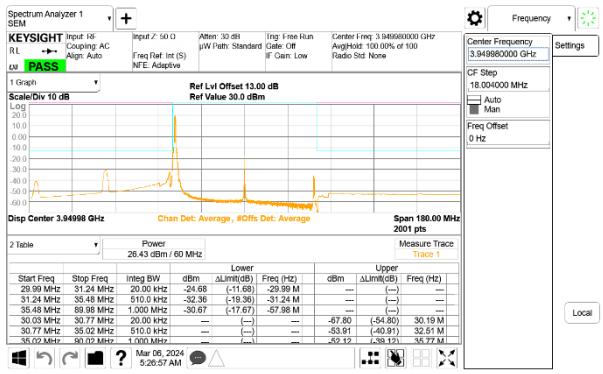
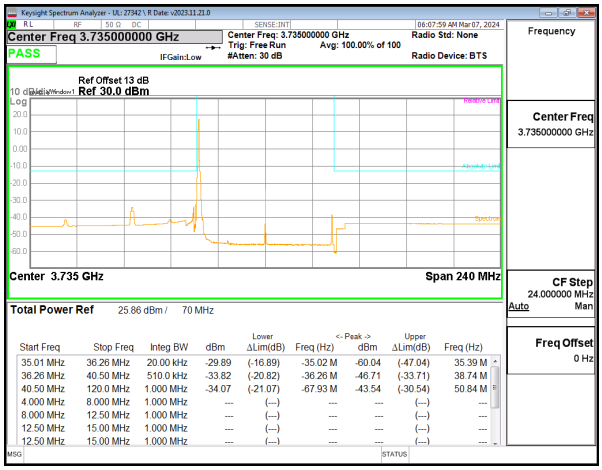
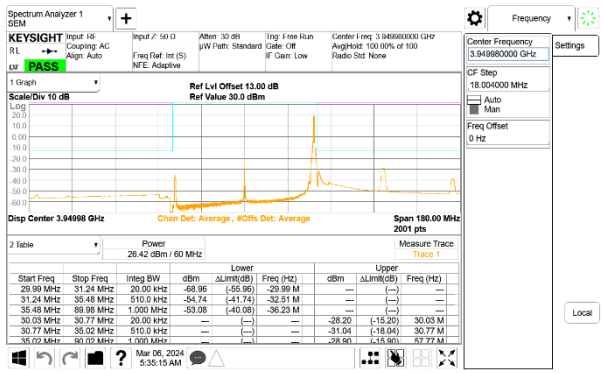


5G NR n77 60MHz BPSK High Channel RB1-0 ID:27342



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



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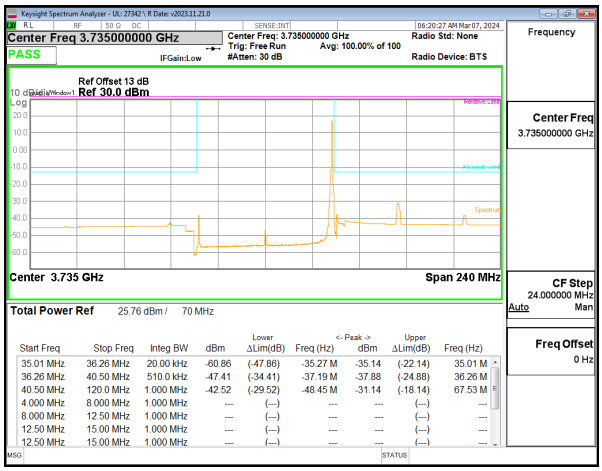
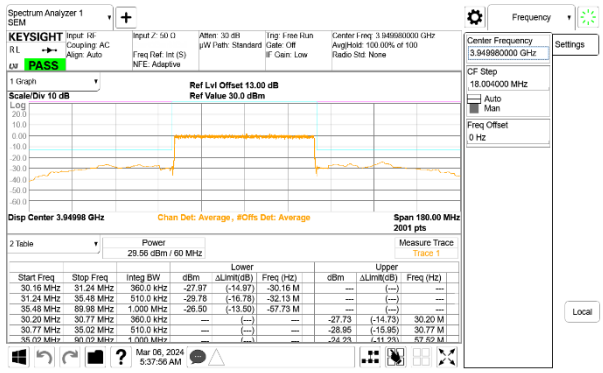


5G NR n77 70MHz BPSK Low Channel RB1-188



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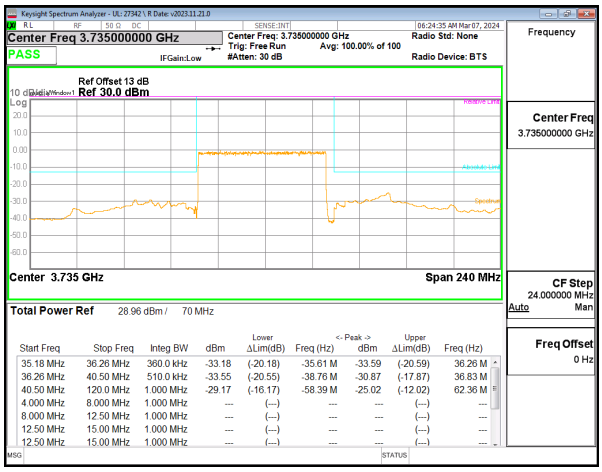

5G NR n77 70MHz BPSK Low Channel RB180-0

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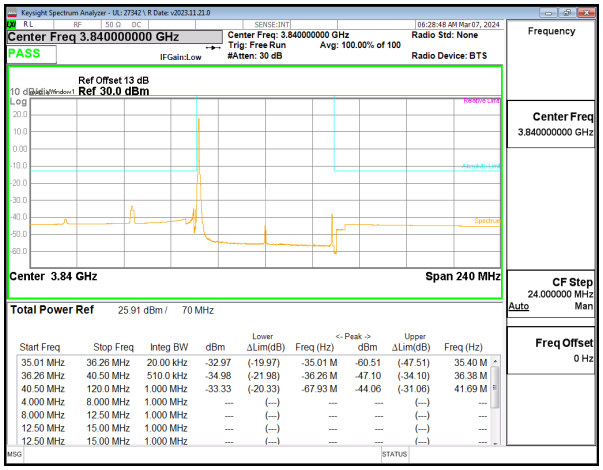
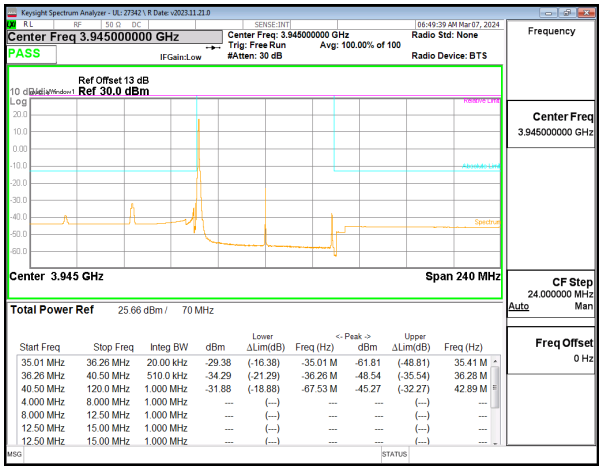
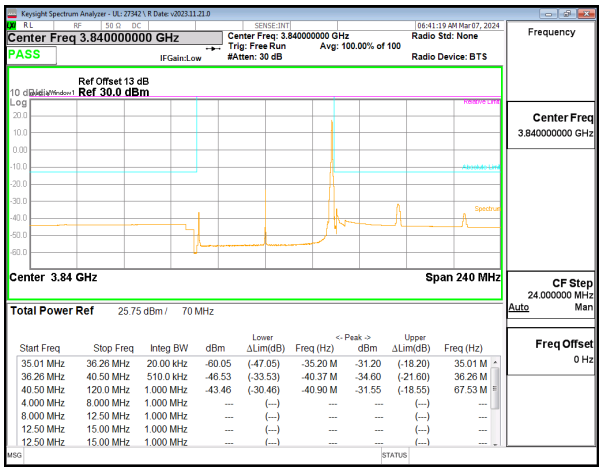


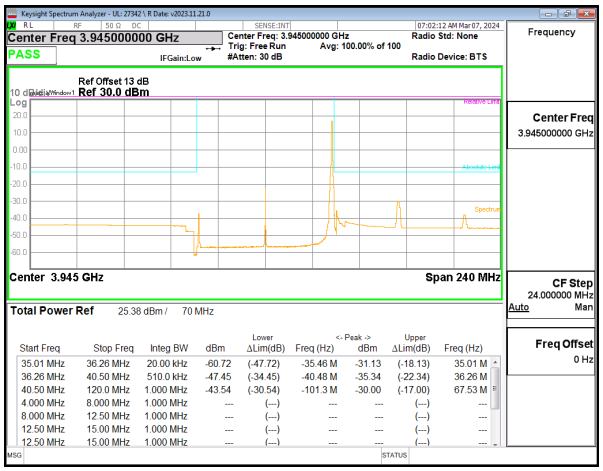
5G NR n77 70MHz BPSK Middle Channel RB1-0



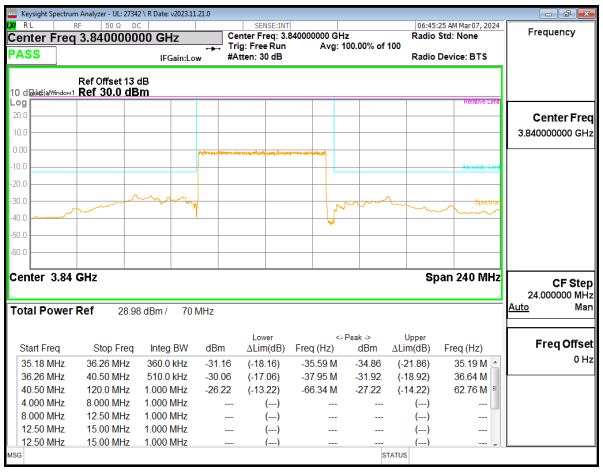
5G NR n77 70MHz BPSK High Channel RB1-0



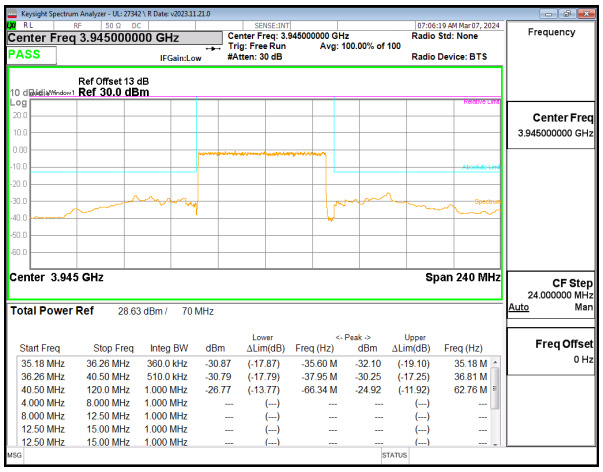
5G NR n77 70MHz BPSK Middle Channel RB1-188



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



5G NR n77 70MHz BPSK Middle Channel RB180-0



5G NR n77 70MHz BPSK High Channel RB180-0

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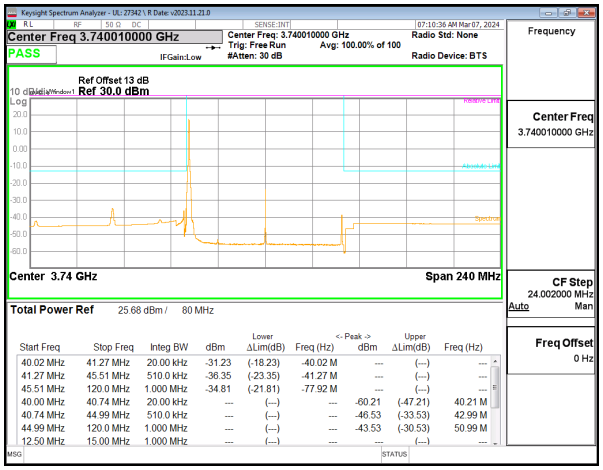
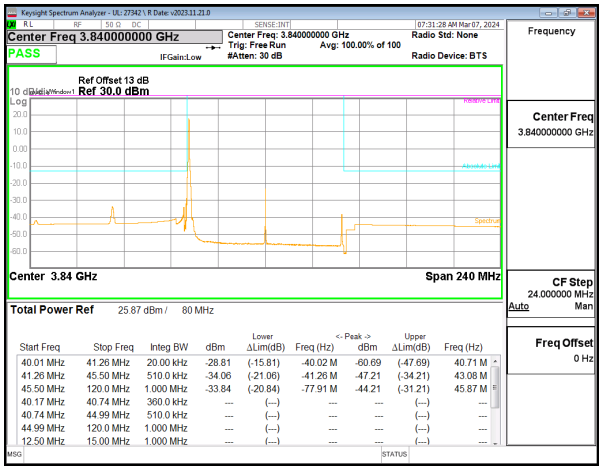
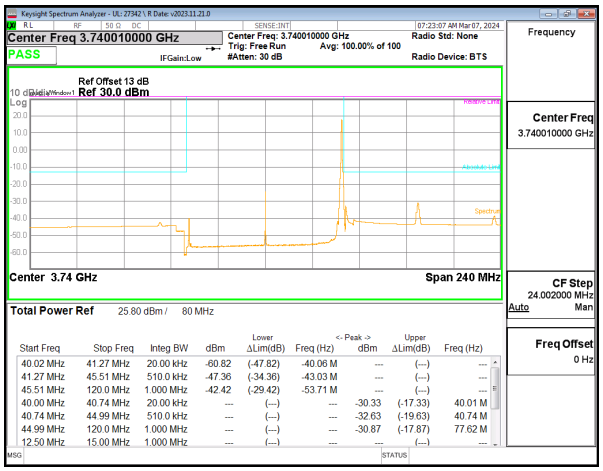


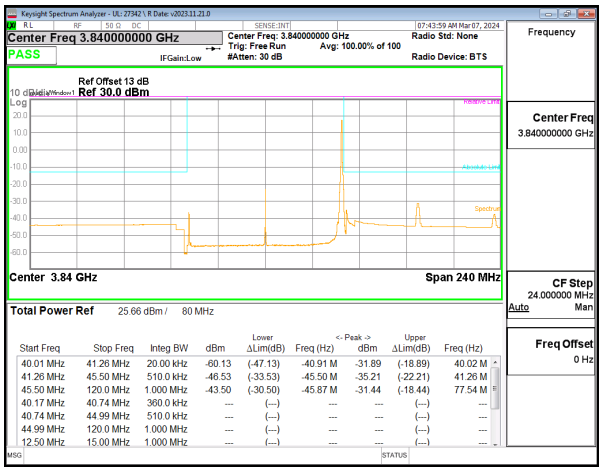
5G NR n77 80MHz BPSK Low Channel RB1-0



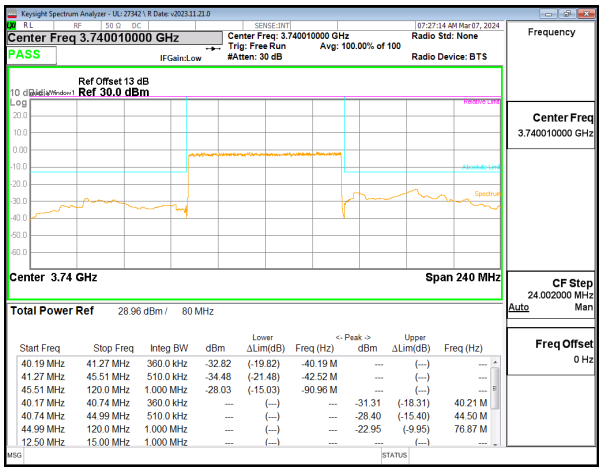
5G NR n77 80MHz BPSK Middle Channel RB1-0



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



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



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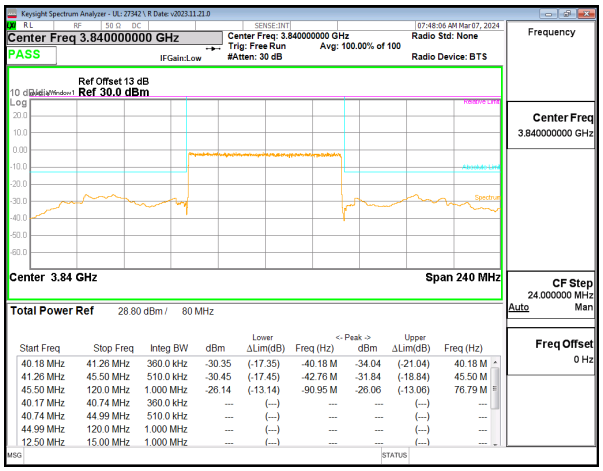

5G NR n77 80MHz BPSK Middle Channel RB216-0

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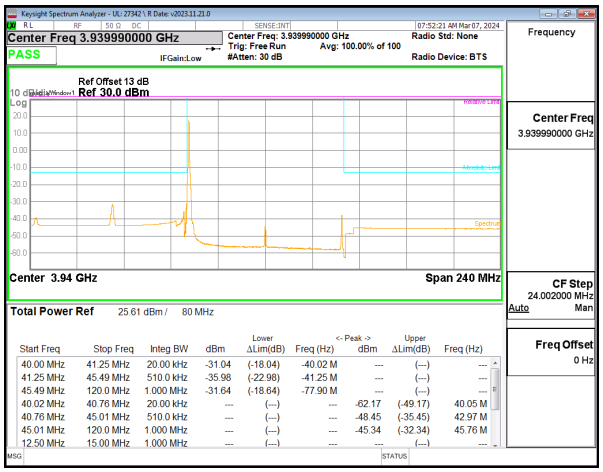
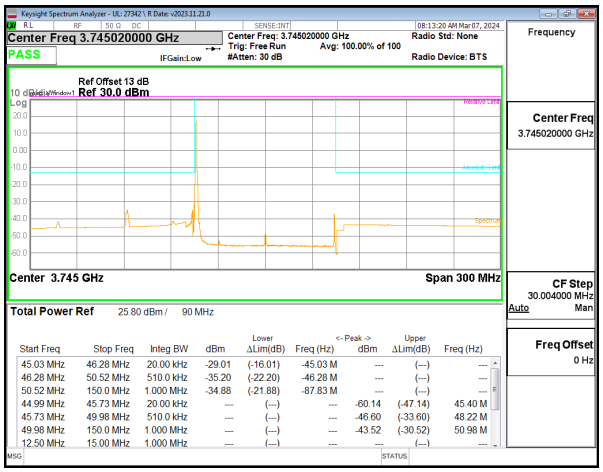
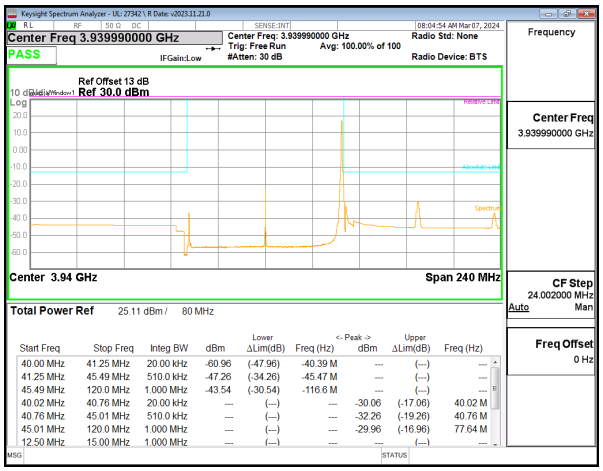


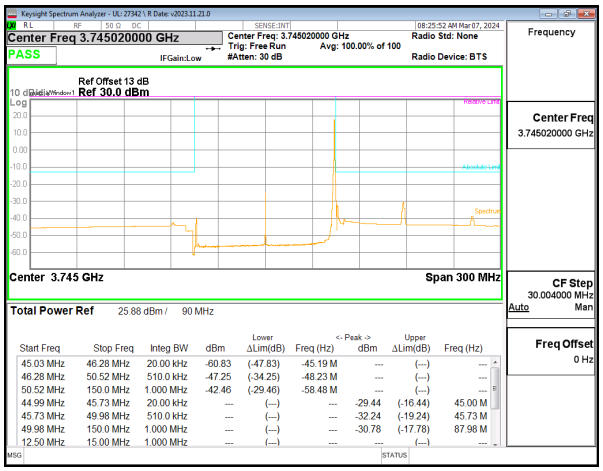
5G NR n77 80MHz BPSK High Channel RB1-0



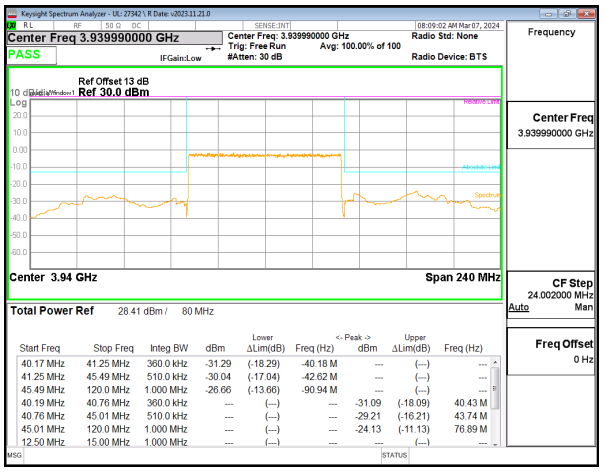
5G NR n77 90MHz BPSK Low Channel RB1-0



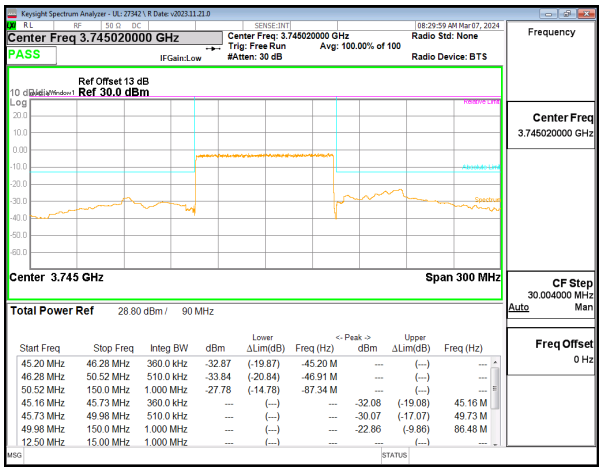
5G NR n77 80MHz BPSK High Channel RB1-216



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



5G NR n77 80MHz BPSK High Channel RB216-0



5G NR n77 90MHz BPSK Low Channel RB243-0

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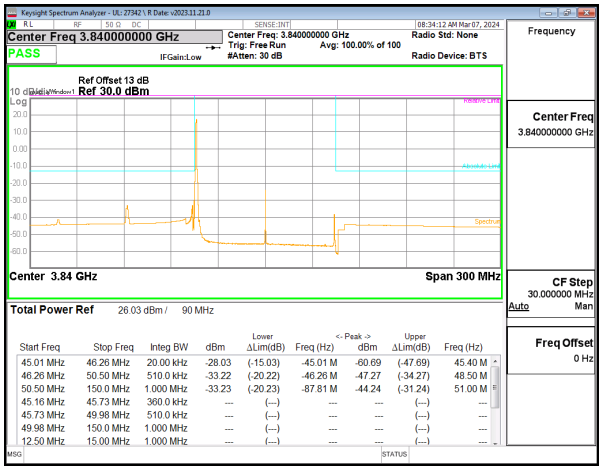
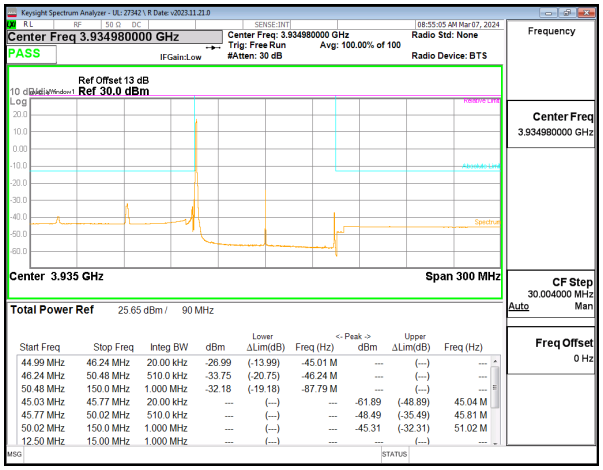
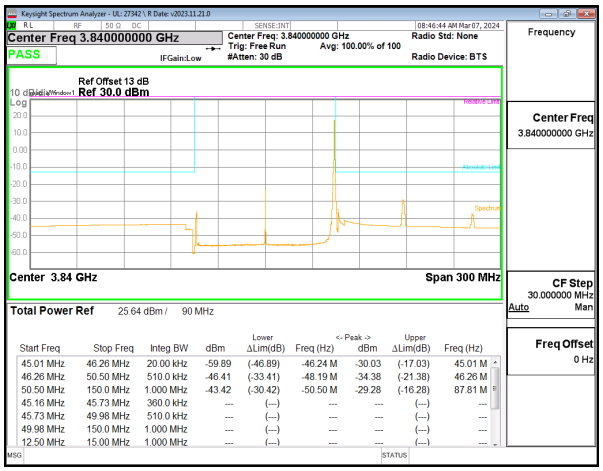


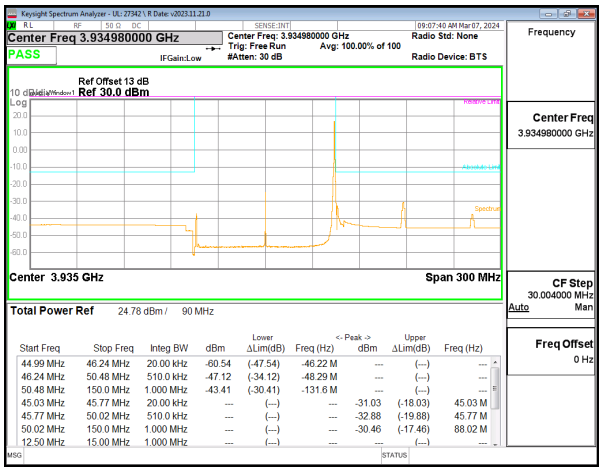
5G NR n77 90MHz BPSK Middle Channel RB1-0



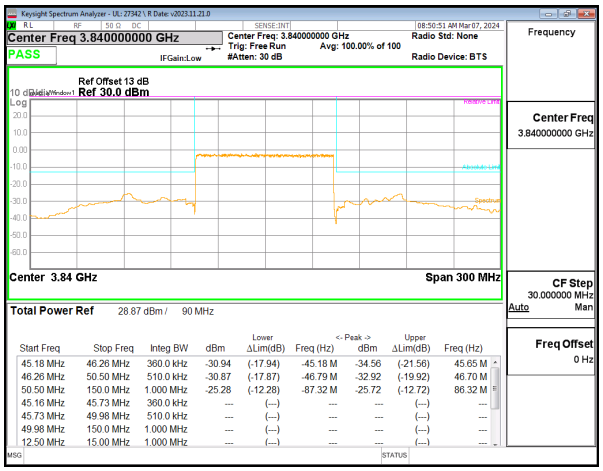
5G NR n77 90MHz BPSK High Channel RB1-0



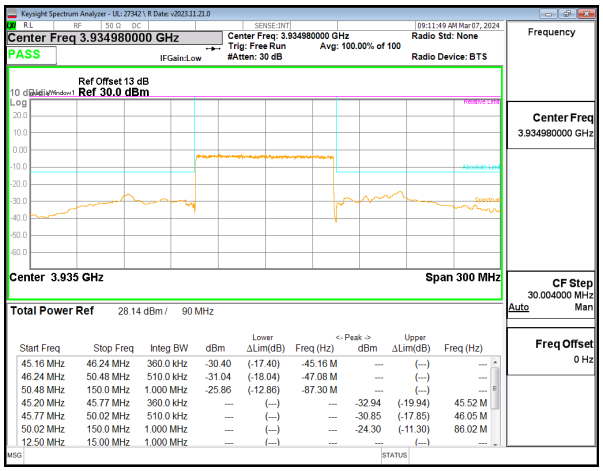
5G NR n77 90MHz BPSK Middle Channel RB1-244



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



5G NR n77 90MHz BPSK Middle Channel RB243-0



5G NR n77 90MHz BPSK High Channel RB243-0

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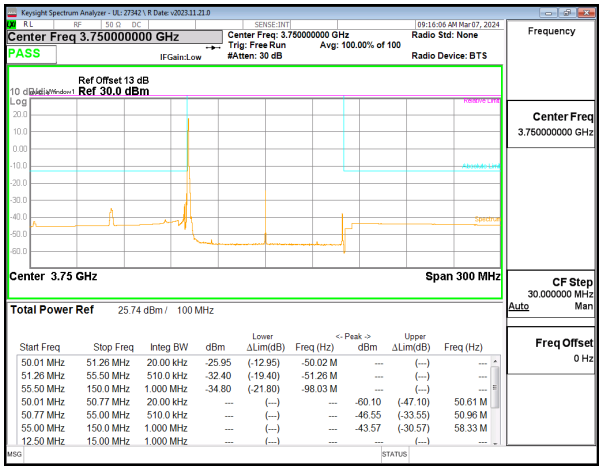
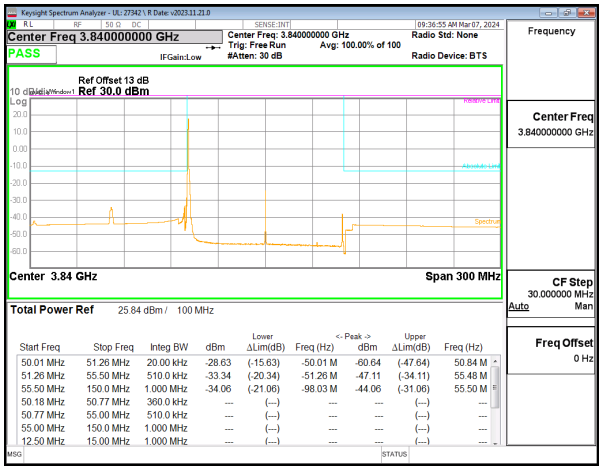
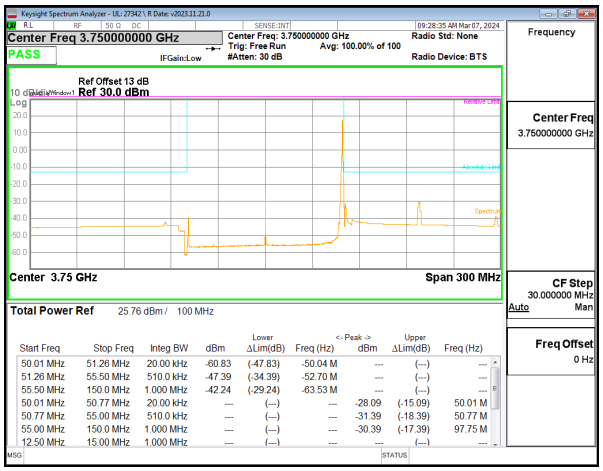


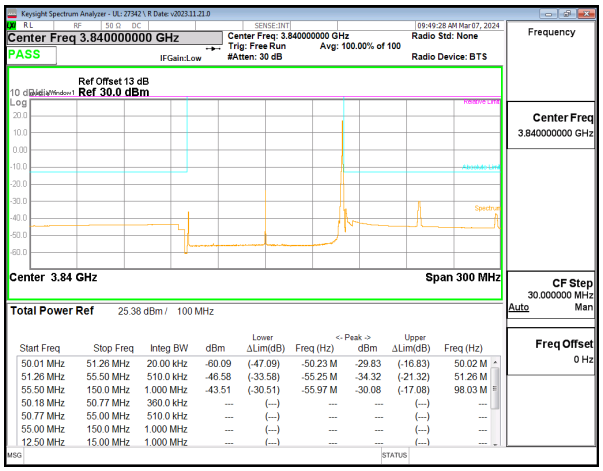
5G NR n77 100MHz BPSK Low Channel RB1-0



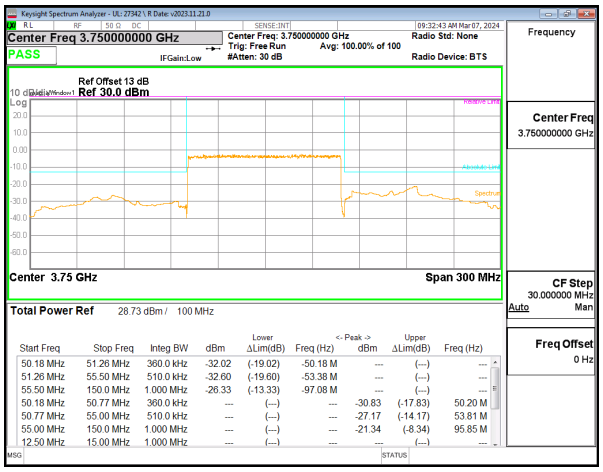
5G NR n77 100MHz BPSK Middle Channel RB1-0



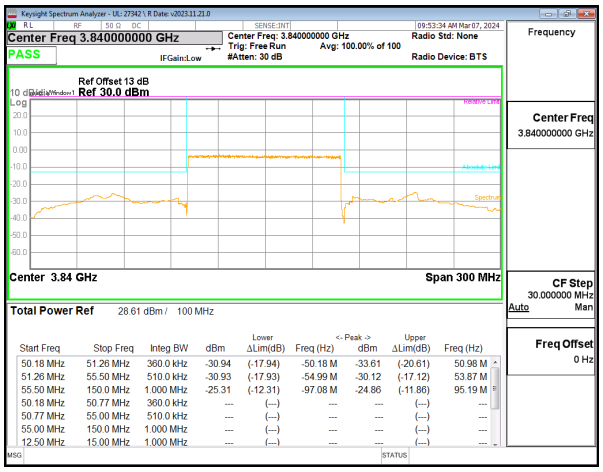
5G NR n77 100MHz BPSK Low Channel RB1-272



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



5G NR n77 100MHz BPSK Low Channel RB270-0



5G NR n77 100MHz BPSK Middle Channel RB270-0

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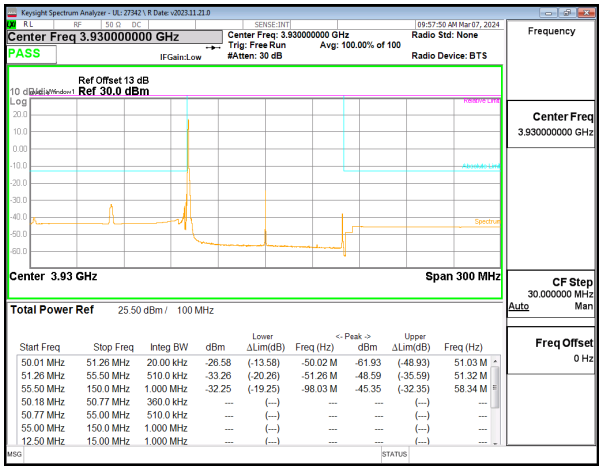
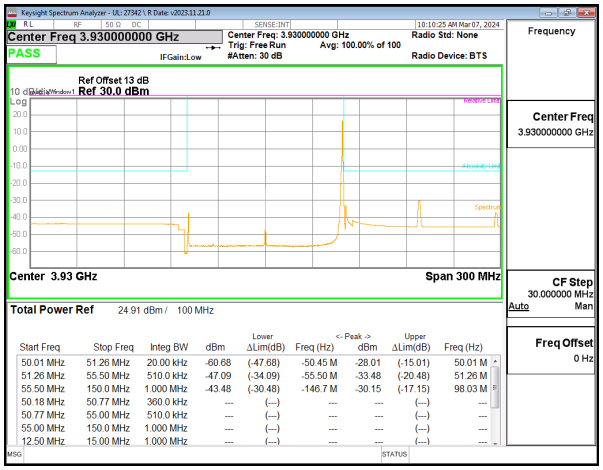
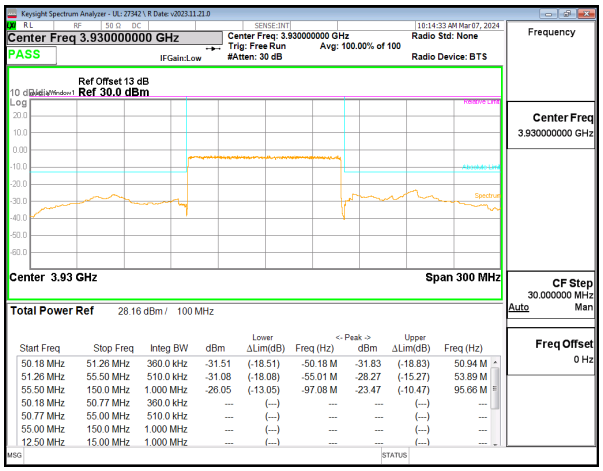


5G NR n77 100MHz BPSK High Channel RB1-0



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



5G NR n77 100MHz BPSK High Channel RB270-0

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9.3. OUT OF BAND EMISSIONS

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

- Set display line at -13 dBm, -25dBm and -40dBm according to the band Limit
- Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

QPSK with 1RB is the highest power and PSD to all bandwidth. 1RB has the same frequency and power to all bandwidth. Therefore, QPSK with 1RB and wider bandwidths results are reported as worst case for LTE bands.

BPSK with 1RB is the highest power and PSD to all bandwidth. 1RB has the same frequency and power to all bandwidth. Therefore, BPSK with 1RB and wider bandwidths results are reported as worst case for 5G NRs.

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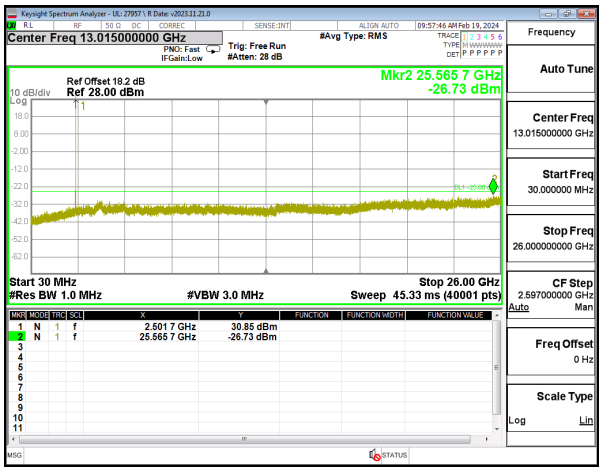
9.3.1. LTE BAND 7 AND 5G NR n7

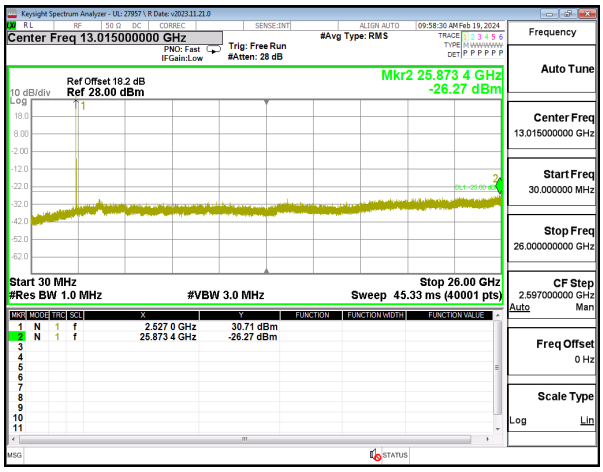
LIMITS

FCC: §27.53 (m)
The minimum permissible attenuation level of any spurious emissions is 55 + 10 log (P) dB where transmitting power (P) in Watts.

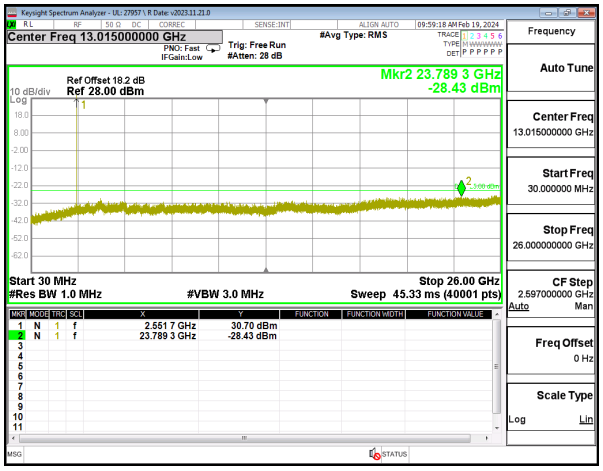
LTE BAND 7



LTE B7 20MHz QPSK Low Channel RB1-0



LTE B7 20MHz QPSK Middle Channel RB1-0



LTE B7 20MHz QPSK High Channel RB1-0

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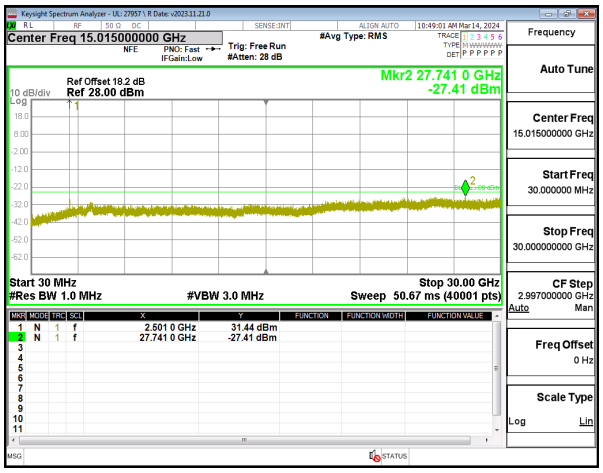
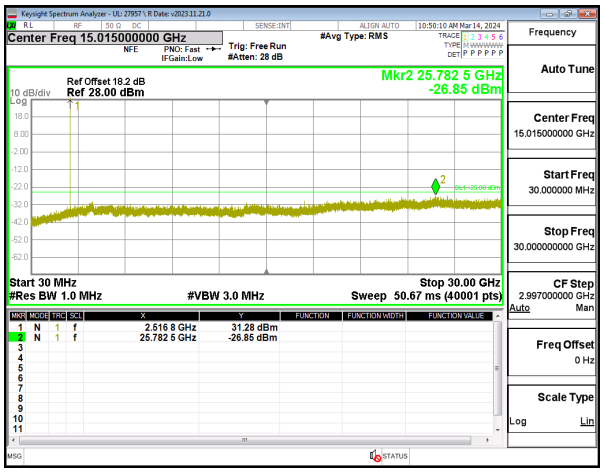
5G NR n7



5G NR n7 40MHz BPSK Low Channel RB1-0



5G NR n7 40MHz BPSK Middle Channel RB1-1

5G NR n7 40MHz BPSK High Channel RB1-215

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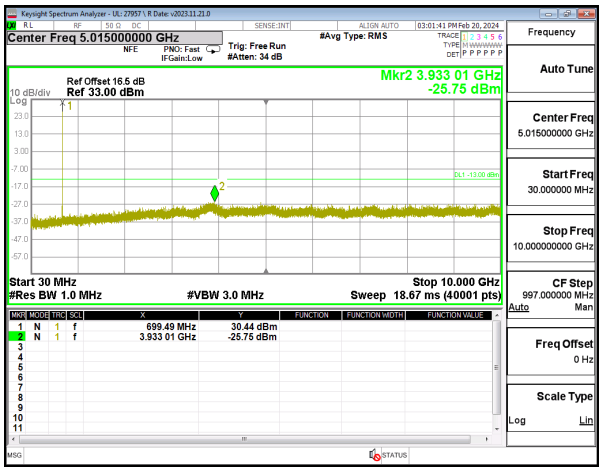
9.3.2. LTE BAND 12 AND 5G NR n12

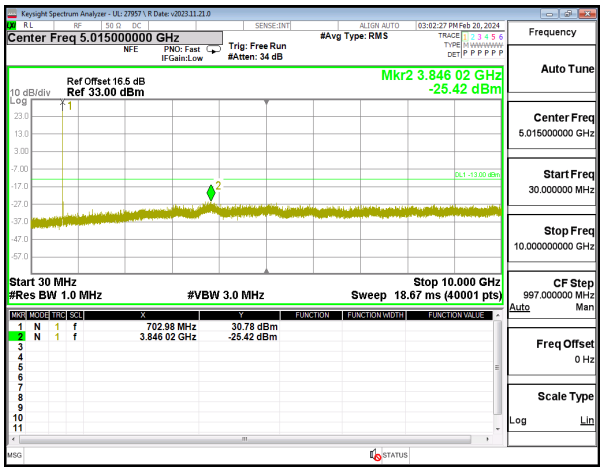
LIMITS

FCC: §27.53 (g)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

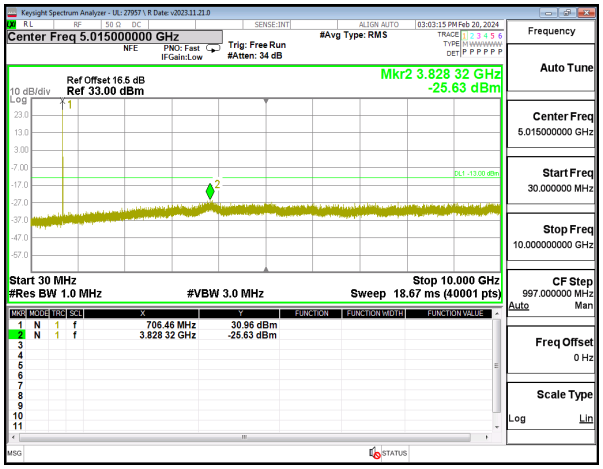
LTE BAND 12



LTE B12 10MHz QPSK Low Channel RB1-0



LTE B12 10MHz QPSK Middle Channel RB1-0



LTE B12 10MHz QPSK High Channel RB1-0

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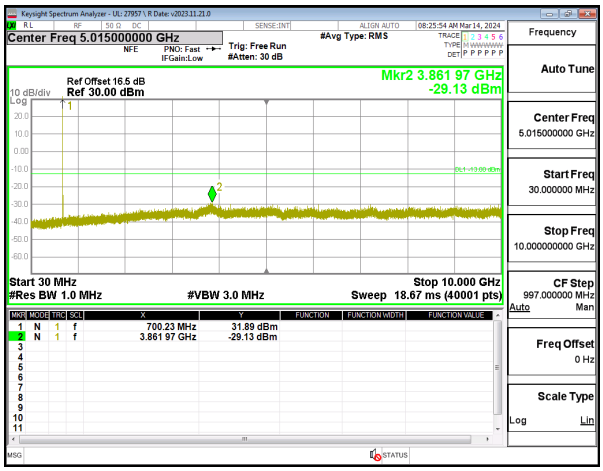
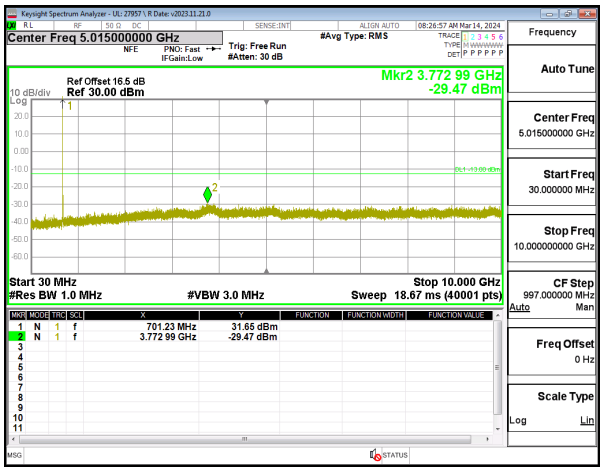
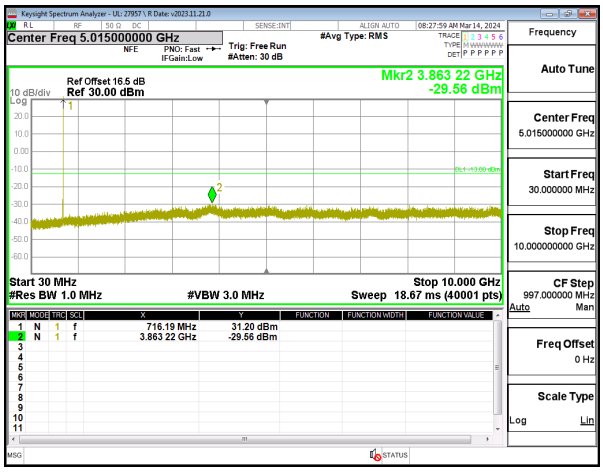
5G NR n12



5G NR n12 15MHz BPSK Low Channel RB1-0



5G NR n12 15MHz BPSK Middle Channel RB1-1



5G NR n12 15MHz BPSK High Channel RB1-78

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9.3.3. LTE BAND 13

LIMITS

FCC: §27.53 (c), (f)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts. The band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.
Note: Radiated data in section 9.1.6 confirms a compliance for the emissions in GPS 1559-1610 MHz band were wideband emissions therefore the -40dBm/MHz limit was used.

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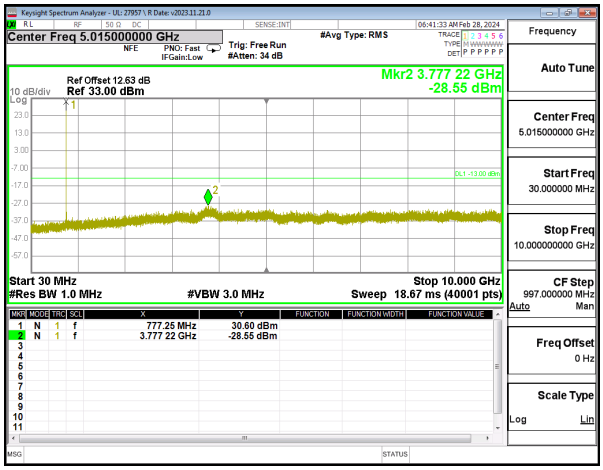
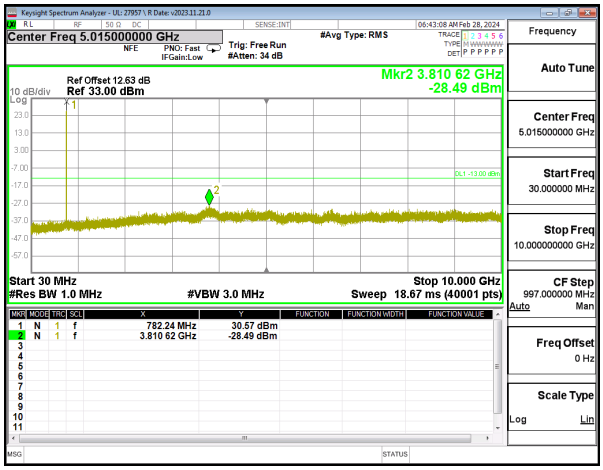
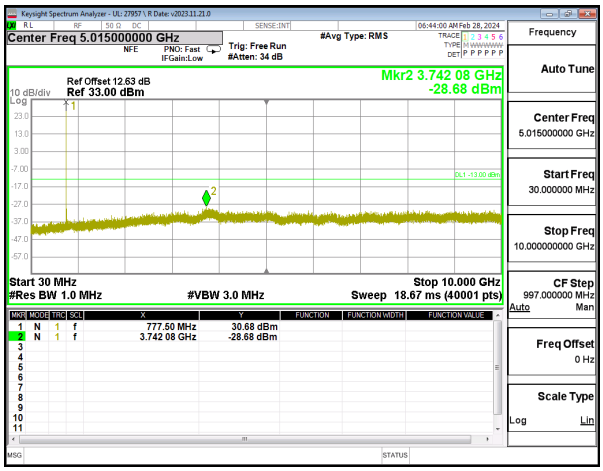


LTE B13 5MHz QPSK Low Channel RB1-0



LTE B13 5MHz QPSK High Channel RB1-0



LTE B13 10MHz QPSK Middle Channel RB1-0

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Note: Radiated data in section 9.1.6 confirms a compliance with narrowband limits for GPS1559-1610 MHz band.

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9.3.4. LTE BAND 14

LIMITS

FCC: §90.543 (e), (f)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts. The band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.
Note: Radiated data in section 9.1.7 confirms a compliance for the emissions in GPS 1559-1610 MHz band were wideband emissions therefore the -40dBm/MHz limit was used.

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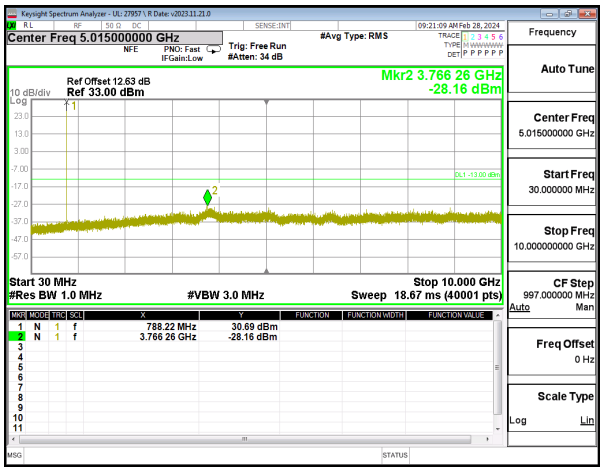
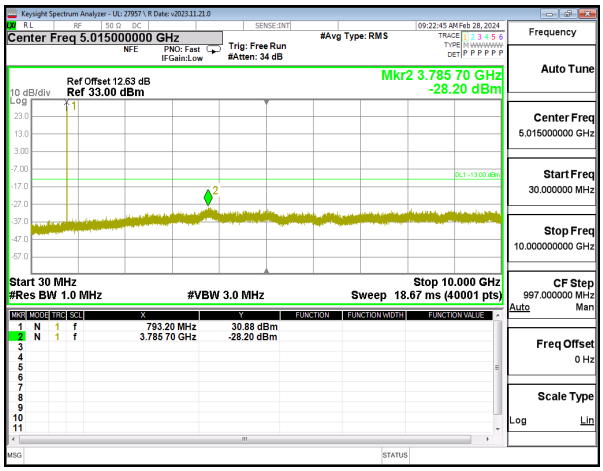
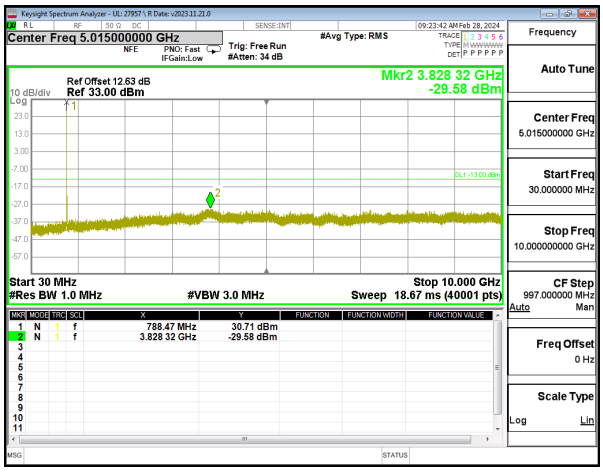
LTE BAND 14



LTE B14 5MHz QPSK Low Channel RB1-0



LTE B14 5MHz QPSK High Channel RB1-0



LTE B14 10MHz QPSK Middle Channel RB1-0

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Note: Radiated data in section 9.1.7 confirms a compliance with narrowband limits for GPS1559-1610 MHz band.

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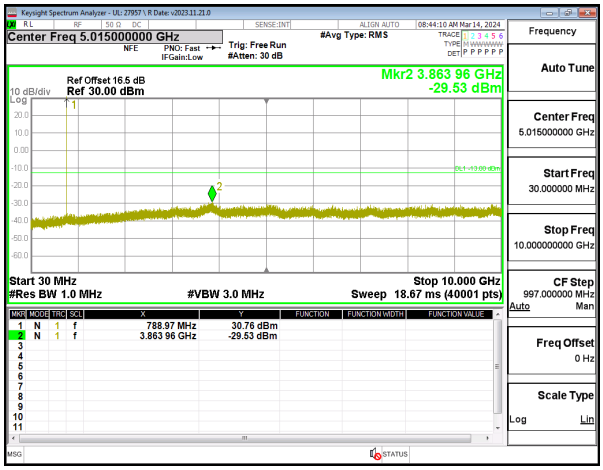
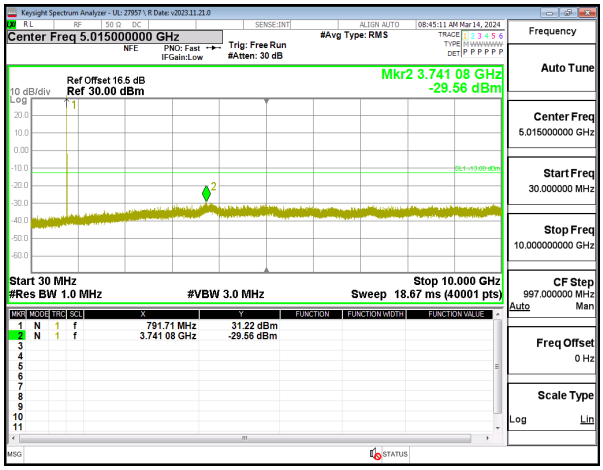
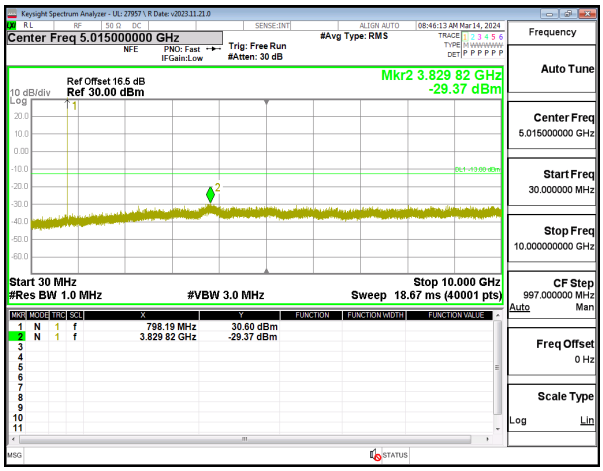
5G NR n14



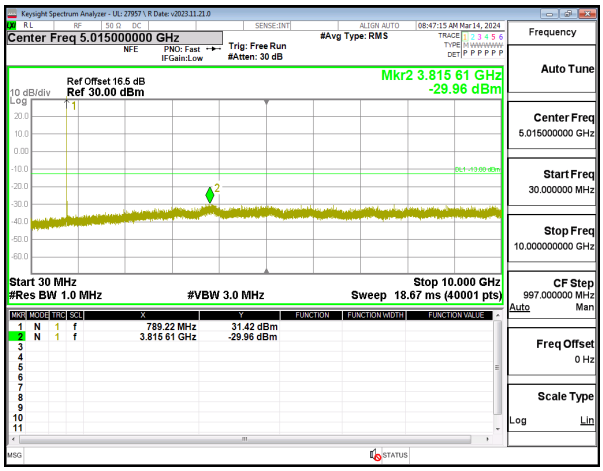
5G NR n14 5MHz BPSK Low Channel RB1-0



5G NR n14 5MHz BPSK Middle Channel RB1-1



5G NR n14 5MHz BPSK High Channel RB1-24



5G NR n14 10MHz BPSK Middle Channel RB1-0

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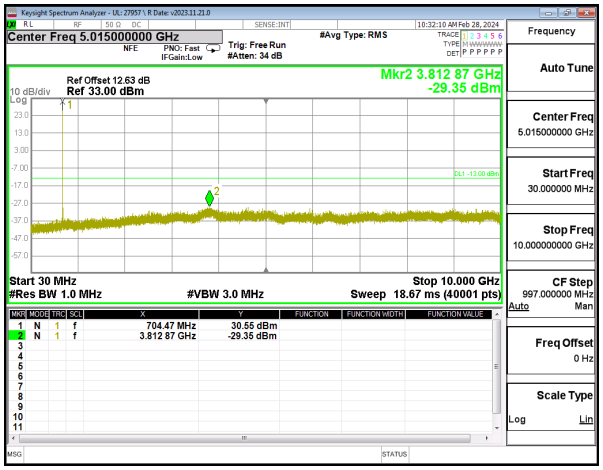
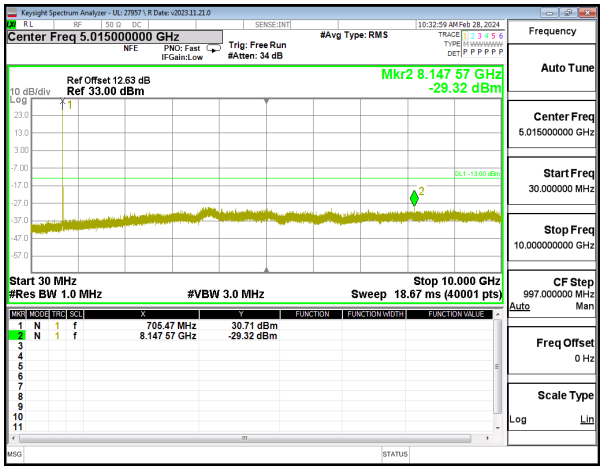
9.3.5. LTE BAND 17

LIMITS

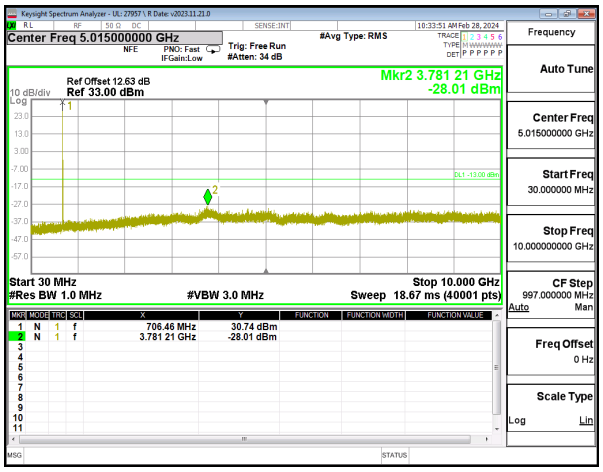
FCC: §27.53 (g)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.



LTE B17 10MHz QPSK Low Channel RB1-0



LTE B17 10MHz QPSK Middle Channel RB1-0



LTE B17 10MHz QPSK High Channel RB1-0

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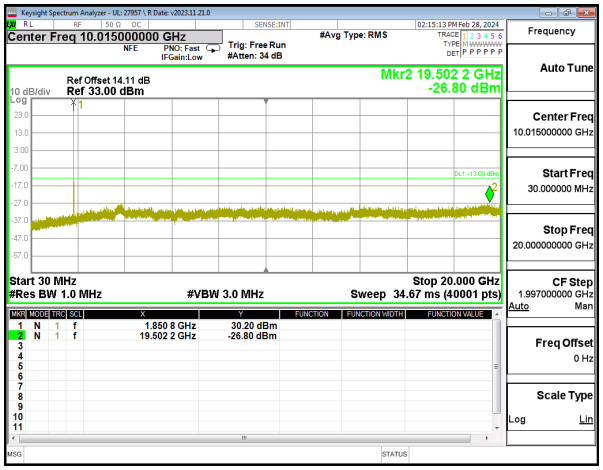
9.3.6. LTE BAND 25 AND 5G NR n25

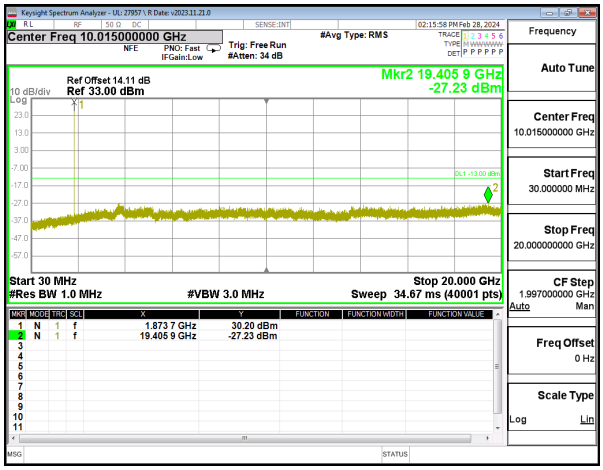
LIMITS

FCC: §24.238 (a)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

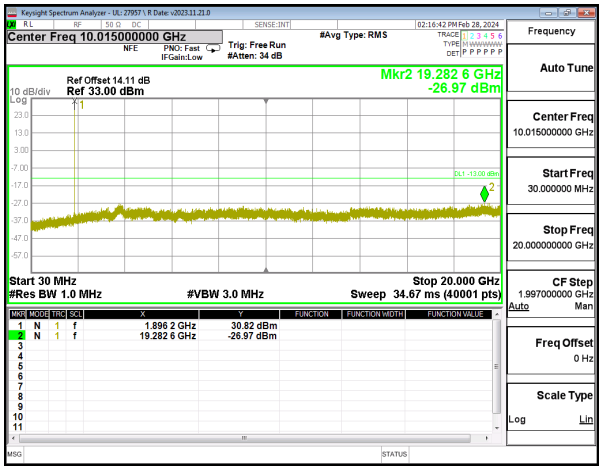
LTE BAND 25



LTE B25 20MHz QPSK Low Channel RB1-0



LTE B25 20MHz QPSK Middle Channel RB1-0



LTE B25 20MHz QPSK High Channel RB1-0

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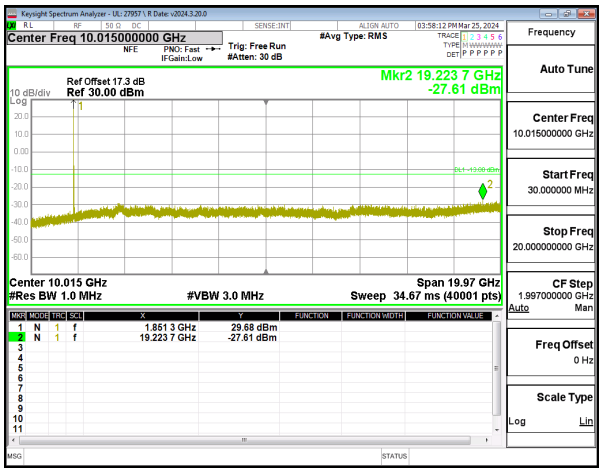
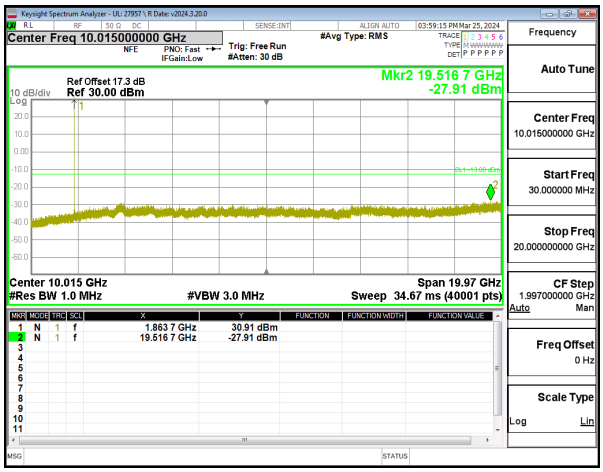
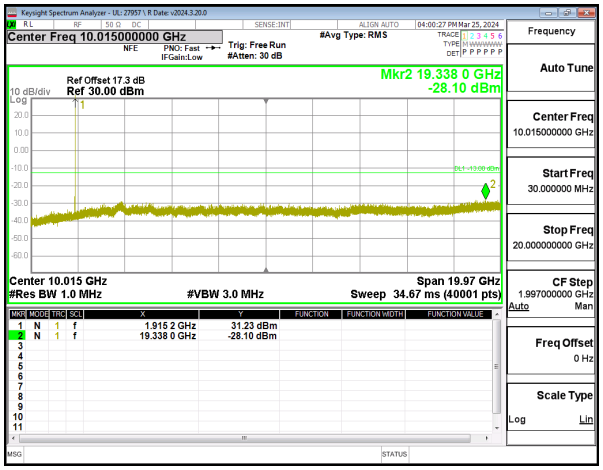
5G NR n25



5G NR n25 40MHz BPSK Low Channel RB1-0



5G NR n25 40MHz BPSK Middle Channel RB1-1



5G NR n25 40MHz BPSK High Channel RB1-215

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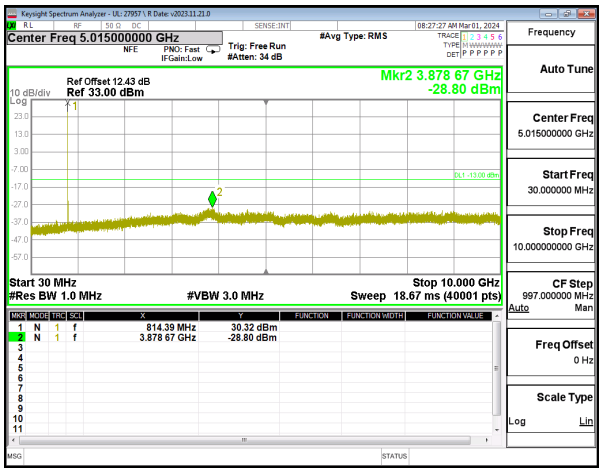
9.3.7. LTE BAND 26 AND 5G NR n26 (FCC PART 90S)

LIMITS

FCC: §90.691
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

LTE BAND 26



LTE B26 10MHz QPSK Middle Channel RB1-0

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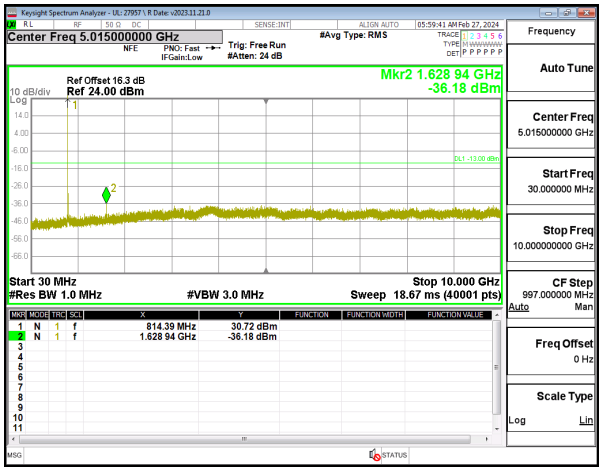
5G NR n26



5G NR n26 10MHz BPSK Middle Channel RB1-0

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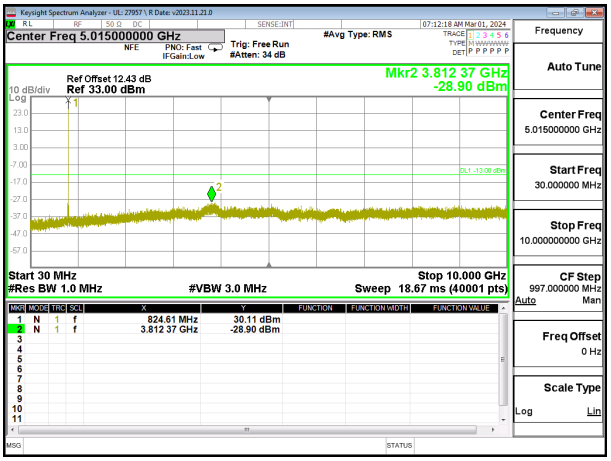
9.3.8. LTE BAND 26 AND 5G NR n26 (FCC PART 22)

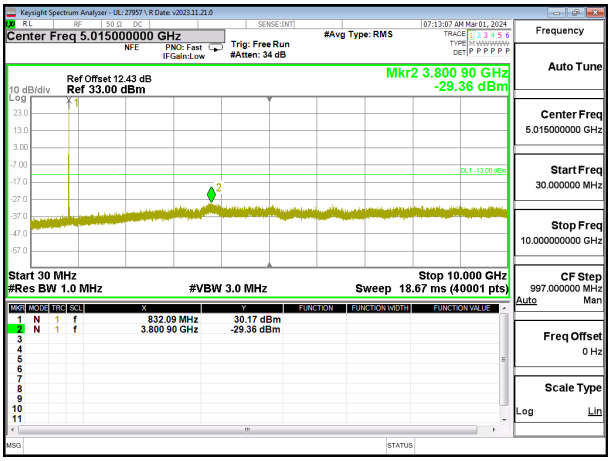
LIMITS

FCC: §22.917 (a)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

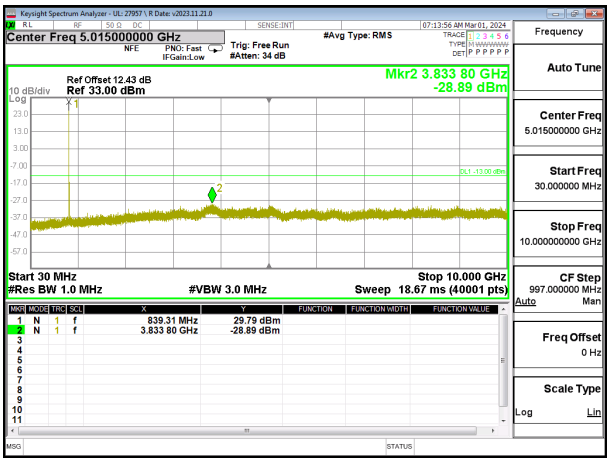
LTE BAND 26



LTE B26 10MHz QPSK Low Channel RB1-0



LTE B26 10MHz QPSK Middle Channel RB1-0



LTE B26 10MHz QPSK High Channel RB1-0

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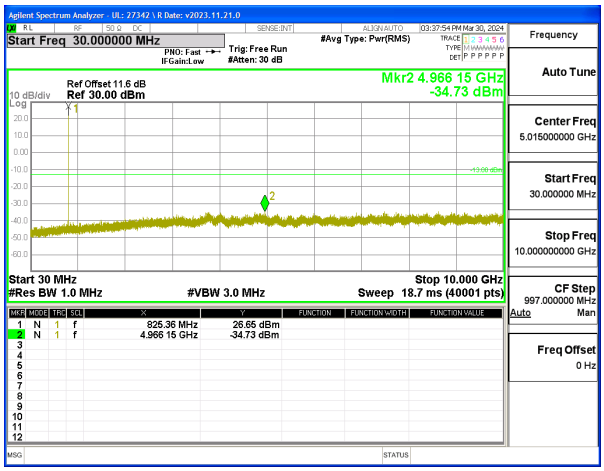
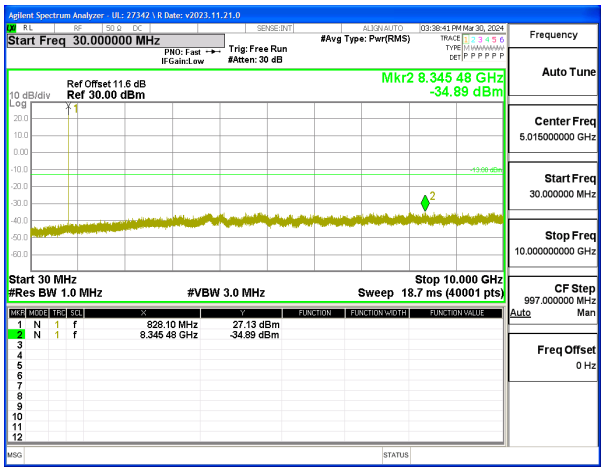
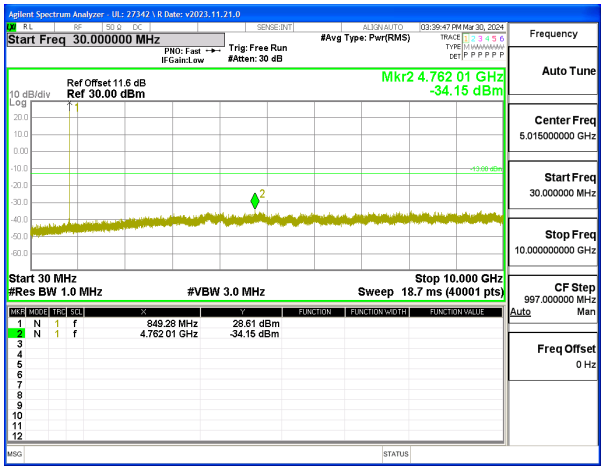
5G NR n26



5G NR n26 20MHz BPSK Low Channel RB1-0



5G NR n26 20MHz BPSK Middle Channel RB1-1



5G NR n26 20MHz BPSK High Channel RB1-105

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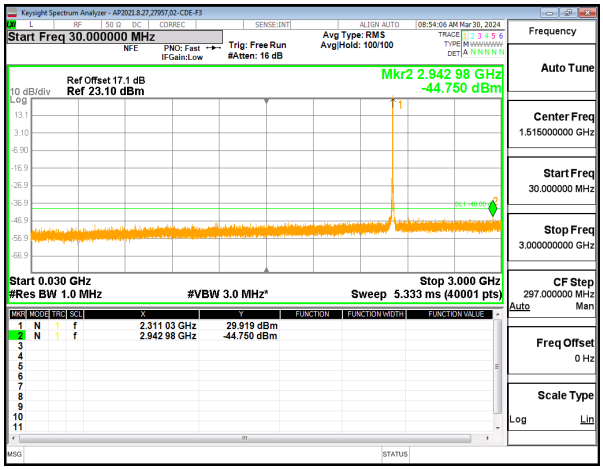
9.3.9. LTE BAND 30 AND 5G NR n30

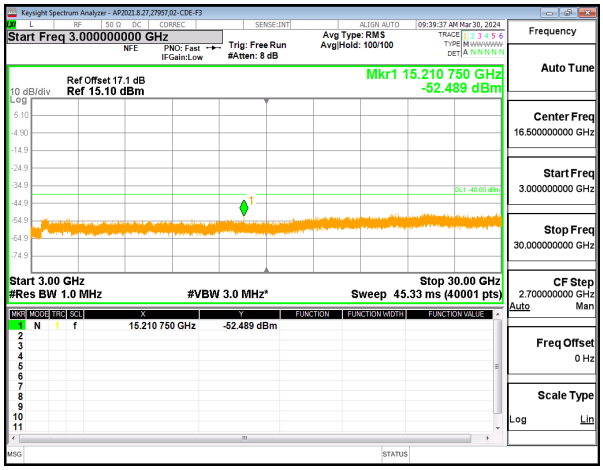
LIMITS

FCC: §27.53 (a)
The minimum permissible attenuation level of any spurious emissions is 70 + 10 log (P) dB where transmitting power (P) in Watts.

LTE BAND 30

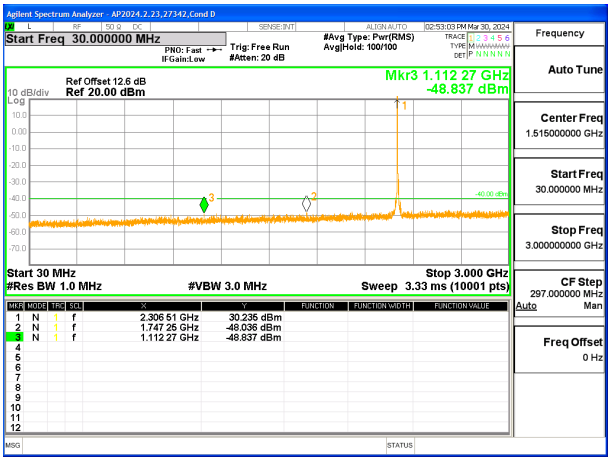


LTE B30 10MHz QPSK Mid Channel RB1-0 (30MHz to 3GHz)

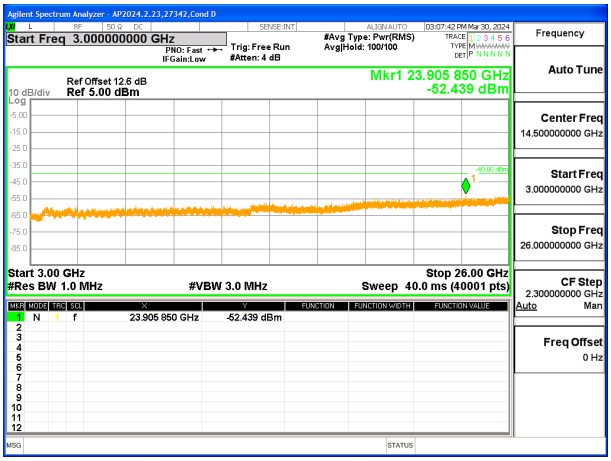


LTE B30 10MHz QPSK Middle Channel RB1-0 (3G to 26G)

5G NR n30



5G NR n30 10MHz BPSK Middle Channel RB1-0 (30MHz to 3GHz)



5G NR n30 10MHz BPSK Middle Channel RB1-0 (3HHz to 30GHz

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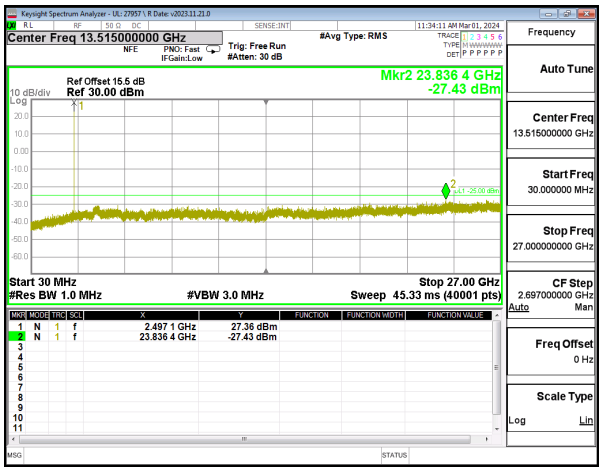
9.3.10. LTE BAND 41

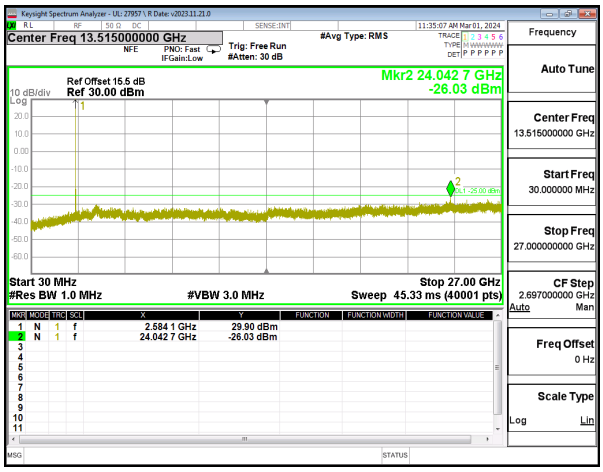
LIMITS

FCC: §27.53 (m)
The minimum permissible attenuation level of any spurious emissions is 55 + 10 log (P) dB where transmitting power (P) in Watts.

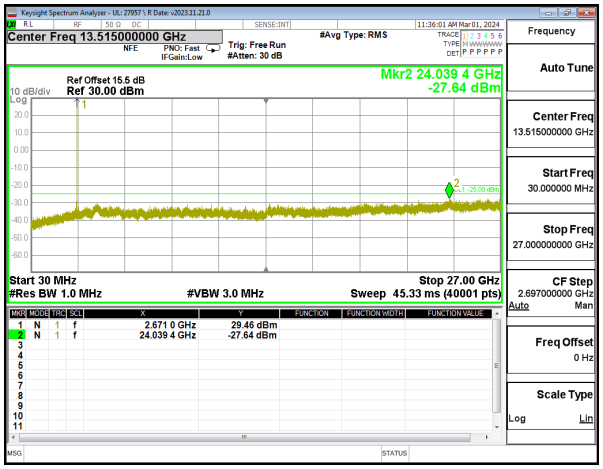
LTE BAND 41



LTE B41 20MHz QPSK Low Channel RB1-0



LTE B41 20MHz QPSK Middle Channel RB1-0



LTE B41 20MHz QPSK High Channel RB1-0

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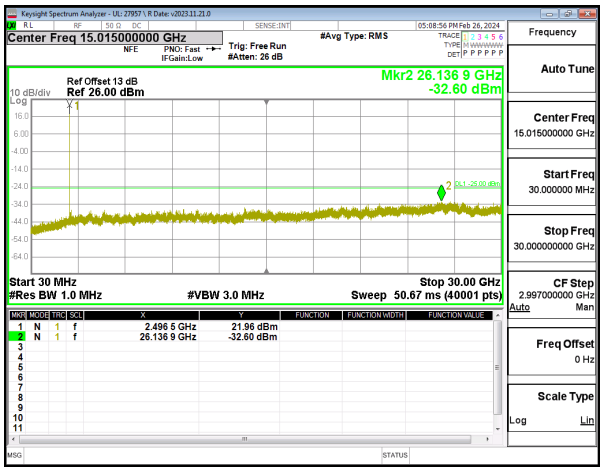
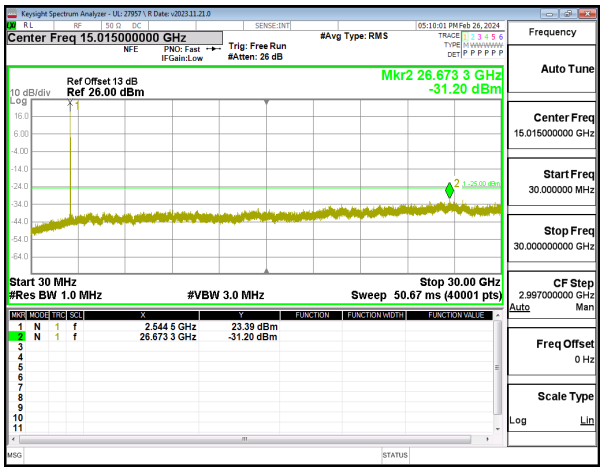
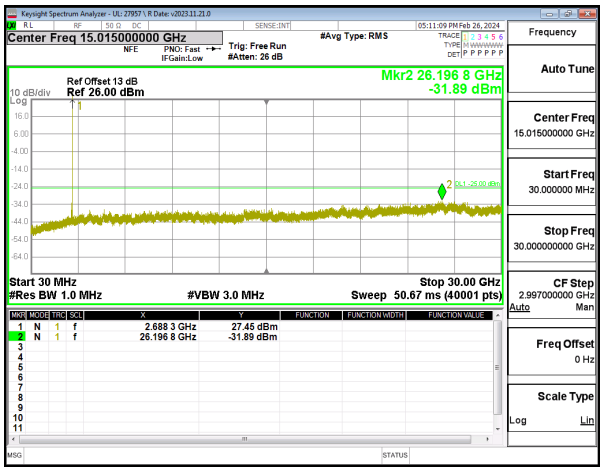
5G NR n41 (FCC)



5G NR n41 100MHz BPSK Low Channel RB1-0



5G NR n41 100MHz BPSK Middle Channel RB1-1



5G NR n41 100MHz BPSK High Channel RB1-272

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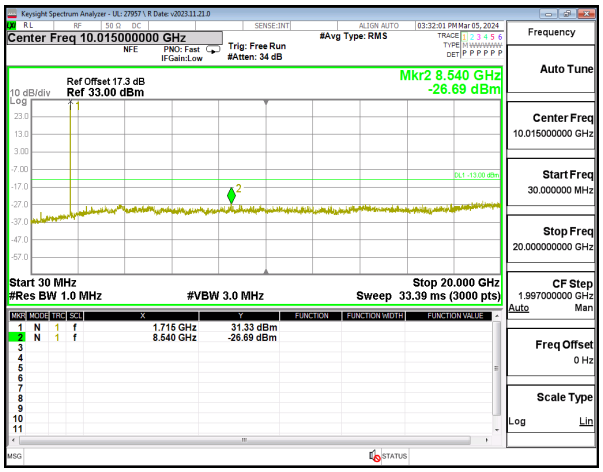
9.3.12. LTE BAND 66 AND 5G NR n66

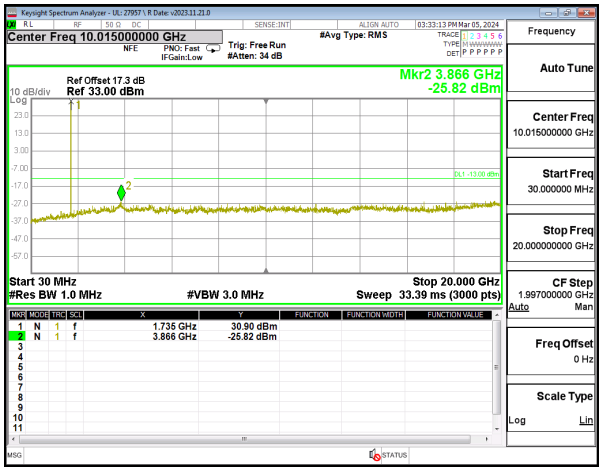
LIMITS

FCC: §27.53 (h)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

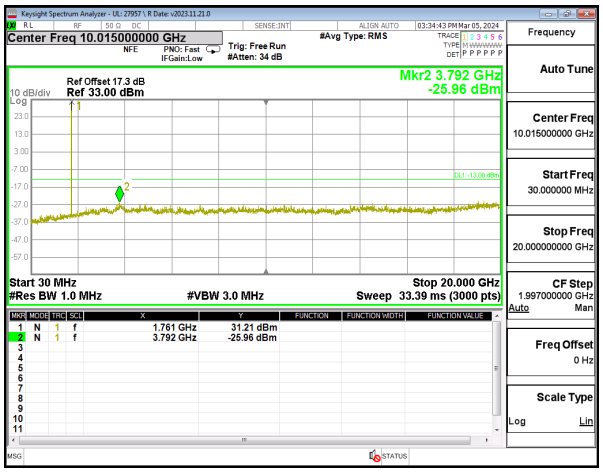
LTE BAND 66



LTE B66 20MHz QPSK Low Channel RB1-0



LTE B66 20MHz QPSK Middle Channel RB1-0



LTE B66 20MHz QPSK High Channel RB1-0

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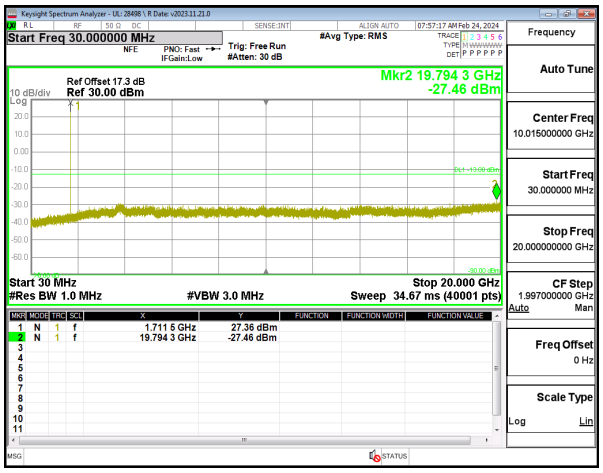
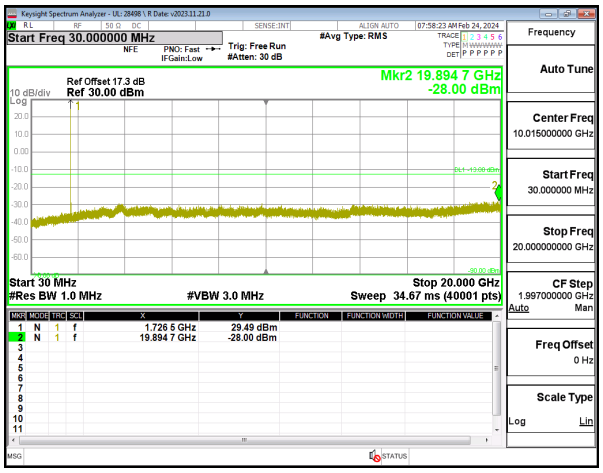
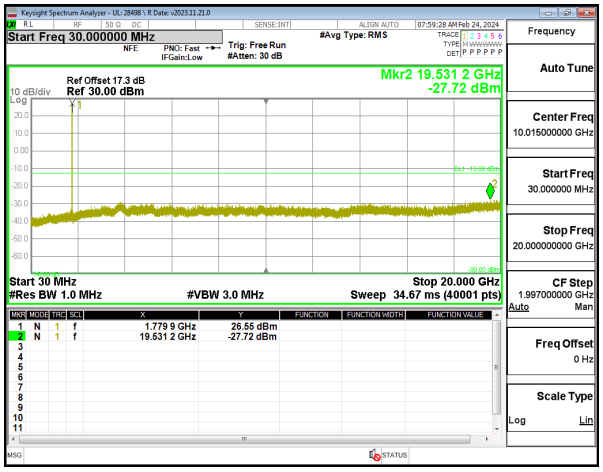
5G NR n66



5G NR n66 40MHz BPSK Low Channel RB1-0



5G NR n66 40MHz BPSK Middle Channel RB1-1



5G NR n66 40MHz BPSK High Channel RB1-215

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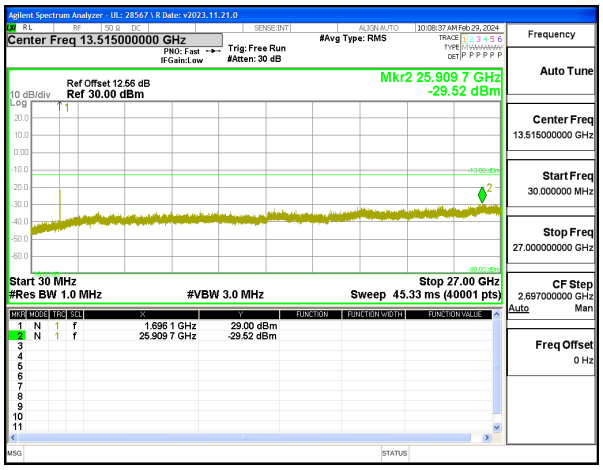
9.3.13. 5G NR n70

LIMITS

FCC: §27.53 (h)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

5G NR n70

 5G NR n70 15MHz BPSK Middle Channel RB1-0	Intentionally Blank

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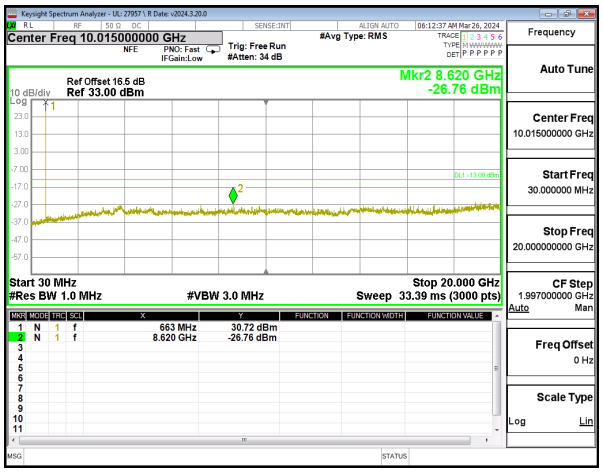
9.3.14. LTE BAND 71 AND 5G NR n71

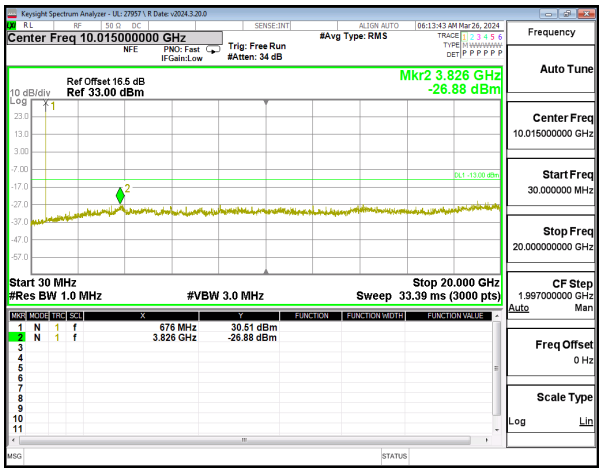
LIMITS

FCC: §27.53 (g)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

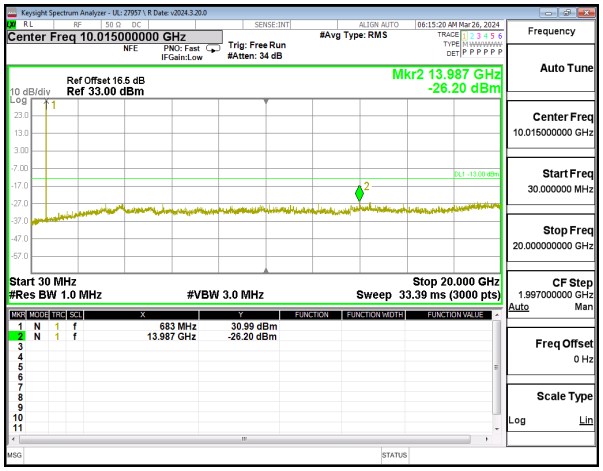
LTE BAND 71



LTE B71 20MHz QPSK Low Channel RB1-0



LTE B71 20MHz QPSK Middle Channel RB1-0



LTE B71 20MHz QPSK High Channel RB1-0

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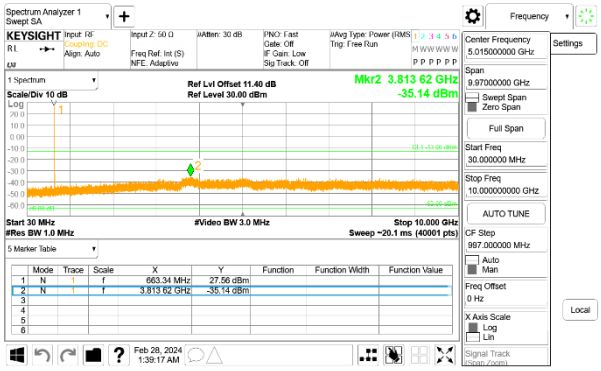
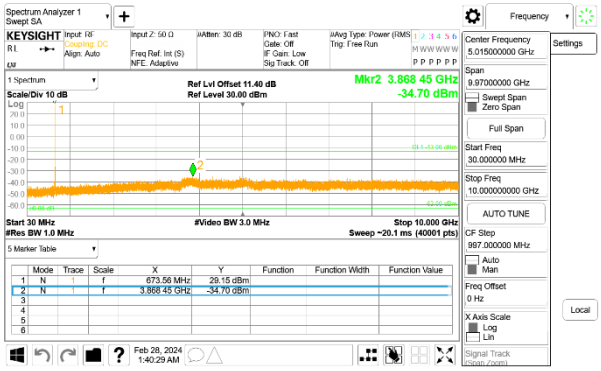
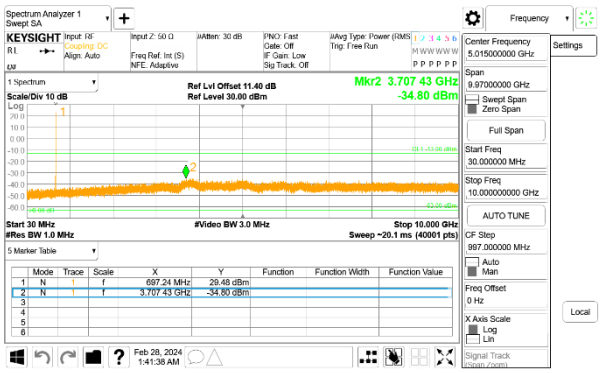
5G NR n71



5G NR n71 20MHz BPSK Low Channel RB1-0, ID:28567



5G NR n71 20MHz BPSK Middle Channel RB1-1, ID:28567



5G NR n71 20MHz BPSK High Channel RB1-105, ID:28567

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9.3.15. 5G NR n77 (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.

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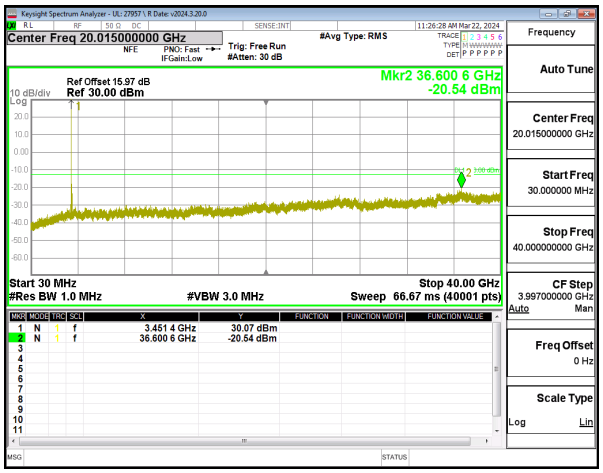

5G NR n77 100MHz BPSK Mid Channel RB1-1

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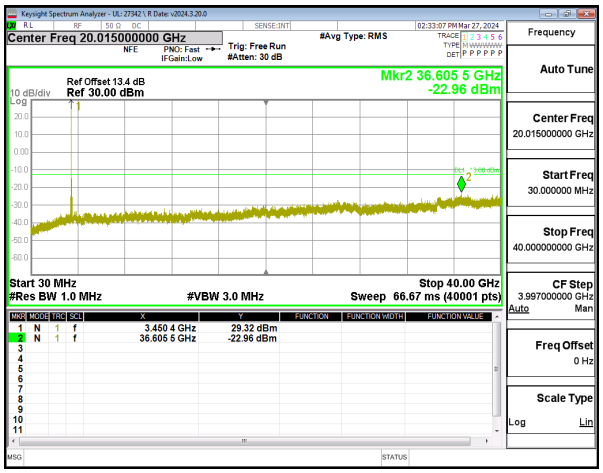
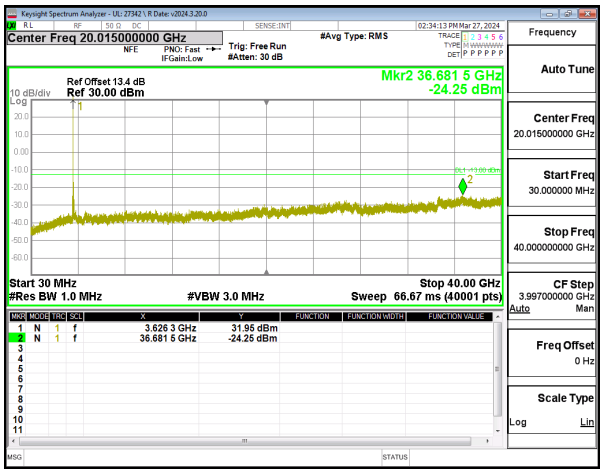
9.3.16. 5G NR n77 (Part 27 3700-3980MHz)

LIMITS

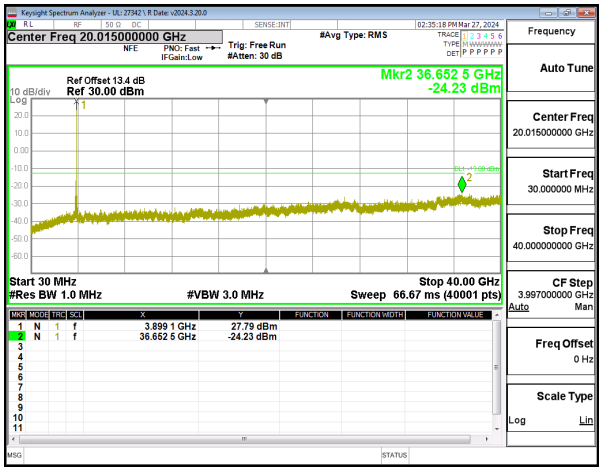
FCC: §27.53
Emission limits
(I) 3.7 GHz Service. The following emission limits apply to stations transmitting in the 3700-3980 MHz band:
(2) For mobile operations in the 3700-3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz.



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



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



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

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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, 3.2VDC.

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.

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9.4.1. LTE BAND 7 AND 5G NR n7

LIMITS

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

Test Engineer ID:	39004	Test Date:	2024-04-10

LTE BAND 7 QPSK (20MHz BANDWIDTH)

Band	7	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2500	2570			
Temperature	Voltage	Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Normal (20°C)	Normal	2501.0830	2568.9524			
Extreme (50°C)		2501.0195	2568.9256	-1.2	0.000	Yes
Extreme (40°C)		2501.0195	2568.9256	-0.7	0.000	Yes
Extreme (30°C)		2501.0195	2568.9256	0.8	0.000	Yes
Extreme (10°C)		2501.0195	2568.9256	-0.2	0.000	Yes
Extreme (0°C)		2501.0195	2568.9256	-0.7	0.000	Yes
Extreme (-10°C)		2501.0195	2568.9256	2.4	0.001	Yes
Extreme (-20°C)		2501.0195	2568.9256	1.4	0.001	Yes
Extreme (-30°C)		2501.0195	2568.9256	2.6	0.001	Yes
20°C	15%	2501.0195	2568.9256	2.9	0.001	Yes
	-15%	2501.0195	2568.9256	3.5	0.001	Yes
	End Point Voltage	2501.0195	2568.9256	3.1	0.001	Yes

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