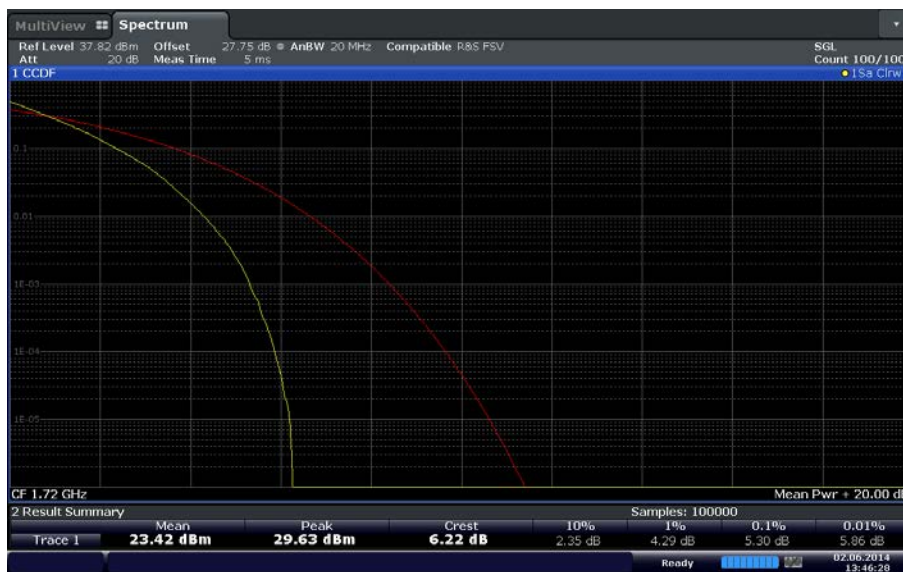


LTE Band 4 (15 MHz BW)/1717.5 MHz/QPSK



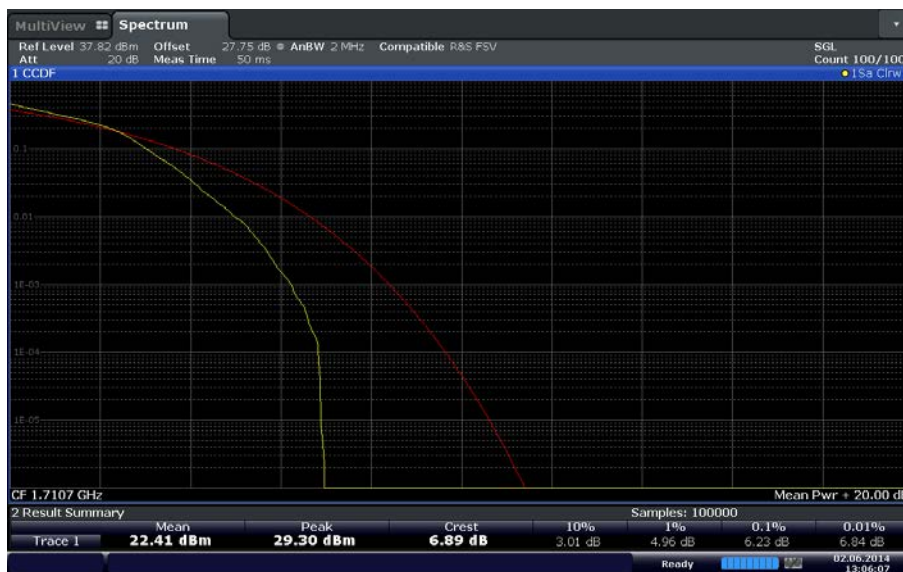
Date: 2 JUN 2014 13:43:52

LTE Band 4 (20 MHz BW)/1720 MHz/QPSK



Date: 2 JUN 2014 13:46:28

LTE Band 4 (1.4 MHz BW)/1710.7 MHz/16QAM



Date: 2 JUN 2014 13:06:07

LTE Band 4 (3 MHz BW)/1753.5 MHz/16QAM



Date: 2 JUN 2014 13:50:35

LTE Band 4 (5 MHz BW)/1712.5 MHz/16QAM



Date: 2 JUN 2014 13:09:17

LTE Band 4 (10 MHz BW)/1715 MHz/16QAM



Date: 2 JUN 2014 13:10:28

LTE Band 4 (15 MHz BW)/1717.5 MHz/16QAM



Date: 2 JUN 2014 14:29:05

LTE Band 4 (20 MHz BW)/1745 MHz/16QAM



Date: 2 JUN 2014 14:36:15

LTE Band 13 (5 MHz BW)/779.5 MHz/QPSK



Date: 2 JUN 2014 13:03:00

LTE Band 13 (10 MHz BW)/782 MHz/QPSK



Date: 2 JUN 2014 13:02:24

LTE Band 13 (5 MHz BW)/784.5 MHz/16QAM



Date: 2 JUN 2014 13:03:50

LTE Band 13 (10 MHz BW)/782 MHz/16QAM



Date: 2 JUN 2014 13:04:27



2.6 BAND EDGE

2.6.1 Specification Reference

Part 27 Subpart C §27.53(c)(2)(5),(g) and (g)(3)

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;

(g) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1710-1755 MHz, 2110-2155 MHz, 2000-2020 MHz, 2180-2200 MHz, 1915-1920 MHz, and 1995-2000 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ 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: SS220414800535 / Test Configuration A

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

June 17, 2014 / AC

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).

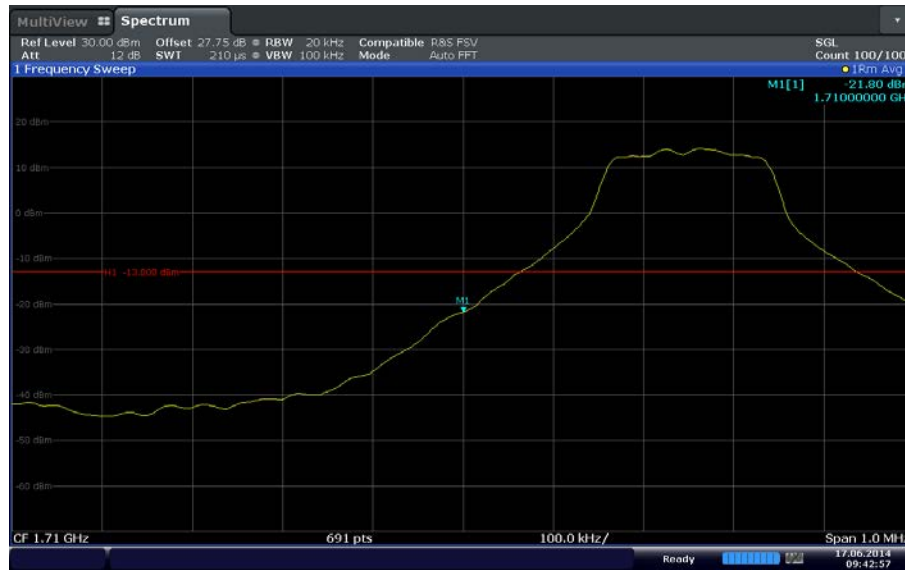


- The 27.75dB (Band 4) / 27.38 (Band 13) offset was used for the power splitter, external attenuator and cable used.
- The center frequency of the spectrum is the band edge frequency.
- Using a span of 1MHz for Band 13, RBW is set to 100 kHz (minimum of 30kHz limited to 1% of EBW) and VBW is set to 3X 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 plots.

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



Date: 17 JUN 2014 09:42:58

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



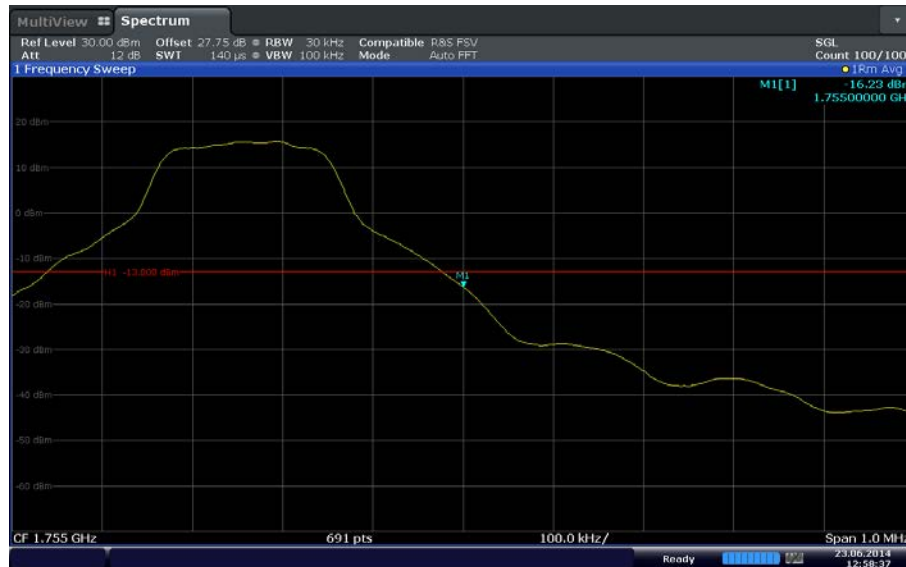
Date: 17 JUN 2014 09:43:58

LTE Band 4 (3 MHz BW)/Low Channel (19965) Band Edge @ 1710 MHz



Date: 23 JUN 2014 12:57:42

LTE Band 4 (3 MHz BW)/High Channel (20385) Band Edge @ 1755 MHz



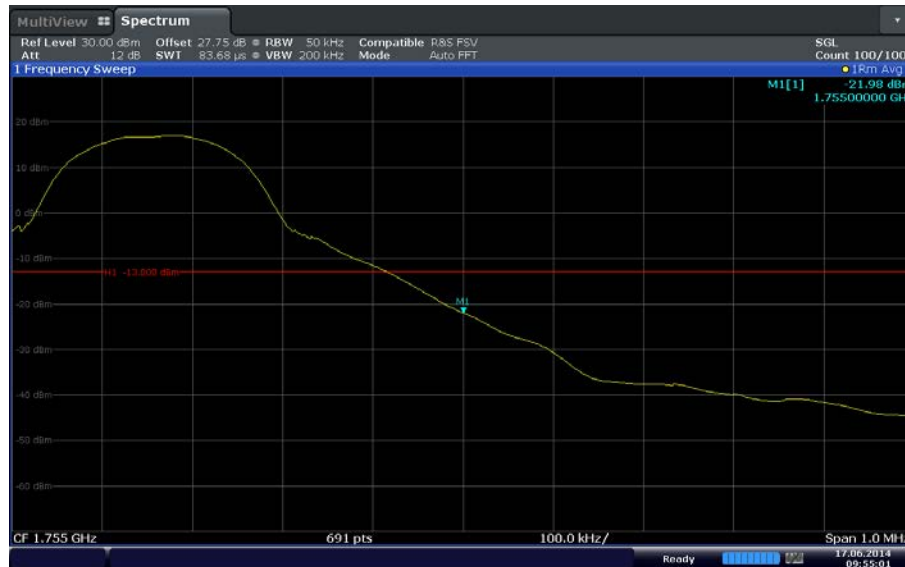
Date: 23 JUN 2014 12:58:37

LTE Band 4 (5 MHz BW)/Low Channel (19975) Band Edge @ 1710 MHz



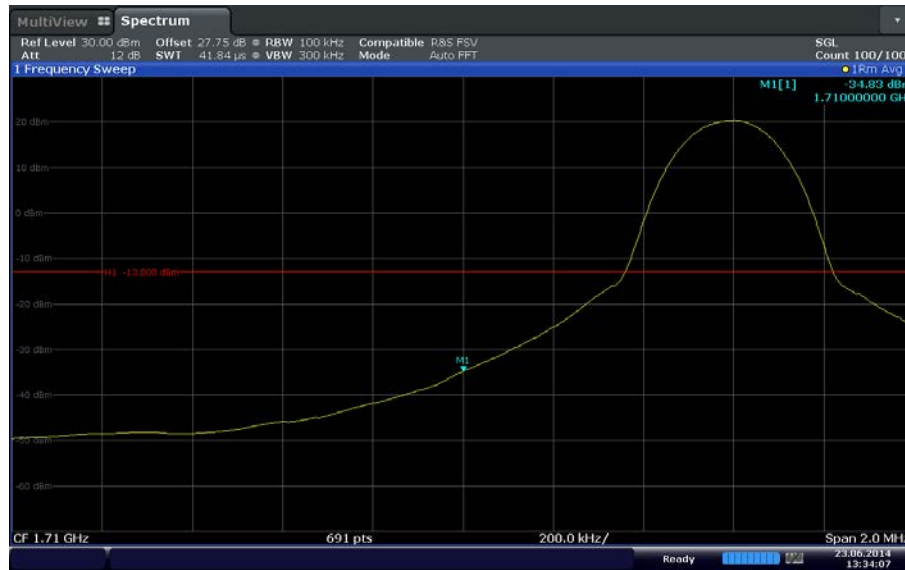
Date: 23 JUN 2014 13:30:35

LTE Band 4 (5 MHz BW)/High Channel (20375) Band Edge @ 1755 MHz



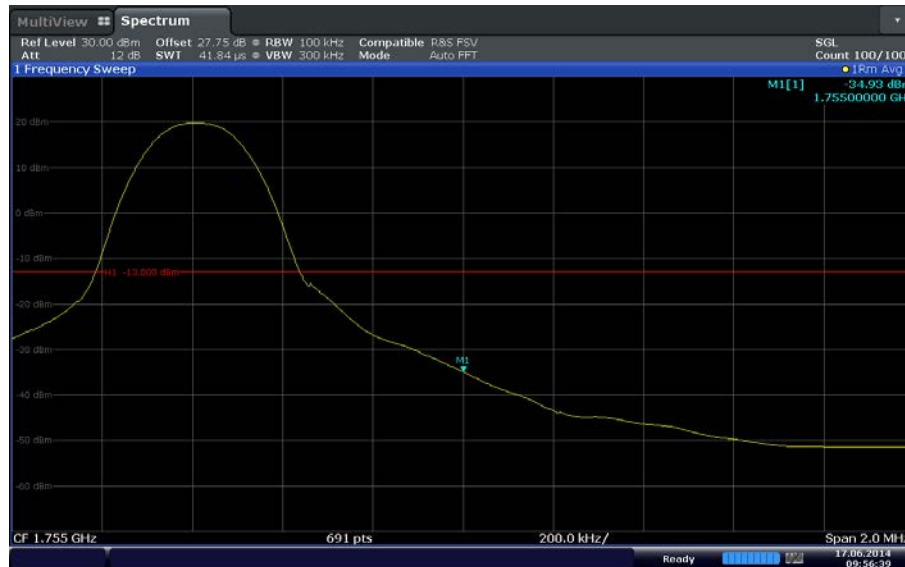
Date: 17 JUN 2014 09:55:01

LTE Band 4 (10 MHz BW)/Low Channel (20000) Band Edge @ 1710 MHz



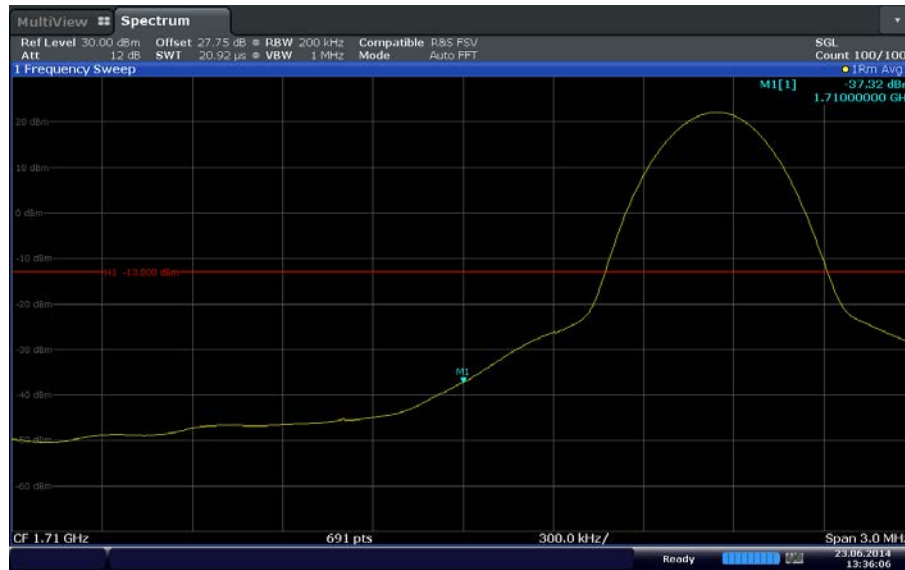
Date: 23 JUN 2014 13:34:08

LTE Band 4 (10 MHz BW)/High Channel (20350) Band Edge @ 1755 MHz



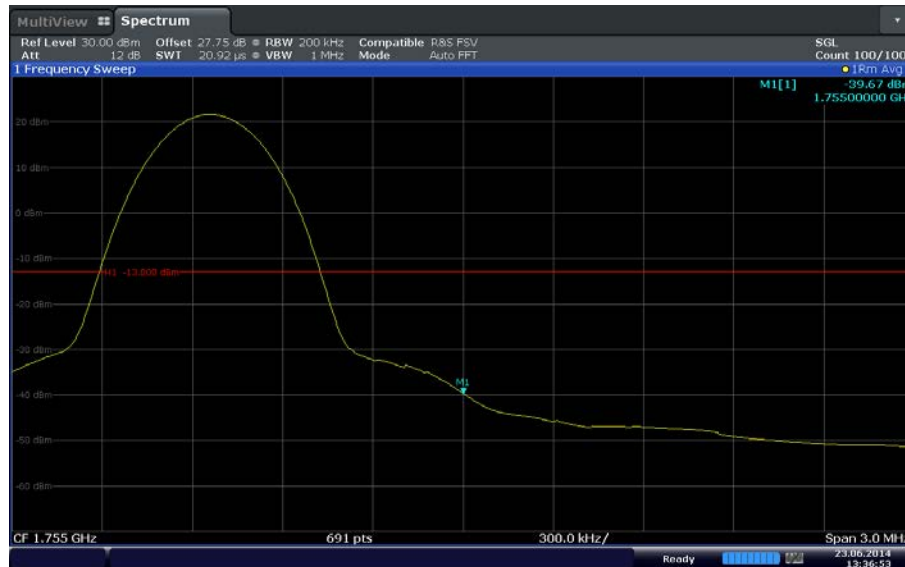
Date: 17 JUN 2014 09:56:39

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



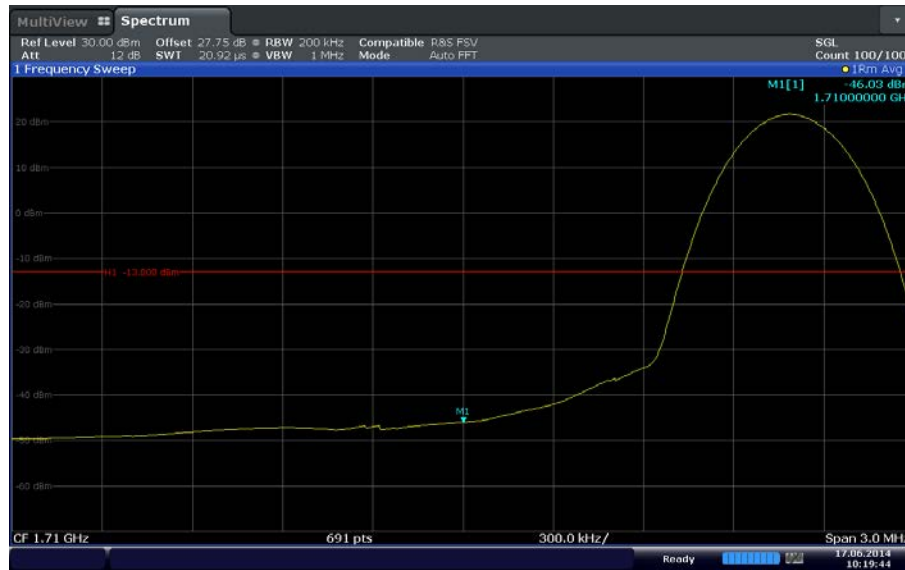
Date: 23 JUN 2014 13:36:06

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



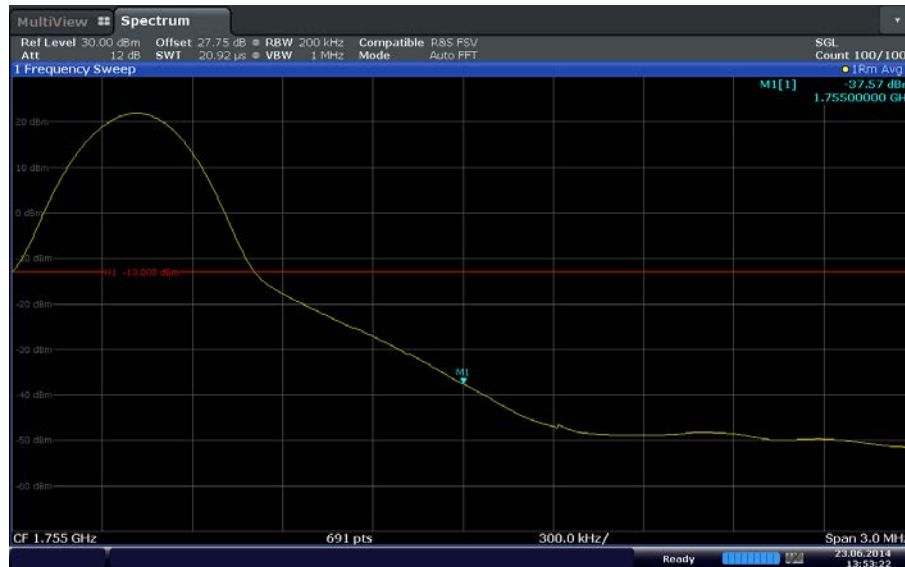
Date: 23 JUN 2014 13:36:53

LTE Band 4 (20 MHz BW)/Low Channel (20050) Band Edge @ 1710 MHz



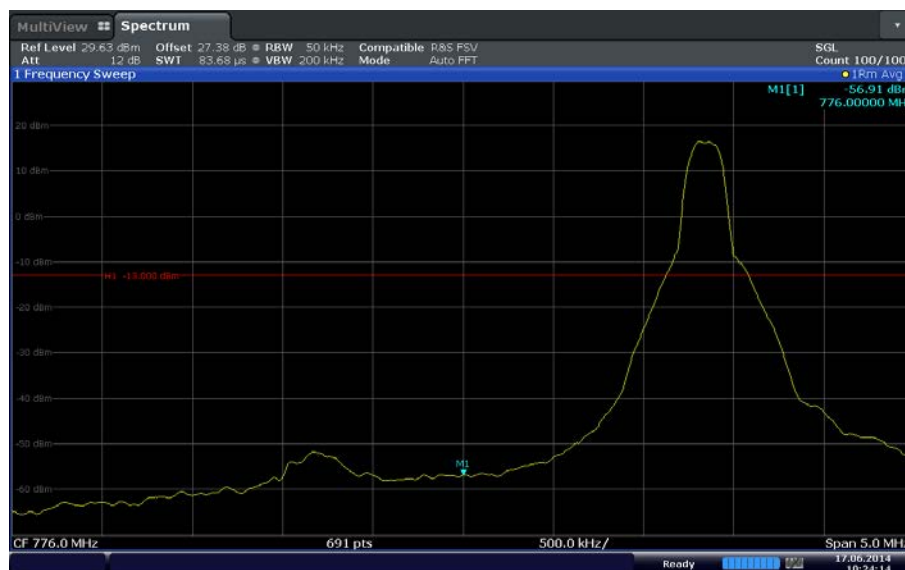
Date: 17 JUN 2014 10:19:44

LTE Band 4 (20 MHz BW)/High Channel (20300) Band Edge @ 1755 MHz



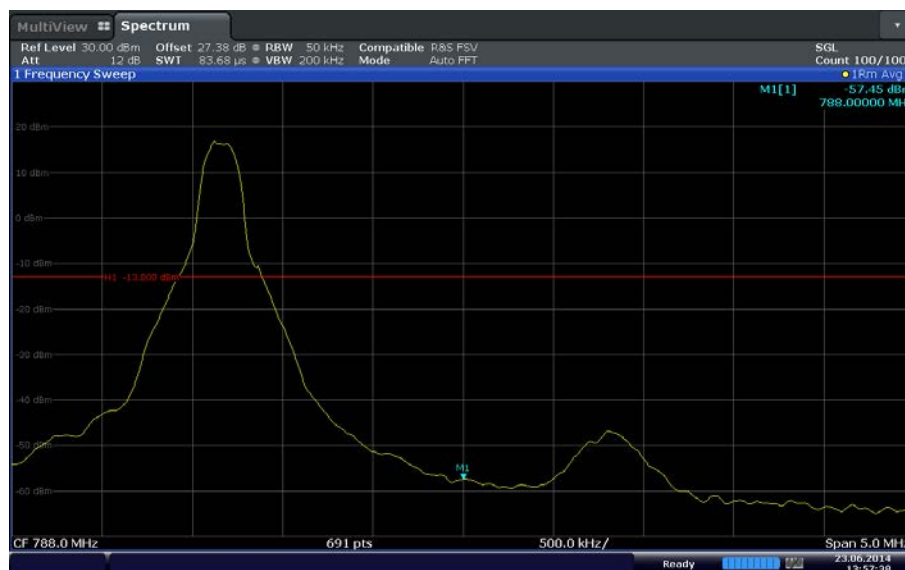
Date: 23 JUN 2014 13:53:22

LTE Band 13 (5 MHz BW)/Low Channel (23205) Band Edge @ 776 MHz



Date: 17 JUN 2014 10:24:14

LTE Band 13 (5 MHz BW)/High Channel (23255) Band Edge @ 788 MHz



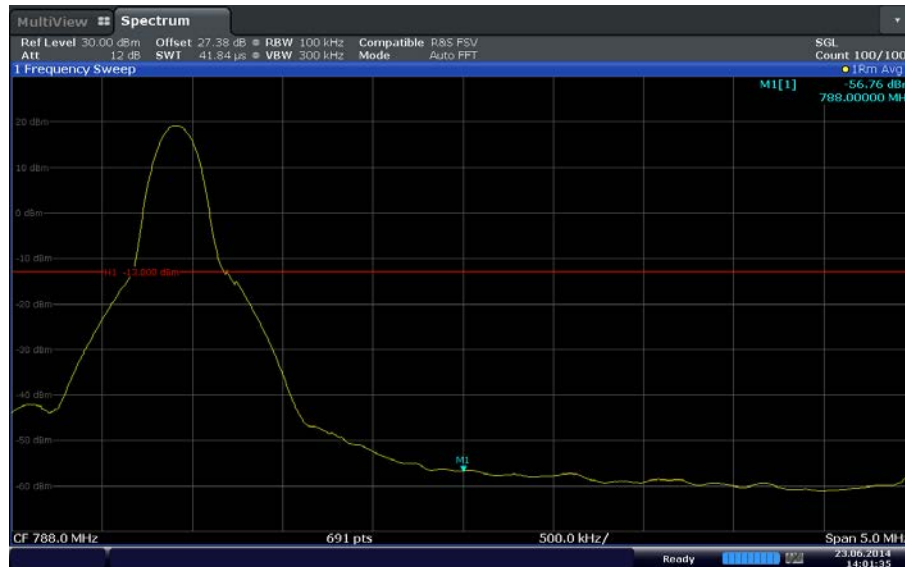
Date: 23 JUN 2014 13:57:38

LTE Band 13 (10 MHz BW)/Channel (23230) Band Edge @ 776 MHz



Date: 23 JUN 2014 14:00:57

LTE Band 13 (10 MHz BW)/Channel (23230) Band Edge @ 788 MHz



Date: 23 JUN 2014 14:01:35



2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

Part 27 Subpart C §27.53 (c)(2)(5),(e),(g) and Part 2.1051

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;

(e) For operations in the 746–758 MHz, 775–788 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.

(g) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1710-1755 MHz, 2110-2155 MHz, 2000-2020 MHz, 2180-2200 MHz, 1915-1920 MHz, and 1995-2000 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

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 / 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

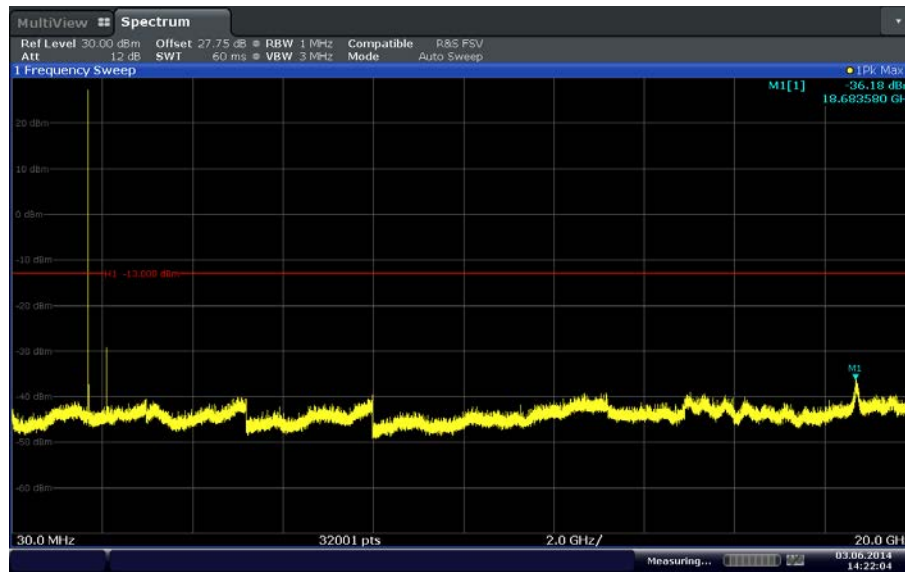
- This is a conducted test.
- The 27.75dB (Band 4) / 27.38 (Band 13) offset was used for the power splitter, external attenuator and cable used.
- The spectrum was searched from 30MHz to the 10th harmonic (20GHz) for Band 4. Band 13 was verified up to 20GHz.
- Low, Mid and High channels on all channel bandwidth verified. Only the worst RB size/offset presented (See Section 1.4.4 for worst case modulation).



2.7.8 Test Results

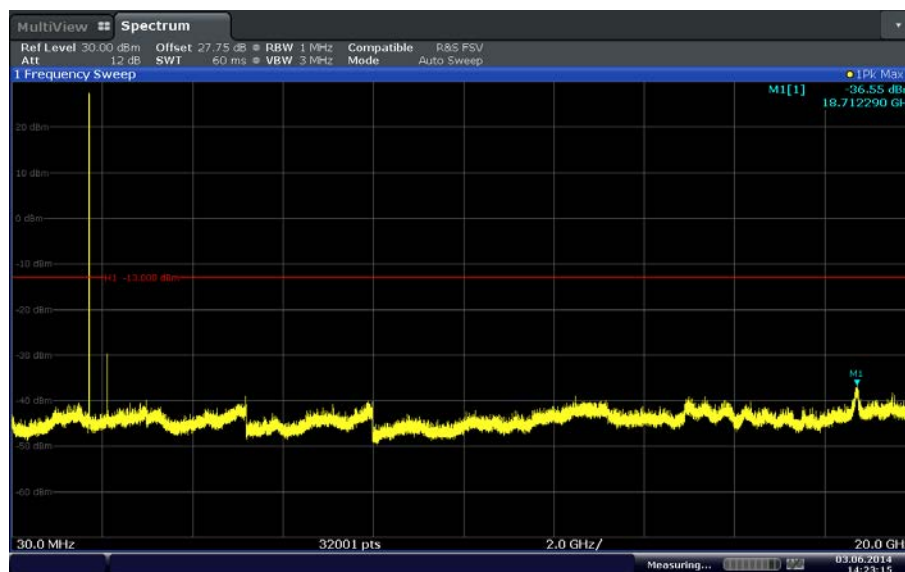
Compliant. See attached plots.

LTE Band 4 (1.4 MHz BW) Low Channel (19957)



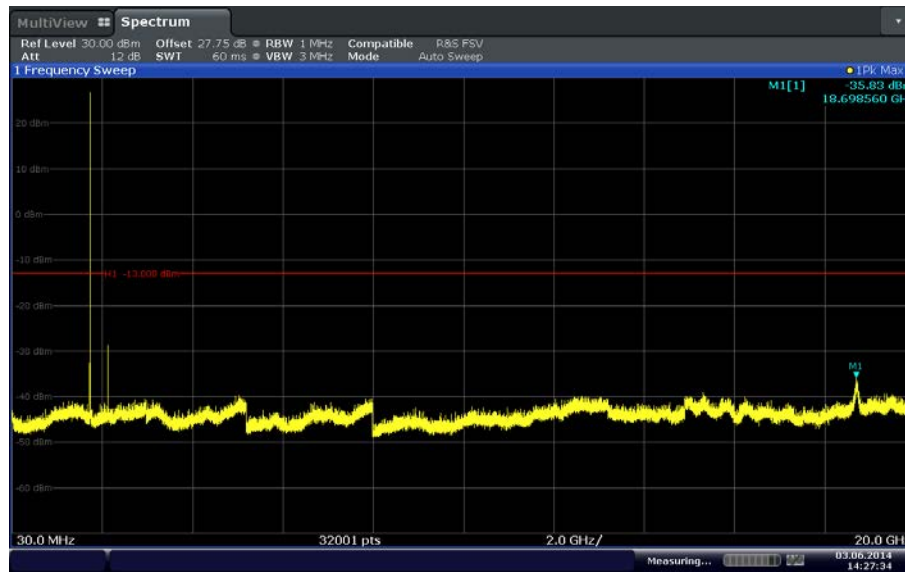
Date: 3 JUN 2014 14:22:04

LTE Band 4 (1.4 MHz BW) Mid Channel (20175)



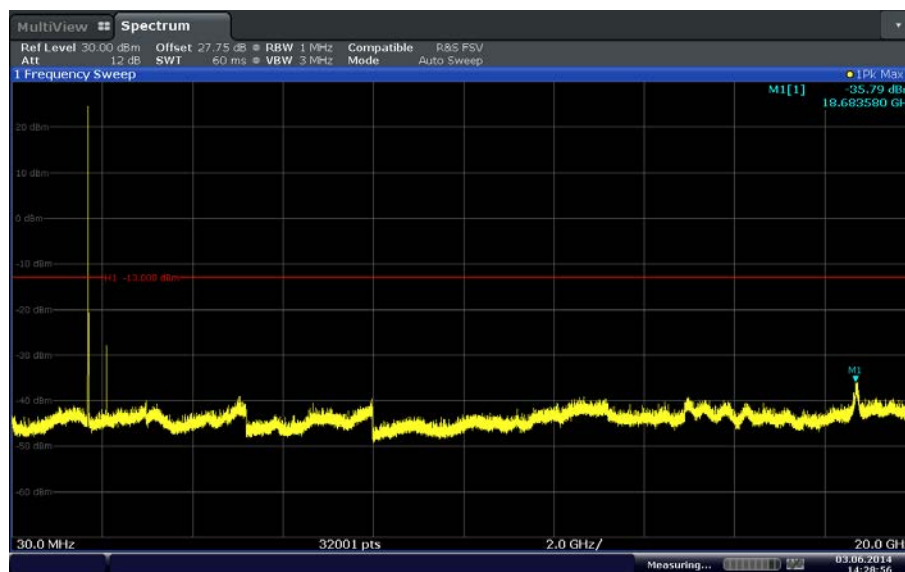
Date: 3 JUN 2014 14:23:14

LTE Band 4 (1.4 MHz BW) High Channel (20393)



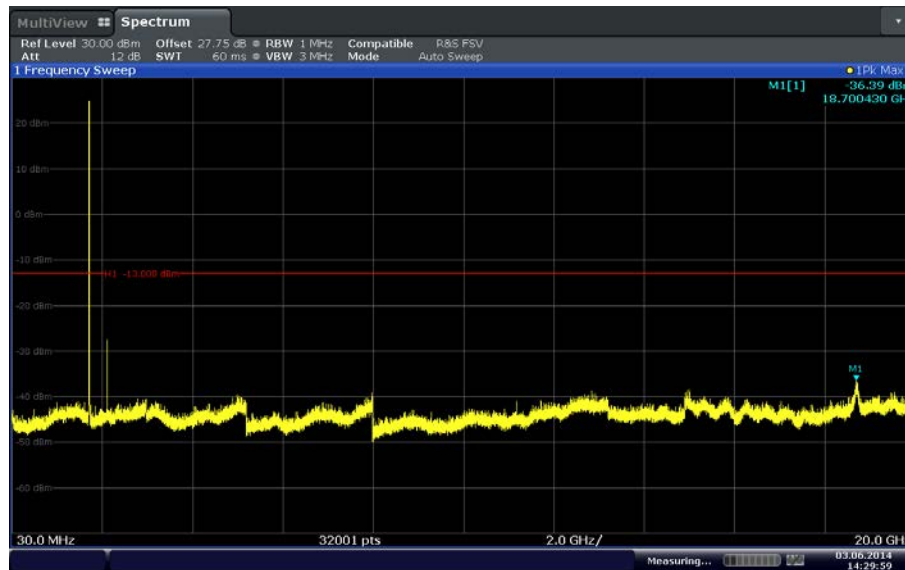
Date: 3 JUN 2014 14:27:35

LTE Band 4 (3 MHz BW) Low Channel (19965)



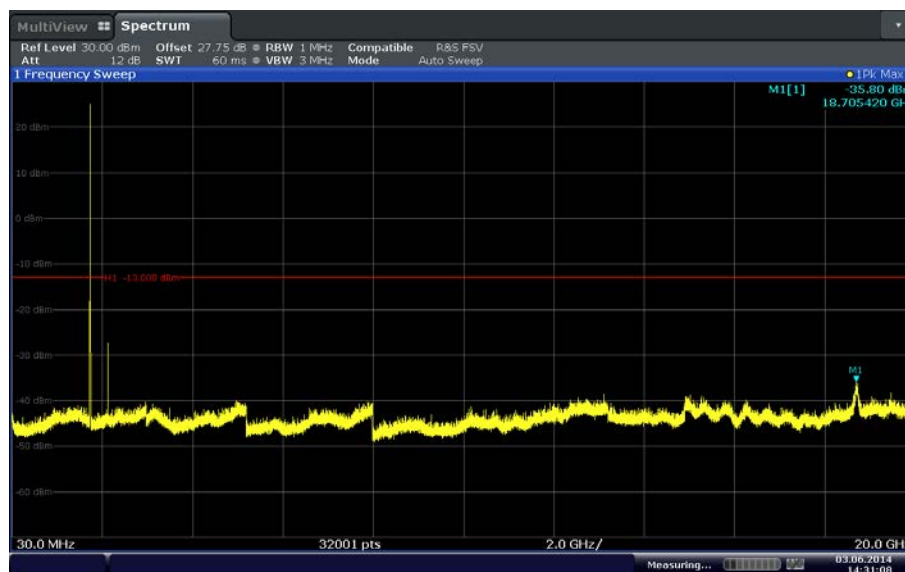
Date: 3 JUN 2014 14:28:57

LTE Band 4 (3 MHz BW) Mid Channel (20175)



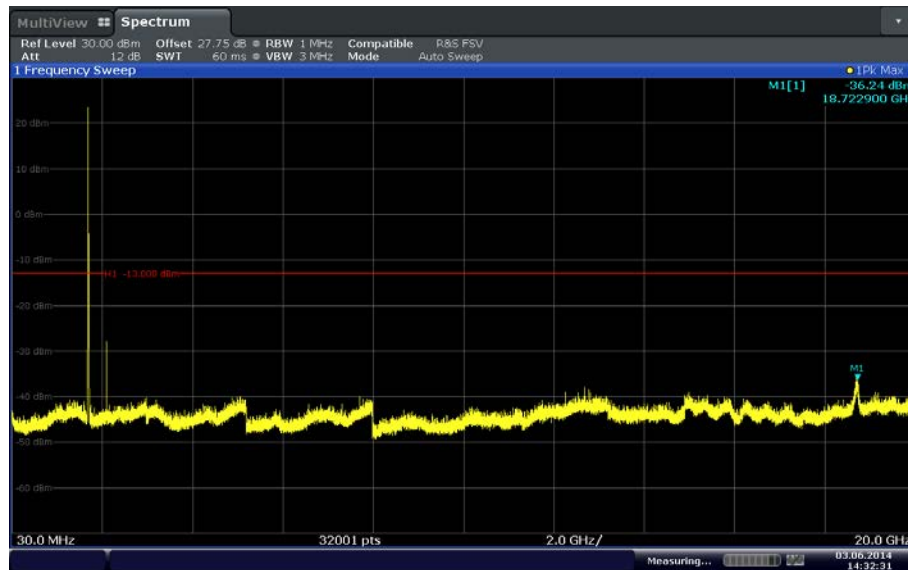
Date: 3 JUN 2014 14:29:59

LTE Band 4 (3 MHz BW) High Channel (20385)



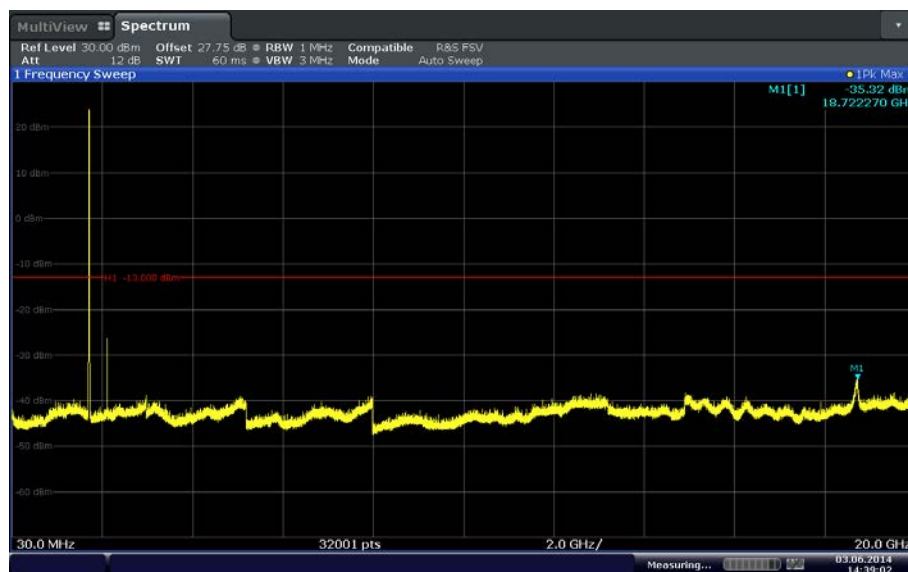
Date: 3 JUN 2014 14:31:08

LTE Band 4 (5 MHz BW) Low Channel (19975)



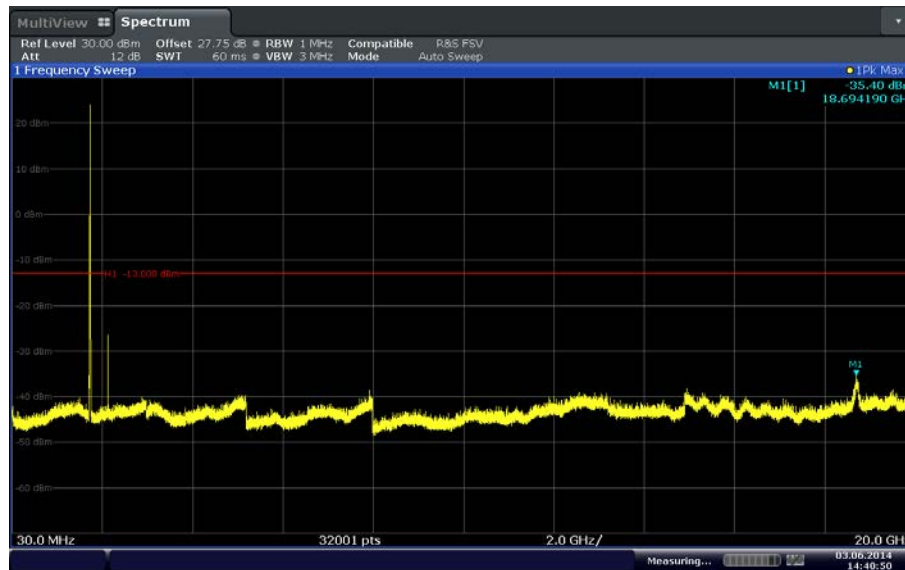
Date: 3 JUN 2014 14:32:31

LTE Band 4 (5 MHz BW) Mid Channel (20175)



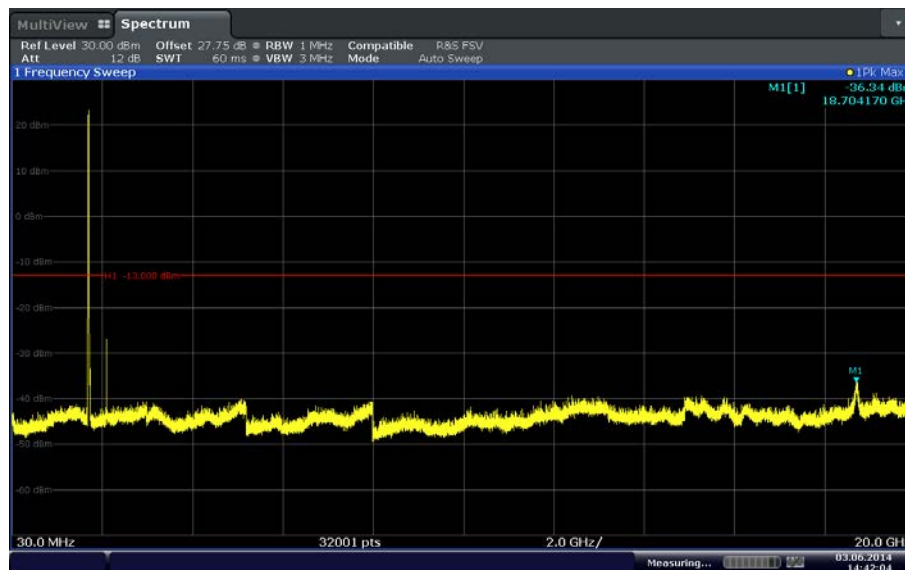
Date: 3 JUN 2014 14:39:02

LTE Band 4 (5 MHz BW) High Channel (20375)



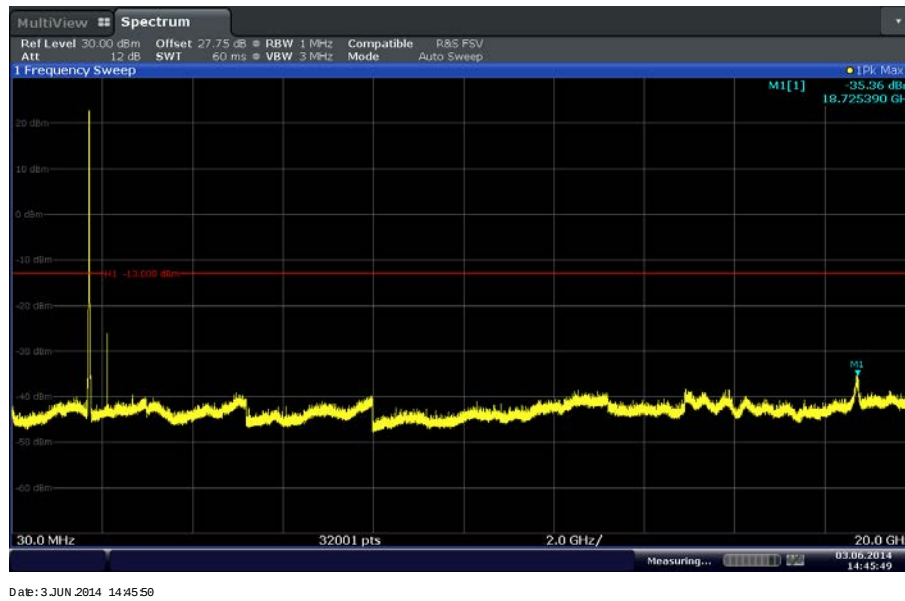
Date: 3 JUN 2014 14:40:50

LTE Band 4 (10 MHz BW) Low Channel (20000)

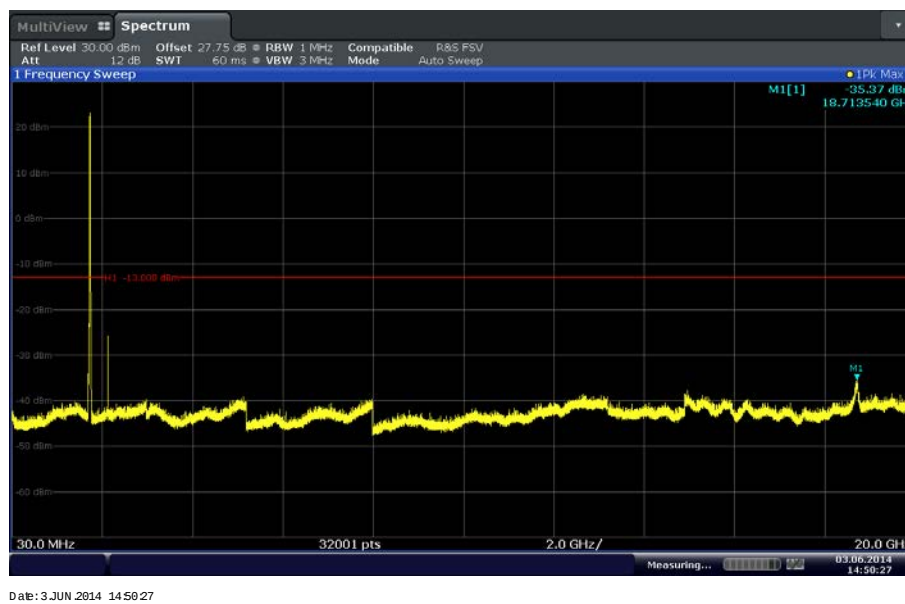


Date: 3 JUN 2014 14:42:04

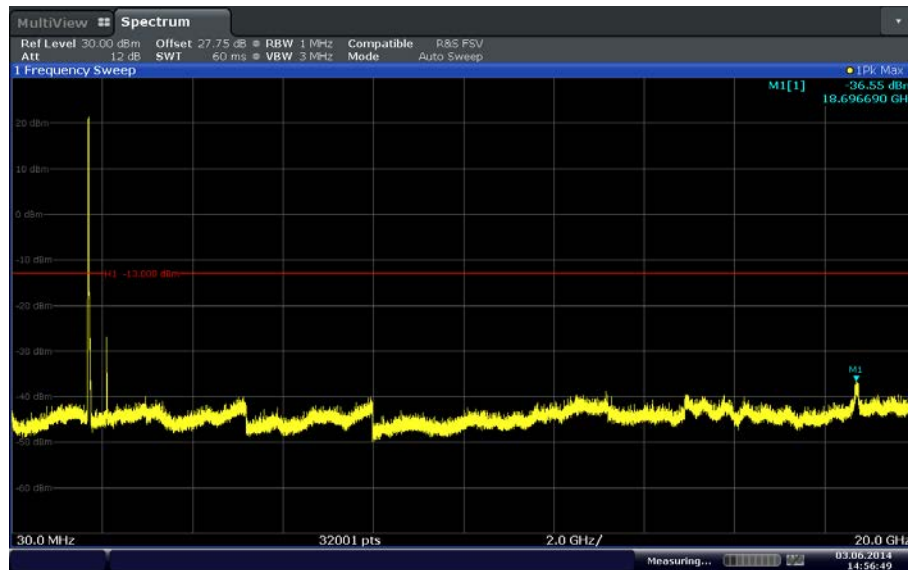
LTE Band 4 (10 MHz BW) Mid Channel (20175)



LTE Band 4 (10 MHz BW) High Channel (20350)

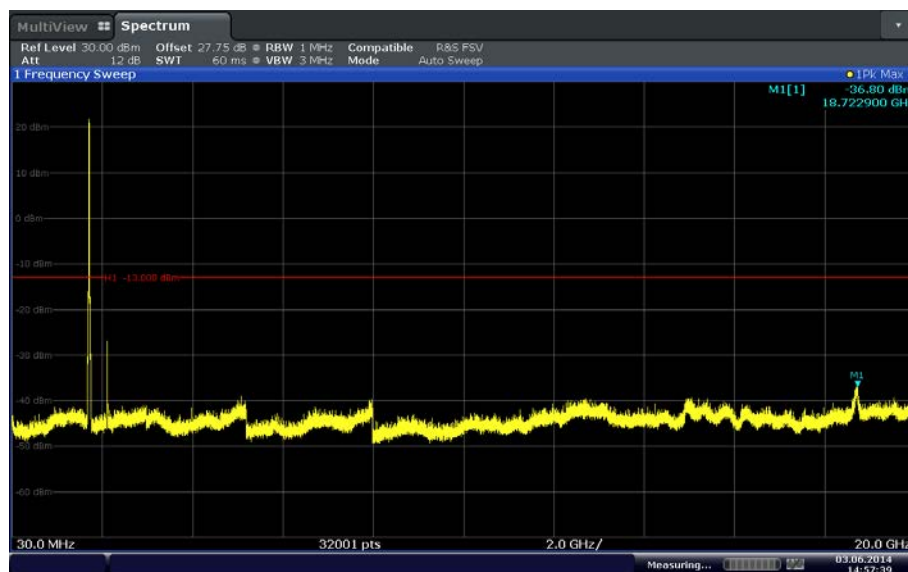


LTE Band 4 (15 MHz BW) Low Channel (20025)



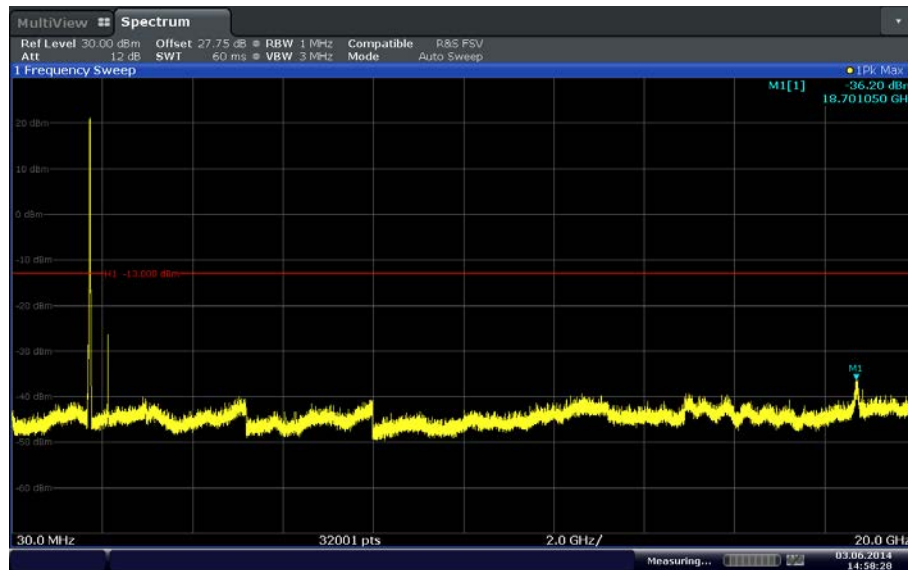
Date: 3 JUN 2014 14:56:59

LTE Band 4 (15 MHz BW) Mid Channel (20175)



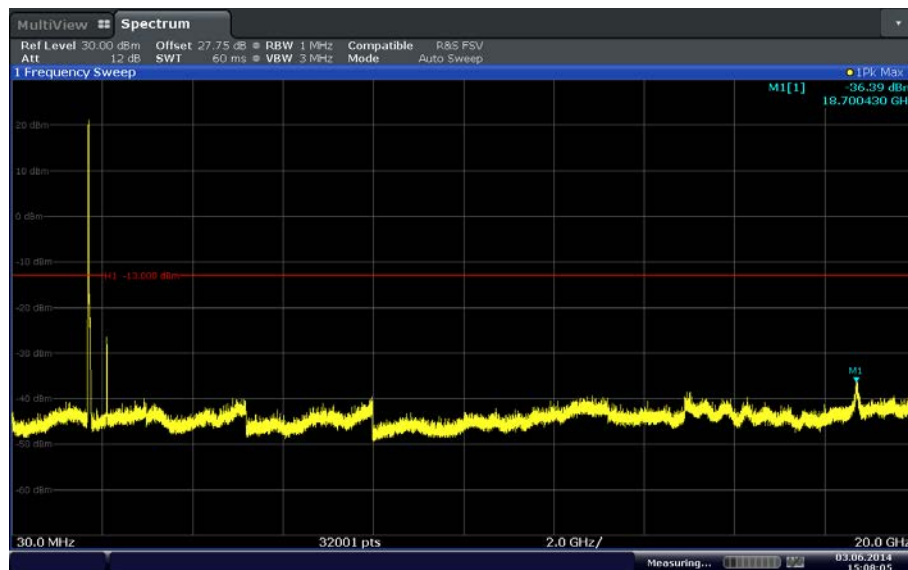
Date: 3 JUN 2014 14:57:39

LTE Band 4 (15 MHz BW) High Channel (20325)



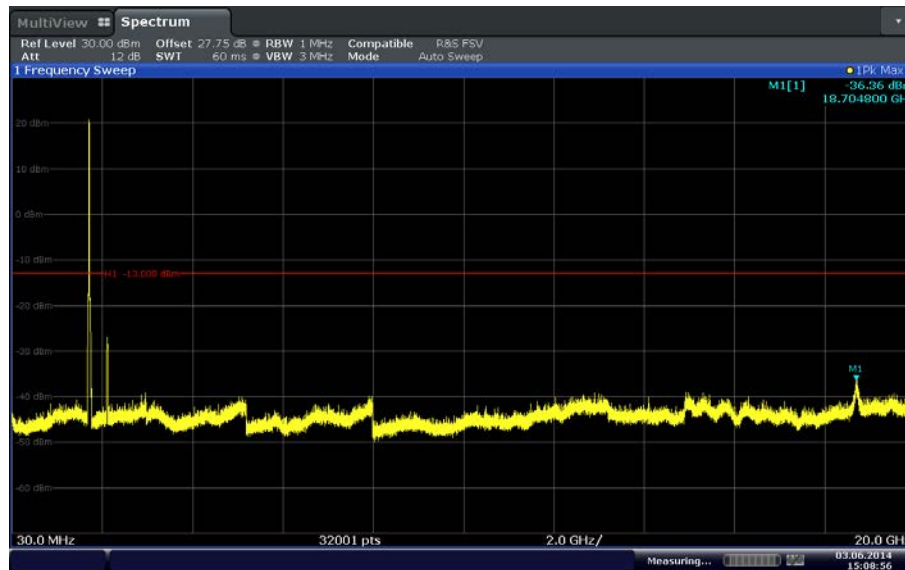
Date: 3 JUN 2014 14:58:28

LTE Band 4 (20 MHz BW) Low Channel (20050)



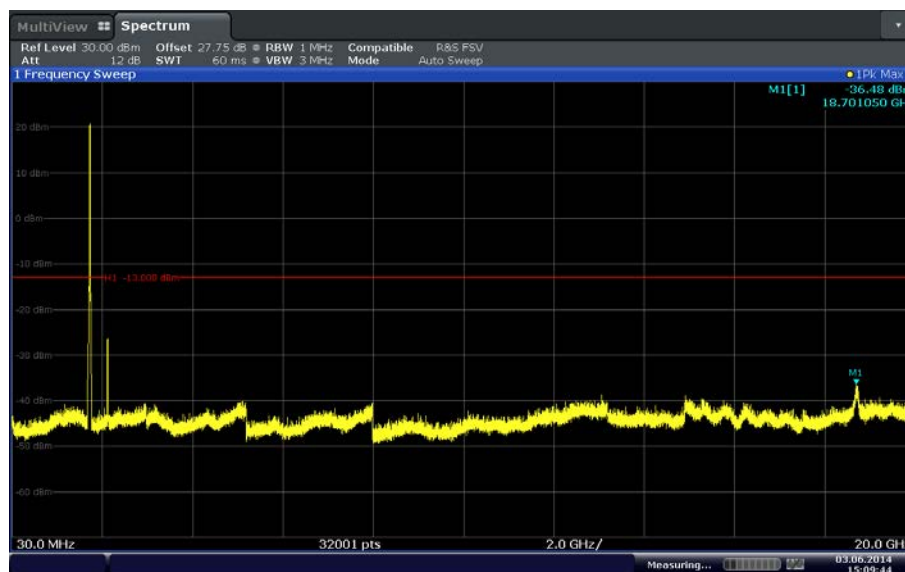
Date: 3 JUN 2014 15:08:05

LTE Band 4 (20 MHz BW) Mid Channel (20175)



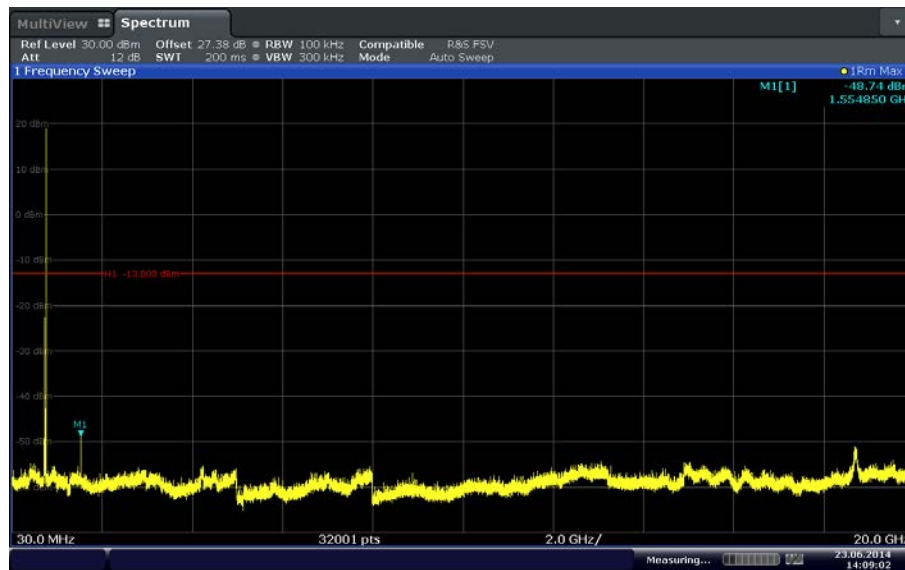
Date: 3 JUN 2014 15:00:55

LTE Band 4 (20 MHz BW) High Channel (20300)



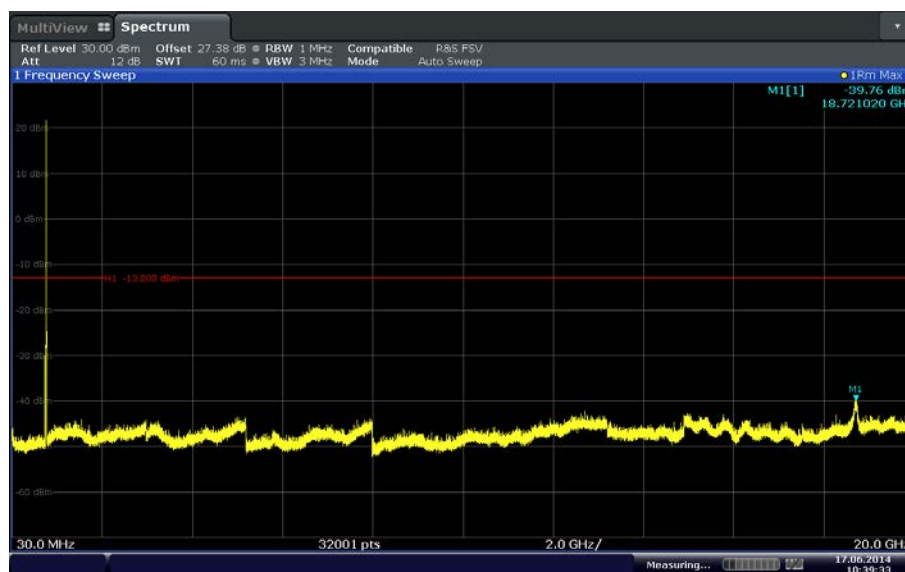
Date: 3 JUN 2014 15:09:45

LTE Band 13 (5 MHz BW) Low Channel (23205)



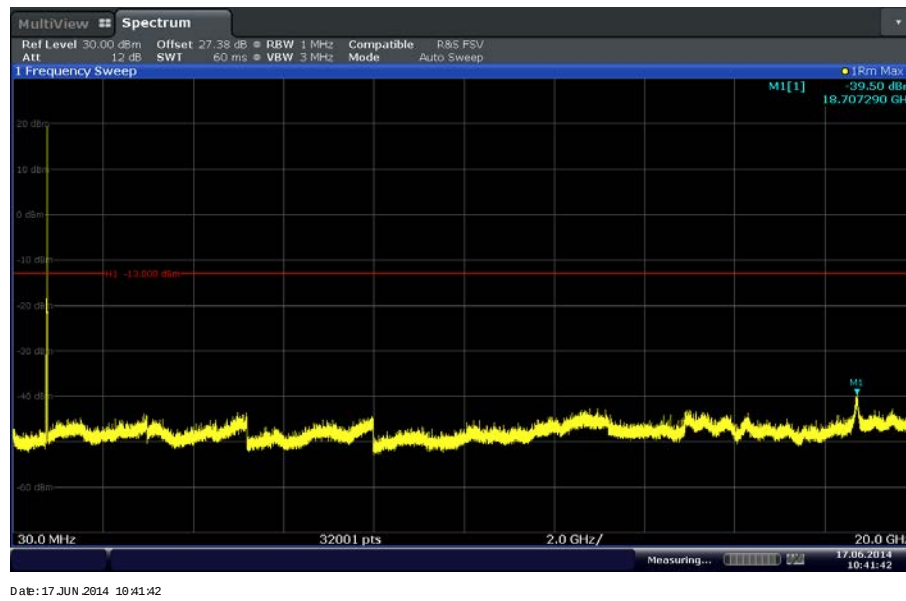
Date: 23 JUN 2014 14:09:03

LTE Band 13 (5 MHz BW) High Channel (23255)



Date: 17 JUN 2014 10:39:33

LTE Band 13 (10 MHz BW) Channel (23230)





2.8 FIELD STRENGTH OF SPURIOUS RADIATION

2.8.1 Specification Reference

Part 27 Subpart C §27.53(c) and (g) and Part 2.1053

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;

(g) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1710-1755 MHz, 2110-2155 MHz, 2000-2020 MHz, 2180-2200 MHz, 1915-1920 MHz, and 1995-2000 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log_{10}(P)$ dB.

2.8.3 Equipment Under Test and Modification State

Serial No: SS220414800535 / Test Configuration B

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

June 20, 2014 / 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

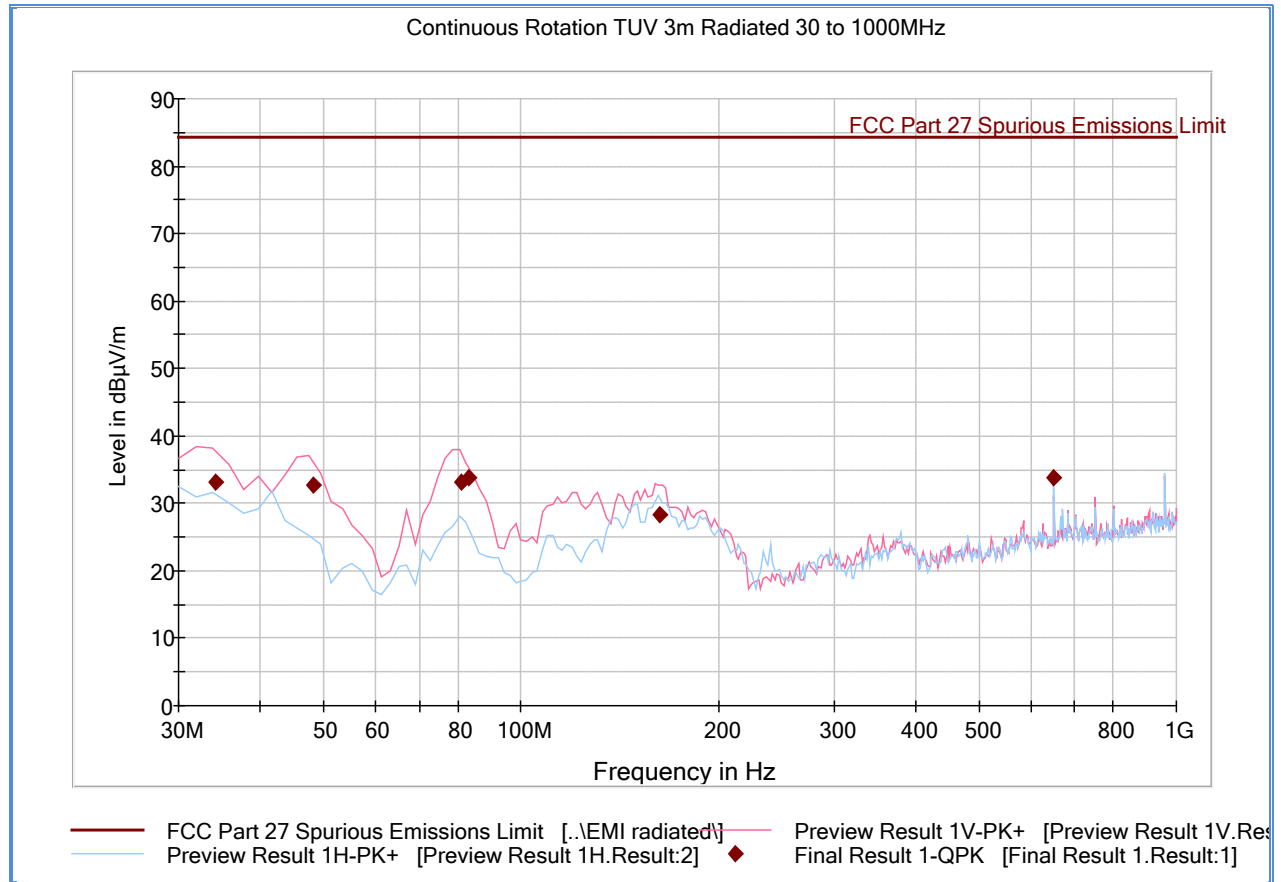
- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Only the worst case configuration presented in this test report.
- There are no emission found that do not comply with the restricted bands 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

Compliant. See attached plots.

2.8.9 Test Results Below 1GHz – Band 4 worst case presented

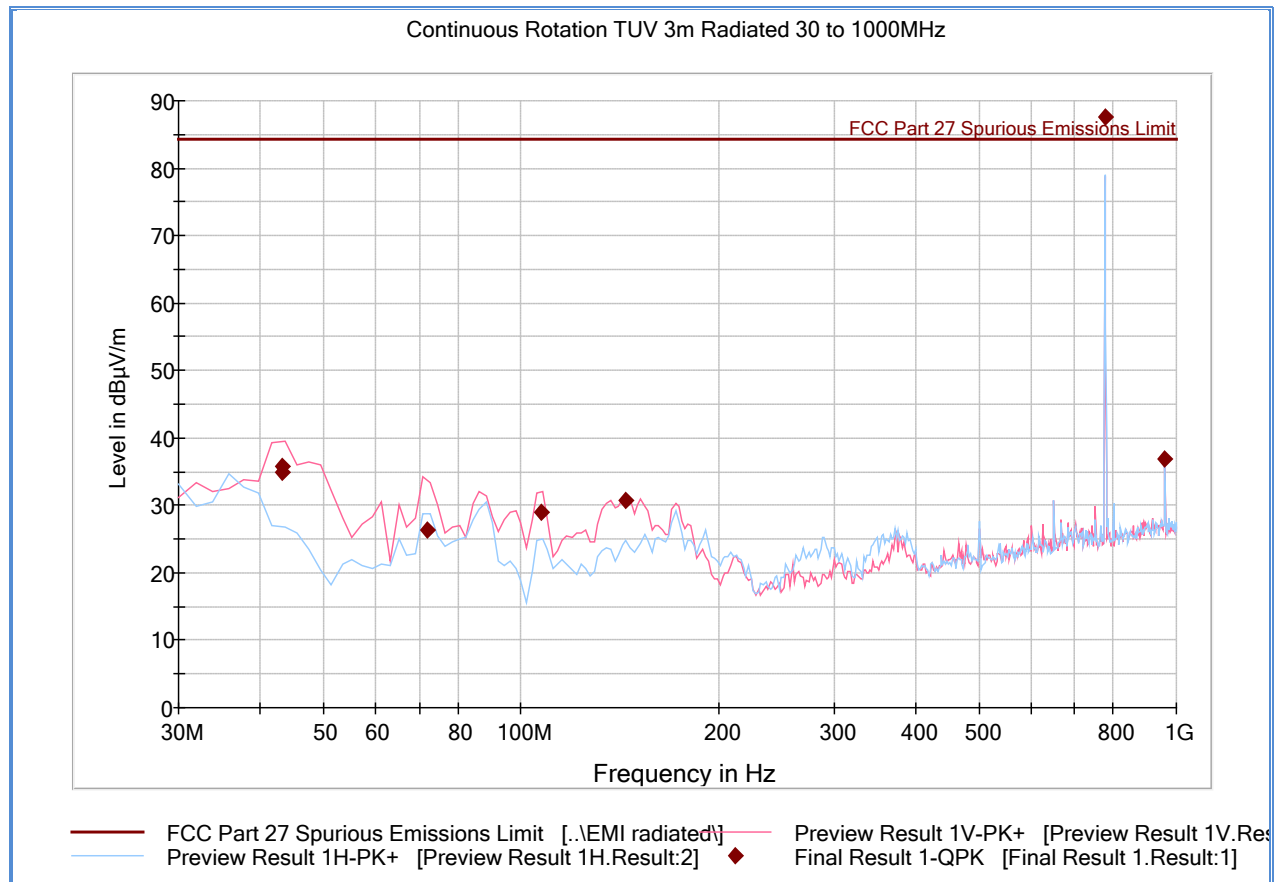


Quasi Peak Data

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 Below 1GHz – Band 13 worst case presented

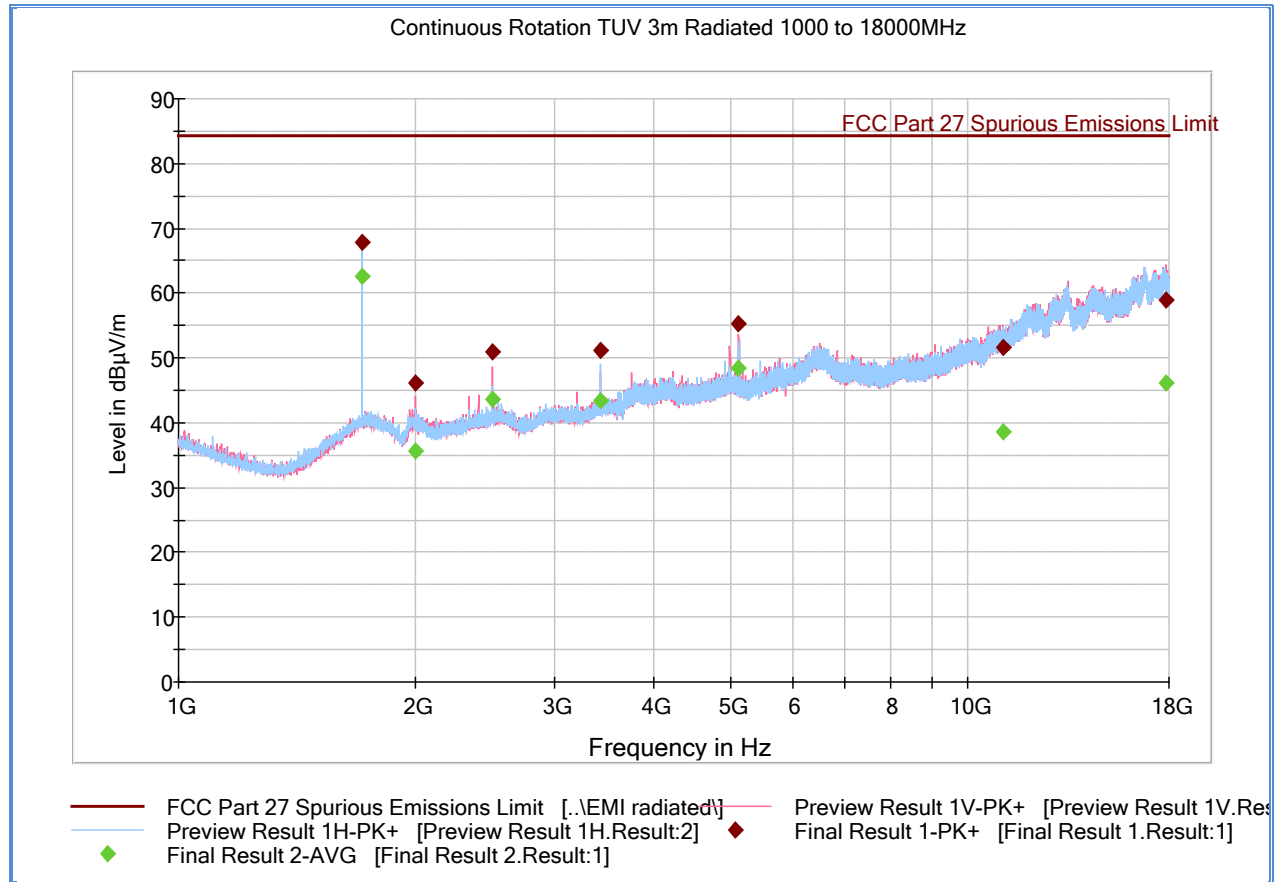


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
43.127214	35.7	1000.0	120.000	100.0	V	230.0	-16.9	48.7	84.4
43.223327	34.8	1000.0	120.000	100.0	V	118.0	-16.9	49.6	84.4
71.821643	26.4	1000.0	120.000	100.0	V	261.0	-21.4	58.0	84.4
107.155511	29.1	1000.0	120.000	100.0	V	262.0	-18.9	55.3	84.4
144.369379	30.8	1000.0	120.000	106.0	V	158.0	-18.6	53.6	84.4
777.396794	87.6	1000.0	120.000	100.0	H	-15.0	Fundamental		
960.082244	36.9	1000.0	120.000	100.0	V	99.0	2.4	47.5	84.4

Test Notes: Only worst case channel presented for spurious emissions below 1GHz in band 13. Plot presented in band 13, low channel (23205), 5MHz channel bandwidth with QPSK modulation and RB size/offset of 1/0. Emissions within 20dB of the Part 27 Subpart C §27.53 limit are proven by substitution method. However no such emission observed. 777.39 MHz is part of the fundamental frequency and not part of consider evaluation of this test.

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



Peak and Average Data

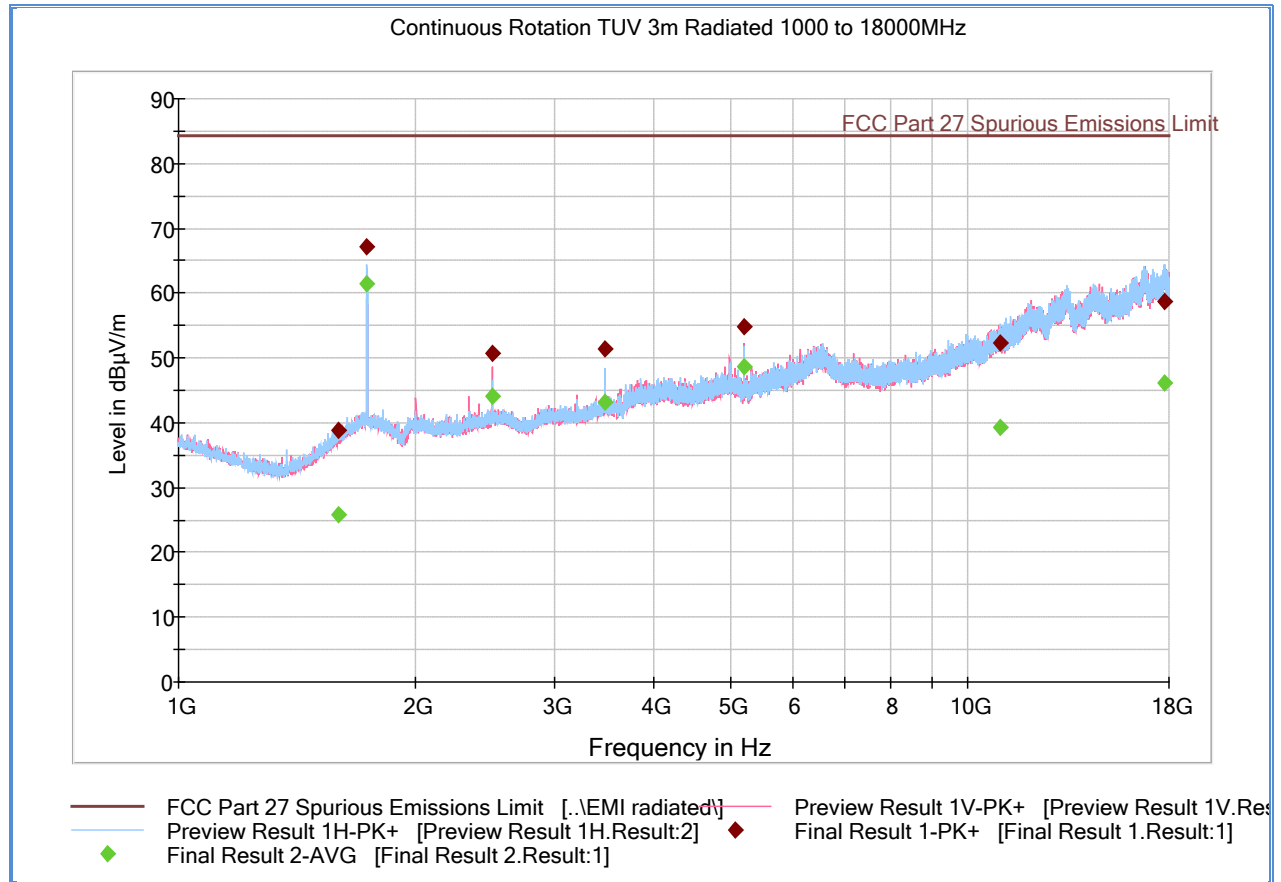
Frequency (MHz)	Max Peak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1710.233333	67.9	62.5	1000.0	1000.000	99.7	H	118.0		Fundamental		
2000.200000	46.3	35.6	1000.0	1000.000	196.5	V	-3.0	-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).

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



Peak and Average Data

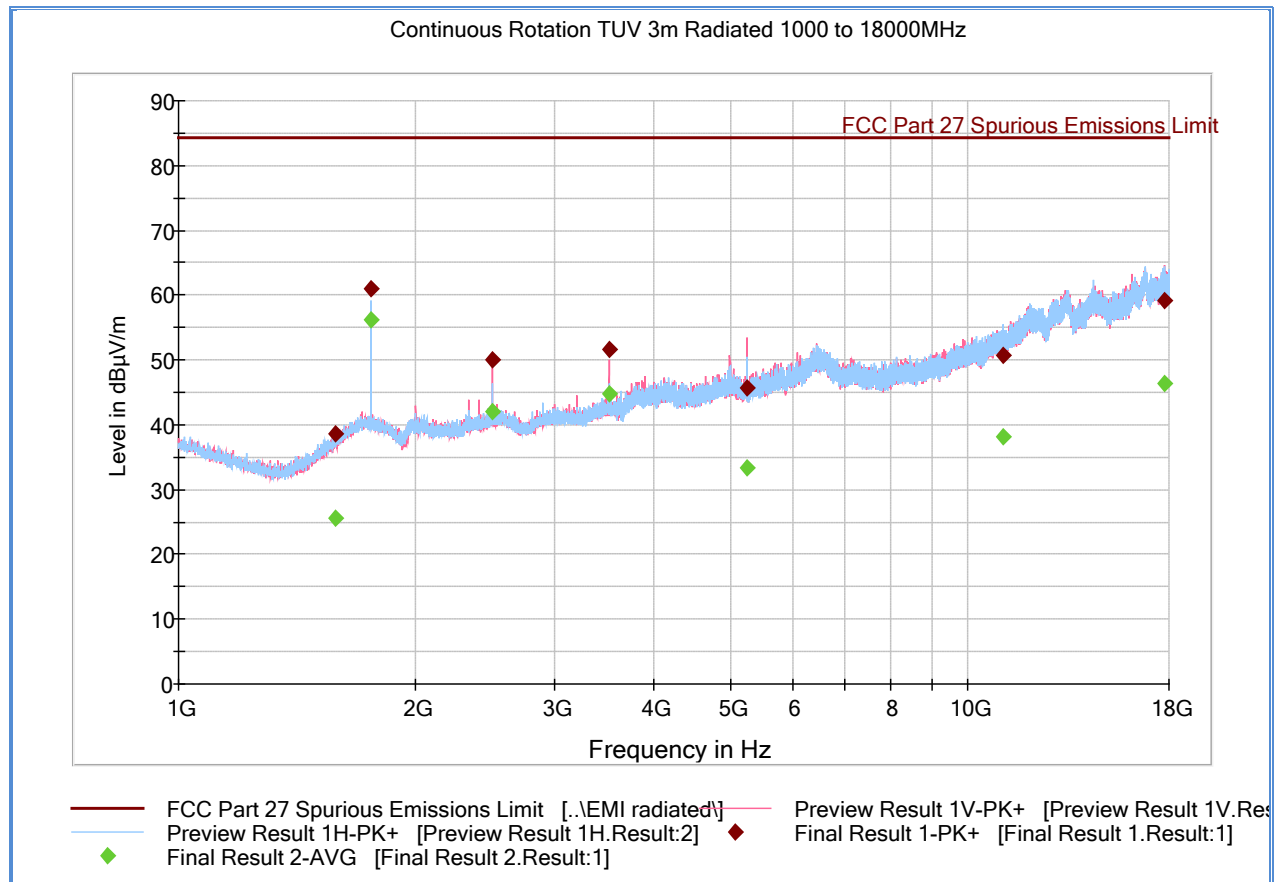
Frequency (MHz)	Max Peak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1593.266667	38.8	25.7	1000.0	1000.000	302.2	H	17.0	-4.9	45.6	58.7	84.4
1734.600000	67.1	61.3	1000.0	1000.000	128.7	H	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).

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



Peak and Average Data

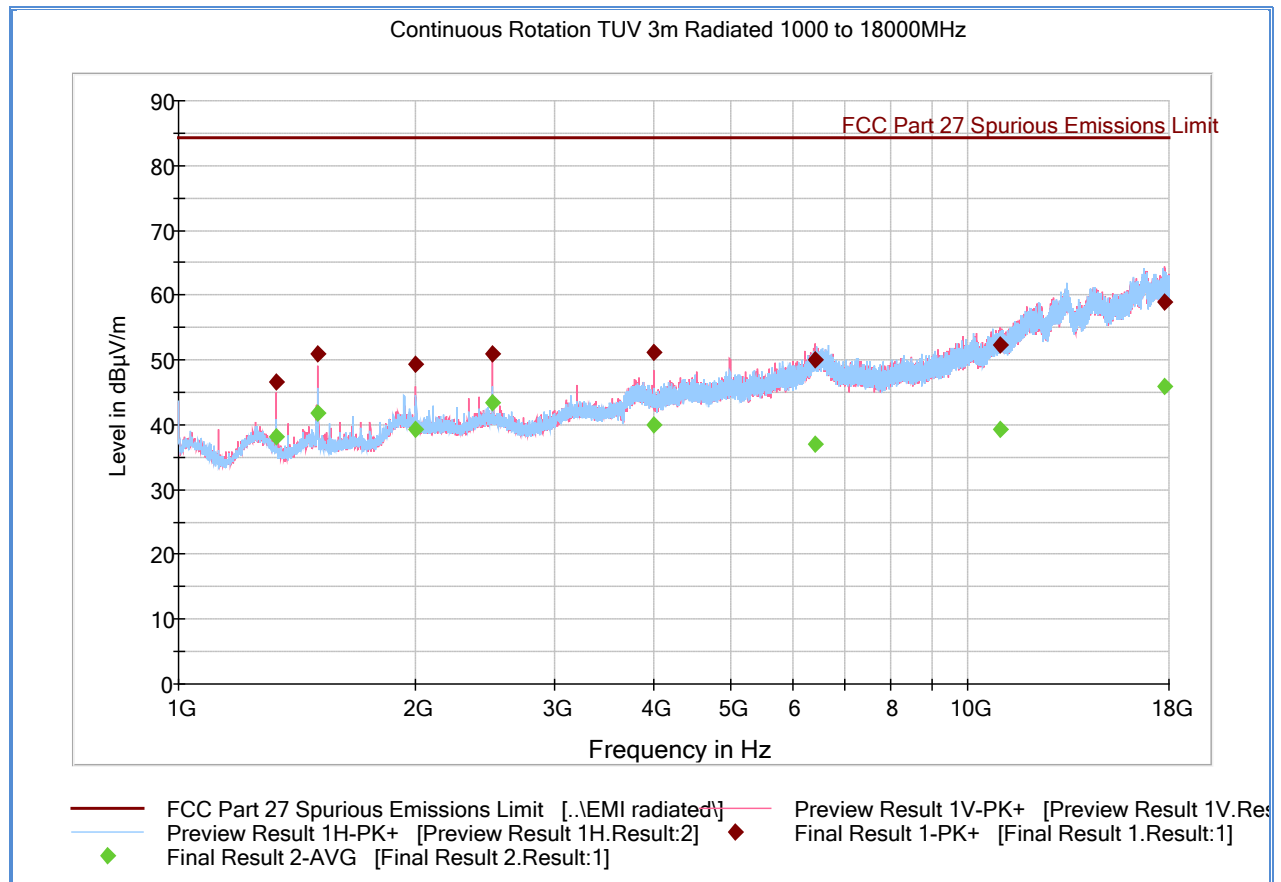
Frequency (MHz)	Max Peak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBµV/m)
1581.933333	38.6	25.6	1000.0	1000.000	404.4	H	234.0	-4.9	45.8	58.8	84.4
1754.633333	61.1	56.1	1000.0	1000.000	99.7	H	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).

2.8.14 Test Results Above 1GHz – Band 13 (Low Channel Worst Case Configuration)



Peak and Average Data

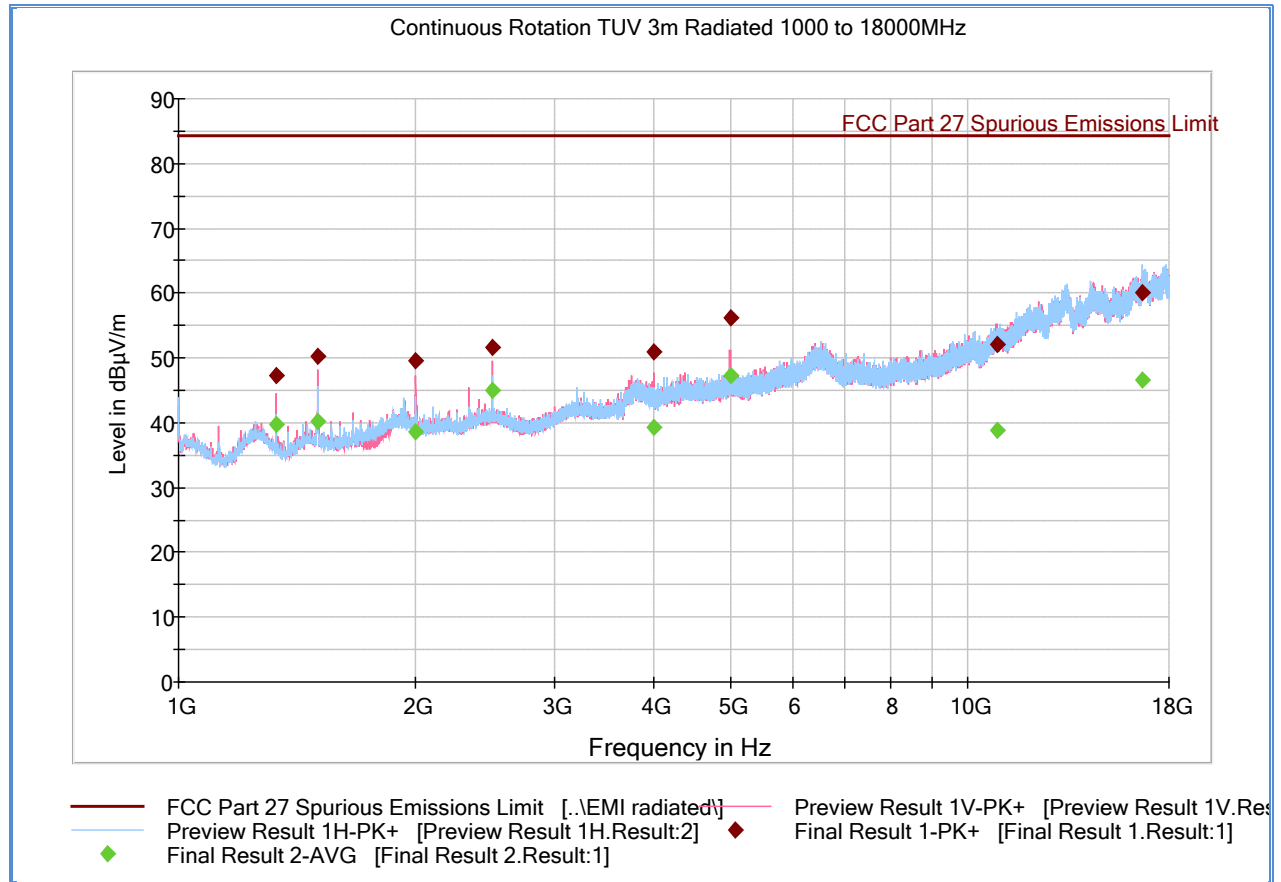
Frequency (MHz)	Max Peak (dBμV/m)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBμV/m)
1332.266667	46.5	38.2	1000.0	1000.000	99.7	V	159.0	-5.0	37.9	46.2	84.4
1500.000000	50.9	41.8	1000.0	1000.000	238.4	V	38.0	-5.1	33.5	42.6	84.4
2000.000000	49.4	39.4	1000.0	1000.000	199.5	V	-4.0	-1.0	35.0	45.0	84.4
2499.766667	51.0	43.4	1000.0	1000.000	103.7	V	349.0	0.2	33.4	41.0	84.4
4000.133333	51.2	39.9	1000.0	1000.000	103.7	V	4.0	5.9	33.2	44.5	84.4
6396.566667	50.1	36.9	1000.0	1000.000	334.1	V	133.0	12.7	34.3	47.5	84.4
10979.033333	52.3	39.3	1000.0	1000.000	145.7	V	312.0	17.0	32.1	45.1	84.4
17733.466667	59.0	45.9	1000.0	1000.000	146.7	V	16.0	25.7	25.4	38.5	84.4

Substitution Data

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

Test Notes: Only worst case modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 800MHz high pass filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

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



Peak and Average Data

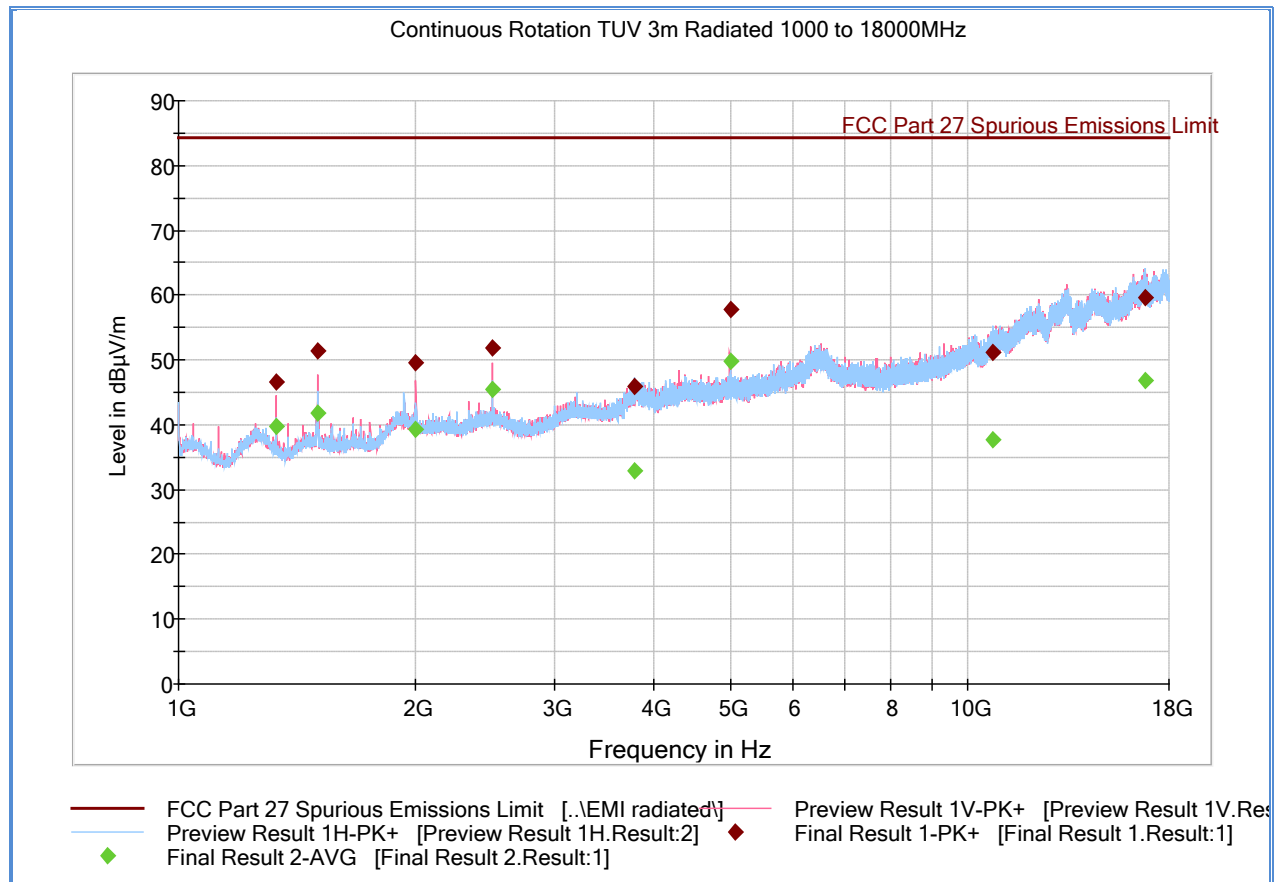
Frequency (MHz)	Max Peak (dBμV/m)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Average Margin (dB)	Limit (dBμV/m)
1332.100000	47.4	39.7	1000.0	1000.000	101.7	V	160.0	-5.0	37.0	44.7	84.4
1500.000000	50.2	40.2	1000.0	1000.000	100.7	V	147.0	-5.1	34.2	44.2	84.4
2000.000000	49.5	38.6	1000.0	1000.000	213.4	V	-3.0	-1.0	34.9	45.8	84.4
2499.766667	51.6	45.1	1000.0	1000.000	103.7	V	345.0	0.2	32.8	39.3	84.4
4000.133333	50.9	39.4	1000.0	1000.000	99.7	V	4.0	5.9	33.5	45.0	84.4
4999.933333	56.2	47.3	1000.0	1000.000	99.7	V	332.0	7.6	28.2	37.1	84.4
10923.866667	52.0	38.7	1000.0	1000.000	202.3	V	270.0	16.8	32.4	45.7	84.4
16676.633333	60.0	46.5	1000.0	1000.000	285.3	H	104.0	25.5	24.4	37.9	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

Test Notes: Only worst case modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 800MHz high pass filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).

2.8.16 Test Results Above 1GHz – Band 13 (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)
1331.900000	46.6	39.8	1000.0	1000.000	99.7	V	158.0	-5.0	37.8	44.6	84.4
1500.000000	51.3	41.9	1000.0	1000.000	249.3	V	38.0	-5.1	33.1	42.5	84.4
1999.966667	49.6	39.2	1000.0	1000.000	200.5	V	-3.0	-1.0	34.8	45.2	84.4
2500.166667	51.9	45.4	1000.0	1000.000	103.7	V	336.0	0.2	32.5	39.0	84.4
3780.633333	45.8	32.9	1000.0	1000.000	302.2	H	72.0	5.7	38.6	51.5	84.4
4999.933333	57.8	49.9	1000.0	1000.000	161.6	V	334.0	7.6	26.6	34.5	84.4
10746.466667	51.1	37.7	1000.0	1000.000	101.7	H	197.0	16.2	33.3	46.7	84.4
16779.766667	59.7	46.9	1000.0	1000.000	268.3	H	274.0	25.9	24.7	37.5	84.4

Substitution Data

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

Test Notes: Only worst case modulation/bandwidth presented for spurious emissions above 1GHz. Measurement was performed with a 800MHz high pass filter. Substitution data not required since margin is >20dB compared to the -13dBm limit (converted to field strength @ 3 meters).



2.9 FREQUENCY STABILITY

2.9.1 Specification Reference

Part 27 Subpart C §27.54 and Part 2.1055(a)(1) and (d)(1)

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: SS220414800535 / Test Configuration A

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

June 18, 2014 / 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	13.28	
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 13 – QPSK 5MHz - Channel 23205– Frequency 779.5MHz – RB 1/0				
Voltage (%)	Power (VDC)	Temp (°C)	Frequency Deviation (Hz)	Complies (Y or N)
100	3.8	-30	6.21	EUT complies
100		-20	-5.01	
100		-10	4.66	
100		0	5.25	
100		+10	4.99	
100		+20	-7.41	
100		+30	-6.34	
100		+40	-7.20	
100		+50	-7.04	
115	4.37	+20	5.92	
85	3.23	+20	-10.07	

LTE Band 13 worst case frequency error: -10.07 Hz
 Worst case 99% OBW of LTE Band 13 5.0MHz BW: 4.49 MHz

Low Channel Sample Calculation:

Edge of fundamental emission $(779.5 - (4.49/2))$: 777.255 MHz
 Max. fundamental frequency error $(777.255 - 0.00001007)$: 777.2549899 MHz
 EUT complies. 777.2549899 MHz > 776 MHz (edge of authorized band)

High Channel Sample Calculation:

Edge of fundamental emission $(784.5 + (4.49/2))$: 786.745 MHz
 Max. fundamental frequency error $(786.745 - 0.00001007)$: 786.7449899 MHz
 EUT complies. 786.7449899 MHz < 788 MHz (edge of authorized band)



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

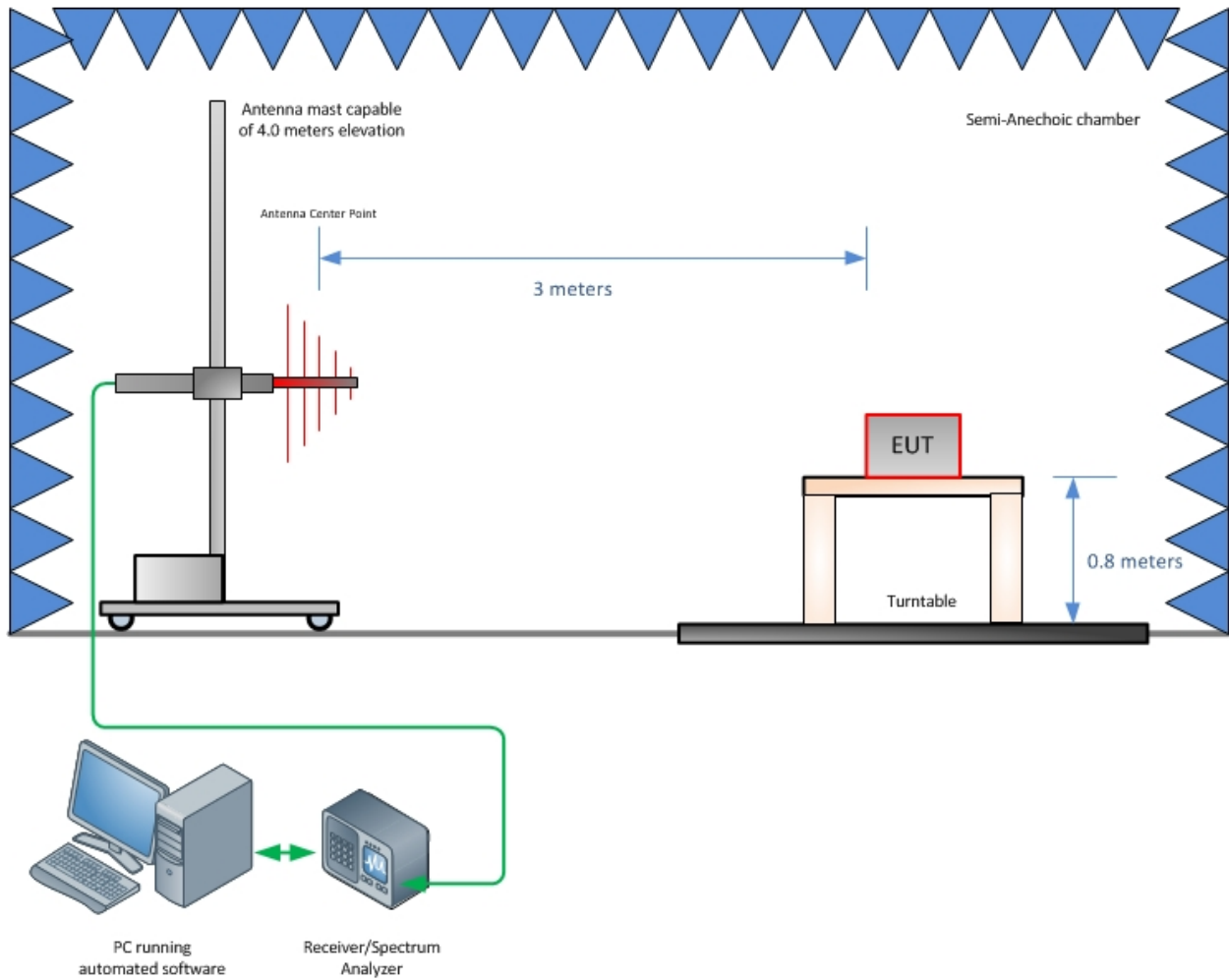
Contribution		Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
Combined Uncertainty (u_c):					0.72
Coverage Factor (k):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



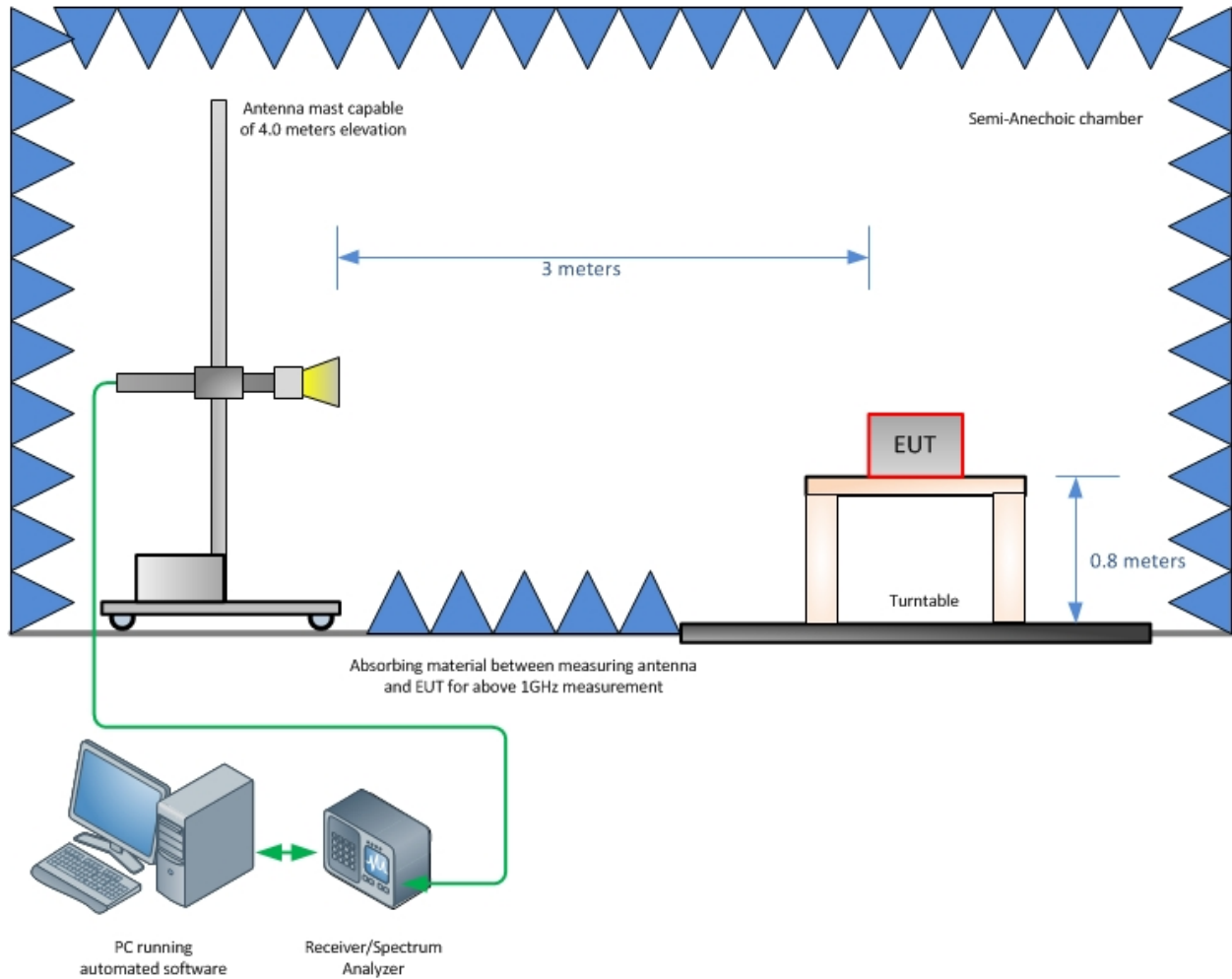
SECTION 4

DIAGRAM OF TEST SETUP

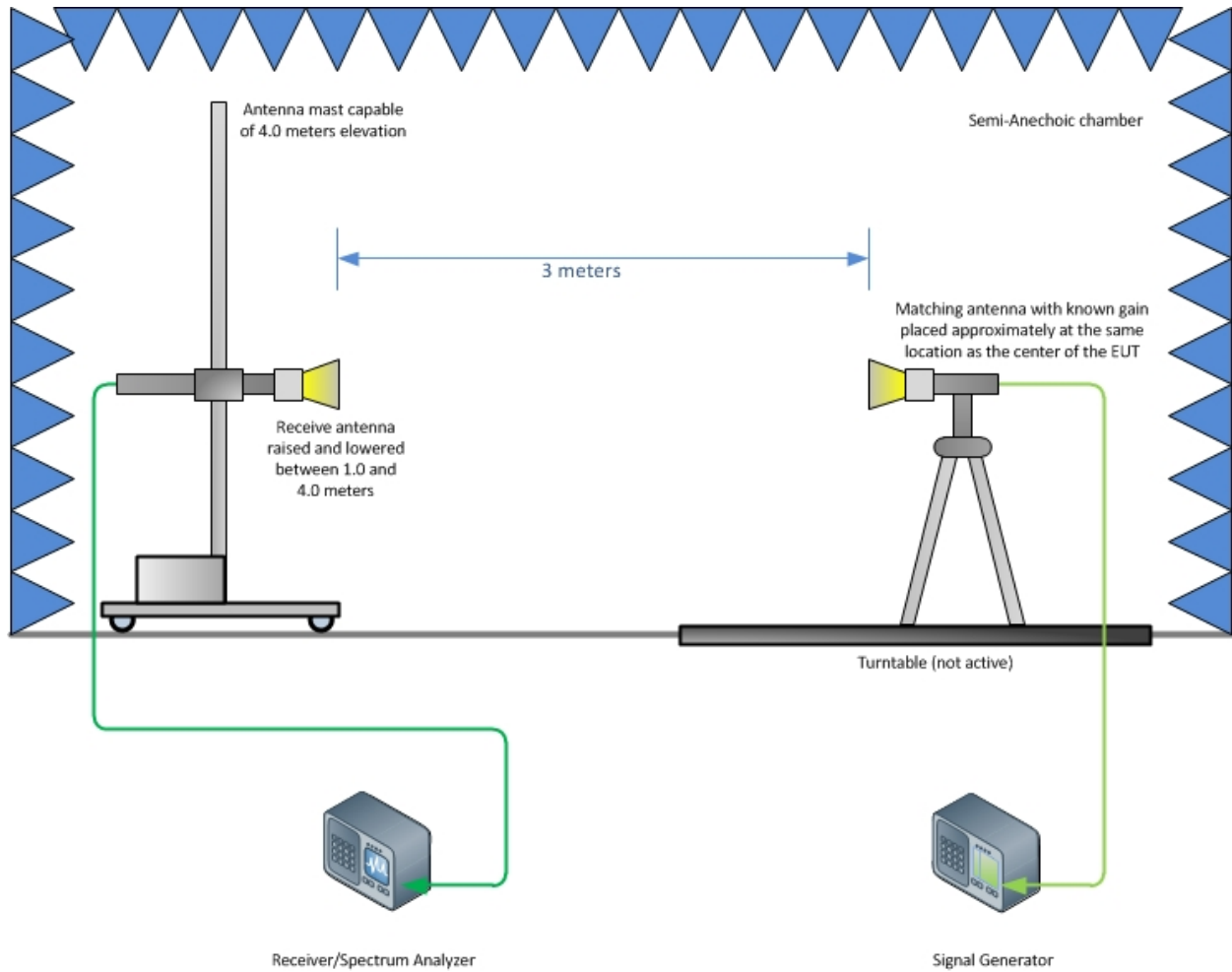
4.1 TEST SETUP DIAGRAM



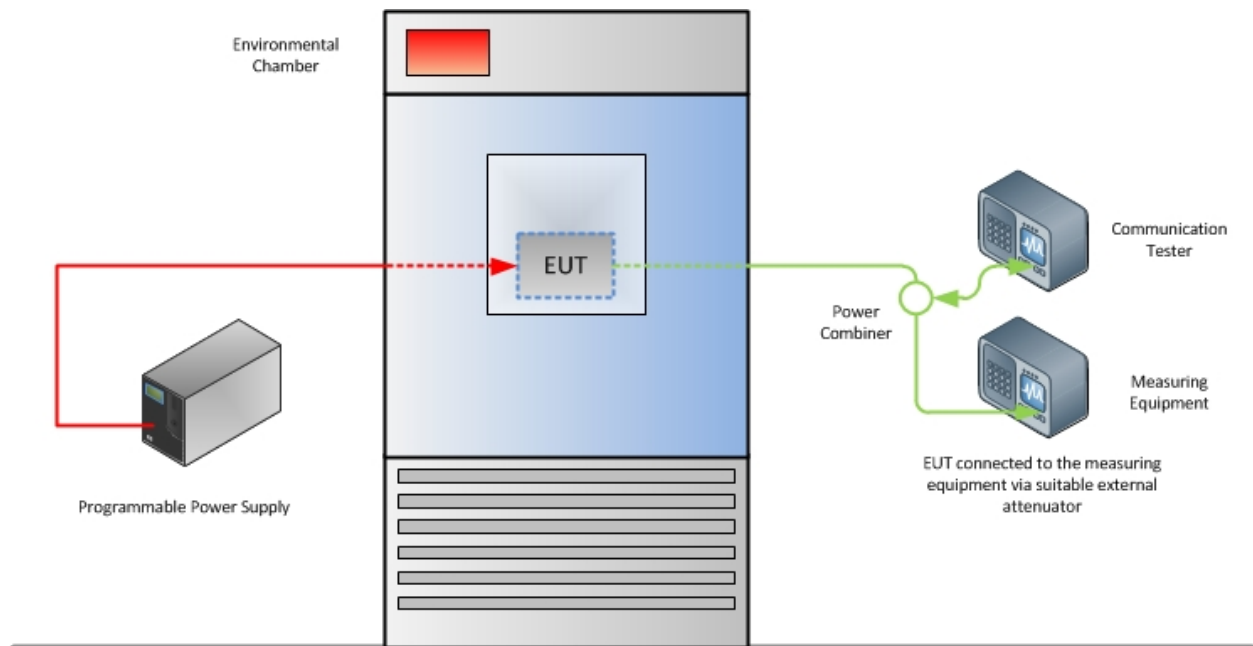
Radiated Emission Test Setup (Below 1GHz)



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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