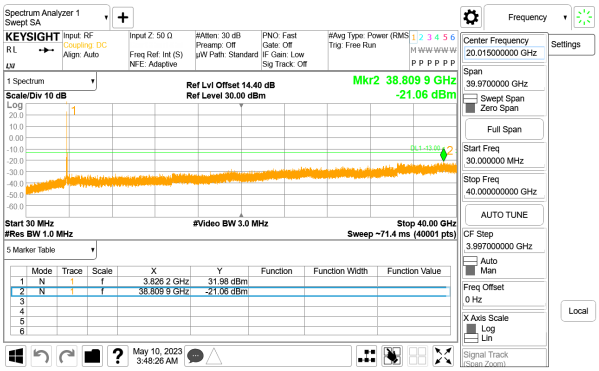
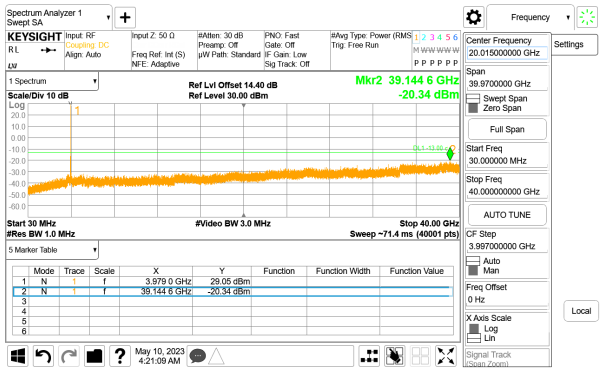
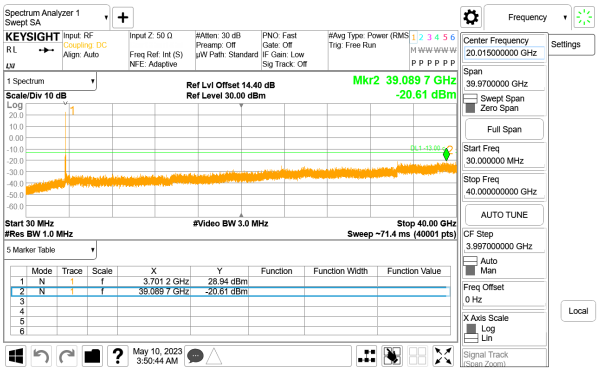


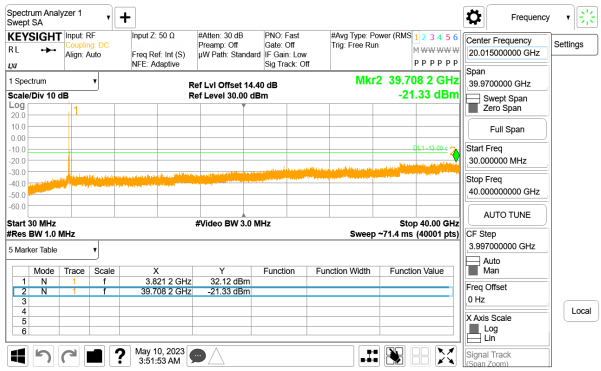
5G NR n77 30MHz BPSK Middle Channel RB1-1, ID:19210



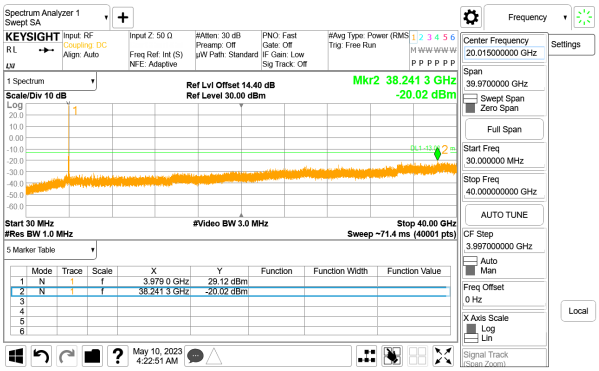
5G NR n77 30MHz BPSK High Channel RB1-77, ID:19210



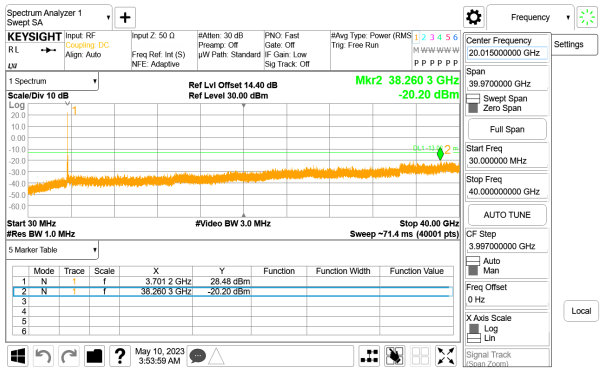
5G NR n77 40MHz BPSK Low Channel RB1-0, ID:19210



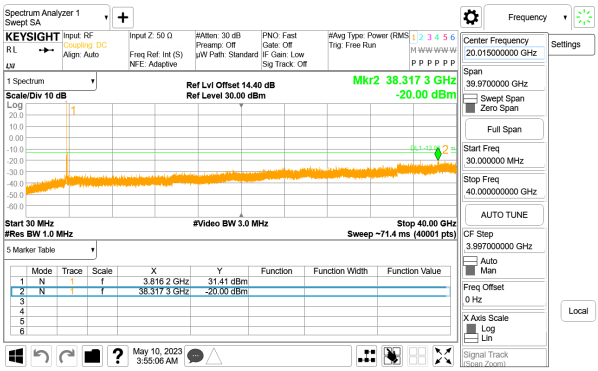
5G NR n77 40MHz BPSK Middle Channel RB1-1, ID:19210



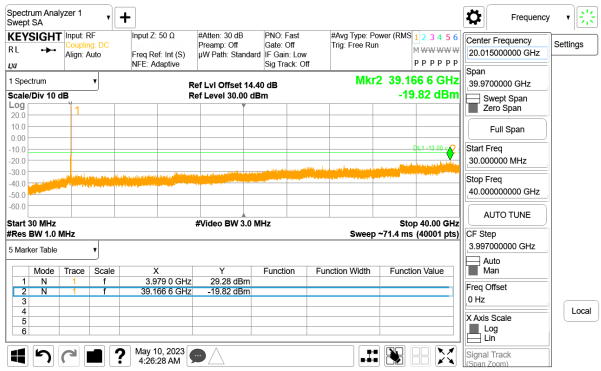
5G NR n77 40MHz BPSK High Channel RB1-105, ID:19210



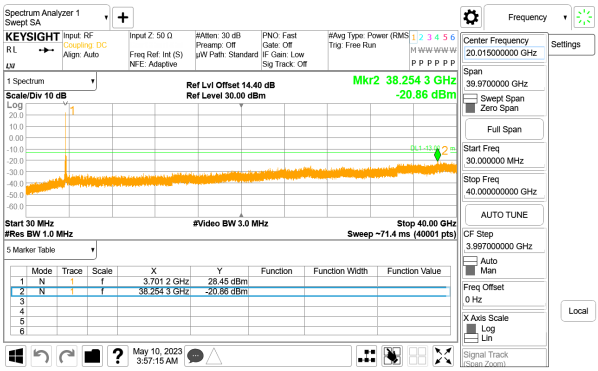
5G NR n77 50MHz BPSK Middle Channel RB1-0, ID:19210



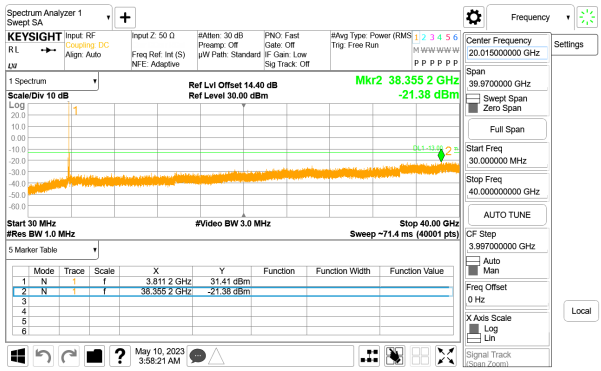
5G NR n77 50MHz BPSK Middle Channel RB1-1, ID:19210



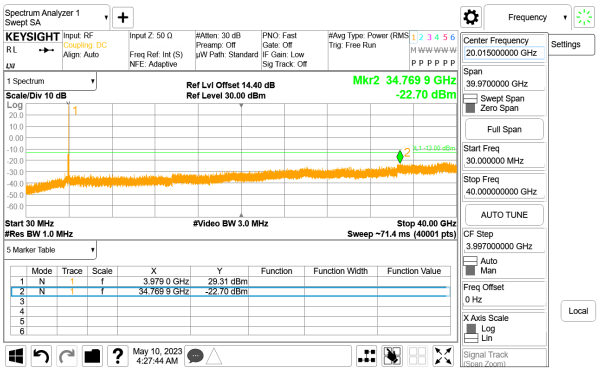
5G NR n77 50MHz BPSK High Channel RB1-132, ID:19210



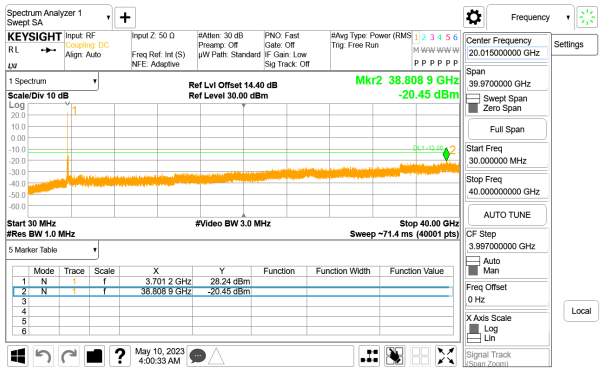
5G NR n77 60MHz BPSK Low Channel RB1-0, ID:19210



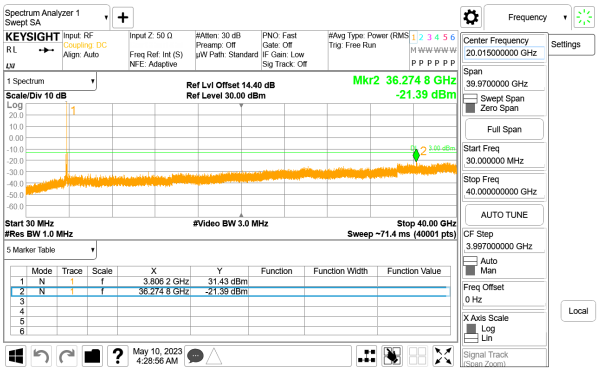
5G NR n77 60MHz BPSK Middle Channel RB1-1, ID:19210



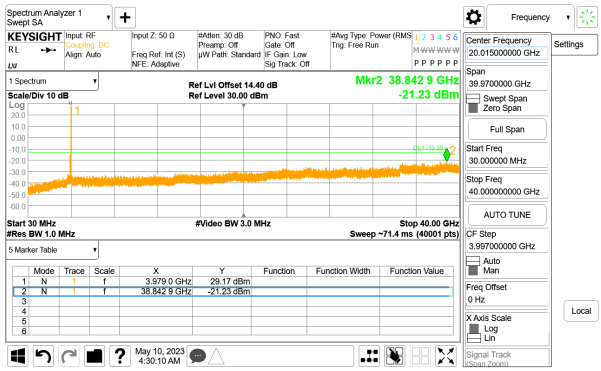
5G NR n77 60MHz BPSK High Channel RB1-161, ID:19210



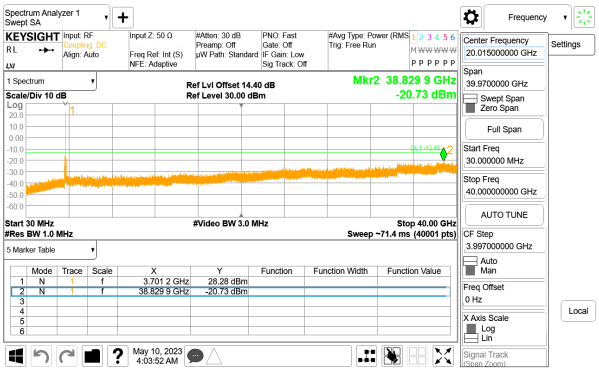
5G NR n77 70MHz BPSK Low Channel RB1-0, ID:19210



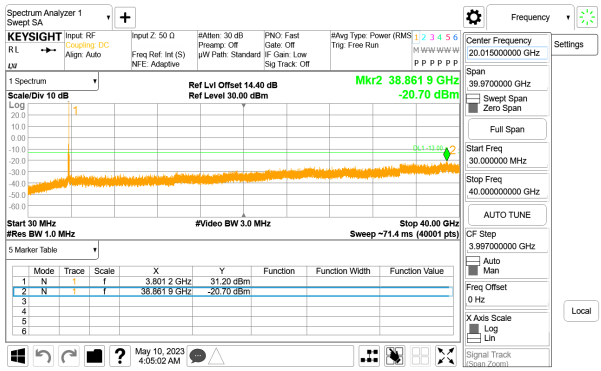
5G NR n77 70MHz BPSK Middle Channel RB1-1, ID:19210



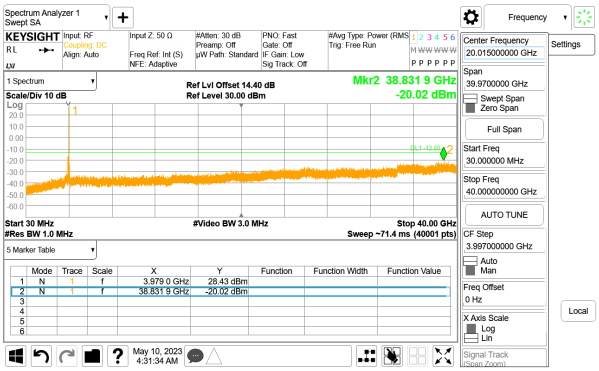
5G NR n77 70MHz BPSK High Channel RB1-188, ID:19210



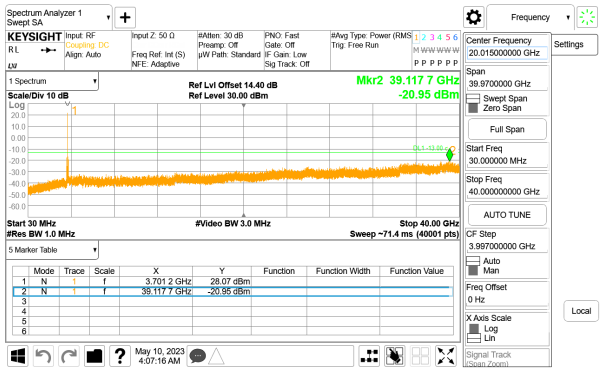
5G NR n77 80MHz BPSK Low Channel RB1-0, ID:19210



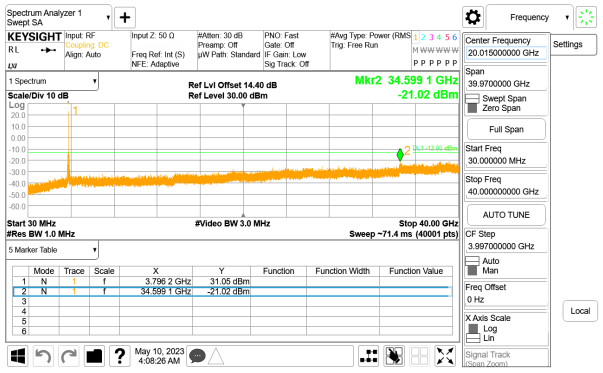
5G NR n77 80MHz BPSK Middle Channel RB1-1, ID:19210



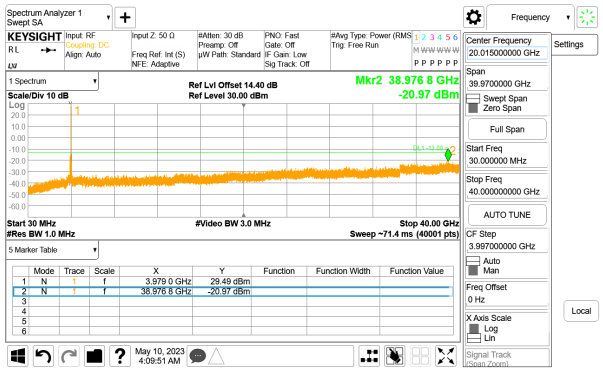
5G NR n77 80MHz BPSK High Channel RB1-216, ID:19210



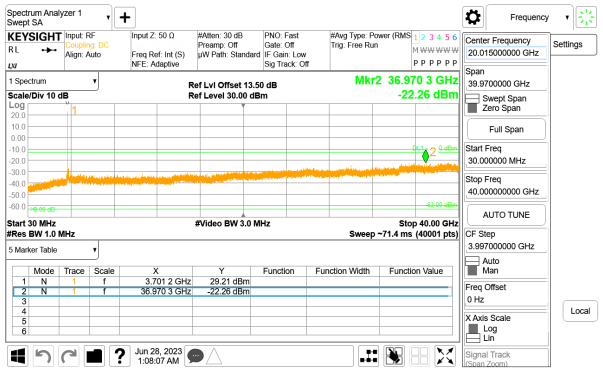
5G NR n77 90MHz BPSK Low Channel RB1-0, ID:19210



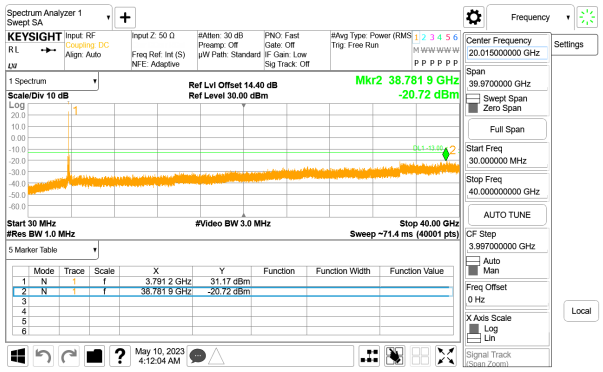
5G NR n77 90MHz BPSK Middle Channel RB1-1, ID:19210



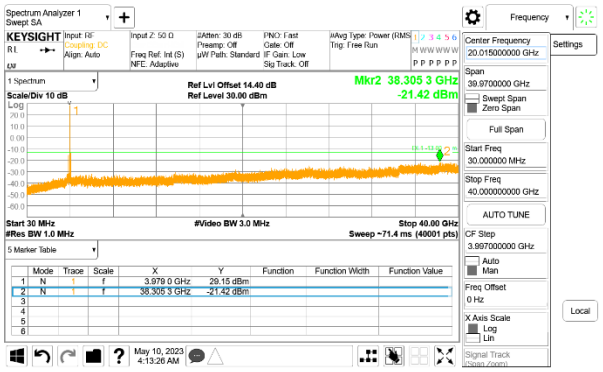
5G NR n77 90MHz BPSK High Channel RB1-244, ID:19210



5G NR n77 100MHz BPSK Low Channel RB1-0, ID:28498



5G NR n77 100MHz BPSK Middle Channel RB1-1, ID:19210



5G NR n77 100MHz BPSK High Channel RB1-272, ID:19210

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, 3.80VDC and High voltage, 4.37VDC.
  End Voltage, 2.90VDC.

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.

LTE BAND 7 QPSK (20MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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	2501.0760	2568.9446			
Extreme (50°C)		2501.0760	2568.9446	0.9	0.000	Yes
Extreme (40°C)		2501.0760	2568.9446	-0.7	0.000	Yes
Extreme (30°C)		2501.0760	2568.9446	-2.2	-0.001	Yes
Extreme (10°C)		2501.0760	2568.9446	1.0	0.000	Yes
Extreme (0°C)		2501.0760	2568.9446	1.4	0.001	Yes
Extreme (-10°C)		2501.0760	2568.9446	1.9	0.001	Yes
Extreme (-20°C)		2501.0760	2568.9446	2.2	0.001	Yes
Extreme (-30°C)		2501.0760	2568.9446	3.1	0.001	Yes
20°C	15%	2501.0760	2568.9446	1.5	0.001	Yes
	-15%	2501.0760	2568.9446	2.3	0.001	Yes
	End Point Voltage	2501.0760	2568.9446	3.2	0.001	Yes

5G NR n7 BPSK (40MHz 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)		2499.5100	2570.5100			
Extreme (50°C)		2499.5100	2570.5100	-4.13	-0.002	Yes
Extreme (40°C)		2499.5100	2570.5100	-6.2	-0.002	Yes
Extreme (30°C)		2499.5100	2570.5100	-2.18	-0.001	Yes
Extreme (10°C)	Normal	2499.5100	2570.5100	-5.71	-0.002	Yes
Extreme (0°C)		2499.5100	2570.5100	-5.24	-0.002	Yes
Extreme (-10°C)		2499.5100	2570.5100	-4.31	-0.002	Yes
Extreme (-20°C)		2499.5100	2570.5100	-11.06	-0.004	Yes
Extreme (-30°C)		2499.5100	2570.5100	-6.31	-0.002	Yes
20°C	15%	2499.5100	2570.5100	4.16	0.002	Yes
	-15%	2499.5100	2570.5100	-2.29	-0.001	Yes
	End Point Voltage	2499.5100	2570.5100	2.82	0.001	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.

LTE BAND 12 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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)	Normal	699.6995	715.4790			
Extreme (50°C)		699.2650	715.7350	-0.5	-0.001	Yes
Extreme (40°C)		699.2650	715.7350	0.4	0.001	Yes
Extreme (30°C)		699.2650	715.7350	0.7	0.001	Yes
Extreme (10°C)		699.2650	715.7350	1.2	0.002	Yes
Extreme (0°C)		699.2650	715.7350	0.6	0.001	Yes
Extreme (-10°C)		699.2650	715.7350	0.4	0.001	Yes
Extreme (-20°C)		699.2650	715.7350	1.2	0.002	Yes
Extreme (-30°C)		699.2650	715.7350	1.5	0.002	Yes
20°C	15%	699.2650	715.7350	1.5	0.002	Yes
	-15%	699.2650	715.7350	2.5	0.004	Yes
	End Point Voltage	699.2650	715.7350	3.0	0.004	Yes

5G NR n12 BPSK (15MHz 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)	Normal	699.2288	715.0313			
Extreme (50°C)		699.2287	715.0312	-1.52	-0.002	Yes
Extreme (40°C)		699.2288	715.0313	1.61	0.002	Yes
Extreme (30°C)		699.2288	715.0313	1.65	0.002	Yes
Extreme (10°C)		699.2288	715.0313	2.94	0.004	Yes
Extreme (0°C)		699.2288	715.0313	1.78	0.003	Yes
Extreme (-10°C)		699.2288	715.0313	1.75	0.002	Yes
Extreme (-20°C)		699.2288	715.0313	2.32	0.003	Yes
Extreme (-30°C)		699.2287	715.0312	-2.02	-0.003	Yes
20°C	15%	699.2288	715.0313	1.67	0.002	Yes
	-15%	699.2288	715.0313	3.1	0.004	Yes
	End Point Voltage	699.2288	715.0313	2.66	0.004	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.

LTE BAND 13 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

Band	13	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		777	787			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	777.5265	786.4780			
Extreme (50°C)		777.5265	786.4780	0.7	0.001	Yes
Extreme (40°C)		777.5265	786.4780	1.2	0.002	Yes
Extreme (30°C)		777.5265	786.4780	2.4	0.003	Yes
Extreme (10°C)		777.5265	786.4780	2.7	0.003	Yes
Extreme (0°C)		777.5265	786.4780	2.2	0.003	Yes
Extreme (-10°C)		777.5265	786.4780	1.2	0.002	Yes
Extreme (-20°C)		777.5265	786.4780	1.7	0.002	Yes
Extreme (-30°C)		777.5265	786.4780	2.1	0.003	Yes
20°C	15%	777.5265	786.4780	3.5	0.004	Yes
	-15%	777.5265	786.4780	4.2	0.005	Yes
	End Point Voltage	777.5265	786.4780	2.7	0.003	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.

LTE BAND 14 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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	788.5131	797.4725			
Extreme (50°C)		788.5131	797.4725	0.6	0.001	Yes
Extreme (40°C)		788.5131	797.4725	1.2	0.002	Yes
Extreme (30°C)		788.5131	797.4725	2.9	0.004	Yes
Extreme (10°C)		788.5131	797.4725	3.2	0.004	Yes
Extreme (0°C)		788.5131	797.4725	1.9	0.002	Yes
Extreme (-10°C)		788.5131	797.4725	1.2	0.002	Yes
Extreme (-20°C)		788.5131	797.4725	0.1	0.000	Yes
Extreme (-30°C)		788.5131	797.4725	1.1	0.001	Yes
20°C	15%	788.5131	797.4725	2.4	0.003	Yes
	-15%	788.5131	797.4725	2.7	0.003	Yes
	End Point Voltage	788.5131	797.4725	1.9	0.002	Yes

5G NR n14 BPSK (10MHz BANDWIDTH)

Band	14	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		788	798			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	788.3470	797.2785			
Extreme (50°C)		788.3470	797.2785	3.06	0.004	Yes
Extreme (40°C)		788.3470	797.2785	1.62	0.002	Yes
Extreme (30°C)		788.3470	797.2785	1.95	0.002	Yes
Extreme (10°C)		788.3470	797.2785	-1.87	-0.002	Yes
Extreme (0°C)		788.3470	797.2785	2.46	0.003	Yes
Extreme (-10°C)		788.3470	797.2785	-1.71	-0.002	Yes
Extreme (-20°C)		788.3470	797.2785	3.2	0.004	Yes
Extreme (-30°C)		788.3470	797.2785	1.29	0.002	Yes
20°C	15%	788.3470	797.2785	-1.33	-0.002	Yes
	-15%	788.3470	797.2785	1.31	0.002	Yes
	End Point Voltage	788.3470	797.2785	1.56	0.002	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.

LTE BAND 17 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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)	Normal	704.5166	715.4771			
Extreme (50°C)		704.5166	715.4771	0.5	0.001	Yes
Extreme (40°C)		704.5166	715.4771	-0.3	0.000	Yes
Extreme (30°C)		704.5166	715.4771	-1.0	-0.001	Yes
Extreme (10°C)		704.5166	715.4771	-2.1	-0.003	Yes
Extreme (0°C)		704.5166	715.4771	1.9	0.003	Yes
Extreme (-10°C)		704.5166	715.4771	0.4	0.001	Yes
Extreme (-20°C)		704.5166	715.4771	0.6	0.001	Yes
Extreme (-30°C)		704.5166	715.4771	0.5	0.001	Yes
20°C	15%	704.5166	715.4771	-1.5	-0.002	Yes
	-15%	704.5166	715.4771	-1.0	-0.001	Yes
	End Point Voltage	704.5166	715.4771	-2.6	-0.004	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.

LTE BAND 25 QPSK (20MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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	1851.0629	1913.9315			
Extreme (50°C)		1851.0629	1913.9315	-1.4	-0.001	Yes
Extreme (40°C)		1851.0629	1913.9315	-1.3	-0.001	Yes
Extreme (30°C)		1851.0629	1913.9315	2.1	0.001	Yes
Extreme (10°C)		1851.0629	1913.9315	2.4	0.001	Yes
Extreme (0°C)		1851.0629	1913.9315	1.7	0.001	Yes
Extreme (-10°C)		1851.0629	1913.9315	0.3	0.000	Yes
Extreme (-20°C)		1851.0629	1913.9315	-0.2	0.000	Yes
Extreme (-30°C)		1851.0629	1913.9315	0.4	0.000	Yes
20°C	15%	1851.0629	1913.9315	2.9	0.002	Yes
	-15%	1851.0629	1913.9315	3.2	0.002	Yes
	End Point Voltage	1851.0629	1913.9315	2.5	0.001	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	1850.1300	1914.8300			
Extreme (50°C)		1850.1300	1914.8300	3.07	0.002	Yes
Extreme (40°C)		1850.1300	1914.8300	-4.28	-0.002	Yes
Extreme (30°C)		1850.1300	1914.8300	-7.25	-0.004	Yes
Extreme (10°C)		1850.1300	1914.8300	4.54	0.002	Yes
Extreme (0°C)		1850.1300	1914.8300	1.73	0.001	Yes
Extreme (-10°C)		1850.1300	1914.8300	1.99	0.001	Yes
Extreme (-20°C)		1850.1300	1914.8300	1.38	0.001	Yes
Extreme (-30°C)		1850.1300	1914.8300	-3.66	-0.002	Yes
20°C	15%	1850.1300	1914.8300	3.07	0.002	Yes
	-15%	1850.1300	1914.8300	-5.86	-0.003	Yes
	End Point Voltage	1850.1300	1914.8300	-1.29	-0.001	Yes

9.4.7. LTE BAND 26 AND 5G NR n26 (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.

LTE BAND 26 QPSK (5MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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	814.5255	823.7675			
Extreme (50°C)		814.2725	823.7675	-0.5	-0.001	Yes
Extreme (40°C)		814.2725	823.7675	0.7	0.001	Yes
Extreme (30°C)		814.2725	823.7675	1.3	0.002	Yes
Extreme (10°C)		814.2725	823.7675	1.8	0.002	Yes
Extreme (0°C)		814.2725	823.7675	1.4	0.002	Yes
Extreme (-10°C)		814.2725	823.7675	1.6	0.002	Yes
Extreme (-20°C)		814.2725	823.7675	0.5	0.001	Yes
Extreme (-30°C)		814.2725	823.7675	0.7	0.001	Yes
20°C	15%	814.2725	823.7675	1.2	0.001	Yes
	-15%	814.2725	823.7675	2.6	0.003	Yes
	End Point Voltage	814.2725	823.7675	3.0	0.004	Yes

5G NR n26 Part 90sBPSK (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	814.1025	823.5325			
Extreme (50°C)		814.1025	823.5325	-1.42	-0.002	Yes
Extreme (40°C)		814.1025	823.5325	-2.72	-0.003	Yes
Extreme (30°C)		814.1025	823.5325	-2.93	-0.004	Yes
Extreme (10°C)		814.1025	823.5325	-4.58	-0.006	Yes
Extreme (0°C)		814.1025	823.5325	-2.44	-0.003	Yes
Extreme (-10°C)		814.1025	823.5325	-1.19	-0.001	Yes
Extreme (-20°C)		814.1025	823.5325	-1.38	-0.002	Yes
Extreme (-30°C)		814.1025	823.5325	-2.09	-0.003	Yes
20°C	15%	814.1025	823.5325	-2.36	-0.003	Yes
	-15%	814.1025	823.5325	-1.98	-0.002	Yes
	End Point Voltage	814.1025	823.5325	-2.12	-0.003	Yes

9.4.8. LTE BAND 26 AND 5G NR n26(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.

LTE BAND 26 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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)		824.5201	848.4749			
Extreme (50°C)		824.5201	848.4749	7.0	0.008	Yes
Extreme (40°C)		824.5201	848.4749	1.4	0.002	Yes
Extreme (30°C)		824.5201	848.4749	0.9	0.001	Yes
Extreme (10°C)	Normal	824.5201	848.4749	0.2	0.000	Yes
Extreme (0°C)		824.5201	848.4749	1.3	0.002	Yes
Extreme (-10°C)		824.5201	848.4749	1.8	0.002	Yes
Extreme (-20°C)		824.5201	848.4749	0.6	0.001	Yes
Extreme (-30°C)		824.5201	848.4749	0.8	0.001	Yes
20°C	15%	824.5201	848.4749	1.0	0.001	Yes
	-15%	824.5201	848.4749	0.7	0.001	Yes
	End Point Voltage	824.5201	848.4749	1.4	0.002	Yes

5G NR n26 Part 22 BPSK (20MHz BANDWIDTH)

Band	22	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		824	849			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	824.0900	848.5300			
Extreme (50°C)		824.0900	848.5300	1.13	0.001	Yes
Extreme (40°C)		824.0900	848.5300	4.03	0.005	Yes
Extreme (30°C)		824.0900	848.5300	2.52	0.003	Yes
Extreme (10°C)		824.0900	848.5300	2.47	0.003	Yes
Extreme (0°C)		824.0900	848.5300	1.89	0.002	Yes
Extreme (-10°C)		824.0900	848.5300	3.94	0.005	Yes
Extreme (-20°C)		824.0900	848.5300	2.54	0.003	Yes
Extreme (-30°C)		824.0900	848.5300	2.02	0.002	Yes
20°C	15%	824.0900	848.5300	-4.82	-0.006	Yes
	-15%	824.0900	848.5300	-1.48	-0.002	Yes
	End Point Voltage	824.0900	848.5300	-1.42	-0.002	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.

LTE BAND 30 QPSK (10MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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)	Normal	2305.5223	2314.4695			
Extreme (50°C)		2305.5223	2314.4695	0.2	0.000	Yes
Extreme (40°C)		2305.5223	2314.4695	1.1	0.000	Yes
Extreme (30°C)		2305.5223	2314.4695	2.8	0.001	Yes
Extreme (10°C)		2305.5223	2314.4695	3.1	0.001	Yes
Extreme (0°C)		2305.5223	2314.4695	0.1	0.000	Yes
Extreme (-10°C)		2305.5223	2314.4695	0.3	0.000	Yes
Extreme (-20°C)		2305.5223	2314.4695	0.2	0.000	Yes
Extreme (-30°C)		2305.5223	2314.4695	-0.4	0.000	Yes
20°C	15%	2305.5223	2314.4695	3.5	0.002	Yes
	-15%	2305.5223	2314.4695	2.7	0.001	Yes
	End Point Voltage	2305.5223	2314.4695	4.0	0.002	Yes

5G NR n30 BPSK (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)		2305.2050	2314.4125			
Extreme (50°C)		2305.2050	2314.4125	-1.65	-0.001	Yes
Extreme (40°C)		2305.2050	2314.4125	-2.52	-0.001	Yes
Extreme (30°C)		2305.2050	2314.4125	-4.01	-0.002	Yes
Extreme (10°C)	Normal	2305.2050	2314.4125	-9.44	-0.004	Yes
Extreme (0°C)		2305.2050	2314.4125	-6.3	-0.003	Yes
Extreme (-10°C)		2305.2050	2314.4125	-5.27	-0.002	Yes
Extreme (-20°C)		2305.2050	2314.4125	-4.78	-0.002	Yes
Extreme (-30°C)		2305.2050	2314.4125	-6.89	-0.003	Yes
20°C	15%	2305.2050	2314.4125	-4.56	-0.002	Yes
	-15%	2305.2050	2314.4125	-2.14	-0.001	Yes
	End Point Voltage	2305.2050	2314.4125	-7.13	-0.003	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.

LTE BAND 41 QPSK (20MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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	2497.0577	2688.9720			
Extreme (50°C)		2497.0577	2688.9720	-0.8	0.000	Yes
Extreme (40°C)		2497.0577	2688.9720	-1.4	-0.001	Yes
Extreme (30°C)		2497.0577	2688.9720	-2.1	-0.001	Yes
Extreme (10°C)		2497.0577	2688.9720	-3.1	-0.001	Yes
Extreme (0°C)		2497.0577	2688.9720	-2.2	-0.001	Yes
Extreme (-10°C)		2497.0577	2688.9720	-3.1	-0.001	Yes
Extreme (-20°C)		2497.0577	2688.9720	-4.0	-0.002	Yes
Extreme (-30°C)		2497.0577	2688.9720	-3.3	-0.001	Yes
20°C	15%	2497.0577	2688.9720	-4.0	-0.002	Yes
	-15%	2497.0577	2688.9720	-3.5	-0.001	Yes
	End Point Voltage	2497.0577	2688.9720	-2.0	-0.001	Yes

5G NR n41FCC BPSK (100MHz BANDWIDTH)

Band	41	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2496	2690		0	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	2495.9000	2689.1250			
Extreme (50°C)		2495.9000	2689.1250	-4.52	-0.002	Yes
Extreme (40°C)		2495.9000	2689.1250	-9.06	-0.003	Yes
Extreme (30°C)		2495.9000	2689.1250	-9.72	-0.004	Yes
Extreme (10°C)		2495.9000	2689.1250	-11.1	-0.004	Yes
Extreme (0°C)		2495.9000	2689.1250	-1.34	-0.001	Yes
Extreme (-10°C)		2495.9000	2689.1250	-8.31	-0.003	Yes
Extreme (-20°C)		2495.9000	2689.1250	-9.5	-0.004	Yes
Extreme (-30°C)		2495.9000	2689.1250	-5.46	-0.002	Yes
20°C	15%	2495.9000	2689.1250	-6.29	-0.002	Yes
	-15%	2495.9000	2689.1250	-6.52	-0.003	Yes
	End Point Voltage	2495.9000	2689.1250	-8.2	-0.003	Yes

9.4.11. LTE BAND 48 AND 5G NR n48

LTE BAND 48 QPSK (20MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

Band	48	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3550	3700			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)		3550.9922	3698.9142			
Extreme (50°C)		3550.9922	3698.9142	0.7	0.000	Yes
Extreme (40°C)		3550.9922	3698.9142	-1.2	0.000	Yes
Extreme (30°C)		3550.9922	3698.9142	-2.2	-0.001	Yes
Extreme (10°C)	Normal	3550.9922	3698.9142	-3.7	-0.001	Yes
Extreme (0°C)		3550.9922	3698.9142	-1.8	0.000	Yes
Extreme (-10°C)		3550.9922	3698.9142	-5.3	-0.001	Yes
Extreme (-20°C)		3550.9922	3698.9142	-4.0	-0.001	Yes
Extreme (-30°C)		3550.9922	3698.9142	-4.2	-0.001	Yes
20°C	15%	3550.9922	3698.9142	-4.5	-0.001	Yes
	-15%	3550.9922	3698.9142	-6.0	-0.002	Yes
	End Point Voltage	3550.9922	3698.9142	-5.4	-0.001	Yes

5G NR BAND 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)		3549.7900	3698.0300			
Extreme (50°C)		3549.7900	3698.0300	-1.73	0.000	Yes
Extreme (40°C)		3549.7900	3698.0300	-2.53	-0.001	Yes
Extreme (30°C)		3549.7900	3698.0300	-14.34	-0.004	Yes
Extreme (10°C)	Normal	3549.7900	3698.0300	-5.49	-0.002	Yes
Extreme (0°C)		3549.7900	3698.0300	-8.46	-0.002	Yes
Extreme (-10°C)		3549.7900	3698.0300	-4.38	-0.001	Yes
Extreme (-20°C)		3549.7900	3698.0300	-3.39	-0.001	Yes
Extreme (-30°C)		3549.7900	3698.0300	-5.97	-0.002	Yes
20°C	15%	3549.7900	3698.0300	-6.02	-0.002	Yes
	-15%	3549.7900	3698.0300	-10.55	-0.003	Yes
	End Point Voltage	3549.7900	3698.0300	-7.25	-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.

LTE BAND 66 QPSK (20MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

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	1711.0620	1778.9352	-0.4	0.000	Yes
Extreme (50°C)		1711.0620	1778.9352	1.0	0.001	Yes
Extreme (40°C)		1711.0620	1778.9352	2.1	0.001	Yes
Extreme (30°C)		1711.0620	1778.9352	3.3	0.002	Yes
Extreme (10°C)		1711.0620	1778.9352	0.7	0.000	Yes
Extreme (0°C)		1711.0620	1778.9352	0.9	0.001	Yes
Extreme (-10°C)		1711.0620	1778.9352	1.1	0.001	Yes
Extreme (-20°C)		1711.0620	1778.9352	0.8	0.000	Yes
Extreme (-30°C)		1711.0620	1778.9352	4.0	0.002	Yes
20°C	15%	1711.0620	1778.9352	3.5	0.002	Yes
	-15%	1711.0620	1778.9352	3.3	0.002	Yes
	End Point Voltage	1711.0620	1778.9352			

5G NR n66 BPSK (40MHz 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	1709.4500	1780.4900			
Extreme (50°C)		1709.4500	1780.4900	-8.24	-0.005	Yes
Extreme (40°C)		1709.4500	1780.4900	-3.91	-0.002	Yes
Extreme (30°C)		1709.4500	1780.4900	-2.21	-0.001	Yes
Extreme (10°C)		1709.4500	1780.4900	-1.72	-0.001	Yes
Extreme (0°C)		1709.4500	1780.4900	-5.63	-0.003	Yes
Extreme (-10°C)		1709.4500	1780.4900	1.24	0.001	Yes
Extreme (-20°C)		1709.4500	1780.4900	-4.23	-0.002	Yes
Extreme (-30°C)		1709.4500	1780.4900	-3.34	-0.002	Yes
20°C	15%	1709.4500	1780.4900	-7.44	-0.004	Yes
	-15%	1709.4500	1780.4900	-4.61	-0.003	Yes
	End Point Voltage	1709.4500	1780.4900	-1.47	-0.001	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.

5G NR n70 BPSK (15MHz BANDWIDTH)

Test Engineer ID:	27342	Test Date:	6/17/2023

Band	70	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1695	1710			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	1694.6550	1709.5950			
Extreme (50°C)		1694.6550	1709.5950	-3.16	-0.002	Yes
Extreme (40°C)		1694.6550	1709.5950	4.36	0.003	Yes
Extreme (30°C)		1694.6550	1709.5950	2.01	0.001	Yes
Extreme (10°C)		1694.6550	1709.5950	-4.21	-0.002	Yes
Extreme (0°C)		1694.6550	1709.5950	-1.96	-0.001	Yes
Extreme (-10°C)		1694.6550	1709.5950	-3.26	-0.002	Yes
Extreme (-20°C)		1694.6550	1709.5950	-5.75	-0.003	Yes
Extreme (-30°C)		1694.6550	1709.5950	-3.62	-0.002	Yes
20°C	15%	1694.6550	1709.5950	-4.05	-0.002	Yes
	-15%	1694.6550	1709.5950	-6.95	-0.004	Yes
	End Point Voltage	1694.6550	1709.5950	-3.7	-0.002	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.

LTE BAND 71 QPSK (20MHz BANDWIDTH)

Test Engineer ID:	39004	Test Date:	5/8/2023

Band	71	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		663	698			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)		664.0534	696.9382			
Extreme (50°C)		664.0534	696.9382	-0.3	0.000	Yes
Extreme (40°C)		664.0534	696.9382	-0.7	-0.001	Yes
Extreme (30°C)		664.0534	696.9382	-1.3	-0.002	Yes
Extreme (10°C)	Normal	664.0534	696.9382	-2.5	-0.004	Yes
Extreme (0°C)		664.0534	696.9382	0.9	0.001	Yes
Extreme (-10°C)		664.0534	696.9382	0.5	0.001	Yes
Extreme (-20°C)		664.0534	696.9382	0.7	0.001	Yes
Extreme (-30°C)		664.0534	696.9382	0.5	0.001	Yes
20°C	15%	664.0534	696.9382	-2.0	-0.003	Yes
	-15%	664.0534	696.9382	5.0	0.007	Yes
	End Point Voltage	664.0534	696.9382	1.4	0.002	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	663.1500	696.7600			
Extreme (50°C)		663.1500	696.7600	-6.18	-0.009	Yes
Extreme (40°C)		663.1500	696.7600	-1.57	-0.002	Yes
Extreme (30°C)		663.1500	696.7600	-2.08	-0.003	Yes
Extreme (10°C)		663.1500	696.7600	-1.24	-0.002	Yes
Extreme (0°C)		663.1500	696.7600	1.05	0.002	Yes
Extreme (-10°C)		663.1500	696.7600	1.06	0.002	Yes
Extreme (-20°C)		663.1500	696.7600	-2.65	-0.004	Yes
Extreme (-30°C)		663.1500	696.7600	3.18	0.005	Yes
20°C	15%	663.1500	696.7600	-1.22	-0.002	Yes
	-15%	663.1500	696.7600	1.01	0.001	Yes
	End Point Voltage	663.1500	696.7600	1.03	0.002	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.

5G NR n77a BPSK (100MHz BANDWIDTH)

Test Engineer ID:	273424	Test Date:	6/17/2023

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)	Normal	3449.7000	3549.1000			
Extreme (50°C)		3449.7000	3549.1000	0.77	0.000	Yes
Extreme (40°C)		3449.7000	3549.1000	0.25	0.000	Yes
Extreme (30°C)		3449.7000	3549.1000	0.18	0.000	Yes
Extreme (10°C)		3449.7000	3549.1000	1.23	0.000	Yes
Extreme (0°C)		3449.7000	3549.1000	2.33	0.001	Yes
Extreme (-10°C)		3449.7000	3549.1000	0.5	0.000	Yes
Extreme (-20°C)		3449.7000	3549.1000	0.19	0.000	Yes
Extreme (-30°C)		3449.7000	3549.1000	3.33	0.001	Yes
20°C	15%	3449.7000	3549.1000	1.22	0.000	Yes
	-15%	3449.7000	3549.1000	2.66	0.001	Yes
	End Point Voltage	3449.7000	3549.1000	3.6	0.001	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:	27342	Test Date:	7/21/2023

5G NR n77c 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	3699.7000	3979.1250			
Extreme (50°C)		3699.7000	3979.1250	-7.04	-0.002	Yes
Extreme (40°C)		3699.7000	3979.1250	-8.22	-0.002	Yes
Extreme (30°C)		3699.7000	3979.1250	-5.87	-0.002	Yes
Extreme (10°C)		3699.7000	3979.1250	-9.56	-0.002	Yes
Extreme (0°C)		3699.7000	3979.1250	-8.69	-0.002	Yes
Extreme (-10°C)		3699.7000	3979.1250	-16.04	-0.004	Yes
Extreme (-20°C)		3699.7000	3979.1250	-9.74	-0.003	Yes
Extreme (-30°C)		3699.7000	3979.1250	-14.33	-0.004	Yes
20°C	15%	3699.7000	3979.1250	-14.85	-0.004	Yes
	-15%	3699.7000	3979.1250	7.06	0.002	Yes
	End Point Voltage	3699.7000	3979.1250	-6.7	-0.002	Yes

9.5. PEAK-TO-AVERAGE POWER RATIO

LIMIT

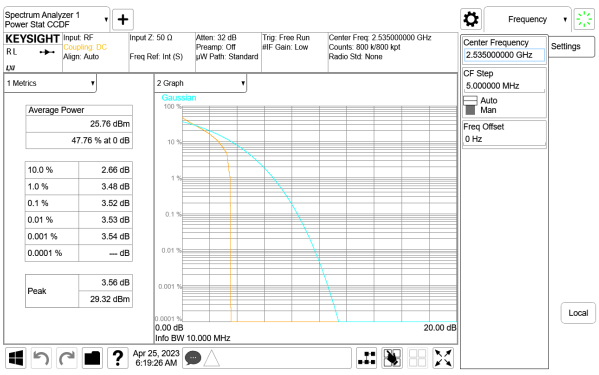
In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

RESULT

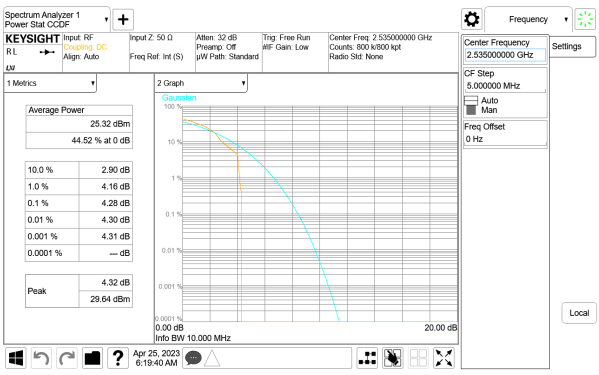
Antenna 1 was used to measure as the worst case; full resource block (FRB) for each bandwidth was used to measure as the worst case. The results from all CCDF measurements are passed with 13dB peak-to-average power ratio criteria.

9.5.1. LTE BAND 7 AND 5G NR n7

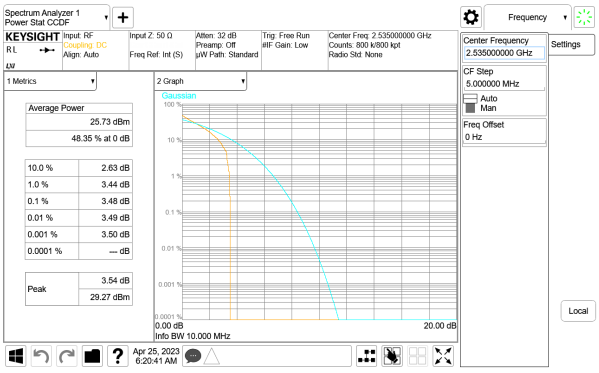
LTE BAND 7



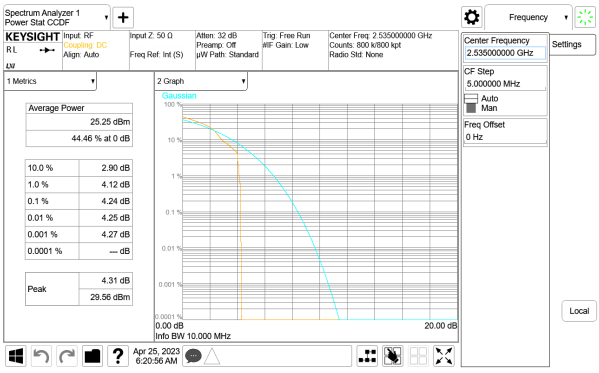
LTE B7 5MHz QPSK Middle Channel, ID:19210



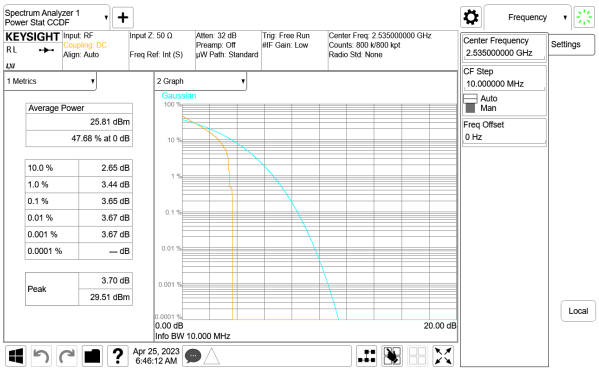
LTE B7 5MHz 16QAM Middle Channel, ID:19210



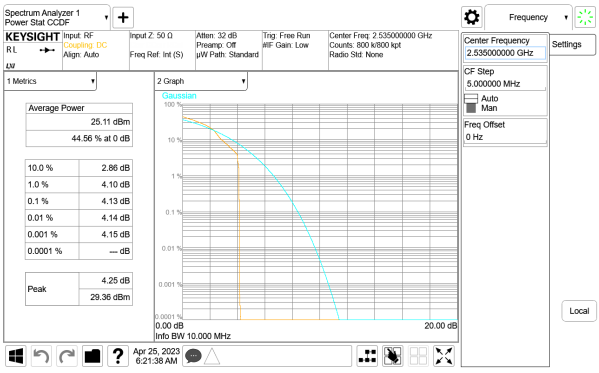
LTE B7 10MHz QPSK Middle Channel, ID:19210



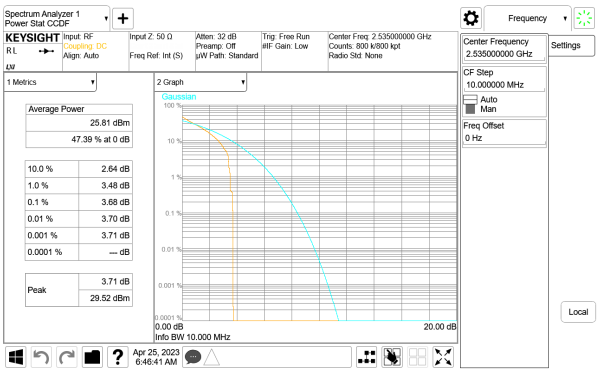
LTE B7 10MHz 16QAM Middle Channel, ID:19210



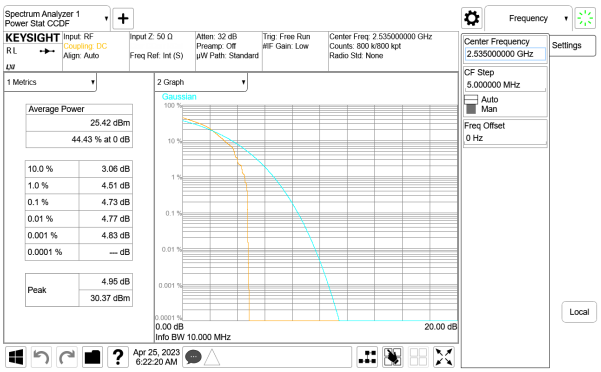
LTE B7 15MHz QPSK Middle Channel, ID:19210



LTE B7 15MHz 16QAM Middle Channel, ID:19210

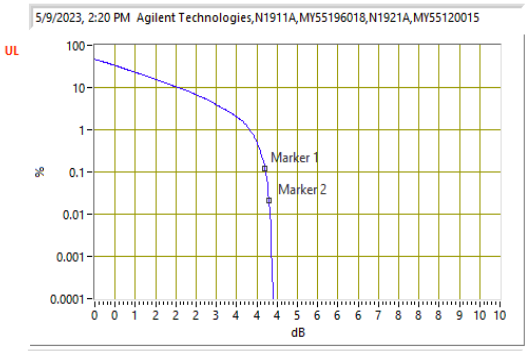


LTE B7 20MHz QPSK Middle Channel, ID:19210

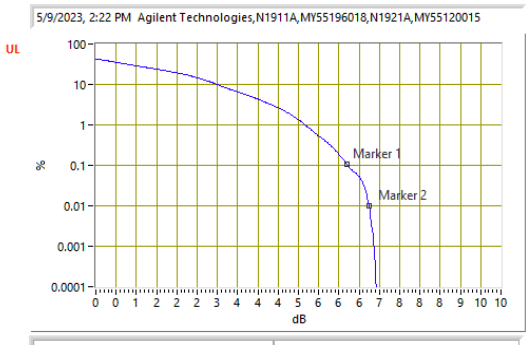


LTE B7 20MHz 16QAM Middle Channel, ID:19210

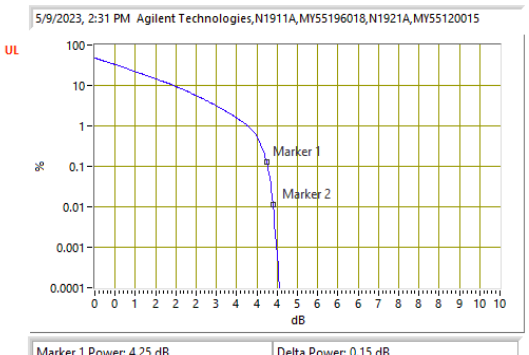
5G NR n7



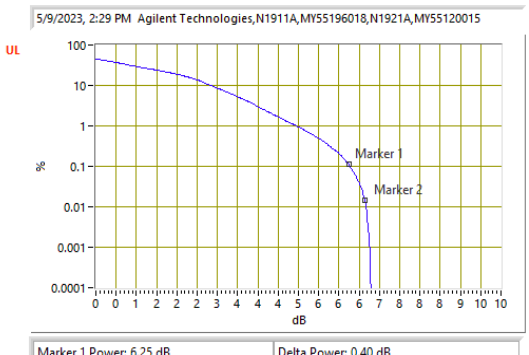
5G NR n7 5MHz BPSK Middle Channel, ID: 19210



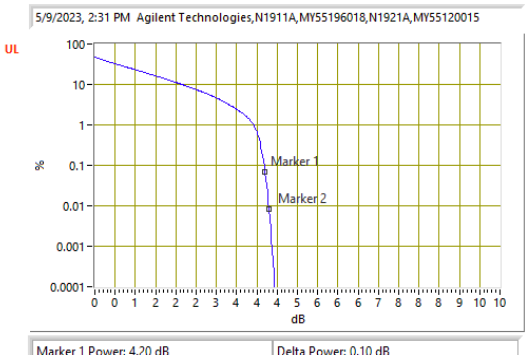
5G NR n7 5MHz 16QAM Middle Channel, ID:19210



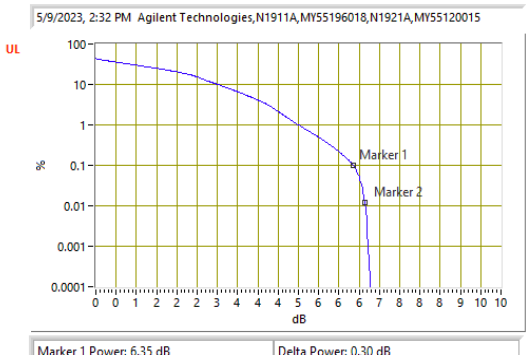
5G NR n7 10MHz BPSK Middle Channel, ID:19210



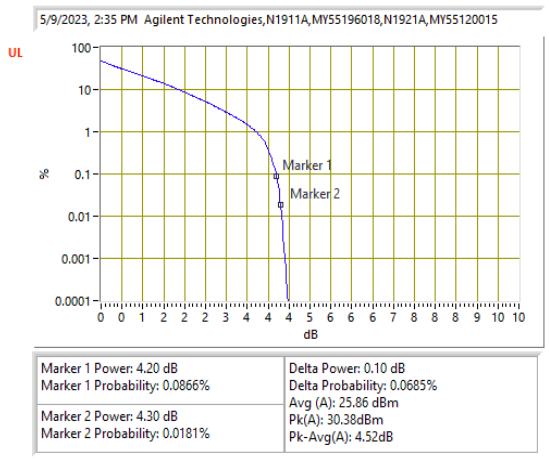
5G NR n7 10MHz 16QAM Middle Channel, ID:19210



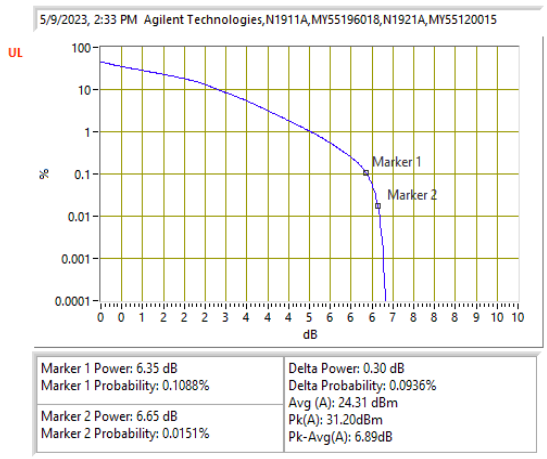
5G NR n7 15MHz BPSK Middle Channel, ID:19210



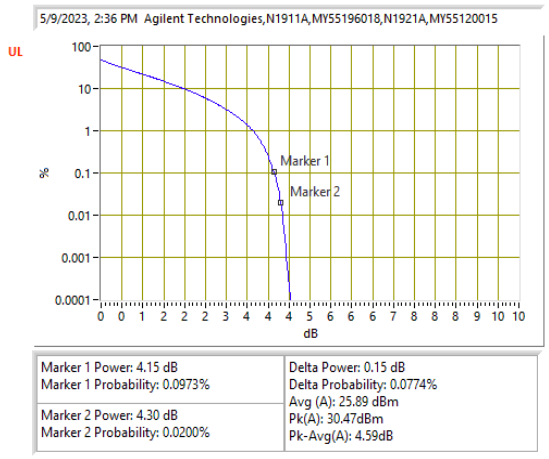
5G NR n7 15MHz 16QAM Middle Channel, ID:19210



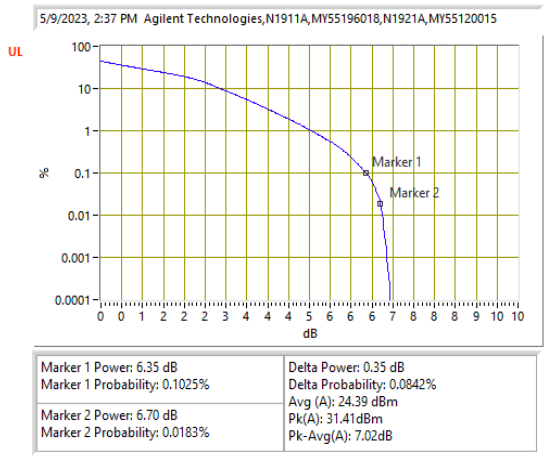
5G NR n7 20MHz BPSK Middle Channel, ID:19210



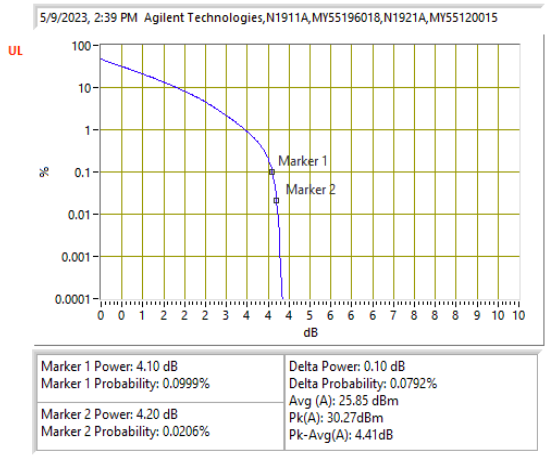
5G NR n7 20MHz 16QAM Middle Channel, ID:19210



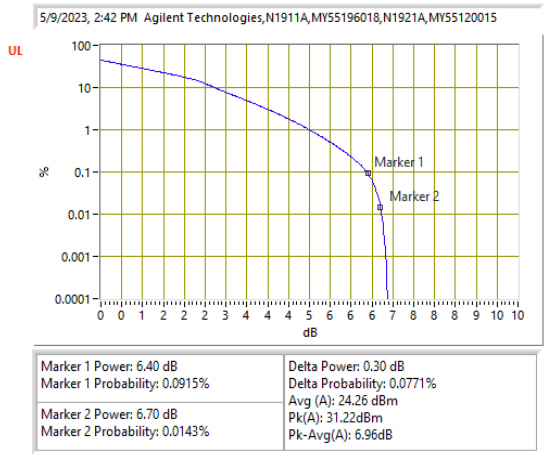
5G NR n7 25MHz BPSK Middle Channel, ID:19210



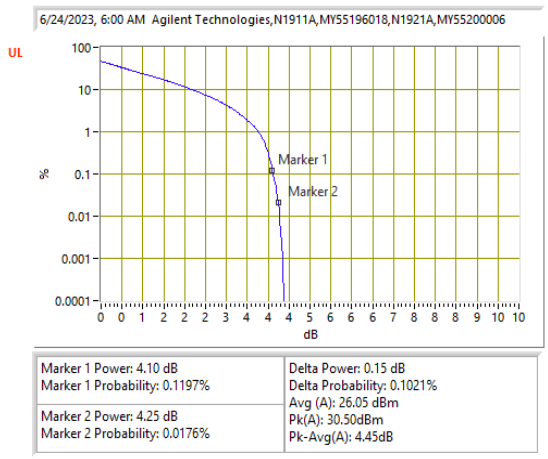
5G NR n7 25MHz 16QAM Middle Channel, ID:19210



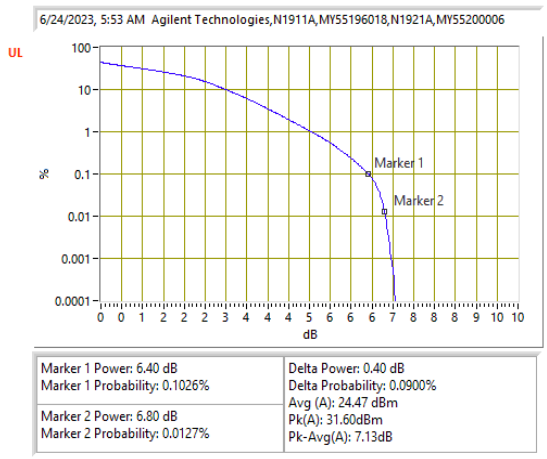
5G NR n7 30MHz BPSK Middle Channel, ID:19210



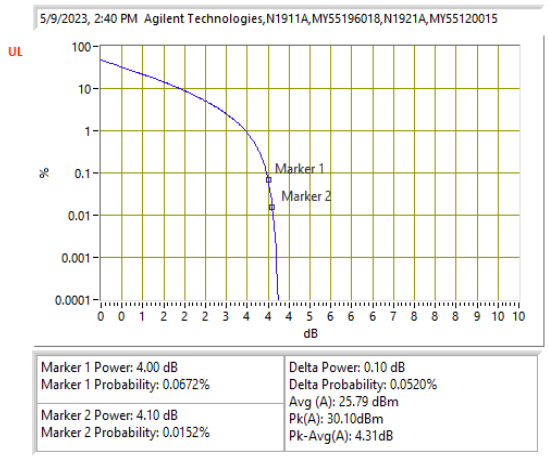
5G NR n7 30MHz 16QAM Middle Channel, ID:19210



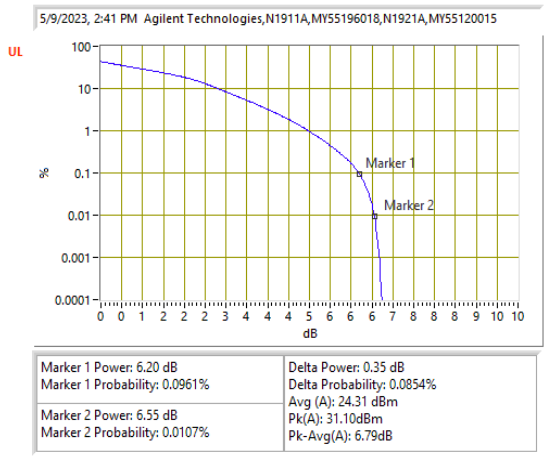
5G NR n7 35MHz BPSK Middle Channel, ID:19210



5G NR n7 35MHz 16QAM Middle Channel, ID:19210



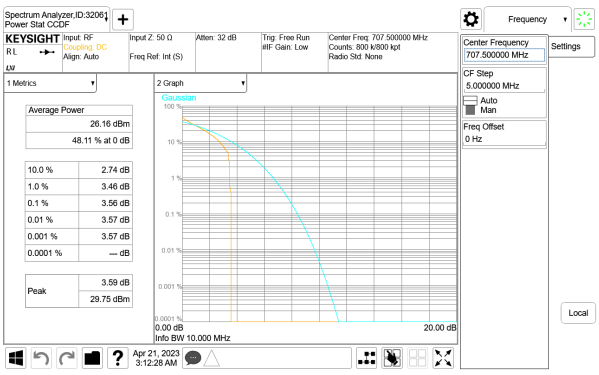
5G NR n7 40MHz BPSK Middle Channel, ID:19210



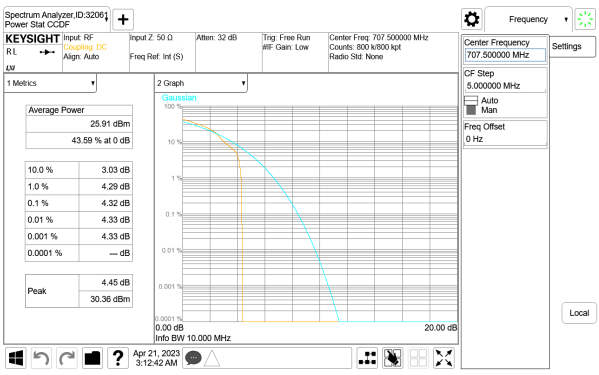
5G NR n7 40MHz 16QAM Middle Channel, ID:19210

9.5.2. LTE BAND 12 AND 5G NR n12

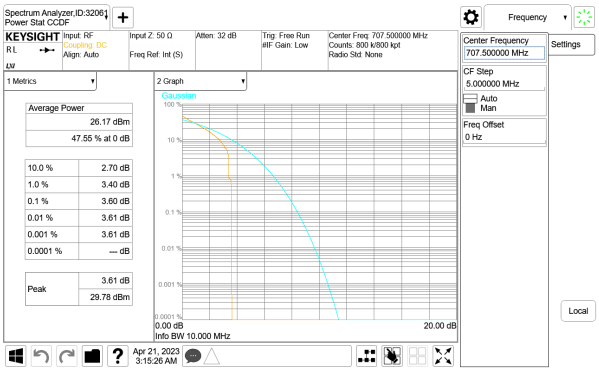
LTE BAND 12



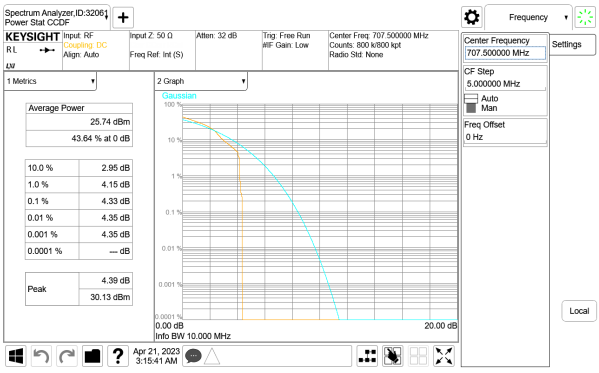
LTE B12 1.4MHz QPSK Middle Channel



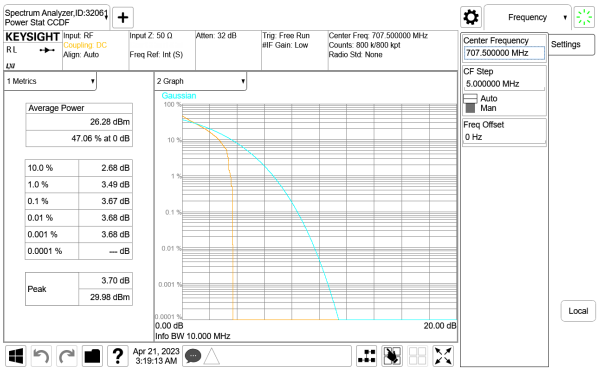
LTE B12 1.4MHz 16QAM Middle Channel



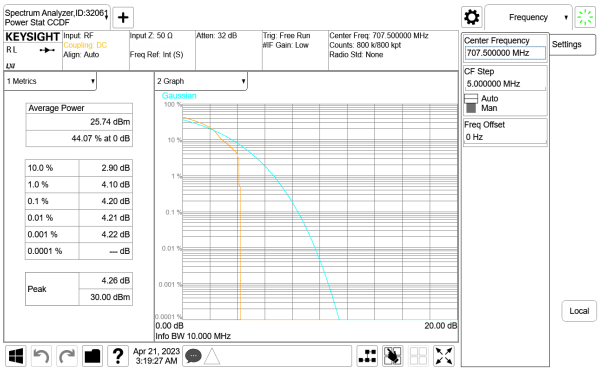
LTE B12 3MHz QPSK Middle Channel



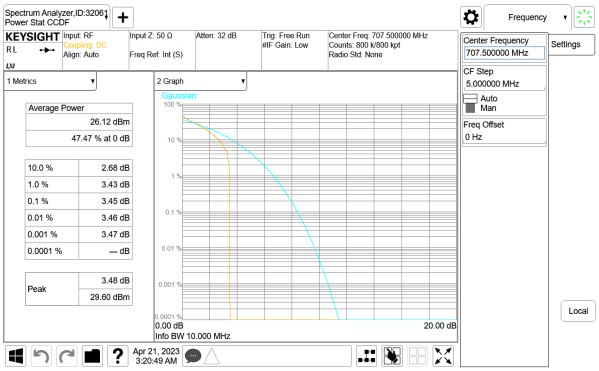
LTE B12 3MHz 16QAM Middle Channel



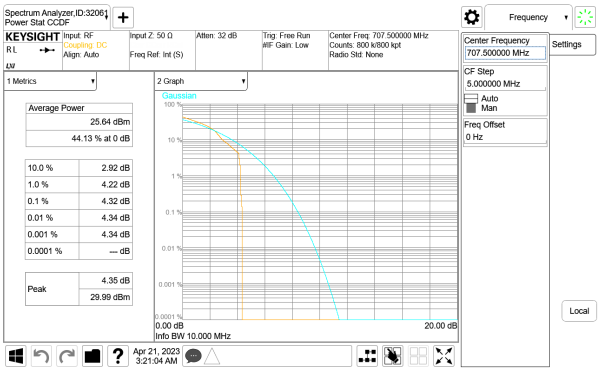
LTE B12 5MHz QPSK Middle Channel



LTE B12 5MHz 16QAM Middle Channel

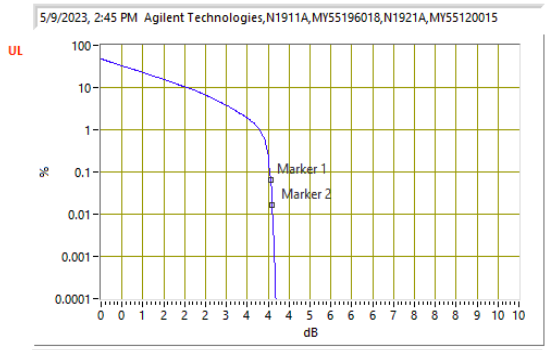


LTE B12 10MHz QPSK Middle Channel



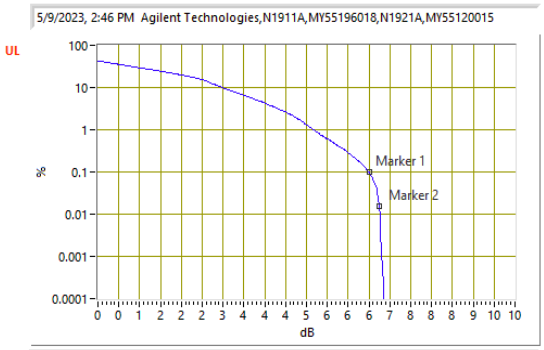
LTE B12 10MHz 16QAM Middle Channel

5G NR n12



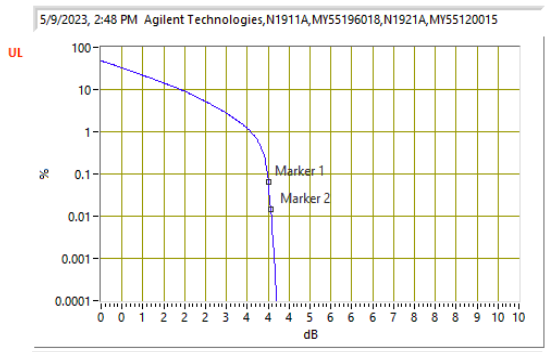
Marker 1 Power: 4.05 dB	Delta Power: 0.05 dB
Marker 1 Probability: 0.0831%	Delta Probability: 0.0663%
	Avg (A): 25.84 dBm
Marker 2 Power: 4.10 dB	Pk(A): 30.04dBm
Marker 2 Probability: 0.0168%	Pk-Avg(A): 4.19dB

5G NR n12 5MHz BPSK Middle Channel, ID: 19210



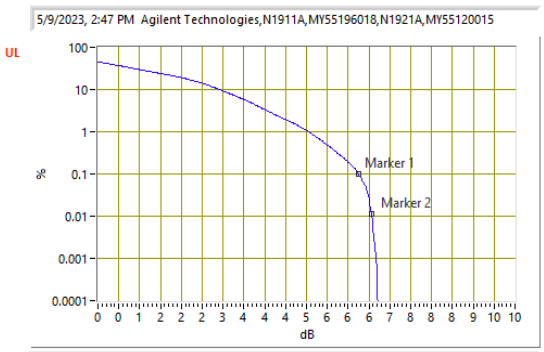
Marker 1 Power: 6.50 dB	Delta Power: 0.25 dB
Marker 1 Probability: 0.0975%	Delta Probability: 0.0854%
	Avg (A): 24.41 dBm
Marker 2 Power: 6.75 dB	Pk(A): 31.34dBm
Marker 2 Probability: 0.0121%	Pk-Avg(A): 6.92dB

5G NR n12 5MHz 16QAM Middle Channel, ID:19210



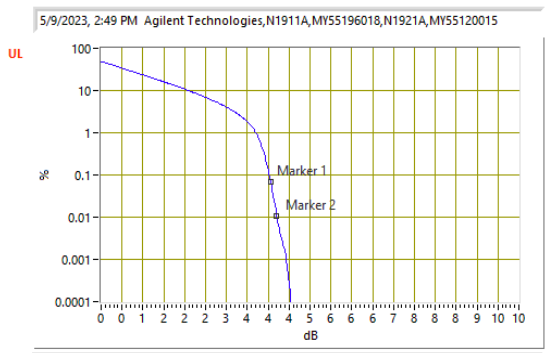
Marker 1 Power: 4.00 dB	Delta Power: 0.05 dB
Marker 1 Probability: 0.0657%	Delta Probability: 0.0474%
	Avg (A): 25.96 dBm
Marker 2 Power: 4.05 dB	Pk(A): 30.19dBm
Marker 2 Probability: 0.0182%	Pk-Avg(A): 4.23dB

5G NR n12 10MHz BPSK Middle Channel, ID:19210



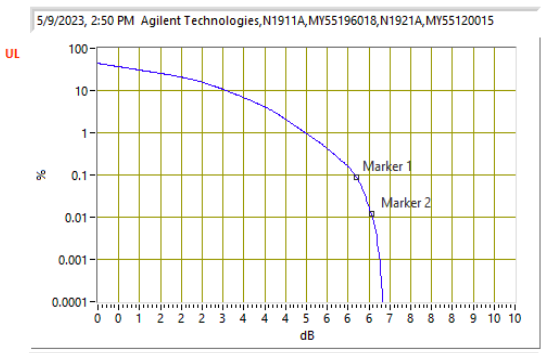
Marker 1 Power: 6.25 dB	Delta Power: 0.30 dB
Marker 1 Probability: 0.0993%	Delta Probability: 0.0862%
	Avg (A): 24.41 dBm
Marker 2 Power: 6.55 dB	Pk(A): 31.16dBm
Marker 2 Probability: 0.0131%	Pk-Avg(A): 6.75dB

5G NR n12 10MHz 16QAM Middle Channel, ID:19210



Marker 1 Power: 4.05 dB	Delta Power: 0.15 dB
Marker 1 Probability: 0.0785%	Delta Probability: 0.0676%
	Avg (A): 26.03 dBm
Marker 2 Power: 4.20 dB	Pk(A): 30.66dBm
Marker 2 Probability: 0.0109%	Pk-Avg(A): 4.63dB

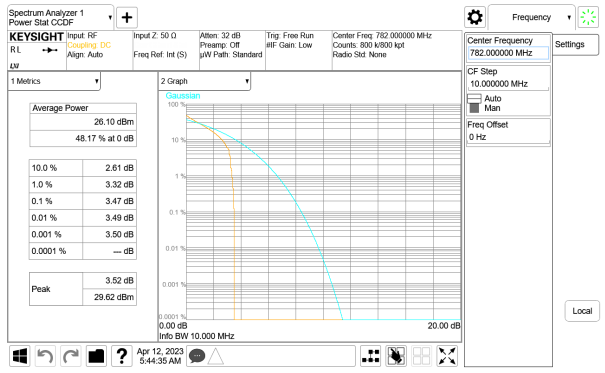
5G NR n12 15MHz BPSK Middle Channel, ID:19210



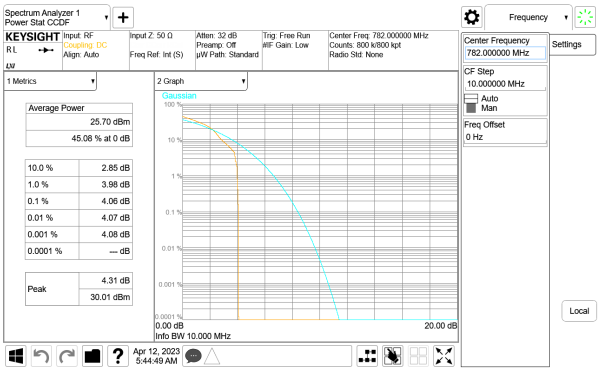
Marker 1 Power: 6.20 dB	Delta Power: 0.35 dB
Marker 1 Probability: 0.0909%	Delta Probability: 0.0782%
	Avg (A): 24.38 dBm
Marker 2 Power: 6.55 dB	Pk(A): 31.24dBm
Marker 2 Probability: 0.0128%	Pk-Avg(A): 6.86dB

5G NR n12 15MHz 16QAM Middle Channel, ID:19210

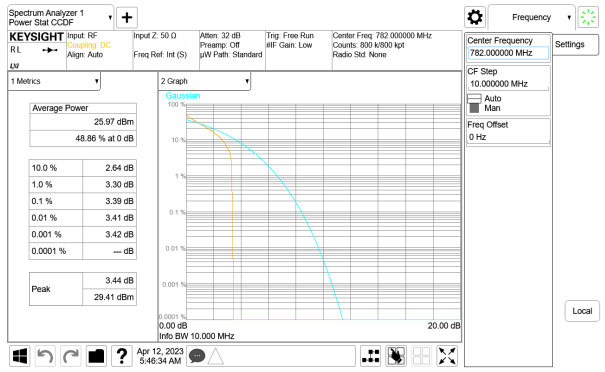
9.5.3. LTE BAND 13



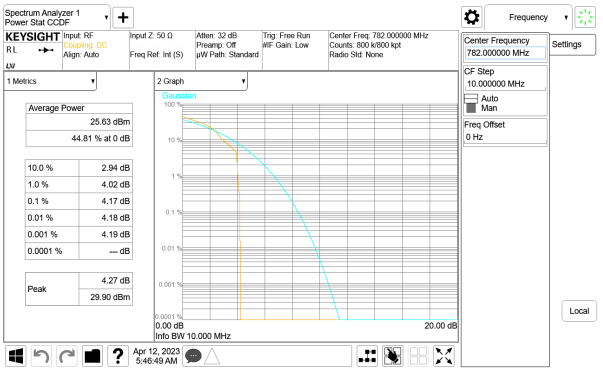
LTE B13 5MHz QPSK Middle Channel ID:28498



LTE B13 5MHz 16QAM Middle Channel, ID:28498



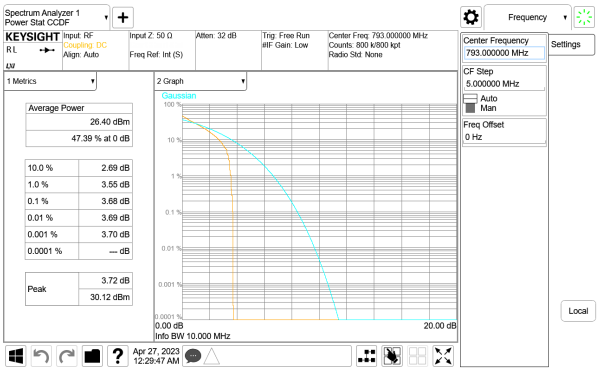
LTE B13 10MHz QPSK Middle Channel ID:28498



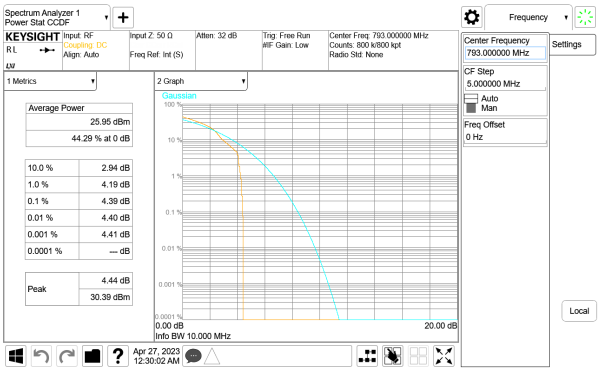
LTE B13 10MHz 16QAM Middle Channel ID:28498

9.5.4. LTE BAND 14 AND 5G NR n14

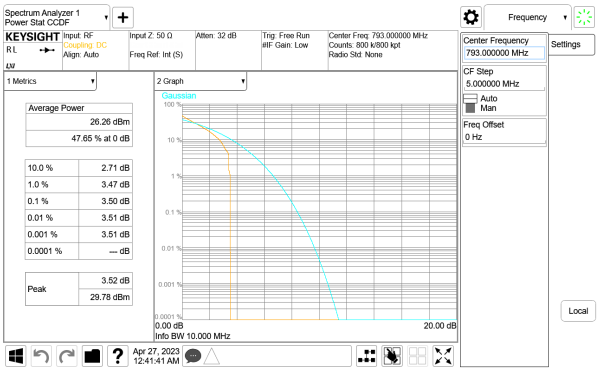
LTE BAND 14



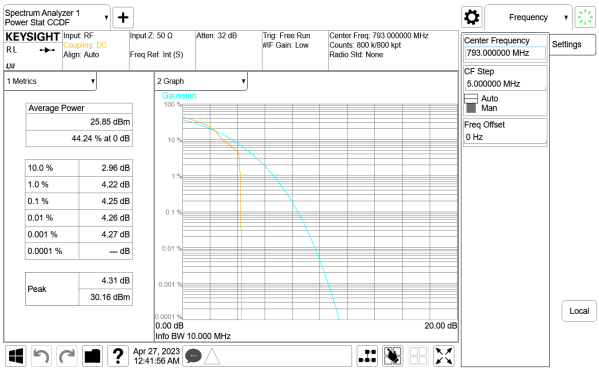
LTE B14 5MHz QPSK Middle Channel ID:28498



LTE B14 5MHz 16QAM Middle Channel ID:28498

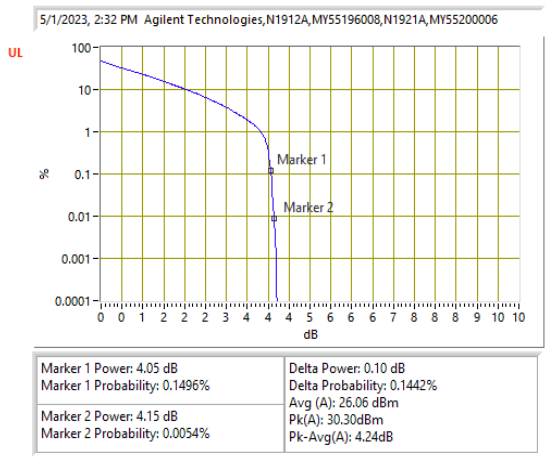


LTE B14 10MHz QPSK Middle Channel ID:28498

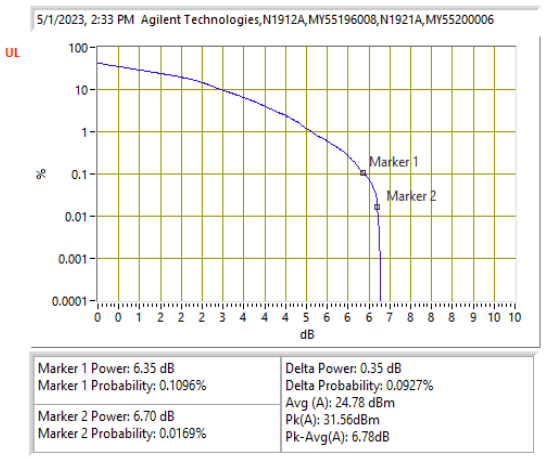


LTE B14 10MHz 16QAM Middle Channel ID:28498

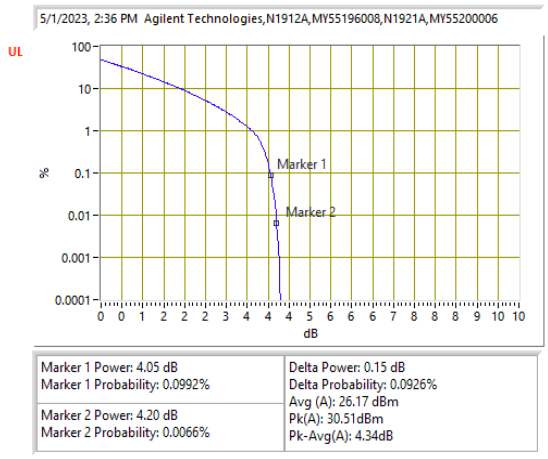
5G NR n14



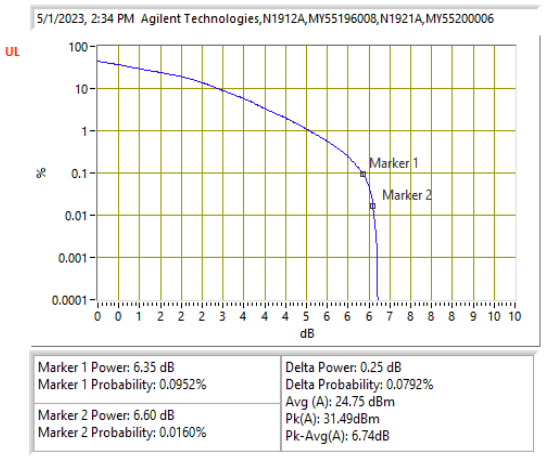
5G NR n14 5MHz BPSK Middle Channel, ID:27342



5G NR n14 5MHz 16QAM Middle Channel, ID:27342



5G NR n14 10MHz BPSK Middle Channel, ID:27342



5G NR n14 10MHz 16QAM Middle Channel, ID:27342