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 ㎧.

- §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 ㎧.

- §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 ㎧.

IC

- RSS-130 Issue 1

4.4, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 ㎧ 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 ㎧ 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 ㎧ for more than 0.1 % of the time using a signal corresponding 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 ㎧ 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 ㎧ 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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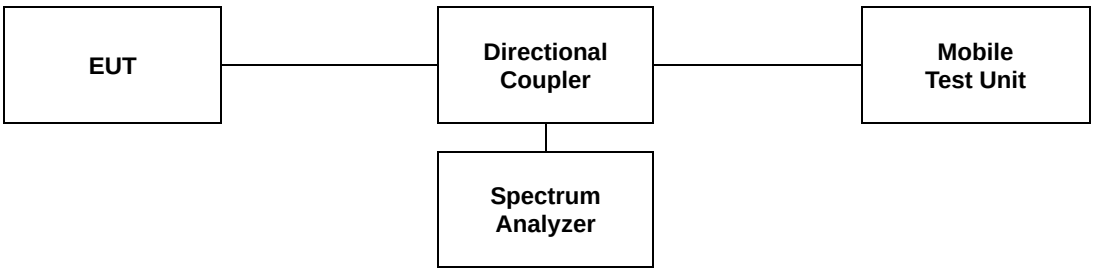
5.2. Test Procedure

The test follows section 5.7.1 of FCC KDB Publication 971168 D01 v02r02.

1. Refer to the instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function.
2. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth.
3. Set the number of counts to a value that stabilizes the measured CCDF curve.
4. Set the measurement interval as follows:
   a) For continuous transmissions, set to 1 ㎳.
   b) 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 and set the measurement interval to a time that is less than or equal to the burst duration.
5. Record the maximum PAPR level associated with a probability of 0.1 %.



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5.3 Test Results

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

- LTE

Band	Mode	Frequency (㎒)	PAR (㏈)
2 (1.4 ㎒)	QPSK	1 850.7	4.38
		1 880.0	4.99
		1 909.3	5.04
2 (3 ㎒)	QPSK	1 851.5	4.35
		1 880.0	4.93
		1 908.5	5.04
2 (5 ㎒)	QPSK	1 852.5	4.35
		1 880.0	4.81
		1 907.5	4.93
2 (10 ㎒)	QPSK	1 855.0	4.46
		1 880.0	4.84
		1 905.0	4.78
2 (15 ㎒)	QPSK	1 857.5	4.93
		1 880.0	5.04
		1 902.5	4.90
2 (20 ㎒)	QPSK	1 860.0	4.81
		1 880.0	4.72
		1 900.0	4.67

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Band	Mode	Frequency (㎒)	PAR (㏈)
4 (1.4 ㎒)	QPSK	1 710.7	5.16
		1 732.5	4.81
		1 754.3	4.90
4 (3 ㎒)	QPSK	1 711.5	5.10
		1 732.5	4.64
		1 753.5	4.75
4 (5 ㎒)	QPSK	1 712.5	5.01
		1 732.5	4.70
		1 752.5	4.81
4 (10 ㎒)	QPSK	1 715.0	4.84
		1 732.5	4.70
		1 750.0	4.90
4 (15 ㎒)	QPSK	1 717.5	5.07
		1 732.5	4.99
		1 747.5	5.13
4 (20 ㎒)	QPSK	1 720.0	4.67
		1 732.5	4.72
		1 745.0	4.90

Band	Mode	Frequency (㎒)	PAR (㏈)
5 (1.4 ㎒)	QPSK	824.7	4.46
		836.5	4.58
		848.3	4.84
5 (3 ㎒)	QPSK	825.5	4.52
		836.5	4.52
		847.5	4.84
5 (5 ㎒)	QPSK	826.5	4.55
		836.5	4.55
		846.5	4.84
5 (10 ㎒)	QPSK	829.0	4.58
		836.5	4.55
		844.0	4.64

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Band	Mode	Frequency (㎒)	PAR (㏈)
7 (5 ㎒)	QPSK	2 502.5	4.14
		2 535.0	4.55
		2 567.5	4.35
7 (10 ㎒)	QPSK	2 502.5	4.03
		2 535.0	4.58
		2 567.5	4.49
7 (15 ㎒)	QPSK	2 505.0	4.29
		2 535.0	4.72
		2 565.0	4.67
7 (20 ㎒)	QPSK	2 505.0	4.17
		2 535.0	4.49
		2 565.0	4.46

Band	Mode	Frequency (㎒)	PAR (㏈)
12 (1.4 ㎒)	QPSK	699.7	4.09
		707.5	4.78
		715.3	4.70
12 (3 ㎒)	QPSK	700.5	4.03
		707.5	4.75
		714.5	4.43
12 (5 ㎒)	QPSK	701.5	4.23
		707.5	4.49
		713.5	4.35
12 (10 ㎒)	QPSK	704.0	4.58
		707.5	4.38
		711.0	4.46

Band	Mode	Frequency (㎒)	PAR (㏈)
17 (5 ㎒)	QPSK	706.5	4.93
		710.0	4.58
		713.5	4.67
17 (10 ㎒)	QPSK	709.0	4.67
		710.0	4.67
		711.0	4.67

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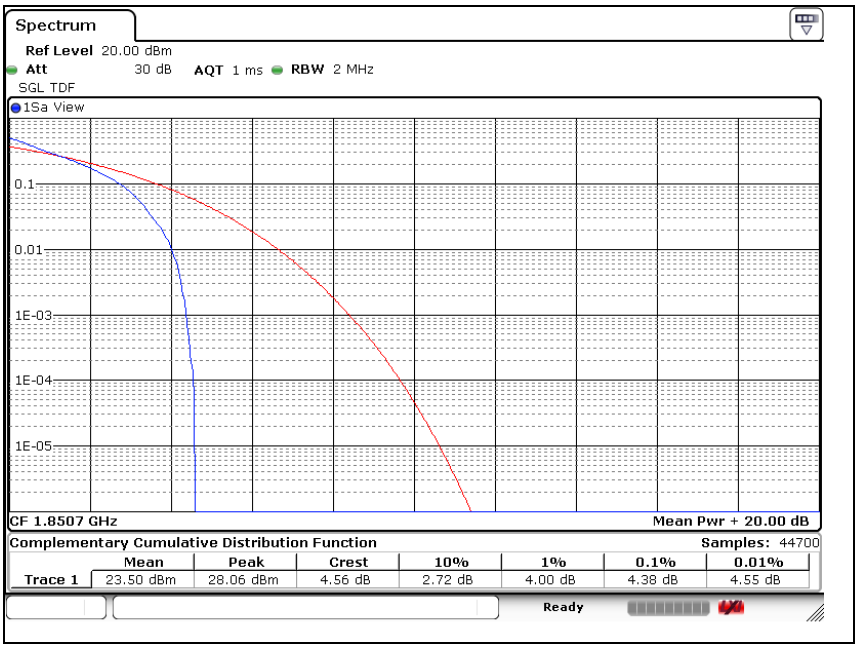
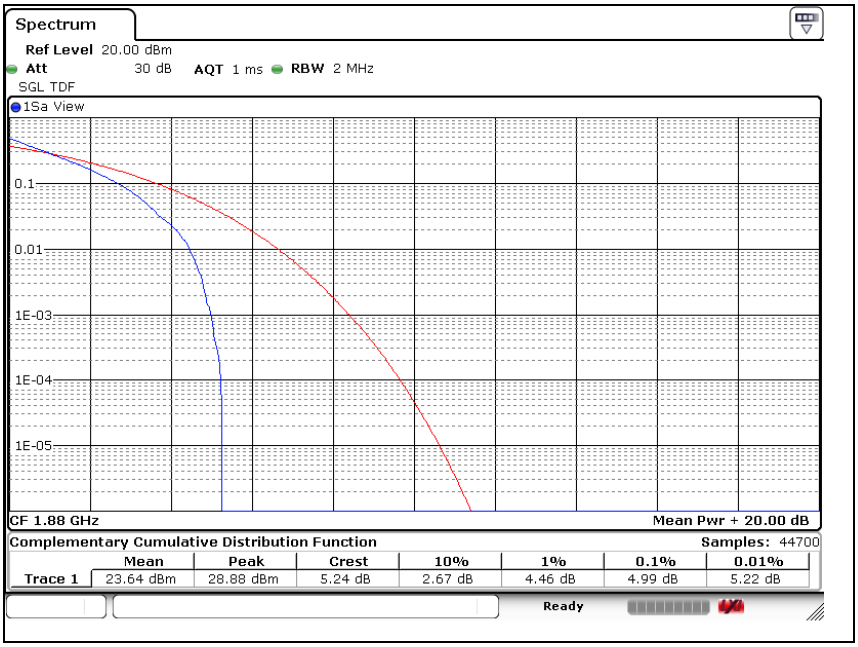
LTE band 2 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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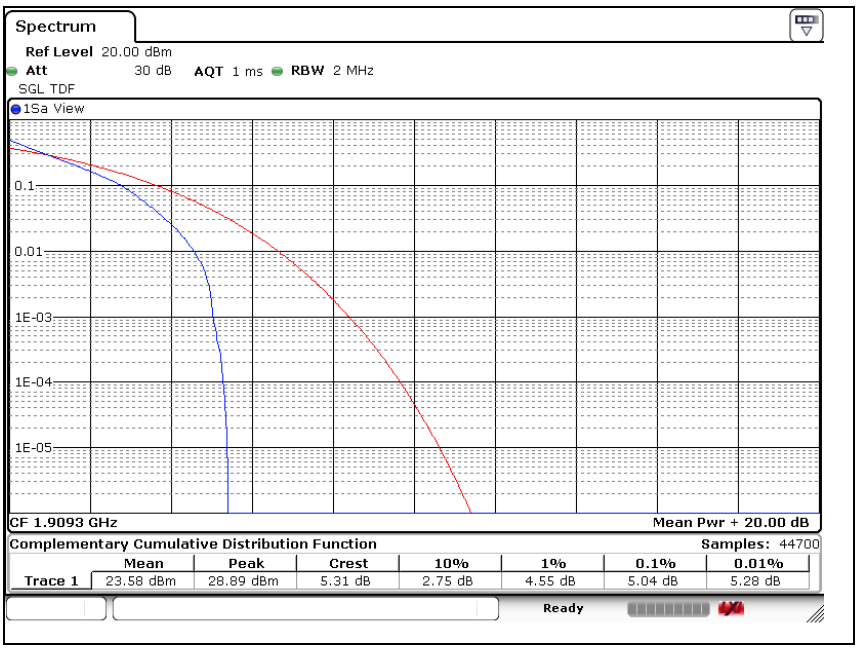
High Channel



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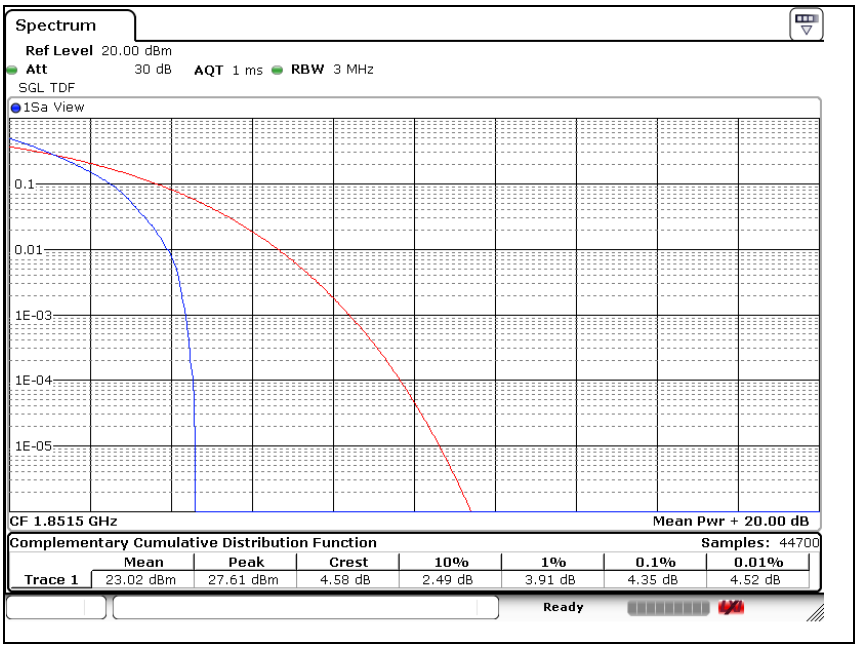
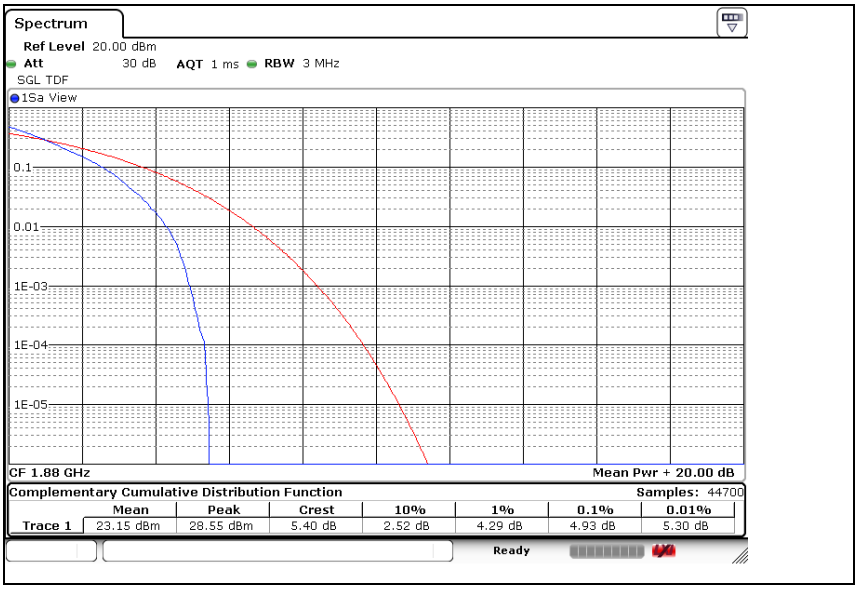
LTE band 2 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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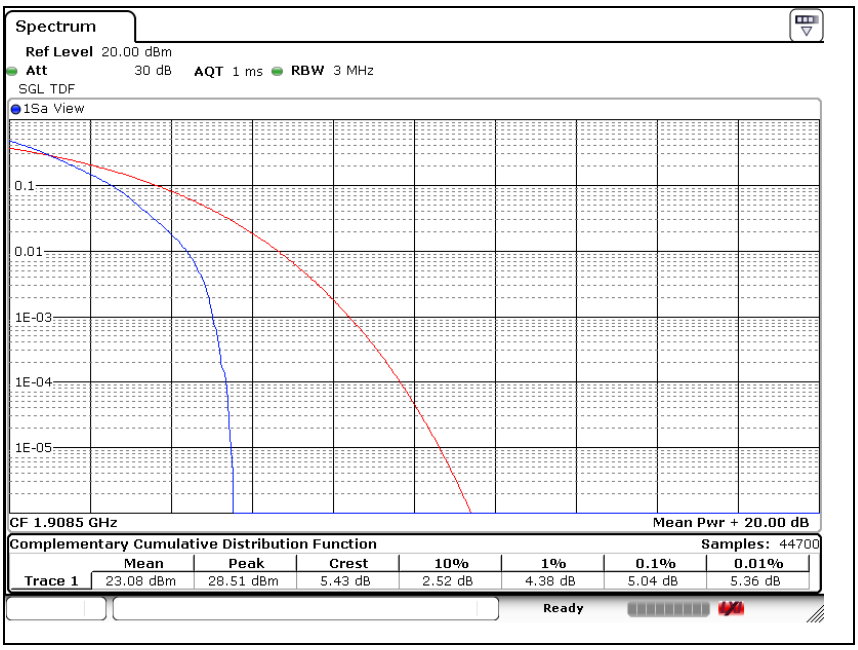
High Channel



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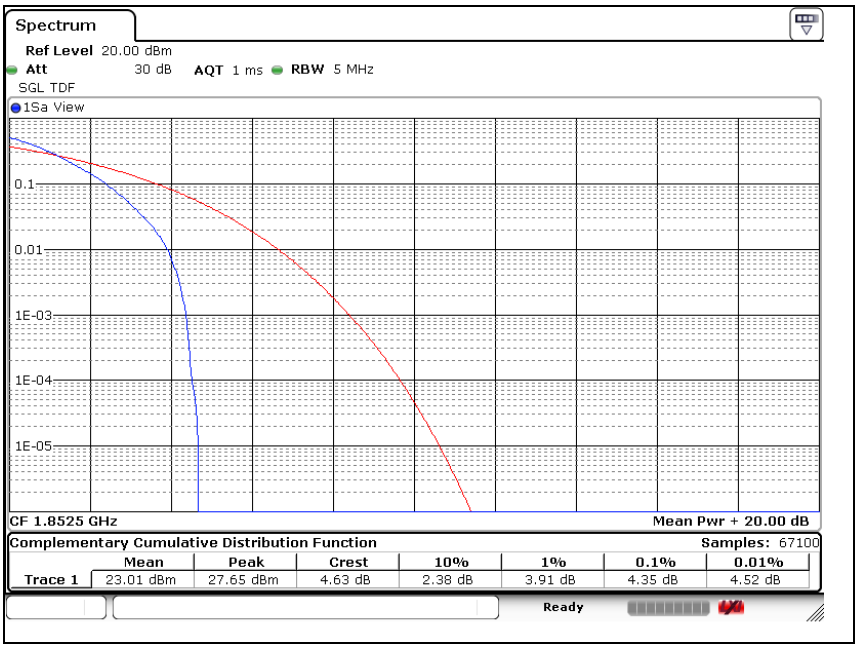
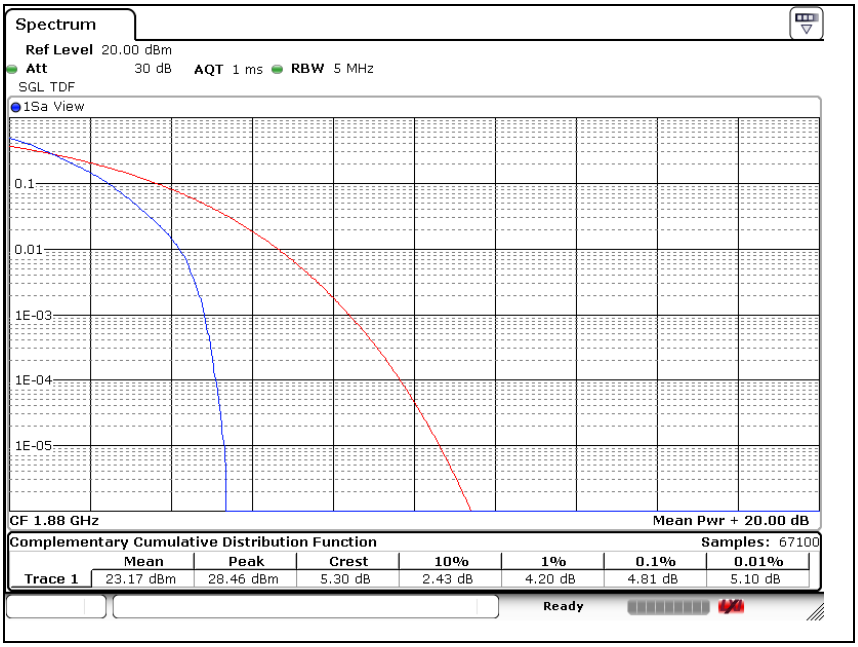
LTE band 2 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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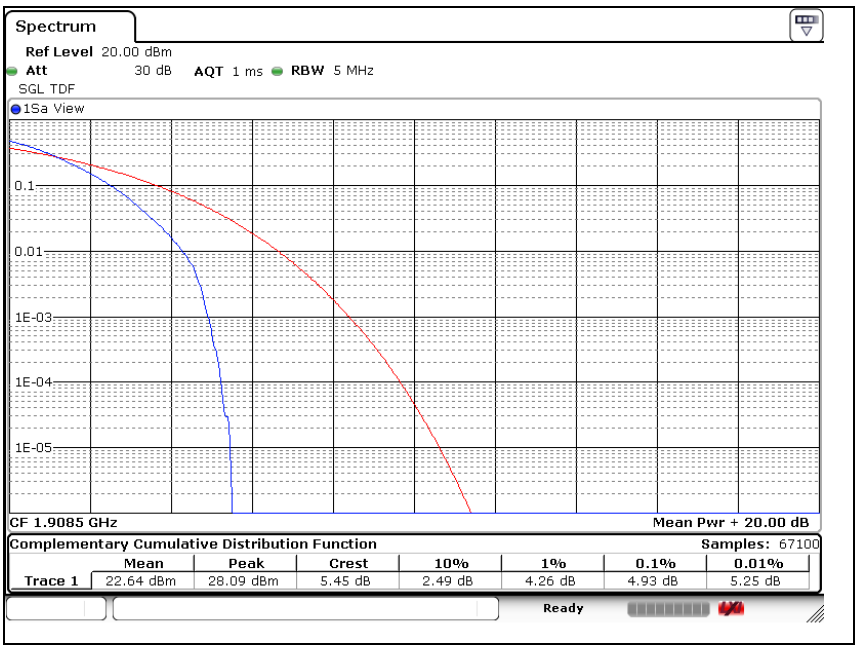
High Channel



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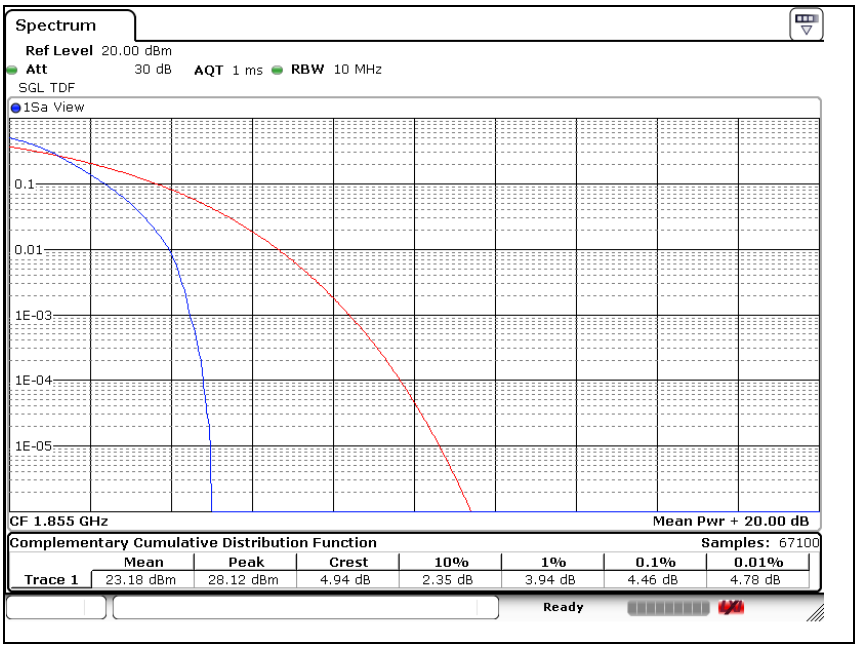
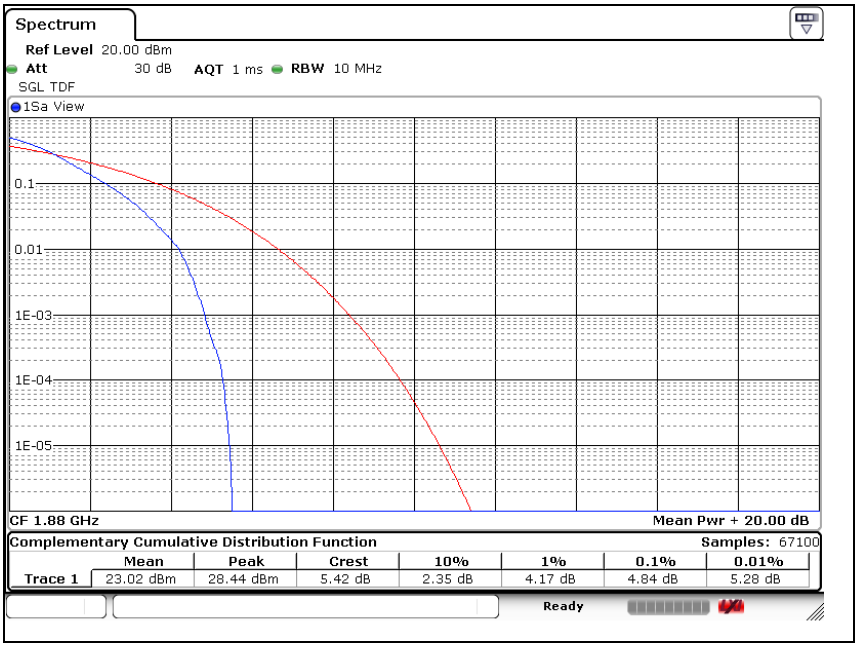
LTE band 2 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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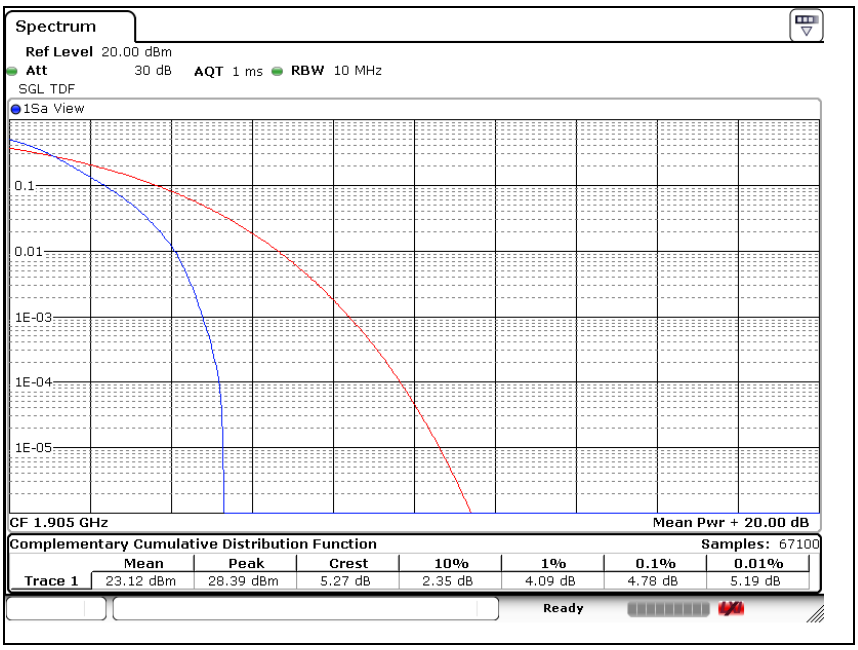
High Channel



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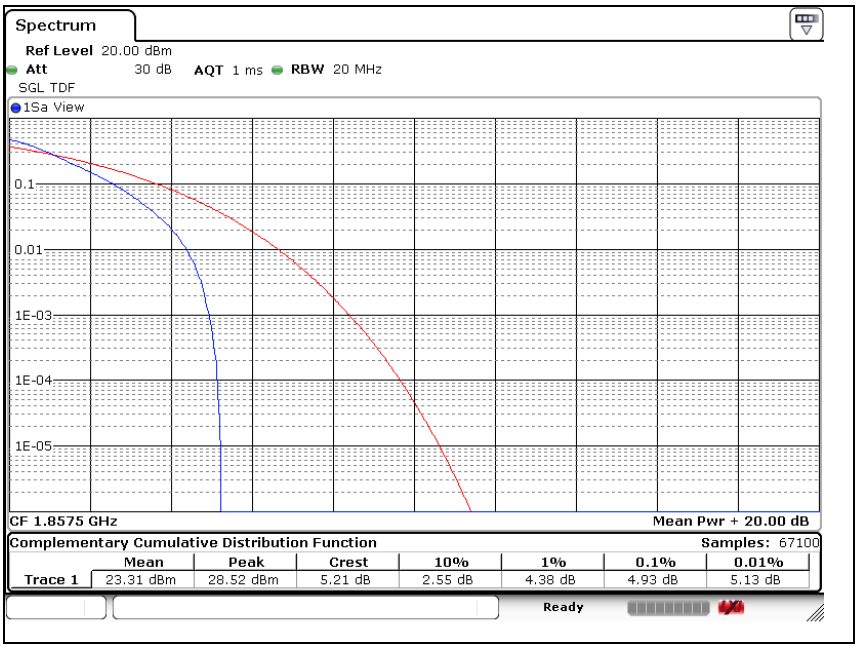
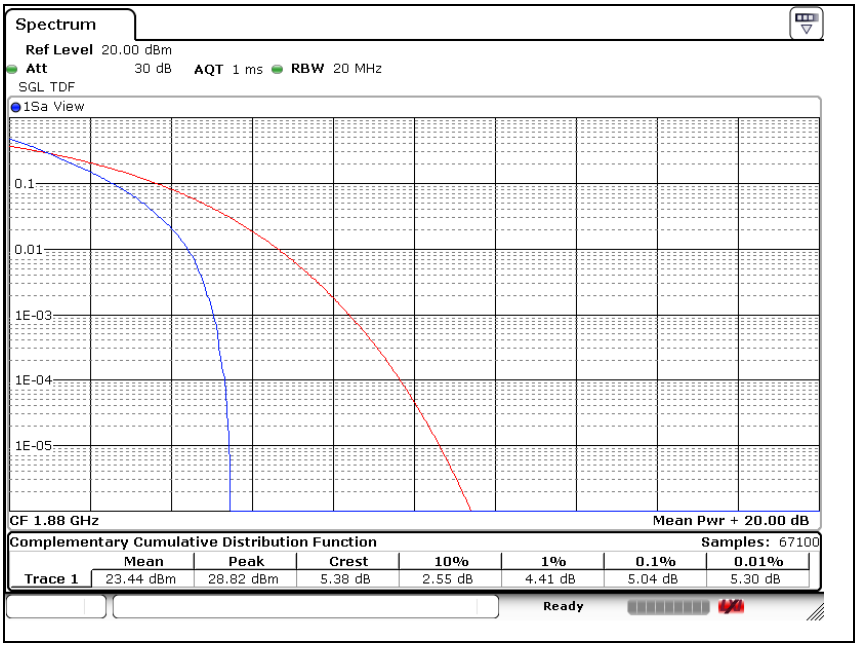
LTE band 2 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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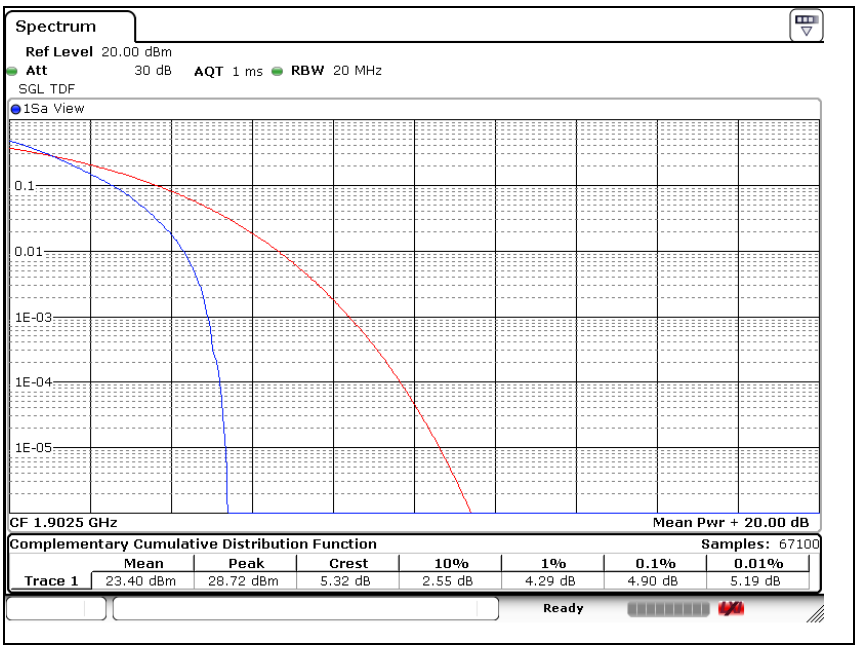
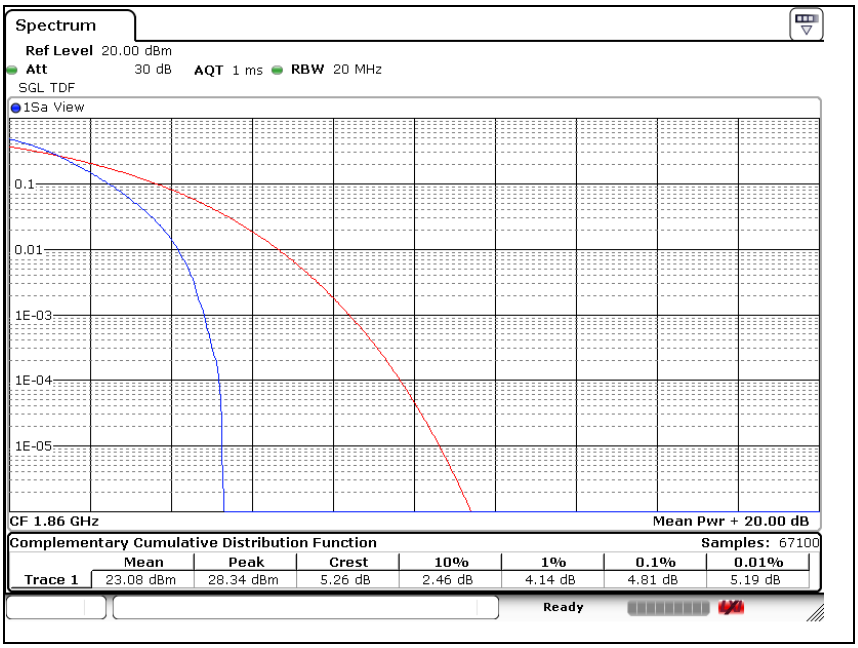
High Channel

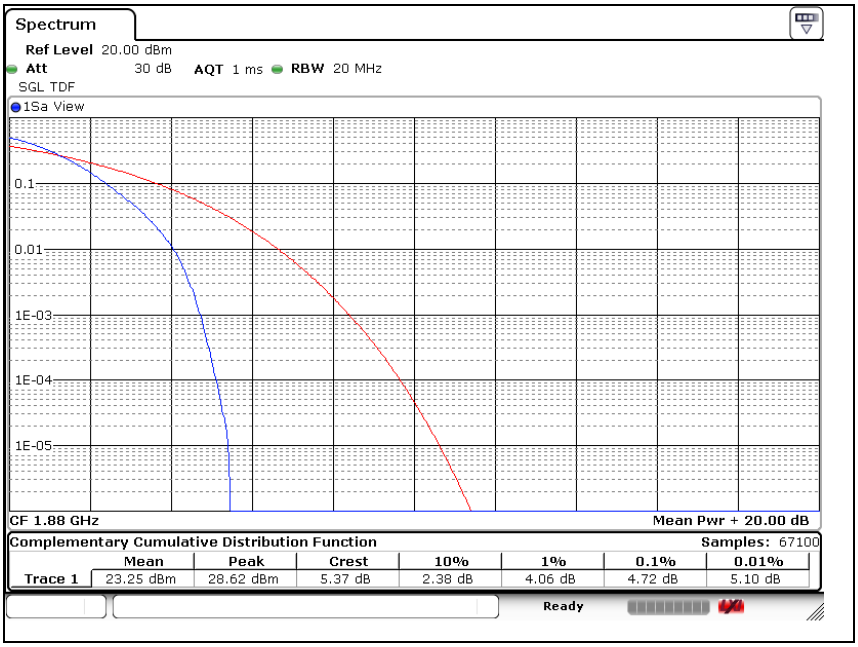


LTE band 2 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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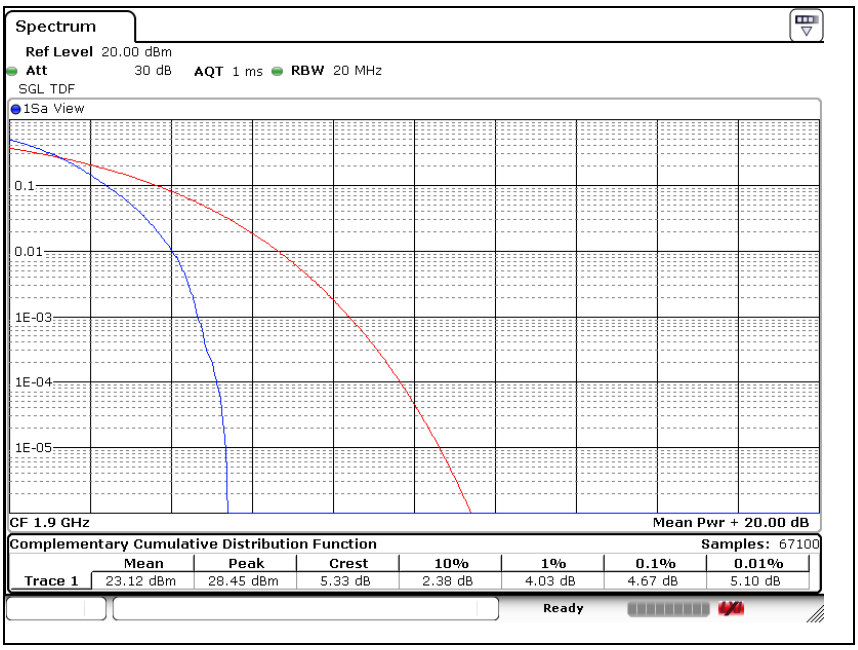
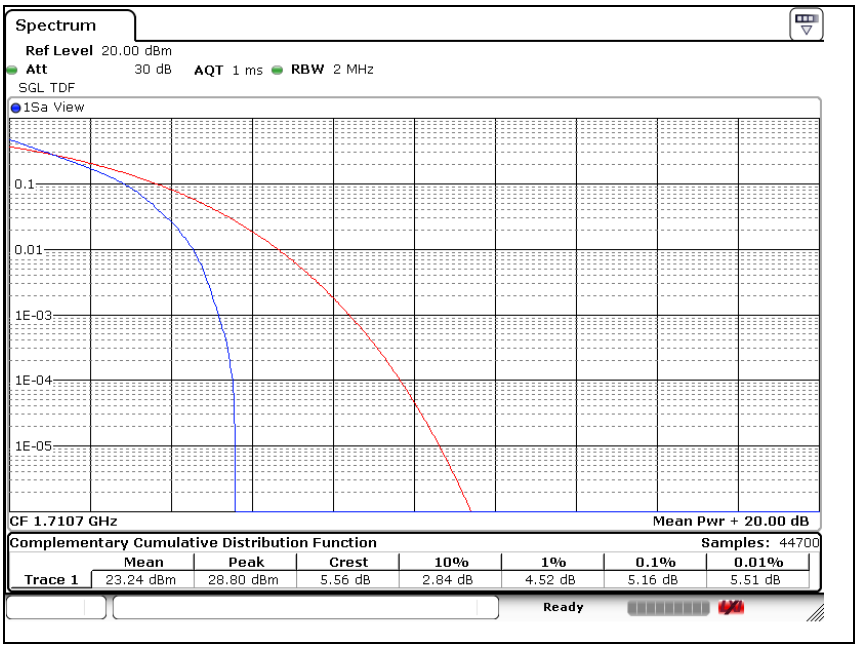
High Channel

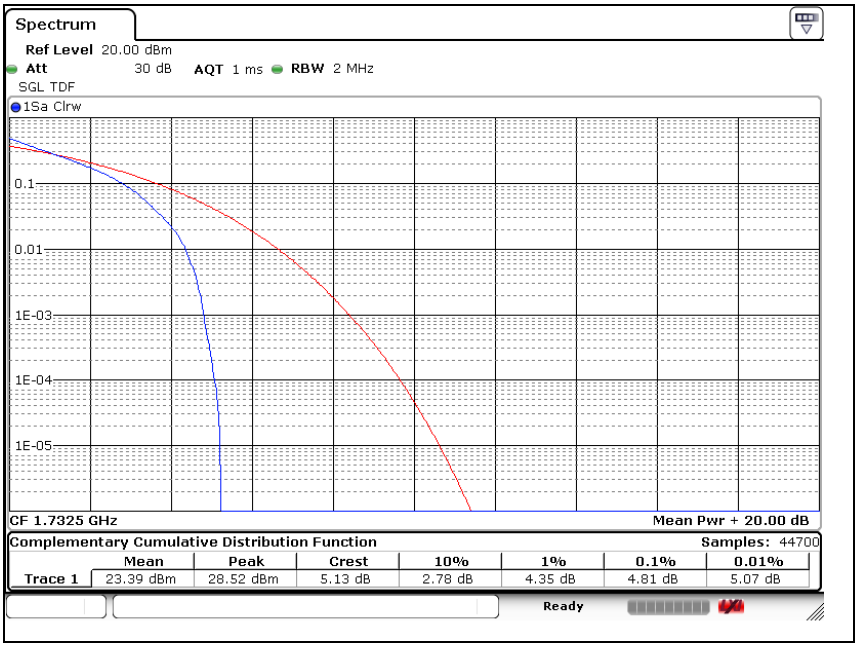


LTE band 4 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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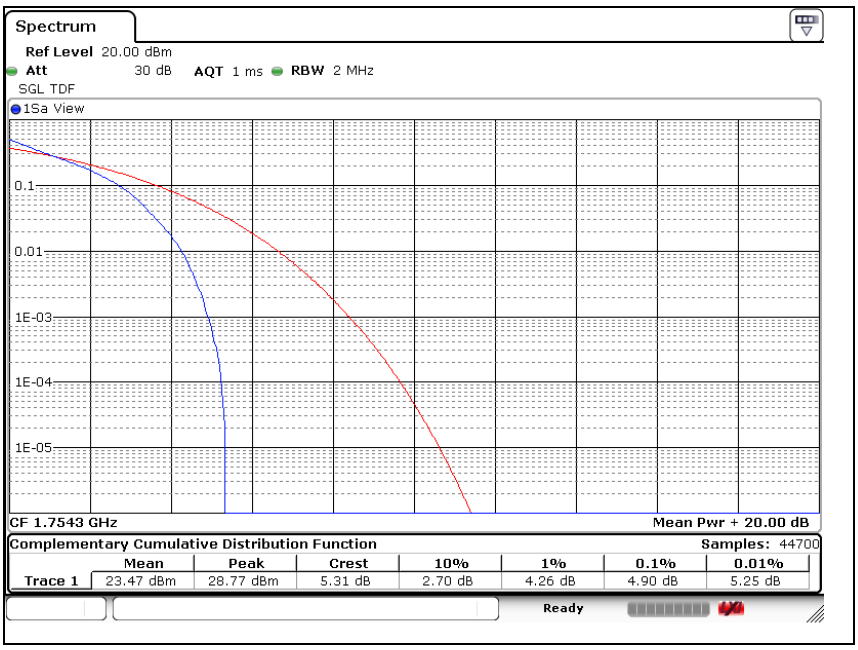
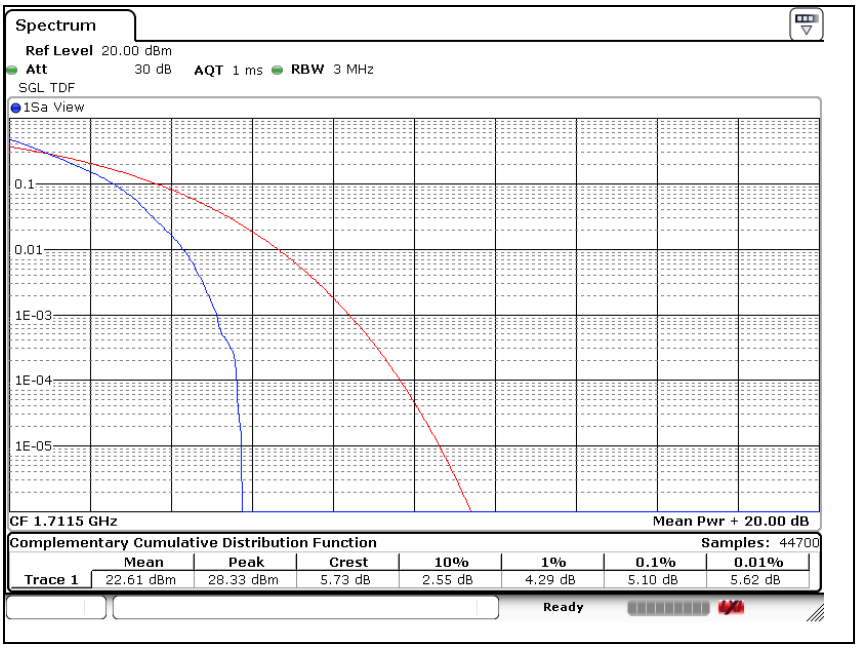
High Channel

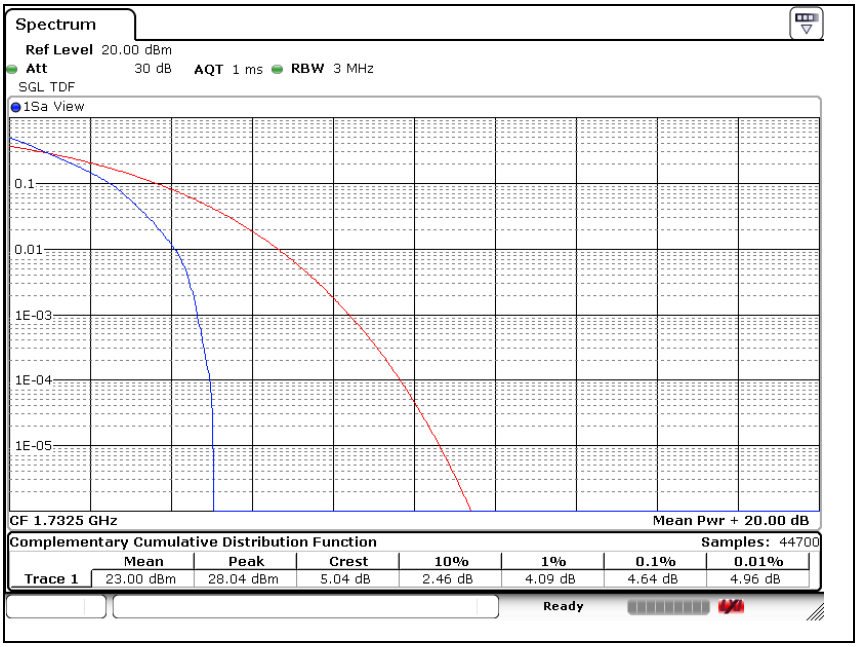


LTE band 4 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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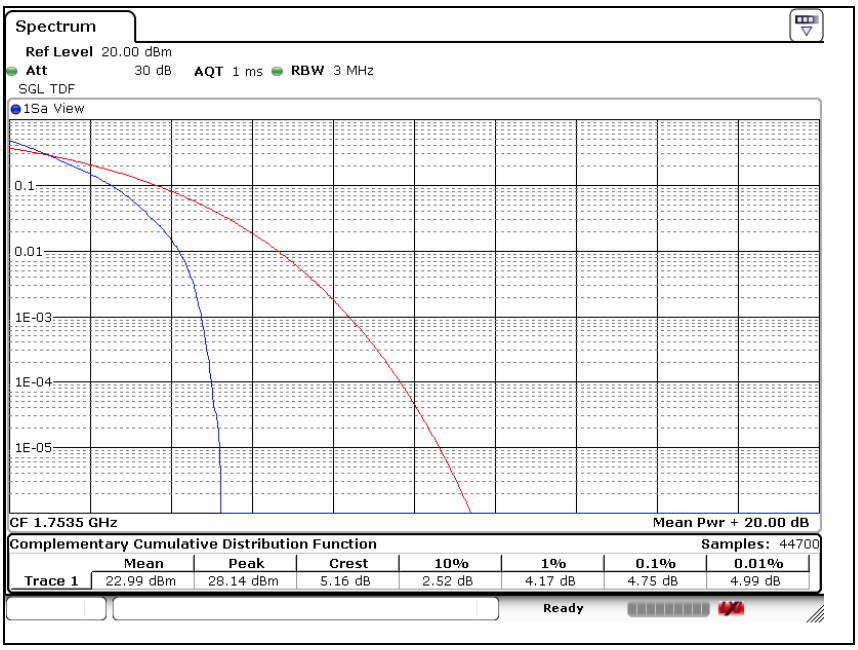
High Channel



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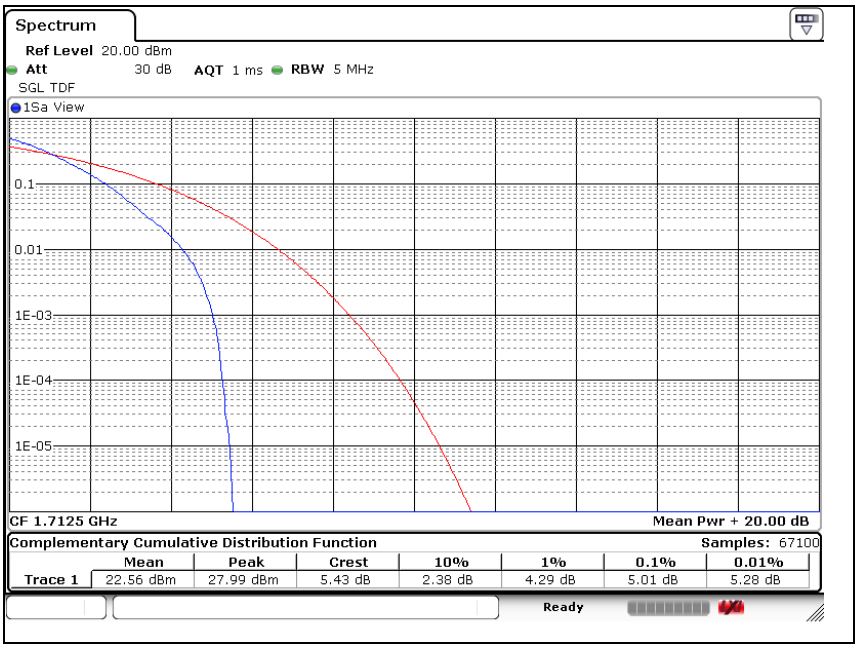
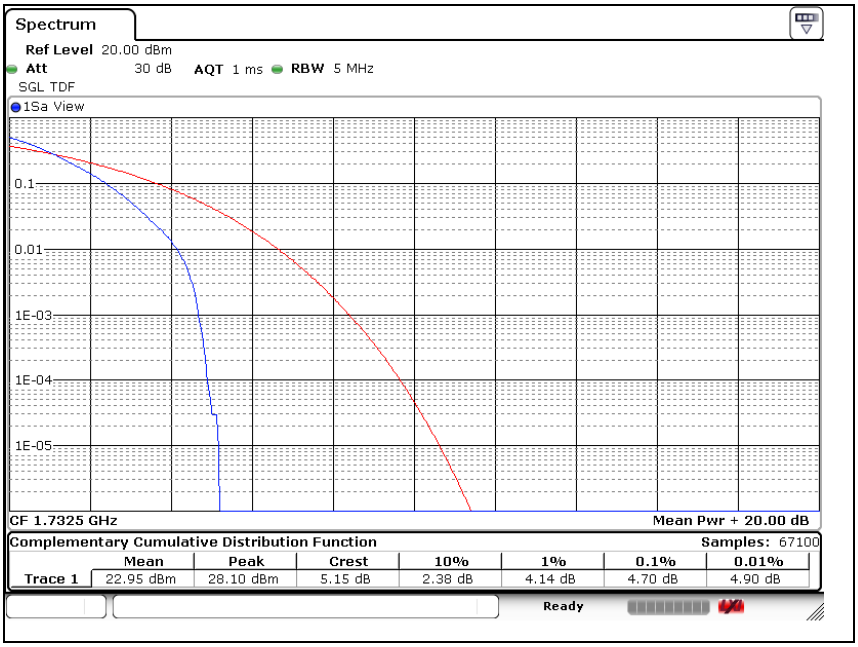
LTE band 4 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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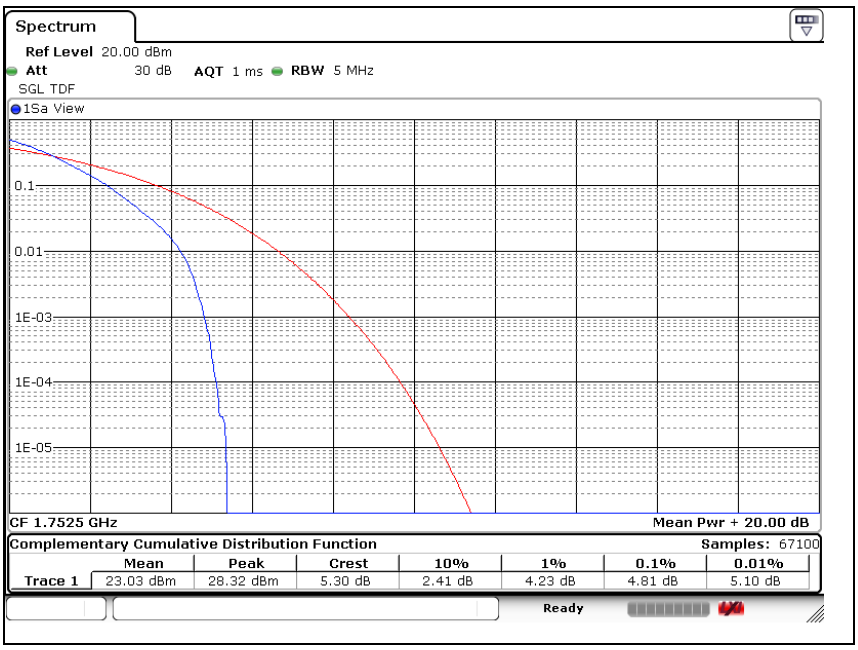
High Channel



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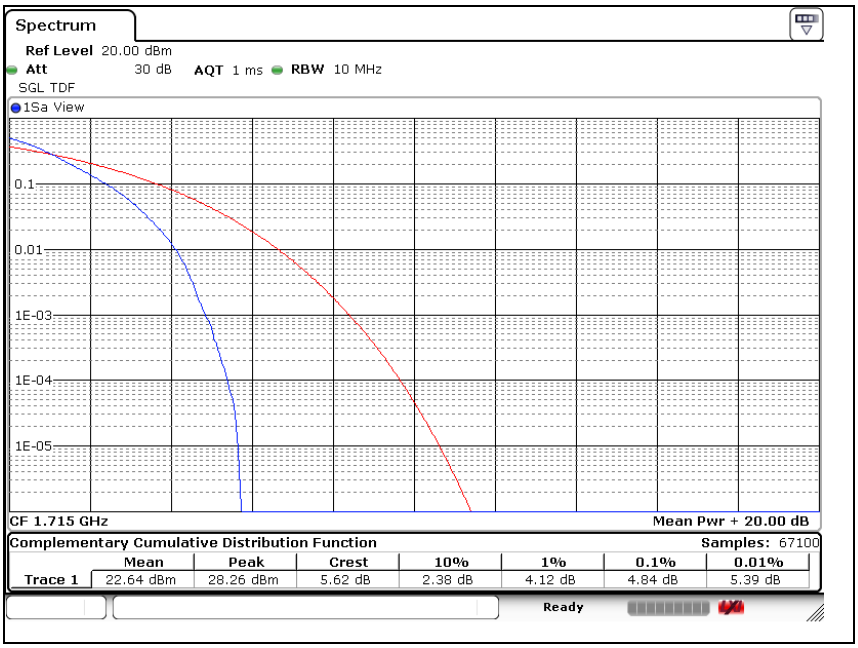
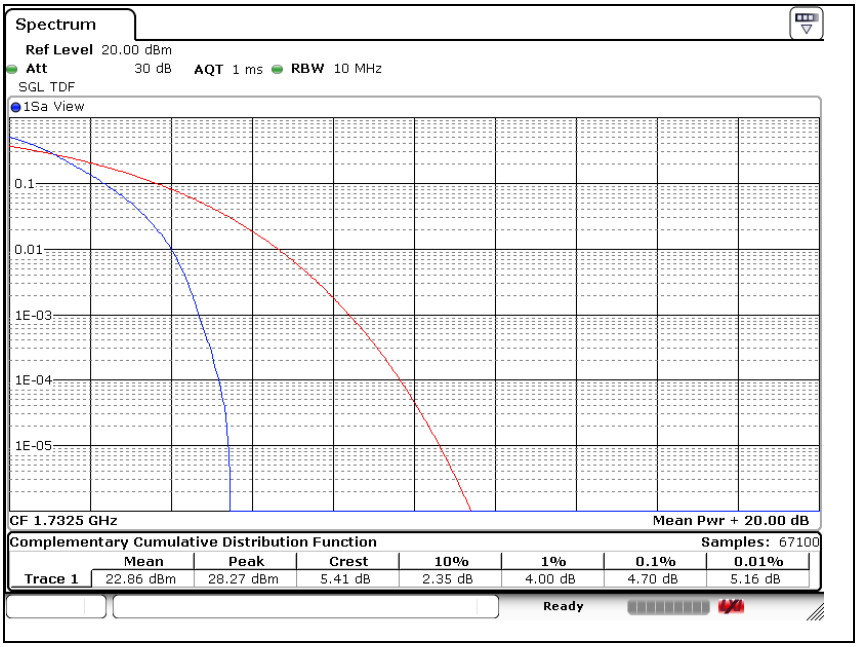
LTE band 4 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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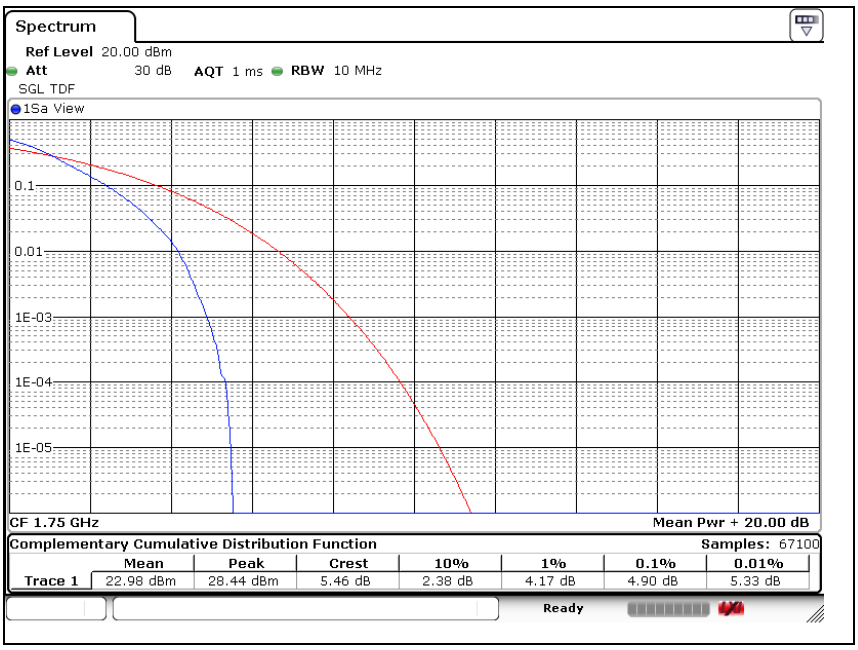
High Channel



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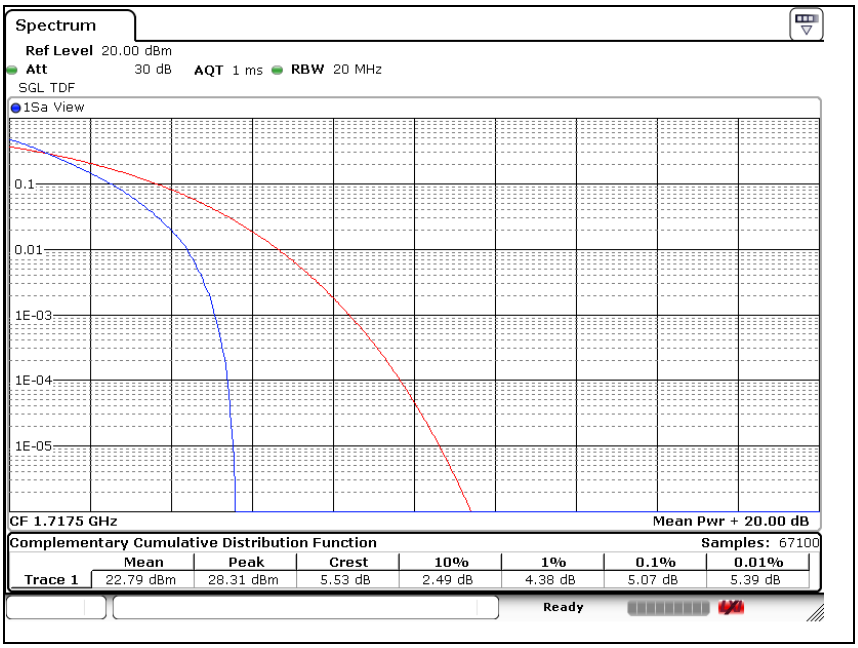
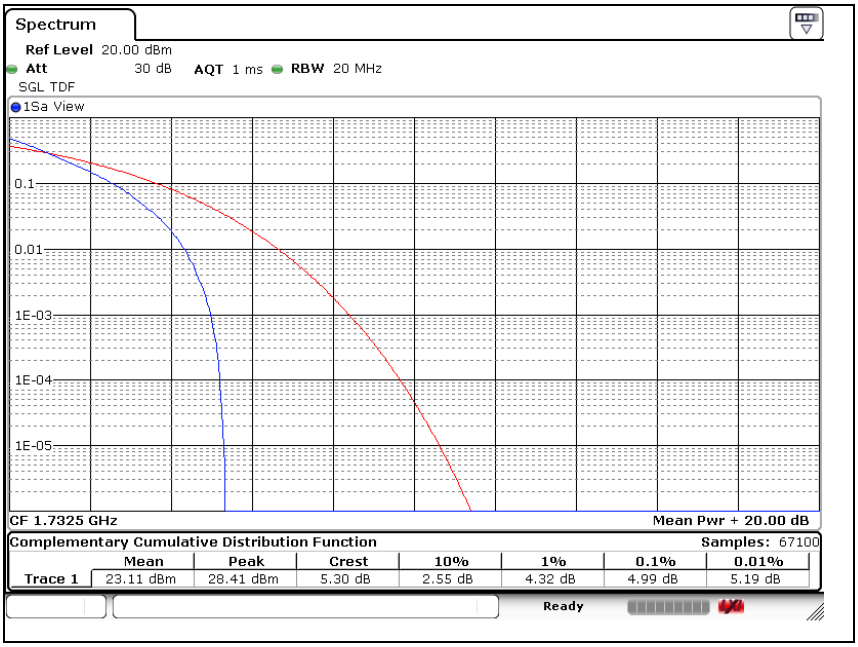
LTE band 4 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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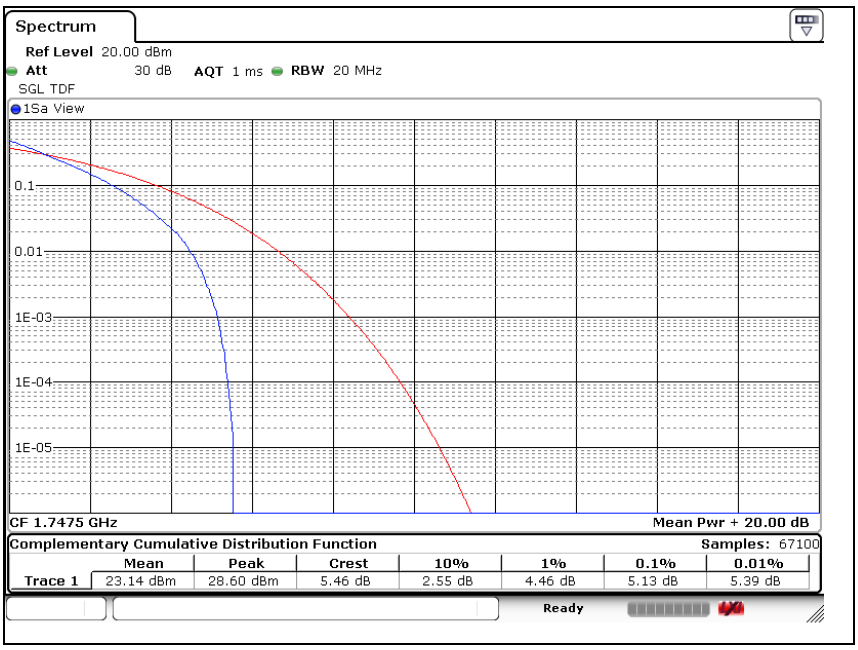
High Channel



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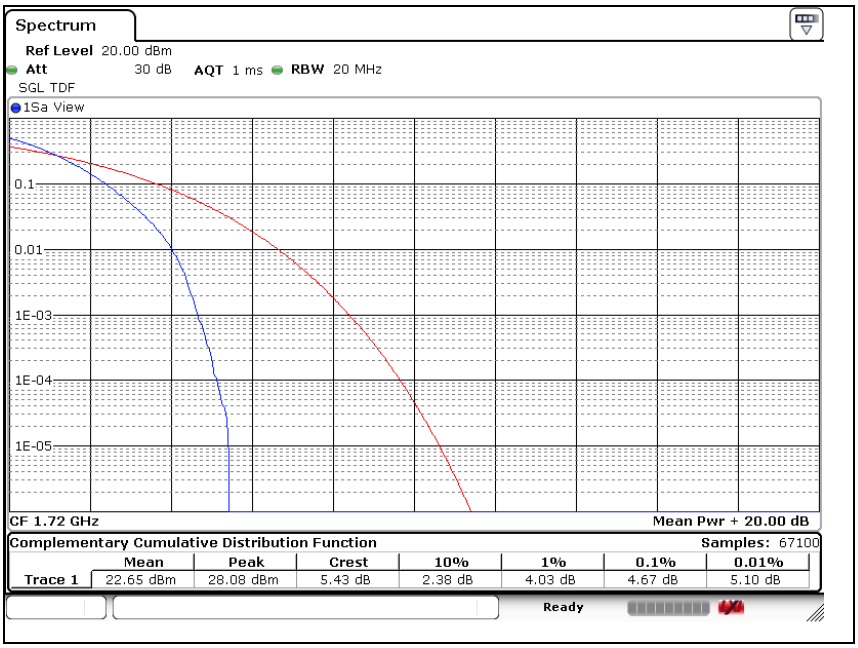
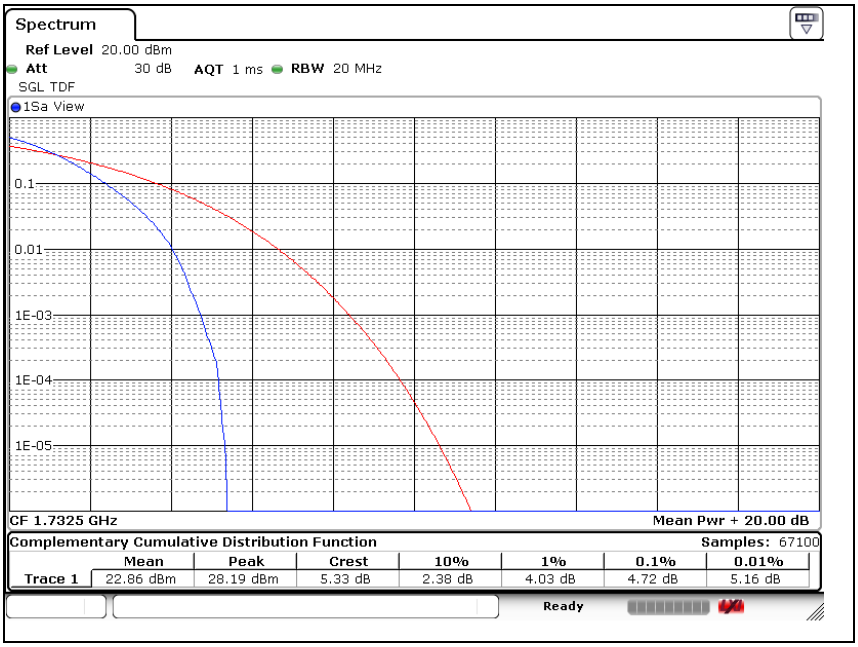
LTE band 4 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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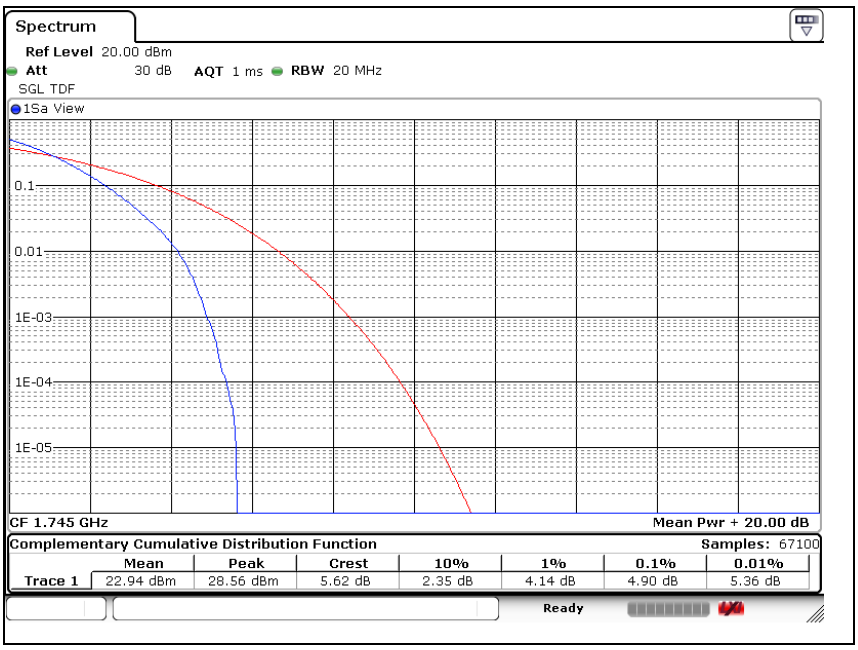
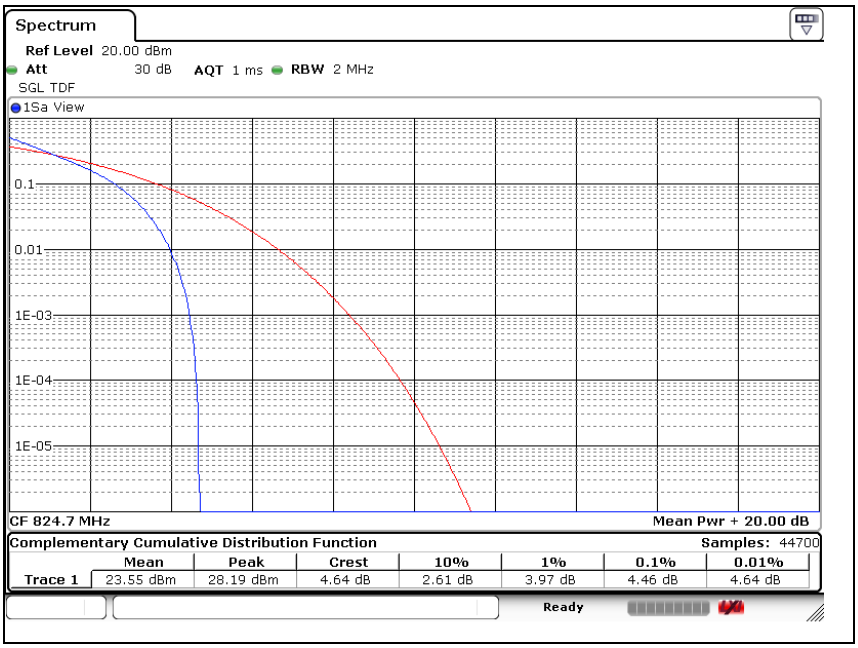
High Channel

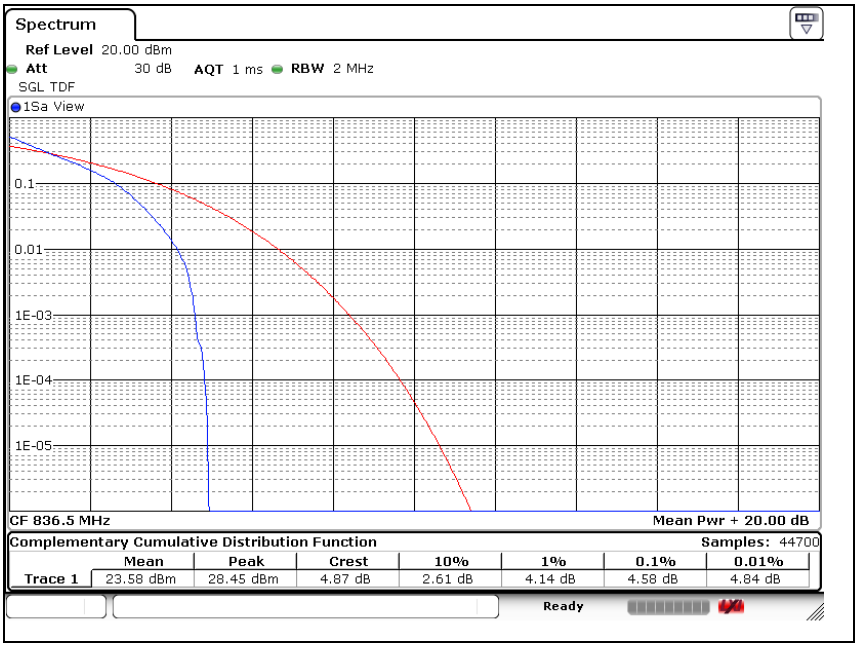


LTE band 5 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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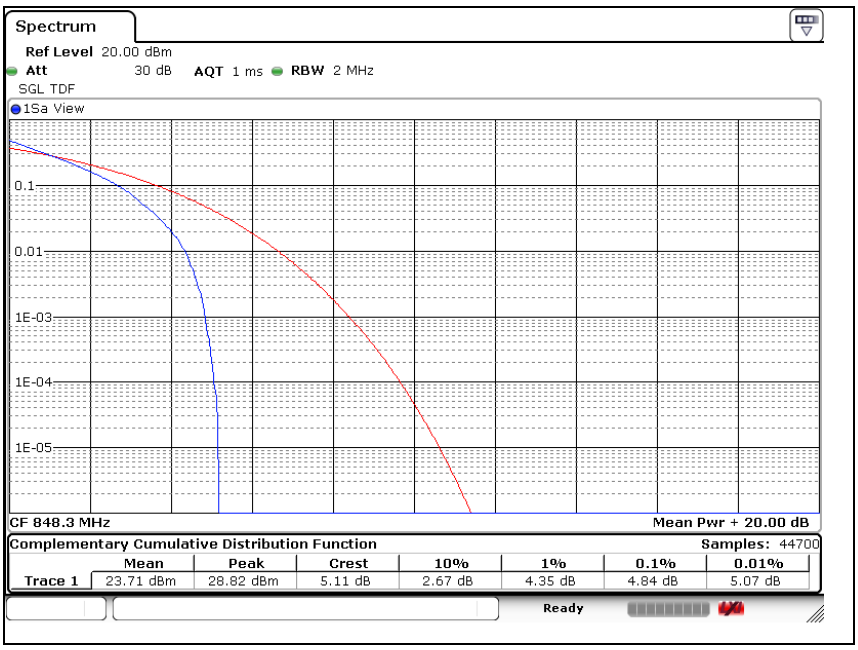
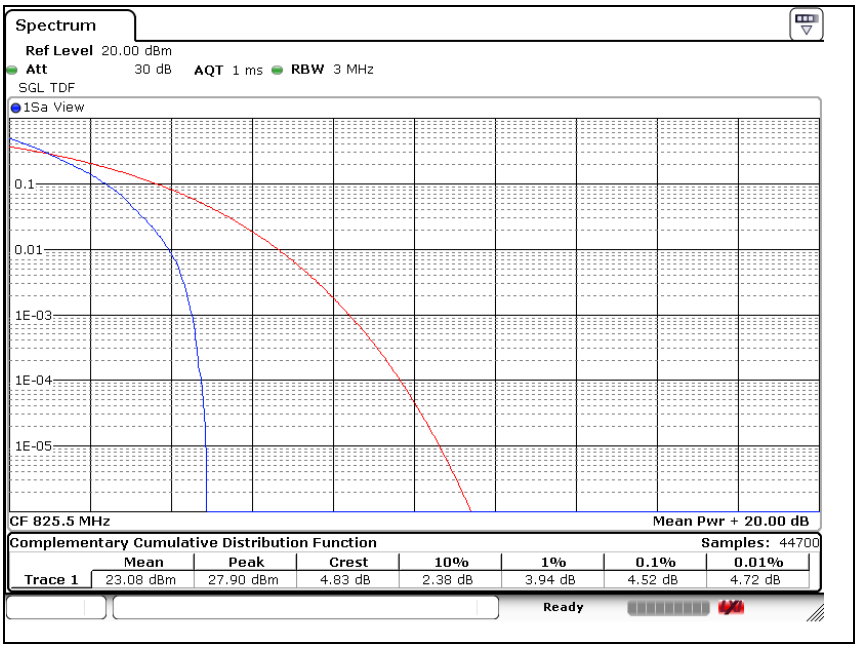
High Channel

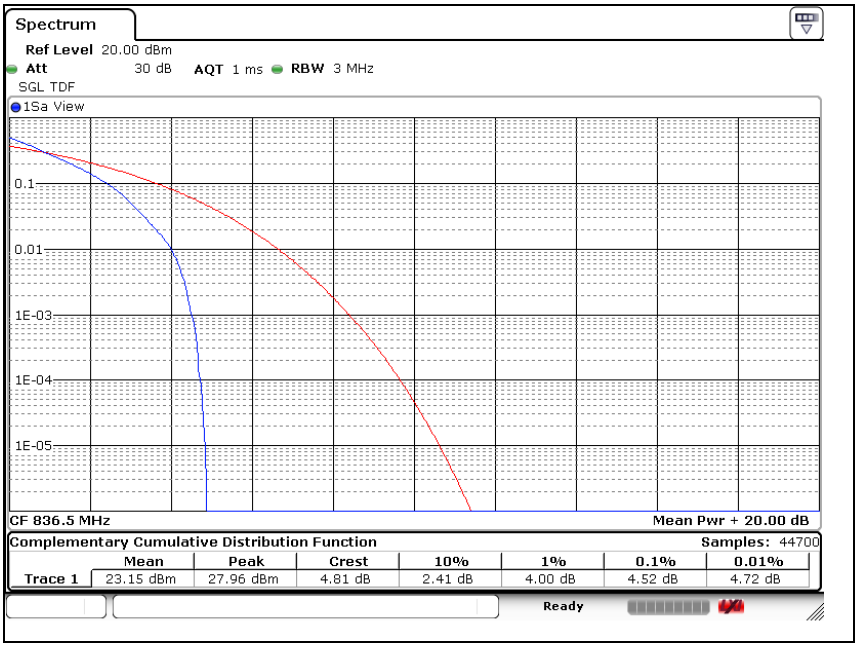


LTE band 5 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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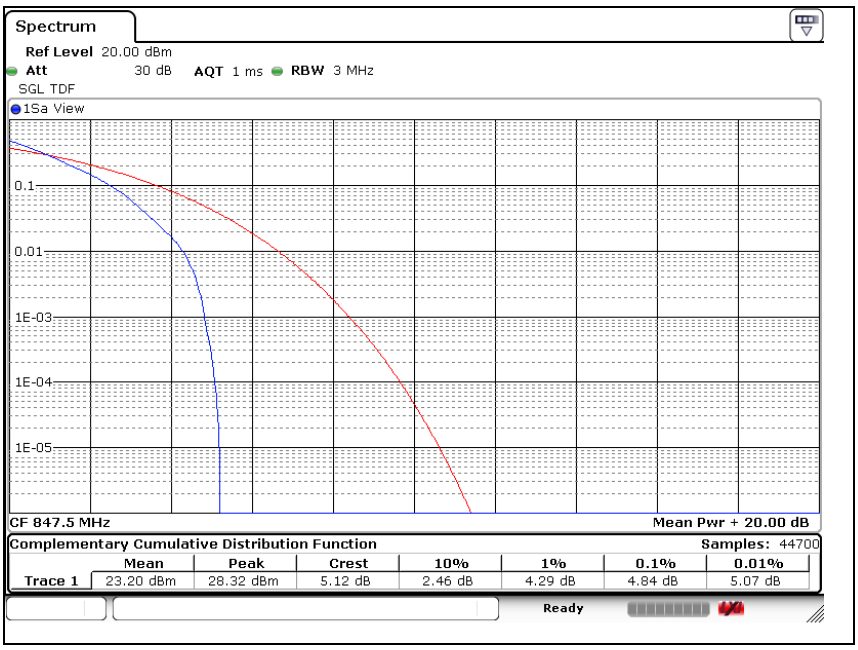
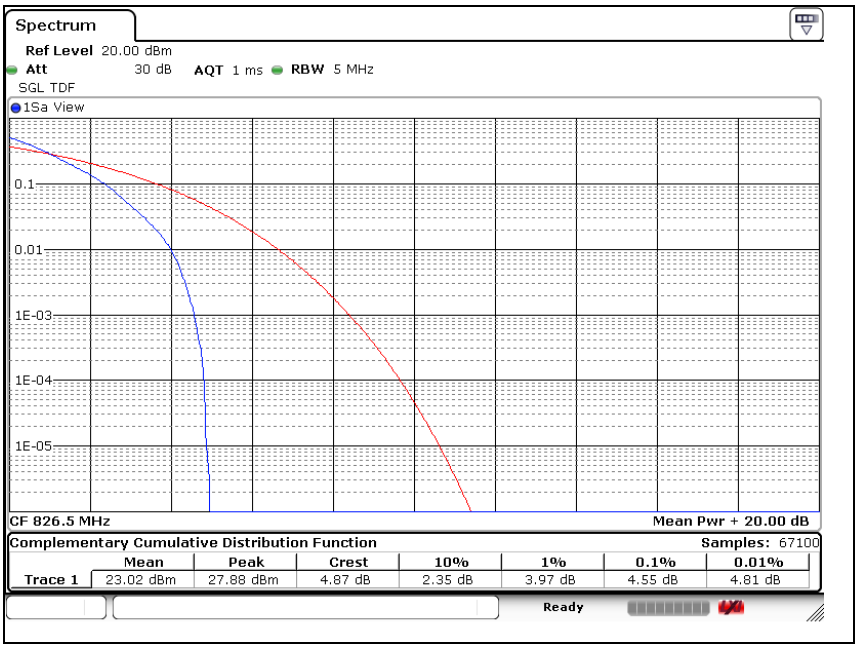
High Channel

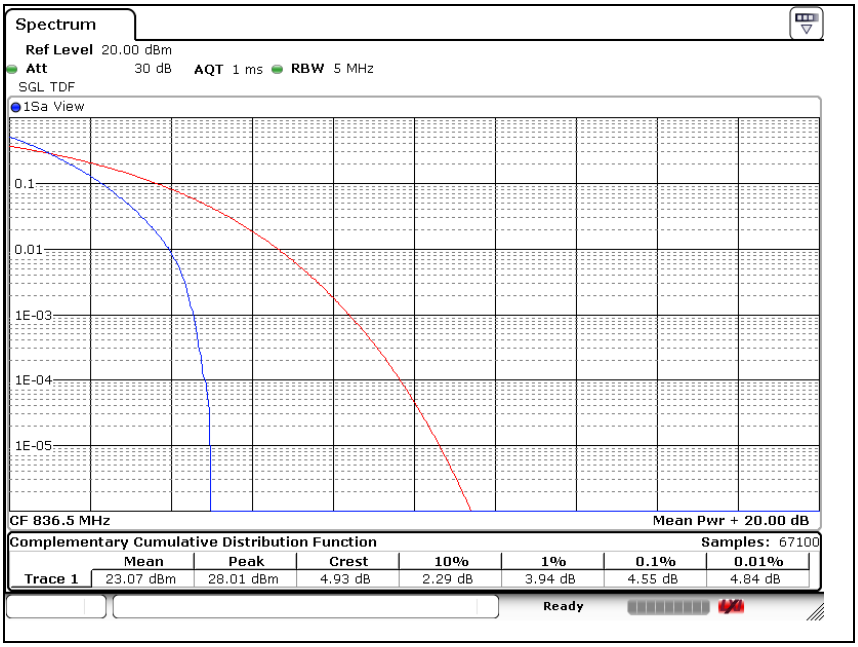


LTE band 5 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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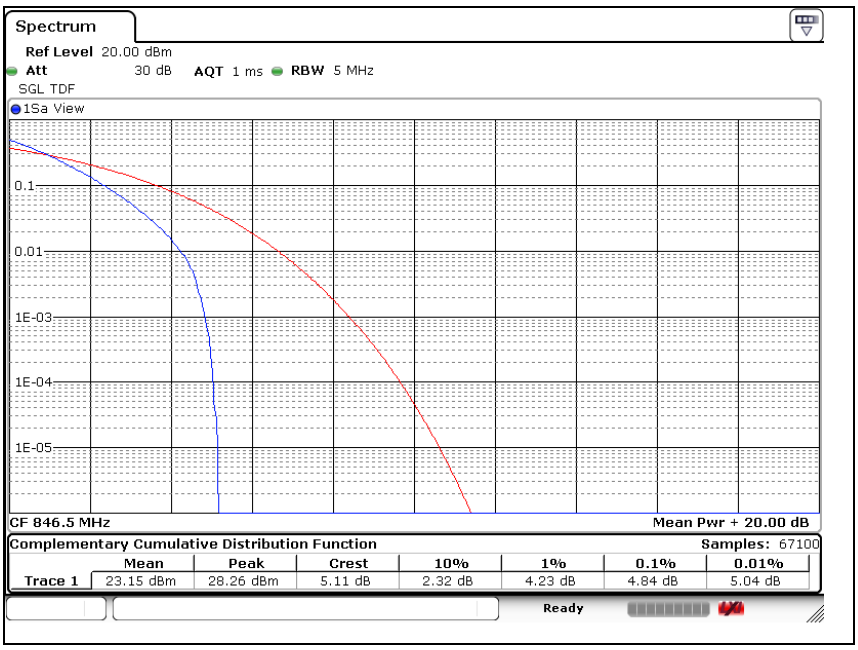
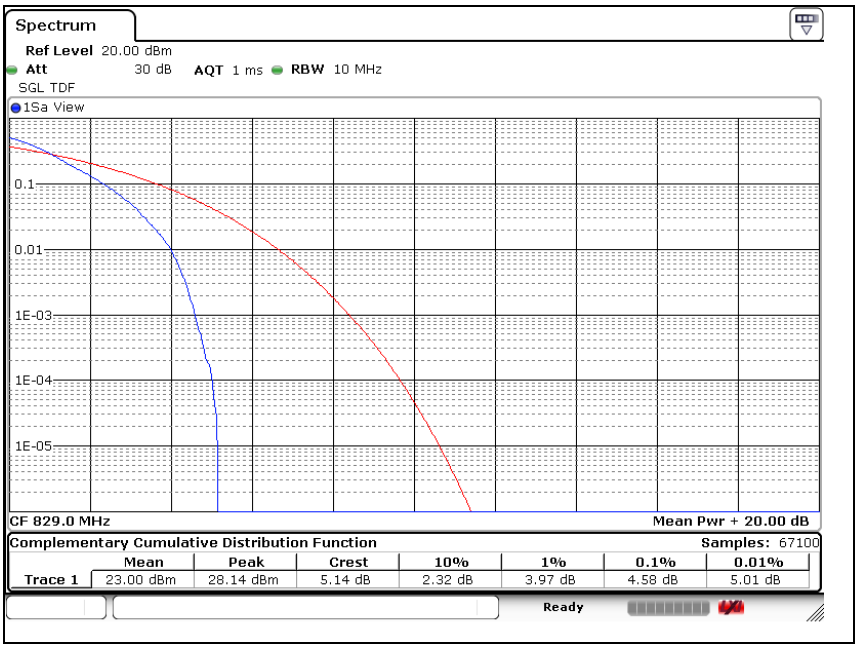
High Channel

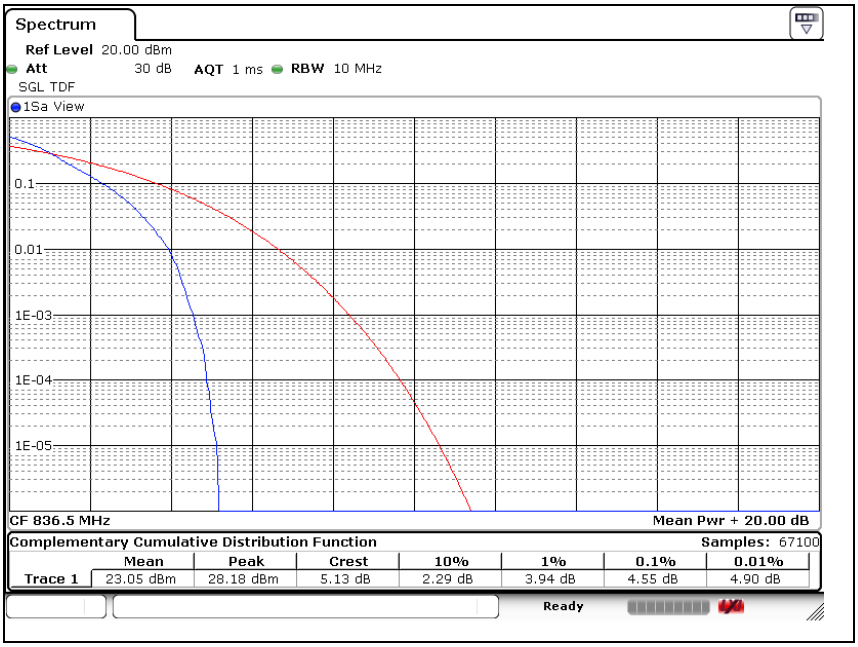


LTE band 5 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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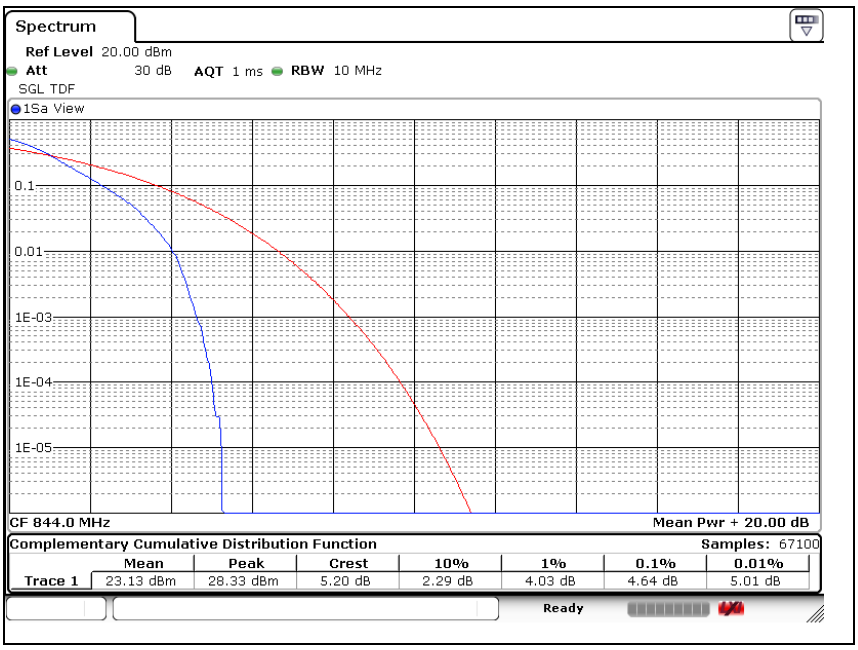
High Channel



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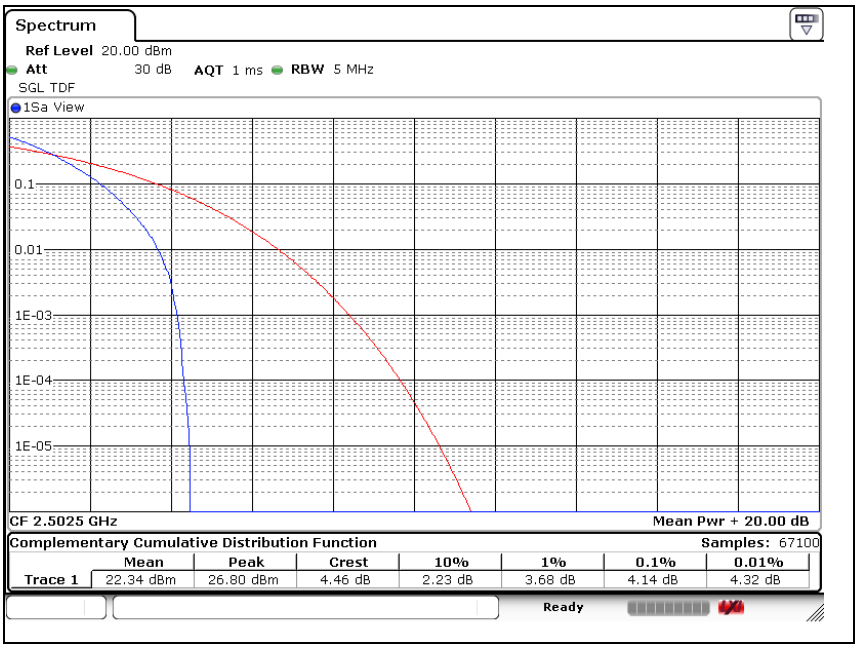
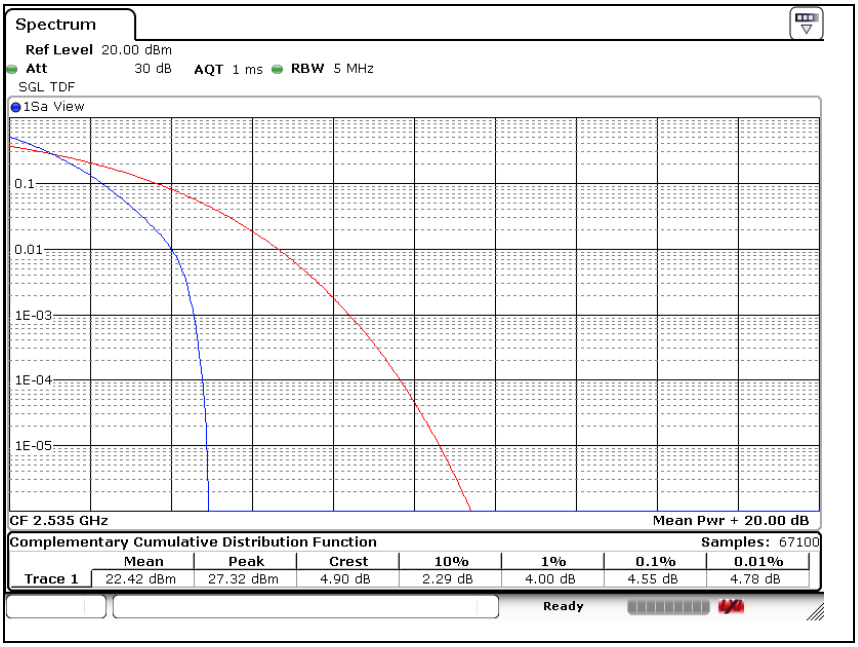
LTE band 7 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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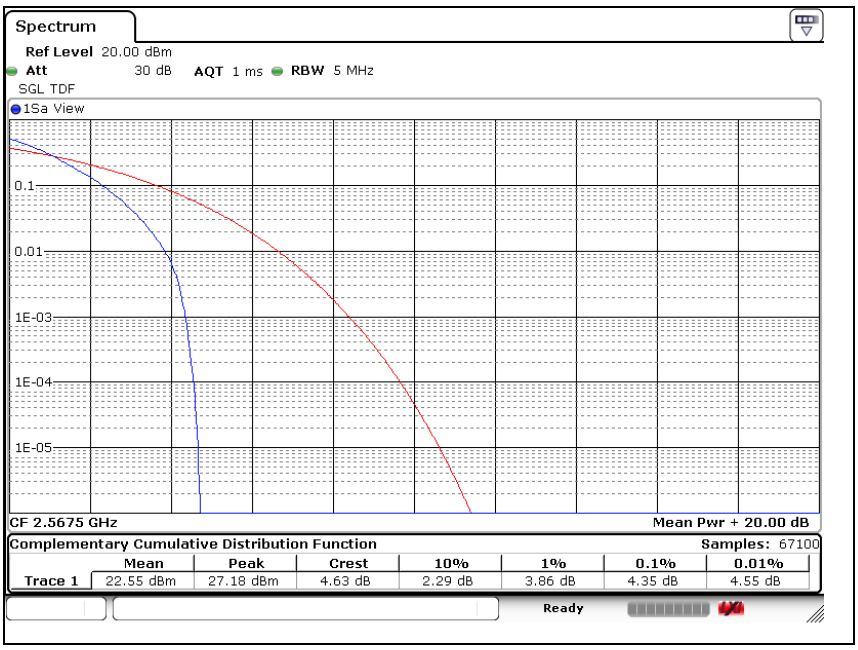
High Channel



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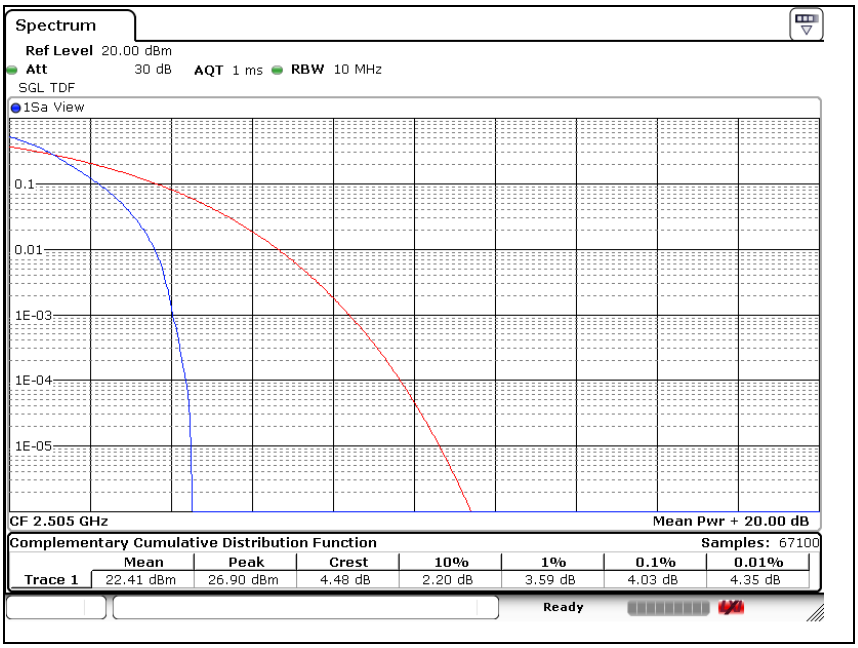
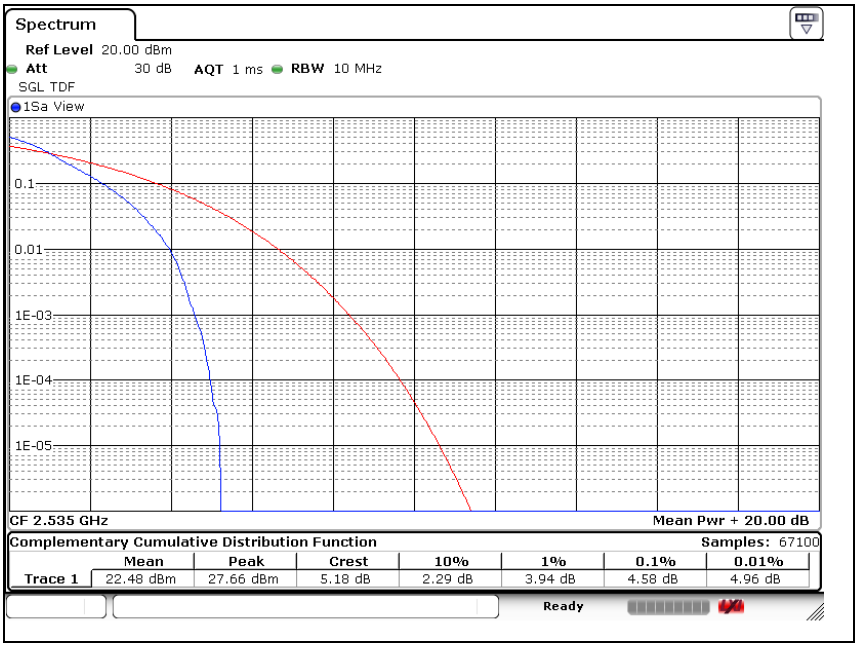
LTE band 7 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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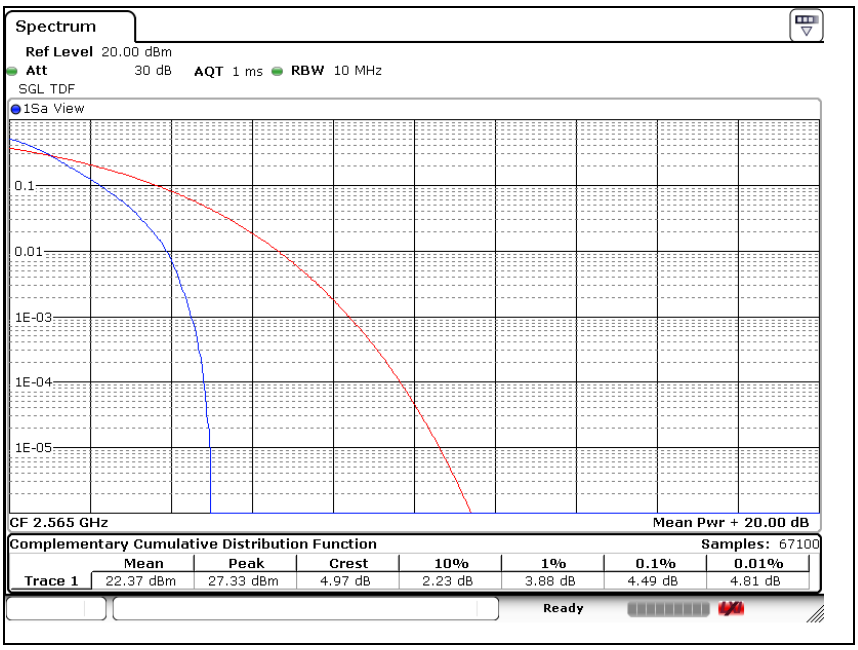
High Channel



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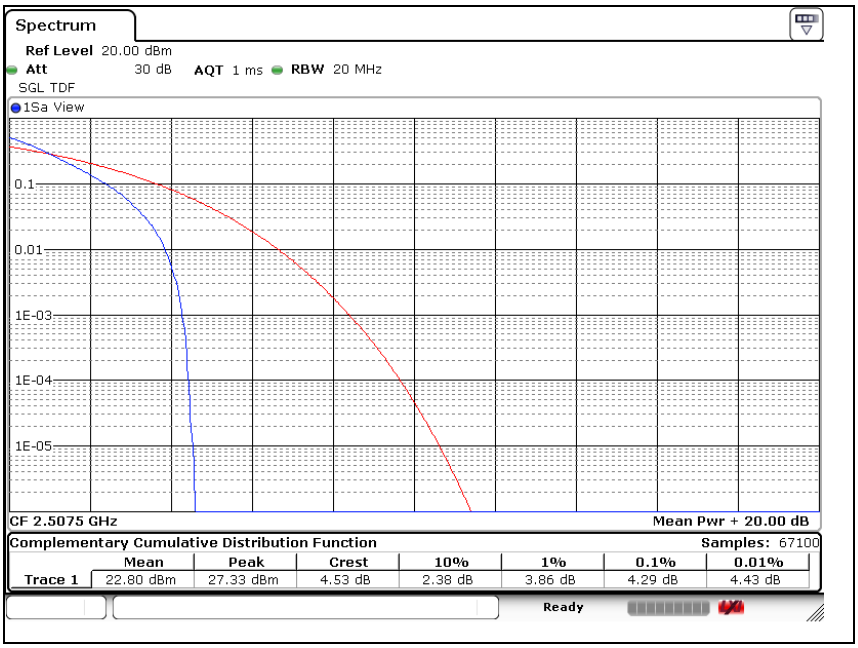
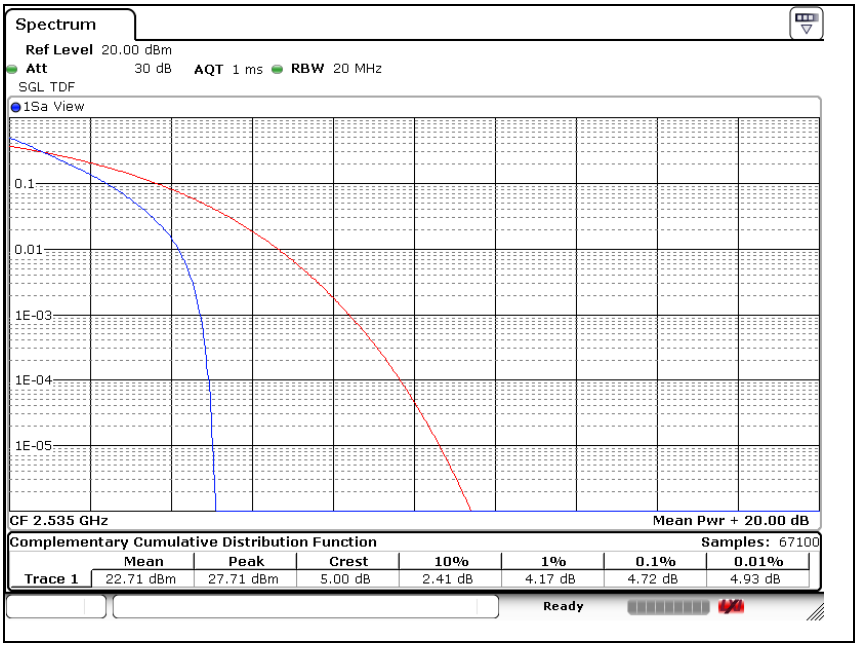
LTE band 7 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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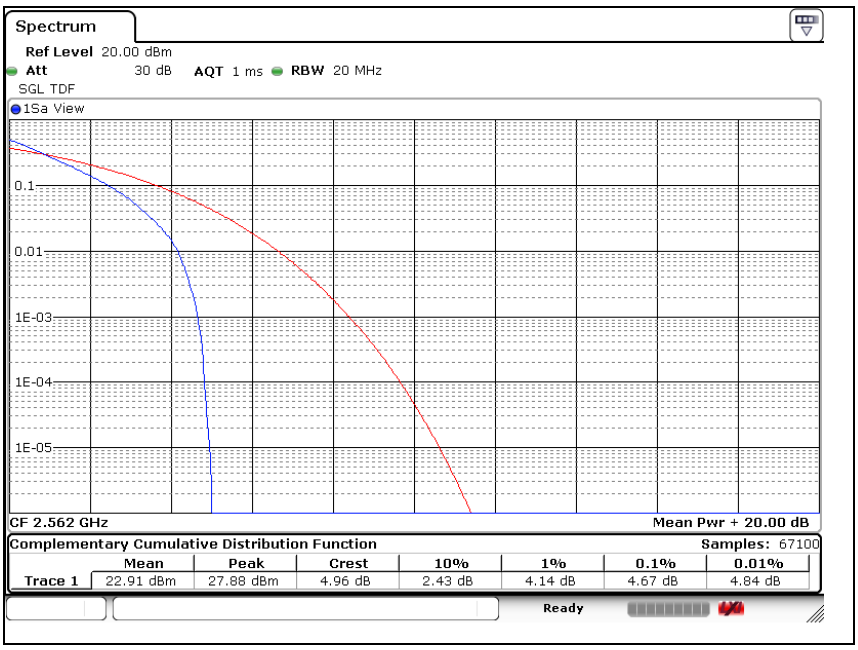
High Channel



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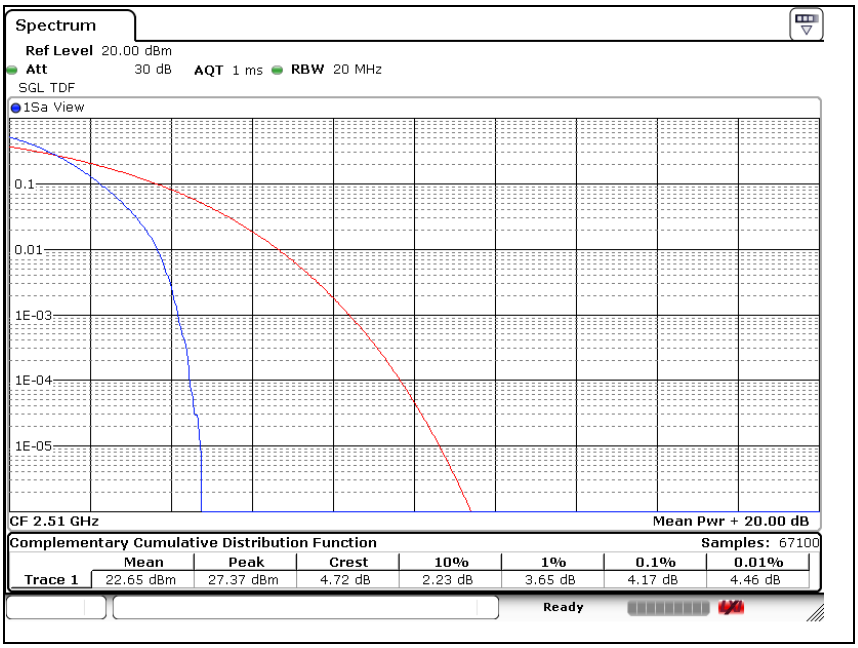
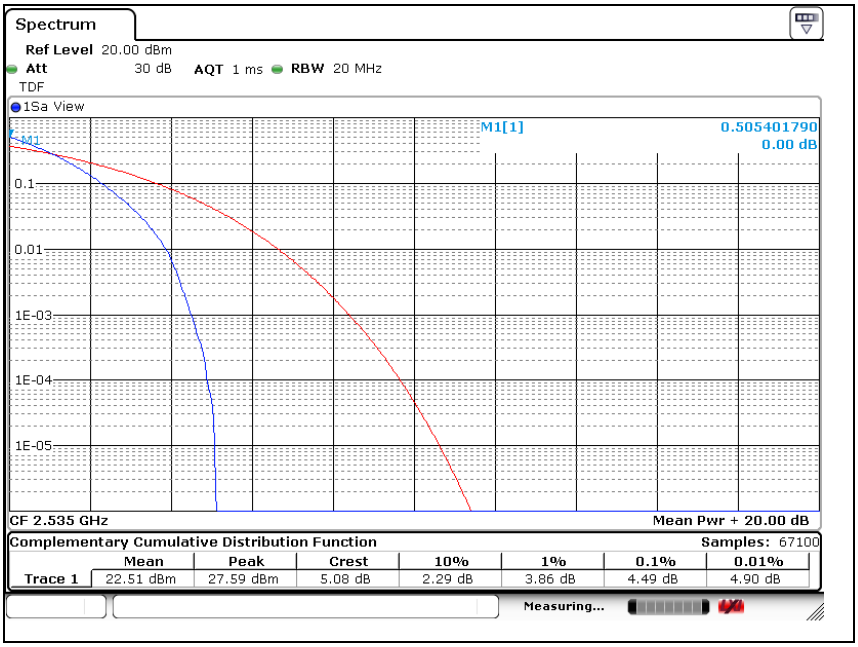
LTE band 7 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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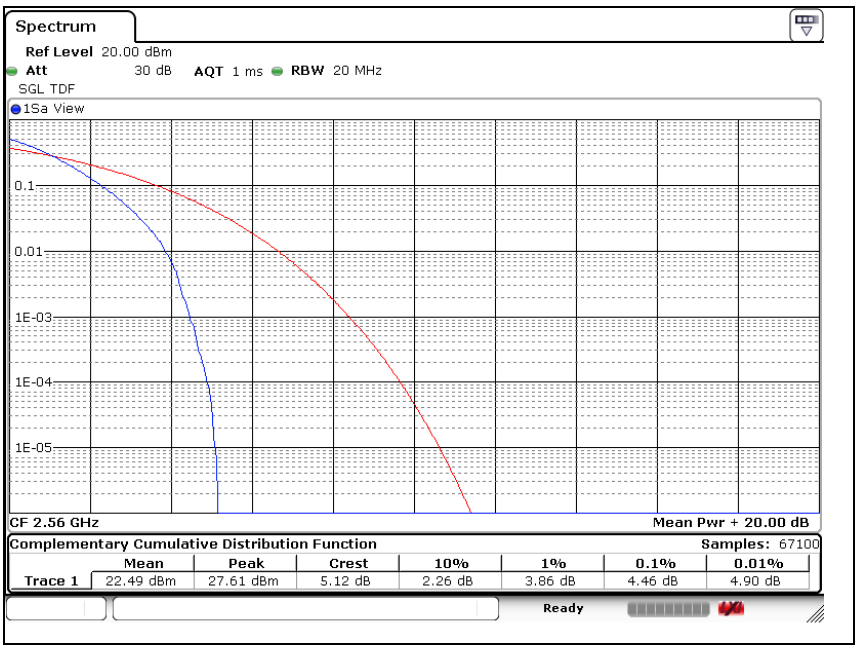
High Channel



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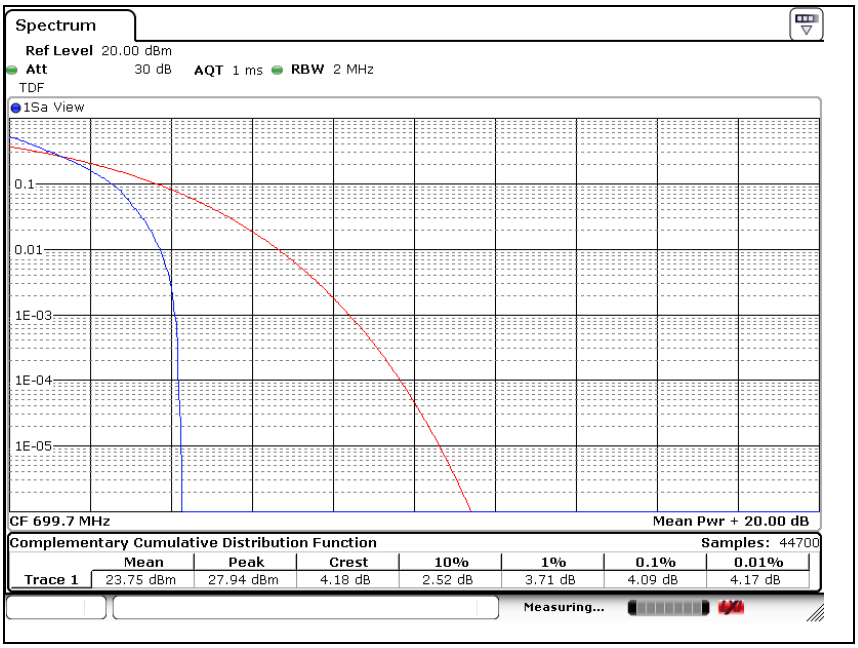
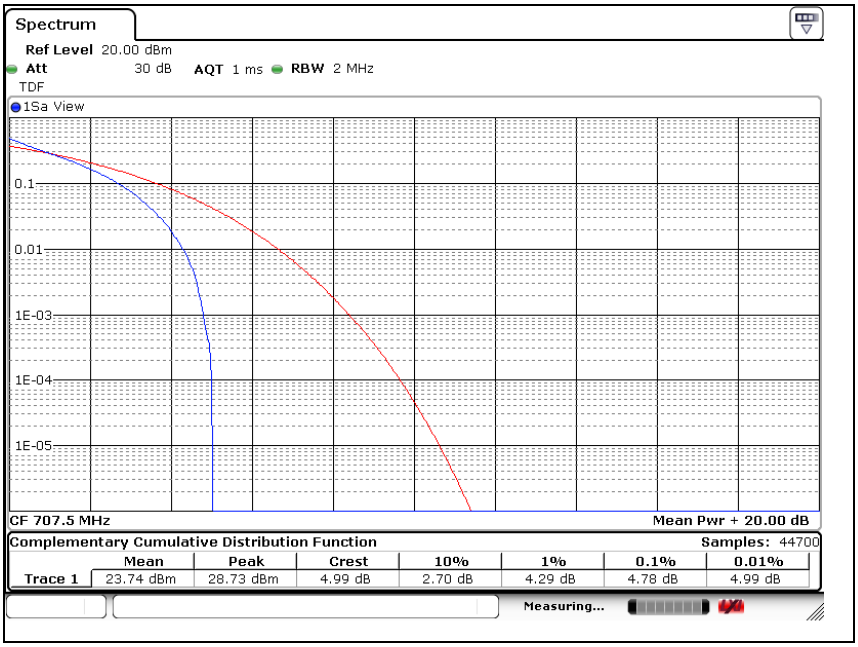
LTE band 12 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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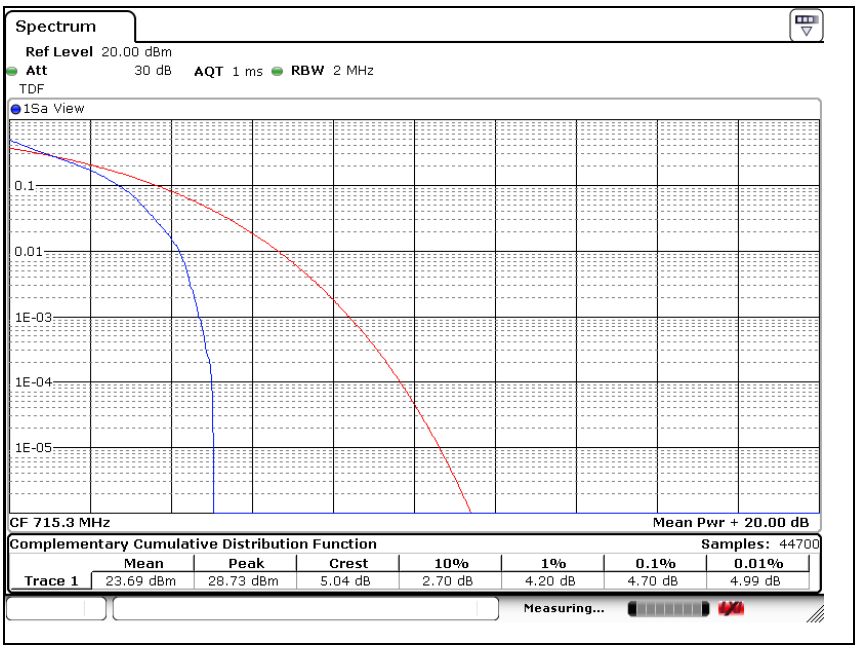
High Channel



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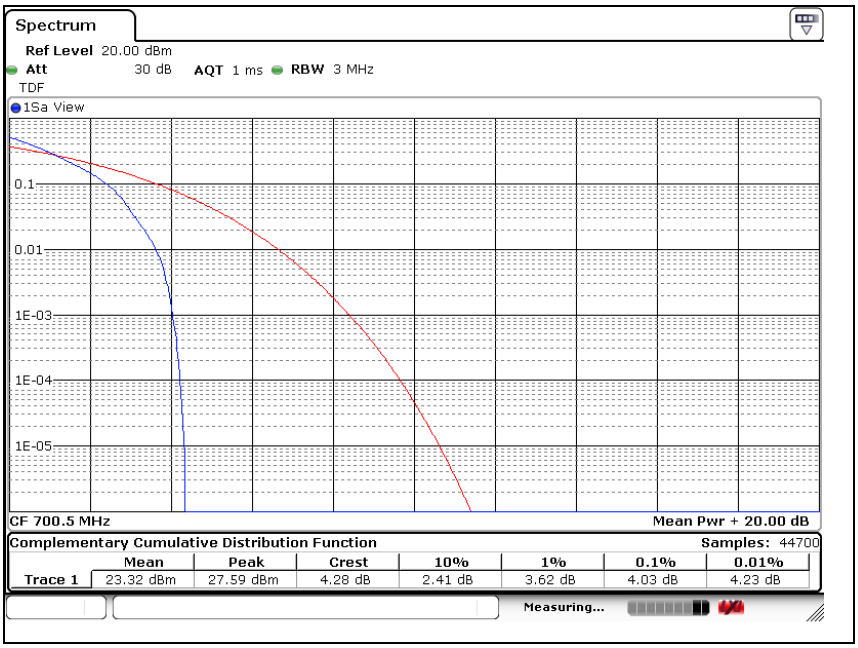
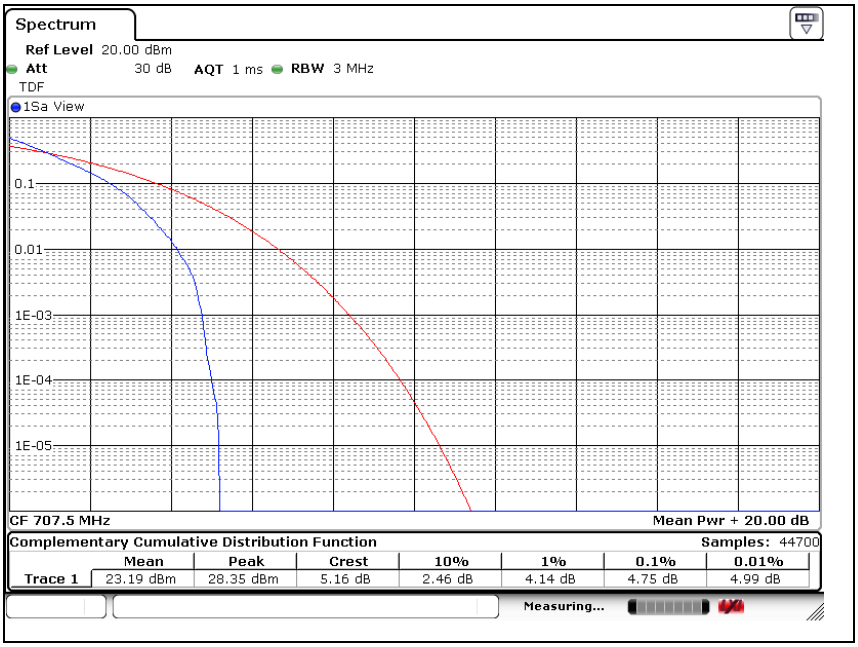
LTE band 12 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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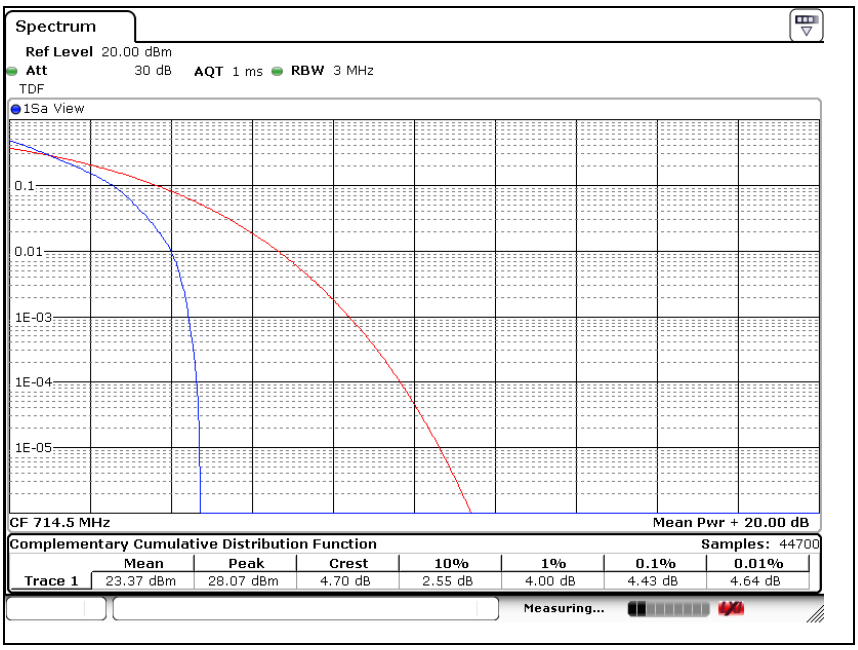
High Channel



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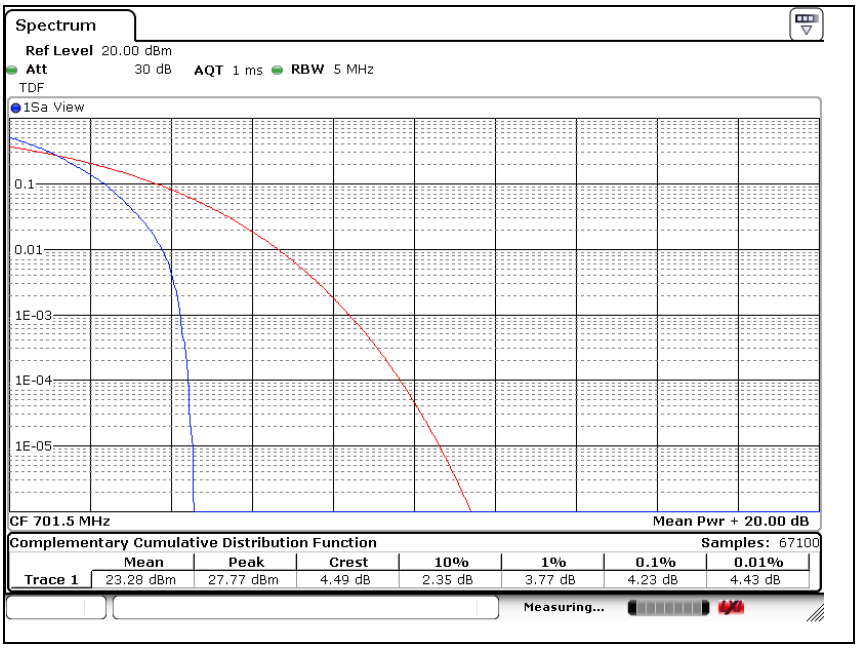
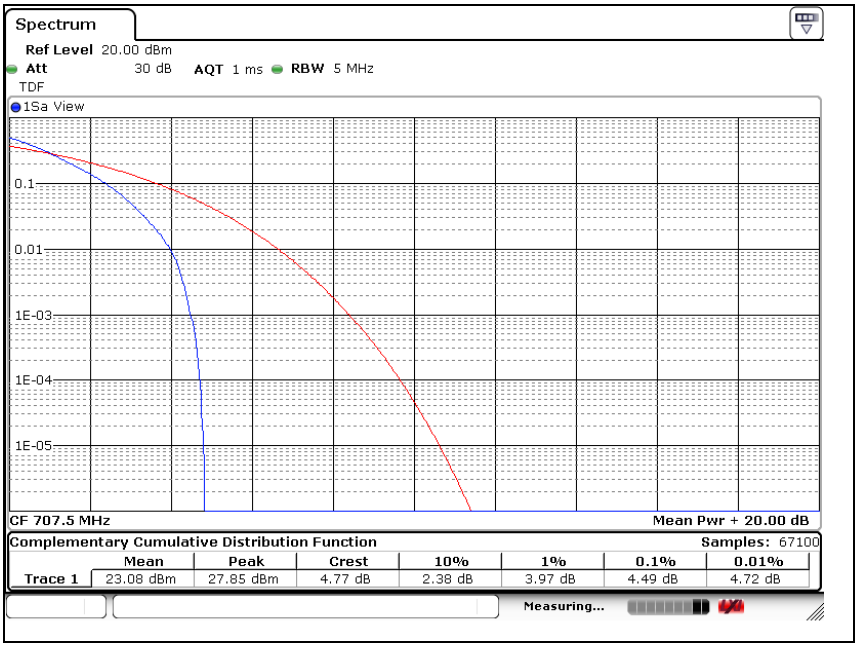
LTE band 12 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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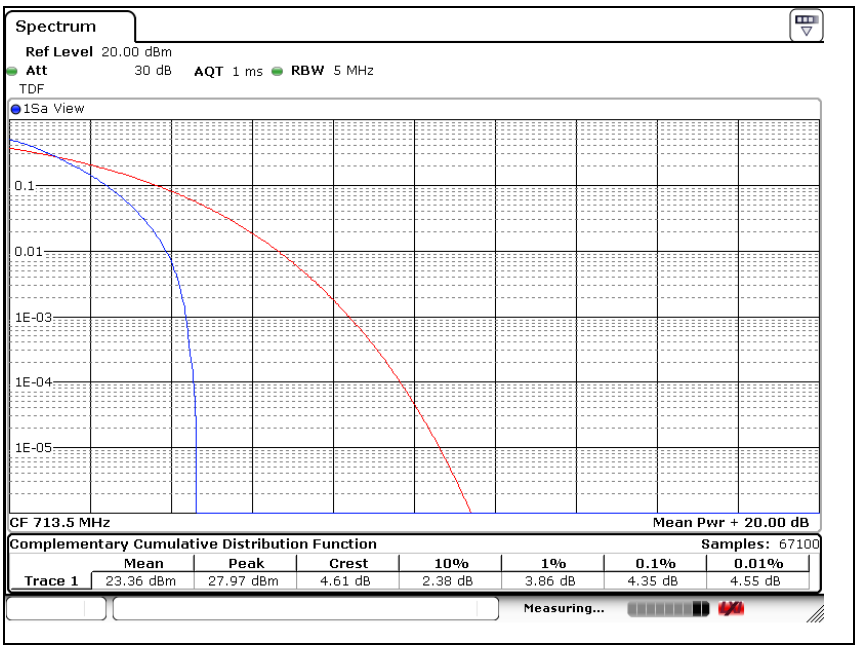
High Channel



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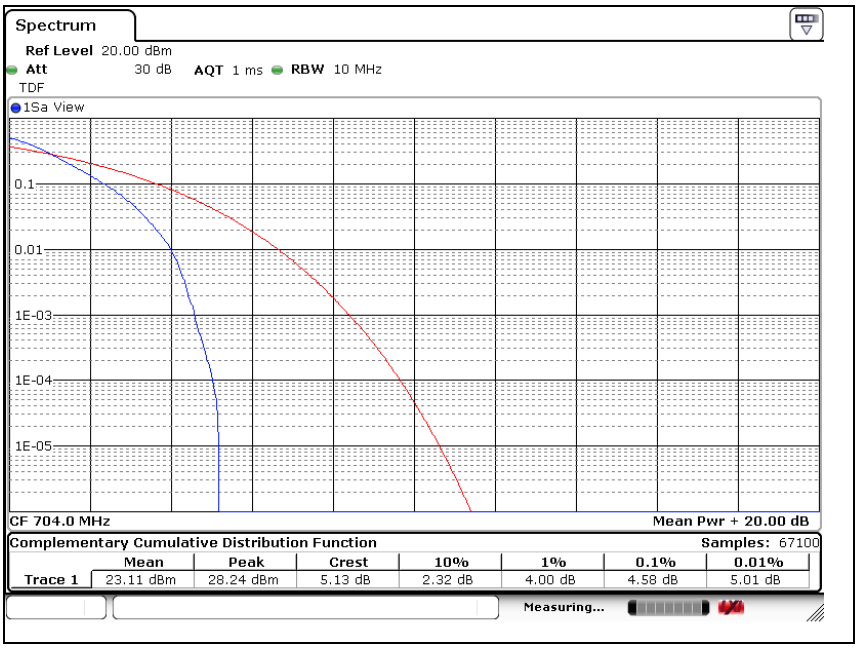
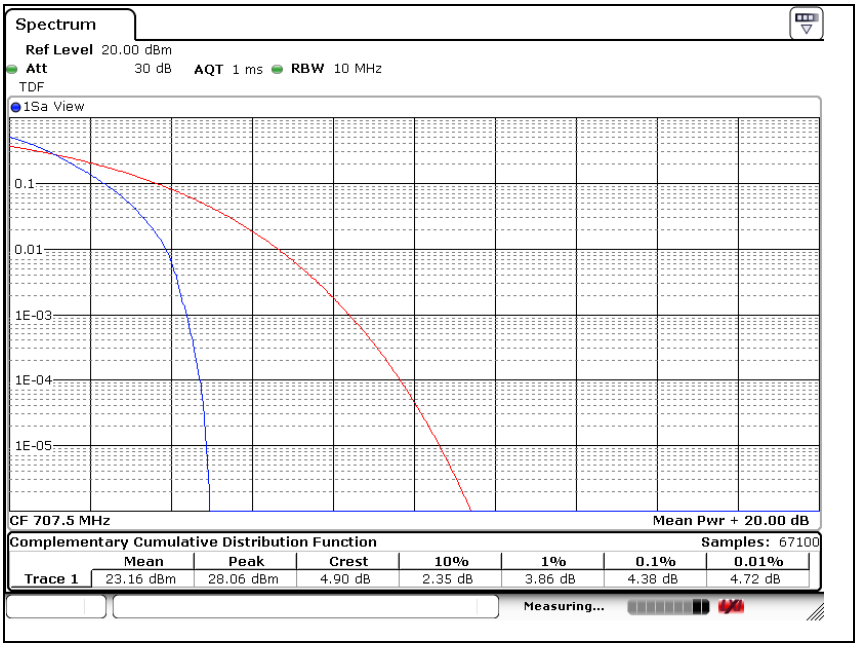
LTE band 12 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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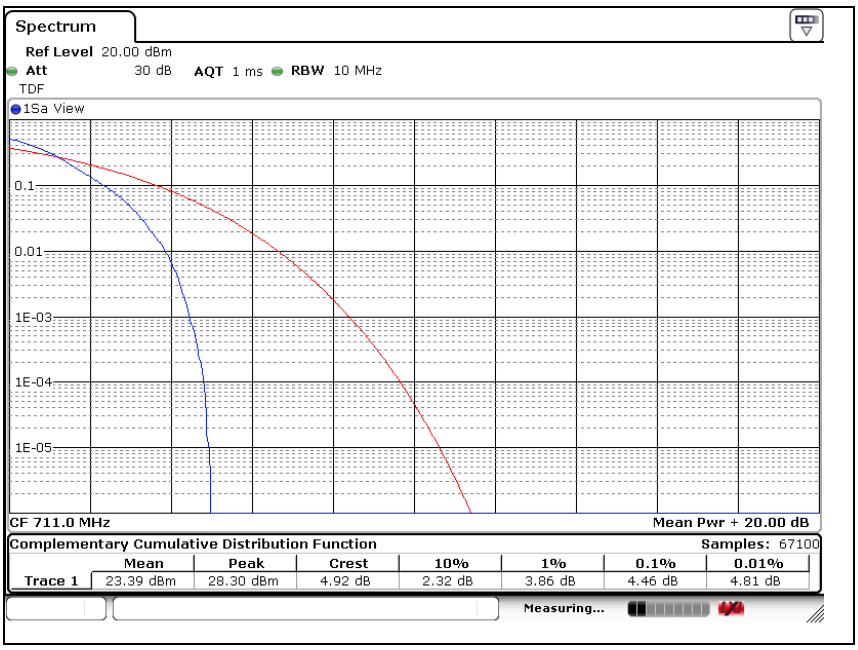
High Channel



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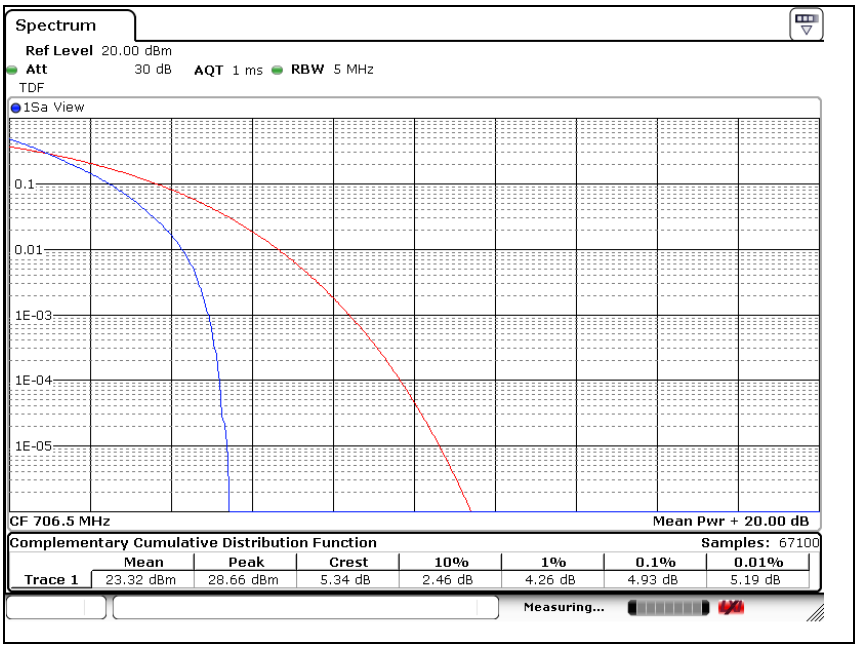
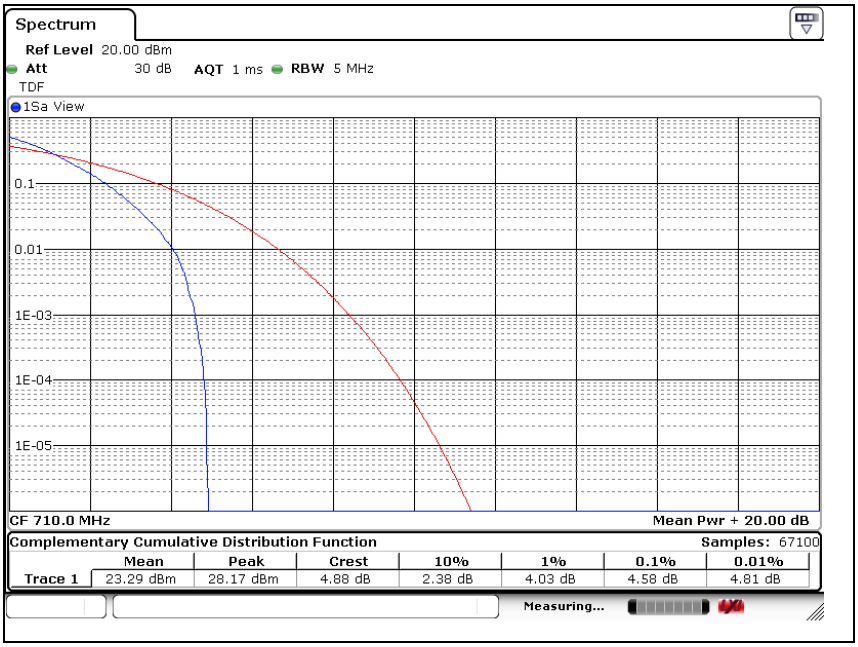
LTE band 17 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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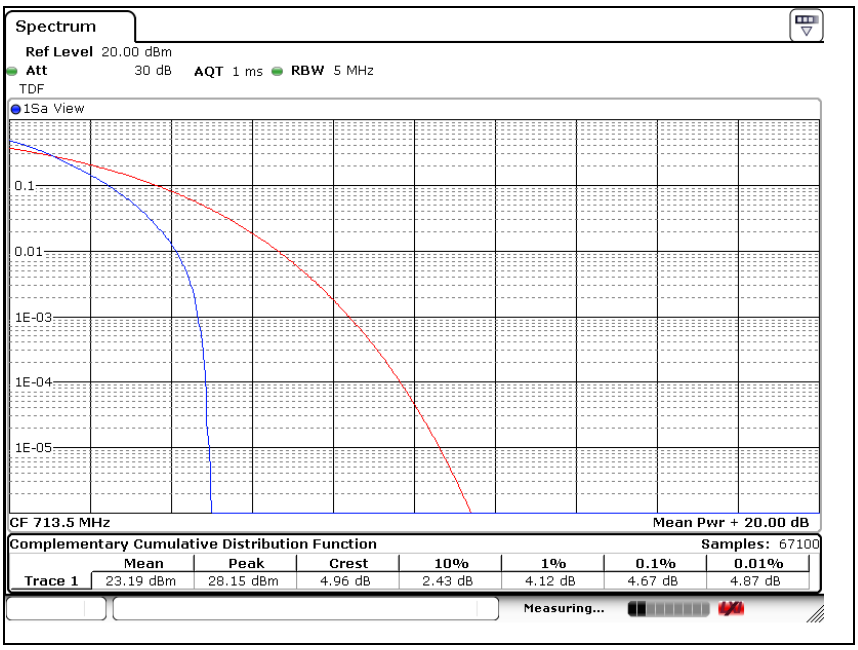
High Channel



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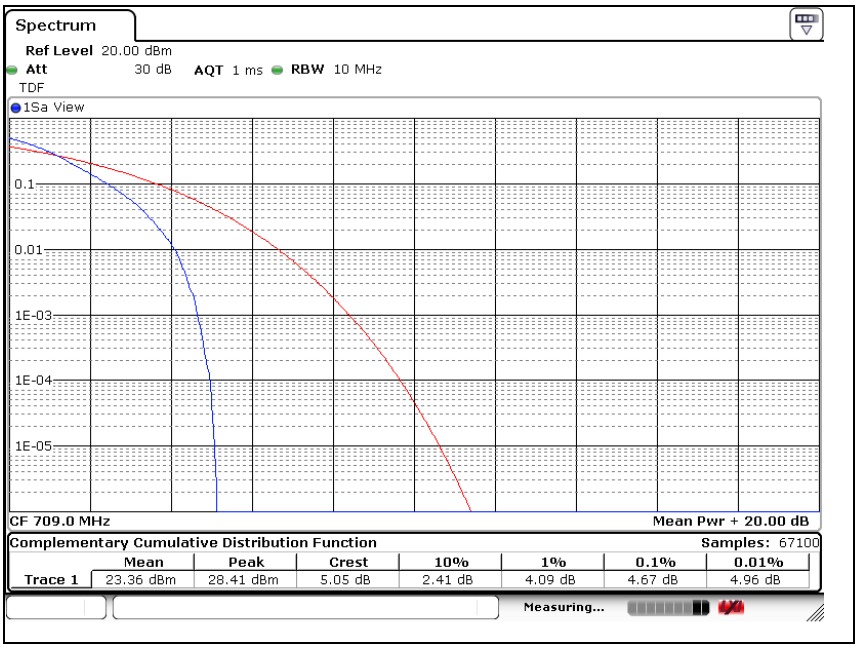
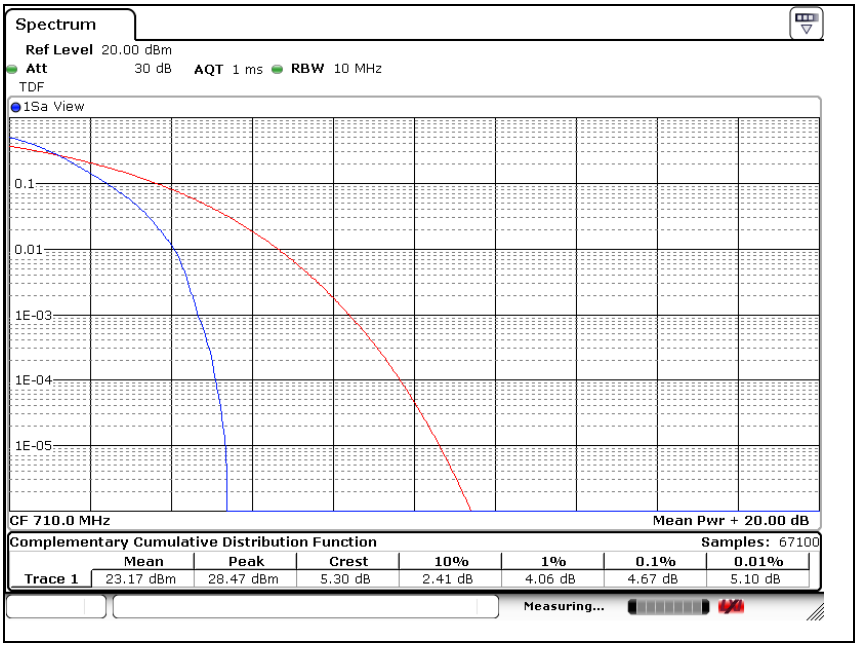
LTE band 17 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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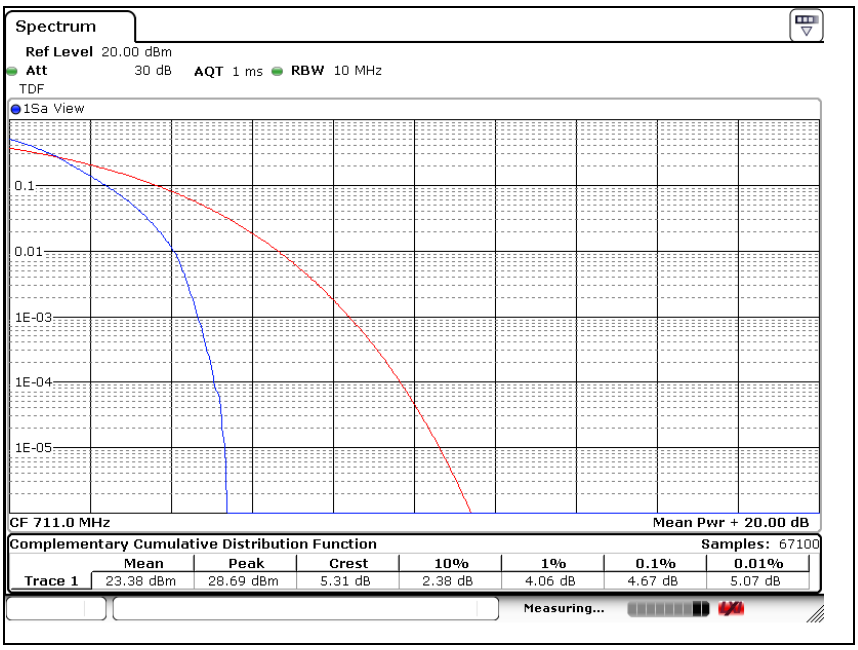
High Channel



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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 + 10log(P) ㎧.

- §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) ㎧.

- §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) ㎧.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, 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) ㎧.

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㎧ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㎧ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㎧ on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 $\log_{10}$ (P) ㎧ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 $\log_{10}$ (P) ㎧ at or below 2490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2495 ㎒ 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 1

4.6.1, the power of any unwanted emissions in any 100 ㎑ bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (㎧ W), by at least 43 + 10 $\log_{10}$ p (watts), ㎧. However, in the 100 ㎑ band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 ㎑ 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 ㎒ 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 ㎧) below the transmitter output power P (㎧ W) by at least 43 + 10 $\log_{10}$ p (watts).

(ii) After the first 1.0 ㎒ immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 ㎑ bandwidth shall be attenuated (in ㎧) below the transmitter output power P (㎧ 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 ㎑ is required.

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- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.
(i) In the 1.0 ㎒ 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 ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts).

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

- RSS-139 Issue 3

6.6, (i) In the first 1.0 ㎒ 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 ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

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

- RSS-199 Issue 3

4.5, (b)
for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in ㏈) below the transmitter power, P (㏈W), by at least:

(i) 40 + 10 $\log_{10}$ p from the channel edges to 5 ㎒ away
(ii) 43 + 10 $\log_{10}$ p between 5 ㎒ and X ㎒ from the channel edges, and
(iii) 55 + 10 $\log_{10}$ p at X ㎒ 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 ㎒ and 2496 ㎒, and 55 + 10 $\log_{10}$ p at or below 2490.5 ㎒.

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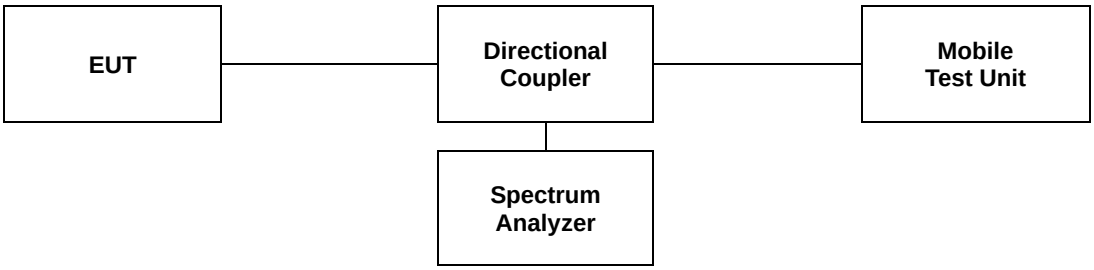
6.2. Test Procedure

The test follows section 6 of FCC KDB Publication 971168 D01 v02r02.

1. Start frequency was set to 30 ㎒ 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 30 ㎒ to 26 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction factor.



Notes;

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

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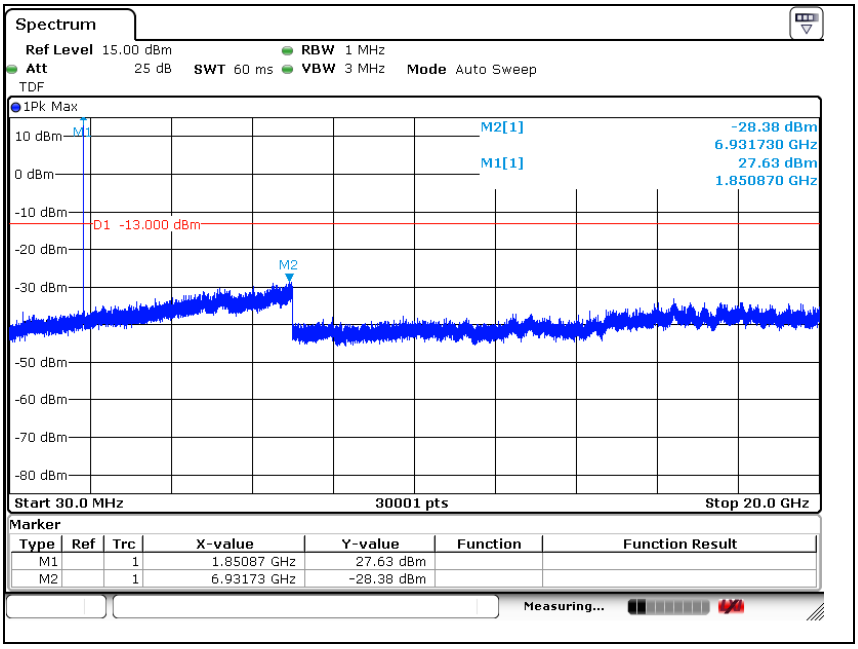
6.3. Test Results

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

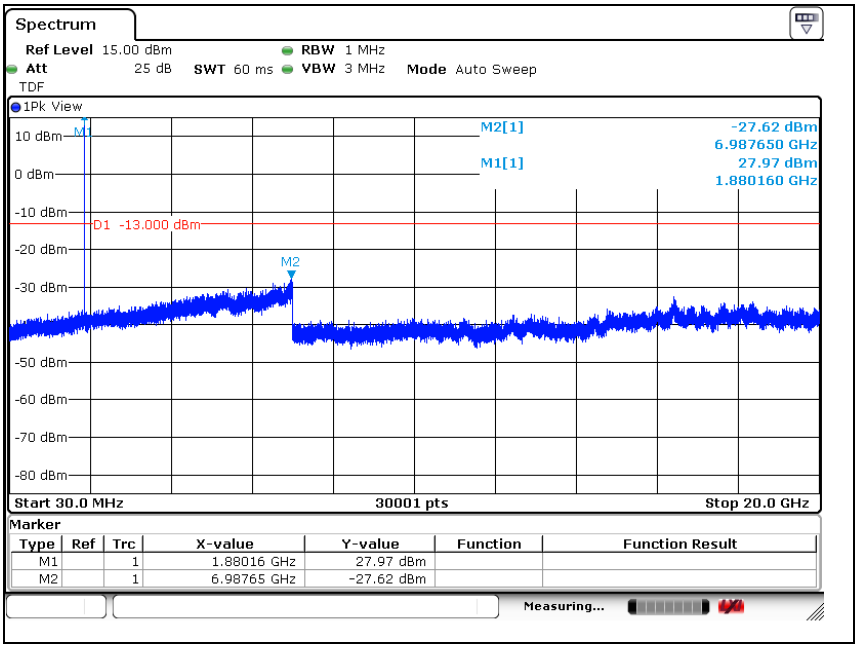
Please refer to the following plots.

LTE band 2 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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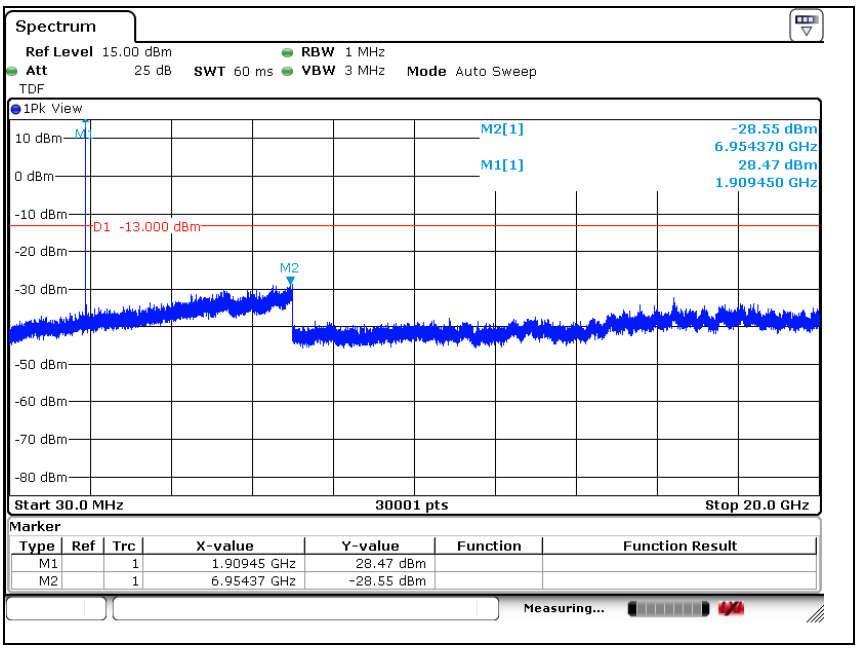
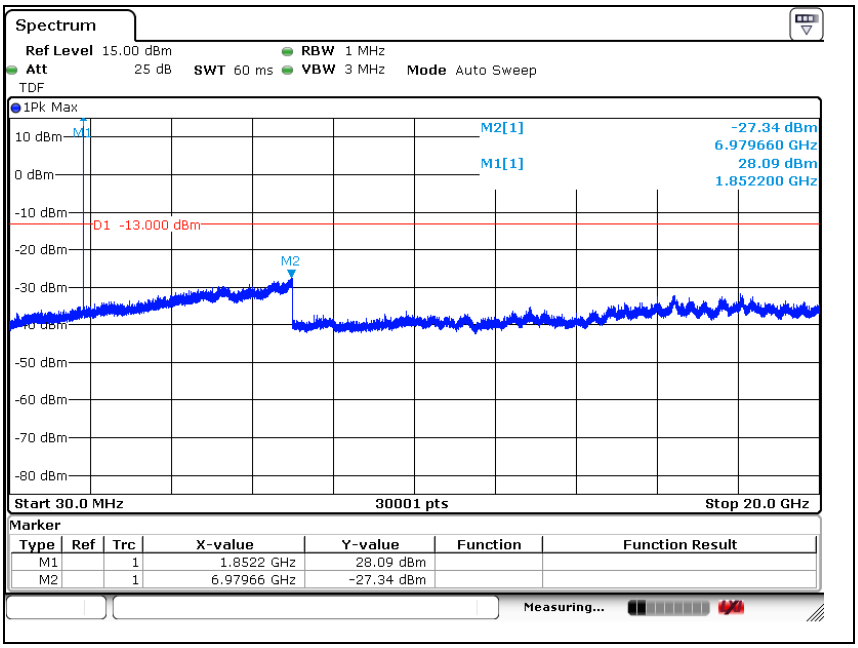
High Channel

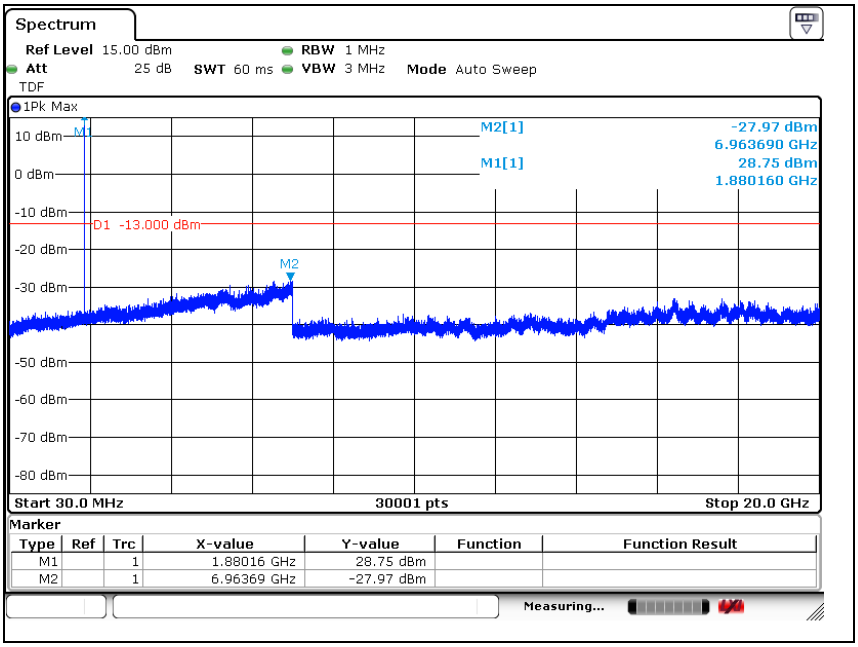


LTE band 2 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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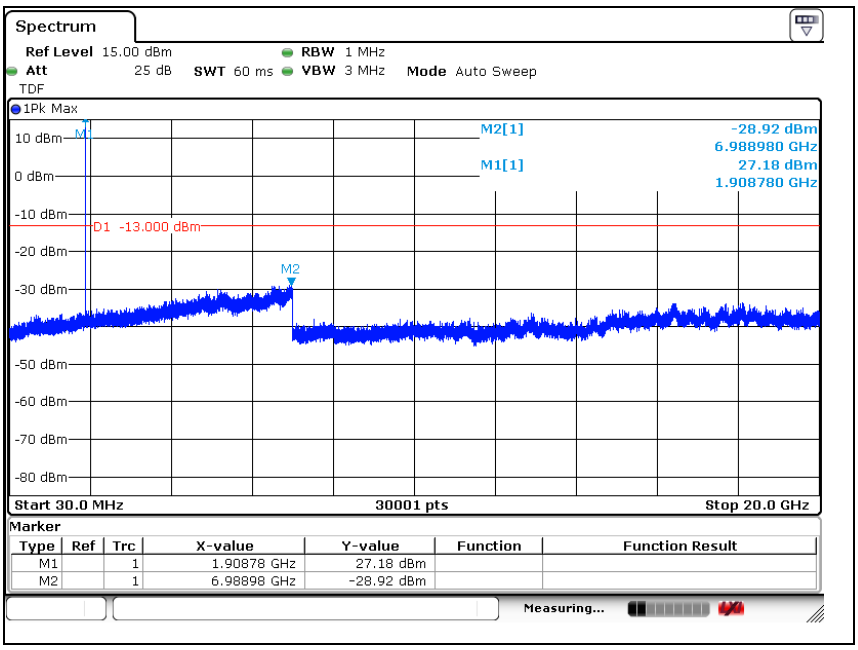
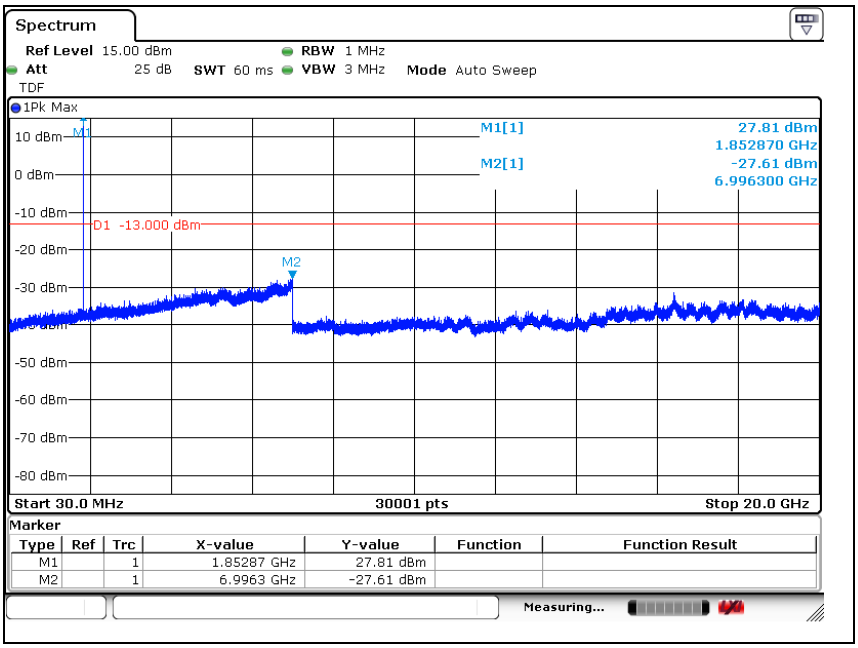
High Channel

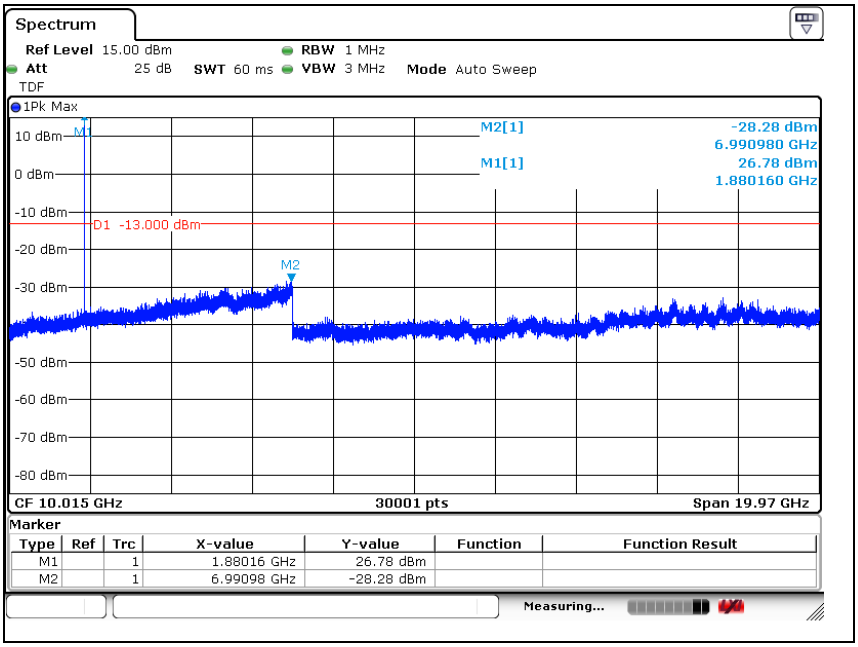


LTE band 2 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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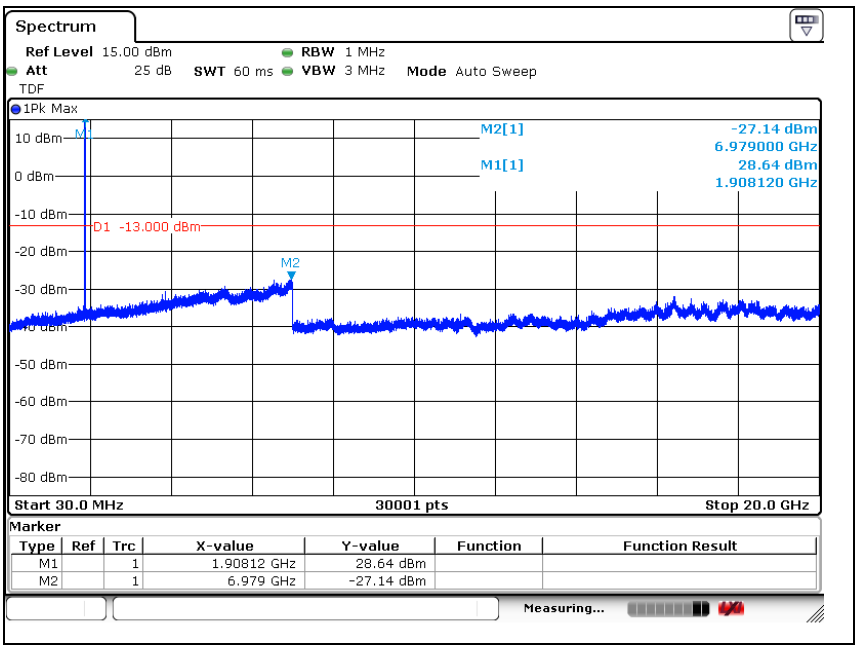
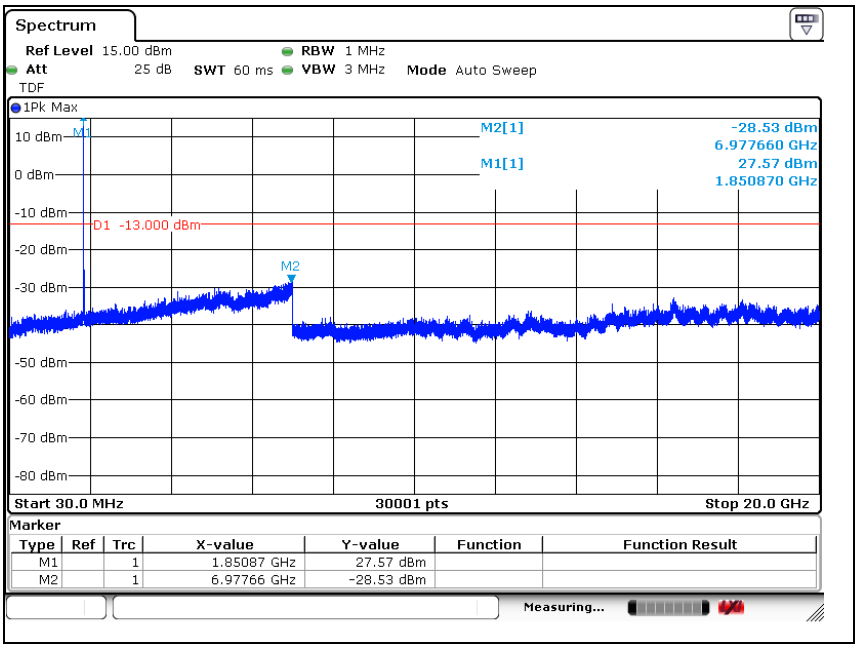
High Channel

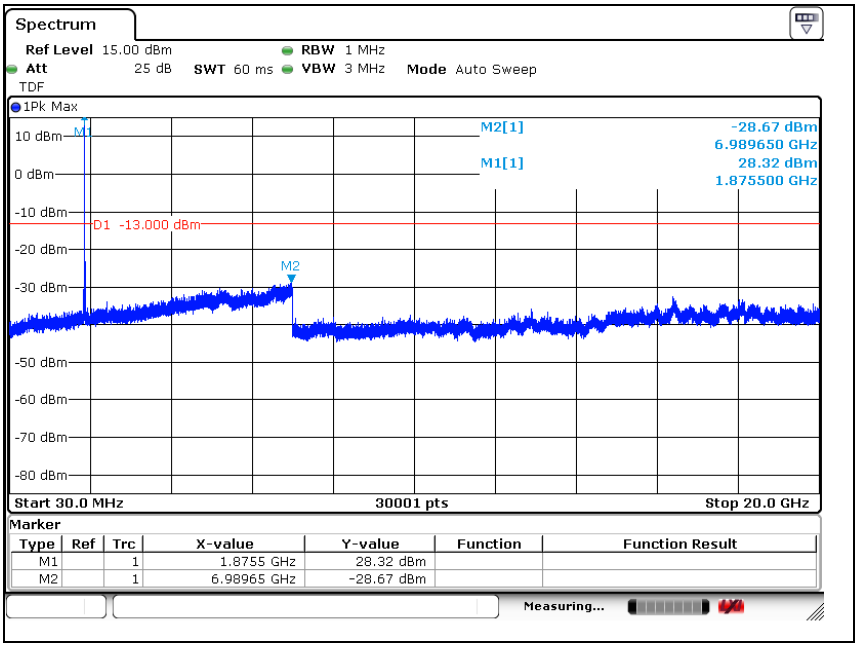


LTE band 2 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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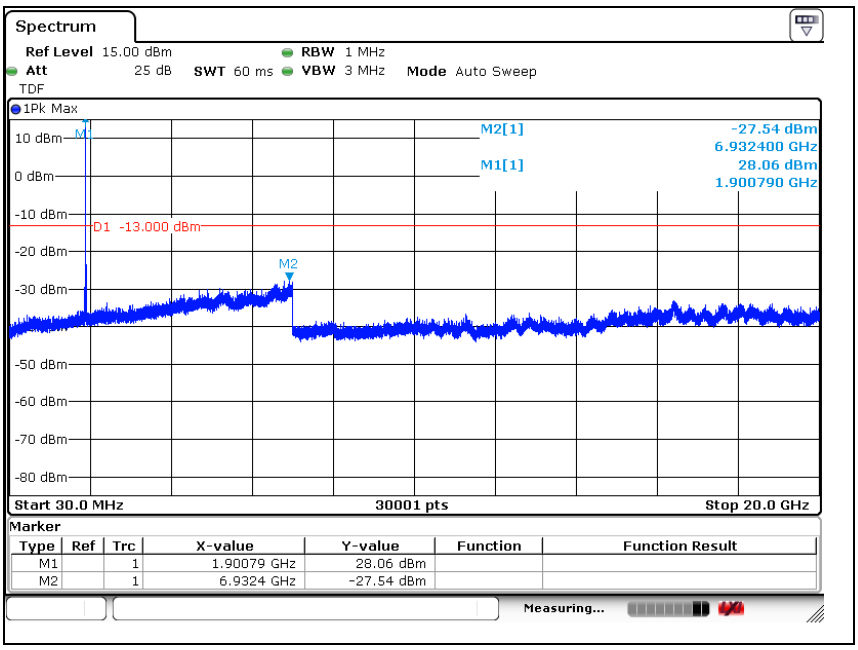
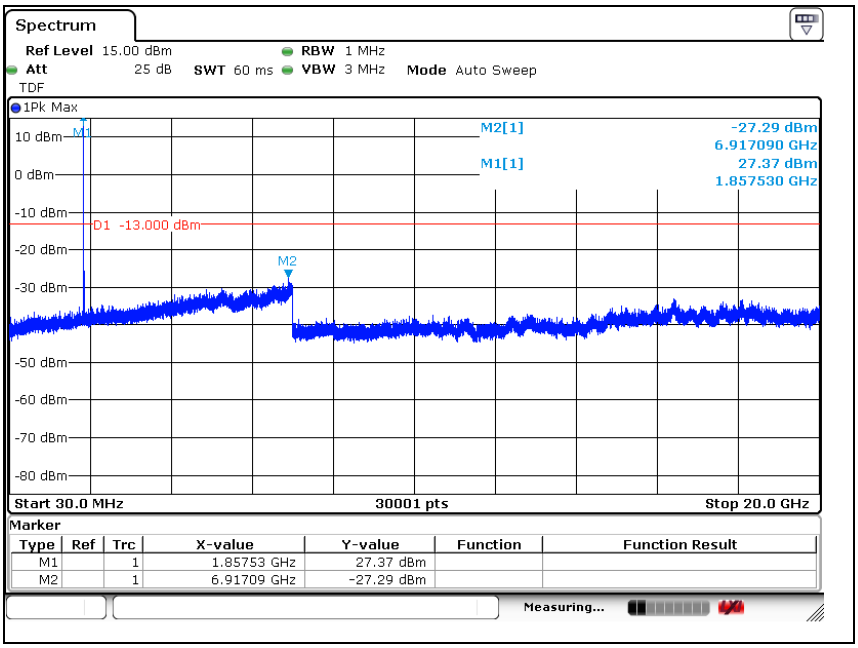
High Channel

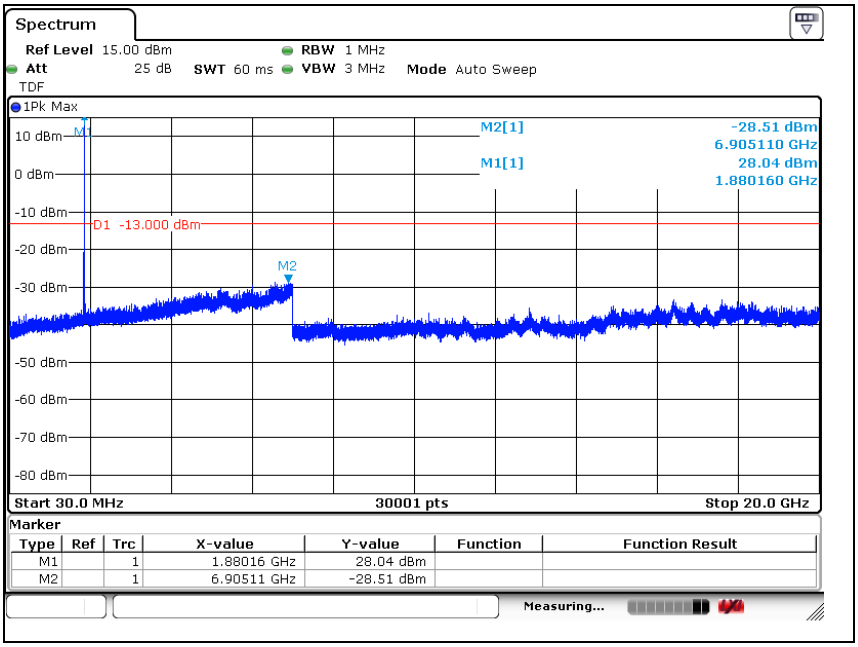


LTE band 2 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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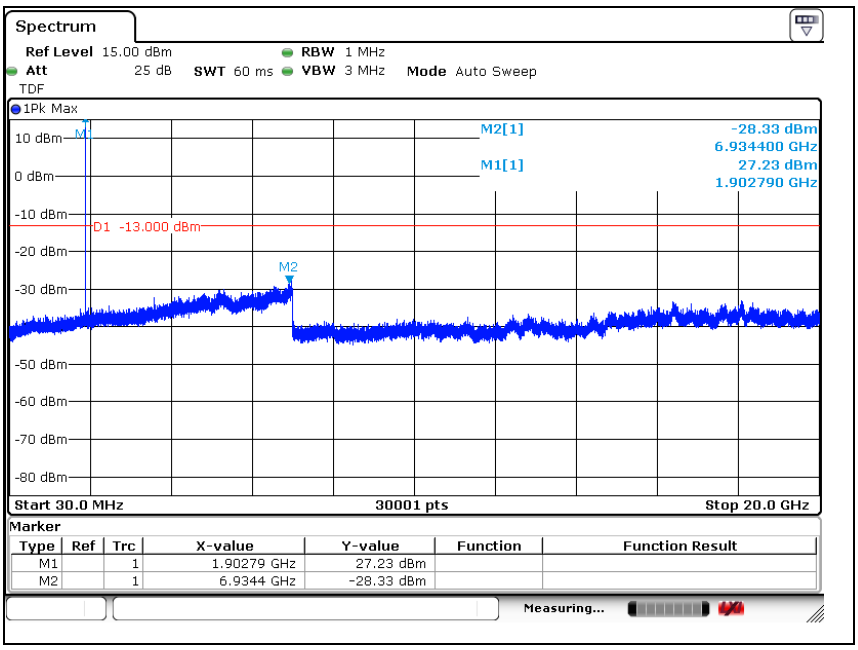
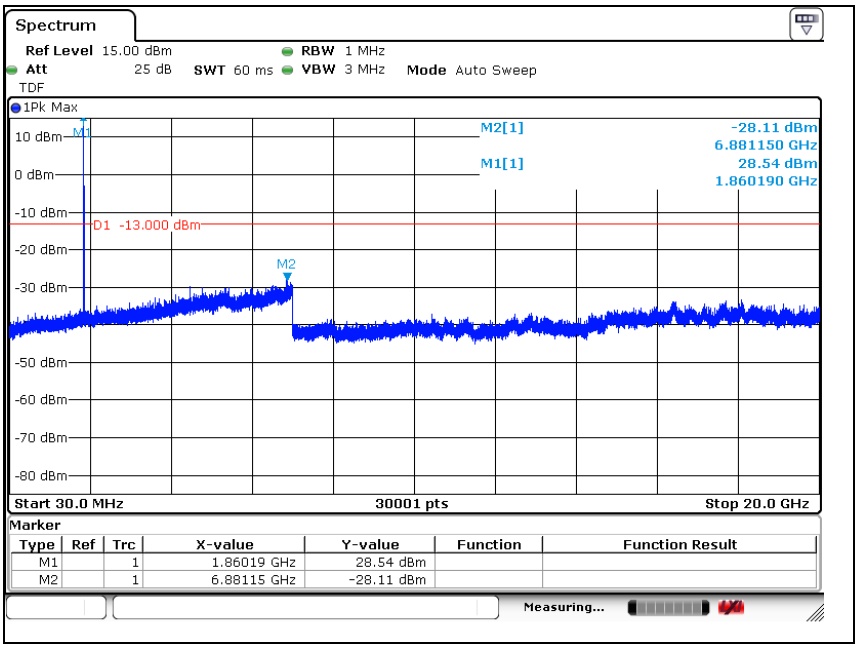
High Channel

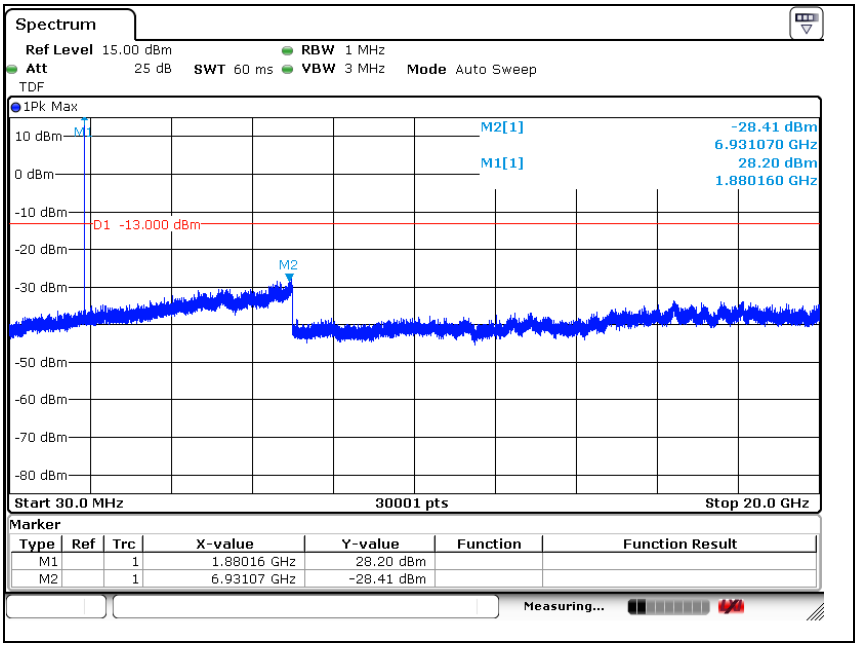


LTE band 2 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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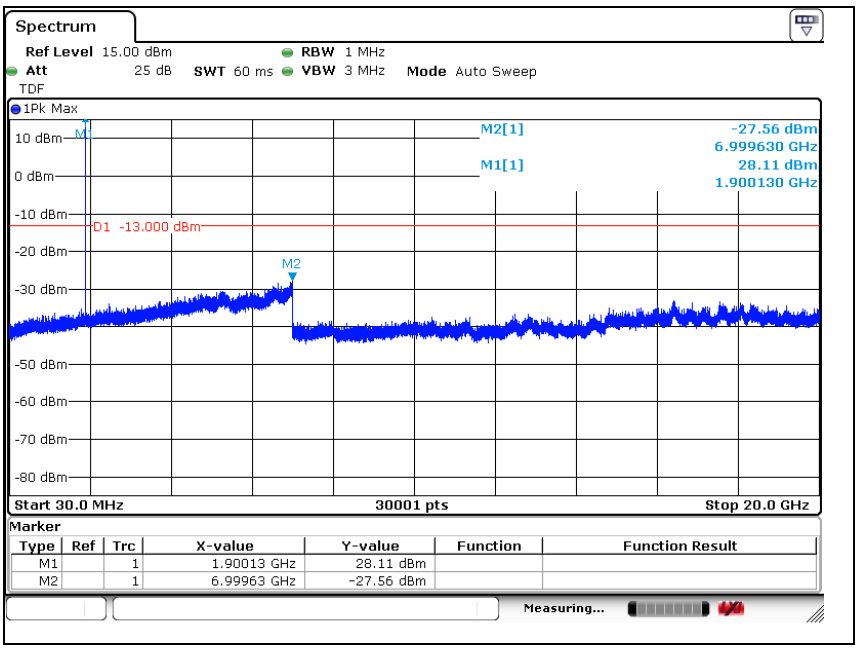
High Channel



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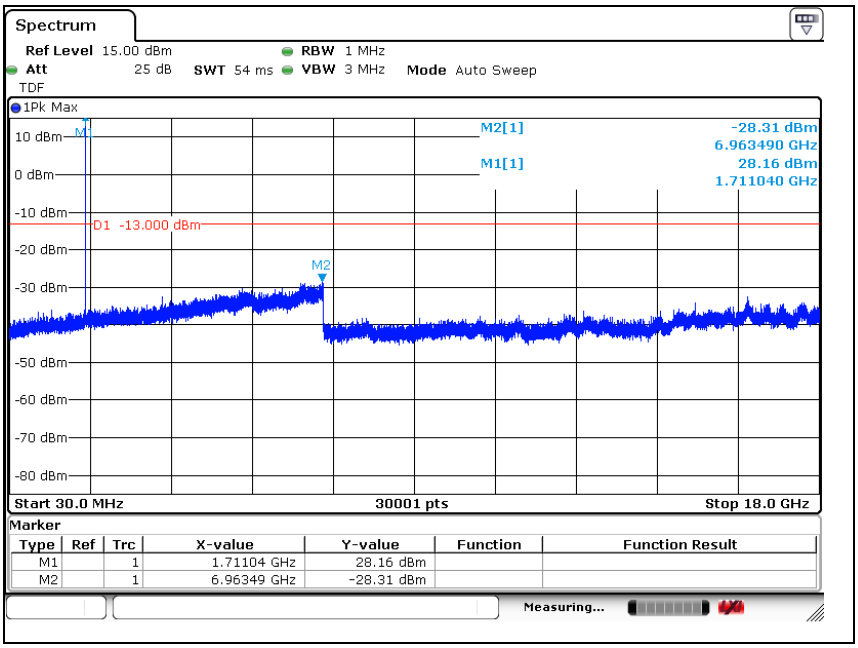
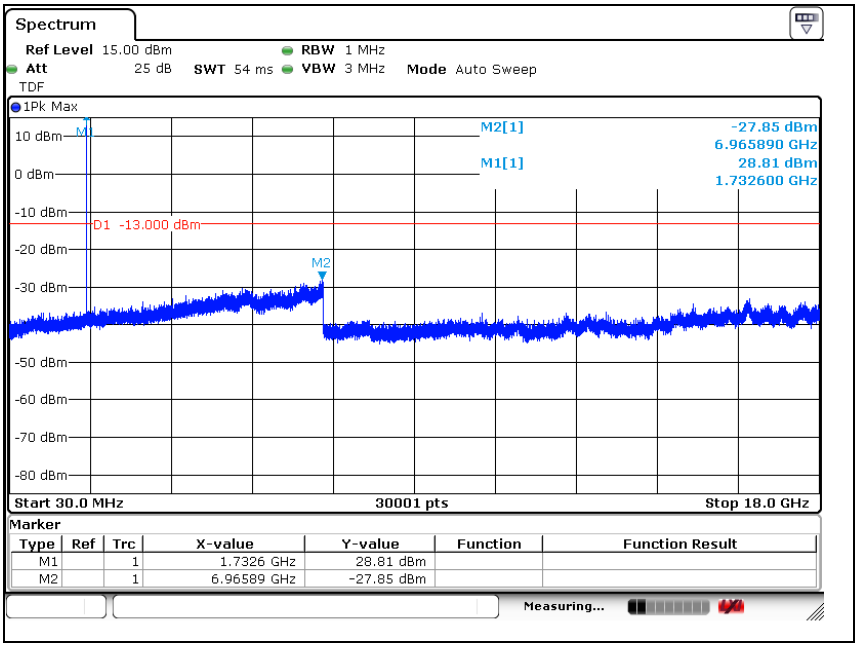
LTE band 4 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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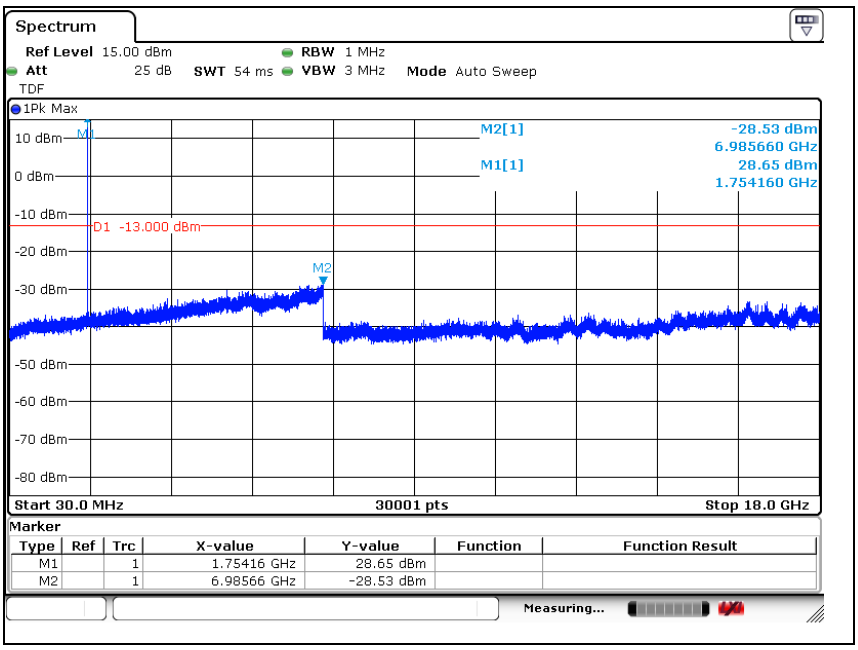
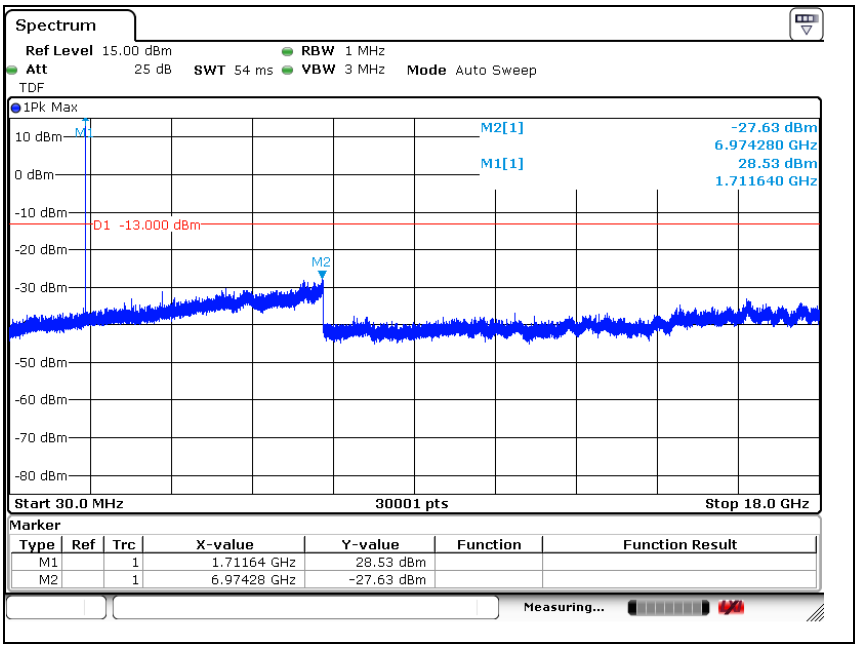
High Channel

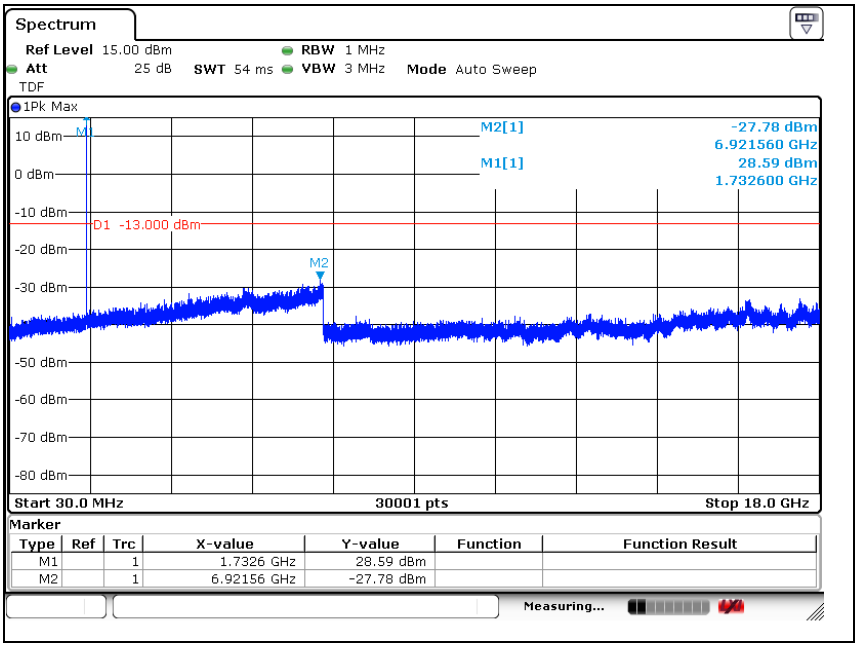


LTE band 4 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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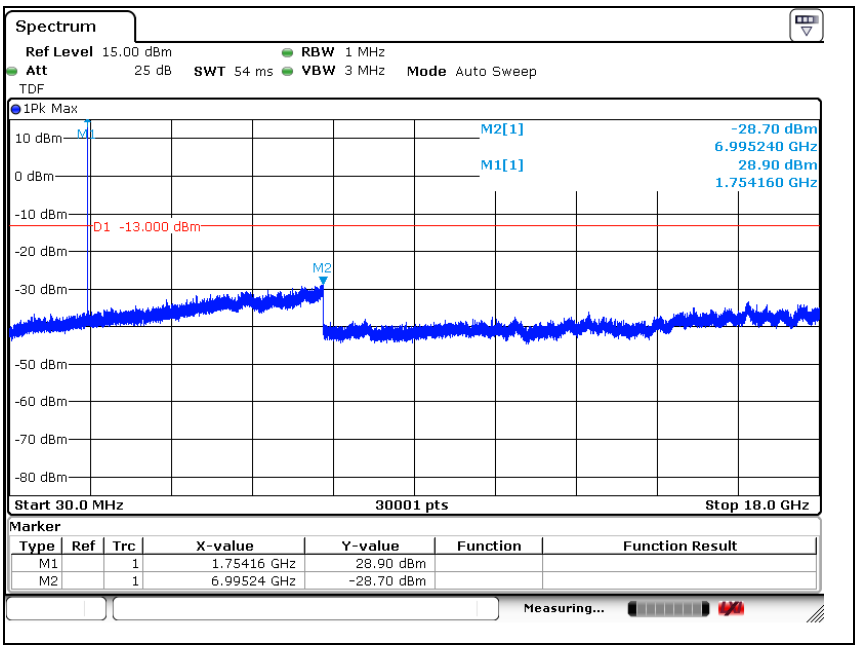
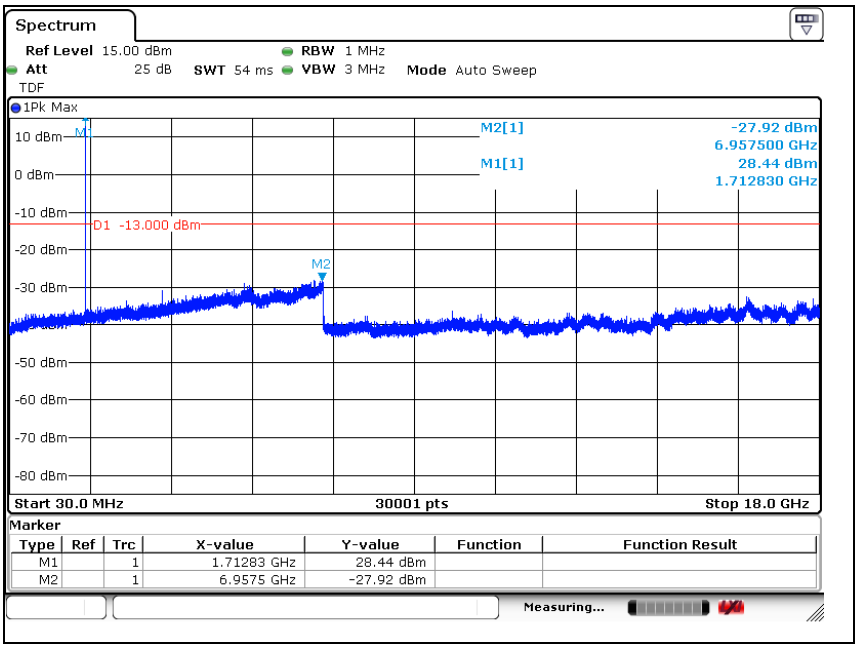
High Channel

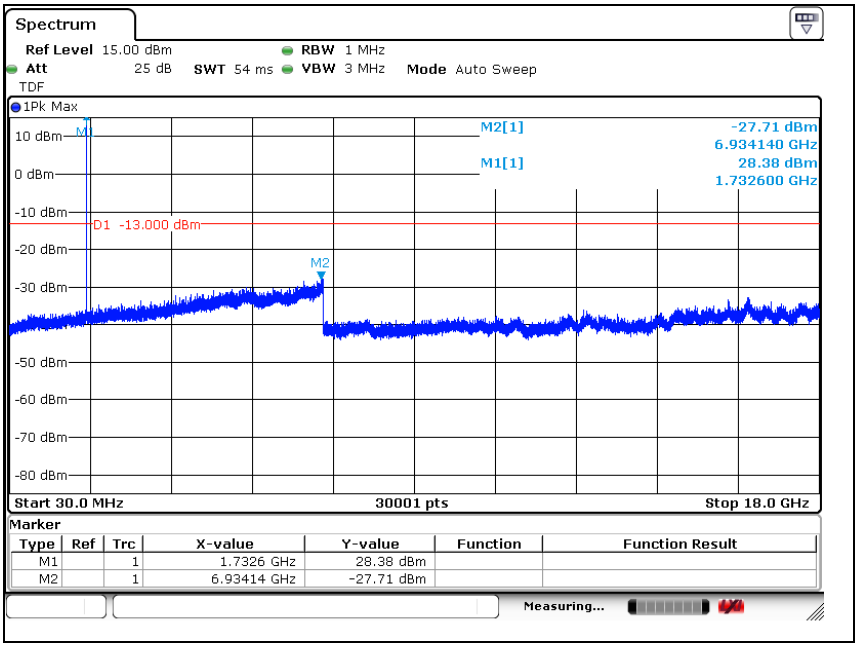


LTE band 4 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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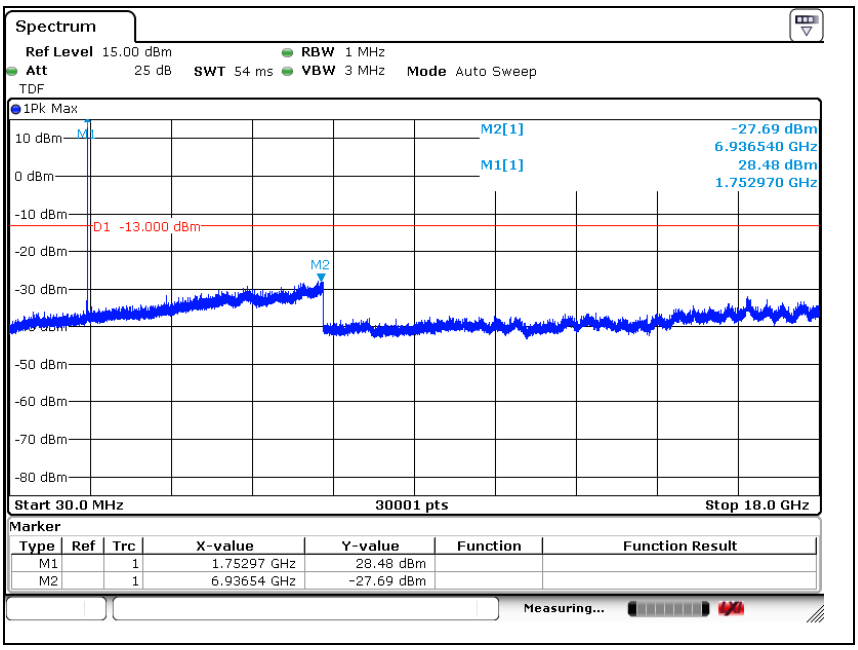
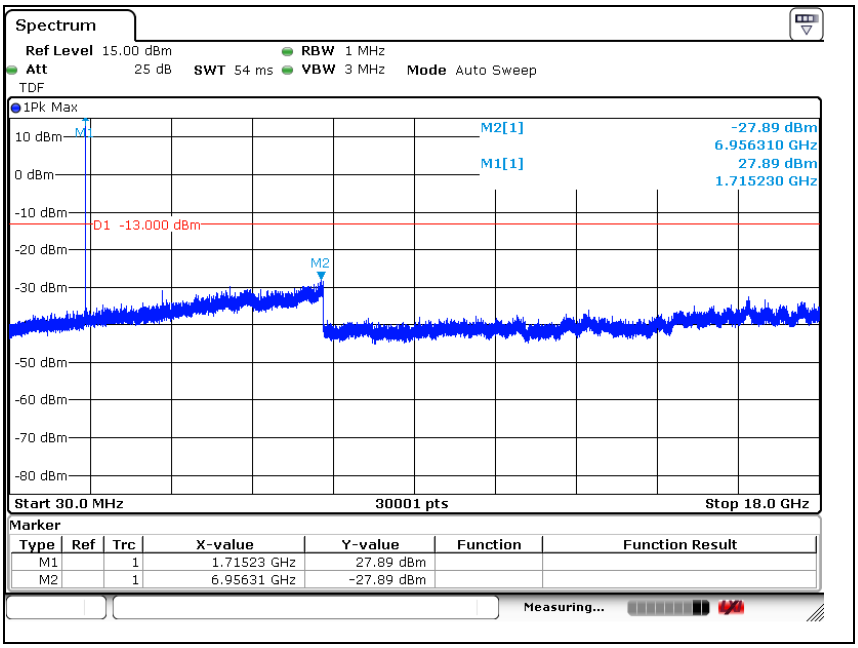
High Channel

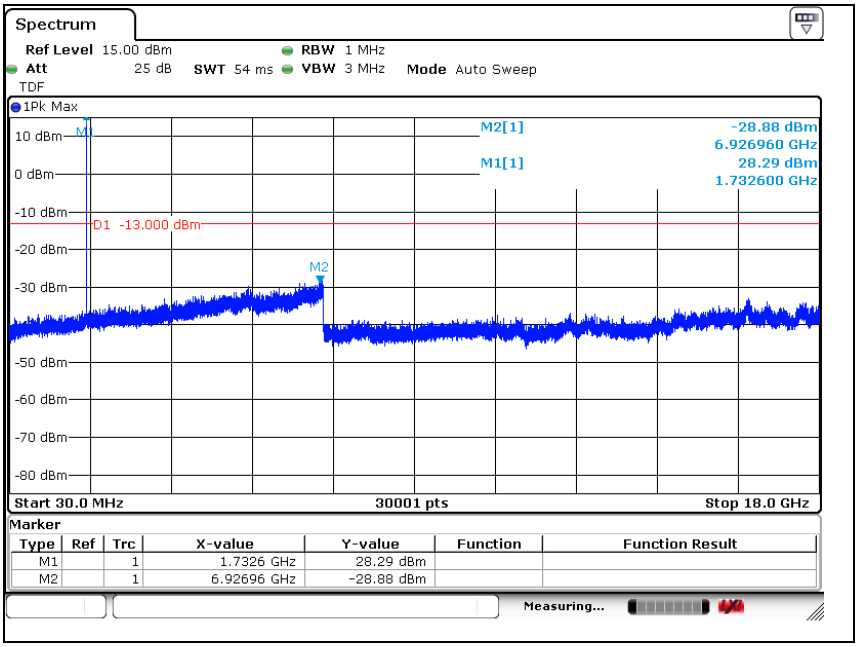


LTE band 4 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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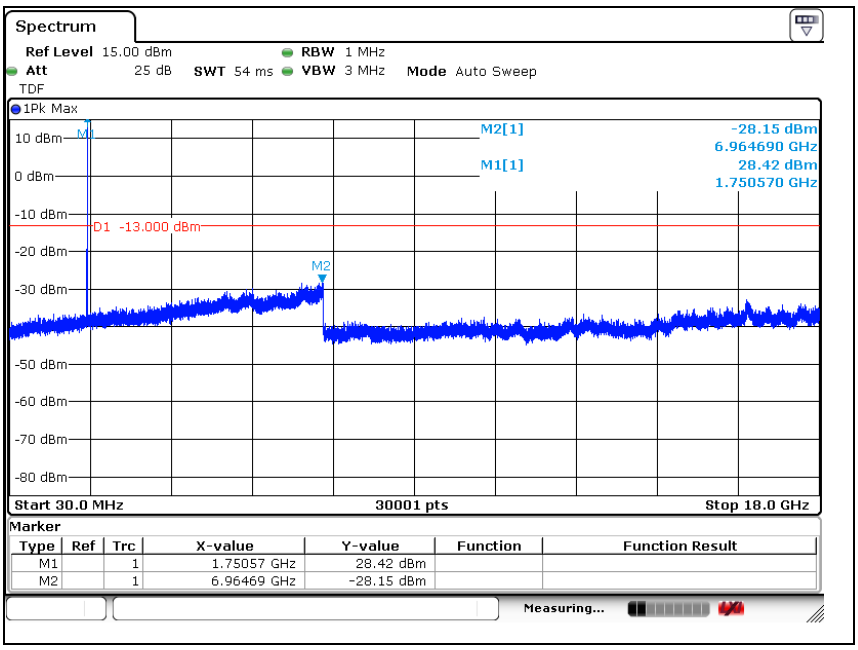
High Channel



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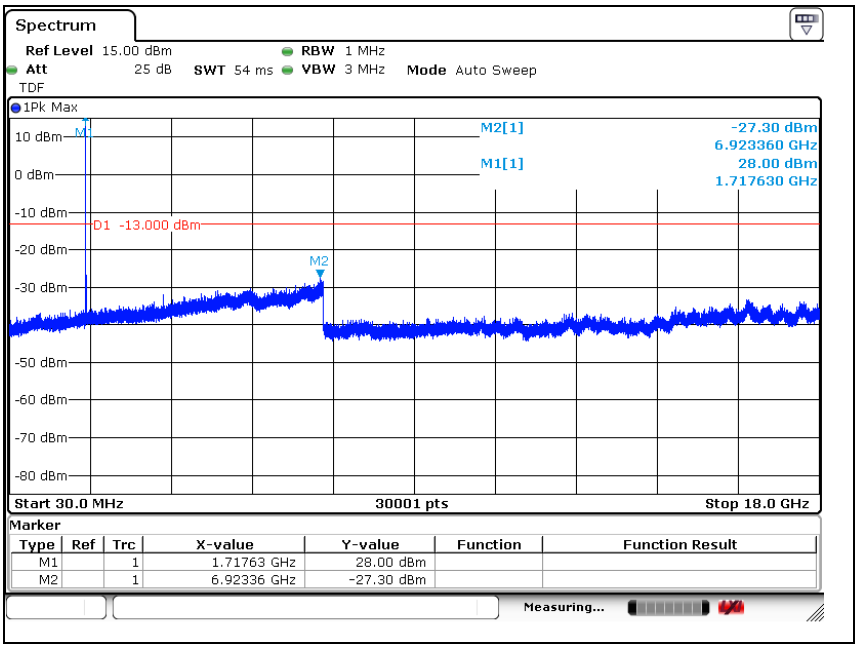
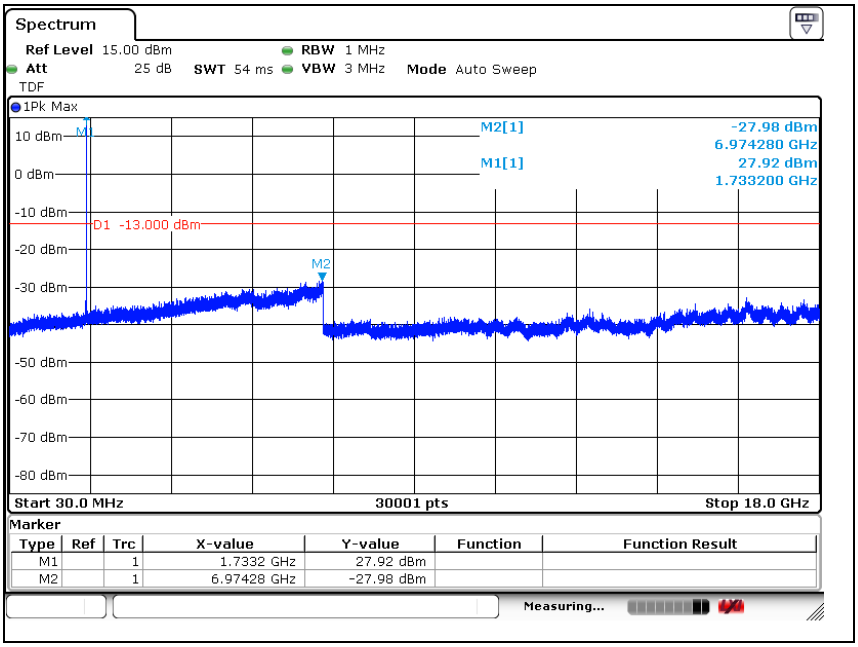
LTE band 4 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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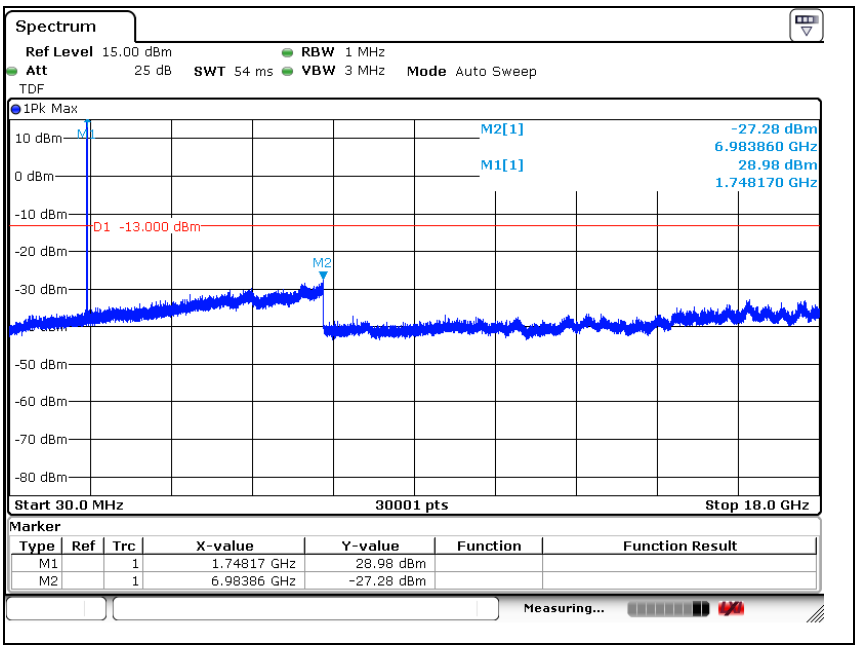
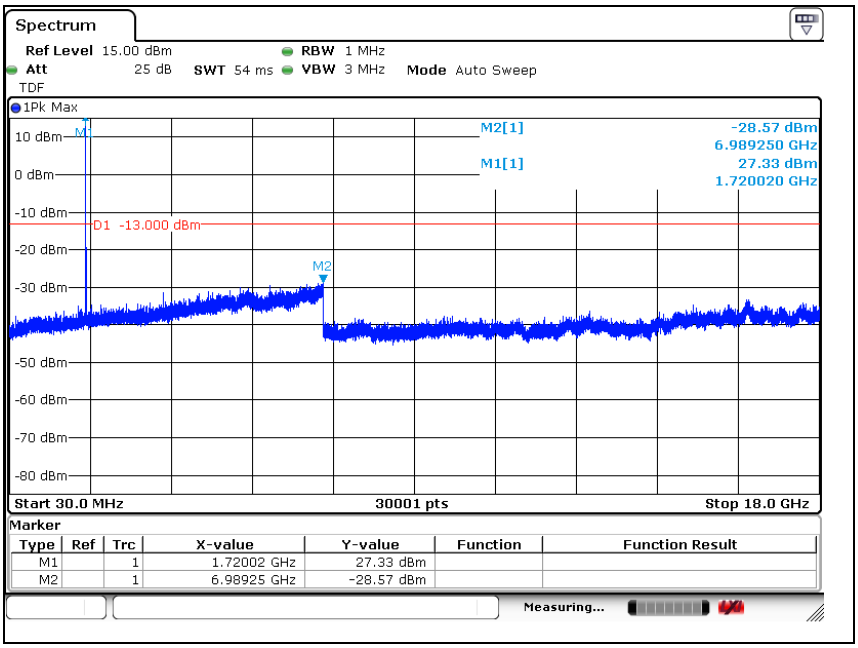
High Channel

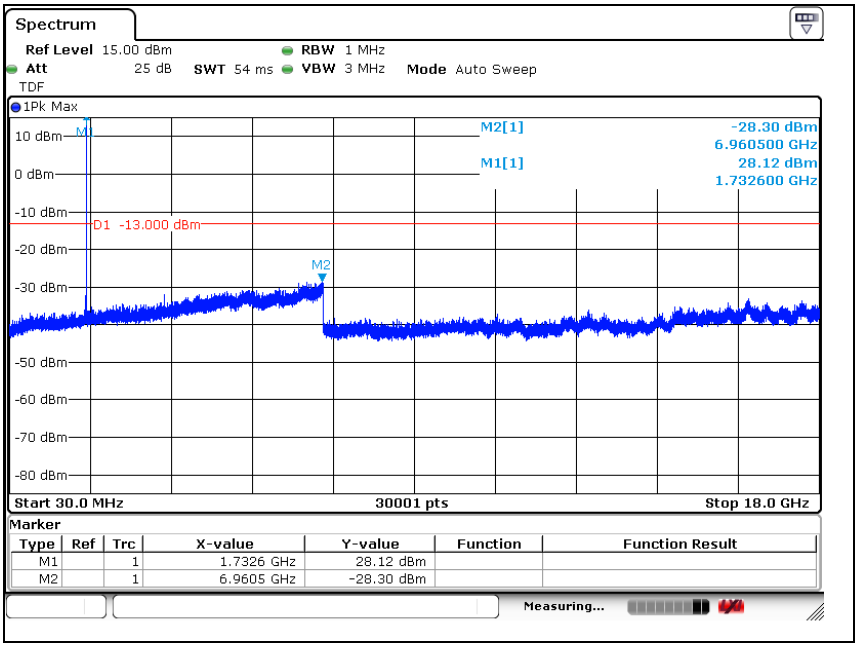


LTE band 4 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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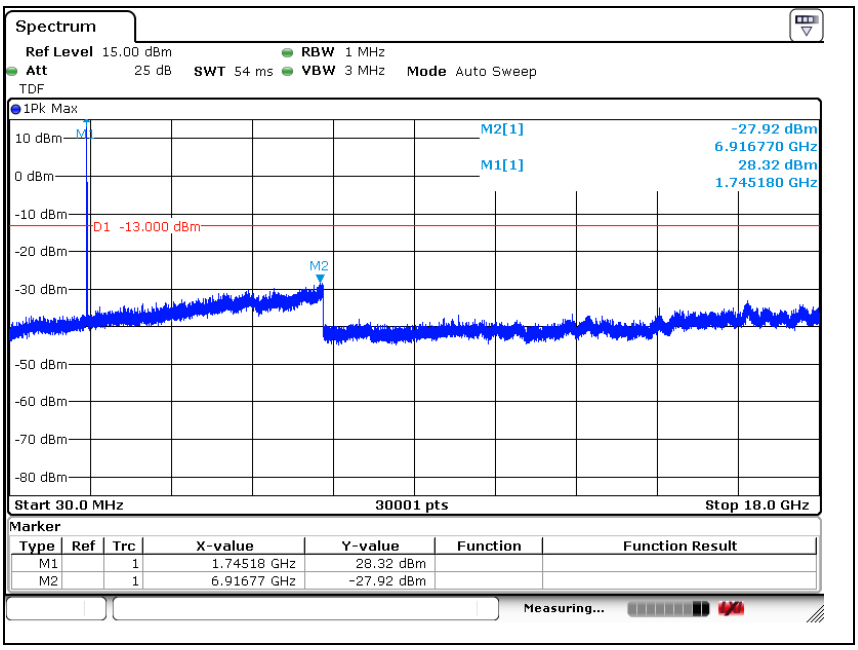
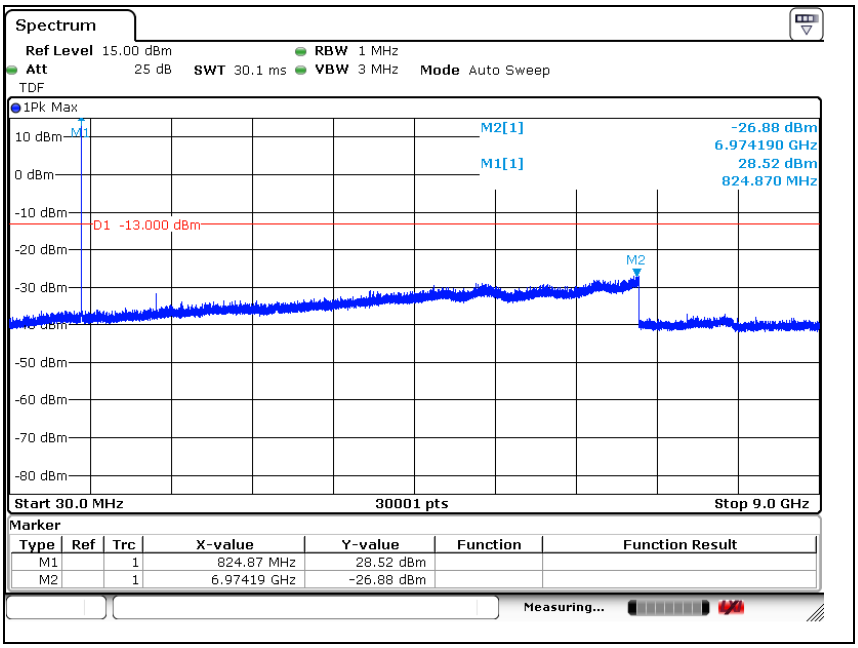
High Channel

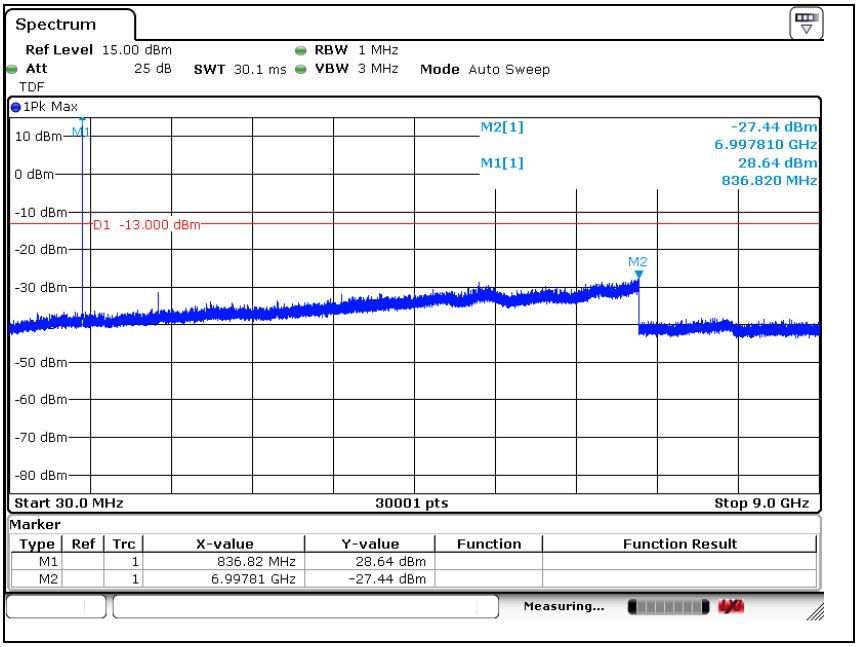


LTE band 5 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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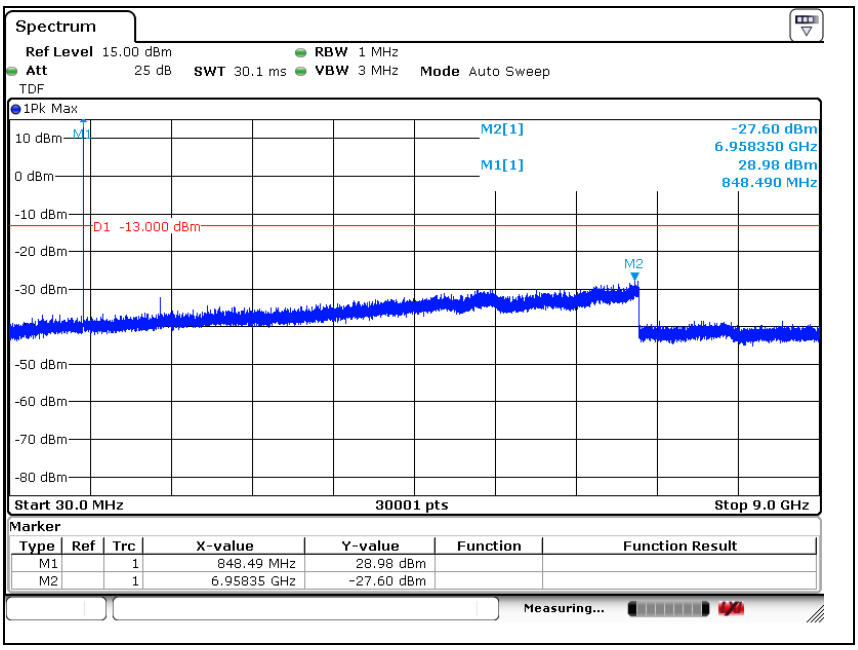
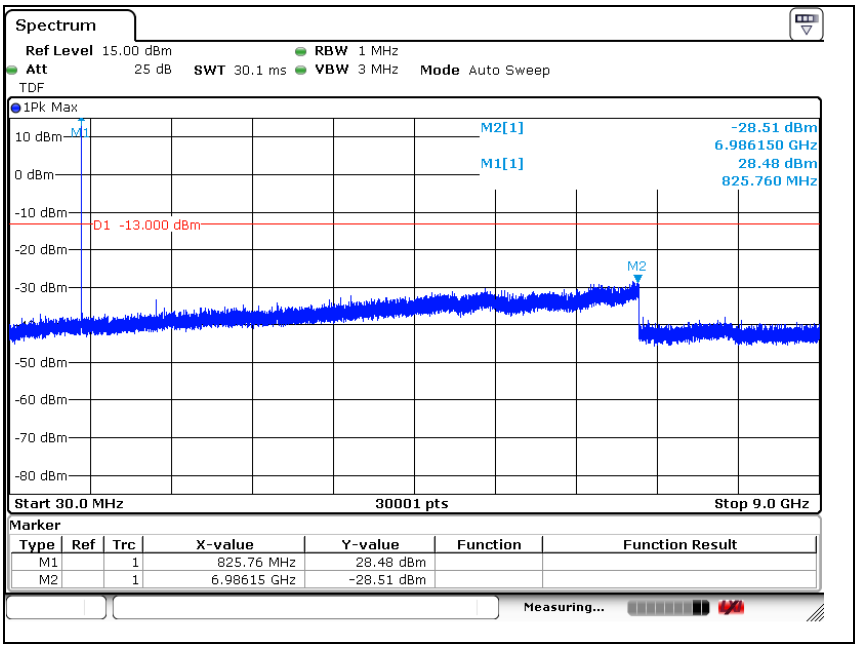
High Channel

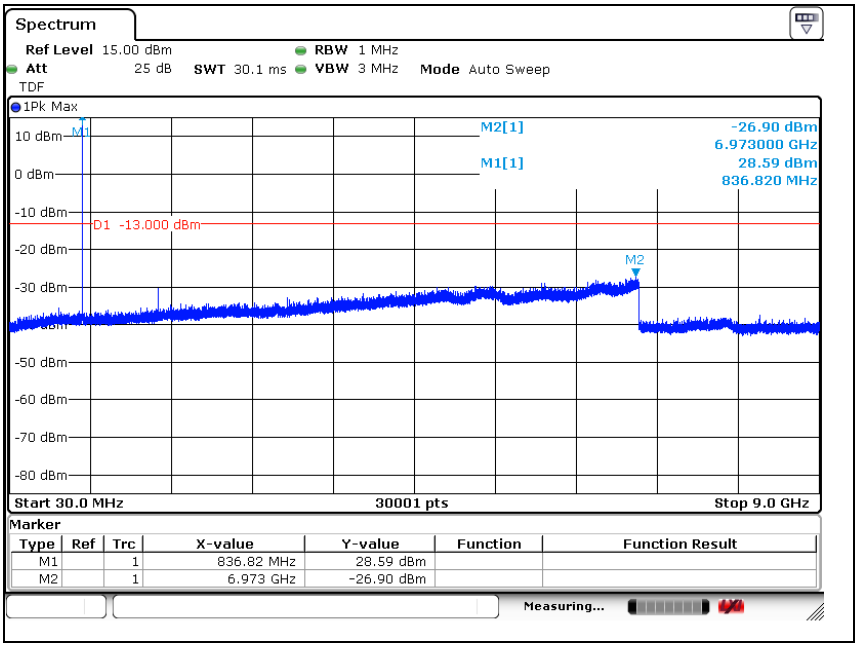


LTE band 5 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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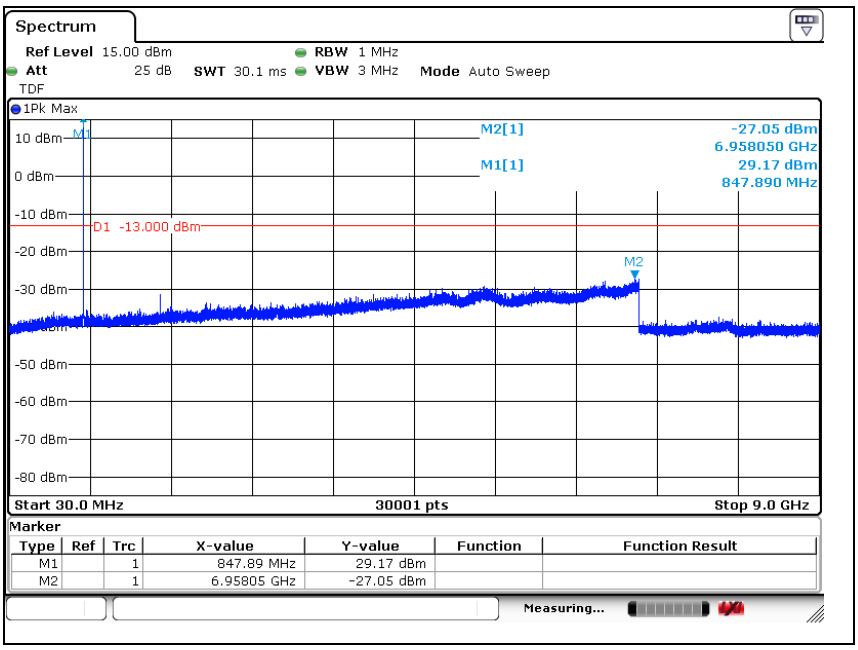
High Channel



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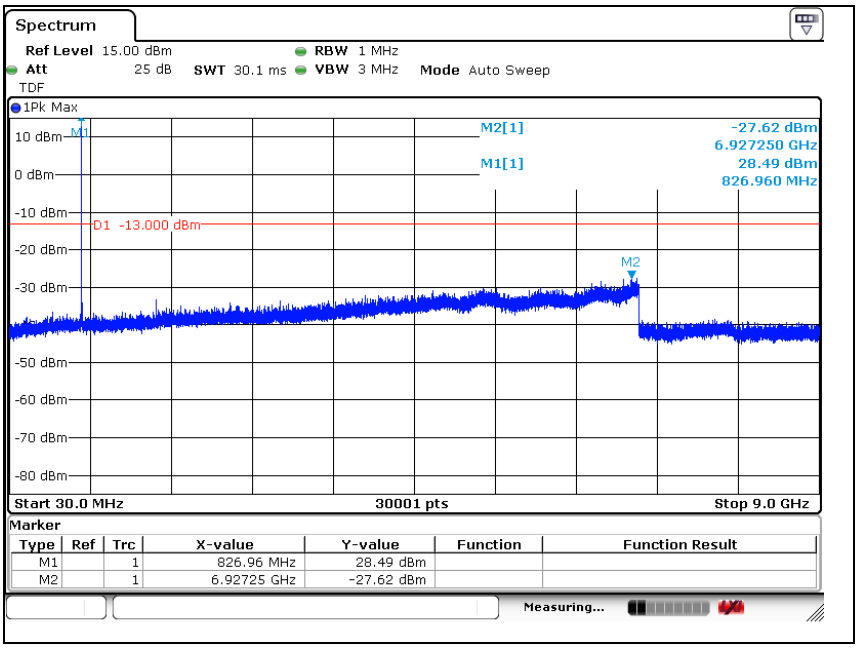
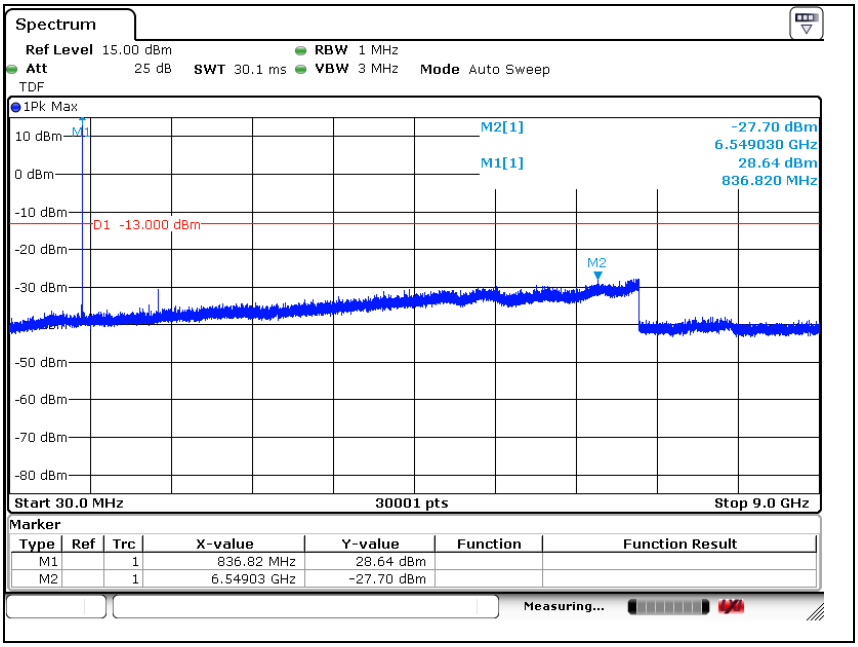
LTE band 5 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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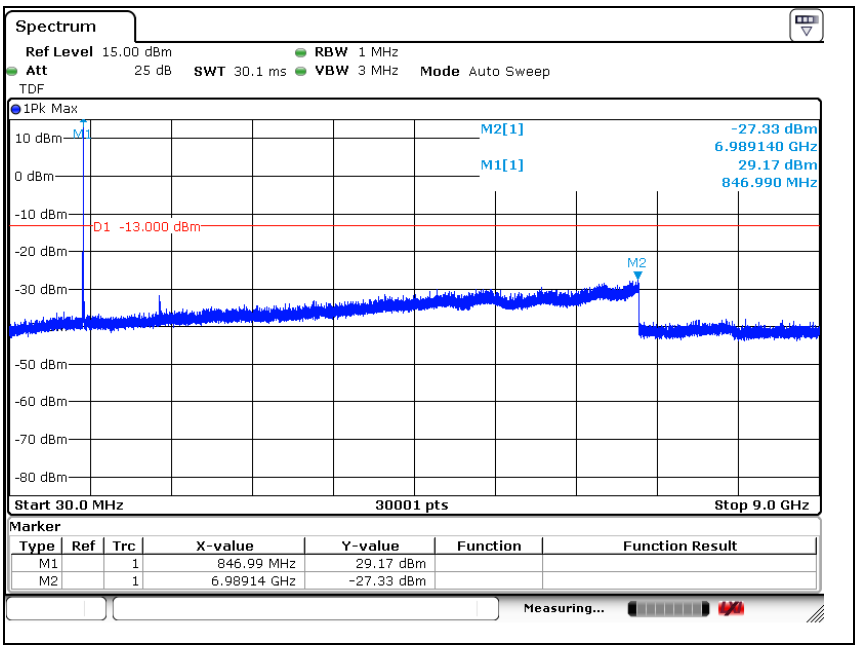
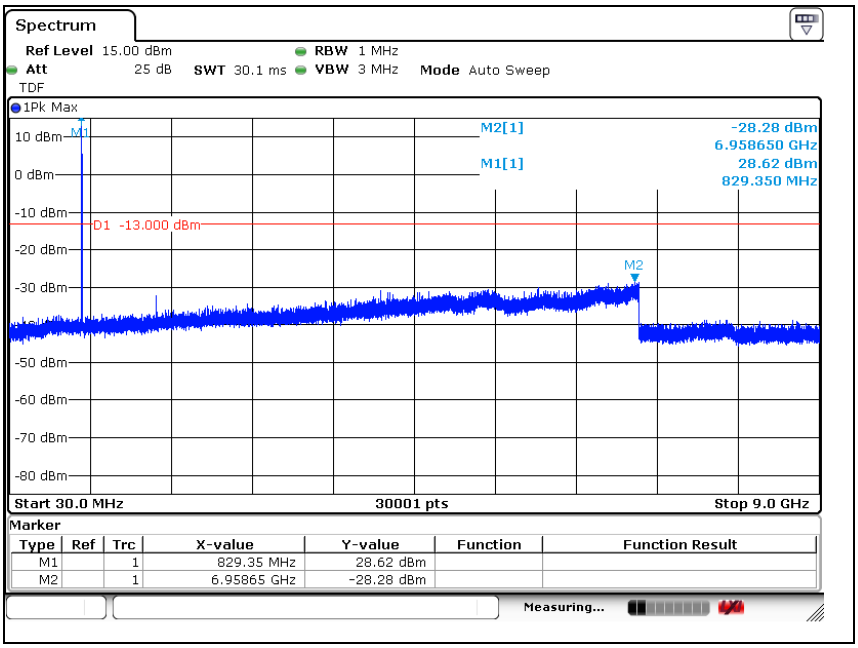
High Channel

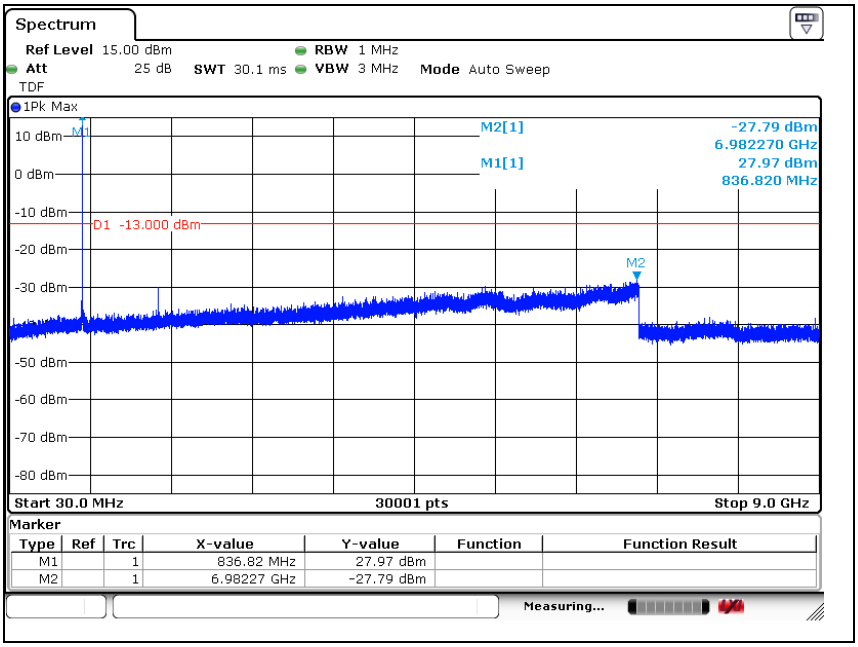


LTE band 5 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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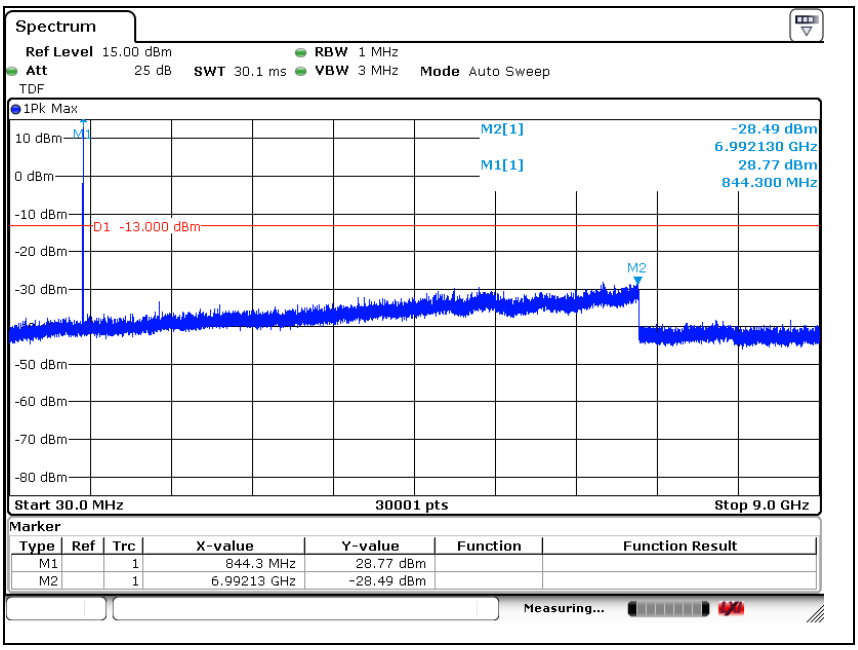
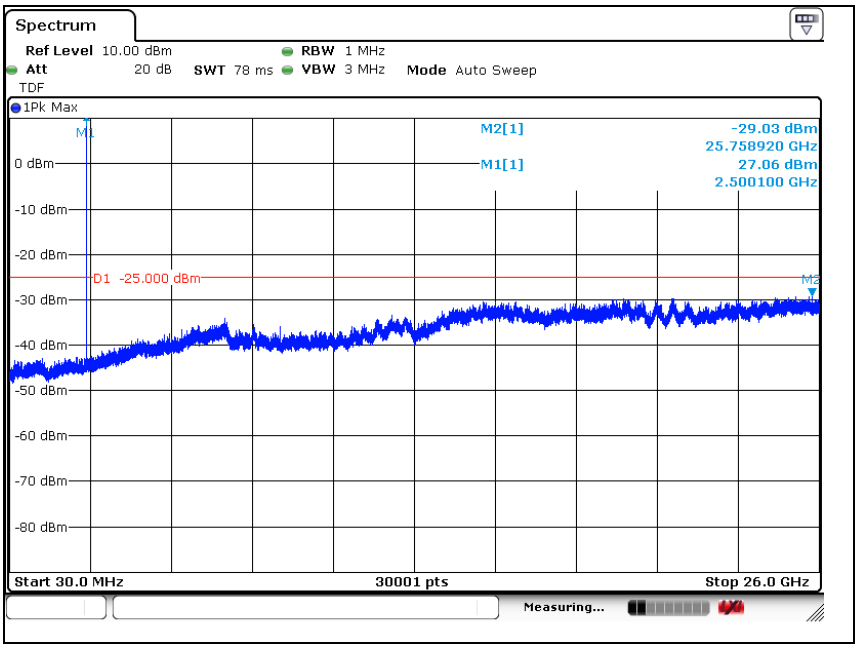
High Channel

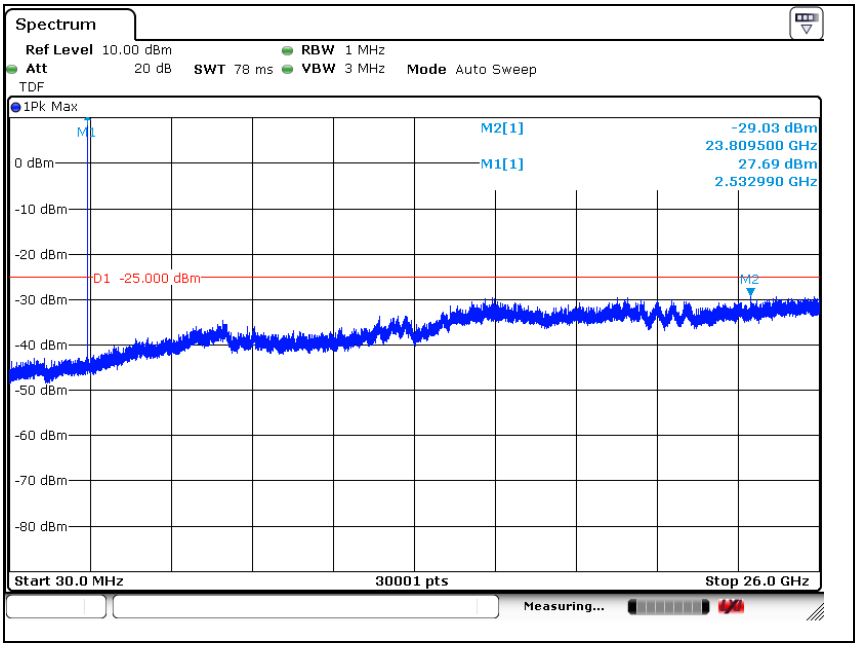


LTE band 7 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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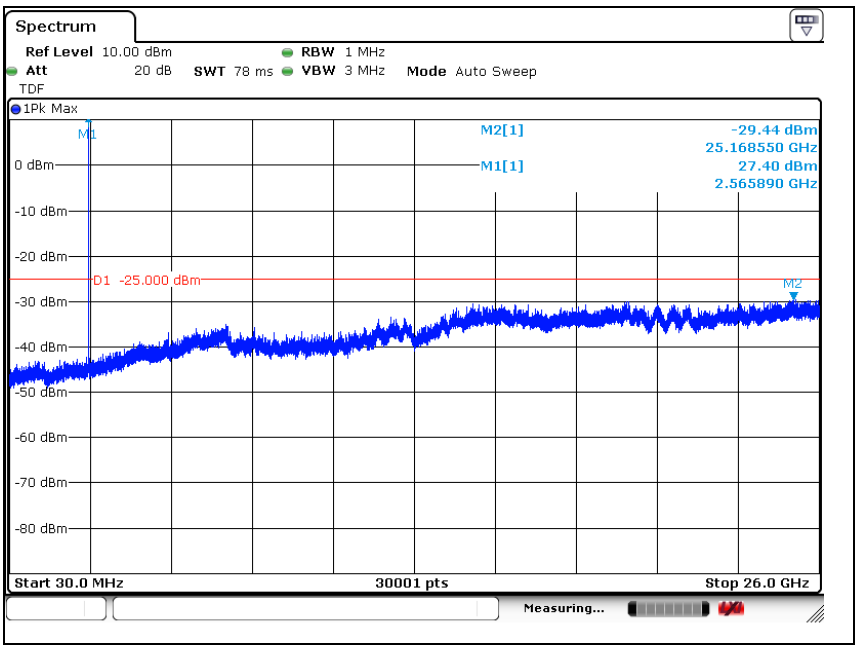
High Channel



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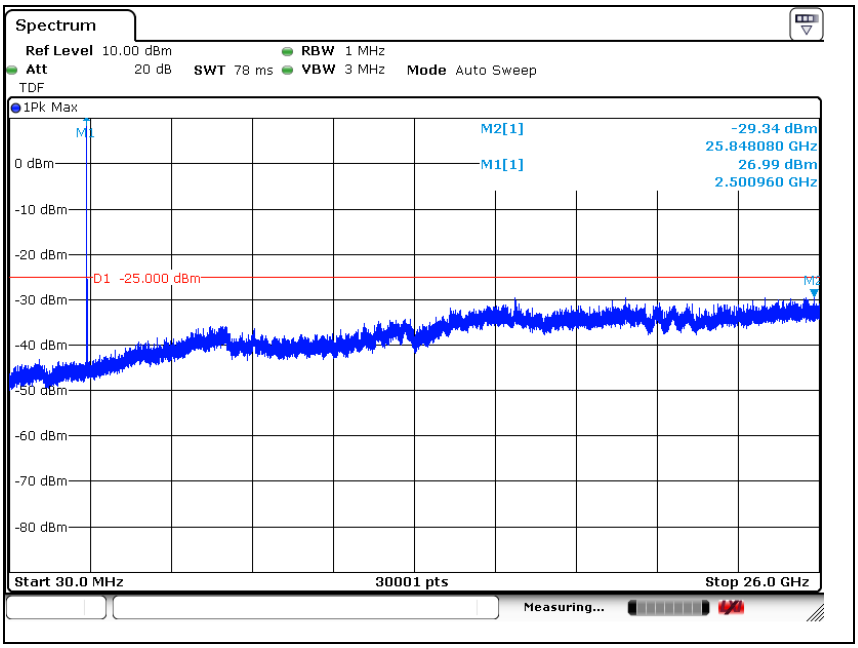
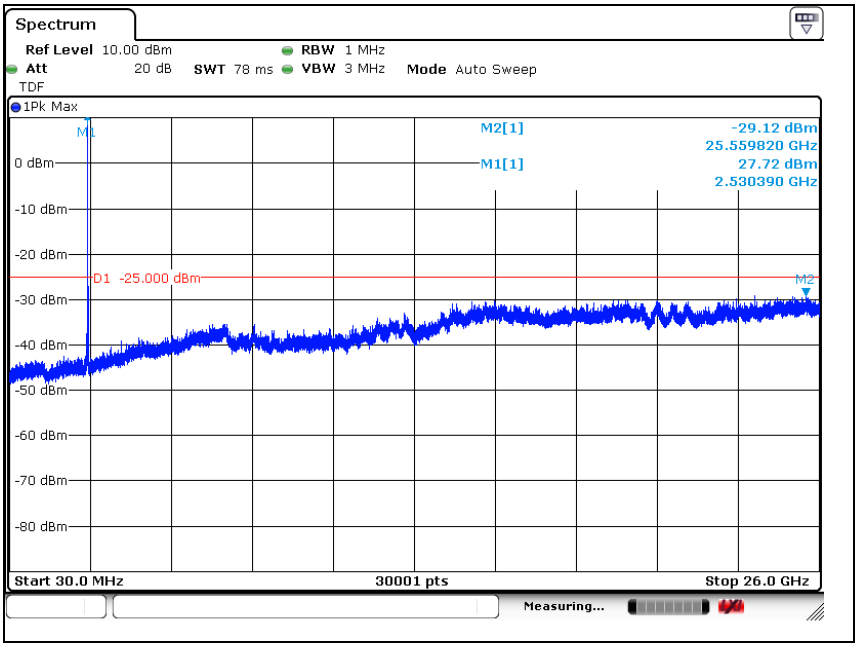
LTE band 7 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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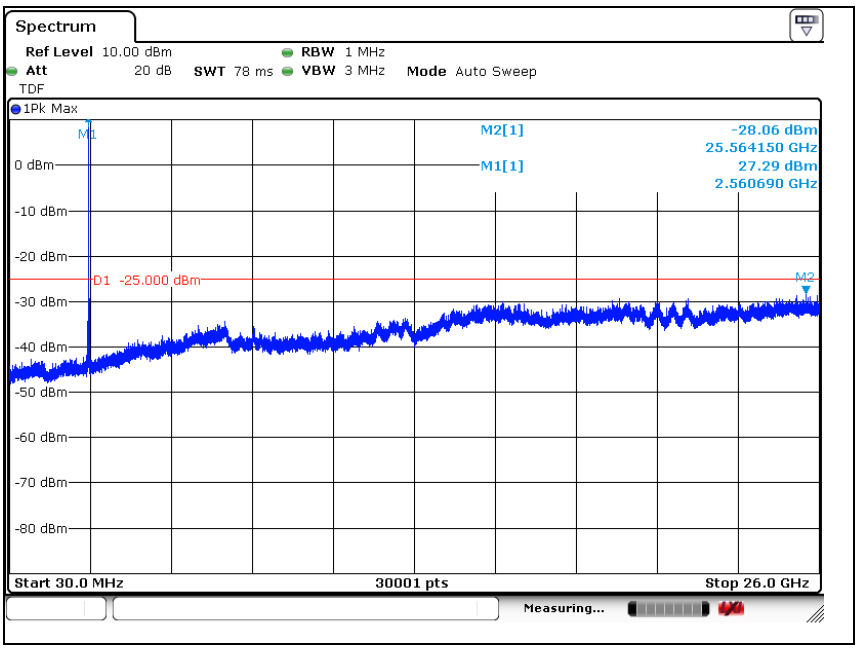
High Channel



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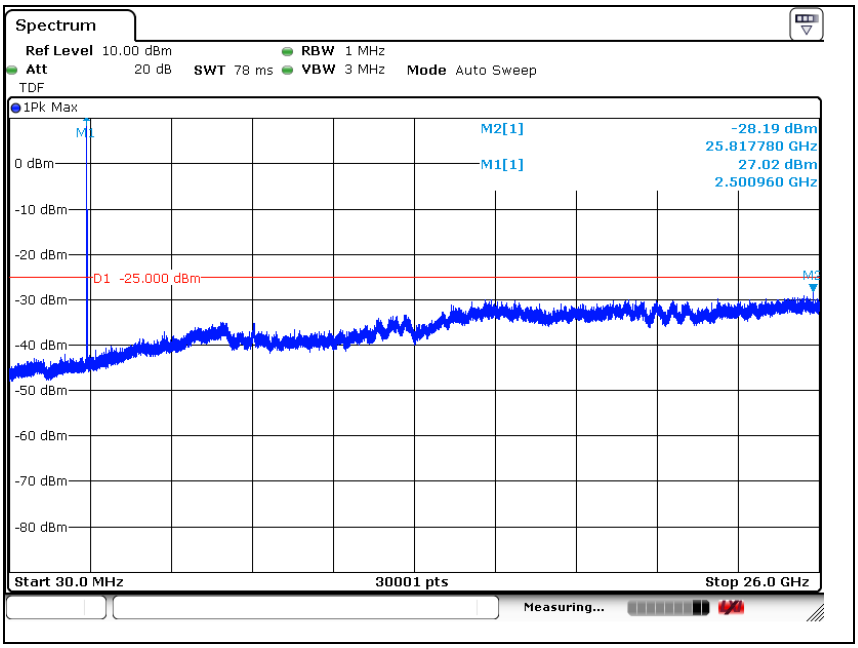
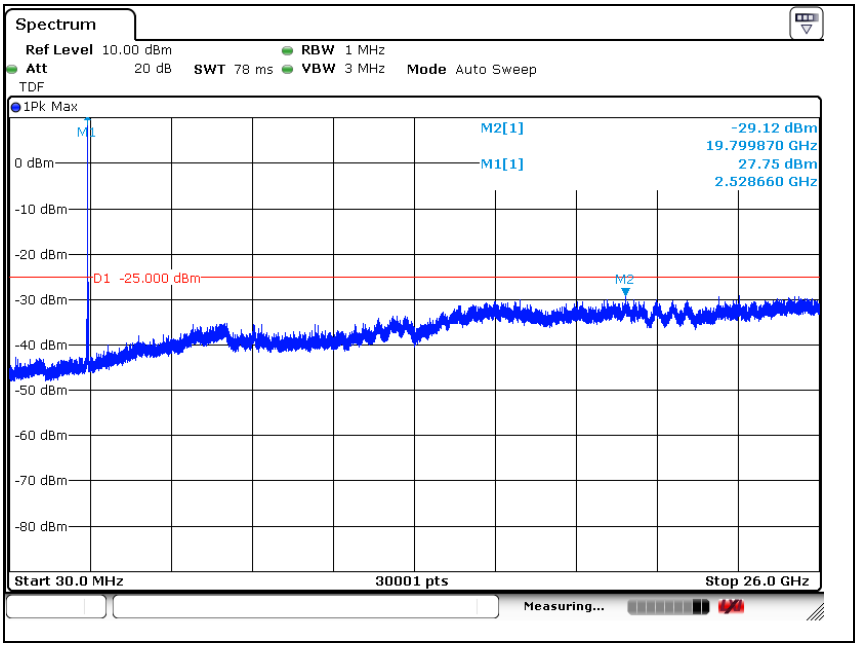
LTE band 7 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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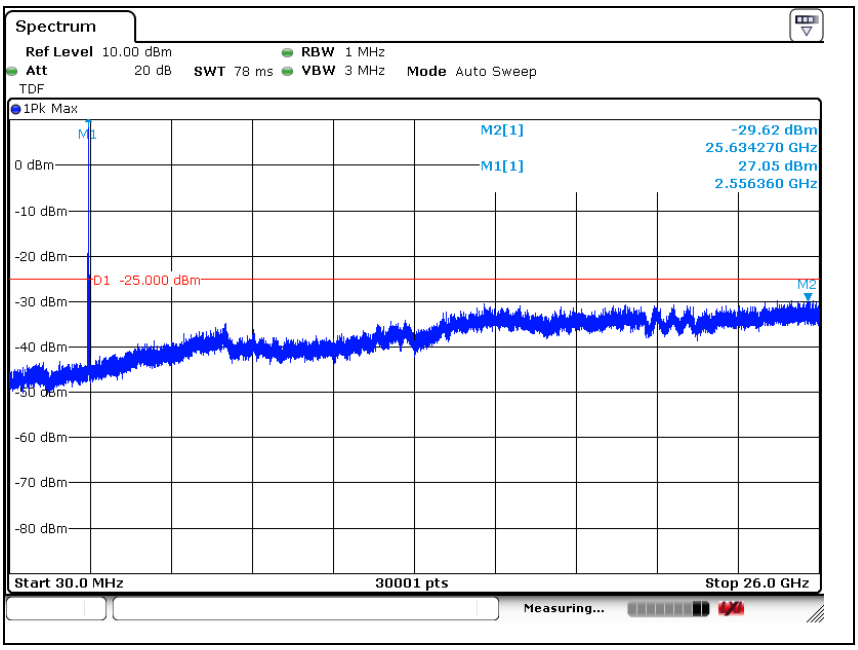
High Channel



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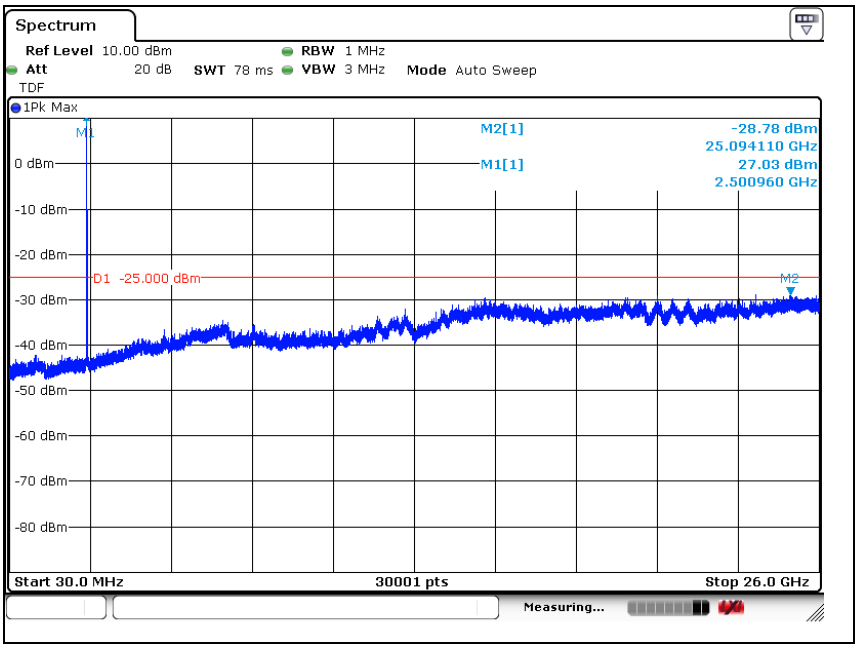
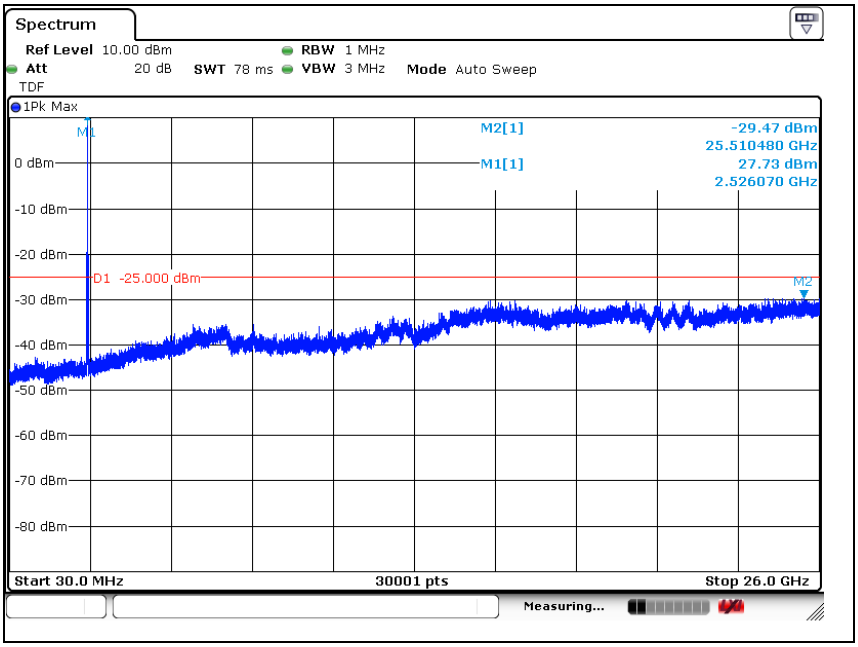
LTE band 7 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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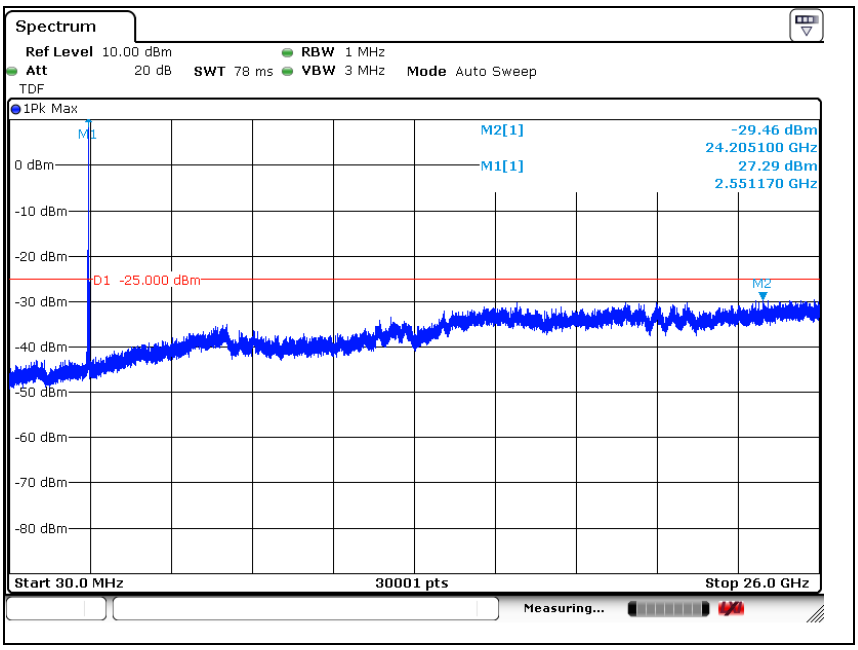
High Channel



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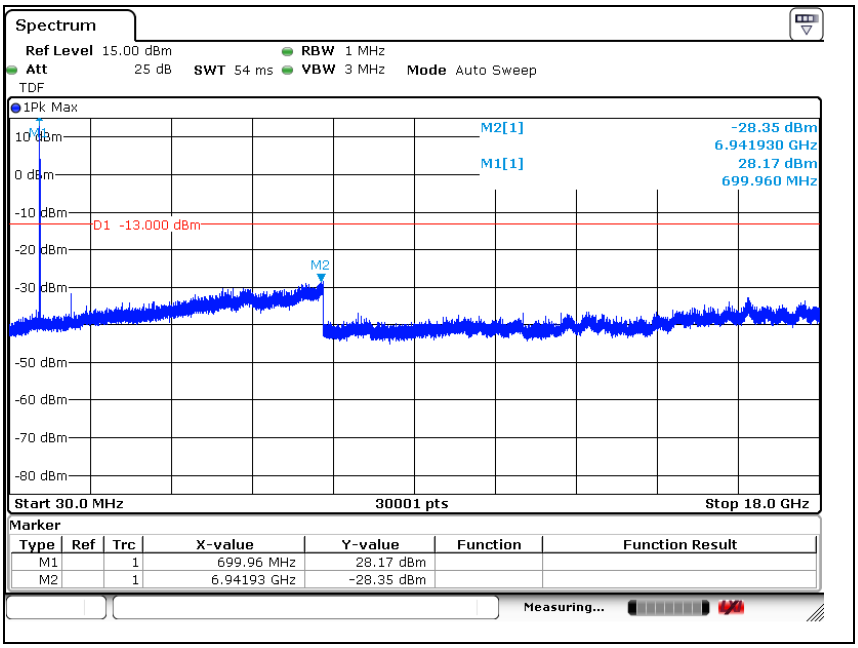
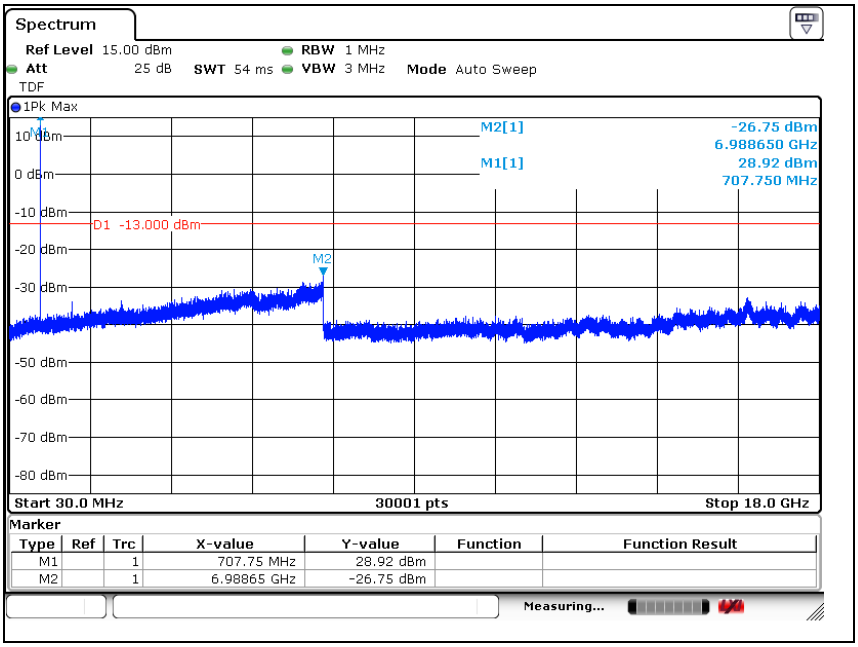
LTE band 12 (1.4 ㎒ - QPSK)

Low Channel



Middle Channel



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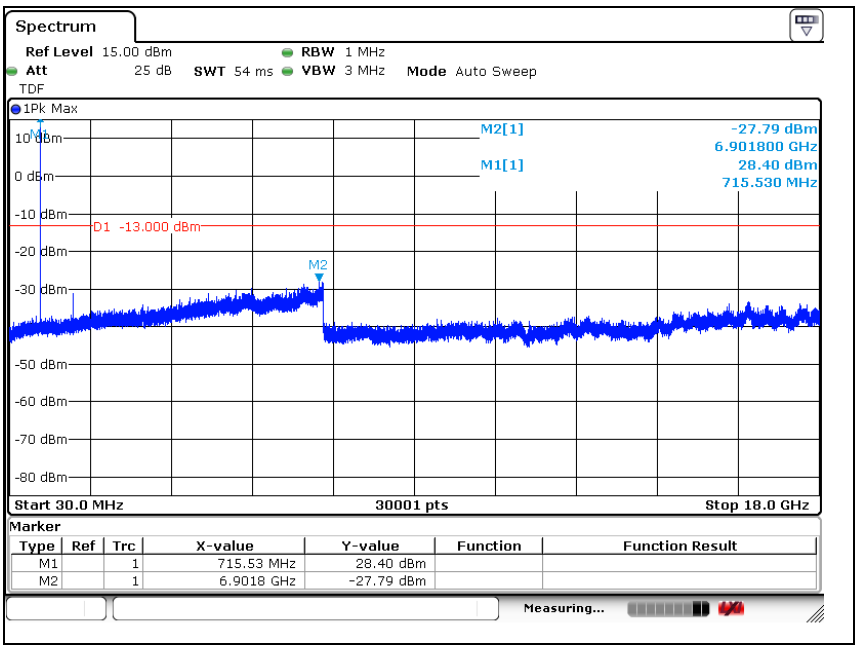
High Channel



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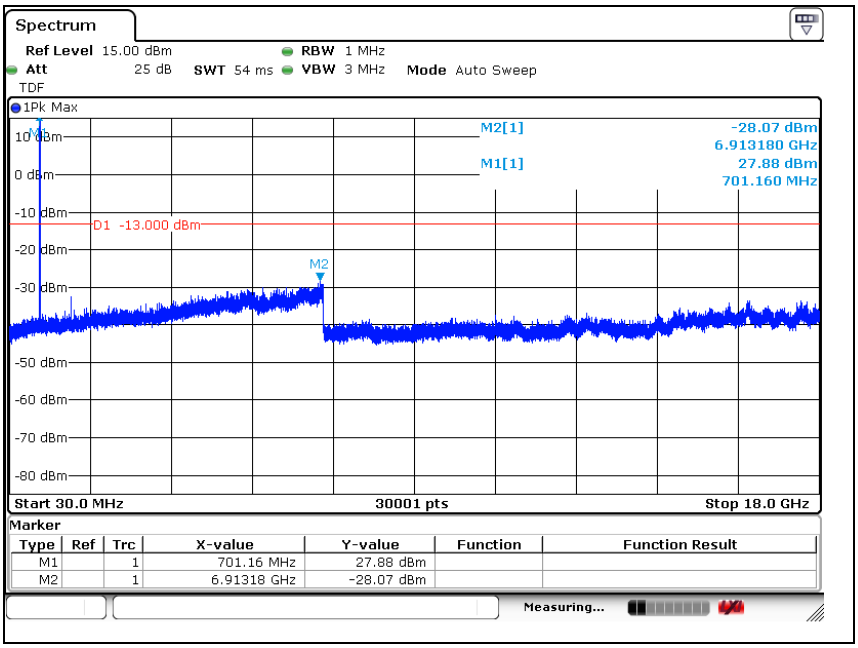
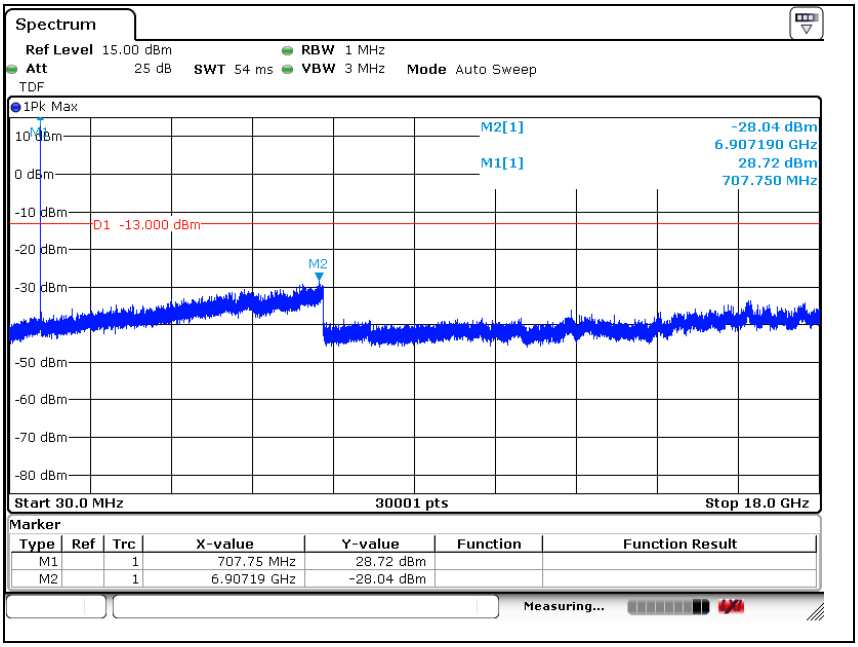
LTE band 12 (3 ㎒ - QPSK)

Low Channel



Middle Channel



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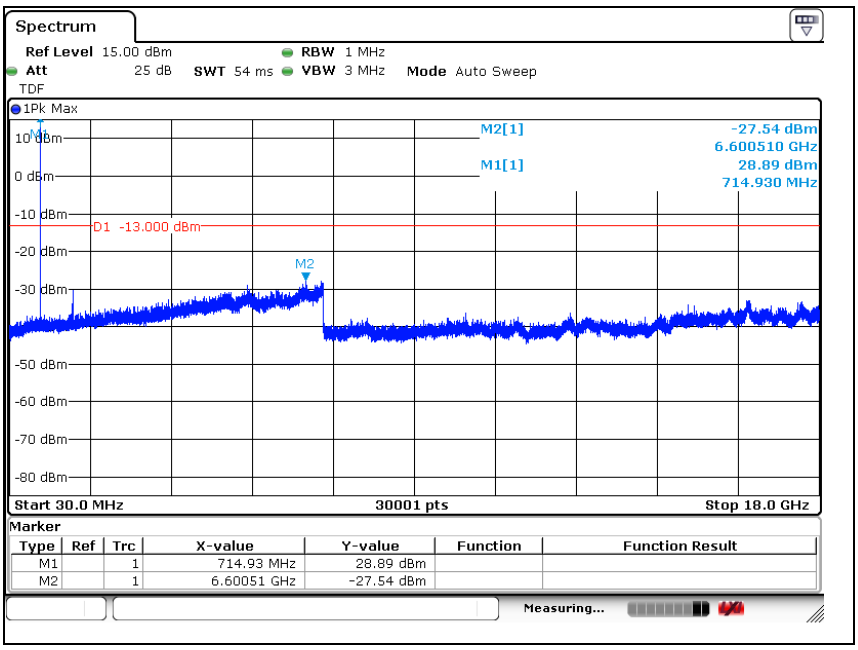
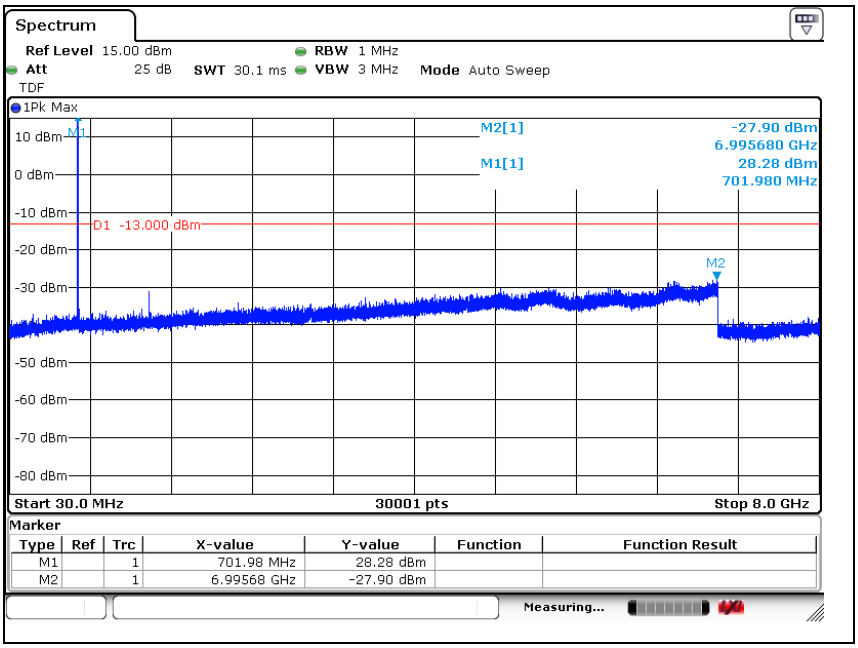
High Channel

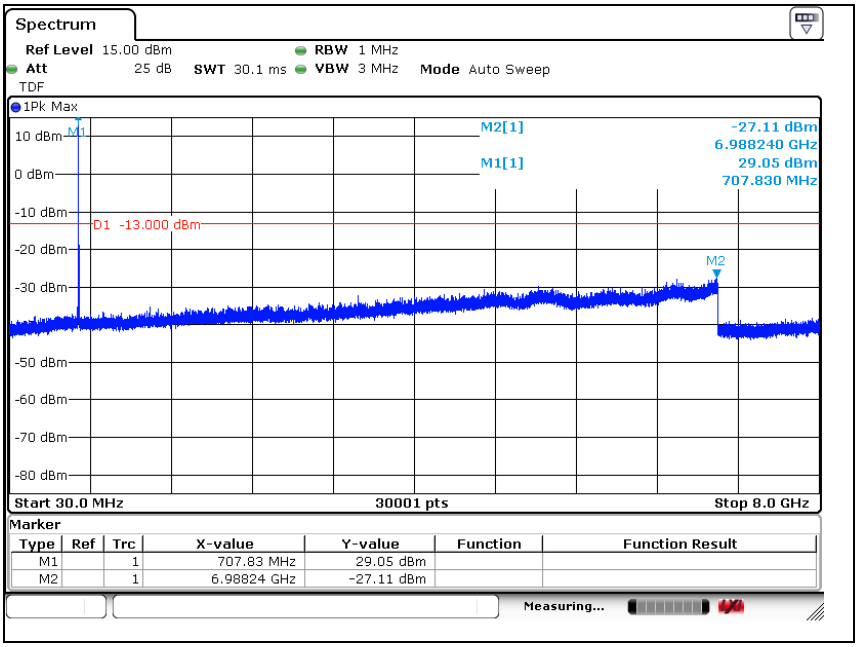


LTE band 12 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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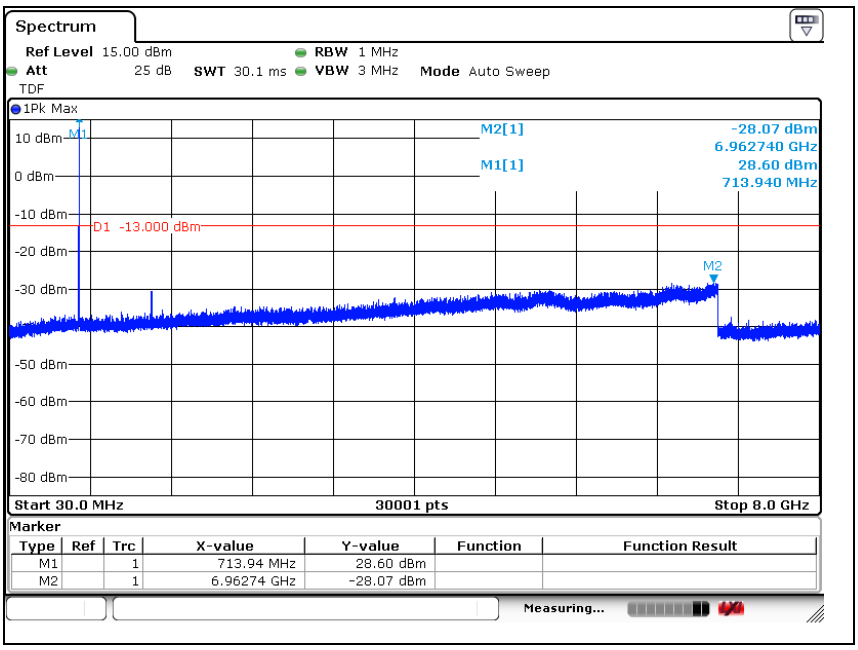
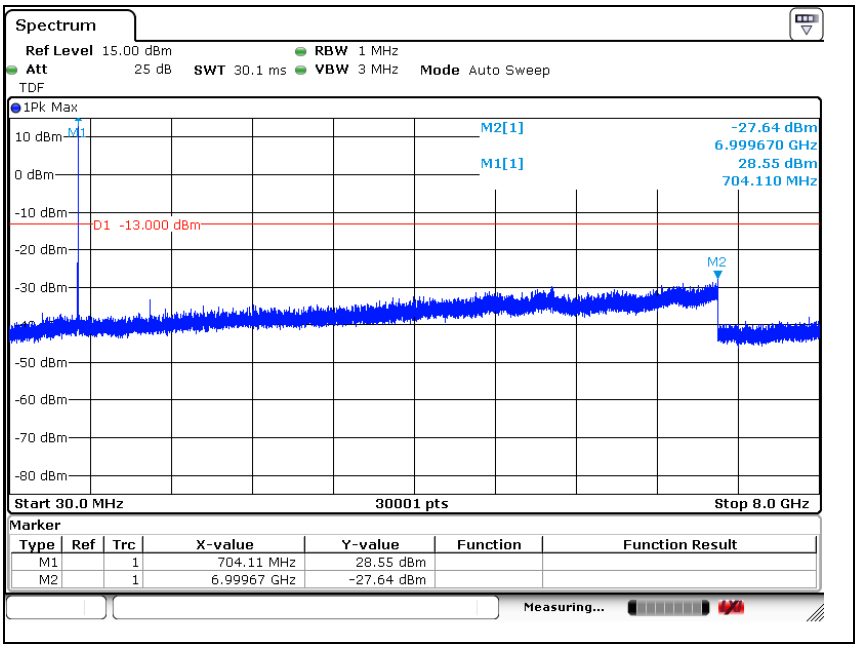
High Channel

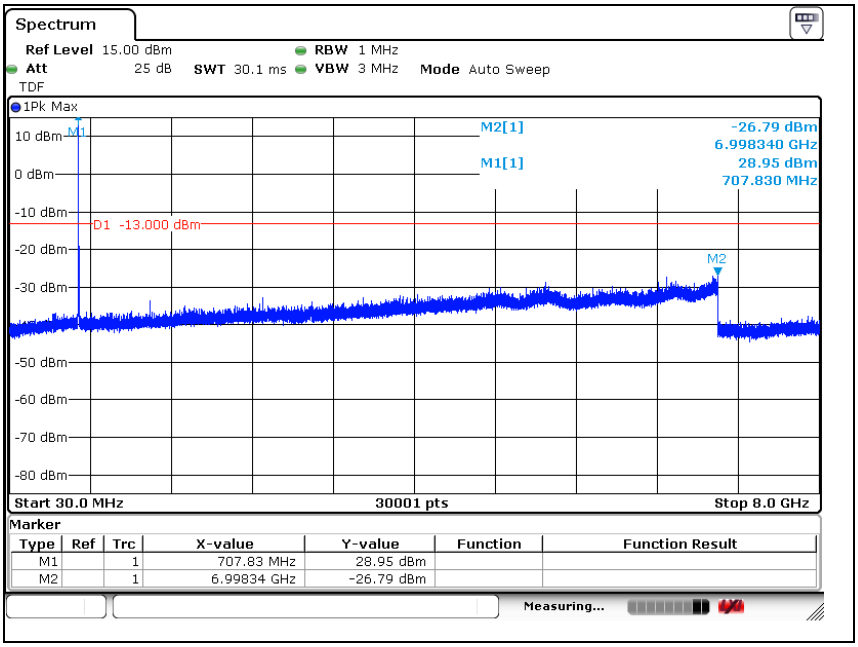


LTE band 12 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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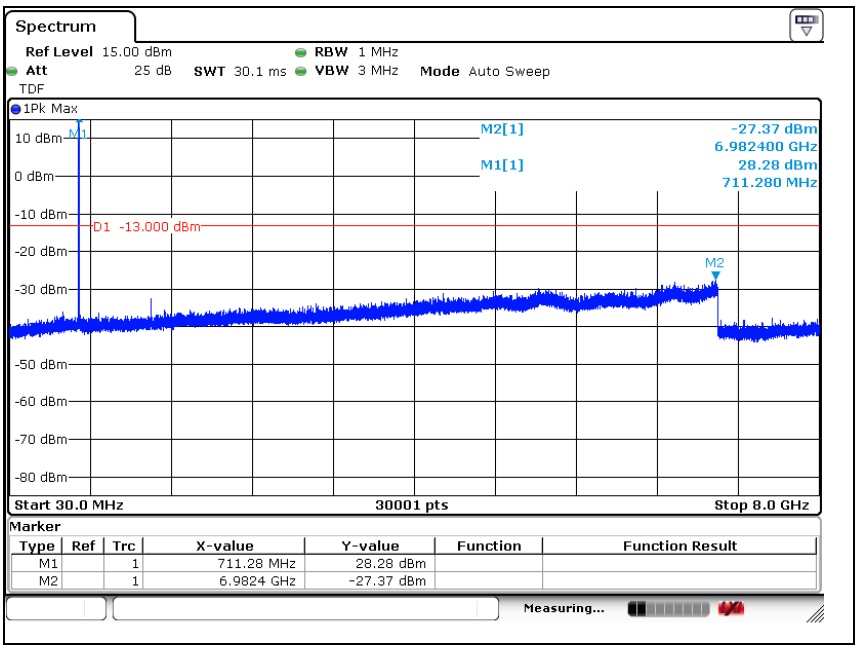
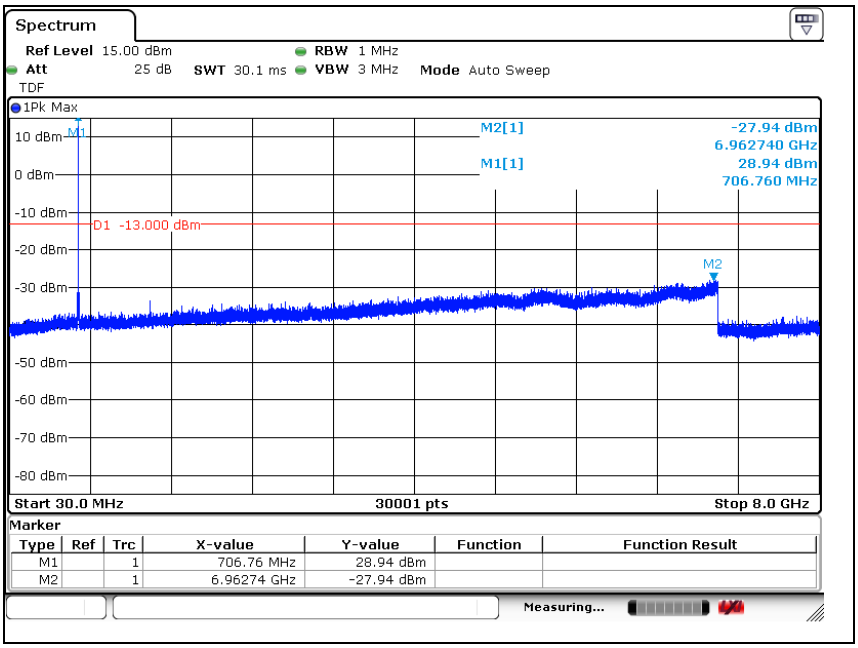
High Channel

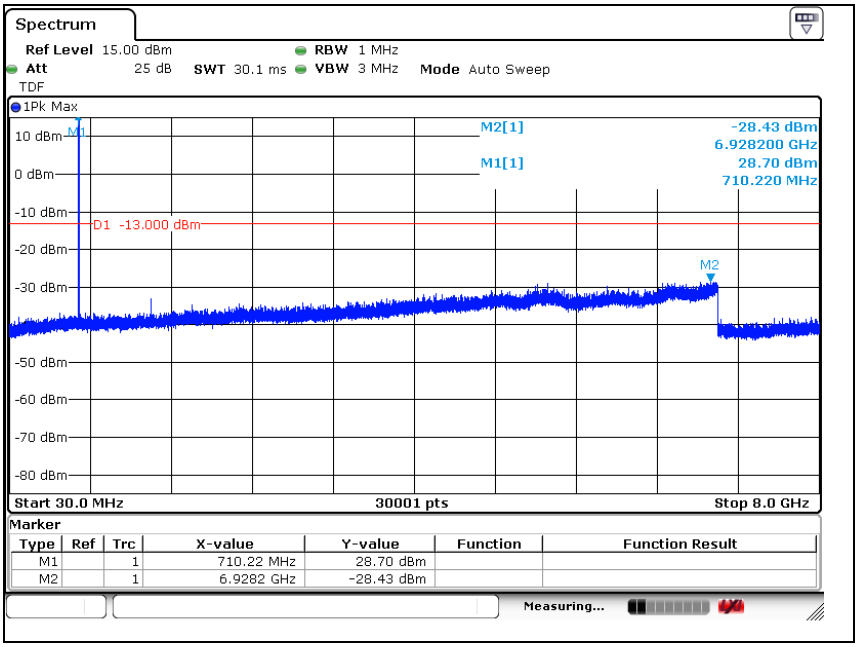


LTE band 17 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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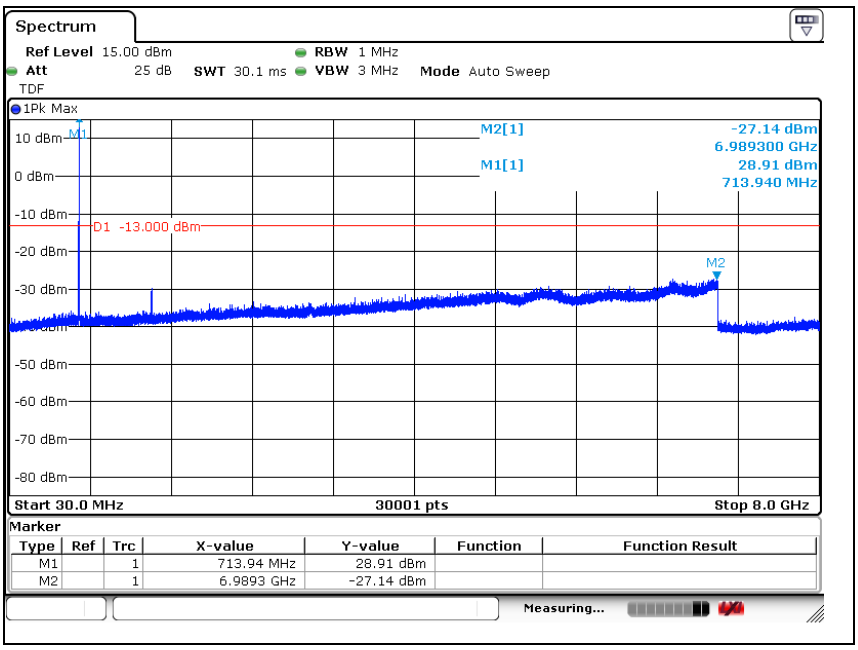
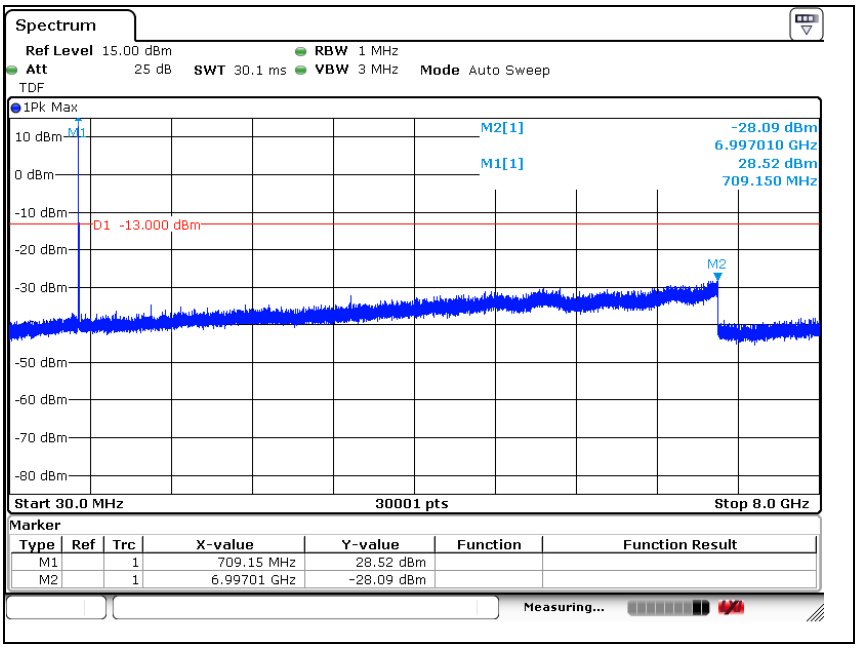
High Channel

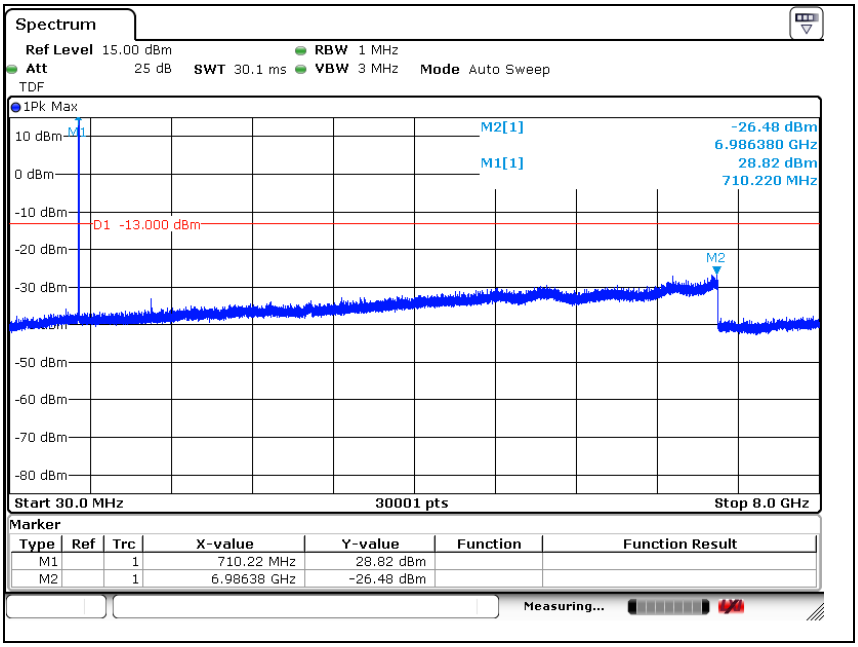


LTE band 17 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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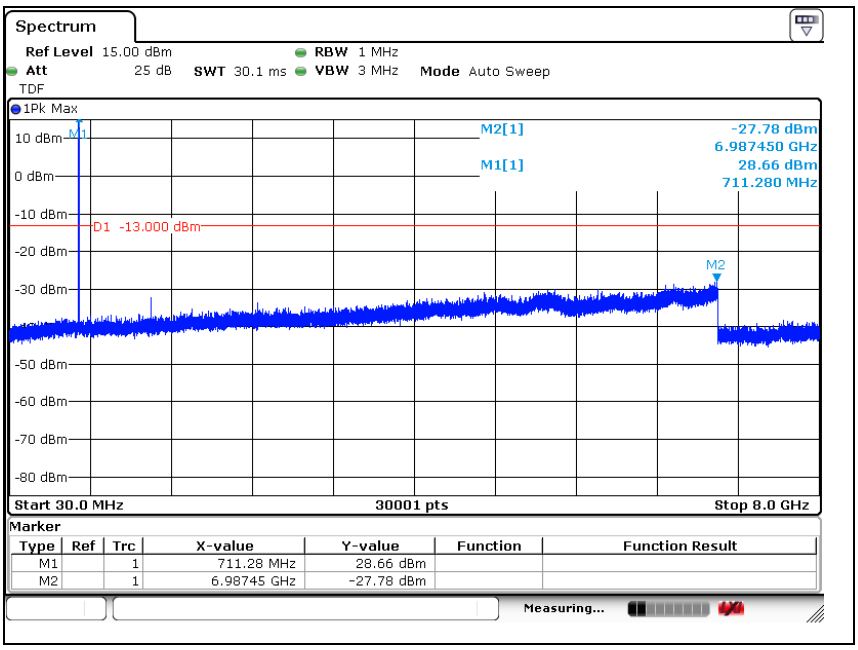
High Channel



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 + 10log(P) ㎧.

- §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) ㎧.

- §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) ㎧.

- §27.53(h)(1), for operations in the 1 695-1 710 ㎒, 1 710-1 755 ㎒, 1 755-1 780 ㎒, 1 915-1 920 ㎒, 1 995-2 000 ㎒, 2 000-2 020 ㎒, 2 110-2 155 ㎒, 2 155-2 180 ㎒, 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) ㎧.

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㎧ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㎧ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㎧ on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 $\log_{10}$ (P) ㎧ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 $\log_{10}$ (P) ㎧ at or below 2490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2495 ㎒ 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 1

4.6.1, the power of any unwanted emissions in any 100 ㎑ bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (㎧ W), by at least 43 + 10 $\log_{10}$ p (watts), ㎧. However, in the 100 ㎑ band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 ㎑ 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 ㎒ 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 ㎧) below the transmitter output power P (㎧ W) by at least 43 + 10 $\log_{10}$ p (watts).

(ii) After the first 1.0 ㎒ immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 ㎑ bandwidth shall be attenuated (in ㎧) below the transmitter output power P (㎧ 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 ㎑ is required.

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- RSS-133 Issue 6

6.5, Equipment shall comply with the limits in (i) and (ii) below.
(i) In the 1.0 ㎒ 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 ㏈) below the transmitter output power P (㏈ W) by at least 43 + 10 $\log_{10}$ p(watts).

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

- RSS-139 Issue 3

6.6, (i) In the first 1.0 ㎒ 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 ㏈ W) by at least 43 + 10 $\log_{10}$ p (watts) ㏈.

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

- RSS-199 Issue 3

4.5, (b)
for mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in ㏈) below the transmitter power, P (㏈W), by at least:

(i) 40 + 10 $\log_{10}$ p from the channel edges to 5 ㎒ away
(ii) 43 + 10 $\log_{10}$ p between 5 ㎒ and X ㎒ from the channel edges, and
(iii) 55 + 10 $\log_{10}$ p at X ㎒ 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 ㎒ and 2496 ㎒, and 55 + 10 $\log_{10}$ p at or below 2490.5 ㎒.

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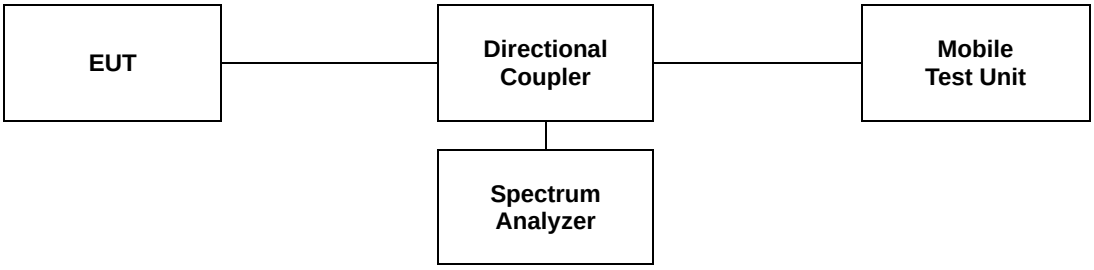
7.2. Test Procedure

The test follows section 6 of FCC KDB Publication 971168 D01 v02r02.

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



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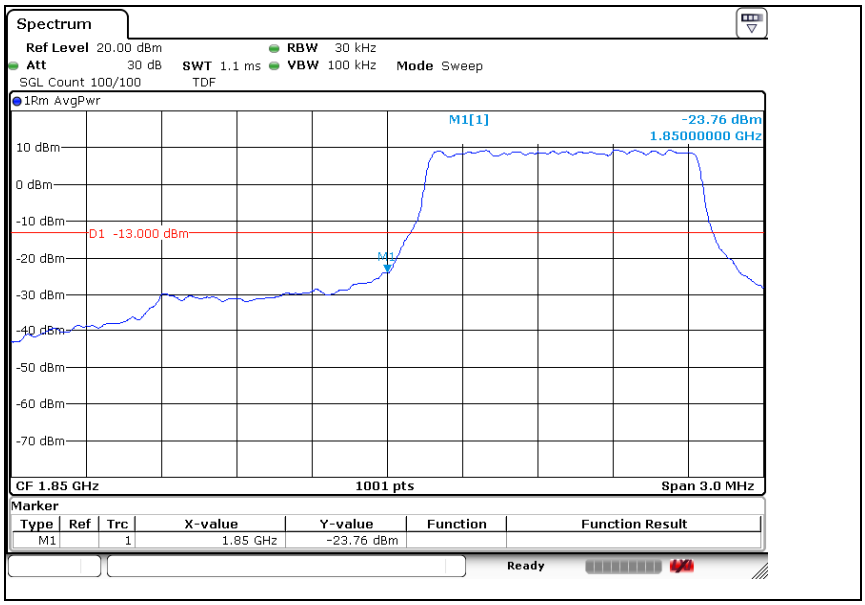
7.3. Test Results

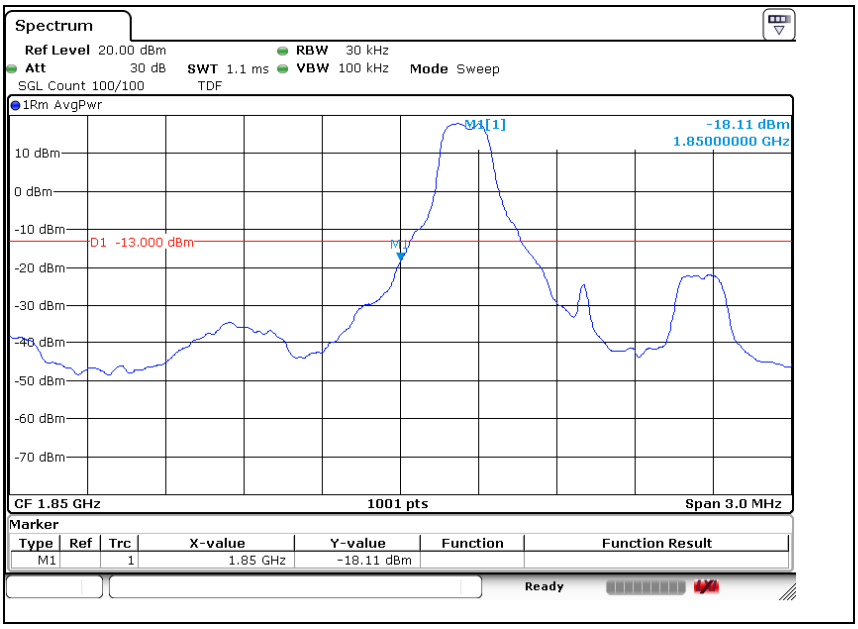
Ambient temperature	:	(23 ± 1) ℃
Relative humidity	:	47 % R.H.

Please refer to the following plots.

LTE band 2 (1.4 ㎒ - QPSK_RB 6)
Low Channel



LTE band 2 (1.4 ㎒ - QPSK_RB 1)
Low Channel



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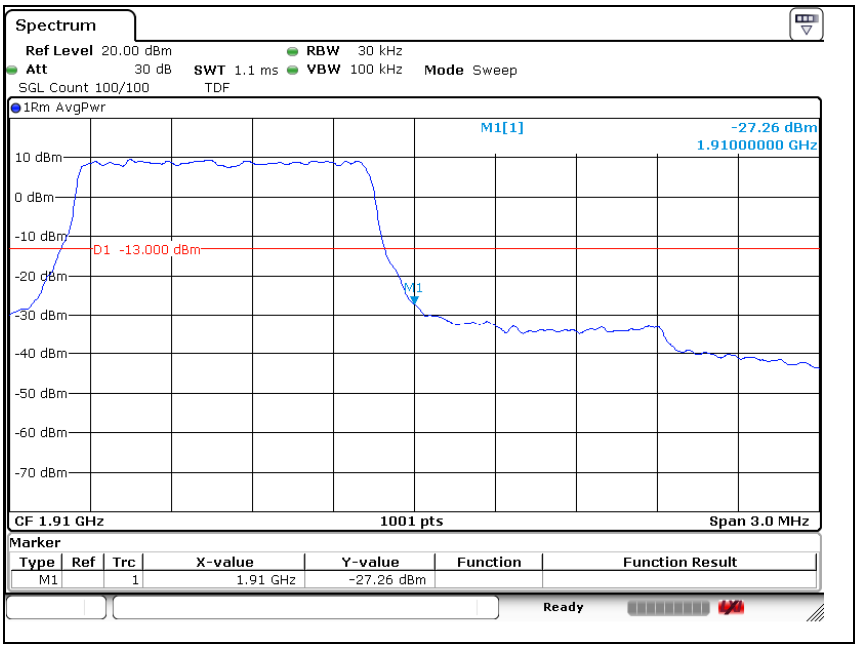
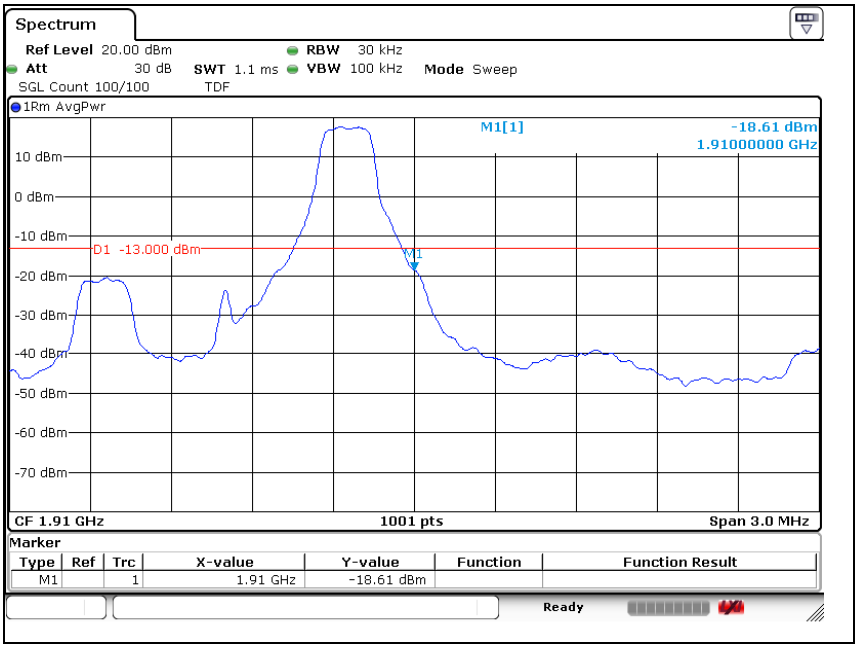
LTE band 2 (1.4 ㎒ - QPSK_RB 6)
High Channel



LTE band 2 (1.4 ㎒ - QPSK_RB 1)
High Channel



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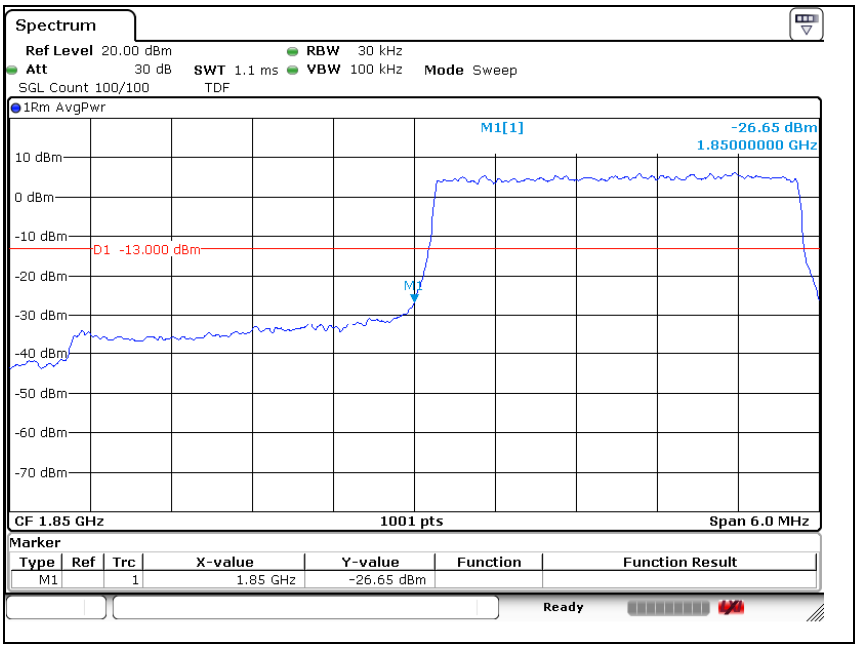
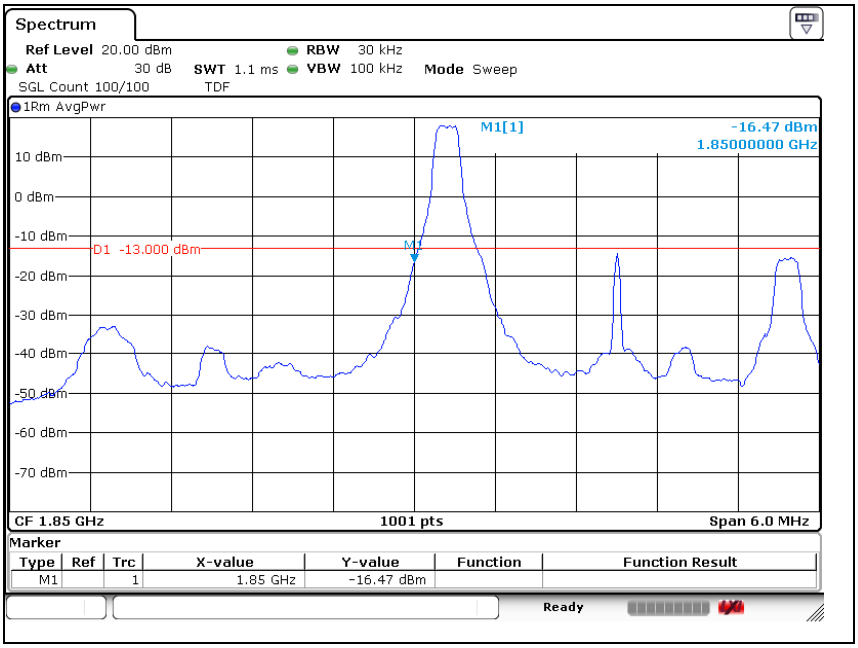
LTE band 2 (3 ㎒ - QPSK_RB 15)
Low Channel



LTE band 2 (3 ㎒ - QPSK_RB 1)
Low Channel



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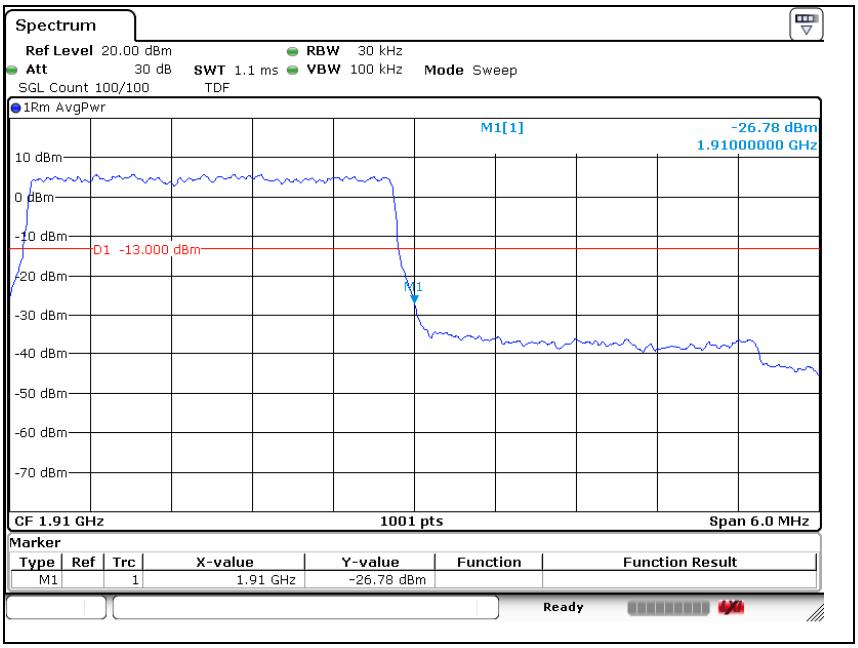
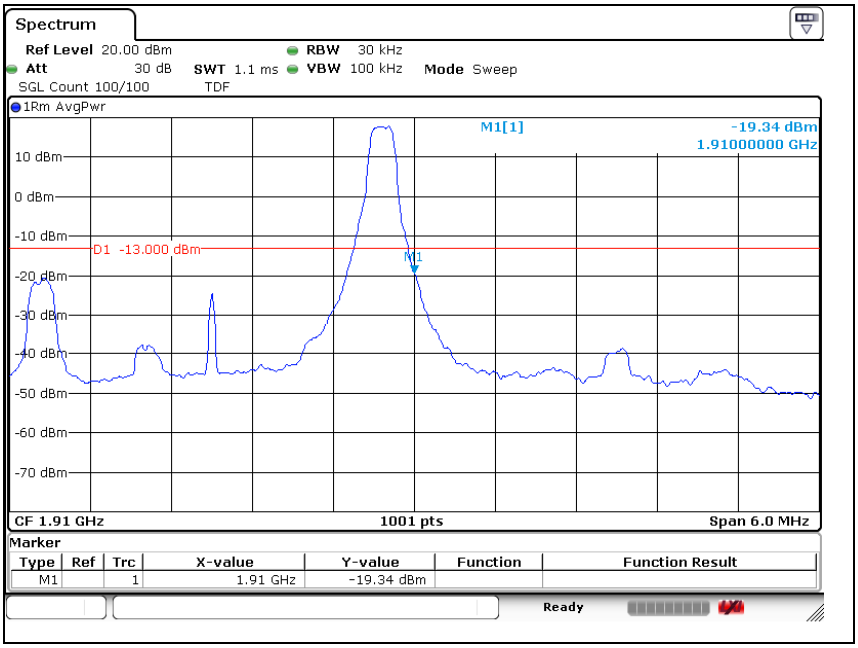
LTE band 2 (3 ㎒ - QPSK_RB 15)
High Channel



LTE band 2 (3 ㎒ - QPSK_RB 1)
High Channel



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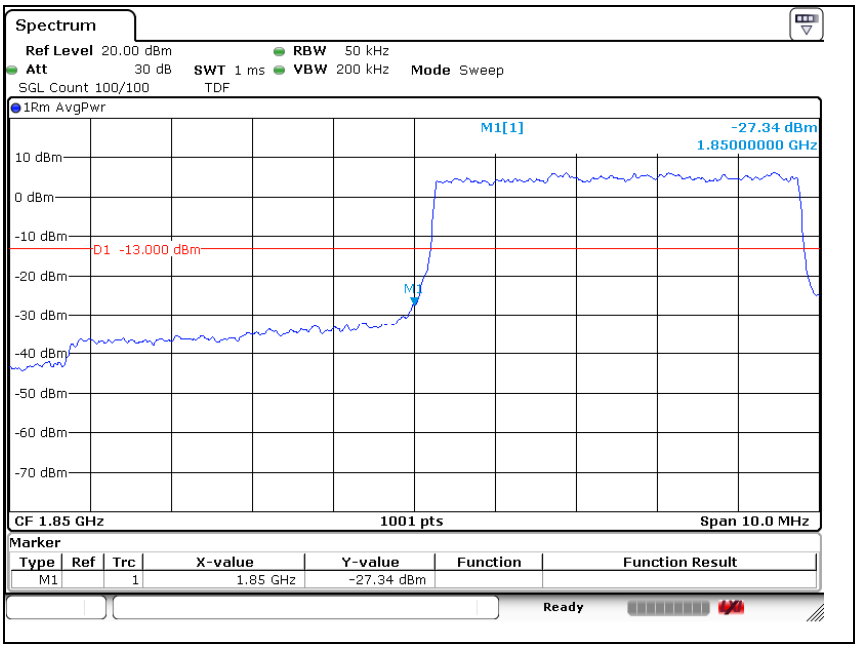
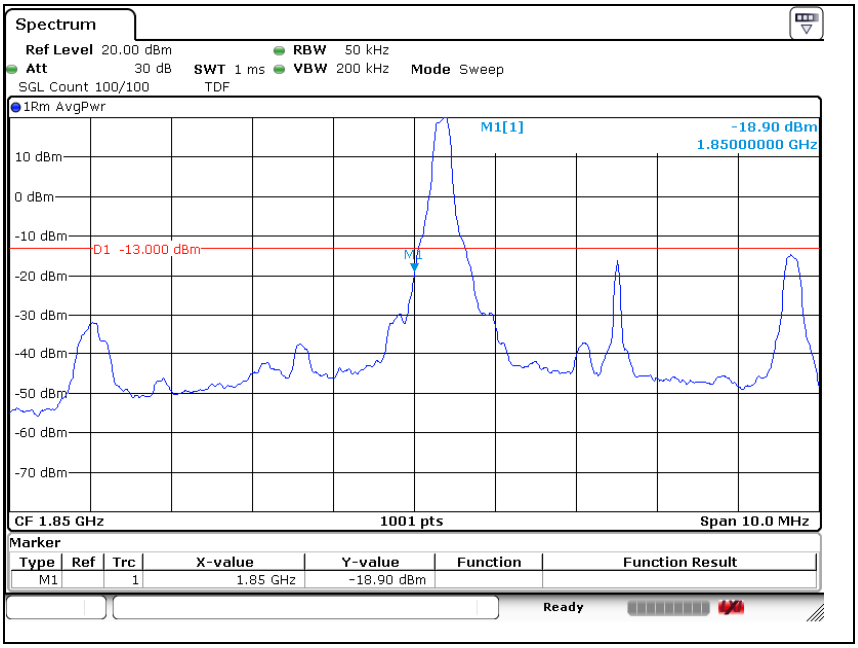
LTE band 2 (5 ㎒ - QPSK_RB 25)

Low Channel



LTE band 2 (5 ㎒ - QPSK_RB 1)

Low Channel



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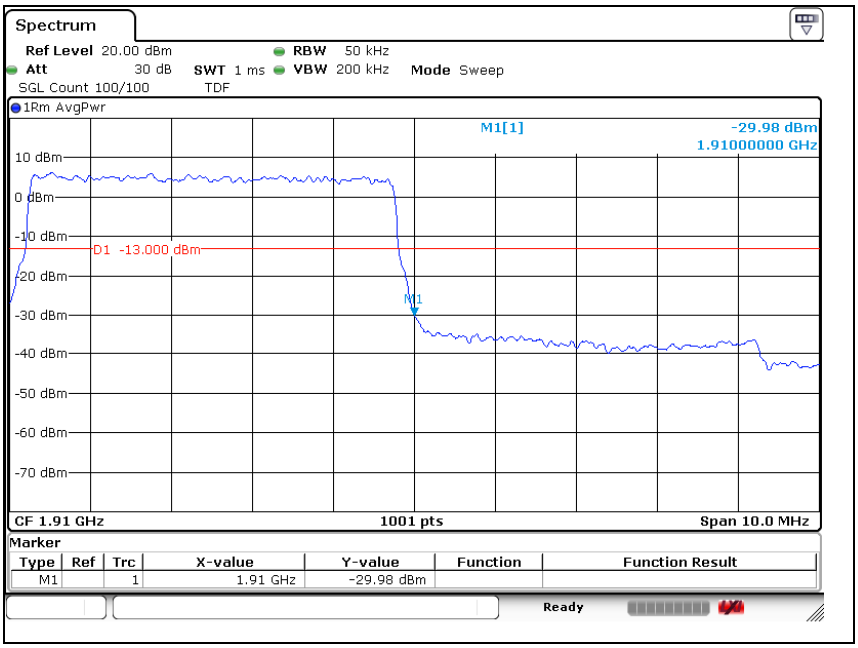
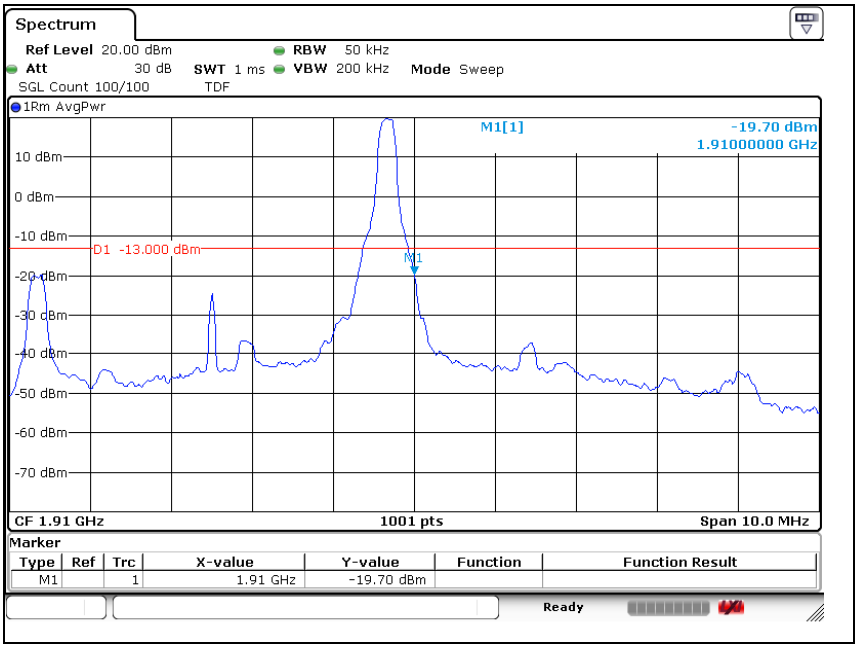
LTE band 2 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 2 (5 ㎒ - QPSK_RB 1)
High Channel



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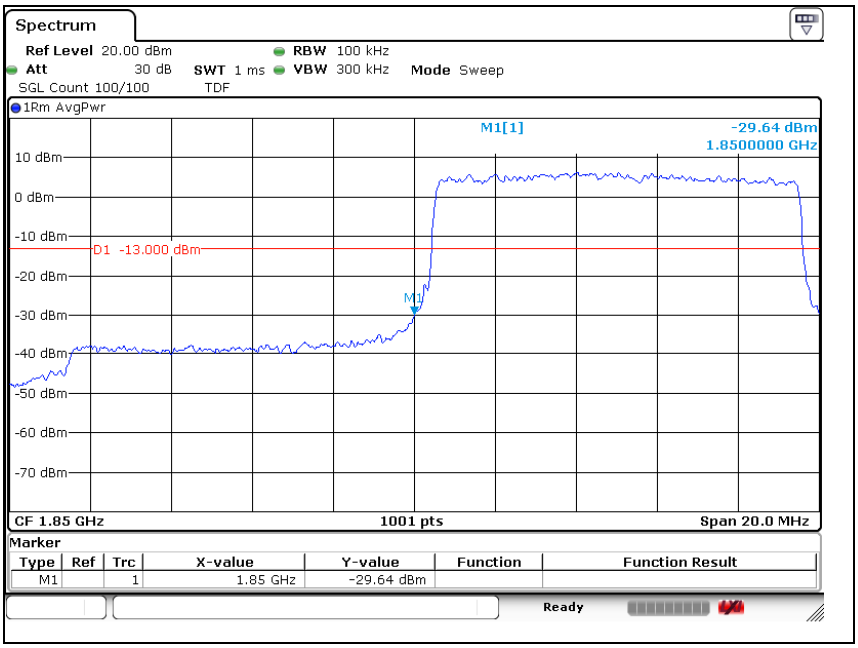
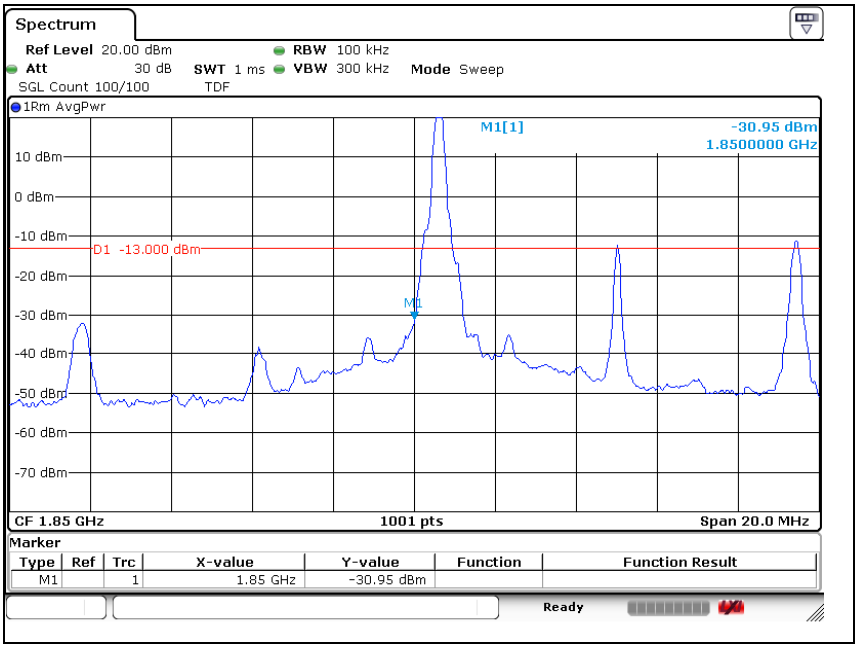
LTE band 2 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 2 (10 ㎒ - QPSK_RB 1)

Low Channel



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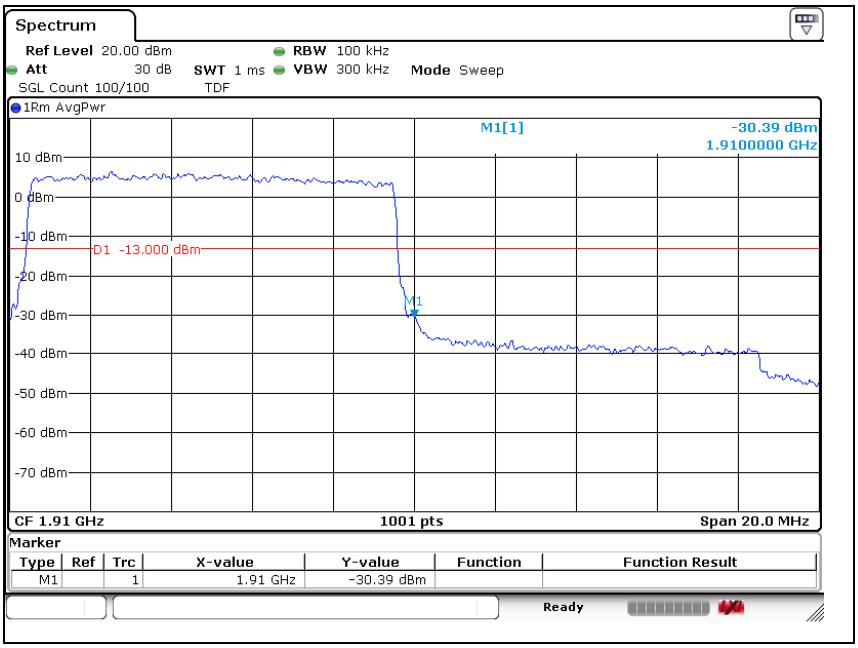
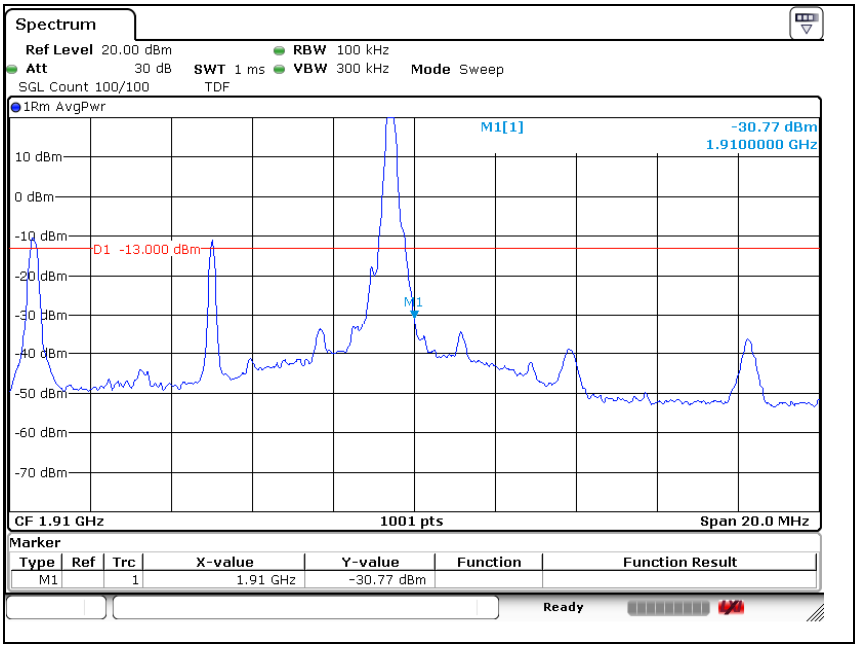
LTE band 2 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 2 (10 ㎒ - QPSK_RB 1)
High Channel



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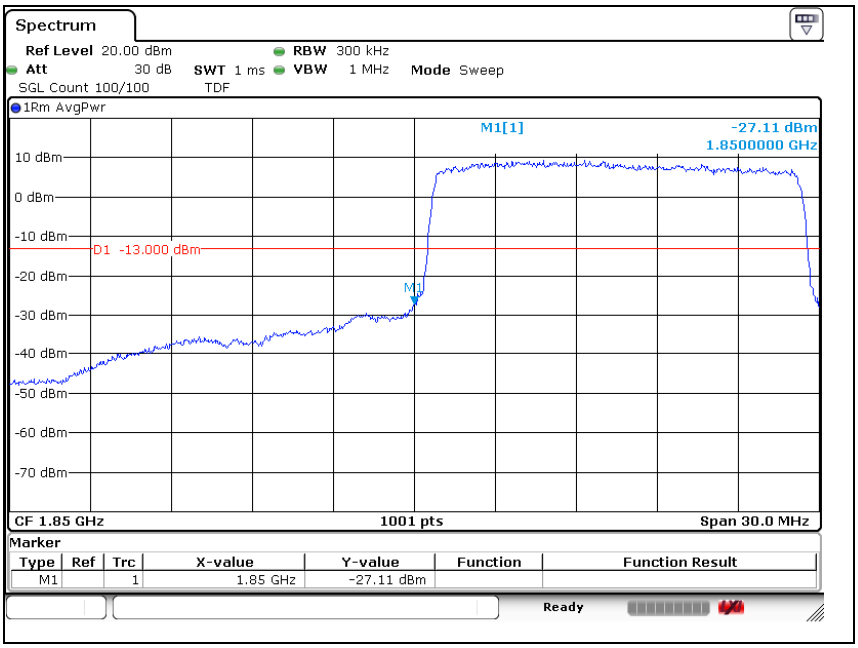
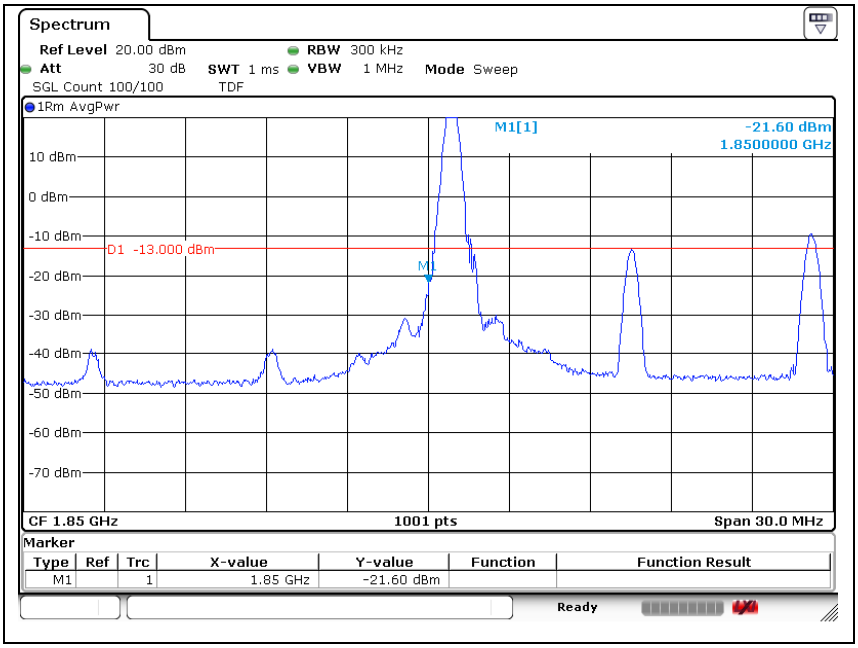
LTE band 2 (15 ㎒ - QPSK_RB 75)
Low Channel



LTE band 2 (15 ㎒ - QPSK_RB 1)
Low Channel



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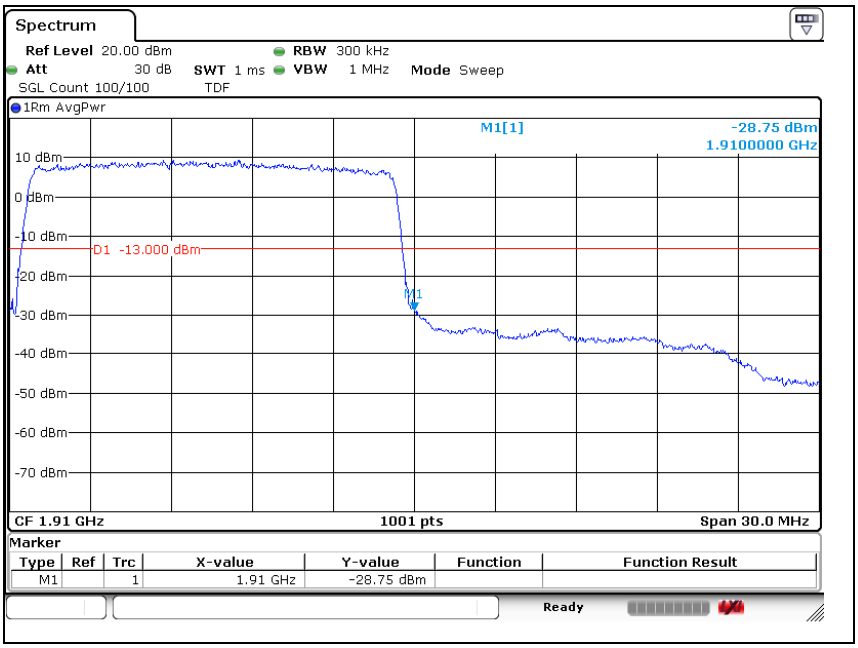
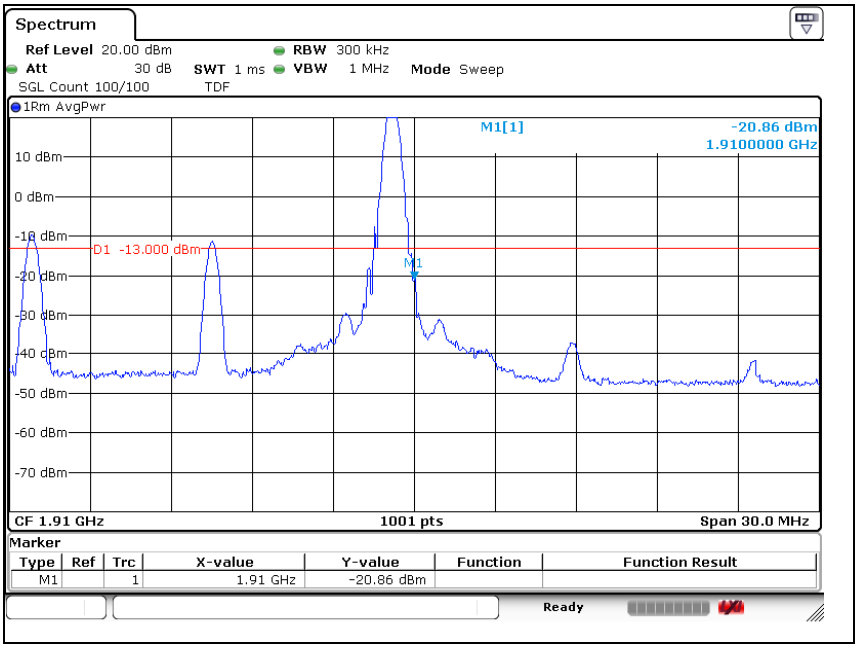
LTE band 2 (15 ㎒ - QPSK_RB 75)
High Channel



LTE band 2 (15 ㎒ - QPSK_RB 1)
High Channel



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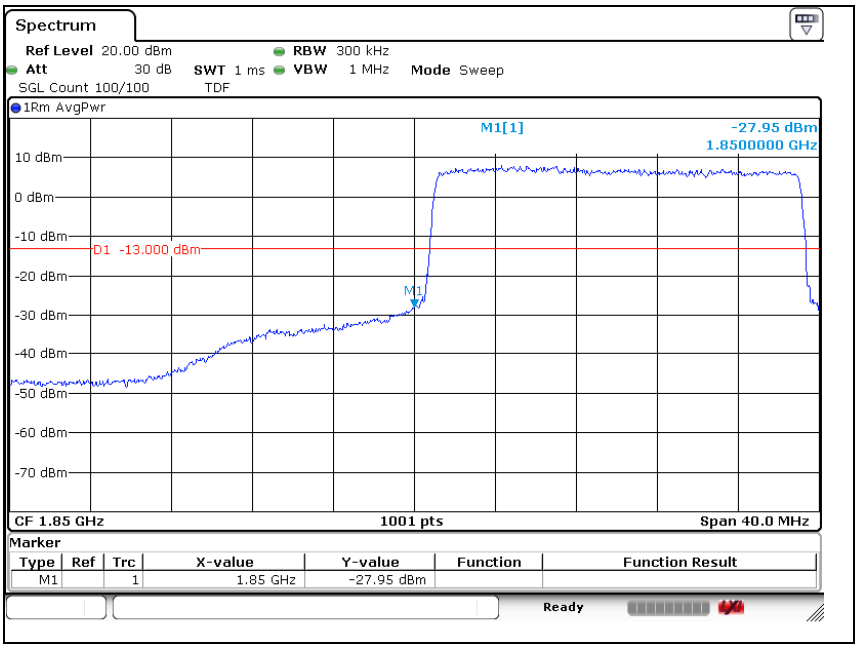
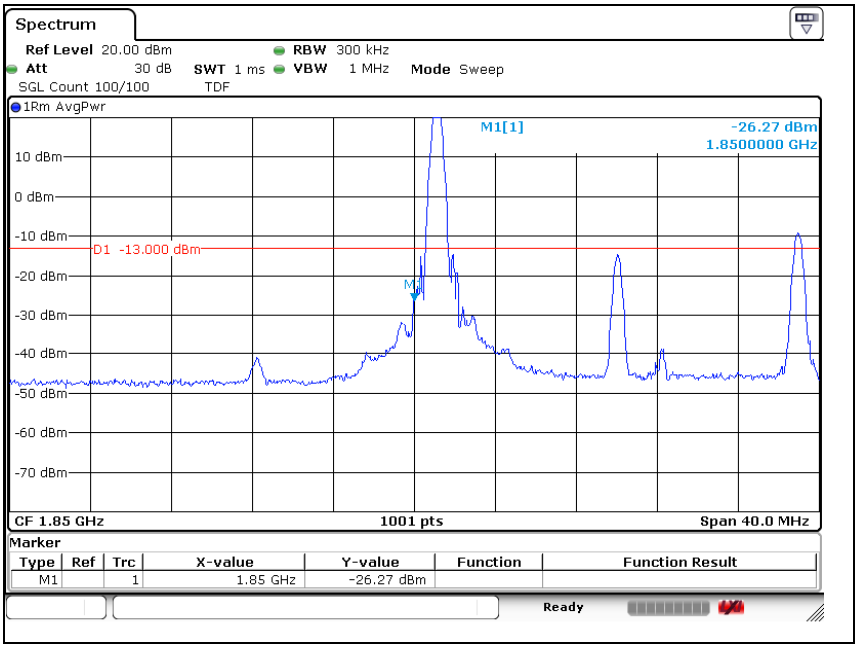
LTE band 2 (20 ㎒ - QPSK_RB 100)

Low Channel



LTE band 2 (20 ㎒ - QPSK_RB 1)

Low Channel



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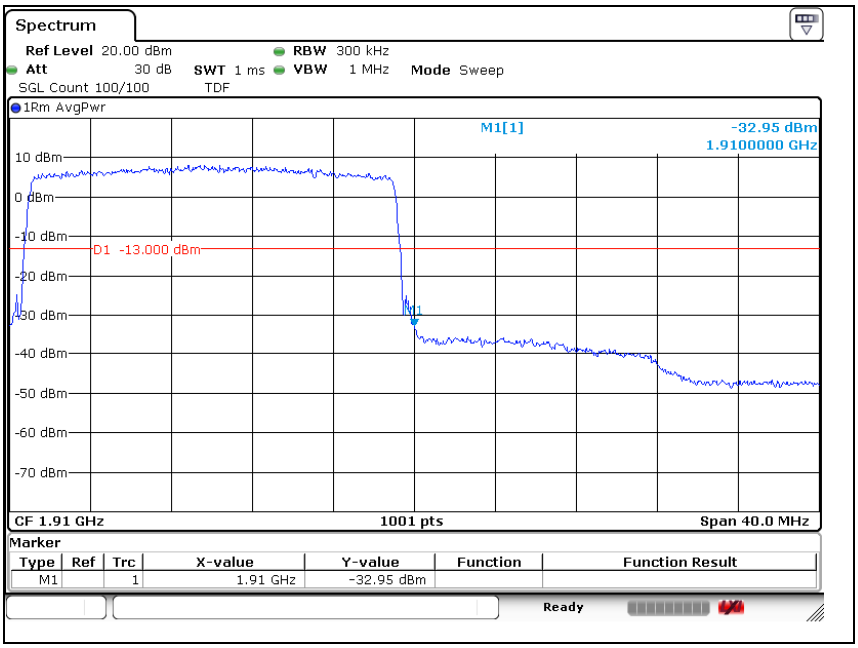
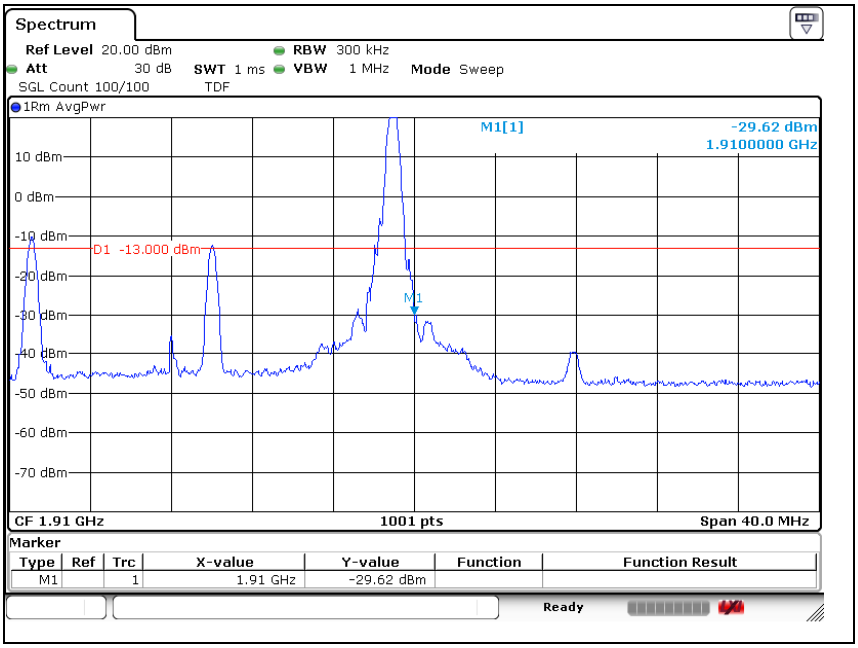
LTE band 2 (20 ㎒ - QPSK_RB 100)
High Channel



LTE band 2 (20 ㎒ - QPSK_RB 1)
High Channel



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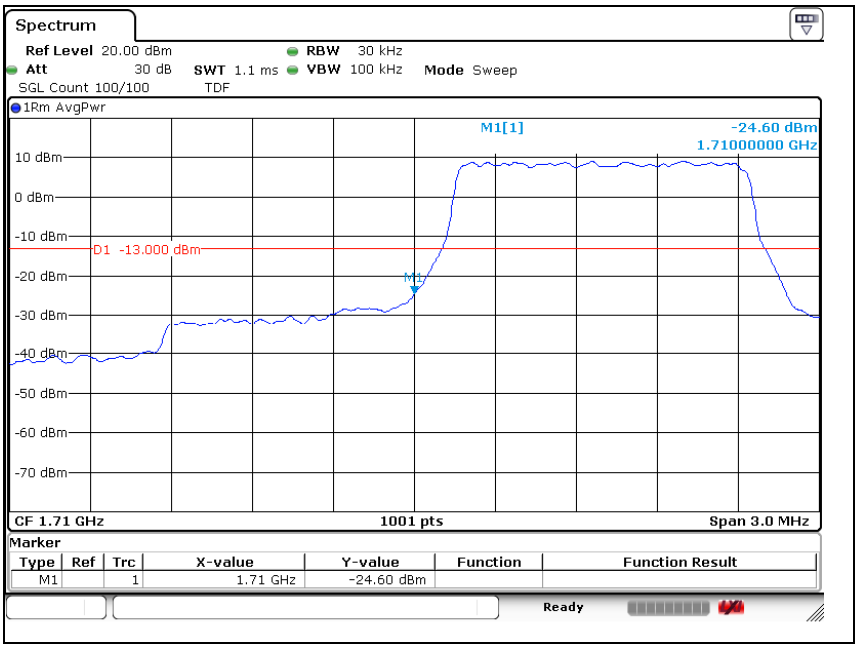
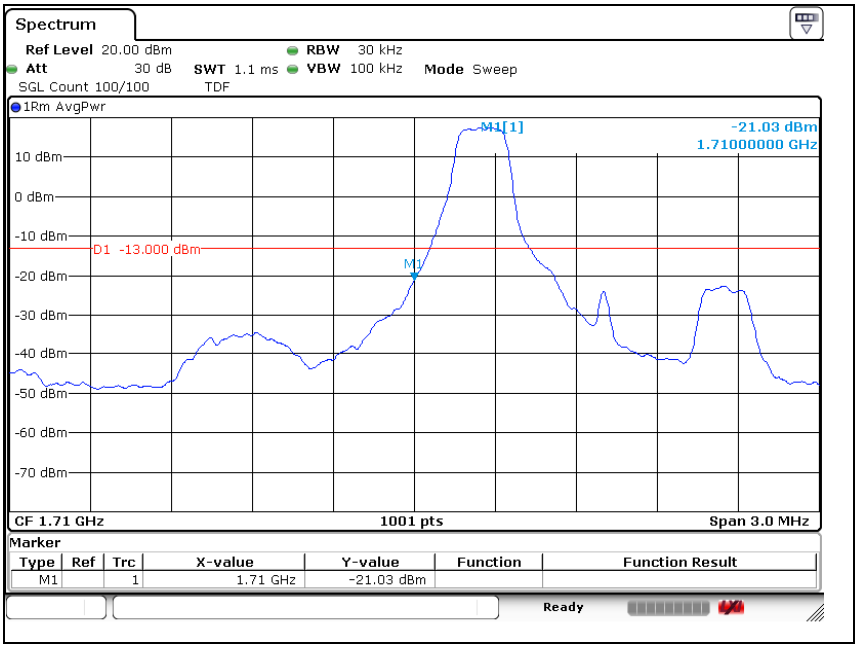
LTE band 4 (1.4 ㎒ - QPSK_RB 6)

Low Channel



LTE band 4 (1.4 ㎒ - QPSK_RB 1)

Low Channel



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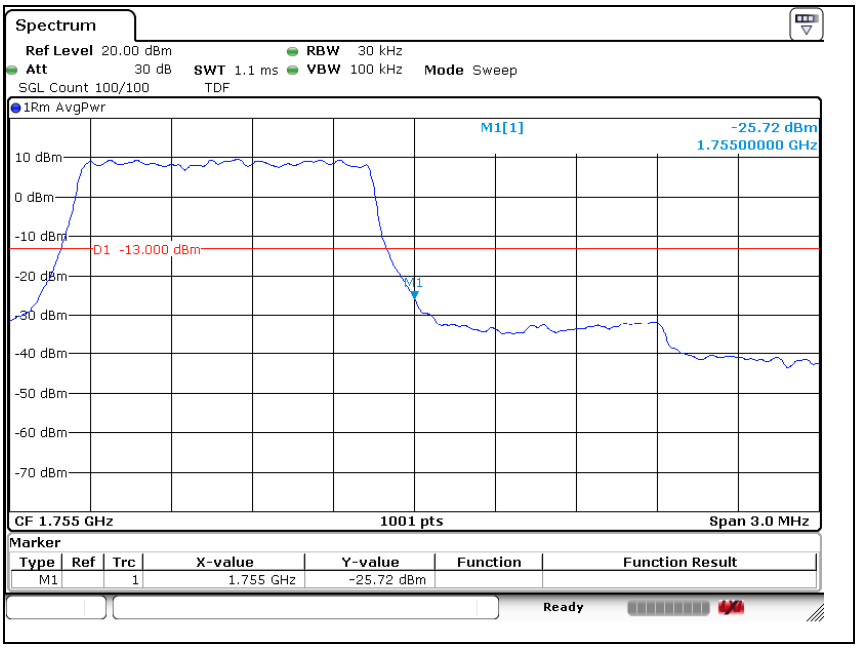
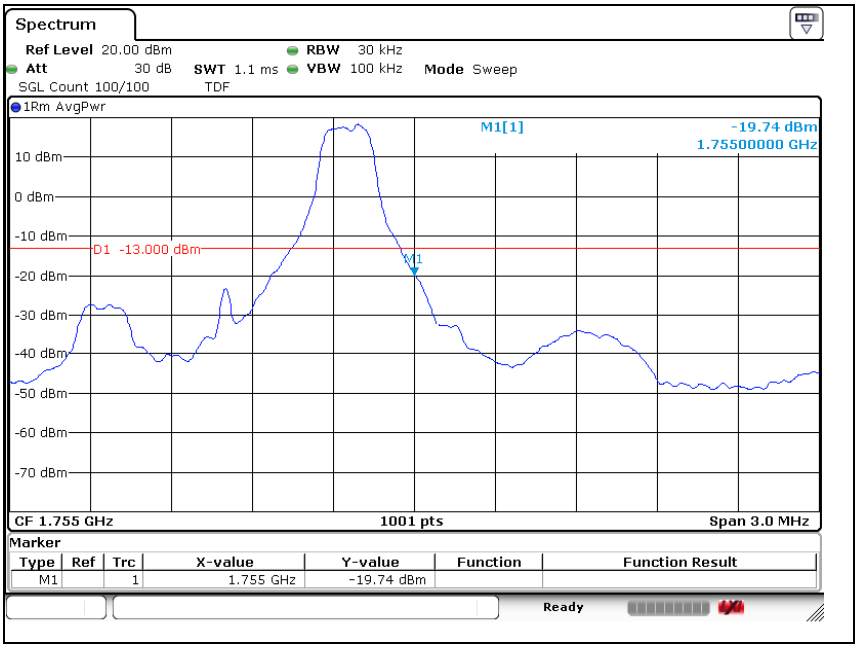
LTE band 4 (1.4 ㎒ - QPSK_RB 6)
High Channel



LTE band 4 (1.4 ㎒ - QPSK_RB 1)
High Channel



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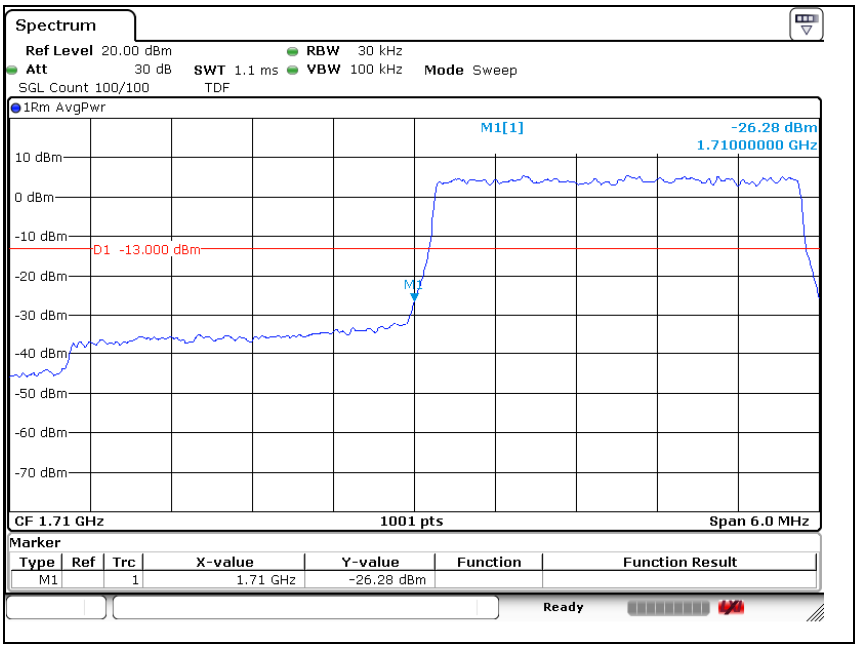
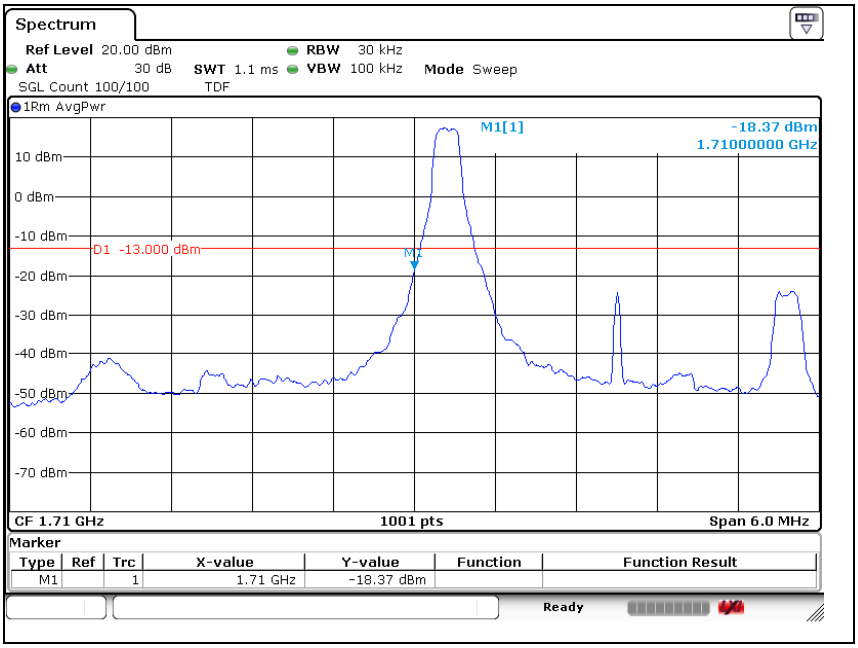
LTE band 4 (3 ㎒ - QPSK_RB 15)
Low Channel



LTE band 4 (3 ㎒ - QPSK_RB 1)
Low Channel



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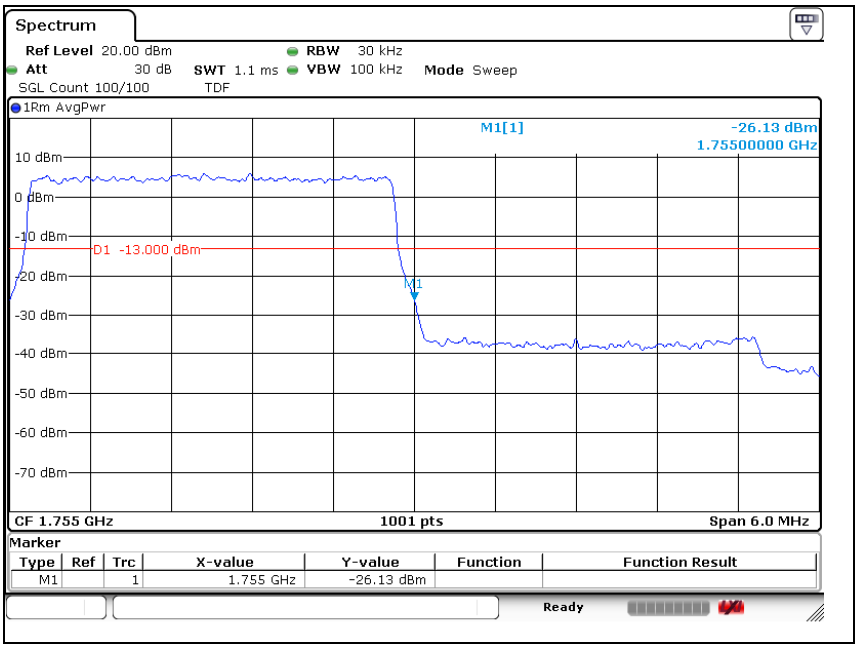
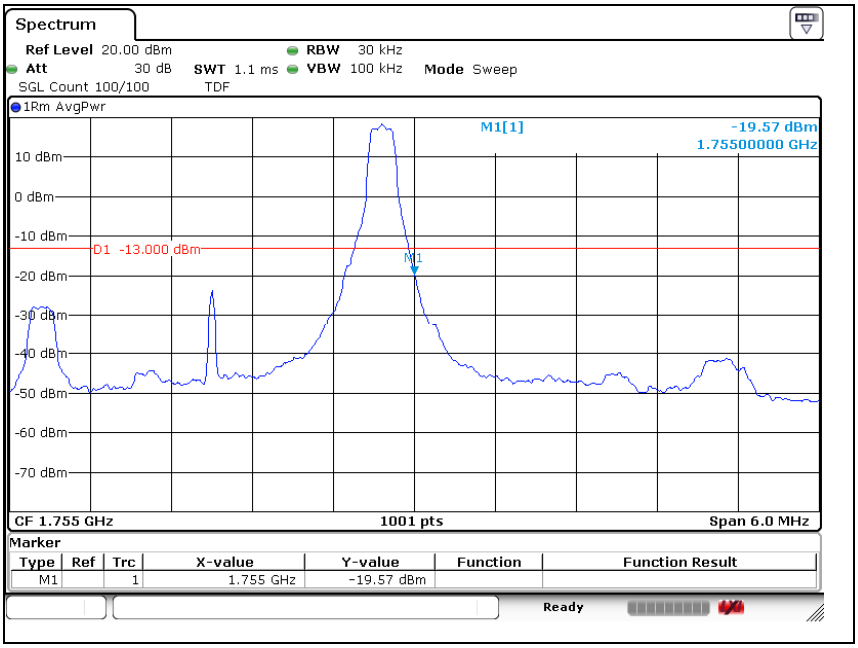
LTE band 4 (3 ㎒ - QPSK_RB 15)
High Channel



LTE band 4 (3 ㎒ - QPSK_RB 1)
High Channel



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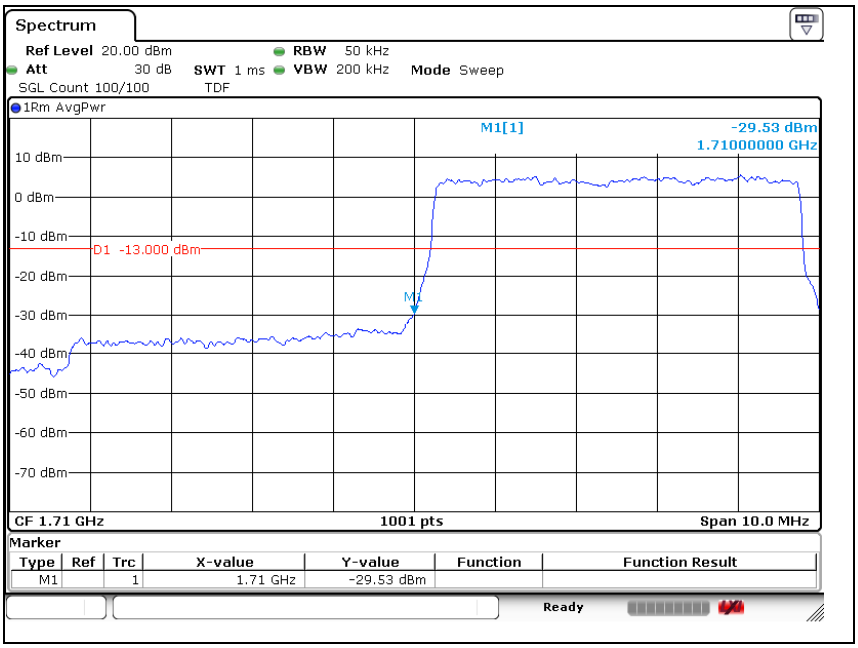
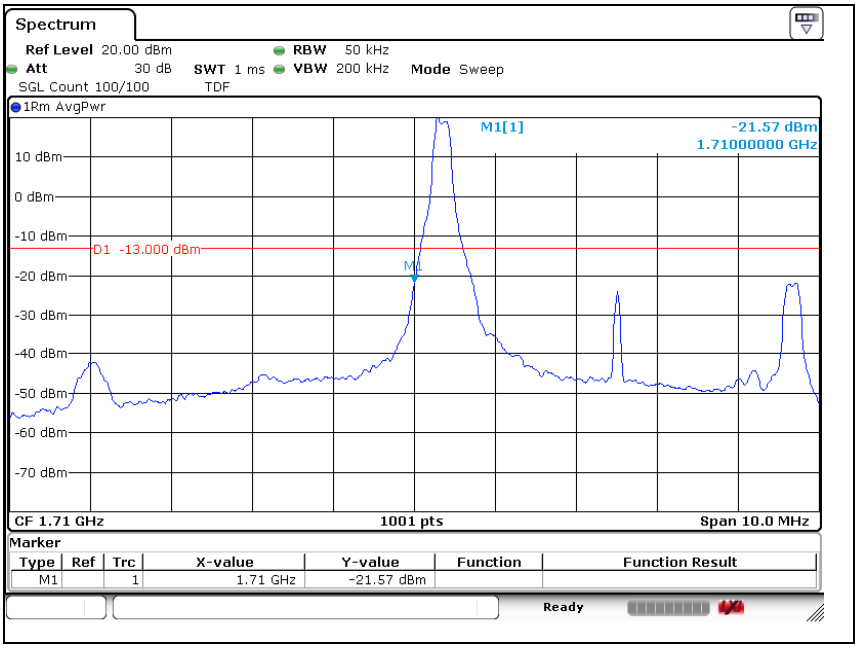
LTE band 4 (5 ㎒ - QPSK_RB 25)
Low Channel



LTE band 4 (5 ㎒ - QPSK_RB 1)
Low Channel



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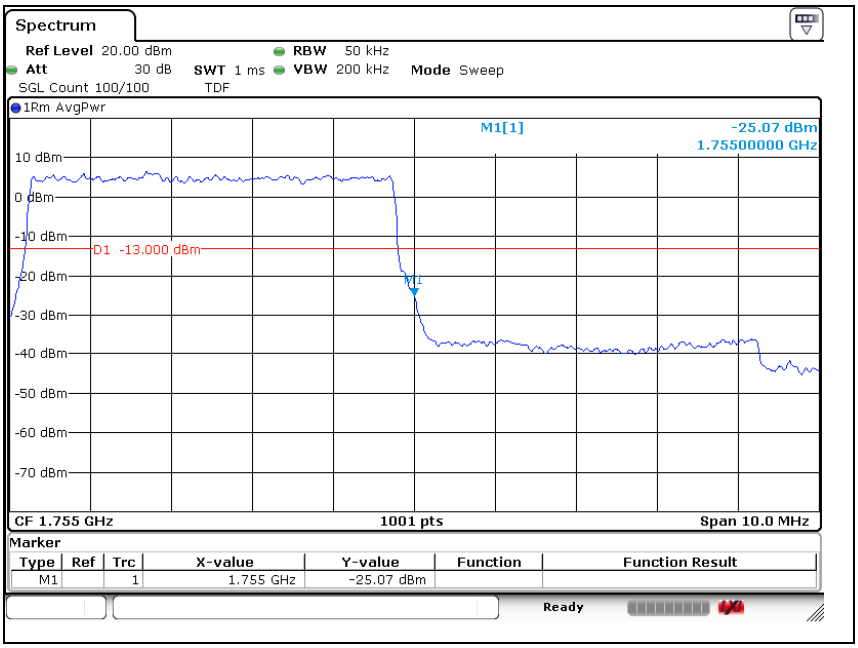
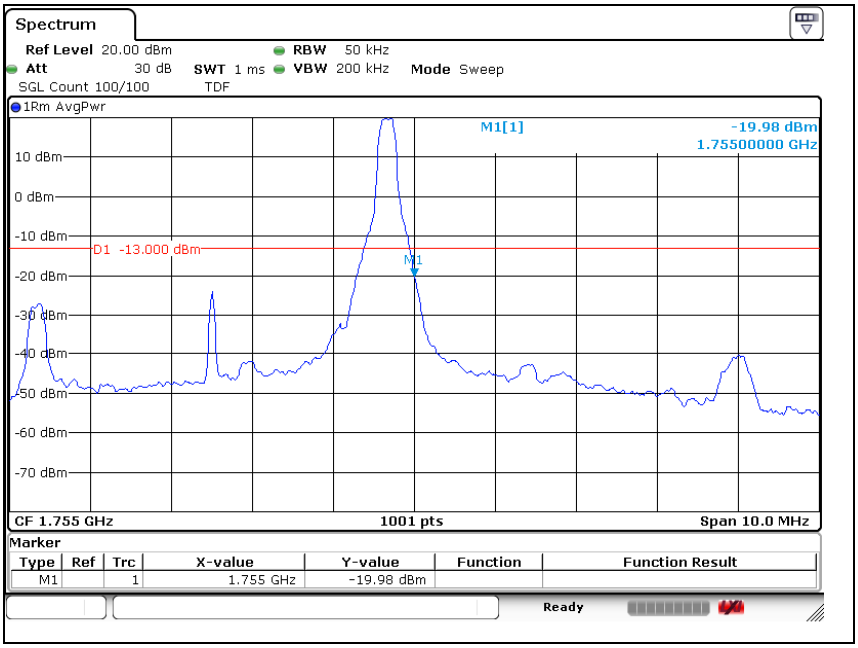
LTE band 4 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 4 (5 ㎒ - QPSK_RB 1)
High Channel



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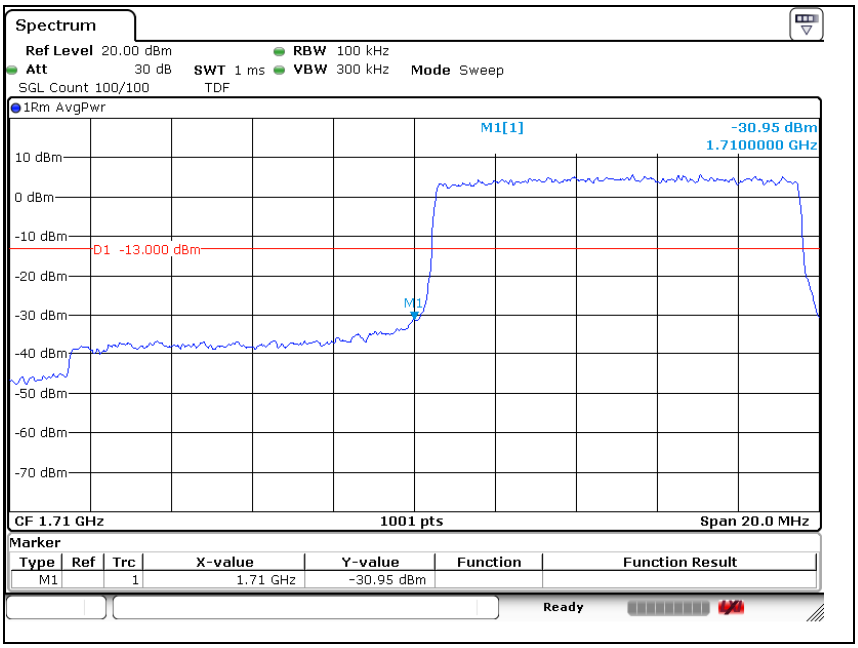
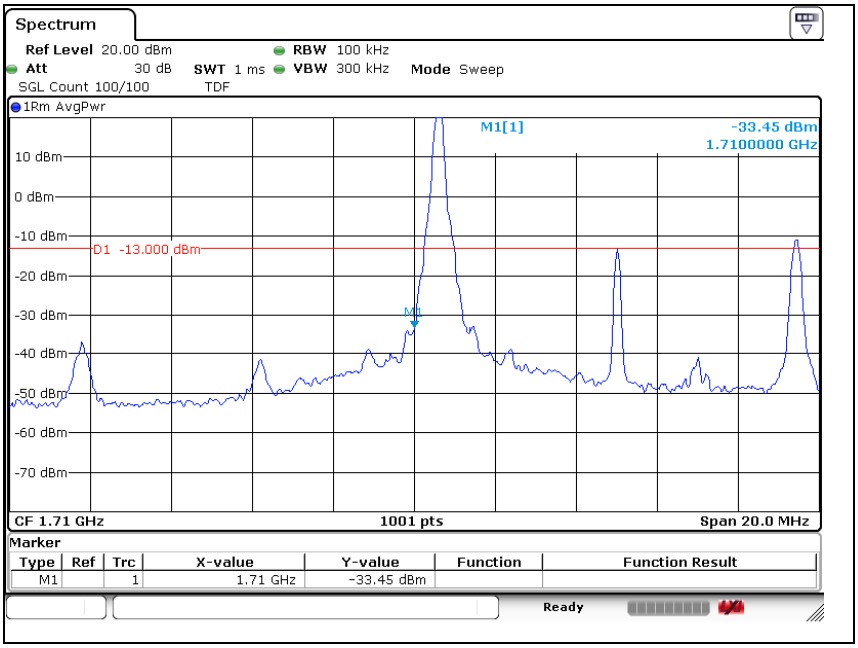
LTE band 4 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 4 (10 ㎒ - QPSK_RB 1)

Low Channel



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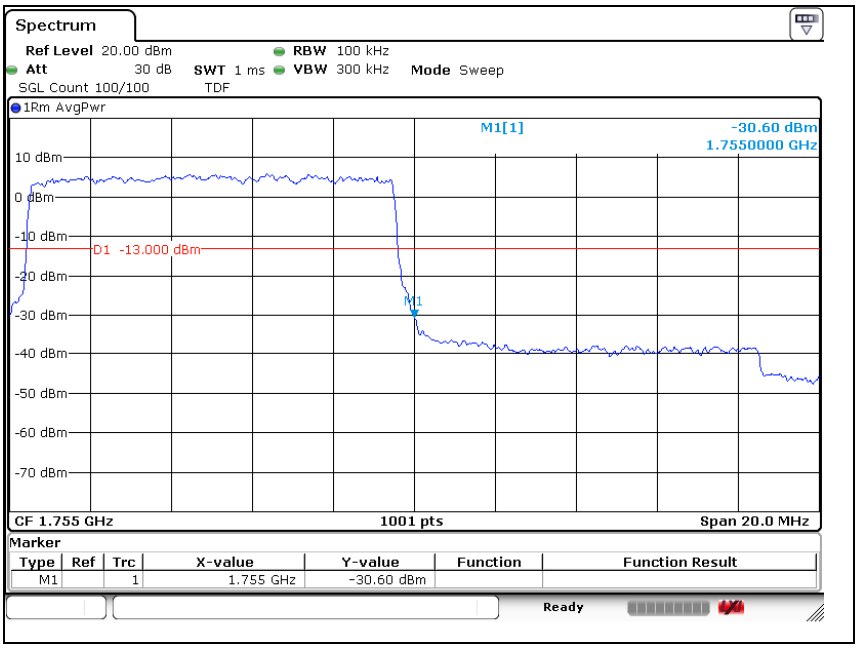
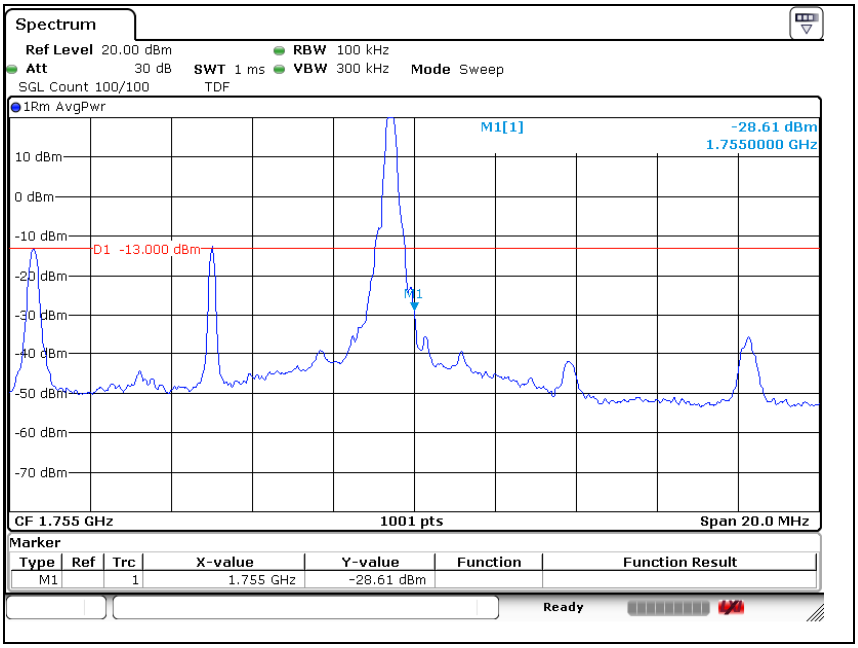
LTE band 4 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 4 (10 ㎒ - QPSK_RB 1)
High Channel



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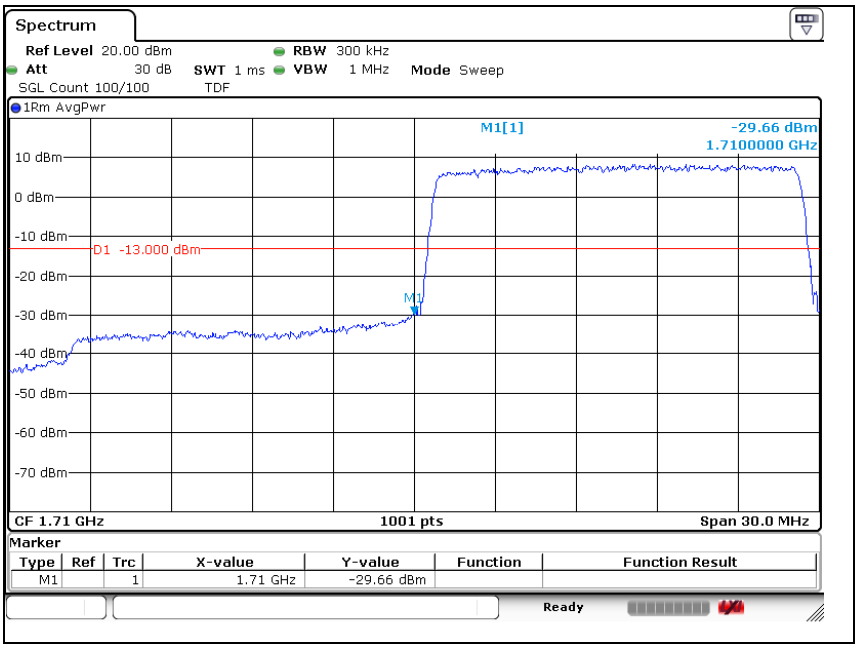
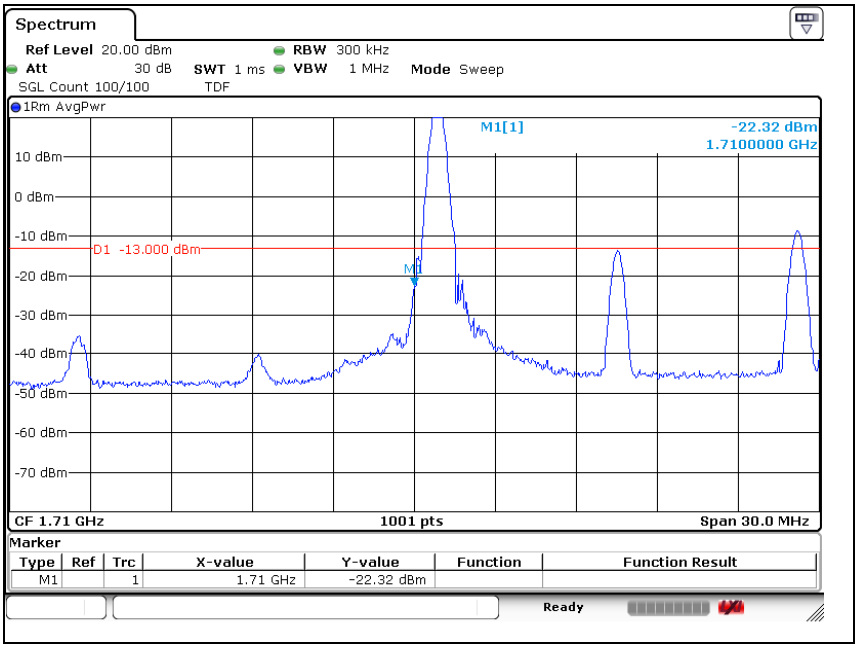
LTE band 4 (15 ㎒ - QPSK_RB 75)

Low Channel



LTE band 4 (15 ㎒ - QPSK_RB 1)

Low Channel



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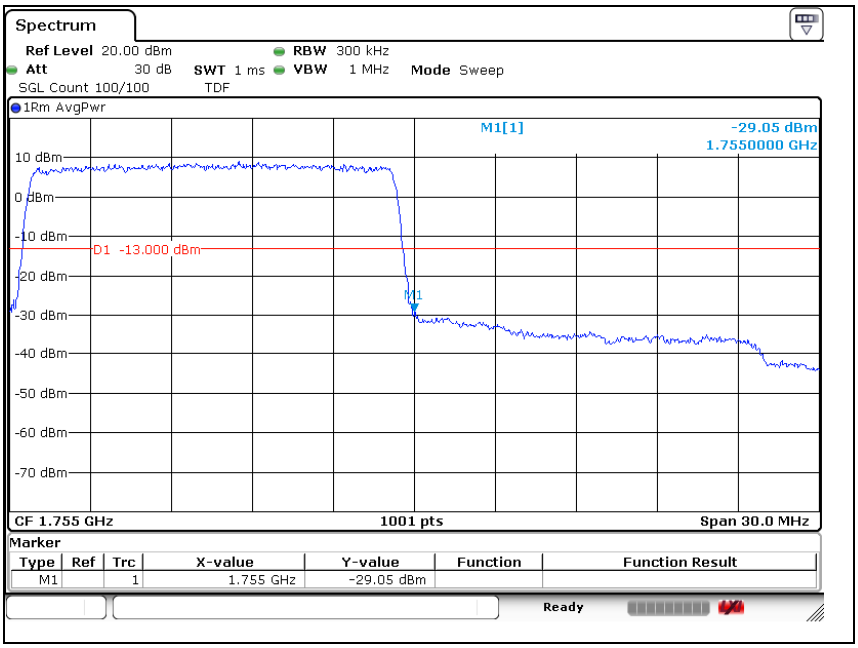
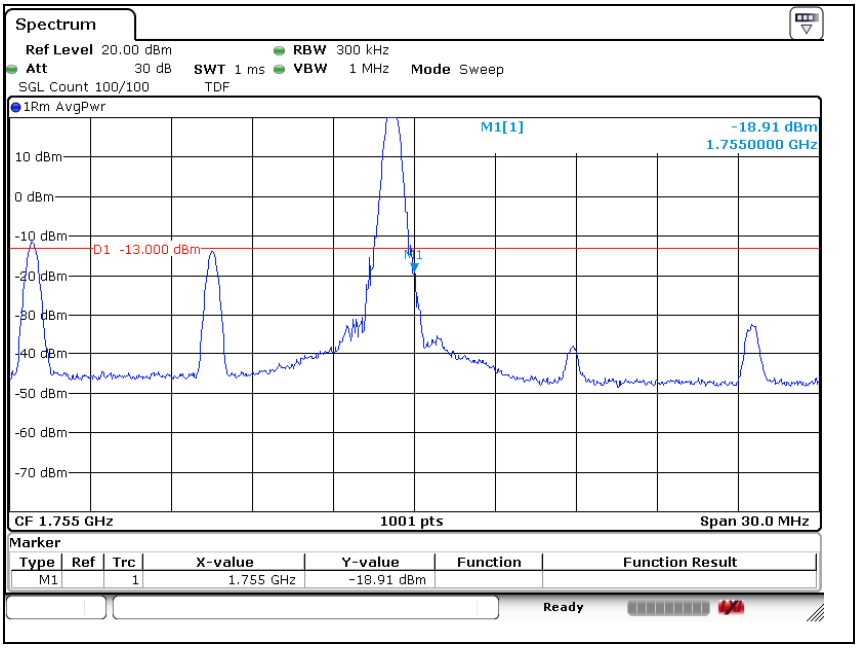
LTE band 4 (15 ㎒ - QPSK_RB 75)
High Channel



LTE band 4 (15 ㎒ - QPSK_RB 1)
High Channel



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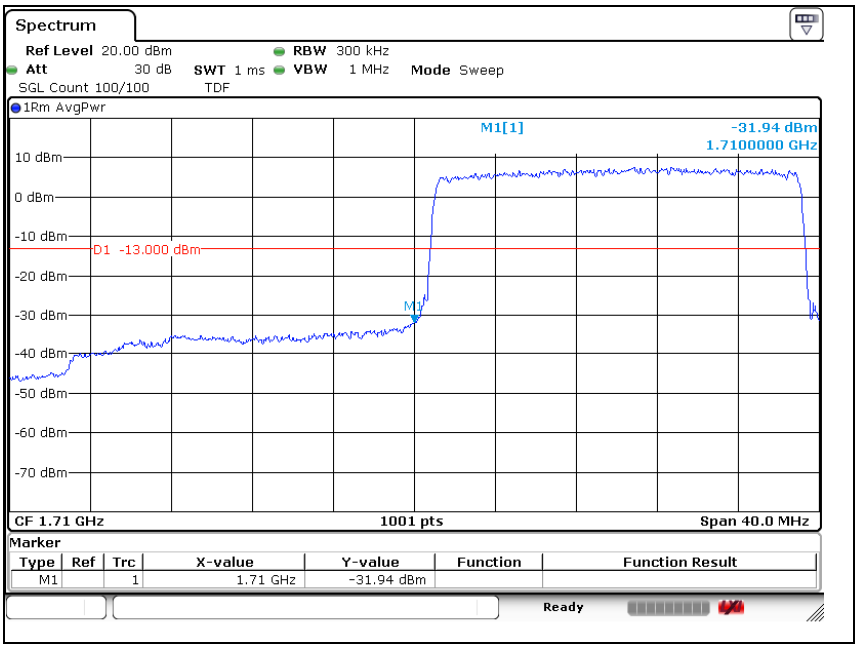
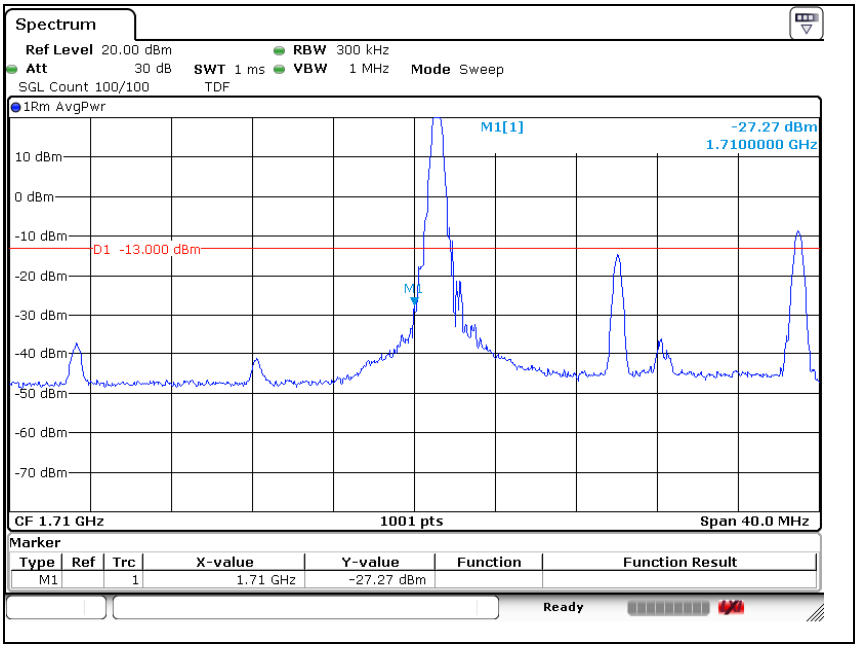
LTE band 4 (20 ㎒ - QPSK_RB 100)

Low Channel



LTE band 4 (20 ㎒ - QPSK_RB 1)

Low Channel



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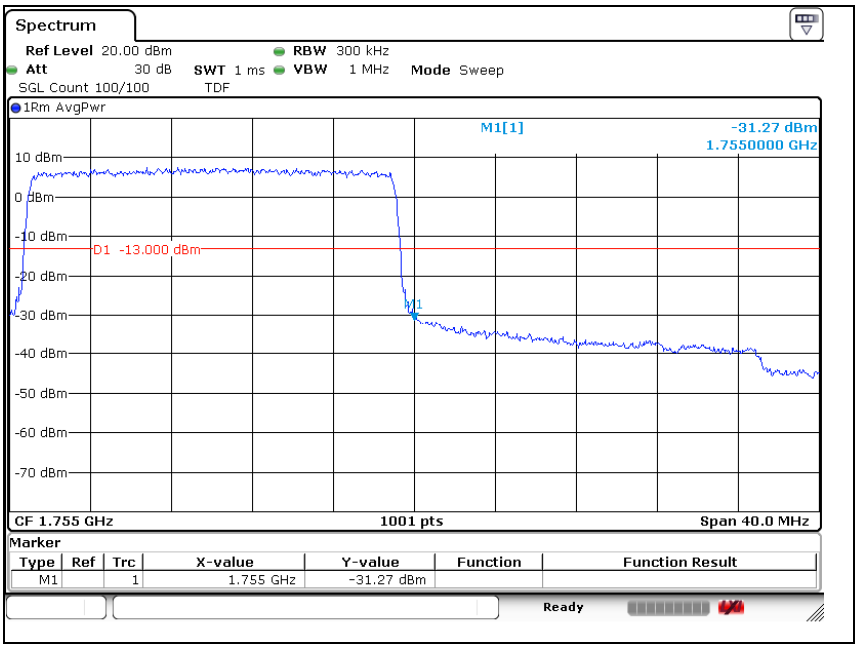
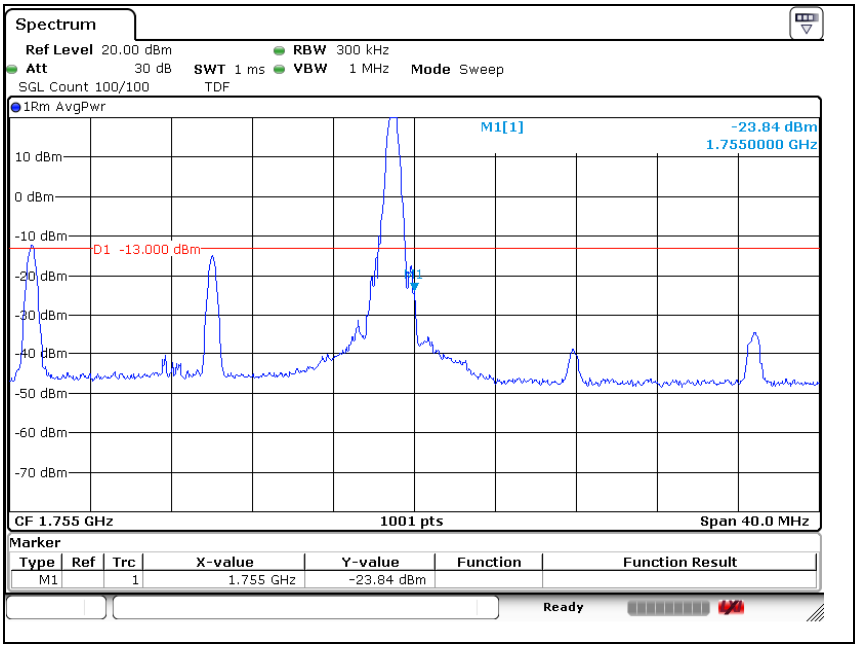
LTE band 4 (20 ㎒ - QPSK_RB 100)
High Channel



LTE band 4 (20 ㎒ - QPSK_RB 1)
High Channel



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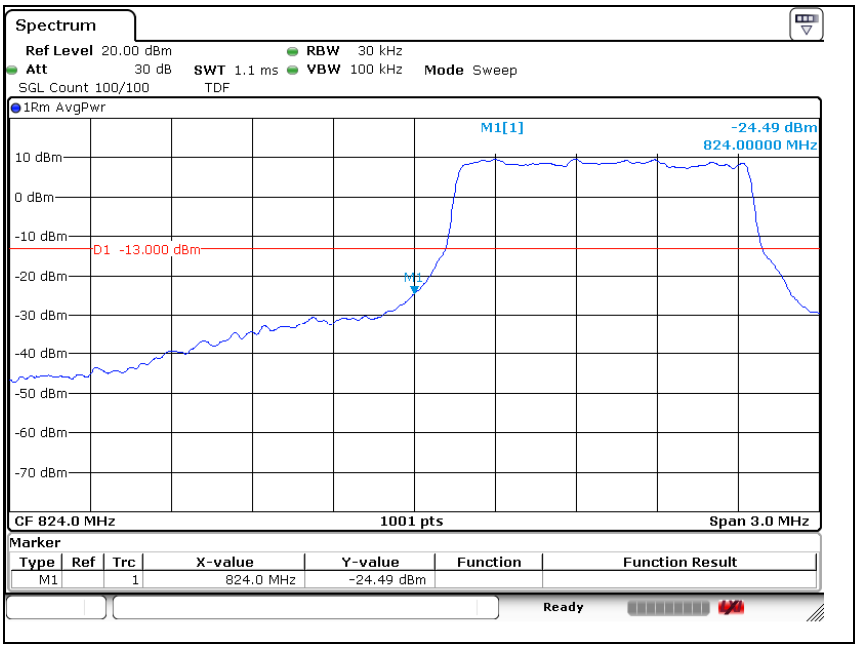
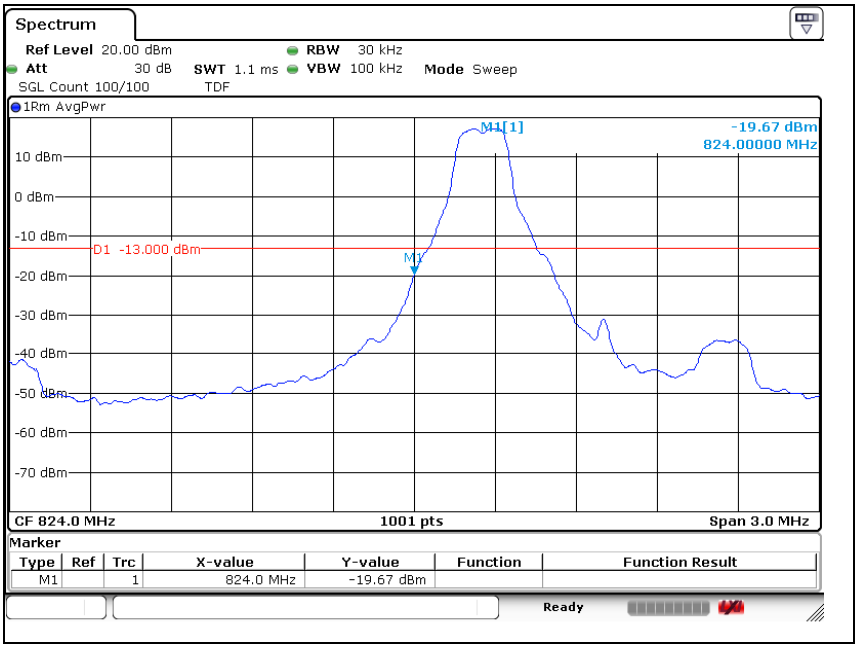
LTE band 5 (1.4 ㎒ - QPSK_RB 6)
Low Channel



LTE band 5 (1.4 ㎒ - QPSK_RB 1)
Low Channel



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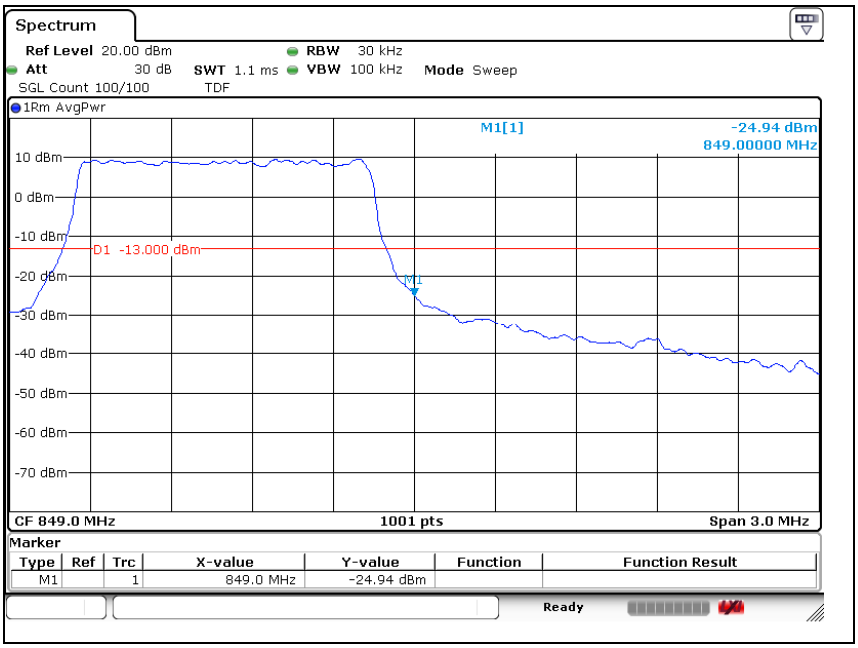
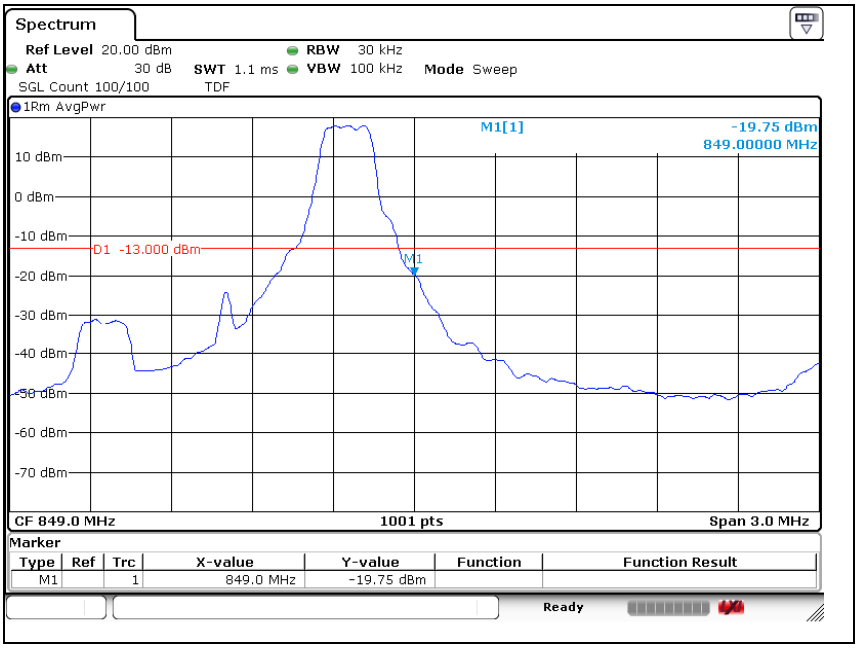
LTE band 5 (1.4 ㎒ - QPSK_RB 6)
High Channel



LTE band 5 (1.4 ㎒ - QPSK_RB 1)
High Channel



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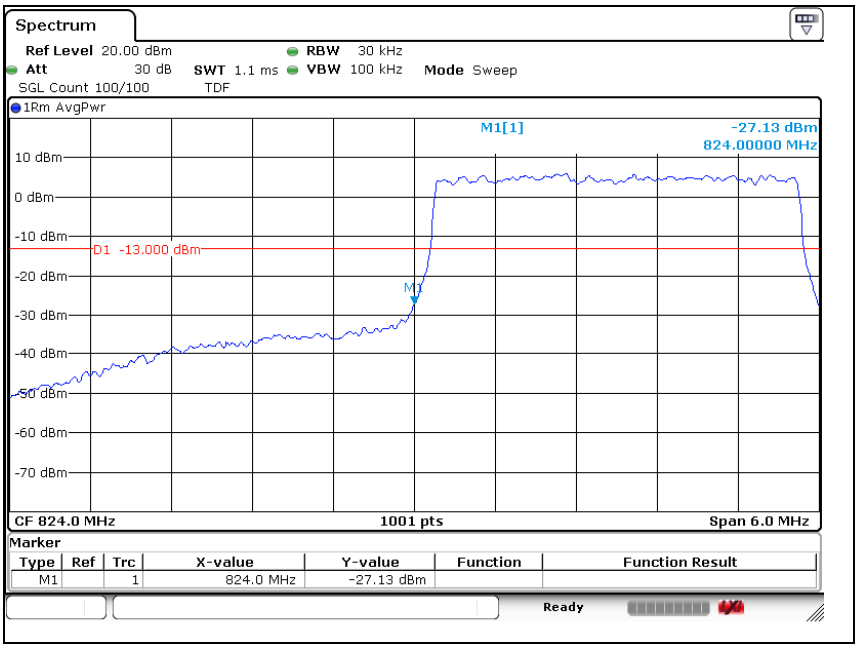
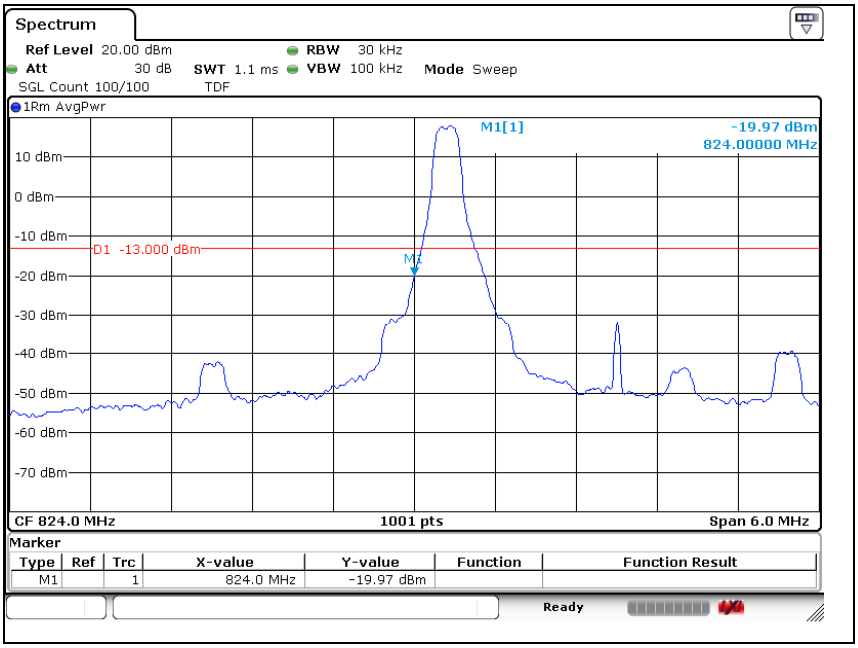
LTE band 5 (3 ㎒ - QPSK_RB 15)
Low Channel



LTE band 5 (3 ㎒ - QPSK_RB 1)
Low Channel



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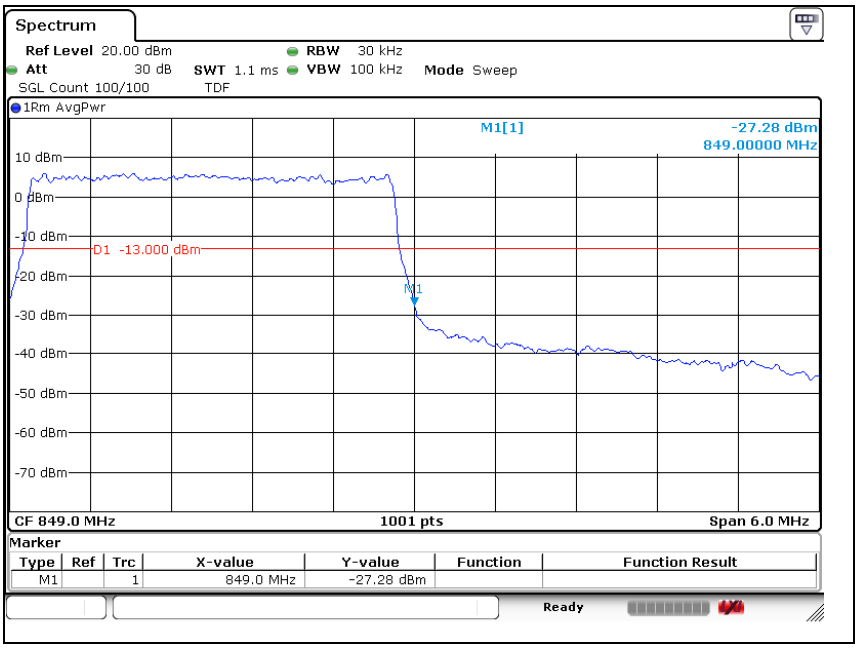
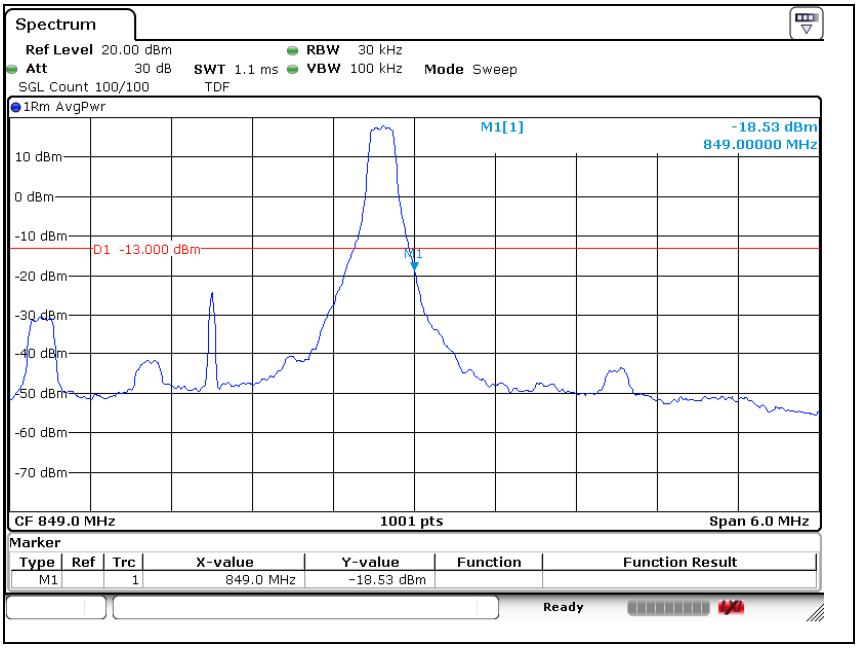
LTE band 5 (3 ㎒ - QPSK_RB 15)
High Channel



LTE band 5 (3 ㎒ - QPSK_RB 1)
High Channel



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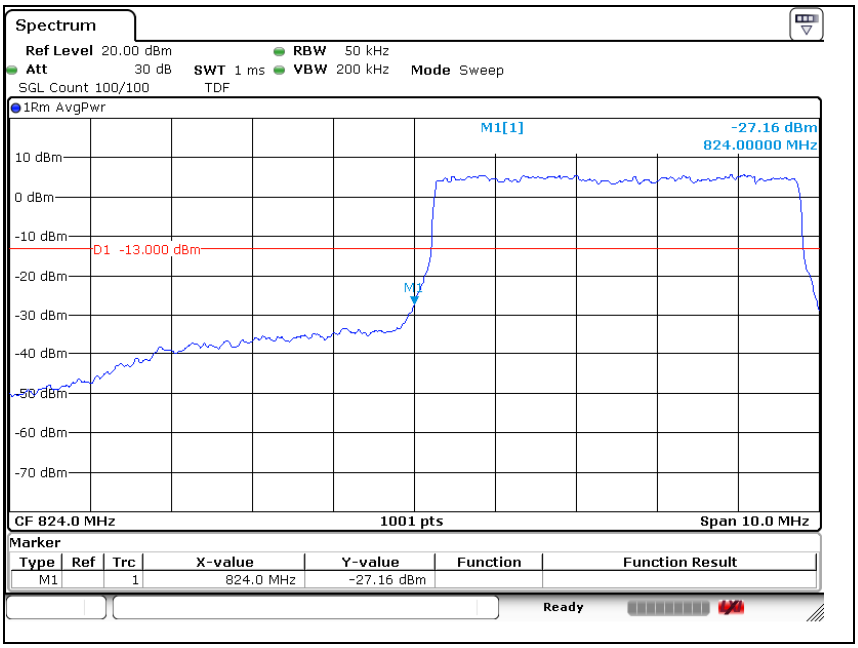
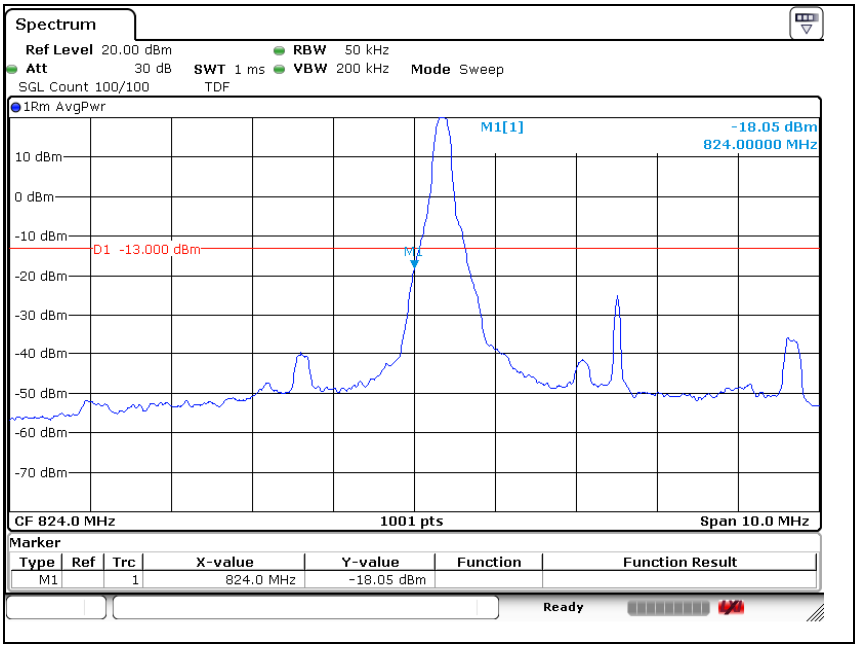
LTE band 5 (5 ㎒ - QPSK_RB 25)
Low Channel



LTE band 5 (5 ㎒ - QPSK_RB 1)
Low Channel



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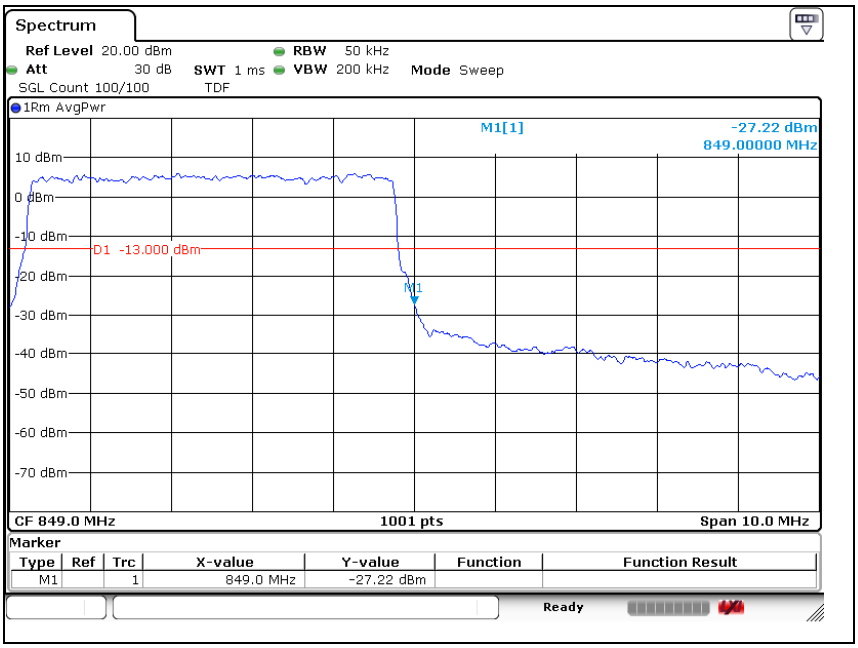
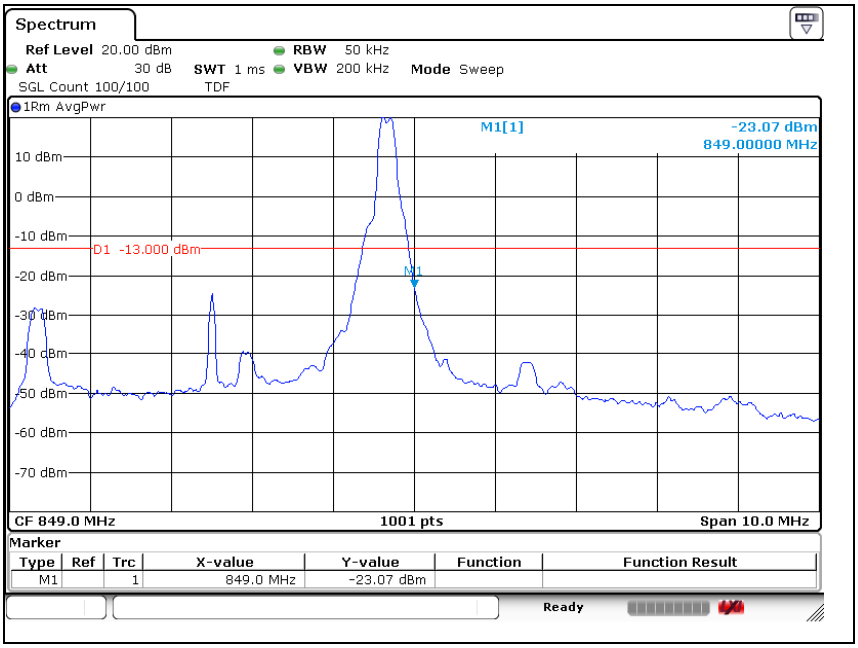
LTE band 5 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 5 (5 ㎒ - QPSK_RB 1)
High Channel



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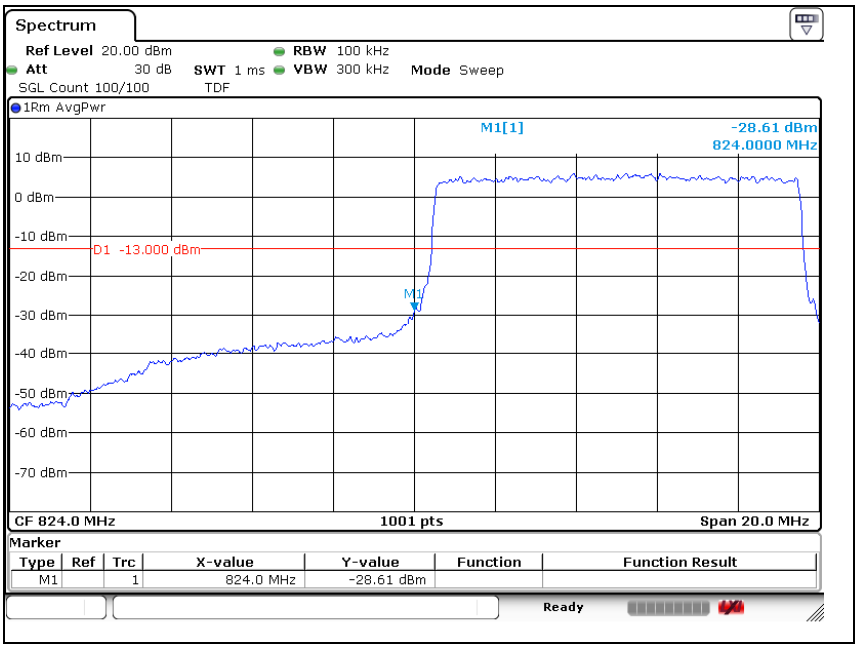
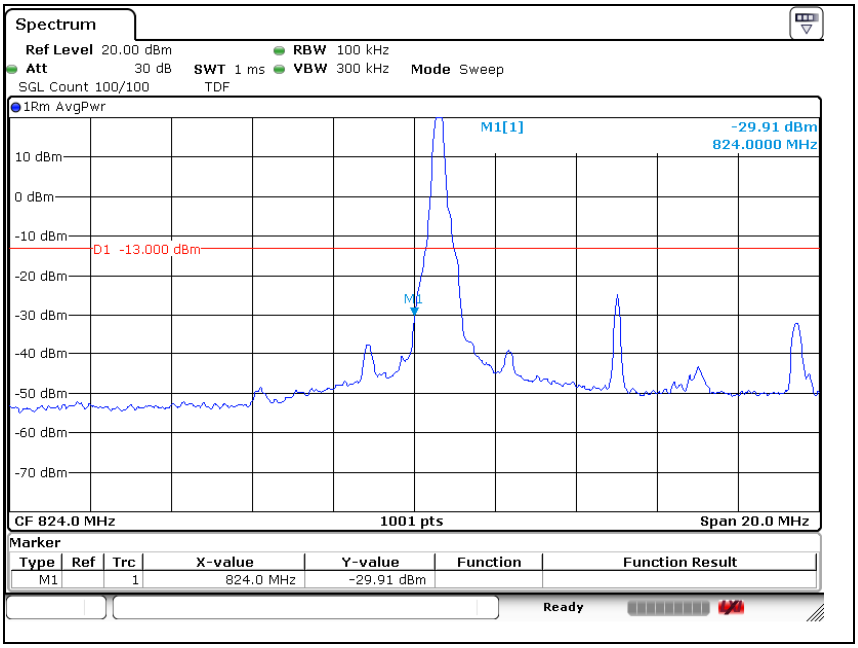
LTE band 5 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 5 (10 ㎒ - QPSK_RB 1)

Low Channel



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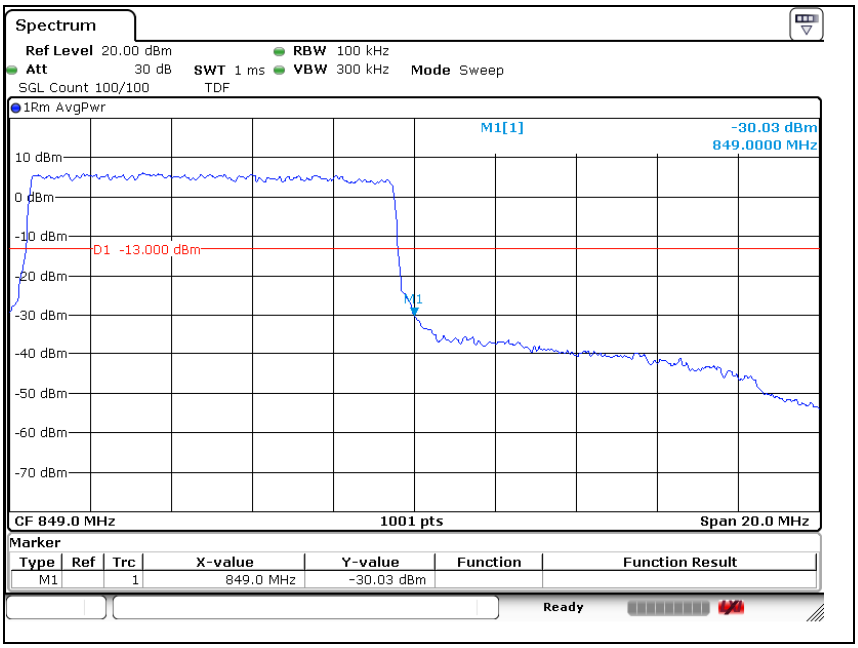
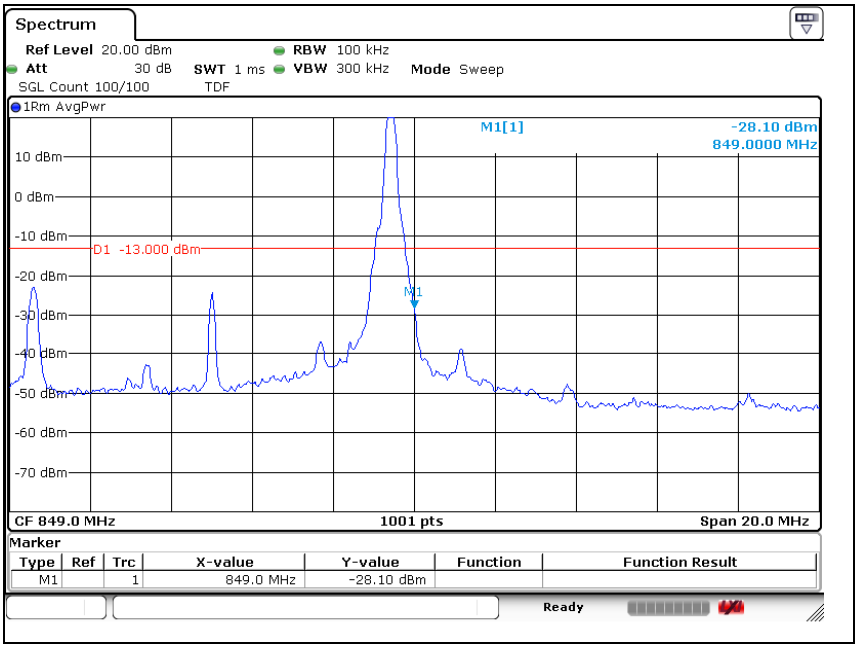
LTE band 5 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 5 (10 ㎒ - QPSK_RB 1)
High Channel



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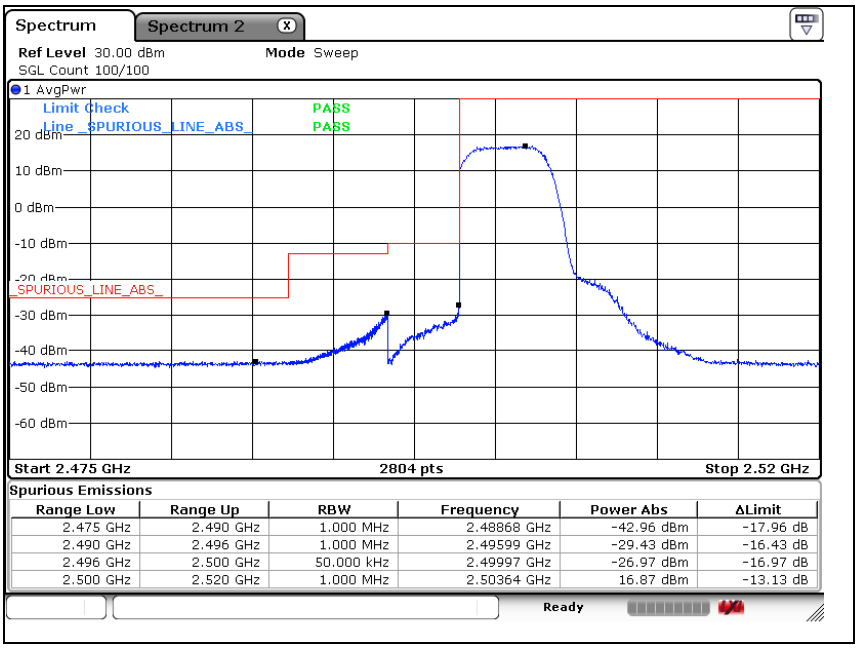
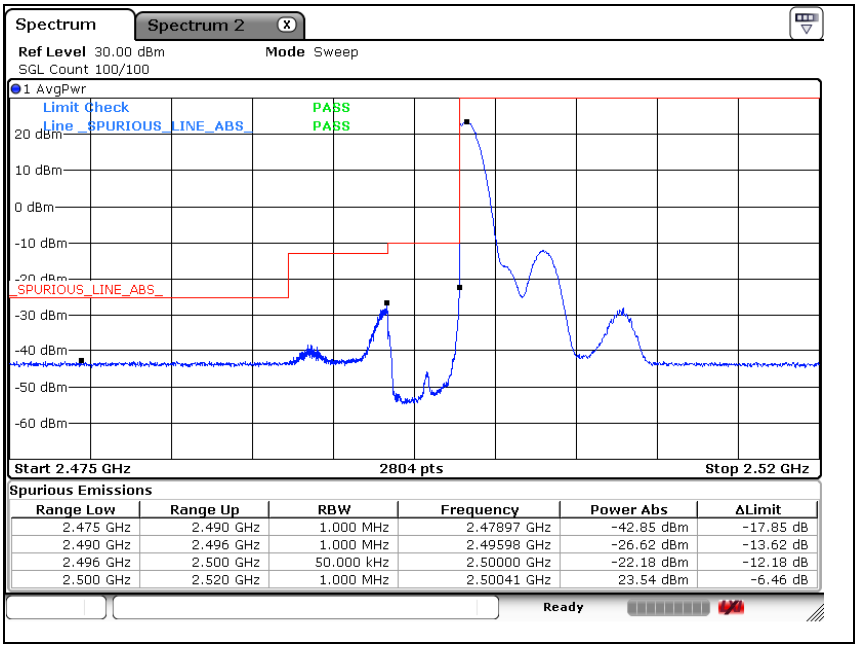
LTE band 7 (5 ㎒ - QPSK_RB 25)
Low Channel



LTE band 7 (5 ㎒ - QPSK_RB 1)
Low Channel



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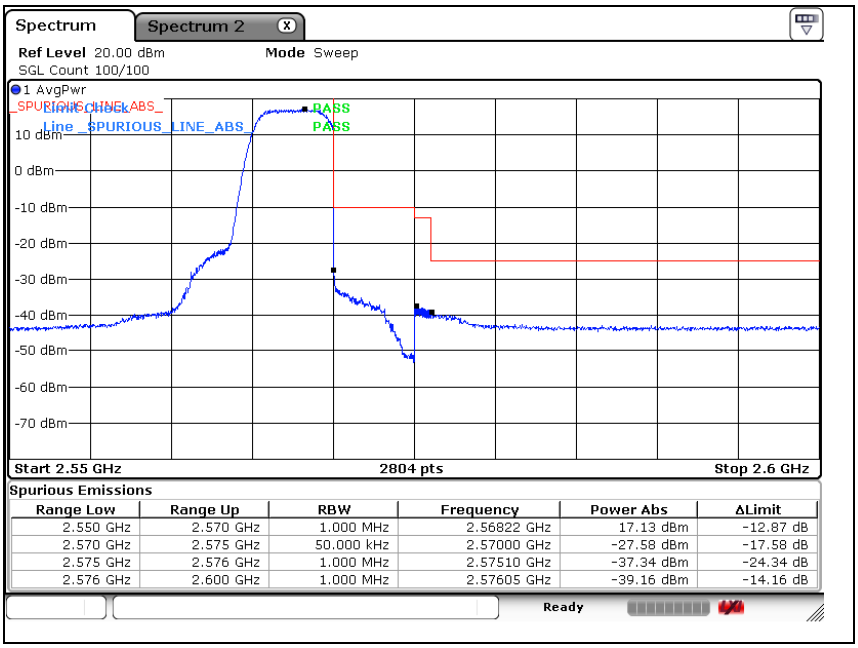
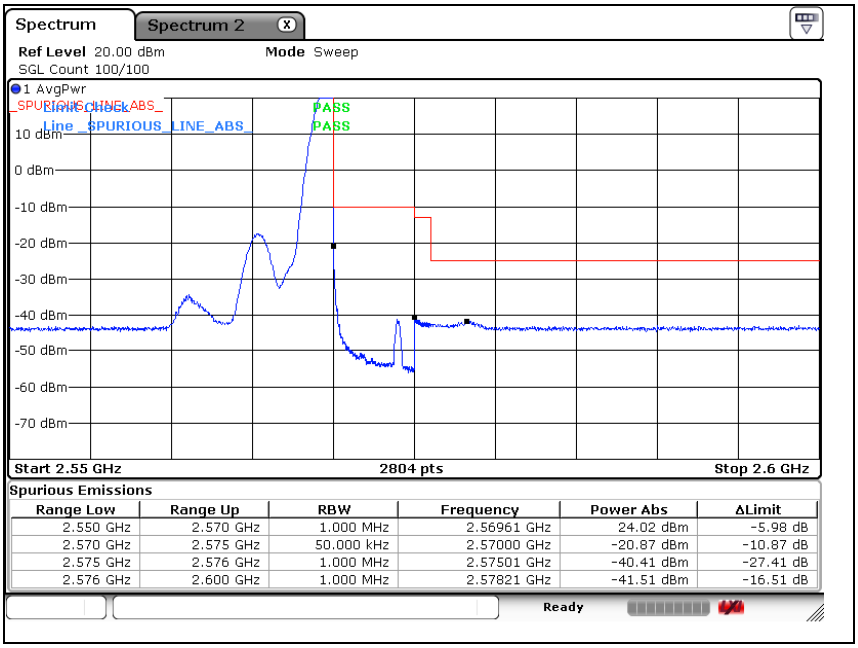
LTE band 7 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 7 (5 ㎒ - QPSK_RB 1)
High Channel



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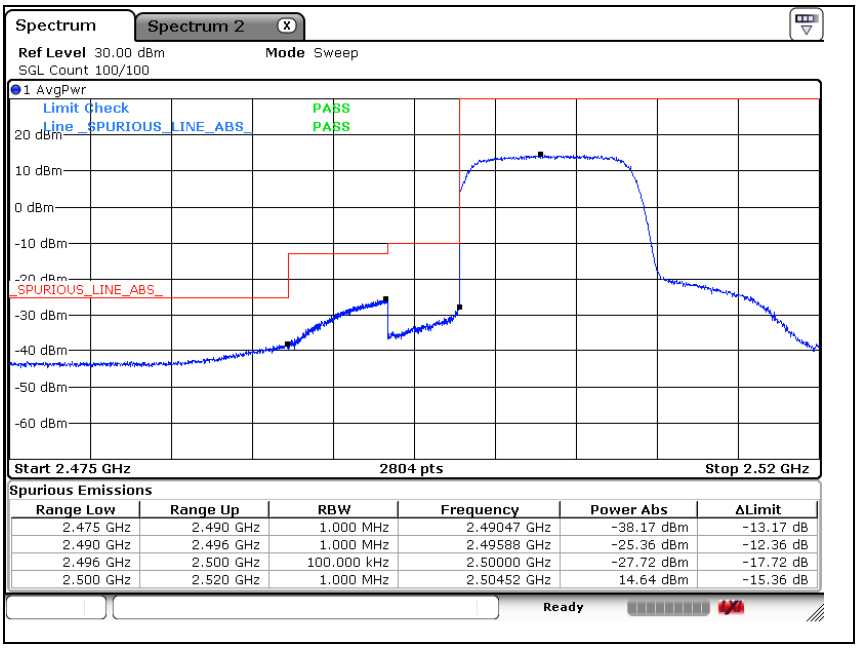
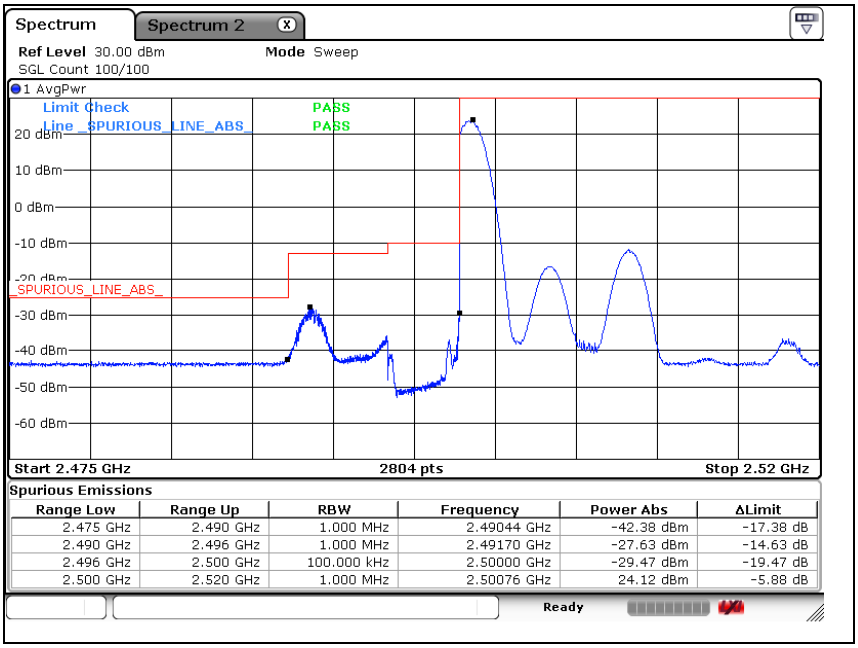
LTE band 7 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 7 (10 ㎒ - QPSK_RB 1)

Low Channel



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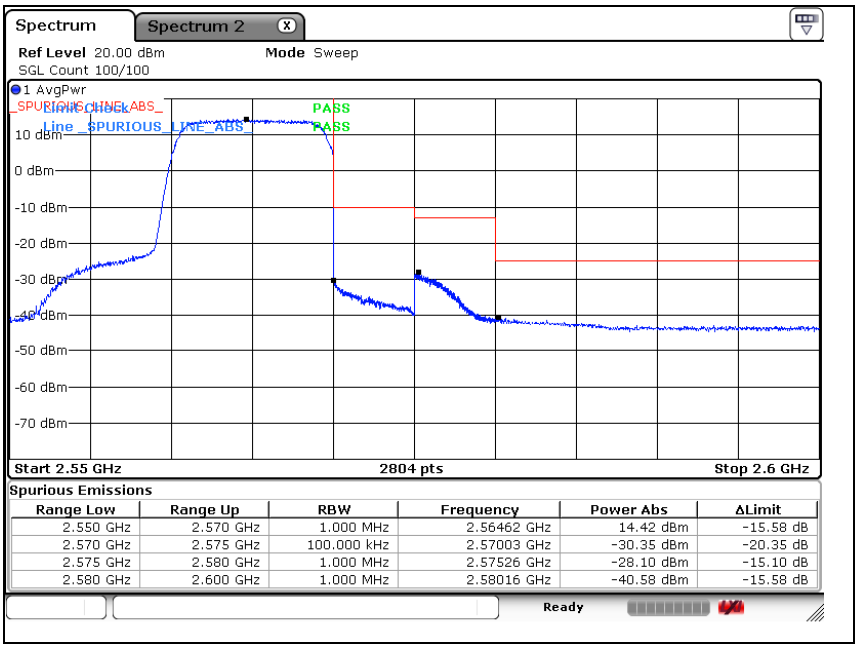
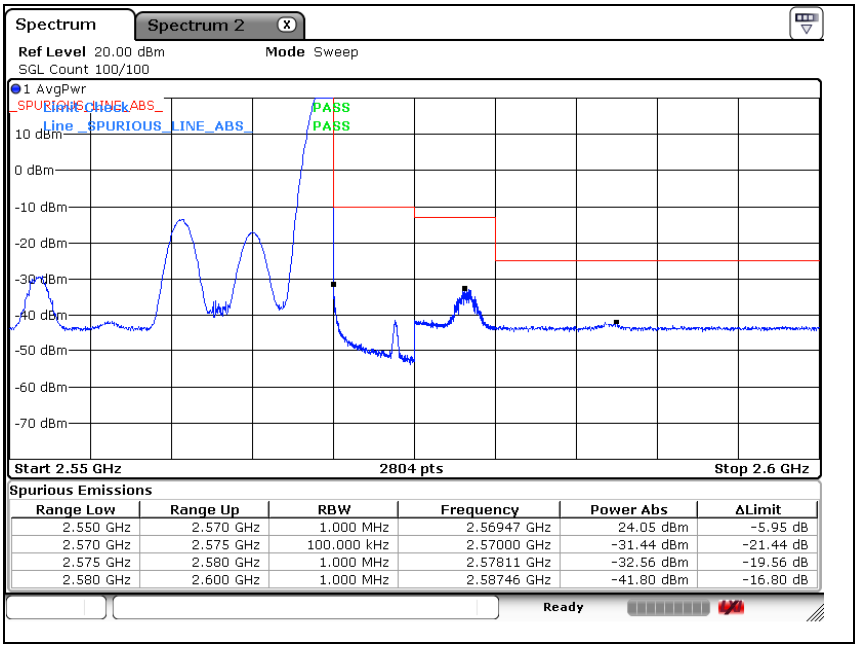
LTE band 7 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 7 (10 ㎒ - QPSK_RB 1)
High Channel



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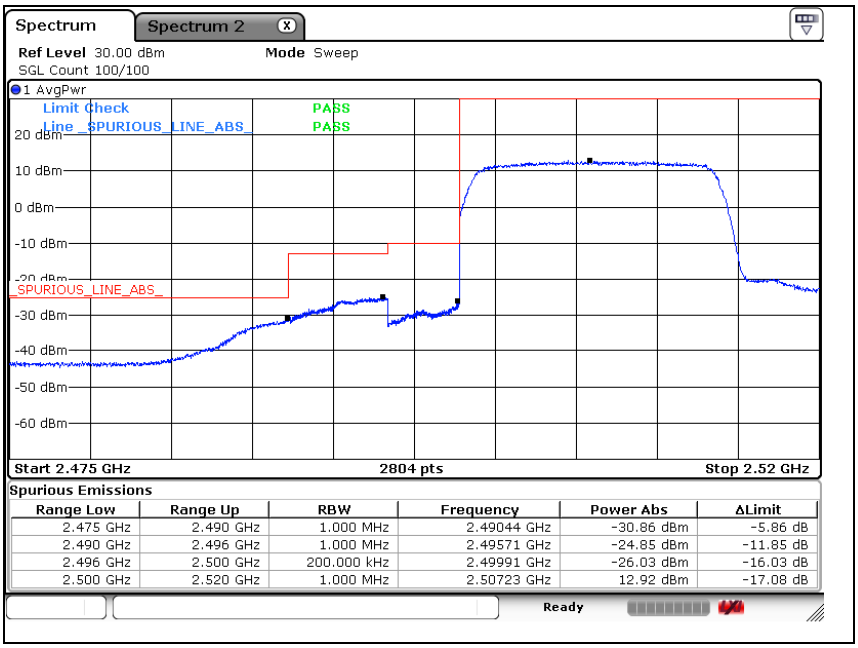
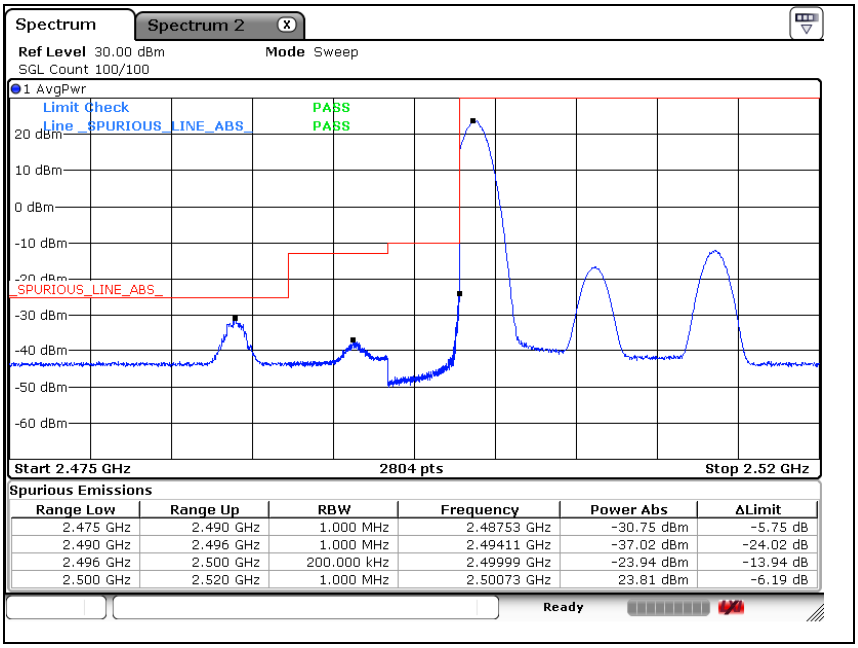
LTE band 7 (15 ㎒ - QPSK_RB 75)

Low Channel



LTE band 7 (15 ㎒ - QPSK_RB 1)

Low Channel



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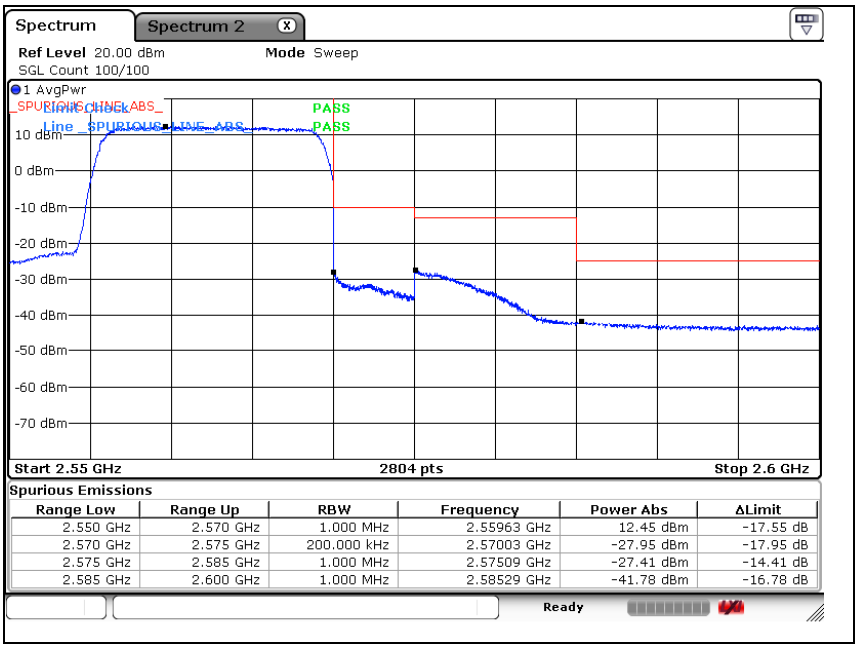
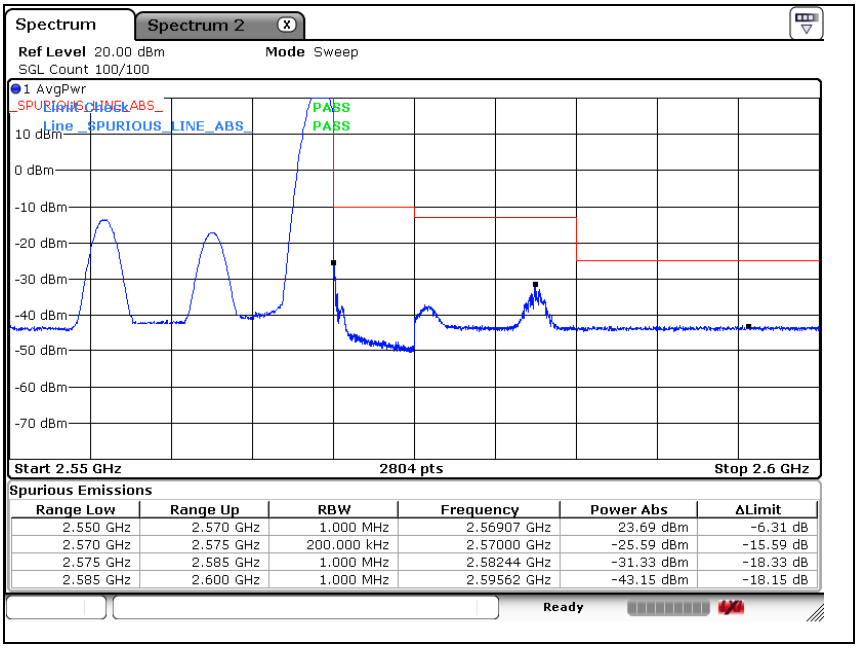
LTE band 7 (15 ㎒ - QPSK_RB 75)
High Channel



LTE band 7 (15 ㎒ - QPSK_RB 1)
High Channel



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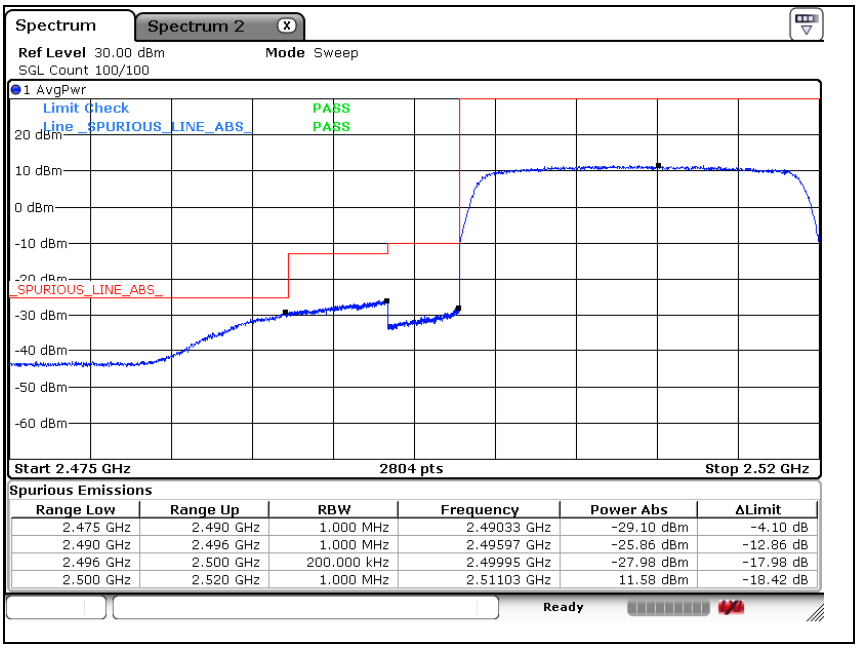
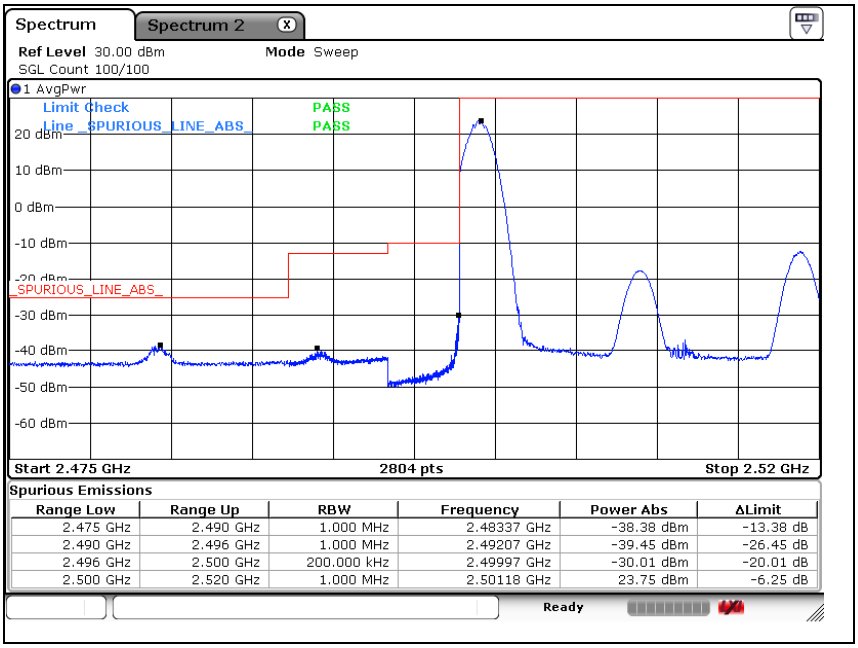
LTE band 7 (20 ㎒ - QPSK_RB 100)
Low Channel



LTE band 7 (20 ㎒ - QPSK_RB 1)
Low Channel



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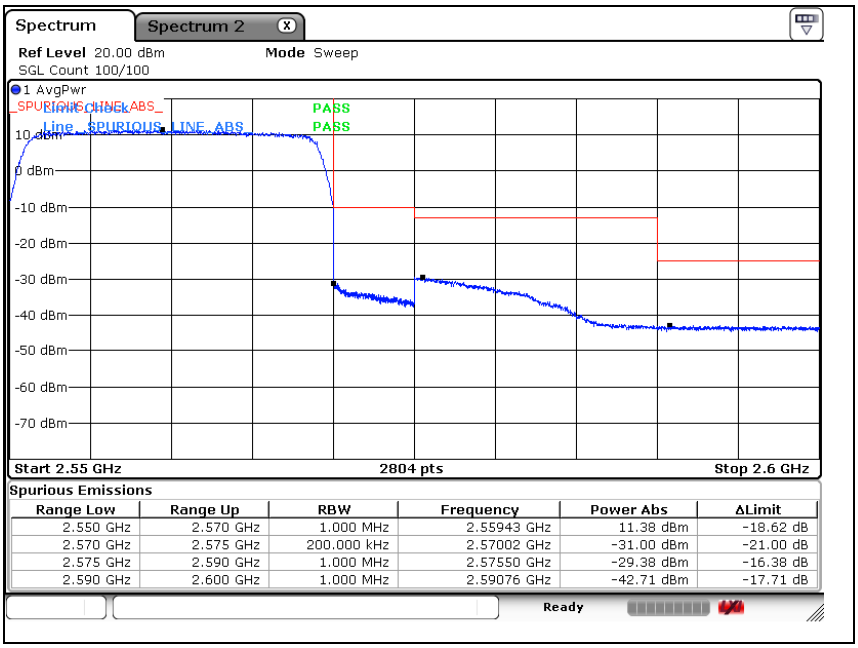
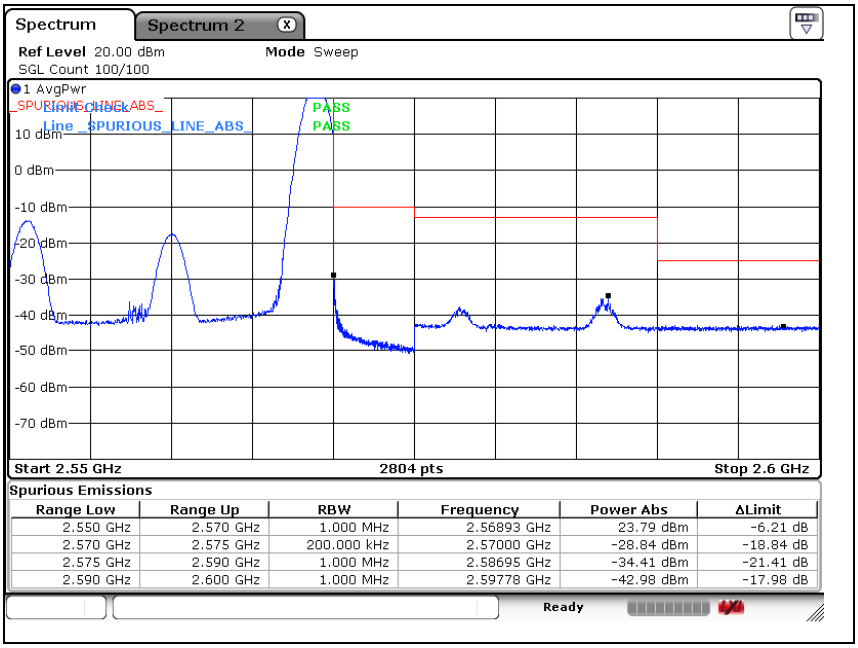
LTE band 7 (20 ㎒ - QPSK_RB 100)
High Channel



LTE band 7 (20 ㎒ - QPSK_RB 1)
High Channel



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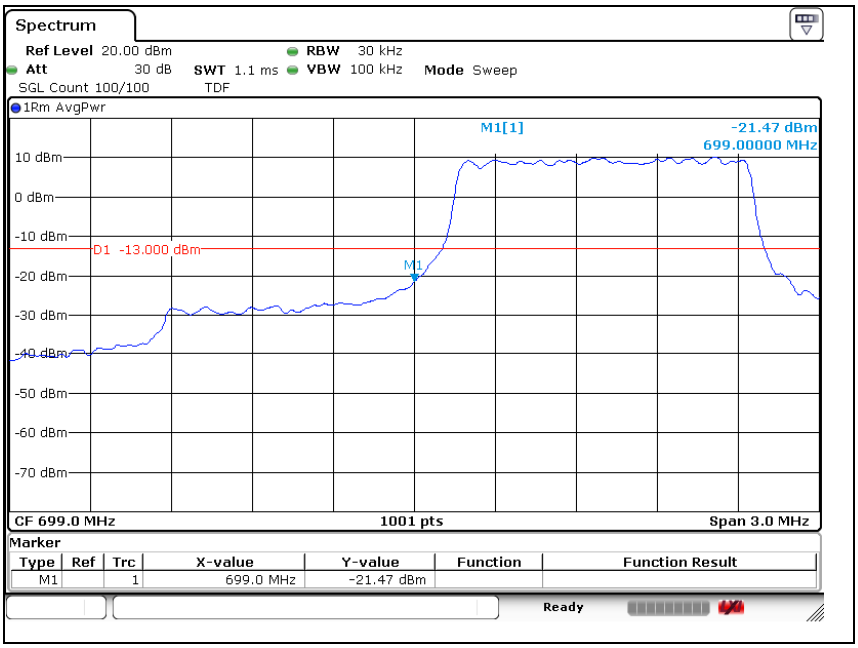
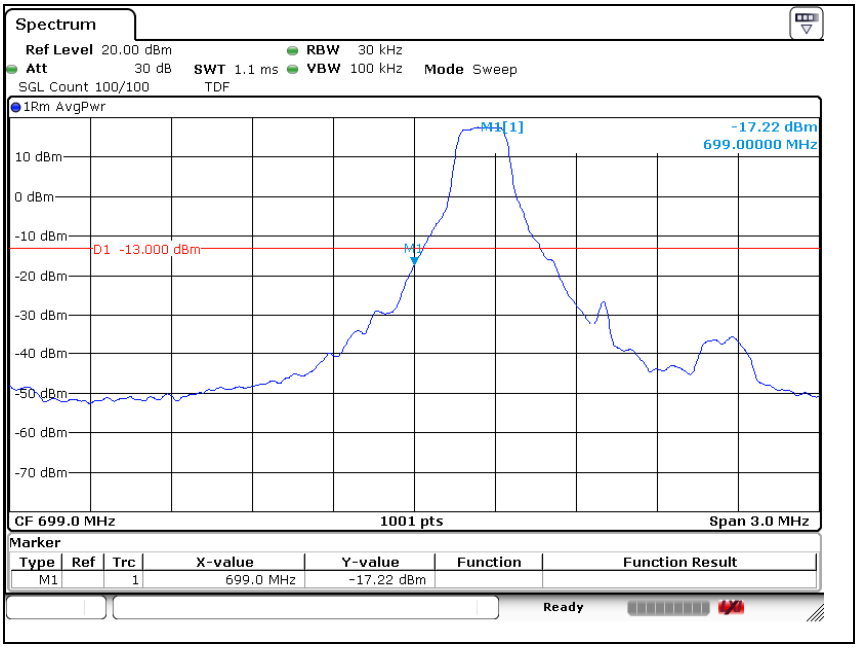
LTE band 12 (1.4 ㎒ - QPSK_RB 6)

Low Channel



LTE band 12 (1.4 ㎒ - QPSK_RB 1)

Low Channel



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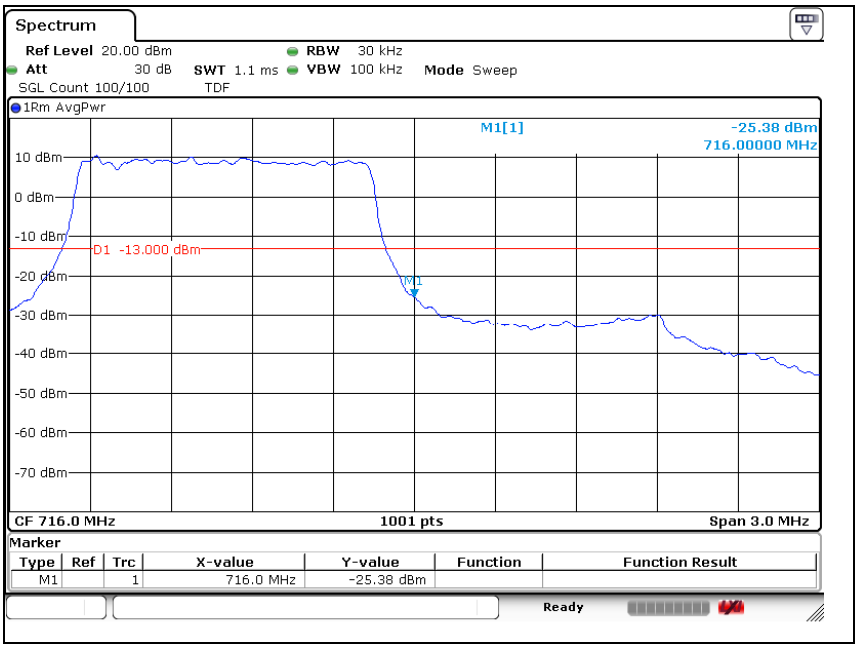
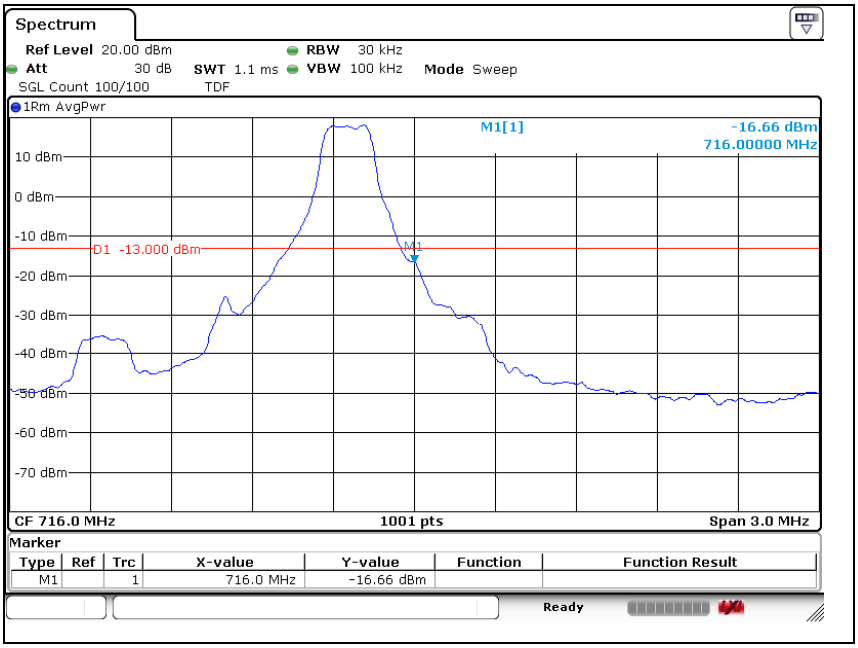
LTE band 12 (1.4 ㎒ - QPSK_RB 6)
High Channel



LTE band 12 (1.4 ㎒ - QPSK_RB 1)
High Channel



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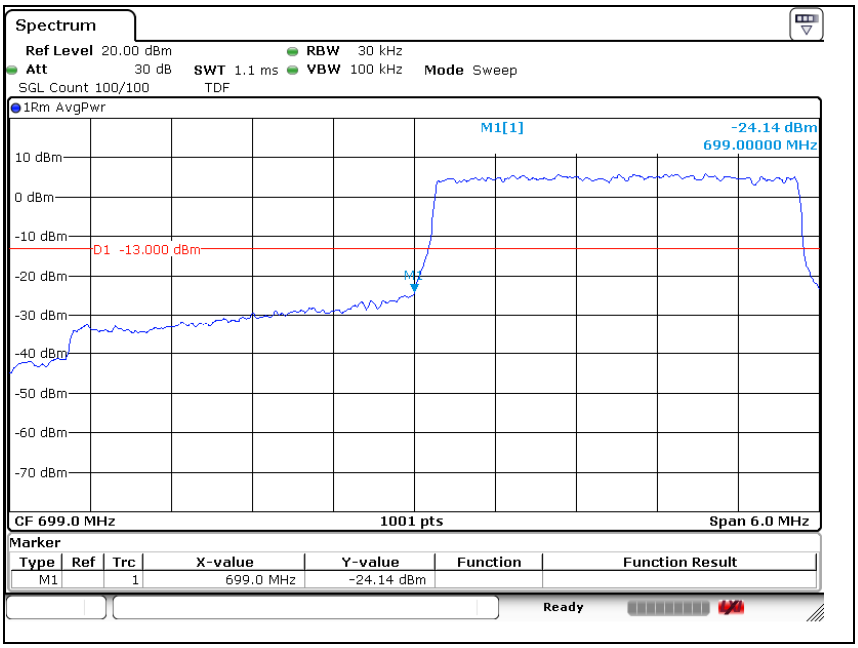
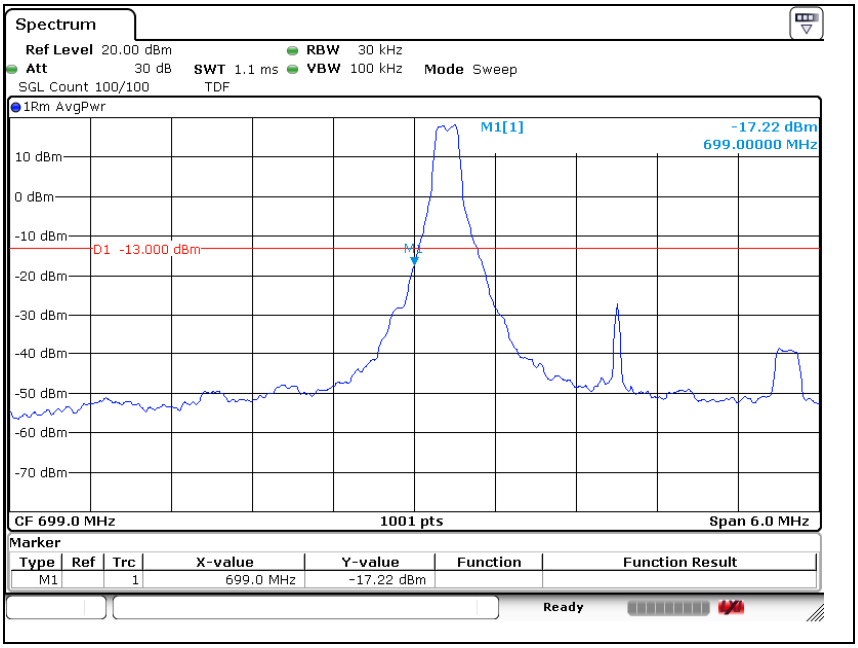
LTE band 12 (3 ㎒ - QPSK_RB 15)

Low Channel



LTE band 12 (3 ㎒ - QPSK_RB 1)

Low Channel



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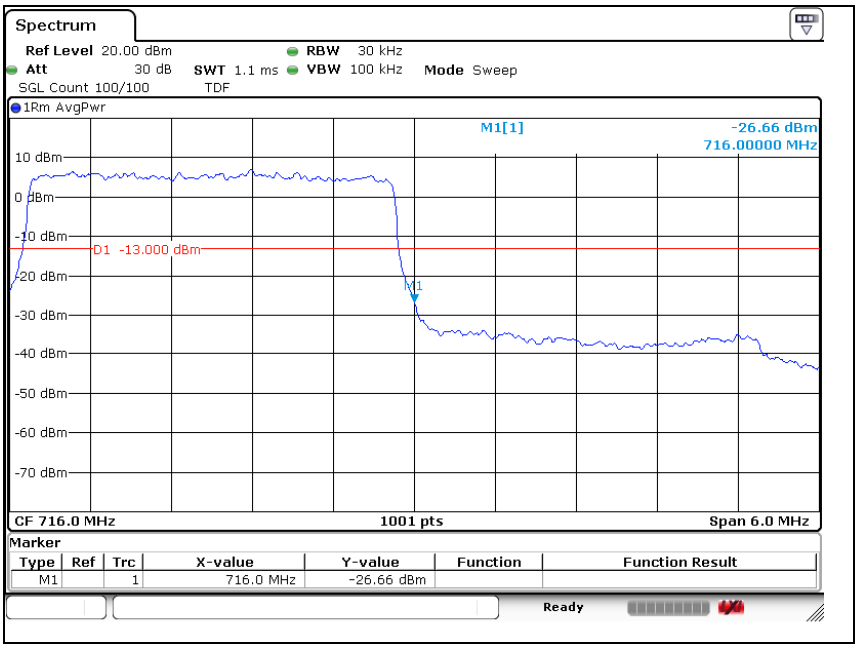
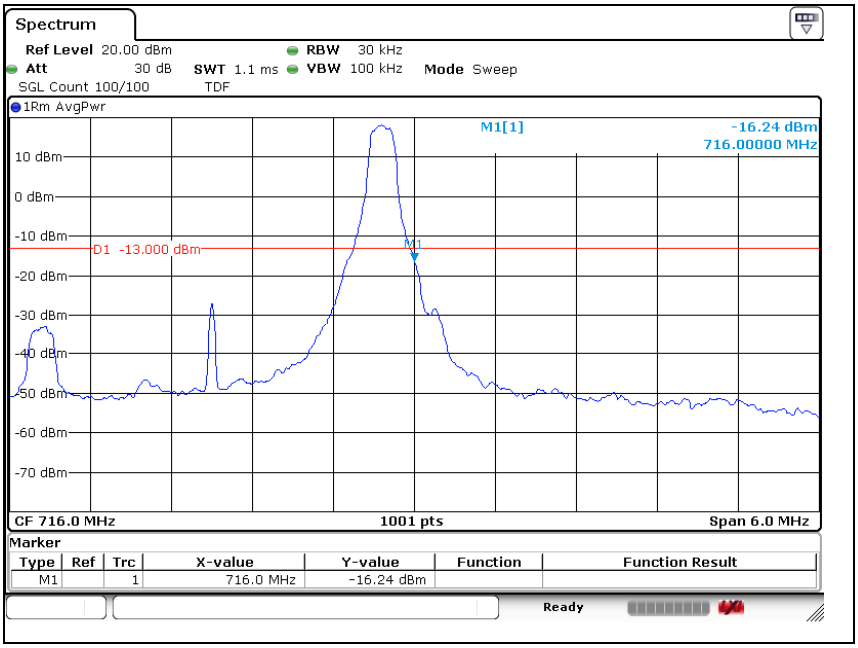
LTE band 12 (3 ㎒ - QPSK_RB 15)
High Channel



LTE band 12 (3 ㎒ - QPSK_RB 1)
High Channel



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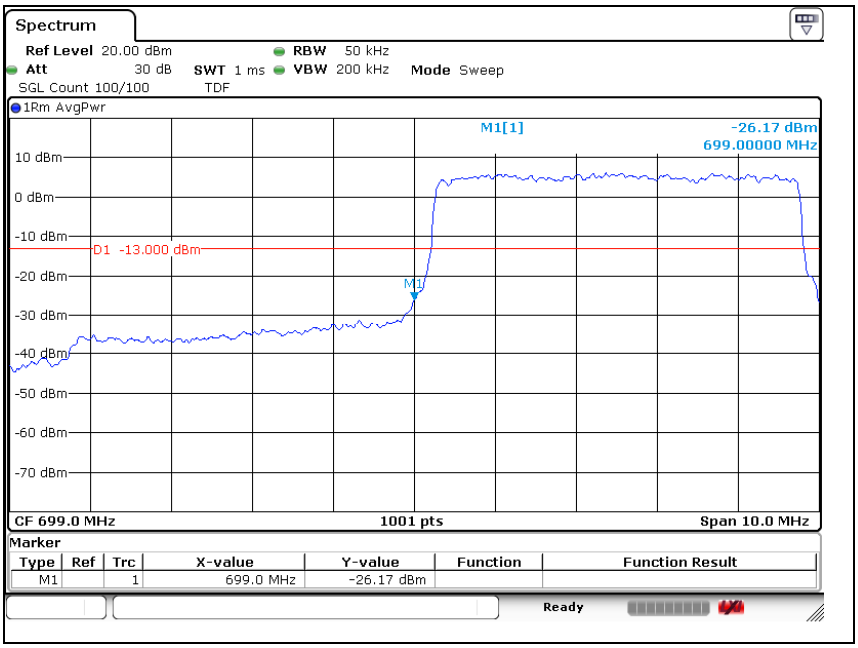
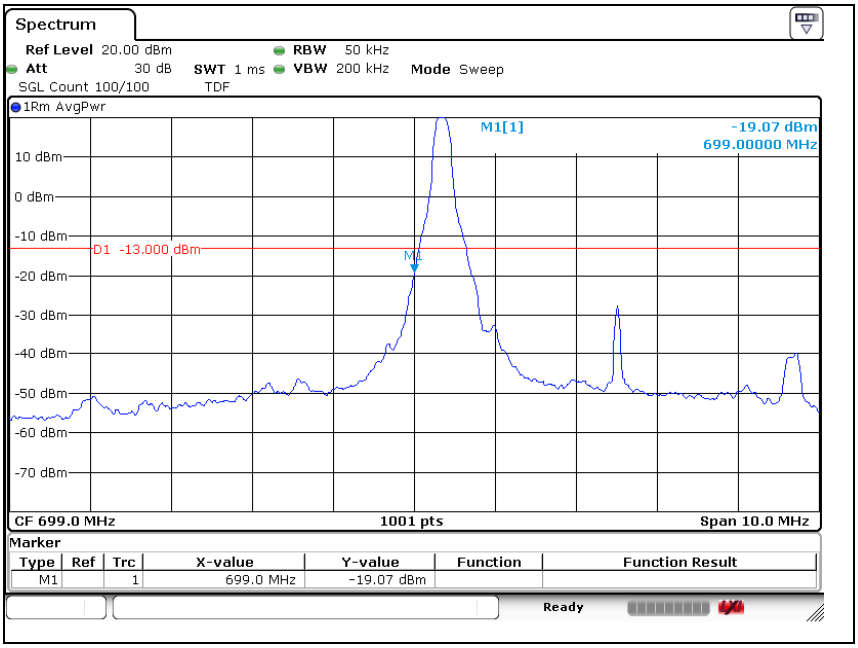
LTE band 12 (5 ㎒ - QPSK_RB 25)

Low Channel



LTE band 12 (5 ㎒ - QPSK_RB 1)

Low Channel



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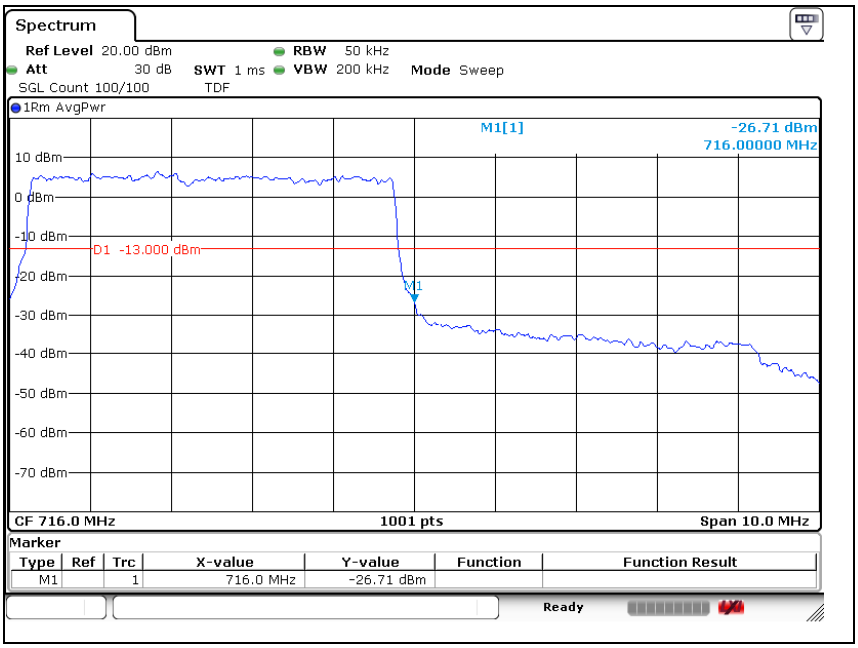
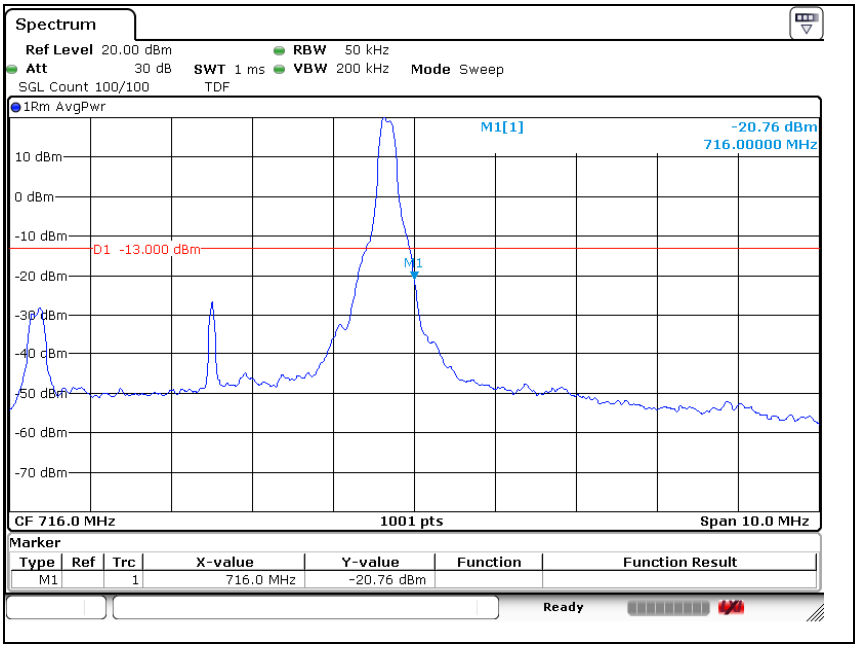
LTE band 12 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 12 (5 ㎒ - QPSK_RB 1)
High Channel



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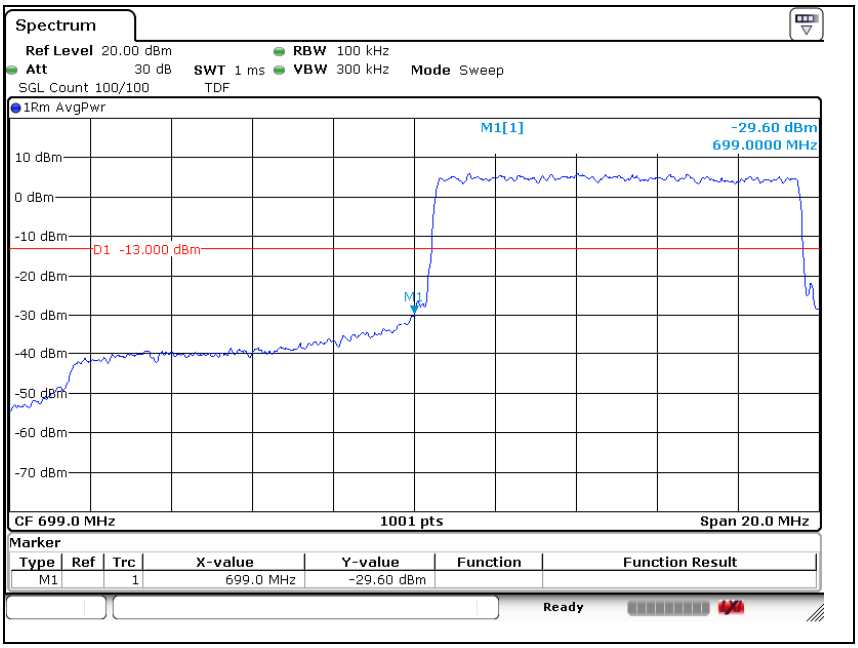
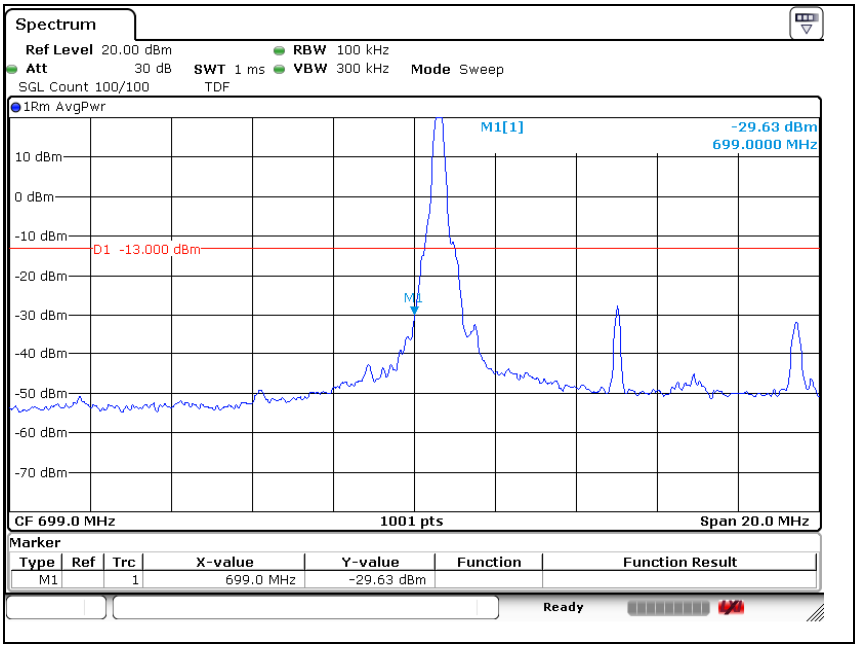
LTE band 12 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 12 (10 ㎒ - QPSK_RB 1)

Low Channel



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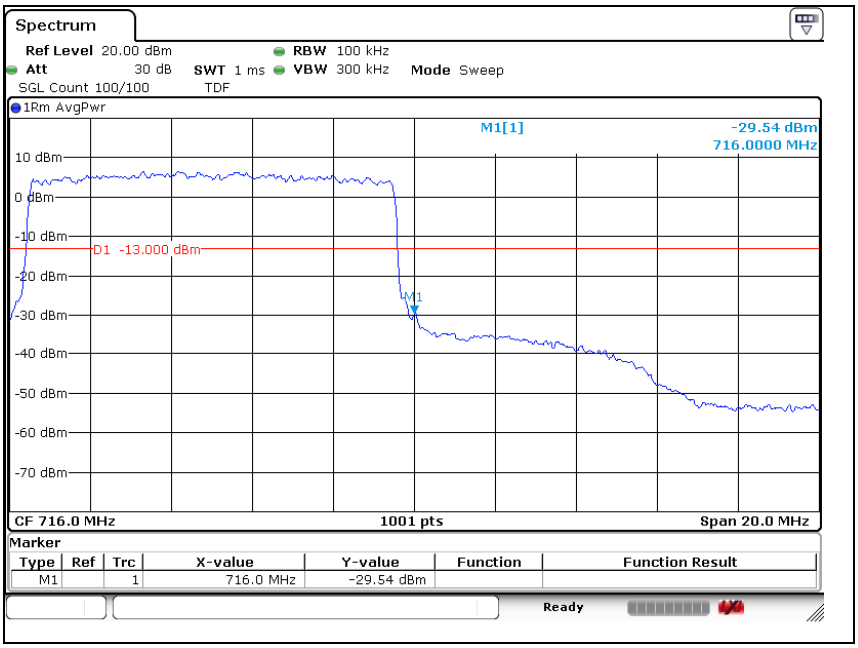
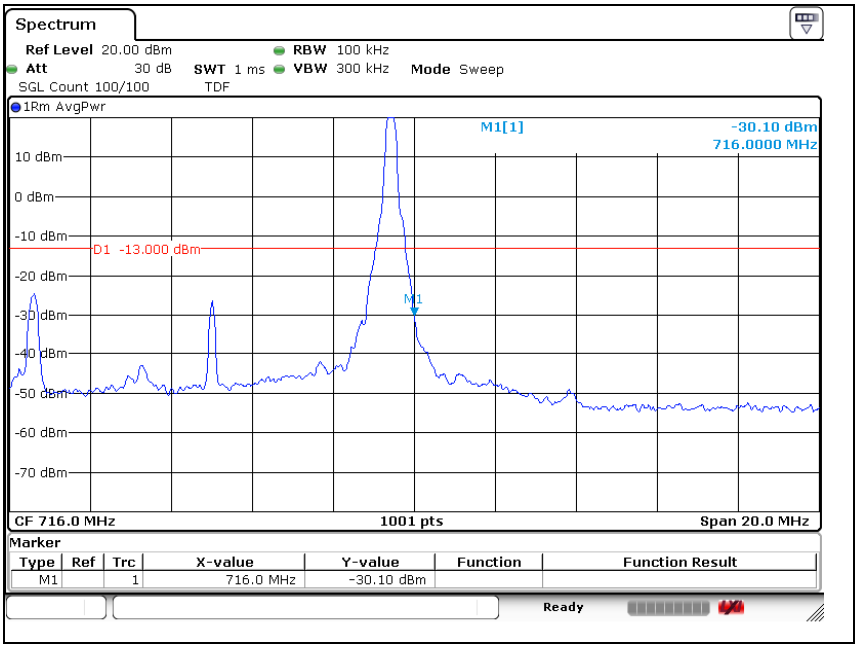
LTE band 12 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 12 (10 ㎒ - QPSK_RB 1)
High Channel



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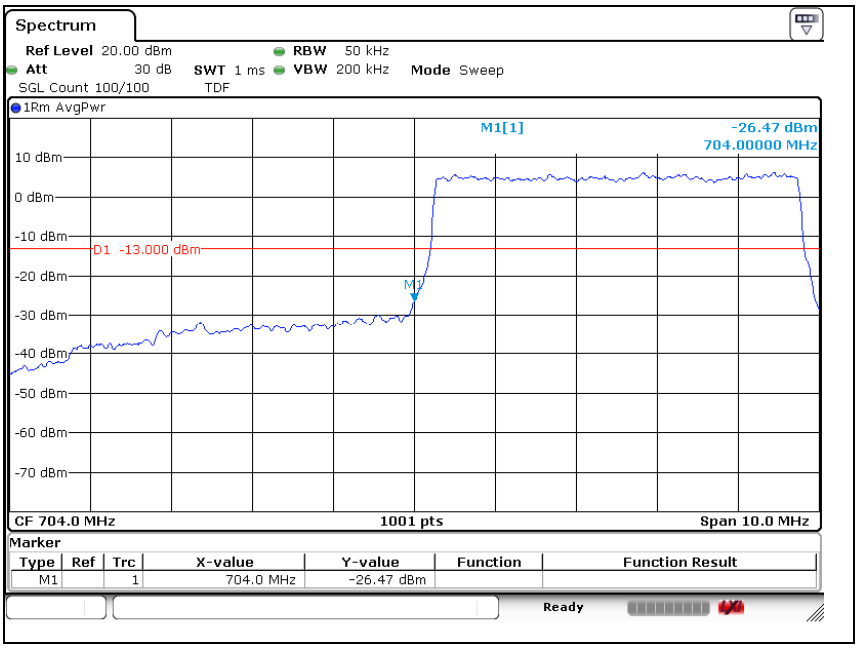
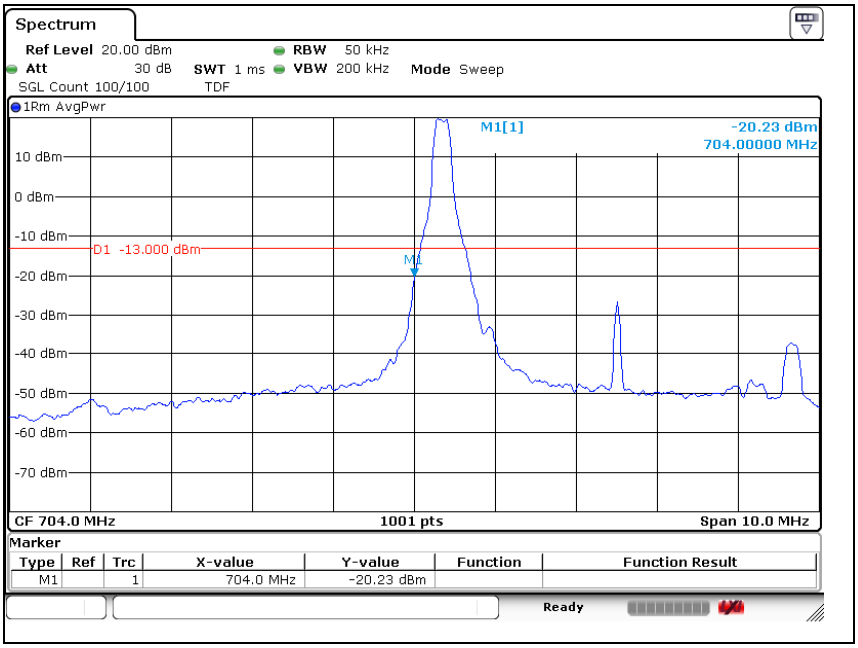
LTE band 17 (5 ㎒ - QPSK_RB 25)

Low Channel



LTE band 17 (5 ㎒ - QPSK_RB 1)

Low Channel



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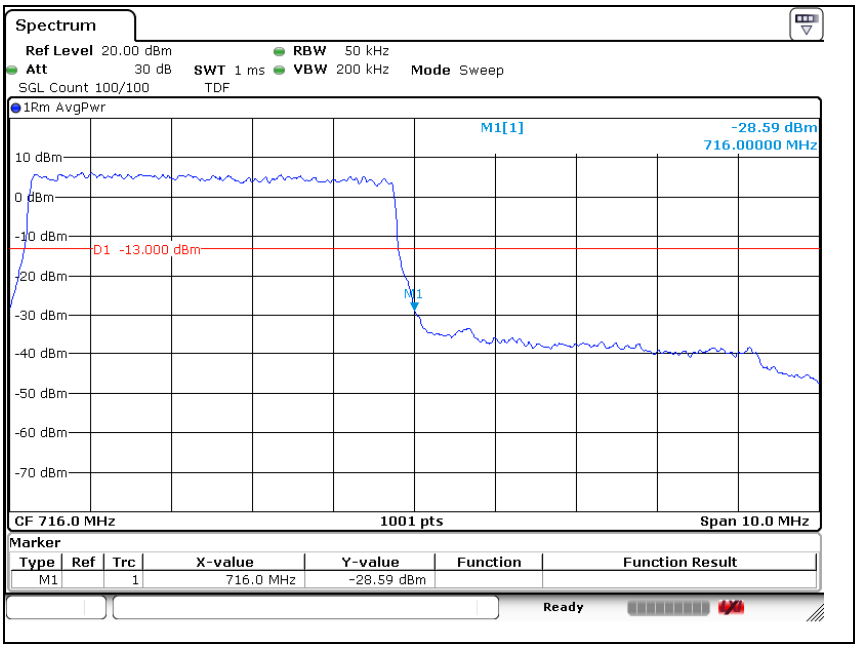
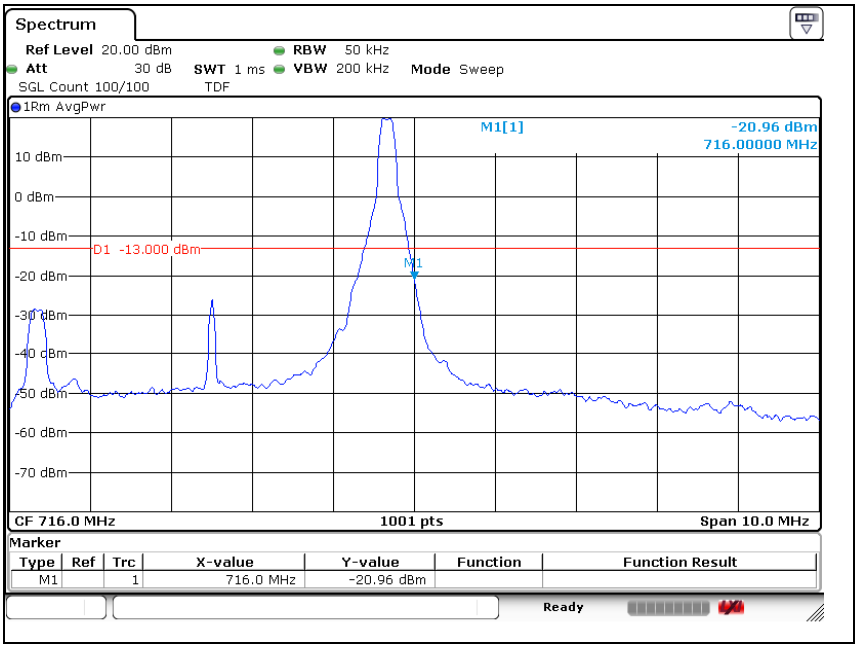
LTE band 17 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 17 (5 ㎒ - QPSK_RB 1)
High Channel



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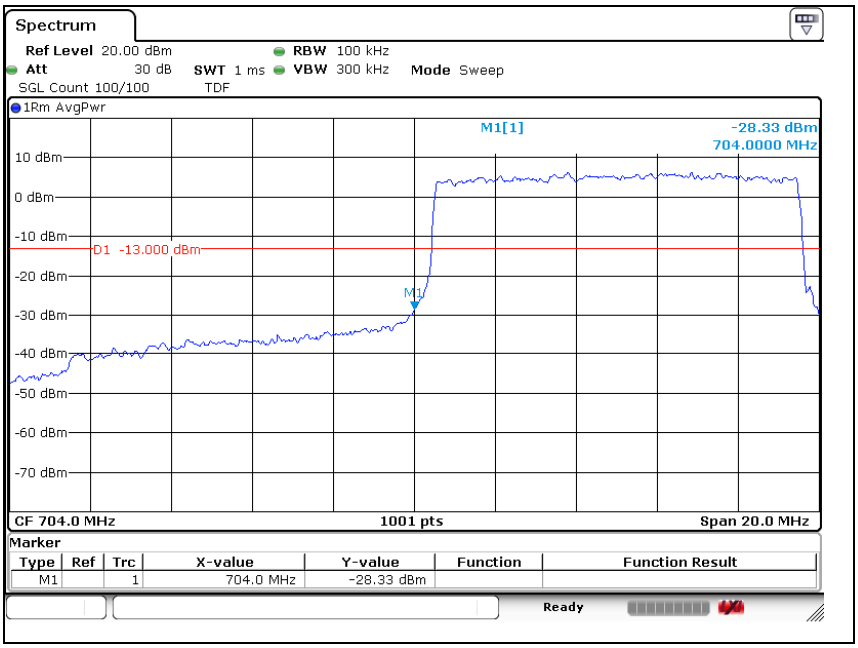
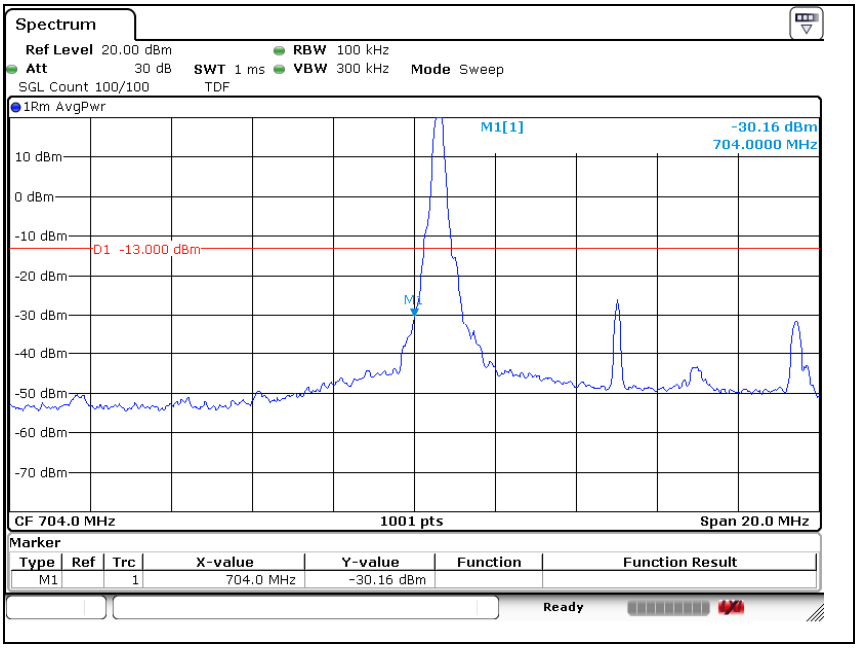
LTE band 17 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 17 (10 ㎒ - QPSK_RB 1)

Low Channel



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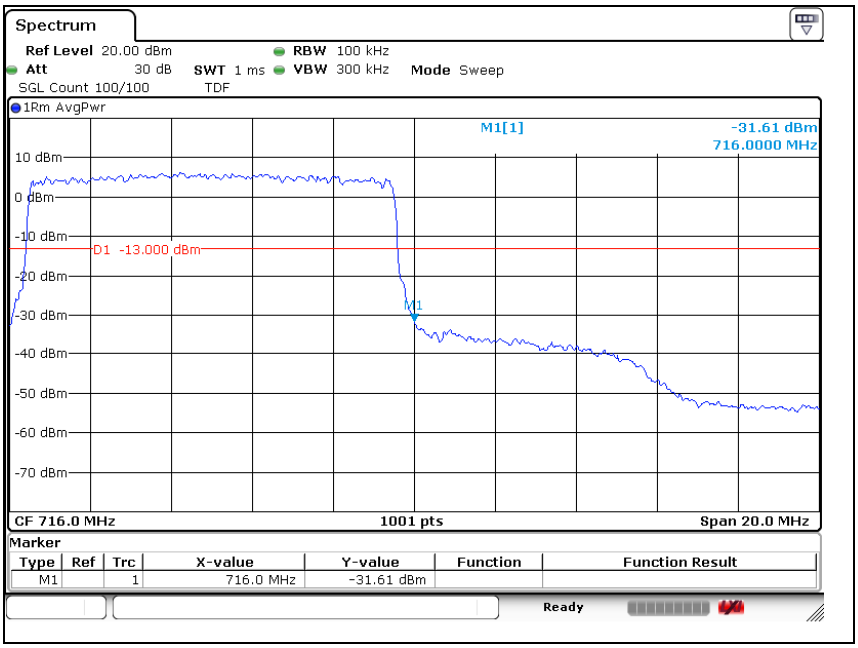
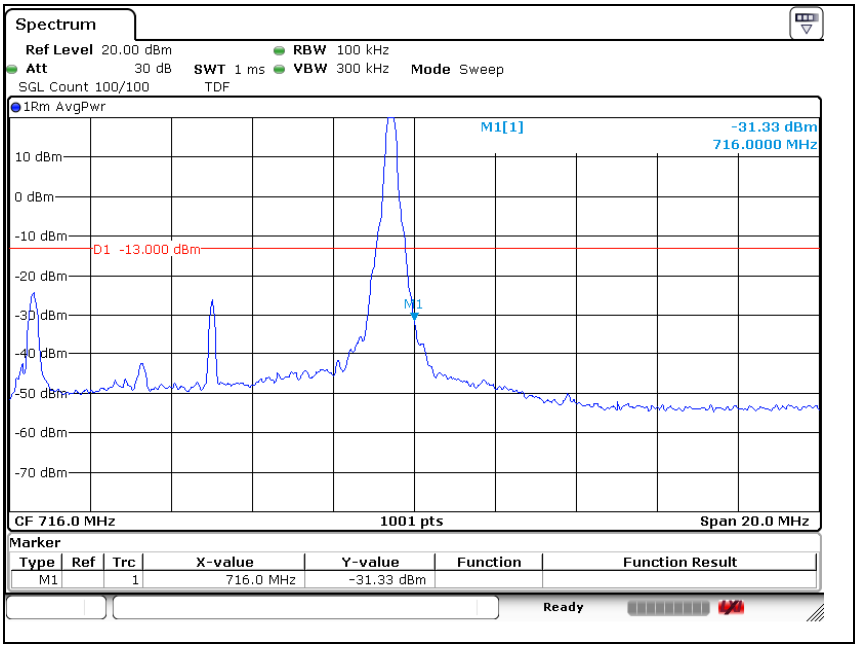
LTE band 17 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 17 (10 ㎒ - QPSK_RB 1)
High Channel



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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 ㎒ 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-130 Issue 1
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 of 1 % of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 log10 p (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as f_L and f_H respectively.

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

- 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.

- 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 ㎒ band immediately outside the channel edge, as found in section 4.5, reference points will be selected at the unwanted emission limits,

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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.

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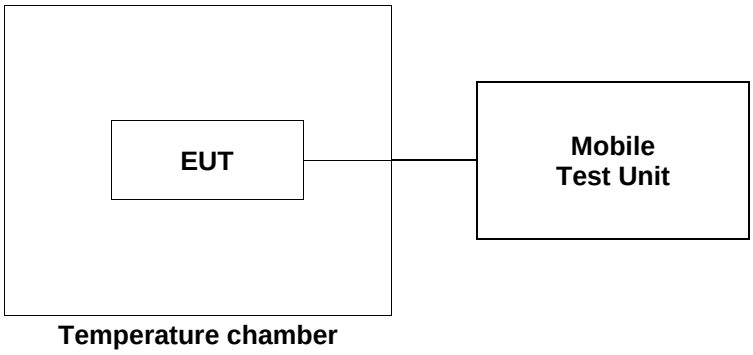
8.2. Test Procedure

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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8.3. Test Results

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

LTE band 2 at middle channel

Reference Frequency: 1 880.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4	7	0.003 7
40		4	0.002 1
30		-9	-0.004 8
23		4	0.002 1
10		-5	-0.002 7
0		1	0.000 5
-10		5	0.002 7
-20		7	0.003 7
-30		2	0.001 1
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	3.6	-4	-0.002 1
	4.4	-6	-0.003 2

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LTE band 4 at middle channel

Reference Frequency: 1 732.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4	-2	-0.001 2
40		7	0.004 0
30		5	0.002 9
23		8	0.004 6
10		-1	-0.000 6
0		4	0.002 3
-10		-7	-0.004 0
-20		2	0.001 2
-30		11	0.006 3
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	3.6	-6	-0.003 5
	4.4	4	0.002 3

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LTE band 5 at middle channel

Reference Frequency: 836.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4	5	0.006 0
40		11	0.013 2
30		1	0.001 2
23		-4	-0.004 8
10		7	0.008 4
0		-5	-0.006 0
-10		-1	-0.001 2
-20		7	0.008 4
-30		-4	-0.004 8
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	3.6	-7	-0.008 4
	4.4	1	0.001 2

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LTE band 7 at middle channel

Reference Frequency: 2 535.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4	6	0.002 4
40		-2	-0.000 8
30		8	0.003 2
23		5	0.002 0
10		-2	-0.000 8
0		-8	-0.003 2
-10		-11	-0.004 3
-20		-9	-0.003 6
-30		6	0.002 4
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	3.6	-8	-0.003 2
	4.4	6	0.002 4

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LTE band 12 at middle channel

Reference Frequency: 707.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4	-5	-0.007 1
40		8	0.011 3
30		-1	-0.001 4
23		4	0.005 7
10		6	0.008 5
0		-2	-0.002 8
-10		-8	-0.011 3
-20		-1	-0.001 4
-30		-10	-0.014 1
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	3.6	11	0.015 5
	4.4	7	0.009 9

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LTE band 17 at middle channel

Reference Frequency: 710.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4	-6	-0.008 5
40		8	0.011 3
30		-2	-0.002 8
23		5	0.007 0
10		-8	-0.011 3
0		1	0.001 4
-10		-2	-0.002 8
-20		5	0.007 0
-30		7	0.009 9
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	3.6	1	0.001 4
	4.4	-7	-0.009 9

- End of the Test Report -

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