

7. Band Edge

7.1. Limit

FCC §22.917(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

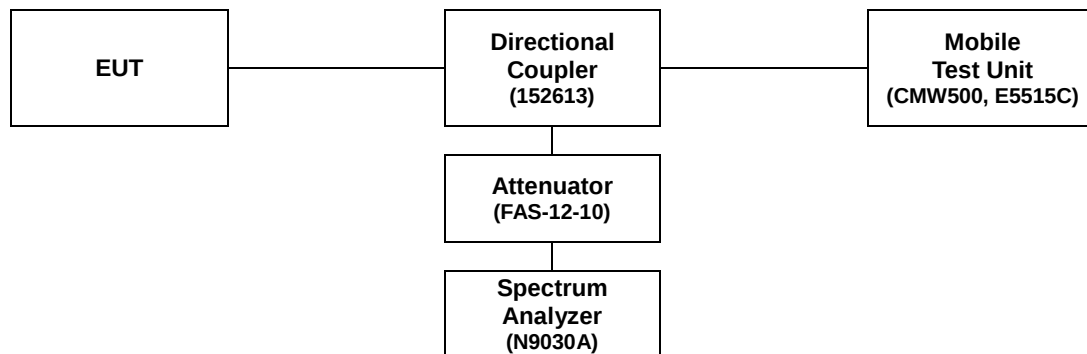
FCC §24.238(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC §27.53(g), 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.

FCC §27.53(h), when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

7.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The center of the spectrum analyzer was set to block edge frequency.



7.2.1 Actual equipment used for Band edge

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due.
Signal Generator	Agilent	E8257d	MY51501169	Jul. 23, 2013	Annual	Jul. 23, 2014
Spectrum Analyzer	Agilent	N9030A	US51350132	Oct. 08, 2013	Annual	Oct. 08, 2014
Mobile Test Unit	Agilent	E5515C	GB43345198	Mar. 28, 2014	Annual	Mar. 28, 2015
Mobile Test Unit	R&S	CMW500	144035	Mar. 03, 2014	Annual	Mar. 03, 2015
Directional Coupler	KRYTAR	152613	140972	Jun. 07, 2013	Annual	Jun. 07, 2014
Attenuator	MCLI	FAS-12-10	1	Jun. 19, 2013	Annual	Jun. 19, 2014
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 27, 2014	Annual	Mar. 27, 2015

Note;

- Mobile test unit(E5515C) is used to test for GSM 850 & 1900
- Mobile test unit(CMW500) is used to test for WCDMA 850 & 1900 and LTE band 7

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SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-040 <http://www.sgsgroup.kr>

RTT5041-20(2014.01.20)(2)

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

7.3. Test Results

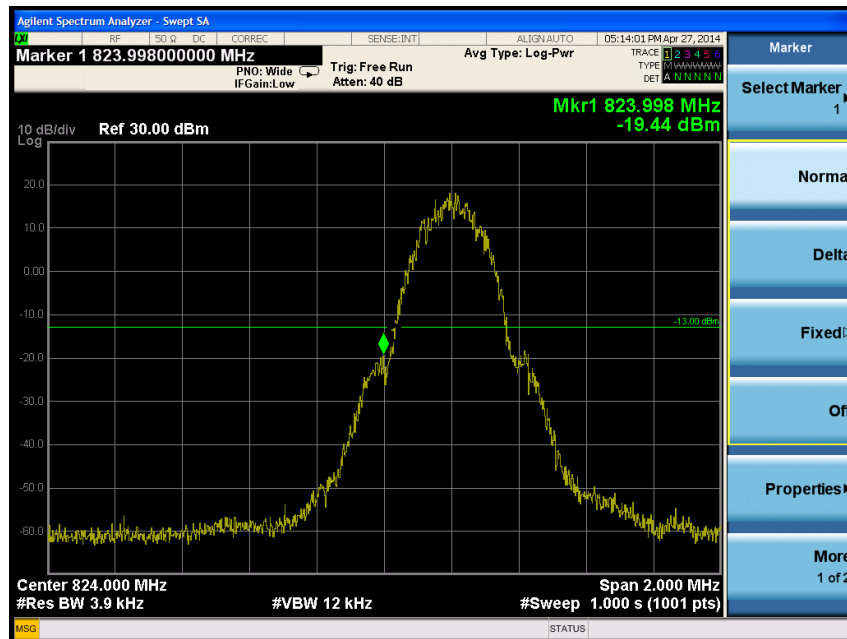
Ambient temperature : (24 ± 2) °C

Relative humidity : 47 % R.H.

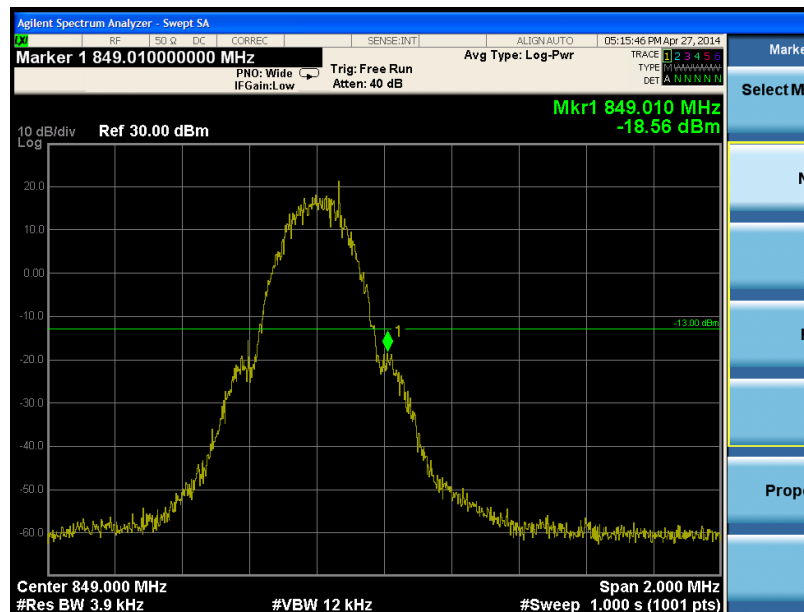
Please refer to the following plots.

Bandedge_GSM850

Low Channel



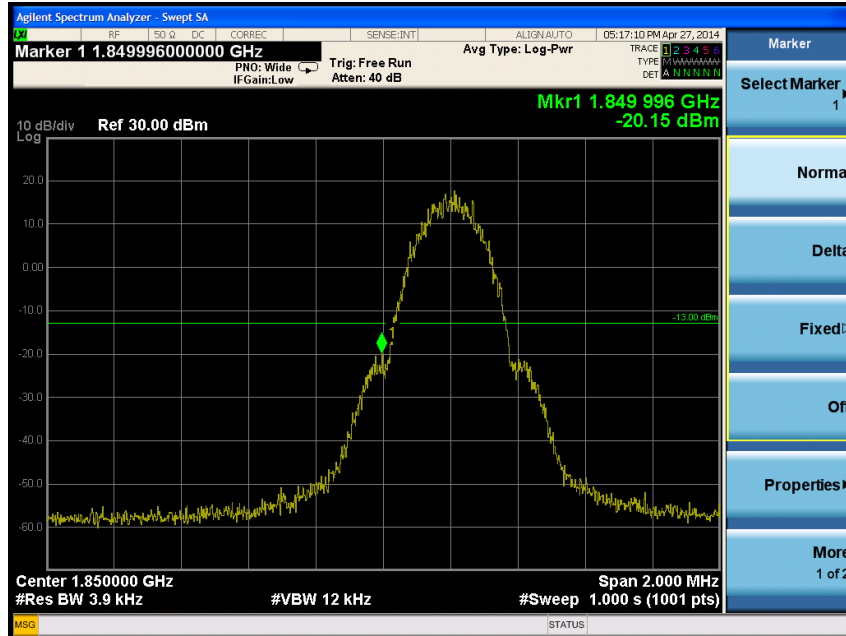
High Channel



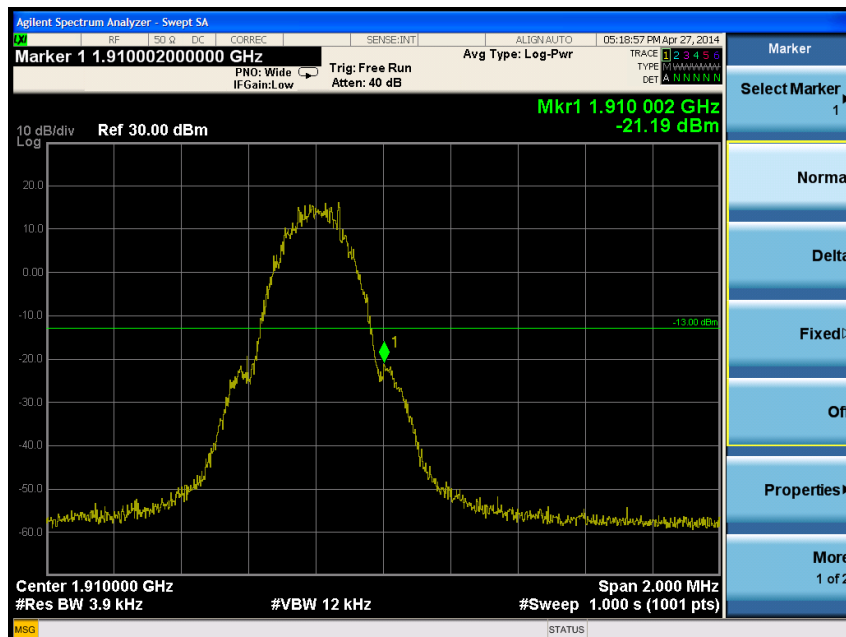
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Bandedge_GSM1900

Low Channel



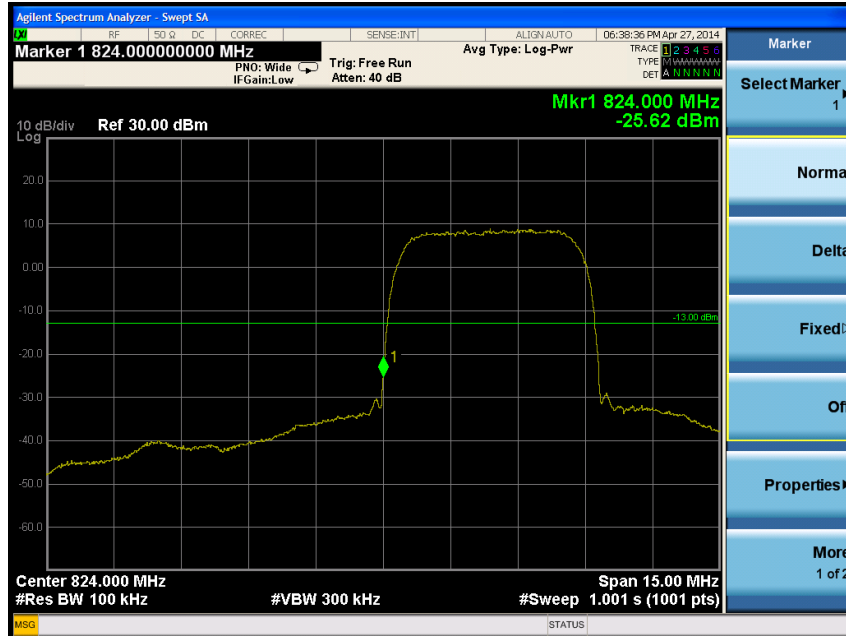
High Channel



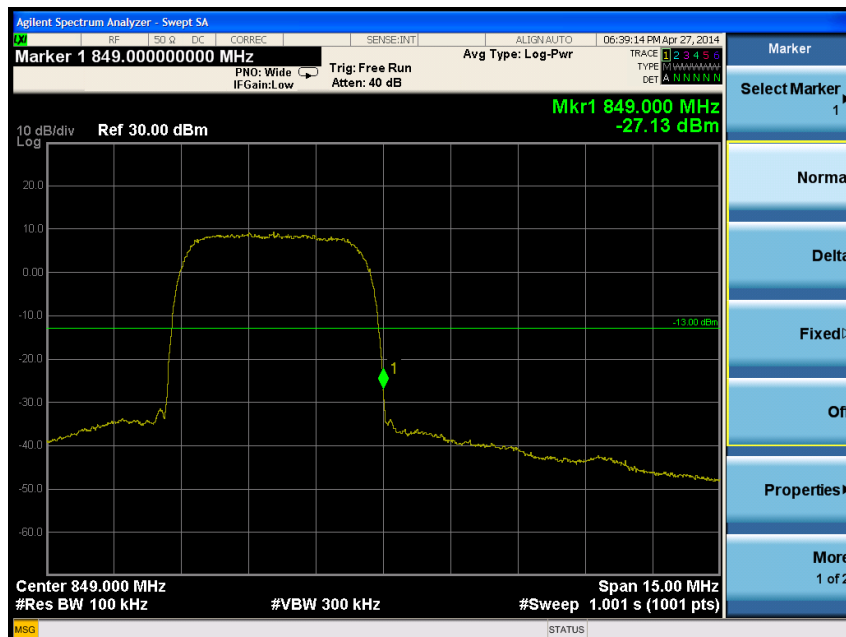
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Bandedge_WDCMA850

Low Channel



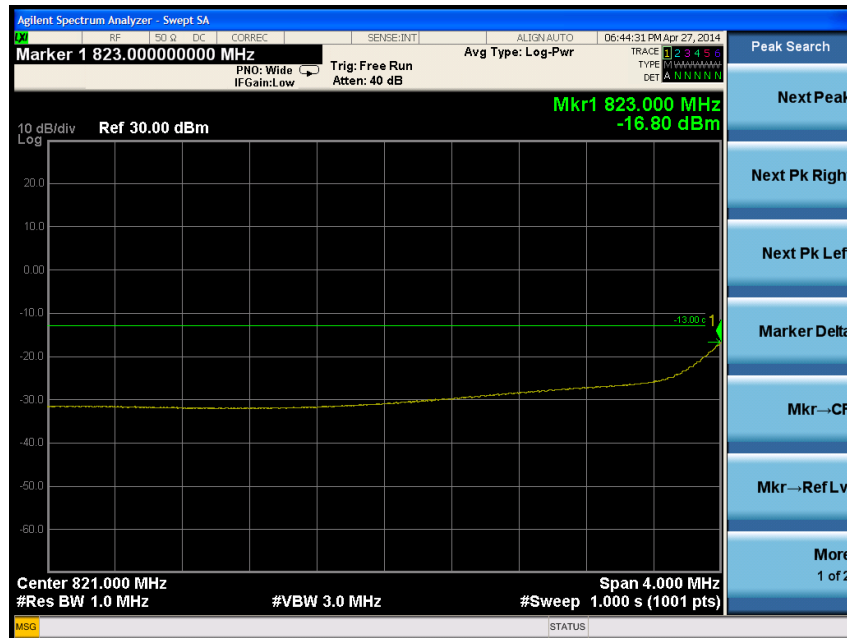
High Channel



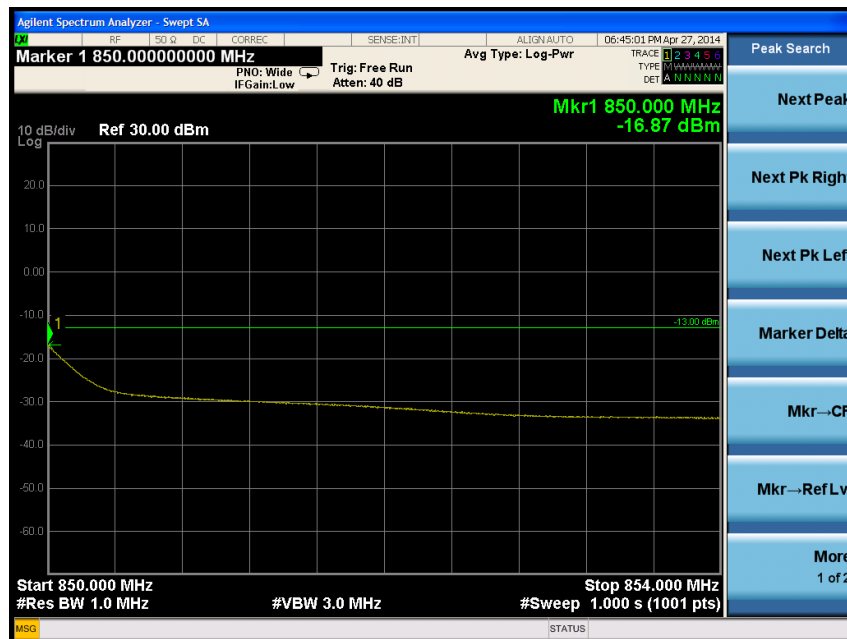
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4 MHz span plot_WCDMA850

Low Channel



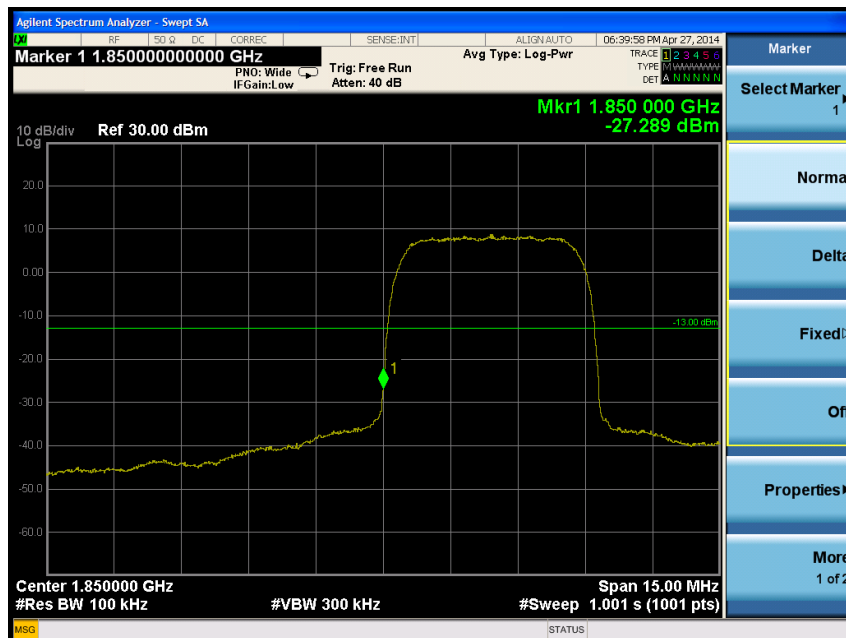
High Channel



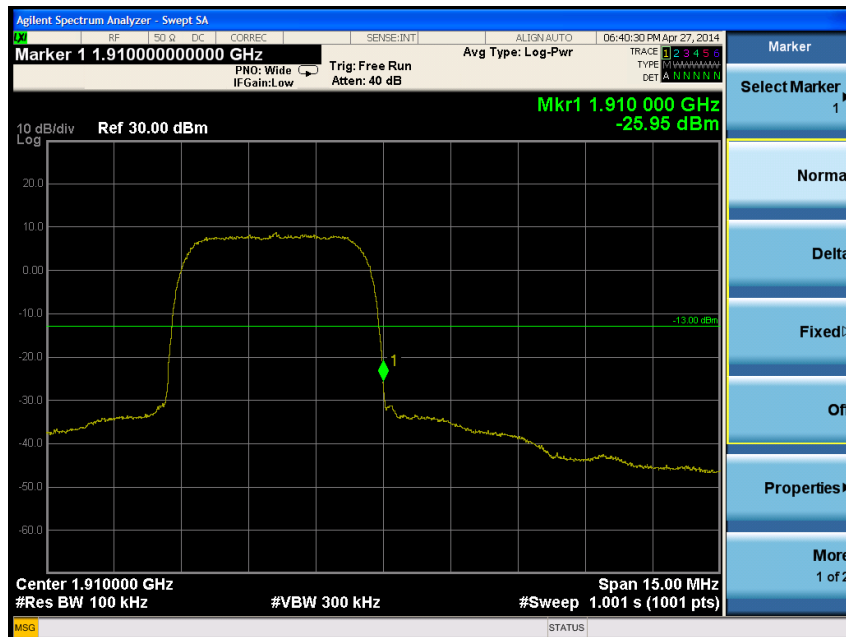
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Bandedge_WCDMA1900

Low Channel



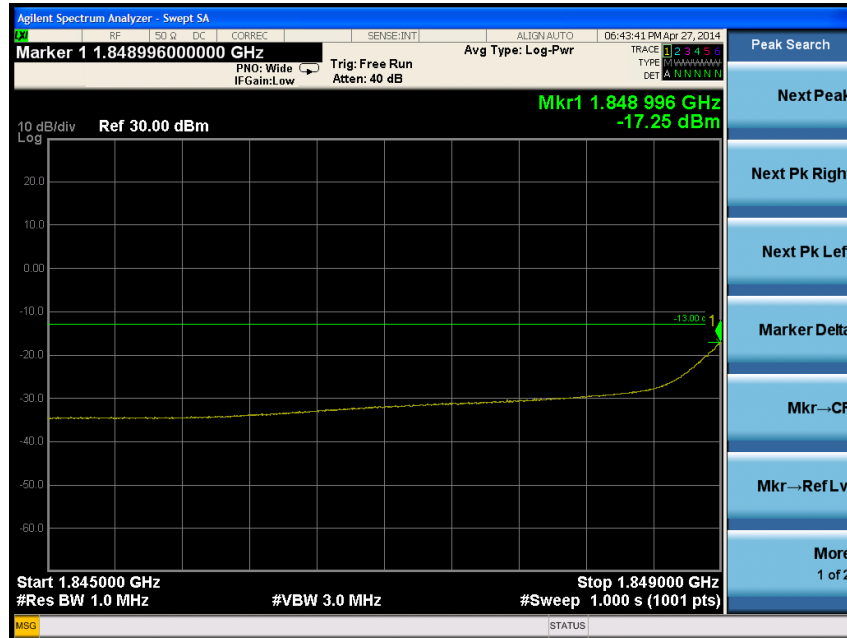
High Channel



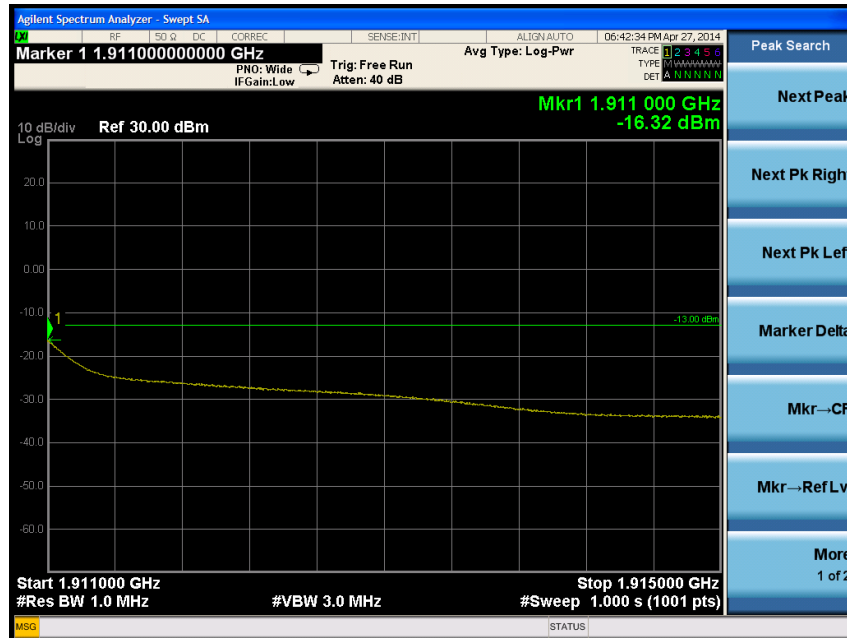
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4 MHz span plot_WCDMA1900

Low Channel



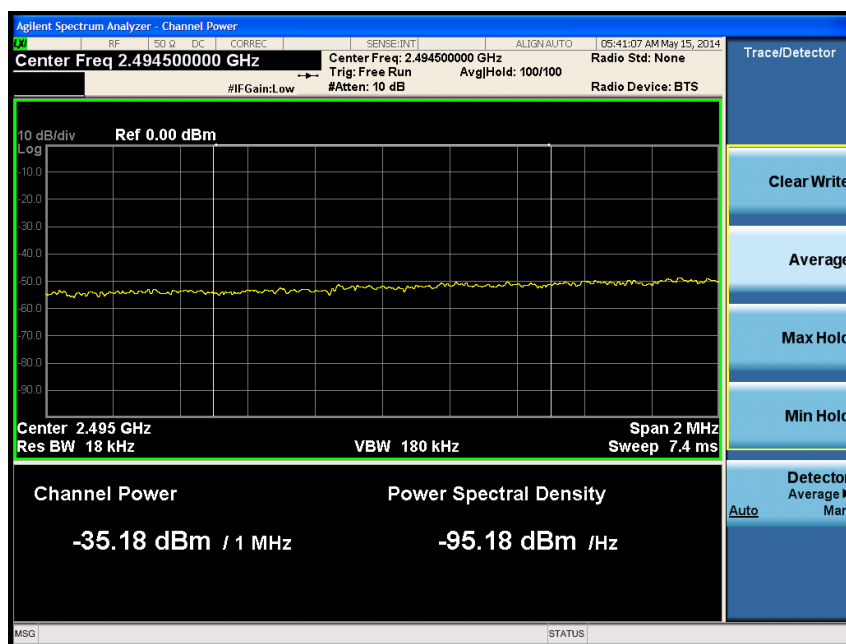
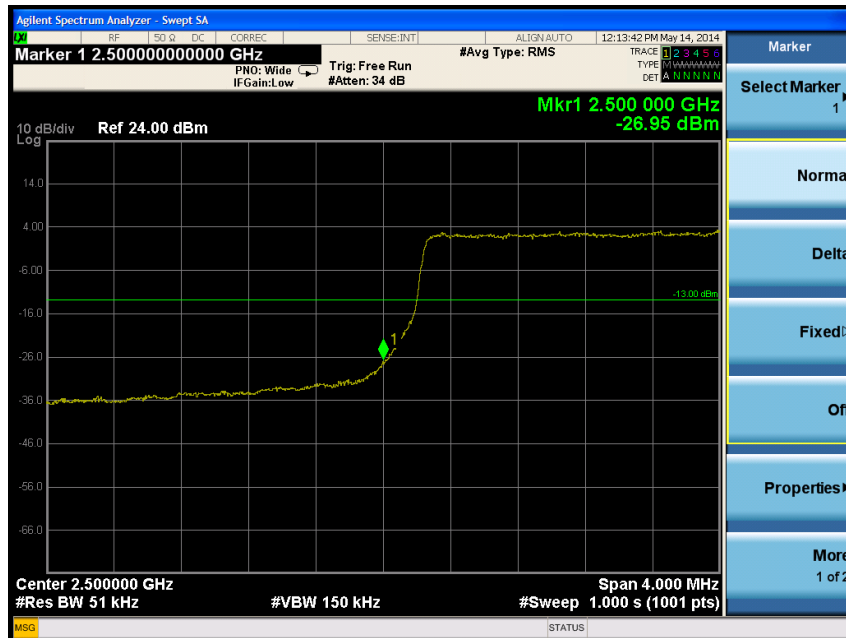
High Channel



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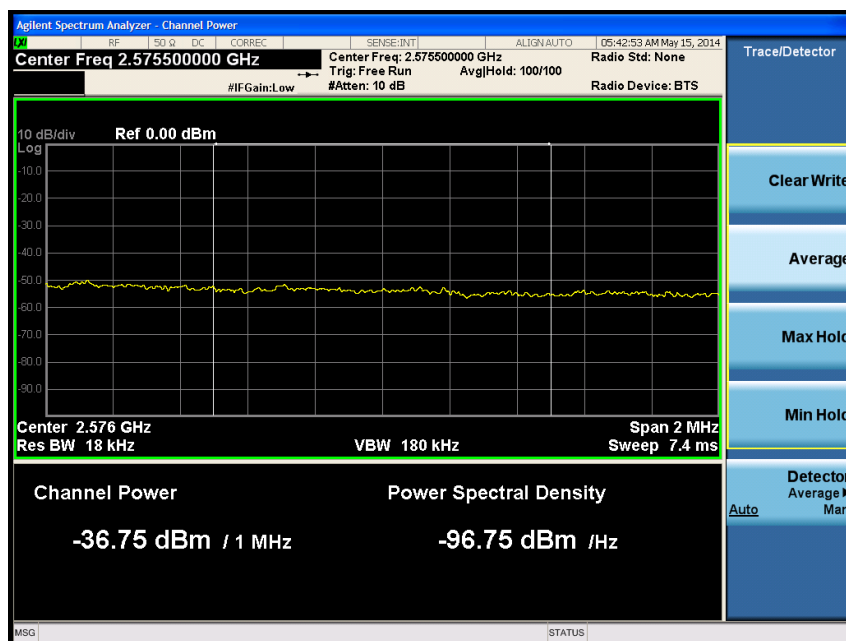
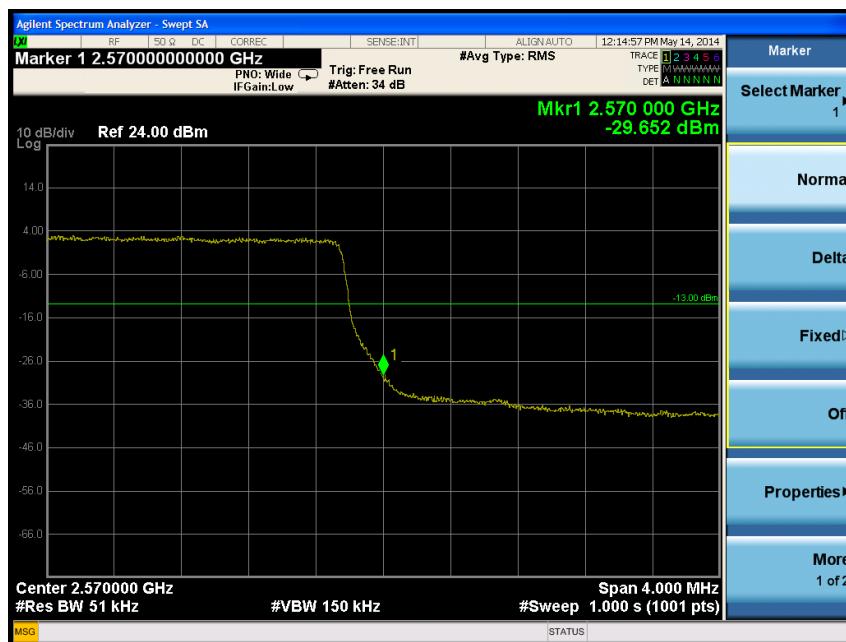
Bandedge_LTE band 7 (5 MHz – QPSK_RB 25)

Low Channel



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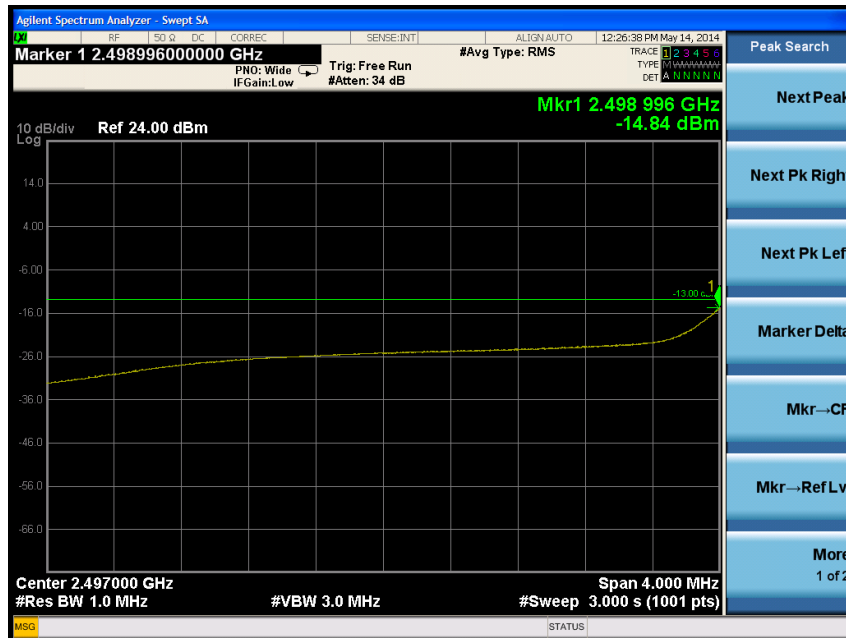
High Channel



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4 MHz span plot_ LTE band 7 (5 MHz – QPSK_RB 25)

Low Channel



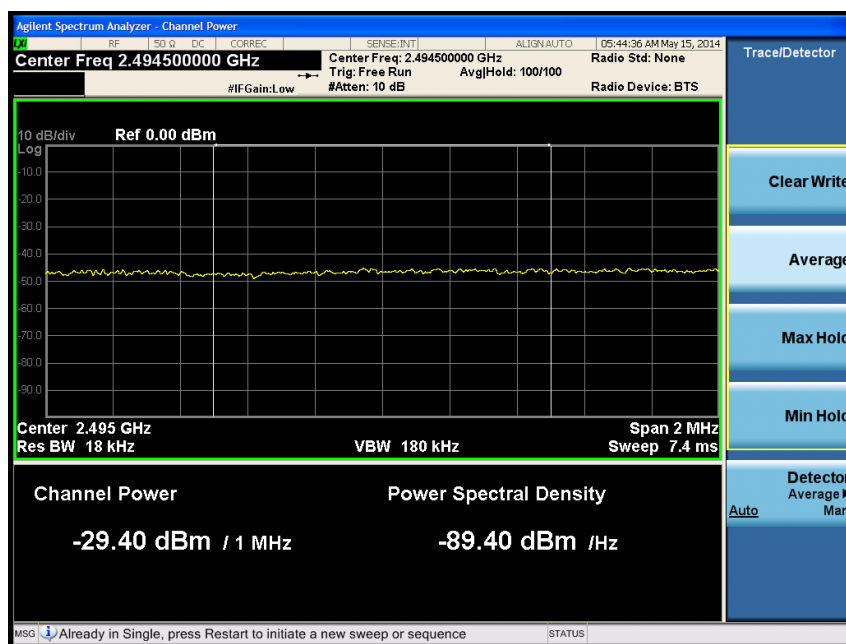
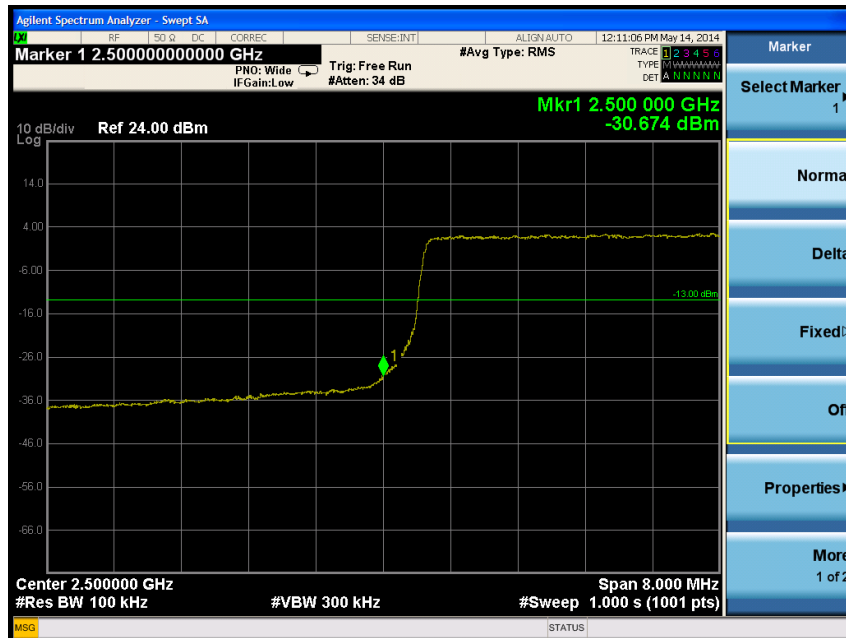
High Channel



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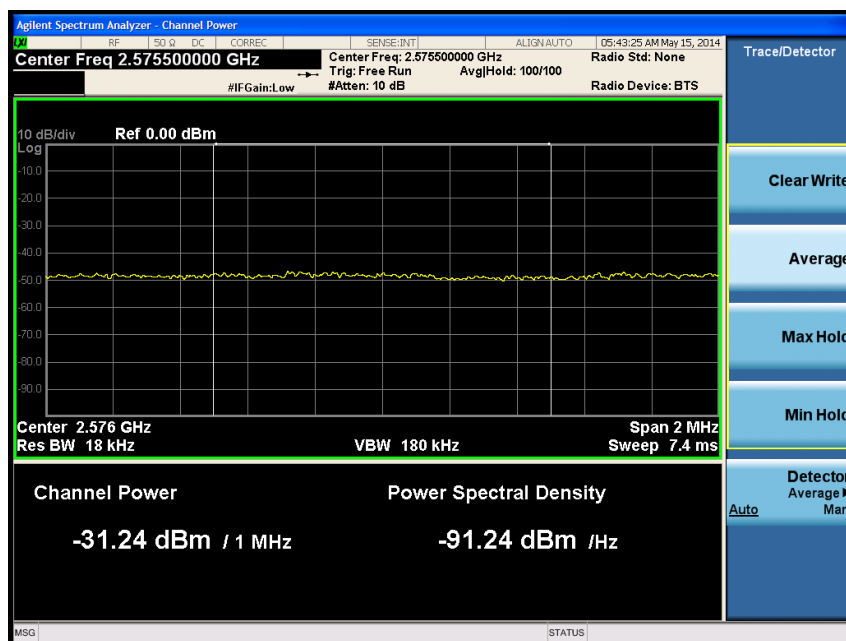
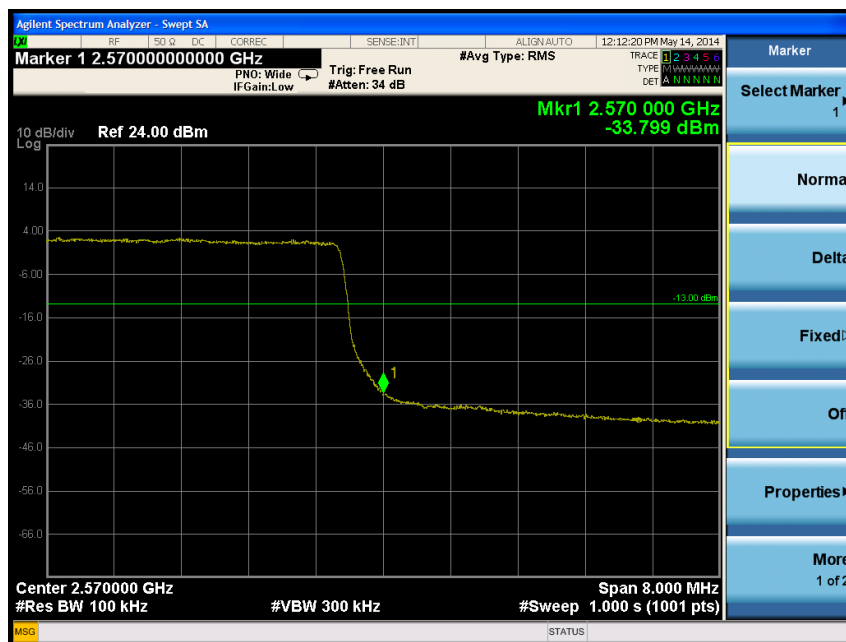
Bandedge_LTE band 7 (10 MHz – QPSK_RB 50)

Low Channel



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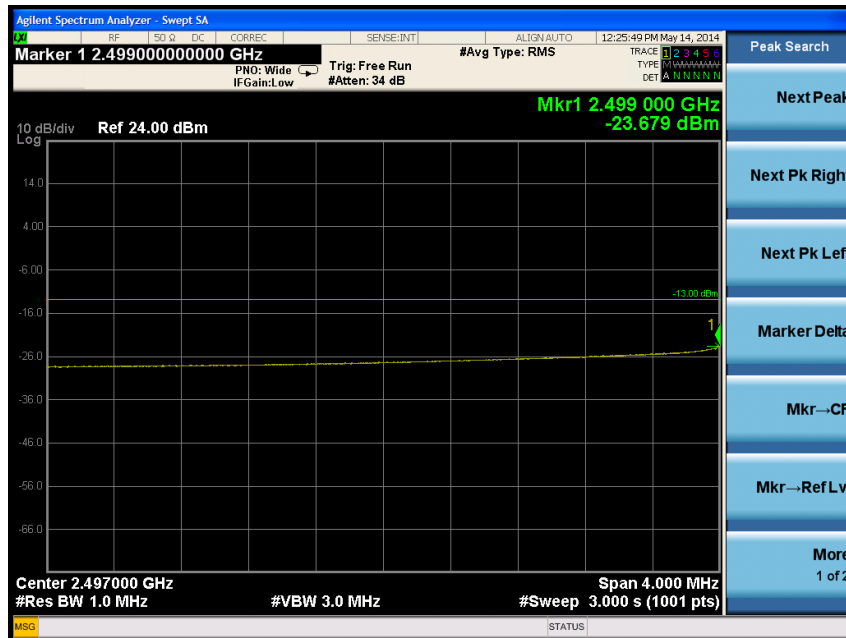
High Channel



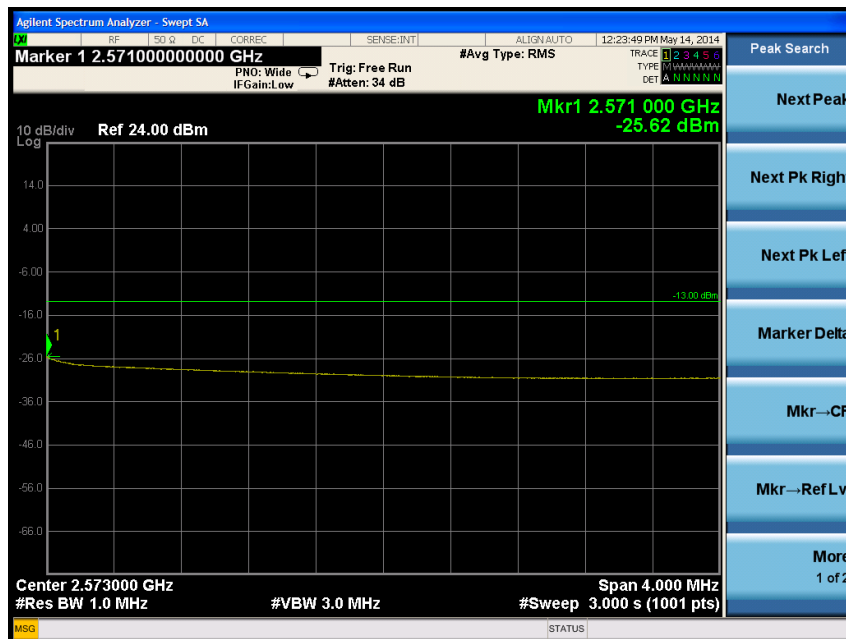
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4 MHz span plot_ LTE band 7 (10 MHz – QPSK_RB 50)

Low Channel



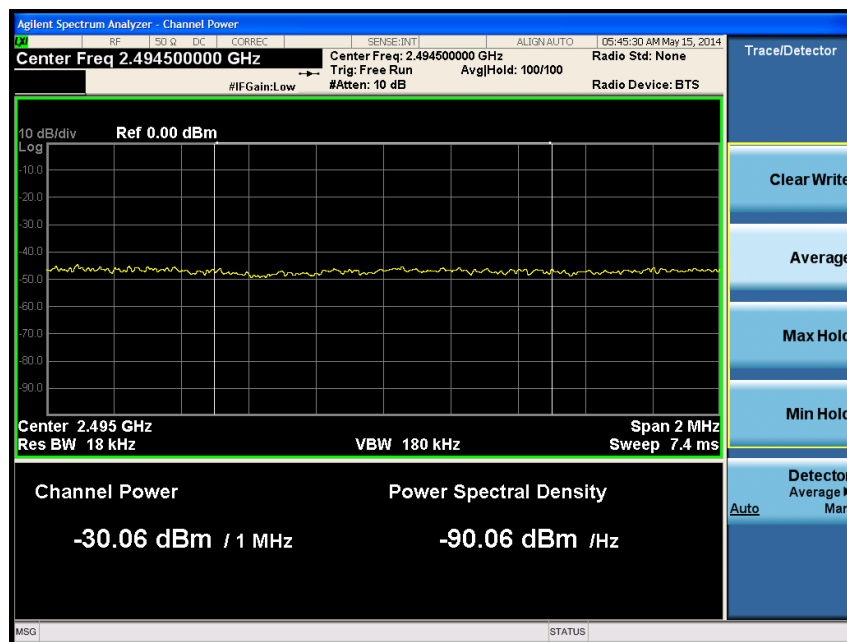
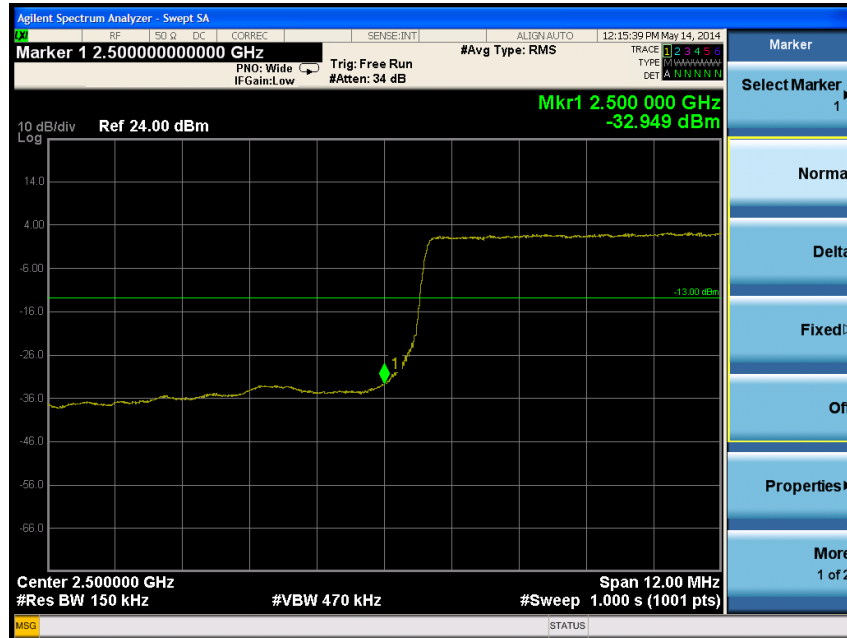
High Channel



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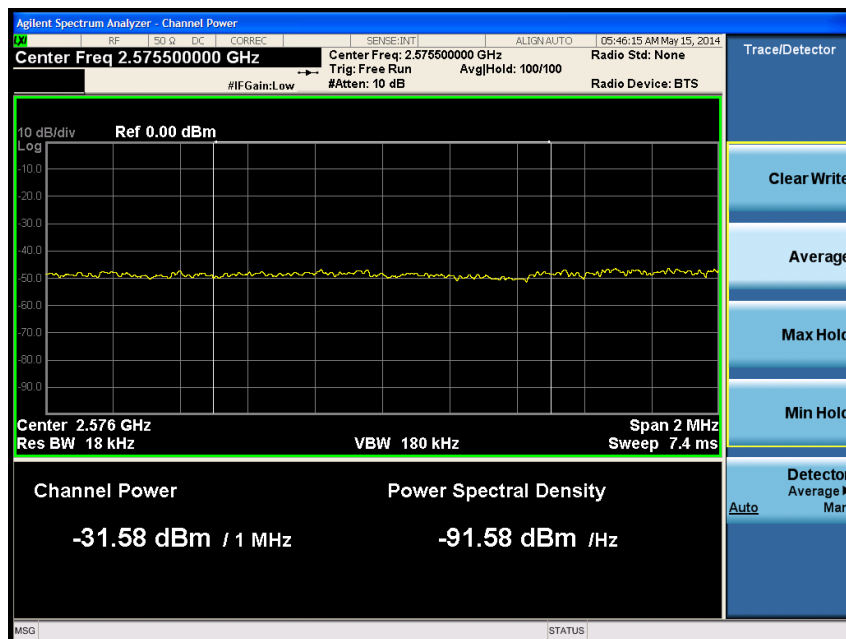
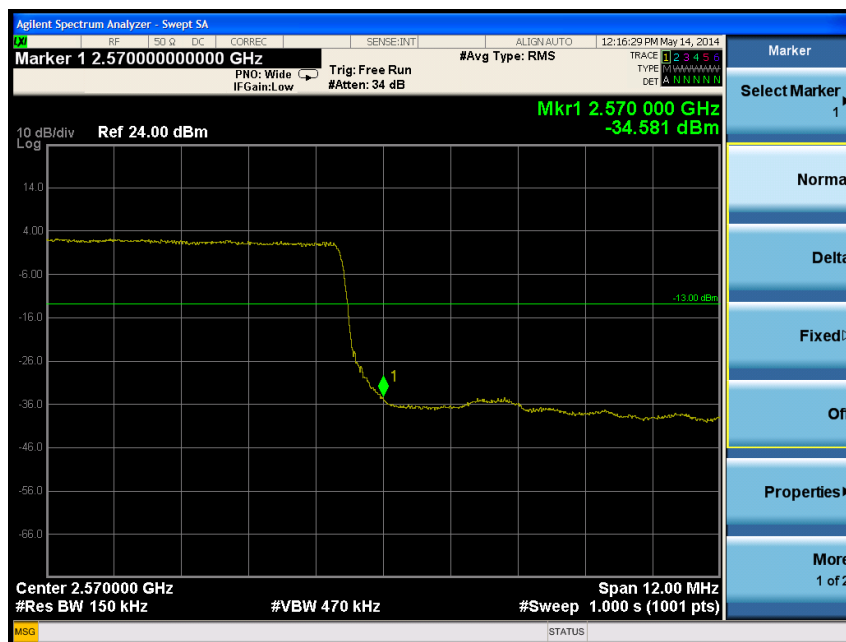
Bandedge_LTE band 7 (15 MHz – QPSK_RB 75)

Low Channel



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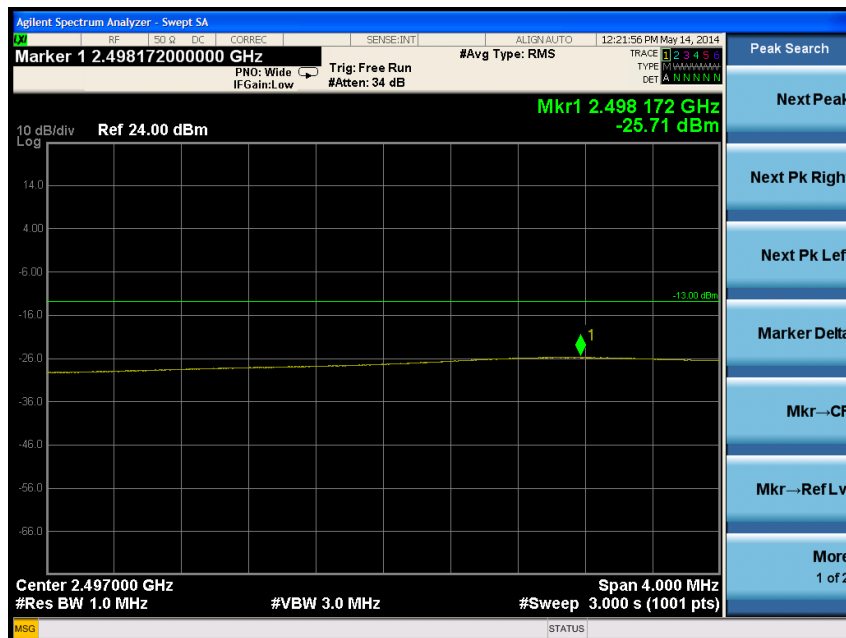
High Channel



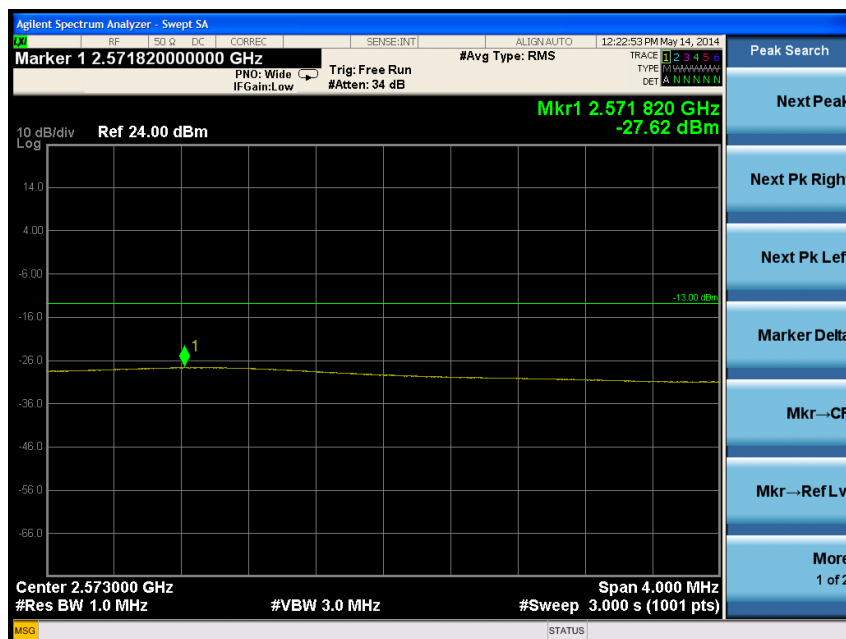
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4 MHz span plot_ LTE band 7 (15 MHz – QPSK_RB 75)

Low Channel



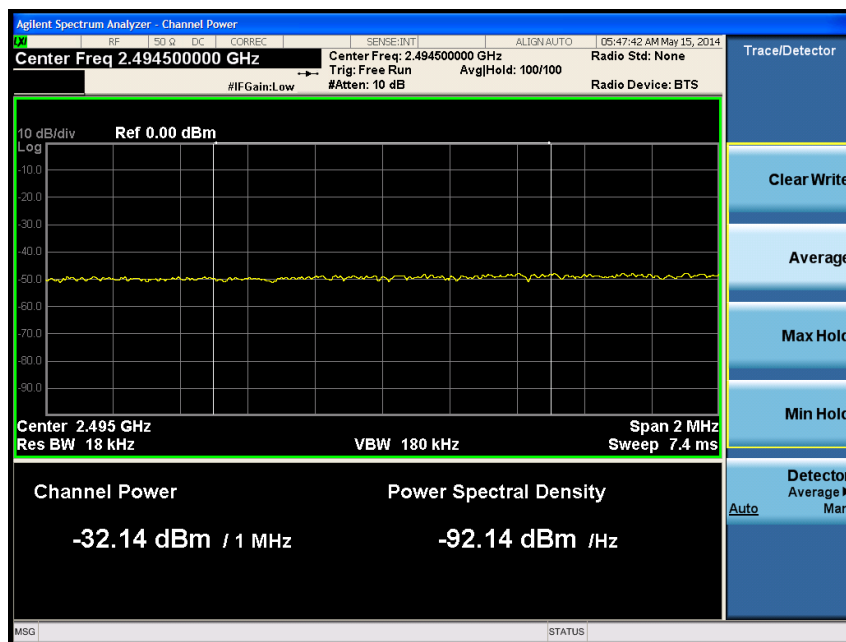
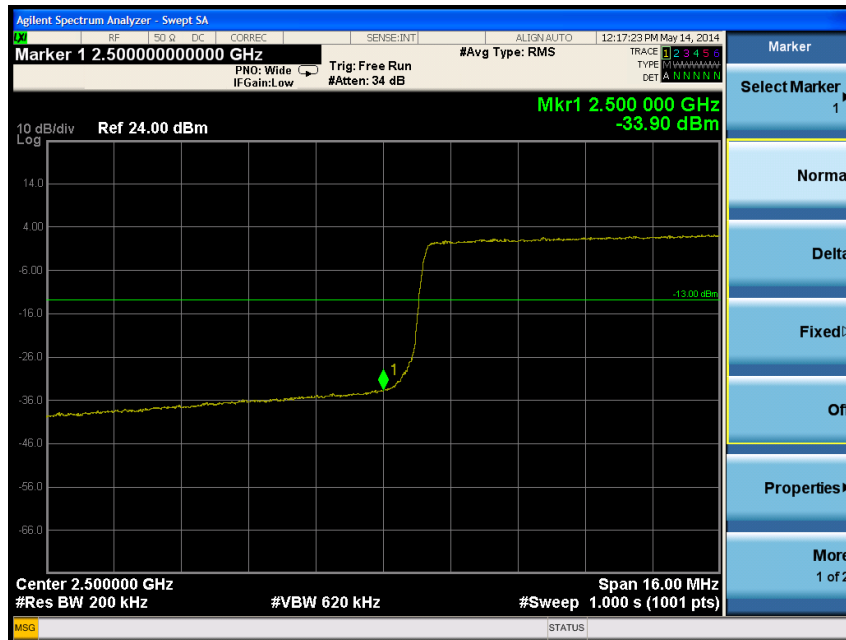
High Channel



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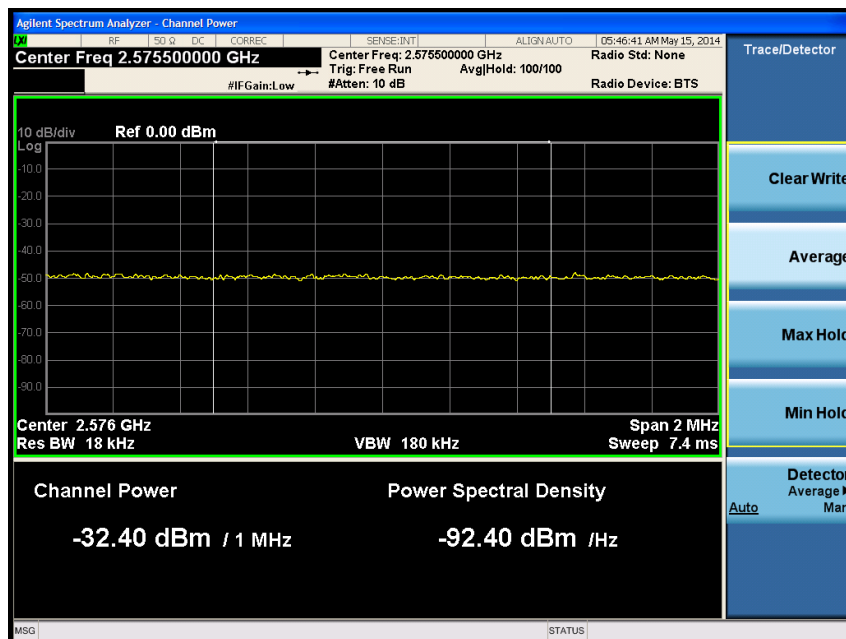
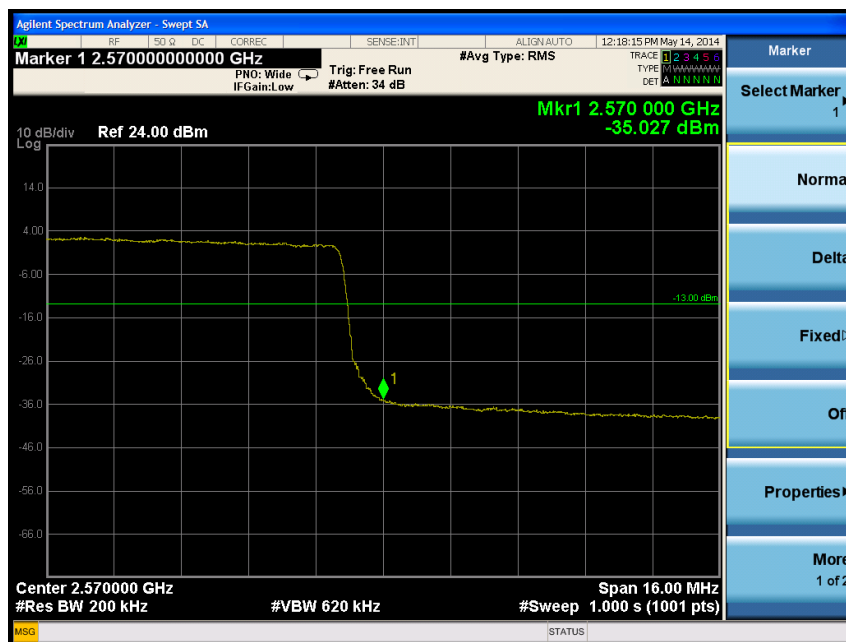
Bandedge_LTE band 7 (20 MHz – QPSK_RB 100)

Low Channel



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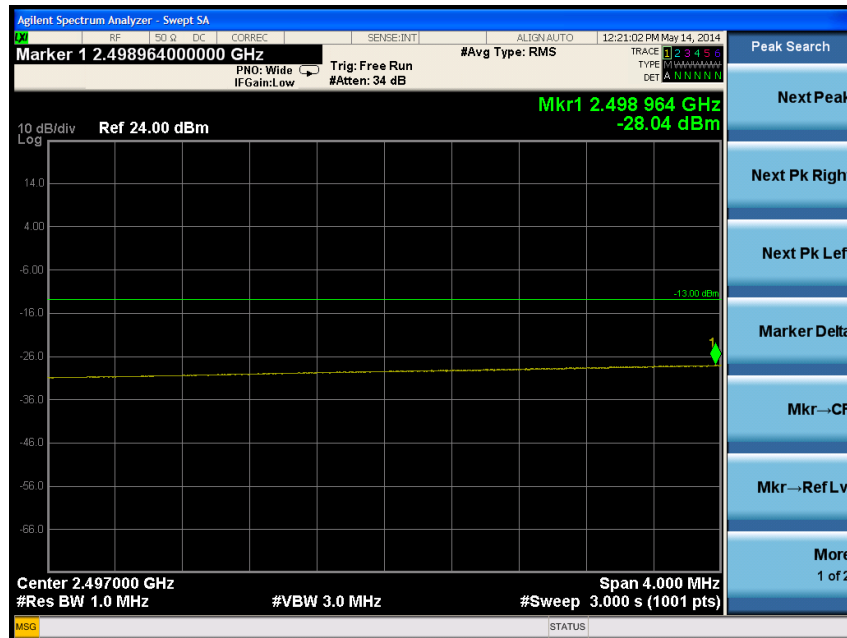
High Channel



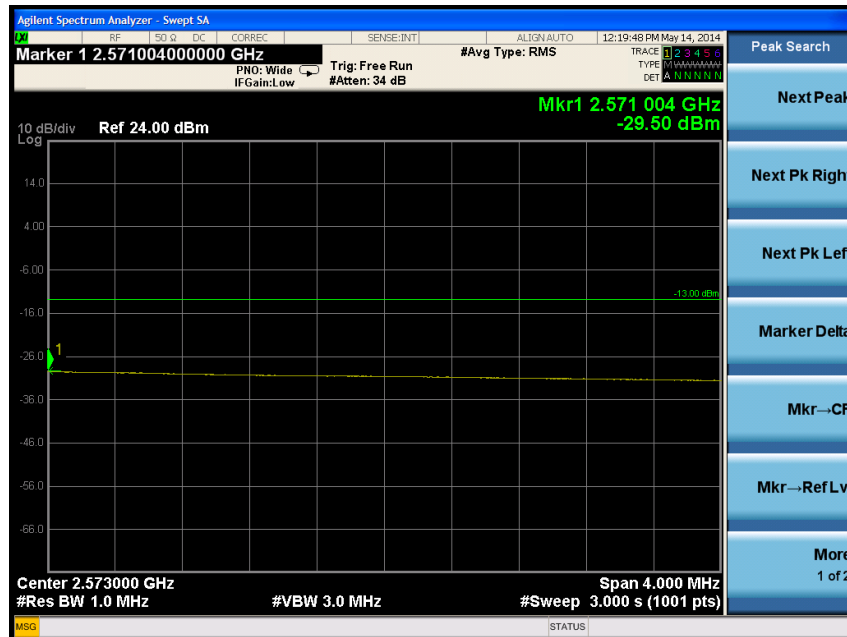
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4 MHz span plot_ LTE band 7 (20 MHz – QPSK_RB 100)

Low Channel



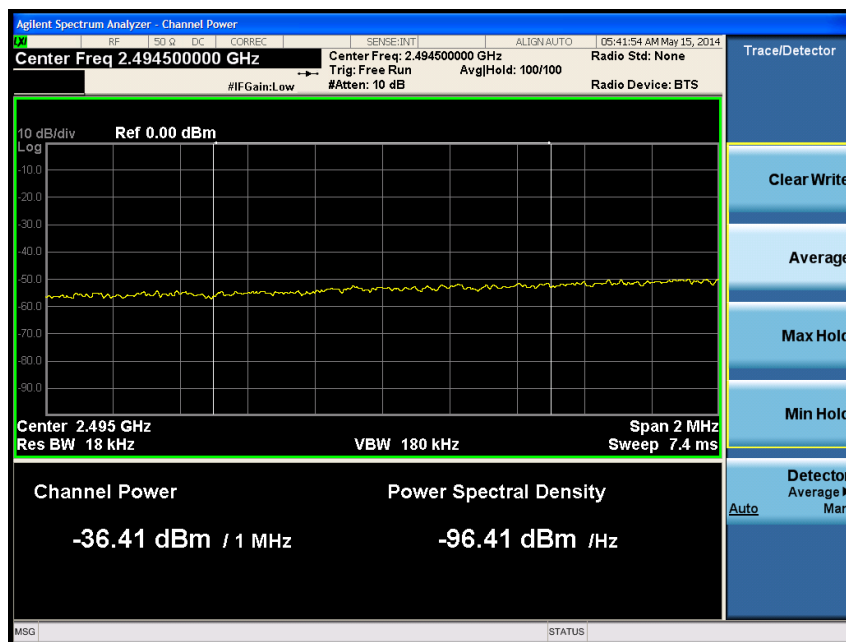
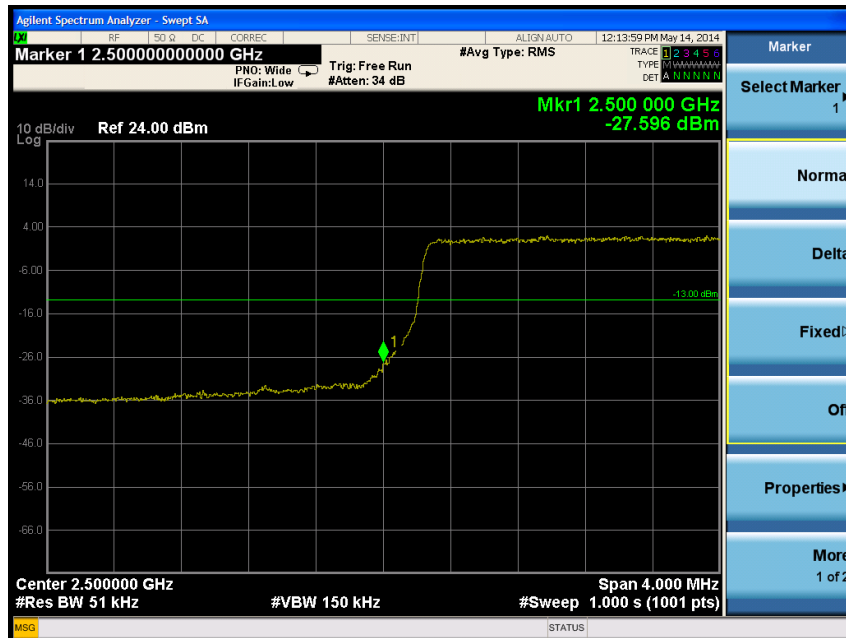
High Channel



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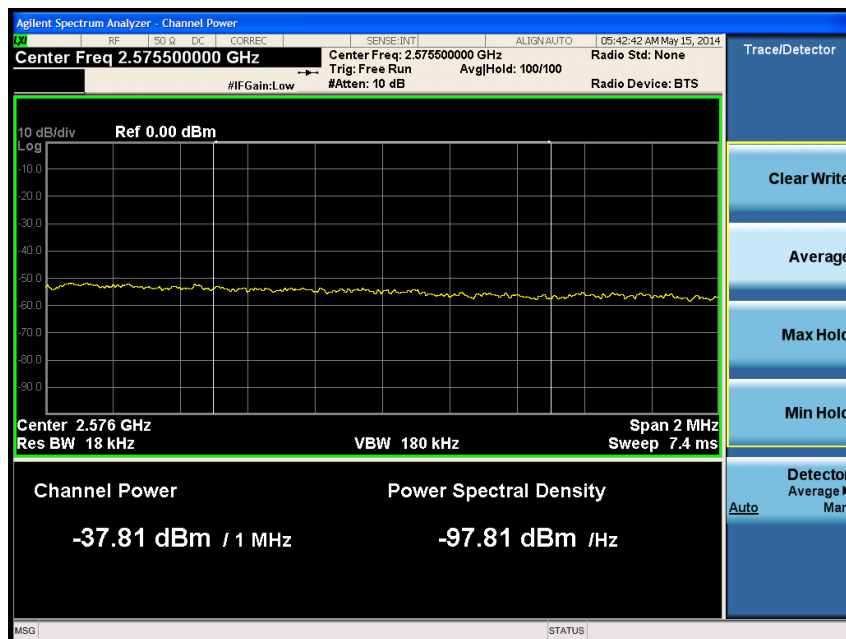
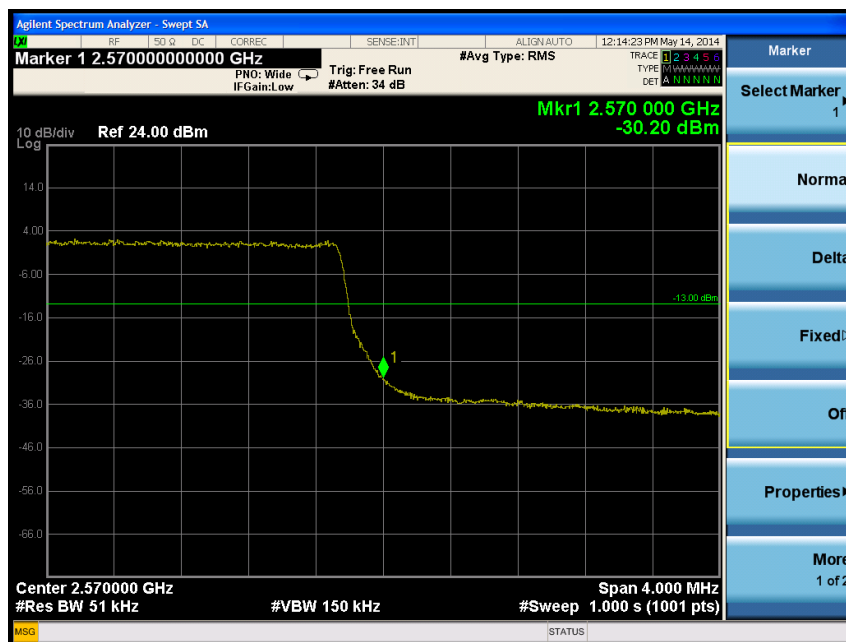
Bandedge_LTE band 7 (5 MHz – 16QAM_RB 25)

Low Channel



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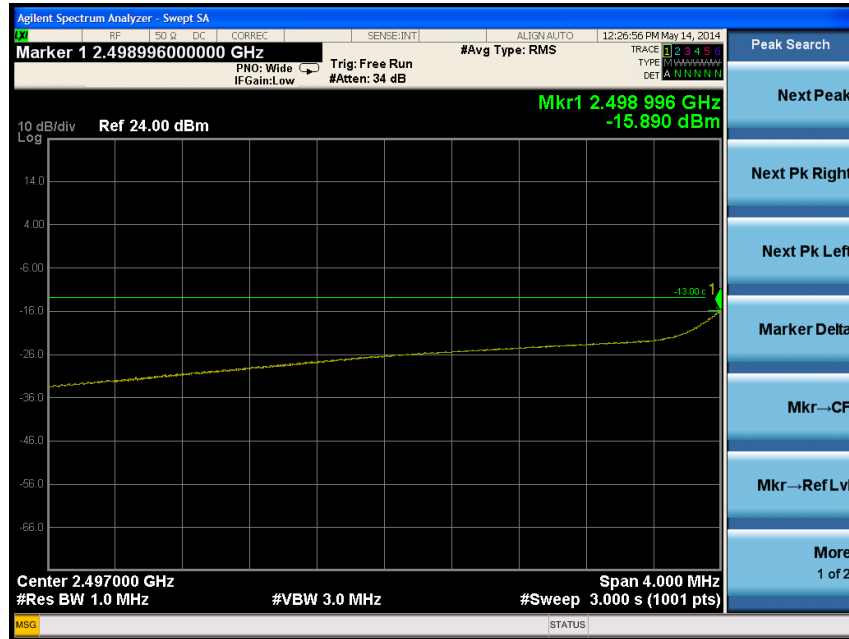
High Channel



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4 MHz span plot_ LTE band 7 (5 MHz – 16QAM_RB 25)

Low Channel



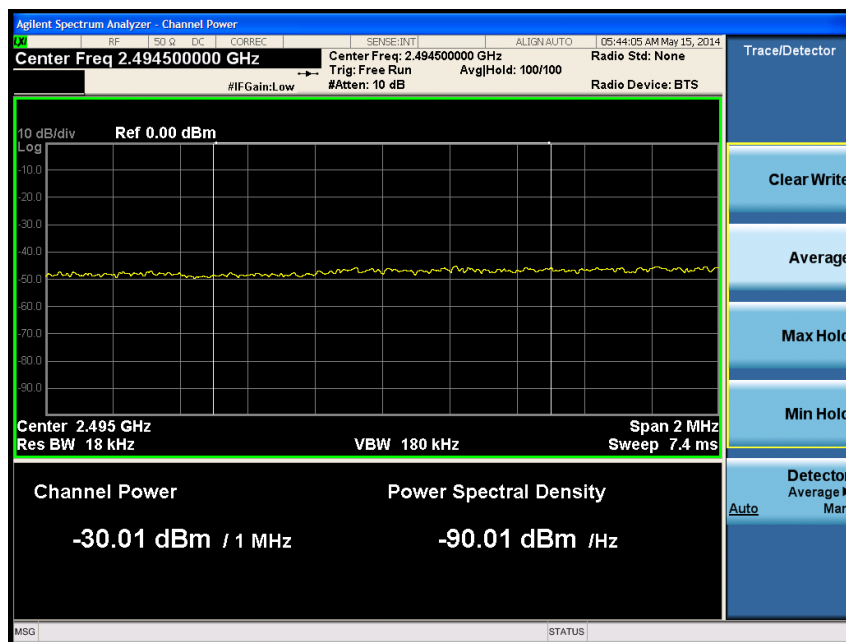
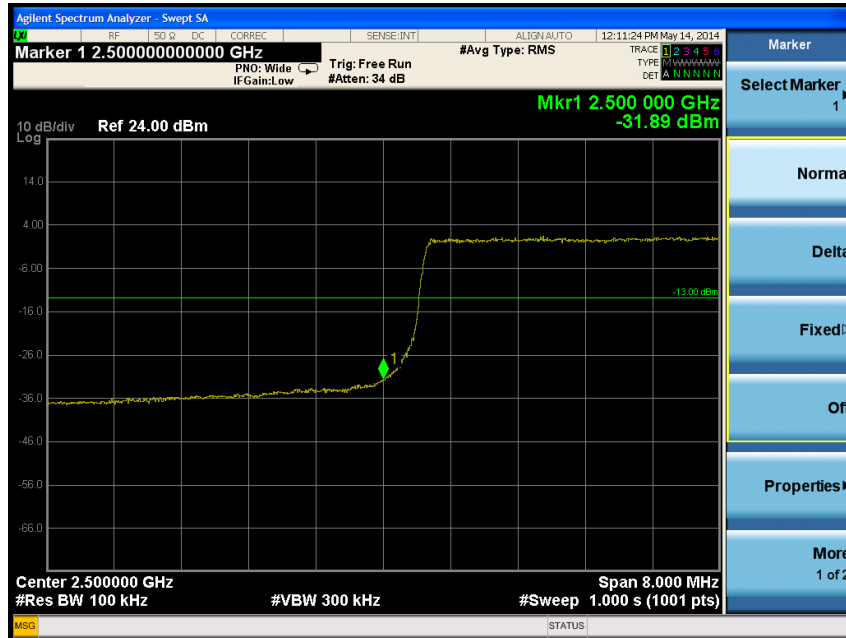
High Channel



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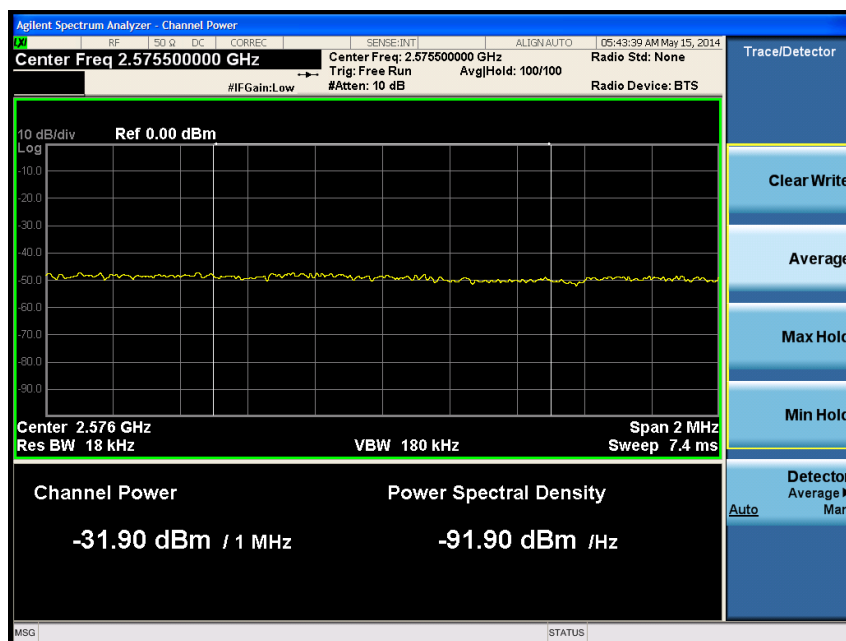
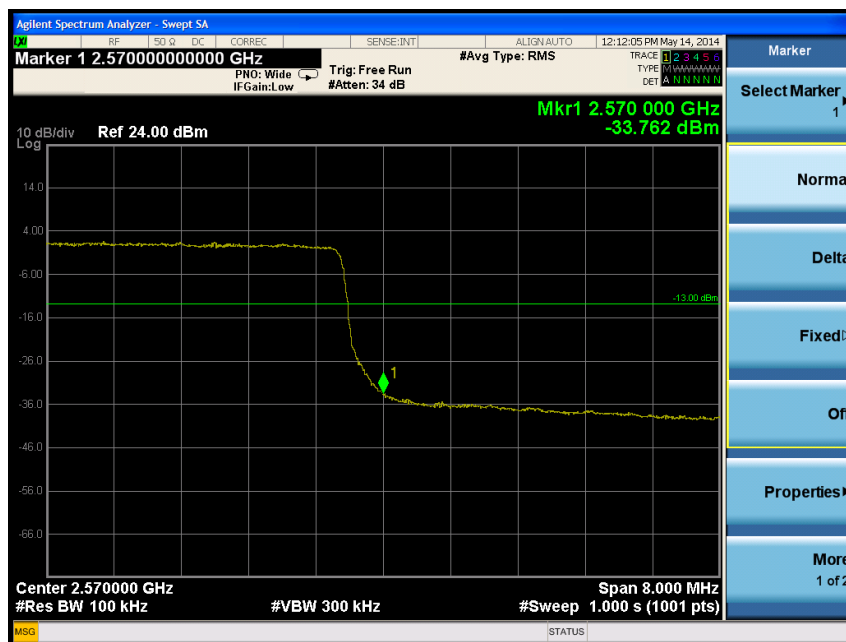
Bandedge_LTE band 7 (10 MHz – 16QAM_RB 50)

Low Channel



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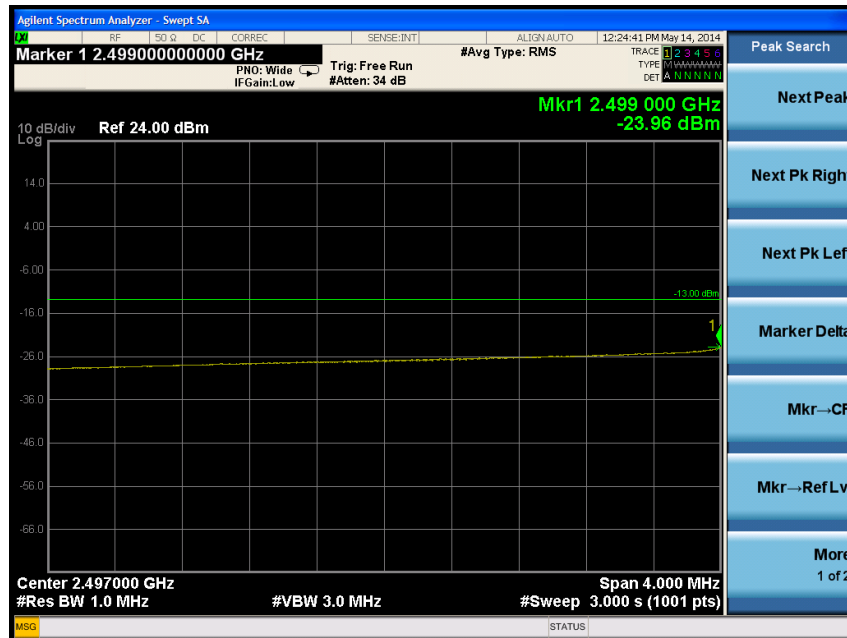
High Channel



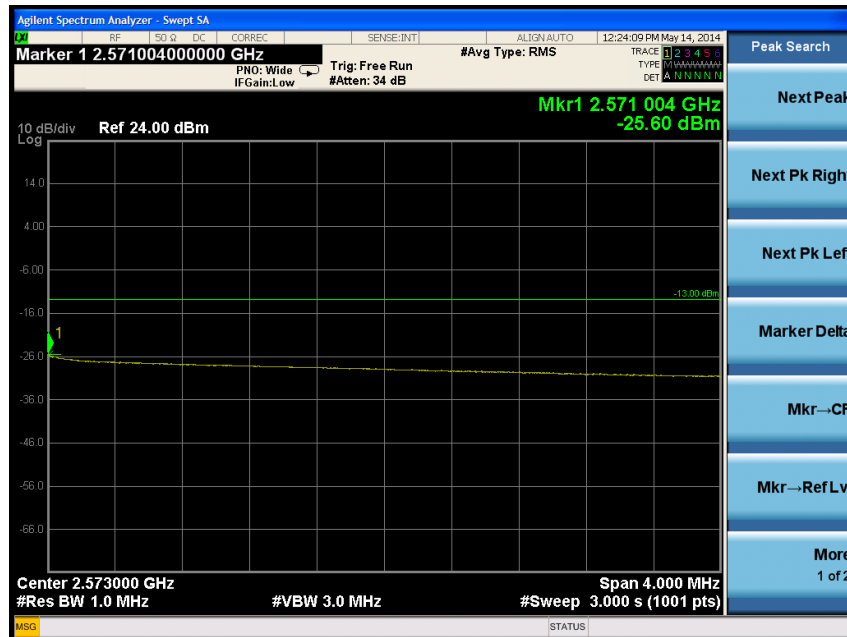
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4 MHz span plot_ LTE band 7 (10 MHz – 16QAM_RB 50)

Low Channel



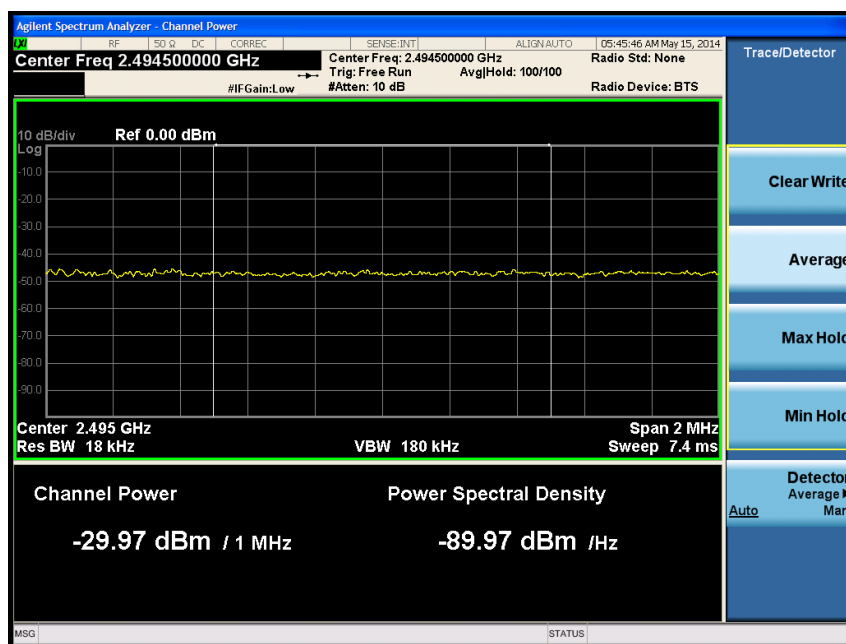
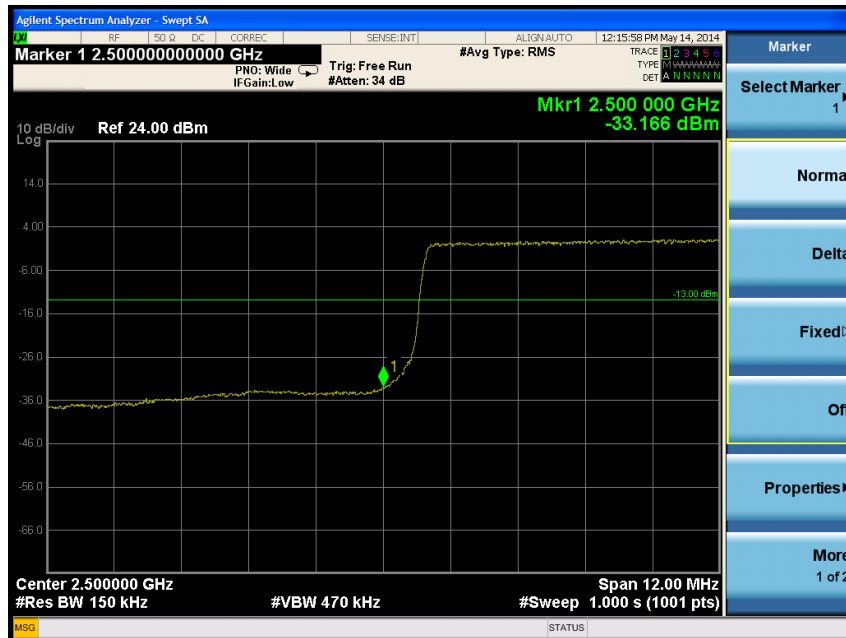
High Channel



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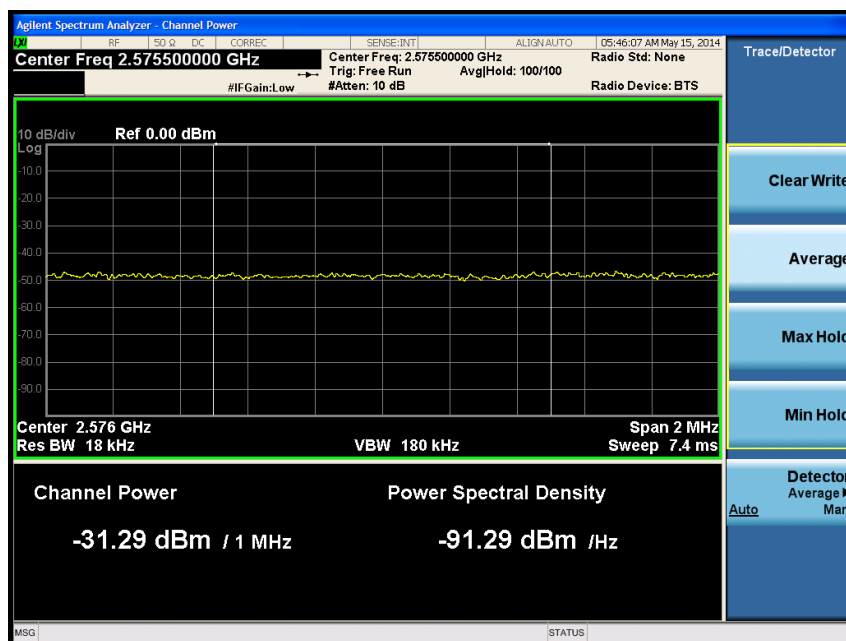
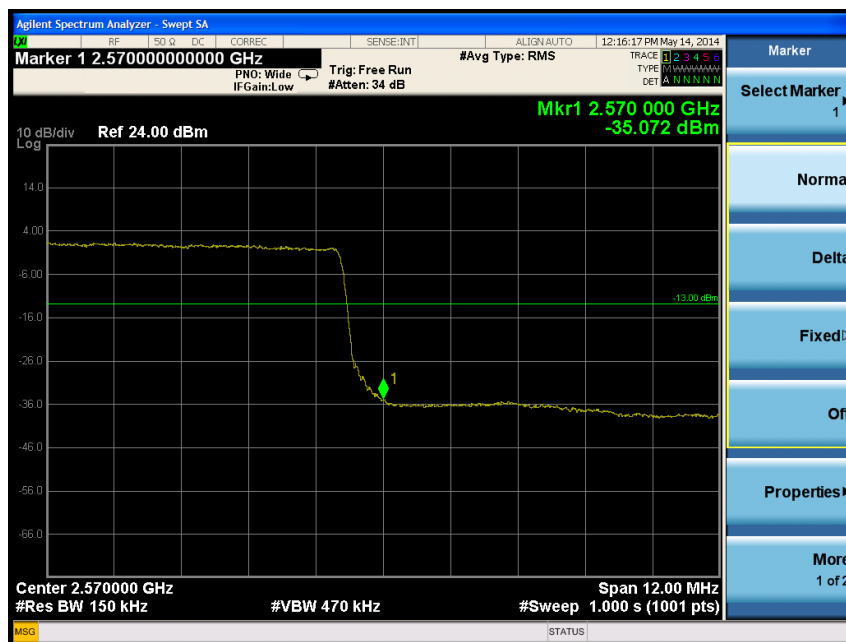
Bandedge_LTE band 7 (15 MHz – 16QAM_RB 75)

Low Channel



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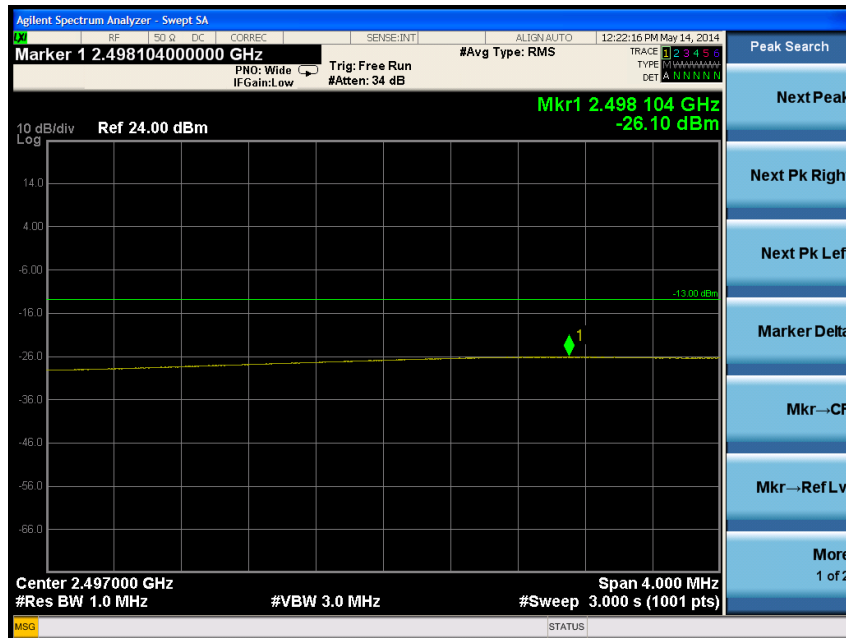
High Channel



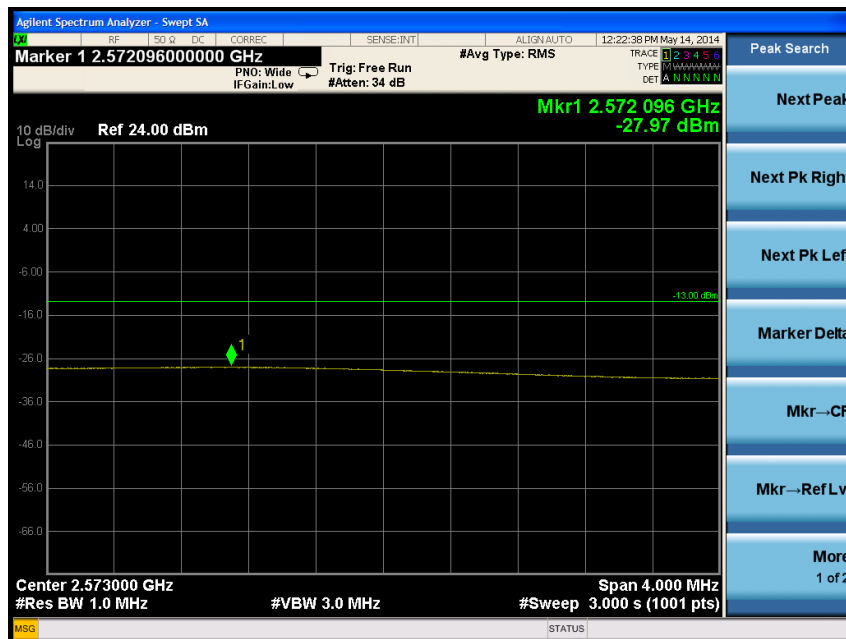
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4 MHz span plot_ LTE band 7 (15 MHz – 16QAM_RB 75)

Low Channel



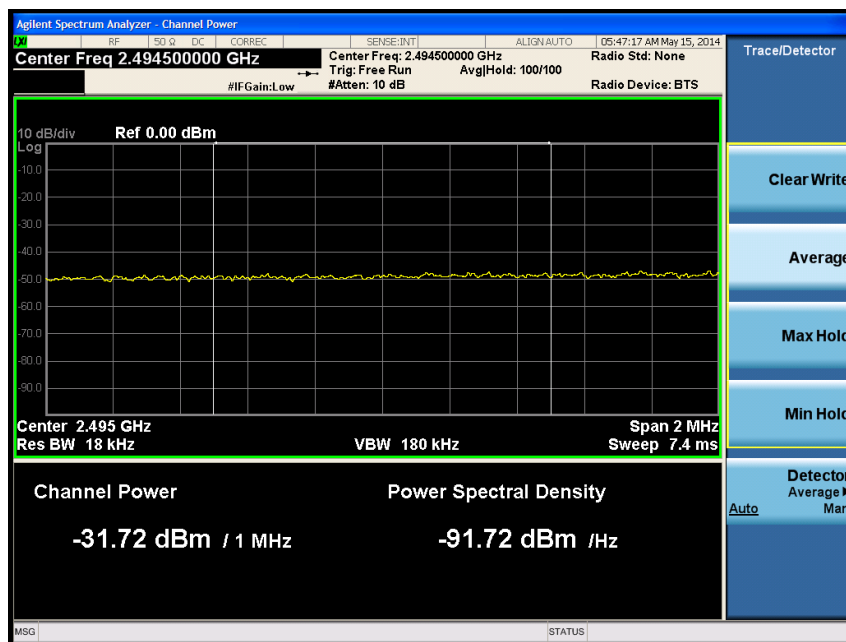
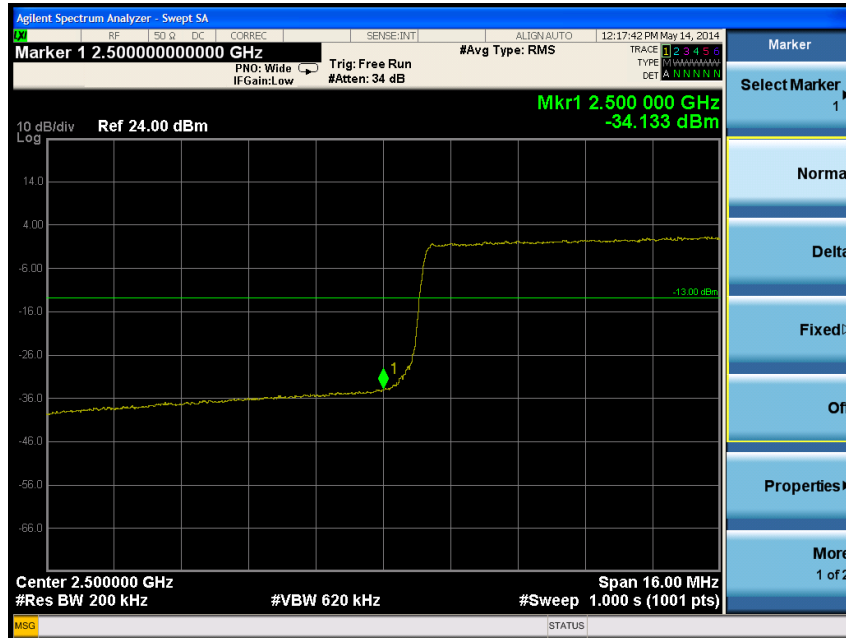
High Channel



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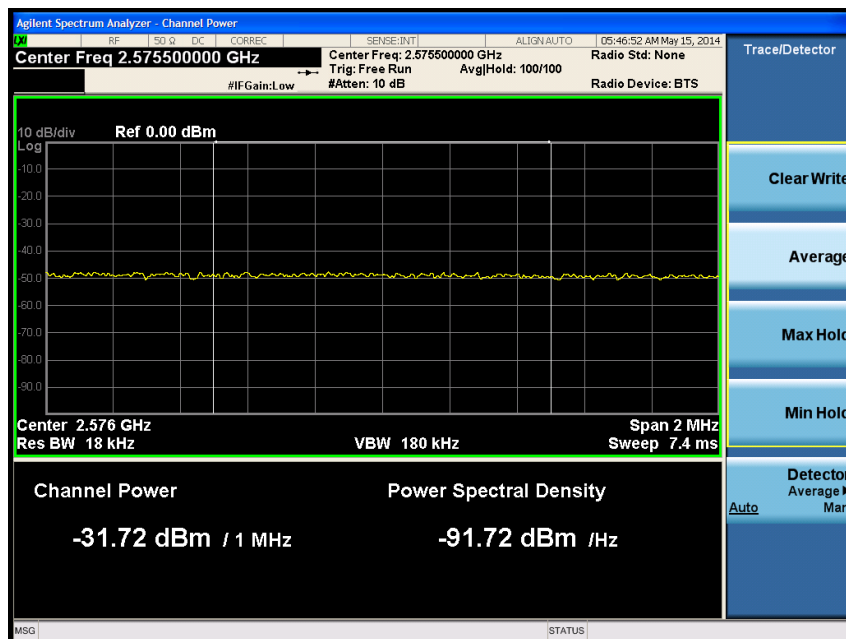
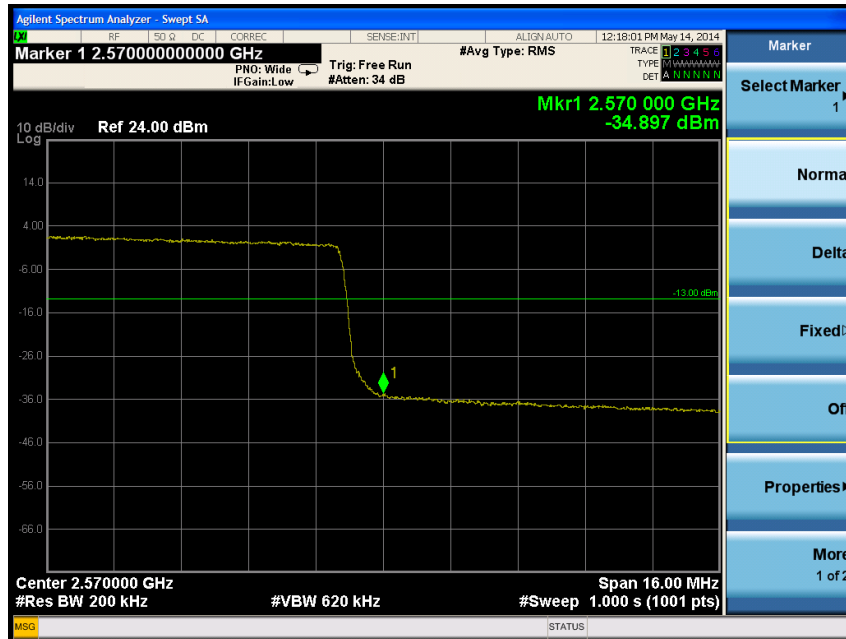
Bandedge_LTE band 7 (20 MHz – 16QAM_RB 100)

Low Channel



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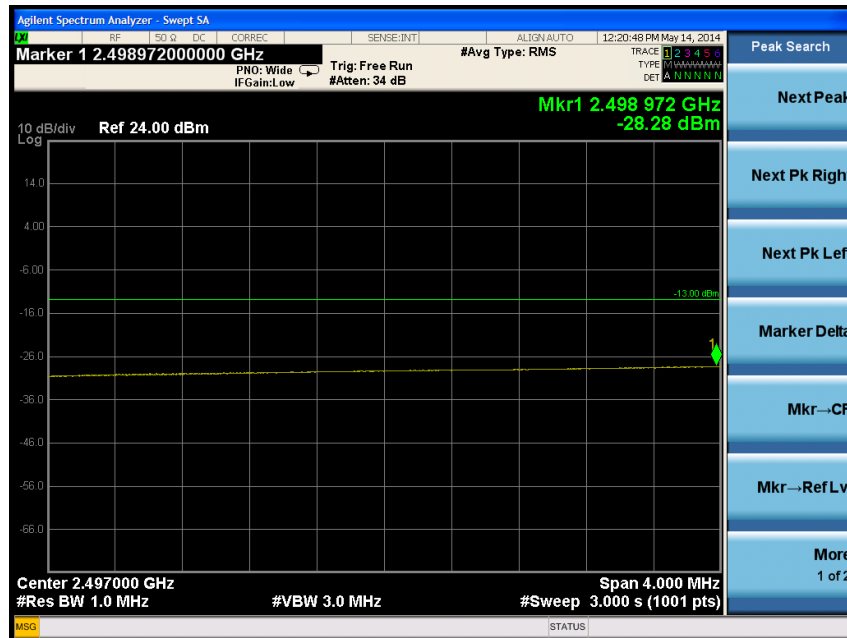
High Channel



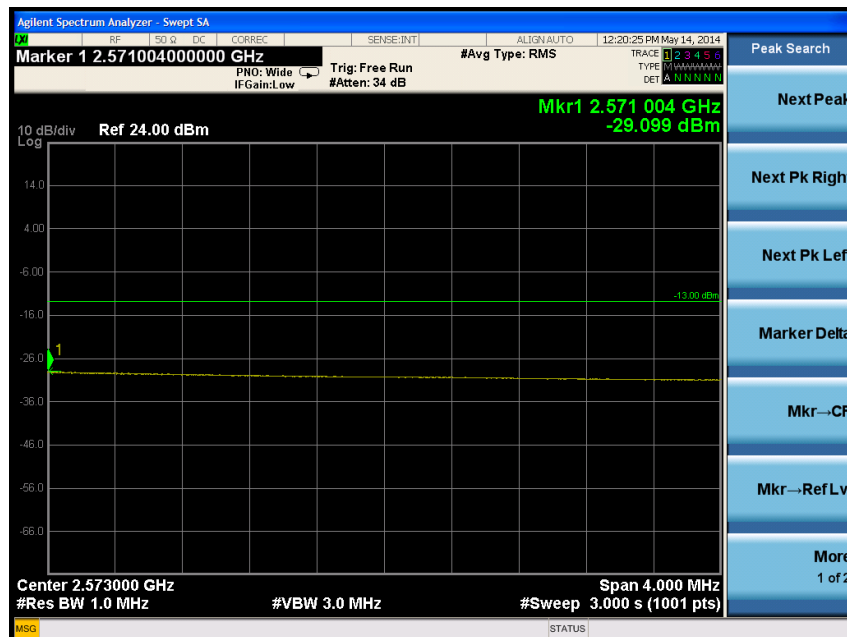
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4 MHz span plot_ LTE band 7 (20 MHz – 16QAM_RB 100)

Low Channel



High Channel



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8. Frequency Stability

8.1. Limit

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:

FCC §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.

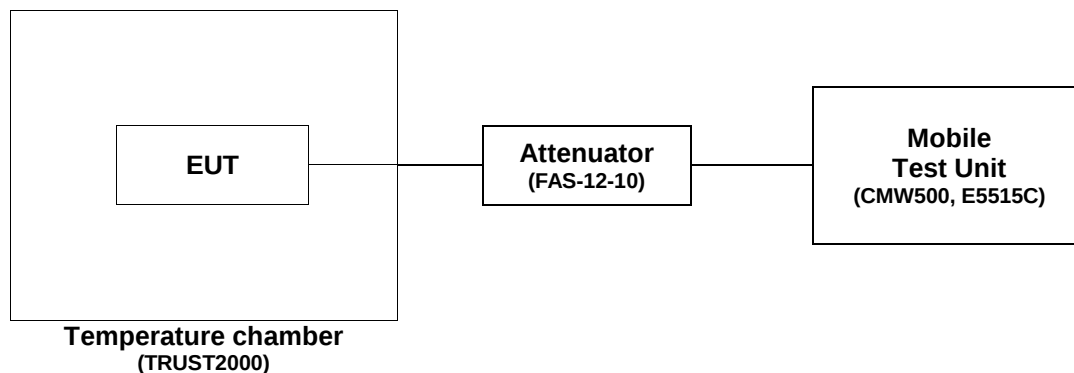
For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

FCC §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

FCC §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



8.2.1 Actual equipment used for Frequency Stability

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due.
Mobile Test Unit	Agilent	E5515C	GB43345198	Mar. 28, 2014	Annual	Mar. 28, 2015
Mobile Test Unit	R&S	CMW500	144035	Mar. 03, 2014	Annual	Mar. 03, 2015
Attenuator	MCLI	FAS-12-10	1	Jun. 19, 2013	Annual	Jun. 19, 2014
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 27, 2014	Annual	Mar. 27, 2015
Temperature Chamber	ENEX	TRUST2000	980111	Dec. 26, 2013	Annual	Dec. 26, 2014

Note;

- Mobile test unit(E5515C) is used to test for GSM 850 & 1900
- Mobile test unit(CMW500) is used to test for WCDMA 850 & 1900 and LTE band 7

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8.3. Test Results

Ambient temperature : (24 ± 2) °C
Relative humidity : 47 % R.H.

GSM850 mode at middle channel

Connect mode at middle channel:

Reference Frequency: 836.6 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	3.80	17	0.014 344
40		12	0.008 367
30		8	0.003 586
24		5	Ref.
10		12	0.008 367
0		18	0.015 539
-10		11	0.007 172
-20		28	0.027 492
-30		25	0.023 906
Frequency Stability versus Power Supply			
Environment Temperature (℃)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	4.37	13	0.009 563
	3.05(batt. End point)	18	0.015 539

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GSM1900 mode at middle channel

Reference Frequency: 1 880.0 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	3.80	51	-0.002 128
40		45	-0.005 319
30		49	-0.003 191
24		55	Ref.
10		63	0.004 255
0		69	0.007 447
-10		58	0.001 596
-20		72	0.009 043
-30		74	0.010 106
Frequency Stability versus Power Supply			
Environment Temperature (℃)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	4.37	65	0.005 319
	3.05(batt. End point)	49	-0.003 191

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WCDMA850 mode at middle channel

Reference Frequency: 836.4 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	3.80	5	0.007 174
40		3	0.004 782
30		-2	-0.001 196
24		-1	Ref.
10		4	0.005 978
0		2	0.003 587
-10		-3	-0.002 391
-20		3	0.004 782
-30		-6	-0.005 978
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	Ppm
24	4.37	-4	-0.003 587
	3.05(batt. End point)	-2	-0.001 196

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WCDMA1900 mode at middle channel

Reference Frequency: 1880.0 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	3.80	7	0.002 128
40		-4	-0.003 723
30		2	-0.000 532
24		3	Ref.
10		-1	-0.002 128
0		-4	-0.003 723
-10		7	0.002 128
-20		-3	-0.003 191
-30		5	0.001 064
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	4.37	-3	-0.003 191
	3.05(batt. End point)	2	-0.000 532

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LTE band 7 mode at middle channel

Reference Frequency: 2 535.0 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	3.80	13	0.011 440
40		3	0.007 495
30		-5	0.004 339
24		-16	Ref.
10		-18	-0.000 789
0		-12	0.001 578
-10		-23	-0.002 761
-20		-28	-0.004 734
-30		-39	-0.009 073
Frequency Stability versus Power Supply			
Environment Temperature (℃)	Power Supplied (Vdc)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	4.37	-24	-0.003 156
	3.05(batt. End point)	-19	-0.001 183

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