7.4 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

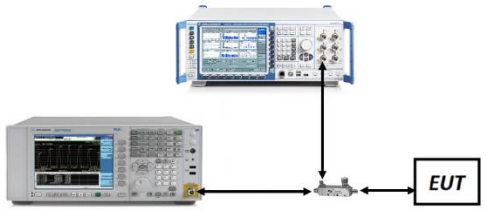


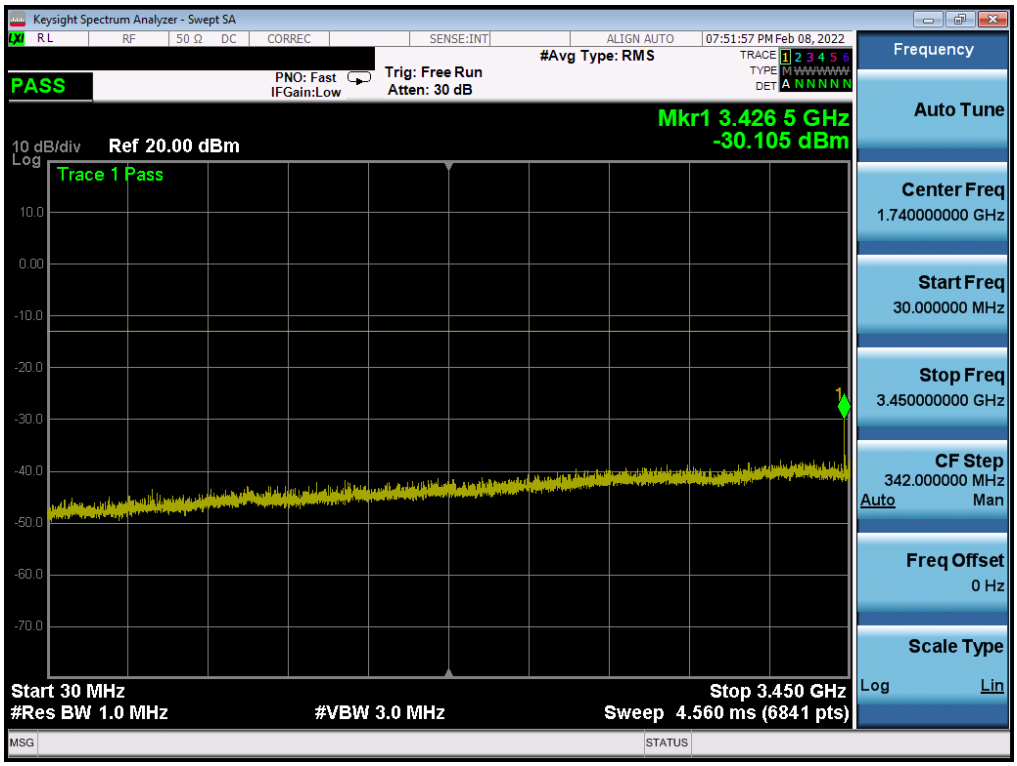
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

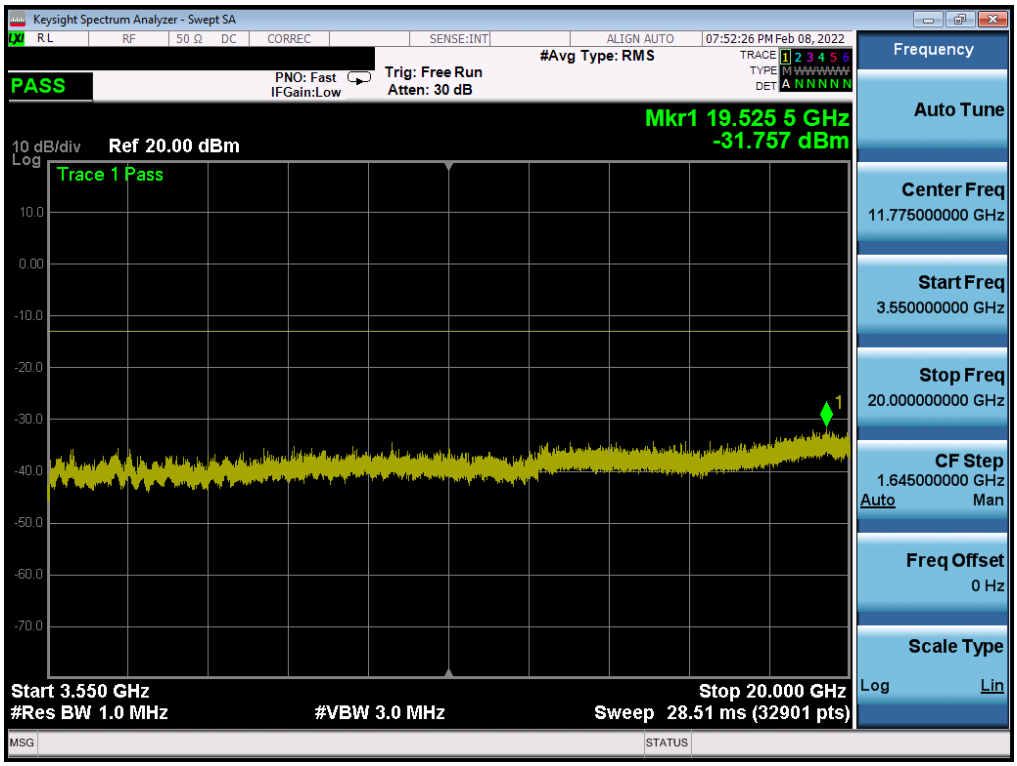
1. Per Part 27 and RSS-199, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

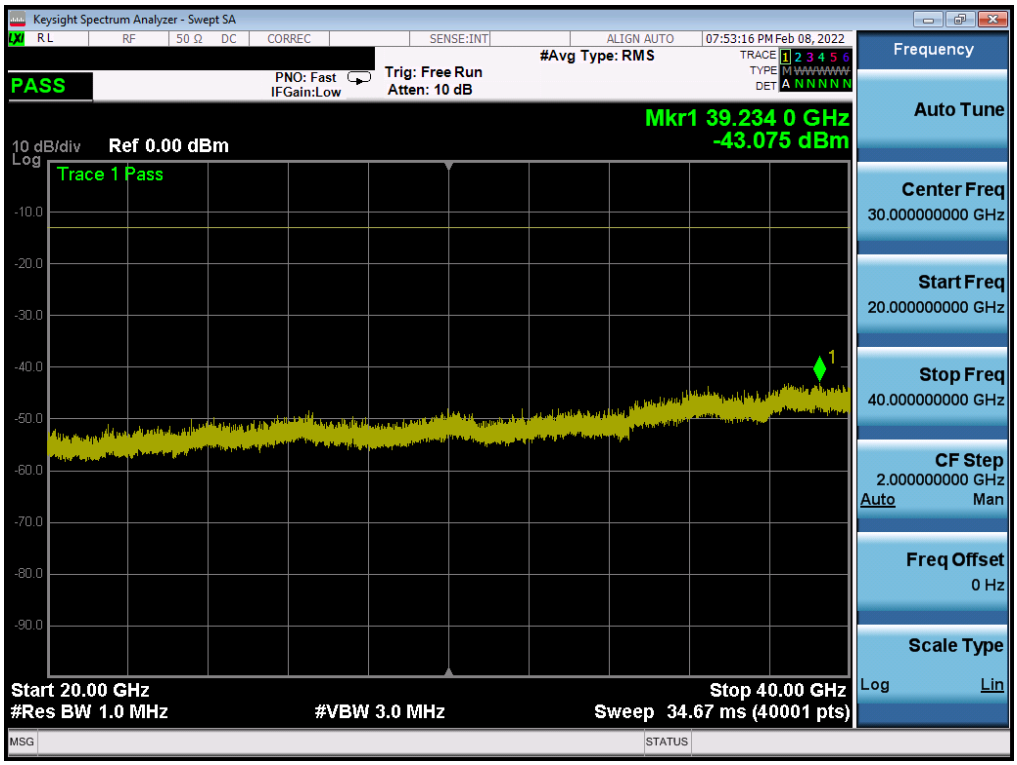
NR Band n77 – DoD Band – SRS-1- Ant F



Plot 7-67. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant F)

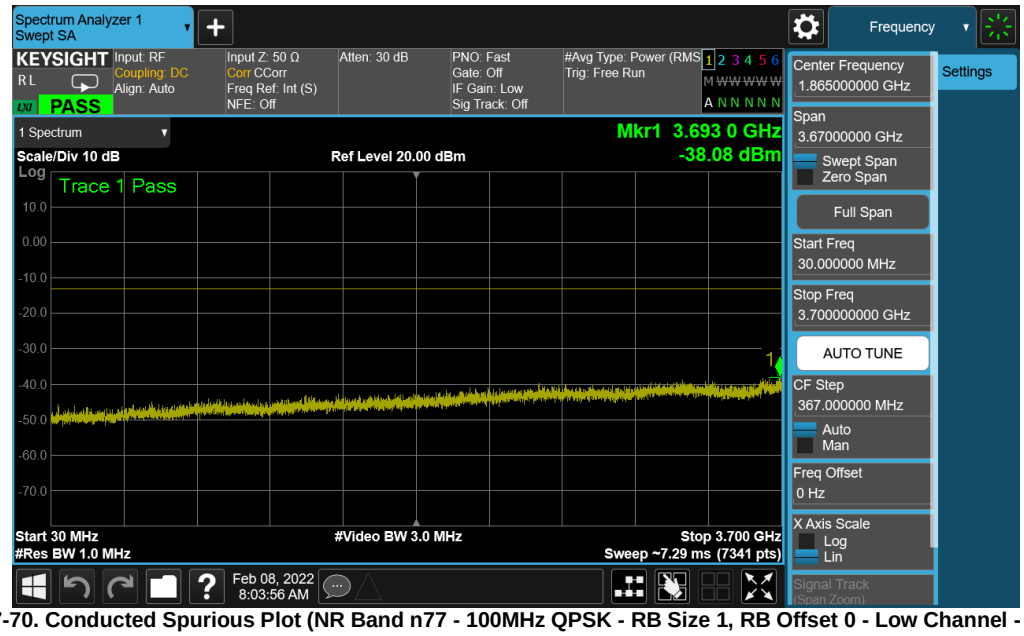


Plot 7-68. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant F)

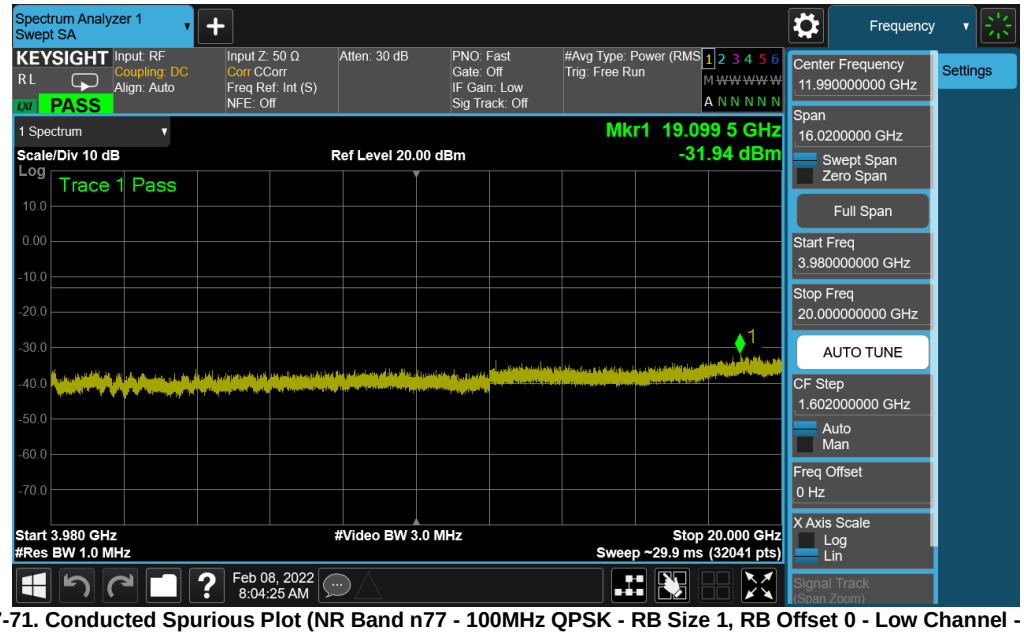


Plot 7-69. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant F)

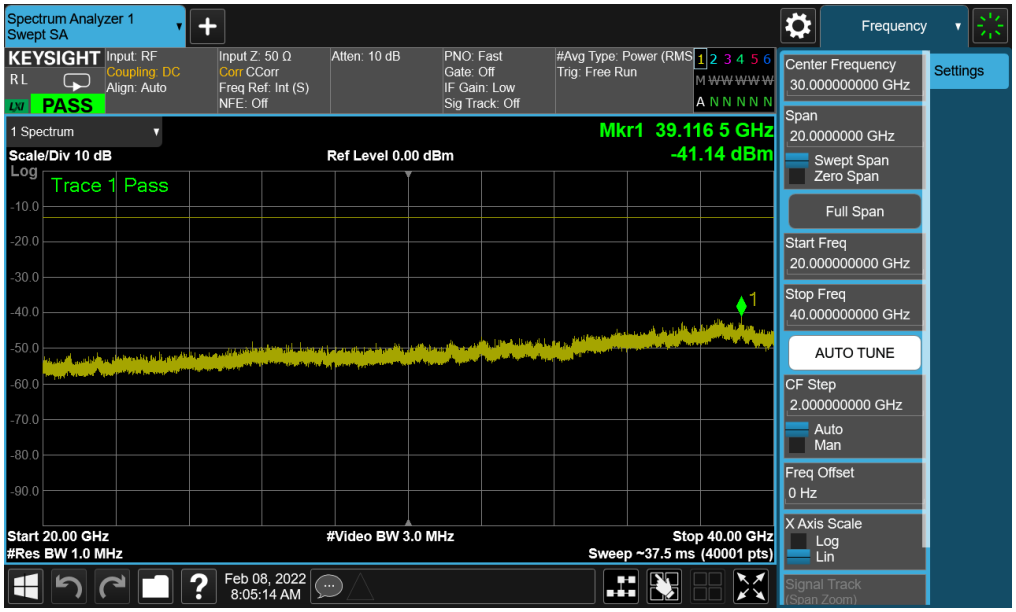
NR Band n77 – C-Band – SRS-1- Ant F



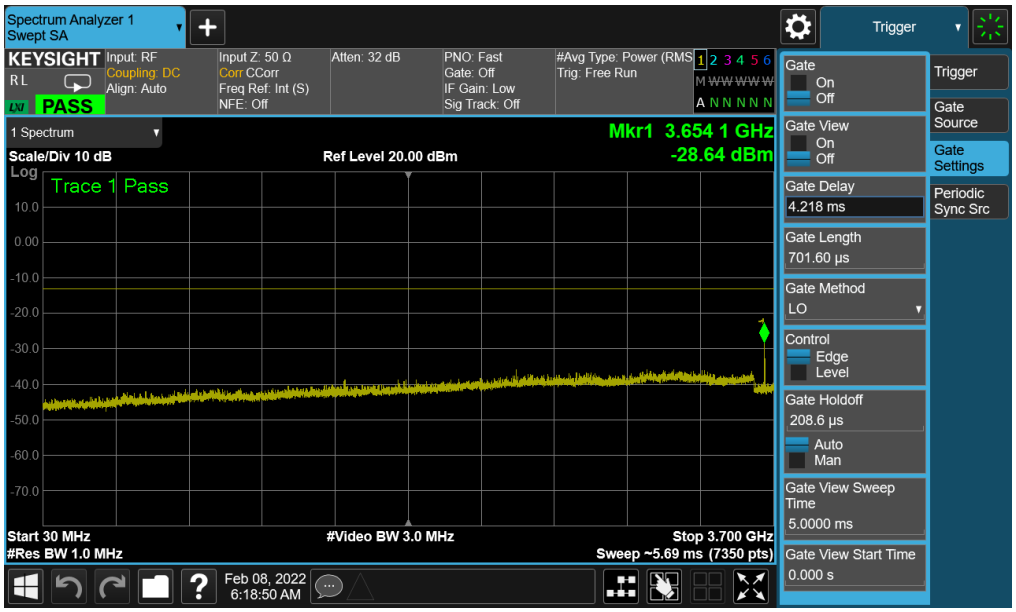
Plot 7-70. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant F)



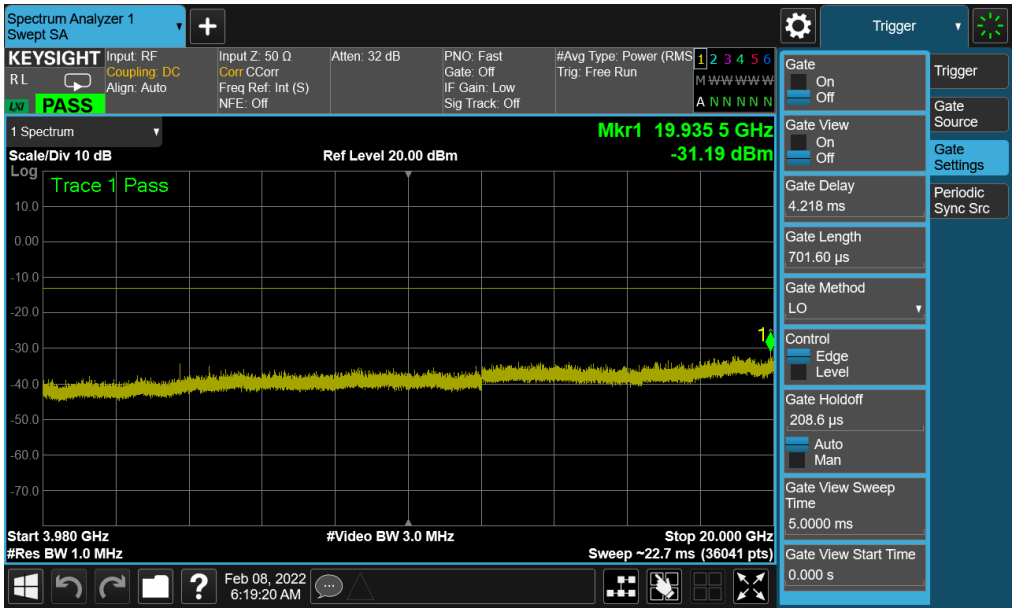
Plot 7-71. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant F)



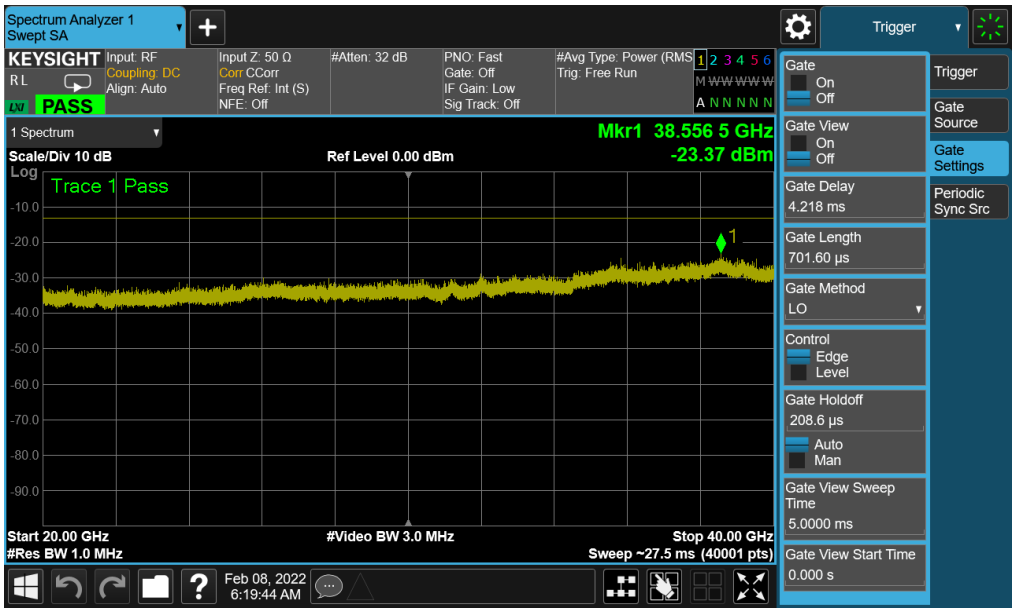
Plot 7-72. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant F)



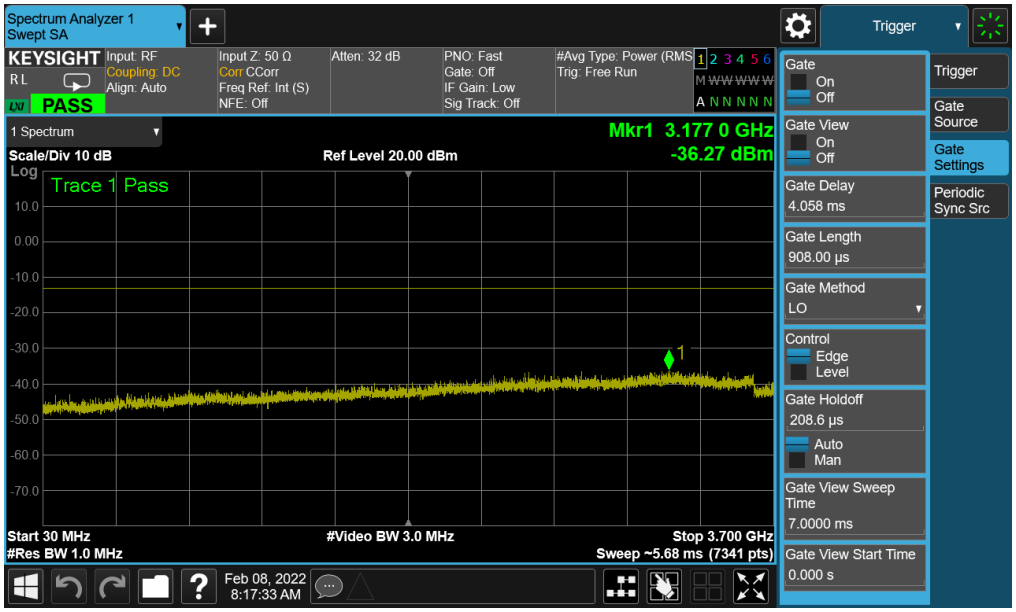
Plot 7-73. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant F)



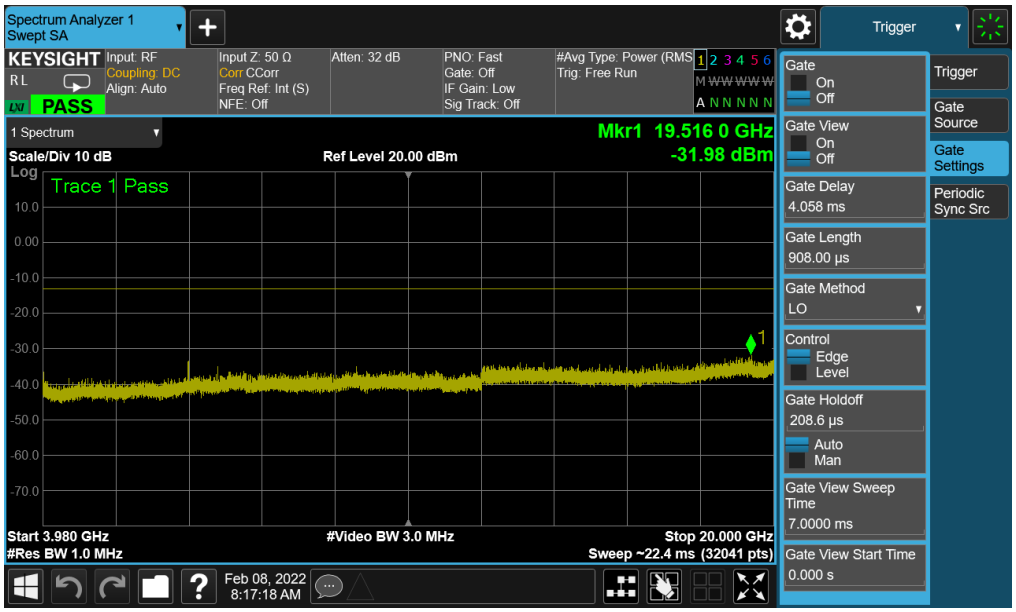
Plot 7-74. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant F)



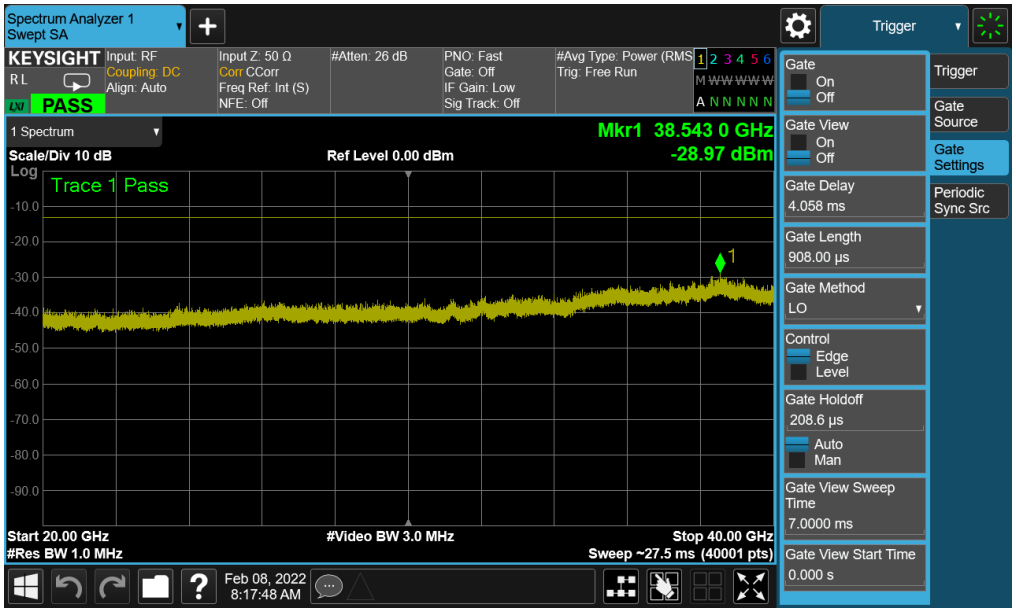
Plot 7-75. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant F)



Plot 7-76. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant F)

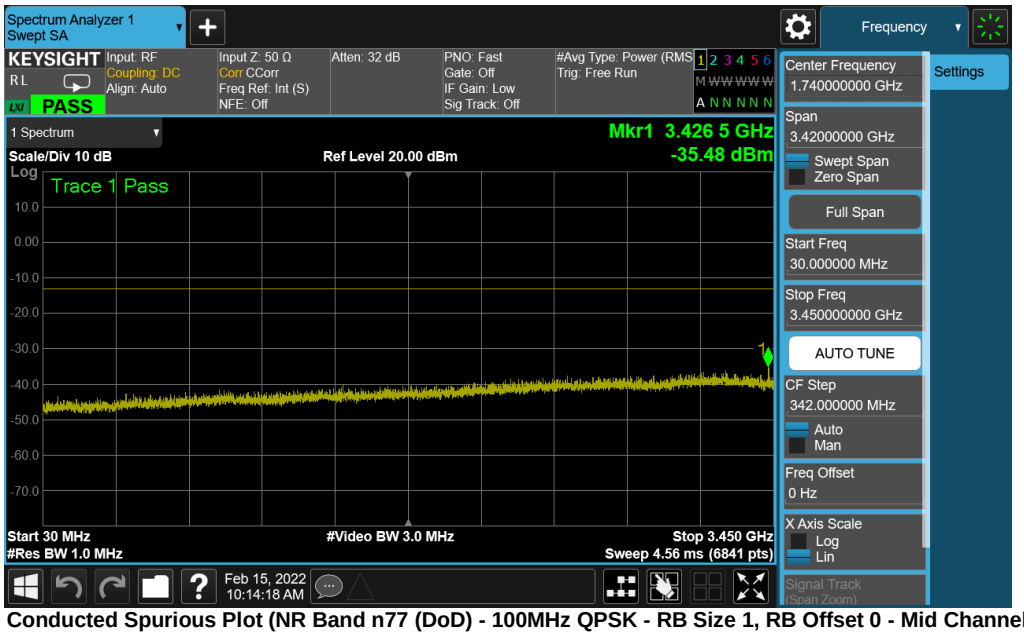


Plot 7-77. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant F)

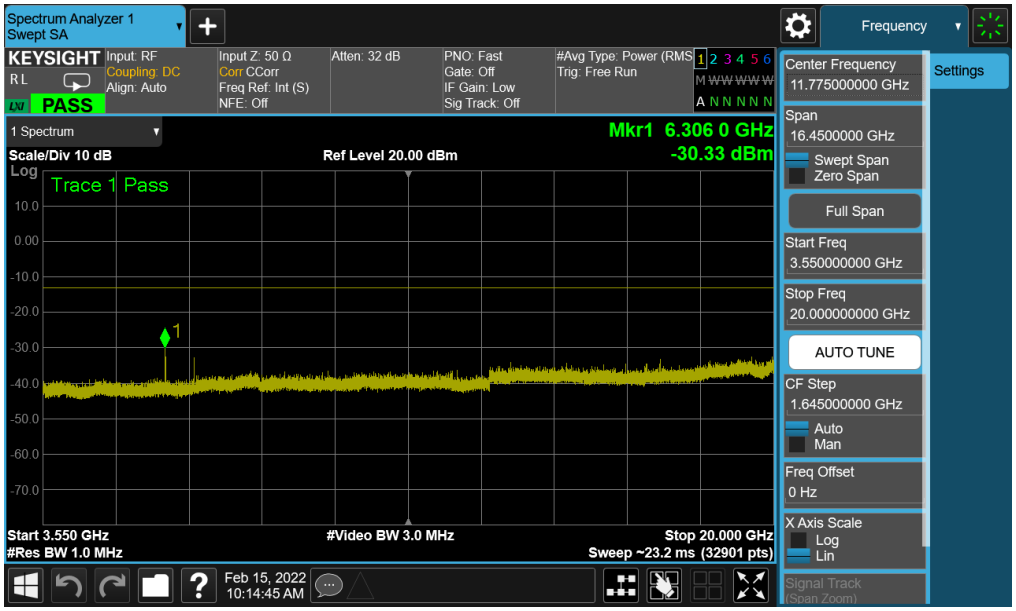


Plot 7-78. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant F)

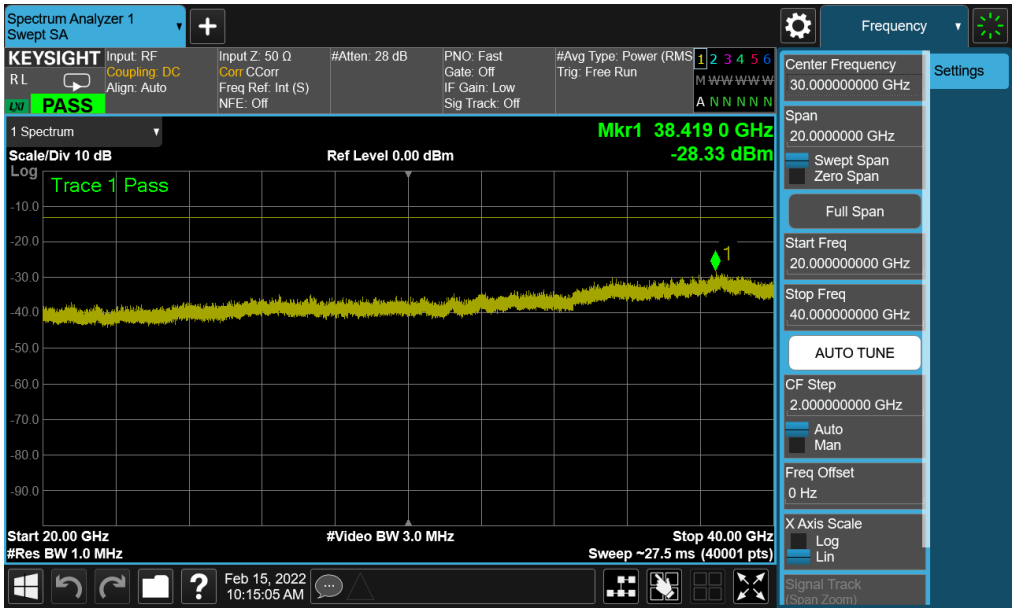
NR Band n77 – DoD Band – SRS-2- Ant H



Plot 7-79. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant H)

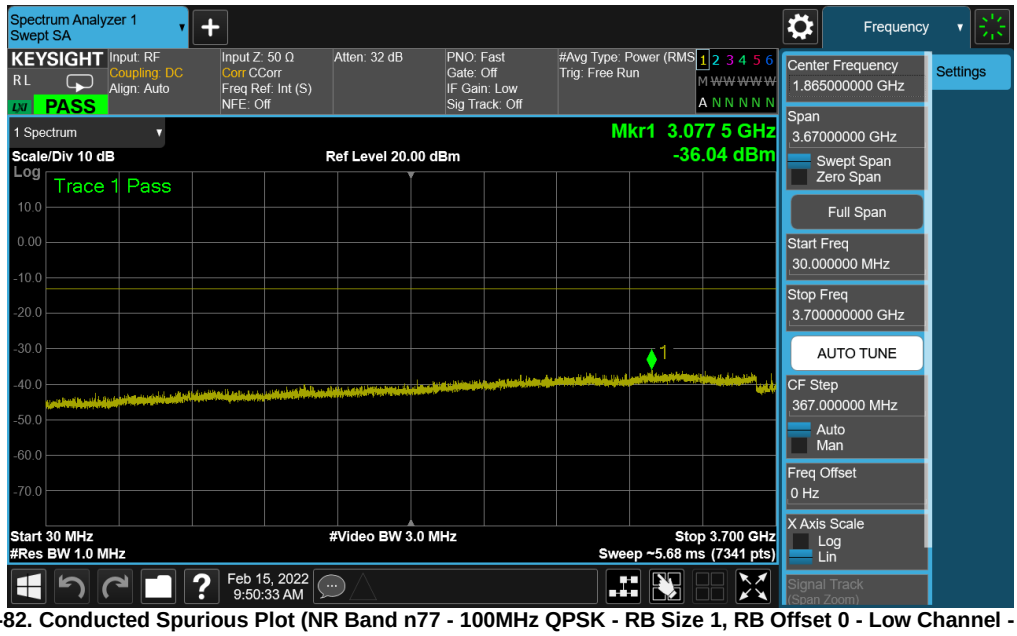


Plot 7-80. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant H)

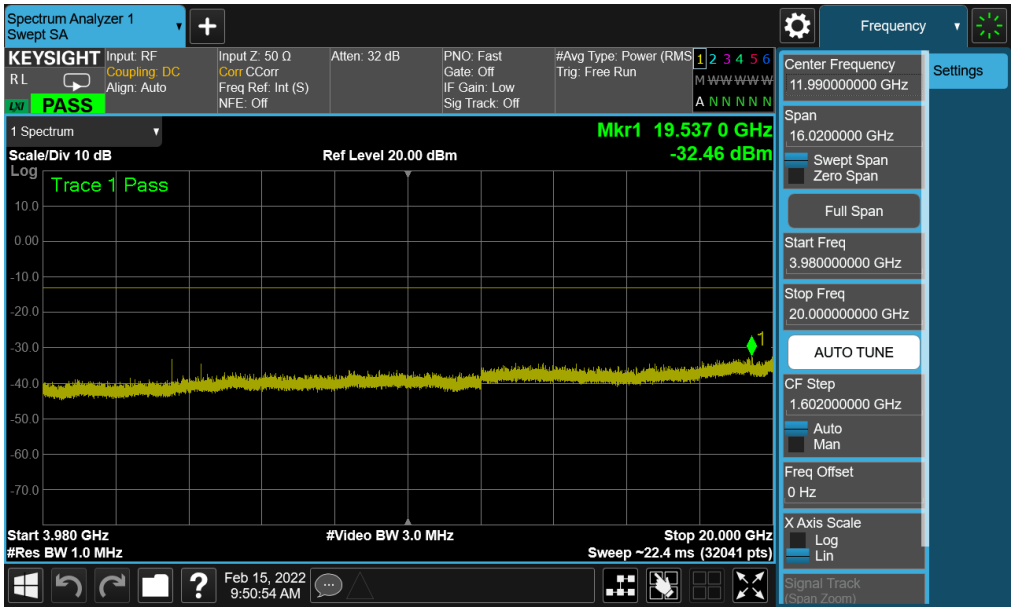


Plot 7-81. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant H)

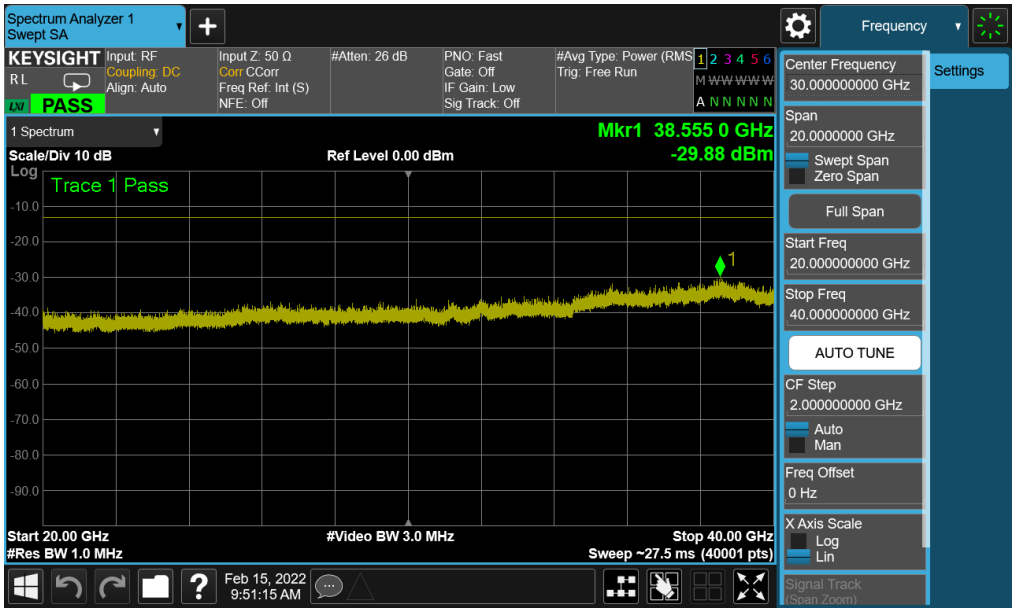
NR Band n77 – C-Band – SRS-2- Ant H



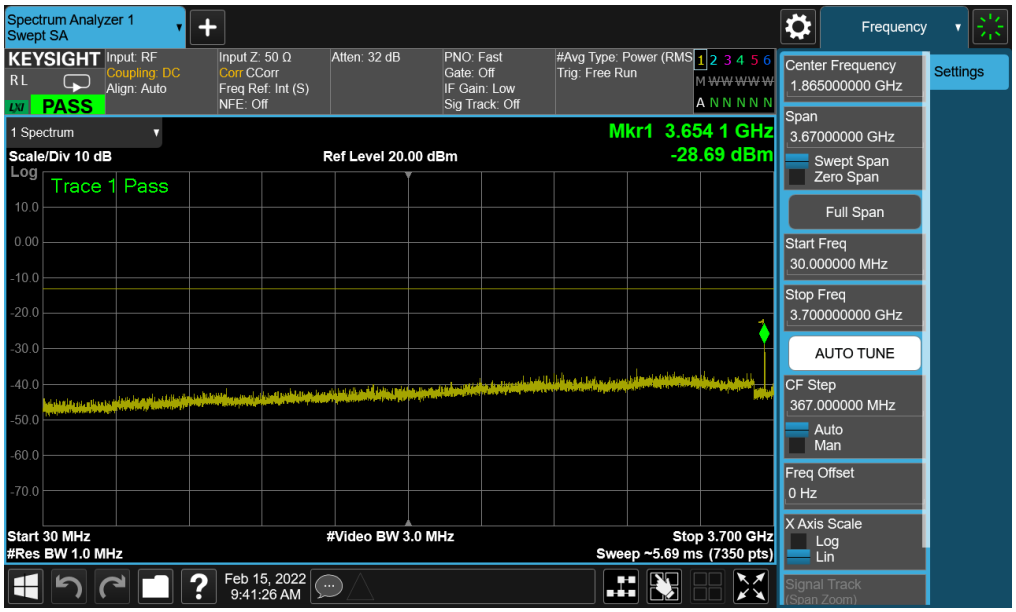
Plot 7-82. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant H)



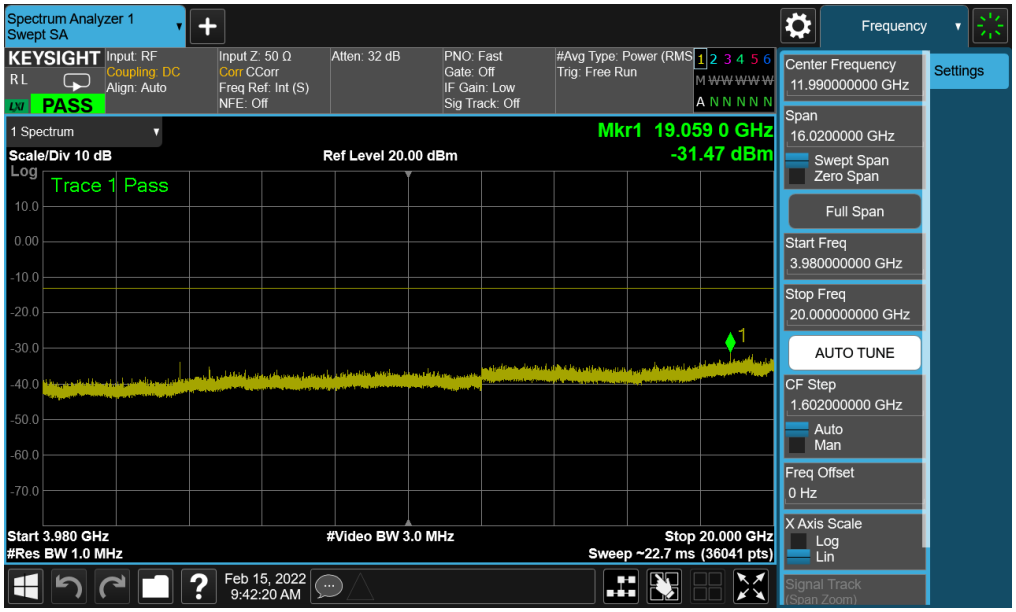
Plot 7-83. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant H)



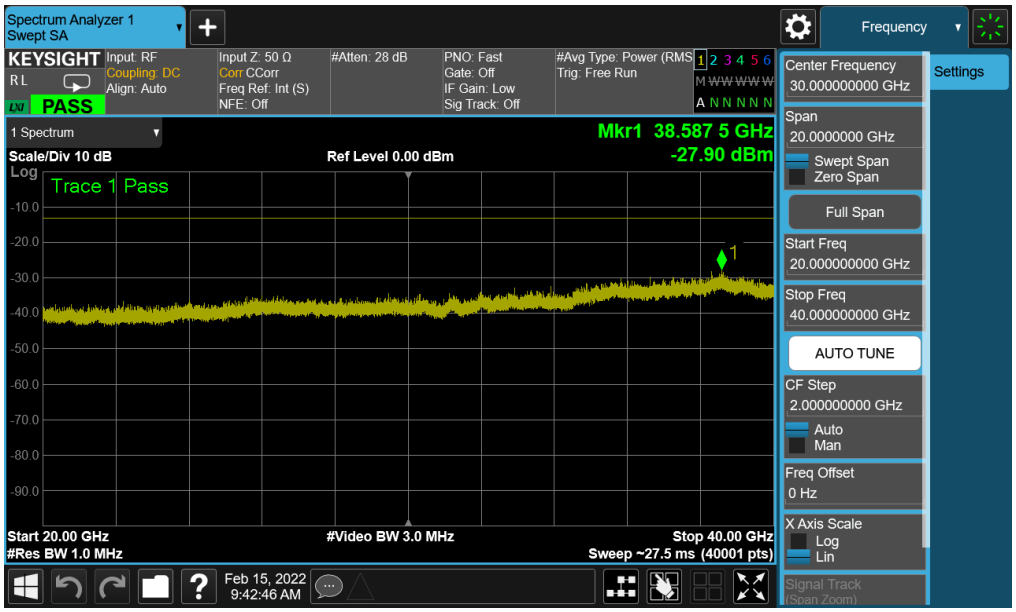
Plot 7-84. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant H)



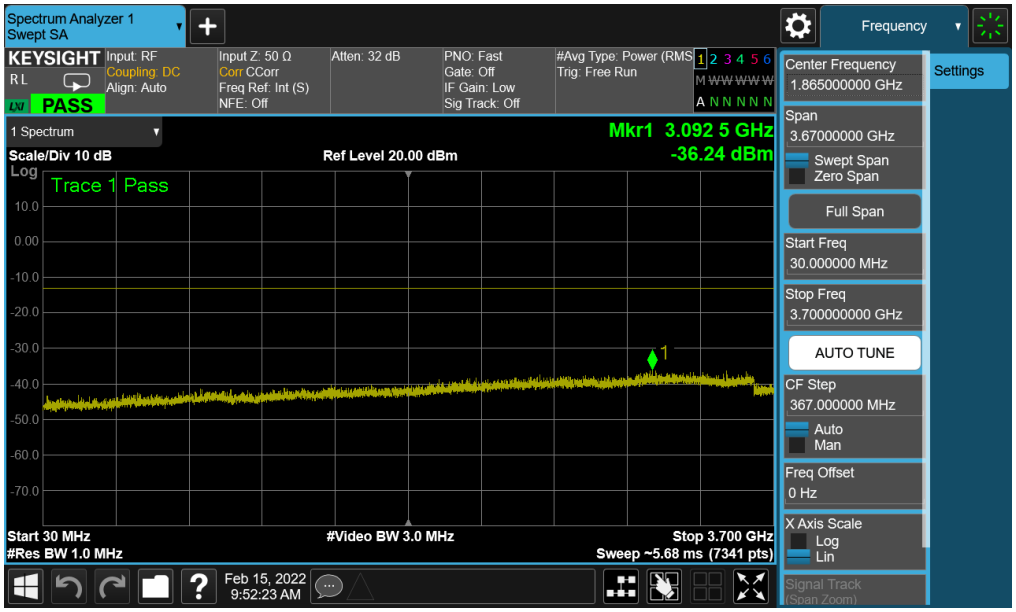
Plot 7-85. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant H)



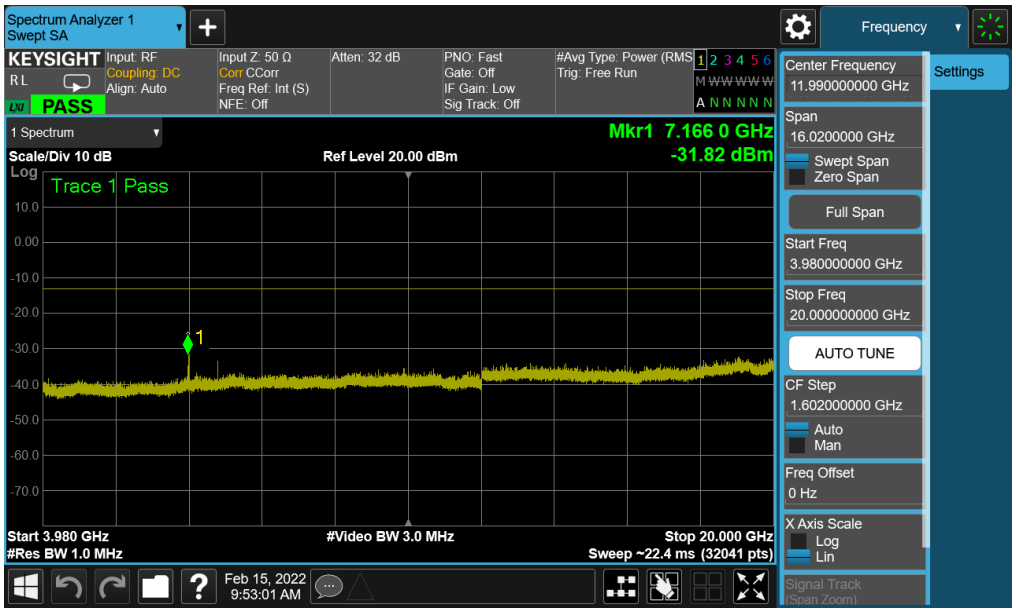
Plot 7-86. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant H)



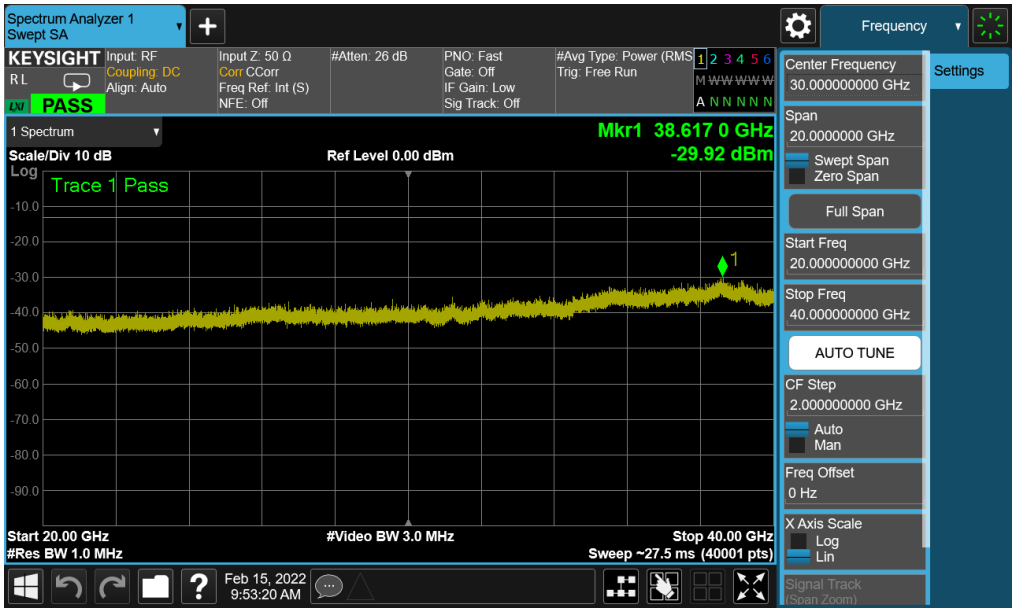
Plot 7-87. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant H)



Plot 7-88. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant H)

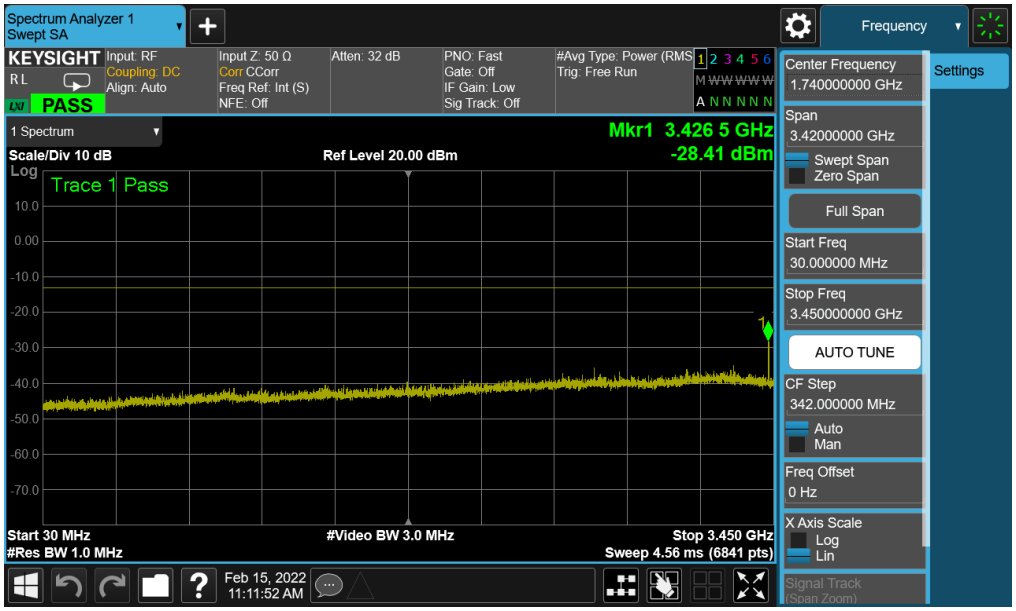


Plot 7-89. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant H)

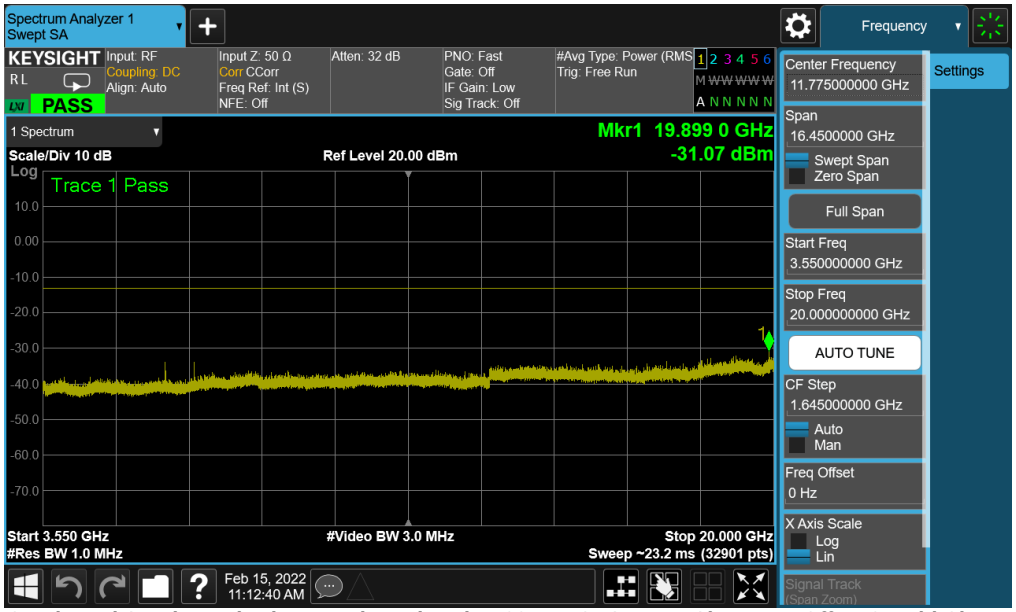


Plot 7-90. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant H)

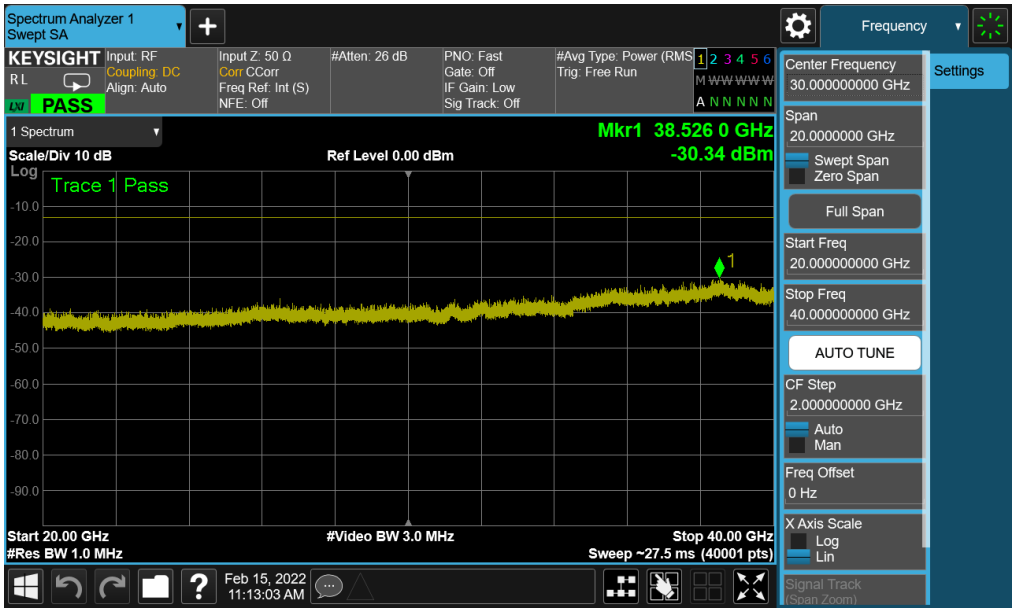
NR Band n77 – DoD Band – SRS-2- Ant C



Plot 7-91. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant C)

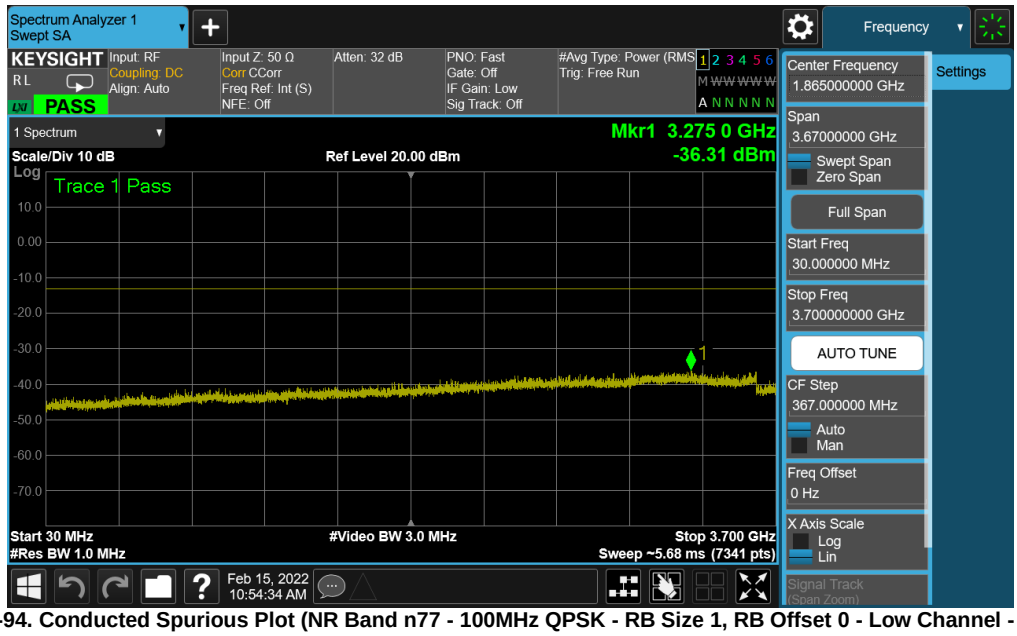


Plot 7-92. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant C)

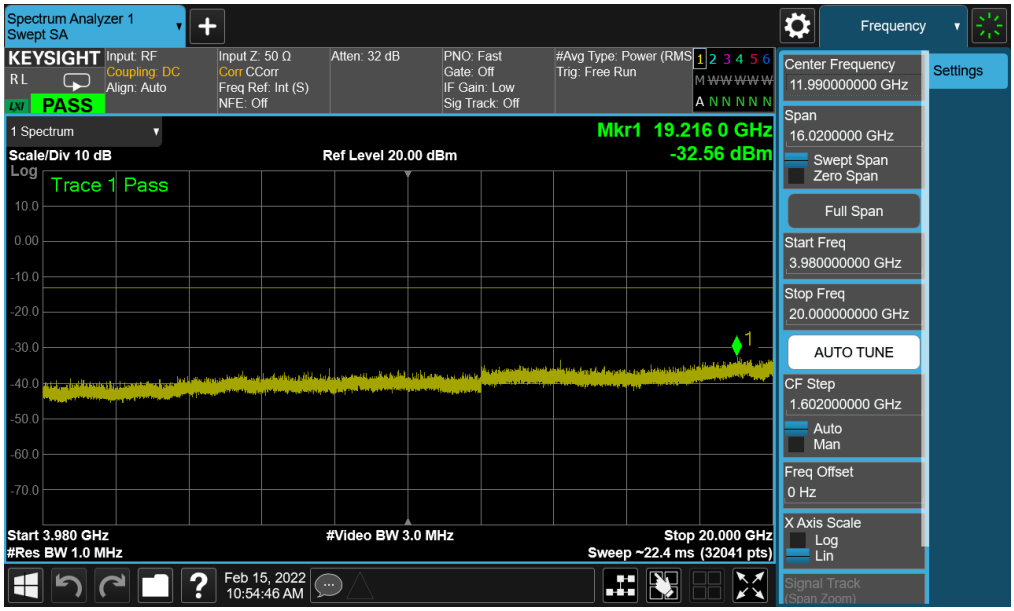


Plot 7-93. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant C)

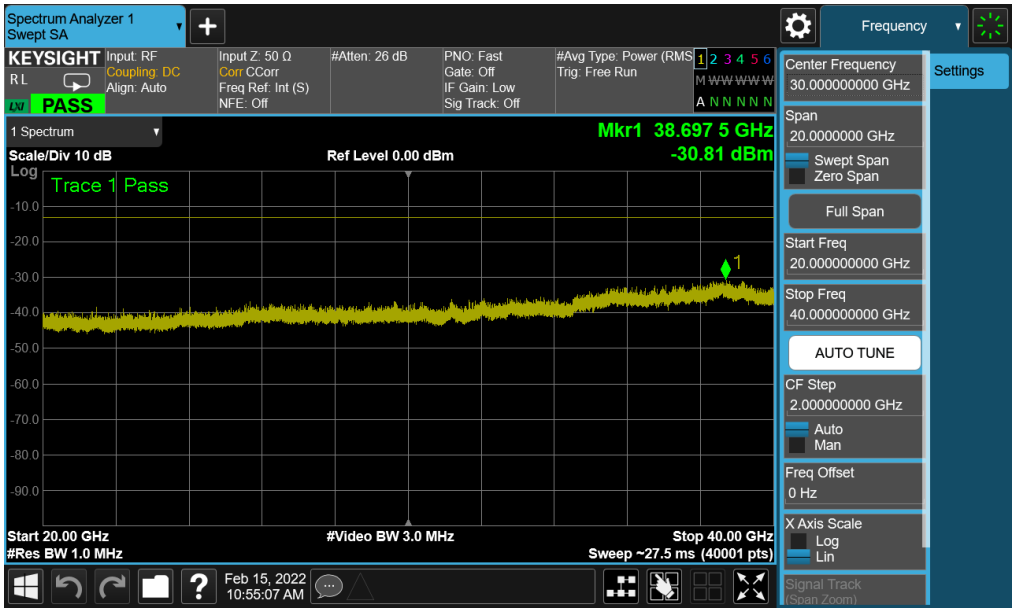
NR Band n77 – C-Band – SRS-2- Ant C



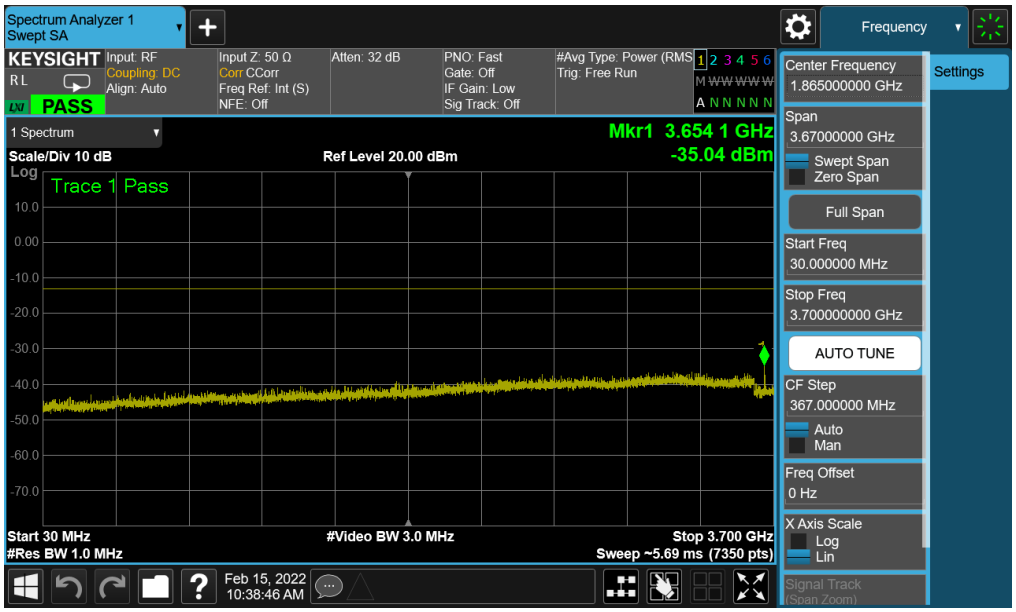
Plot 7-94. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant C)



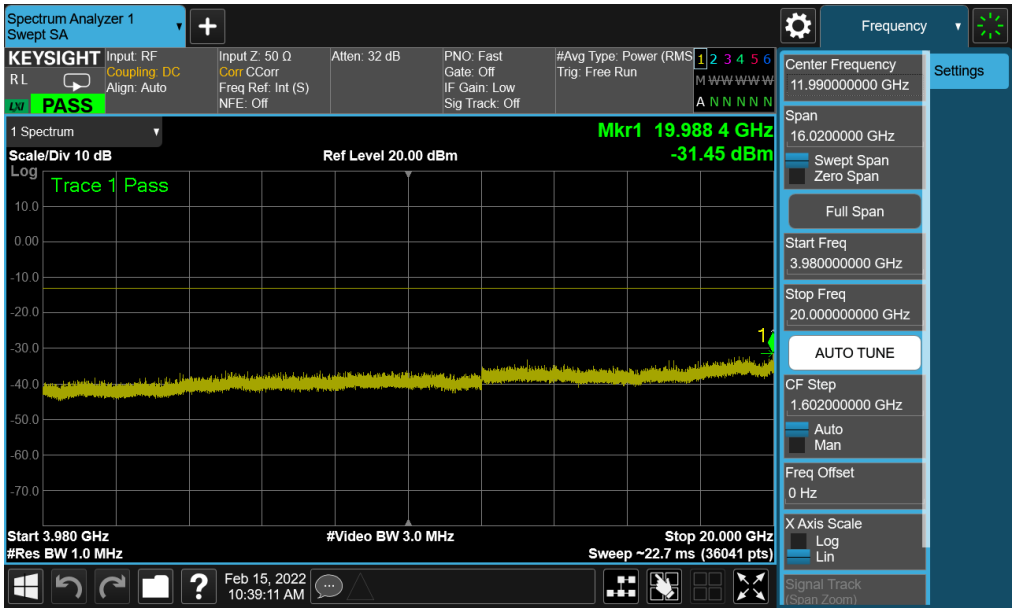
Plot 7-95. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant C)



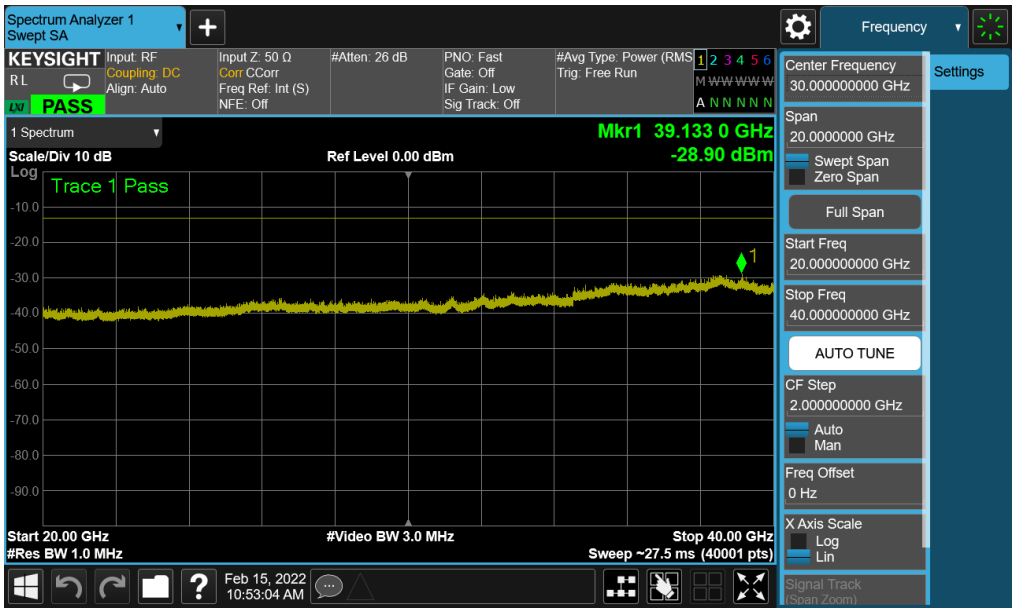
Plot 7-96. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant C)



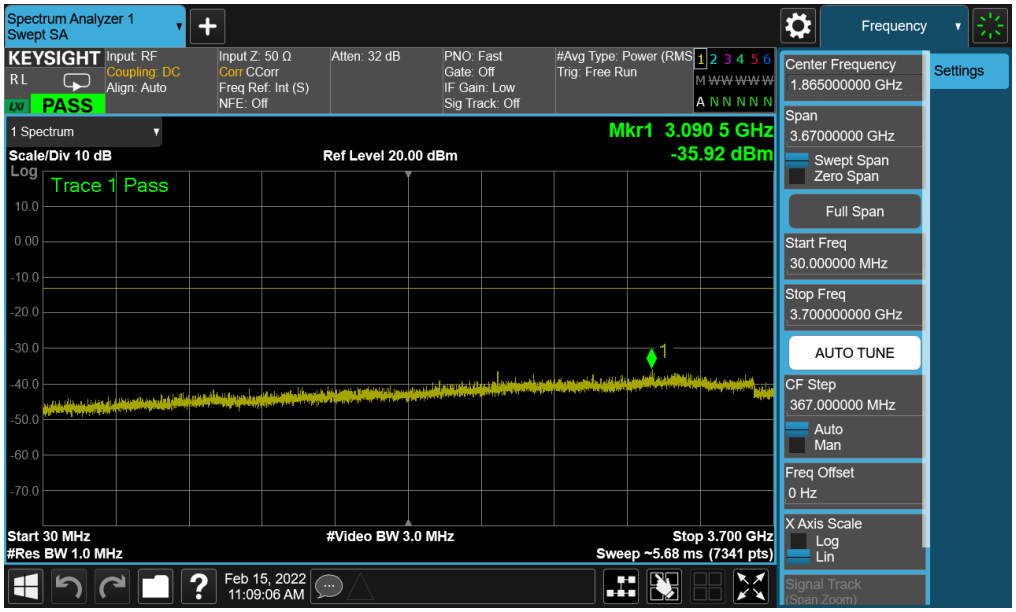
Plot 7-97. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant C)



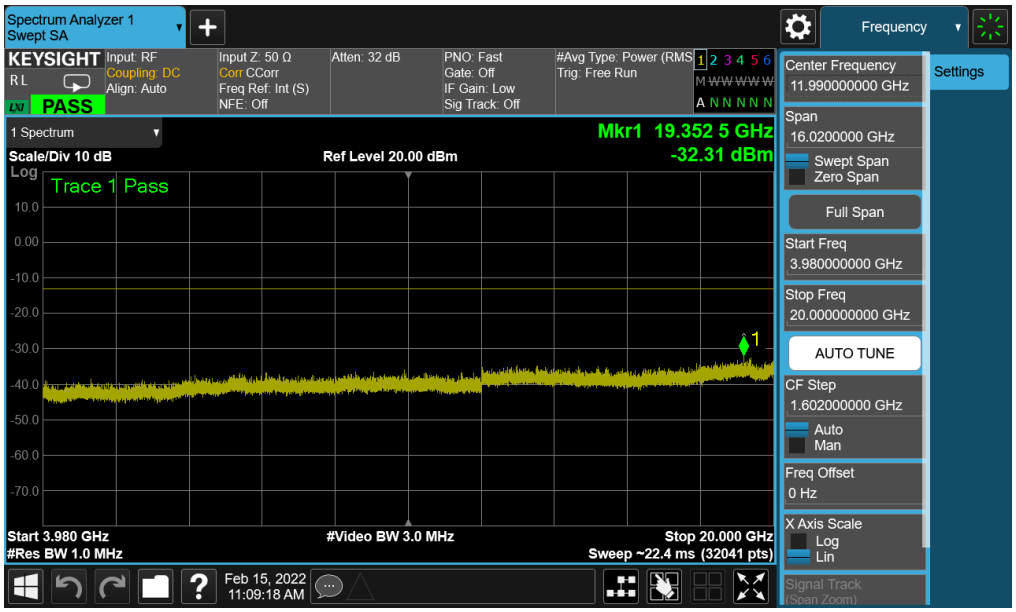
Plot 7-98. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant C)



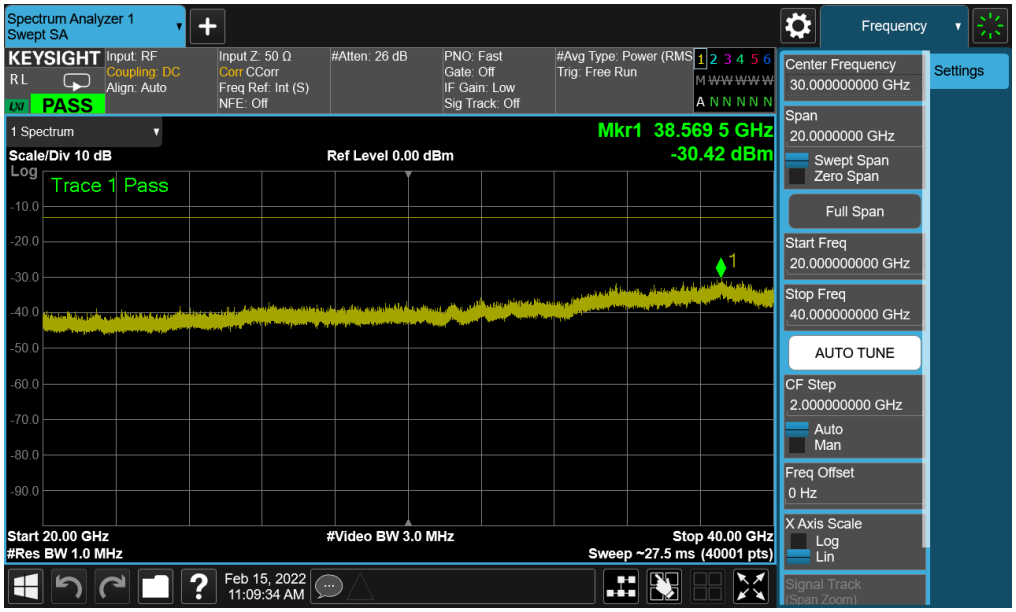
Plot 7-99. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant C)



Plot 7-100. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant C)

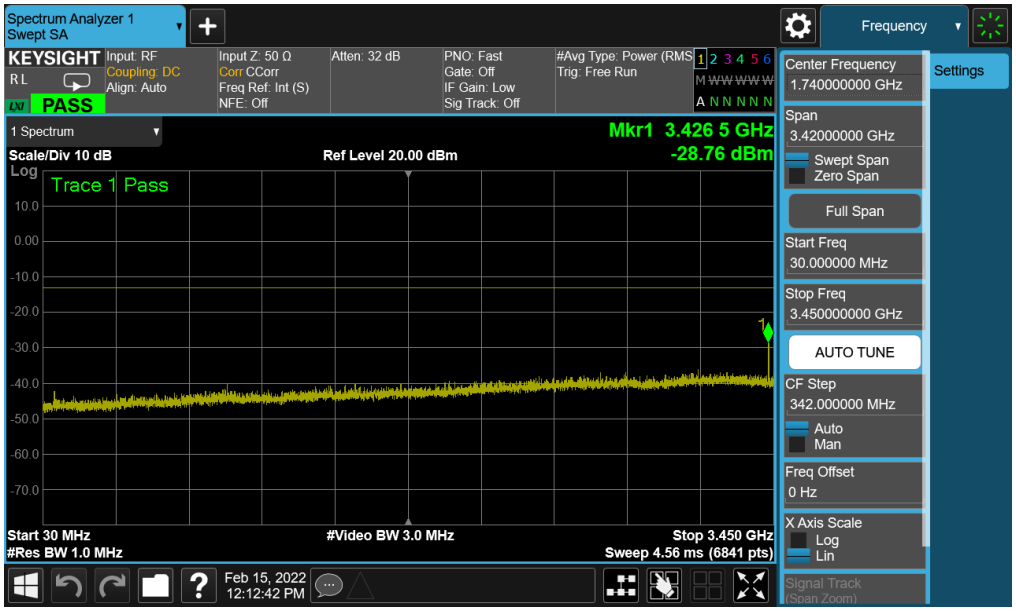


Plot 7-101. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant C)

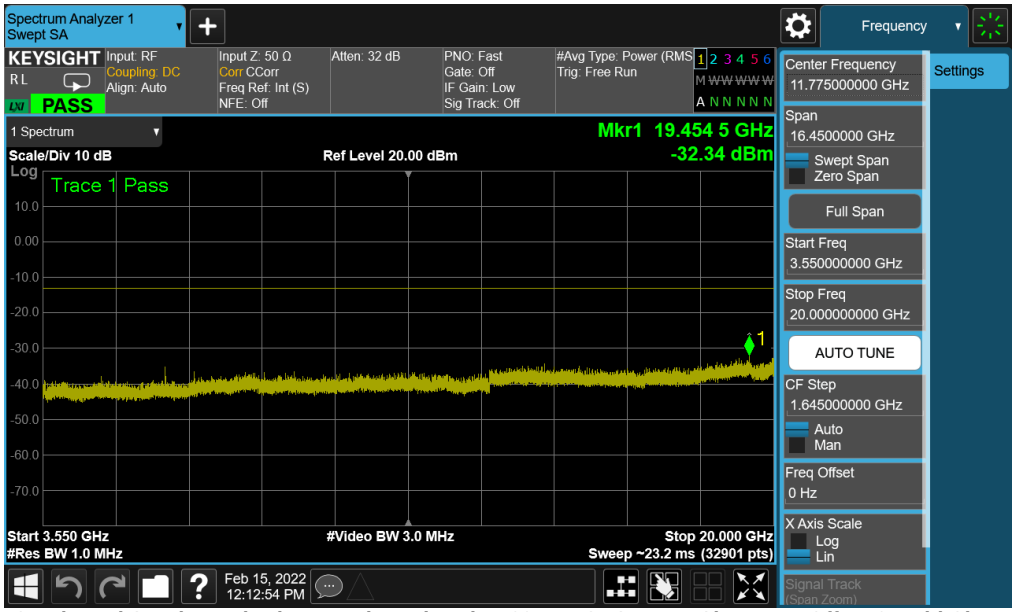


Plot 7-102. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant C)

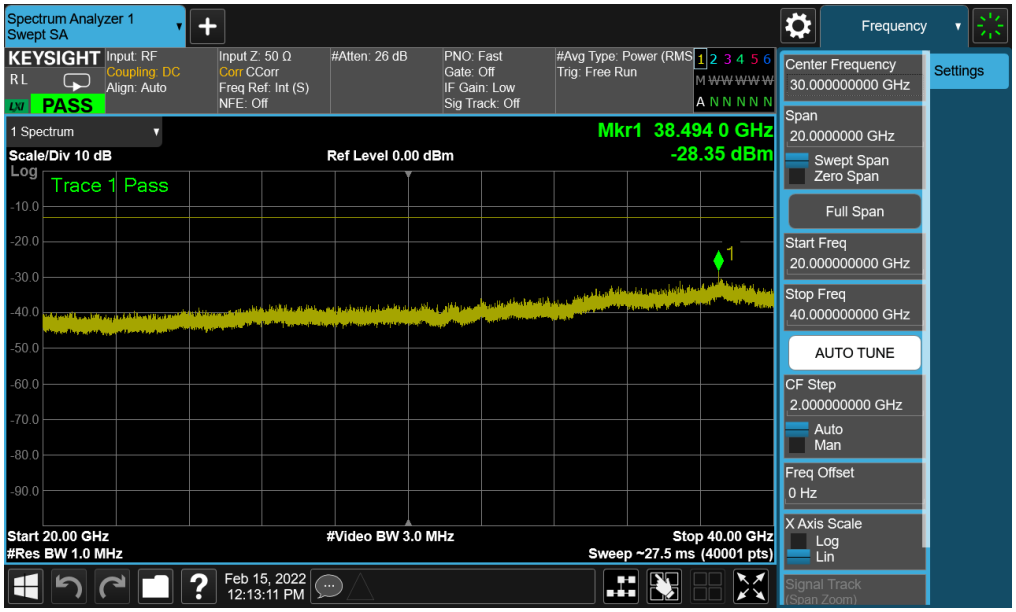
NR Band n77 – DoD Band – SRS-2- Ant D



Plot 7-103. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant D)

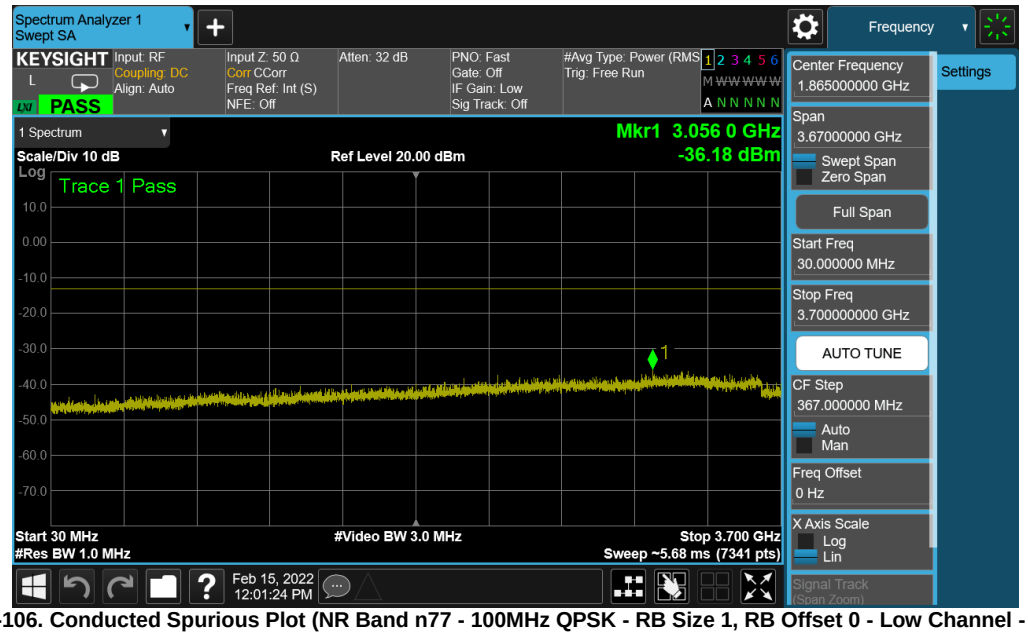


Plot 7-104. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant D)

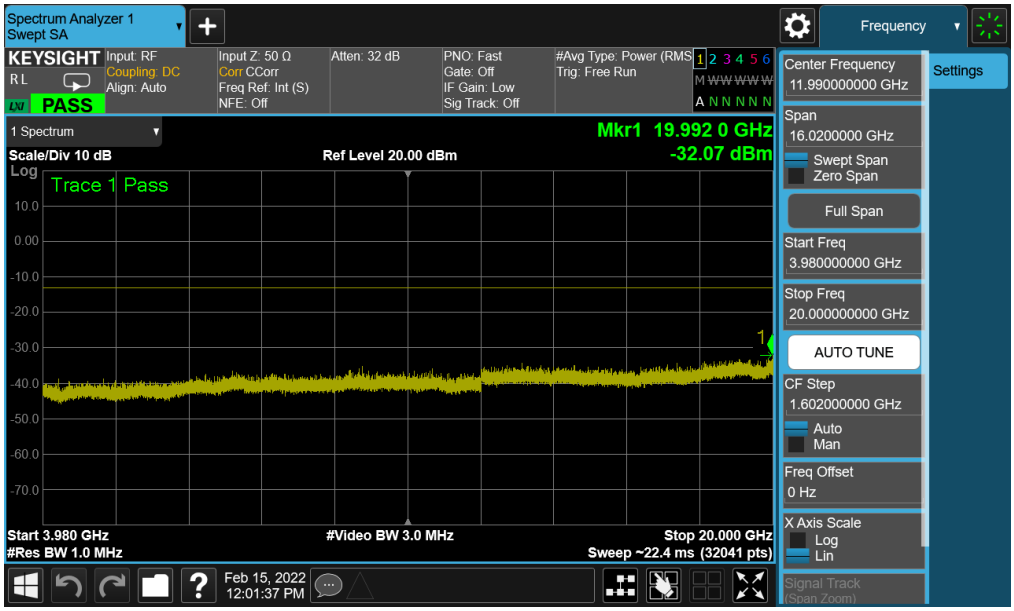


Plot 7-105. Conducted Spurious Plot (NR Band n77 (DoD) - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant D)

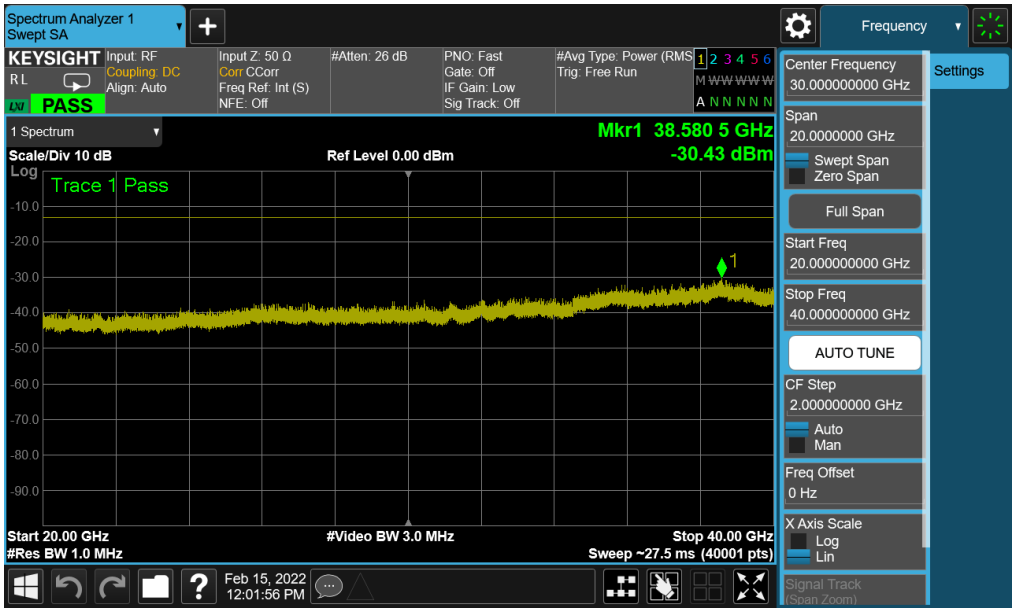
NR Band n77 – C-Band – SRS-2- Ant D



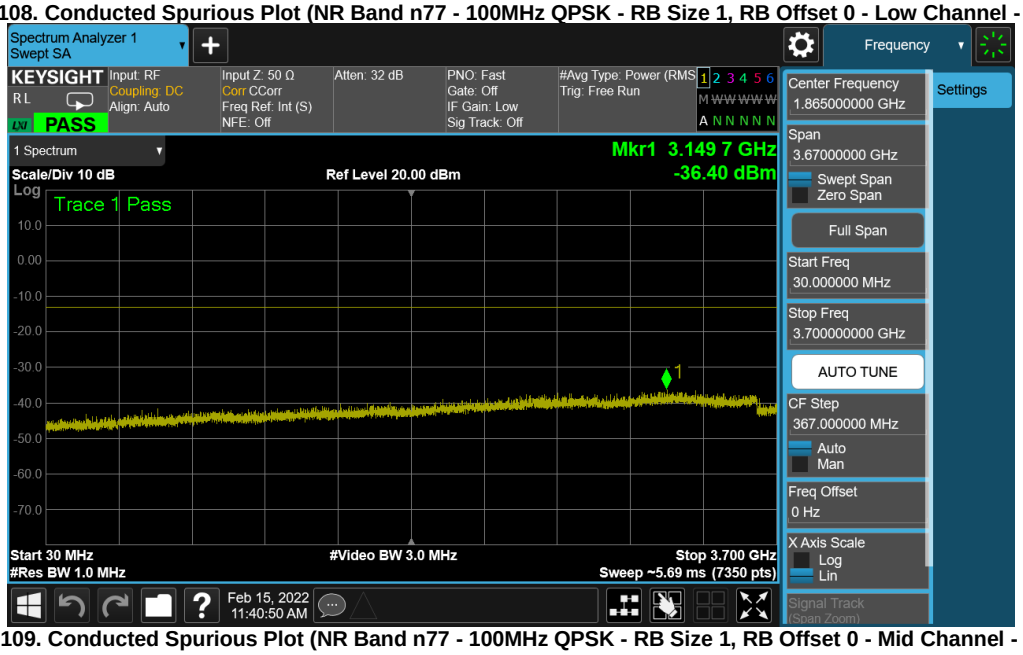
Plot 7-106. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant D)



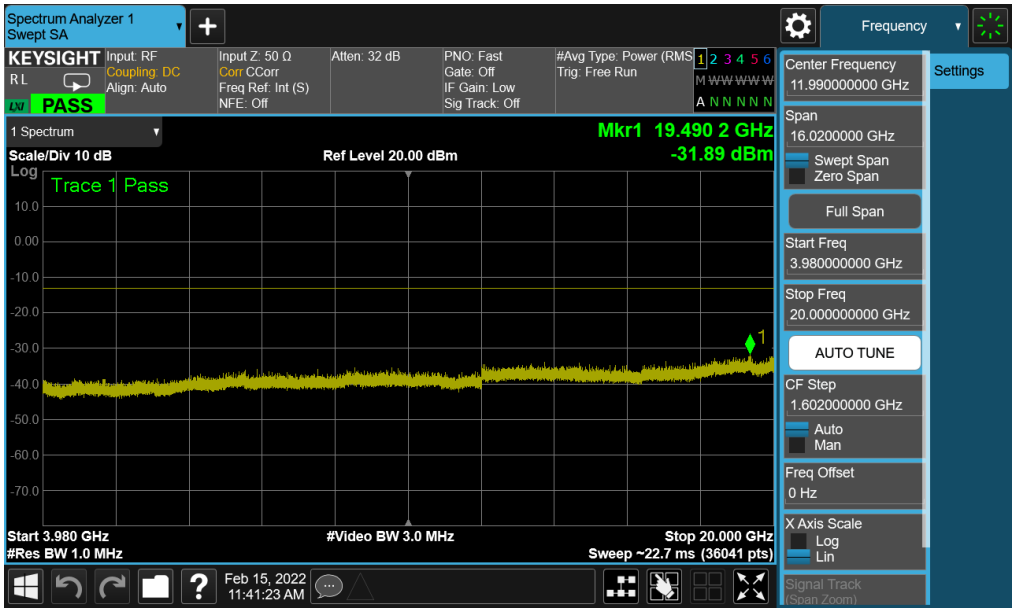
Plot 7-107. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant D)



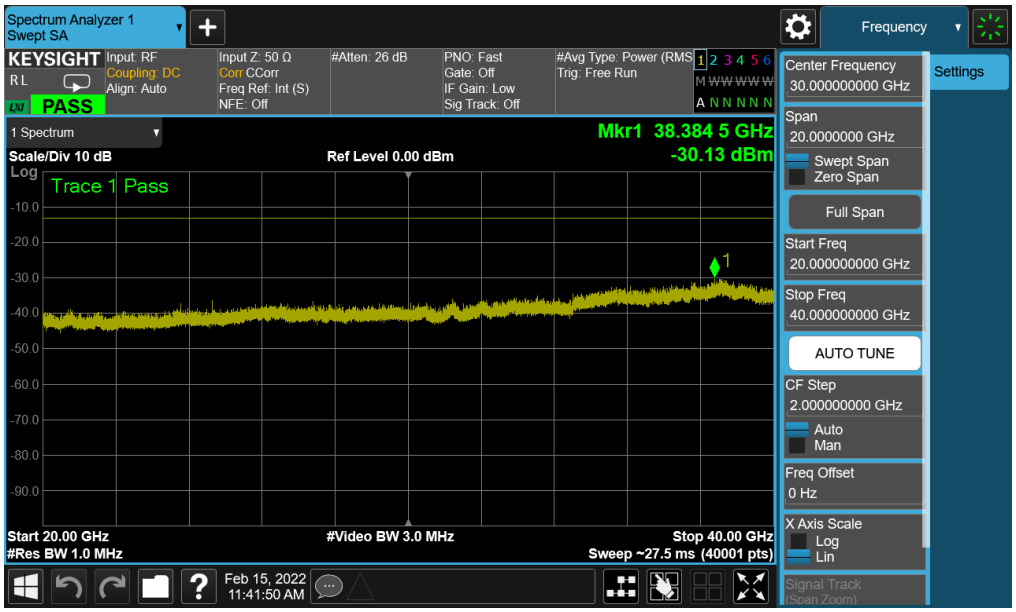
Plot 7-108. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Low Channel - Ant D)



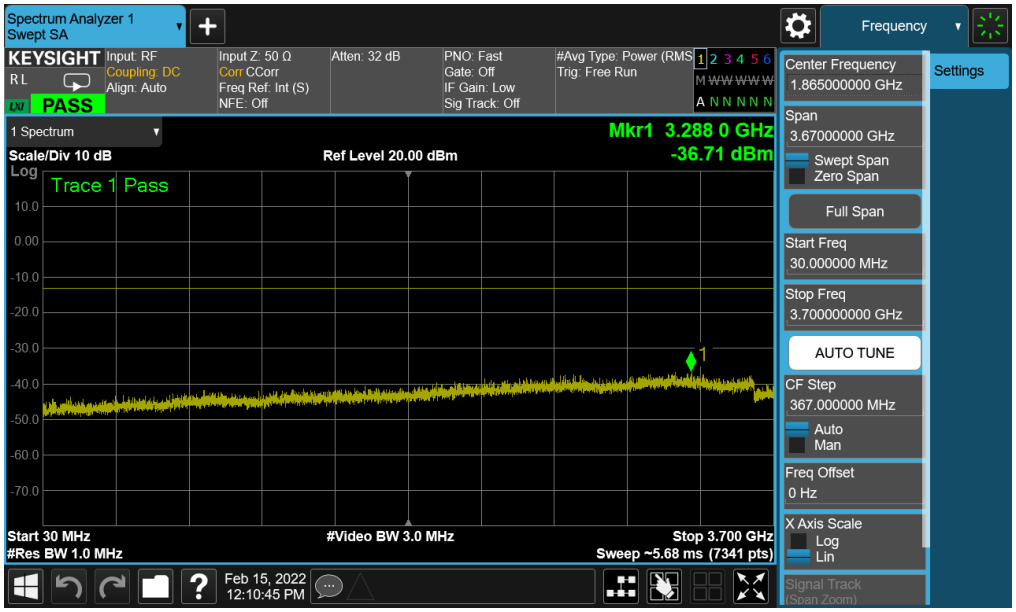
Plot 7-109. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant D)



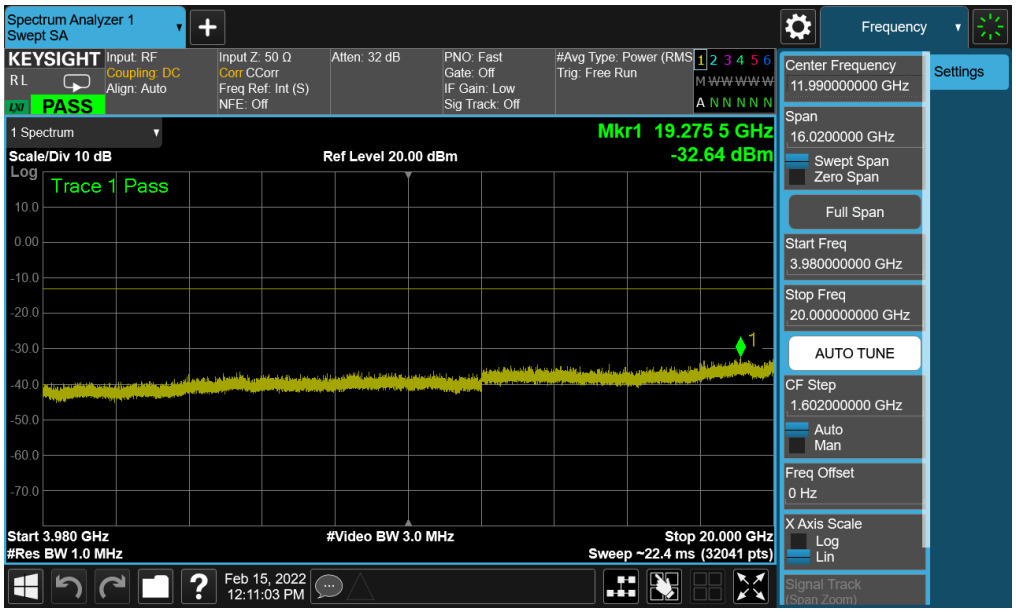
Plot 7-110. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant D)



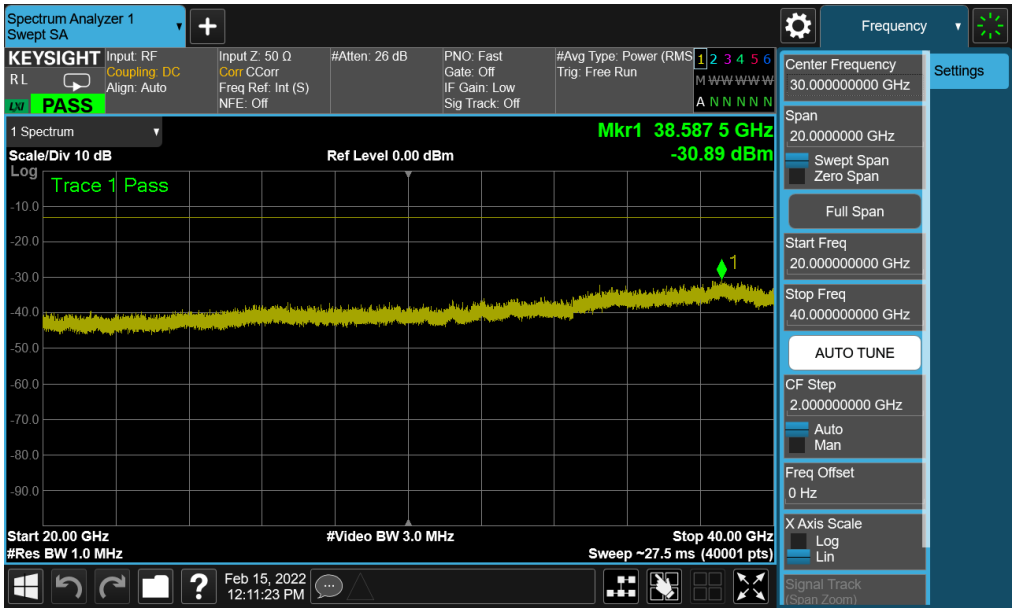
Plot 7-111. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel - Ant D)



Plot 7-112. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant D)



Plot 7-113. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant D)



Plot 7-114. Conducted Spurious Plot (NR Band n77 - 100MHz QPSK - RB Size 1, RB Offset 0 - High Channel - Ant D)

7.5 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

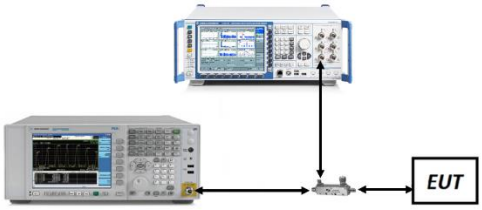


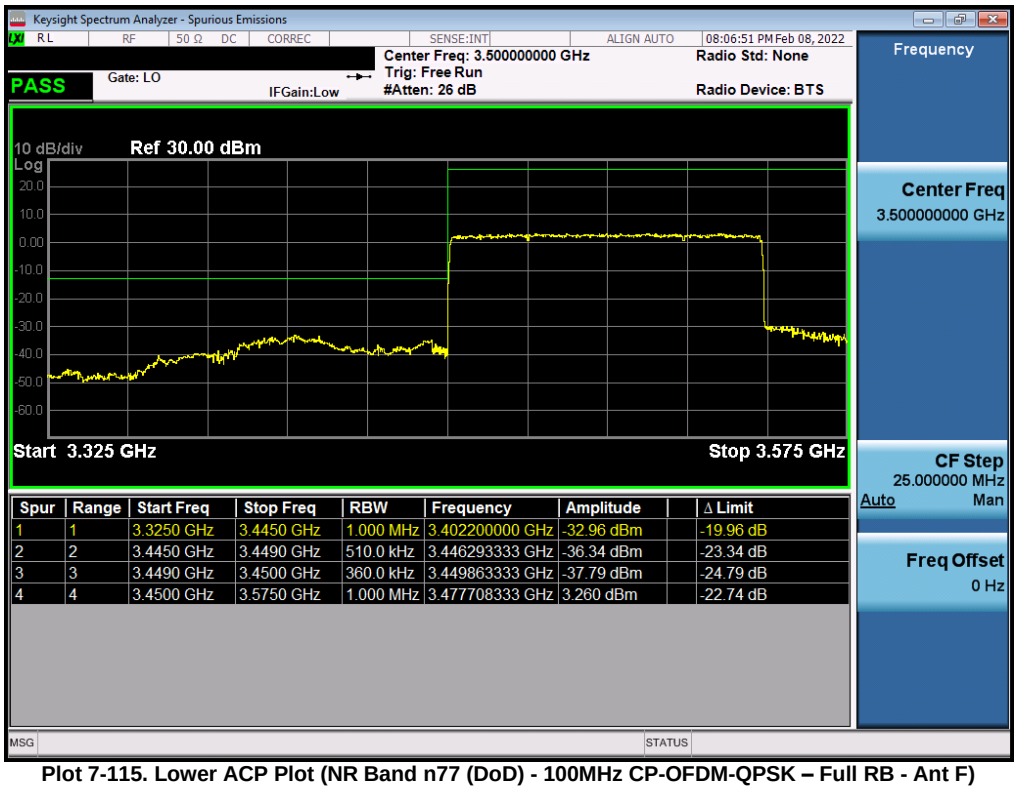
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. Per 27.53(h), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

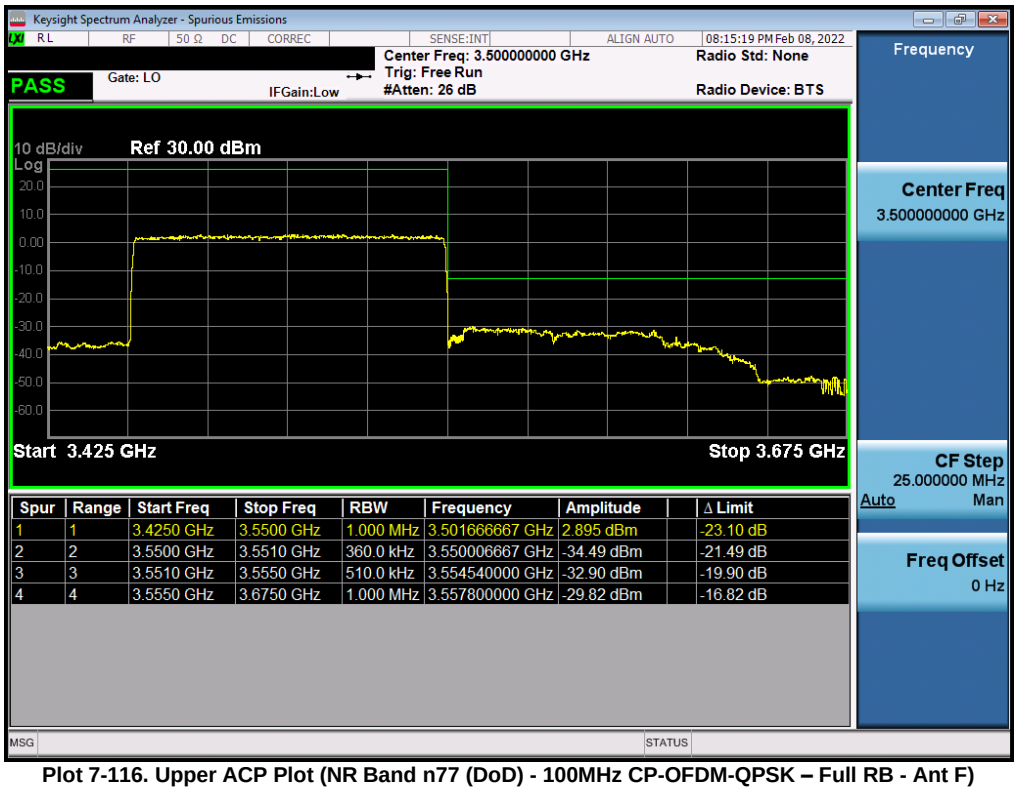
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

NR Band n77 – DoD Band – SRS-1-Ant F



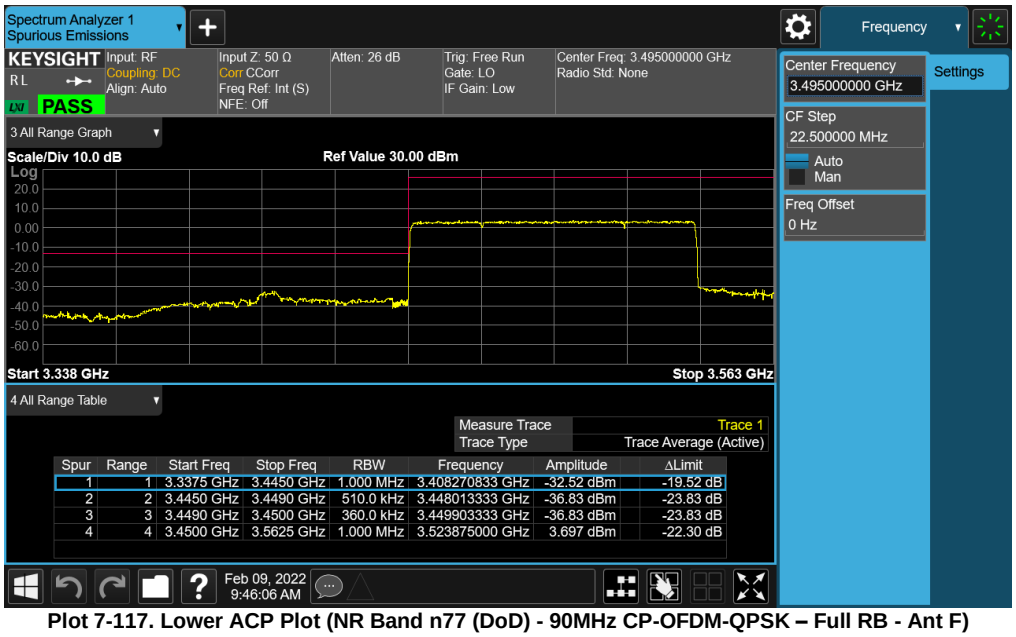
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.3250 GHz	3.4450 GHz	1.000 MHz	3.402200000 GHz	-32.96 dBm	-19.96 dB
2	2	3.4450 GHz	3.4490 GHz	510.0 kHz	3.446293333 GHz	-36.34 dBm	-23.34 dB
3	3	3.4490 GHz	3.4500 GHz	360.0 kHz	3.449863333 GHz	-37.79 dBm	-24.79 dB
4	4	3.4500 GHz	3.5750 GHz	1.000 MHz	3.477708333 GHz	3.260 dBm	-22.74 dB

Plot 7-115. Lower ACP Plot (NR Band n77 (DoD) - 100MHz CP-OFDM-QPSK – Full RB - Ant F)

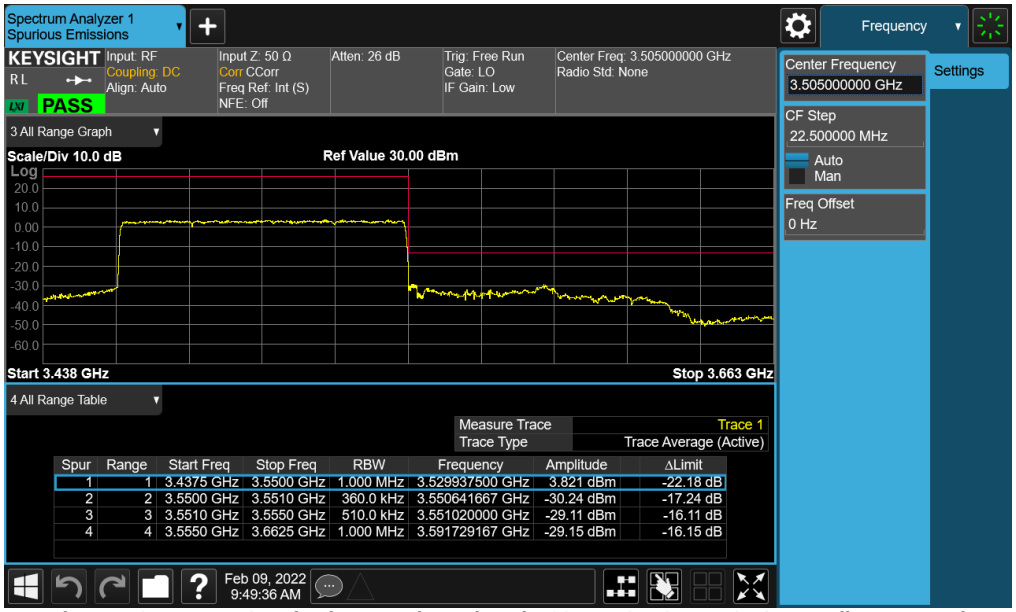


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.4250 GHz	3.5500 GHz	1.000 MHz	3.501666667 GHz	2.895 dBm	-23.10 dB
2	2	3.5500 GHz	3.5510 GHz	360.0 kHz	3.550006667 GHz	-34.49 dBm	-21.49 dB
3	3	3.5510 GHz	3.5550 GHz	510.0 kHz	3.554540000 GHz	-32.90 dBm	-19.90 dB
4	4	3.5550 GHz	3.6750 GHz	1.000 MHz	3.557800000 GHz	-29.82 dBm	-16.82 dB

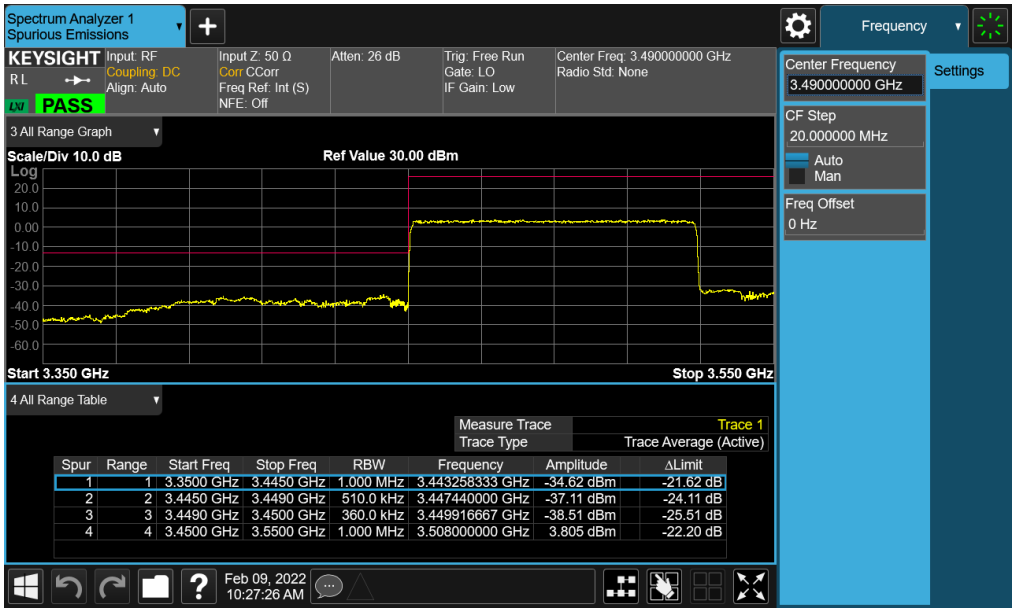
Plot 7-116. Upper ACP Plot (NR Band n77 (DoD) - 100MHz CP-OFDM-QPSK – Full RB - Ant F)



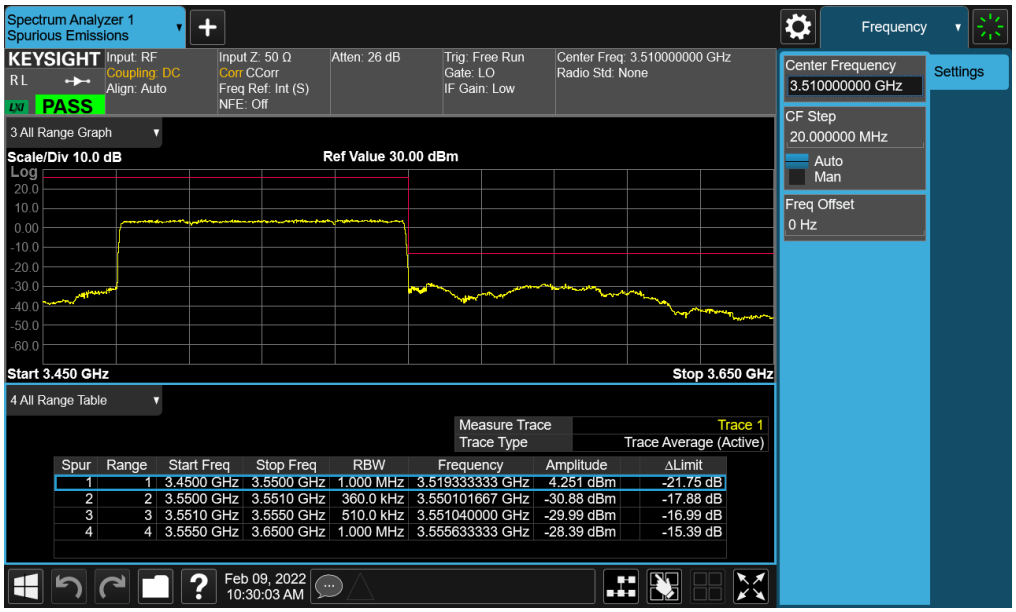
Plot 7-117. Lower ACP Plot (NR Band n77 (DoD) - 90MHz CP-OFDM-QPSK – Full RB - Ant F)



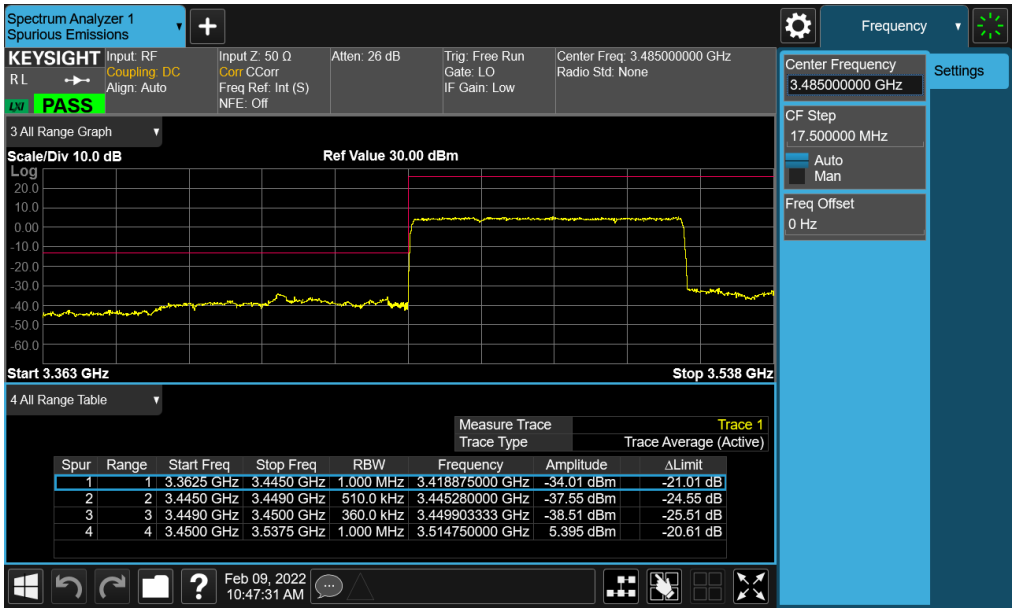
Plot 7-118. Upper ACP Plot (NR Band n77 (DoD) - 90MHz CP-OFDM-QPSK – Full RB - Ant F)



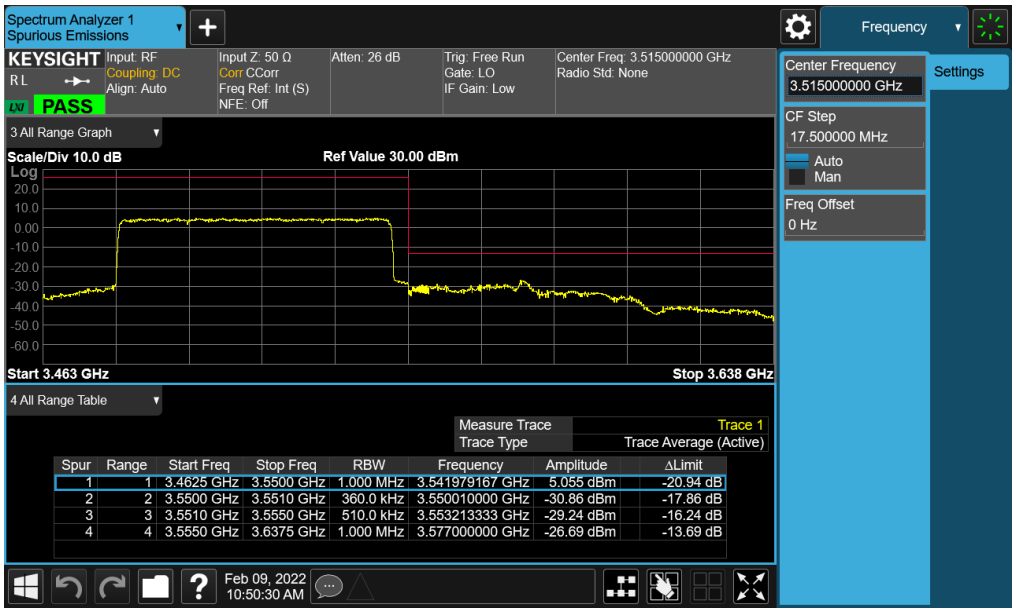
Plot 7-119. Lower ACP Plot (NR Band n77 (DoD) - 80MHz CP-OFDM-QPSK – Full RB - Ant F)



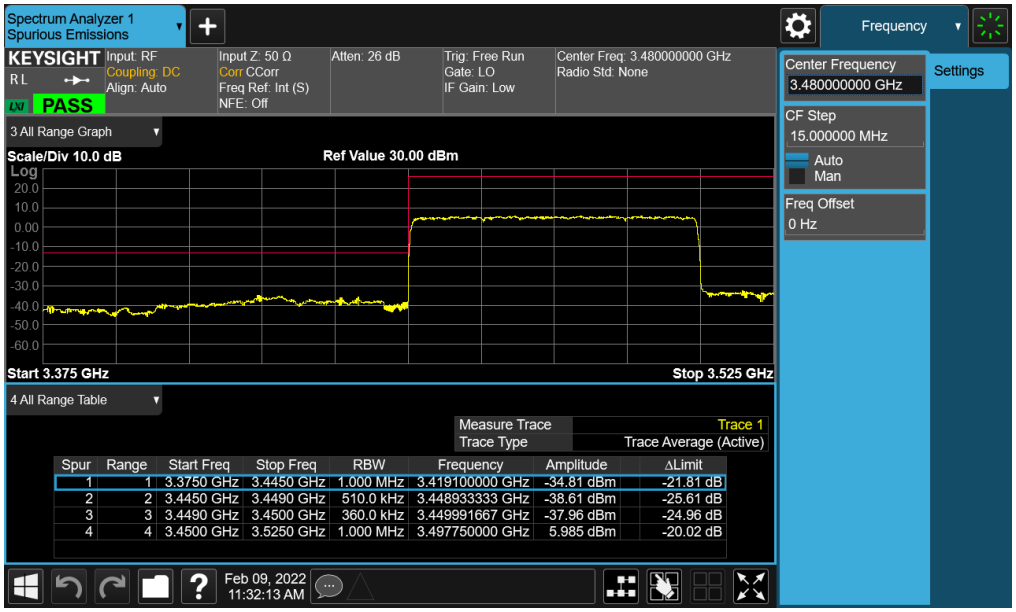
Plot 7-120. Upper ACP Plot (NR Band n77 (DoD) - 80MHz CP-OFDM-QPSK – Full RB - Ant F)



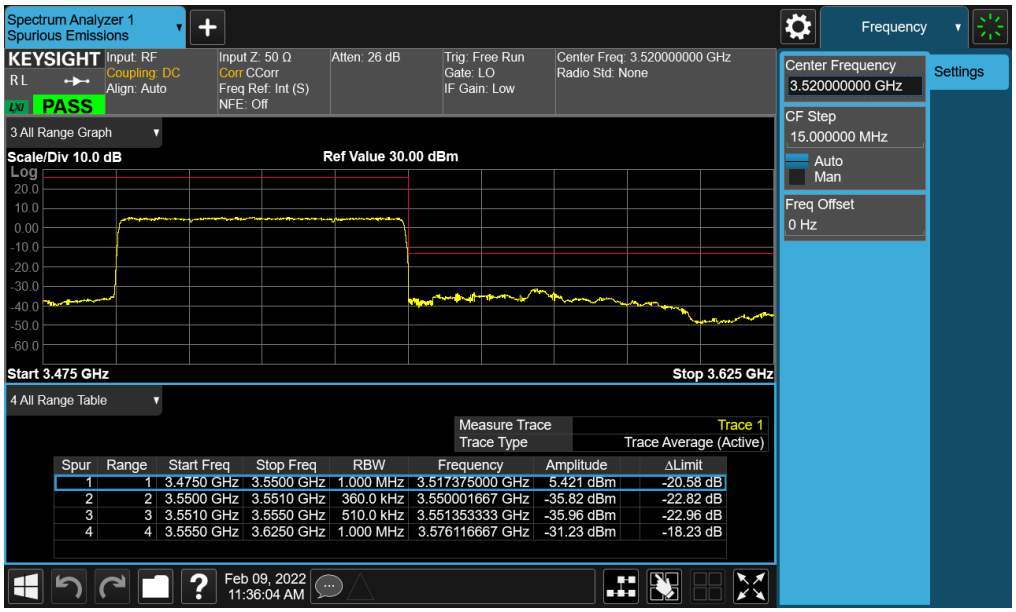
Plot 7-121. Lower ACP Plot (NR Band n77 (DoD) - 70MHz CP-OFDM-QPSK – Full RB - Ant F)



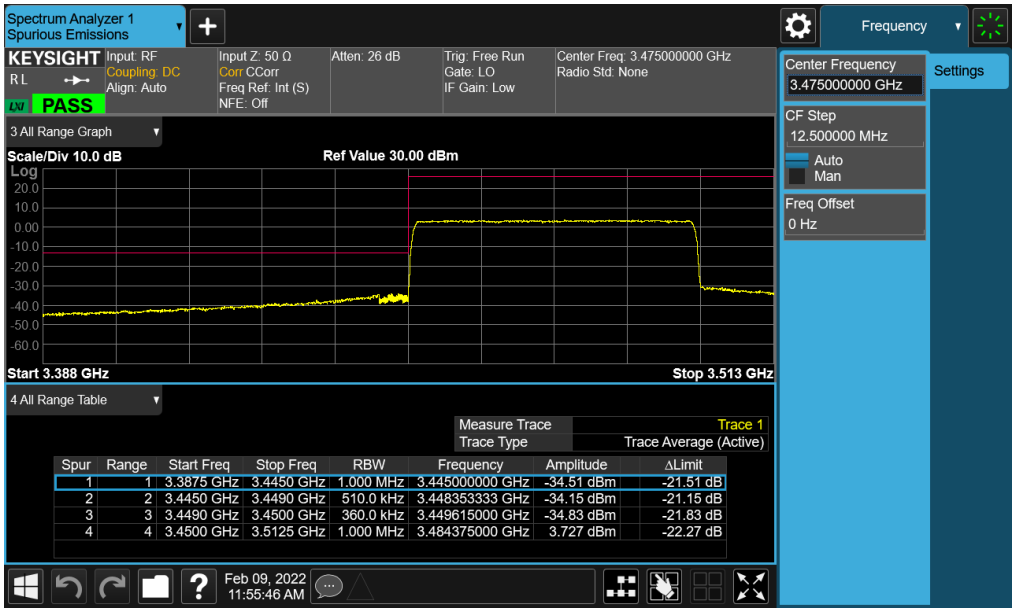
Plot 7-122. Upper ACP Plot (NR Band n77(DoD) - 70MHz CP-OFDM-QPSK – Full RB - Ant F)



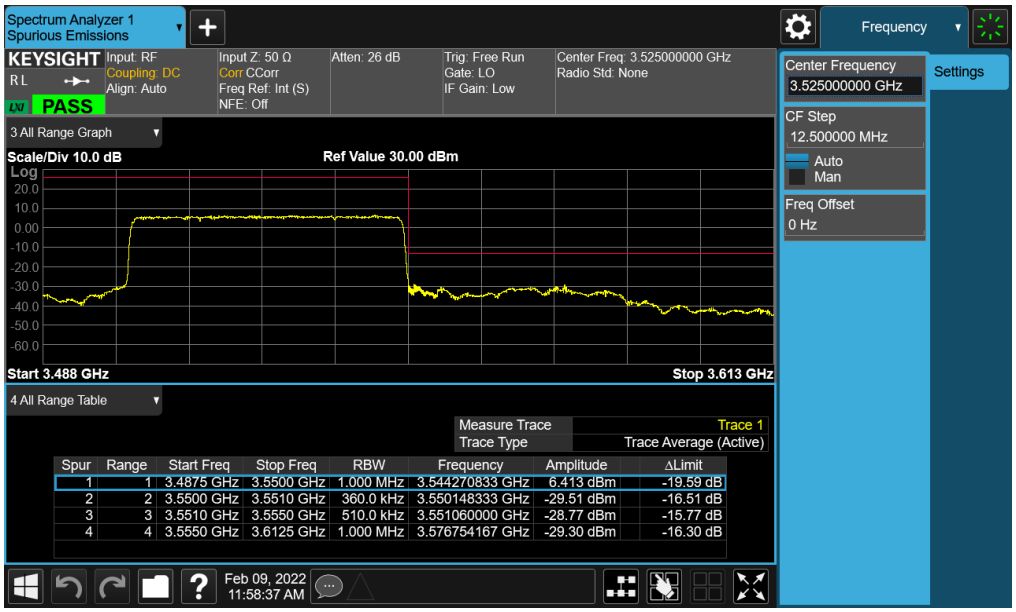
Plot 7-123. Lower ACP Plot (NR Band n77 (DoD) - 60MHz CP-OFDM-QPSK – Full RB - Ant F)



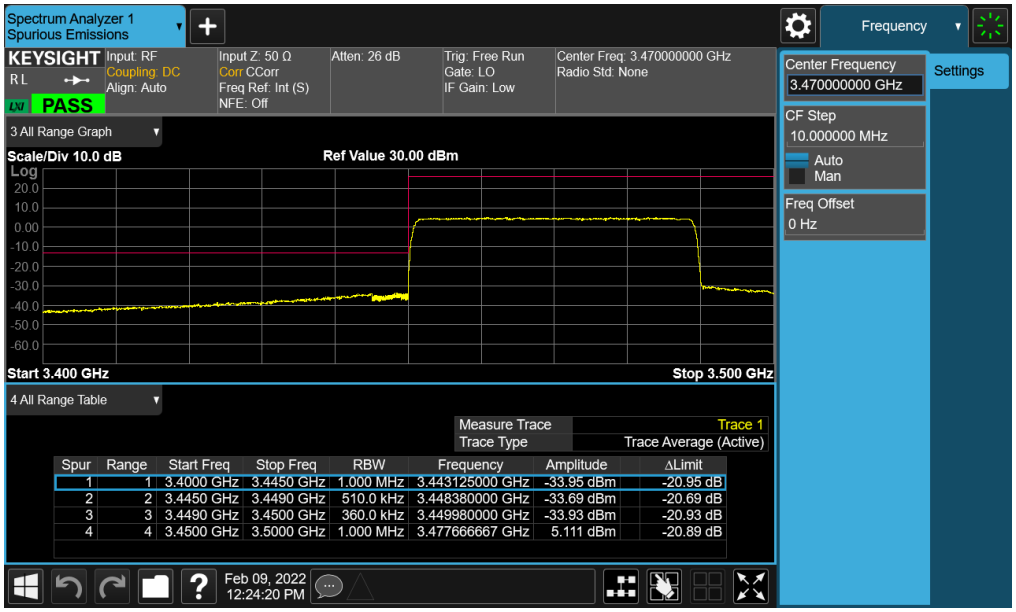
Plot 7-124. Upper ACP Plot (NR Band n77 (DoD) - 60MHz CP-OFDM-QPSK – Full RB - Ant F)



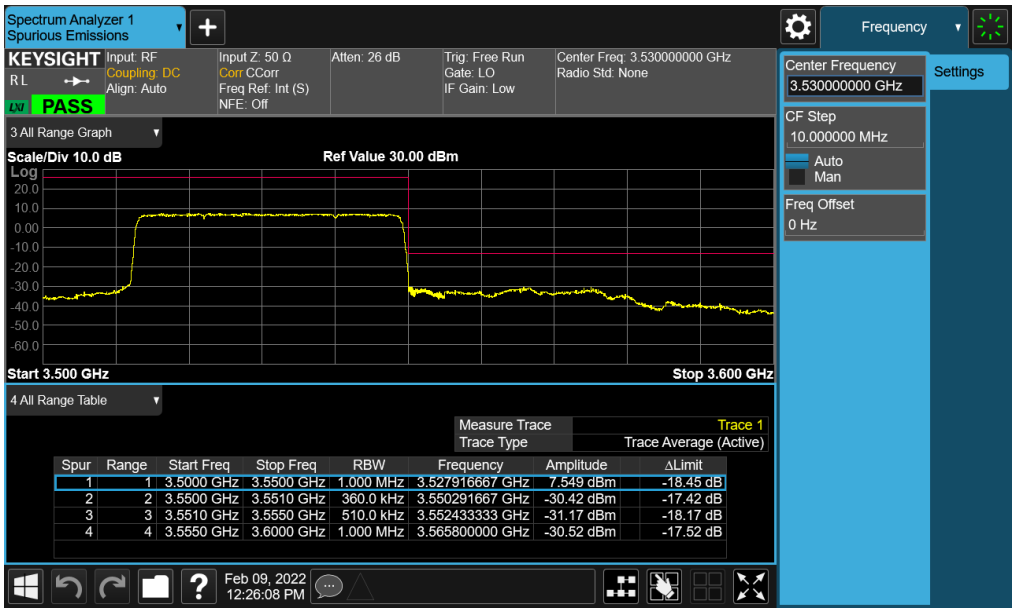
Plot 7-125. Lower ACP Plot (NR Band n77 (DoD) - 50MHz CP-OFDM-QPSK – Full RB - Ant F)



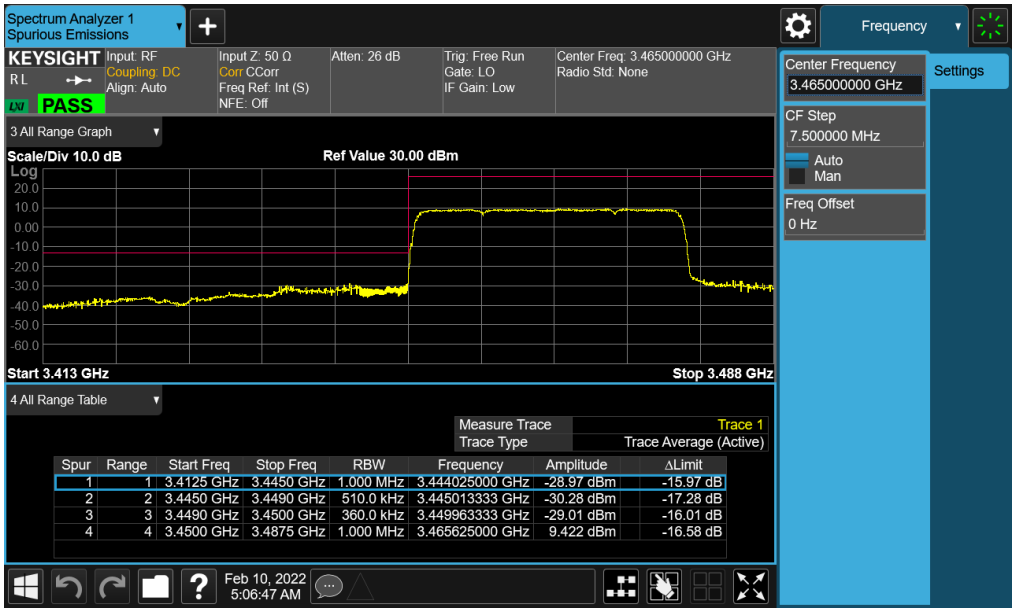
Plot 7-126. Upper ACP Plot (NR Band n77 (DoD) - 50MHz CP-OFDM-QPSK – Full RB - Ant F)



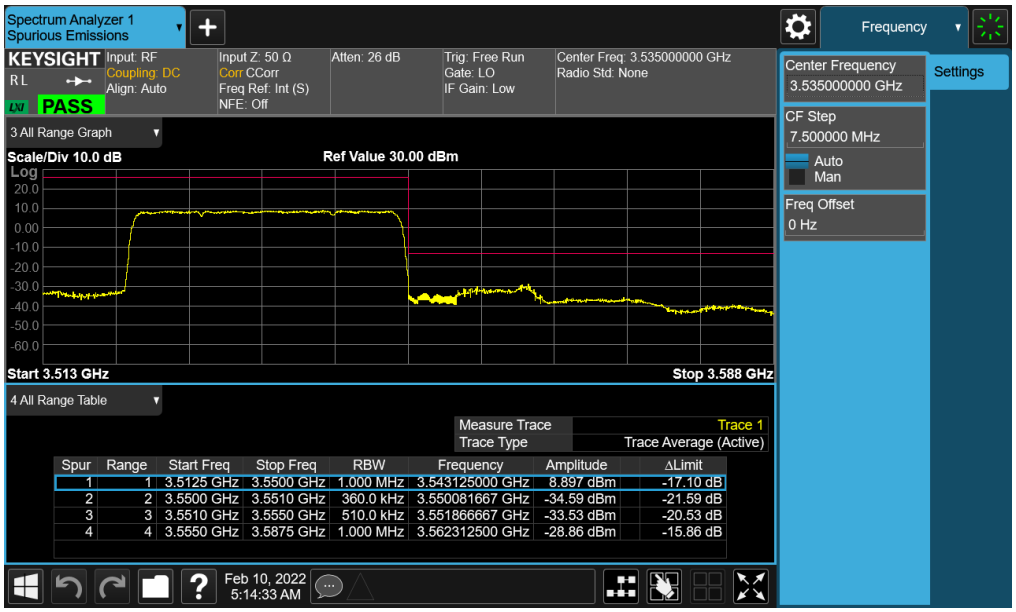
Plot 7-127. Lower ACP Plot (NR Band n77 (DoD) - 40MHz CP-OFDM-QPSK – Full RB - Ant F)



Plot 7-128. Upper ACP Plot (NR Band n77(DoD) - 40MHz CP-OFDM-QPSK – Full RB - Ant F)



Plot 7-129. Lower ACP Plot (NR Band n77 (DoD) - 30MHz CP-OFDM-QPSK – Full RB - Ant F)



Plot 7-130. Upper ACP Plot (NR Band n77 (DoD) - 30MHz CP-OFDM-QPSK – Full RB - Ant F)