

4. Occupied Bandwidth 99 %

4.1. Limit

CFR 47, Section FCC §2.1049 and IC RSS-Gen Issue 5 6.7.

4.2. Test Procedure

FCC

The test follows section 4.2 of FCC KDB Publication 971168 D01 v03r01.

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of $1.5 \times$ OBW is sufficient).
- b. The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. Set the detection mode to peak, and the trace mode to max-hold.
- e. If the instrument does not have a 99 % OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5 % of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5 % of the total is reached and record that frequency as the upper OBW frequency. The 99 % power OBW can be determined by computing the difference these two frequencies.
- f. The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

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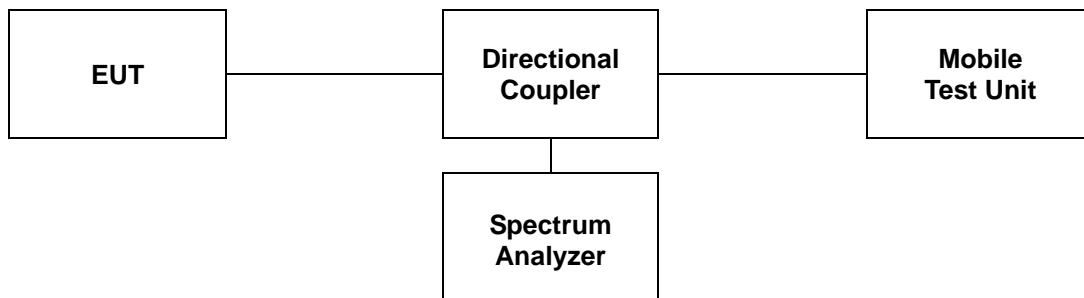
IC

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



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4.3 Test Results

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

- LTE

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
2 (1.4 MHz)	QPSK	1 850.7	1.098
		1 880.0	1.098
		1 909.3	1.103
2 (1.4 MHz)	16QAM	1 850.7	1.098
		1 880.0	1.103
		1 909.3	1.103
2 (3 MHz)	QPSK	1 851.5	2.692
		1 880.0	2.692
		1 908.5	2.692
2 (3 MHz)	16QAM	1 851.5	2.692
		1 880.0	2.683
		1 908.5	2.683
2 (5 MHz)	QPSK	1 852.5	4.515
		1 880.0	4.530
		1 907.5	4.501
2 (5 MHz)	16QAM	1 852.5	4.530
		1 880.0	4.515
		1 907.5	4.530
2 (10 MHz)	QPSK	1 855.0	8.915
		1 880.0	8.944
		1 905.0	8.944
2 (10 MHz)	16QAM	1 855.0	8.944
		1 880.0	8.915
		1 905.0	8.944
2 (15 MHz)	QPSK	1 857.5	13.415
		1 880.0	13.459
		1 902.5	13.459
2 (15 MHz)	16QAM	1 857.5	13.502
		1 880.0	13.459
		1 902.5	13.459
2 (20 MHz)	QPSK	1 860.0	17.829
		1 880.0	17.945
		1 900.0	17.829
2 (20 MHz)	16QAM	1 860.0	17.887
		1 880.0	17.945
		1 900.0	17.829

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Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
4 (1.4 MHz)	QPSK	1 710.7	1.098
		1 732.5	1.098
		1 754.3	1.103
4 (1.4 MHz)	16QAM	1 710.7	1.098
		1 732.5	1.103
		1 754.3	1.103
4 (3 MHz)	QPSK	1 711.5	2.692
		1 732.5	2.692
		1 753.5	2.692
4 (3 MHz)	16QAM	1 711.5	2.692
		1 732.5	2.683
		1 753.5	2.683
4 (5 MHz)	QPSK	1 712.5	4.501
		1 732.5	4.515
		1 752.5	4.501
4 (5 MHz)	16QAM	1 712.5	4.530
		1 732.5	4.515
		1 752.5	4.530
4 (10 MHz)	QPSK	1 715.0	8.915
		1 732.5	8.973
		1 750.0	8.915
4 (10 MHz)	16QAM	1 715.0	8.944
		1 732.5	8.915
		1 750.0	8.915
4 (15 MHz)	QPSK	1 717.5	13.415
		1 732.5	13.459
		1 747.5	13.459
4 (15 MHz)	16QAM	1 717.5	13.459
		1 732.5	13.459
		1 747.5	13.502
4 (20 MHz)	QPSK	1 720.0	17.887
		1 732.5	17.945
		1 745.0	17.829
4 (20 MHz)	16QAM	1 720.0	17.887
		1 732.5	17.887
		1 745.0	17.887

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Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
5 (1.4 MHz)	QPSK	824.7	1.098
		836.5	1.103
		848.3	1.103
5 (1.4 MHz)	16QAM	824.7	1.098
		836.5	1.098
		848.3	1.098
5 (3 MHz)	QPSK	825.5	2.692
		836.5	2.692
		847.5	2.692
5 (3 MHz)	16QAM	825.5	2.692
		836.5	2.683
		847.5	2.683
5 (5 MHz)	QPSK	826.5	4.515
		836.5	4.530
		846.5	4.501
5 (5 MHz)	16QAM	826.5	4.530
		836.5	4.515
		846.5	4.530
5 (10 MHz)	QPSK	829.0	8.915
		836.5	8.944
		844.0	8.944
5 (10 MHz)	16QAM	829.0	8.915
		836.5	8.944
		844.0	8.944

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Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
7 (5 MHz)	QPSK	2 502.5	4.515
		2 535.0	4.530
		2 567.5	4.501
7 (5 MHz)	16QAM	2 502.5	4.515
		2 535.0	4.501
		2 567.5	4.530
7 (10 MHz)	QPSK	2 505.0	8.915
		2 535.0	8.944
		2 565.0	8.944
7 (10 MHz)	16QAM	2 505.0	8.944
		2 535.0	8.944
		2 565.0	8.915
7 (15 MHz)	QPSK	2 507.5	13.415
		2 535.0	13.502
		2 562.5	13.459
7 (15 MHz)	16QAM	2 507.5	13.459
		2 535.0	13.459
		2 562.5	13.459
7 (20 MHz)	QPSK	2 510.0	17.887
		2 535.0	17.887
		2 560.0	17.887
7 (20 MHz)	16QAM	2 510.0	17.945
		2 535.0	17.887
		2 560.0	17.887

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Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
12 (1.4 MHz)	QPSK	699.7	1.103
		707.5	1.098
		715.3	1.103
12 (1.4 MHz)	16QAM	699.7	1.098
		707.5	1.098
		715.3	1.098
12 (3 MHz)	QPSK	700.5	2.683
		707.5	2.692
		714.5	2.692
12 (3 MHz)	16QAM	700.5	2.683
		707.5	2.683
		714.5	2.683
12 (5 MHz)	QPSK	701.5	4.530
		707.5	4.515
		713.5	4.515
12 (5 MHz)	16QAM	701.5	4.501
		707.5	4.530
		713.5	4.530
12 (10 MHz)	QPSK	704.0	8.915
		707.5	8.973
		711.0	8.944
12 (10 MHz)	16QAM	704.0	8.915
		707.5	8.915
		711.0	8.915

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RTT5041-19(2017.07.10)(0)

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A4(210 mm x 297 mm)

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
17 (5 MHz)	QPSK	706.5	4.515
		710.0	4.501
		713.5	4.515
17 (5 MHz)	16QAM	706.5	4.515
		710.0	4.515
		713.5	4.530
17 (10 MHz)	QPSK	709.0	8.915
		710.0	8.944
		711.0	8.944
17 (10 MHz)	16QAM	709.0	8.944
		710.0	8.915
		711.0	8.944

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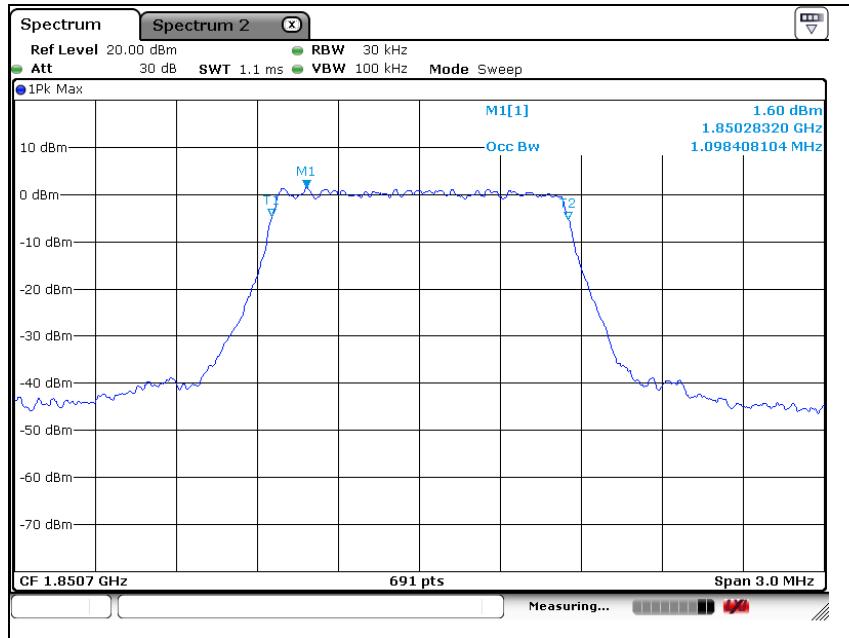
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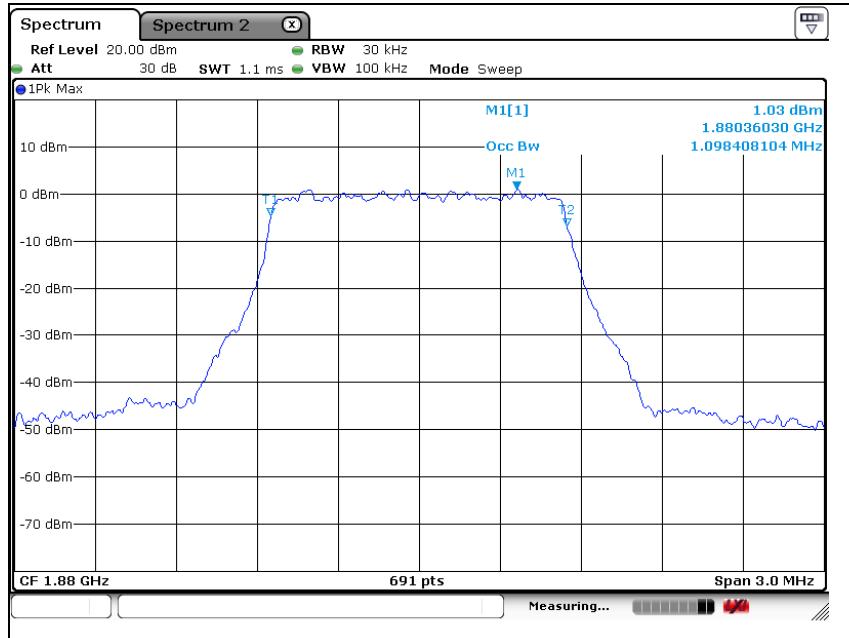
A4(210 mm x 297 mm)

LTE band 2 (1.4 MHz - QPSK)

Low Channel



Middle Channel



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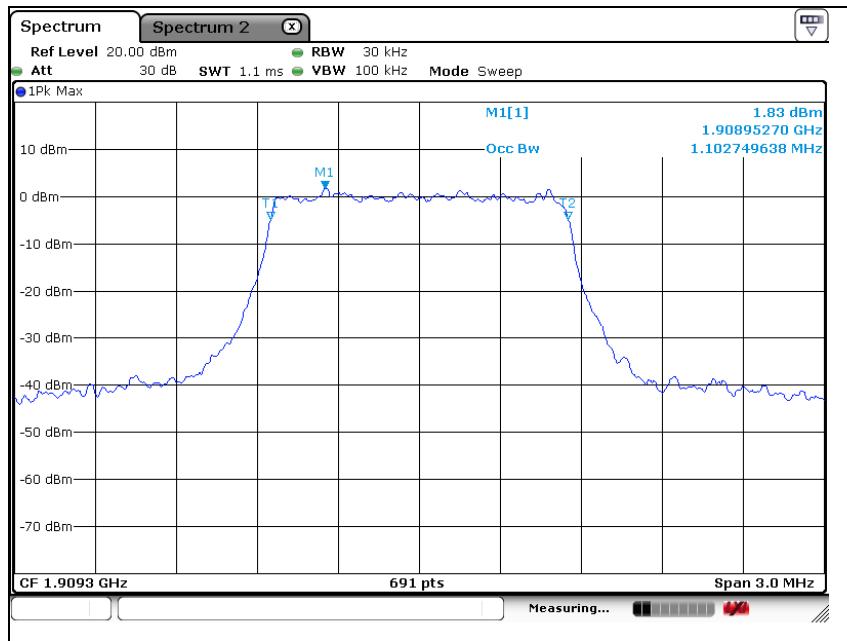
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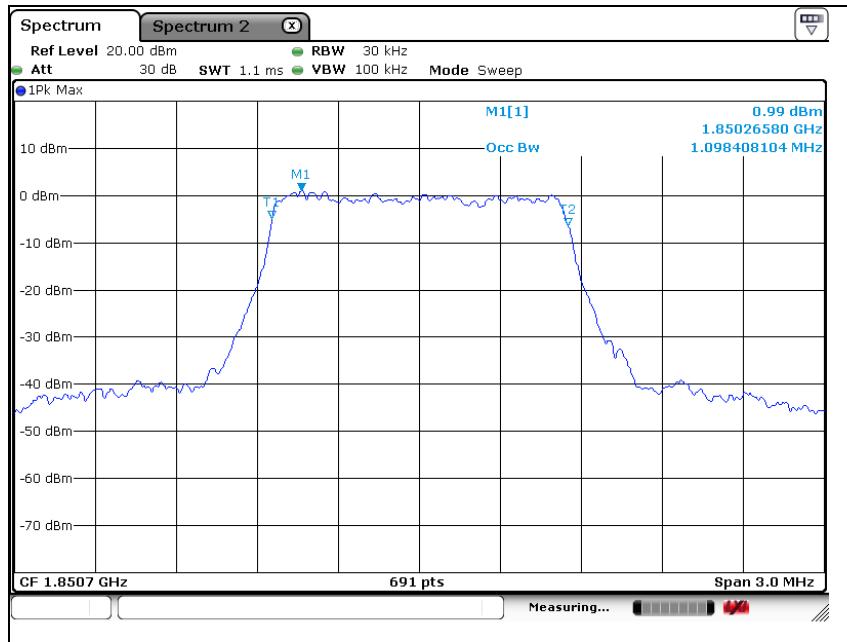
A4(210 mm x 297 mm)

High Channel



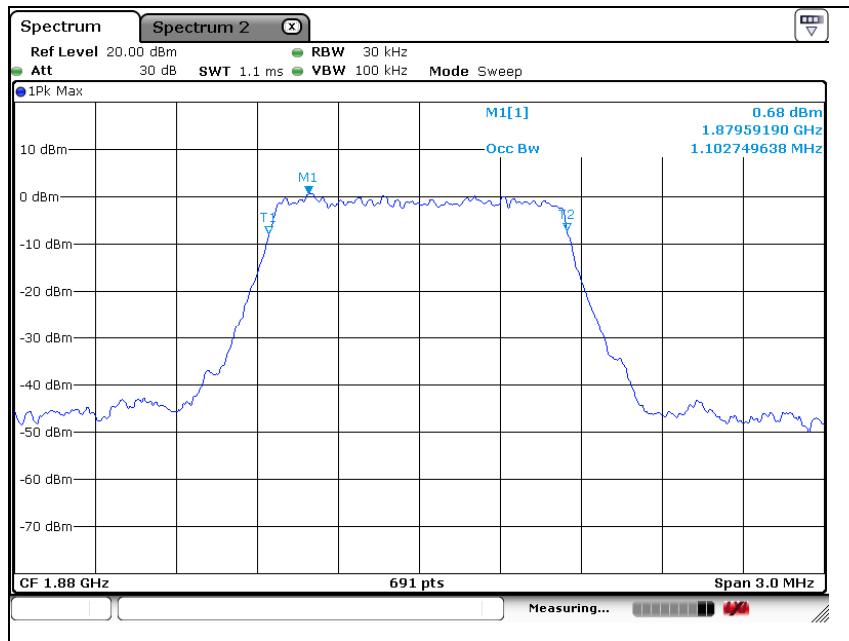
LTE band 2 (1.4 MHz - 16QAM)

Low Channel

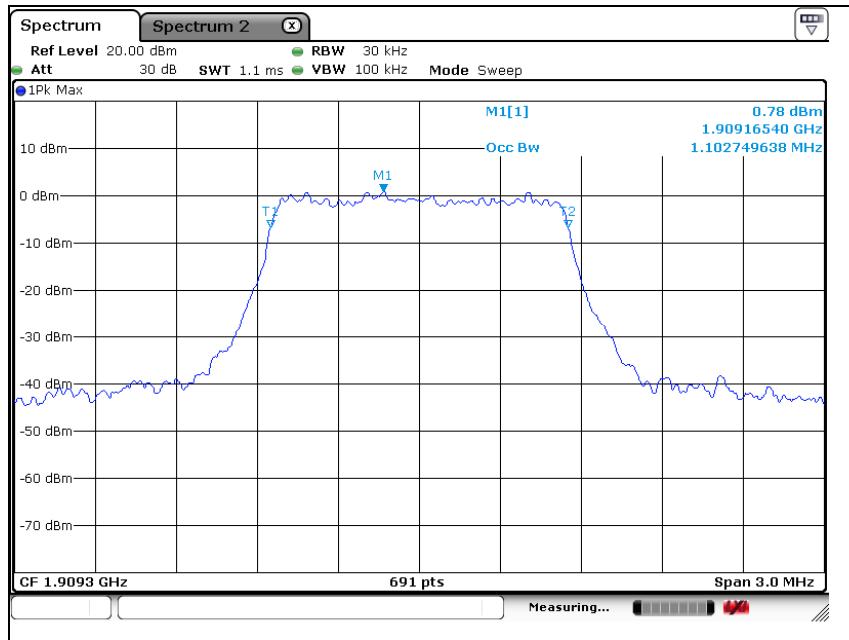


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Middle Channel



High Channel



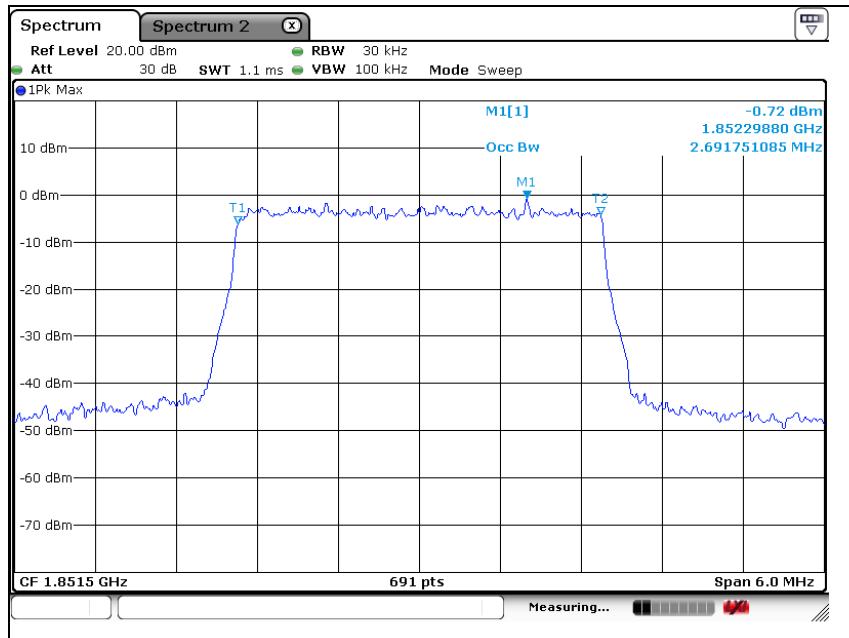
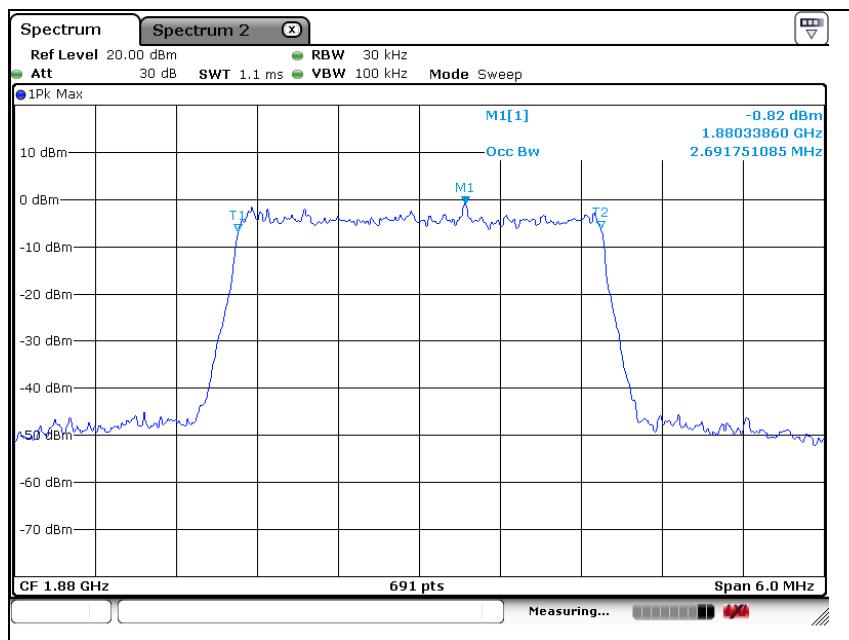
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A4(210 mm x 297 mm)

LTE band 2 (3 MHz - QPSK)**Low Channel****Middle Channel**

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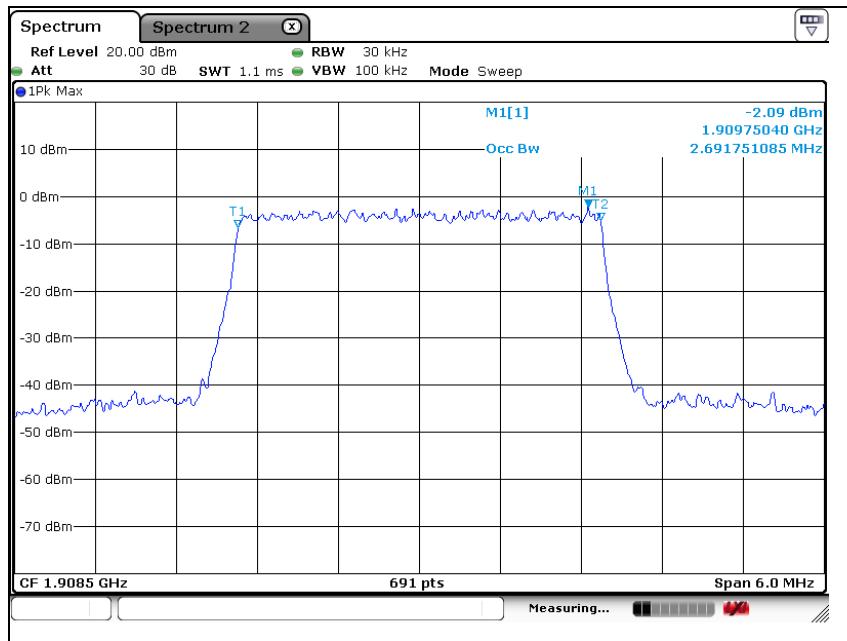
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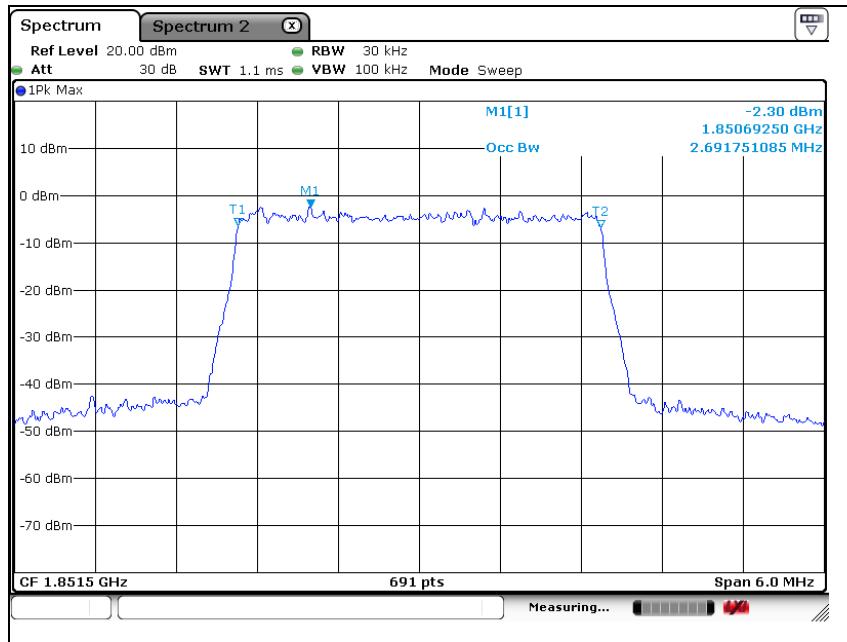
A4(210 mm x 297 mm)

High Channel



LTE band 2 (3 MHz - 16QAM)

Low Channel



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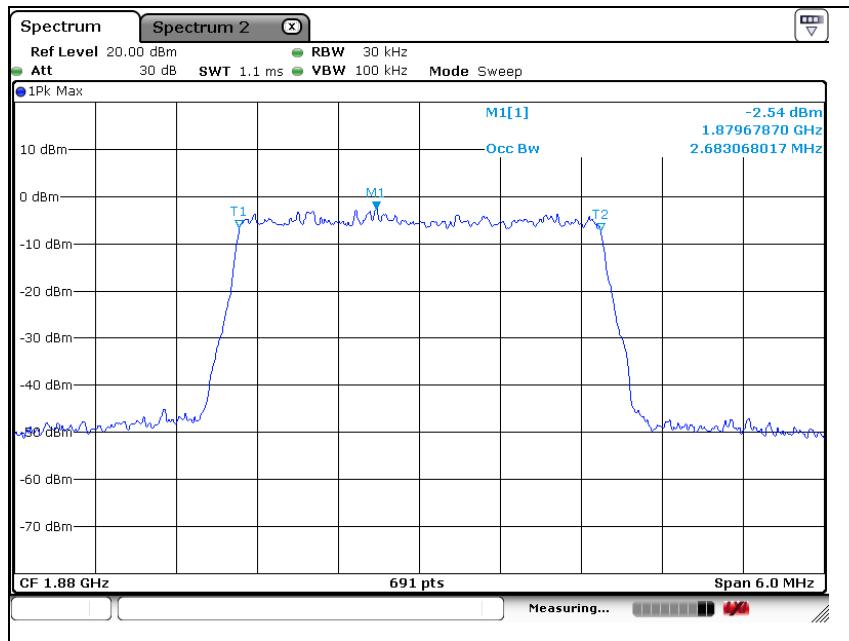
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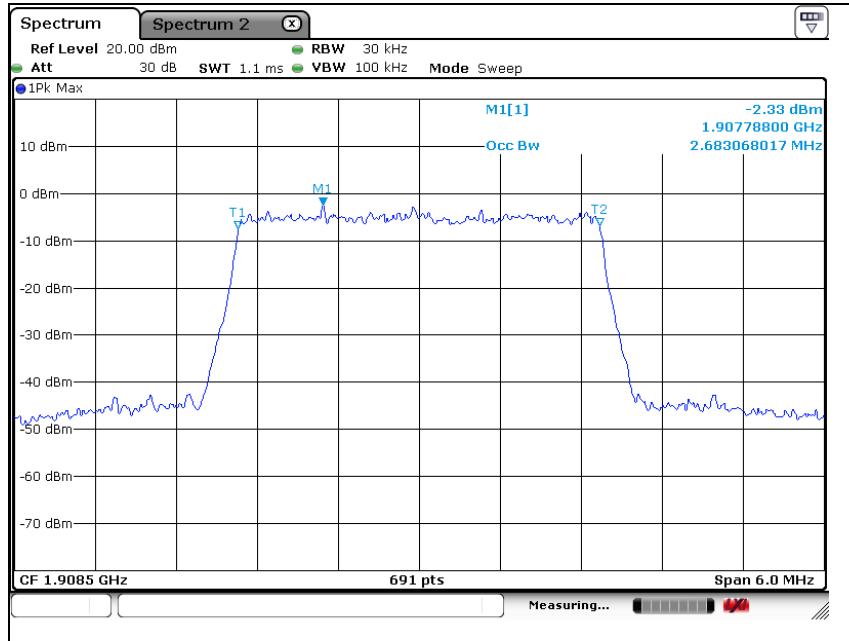
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A4(210 mm x 297 mm)

Middle Channel



High Channel



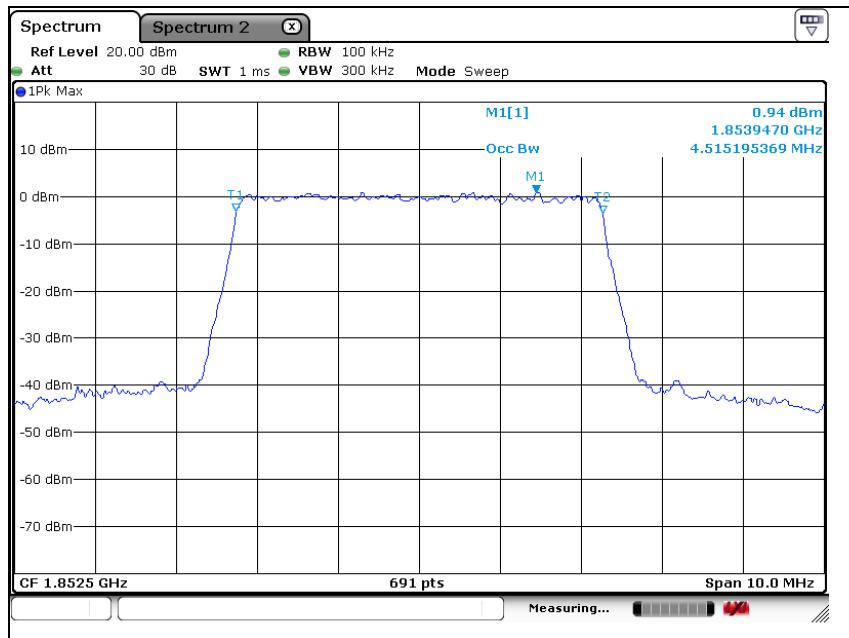
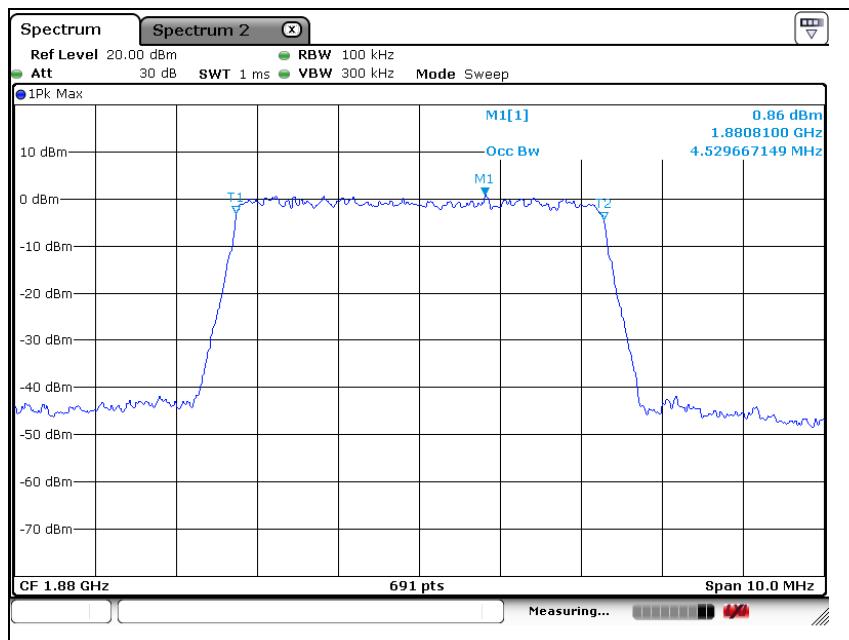
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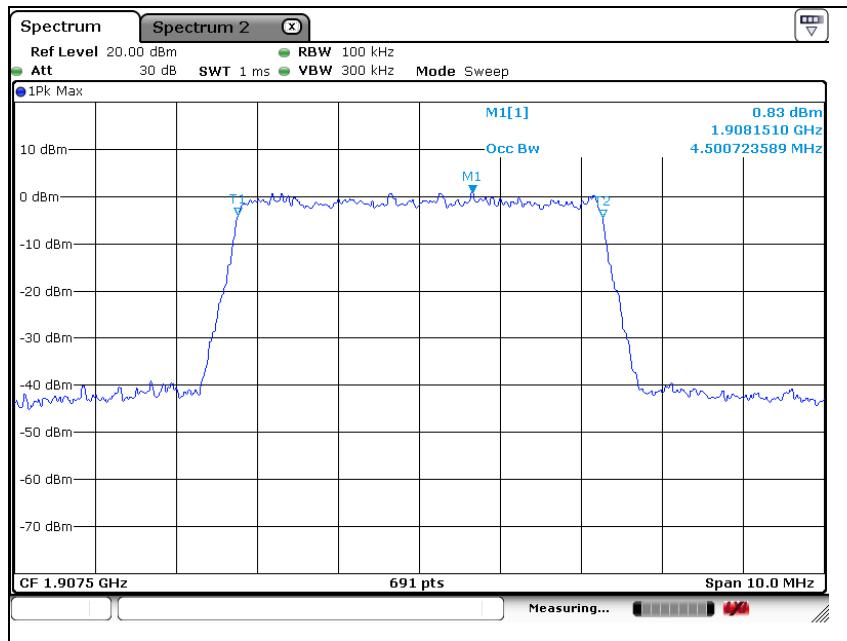
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A4(210 mm x 297 mm)

LTE band 2 (5 MHz - QPSK)**Low Channel****Middle Channel**

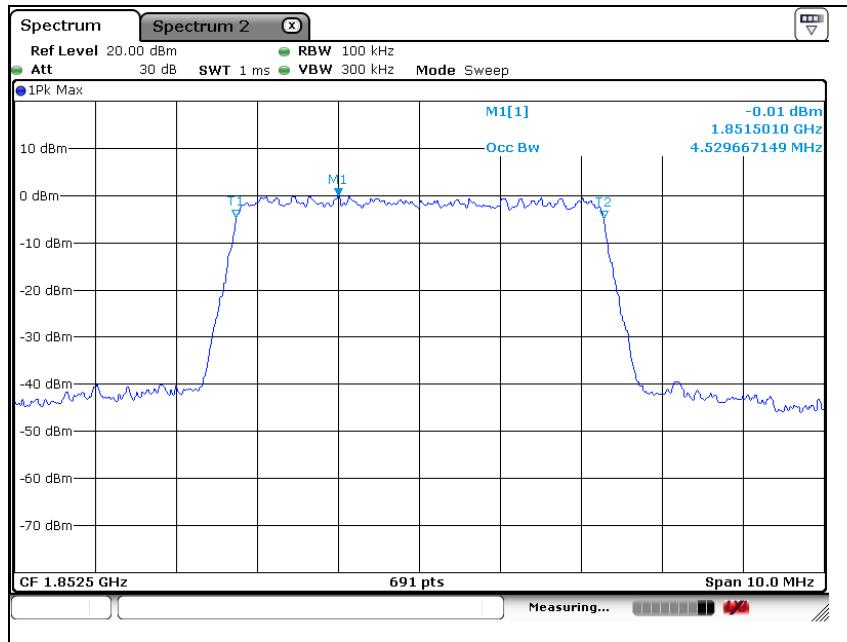
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High Channel



LTE band 2 (5 MHz - 16QAM)

Low Channel



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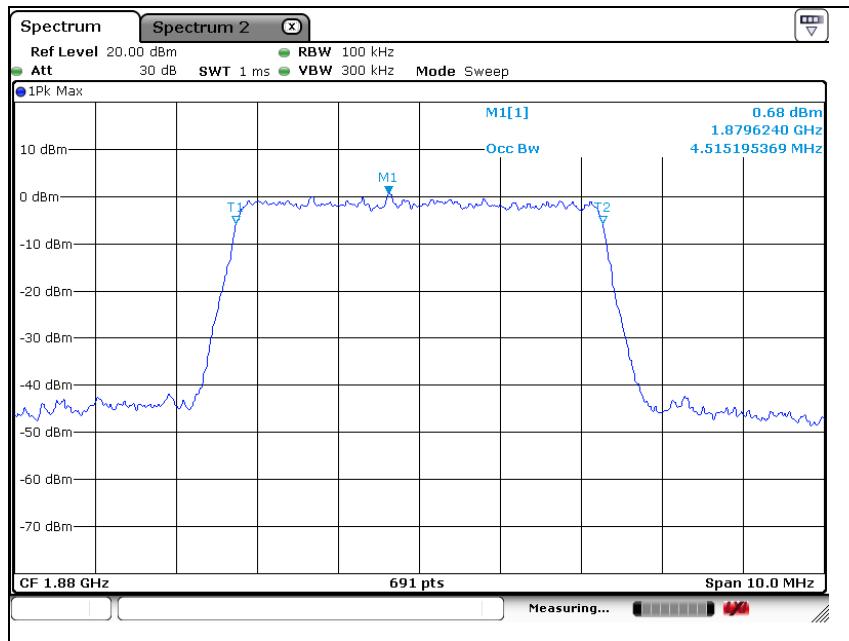
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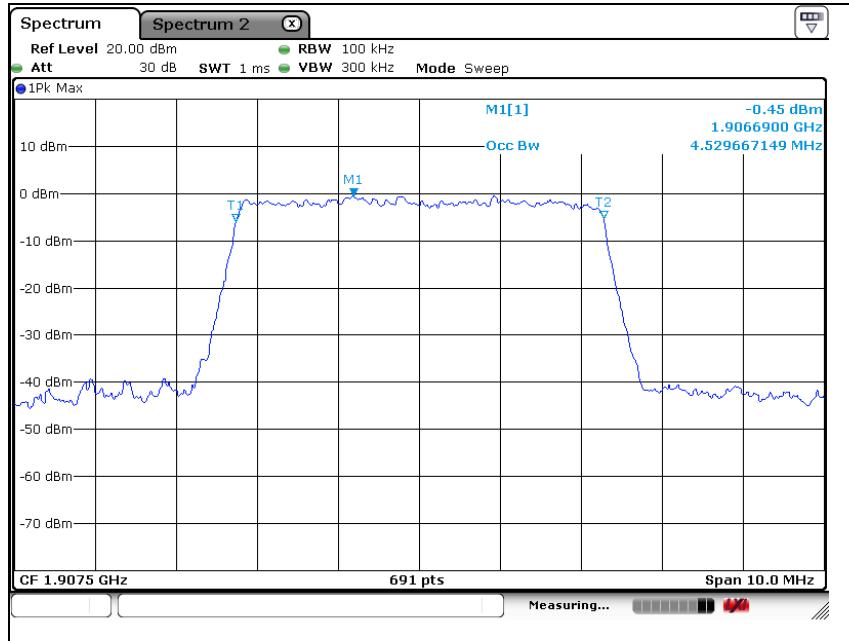
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A4(210 mm x 297 mm)

Middle Channel



High Channel



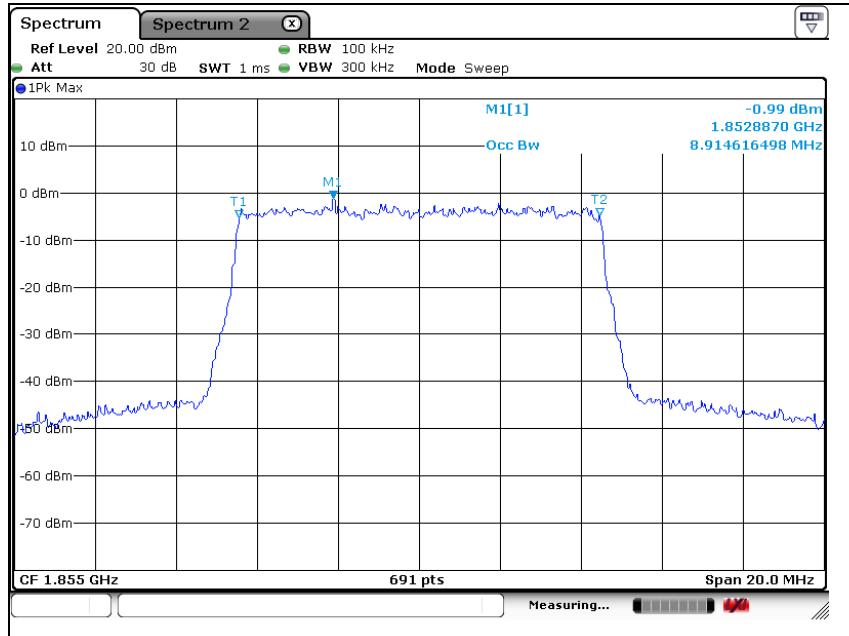
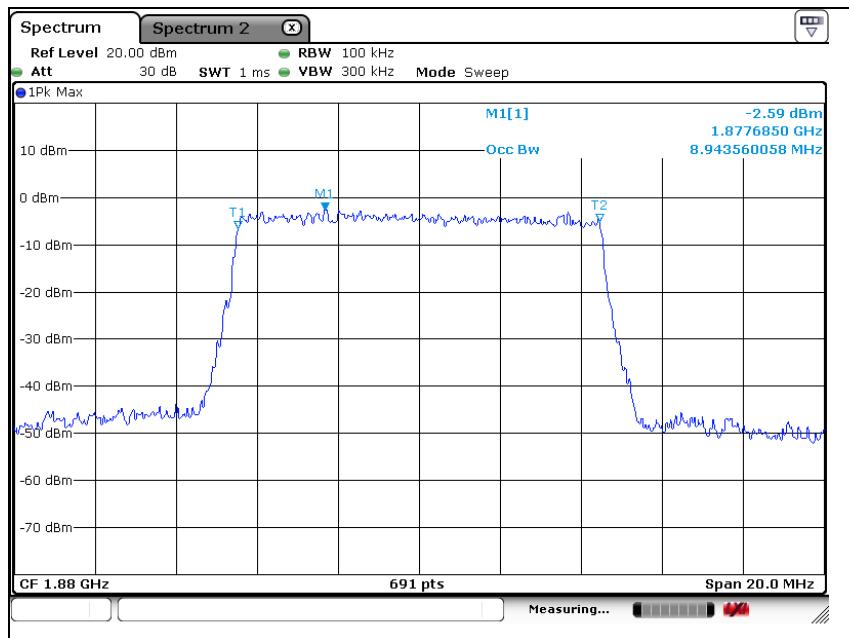
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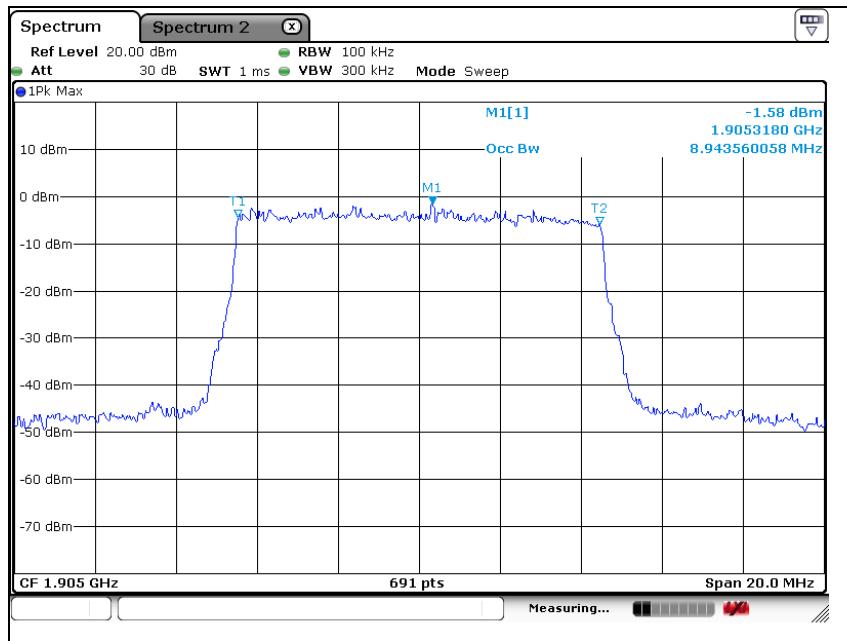
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A4(210 mm x 297 mm)

LTE band 2 (10 MHz - QPSK)**Low Channel****Middle Channel**

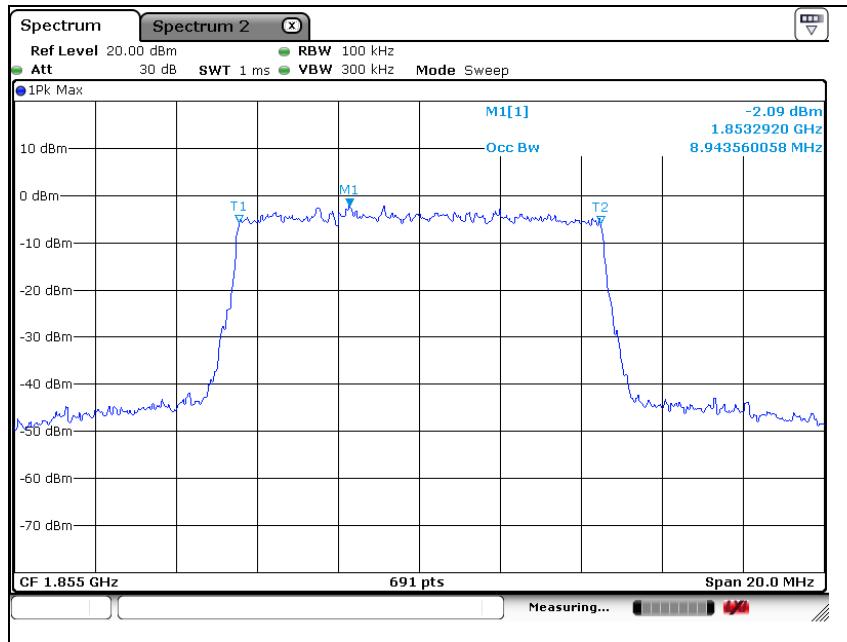
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High Channel



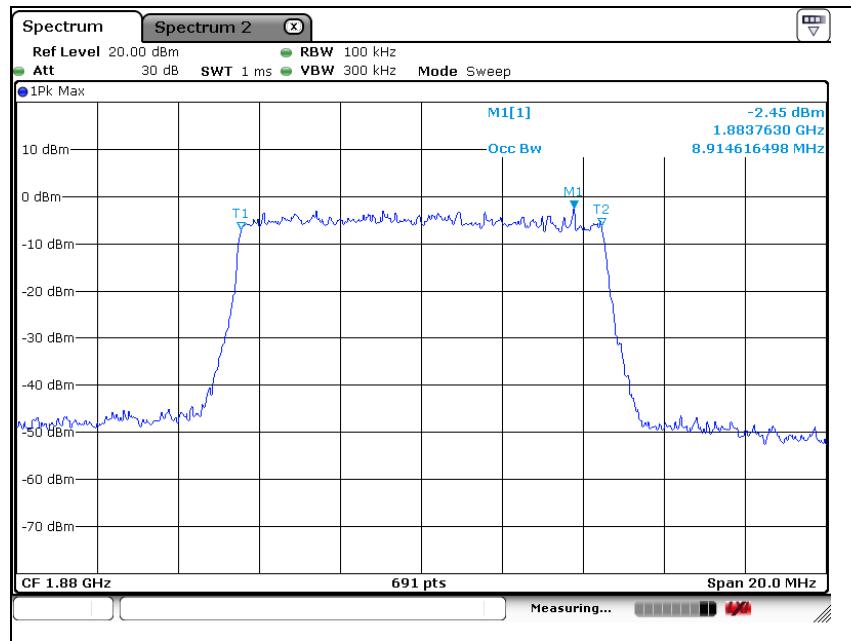
LTE band 2 (10 MHz - 16QAM)

Low Channel

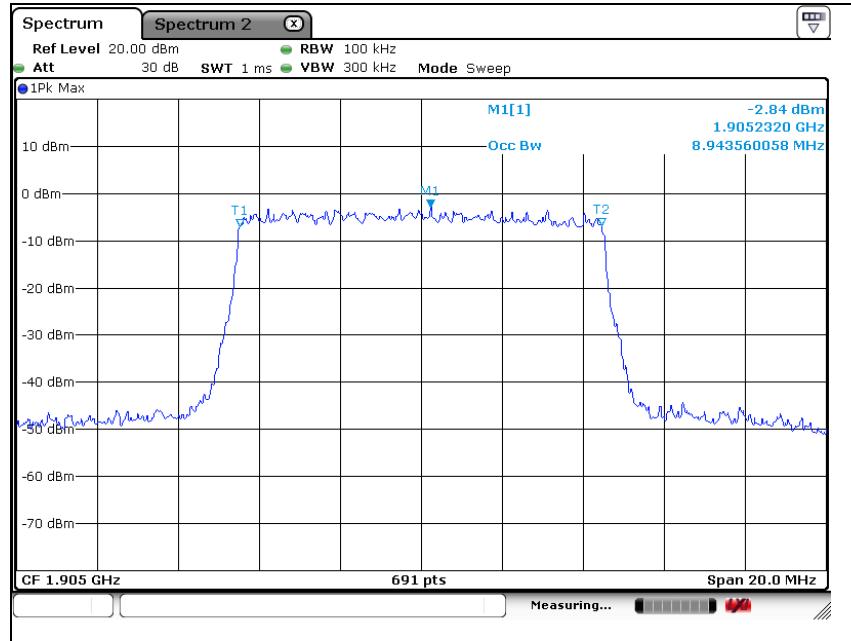


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Middle Channel



High Channel



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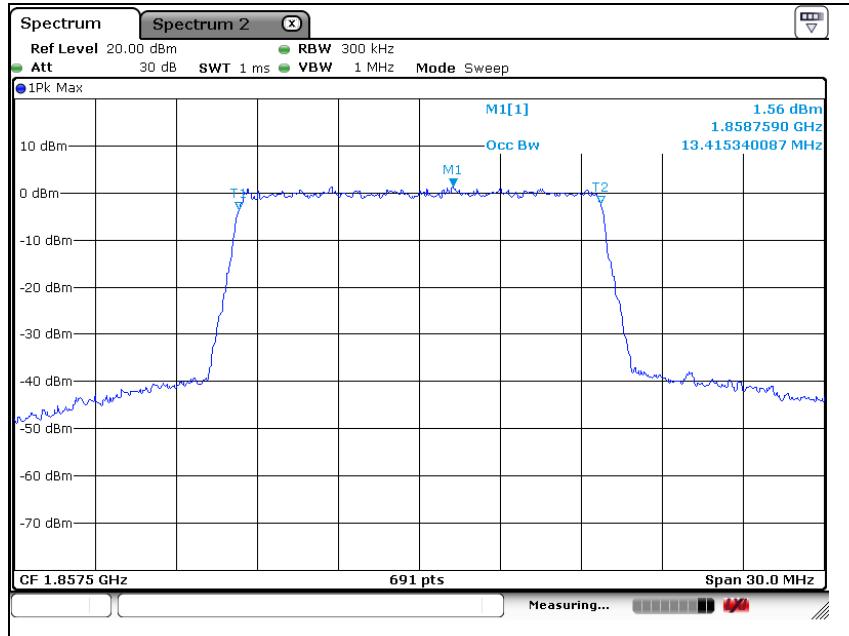
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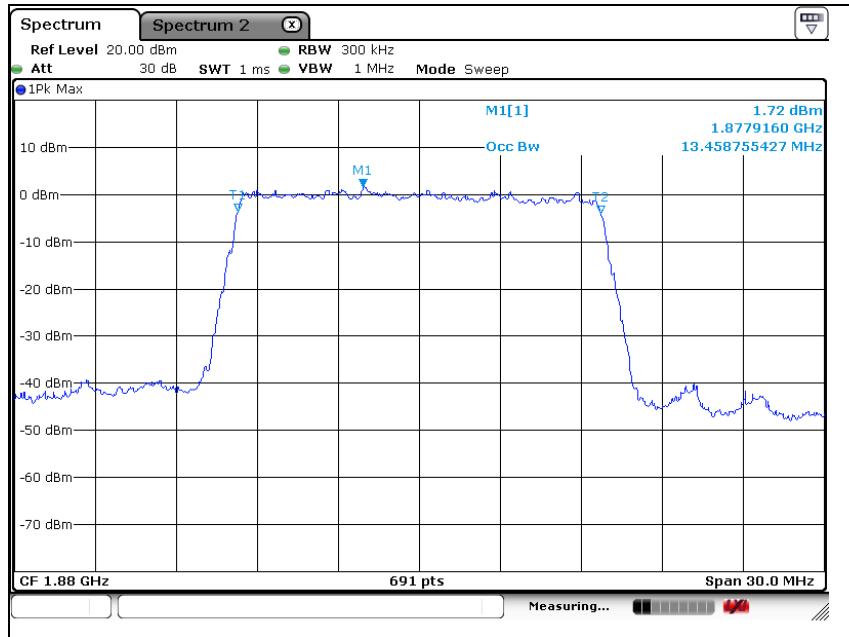
A4(210 mm x 297 mm)

LTE band 2 (15 MHz - QPSK)

Low Channel



Middle Channel



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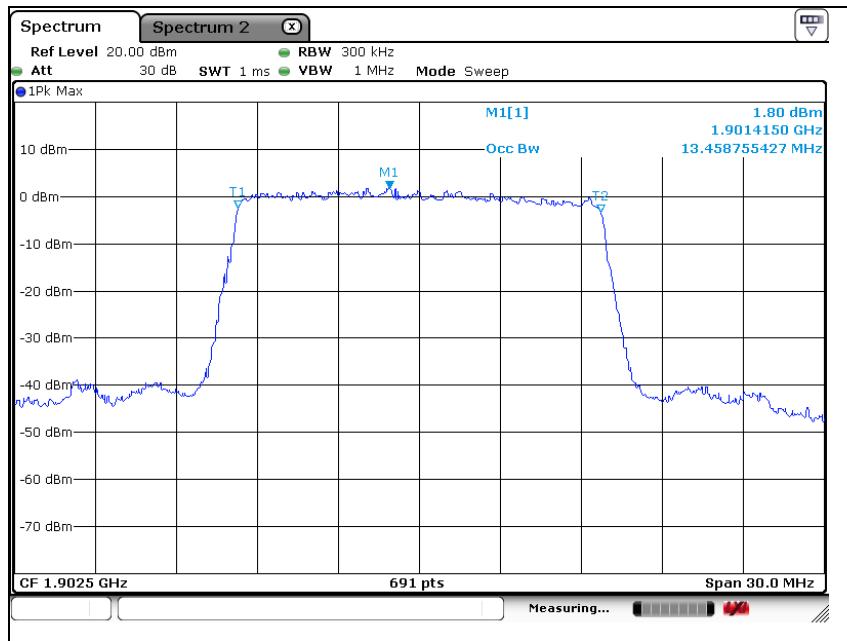
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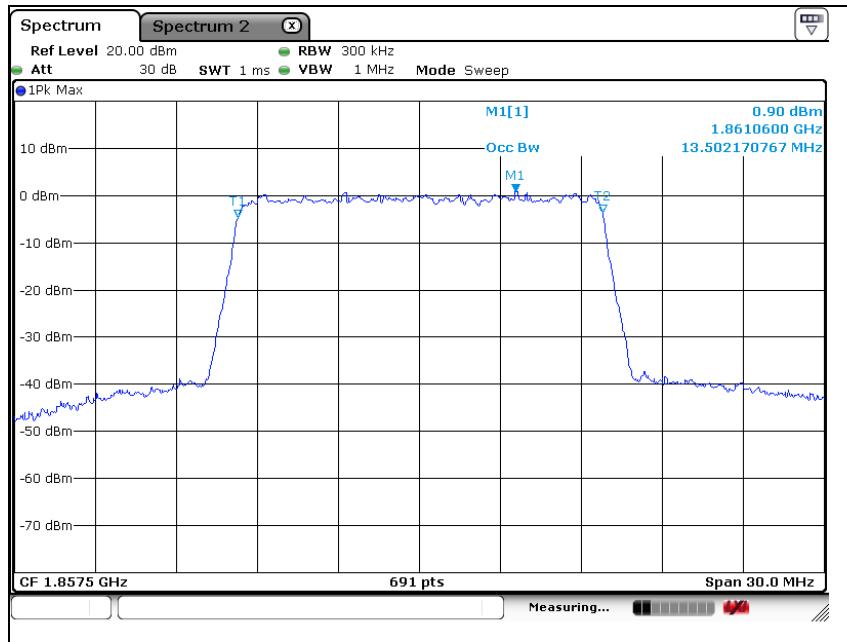
A4(210 mm x 297 mm)

High Channel



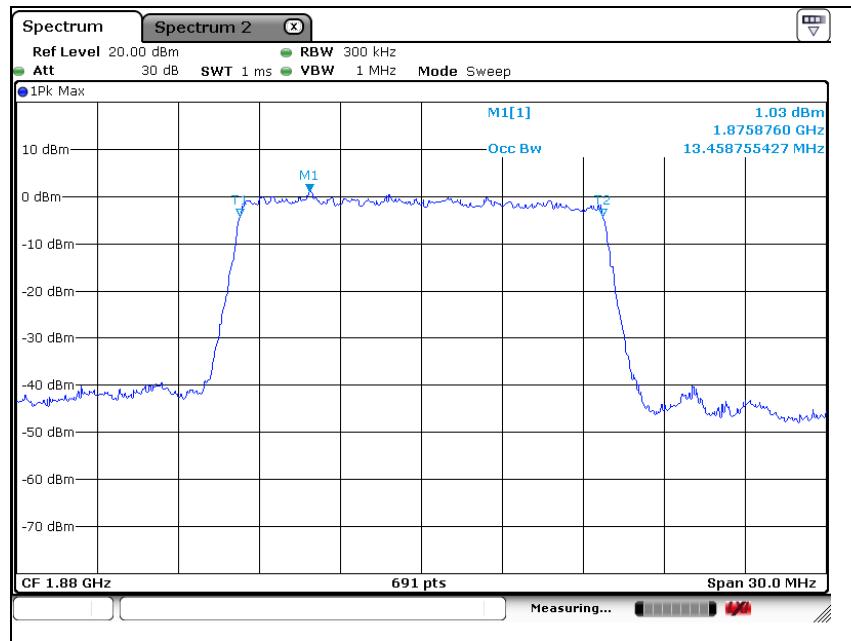
LTE band 2 (15 MHz - 16QAM)

Low Channel

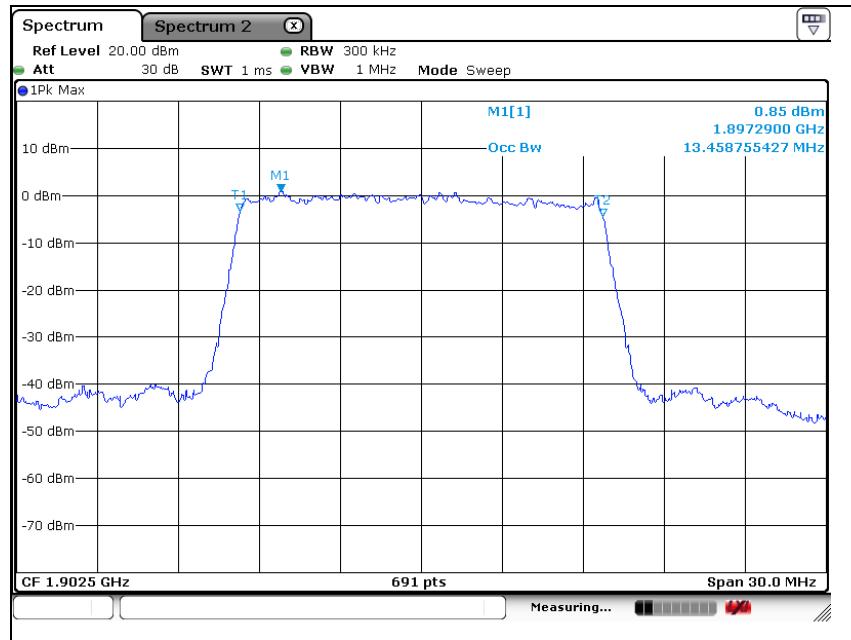


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Middle Channel



High Channel



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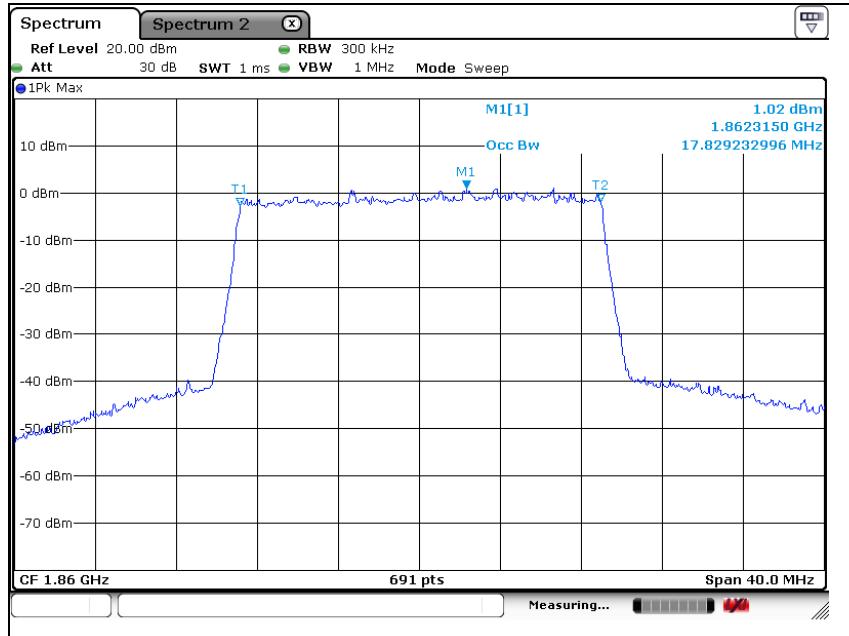
RTT5041-19(2017.07.10)(0)

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

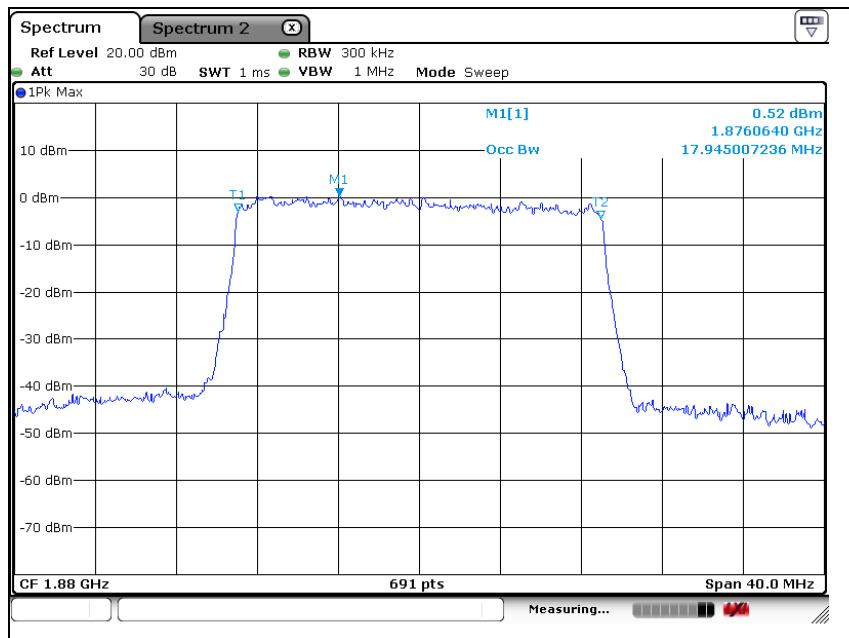
A4(210 mm x 297 mm)

LTE band 2 (20 MHz - QPSK)

Low Channel



Middle Channel



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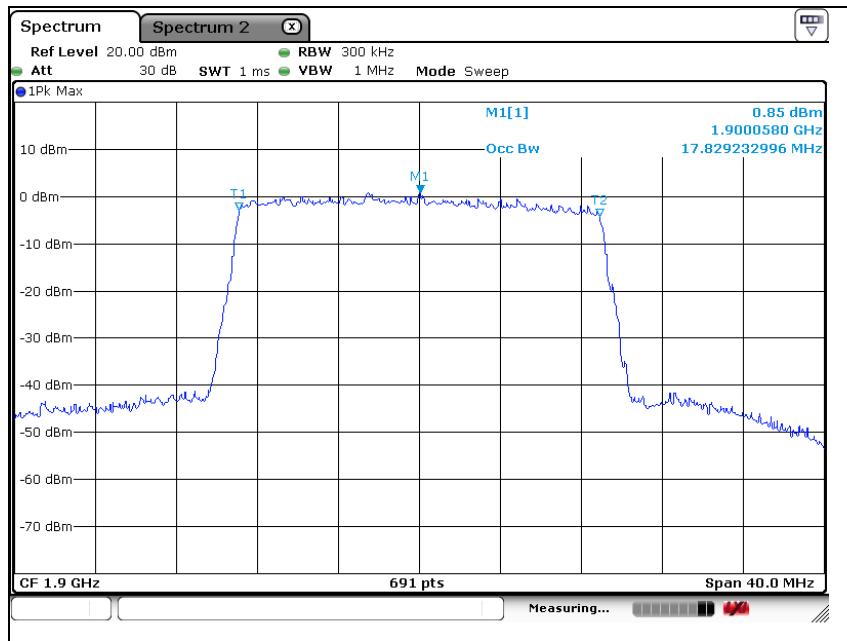
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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A4(210 mm x 297 mm)

High Channel



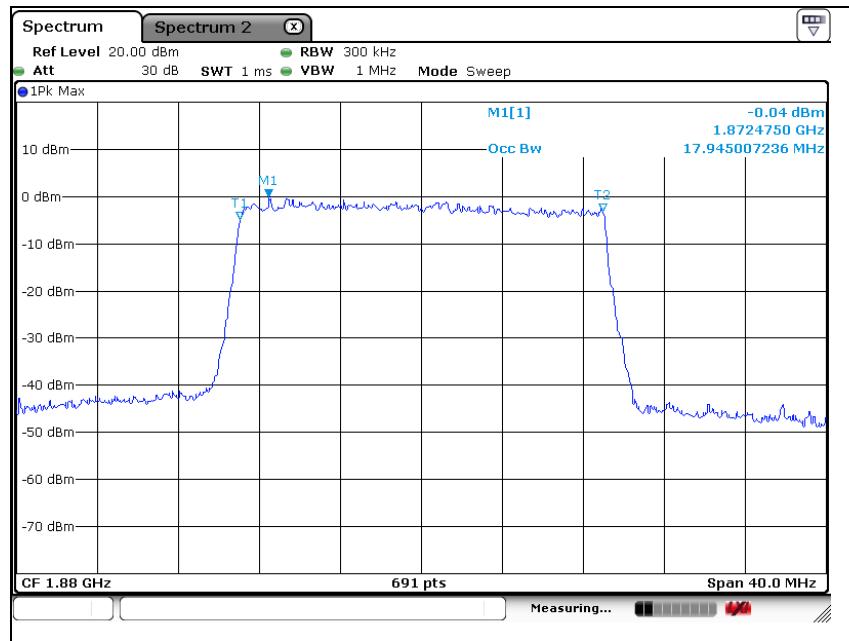
LTE band 2 (20 MHz - 16QAM)

Low Channel

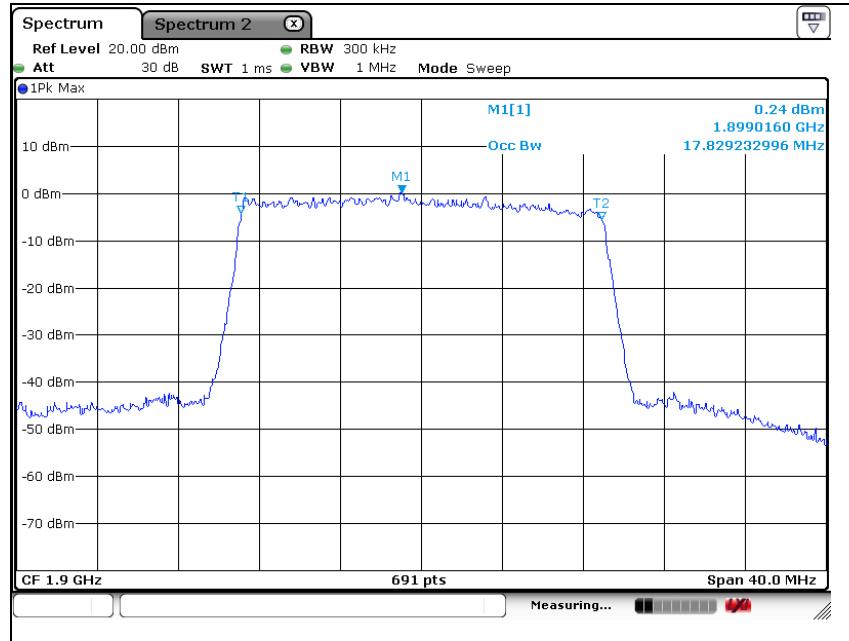


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Middle Channel



High Channel



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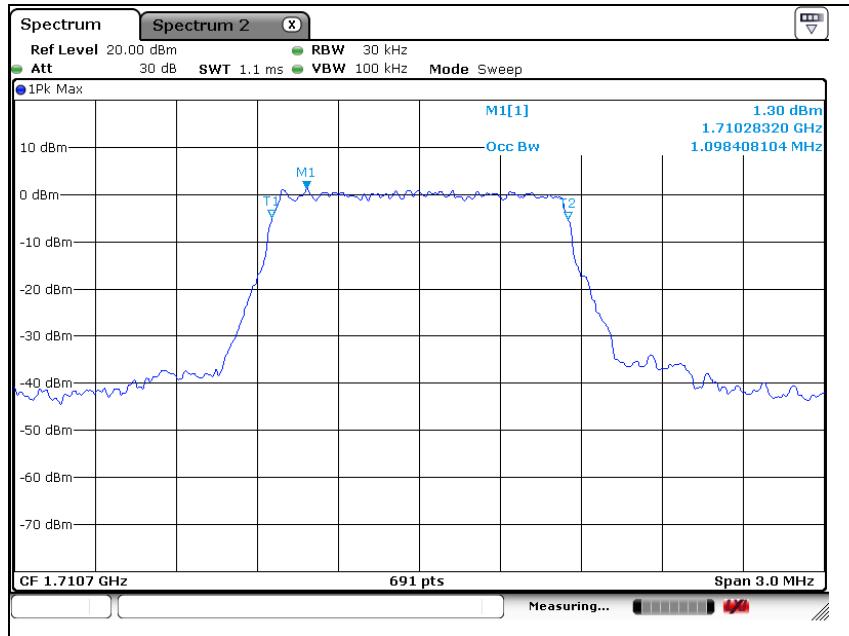
RTT5041-19(2017.07.10)(0)

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

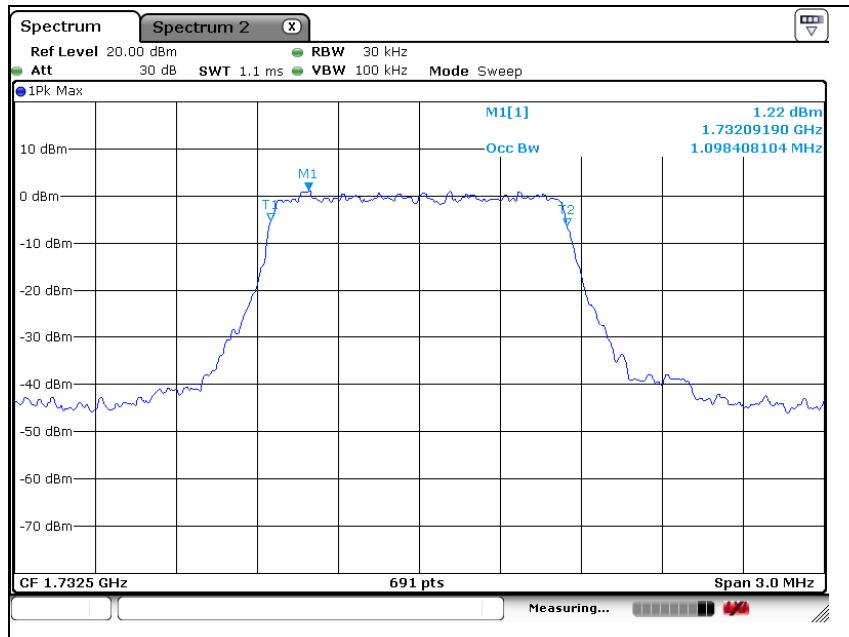
A4(210 mm x 297 mm)

LTE band 4 (1.4 MHz - QPSK)

Low Channel



Middle Channel



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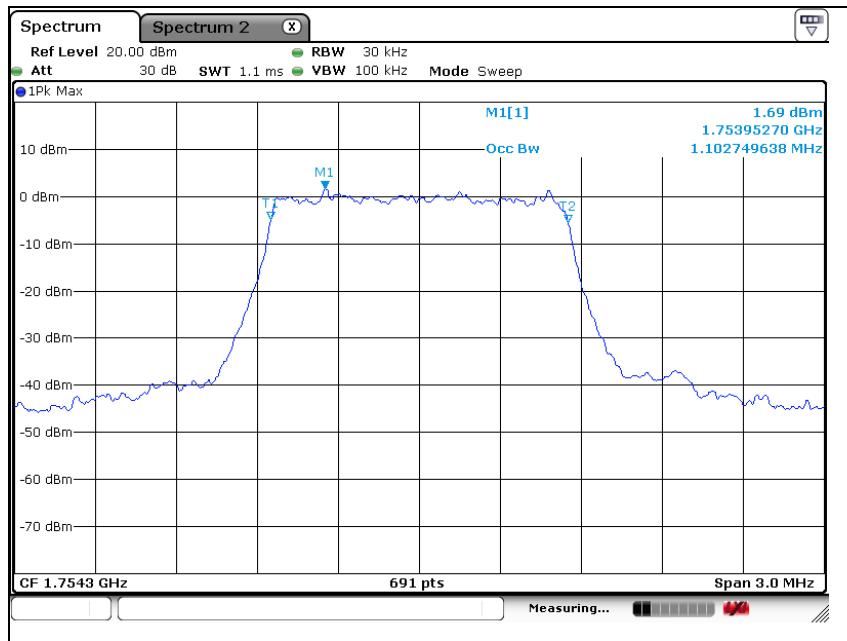
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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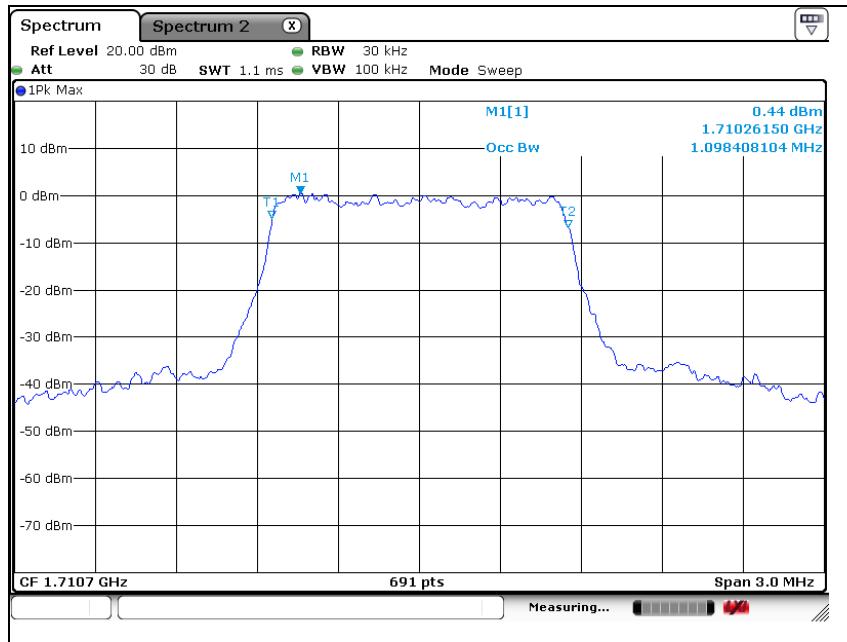
A4(210 mm x 297 mm)

High Channel



LTE band 4 (1.4 MHz - 16QAM)

Low Channel



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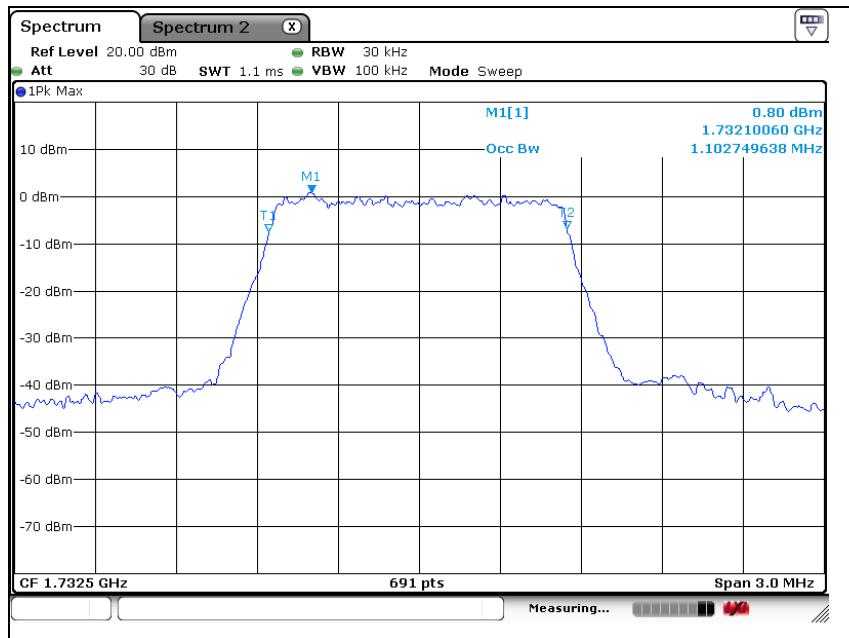
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2017.07.10)(0)

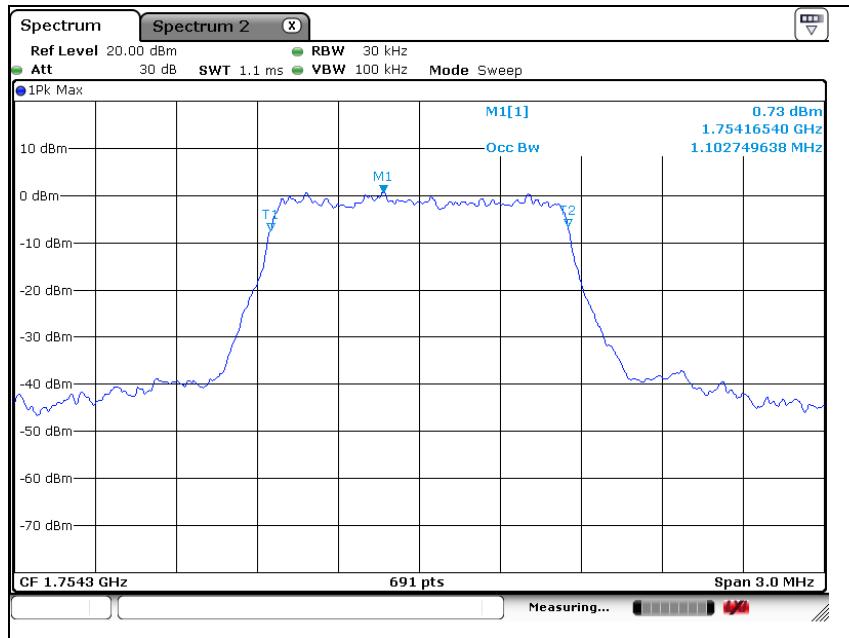
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



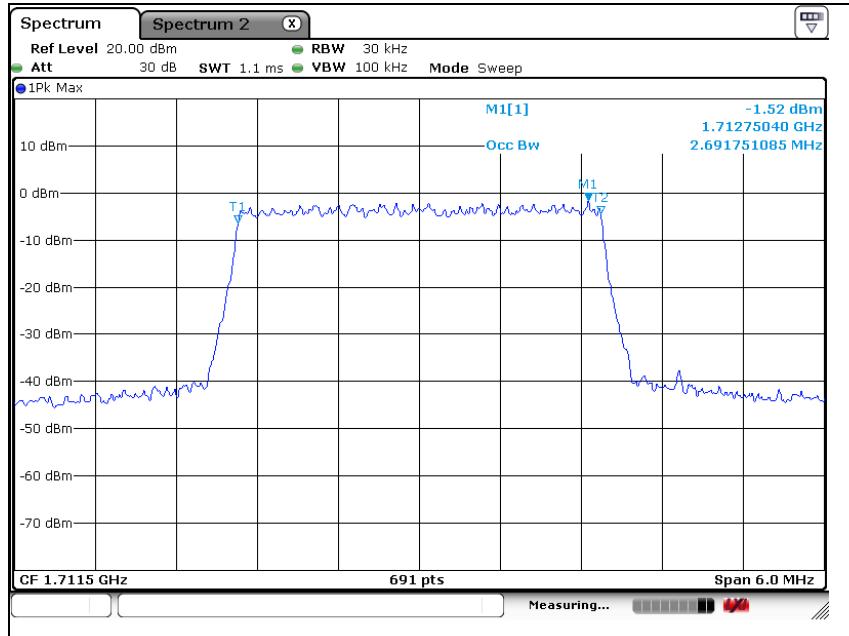
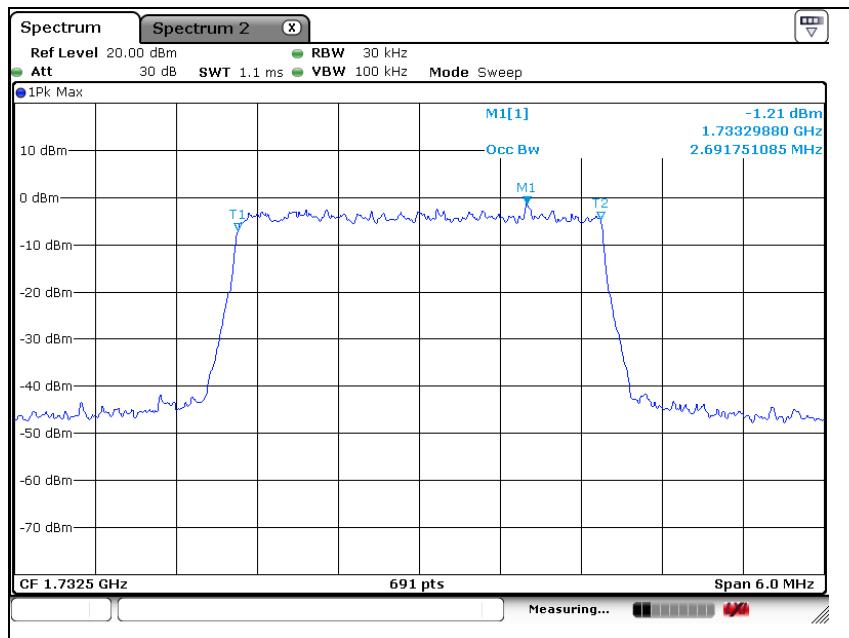
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A4(210 mm x 297 mm)

LTE band 4 (3 MHz - QPSK)**Low Channel****Middle Channel**

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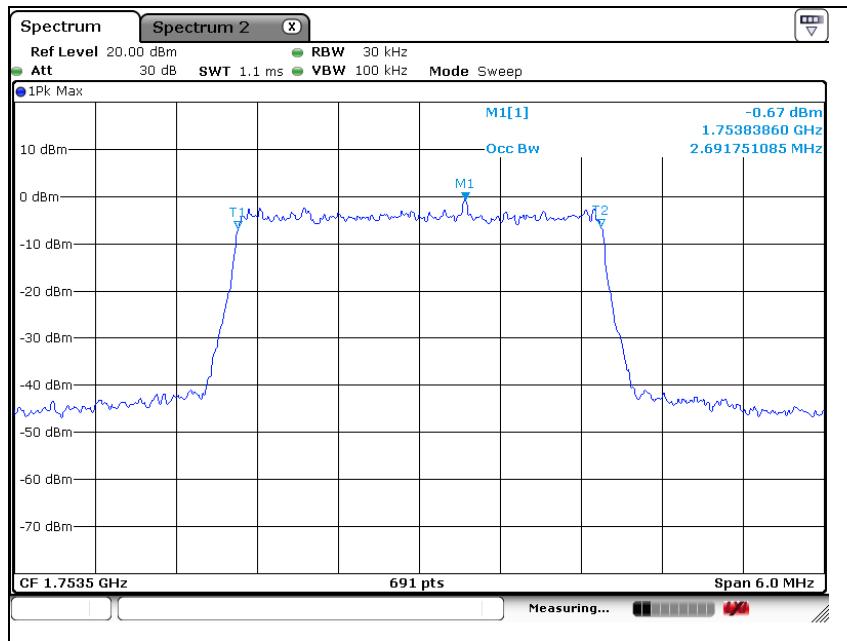
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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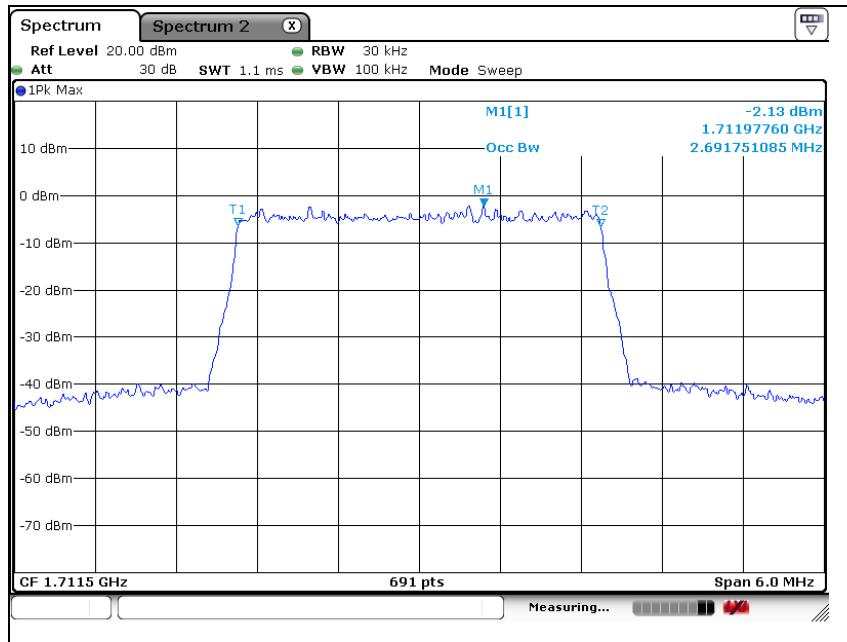
A4(210 mm x 297 mm)

High Channel



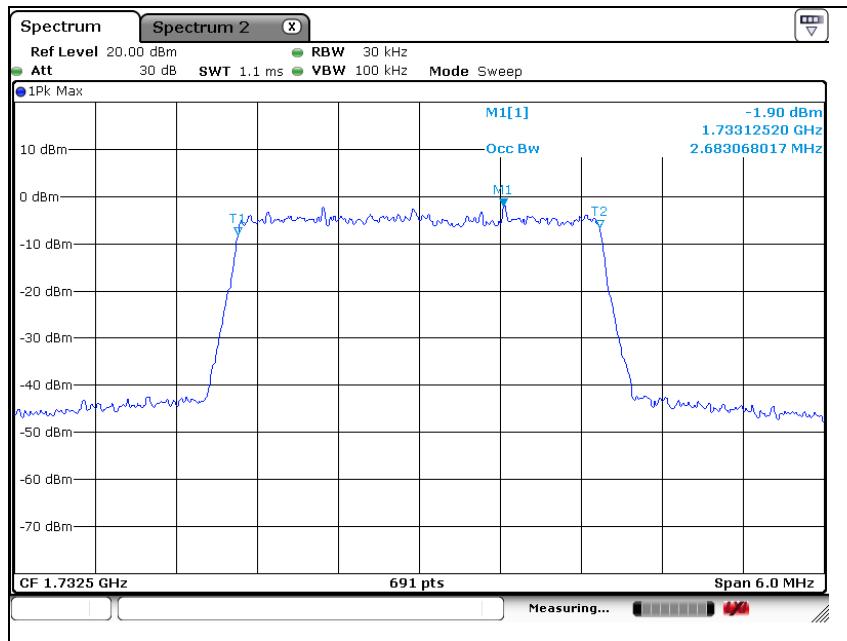
LTE band 4 (3 MHz - 16QAM)

Low Channel

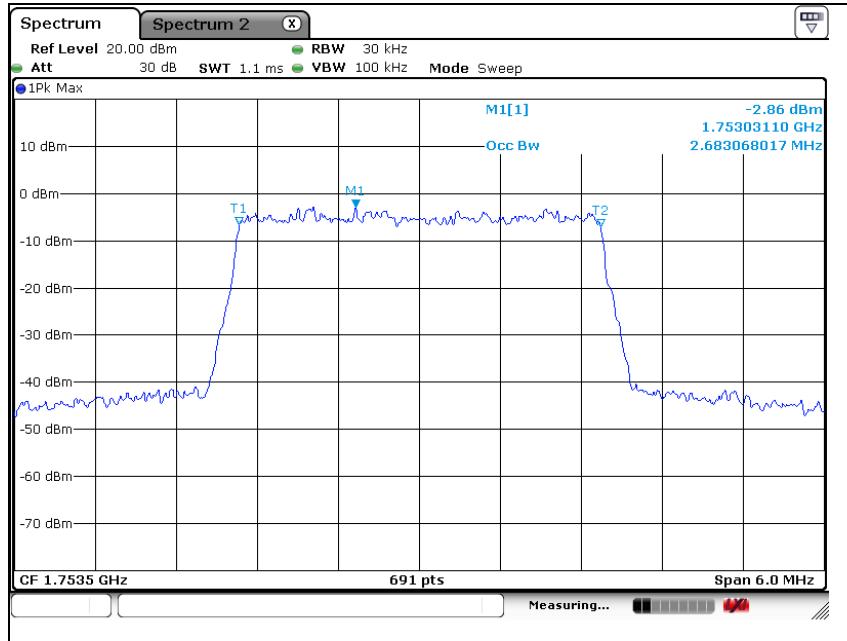


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Middle Channel



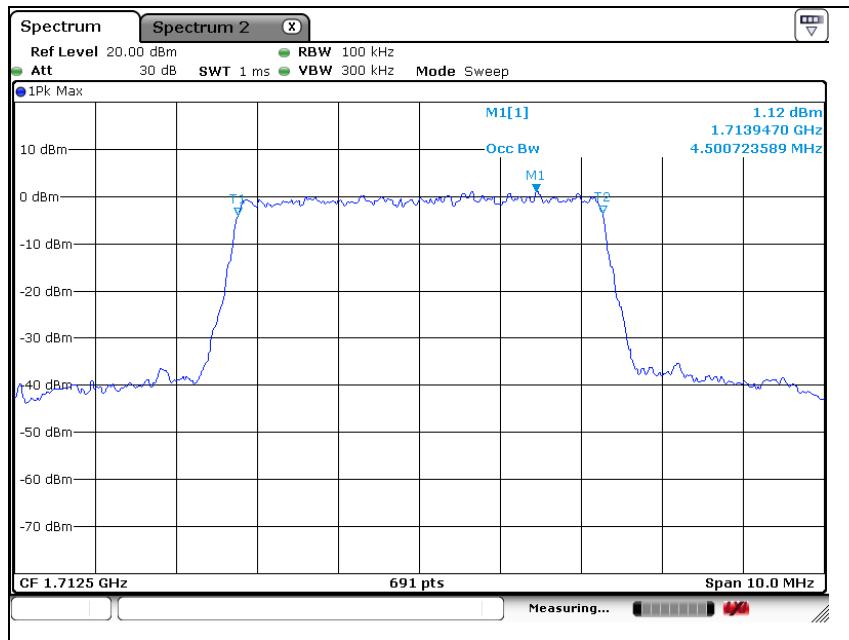
High Channel



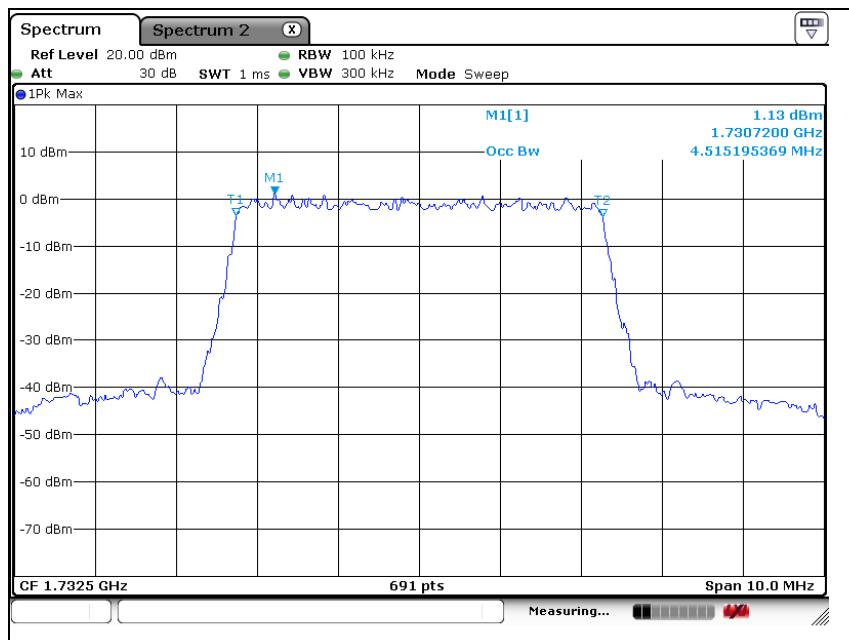
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LTE band 4 (5 MHz - QPSK)

Low Channel



Middle Channel



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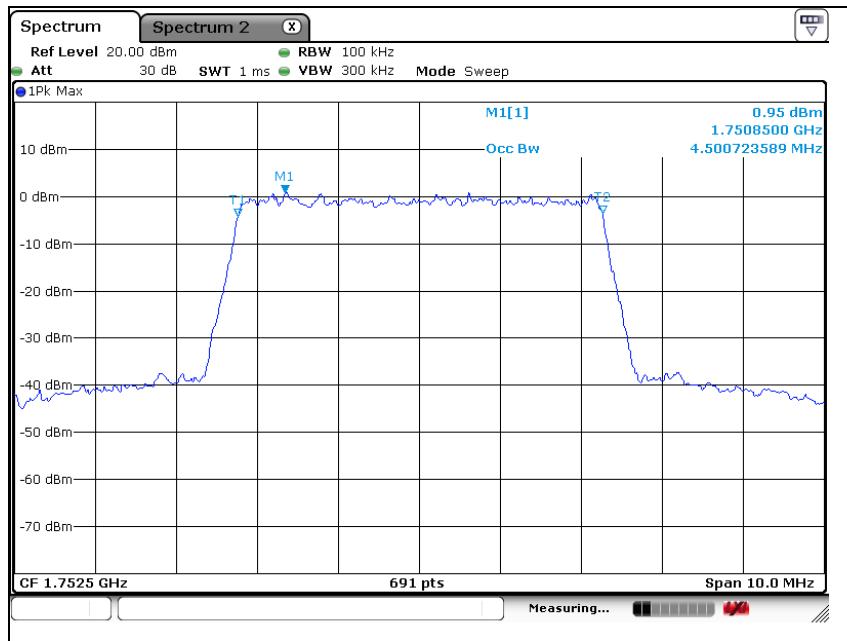
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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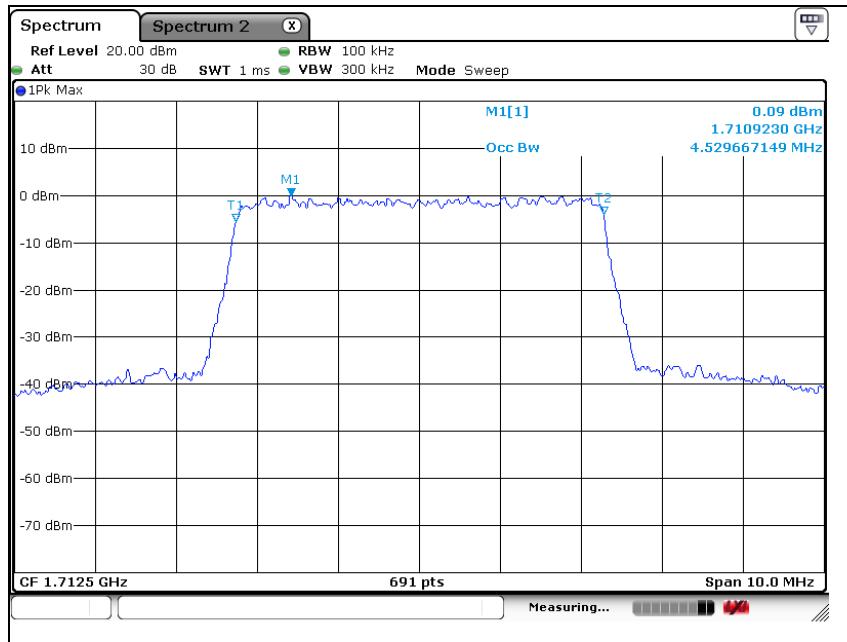
A4(210 mm x 297 mm)

High Channel



LTE band 4 (5 MHz - 16QAM)

Low Channel



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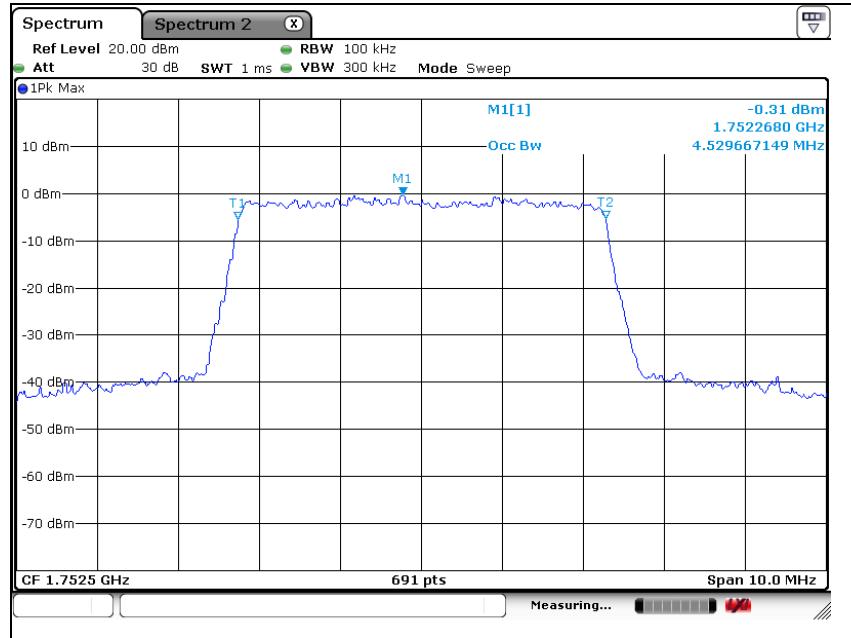
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A4(210 mm x 297 mm)

Middle Channel



High Channel



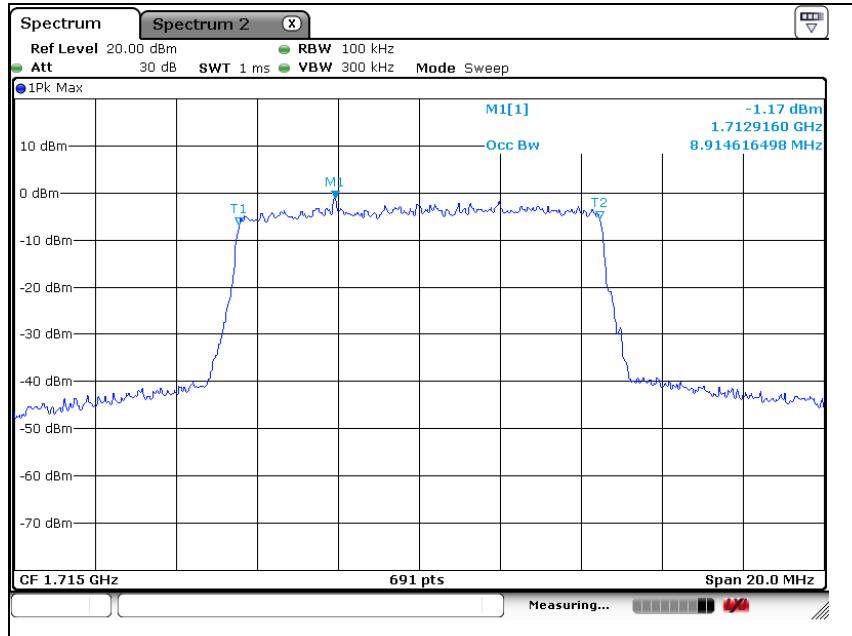
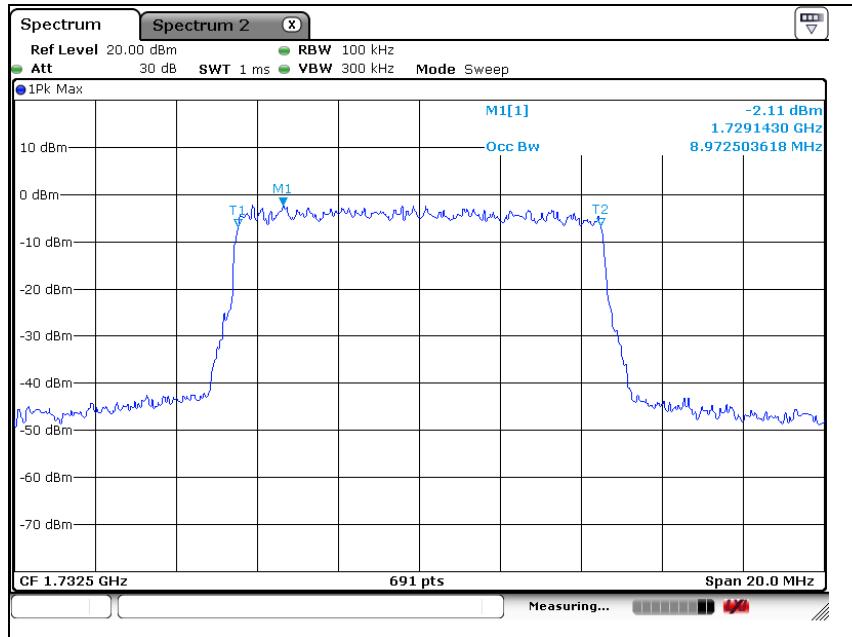
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A4(210 mm x 297 mm)

LTE band 4 (10 MHz - QPSK)**Low Channel****Middle Channel**

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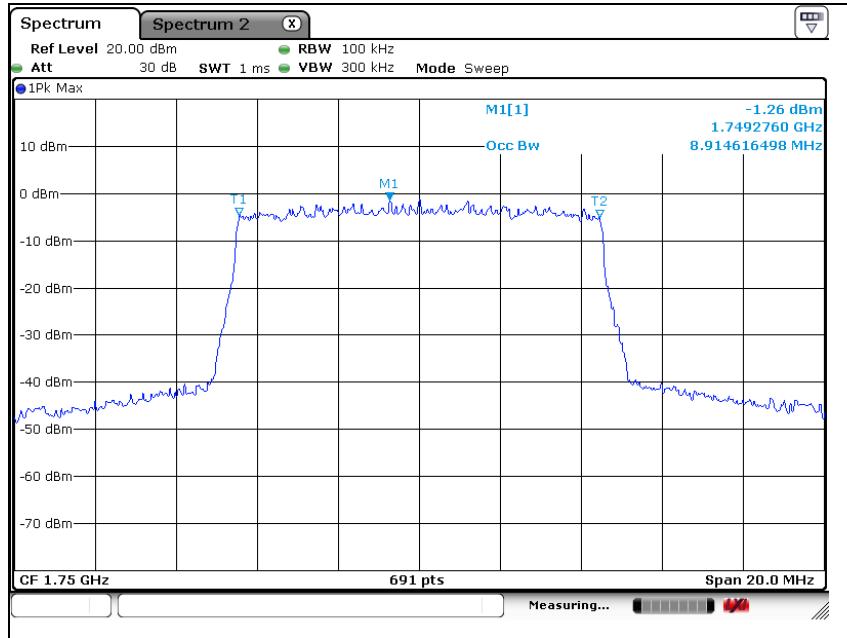
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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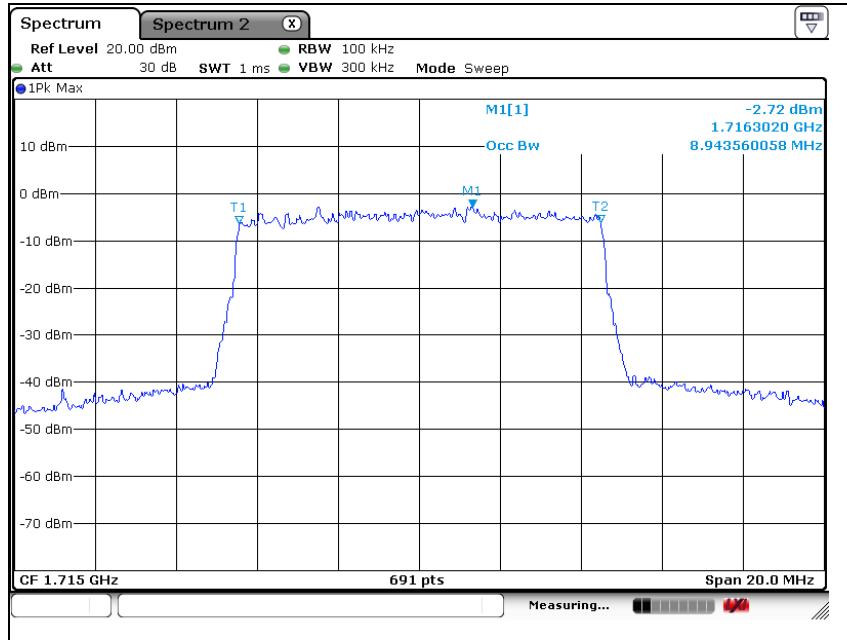
A4(210 mm x 297 mm)

High Channel



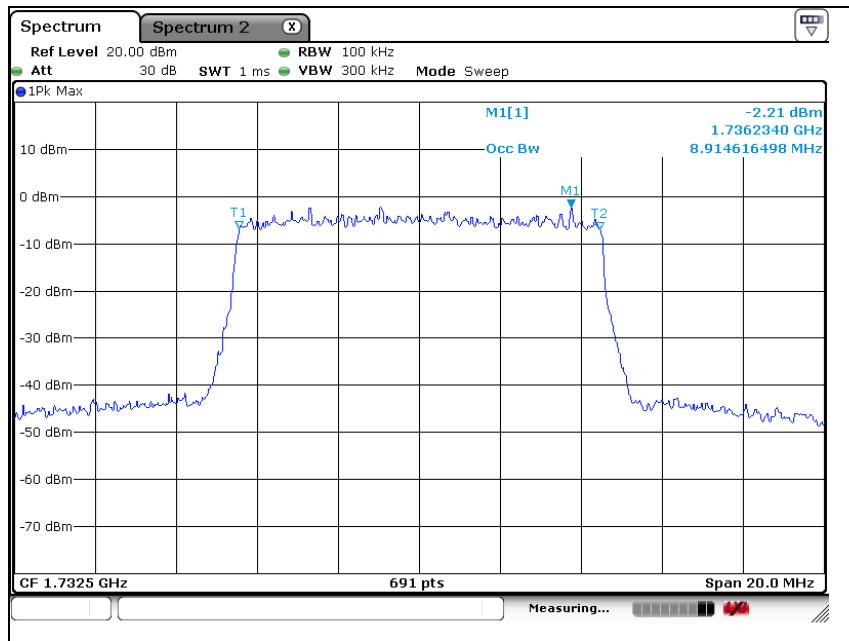
LTE band 4 (10 MHz - 16QAM)

Low Channel

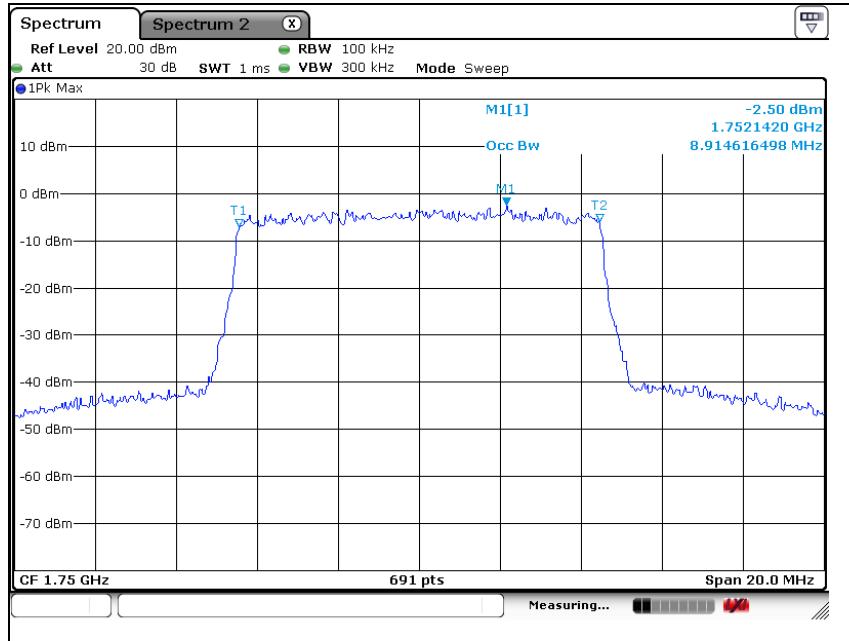


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Middle Channel



High Channel



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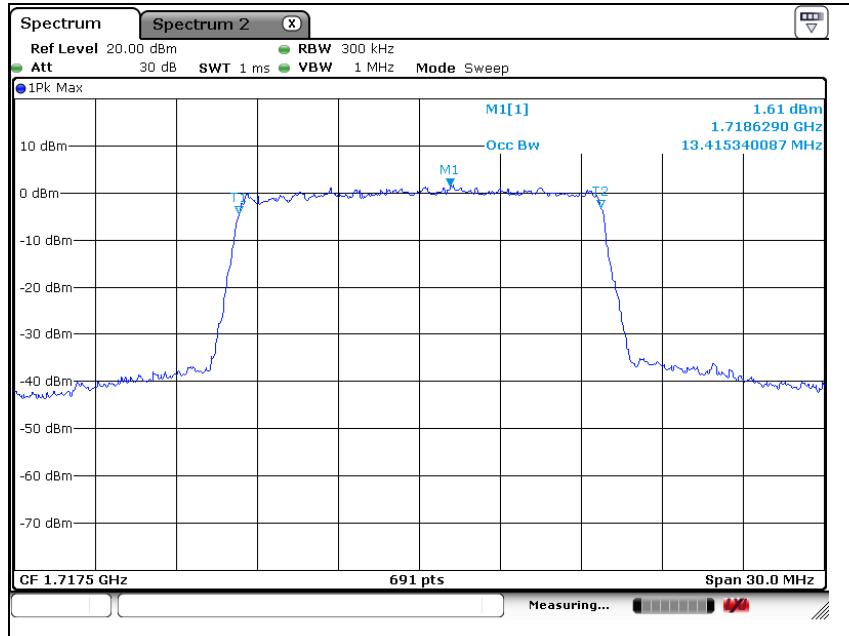
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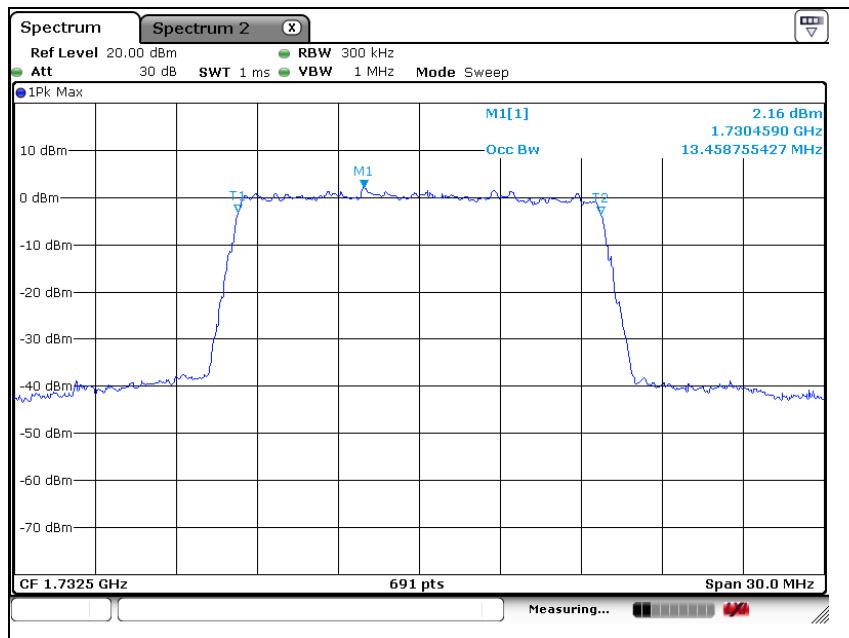
A4(210 mm x 297 mm)

LTE band 4 (15 MHz - QPSK)

Low Channel



Middle Channel



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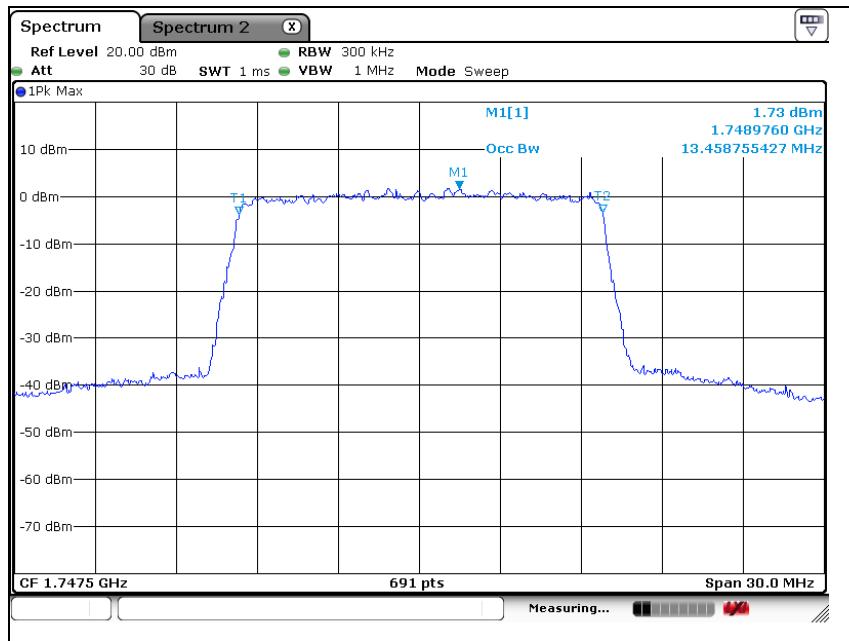
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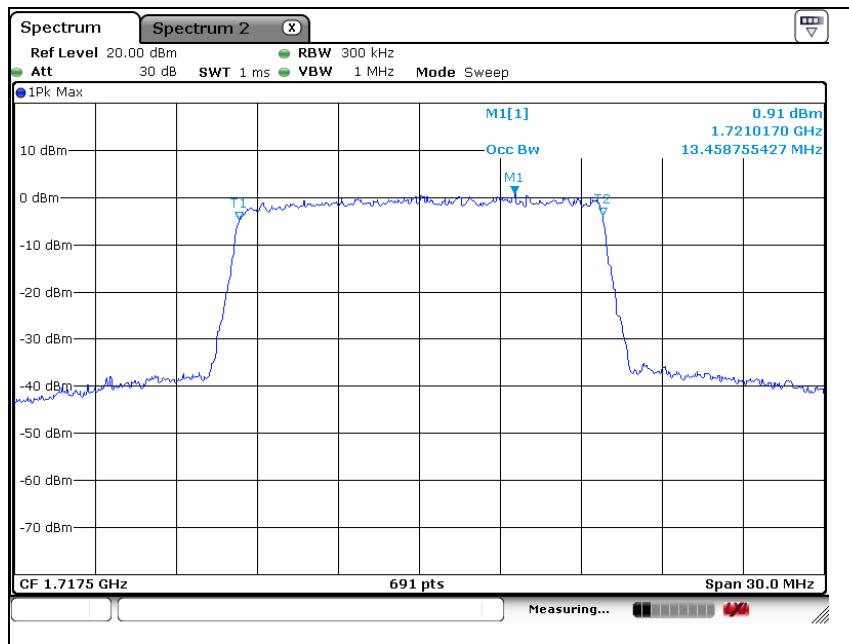
A4(210 mm x 297 mm)

High Channel



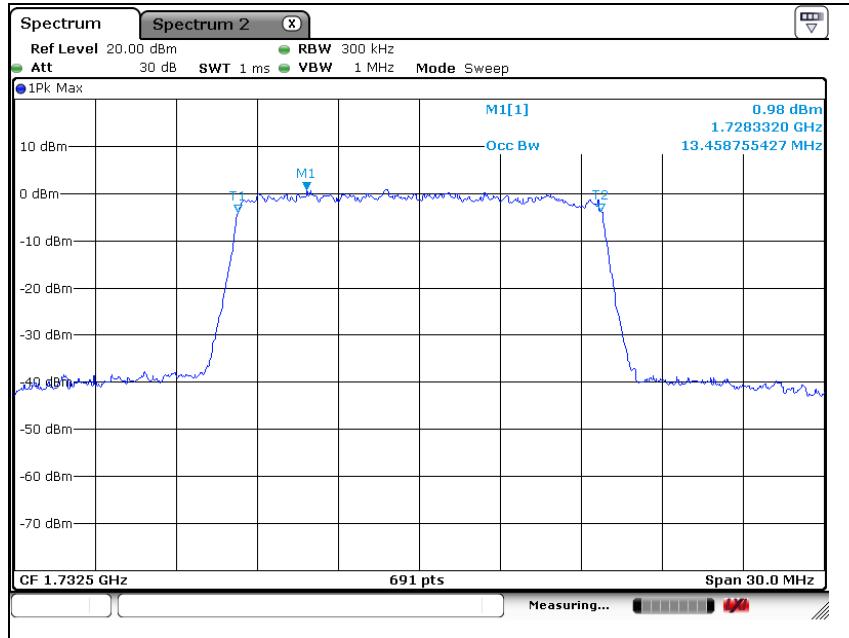
LTE band 4 (15 MHz - 16QAM)

Low Channel

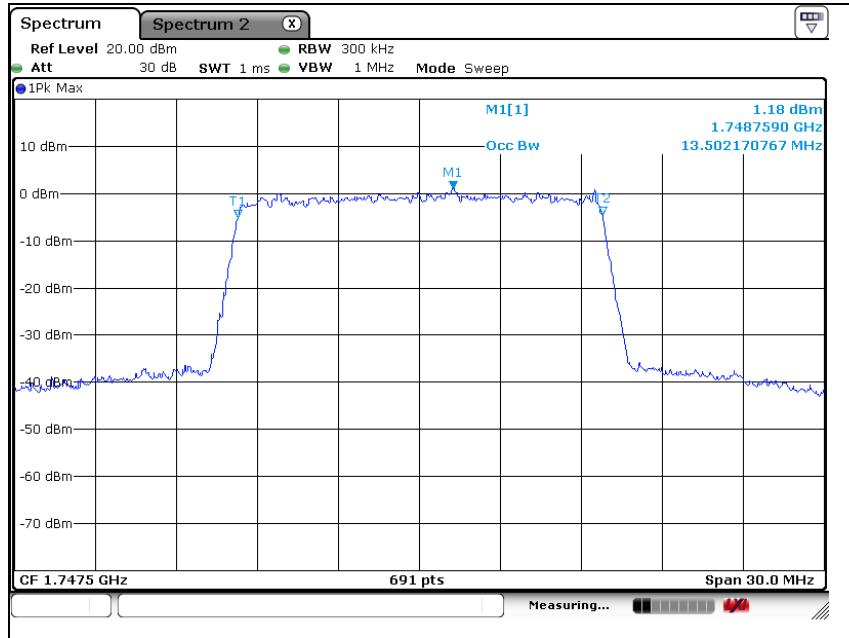


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Middle Channel



High Channel



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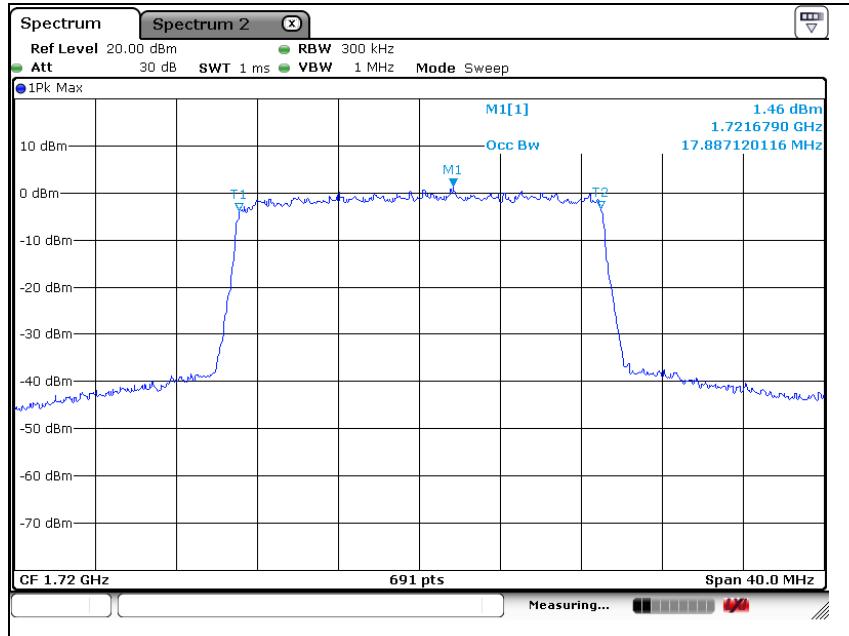
RTT5041-19(2017.07.10)(0)

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

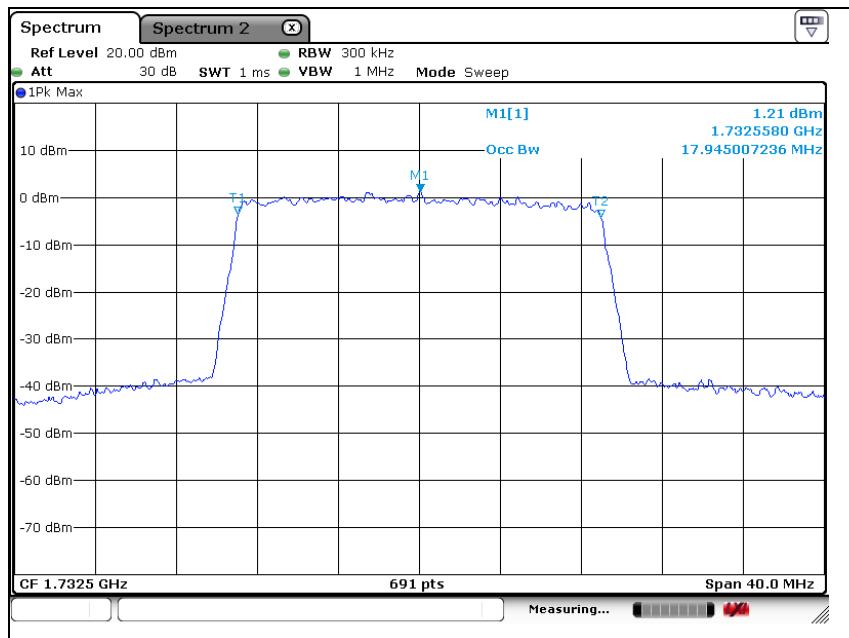
A4(210 mm x 297 mm)

LTE band 4 (20 MHz - QPSK)

Low Channel



Middle Channel



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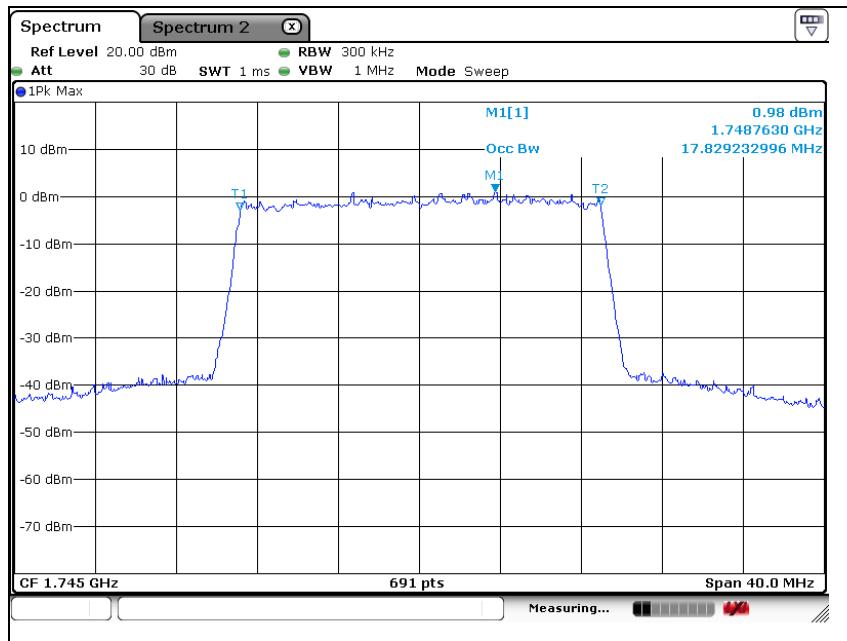
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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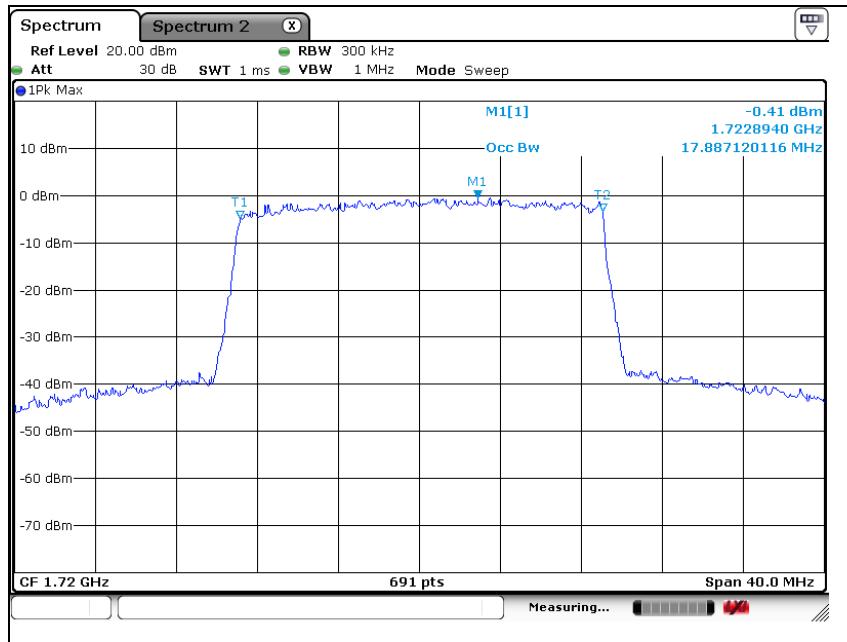
A4(210 mm x 297 mm)

High Channel



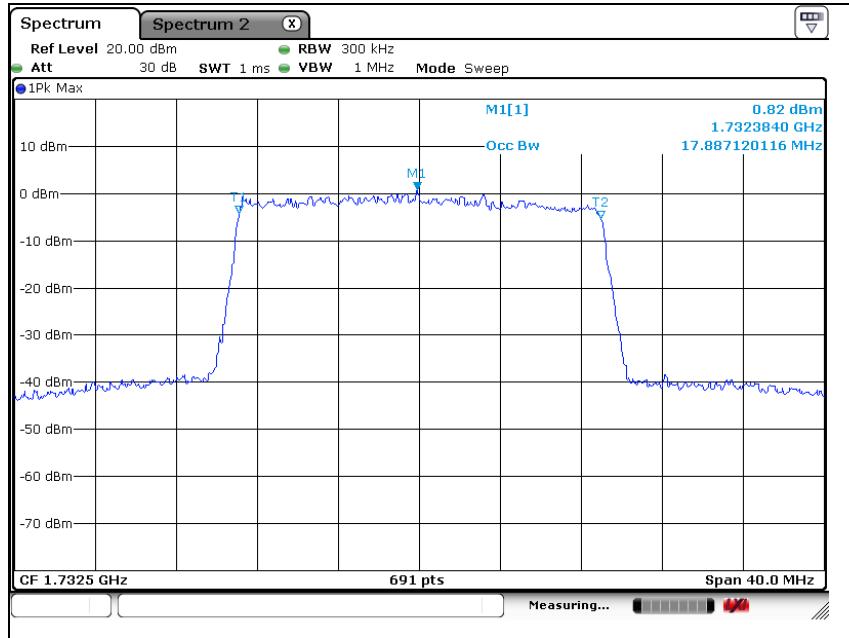
LTE band 4 (20 MHz - 16QAM)

Low Channel

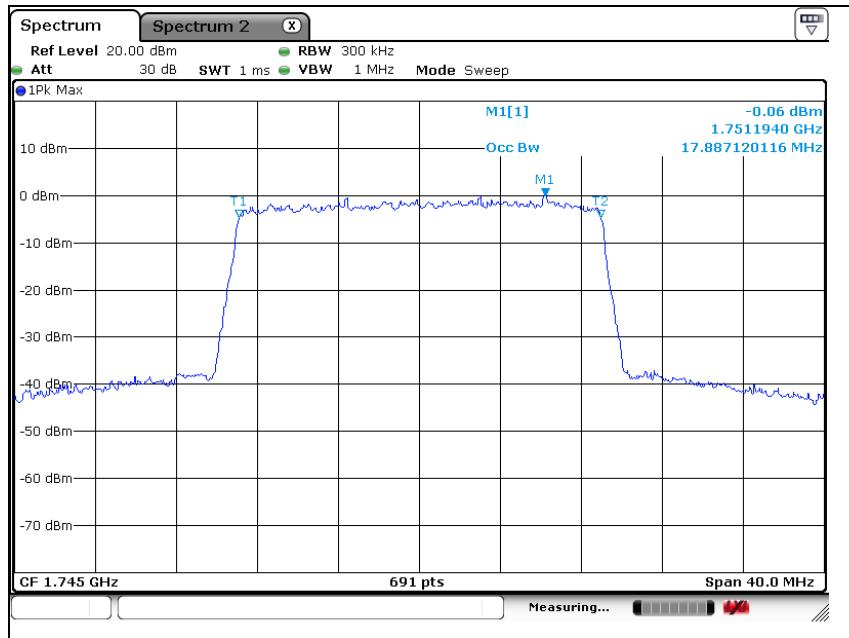


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Middle Channel



High Channel



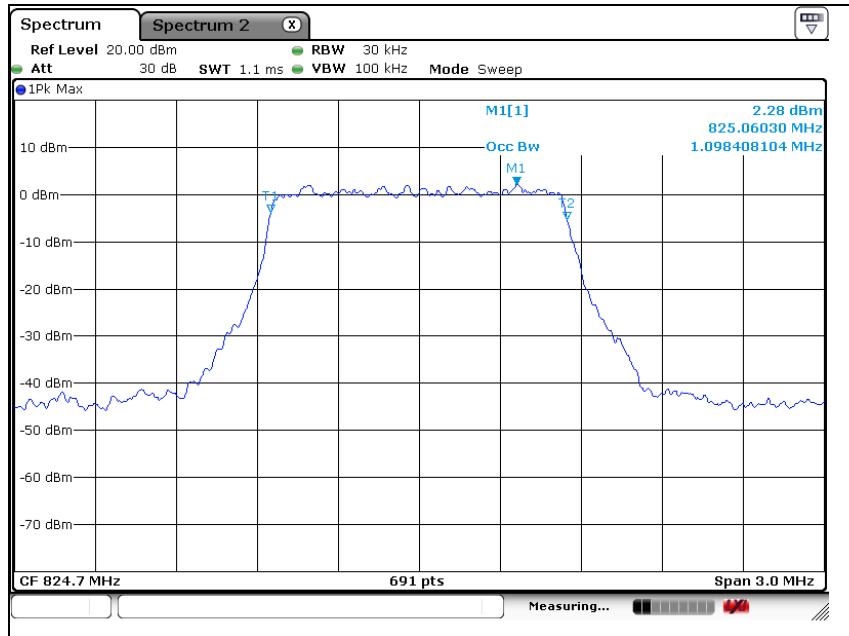
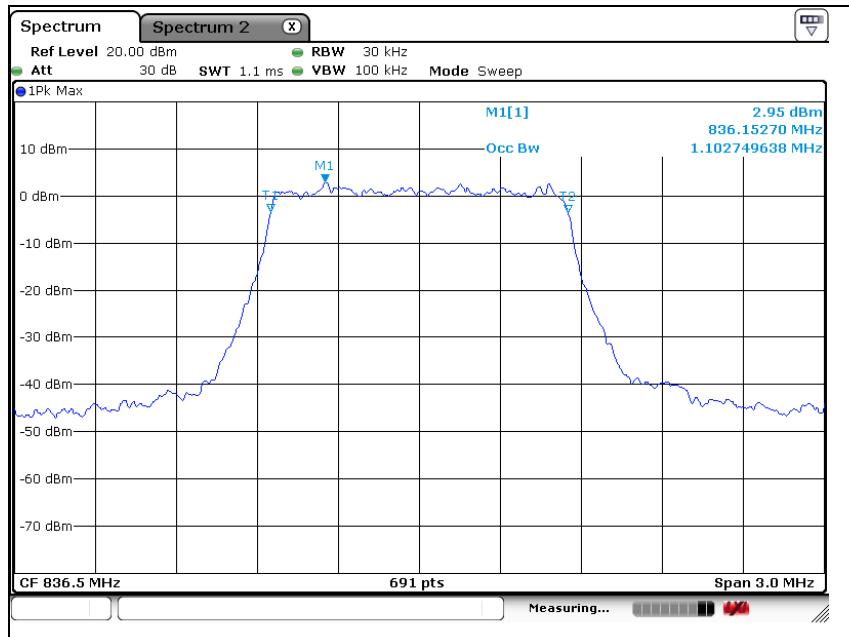
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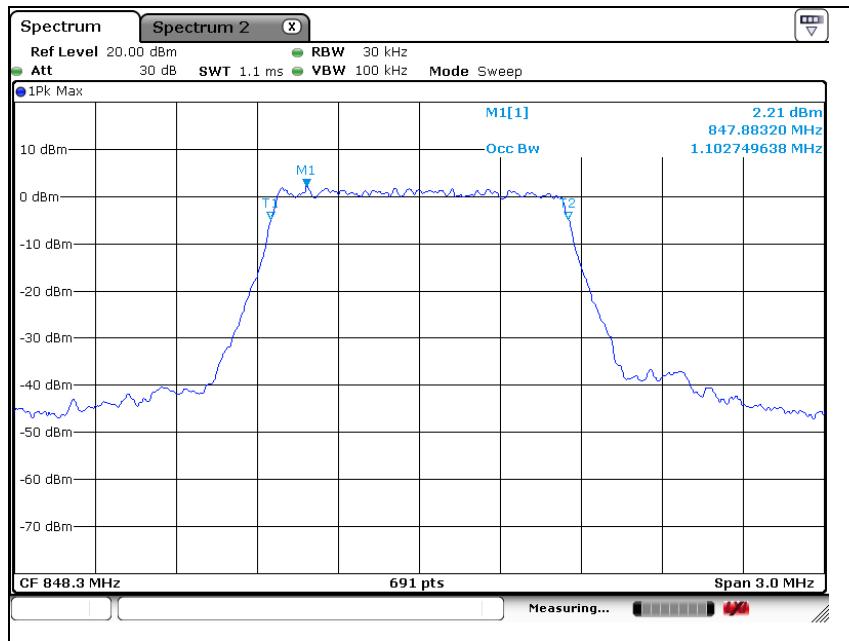
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A4(210 mm x 297 mm)

LTE band 5 (1.4 MHz - QPSK)**Low Channel****Middle Channel**

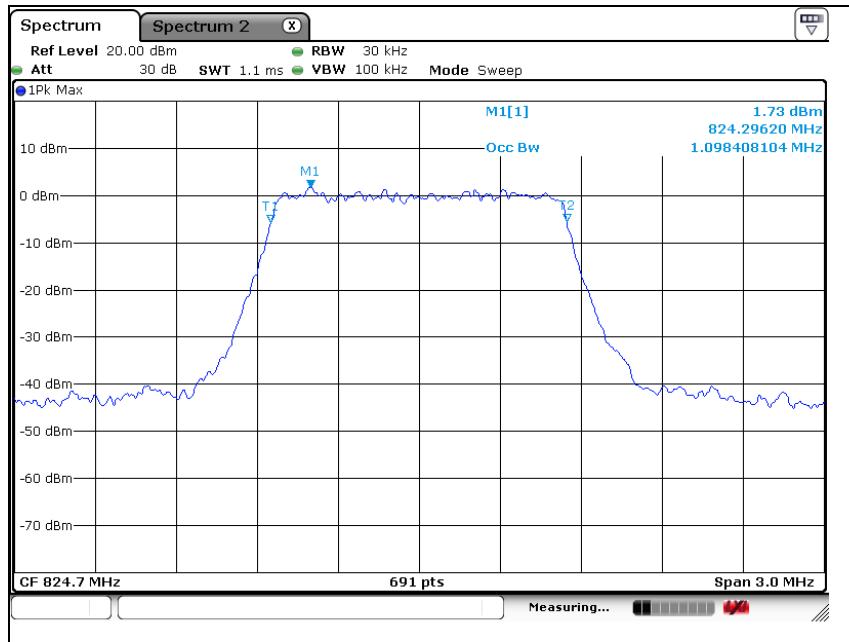
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High Channel



LTE band 5 (1.4 MHz - 16QAM)

Low Channel



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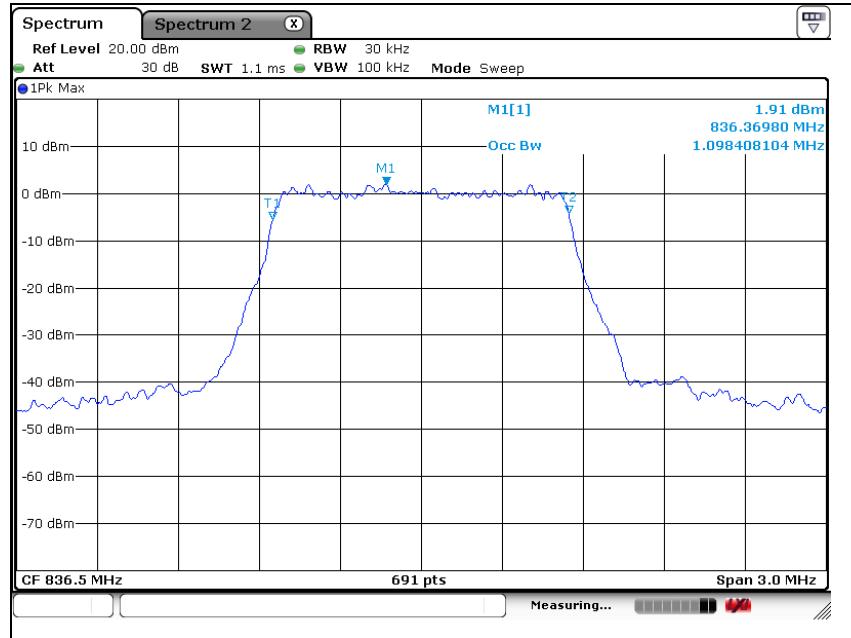
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RTT5041-19(2017.07.10)(0)

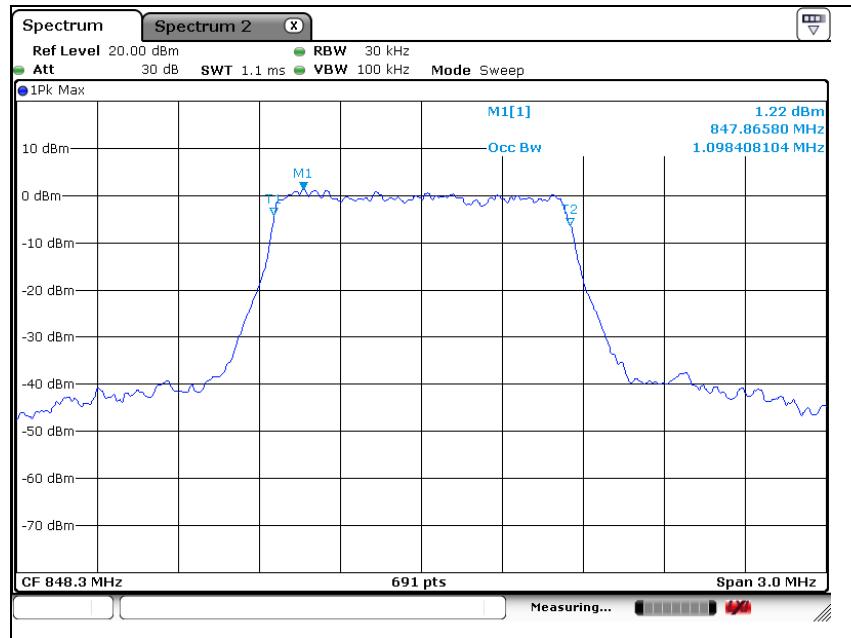
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



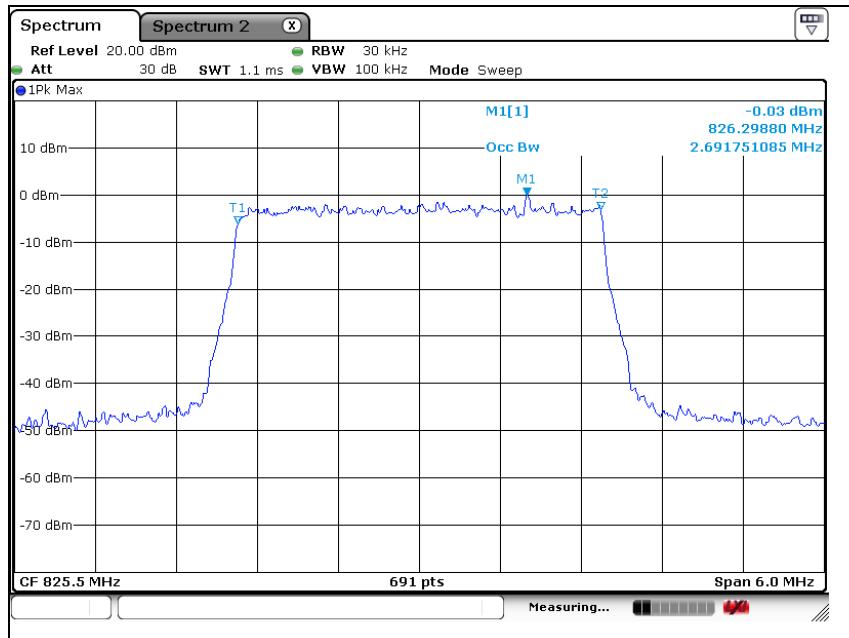
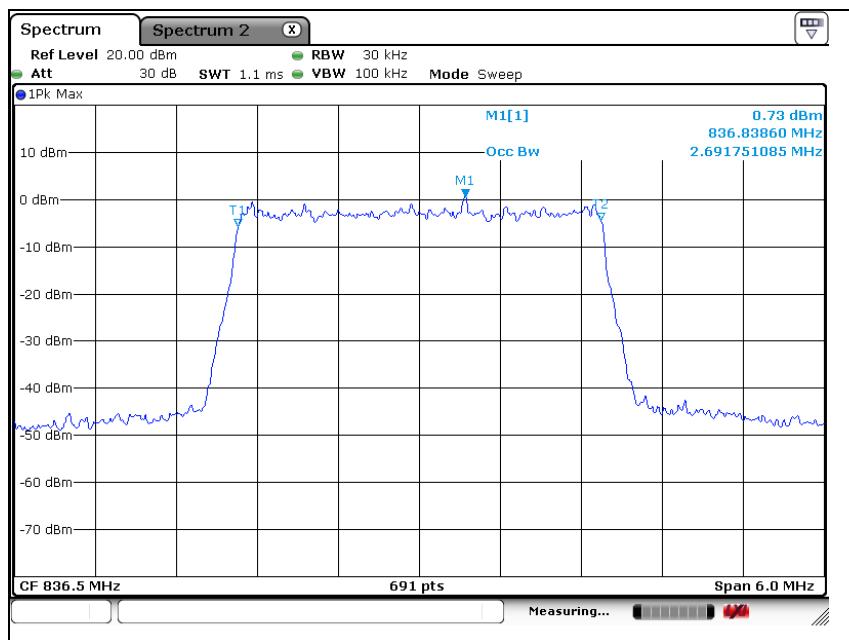
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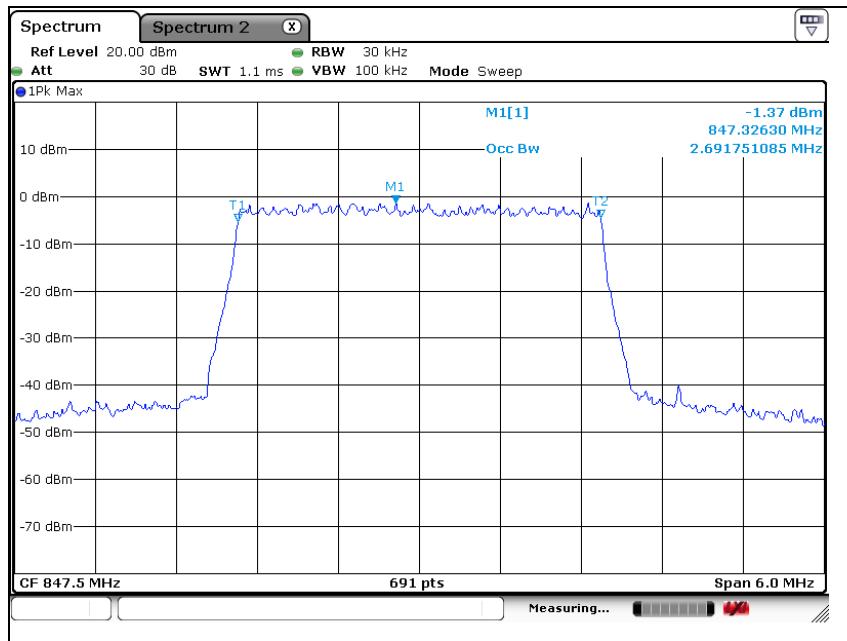
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 5 (3 MHz - QPSK)**Low Channel****Middle Channel**

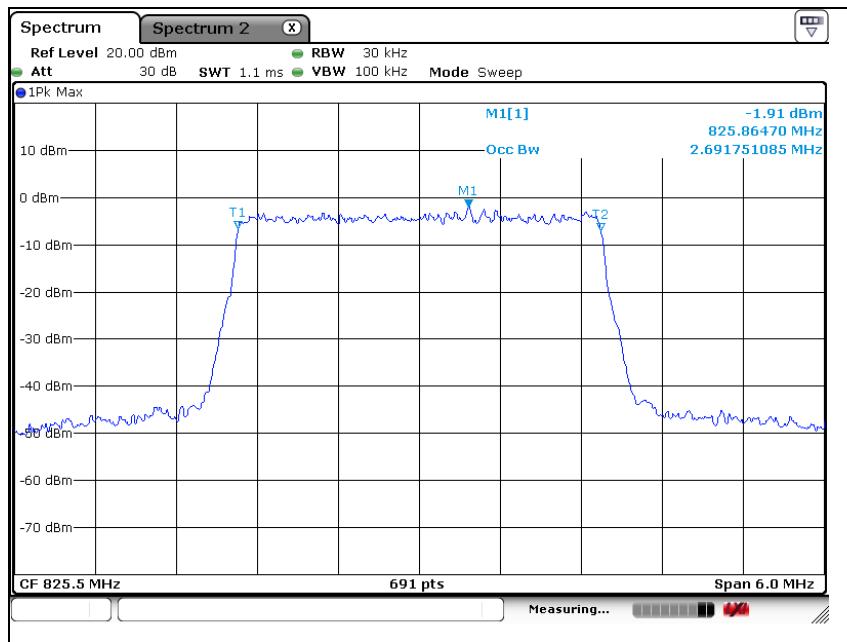
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High Channel



LTE band 5 (3 MHz - 16QAM)

Low Channel



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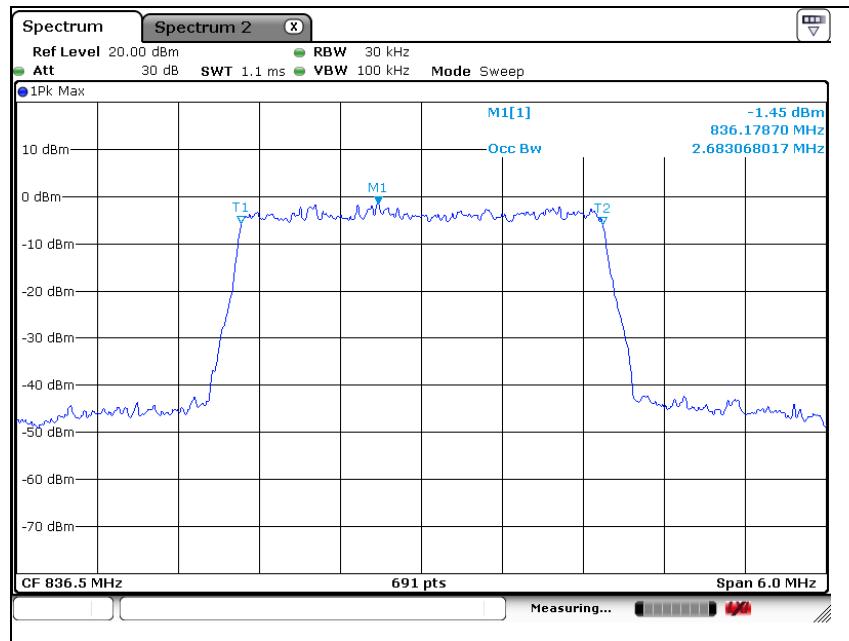
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RTT5041-19(2017.07.10)(0)

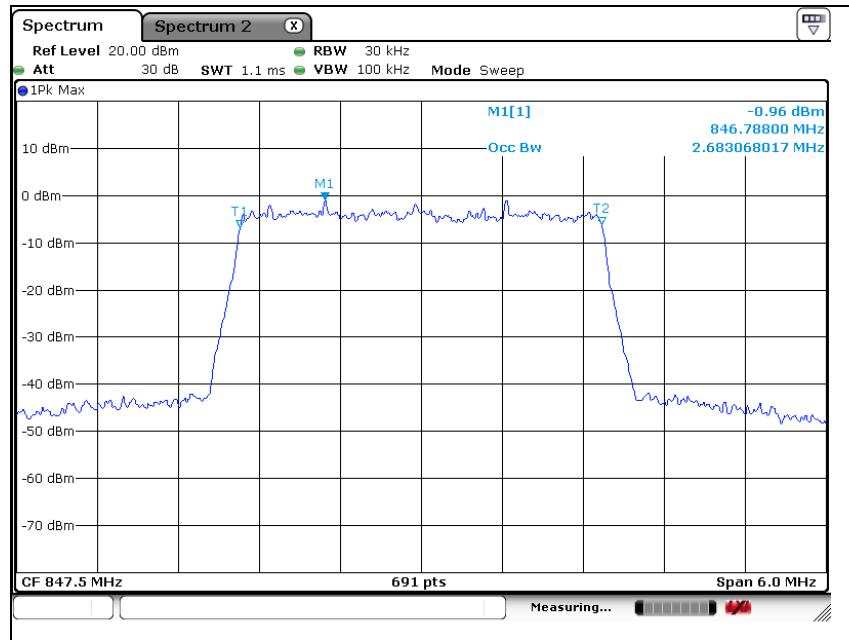
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



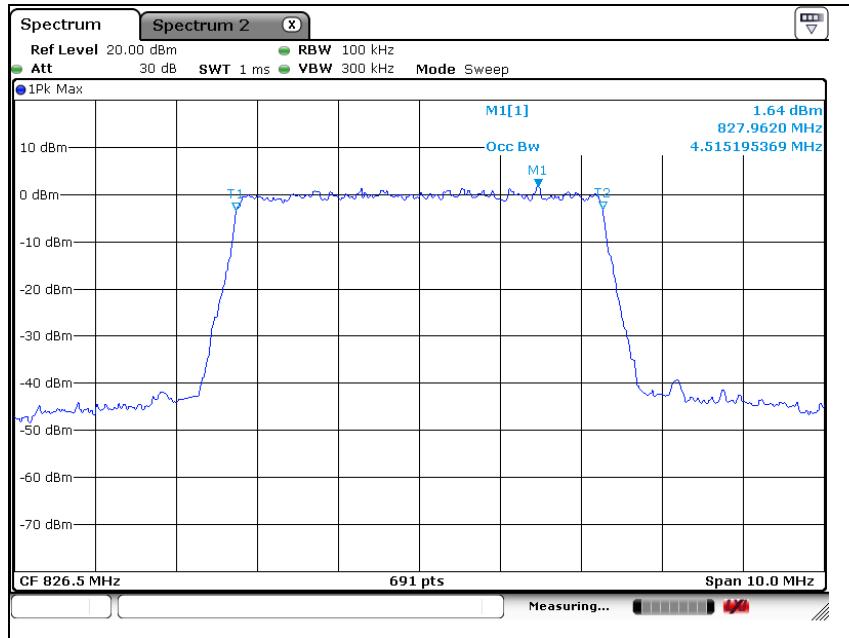
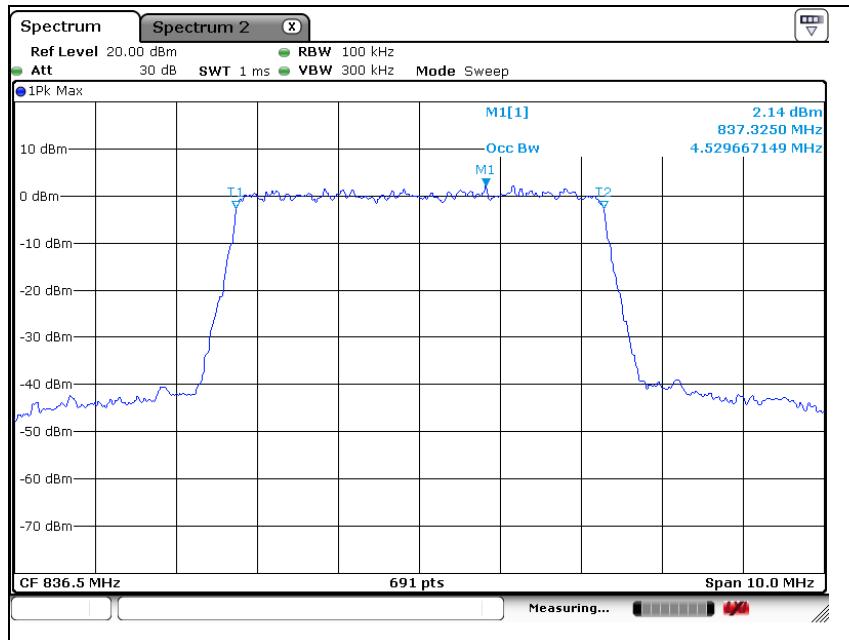
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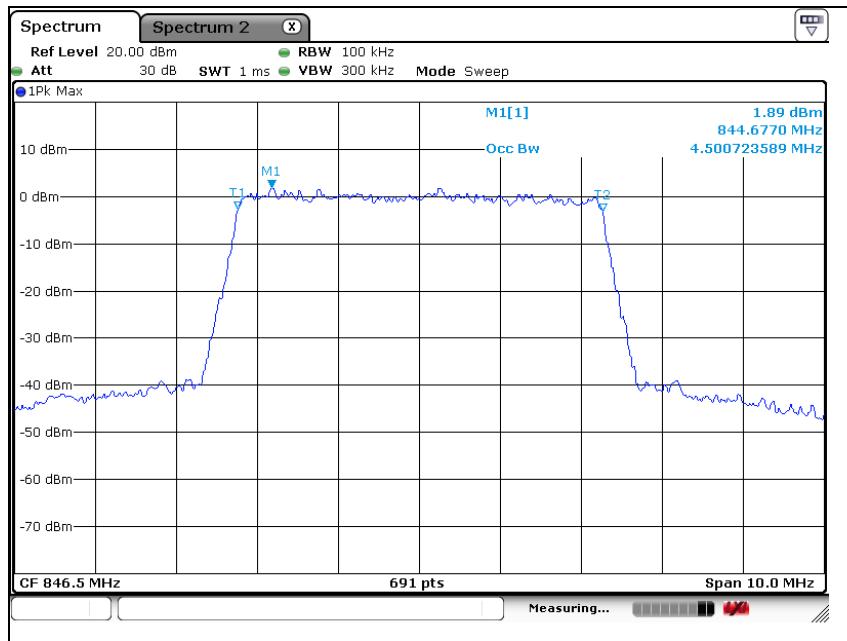
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 5 (5 MHz - QPSK)**Low Channel****Middle Channel**

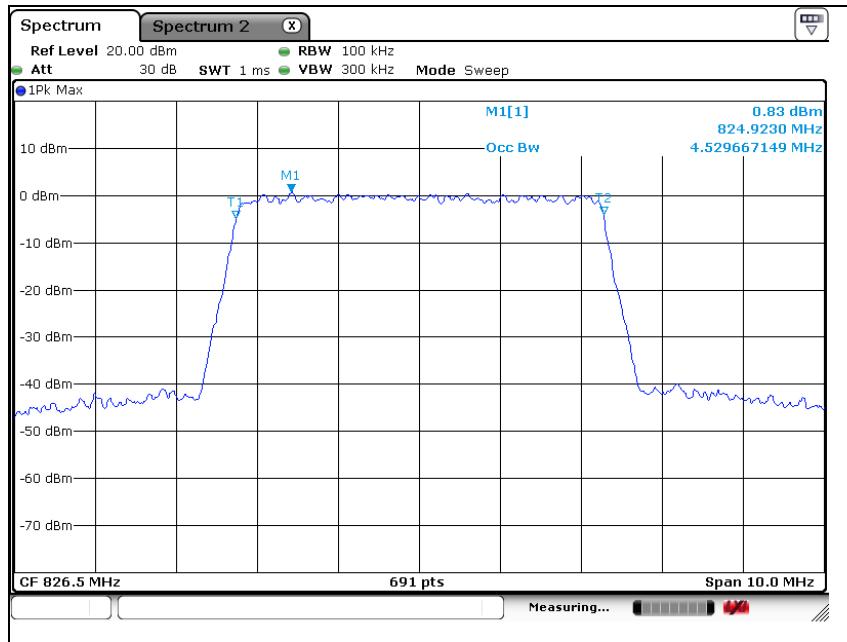
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High Channel



LTE band 5 (5 MHz - 16QAM)

Low Channel



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RTT5041-19(2017.07.10)(0)

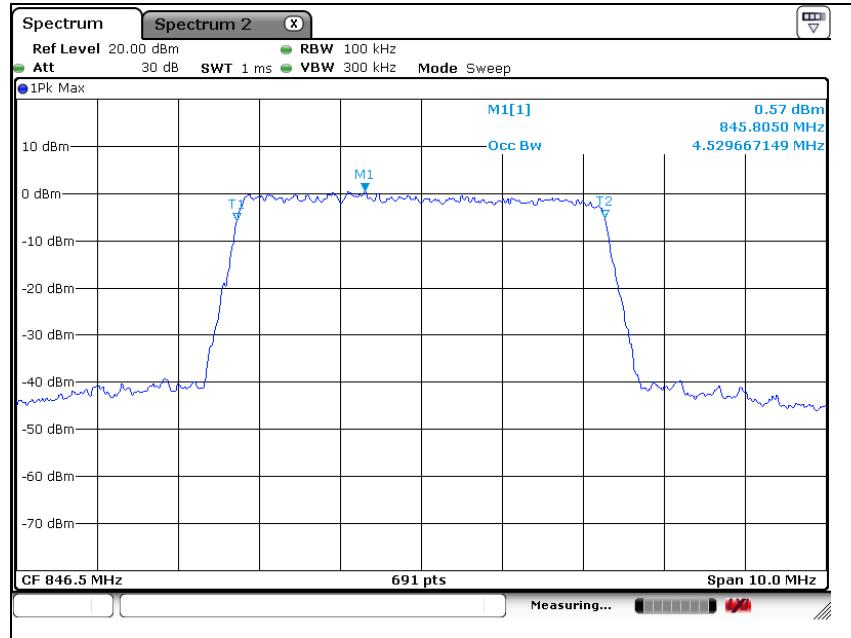
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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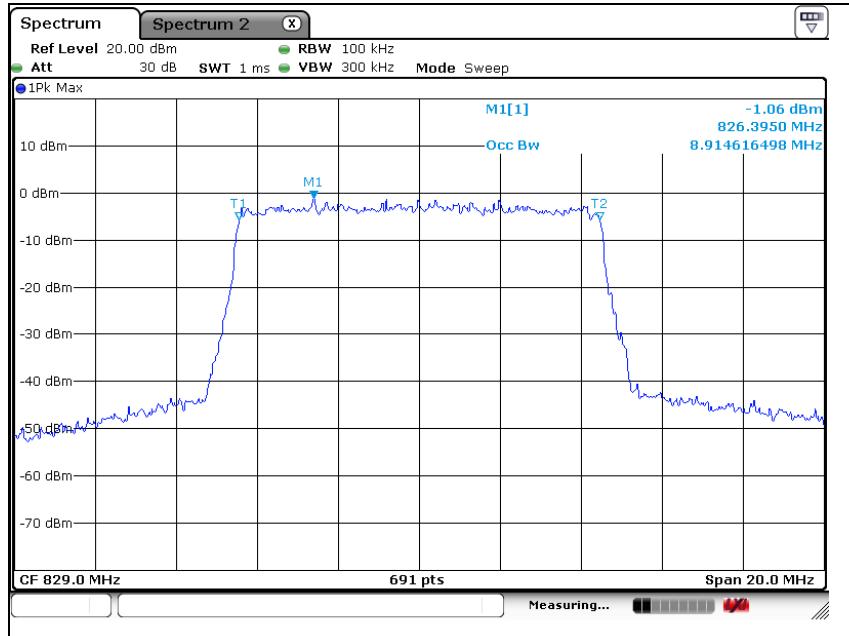
RTT5041-19(2017.07.10)(0)

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

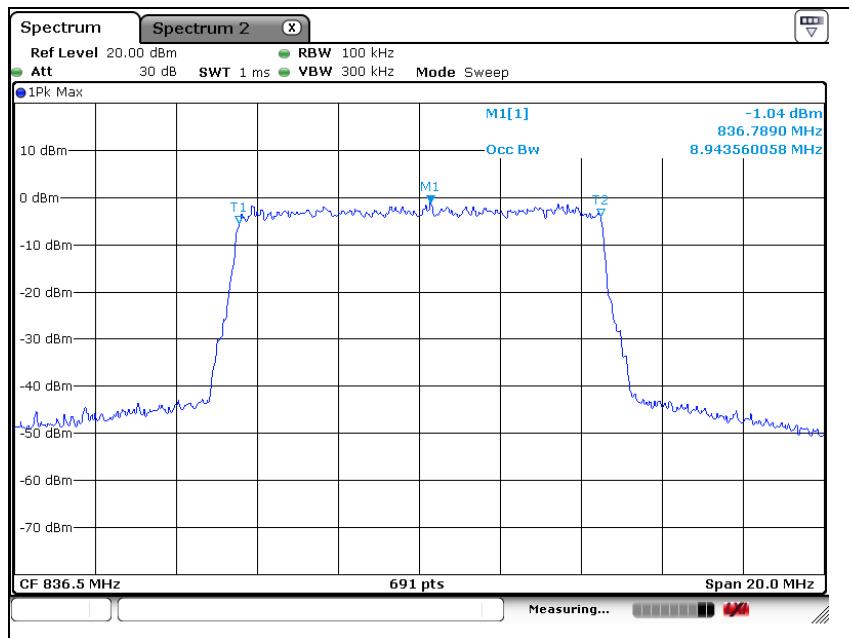
A4(210 mm x 297 mm)

LTE band 5 (10 MHz - QPSK)

Low Channel



Middle Channel



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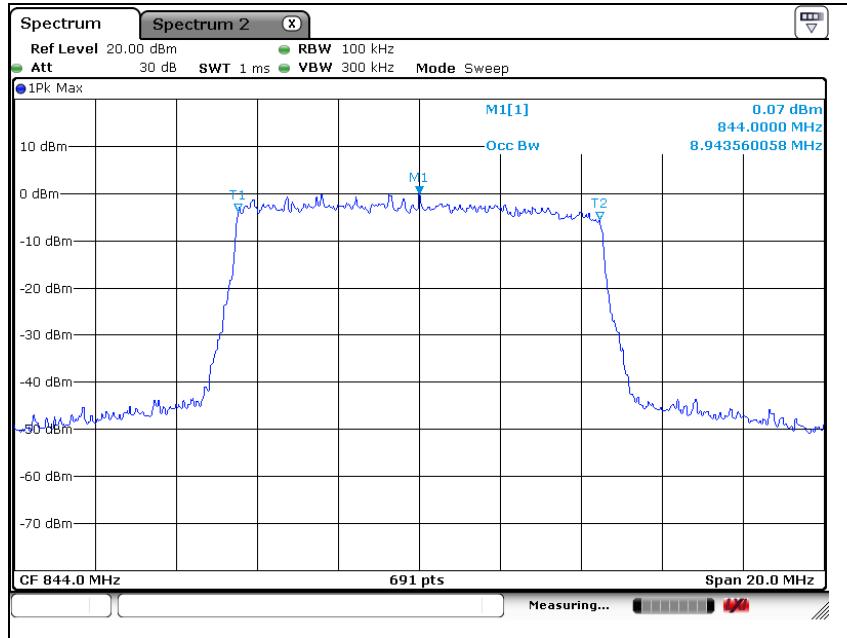
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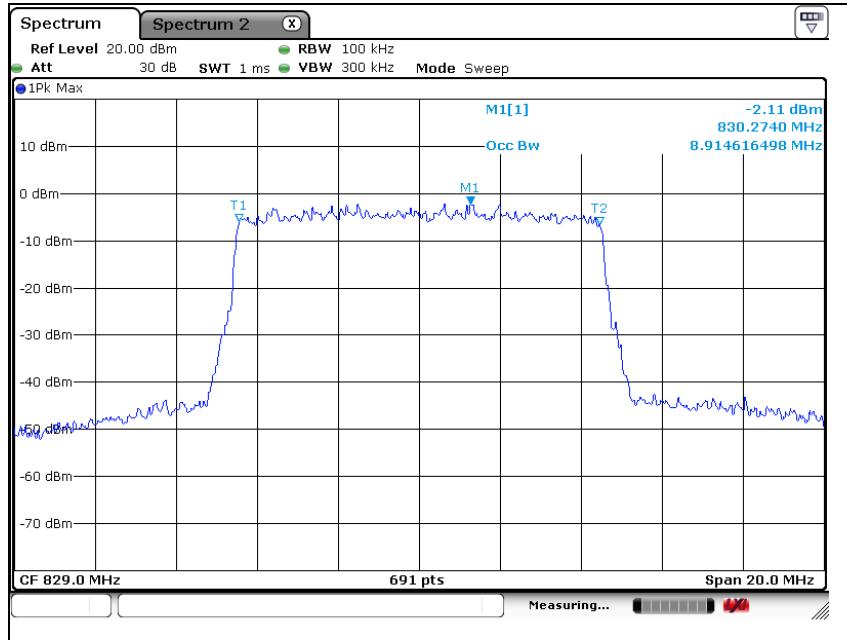
A4(210 mm x 297 mm)

High Channel



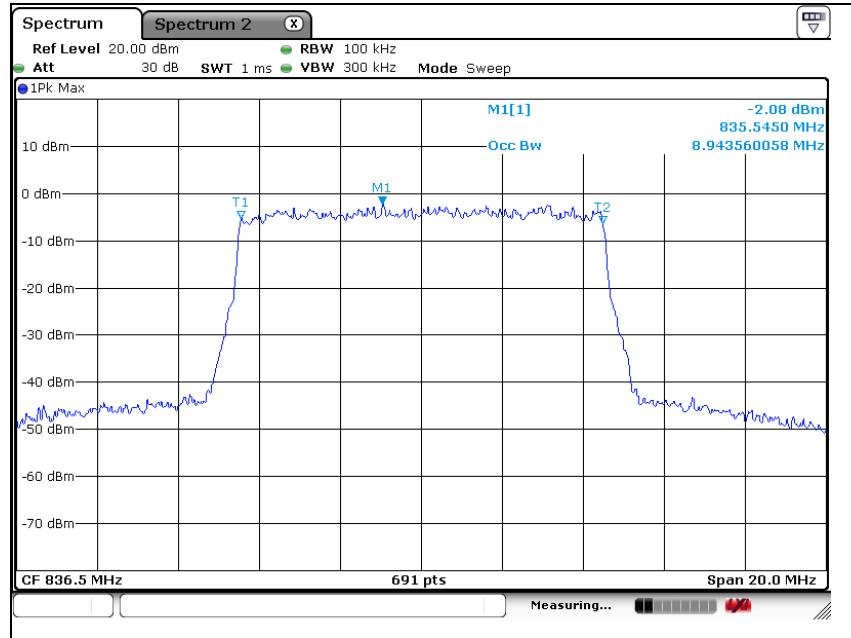
LTE band 5 (10 MHz - 16QAM)

Low Channel

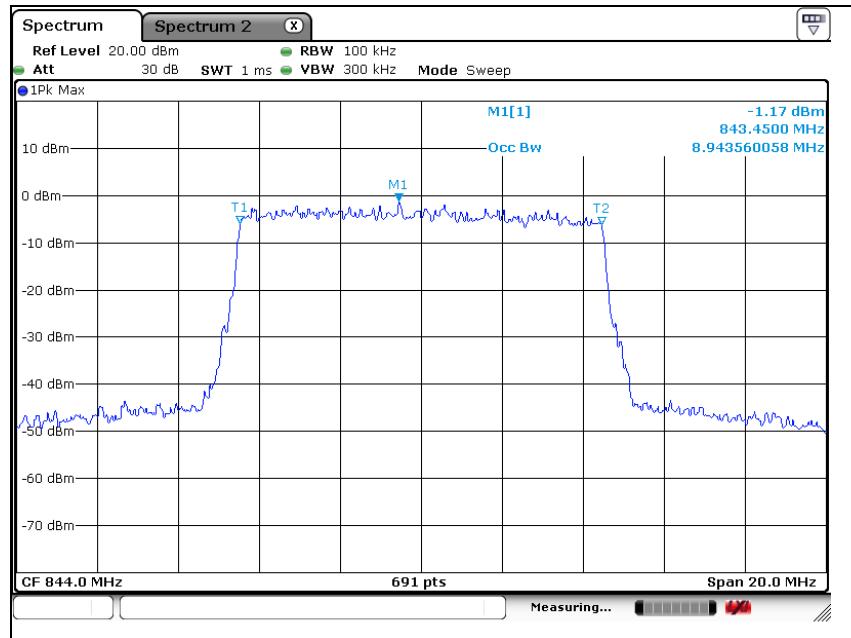


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Middle Channel



High Channel



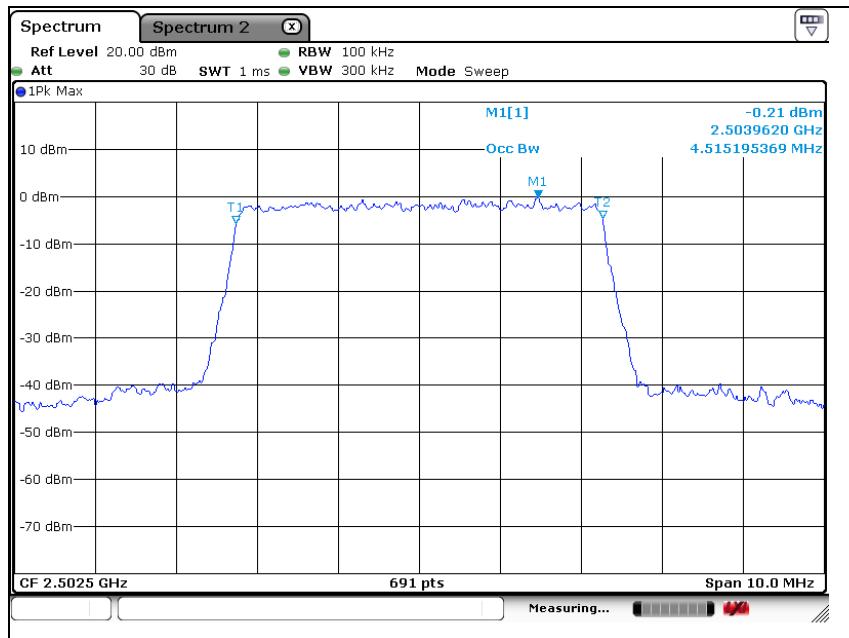
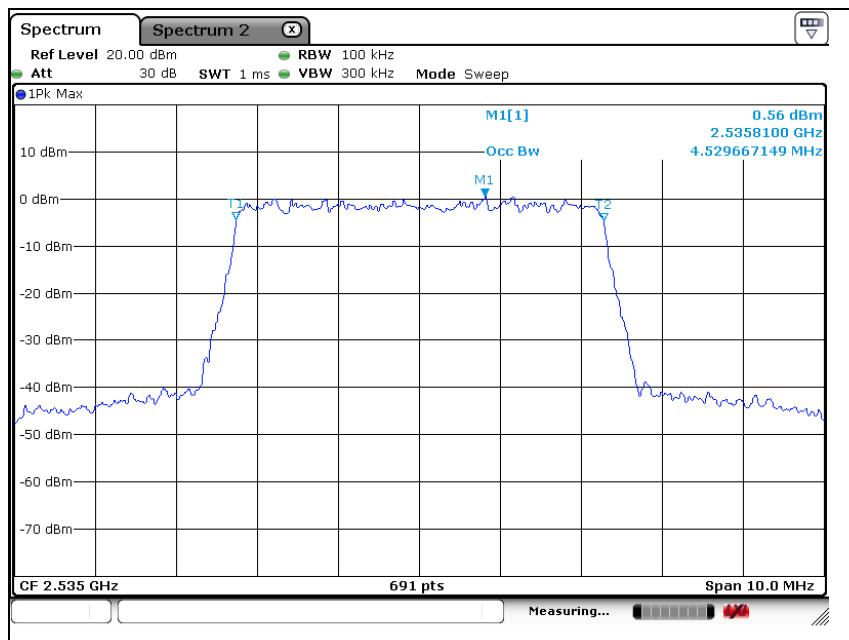
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A4(210 mm x 297 mm)

LTE band 7 (5 MHz - QPSK)**Low Channel****Middle Channel**

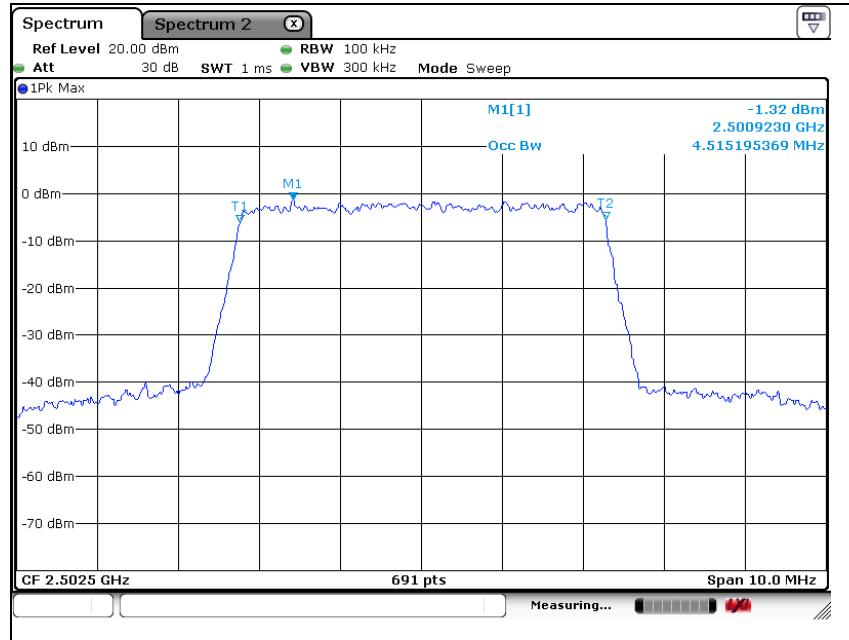
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High Channel



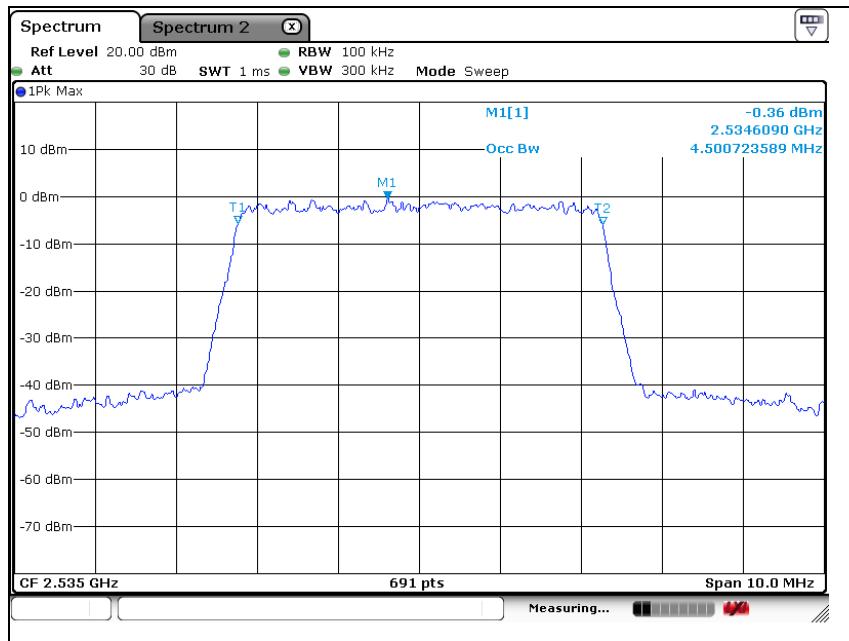
LTE band 7 (5 MHz - 16QAM)

Low Channel

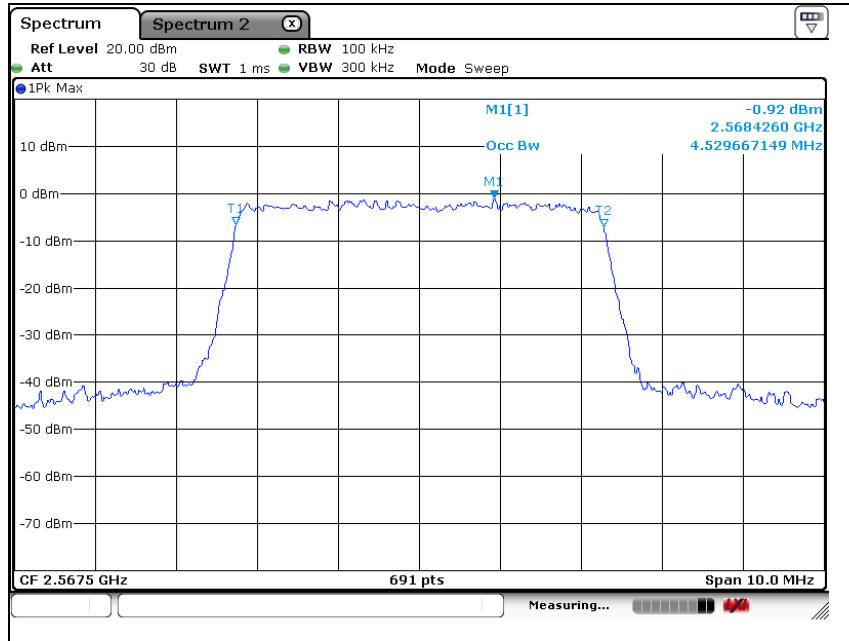


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Middle Channel



High Channel



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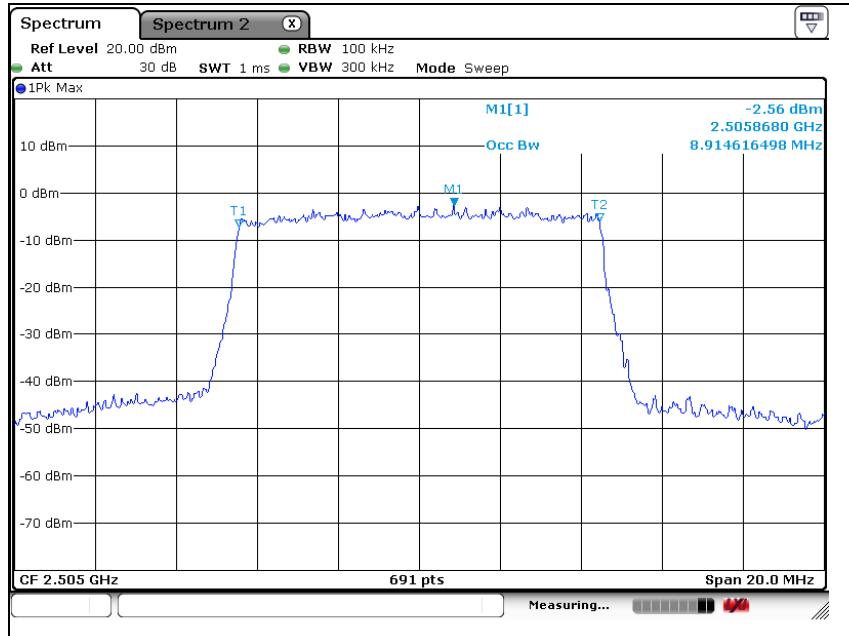
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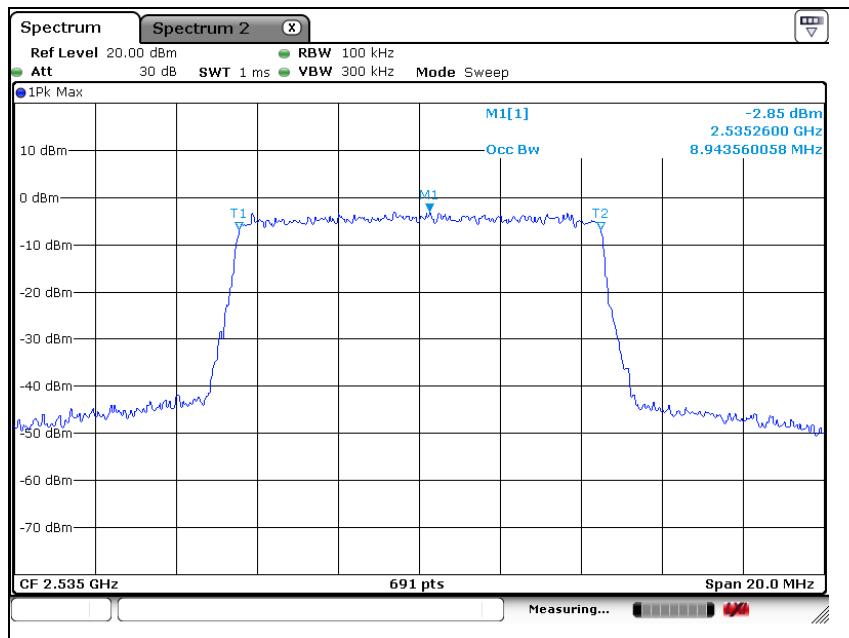
A4(210 mm x 297 mm)

LTE band 7 (10 MHz - QPSK)

Low Channel



Middle Channel



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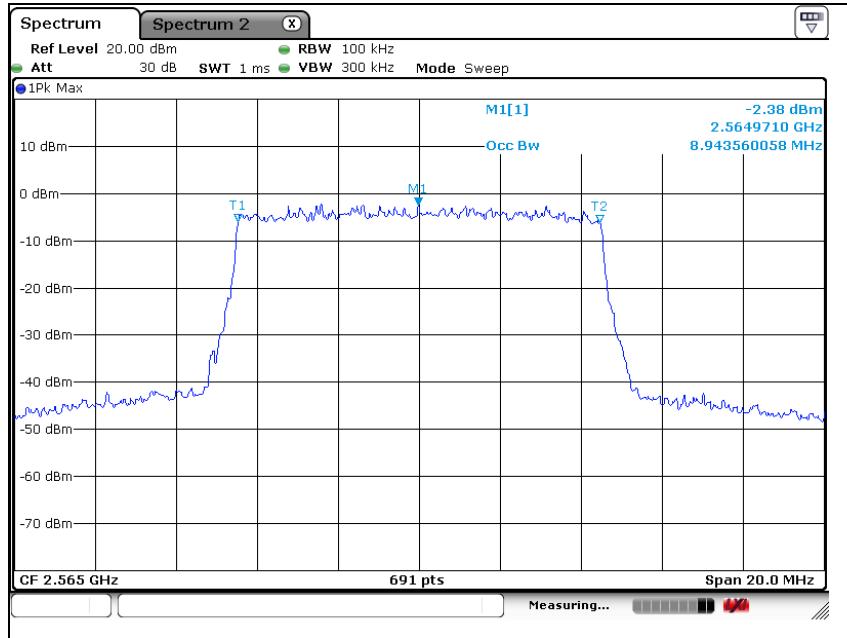
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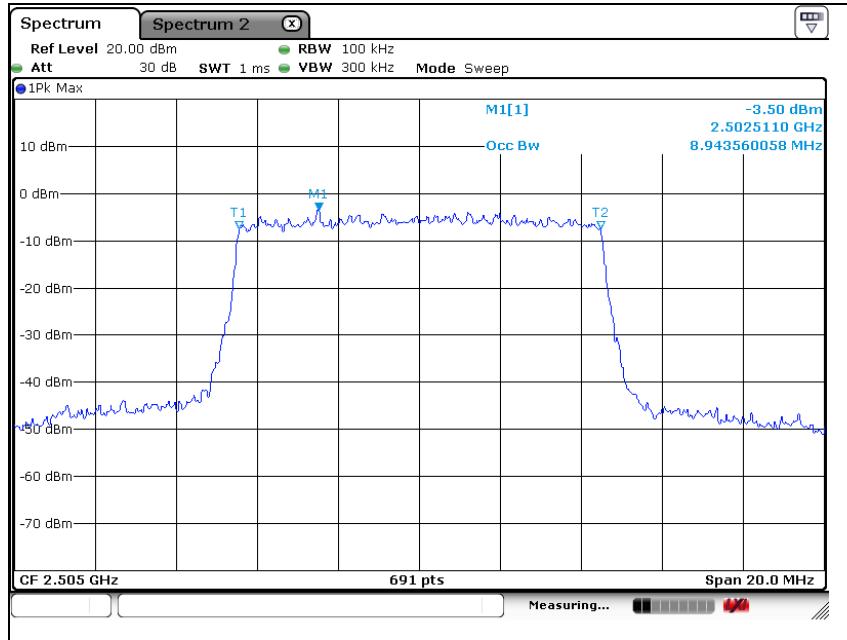
A4(210 mm x 297 mm)

High Channel



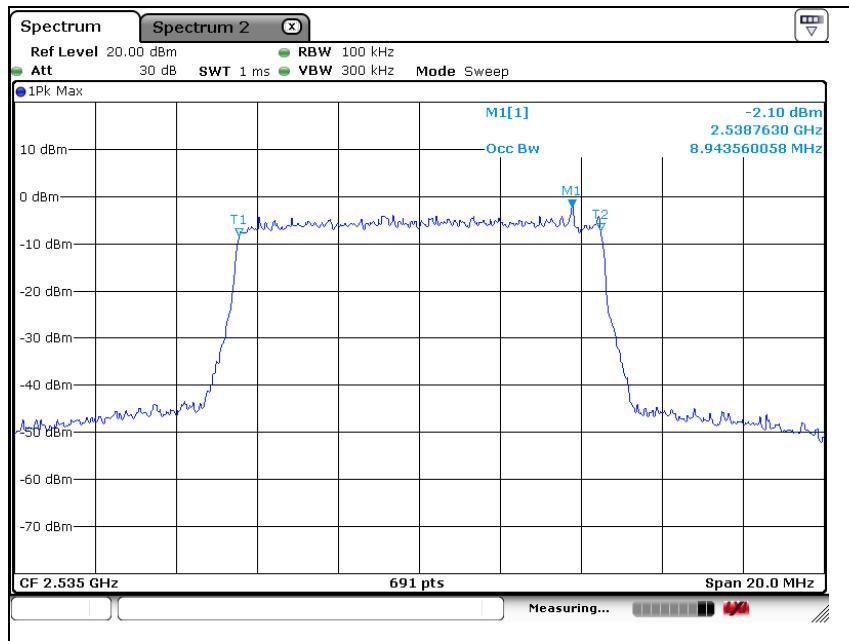
LTE band 7 (10 MHz - 16QAM)

Low Channel

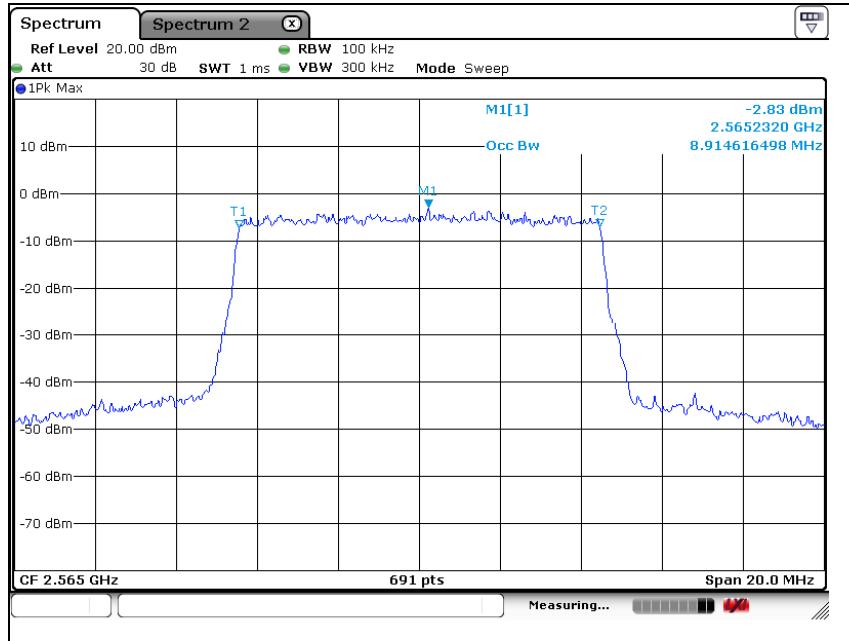


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Middle Channel



High Channel



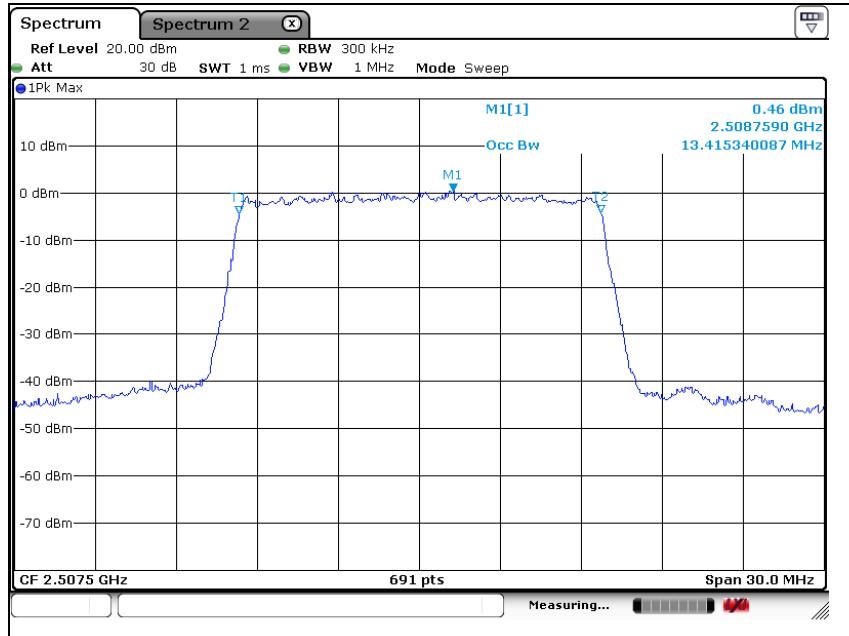
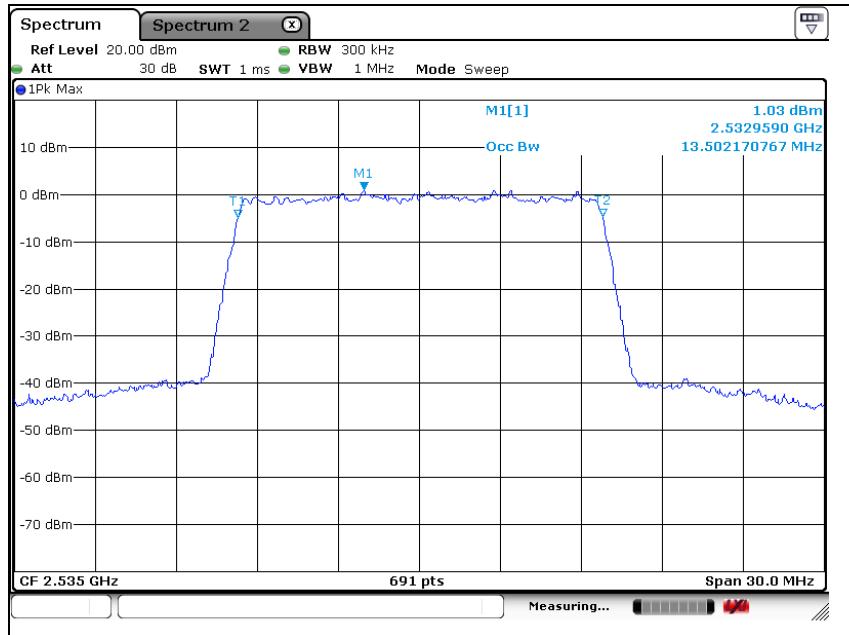
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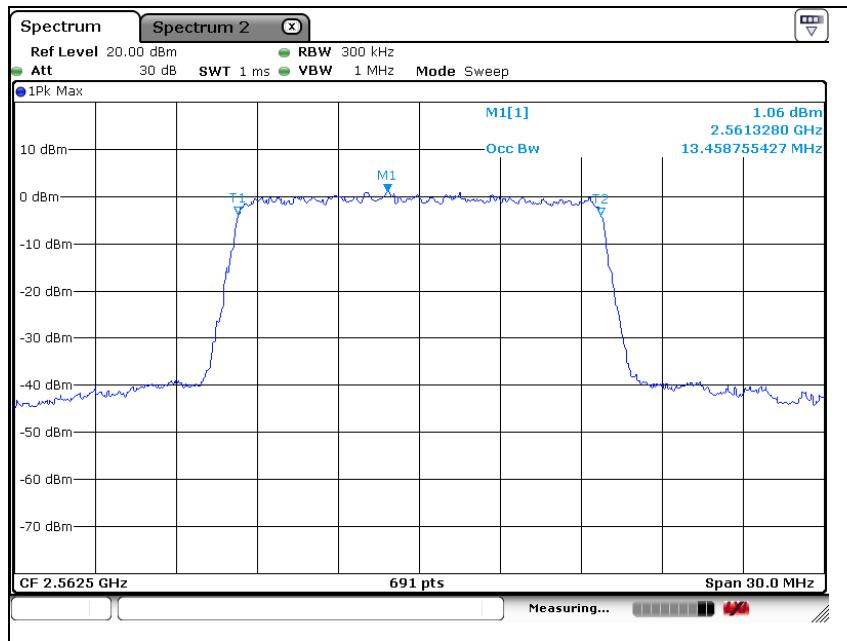
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 7 (15 MHz - QPSK)**Low Channel****Middle Channel**

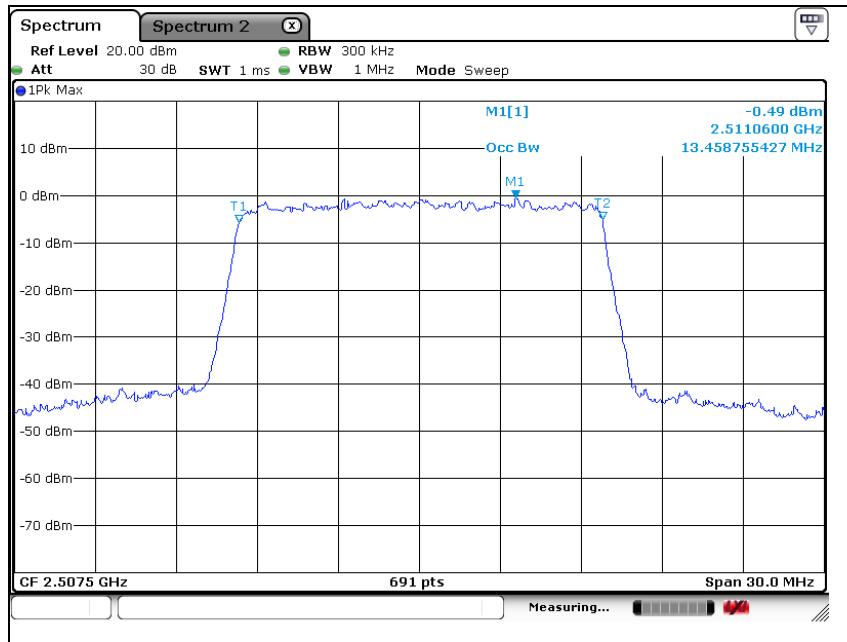
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High Channel



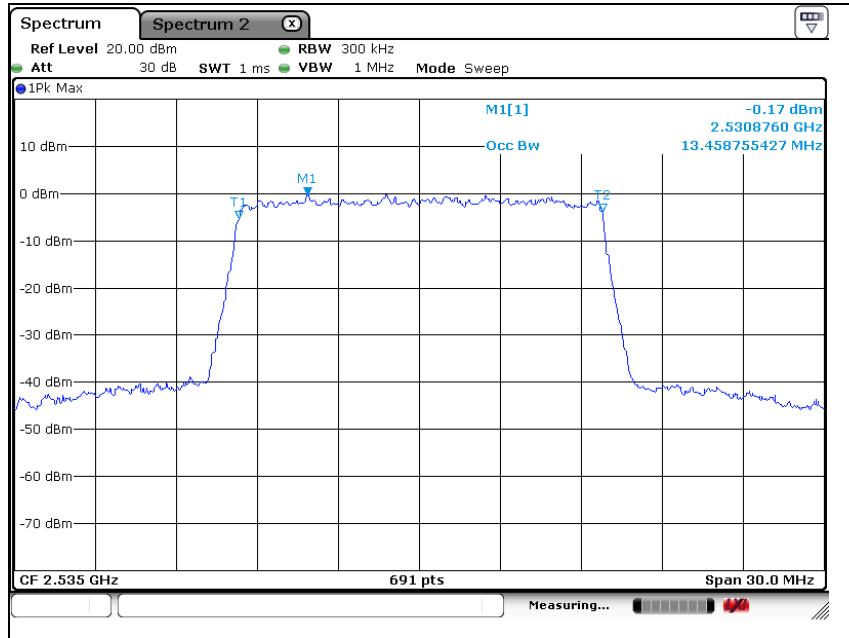
LTE band 7 (15 MHz - 16QAM)

Low Channel

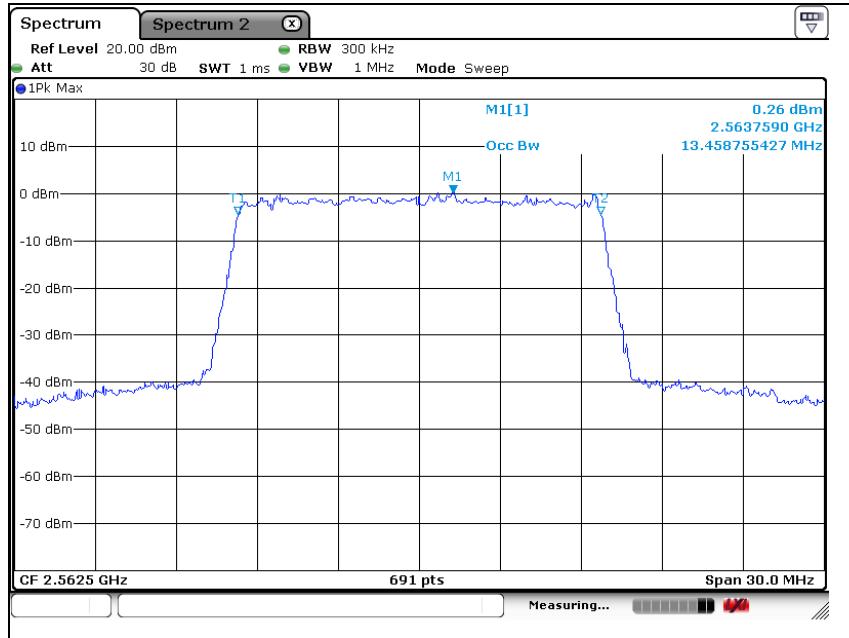


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Middle Channel



High Channel



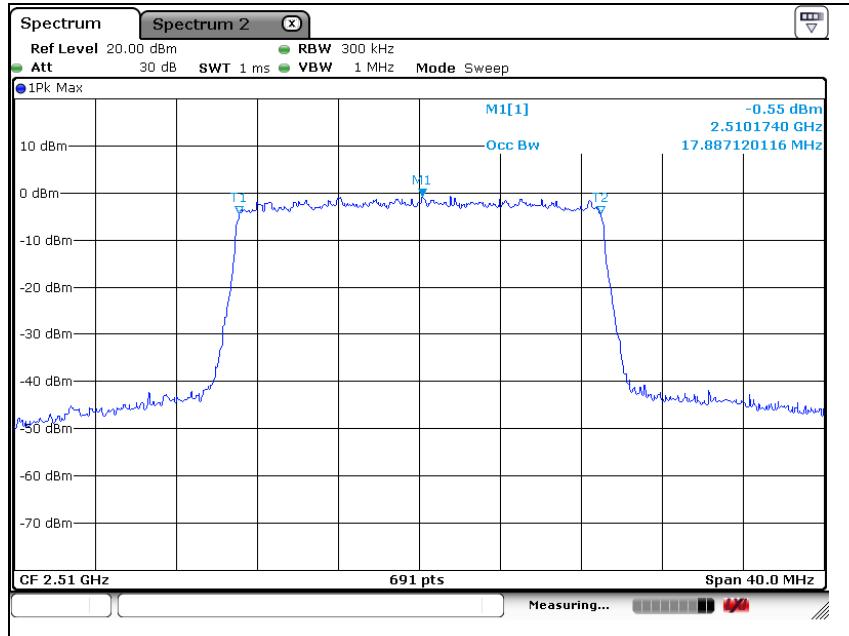
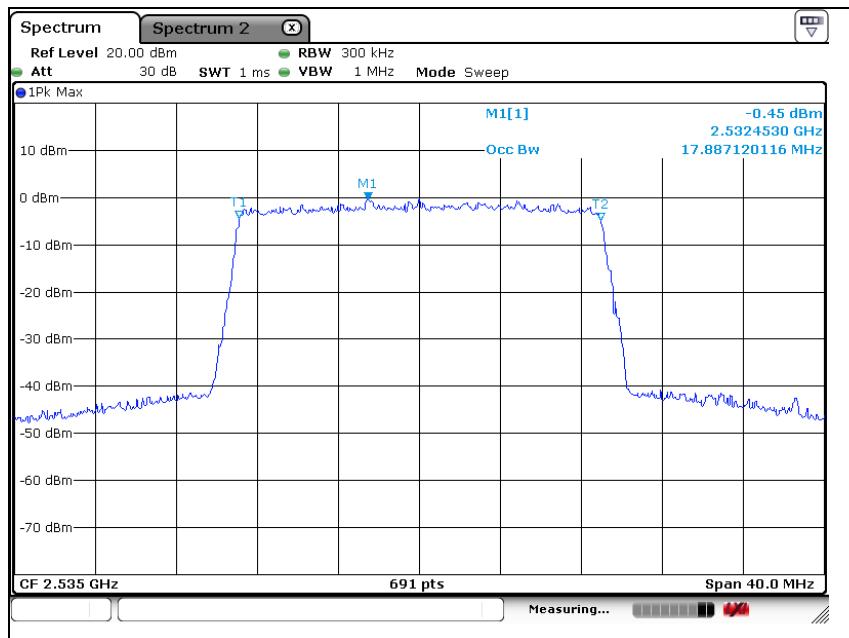
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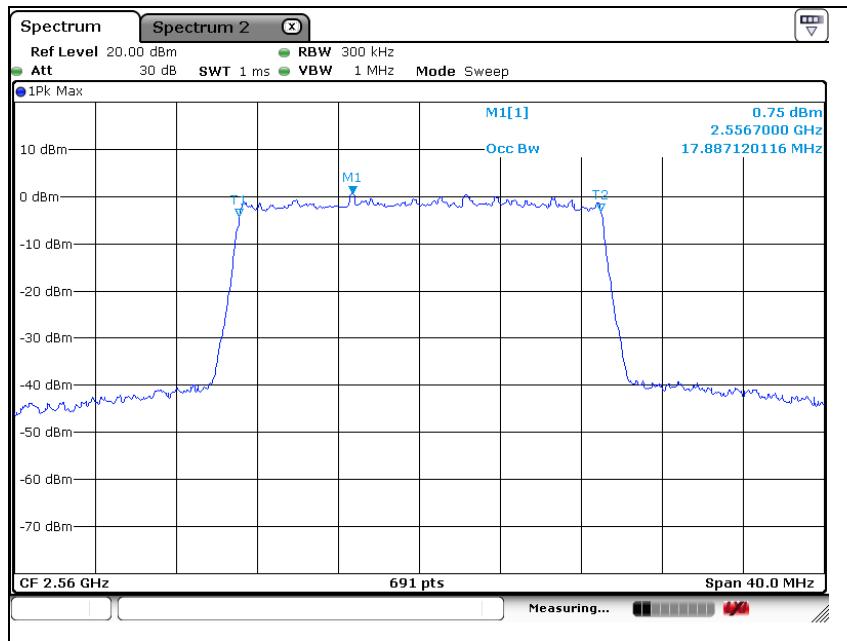
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 7 (20 MHz - QPSK)**Low Channel****Middle Channel**

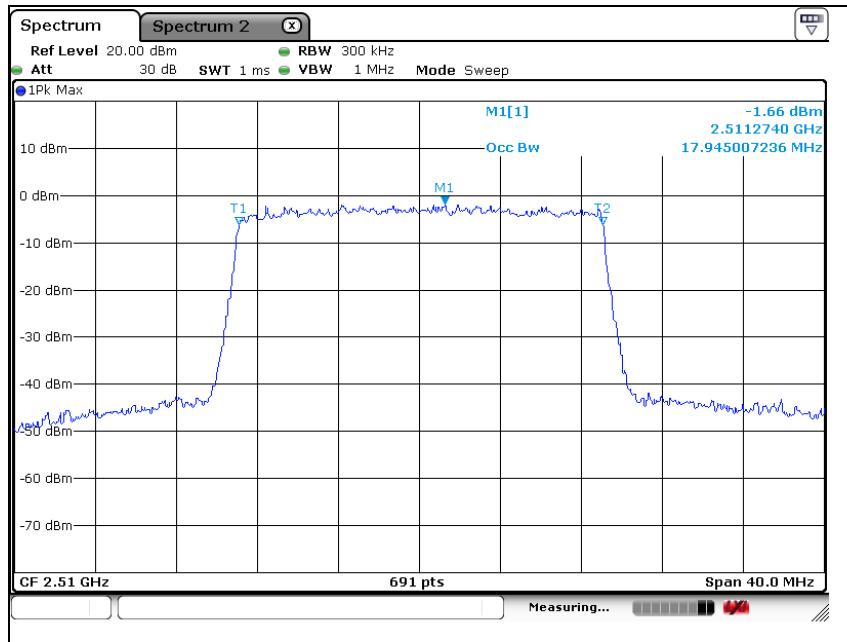
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High Channel



LTE band 7 (20 MHz - 16QAM)

Low Channel



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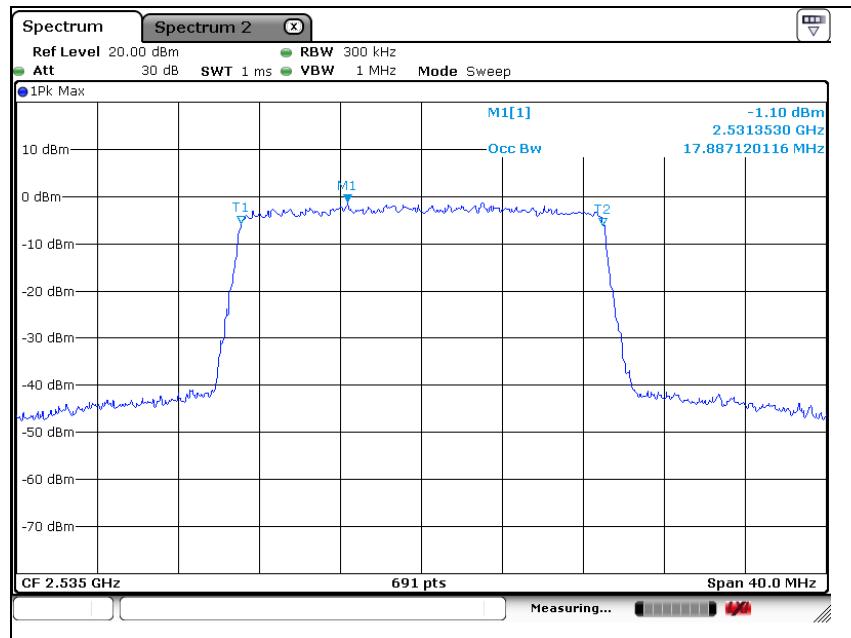
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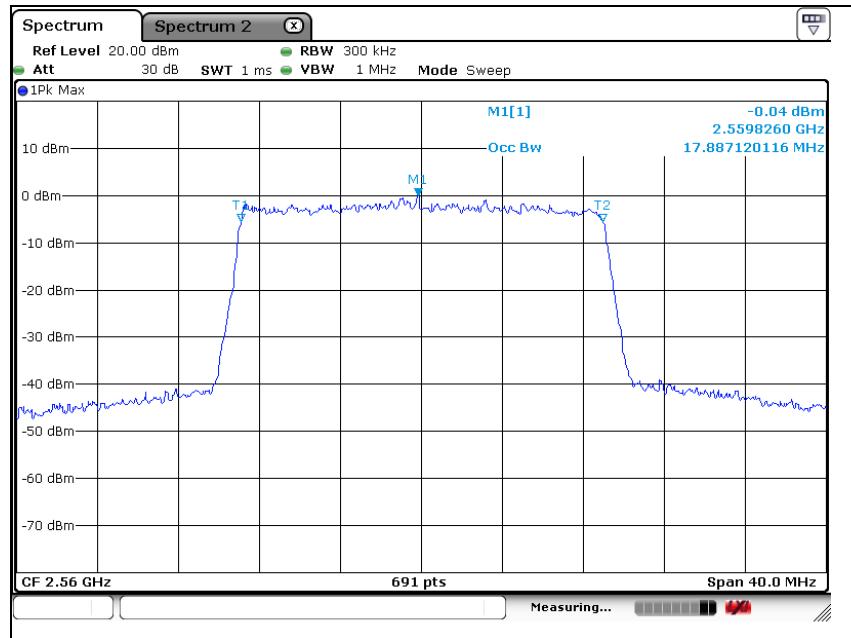
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



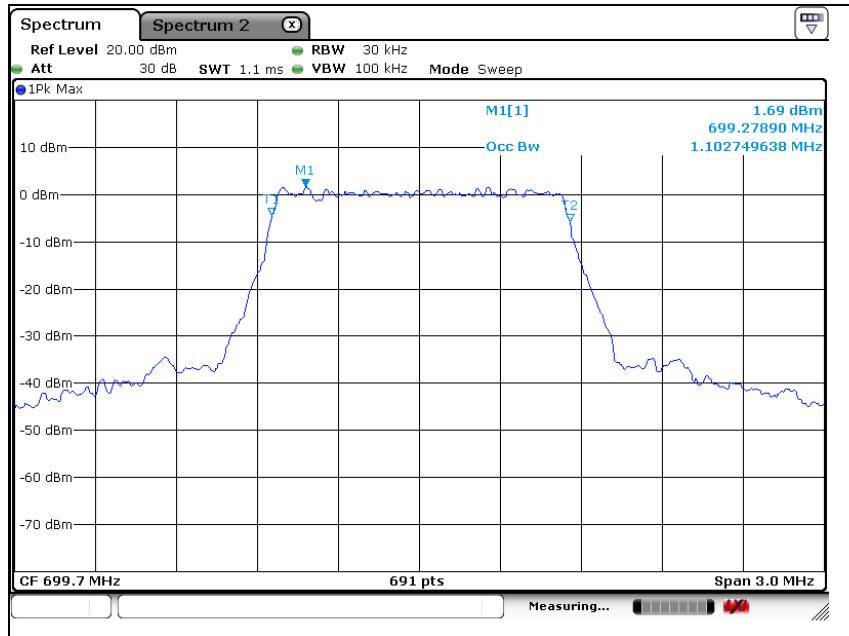
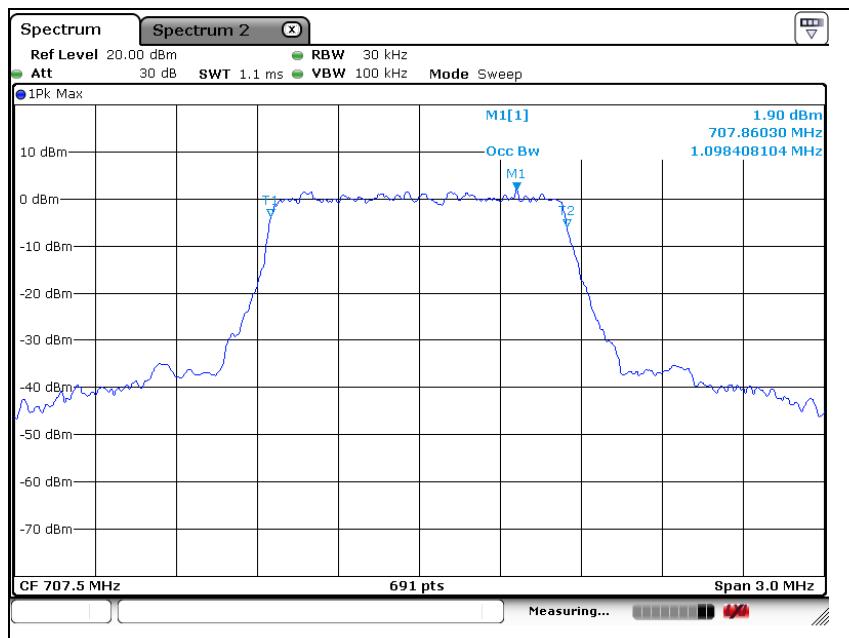
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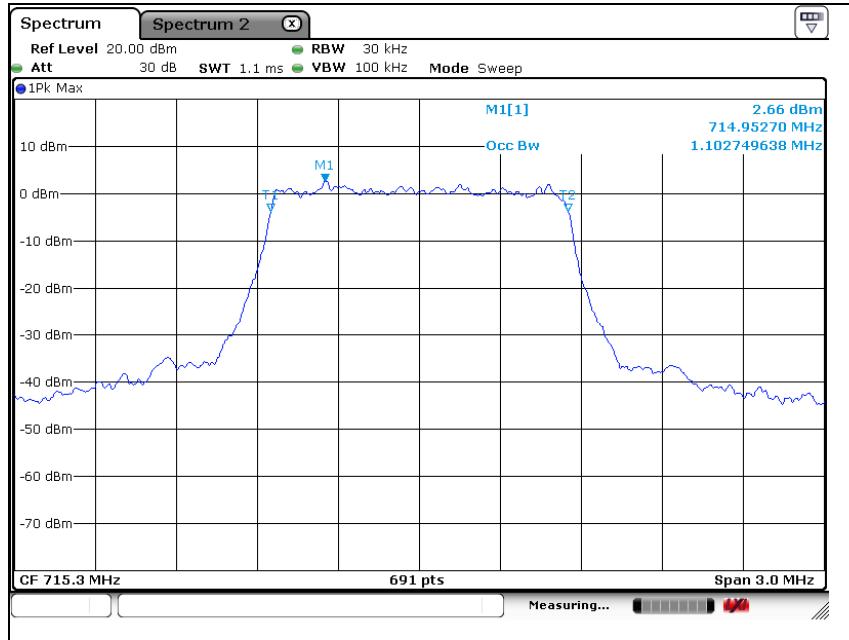
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A4(210 mm x 297 mm)

LTE band 12 (1.4 MHz - QPSK)**Low Channel****Middle Channel**

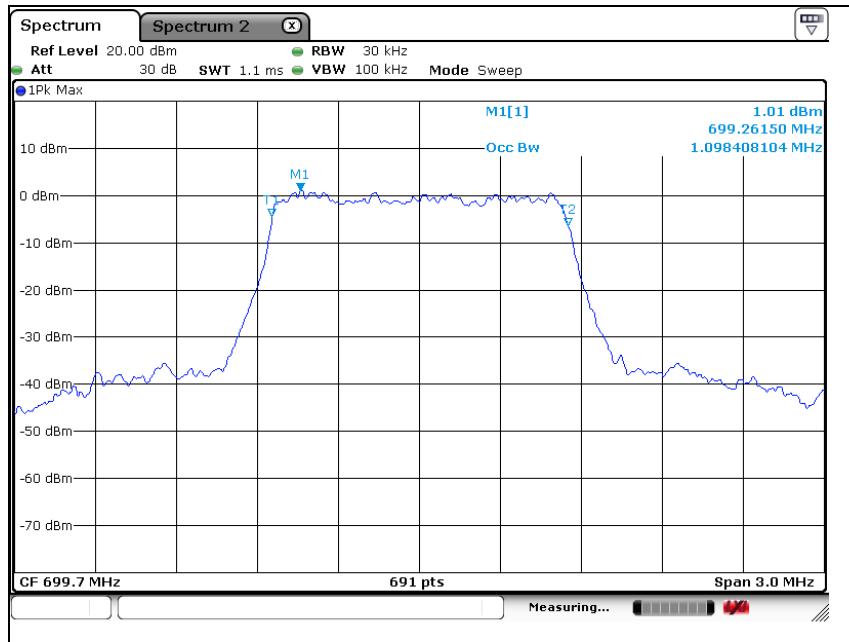
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High Channel



LTE band 12 (1.4 MHz - 16QAM)

Low Channel



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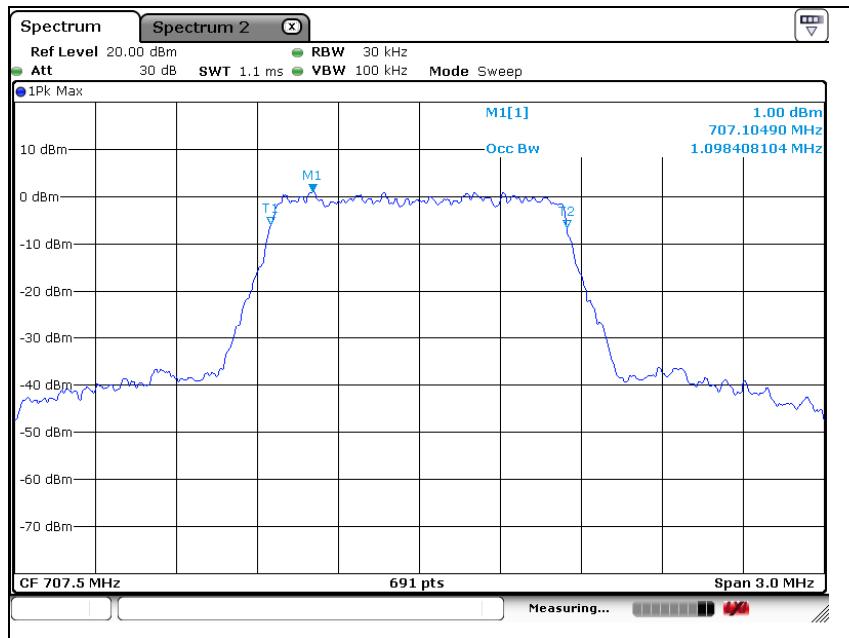
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RTT5041-19(2017.07.10)(0)

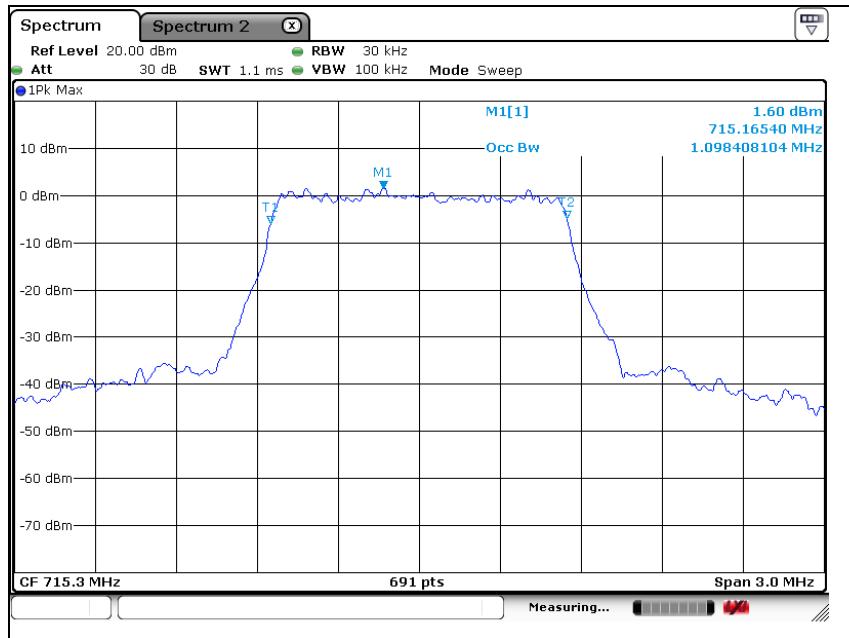
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



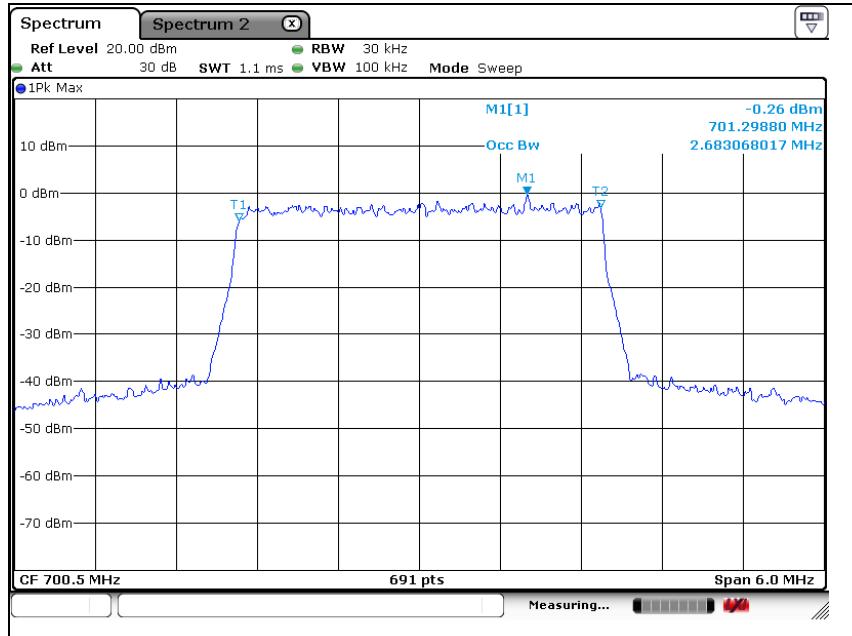
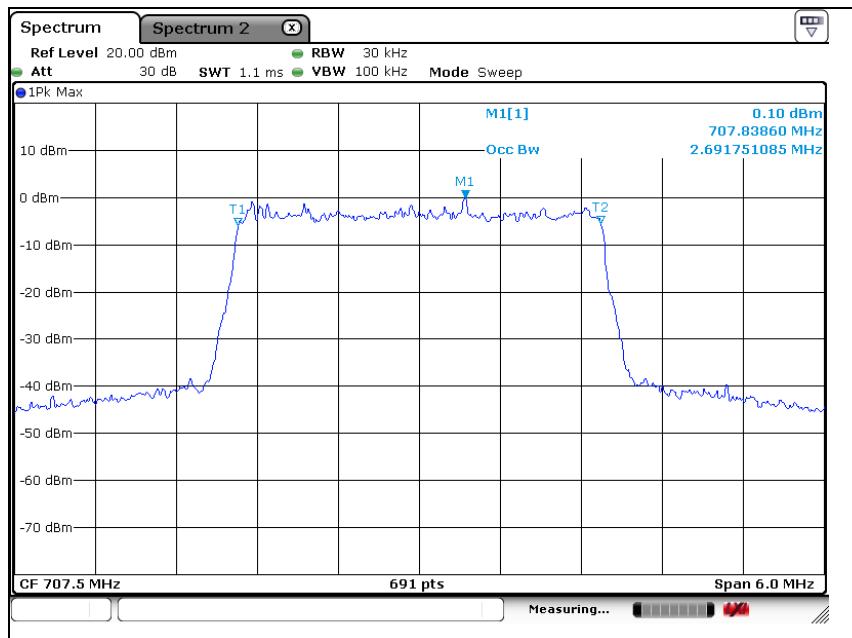
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A4(210 mm x 297 mm)

LTE band 12 (3 MHz - QPSK)**Low Channel****Middle Channel**

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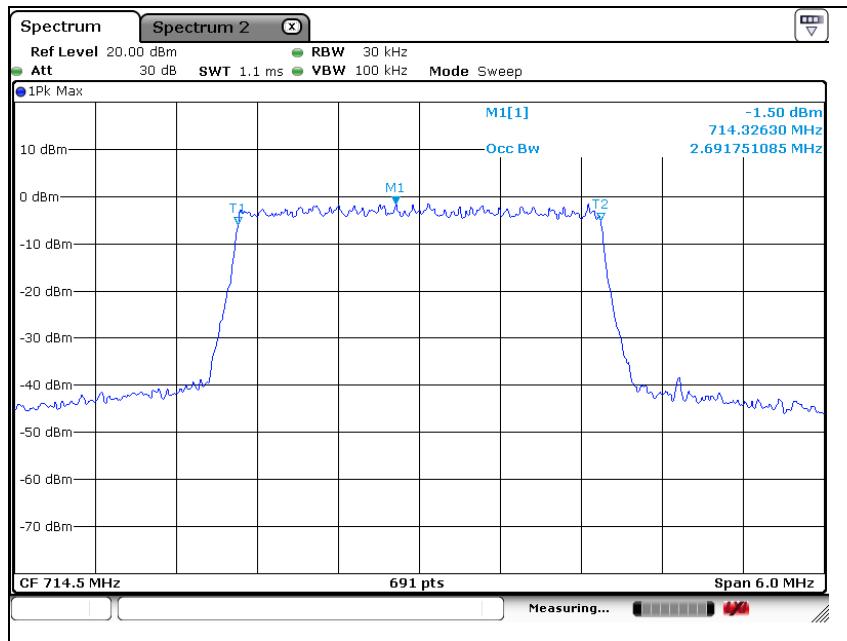
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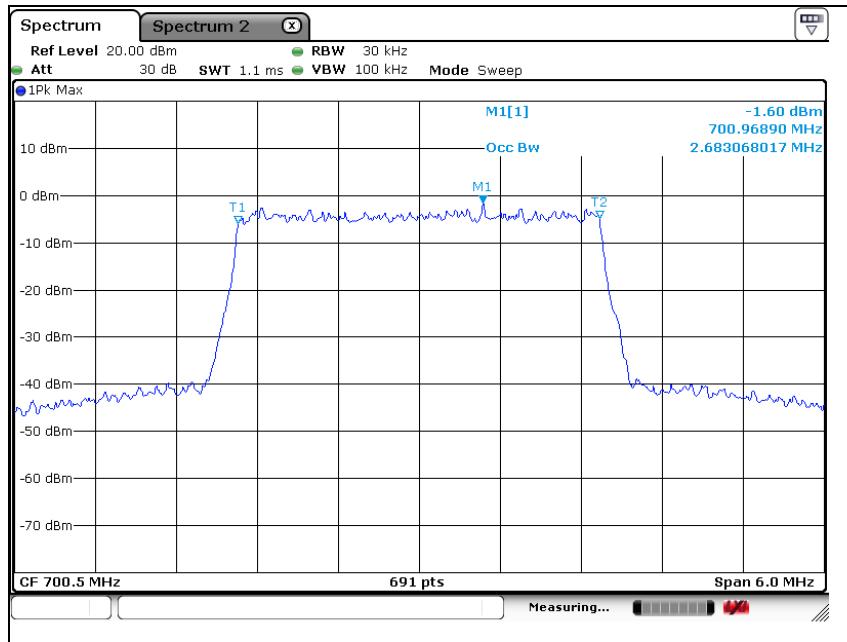
A4(210 mm x 297 mm)

High Channel



LTE band 12 (3 MHz - 16QAM)

Low Channel



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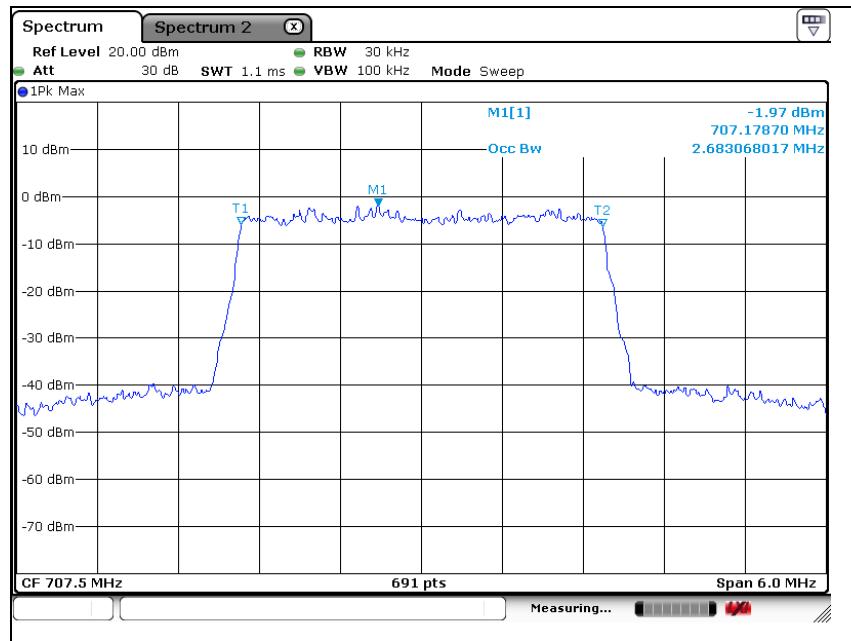
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RTT5041-19(2017.07.10)(0)

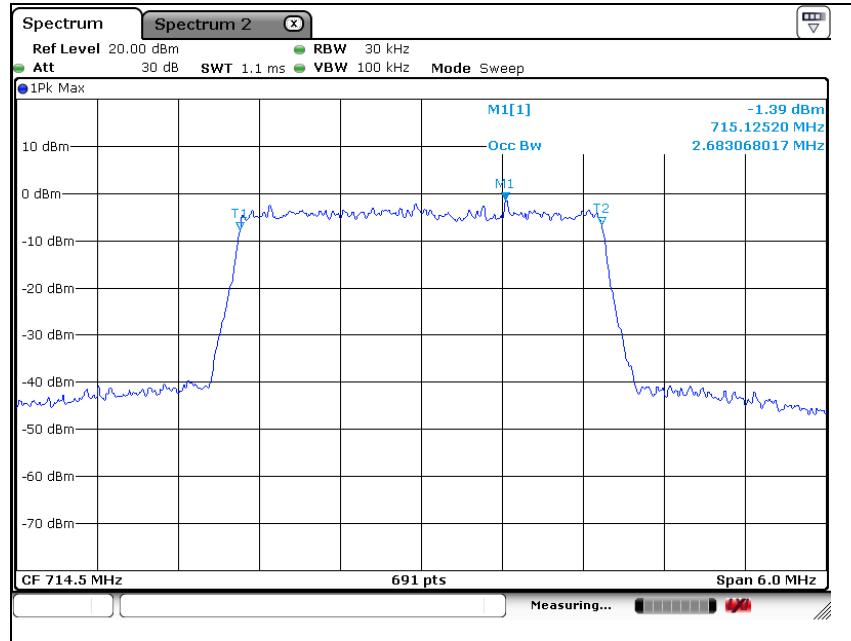
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



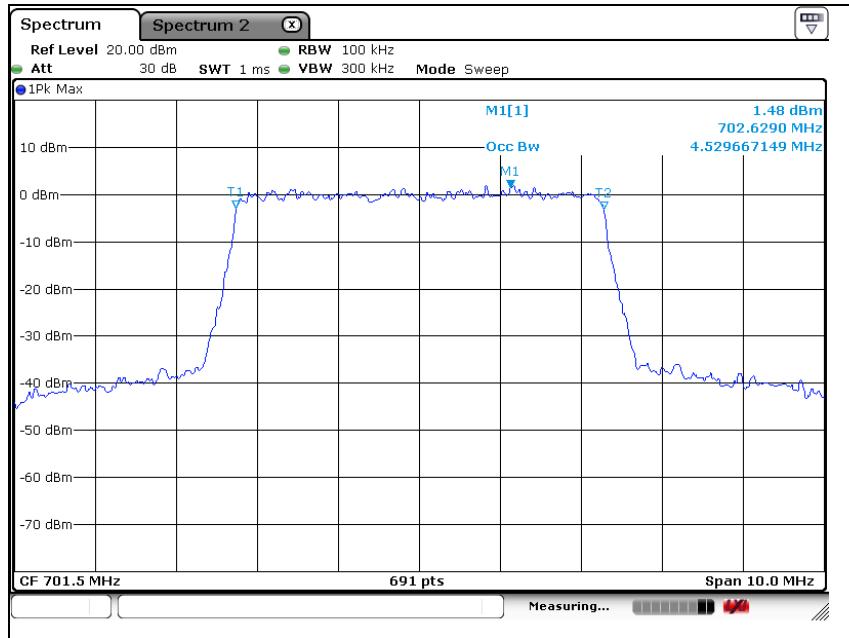
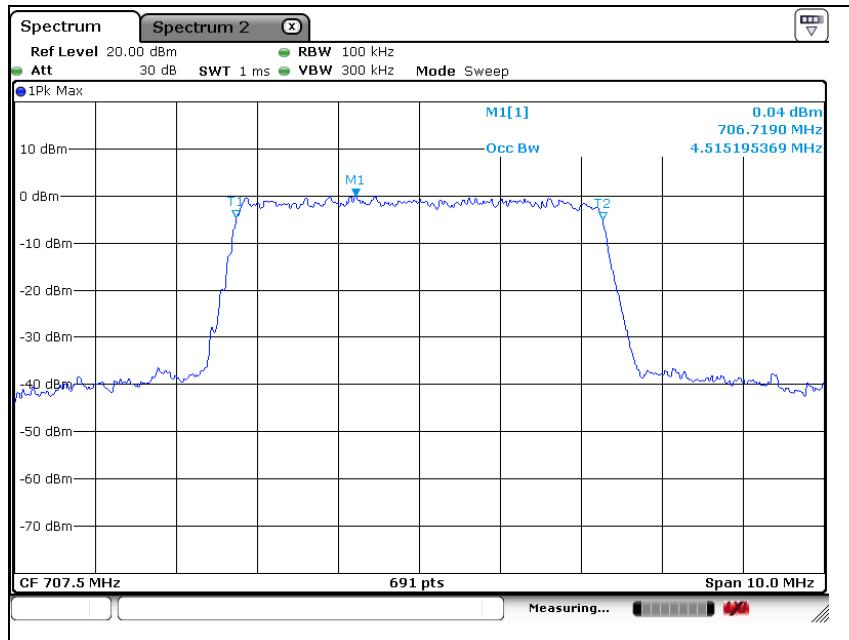
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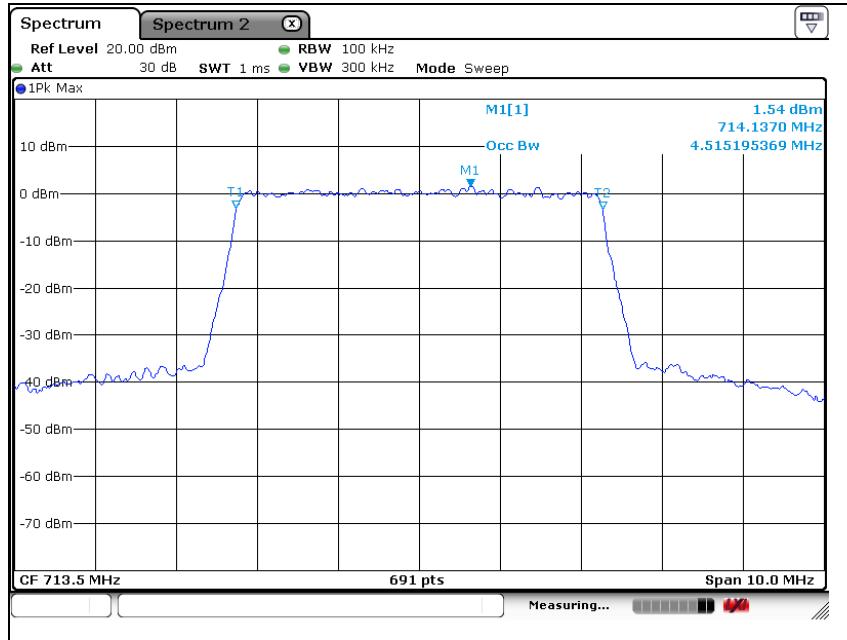
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 12 (5 MHz - QPSK)**Low Channel****Middle Channel**

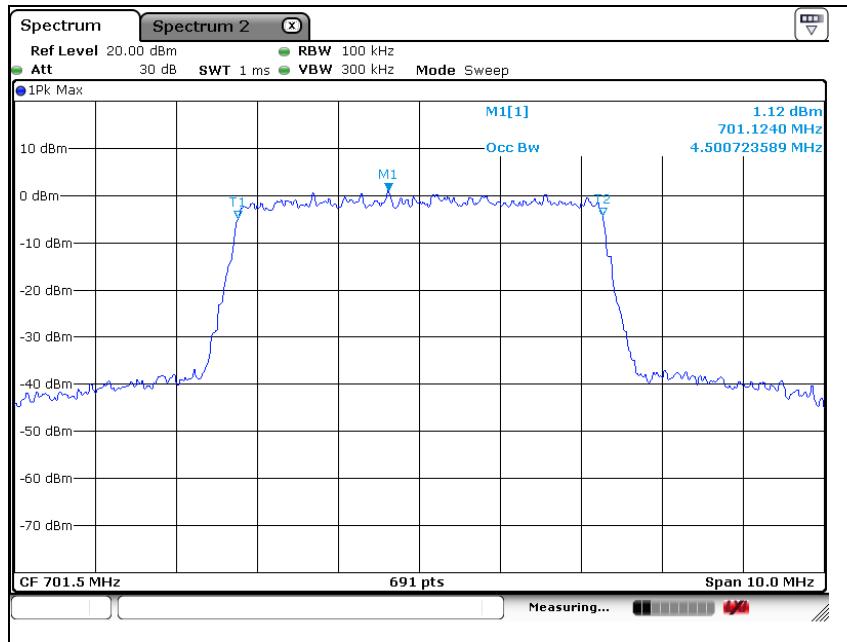
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High Channel



LTE band 12 (5 MHz - 16QAM)

Low Channel



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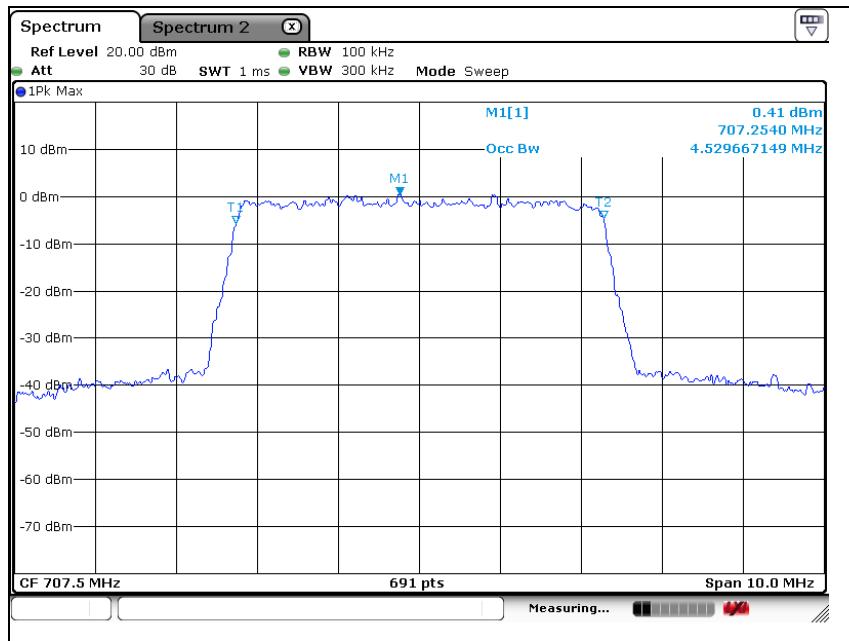
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RTT5041-19(2017.07.10)(0)

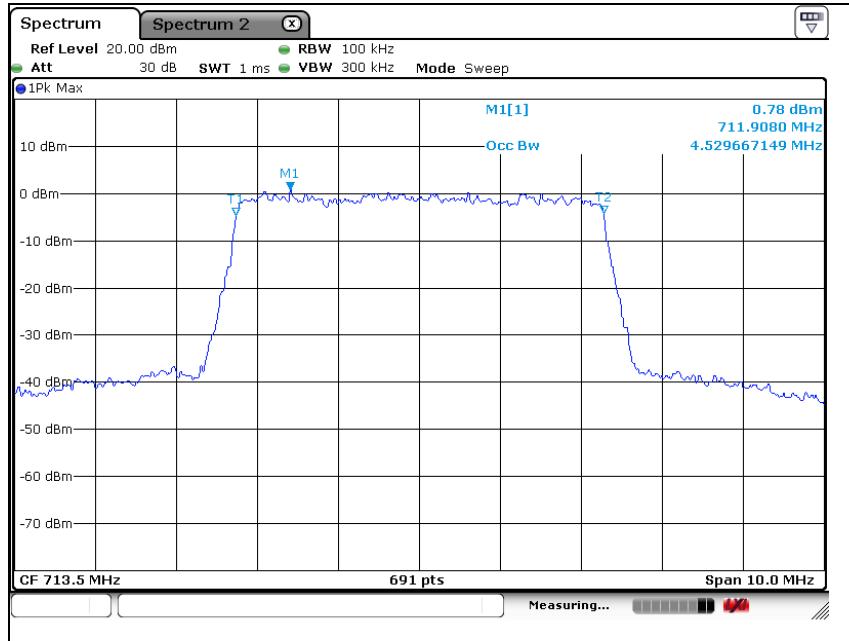
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



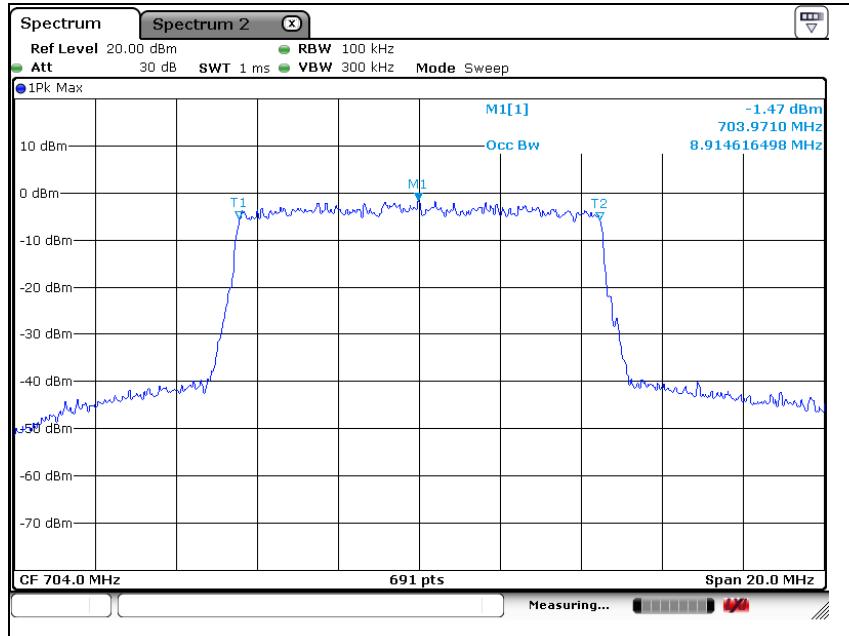
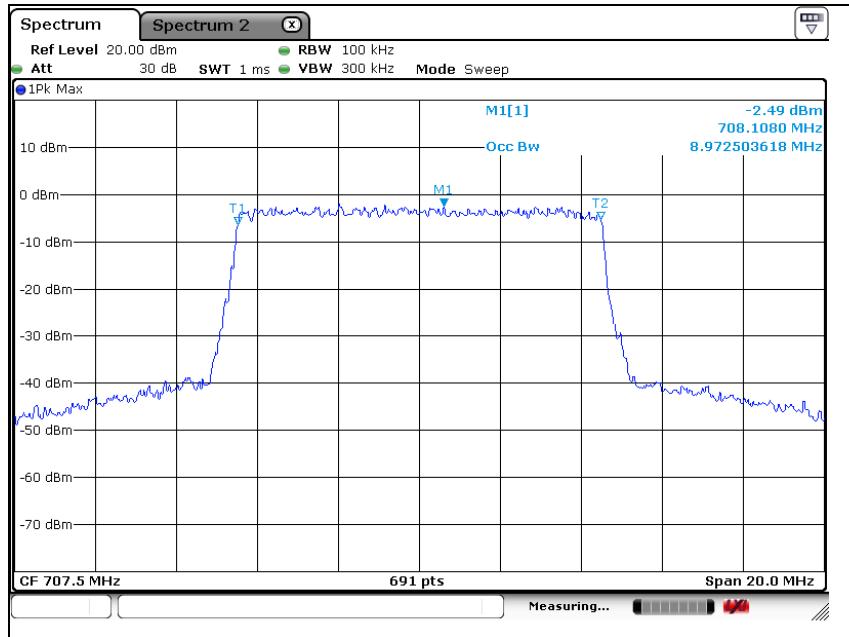
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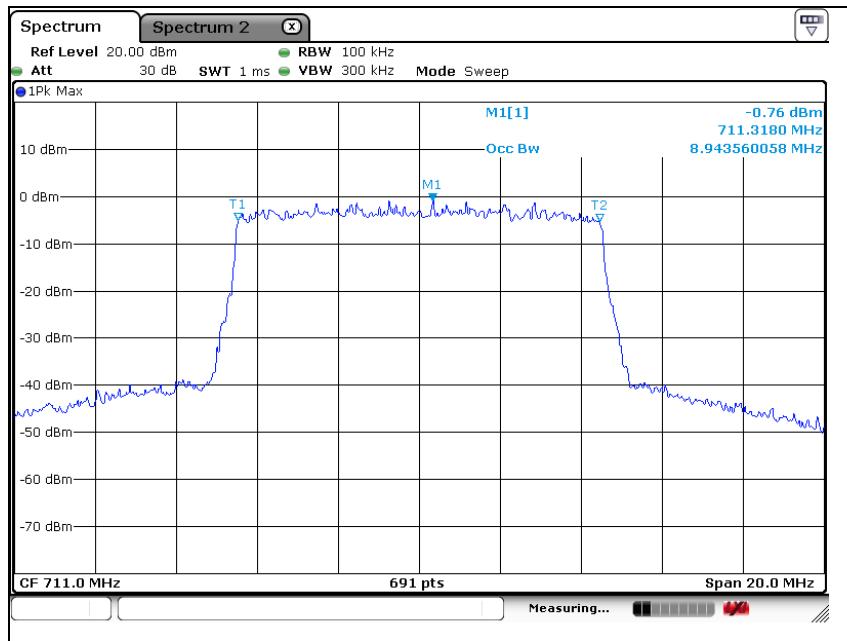
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 12 (10 MHz - QPSK)**Low Channel****Middle Channel**

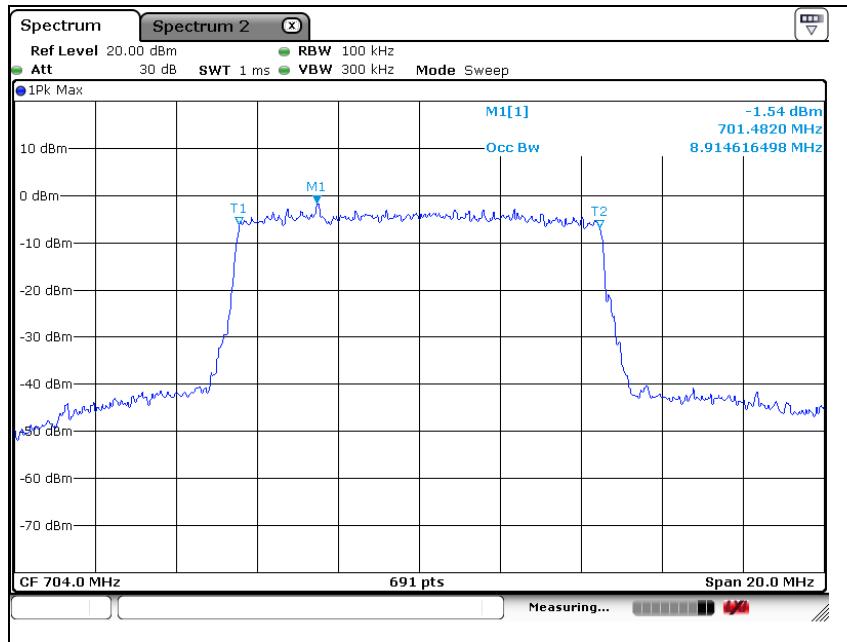
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High Channel



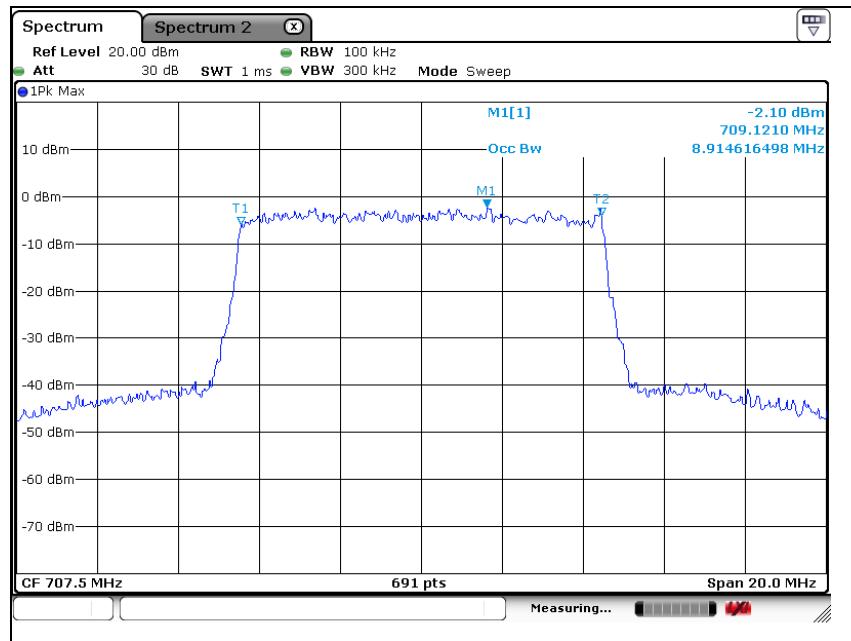
LTE band 12 (10 MHz - 16QAM)

Low Channel

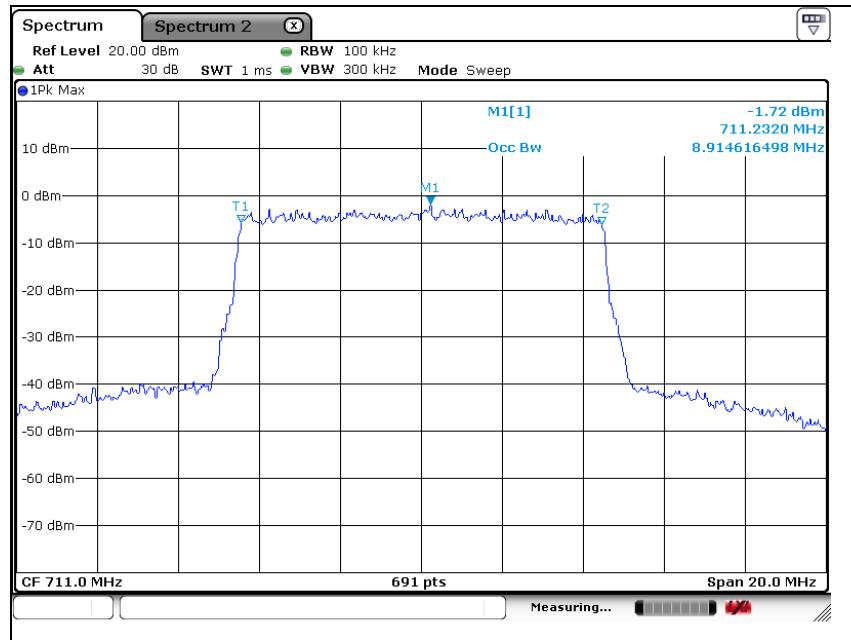


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Middle Channel



High Channel



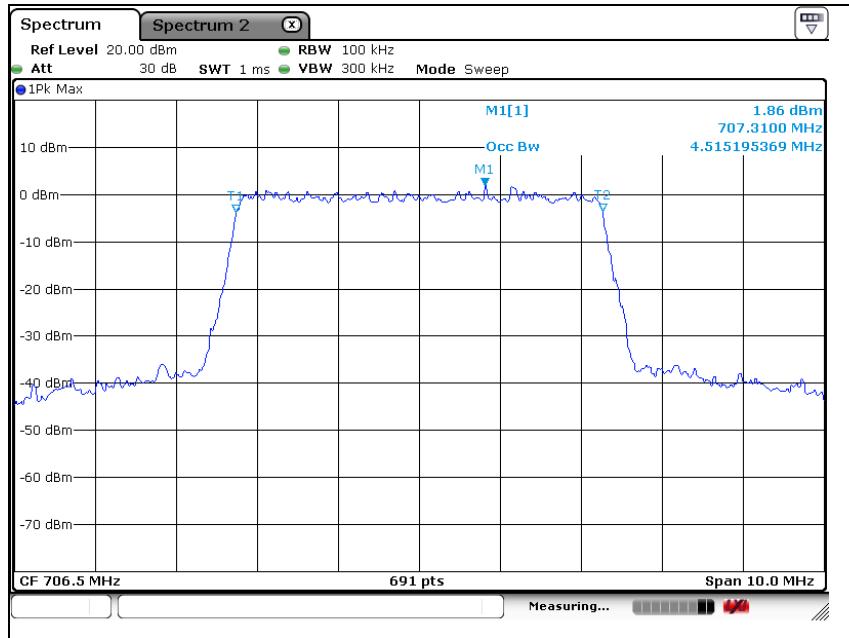
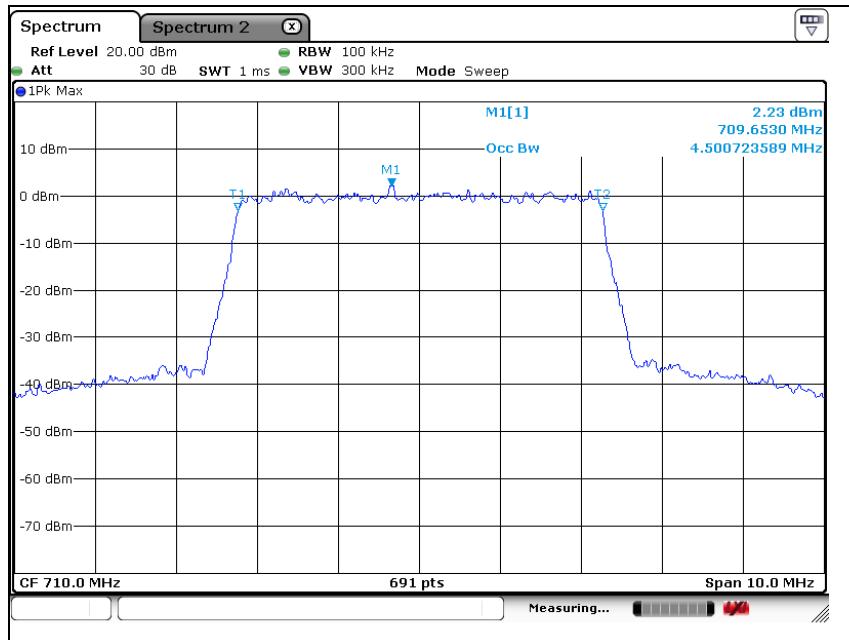
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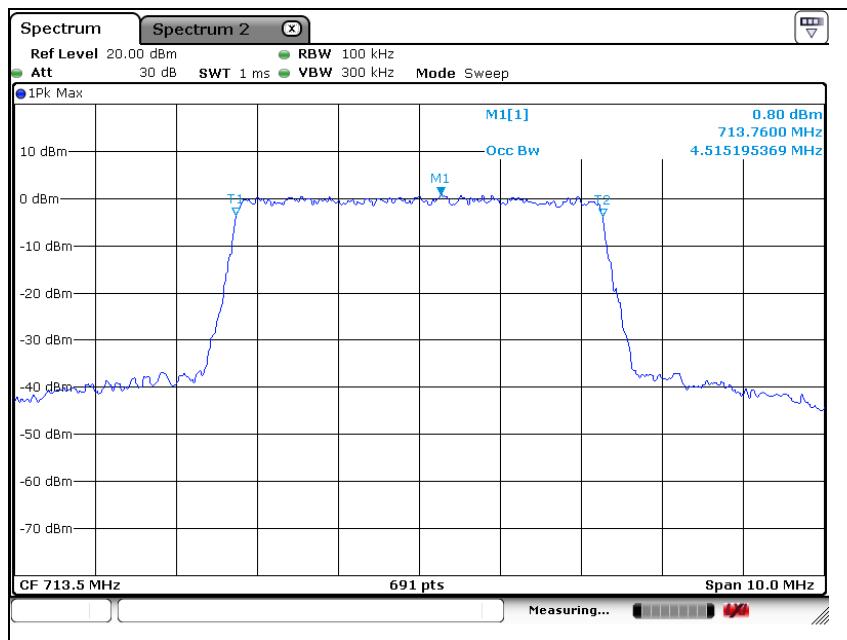
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 17 (5 MHz - QPSK)**Low Channel****Middle Channel**

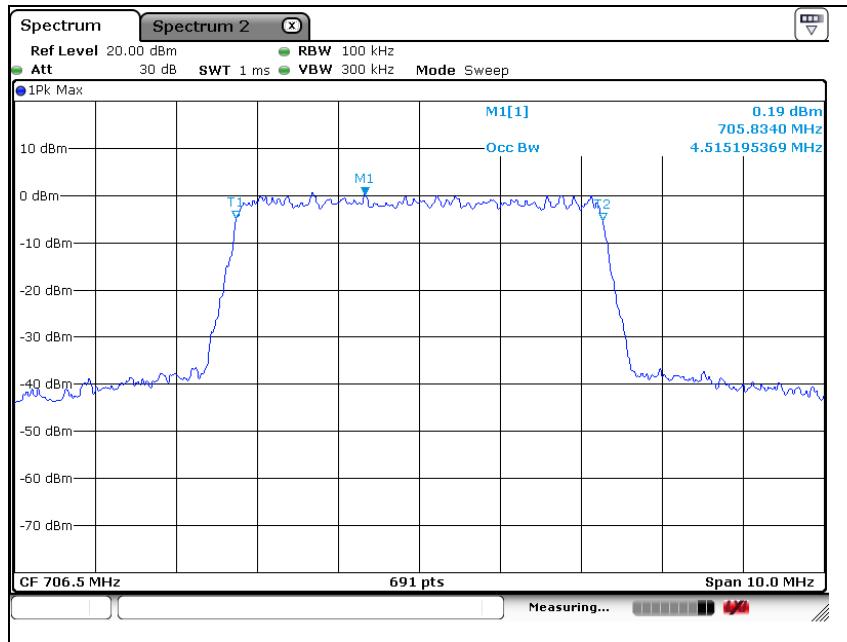
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

High Channel



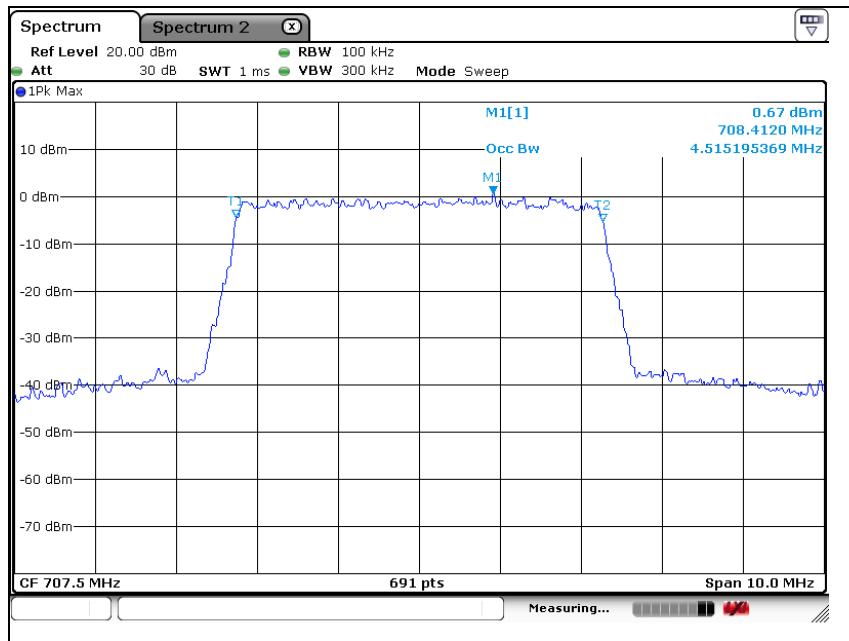
LTE band 17 (5 MHz - 16QAM)

Low Channel

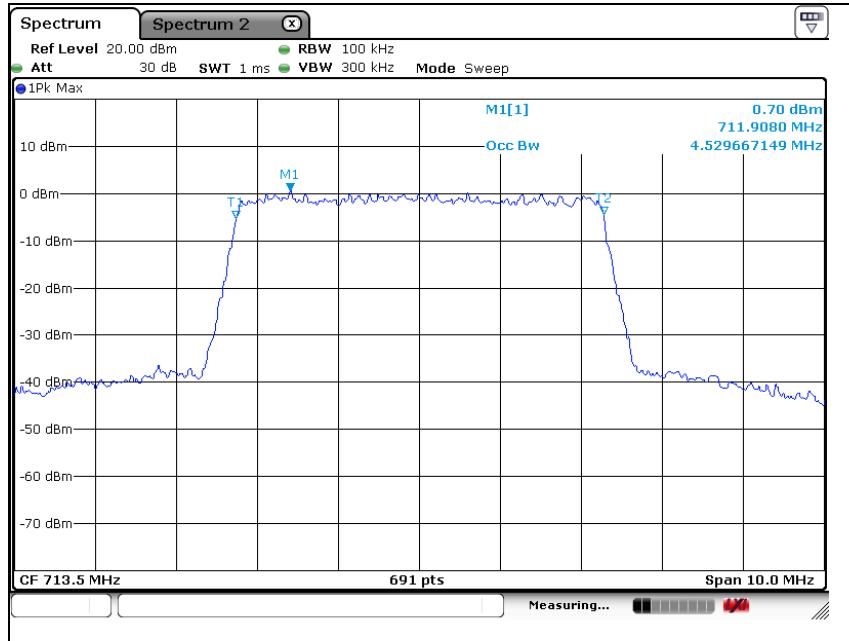


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Middle Channel



High Channel



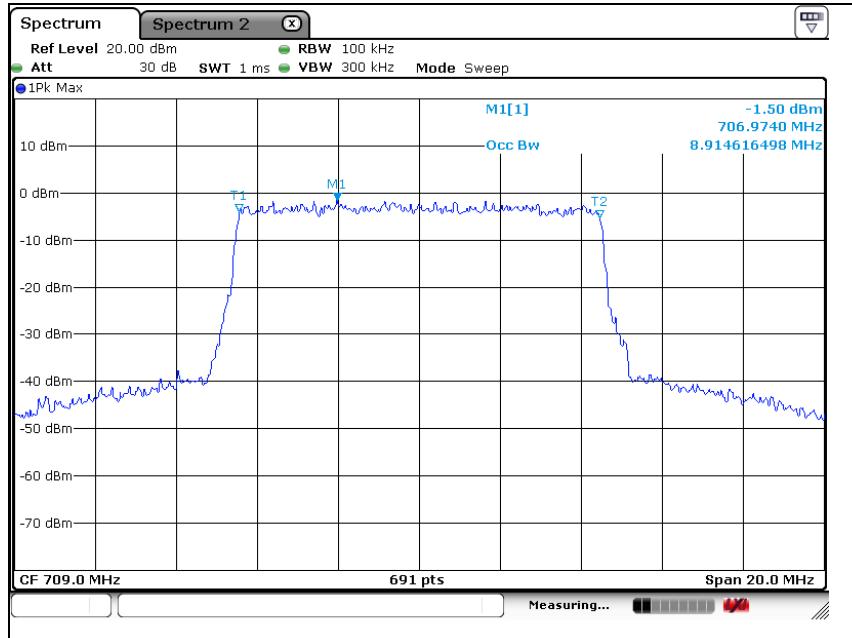
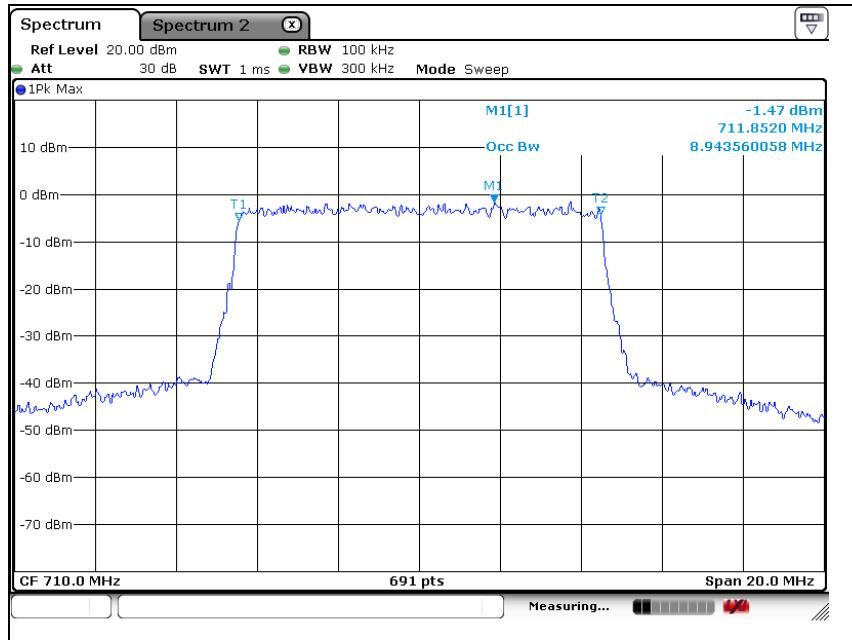
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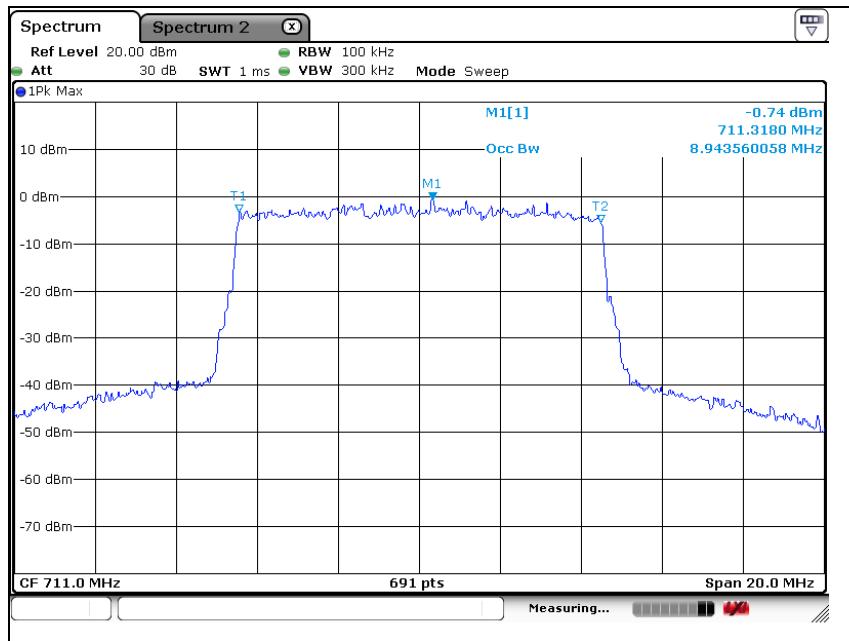
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 17 (10 MHz - QPSK)**Low Channel****Middle Channel**

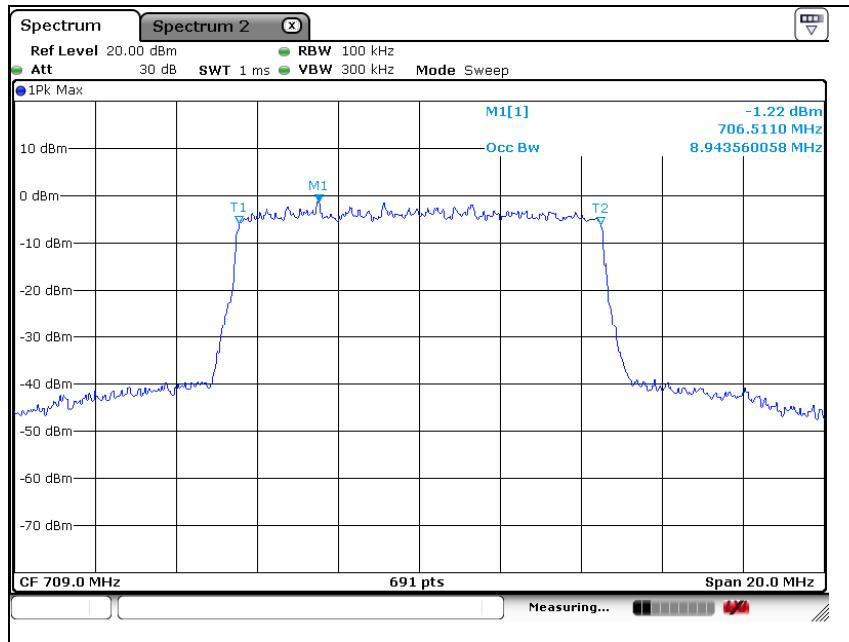
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

High Channel



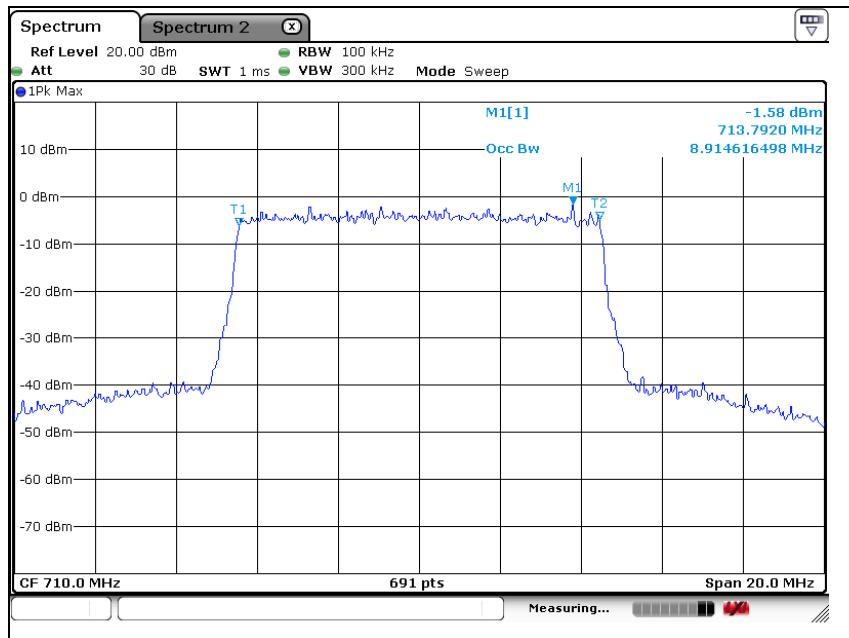
LTE band 17 (10 MHz - 16QAM)

Low Channel

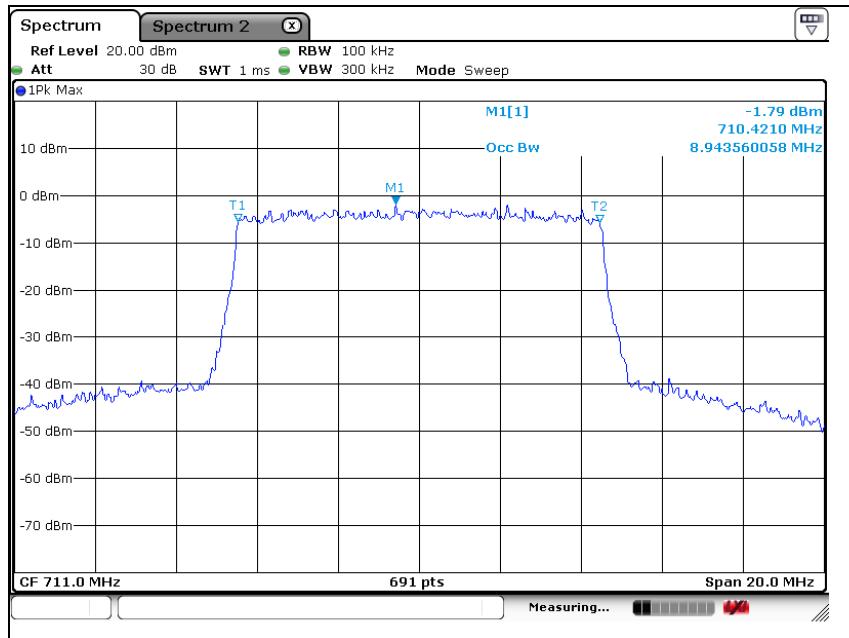


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Middle Channel



High Channel



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

A4(210 mm x 297 mm)

5. Peak-Average Ratio

5.1. Limit

FCC

- §22.913(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

- §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

IC

- RSS-130 Issue 1

4.4, 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.

- RSS-132 Issue 3

5.4, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1 % of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

- RSS-133 Issue 6

6.4, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1 % of the time using a signal that corresponds to the highest PAPR during periods of continuous transmission.

- RSS-139 Issue 3

6.5, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1 % of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

- RSS-199 Issue 3

4.4, 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.

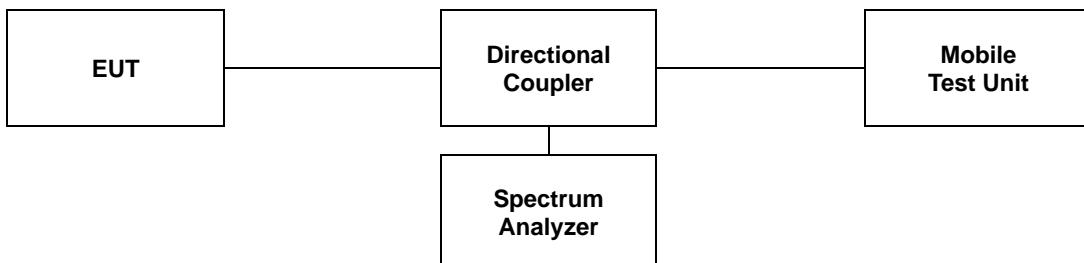
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5.2. Test Procedure

The test follows section 5.7.2 of FCC KDB Publication 971168 D01 v03r01.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

- a. Set resolution/measurement bandwidth \geq OBW or specified reference bandwidth.
- b. Set the number of counts to a value that stabilizes the measured CCDF curve.
- c. Set the measurement interval as follows:
 - 1) For continuous transmissions, set to greater of $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ or 1 ms.
 - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
 - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d. Record the maximum PAPR level associated with a probability of 0.1 %.
- e. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.



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5.3 Test Results

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

- LTE

Band	Mode	Frequency (MHz)	PAR (dB)
2 (1.4 MHz)	QPSK	1 850.7	4.81
		1 880.0	4.87
		1 909.3	4.41
2 (3 MHz)	QPSK	1 851.5	4.81
		1 880.0	4.72
		1 908.5	4.38
2 (5 MHz)	QPSK	1 852.5	4.90
		1 880.0	4.72
		1 907.5	4.49
2 (10 MHz)	QPSK	1 855.0	4.87
		1 880.0	4.64
		1 905.0	4.43
2 (15 MHz)	QPSK	1 857.5	5.28
		1 880.0	4.84
		1 902.5	4.70
2 (20 MHz)	QPSK	1 860.0	4.90
		1 880.0	4.67
		1 900.0	4.58

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Band	Mode	Frequency (MHz)	PAR (dB)
4 (1.4 MHz)	QPSK	1 710.7	5.07
		1 732.5	4.96
		1 754.3	5.16
4 (3 MHz)	QPSK	1 711.5	4.93
		1 732.5	4.81
		1 753.5	5.04
4 (5 MHz)	QPSK	1 712.5	5.07
		1 732.5	4.90
		1 752.5	4.99
4 (10 MHz)	QPSK	1 715.0	4.93
		1 732.5	4.72
		1 750.0	4.96
4 (15 MHz)	QPSK	1 717.5	5.19
		1 732.5	5.04
		1 747.5	5.25
4 (20 MHz)	QPSK	1 720.0	4.87
		1 732.5	4.78
		1 745.0	4.96

Band	Mode	Frequency (MHz)	PAR (dB)
5 (1.4 MHz)	QPSK	824.7	4.78
		836.5	5.01
		848.3	5.07
5 (3 MHz)	QPSK	825.5	4.75
		836.5	4.81
		847.5	5.01
5 (5 MHz)	QPSK	826.5	4.75
		836.5	4.90
		846.5	4.90
5 (10 MHz)	QPSK	829.0	4.90
		836.5	4.93
		844.0	4.78

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Band	Mode	Frequency (MHz)	PAR (dB)
7 (5 MHz)	QPSK	2 502.5	4.70
		2 535.0	4.93
		2 567.5	4.64
7 (10 MHz)	QPSK	2 505.0	4.64
		2 535.0	4.84
		2 565.0	4.64
7 (15 MHz)	QPSK	2 507.5	4.96
		2 535.0	5.16
		2 562.5	4.96
7 (20 MHz)	QPSK	2 510.0	4.75
		2 535.0	4.81
		2 560.0	4.70

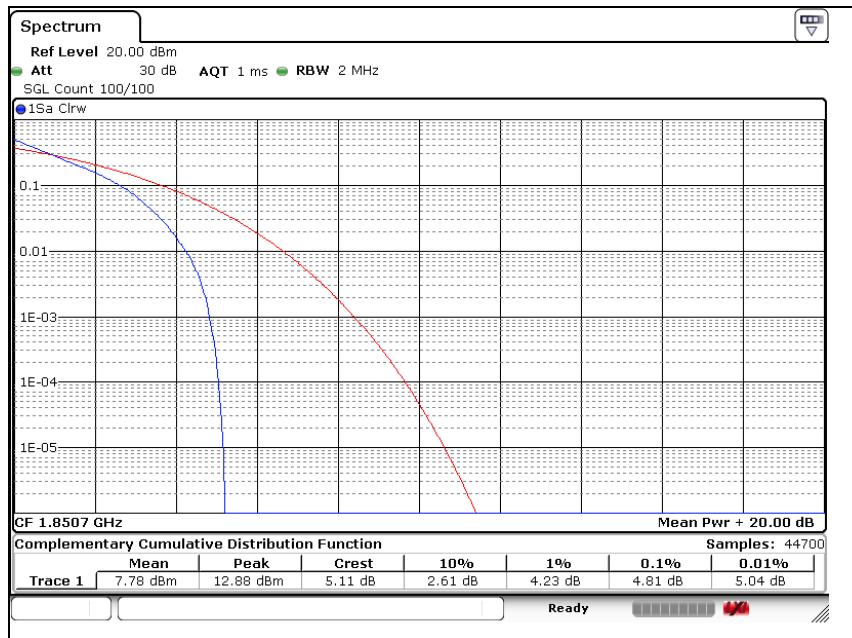
Band	Mode	Frequency (MHz)	PAR (dB)
12 (1.4 MHz)	QPSK	699.7	5.16
		707.5	5.22
		715.3	5.01
12 (3 MHz)	QPSK	700.5	4.99
		707.5	5.13
		714.5	4.87
12 (5 MHz)	QPSK	701.5	5.01
		707.5	5.10
		713.5	4.93
12 (10 MHz)	QPSK	704.0	5.04
		707.5	5.04
		711.0	5.13

Band	Mode	Frequency (MHz)	PAR (dB)
17 (5 MHz)	QPSK	706.5	5.04
		710.0	5.16
		713.5	4.99
17 (10 MHz)	QPSK	709.0	5.07
		710.0	4.99
		711.0	5.10

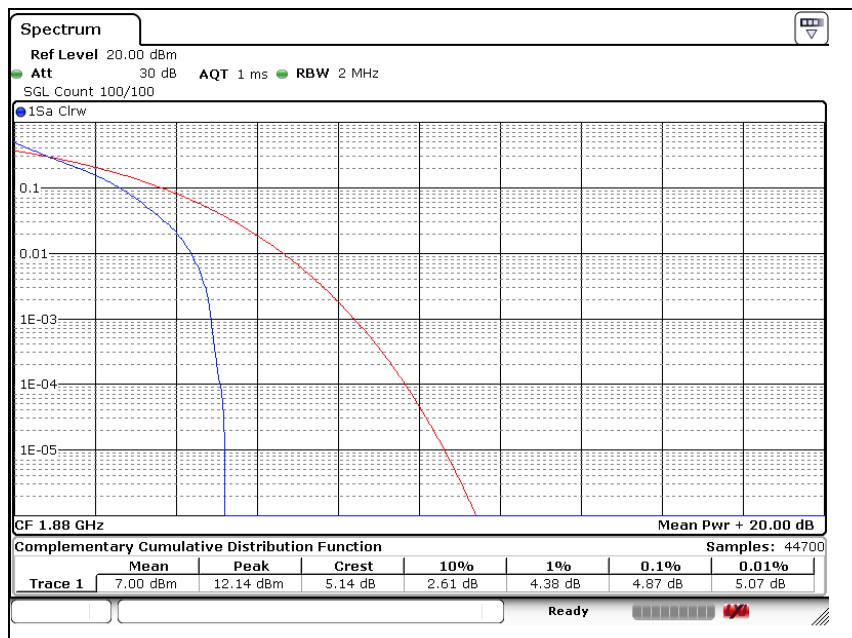
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LTE band 2 (1.4 MHz - QPSK)

Low Channel

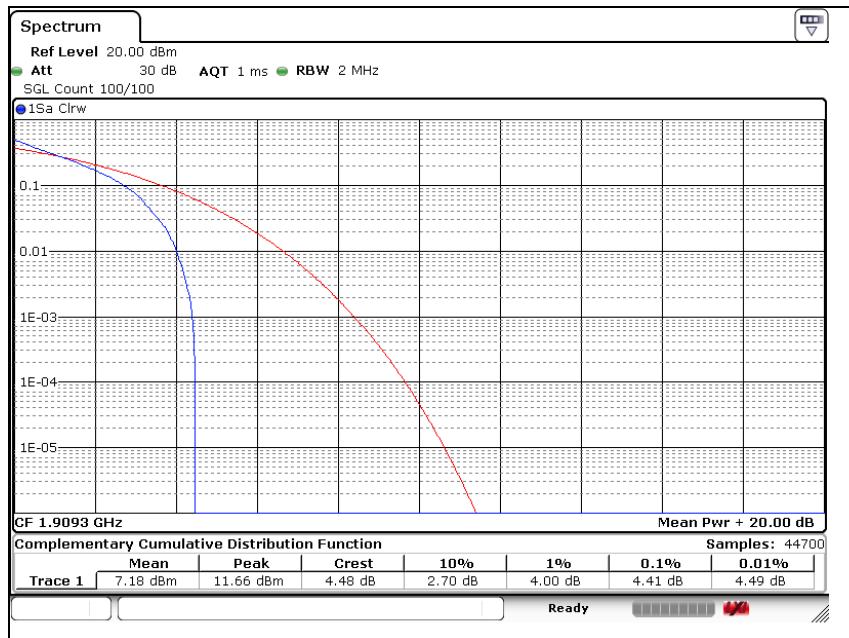


Middle Channel



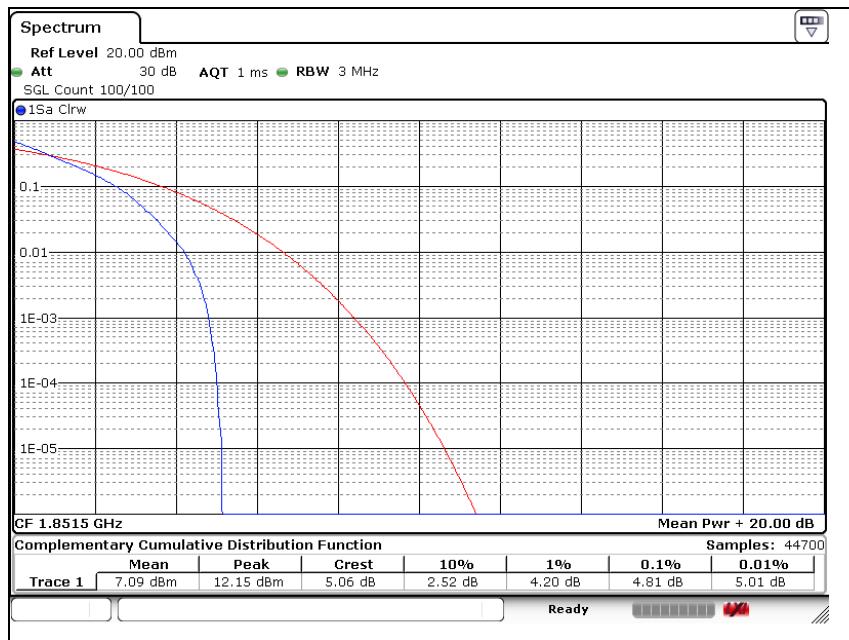
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High Channel



LTE band 2 (3 MHz - QPSK)

Low Channel



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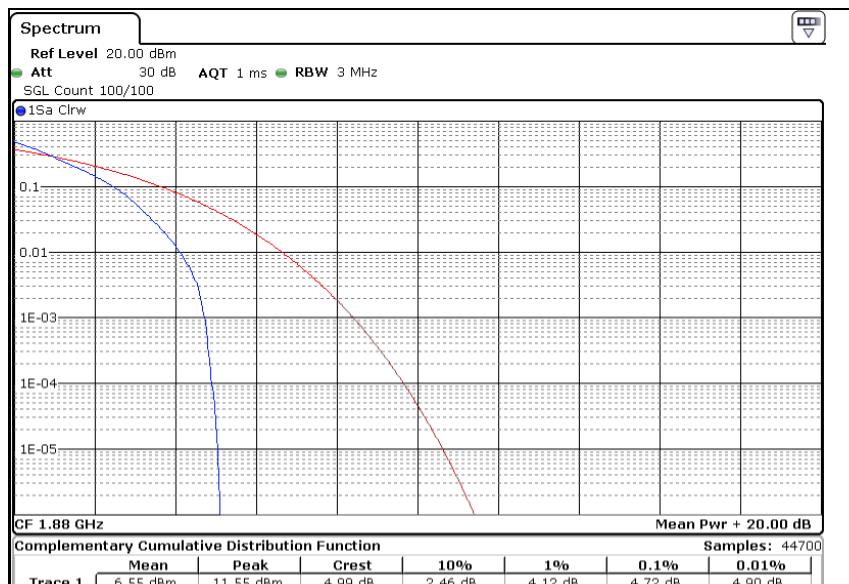
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RTT5041-19(2017.07.10)(0)

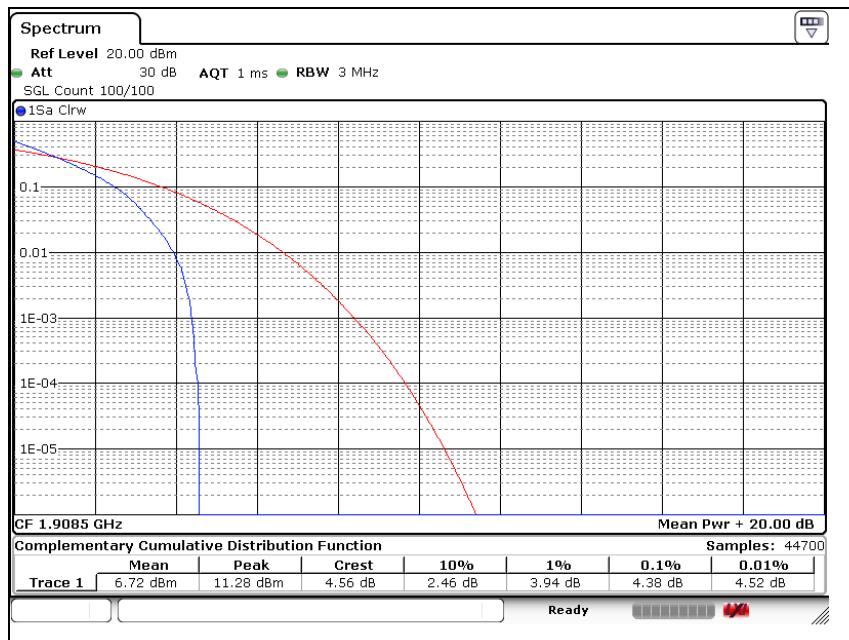
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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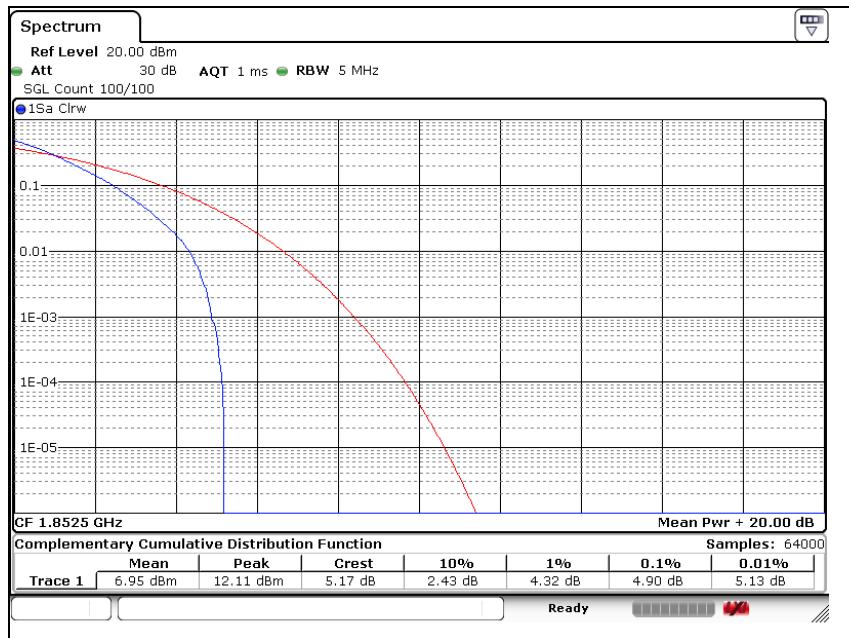
RTT5041-19(2017.07.10)(0)

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

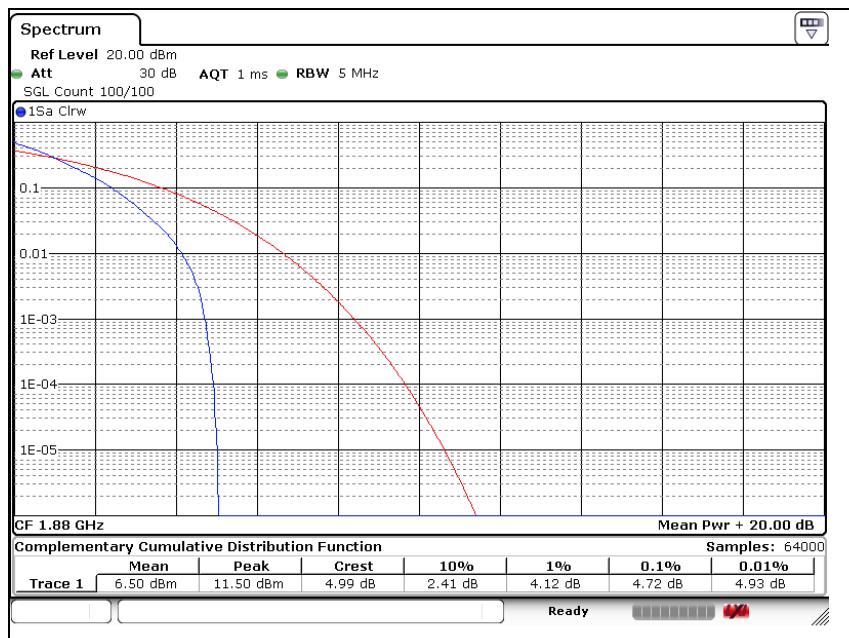
A4(210 mm x 297 mm)

LTE band 2 (5 MHz - QPSK)

Low Channel

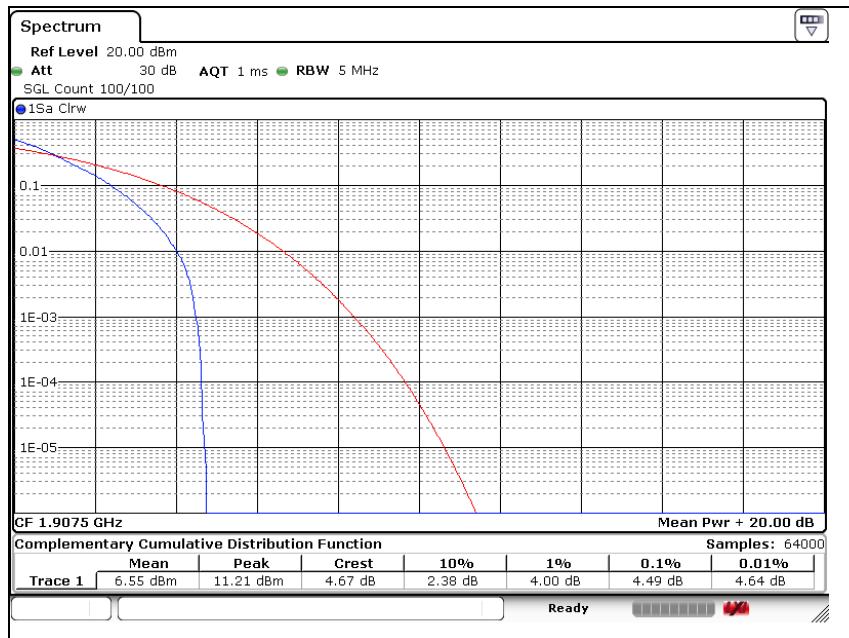


Middle Channel



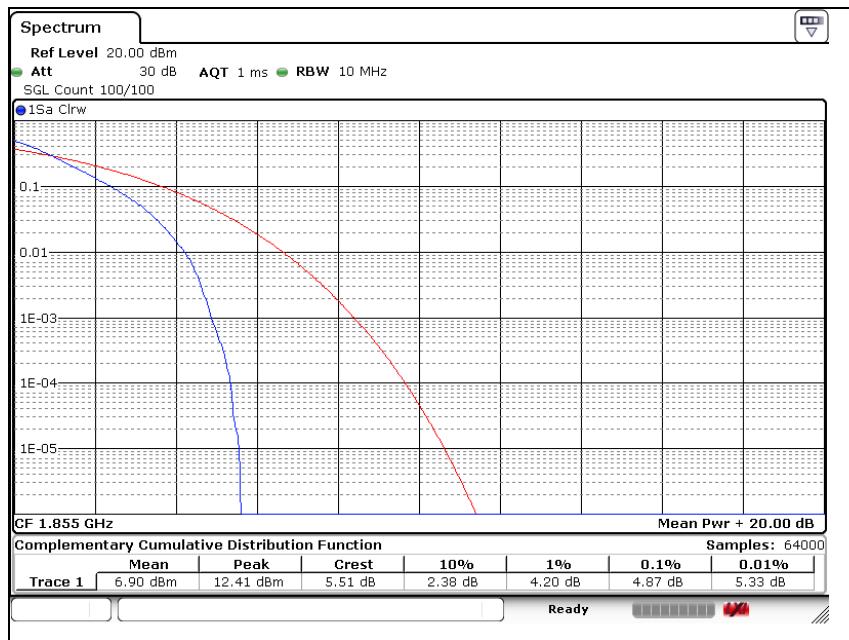
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High Channel



LTE band 2 (10 MHz - QPSK)

Low Channel



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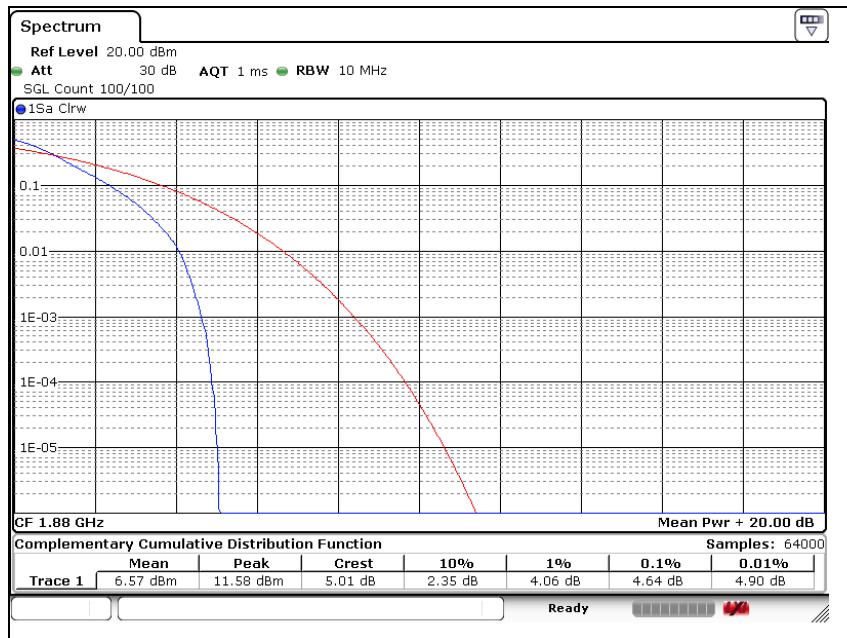
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RTT5041-19(2017.07.10)(0)

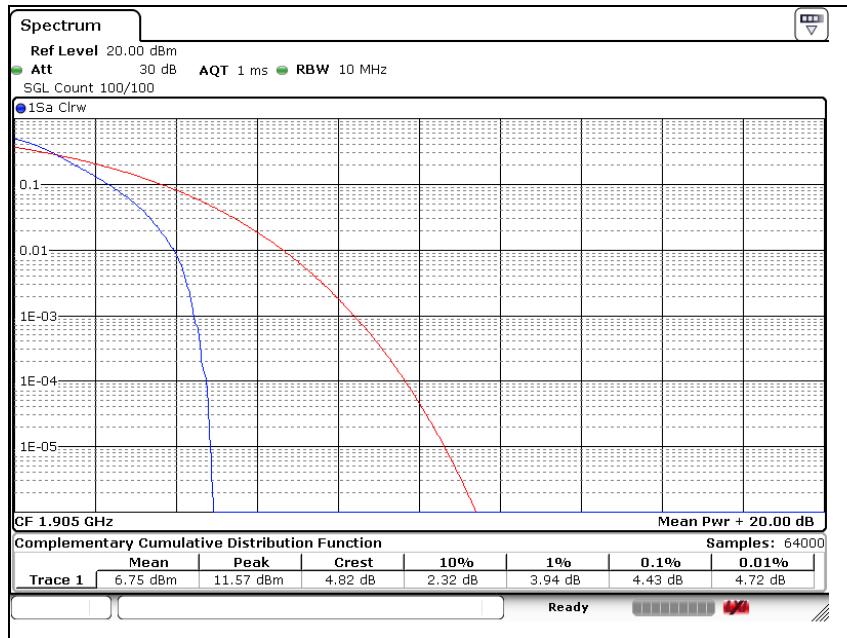
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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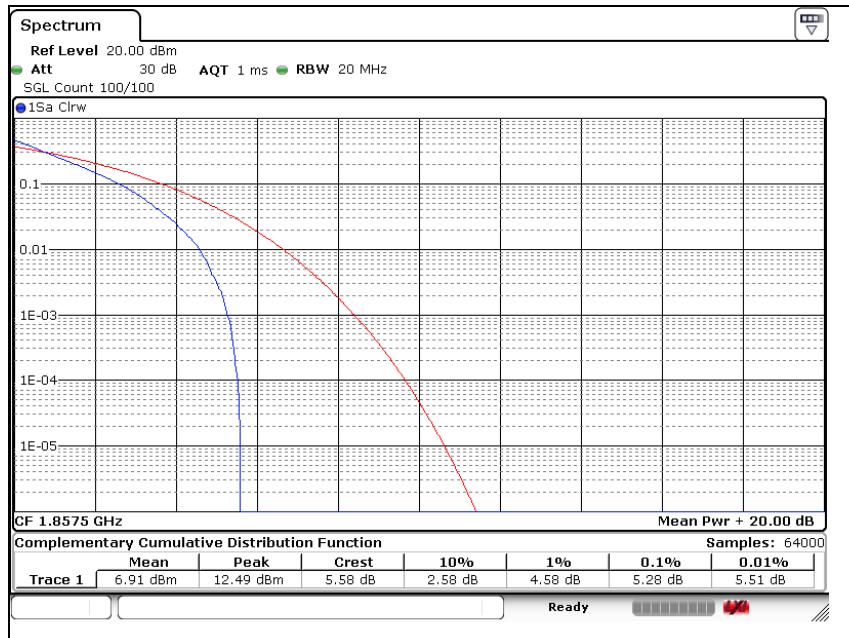
RTT5041-19(2017.07.10)(0)

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

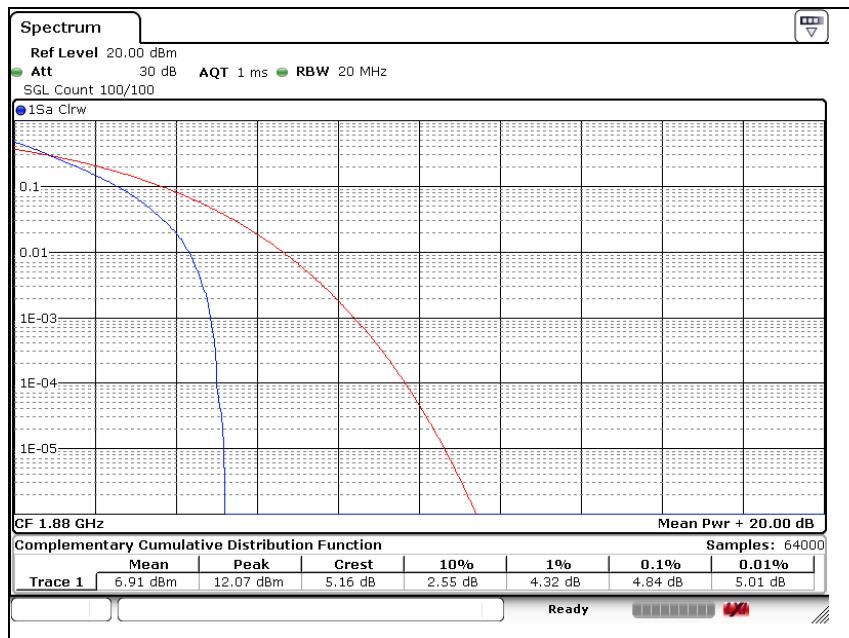
A4(210 mm x 297 mm)

LTE band 2 (15 MHz - QPSK)

Low Channel



Middle Channel



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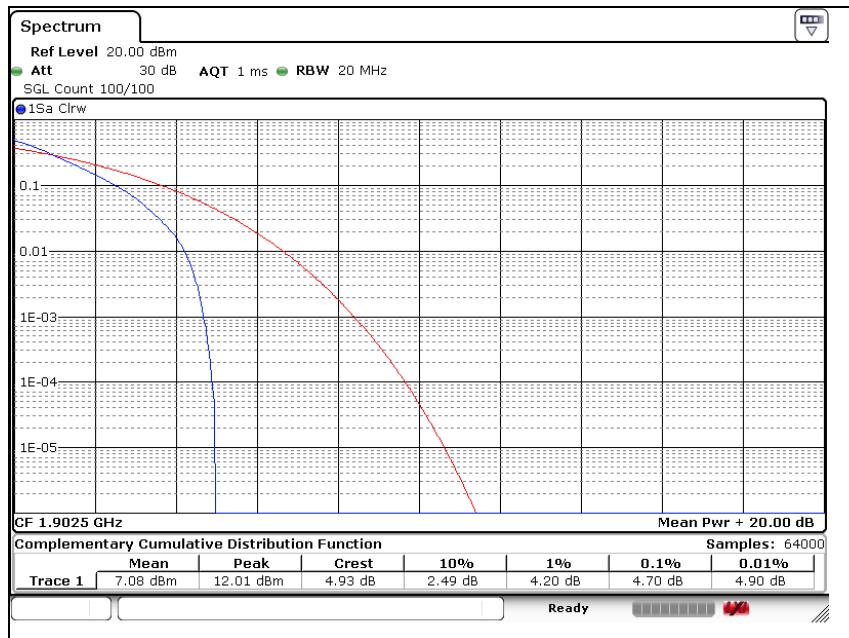
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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

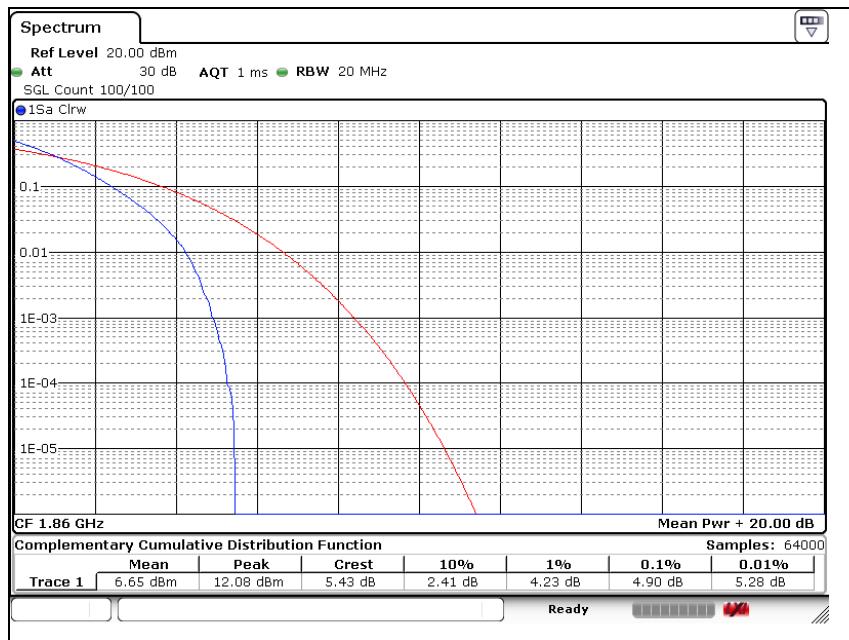
A4(210 mm x 297 mm)

High Channel



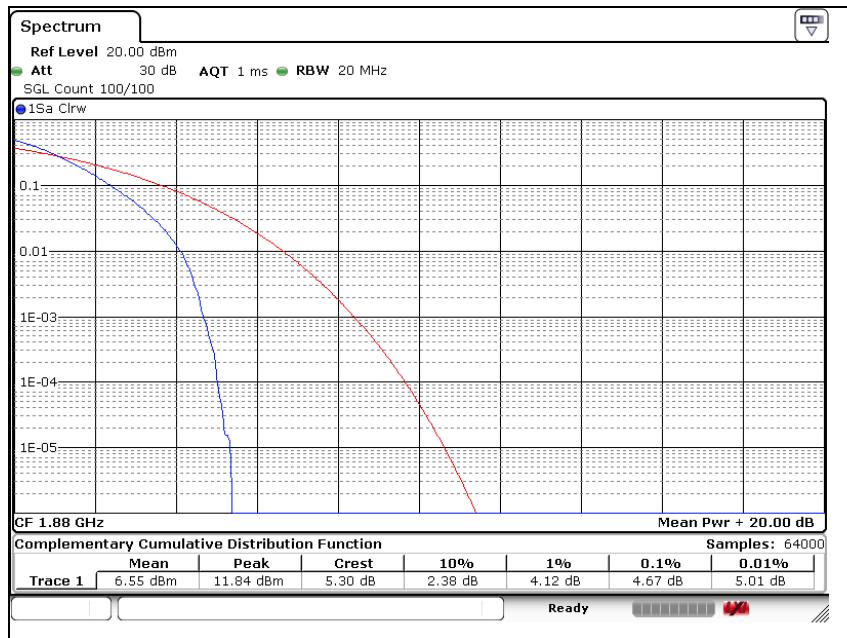
LTE band 2 (20 MHz - QPSK)

Low Channel

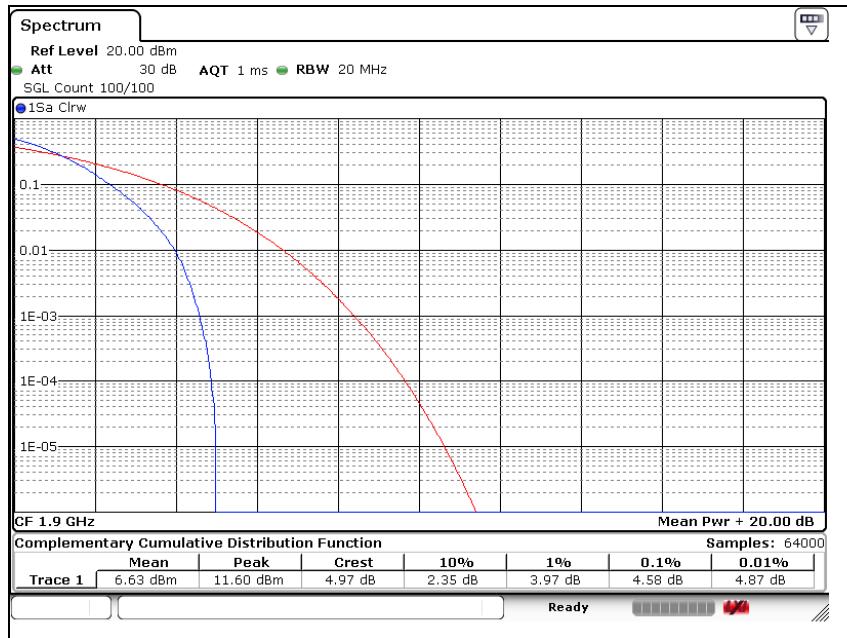


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Middle Channel



High Channel



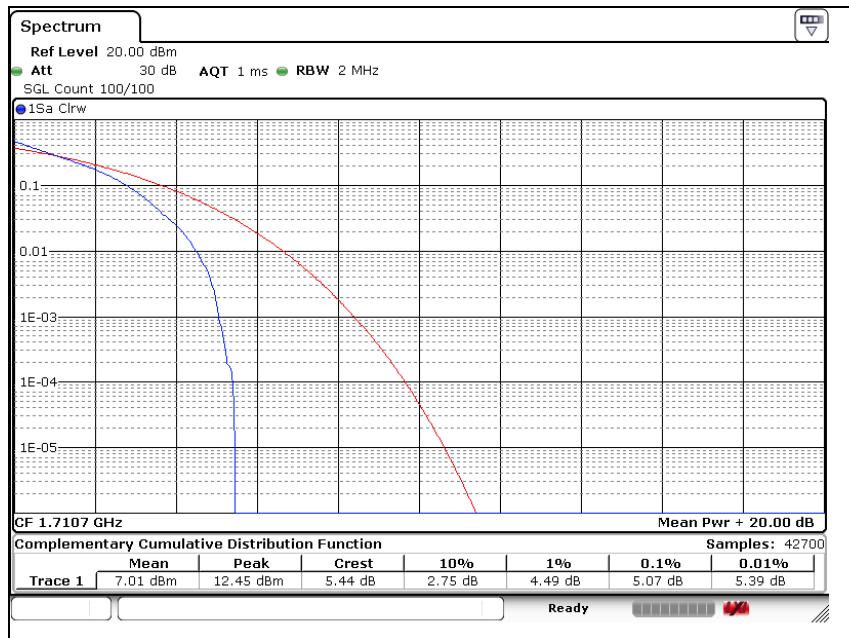
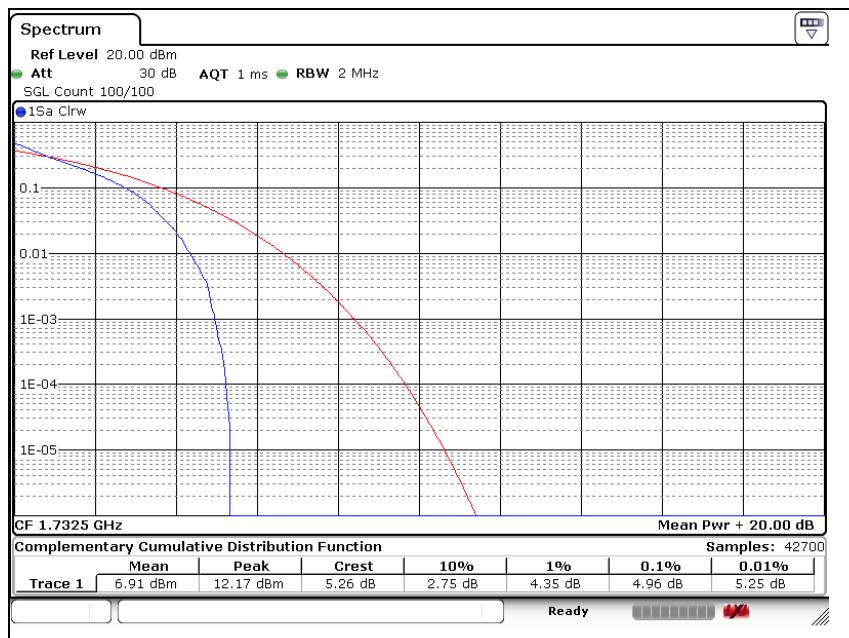
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RTT5041-19(2017.07.10)(0)

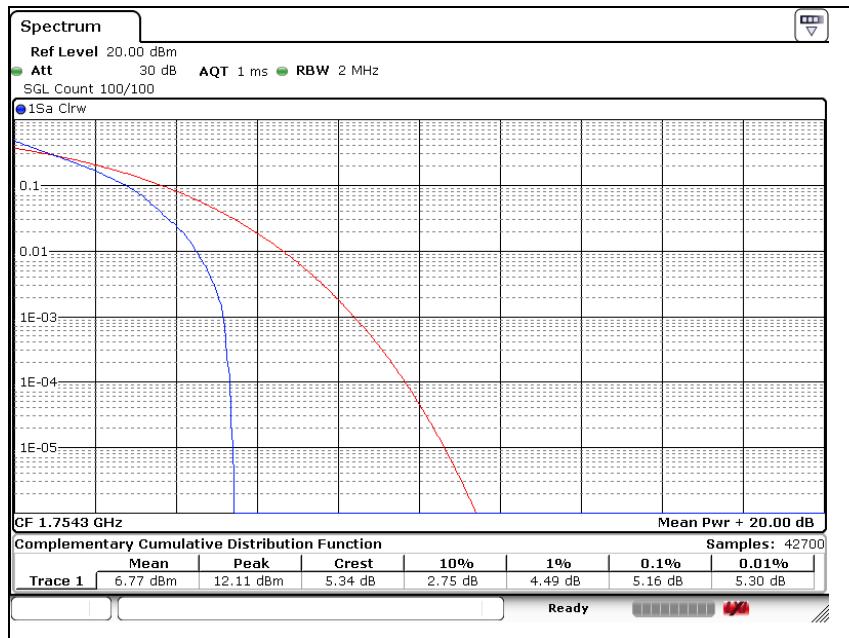
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 4 (1.4 MHz - QPSK)**Low Channel****Middle Channel**

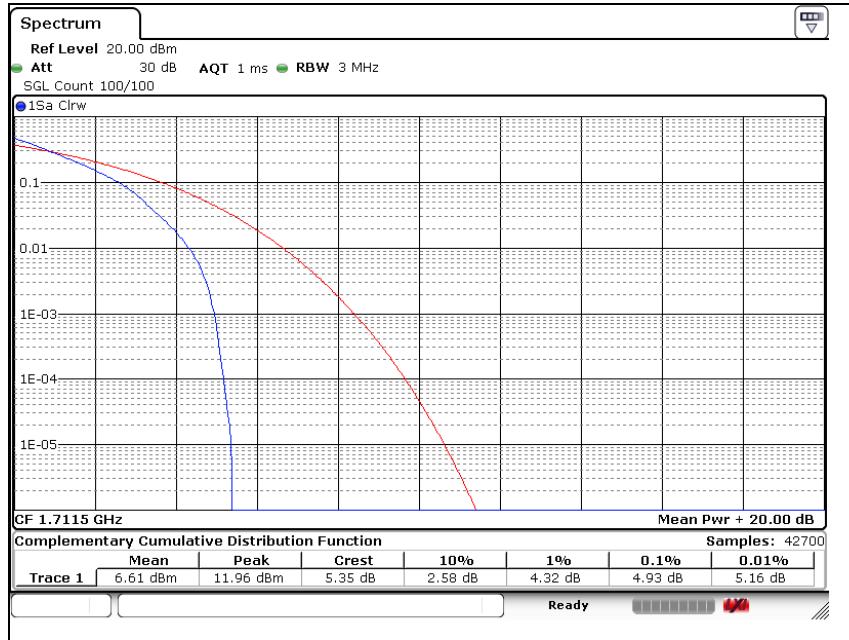
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High Channel



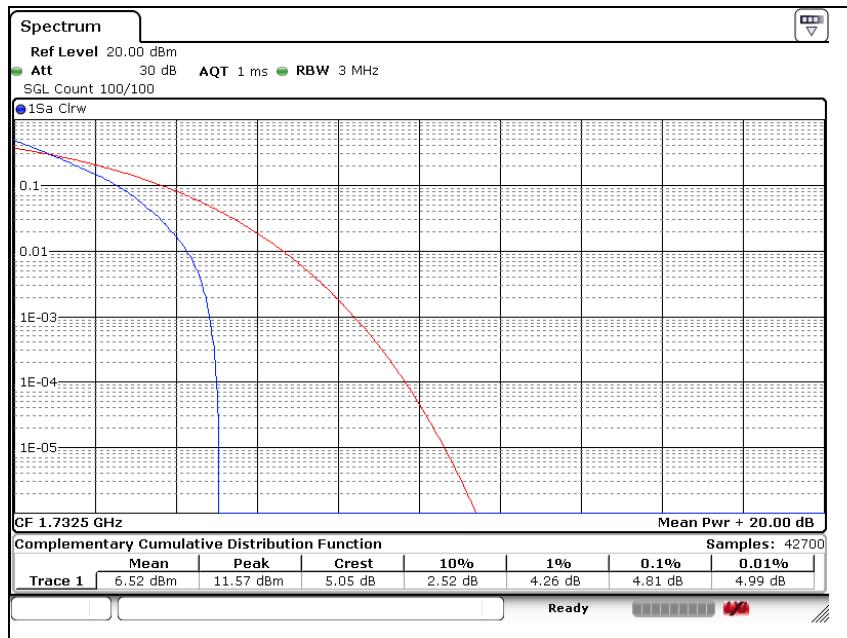
LTE band 4 (3 MHz - QPSK)

Low Channel

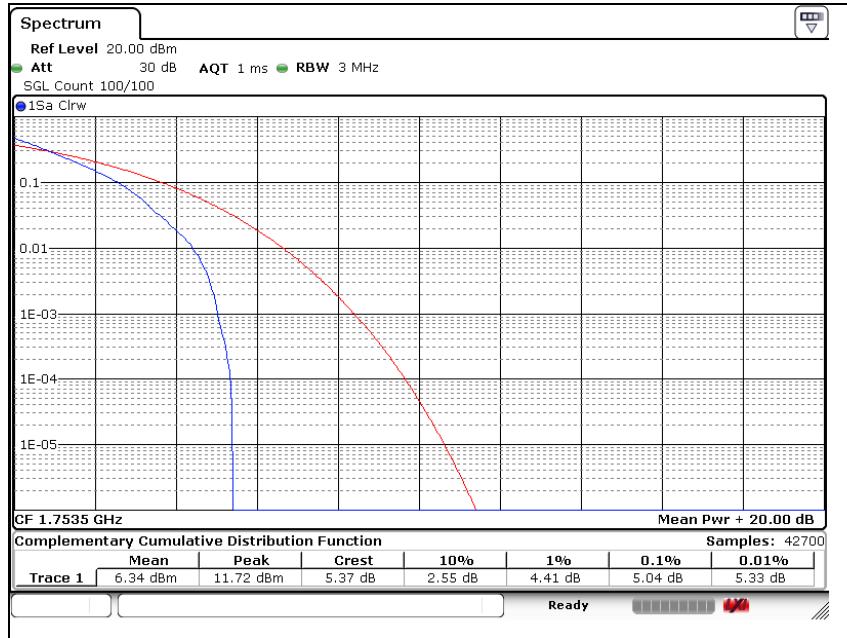


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Middle Channel



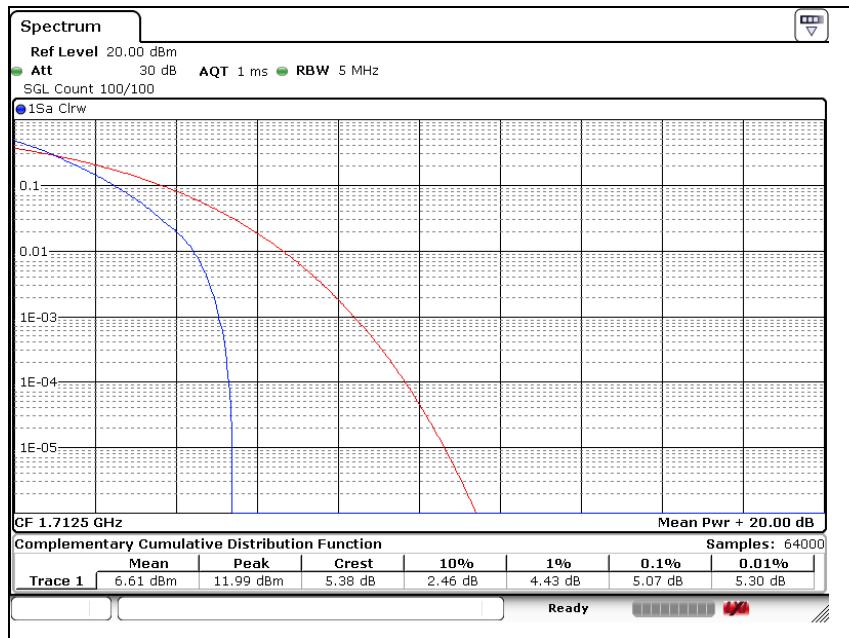
High Channel



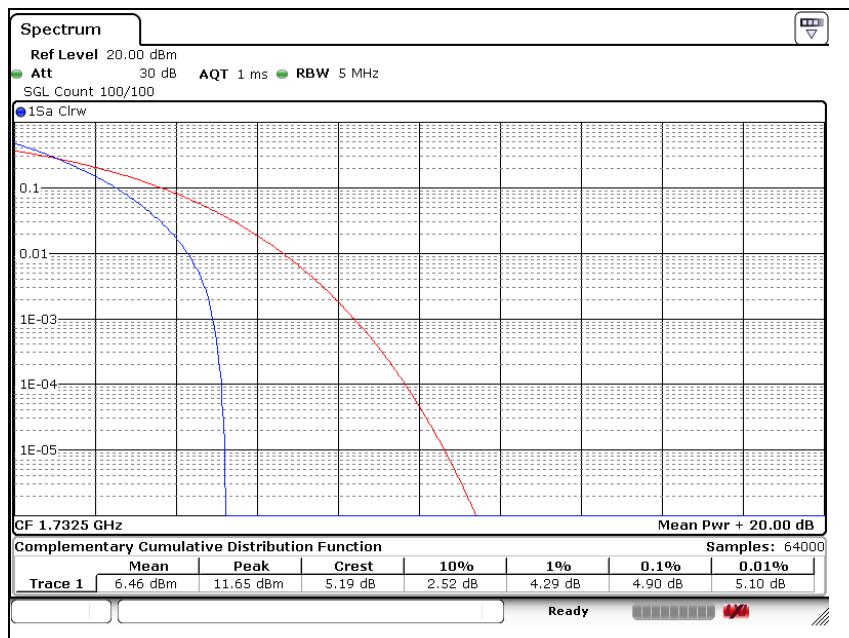
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LTE band 4 (5 MHz - QPSK)

Low Channel

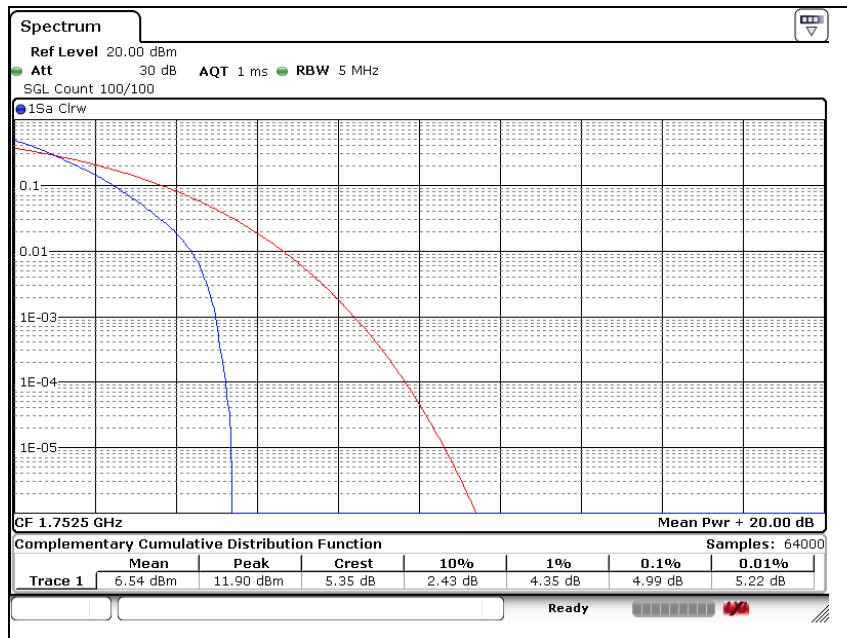


Middle Channel



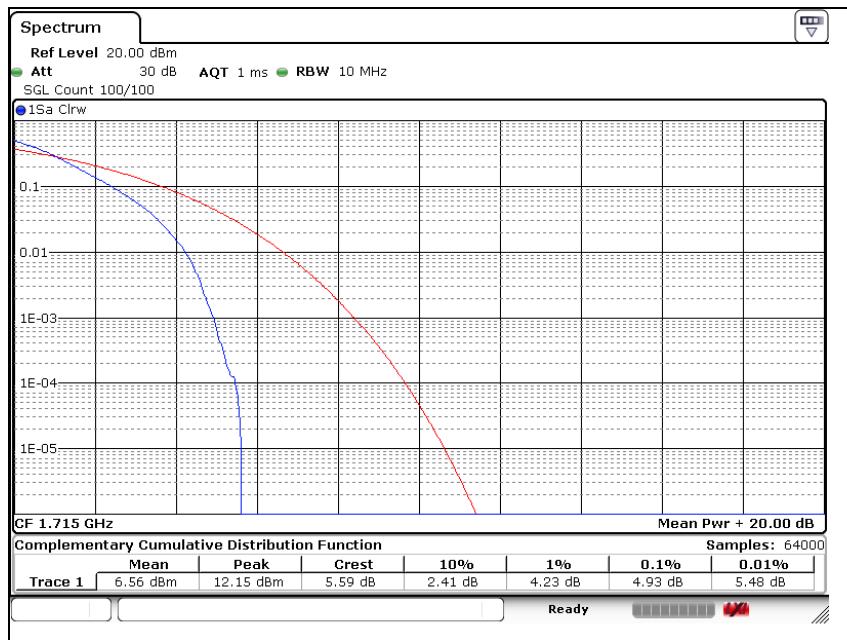
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High Channel



LTE band 4 (10 MHz - QPSK)

Low Channel



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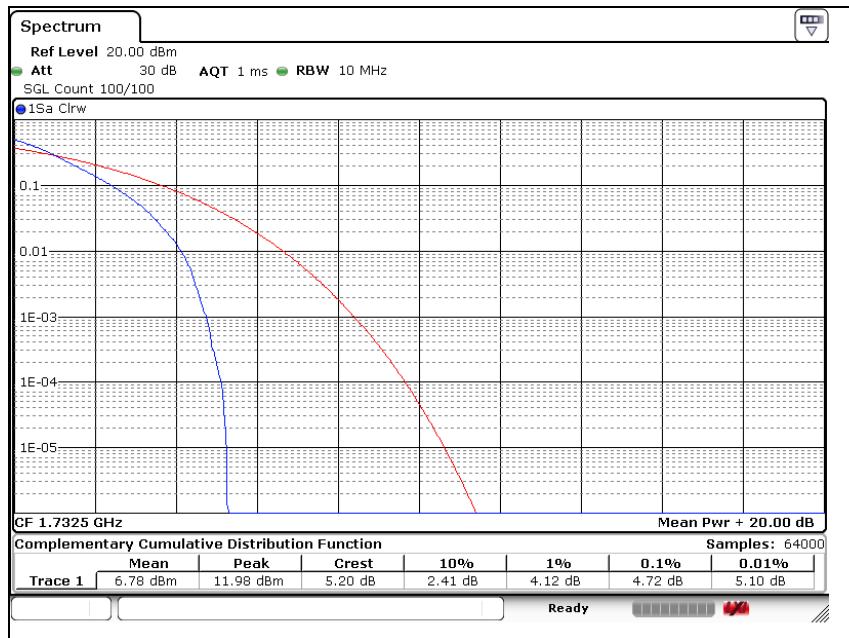
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RTT5041-19(2017.07.10)(0)

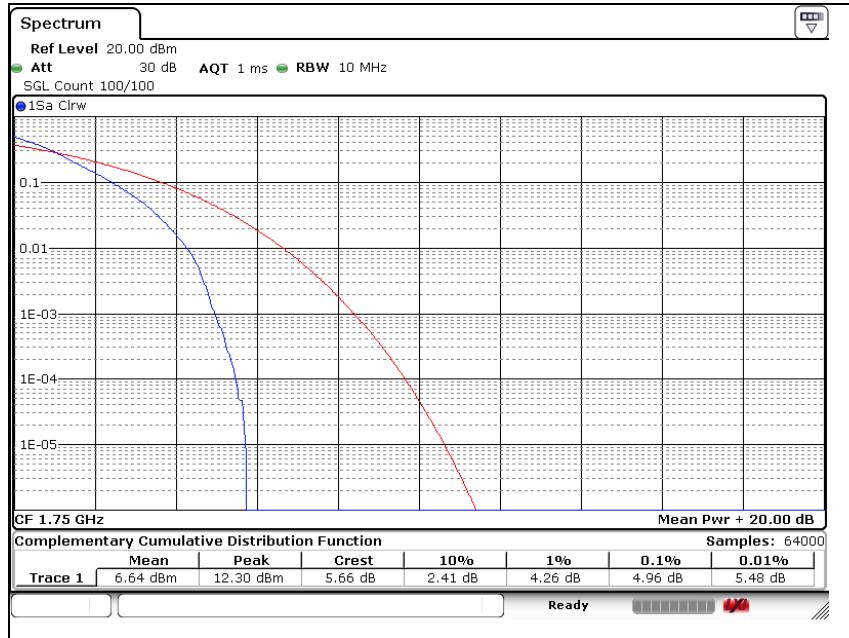
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A4(210 mm x 297 mm)

Middle Channel



High Channel



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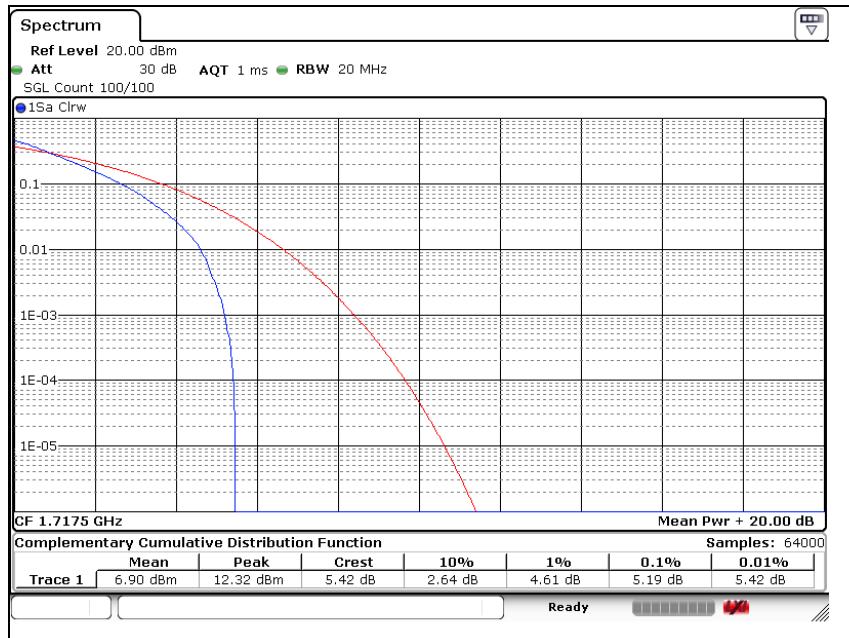
RTT5041-19(2017.07.10)(0)

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

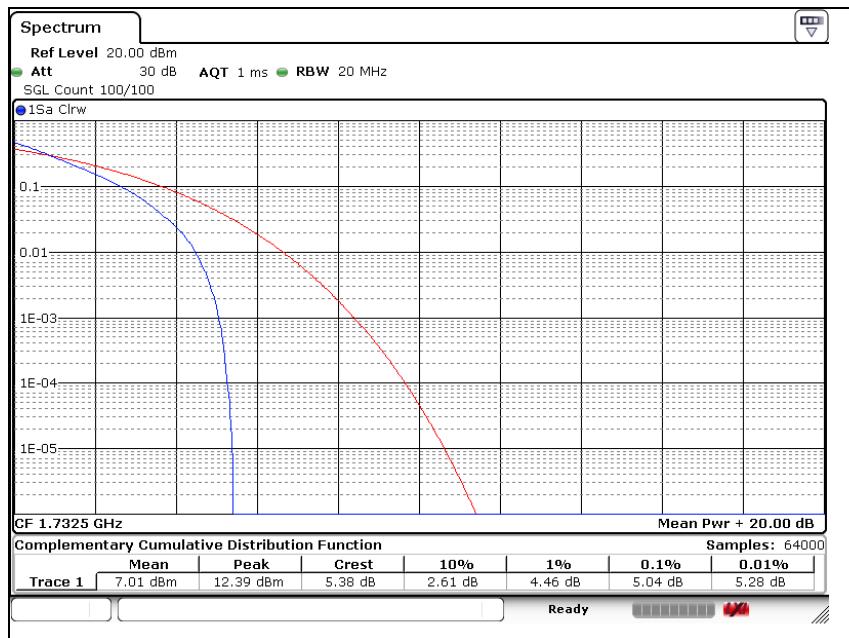
A4(210 mm x 297 mm)

LTE band 4 (15 MHz - QPSK)

Low Channel



Middle Channel



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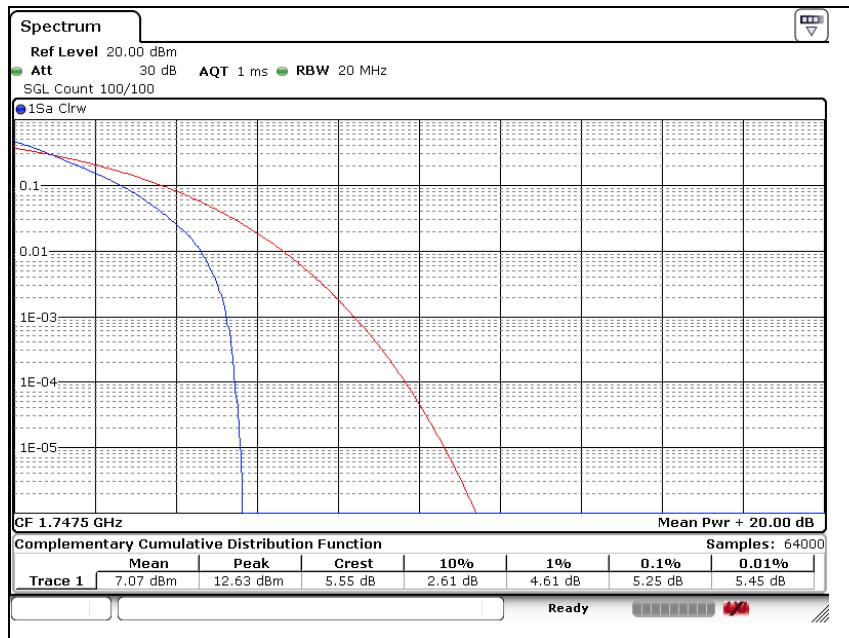
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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

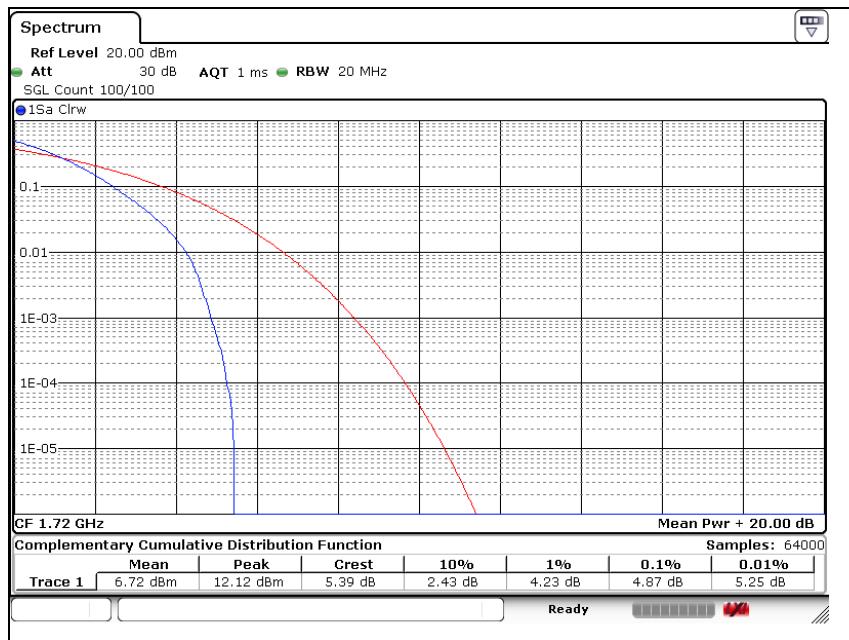
A4(210 mm x 297 mm)

High Channel



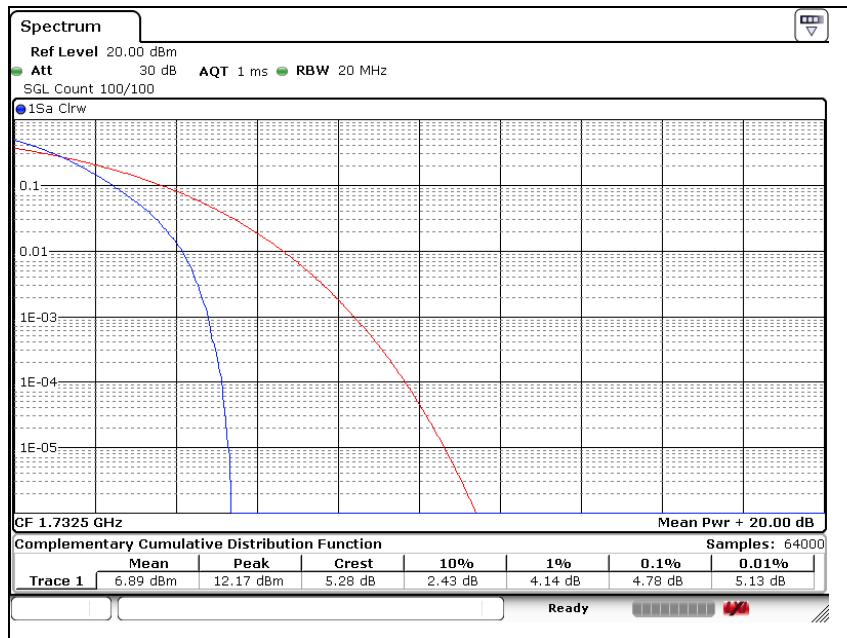
LTE band 4 (20 MHz - QPSK)

Low Channel

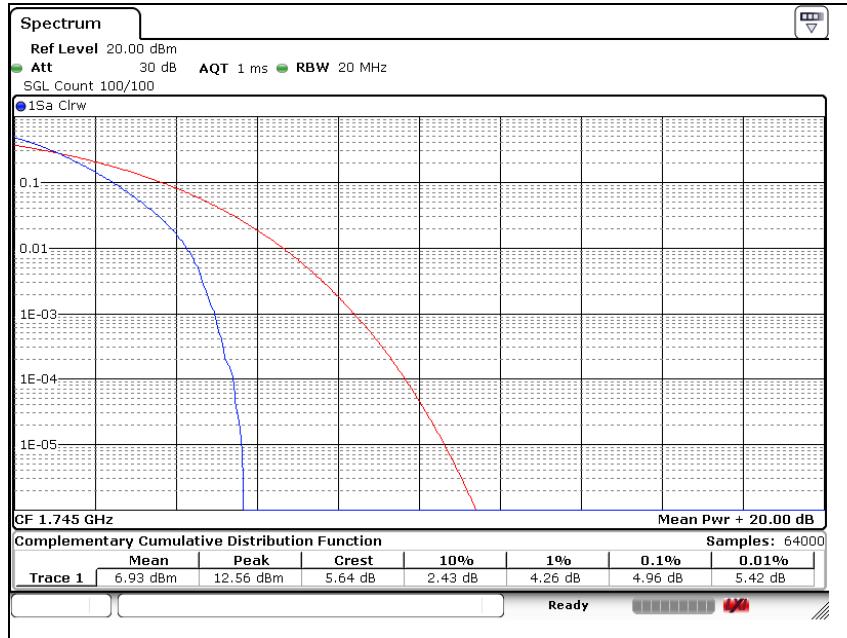


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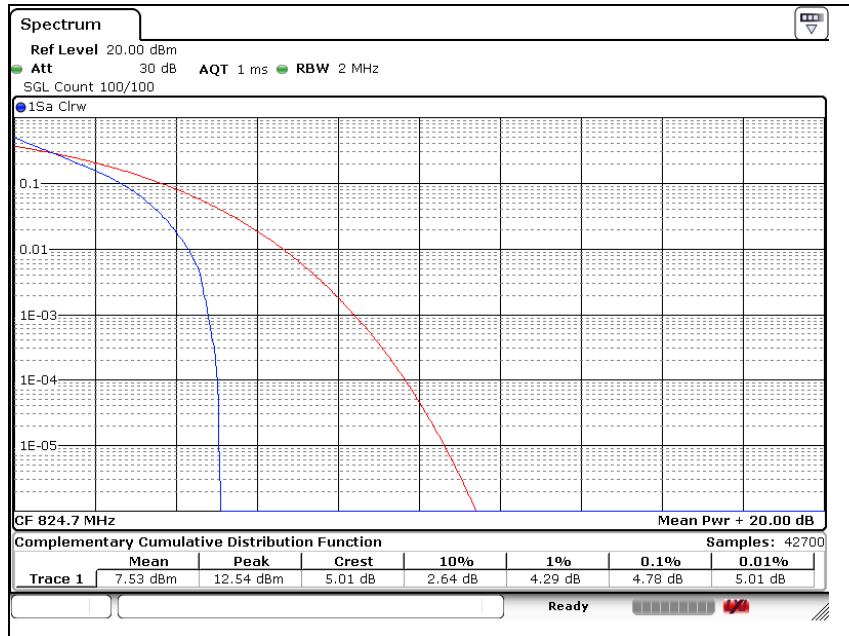
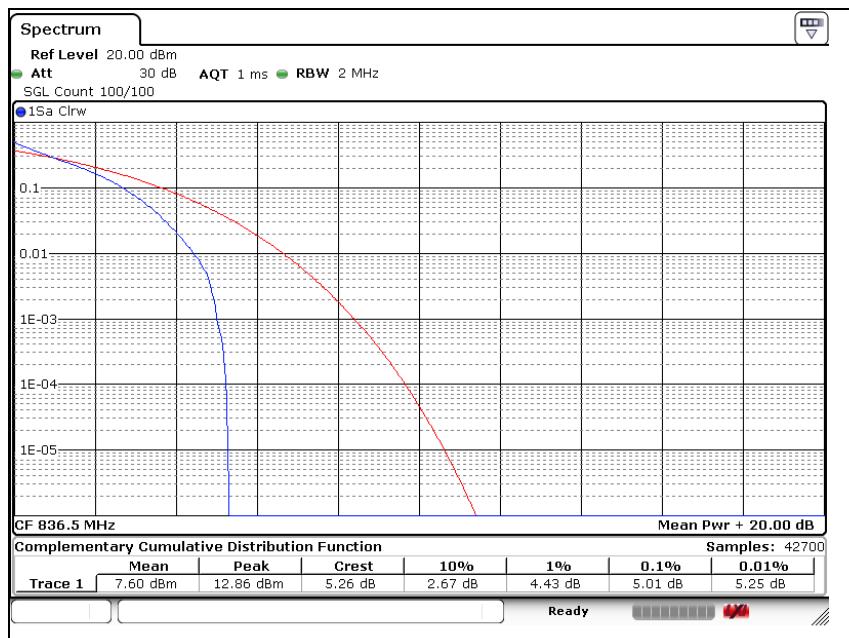
Middle Channel



High Channel

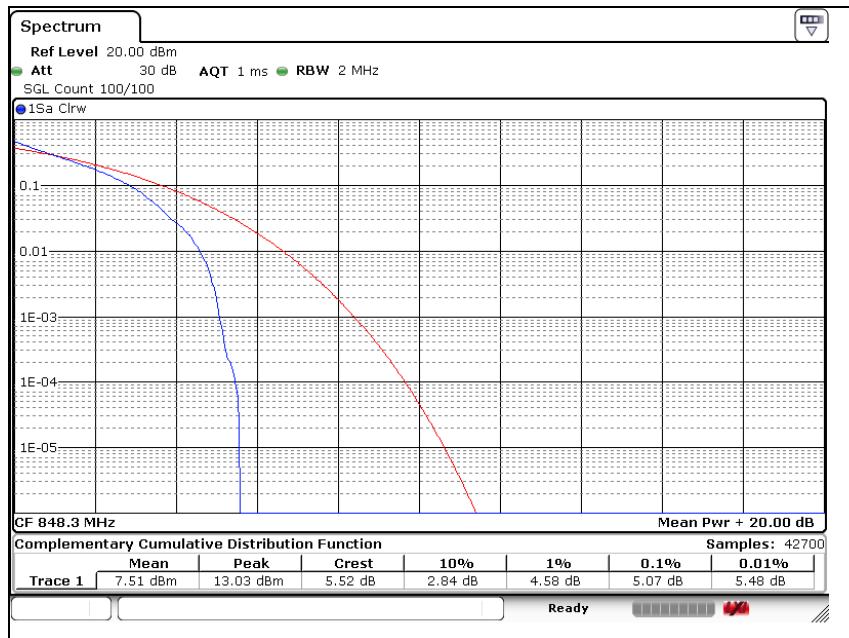


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LTE band 5 (1.4 MHz - QPSK)**Low Channel****Middle Channel**

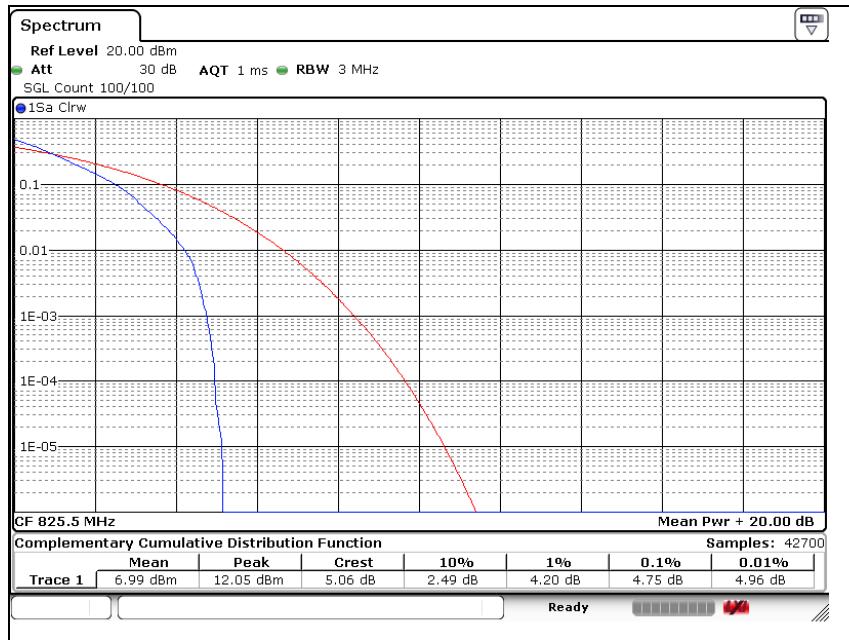
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High Channel



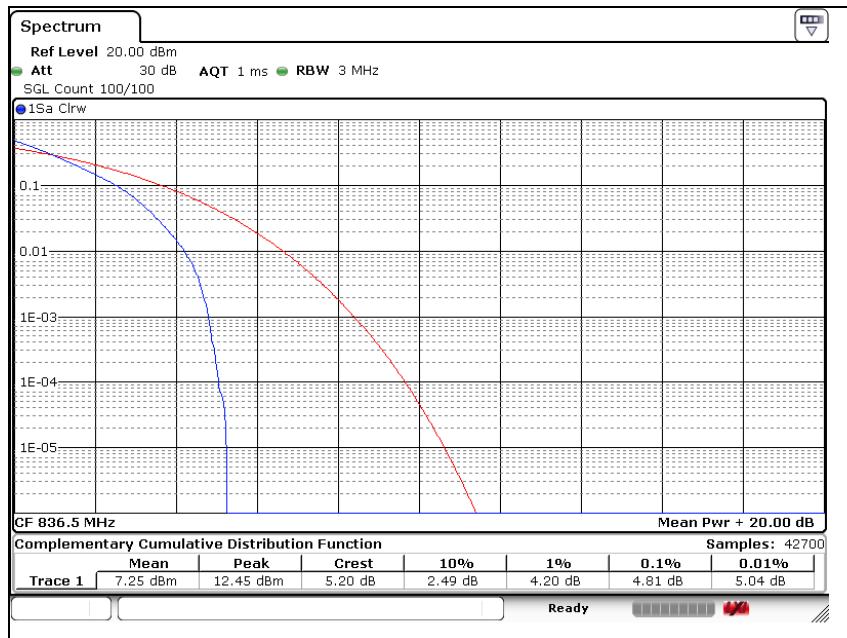
LTE band 5 (3 MHz - QPSK)

Low Channel

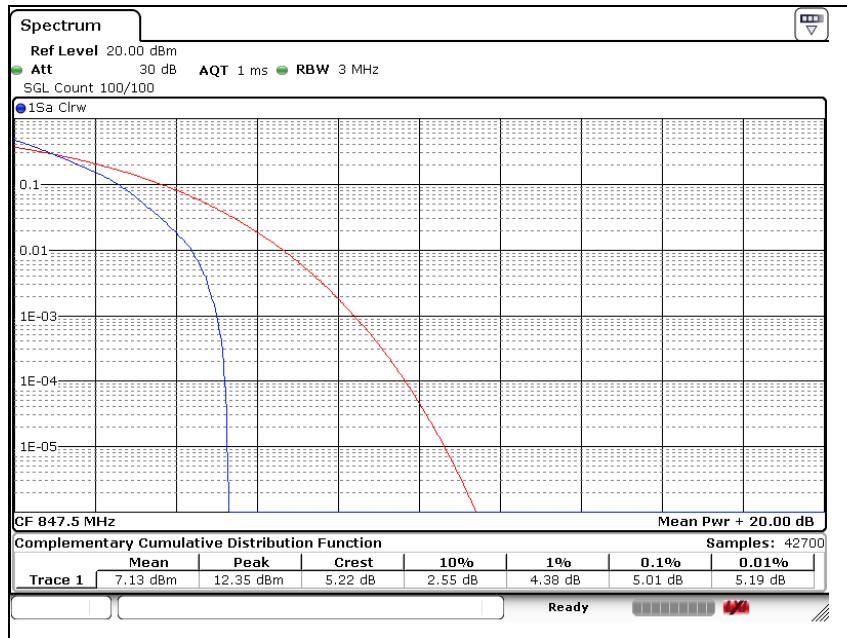


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Middle Channel



High Channel



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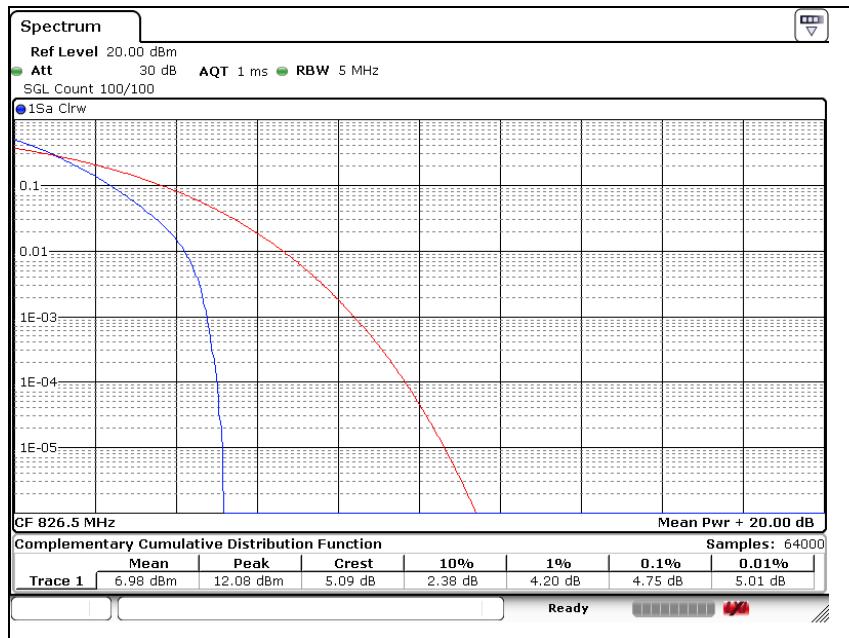
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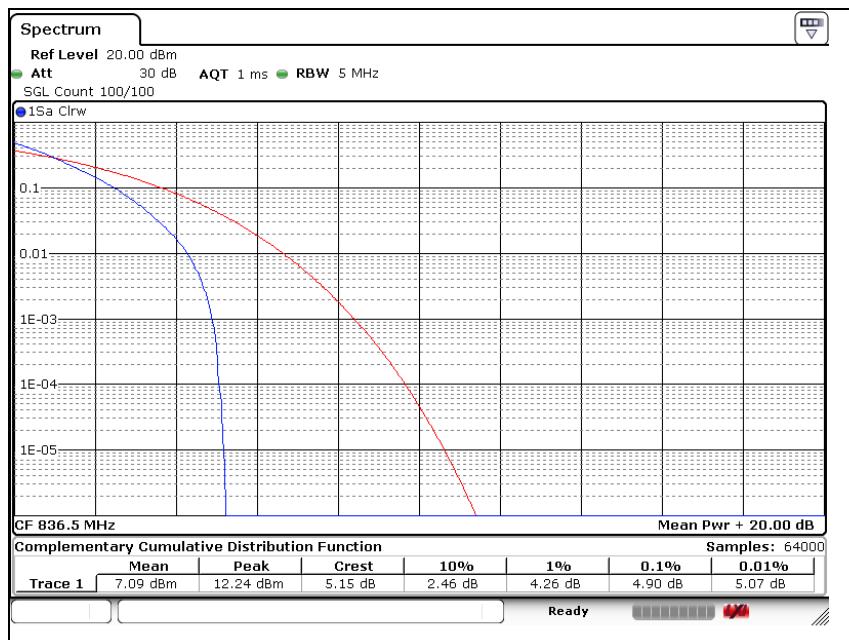
A4(210 mm x 297 mm)

LTE band 5 (5 MHz - QPSK)

Low Channel

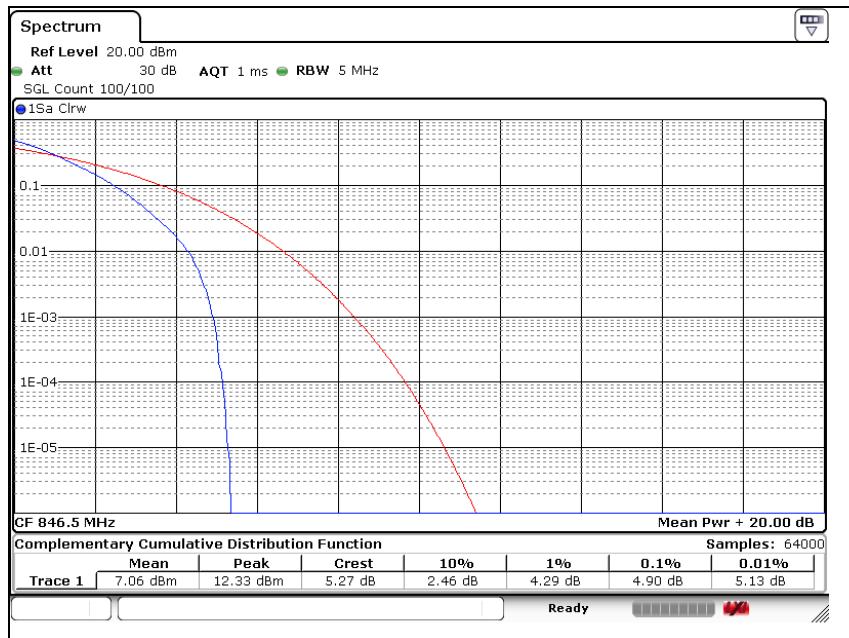


Middle Channel



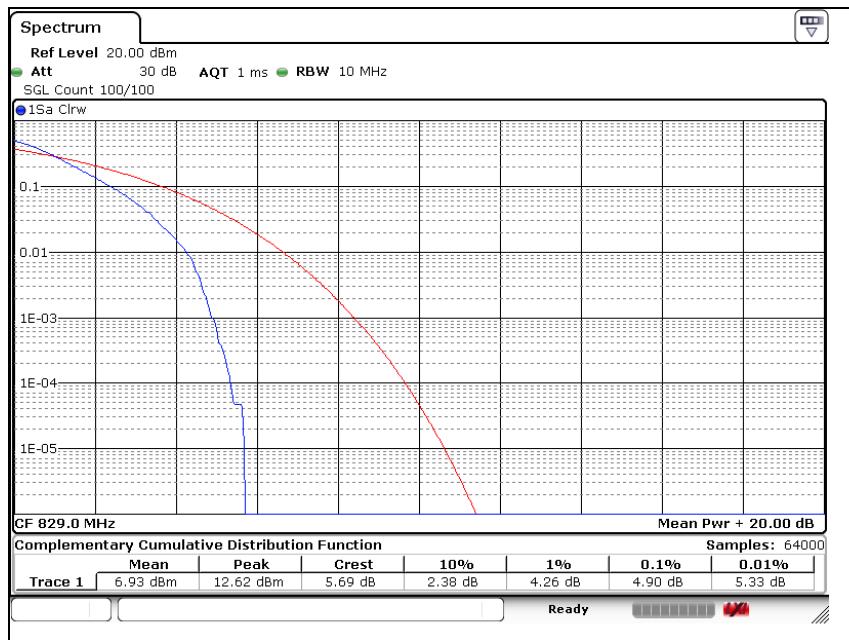
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High Channel



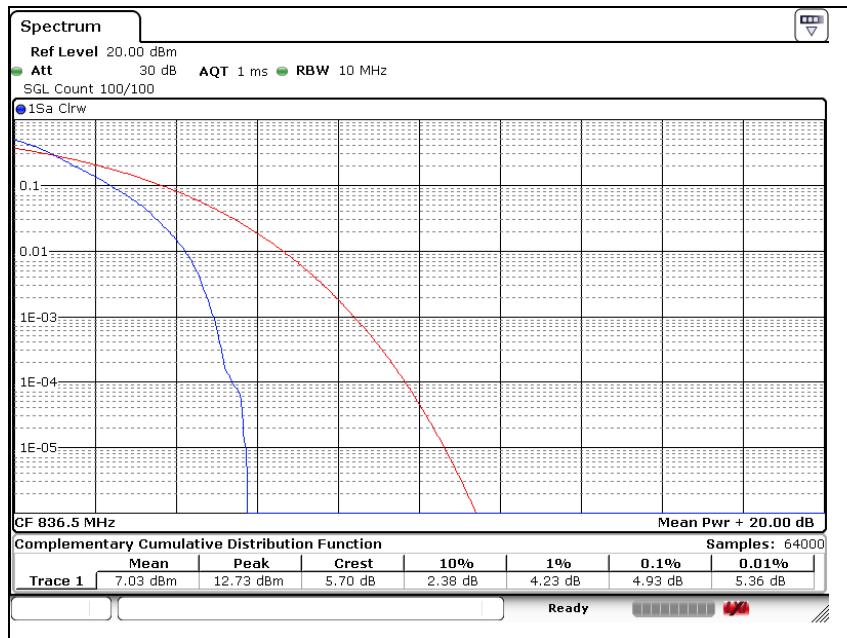
LTE band 5 (10 MHz - QPSK)

Low Channel

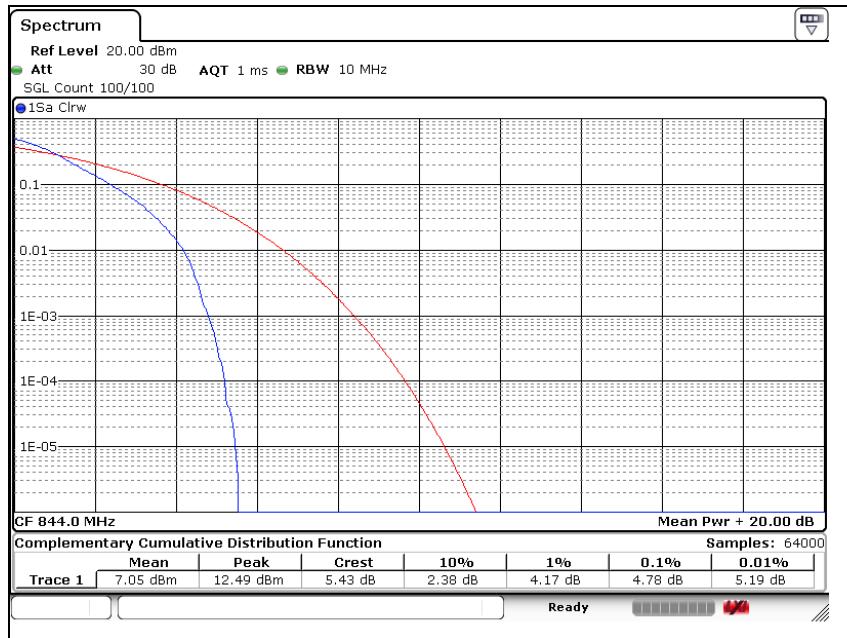


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Middle Channel



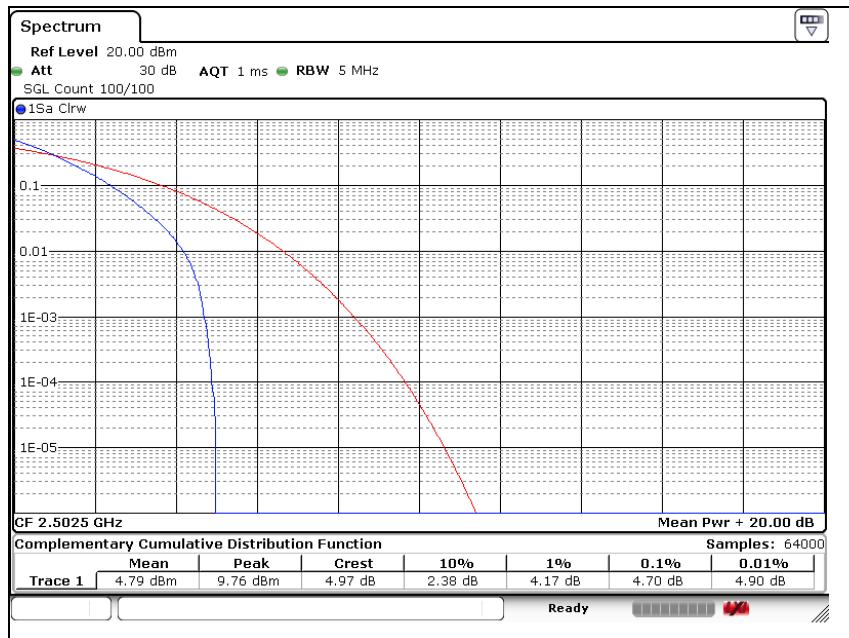
High Channel



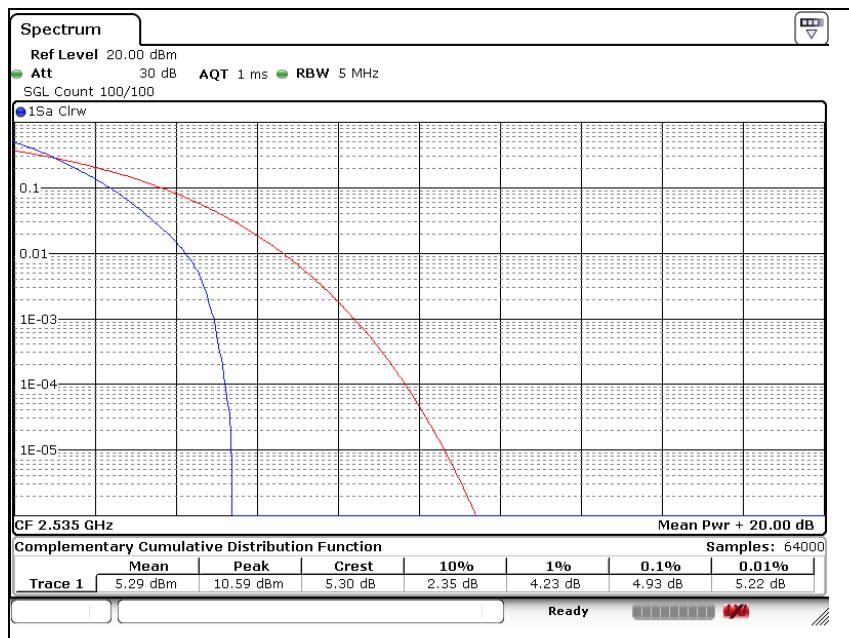
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LTE band 7 (5 MHz - QPSK)

Low Channel



Middle Channel



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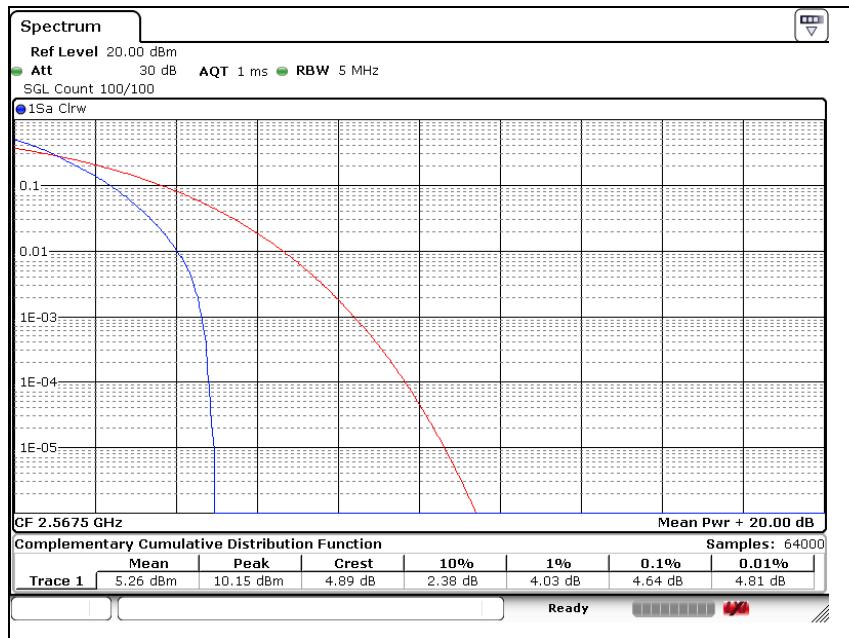
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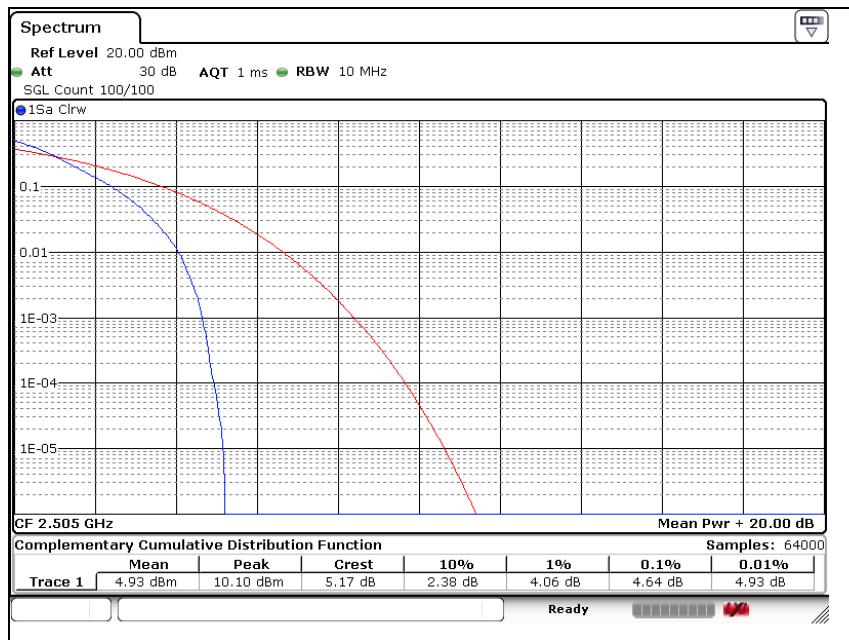
A4(210 mm x 297 mm)

High Channel



LTE band 7 (10 MHz - QPSK)

Low Channel



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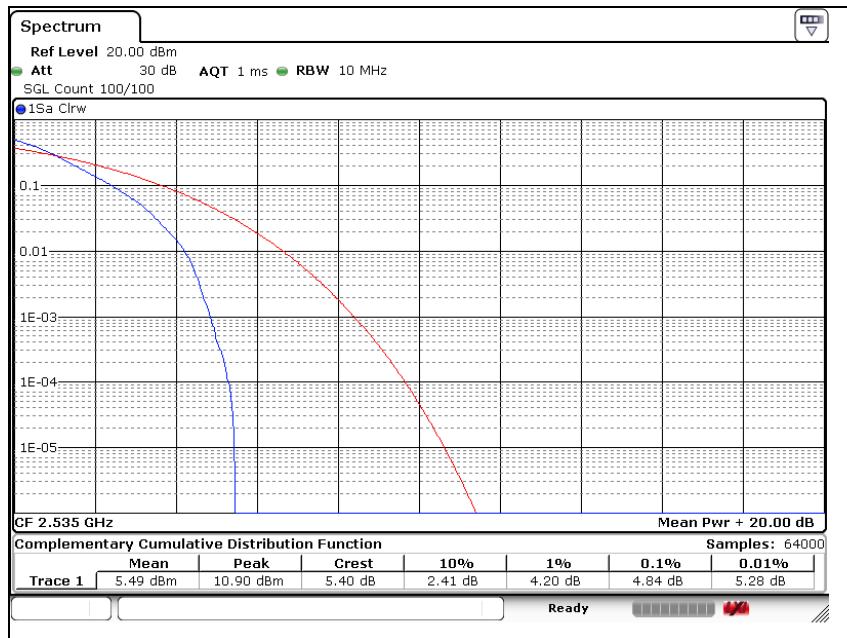
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2017.07.10)(0)

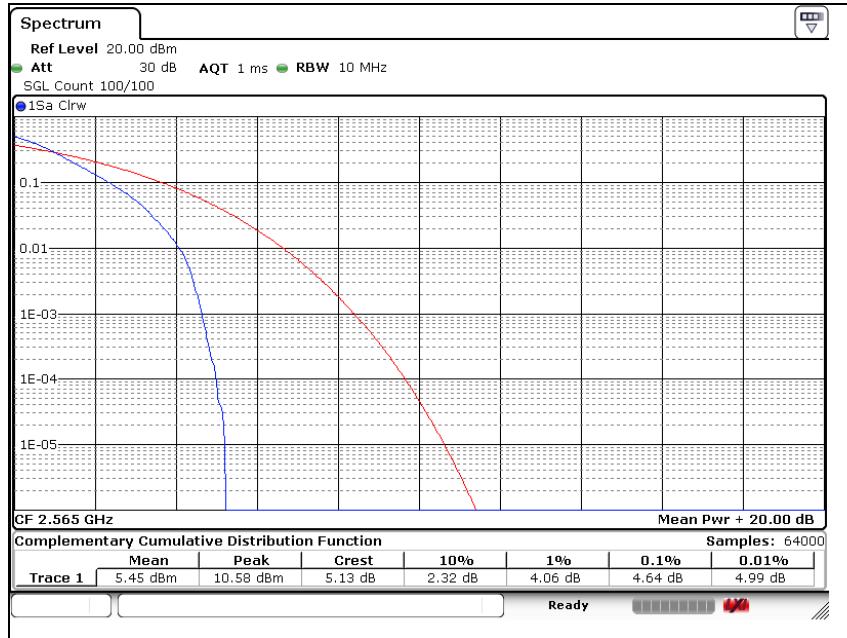
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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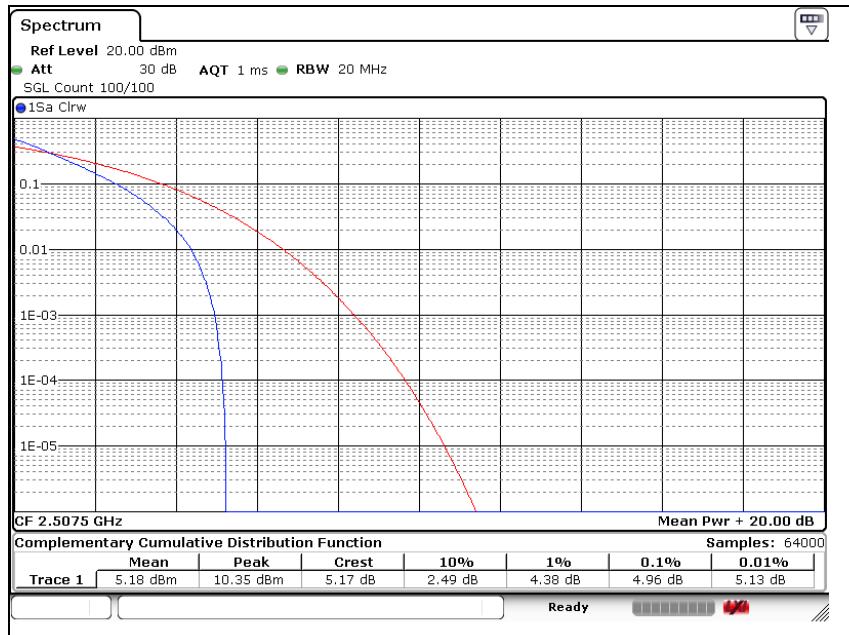
RTT5041-19(2017.07.10)(0)

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

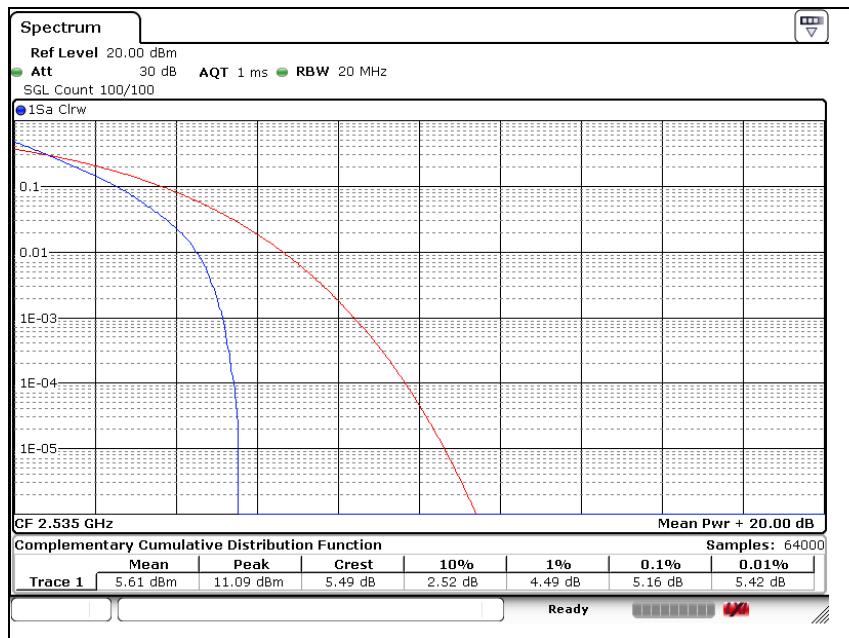
A4(210 mm x 297 mm)

LTE band 7 (15 MHz - QPSK)

Low Channel

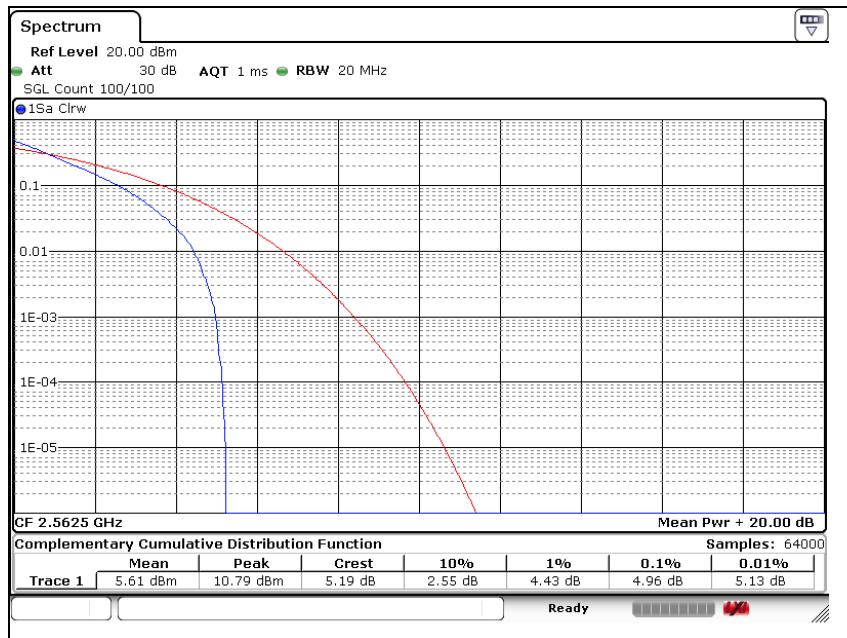


Middle Channel



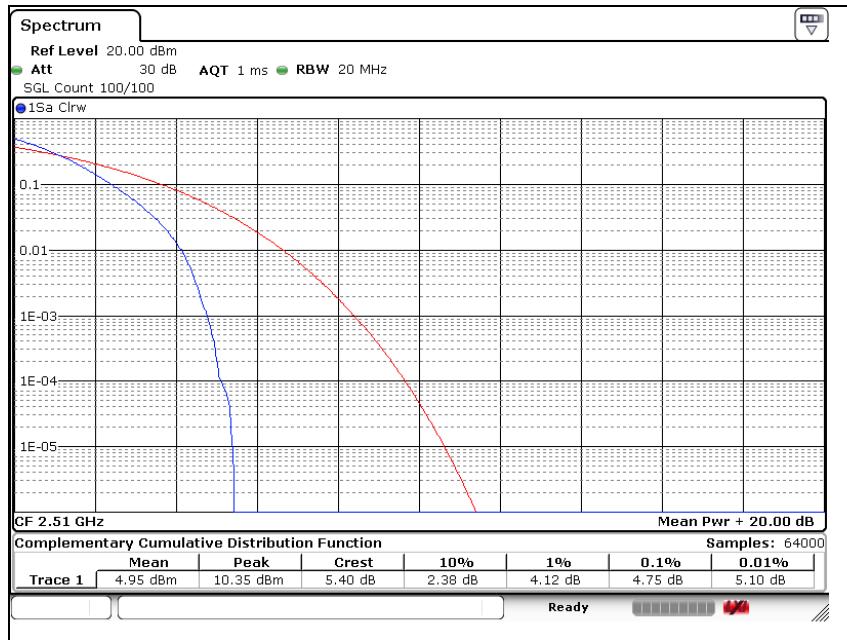
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High Channel



LTE band 7 (20 MHz - QPSK)

Low Channel



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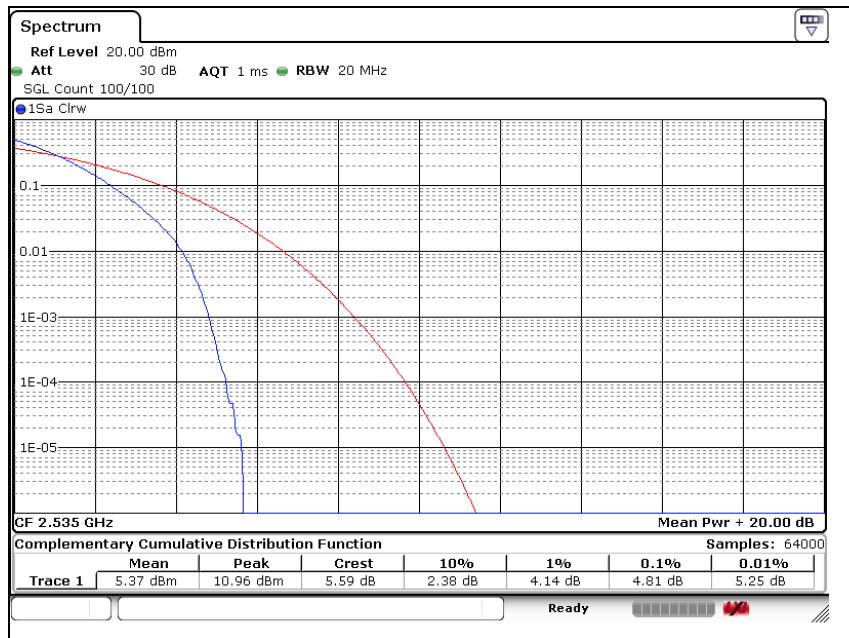
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RTT5041-19(2017.07.10)(0)

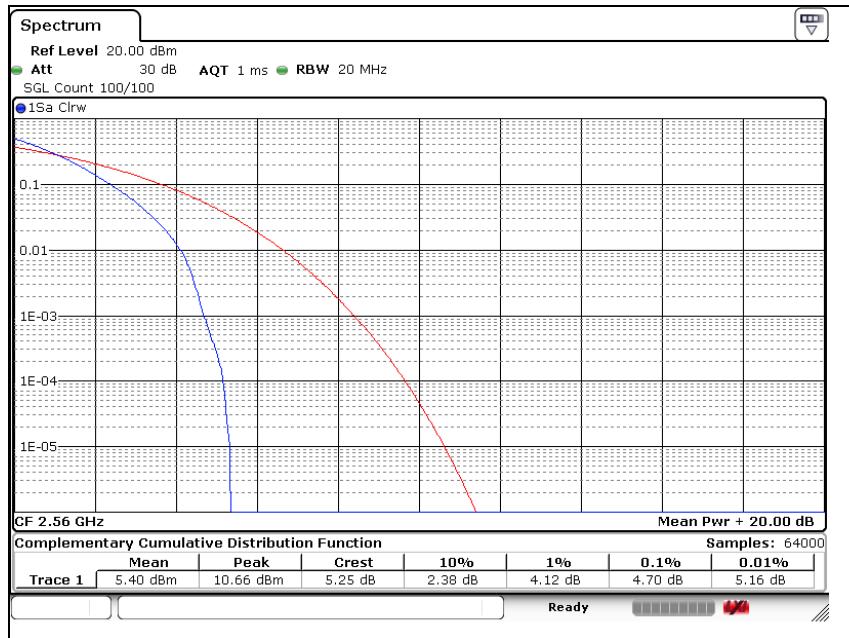
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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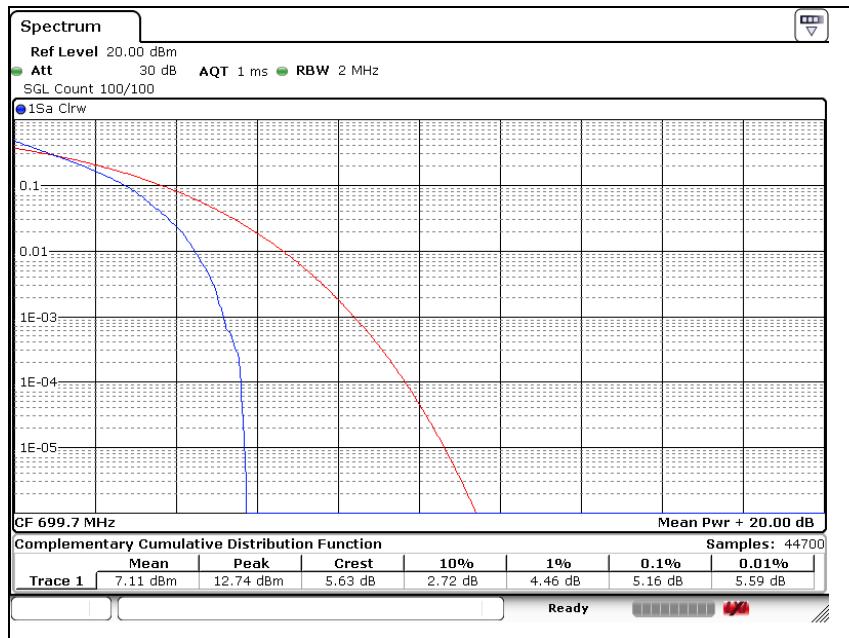
RTT5041-19(2017.07.10)(0)

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

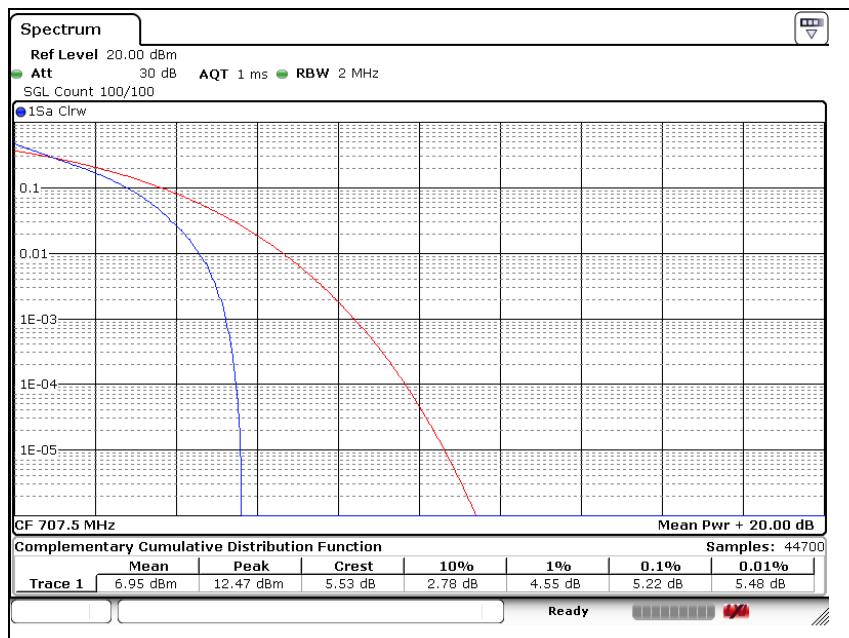
A4(210 mm x 297 mm)

LTE band 12 (1.4 MHz - QPSK)

Low Channel

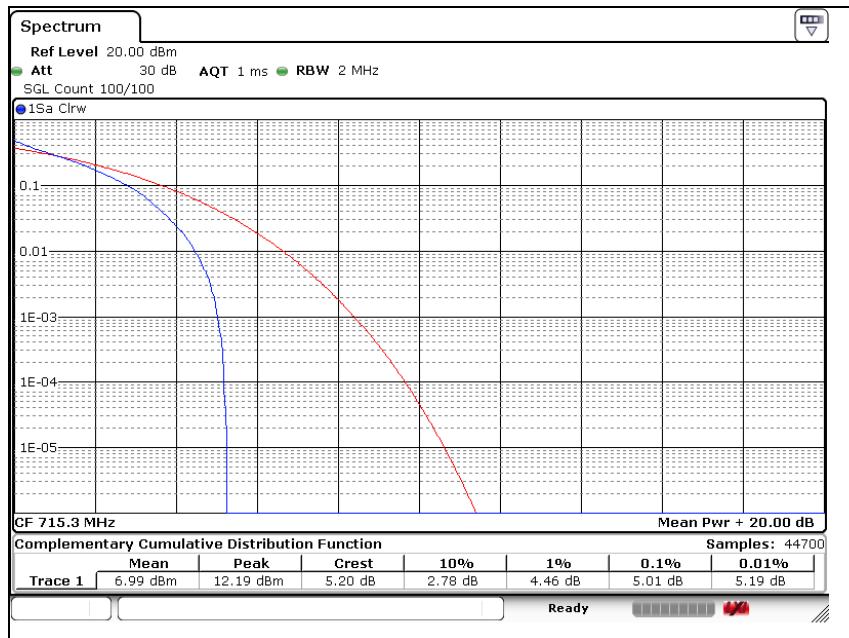


Middle Channel



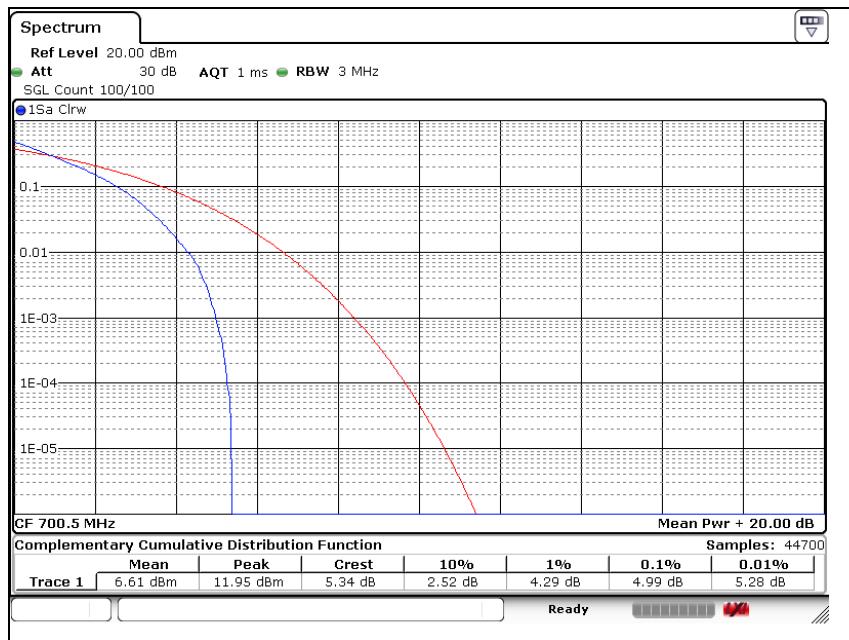
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High Channel



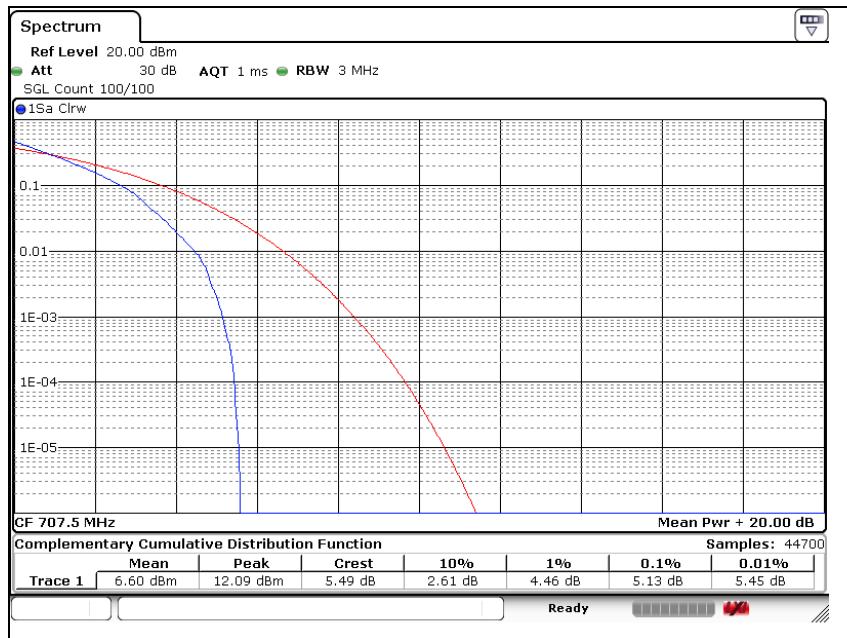
LTE band 12 (3 MHz - QPSK)

Low Channel

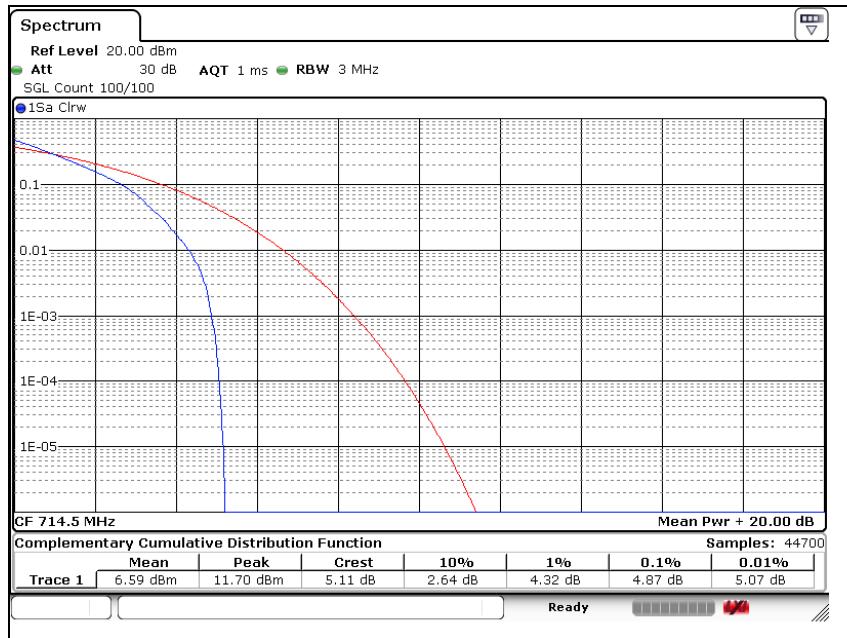


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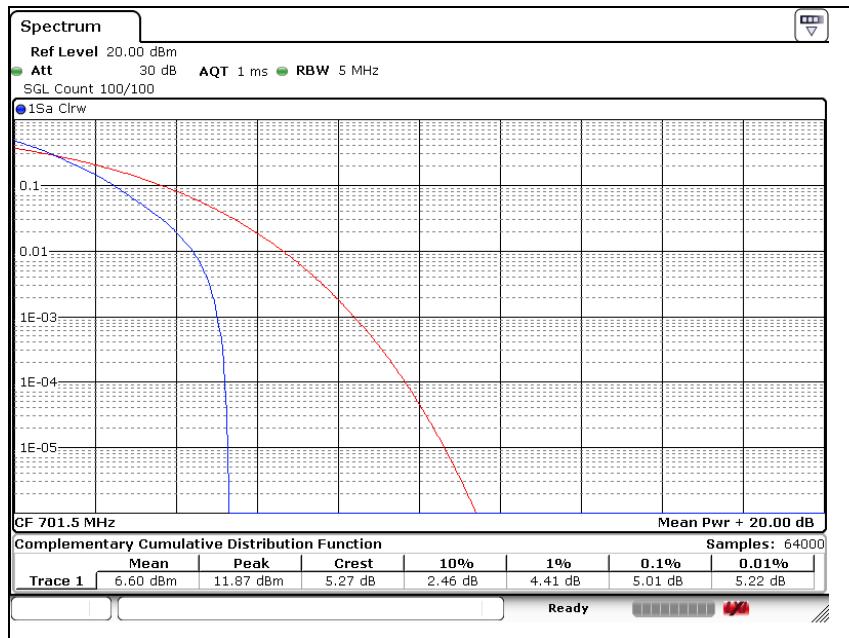
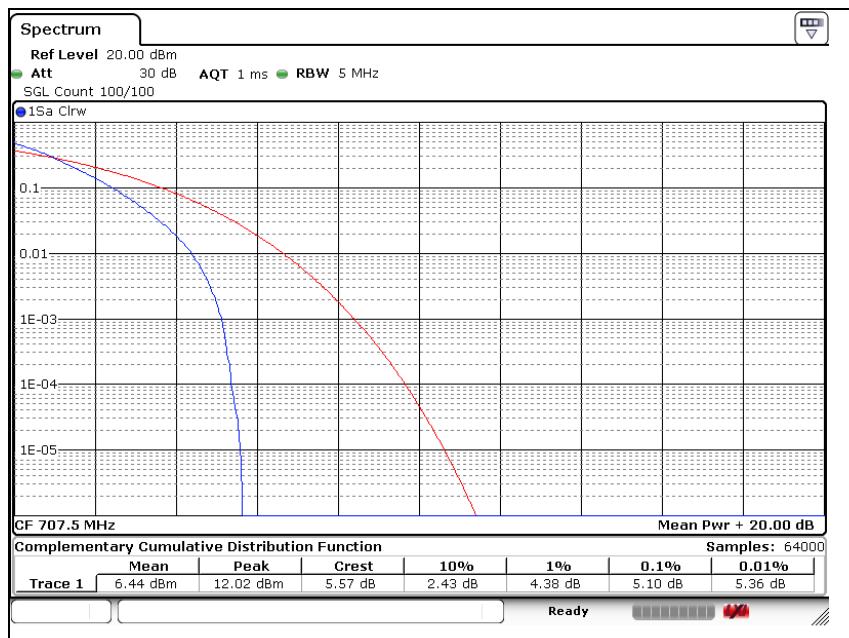
Middle Channel



High Channel

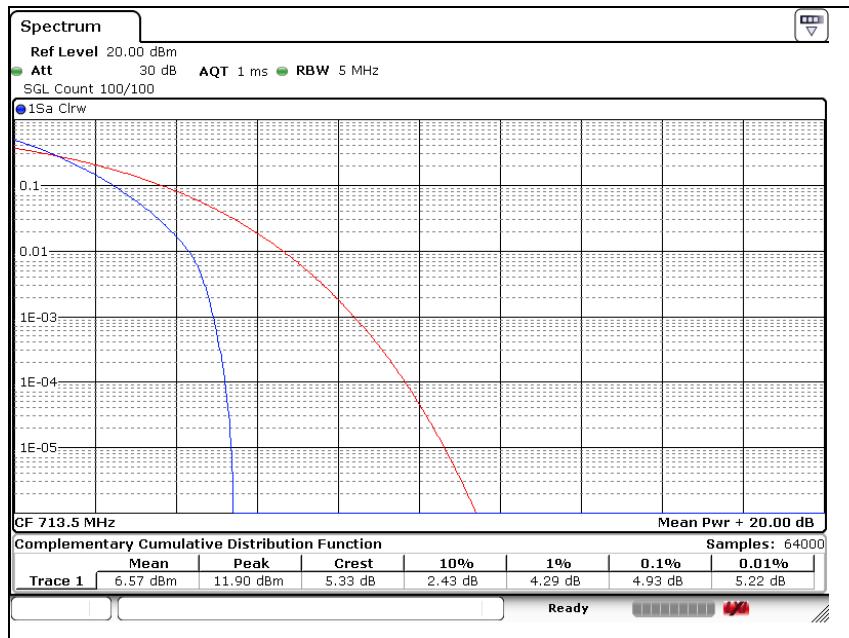


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LTE band 12 (5 MHz - QPSK)**Low Channel****Middle Channel**

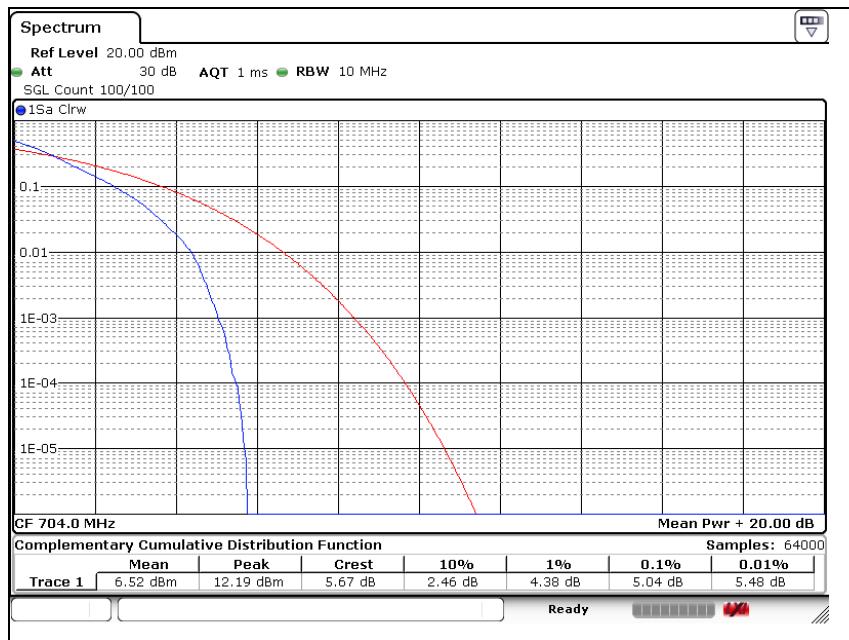
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High Channel



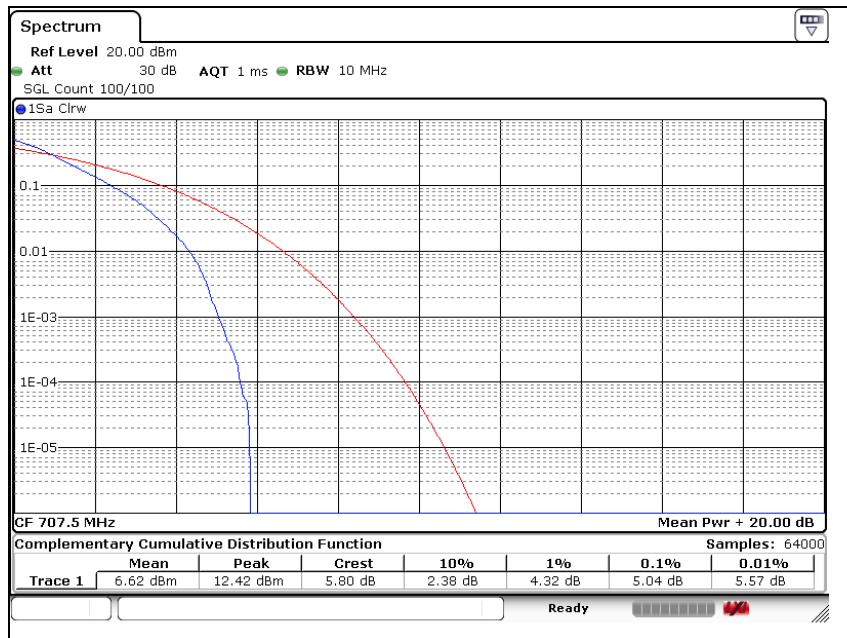
LTE band 12 (10 MHz - QPSK)

Low Channel

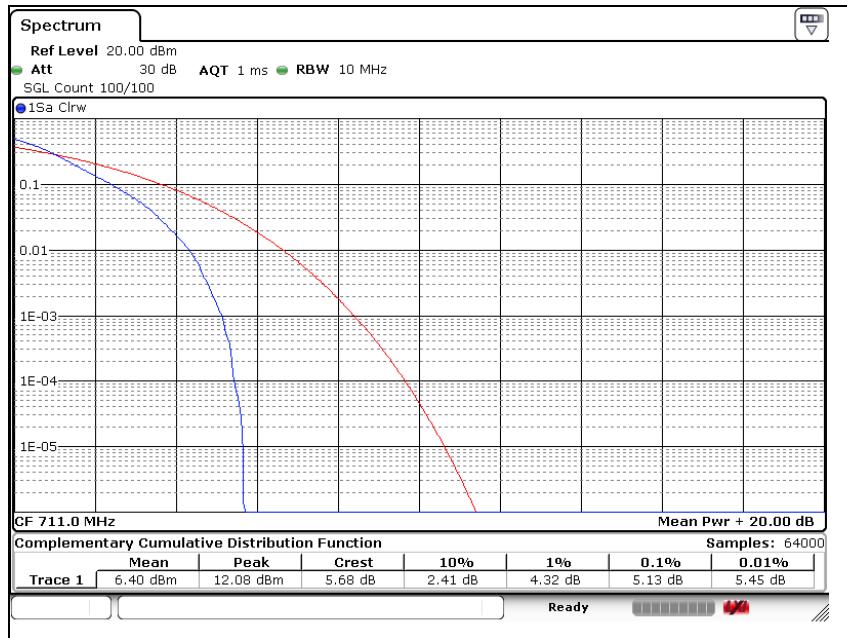


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Middle Channel



High Channel



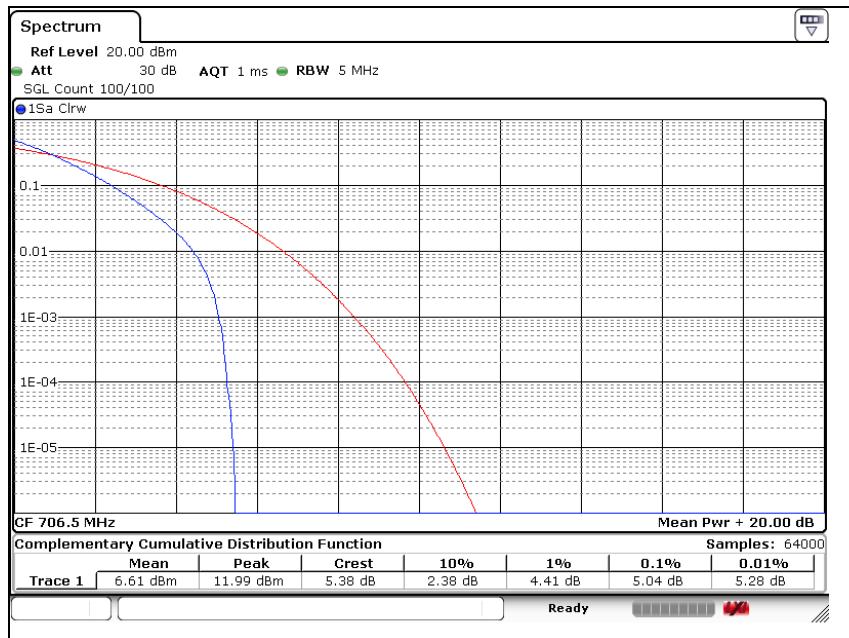
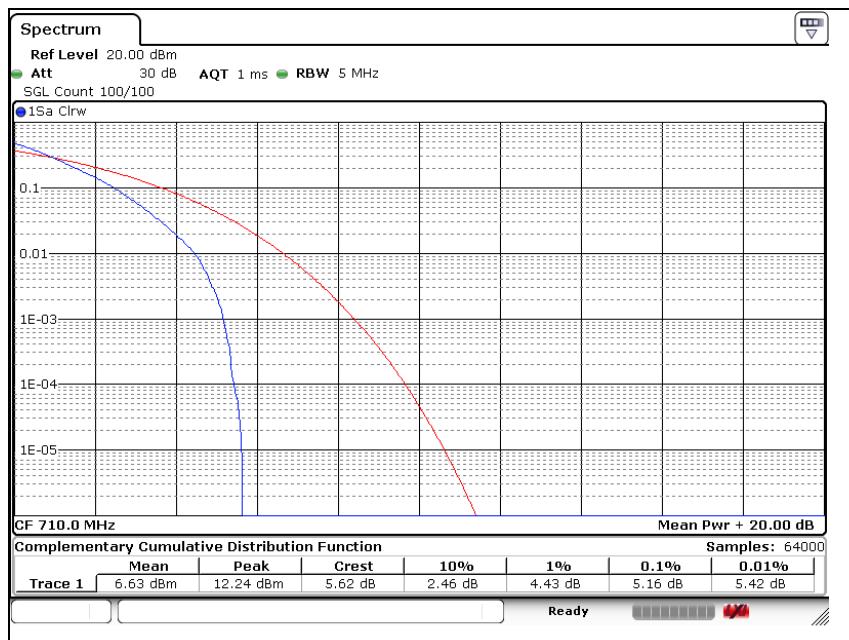
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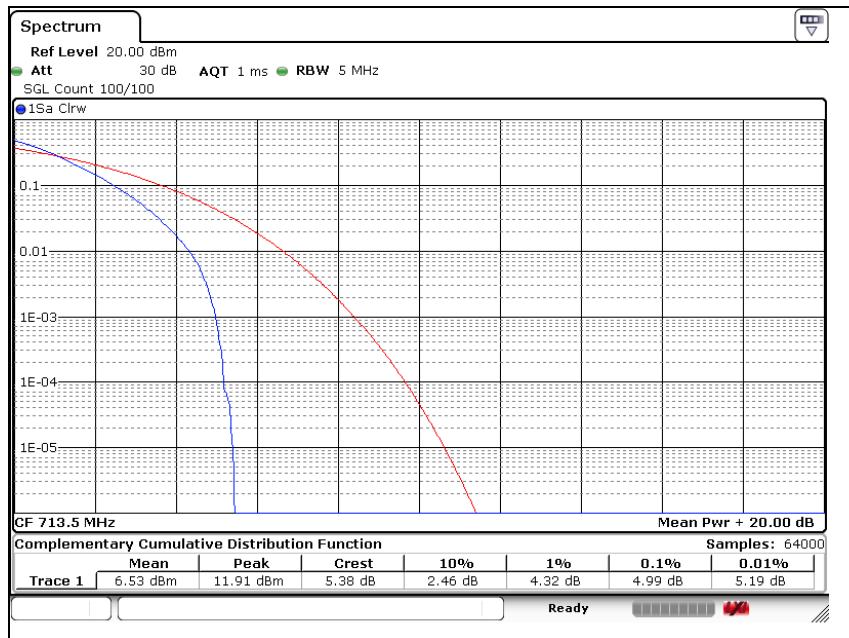
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

LTE band 17 (5 MHz - QPSK)**Low Channel****Middle Channel**

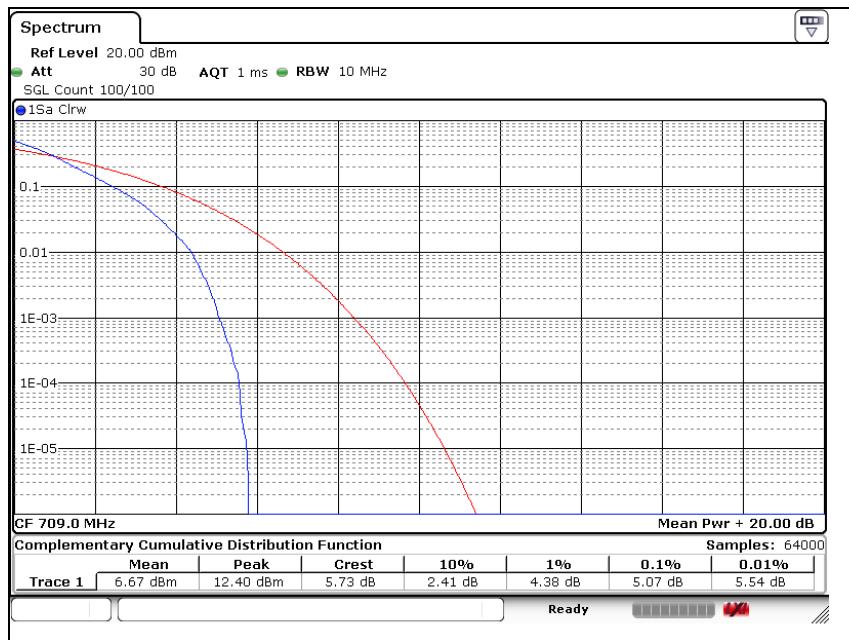
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High Channel



LTE band 17 (10 MHz - QPSK)

Low Channel



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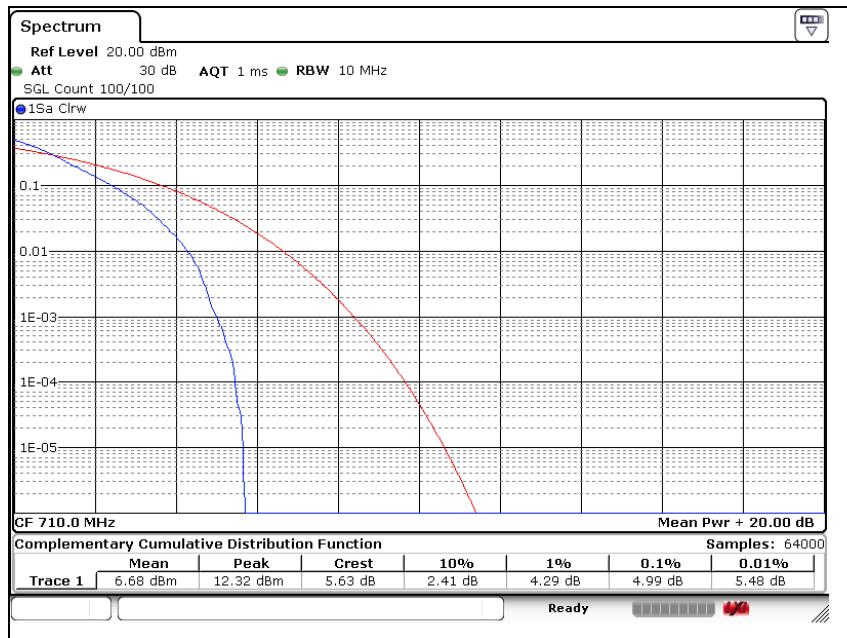
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2017.07.10)(0)

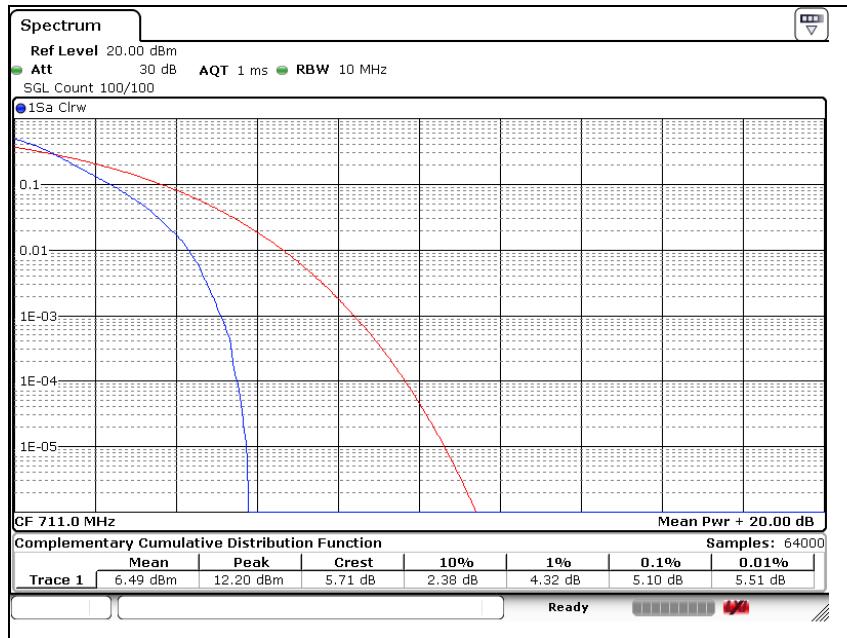
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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