

6. Spurious Emissions at Antenna Terminal

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 $43 + 10\log(P)$ dB.

- §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.

- §27.53(g), 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.

- §27.53(h)(1), for operations in the 1 695-1 710 MHz, 1 710-1 755 MHz, 1 755-1 780 MHz, 1 915-1 920 MHz, 1 995-2 000 MHz, 2 000-2 020 MHz, 2 110-2 155 MHz, 2 155-2 180 MHz, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ dB.

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than $40 + 10\log_{10}(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10\log_{10}(P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10\log_{10}(P)$ 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 than $43 + 10\log_{10}(P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10\log_{10}(P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz 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.

IC

- RSS-130 Issue 2

4.7.1, the unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dB W), by at least $43 + 10\log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 kHz is required.

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A4(210 mm x 297 mm)

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

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

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10 \log_{10} p(\text{watts})$. If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 MHz is required.

- RSS-139 Issue 3

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

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

- RSS-199 Issue 3

4.5, In the 1 MHz band immediately outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

Equipment shall comply with the following unwanted emission limits:

- a. for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$
- b. for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:
 - i. $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
 - ii. $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
 - iii. $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

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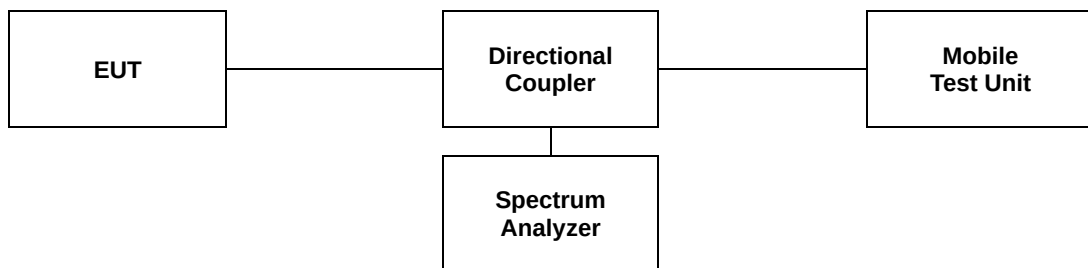
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A4(210 mm x 297 mm)

6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 kHz and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = Peak.
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 9 kHz to 26 GHz, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction factor.



Note;

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and frequencies greater than 1 GHz. However, in the 1 MHz 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 dB below the transmitter power.

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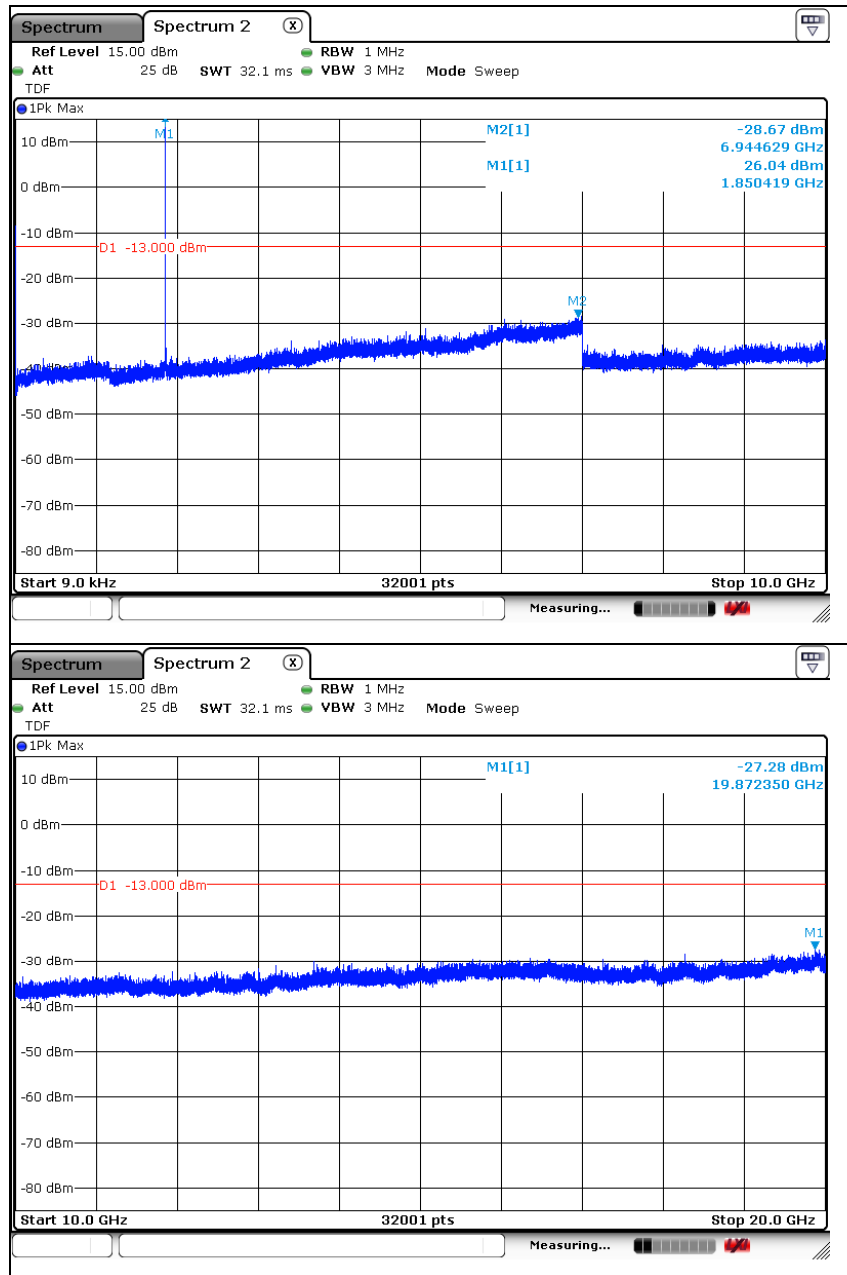
6.3. Test Results

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

- Test plots

LTE band 2 (1.4 MHz – QPSK)

Low Channel



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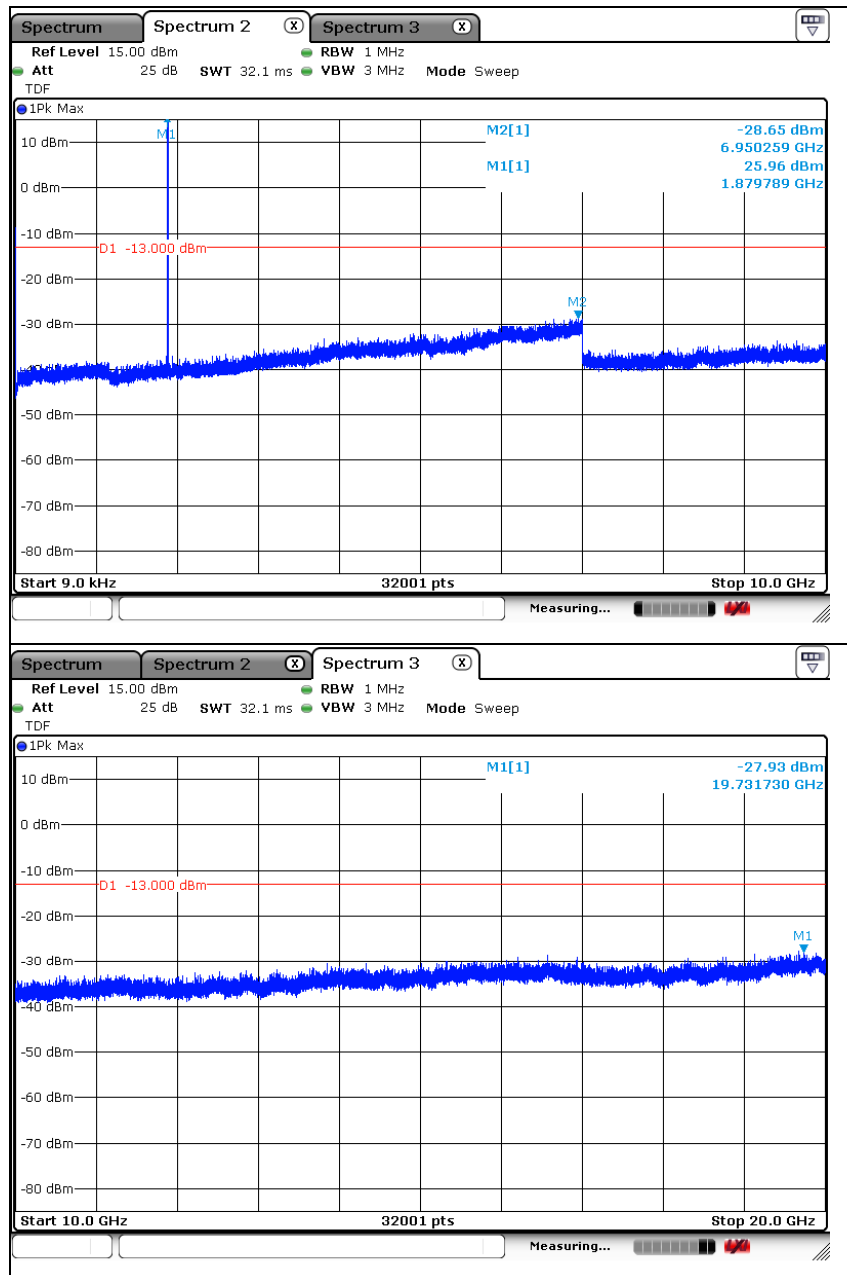
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Middle Channel



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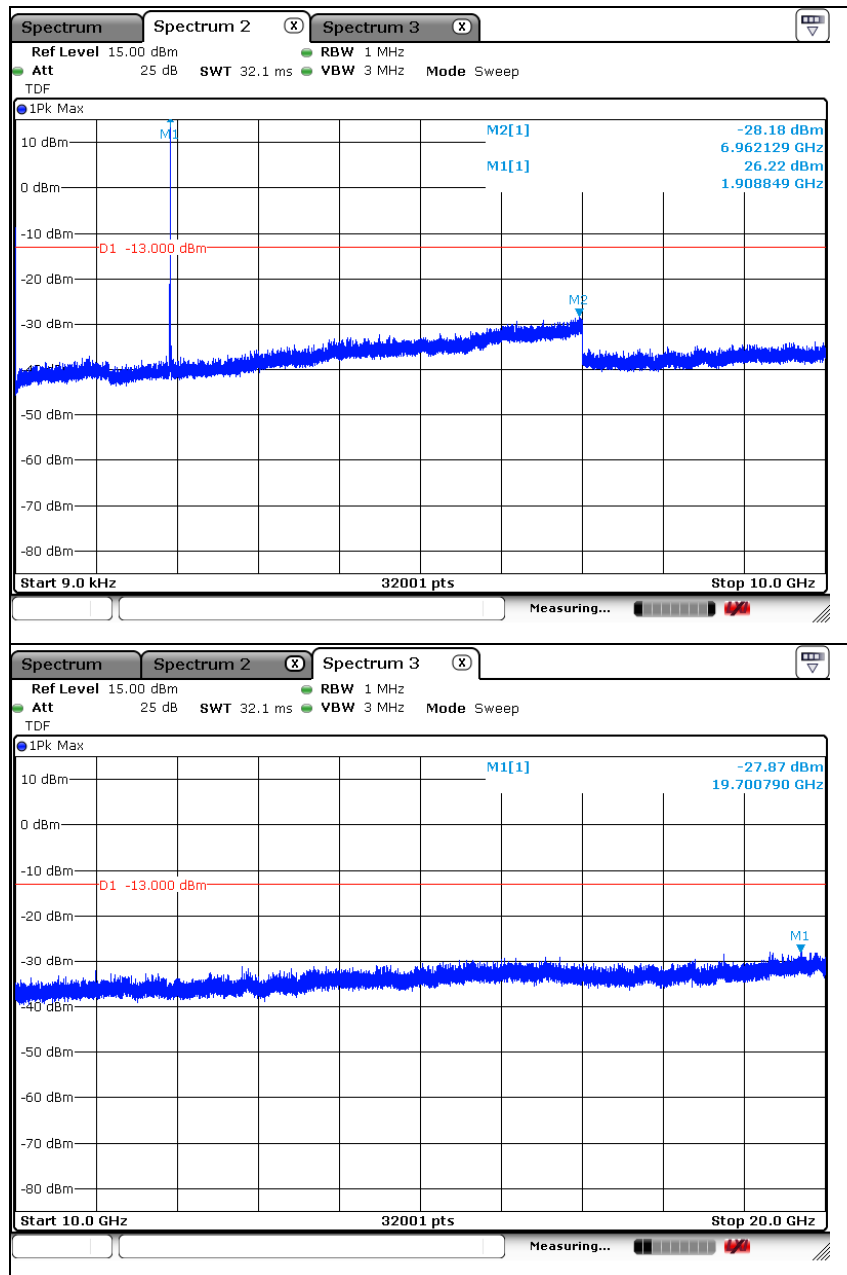
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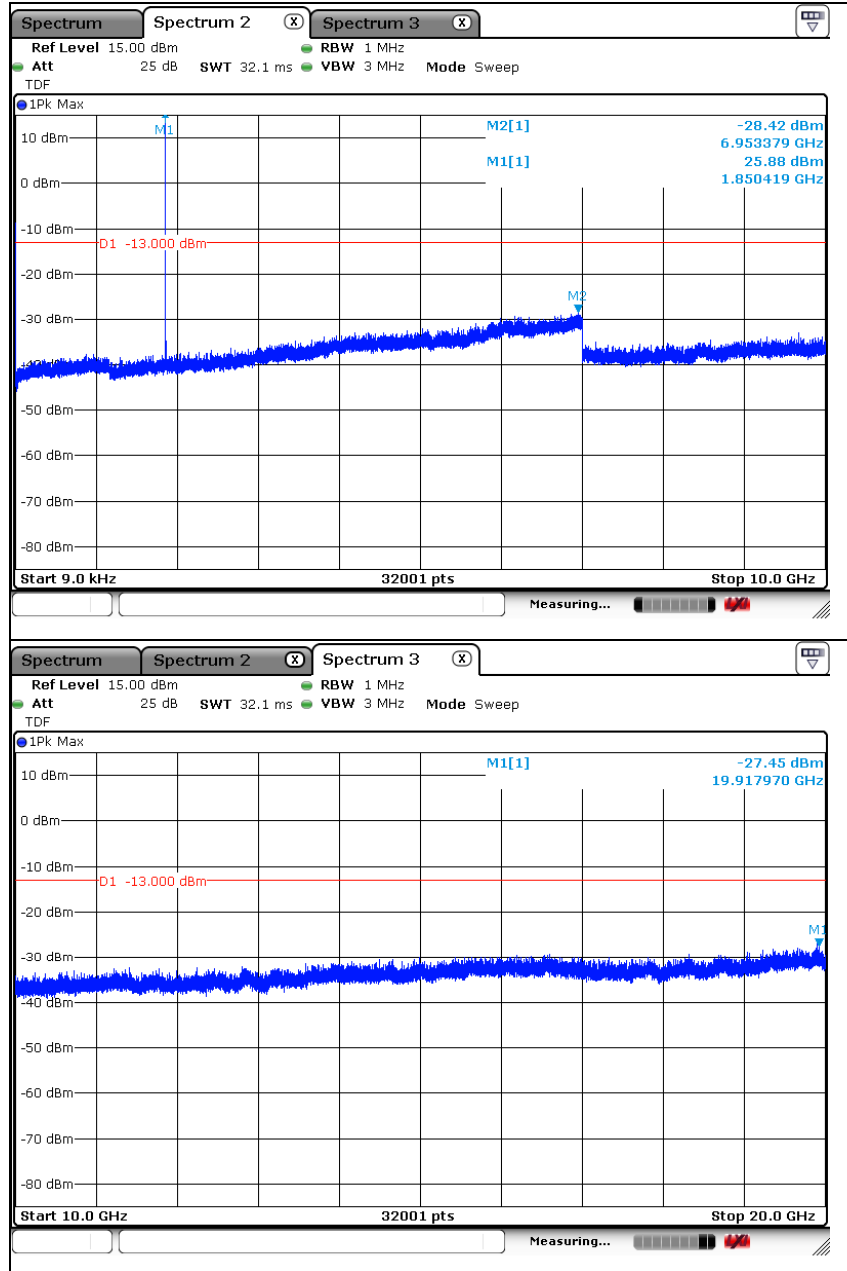
High Channel



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LTE band 2 (3 MHz – QPSK)

Low Channel



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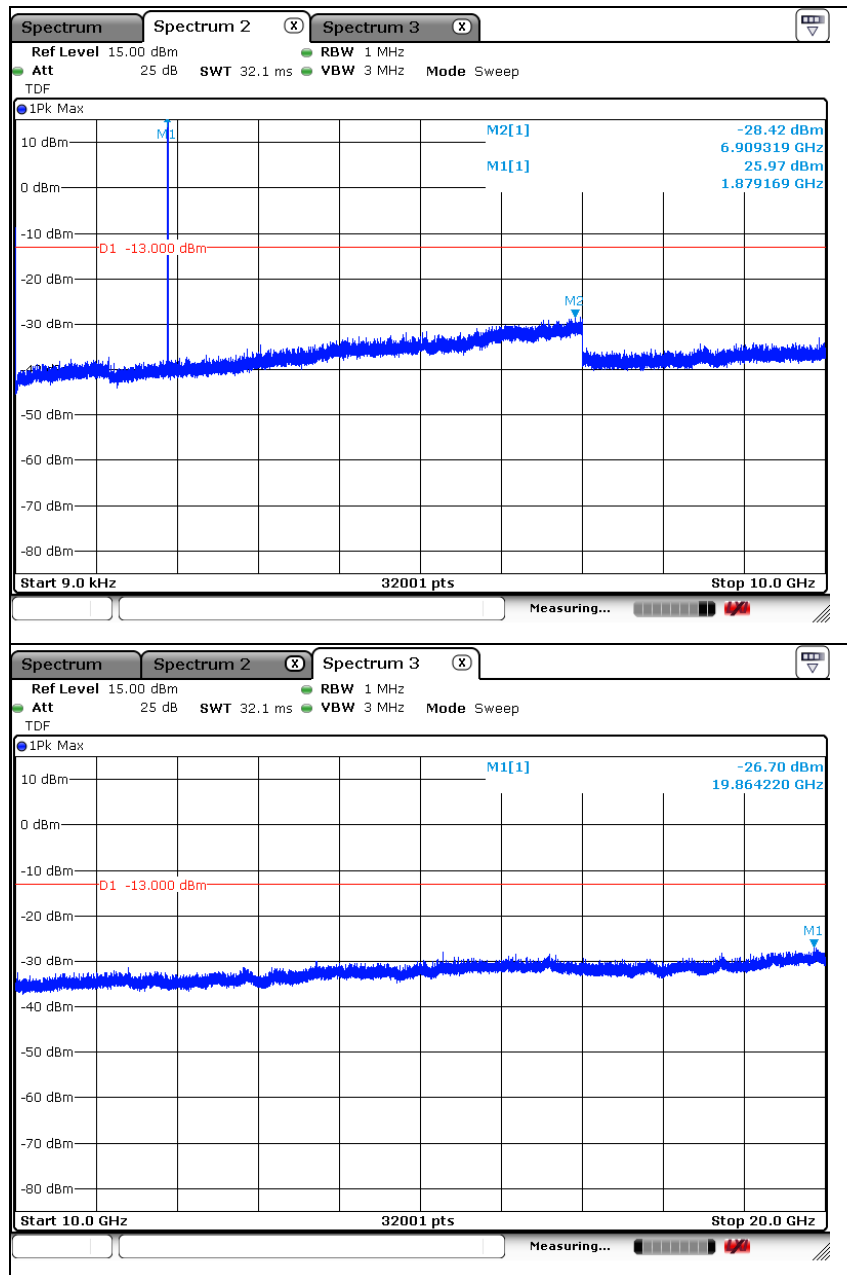
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A4(210 mm x 297 mm)

Middle Channel



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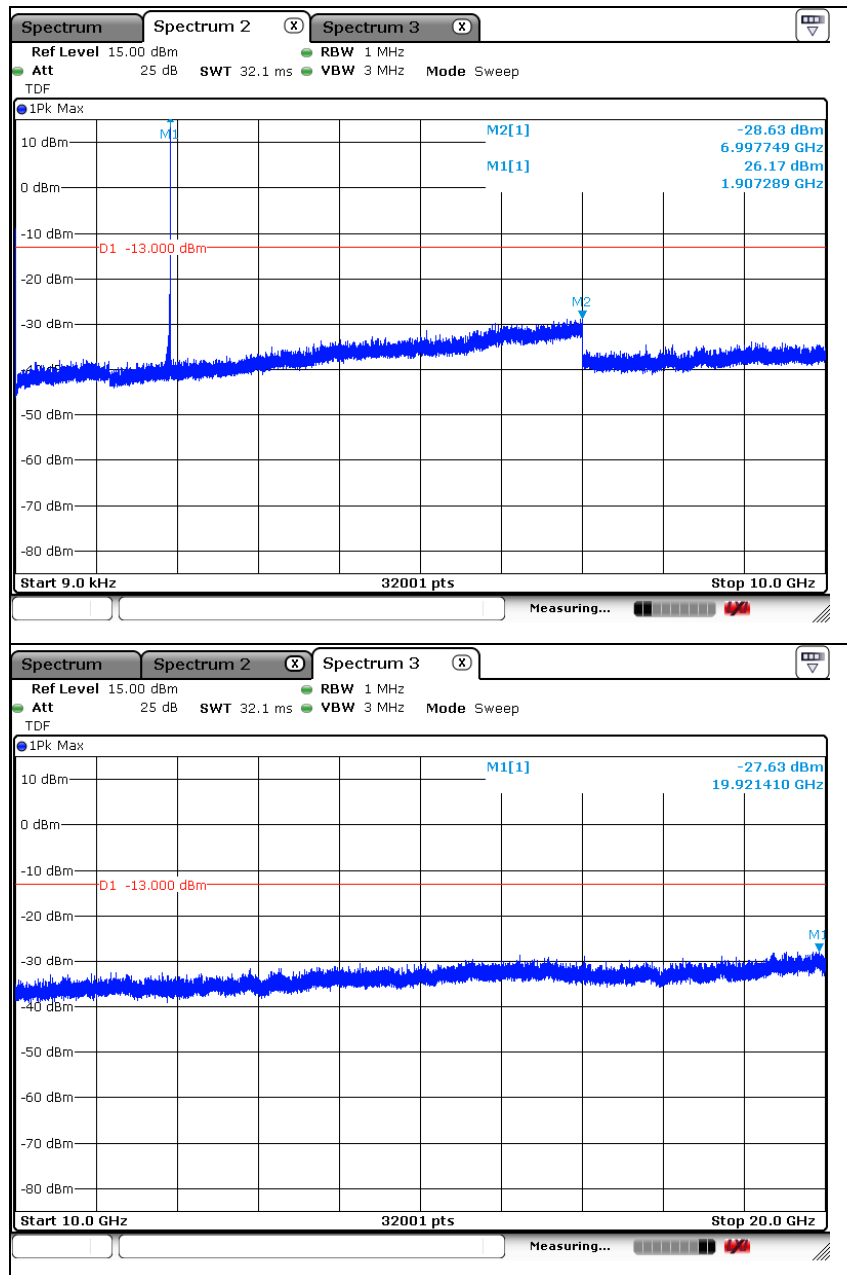
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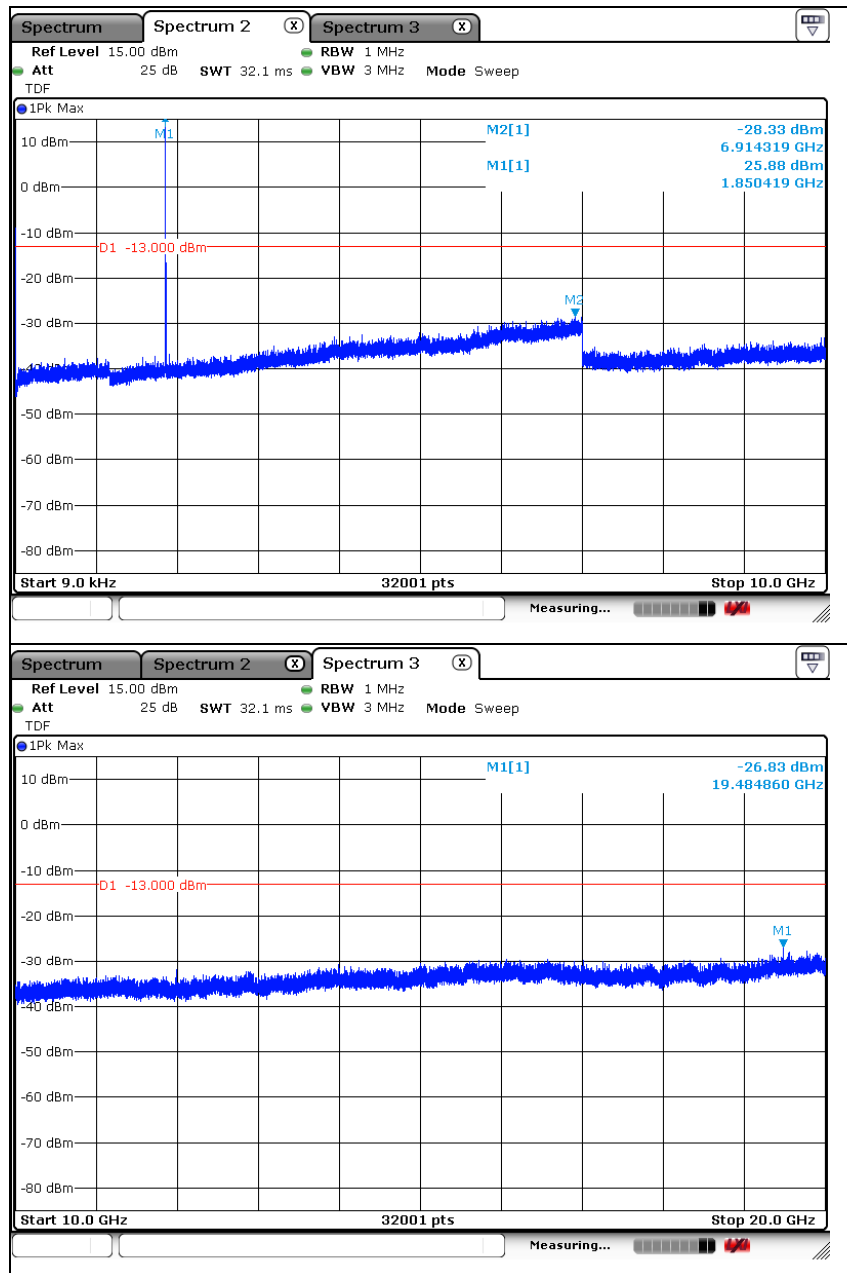
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LTE band 2 (5 MHz – QPSK)

Low Channel



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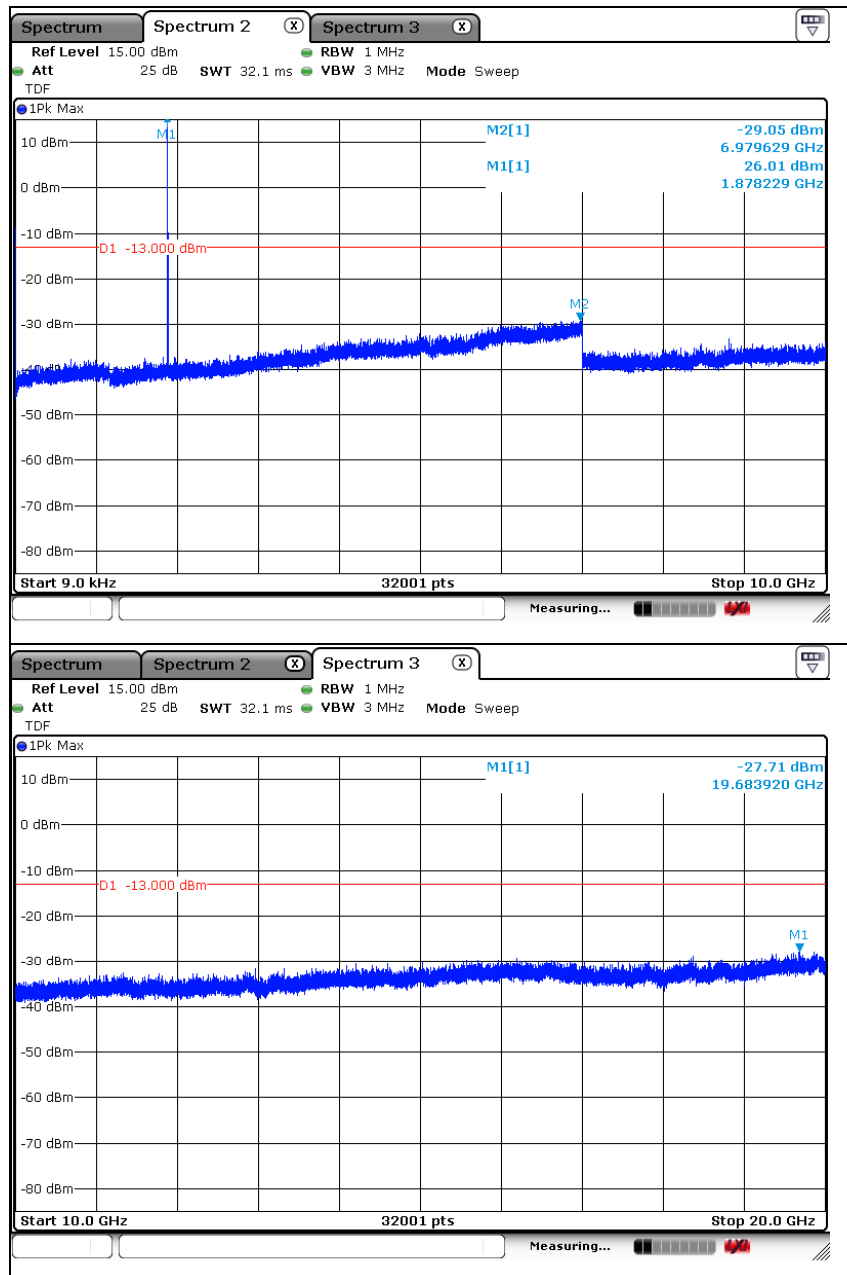
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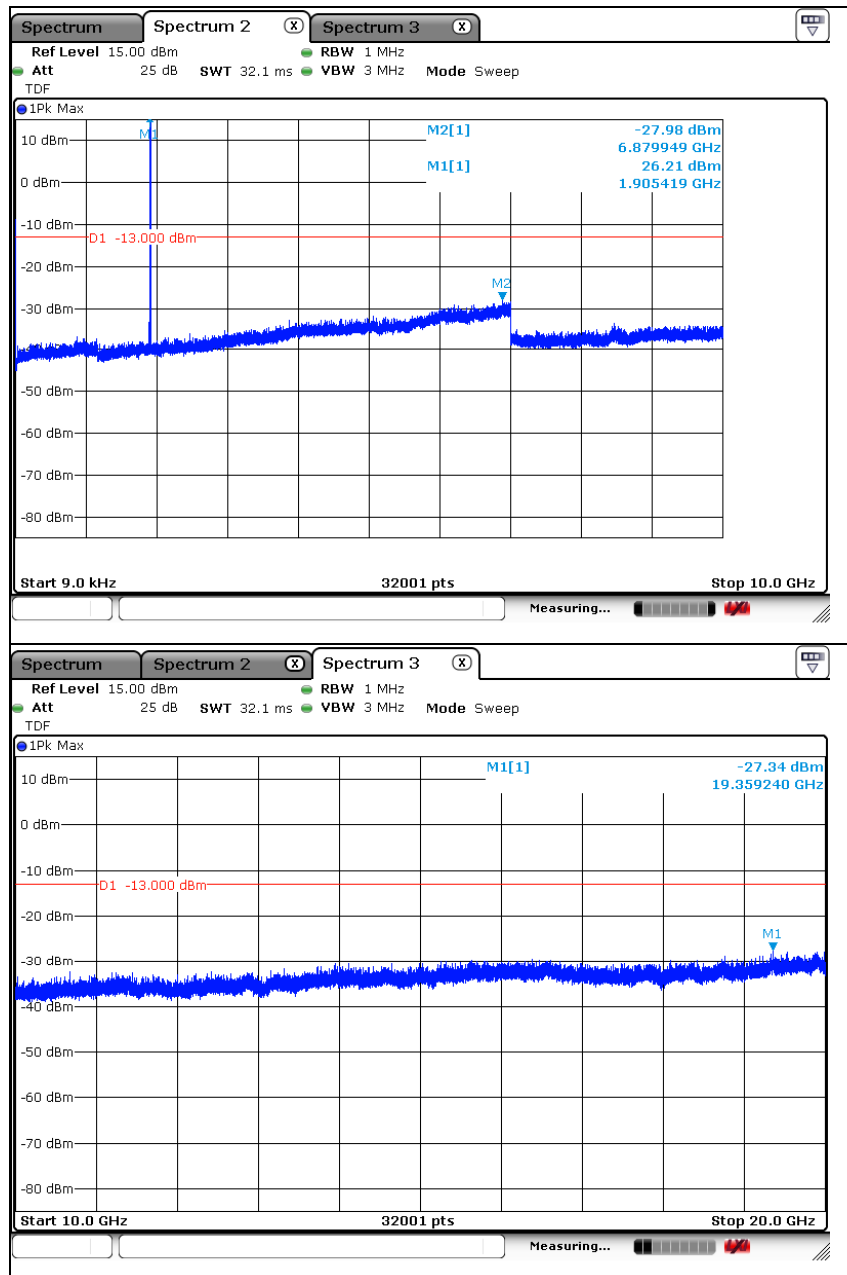
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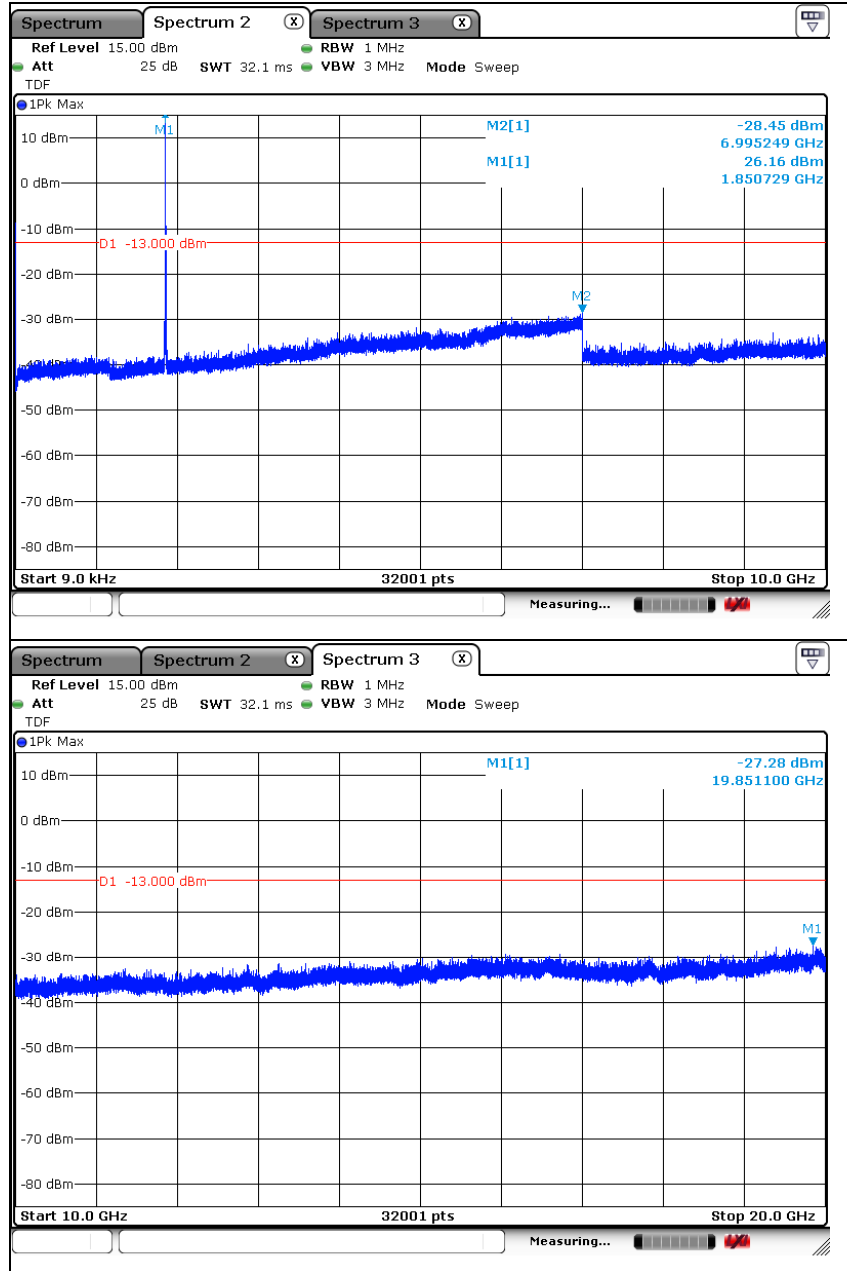
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LTE band 2 (10 MHz – QPSK)

Low Channel



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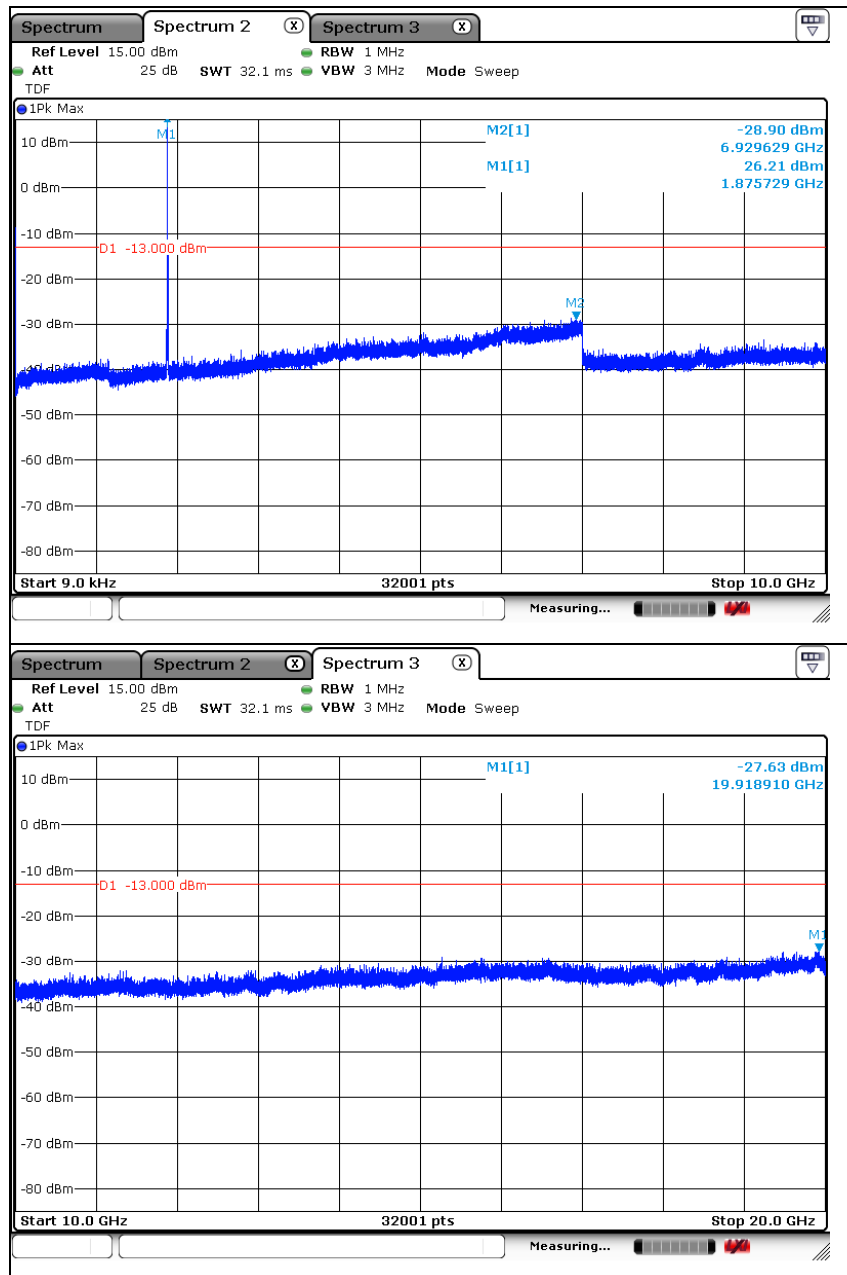
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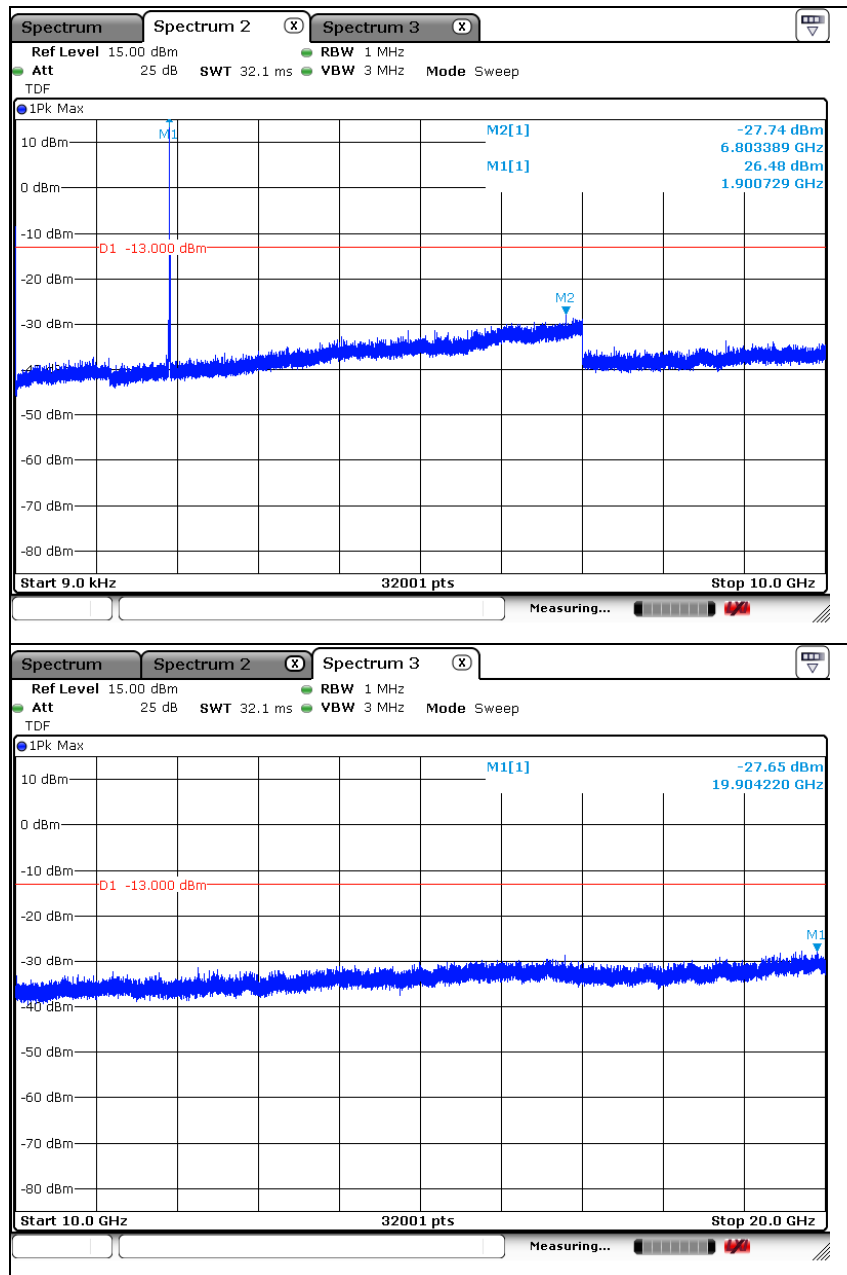
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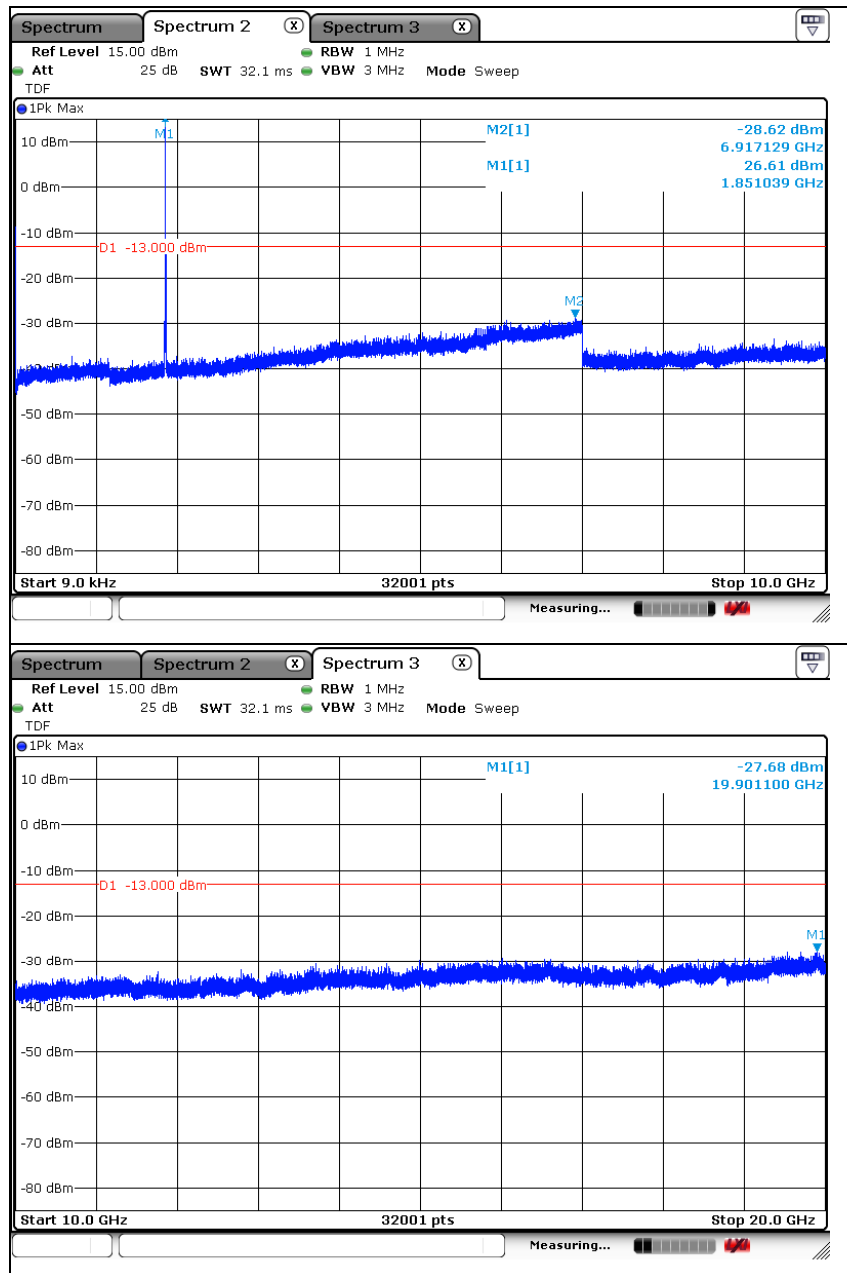
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LTE band 2 (15 MHz – QPSK)

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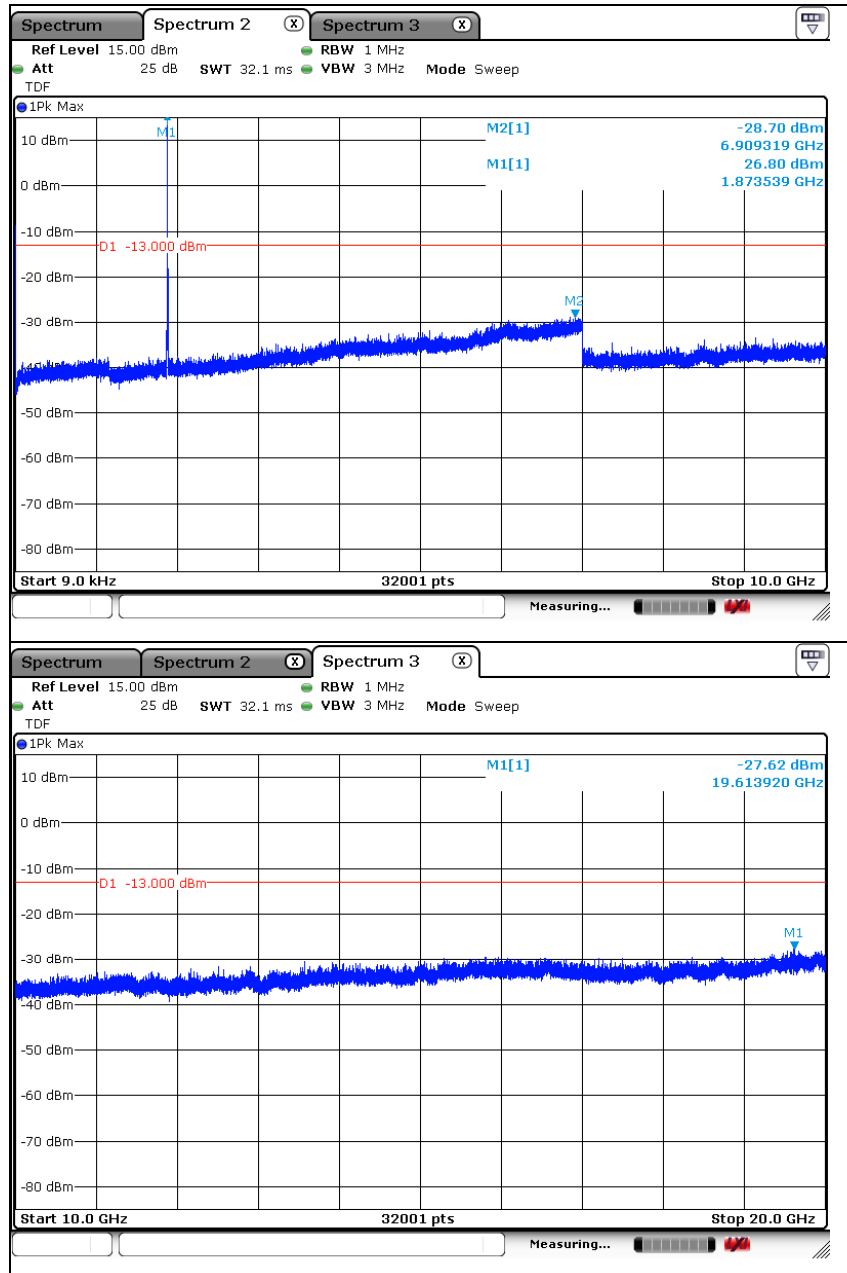
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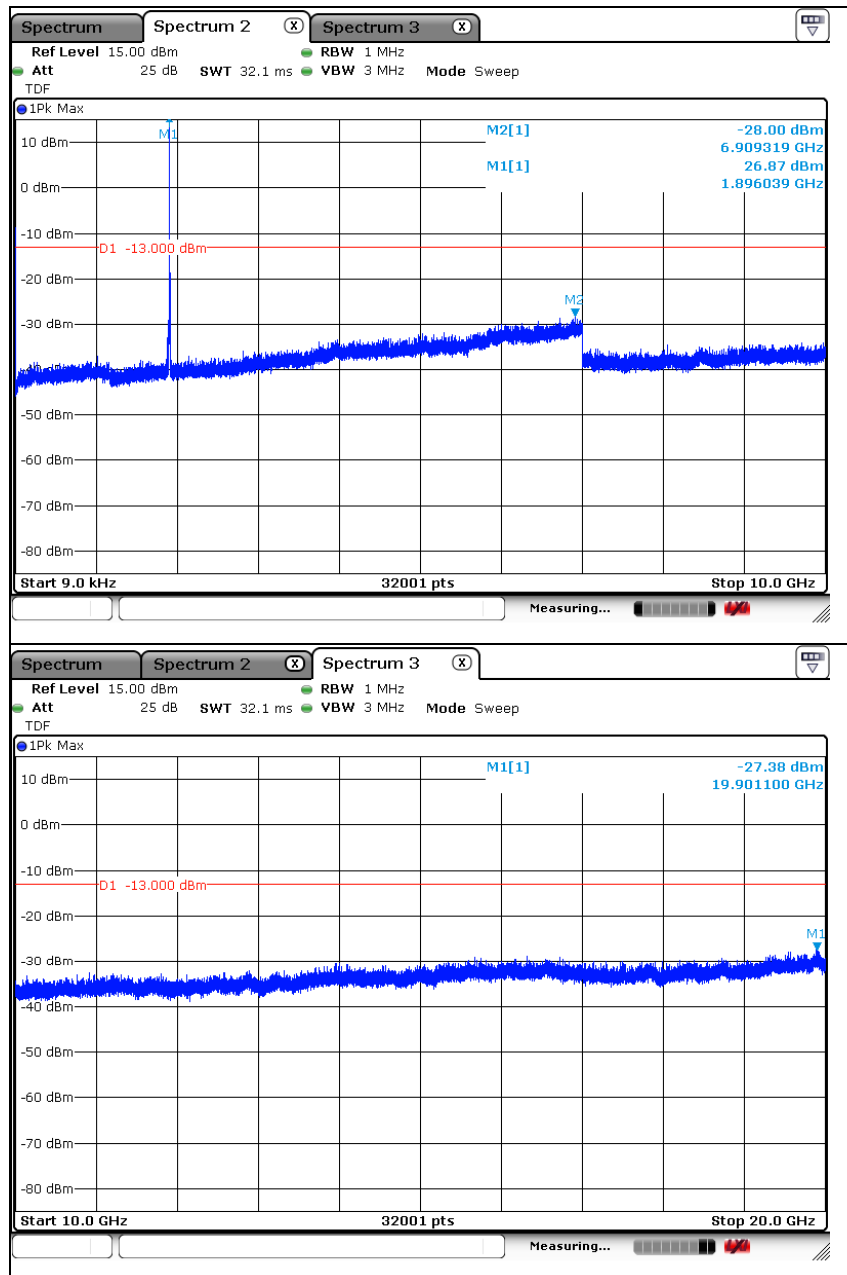
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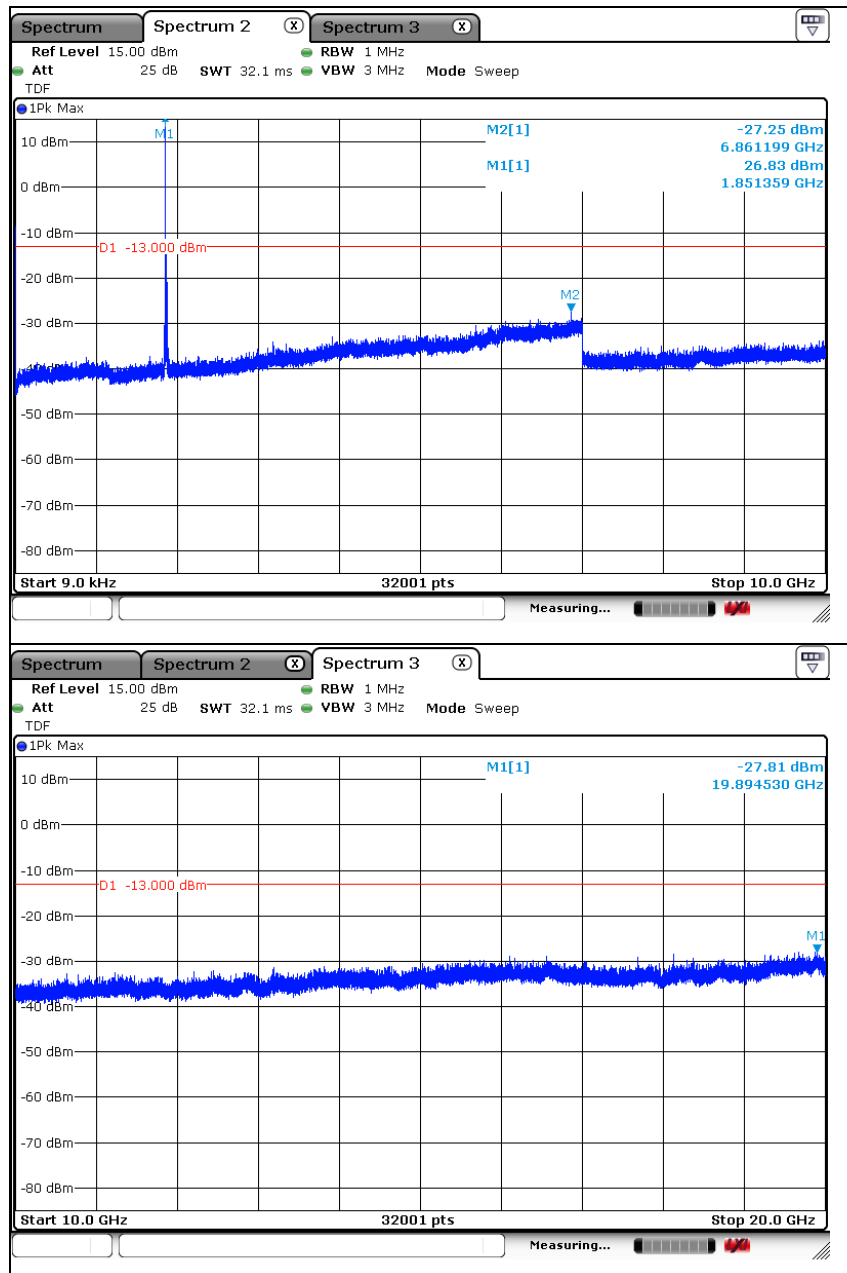
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LTE band 2 (20 MHz – QPSK)

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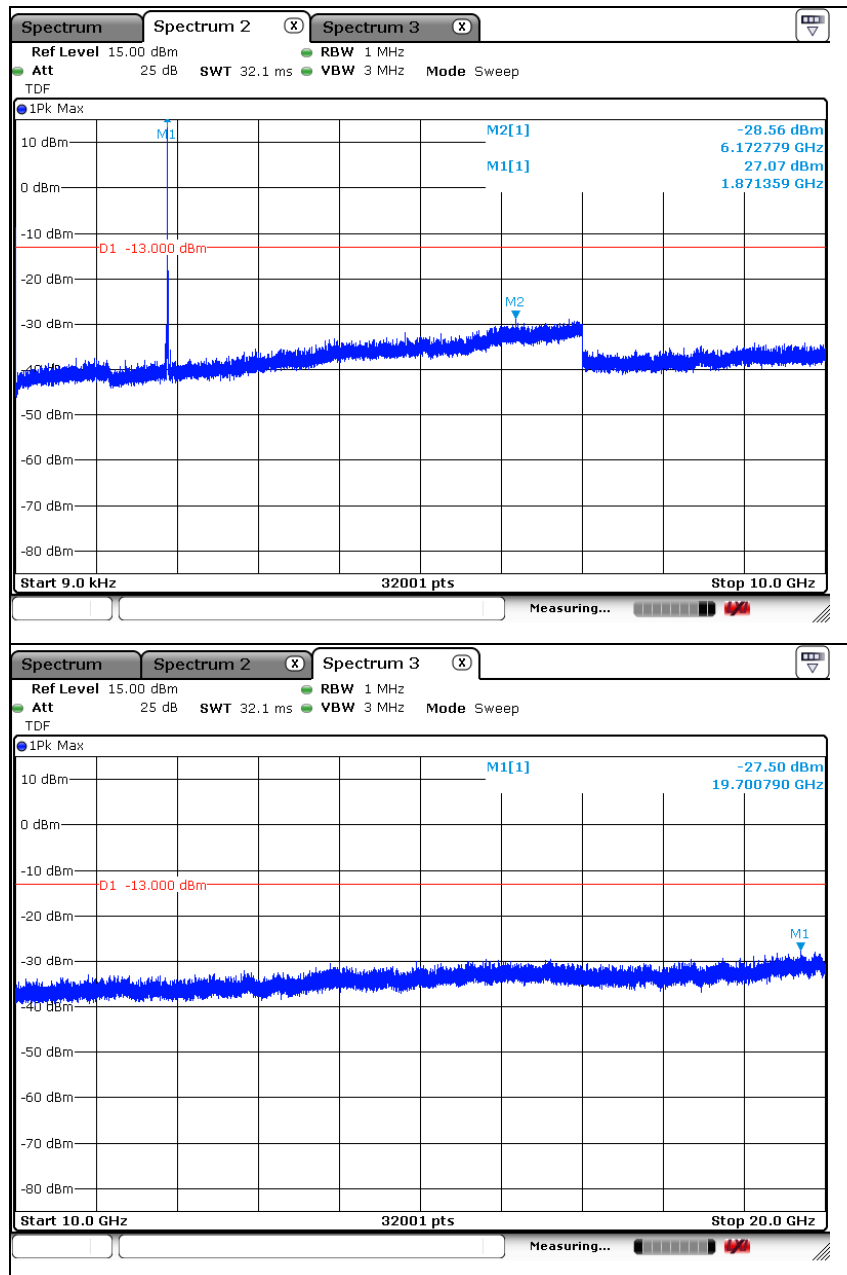
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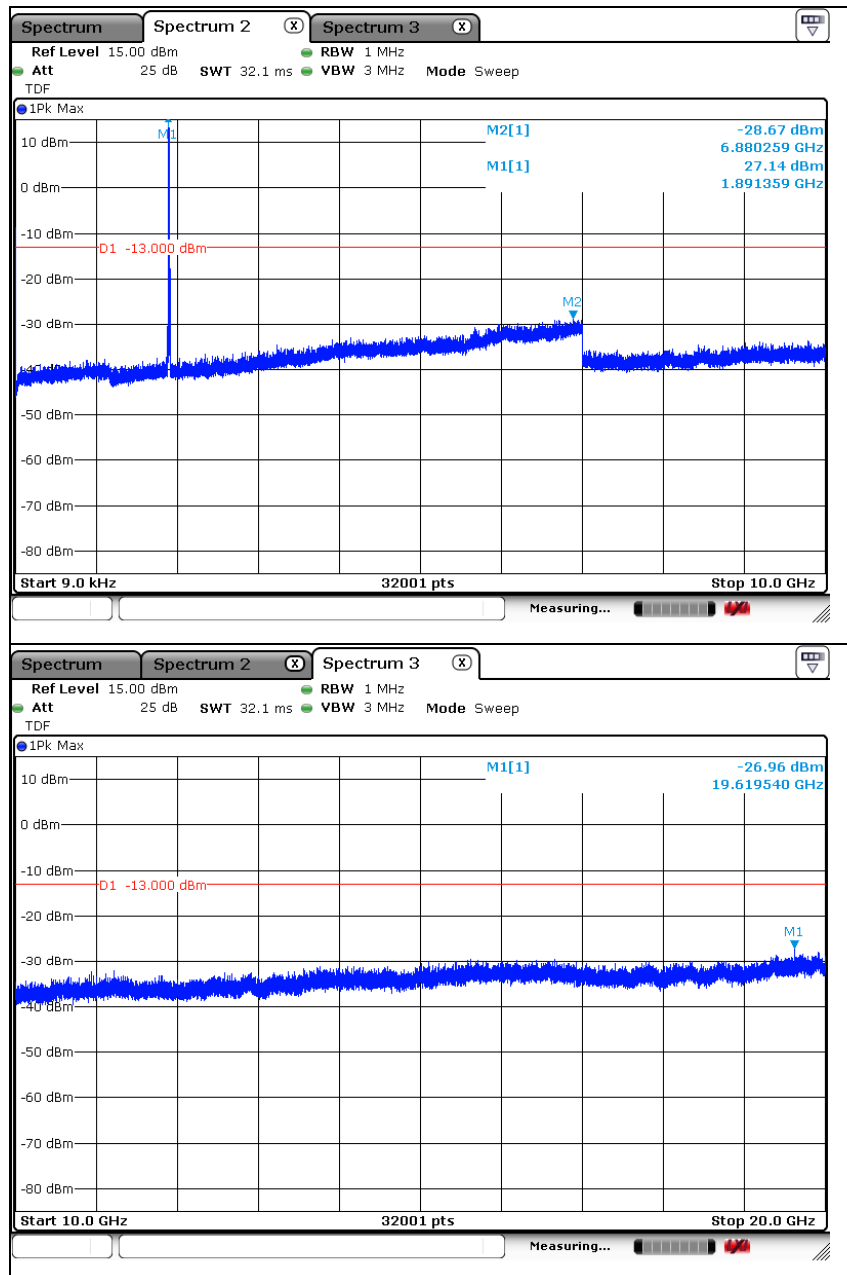
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Middle Channel



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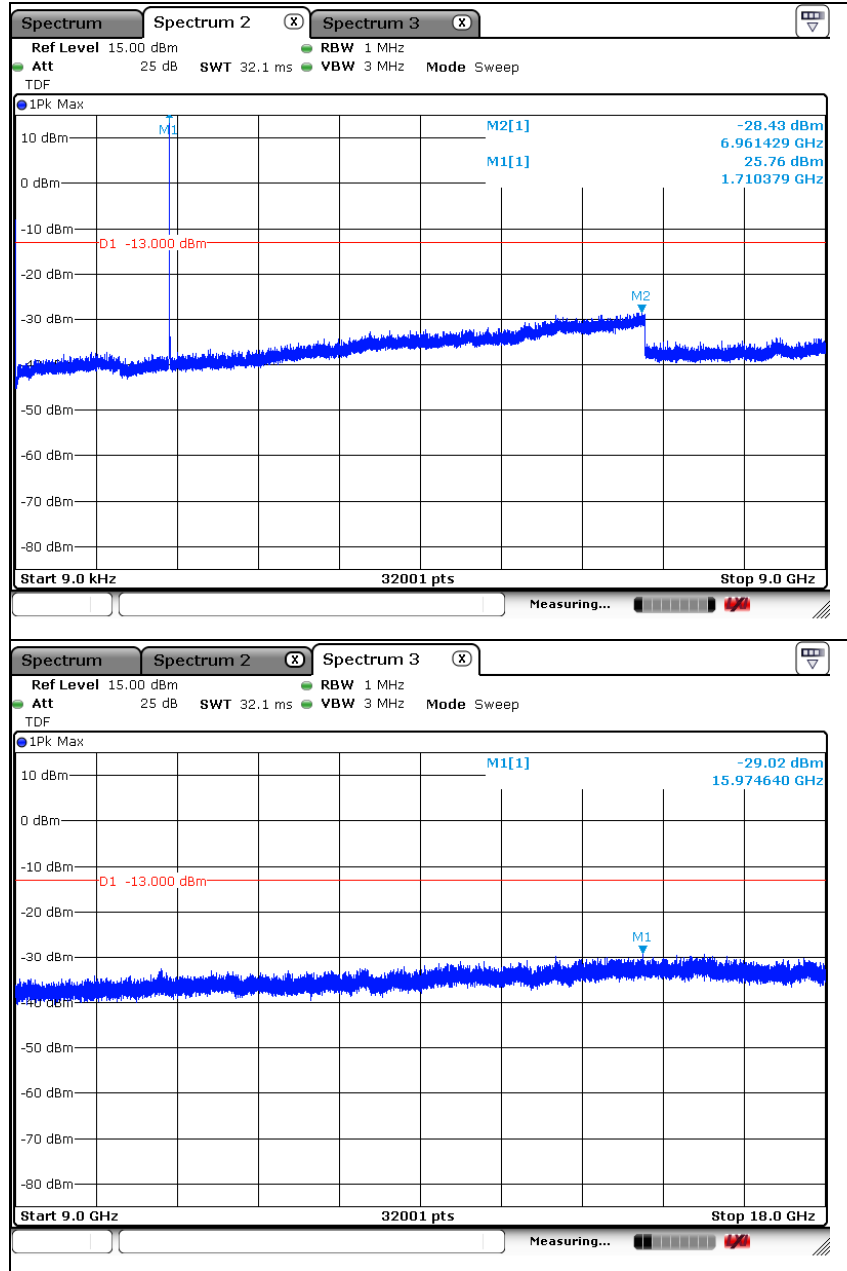
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LTE band 4 (1.4 MHz – QPSK)

Low Channel



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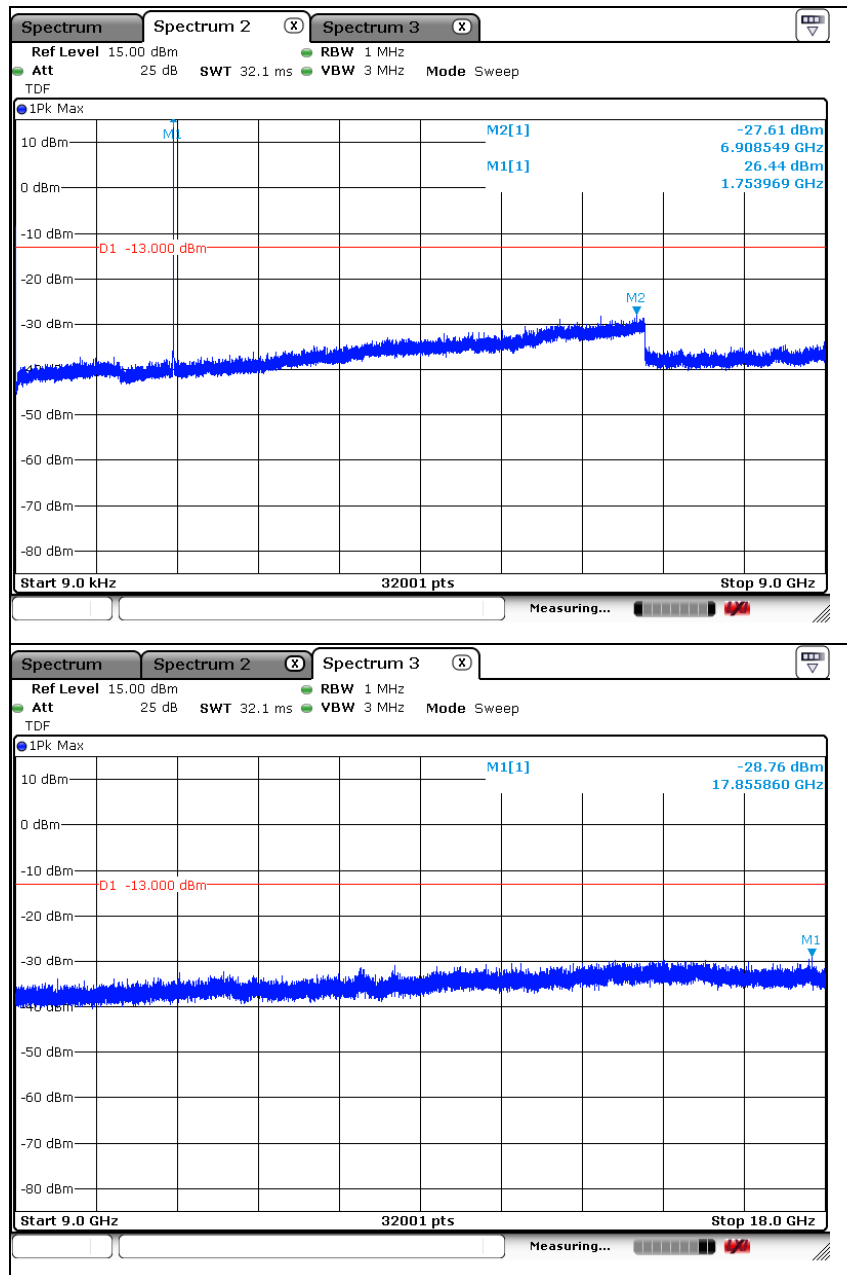
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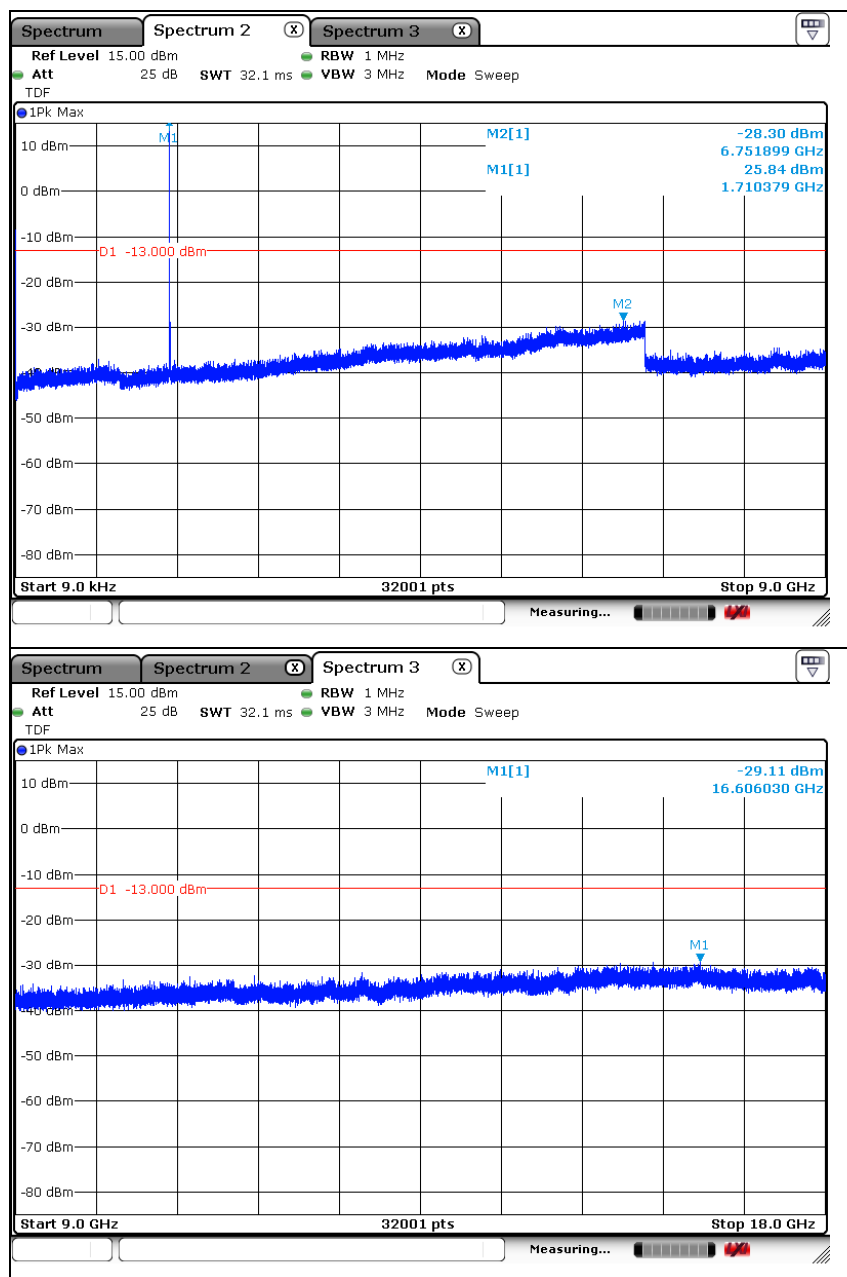
High Channel



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LTE band 4 (3 MHz – QPSK)

Low Channel



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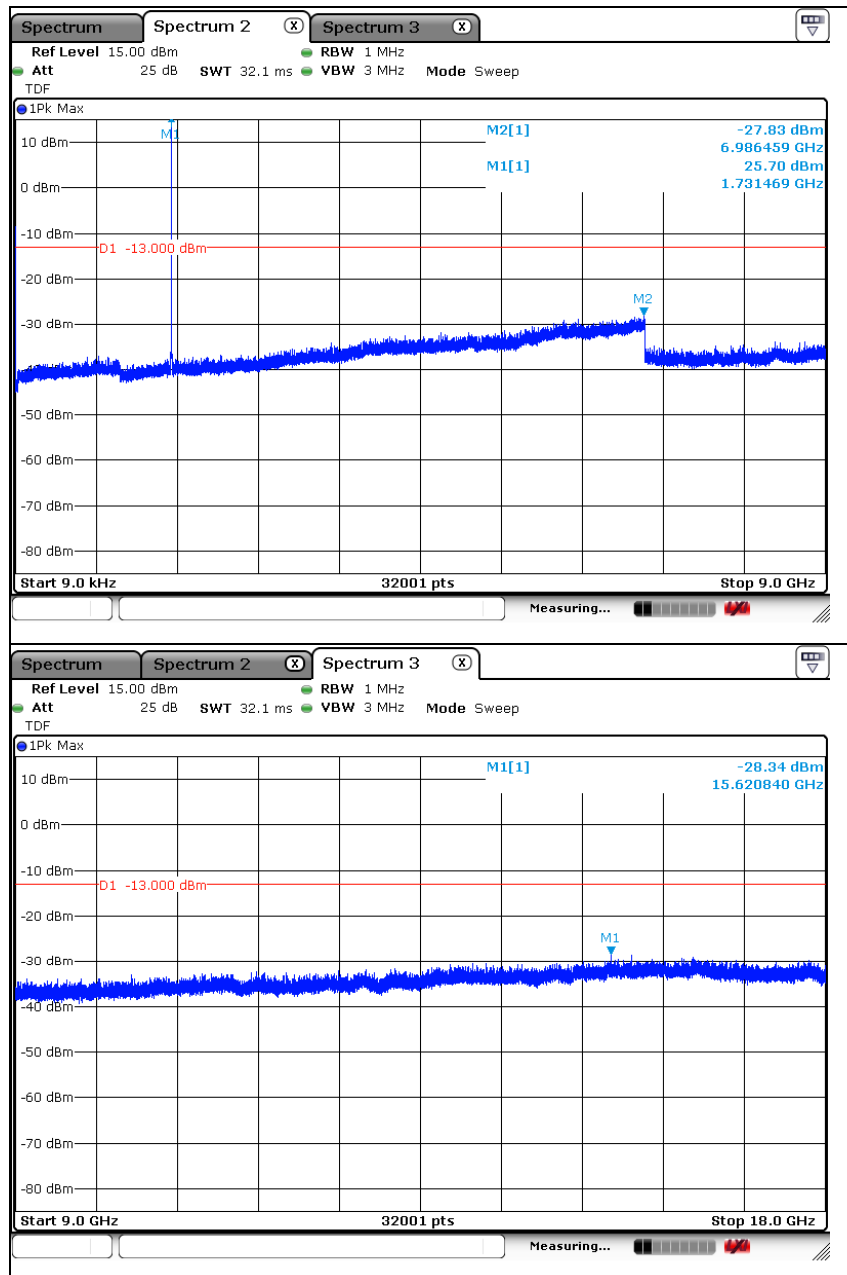
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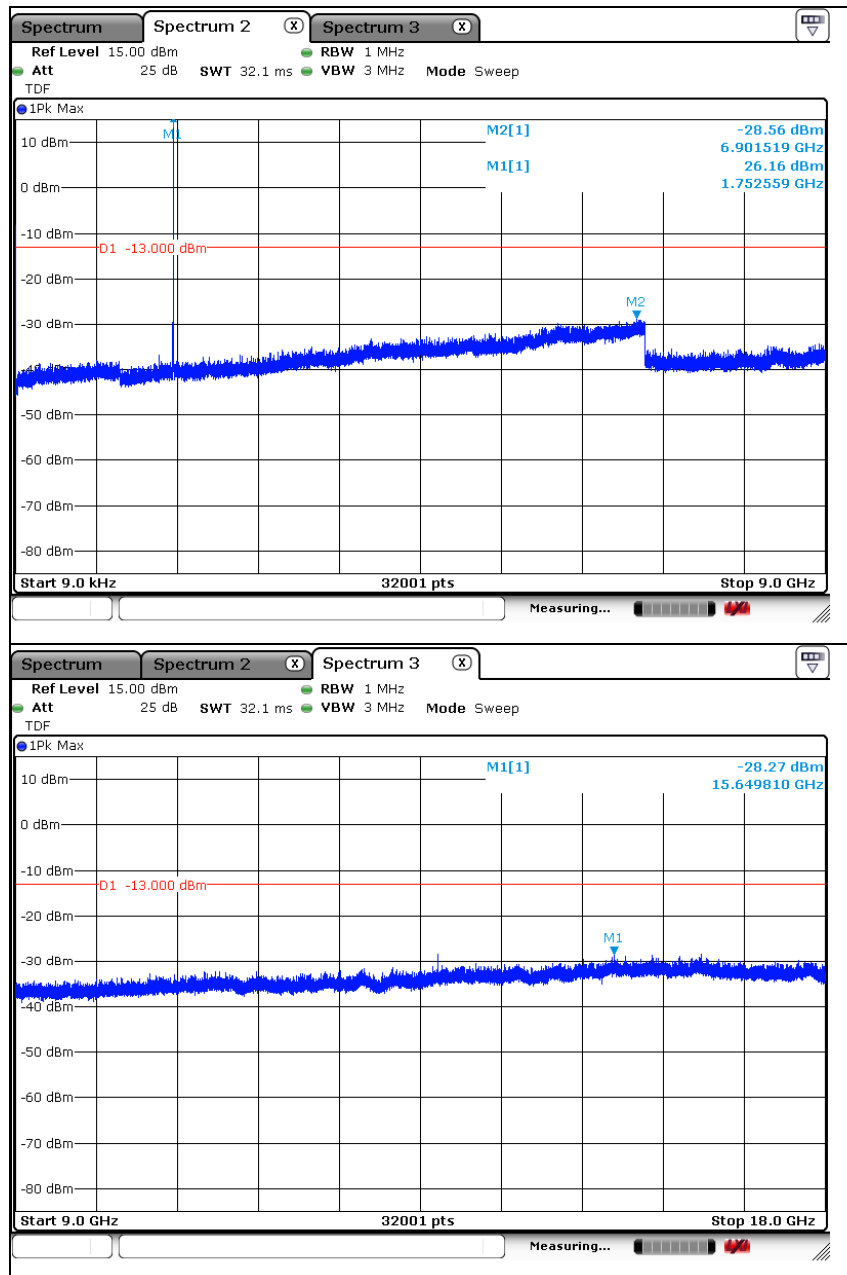
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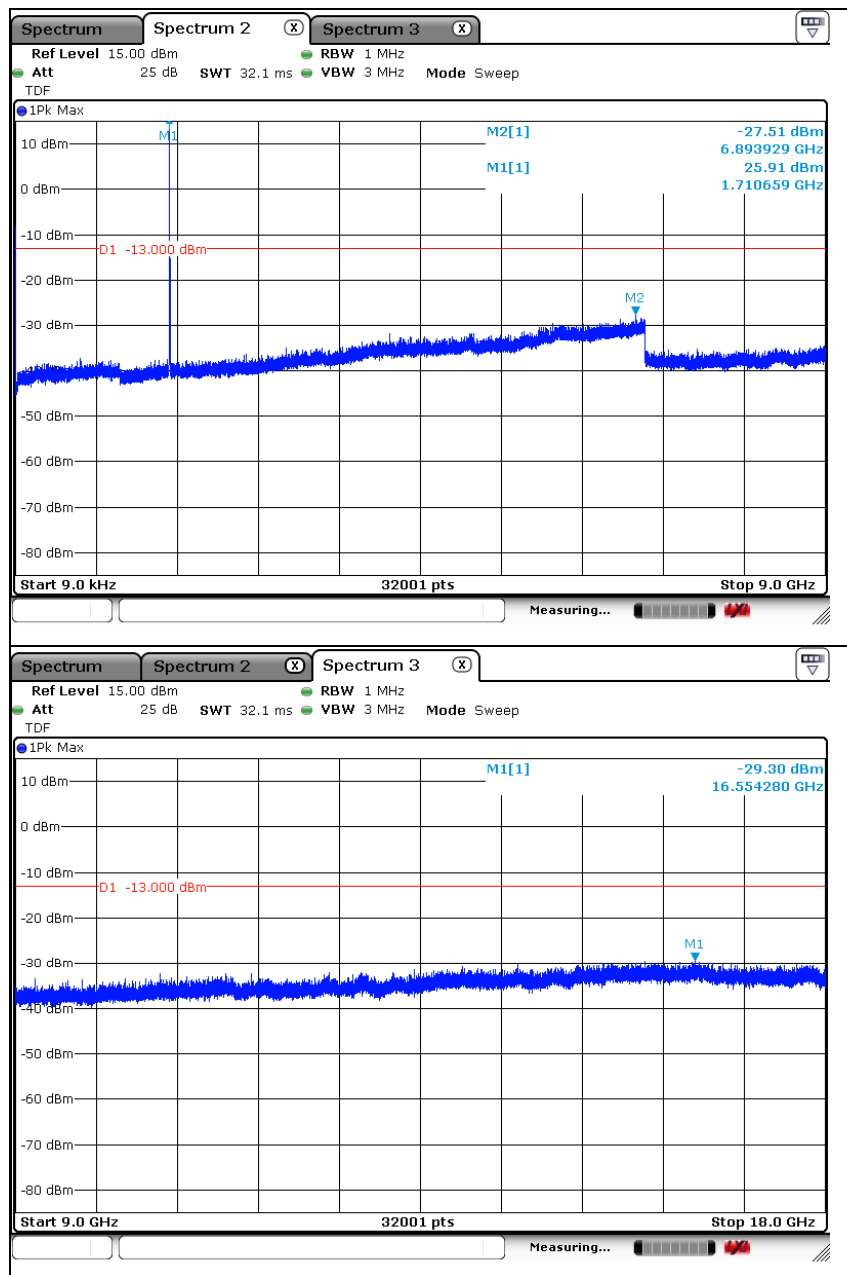
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LTE band 4 (5 MHz – QPSK)

Low Channel



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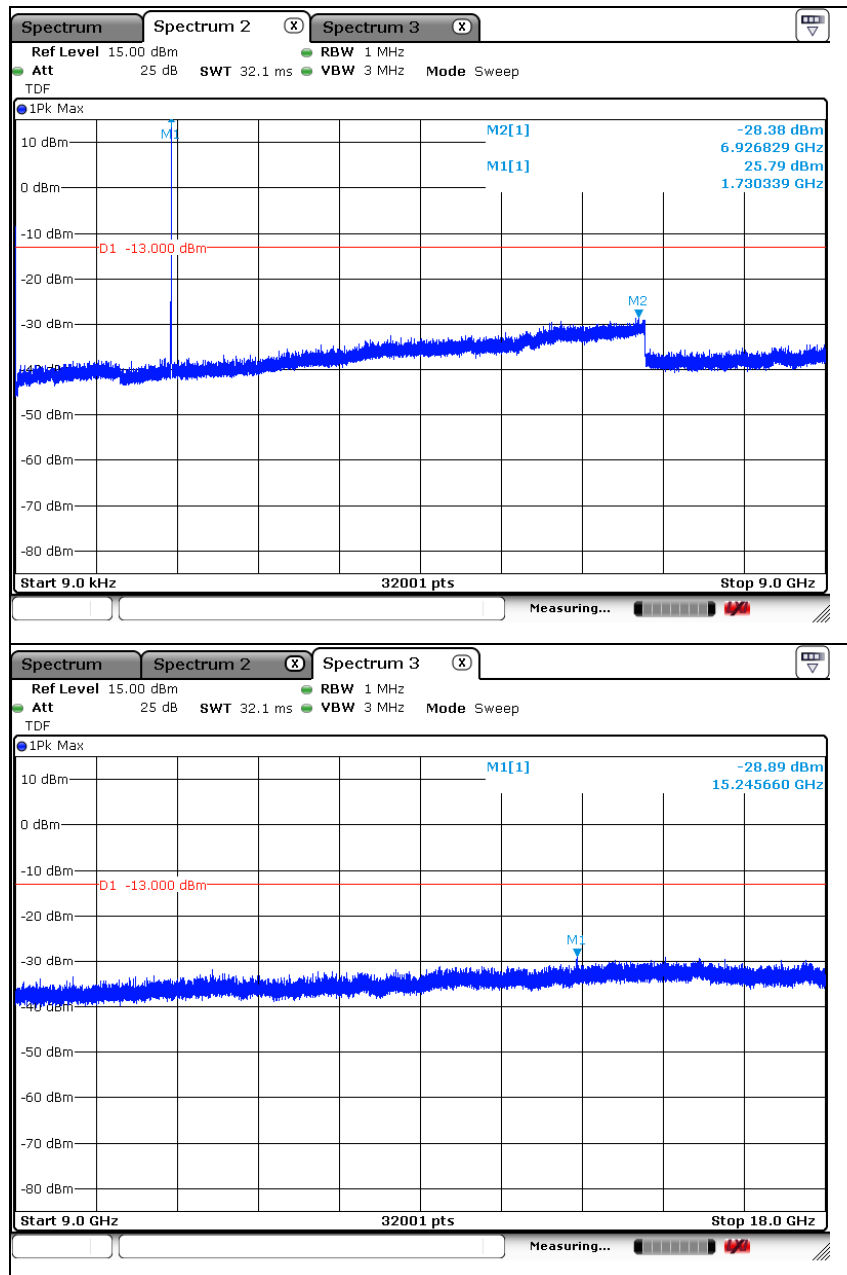
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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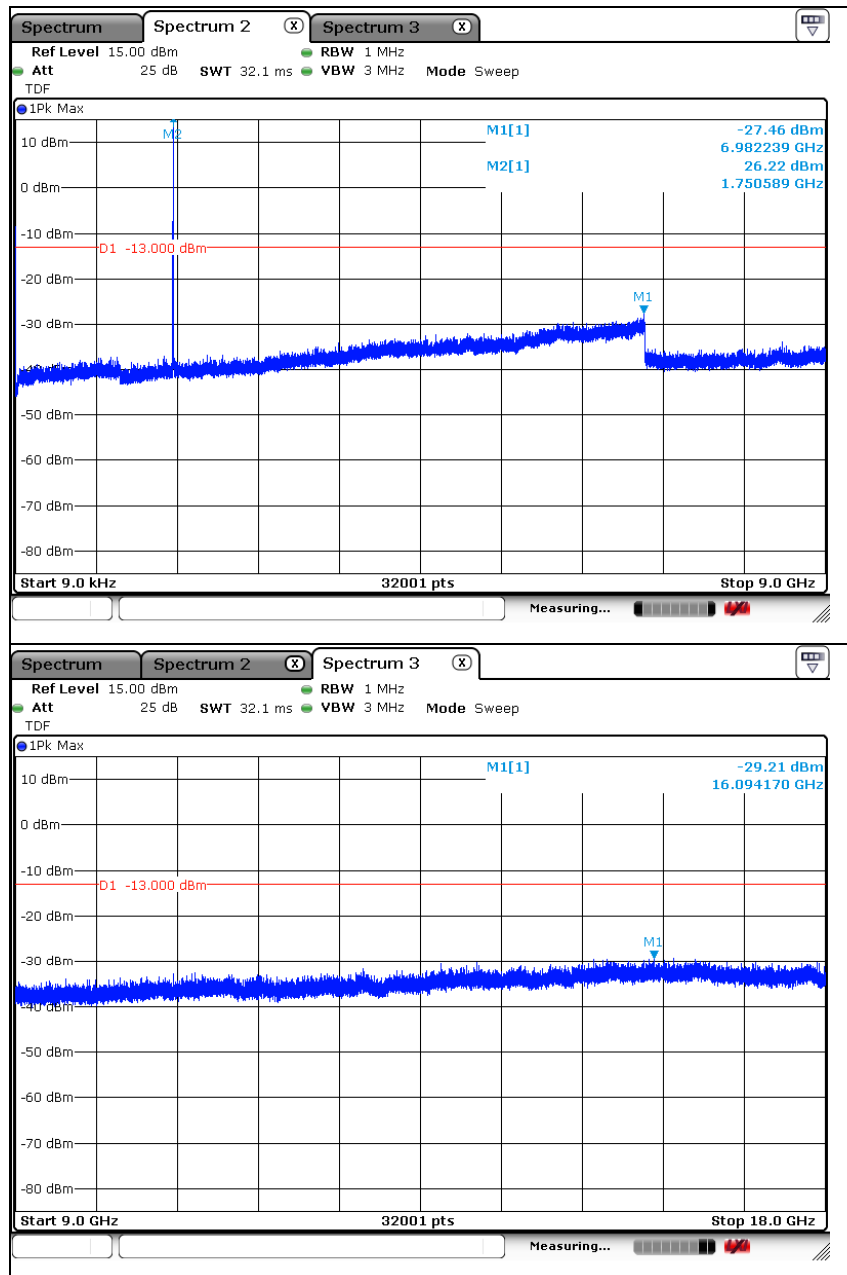
A4(210 mm x 297 mm)

Middle Channel



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High Channel



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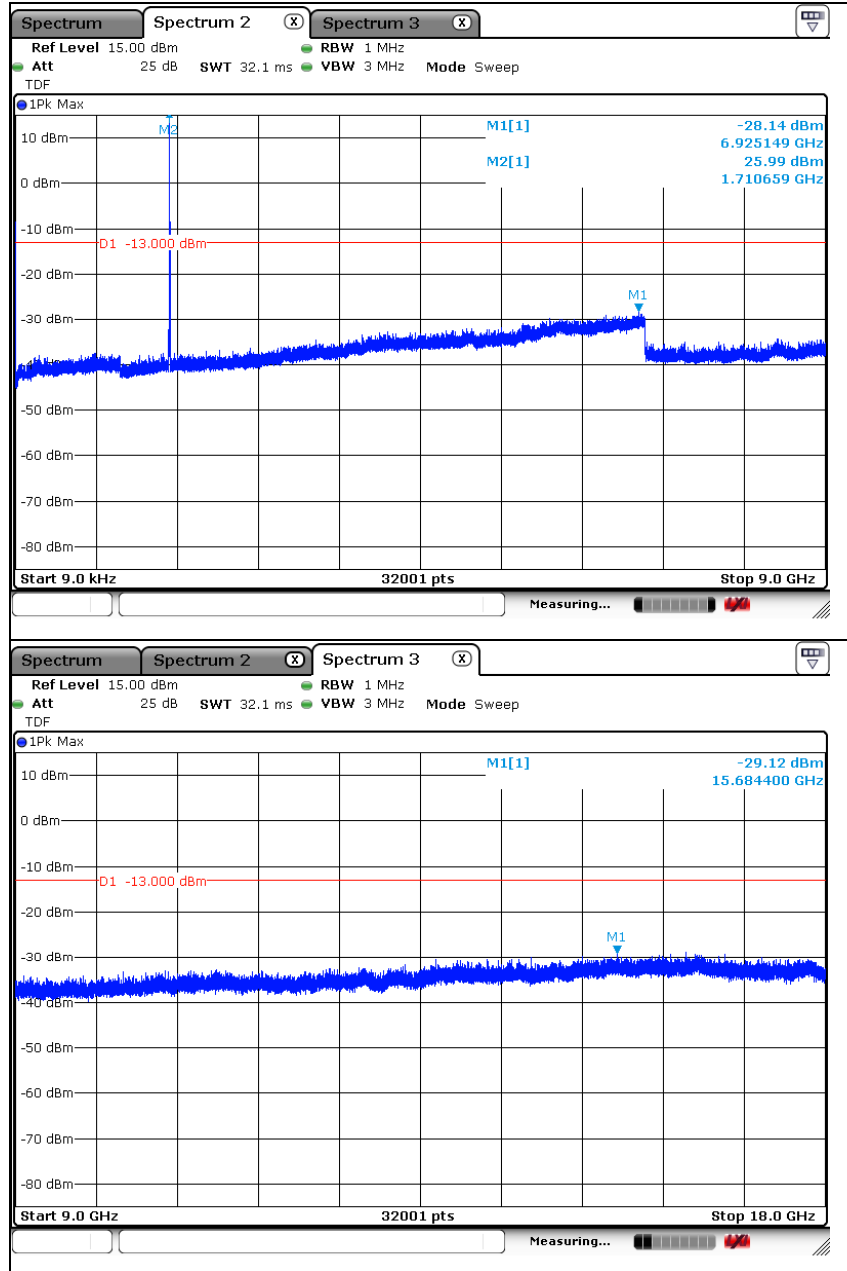
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

LTE band 4 (10 MHz – QPSK)

Low Channel



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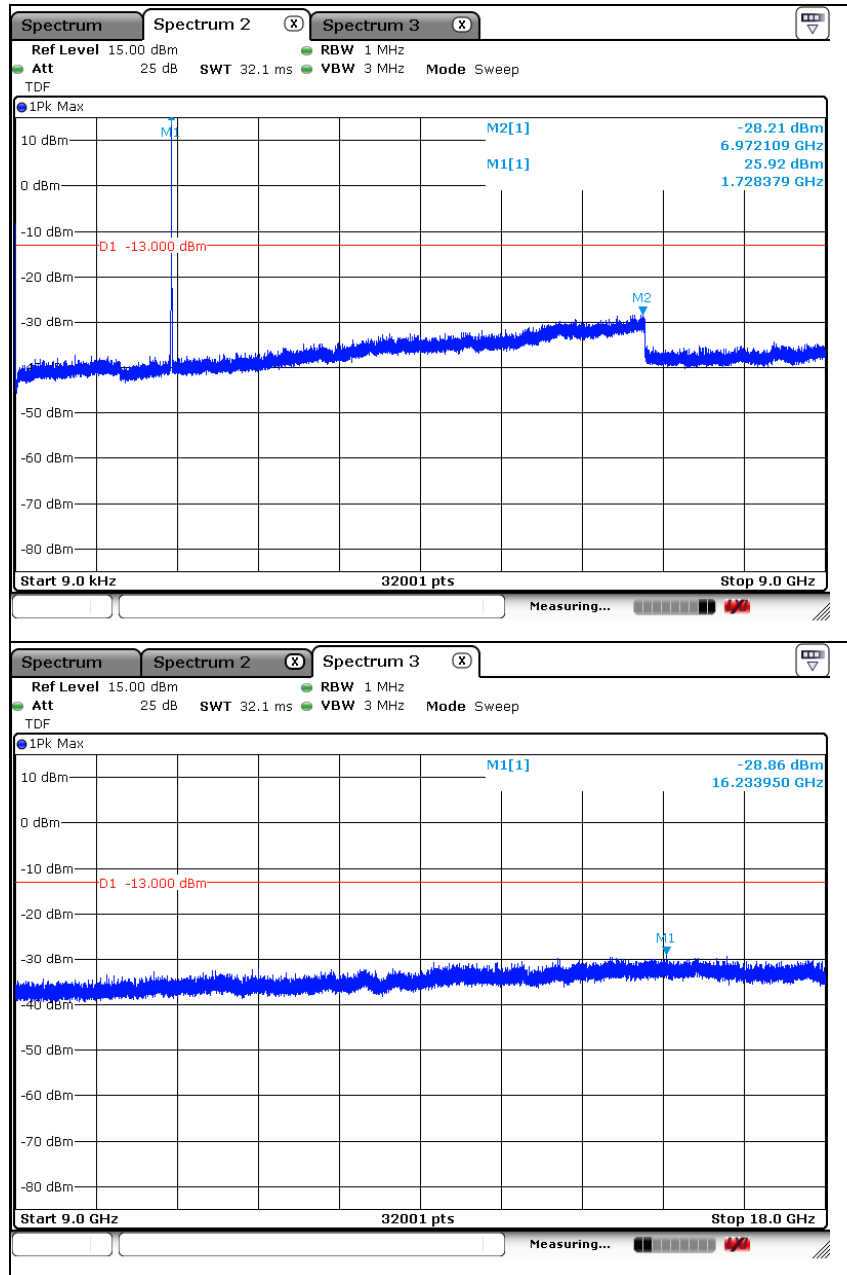
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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

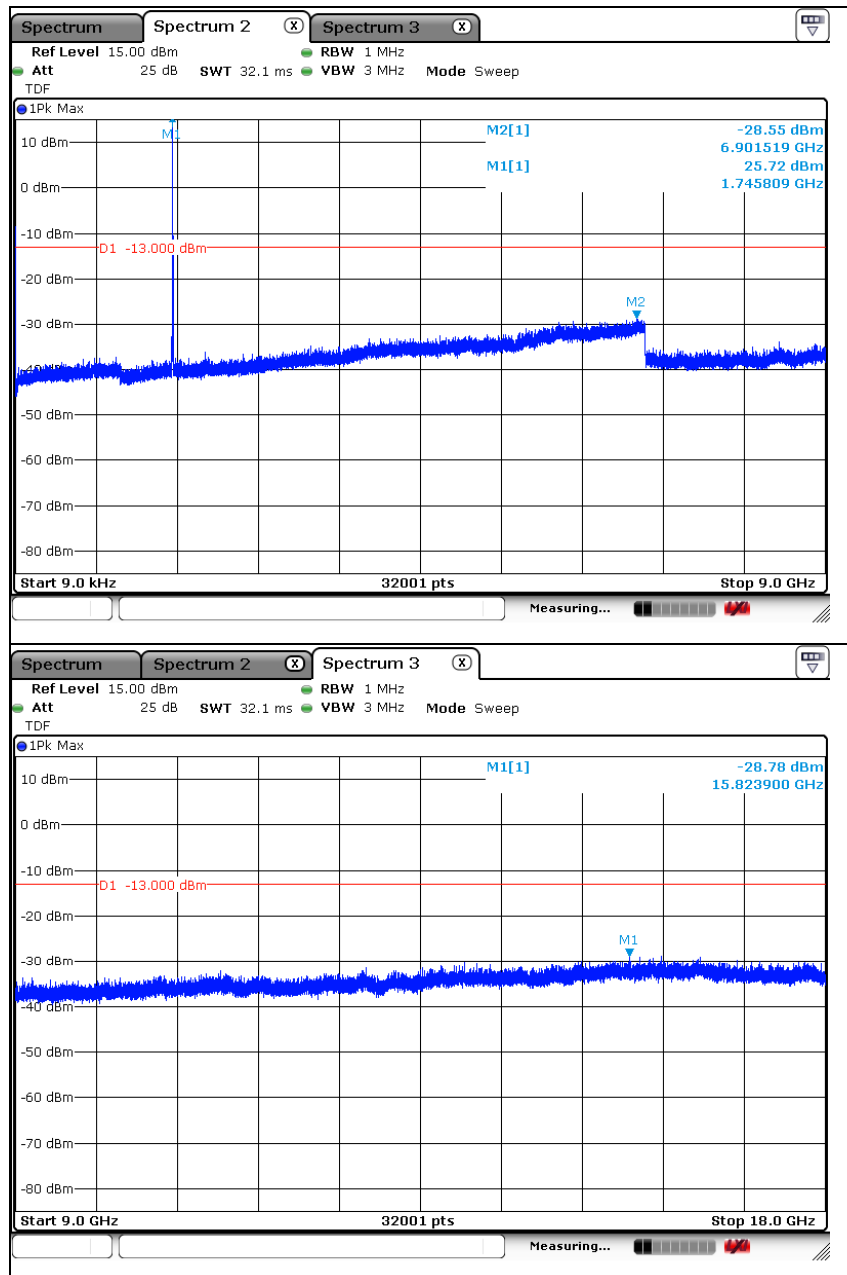
A4(210 mm x 297 mm)

Middle Channel



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High Channel



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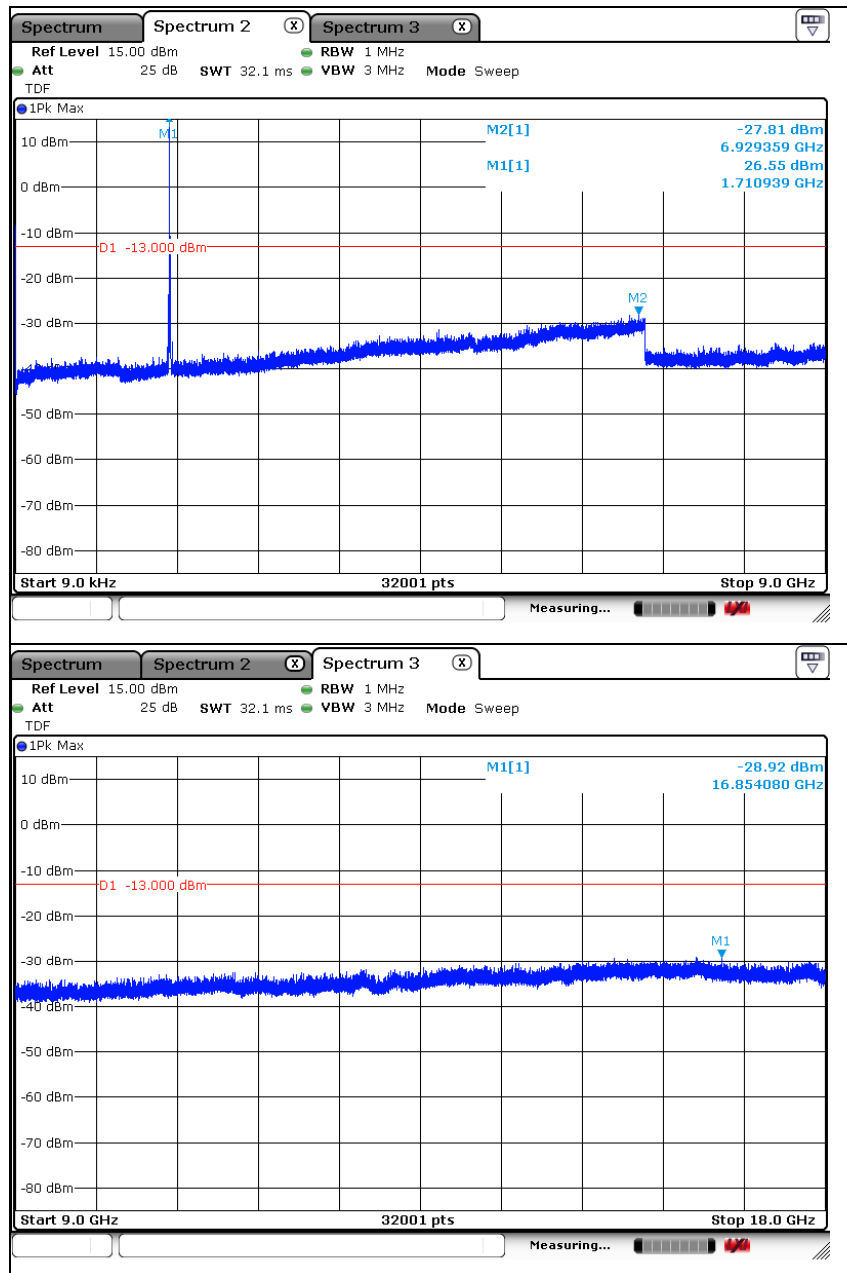
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

LTE band 4 (15 MHz – QPSK)

Low Channel



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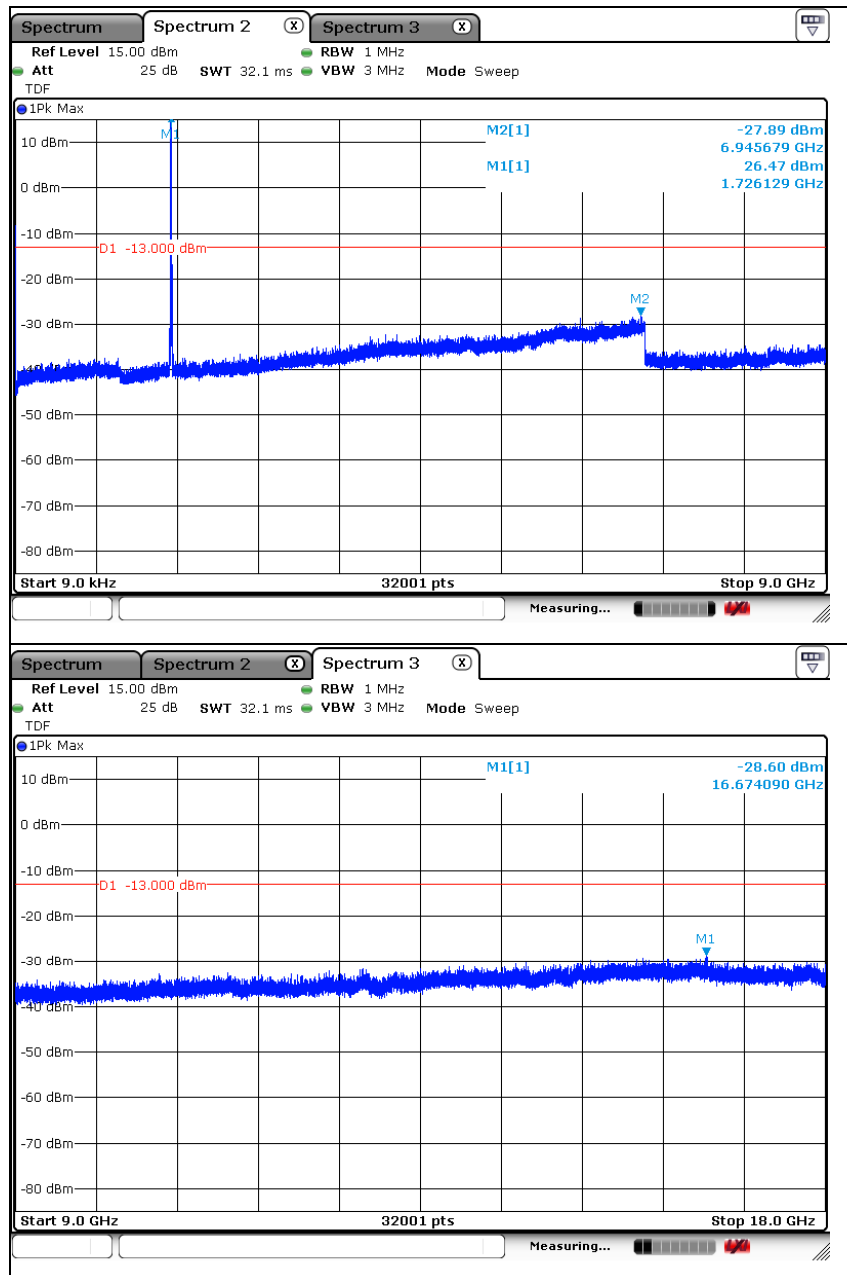
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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A4(210 mm x 297 mm)

Middle Channel



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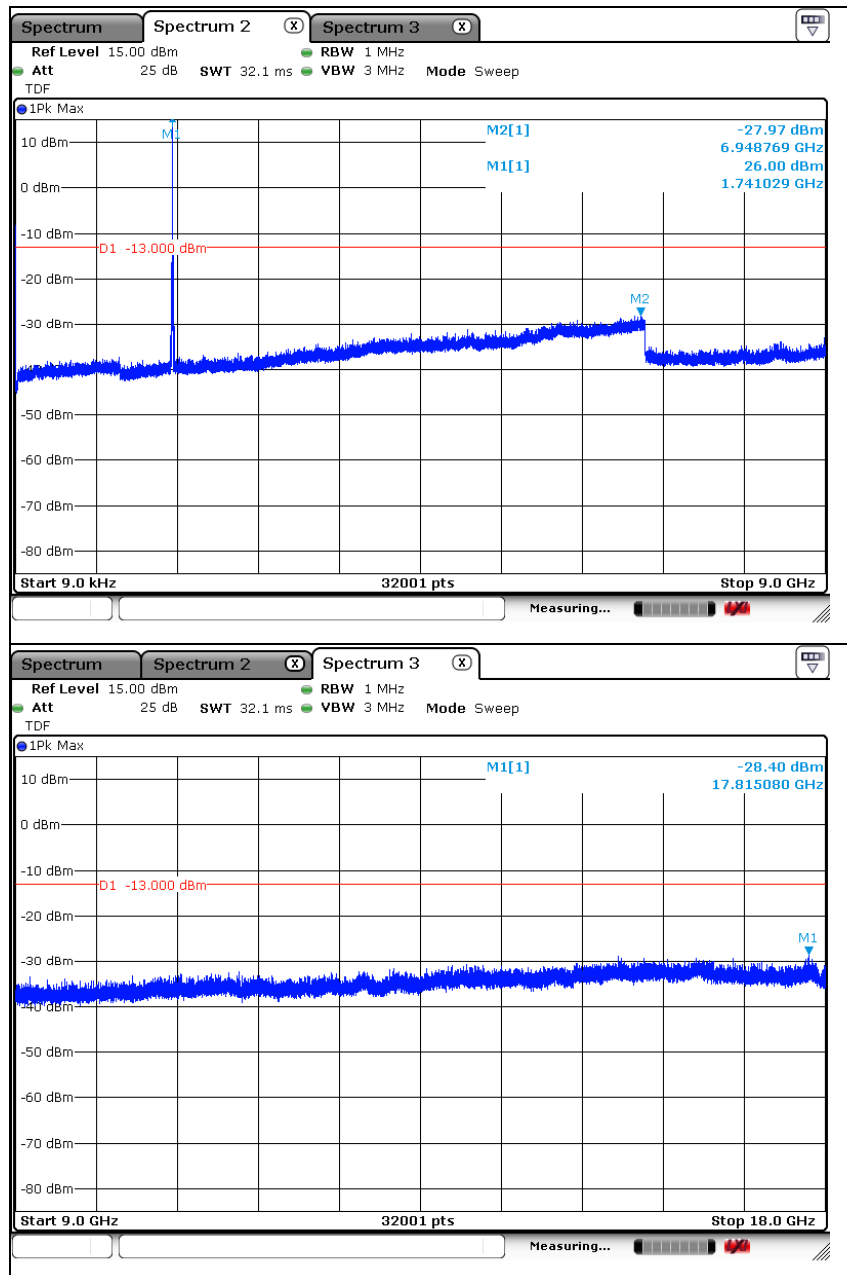
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

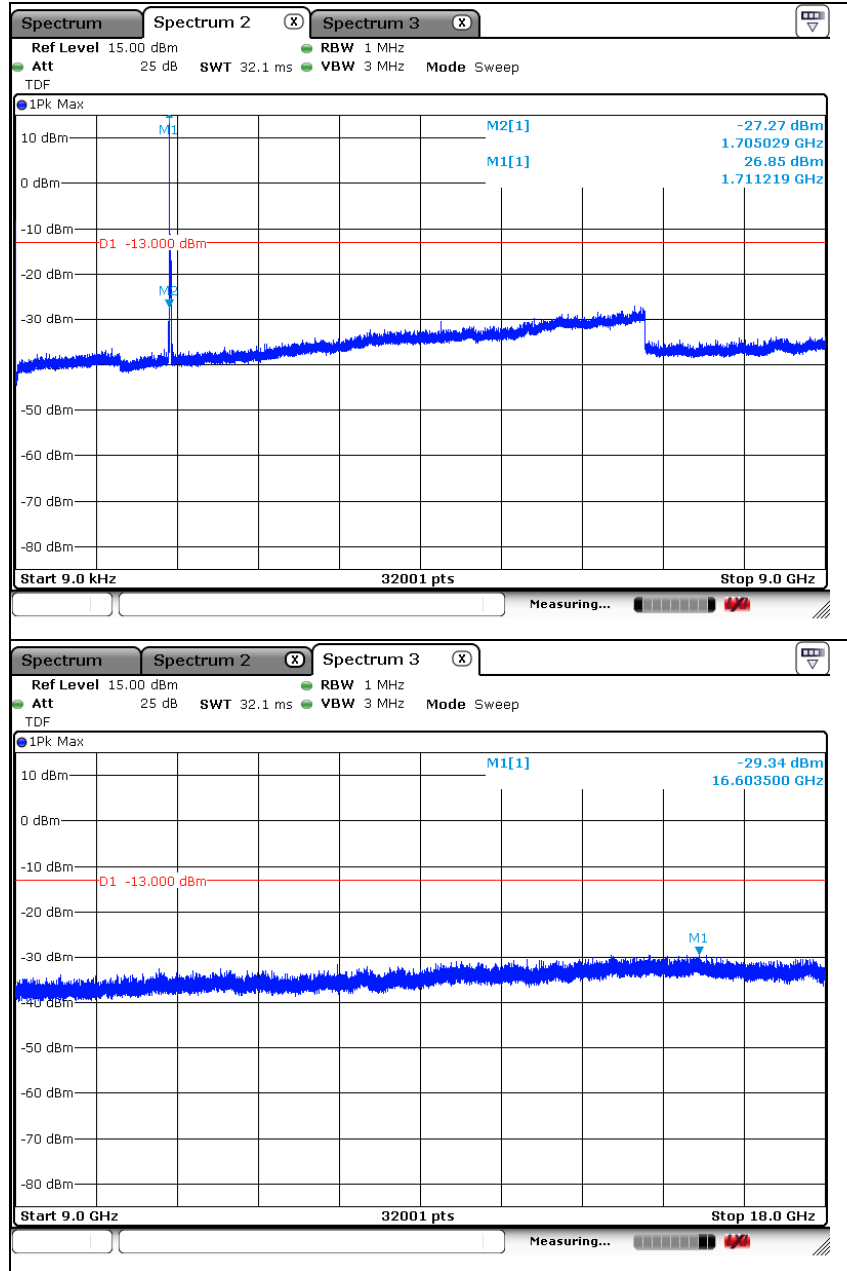
High Channel



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LTE band 4 (20 MHz – QPSK)

Low Channel



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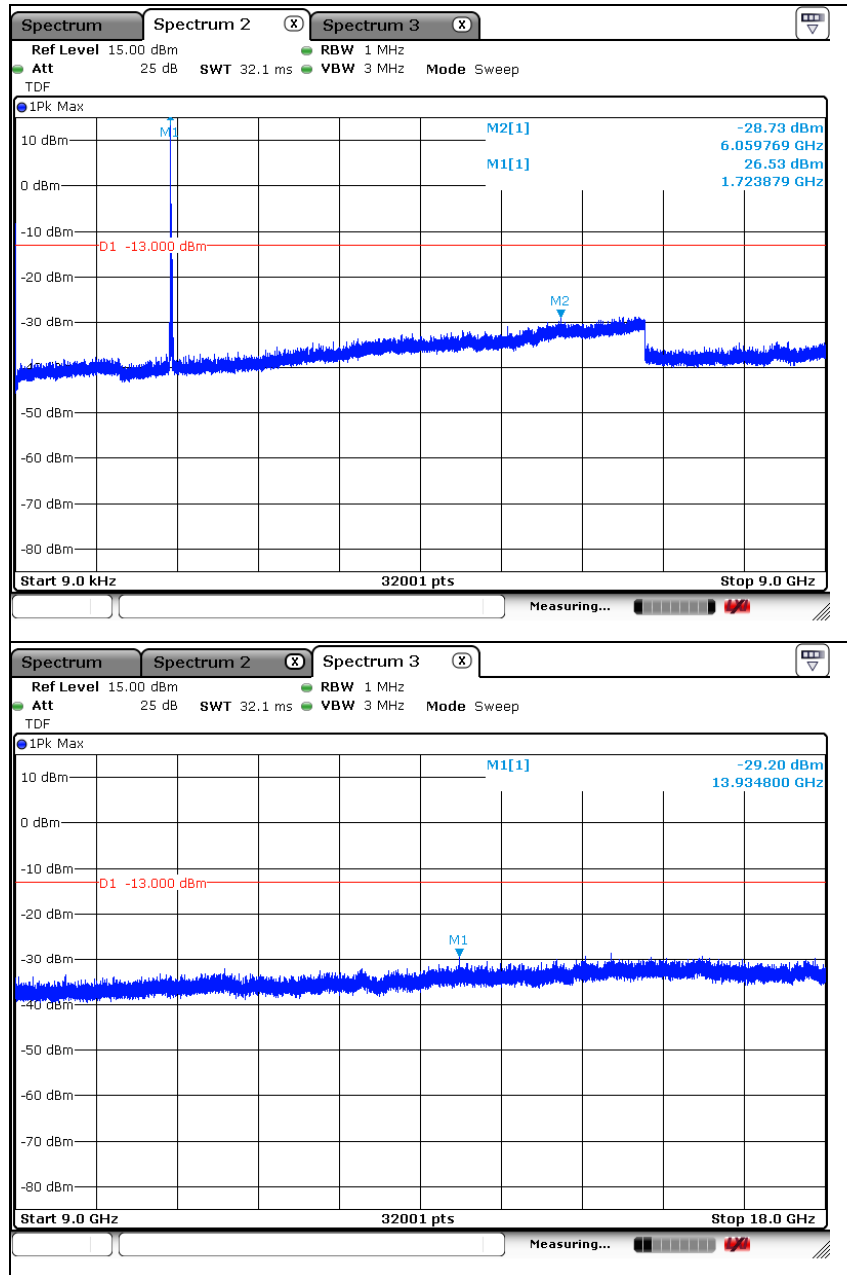
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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A4(210 mm x 297 mm)

Middle Channel



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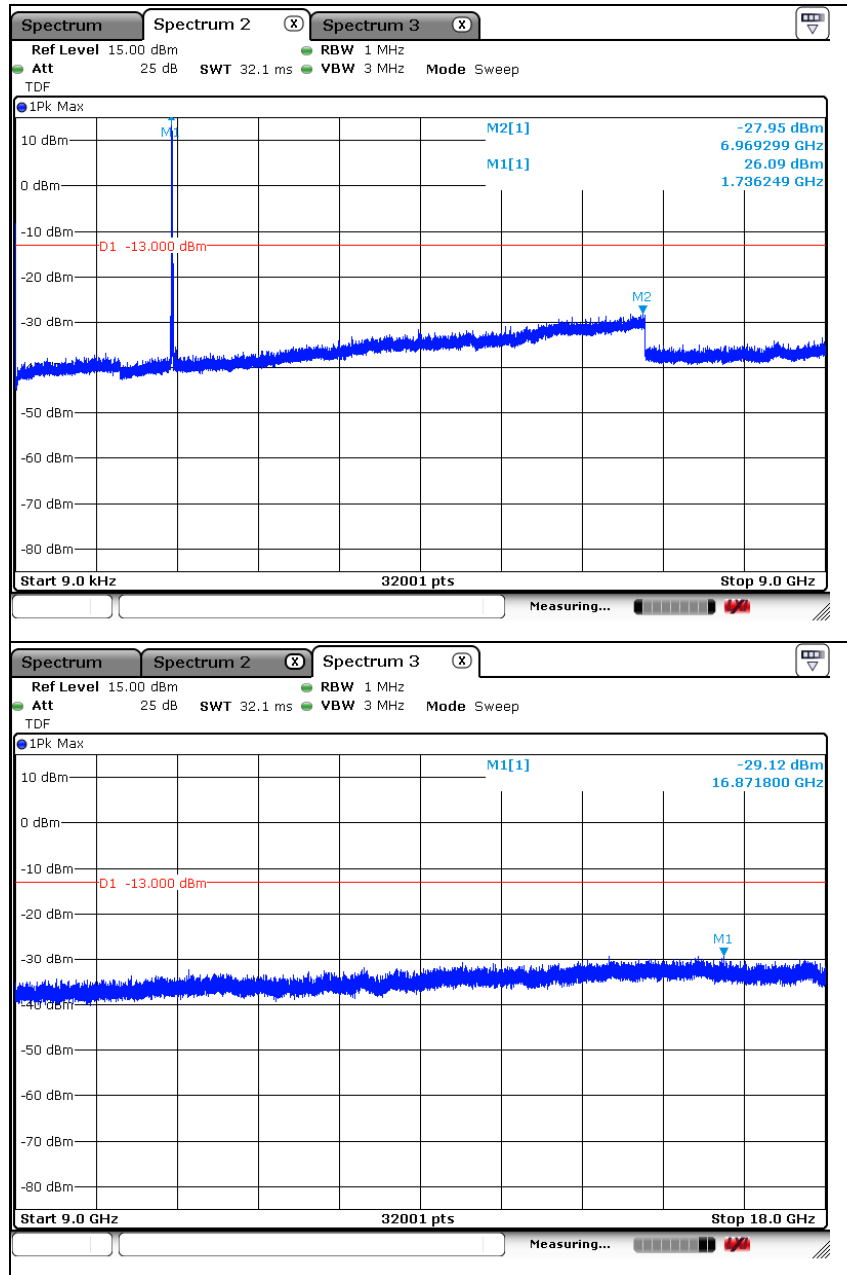
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

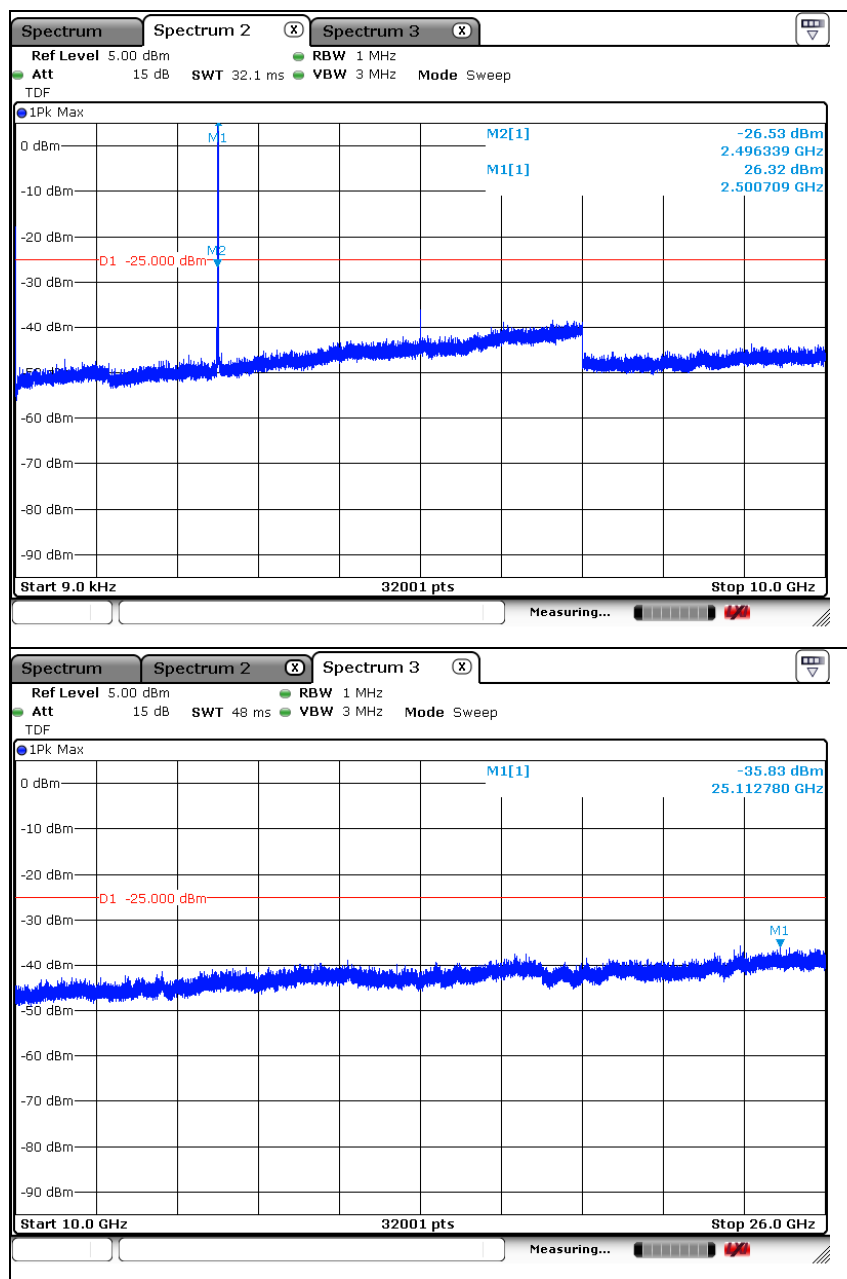
High Channel



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LTE band 7 (5 MHz – QPSK)

Low Channel



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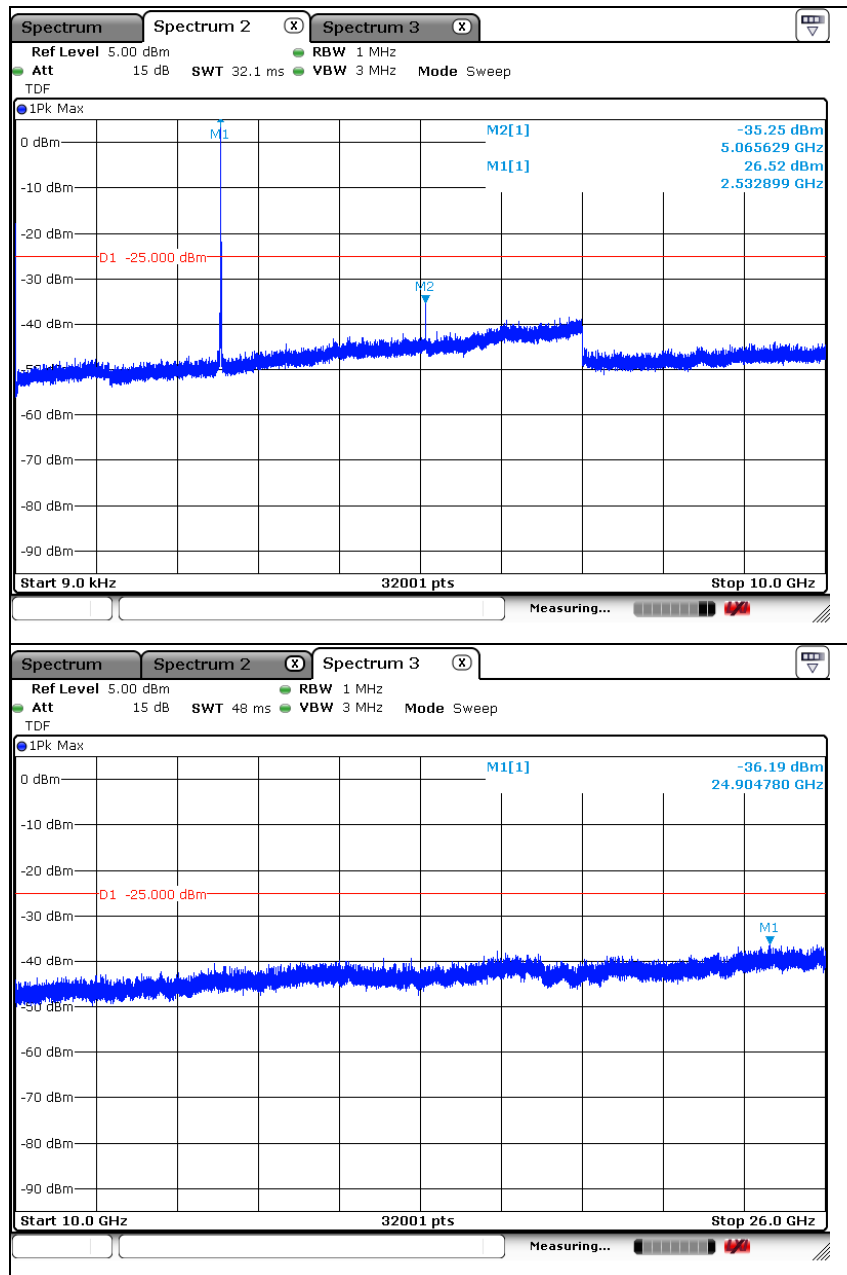
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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A4(210 mm x 297 mm)

Middle Channel



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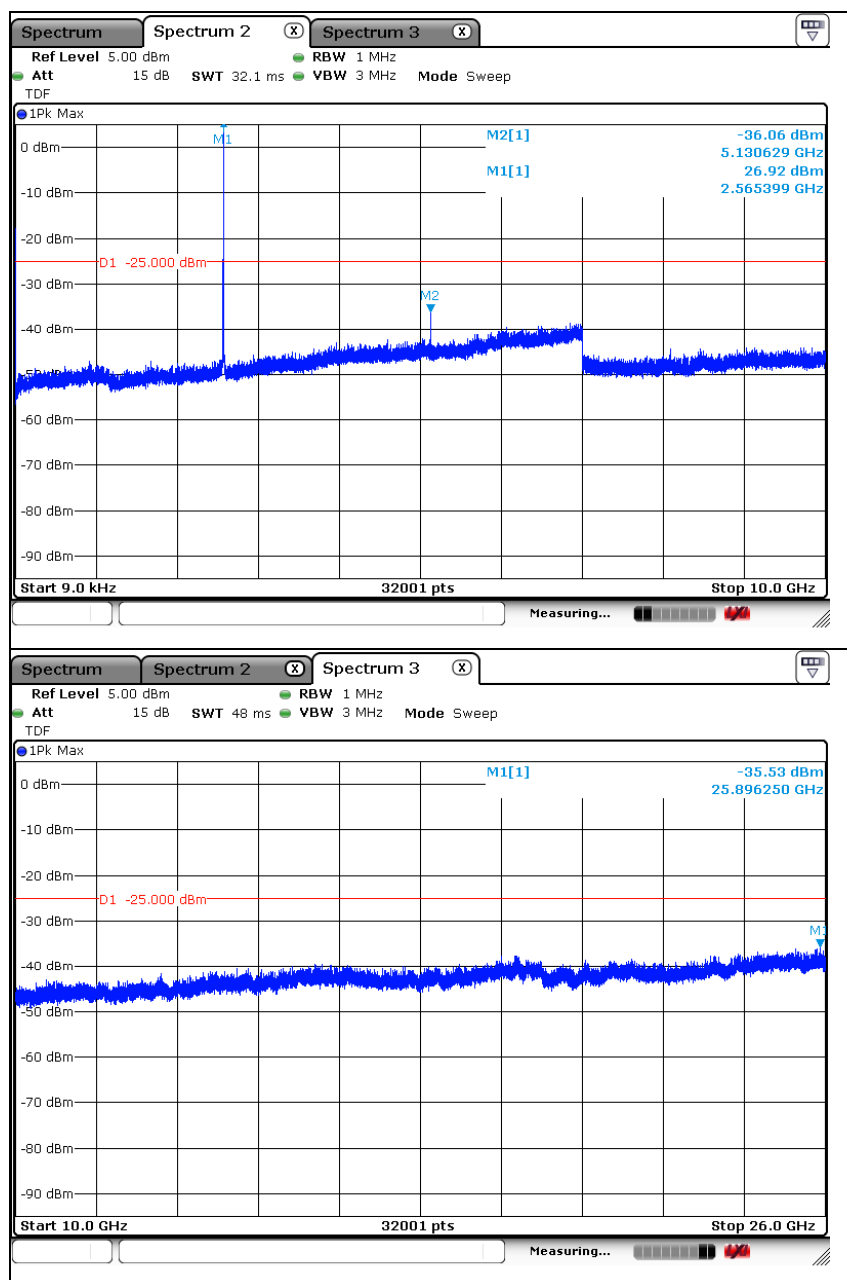
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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A4(210 mm x 297 mm)

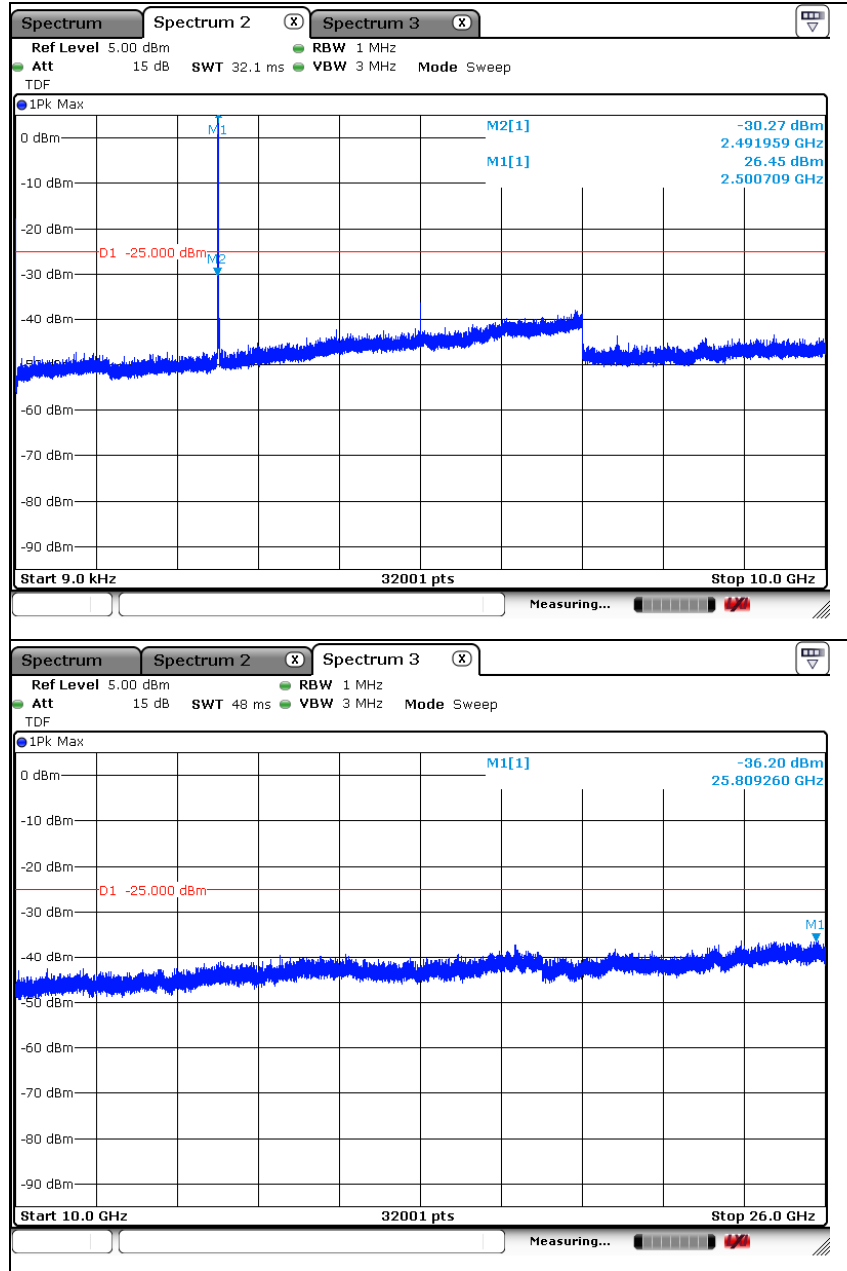
High Channel



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LTE band 7 (10 MHz – QPSK)

Low Channel



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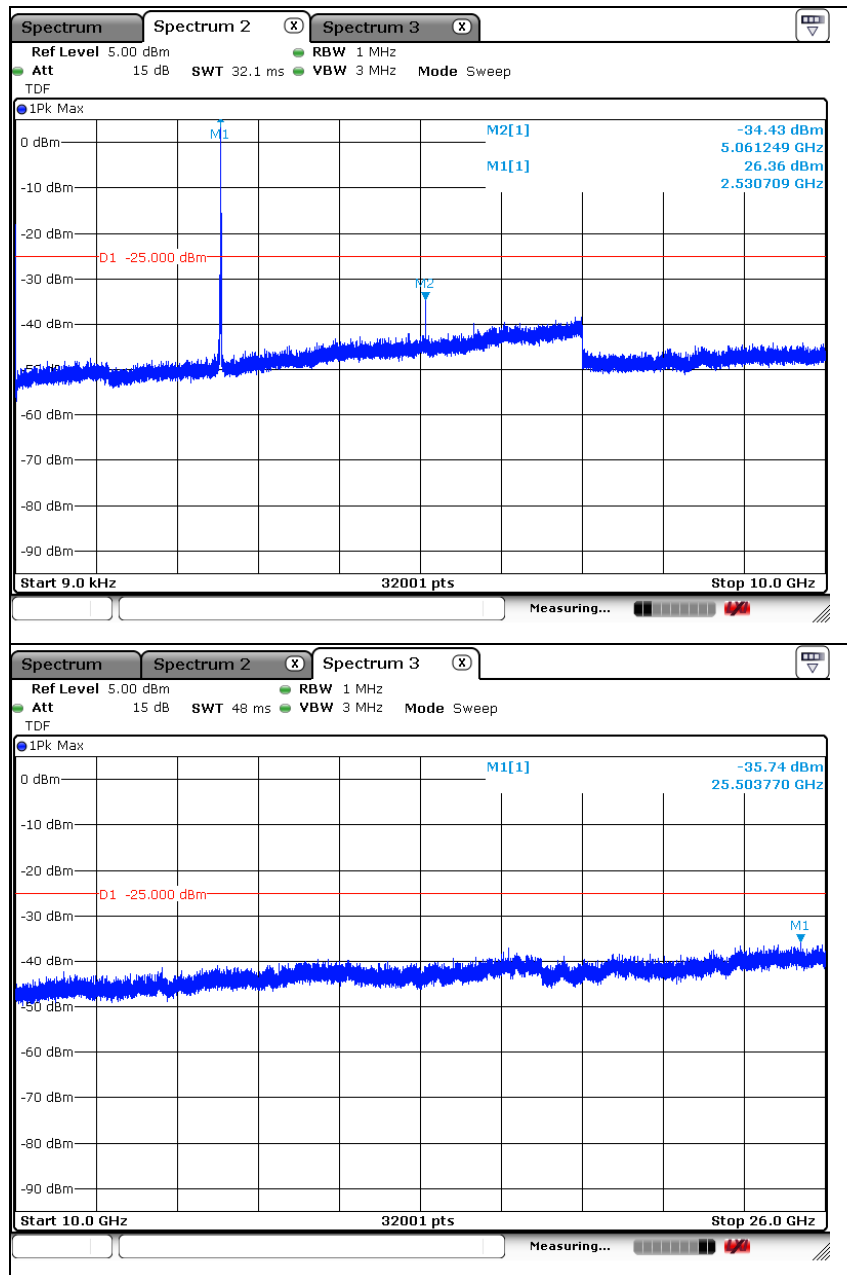
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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A4(210 mm x 297 mm)

Middle Channel



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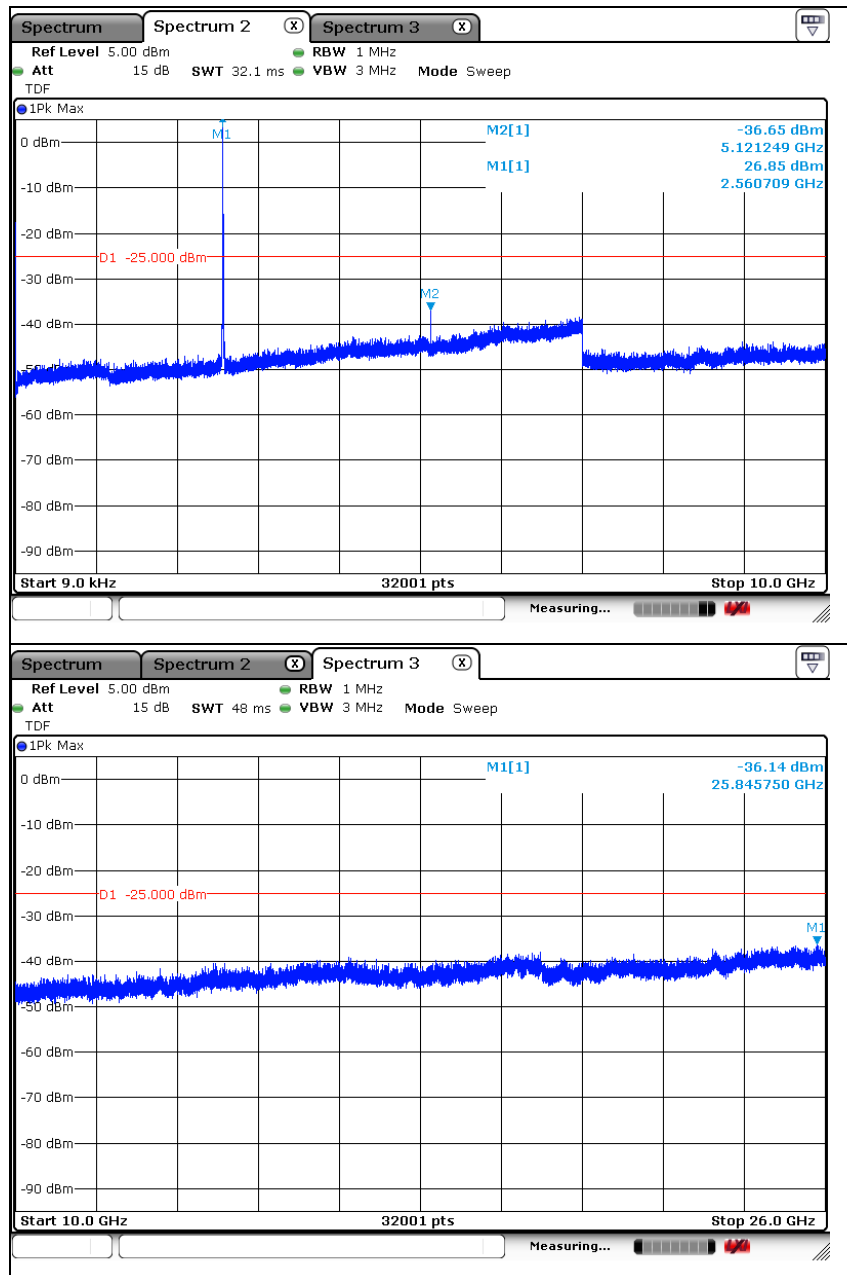
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RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

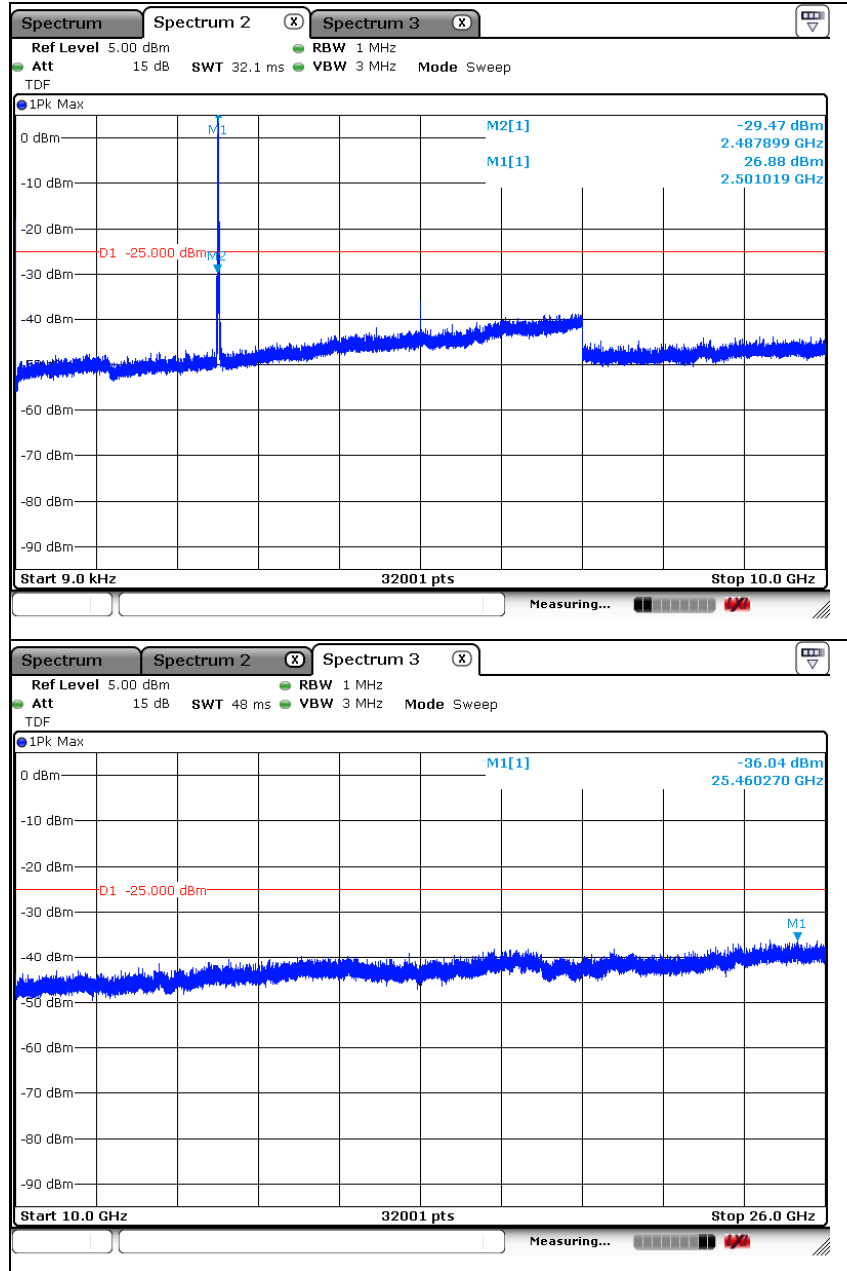
High Channel



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LTE band 7 (15 MHz – QPSK)

Low Channel



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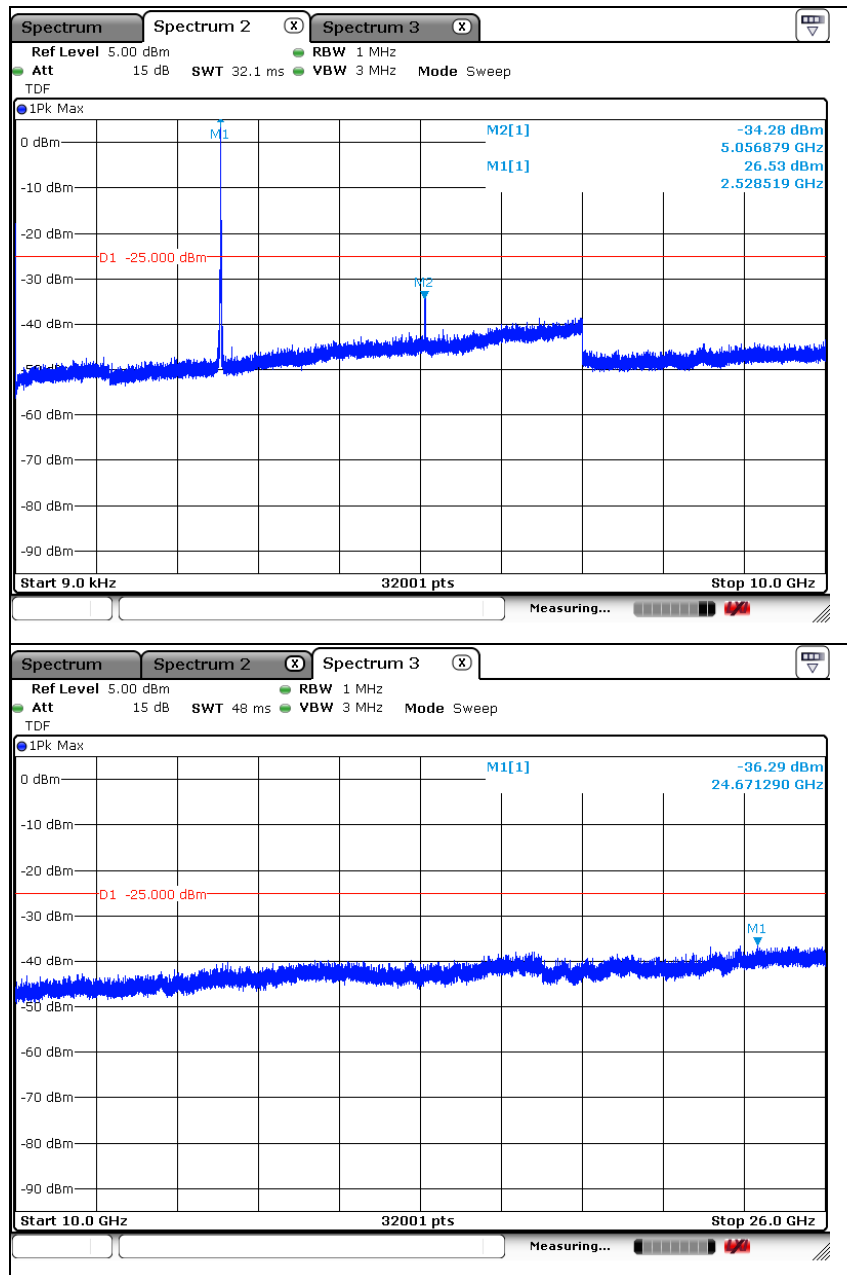
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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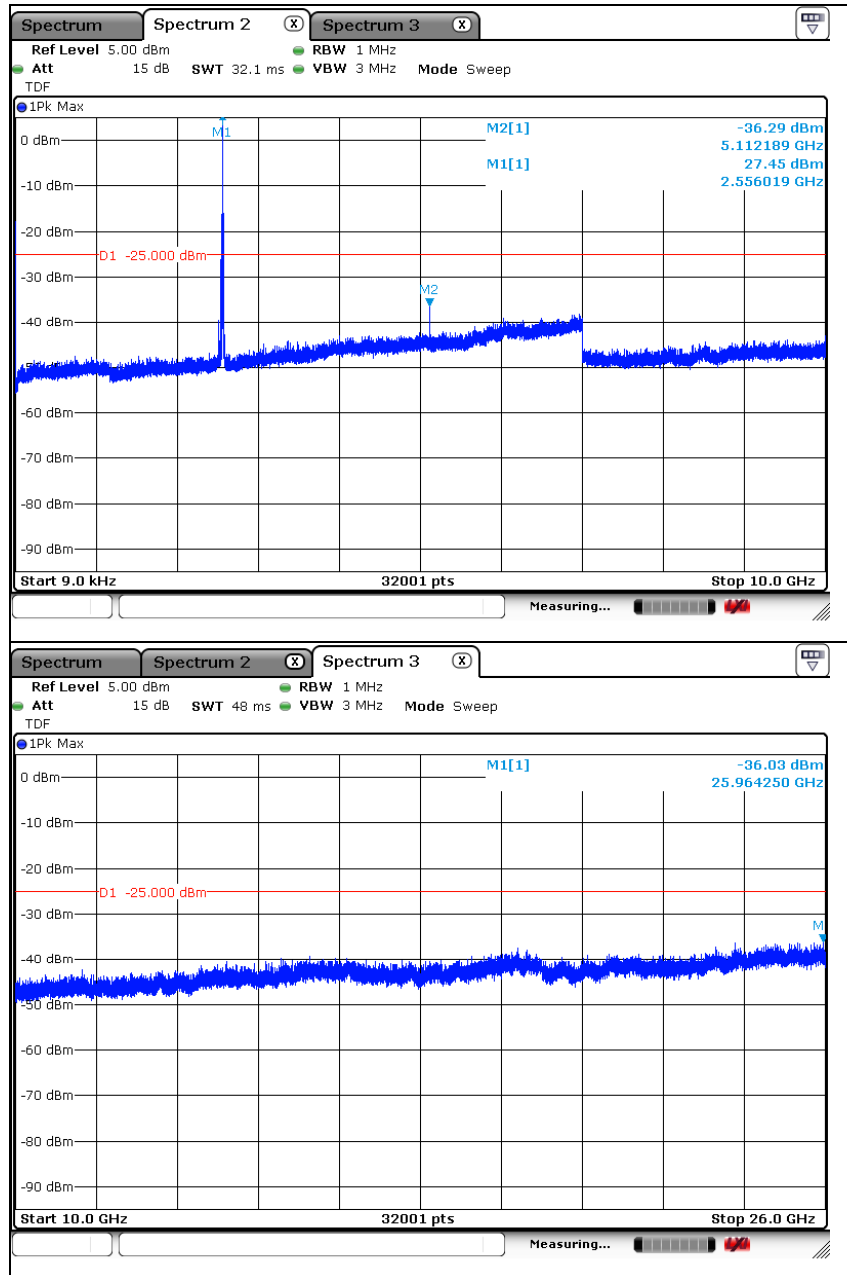
A4(210 mm x 297 mm)

Middle Channel



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High Channel



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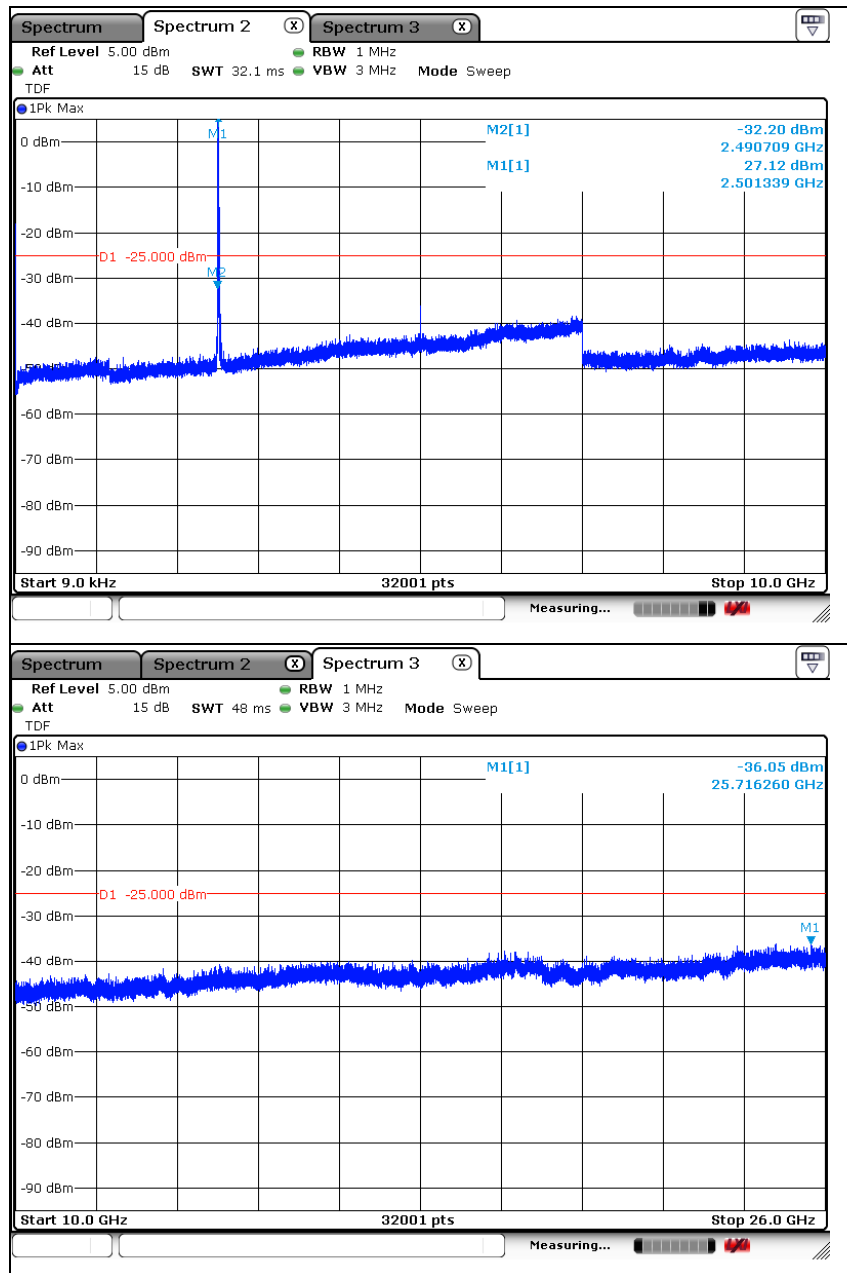
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

LTE band 7 (20 MHz – QPSK)

Low Channel



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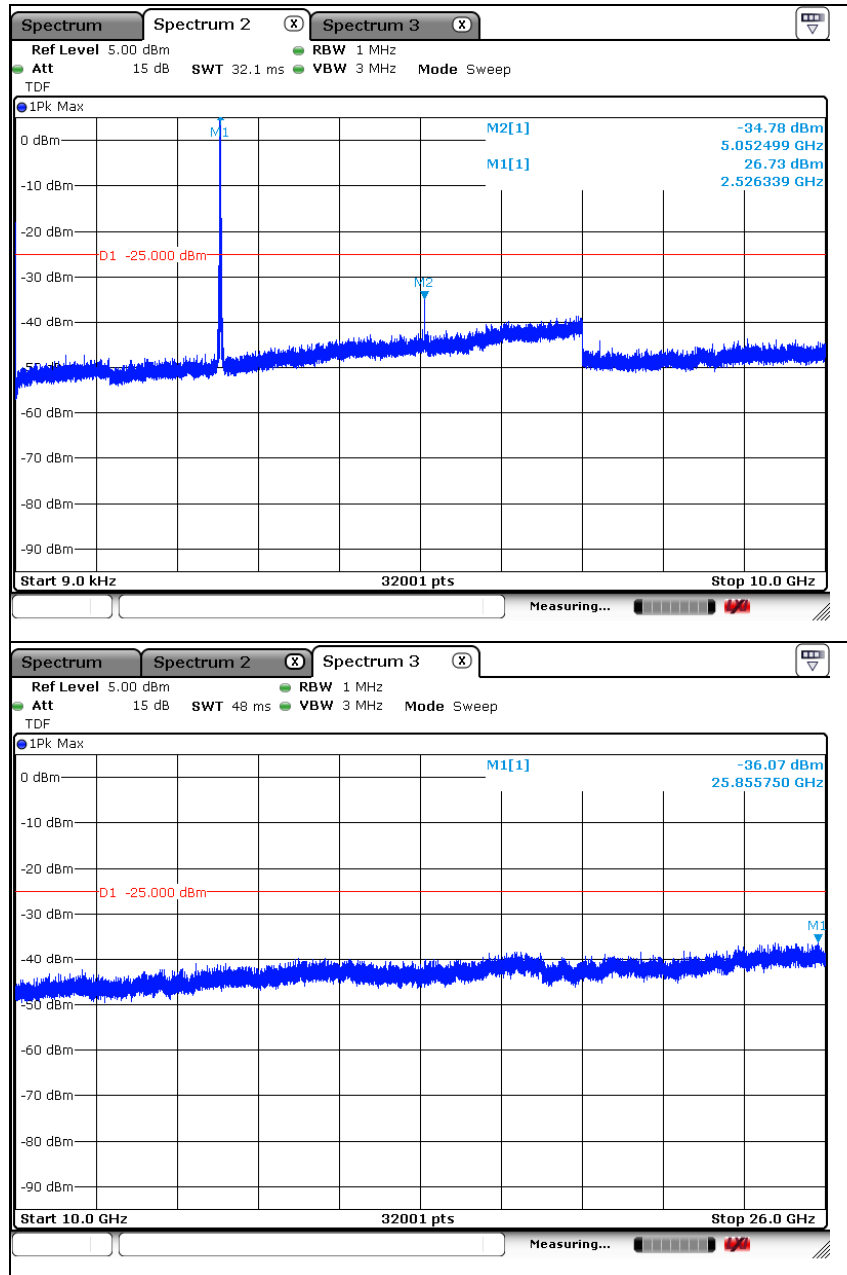
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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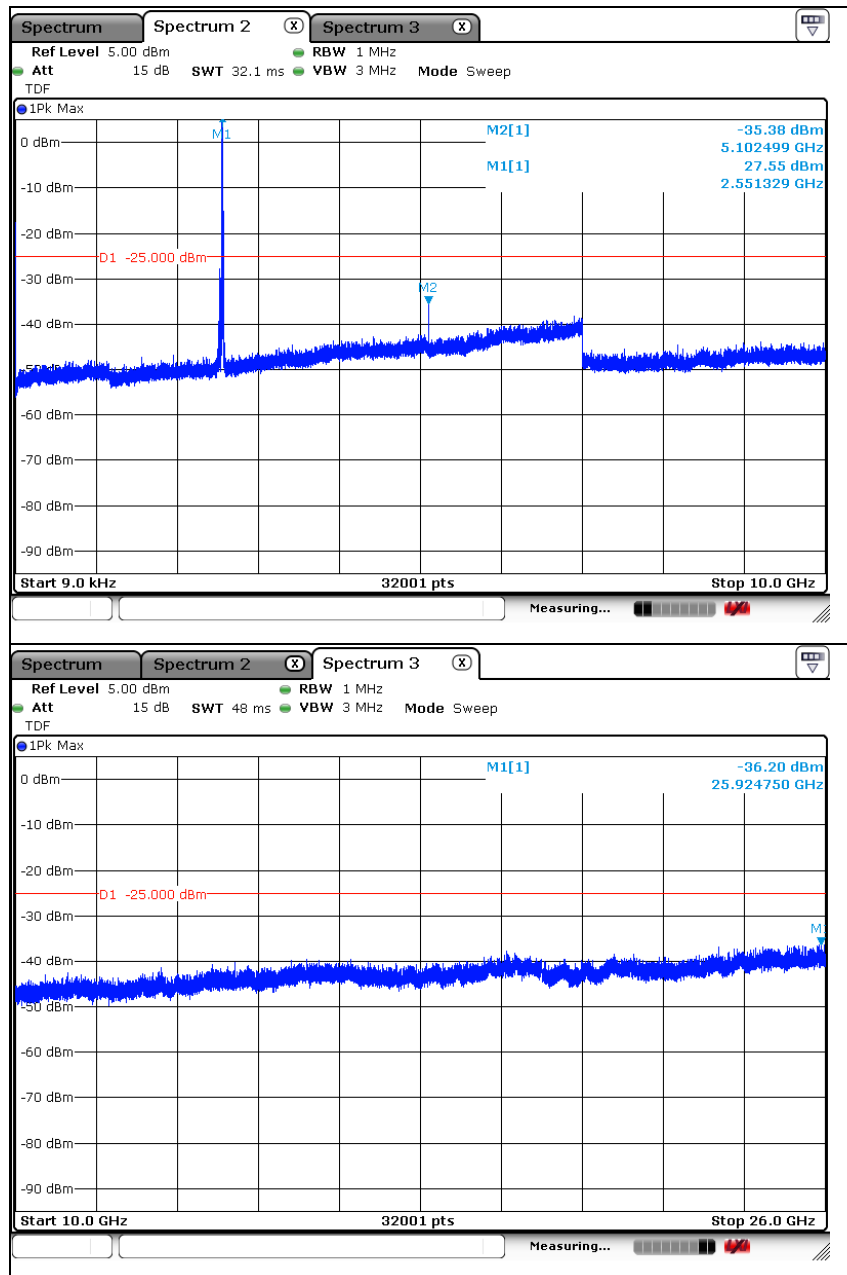
A4(210 mm x 297 mm)

Middle Channel



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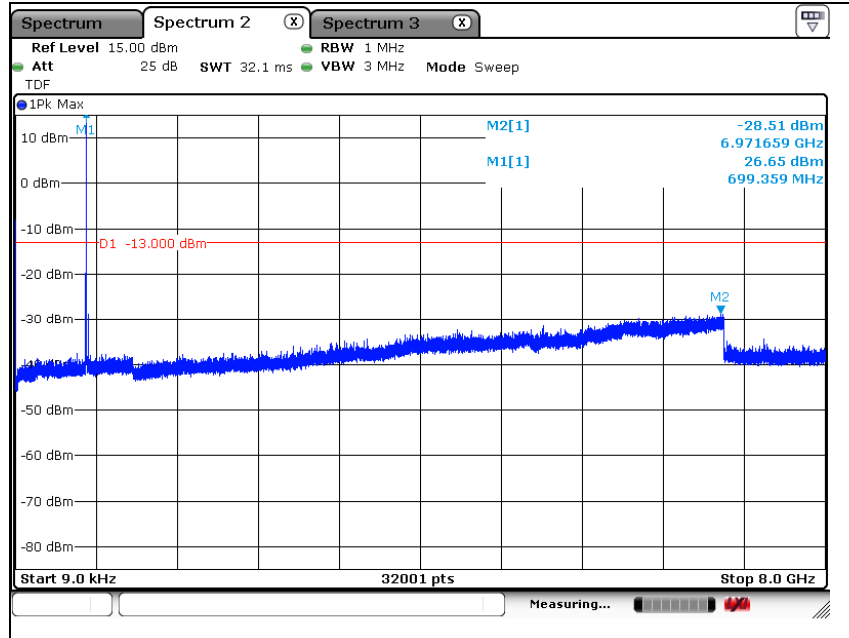
High Channel



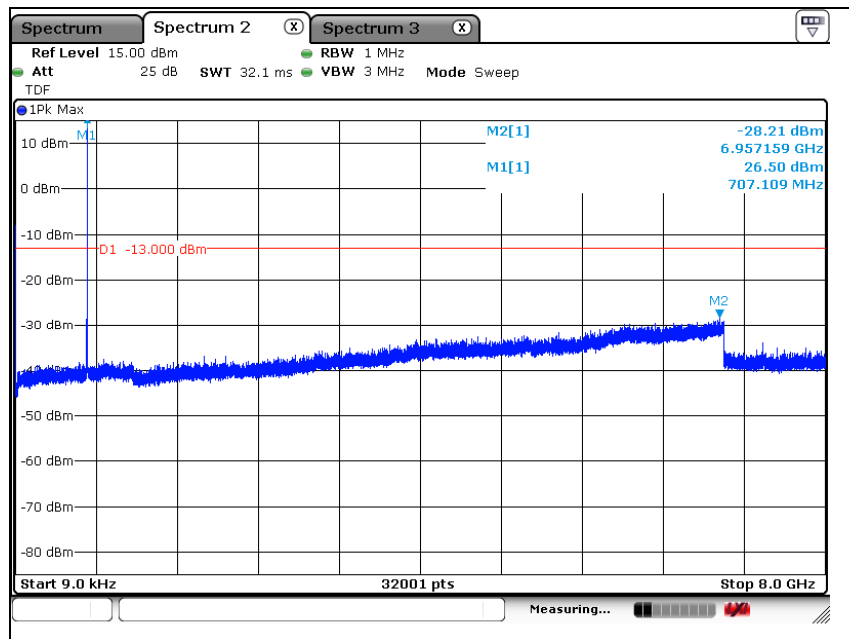
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LTE band 12 (1.4 MHz – QPSK)

Low Channel

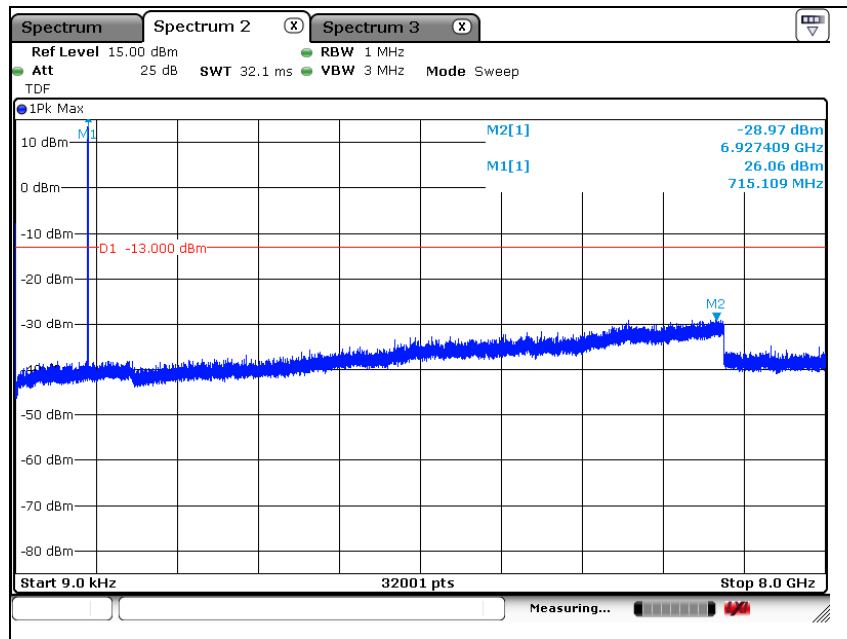


Middle Channel



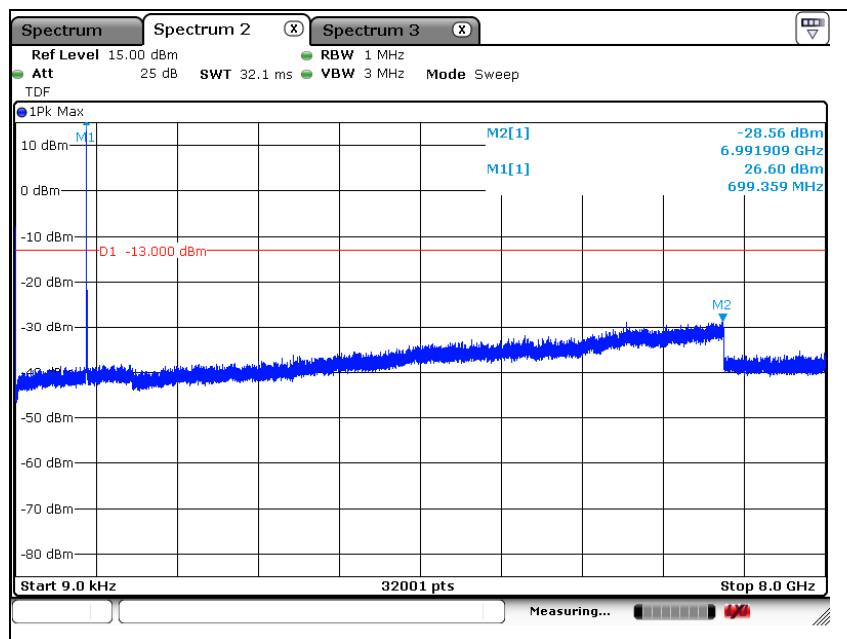
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High Channel



LTE band 12 (3 MHz – QPSK)

Low Channel



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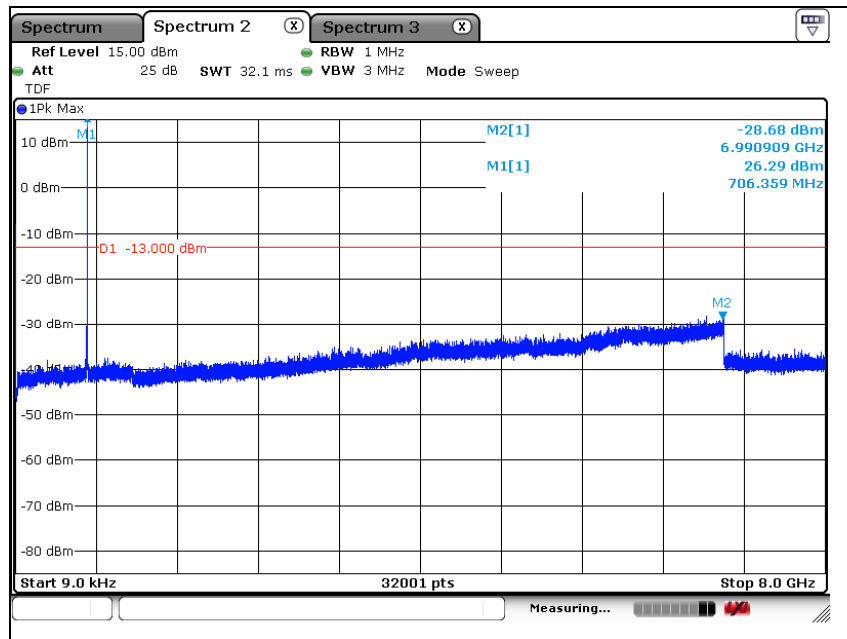
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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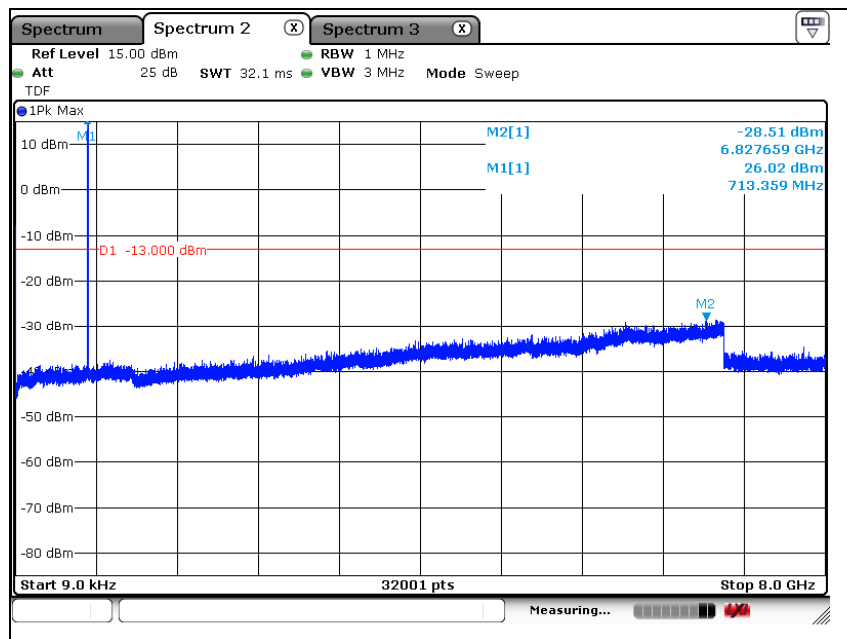
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



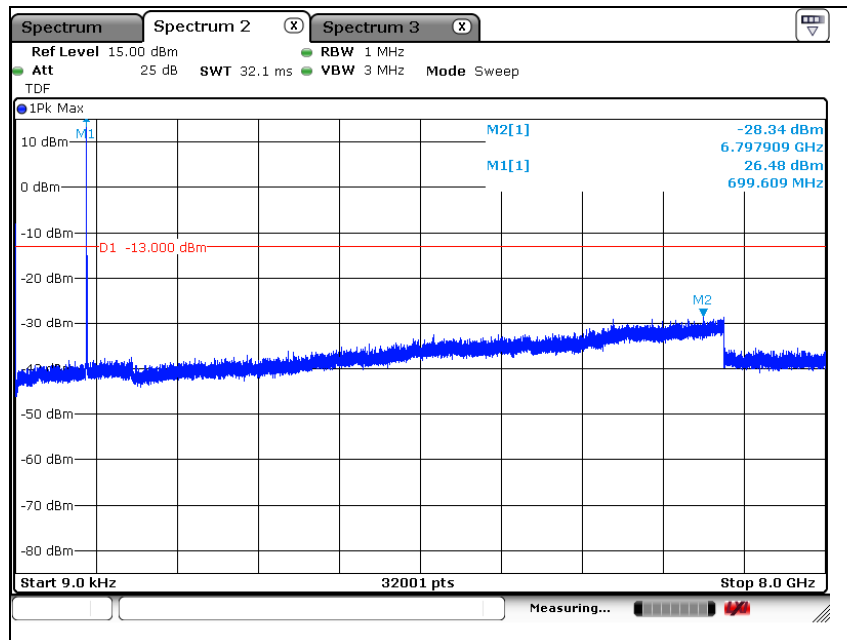
High Channel



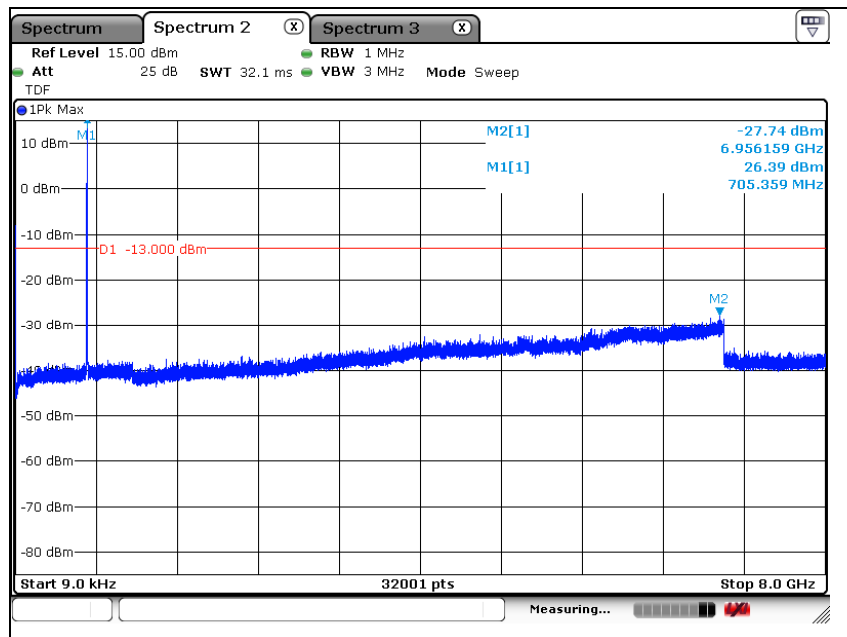
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LTE band 12 (5 MHz – QPSK)

Low Channel

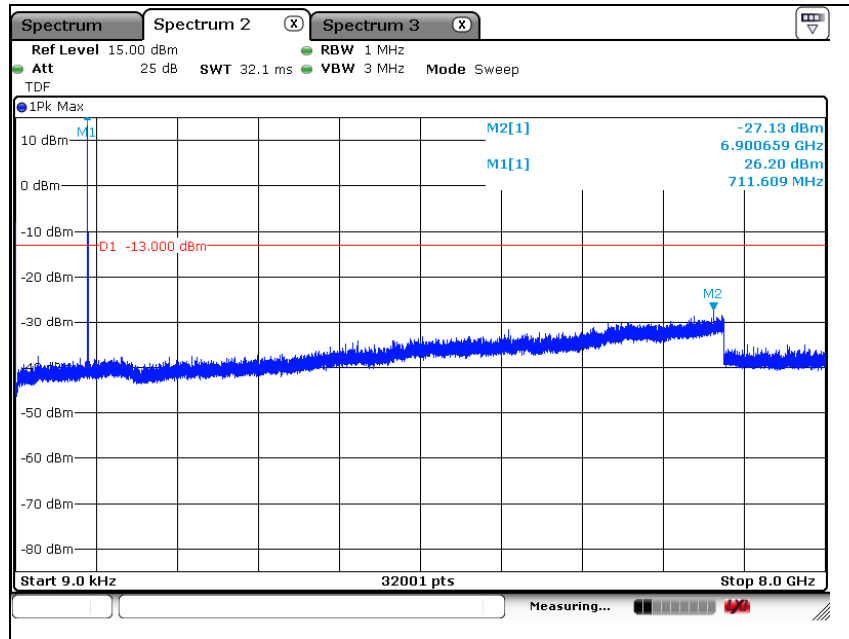


Middle Channel



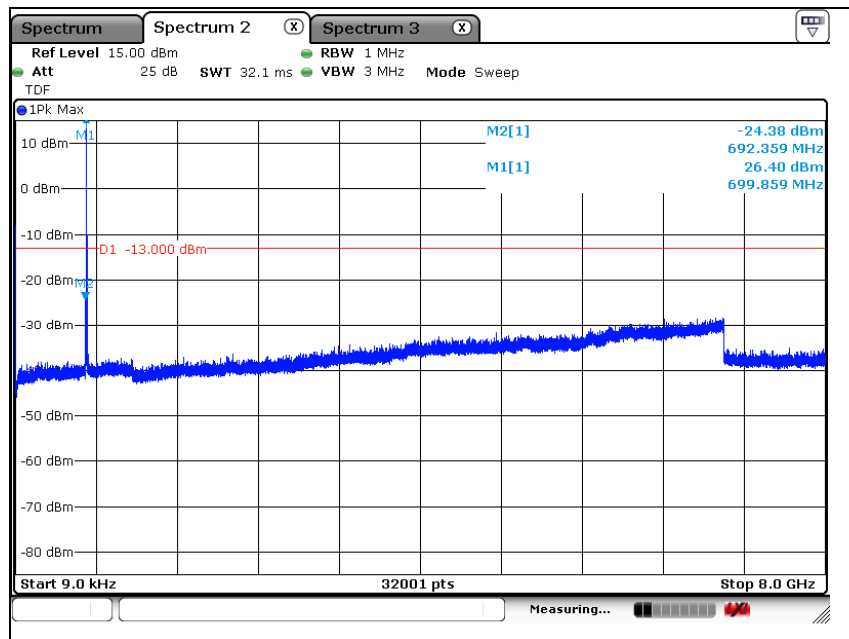
The results of this test report are effective only to the items tested. The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received. This test report cannot be reproduced, except in full, without prior written permission of the Company. This test report does not assure KOLAS accreditation.

High Channel



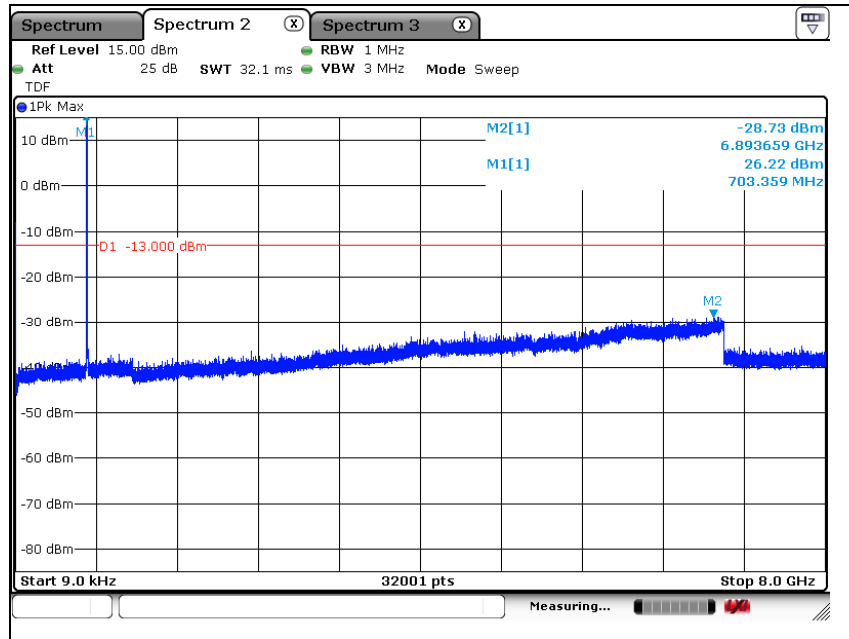
LTE band 12 (10 MHz – QPSK)

Low Channel

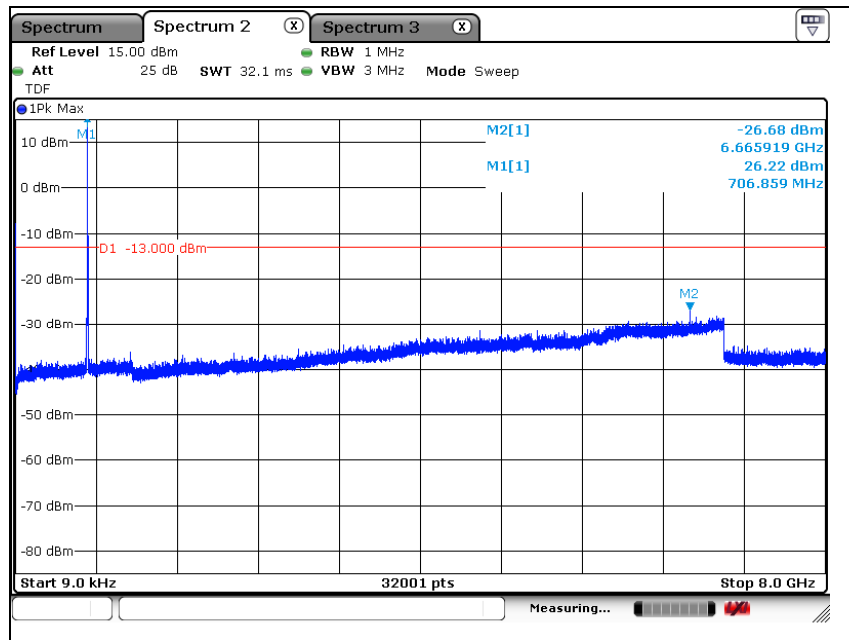


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Middle Channel



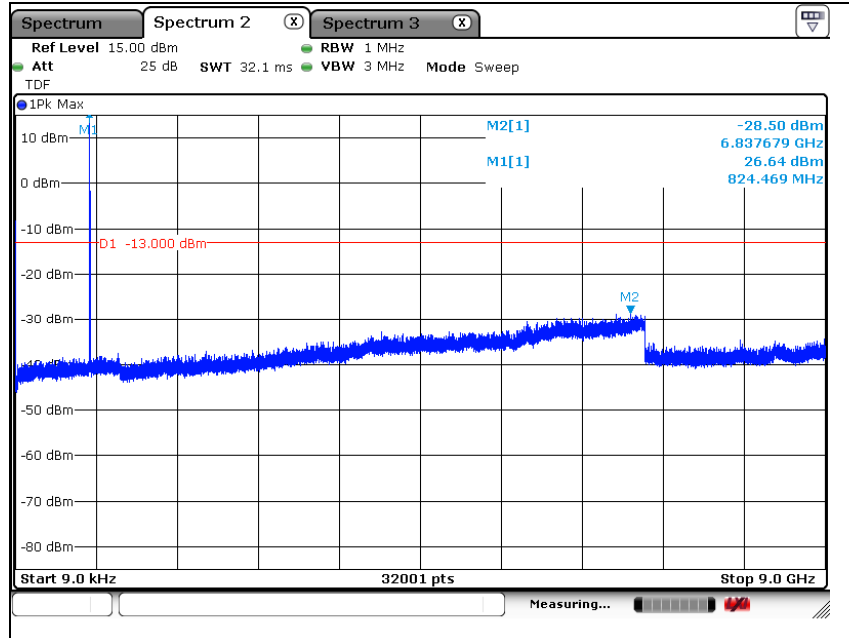
High Channel



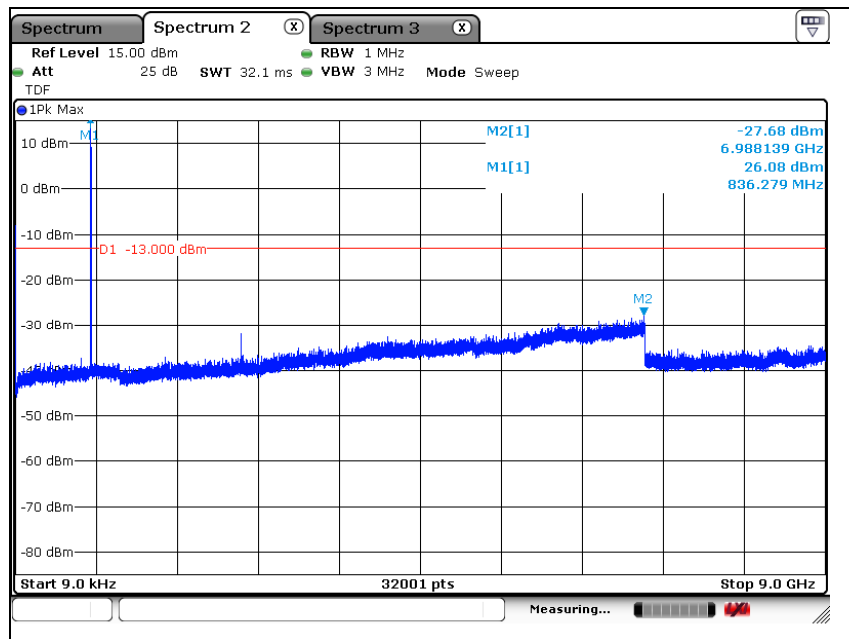
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LTE band 26/5 (1.4 MHz – QPSK)

Low Channel



Middle Channel



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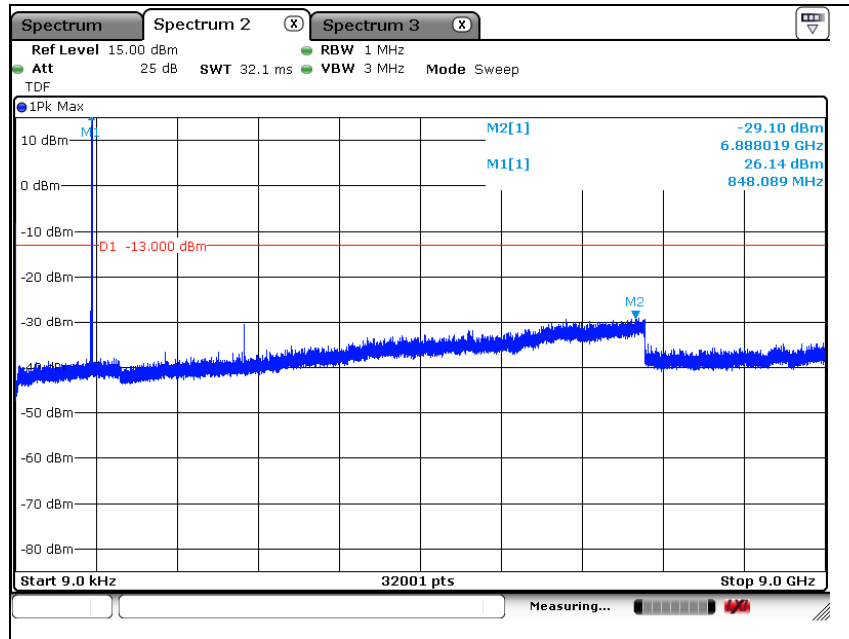
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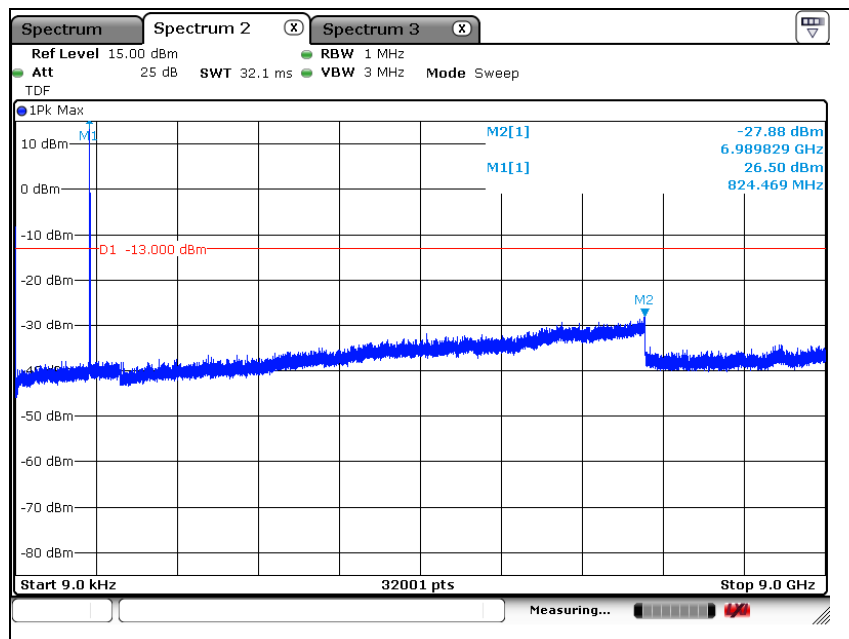
A4(210 mm x 297 mm)

High Channel



LTE band 26/5 (3 MHz – QPSK)

Low Channel



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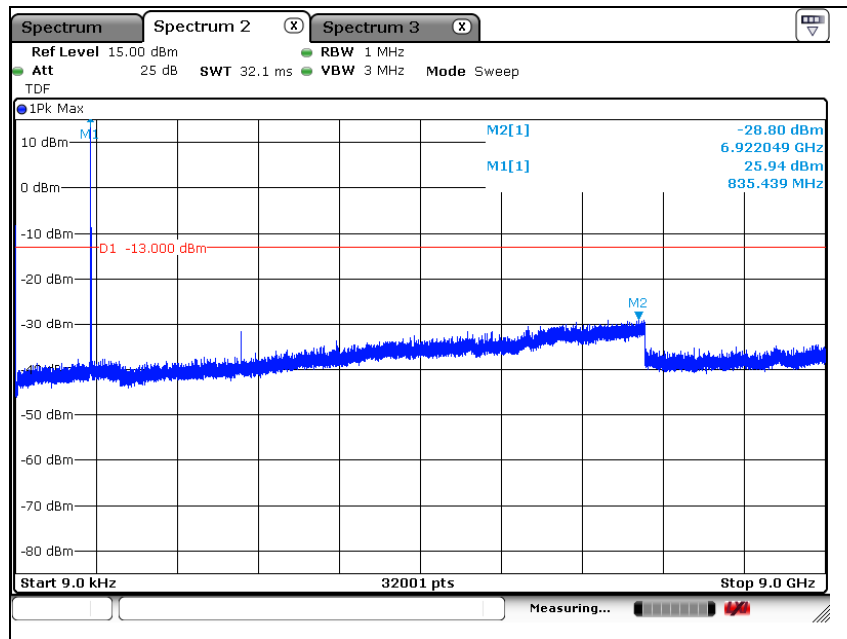
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

RTT5041-19(2019.04.24)(1)

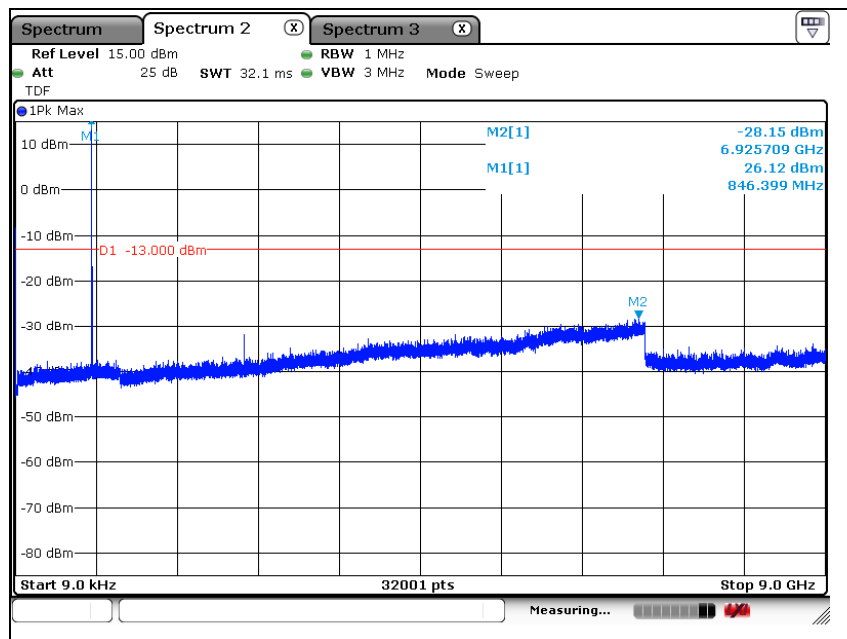
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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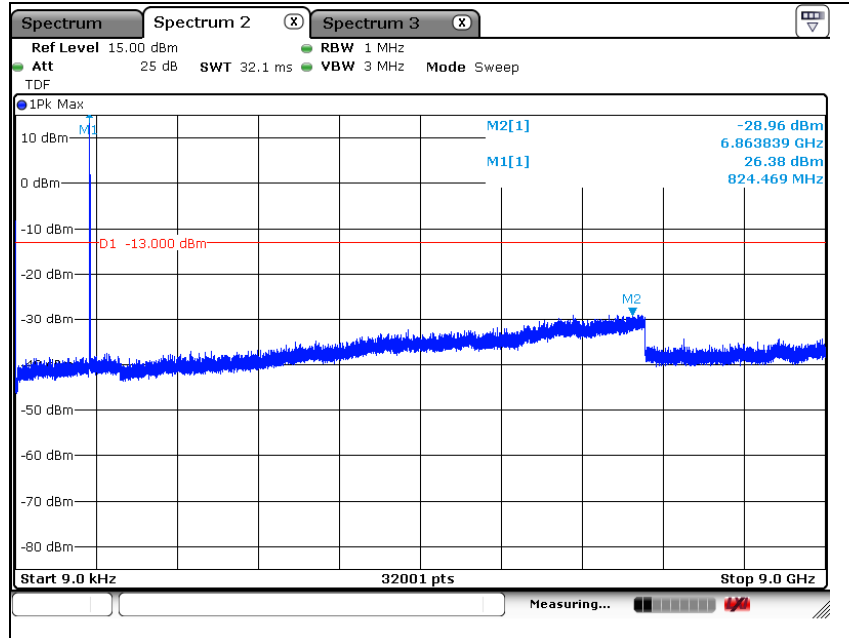
RTT5041-19(2019.04.24)(1)

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

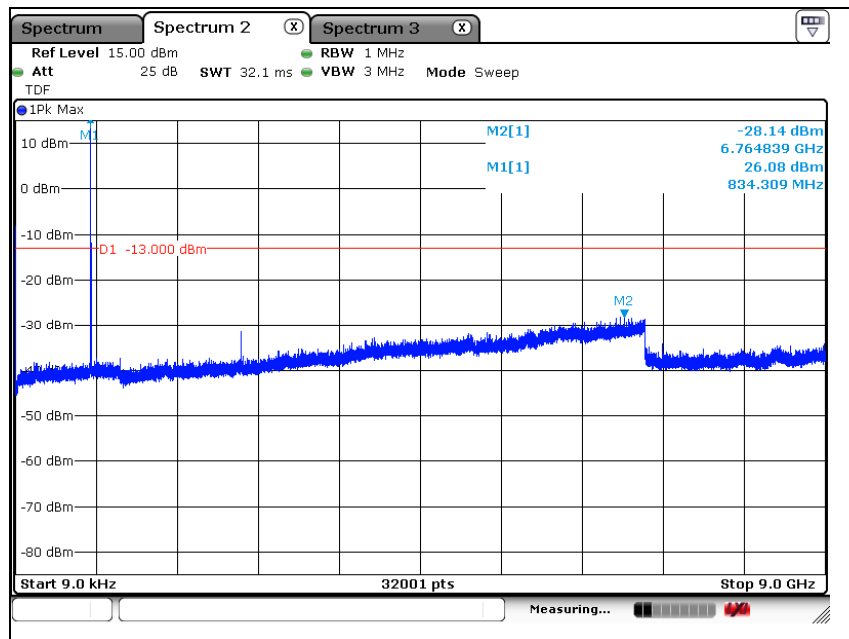
A4(210 mm x 297 mm)

LTE band 26/5 (5 MHz – QPSK)

Low Channel

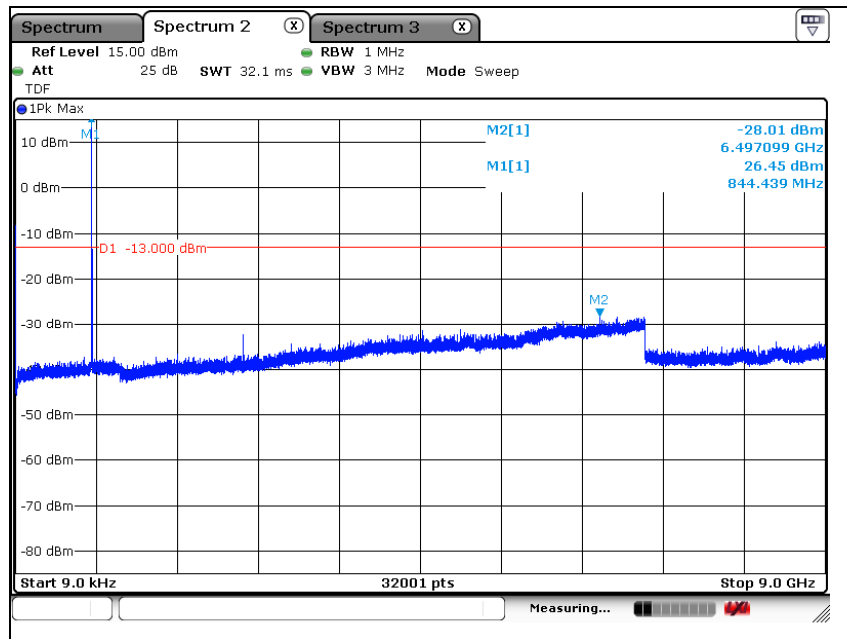


Middle Channel



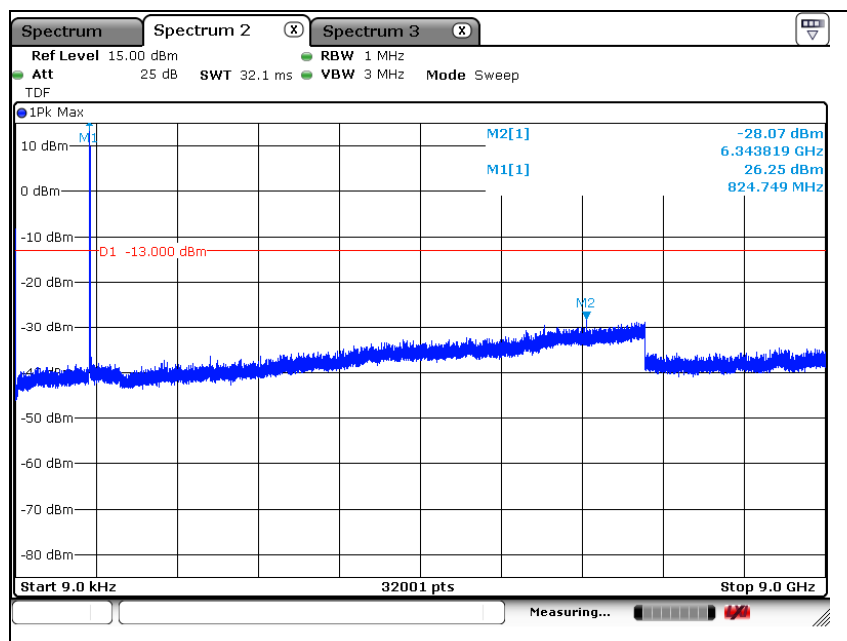
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High Channel



LTE band 26/5 (10 MHz – QPSK)

Low Channel



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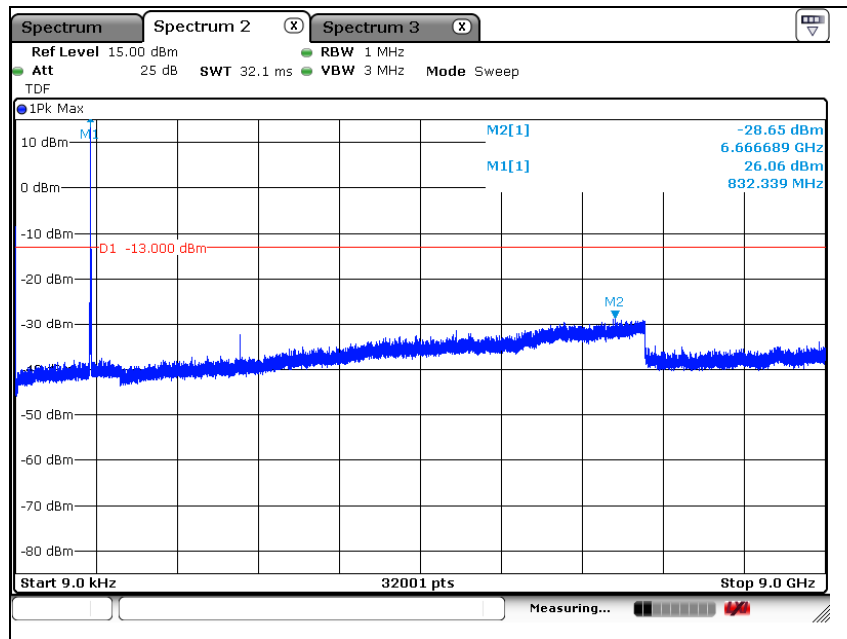
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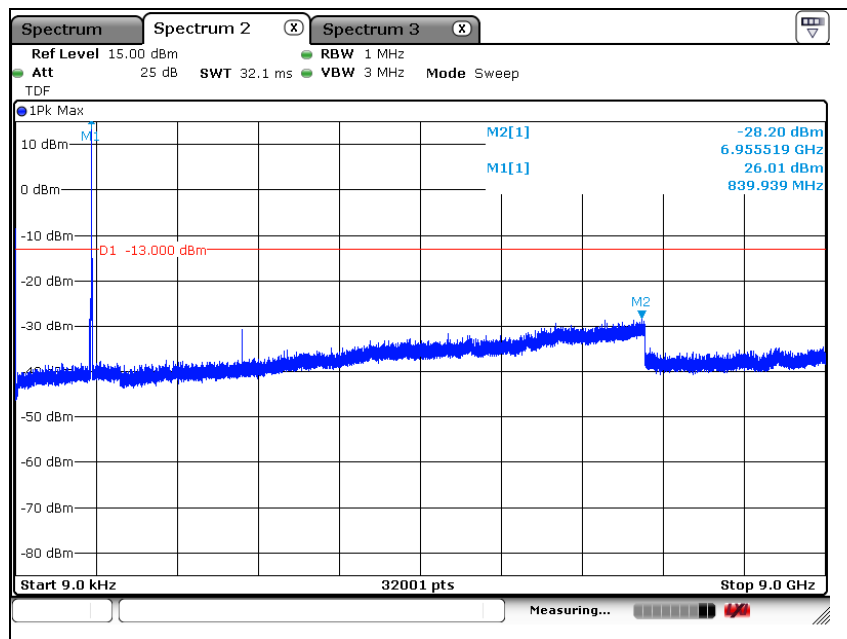
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

Middle Channel



High Channel



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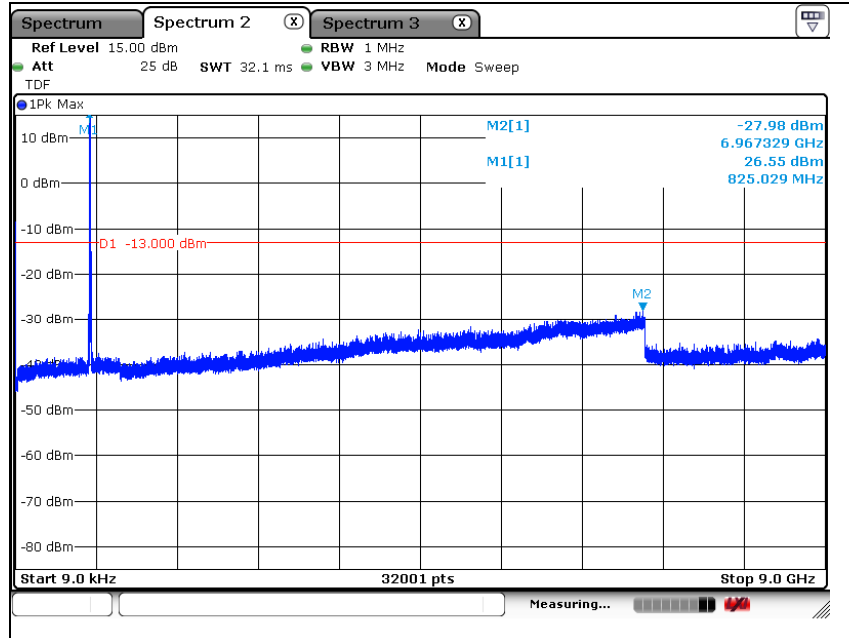
RTT5041-19(2019.04.24)(1)

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

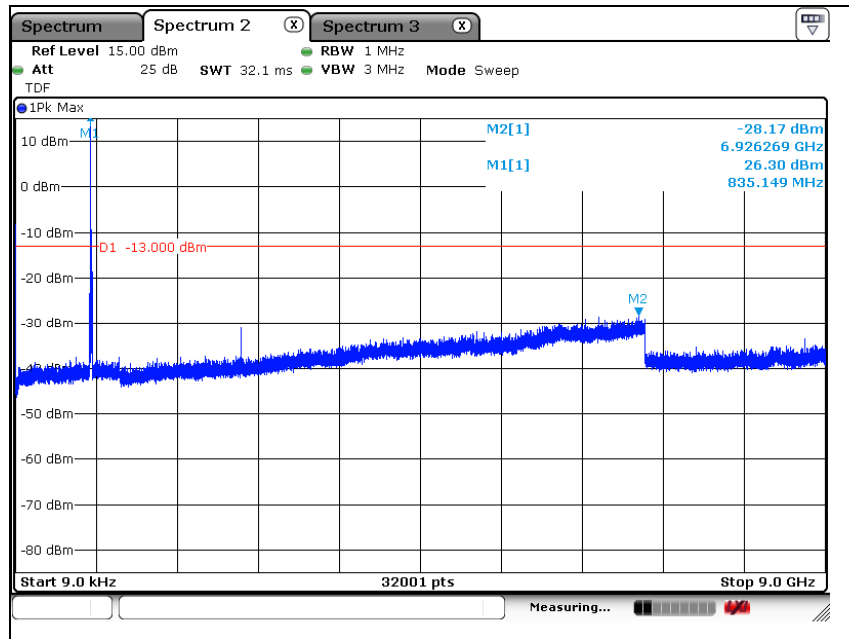
A4(210 mm x 297 mm)

LTE band 26 (15 MHz – QPSK)

Low Channel



High Channel



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A4(210 mm x 297 mm)

7. Band Edge

7.1. Limit

FCC

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

- §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.

- §27.53(g), 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.

- §27.53(h)(1), for operations in the 1 695-1 710 MHz, 1 710-1 755 MHz, 1 755-1 780 MHz, 1 915-1 920 MHz, 1 995-2 000 MHz, 2 000-2 020 MHz, 2 110-2 155 MHz, 2 155-2 180 MHz, and 2 180-2 200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ dB.

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than $40 + 10\log_{10}(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10\log_{10}(P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10\log_{10}(P)$ 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 than $43 + 10\log_{10}(P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10\log_{10}(P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz 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.

IC

- RSS-130 Issue 2

4.7.1, the unwanted emissions in any 100 kHz bandwidth on any frequency the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dB W), by at least $43 + 10\log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

- RSS-132 Issue 3

5.5, Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1 % of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10\log_{10} p$ (watts). If the measurement is performed using 1 % of the occupied bandwidth, power integration over 100 kHz is required.

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A4(210 mm x 297 mm)

- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.

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

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dB W) by at least $43 + 10 \log_{10} p(\text{watts})$. If the measurement is performed using 1 % of the emission bandwidth, power integration over 1.0 MHz is required.

- RSS-139 Issue 3

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

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

- RSS-199 Issue 3

4.5, In the 1 MHz band immediately outside and adjacent to the channel edge, the unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for base station and fixed subscriber equipment, and 2% for mobile subscriber equipment. Beyond the 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

Equipment shall comply with the following unwanted emission limits:

- a. for base station and fixed subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$
- b. for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:
 - i. $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
 - ii. $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
 - iii. $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

In (a) and (b), p is the transmitter power measured in watts and X is 6 MHz or the equipment occupied bandwidth, whichever is greater.

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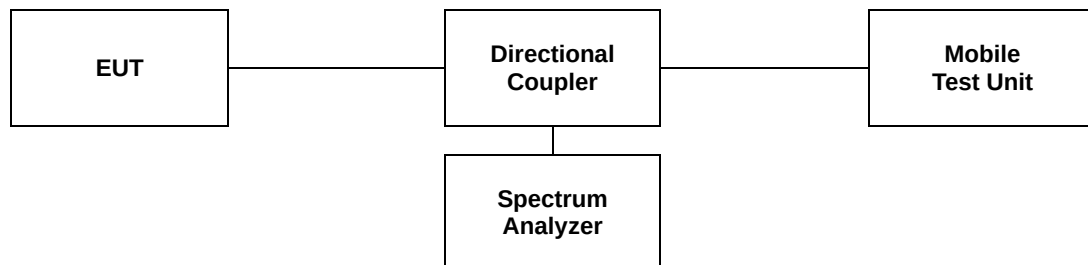
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

7.2. Test Procedure

The test follows section 5.7.2 of ANSI C63.26-2015.

- a. Span was set large enough so as to capture all out of band emissions near the band edge.
- b. RBW $\geq 1\%$ of OBW
- c. VBW $\geq 3 \times$ RBW.
- d. Detector = RMS.
- e. Trace mode = Average.
- f. Sweep time = Auto.
- g. The trace was allowed to stabilize.
- h. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.



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A4(210 mm x 297 mm)

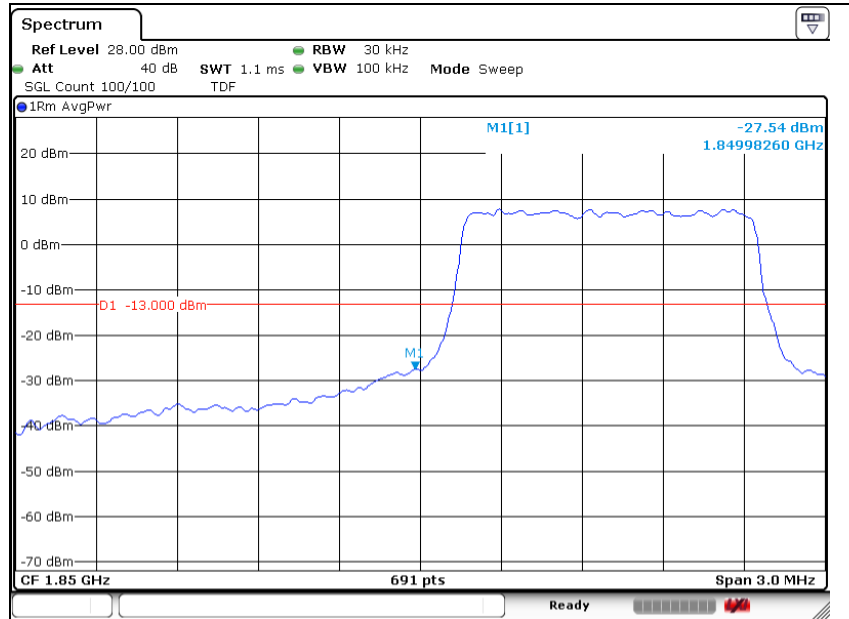
7.3. Test Results

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

- Test plots

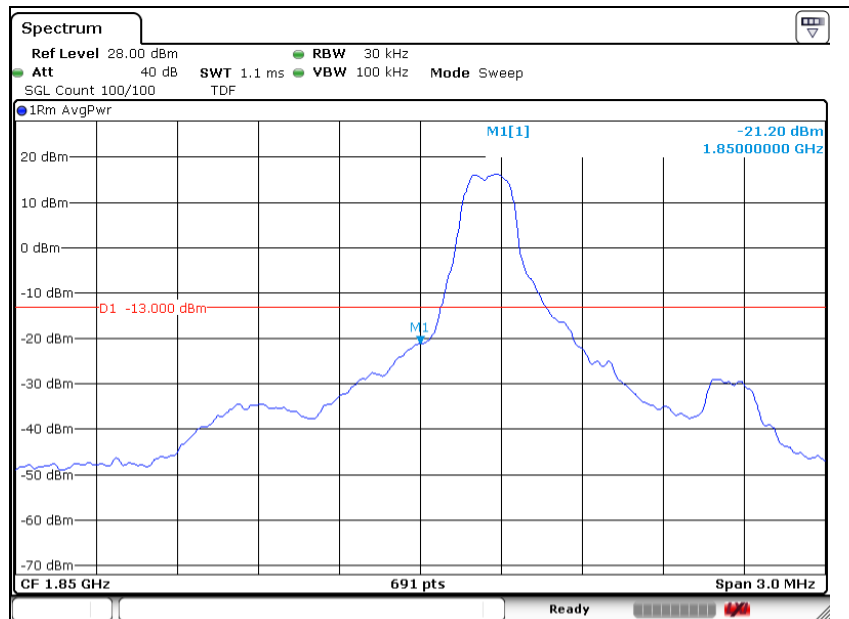
LTE band 2 (1.4 MHz – QPSK_Full RB)

Low Channel



LTE band 2 (1.4 MHz – QPSK_1 RB)

Low Channel

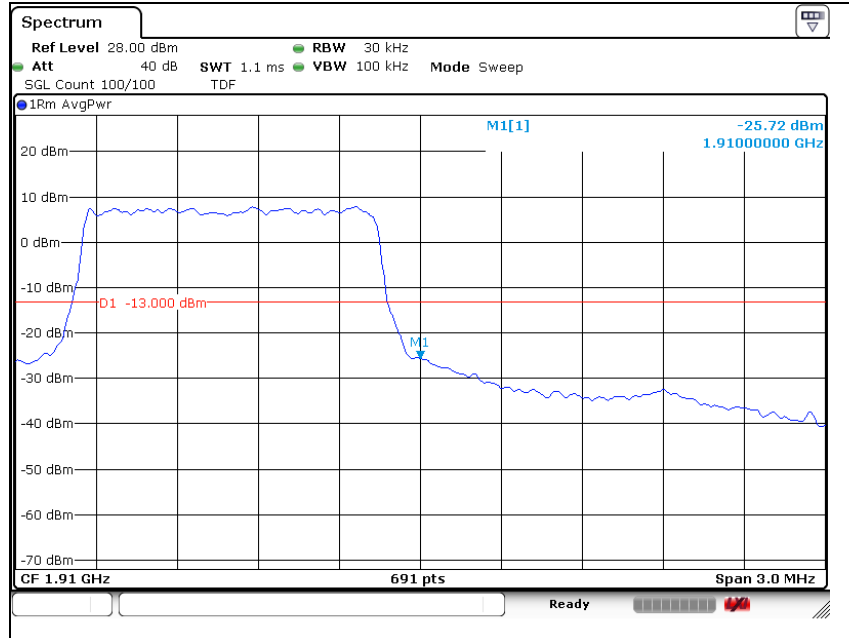


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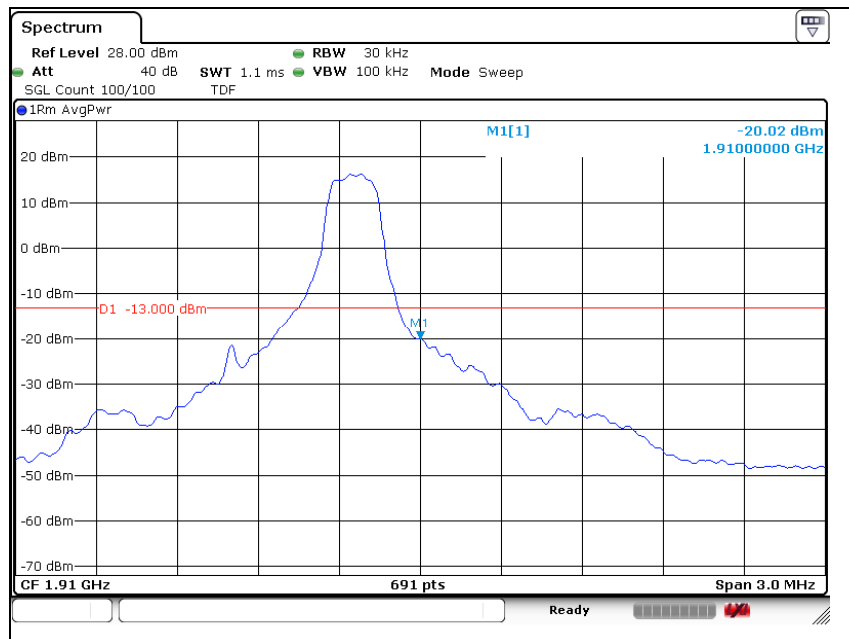
LTE band 2 (1.4 MHz – QPSK_Full RB)

High Channel



LTE band 2 (1.4 MHz – QPSK_1 RB)

High Channel



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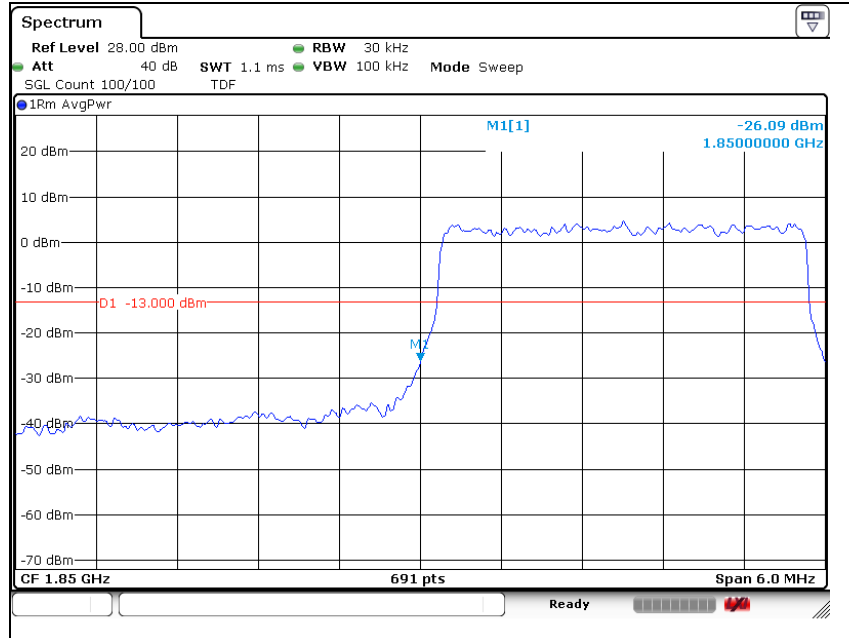
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

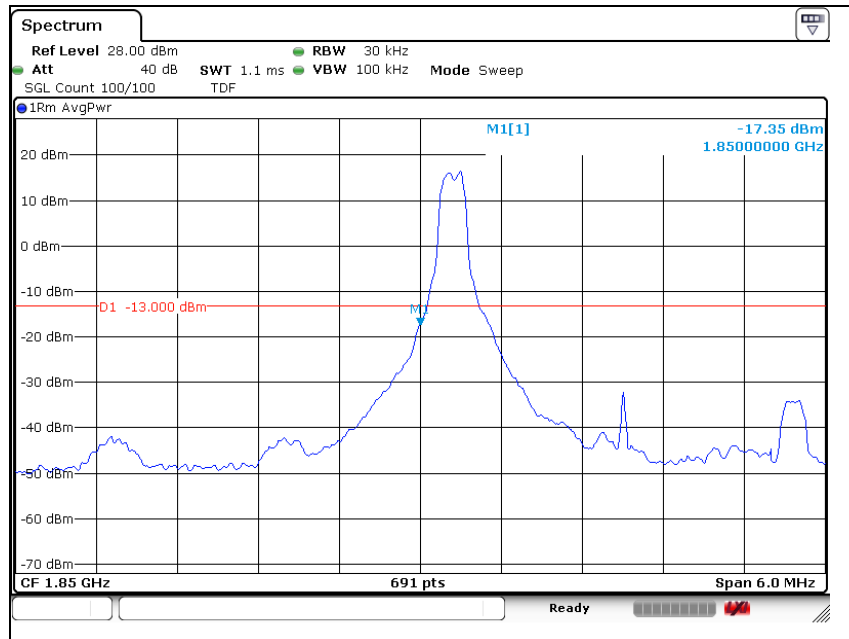
LTE band 2 (3 MHz – QPSK_Full RB)

Low Channel



LTE band 2 (3 MHz – QPSK_1 RB)

Low Channel



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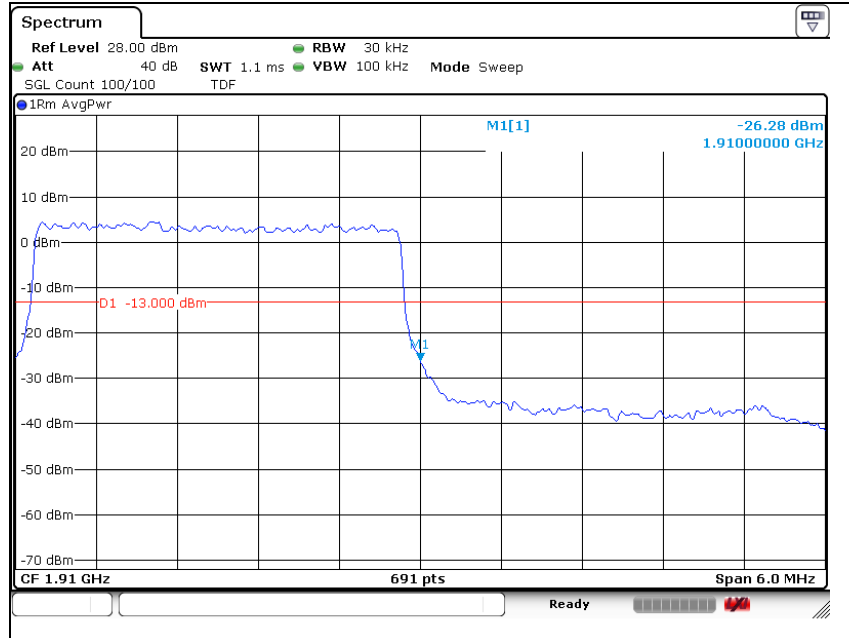
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

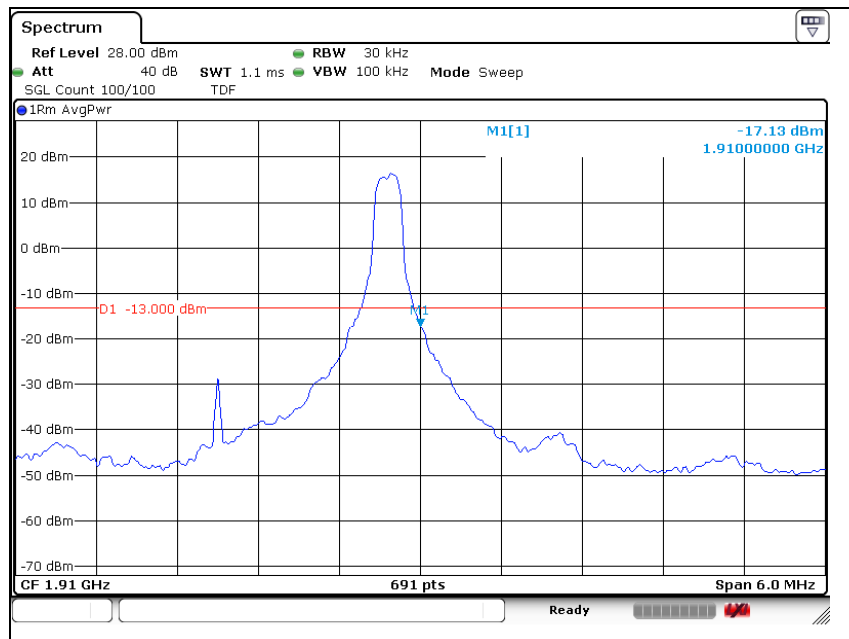
LTE band 2 (3 MHz – QPSK_Full RB)

High Channel



LTE band 2 (3 MHz – QPSK_1 RB)

High Channel



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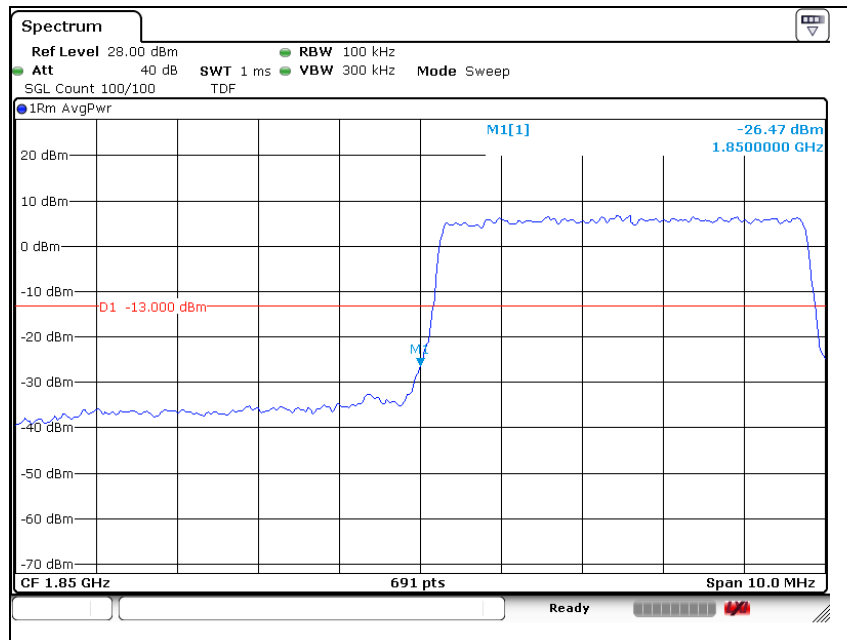
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

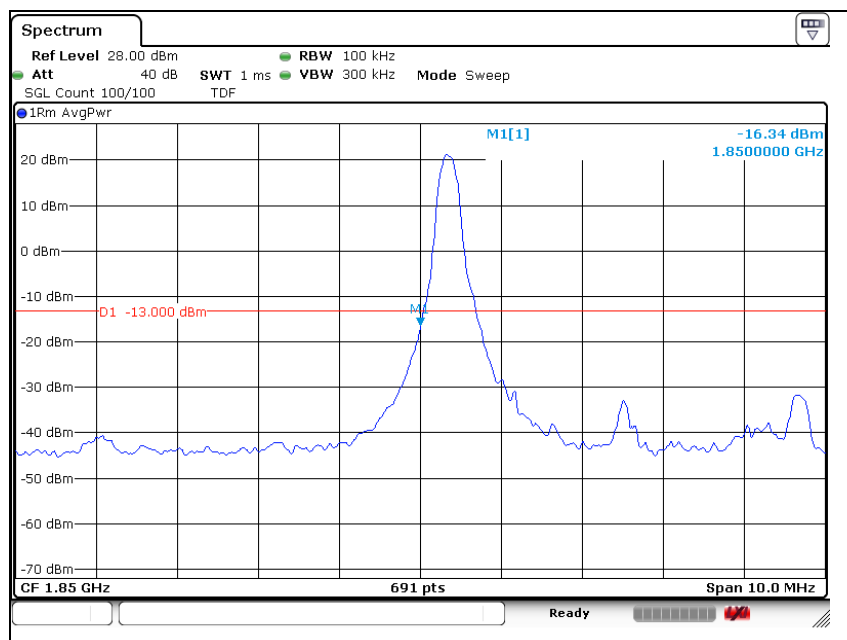
LTE band 2 (5 MHz – QPSK_Full RB)

Low Channel



LTE band 2 (5 MHz – QPSK_1 RB)

Low Channel



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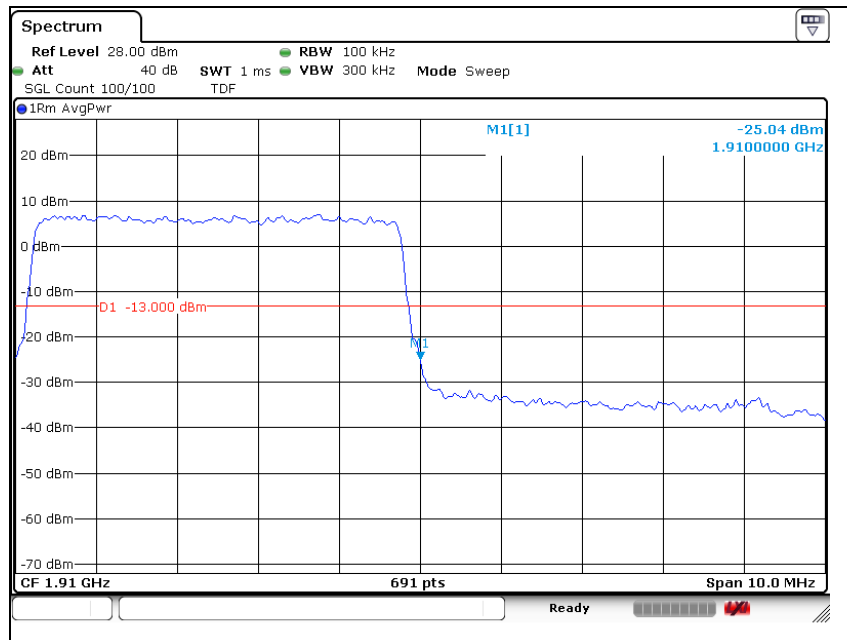
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

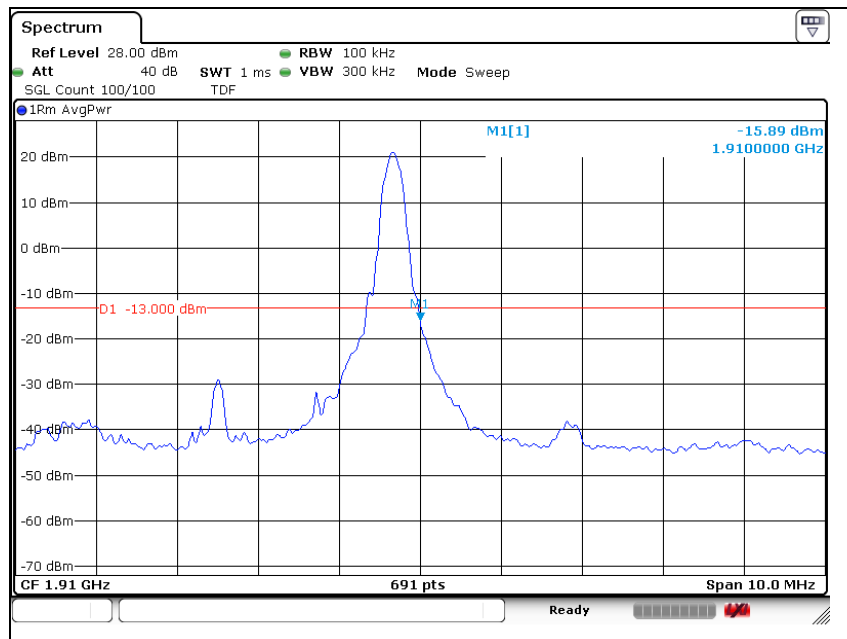
LTE band 2 (5 MHz – QPSK_Full RB)

High Channel



LTE band 2 (5 MHz – QPSK_1 RB)

High Channel



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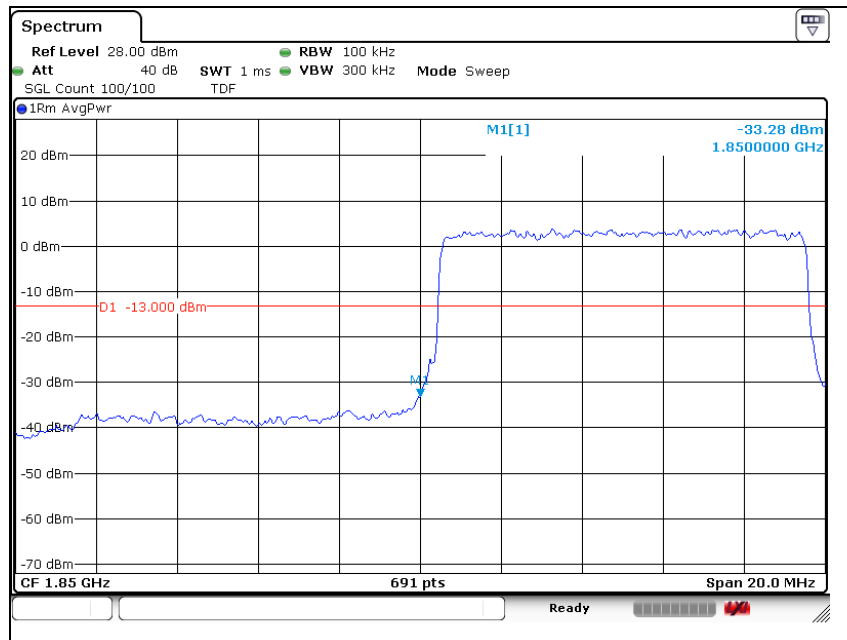
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

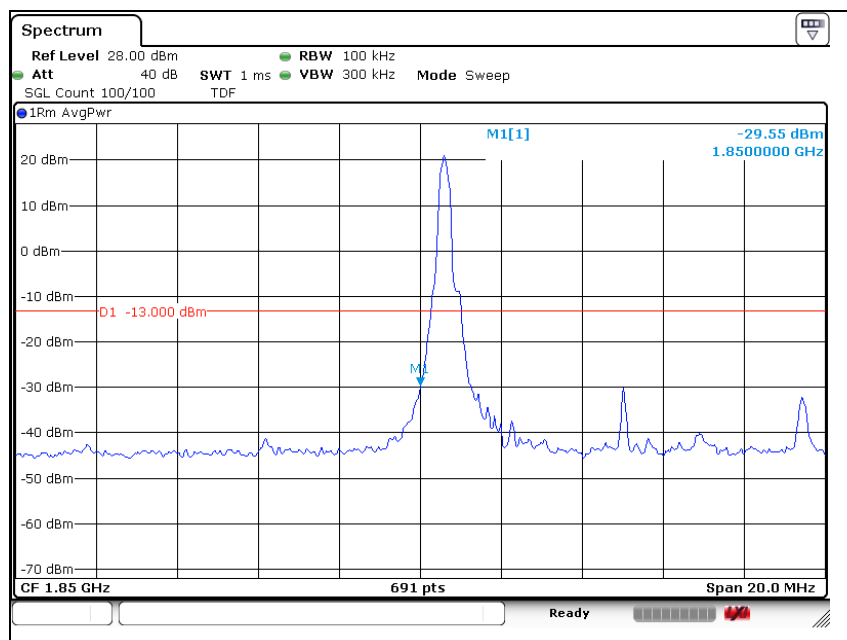
LTE band 2 (10 MHz – QPSK_Full RB)

Low Channel



LTE band 2 (10 MHz – QPSK_1 RB)

Low Channel



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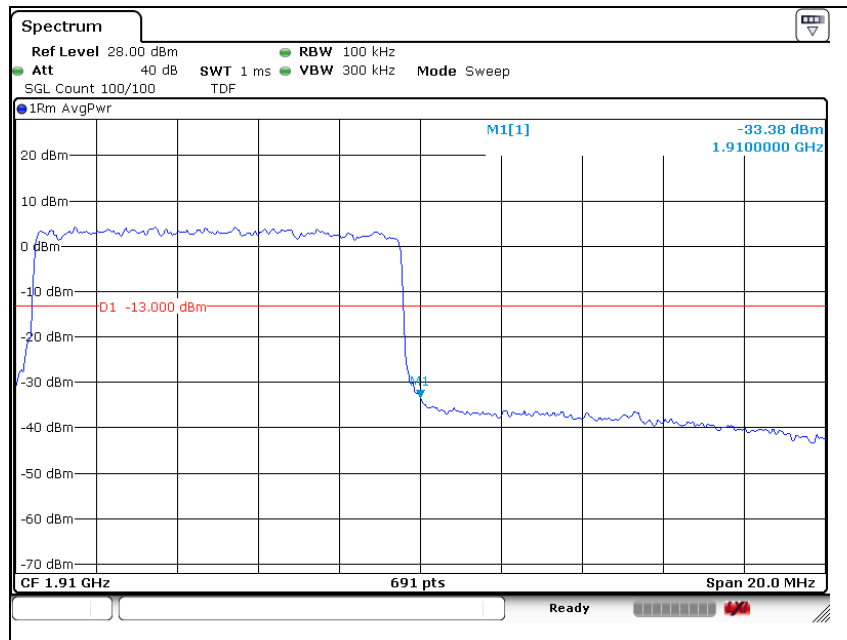
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

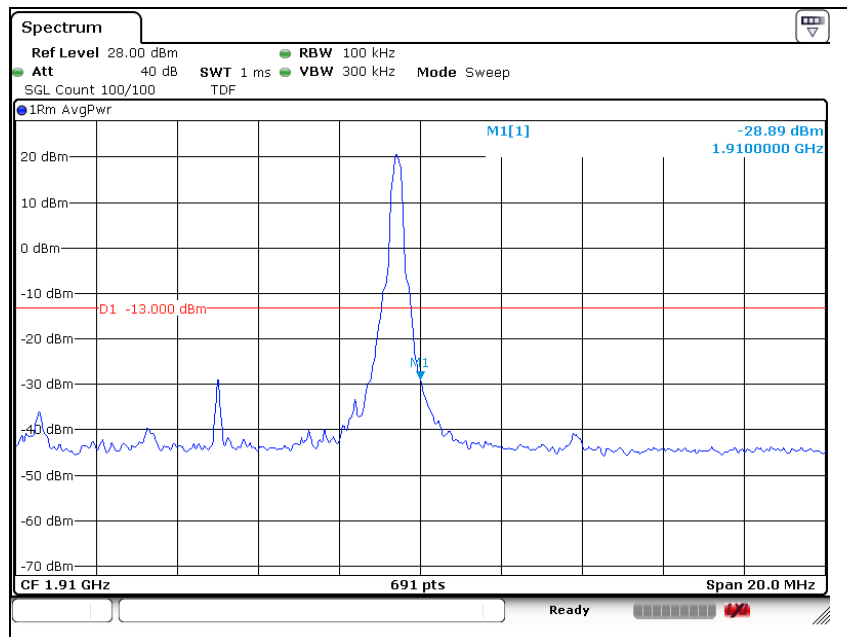
LTE band 2 (10 MHz – QPSK_Full RB)

High Channel



LTE band 2 (10 MHz – QPSK_1 RB)

High Channel



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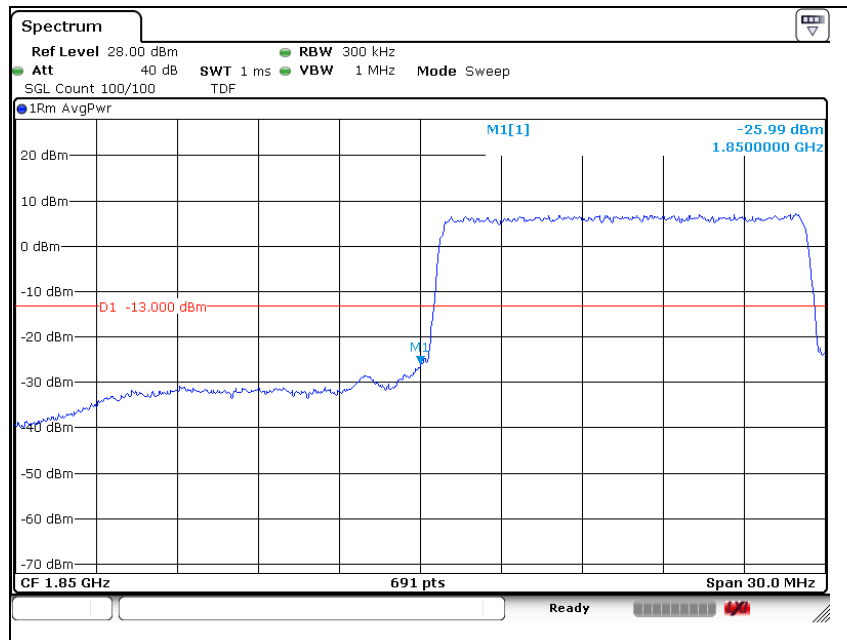
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

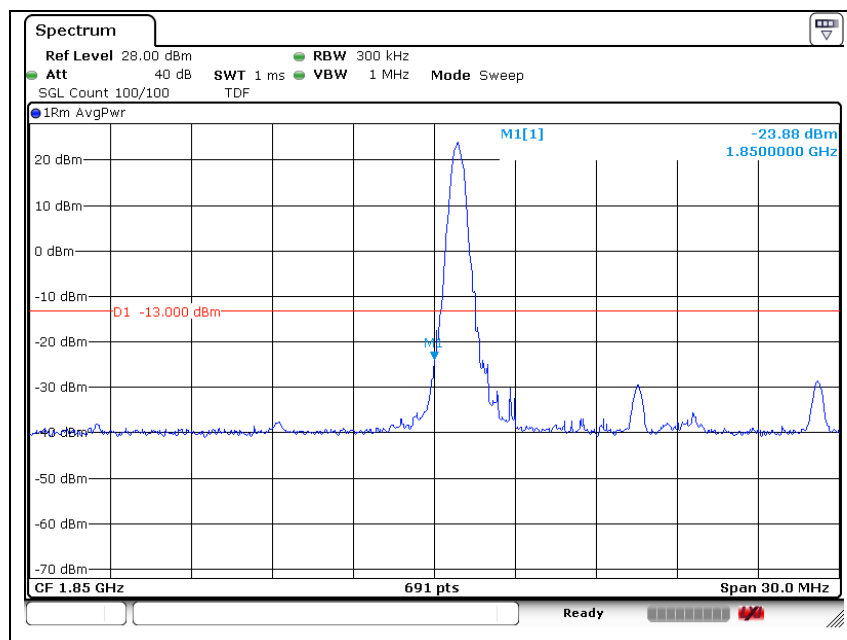
LTE band 2 (15 MHz – QPSK_Full RB)

Low Channel



LTE band 2 (15 MHz – QPSK_1 RB)

Low Channel



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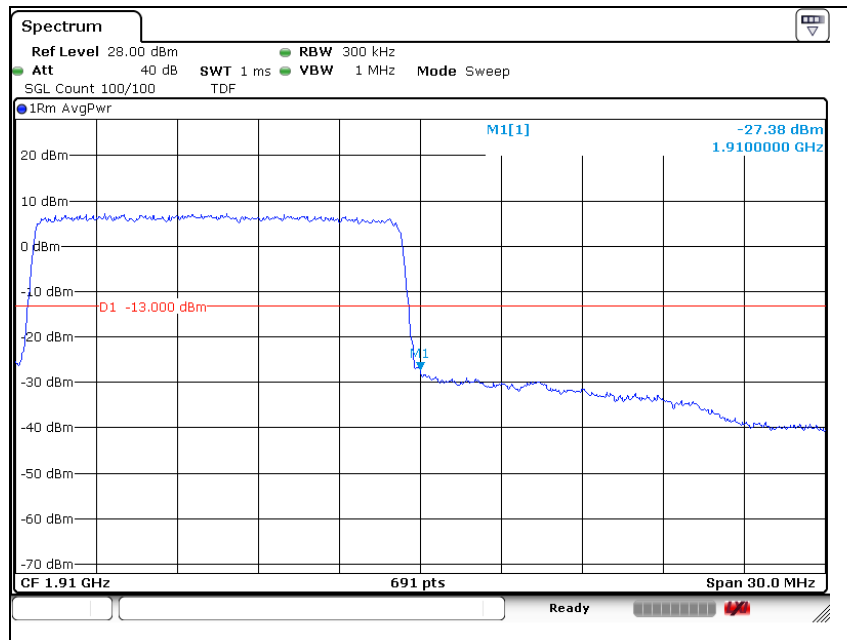
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

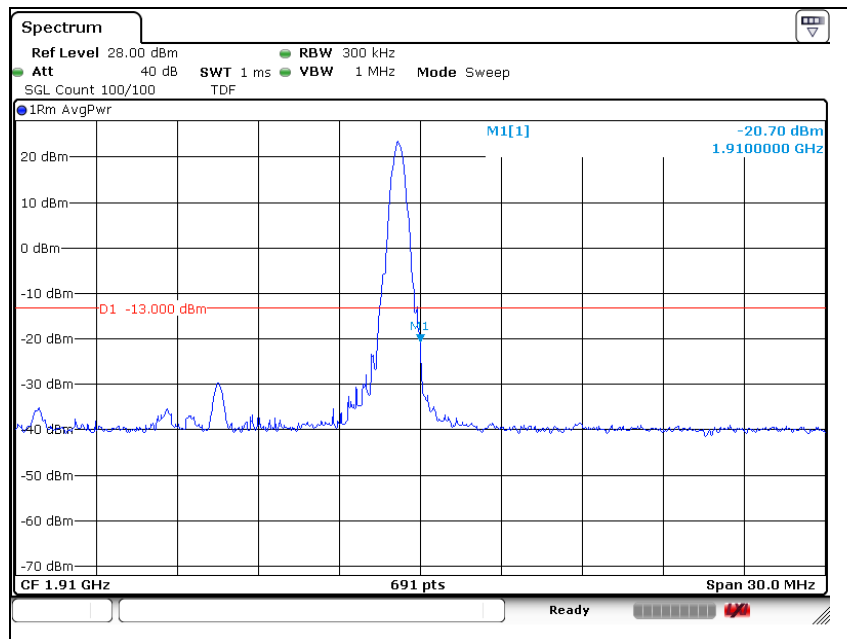
LTE band 2 (15 MHz – QPSK_Full RB)

High Channel



LTE band 2 (15 MHz – QPSK_1 RB)

High Channel



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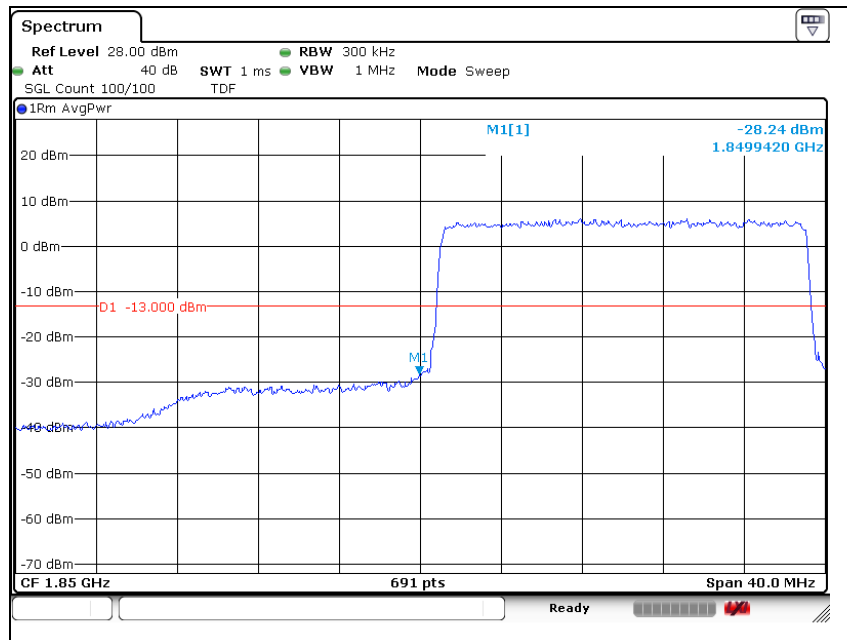
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

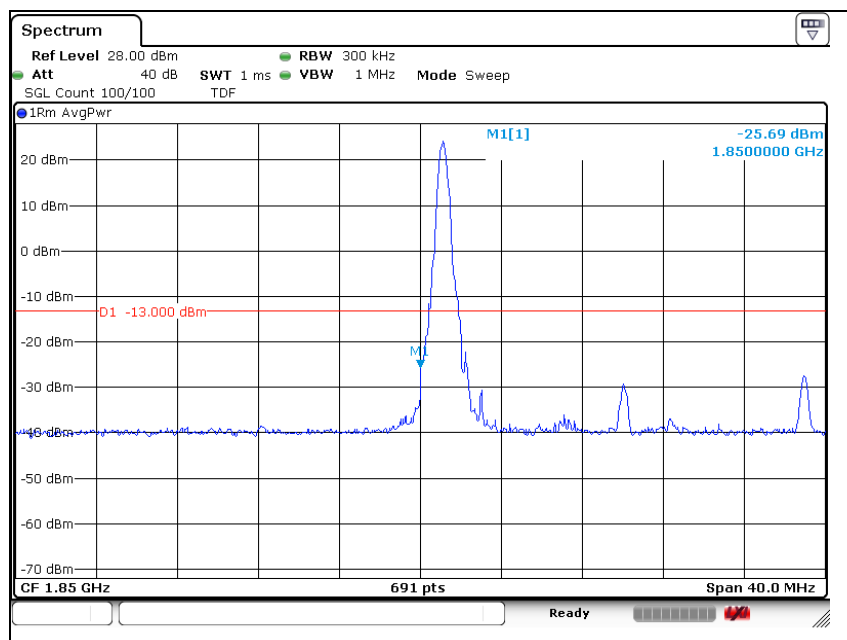
LTE band 2 (20 MHz – QPSK_Full RB)

Low Channel



LTE band 2 (20 MHz – QPSK_1 RB)

Low Channel



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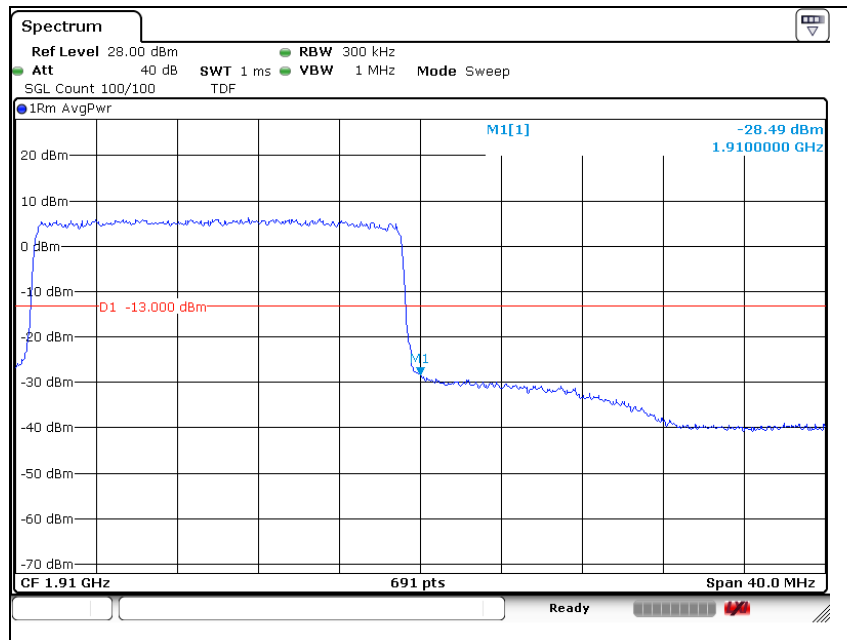
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Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

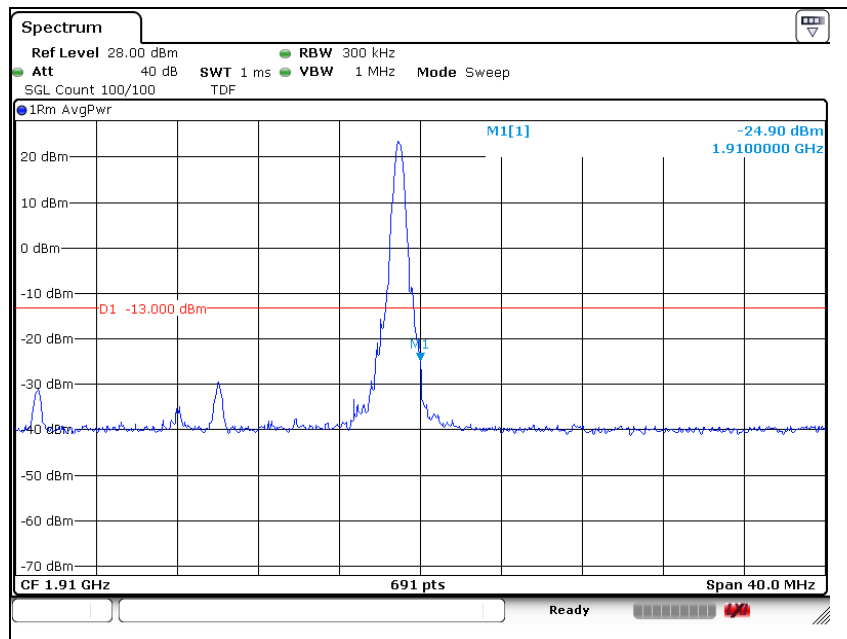
LTE band 2 (20 MHz – QPSK_Full RB)

High Channel



LTE band 2 (20 MHz – QPSK_1 RB)

High Channel



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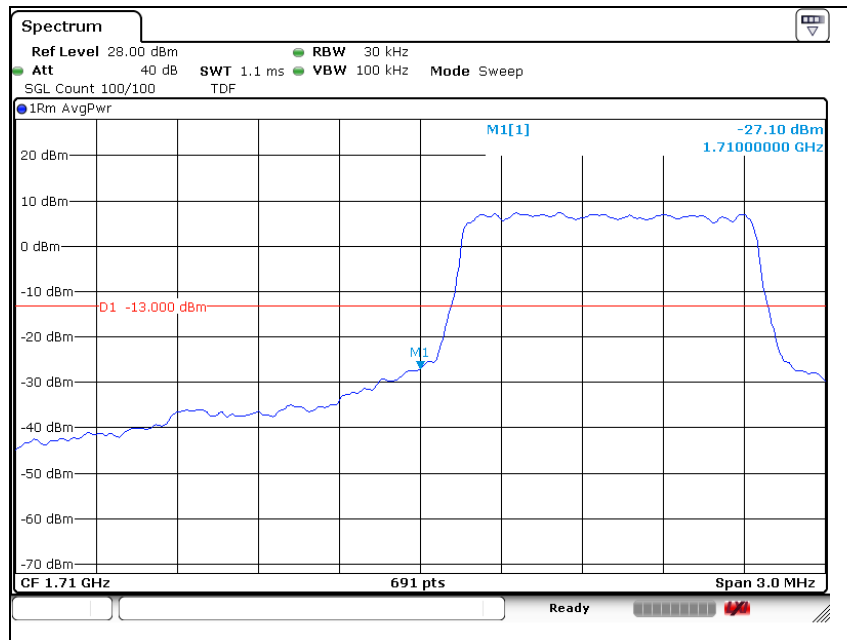
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

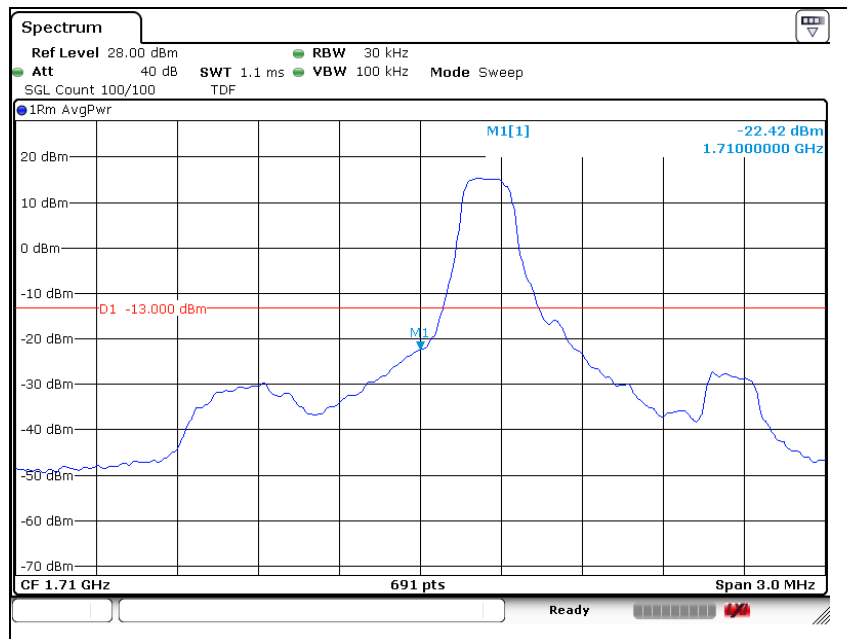
LTE band 4 (1.4 MHz – QPSK_Full RB)

Low Channel



LTE band 4 (1.4 MHz – QPSK_1 RB)

Low Channel



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RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

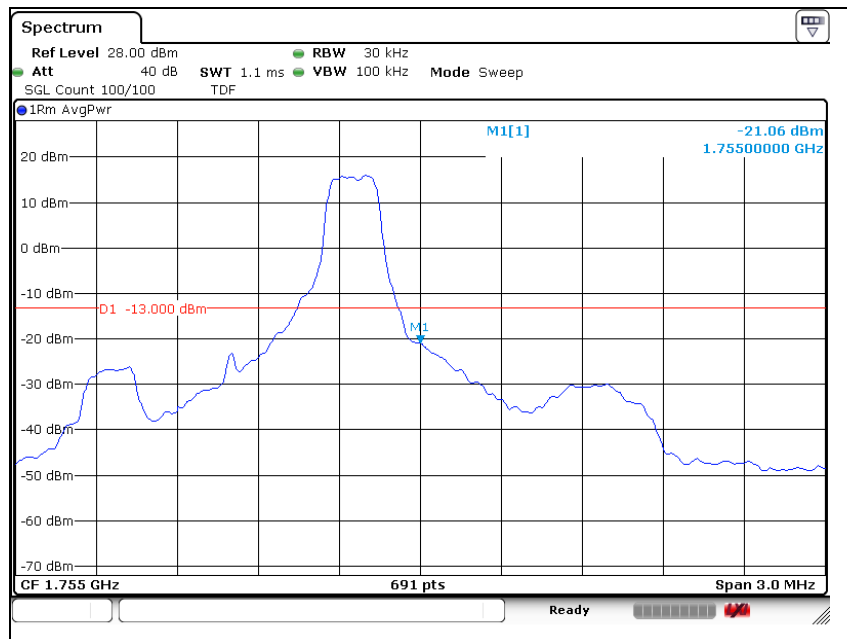
LTE band 4 (1.4 MHz – QPSK_Full RB)

High Channel



LTE band 4 (1.4 MHz – QPSK_1 RB)

High Channel



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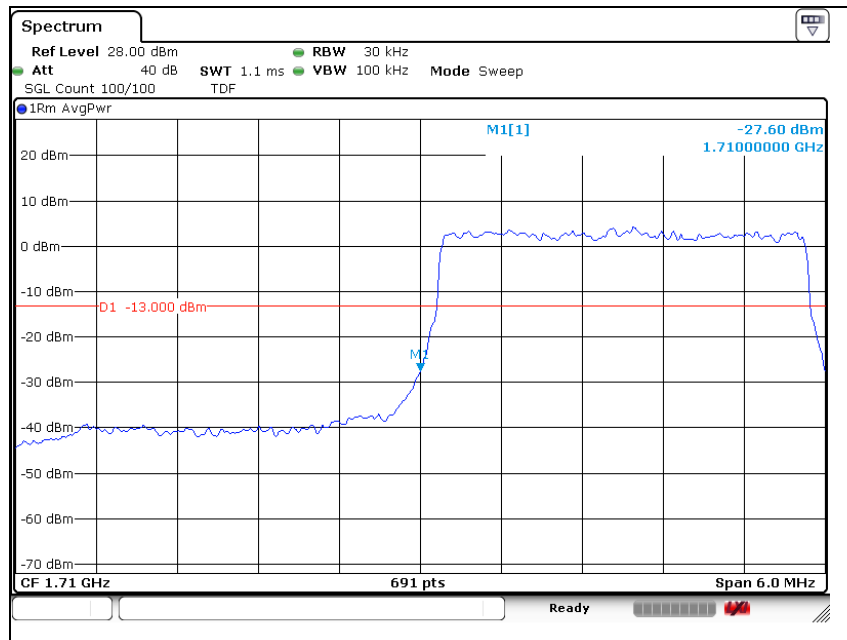
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

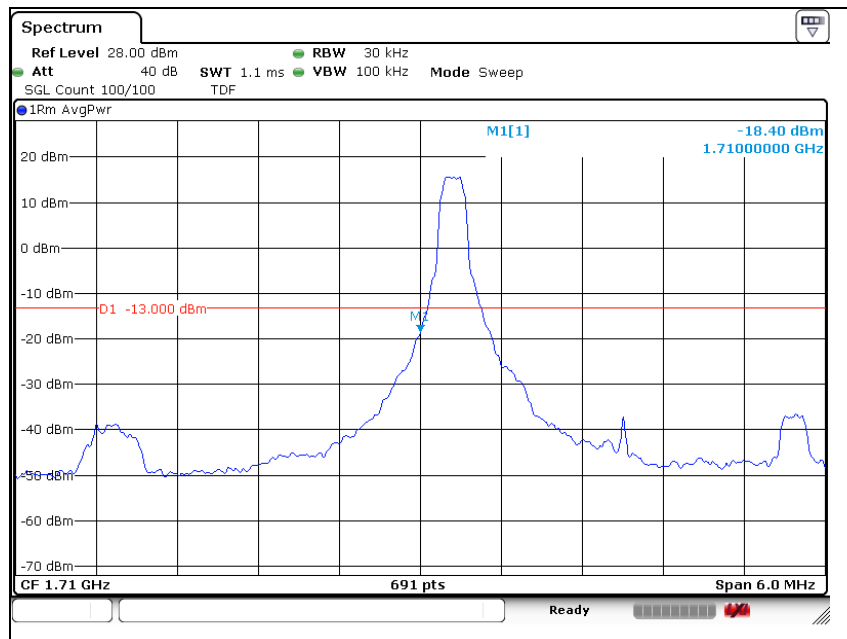
LTE band 4 (3 MHz – QPSK_Full RB)

Low Channel



LTE band 4 (3 MHz – QPSK_1 RB)

Low Channel



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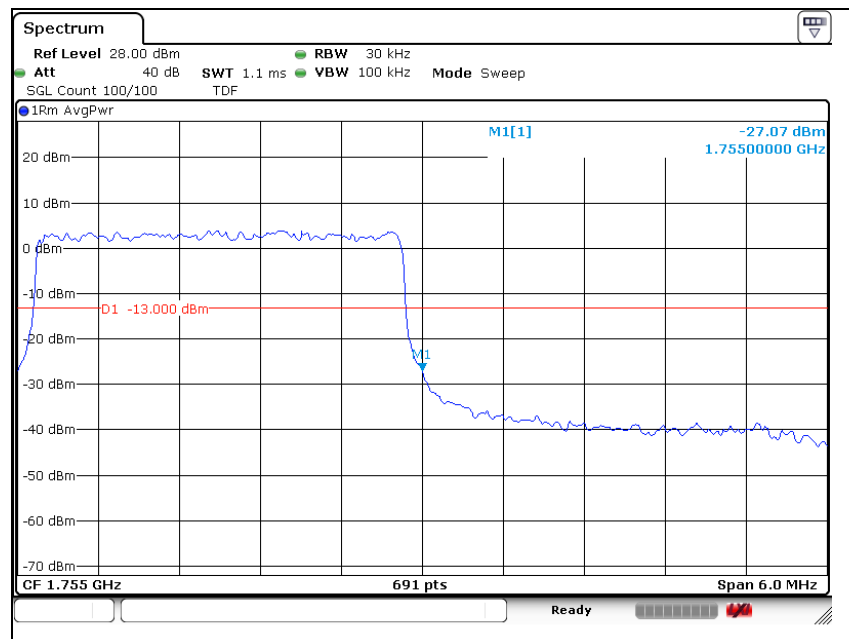
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

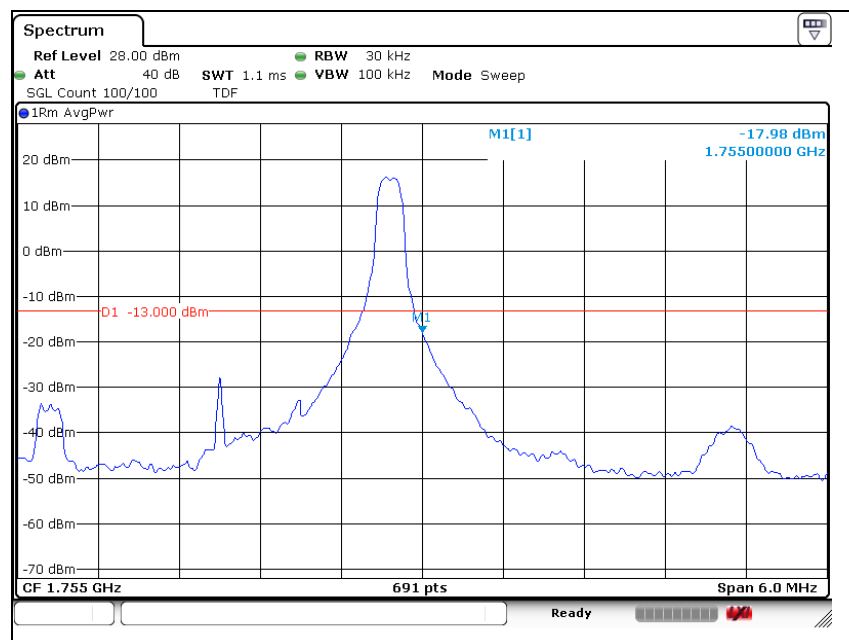
LTE band 4 (3 MHz – QPSK_Full RB)

High Channel



LTE band 4 (3 MHz – QPSK_1 RB)

High Channel



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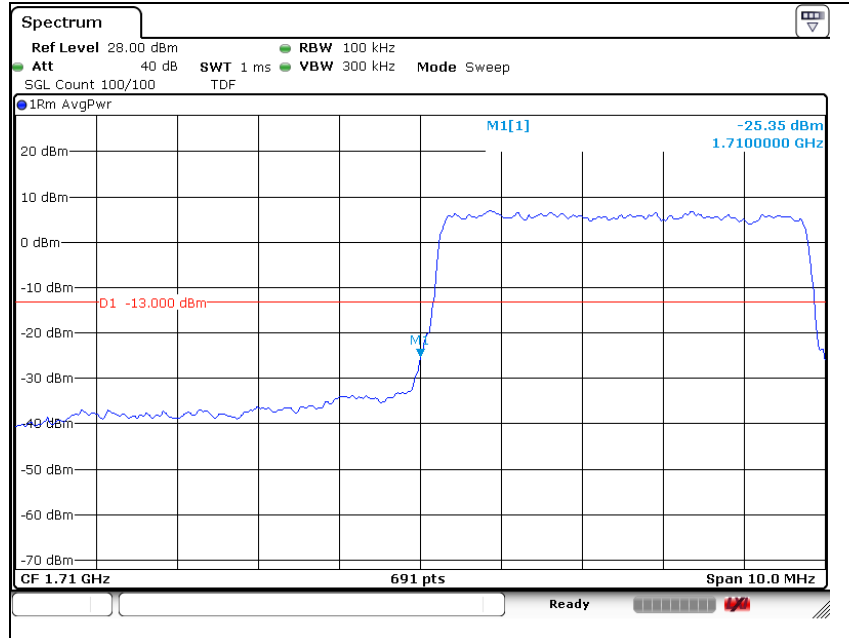
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

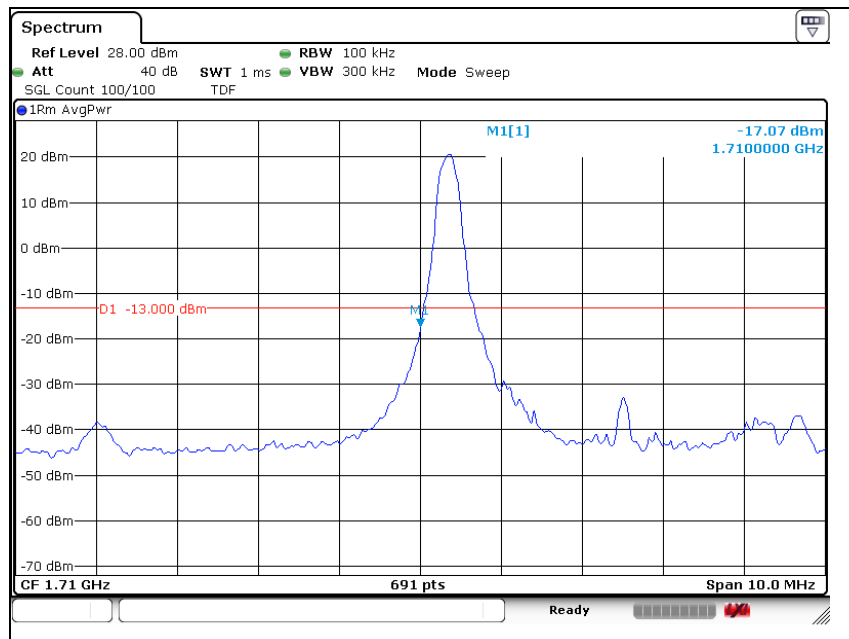
LTE band 4 (5 MHz – QPSK_Full RB)

Low Channel



LTE band 4 (5 MHz – QPSK_1 RB)

Low Channel



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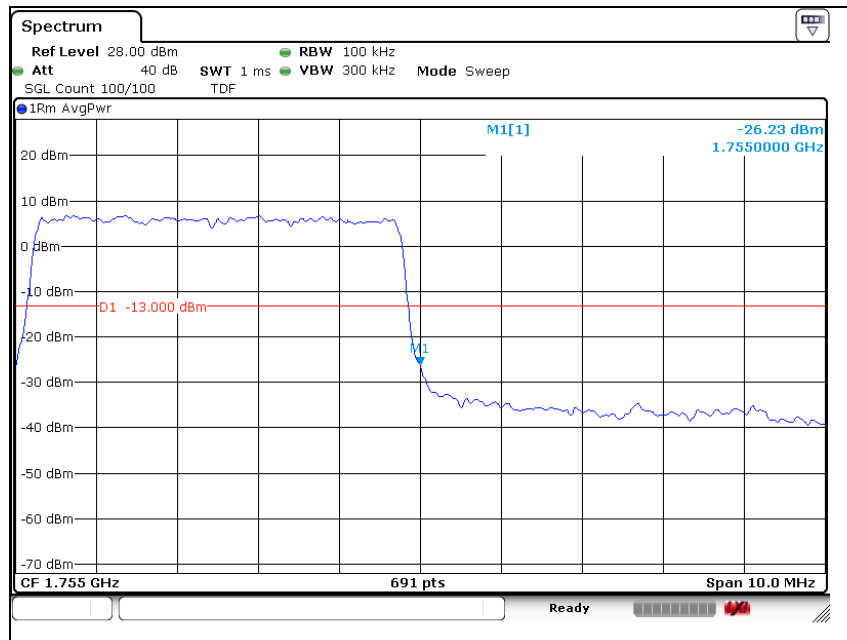
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

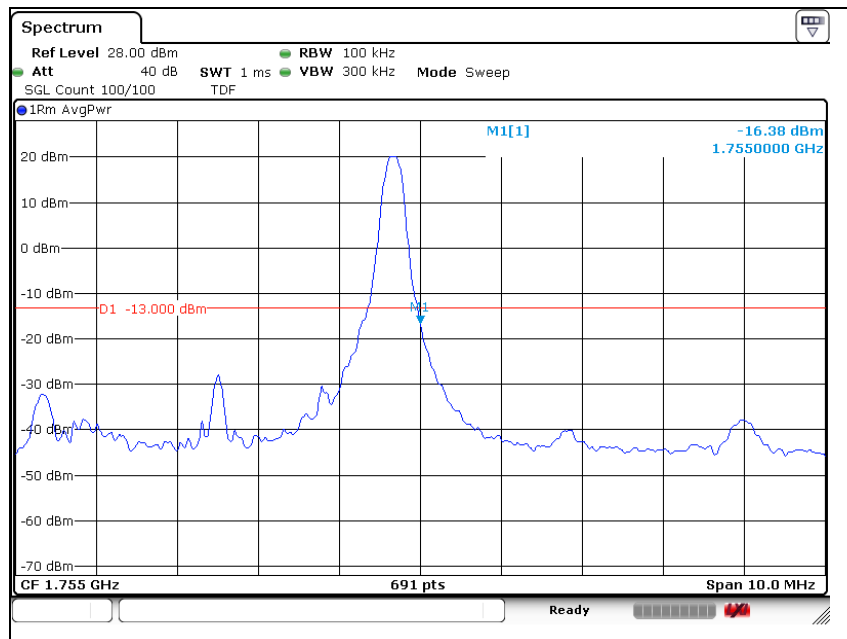
LTE band 4 (5 MHz – QPSK_Full RB)

High Channel



LTE band 4 (5 MHz – QPSK_1 RB)

High Channel



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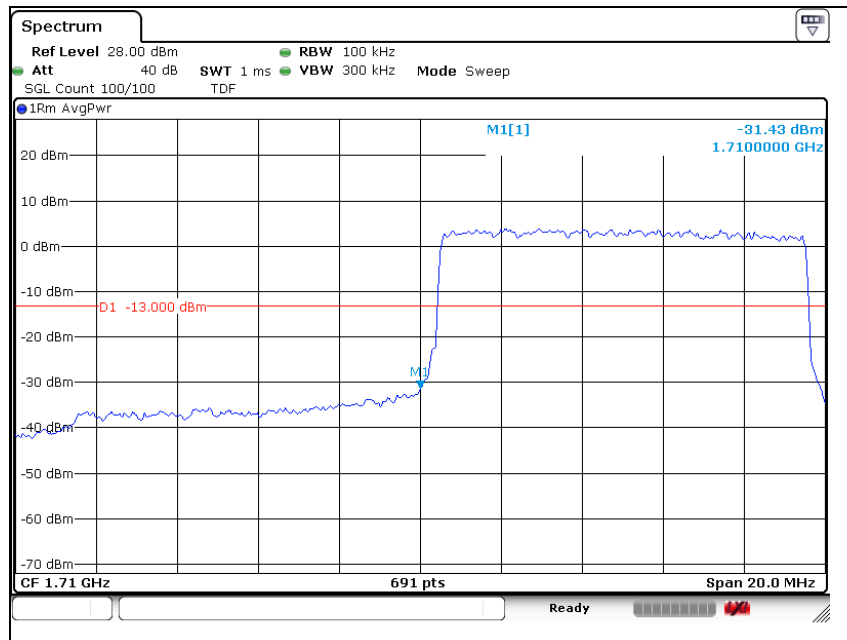
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

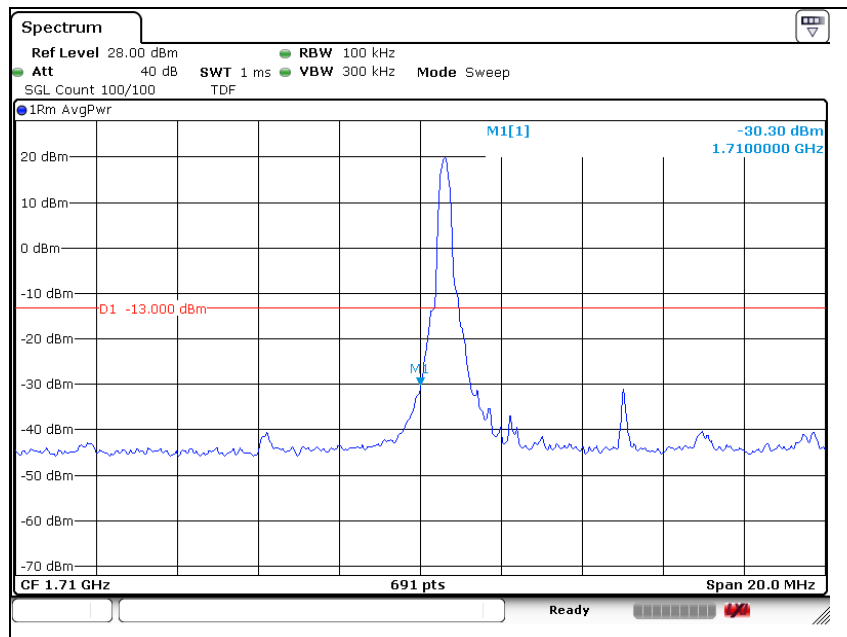
LTE band 4 (10 MHz – QPSK_Full RB)

Low Channel



LTE band 4 (10 MHz – QPSK_1 RB)

Low Channel



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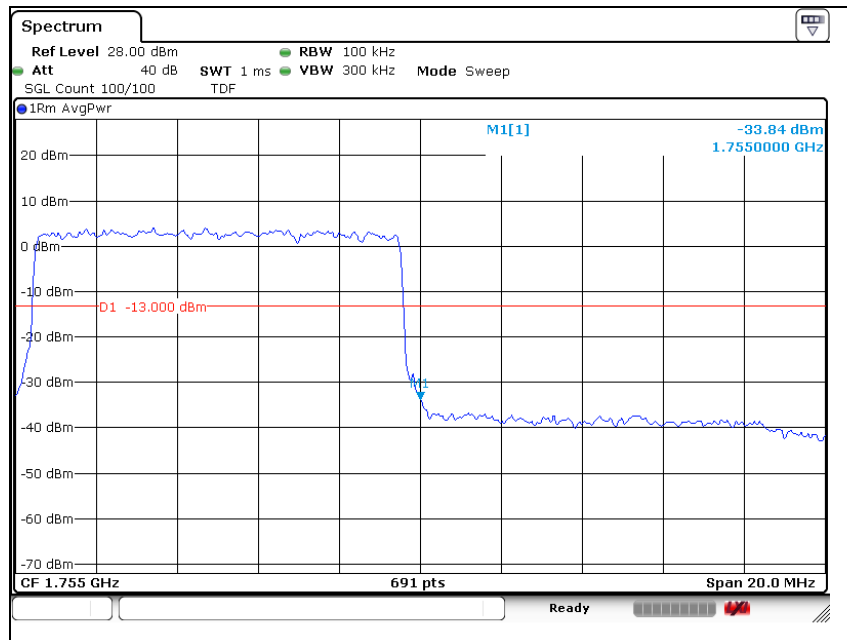
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

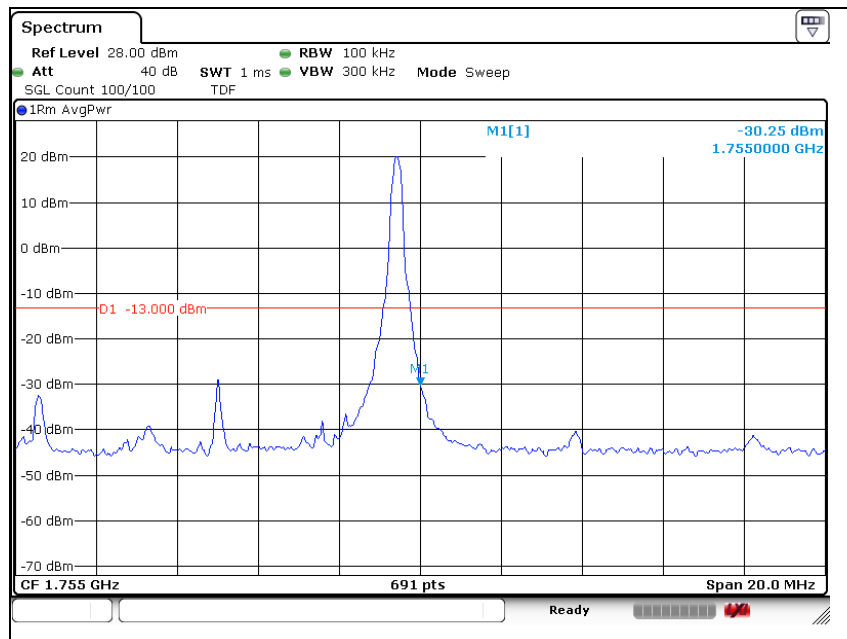
LTE band 4 (10 MHz – QPSK_Full RB)

High Channel



LTE band 4 (10 MHz – QPSK_1 RB)

High Channel



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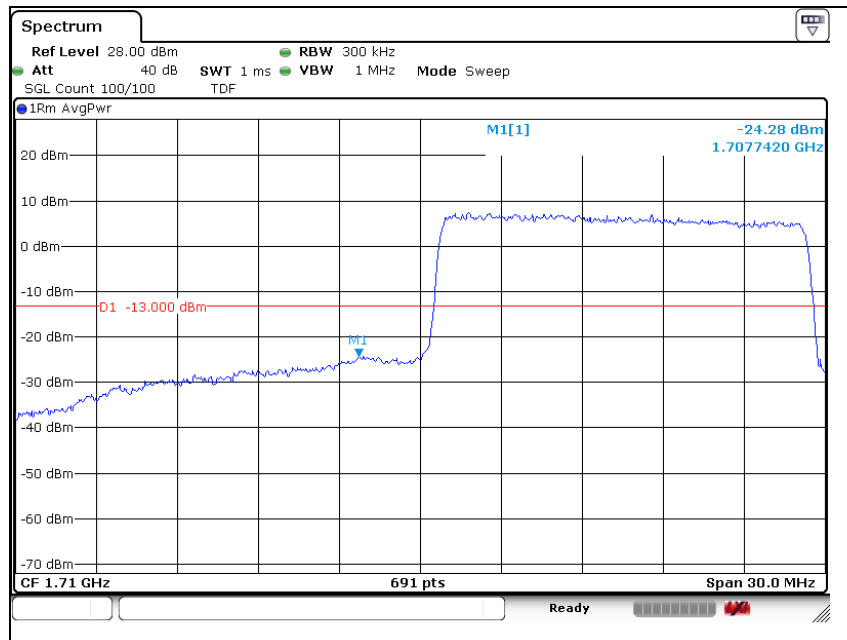
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

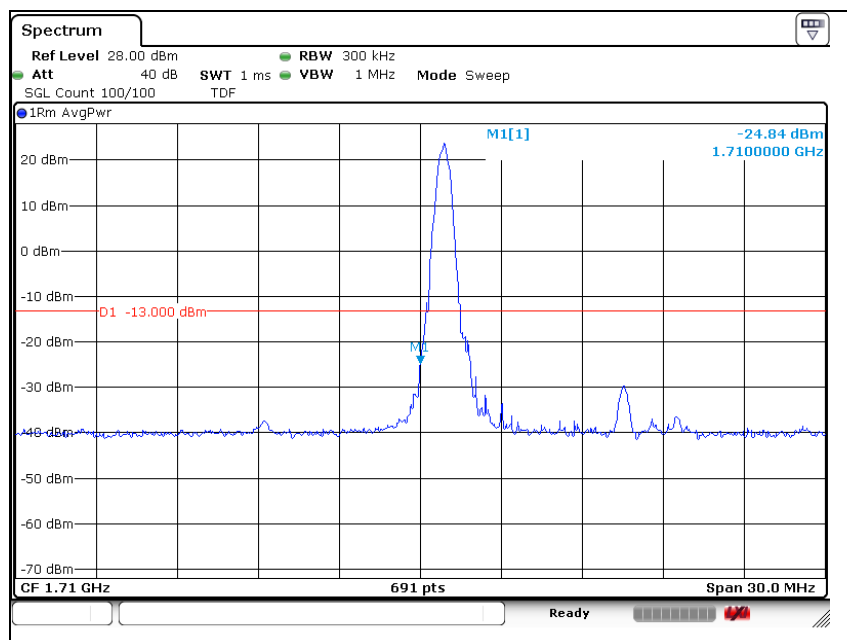
LTE band 4 (15 MHz – QPSK_Full RB)

Low Channel



LTE band 4 (15 MHz – QPSK_1 RB)

Low Channel



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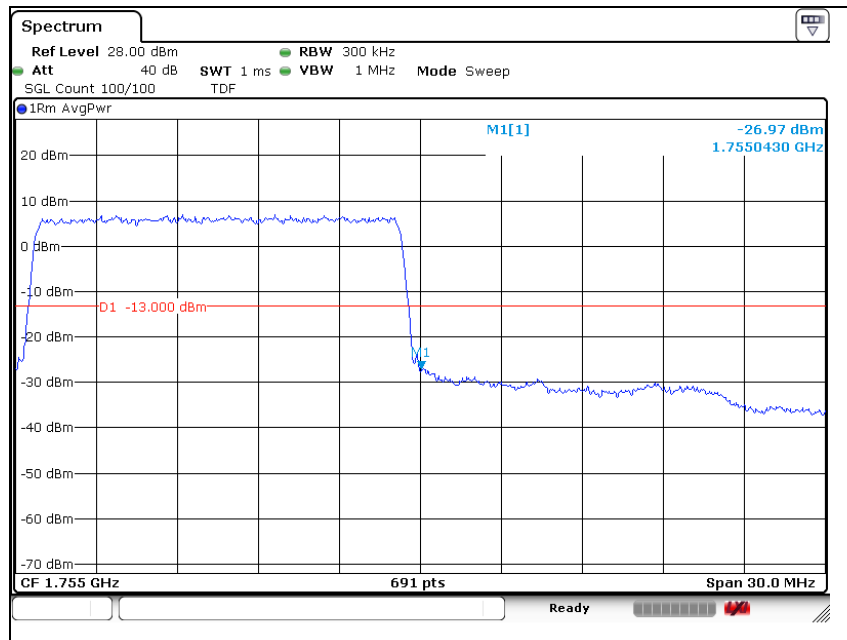
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

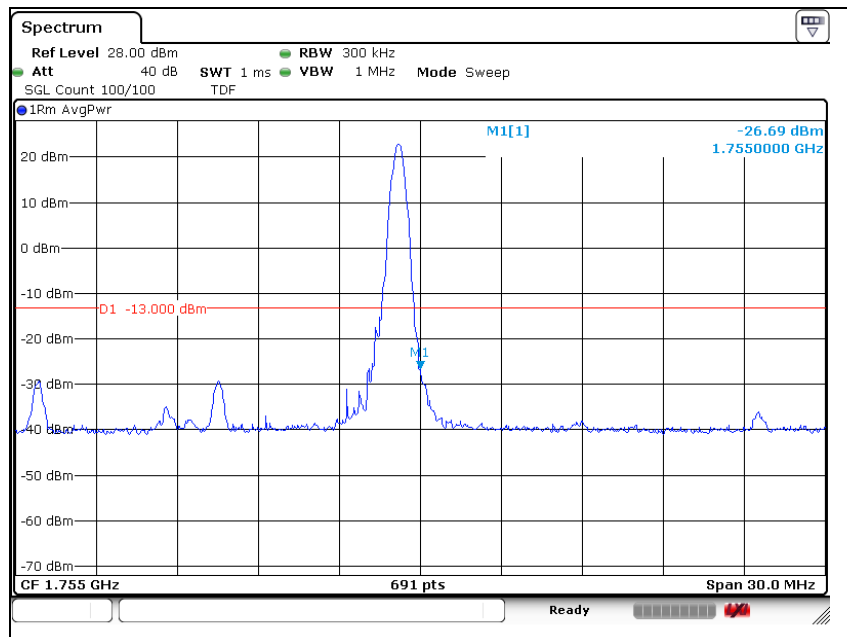
LTE band 4 (15 MHz – QPSK_Full RB)

High Channel



LTE band 4 (15 MHz – QPSK_1 RB)

High Channel



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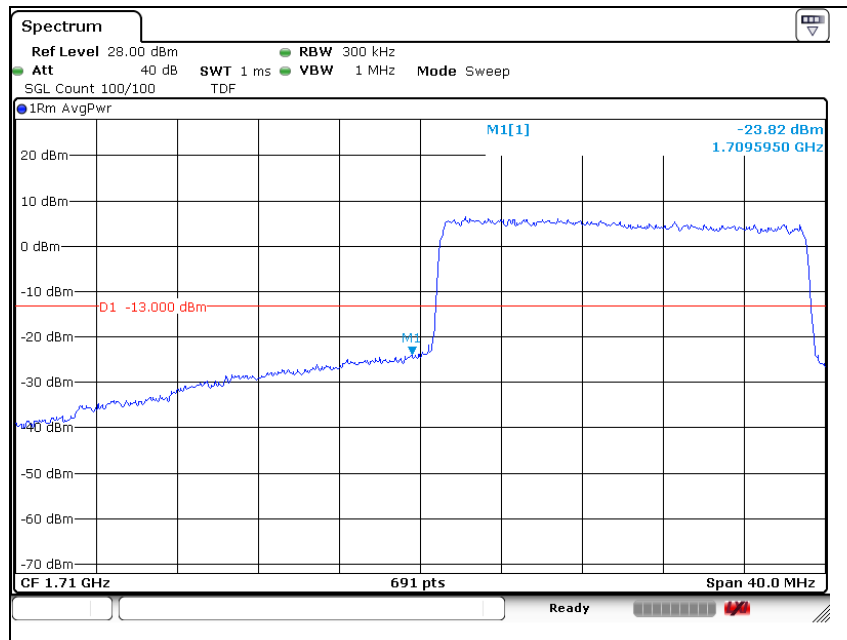
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

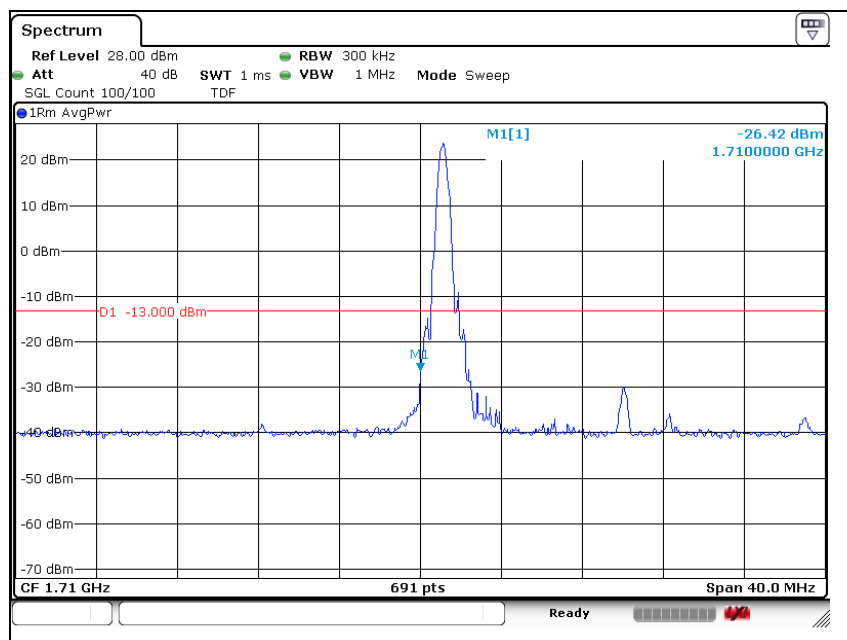
LTE band 4 (20 MHz – QPSK_Full RB)

Low Channel



LTE band 4 (20 MHz – QPSK_1 RB)

Low Channel



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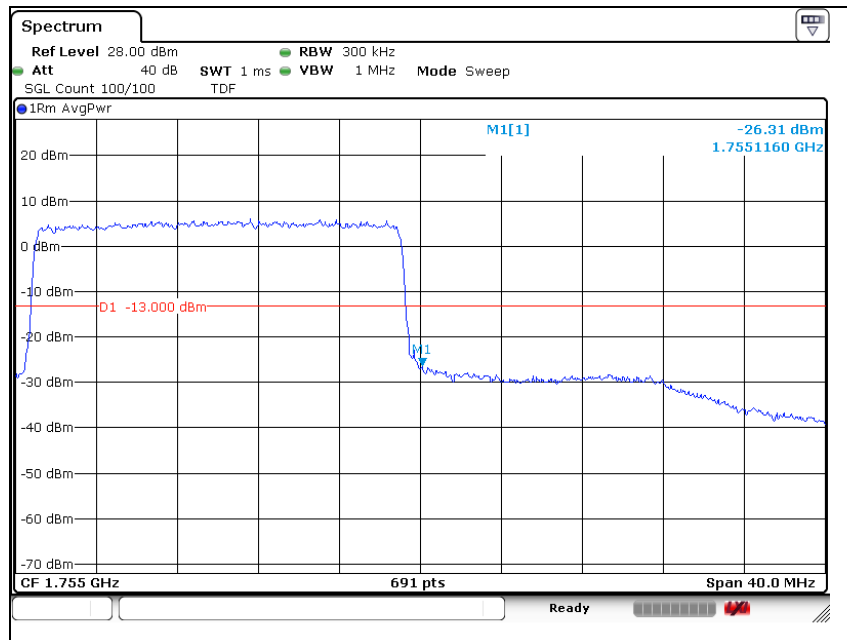
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

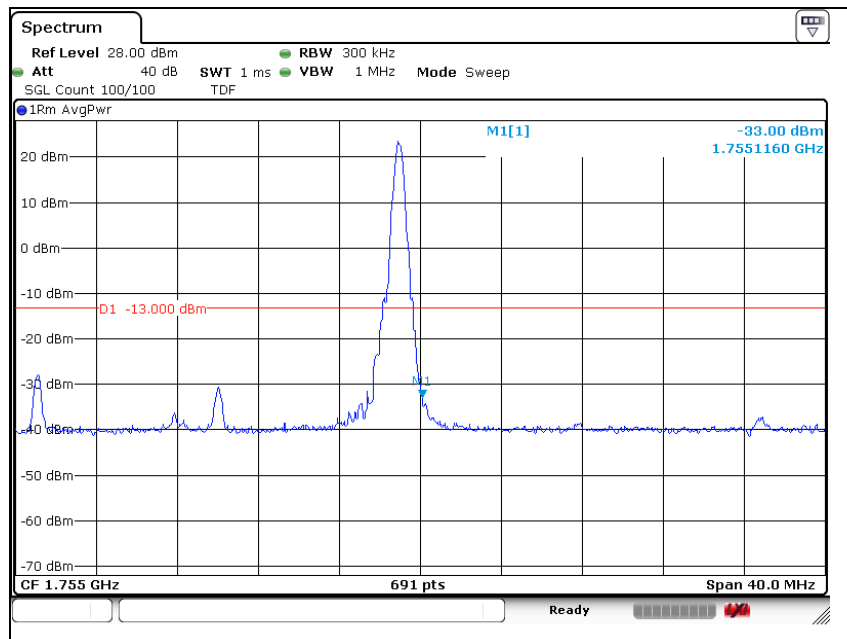
LTE band 4 (20 MHz – QPSK_Full RB)

High Channel



LTE band 4 (20 MHz – QPSK_1 RB)

High Channel



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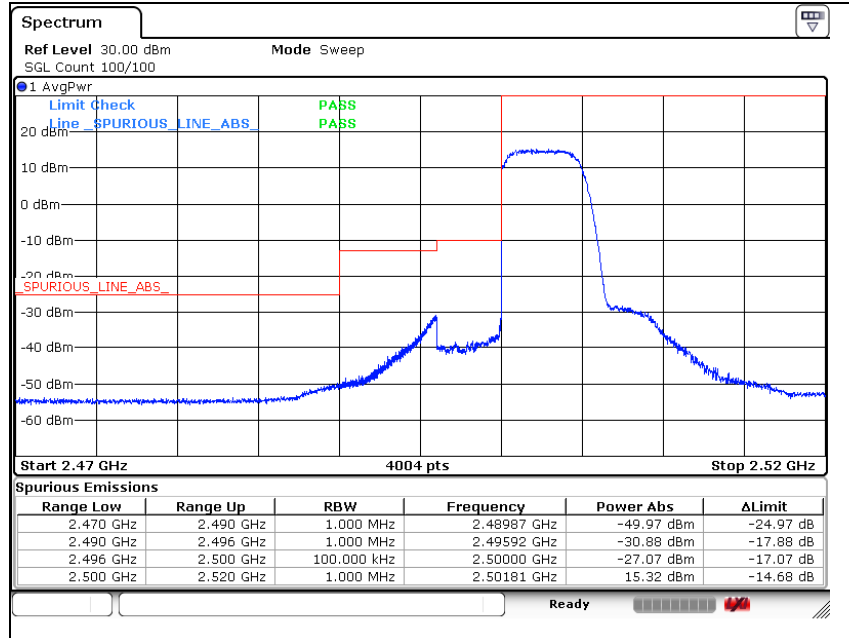
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

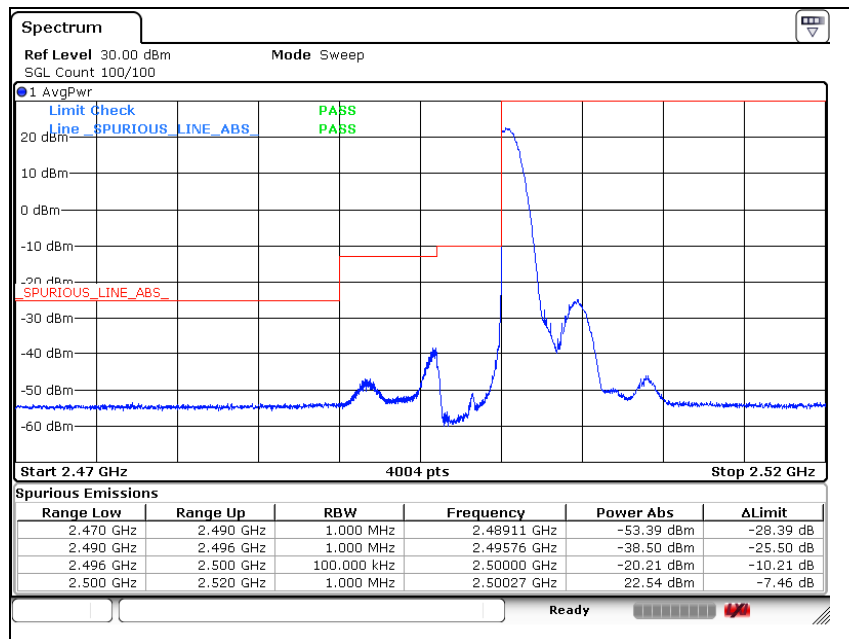
LTE band 7 (5 MHz – QPSK_Full RB)

Low Channel



LTE band 7 (5 MHz – QPSK_1 RB)

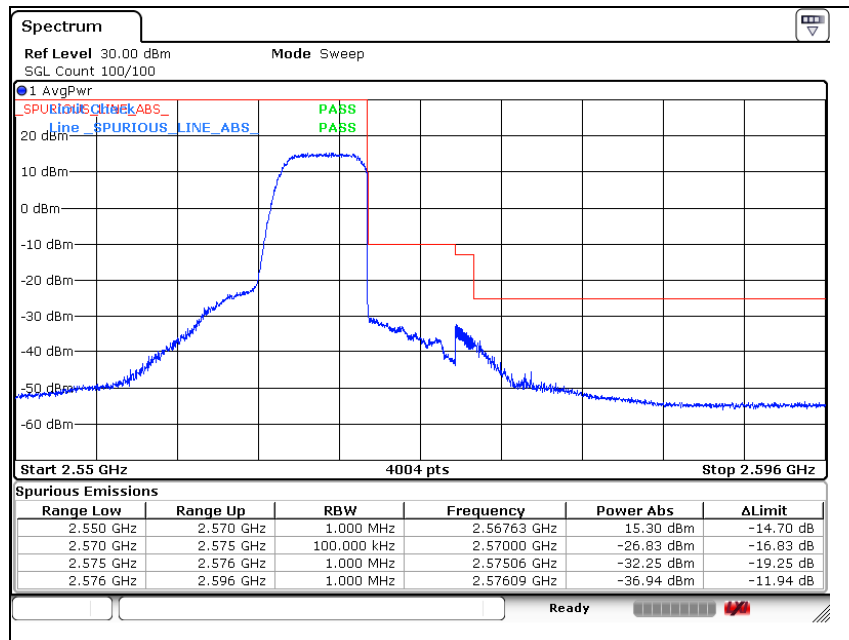
Low Channel



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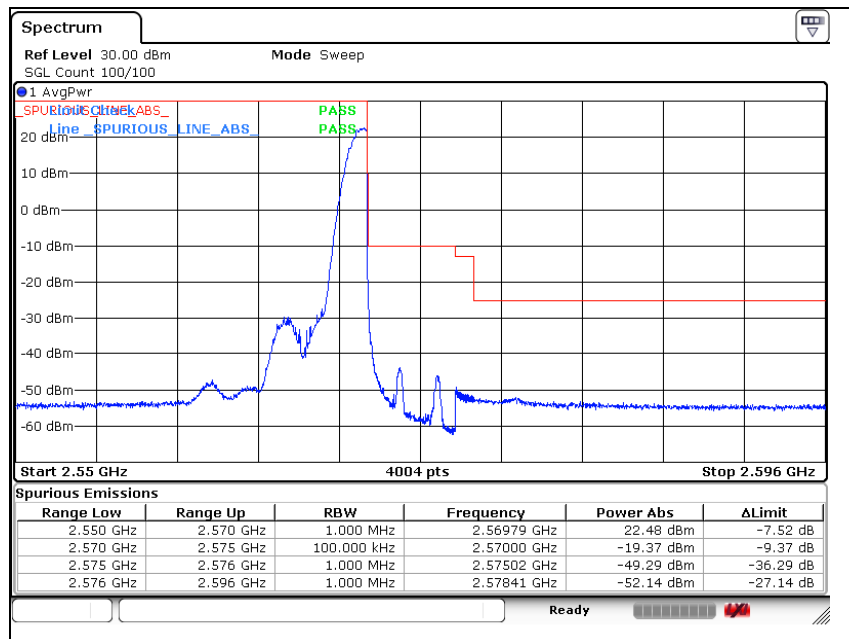
LTE band 7 (5 MHz – QPSK_Full RB)

High Channel



LTE band 7 (5 MHz – QPSK_1 RB)

High Channel



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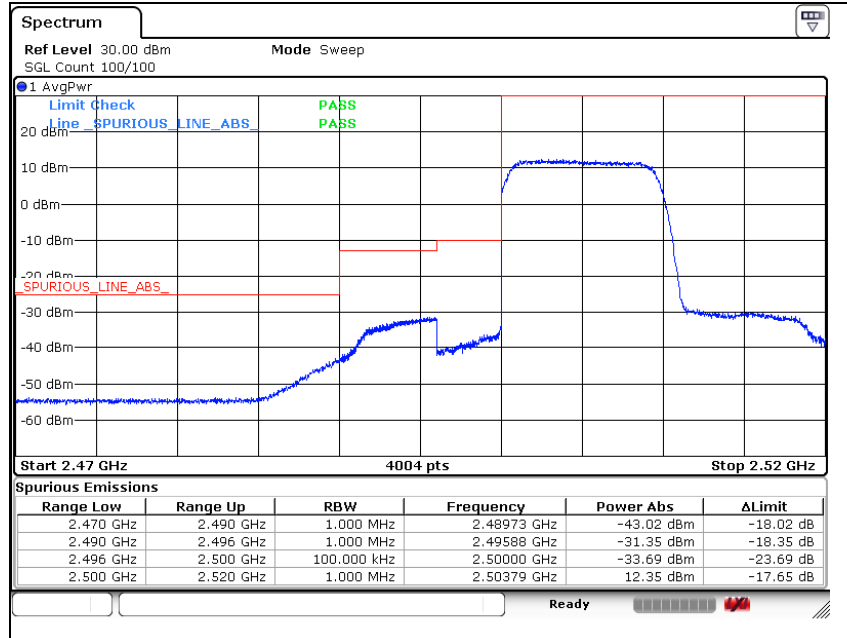
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

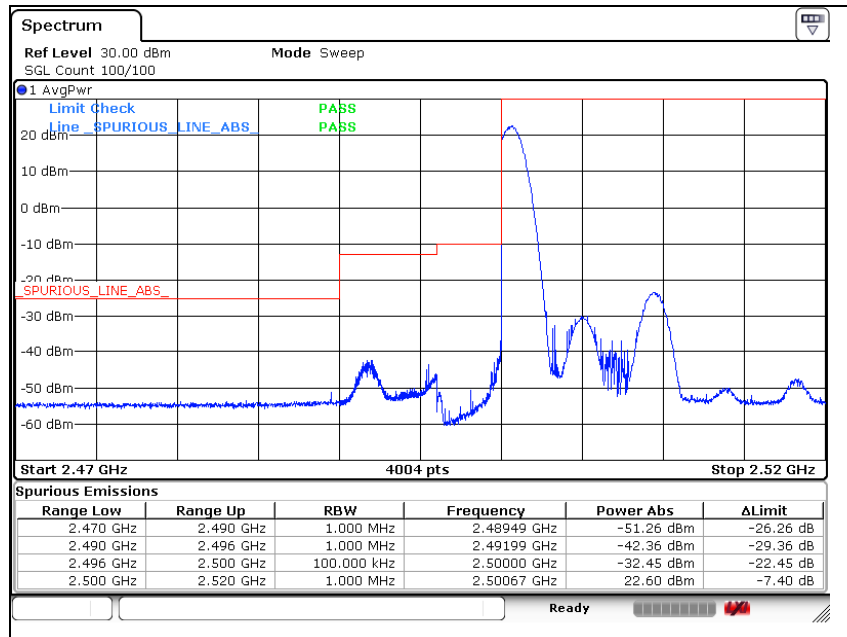
LTE band 7 (10 MHz – QPSK_Full RB)

Low Channel



LTE band 7 (10 MHz – QPSK_1 RB)

Low Channel



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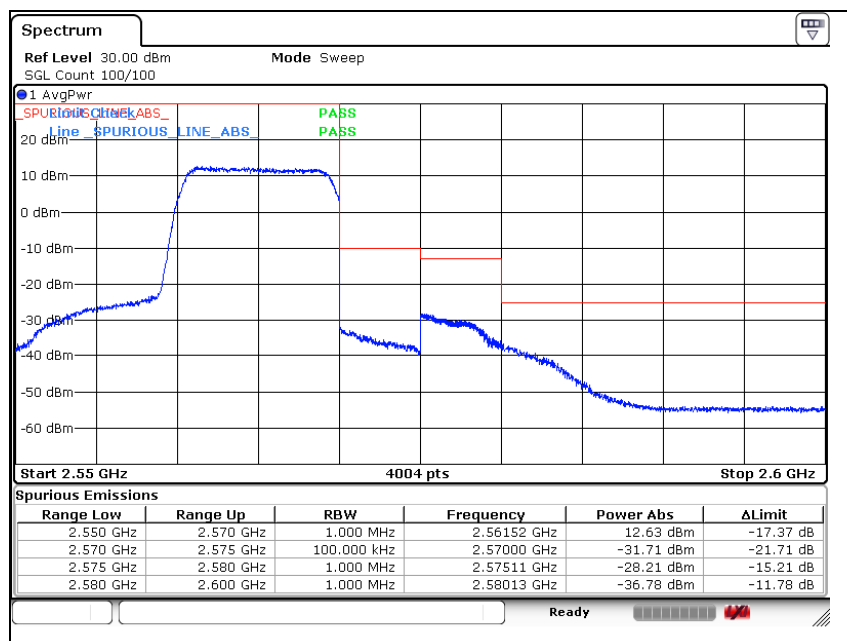
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

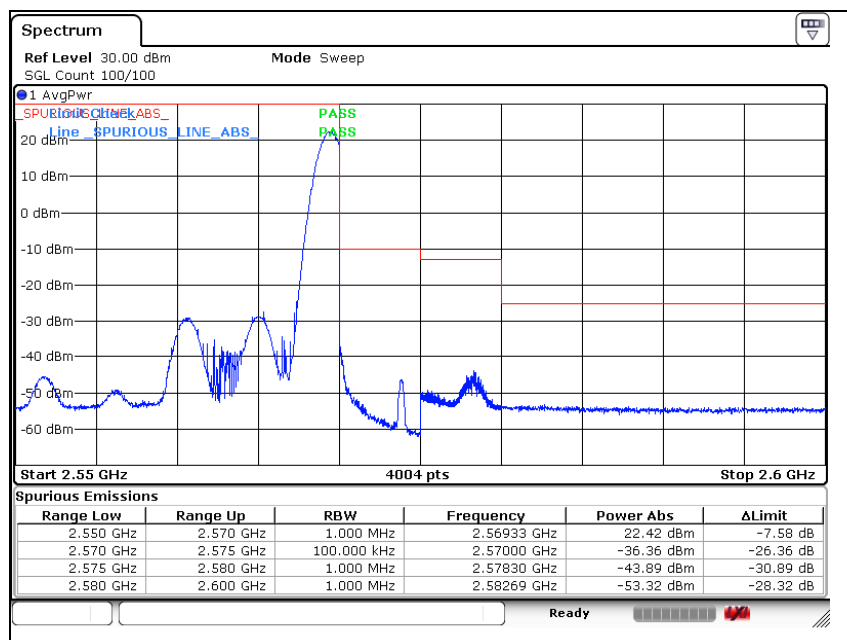
LTE band 7 (10 MHz – QPSK_Full RB)

High Channel



LTE band 7 (10 MHz – QPSK_1 RB)

High Channel



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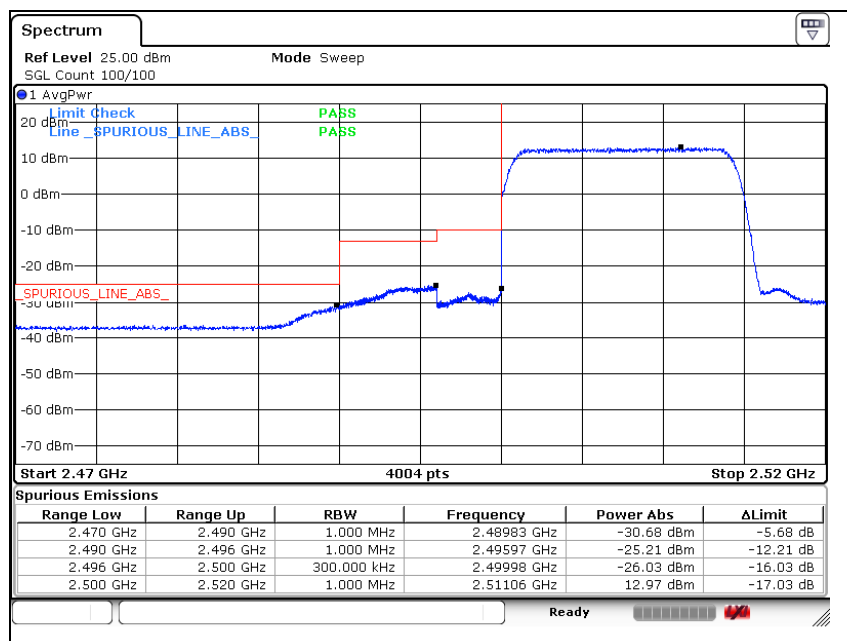
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

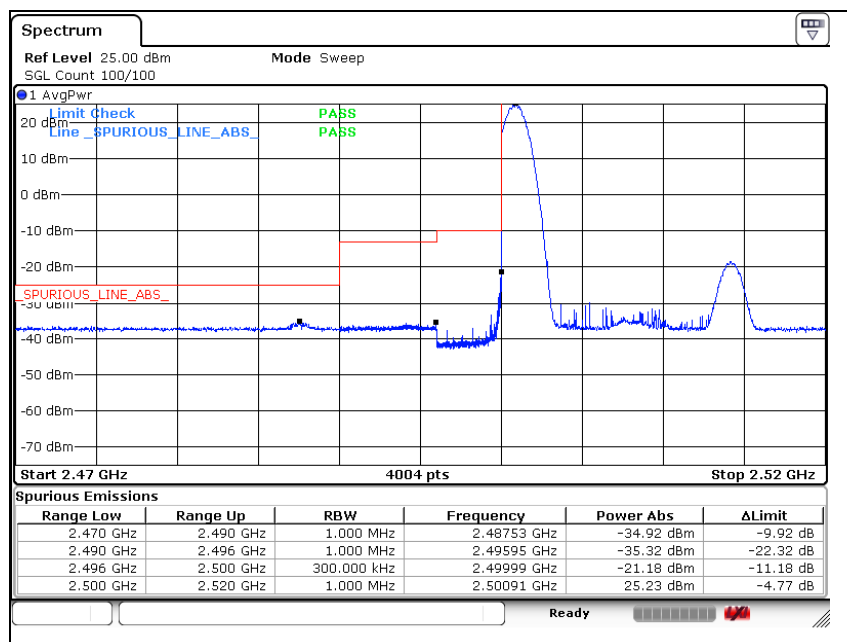
LTE band 7 (15 MHz – QPSK_Full RB)

Low Channel



LTE band 7 (15 MHz – QPSK_1 RB)

Low Channel

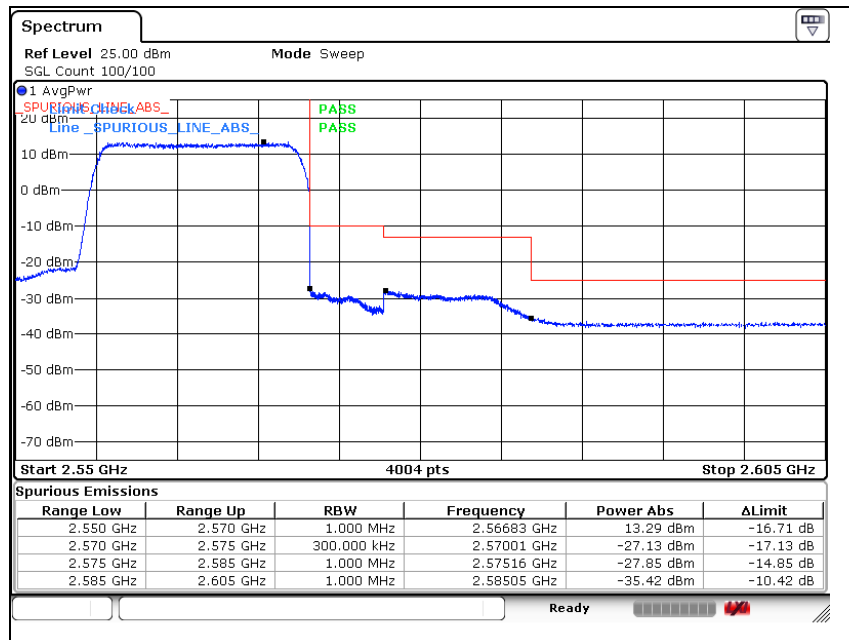


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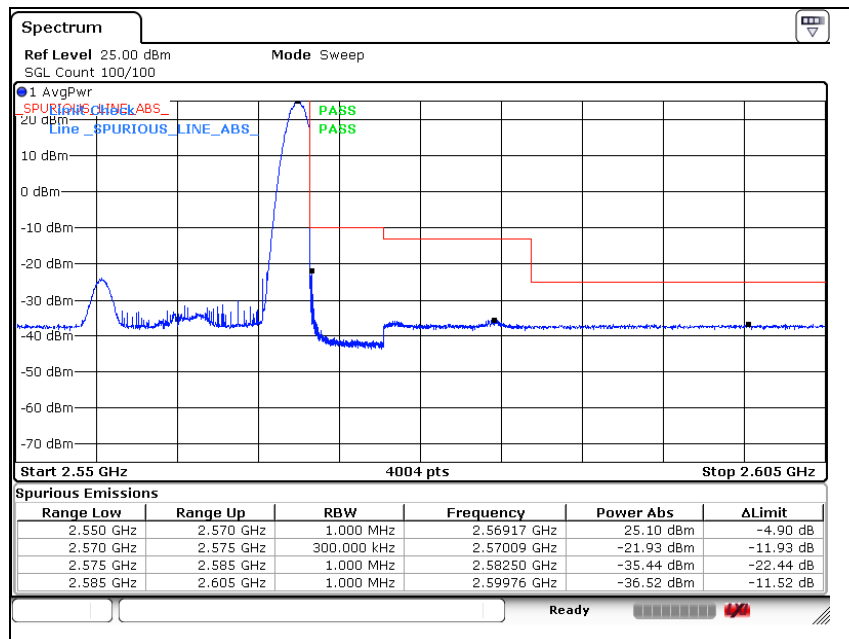
LTE band 7 (15 MHz – QPSK_Full RB)

High Channel



LTE band 7 (15 MHz – QPSK_1 RB)

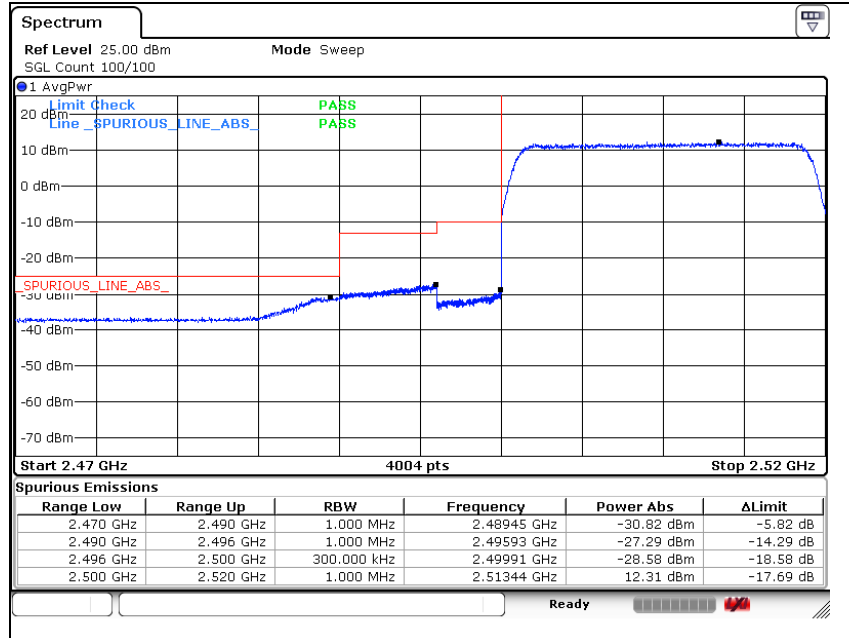
High Channel



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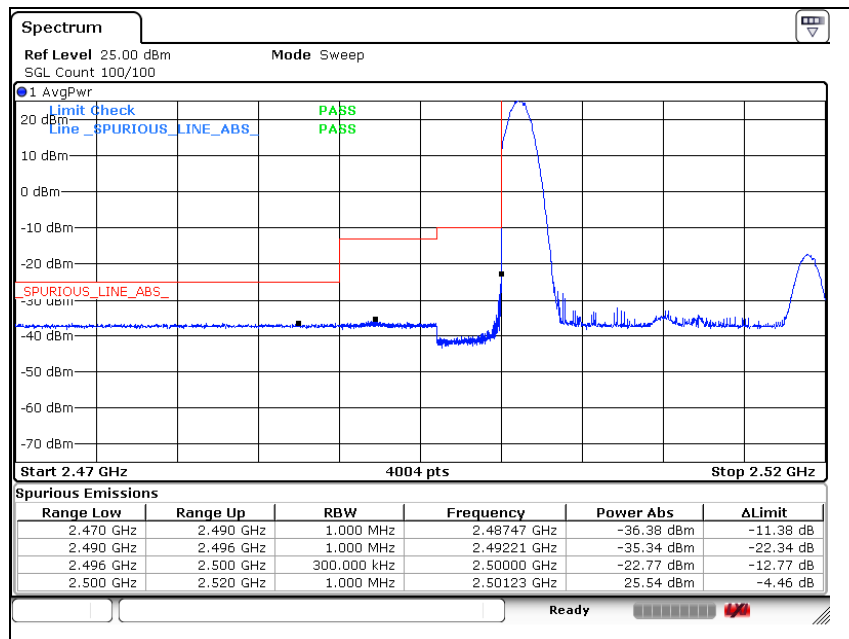
LTE band 7 (20 MHz – QPSK_Full RB)

Low Channel



LTE band 7 (20 MHz – QPSK_1 RB)

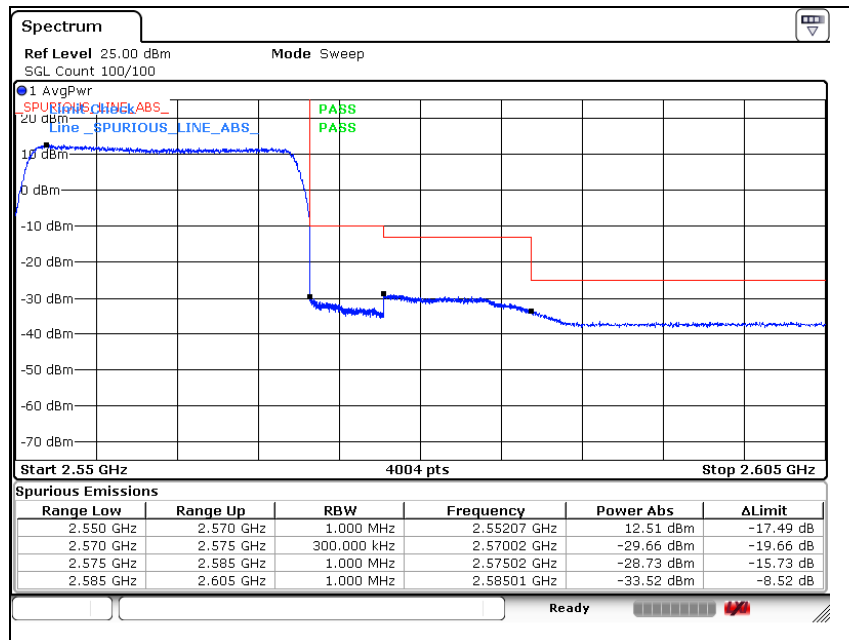
Low Channel



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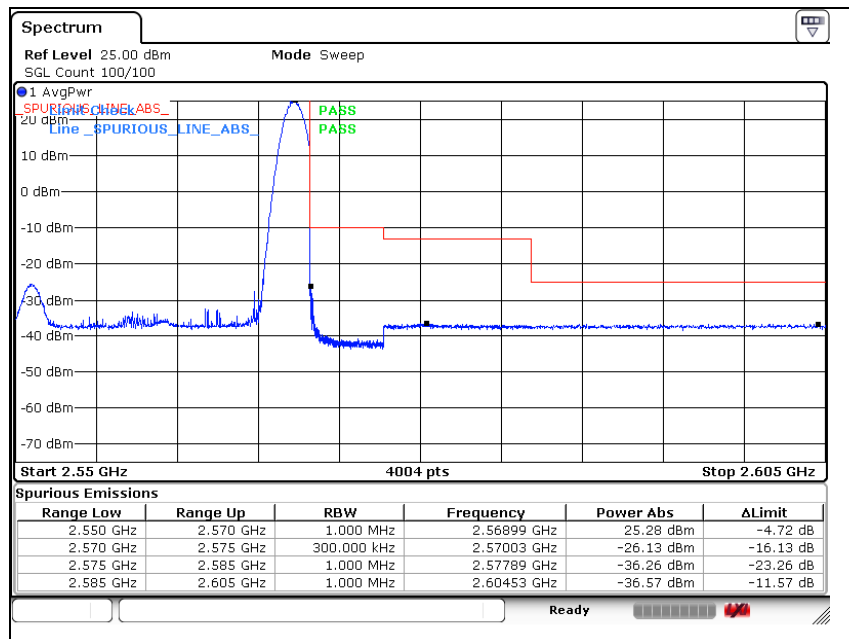
LTE band 7 (20 MHz – QPSK_Full RB)

High Channel



LTE band 7 (20 MHz – QPSK_1 RB)

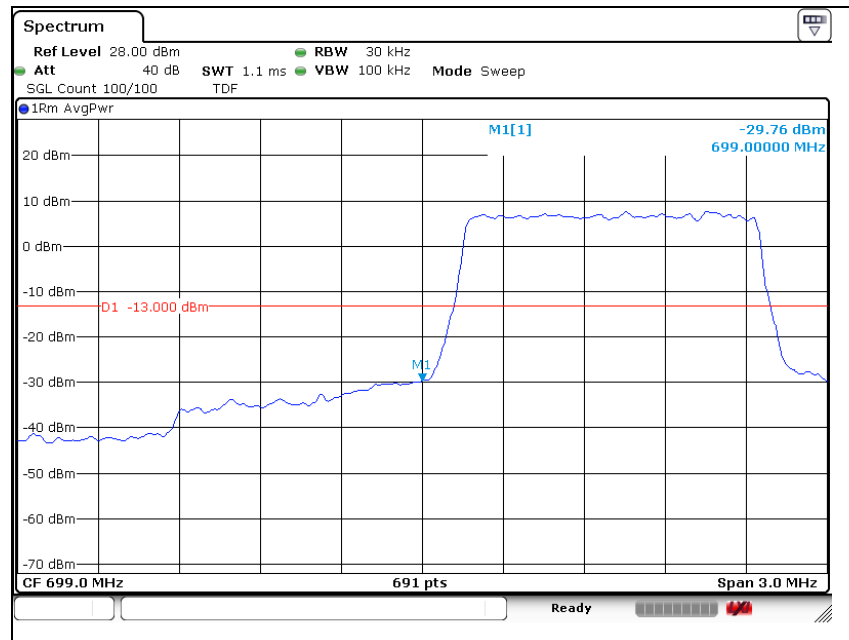
High Channel



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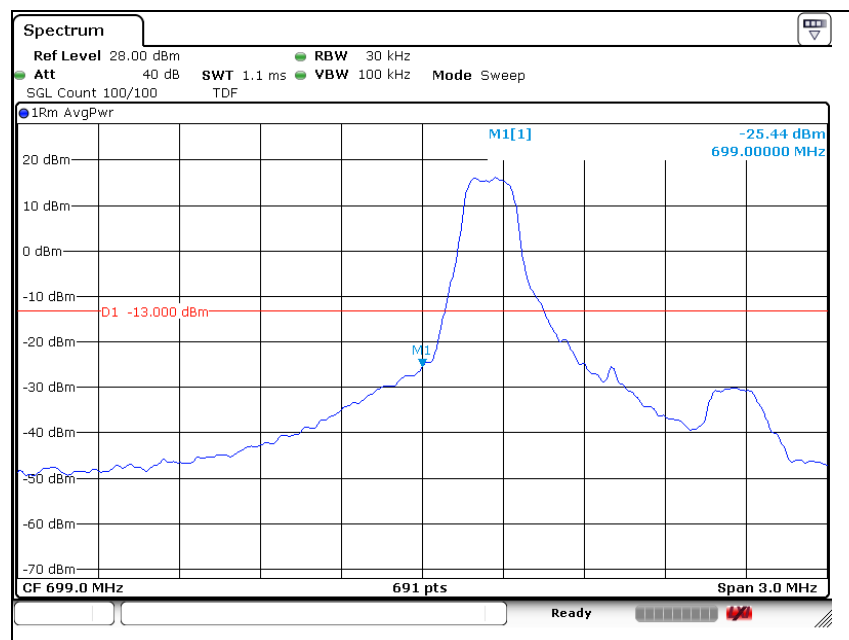
LTE band 12 (1.4 MHz – QPSK_Full RB)

Low Channel



LTE band 12 (1.4 MHz – QPSK_1 RB)

Low Channel



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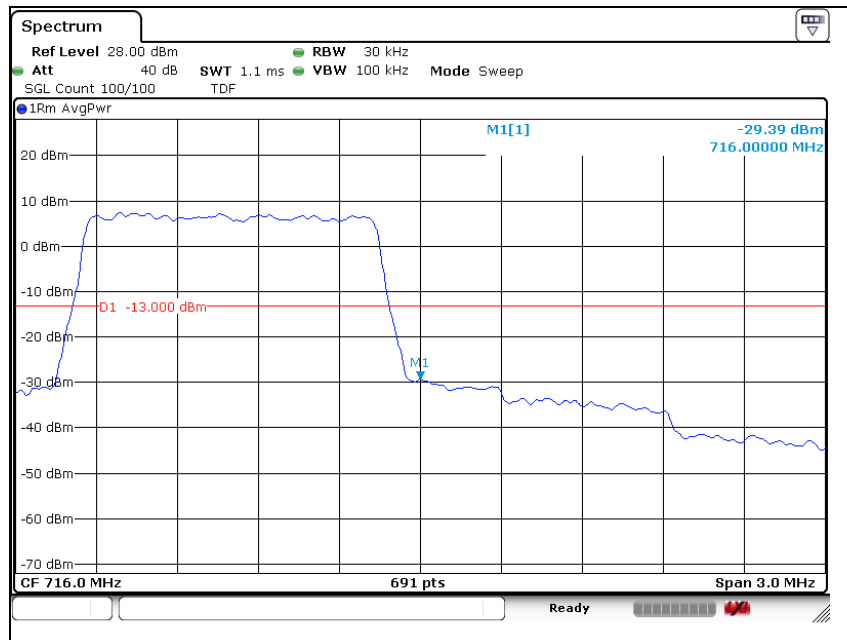
RTT5041-19(2019.04.24)(1)

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A4(210 mm x 297 mm)

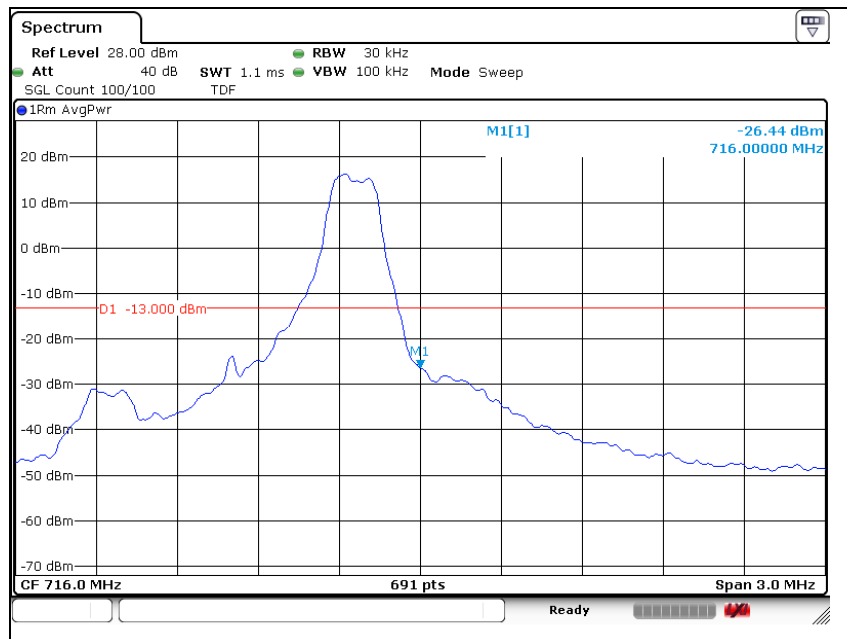
LTE band 12 (1.4 MHz – QPSK_Full RB)

High Channel



LTE band 12 (1.4 MHz – QPSK_1 RB)

High Channel



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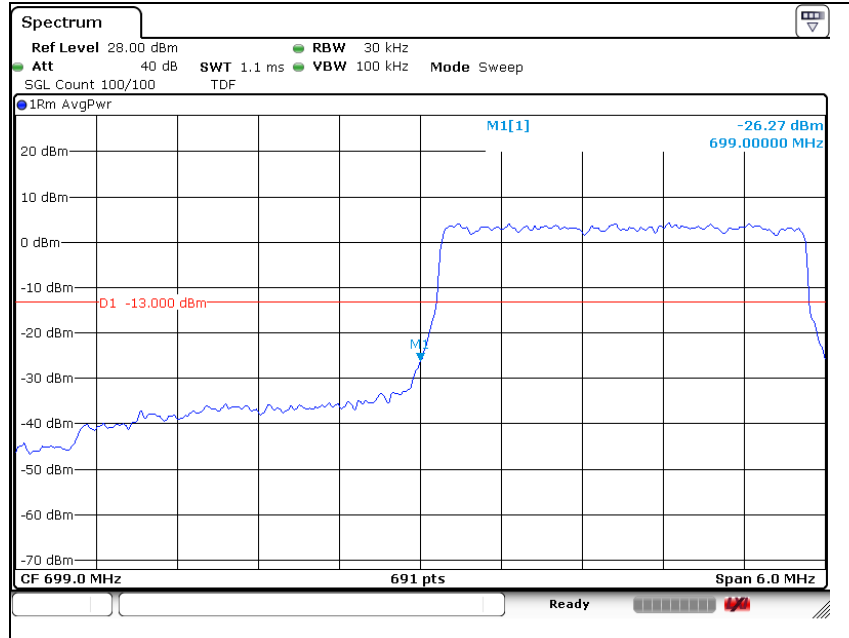
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

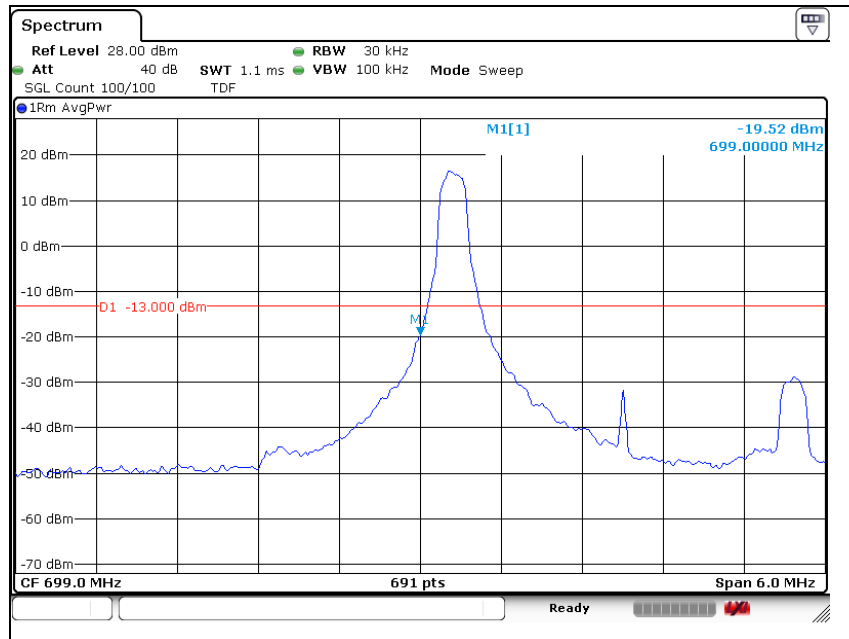
LTE band 12 (3 MHz – QPSK_Full RB)

Low Channel



LTE band 12 (3 MHz – QPSK_1 RB)

Low Channel



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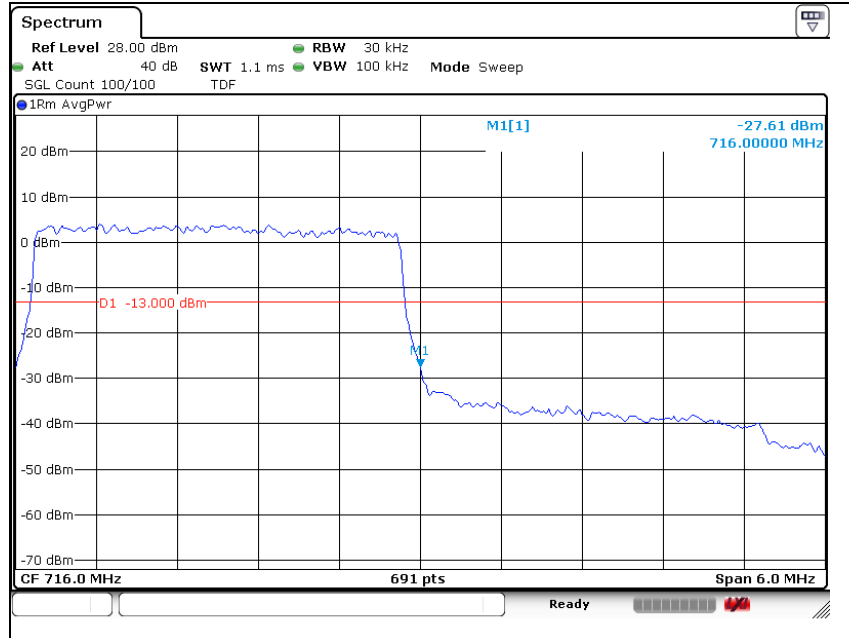
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Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

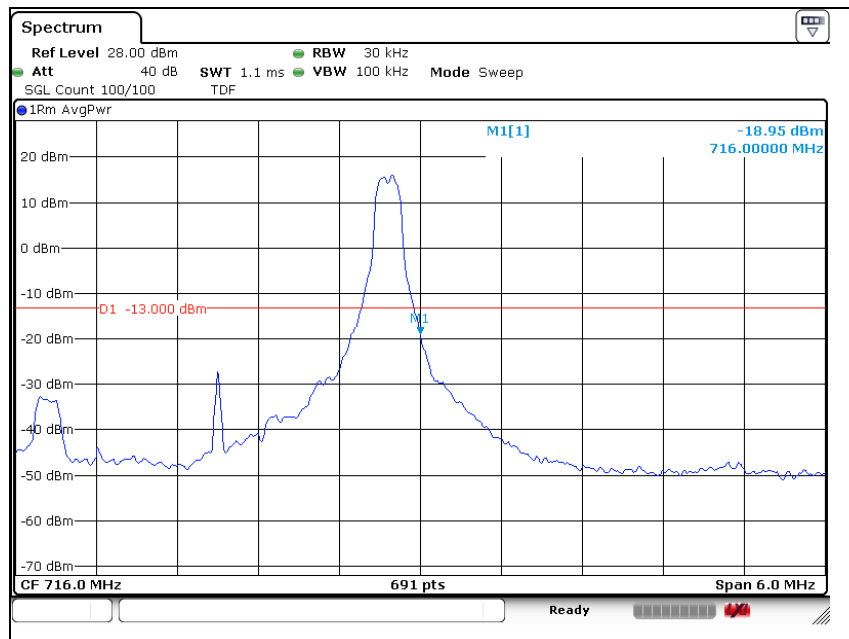
LTE band 12 (3 MHz – QPSK_Full RB)

High Channel



LTE band 12 (3 MHz – QPSK_1 RB)

High Channel



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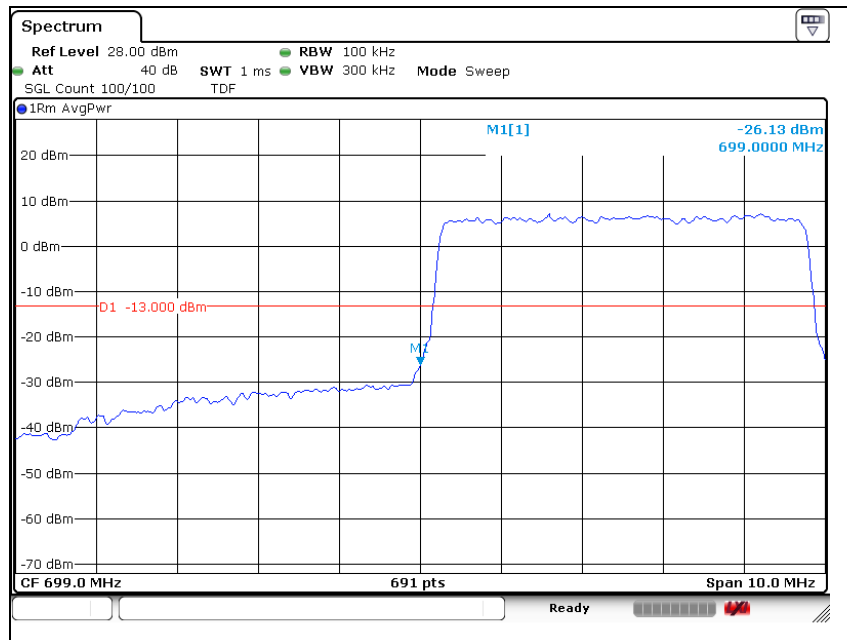
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

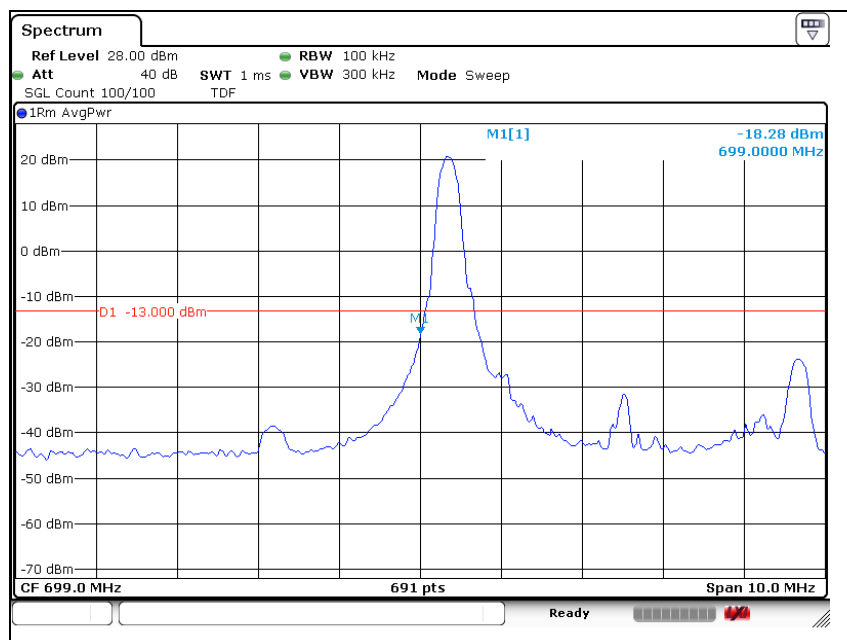
LTE band 12 (5 MHz – QPSK_Full RB)

Low Channel



LTE band 12 (5 MHz – QPSK_1 RB)

Low Channel



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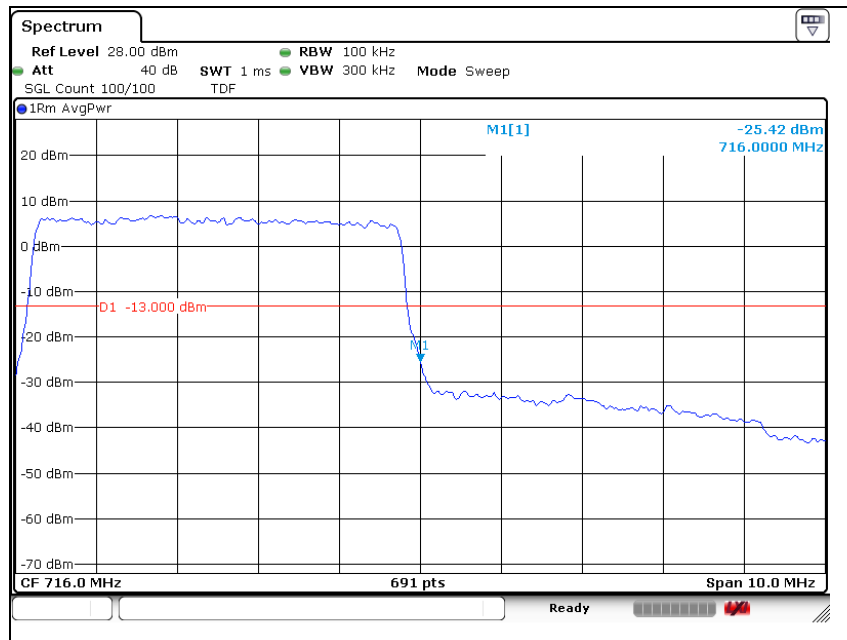
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

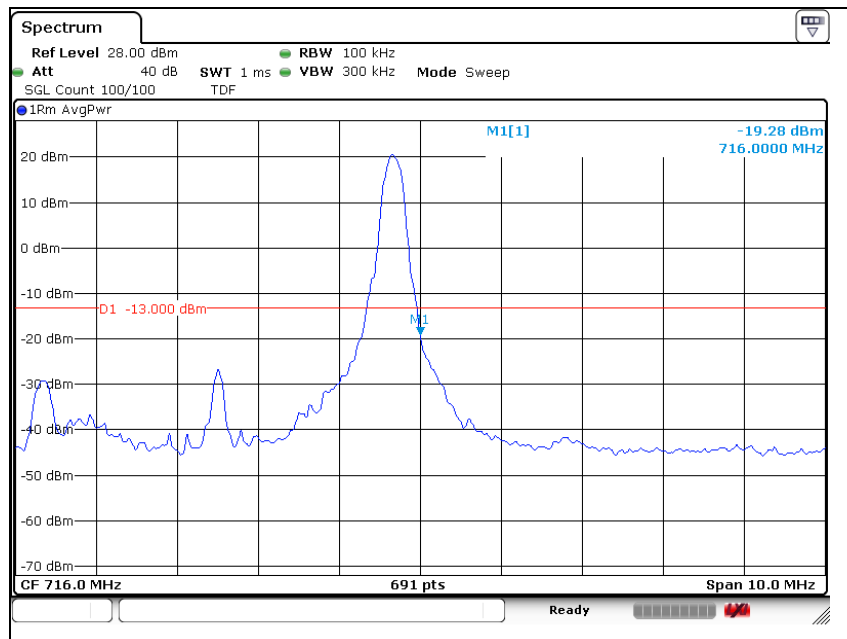
LTE band 12 (5 MHz – QPSK_Full RB)

High Channel



LTE band 12 (5 MHz – QPSK_1 RB)

High Channel



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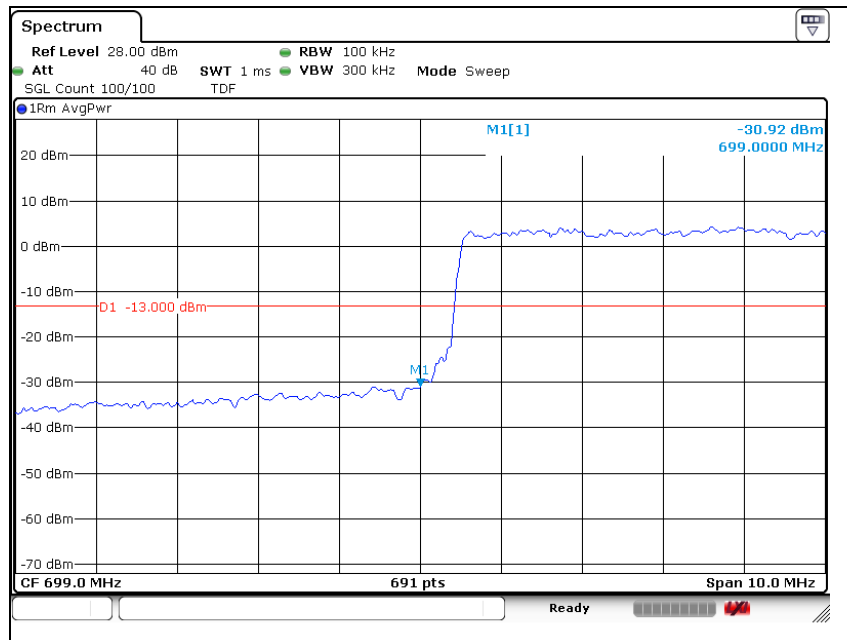
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

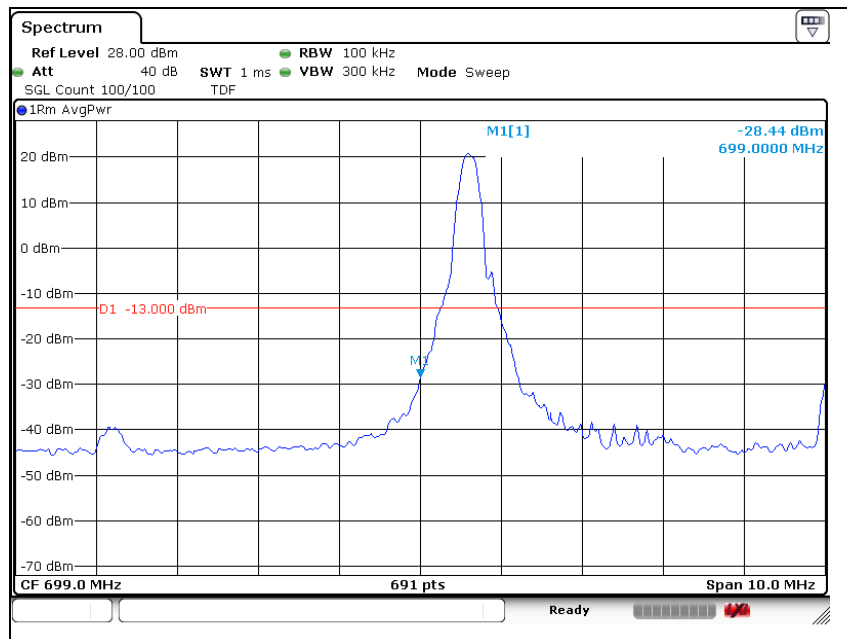
LTE band 12 (10 MHz – QPSK_Full RB)

Low Channel



LTE band 12 (10 MHz – QPSK_1 RB)

Low Channel



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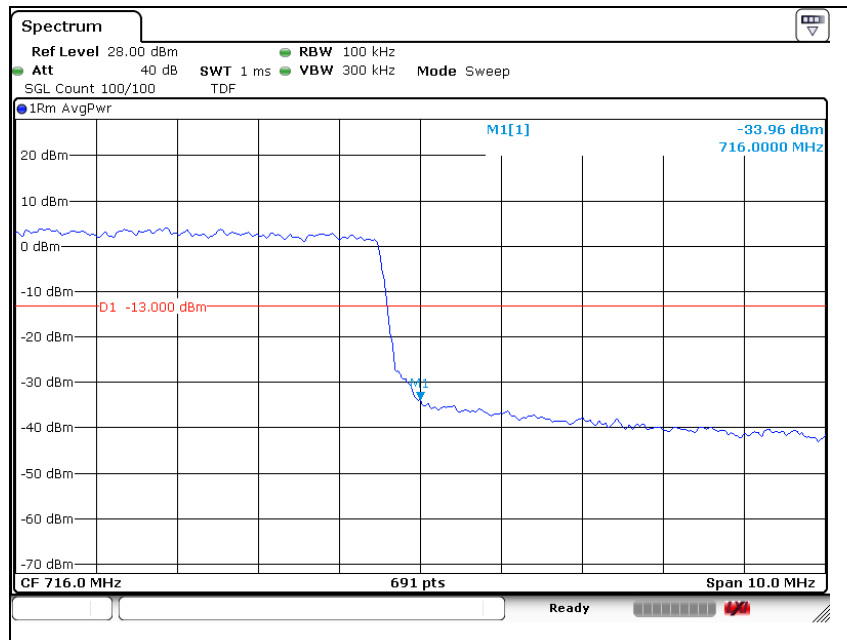
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

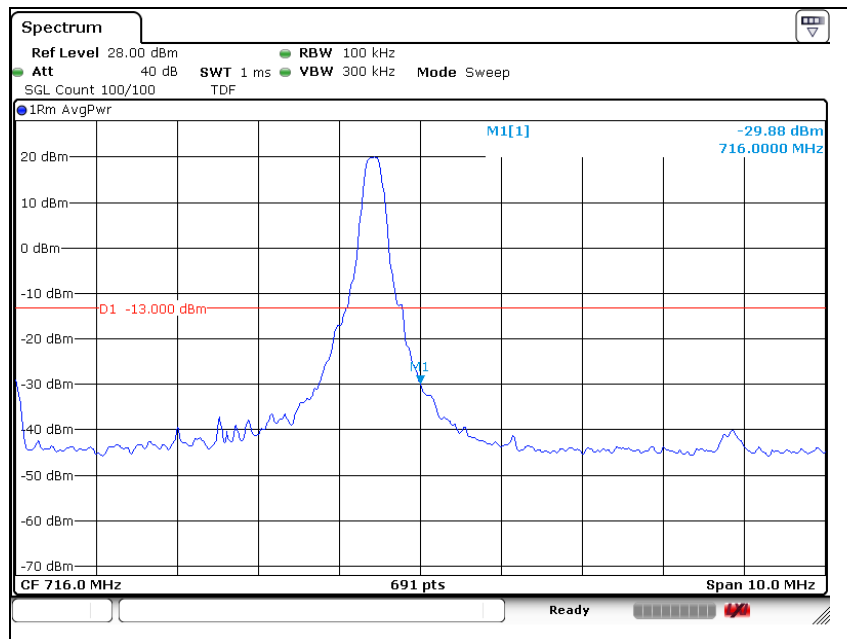
LTE band 12 (10 MHz – QPSK_Full RB)

High Channel



LTE band 12 (10 MHz – QPSK_1 RB)

High Channel



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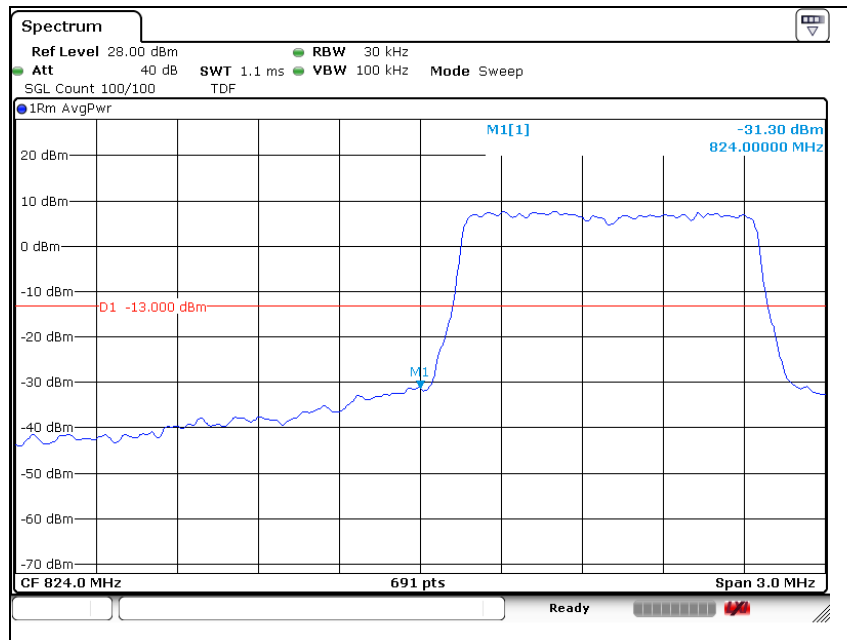
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

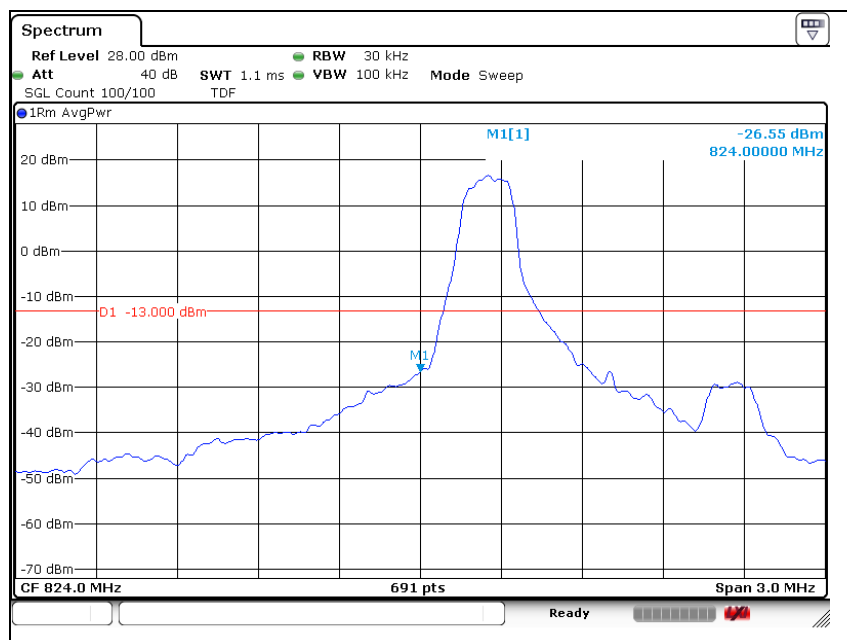
LTE band 26/5 (1.4 MHz – QPSK_Full RB)

Low Channel



LTE band 26/5 (1.4 MHz – QPSK_1 RB)

Low Channel



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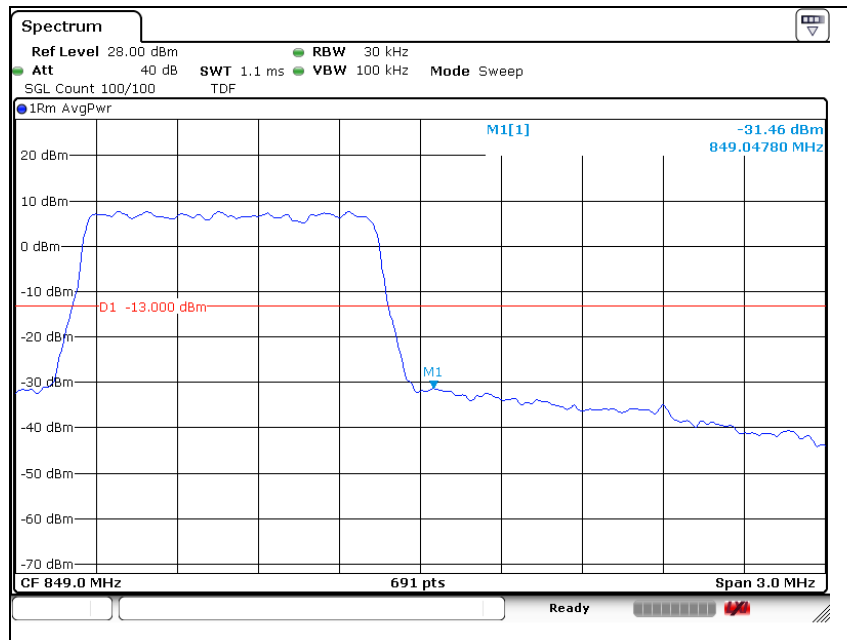
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

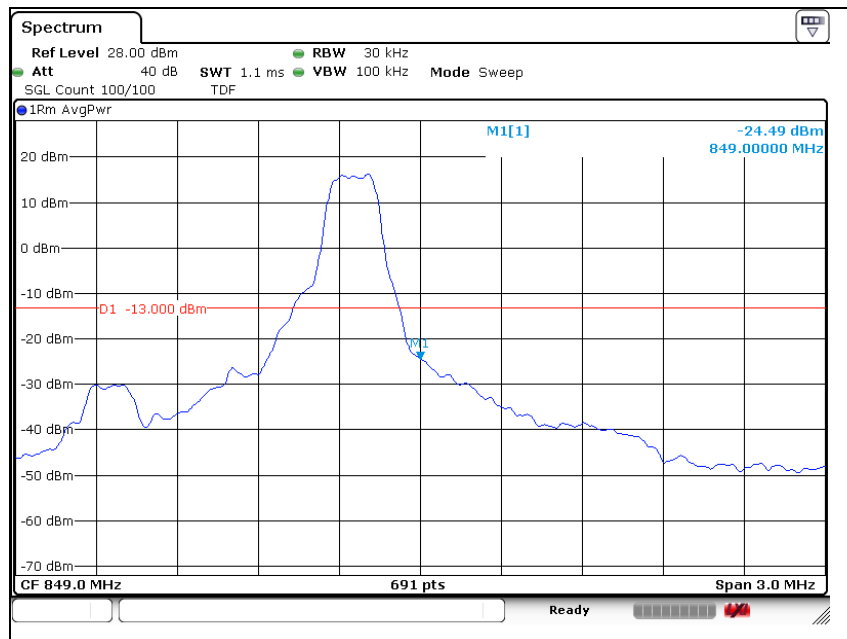
LTE band 26/5 (1.4 MHz – QPSK_Full RB)

High Channel



LTE band 26/5 (1.4 MHz – QPSK_1 RB)

High Channel



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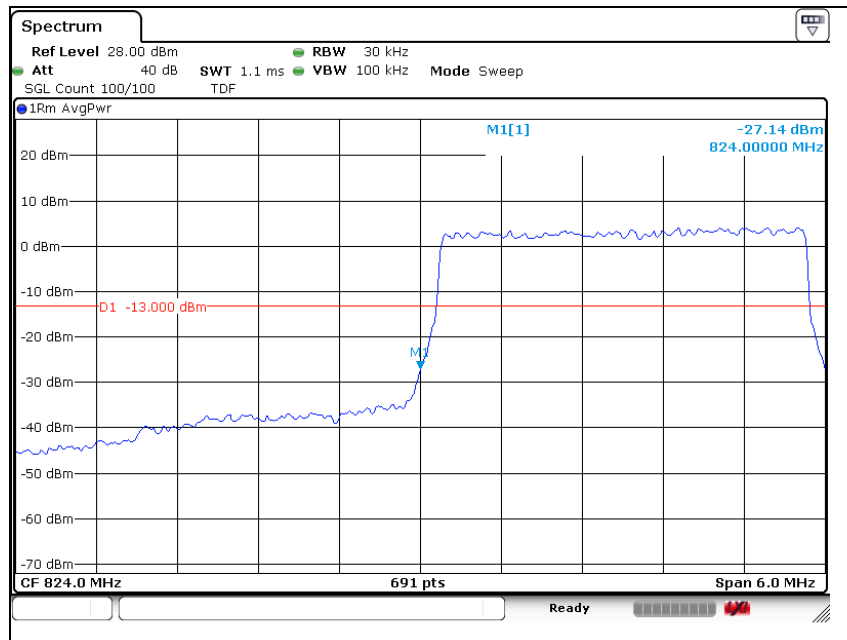
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

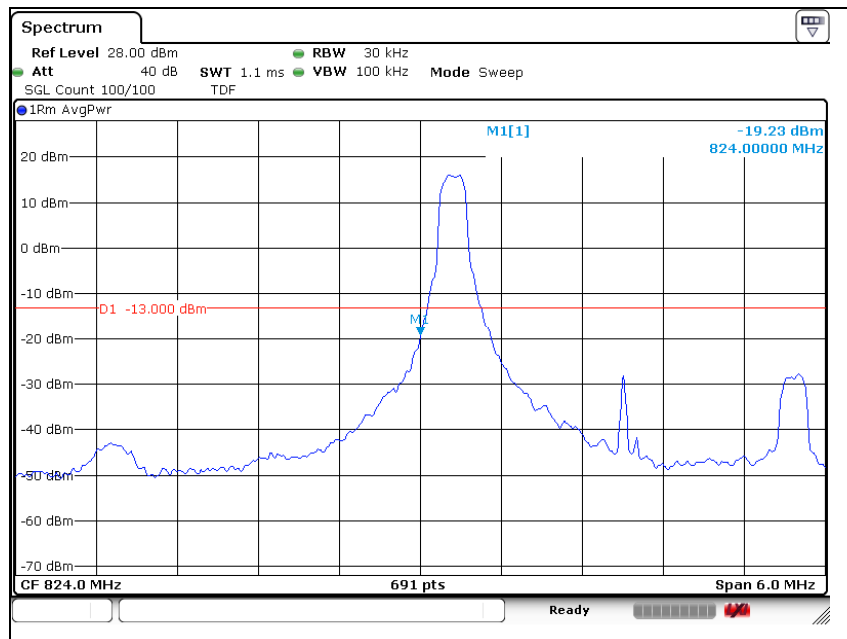
LTE band 26/5 (3 MHz – QPSK_Full RB)

Low Channel



LTE band 26/5 (3 MHz – QPSK_1 RB)

Low Channel



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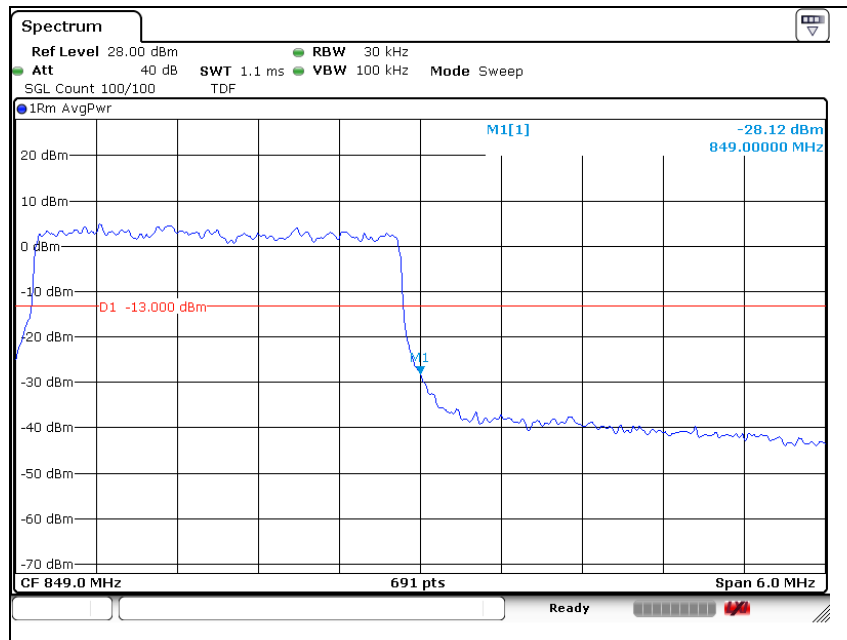
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

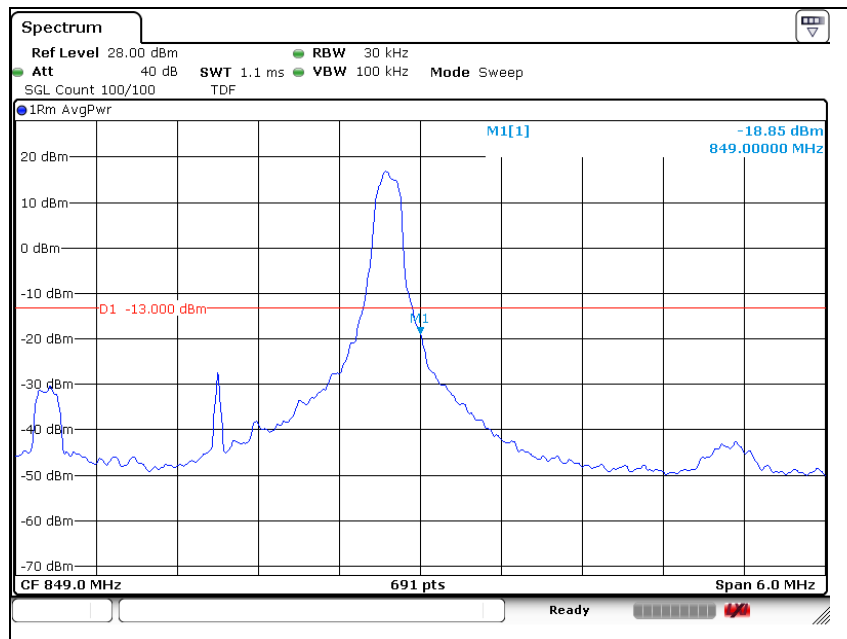
LTE band 26/5 (3 MHz – QPSK_Full RB)

High Channel



LTE band 26/5 (3 MHz – QPSK_1 RB)

High Channel



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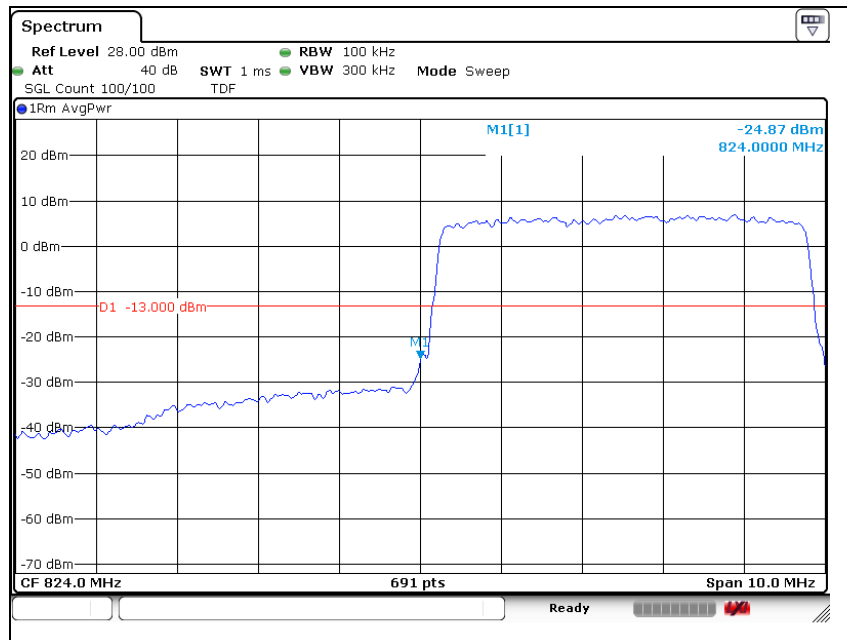
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

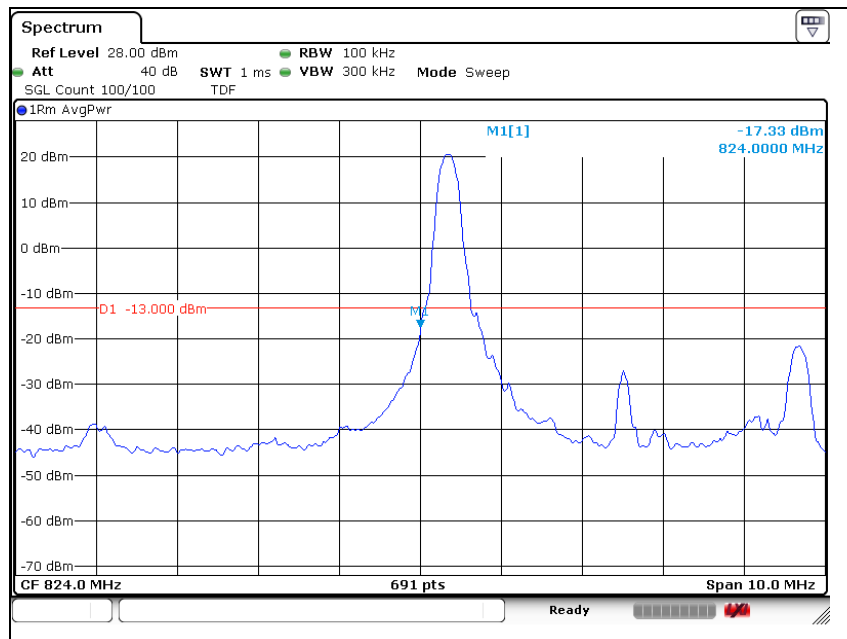
LTE band 26/5 (5 MHz – QPSK_Full RB)

Low Channel



LTE band 26/5 (5 MHz – QPSK_1 RB)

Low Channel



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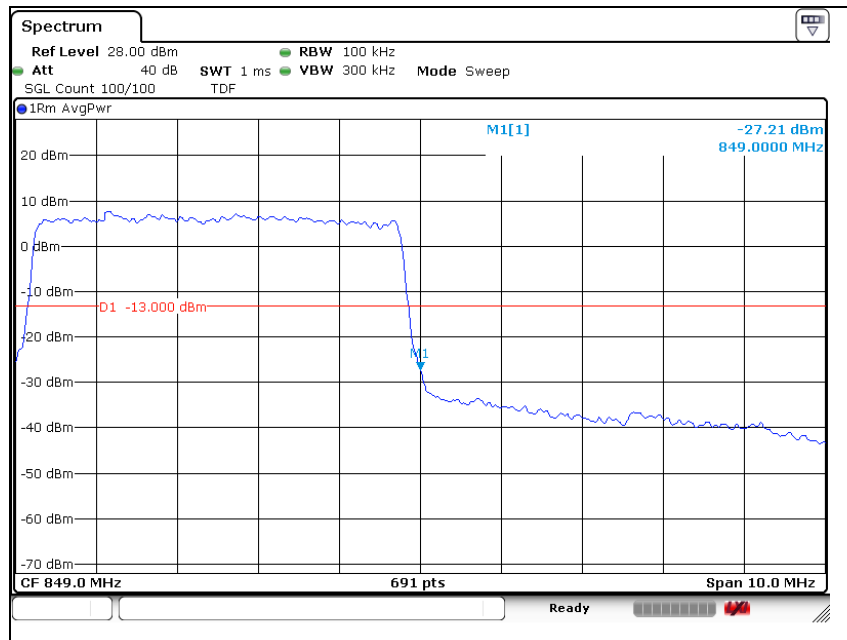
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

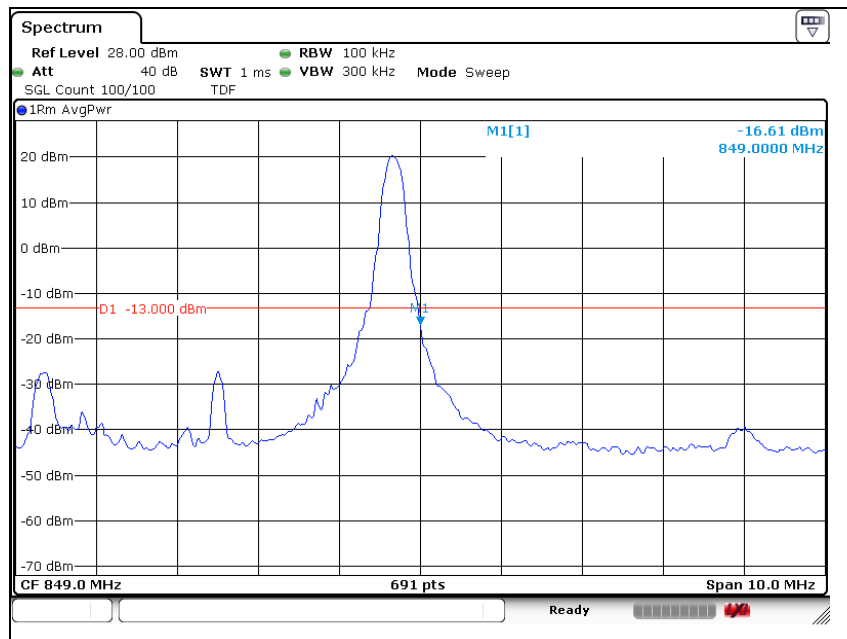
LTE band 26/5 (5 MHz – QPSK_Full RB)

High Channel



LTE band 26/5 (5 MHz – QPSK_1 RB)

High Channel



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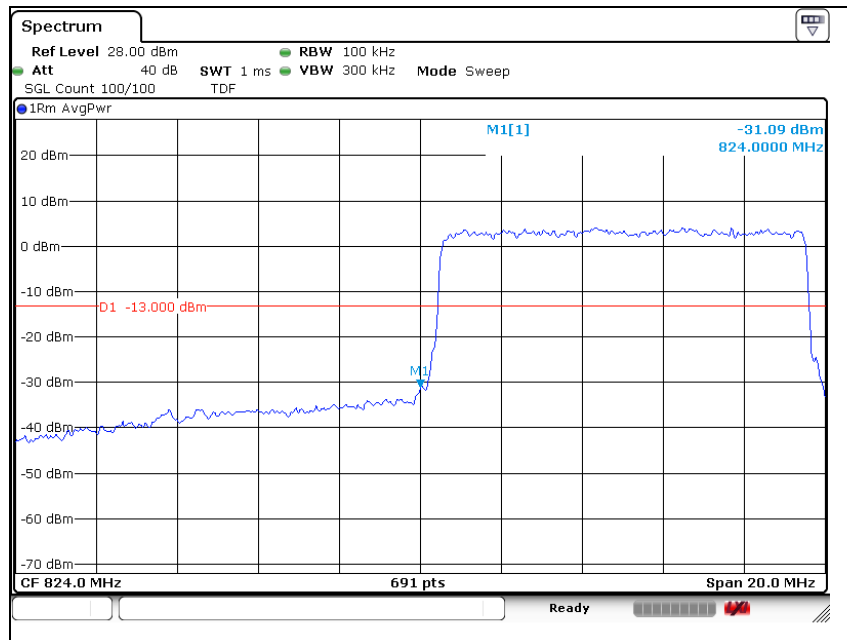
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

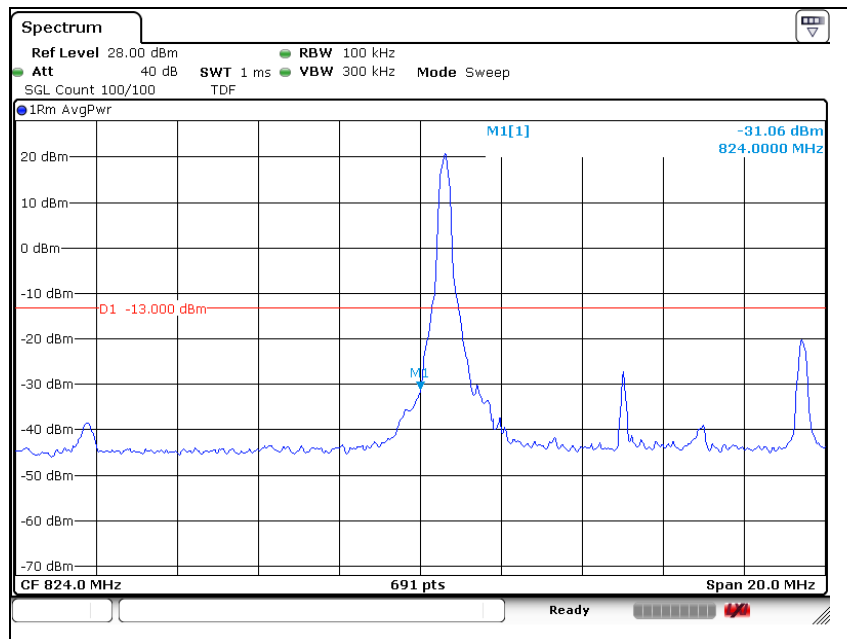
LTE band 26/5 (10 MHz – QPSK_Full RB)

Low Channel



LTE band 26/5 (10 MHz – QPSK_1 RB)

Low Channel



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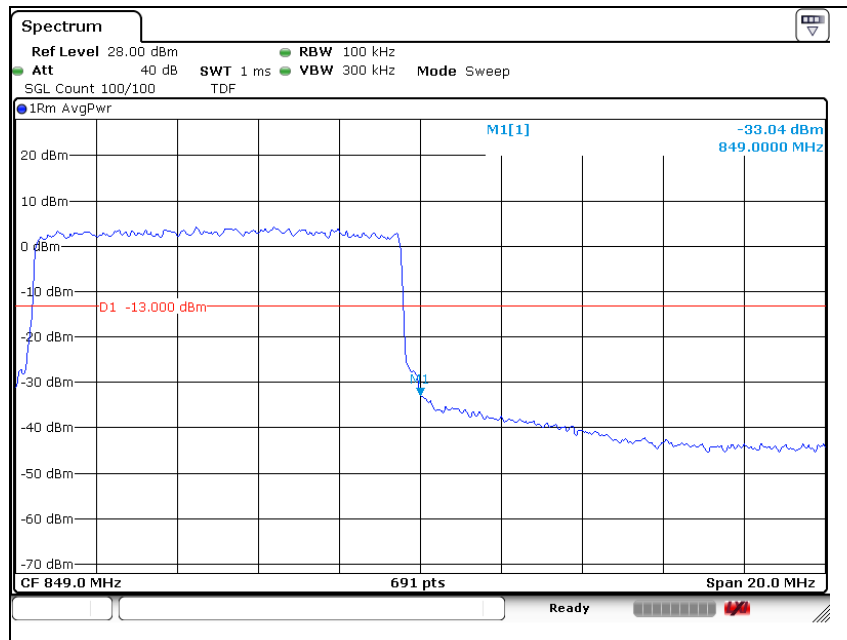
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

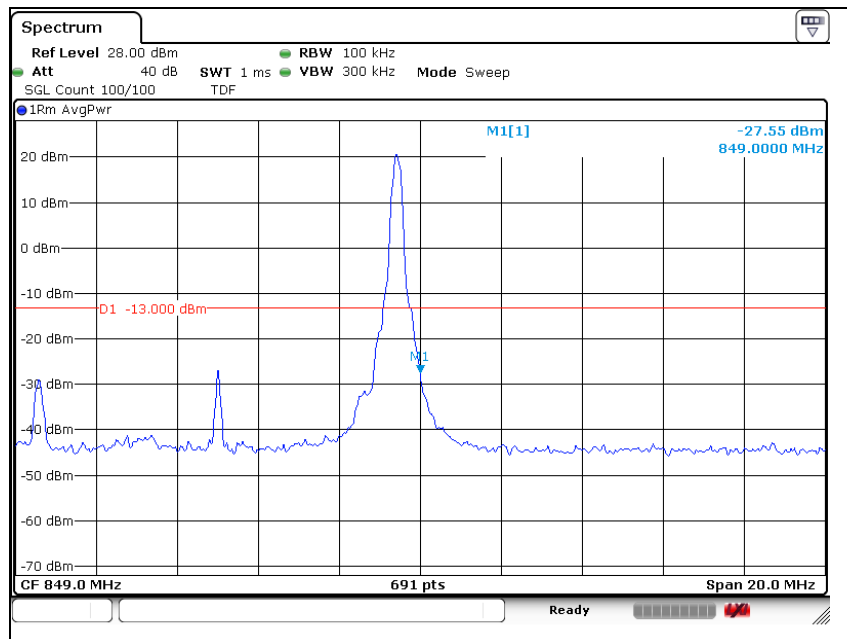
LTE band 26/5 (10 MHz – QPSK_Full RB)

High Channel



LTE band 26/5 (10 MHz – QPSK_1 RB)

High Channel



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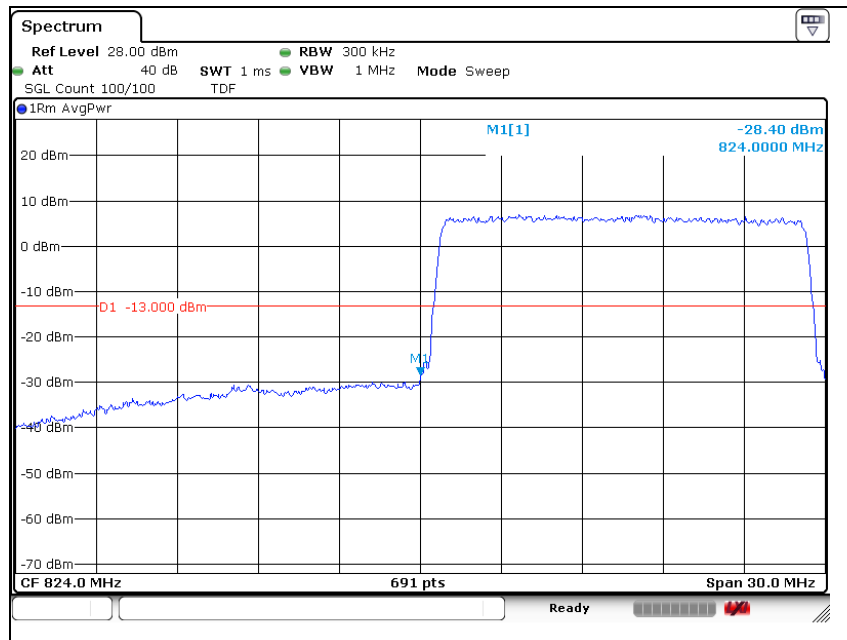
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

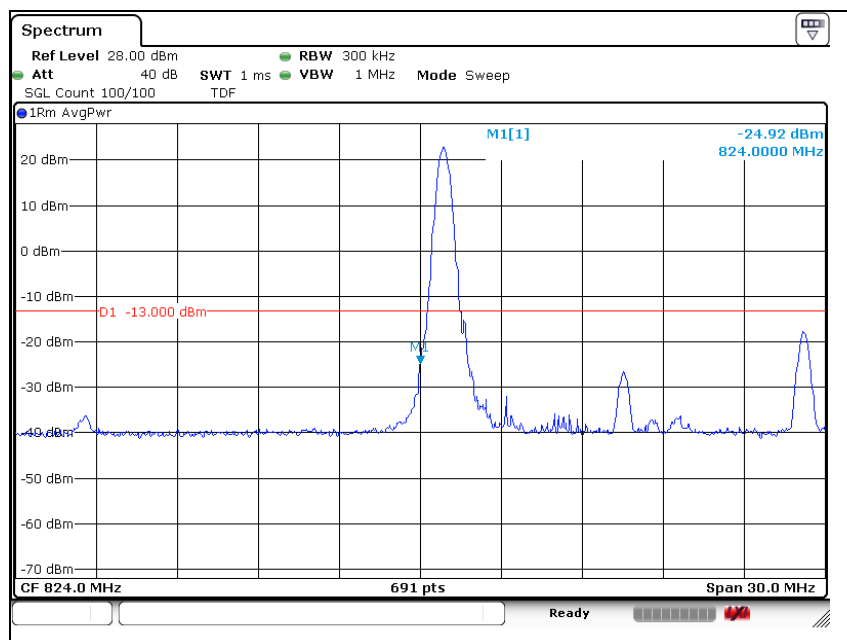
LTE band 26 (15 MHz – QPSK_Full RB)

Low Channel



LTE band 26 (15 MHz – QPSK_1 RB)

Low Channel



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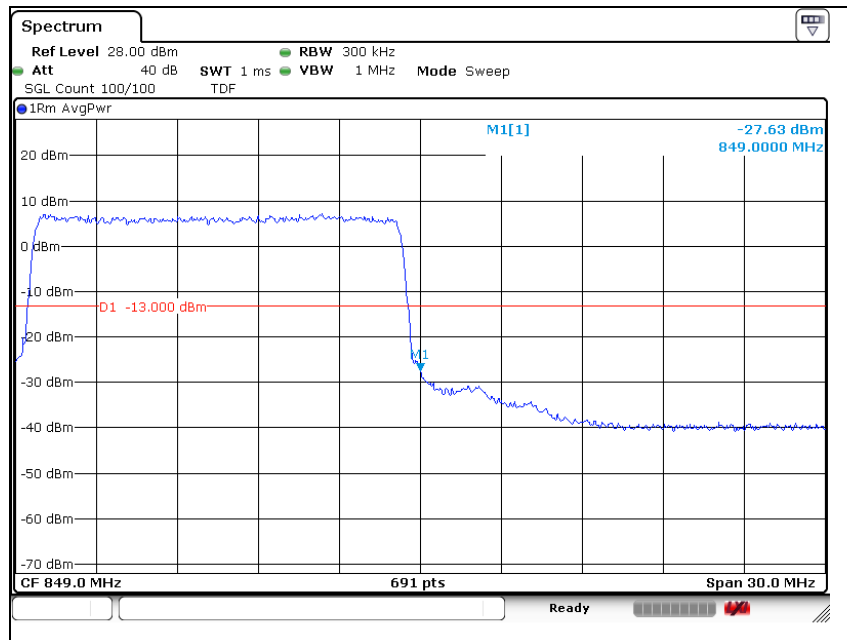
RTT5041-19(2019.04.24)(1)

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

A4(210 mm x 297 mm)

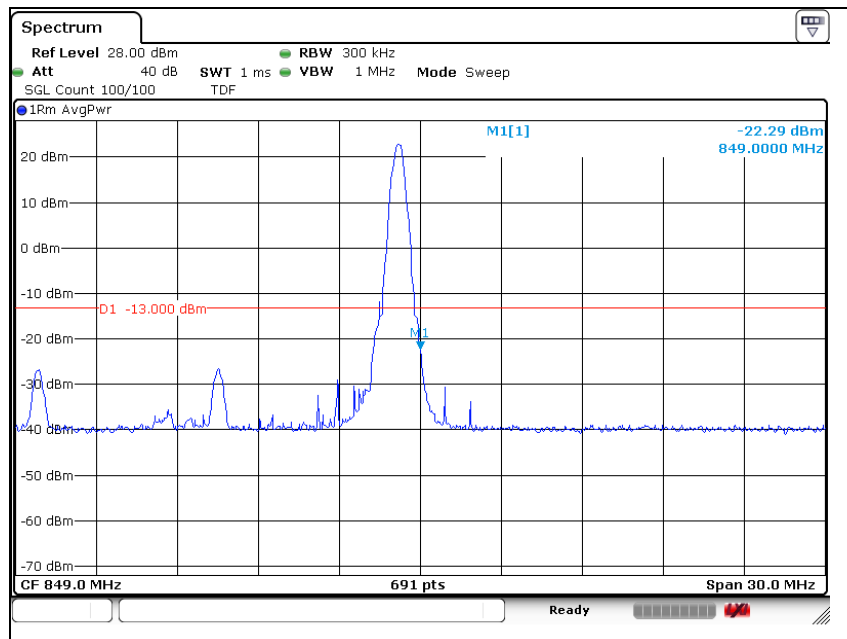
LTE band 26 (15 MHz – QPSK_Full RB)

High Channel



LTE band 26 (15 MHz – QPSK_1 RB)

High Channel



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A4(210 mm x 297 mm)

8. Frequency Stability

8.1. Limit

FCC

- § 2.1055(a), § 2.1055(d) & following:

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

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

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

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

IC

- RSS-Gen Issue 5

6.11, for licensed devices, the following measurement conditions apply:

a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage

- RSS-130 Issue 2

4.5, for equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – internet of things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

- RSS-132 Issue 3

5.3, the carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

- RSS-133 Issue 6

6.3, the carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

- RSS-139 Issue 3

6.4, the frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

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- RSS-199 Issue 3

4.3, the transmitter frequency stability limit shall be determined as follows:

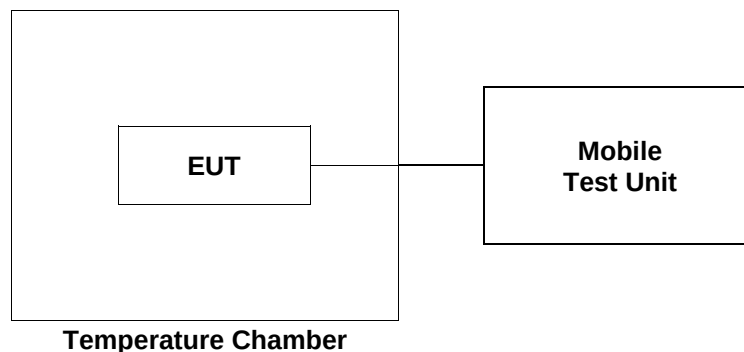
(a) the frequency offset shall be measured according to the procedure described in RSS-Gen and recorded.

(b) using a resolution bandwidth equal to that permitted within the 1 MHz band immediately outside the channel edge, as found in section 4.5, reference points will be selected at the unwanted emission limits, which comply with the attenuation specified in section 4.5 for the type of device under test, on the emission mask of the lowest and highest channels. The frequency at these points shall be recorded as f_L and f_H respectively.

The applicant shall ensure compliance with frequency stability requirements by showing that f_L minus the frequency offset and f_H plus the frequency offset is within the frequency range in which the equipment is designed to operate.

8.2. Test Procedure

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



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A4(210 mm x 297 mm)

8.3. Test Results

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

LTE band 2 at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.0	4	0.002 1
40		4	0.002 1
30		-3	-0.001 6
23		5	0.002 7
10		2	0.001 1
0		-4	-0.002 1
-10		-3	-0.001 6
-20		5	0.002 7
-30		-2	-0.001 1
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
23	13.8	-3	-0.001 6
	10.2	4	0.002 1

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LTE band 4 at middle channel

Reference Frequency: 1 732.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.0	-1	-0.000 6
40		3	0.001 7
30		2	0.001 2
23		-4	-0.002 3
10		-4	-0.002 3
0		2	0.001 2
-10		1	0.000 6
-20		1	0.000 6
-30		-5	-0.002 9
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
23	13.8	-3	-0.001 7
	10.2	2	0.001 2

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LTE band 7 at middle channel

Reference Frequency: 2 535.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.0	5	0.002 0
40		2	0.000 8
30		-1	-0.000 4
23		3	0.001 2
10		-1	-0.000 4
0		-2	-0.000 8
-10		-4	-0.001 6
-20		3	0.001 2
-30		-4	-0.001 6
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
23	13.8	-2	-0.000 8
	10.2	1	0.000 4

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LTE band 12 at middle channel

Reference Frequency: 707.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.0	1	0.001 4
40		-5	-0.007 1
30		2	0.002 8
23		-1	-0.001 4
10		2	0.002 8
0		-1	-0.001 4
-10		3	0.004 2
-20		1	0.001 4
-30		-2	-0.002 8
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
23	13.8	3	0.004 2
	10.2	3	0.004 2

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LTE band 26/5 at middle channel

Reference Frequency: 836.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	12.0	3	0.003 6
40		2	0.002 4
30		-1	-0.001 2
23		3	0.003 6
10		3	0.003 6
0		2	0.002 4
-10		4	0.004 8
-20		-1	-0.001 2
-30		-1	-0.001 2
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V _{d.c})	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
23	13.8	-2	-0.002 4
	10.2	3	0.003 6

- End of the Test Report -

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