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Report On

Application for Grant of Equipment Authorization of the
Novatel Wireless Inc.

MiFi 6630 Wireless Hotspot Modem

FCC CFR 47 Part 2 and 27

RSS-130 Issue 1 October 2013

Report No. SD72101251E

March 2015



REPORT ON Radio Testing of the
Novatel Wireless Inc.
Wireless Hotspot Modem

TEST REPORT NUMBER SD72101251E

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DATED March 30, 2015



Revision History

SD72101251E Novatel Wireless Inc. MiFi 6630 Wireless Hotspot Modem					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
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SECTION 1

REPORT SUMMARY

Radio Testing of the
Novatel Wireless Inc.
MiFi 6630 Wireless Hotspot Modem



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Novatel Wireless Inc. MiFi 6630 Wireless Hotspot Modem to the requirements of the following:

- FCC CFR 47 Part 2 and 27
- RSS-Gen Issue 4 November 2014
- RSS-130 Issue 1 October 2013.
- IC 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	Novatel Wireless Inc.
Model Number(s)	MIFI6630
FCC ID Number	PKRNVWMIFI6630
IC Number	3229A-MIFI6630
Serial Number(s)	SS220414800535
Number of Samples Tested	1
Test Specification/Issue/Date	<ul style="list-style-type: none">• FCC CFR 47 Part 2 and 27 (October 1, 2014).• RSS-130 - Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 (Issue 1, October 2013).• 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 Compliance of Radio Apparatus (Issue 4, November 2014).
Start of Test	May 30, 2014
Finish of Test	July 03, 2014
Name of Engineer(s)	Alex Chang
Related Document(s)	<ul style="list-style-type: none">• RF Exposure Lab Certificate of Compliance SAR Evaluation Test Report Number: SAR.20140601 Revision D.• Supporting documents for EUT certificate 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 (a) and (c)		Transmitter Conducted Output Power	Compliant
2.2	27.50 (d)(4), Part 2.1046	RSS-139 (6.4)	Equivalent Isotropic Radiated Power	Compliant
2.3	27.50 (b)(10)(12) and Part 2.1046	RSS-130 (4.4)	Effective Radiated Power	Compliant
2.4	27.53 (g)(h)(1), 2.1049	RSS-Gen (6.6)	Occupied Bandwidth	Compliant
2.5	27.50 (d)(5)	RSS-130 (4.4) RSS-139 (6.4)	Peak-Average Ratio	Compliant
2.6	27.53 (c)(2)(5), (g) and (g)(3) 27.53 (h)	RSS-130(4.6.1) RSS-139 (6.5)	Band Edge	Compliant
2.7	27.53 (c)(2)(5), (e), (g) and Part 2.1051 27.53 (h)	RSS-130(4.6.2) RSS-139 (6.5)	Conducted Spurious Emissions	Compliant
2.8	27.53 (c), (g) and Part 2.1053 27.53 (h)	RSS-130(4.6.2) RSS-139 (6.5)	Field Strength Of Spurious Radiation	Compliant
2.9	27.54, Part 2.1055 (a)(1) and (d)(1)	RSS-130(4.3) RSS-139 (6.3)	Frequency Stability	Compliant
2.10		RSS-Gen 7.0	Receiver Spurious Emissions	Compliant



1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) was a Novatel Wireless Inc. MiFi 6630 Wireless Hotspot Modem. The EUT creates a personal Wi-Fi cloud, capable of sharing high speed 4G LTE and 3G Mobile Broadband Internet connectivity with up to 15 Wi-Fi enable devices simultaneously. The EUT comes with an AC power adaptor Novatel Wireless, model: SSW-2597.

1.3.2 Technical Description

EUT Description	Wireless Hotspot Modem
Model Number(s)	MiFi 6630
Rated Voltage	Nominal 3.8VDC Li-Ion Battery AC Power Adaptor: Input: 100-240VAC/0.3A/50-60Hz Output: 5.0VDC/2.0A
Mode Verified	LTE Band 4 and 12
Capability	GSM850/1900, WCDMA850/1900, LTE Band 2/3/4/5/7/12/17/29, WLAN 802.11 a/b/g/n
Antenna Type	Monopole
Manufacturer	Novatel Wireless, Inc.
Antenna Model	NVTL DA-01020345
Antenna Gain	LTE Band 3: 0.51dBi LTE Band 4: 0.83dBi LTE Band 2: -1.64dBi LTE Band 7: 0.25dBi WCDMA Band 5: -2dBi WCDMA Band 8: -3.3dBi WCDMA Band 2: -1.64dBi WCDMA Band 1: -1dBi GSM850: -2dBi GMS900: -3.3dBi GSM1800: 0.51dBi GSM1900: -1.64dBi CDMA BC0: -3.46dBi CDMA BC1: -0.97dBi



1.3.3 Transmit Frequency Table

LTE Band 4					
Modulation	Bandwidth (MHz)	Tx Frequency (MHz)	Emission Designator	EIRP	
				Max Power (dBm)	Max Power (Watts)
QPSK	1.4	1710-1755	1M08G7D	24.83	0.304
16QAM	1.4	1710-1755	1M09W7D	24.27	0.267
QPSK	3.0	1710-1755	2M68G7D	24.83	0.304
16QAM	3.0	1710-1755	2M68W7D	24.33	0.271
QPSK	5.0	1710-1755	4M47G7D	24.83	0.304
16QAM	5.0	1710-1755	4M47W7D	24.23	0.264
QPSK	10.0	1710-1755	8M94G7D	24.83	0.304
16QAM	10.0	1710-1755	8M94W7D	24.18	0.261
QPSK	15.0	1710-1755	13M4G7D	24.82	0.303
16QAM	15.0	1710-1755	13M4W7D	24.21	0.263
QPSK	20.0	1710-1755	17M8G7D	24.83	0.304
16QAM	20.0	1710-1755	17M8W7D	24.07	0.255

LTE Band 12					
Bandwidth	Modulation	Tx Frequency (MHz)	Emission Designator	ERP	
				Max. Power (dBm)	Max. Power (W)
5.0 MHz	QPSK	698-746	4M54G7D	23.22	0.210
5.0 MHz	16QAM	698-746	4M53W7D	22.30	0.170
10.0 MHz	QPSK	698-746	8M91G7D	23.18	0.208
10.0 MHz	16QAM	698-746	8M97W7D	22.29	0.169

1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	Conducted antenna port measurement. EUT Tx at a max power and connected to a programmable DC power supply via dummy battery pack.
B	Raidated test setup. EUT Tx through integral antenna and connected to supplied AC-DC power adaptor.

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

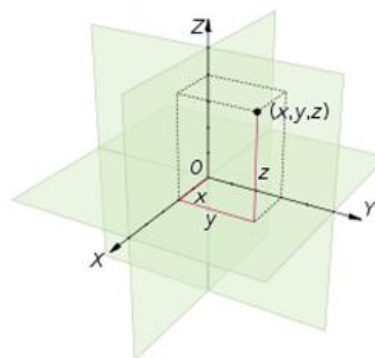
Manufacturer	Equipment/Cable	Description
Novatel Wireless	USB Cable	Micro USB Type B to Standard USB Type B

1.4.4 Worst Case Configuration

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

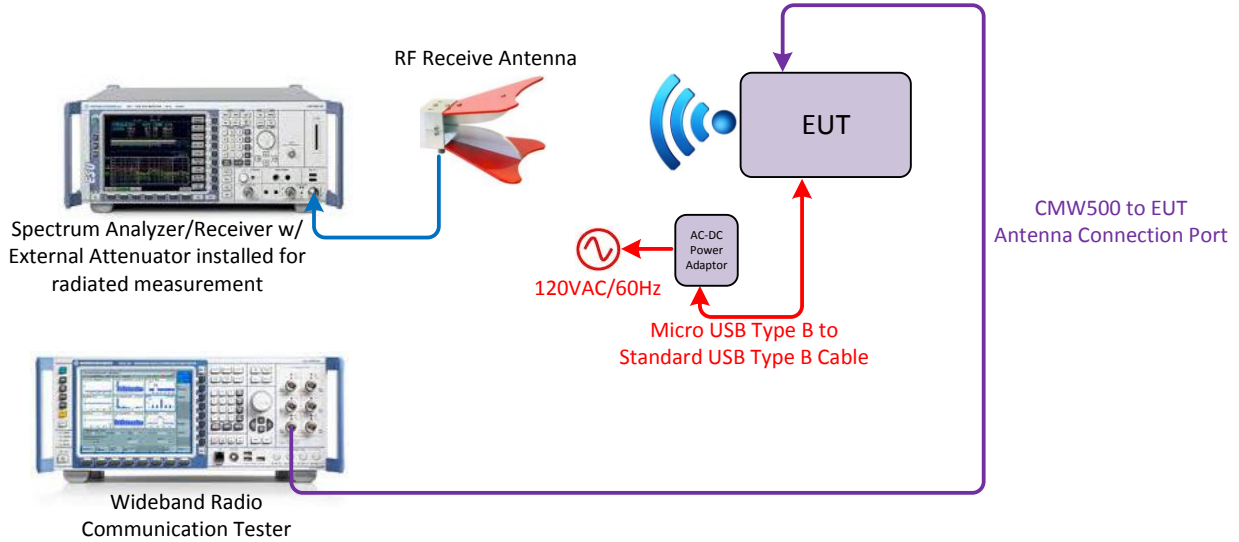
Band	Channel BW	Modulation	RB Size/Offset
LTE Band 4	5.0 MHz	QPSK	1/24
LTE Band 12	5.0 MHz	QPSK	1/24

For radiated measurements X, Y, and Z orientations were verified. The verification was determined “Y” as worst case configuration.

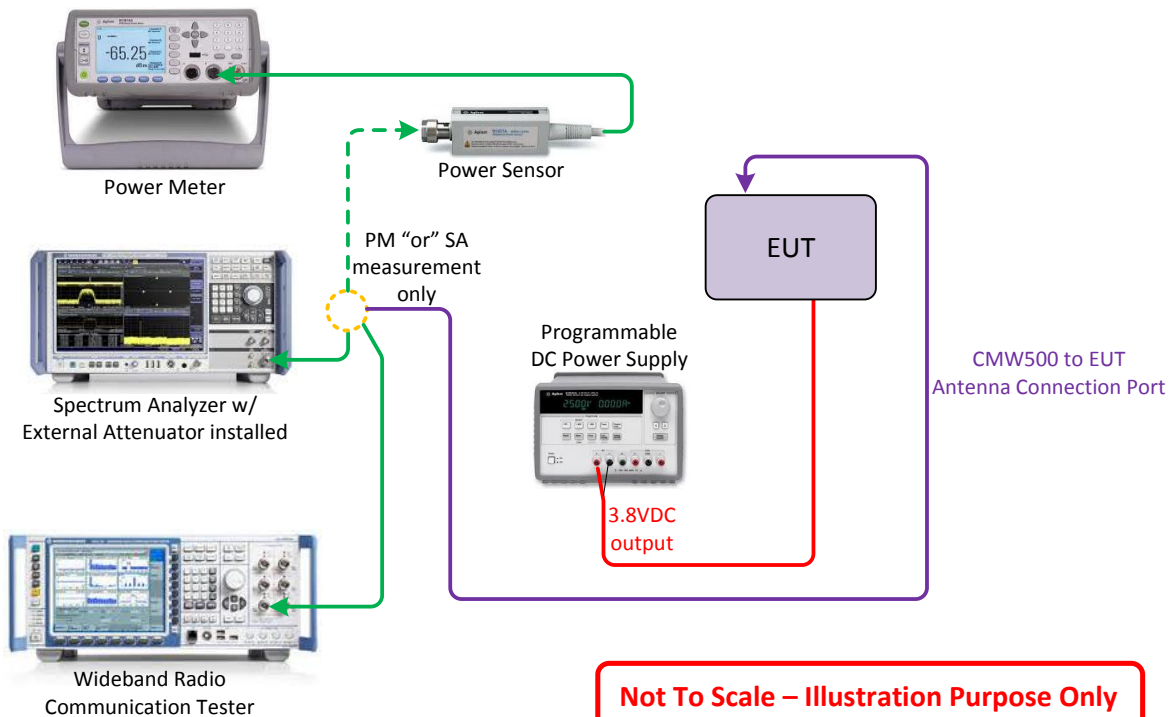


1.4.5 Simplified Test Configuration Diagram

Radiated/Conducted Emission Test Configuration via Conducted Port



Conducted (Antenna Port) Test Configuration



Not To Scale – Illustration Purpose Only
 Objects may not represent actual image of original equipment/s or set-up.



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 SS220414800535		
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 US1146.



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
Novatel Wireless Inc.
MiFi 6630 Wireless Hotspot Modem



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: SS220414800535 / Test Configuration A

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

*May 30, 2014 and January 08, 2015 / AC

*The tables presented on this test report are from SAR Evaluation Test Report Number: SAR.20140601 Revision D ; TÜV performed Verification on random channels and worst case conditions and did not find any significant differences.

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	25.4°C
Relative Humidity	51.7%
ATM Pressure	98.7 kPa

2.1.7 Additional Observations

- These are the Conducted port measurement provided by the RF exposure SAR laboratory. The data was used and help in determining worst case testing conditions for the remainder of the report.
- This is a conducted test using a peak/average power meter.



- The 27.75dB (Band 4) offset on the power meter was used for the power splitter, external attenuator and cable used.
- The 27.6dB LTE Band 12 offset on the power meter was used for the power splitter, external attenuator and cable used.
- TÜV performed verification checks and compared the measurements to the data provided by RF Exposure Labs (SAR.20140601 Revision D and SAR.20141207 Revision B) and the results were found to be similar and are used to show compliance in this test report.
- Only representative worst case RB size and RB offset presented. Verification done using both RMC and User Defined Channels options for scheduling (CMW500).
- All available RB size and RB offset were verified. The worst case for each mode (marked bold and italic) will be verified for each test throughout this test report.

2.1.8 Test Results

See attached table.



LTE Band 4								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)	
QPSK	1.4 MHz	6	0	19957	1710.7	23.67	27.83	
		3	1			23.99	27.87	
		1	0			23.98	26.86	
		1	5	20175	1732.5	23.98	27.88	
		6	0			23.06	28.03	
		3	1			24.00	28.14	
		1	0	20393	1754.3	23.58	27.96	
		1	5			23.93	28.14	
		6	0			23.61	26.80	
		3	1	19965	1711.5	23.99	26.86	
		1	0			23.99	26.82	
		1	5			24.00	26.85	
	3 MHz	15	0	20175	1732.5	23.11	27.86	
			8			3	23.02	27.79
			1			0	24.00	27.78
			1	14	20385	1753.5	23.34	27.83
			15	0			23.09	28.02
			8	3			22.93	27.93
		1	0	19975	1712.5	23.40	27.75	
		1	14			23.99	28.27	
		15	0			23.15	26.77	
		8	3	20175	1732.5	23.07	26.69	
		1	0			23.53	26.71	
		1	14			23.94	26.77	
	5 MHz	25	0	20375	1752.5	22.49	27.81	
			12			6	22.44	27.79
			1			0	23.99	27.81
			1	24	20175	1732.5	23.19	27.92
			25	0			23.19	27.97
			12	6			23.13	27.96
1		0	19975	1712.5	23.31	27.66		
1		24			24.00	28.34		
25		0			22.87	26.70		
12		6	20375	1752.5	22.64	26.71		
1		0			23.67	27.01		
1		24			23.99	26.87		



LTE Band 4								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)	
QPSK	10 MHz	50	0	20000	1715.0	22.36	27.80	
		25	12			21.92	27.75	
		1	0			24.00	27.13	
		1	24			23.14	27.89	
		50	0	20175	1732.5	22.99	27.88	
		25	12			23.04	27.96	
		1	0			23.31	27.48	
		1	24			23.92	28.02	
		50	0	20350	1750.0	22.80	27.06	
		25	12			22.57	27.01	
		1	0			23.60	27.80	
		1	24			23.67	27.06	
	15 MHz	75	0	20025	1717.5	22.29	27.65	
			36			19	22.01	27.72
			1			0	23.99	27.87
			1			74	23.18	27.38
		75	0	20175	1732.5	22.67	27.80	
			36			19	23.17	27.92
			1			0	23.13	27.35
			1			74	23.45	28.44
		75	0	20325	1747.5	22.62	27.30	
			36			19	22.64	27.43
			1			0	23.38	28.25
			1			74	23.60	28.13
	20 MHz	100	0	20050	1720.0	22.23	27.41	
			50			25	22.21	27.58
			1			0	24.00	27.89
			1			99	23.28	27.51
		100	0	20175	1732.5	22.68	27.63	
			50			25	23.00	27.84
1			0			23.10	27.41	
1			99			23.56	28.26	
100		0	20300	1745.0	22.52	27.32		
		50			25	22.61	27.72	
		1			0	23.98	28.37	
		1			99	24.00	26.86	



LTE Band 4								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)	
16QAM	1.4 MHz	6	0	19957	1710.7	22.51	27.79	
		3	1			23.44	27.87	
		1	0			23.39	27.82	
		1	5			23.09	27.91	
		6	0	20175	1732.5	22.02	28.00	
		3	1			22.90	28.13	
		1	0			22.52	28.02	
		1	5			23.05	28.20	
		6	0	20393	1754.3	22.52	26.76	
		3	1			23.25	26.85	
		1	0			23.25	26.85	
		1	5			23.21	26.87	
	3 MHz	15	0	19965	1711.5	22.12	27.86	
			8			3	22.02	27.76
			1			0	23.20	27.85
			1			14	22.18	27.91
		8	0	20175	1732.5	22.19	28.02	
			3			22.05	27.90	
			0			22.22	27.78	
			1			14	23.32	28.28
		15	0	20385	1753.5	22.22	26.77	
			8			3	22.27	26.68
			0			22.51	26.79	
			1			14	23.50	26.85
	5 MHz	25	0	19975	1712.5	21.53	27.75	
			12			6	21.51	27.86
			1			0	23.40	27.86
			1			24	21.62	28.04
		12	0	20175	1732.5	22.19	27.94	
			6			22.00	27.98	
0			22.03			27.78		
1			24			23.26	28.39	
25		0	20375	1752.5	21.94	26.68		
		12			6	21.59	26.73	
		0			22.33	27.08		
		1			24	23.33	26.88	



LTE Band 4								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)	Tx Peak (dBm)	
16QAM	10 MHz	50	0	20000	1715.0	21.37	27.84	
		25	12			21.11	27.71	
		1	0			23.35	27.91	
		1	24			22.00	28.10	
		50	0	20175	1732.5	22.06	27.92	
		25	12			21.96	27.90	
		1	0			21.91	27.56	
		1	24			22.83	28.10	
		50	0	20350	1750.0	21.69	27.05	
		25	12			21.44	26.96	
		1	0			22.26	27.97	
		1	24			22.33	27.18	
	15 MHz	75	0	20025	1717.5	21.23	27.63	
			36			19	21.13	27.82
			1			0	23.38	27.90
			1			74	21.96	27.50
		75	0	20175	1732.5	21.58	27.77	
			36			19	22.17	28.00
			1			0	21.79	27.44
			1			74	22.32	28.58
		75	0	20325	1747.5	21.61	27.37	
			36			19	21.55	27.51
			1			0	22.15	28.38
			1			74	23.19	26.88
	20 MHz	100	0	20050	1720.0	21.30	27.46	
			50			25	21.21	27.52
			1			0	23.20	27.97
			1			99	21.94	27.63
		100	0	20175	1732.5	21.65	27.71	
			50			25	22.12	27.84
1			0			23.13	27.96	
1			99			22.35	28.45	
100		0	20300	1745.0	21.57	27.40		
		50			25	21.58	27.73	
		1			0	22.75	28.45	
		1			99	23.24	26.93	

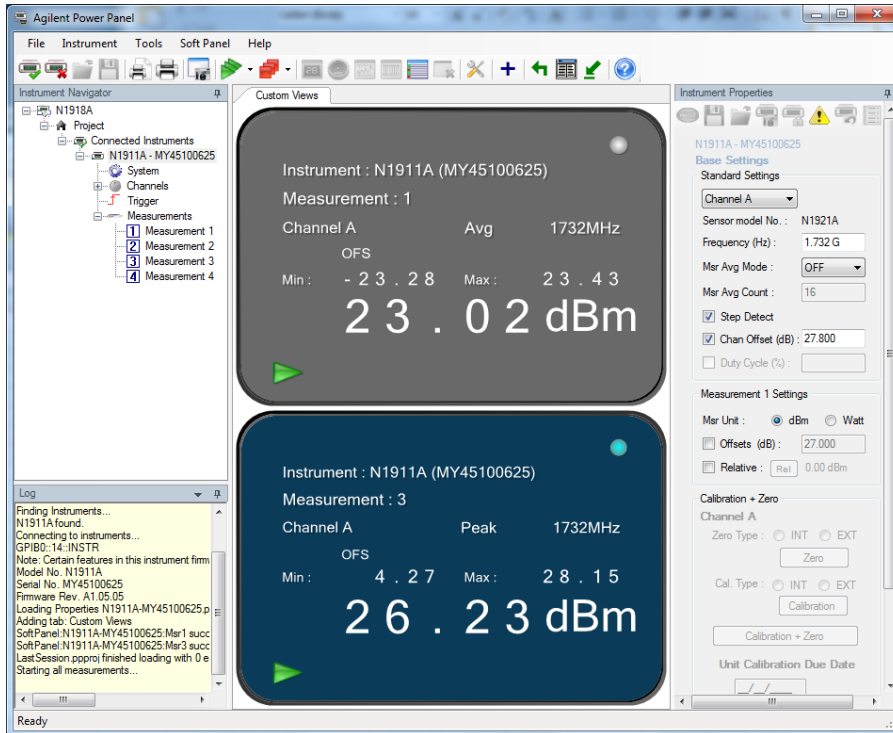


LTE Band 12						
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)
QPSK	5 MHz	25	0	23035	701.5	22.23
		12	6			23.08
		1	0			23.14
		1	24			23.22
		25	0	23095	707.5	22.24
		12	6			23.06
		1	0			23.16
		1	24			23.14
		25	0	23155	713.5	22.20
		12	6			23.01
		1	0			23.18
		1	24			23.21
	50	0	23060	704.0	22.11	
	25	12			23.01	
	1	0			23.05	
	1	24			23.18	
	50	0	23095	707.5	22.19	
	25	12			23.05	
	1	0			23.13	
	1	24			23.17	
50	0	23130	711.0	22.23		
25	12			23.09		
1	0			23.12		
1	24			23.11		



LTE Band 12								
Modulation	Bandwidth	RB Size	RB Offset	Channels	Frequency	Tx Average (dBm)		
16QAM	5 MHz	25	0	23035	701.5	20.31		
		12	6			22.12		
		1	0			22.23		
		1	24			22.30		
		25	0	23095	707.5	20.32		
		12	6			22.11		
		1	0			22.26		
		1	24			22.22		
		25	0	23155	713.5	20.26		
		12	6			22.16		
		1	0			22.27		
		1	24			22.28		
	10 MHz	5 MHz	50	0	23060	704.0	20.16	
			25	12			22.08	
			1	0			22.09	
			1	24			22.26	
		10 MHz	5 MHz	50	0	23095	707.5	20.29
				25	12			22.10
				1	0			22.20
				1	24			22.29
10 MHz	5 MHz	50	0	23130	711.0	20.33		
		25	12			22.17		
		1	0			22.18		
		1	24			22.22		

2.1.9 Sample Test Measurement Screen





2.2 EQUIVALENT ISOTROPIC RADIATED POWER

2.2.1 Specification Reference

27.50 (d)(4), Part 2.1046 and RSS-139 (6.4)

2.2.2 Standard Applicable

(d) The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

The average equivalent isotropically radiated power (e.i.r.p.) for fixed, mobile and portable transmitters in the 1710-1755 MHz shall not exceed 1 watt.

2.2.3 Equipment Under Test

Serial No: SS220414800535, Test Configuration (N/A, calculation only)

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

July 03, 2014 / AC

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:

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

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.



LTE Band 4									
Modulation	Bandwidth (MHz)	RB Size/Offset	Channels	Frequency (MHz)	Tx Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
QPSK	1.4	3 / 1	19957	1710.7	23.99	0.83	24.82	30.00	5.18
		3 / 1	20175	1732.5	24.00	0.83	24.83	30.00	5.17
		1 / 5	20393	1754.3	24.00	0.83	24.83	30.00	5.17
	3	1 / 0	19965	1711.5	24.00	0.83	24.83	30.00	5.17
		1 / 14	20175	1732.5	23.99	0.83	24.82	30.00	5.18
		1 / 14	20385	1753.5	23.94	0.83	24.77	30.00	5.23
	5	1 / 0	19975	1712.5	23.99	0.83	24.82	30.00	5.18
		1 / 24	20175	1732.5	24.00	0.83	24.83	30.00	5.17
		1 / 24	20375	1752.5	23.99	0.83	24.82	30.00	5.18
	10	1 / 0	20000	1715.0	24.00	0.83	24.83	30.00	5.17
		1 / 24	20175	1732.5	23.92	0.83	24.75	30.00	5.25
		1 / 24	20350	1750.0	23.67	0.83	24.50	30.00	5.50
	15	1 / 0	20025	1717.5	23.99	0.83	24.82	30.00	5.18
		1 / 74	20175	1732.5	23.45	0.83	24.28	30.00	5.72
		1 / 74	20325	1747.5	23.60	0.83	24.43	30.00	5.57
	20	1 / 0	20050	1720.0	24.00	0.83	24.83	30.00	5.17
		1 / 99	20175	1732.5	23.56	0.83	24.39	30.00	5.61
		1 / 99	20300	1745.0	24.00	0.83	24.83	30.00	5.17



LTE Band 4									
Modulation	Bandwidth (MHz)	RB Size/Offset	Channels	Frequency (MHz)	Tx Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
16QAM	1.4	3 / 1	19957	1710.7	23.44	0.83	24.27	30.00	5.73
		1 / 5	20175	1732.5	23.05	0.83	23.88	30.00	6.12
		1 / 0	20393	1754.3	23.25	0.83	24.08	30.00	5.92
	3	1 / 0	19965	1711.5	23.20	0.83	24.03	30.00	5.97
		1 / 14	20175	1732.5	23.32	0.83	24.15	30.00	5.85
		1 / 14	20385	1753.5	23.50	0.83	24.33	30.00	5.67
	5	1 / 0	19975	1712.5	23.40	0.83	24.23	30.00	5.77
		1 / 24	20175	1732.5	23.26	0.83	24.09	30.00	5.91
		1 / 24	20375	1752.5	23.33	0.83	24.16	30.00	5.84
	10	1 / 0	20000	1715.0	23.35	0.83	24.18	30.00	5.82
		1 / 24	20175	1732.5	22.83	0.83	23.66	30.00	6.34
		1 / 24	20350	1750.0	22.33	0.83	23.16	30.00	6.84
	15	1 / 0	20025	1717.5	23.38	0.83	24.21	30.00	5.79
		1 / 74	20175	1732.5	22.32	0.83	23.15	30.00	6.85
		1 / 74	20325	1747.5	23.19	0.83	24.02	30.00	5.98
	20	1 / 0	20050	1720.0	23.20	0.83	24.03	30.00	5.97
		1 / 0	20175	1732.5	23.13	0.83	23.96	30.00	6.04
		1 / 99	20300	1745.0	23.24	0.83	24.07	30.00	5.93



2.3 EFFECTIVE RADIATED POWER OUTPUT DATA

2.3.1 Specification Reference

27.50 (b)(10)(12) and Part 2.1046 and RSS-130 (4.4)

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.

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.

2.3.3 Equipment Under Test

Serial No: SS220414800535, Test Configuration (N/A, calculation only)

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

July 03, 2014 and January 21, 2015 / AC

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.



America

LTE BAND 12						
Frequency (MHz)	Channel BW (MHz)	Modulation	RB Size/Offset	ERP (dBm)	ERP (Watt)	Limit (Watt)
701.5	5	QPSK	1/24	22.13	0.210	3
707.5	5	QPSK	1/0	22.07	0.207	3
713.5	5	QPSK	1/24	22.12	0.209	3
701.5	5	16-QAM	1/24	21.21	0.170	3
707.5	5	16-QAM	1/0	21.17	0.168	3
713.5	5	16-QAM	1/24	21.19	0.169	3
704.0	10	QPSK	1/24	22.09	0.208	3
707.5	10	QPSK	1/24	22.08	0.207	3
711.0	10	QPSK	1/0	22.03	0.205	3
704.0	10	16-QAM	1/24	21.17	0.168	3
707.5	10	16-QAM	1/24	21.20	0.169	3
711.0	10	16-QAM	1/24	21.13	0.167	3



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 transmitted signal bandwidth shall be reported as the 99% emission bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. 26dB 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 by at least 26 dB below the transmitter power.

Using the occupied bandwidth measurement function in the spectrum analyzer, the 99% occupied bandwidth was measured.

In addition, the 26dB bandwidth was measured in accordance with FCC KDB 971168 D01 V0202 Clause 4.1 using the ndB measurement function in the spectrum analyzer.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be at least 3x RBW.

2.4.3 Equipment Under Test and Modification State

Serial No: SS220414800535 / Test Configuration B

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

May 30, 2014 and January 13, 2015 / AC

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	25.4°C
Relative Humidity	51.7%
ATM Pressure	98.7 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 v02 DR02-41372).
- The 27.75dB (Band 4) offset on the power meter was used for the power splitter, external attenuator and cable used.
- The 27.6dB LTE Band 12 offset on the power meter was used for the power splitter, external attenuator and cable used.
- Both relative 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 Sample test plots.



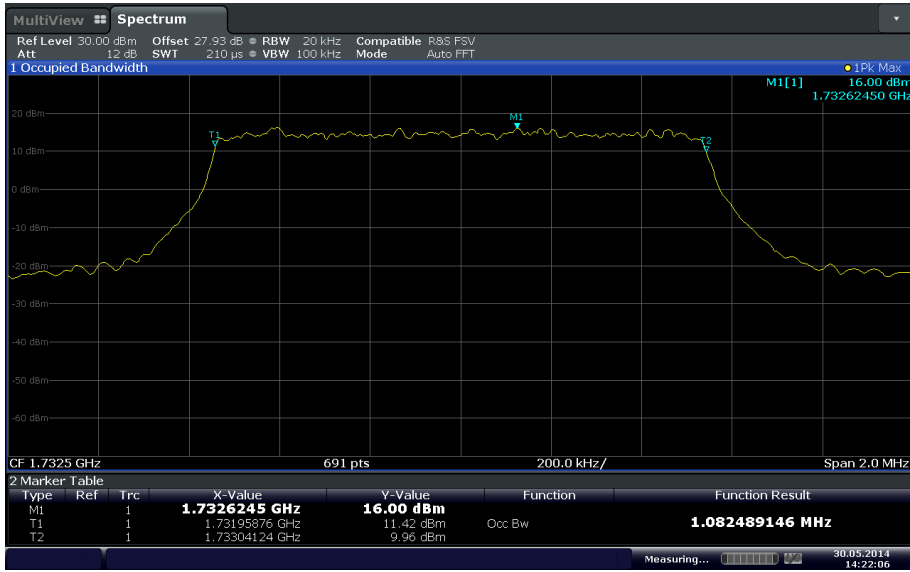
LTE Band 4							
Modulation	BW	RB Size	RB Offset	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
QPSK	1.4 MHz	3	1	20175	1732.5	1.08	1.28
	3 MHz	1	0	19965	1711.5	2.68	2.94
	5 MHz	1	24	20175	1732.5	4.47	4.95
	10 MHz	1	0	20000	1715.0	8.94	9.81
	15 MHz	1	0	20025	1717.5	13.46	14.70
	20 MHz	1	0	20050	1720.0	17.80	18.97

LTE Band 4							
Modulation	BW	RB Size	RB Offset	Channel	Frequency	99% OBW (MHz)	26dB BW (MHz)
16QAM	1.4 MHz	3	1	19957	1710.7	1.09	1.29
	3 MHz	1	14	20385	1753.5	2.68	2.93
	5 MHz	1	0	19975	1712.5	4.47	4.96
	10 MHz	1	0	20000	1715.0	8.94	9.77
	15 MHz	1	0	20025	1717.5	13.40	14.62
	20 MHz	1	99	20300	1745.0	17.89	19.15

LTE Band	Channel	Frequency (MHz)	BW (MHz)	Modulation	99% OBW (MHz)	-26dB BW (MHz)
12	23035	701.5	5.0	QPSK	4.54	5.07
12	23035	701.5	5.0	16QAM	4.53	5.04
12	23060	704.0	10.0	QPSK	8.91	9.70
12	23095	707.5	10.0	16QAM	8.97	9.75

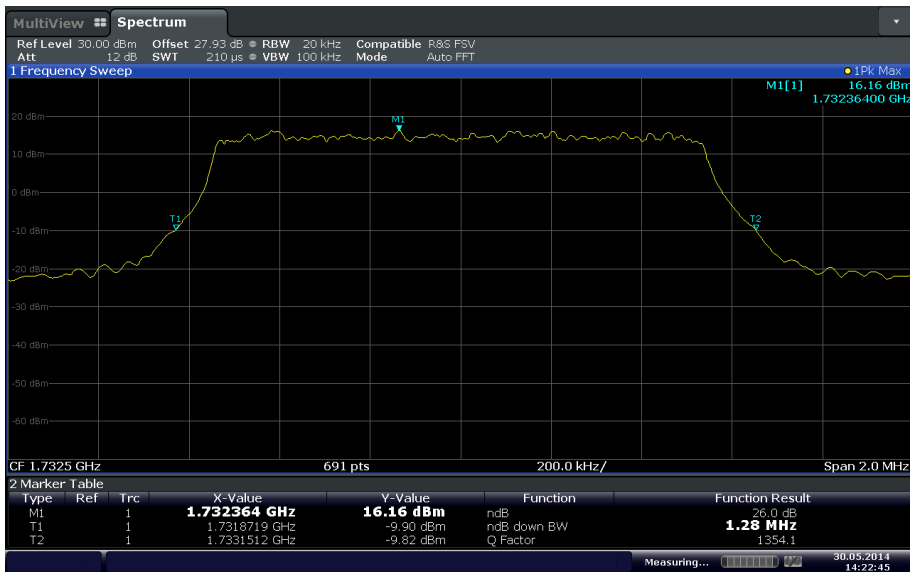


LTE Band 4 (1.4 MHz BW)/1732.5 MHz/QPSK/99%OBW



Date: 30 MAY 2014 14:22:06

LTE Band 4 (1.4 MHz BW)/1732.5 MHz/QPSK/26dB BW



Date: 30 MAY 2014 14:22:45



2.5 PEAK-AVERAGE POWER RATIO

2.5.1 Specification Reference

27.50 (d)(5) , RSS-130 (4.4) and RSS-139 (6.4)

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: SS220414800535 / Test Configuration A

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

June 02, 2014 and January 13, 2015 / AC

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	25.2°C
Relative Humidity	45.7%
ATM Pressure	98.9 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 v02 DR02-41372).
- The 27.75dB (Band 4) offset on the power meter was used for the power splitter, external attenuator and cable used.
- The 27.6dB LTE Band 12 offset on the power meter was used for the power splitter, external attenuator and cable used.
- 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



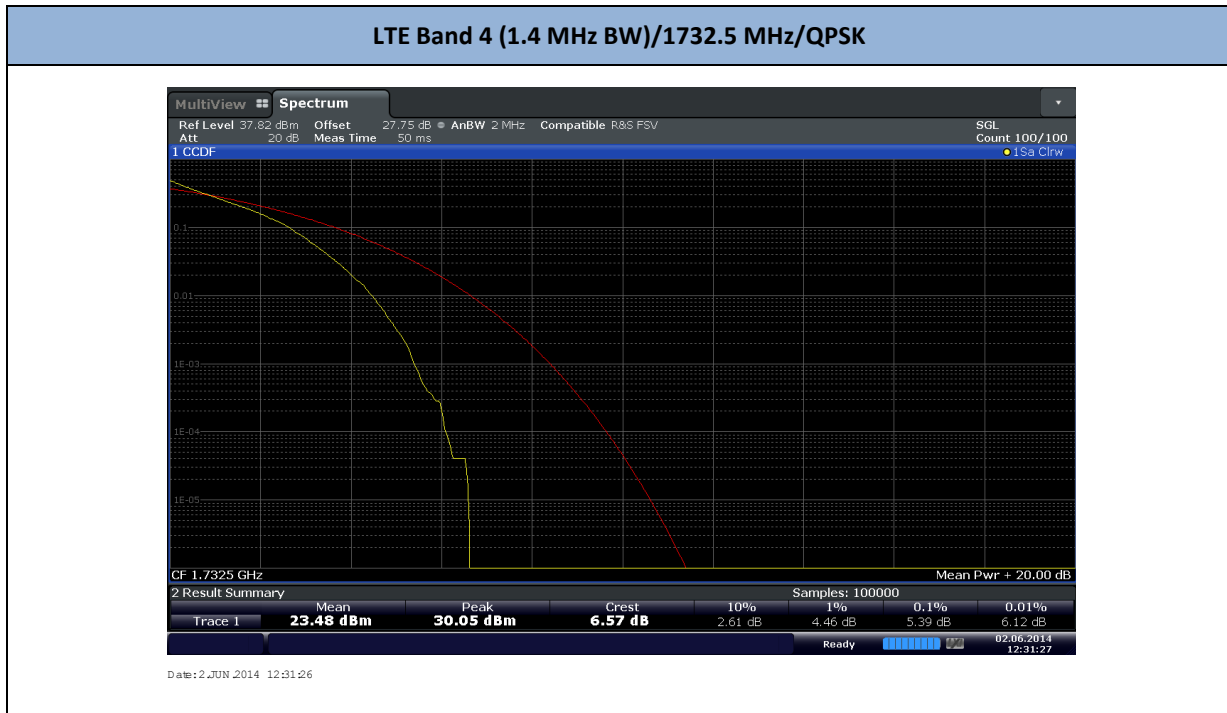
amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.

- 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 7.99 dB. EUT complies.

2.5.8 Test Results

See attached summary table and sample test plots.

Band / Frequency	Mean (dBm)	Peak (dBm)	0.1 % (dB)	Limit for 0.1 % (dB)
LTE Band 4 (1.4MHz BW)/1732.5MHz/QPSK	23.48	30.05	5.39	13
LTE Band 4 (3MHz BW)/1711.5MHz/QPSK	23.30	29.75	5.51	13
LTE Band 4 (5MHz BW)/1732.5MHz/QPSK	23.48	30.01	5.54	13
LTE Band 4 (10MHz BW)/1715MHz/QPSK	23.39	29.76	5.36	13
LTE Band 4 (15MHz BW)/1717.5MHz/QPSK	23.48	29.76	5.48	13
LTE Band 4 (20MHz BW)/1720MHz/QPSK	23.42	29.63	5.30	13
LTE Band 4 (1.4MHz BW)/1710.7MHz/16QAM	22.41	29.30	6.23	13
LTE Band 4 (3MHz BW)/1753.5MHz/16QAM	22.70	29.31	5.77	13
LTE Band 4 (5MHz BW)/1712.5MHz/16QAM	22.28	30.09	6.23	13
LTE Band 4 (10MHz BW)/1715MHz/16QAM	22.45	29.74	6.14	13
LTE Band 4 (15MHz BW)/1717.5MHz/16QAM	22.54	29.66	6.09	13
LTE Band 4 (20MHz BW)/1745MHz/16QAM	22.71	29.77	6.00	13
LTE Band 12 (5MHz BW)/701.5MHz/QPSK	22.62	29.44	5.65	13
LTE Band 12 (5MHz BW)/701.5MHz/16QAM	21.41	28.83	6.35	13
LTE Band 12 (10MHz BW)/704.0MHz/QPSK	22.84	29.74	5.48	13
LTE Band 12 (10MHz BW)/707.5MHz/16QAM	21.72	29.71	5.13	13





2.6 BAND EDGE

2.6.1 Specification Reference

27.53 (c)(2)(5), (g) and (g)(3) 27.53 (h) and RSS-130 (4.6.1) and RSS-139 (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.

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: SS220414800535 / 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	25.2°C
Relative Humidity	45.7%
ATM Pressure	98.9 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 v02 DR02-41372).
- The 27.75dB (Band 4) offset was used for the power splitter, external attenuator and cable used.



- The 27.6dB LTE Band 12 offset on the power meter was used for 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).
- All RB size available verified and the worst case size for band edge verification presented in this test report.

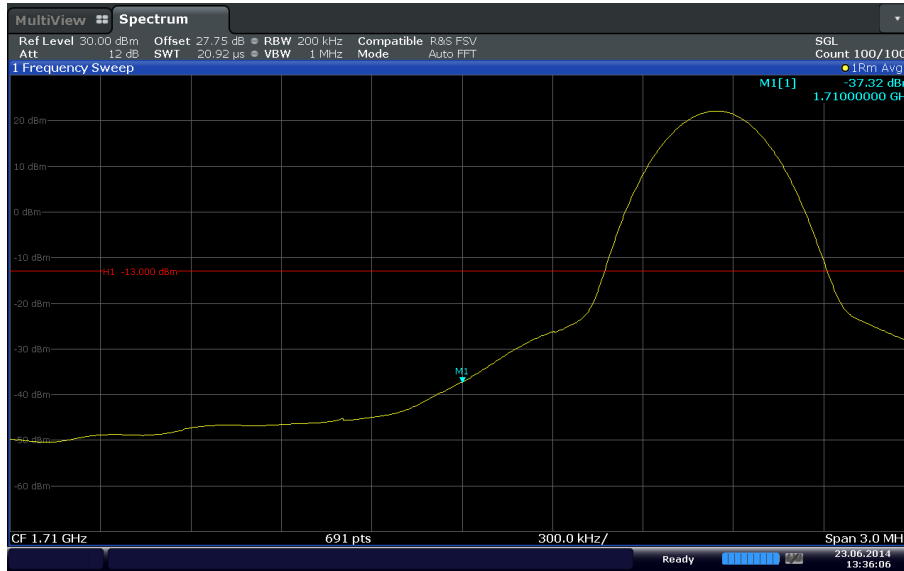
2.6.8 Test Results

See attached summary table and sample test plots.

Band / Mode / Frequency	Measured (dBm)	Limit (dBm)
LTE Band 4 (1.4MHz BW)/Low Channel (19957) Band Edge @ 1710MHz	-21.80	-13
LTE Band 4 (1.4MHz BW)/High Channel (20393) Band Edge @ 1755MHz	-19.65	-13
LTE Band 4 (3MHz BW)/Low Channel (19965) Band Edge @ 1710MHz	-18.38	-13
LTE Band 4 (3MHz BW)/High Channel (20385) Band Edge @ 1755MHz	-16.23	-13
LTE Band 4 (5MHz BW)/Low Channel (19975) Band Edge @ 1710MHz	-23.03	-13
LTE Band 4 (5MHz BW)/High Channel (20375) Band Edge @ 1755MHz	-21.98	-13
LTE Band 4 (10MHz BW)/Low Channel (20000) Band Edge @ 1710MHz	-34.83	-13
LTE Band 4 (10MHz BW)/High Channel (20350) Band Edge @ 1755MHz	-34.93	-13
LTE Band 4 (15MHz BW)/Low Channel (20025) Band Edge @ 1710MHz	-37.32	-13
LTE Band 4 (15MHz BW)/High Channel (20325) Band Edge @ 1755MHz	-39.67	-13
LTE Band 4 (20MHz BW)/Low Channel (20050) Band Edge @ 1710MHz	-46.03	-13
LTE Band 4 (20MHz BW)/High Channel (20300) Band Edge @ 1755MHz	-37.57	-13
LTE Band 12 (5MHz BW)/Low Channel (23035) Band Edge @ 698MHz/QPSK	-21.43	-13
LTE Band 12 (5MHz BW)/High Channel (23155) Band Edge @ 747MHz/QPSK	-29.52	-13
LTE Band 12 (10MHz BW)/Low Channel (23060) Band Edge @ 698MHz/QPSK	-21.89	-13
LTE Band 12 (10MHz BW)/High Channel (23130) Band Edge @ 747MHz/QPSK	-27.85	-13
LTE Band 12 (5MHz BW)/Low Channel (23035) Band Edge @ 698MHz/16QAM	-19.57	-13
LTE Band 12 (5MHz BW)/High Channel (23155) Band Edge @ 747MHz/16QAM	-19.57	-13
LTE Band 12 (10MHz BW)/Low Channel (23060) Band Edge @ 698MHz/16QAM	-22.12	-13
LTE Band 12 (10MHz BW)/High Channel (23130) Band Edge @ 747MHz/16QAM	-27.70	-13

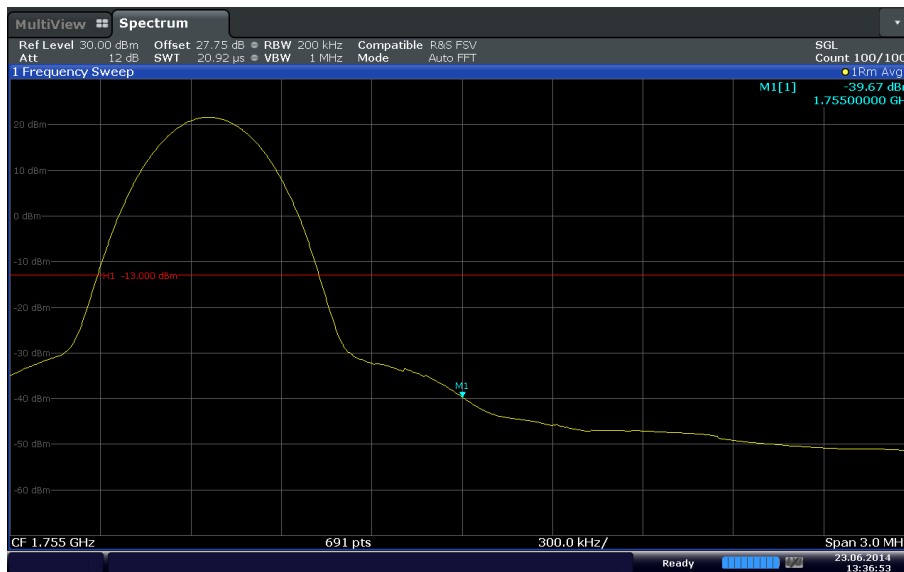


LTE Band 4 (15 MHz BW)/Low Channel (20025) Band Edge @ 1710 MHz



Date: 23 JUN 2014 13:36:06

LTE Band 4 (15 MHz BW)/High Channel (20325) Band Edge @ 1755 MHz



Date: 23 JUN 2014 13:36:53



2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

27.53 (c)(2)(5), (g) and (g)(3) 27.53 (h) and RSS-130 (4.6.1) and RSS-139 (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.

4.6.2 In addition to the limit outlined in Section 4.6.1 (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.

2.7.3 Equipment Under Test and Modification State

Serial No: SS220414800535 / Test Configuration A

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

June 03, 2014 and January 28, 2015/ AC

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	25.0°C
Relative Humidity	42.3%
ATM Pressure	98.9 kPa



2.7.7 Additional Observations

- This is a conducted test.
- The 27.75dB (Band 4) offset was used for the power splitter, external attenuator and cable used.
- The 27.6dB LTE Band 12 offset on the power meter was used for the power splitter, external attenuator and cable used.
- The spectrum was searched from 30MHz to the 10th harmonic (20GHz) for Band 4. Band 13 was verified up to 20GHz.
- 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).

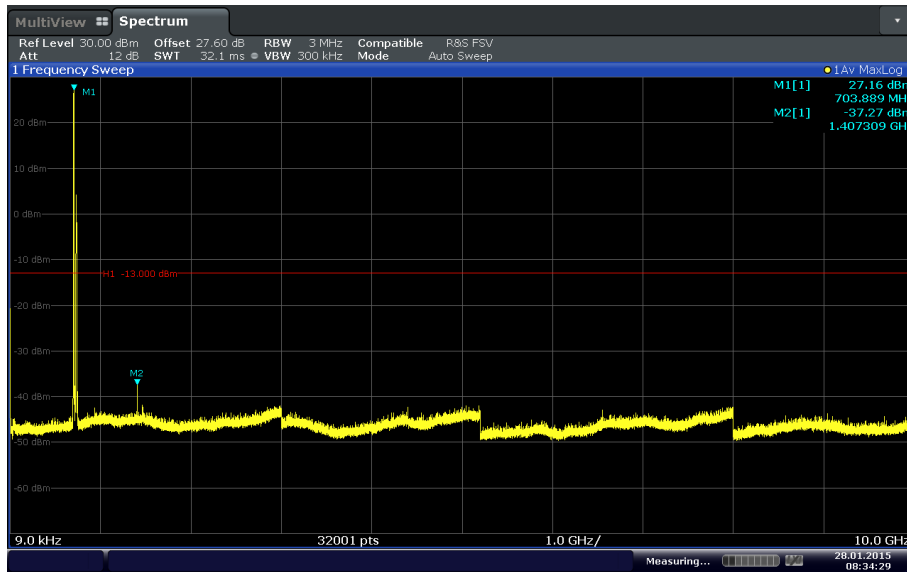
2.7.8 Test Results

Compliant. See attached summary table and sample test plots.

Conducted Spurious Emission from 30MHz to 20GHz			
Band / Mode / Frequency	Highest Emission Measured (dBm)	Limit (dBm)	Verdict
LTE Band 4 (1.4MHz BW)/Low Channel (19957)	-36.18	13	Complies
LTE Band 4 (1.4MHz BW)/Mid Channel (20175)	-36.55	13	Complies
LTE Band 4 (1.4MHz BW)/High Channel (20393)	-35.83	13	Complies
LTE Band 4 (3 MHz BW)/Low Channel (19965)	-35.79	13	Complies
LTE Band 4 (3MHz BW)/Mid Channel (20175)	-36.39	13	Complies
LTE Band 4 (3MHz BW)/High Channel (20385)	-35.80	13	Complies
LTE Band 4 (5 MHz BW)/Low Channel (19975)	-36.24	13	Complies
LTE Band 4 (5MHz BW)/Mid Channel (20175)	-35.32	13	Complies
LTE Band 4 (5MHz BW)/High Channel (20375)	-35.40	13	Complies
LTE Band 4 (10 MHz BW)/Low Channel (20000)	-36.34	13	Complies
LTE Band 4 (10MHz BW)/Mid Channel (20175)	-35.36	13	Complies
LTE Band 4 (10MHz BW)/High Channel (20350)	-35.37	13	Complies
LTE Band 4 (15 MHz BW)/Low Channel (20025)	-36.55	13	Complies
LTE Band 4 (15MHz BW)/Mid Channel (20175)	-36.80	13	Complies
LTE Band 4 (15MHz BW)/High Channel (20325)	-36.20	13	Complies
LTE Band 4 (20 MHz BW)/Low Channel (20050)	-36.39	13	Complies
LTE Band 4 (20MHz BW)/Mid Channel (20175)	-36.36	13	Complies
LTE Band 4 (20MHz BW)/High Channel (20300)	-36.48	13	Complies
LTE Band 12 (5MHz BW)/Channel (23035)/QPSK	-37.27	13	Complies
LTE Band 12 (10MHz BW)/Channel (23060)/QPSK	-35.45	13	Complies
LTE Band 12 (5MHz BW)/Channel (23035)/16QAM	-37.24	13	Complies
LTE Band 12 (10MHz BW)/Channel (23095)/16QAM	-37.05	13	Complies



LTE Band12_5M BW_QPSK_Channel 23035 @ 701.5MHz



Date: 28 JAN 2015 08:34:29



2.8 FIELD STRENGTH OF SPURIOUS RADIATION

2.8.1 Specification Reference

27.53 (c), (g) and Part 2.1053 27.53 (h) RSS-130(4.6.2) and RSS-139 (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.

4.6.2 In addition to the limit outlined in Section 4.6.1 (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.

6.5

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in watts) by at least $43 + 10 \log_{10}(P)$, dB.

(ii) After the first 1.0 MHz outside the equipment's operating frequency block, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in watts) by at least $43 + 10 \log_{10}(P)$, dB

2.8.3 Equipment Under Test and Modification State

Serial No: SS220414800535 / Test Configuration A

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

June 20, 2014 and February 12, 2015 / AC

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	25.1°C
Relative Humidity	44.5%
ATM Pressure	98.7 kPa

2.8.7 Additional Observations

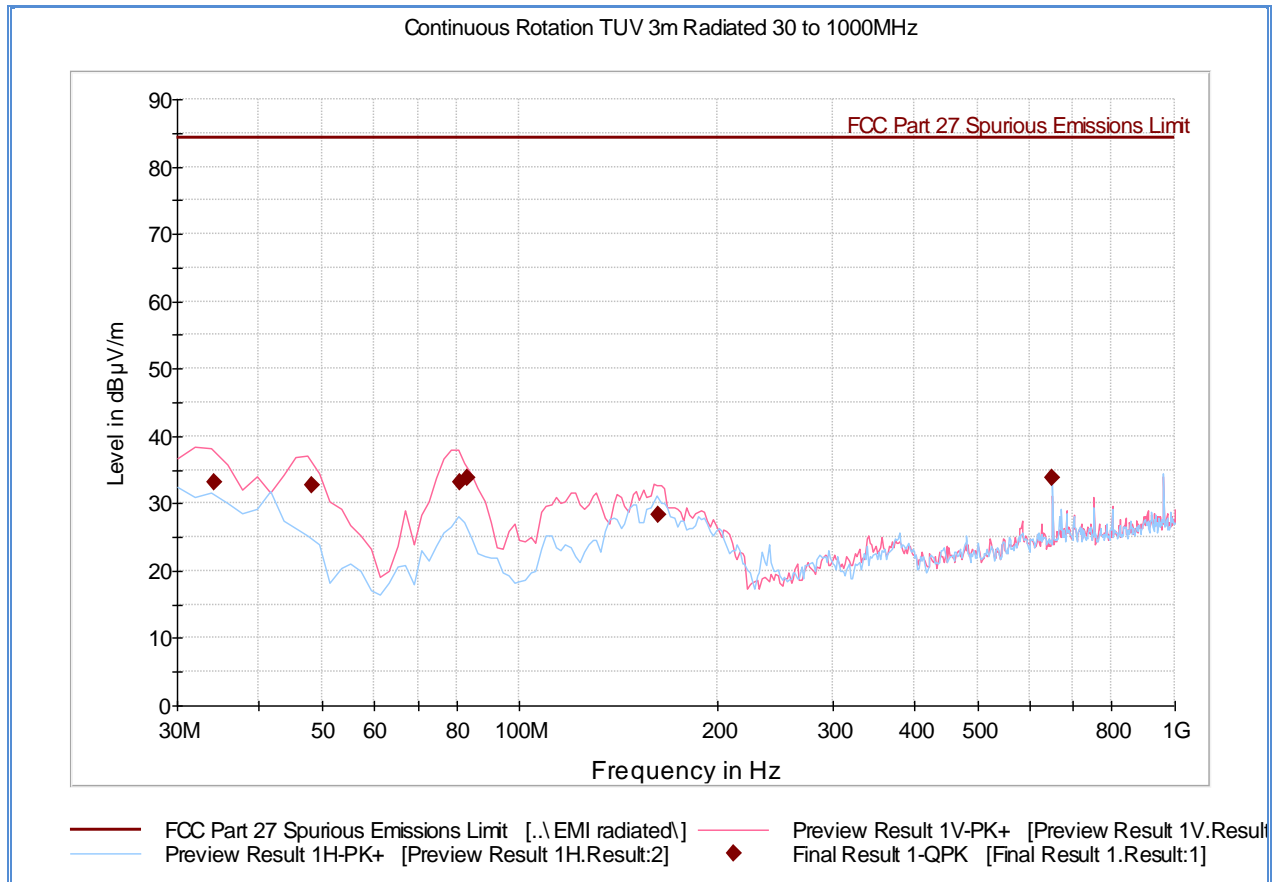
- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Only the worst case configuration presented in this test report.
- There are no emissions found that doesn't comply with -13dBW limit in the 698-747 MHz frequency range. This limit corresponds to 84.4dBµV/m @ 3 meters.
- There are no emission found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- 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 worst case presented



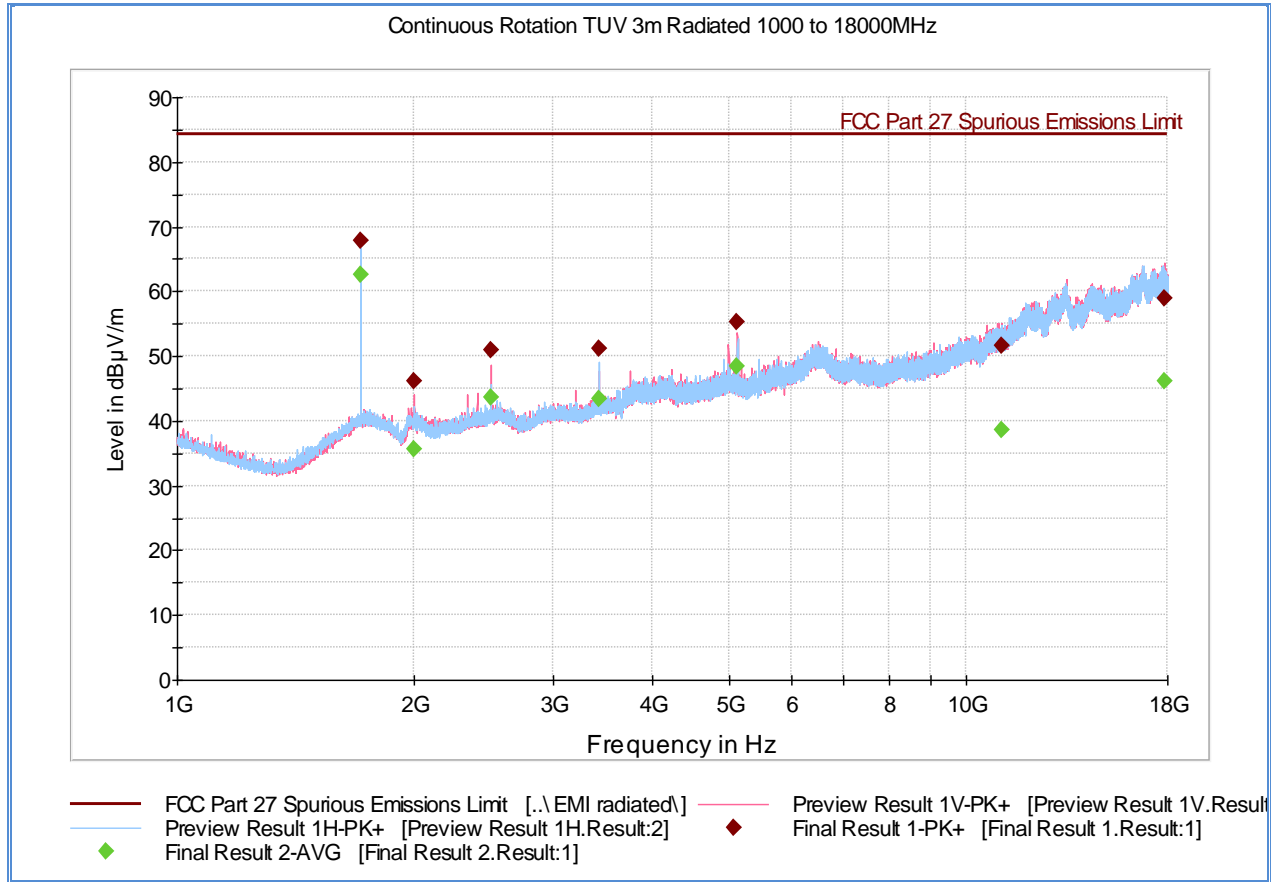
Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
34.120000	33.1	1000.0	120.000	100.0	V	239.0	-12.9	51.3	84.4
48.134990	32.8	1000.0	120.000	100.0	V	211.0	-18.3	51.6	84.4
80.997194	33.0	1000.0	120.000	106.0	V	358.0	-21.0	51.4	84.4
82.972745	33.8	1000.0	120.000	100.0	V	134.0	-20.8	50.6	84.4
162.920481	28.3	1000.0	120.000	106.0	V	213.0	-17.3	56.1	84.4
649.980200	33.8	1000.0	120.000	100.0	H	146.0	-2.7	50.6	84.4

Test Notes: Only worst case channel presented for spurious emissions below 1GHz in band 4. Plot presented in band 4, mid channel (20175), 5MHz channel bandwidth with QPSK modulation and RB size/offset of 1/24. Emissions within 20dB of the Part 27 Subpart C §27.53 limit are proven by substitution method. However no such emission observed.



2.8.10 Test Results Above 1GHz – Band 4 (Low Channel Worst Case Configuration)



Peak and Average Data

Frequency (MHz)	Max Peak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1710.233333	67.9	62.5	1000.0	1000.000	99.7	H	118.0		Fundamental		
2000.200000	46.3	35.6	1000.0	1000.000	196.5	V	-3.0	-1.0	38.2	48.8	84.4
2500.166667	50.9	43.5	1000.0	1000.000	103.7	V	349.0	0.2	33.5	40.9	84.4
3420.633333	51.2	43.5	1000.0	1000.000	100.7	H	149.0	2.4	33.2	40.9	84.4
5130.833333	55.3	48.4	1000.0	1000.000	200.5	V	116.0	7.7	29.1	36.0	84.4
11076.300000	51.7	38.5	1000.0	1000.000	279.3	V	289.0	16.7	32.7	45.9	84.4
17826.833333	59.0	46.2	1000.0	1000.000	270.3	V	140.0	25.7	25.4	38.2	84.4

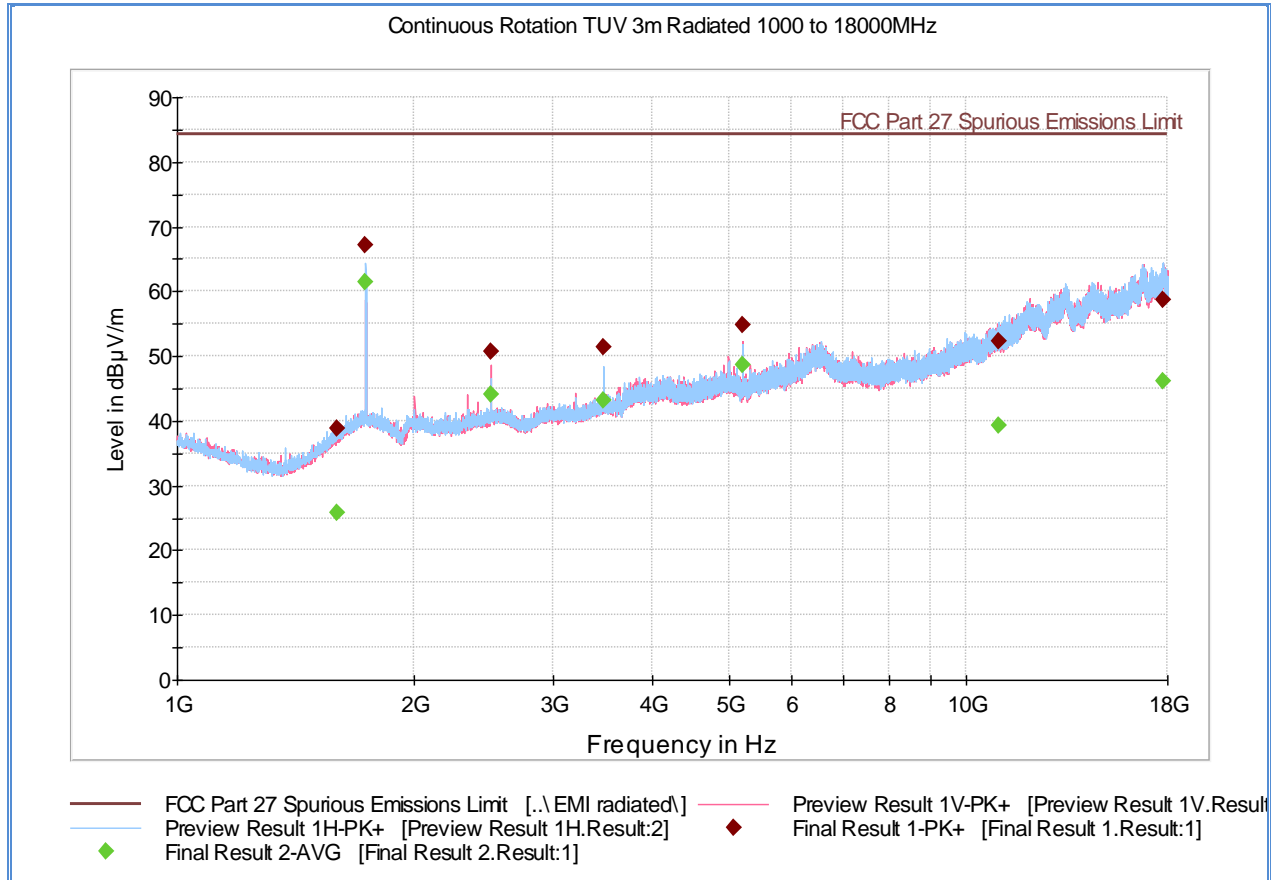
Substitution Data

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

Test Notes: Only worst case modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 2GHz high pass filter. 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 – Band 4 (Mid Channel Worst Case Configuration)



Peak and Average Data

Frequency (MHz)	Max Peak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1593.266667	38.8	25.7	1000.0	1000.000	302.2	H	17.0	-4.9	45.6	58.7	84.4
1734.600000	67.1	61.3	1000.0	1000.000	128.7	H	108.0	Fundamental			
2500.166667	50.7	44.1	1000.0	1000.000	103.7	V	337.0	0.2	33.7	40.3	84.4
3469.166667	51.4	43.2	1000.0	1000.000	99.7	H	148.0	2.6	33.0	41.2	84.4
5203.900000	54.9	48.8	1000.0	1000.000	200.5	V	104.0	7.8	29.5	35.6	84.4
11000.166667	52.2	39.3	1000.0	1000.000	267.3	H	344.0	17.1	32.2	45.1	84.4
17766.533333	58.7	46.3	1000.0	1000.000	161.6	H	119.0	25.8	25.7	38.1	84.4

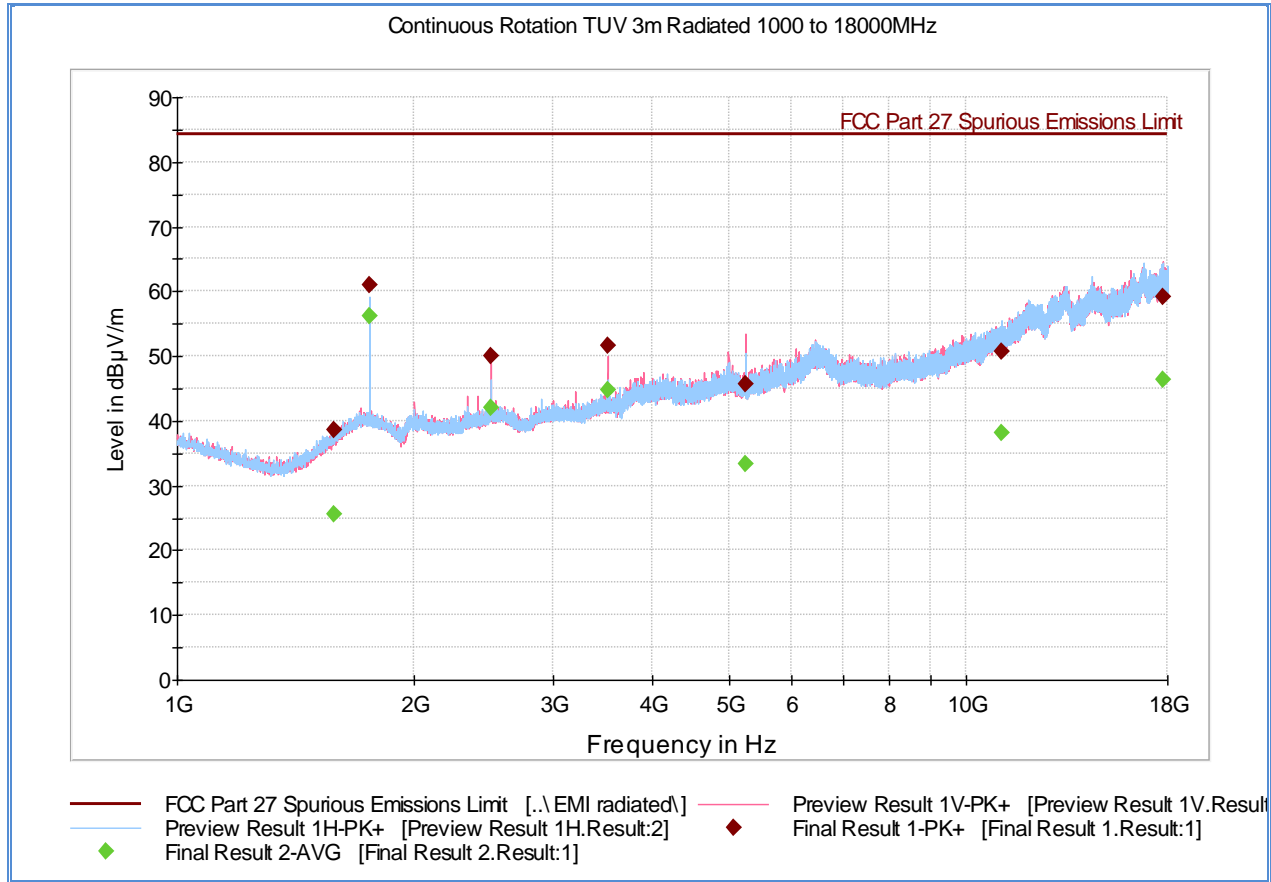
Substitution Data

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/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 2GHz high pass filter. 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 4 (High Channel Worst Case Configuration)



Peak and Average Data

Frequency (MHz)	Max Peak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1581.933333	38.6	25.6	1000.0	1000.000	404.4	H	234.0	-4.9	45.8	58.8	84.4
1754.633333	61.1	56.1	1000.0	1000.000	99.7	H	72.0		Fundamental		
2500.166667	50.1	42.1	1000.0	1000.000	99.7	V	356.0	0.2	34.3	42.3	84.4
3509.400000	51.7	44.7	1000.0	1000.000	113.7	V	81.0	2.7	32.7	39.7	84.4
5264.000000	45.8	33.3	1000.0	1000.000	136.6	V	356.0	7.9	38.6	51.1	84.4
11113.133333	50.8	38.2	1000.0	1000.000	201.5	H	-3.0	16.5	33.6	46.2	84.4
17741.166667	59.2	46.3	1000.0	1000.000	404.4	V	331.0	25.8	25.2	38.1	84.4

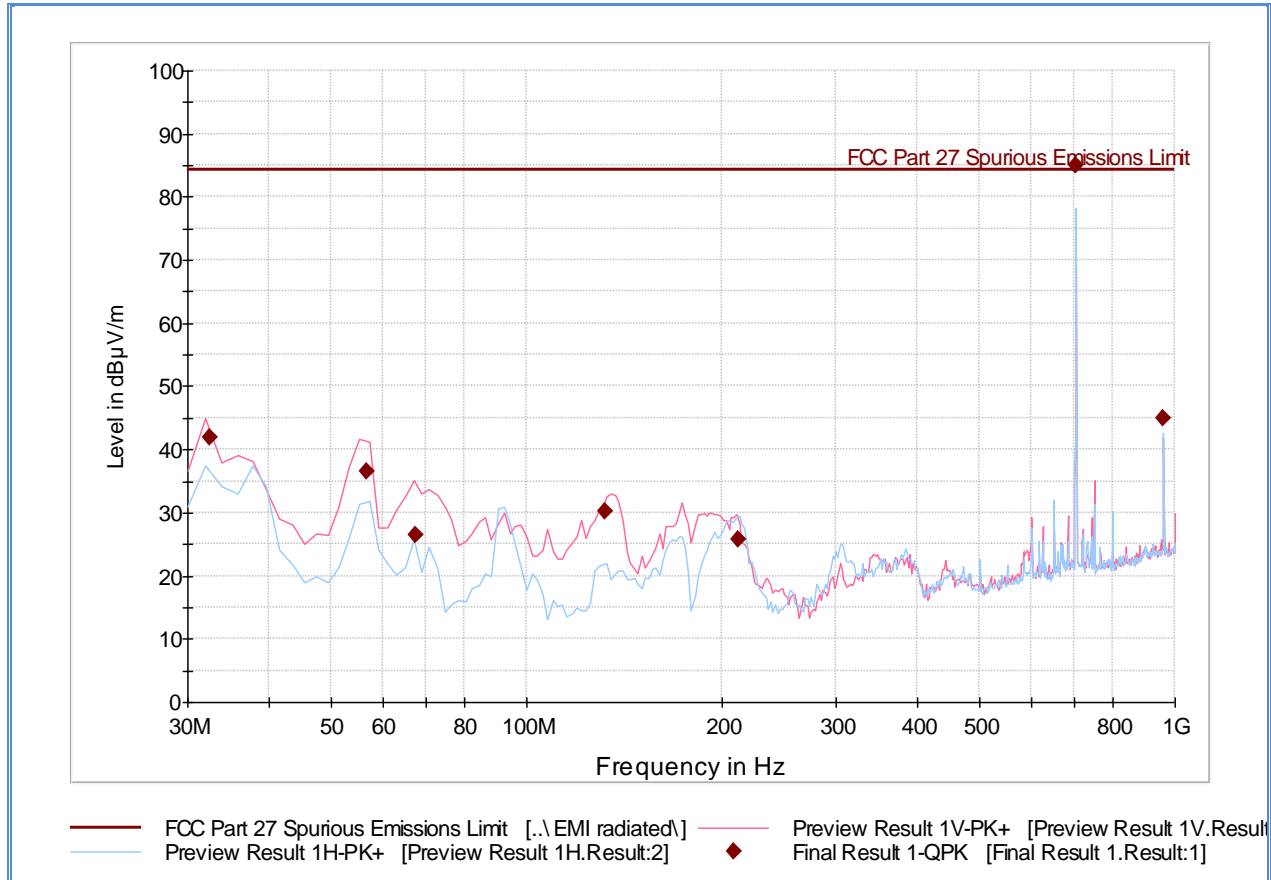
Substitution Data

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/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 2GHz high pass filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.8.13 Test Results Below 1GHz (LTE Band12_5M BW_QPSK_Channel 23035 @ Frequency 701.5)



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)
32.520000	42.0	1000.0	120.000	100.0	V	148.0	-12.4	42.4	84.4
56.750541	36.5	1000.0	120.000	100.0	V	142.0	-21.0	47.9	84.4
67.333868	26.6	1000.0	120.000	100.0	V	252.0	-21.9	57.8	84.4
132.169940	30.3	1000.0	120.000	100.0	V	91.0	-20.5	54.1	84.4
212.381563	25.8	1000.0	120.000	100.0	V	144.0	-15.6	58.6	84.4
703.729058	84.9	1000.0	120.000	109.0	H	4.0	-1.3	Fundamental *)	
959.962244	44.9	1000.0	120.000	159.0	H	113.0	1.4	39.5	84.4

*) this is the fundamental frequency is not part of spurious emission evaluation. Data show for information purpose only.

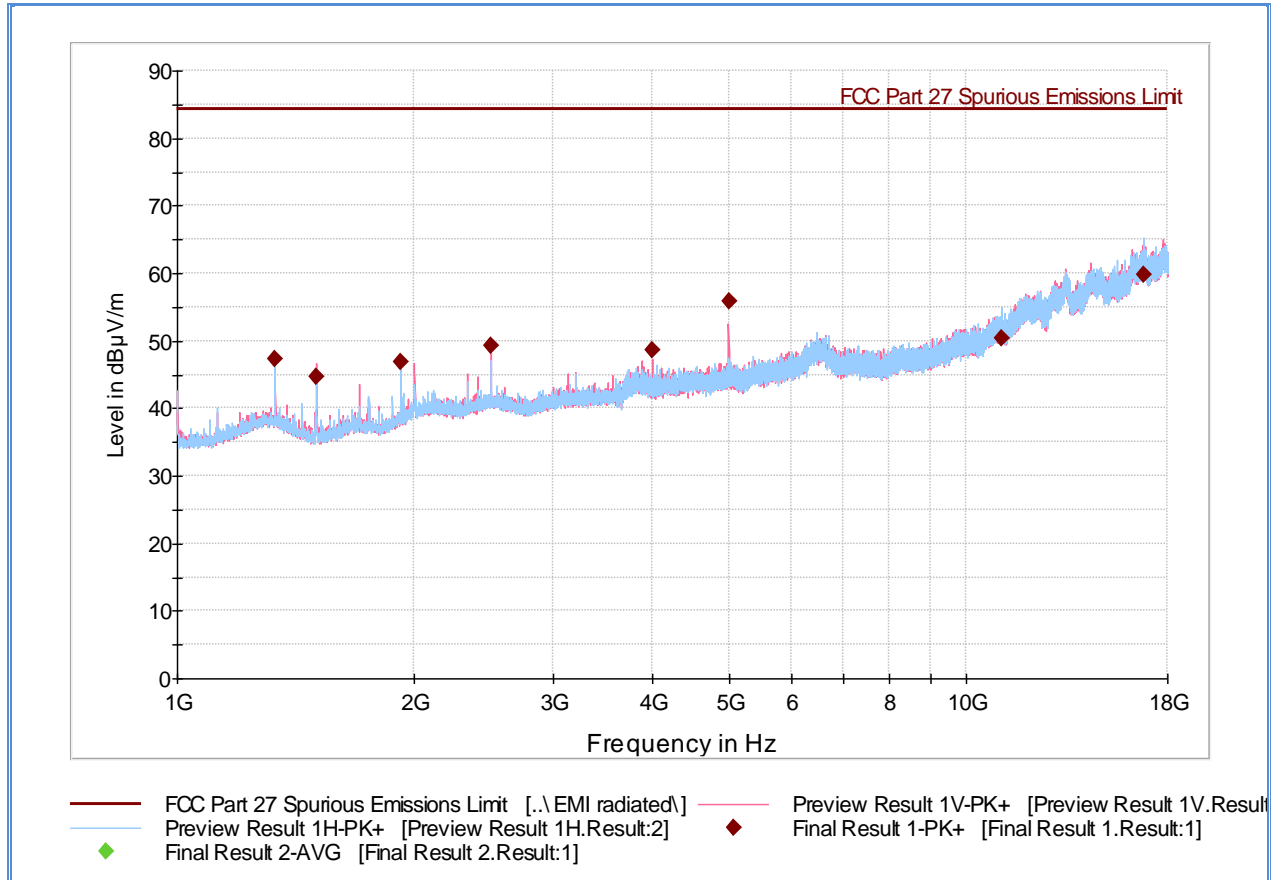
Substitution Data

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 configuration presented for spurious emissions below 1GHz. Substitution data not needed since Peak data > 20dB in all peaks.



2.8.14 Test Results Above 1GHz (LTE Band12_5M BW_QPSK_Channel 23035 @ Frequency 701.5MHz)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1331.700000	47.3	1000.0	1000.000	116.7	V	178.0	-5.4	37.1	84.4
1500.000000	44.6	1000.0	1000.000	182.6	H	43.0	-5.6	39.8	84.4
1919.900000	46.9	1000.0	1000.000	201.3	H	97.0	-1.9	37.5	84.4
2500.000000	49.3	1000.0	1000.000	173.6	V	353.0	0.2	35.1	84.4
4000.166667	48.6	1000.0	1000.000	172.6	V	9.0	4.9	35.8	84.4
4999.933333	55.9	1000.0	1000.000	149.6	V	337.0	6.5	28.5	84.4
11079.100000	50.4	1000.0	1000.000	102.7	H	35.0	15.2	34.0	84.4
16817.733333	59.8	1000.0	1000.000	227.4	H	262.0	26.3	24.6	84.4

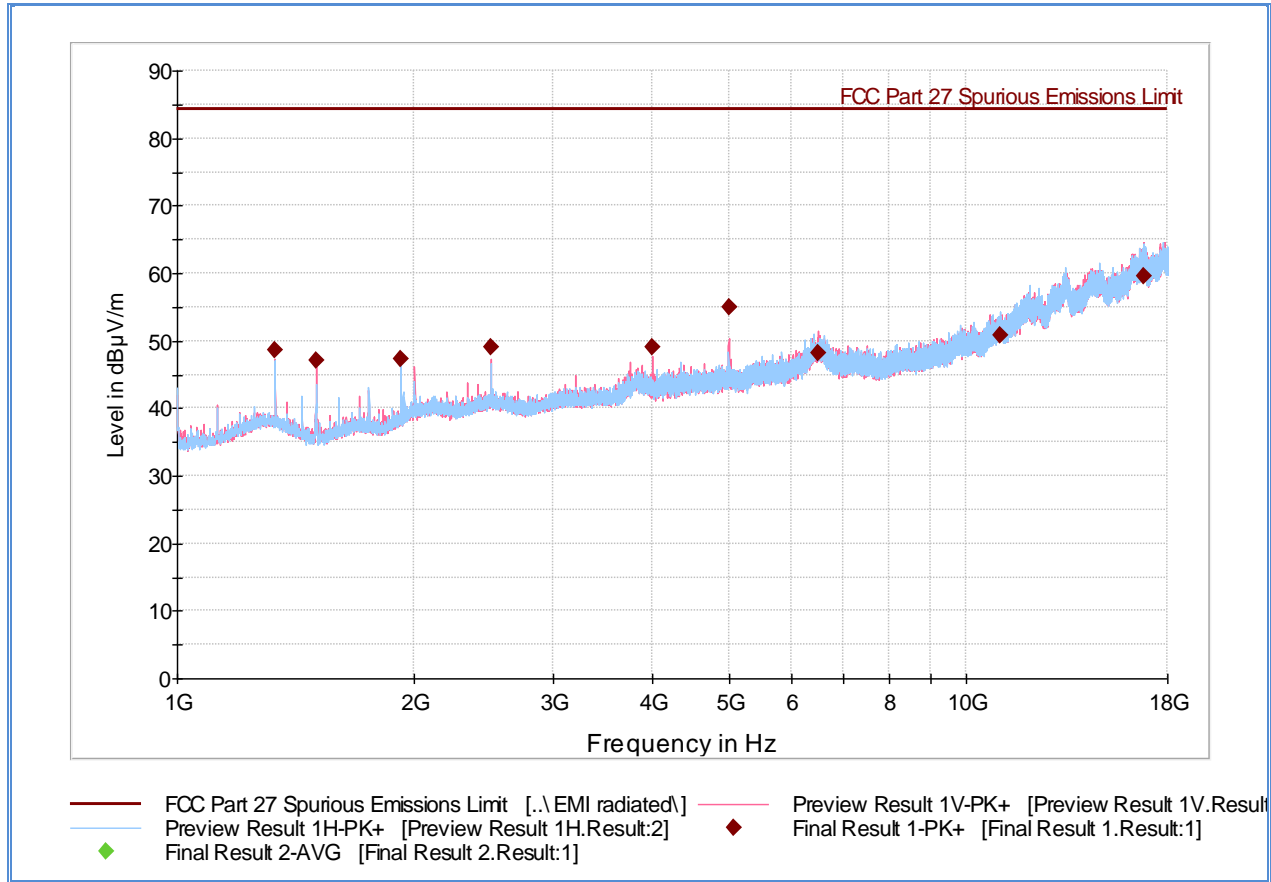
Substitution Data

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 configuration in modulation, bandwidth and RB size presented for spurious emissions above 1GHz. Substitution data not needed since Peak data > 20dB in all peaks.



2.8.15 Test Results Above 1GHz (LTE Band12_10M BW_QPSK_Channel 23060 @ Frequency 704.0MHz)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1332.300000	48.5	1000.0	1000.000	103.7	V	174.0	-5.4	35.9	84.4
1500.000000	47.1	1000.0	1000.000	332.2	V	37.0	-5.6	37.3	84.4
1919.900000	47.3	1000.0	1000.000	201.3	H	99.0	-1.9	37.1	84.4
2499.800000	49.0	1000.0	1000.000	100.7	V	352.0	0.2	35.4	84.4
3999.733333	49.1	1000.0	1000.000	140.7	V	3.0	4.9	35.3	84.4
4999.900000	54.9	1000.0	1000.000	99.7	V	334.0	6.5	29.5	84.4
6485.200000	48.2	1000.0	1000.000	180.6	V	153.0	11.5	36.2	84.4
11048.366667	50.8	1000.0	1000.000	331.2	H	212.0	15.4	33.6	84.4
16787.166667	59.5	1000.0	1000.000	301.6	V	163.0	26.4	24.9	84.4

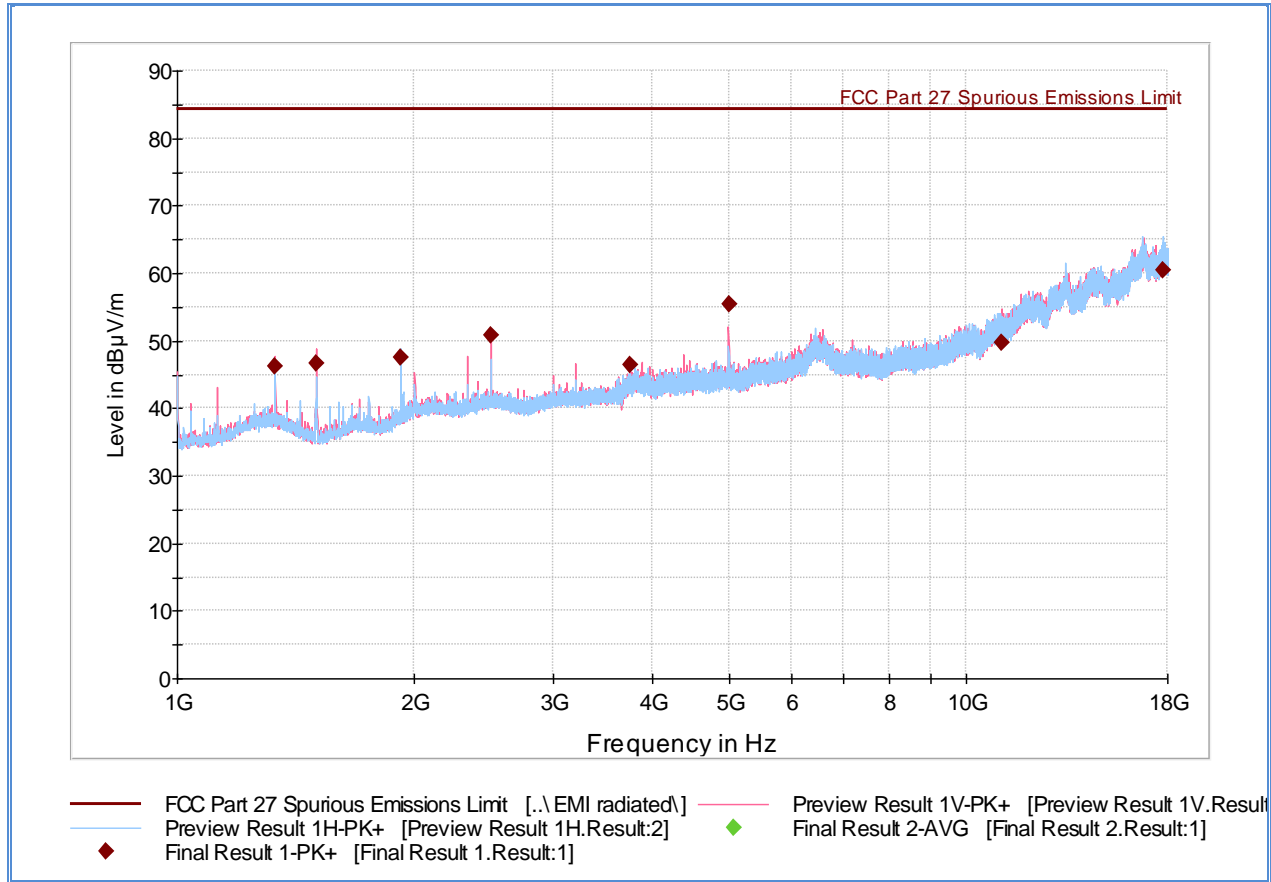
Substitution Data

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 configuration in modulation, bandwidth and RB size presented for spurious emissions above 1GHz. Substitution data not needed since Peak data > 20dB in all peaks.



2.8.16 Test Results Above 1GHz (LTE Band12_5M BW_16QAM_Channel 23155 @ Frequency 713.5MHz)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1331.900000	46.2	1000.0	1000.000	181.6	V	155.0	-5.4	38.2	84.4
1500.200000	46.7	1000.0	1000.000	135.7	V	153.0	-5.6	37.7	84.4
1920.100000	47.6	1000.0	1000.000	201.3	H	111.0	-1.9	36.8	84.4
2499.766667	50.8	1000.0	1000.000	103.7	V	14.0	0.2	33.6	84.4
3749.833333	46.5	1000.0	1000.000	182.6	V	27.0	4.5	37.9	84.4
4999.933333	55.4	1000.0	1000.000	156.6	V	337.0	6.5	29.0	84.4
11114.266667	49.7	1000.0	1000.000	191.5	V	257.0	15.1	34.7	84.4
17777.500000	60.5	1000.0	1000.000	114.7	H	157.0	26.0	23.9	84.4

Substitution Data

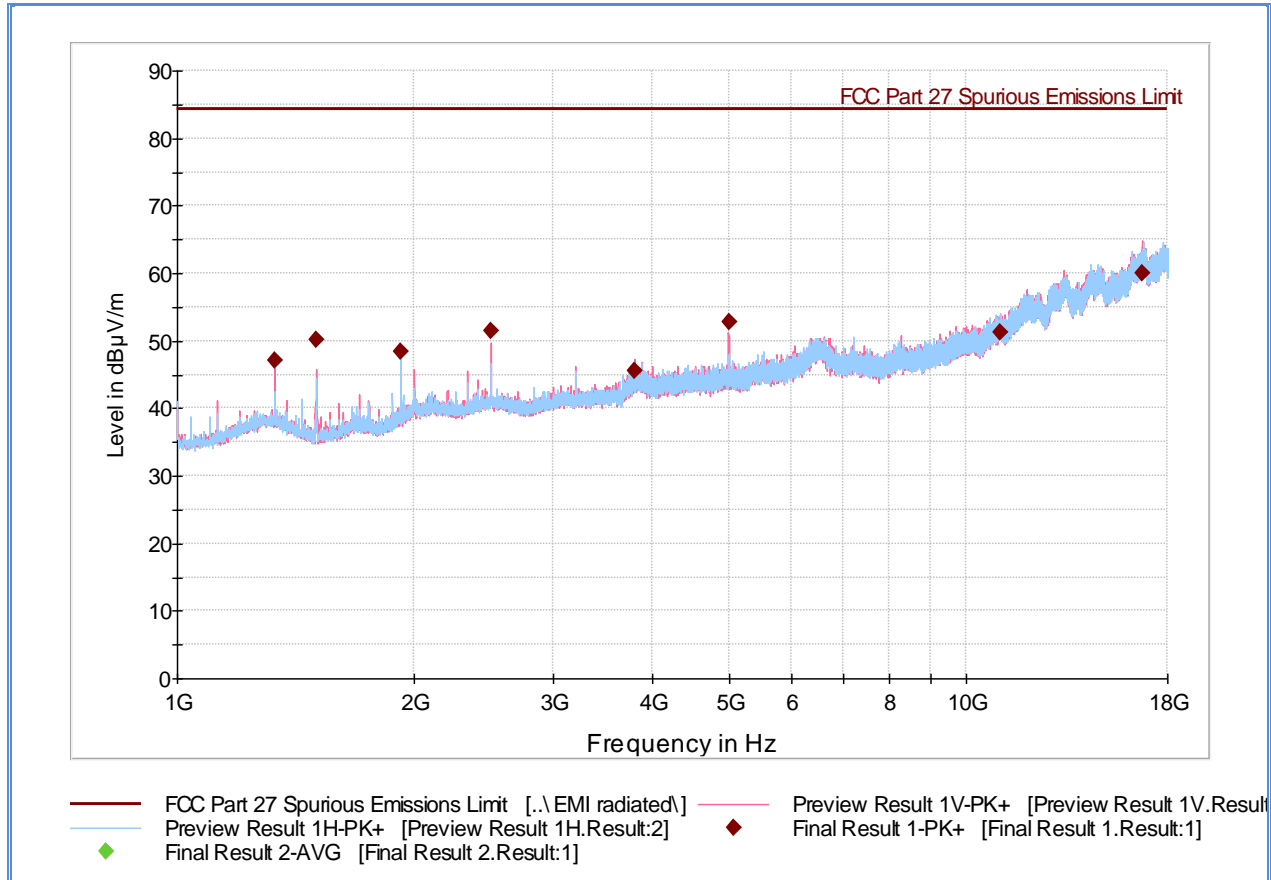
Frequency (MHz)	Field Strength @ 3 meters (dBµV/m)	Cable Loss (dB)	Substitution Antenna Gain (dBi)	Signal Generator Level (dBm)	Substitution Data SGL+AG-CL (dBm)	Limit (dBm)	Compliance (Margin in dB)

Test Notes Only worst case configuration in modulation, bandwidth and RB size presented for spurious emissions above 1GHz. Substitution data not needed since Peak data > 20dB in all peaks.



America

2.8.17 Test Results Above 1GHz (LTE Band12_10M BW_16QAM_Channel 23095 @ Frequency 707.5MHz)



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1331.866667	47.0	1000.0	1000.000	103.7	V	176.0	-5.4	37.4	84.4
1500.000000	50.1	1000.0	1000.000	279.3	V	30.0	-5.6	34.3	84.4
1919.900000	48.4	1000.0	1000.000	101.7	H	105.0	-1.9	36.0	84.4
2500.166667	51.5	1000.0	1000.000	116.7	V	36.0	0.2	32.9	84.4
3806.000000	45.5	1000.0	1000.000	406.7	V	345.0	5.2	38.9	84.4
4999.933333	52.8	1000.0	1000.000	160.6	V	345.0	6.5	31.6	84.4
11065.500000	51.3	1000.0	1000.000	407.7	H	297.0	15.3	33.1	84.4
16759.400000	60.0	1000.0	1000.000	296.3	V	-3.0	26.3	24.4	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 configuration in modulation, bandwidth and RB size presented for spurious emissions above 1GHz. Substitution data not needed since Peak data > 20dB in all peaks.



2.9 FREQUENCY STABILITY

2.9.1 Specification Reference

27.54, Part 2.1055 (a)(1) and (d)(1) RSS-130(4.3) and 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.

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: SS220414800535 / Test Configuration A

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

June 18, 2014 and January 12, 2015 / AC

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	25.1°C
Relative Humidity	44.5%
ATM Pressure	98.7 kPa

2.9.7 Additional Observations

- This is a conducted test. The EUT was operated at 3.8 VDC 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 performed. The temperature was set 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:

2.9.8 Test Results Summary

LTE Band 4 – QPSK 5MHz - Channel 19975– Frequency 1712.5MHz – RB 1/0				
Voltage (%)	Power (VDC)	Temp (°C)	Frequency Deviation (Hz)	Complies (Y or N)
100	3.8	-30	14.88	EUT complies
100		-20	11.70	
100		-10	13.63	
100		0	16.35	
100		+10	11.22	
100		+20	11.22	
100		+30	8.87	
100		+40	13.79	
100		+50	10.24	
115		4.37	+20	
85	3.23	+20	-14.78	

LTE Band 4 worst case frequency error: 16.35 Hz
 Worst case 99% OBW of LTE Band 4 5.0MHz BW: 4.47 MHz

Low Channel Sample Calculation:

Edge of fundamental emission (1712.5-(4.47/2)) : 1710.265 MHz
 Max. fundamental frequency error (1710.265 - 0.00001635): 1710.237037 MHz
 EUT complies. 1710.237037 MHz > 1710 MHz (edge of authorized band)

High Channel Sample Calculation:

Edge of fundamental emission (1752.5+ (4.47/2)) : 1754.735 MHz
 Max. fundamental frequency error (1754.735 - 0.00001635): 1754.735016 MHz
 EUT complies. 1754.735016 MHz < 1755 MHz (edge of authorized band)



LTE Band 12 – QPSK 5MHz BW - Low Channel 23035– Frequency 701.5MHz – RB 1/24				
Voltage (%)	Power (VDC)	Temp (°C)	Frequency Deviation (Hz)	Complies (Y or N)
100	3.8	-30	-6.37	EUT complies. See Section 2.8.7 for sample calculation
100		-20	-6.58	
100		-10	-6.02	
100		0	-5.99	
100		+10	-6.17	
100		+20	-4.82	
100		+30	-5.46	
100		+40	-6.88	
100		+50	--6.78	
115		4.37	+20	
85	3.23	+20	-4.59	

LTE Band 12 worst case frequency error: -6.88 Hz
 Worst case EBW (-26dB) of LTE Band 12 10MHz BW: 9.75 MHz

Low Channel Sample Calculation:

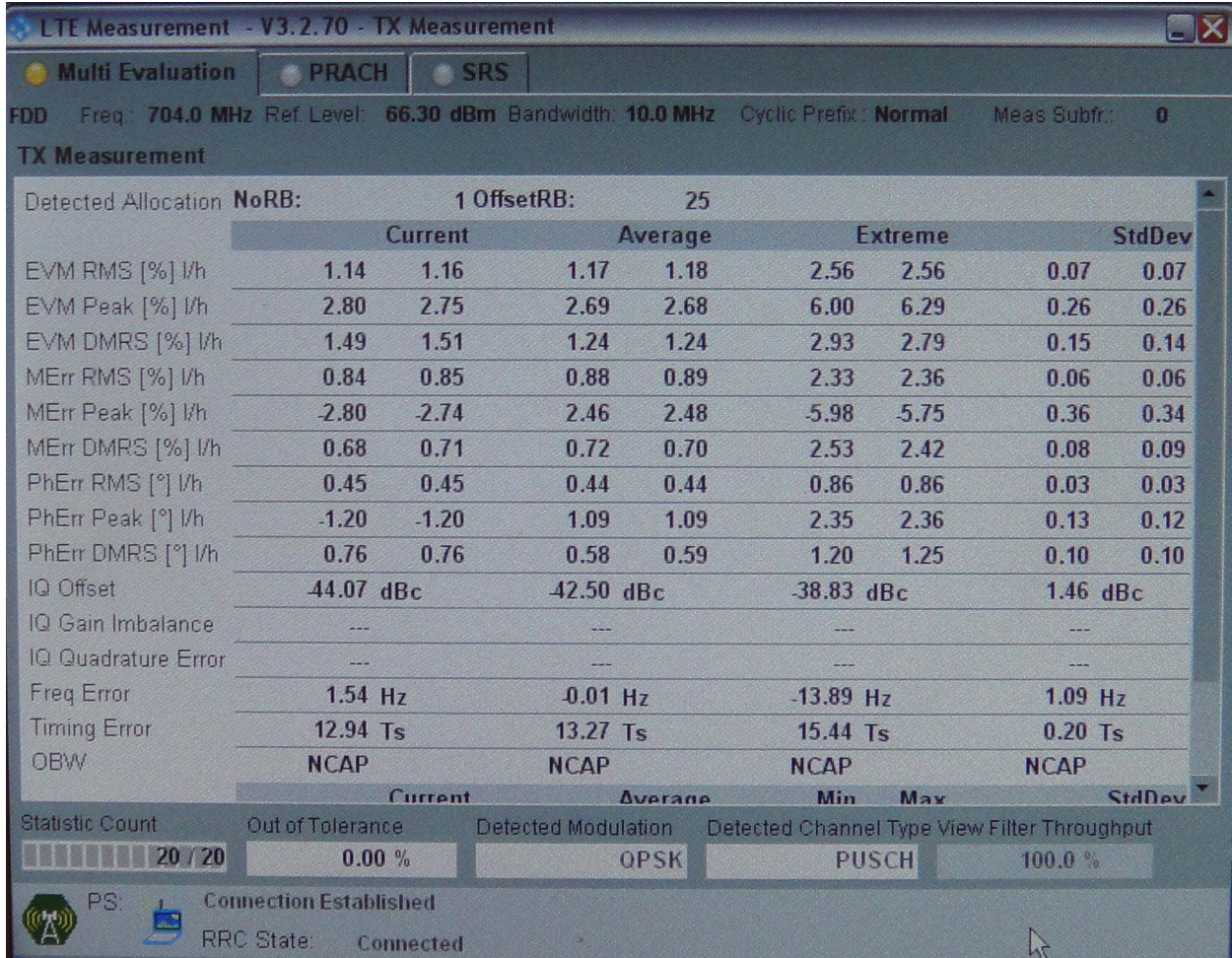
Edge of fundamental emission (701.5-(9.75/2)): 696.62500 MHz
 Max. fundamental frequency error (696.62500 - 0.00000688): 696.62599 MHz
 EUT complies. 696.62599 MHz > 698 MHz (edge of authorized band)

High Channel Sample Calculation:

Edge of fundamental emission (701.5+ (9.75/2)): 706.37500 MHz
 Max. fundamental frequency error (706.37500 + 0.00000688): 706.37501 MHz
 EUT complies. 706.37501 MHz < 746 MHz (edge of authorized band)



2.9.9 Sample Test Plot (FCC)





2.10 RECEIVER SPURIOUS EMISSIONS

2.10.1 Specification Reference

RSS-GEN (7.0)

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: SS220414800535 / Test Configuration A

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

March 14, 2015 / AC and IR

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	22.3-23.3°C
Relative Humidity	47.0-50.0%
ATM Pressure	99.8-99.9 kPa

2.10.7 Additional Observations

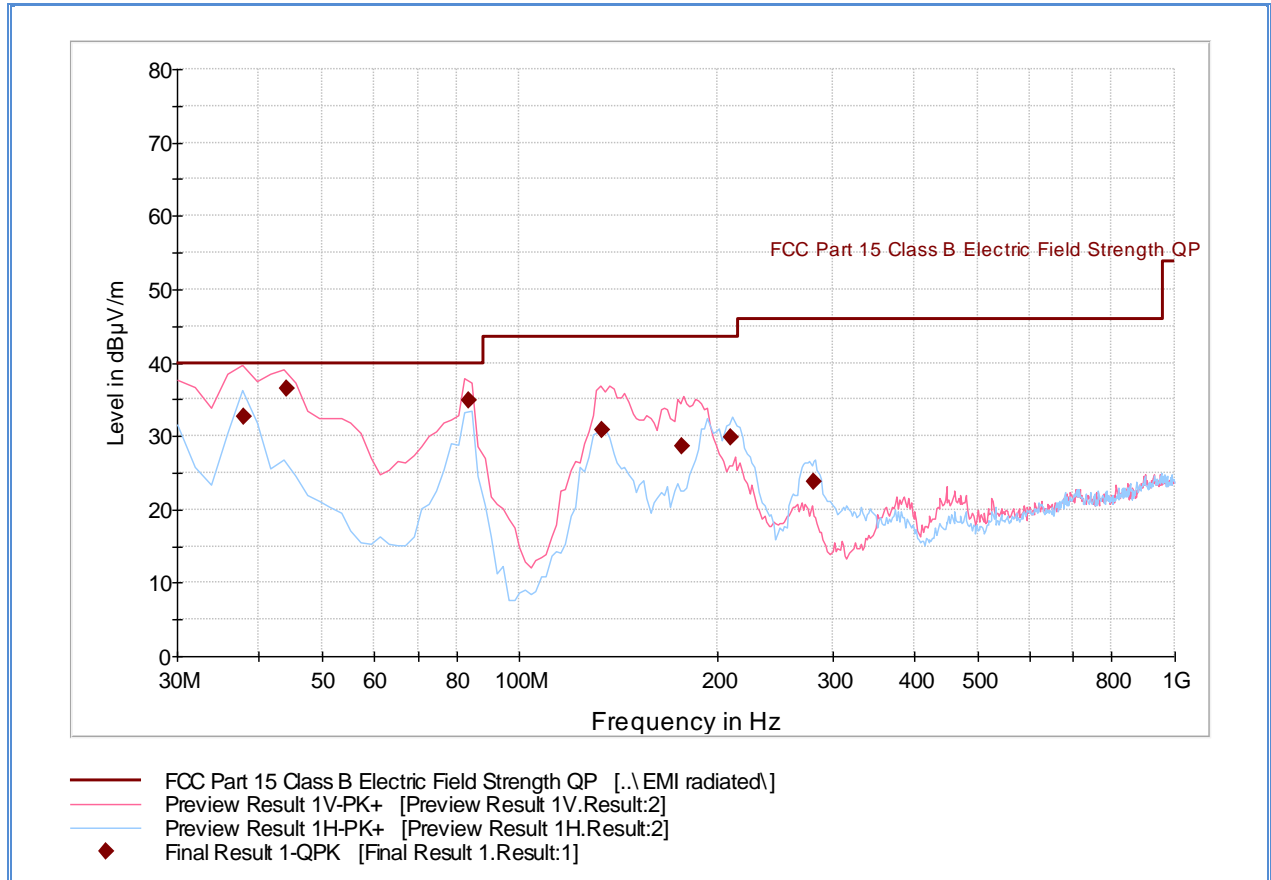
- This is a radiated test. The spectrum was searched from 30MHz to the 18GHz (6GHz as per requirement).
- Limit used is from FCC §15.209 which is identical to RSS-Gen limits.
- There are no separate receive mode configurable during verification, the EUT was verified in stand-by mode.
- Measurement was 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)

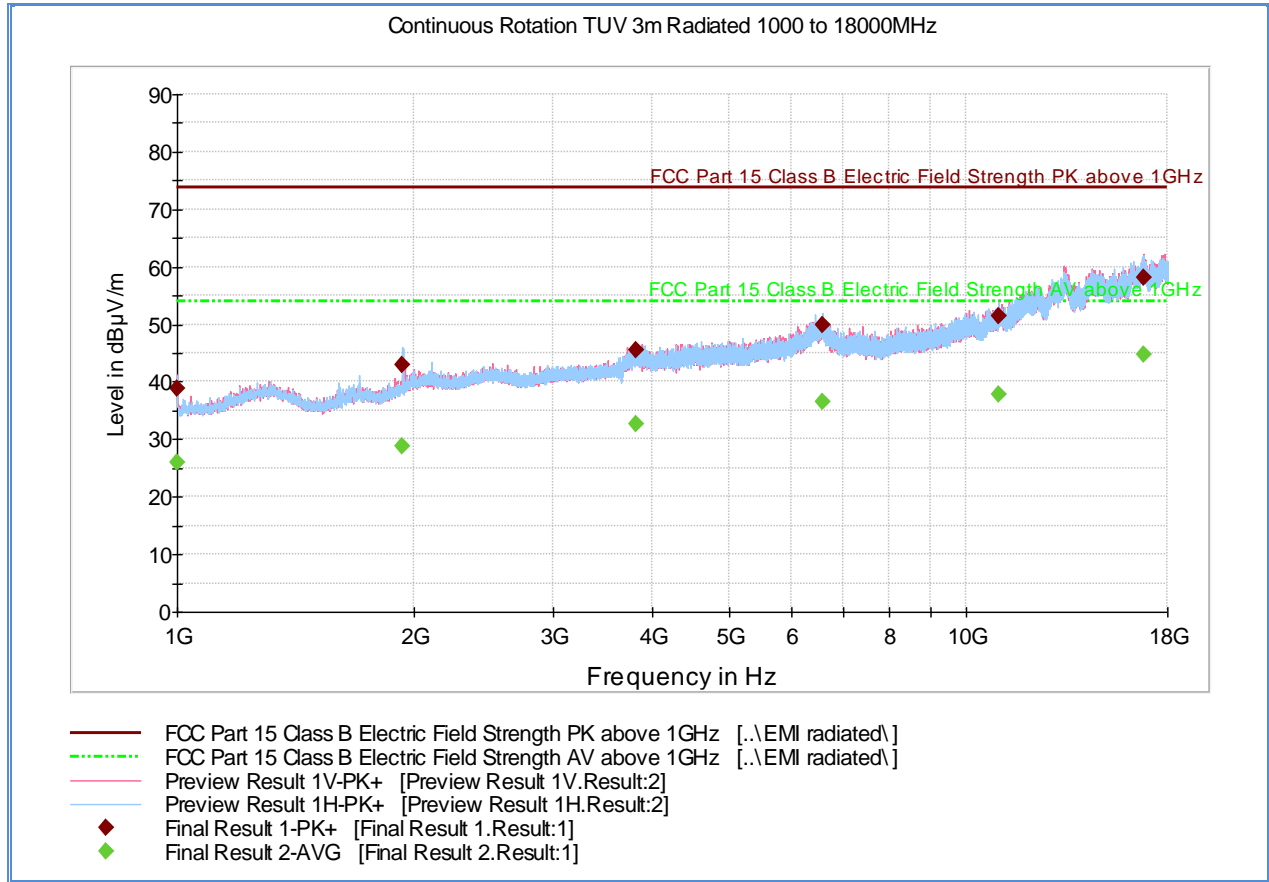


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
37.895551	32.7	1000.0	120.000	100.0	V	18.0	-15.2	7.3	40.0
44.087214	36.5	1000.0	120.000	106.0	V	145.0	-17.9	3.5	40.0
83.684970	34.9	1000.0	120.000	100.0	V	175.0	-21.4	5.1	40.0
133.473828	30.9	1000.0	120.000	100.0	V	-10.0	-20.3	12.6	43.5
176.695471	28.6	1000.0	120.000	100.0	V	-8.0	-17.6	14.9	43.5
209.821563	29.7	1000.0	120.000	150.0	H	33.0	-15.8	13.8	43.5
280.561523	23.8	1000.0	120.000	100.0	H	165.0	-13.1	22.2	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	38.9	1000.0	1000.000	130.7	V	23.0	-7.4	35.0	73.9
1931.966667	43.0	1000.0	1000.000	333.1	H	206.0	-2.0	30.9	73.9
3815.033333	45.6	1000.0	1000.000	379.1	V	289.0	4.9	28.3	73.9
6583.000000	49.8	1000.0	1000.000	403.3	H	179.0	11.2	24.1	73.9
11015.10000	51.4	1000.0	1000.000	378.1	V	212.0	14.8	22.5	73.9
16805.50000	58.0	1000.0	1000.000	403.3	V	61.0	23.6	15.9	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	25.9	1000.0	1000.000	130.7	V	23.0	-7.4	28.0	53.9
1931.966667	28.9	1000.0	1000.000	333.1	H	206.0	-2.0	25.0	53.9
3815.033333	32.7	1000.0	1000.000	379.1	V	289.0	4.9	21.2	53.9
6583.000000	36.5	1000.0	1000.000	403.3	H	179.0	11.2	17.4	53.9
11015.10000	37.9	1000.0	1000.000	378.1	V	212.0	14.8	16.0	53.9
16805.50000	44.8	1000.0	1000.000	403.3	V	61.0	23.6	9.1	53.9

Test Notes: No significant emissions observed above 18GHz.



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						
7570	50MHz-18GHz Wideband Power Sensor	N1921A	MY45240588	Agilent	04/09/14	04/09/15
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	11/19/13	11/19/14
7569	Series Power Meter	N1911A P-	MY45100625	Agilent	04/22/14	04/22/15
Radiated Test Setup						
1051	Double-ridged waveguide horn antenna	3115	9408-4329	EMCO	02/28/14	02/28/16
1150	Horn antenna	3160-09	012054-004	ETS	04/26/13	04/26/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	07/31/13	07/31/14
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/30/14	01/30/16
1016	Pre-amplifier	PAM-0202	187	PAM	10/08/13	10/08/14
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	03/17/14	03/17/15
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	04/08/14	04/08/15
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	04/03/14	04/03/15
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
1072	DC Power Supply	E3610A	KR51311519	Hewlett Packard	Verified by 6452	
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
7562	Wideband Radio Communication Tester	CMW 500	1201.0002k50/10 3829	Rhode & Schwarz	10/09/13	10/09/15
7579	Temperature Chamber	115	151617	TestQuity	07/16/13	07/16/14



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

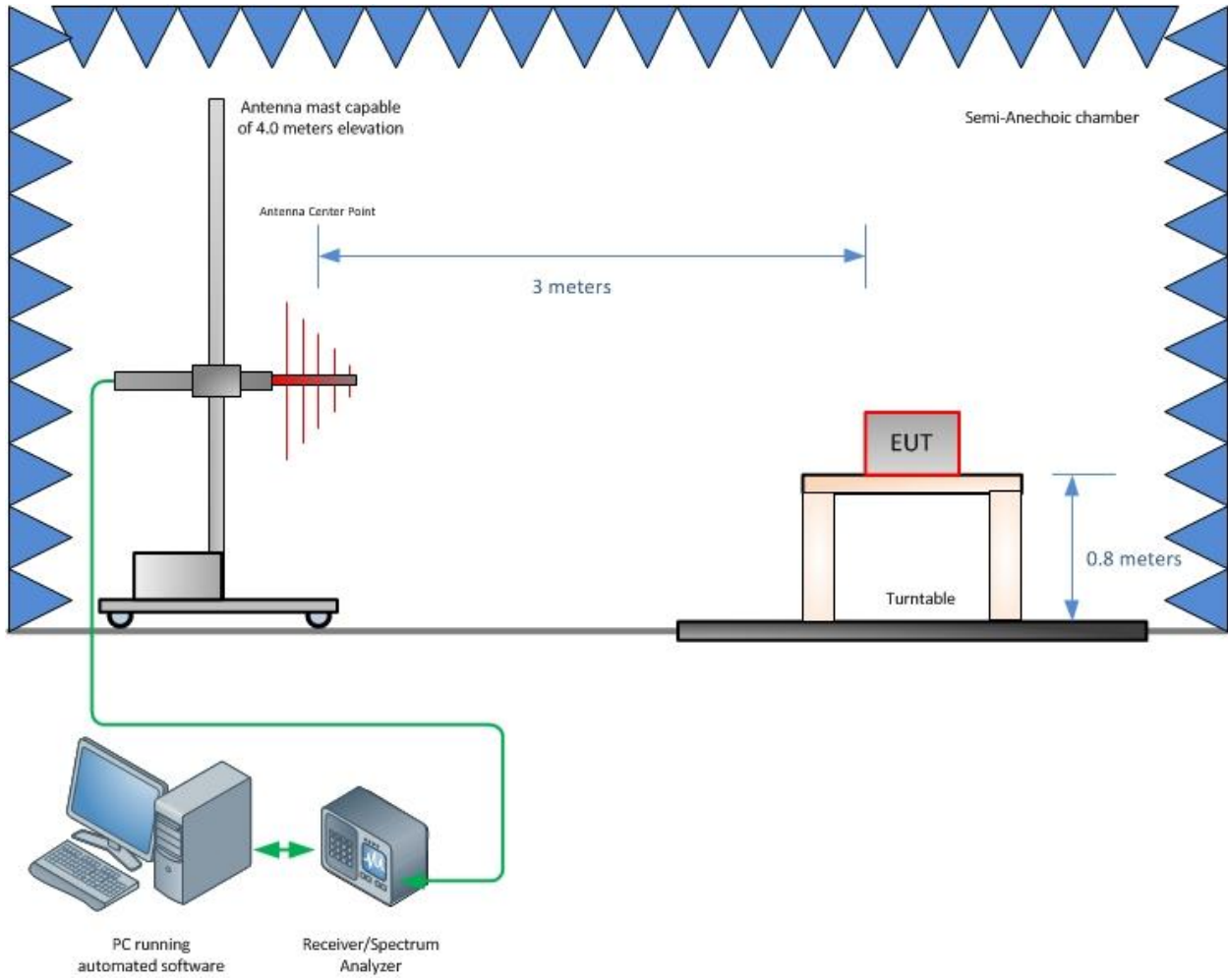
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular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



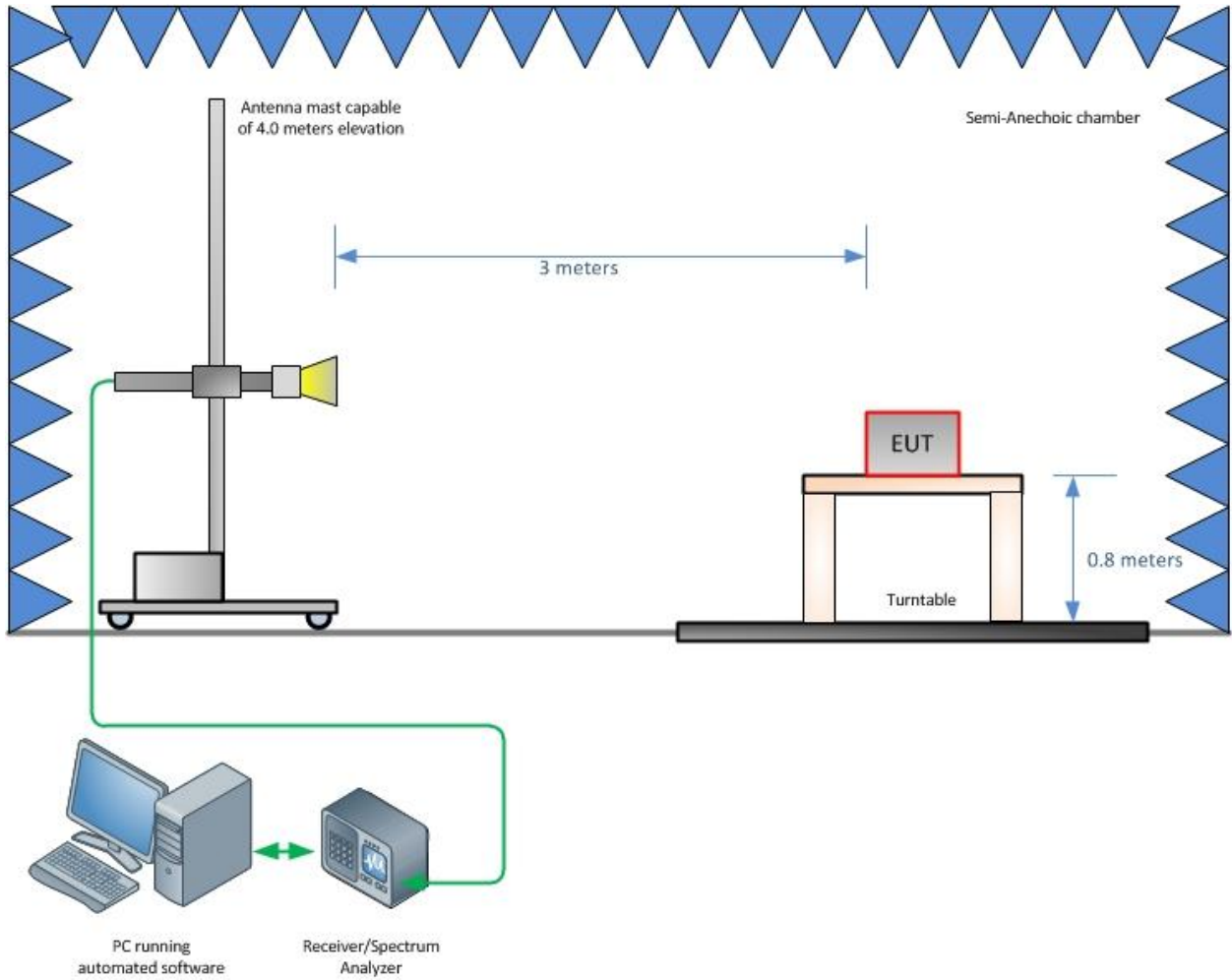
SECTION 4

DIAGRAM OF TEST SETUP

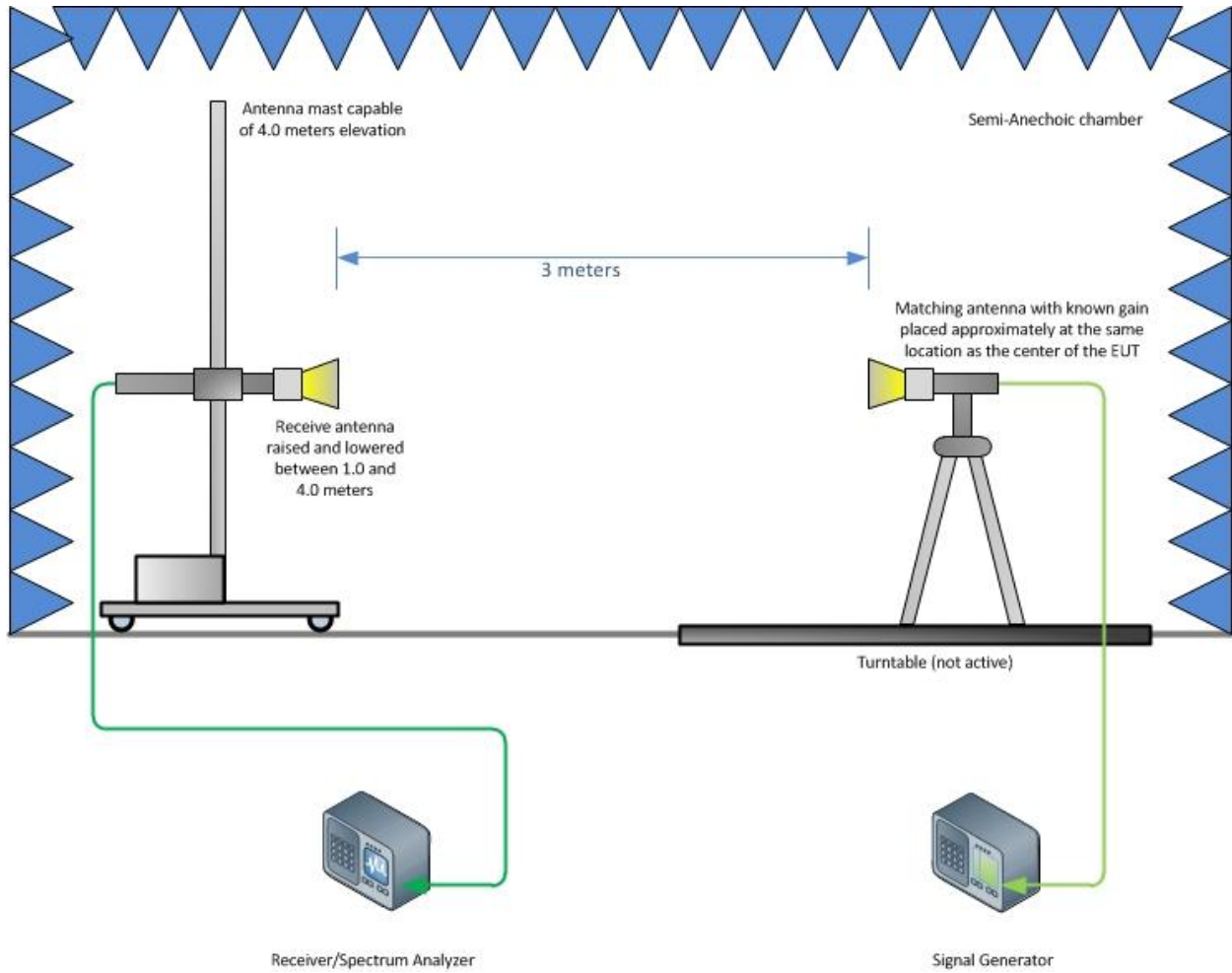
4.1 TEST SETUP DIAGRAM



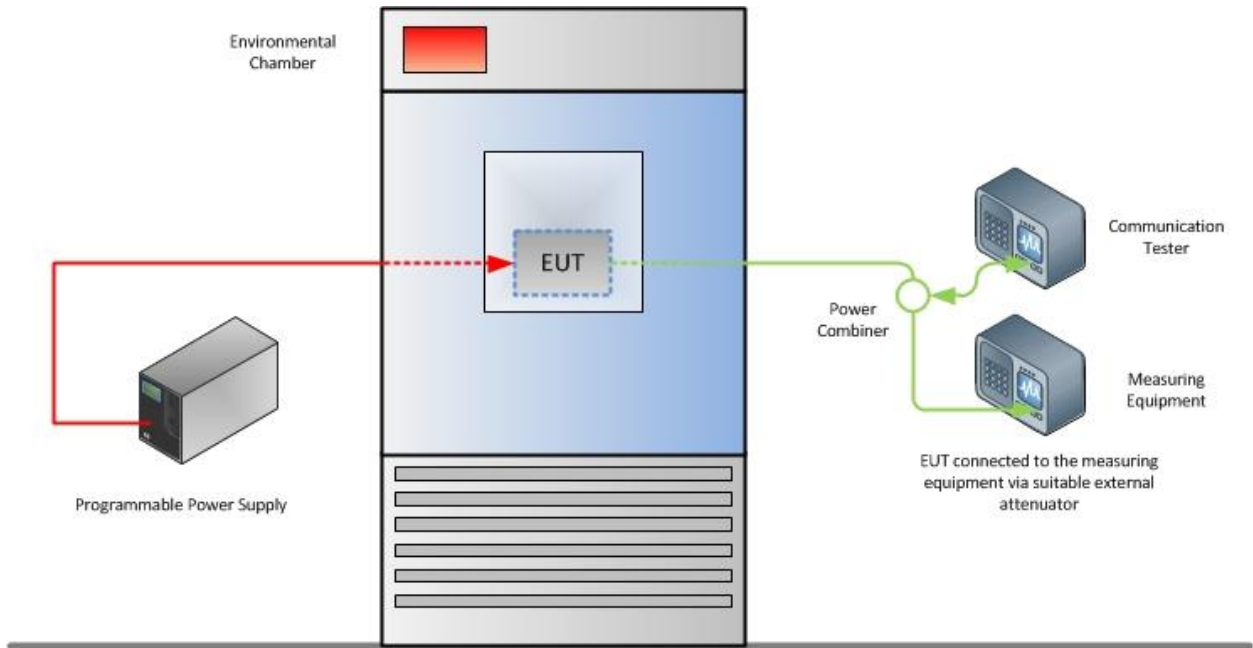
Radiated Emission Test Setup (Below 1GHz)



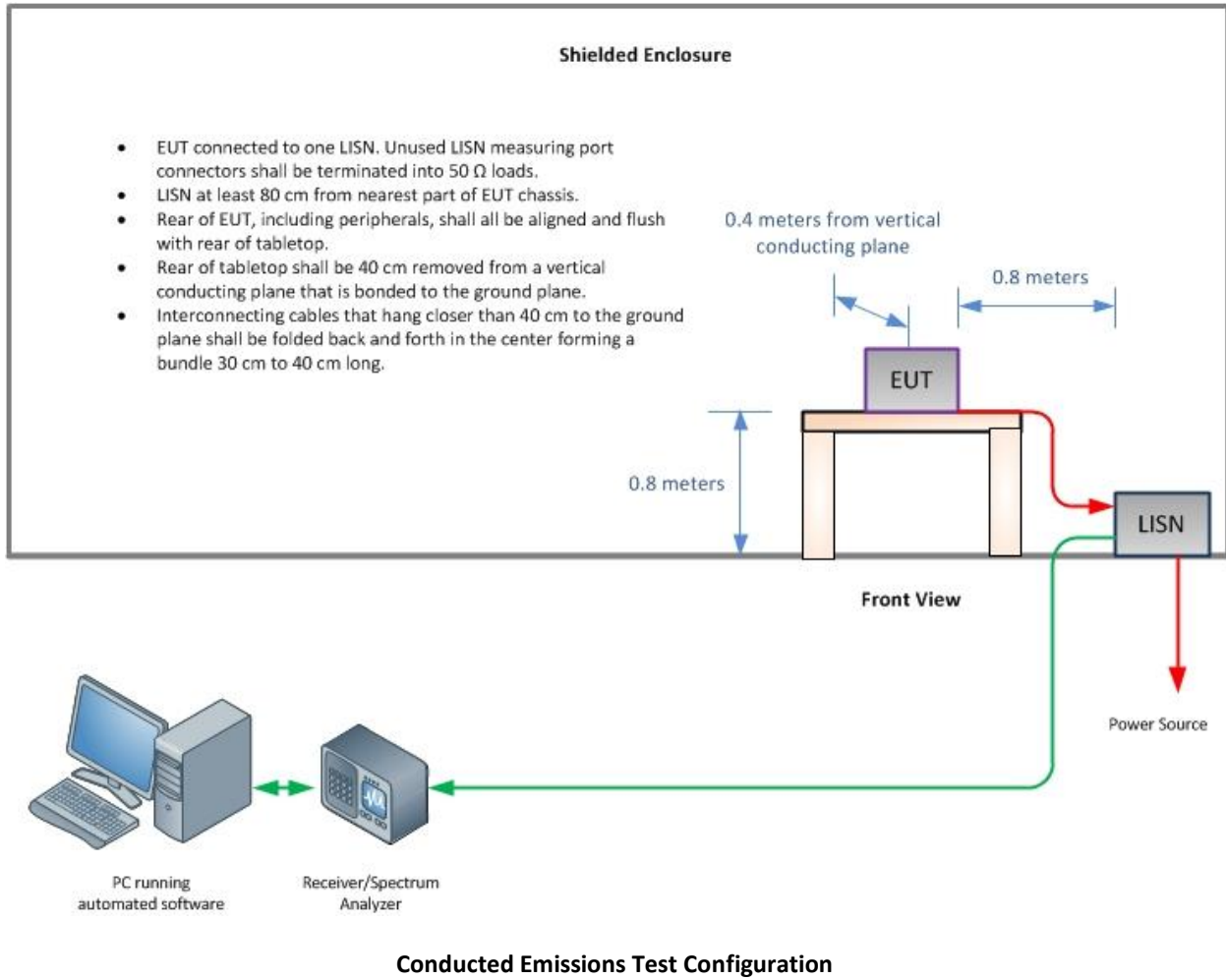
Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz)



Frequency Stability Test Configuration





SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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