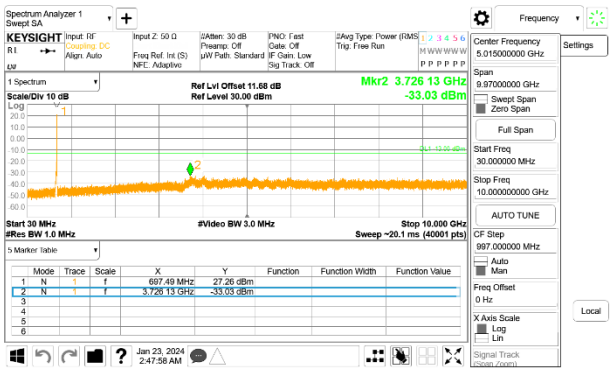
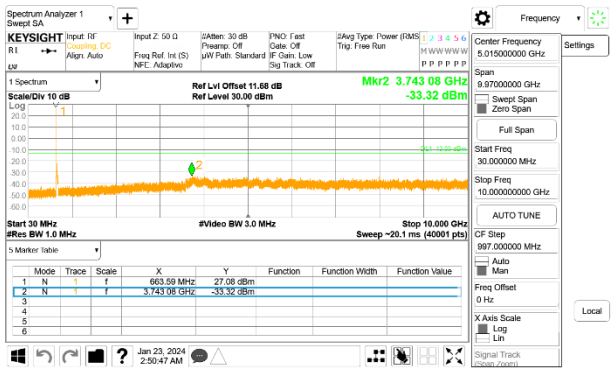
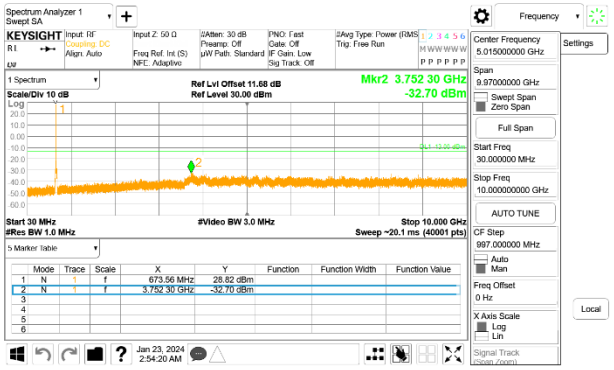


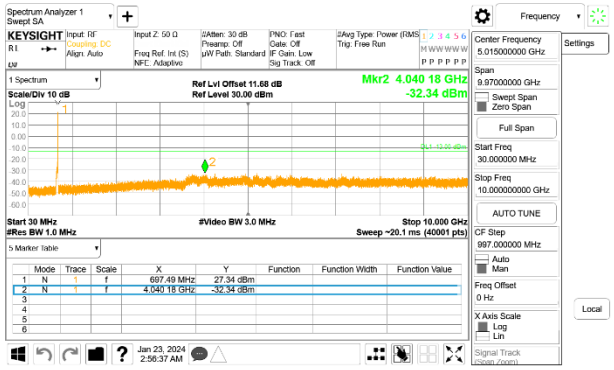
5G NR n71 15MHz BPSK High Channel RB1-78, ID 27979



5G NR n71 20MHz BPSK Low Channel RB1-0, ID 27979



5G NR n71 20MHz BPSK Middle Channel RB1-1, ID 27979



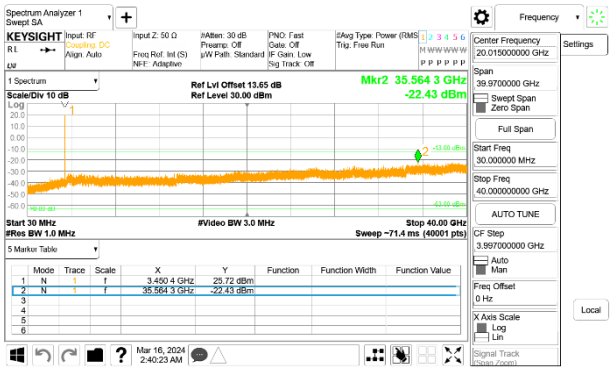
5G NR n71 20MHz BPSK High Channel RB1-105, ID 27979

9.3.16. 5G NR n77 (FCC Part 27 3450-3550MHz)

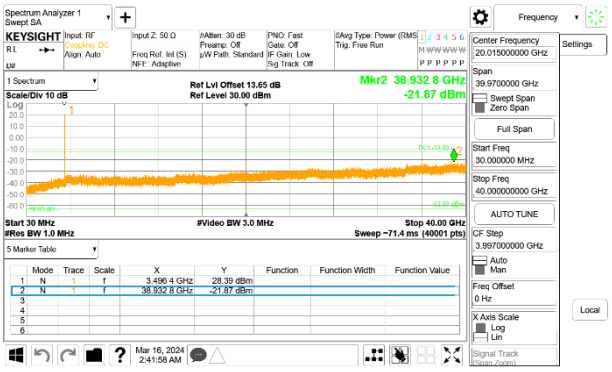
LIMITS

FCC: §27.53
Emission limits
(n) 3.45 GHz Service. The following emission limits apply to stations transmitting in the 3450-3550 MHz band:
(2) For mobile operations in the 3450-3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.

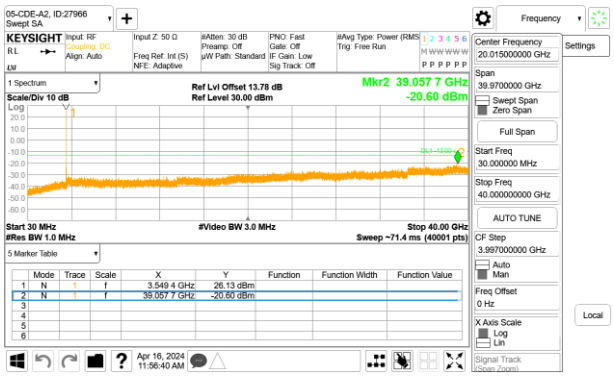
5G NR n77



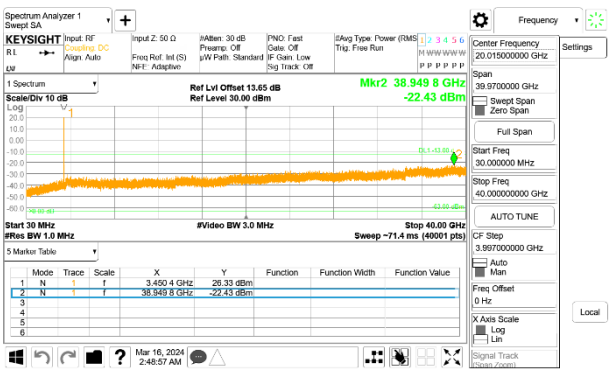
5G NR n77 10MHz BPSK Low Channel RB1-0, ID:28498



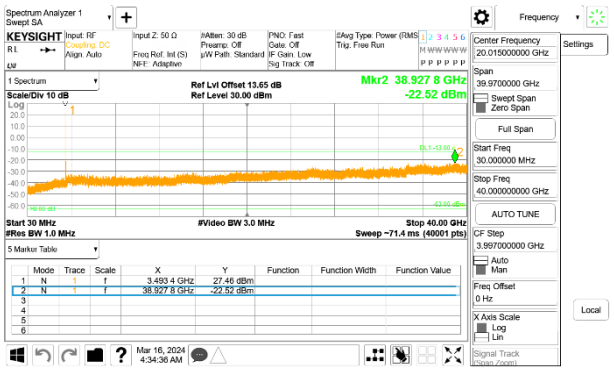
5G NR n77 10MHz BPSK Middle Channel RB1-1, ID:28498



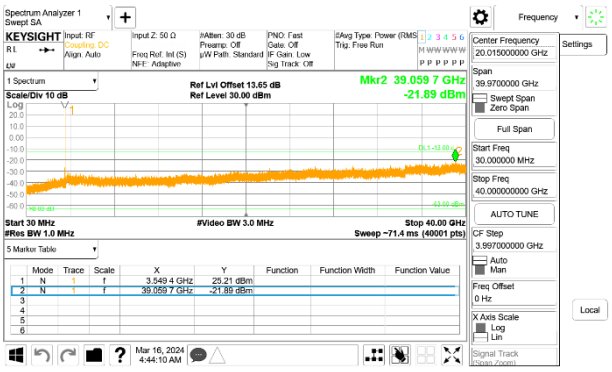
5G NR n77 10MHz BPSK High Channel RB1-23



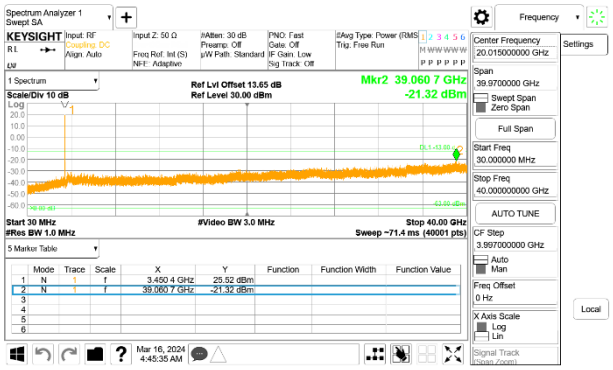
5G NR n77 15MHz BPSK Low Channel RB1-0, ID:28498



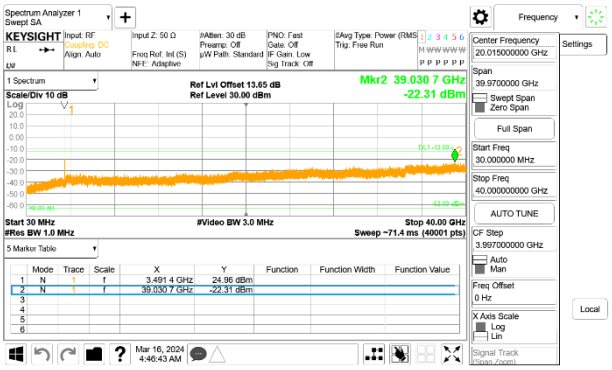
5G NR n77 15MHz BPSK Middle Channel RB1-1, ID:28498



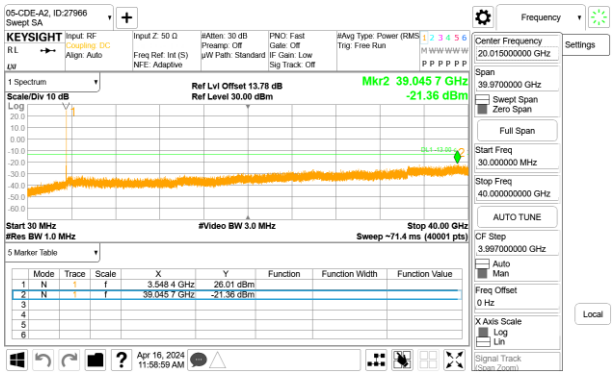
5G NR n77 15MHz BPSK High Channel RB1-37, ID:28498



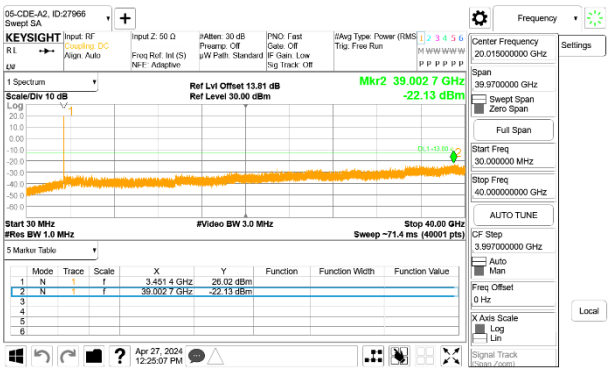
5G NR n77 20MHz BPSK Low Channel RB1-0, ID:28498



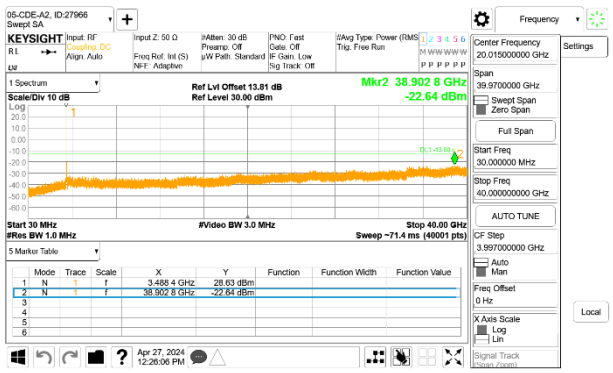
5G NR n77 20MHz BPSK Middle Channel RB1-1, ID:28498



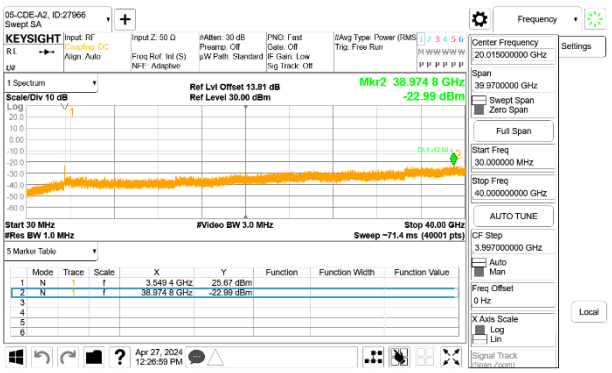
5G NR n77 20MHz BPSK High Channel RB1-50



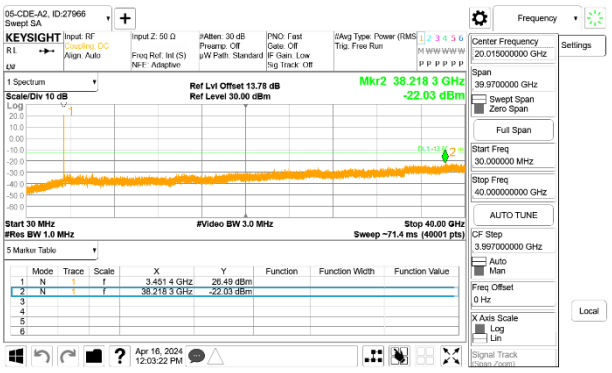
5G NR n77 25MHz BPSK Low Channel RB1-0, ID:27966



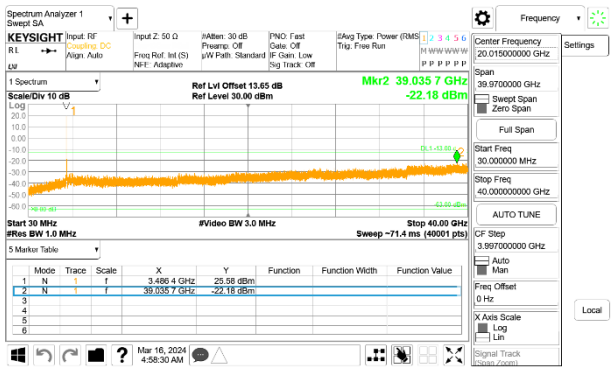
5G NR n77 25MHz BPSK Middle Channel RB1-1, ID:27966



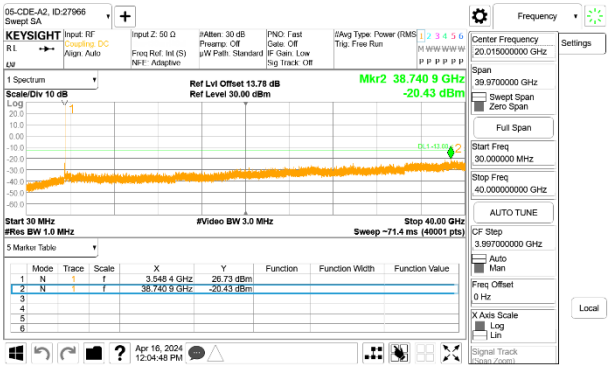
5G NR n77 25MHz BPSK High Channel RB1-64, ID:27966



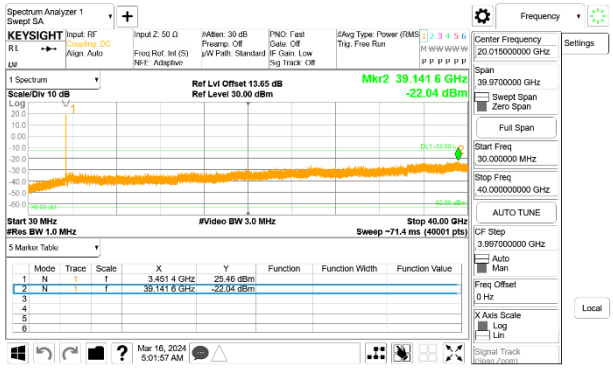
5G NR n77 30MHz BPSK Low Channel RB1-0



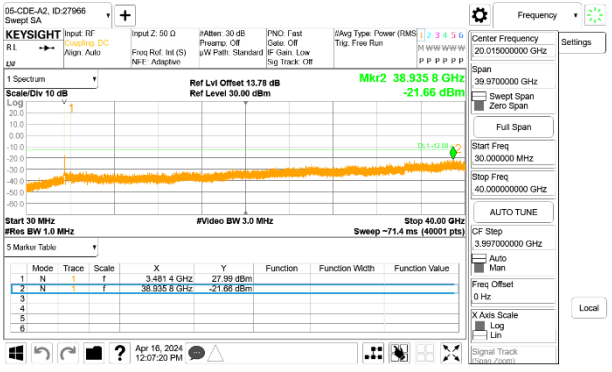
5G NR n77 30MHz BPSK Middle Channel RB1-1, ID:28498



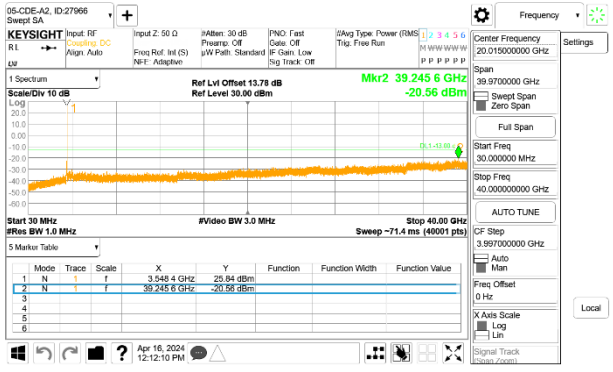
5G NR n77 30MHz BPSK High Channel RB1-77



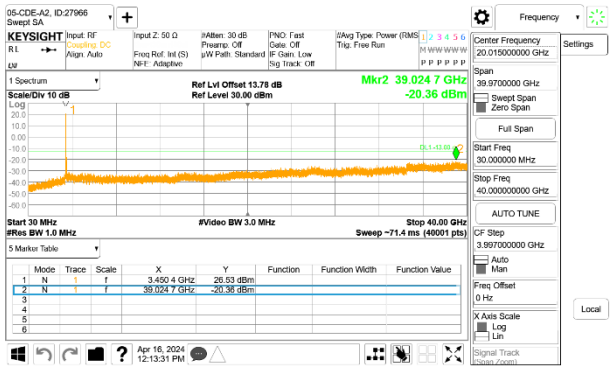
5G NR n77 40MHz BPSK Low Channel RB1-0, ID:28498



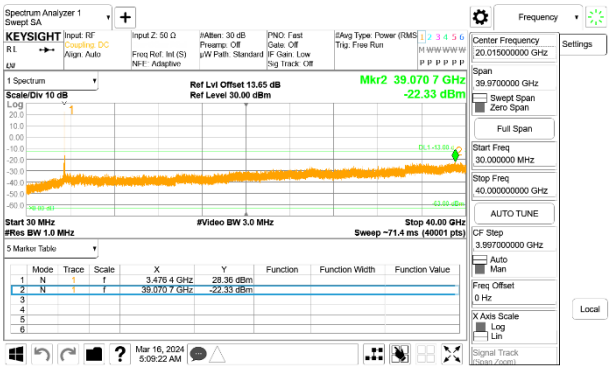
5G NR n77 40MHz BPSK Middle Channel RB1-1



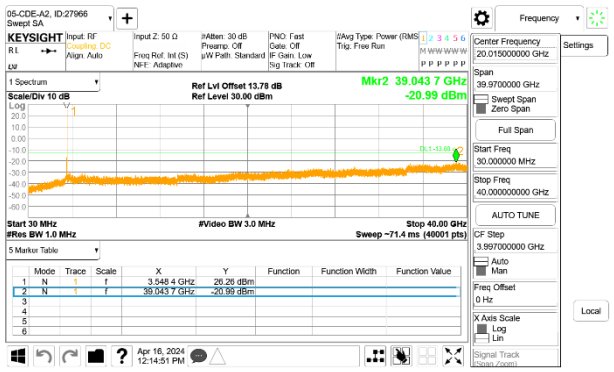
5G NR n77 40MHz BPSK High Channel RB1-105



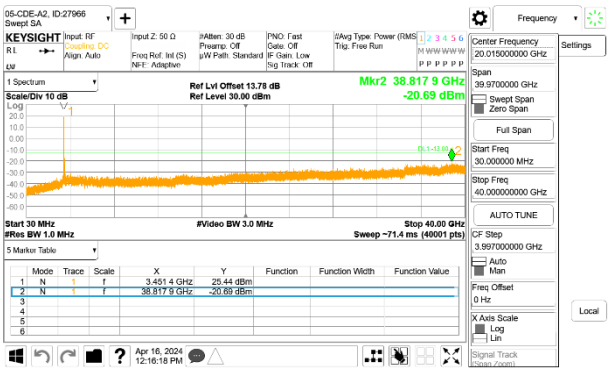
5G NR n77 50MHz BPSK Low Channel RB1-0



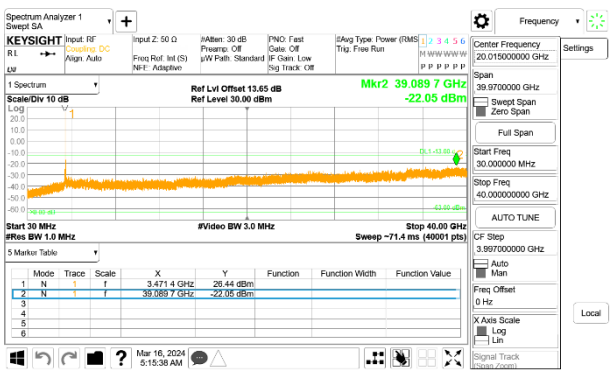
5G NR n77 50MHz BPSK Middle Channel RB1-1, ID:28498



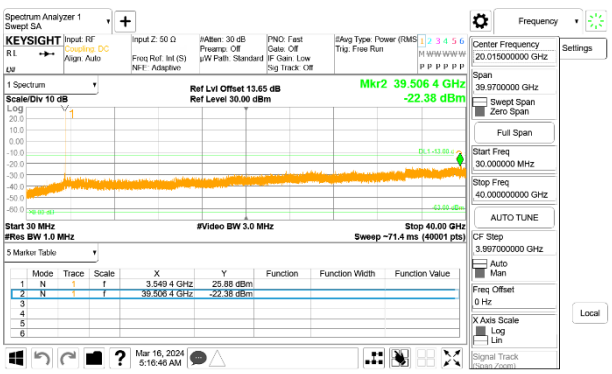
5G NR n77 50MHz BPSK High Channel RB1-132



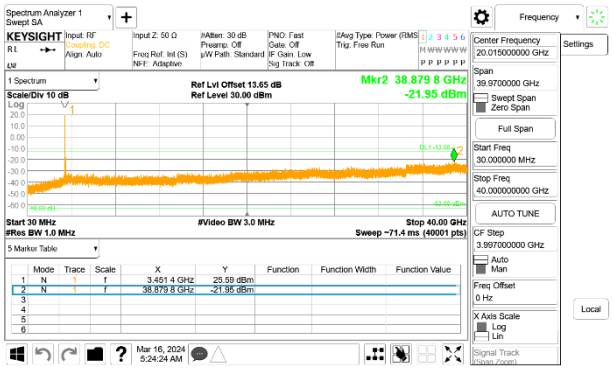
5G NR n77 60MHz BPSK Low Channel RB1-0



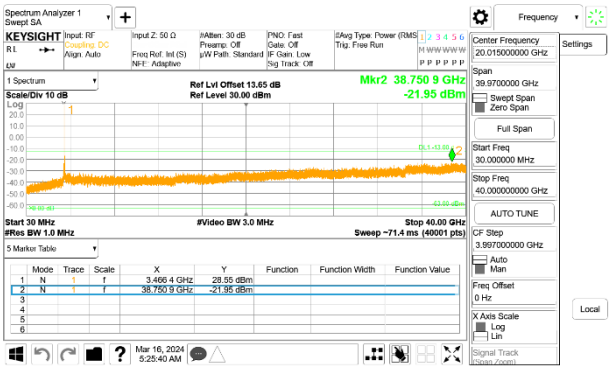
5G NR n77 60MHz BPSK Middle Channel RB1-1, ID:28498



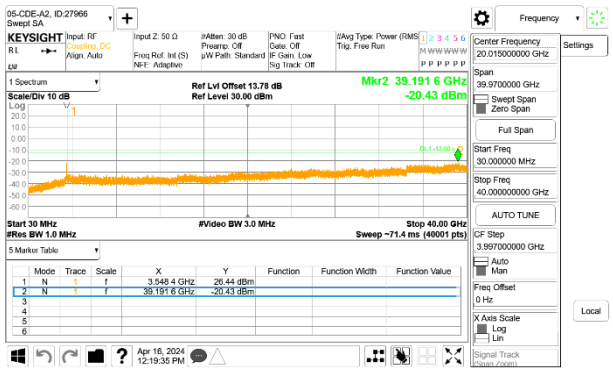
5G NR n77 60MHz BPSK High Channel RB1-161, ID:28498



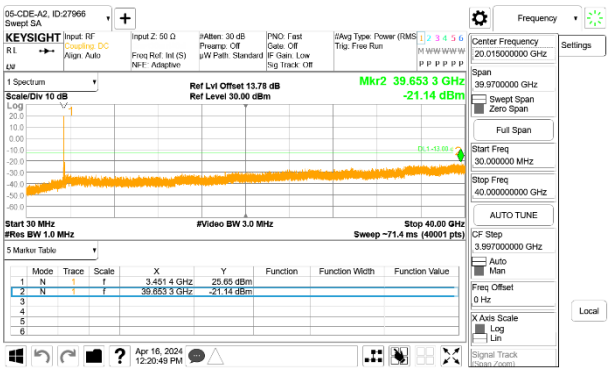
5G NR n77 70MHz BPSK Low Channel RB1-0, ID:28498



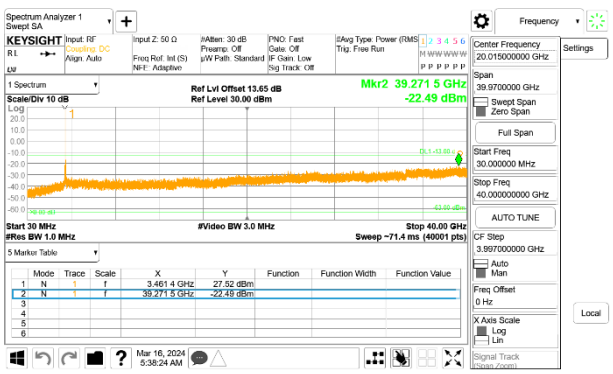
5G NR n77 70MHz BPSK Middle Channel RB1-1, ID:28498



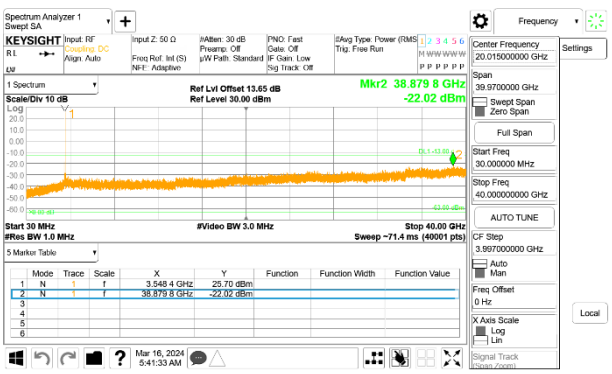
5G NR n77 70MHz BPSK High Channel RB1-188



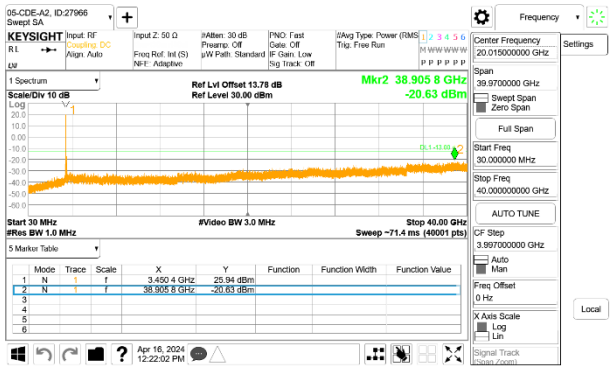
5G NR n77 80MHz BPSK Low Channel RB1-0



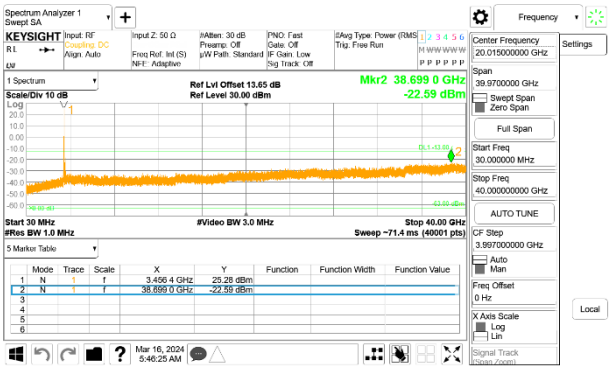
5G NR n77 80MHz BPSK Middle Channel RB1-1, ID:28498



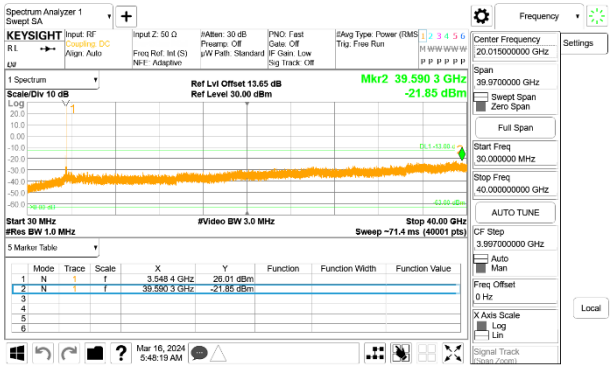
5G NR n77 80MHz BPSK High Channel RB1-216, ID:28498



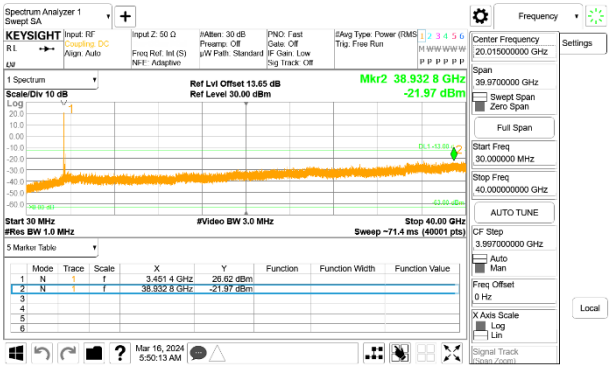
5G NR n77 90MHz BPSK Low Channel RB1-0



5G NR n77 90MHz BPSK Middle Channel RB1-1, ID:28498



5G NR n77 90MHz BPSK High Channel RB1-244, ID:28498



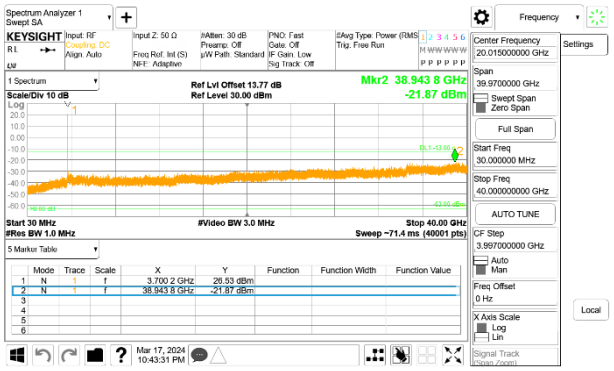
5G NR n77 100MHz BPSK Middle Channel RB1-1, ID:28498

9.3.17. 5G NR n77 (FCC Part 27 3700-3980MHz)

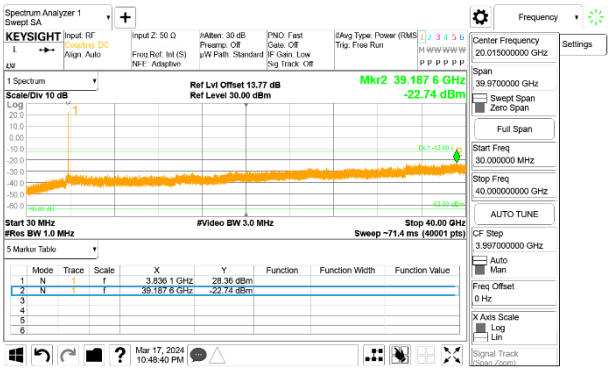
LIMITS

FCC: §27.53
Emission limits
(l) 3.7 GHz Service. The following emission limits apply to stations transmitting in the 3700-3980 MHz band:
(2) For mobile operations in the 3700-3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.

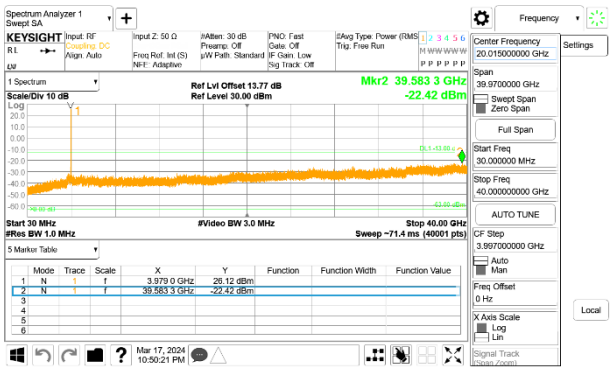
5G NR n77



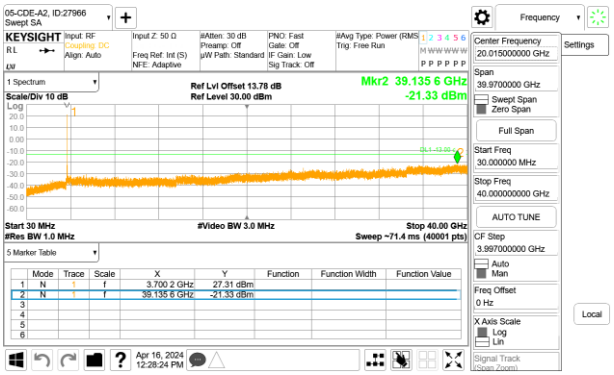
5G NR n77 10MHz BPSK Low Channel RB1-0, ID:28498



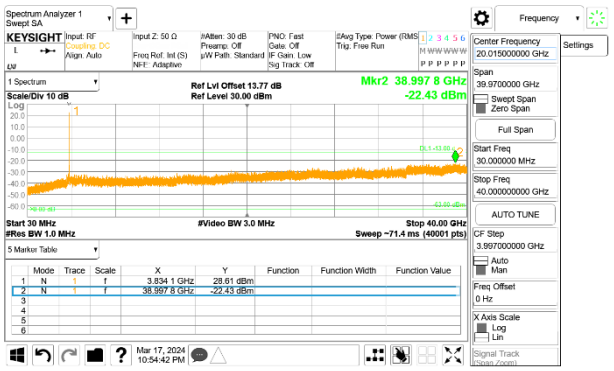
5G NR n77 10MHz BPSK Middle Channel RB1-1, ID:28498



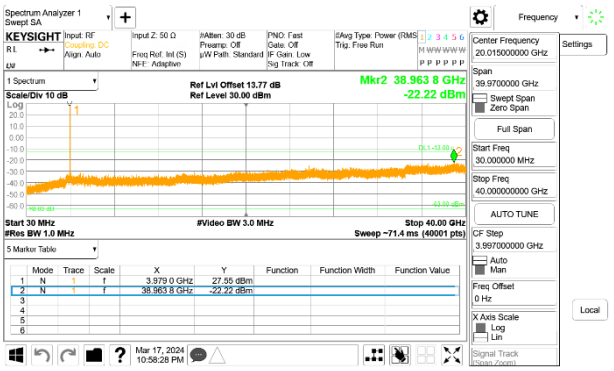
5G NR n77 10MHz BPSK High Channel RB1-23, ID:28498



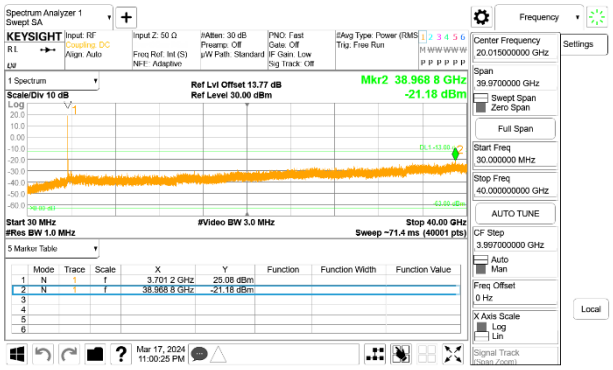
5G NR n77 15MHz BPSK Low Channel RB1-0



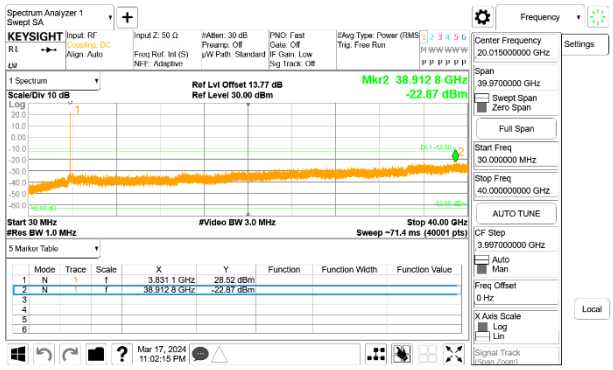
5G NR n77 15MHz BPSK Middle Channel RB1-1, ID:28498



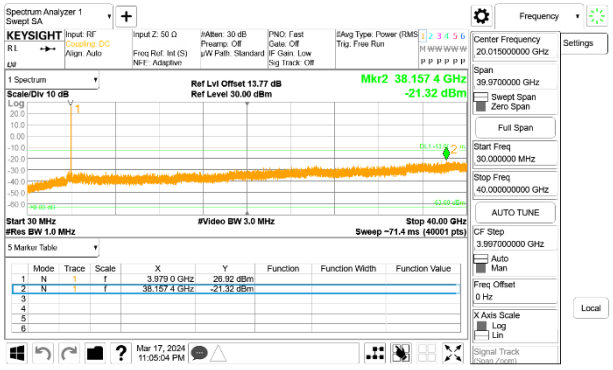
5G NR n77 15MHz BPSK High Channel RB1-37, ID:28498



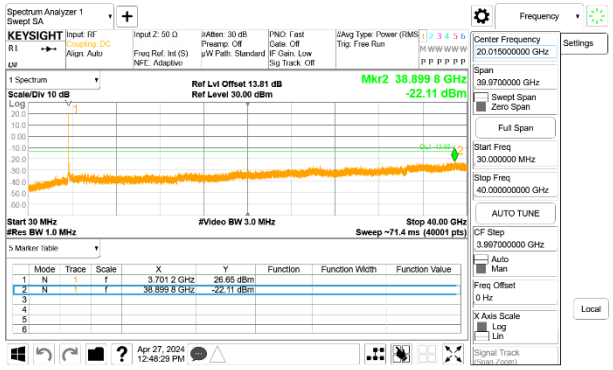
5G NR n77 20MHz BPSK Low Channel RB1-0, ID:28498



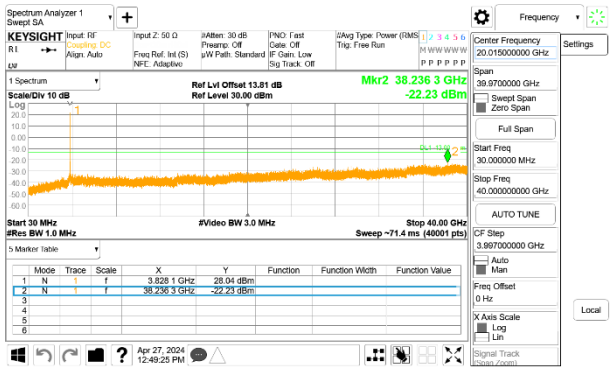
5G NR n77 20MHz BPSK Middle Channel RB1-1, ID:28498



5G NR n77 20MHz BPSK High Channel RB1-50, ID:28498

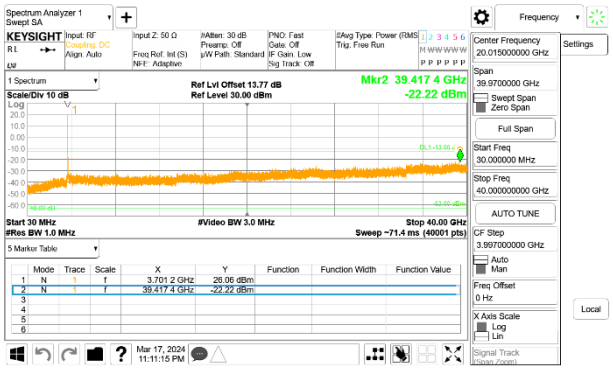


5G NR n77 25MHz BPSK Low Channel RB1-0, ID:28498

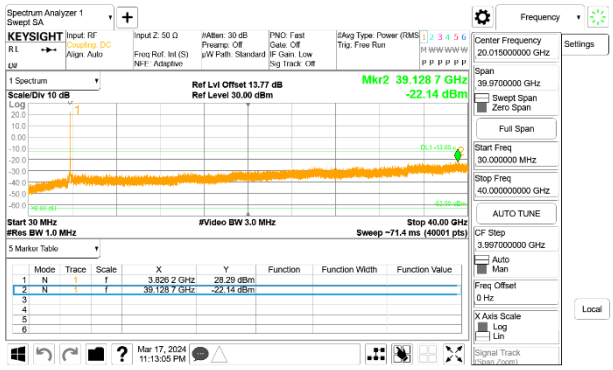


5G NR n77 25MHz BPSK Middle Channel RB1-1, ID:28498

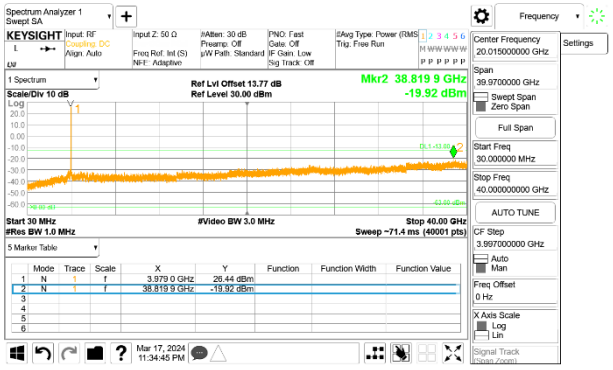
5G NR n77 25MHz BPSK High Channel RB1-64, ID:28498



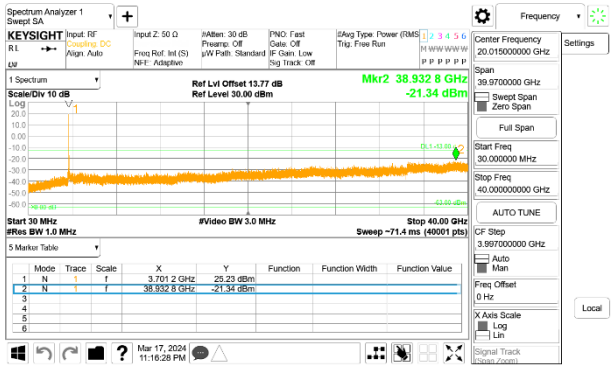
5G NR n77 30MHz BPSK Low Channel RB1-0, ID:28498



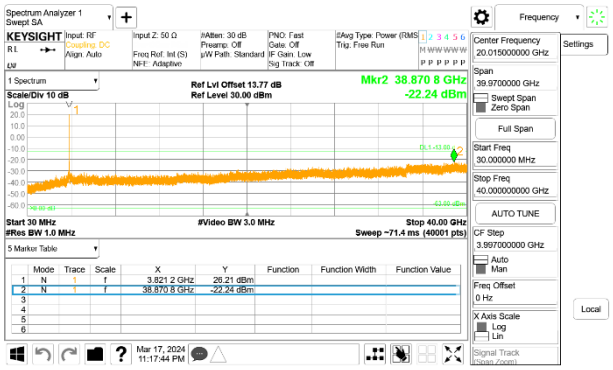
5G NR n77 30MHz BPSK Middle Channel RB1-1, ID:28498



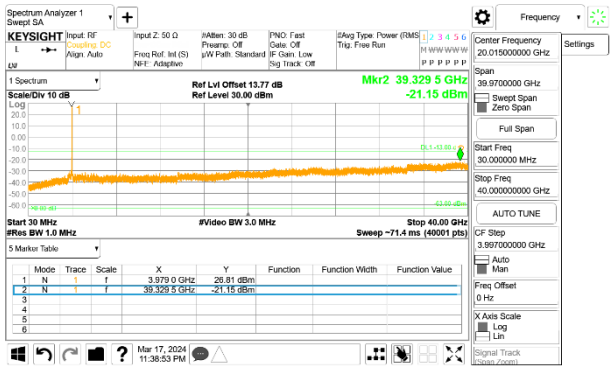
5G NR n77 30MHz BPSK High Channel RB1-77, ID:28498



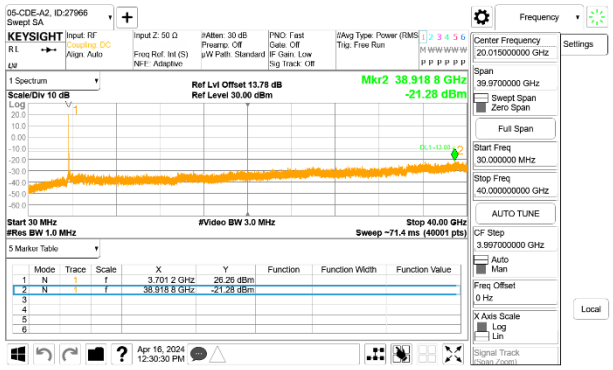
5G NR n77 40MHz BPSK Low Channel RB1-0, ID:28498



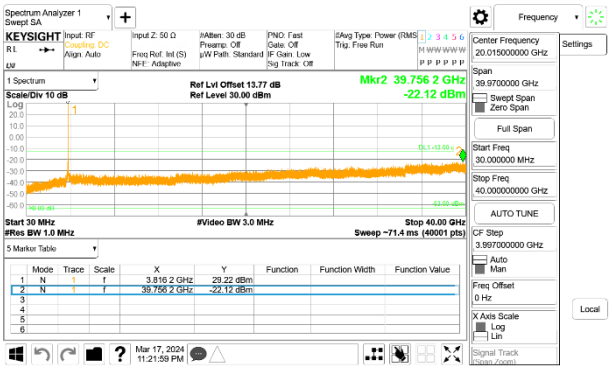
5G NR n77 40MHz BPSK Middle Channel RB1-1, ID:28498



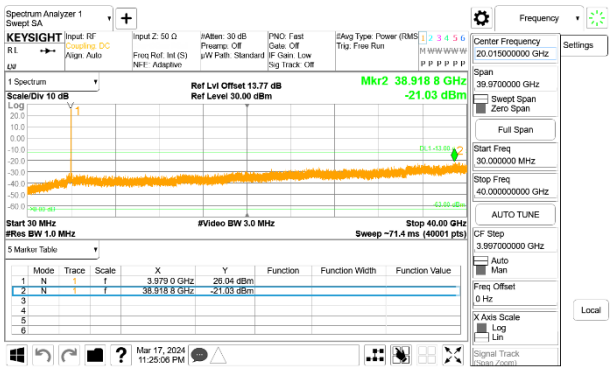
5G NR n77 40MHz BPSK High Channel RB1-105, ID:28498



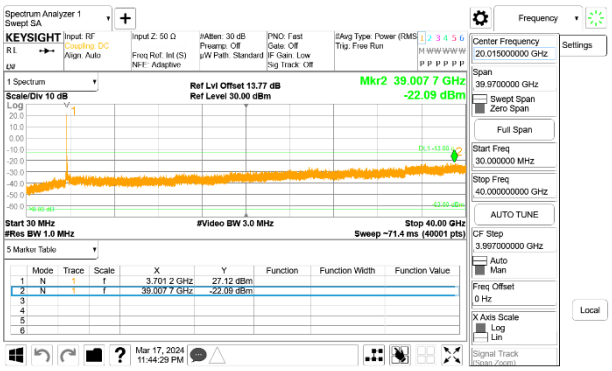
5G NR n77 50MHz BPSK Low Channel RB1-0



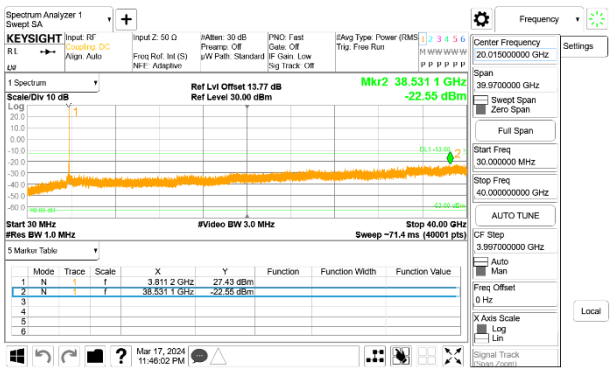
5G NR n77 50MHz BPSK Middle Channel RB1-1, ID:28498



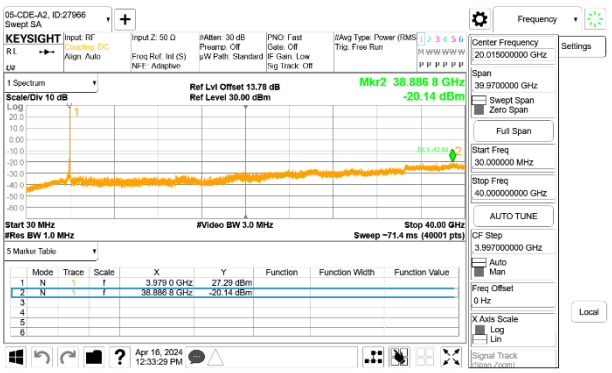
5G NR n77 50MHz BPSK High Channel RB1-132, ID:28498



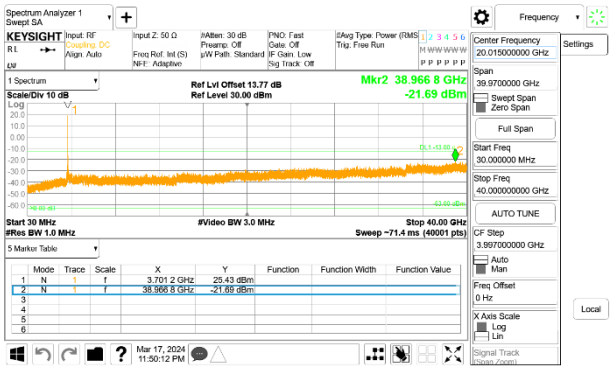
5G NR n77 60MHz BPSK Low Channel RB1-0, ID:28498



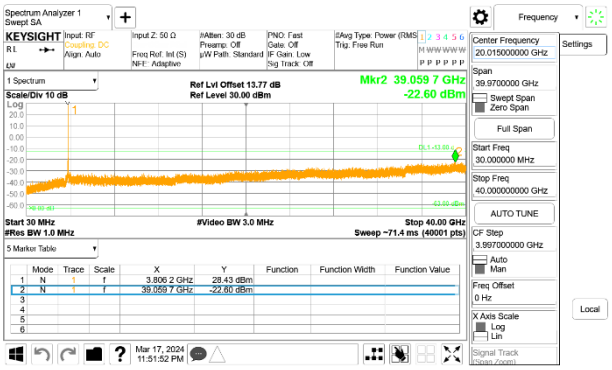
5G NR n77 60MHz BPSK Middle Channel RB1-1, ID:28498



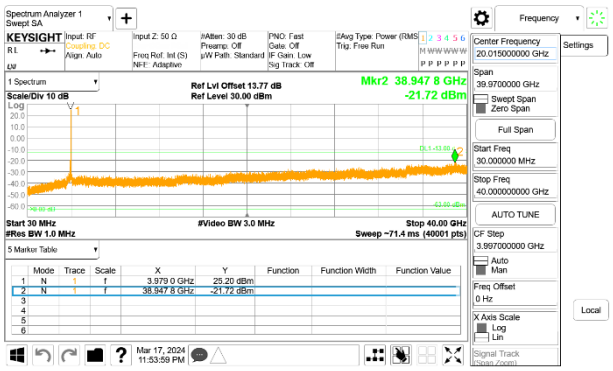
5G NR n77 60MHz BPSK High Channel RB1-161



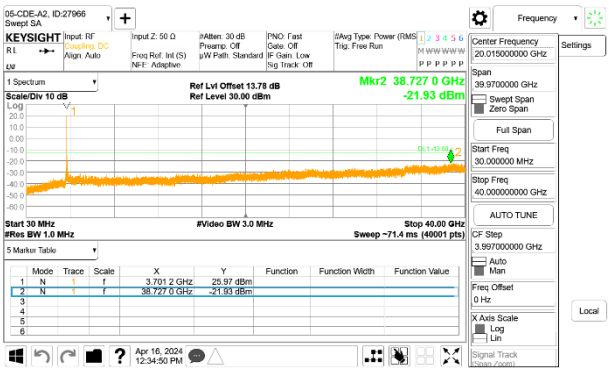
5G NR n77 70MHz BPSK Low Channel RB1-0, ID:28498



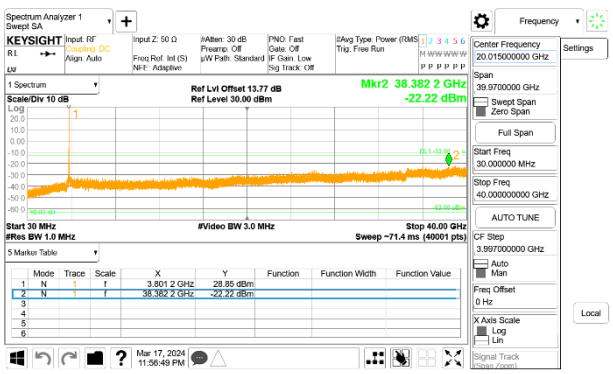
5G NR n77 70MHz BPSK Middle Channel RB1-1, ID:28498



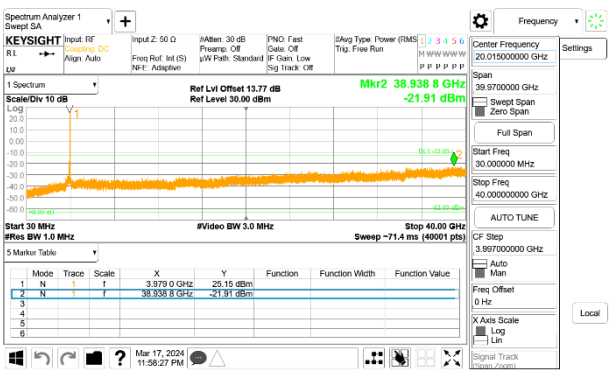
5G NR n77 70MHz BPSK High Channel RB1-188, ID:28498



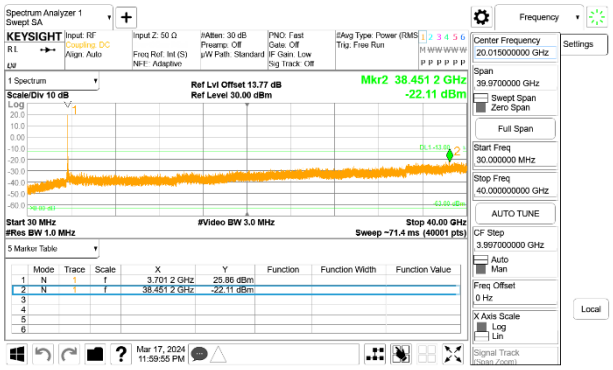
5G NR n77 80MHz BPSK Low Channel RB1-0



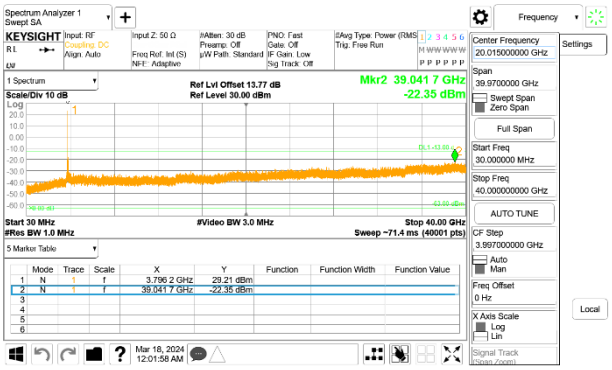
5G NR n77 80MHz BPSK Middle Channel RB1-1, ID:28498



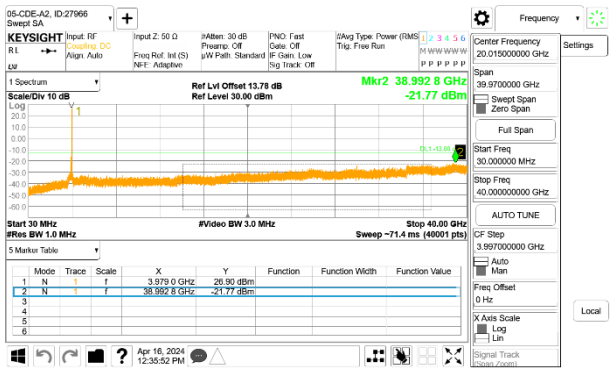
5G NR n77 80MHz BPSK High Channel RB1-216, ID:28498



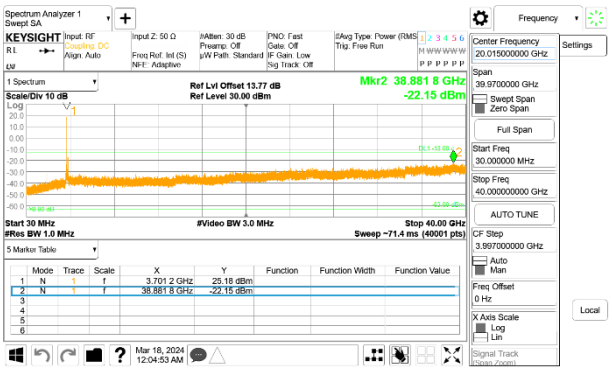
5G NR n77 90MHz BPSK Low Channel RB1-0, ID:28498



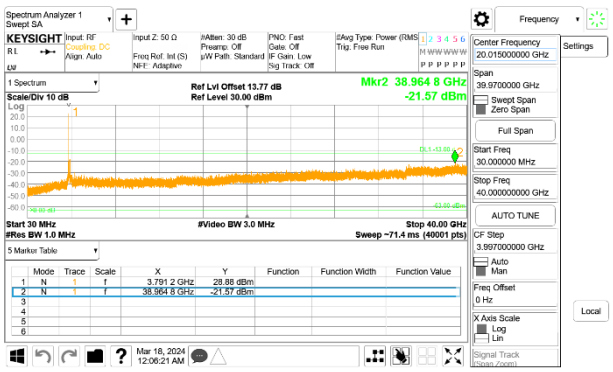
5G NR n77 90MHz BPSK Middle Channel RB1-1, ID:28498



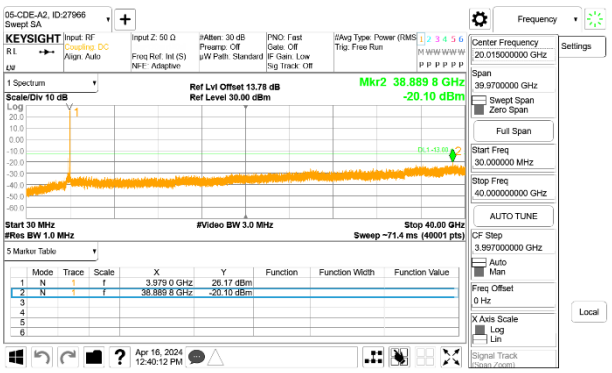
5G NR n77 90MHz BPSK High Channel RB1-244



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



5G NR n77 100MHz BPSK Middle Channel RB1-1, ID:28498



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

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, 2.85VDC.

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 5 AND 5G NR n5

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:	3/18/2024

LTE BAND 5 QPSK (10MHz BANDWIDTH)

Band	5	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	824.5284	848.4710			
Extreme (50°C)		824.5284	848.4710	2.9	0.004	Yes
Extreme (40°C)		824.5284	848.4710	3.2	0.004	Yes
Extreme (30°C)		824.5284	848.4710	-2.3	-0.003	Yes
Extreme (10°C)		824.5284	848.4710	-3.4	-0.004	Yes
Extreme (0°C)		824.5284	848.4710	-3.8	-0.005	Yes
Extreme (-10°C)		824.5284	848.4710	-3.4	-0.004	Yes
Extreme (-20°C)		824.5284	848.4710	2.6	0.003	Yes
Extreme (-30°C)		824.5284	848.4710	-2.4	-0.003	Yes
20°C	15%	824.5284	848.4710	4.8	0.006	Yes
	-15%	824.5284	848.4710	3.4	0.004	Yes
	End Point Voltage	824.5284	848.4710	6.1	0.007	Yes

5G NR n5 BPSK (20MHz BANDWIDTH)

Band	5	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	824.4584	847.3837			
Extreme (50°C)		824.4584	847.3837	-1.51	-0.002	Yes
Extreme (40°C)		824.4584	847.3837	0.88	0.001	Yes
Extreme (30°C)		824.4584	847.3837	1.4	0.002	Yes
Extreme (10°C)		824.4584	847.3837	1.97	0.002	Yes
Extreme (0°C)		824.4584	847.3837	2.11	0.003	Yes
Extreme (-10°C)		824.4584	847.3837	1.74	0.002	Yes
Extreme (-20°C)		824.4584	847.3837	2.44	0.003	Yes
Extreme (-30°C)		824.4584	847.3837	2.3	0.003	Yes
20°C	15%	824.4584	847.3837	1.94	0.002	Yes
	-15%	824.4584	847.3837	2.97	0.004	Yes
	End Point Voltage	824.4584	847.3837	2.17	0.003	Yes

9.4.2. 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:	3/18/2024

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	2501.0529	2568.9264			
Extreme (50°C)		2501.0529	2568.9264	6.2	0.002	Yes
Extreme (40°C)		2501.0529	2568.9264	7.7	0.003	Yes
Extreme (30°C)		2501.0529	2568.9264	5.1	0.002	Yes
Extreme (10°C)		2501.0529	2568.9264	-7.6	-0.003	Yes
Extreme (0°C)		2501.0529	2568.9264	-6.4	-0.003	Yes
Extreme (-10°C)		2501.0529	2568.9264	-9.0	-0.004	Yes
Extreme (-20°C)		2501.0529	2568.9264	-5.6	-0.002	Yes
Extreme (-30°C)		2501.0529	2568.9264	5.5	0.002	Yes
20°C	15%	2501.0529	2568.9264	-6.3	-0.002	Yes
	-15%	2501.0529	2568.9264	8.0	0.003	Yes
	End Point Voltage	2501.0529	2568.9265	10.1	0.004	Yes

5G NR n7 BPSK (50MHz 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	2500.6696	2569.3203			
Extreme (50°C)		2500.6696	2569.3202	-5.23	-0.002	Yes
Extreme (40°C)		2500.6696	2569.3203	4.17	0.002	Yes
Extreme (30°C)		2500.6696	2569.3203	4.62	0.002	Yes
Extreme (10°C)		2500.6696	2569.3202	-5.46	-0.002	Yes
Extreme (0°C)		2500.6696	2569.3203	4.91	0.002	Yes
Extreme (-10°C)		2500.6696	2569.3202	-5.79	-0.002	Yes
Extreme (-20°C)		2500.6696	2569.3202	-7.3	-0.003	Yes
Extreme (-30°C)		2500.6696	2569.3202	-6.6	-0.003	Yes
20°C	15%	2500.6696	2569.3202	-8.3	-0.003	Yes
	-15%	2500.6696	2569.3202	-6.26	-0.002	Yes
	End Point Voltage	2500.6696	2569.3202	-5.15	-0.002	Yes

9.4.3. 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:	3/18/2024

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)	Normal	699.5200	715.4758			
Extreme (50°C)		699.5200	715.4758	3.0	0.004	Yes
Extreme (40°C)		699.5200	715.4758	2.2	0.003	Yes
Extreme (30°C)		699.5200	715.4758	2.5	0.003	Yes
Extreme (10°C)		699.5200	715.4758	-2.1	-0.003	Yes
Extreme (0°C)		699.5200	715.4758	-2.5	-0.004	Yes
Extreme (-10°C)		699.5200	715.4758	-3.0	-0.004	Yes
Extreme (-20°C)		699.5200	715.4758	-3.5	-0.005	Yes
Extreme (-30°C)		699.5200	715.4758	3.4	0.005	Yes
20°C	15%	699.5200	715.4758	4.6	0.006	Yes
	-15%	699.5200	715.4758	3.8	0.005	Yes
	End Point Voltage	699.5200	715.4758	4.1	0.006	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	699.4256	832707087.0000			
Extreme (50°C)		699.4256	832707087.0000	1.19	0.002	Yes
Extreme (40°C)		699.4256	832707087.0000	1.63	0.002	Yes
Extreme (30°C)		699.4256	832707087.0000	1.97	0.003	Yes
Extreme (10°C)		699.4256	832707087.0000	2.14	0.003	Yes
Extreme (0°C)		699.4256	832707087.0000	2.2	0.003	Yes
Extreme (-10°C)		699.4256	832707087.0000	1.9	0.003	Yes
Extreme (-20°C)		699.4256	832707087.0000	2.77	0.004	Yes
Extreme (-30°C)		699.4256	832707087.0000	1.35	0.002	Yes
20°C	15%	699.4256	832707087.0000	2.63	0.004	Yes
	-15%	699.4256	832707087.0000	3.48	0.005	Yes
	End Point Voltage	699.4256	832707087.0000	2.08	0.003	Yes

9.4.4. 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:	3/18/2023

QPSK (10MHz BANDWIDTH)

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	777.5359	786.4676			
Extreme (50°C)		777.5359	786.4676	2.9	0.004	Yes
Extreme (40°C)		777.5359	786.4676	2.6	0.003	Yes
Extreme (30°C)		777.5359	786.4676	-2.6	-0.003	Yes
Extreme (10°C)		777.5359	786.4676	-2.8	-0.004	Yes
Extreme (0°C)		777.5359	786.4676	-2.8	-0.004	Yes
Extreme (-10°C)		777.5359	786.4676	-3.6	-0.005	Yes
Extreme (-20°C)		777.5359	786.4676	-2.7	-0.003	Yes
Extreme (-30°C)		777.5359	786.4676	3.0	0.004	Yes
20°C	15%	777.5359	786.4676	-5.1	-0.006	Yes
	-15%	777.5359	786.4676	4.6	0.006	Yes
	End Point Voltage	777.5359	786.4676	4.0	0.005	Yes

9.4.5. 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:	32061	Test Date:	3/18/2024

LTE BAND 14 QPSK (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	788.5245	797.4684			
Extreme (50°C)		788.5245	797.4684	-2.7	-0.003	Yes
Extreme (40°C)		788.5245	797.4684	3.3	0.004	Yes
Extreme (30°C)		788.5245	797.4684	3.1	0.004	Yes
Extreme (10°C)		788.5245	797.4684	2.9	0.004	Yes
Extreme (0°C)		788.5245	797.4684	-2.9	-0.004	Yes
Extreme (-10°C)		788.5245	797.4684	-2.8	-0.004	Yes
Extreme (-20°C)		788.5245	797.4684	-2.1	-0.003	Yes
Extreme (-30°C)		788.5245	797.4684	-2.7	-0.003	Yes
20°C	15%	788.5245	797.4684	4.7	0.006	Yes
	-15%	788.5245	797.4684	4.8	0.006	Yes
	End Point Voltage	788.5245	797.4684	3.9	0.005	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	788.3460	84667876.0000			
Extreme (50°C)		788.3460	84667876.0000	-2.39	-0.003	Yes
Extreme (40°C)		788.3460	84667876.0000	-1.3	-0.002	Yes
Extreme (30°C)		788.3460	84667876.0000	1.62	0.002	Yes
Extreme (10°C)		788.3460	84667876.0000	1.87	0.002	Yes
Extreme (0°C)		788.3460	84667876.0000	1.32	0.002	Yes
Extreme (-10°C)		788.3460	84667876.0000	1.62	0.002	Yes
Extreme (-20°C)		788.3460	84667876.0000	1.37	0.002	Yes
Extreme (-30°C)		788.3460	84667876.0000	1.84	0.002	Yes
20°C	15%	788.3460	84667876.0000	-2.2	-0.003	Yes
	-15%	788.3460	84667876.0000	-2.85	-0.004	Yes
	End Point Voltage	788.3460	84667876.0000	-3.13	-0.004	Yes

9.4.6. 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:	3/18/2024

QPSK (10MHz BANDWIDTH)

Band	17	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		704	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	704.5282	715.4760			
Extreme (50°C)		704.5282	715.4760	3.0	0.004	Yes
Extreme (40°C)		704.5282	715.4760	2.3	0.003	Yes
Extreme (30°C)		704.5282	715.4760	3.5	0.005	Yes
Extreme (10°C)		704.5282	715.4760	-2.8	-0.004	Yes
Extreme (0°C)		704.5282	715.4760	-2.5	-0.004	Yes
Extreme (-10°C)		704.5282	715.4760	-3.2	-0.004	Yes
Extreme (-20°C)		704.5282	715.4760	-2.9	-0.004	Yes
Extreme (-30°C)		704.5282	715.4760	2.6	0.004	Yes
20°C	15%	704.5282	715.4760	5.1	0.007	Yes
	-15%	704.5282	715.4760	4.1	0.006	Yes
	End Point Voltage	704.5282	715.4760	-4.8	-0.007	Yes

9.4.7. 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:	3/18/2024

LTE BAND 25 QPSK (20MHz BANDWIDTH)

Band	25	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1915		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	1851.0506	1913.9289			
Extreme (50°C)		1851.0506	1913.9289	5.0	0.003	Yes
Extreme (40°C)		1851.0506	1913.9289	5.5	0.003	Yes
Extreme (30°C)		1851.0506	1913.9288	-6.1	-0.003	Yes
Extreme (10°C)		1851.0506	1913.9288	-4.6	-0.002	Yes
Extreme (0°C)		1851.0506	1913.9289	-3.9	-0.002	Yes
Extreme (-10°C)		1851.0506	1913.9288	-6.7	-0.004	Yes
Extreme (-20°C)		1851.0506	1913.9288	-6.9	-0.004	Yes
Extreme (-30°C)		1851.0506	1913.9288	-6.9	-0.004	Yes
20°C	15%	1851.0506	1913.9288	-4.3	-0.002	Yes
	-15%	1851.0506	1913.9289	6.3	0.003	Yes
	End Point Voltage	1851.0507	1913.9289	7.3	0.004	Yes

5G NR n25 BPSK (40MHz BANDWIDTH)

Band	25	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		1850	1915		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	1850.6823	1914.2679			
Extreme (50°C)		1850.6823	1914.2679	-7	-0.004	Yes
Extreme (40°C)		1850.6823	1914.2679	-7.01	-0.004	Yes
Extreme (30°C)		1850.6823	1914.2679	-6.23	-0.003	Yes
Extreme (10°C)		1850.6823	1914.2679	-5.44	-0.003	Yes
Extreme (0°C)		1850.6823	1914.2679	-6.37	-0.003	Yes
Extreme (-10°C)		1850.6823	1914.2679	-8.31	-0.004	Yes
Extreme (-20°C)		1850.6823	1914.2679	-6.4	-0.003	Yes
Extreme (-30°C)		1850.6823	1914.2679	-9.15	-0.005	Yes
20°C	15%	1850.6823	1914.2679	-4.22	-0.002	Yes
	-15%	1850.6823	1914.2679	-6.01	-0.003	Yes
	End Point Voltage	1850.6823	1914.2679	4.09	0.002	Yes

9.4.8. LTE BAND 26(FCC 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:	3/18/2024

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	814.5313	823.4683			
Extreme (50°C)		814.5313	823.4683	3.6	0.004	Yes
Extreme (40°C)		814.5313	823.4683	3.2	0.004	Yes
Extreme (30°C)		814.5313	823.4683	2.2	0.003	Yes
Extreme (10°C)		814.5313	823.4683	-2.5	-0.003	Yes
Extreme (0°C)		814.5313	823.4683	-3.0	-0.004	Yes
Extreme (-10°C)		814.5313	823.4683	-2.5	-0.003	Yes
Extreme (-20°C)		814.5313	823.4683	-2.4	-0.003	Yes
Extreme (-30°C)		814.5313	823.4683	2.3	0.003	Yes
20°C	15%	814.5313	823.4683	4.8	0.006	Yes
	-15%	814.5313	823.4683	5.6	0.007	Yes
	End Point Voltage	814.5313	823.4683	-2.8	-0.003	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	814.3279	823.2713			
Extreme (50°C)		814.3279	823.2713	1.41	0.002	Yes
Extreme (40°C)		814.3279	823.2713	1.72	0.002	Yes
Extreme (30°C)		814.3279	823.2713	1.66	0.002	Yes
Extreme (10°C)		814.3279	823.2713	2	0.002	Yes
Extreme (0°C)		814.3279	823.2713	2.42	0.003	Yes
Extreme (-10°C)		814.3279	823.2713	1.32	0.002	Yes
Extreme (-20°C)		814.3279	823.2713	1.42	0.002	Yes
Extreme (-30°C)		814.3279	823.2713	1.94	0.002	Yes
20°C	15%	814.3279	823.2713	-3.94	-0.005	Yes
	-15%	814.3279	823.2713	-1.85	-0.002	Yes
	End Point Voltage	814.3279	823.2713	-2.38	-0.003	Yes

9.4.9. LTE BAND 26(FCC 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:	3/18/2024

LTE BAND 26 QPSK (10MHz 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	824.5160	848.4803			
Extreme (50°C)		824.5160	848.4803	3.3	0.004	Yes
Extreme (40°C)		824.5160	848.4803	2.7	0.003	Yes
Extreme (30°C)		824.5160	848.4803	2.4	0.003	Yes
Extreme (10°C)		824.5160	848.4803	-3.5	-0.004	Yes
Extreme (0°C)		824.5160	848.4803	-3.0	-0.004	Yes
Extreme (-10°C)		824.5160	848.4803	-2.9	-0.003	Yes
Extreme (-20°C)		824.5160	848.4803	-2.7	-0.003	Yes
Extreme (-30°C)		824.5160	848.4803	2.4	0.003	Yes
20°C	15%	824.5160	848.4803	4.1	0.005	Yes
	-15%	824.5160	848.4803	-4.3	-0.005	Yes
	End Point Voltage	824.5160	848.4803	-3.3	-0.004	Yes

5G NR n26 BPSK (20MHz BANDWIDTH)

Band	26	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		824	848		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	824.5133	847.3682			
Extreme (50°C)		824.5133	847.3682	1.26	0.002	Yes
Extreme (40°C)		824.5133	847.3682	1.24	0.001	Yes
Extreme (30°C)		824.5133	847.3682	-1.5	-0.002	Yes
Extreme (10°C)		824.5133	847.3682	-2.31	-0.003	Yes
Extreme (0°C)		824.5133	847.3682	-2.01	-0.002	Yes
Extreme (-10°C)		824.5133	847.3682	1.85	0.002	Yes
Extreme (-20°C)		824.5133	847.3682	1.69	0.002	Yes
Extreme (-30°C)		824.5133	847.3682	-2	-0.002	Yes
20°C	15%	824.5133	847.3682	1.54	0.002	Yes
	-15%	824.5133	847.3682	1.9	0.002	Yes
	End Point Voltage	824.5133	847.3682	2.97	0.004	Yes

9.4.10. 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:	3/18/2024

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)	Normal	2305.5249	2314.4757			
Extreme (50°C)		2305.5249	2314.4757	7.5	0.003	Yes
Extreme (40°C)		2305.5249	2314.4757	6.6	0.003	Yes
Extreme (30°C)		2305.5249	2314.4757	4.6	0.002	Yes
Extreme (10°C)		2305.5249	2314.4757	-7.3	-0.003	Yes
Extreme (0°C)		2305.5249	2314.4757	-6.8	-0.003	Yes
Extreme (-10°C)		2305.5249	2314.4757	-7.5	-0.003	Yes
Extreme (-20°C)		2305.5249	2314.4757	4.1	0.002	Yes
Extreme (-30°C)		2305.5249	2314.4757	6.2	0.003	Yes
20°C	15%	2305.5249	2314.4757	10.5	0.005	Yes
	-15%	2305.5249	2314.4757	8.0	0.003	Yes
	End Point Voltage	2305.5249	2314.4757	7.6	0.003	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)	Normal	2305.2015	2314.2849			
Extreme (50°C)		2305.2015	2314.2849	-5.66	-0.002	Yes
Extreme (40°C)		2305.2015	2314.2849	-5.29	-0.002	Yes
Extreme (30°C)		2305.2015	2314.2849	-5.82	-0.003	Yes
Extreme (10°C)		2305.2015	2314.2849	-5.72	-0.002	Yes
Extreme (0°C)		2305.2015	2314.2849	-4.75	-0.002	Yes
Extreme (-10°C)		2305.2015	2314.2849	-5.19	-0.002	Yes
Extreme (-20°C)		2305.2015	2314.2849	-7.14	-0.003	Yes
Extreme (-30°C)		2305.2015	2314.2849	-6.42	-0.003	Yes
20°C	15%	2305.2015	2314.2849	-7.22	-0.003	Yes
	-15%	2305.2015	2314.2849	-6.27	-0.003	Yes
	End Point Voltage	2305.2015	2314.2849	-7.45	-0.003	Yes

9.4.11. 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:	3/18/2024

LTE BAND 41 QPSK (20MHz 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	2497.0296	2689.1007			
Extreme (50°C)		2497.0296	2689.1007	-8.6	-0.003	Yes
Extreme (40°C)		2497.0296	2689.1007	-6.8	-0.003	Yes
Extreme (30°C)		2497.0296	2689.1007	-9.9	-0.004	Yes
Extreme (10°C)		2497.0296	2689.1007	-12.7	-0.005	Yes
Extreme (0°C)		2497.0296	2689.1007	-12.2	-0.005	Yes
Extreme (-10°C)		2497.0296	2689.1007	-18.2	-0.007	Yes
Extreme (-20°C)		2497.0296	2689.1007	-10.6	-0.004	Yes
Extreme (-30°C)		2497.0296	2689.1007	-10.2	-0.004	Yes
20°C	15%	2497.0296	2689.1007	-12.6	-0.005	Yes
	-15%	2497.0296	2689.1007	-10.9	-0.004	Yes
	End Point Voltage	2497.0296	2689.1007	-17.1	-0.007	Yes

5G NR n41 BPSK (100MHz BANDWIDTH)

Band	41	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2496.01	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	2496.9949	2688.9062			
Extreme (50°C)		2496.9949	2688.9062	-13.98	-0.005	Yes
Extreme (40°C)		2496.9949	2688.9062	-11.63	-0.004	Yes
Extreme (30°C)		2496.9949	2688.9062	-12.84	-0.005	Yes
Extreme (10°C)		2496.9949	2688.9062	-11.19	-0.004	Yes
Extreme (0°C)		2496.9949	2688.9062	-13.8	-0.005	Yes
Extreme (-10°C)		2496.9949	2688.9062	-14.1	-0.005	Yes
Extreme (-20°C)		2496.9949	2688.9062	-11.32	-0.004	Yes
Extreme (-30°C)		2496.9949	2688.9062	-15.64	-0.006	Yes
20°C	15%	2496.9949	2688.9062	-6.78	-0.003	Yes
	-15%	2496.9949	2688.9062	-11.23	-0.004	Yes
	End Point Voltage	2496.9949	2688.9062	-8.67	-0.003	Yes

9.4.12. LTE BAND 48 AND 5G NR n48

Test Engineer ID:	32061	Test Date:	3/19/2024

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)	Normal	3550.9552	3699.0748			
Extreme (50°C)		3550.9553	3699.0748	11.5	0.003	Yes
Extreme (40°C)		3550.9553	3699.0748	9.9	0.003	Yes
Extreme (30°C)		3550.9553	3699.0748	12.7	0.004	Yes
Extreme (10°C)		3550.9553	3699.0748	10.1	0.003	Yes
Extreme (0°C)		3550.9553	3699.0748	10.8	0.003	Yes
Extreme (-10°C)		3550.9553	3699.0748	10.5	0.003	Yes
Extreme (-20°C)		3550.9553	3699.0748	11.2	0.003	Yes
Extreme (-30°C)		3550.9553	3699.0748	11.4	0.003	Yes
20°C	15%	3550.9553	3699.0748	16.0	0.004	Yes
	-15%	3550.9553	3699.0748	15.8	0.004	Yes
	End Point Voltage	3550.9553	3699.0748	12.8	0.004	Yes

5G NR n48 BPSK (40MHz BANDWIDTH)

Band	48	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3550	3699.98			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	3550.0396	3697.6772			
Extreme (50°C)		3550.0396	3697.6772	13.84	0.004	Yes
Extreme (40°C)		3550.0396	3697.6772	13.28	0.004	Yes
Extreme (30°C)		3550.0396	3697.6772	8.03	0.002	Yes
Extreme (10°C)		3550.0396	3697.6772	9.57	0.003	Yes
Extreme (0°C)		3550.0396	3697.6772	8.49	0.002	Yes
Extreme (-10°C)		3550.0396	3697.6772	6.32	0.002	Yes
Extreme (-20°C)		3550.0396	3697.6772	7.71	0.002	Yes
Extreme (-30°C)		3550.0396	3697.6772	-10.73	-0.003	Yes
20°C	15%	3550.0396	3697.6772	8.91	0.002	Yes
	-15%	3550.0396	3697.6772	8.04	0.002	Yes
	End Point Voltage	3550.0396	3697.6772	8.06	0.002	Yes

9.4.13. 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:	3/18/2024

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	1711.0520	1778.9348			
Extreme (50°C)		1711.0520	1778.9348	6.3	0.004	Yes
Extreme (40°C)		1711.0520	1778.9348	4.9	0.003	Yes
Extreme (30°C)		1711.0520	1778.9348	4.6	0.003	Yes
Extreme (10°C)		1711.0520	1778.9348	-3.7	-0.002	Yes
Extreme (0°C)		1711.0520	1778.9348	-5.4	-0.003	Yes
Extreme (-10°C)		1711.0520	1778.9348	-5.6	-0.003	Yes
Extreme (-20°C)		1711.0520	1778.9348	-6.8	-0.004	Yes
Extreme (-30°C)		1711.0520	1778.9348	-5.6	-0.003	Yes
20°C	15%	1711.0520	1778.9348	-5.3	-0.003	Yes
	-15%	1711.0520	1778.9348	-6.2	-0.004	Yes
	End Point Voltage	1711.0520	1778.9348	-3.8	-0.002	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	1710.6438	1779.2696			
Extreme (50°C)		1710.6438	1779.2696	-2.13	-0.001	Yes
Extreme (40°C)		1710.6438	1779.2696	-2.76	-0.002	Yes
Extreme (30°C)		1710.6438	1779.2696	2.55	0.001	Yes
Extreme (10°C)		1710.6438	1779.2696	4.66	0.003	Yes
Extreme (0°C)		1710.6438	1779.2696	-3.75	-0.002	Yes
Extreme (-10°C)		1710.6438	1779.2696	-3.21	-0.002	Yes
Extreme (-20°C)		1710.6438	1779.2696	-5.64	-0.003	Yes
Extreme (-30°C)		1710.6438	1779.2696	-3.91	-0.002	Yes
20°C	15%	1710.6438	1779.2696	4.58	0.003	Yes
	-15%	1710.6438	1779.2696	-4.58	-0.003	Yes
	End Point Voltage	1710.6438	1779.2696	-4.52	-0.003	Yes

9.4.14. 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:	3/18/2024

5G NR n70 BPSK (15MHz BANDWIDTH)

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	1695.4215	1709.0860			
Extreme (50°C)		1695.4215	1709.0860	-5.28	-0.003	Yes
Extreme (40°C)		1695.4215	1709.0860	-4.87	-0.003	Yes
Extreme (30°C)		1695.4215	1709.0860	-3.81	-0.002	Yes
Extreme (10°C)		1695.4215	1709.0860	-5.22	-0.003	Yes
Extreme (0°C)		1695.4215	1709.0860	-6.66	-0.004	Yes
Extreme (-10°C)		1695.4215	1709.0860	-5.96	-0.004	Yes
Extreme (-20°C)		1695.4215	1709.0860	-6.06	-0.004	Yes
Extreme (-30°C)		1695.4215	1709.0860	6.93	0.004	Yes
20°C	15%	1695.4215	1709.0860	-6.61	-0.004	Yes
	-15%	1695.4215	1709.0860	-5.09	-0.003	Yes
	End Point Voltage	1695.4215	1709.0860	-7.03	-0.004	Yes

9.4.15. 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:	3/18/2024

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)	Normal	664.0632	696.9172			
Extreme (50°C)		664.0632	696.9173	3.8	0.006	Yes
Extreme (40°C)		664.0632	696.9172	2.6	0.004	Yes
Extreme (30°C)		664.0632	696.9172	3.2	0.005	Yes
Extreme (10°C)		664.0632	696.9172	-3.1	-0.005	Yes
Extreme (0°C)		664.0632	696.9172	-2.6	-0.004	Yes
Extreme (-10°C)		664.0632	696.9172	-3.4	-0.005	Yes
Extreme (-20°C)		664.0632	696.9172	-2.5	-0.004	Yes
Extreme (-30°C)		664.0632	696.9172	-2.0	-0.003	Yes
20°C	15%	664.0632	696.9173	5.1	0.007	Yes
	-15%	664.0632	696.9173	4.0	0.006	Yes
	End Point Voltage	664.0632	696.9173	4.7	0.007	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	663.5271	696.5036			
Extreme (50°C)		663.5271	696.5036	-3.41	-0.005	Yes
Extreme (40°C)		663.5271	696.5036	-3.69	-0.005	Yes
Extreme (30°C)		663.5271	696.5036	-4.5	-0.007	Yes
Extreme (10°C)		663.5271	696.5036	-3.57	-0.005	Yes
Extreme (0°C)		663.5271	696.5036	-3.15	-0.005	Yes
Extreme (-10°C)		663.5271	696.5036	-3.25	-0.005	Yes
Extreme (-20°C)		663.5271	696.5036	3.24	0.005	Yes
Extreme (-30°C)		663.5271	696.5036	4.84	0.007	Yes
20°C	15%	663.5271	696.5036	-3.75	-0.006	Yes
	-15%	663.5271	696.5036	-3.16	-0.005	Yes
	End Point Voltage	663.5271	696.5036	-3.39	-0.005	Yes

9.4.16. 5G NR n77 (FCC 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:	3/25/2024

5G NR n77a FCC BPSK (100MHz BANDWIDTH)

Band	77	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		3450.01	3549.98			
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	3450.9204	3548.3917			
Extreme (50°C)		3450.9205	3548.3917	19.22	0.005	Yes
Extreme (40°C)		3450.9205	3548.3917	8.94	0.003	Yes
Extreme (30°C)		3450.9205	3548.3917	4.4	0.001	Yes
Extreme (10°C)		3450.9205	3548.3917	7.41	0.002	Yes
Extreme (0°C)		3450.9205	3548.3917	5.85	0.002	Yes
Extreme (-10°C)		3450.9205	3548.3917	9.7	0.003	Yes
Extreme (-20°C)		3450.9204	3548.3917	-7.33	-0.002	Yes
Extreme (-30°C)		3450.9204	3548.3917	-6.23	-0.002	Yes
20°C	15%	3450.9205	3548.3917	7.27	0.002	Yes
	-15%	3450.9204	3548.3917	-10.61	-0.003	Yes
	End Point Voltage	3450.9205	3548.3917	6.96	0.002	Yes

9.4.17. 5G NR n77 (FCC 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:	3/14/2023

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)	Au Freq
Normal (20°C)	Normal	3700.2782	3977.8398			
Extreme (50°C)		3700.2781	3977.8398	-20.97	-0.005	
Extreme (40°C)		3700.2781	3977.8398	-24.17	-0.006	
Extreme (30°C)		3700.2782	3977.8398	7.51	0.002	
Extreme (10°C)		3700.2781	3977.8398	-9	-0.002	
Extreme (0°C)		3700.2782	3977.8398	6.48	0.002	
Extreme (-10°C)		3700.2782	3977.8398	8.45	0.002	
Extreme (-20°C)		3700.2781	3977.8398	-7.88	-0.002	
Extreme (-30°C)		3700.2781	3977.8398	-13.44	-0.004	
20°C	15%	3700.2781	3977.8398	-10.63	-0.003	
	-15%	3700.2782	3977.8398	9.48	0.002	
	End Point Voltage	3700.2781	3977.8398	-10.53	-0.003	

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.