

7. Band Edge and Emission Mask

7.1. Limit

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

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

- §27.53(c)(2), on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

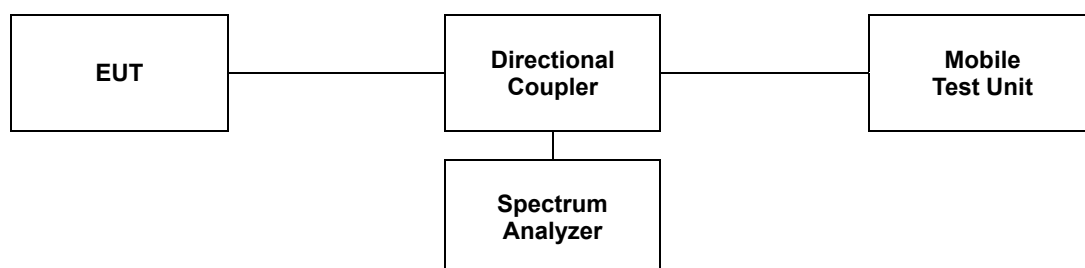
- §27.53(c)(4), on all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 MHz band segment, for mobile and portable stations;

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

7.2. Test Procedure

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

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



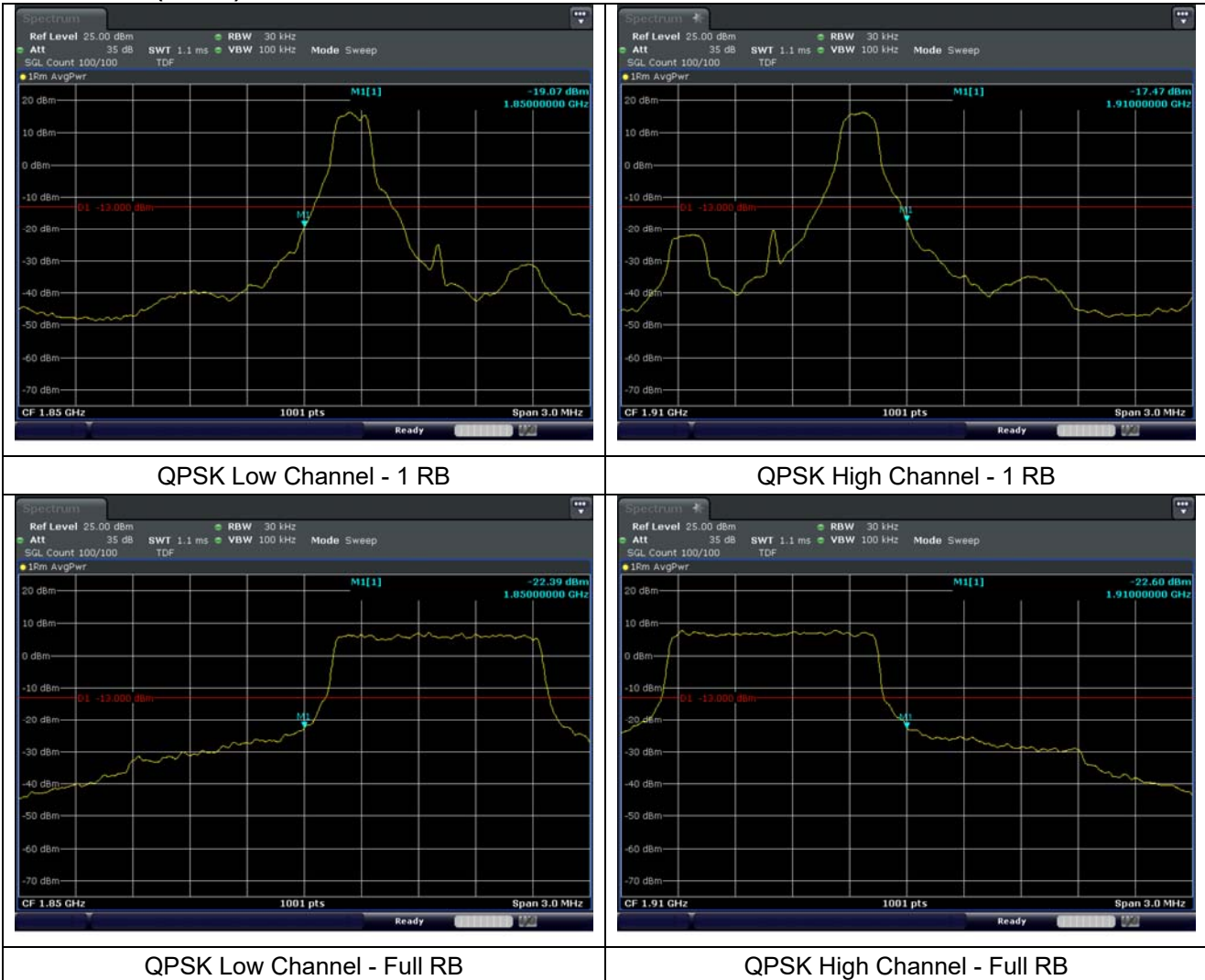
7.3. Test Results

Ambient temperature : (23 ± 1) °C

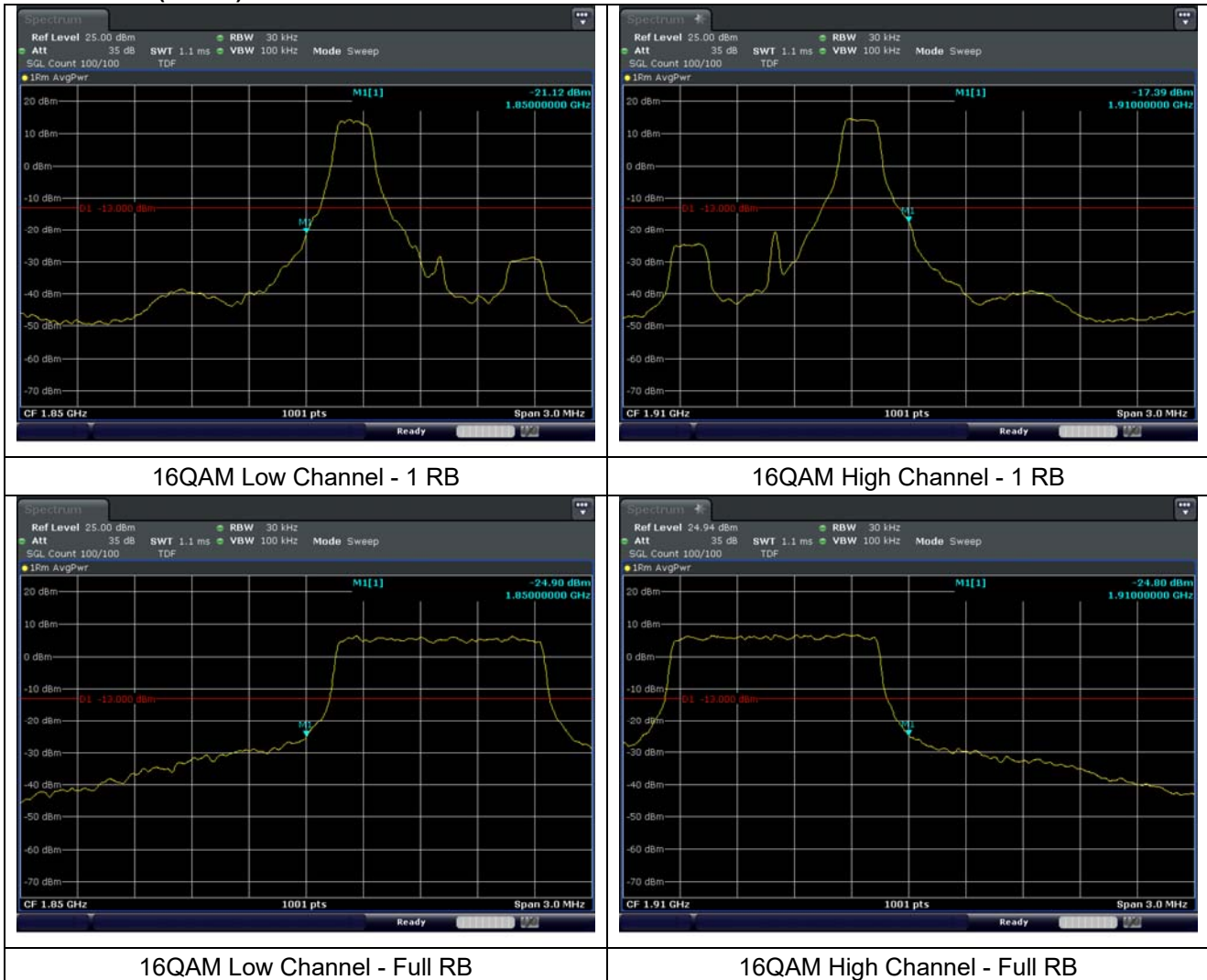
Relative humidity : 47 % R.H.

- Test plots

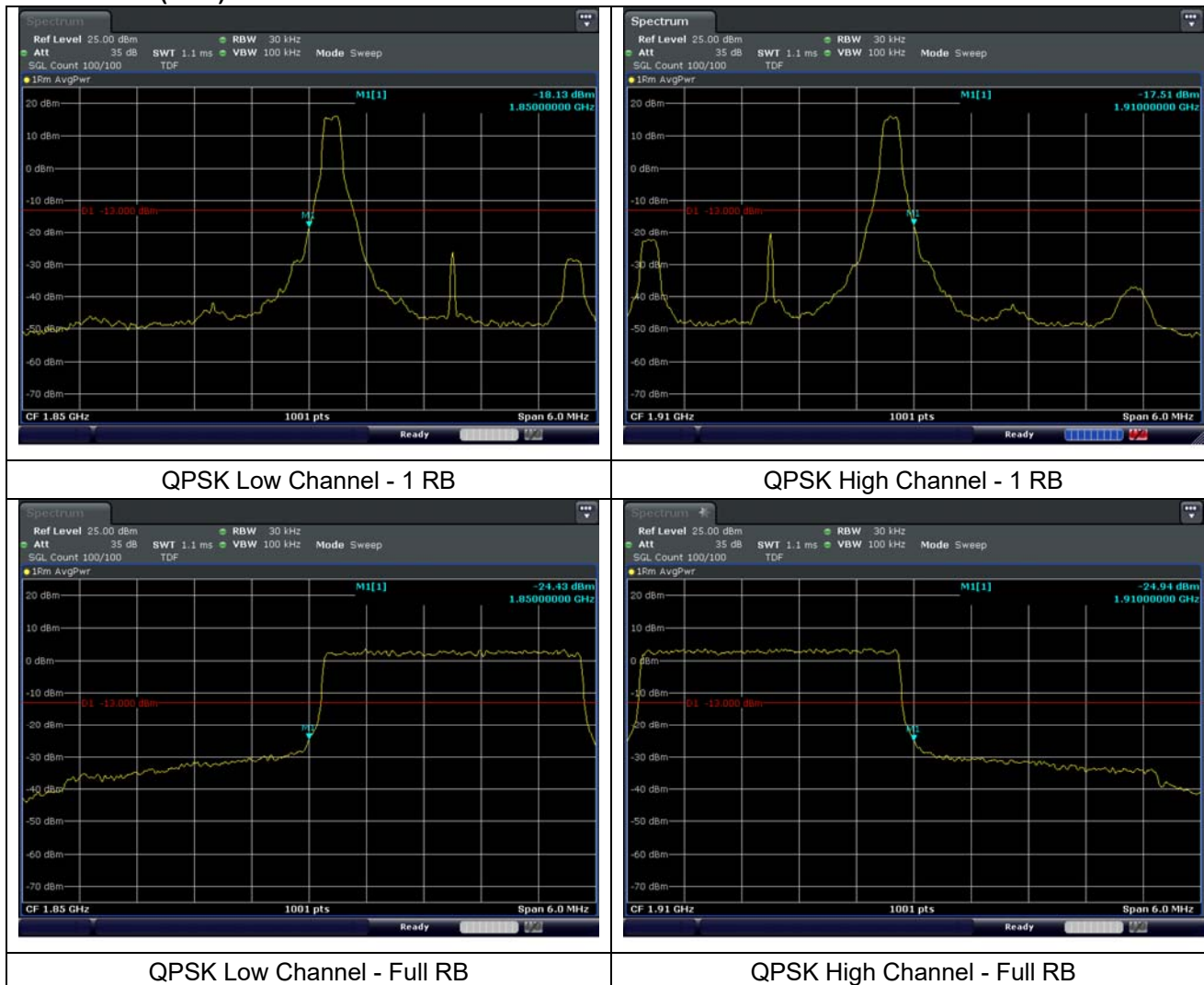
LTE band 2 (1.4 MHz)



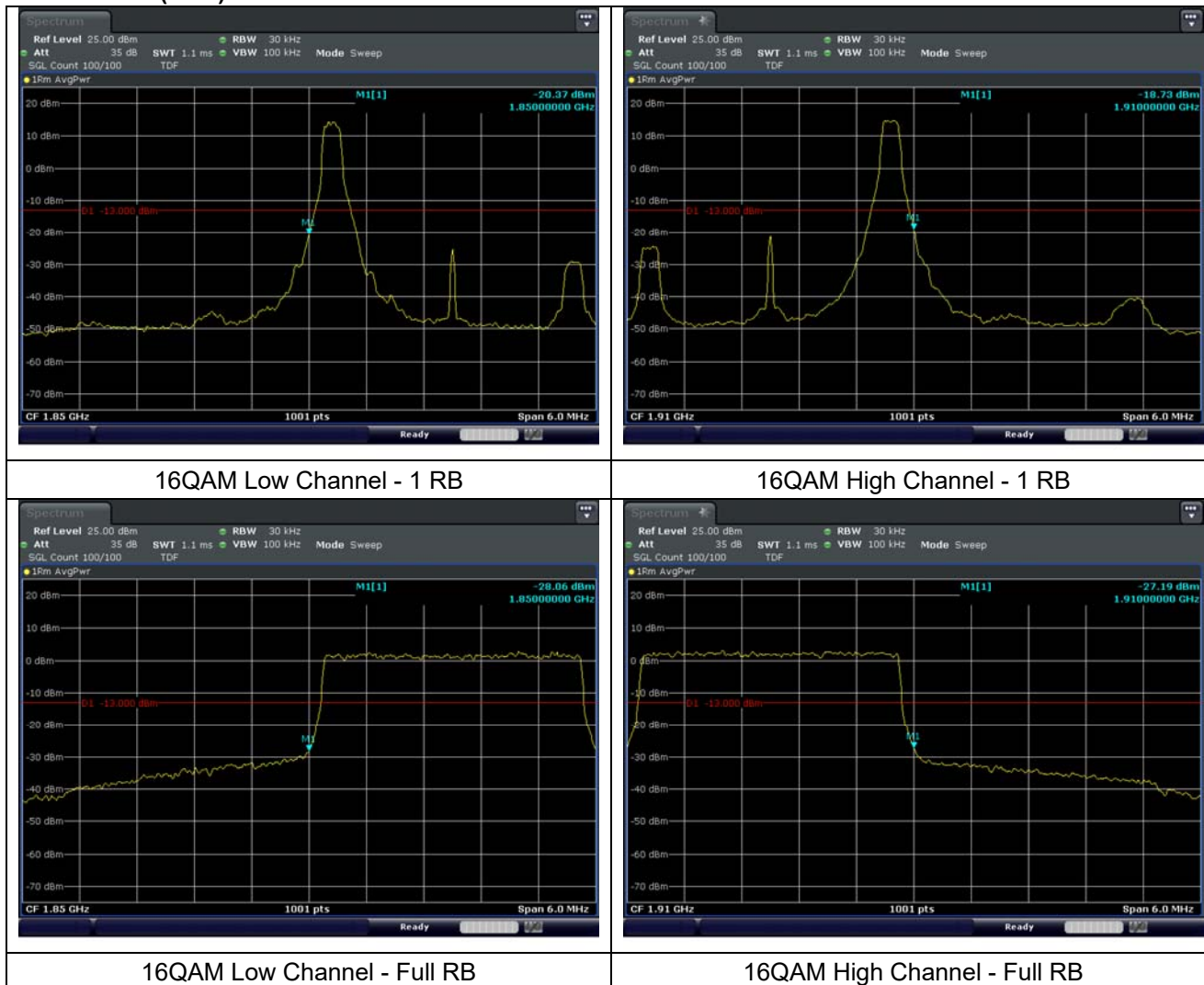
LTE band 2 (1.4 MHz)



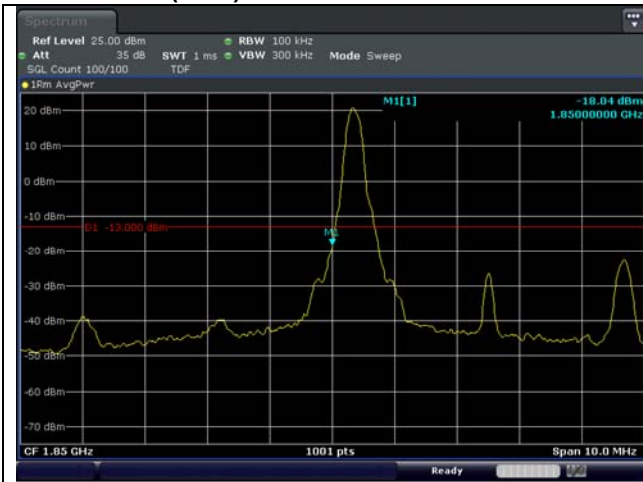
LTE band 2 (3 MHz)



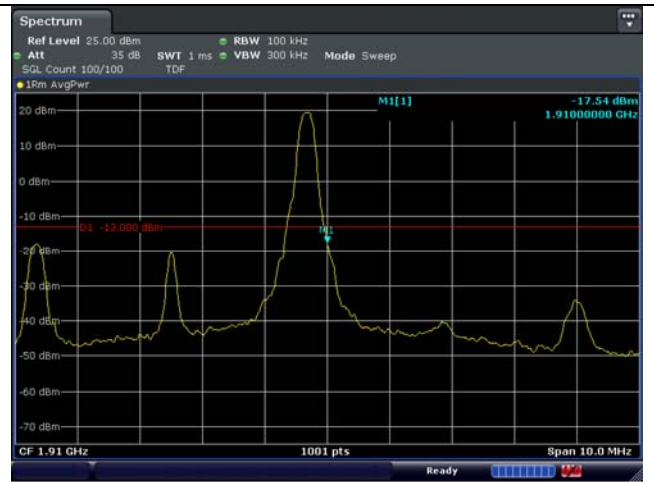
LTE band 2 (3 MHz)



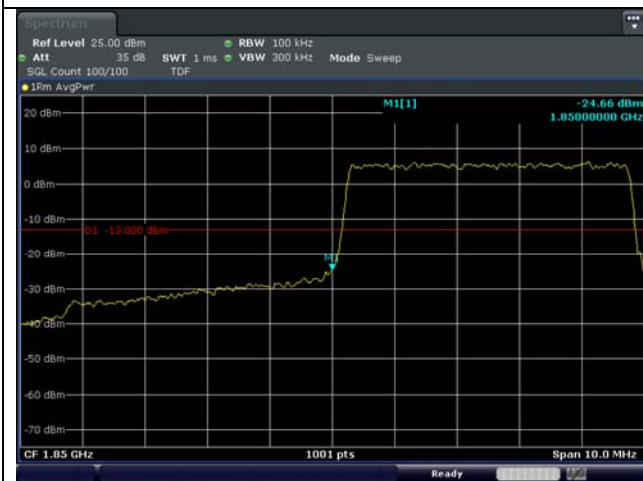
LTE band 2 (5 MHz)



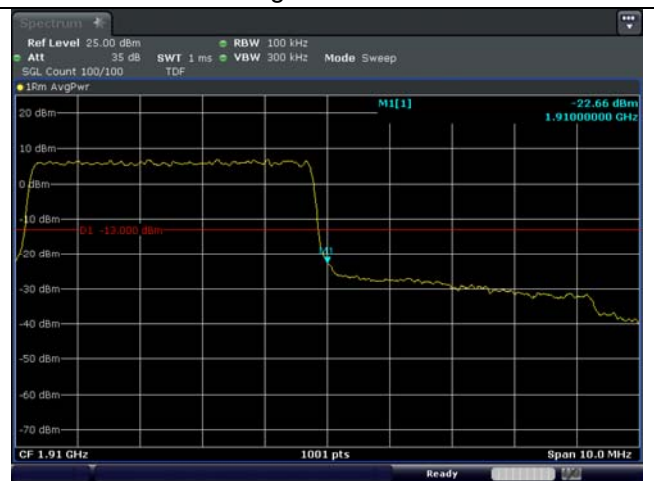
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

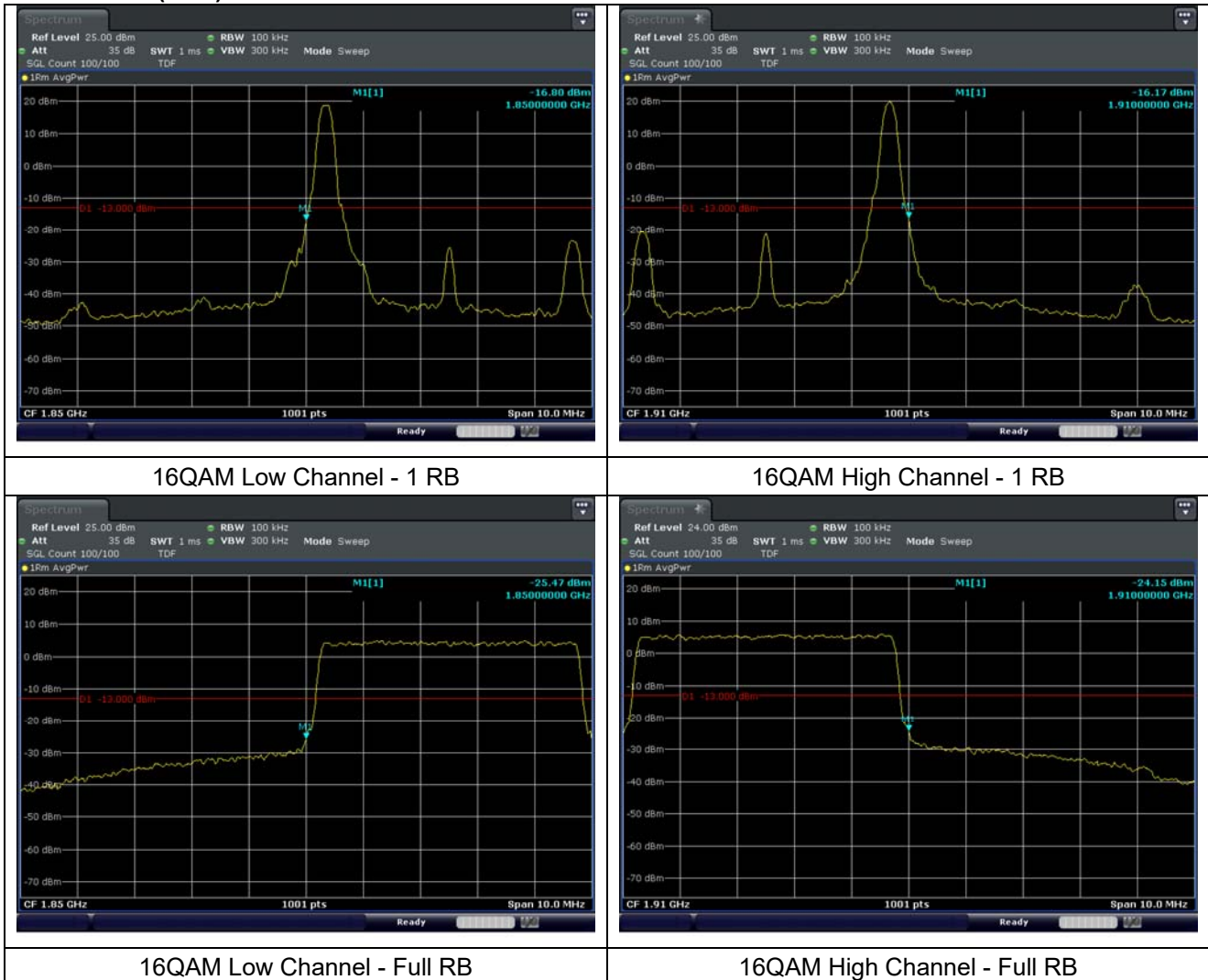


QPSK Low Channel - Full RB

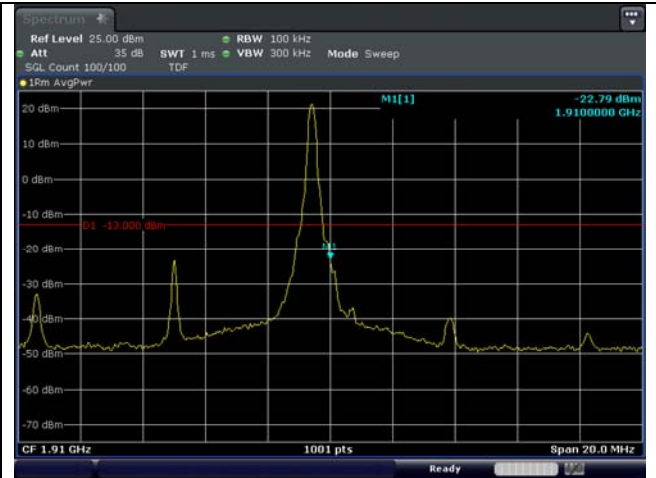
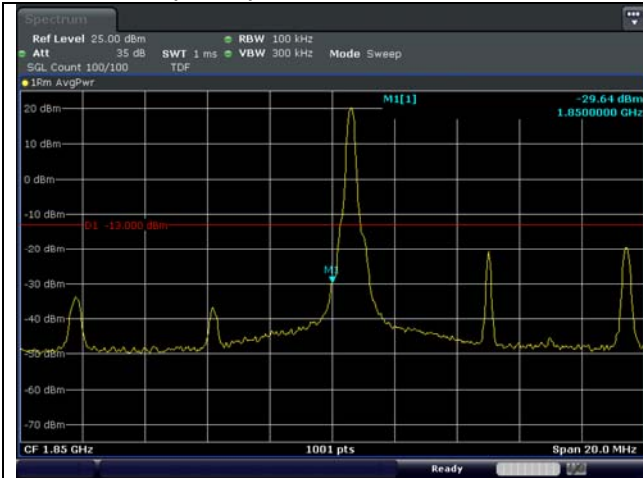


QPSK High Channel - Full RB

LTE band 2 (5 MHz)

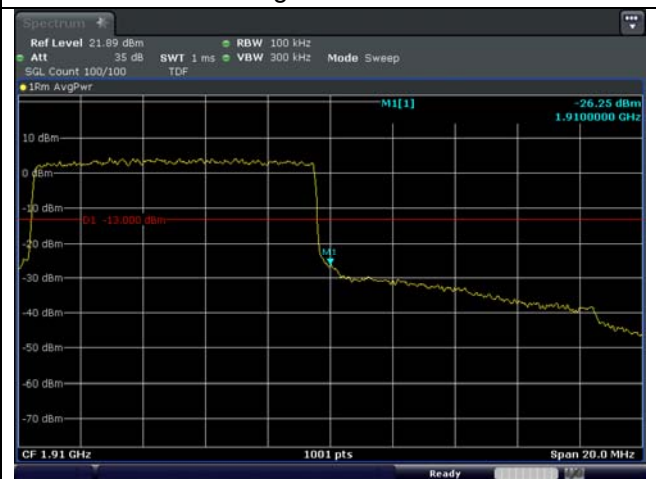
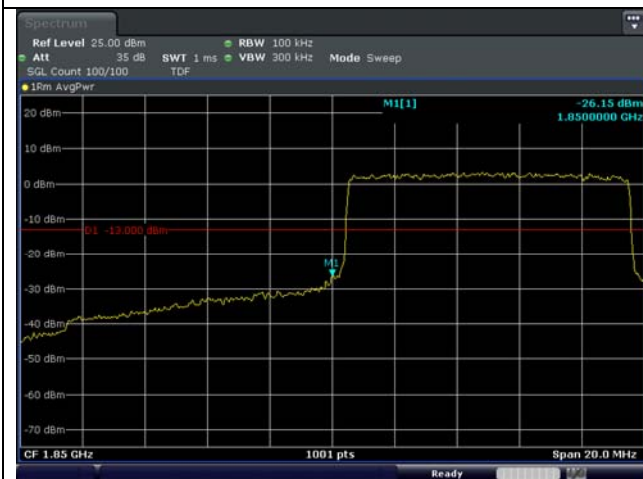


LTE band 2 (10 MHz)



QPSK Low Channel - 1 RB

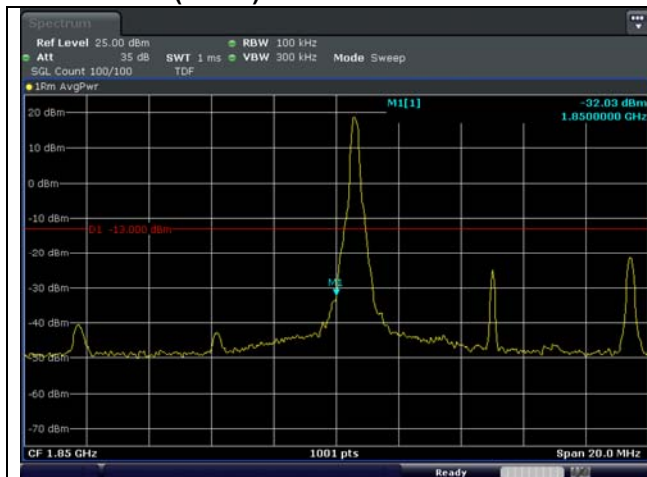
QPSK High Channel - 1 RB



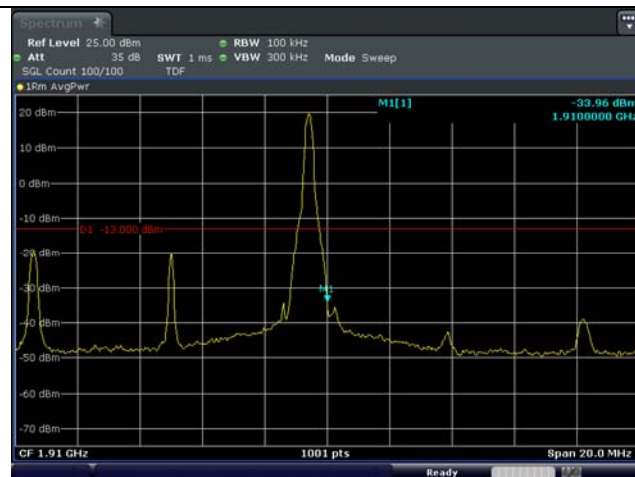
QPSK Low Channel - Full RB

QPSK High Channel - Full RB

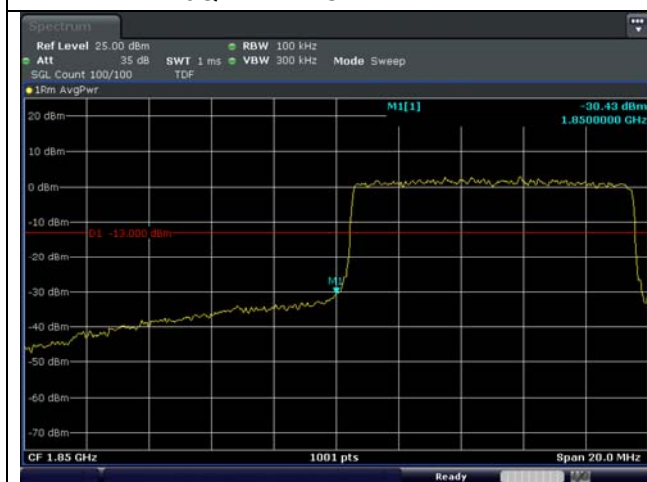
LTE band 2 (10 MHz)



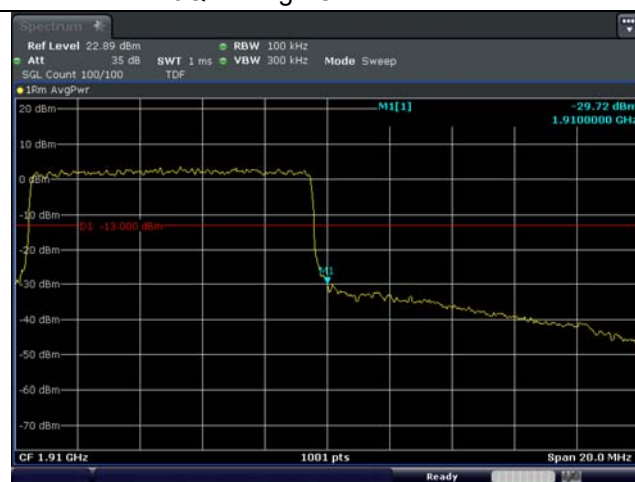
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

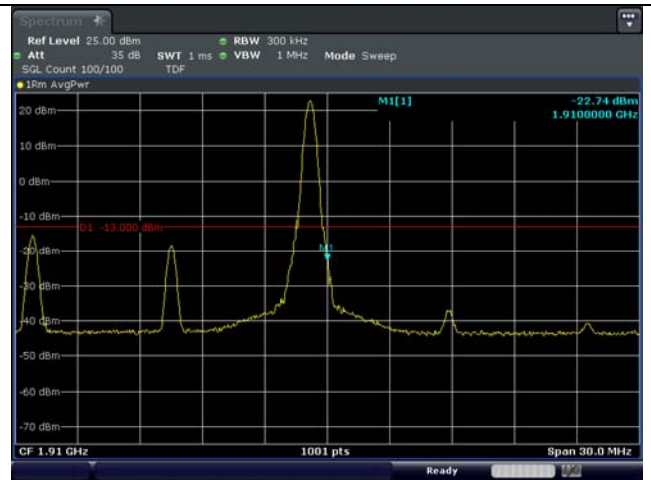
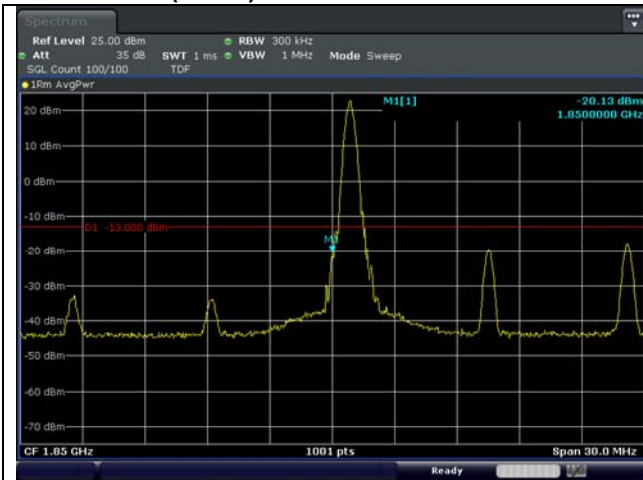


16QAM Low Channel - Full RB



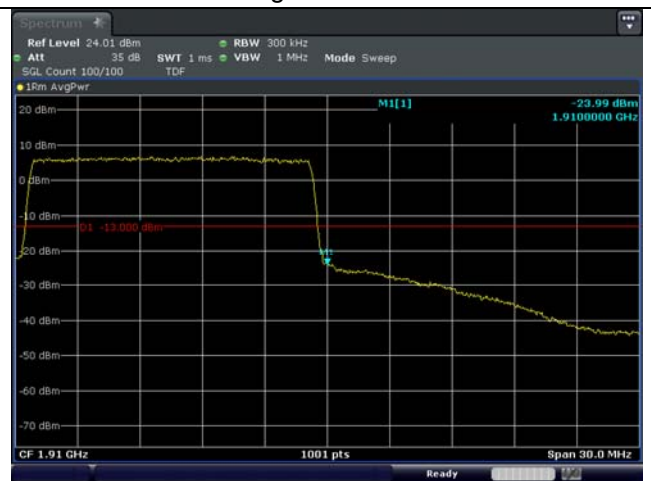
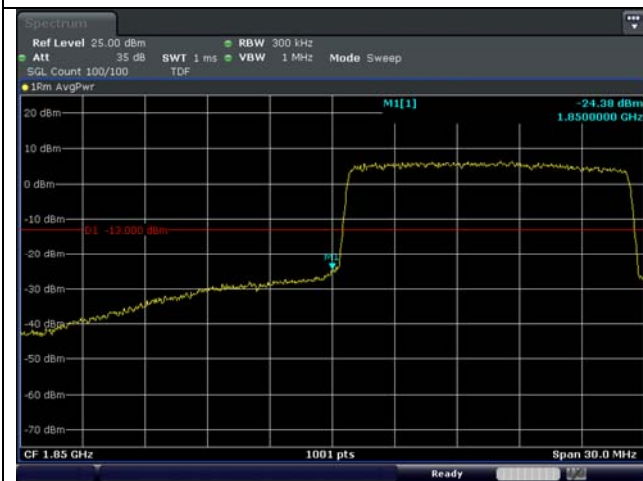
16QAM High Channel - Full RB

LTE band 2 (15 MHz)



QPSK Low Channel - 1 RB

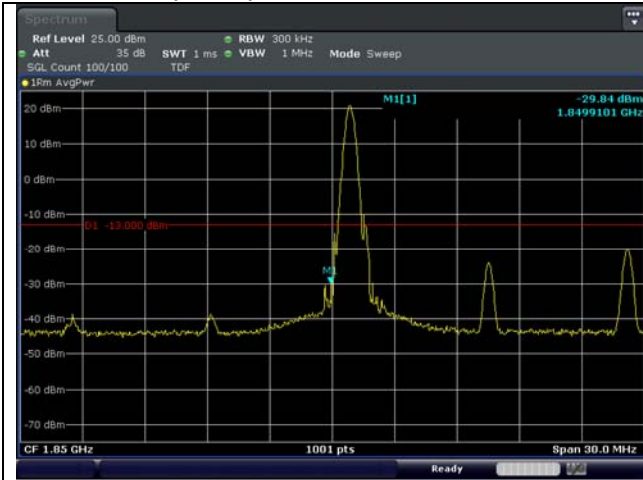
QPSK High Channel - 1 RB



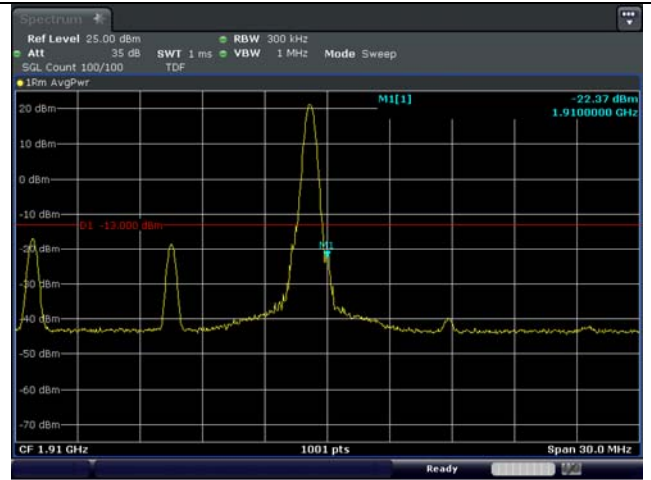
QPSK Low Channel - Full RB

QPSK High Channel - Full RB

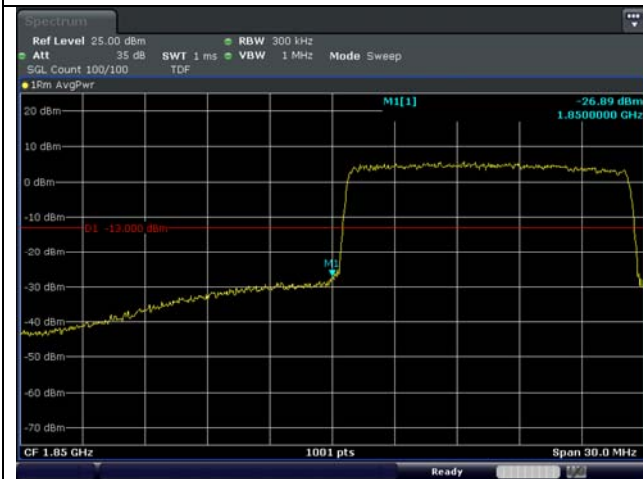
LTE band 2 (15 MHz)



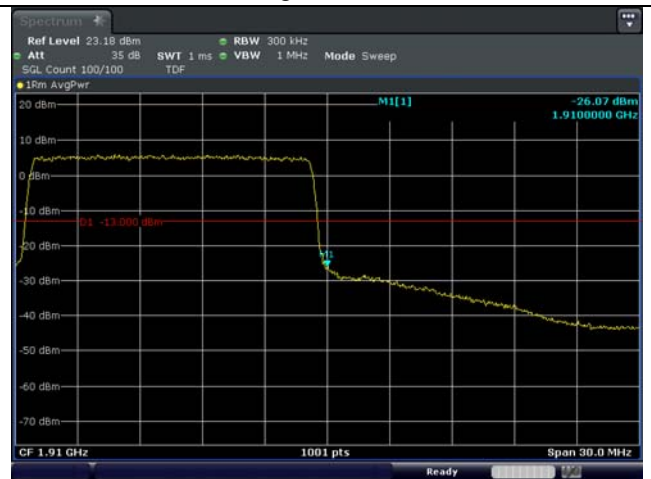
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

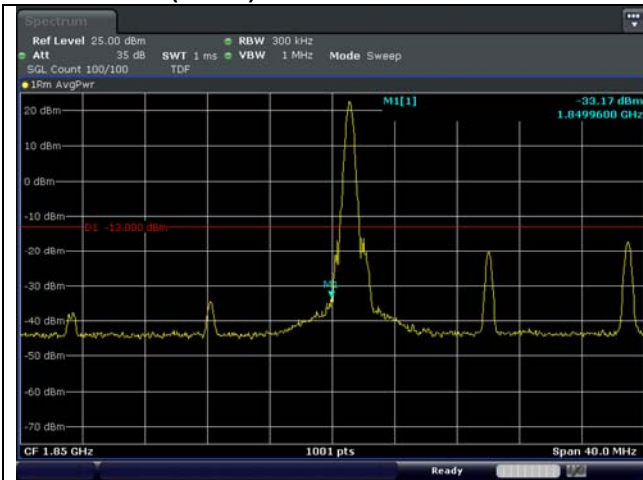


16QAM Low Channel - Full RB

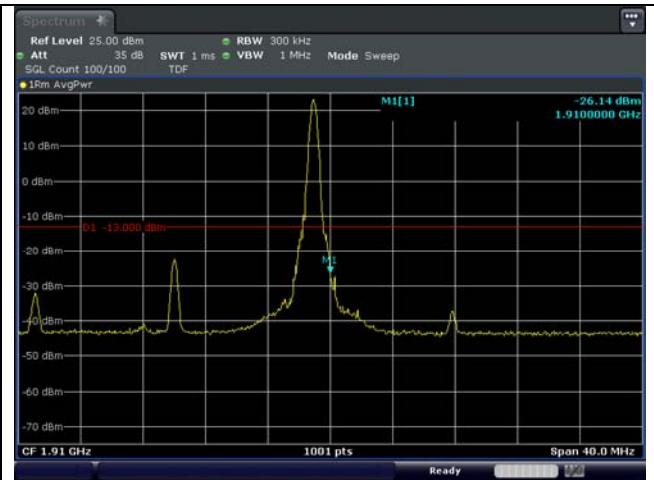


16QAM High Channel - Full RB

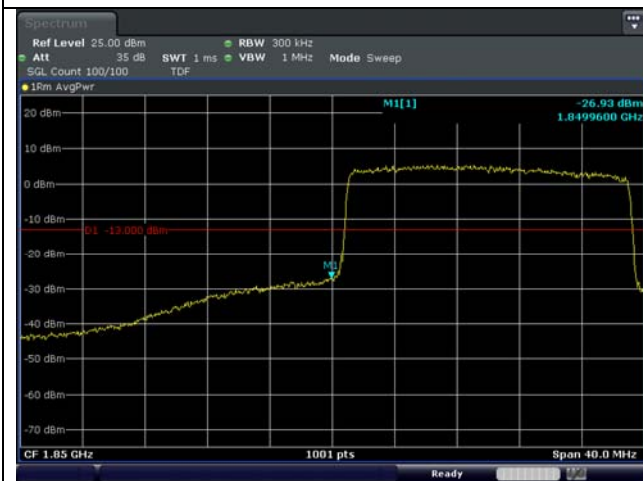
LTE band 2 (20 MHz)



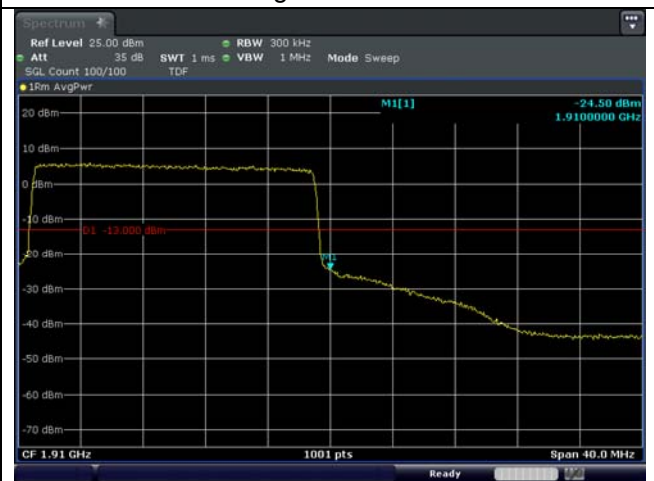
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

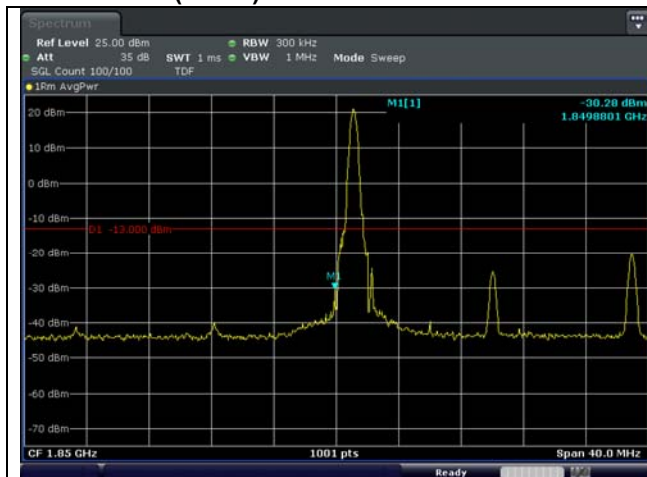


QPSK Low Channel - Full RB

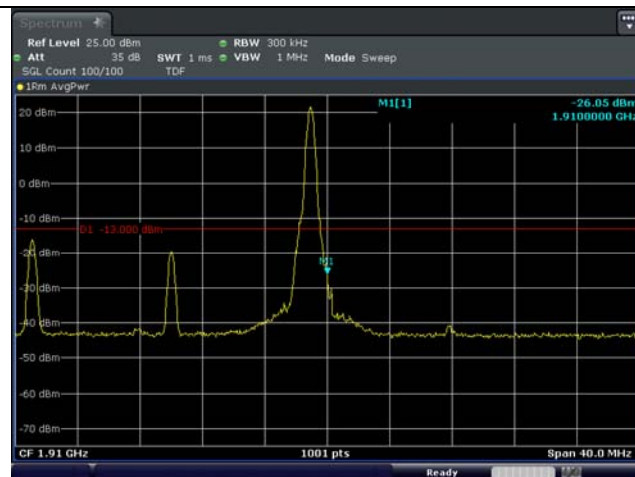


QPSK High Channel - Full RB

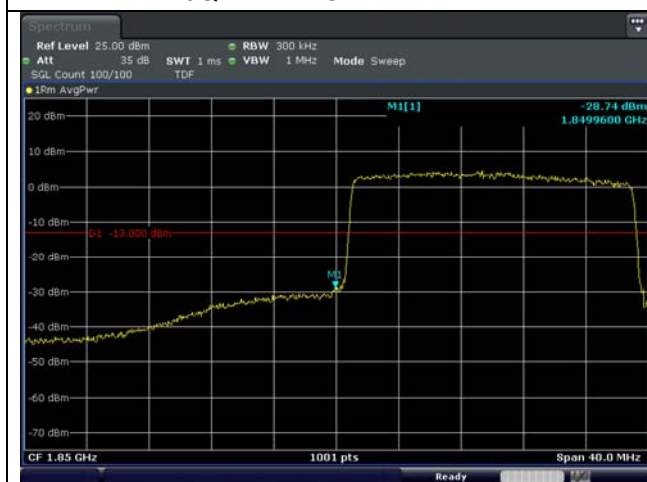
LTE band 2 (20 MHz)



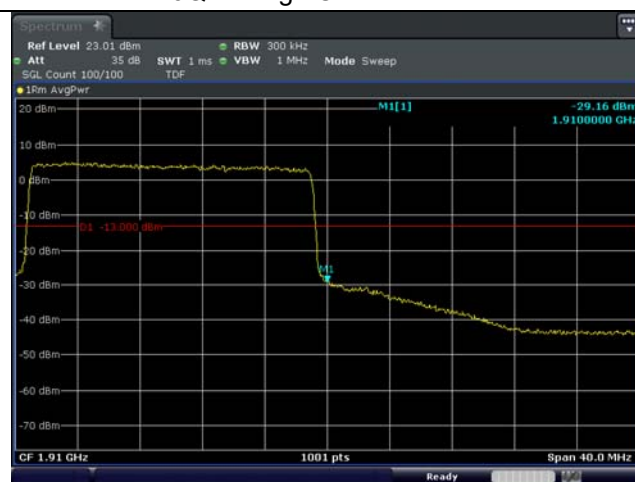
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

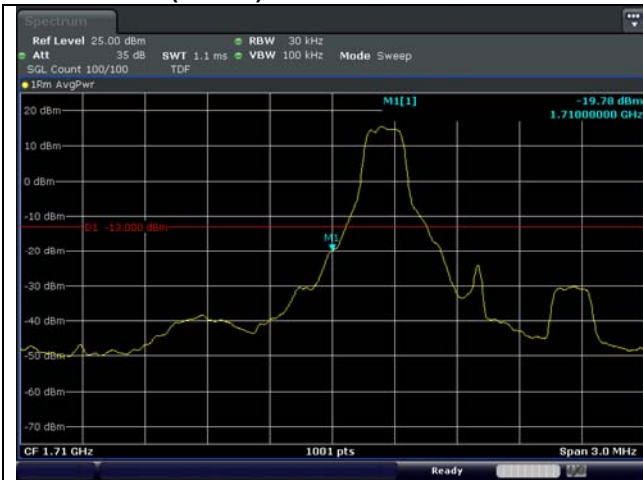


16QAM Low Channel - Full RB

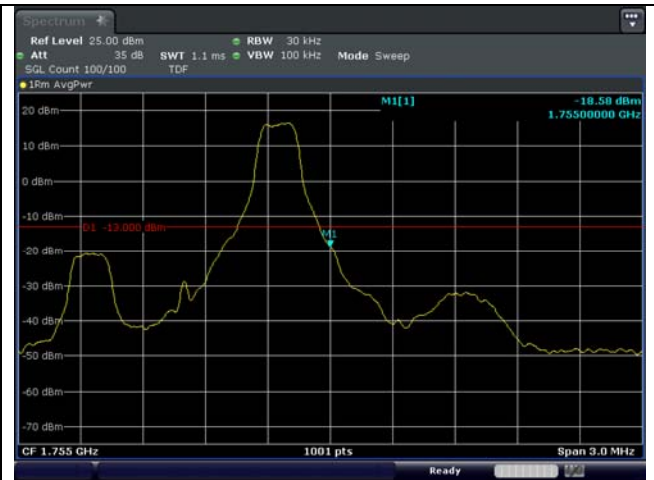


16QAM High Channel - Full RB

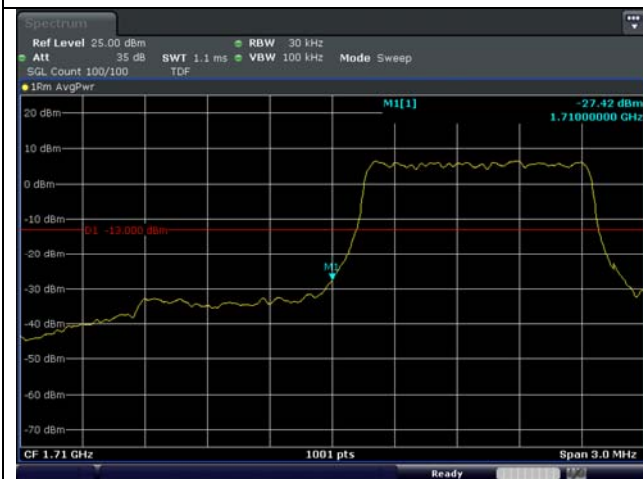
LTE band 4 (1.4 MHz)



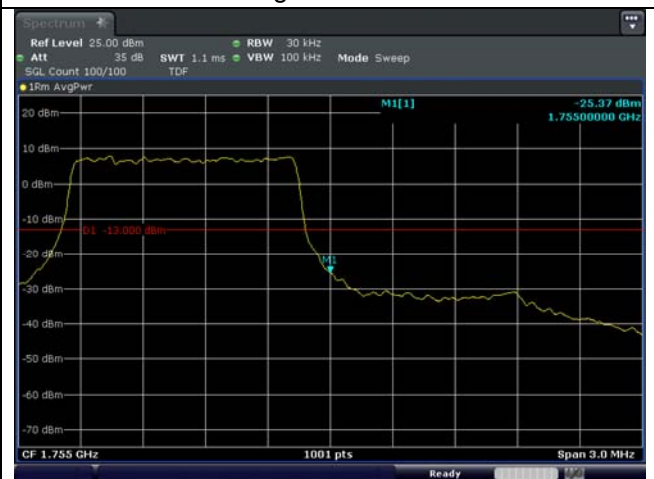
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

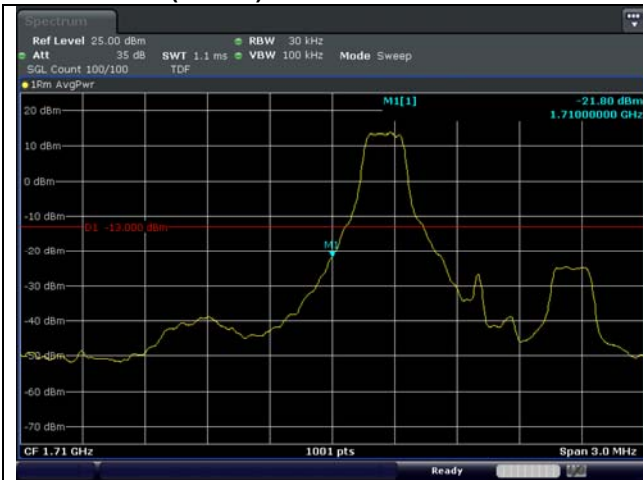


QPSK Low Channel - Full RB

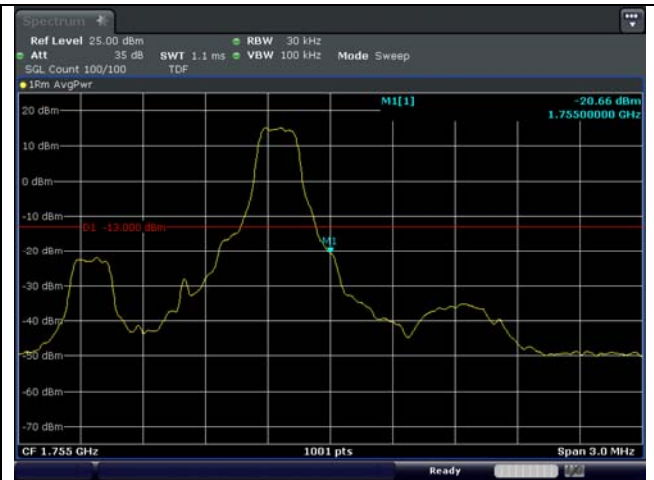


QPSK High Channel - Full RB

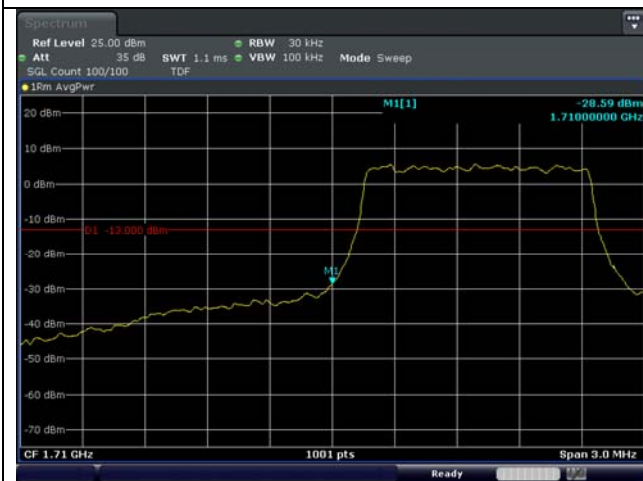
LTE band 4 (1.4 MHz)



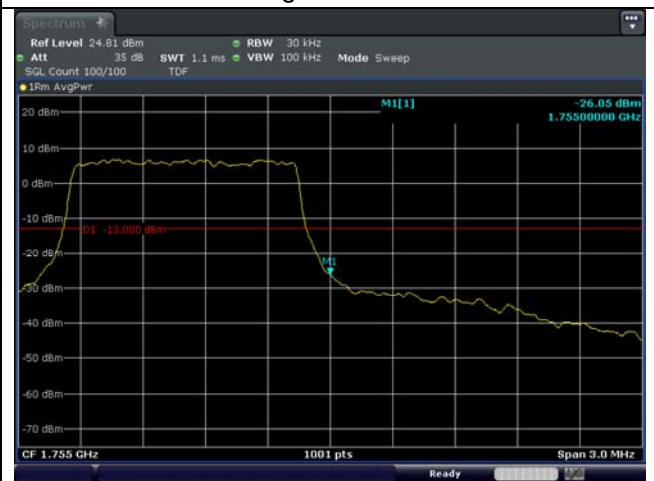
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

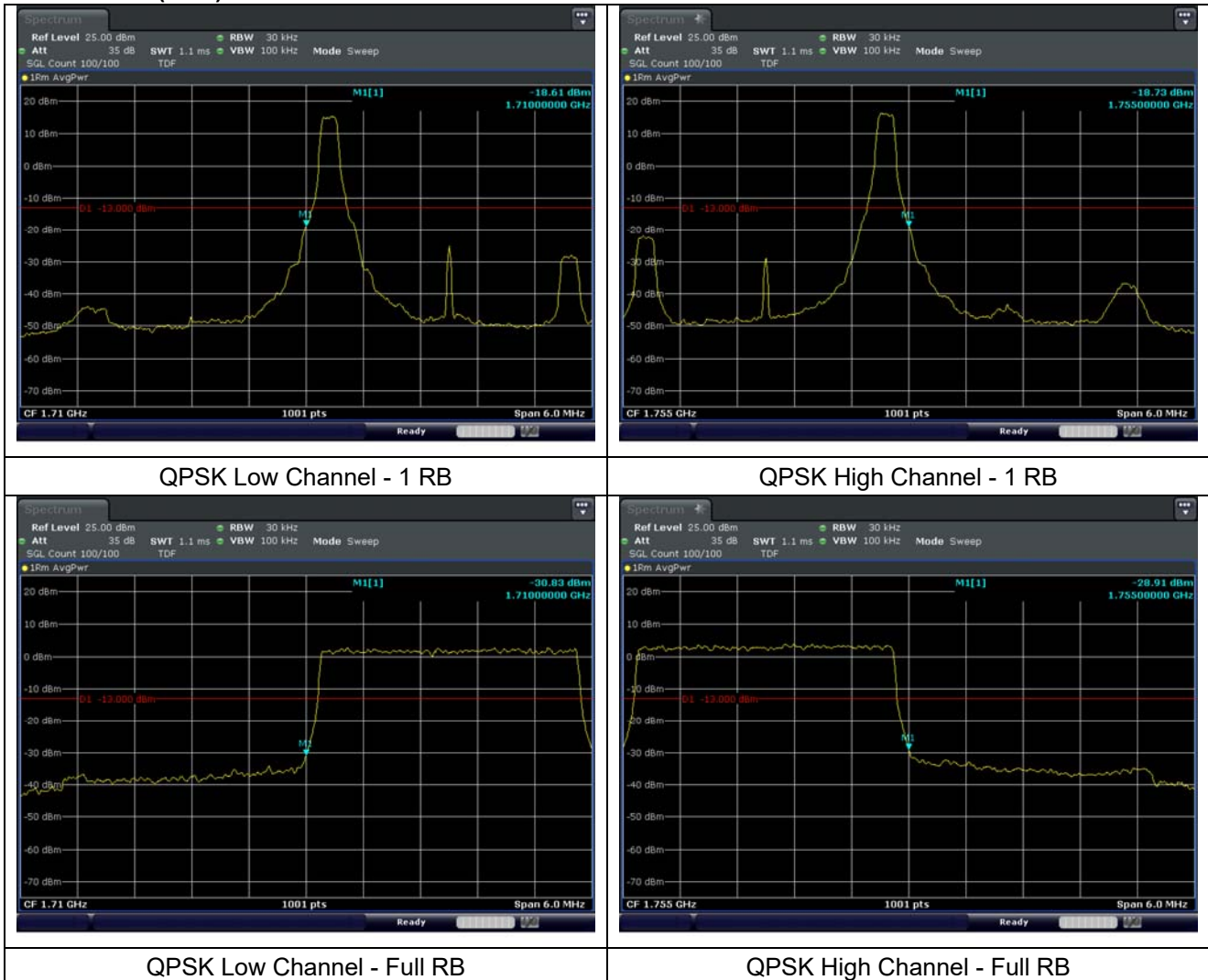


16QAM Low Channel - Full RB

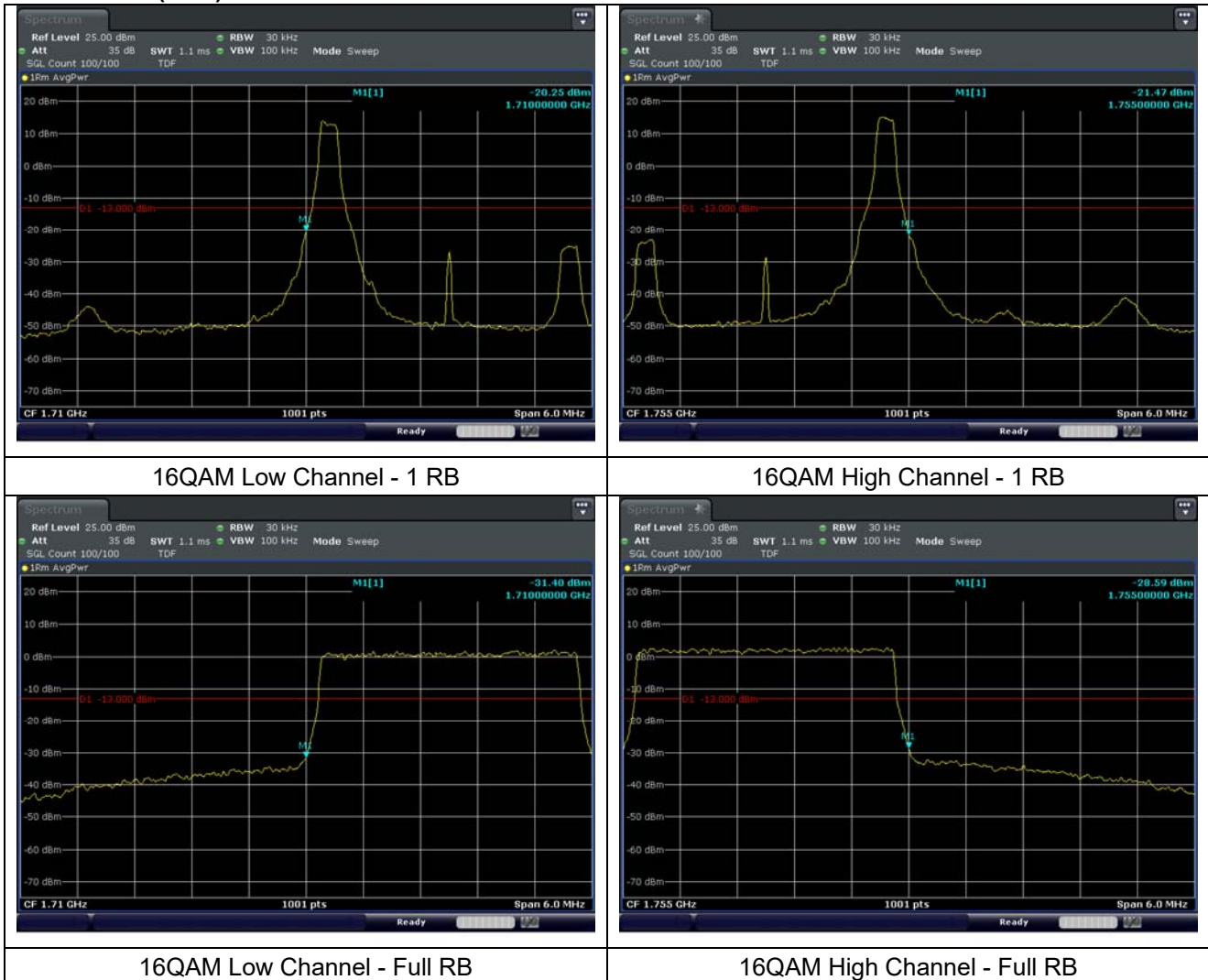


16QAM High Channel - Full RB

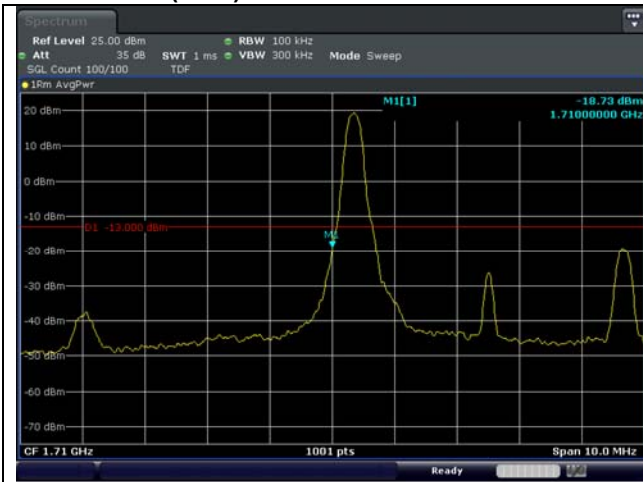
LTE band 4 (3 MHz)



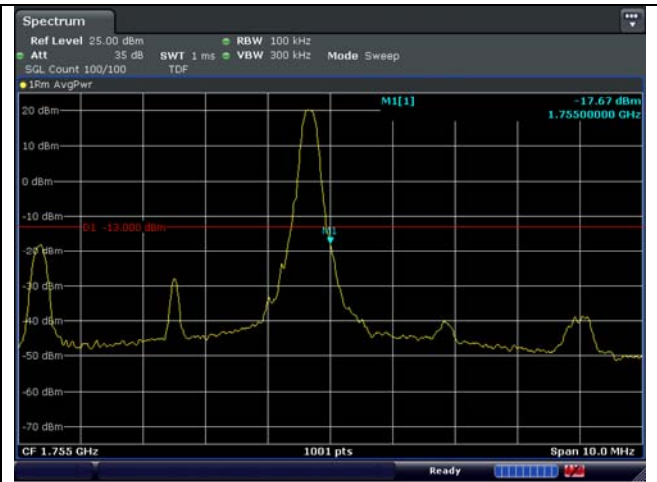
LTE band 4 (3 MHz)



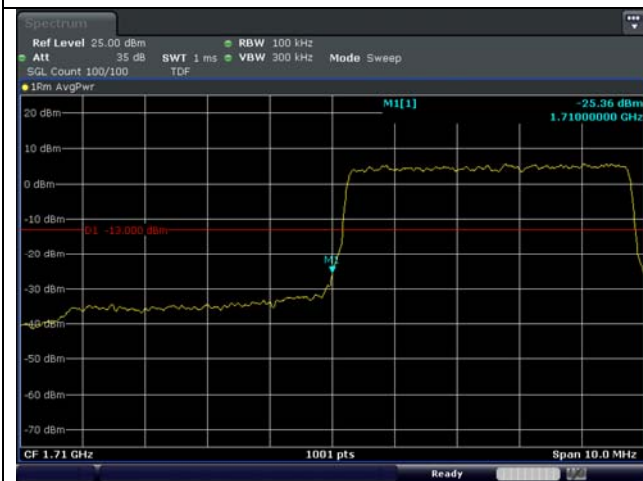
LTE band 4 (5 MHz)



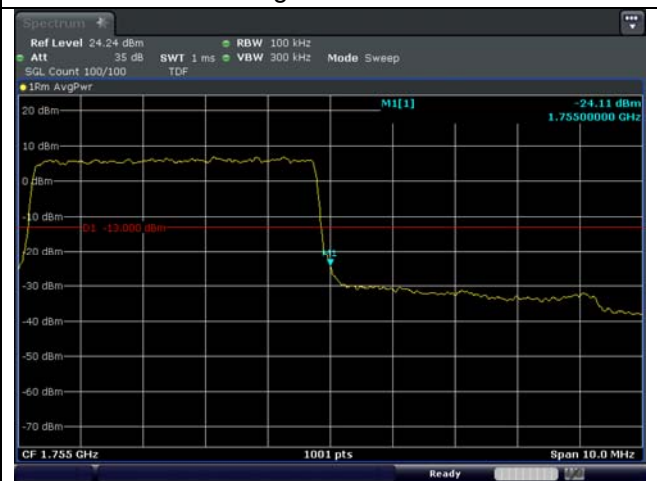
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

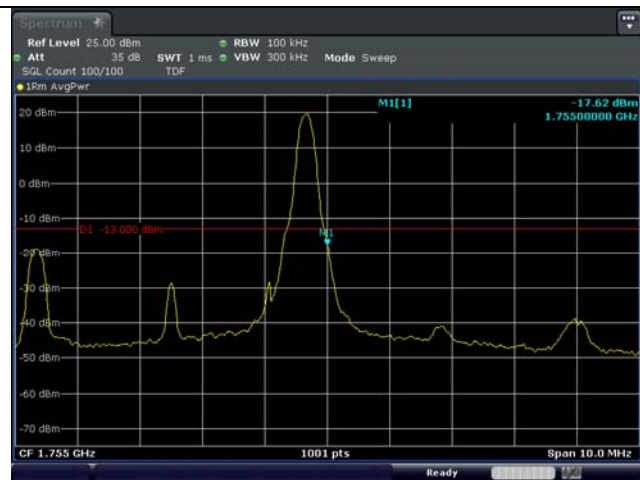
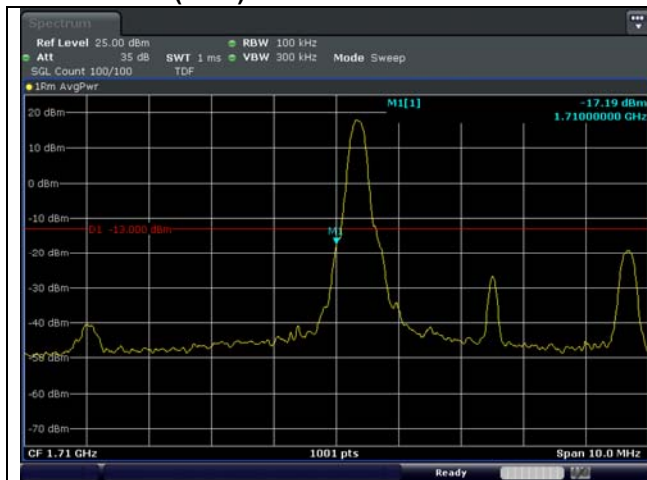


QPSK Low Channel - Full RB



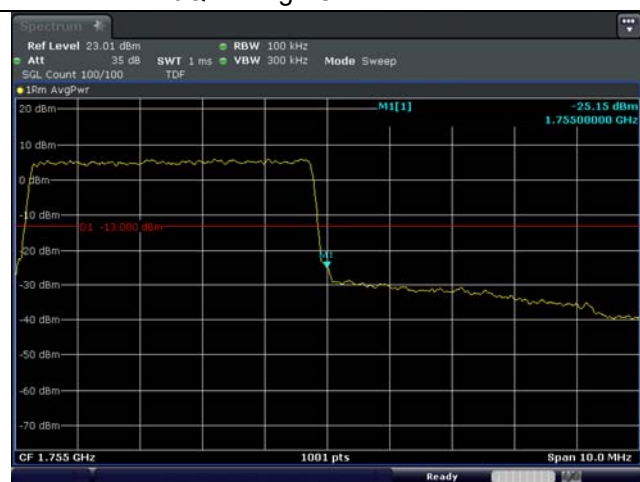
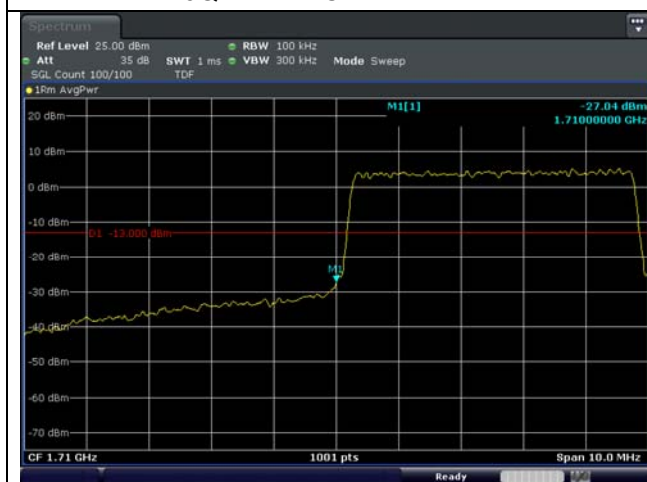
QPSK High Channel - Full RB

LTE band 4 (5 MHz)



16QAM Low Channel - 1 RB

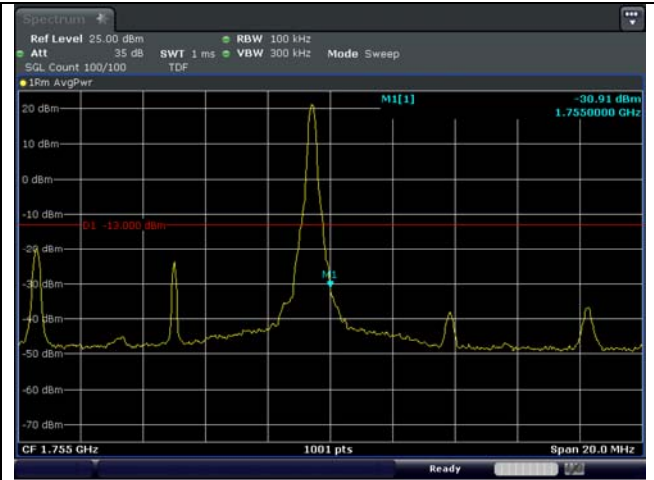
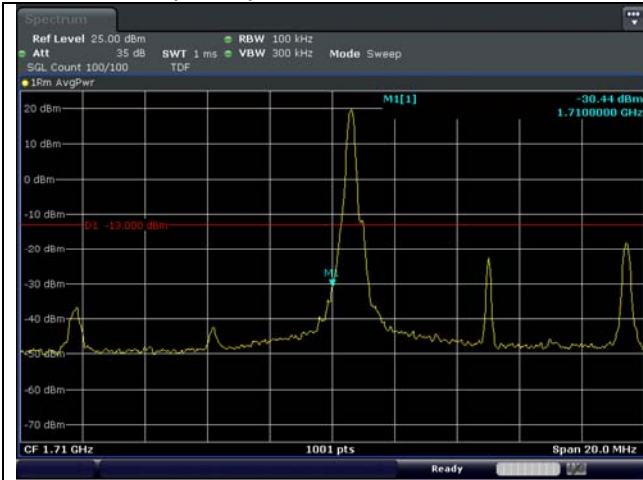
16QAM High Channel - 1 RB



16QAM Low Channel - Full RB

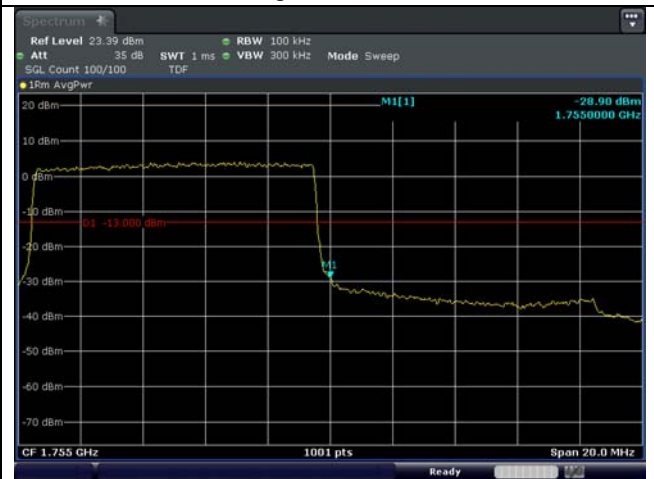
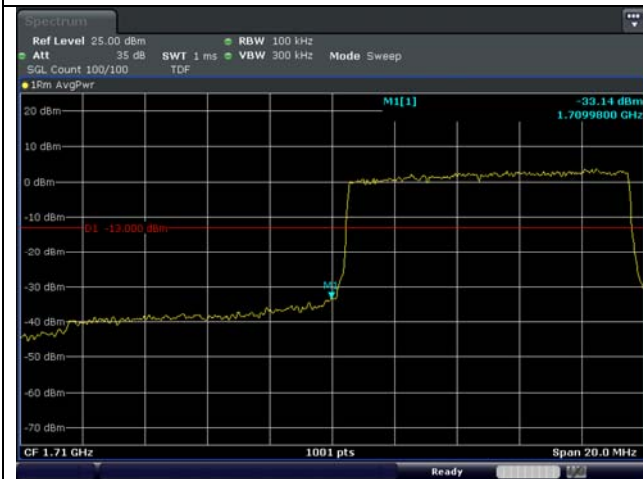
16QAM High Channel - Full RB

LTE band 4 (10 MHz)



QPSK Low Channel - 1 RB

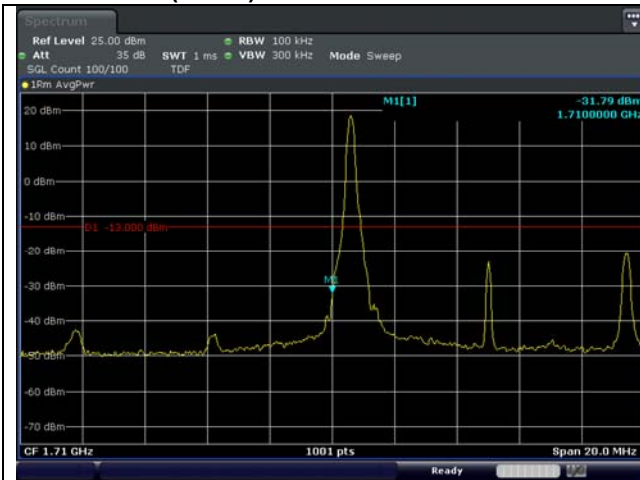
QPSK High Channel - 1 RB



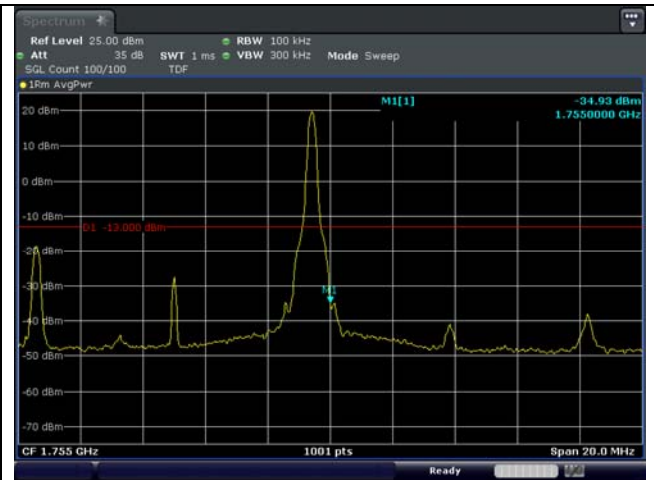
QPSK Low Channel - Full RB

QPSK High Channel - Full RB

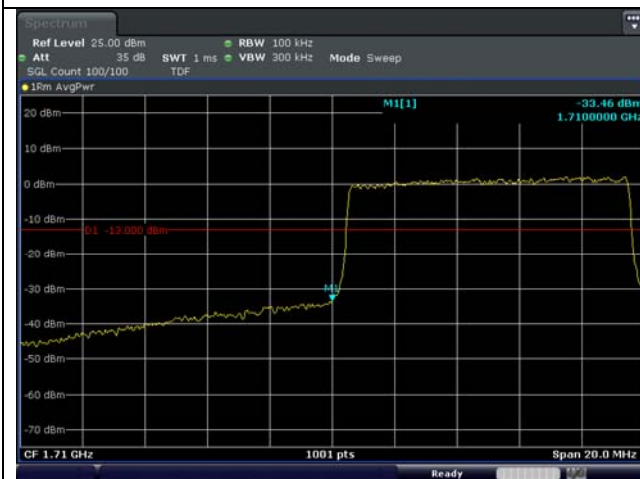
LTE band 4 (10 MHz)



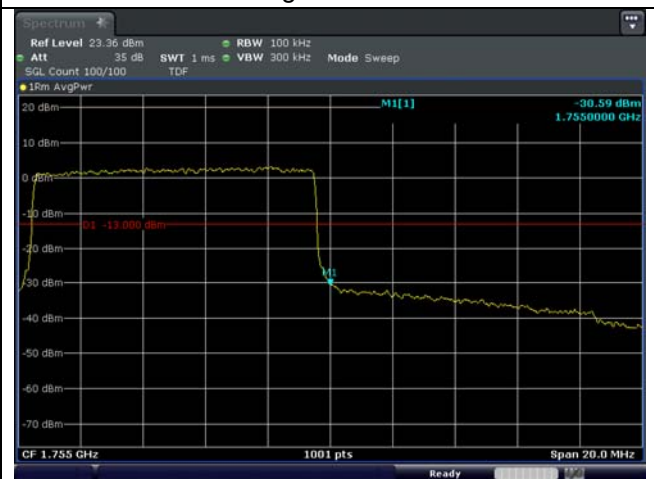
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

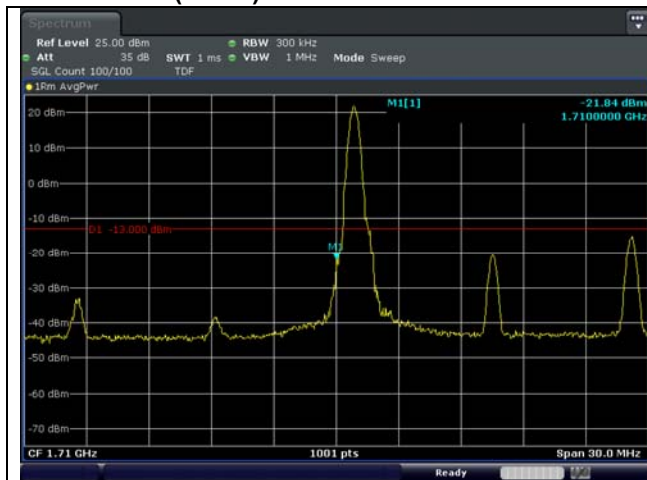


16QAM Low Channel - Full RB

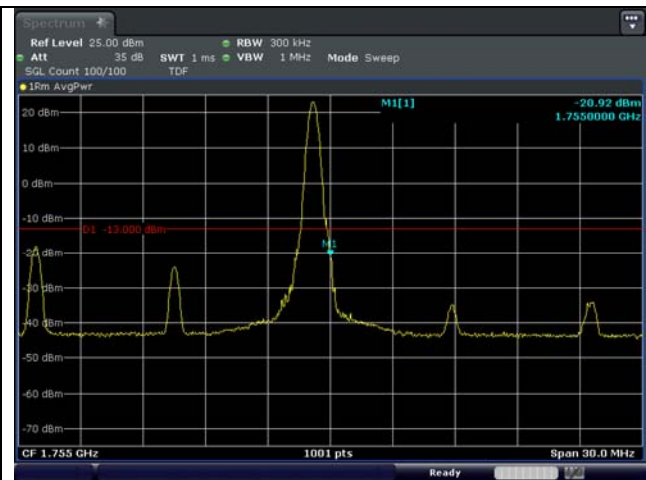


16QAM High Channel - Full RB

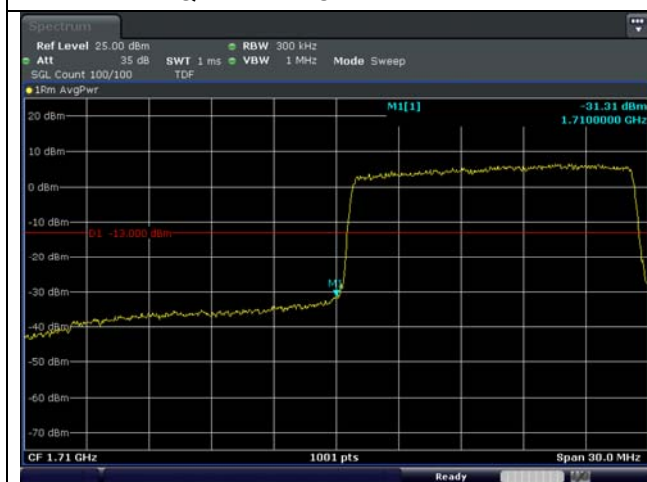
LTE band 4 (15 MHz)



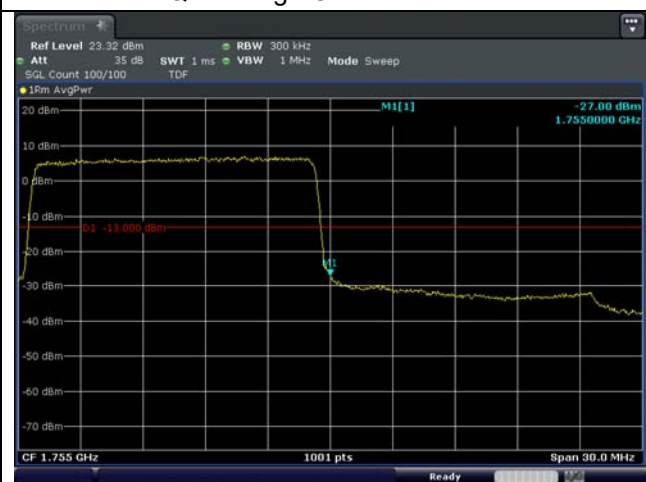
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

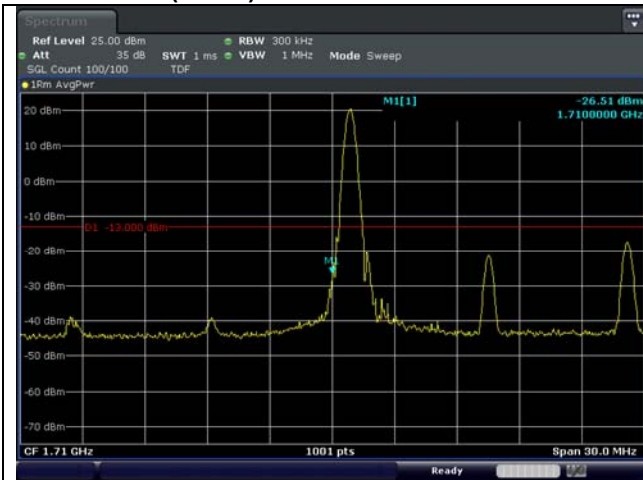


QPSK Low Channel - Full RB

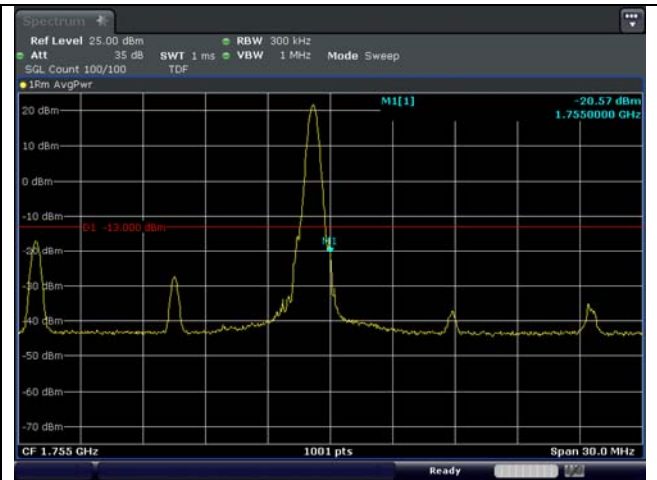


QPSK High Channel - Full RB

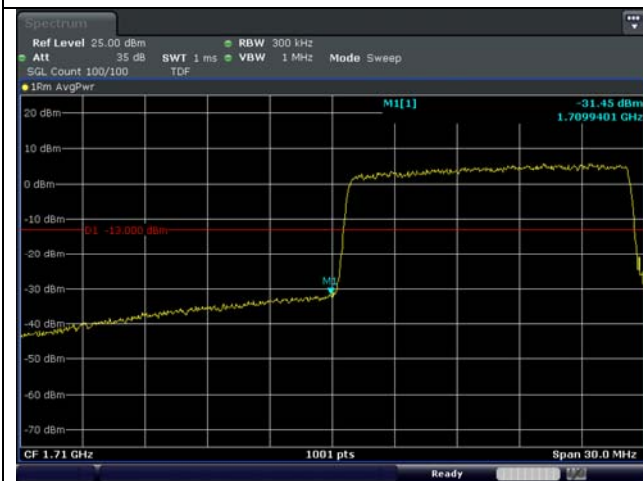
LTE band 4 (15 MHz)



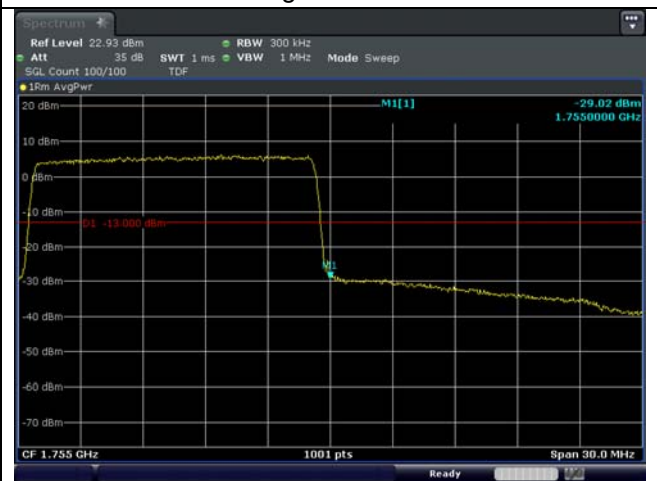
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

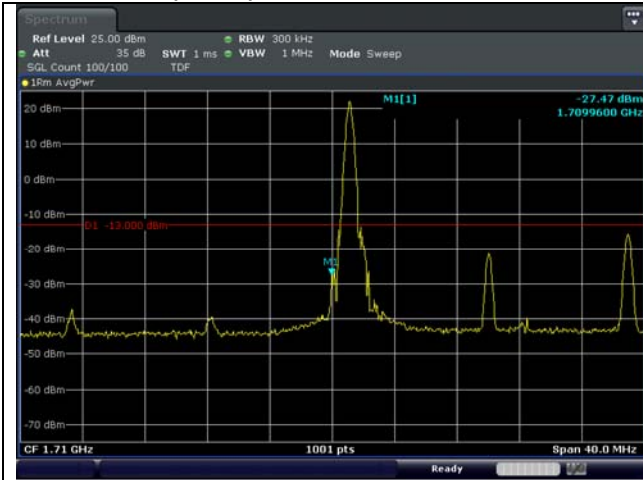


16QAM Low Channel - Full RB

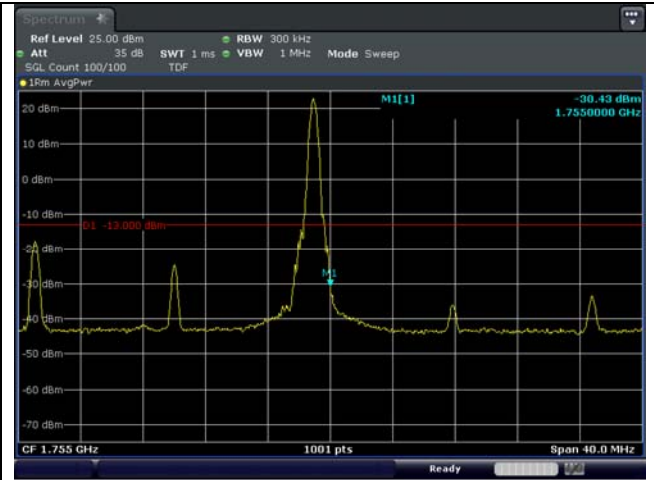


16QAM High Channel - Full RB

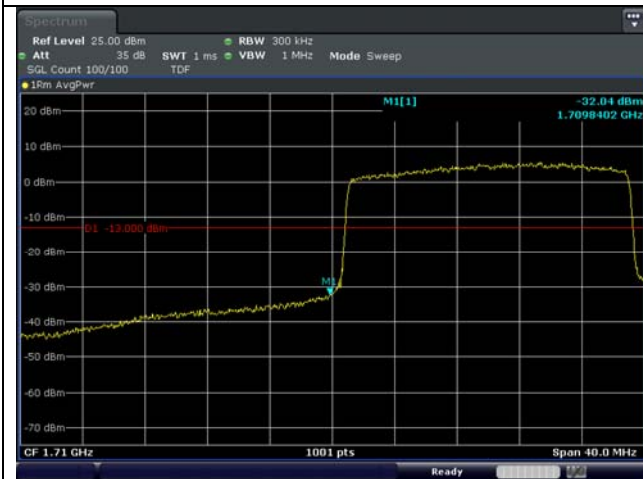
LTE band 4 (20 MHz)



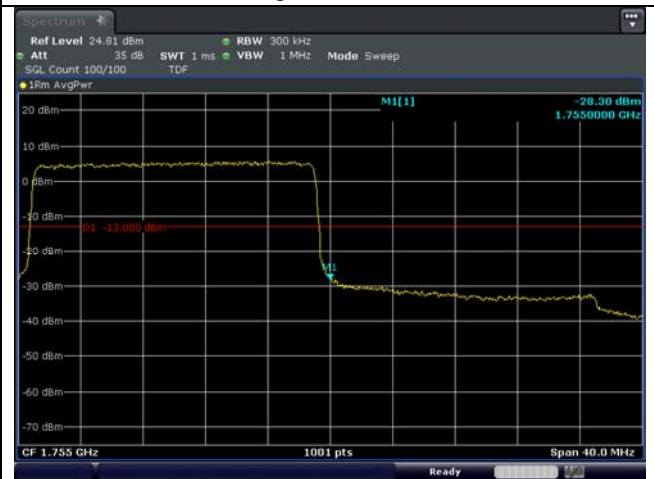
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

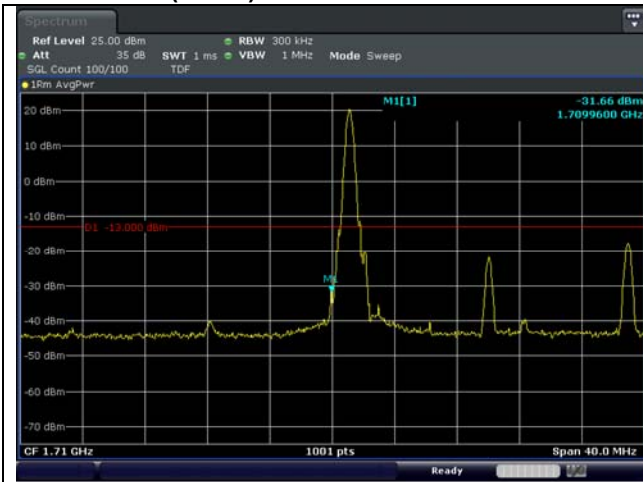


QPSK Low Channel - Full RB

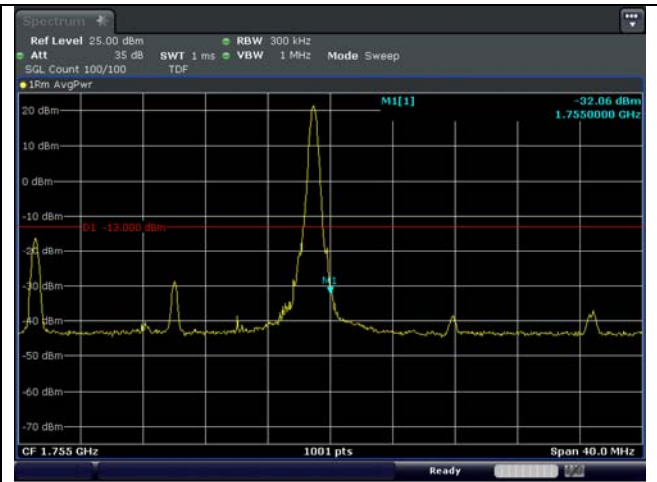


QPSK High Channel - Full RB

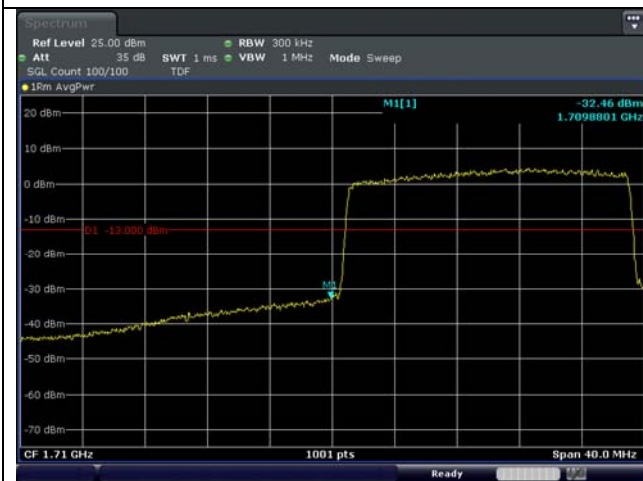
LTE band 4 (20 MHz)



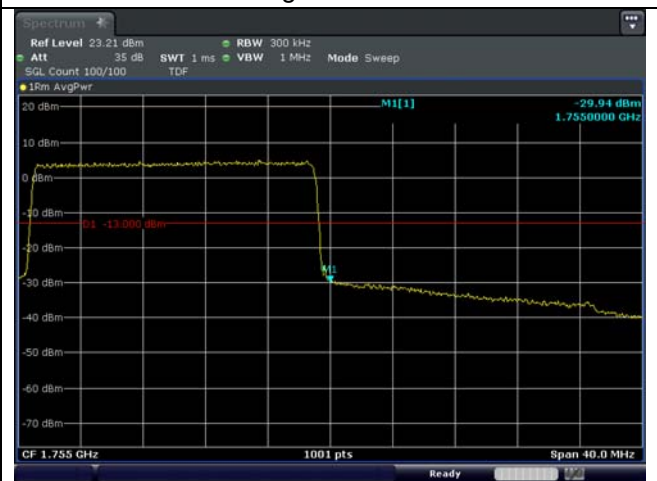
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

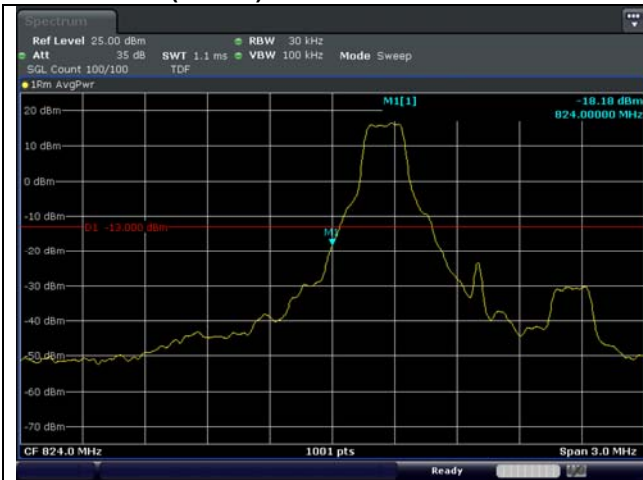


16QAM Low Channel - Full RB



16QAM High Channel - Full RB

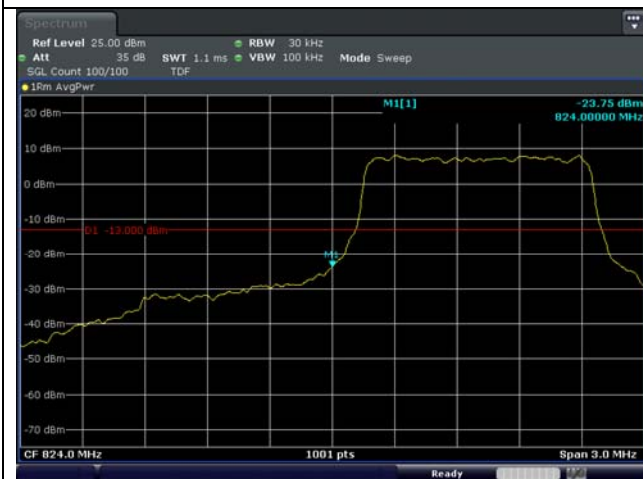
LTE band 5 (1.4 MHz)



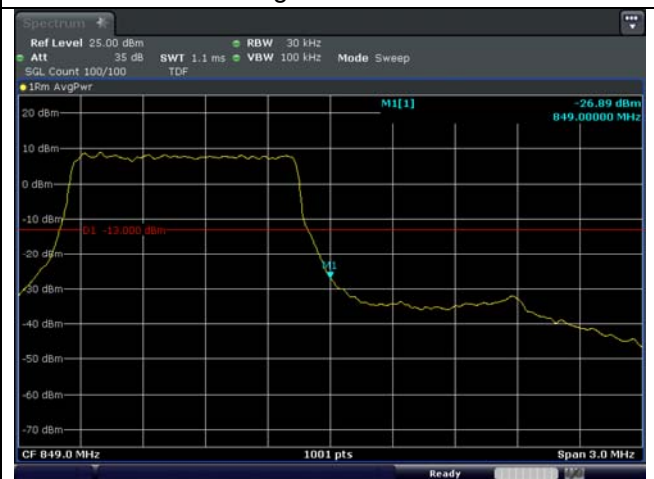
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

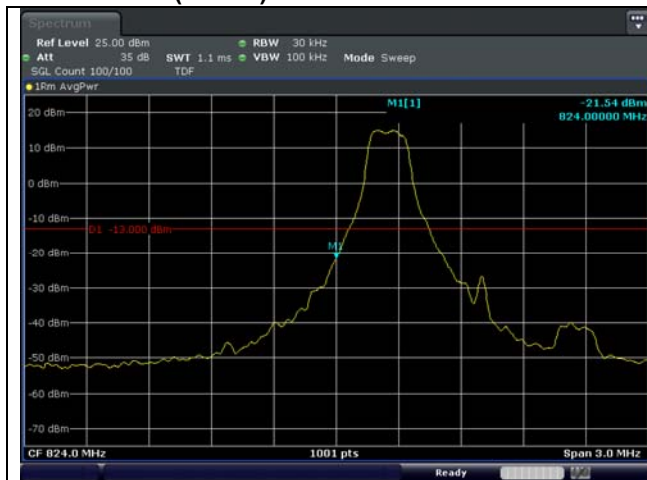


QPSK Low Channel - Full RB

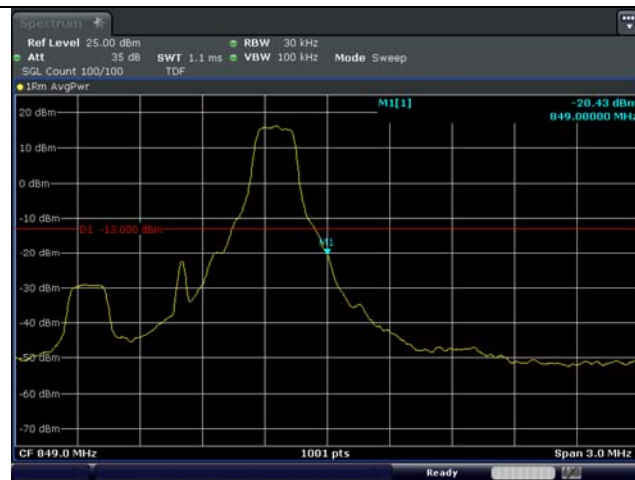


QPSK High Channel - Full RB

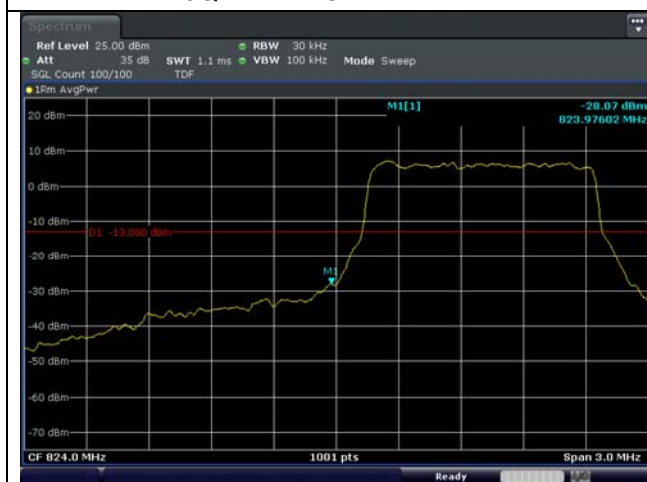
LTE band 5 (1.4 MHz)



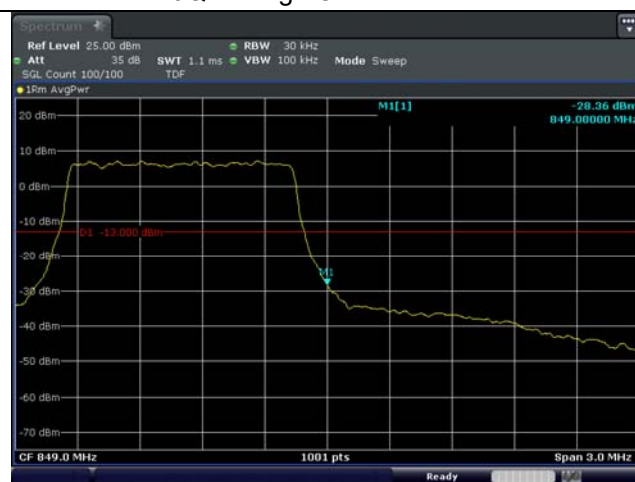
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

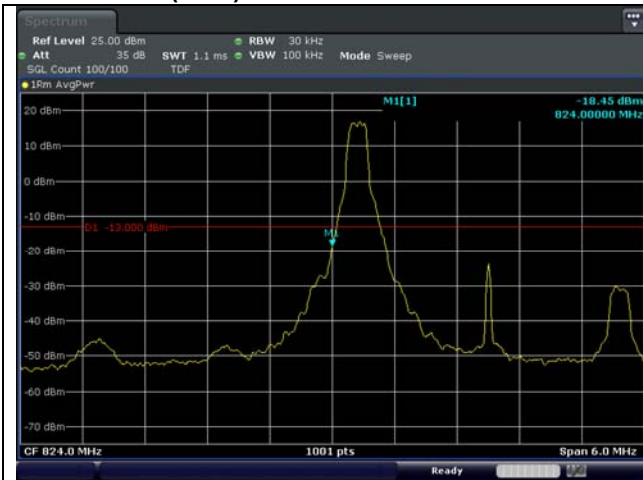


16QAM Low Channel - Full RB

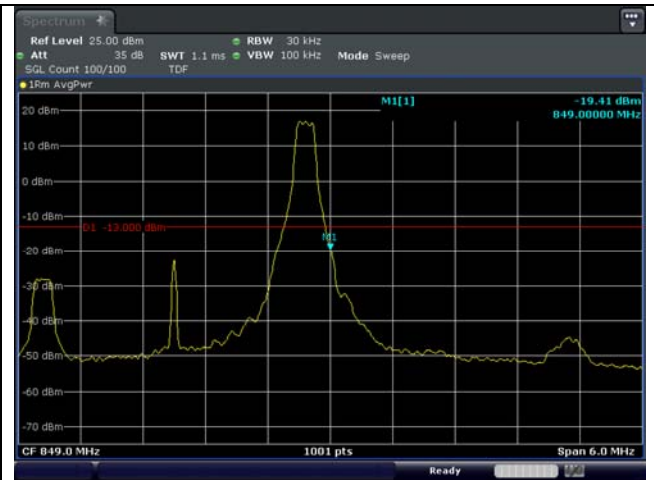


16QAM High Channel - Full RB

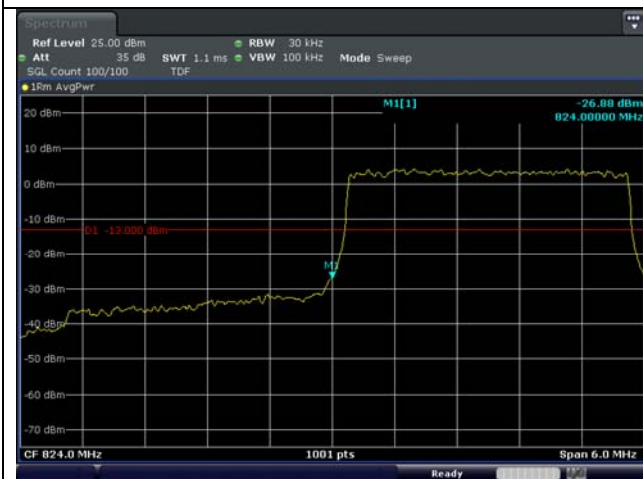
LTE band 5 (3 MHz)



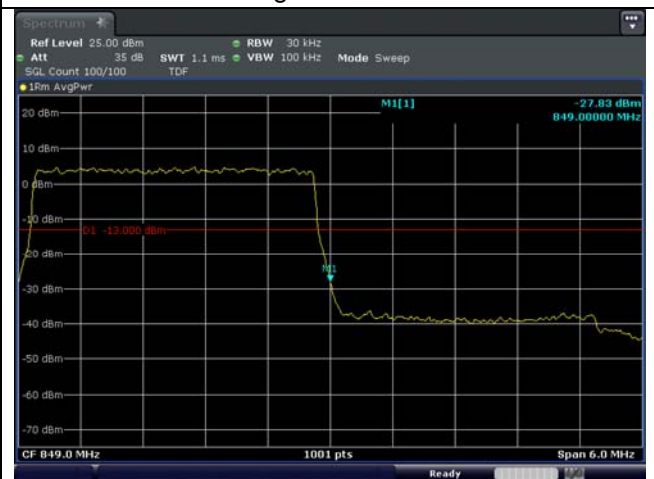
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

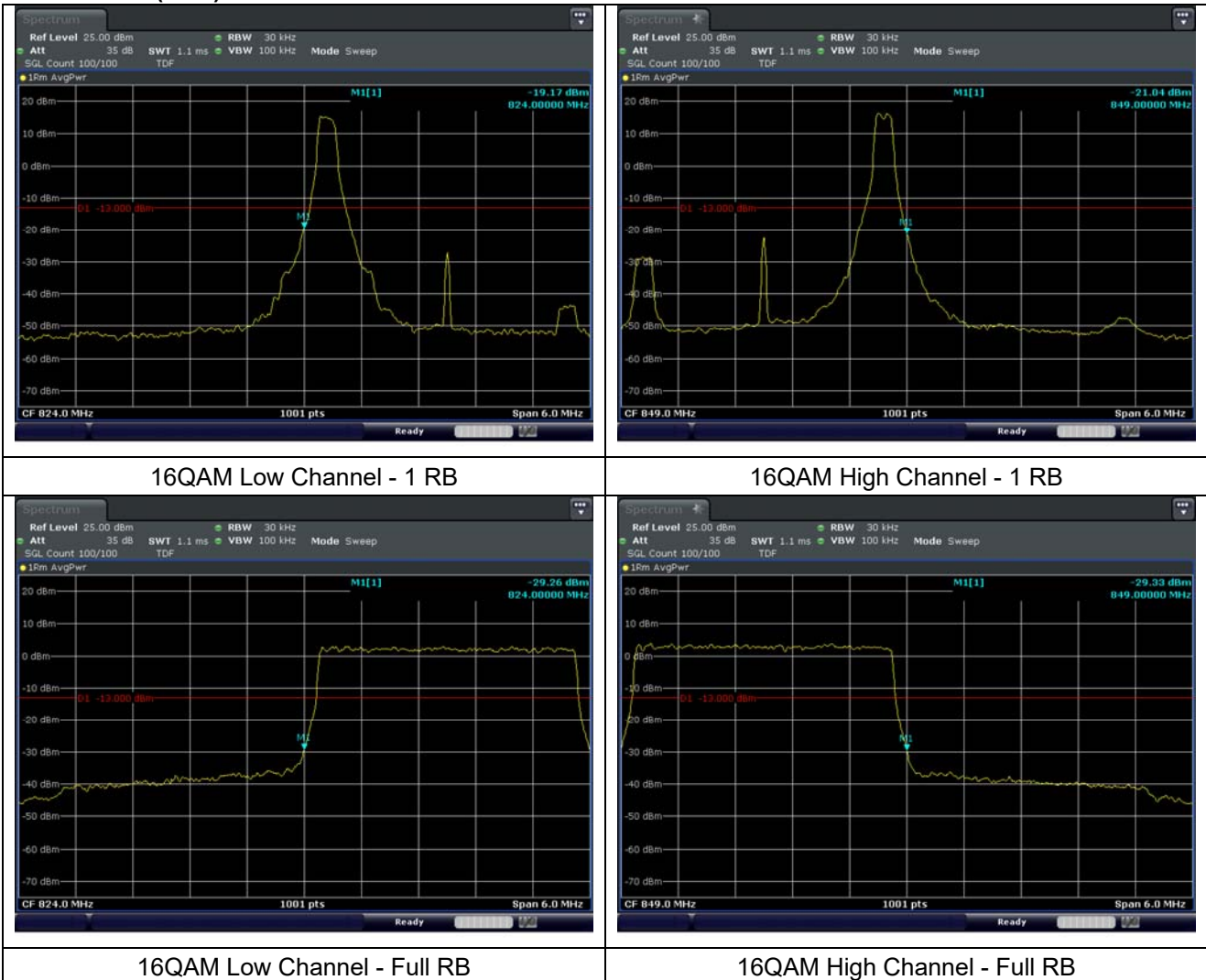


QPSK Low Channel - Full RB

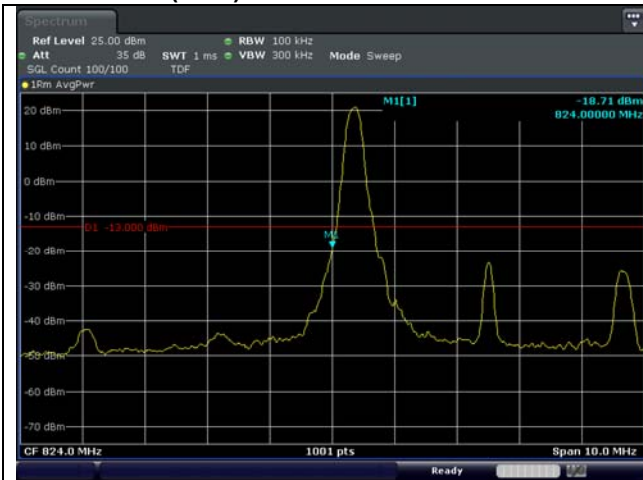


QPSK High Channel - Full RB

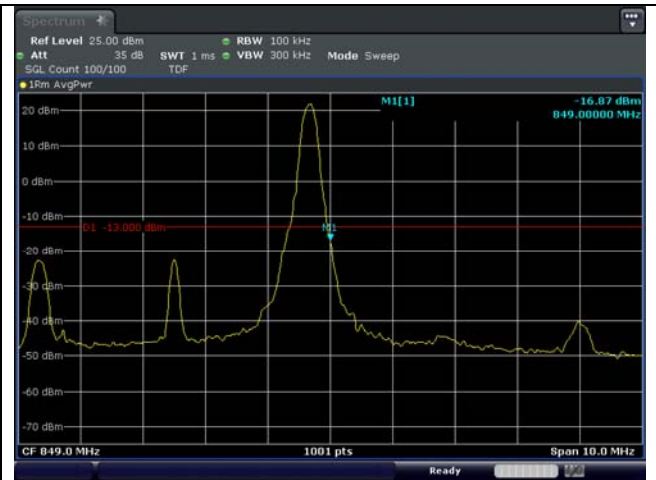
LTE band 5 (3 MHz)



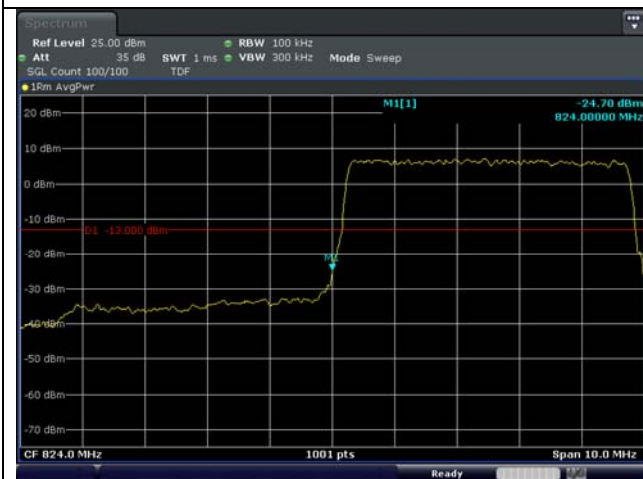
LTE band 5 (5 MHz)



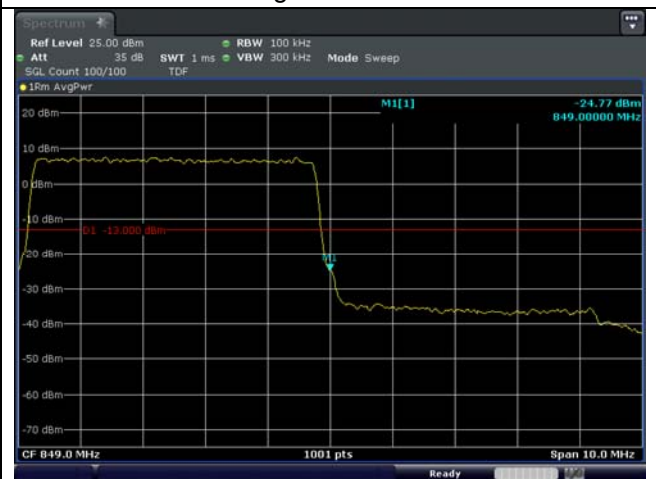
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

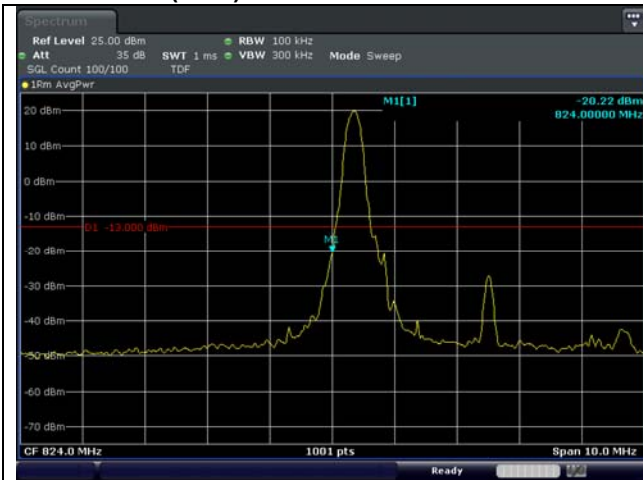


QPSK Low Channel - Full RB

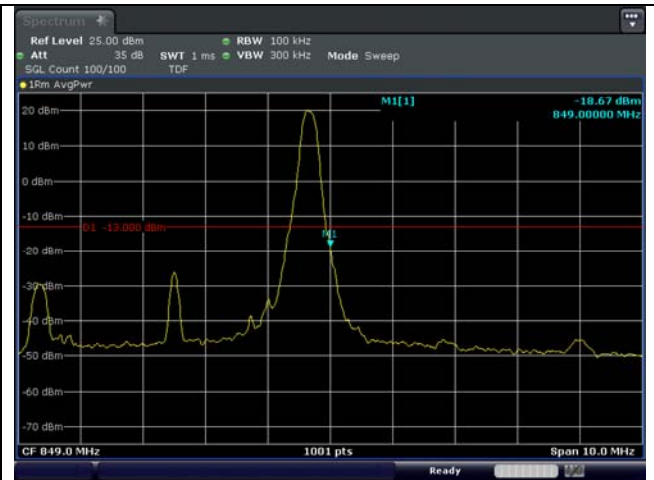


QPSK High Channel - Full RB

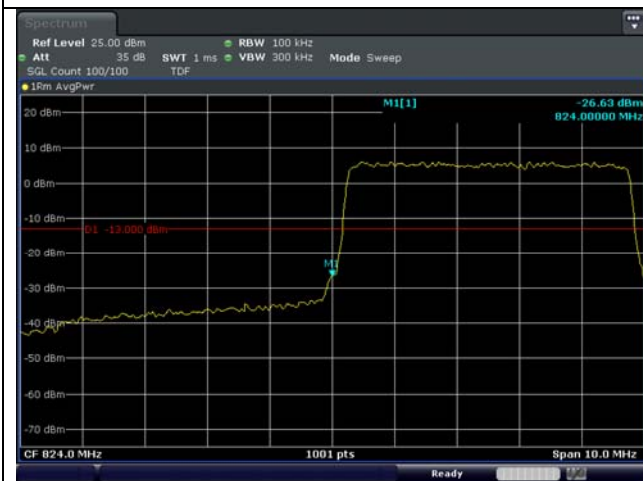
LTE band 5 (5 MHz)



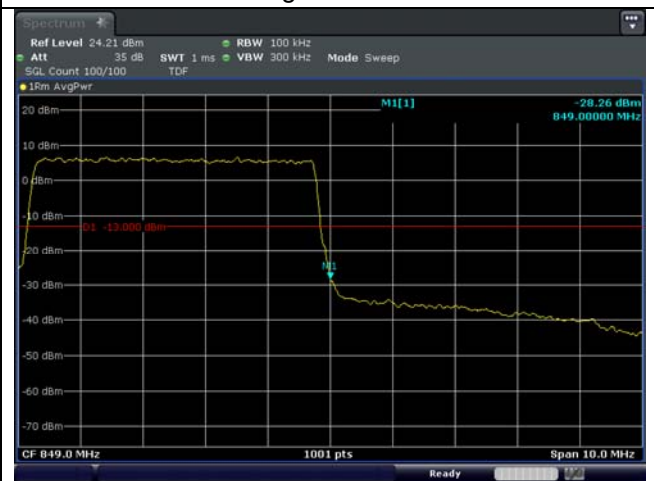
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

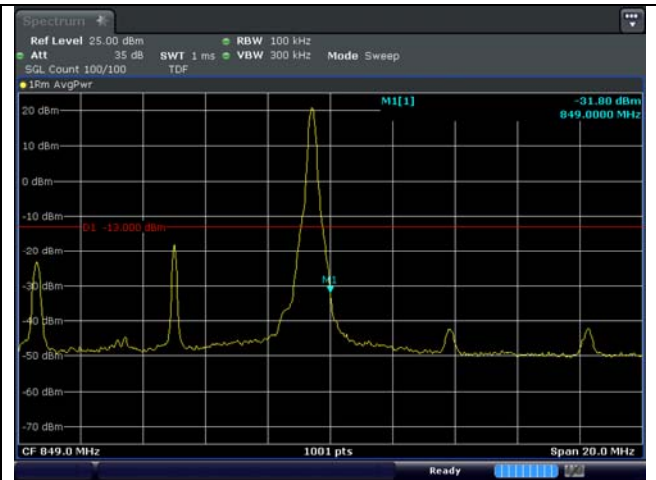
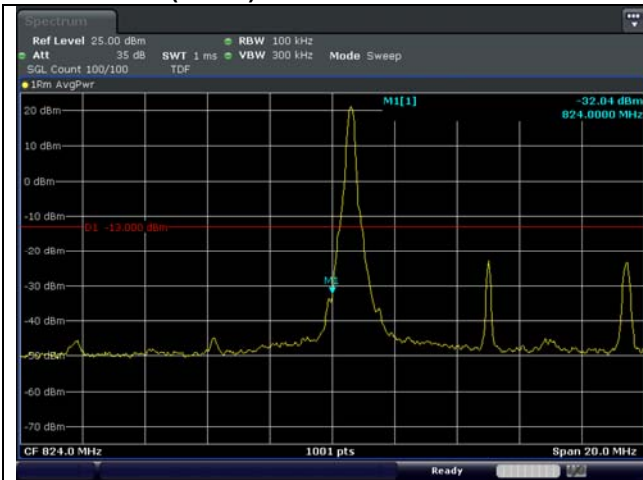


16QAM Low Channel - Full RB



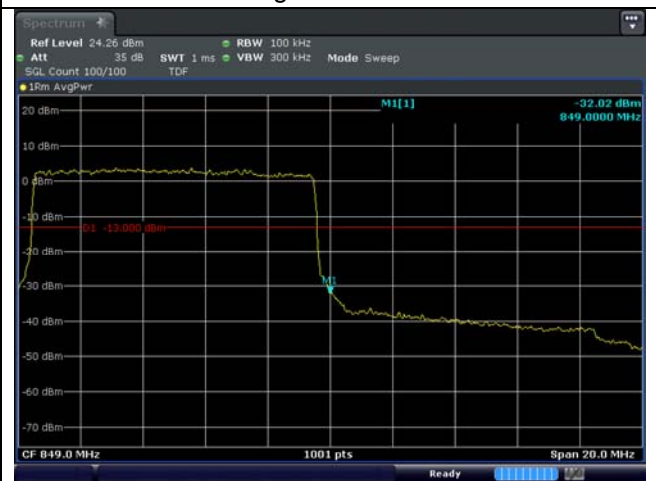
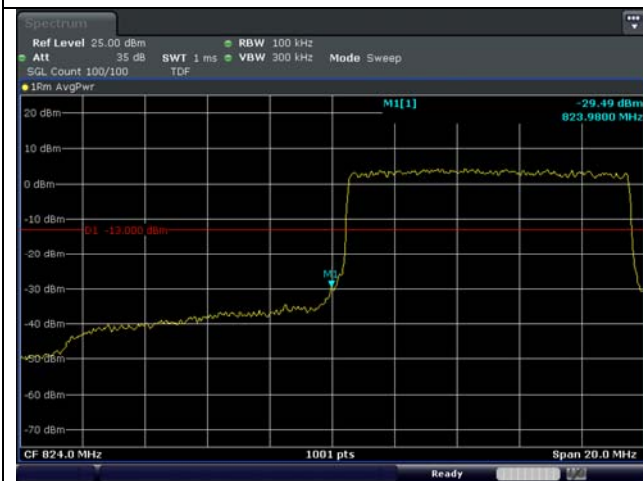
16QAM High Channel - Full RB

LTE band 5 (10 MHz)



QPSK Low Channel - 1 RB

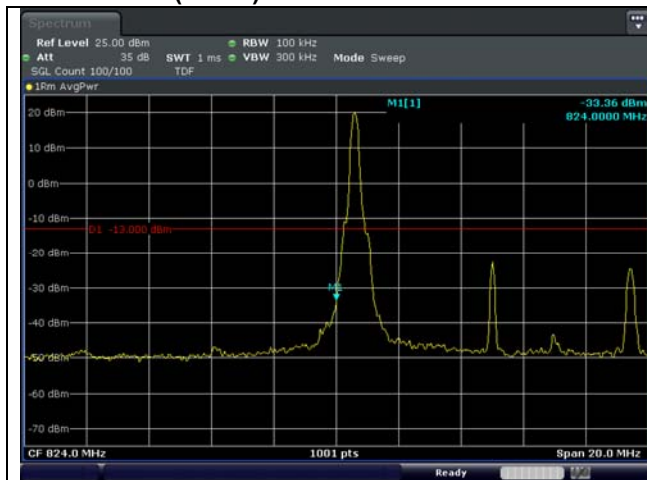
QPSK High Channel - 1 RB



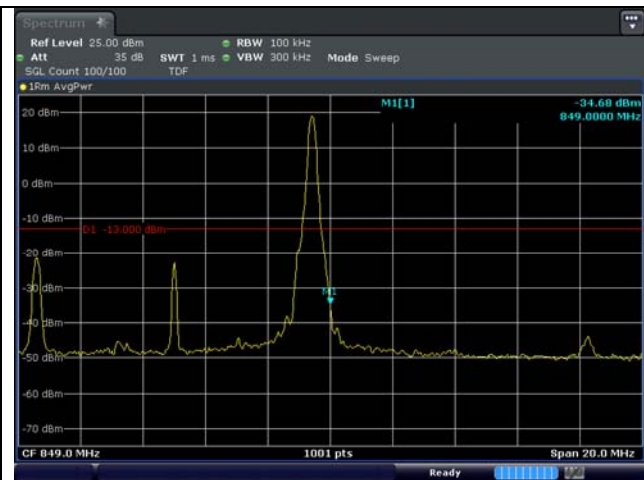
QPSK Low Channel - Full RB

QPSK High Channel - Full RB

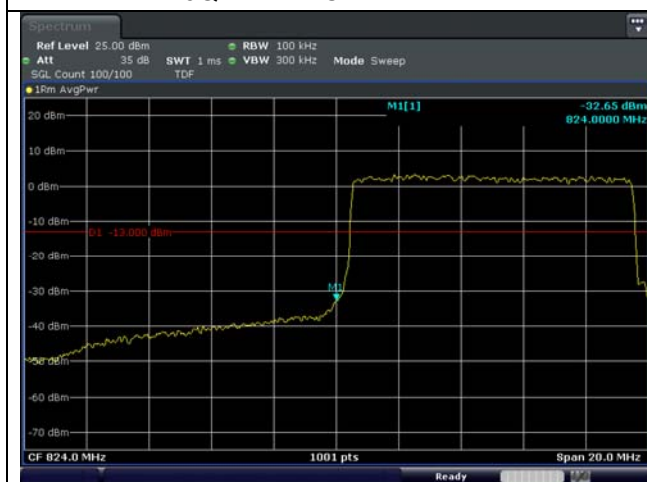
LTE band 5 (10 MHz)



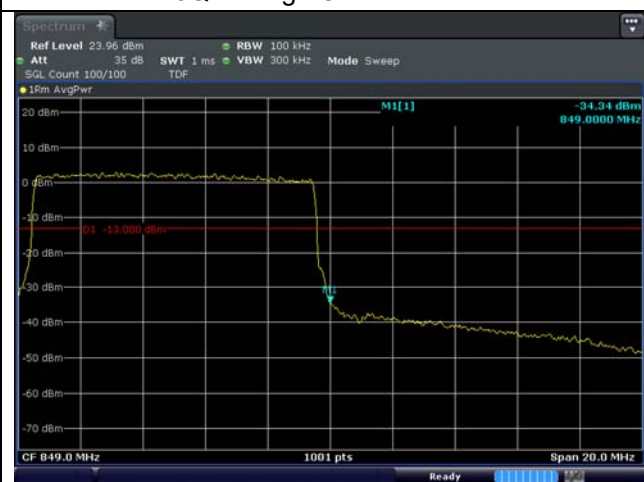
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

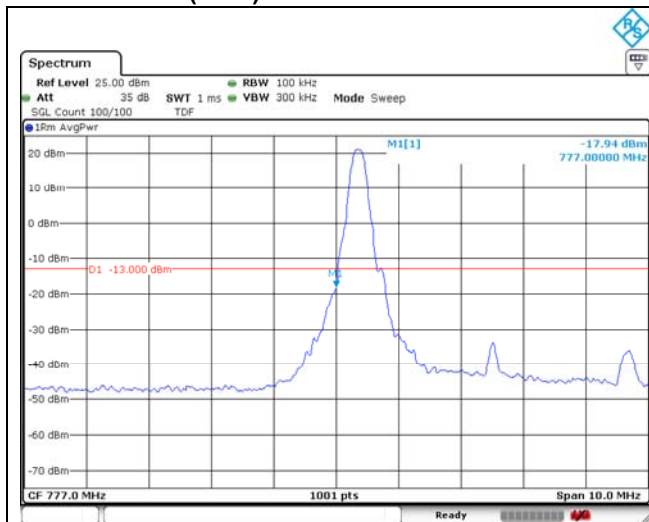


16QAM Low Channel - Full RB

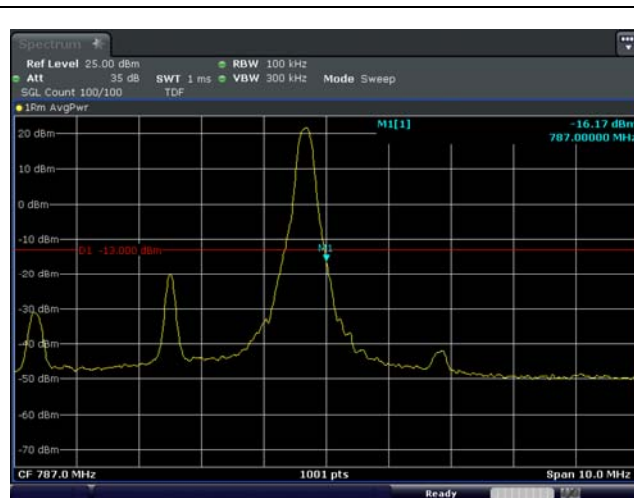


16QAM High Channel - Full RB

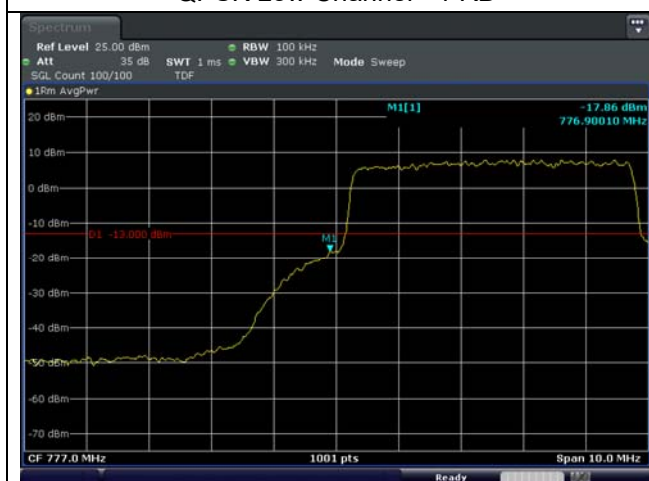
LTE band 13 (5 MHz)



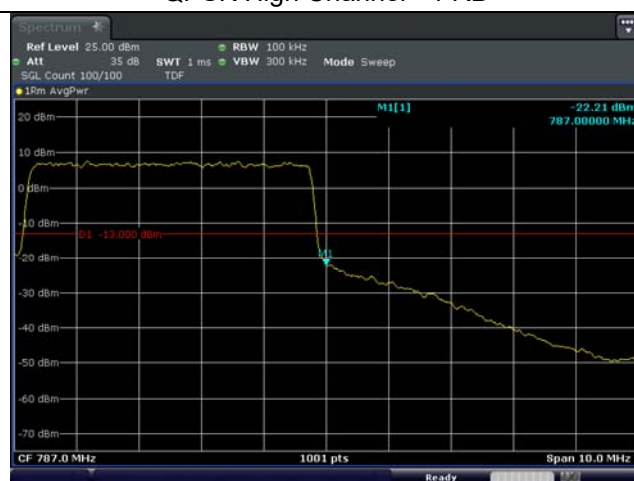
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

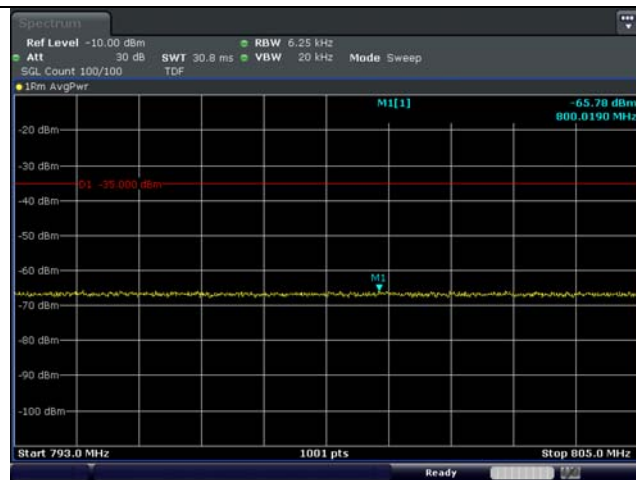
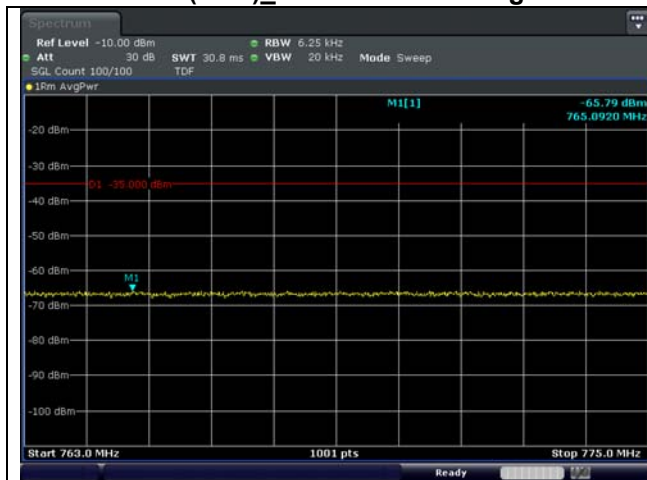


QPSK Low Channel - Full RB



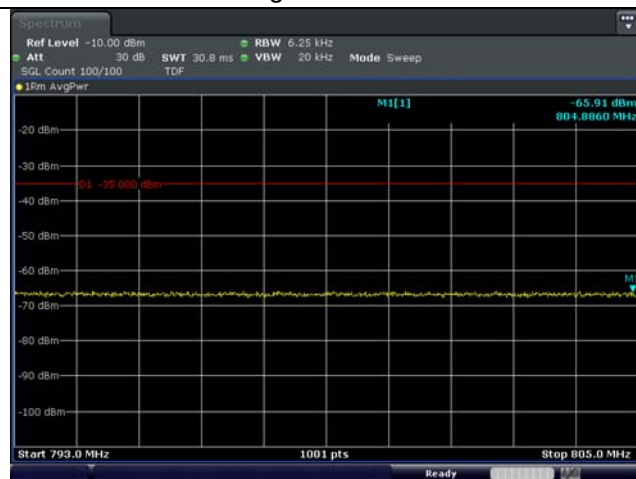
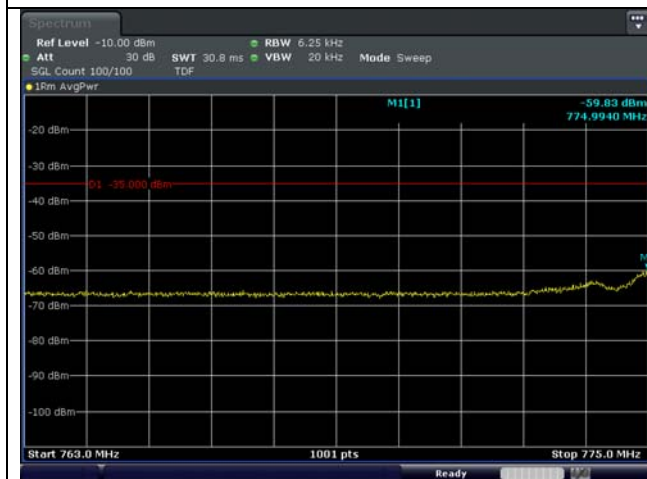
QPSK High Channel - Full RB

LTE band 13 (5 MHz)_Extended Band edge



QPSK Low Channel - 1 RB

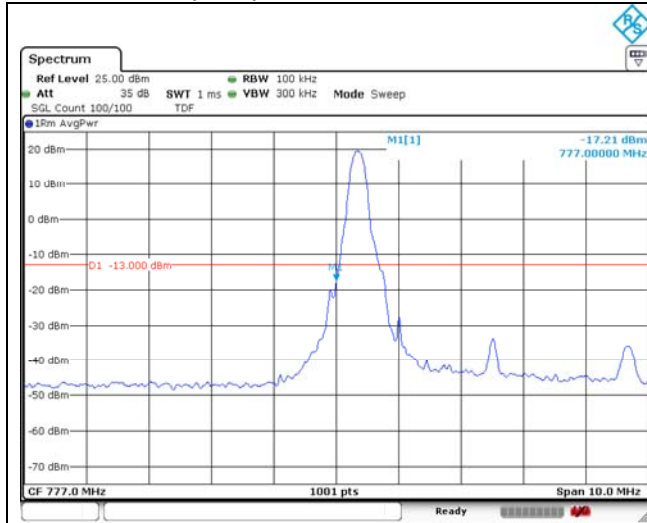
QPSK High Channel - 1 RB



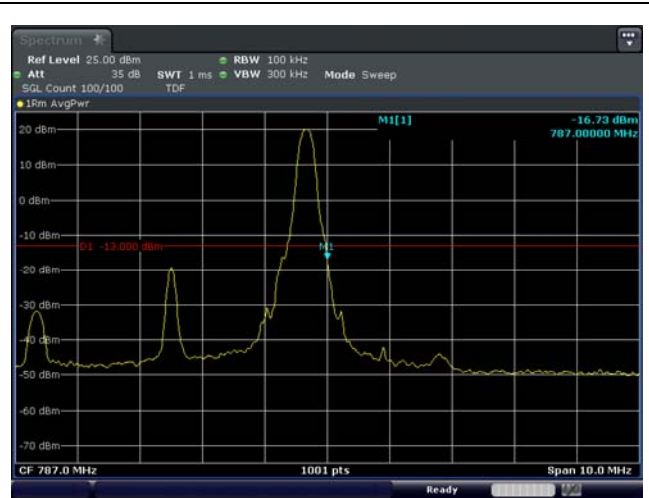
QPSK Low Channel - Full RB

QPSK High Channel - Full RB

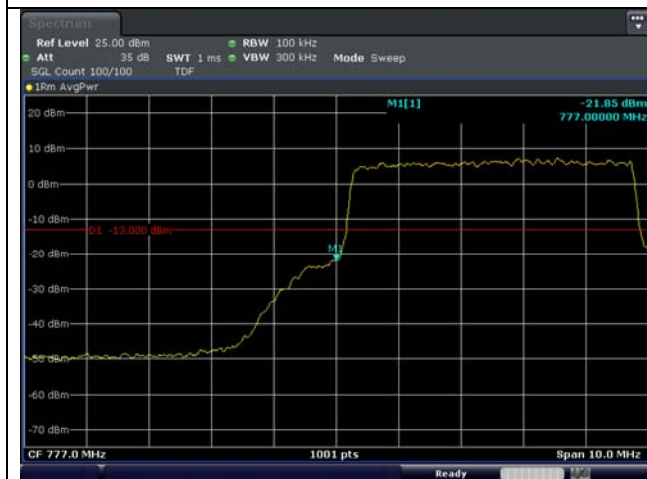
LTE band 13 (5 MHz)



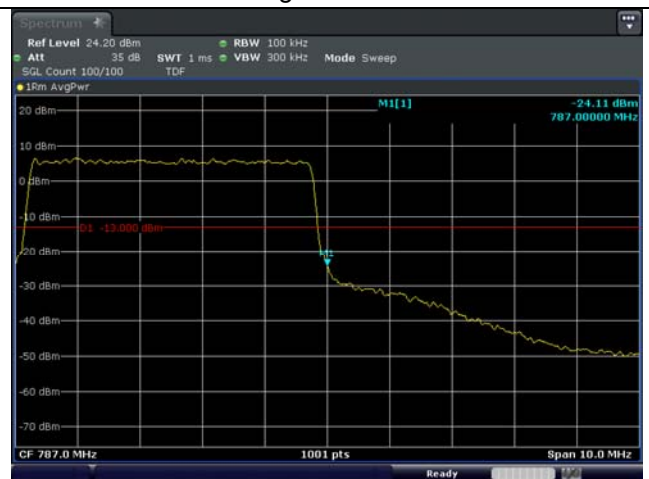
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

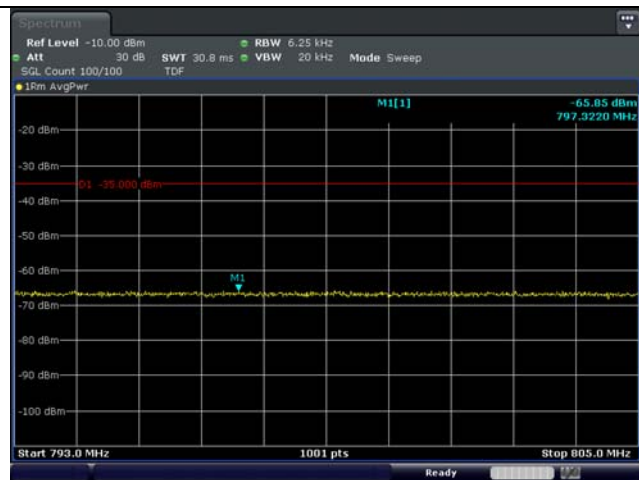
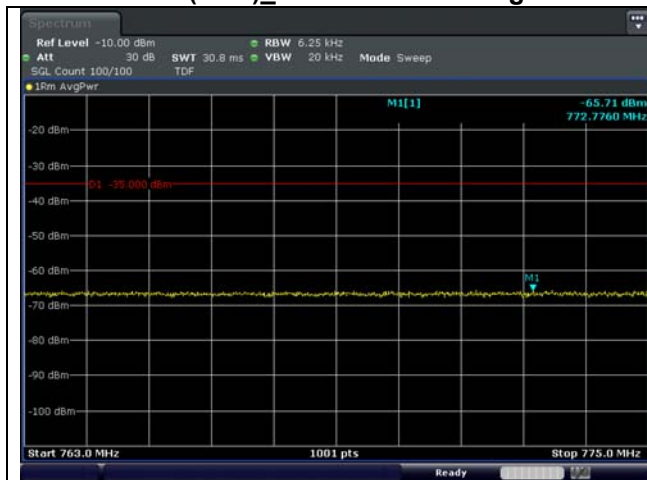


16QAM Low Channel - Full RB



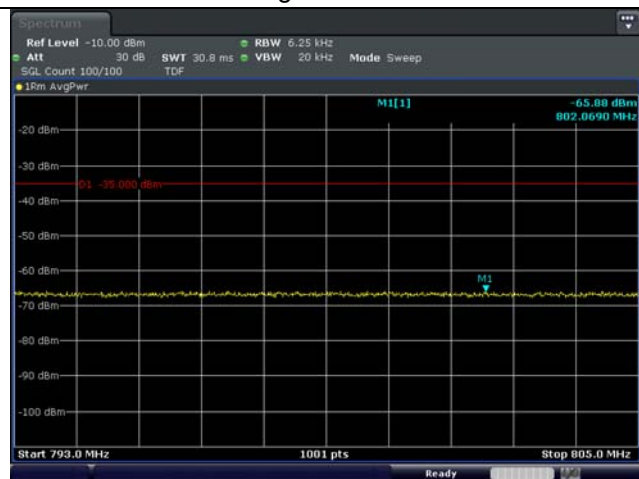
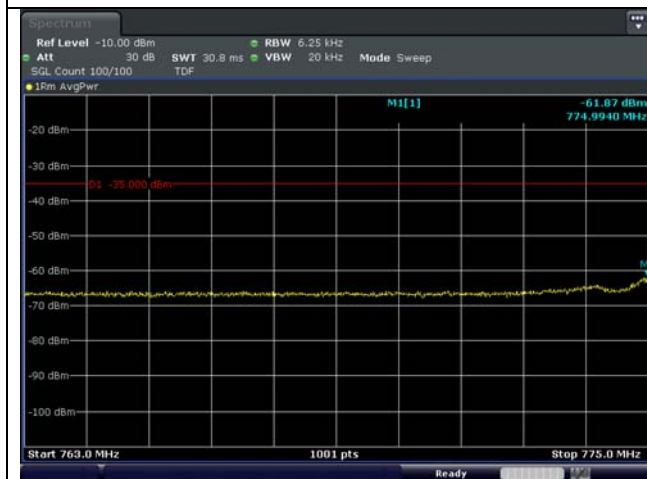
16QAM High Channel - Full RB

LTE band 13 (5 MHz)_Extended Band edge



16QAM Low Channel - 1 RB

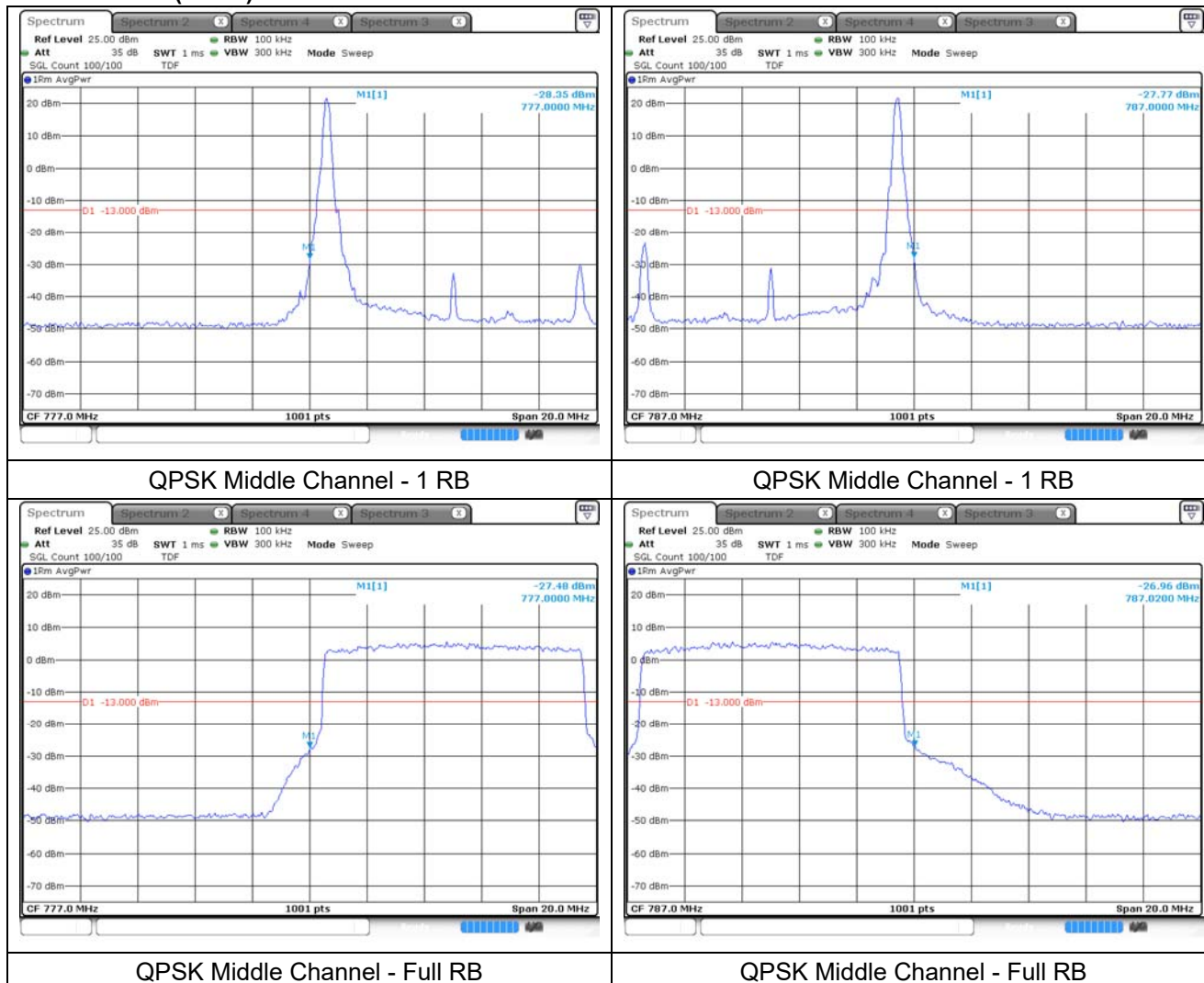
16QAM High Channel - 1 RB



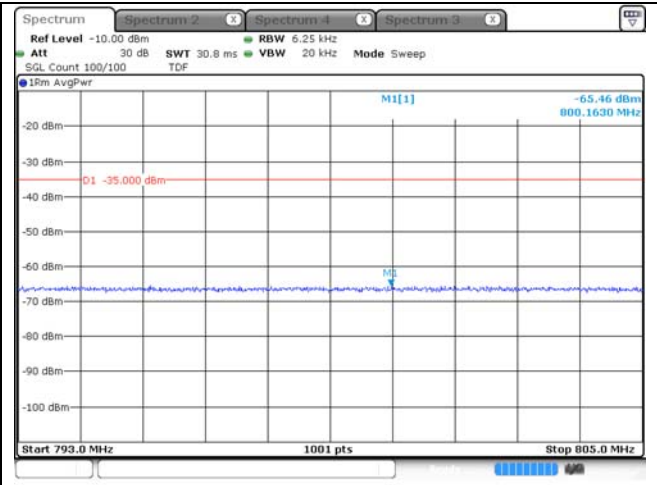
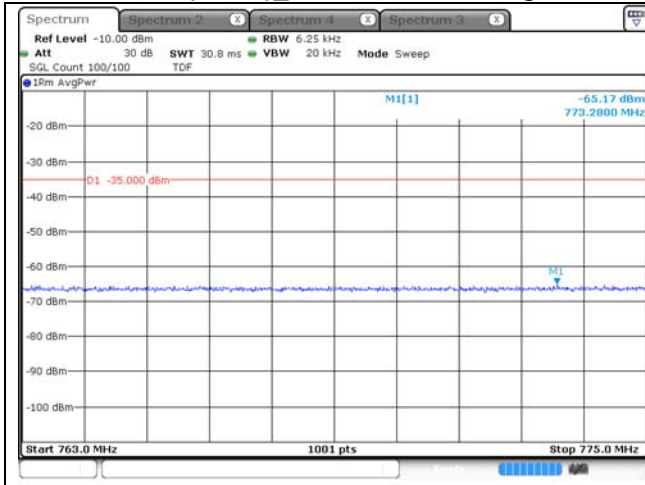
16QAM Low Channel - Full RB

16QAM High Channel - Full RB

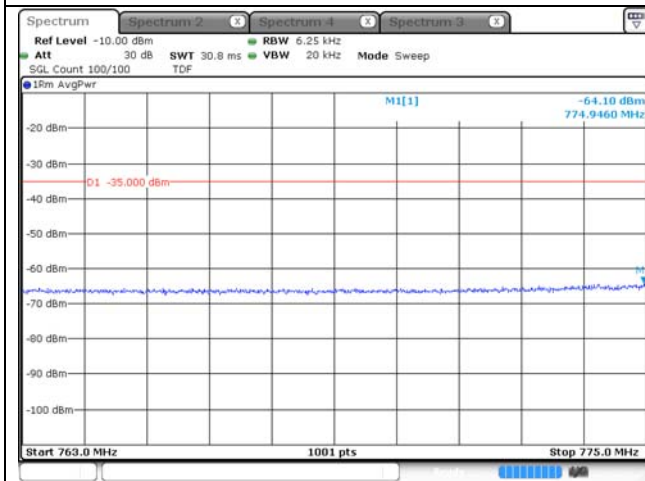
LTE band 13 (10 MHz)



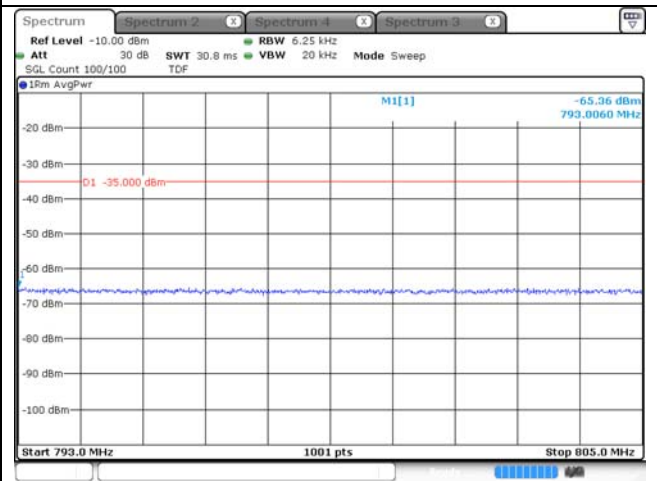
LTE band 13 (10 MHz) Extended Band edge



QPSK Middle Channel - 1 RB



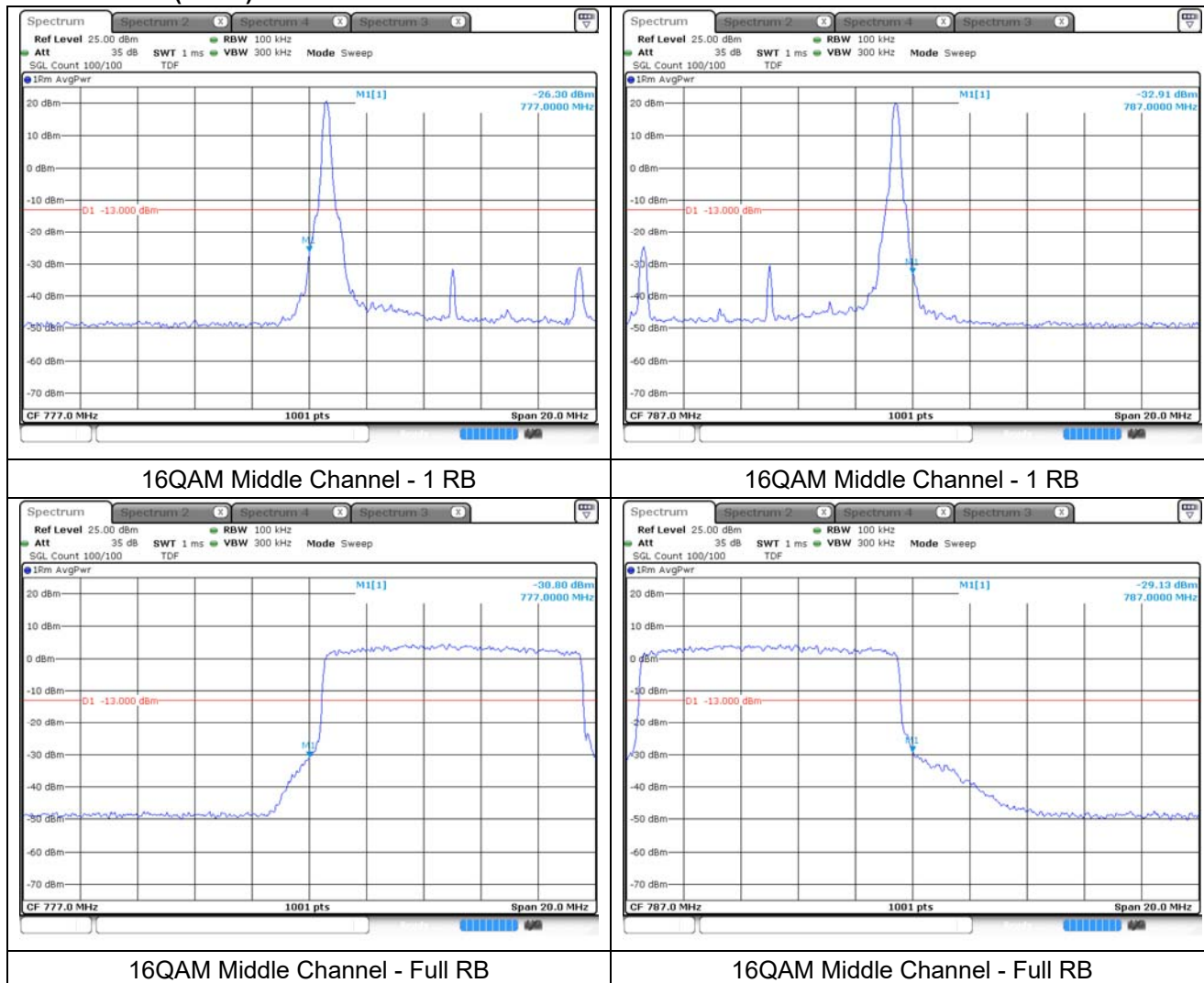
QPSK Middle Channel - 1 RB



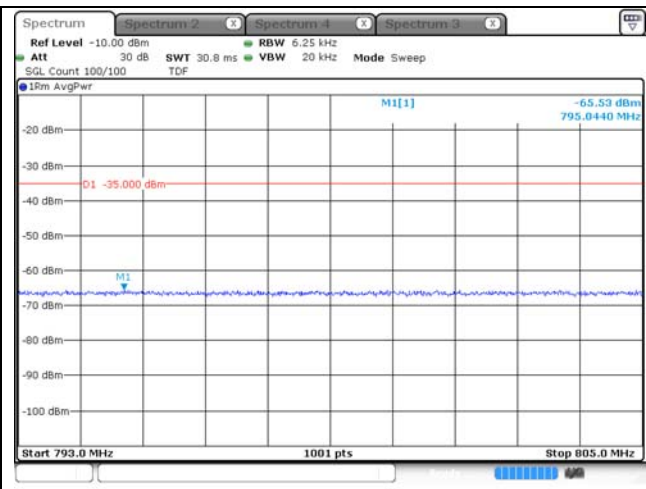
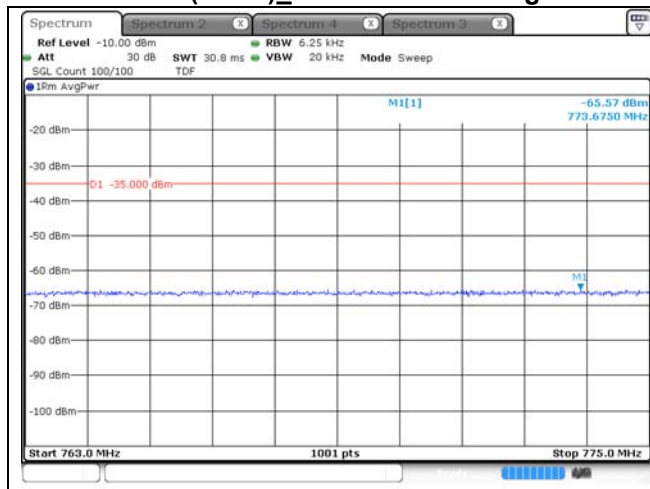
QPSK Middle Channel - Full RB

QPSK Middle Channel - Full RB

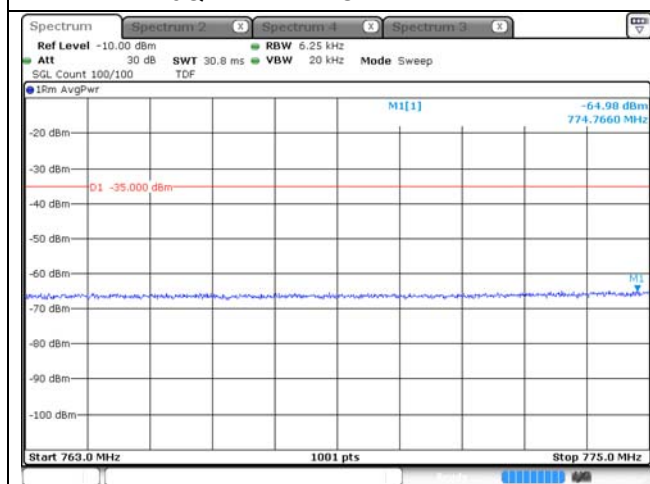
LTE band 13 (10 MHz)



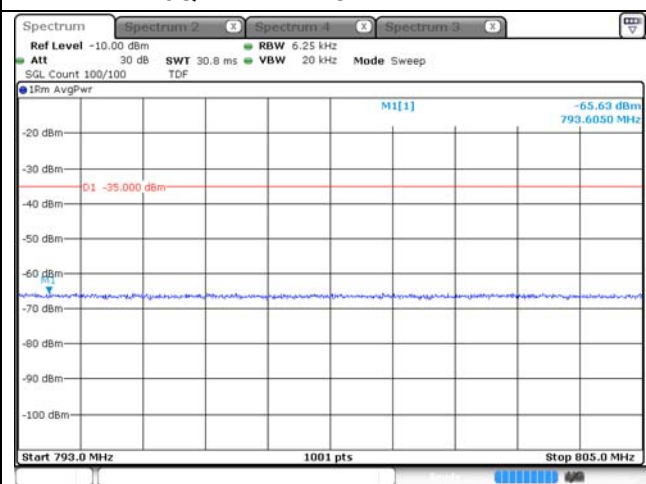
LTE band 13 (10 MHz) Extended Band edge



16QAM Middle Channel - 1 RB



16QAM Middle Channel - 1 RB



16QAM Middle Channel - Full RB

16QAM Middle Channel - Full RB

8. Frequency Stability

8.1. Limit

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

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

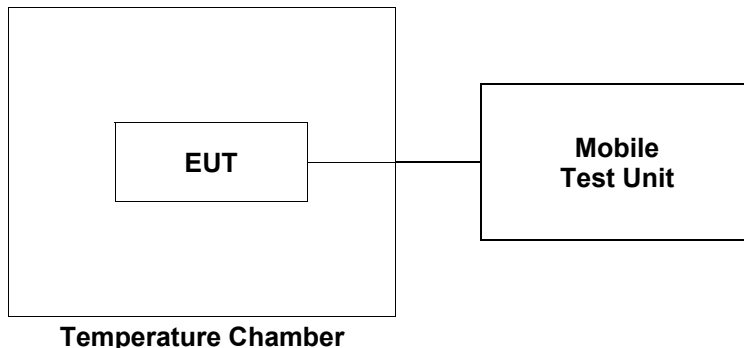
For Mobile devices operating in the 824 to 849 MHz band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.

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

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

8.2. Test Procedure

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



8.3. Test Results

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

LTE band 2 at middle channel

Reference Frequency: 1 880.0 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	4.00	-2.72	0.000 24
40		-3.75	-0.000 30
30		-4.35	-0.000 62
20(Ref.)		-3.18	-
10		-2.15	0.000 55
0		-3.10	0.000 04
-10		-3.62	-0.000 23
-20		-1.87	0.000 70
-30		-3.71	-0.000 28
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	3.40 (85%)	-2.95	0.000 12
	4.60 (115%)	-3.35	-0.000 09

LTE band 4 at middle channel

Reference Frequency: 1 732.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	4.00	0.67	0.000 02
40		-0.97	-0.000 92
30		-1.30	-0.001 11
20(Ref.)		0.63	-
10		2.05	0.000 82
0		1.36	0.000 42
-10		1.80	0.000 68
-20		2.45	0.001 05
-30		1.07	0.000 25
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	3.40 (85%)	0.78	0.000 09
	4.60 (115%)	1.10	0.000 27

LTE band 5 at middle channel

Reference Frequency: 836.5 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	4.00	-0.46	0.001 60
40		-0.70	0.001 32
30		-1.04	0.000 91
20(Ref.)		-1.80	-
10		1.13	0.003 50
0		0.87	0.003 19
-10		-0.70	0.001 32
-20		1.22	0.003 61
-30		-0.53	0.001 52
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	3.40 (85%)	-1.62	0.000 22
	4.60 (115%)	-1.55	0.000 30

LTE band 13 at middle channel

Reference Frequency: 782 MHz			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	4.00	-0.94	0.000 75
40		-1.09	0.000 56
30		-0.86	0.000 86
20(Ref.)		-1.53	-
10		1.41	0.003 76
0		1.13	0.003 40
-10		-0.23	0.001 66
-20		0.97	0.003 20
-30		-0.80	0.000 93
Frequency Stability versus Power Supply			
Environment Temperature (°C)	Power Supplied (V)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
20	3.40 (85%)	-1.55	-0.000 03
	4.60 (115%)	-1.47	0.000 08

- End of the Test Report -