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Report On

Application for Grant of Equipment Authorization of the
u-blox San Diego, Inc.
TOBY-L100 4G LTE Surface Mount Module

FCC CFR 47 Part 2 and 27
IC RSS-Gen and RSS-139 Issue 2 February 2009

Report No. SC1307902 **August 2013**

REPORT ON	Radio Testing of the u-blox San Diego, Inc. 4G LTE Surface Mount Module
TEST REPORT NUMBER	SC1307902
PREPARED FOR	u-blox San Diego, Inc. 12626 High Bluff Drive #200 San Diego, CA 92130
CONTACT PERSON	Jake Bascon Certification Engineer (858) 847-9611 x216 jake.bascon@u-blox.com
PREPARED BY	Ferdinand S. Custodio **Name** Authorized Signatory Title: EMC/Wireless Test Engineer
APPROVED BY	Chip R. Fleury **Name** Authorized Signatory
DATED	August 13, 2013

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

Revision History

SC1307902 u-blox San Diego, Inc. TOBY-L100 4G LTE Surface Mount Module					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
08/13/13	Initial Release				Ferdinand Custodio

CONTENTS

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SECTION 1

REPORT SUMMARY

Radio Testing of the
u-blox San Diego, Inc.
4G LTE Surface Mount Module

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the u-blox San Diego, Inc. TOBY-L100 4G LTE Surface Mount Module to the requirements of the following:

- FCC CFR 47 Part 2 and 27
- IC RSS-Gen and RSS-139 Issue 2 February 2009.

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	u-blox San Diego, Inc.
Model Number(s)	TOBY- L100
FCC ID Number	R5Q-TOBYL100
IC Number	8595B-TOBYL100
Serial Number(s)	356075050013822 , 356075050014218
Number of Samples Tested	2
Test Specification/Issue/Date	• FCC CFR 47 Part 2 and 27 (October 1, 2012). • RSS-139 - Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz (Issue 2, February 2009). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 3, December 2010).
Start of Test	August 05, 2013
Finish of Test	August 11, 2013
Name of Engineer(s)	Ferdinand Custodio
Related Document(s)	• 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 • 412172 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. • Supporting documents for EUT certification are separate exhibits.

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	2.1046 and 27.50 (d)(4)	RSS-139(6.4)	Equivalent Isotropic Radiated Power	Compliant
2.3	2.1046, 27.50 (b) (10) and (12)		Effective Radiated Power	Compliant
2.4	2.1049 and 27.53(h)(1)	RSS-Gen (4.6.1)	Occupied Bandwidth	Compliant
2.5	27.50(d)(5)	RSS-139(6.4)	Peak-Average Ratio	Compliant
2.6	27.53(c)(2)(5) and (h)	RSS-139(6.5)	Band Edge	Compliant
2.7	27.53(c)(2)(5),(f) and (h)	RSS-139(6.5)	Conducted Spurious Emissions	Compliant
2.8	2.1053, 27.53(c) and (h)	RSS-139(6.5)	Field Strength Of Spurious Radiation	Compliant
2.9	2.1055(a)(1) 2.1055(d)(1) and 27.54	RSS-139(6.3)	Frequency Stability	Compliant
2.10		RSS-139(6.6)	Receiver Spurious Emissions	Compliant
2.11		RSS-Gen 7.2.4	Powerline Conducted Emissions	Compliant

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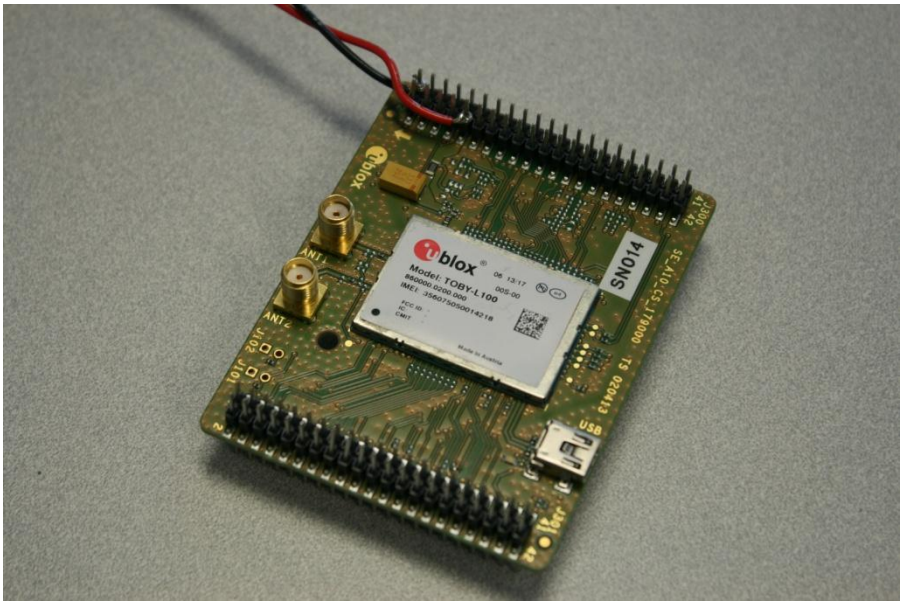
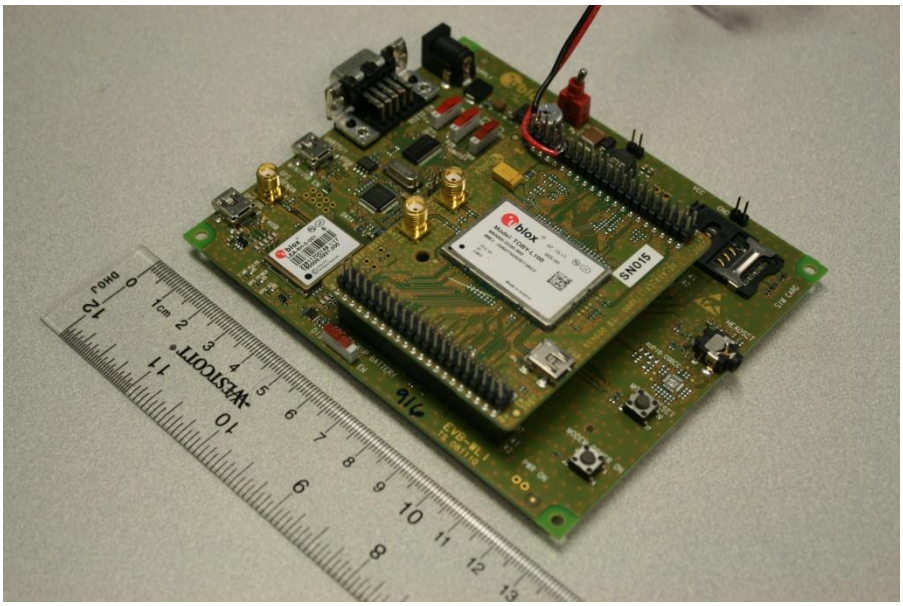
1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) was a u-blox San Diego, Inc. TOBY-L100 4G LTE Surface Mount Module as shown in the photograph below. The EUT uses LTE Bands 4 and 13 and features MIMO 2x2 for Rx diversity. The EUT dimension is 24.8 x 35.6 x 2.6 mm in a compact 152 pin LGA (Land Grid Array) package. The EUT was tested both stand-alone welded on an interface board and the interface board mounted on a development board (u-blox EVB-WL1).





1.3.2 EUT General Description

EUT Description	4G LTE Surface Mount Module
Model Number(s)	TOBY-L100
Rated Voltage	3.8 VDC Nominal voltage.
Mode Verified	4G-LTE
Capability	Band 4 (1.4, 5.0, 10, 15 and 20MHz BW) and 13 (5 and 10MHz BW) LTE
Primary Unit (EUT)	☐ Production ☒ Pre-Production ☐ Engineering
Antenna Type	EUT is a module. Manufacturer recommended antenna is a 2G/3G/4G Ultra-wideband I-Bar Antenna for First-Tier Automotive Application manufactured by taoglas with Part No. GSA.8827.A.101111 Phoenix. For radiated spurious emissions tests, a similar representative hinged ultra-wideband dipole LTE antenna was used. Manufacturer is taoglas, Part No. TG.30.8113, product name is Apex Hinged TG.30.
Antenna Gain (Max. antenna gain covered under this filing, assume separation distance with the end user is 20cm.)	LTE Band 4 (1710-1755 MHz) = +6.57 dBi LTE Band 13 (777-787 MHz) = +10.7 dBi

1.3.3 Transmit Frequency Table

LTE Band 4				
Bandwidth (MHz)	**Tx Frequency (MHz)**	**Emission Designator**	**Max.Conducted Power (W)**	**Max.EIRP Power (W)**
1.4	1710-1755	1M12G7D	0.206	0.933
1.4	**1710-1755**	**1M12W7D**	**0.220**	**1.000**
3.0	1710-1755	Not verified as per Client's recommendation and requirement		
3.0	1710-1755			
5.0	1710-1755	4M54G7D	0.188	0.855
5.0	1710-1755	4M53W7D	0.212	0.962
10.0	1710-1755	8M94G7D	0.188	0.853

10.0	1710-1755	8M95W7D	0.212	0.964
15.0	1710-1755	13M5G7D	0.182	0.826
15.0	1710-1755	13M6W7D	0.211	0.957
20.0	1710-1755	17M9G7D	0.198	0.897
20.0	1710-1755	18M0W7D	0.200	0.906
LTE Band 13				
Bandwidth (MHz)	**Tx Frequency (MHz)**	**Emission Designator**	**Max.Conducted Power (W)**	**Max.ERP Power (W)**
5.0	777-787	4M52G7D	0.187	1.337
5.0	777-787	4M51W7D	0.193	1.380
10.0	777-787	8M96G7D	0.189	1.355
10.0	**777-787**	**8M95W7D**	**0.214**	**1.535**

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement (EUT mounted on an interface board)
B	Conducted antenna port measurement (Test Configuration A mounted on a development board)
C	Radiated test setup. Representative antenna installed on the interface board where the EUT is mounted. EUT connected wirelessly with the wideband radio communication tester (CMW500)

Note: *Antenna port is for test purposes only. EUT is a RF module and will be sold as a stand-alone unit.*

1.4.2 EUT Exercise Software

EUT is controlled by a CMW 500 Wideband Radio Communication Tester. There are no other test software used during verification.

1.4.3 Support Equipment and I/O cables

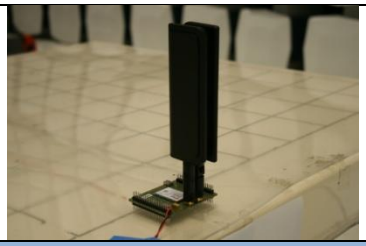
Manufacturer	Equipment/Cable	Description
u-blox	Interface Board	SE_A10_CS_179000 (TS 0204130)
u-blox	Development Board	Development Kit Board (EVB-WL1 TS 081110)
taoglas	(2X) Ultra-Wideband 4G LTE Antenna	TG.30.8113 Apex Hinged TG.30 Dipole LTE Antenna

1.4.4 Worst Case Configuration

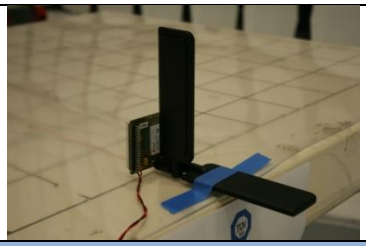
Worst-case configuration used in this test report as per output power measurements:

Band	Channel BW	Modulation	RB Size/Offset
LTE Band 4	1.4MHz	16QAM	5/5
LTE Band 13	10.0MHz	16QAM	1/0

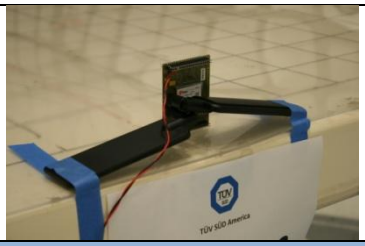
For radiated spurious measurements X, Y and Z orientations were verified. There are no significant spurious emissions variations between the three axes. Radiated spurious emissions verifications performed in “X” configuration.



“X” Configuration



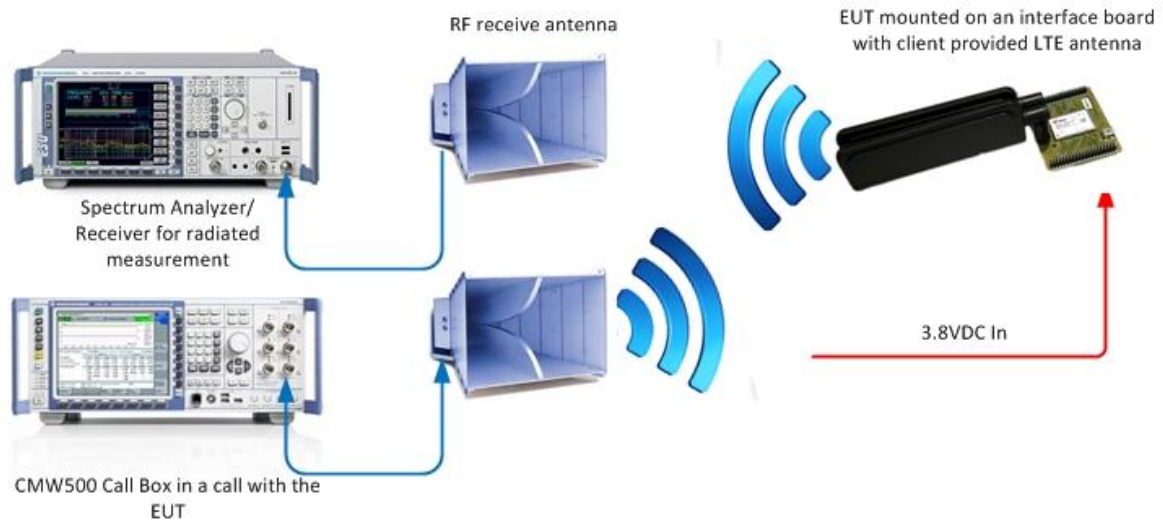
“Y” Configuration



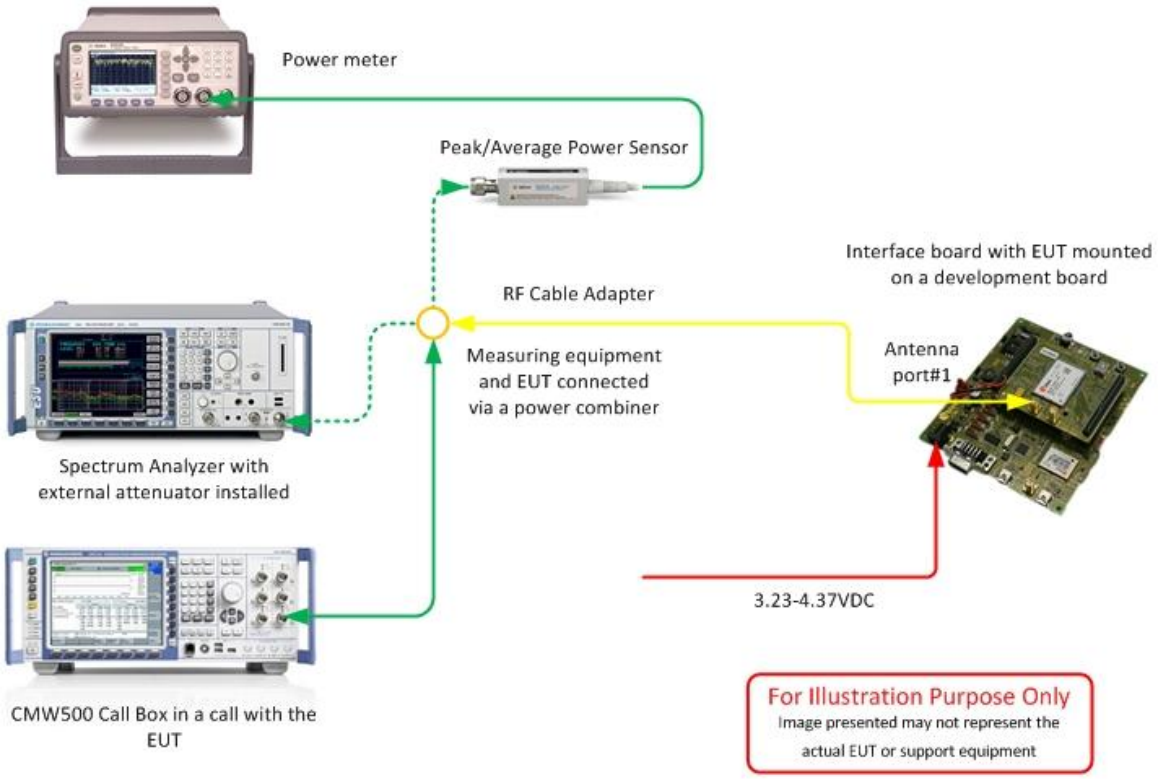
“Z” Configuration

1.4.5 Simplified Test Configuration Diagram

Radiated Test Configuration Test Configuration



Conducted (Antenna Port) and Conducted Emissions 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 356075050013822 and 356075050014218		
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

1.8.1 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 §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US5296.

1.8.2 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.

1.9 SAMPLE CALCULATIONS

1.9.1 LTE Emission Designator (QPSK)

Emission Designator = 4M51G7D
G = Phase Modulation
7= Quantized/Digital Info
D = Combination (Audio/Data)

1.9.2 LTE Emission Designator (16QAM)

Emission Designator = 4M50W7D
W = Frequency Modulation
7= Quantized/Digital Info
D = Combination (Audio/Data)

1.9.3 Spurious Radiated Emission (below 1GHz)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	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**

1.9.4 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:

P_{EIRP} = -18 dBm + 7.8 dBi – 1dB
= 11.2 dBm
P_{ERP} = P_{EIRP} – 2.15 dB
= 11.2 dBm – 2.15 dB
= 9.05 dBm

SECTION 2

TEST DETAILS

Radio Testing of the
u-blox San Diego, Inc.
4G LTE Surface Mount Module

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: 356075050013822 / Test Configuration B

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

August 06, 2013/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

Ambient Temperature	25.8°C
Relative Humidity	48.5%
ATM Pressure	99.2 kPa

2.1.7 Additional Observations

- This is a conducted test using a peak/average power meter.
- A 27.8dB power meter offset was used for the power splitter, external attenuator and cable used.
- Only representative worst case RB size and RB offset presented. Verification done using both RMC and User Defined Channels options for scheduling (CMW500).

2.1.8 Test Results

See attached table.

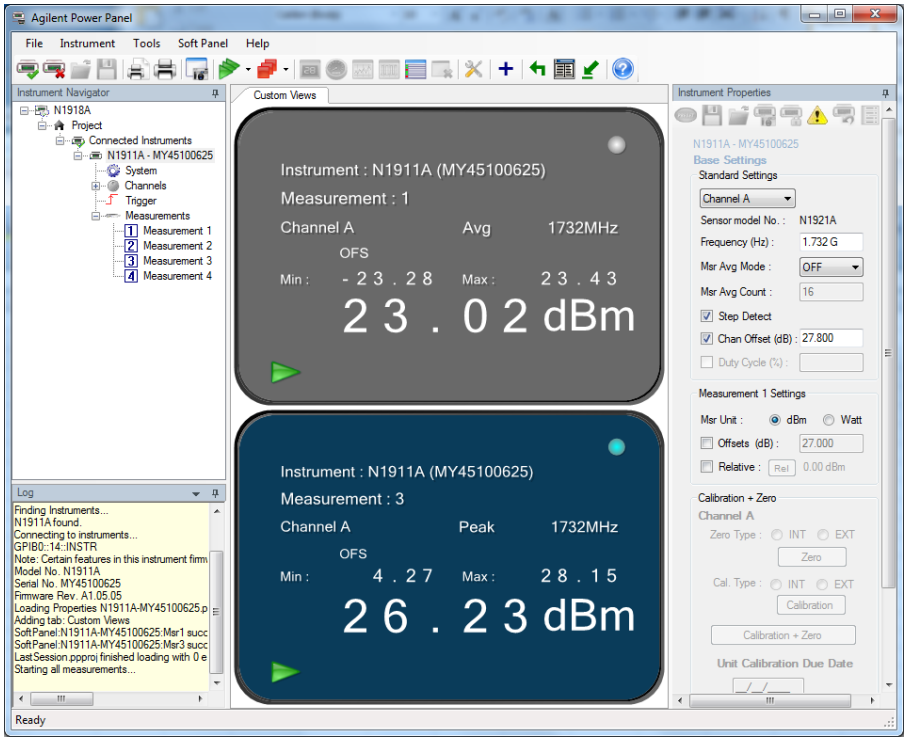
Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
4	QPSK	1.4 MHz	**6**	**0**	19957	1710.7	22.68
					20175	**1732.5**	**23.13**
					20393	1754.3	22.63
			3	0	19957	1710.7	21.76
					20175	1732.5	22.24
					20393	1754.3	22.33
			1	Low	19957	1710.7	22.26
					20175	1732.5	22.59
					20393	1754.3	22.09
			1	High	19957	1710.7	22.29
					20175	1732.5	22.70
					20393	1754.3	22.02
		3.0 MHz	15	0	19965	1711.5	N/A
					20175	1732.5	
					20385	1753.5	
			6	High	19965	1711.5	
					20175	1732.5	
					20385	1753.5	
			1	0	19965	1711.5	
					20175	1732.5	
					20385	1753.5	
			1	14	19965	1711.5	
					20175	1732.5	
					20385	1753.5	
		5.0 MHz	25	0	19975	1712.5	21.97
					20175	1732.5	22.51
					20375	1752.5	21.74
			10	High	19975	1712.5	22.11
					20175	1732.5	22.62
					20375	1752.5	21.87
			1	0	19975	1712.5	22.25
					20175	1732.5	22.72
					20375	1752.5	22.33
			1	High	19975	1712.5	22.49
					20175	1732.5	22.75
					20375	1752.5	22.44
		10.0 MHz	50	0	20000	1715	22.20
					20175	1732.5	22.43
					20350	1750	22.11
			25	High	20000	1715	22.06
					20175	1732.5	22.45
					20350	1750	21.61
			1	0	20000	1715	22.29
					20175	1732.5	22.74
					20350	1750	22.19
			1	High	20000	1715	22.15
					20175	1732.5	22.60
					20350	1750	22.00

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
4	QPSK	15.0 MHz	75	0	20025	1717.5	21.93
					20175	1732.5	22.32
					20325	1747.5	22.41
			36	High	20025	1717.5	21.75
					20175	1732.5	22.13
					20325	1747.5	22.36
			1	0	20025	1717.5	22.14
					20175	1732.5	22.05
					20325	1747.5	22.43
			1	High	20025	1717.5	21.93
					20175	1732.5	22.01
					20325	1747.5	22.60
		20.0 MHz	100	0	20050	1720	22.21
					20175	1732.5	21.73
					20300	1745	21.75
			50	High	20050	1720	22.06
					20175	1732.5	21.77
					20300	1745	22.24
			1	0	20050	1720	22.96
					20175	1732.5	21.55
					20300	1745	22.46
			1	High	20050	1720	22.91
					20175	1732.5	21.67
					20300	1745	22.73
	16QAM	**1.4 MHz**	6	0	19957	1710.7	22.97
					20175	1732.5	23.42
					20393	1754.3	22.95
			5	**High**	19957	1710.7	23.08
					20175	**1732.5**	**23.43**
					20393	1754.3	22.91
			1	Low	19957	1710.7	22.76
					20175	1732.5	23.07
					20393	1754.3	22.68
			1	High	19957	1710.7	22.17
					20175	1732.5	23.15
					20393	1754.3	22.44
		3.0 MHz	15	0	19965	1711.5	N/A
					20175	1732.5	
					20385	1753.5	
			6	High	19965	1711.5	
					20175	1732.5	
					20385	1753.5	
			1	0	19965	1711.5	
					20175	1732.5	
					20385	1753.5	
			1	14	19965	1711.5	
					20175	1732.5	
					20385	1753.5	

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
4	16QAM	5.0 MHz	25	0	19975	1712.5	22.37
					20175	1732.5	22.99
					20375	1752.5	22.21
			8	High	19975	1712.5	22.55
					20175	1732.5	23.17
					20375	1752.5	22.76
			1	0	19975	1712.5	22.28
					20175	1732.5	23.26
					20375	1752.5	22.97
			1	High	19975	1712.5	22.74
					20175	1732.5	23.02
					20375	1752.5	22.97
		10.0 MHz	50	0	20000	1715	22.21
					20175	1732.5	22.35
					20350	1750	22.12
			30	High	20000	1715	22.26
					20175	1732.5	22.39
					20350	1750	22.13
			1	0	20000	1715	22.83
					20175	1732.5	23.16
					20350	1750	22.89
			1	High	20000	1715	23.04
					20175	1732.5	23.27
					20350	1750	22.97
		15.0 MHz	75	0	20025	1717.5	22.26
					20175	1732.5	22.56
					20325	1747.5	22.77
			24	High	20025	1717.5	22.08
					20175	1732.5	22.43
					20325	1747.5	22.36
			1	0	20025	1717.5	22.37
					20175	1732.5	22.86
					20325	1747.5	23.24
			1	High	20025	1717.5	22.69
					20175	1732.5	22.74
					20325	1747.5	22.60
		20.0 MHz	100	0	20050	1720	22.74
					20175	1732.5	22.04
					20300	1745	22.19
			75	High	20050	1720	22.84
					20175	1732.5	22.51
					20300	1745	21.94
			1	0	20050	1720	23.00
					20175	1732.5	22.55
					20300	1745	21.78
			1	High	20050	1720	22.90
					20175	1732.5	22.66
					20300	1745	22.08

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
13	QPSK	5.0 MHz	25	0	23205	779.5	22.47
					23255	784.5	22.52
			10	24	23205	779.5	22.71
					23255	784.5	22.47
			1	0	23205	779.5	21.62
					23255	784.5	21.71
			1	24	23205	779.5	21.68
					23255	784.5	21.91
		10.0 MHz	**50**	**0**	**23230**	**782.0**	**22.77**
			25	0	23230	782.0	22.58
			1	0	23230	782.0	22.72
			1	49	23230	782.0	22.73
	16QAM	5.0 MHz	25	0	23205	779.5	22.76
					23255	784.5	22.67
			8	24	23205	779.5	22.85
					23255	784.5	22.63
			1	0	23205	779.5	22.21
					23255	784.5	22.32
			1	24	23205	779.5	22.51
					23255	784.5	22.6
		10.0 MHz	50	0	23230	782.0	22.57
			25	0	23230	782.0	22.65
			1	**0**	**23230**	**782.0**	**23.39**
			1	49	23230	782.0	23.31

2.1.9 Sample Test Measurement Screen (16-QAM 1.4MHz 5/1 RB Size/RB Offset)



2.2 EQUIVALENT ISOTROPIC RADIATED POWER

2.2.1 Specification Reference

Part 27 Subpart C §27.50 (d) (4), Part 2.1046, RSS-139 Issue 2 (6.4)

2.2.2 Standard Applicable

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in this band must employ a means for limiting power to the minimum necessary for successful communications

2.2.3 Equipment Under Test

Serial No: 356075050013822, Test Configuration (N/A, calculation only)

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

August 06, 2013/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:

$$\mathbf{EIRP = P_T + G_T - L_C}$$

Where:

$\mathbf{P_T}$ = transmitter conducted output power dBm (Section 2.1 of this test report)
$\mathbf{G_T}$ = gain of the transmitting antenna, in dBi (EIRP);
$\mathbf{L_C}$ = signal attenuation in the connecting cable between the transmitter and antenna, in dB (EUT configuration during verification is mounted on an interface board with short direct connection to the antenna port. The loss between the EUT and the antenna port is considered negligible).

2.2.6 Test Results

See attached table.

Band 4 QPSK								
Bandwidth	**RB Size**	**RB Offset**	**Channel**	**Frequency (MHz)**	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**Limit (dBm)**
1.4 MHz	6	0	19957	1710.7	22.68	+6.57	**29.25**	30
			20175	1732.5	23.13	+6.57	**29.7**	30
			20393	1754.3	22.63	+6.57	**29.2**	30
	3	0	19957	1710.7	21.76	+6.57	**28.33**	30
			20175	1732.5	22.24	+6.57	**28.81**	30
			20393	1754.3	22.33	+6.57	**28.9**	30
	1	Low	19957	1710.7	22.26	+6.57	**28.83**	30
			20175	1732.5	22.59	+6.57	**29.16**	30
			20393	1754.3	22.09	+6.57	**28.66**	30
	1	High	19957	1710.7	22.29	+6.57	**28.86**	30
			20175	1732.5	22.70	+6.57	**29.27**	30
			20393	1754.3	22.02	+6.57	**28.59**	30
3.0 MHz	15	0	19965	1711.5	N/A	+6.57	N/A	30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
	6	High	19965	1711.5		+6.57		30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
	1	0	19965	1711.5		+6.57		30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
	1	14	19965	1711.5		+6.57		30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
5.0 MHz	25	0	19975	1712.5	21.97	+6.57	**28.54**	30
			20175	1732.5	22.51	+6.57	**29.08**	30
			20375	1752.5	21.74	+6.57	**28.31**	30
	10	High	19975	1712.5	22.11	+6.57	**28.68**	30
			20175	1732.5	22.62	+6.57	**29.19**	30
			20375	1752.5	21.87	+6.57	**28.44**	30
	1	0	19975	1712.5	22.25	+6.57	**28.82**	30
			20175	1732.5	22.72	+6.57	**29.29**	30
			20375	1752.5	22.33	+6.57	**28.9**	30
	1	High	19975	1712.5	22.49	+6.57	**29.06**	30
			20175	1732.5	22.75	+6.57	**29.32**	30
			20375	1752.5	22.44	+6.57	**29.01**	30

10.0 MHz	50	0	20000	1715	22.20	+6.57	**28.77**	30
			20175	1732.5	22.43	+6.57	**29**	30
			20350	1750	22.11	+6.57	**28.68**	30
	25	High	20000	1715	22.06	+6.57	**28.63**	30
			20175	1732.5	22.45	+6.57	**29.02**	30
			20350	1750	21.61	+6.57	**28.18**	30
	1	0	20000	1715	22.29	+6.57	**28.86**	30
			20175	1732.5	22.74	+6.57	**29.31**	30
			20350	1750	22.19	+6.57	**28.76**	30
	1	High	20000	1715	22.15	+6.57	**28.72**	30
			20175	1732.5	22.60	+6.57	**29.17**	30
			20350	1750	22.00	+6.57	**28.57**	30
15.0 MHz	75	0	20025	1717.5	21.93	+6.57	**28.5**	30
			20175	1732.5	22.32	+6.57	**28.89**	30
			20325	1747.5	22.41	+6.57	**28.98**	30
	36	High	20025	1717.5	21.75	+6.57	**28.32**	30
			20175	1732.5	22.13	+6.57	**28.7**	30
			20325	1747.5	22.36	+6.57	**28.93**	30
	1	0	20025	1717.5	22.14	+6.57	**28.71**	30
			20175	1732.5	22.05	+6.57	**28.62**	30
			20325	1747.5	22.43	+6.57	**29**	30
	1	High	20025	1717.5	21.93	+6.57	**28.5**	30
			20175	1732.5	22.01	+6.57	**28.58**	30
			20325	1747.5	22.60	+6.57	**29.17**	30
20.0 MHz	100	0	20050	1720	22.21	+6.57	**28.78**	30
			20175	1732.5	21.73	+6.57	**28.3**	30
			20300	1745	21.75	+6.57	**28.32**	30
	50	High	20050	1720	22.06	+6.57	**28.63**	30
			20175	1732.5	21.77	+6.57	**28.34**	30
			20300	1745	22.24	+6.57	**28.81**	30
	1	0	20050	1720	22.96	+6.57	**29.53**	30
			20175	1732.5	21.55	+6.57	**28.12**	30
			20300	1745	22.46	+6.57	**29.03**	30
	1	High	20050	1720	22.91	+6.57	**29.48**	30
			20175	1732.5	21.67	+6.57	**28.24**	30
			20300	1745	22.73	+6.57	**29.3**	30

Band 4 16QAM								
Bandwidth	**RB Size**	**RB Offset**	**Channel**	**Frequency (MHz)**	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**Limit (dBm)**
1.4 MHz	6	0	19957	1710.7	22.97	+6.57	**29.54**	30
			20175	1732.5	23.42	+6.57	**29.99**	30
			20393	1754.3	22.95	+6.57	**29.52**	30
	5	High	19957	1710.7	23.08	+6.57	**29.65**	30
			20175	1732.5	23.43	+6.57	**30**	30
			20393	1754.3	22.91	+6.57	**29.48**	30
	1	Low	19957	1710.7	22.76	+6.57	**29.33**	30
			20175	1732.5	23.07	+6.57	**29.64**	30
			20393	1754.3	22.68	+6.57	**29.25**	30
	1	High	19957	1710.7	22.17	+6.57	**28.74**	30
			20175	1732.5	23.15	+6.57	**29.72**	30
			20393	1754.3	22.44	+6.57	**29.01**	30
3.0 MHz	15	0	19965	1711.5	N/A	+6.57	N/A	30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
	6	High	19965	1711.5		+6.57		30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
	1	0	19965	1711.5		+6.57		30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
	1	14	19965	1711.5		+6.57		30
			20175	1732.5		+6.57		30
			20385	1753.5		+6.57		30
5.0 MHz	25	0	19975	1712.5	22.37	+6.57	**28.94**	30
			20175	1732.5	22.99	+6.57	**29.56**	30
			20375	1752.5	22.21	+6.57	**28.78**	30
	8	High	19975	1712.5	22.55	+6.57	**29.12**	30
			20175	1732.5	23.17	+6.57	**29.74**	30
			20375	1752.5	22.76	+6.57	**29.33**	30
	1	0	19975	1712.5	22.28	+6.57	**28.85**	30
			20175	1732.5	23.26	+6.57	**29.83**	30
			20375	1752.5	22.97	+6.57	**29.54**	30
	1	High	19975	1712.5	22.74	+6.57	**29.31**	30
			20175	1732.5	23.02	+6.57	**29.59**	30
			20375	1752.5	22.97	+6.57	**29.54**	30

10.0 MHz	50	0	20000	1715	22.21	+6.57	**28.78**	30
			20175	1732.5	22.35	+6.57	**28.92**	30
			20350	1750	22.12	+6.57	**28.69**	30
	30	High	20000	1715	22.26	+6.57	**28.83**	30
			20175	1732.5	22.39	+6.57	**28.96**	30
			20350	1750	22.13	+6.57	**28.7**	30
	1	0	20000	1715	22.83	+6.57	**29.4**	30
			20175	1732.5	23.16	+6.57	**29.73**	30
			20350	1750	22.89	+6.57	**29.46**	30
	1	High	20000	1715	23.04	+6.57	**29.61**	30
			20175	1732.5	23.27	+6.57	**29.84**	30
			20350	1750	22.97	+6.57	**29.54**	30
15.0 MHz	75	0	20025	1717.5	22.26	+6.57	**28.83**	30
			20175	1732.5	22.56	+6.57	**29.13**	30
			20325	1747.5	22.77	+6.57	**29.34**	30
	24	High	20025	1717.5	22.08	+6.57	**28.65**	30
			20175	1732.5	22.43	+6.57	**29**	30
			20325	1747.5	22.36	+6.57	**28.93**	30
	1	0	20025	1717.5	22.37	+6.57	**28.94**	30
			20175	1732.5	22.86	+6.57	**29.43**	30
			20325	1747.5	23.24	+6.57	**29.81**	30
	1	High	20025	1717.5	22.69	+6.57	**29.26**	30
			20175	1732.5	22.74	+6.57	**29.31**	30
			20325	1747.5	22.60	+6.57	**29.17**	30
20.0 MHz	100	0	20050	1720	22.74	+6.57	**29.31**	30
			20175	1732.5	22.04	+6.57	**28.61**	30
			20300	1745	22.19	+6.57	**28.76**	30
	75	High	20050	1720	22.84	+6.57	**29.41**	30
			20175	1732.5	22.51	+6.57	**29.08**	30
			20300	1745	21.94	+6.57	**28.51**	30
	1	0	20050	1720	23.00	+6.57	**29.57**	30
			20175	1732.5	22.55	+6.57	**29.12**	30
			20300	1745	21.78	+6.57	**28.35**	30
	1	High	20050	1720	22.90	+6.57	**29.47**	30
			20175	1732.5	22.66	+6.57	**29.23**	30
			20300	1745	22.08	+6.57	**28.65**	30

2.3 EFFECTIVE RADIATED POWER OUTPUT DATA

2.3.1 Specification Reference

Part 27 Subpart C §27.50 (b) (10) (12) 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: 356075050013822, Test Configuration (N/A, calculation only)

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

August 06, 2013/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:

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

Where:

$\mathbf{P_T}$ = transmitter conducted output power dBm (Section 2.1 of this test report)
$\mathbf{G_T}$ = gain of the transmitting antenna, in dBi (EIRP - the -2.15 in the formula is to convert EIRP to ERP);
$\mathbf{L_C}$ = signal attenuation in the connecting cable between the transmitter and antenna, in dB (EUT configuration during verification is mounted on a interface board with short direct connection to the antenna port. The loss between the EUT and the 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	22.47	+10.7	**31.02**	34.77
			23255	784.5	22.52	+10.7	**31.07**	34.77
	10	24	23205	779.5	22.71	+10.7	**31.26**	34.77
			23255	784.5	22.47	+10.7	**31.02**	34.77
	1	0	23205	779.5	21.62	+10.7	**30.17**	34.77
			23255	784.5	21.71	+10.7	**30.26**	34.77
	1	24	23205	779.5	21.68	+10.7	**30.23**	34.77
			23255	784.5	21.91	+10.7	**30.46**	34.77
10.0 MHz	50	0	23230	782.0	22.77	+10.7	**31.32**	34.77
	25	0	23230	782.0	22.58	+10.7	**31.13**	34.77
	1	0	23230	782.0	22.72	+10.7	**31.27**	34.77
	1	49	23230	782.0	22.73	+10.7	**31.28**	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	22.76	+10.7	**31.31**	34.77
			23255	784.5	22.67	+10.7	**31.22**	34.77
	8	24	23205	779.5	22.85	+10.7	**31.4**	34.77
			23255	784.5	22.63	+10.7	**31.18**	34.77
	1	0	23205	779.5	22.21	+10.7	**30.76**	34.77
			23255	784.5	22.32	+10.7	**30.87**	34.77
	1	24	23205	779.5	22.51	+10.7	**31.06**	34.77
			23255	784.5	22.6	+10.7	**31.15**	34.77
10.0 MHz	50	0	23230	782.0	22.57	+10.7	**31.12**	34.77
	25	0	23230	782.0	22.65	+10.7	**31.2**	34.77
	1	0	23230	782.0	23.39	+10.7	**31.94**	34.77
	1	49	23230	782.0	23.31	+10.7	**31.86**	34.77

2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

Part 27 Subpart C §27.53(h)(1), 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: 356075050013822 / Test Configuration B

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

August 05, 2013/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

Ambient Temperature	25.8°C
Relative Humidity	52.3%
ATM Pressure	99.1 kPa

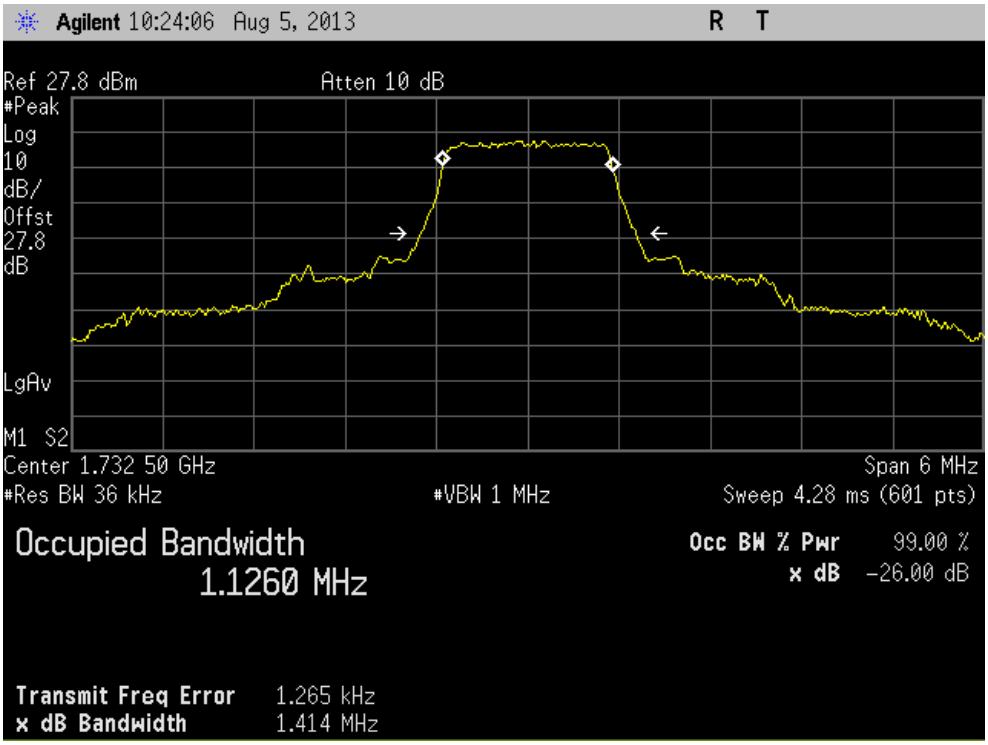
2.4.7 Additional Observations

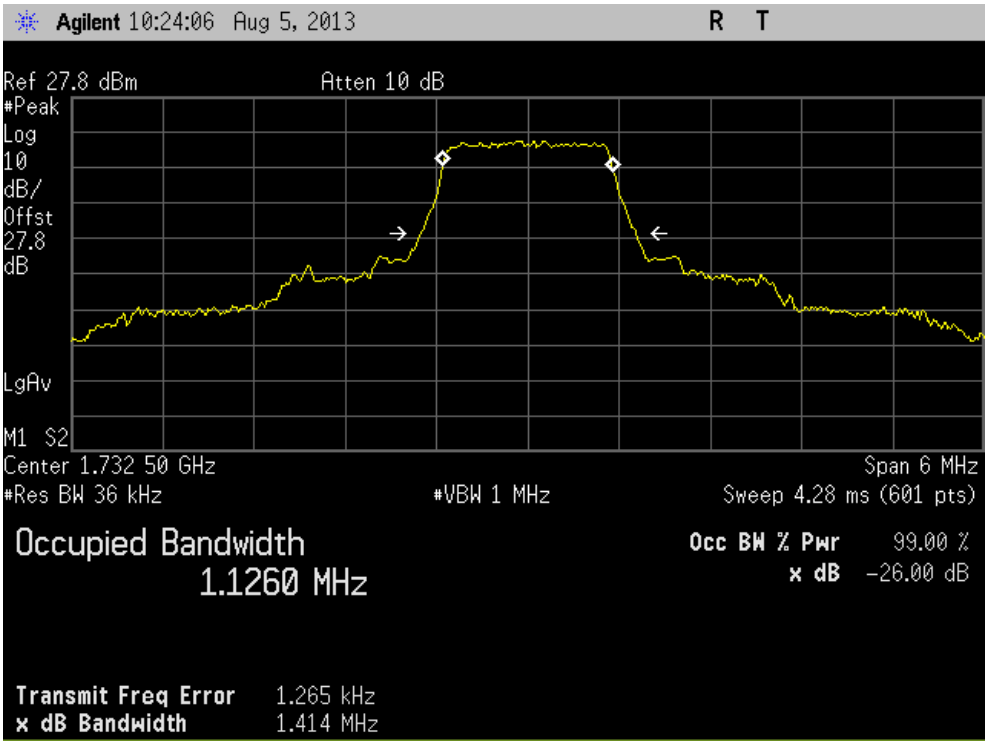
- This is a conducted test. Test procedure is per Section 4.0 of KDB971168 (D01 Power Meas License Digital Systems v02r01).
- Both relative OBW (-26dB BW) and 99% OBW presented.
- All channels per each channel bandwidth/band were verified. No significant difference observed. Only the worst channel presented.

2.4.8 Test Results

See attached table and plots.

LTE Band	Channel	Frequency (MHz)	BW (MHz)	Modulation	99% OBW (MHz)	-26dB BW (MHz)
4	20175	1732.5	1.4	QPSK	1.1260	1.414
4	20175	1732.5	1.4	16QAM	1.1260	1.414
4	20175	1732.5	3.0	QPSK	N/A	
4	20175	1732.5	3.0	16QAM		
4	20175	1732.5	5.0	QPSK	4.5424	5.390
4	20175	1732.5	5.0	16QAM	4.5322	5.392
4	20175	1732.5	10.0	QPSK	8.9405	10.291
4	20175	1732.5	10.0	16QAM	8.9500	10.496
4	20175	1732.5	15.0	QPSK	13.5325	17.913
4	20175	1732.5	15.0	16QAM	13.5781	18.441
4	20175	1732.5	20.0	QPSK	17.8797	20.475
4	20175	1732.5	20.0	16QAM	17.9476	20.377
13	23255	784.5	5.0	QPSK	4.5137	5.335
13	23255	784.5	5.0	16QAM	4.5107	5.304
13	23230	782.0	10.0	QPSK	8.9600	10.269
13	23230	782.0	10.0	16QAM	8.9478	10.409

LTE Band 4 1732.5MHz (1.4 MHz BW) QPSK


LTE Band 4 1732.5MHz (1.4 MHz BW) 16QAM


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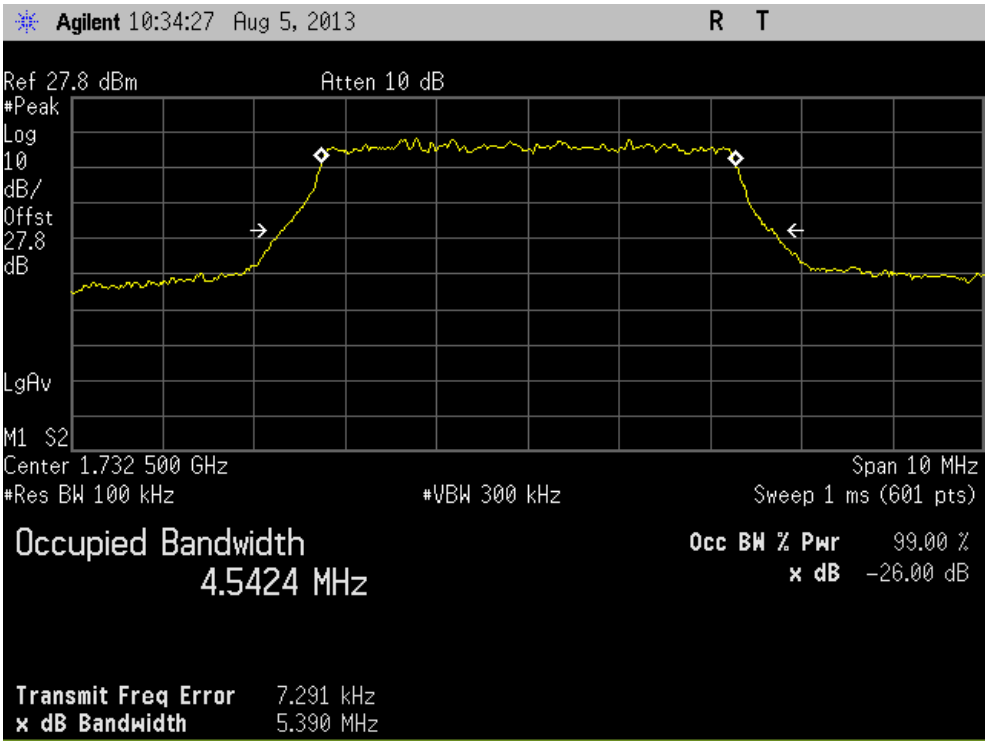
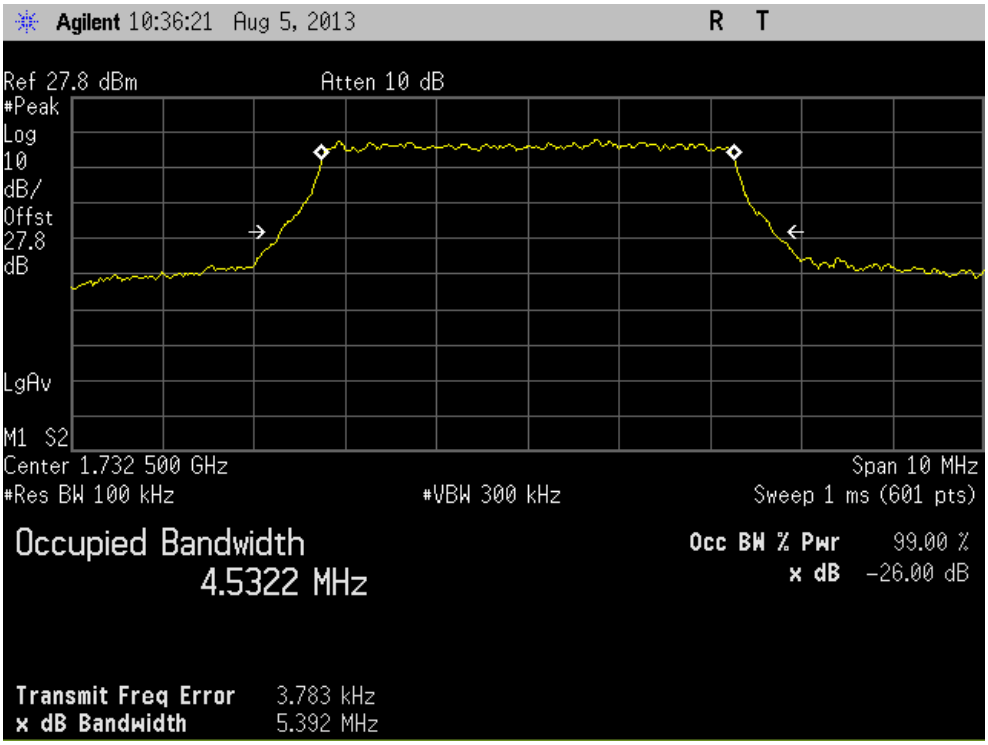
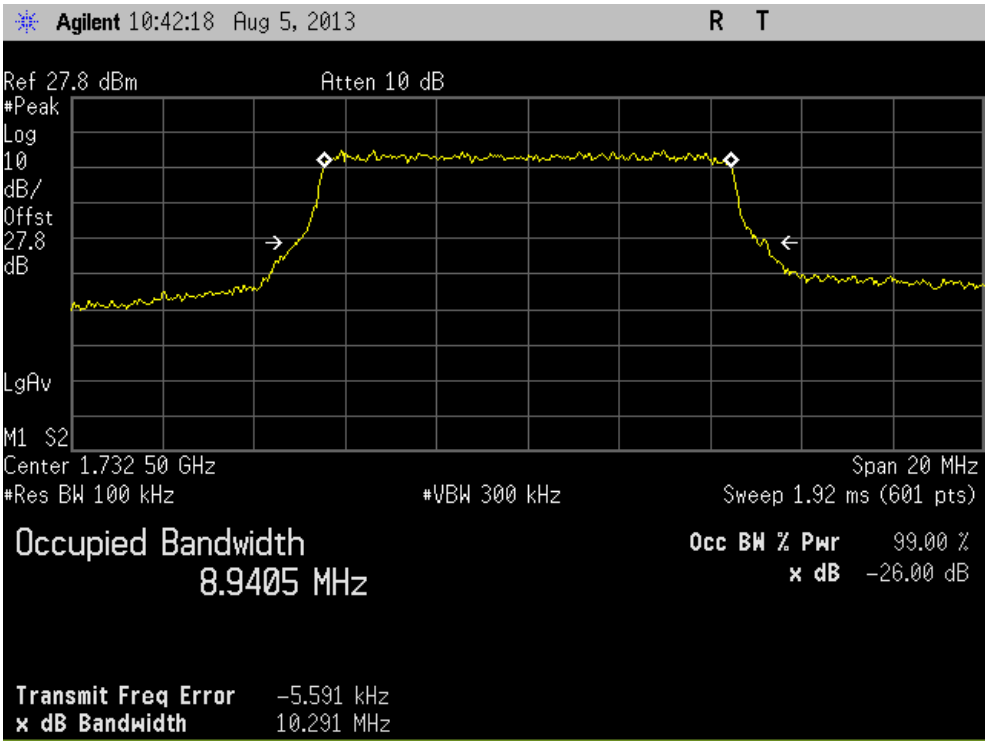
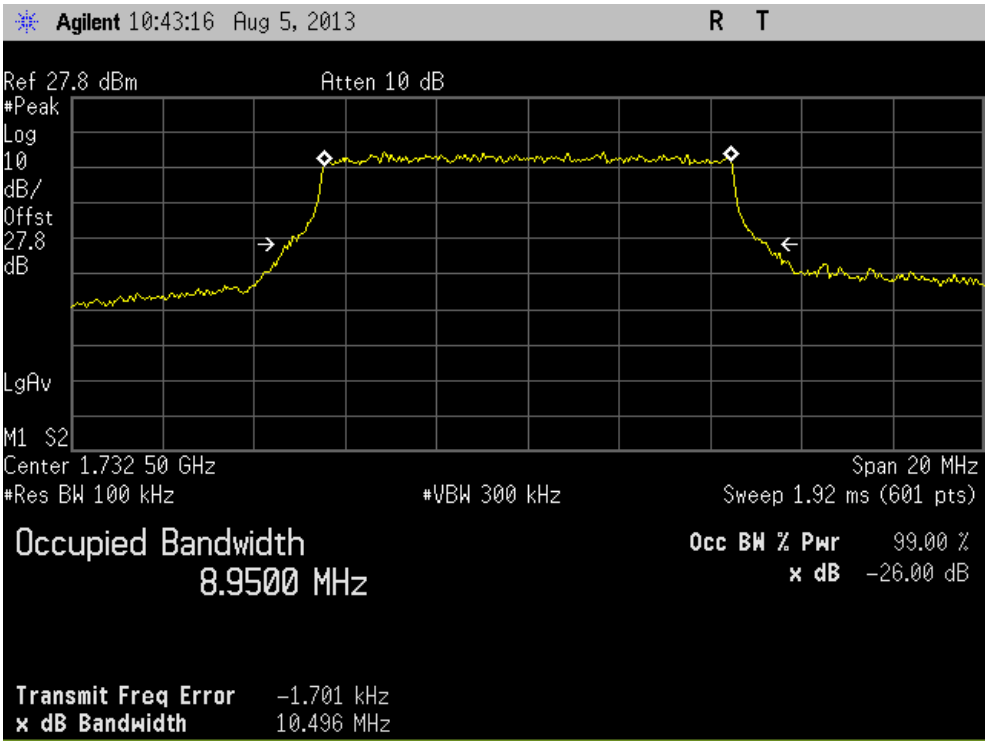
LTE Band 4 1732.5MHz (5.0 MHz BW) QPSK


LTE Band 4 1732.5MHz (5.0 MHz BW) 16QAM


LTE Band 4 1732.5MHz (10.0 MHz BW) QPSK


LTE Band 4 1732.5MHz (10.0 MHz BW) 16QAM


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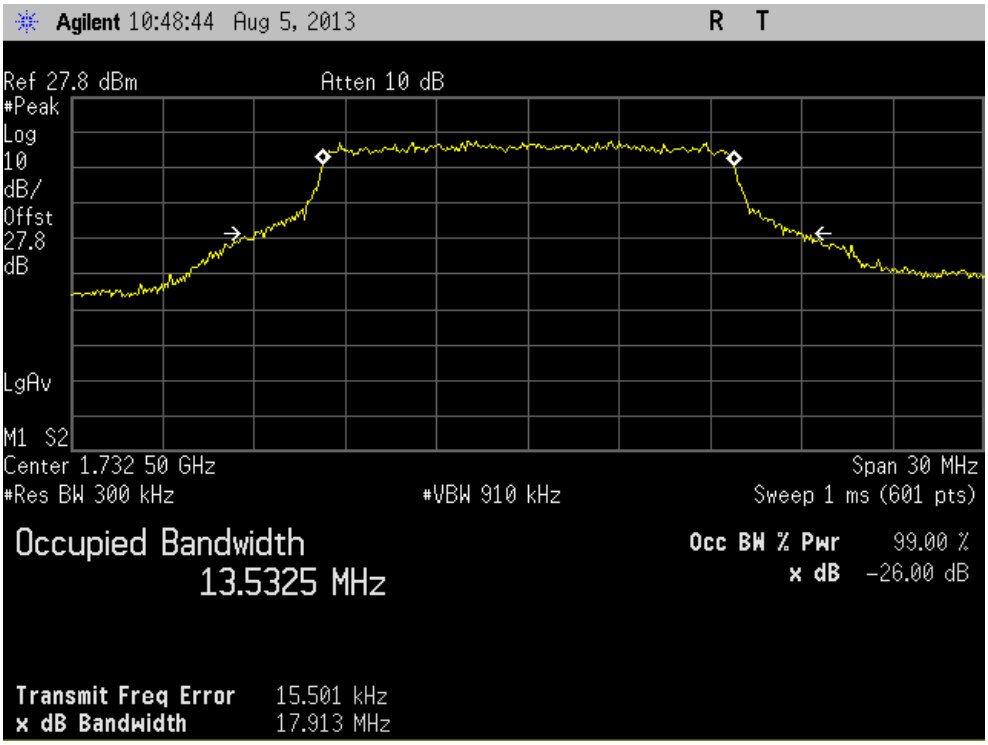
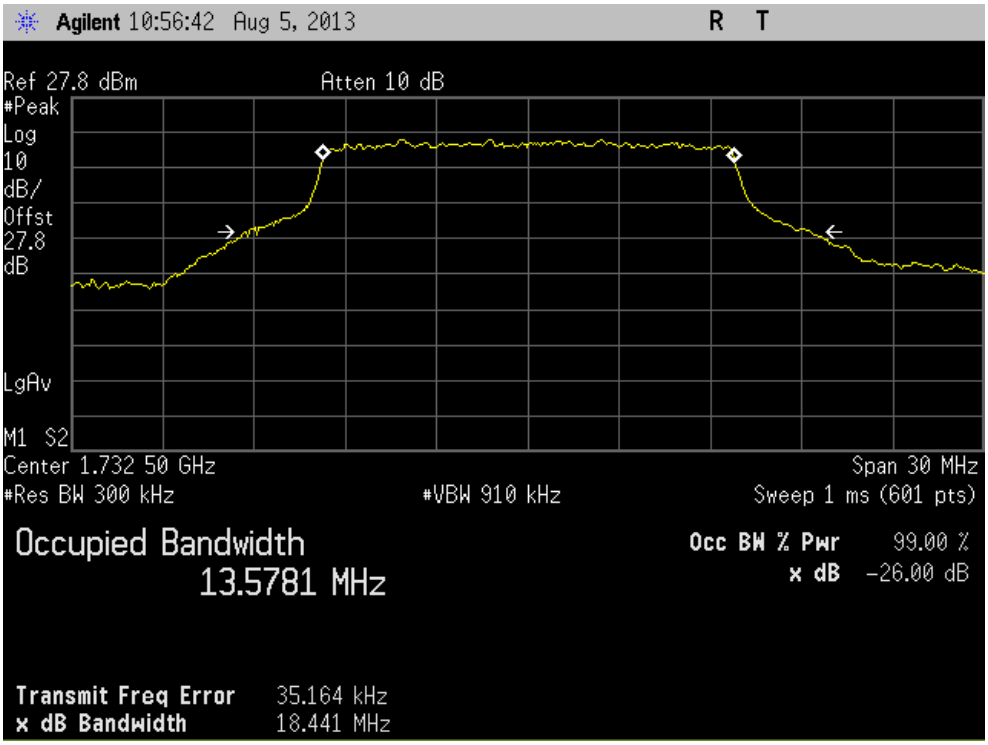
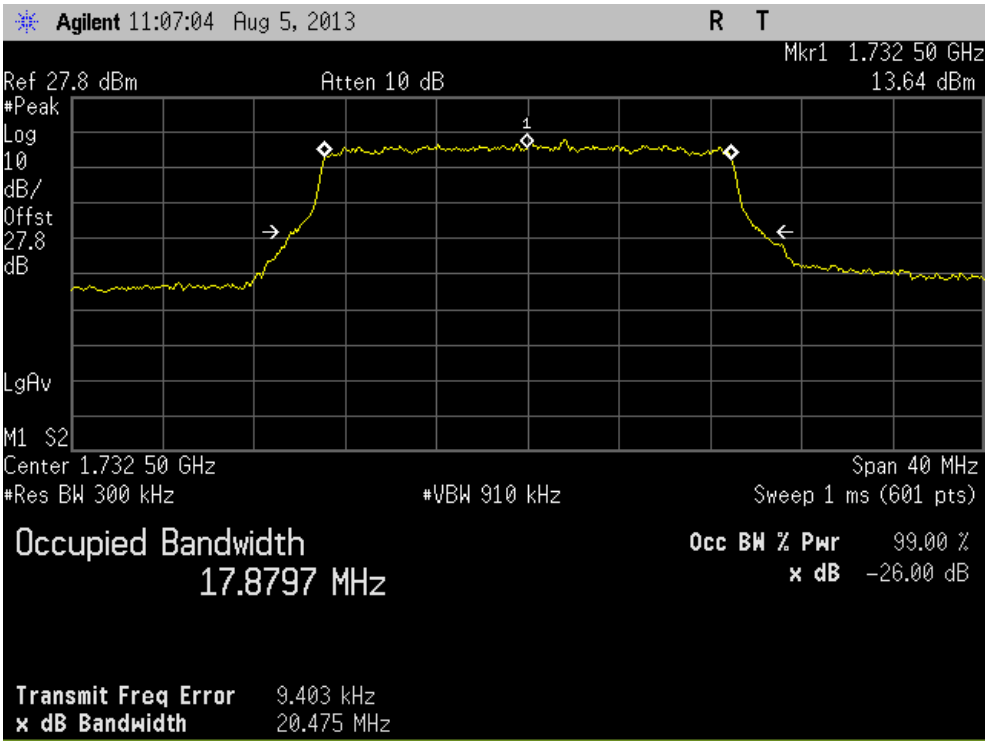
LTE Band 4 1732.5MHz (15.0 MHz BW) QPSK


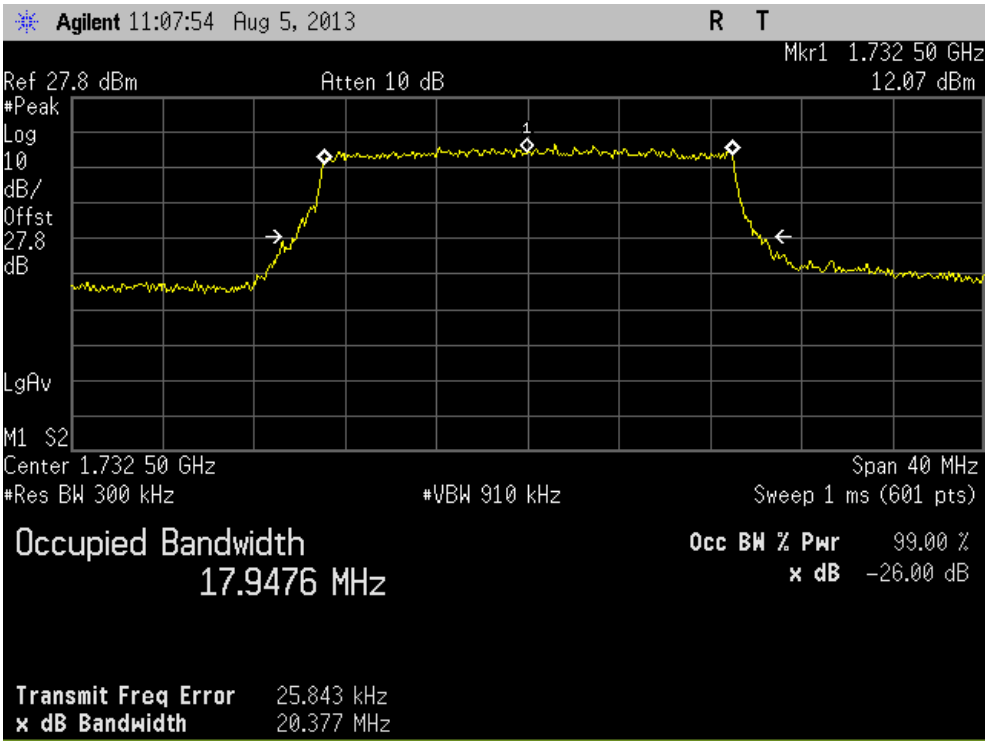
LTE Band 4 1732.5MHz (15.0 MHz BW) 16QAM


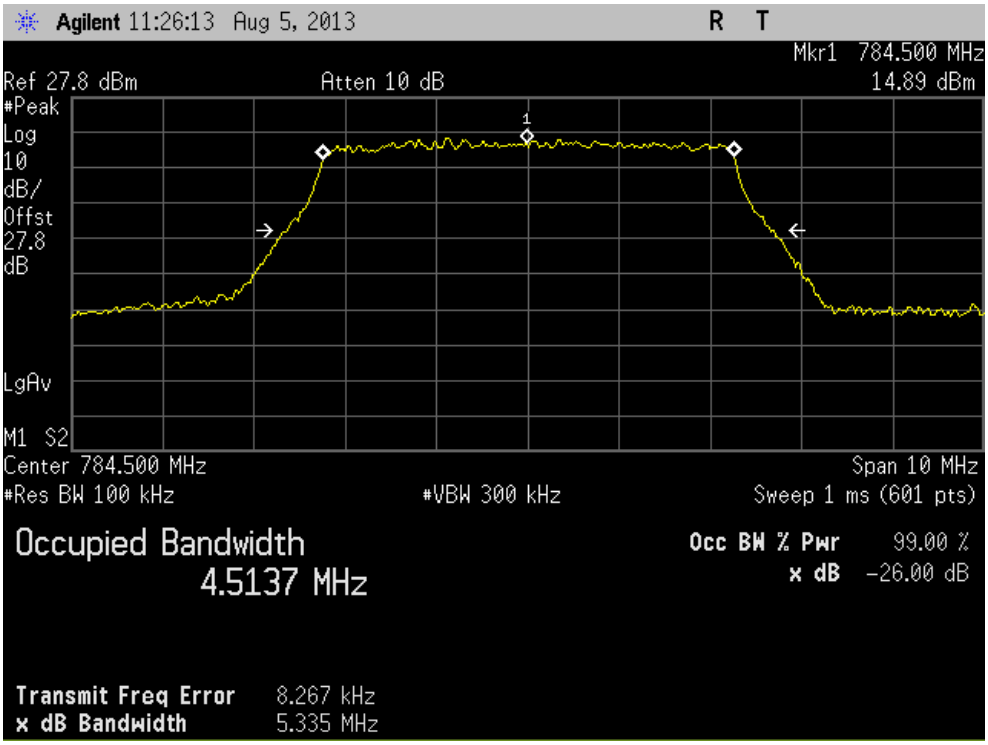
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

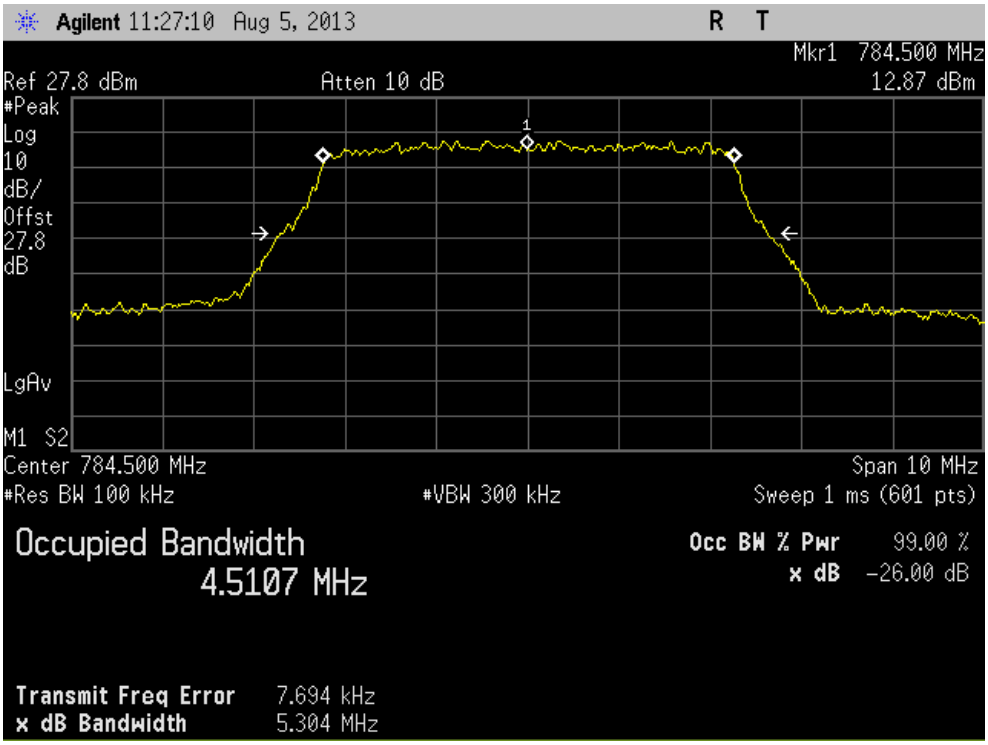
LTE Band 4 1732.5MHz (20.0 MHz BW) QPSK

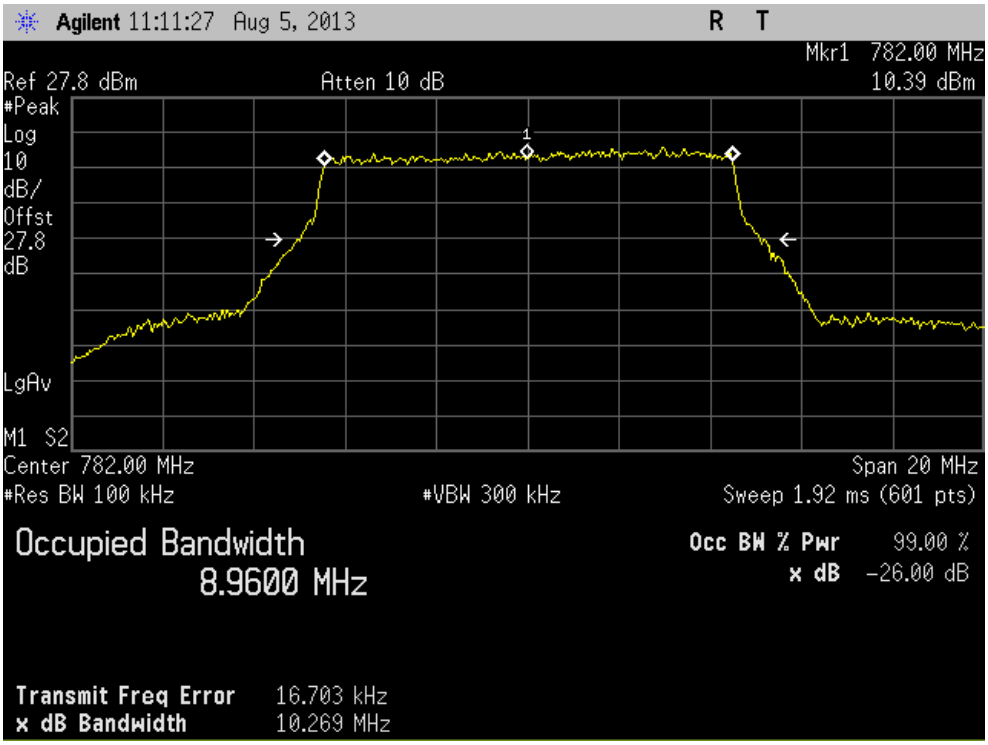


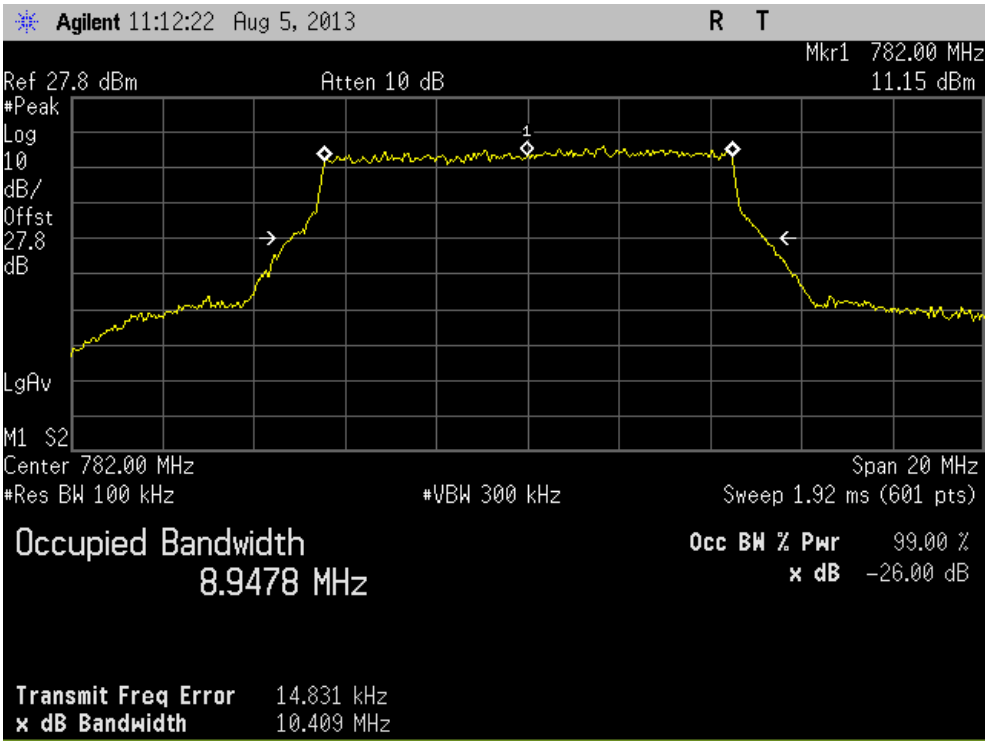
LTE Band 4 1732.5MHz (20.0 MHz BW) 16QAM



LTE Band 13 784.5MHz (5.0 MHz BW) QPSK


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


LTE Band 13 782.0MHz (10.0 MHz BW) QPSK


LTE Band 13 782.0MHz (10.0 MHz BW) 16QAM


2.5 PEAK-AVERAGE POWER RATIO

2.5.1 Specification Reference

Part 27 Subpart C §27.50(d)(5), RSS-139 Issue 2 (6.4)

2.5.2 Standard Applicable

(d) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands:
(5) Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

2.5.3 Equipment Under Test and Modification State

Serial No: 356075050013822 / Test Configuration B

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

August 06, 2013/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

Ambient Temperature	25.8°C
Relative Humidity	48.5%
ATM Pressure	99.2 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).
- 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.
- For 10,15 and 20MHz BW measurements, PAR were also verified using power measurements (power meter method) under Section 2.1 of this test report using the formula:

  PAPR (dB) = P_{Pk} (dBm) – P_{Avg} (dBm)

  Sample calculation (base from Section 2.1.9 of this test report):

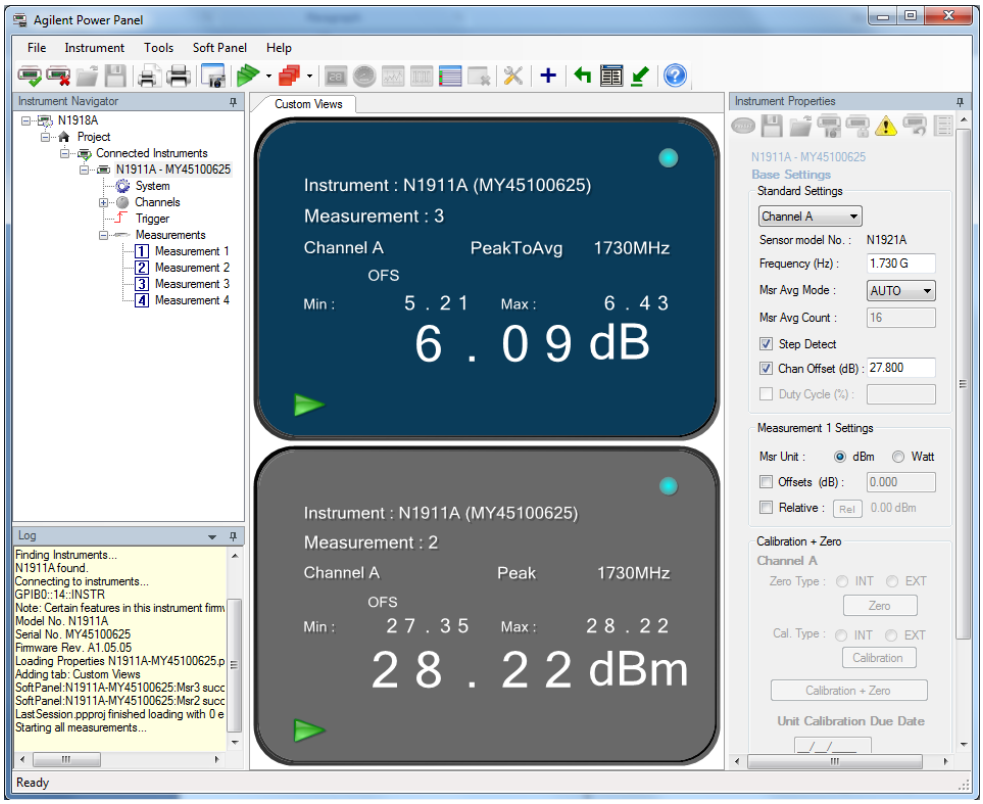
  PAPR (dB) = 28.15 dBm – 23.43 dBm
  = 4.72 dB

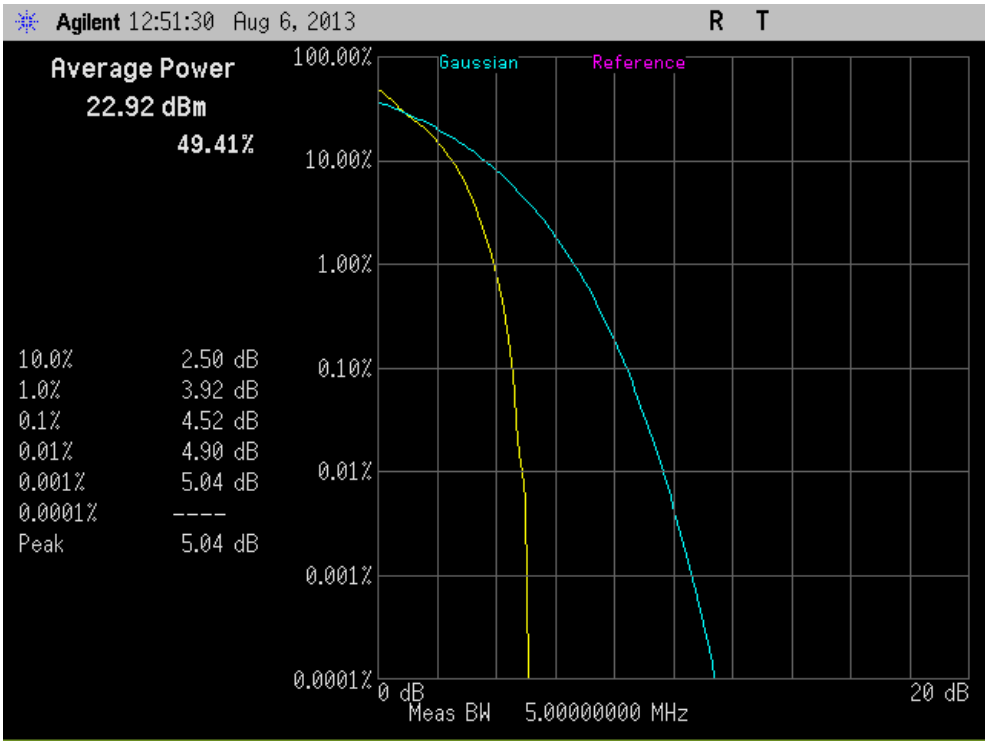
  There are no significant differences between the above procedure and the CCDF procedure, only the CCDF procedure presented.
- There are no measured PAR levels greater than 13dB. EUT complies.

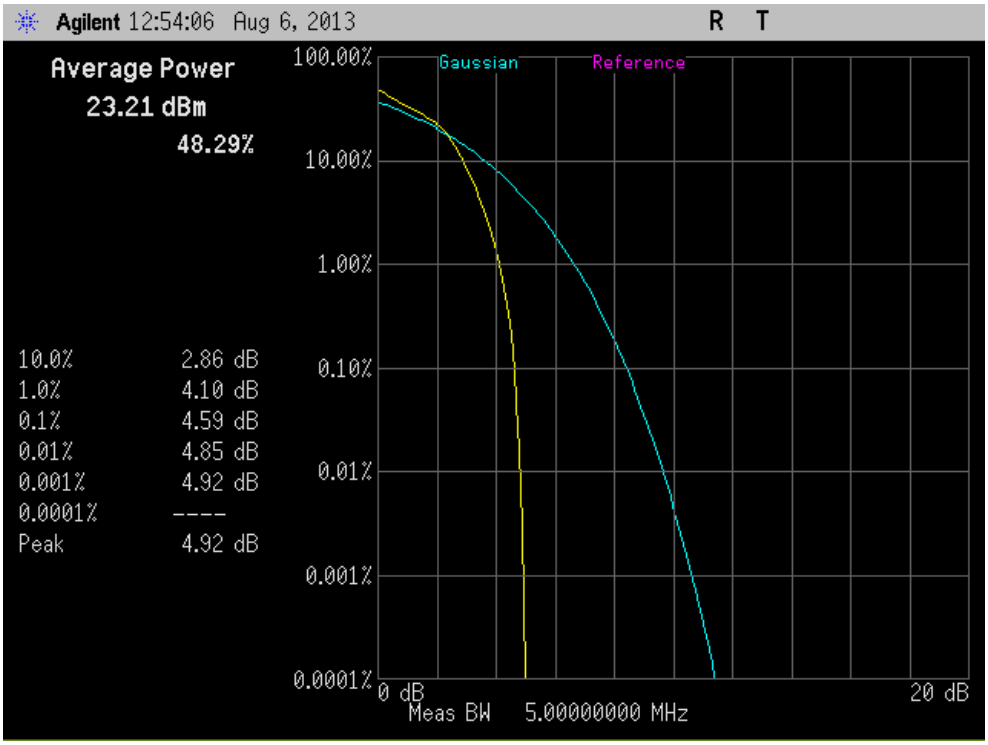
2.5.8 Test Results

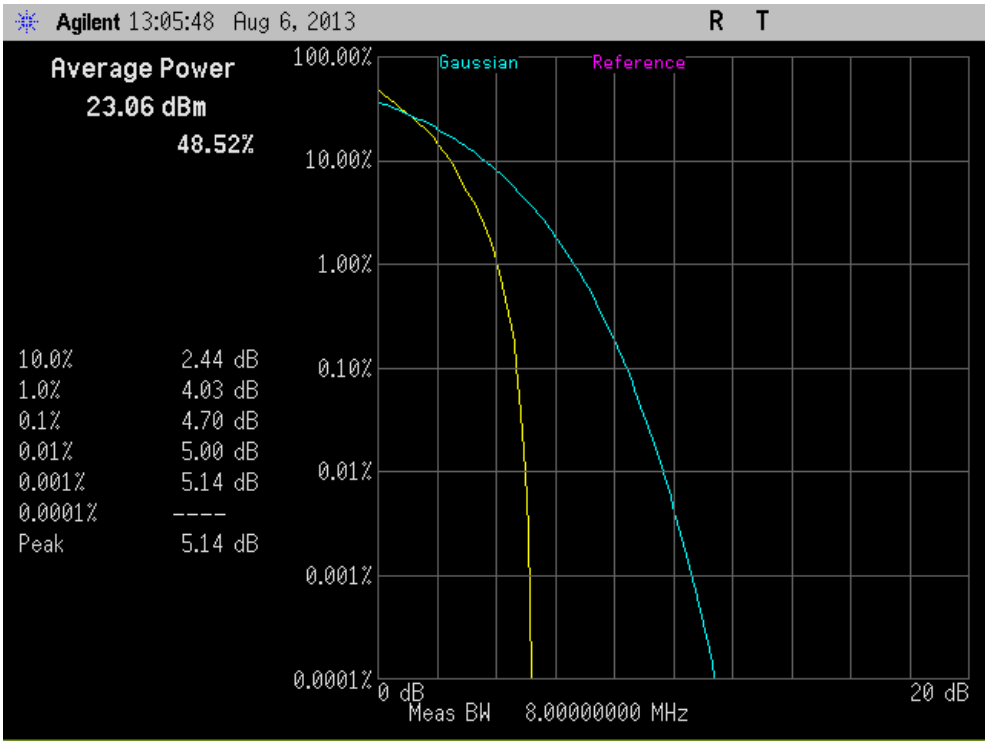
The worst case measured PAR level was 6.66 dB (0.1%) using CCDF method and 6.43 dB using power meter method (see sample plot below) at 1720.0 MHz using 16QAM with a 20MHz BW.

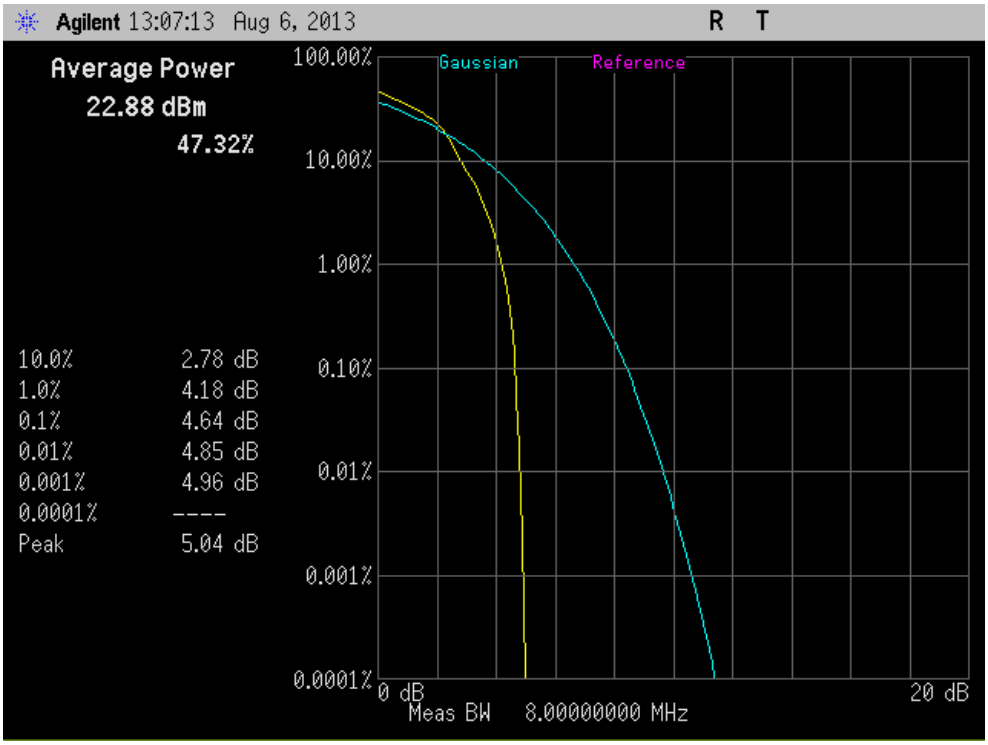
See attached plots.

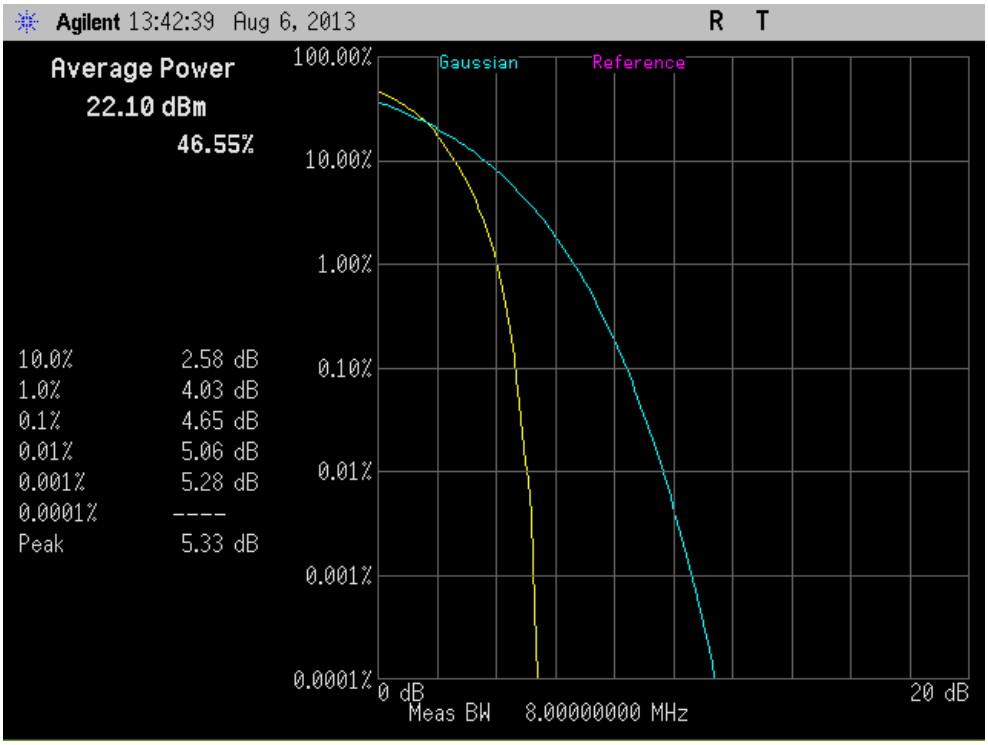


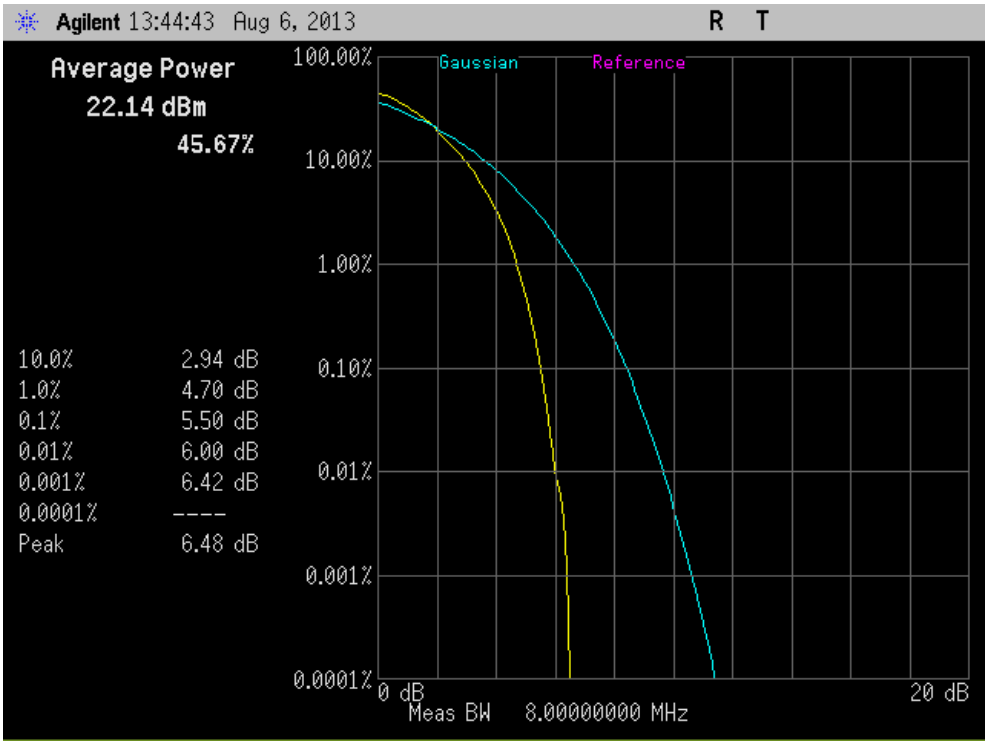
LTE Band 4 1732.5MHz (1.4 MHz BW) QPSK


LTE Band 4 1732.5MHz (1.4 MHz BW) 16QAM


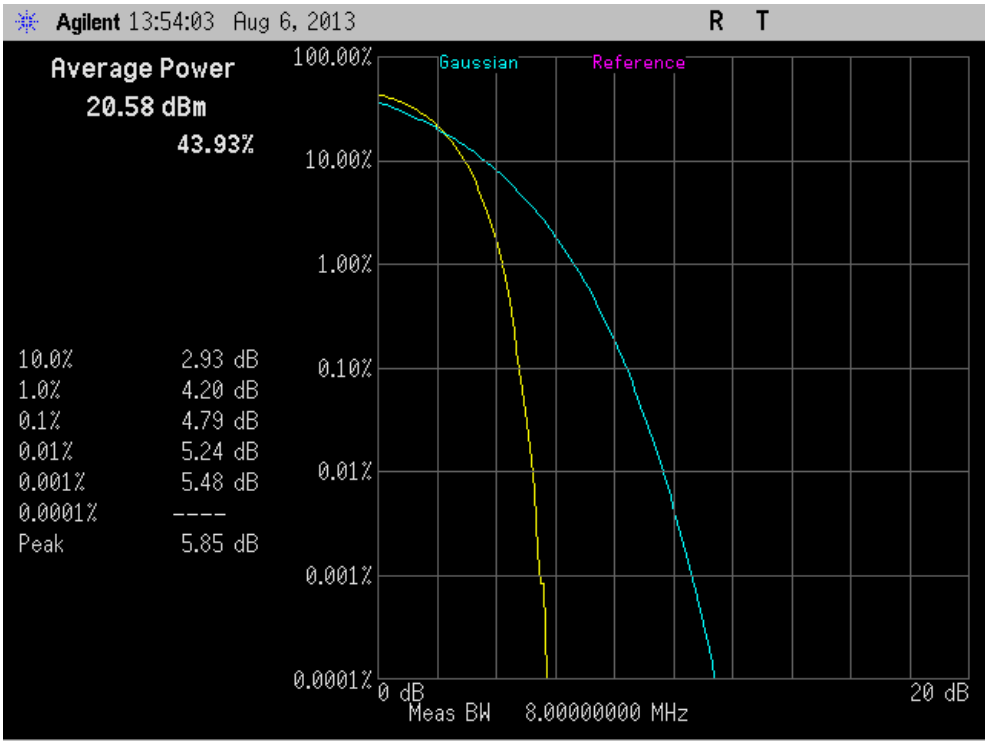
LTE Band 4 1732.5MHz (5.0 MHz BW) QPSK


LTE Band 4 1732.5MHz (5.0 MHz BW) 16QAM


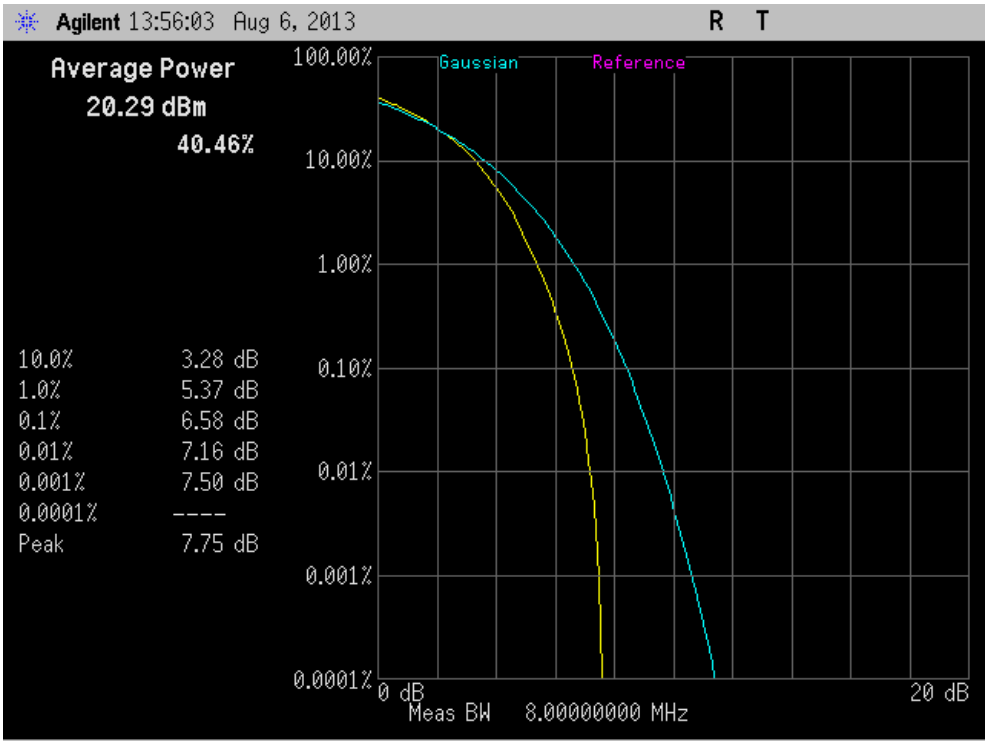
LTE Band 4 1732.5MHz (10.0 MHz BW) QPSK


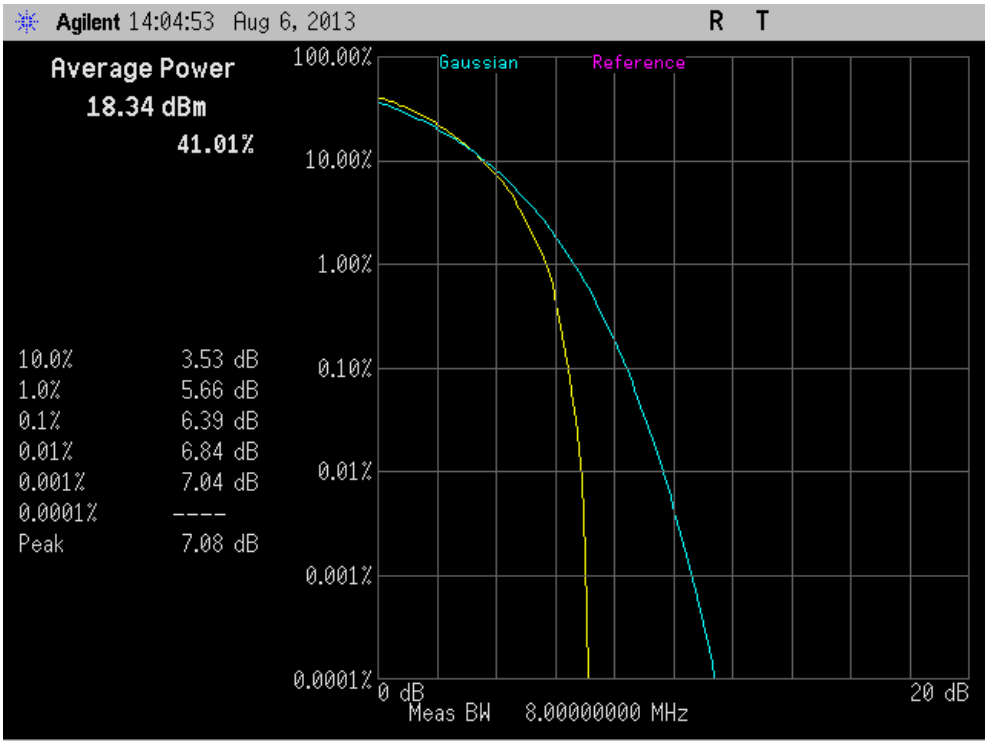
LTE Band 4 1732.5MHz (10.0 MHz BW) 16QAM


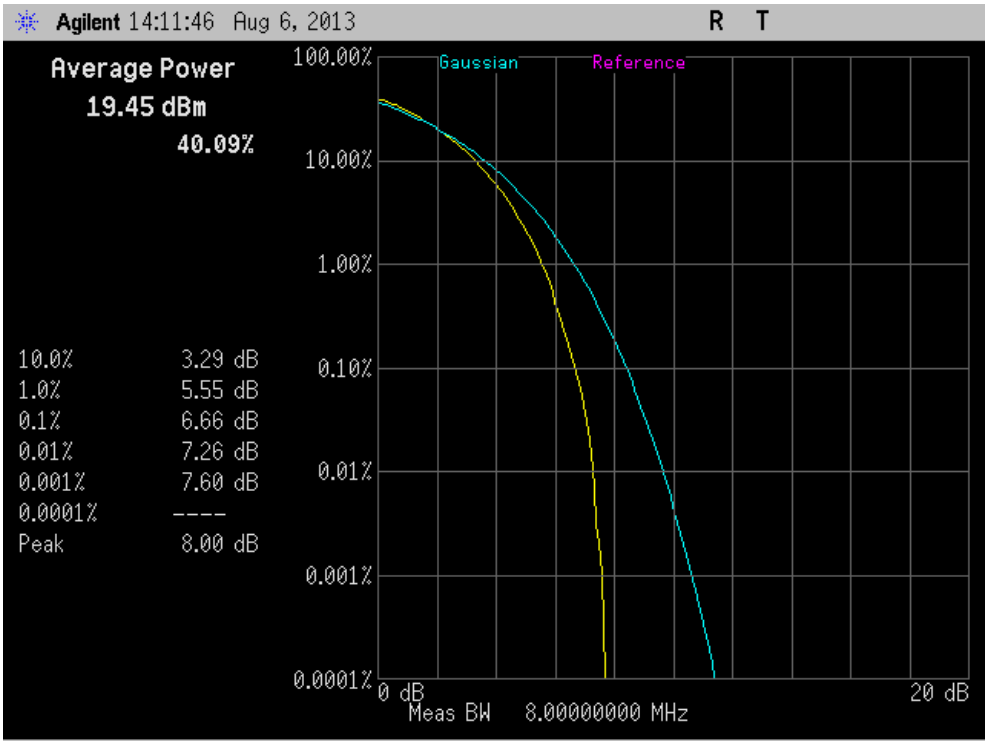
LTE Band 4 1747.5MHz (15.0 MHz BW) QPSK



LTE Band 4 1747.5MHz (15.0 MHz BW) 16QAM



LTE Band 4 1745.0MHz (20.0 MHz BW) QPSK


LTE Band 4 1720.0MHz (20.0 MHz BW) 16QAM


2.6 BAND EDGE

2.6.1 Specification Reference

Part 27 Subpart C §27.53(c)(2)(5) and (h), RSS-139 Issue 2 (6.5)

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;
(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.
(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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

2.6.3 Equipment Under Test and Modification State

Serial No: 356075050013822 / Test Configuration B

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

August 06, 2013/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

Ambient Temperature	25.8°C
Relative Humidity	48.5%
ATM Pressure	99.2 kPa

2.6.7 Additional Observations

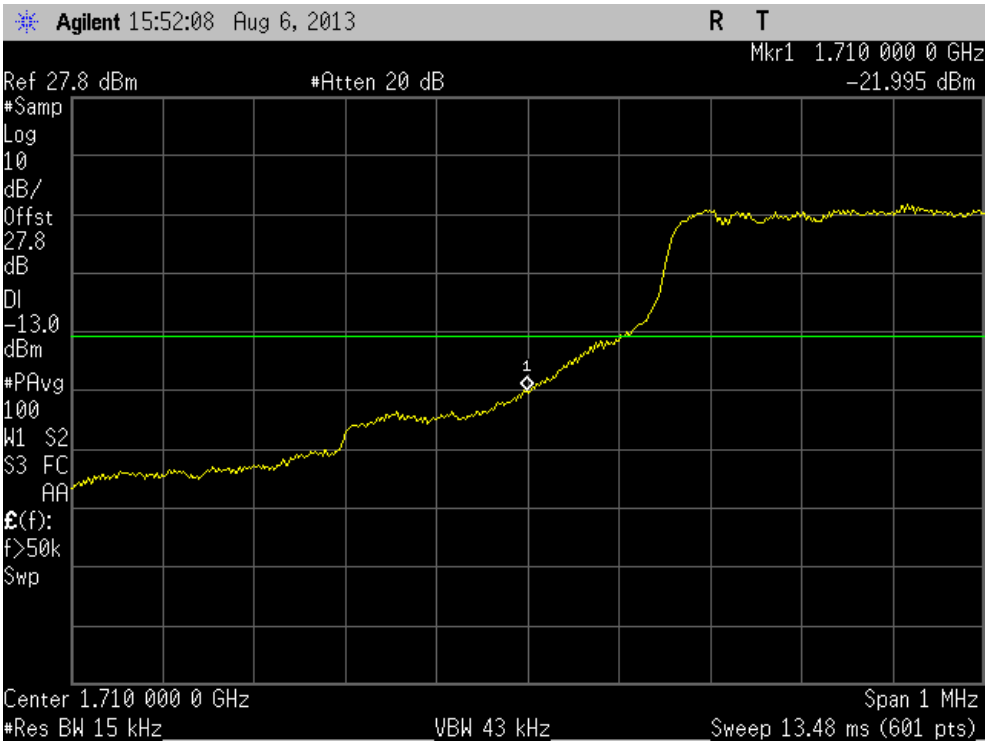
- This is a conducted test. Test guidance is per Section 6.0 of KDB971168 (D01 Power Meas License Digital Systems v02r01).

- The 27.8dB offset is from the power splitter, external attenuator and cable used.
- The center frequency of the spectrum is the band edge frequency.
- 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.
- In the band 1710-1755MHz (Band 4), RBW setting used is 1% of the -26dB bandwidth (EBW).
- 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.

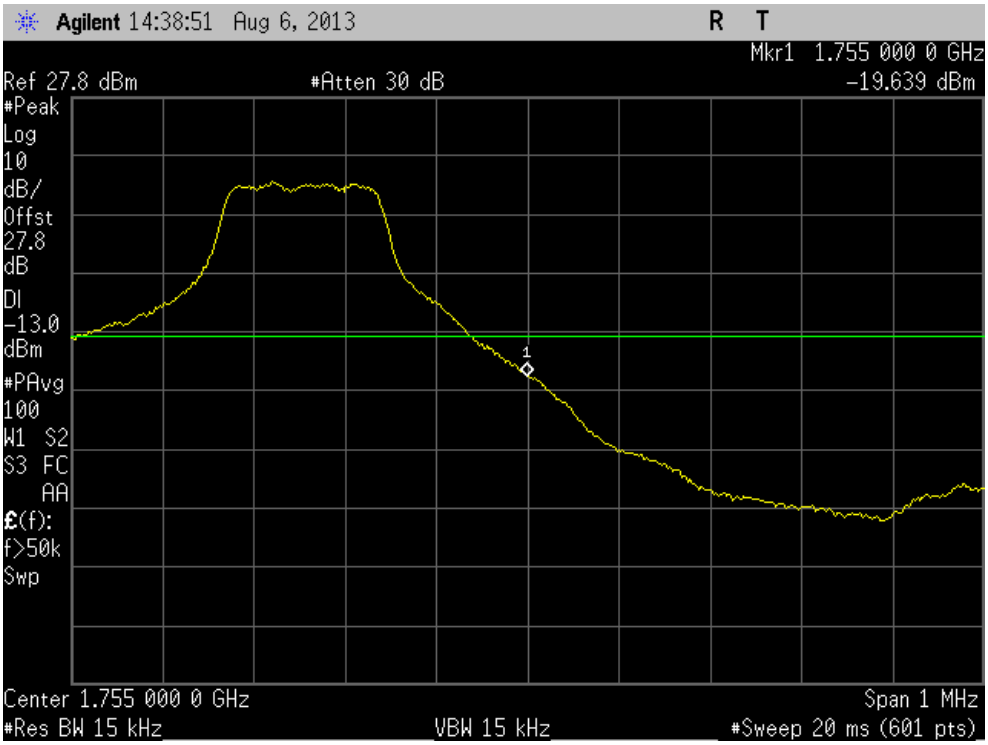
2.6.8 Test Results

See attached plots.

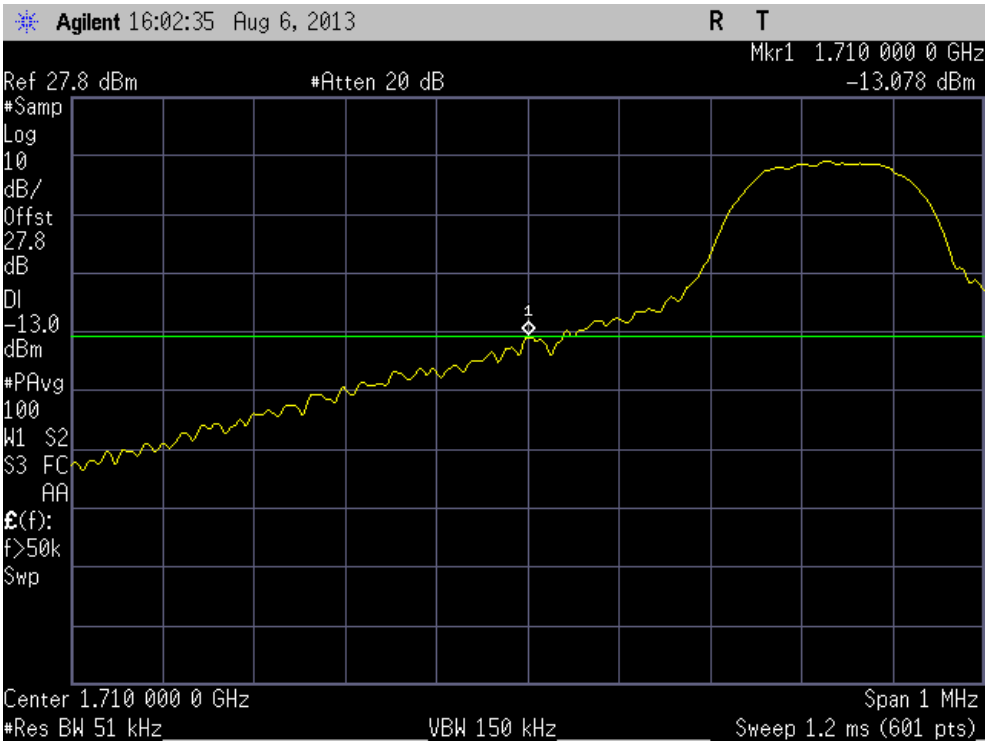
LTE Band 4 1.4MHz BW Low Channel (19957) Band Edge @ 1710MHz (2RB)



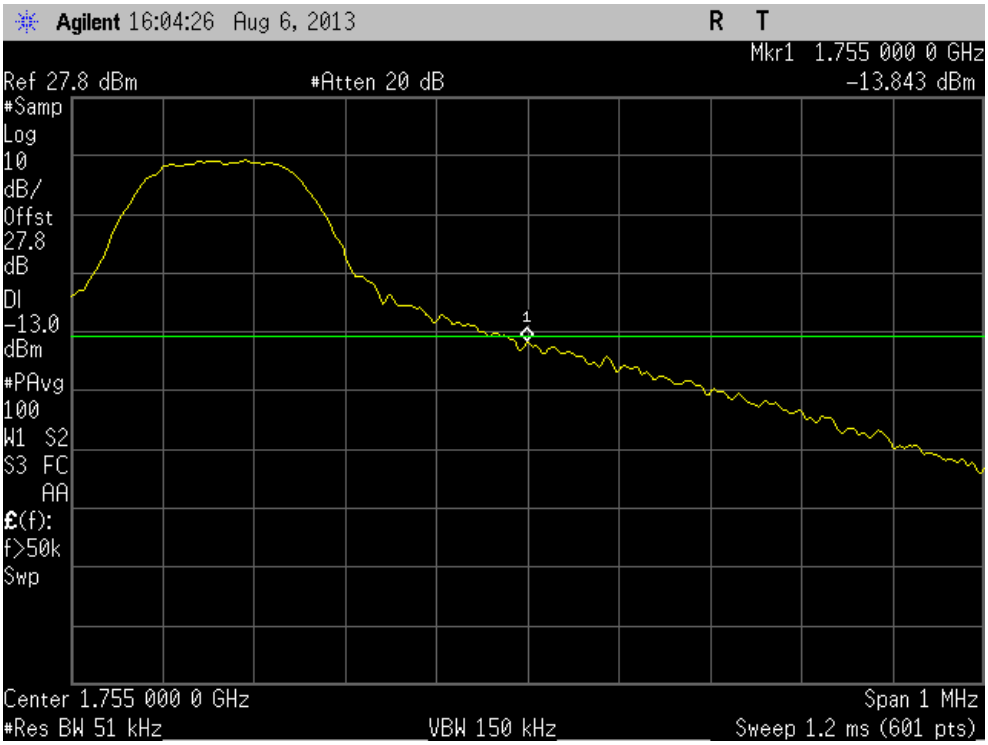
LTE Band 4 1.4MHz BW High Channel (20393) Band Edge @ 1755MHz (1RB)



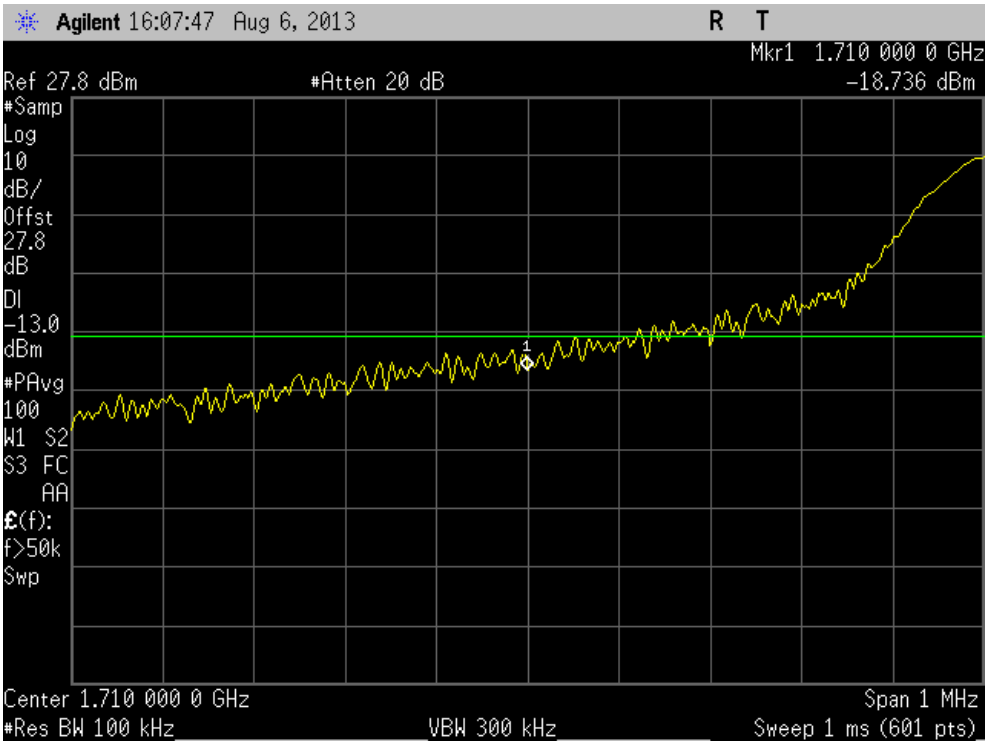
LTE Band 4 5.0MHz BW Low Channel (19975) Band Edge @ 1710MHz (1RB)



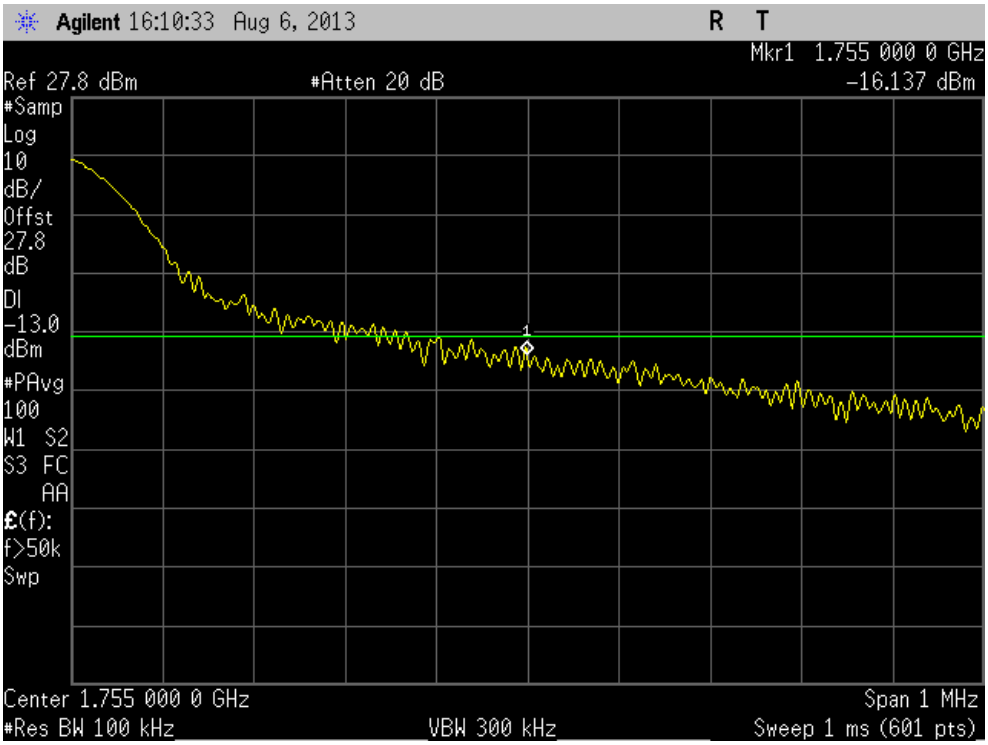
LTE Band 4 5.0MHz BW High Channel (20375) Band Edge @ 1755MHz (1RB)



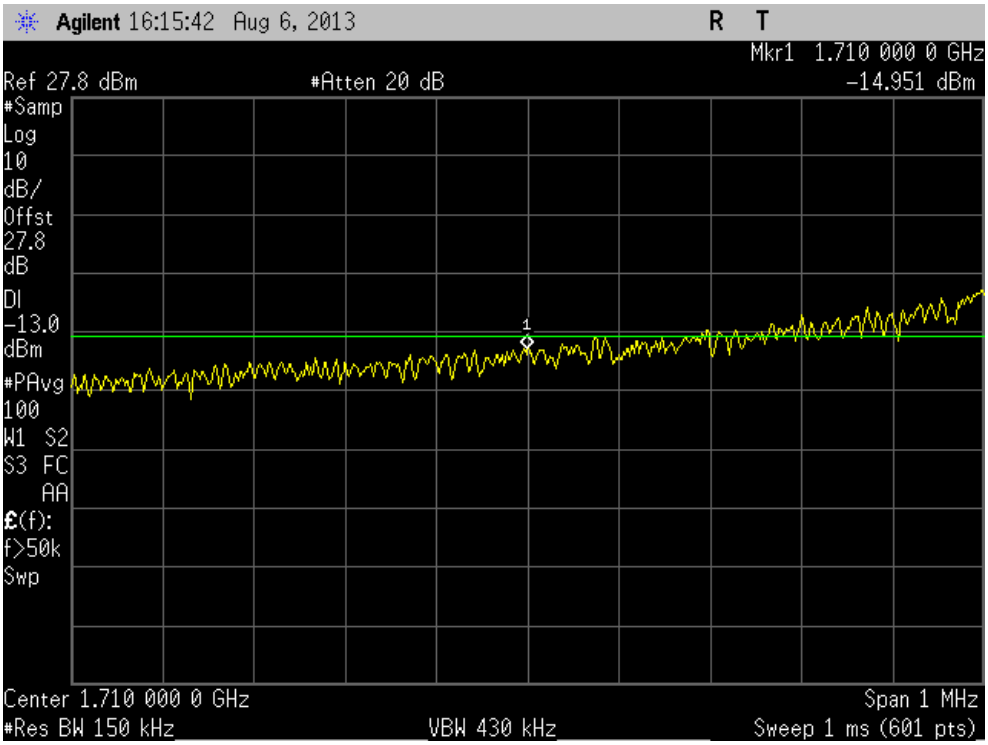
LTE Band 4 10.0MHz BW Low Channel (20000) Band Edge @ 1710MHz (1RB)



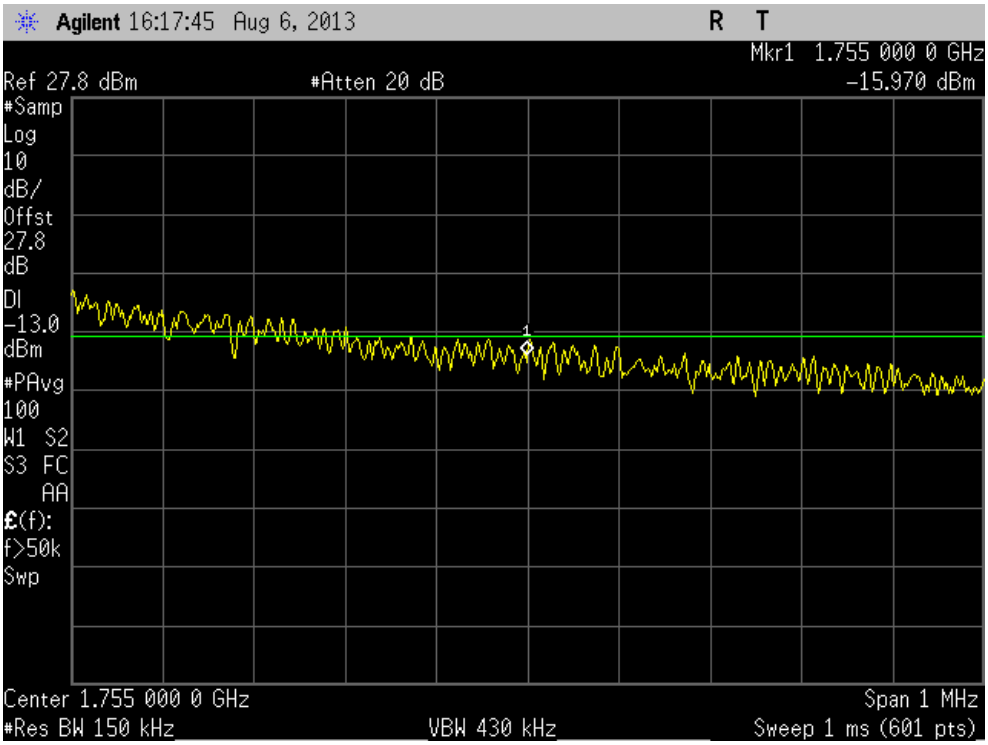
LTE Band 4 10.0MHz BW High Channel (20350) Band Edge @ 1755MHz (1RB)



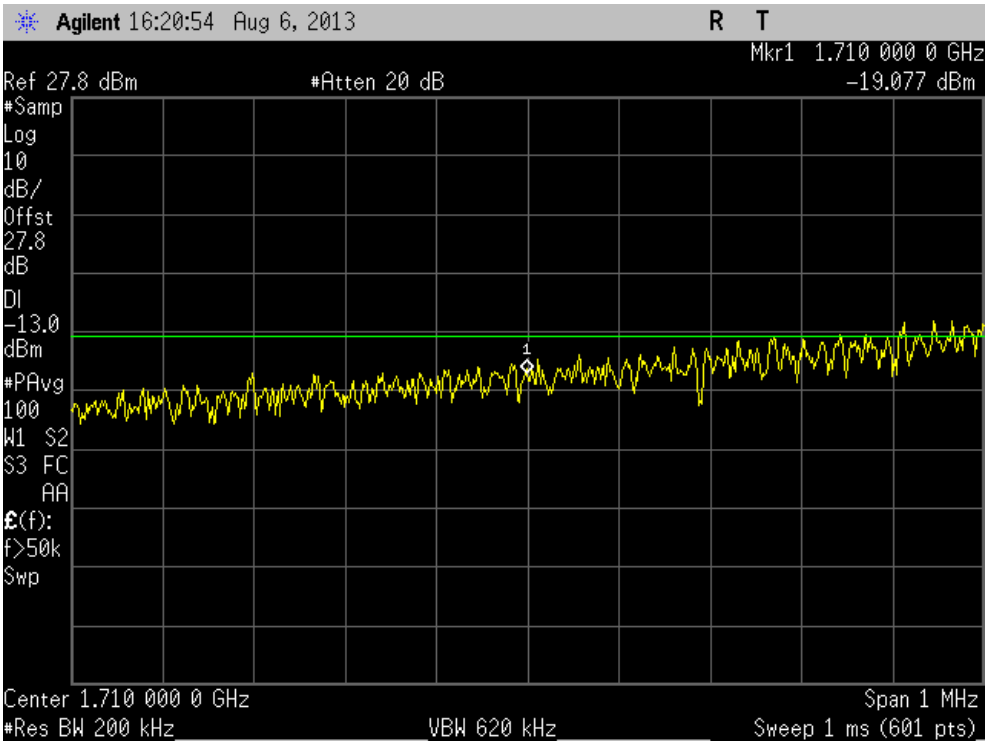
LTE Band 4 15.0MHz BW Low Channel (20025) Band Edge @ 1710MHz (1RB)



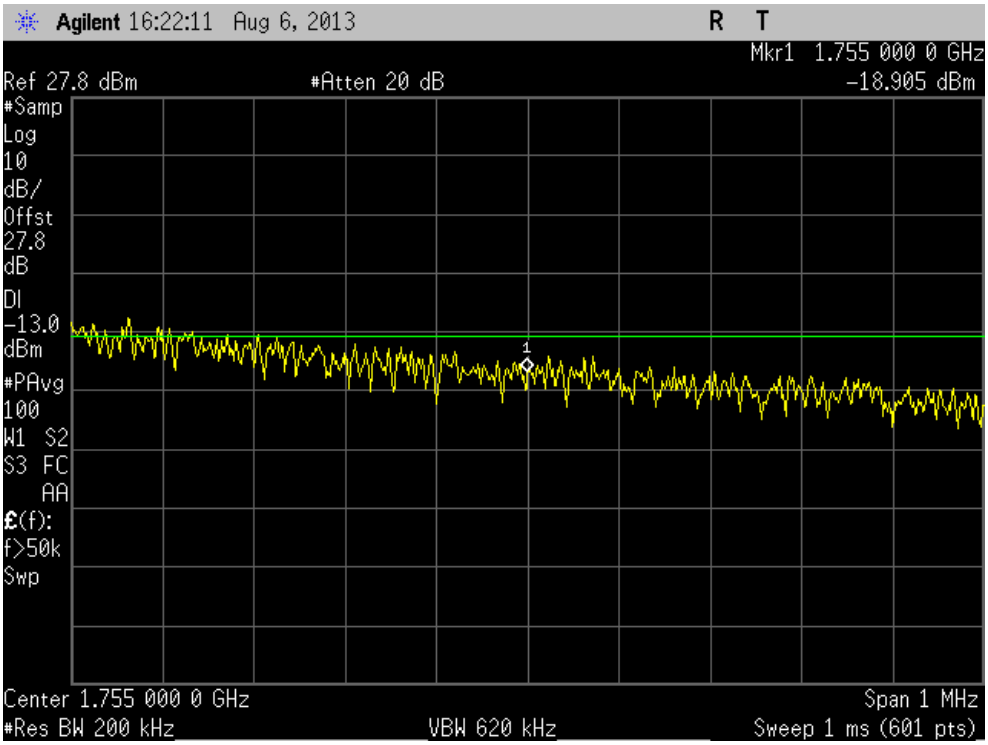
LTE Band 4 15.0MHz BW High Channel (20325) Band Edge @ 1755MHz (1RB)



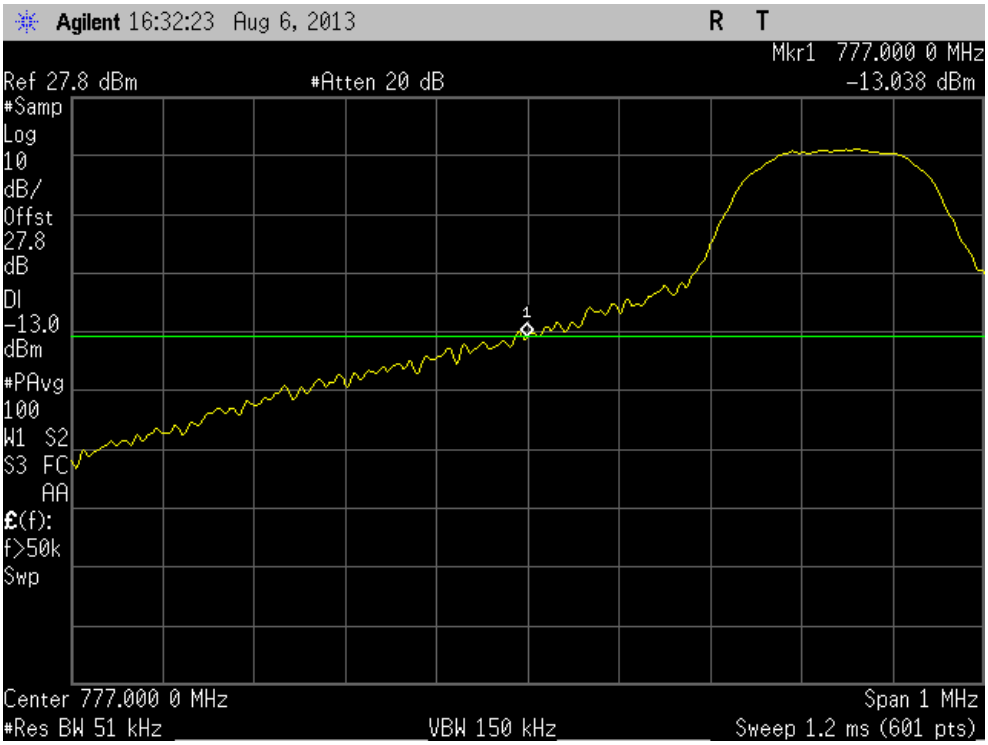
LTE Band 4 20.0MHz BW Low Channel (20050) Band Edge @ 1710MHz (1RB)



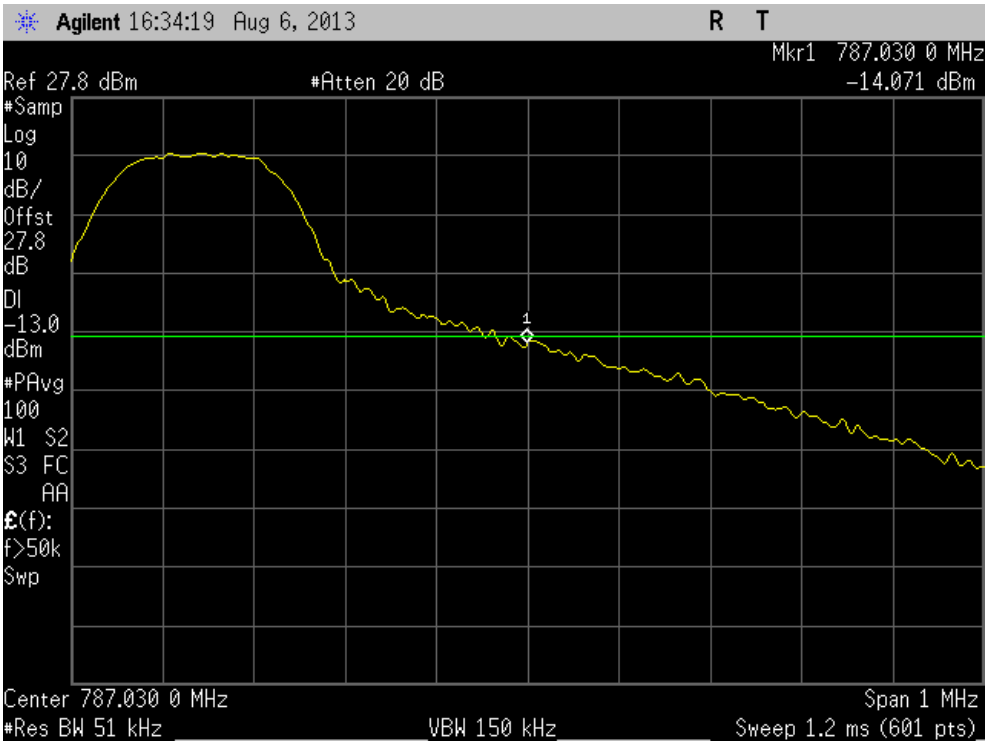
LTE Band 4 20.0MHz BW High Channel (20300) Band Edge @ 1755MHz (1RB)



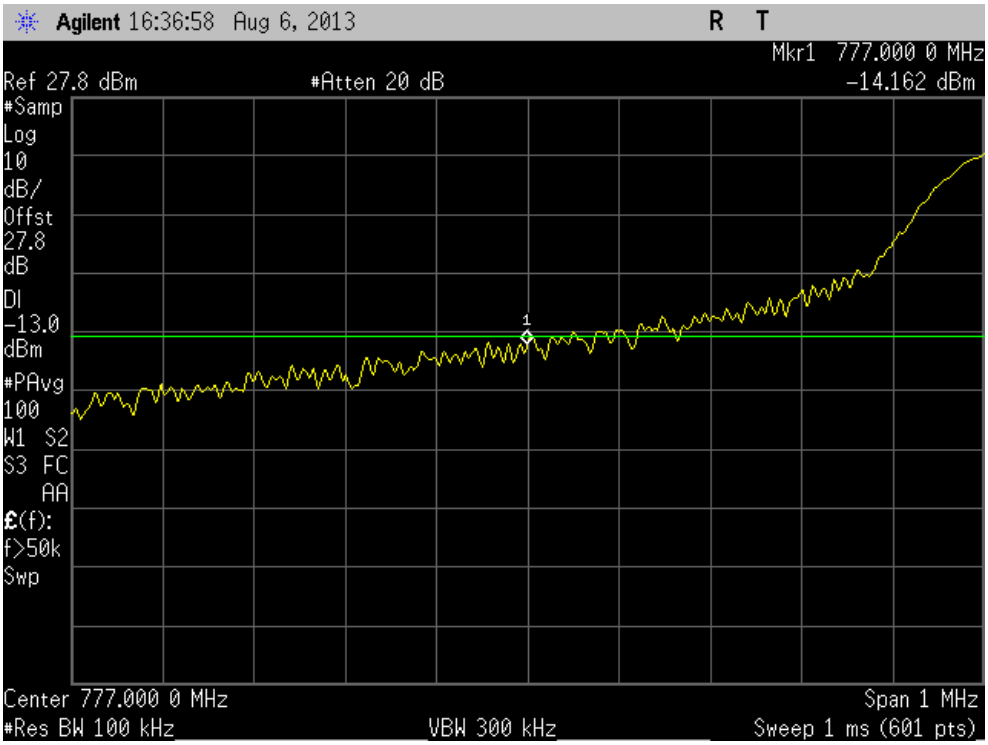
LTE Band 13 5.0MHz BW Low Channel (23205) Band Edge @ 777MHz (1RB)



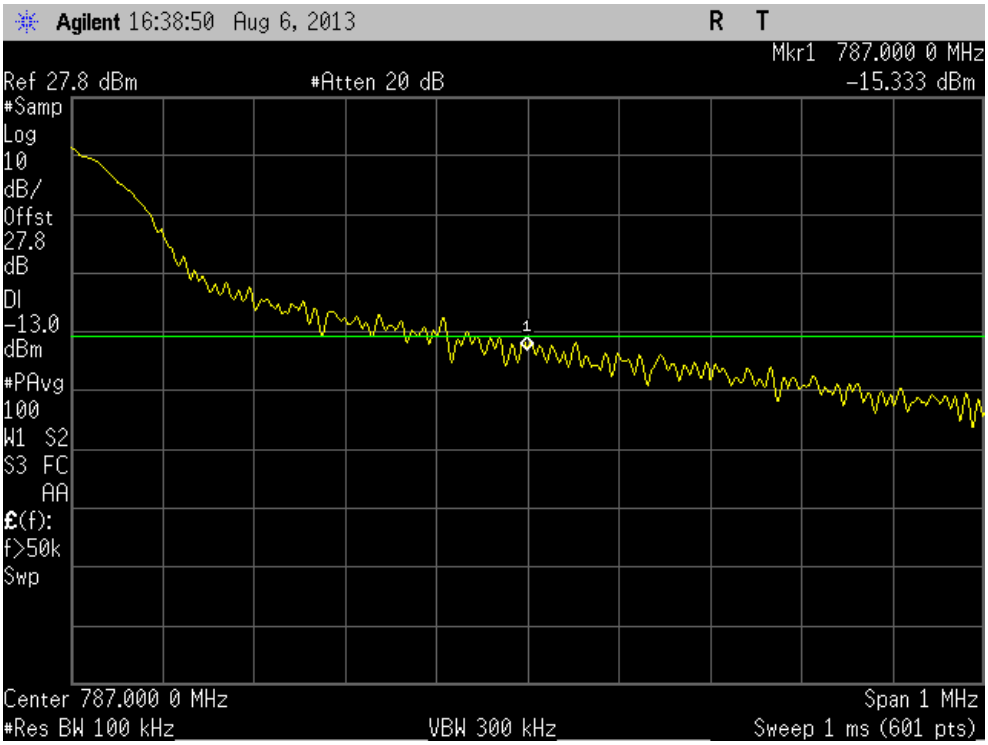
LTE Band 13 5.0MHz BW High Channel (23255) Band Edge @ 787MHz (1RB)



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



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



2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

Part 27 Subpart C §27.53 (c)(2)(5),(f),(h) and Part 2.1051, RSS-139 Issue 2(6.5)

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;
(f) For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.
(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.

2.7.3 Equipment Under Test and Modification State

Serial No: 356075050013822 / Test Configuration B

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

August 07, 2013/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

Ambient Temperature	25.4°C
Relative Humidity	51.1%
ATM Pressure	99.4 kPa

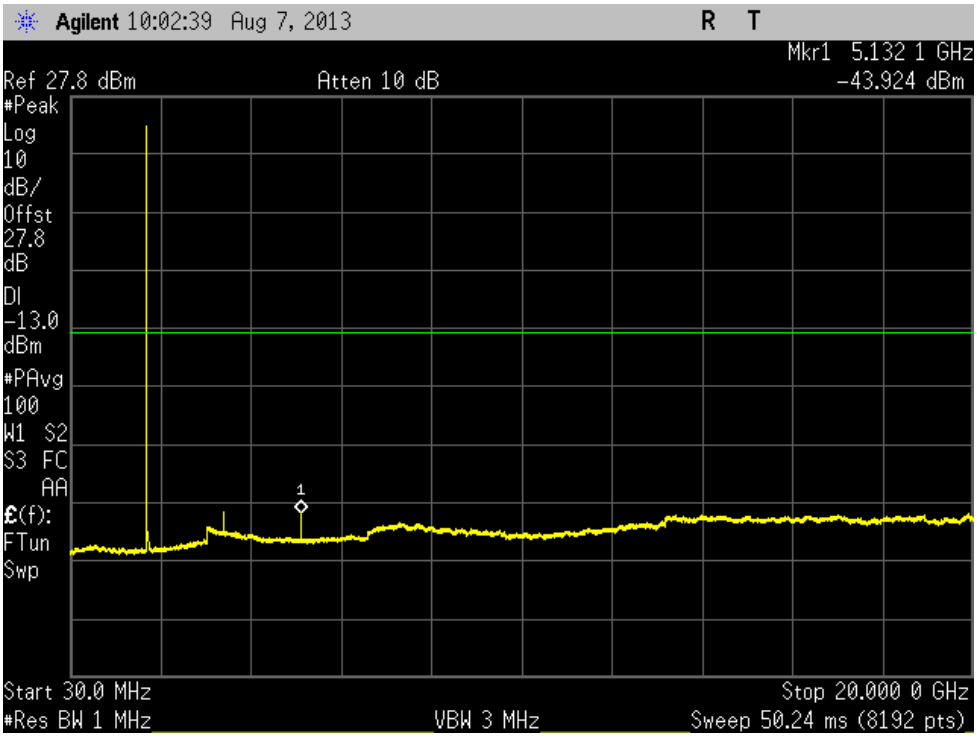
2.7.7 Additional Observations

- This is a conducted test. The 27.8dB offset is from the power splitter, external attenuator and cable used.
- The spectrum was searched from 30MHz to the 10th harmonic (20GHz) for Band 4. Band 17 was verified up to 10GHz.
- Low, Mid and High channels on all channel bandwidth verified. Only the worst RB size/offset presented (See Section 1.4.4 for worst case modulation).

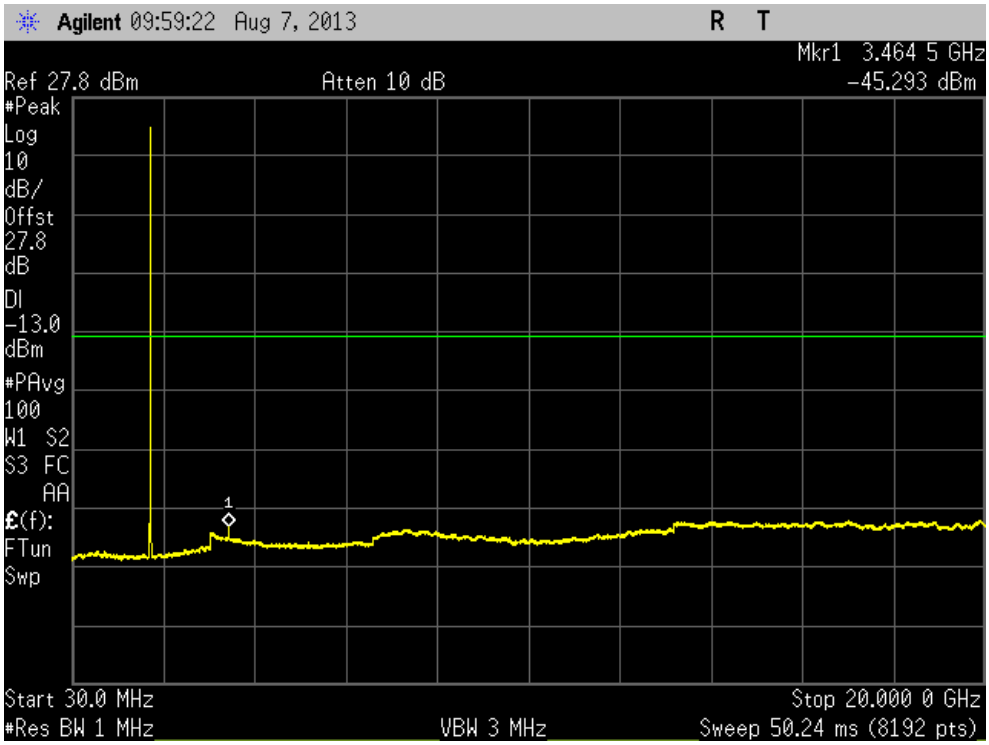
2.7.8 Test Results

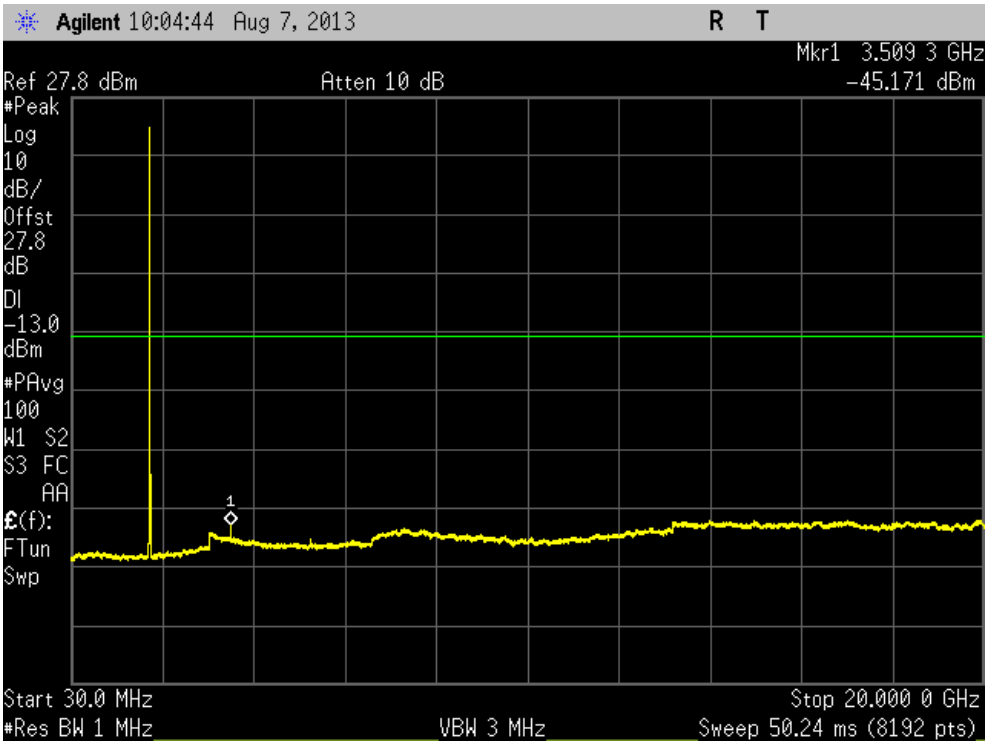
Compliant. See attached plots.

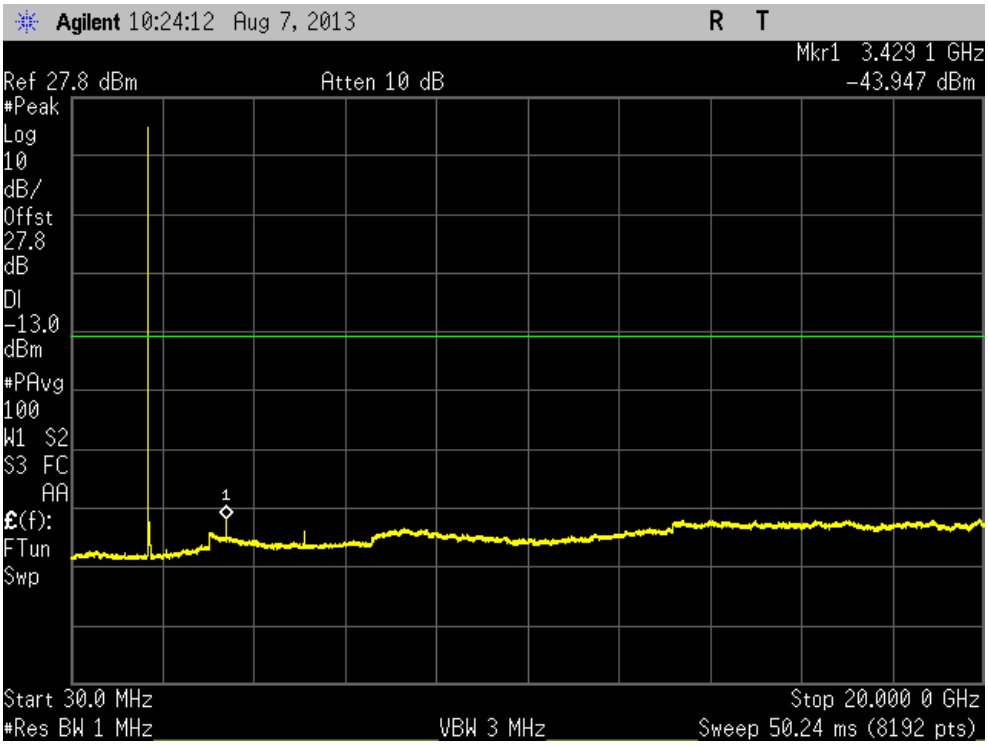
LTE Band 4 1.4MHz BW Low Channel

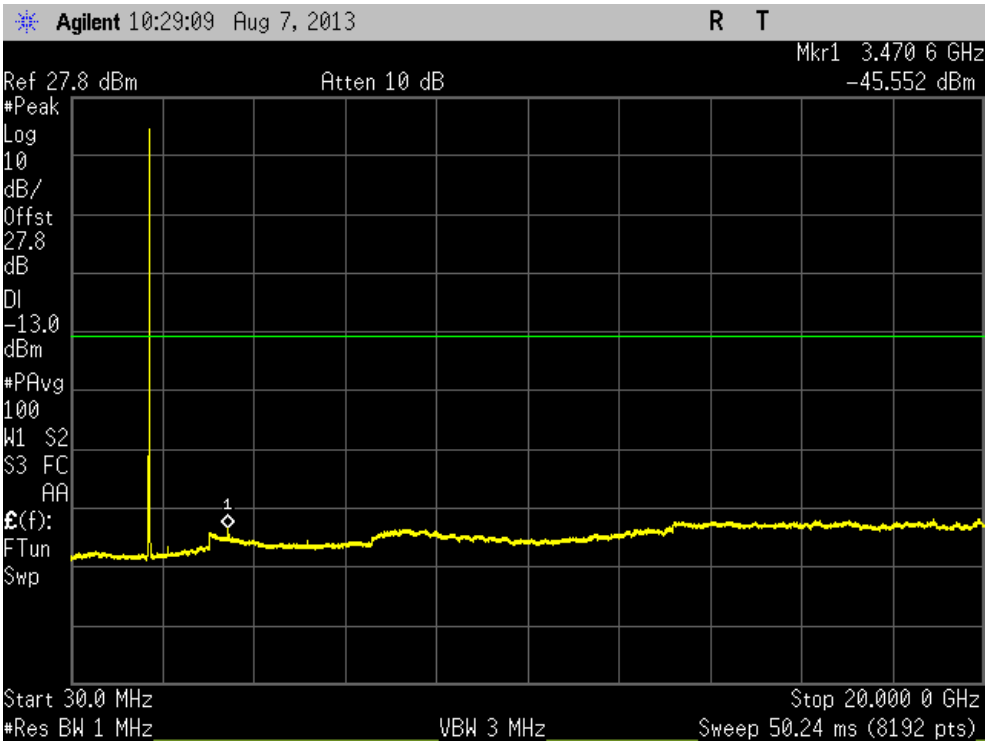


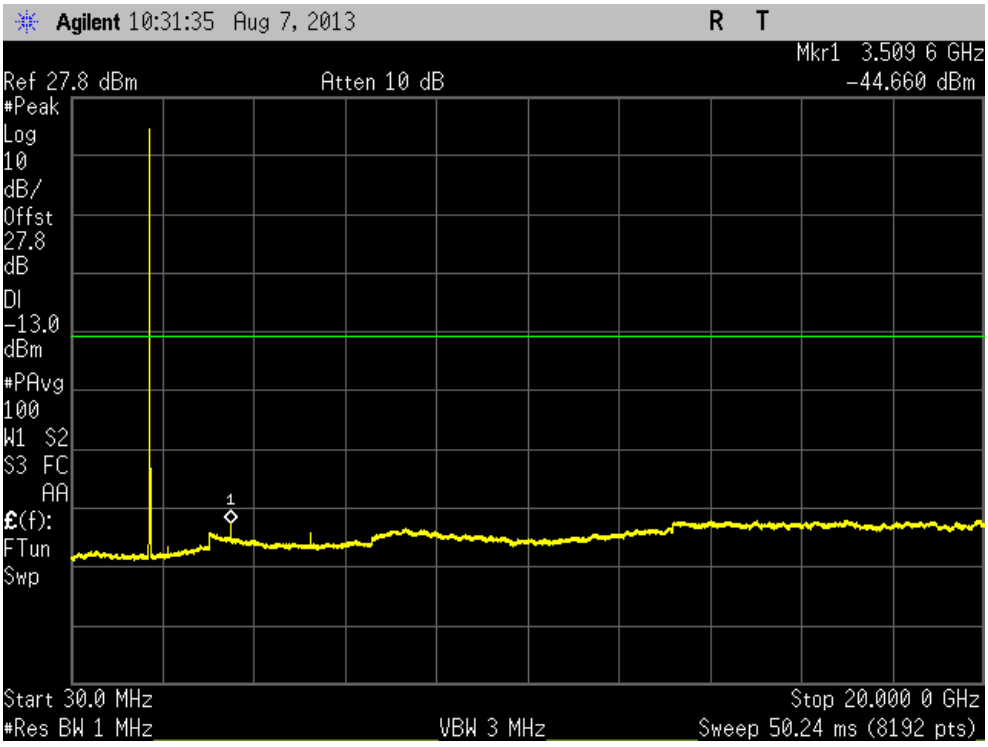
LTE Band 4 1.4MHz BW Mid Channel

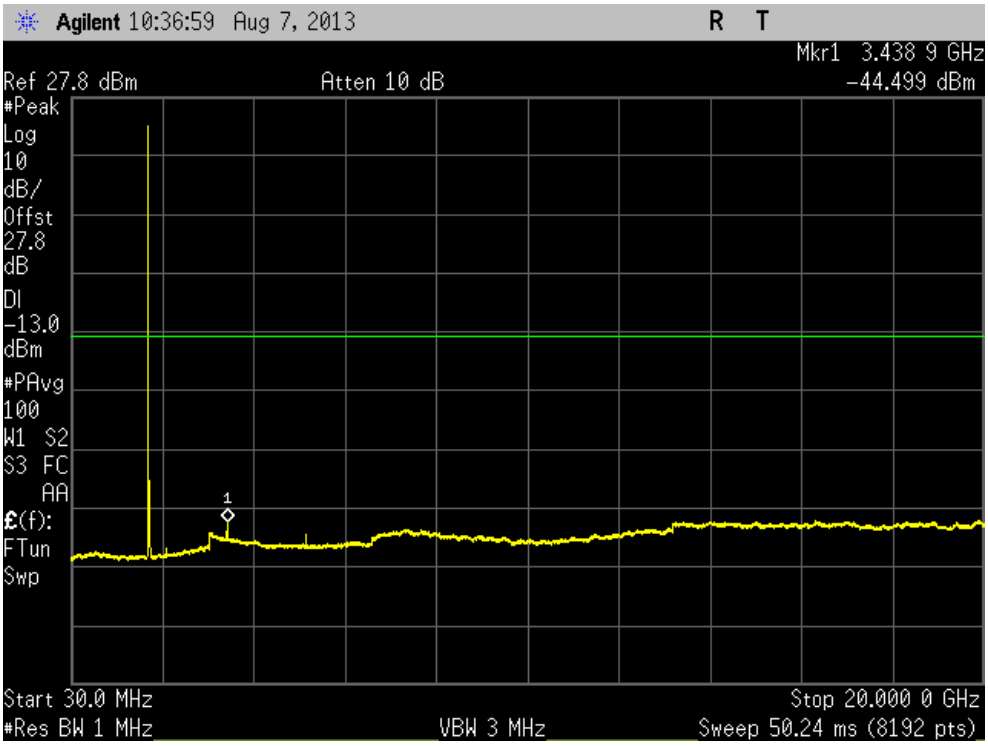


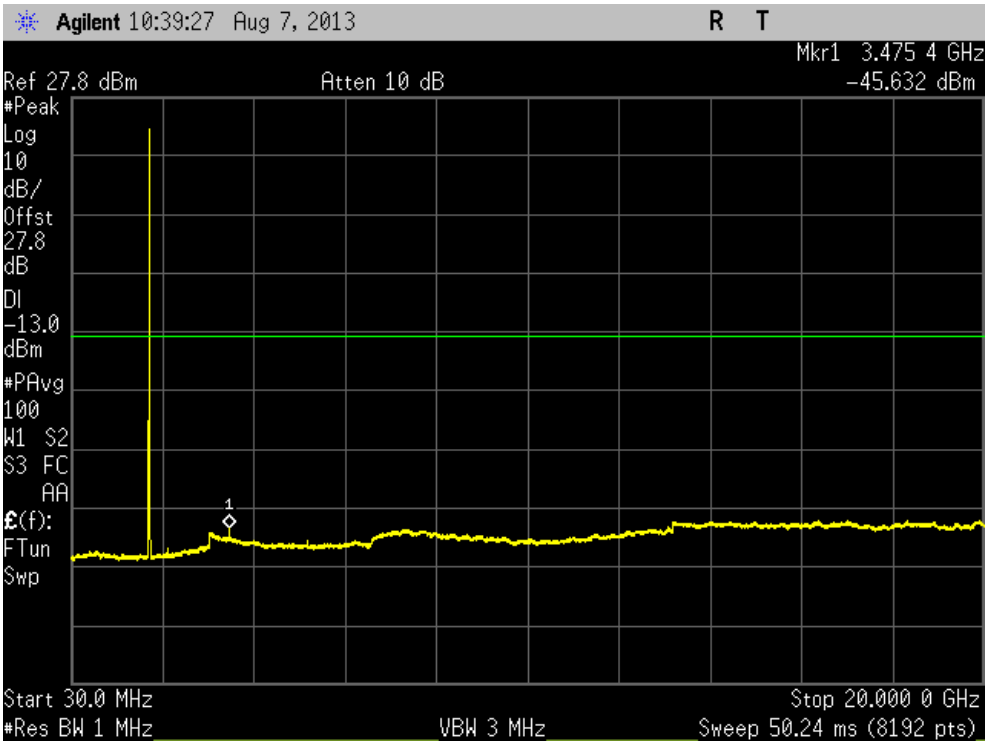
LTE Band 4 1.4MHz BW High Channel


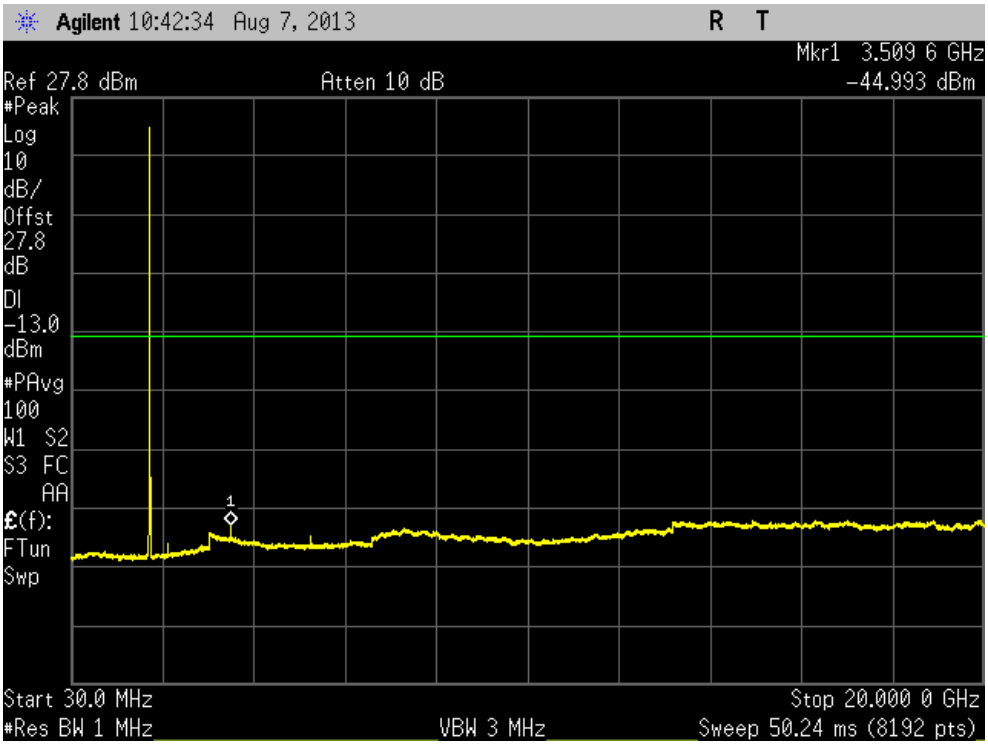
LTE Band 4 5MHz BW Low Channel


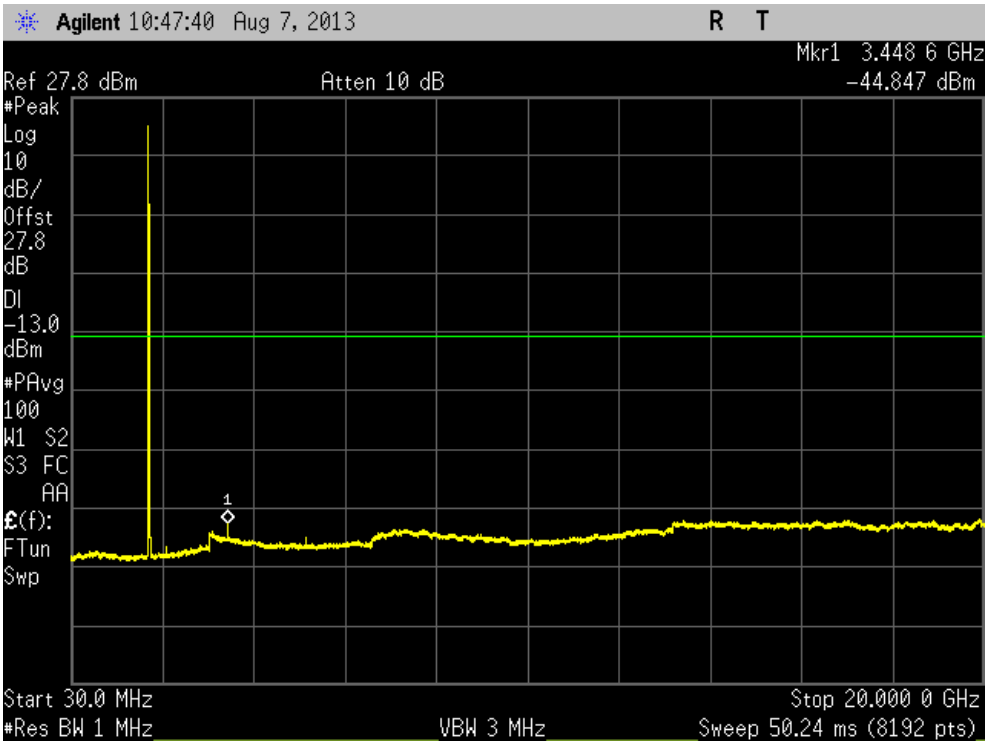
LTE Band 4 5MHz BW Mid Channel


LTE Band 4 5MHz BW High Channel


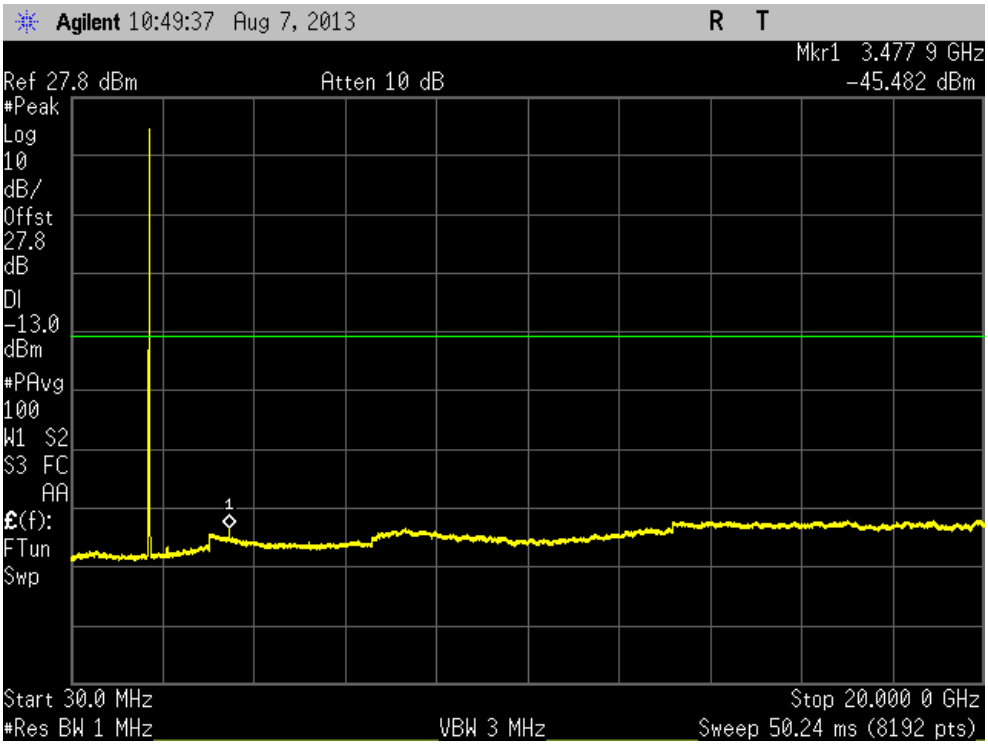
LTE Band 4 10MHz BW Low Channel


LTE Band 4 10MHz BW Mid Channel


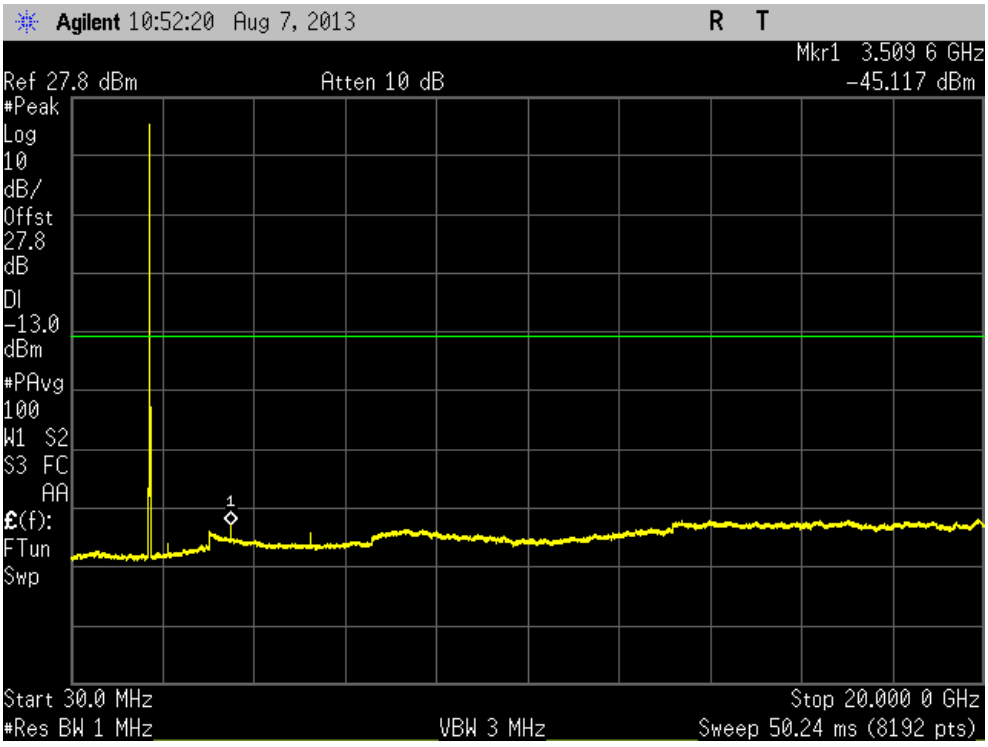
LTE Band 4 10MHz BW High Channel


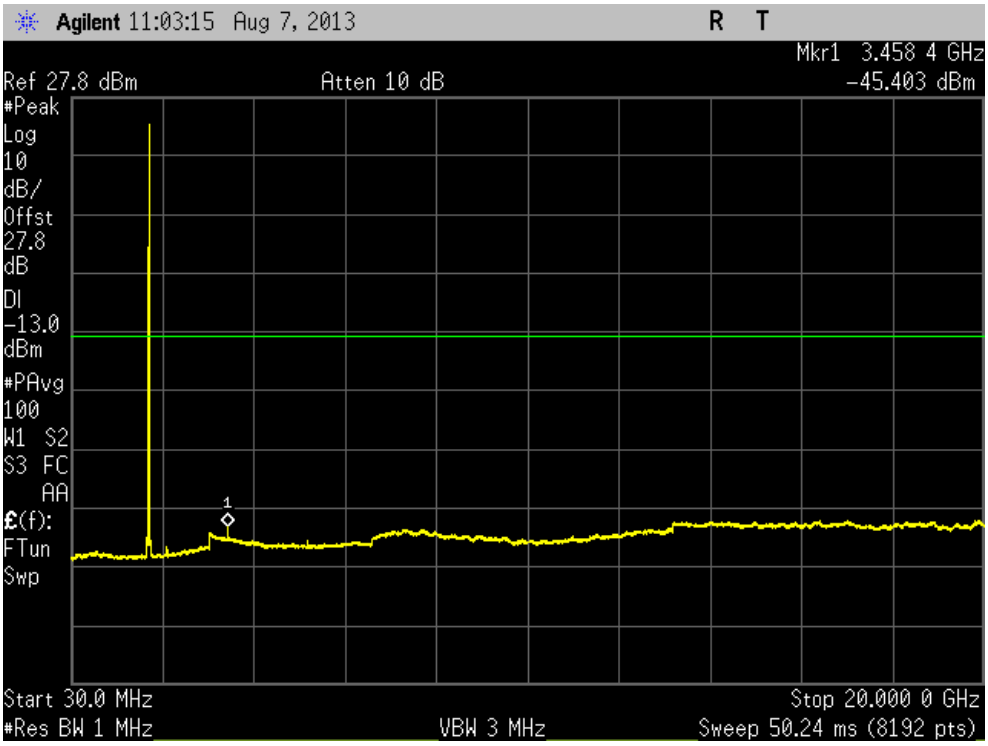
LTE Band 4 15MHz BW Low Channel


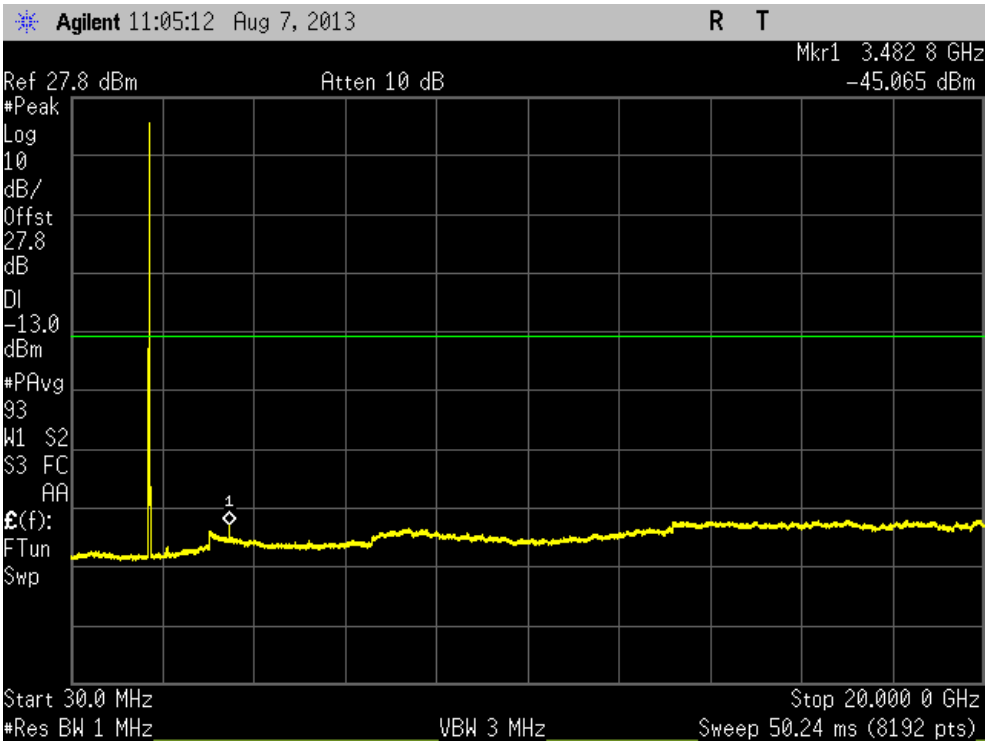
LTE Band 4 15MHz BW Mid Channel

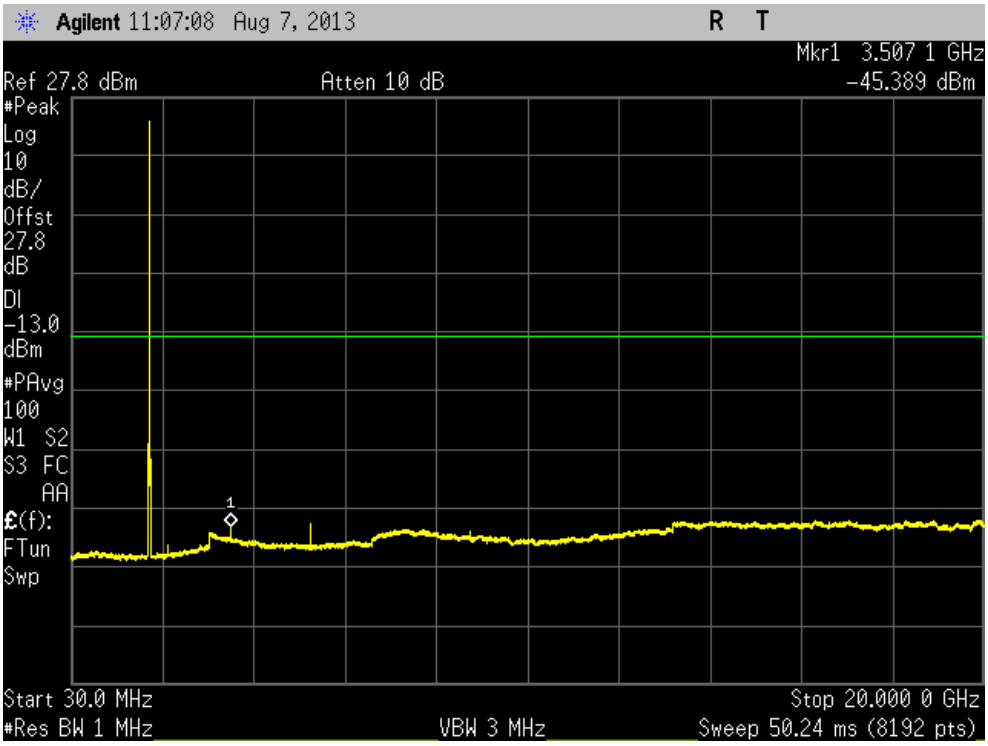


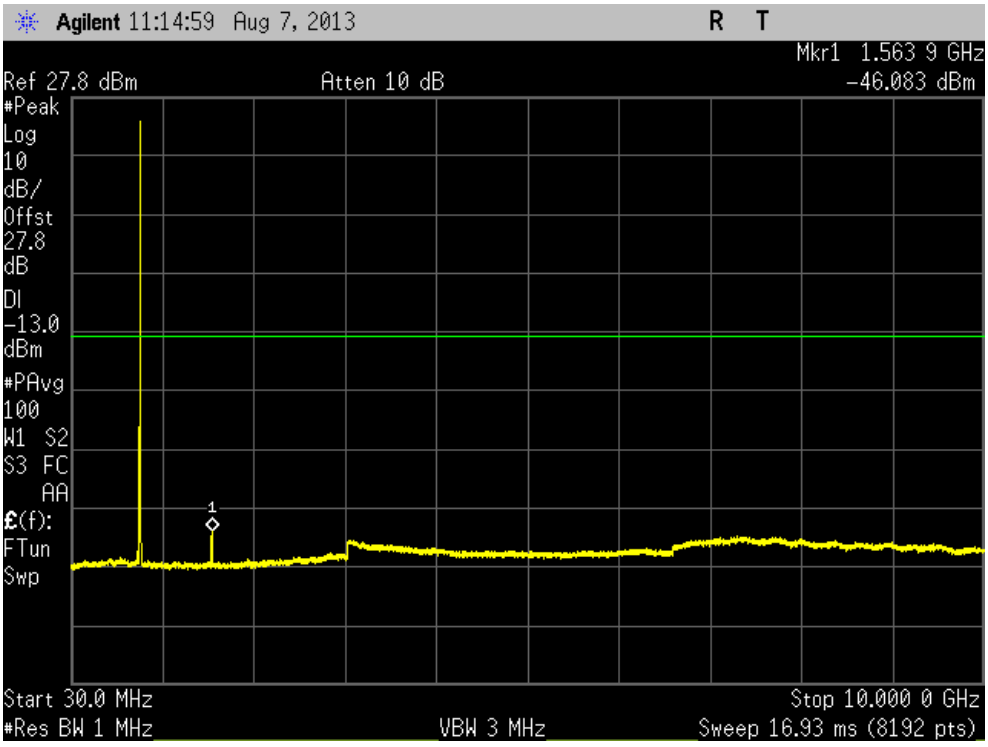
LTE Band 4 15MHz BW High Channel

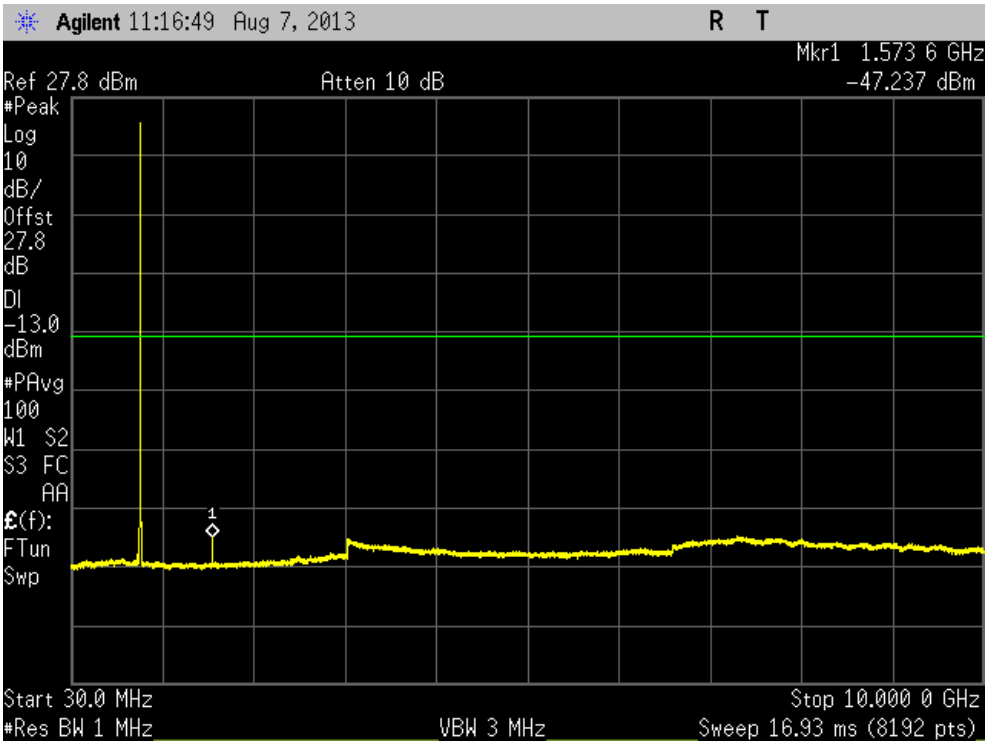


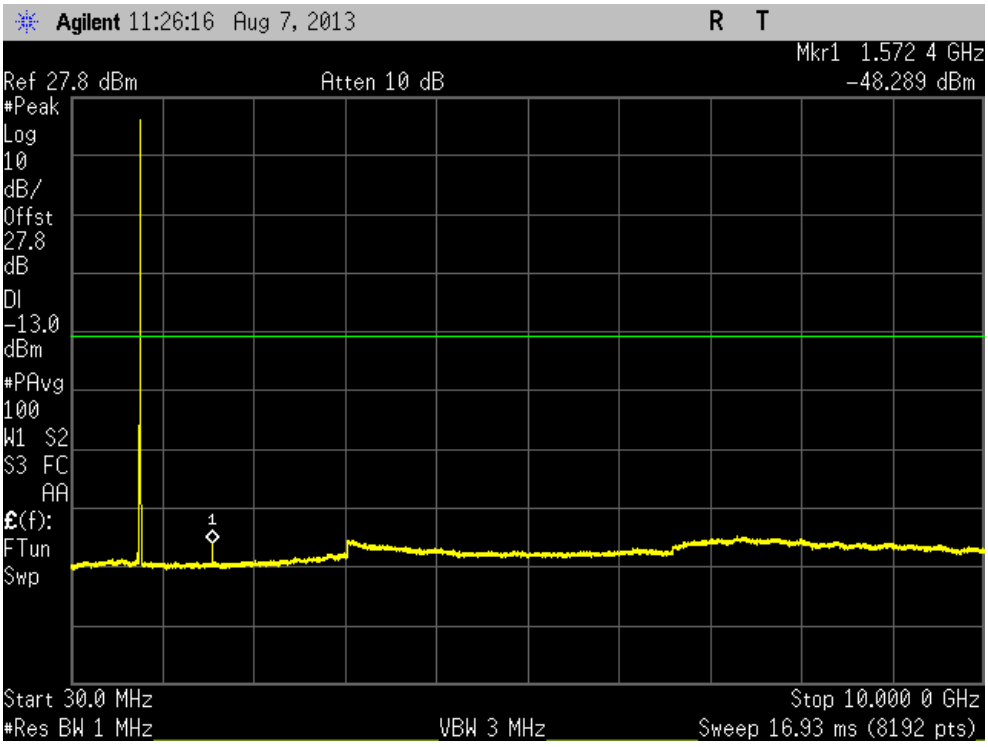
LTE Band 4 20MHz BW Low Channel


LTE Band 4 20MHz BW Mid Channel


LTE Band 4 20MHz BW High Channel


LTE Band 13 5MHz BW Low Channel


LTE Band 13 5MHz BW High Channel


LTE Band 13 10MHz BW Mid Channel


2.8 FIELD STRENGTH OF SPURIOUS RADIATION

2.8.1 Specification Reference

Part 27 Subpart C §27.53(c) and (h) and Part 2.1053, RSS-139 Issue 2(6.5)

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;

(h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.

2.8.3 Equipment Under Test and Modification State

Serial No: 356075050014218 / Test Configuration C

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

August 09 and 11, 2013/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

Ambient Temperature	24.8-25.2 °C
Relative Humidity	50.2-50.4 %
ATM Pressure	99.0-99.4 kPa

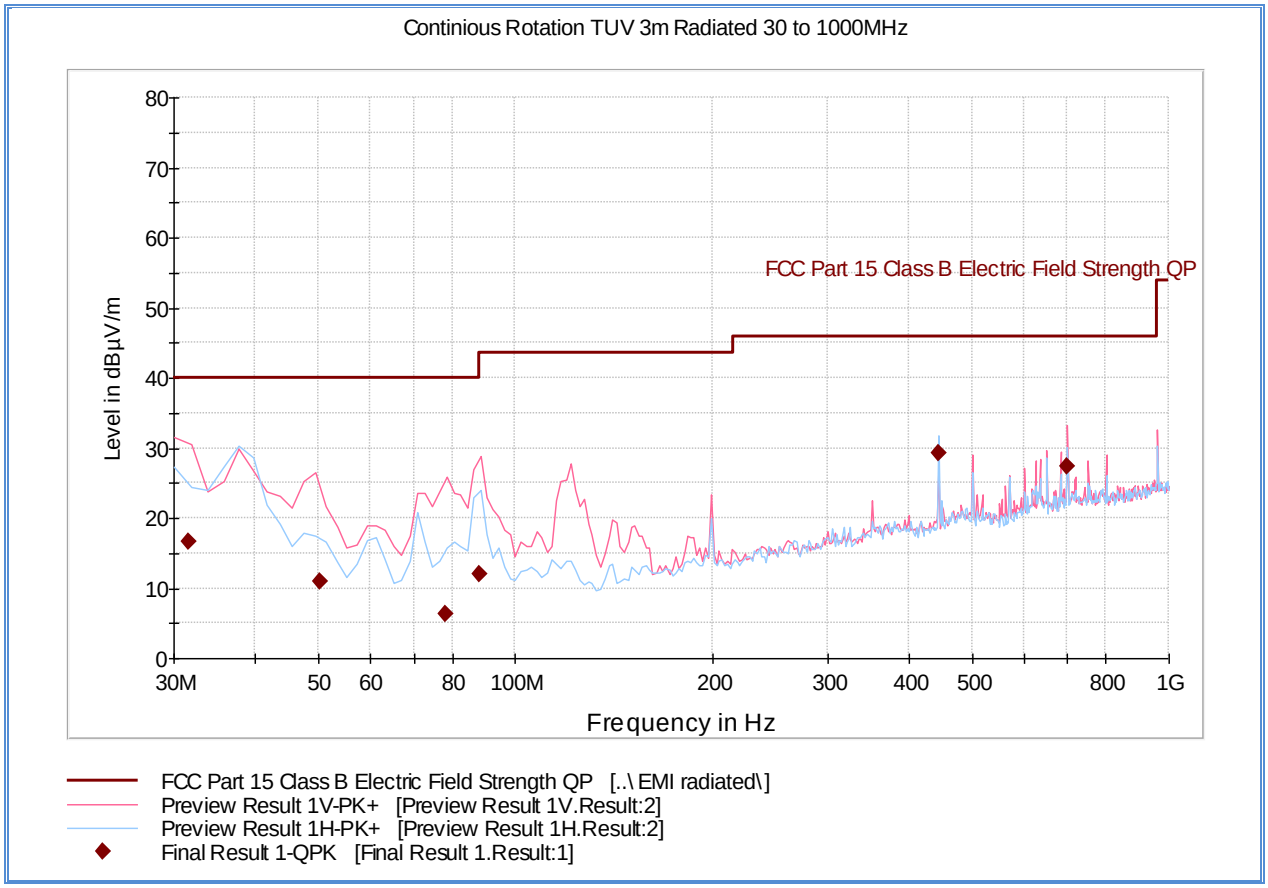
2.8.7 Additional Observations

- 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.
- 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 4)

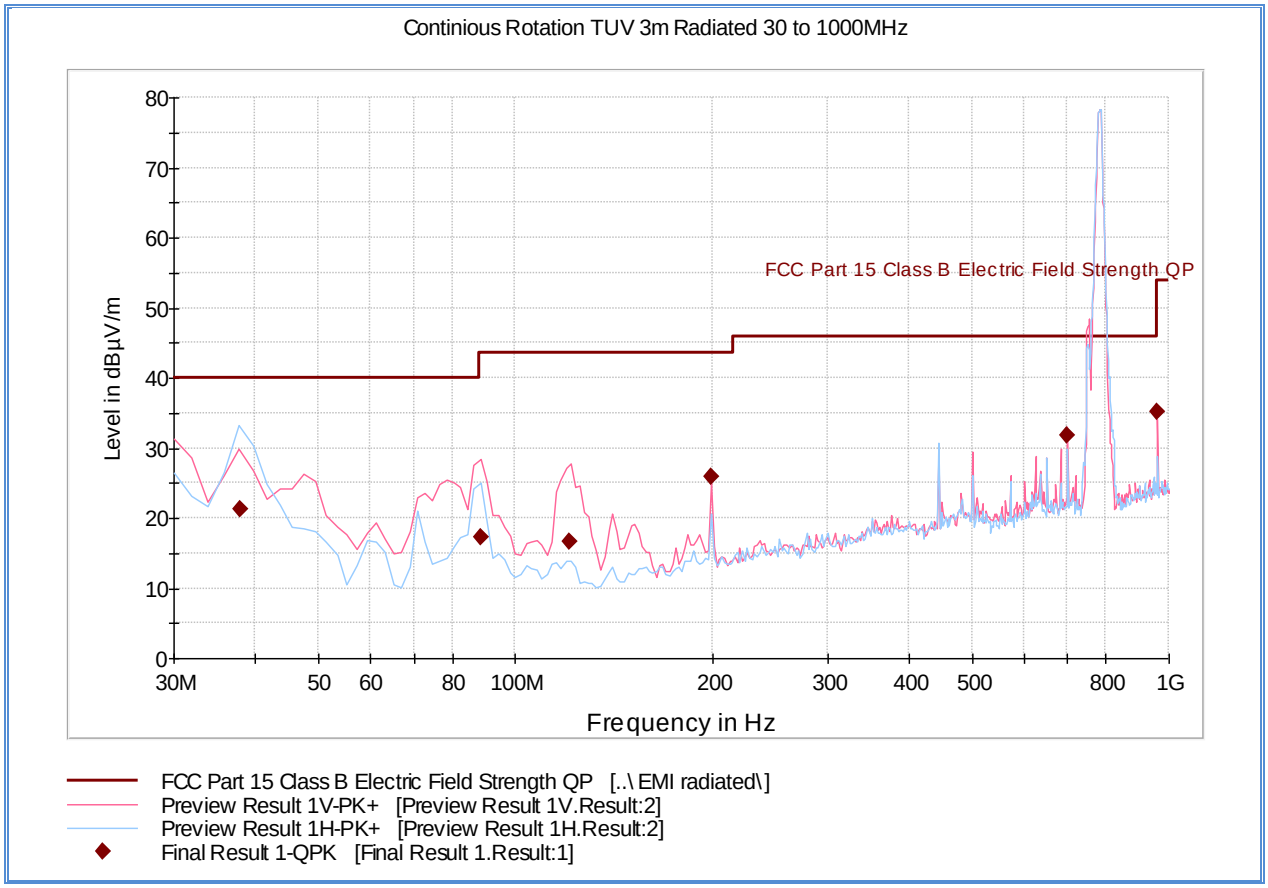


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.600000	16.7	1000.0	120.000	129.0	V	3.0	-11.7	23.3	40.0
50.158878	11.0	1000.0	120.000	115.0	V	300.0	-19.2	29.0	40.0
78.157194	6.4	1000.0	120.000	105.0	V	200.0	-21.3	33.6	40.0
87.892745	12.1	1000.0	120.000	300.0	V	-4.0	-20.4	27.9	40.0
444.048096	29.2	1000.0	120.000	100.0	H	227.0	-7.6	16.8	46.0
697.737395	27.4	1000.0	120.000	116.0	V	55.0	-2.2	18.6	46.0

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. Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 82.23 dBµV/m.

2.8.10 Test Results Below 1GHz-(Band 13)

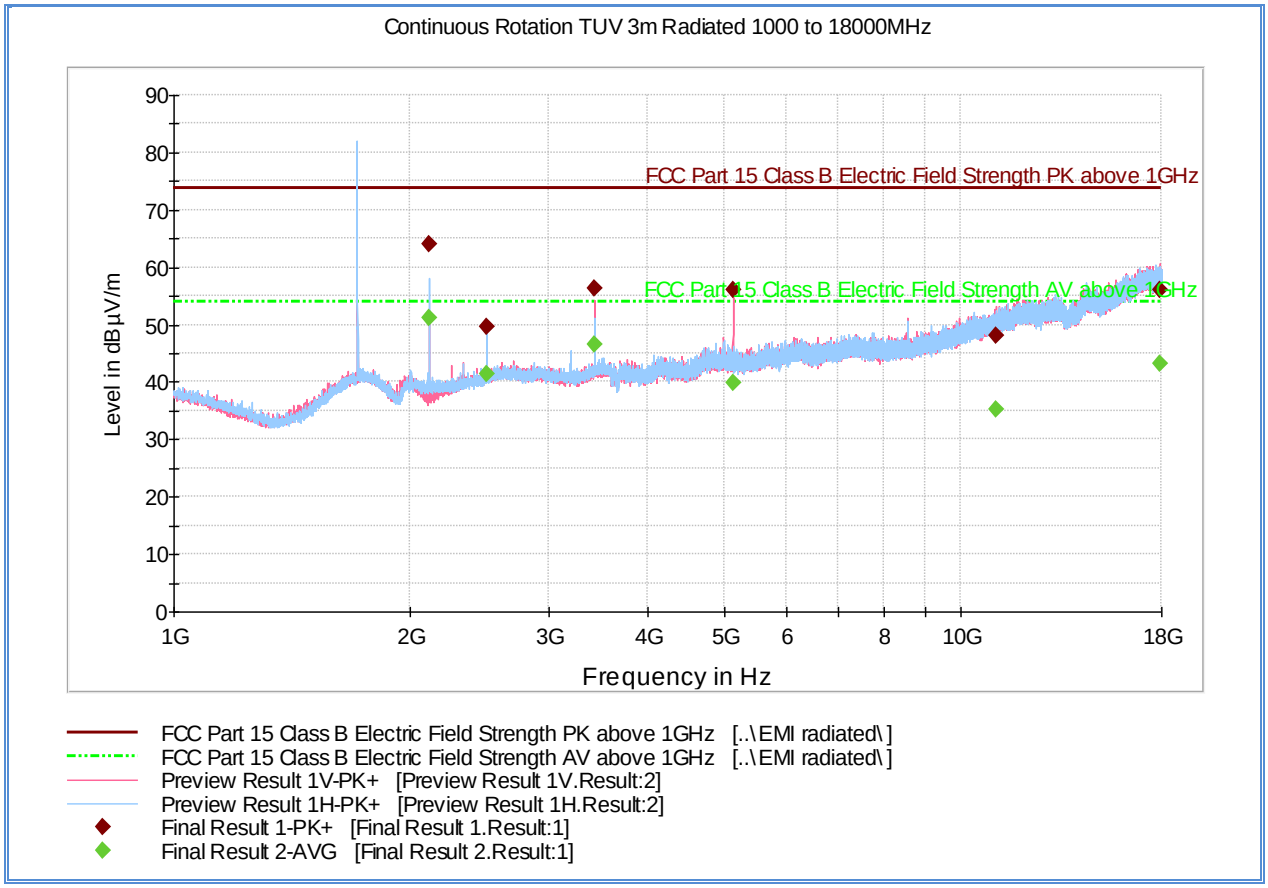


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
37.975551	21.3	1000.0	120.000	400.0	H	-7.0	-15.2	18.7	40.0
88.532745	17.3	1000.0	120.000	300.0	V	10.0	-20.3	26.2	43.5
120.682725	16.6	1000.0	120.000	150.0	V	343.0	-19.4	26.9	43.5
199.318236	25.9	1000.0	120.000	150.0	V	-14.0	-15.4	17.6	43.5
697.777395	31.8	1000.0	120.000	100.0	V	48.0	-2.2	14.2	46.0
960.082244	35.1	1000.0	120.000	100.0	V	89.0	0.9	18.8	53.9

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. Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 84.38 dBµV/m.

2.8.11 Test Results Above 1GHz (Low Channel - Worst Case Configuration Band 4)



Peak Data

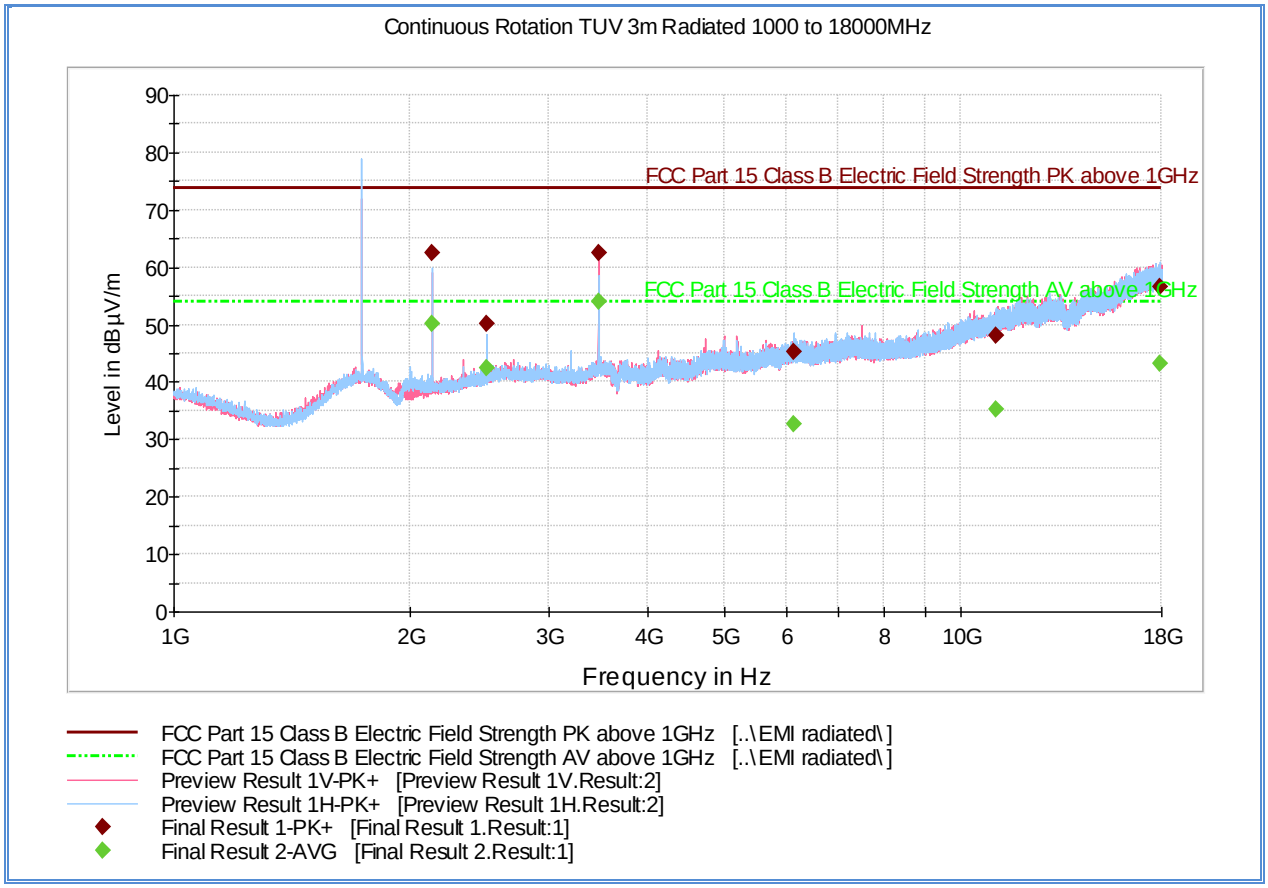
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2110.466667	63.9	1000.0	1000.000	228.3	H	102.0	-1.4	10.0	73.9
2500.166667	49.7	1000.0	1000.000	99.6	V	3.0	-0.1	24.2	73.9
3422.133333	56.3	1000.0	1000.000	142.5	V	187.0	1.9	17.6	73.9
5132.333333	56.0	1000.0	1000.000	124.6	V	70.0	6.2	17.9	73.9
11092.200000	48.1	1000.0	1000.000	101.6	V	209.0	14.6	25.8	73.9
17920.066667	56.0	1000.0	1000.000	246.3	V	355.0	22.4	17.9	73.9

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). 2110.0 MHz is the downlink frequency from the CMW500. A 2.0GHz high pass filter was used. Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 82.23 dBµV/m.

2.8.12 Test Results Above 1GHz (Mid Channel - Worst Case Configuration Band 4)



Peak Data

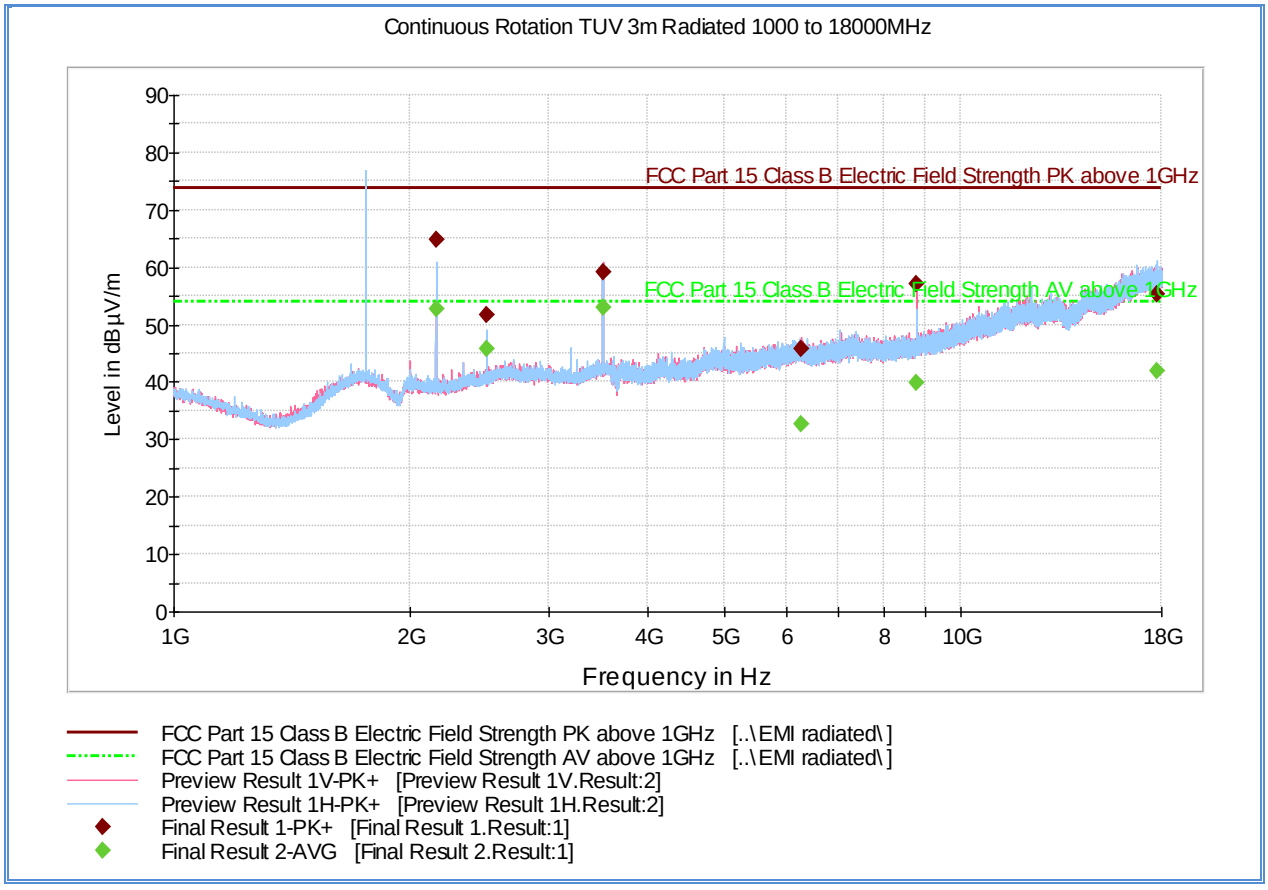
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2132.166667	62.5	1000.0	1000.000	218.4	H	108.0	-1.4	11.4	73.9
2499.766667	50.1	1000.0	1000.000	123.6	H	224.0	-0.1	23.8	73.9
3464.800000	62.5	1000.0	1000.000	200.4	V	102.0	2.0	11.4	73.9
6141.200000	45.4	1000.0	1000.000	354.1	H	134.0	8.2	28.5	73.9
11107.666667	48.2	1000.0	1000.000	300.6	H	-16.0	14.6	25.7	73.9
17896.333333	56.6	1000.0	1000.000	400.3	H	16.0	22.4	17.3	73.9

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)
3464.800000	62.5	-4.2	9.815	-36	-30.385	-13	17.385

Test Notes: Only worst case bandwidth/modulation presented for spurious emissions above 1GHz. 2132.50 MHz is the downlink frequency from the CMW500. A 2.0GHz high pass filter was used. Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 82.23 dBµV/m.

2.8.13 Test Results Above 1GHz (High Channel - Worst Case Configuration Band 4)



Peak Data

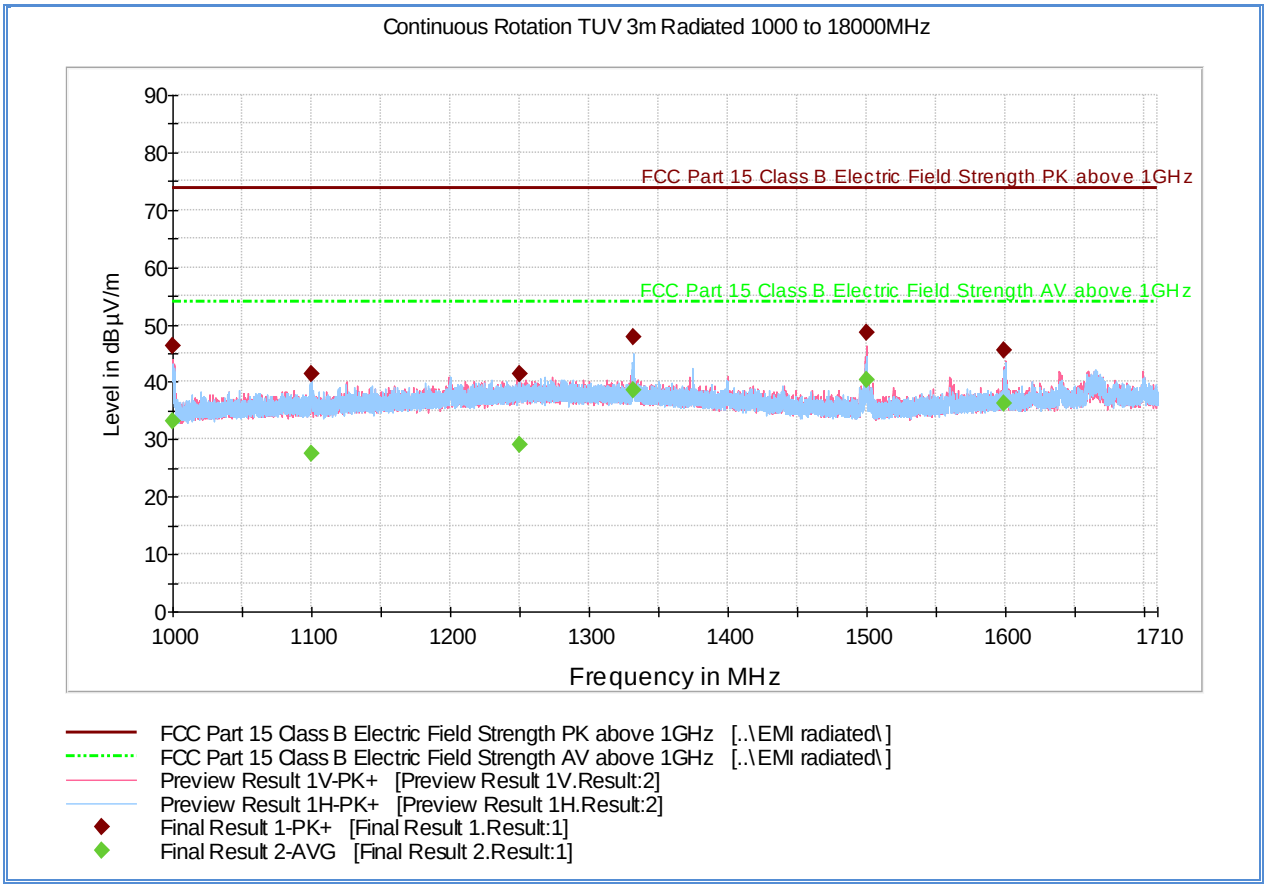
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2154.100000	64.7	1000.0	1000.000	209.4	H	102.0	-1.3	9.2	73.9
2500.166667	51.7	1000.0	1000.000	99.6	H	294.0	-0.1	22.2	73.9
3508.433333	59.1	1000.0	1000.000	131.6	V	193.0	2.2	14.9	73.9
6261.866667	45.8	1000.0	1000.000	150.5	V	240.0	8.5	28.1	73.9
8771.466667	57.0	1000.0	1000.000	198.4	V	144.0	10.0	16.9	73.9
17755.733333	55.2	1000.0	1000.000	343.1	H	256.0	22.2	18.7	73.9

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). 2154.30 MHz is the downlink frequency from the CMW500. A 2.0GHz high pass filter was used. Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 82.23 dBµV/m.

2.8.14 Test Results Between 1GHz and 1.71GHz-(Worst Case Channel/Configuration Band 4)



Peak Data

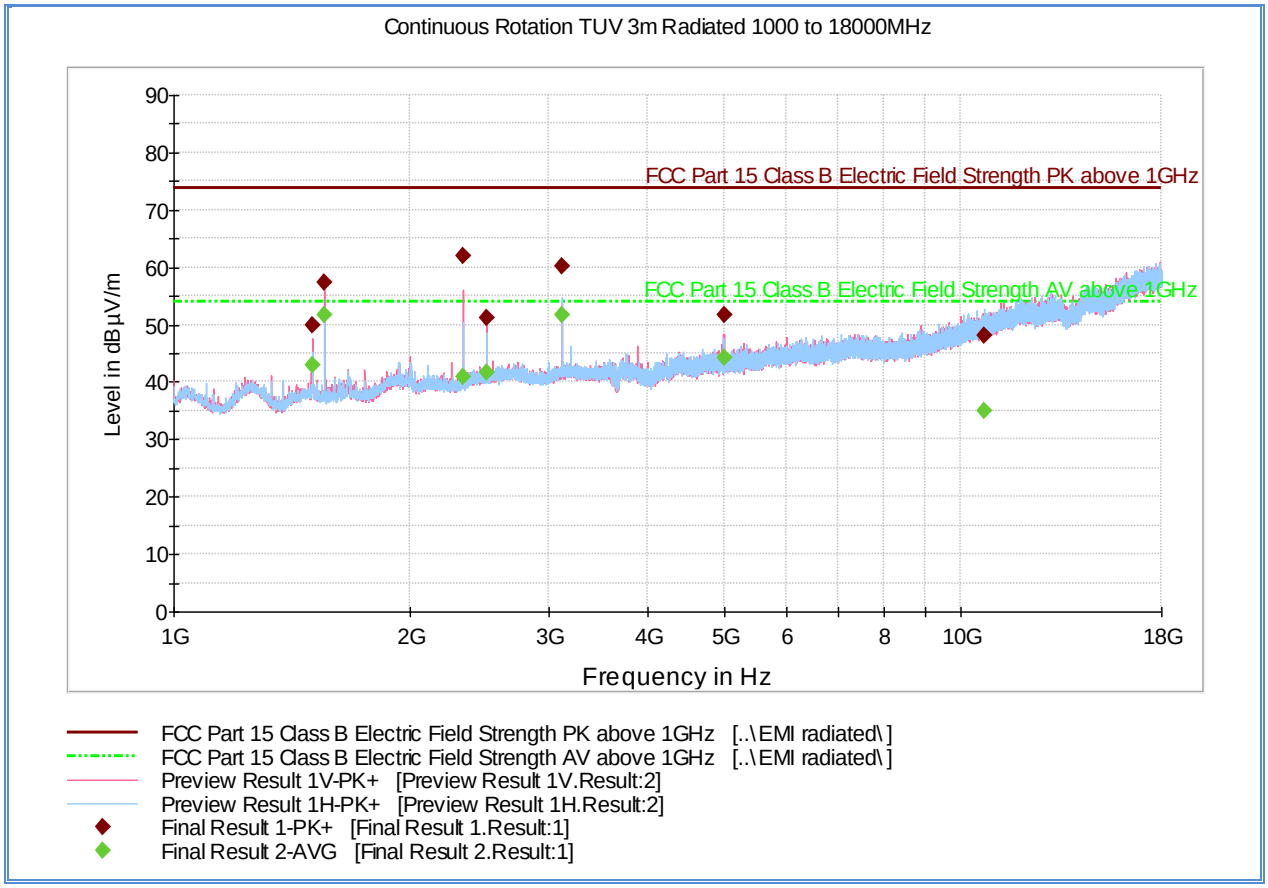
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	46.4	1000.0	1000.000	207.4	V	324.0	-6.3	27.5	73.9
1100.439000	41.3	1000.0	1000.000	315.1	H	261.0	-5.7	32.6	73.9
1250.414667	41.4	1000.0	1000.000	301.6	V	220.0	-4.7	32.5	73.9
1332.054000	47.7	1000.0	1000.000	201.4	H	231.0	-4.9	26.2	73.9
1499.876667	48.6	1000.0	1000.000	187.4	V	309.0	-5.1	25.3	73.9
1599.773667	45.5	1000.0	1000.000	99.6	V	235.0	-4.3	28.4	73.9

Average Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	33.1	1000.0	1000.000	207.4	V	324.0	-6.3	20.8	53.9
1100.439000	27.6	1000.0	1000.000	315.1	H	261.0	-5.7	26.3	53.9
1250.414667	29.0	1000.0	1000.000	301.6	V	220.0	-4.7	24.9	53.9
1332.054000	38.5	1000.0	1000.000	201.4	H	231.0	-4.9	15.4	53.9
1499.876667	40.2	1000.0	1000.000	187.4	V	309.0	-5.1	13.7	53.9
1599.773667	36.3	1000.0	1000.000	99.6	V	235.0	-4.3	17.6	53.9

Test Notes: This verification performed without the 2.0GHz High Pass filter. Only the worst channel presented. This is to show general compliance of the EUT from 1000MHz to 1710MHz (Band Edge). Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 82.23 dBµV/m.

2.8.15 Test Results Above 1GHz (Worst Case Configuration Band 13)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1500.140000	50.2	1000.0	1000.000	101.8	V	45.0	-5.1	34.2	84.4
2499.986667	51.4	1000.0	1000.000	101.8	V	354.0	-0.1	33.0	84.4
2999.986667	47.3	1000.0	1000.000	100.9	H	132.0	1.5	37.1	84.4
6108.146667	45.8	1000.0	1000.000	264.3	H	162.0	8.1	38.6	84.4
11089.393333	48.2	1000.0	1000.000	350.6	H	264.0	14.6	36.2	84.4
17301.766667	55.6	1000.0	1000.000	339.2	V	281.0	21.9	28.8	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 modulation presented for spurious emissions above 1GHz. There is only one channel under 10MHz BW for band 13. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters). A 900MHz high pass filter was used. Verification performed with the more stringent §15.205 requirement. Part 27 Subpart C §27.53 limit @ 3 meters is 84.38 dBµV/m.

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-139(6.3)

2.9.2 Standard Applicable

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

2.9.3 Equipment Under Test and Modification State

Serial No: 356075050014218 / Test Configuration A

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

August 08, 2013/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

Ambient Temperature	25.5°C
Relative Humidity	46.7%
ATM Pressure	99.1 kPa

2.9.7 Additional Observations

- This is a conducted test. The EUT was operated at 3.8VDC 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. These results are then verified against Transmit Frequency Error function of the Spectrum Analyzer used.
- 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 on both Band 4 and Band 13 were then performed. The temperature was them 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 4 worst case frequency error:	*15.34 Hz*
Worst case EBW (-26dB) of LTE Band 4 1.4MHz BW:	*1.126 MHz*

Low Channel Sample Calculation:

Edge of fundamental emission (1710.7-(1.126/2)) : 1710.137 MHz
Max. fundamental frequency error (1710.137 + 0.00001534): 1710.137015 MHz
EUT complies. 1710.137015 MHz > 1710 MHZ (edge of authorized band)

High Channel Sample Calculation:

Edge of fundamental emission (1754.3+ (1.126/2)) : 1754.863 MHz
Max. fundamental frequency error (1754.863 + 0.00001534): 1754.863015 MHz
EUT complies. 1754.863015 MHz < 1755 MHZ (edge of authorized band)

2.9.8 Test Results Summary

LTE Band 4 – 16QAM 1.4MHz - Channel 20175– Frequency 1732.5MHz – RB 5/1				
Voltage (%)	***Power (VDC)***	***Temp (°C)***	***Frequency Deviation (Hz)***	***Complies (Y or N)***
100	3.8	-30	7.51	EUT complies. See Section 2.9.7 for sample calculation
100		**-20**	**15.34**	
100		-10	14.71	
100		0	-7.85	
100		+10	5.04	
100		+20	-4.63	
100		+30	6.90	
100		+40	5.22	
100		+50	8.65	
115	4.37	+20	-15.15	
85	3.23	+20	7.20	

LTE Band 13 – 16QAM 10MHz - Channel 23230– Frequency 782.0MHz – RB 1/0				
Voltage (%)	***Power (VDC)***	***Temp (°C)***	***Frequency Deviation (Hz)***	***Complies (Y or N)***
100	3.8	-30	-1.85	EUT complies. See Section 2.9.7 for sample calculation
100		-20	13.68	
100		-10	7.41	
100		0	11.23	
100		+10	7.20	
100		+20	-5.06	
100		+30	-1.77	
100		+40	-13.66	
100		**+50**	**-14.06**	
115	4.37	+20	-7.17	
85	3.23	+20	-4.12	

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

2.10 RECEIVER SPURIOUS EMISSIONS

2.10.1 Specification Reference

RSS-139(6.6) and RSS-GEN Issue 3

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: 356075050014218 / Test Configuration C

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

August 11, 2013/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

Ambient Temperature	25.3°C
Relative Humidity	52.3%
ATM Pressure	99.0 kPa

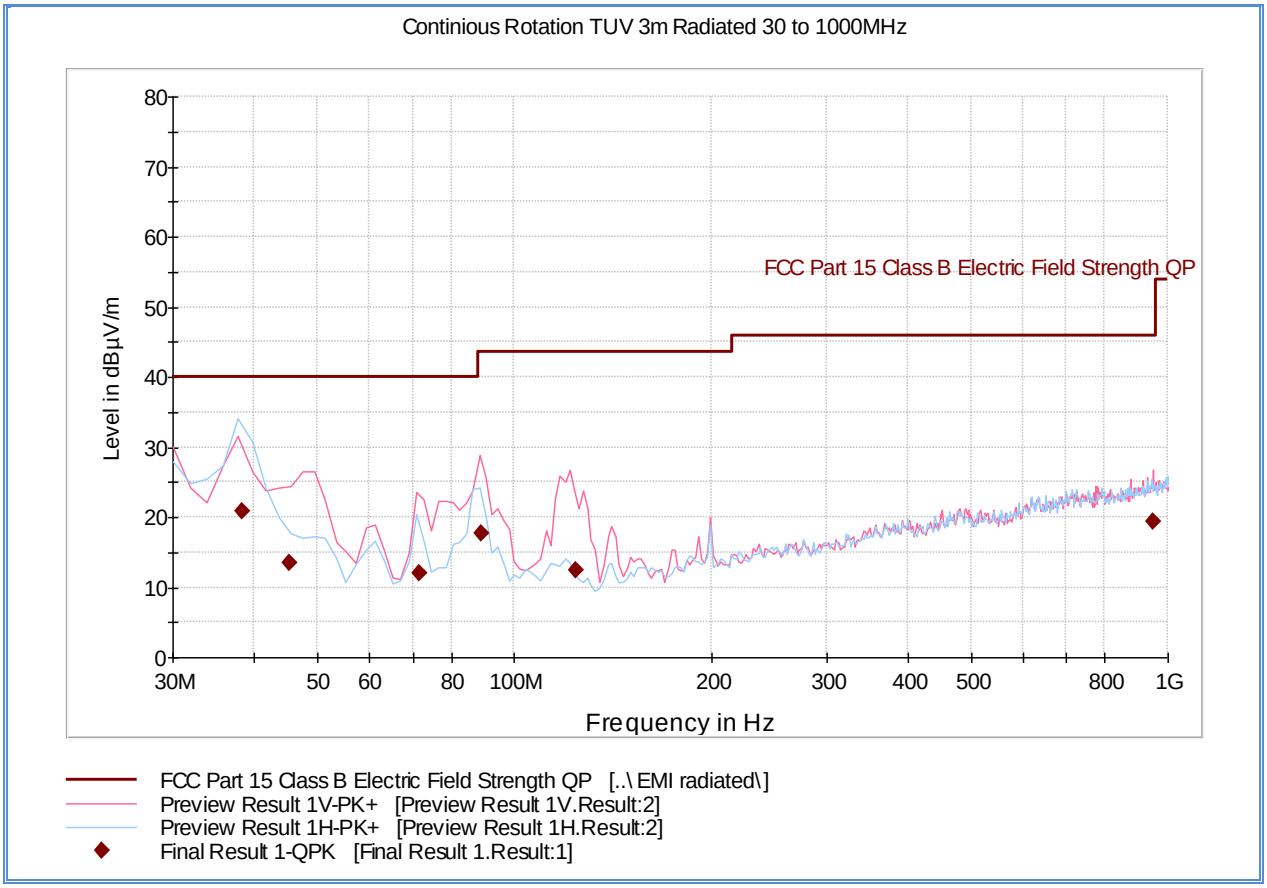
2.10.7 Additional Observations

- 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.

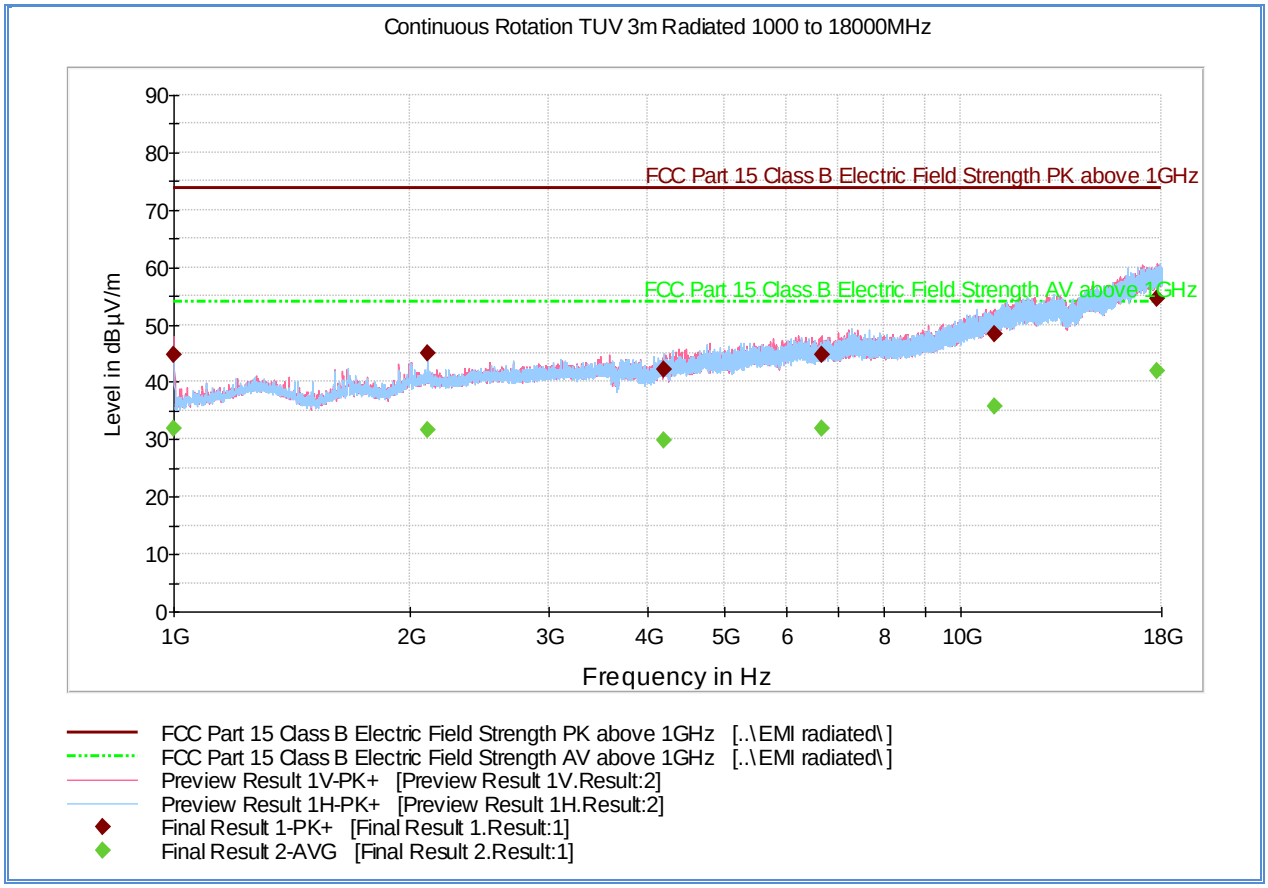
2.10.9 Test Results Below 1GHz (Receive Mode)



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)
38.255551	20.8	1000.0	120.000	350.0	H	342.0	-15.3	19.2	40.0
45.174990	13.4	1000.0	120.000	100.0	V	281.0	-18.0	26.6	40.0
71.541643	12.0	1000.0	120.000	100.0	V	222.0	-21.7	28.0	40.0
88.916633	17.7	1000.0	120.000	300.0	V	-12.0	-20.2	25.8	43.5
124.114389	12.3	1000.0	120.000	111.0	V	13.0	-19.6	31.2	43.5
949.378918	19.4	1000.0	120.000	265.0	V	324.0	0.7	26.6	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)
1000.000000	44.6	1000.0	1000.000	197.4	V	225.0	-6.3	29.3	73.9
2099.733333	45.0	1000.0	1000.000	238.3	H	297.0	-1.4	28.9	73.9
4193.166667	42.3	1000.0	1000.000	400.3	H	278.0	3.8	31.6	73.9
6660.433333	44.8	1000.0	1000.000	101.6	V	257.0	8.3	29.1	73.9
11035.46666	48.4	1000.0	1000.000	400.3	V	61.0	14.6	25.5	73.9
17774.46666	54.6	1000.0	1000.000	350.1	V	262.0	22.2	19.3	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)
1000.000000	31.8	1000.0	1000.000	197.4	V	225.0	-6.3	22.1	53.9
2099.733333	31.5	1000.0	1000.000	238.3	H	297.0	-1.4	22.4	53.9
4193.166667	29.8	1000.0	1000.000	400.3	H	278.0	3.8	24.1	53.9
6660.433333	31.9	1000.0	1000.000	101.6	V	257.0	8.3	22.0	53.9
11035.46666	35.7	1000.0	1000.000	400.3	V	61.0	14.6	18.2	53.9
17774.46666	42.0	1000.0	1000.000	350.1	V	262.0	22.2	11.9	53.9

Test Notes: No significant emissions observed.

2.11 POWER LINE CONDUCTED EMISSIONS

2.11.1 Specification Reference

RSS-Gen 7.2.4

2.11.2 Standard Applicable

Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The more stringent limit applies at the frequency range boundaries.
The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network (LISN).

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.11.3 Equipment Under Test and Modification State

Serial No: 356075050013822 / Test Configuration B

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

August 07, 2013/FSC

2.11.5 Test Equipment Used

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

2.11.6 Environmental Conditions

Ambient Temperature	25.4°C
Relative Humidity	51.1%
ATM Pressure	99.4 kPa

2.11.7 Additional Observations

- Limit used is from FCC Part 15.107 Class B which is identical to RSS-Gen limits.
- EUT is a RF module, to show general compliance to the requirement, the EUT was installed in a Development board using a representative AC adapter.

- 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. See Section 2.11.8 for sample computation.

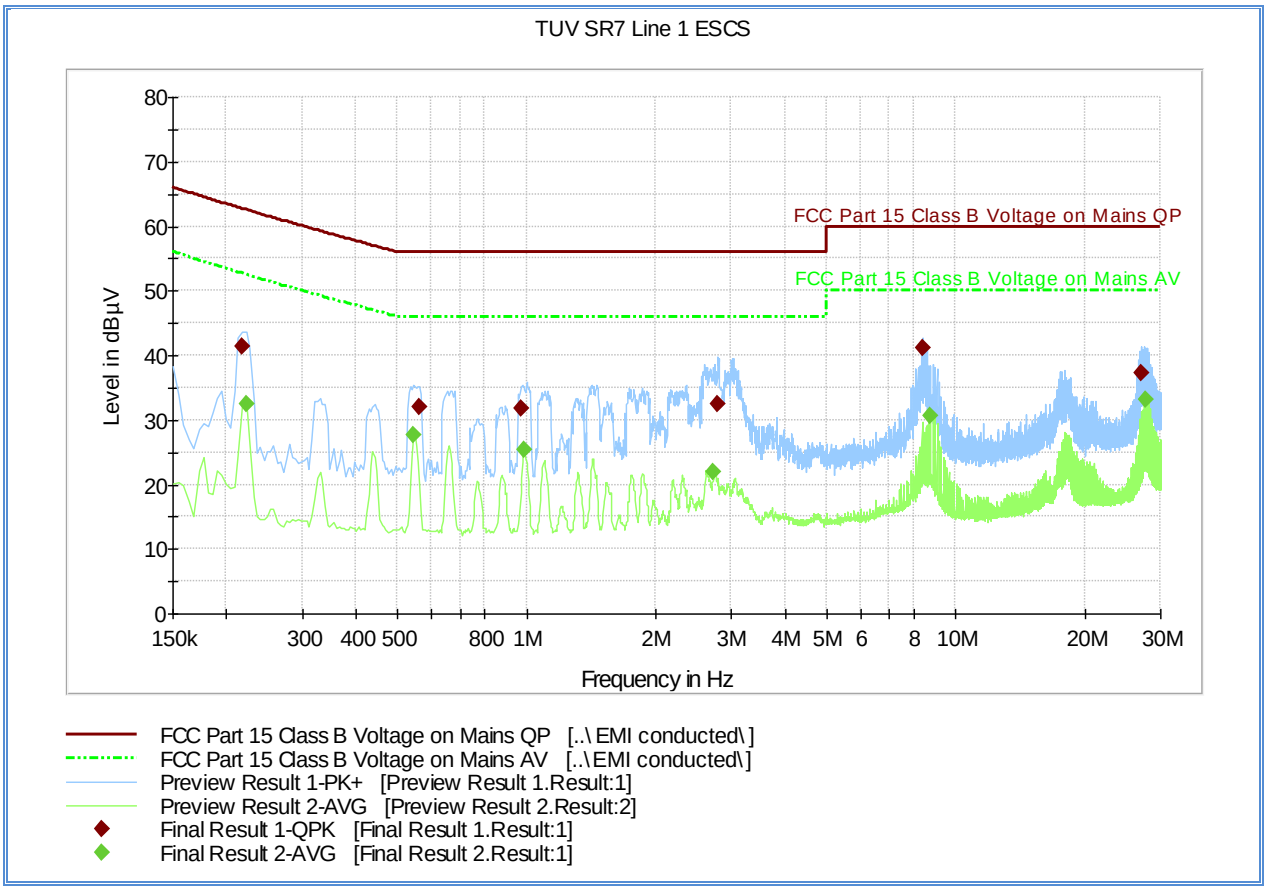
2.11.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.11.9 Test Results

Compliant. See attached plots and tables.

2.11.9.1 Line 1 (with support laptop)



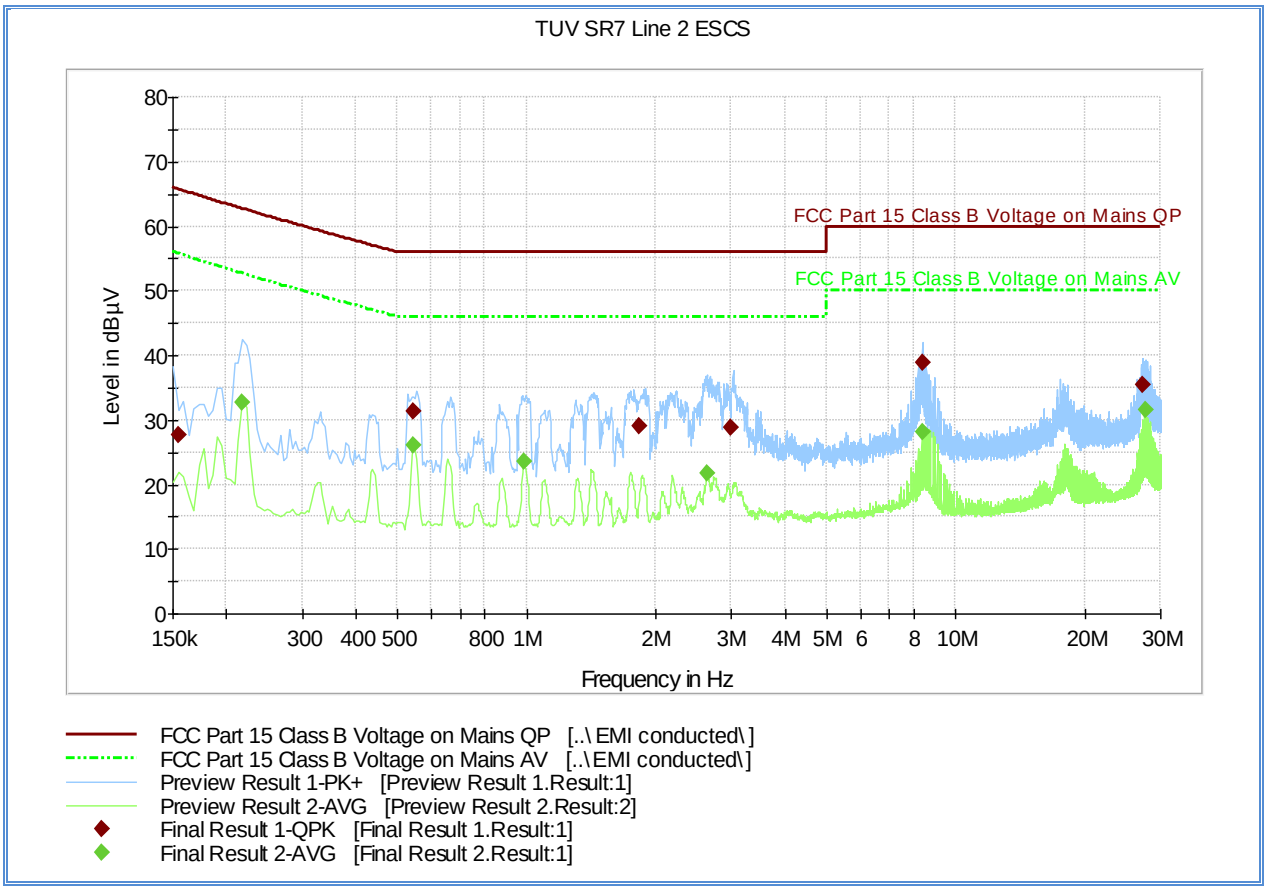
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.217500	41.5	1000.0	9.000	Off	L1	20.3	21.3	62.7
0.564000	32.0	1000.0	9.000	Off	L1	20.2	24.0	56.0
0.973500	31.9	1000.0	9.000	Off	L1	20.2	24.1	56.0
2.796000	32.4	1000.0	9.000	Off	L1	20.3	23.6	56.0
8.353500	41.1	1000.0	9.000	Off	L1	20.4	18.9	60.0
27.024000	37.2	1000.0	9.000	Off	L1	21.4	22.8	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.222000	32.4	1000.0	9.000	Off	L1	20.3	20.1	52.5
0.546000	27.6	1000.0	9.000	Off	L1	20.2	18.4	46.0
0.987000	25.4	1000.0	9.000	Off	L1	20.2	20.6	46.0
2.733000	21.9	1000.0	9.000	Off	L1	20.3	24.1	46.0
8.745000	30.5	1000.0	9.000	Off	L1	20.4	19.5	50.0
27.712500	33.0	1000.0	9.000	Off	L1	21.5	17.0	50.0

2.11.9.2 Line 2



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.154500	27.7	1000.0	9.000	Off	N	21.2	38.1	65.7
0.546000	31.4	1000.0	9.000	Off	N	21.1	24.6	56.0
1.833000	29.1	1000.0	9.000	Off	N	21.1	26.9	56.0
2.994000	28.8	1000.0	9.000	Off	N	21.1	27.2	56.0
8.353500	38.8	1000.0	9.000	Off	N	21.2	21.2	60.0
27.321000	35.4	1000.0	9.000	Off	N	22.2	24.6	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit - Ave (dBµV)
0.217500	32.7	1000.0	9.000	Off	N	21.1	20.0	52.7
0.546000	26.1	1000.0	9.000	Off	N	21.1	19.9	46.0
0.987000	23.7	1000.0	9.000	Off	N	21.1	22.3	46.0
2.634000	21.8	1000.0	9.000	Off	N	21.1	24.2	46.0
8.353500	28.1	1000.0	9.000	Off	N	21.2	21.9	50.0
27.613500	31.5	1000.0	9.000	Off	N	22.2	18.5	50.0

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
7571	Wideband Radio Communication Tester	CMW 500	1201.0002k50/103829	Rhode & Schwarz	05/06/13	05/06/14
6814	PSA Series Spectrum Analyzer	E4440A	MY42510441	Agilent	11/07/12	11/07/13
7579	Temperature Chamber	Model 115	92009707	Test Equity	07/16/13	07/16/14
	20dB Attenuator	34-20-34	BP4180	MCE/Weinschel	Verified by 6814 and 1003	
8686	20dB Attenuator	0846	BW-N20W5+	MCL	Verified by 6814 and 1003	
Radiated Test Setup						
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
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	03/25/13	03/25/14
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	06/11/13	06/11/14
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	09/21/12	09/21/13
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	09/21/12	09/21/13
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	09/21/12	09/21/13
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
TUV777	900MHz High Pass Filter	FF6549-1	004	Sage	Verified by 1049 and 1003	
TUV783	2.0GHz High Pass Filter	FF6549-2	008	Sage	Verified by 1049 and 1003	
1016	Pre-amplifier	PAM-0202	187	PAM	09/24/12	09/24/13
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	03/11/13	03/11/14
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
8607	20dB Attenuator	CAT-20	N/A	MCL HAT-20	08/21/12	08/21/13
8609	20dB Attenuator	CAT-20	N/A	MCL HAT-20	08/21/12	08/21/13
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	11/12/12	11/12/13
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	08/02/14
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	11/19/12	11/19/13
7539	DC Power Supply	6434B	1140A01866	Hewlett Packard	Verified by 6452	

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

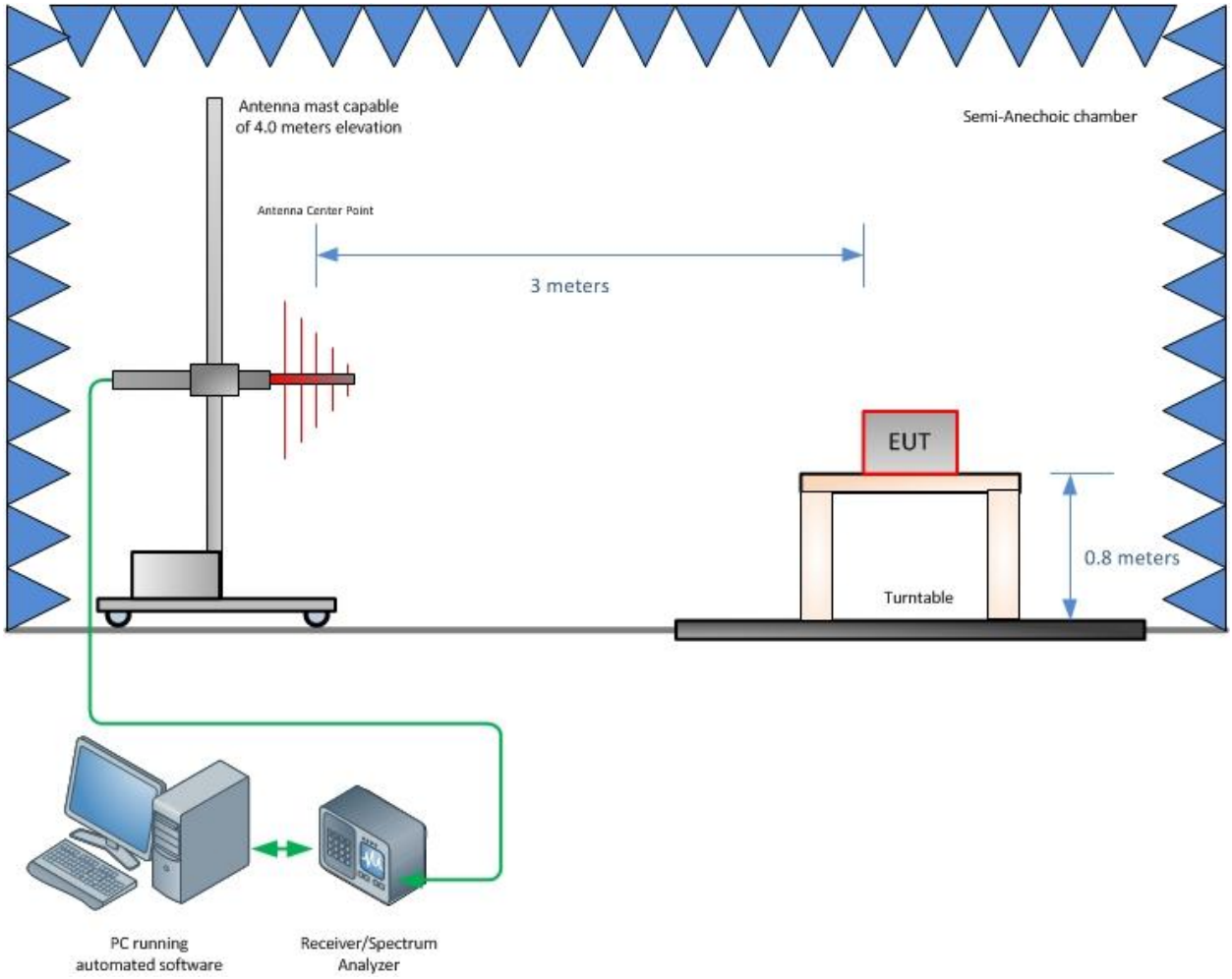
3.2.3 Conducted Antenna Port Measurement

	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

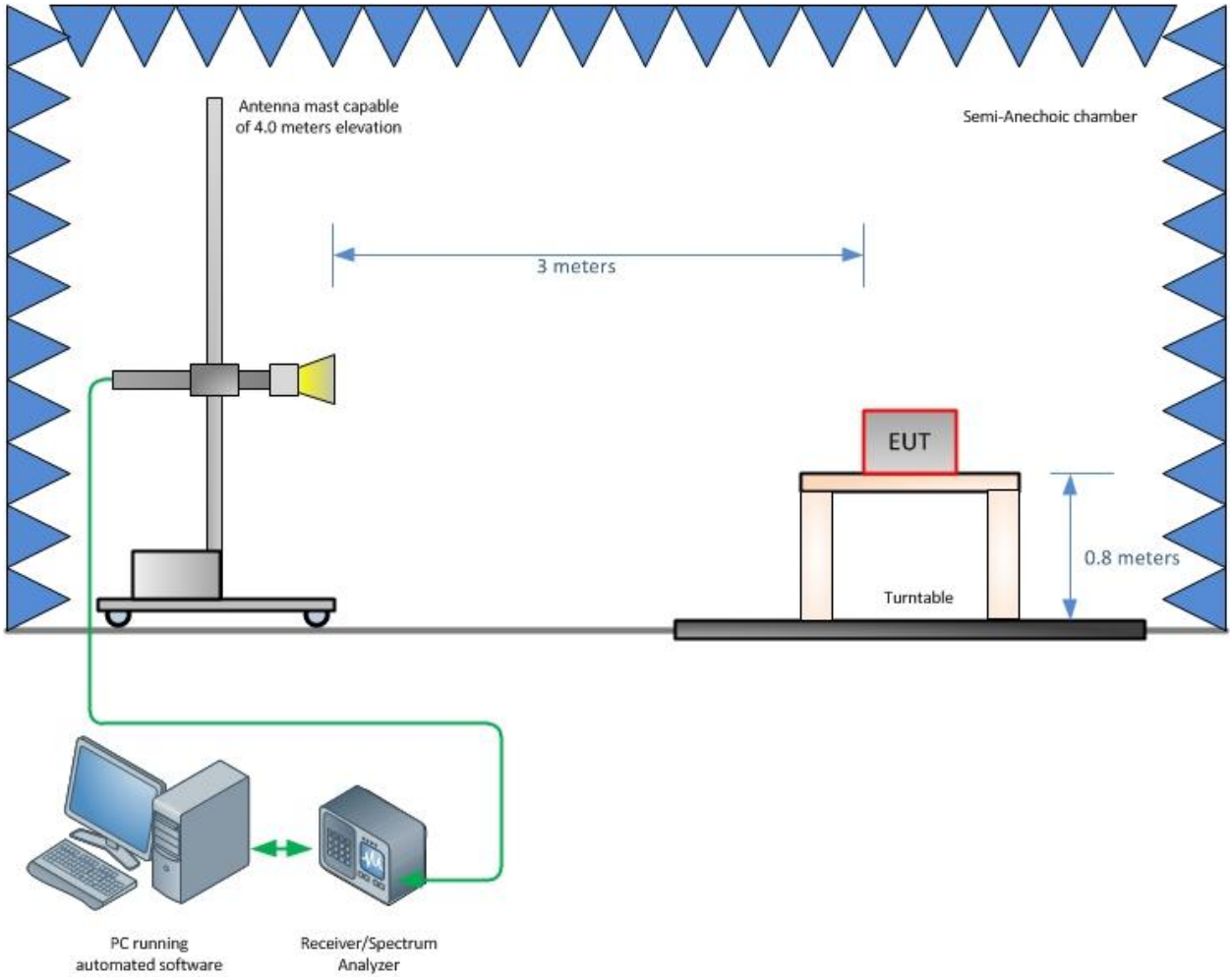
SECTION 4

DIAGRAM OF TEST SETUP

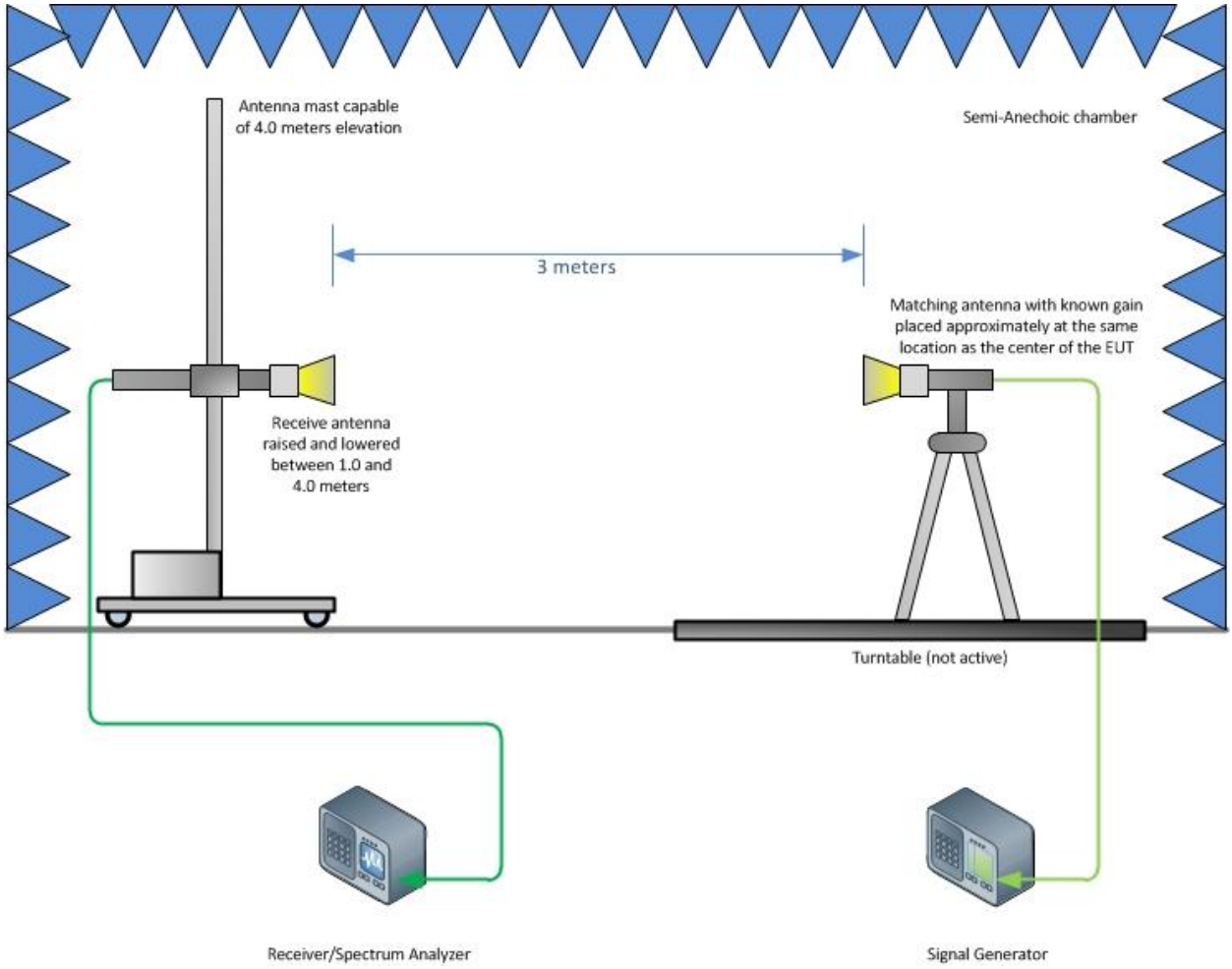
4.1 TEST SETUP DIAGRAM



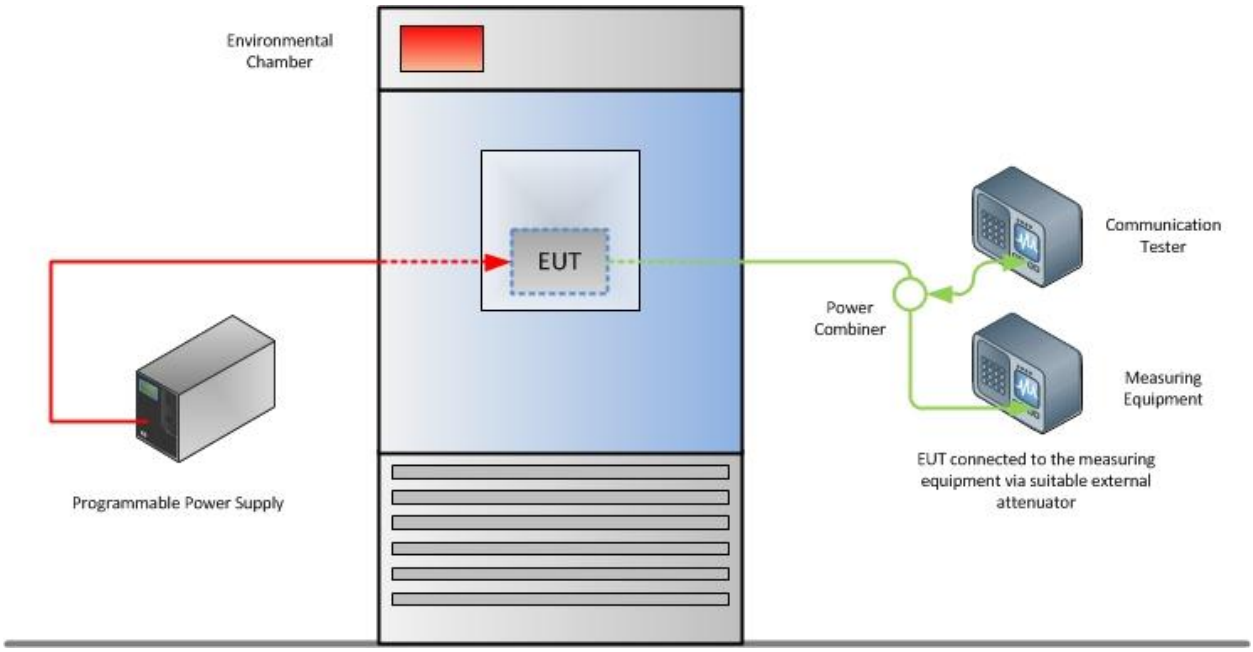
Radiated Emission Test Setup (Below 1GHz)



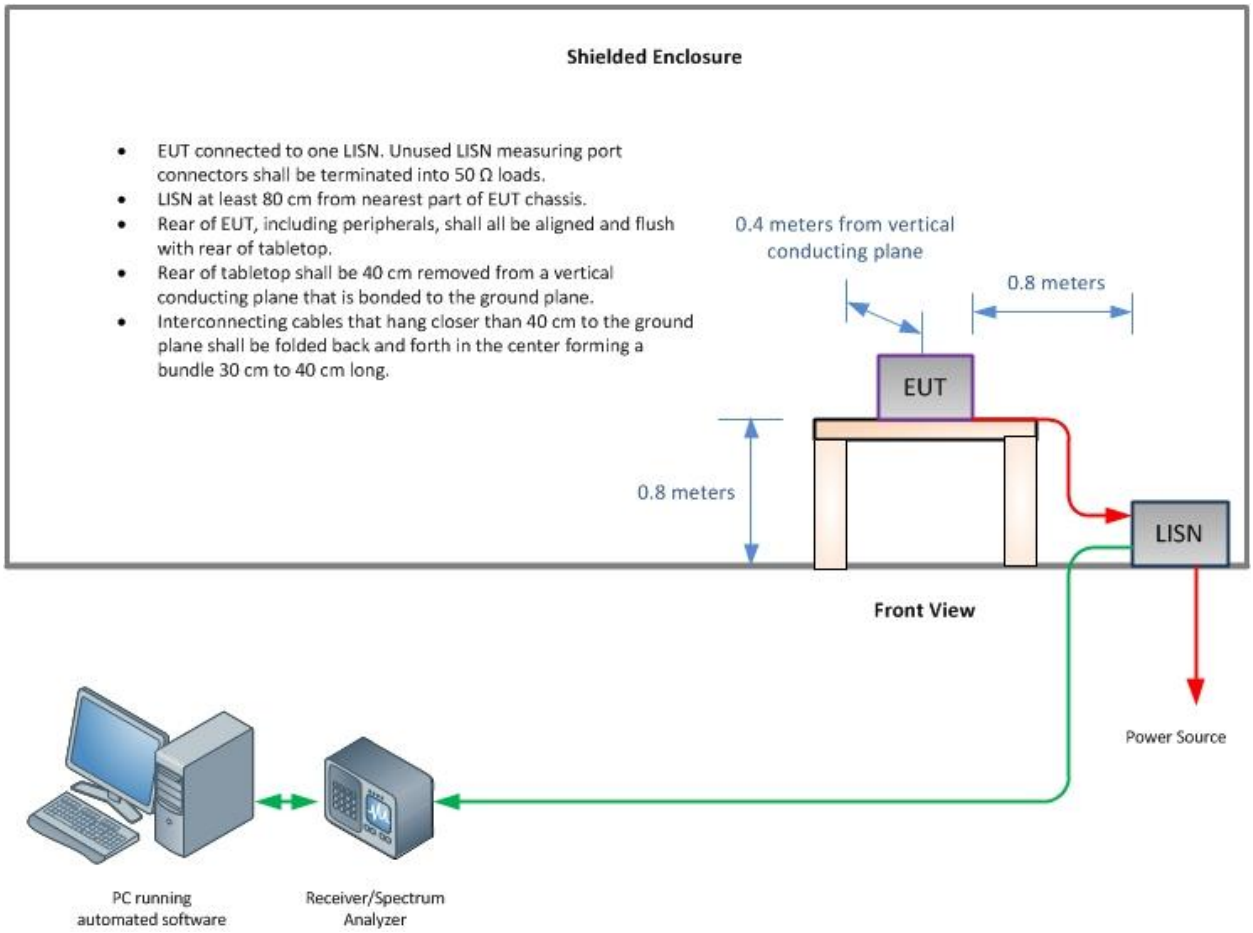
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz)



Frequency Stability Test Comfiguration



Conducted Emissions Test Configuration

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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