5. Spurious Emissions at Antenna Terminal

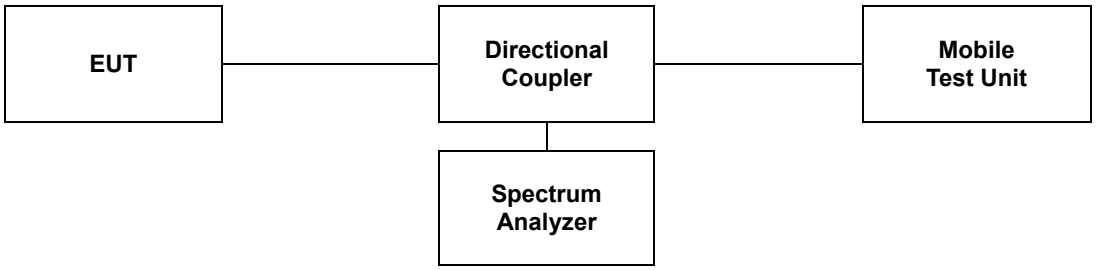
5.1. Limit

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 + 10log(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), For operations in the 600 ㎒ band and the 698-746 ㎒ band, the power of any emission outside a 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, by at least 43 + 10 log (P) dB.
FCC §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 log (P) dB at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

5.2. Test Procedure

The test follows section 6.0 of FCC KDB Publication 971168_v02r02.

1. Start frequency was set to 30 ㎒ and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = RMS.
3. Trace mode = max hold.
4. Sweep time = auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 30 ㎒ to 27 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction factor.



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Notes;

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ bands immediately outside and adjacent to the 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 point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 ㏈ below the transmitter power.

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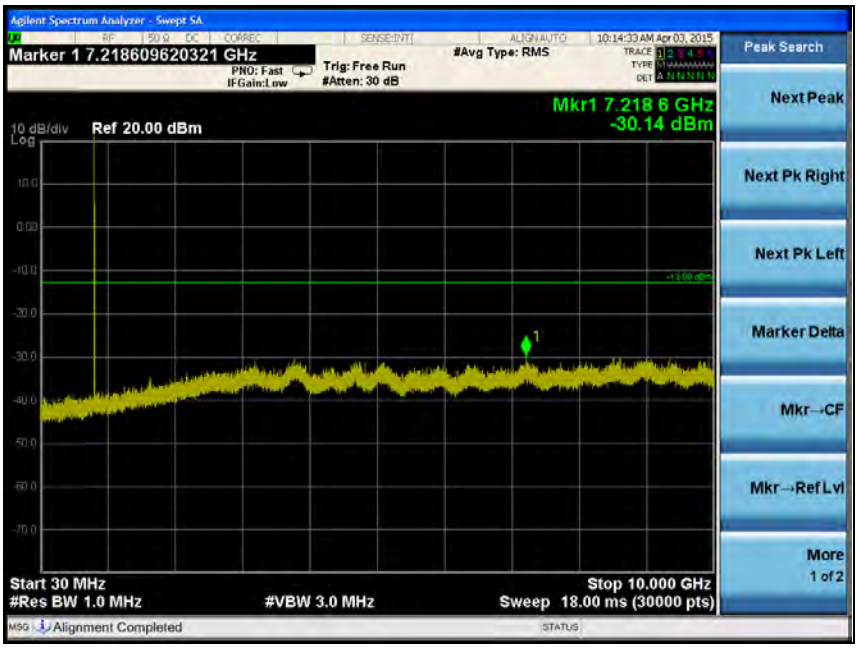
5.3. Test Results

Ambient temperature	:	(24 ± 1) ℃
Relative humidity	:	47 % R.H.

Please refer to the following plots.

GSM850
Low Channel



Middle Channel

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High Channel

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GSM1900
Low Channel

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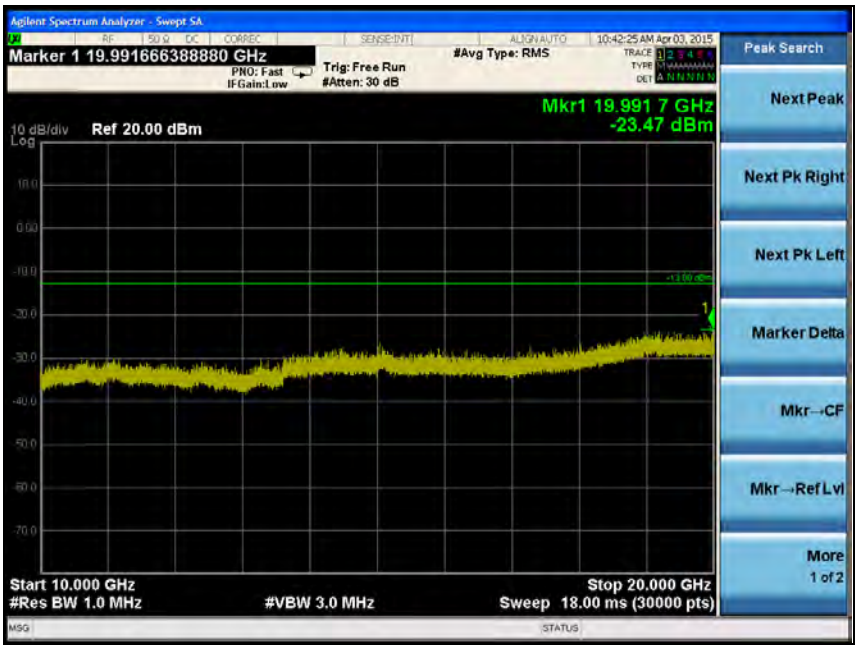
Middle Channel



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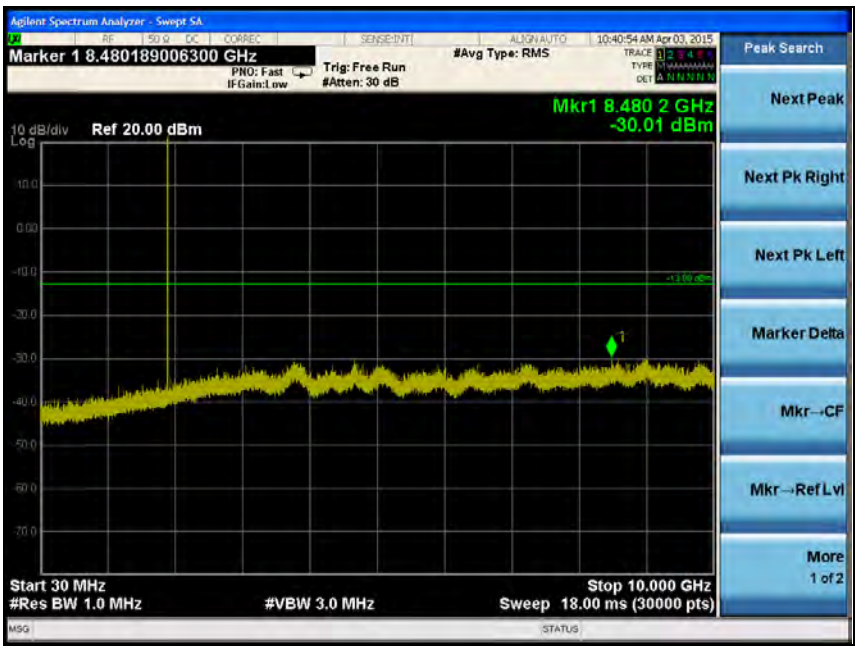
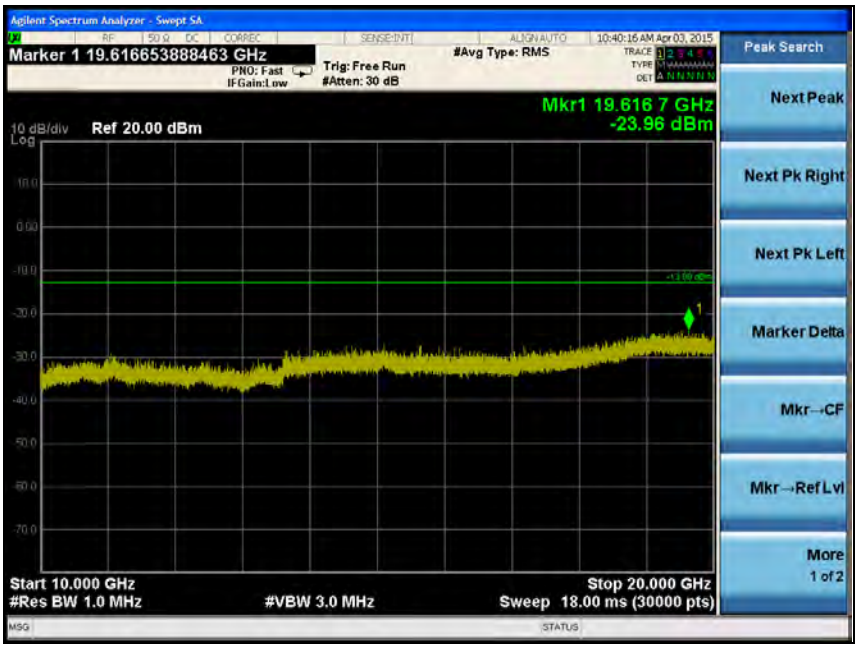
High Channel





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WCDMA850
Low Channel

Middle Channel

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High Channel

LTE band 5 (1.4 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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LTE band 5 (1.4 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

Middle Channel

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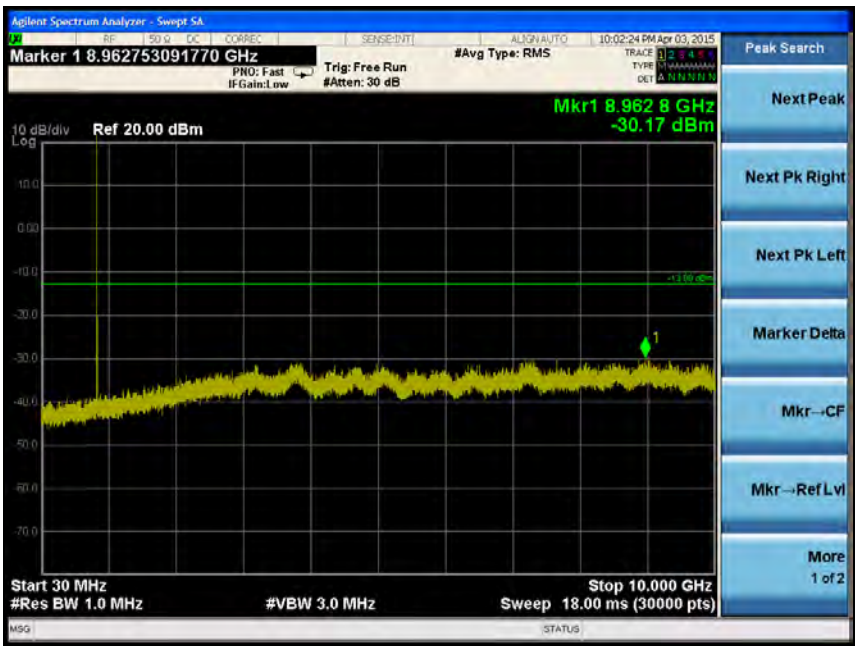
High Channel



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LTE band 5 (3 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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LTE band 5 (3 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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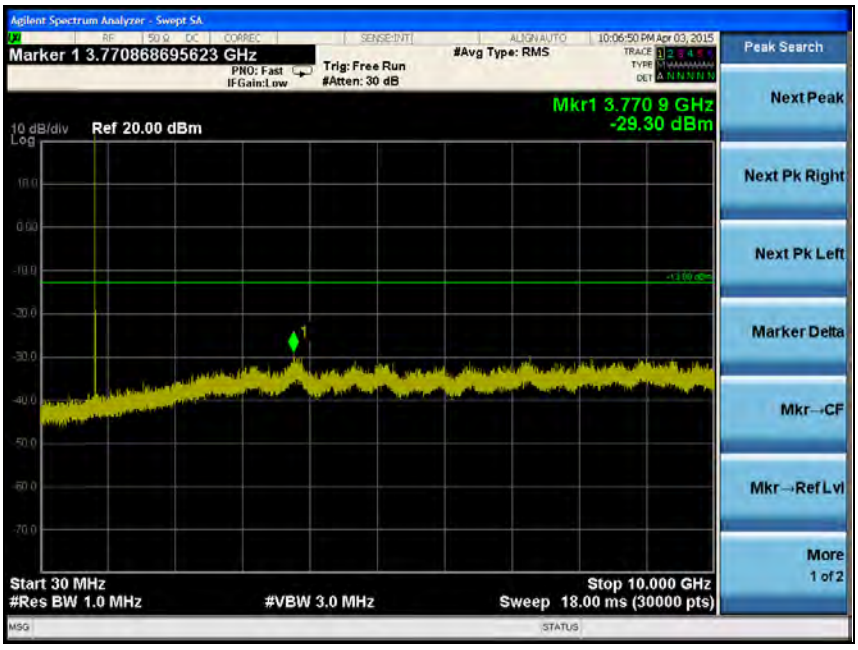
LTE band 5 (5 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

Middle Channel



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High Channel

LTE band 5 (5 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

Middle Channel

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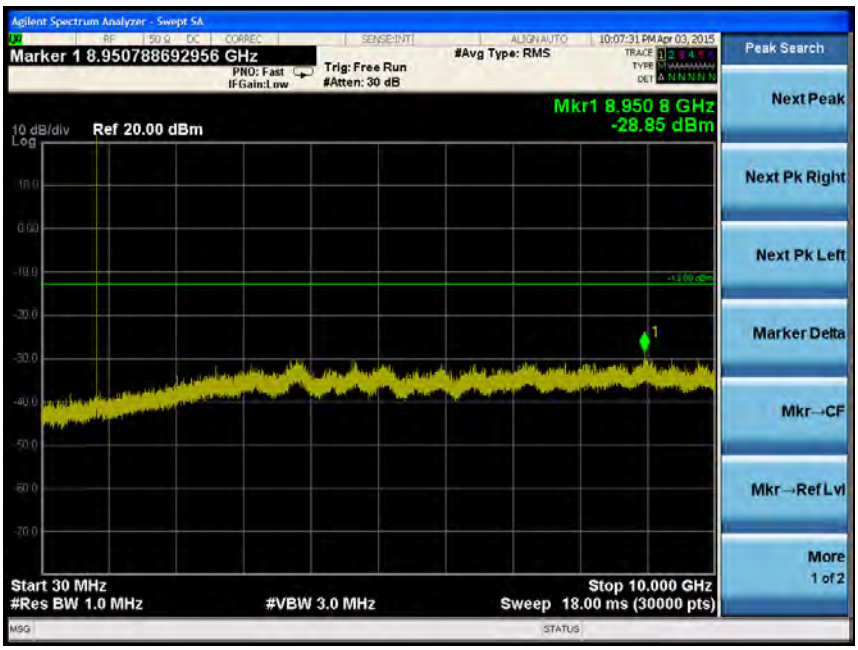
High Channel



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LTE band 5 (10 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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LTE band 5 (10 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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LTE band 17 (5 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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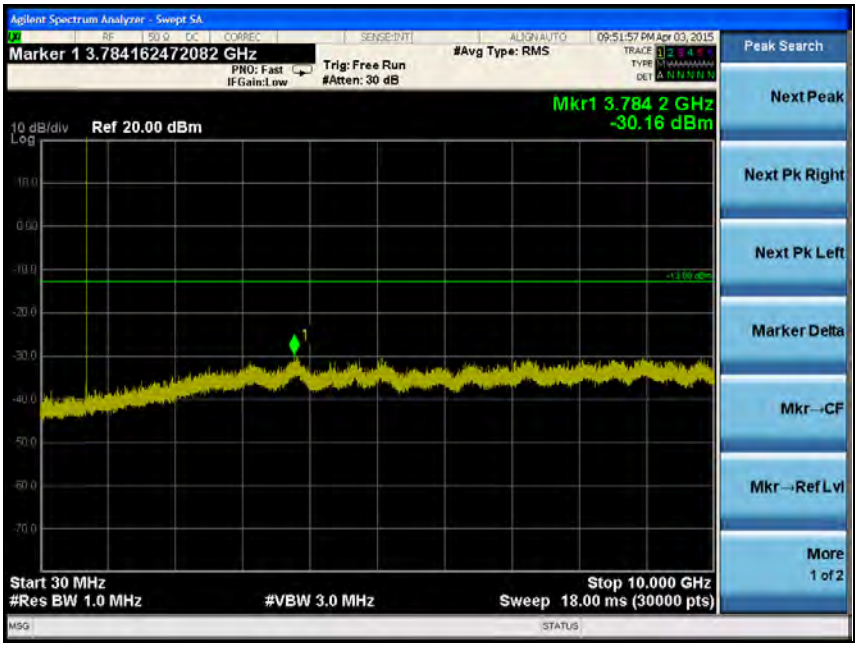
LTE band 17 (5 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

Middle Channel



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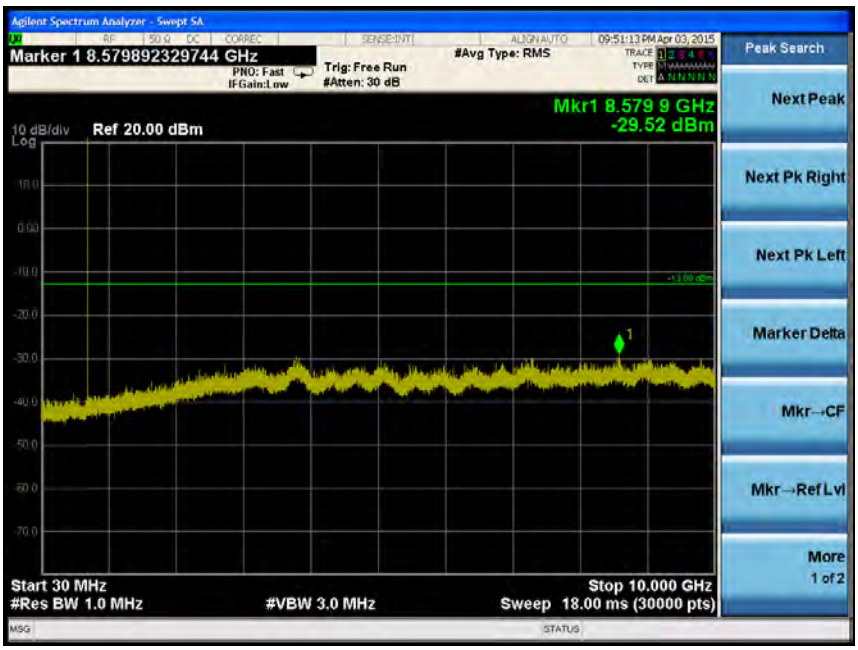
High Channel



LTE band 17 (10 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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LTE band 17 (10 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

Middle Channel

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High Channel

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LTE band 41 (5 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

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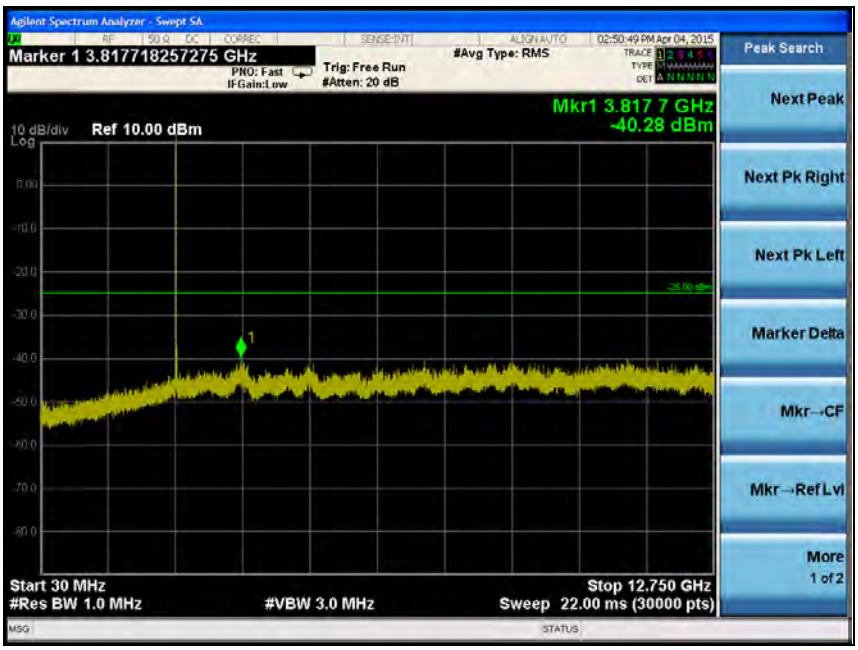
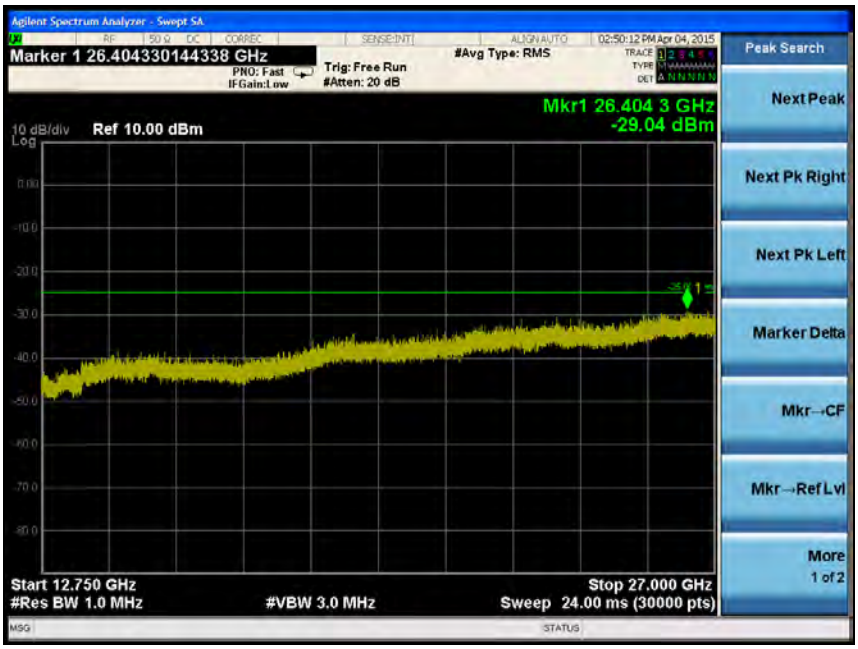
Middle Channel





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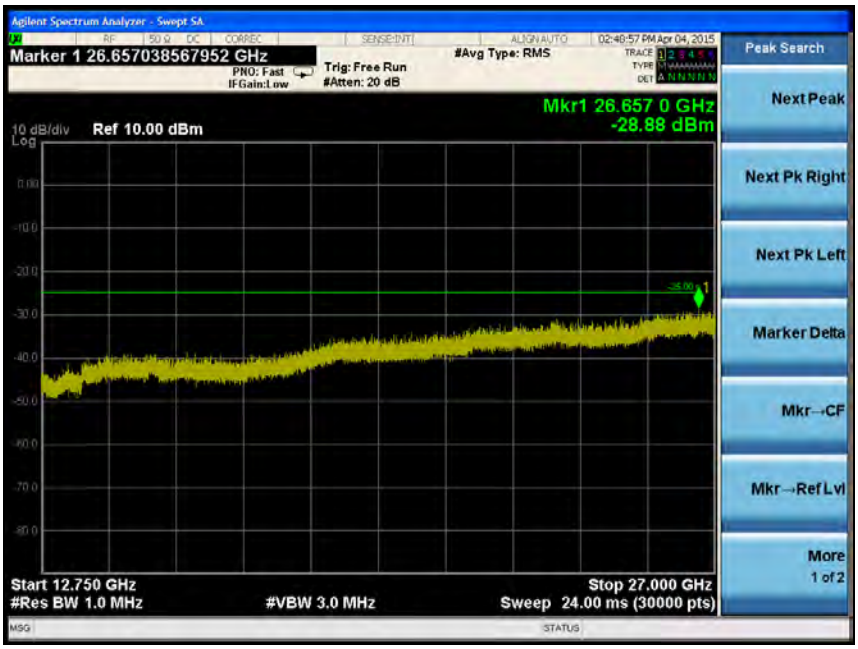
High Channel



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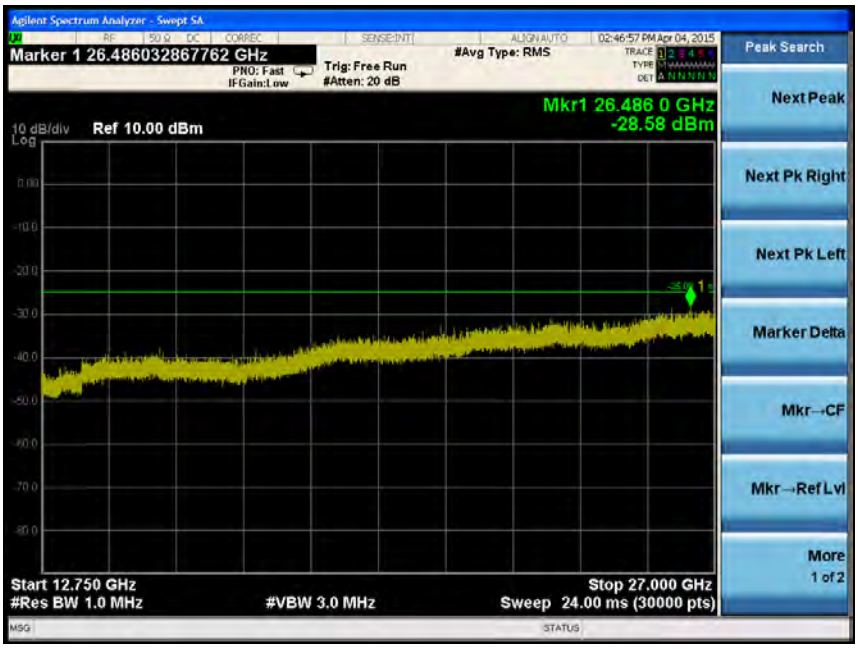
LTE band 41 (5 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel



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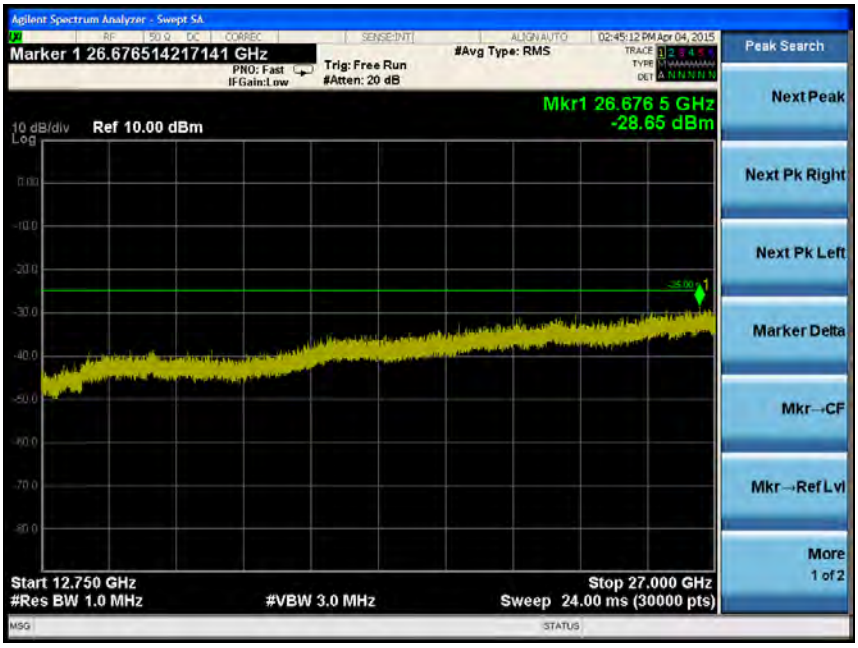
Middle Channel



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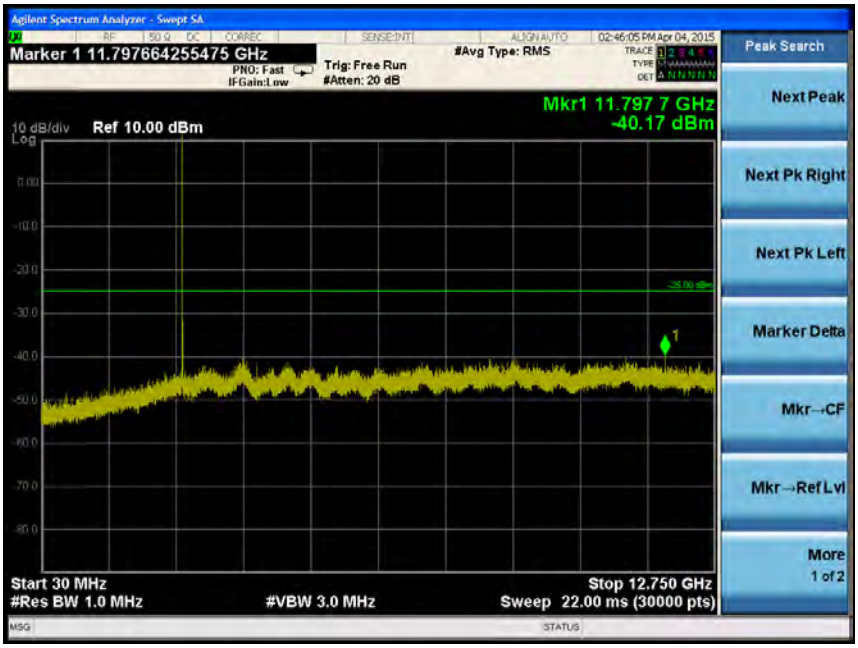
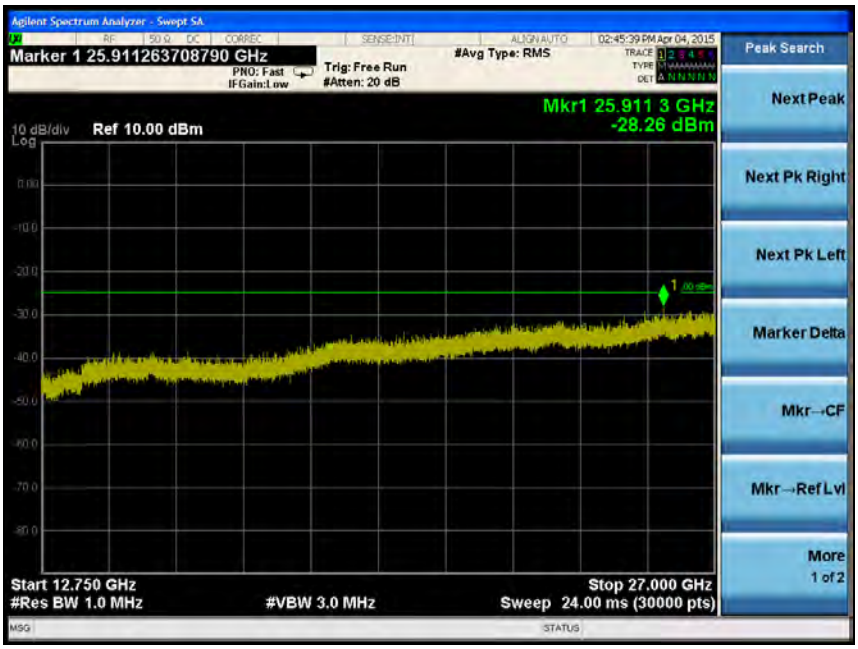
High Channel





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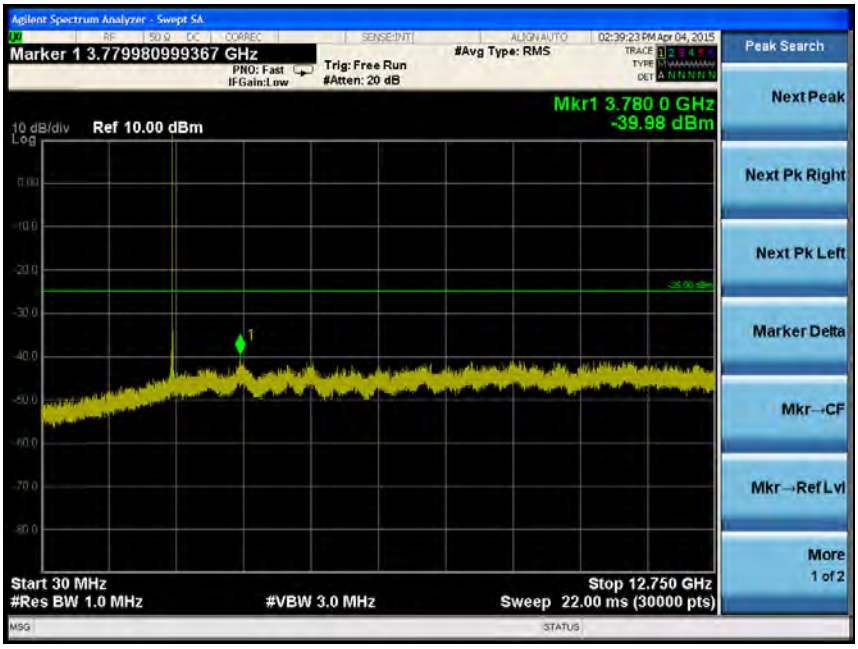
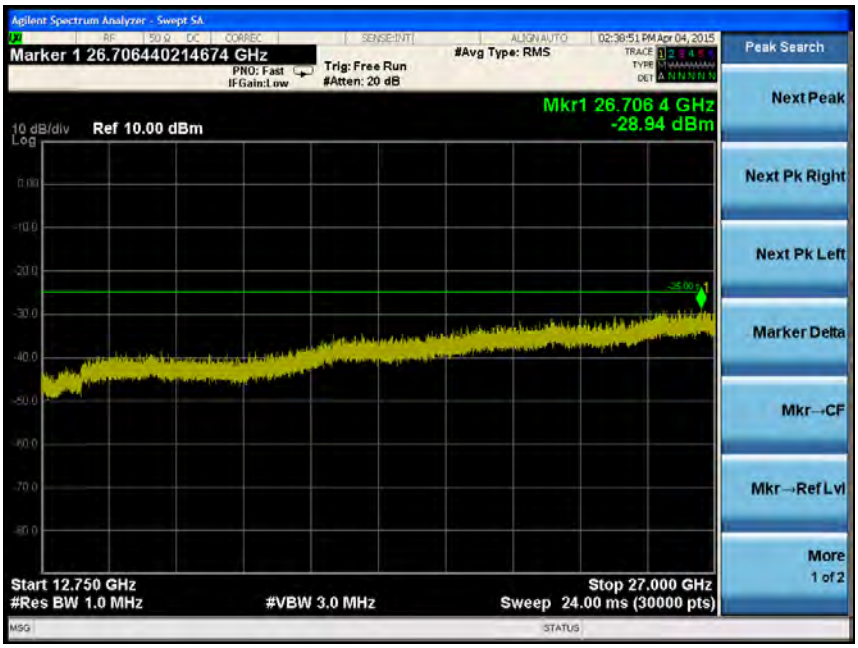
LTE band 41 (10 ㎒ – QPSK_RB 1_Offset 0)

Low Channel





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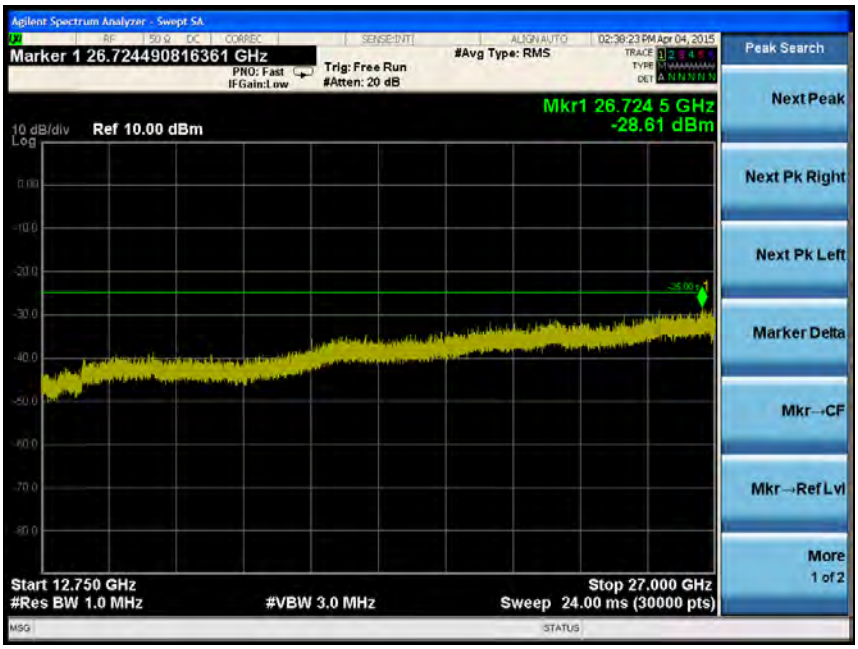
Middle Channel



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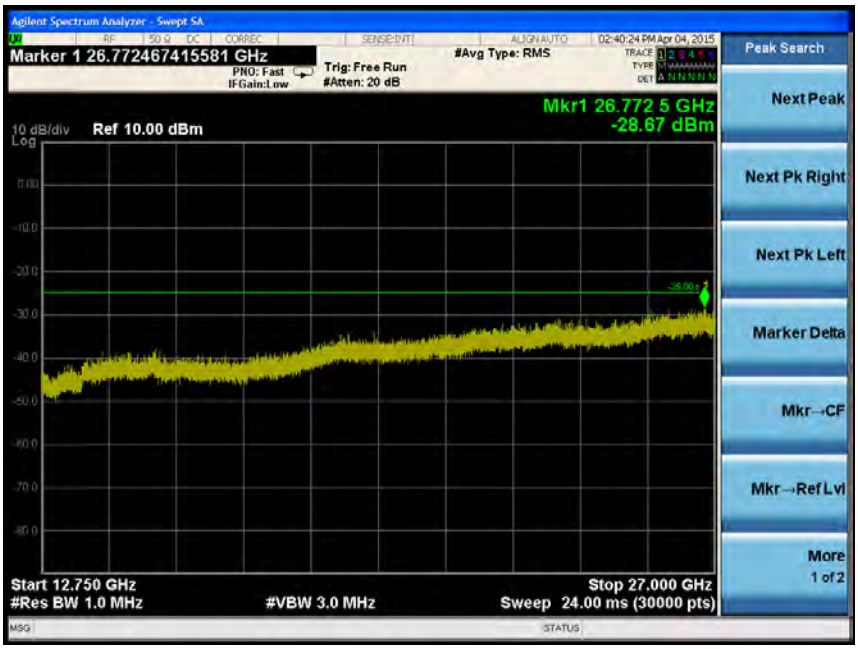
High Channel



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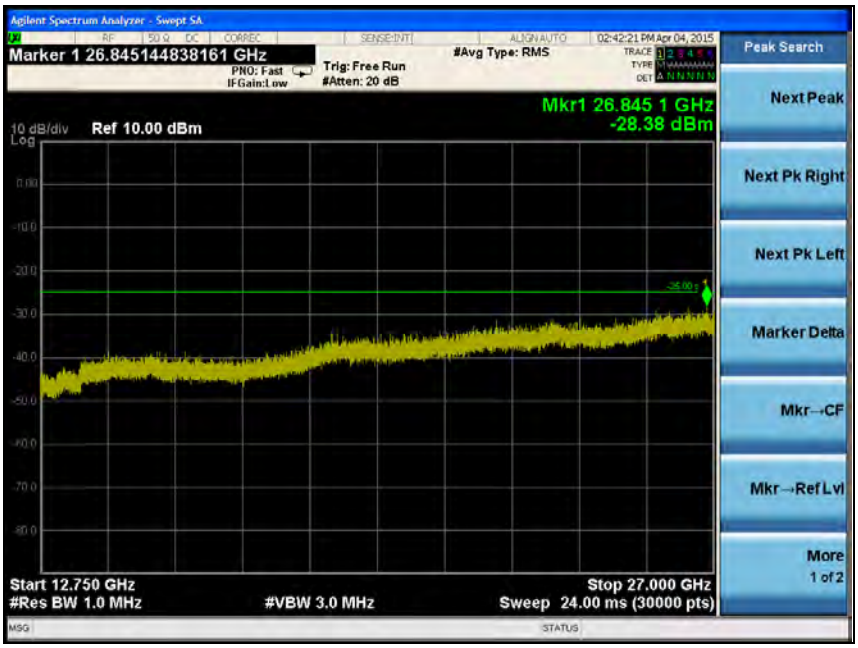
LTE band 41 (10 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel



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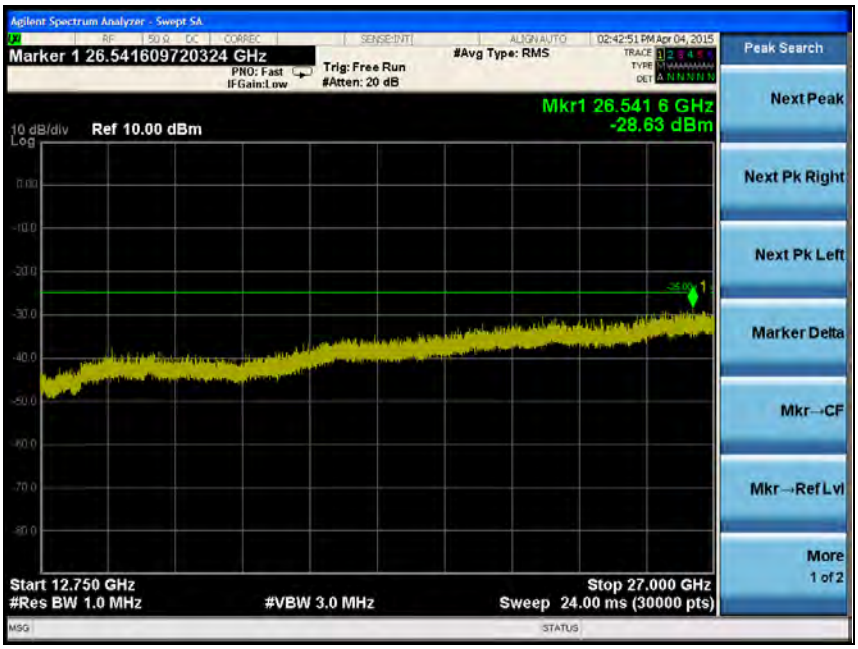
Middle Channel



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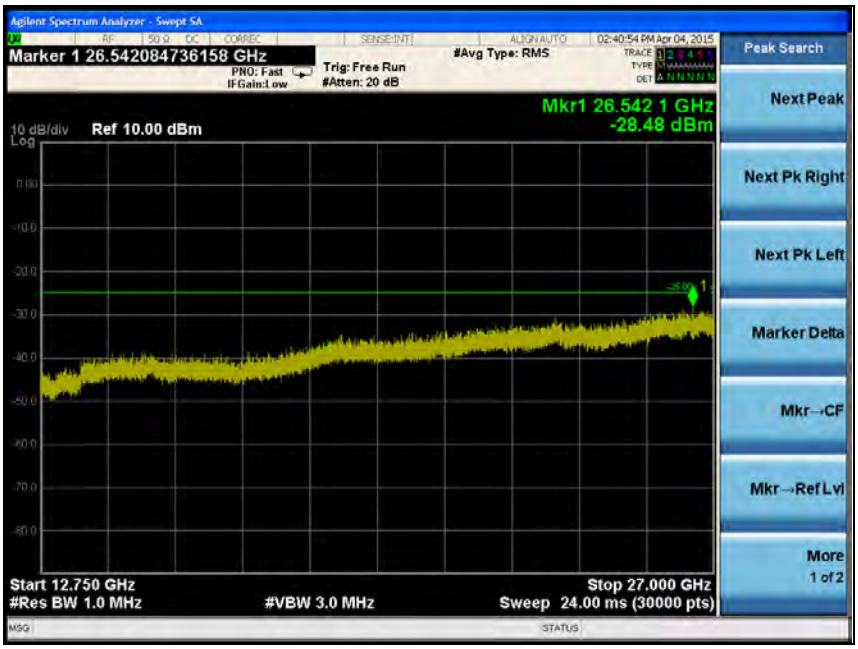
High Channel



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LTE band 41 (15 ㎒ – QPSK_RB 1_Offset 0)

Low Channel

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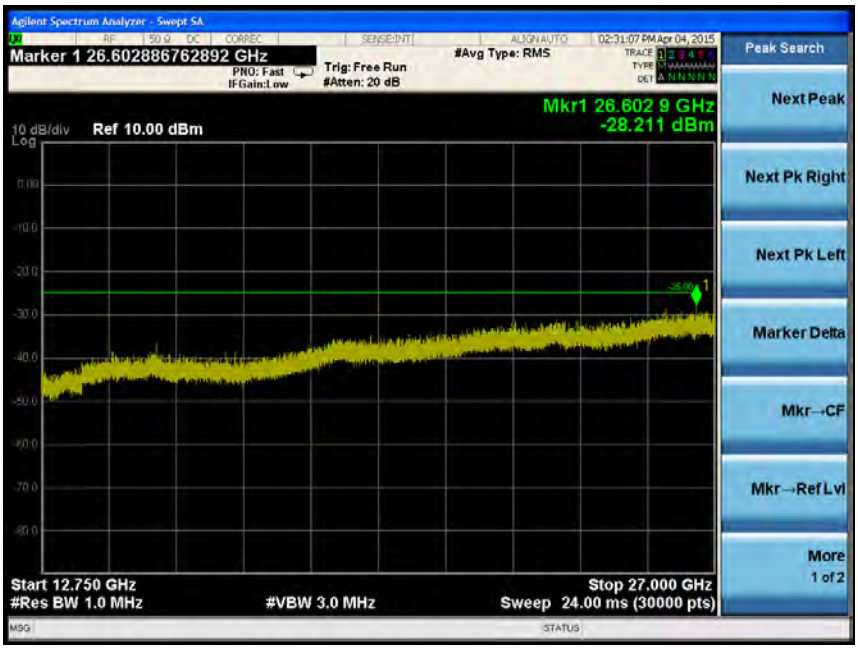
Middle Channel



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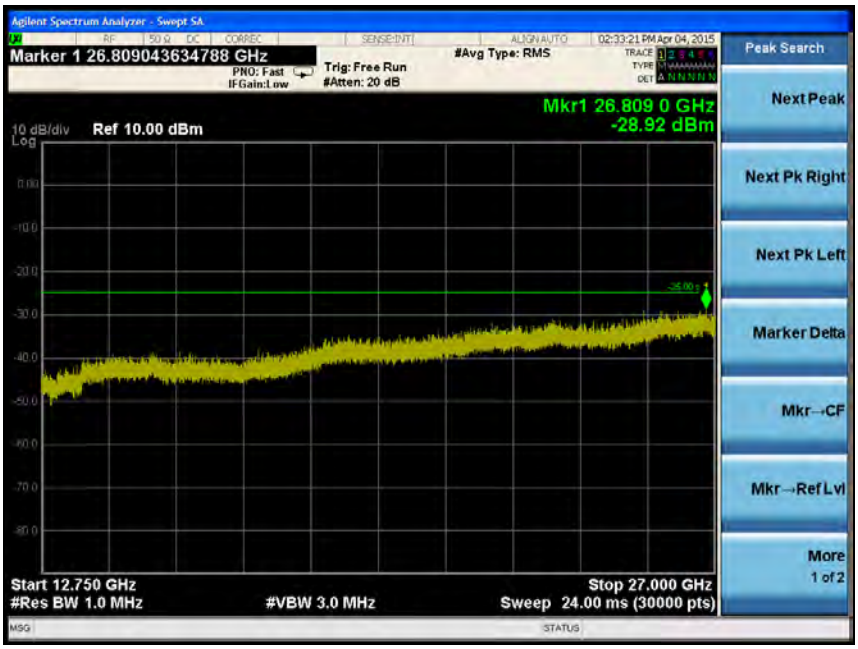
High Channel



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LTE band 41 (15 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel

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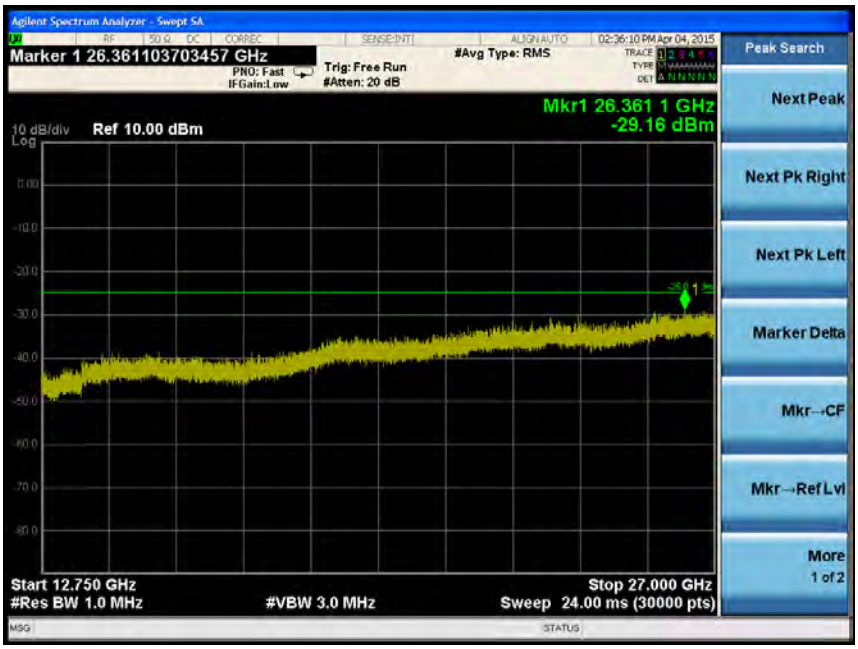
Middle Channel



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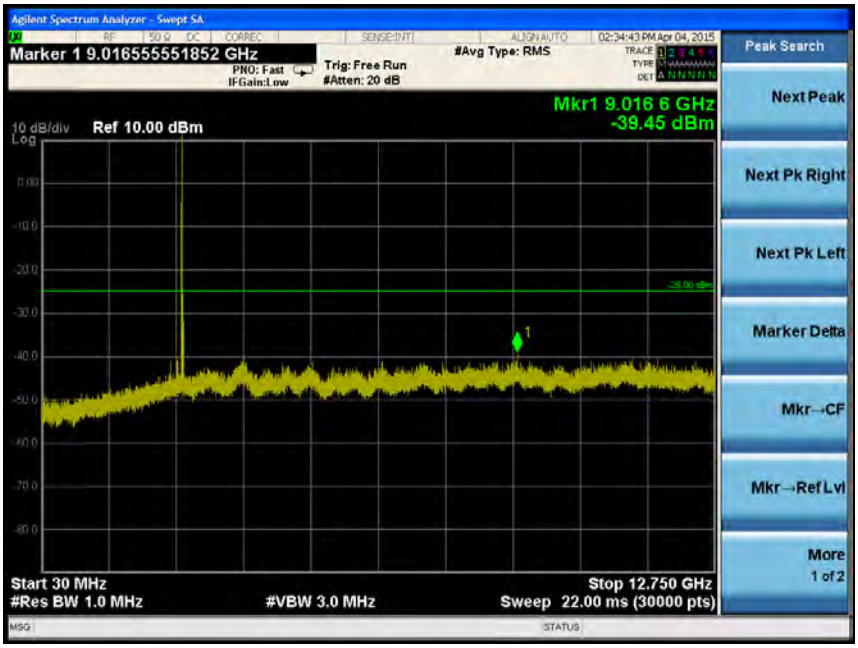
High Channel



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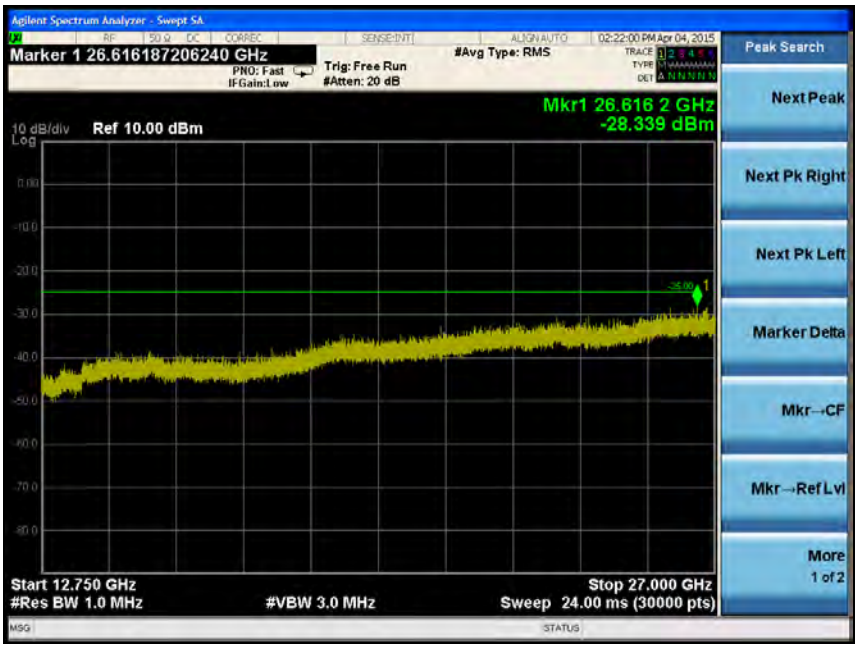
LTE band 41 (20 ㎒ – QPSK_RB 1_Offset 0)

Low Channel



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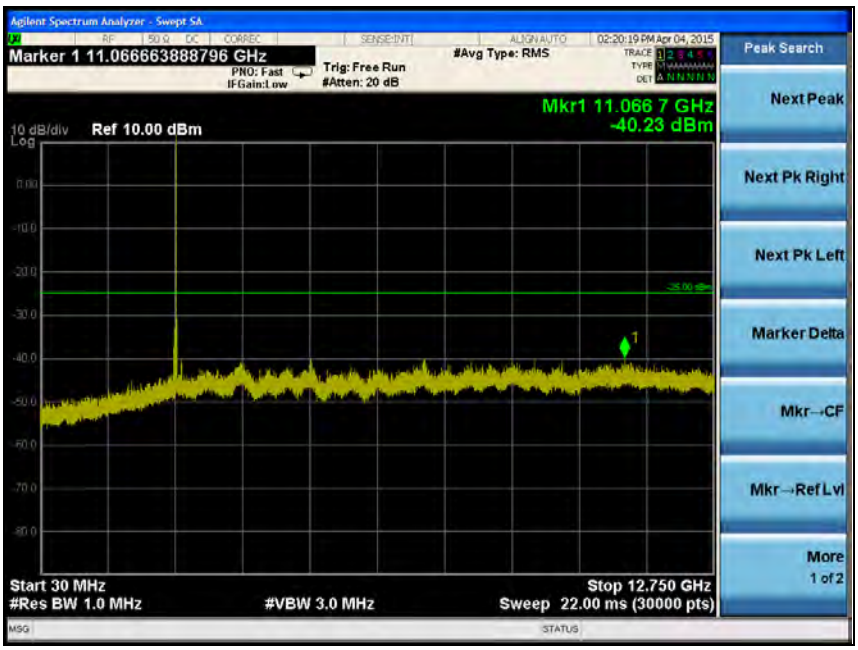
Middle Channel



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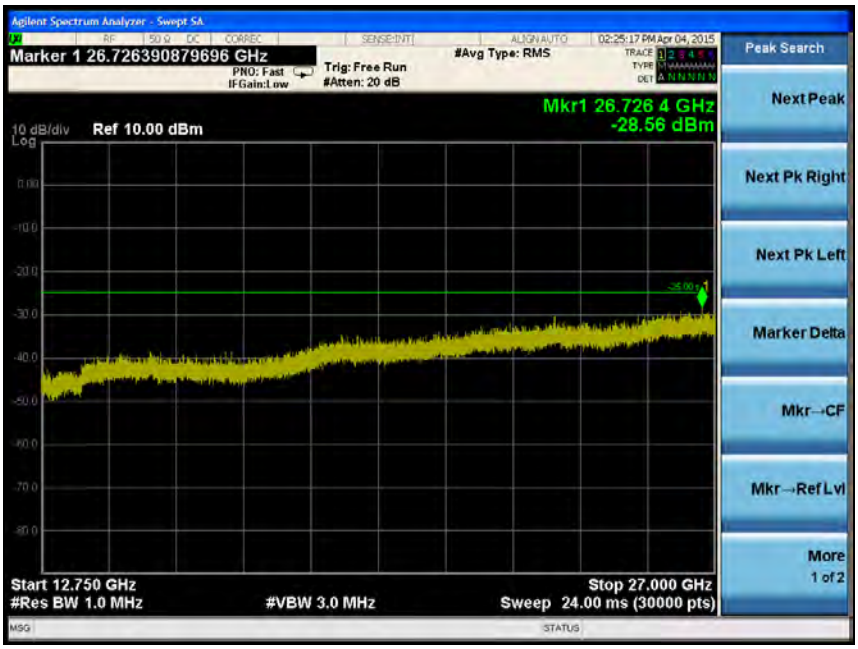
High Channel



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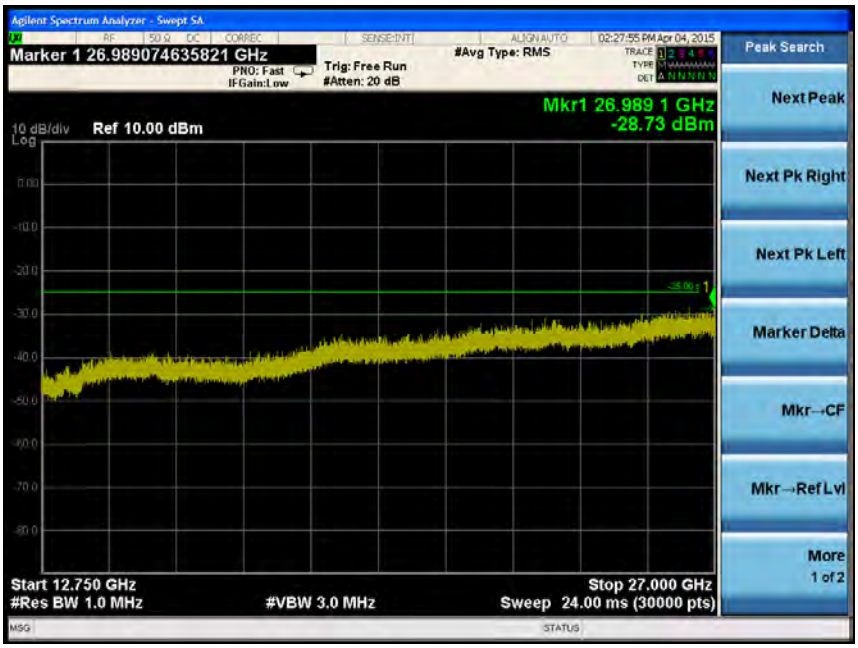
LTE band 41 (20 ㎒ – 16QAM_RB 1_Offset 0)

Low Channel



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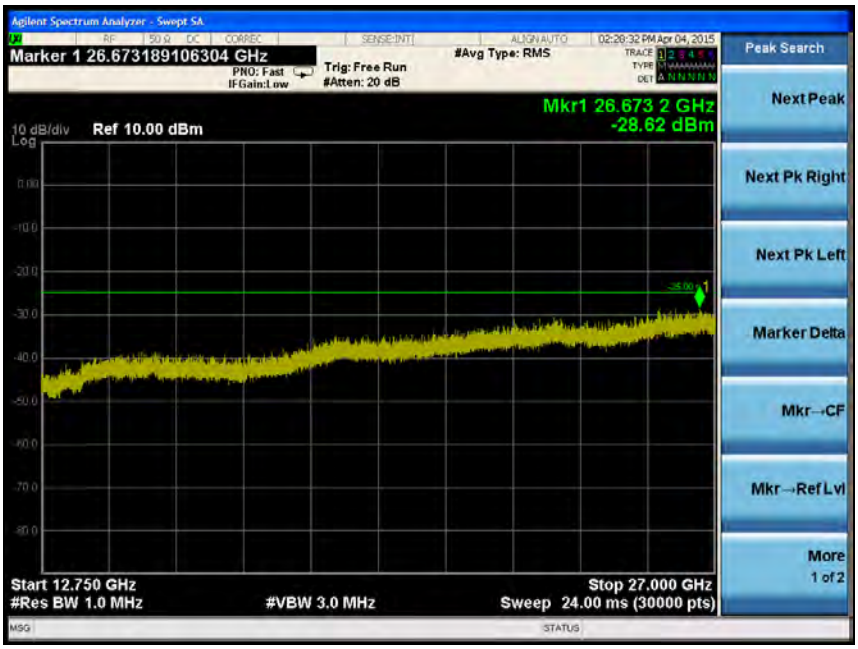
Middle Channel



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High Channel

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6. Band Edge

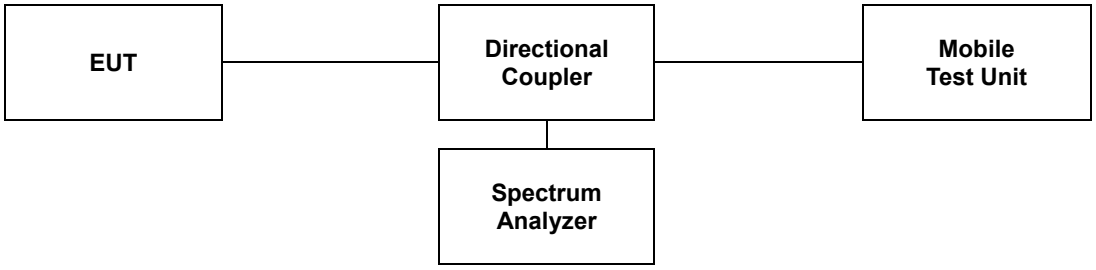
6.1. Limit

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 + 10log(P) ㏈.
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) ㏈.
FCC §27.53(g), For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a 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, by at least 43 + 10 log (P) dB.
FCC §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) ㏈ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) ㏈ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) ㏈ on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 log (P) ㏈ at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

6.2. Test Procedure

The test follows section 6.0 of FCC KDB Publication 971168_v02r02.

1. Span was set large enough so as to capture all out of band emissions near the band edge.
2. RBW ≥ 1 % of EBW
3. VBW ≥ RBW.
4. Detector = RMS.
5. Trace mode = max hold.
6. Sweep time = auto couple.
7. The trace was allowed to stabilize.
8. All path loss of frequency range was investigated and compensated to spectrum analyzer as correction factor.



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6.3. Test Results

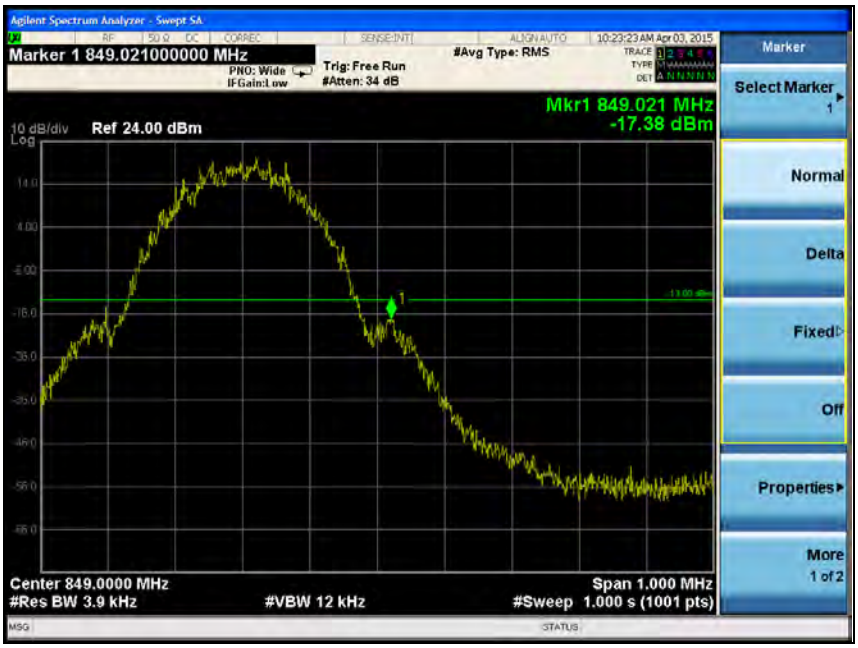
Ambient temperature	:	(24 ± 1) ℃
Relative humidity	:	47 % R.H.

Please refer to the following plots.

GSM850

Low Channel

High Channel



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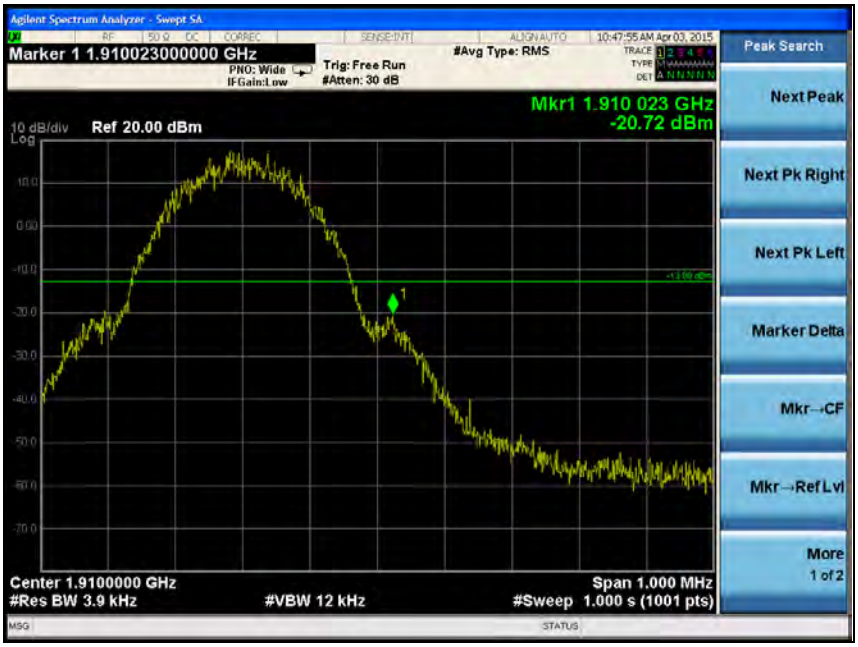
GSM1900
Low Channel

High Channel



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WDCMA850
Low Channel

High Channel

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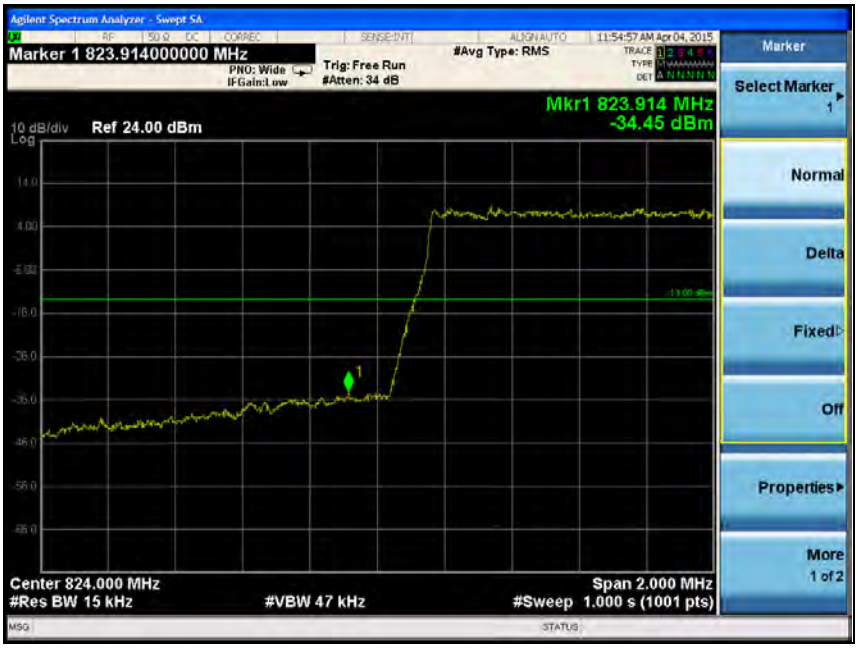
LTE band 5 (1.4 ㎒ – QPSK_RB 6)

Low Channel



High Channel

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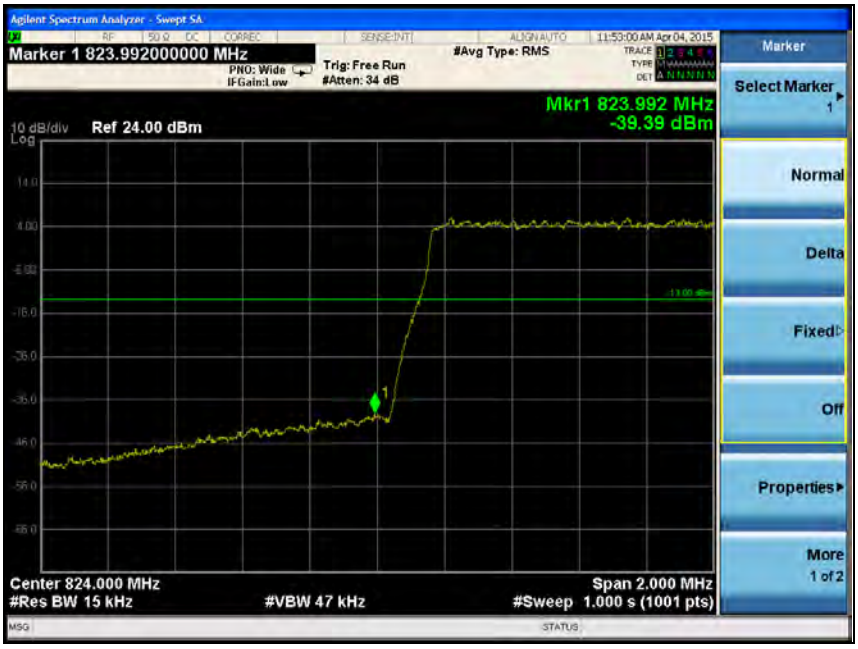
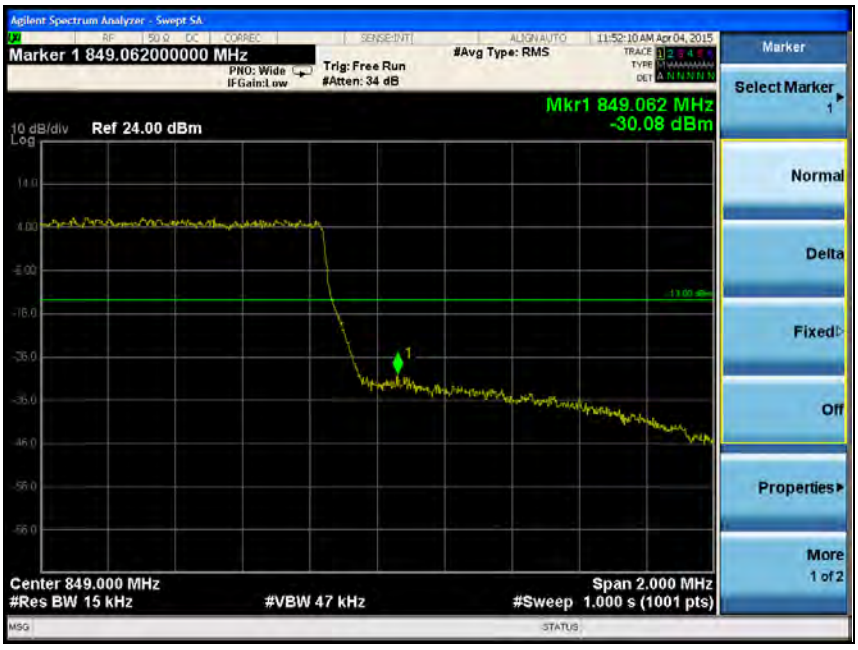
LTE band 5 (1.4 ㎒ – 16QAM_RB 6)

Low Channel



High Channel



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LTE band 5 (3 ㎒ – QPSK_RB 15)

Low Channel

High Channel

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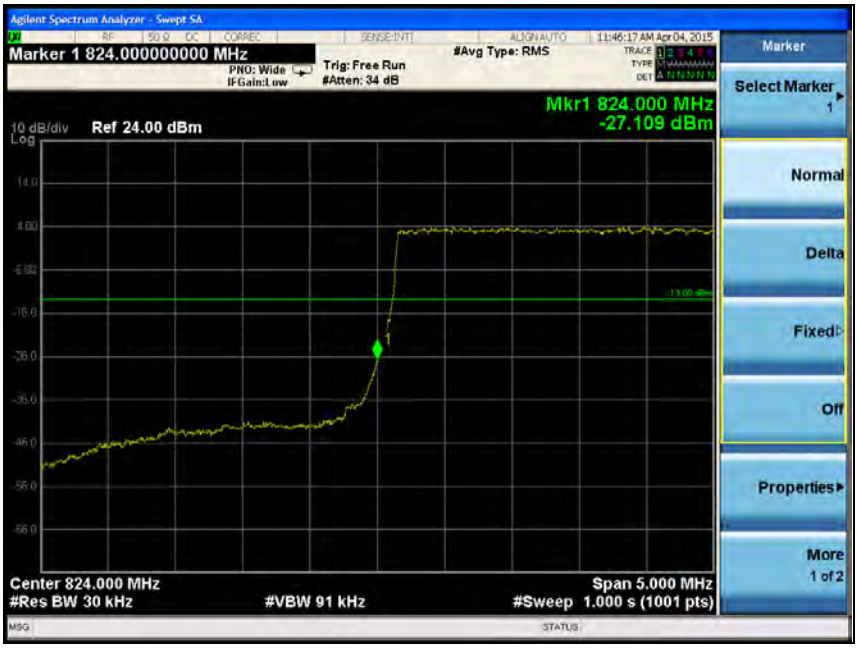
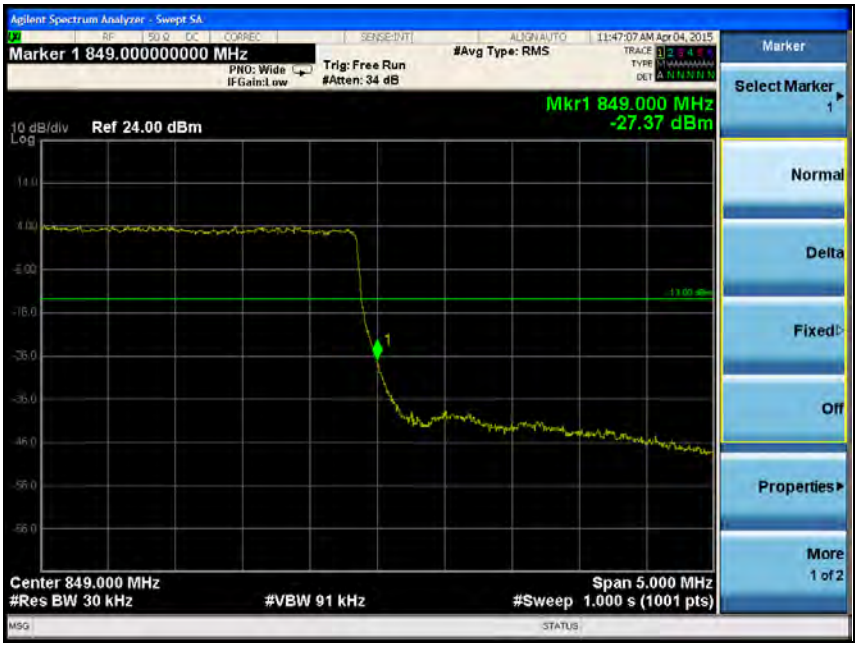
LTE band 5 (3 ㎒ – 16QAM_RB 15)

Low Channel



High Channel



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LTE band 5 (5 ㎒ – QPSK_RB 25)

Low Channel

High Channel

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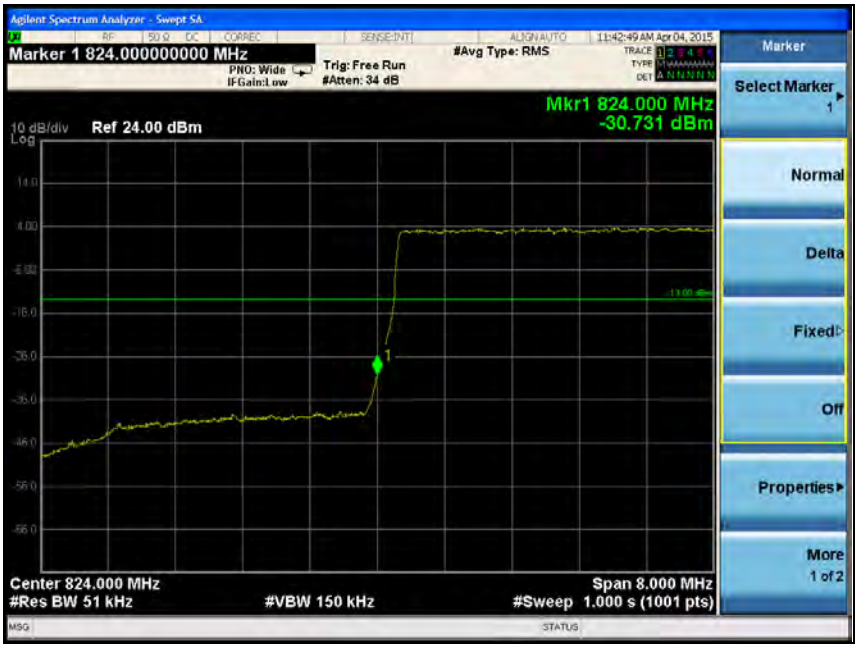
LTE band 5 (5 ㎒ – 16QAM_RB 25)

Low Channel



High Channel

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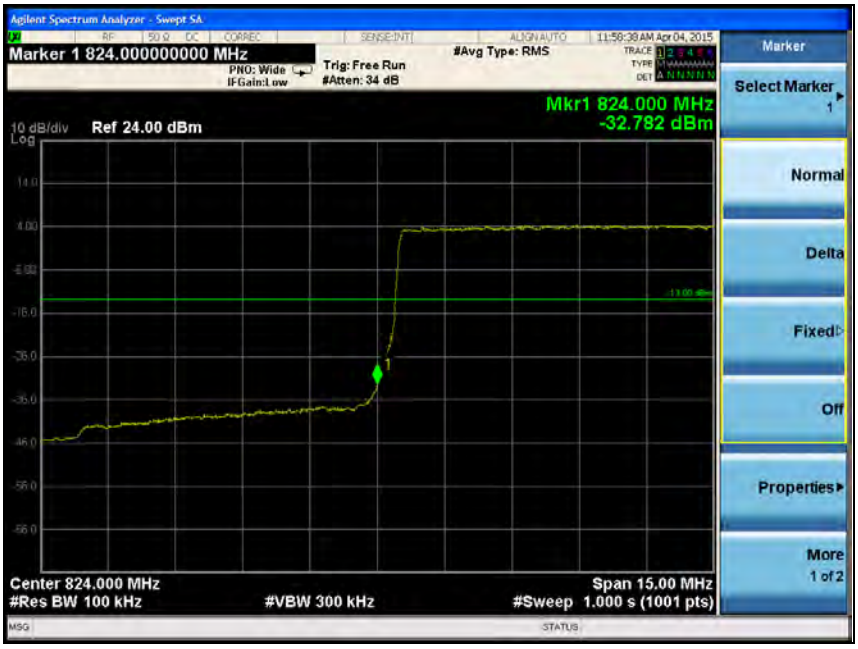
LTE band 5 (10 ㎒ – QPSK_RB 50)

Low Channel



High Channel

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LTE band 5 (10 ㎒ – 16QAM_RB 50)

Low Channel

High Channel

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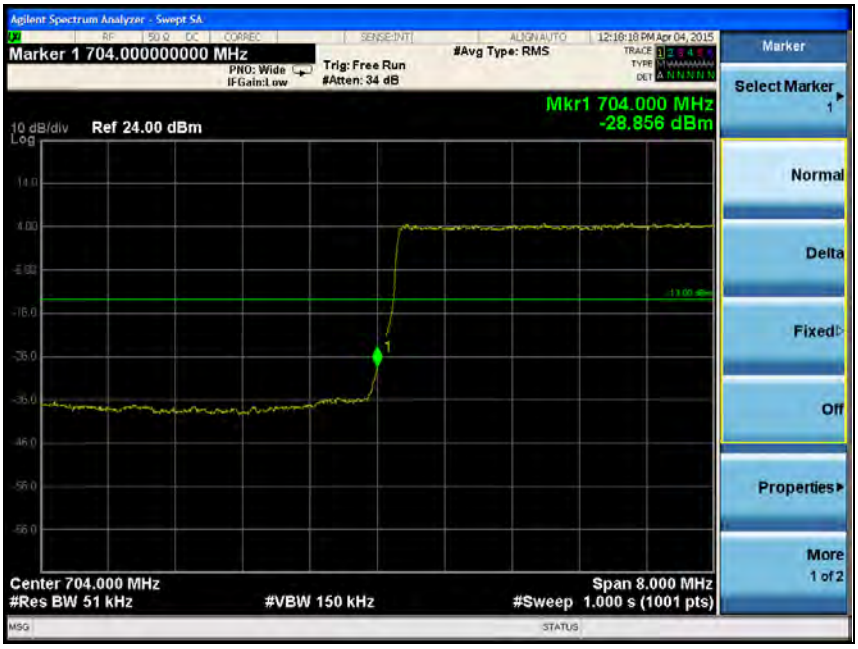
LTE band 17 (5 ㎒ – QPSK_RB 25)

Low Channel



High Channel

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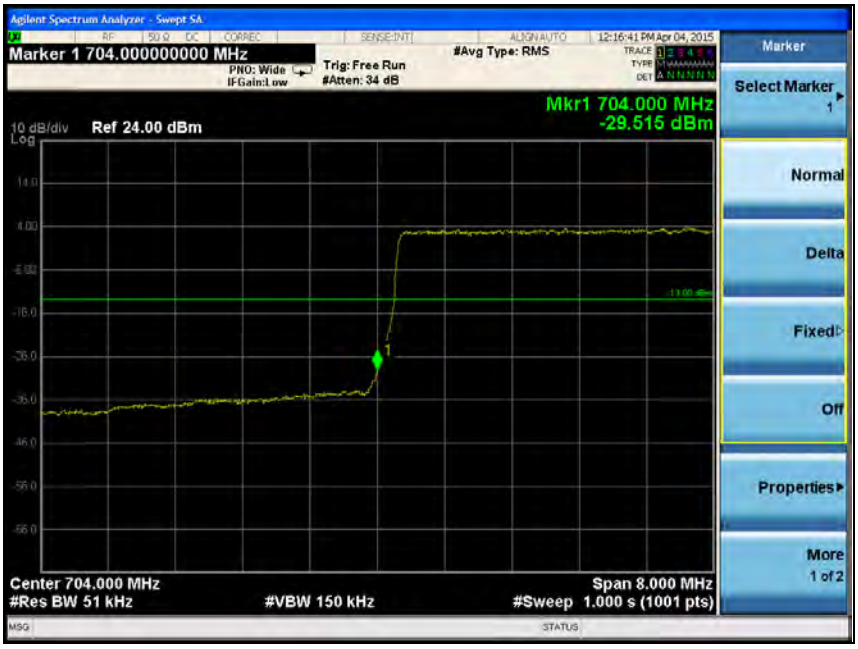
LTE band 17 (5 ㎒ – 16QAM_RB 25)

Low Channel



High Channel

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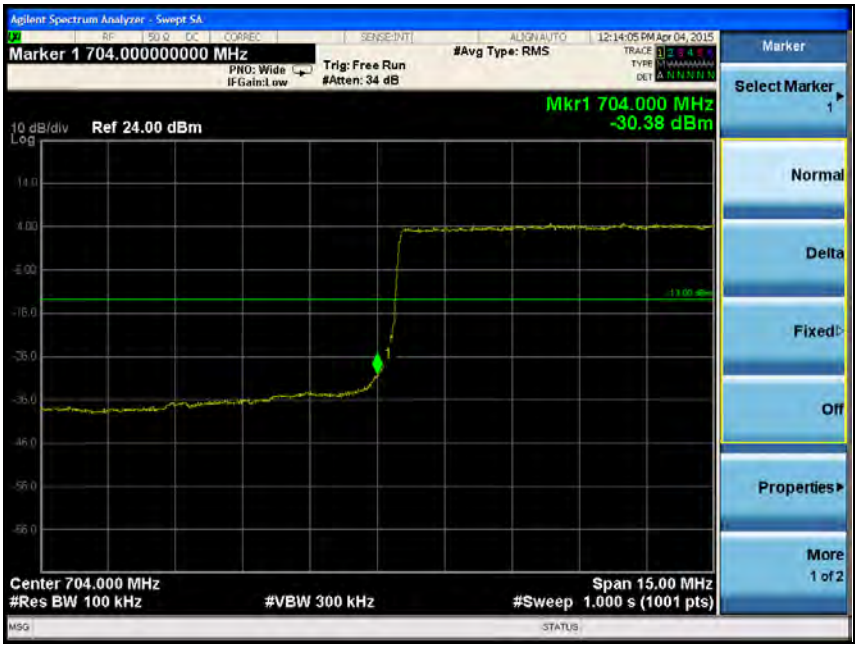
LTE band 17 (10 ㎒ – QPSK_RB 50)

Low Channel



High Channel

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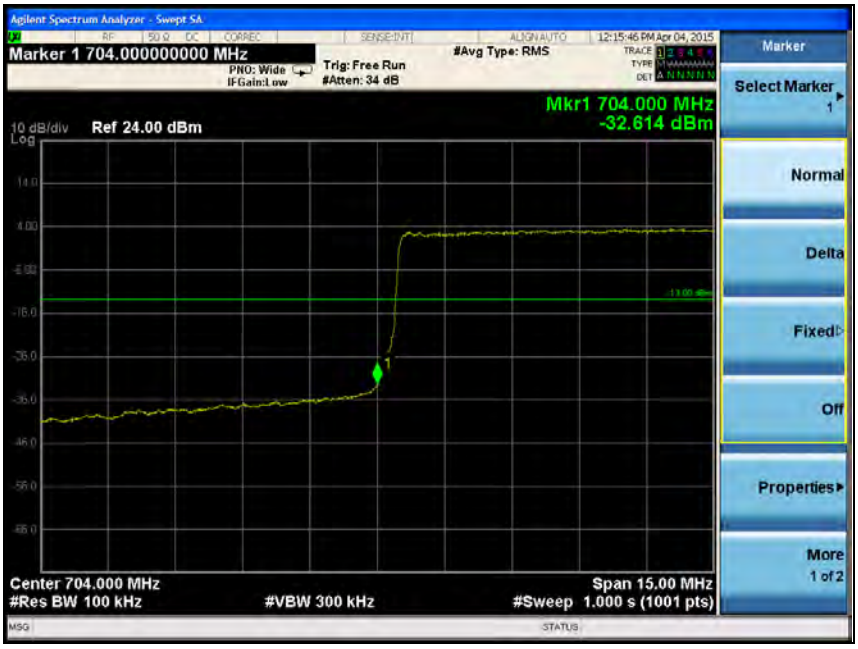
LTE band 17 (10 ㎒ – 16QAM_RB 50)

Low Channel



High Channel

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LTE band 41 (5 ㎒ – QPSK_RB 25)

Low Channel

High Channel

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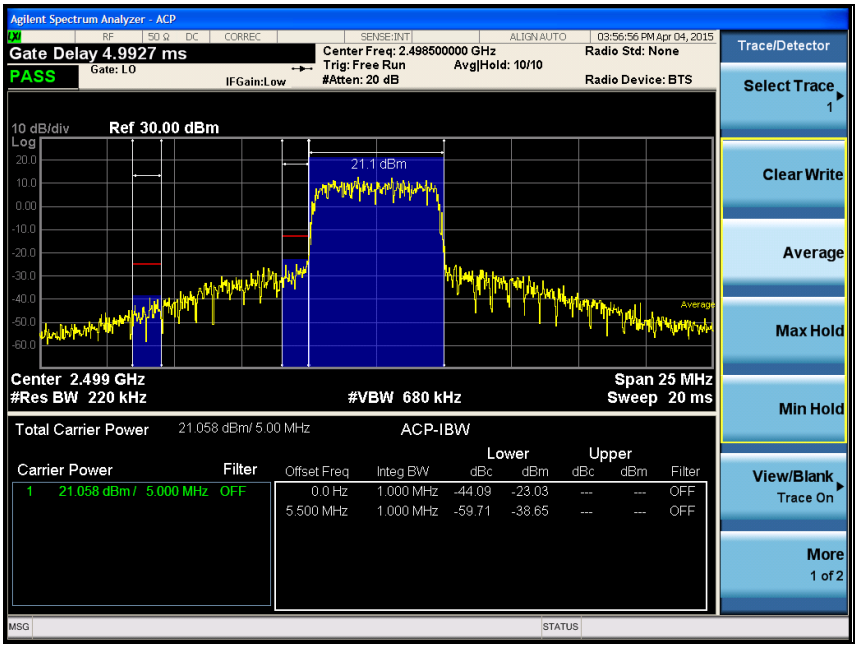
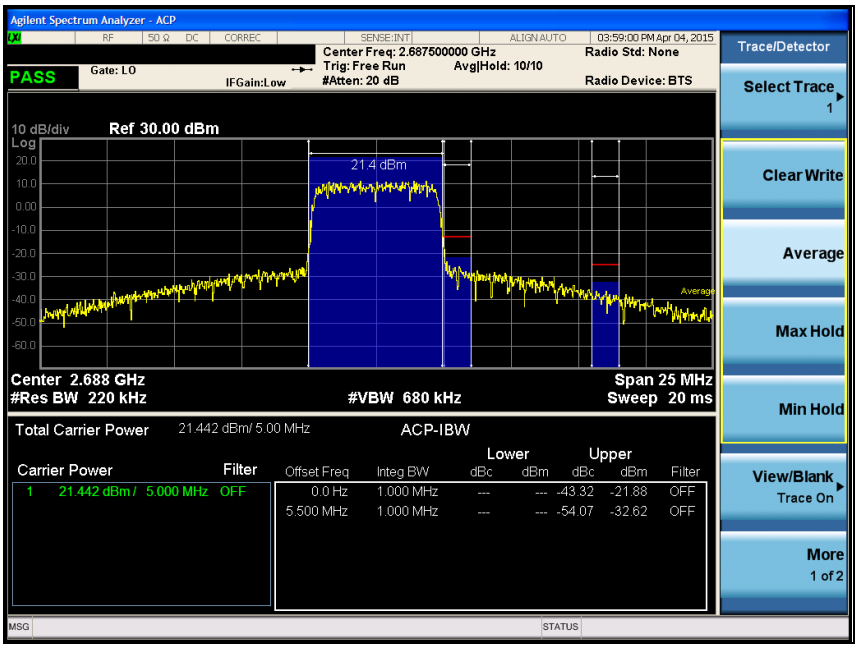
LTE band 41 (5 ㎒ – 16QAM_RB 25)

Low Channel



High Channel



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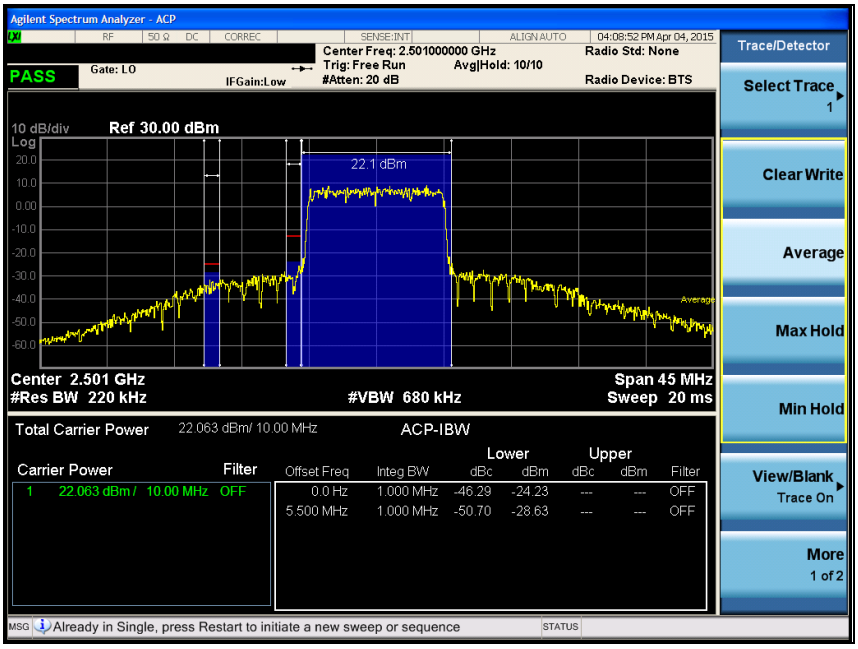
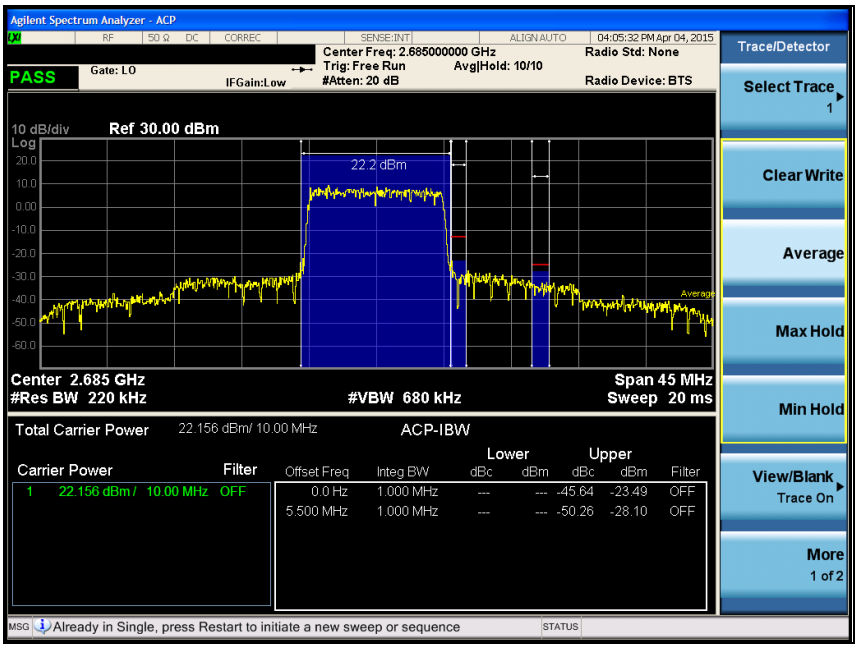
LTE band 41 (10 ㎒ – QPSK_RB 50)

Low Channel

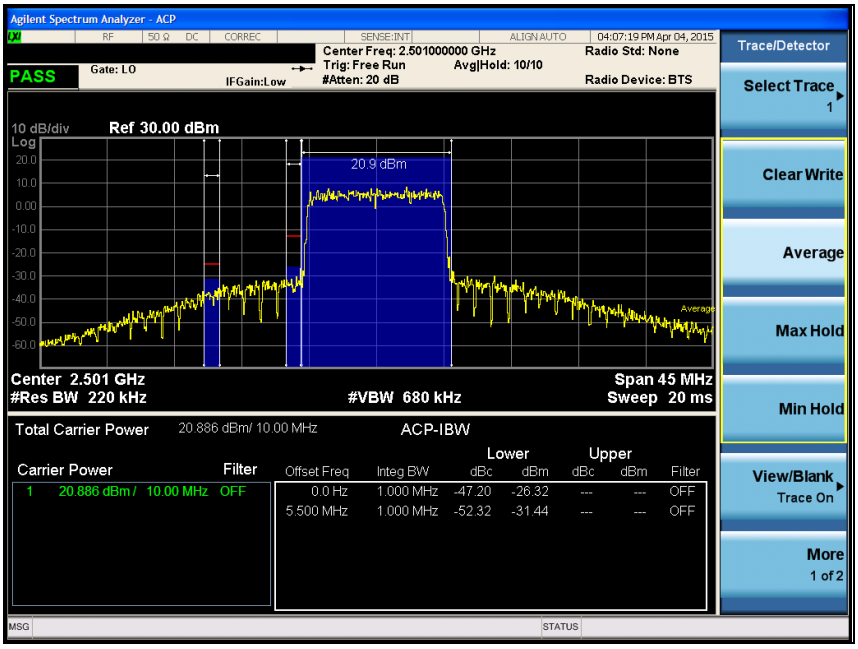


High Channel

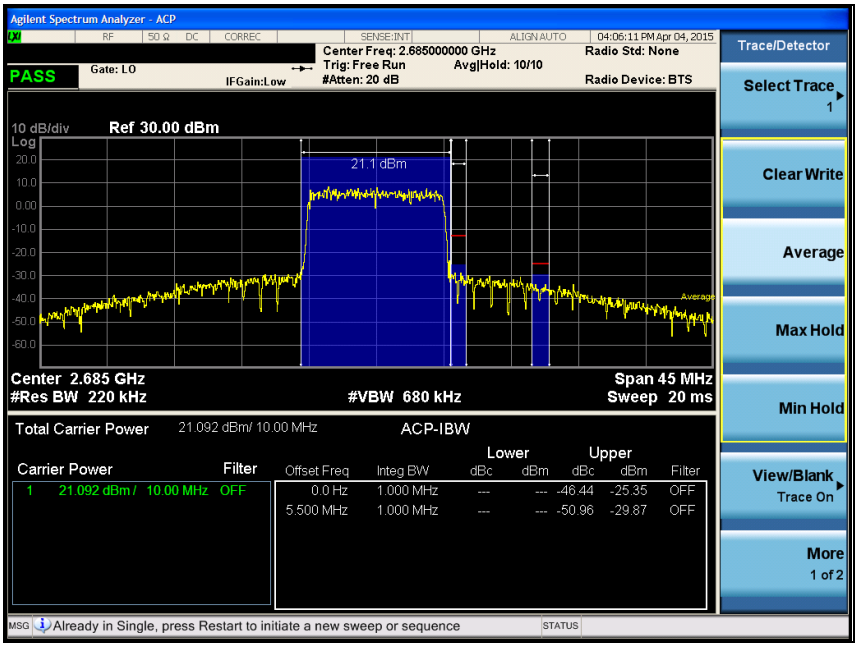


LTE band 41 (10 ㎒ – 16QAM_RB 50)

Low Channel



High Channel



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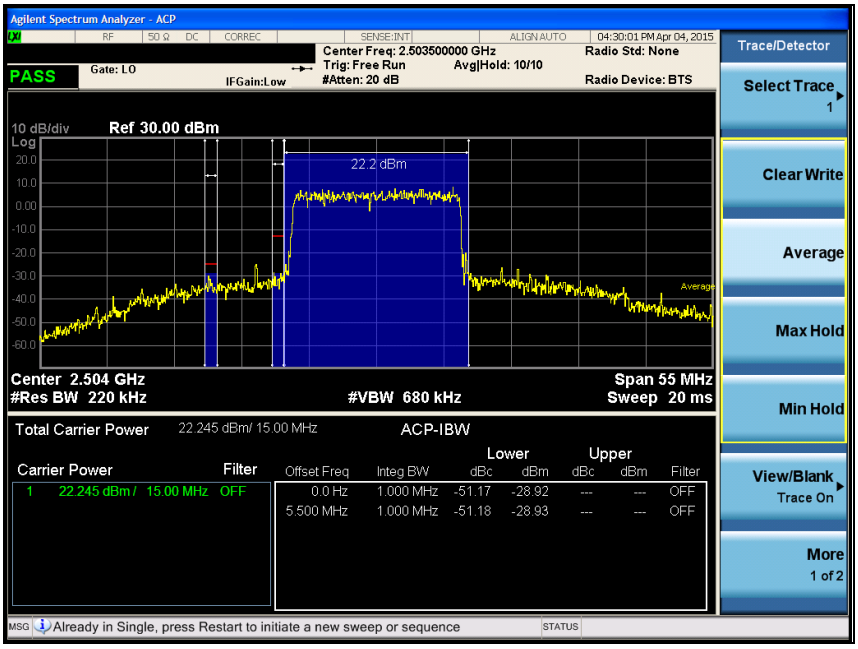
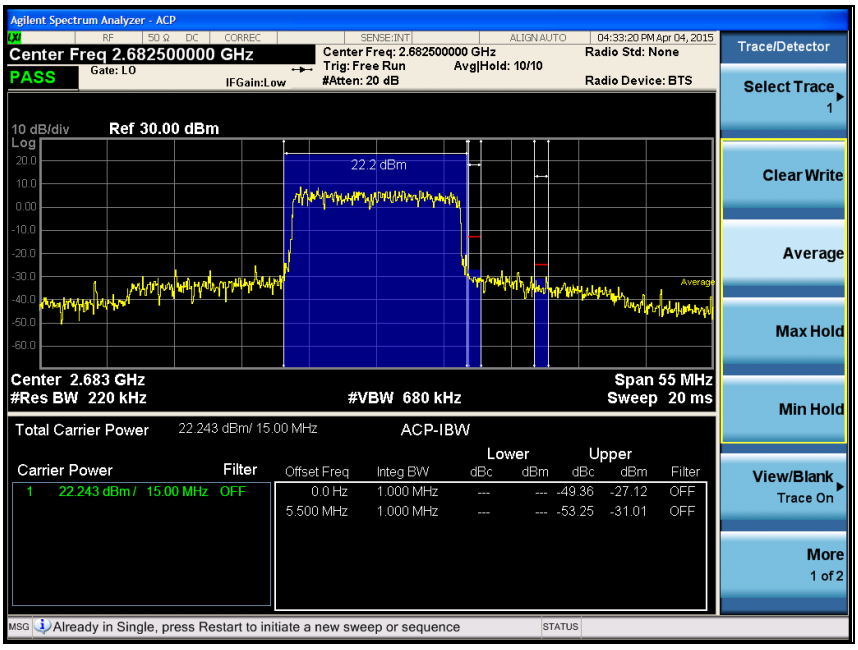
LTE band 41 (15 ㎒ – QPSK_RB 75)

Low Channel



High Channel



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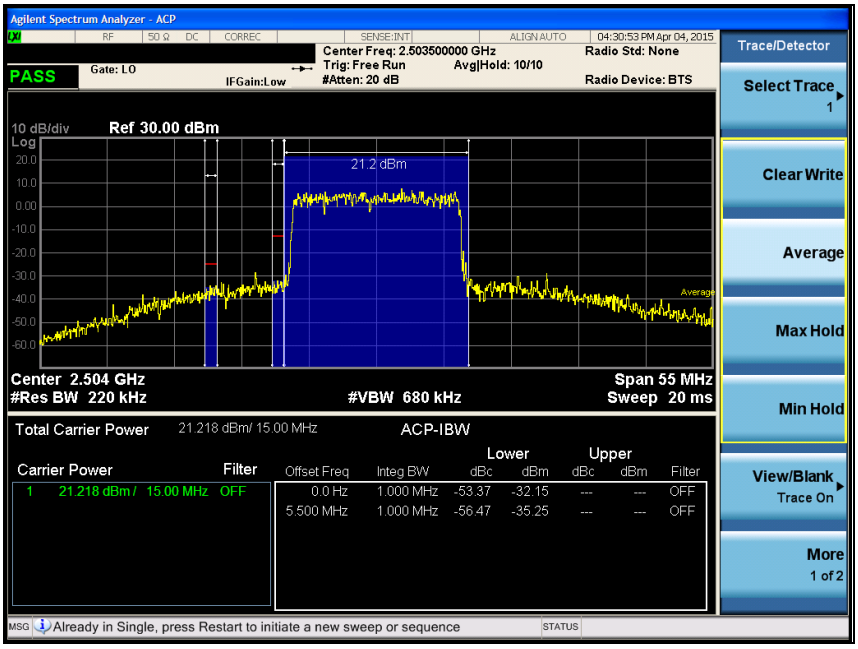
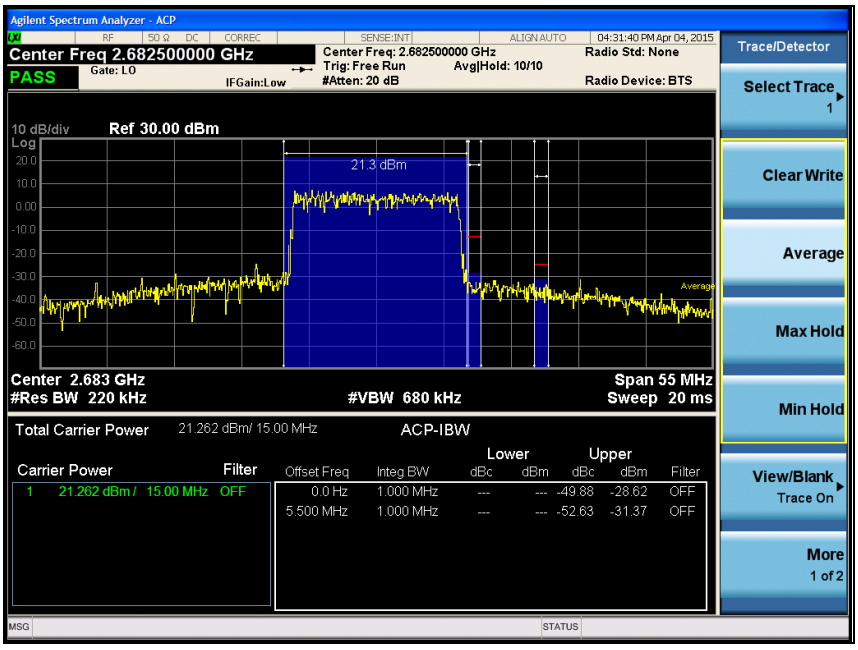
LTE band 41 (15 ㎒ – 16QAM_RB 75)

Low Channel



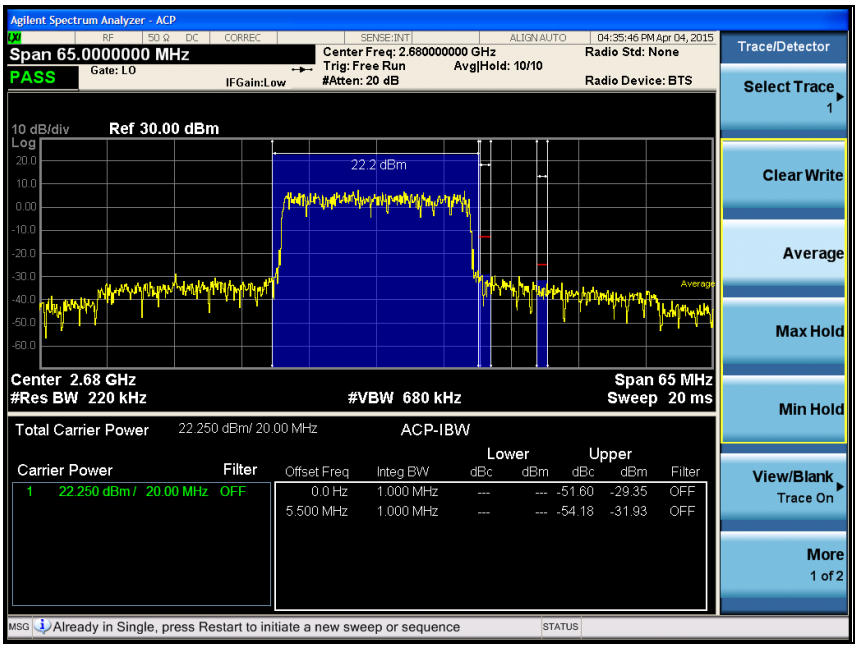
High Channel



LTE band 41 (20 ㎒ – QPSK_RB 100)

Low Channel

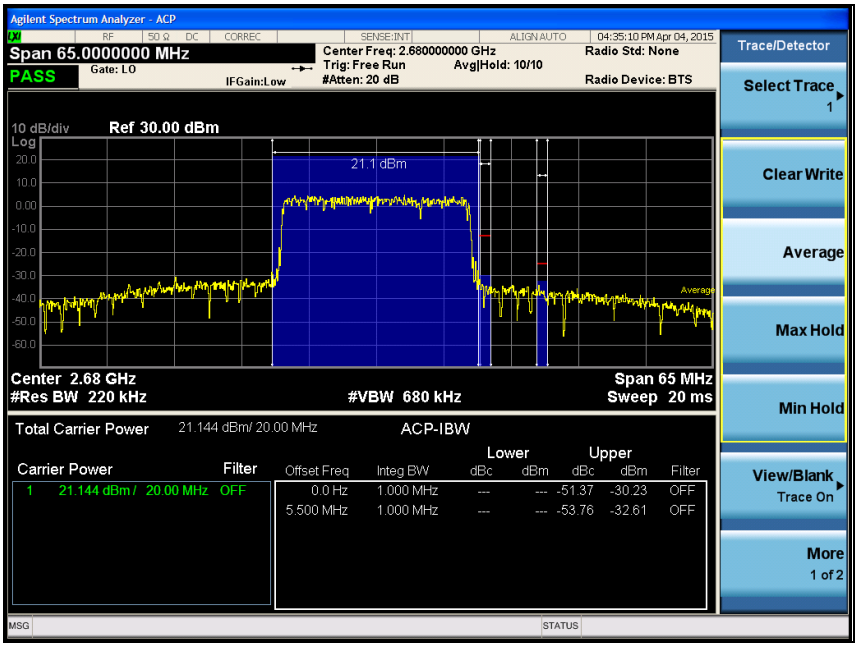
High Channel



LTE band 41 (20 ㎒ – 16QAM_RB 100)

Low Channel

High Channel



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7. Frequency Stability

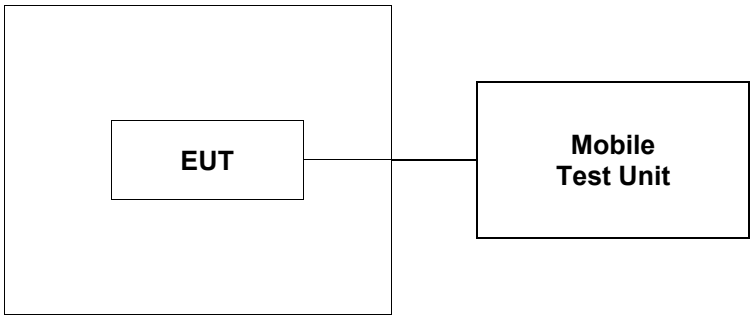
7.1. Limit

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 ㎒ 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.

7.2. 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.



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7.3. Test Results

Ambient temperature : (24 ± 1) ℃
Relative humidity : 47 % R.H.

GSM850 mode at middle channel

Reference Frequency: 836.6 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.85	-1	-0.001 2
40		10	0.012 0
30		3	0.003 6
24		2	0.002 4
10		-2	-0.002 4
0		4	0.004 8
-10		2	0.002 4
-20		4	0.004 8
-30		-2	-0.002 4
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	3.45 (batt. End point)	7	0.008 4

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GSM1900 mode at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.85	8	0.004 3
40		7	0.003 7
30		-5	-0.002 7
24		-3	-0.001 6
10		2	0.001 1
0		1	0.000 5
-10		6	0.003 2
-20		-5	-0.002 7
-30		7	0.003 7
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**Ppm**
24	3.45 (batt. End point)	3	0.001 6

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WCDMA850 mode at middle channel

Reference Frequency: 836.6 ㎒, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.85	4	0.004 8
40		7	0.008 4
30		1	0.001 2
24		-5	-0.006 0
10		8	0.009 6
0		11	0.013 1
-10		-2	-0.002 4
-20		13	0.015 5
-30		10	0.012 0
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	3.45 (batt. End point)	3	0.003 6

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LTE band 5 at middle channel

Reference Frequency: 836.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.85	-4	-0.004 8
40		-1	-0.001 2
30		-10	-0.012 0
24		5	0.006 0
10		-8	-0.009 6
0		-3	-0.003 6
-10		-1	-0.001 2
-20		4	0.004 8
-30		7	0.008 4
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	3.45 (batt. End point)	-3	-0.003 6

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LTE band 17 at middle channel

Reference Frequency: 710.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.85	5	0.007 0
40		10	0.014 1
30		-11	-0.015 5
24		-10	-0.014 1
10		-2	-0.002 8
0		-3	-0.004 2
-10		5	0.007 0
-20		-1	-0.001 4
-30		6	0.008 5
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	3.45 (batt. End point)	11	0.015 5

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.

LTE band 41 at middle channel

Reference Frequency: 2 593.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	3.85	7	0.002 7
40		6	0.002 3
30		-1	-0.000 4
24		3	0.001 2
10		-6	-0.002 3
0		-3	-0.001 2
-10		8	0.003 1
-20		2	0.000 8
-30		2	0.000 8
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	3.45 (batt. End point)	-7	-0.002 7

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