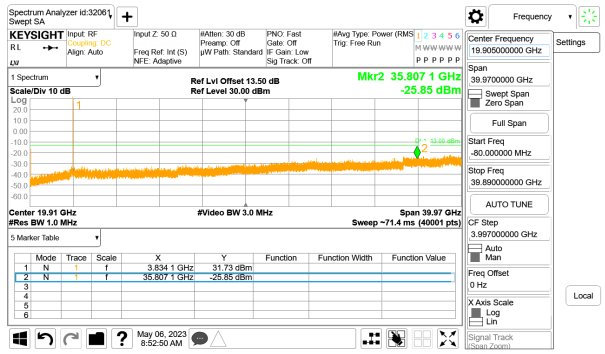
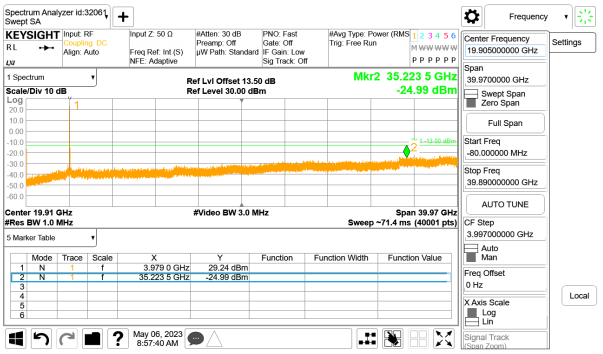
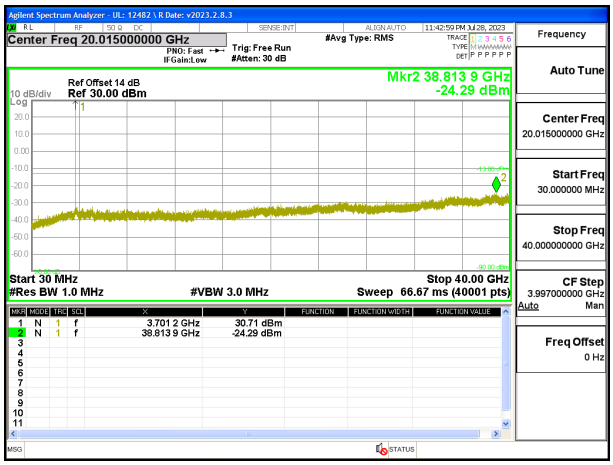


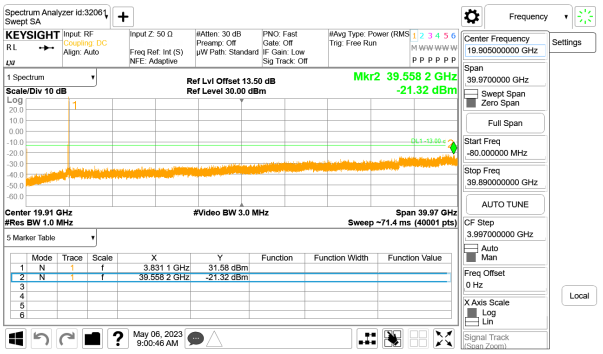
5G NR n77 15MHz BPSK Middle Channel RB1-1



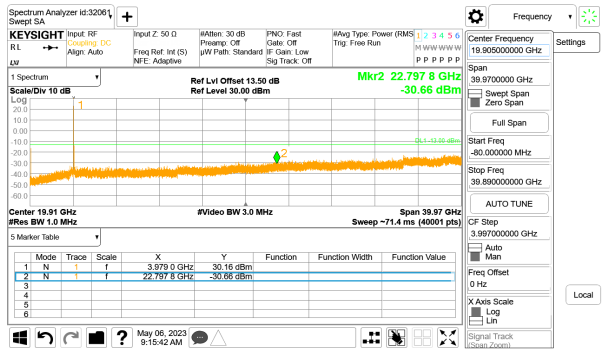
5G NR n77 15MHz BPSK High Channel RB1-37



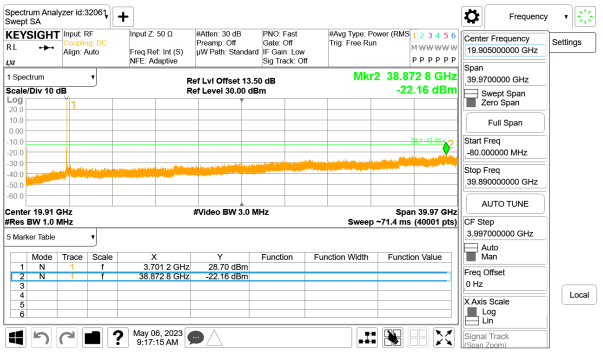
5G NR n77 20MHz BPSK Low Channel RB1-0



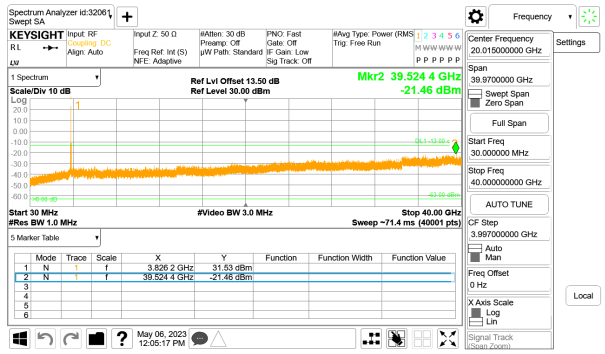
5G NR n77 20MHz BPSK Middle Channel RB1-1



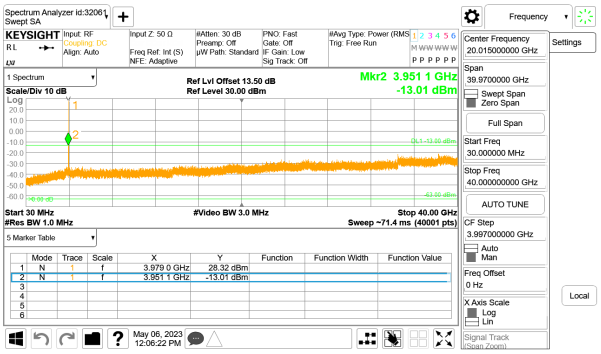
5G NR n77 20MHz BPSK High Channel RB1-50



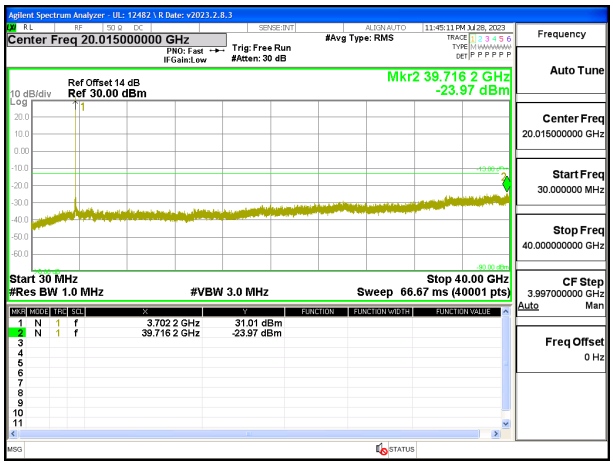
5G NR n77 30MHz BPSK Low Channel RB1-0



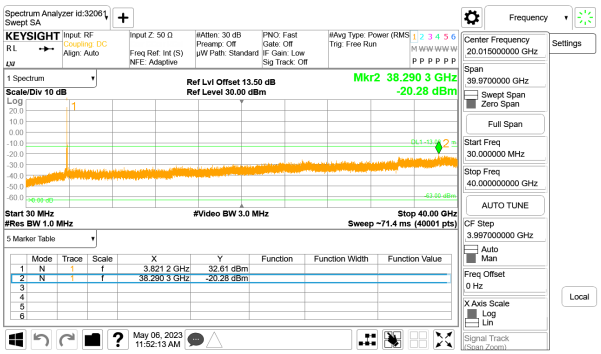
5G NR n77 30MHz BPSK Middle Channel RB1-1



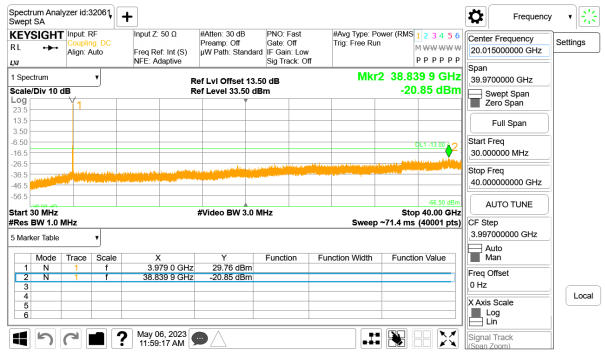
5G NR n77 30MHz BPSK High Channel RB1-77



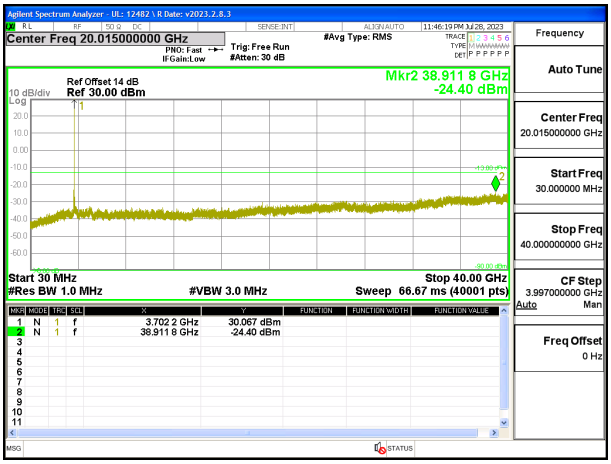
5G NR n77 40MHz BPSK Low Channel RB1-0



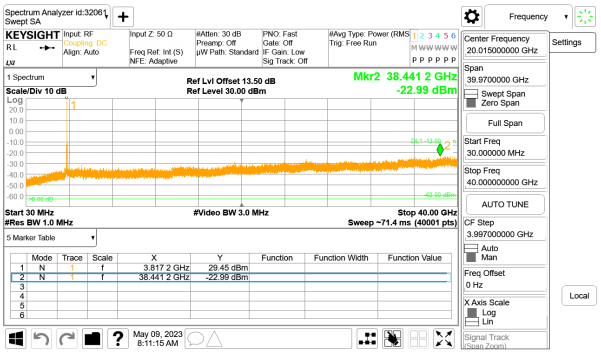
5G NR n77 40MHz BPSK Middle Channel RB1-1



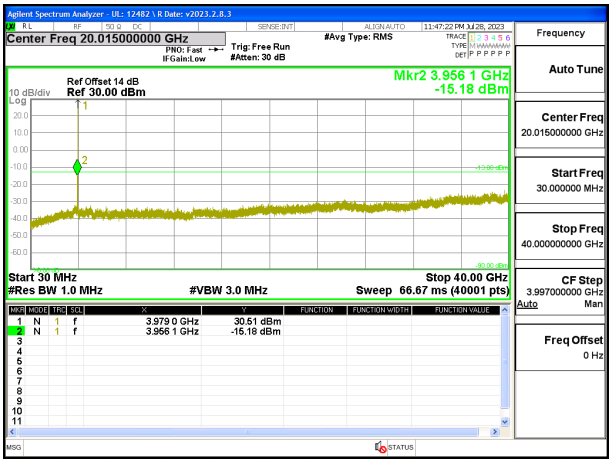
5G NR n77 40MHz BPSK High Channel RB1-105



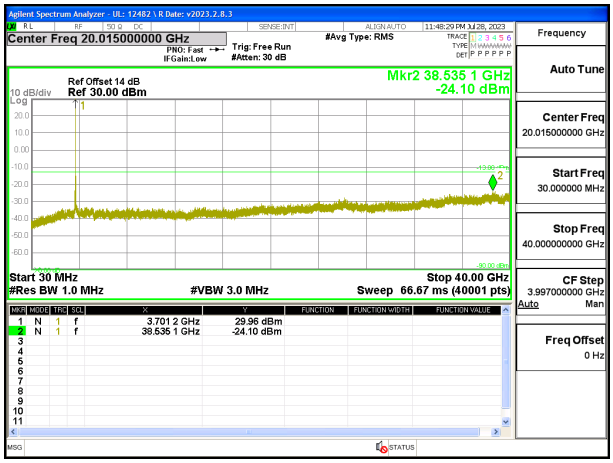
5G NR n77 50MHz BPSK Middle Channel RB1-0



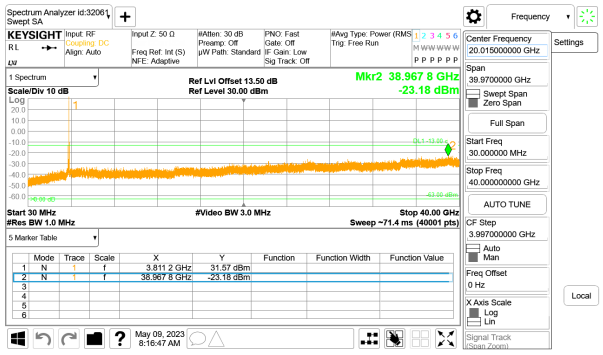
5G NR n77 50MHz BPSK Middle Channel RB1-1



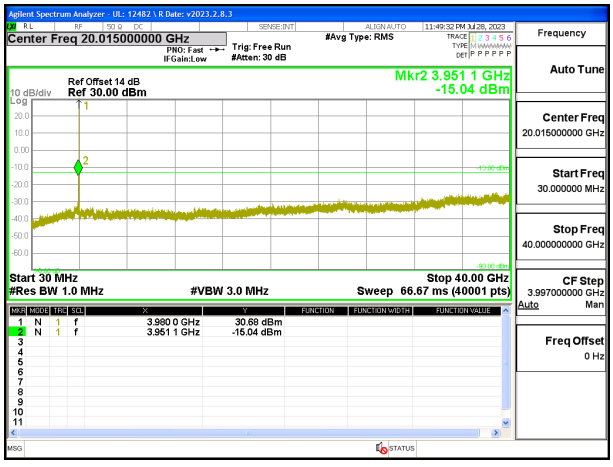
5G NR n77 50MHz BPSK High Channel RB1-132



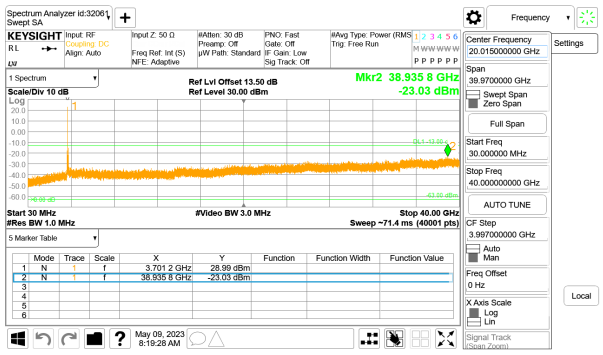
5G NR n77 60MHz BPSK Low Channel RB1-0



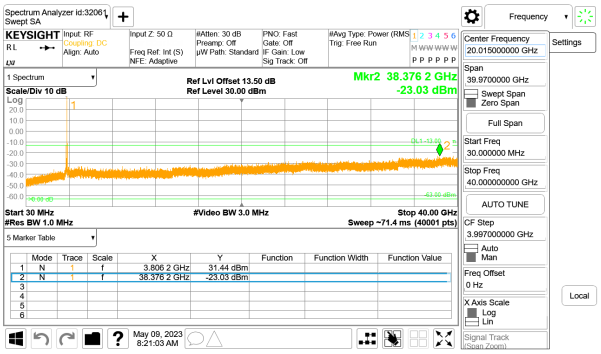
5G NR n77 60MHz BPSK Middle Channel RB1-1



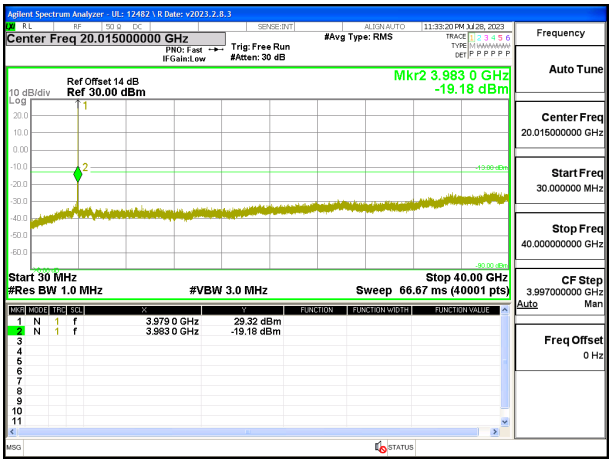
5G NR n77 60MHz BPSK High Channel RB1-161



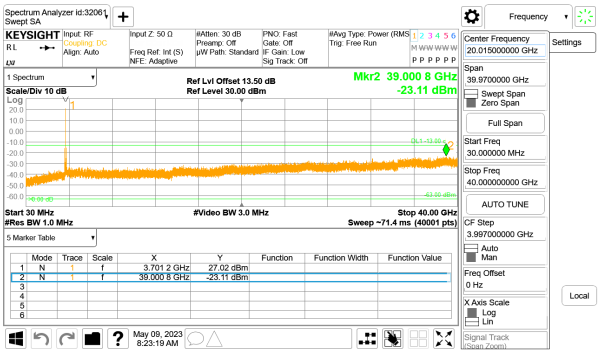
5G NR n77 70MHz BPSK Low Channel RB1-0



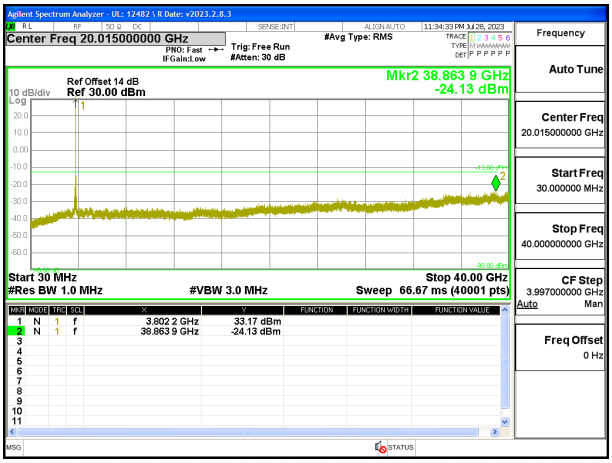
5G NR n77 70MHz BPSK Middle Channel RB1-1



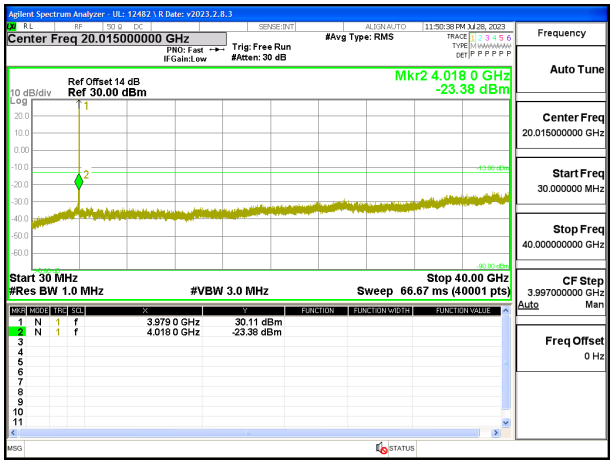
5G NR n77 70MHz BPSK High Channel RB1-188



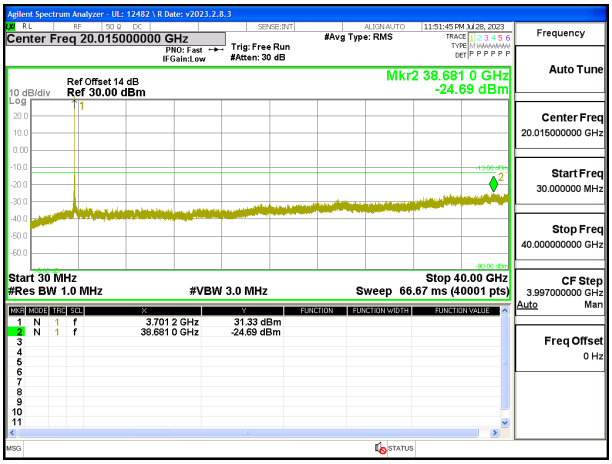
5G NR n77 80MHz BPSK Low Channel RB1-0



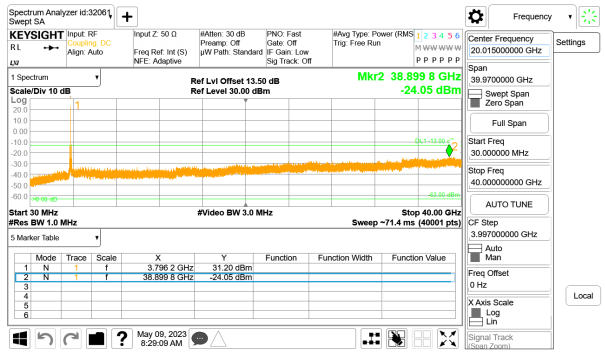
5G NR n77 80MHz BPSK Middle Channel RB1-1



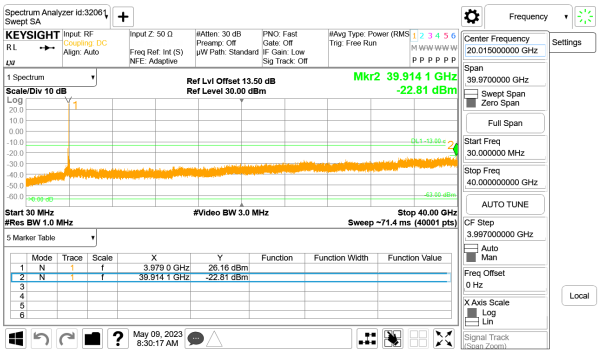
5G NR n77 80MHz BPSK High Channel RB1-216



5G NR n77 90MHz BPSK Low Channel RB1-0



5G NR n77 90MHz BPSK Middle Channel RB1-1



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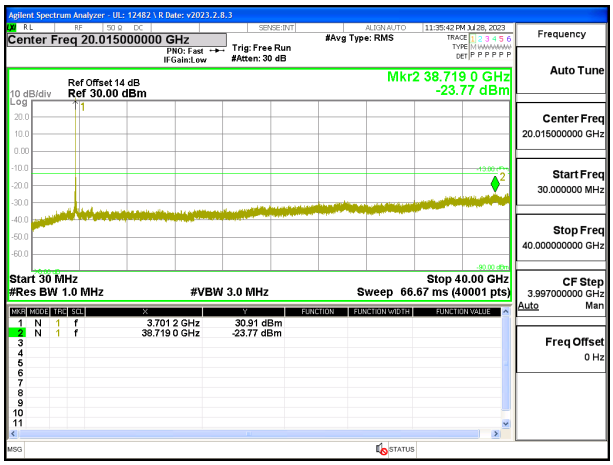
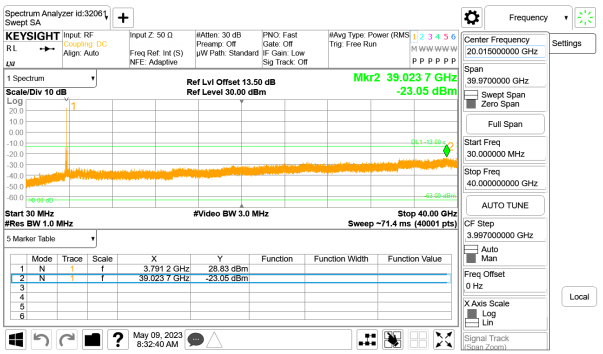
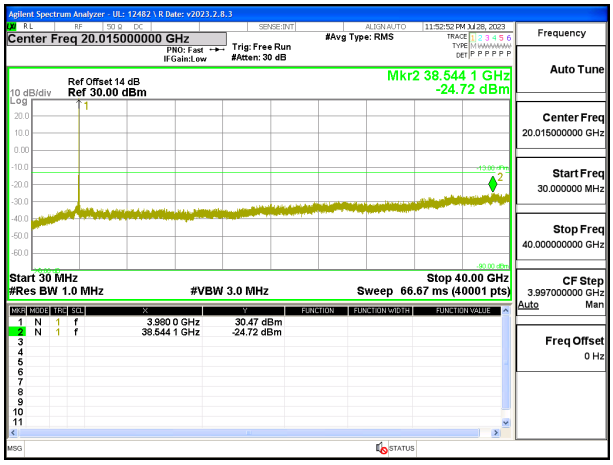


5G NR n77 100MHz BPSK Low Channel RB1-0



5G NR n77 100MHz BPSK Middle Channel RB1-1



5G NR n77 100MHz BPSK High Channel RB1-272

Intentionally Blank

9.4. FREQUENCY STABILITY

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

- Temp. = −30°C to +50°C
- Voltage = (85% - 115%)

  Low voltage, 3.23VDC, Normal, 3.8VDC and High voltage, 4.37VDC.
  End Voltage, 2.8VDC.

Frequency Stability vs Temperature:
The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

RESULTS

See the following pages.

9.4.1. LTE BAND 7 AND 5G NR n7

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 7 QPSK (20MHz BANDWIDTH)

Band	7	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2500	2570			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	2501.0378	2568.9501			
Extreme (50°C)		2501.0378	2568.9501	7.1	0.003	Yes
Extreme (40°C)		2501.0378	2568.9501	6.0	0.002	Yes
Extreme (30°C)		2501.0378	2568.9501	-6.4	-0.003	Yes
Extreme (10°C)		2501.0378	2568.9501	5.3	0.002	Yes
Extreme (0°C)		2501.0378	2568.9501	8.3	0.003	Yes
Extreme (-10°C)		2501.0378	2568.9501	6.6	0.003	Yes
Extreme (-20°C)		2501.0378	2568.9501	6.1	0.002	Yes
Extreme (-30°C)		2501.0378	2568.9501	6.5	0.003	Yes
20°C	15%	2501.0378	2568.9501	5.8	0.002	Yes
	-15%	2501.0378	2568.9501	-5.4	-0.002	Yes
	End Point Voltage	2501.0378	2568.9501	6.5	0.003	Yes

5G NR n7 BPSK (40MHz BANDWIDTH)

Band	7	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2500	2570			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	2500.4430	2569.6818			
Extreme (50°C)		2500.4430	2569.6818	-7.4	-0.003	Yes
Extreme (40°C)		2500.4430	2569.6818	-6.0	-0.002	Yes
Extreme (30°C)		2500.4430	2569.6818	-8.1	-0.003	Yes
Extreme (10°C)		2500.4430	2569.6818	-7.0	-0.003	Yes
Extreme (0°C)		2500.4430	2569.6818	-6.9	-0.003	Yes
Extreme (-10°C)		2500.4430	2569.6818	-7.7	-0.003	Yes
Extreme (-20°C)		2500.4430	2569.6818	-6.7	-0.003	Yes
Extreme (-30°C)		2500.4430	2569.6818	-6.4	-0.003	Yes
20°C	15%	2500.4430	2569.6818	-8.3	-0.003	Yes
	-15%	2500.4430	2569.6818	-5.7	-0.002	Yes
	End Point Voltage	2500.4430	2569.6818	-8.3	-0.003	Yes

9.4.2. LTE BAND 12 AND 5G NR n12

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 12 QPSK (10MHz BANDWIDTH)

Band	12	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		699	716			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)		699.5237	715.4736			
Extreme (50°C)		699.5237	715.4736	4.1	0.006	Yes
Extreme (40°C)		699.5237	715.4736	3.2	0.004	Yes
Extreme (30°C)		699.5237	715.4736	2.0	0.003	Yes
Extreme (10°C)	Normal	699.5237	715.4736	-3.3	-0.005	Yes
Extreme (0°C)		699.5237	715.4736	3.2	0.004	Yes
Extreme (-10°C)		699.5237	715.4736	3.5	0.005	Yes
Extreme (-20°C)		699.5237	715.4736	3.7	0.005	Yes
Extreme (-30°C)		699.5237	715.4736	3.2	0.004	Yes
20°C	15%	699.5237	715.4736	3.0	0.004	Yes
	-15%	699.5237	715.4736	2.7	0.004	Yes
	End Point Voltage	699.5237	715.4736	3.8	0.005	Yes

5G NR n12 BPSK (15MHz BANDWIDTH)

Band	12	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		699	716			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	699.4275	714.8212			
Extreme (50°C)		699.4275	714.8212	1.5	0.002	Yes
Extreme (40°C)		699.4275	714.8212	2.1	0.003	Yes
Extreme (30°C)		699.4275	714.8212	2.1	0.003	Yes
Extreme (10°C)		699.4275	714.8212	2.0	0.003	Yes
Extreme (0°C)		699.4275	714.8212	2.5	0.004	Yes
Extreme (-10°C)		699.4275	714.8212	1.9	0.003	Yes
Extreme (-20°C)		699.4275	714.8212	2.2	0.003	Yes
Extreme (-30°C)		699.4275	714.8212	1.5	0.002	Yes
20°C	15%	699.4275	714.8212	1.6	0.002	Yes
	-15%	699.4275	714.8212	1.8	0.003	Yes
	End Point Voltage	699.4275	714.8212	1.8	0.003	Yes

9.4.3. LTE BAND 13

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

QPSK (10MHz BANDWIDTH)

Band	13	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		777	787			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	777.5261	786.4740			
Extreme (50°C)		777.5262	786.4740	5.4	0.007	Yes
Extreme (40°C)		777.5261	786.4740	4.2	0.005	Yes
Extreme (30°C)		777.5261	786.4740	4.3	0.005	Yes
Extreme (10°C)		777.5261	786.4740	4.6	0.006	Yes
Extreme (0°C)		777.5262	786.4740	5.6	0.007	Yes
Extreme (-10°C)		777.5261	786.4740	4.5	0.006	Yes
Extreme (-20°C)		777.5261	786.4740	4.7	0.006	Yes
Extreme (-30°C)		777.5262	786.4740	5.4	0.007	Yes
20°C	15%	777.5261	786.4740	4.3	0.005	Yes
	-15%	777.5261	786.4740	2.7	0.003	Yes
	End Point Voltage	777.5261	786.4740	4.0	0.005	Yes

9.4.4. LTE BAND 14 AND 5G NR n14

LIMITS

FCC: §90.539
(e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 ppm or better when AFC is locked to a base station, and 5 ppm or better when AFC is not locked.

Test Engineer ID:	28774	Test Date:	3/29/2023

LTE BAND 14 QPSK (10MHz BANDWIDTH

Band	14	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		788	798			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	788.5303	797.4705			
Extreme (50°C)		788.5303	797.4705	2.9	0.004	Yes
Extreme (40°C)		788.5303	797.4705	3.3	0.004	Yes
Extreme (30°C)		788.5303	797.4705	3.0	0.004	Yes
Extreme (10°C)		788.5303	797.4705	3.1	0.004	Yes
Extreme (0°C)		788.5303	797.4705	3.5	0.004	Yes
Extreme (-10°C)		788.5303	797.4705	4.0	0.005	Yes
Extreme (-20°C)		788.5303	797.4705	3.7	0.005	Yes
Extreme (-30°C)		788.5303	797.4705	2.8	0.004	Yes
20°C	15%	788.5303	797.4705	3.5	0.004	Yes
	-15%	788.5303	797.4705	3.9	0.005	Yes
	End Point Voltage	788.5303	797.4705	3.4	0.004	Yes

5G NR n14 BPSK (10MHz BANDWIDTH)

Band	14	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		788	798			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	788.3276	797.2754			
Extreme (50°C)		788.3276	797.2754	2.2	0.003	Yes
Extreme (40°C)		788.3276	797.2754	1.7	0.002	Yes
Extreme (30°C)		788.3276	797.2754	2.0	0.003	Yes
Extreme (10°C)		788.3276	797.2754	2.3	0.003	Yes
Extreme (0°C)		788.3276	797.2754	1.9	0.002	Yes
Extreme (-10°C)		788.3276	797.2754	2.0	0.003	Yes
Extreme (-20°C)		788.3276	797.2754	2.1	0.003	Yes
Extreme (-30°C)		788.3276	797.2754	2.5	0.003	Yes
20°C	15%	788.3276	797.2754	1.9	0.002	Yes
	-15%	788.3276	797.2754	1.4	0.002	Yes
	End Point Voltage	788.3276	797.2754	2.2	0.003	Yes

9.4.5. LTE BAND 17

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

QPSK (10MHz BANDWIDTH)

Band	17	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		704	716			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)		704.5180	715.4739			
Extreme (50°C)		704.5180	715.4739	3.0	0.004	Yes
Extreme (40°C)		704.5180	715.4739	2.6	0.004	Yes
Extreme (30°C)		704.5180	715.4739	2.9	0.004	Yes
Extreme (10°C)	Normal	704.5180	715.4739	2.3	0.003	Yes
Extreme (0°C)		704.5180	715.4739	3.0	0.004	Yes
Extreme (-10°C)		704.5180	715.4739	4.3	0.006	Yes
Extreme (-20°C)		704.5180	715.4739	3.2	0.005	Yes
Extreme (-30°C)		704.5180	715.4739	3.7	0.005	Yes
20°C	15%	704.5180	715.4739	2.7	0.004	Yes
	-15%	704.5180	715.4739	-3.3	-0.005	Yes
	End Point Voltage	704.5180	715.4739	3.5	0.005	Yes

9.4.6. LTE BAND 25 AND 5G NR n25

LIMITS

FCC: §24.235
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 25 QPSK (20MHz BANDWIDTH)

Band	25	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1915		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	1851.0733	1913.9271			
Extreme (50°C)		1851.0733	1913.9271	4.2	0.002	Yes
Extreme (40°C)		1851.0733	1913.9271	-4.4	-0.002	Yes
Extreme (30°C)		1851.0733	1913.9271	-5.7	-0.003	Yes
Extreme (10°C)		1851.0733	1913.9271	-5.5	-0.003	Yes
Extreme (0°C)		1851.0733	1913.9271	-4.6	-0.002	Yes
Extreme (-10°C)		1851.0733	1913.9271	-5.2	-0.003	Yes
Extreme (-20°C)		1851.0733	1913.9271	4.4	0.002	Yes
Extreme (-30°C)		1851.0733	1913.9271	-4.8	-0.003	Yes
20°C	15%	1851.0733	1913.9271	-5.1	-0.003	Yes
	-15%	1851.0733	1913.9271	-6.0	-0.003	Yes
	End Point Voltage	1851.0733	1913.9271	-4.4	-0.002	Yes

5G NR n25 BPSK (40MHz BANDWIDTH)

Band	25	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1915		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	1850.6860	1914.2805			
Extreme (50°C)		1850.6860	1914.2805	4.5	0.002	Yes
Extreme (40°C)		1850.6860	1914.2805	-2.2	-0.001	Yes
Extreme (30°C)		1850.6860	1914.2805	-3.7	-0.002	Yes
Extreme (10°C)		1850.6860	1914.2805	-3.8	-0.002	Yes
Extreme (0°C)		1850.6860	1914.2805	-5.3	-0.003	Yes
Extreme (-10°C)		1850.6860	1914.2805	-3.1	-0.002	Yes
Extreme (-20°C)		1850.6860	1914.2805	-4.9	-0.003	Yes
Extreme (-30°C)		1850.6860	1914.2805	3.3	0.002	Yes
20°C	15%	1850.6860	1914.2805	-3.0	-0.002	Yes
	-15%	1850.6860	1914.2805	-3.9	-0.002	Yes
	End Point Voltage	1850.6860	1914.2805	-2.8	-0.001	Yes

9.4.7. LTE BAND 26(PART 90S)

LIMITS

FCC: §90.213
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 26 QPSK (10MHz BANDWIDTH)

Band	26	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		814	824		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	814.5137	823.4758			
Extreme (50°C)		814.5137	823.4758	3.6	0.004	Yes
Extreme (40°C)		814.5137	823.4758	4.2	0.005	Yes
Extreme (30°C)		814.5137	823.4758	3.5	0.004	Yes
Extreme (10°C)		814.5137	823.4758	4.1	0.005	Yes
Extreme (0°C)		814.5137	823.4758	4.1	0.005	Yes
Extreme (-10°C)		814.5137	823.4758	3.8	0.005	Yes
Extreme (-20°C)		814.5137	823.4758	3.0	0.004	Yes
Extreme (-30°C)		814.5137	823.4758	4.9	0.006	Yes
20°C	15%	814.5137	823.4758	2.8	0.003	Yes
	-15%	814.5137	823.4758	2.4	0.003	Yes
	End Point Voltage	814.5137	823.4758	4.1	0.005	Yes

5G NR n26 BPSK (10MHz BANDWIDTH)

Band	26	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		814	824		2.5	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	814.3514	823.2609			
Extreme (50°C)		814.3514	823.2609	2.5	0.003	Yes
Extreme (40°C)		814.3514	823.2609	2.1	0.003	Yes
Extreme (30°C)		814.3514	823.2609	2.9	0.003	Yes
Extreme (10°C)		814.3514	823.2609	1.9	0.002	Yes
Extreme (0°C)		814.3514	823.2609	2.1	0.003	Yes
Extreme (-10°C)		814.3514	823.2609	1.5	0.002	Yes
Extreme (-20°C)		814.3514	823.2609	-1.6	-0.002	Yes
Extreme (-30°C)		814.3514	823.2609	2.3	0.003	Yes
20°C	15%	814.3514	823.2609	2.2	0.003	Yes
	-15%	814.3514	823.2609	2.1	0.003	Yes
	End Point Voltage	814.3514	823.2609	2.3	0.003	Yes

9.4.8. LTE BAND 26(PART 22)

LIMITS

FCC: §22.355
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 26 QPSK (10MHz BANDWIDTH)

Band	26	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		824	849		2.5	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	824.5201	848.4749			
Extreme (50°C)		824.5201	848.4749	3.1	0.004	Yes
Extreme (40°C)		824.5201	848.4749	-3.6	-0.004	Yes
Extreme (30°C)		824.5201	848.4749	3.9	0.005	Yes
Extreme (10°C)		824.5201	848.4749	2.9	0.003	Yes
Extreme (0°C)		824.5201	848.4749	4.4	0.005	Yes
Extreme (-10°C)		824.5201	848.4749	3.2	0.004	Yes
Extreme (-20°C)		824.5201	848.4749	2.8	0.003	Yes
Extreme (-30°C)		824.5201	848.4749	2.4	0.003	Yes
20°C	15%	824.5201	848.4749	-3.4	-0.004	Yes
	-15%	824.5201	848.4749	3.2	0.004	Yes
	End Point Voltage	824.5201	848.4749	4.9	0.006	Yes

5G NR n26 BPSK (20MHz BANDWIDTH)

Band	26	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		824	849		2.5	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	824.3571	848.3831			
Extreme (50°C)		824.3571	848.3831	2.1	0.002	Yes
Extreme (40°C)		824.3571	848.3831	2.4	0.003	Yes
Extreme (30°C)		824.3571	848.3831	2.3	0.003	Yes
Extreme (10°C)		824.3571	848.3831	2.4	0.003	Yes
Extreme (0°C)		824.3571	848.3831	1.6	0.002	Yes
Extreme (-10°C)		824.3571	848.3831	2.7	0.003	Yes
Extreme (-20°C)		824.3571	848.3831	1.8	0.002	Yes
Extreme (-30°C)		824.3571	848.3831	2.4	0.003	Yes
20°C	15%	824.3571	848.3831	1.7	0.002	Yes
	-15%	824.3571	848.3831	-1.6	-0.002	Yes
	End Point Voltage	824.3571	848.3831	2.3	0.003	Yes

9.4.9. LTE BAND 30 AND 5G NR n30

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 30 QPSK (10MHz BANDWIDTH)

Band	30	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2305	2315			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)		2305.5326	2314.4754			
Extreme (50°C)		2305.5326	2314.4754	6.7	0.003	Yes
Extreme (40°C)		2305.5326	2314.4754	-5.6	-0.002	Yes
Extreme (30°C)		2305.5326	2314.4754	-5.1	-0.002	Yes
Extreme (10°C)	Normal	2305.5326	2314.4754	5.1	0.002	Yes
Extreme (0°C)		2305.5326	2314.4754	5.4	0.002	Yes
Extreme (-10°C)		2305.5326	2314.4754	5.7	0.002	Yes
Extreme (-20°C)		2305.5326	2314.4754	6.0	0.003	Yes
Extreme (-30°C)		2305.5326	2314.4754	4.6	0.002	Yes
20°C	15%	2305.5326	2314.4754	-5.4	-0.002	Yes
	-15%	2305.5326	2314.4754	-4.9	-0.002	Yes
	End Point Voltage	2305.5326	2314.4754	3.9	0.002	Yes

5G NR n30 BPSK (10MHz BANDWIDTH)

Band	30	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2305	2315			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	2305.3230	2314.2988			
Extreme (50°C)		2305.3230	2314.2988	-9.3	-0.004	Yes
Extreme (40°C)		2305.3230	2314.2988	-8.2	-0.004	Yes
Extreme (30°C)		2305.3230	2314.2988	-10.2	-0.004	Yes
Extreme (10°C)		2305.3230	2314.2988	-8.3	-0.004	Yes
Extreme (0°C)		2305.3230	2314.2988	-7.9	-0.003	Yes
Extreme (-10°C)		2305.3230	2314.2988	-8.2	-0.004	Yes
Extreme (-20°C)		2305.3230	2314.2988	-7.4	-0.003	Yes
Extreme (-30°C)		2305.3230	2314.2988	-7.4	-0.003	Yes
20°C	15%	2305.3230	2314.2988	-9.3	-0.004	Yes
	-15%	2305.3230	2314.2988	-10.5	-0.005	Yes
	End Point Voltage	2305.3230	2314.2988	-10.1	-0.004	Yes

9.4.10. LTE BAND 41 AND 5G NR n41

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 41 QPSK (20MHz BANDWIDTH)

Band	41	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2496	2690		0	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	2497.0147	2688.9738			
Extreme (50°C)		2497.0146	2688.9738	-8.2	-0.003	Yes
Extreme (40°C)		2497.0146	2688.9738	-8.6	-0.003	Yes
Extreme (30°C)		2497.0146	2688.9738	-9.4	-0.004	Yes
Extreme (10°C)		2497.0146	2688.9738	-9.0	-0.003	Yes
Extreme (0°C)		2497.0146	2688.9738	-8.8	-0.003	Yes
Extreme (-10°C)		2497.0146	2688.9738	-9.0	-0.003	Yes
Extreme (-20°C)		2497.0146	2688.9738	-10.4	-0.004	Yes
Extreme (-30°C)		2497.0146	2688.9738	-9.6	-0.004	Yes
20°C	15%	2497.0146	2688.9738	-10.1	-0.004	Yes
	-15%	2497.0146	2688.9738	-10.0	-0.004	Yes
	End Point Voltage	2497.0146	2688.9738	-10.7	-0.004	Yes

5G NR n41 BPSK (100MHz BANDWIDTH)

Band	41	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2496	2690		0	
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	2497.1713	2687.6852			
Extreme (50°C)		2497.1713	2687.6852	-11.6	-0.004	Yes
Extreme (40°C)		2497.1713	2687.6852	-11.0	-0.004	Yes
Extreme (30°C)		2497.1713	2687.6852	-11.7	-0.004	Yes
Extreme (10°C)		2497.1713	2687.6852	-10.0	-0.004	Yes
Extreme (0°C)		2497.1713	2687.6852	-15.6	-0.006	Yes
Extreme (-10°C)		2497.1713	2687.6852	-17.2	-0.007	Yes
Extreme (-20°C)		2497.1713	2687.6852	-12.4	-0.005	Yes
Extreme (-30°C)		2497.1713	2687.6852	-15.8	-0.006	Yes
20°C	15%	2497.1713	2687.6852	-11.0	-0.004	Yes
	-15%	2497.1713	2687.6852	-16.0	-0.006	Yes
	End Point Voltage	2497.1713	2687.6852	-11.9	-0.005	Yes

9.4.11. LTE BAND 48 AND 5G NR n48

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 48 QPSK (20MHz BANDWIDTH)

Band	48	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3550	3700			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)		3550.9226	3699.2834			
Extreme (50°C)		3550.9226	3699.2835	8.1	0.002	Yes
Extreme (40°C)		3550.9226	3699.2835	7.4	0.002	Yes
Extreme (30°C)		3550.9226	3699.2835	7.7	0.002	Yes
Extreme (10°C)	Normal	3550.9226	3699.2835	9.0	0.002	Yes
Extreme (0°C)		3550.9226	3699.2835	8.0	0.002	Yes
Extreme (-10°C)		3550.9226	3699.2835	7.5	0.002	Yes
Extreme (-20°C)		3550.9226	3699.2835	7.0	0.002	Yes
Extreme (-30°C)		3550.9226	3699.2835	6.6	0.002	Yes
20°C	15%	3550.9226	3699.2835	8.3	0.002	Yes
	-15%	3550.9226	3699.2835	10.8	0.003	Yes
	End Point Voltage	3550.9226	3699.2835	6.7	0.002	Yes

5G NR n48 BPSK (40MHz BANDWIDTH)

Band	48	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3550	3700			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	3550.9673	3696.8419			
Extreme (50°C)		3550.9673	3696.8419	-10.6	-0.003	Yes
Extreme (40°C)		3550.9673	3696.8419	-13.3	-0.004	Yes
Extreme (30°C)		3550.9673	3696.8419	-12.7	-0.003	Yes
Extreme (10°C)		3550.9673	3696.8419	-12.5	-0.003	Yes
Extreme (0°C)		3550.9673	3696.8419	-15.7	-0.004	Yes
Extreme (-10°C)		3550.9673	3696.8419	-13.9	-0.004	Yes
Extreme (-20°C)		3550.9673	3696.8419	-14.9	-0.004	Yes
Extreme (-30°C)		3550.9673	3696.8419	-10.5	-0.003	Yes
20°C	15%	3550.9673	3696.8419	-13.5	-0.004	Yes
	-15%	3550.9673	3696.8419	-13.7	-0.004	Yes
	End Point Voltage	3550.9673	3696.8419	-8.6	-0.002	Yes

9.4.12. LTE BAND 66 AND 5G NR n66

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 66 QPSK (20MHz BANDWIDTH)

Band	66	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1710	1780			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	1711.0616	1778.9456			
Extreme (50°C)		1711.0616	1778.9456	4.4	0.003	Yes
Extreme (40°C)		1711.0616	1778.9456	3.7	0.002	Yes
Extreme (30°C)		1711.0616	1778.9456	-3.8	-0.002	Yes
Extreme (10°C)		1711.0616	1778.9456	-3.7	-0.002	Yes
Extreme (0°C)		1711.0616	1778.9456	4.0	0.002	Yes
Extreme (-10°C)		1711.0616	1778.9456	4.6	0.003	Yes
Extreme (-20°C)		1711.0616	1778.9456	-4.3	-0.002	Yes
Extreme (-30°C)		1711.0616	1778.9456	4.2	0.002	Yes
20°C	15%	1711.0616	1778.9456	-4.3	-0.002	Yes
	-15%	1711.0616	1778.9456	-4.6	-0.003	Yes
	End Point Voltage	1711.0616	1778.9456	-4.9	-0.003	Yes

5G NR n66 BPSK (40MHz BANDWIDTH)

Band	66	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1710	1780			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	1710.6424	1779.3458			
Extreme (50°C)		1710.6424	1779.3458	-7.4	-0.004	Yes
Extreme (40°C)		1710.6424	1779.3458	-6.5	-0.004	Yes
Extreme (30°C)		1710.6424	1779.3458	-7.2	-0.004	Yes
Extreme (10°C)		1710.6424	1779.3458	-8.4	-0.005	Yes
Extreme (0°C)		1710.6424	1779.3458	-7.3	-0.004	Yes
Extreme (-10°C)		1710.6424	1779.3458	-7.6	-0.004	Yes
Extreme (-20°C)		1710.6424	1779.3458	6.9	0.004	Yes
Extreme (-30°C)		1710.6424	1779.3458	-8.2	-0.005	Yes
20°C	15%	1710.6424	1779.3458	-8.6	-0.005	Yes
	-15%	1710.6424	1779.3458	-7.7	-0.004	Yes
	End Point Voltage	1710.6424	1779.3458	-6.3	-0.004	Yes

9.4.13. 5G NR n70

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/27/2023

5G NR n70 BPSK (15MHz BANDWIDTH)

Band	70	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1695	1710			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	1695.4114	1708.8544			
Extreme (50°C)		1695.4114	1708.8544	-6.2	-0.004	Yes
Extreme (40°C)		1695.4114	1708.8544	-6.1	-0.004	Yes
Extreme (30°C)		1695.4114	1708.8544	-6.8	-0.004	Yes
Extreme (10°C)		1695.4114	1708.8544	-5.6	-0.003	Yes
Extreme (0°C)		1695.4114	1708.8544	-7.2	-0.004	Yes
Extreme (-10°C)		1695.4114	1708.8544	-7.2	-0.004	Yes
Extreme (-20°C)		1695.4114	1708.8544	-7.2	-0.004	Yes
Extreme (-30°C)		1695.4114	1708.8544	-9.1	-0.005	Yes
20°C	15%	1695.4114	1708.8544	-6.8	-0.004	Yes
	-15%	1695.4114	1708.8544	-5.5	-0.003	Yes
	End Point Voltage	1695.4114	1708.8544	-8.1	-0.005	Yes

9.4.14. LTE BAND 71 AND 5G NR n71

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/29/2023

LTE BAND 71 QPSK (20MHz BANDWIDTH)

Band	71	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		663	698			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)		664.0430	696.9367			
Extreme (50°C)		664.0430	696.9367	3.1	0.005	Yes
Extreme (40°C)		664.0430	696.9367	-2.8	-0.004	Yes
Extreme (30°C)		664.0430	696.9367	-2.7	-0.004	Yes
Extreme (10°C)	Normal	664.0430	696.9367	-3.4	-0.005	Yes
Extreme (0°C)		664.0430	696.9367	3.6	0.005	Yes
Extreme (-10°C)		664.0430	696.9367	3.0	0.004	Yes
Extreme (-20°C)		664.0430	696.9367	3.8	0.006	Yes
Extreme (-30°C)		664.0430	696.9367	3.1	0.005	Yes
20°C	15%	664.0430	696.9367	-2.8	-0.004	Yes
	-15%	664.0430	696.9367	-3.2	-0.005	Yes
	End Point Voltage	664.0430	696.9367	3.0	0.004	Yes

5G NR n71 BPSK (20MHz BANDWIDTH)

Band	71	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		663	698			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	663.5179	696.3786			
Extreme (50°C)		663.5179	696.3786	-5.7	-0.008	Yes
Extreme (40°C)		663.5179	696.3786	-5.1	-0.007	Yes
Extreme (30°C)		663.5179	696.3786	-5.9	-0.009	Yes
Extreme (10°C)		663.5179	696.3786	-5.6	-0.008	Yes
Extreme (0°C)		663.5179	696.3786	-5.3	-0.008	Yes
Extreme (-10°C)		663.5179	696.3786	-6.2	-0.009	Yes
Extreme (-20°C)		663.5179	696.3786	-5.4	-0.008	Yes
Extreme (-30°C)		663.5179	696.3786	-5.2	-0.008	Yes
20°C	15%	663.5179	696.3786	-5.0	-0.007	Yes
	-15%	663.5179	696.3786	-5.8	-0.008	Yes
	End Point Voltage	663.5179	696.3786	-5.7	-0.008	Yes

9.4.15. 5G NR n77 (Part 27 3450-3550MHz)

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/28/2023

5G NR n77 BPSK (100MHz BANDWIDTH)

Band	77	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3450	3550			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)		3451.0629	3547.7163			
Extreme (50°C)		3451.0629	3547.7163	-16.0	-0.005	Yes
Extreme (40°C)		3451.0629	3547.7163	-11.4	-0.003	Yes
Extreme (30°C)		3451.0629	3547.7163	-14.7	-0.004	Yes
Extreme (10°C)	Normal	3451.0629	3547.7163	-10.3	-0.003	Yes
Extreme (0°C)		3451.0629	3547.7163	-13.0	-0.004	Yes
Extreme (-10°C)		3451.0629	3547.7163	-13.6	-0.004	Yes
Extreme (-20°C)		3451.0629	3547.7163	-12.5	-0.004	Yes
Extreme (-30°C)		3451.0629	3547.7163	-15.3	-0.004	Yes
20°C	15%	3451.0629	3547.7163	-10.4	-0.003	Yes
	-15%	3451.0629	3547.7163	-8.8	-0.003	Yes
	End Point Voltage	3451.0629	3547.7163	-14.1	-0.004	Yes

9.4.16. 5G NR n77 (Part 27 3700-3980MHz)

LIMITS

FCC: §27.54
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Engineer ID:	32061	Test Date:	3/28/2023

5G NR n77 BPSK (100MHz BANDWIDTH)

Band	77	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3700	3980			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	3700.9579	3977.7333			
Extreme (50°C)		3700.9579	3977.7332	-21.4	-0.006	Yes
Extreme (40°C)		3700.9579	3977.7332	-17.7	-0.005	Yes
Extreme (30°C)		3700.9579	3977.7332	-11.5	-0.003	Yes
Extreme (10°C)		3700.9579	3977.7332	-12.3	-0.003	Yes
Extreme (0°C)		3700.9579	3977.7332	-9.3	-0.002	Yes
Extreme (-10°C)		3700.9579	3977.7332	-11.1	-0.003	Yes
Extreme (-20°C)		3700.9579	3977.7332	-9.1	-0.002	Yes
Extreme (-30°C)		3700.9579	3977.7332	-10.1	-0.003	Yes
20°C	15%	3700.9579	3977.7332	-10.5	-0.003	Yes
	-15%	3700.9579	3977.7332	-11.6	-0.003	Yes
	End Point Voltage	3700.9579	3977.7332	-18.4	-0.005	Yes

9.5. PEAK-TO-AVERAGE POWER RATIO

LIMIT

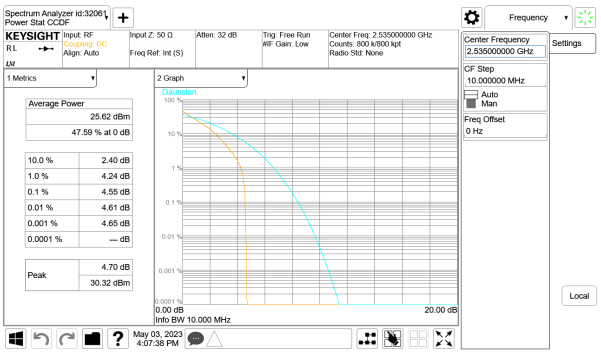
In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

RESULT

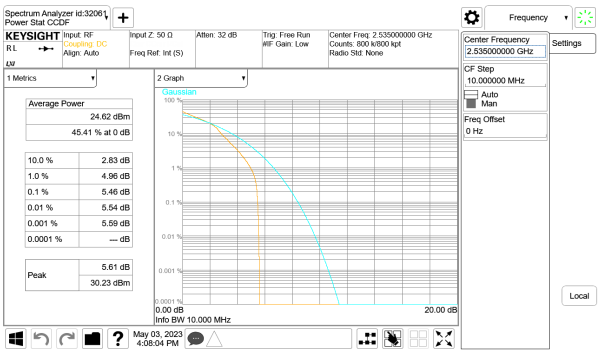
Antenna 1 was used to measure as the worst case; full resource block (FRB) for each bandwidth was used to measure as the worst case. The results from all CCDF measurements are passed with 13dB peak-to-average power ratio criteria.

9.5.1. LTE BAND 7 AND 5G NR n7

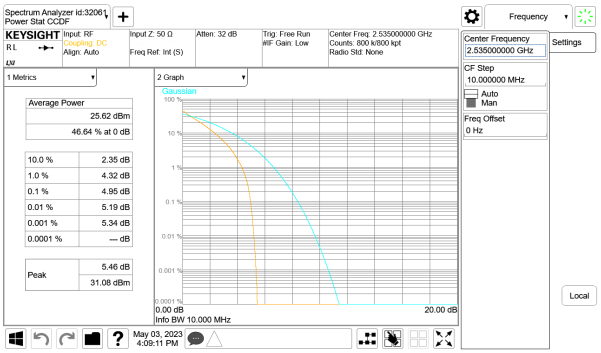
LTE BAND 7



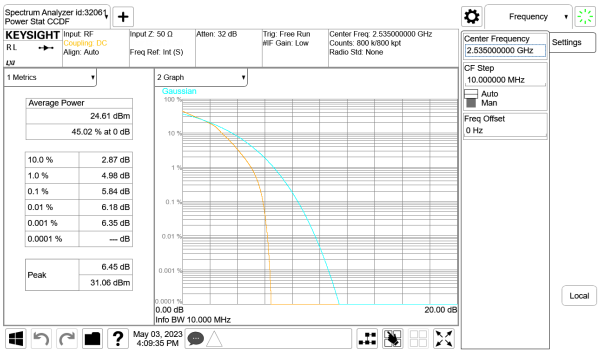
LTE B7 5MHz QPSK Middle Channel



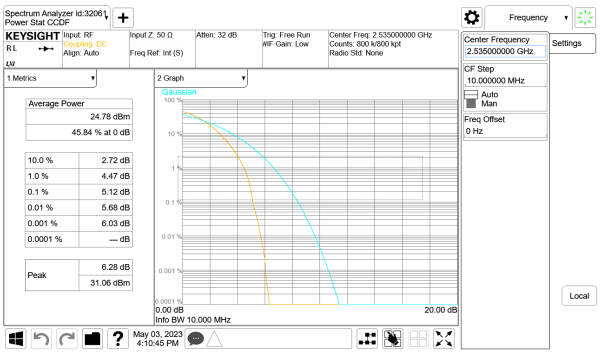
LTE B7 5MHz 16QAM Middle Channel



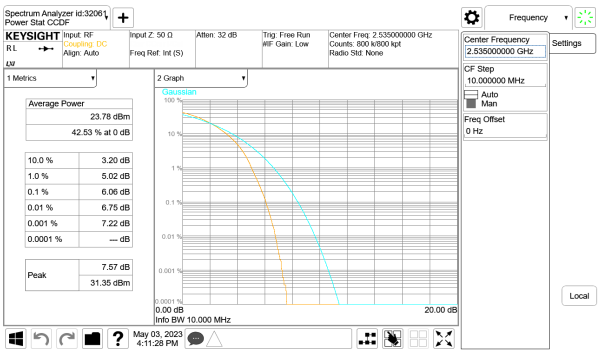
LTE B7 10MHz QPSK Middle Channel



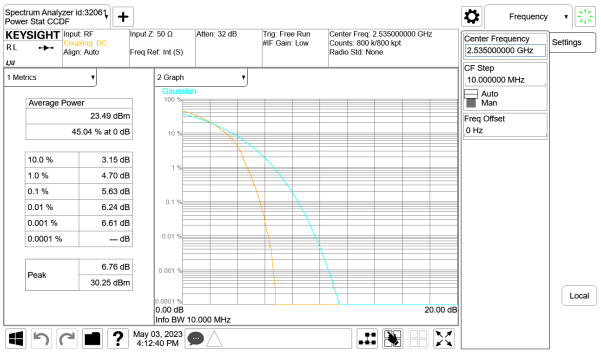
LTE B7 10MHz 16QAM Middle Channel



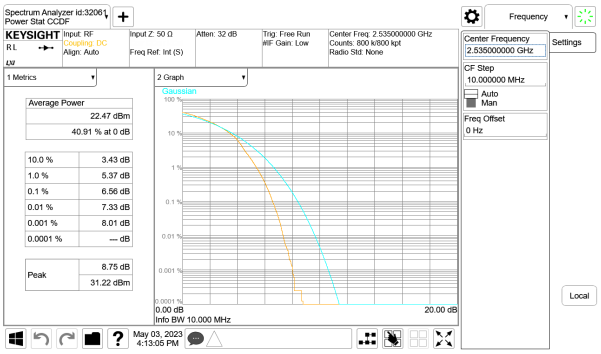
LTE B7 15MHz QPSK Middle Channel



LTE B7 15MHz 16QAM Middle Channel

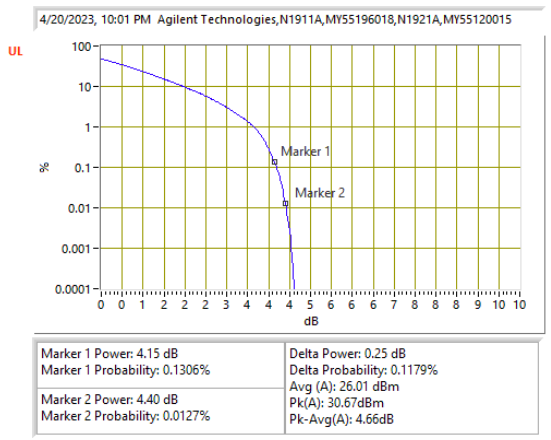


LTE B7 20MHz QPSK Middle Channel

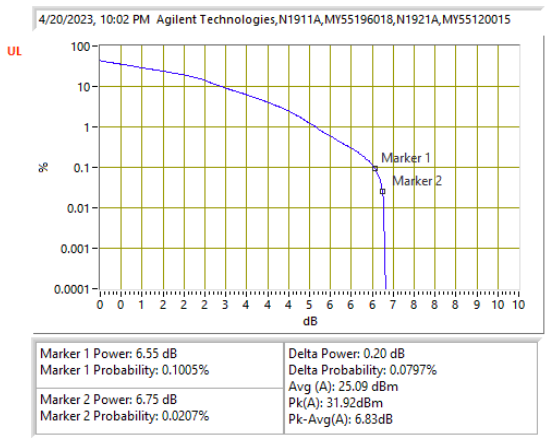


LTE B7 20MHz 16QAM Middle Channel

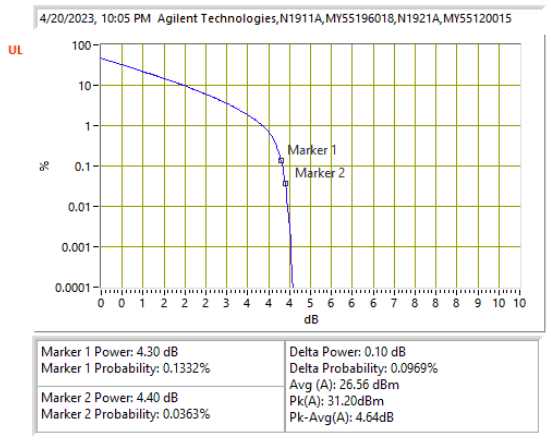
5G NR n7



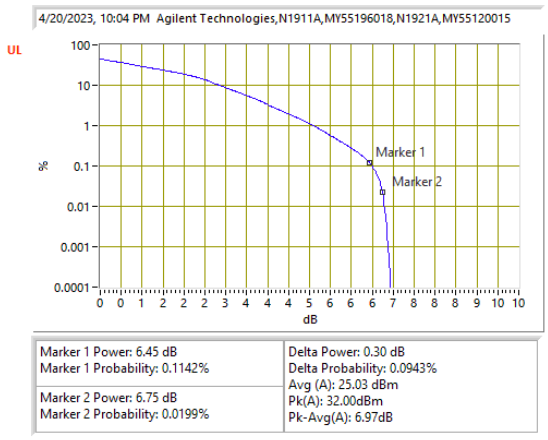
5G NR n7 5MHz BPSK Middle Channel, ID: 50822



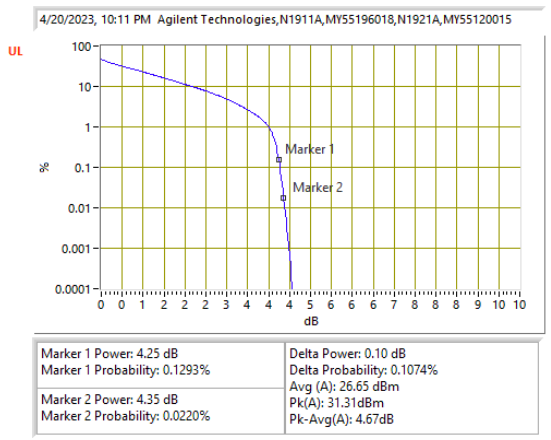
5G NR n7 5MHz 16QAM Middle Channel, ID: 50822



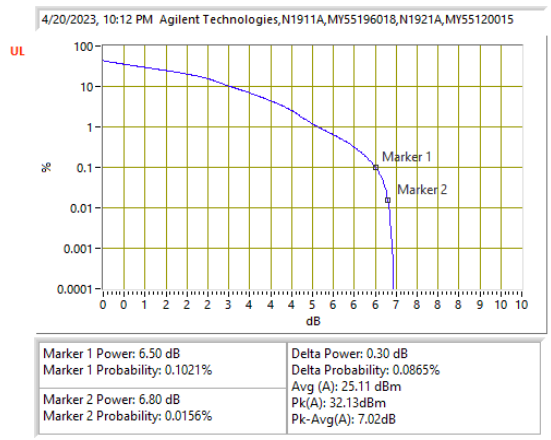
5G NR n7 10MHz BPSK Middle Channel, ID: 50822



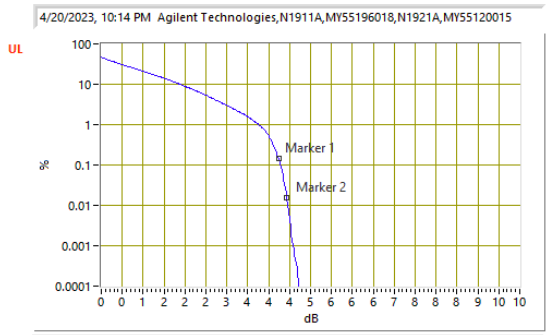
5G NR n7 10MHz 16QAM Middle Channel, ID: 50822



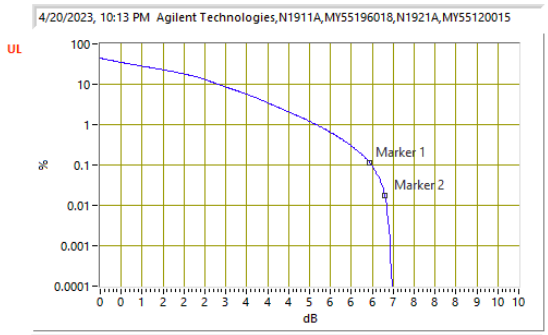
5G NR n7 15MHz BPSK Middle Channel, ID: 50822



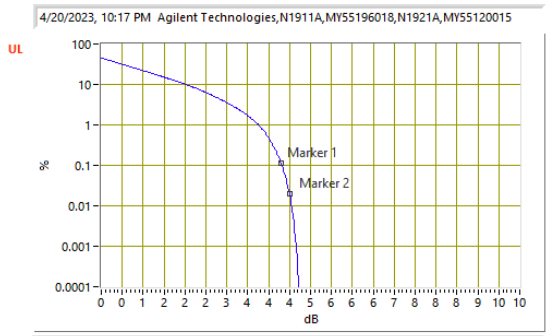
5G NR n7 15MHz 16QAM Middle Channel, ID: 50822



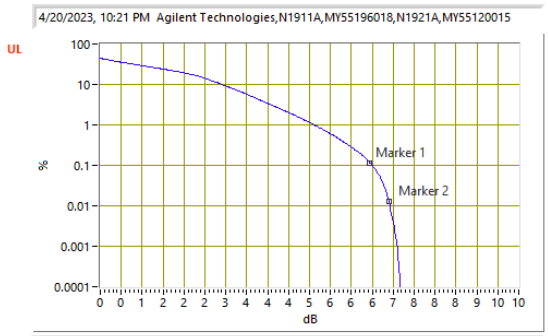
5G NR n7 20MHz BPSK Middle Channel, ID: 50822



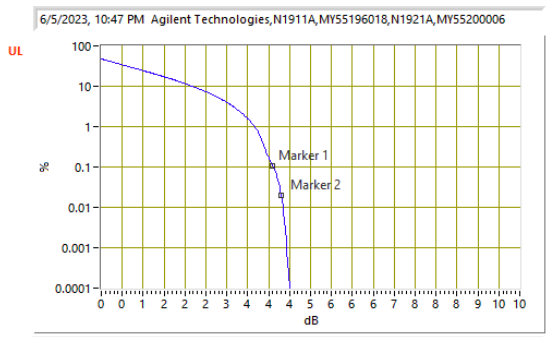
5G NR n7 20MHz 16QAM Middle Channel, ID: 50822



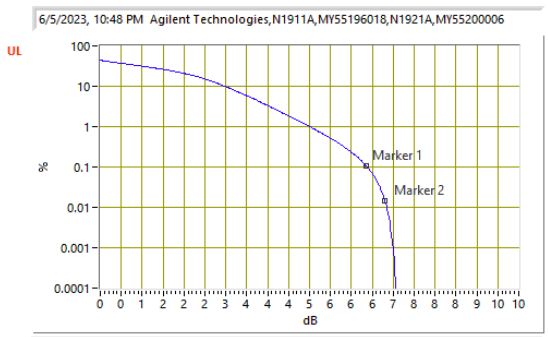
5G NR n7 25MHz BPSK Middle Channel, ID: 50822



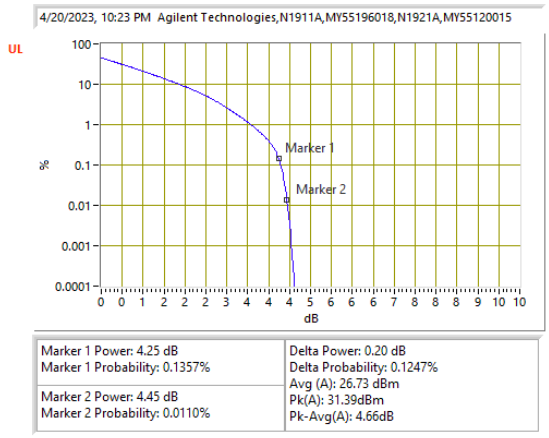
5G NR n7 25MHz 16QAM Middle Channel, ID: 50822



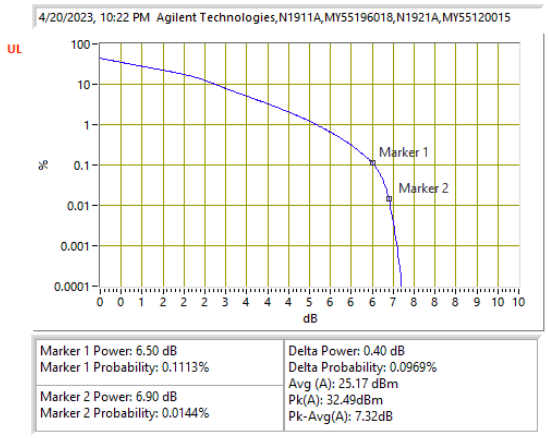
5G NR n7 35MHz BPSK Middle Channel, ID: 50822



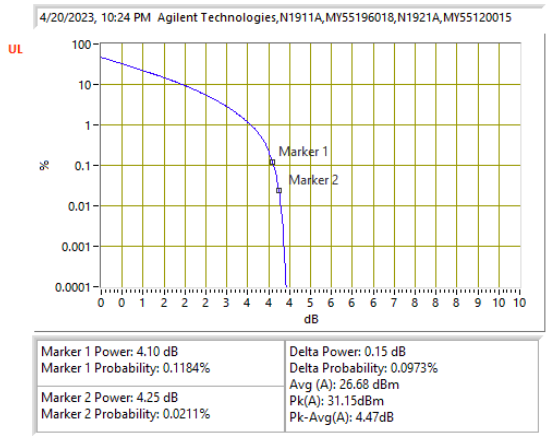
5G NR n7 35MHz 16QAM Middle Channel, ID: 50822



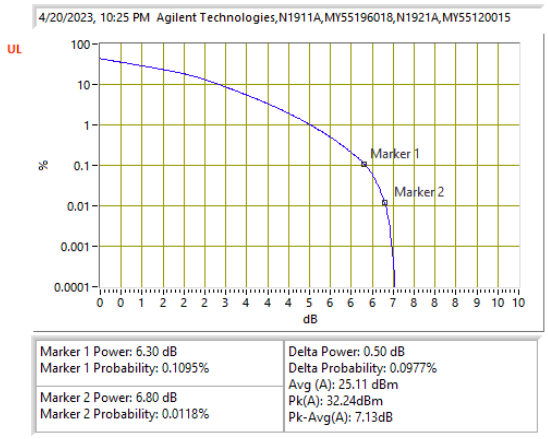
5G NR n7 30MHz BPSK Middle Channel



5G NR n7 30MHz 16QAM Middle Channel



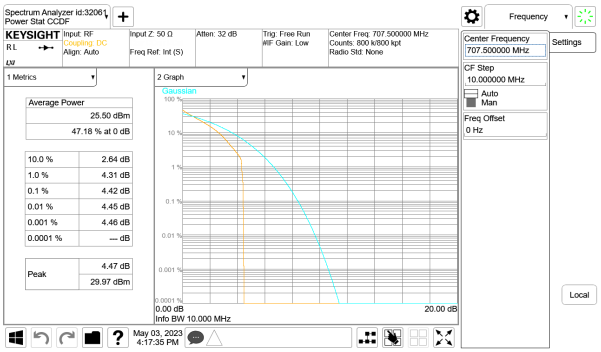
5G NR n7 40MHz BPSK Middle Channel, ID: 50822



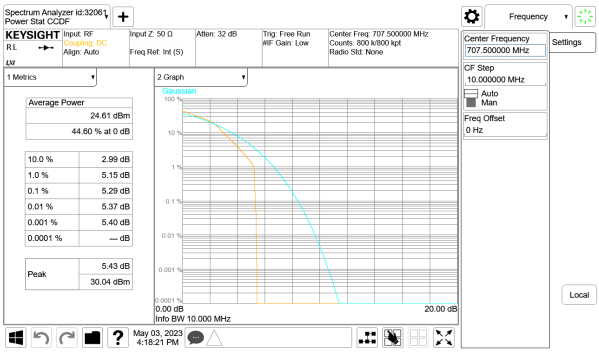
5G NR n7 40MHz 16QAM Middle Channel, ID: 50822

9.5.2. LTE BAND 12 AND 5G NR n12

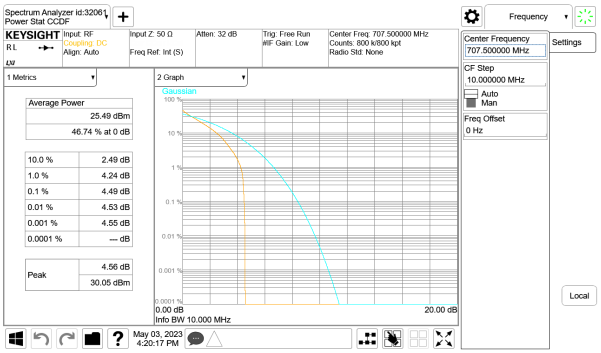
LTE BAND 12



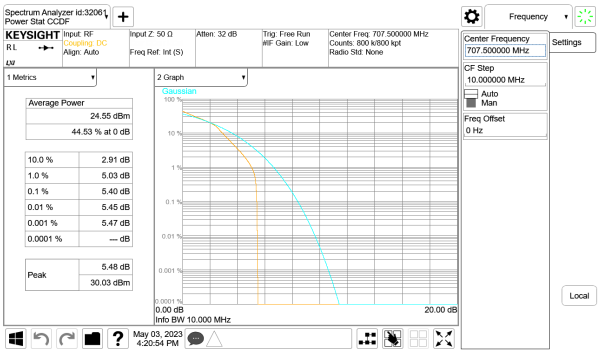
LTE B12 1.4MHz QPSK Middle Channel



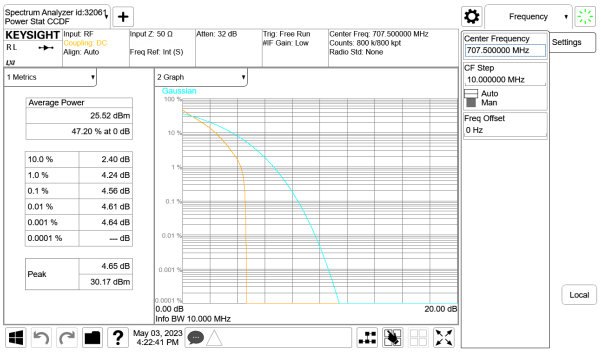
LTE B12 1.4MHz 16QAM Middle Channel



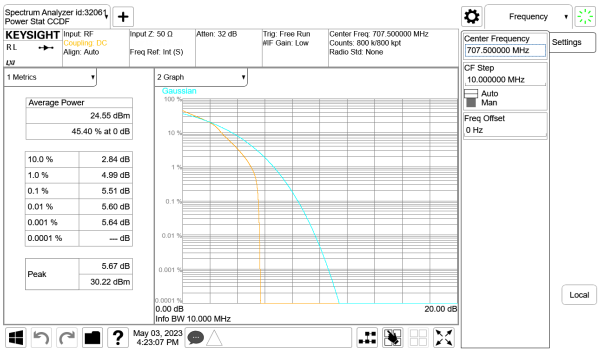
LTE B12 3MHz QPSK Middle Channel



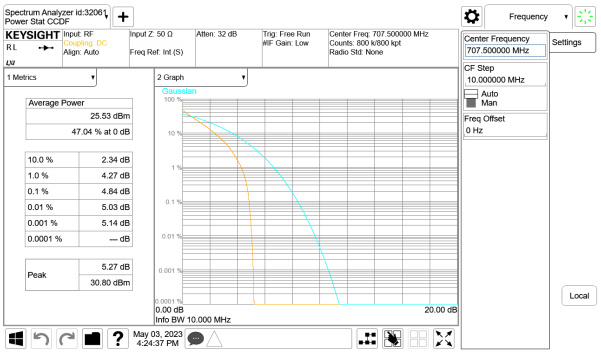
LTE B12 3MHz 16QAM Middle Channel



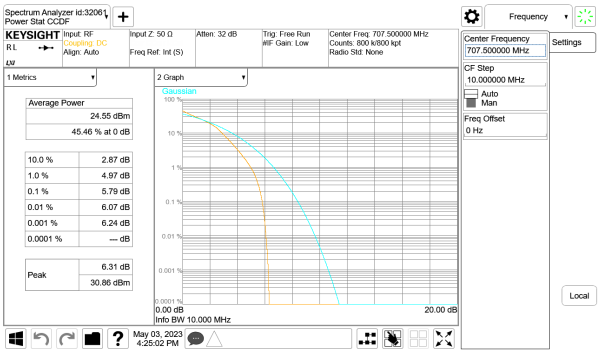
LTE B12 5MHz QPSK Middle Channel



LTE B12 5MHz 16QAM Middle Channel

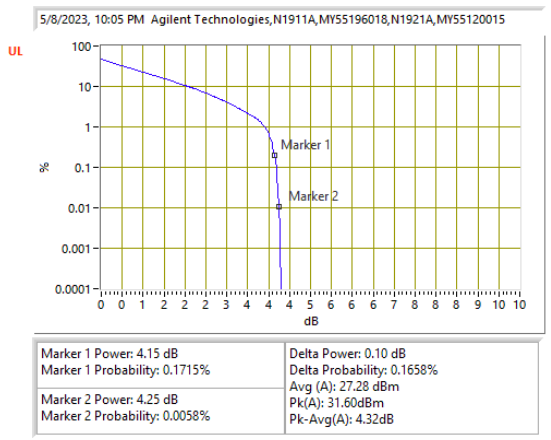


LTE B12 10MHz QPSK Middle Channel

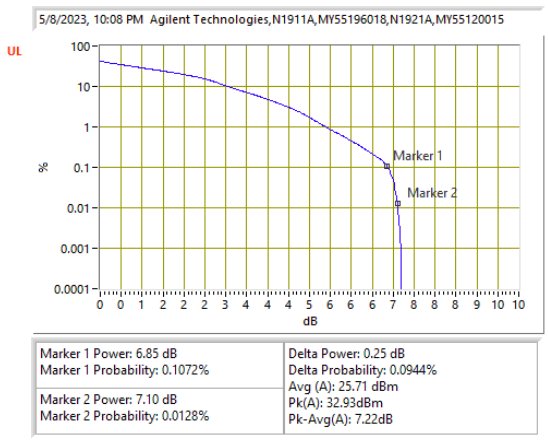


LTE B12 10MHz 16QAM Middle Channel

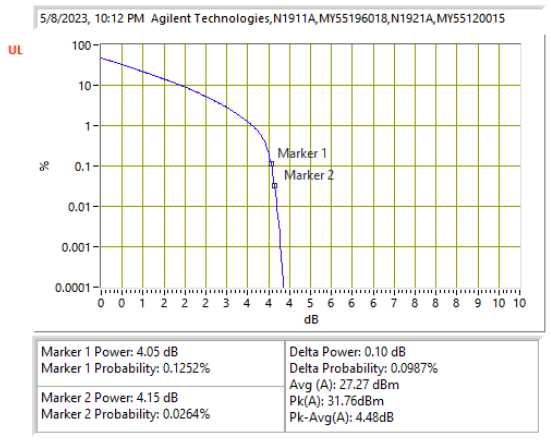
5G NR n12



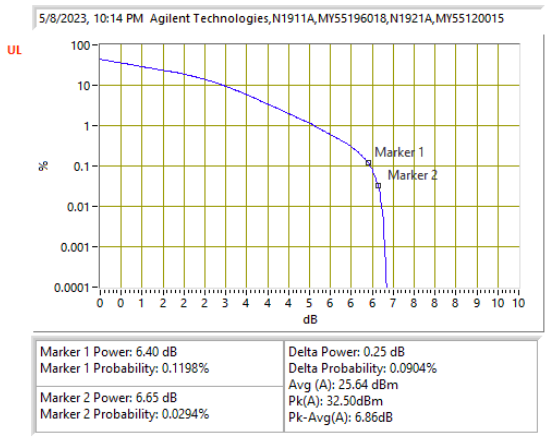
5G NR n12 5MHz BPSK Middle Channel, ID: 50822



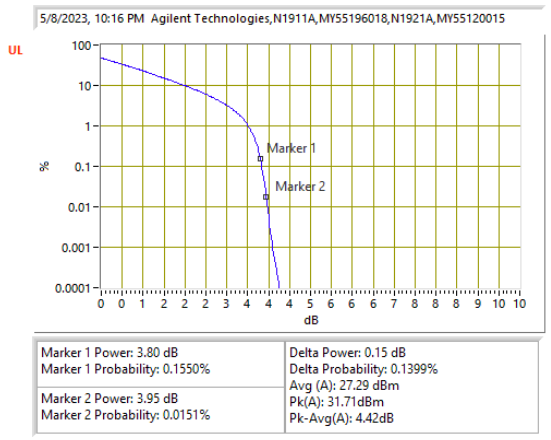
5G NR n12 5MHz 16QAM Middle Channel, ID: 50822



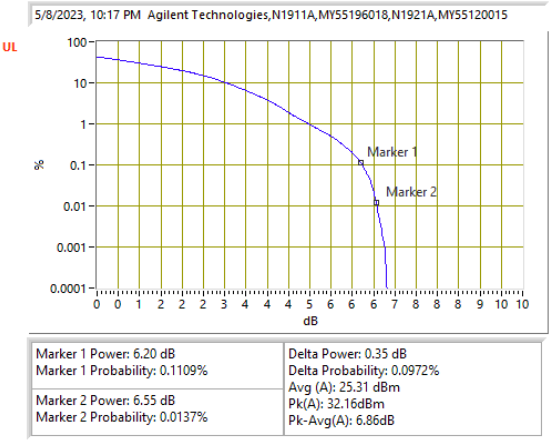
5G NR n12 10MHz BPSK Middle Channel, ID: 50822



5G NR n12 10MHz 16QAM Middle Channel, ID: 50822

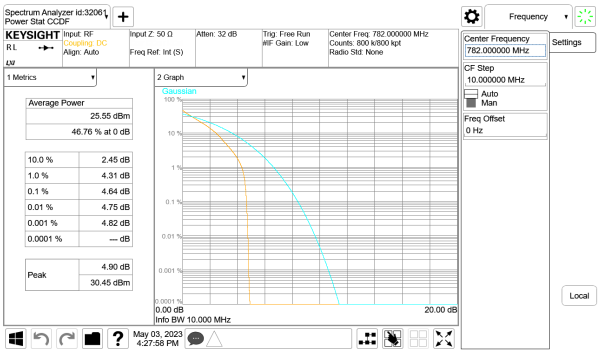


5G NR n12 15MHz BPSK Middle Channel, ID: 50822

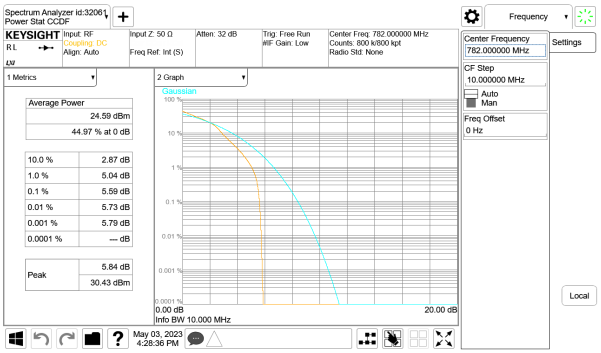


5G NR n12 15MHz 16QAM Middle Channel, ID: 50822

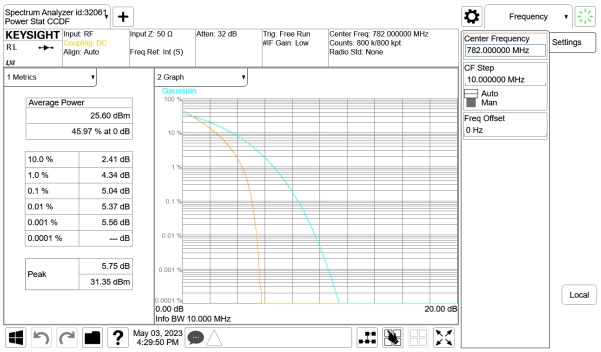
9.5.3. LTE BAND 13



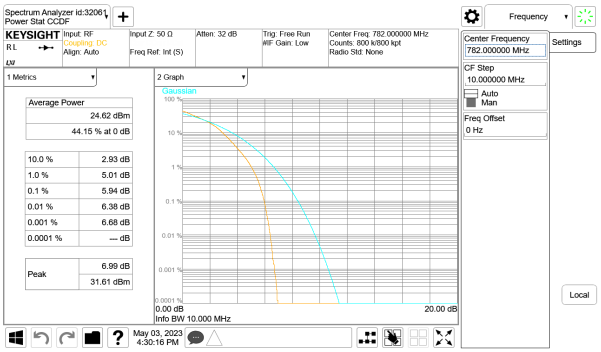
LTE B13 5MHz QPSK Middle Channel



LTE B13 5MHz 16QAM Middle Channel



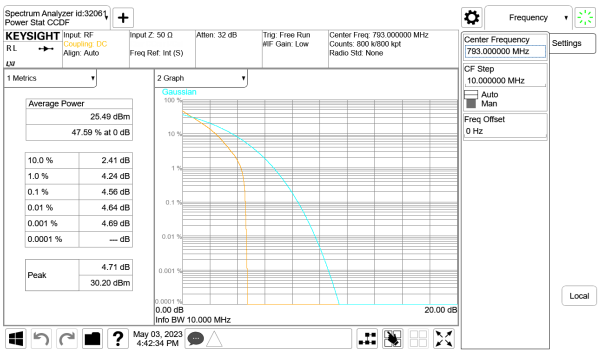
LTE B13 10MHz QPSK Middle Channel



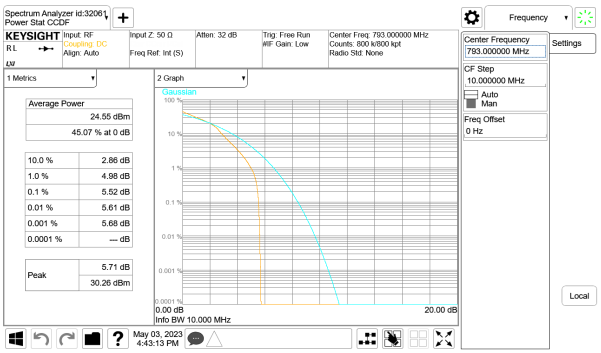
LTE B13 10MHz 16QAM Middle Channel

9.5.4. LTE BAND 14 AND 5G NR n14

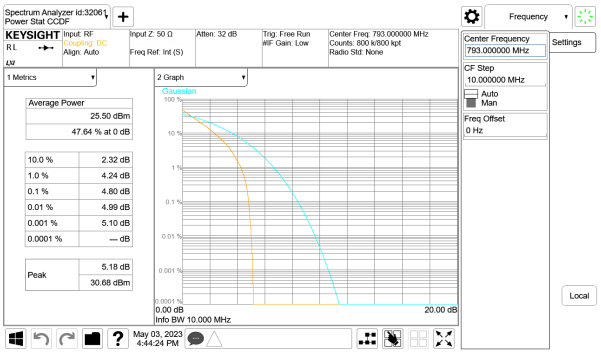
LTE BAND 14



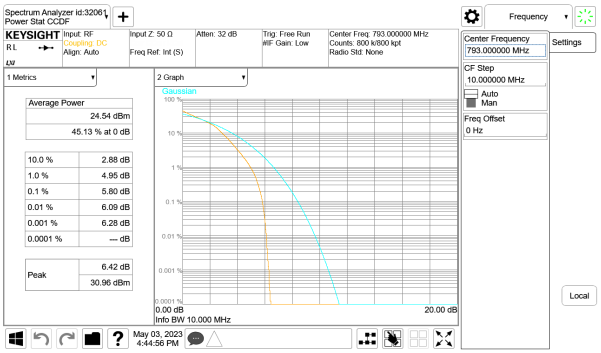
LTE B14 5MHz QPSK Middle Channel



LTE B14 5MHz 16QAM Middle Channel

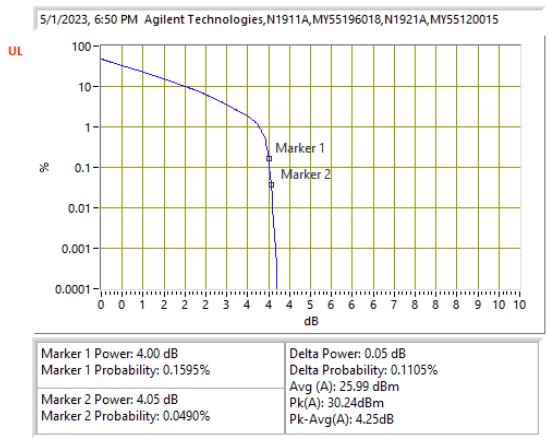


LTE B14 10MHz QPSK Middle Channel

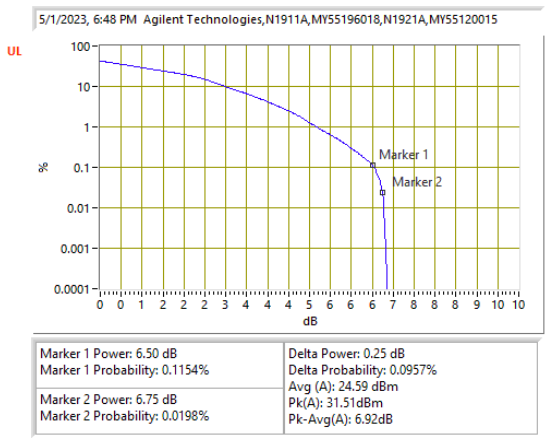


LTE B14 10MHz 16QAM Middle Channel

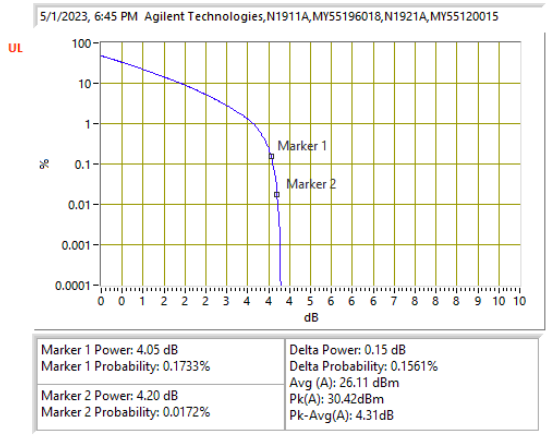
5G NR n14



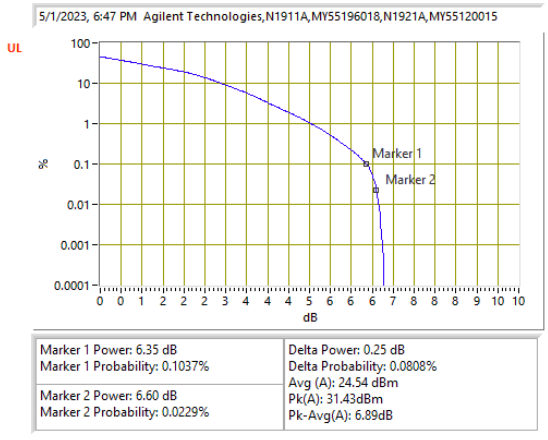
5G NR n14 5MHz BPSK Middle Channel, ID: 50822



5G NR n14 5MHz 16QAM Middle Channel, ID: 50822

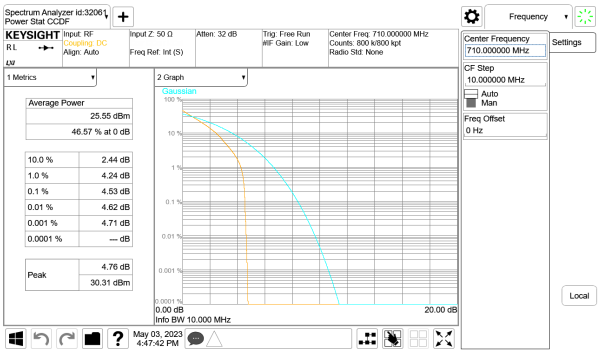


5G NR n14 10MHz BPSK Middle Channel, ID: 50822

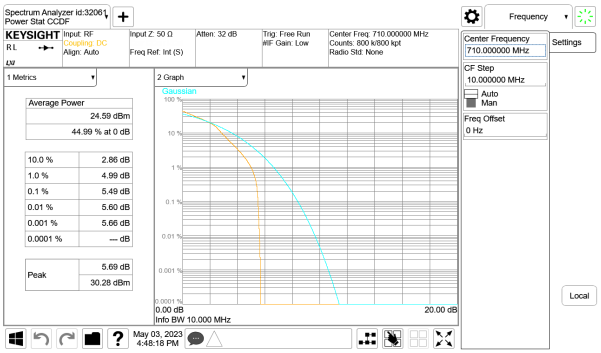


5G NR n14 10MHz 16QAM Middle Channel, ID: 50822

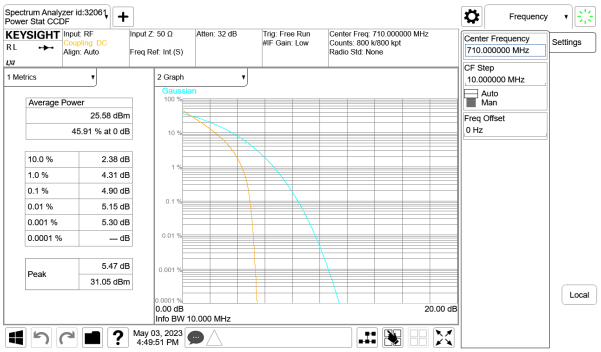
9.5.5. LTE BAND 17



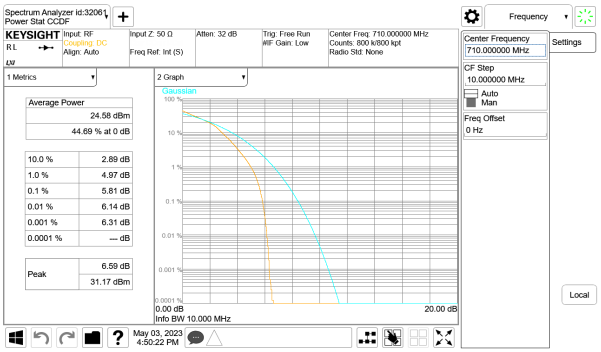
LTE B17 5MHz QPSK Middle Channel



LTE B17 5MHz 16QAM Middle Channel



LTE B17 10MHz QPSK Middle Channel



LTE B17 10MHz 16QAM Middle Channel