Connector (EAC) port. The carrier Frequency deviations were measured. The nominal Voltage input to this device is 24V DC. The 9412 eNodeB Compact indoor cube is designed to operate in the Voltage range of 20.4V to 27.6V and in the temperature range of -5C to 50C. However, the carrier frequency is designed to be within an accuracy of **750mHz** in the temperature range -30C to 50C. The frequency stability tests were for the voltage 20.4 to 28.8VDC range and for the temperature -30C to 50C range. The measurement setup is depicted in Block diagram A.



Frquency Stability Test Set-up Block Diagram  
9412 eNodeB Compact Indoor (700 MHz)

Block Diagram A

**TEST RESULTS:****Test Data****Transmit Frequency Deviation at 24VDC Over Temperature Range**

Temperature in C	TX Frequency Deviation in (Hz)
25	-0.106
30	-0.11
40	-0.10
50	-0.109
40	-0.104
30	-0.101
20	-0.10
10	-0.09
0	-0.08
-10	-0.07
-20	-0.06
-30	-0.06
-20	-0.07
-10	-0.06
0	-0.08
10	-0.09
20	-0.103
25	-0.107

**Transmit Frequency Deviation at 25C Over Voltage Range**

Voltage id DC	TX Frequency Deviation in (Hz)
24	-0.108
23	-0.106
22	-0.105
21	-0.103
20.4	-0.104
21	-0.107
22	-0.103
23	-0.105
24	-0.102
25	-0.104
26	-0.101
27	-0.106
27.6	-0.102
28	-0.105
28.8	-0.107

**Conclusions**

The 9412 eNodeB Compact indoor cube met the Frequency Stability requirement of “ 750mHz” over the temperature range -30 to 50C and voltage range 20.4 to 28.8VDC.

**Instrument Used for Measurement**

Instrument Type	Serial Number	Vendor	Expiration Date
Frequency Counter	3418A00309	HP	Jan 7, 2010
MXA Signal Analyzer	1092995	Agilent Technology	Feb 12, 2009
Power Meter	149787	HP	May 22, 2009

Measurement Uncertainty: 1%

APPLICANT: **Alcatel-Lucent**

FCC ID: **AS5BBTRX-01**

**FREQUENCY SPECTRUM TO BE INVESTIGATED  
SECTION 2.1057**

**SECTION 2.1057**

**FREQUENCY SPECTRUM TO BE INVESTIGATED**

**Frequency Spectrum to be investigated, Measurement Bandwidth and detector function used meet or exceed the Specification contained in Section 2.1057, 27, and 3GGP TS36.104 V8.4.0 (2008-12)**

**All instrumentations and antennas used for the test were calibrated and calibration are traceable to NIST**

## **Measurement Instrumentation and Antennas**

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