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Report On

Application for Grant of Equipment Authorization of the
Motorola Solutions, Inc.

APX7000 LTE Multi-Band Portable Radio

FCC CFR 47 Part 2 and 27

IC RSS-Gen and RSS-130 Issue 1 October 2013

Report No. SC1400580B Rev. 1

June 2014



REPORT ON Radio Testing of the
Motorola Solutions, Inc.
Multi-Band Portable Radio

TEST REPORT NUMBER SC1400580B Rev. 1

PREPARED FOR Motorola Solutions, Inc.
8000 West Sunrise Blvd.
Ft. Lauderdale, FL 33322

ATTESTATION The EUT has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report. All instrumentations and accessories used to verify the EUT for compliance to the indicated standards are calibrated in accordance with ISO 17025:2005 requirements.

I attest that the necessary measurements were made under my supervision.

A handwritten signature in black ink, appearing to read 'Ferdinand S. Custodio', written over a horizontal line.

Name
Authorized Signatory
Title: EMC/Senior Wireless Test Engineer

A handwritten signature in black ink, appearing to read 'Chip R. Fleury', written over a horizontal line.

APPROVED BY Chip R. Fleury
Name
Authorized Signatory
Title: EMC West General Manager

DATED June 19, 2014



Revision History

| SC1400580B Rev. 1 Motorola Solutions, Inc. APX7000 LTE Multi-Band Portable Radio | | | | | |
|---|-----------------|--------------|--|----------------|----------------|
| DATE | OLD REVISION | NEW REVISION | REASON | PAGES AFFECTED | APPROVED BY |
| 06/19/2014 | Initial Release | | | | Chip R. Fleury |
| 07/15/2014 | Initial Release | Rev. 1.0 | Updated model number to NUR1065A, NUR1066A | 6 | Chip R. Fleury |
| | | | | | |
| | | | | | |
| | | | | | |



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SECTION 1

REPORT SUMMARY

Radio Testing of the
Motorola Solutions, Inc.
Multi-Band Portable Radio



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Motorola Solutions, Inc. APX7000 LTE Multi-Band Portable Radio to the requirements of the following:

- FCC CFR 47 Part 2 and 27
- IC RSS-Gen and RSS-130 Issue 1 October 2013.

| | |
|-------------------------------|--|
| Objective | To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | Motorola Solutions, Inc. |
| Model Number(s) | NUR1065A, NUR1066A |
| FCC ID Number | AZ489FT7059 |
| IC Number | 109U-89FT7059 |
| Serial Number(s) | 655CPX3214 (Conducted sample) , 655CPX1171 (Radiated sample) |
| Number of Samples Tested | 2 |
| Test Specification/Issue/Date | <ul style="list-style-type: none">• FCC CFR 47 Part 2 and 27 (October 1, 2013).• RSS-130 - Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 (Issue 1, October 2013).• RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 3, December 2010). |
| Start of Test | February 17, 2014 |
| Finish of Test | February 27, 2014 |
| Name of Engineer(s) | Ferdinand Custodio |
| Related Document(s) | <ul style="list-style-type: none">• ANSI/TIA-603-C-2004 – Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards.• KDB971168 (D01 Power Meas License Digital Systems v02r01) Measurement Guidance for Certification of Licensed Digital Transmitters• KDB412172 D01 Determining ERP and EIRP v01 (Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System. |



1.2 BRIEF SUMMARY OF RESULTS

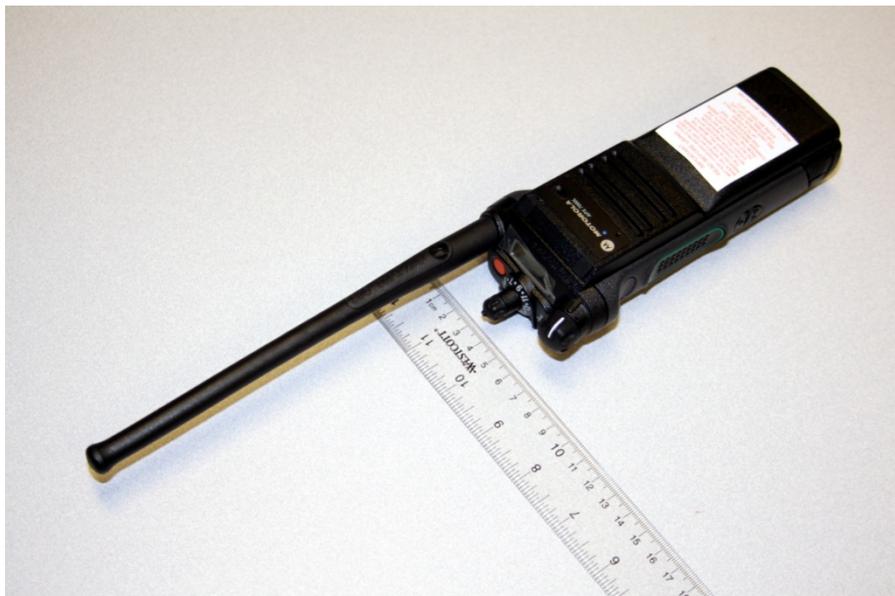
A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2 and 27 with cross-reference to the corresponding IC RSS standard is shown below.

| Section | FCC Part Sections(s) | RSS Section(s) | Test Description | Result |
|---------|-------------------------------------|-----------------|--------------------------------------|-----------|
| 2.1 | 2.1046 | | Transmitter Conducted Output Power | Compliant |
| 2.2 | | RSS-130(4.4) | Equivalent Isotropic Radiated Power | Compliant |
| 2.3 | 2.1046, 27.50 (b) (10) | | Effective Radiated Power | Compliant |
| 2.4 | 2.1049 and 27.53(h) | RSS-Gen (4.6.1) | Occupied Bandwidth | Compliant |
| 2.5 | | RSS-130(4.4) | Peak-Average Ratio | Compliant |
| 2.6 | 27.53(c)(2)(5) and (h) | RSS-130(4.6.1) | Band Edge | Compliant |
| 2.7 | 2.1051, 27.53(c)(2) and (5) | RSS-130(4.6.2) | Conducted Spurious Emissions | Compliant |
| 2.8 | 2.1053, 27.53(c) | RSS-130(4.6.2) | Field Strength Of Spurious Radiation | Compliant |
| 2.9 | 2.1055(a)(1) 2.1055(d)(1) and 27.54 | RSS-130(4.3) | Frequency Stability | Compliant |
| 2.10 | | RSS-Gen 6.0 | Receiver Spurious Emissions | Compliant |

1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) was a Motorola Solutions, Inc. APX7000 LTE Multi-Band Portable Radio as shown in the photograph below. The EUT is a licensed non-broadcast transmitter held to face (portable 2-way radio) originally under FCC ID AZ489FT7036/IC #109U-89FT7036. The EUT is being verified due to integration of an option board that includes a Bluetooth module and a LTE module. This test report covers verification of the LTE module (Band 13).





1.3.2 Technical Description

| | |
|---|---|
| EUT Description | Multi-Band Portable Radio |
| Model Number(s) | APX7000 LTE |
| Rated Voltage | 7.5 VDC Nominal voltage. |
| Mode Verified | 4G-LTE Band 13 |
| Capability | 700-800/VHF, LTE Band 13, LTE Band 14(Public Safety) and Bluetooth (V2.0 + EDR) |
| Primary Unit (EUT) | <input checked="" type="checkbox"/> Production <input type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering |
| Antenna Type/Details | Embedded FICA, Motorola Solutions P/N: 85009332001, 4.6 cm |
| Antenna Gain (Client declaration, max. antenna gain covered under this test report) | LTE Band 13 (779-785 MHz) = -5.0 dBi |

1.3.3 Transmit Frequency Table

| LTE Band 13 | | | | | |
|-----------------|--------------------|---------------------|--------------------------------|-------------------|--------------------|
| Bandwidth (MHz) | Tx Frequency (MHz) | Emission Designator | Max. Meas. Conducted Power (W) | Max.ERP Power (W) | Max.EIRP Power (W) |
| 5.0 | 777-787 | 4M51G7D | 0.230 | 0.0442 | 0.0726 |
| 5.0 | 777-787 | 4M50W7D | 0.247 | 0.0475 | 0.0780 |
| 10.0 | 777-787 | 8M97G7D | 0.206 | 0.0397 | 0.0652 |
| 10.0 | 777-787 | 9M00W7D | 0.222 | 0.0428 | 0.0701 |

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

| Test Configuration | Description |
|--------------------|--|
| A | EUT connected directly with the Wideband Radio Communication Tester. Radio functionality is directly controlled through the call box. USB programming cable is also connected to the EUT, prior to synching with the call box, the LTE module is enabled via Telnet and AT commands. |
| B | A temporary test antenna is connected to the EUT to provide isolation with the Wideband Radio Communication Tester during AC Mains Conducted Spurious Emissions test. |

1.4.2 EUT Exercise Software

EUT is controlled by a CMW 500 Wideband Radio Communication Tester. Prior to synching with the CMW500, the LTE module is enabled via Telnet and AT commands through the optional USB programming cable.

1.4.3 Support Equipment and I/O cables

| Manufacturer | Equipment/Cable | Description |
|--------------|---------------------------|--|
| Lenovo | Support Laptop | Model 2522-26U S/N R8-P39EN 11/02 Product ID:25226U |
| Motorola | USB programming cable | PMKN4012B Rev. B 15/12 |
| Motorola | Adaptive Charger | Impres™ WPLN4114AR V3.40 Single Unit Charger S/N 0726 377673 7088MKF02 |
| Schwarzbeck | Log-periodic antenna (2X) | UHALP 9108-A (494) |

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per output power measurements:

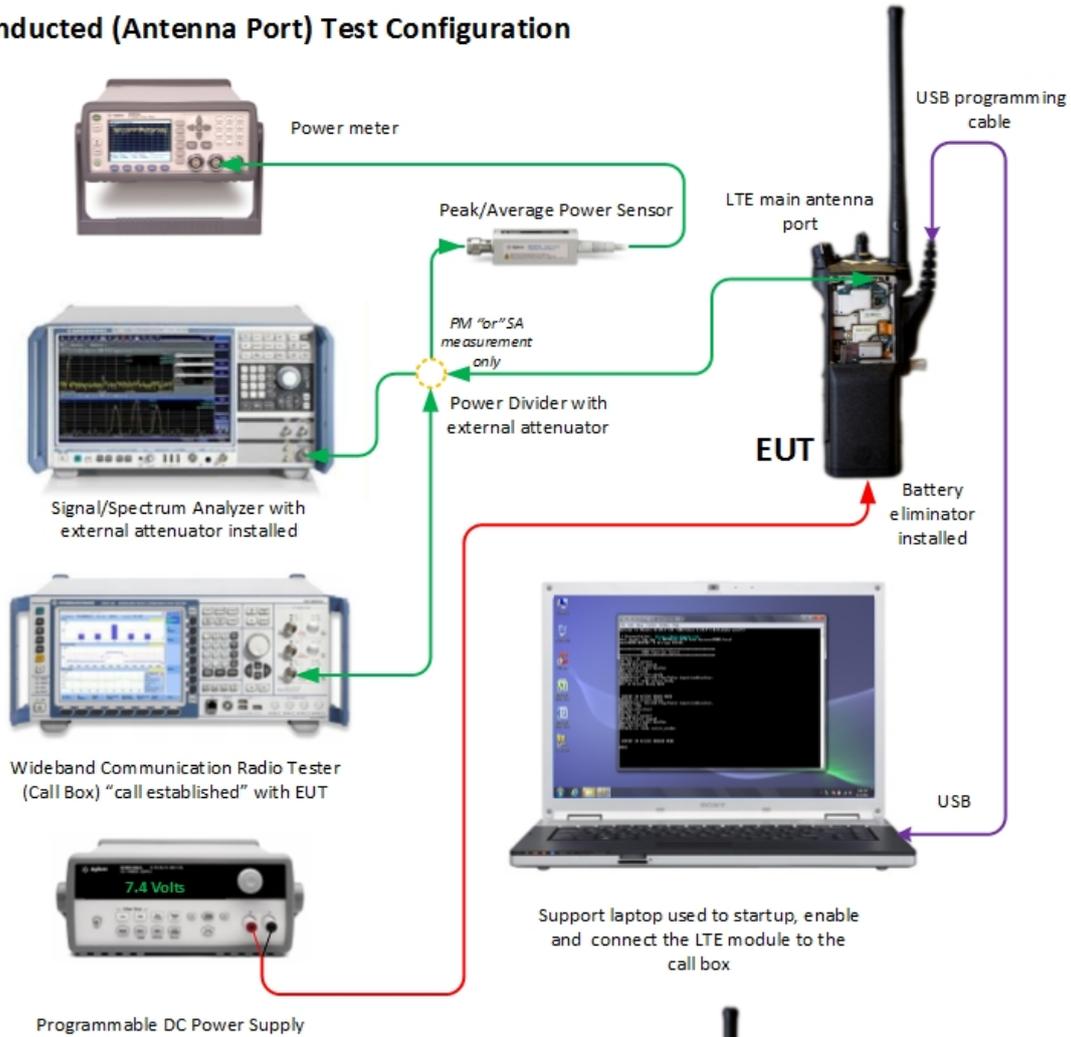
| Band | Channel BW | Modulation | RB Size/Offset |
|-------------|------------|------------|----------------|
| LTE Band 13 | 5MHz | 16QAM | 1/0 |

For radiated spurious measurements X, Y and Z orientations were verified. There are no significant spurious emissions variations between the three axes. Radiated spurious emissions verifications performed in "X" configuration.

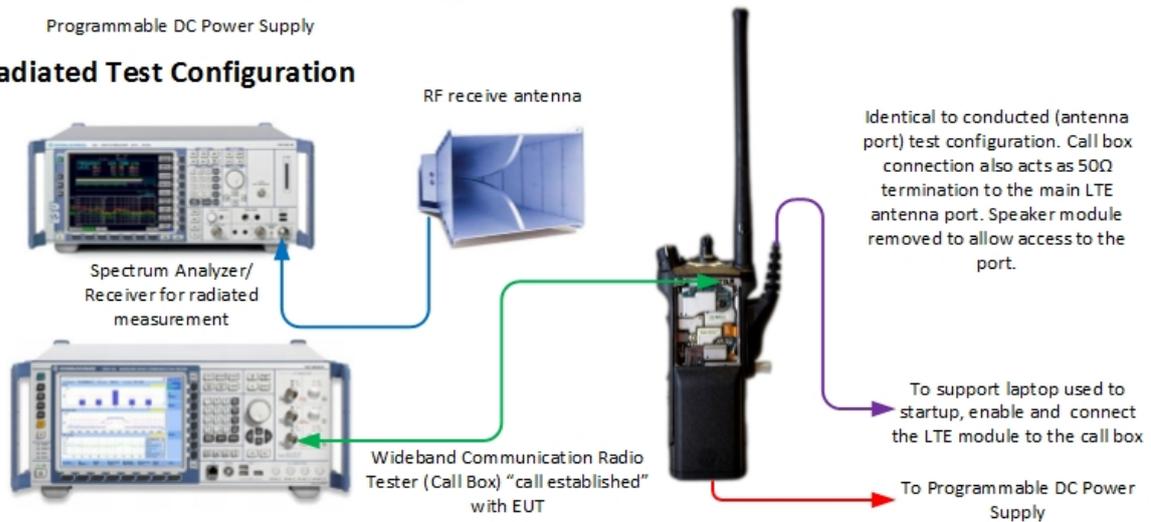


1.4.5 Simplified Test Configuration Diagram

Conducted (Antenna Port) Test Configuration



Radiated Test Configuration





1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

| Description of Modification | Modification Fitted By | Date Modification Fitted |
|-----------------------------|------------------------|--------------------------|
| Serial Number | | |
| N/A | | |

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

For conducted (if applicable) and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 FAX: 858-546 0364

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No.: US5296

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.



1.9.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.

1.10 SAMPLE CALCULATIONS

1.10.1 LTE Emission Designator (QPSK)

Emission Designator = 4M51G7D
 G = Phase Modulation
 7= Quantized/Digital Info
 D = Data Transmission, telemetry, telecommand

1.10.2 LTE Emission Designator (16QAM)

Emission Designator = 4M50W7D
 W = Frequency Modulation
 7= Quantized/Digital Info
 D = Data Transmission, telemetry, telecommand

1.10.3 Spurious Radiated Emission (below 1GHz)

| | | |
|---|----------------------------|-------|
| Measuring equipment raw measurement (dbμV) @ 30 MHz | | 24.4 |
| Correction Factor (dB) | Asset# 1066 (cable) | 0.3 |
| | Asset# 1172 (cable) | 0.3 |
| | Asset# 1016 (preamplifier) | -30.7 |
| | Asset# 1175(cable) | 0.3 |
| | Asset# 1002 (antenna) | 17.2 |
| Reported QuasiPeak Final Measurement (dbμV/m) @ 30MHz | | 11.8 |

1.10.4 Spurious Radiated Emission – Substitution Method

Example = 84dBμV/m @ 1413 MHz (numerical sample only)

The field strength reading of 84dBμV/m @ 1413 MHz (2nd Harmonic of 706.5 MHz) is the maximized measurement when the EUT is on the turntable measured at 3 meters. The gain of the substituted antenna is 7.8dBi while the transmit cable loss is 1.0 dB (cable between signal generator and the substituted antenna). The signal generator level is adjusted until the 84dBμV/m level at the receiving end is replicated (identical test setup, i.e. same antenna, cable/s and preamp). If the adjusted signal generator level is -18dBm, then we have the following for both EIRP and ERP as required:

$$\begin{aligned}
 P_{EIRP} &= -18 \text{ dBm} + 7.8 \text{ dBi} - 1 \text{ dB} \\
 &= 11.2 \text{ dBm} \\
 P_{ERP} &= P_{EIRP} - 2.15 \text{ dB} \\
 &= 11.2 \text{ dBm} - 2.15 \text{ dB} \\
 &= 9.05 \text{ dBm}
 \end{aligned}$$



SECTION 2

TEST DETAILS

Radio Testing of the
Motorola Solutions, Inc.
Multi-Band Portable Radio



2.1 TRANSMITTER CONDUCTED POWER MEASUREMENTS

2.1.1 Specification Reference

Part 2.1046 (a) and (c)

2.1.2 Standard Applicable

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

2.1.3 Equipment Under Test and Modification State

Serial No: 655CPX3214 / Test Configuration A

2.1.4 Date of Test/Initial of test personnel who performed the test

February 18, 2014/FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|----------|
| Ambient Temperature | 22.4°C |
| Relative Humidity | 41.7% |
| ATM Pressure | 99.3 kPa |

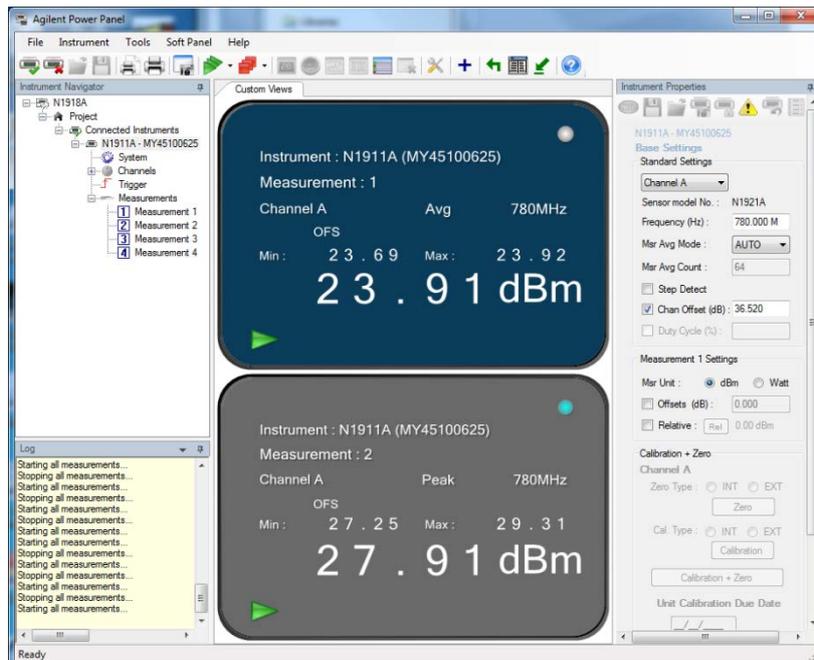
2.1.7 Additional Observations

- This is a conducted test using a peak/average power meter.
- Test performed at the primary antenna only. Diversity antenna is RX only (MISO).
- A 36.52dB power meter offset was used for the power splitter, external attenuators and cables used.
- Only representative worst case RB size and RB offset presented. Verification done using both RMC (Reference Measurement Channel) and User Defined Channels options for scheduling (CMW500).

2.1.8 Test Results

| Band | Modulation | Bandwidth | RB Size | RB Offset | Channel | Frequency | Power |
|----------|------------|-----------|---------|--------------|--------------|--------------|--------------|
| 13 | QPSK | 5.0 MHz | 25 | 0 | 23205 | 779.5 | 22.90 |
| | | | | | 23255 | 784.5 | 23.22 |
| | | | 10 | 15 | 23205 | 779.5 | 23.21 |
| | | | | | 23255 | 784.5 | 23.00 |
| | | | 1 | 0 | 23205 | 779.5 | 22.57 |
| | | | | | 23255 | 784.5 | 23.49 |
| | | 1 | 24 | 23205 | 779.5 | 23.61 | |
| | | | | 23255 | 784.5 | 22.84 | |
| | | 10.0 MHz | 50 | 0 | 23230 | 782.0 | 23.10 |
| | | | 25 | 0 | 23230 | 782.0 | 22.95 |
| | 1 | | 0 | 23230 | 782.0 | 22.55 | |
| | 1 | | 49 | 23230 | 782.0 | 23.14 | |
| | 16QAM | 5.0 MHz | 25 | 0 | 23205 | 779.5 | 23.07 |
| | | | | | 23255 | 784.5 | 23.14 |
| | | | 8 | 17 | 23205 | 779.5 | 23.42 |
| | | | | | 23255 | 784.5 | 22.94 |
| | | | 1 | 0 | 23205 | 779.5 | 22.48 |
| | | | | | 23255 | 784.5 | 23.92 |
| | | 1 | 24 | 23205 | 779.5 | 23.83 | |
| | | | | 23255 | 784.5 | 23.34 | |
| 10.0 MHz | | 50 | 0 | 23230 | 782.0 | 23.17 | |
| | | 25 | 0 | 23230 | 782.0 | 22.95 | |
| | 1 | 0 | 23230 | 782.0 | 22.98 | | |
| | 1 | 49 | 23230 | 782.0 | 23.46 | | |

2.1.9 Sample Test Measurement Screen (16-QAM 5MHz 1/0 RB Size/RB Offset)





2.2 EQUIVALENT ISOTROPIC RADIATED POWER

2.2.1 Specification Reference

RSS-130 Issue 1 (4.4)

2.2.2 Standard Applicable

The transmitter output power shall be measured in terms of average power.

For base and fixed equipment, refer to SRSP-518 for power limits.

The e.i.r.p. shall not exceed 50 watts for mobile equipment or for outdoor fixed subscriber equipment, nor shall it exceed 5 watts for portable equipment or for indoor fixed subscriber equipment.

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

2.2.3 Equipment Under Test

Serial No: 655CPX3214, Test Configuration (N/A, calculation only)

2.2.4 Date of Verification/Initial of test personnel who performed the calculation

February 25, 2014/FSC

2.2.5 Additional Observations

- EIRP was calculated as per Section 1.3.2 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$EIRP = P_T + G_T - L_C$$

Where:

P_T = transmitter conducted output power dBm (Section 2.1 of this test report)

G_T = gain of the transmitting antenna, in dBi (EIRP)

L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB (Power measurement performed directly at the primary antenna port. The loss between the LTE module and the primary antenna port is considered negligible).

2.2.6 Test Results

See attached table.



| Band 13 QPSK | | | | | | | | |
|---------------|---------|-----------|--------------|-----------------|-----------------------|--------------------|--------------|-------------|
| Bandwidth | RB Size | RB Offset | Channel | Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) |
| 5.0 MHz | 25 | 0 | 23205 | 779.5 | 22.90 | -5.0 | 17.9 | 37 |
| | | | 23255 | 784.5 | 23.22 | -5.0 | 18.22 | 37 |
| | 10 | 15 | 23205 | 779.5 | 23.21 | -5.0 | 18.21 | 37 |
| | | | 23255 | 784.5 | 23.00 | -5.0 | 18.00 | 37 |
| | 1 | 0 | 23205 | 779.5 | 22.57 | -5.0 | 17.57 | 37 |
| | | | 23255 | 784.5 | 23.49 | -5.0 | 18.49 | 37 |
| | 1 | 24 | 23205 | 779.5 | 23.61 | -5.0 | 18.61 | 37 |
| | | | 23255 | 784.5 | 22.84 | -5.0 | 17.84 | 37 |
| 10.0 MHz | 50 | 0 | 23230 | 782.0 | 23.10 | -5.0 | 18.10 | 37 |
| | 25 | 0 | 23230 | 782.0 | 22.95 | -5.0 | 17.95 | 37 |
| | 1 | 0 | 23230 | 782.0 | 22.55 | -5.0 | 17.55 | 37 |
| | 1 | 49 | 23230 | 782.0 | 23.14 | -5.0 | 18.14 | 37 |
| Band 13 16QAM | | | | | | | | |
| Bandwidth | RB Size | RB Offset | Channel | Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) |
| 5.0 MHz | 25 | 0 | 23205 | 779.5 | 23.07 | -5.0 | 18.07 | 37 |
| | | | 23255 | 784.5 | 23.14 | -5.0 | 18.14 | 37 |
| | 8 | 17 | 23205 | 779.5 | 23.42 | -5.0 | 18.42 | 37 |
| | | | 23255 | 784.5 | 22.94 | -5.0 | 17.94 | 37 |
| | 1 | 0 | 23205 | 779.5 | 22.48 | -5.0 | 17.48 | 37 |
| | | | 23255 | 784.5 | 23.92 | -5.0 | 18.92 | 37 |
| | 1 | 24 | 23205 | 779.5 | 23.83 | -5.0 | 18.83 | 37 |
| | | | 23255 | 784.5 | 23.34 | -5.0 | 18.34 | 37 |
| 10.0 MHz | 50 | 0 | 23230 | 782.0 | 23.17 | -5.0 | 18.17 | 37 |
| | 25 | 0 | 23230 | 782.0 | 22.95 | -5.0 | 17.95 | 37 |
| | 1 | 0 | 23230 | 782.0 | 22.98 | -5.0 | 17.98 | 37 |
| | 1 | 49 | 23230 | 782.0 | 23.46 | -5.0 | 18.46 | 37 |



2.3 EFFECTIVE RADIATED POWER OUTPUT DATA

2.3.1 Specification Reference

Part 27 Subpart C §27.50 (b) (10) and Part 2.1046

2.3.2 Standard Applicable

(b) The following power and antenna height limits apply to transmitters operating in the 746–763 MHz, 775–793 MHz and 805–806 MHz bands:

(10) Portable stations (hand-held devices) transmitting in the 746–757 MHz, 758–763 MHz, 776–793 MHz, and 805–806 MHz bands are limited to 3 watts ERP.

(12) For transmissions in the 746–757, 758–763, 776–787, and 788–793 MHz bands, licensees may employ equipment operating in compliance with either the measurement techniques described in paragraph (b)(11) of this section or a Commission-approved average power technique. In both instances, equipment employed must be authorized in accordance with the provisions of §27.51.

2.3.3 Equipment Under Test

Serial No: 655CPX3214, Test Configuration (N/A, calculation only)

2.3.4 Date of Verification/Initial of test personnel who performed the calculation

February 25, 2014/FSC

2.3.5 Additional Observations

- ERP was calculated as per Section 1.3.2 of KDB412172 D01 (Determining ERP and EIRP v01).
- Calculation formula in logarithmic terms:

$$\text{ERP} = P_T + G_T - L_C - 2.15\text{dB}$$

Where:

P_T = transmitter conducted output power dBm (Section 2.1 of this test report)

G_T = gain of the transmitting antenna, in dBi (EIRP - the -2.15 in the formula is to convert EIRP to ERP);

L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB (Power measurement performed directly at the primary antenna port. The loss between the LTE module and the primary antenna port is considered negligible).

2.3.6 Test Results

See attached table.



| Band 13 QPSK | | | | | | | | |
|---------------|---------|-----------|--------------|-----------------|-----------------------|--------------------|--------------|-------------|
| Bandwidth | RB Size | RB Offset | Channel | Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | ERP (dBm) | Limit (dBm) |
| 5.0 MHz | 25 | 0 | 23205 | 779.5 | 22.90 | -5.0 | 15.75 | 34.77 |
| | | | 23255 | 784.5 | 23.22 | -5.0 | 16.07 | 34.77 |
| | 10 | 24 | 23205 | 779.5 | 23.21 | -5.0 | 16.06 | 34.77 |
| | | | 23255 | 784.5 | 23.00 | -5.0 | 15.85 | 34.77 |
| | 1 | 0 | 23205 | 779.5 | 22.57 | -5.0 | 15.42 | 34.77 |
| | | | 23255 | 784.5 | 23.49 | -5.0 | 16.34 | 34.77 |
| | 1 | 24 | 23205 | 779.5 | 23.61 | -5.0 | 16.46 | 34.77 |
| | | | 23255 | 784.5 | 22.84 | -5.0 | 15.69 | 34.77 |
| 10.0 MHz | 50 | 0 | 23230 | 782.0 | 23.10 | -5.0 | 15.95 | 34.77 |
| | 25 | 0 | 23230 | 782.0 | 22.95 | -5.0 | 15.8 | 34.77 |
| | 1 | 0 | 23230 | 782.0 | 22.55 | -5.0 | 15.4 | 34.77 |
| | 1 | 49 | 23230 | 782.0 | 23.14 | -5.0 | 15.99 | 34.77 |
| Band 13 16QAM | | | | | | | | |
| Bandwidth | RB Size | RB Offset | Channel | Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | ERP (dBm) | Limit (dBm) |
| 5.0 MHz | 25 | 0 | 23205 | 779.5 | 23.07 | -5.0 | 15.92 | 34.77 |
| | | | 23255 | 784.5 | 23.14 | -5.0 | 15.99 | 34.77 |
| | 8 | 24 | 23205 | 779.5 | 23.42 | -5.0 | 16.27 | 34.77 |
| | | | 23255 | 784.5 | 22.94 | -5.0 | 15.79 | 34.77 |
| | 1 | 0 | 23205 | 779.5 | 22.48 | -5.0 | 15.33 | 34.77 |
| | | | 23255 | 784.5 | 23.92 | -5.0 | 16.77 | 34.77 |
| | 1 | 24 | 23205 | 779.5 | 23.83 | -5.0 | 16.68 | 34.77 |
| | | | 23255 | 784.5 | 23.34 | -5.0 | 16.19 | 34.77 |
| 10.0 MHz | 50 | 0 | 23230 | 782.0 | 23.17 | -5.0 | 16.02 | 34.77 |
| | 25 | 0 | 23230 | 782.0 | 22.95 | -5.0 | 15.8 | 34.77 |
| | 1 | 0 | 23230 | 782.0 | 22.98 | -5.0 | 15.83 | 34.77 |
| | 1 | 49 | 23230 | 782.0 | 23.46 | -5.0 | 16.31 | 34.77 |



2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

Part 27 Subpart C §27.53(h), 2.1049, RSS-GEN Issue 3 (4.6.1)

2.4.2 Standard Applicable

The emission 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 26 dB below the transmitter power.

2.4.3 Equipment Under Test and Modification State

Serial No: 655CPX3214 / Test Configuration B

2.4.4 Date of Test/Initial of test personnel who performed the test

February 18, 2014/FSC

2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|----------|
| Ambient Temperature | 22.4°C |
| Relative Humidity | 41.7% |
| ATM Pressure | 99.3 kPa |

2.4.7 Additional Observations

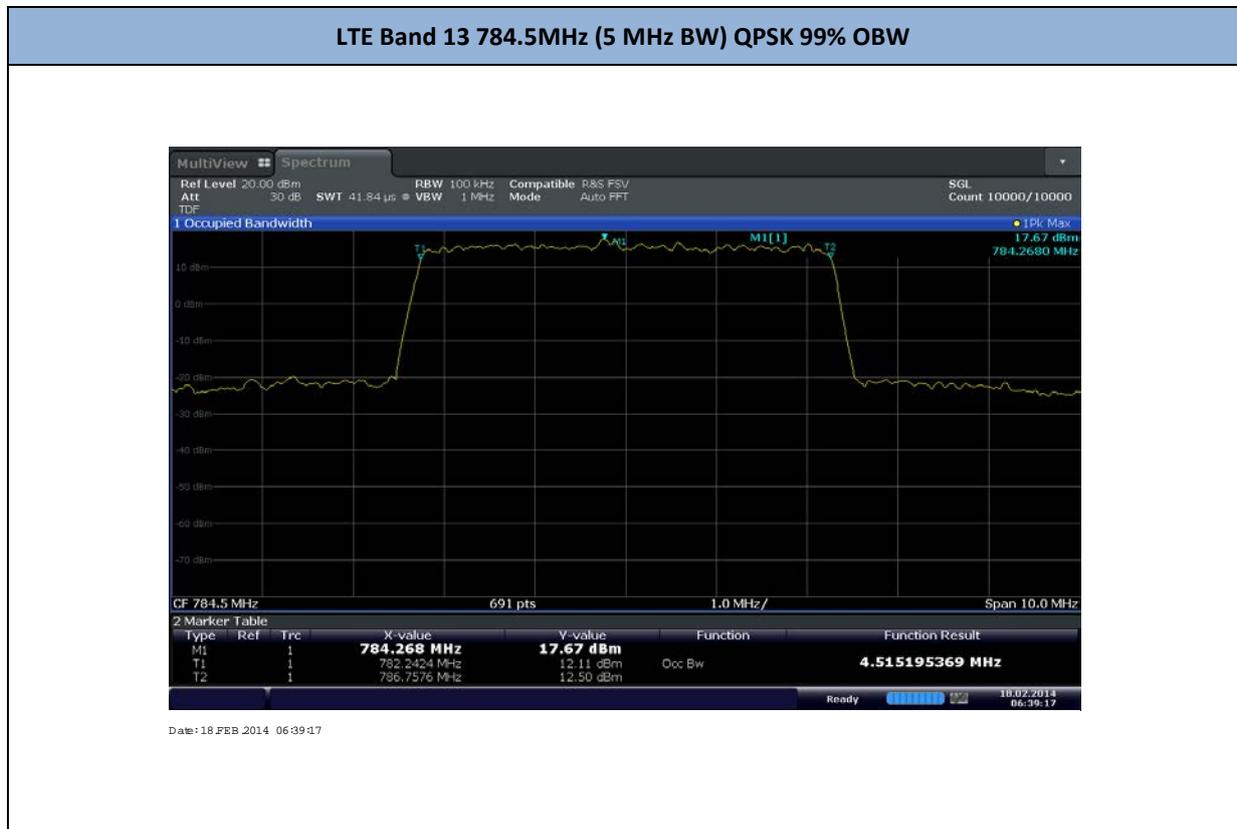
- This is a conducted test. Test procedure is per Section 4.0 of KDB971168 (D01 Power Meas License Digital Systems v02r01).
- Both relative OBW (-26dB BW) and 99% OBW presented.
- All channels per each channel bandwidth/band were verified. No significant difference observed. Only the worst channel presented.

2.4.8 Test Results

See attached table and plots.



| LTE Band | Channel | Frequency (MHz) | BW (MHz) | Modulation | 99% OBW (MHz) | -26dB BW (MHz) |
|----------|---------|-----------------|----------|------------|---------------|----------------|
| 13 | 23255 | 784.5 | 5.0 | QPSK | 4.5151 | 4.89 |
| 13 | 23255 | 784.5 | 5.0 | 16QAM | 4.5007 | 4.89 |
| 13 | 23230 | 782.0 | 10.0 | QPSK | 8.9725 | 9.52 |
| 13 | 23230 | 782.0 | 10.0 | 16QAM | 9.0014 | 9.55 |



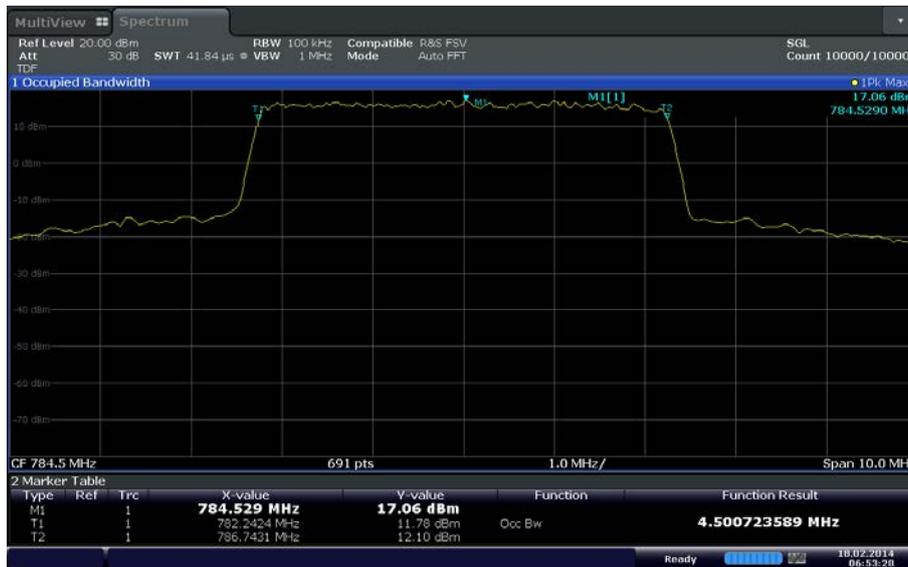


LTE Band 13 784.5MHz (5 MHz BW) QPSK -26dB OBW



Date: 18.FEB.2014 06:46:26

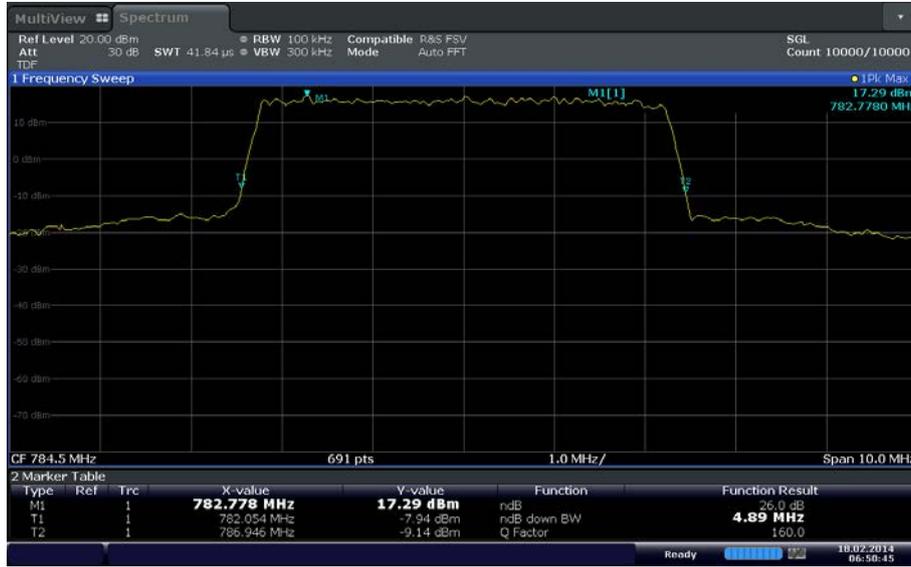
LTE Band 13 784.5MHz (5 MHz BW) 16QAM 99% OBW



Date: 18.FEB.2014 06:53:28

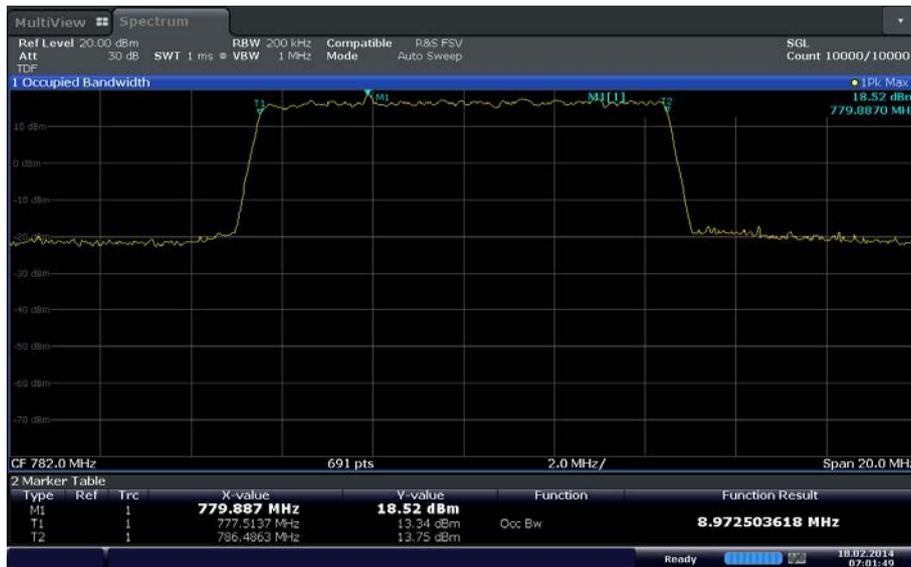


LTE Band 13 784.5MHz (5 MHz BW) 16QAM -26dB OBW



Date: 18.FEB.2014 06:50:44

LTE Band 13 782.0MHz (10 MHz BW) QPSK 99% OBW



Date: 18.FEB.2014 07:01:49



LTE Band 13 782.0MHz (10 MHz BW) QPSK -26dB OBW



Date: 18.FEB.2014 07:03:42

LTE Band 13 782.0MHz (10 MHz BW) 16QAM 99% OBW



Date: 18.FEB.2014 07:31:09



LTE Band 13 782.0MHz (10 MHz BW) 16QAM -26dB OBW



Date: 18.FEB.2014 07:29:21



2.5 PEAK-AVERAGE POWER RATIO

2.5.1 Specification Reference

RSS-130 Issue 1 (4.4)

2.5.2 Standard Applicable

The transmitter output power shall be measured in terms of average power.
For base and fixed equipment, refer to SRSP-518 for power limits.

The e.i.r.p. shall not exceed 50 watts for mobile equipment or for outdoor fixed subscriber equipment, nor shall it exceed 5 watts for portable equipment or for indoor fixed subscriber equipment.

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

2.5.3 Equipment Under Test and Modification State

Serial No: 655CPX3214 / Test Configuration A

2.5.4 Date of Test/Initial of test personnel who performed the test

February 20, 2014/FSC

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|----------|
| Ambient Temperature | 21.9°C |
| Relative Humidity | 42.1% |
| ATM Pressure | 99.0 kPa |

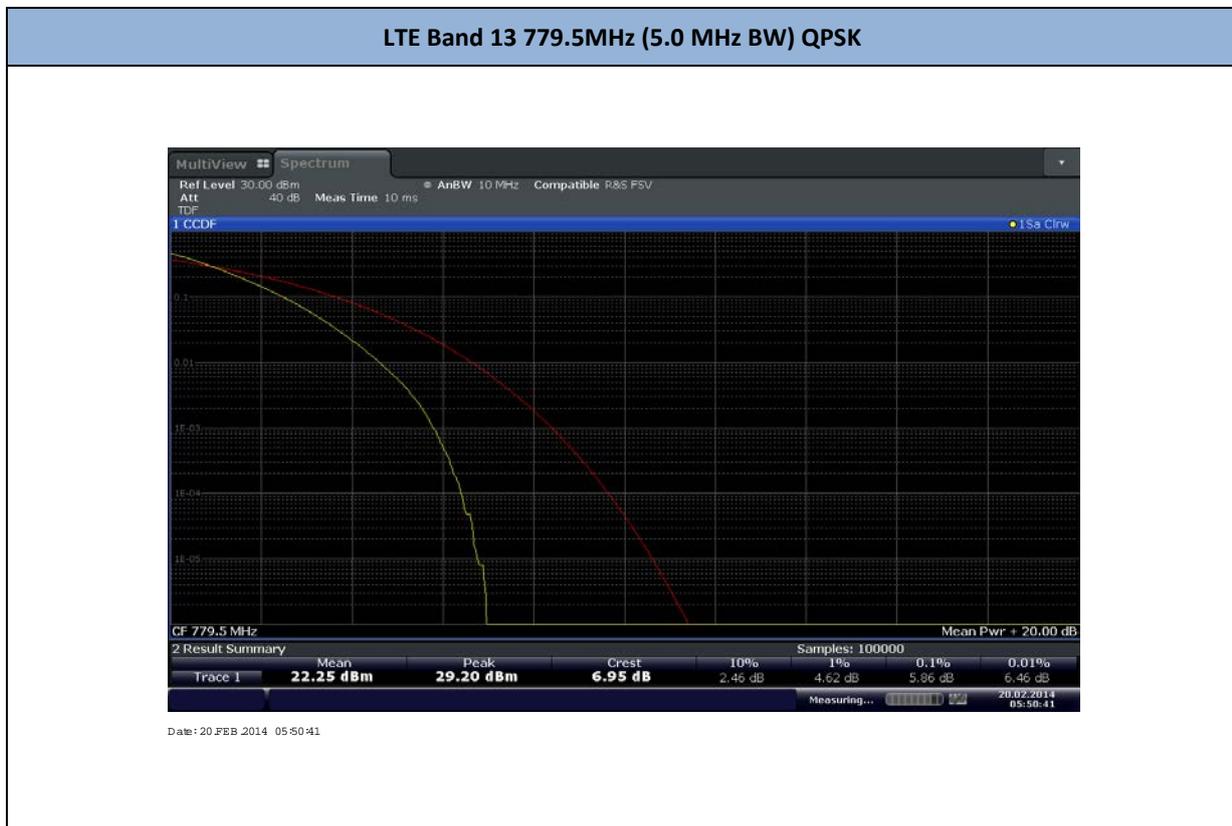
2.5.7 Additional Observations

- This is a conducted test. Test procedure is per Section 5.7.1 of KDB971168 (D01 Power Meas License Digital Systems v02r01).
- The Transducer Correction Factor (TDF) was used as an offset for the power splitter, external attenuators and cables used. At the measurement frequency (777-787MHz), this translates to approximately 36.52dB of loss.



- Measurement was done using the Spectrum Analyzer's Complementary Cumulative Distribution Function (CCDF) measurement profile. The built-in function is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth (crest factor or peak-to-average ratio) A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.
- All channels based from worst case configuration channel bandwidth were verified. Only the worst channel presented.
- There are no measured PAR levels greater than 13dB. The highest measured PAR (0.1% of the time) is 6.28 dB. EUT complies.

2.5.8 Test Results





LTE Band 13 782.0MHz (5.0 MHz BW) QPSK

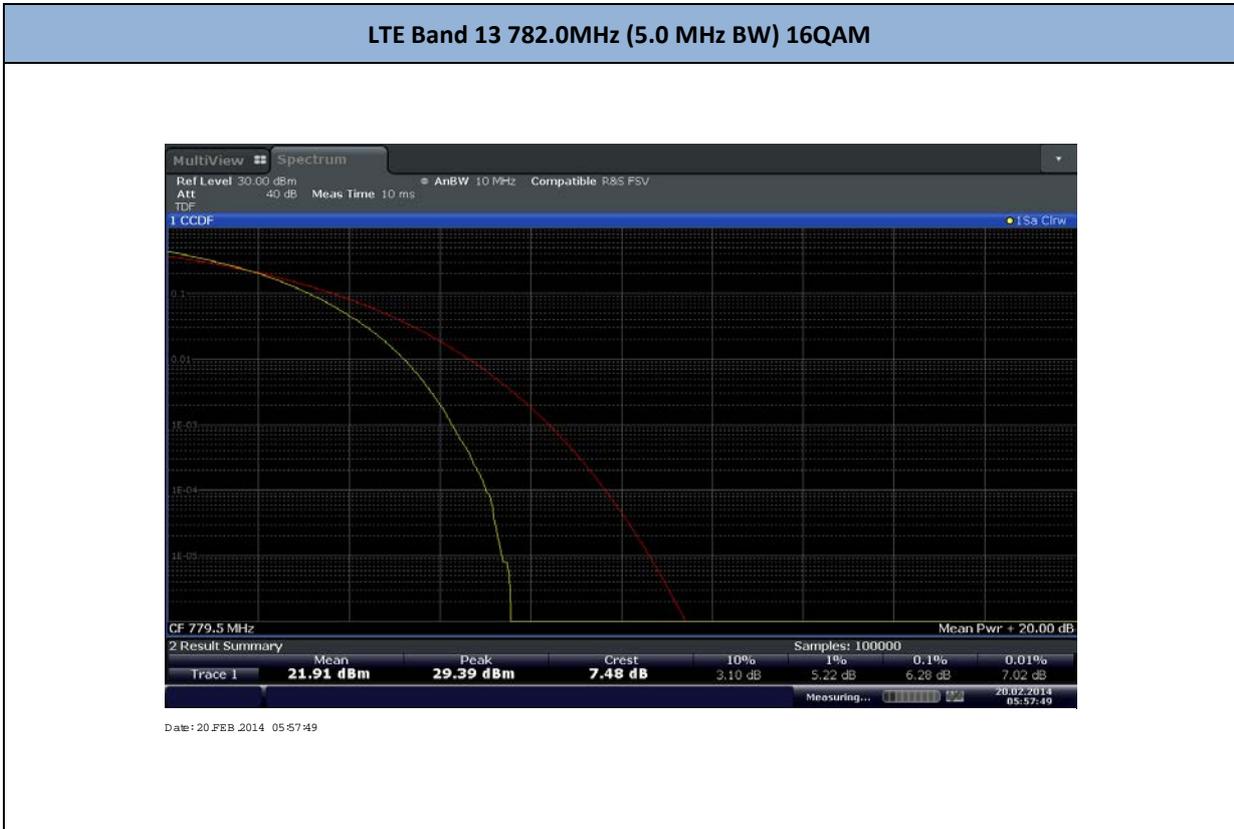


Date: 20.FEB.2014 05:52:46

LTE Band 13 784.5MHz (5.0 MHz BW) 16QAM



Date: 20.FEB.2014 05:58:57





2.6 BAND EDGE

2.6.1 Specification Reference

Part 27 Subpart C §27.53(c)(2)(5) and RSS-130(4.6.1)

2.6.2 Standard Applicable

(c)(2) On any frequency outside the 776–788 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;

(c)(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.

The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10}(p)$ (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

2.6.3 Equipment Under Test and Modification State

Serial No: 655CPX3214 / Test Configuration A

2.6.4 Date of Test/Initial of test personnel who performed the test

February 18 and 27, 2014/FSC

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|----------------|
| Ambient Temperature | 22.4-23.6°C |
| Relative Humidity | 41.7-46.8% |
| ATM Pressure | 99.3-100.2 kPa |

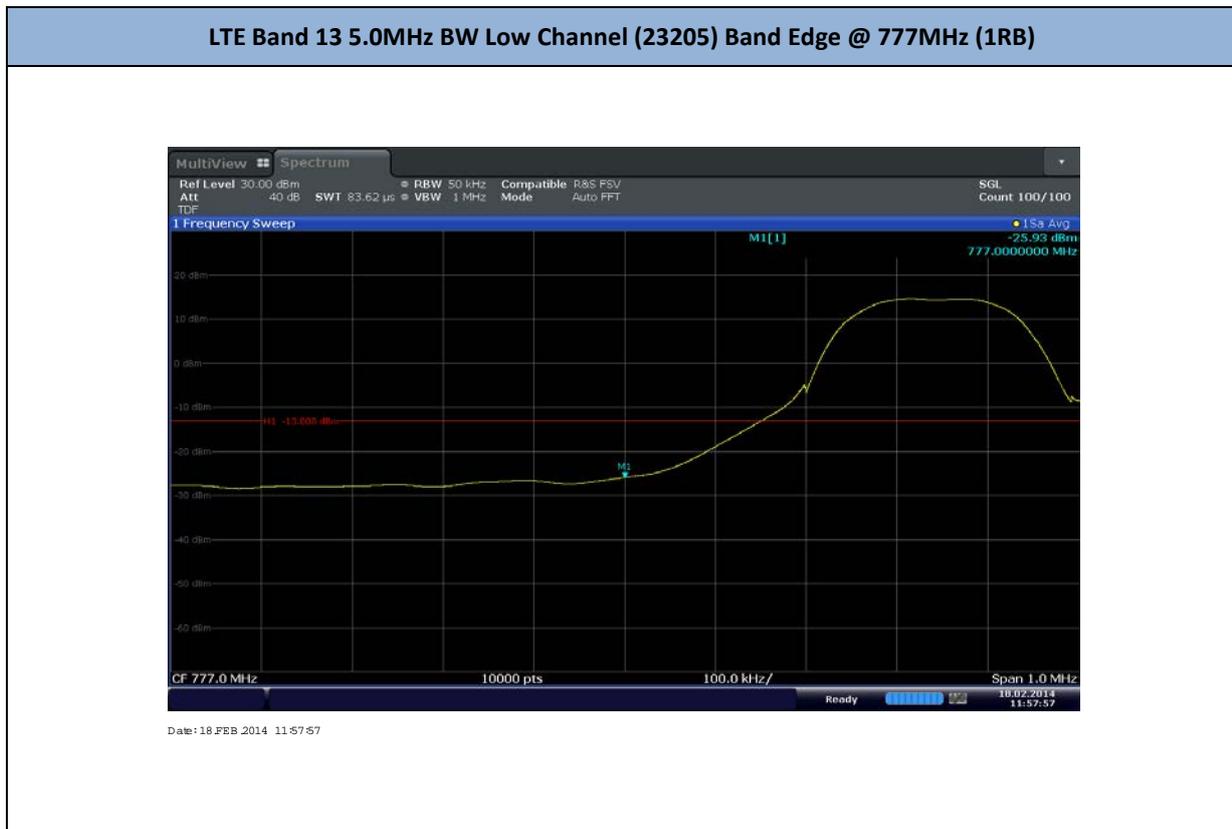
2.6.7 Additional Observations

- This is a conducted test. Test guidance is per Section 6.0 of KDB971168 (D01 Power Meas License Digital Systems v02r01).
- The transducer factor (TDF) used is from the power splitter, external attenuators and cables used.



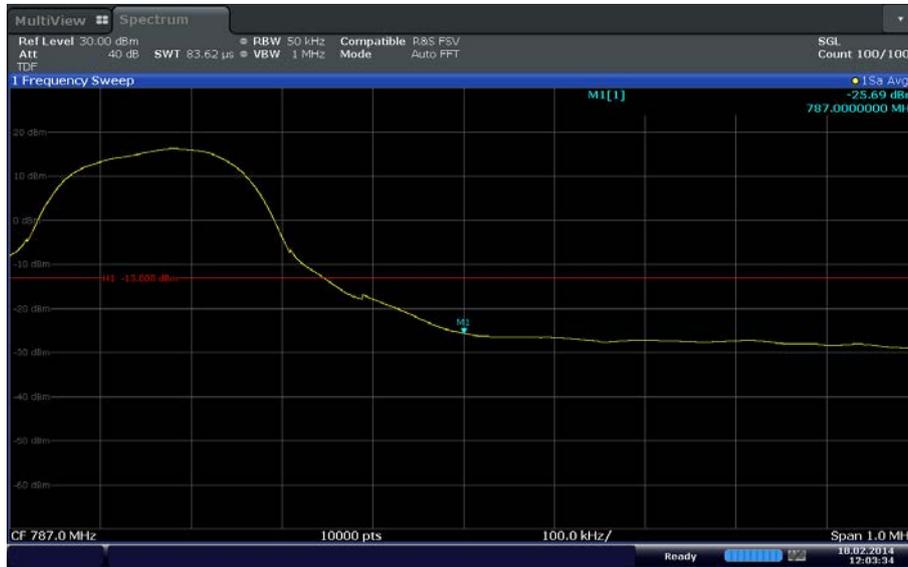
- The center frequency of the spectrum is the band edge frequency (worst case 777 MHz -787 MHz per IC requirement).
- Using a span of 1MHz for Band 13, RBW is set to 100 kHz (minimum of 30kHz limited to 1% of EBW) and VBW is set to 3X RBW.
- For lower band edge, 0 offset is utilized while the maximum allowable offset per channel bandwidth for upper band edge is used.
- All RB size available verified and the worst case size for band edge verification presented in this test report.

2.6.8 Test Results





LTE Band 13 5.0MHz BW High Channel (23255) Band Edge @ 787MHz (1RB)



Date: 18 FEB 2014 12:03:34

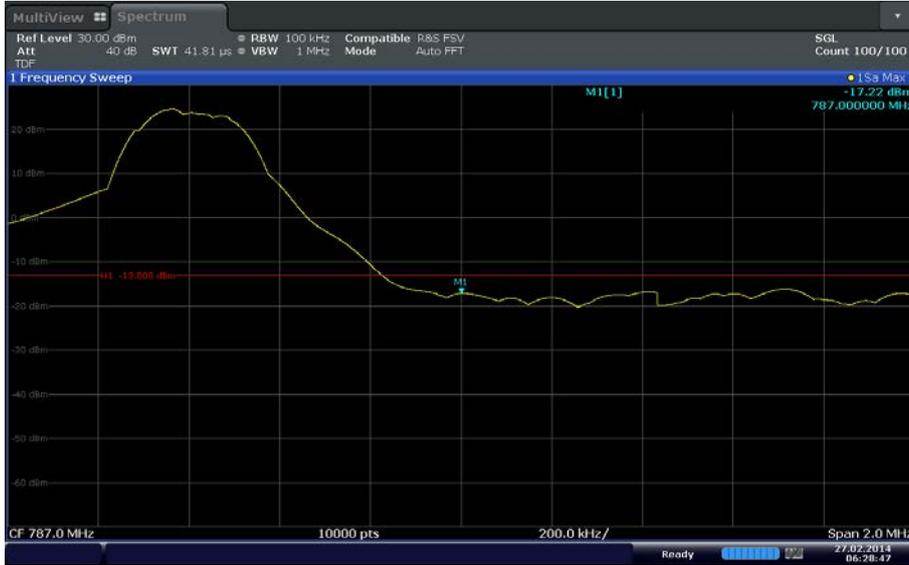
LTE Band 13 10.0MHz BW Channel 23230 Band Edge @ 777MHz (1RB)



Date: 27 FEB 2014 06:33:15



LTE Band 13 10.0MHz BW Channel 23230 Band Edge @ 787MHz (1RB)



Date: 27.FEB.2014 06:28:47



2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

Part 27 Subpart C §27.53 (c)(2)(5) and Part 2.1051, RSS-130 Issue 1(4.6.2)

2.7.2 Standard Applicable

(c)(2) On any frequency outside the 776–788 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;

(c)(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.

4.6.2 In addition to the limit outlined in Section 4.6.1 (IC RSS-Gen and RSS-130 Issue 1 October 2013), equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

(a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} P$ (watts), dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} P$ (watts), dB, for mobile and portable equipment.

(b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

2.7.3 Equipment Under Test and Modification State

Serial No: 655CPX3214 / Test Configuration A

2.7.4 Date of Test/Initial of test personnel who performed the test

February 20, 2014/FSC

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

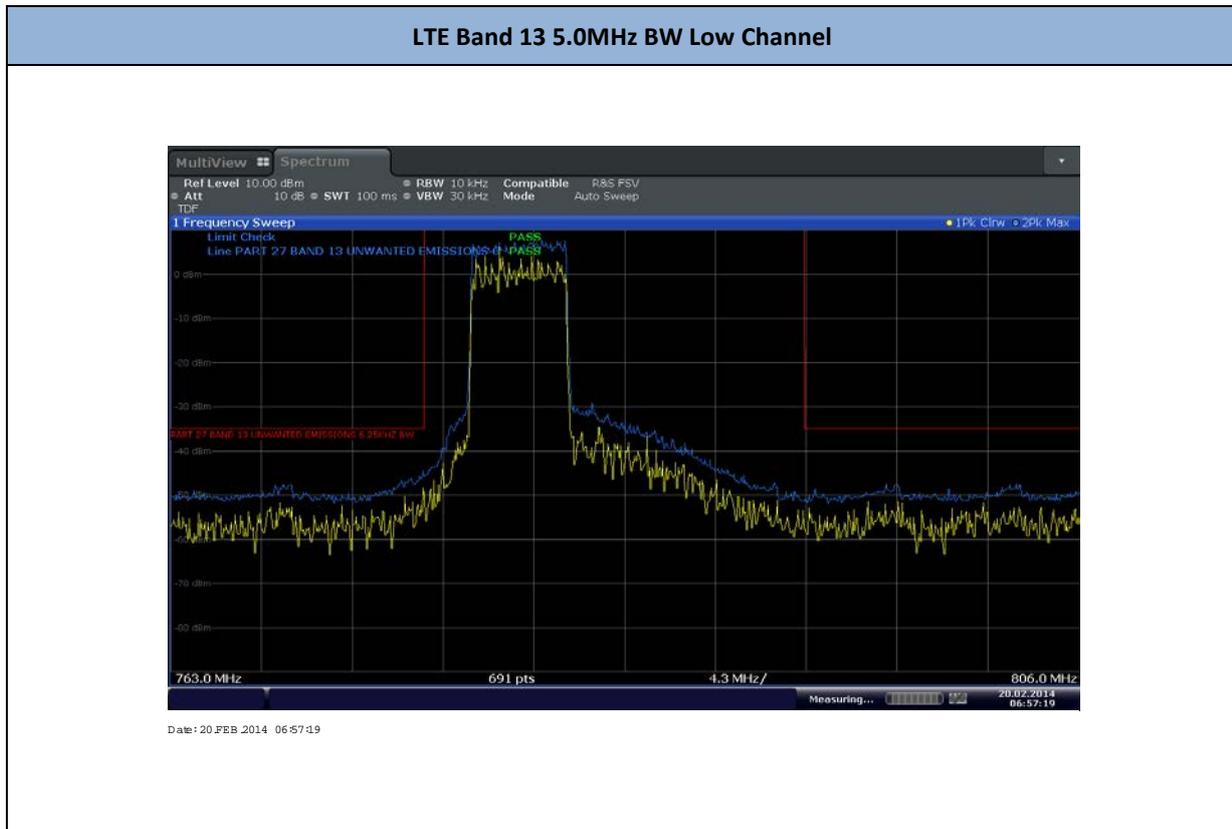
| | |
|---------------------|----------|
| Ambient Temperature | 21.9°C |
| Relative Humidity | 42.1% |
| ATM Pressure | 99.0 kPa |



2.7.7 Additional Observations

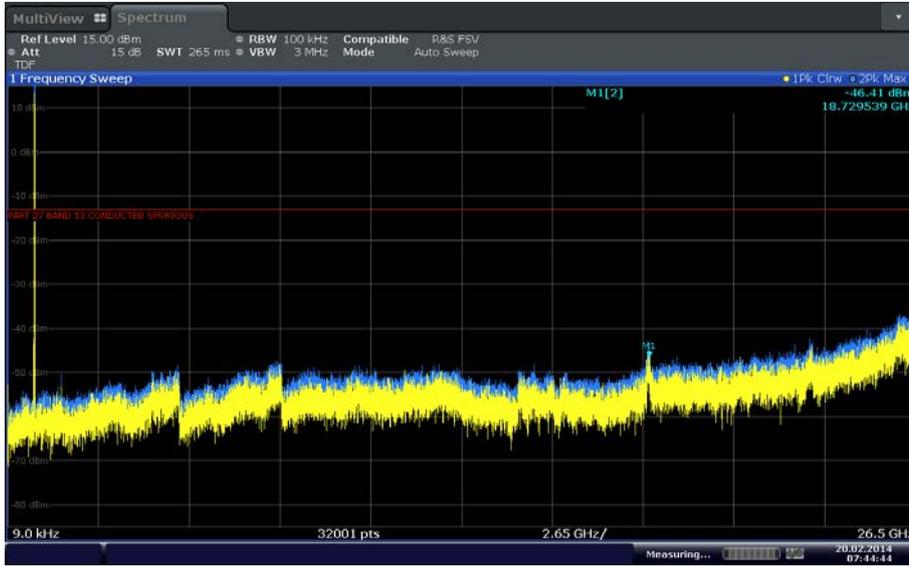
- This is a conducted test. The transducer factor (TDF) used is from the power splitter, external attenuators and cables used.
- The spectrum was searched from 9 kHz to 26.5GHz (requirement is up to the 10th harmonic ($\leq 8\text{GHz}$)).
- All channels and channel bandwidths verified. Only the worst RB size/offset presented.
- For 763-775 MHz and 793-806 MHz verification, the next available RBW was used (6.25 kHz required, 10kHz RBW utilized).

2.7.8 Test Results



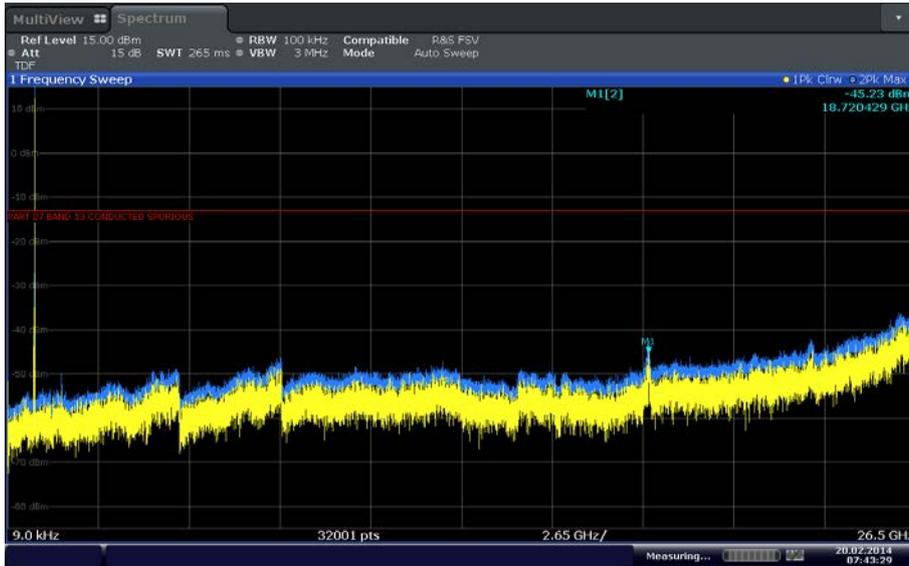


LTE Band 13 5.0MHz BW Low Channel



Date: 20.FEB.2014 07:44:44

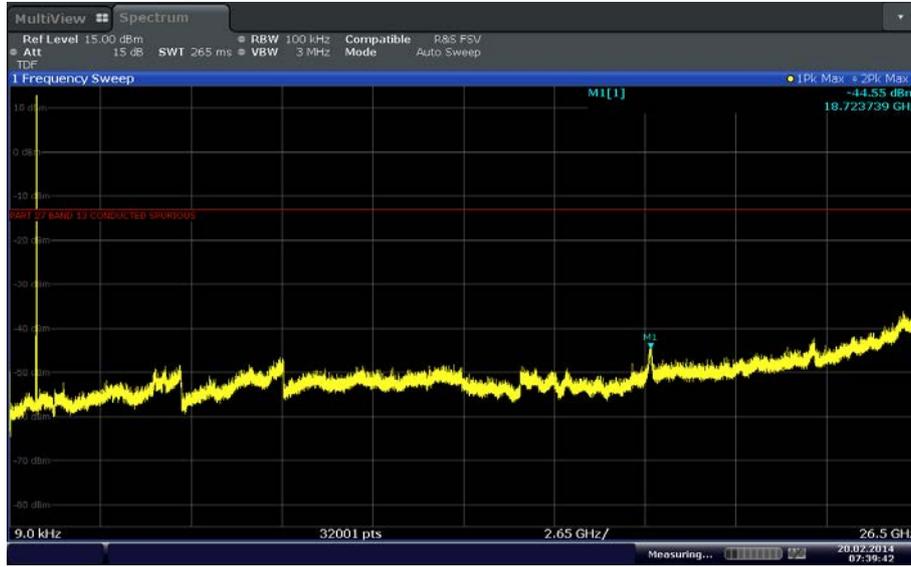
LTE Band 13 5.0MHz BW High Channel



Date: 20.FEB.2014 07:43:29



LTE Band 13 10.0MHz BW



Date: 20 FEB 2014 07:39:41



2.8 FIELD STRENGTH OF SPURIOUS RADIATION

2.8.1 Specification Reference

Part 27 Subpart C §27.53(c) and Part 2.1053, RSS-130(4.6)

2.8.2 Standard Applicable

c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following: (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; (5) Compliance with the provisions of paragraphs (c)(1) 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.

4.6.2 In addition to the limit outlined in Section 4.6.1 (IC RSS-Gen and RSS-130 Issue 1 October 2013), equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

(a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} p(\text{watts})$, dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} p(\text{watts})$, dB, for mobile and portable equipment.

(b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

2.8.3 Equipment Under Test and Modification State

Serial No: 655CPX1171 / Test Configuration A

2.8.4 Date of Test/Initial of test personnel who performed the test

February 12 and 25, 2014/FSC

2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|---------------|
| Ambient Temperature | 23.2-23.7°C |
| Relative Humidity | 41.5-47.2% |
| ATM Pressure | 99.8-99.9 kPa |



2.8.7 Additional Observations

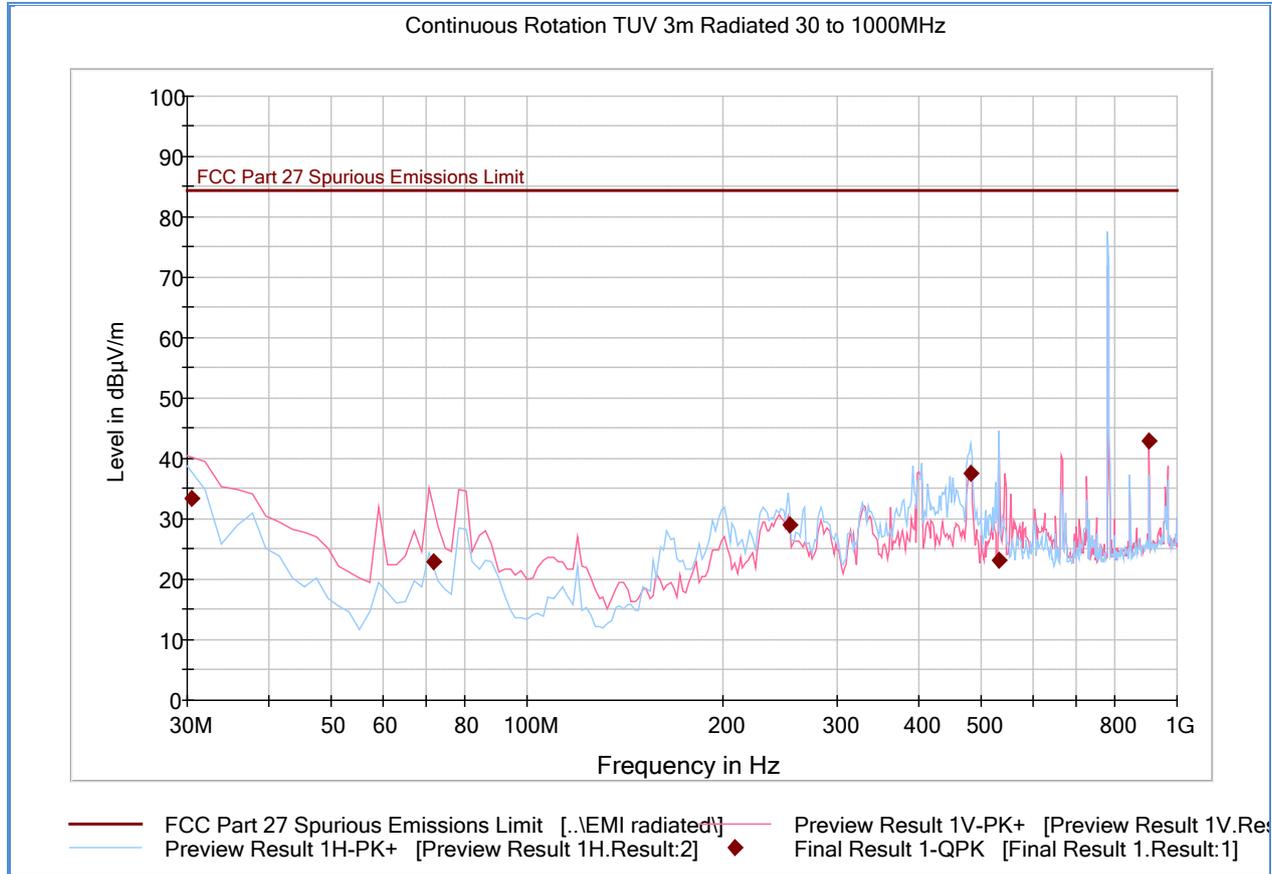
- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Only the worst case configuration presented in this test report.
- The spectrum was searched from 30 MHz to 18 GHz (requirement is up to the 10th harmonic ($\leq 8\text{GHz}$)).
- There are no emissions found that doesn't comply with -70dBW/MHz limit (wideband) in the 1559-1610 MHz frequency range. This limit corresponds to 55.23 dB μ V/m @ 3 meters.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.8.8 Test Results

See attached plots.



2.8.9 Test Results Below 1GHz-(Band 13)



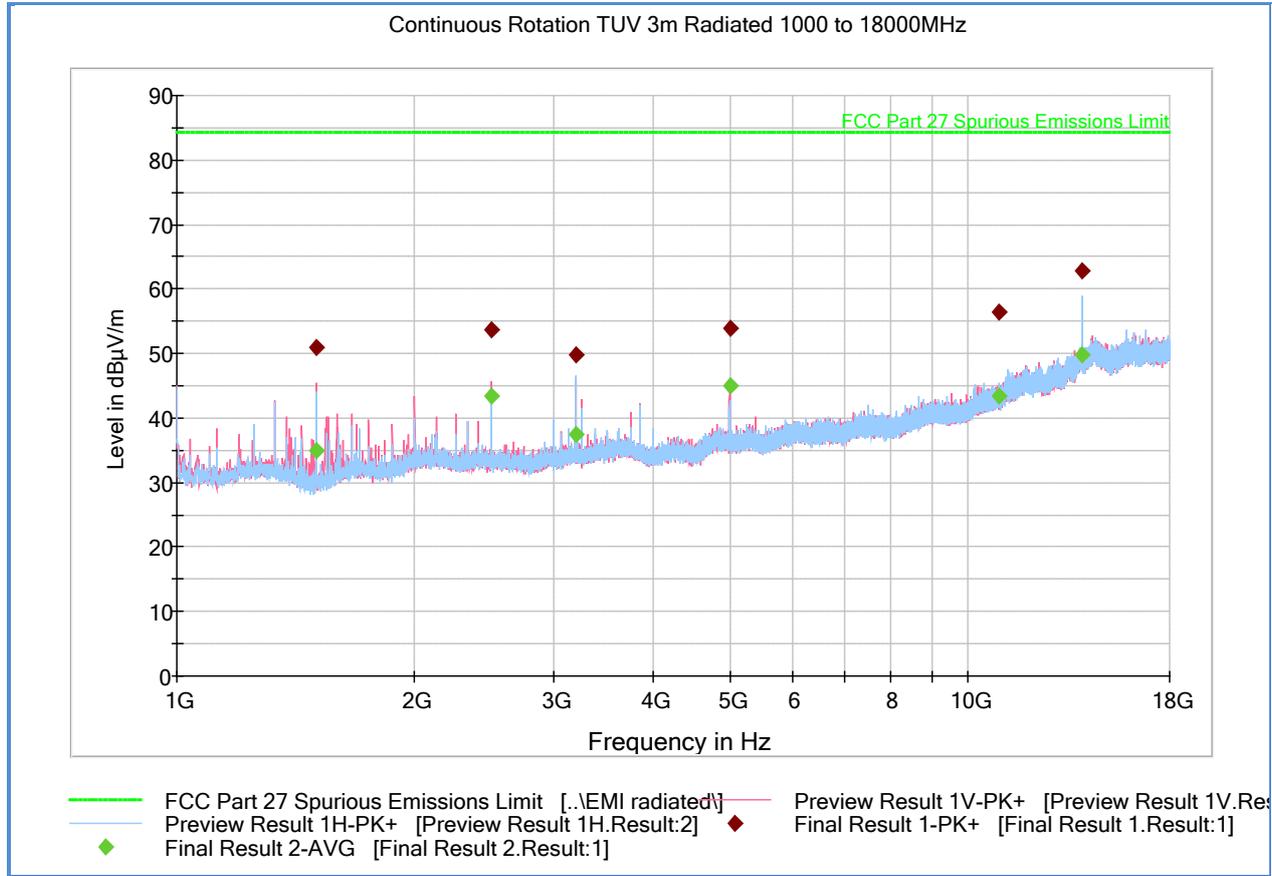
Quasi Peak Data

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 30.400000 | 33.5 | 1000.0 | 120.000 | 110.0 | V | 172.0 | -10.6 | 50.9 | 84.4 |
| 71.621643 | 22.9 | 1000.0 | 120.000 | 200.0 | V | -15.0 | -21.4 | 61.5 | 84.4 |
| 253.883206 | 29.0 | 1000.0 | 120.000 | 100.0 | H | 290.0 | -13.7 | 55.4 | 84.4 |
| 480.701964 | 37.5 | 1000.0 | 120.000 | 110.0 | H | 320.0 | -5.5 | 46.9 | 84.4 |
| 533.083046 | 23.1 | 1000.0 | 120.000 | 350.0 | H | 193.0 | -4.8 | 61.3 | 84.4 |
| 905.413387 | 42.9 | 1000.0 | 120.000 | 100.0 | V | 227.0 | 2.8 | 41.5 | 84.4 |

Test Notes: Only worst case channel presented for spurious emissions below 1GHz. Emissions within 20dB of the Part 27 Subpart C §27.53 limit are proven by substitution method. However no such emission observed. Part 27 Subpart C §27.53 limit @ 3 meters is 82.23 dBµV/m.



2.8.10 Test Results Above 1GHz (Low Channel - Band 13 Worst Case Configuration 5MHz BW)



Peak Data

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1500.000000 | 50.9 | 1000.0 | 1000.000 | 400.0 | V | -15.0 | -1.9 | 33.5 | 84.4 |
| 2500.166667 | 53.7 | 1000.0 | 1000.000 | 137.0 | V | -20.0 | 2.4 | 30.7 | 84.4 |
| 3199.600000 | 49.9 | 1000.0 | 1000.000 | 100.0 | H | 42.0 | 4.2 | 34.5 | 84.4 |
| 4999.900000 | 53.9 | 1000.0 | 1000.000 | 200.0 | V | 309.0 | 7.9 | 30.5 | 84.4 |
| 10968.800000 | 56.4 | 1000.0 | 1000.000 | 200.0 | H | 286.0 | 16.3 | 28.0 | 84.4 |
| 13945.466667 | 62.9 | 1000.0 | 1000.000 | 244.0 | H | 258.0 | 21.3 | 21.5 | 84.4 |

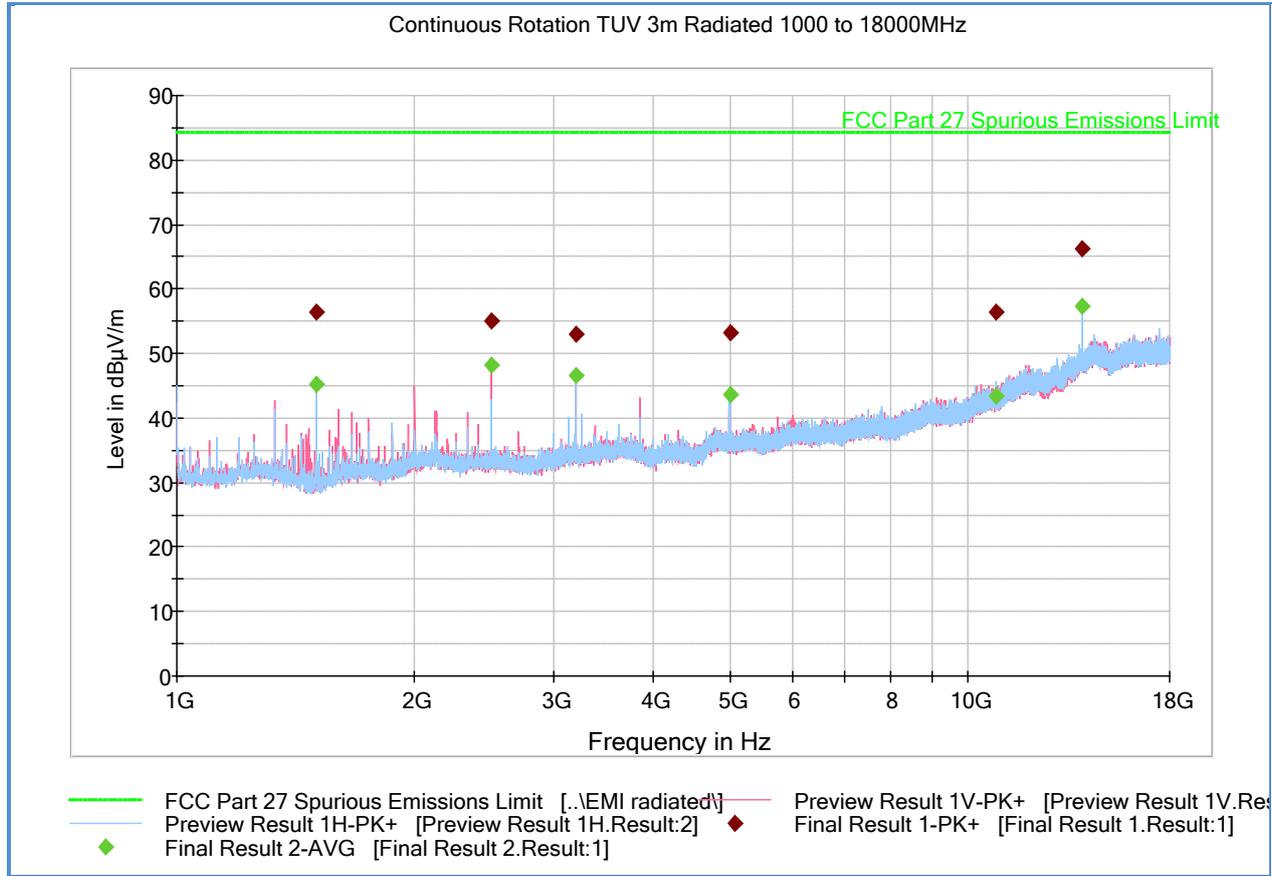
Substitution Data

| Frequency (MHz) | Field Strength @ 3 meters (dBµV/m) | Cable Loss (dB) | Substitution Antenna Gain (dBi) | Signal Generator Level (dBm) | Substitution Data SGL+AG-CL (dBm) | Limit (dBm) | Compliance |
|-----------------|------------------------------------|-----------------|---------------------------------|------------------------------|-----------------------------------|-------------|------------|
| | | | | | | | |

Test Notes: Only worst case bandwidth/modulation presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.8.11 Test Results Above 1GHz (High Channel - Band 13 Worst Case Configuration 5MHz BW)



Peak Data

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1500.000000 | 56.4 | 1000.0 | 1000.000 | 237.0 | V | -16.0 | -1.9 | 28.0 | 84.4 |
| 2500.166667 | 55.1 | 1000.0 | 1000.000 | 177.0 | V | 293.0 | 2.4 | 29.3 | 84.4 |
| 3200.000000 | 52.9 | 1000.0 | 1000.000 | 100.0 | H | 63.0 | 4.2 | 31.5 | 84.4 |
| 4999.900000 | 53.1 | 1000.0 | 1000.000 | 245.0 | V | 313.0 | 7.9 | 31.3 | 84.4 |
| 10848.466667 | 56.4 | 1000.0 | 1000.000 | 151.0 | H | 205.0 | 15.9 | 28.0 | 84.4 |
| 13960.600000 | 66.2 | 1000.0 | 1000.000 | 400.0 | H | 254.0 | 21.3 | 18.2 | 84.4 |

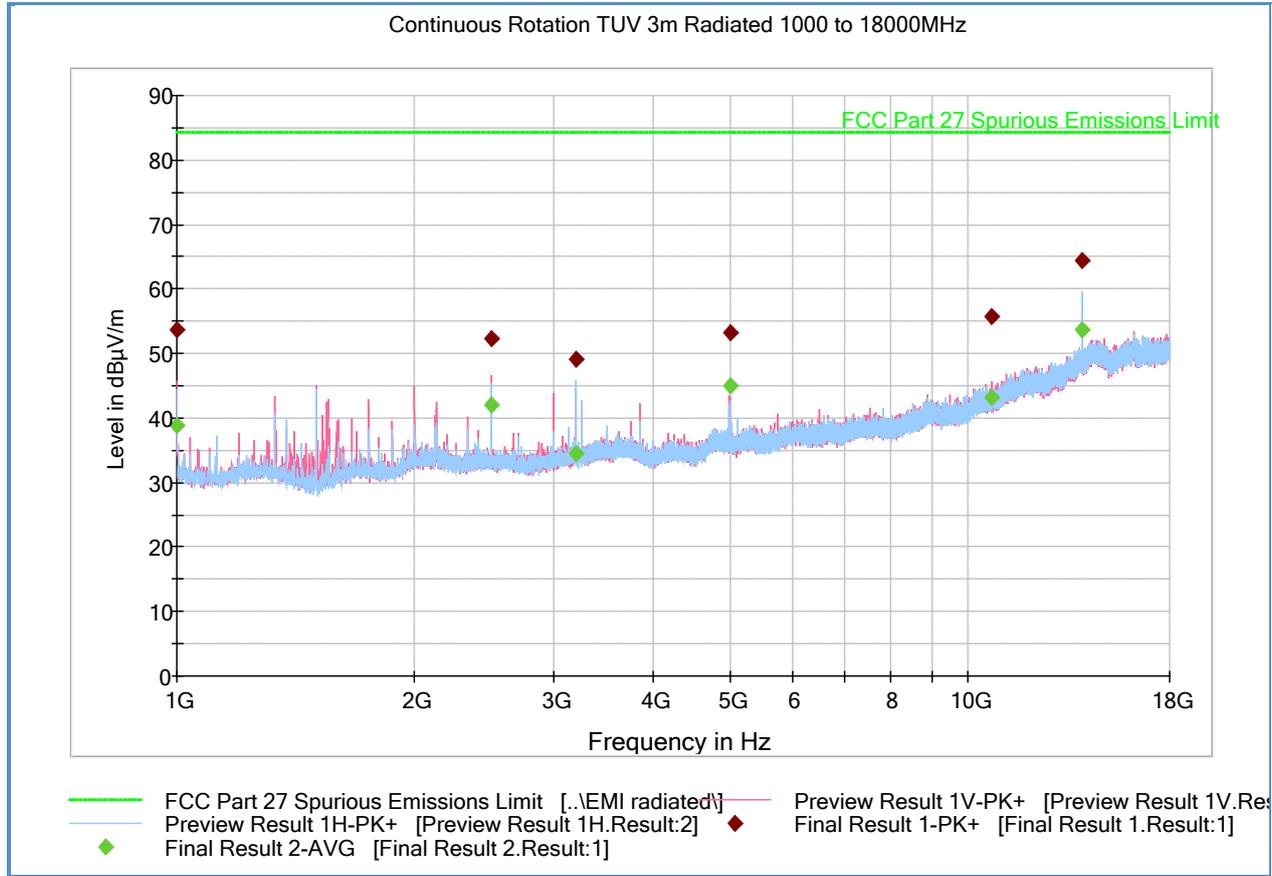
Substitution Data

| Frequency (MHz) | Field Strength @ 3 meters (dBµV/m) | Cable Loss (dB) | Substitution Antenna Gain (dBi) | Signal Generator Level (dBm) | Substitution Data SGL+AG-CL (dBm) | Limit (dBm) | Compliance (Margin in dB) |
|-----------------|------------------------------------|-----------------|---------------------------------|------------------------------|-----------------------------------|-------------|---------------------------|
| | | | | | | | |

Test Notes: Only worst case bandwidth/modulation presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.8.12 Test Results Above 1GHz (Band 13 Worst Case Configuration 10MHz BW)



Peak Data

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1000.500000 | 53.6 | 1000.0 | 1000.000 | 205.0 | V | 4.0 | -1.1 | 30.8 | 84.4 |
| 2500.166667 | 52.3 | 1000.0 | 1000.000 | 138.0 | V | -9.0 | 2.4 | 32.1 | 84.4 |
| 3199.200000 | 49.2 | 1000.0 | 1000.000 | 100.0 | H | 43.0 | 4.2 | 35.2 | 84.4 |
| 4999.933333 | 53.2 | 1000.0 | 1000.000 | 237.0 | V | 310.0 | 7.9 | 31.2 | 84.4 |
| 10738.566667 | 55.7 | 1000.0 | 1000.000 | 192.0 | V | 165.0 | 15.7 | 28.7 | 84.4 |
| 13953.233333 | 64.4 | 1000.0 | 1000.000 | 300.0 | H | 259.0 | 21.3 | 20.0 | 84.4 |

Substitution Data

| Frequency (MHz) | Field Strength @ 3 meters (dBµV/m) | Cable Loss (dB) | Substitution Antenna Gain (dBi) | Signal Generator Level (dBm) | Substitution Data SGL+AG-CL (dBm) | Limit (dBm) | Compliance (Margin in dB) |
|-----------------|------------------------------------|-----------------|---------------------------------|------------------------------|-----------------------------------|-------------|---------------------------|
| | | | | | | | |

Test Notes: Only worst case bandwidth/modulation presented for spurious emissions above 1GHz. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.9 FREQUENCY STABILITY

2.9.1 Specification Reference

Part 27 Subpart C §27.54 and Part 2.1055(a)(1) and (d)(1), RSS-130(4.3)

2.9.2 Standard Applicable

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

The transmitter frequency stability limit shall be determined as follows:

- (a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
- (b) Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of $43 + 10 \log_{10} p$ (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as f_L and f_H respectively.

The applicant shall ensure frequency stability by showing that f_L minus the frequency offset and f_H plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

2.9.3 Equipment Under Test and Modification State

Serial No: 655CPX3214 / Test Configuration A

2.9.4 Date of Test/Initial of test personnel who performed the test

February 26, 2014/FSC

2.9.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|----------|
| Ambient Temperature | 23.3°C |
| Relative Humidity | 43.6% |
| ATM Pressure | 99.4 kPa |

2.9.7 Additional Observations

- This is a conducted test. The EUT was operated at 7.5VDC nominal voltage and was placed in the temperature chamber for this evaluation. The EUT was controlled by a CMW500 and the maximum frequency error was monitored through the Wideband Radio Communication Tester Frequency Error measurement function under LTE TX Measurement.



- The Temperature was reduced to -30°C and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements were then performed. The temperature was then increased by 10°C steps and allowed to settle before taking the next set of measurements.
- Voltage variation was also performed at 85% and 115% of the nominal voltage.
- Only worst case configuration presented. See Section 1.4.4 of this test report for details.
- The maximum frequency deviation was verified against the frequency band edges using the EBW data. Sample calculation:

LTE Band 13 worst case frequency error: -65.67 Hz
Worst case EBW (-26dB) of LTE Band 13 5MHz BW: 4.89 MHz

Low Channel Sample Calculation:

Edge of fundamental emission (784.5-(4.89/2)): 782.05500 MHz
Max. fundamental frequency error (782.055 - 0.00006567): 782.05493 MHz
EUT complies. 782.05493 MHz > 776 MHz (edge of authorized band)

High Channel Sample Calculation:

Edge of fundamental emission (784.5+ (4.89/2)): 786.94500 MHz
Max. fundamental frequency error (786.945 + 0.00006567): 786.94506 MHz
EUT complies. 786.94506 MHz < 787 MHz (edge of authorized band)

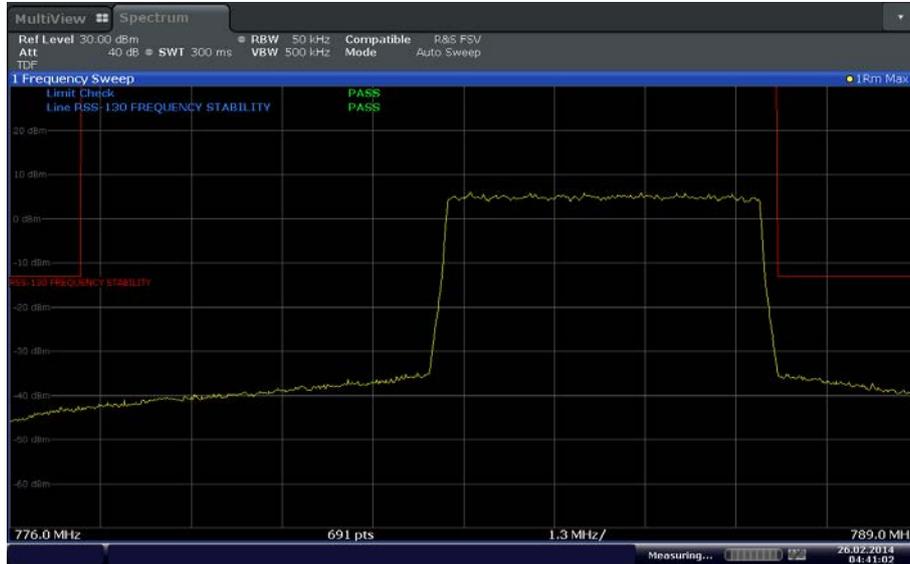
- To show compliance with RSS-130 requirement, plots are presented as per Clause 4.3 of the standard. Frequency range is from 777MHz up to 787MHz.

2.9.8 Test Results Summary

| LTE Band 13 – 16QAM 5MHz - Channel 23255– Frequency 784.5MHz – RB 25/0 | | | | |
|--|-------------|------------|--------------------------|--|
| Voltage (%) | Power (VDC) | Temp (°C) | Frequency Deviation (Hz) | Complies (Y or N) |
| 100 | 7.500 | -30 | -62.08 | EUT complies. See Section 2.9.7 for sample calculation |
| 100 | | -20 | -26.91 | |
| 100 | | -10 | -56.02 | |
| 100 | | 0 | -43.57 | |
| 100 | | +10 | -20.87 | |
| 100 | | +20 | -65.67 | |
| 100 | | +30 | 53.47 | |
| 100 | | +40 | -24.45 | |
| 100 | | +50 | -25.31 | |
| 115 | | 8.625 | +20 | |
| 85 | 6.375 | +20 | -50.90 | |
| TX Inhibit Voltage: | 5.140 | | | |

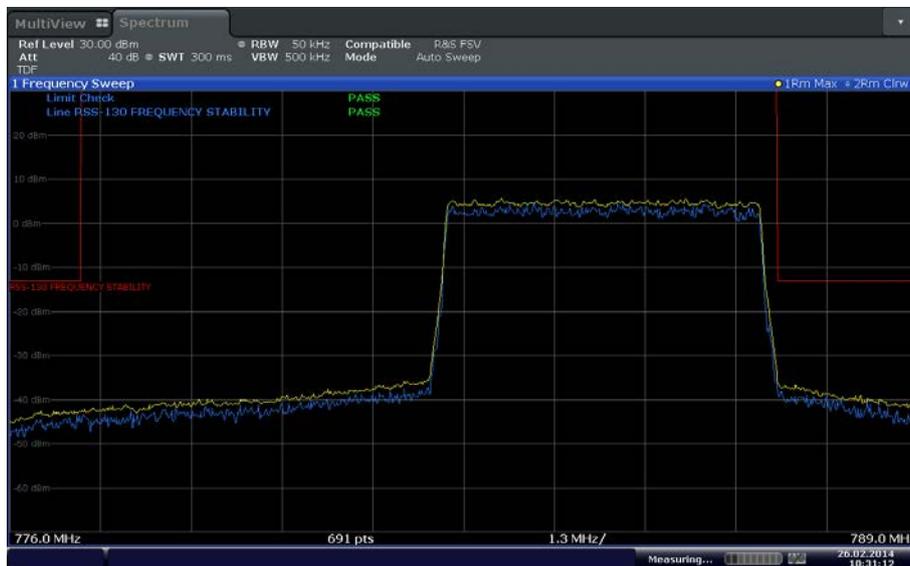


2.9.9 Sample Test Plots (IC)



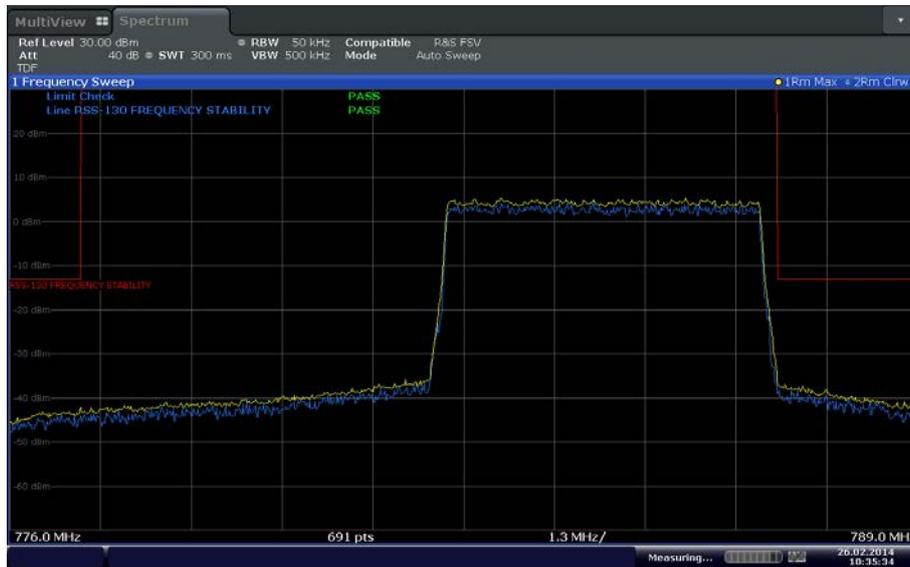
Date: 26_FEB 2014 04:41:02

LTE Band 13 5MHz BW Channel 23255 784.5 MHz 16QAM @ -30°C Nominal Voltage



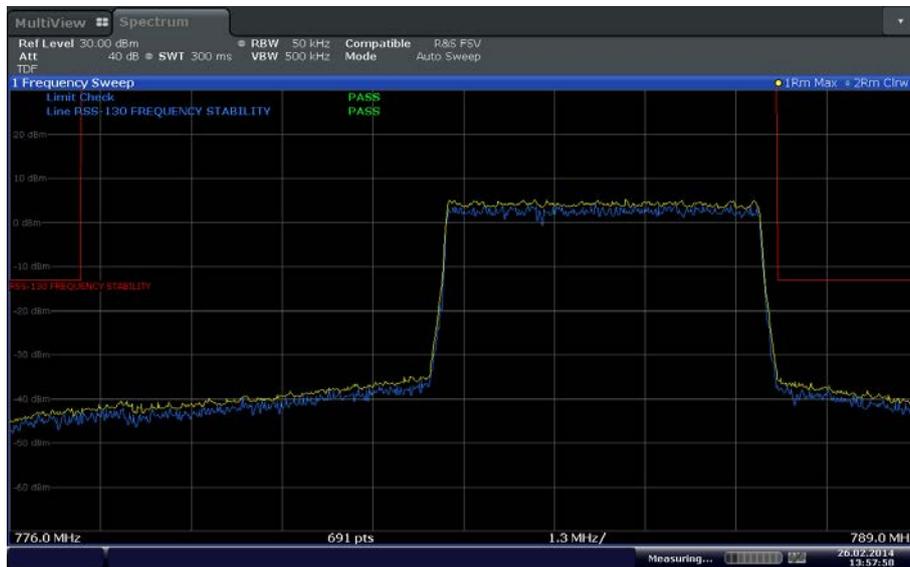
Date: 26_FEB 2014 10:31:12

LTE Band 13 5MHz BW Channel 23255 784.5 MHz 16QAM @ 20°C 6.375VDC



Date: 26.FEB.2014 10:35:34

LTE Band 13 5MHz BW Channel 23255 784.5 MHz 16QAM @ 20°C 8.625VDC

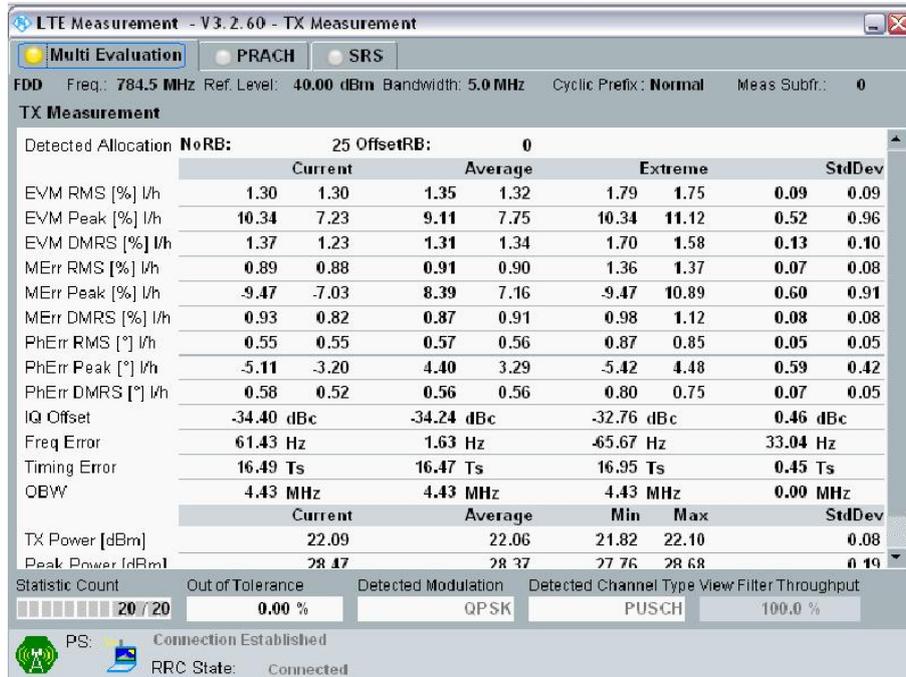


Date: 26.FEB.2014 13:57:58

LTE Band 13 5MHz BW Channel 23255 784.5 MHz 16QAM @ 50°C Nominal Voltage



2.9.10 Sample Test Plot (FCC)





2.10 RECEIVER SPURIOUS EMISSIONS

2.10.1 Specification Reference

RSS-GEN Issue 3 (6.0)

2.10.2 Standard Applicable

Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

2.10.3 Equipment Under Test and Modification State

Serial No: 655CPX1171 / Test Configuration A

2.10.4 Date of Test/Initial of test personnel who performed the test

February 25, 2014/FSC

2.10.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

| | |
|---------------------|----------|
| Ambient Temperature | 26.6°C |
| Relative Humidity | 44.8% |
| ATM Pressure | 99.3 kPa |

2.10.7 Additional Observations

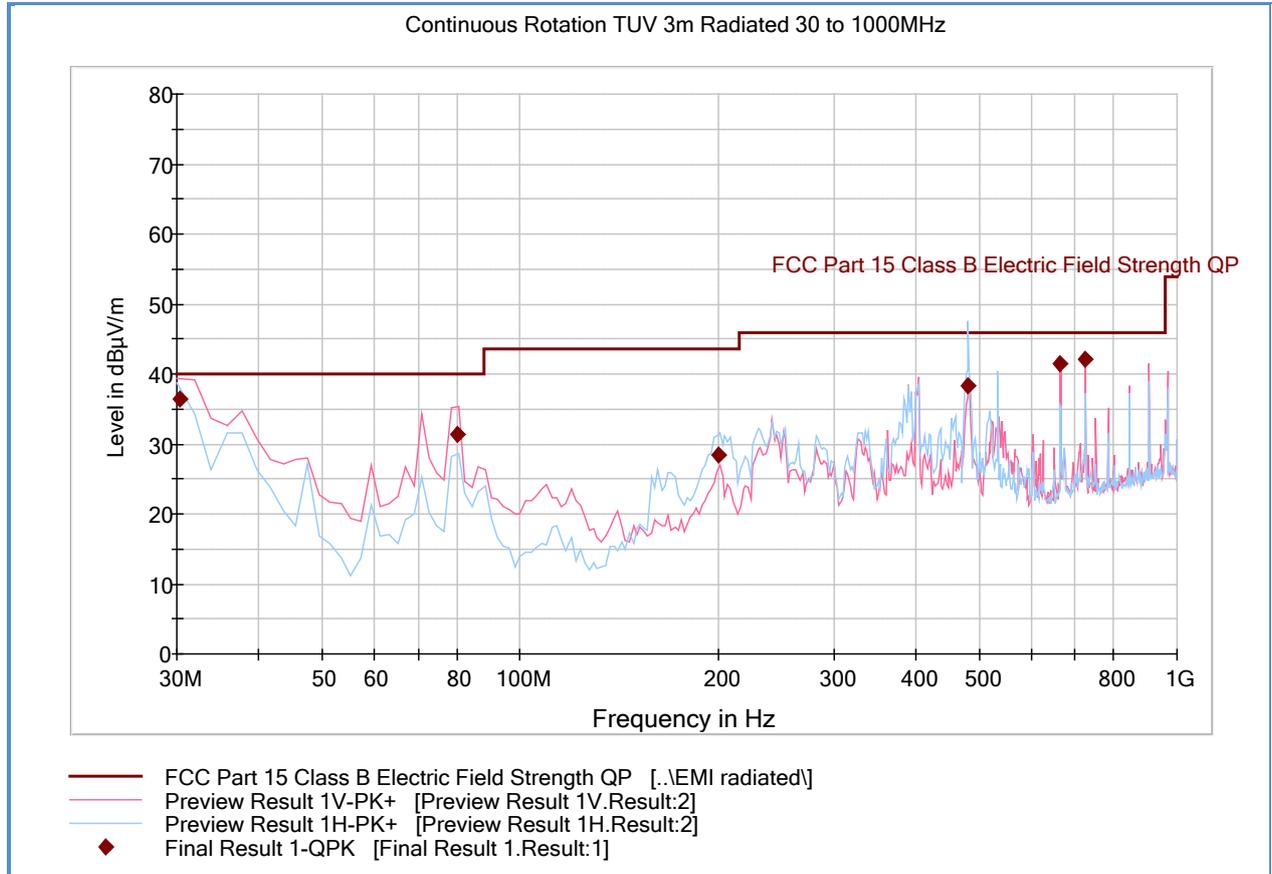
- This is a radiated test. The spectrum was searched from 30MHz to the 18GHz (6GHz as per requirement).
- Limit used is from FCC §15.209 which is identical to RSS-Gen limits.
- There are no separate receive mode configurable during verification, the EUT was verified in stand-by mode.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.10.8 Test Results

See attached plots.



2.10.9 Test Results Below 1GHz (Receive Mode)

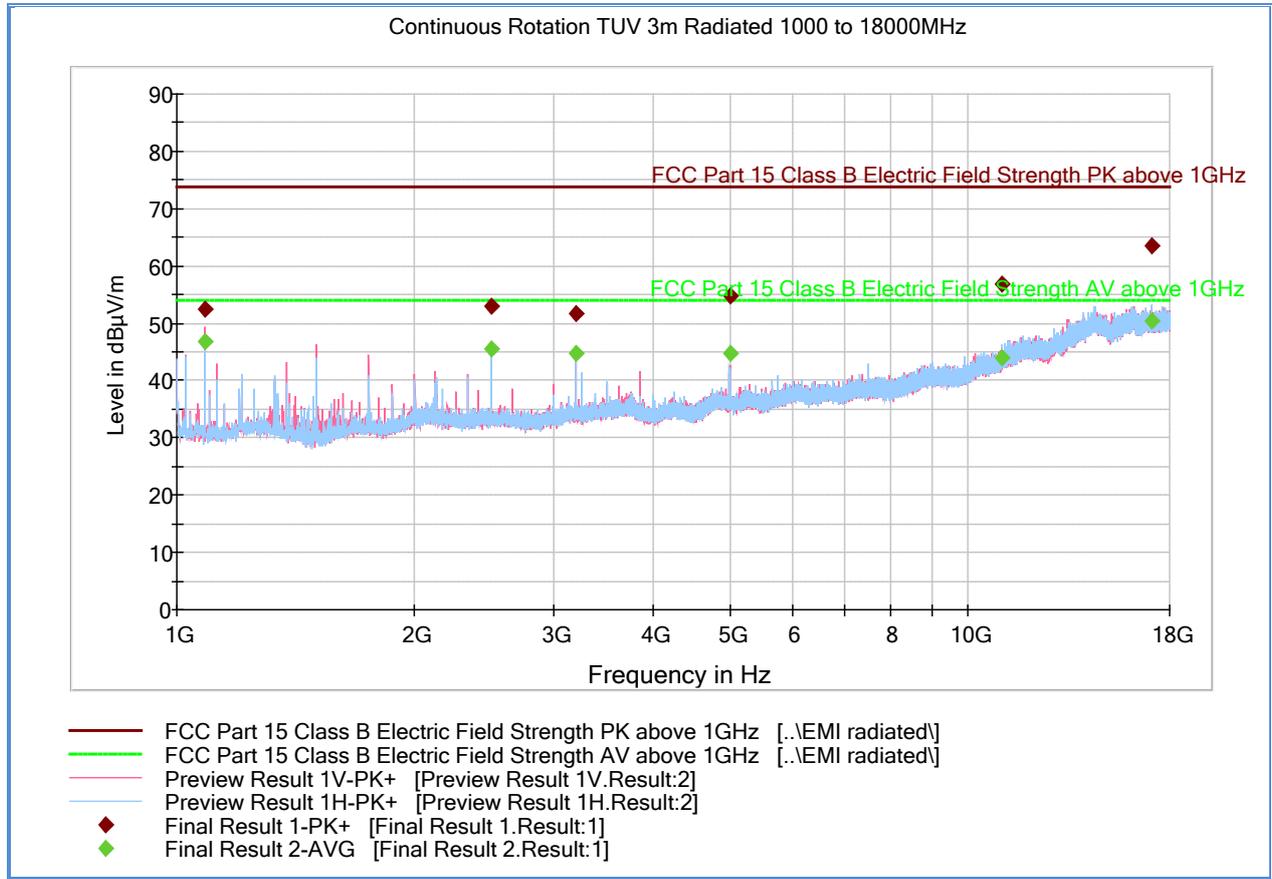


Quasi Peak Data

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 30.360000 | 36.4 | 1000.0 | 120.000 | 100.0 | V | 118.0 | -10.6 | 3.6 | 40.0 |
| 80.021082 | 31.4 | 1000.0 | 120.000 | 100.0 | V | 285.0 | -21.1 | 8.6 | 40.0 |
| 200.382124 | 28.5 | 1000.0 | 120.000 | 250.0 | H | 22.0 | -16.1 | 15.0 | 43.5 |
| 480.421964 | 38.3 | 1000.0 | 120.000 | 100.0 | H | 313.0 | -5.5 | 7.7 | 46.0 |
| 663.987415 | 41.4 | 1000.0 | 120.000 | 100.0 | V | 219.0 | -1.9 | 4.6 | 46.0 |
| 724.351824 | 42.1 | 1000.0 | 120.000 | 100.0 | V | 172.0 | -0.6 | 3.9 | 46.0 |



2.10.10 Test Results Above 1GHz (Receive Mode)



Peak Data

| Frequency (MHz) | MaxPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1086.533333 | 52.3 | 1000.0 | 1000.000 | 300.0 | V | 293.0 | -1.5 | 21.6 | 73.9 |
| 2500.166667 | 52.9 | 1000.0 | 1000.000 | 291.0 | V | 272.0 | 2.4 | 21.0 | 73.9 |
| 3200.000000 | 51.8 | 1000.0 | 1000.000 | 100.0 | H | 91.0 | 4.2 | 22.1 | 73.9 |
| 5000.300000 | 54.8 | 1000.0 | 1000.000 | 291.0 | V | -3.0 | 7.9 | 19.1 | 73.9 |
| 11046.866666 | 56.8 | 1000.0 | 1000.000 | 378.0 | H | 309.0 | 16.4 | 17.1 | 73.9 |
| 17089.400000 | 63.5 | 1000.0 | 1000.000 | 200.0 | H | 148.0 | 23.4 | 10.4 | 73.9 |

Average Data

| Frequency (MHz) | Average (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) |
|-----------------|------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 1086.533333 | 46.9 | 1000.0 | 1000.000 | 300.0 | V | 293.0 | -1.5 | 7.0 | 53.9 |
| 2500.166667 | 45.6 | 1000.0 | 1000.000 | 291.0 | V | 272.0 | 2.4 | 8.3 | 53.9 |
| 3200.000000 | 44.7 | 1000.0 | 1000.000 | 100.0 | H | 91.0 | 4.2 | 9.2 | 53.9 |
| 5000.300000 | 44.8 | 1000.0 | 1000.000 | 291.0 | V | -3.0 | 7.9 | 9.1 | 53.9 |
| 11046.866666 | 43.8 | 1000.0 | 1000.000 | 378.0 | H | 309.0 | 16.4 | 10.1 | 53.9 |
| 17089.400000 | 50.3 | 1000.0 | 1000.000 | 200.0 | H | 148.0 | 23.4 | 3.6 | 53.9 |

Test Notes: No significant emissions observed.



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| ID Number (SDGE/SDRB) | Test Equipment | Type | Serial Number | Manufacturer | Cal Date | Cal Due Date |
|-----------------------------|---|---------------------|----------------------|----------------------------|---------------------------|--------------|
| Conducted Port Setup | | | | | | |
| 7569 | Series Power Meter | N1911A P- | MY45100625 | Agilent | 04/15/13 | 04/15/14 |
| 7570 | 50MHz-18GHz Wideband Power Sensor | N1921A | MY45240588 | Agilent | 05/06/13 | 05/06/14 |
| 7562 | Wideband Radio Communication Tester | CMW 500 | 1201.0002k50 /103829 | Rhode & Schwarz | 10/09/13 | 10/09/15 |
| 7582 | Signal/Spectrum Analyzer | FSW26 | 101614 | Rhode & Schwarz | 11/19/13 | 11/19/14 |
| 7579 | Temperature Chamber | Model 115 | 92009707 | Test Equity | 07/16/13 | 07/16/14 |
| 8825 | 20dB Attenuator | 46-20-34 | BK5773 | Weinschel Corp. | Verified by 1003 and 7582 | |
| 8808 | 10dB Attenuator | ATX3396-10 | N/A | RF Precision Cables | Verified by 1003 and 7582 | |
| 8799 | Resistive Power Divider | 1506A | RR001 | Weinschel Corp. | Verified by 1003 and 7582 | |
| Conducted Emissions | | | | | | |
| 1024 | EMI Test Receiver | ESCS 30 | 847793/001 | Rhode & Schwarz | 03/11/13 | 03/11/14 |
| 7562 | Wideband Radio Communication Tester | CMW 500 | 1201.0002k50 /103829 | Rhode & Schwarz | 10/09/13 | 10/09/15 |
| 7567 | LISN | FCC-LISN-50-25-2-10 | 120304 | Fischer Custom Comm. | 06/11/13 | 06/11/14 |
| 7568 | LISN | FCC-LISN-50-25-2-10 | 120305 | Fischer Custom Comm. | 07/10/13 | 07/10/14 |
| 8822 | 20dB Attenuator | 34-20-34 | N/A | MCE / Weinschel | 01/30/14 | 01/30/15 |
| 8824 | 20dB Attenuator | 34-20-34 | N/A | MCE / Weinschel | 01/30/14 | 01/30/15 |
| Radiated Emissions | | | | | | |
| 1033 | Bilog Antenna | 3142C | 00044556 | EMCO | 06/25/13 | 06/25/14 |
| 7575 | Double-ridged waveguide horn antenna | 3117 | 00155511 | EMCO | 03/25/13 | 03/25/14 |
| 8628 | Pre-amplifier | QLJ 01182835-JO | 8986002 | QuinStar Technologies Inc. | 09/03/13 | 09/03/14 |
| 1153 | High-frequency cable | SucoFlex 100 SX | N/A | Suhner | 09/03/13 | 09/03/14 |
| 1040 | EMI Test Receiver | ESIB40 | 100292 | Rhode & Schwarz | 07/31/13 | 07/31/14 |
| 1049 | EMI Test Receiver | ESU | 100133 | Rhode & Schwarz | 07/24/13 | 07/24/14 |
| 1016 | Pre-amplifier | PAM-0202 | 187 | PAM | 10/08/13 | 10/08/14 |
| Miscellaneous | | | | | | |
| 1003 | Signal Generator | SMR-40 | 1104.0002.40 | Rhode & Schwarz | 01/20/14 | 01/20/15 |
| 6452 | Multimeter | 3478A | 2911A52177 | Hewlett Packard | 08/02/13 | 08/02/14 |
| 7560 | Barometer/Temperature /Humidity Transmitter | iBTHX-W | 1240476 | Omega | 01/30/14 | 01/30/15 |
| 1123 | DC Power Supply | E3631A | N/A | Hewlett Packard | Verified by 6452 | |
| 7539 | DC Power Supply | 6434B | 1140A01866 | Hewlett Packard | Verified by 6452 | |
| | Test Software | EMC32 | V8.53 | Rhode & Schwarz | N/A | |



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1GHz)

| Contribution | | Probability Distribution Type | Probability Distribution x_i | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---------------------------------|----------------------------|-------------------------------|--------------------------------|-------------------------------|--------------|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.45 | 0.26 | 0.07 |
| 2 | Cables | Rectangular | 0.50 | 0.29 | 0.08 |
| 3 | Preamp | Rectangular | 0.50 | 0.29 | 0.08 |
| 4 | Antenna | Rectangular | 0.75 | 0.43 | 0.19 |
| 5 | Site | Rectangular | 3.89 | 2.25 | 5.04 |
| 6 | EUT Setup | Rectangular | 1.00 | 0.58 | 0.33 |
| Combined Uncertainty (u_c): | | | | | 2.41 |
| Coverage Factor (k): | | | | | 2 |
| Expanded Uncertainty: | | | | | 4.82 |

3.2.2 Radiated Emission Measurements (Above 1GHz)

| Contribution | | Probability Distribution Type | Probability Distribution x_i | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---------------------------------|----------------------------|-------------------------------|--------------------------------|-------------------------------|--------------|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.57 | 0.33 | 0.11 |
| 2 | Cables | Rectangular | 0.70 | 0.40 | 0.16 |
| 3 | Preamp | Rectangular | 0.50 | 0.29 | 0.08 |
| 4 | Antenna | Rectangular | 0.37 | 0.21 | 0.05 |
| 5 | Site | Rectangular | 3.89 | 2.25 | 5.04 |
| 6 | EUT Setup | Rectangular | 1.00 | 0.58 | 0.33 |
| Combined Uncertainty (u_c): | | | | | 2.40 |
| Coverage Factor (k): | | | | | 2 |
| Expanded Uncertainty: | | | | | 4.81 |

3.2.3 Conducted Antenna Port Measurement

| Contribution | | Probability Distribution Type | Probability Distribution x_i | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---------------------------------|----------------------------|-------------------------------|--------------------------------|-------------------------------|--------------|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.57 | 0.33 | 0.11 |
| 2 | Cables | Rectangular | 0.50 | 0.29 | 0.08 |
| 3 | EUT Setup | Rectangular | 1.00 | 0.58 | 0.33 |
| Combined Uncertainty (u_c): | | | | | 0.72 |
| Coverage Factor (k): | | | | | 2 |
| Expanded Uncertainty: | | | | | 1.45 |



3.2.1 AC Conducted Emissions Measurements

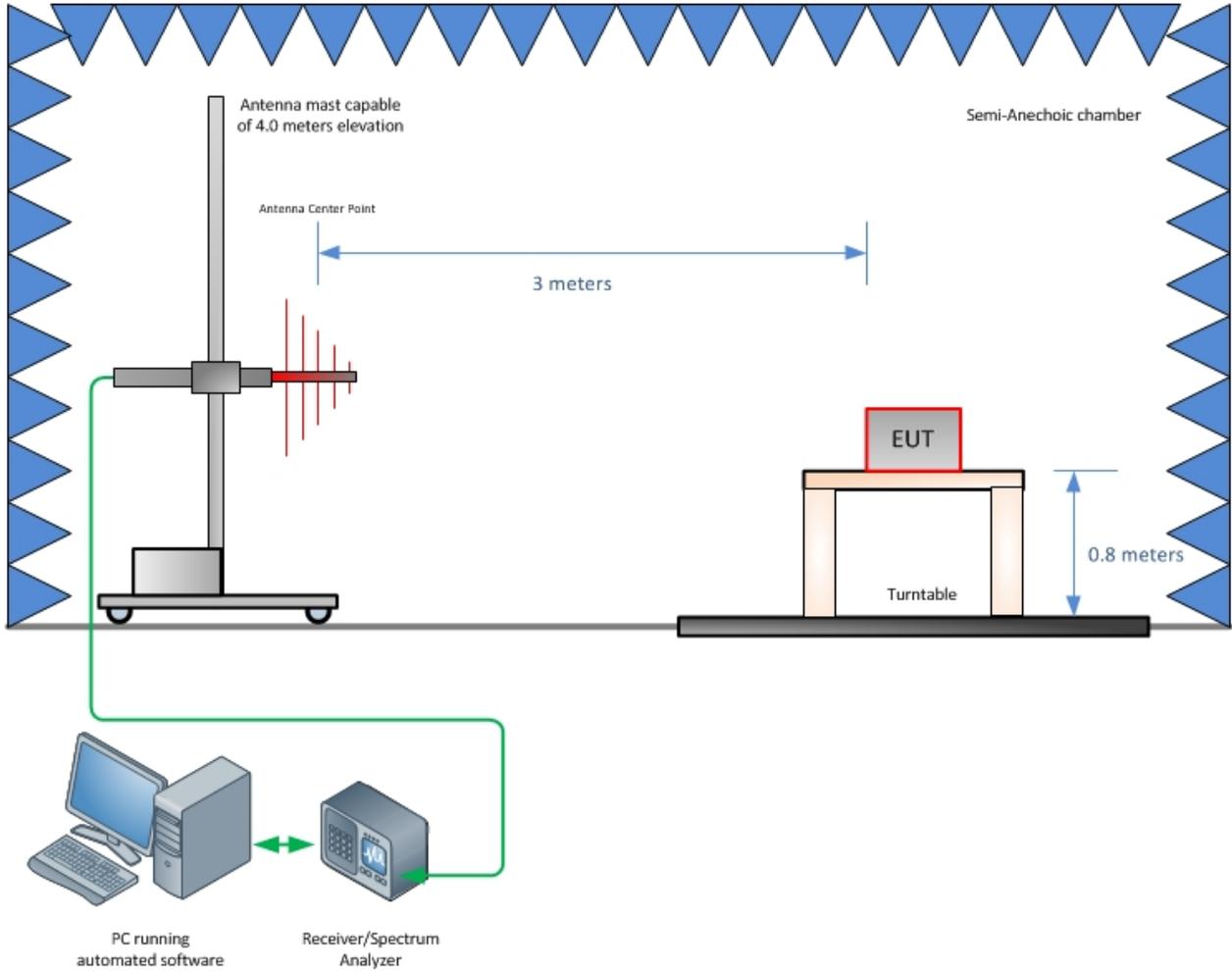
| Contribution | | Probability Distribution Type | Probability Distribution x_i | Standard Uncertainty $u(x_i)$ | $[u(x_i)]^2$ |
|---------------------------------|----------------------------|-------------------------------|--------------------------------|-------------------------------|--------------|
| 1 | Receiver/Spectrum Analyzer | Rectangular | 0.36 | 0.21 | 0.04 |
| 2 | Cables | Rectangular | 0.50 | 0.29 | 0.08 |
| 3 | LISN | Rectangular | 0.66 | 0.38 | 0.15 |
| 4 | Attenuator | Rectangular | 0.30 | 0.17 | 0.03 |
| 5 | EUT Setup | Rectangular | 1.00 | 0.58 | 0.33 |
| Combined Uncertainty (u_c): | | | | | 0.80 |
| Coverage Factor (k): | | | | | 2 |
| Expanded Uncertainty: | | | | | 1.59 |



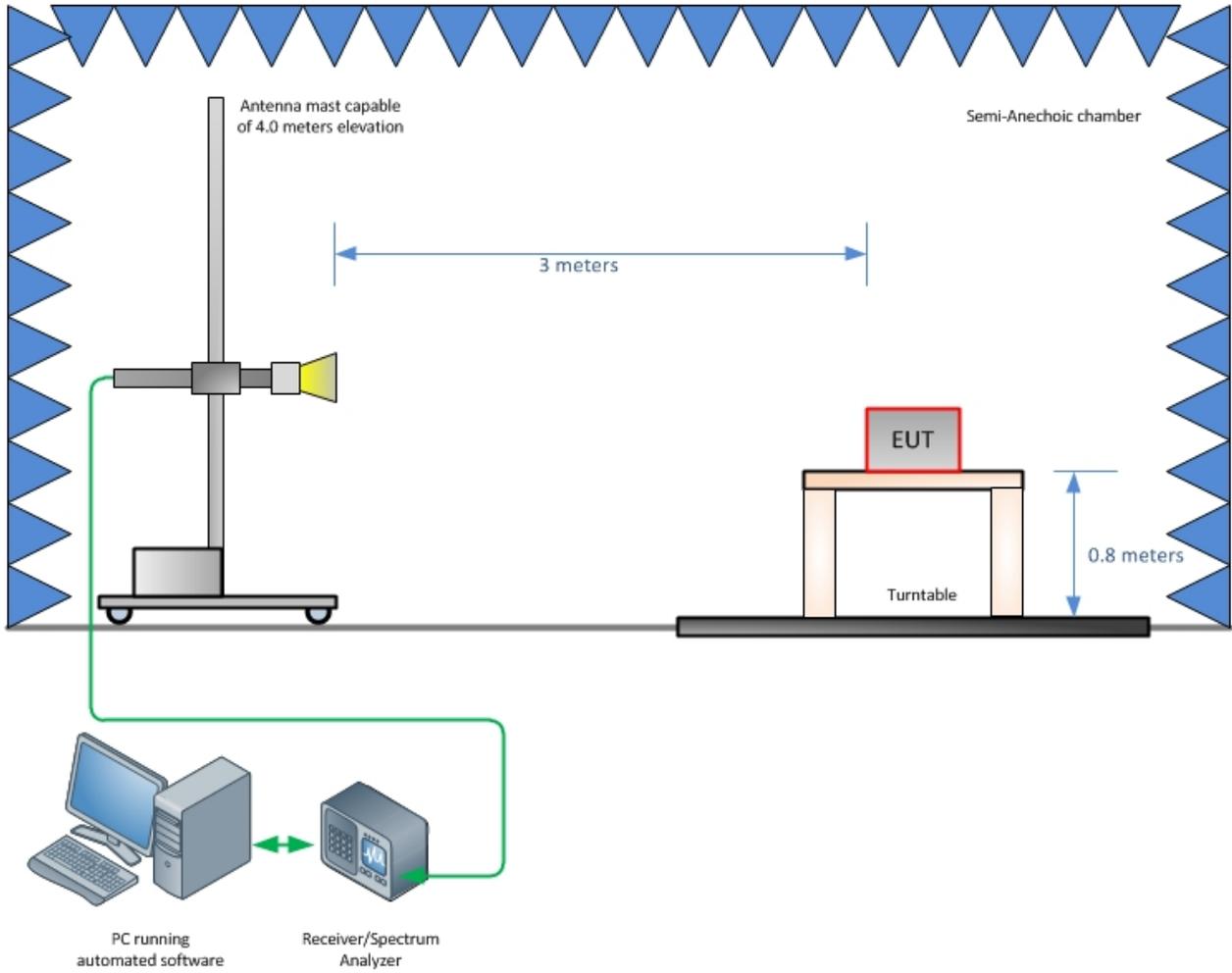
SECTION 4

DIAGRAM OF TEST SETUP

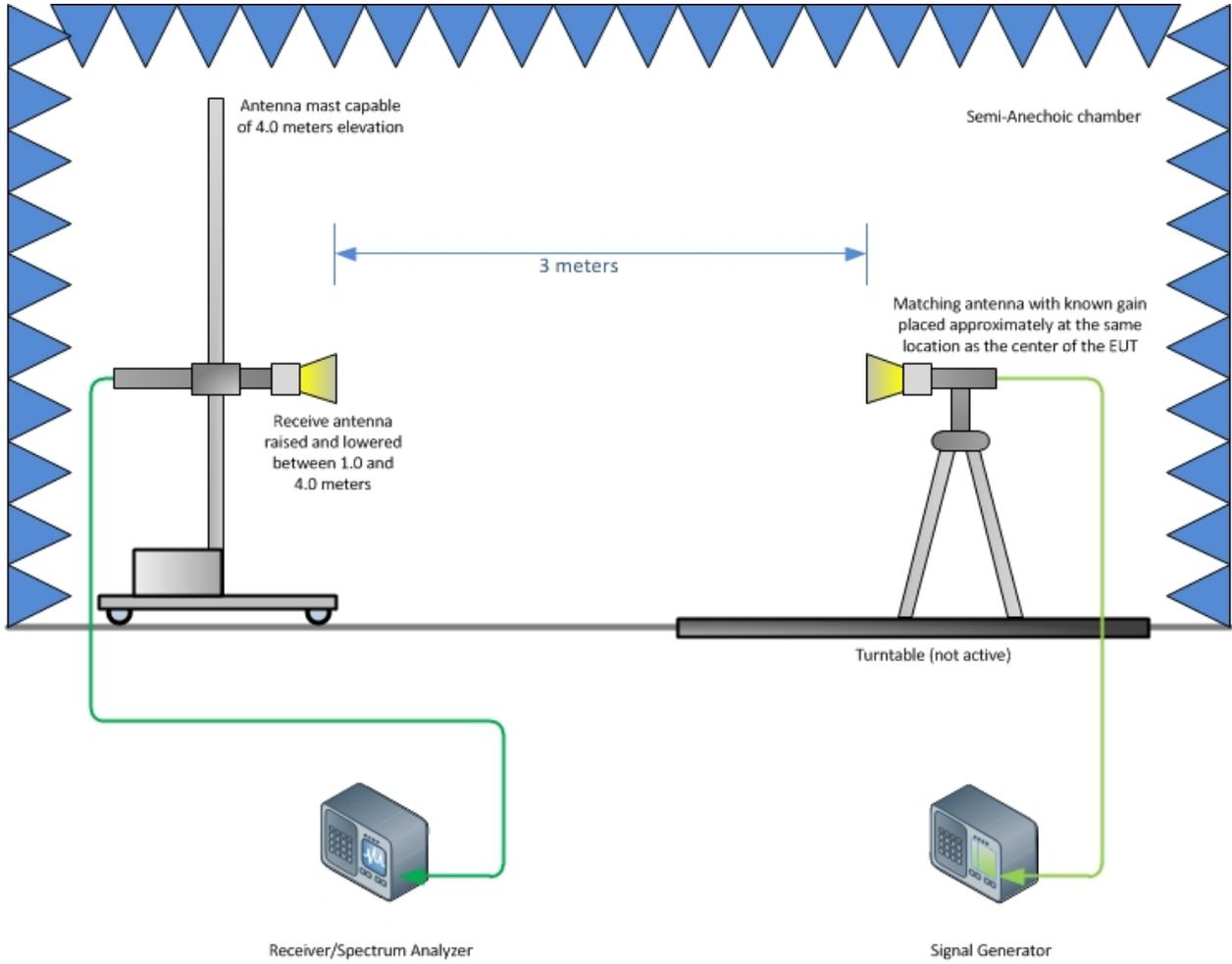
4.1 TEST SETUP DIAGRAM



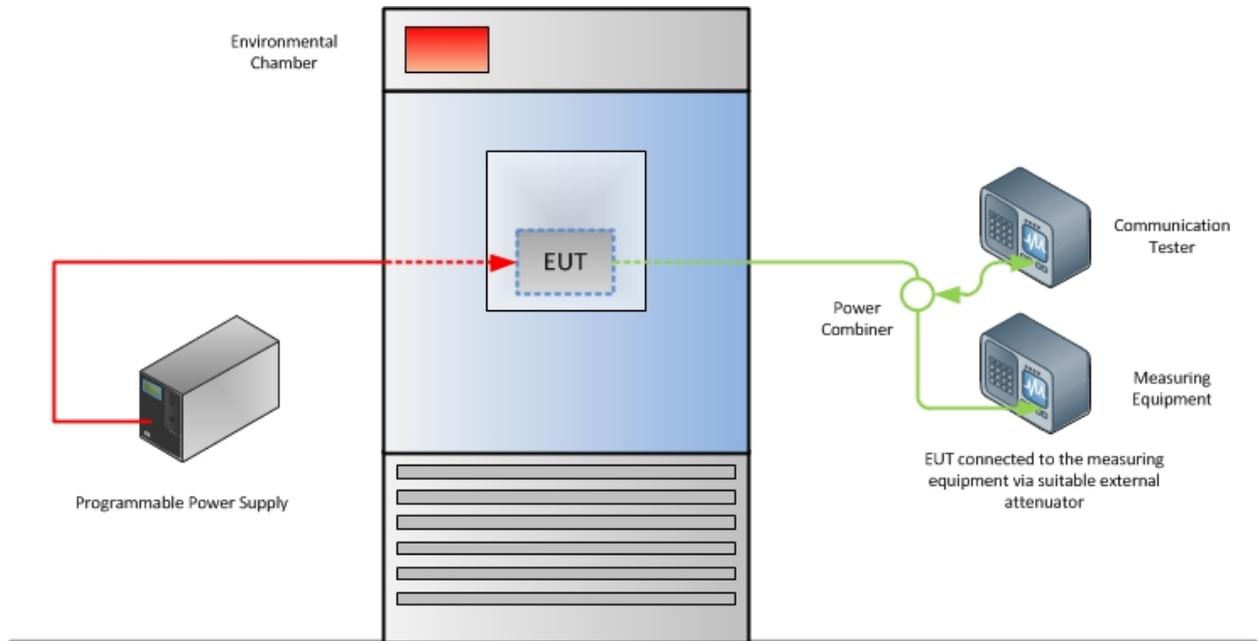
Radiated Emission Test Setup (Below 1GHz)



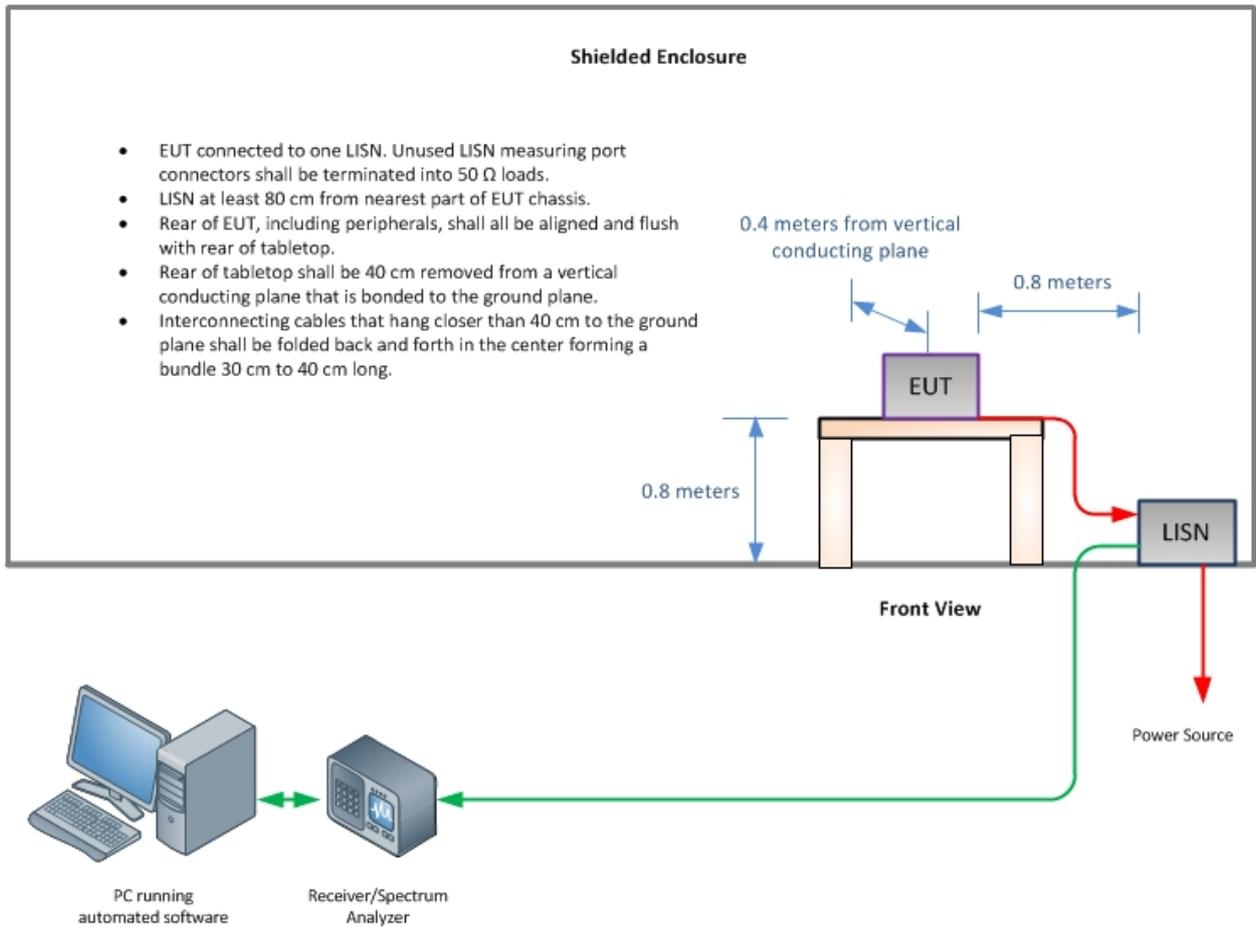
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz)



Frequency Stability Test Configuration



Conducted Emissions Test Configuration



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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