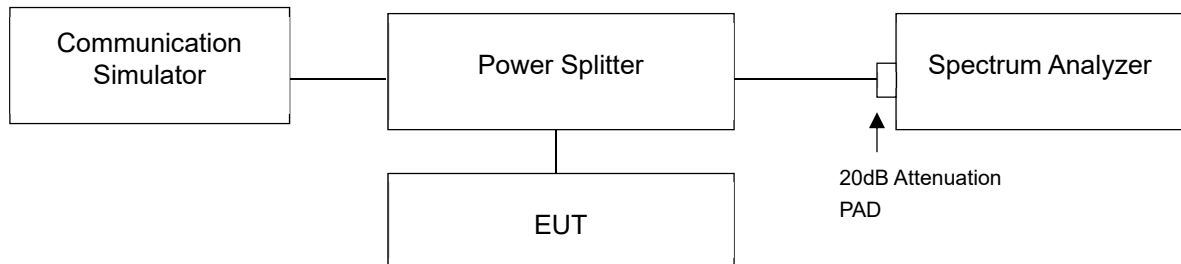


4.6 Peak to Average Ratio

4.6.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.6.2 Test Setup



4.6.3 Test Procedures

- Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

4.6.4 Test Results

| Cat-M1 Band 4, Channel Bandwidth 1.4MHz | | | |
|-----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 19957 | 1710.7 | 4.40 | 5.34 |
| 20175 | 1732.5 | 4.79 | 5.70 |
| 20393 | 1754.3 | 4.90 | 5.72 |

| Cat-M1 Band 4, Channel Bandwidth 3MHz | | | |
|---------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 19965 | 1711.5 | 4.76 | 5.64 |
| 20175 | 1732.5 | 4.71 | 5.67 |
| 20385 | 1753.5 | 4.77 | 5.71 |

| Cat-M1 Band 4, Channel Bandwidth 5MHz | | | |
|---------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 19975 | 1712.5 | 4.89 | 5.89 |
| 20175 | 1732.5 | 4.78 | 5.78 |
| 20375 | 1752.5 | 4.84 | 5.80 |

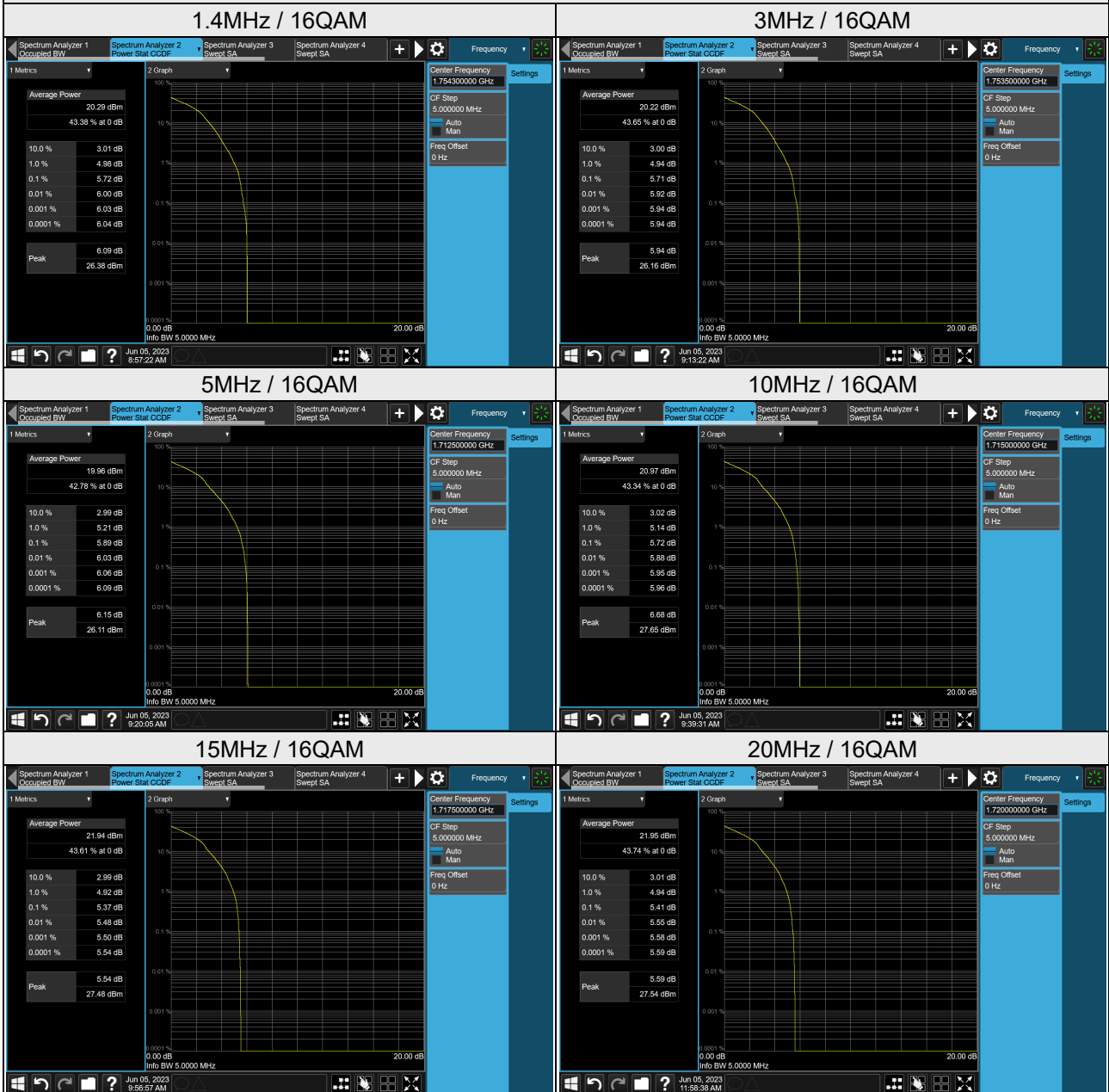
| Cat-M1 Band 4, Channel Bandwidth 10MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 20000 | 1715.0 | 4.88 | 5.72 |
| 20175 | 1732.5 | 4.90 | 5.56 |
| 20350 | 1750.0 | 4.84 | 5.65 |

| Cat-M1 Band 4, Channel Bandwidth 15MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 20025 | 1717.5 | 4.64 | 5.37 |
| 20175 | 1732.5 | 4.60 | 5.34 |
| 20325 | 1747.5 | 4.61 | 5.28 |

Cat-M1 Band 4, Channel Bandwidth 20MHz

| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
|---------|-----------------|----------------------------|-------|
| | | QPSK | 16QAM |
| 20050 | 1720.0 | 4.66 | 5.41 |
| 20175 | 1732.5 | 4.62 | 5.35 |
| 20300 | 1745.0 | 4.66 | 5.39 |

Spectrum Plot of Worst Value



| Cat-M1 Band 12, Channel Bandwidth 1.4MHz | | | |
|------------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 23017 | 699.7 | 4.84 | 5.78 |
| 23095 | 707.5 | 4.81 | 5.76 |
| 23173 | 715.3 | 4.73 | 5.64 |

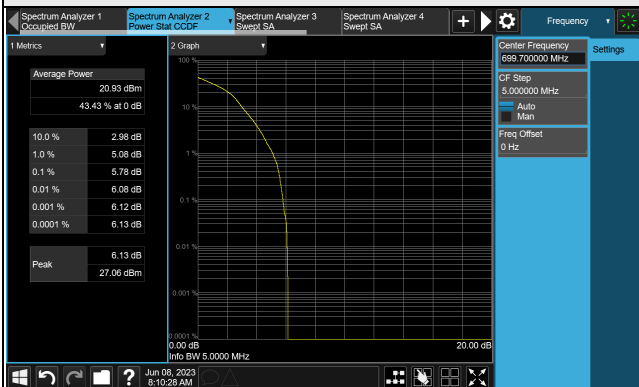
| Cat-M1 Band 12, Channel Bandwidth 3MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 23025 | 700.5 | 4.80 | 5.70 |
| 23095 | 707.5 | 4.76 | 5.72 |
| 23165 | 714.5 | 4.80 | 5.65 |

| Cat-M1 Band 12, Channel Bandwidth 5MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 23035 | 701.5 | 4.87 | 5.82 |
| 23095 | 707.5 | 4.87 | 5.83 |
| 23155 | 713.5 | 4.81 | 5.75 |

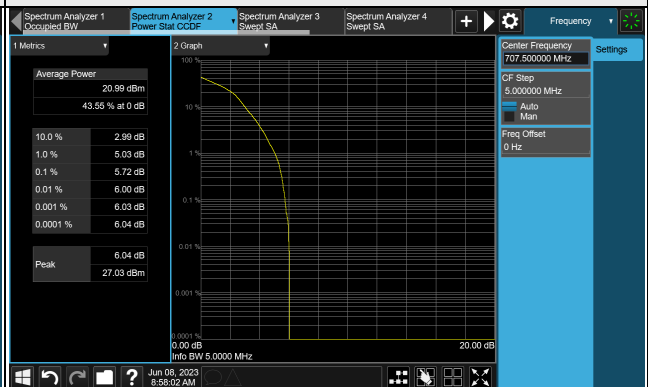
| Cat-M1 Band 12, Channel Bandwidth 10MHz | | | |
|-----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 23060 | 704.0 | 4.85 | 5.75 |
| 23095 | 707.5 | 4.83 | 5.80 |
| 23130 | 711.0 | 4.85 | 5.80 |

Spectrum Plot of Worst Value

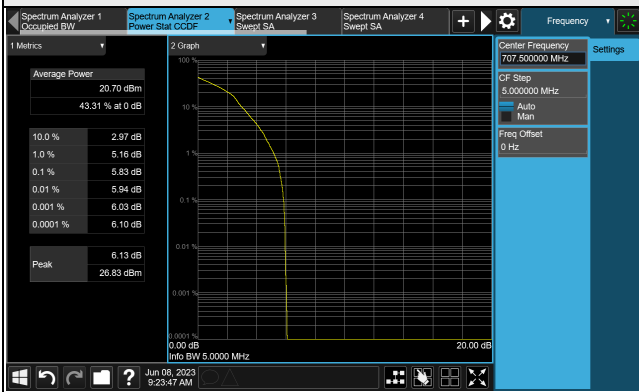
1.4MHz / 16QAM



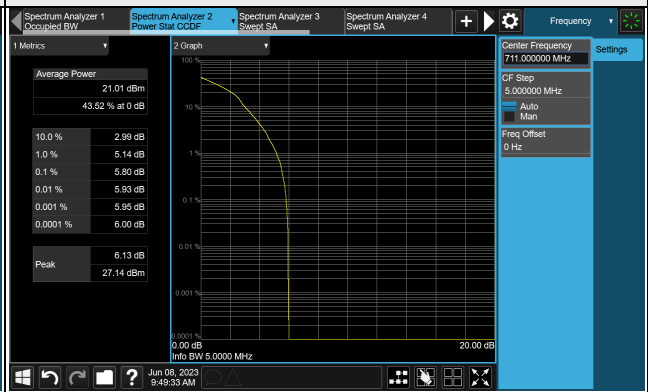
3MHz / 16QAM



5MHz / 16QAM

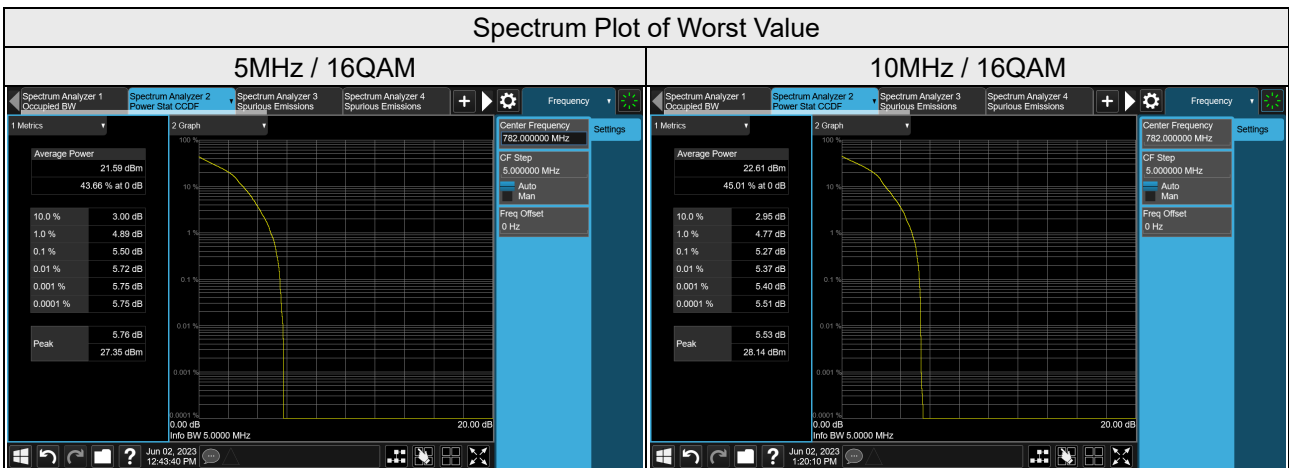


10MHz / 16QAM



| Cat-M1 Band 13, Channel Bandwidth 5MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 23205 | 779.5 | 4.80 | 5.49 |
| 23230 | 782.0 | 4.56 | 5.50 |
| 23255 | 784.5 | 4.55 | 5.48 |

| Cat-M1 Band 13, Channel Bandwidth 10MHz | | | |
|-----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 23230 | 782.0 | 4.51 | 5.27 |



| Cat-M1 Band 66, Channel Bandwidth 1.4MHz | | | |
|------------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 131979 | 1710.7 | 4.54 | 5.49 |
| 132322 | 1745.0 | 4.57 | 5.49 |
| 132665 | 1779.3 | 4.57 | 5.52 |

| Cat-M1 Band 66, Channel Bandwidth 3MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 131987 | 1711.5 | 4.56 | 5.43 |
| 132322 | 1745.0 | 4.53 | 5.44 |
| 132657 | 1778.5 | 4.52 | 5.43 |

| Cat-M1 Band 66, Channel Bandwidth 5MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 131997 | 1712.5 | 4.61 | 5.52 |
| 132322 | 1745.0 | 4.54 | 5.46 |
| 132647 | 1777.5 | 4.58 | 5.43 |

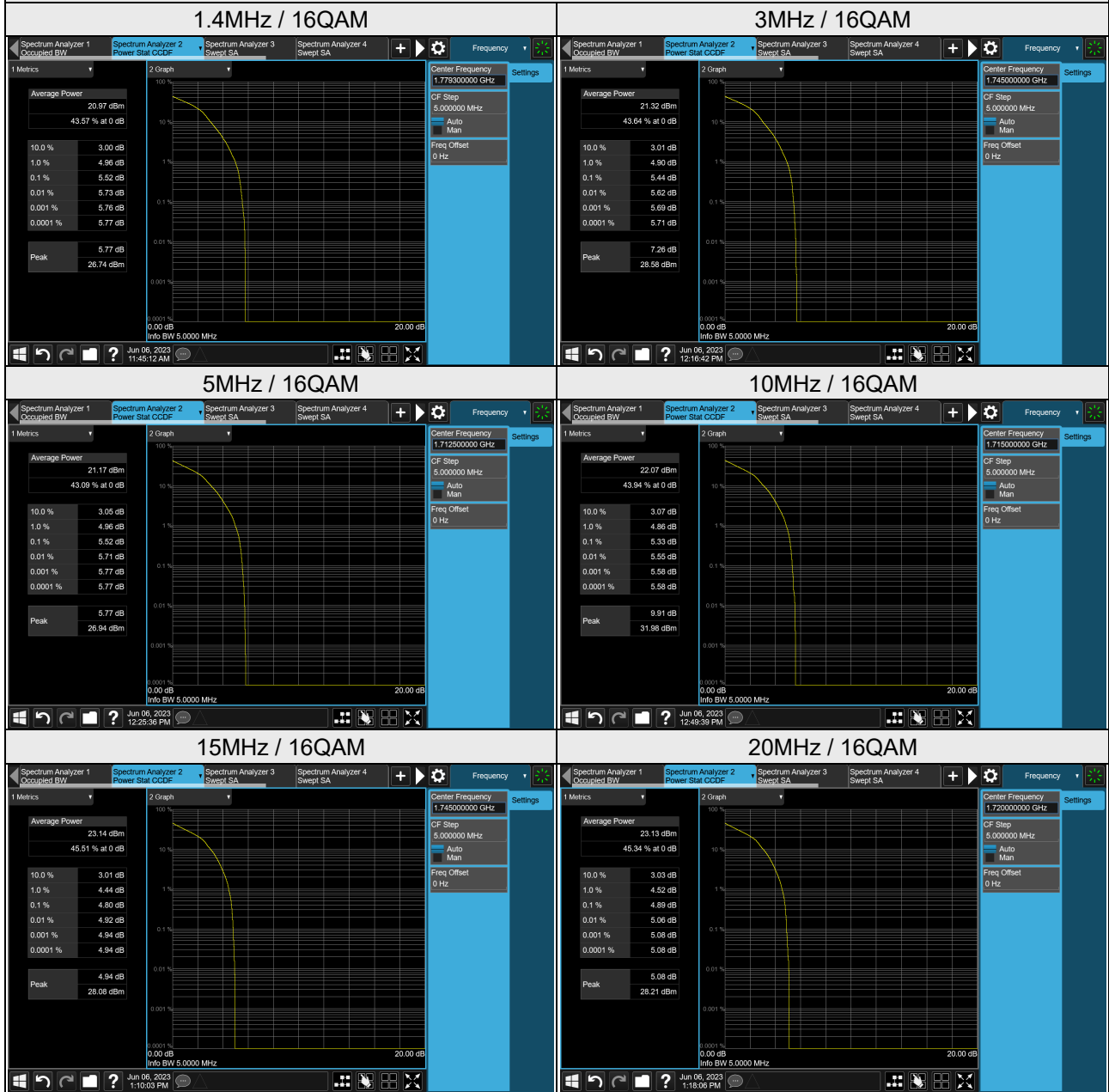
| Cat-M1 Band 66, Channel Bandwidth 10MHz | | | |
|-----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 132022 | 1715.0 | 4.62 | 5.33 |
| 132322 | 1745.0 | 4.56 | 5.26 |
| 132622 | 1775.0 | 4.60 | 5.23 |

| Cat-M1 Band 66, Channel Bandwidth 15MHz | | | |
|-----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 132047 | 1717.5 | 4.29 | 4.79 |
| 132322 | 1745.0 | 4.28 | 4.80 |
| 132597 | 1772.5 | 4.24 | 4.66 |

Cat-M1 Band 66, Channel Bandwidth 20MHz

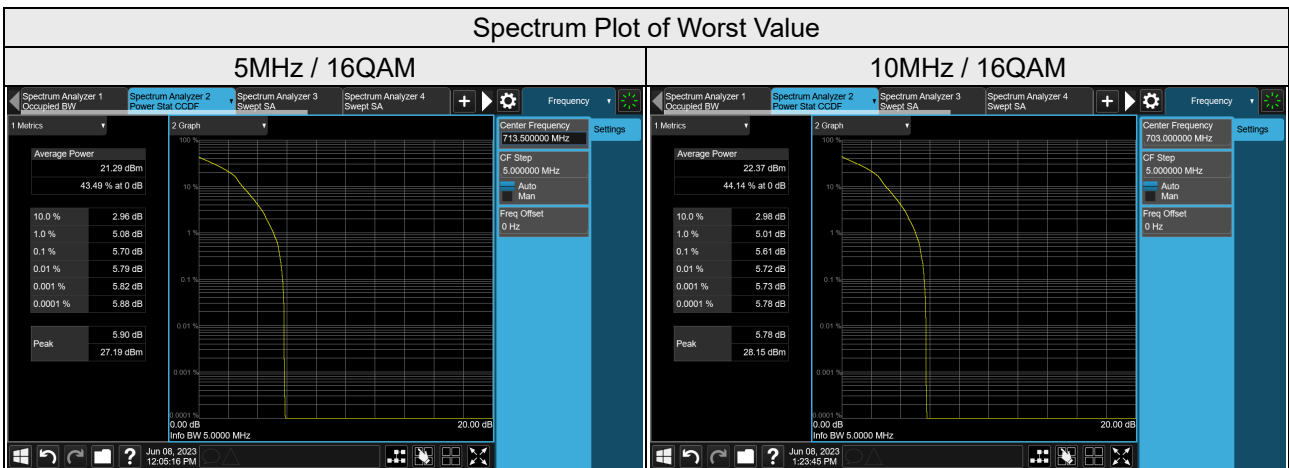
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
|---------|-----------------|----------------------------|-------|
| | | QPSK | 16QAM |
| 132072 | 1720.0 | 4.34 | 4.89 |
| 132322 | 1745.0 | 4.33 | 4.89 |
| 132572 | 1770.0 | 4.25 | 4.70 |

Spectrum Plot of Worst Value



| Cat-M1 Band 85, Channel Bandwidth 5MHz | | | |
|----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 134027 | 700.5 | 4.75 | 5.69 |
| 134092 | 707.0 | 4.74 | 5.66 |
| 134157 | 713.5 | 4.78 | 5.70 |

| Cat-M1 Band 85, Channel Bandwidth 10MHz | | | |
|-----------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 134052 | 703.0 | 4.74 | 5.61 |
| 134092 | 707.0 | 4.71 | 5.55 |
| 134132 | 711.0 | 4.75 | 5.60 |



4.7 Conducted Spurious Emissions

4.7.1 Limits of Conducted Spurious Emissions Measurement

For Cat-M1 Band 4, Cat-M1 Band 66:

In the FCC 27.53(h), on any frequency outside a licensee's frequency block, The power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB. The emission limit equal to -13dBm .

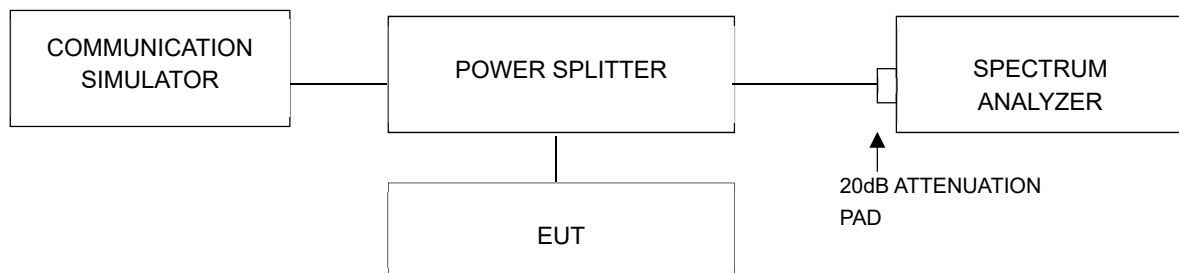
For Cat-M1 Band 12, Cat-M1 Band 85:

According to FCC 27.53(g) for operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

For Cat-M1 Band 13:

According to FCC 27.53(c) (2) for on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB. According to FCC 27.53(f) for operations in the 775-788 MHz, emissions in the band 1559-1610MHz shall be limited to -70 dBW/MHz. The limit of emissions is equal to -40 dBm

4.7.2 Test Setup



4.7.3 Test Procedure

- All measurements were done at low, middle and high operational frequency range.
- Measurement refer to ANSI C63.26 section 5.7.
- Measuring frequency range is from 9kHz to 1GHz. 20dB attenuation pad is connected with spectrum. Detector = Average, RBW=1MHz and VBW=3MHz are for conducted emission measurement.
- Measuring frequency range is from 1GHz to 10GHz / 20GHz. 20dB attenuation pad is connected with spectrum. Detector = Average, RBW=1MHz and VBW=3MHz are used for conducted emission measurement.

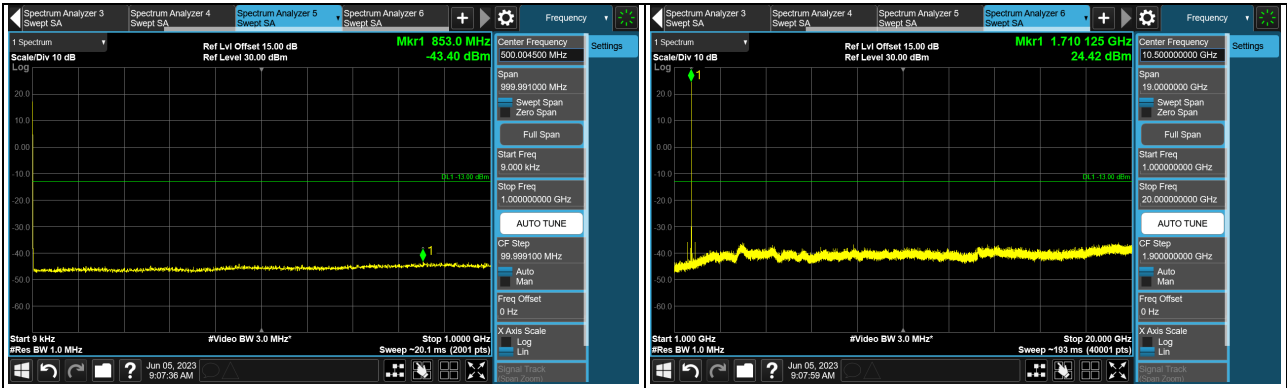
4.7.4 Test Results

Cat-M1 Band 4 (Channel Bandwidth 1.4MHz)

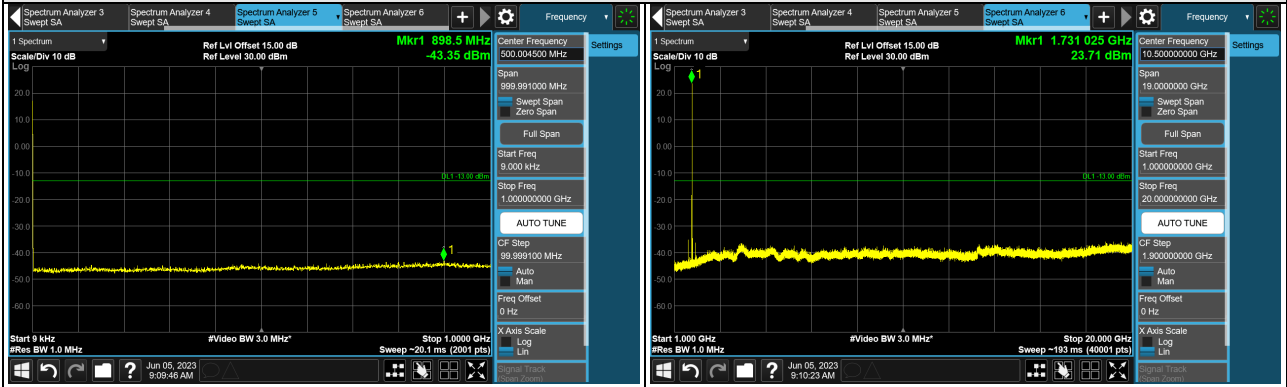


*The 9kHz signal over the limit is from Spectrum.

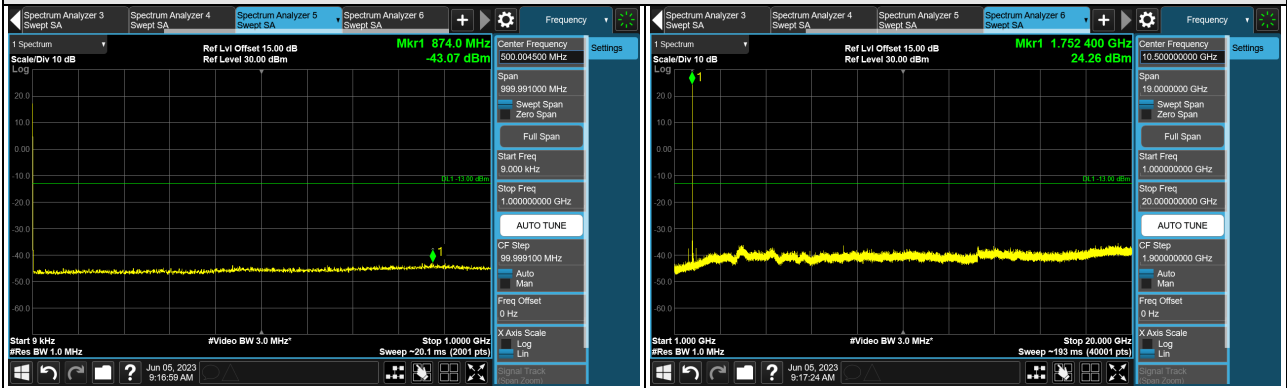
Cat-M1 Band 4 (Channel Bandwidth 3MHz)



CH 1965 (1711.5MHz)



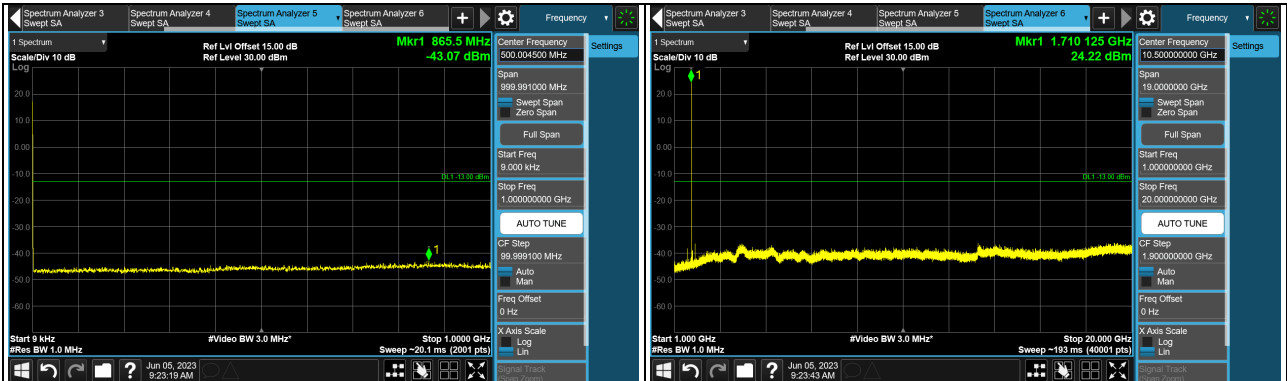
CH 20175 (1732.5MHz)



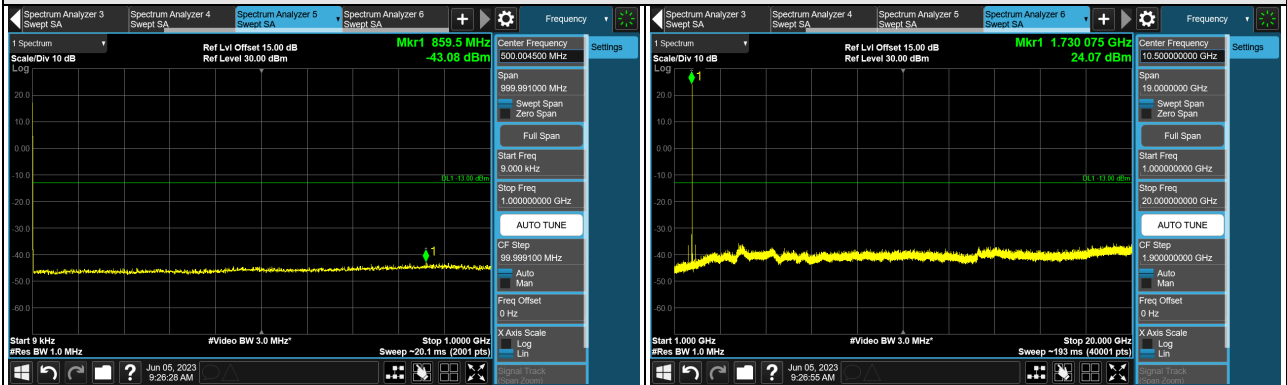
CH 20385 (1753.5MHz)

*The 9kHz signal over the limit is from Spectrum.

Cat-M1 Band 4 (Channel Bandwidth 5MHz)



CH 1975 (1712.5MHz)



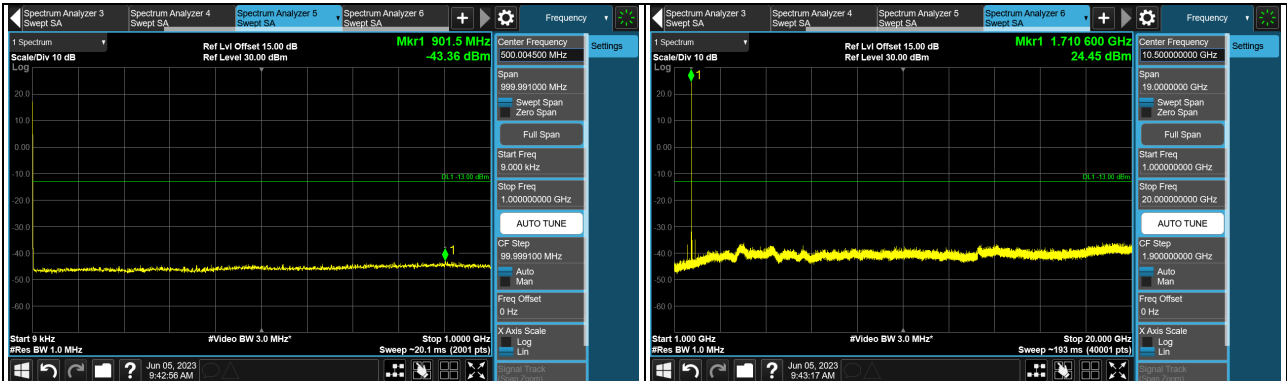
CH 2075 (1732.5MHz)



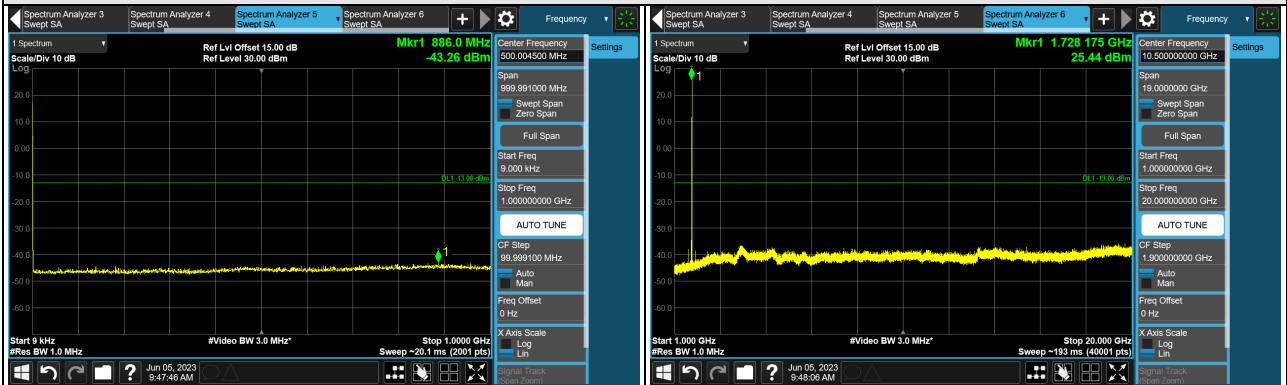
CH 20375 (1752.5MHz)

*The 9kHz signal over the limit is from Spectrum.

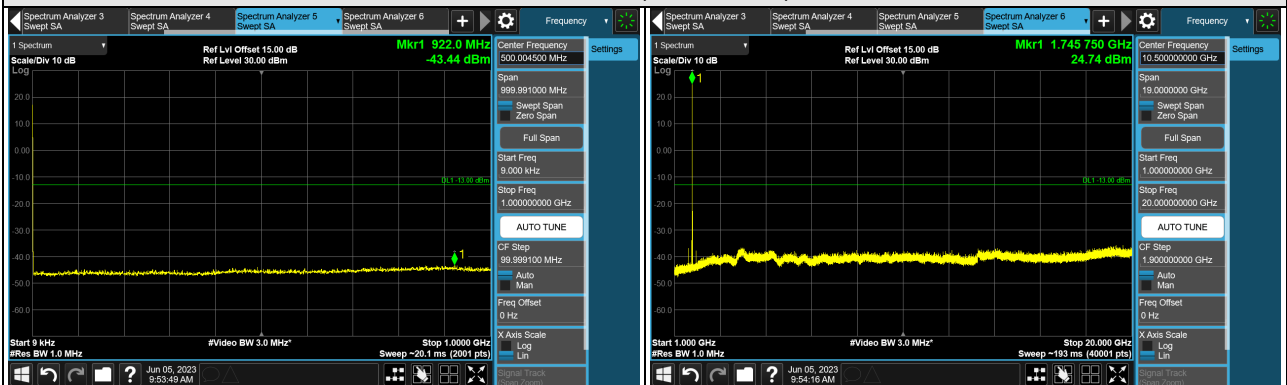
Cat-M1 Band 4 (Channel Bandwidth 10MHz)



CH 2000 (1715MHz)



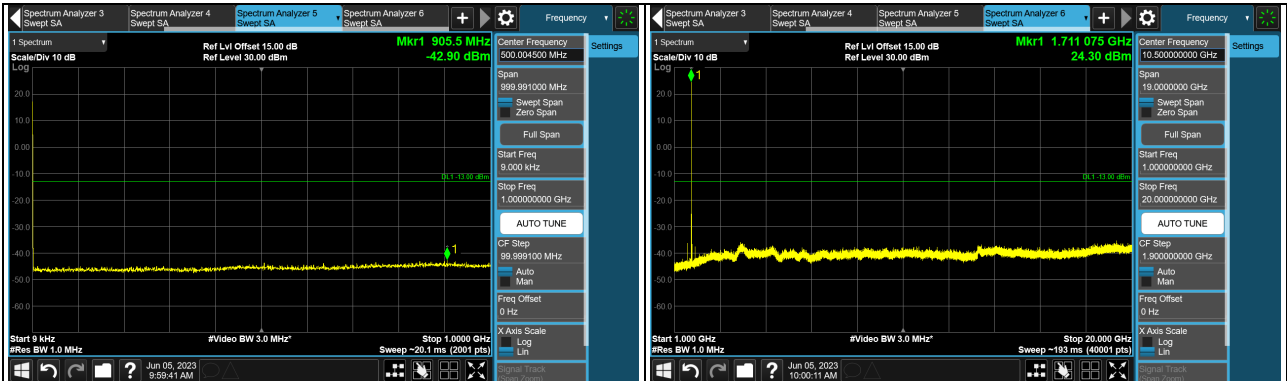
CH 2015 (1732.5MHz)



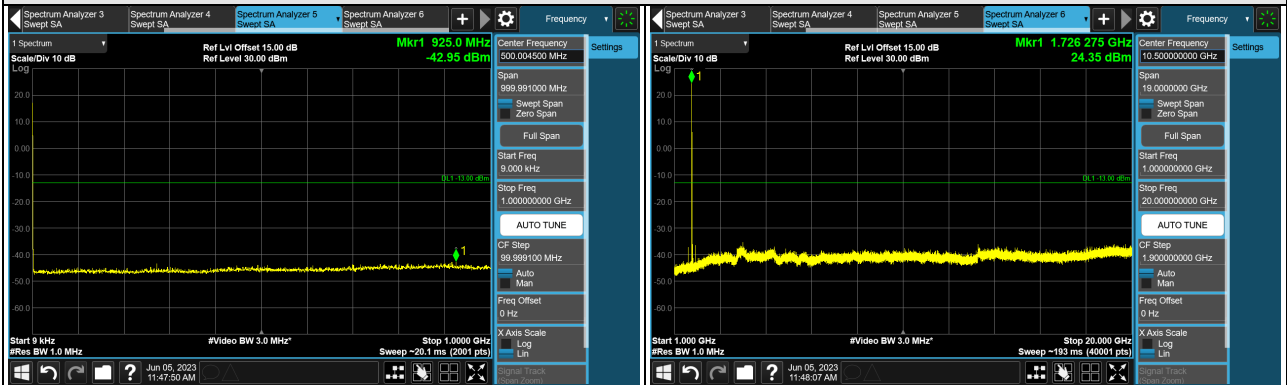
CH 20350 (1750MHz)

*The 9kHz signal over the limit is from Spectrum.

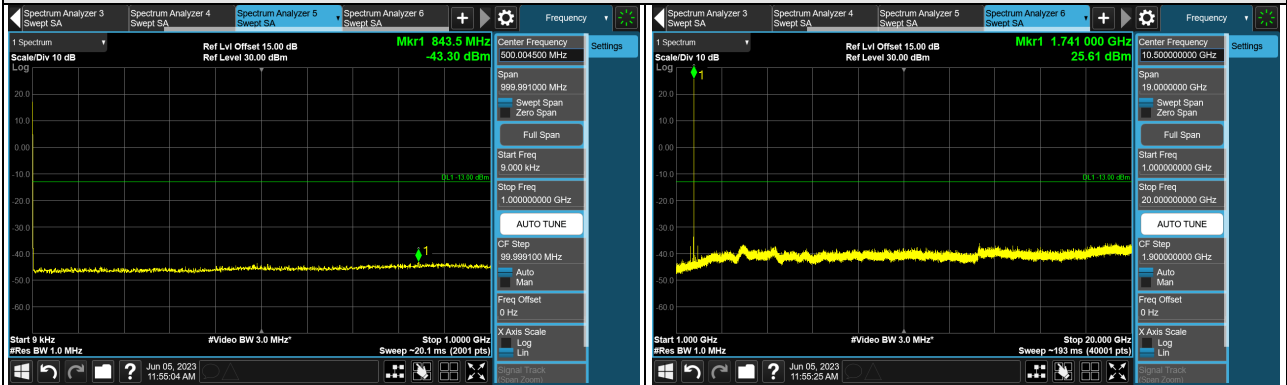
Cat-M1 Band 4 (Channel Bandwidth 15MHz)



CH 2025 (1717.5MHz)



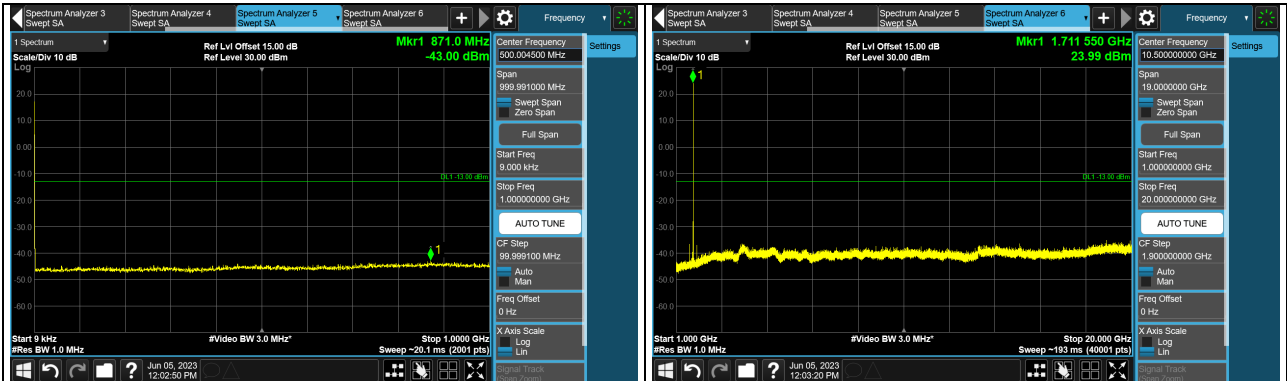
CH 2075 (1732.5MHz)



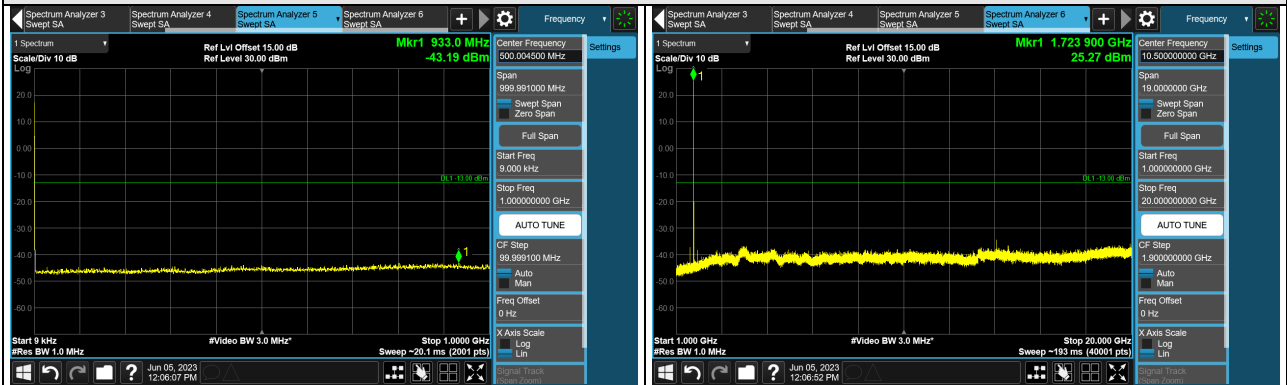
CH 20325 (1747.5MHz)

*The 9kHz signal over the limit is from Spectrum.

Cat-M1 Band 4 (Channel Bandwidth 20MHz)



CH 2050 (1720MHz)



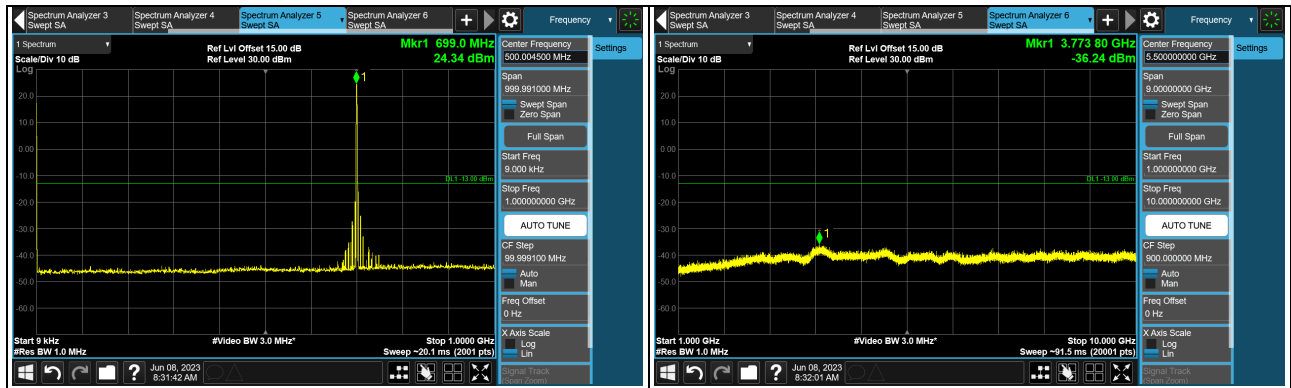
CH 2050 (1720MHz)



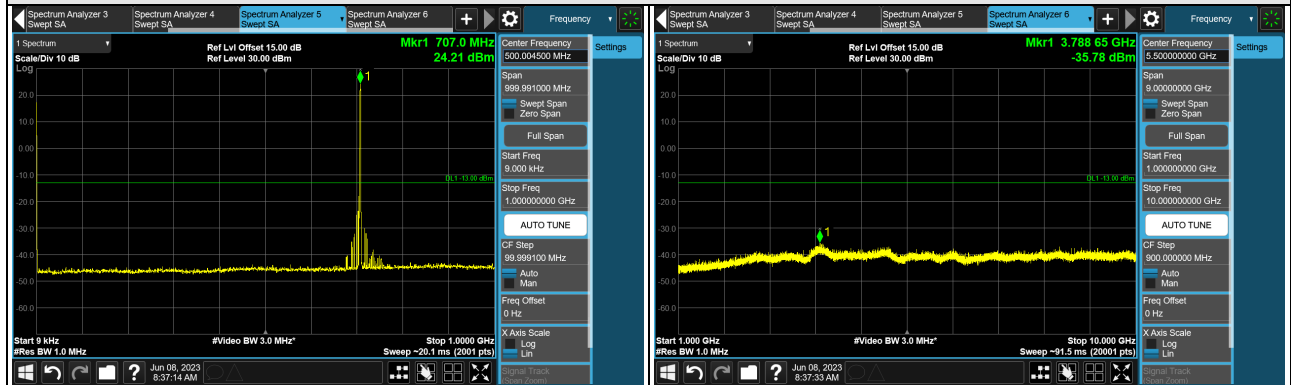
CH 2030 (1745MHz)

*The 9kHz signal over the limit is from Spectrum.

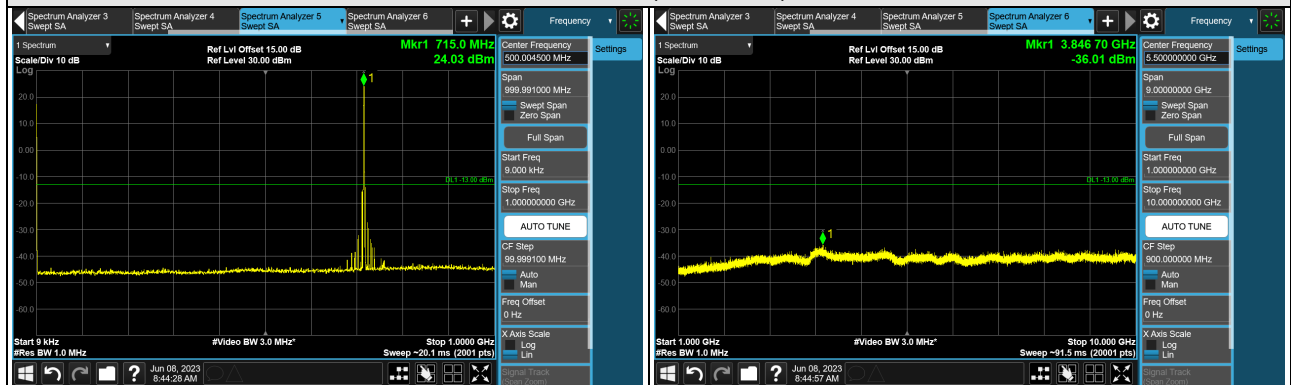
Cat-M1 Band 12 (Channel Bandwidth 1.4MHz)



CH 23017 (699.7MHz)



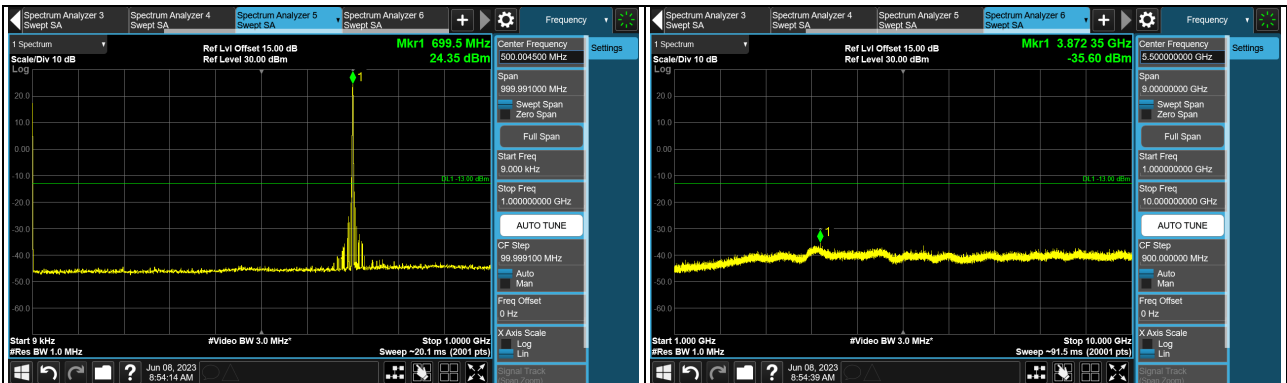
CH 23095 (707.5MHz)



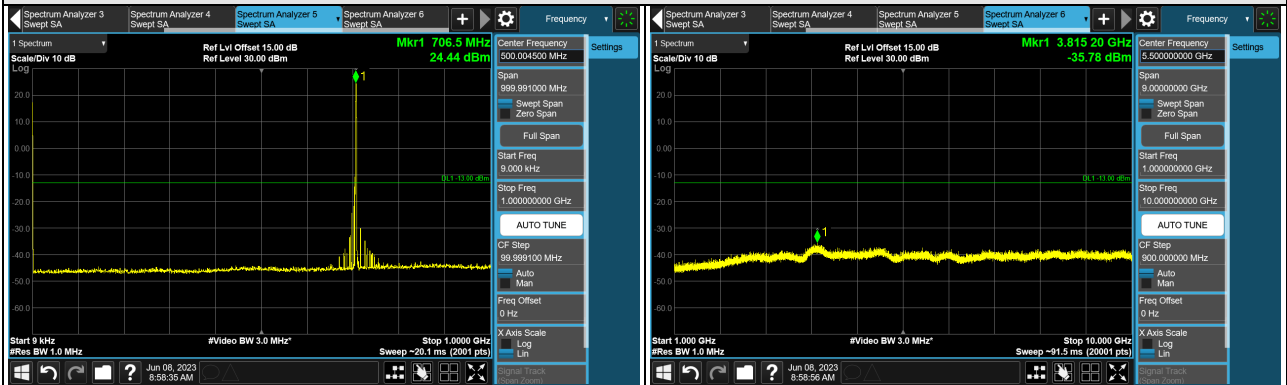
CH 23173 (715.3MHz)

*The 9kHz signal over the limit is from Spectrum.

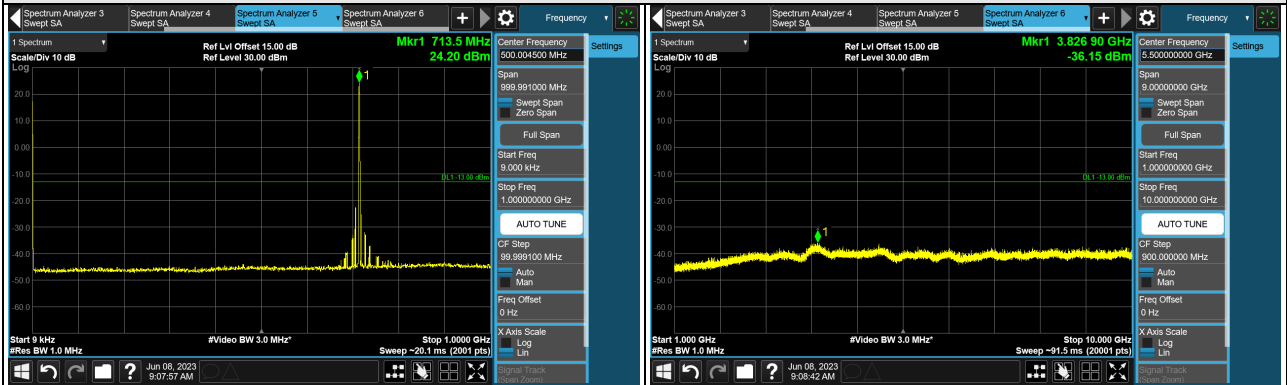
Cat-M1 Band 12 (Channel Bandwidth 3MHz)



CH 23025 (700.5MHz)



CH 23095 (707.5MHz)



CH 23165 (714.5MHz)

*The 9kHz signal over the limit is from Spectrum.

Cat-M1 Band 12 (Channel Bandwidth 5MHz)



*The 9kHz signal over the limit is from Spectrum.