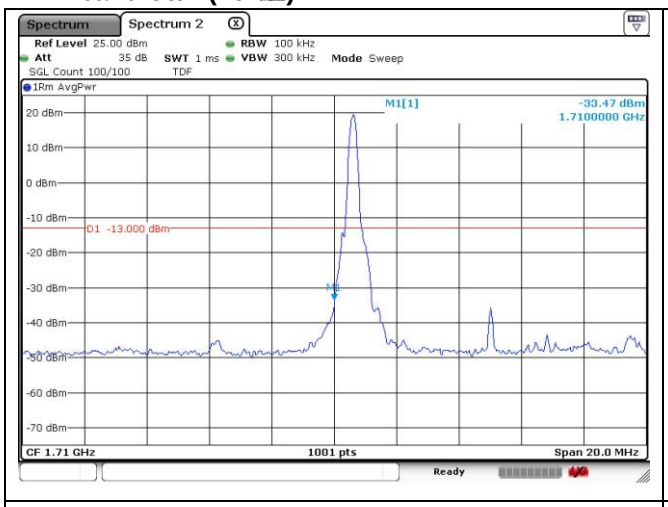
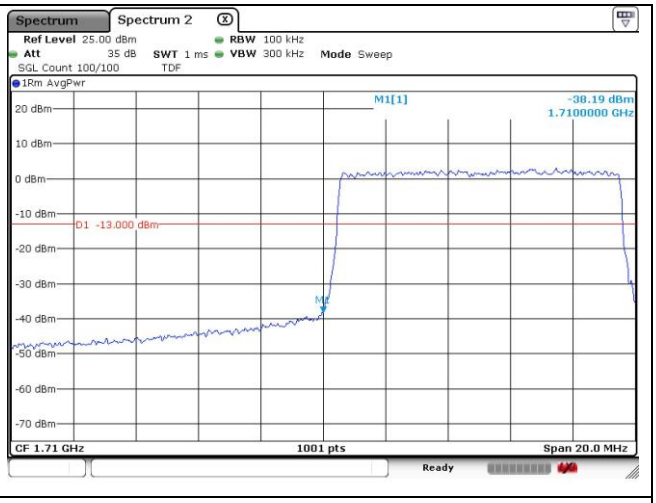
LTE band 66/4 (10 ㎒)

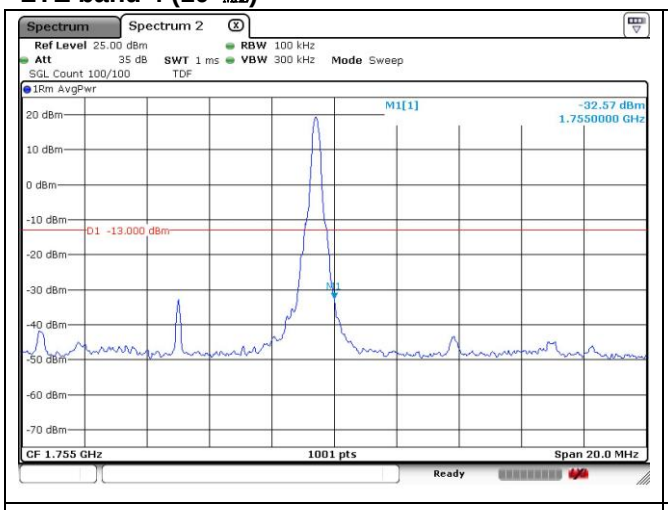


16QAM Low Channel - 1 RB

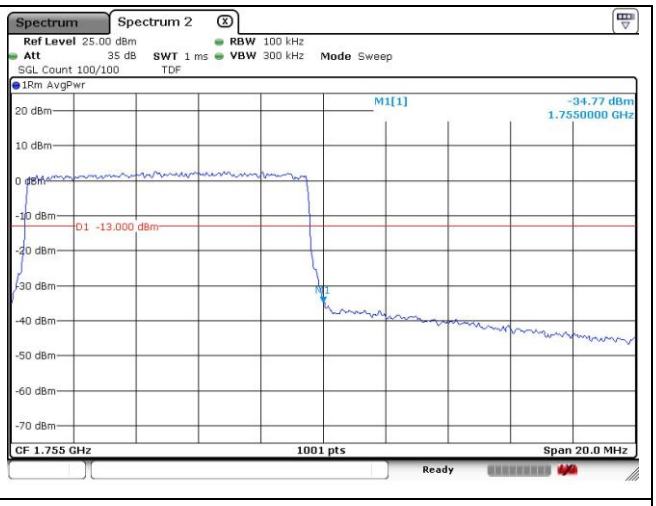


16QAM Low Channel - Full RB

LTE band 4 (10 ㎒)

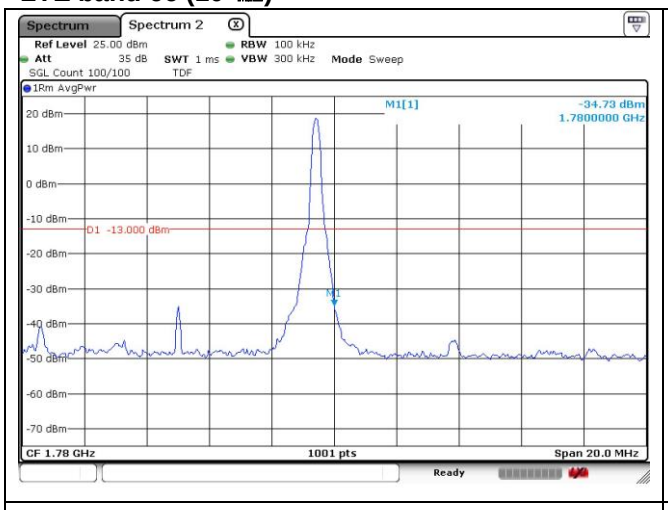


16QAM High Channel - 1 RB

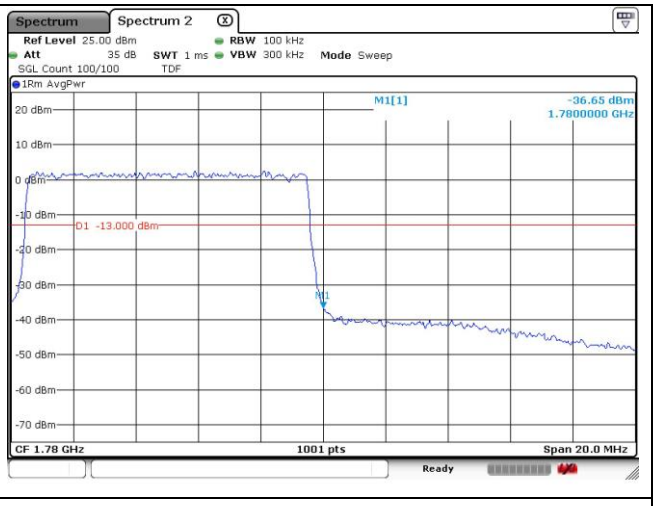


16QAM High Channel - Full RB

LTE band 66 (10 ㎒)

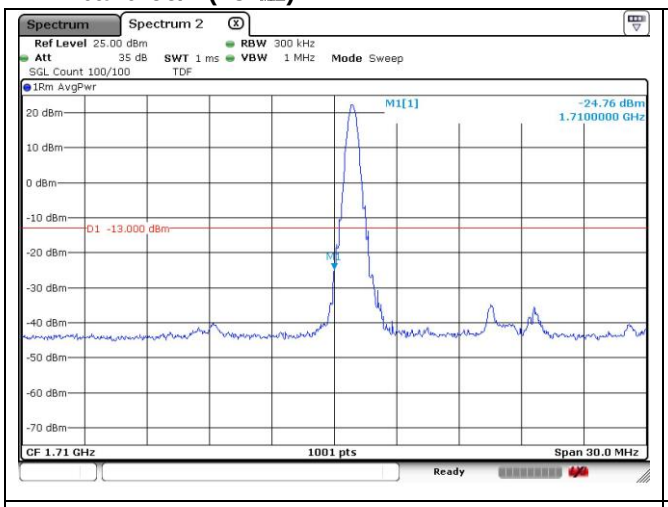


16QAM High Channel - 1 RB

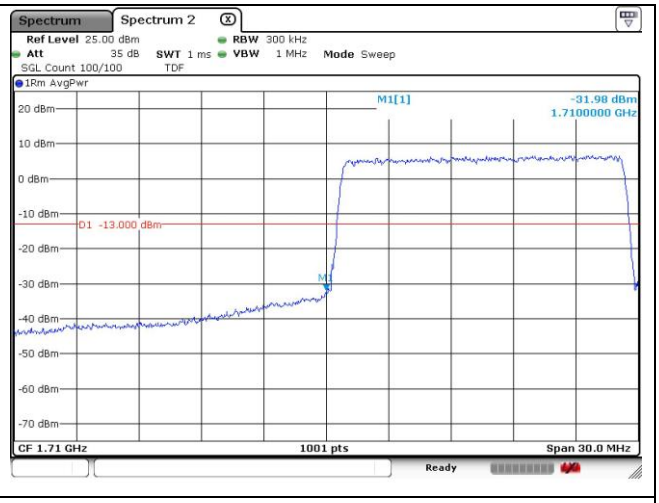


16QAM High Channel - Full RB

LTE band 66/4 (15 ㎒)

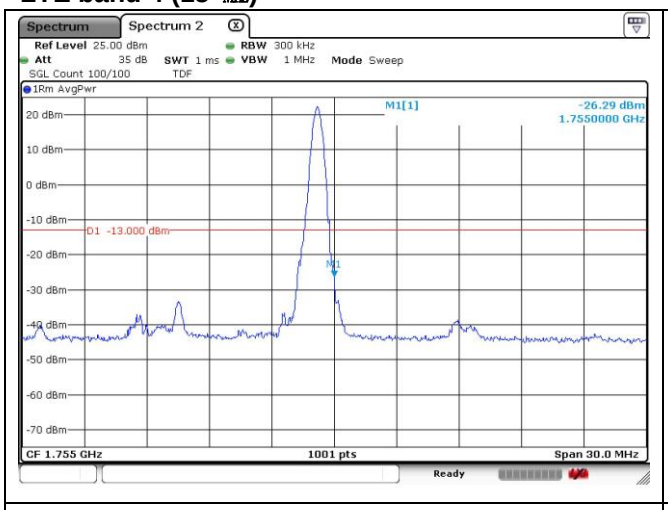


QPSK Low Channel - 1 RB

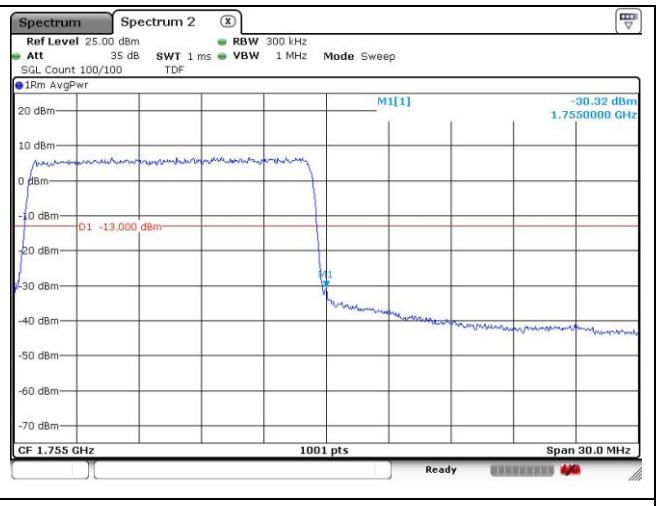


QPSK Low Channel - Full RB

LTE band 4 (15 ㎒)

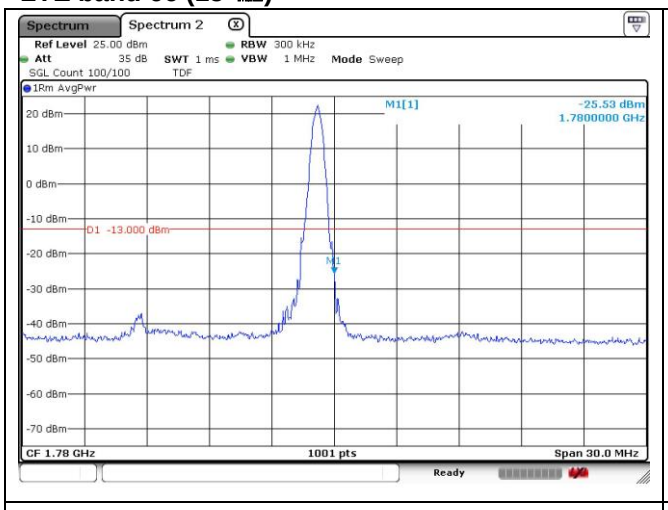


QPSK High Channel - 1 RB

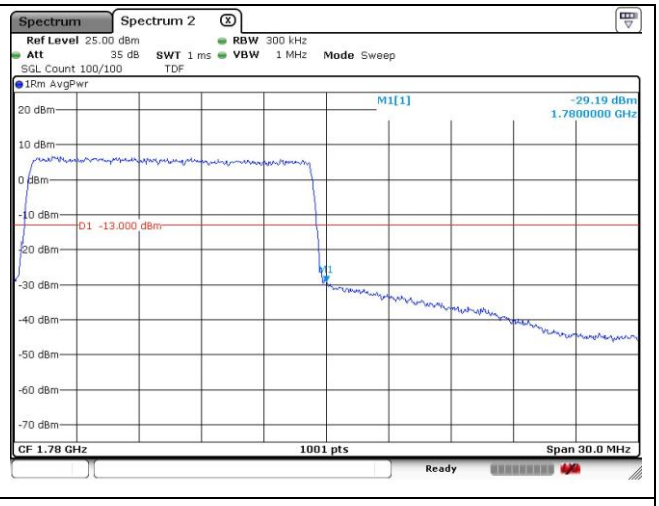


QPSK High Channel - Full RB

LTE band 66 (15 ㎒)

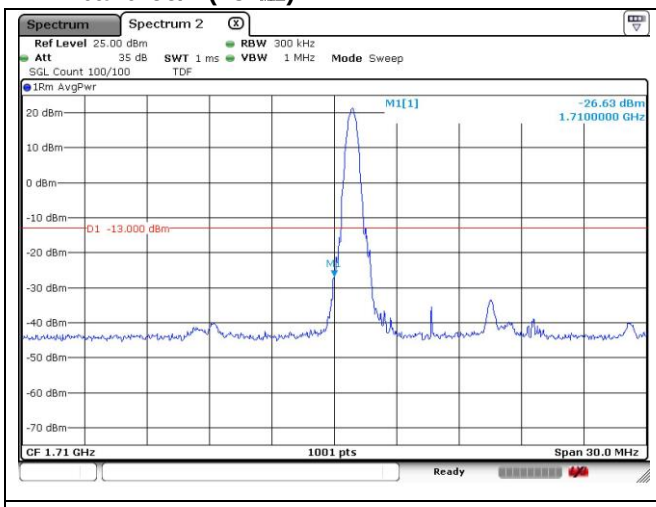


QPSK High Channel - 1 RB

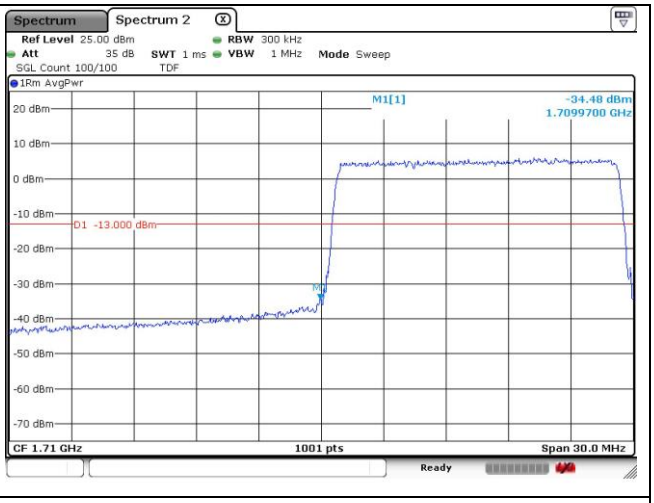


QPSK High Channel - Full RB

LTE band 66/4 (15 ㎒)

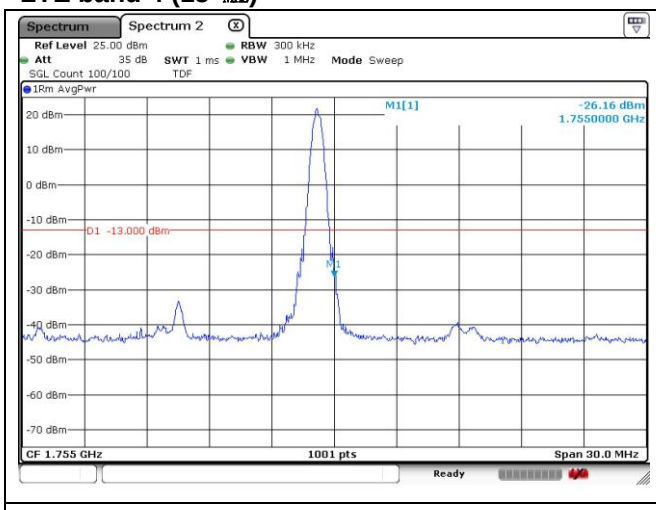


16QAM Low Channel - 1 RB

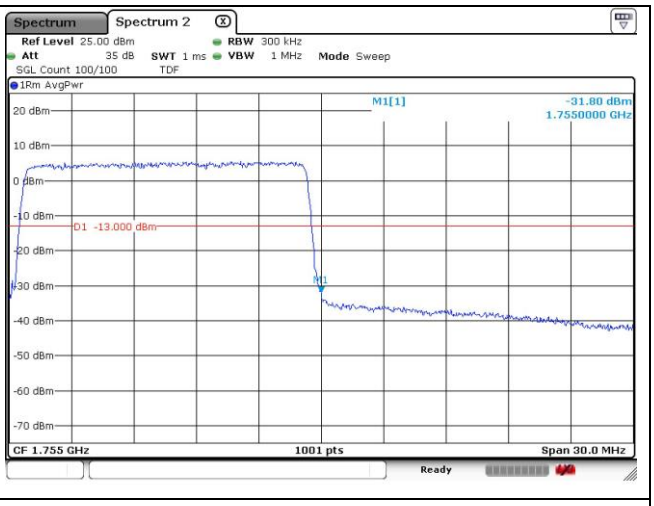


16QAM Low Channel - Full RB

LTE band 4 (15 ㎒)

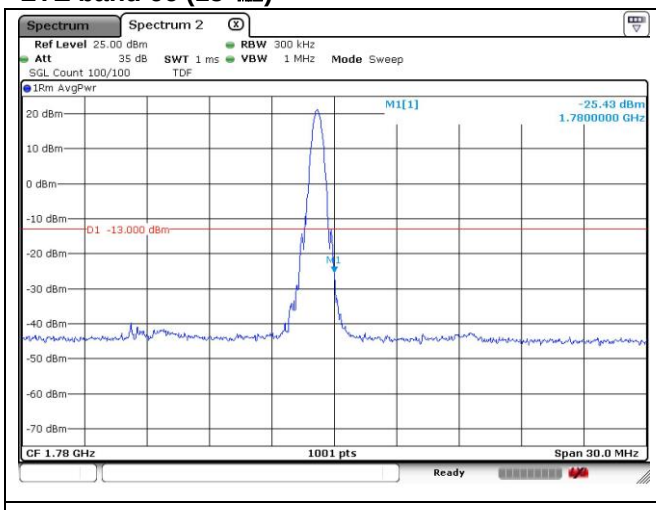


16QAM High Channel - 1 RB

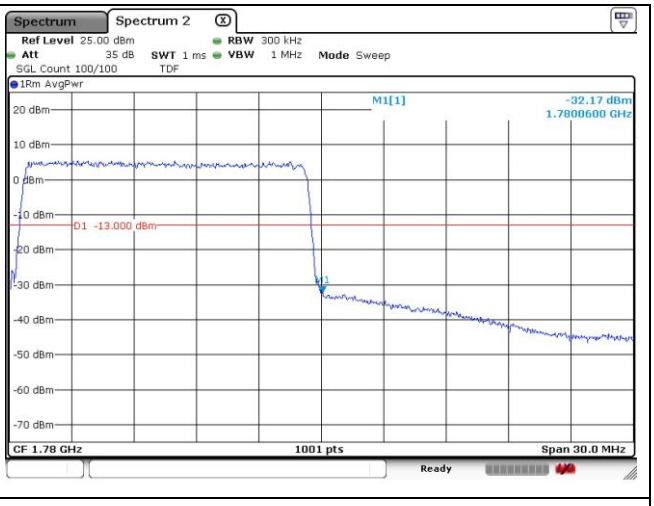


16QAM High Channel - Full RB

LTE band 66 (15 ㎒)

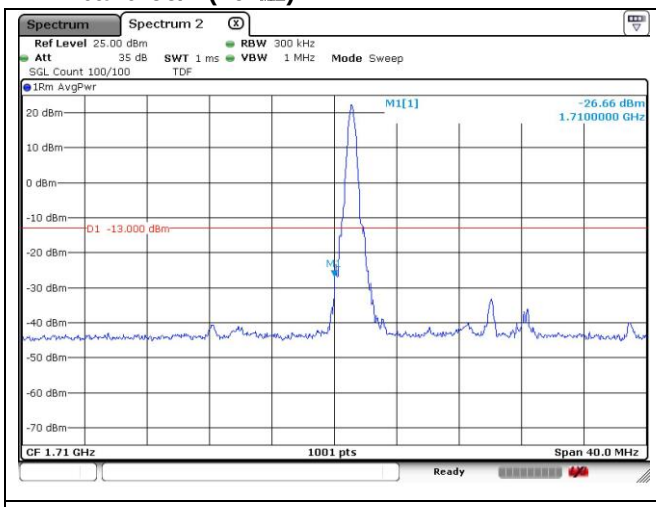


16QAM High Channel - 1 RB

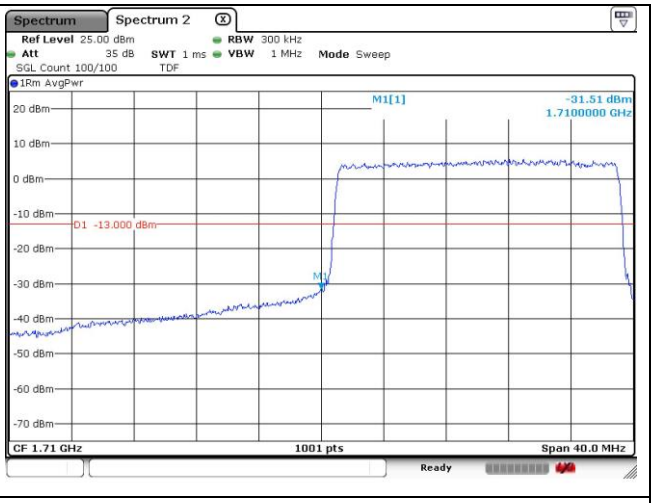


16QAM High Channel - Full RB

LTE band 66/4 (20 ㎒)

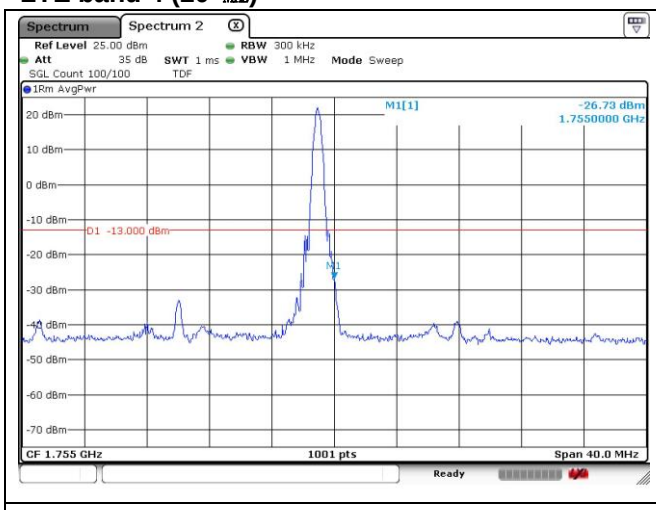


QPSK Low Channel - 1 RB

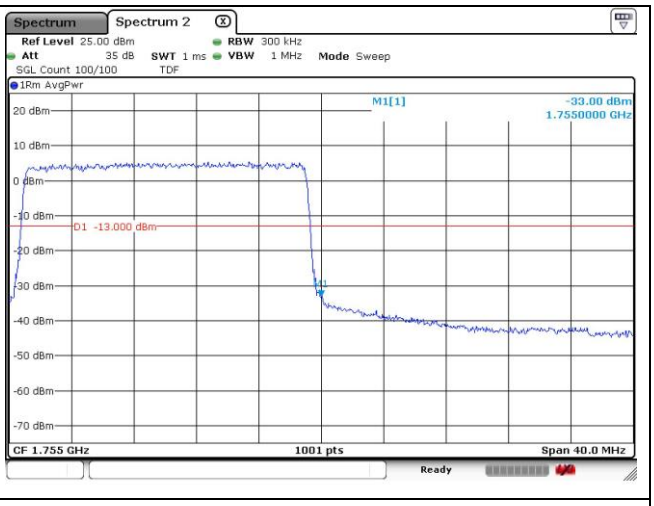


QPSK Low Channel - Full RB

LTE band 4 (20 ㎒)

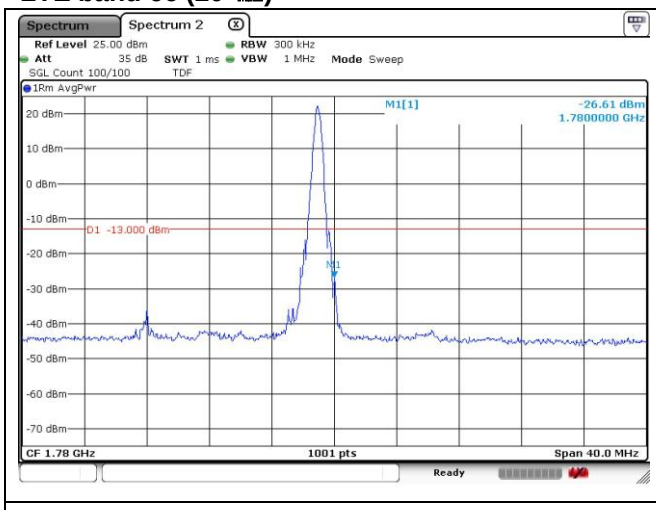


QPSK High Channel - 1 RB

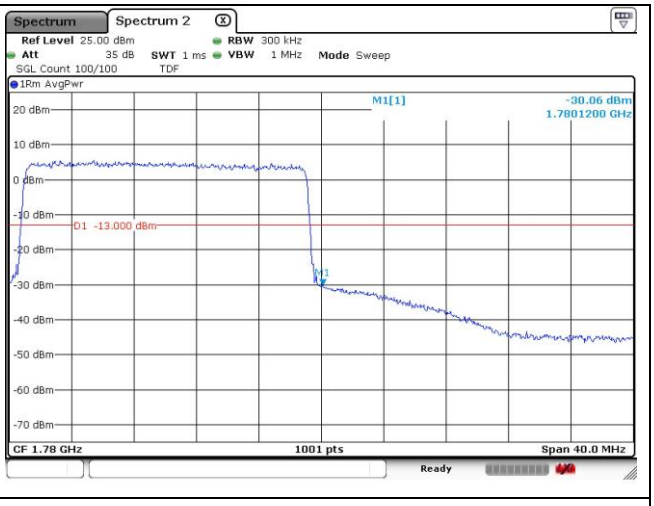


QPSK High Channel - Full RB

LTE band 66 (20 ㎒)

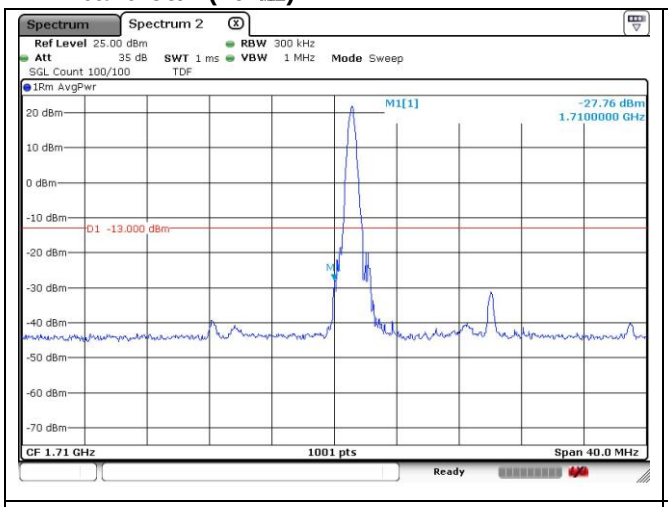


QPSK High Channel - 1 RB



QPSK High Channel - Full RB

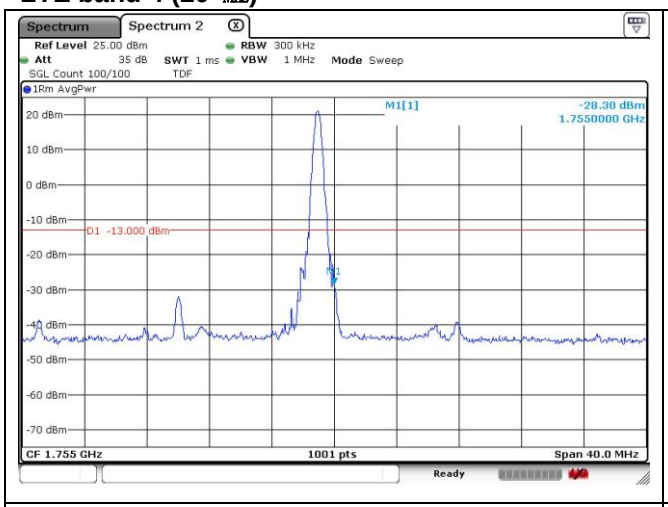
LTE band 66/4 (20 ㎒)



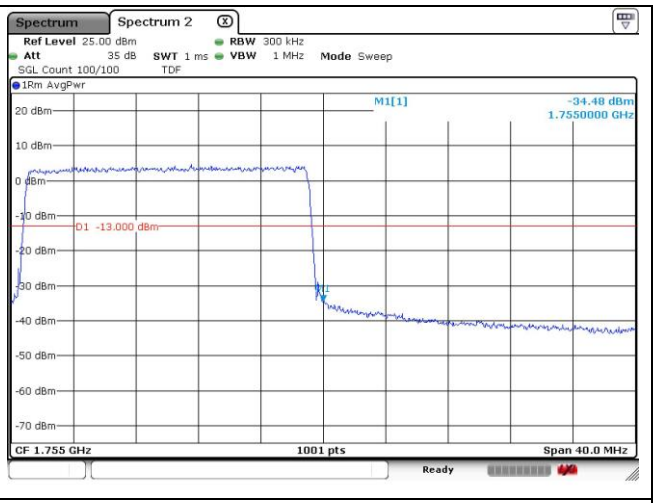
16QAM Low Channel - 1 RB

16QAM Low Channel - Full RB

LTE band 4 (20 ㎒)

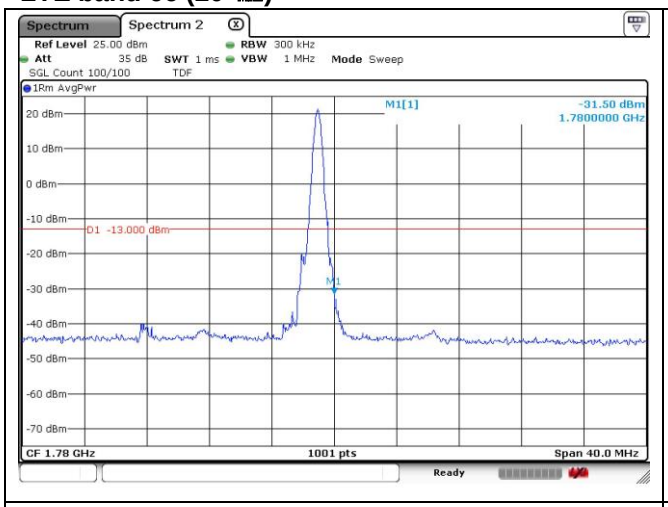


16QAM High Channel - 1 RB

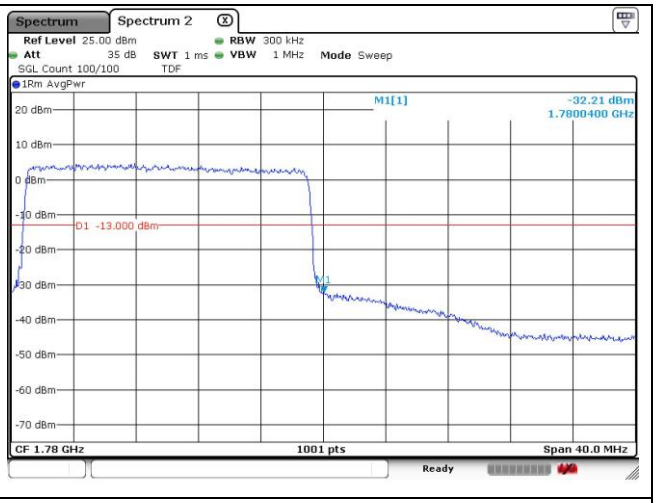


16QAM High Channel - Full RB

LTE band 66 (20 ㎒)

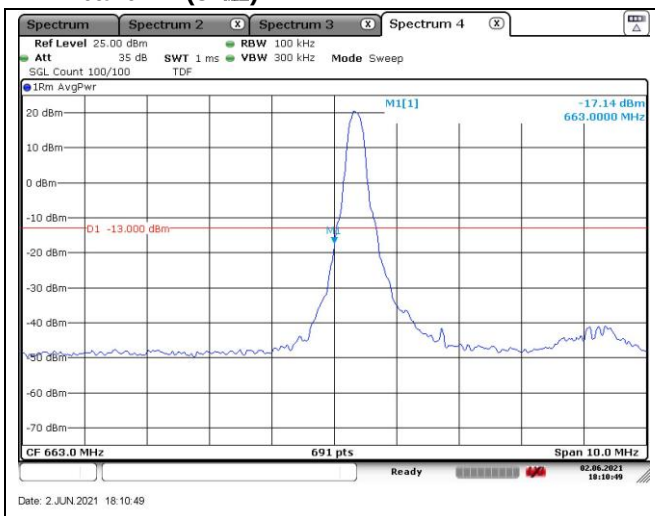


16QAM High Channel - 1 RB

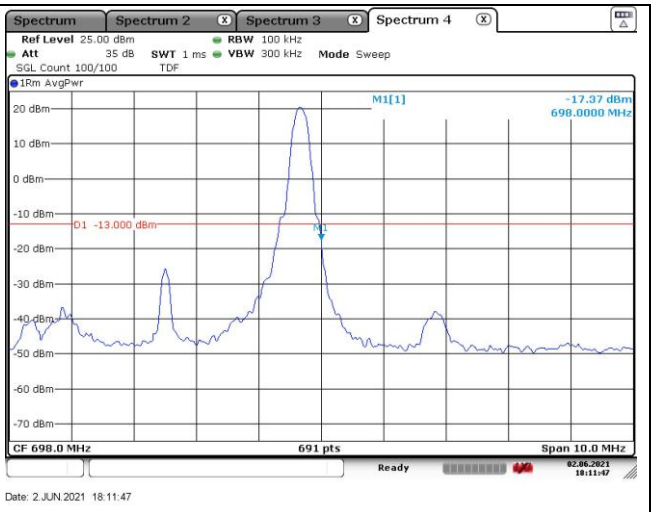


16QAM High Channel - Full RB

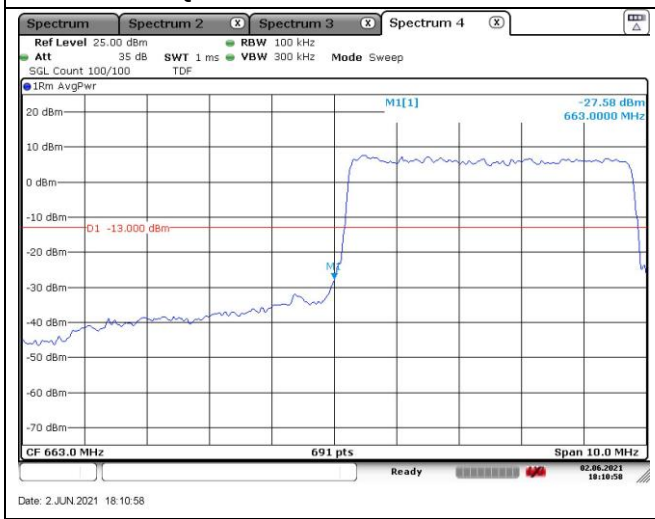
LTE band 71 (5 ㎒)



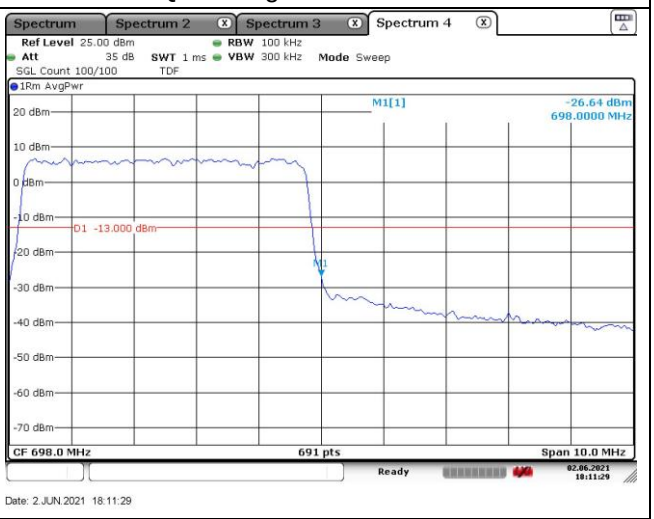
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

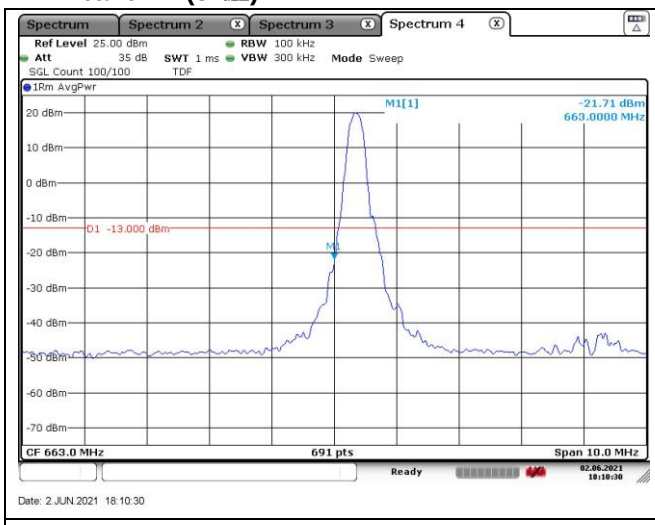


QPSK Low Channel - Full RB

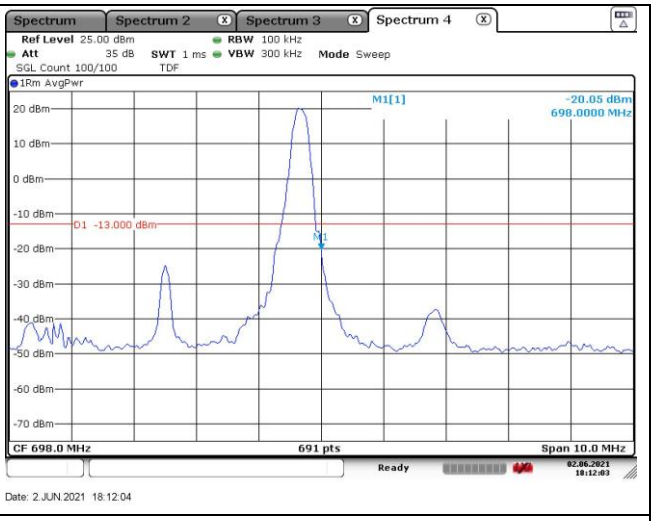


QPSK High Channel - Full RB

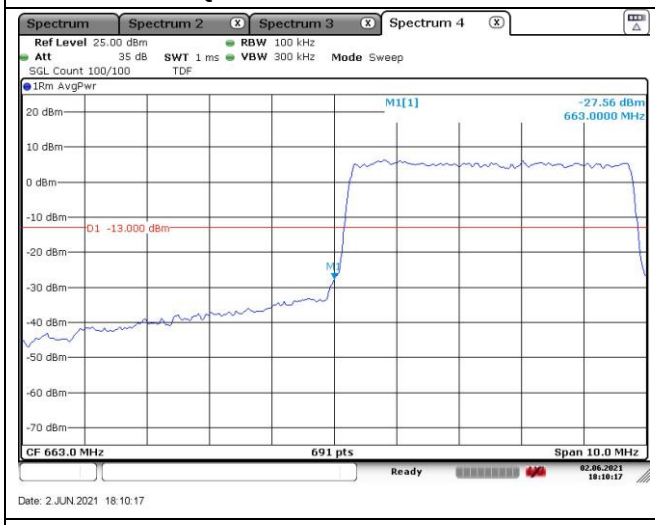
LTE band 71 (5 ㎒)



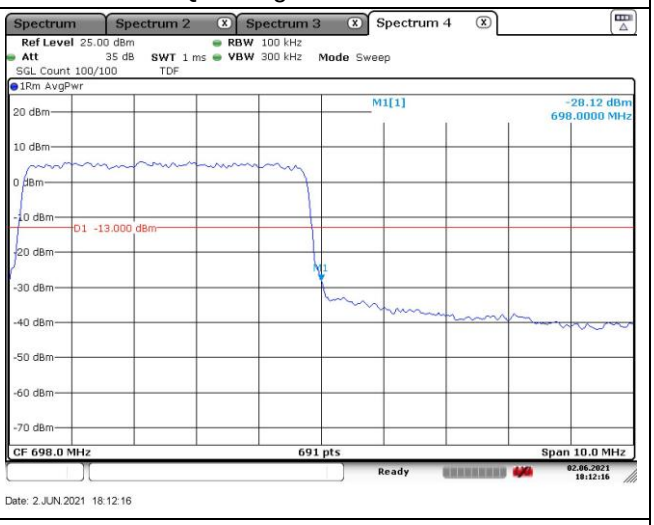
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

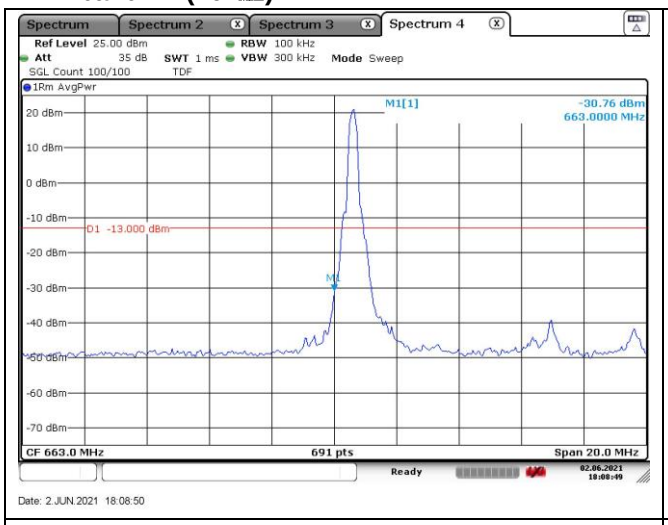


16QAM Low Channel - Full RB

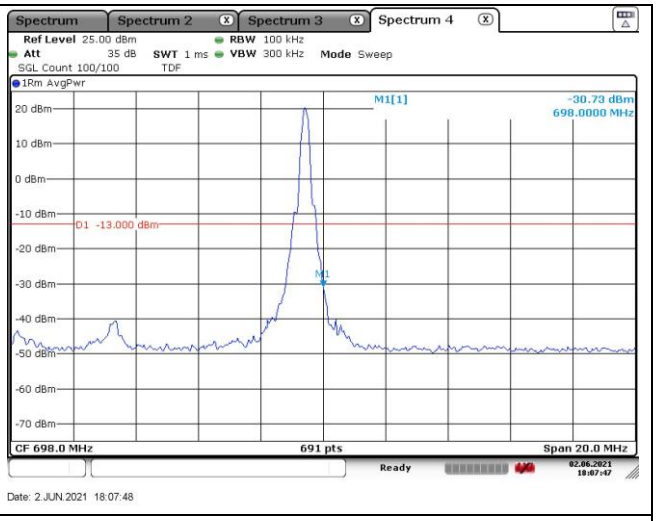


16QAM High Channel - Full RB

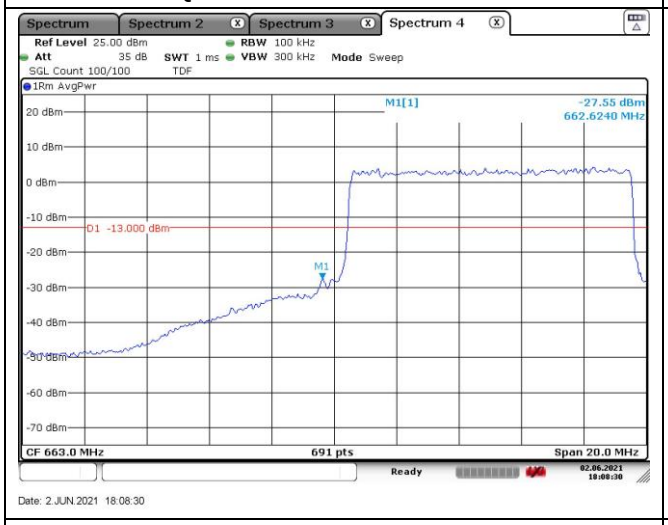
LTE band 71 (10 ㎒)



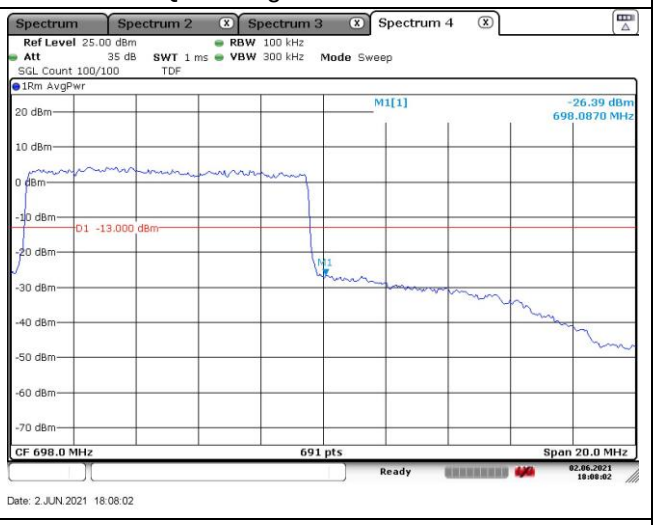
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

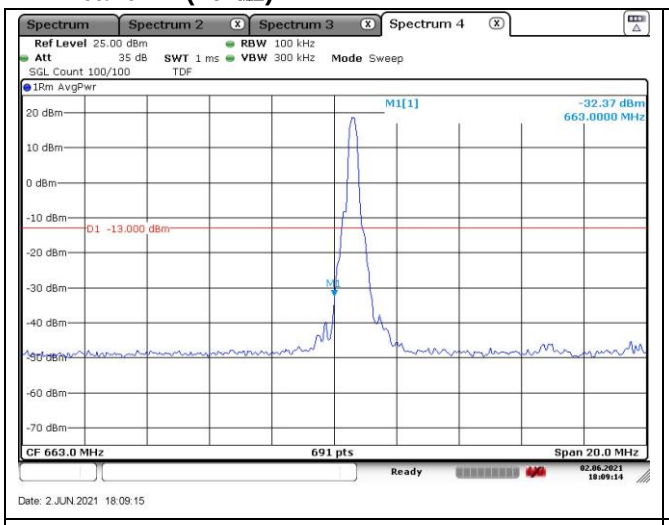


QPSK Low Channel - Full RB

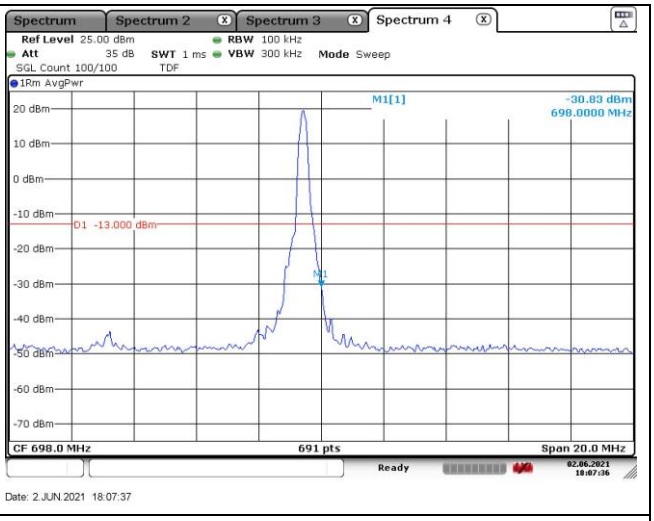


QPSK High Channel - Full RB

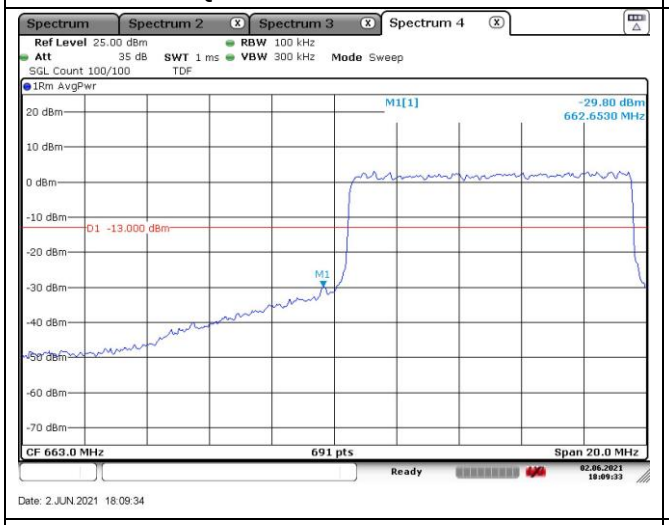
LTE band 71 (10 ㎒)



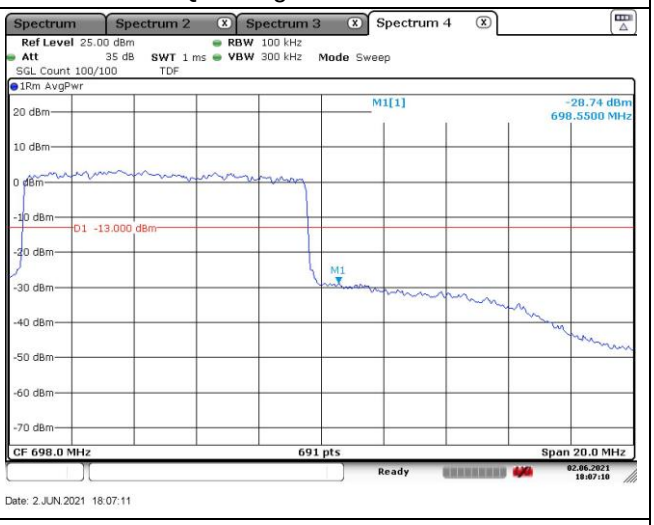
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

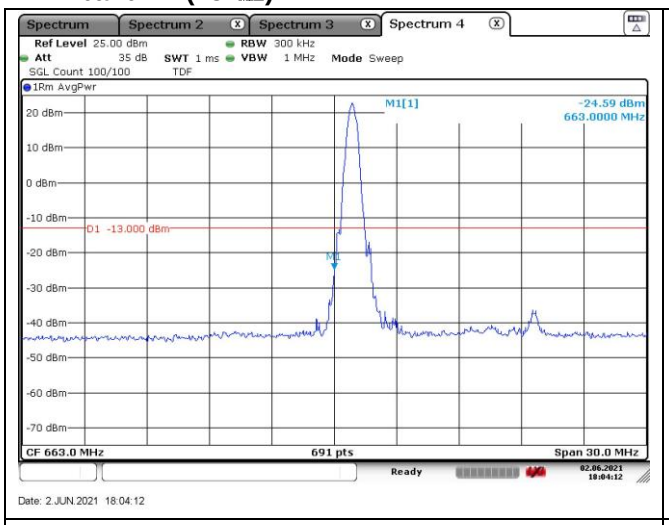


16QAM Low Channel - Full RB

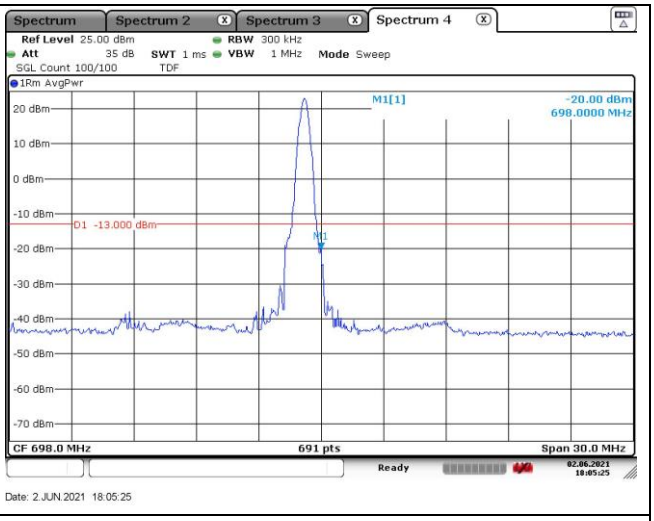


16QAM High Channel - Full RB

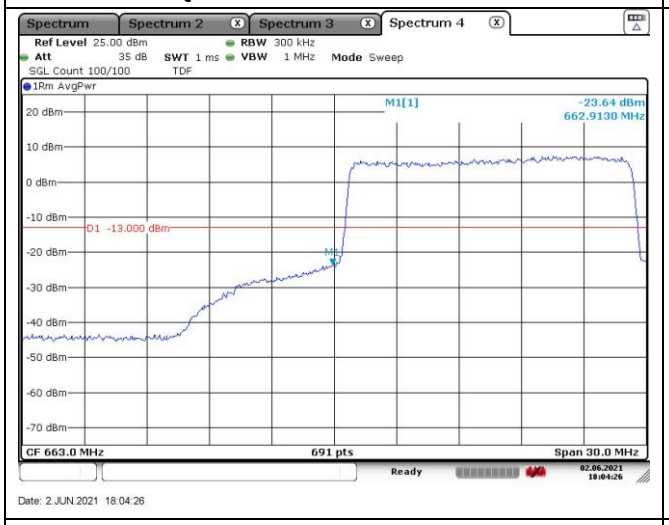
LTE band 71 (15 ㎒)



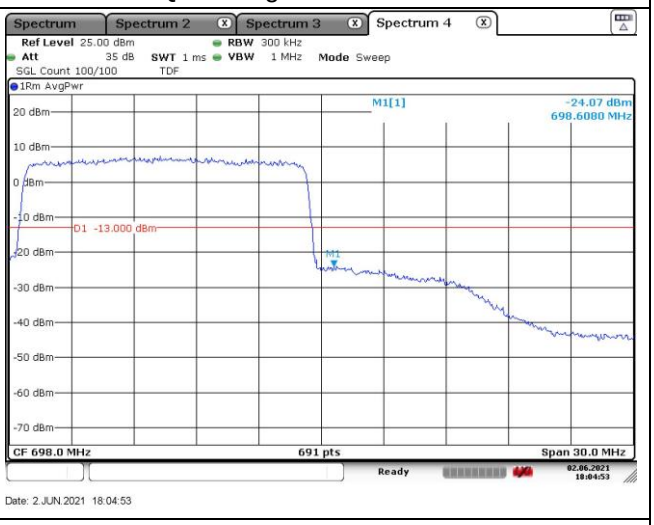
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

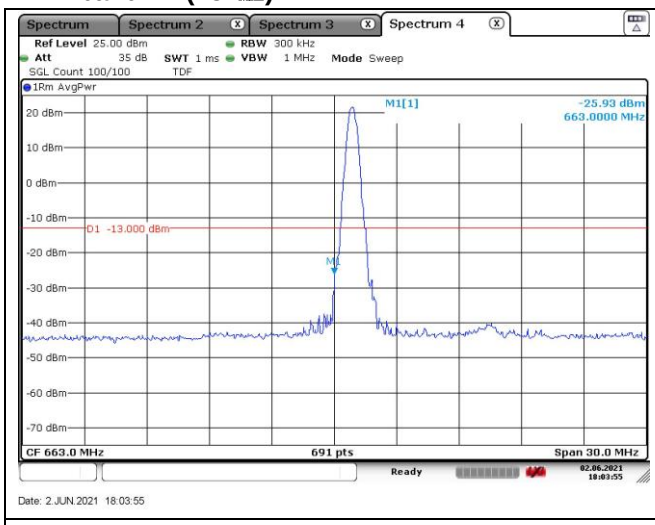


QPSK Low Channel - Full RB

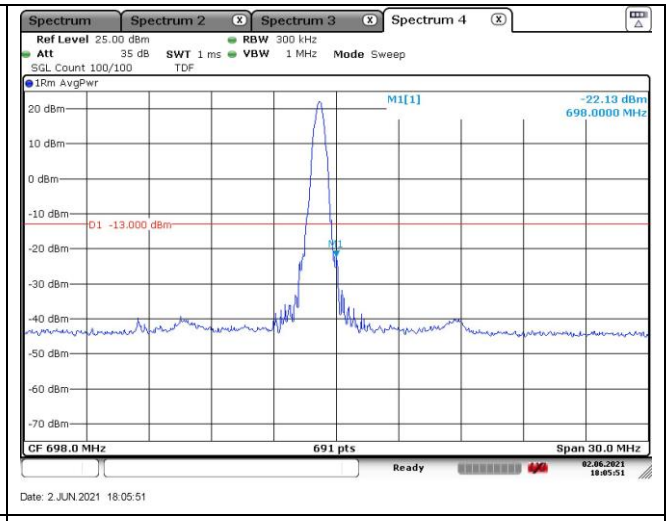


QPSK High Channel - Full RB

LTE band 71 (15 ㎒)



16QAM Low Channel - 1 RB



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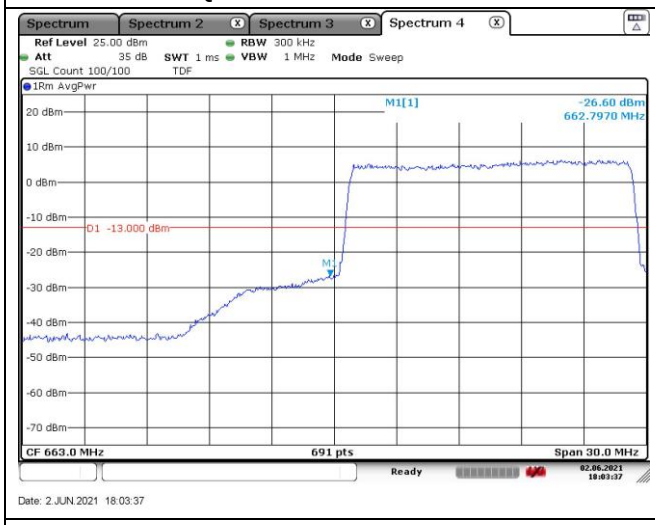
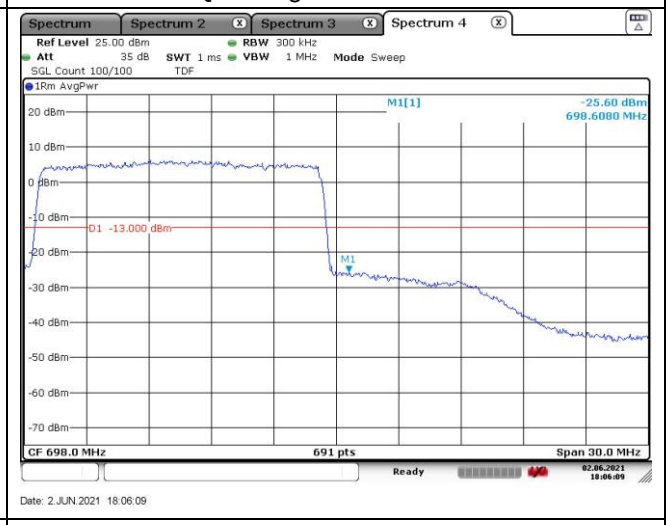
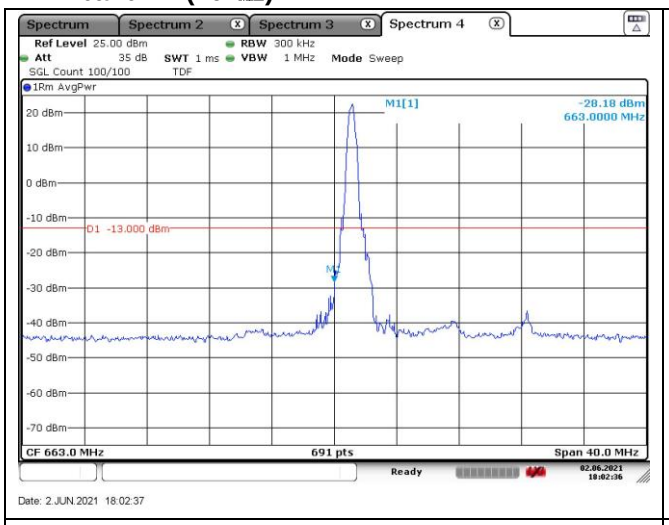


16QAM Low Channel - Full RB

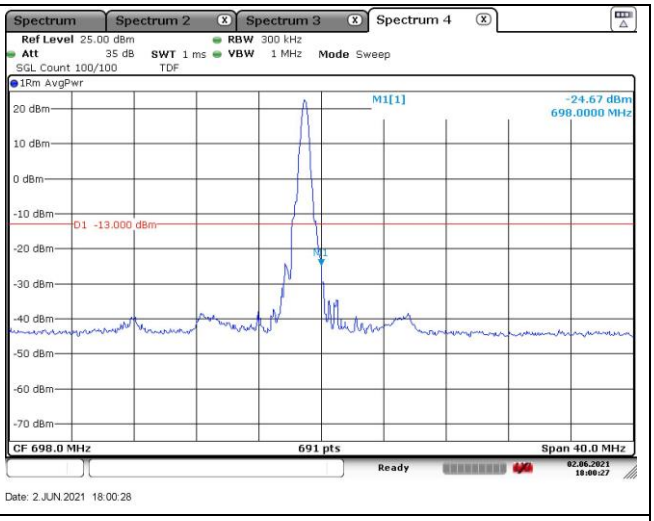


16QAM High Channel - Full RB

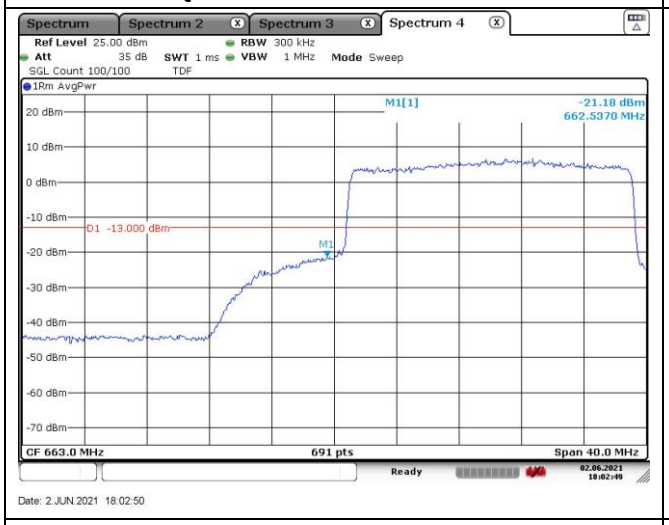
LTE band 71 (20 ㎒)



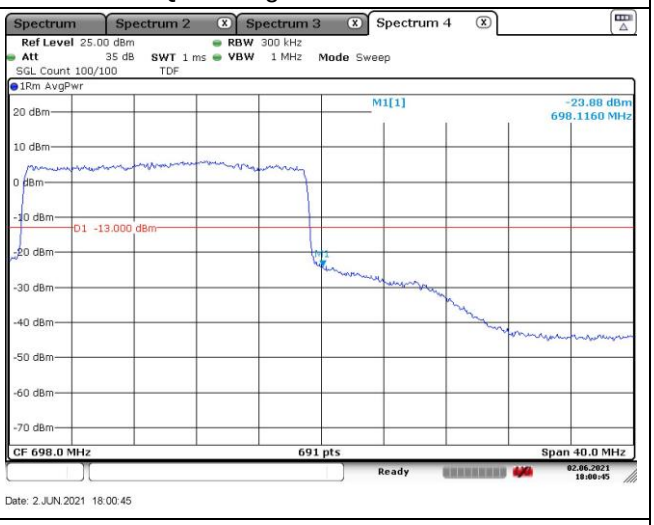
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

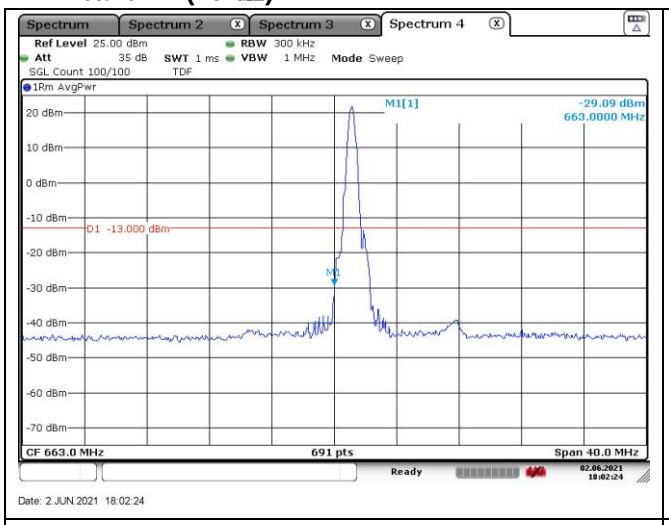


QPSK Low Channel - Full RB

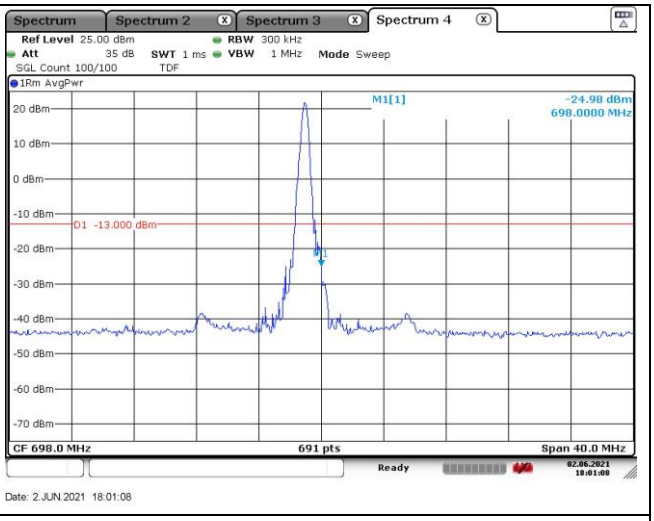


QPSK High Channel - Full RB

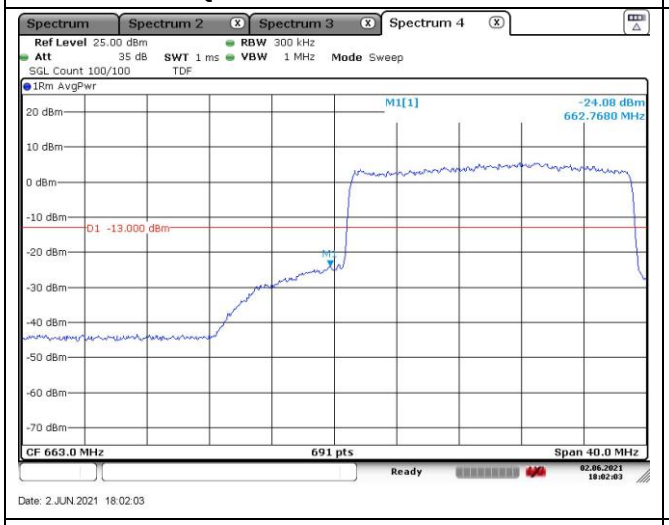
LTE band 71 (20 ㎒)



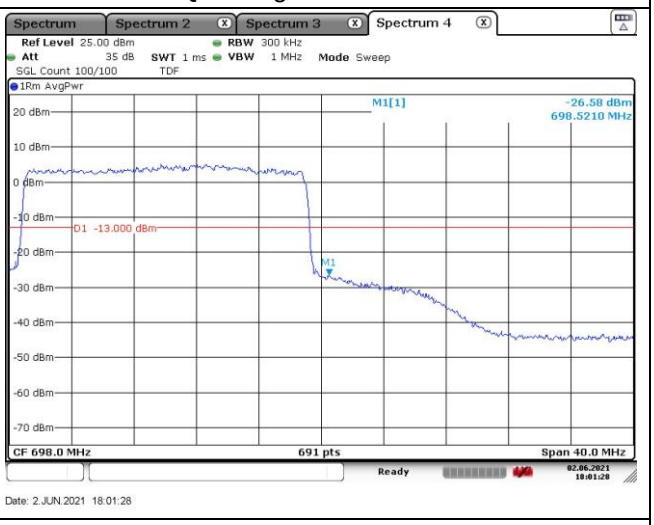
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB



16QAM Low Channel - Full RB



16QAM High Channel - Full RB

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.

- §90.213, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.
For Mobile devices operating in the 809 to 824 ㎒ band at a power level 2 Watts or less, the limit specified in Table is +/- 2.5 ppm.

IC
- RSS-Gen Issue 5
6.11, for licensed devices, the following measurement conditions apply:
a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage

- RSS-130 Issue 2
4.5, the transmitter frequency stability limit shall be determined as follows:

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

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

- RSS-132 Issue 3
5.3, the carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

- RSS-133 Issue 6
6.3, the carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

- RSS-139 Issue 3
6.4, the frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

- RSS-199 Issue 3
4.3, the transmitter frequency stability limit shall be determined as follows:

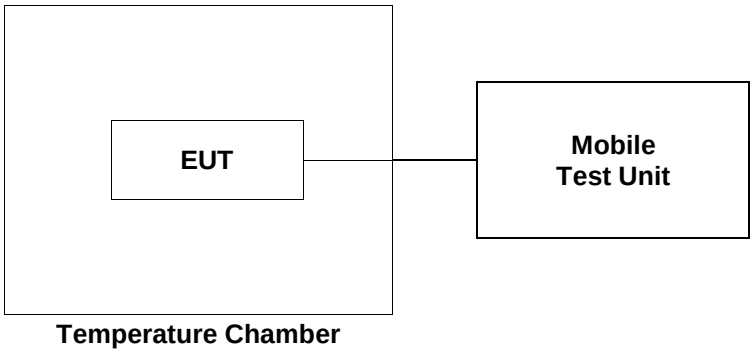
(a) the frequency offset shall be measured according to the procedure described in RSS-Gen and recorded.

(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, which comply with the attenuation specified in section 4.5 for the type of device under test, on the emission mask of the lowest and highest channels. The frequency at these points shall be recorded as f_L and f_H respectively.

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

8.2. Test Procedure

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



8.3. Test Results

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

SIM 1

LTE band 7 at middle channel

Reference Frequency: 2 535.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-4.4	-0.003 75
40		-4.2	-0.003 67
30		8.2	0.001 22
20(Ref.)		5.1	-
10		4.4	-0.000 28
0		3.7	-0.000 55
-10		5.2	0.000 04
-20		4.4	-0.000 28
-30		6.0	0.000 36
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	4.1	-0.000 39
	10.63 (85%)	3.7	-0.000 55

LTE band 12 at middle channel

Reference Frequency: 707.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-2.6	-0.001 70
40		-2.7	-0.001 84
30		-2.1	-0.000 99
20(Ref.)		-1.4	-
10		-1.6	-0.000 28
0		-1.9	-0.000 71
-10		-3.0	-0.002 26
-20		-1.7	-0.000 42
-30		-2.7	-0.001 84
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-4.1	-0.003 82
	10.63 (85%)	-2.1	-0.000 99

LTE band 13 at middle channel

Reference Frequency: 782 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-0.9	0.000 51
40		-2.5	-0.001 53
30		-2.7	-0.001 79
20(Ref.)		-1.3	-
10		2.1	0.004 35
0		2.9	0.005 37
-10		-2.7	-0.001 79
-20		2.3	0.004 60
-30		-2.5	-0.001 53
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-1.5	-0.000 26
	10.63 (85%)	-0.3	0.001 28

LTE band 25/2 at middle channel

Reference Frequency: 1 882.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	5.4	0.001 01
40		6.4	0.001 54
30		4.8	0.000 69
20(Ref.)		3.5	-
10		2.7	-0.000 42
0		3.3	-0.000 11
-10		5.5	0.001 06
-20		7.4	0.002 07
-30		5.9	0.001 27
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	4.3	0.000 42
	10.63 (85%)	4.8	0.000 69

LTE band 26/5 at middle channel

Reference Frequency: 836.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	0.8	0.000 24
40		-1.4	-0.002 39
30		0.5	-0.000 12
20(Ref.)		0.6	-
10		-1.5	-0.002 51
0		1.4	0.000 96
-10		1.2	0.000 72
-20		0.5	-0.000 12
-30		0.7	0.000 12
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	1.6	0.001 20
	10.63 (85%)	1.0	0.000 48

LTE band 26 at middle channel

Reference Frequency: 819 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	1.5	0.000 37
40		-2.2	-0.004 15
30		0.7	-0.000 61
20(Ref.)		1.2	-
10		1.4	0.000 24
0		2.3	0.001 34
-10		1.4	0.000 24
-20		-1.7	-0.003 54
-30		1.2	0.000 00
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	1.1	-0.000 12
	10.63 (85%)	-1.8	-0.003 66

LTE band 41(FCC) at middle channel

Reference Frequency: 2 593.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-9.0	-0.000 35
40		-6.8	0.000 50
30		-9.8	-0.000 66
20(Ref.)		-8.1	-
10		-6.6	0.000 58
0		-6.7	0.000 54
-10		-5.1	0.001 16
-20		-5.8	0.000 89
-30		-6.9	0.000 46
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-10.3	-0.000 85
	10.63 (85%)	-10.6	-0.000 96

LTE band 41(IC) at middle channel

Reference Frequency: 2 595.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-7.5	-0.000 08
40		-6.3	0.000 39
30		-9.5	-0.000 85
20(Ref.)		-7.3	-
10		-5.5	0.000 69
0		-5.6	0.000 66
-10		-4.8	0.000 96
-20		-4.3	0.001 16
-30		-5.5	0.000 69
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-7.5	-0.000 08
	10.63 (85%)	-8.3	-0.000 39

LTE band 66/4 at middle channel

Reference Frequency: 1 745.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	4.4	-0.000 06
40		-3.1	-0.004 36
30		-5.7	-0.005 85
20(Ref.)		4.5	-
10		7.1	0.001 49
0		-5.5	-0.005 73
-10		-6.4	-0.006 25
-20		-6.3	-0.006 19
-30		-5.8	-0.005 90
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-7.2	-0.006 70
	10.63 (85%)	-4.1	-0.004 93

LTE band 71 at middle channel

Reference Frequency: 680.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	1.0	0.000 73
40		3.4	0.004 26
30		1.3	0.001 18
20(Ref.)		0.5	-
10		4.0	0.005 14
0		2.7	0.003 23
-10		2.6	0.003 09
-20		1.4	0.001 32
-30		2.5	0.002 94
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	2.5	0.002 94
	10.63 (85%)	3.2	0.003 97

SIM 2

LTE band 7 at middle channel

Reference Frequency: 2 535.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	4.1	0.003 20
40		1.6	0.002 21
30		-1.3	0.001 07
20(Ref.)		-4.0	-
10		-6.6	-0.001 03
0		6.6	0.004 18
-10		-5.1	-0.000 43
-20		-3.2	0.000 32
-30		-5.9	-0.000 75
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-5.6	-0.000 63
	10.63 (85%)	-7.9	-0.001 54

LTE band 12 at middle channel

Reference Frequency: 707.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-1.5	-0.006 22
40		-1.1	-0.005 65
30		-2.5	-0.007 63
20(Ref.)		2.9	-
10		3.4	0.000 71
0		-3.7	-0.009 33
-10		-2.4	-0.007 49
-20		-2.6	-0.007 77
-30		-4.4	-0.010 32
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-4.3	-0.010 18
	10.63 (85%)	-0.1	-0.004 24

LTE band 13 at middle channel

Reference Frequency: 782 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-4.1	-0.003 84
40		-0.5	0.000 77
30		1.4	0.003 20
20(Ref.)		-1.1	-
10		-2.3	-0.001 53
0		1.2	0.002 94
-10		3.7	0.006 14
-20		-2.7	-0.002 05
-30		-3.2	-0.002 69
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-4.3	-0.004 09
	10.63 (85%)	-0.9	0.000 26

LTE band 25/2 at middle channel

Reference Frequency: 1 882.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-5.6	0.001 54
40		-5.5	0.001 59
30		-4.4	0.002 18
20(Ref.)		-8.5	-
10		-5.4	0.001 65
0		-5.9	0.001 38
-10		-6.3	0.001 17
-20		-6.8	0.000 90
-30		-5.1	0.001 81
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-6.1	0.001 27
	10.63 (85%)	-7.2	0.000 69

LTE band 26/5 at middle channel

Reference Frequency: 836.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-2.8	-0.004 42
40		-0.2	-0.001 32
30		-0.5	-0.001 67
20(Ref.)		0.9	-
10		0.1	-0.000 96
0		0.8	-0.000 12
-10		-2.2	-0.003 71
-20		1.8	0.001 08
-30		-2.2	-0.003 71
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-0.6	-0.001 79
	10.63 (85%)	-1.7	-0.003 11

LTE band 26 at middle channel

Reference Frequency: 819 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-1.1	-0.001 95
40		-1.3	-0.002 20
30		1.9	0.001 71
20(Ref.)		0.5	-
10		-1.5	-0.002 44
0		3.7	0.003 91
-10		3.3	0.003 42
-20		1.4	0.001 10
-30		0.7	0.000 24
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-4.4	-0.005 98
	10.63 (85%)	-1.6	-0.002 56

LTE band 41(FCC) at middle channel

Reference Frequency: 2 593.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-8.4	0.000 73
40		-8.6	0.000 66
30		-5.5	0.001 85
20(Ref.)		-10.3	-
10		-7.8	0.000 96
0		-6.7	0.001 39
-10		-5.5	0.001 85
-20		-10.7	-0.000 15
-30		-7.1	0.001 23
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-5.3	0.001 93
	10.63 (85%)	-8.4	0.000 73

LTE band 41(IC) at middle channel

Reference Frequency: 2 595.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	-6.6	0.001 12
40		-5.8	0.001 43
30		-4.3	0.002 00
20(Ref.)		-9.5	-
10		-8.3	0.000 46
0		-5.7	0.001 46
-10		-6.3	0.001 23
-20		-9.5	0.000 00
-30		-6.1	0.001 31
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-9.3	0.001 62
	10.63 (85%)	-8.4	0.000 42

LTE band 66/4 at middle channel

Reference Frequency: 1 745.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	7.0	0.006 36
40		-6.3	-0.001 26
30		-3.5	0.000 34
20(Ref.)		-4.1	-
10		7.4	0.006 59
0		-7.1	-0.001 72
-10		3.1	0.004 13
-20		-3.1	0.000 57
-30		-4.8	-0.000 40
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	-5.6	-0.000 86
	10.63 (85%)	-6.6	-0.001 43

LTE band 71 at middle channel

Reference Frequency: 680.5 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	12.5	1.4	0.001 18
40		0.4	-0.000 29
30		1.0	0.000 59
20(Ref.)		0.6	-
10		1.8	0.001 76
0		1.9	0.001 91
-10		2.5	0.002 79
-20		0.3	-0.000 44
-30		1.9	0.001 91
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	14.38 (115%)	2.1	0.002 20
	10.63 (85%)	3.3	0.003 97

- End of the Test Report -