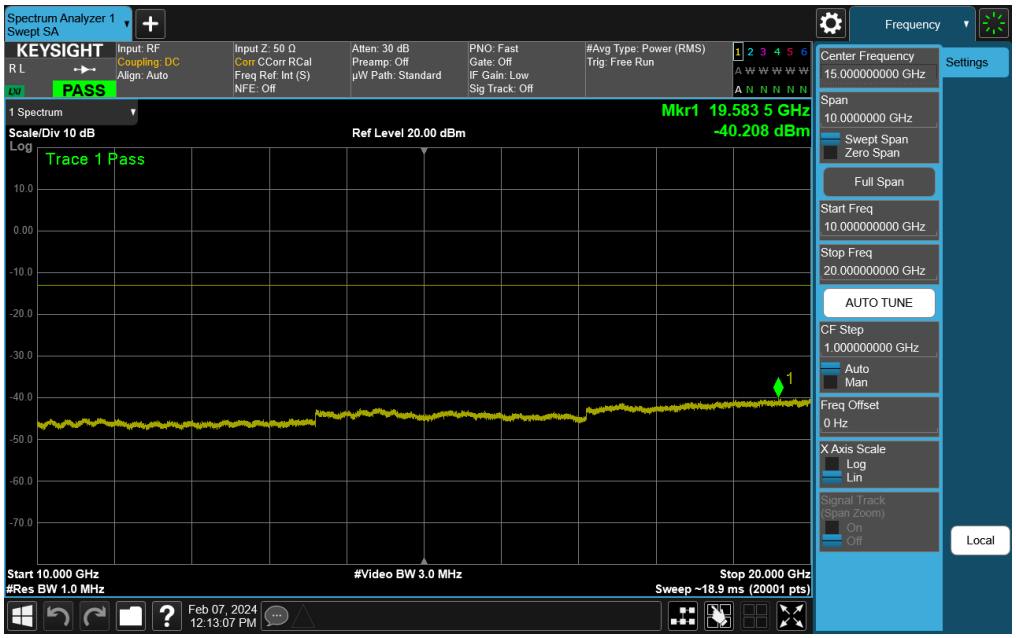


Plot 7-92. Conducted Spurious Plot (WCDMA Ch. 9538)

7.4 Band Edge Emissions at Antenna Terminal

§2.1051, §24.238(a)

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. All ports were tested and only the worst case data was reported.

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 $\geq$ 1% of the emission bandwidth
4. VBW $\geq$ 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.

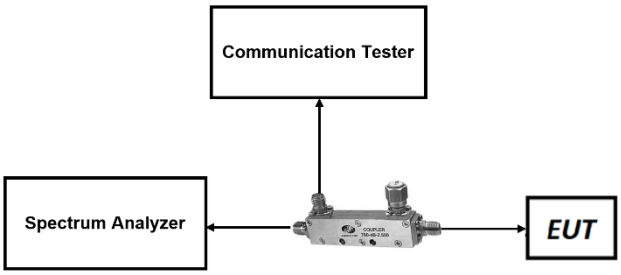


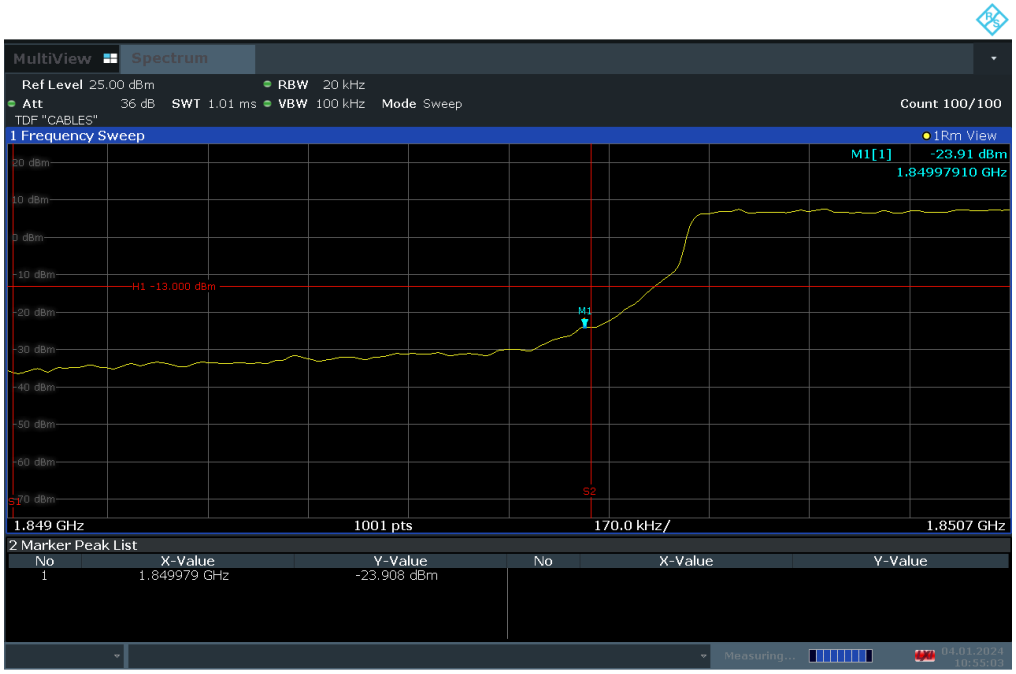
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

1. Per 24.238(a), 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.

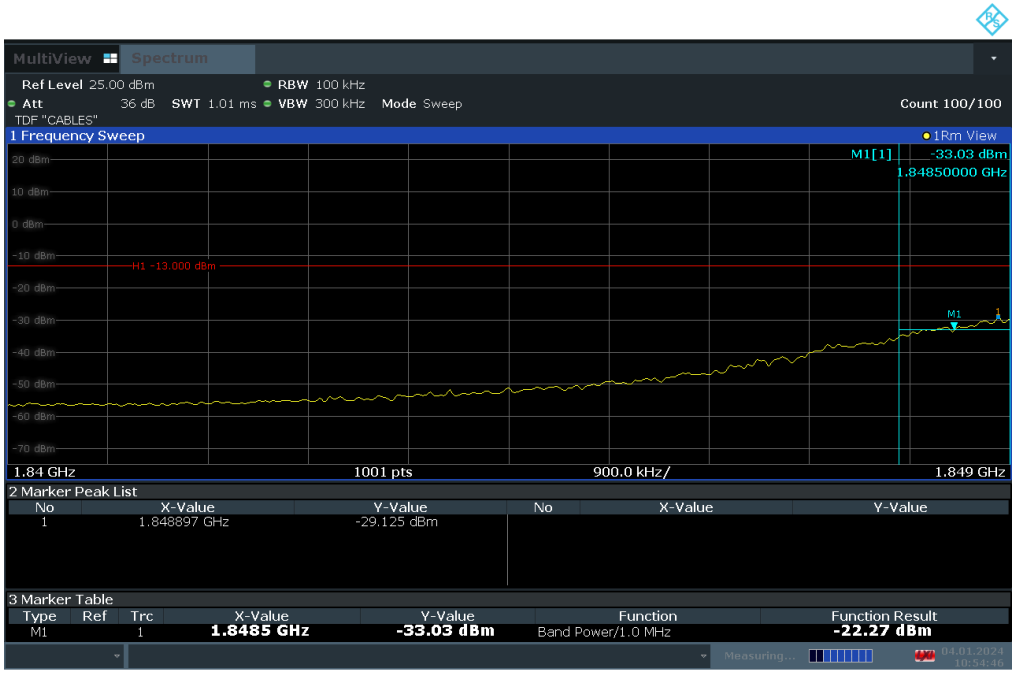
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

LTE Band 25



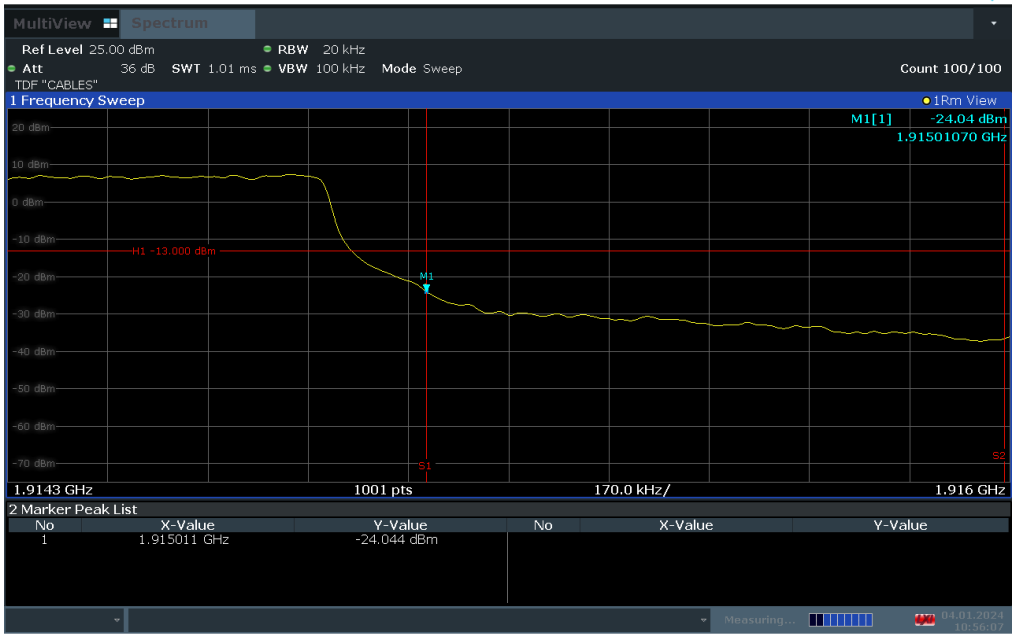
10:55:04 04.01.2024

Plot 7-93. Lower Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)



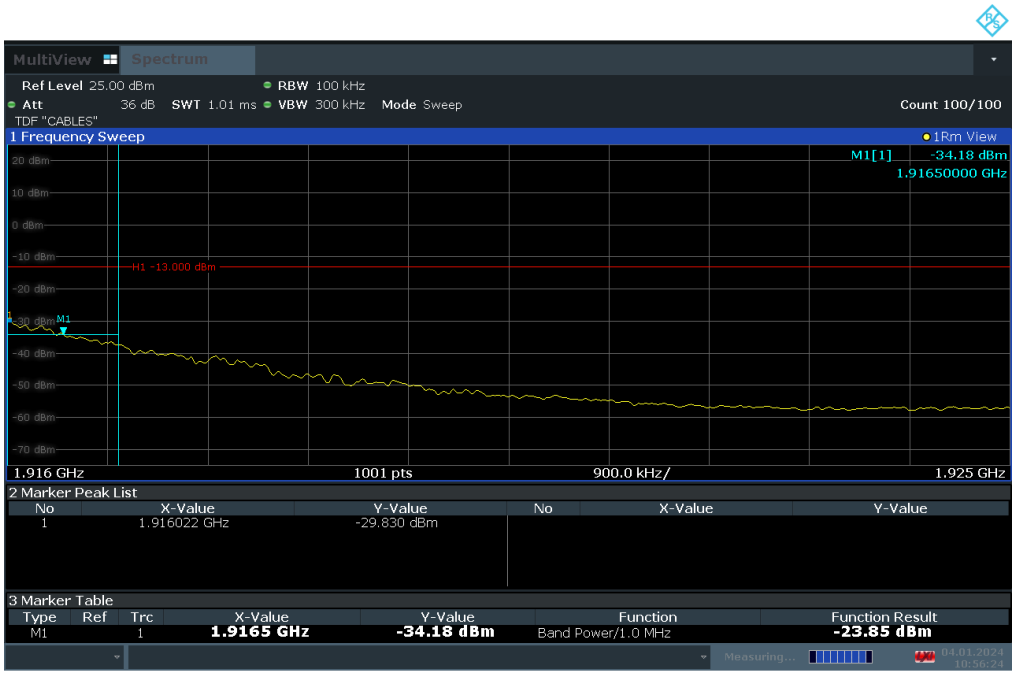
10:54:46 04.01.2024

Plot 7-94. Extended Lower Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)



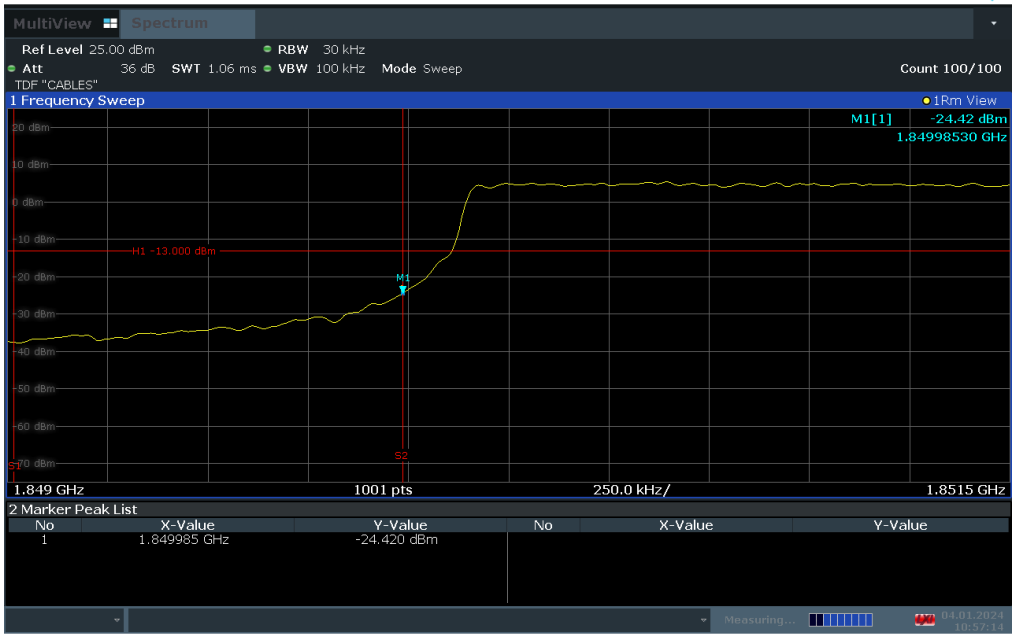
10:56:07 04.01.2024

Plot 7-95. Upper Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)

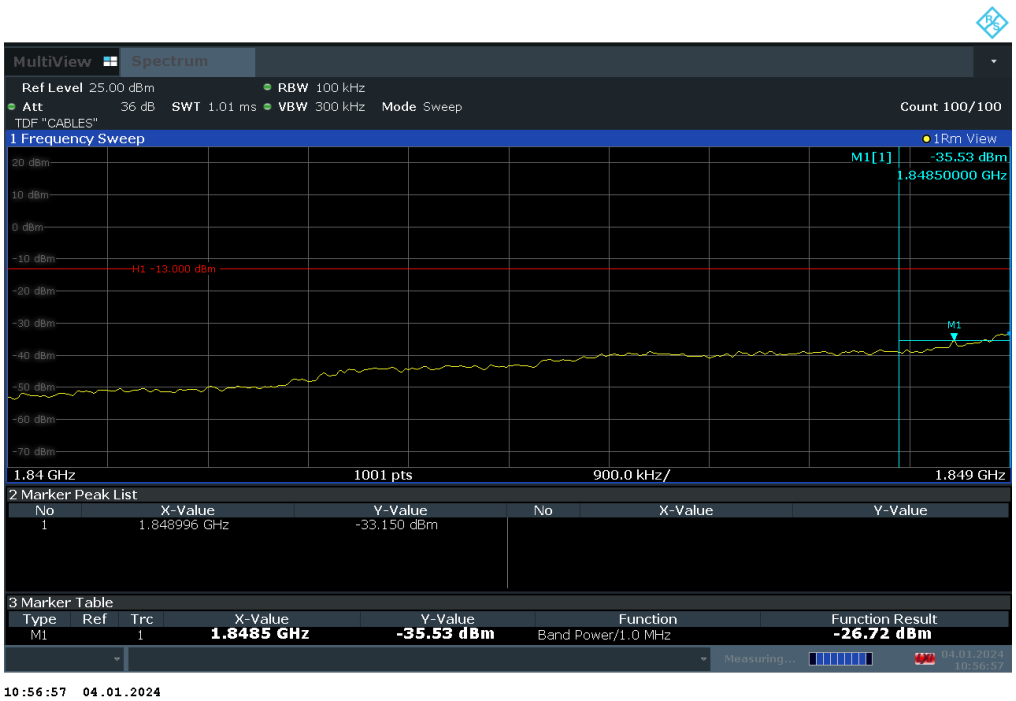


10:56:24 04.01.2024

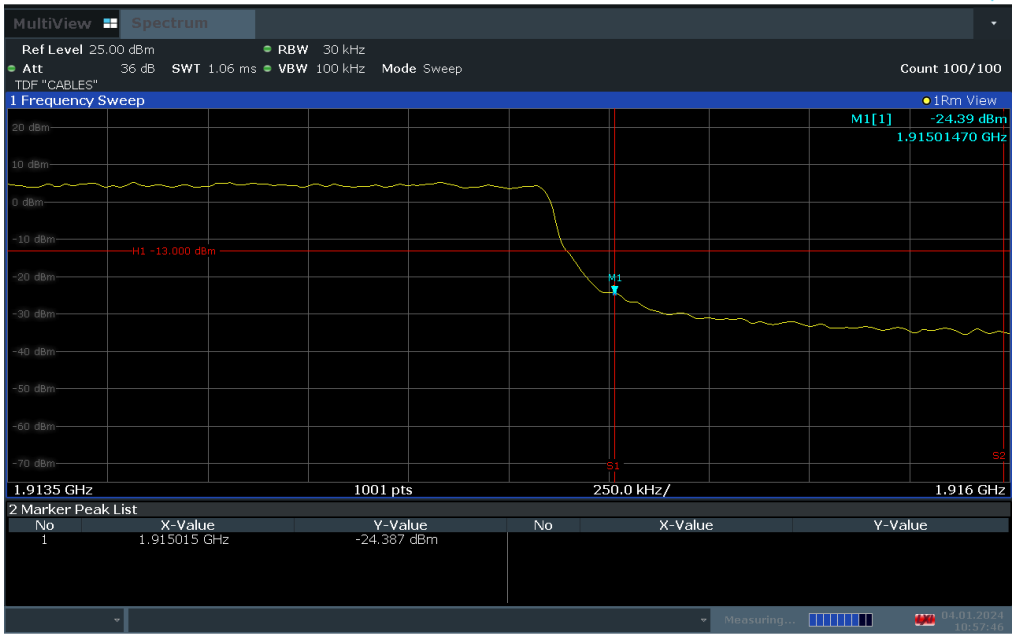
Plot 7-96. Extended Upper Band Edge Plot (LTE Band 25 – 1.4MHz QPSK – Full RB Configuration)



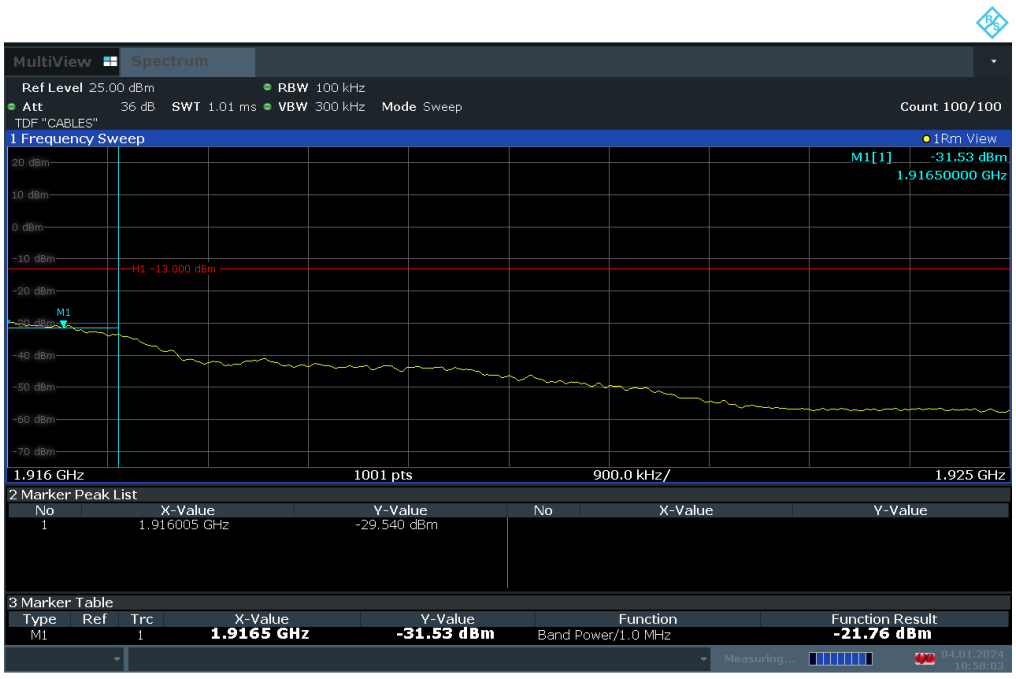
Plot 7-97. Lower Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)



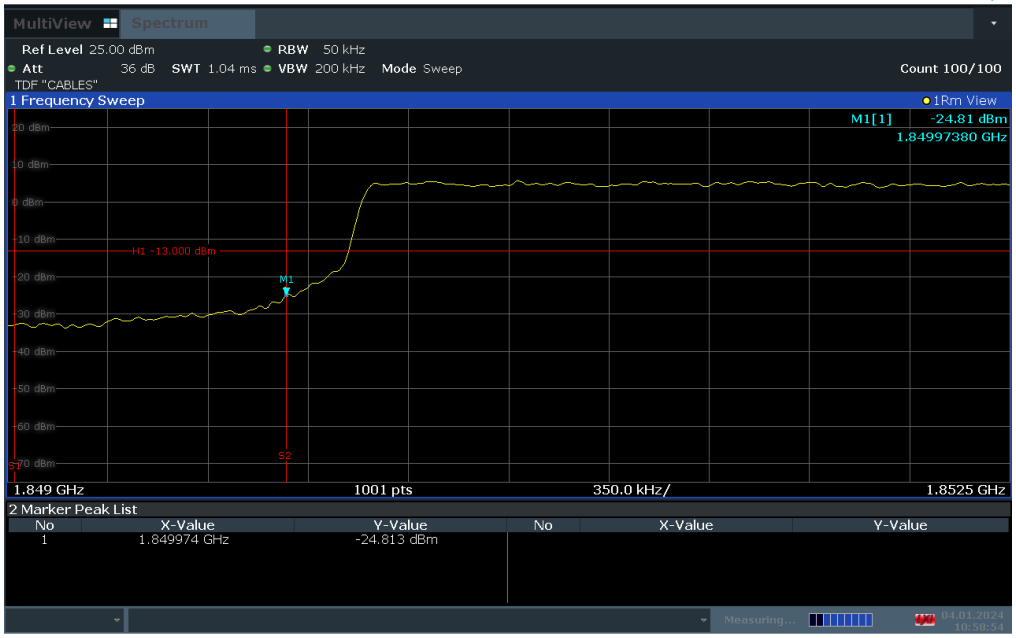
Plot 7-98. Extended Lower Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)



Plot 7-99. Upper Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)

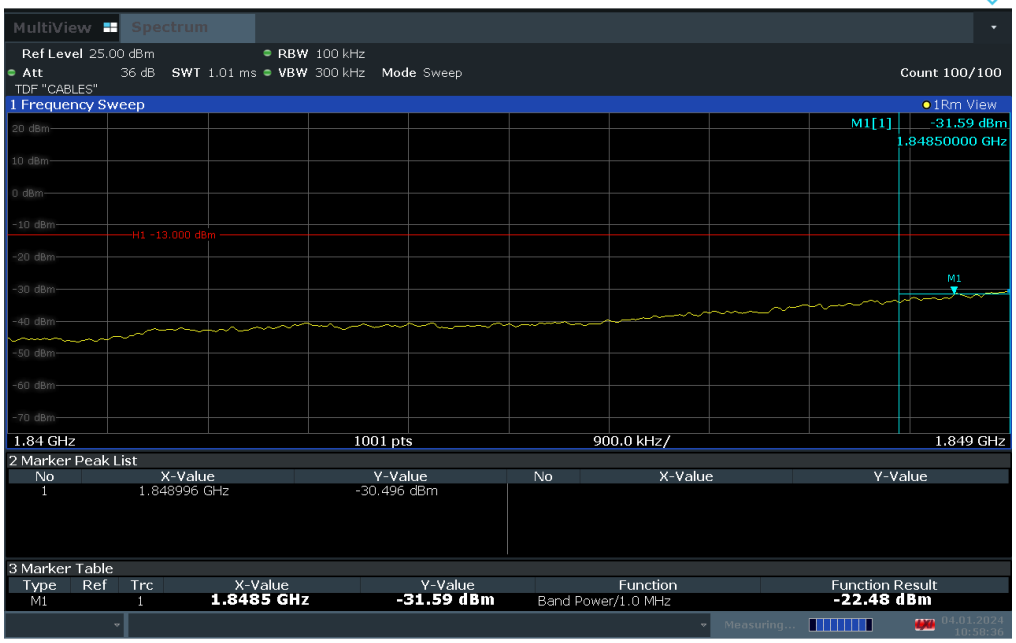


Plot 7-100. Extended Upper Band Edge Plot (LTE Band 25 – 3MHz QPSK – Full RB Configuration)



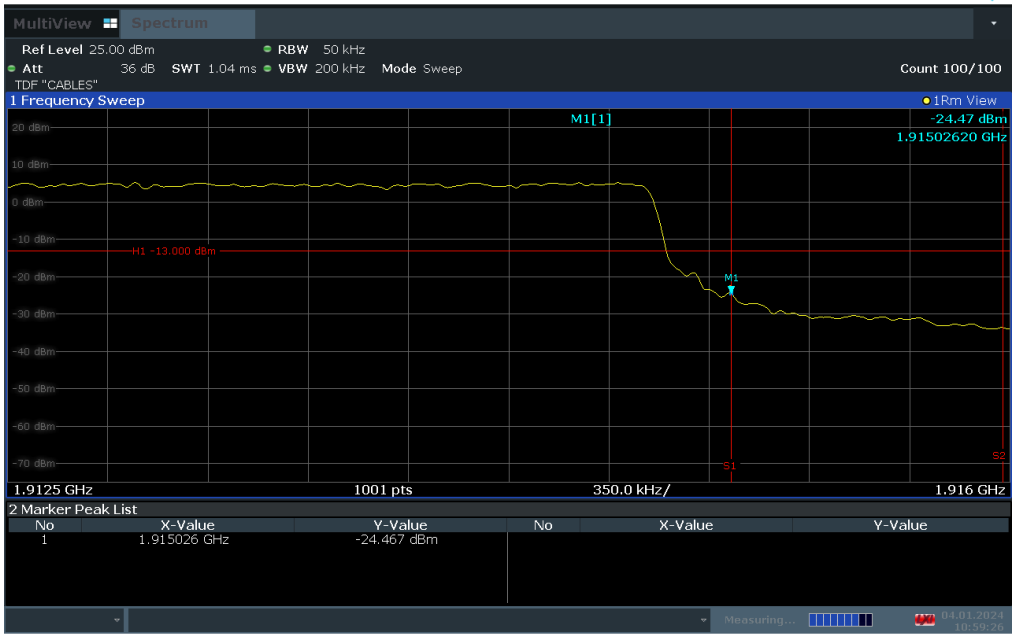
10:58:54 04.01.2024

Plot 7-101. Lower Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)

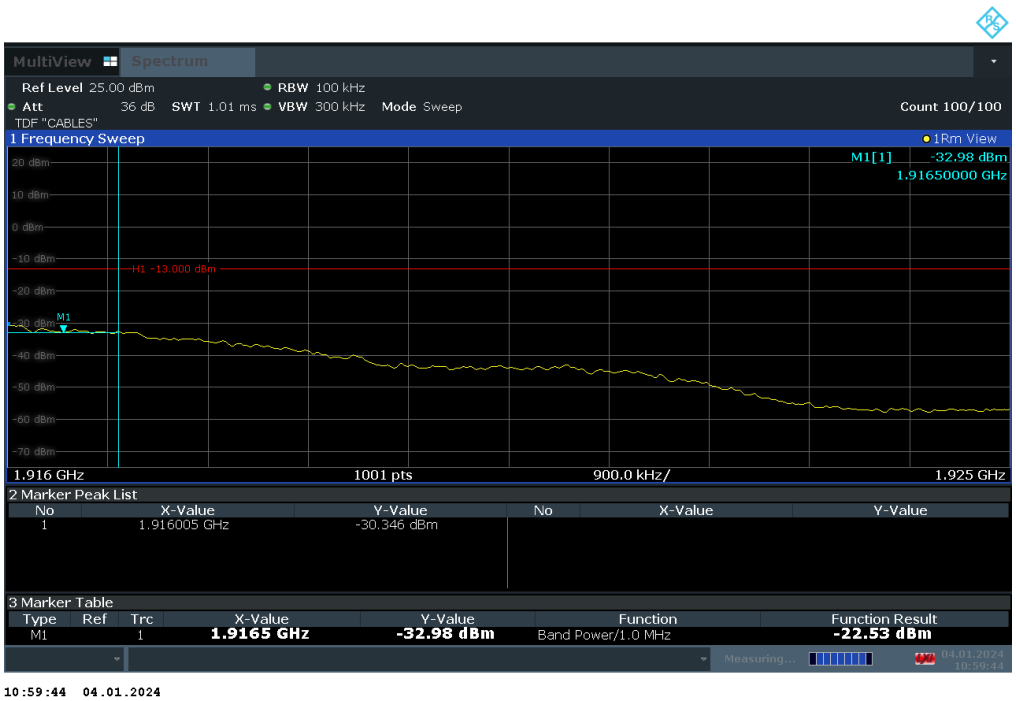


10:58:37 04.01.2024

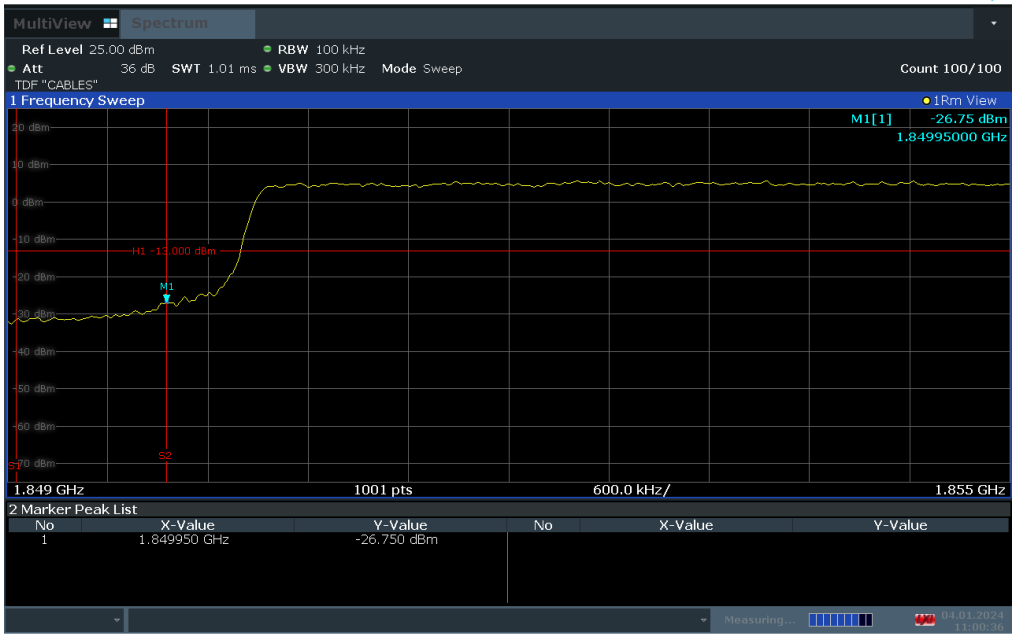
Plot 7-102. Extended Lower Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)



Plot 7-103. Upper Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)

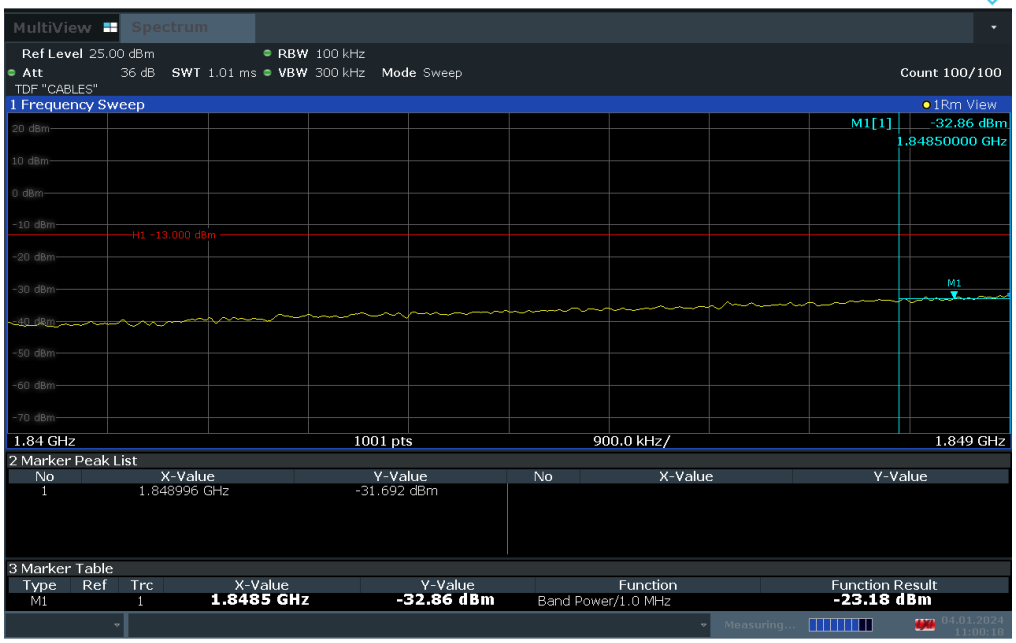


Plot 7-104. Extended Upper Band Edge Plot (LTE Band 25 – 5MHz QPSK – Full RB Configuration)



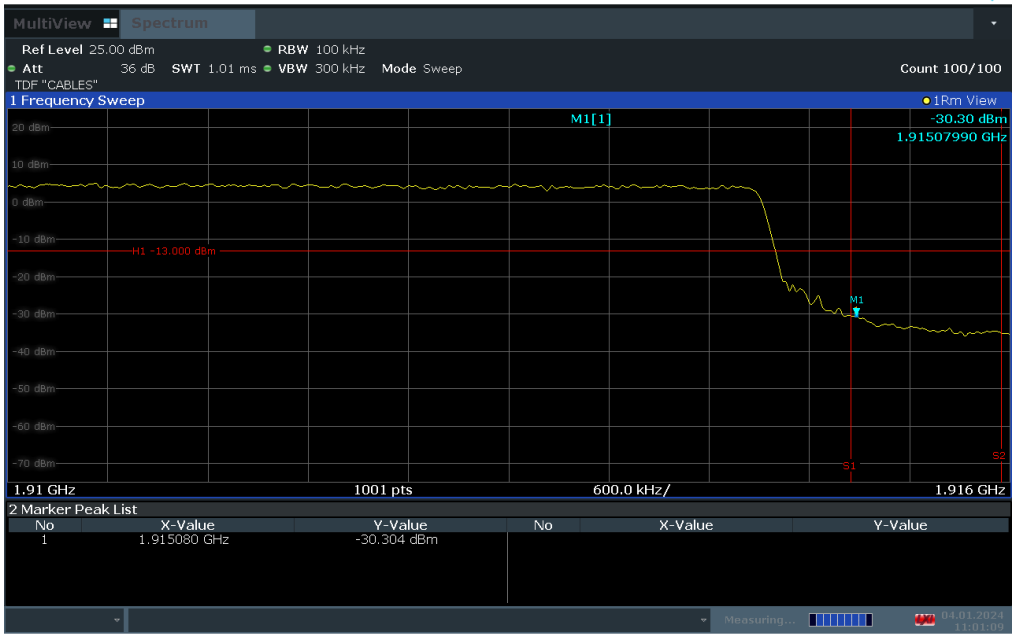
11:00:37 04.01.2024

Plot 7-105. Lower Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)

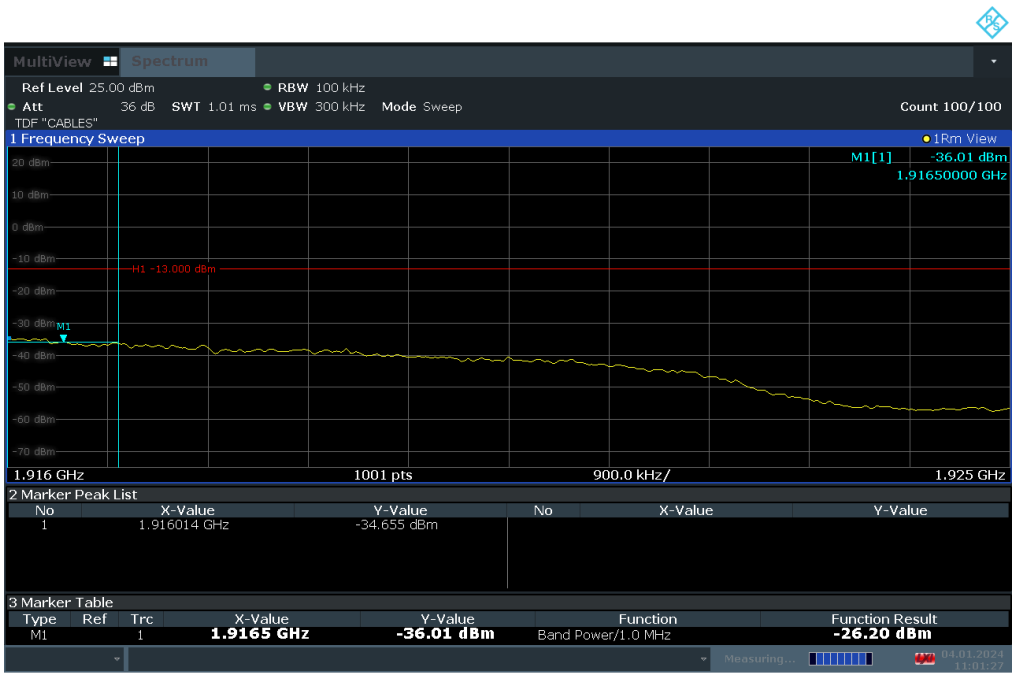


11:00:19 04.01.2024

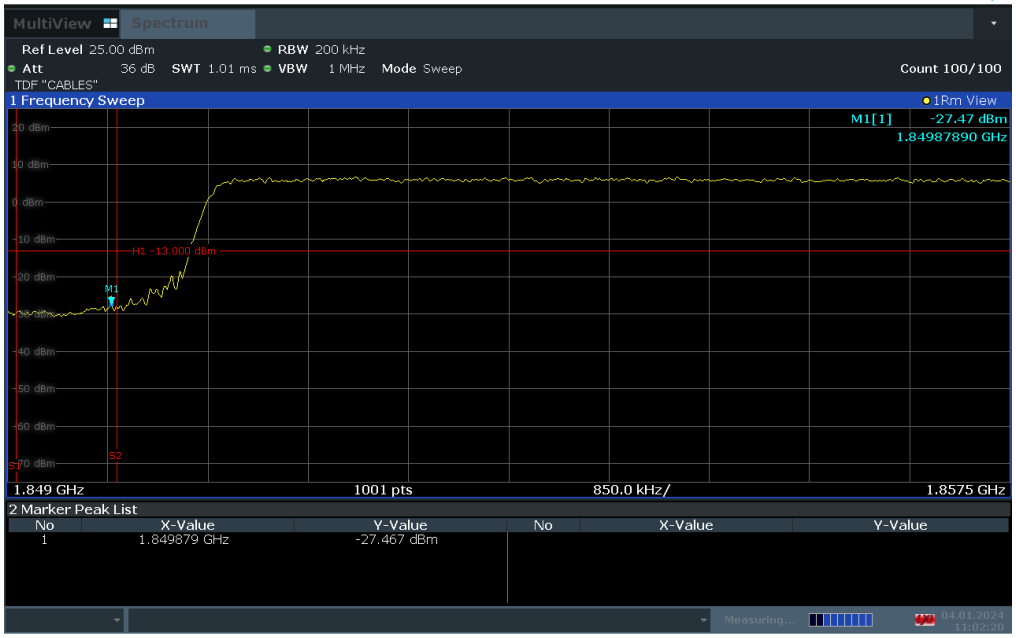
Plot 7-106. Extended Lower Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)



Plot 7-107. Upper Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)

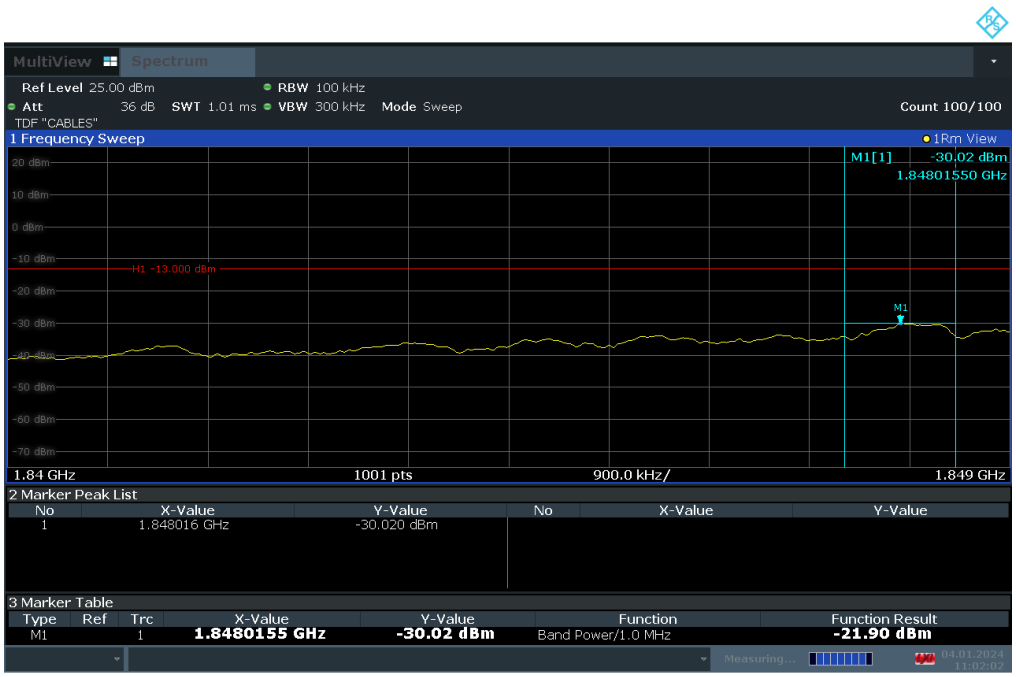


Plot 7-108. Extended Upper Band Edge Plot (LTE Band 25 – 10MHz QPSK – Full RB Configuration)



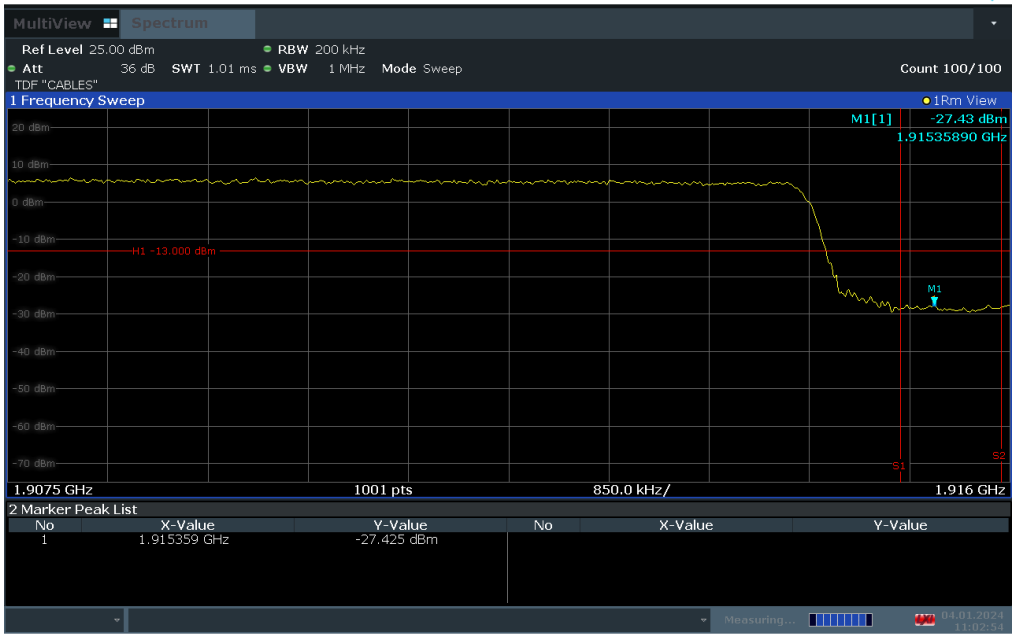
11:02:21 04.01.2024

Plot 7-109. Lower Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)

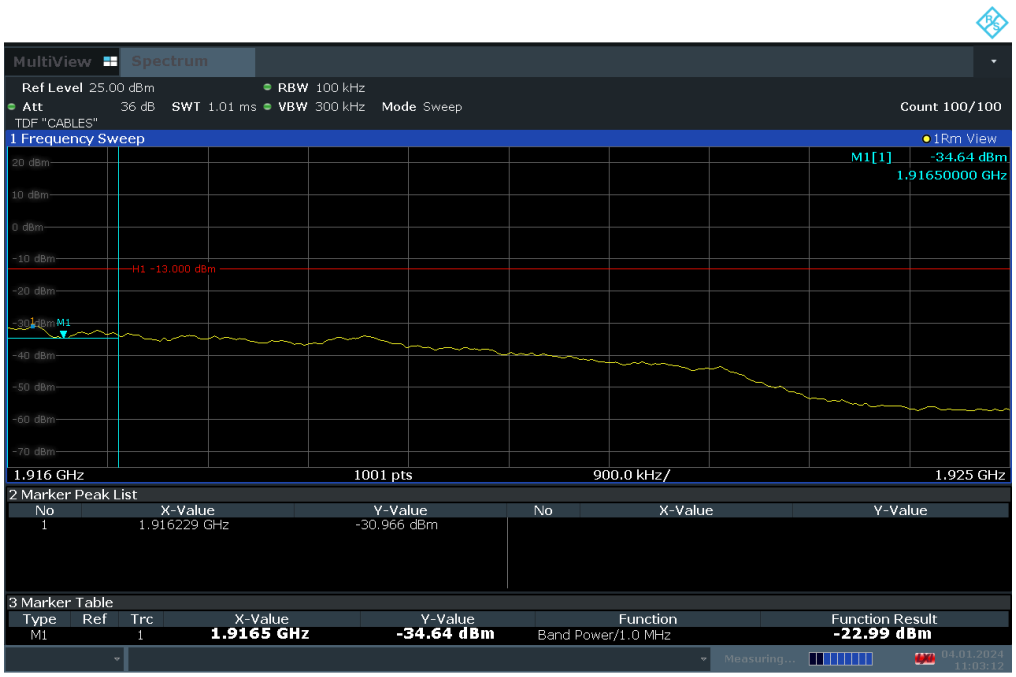


11:02:03 04.01.2024

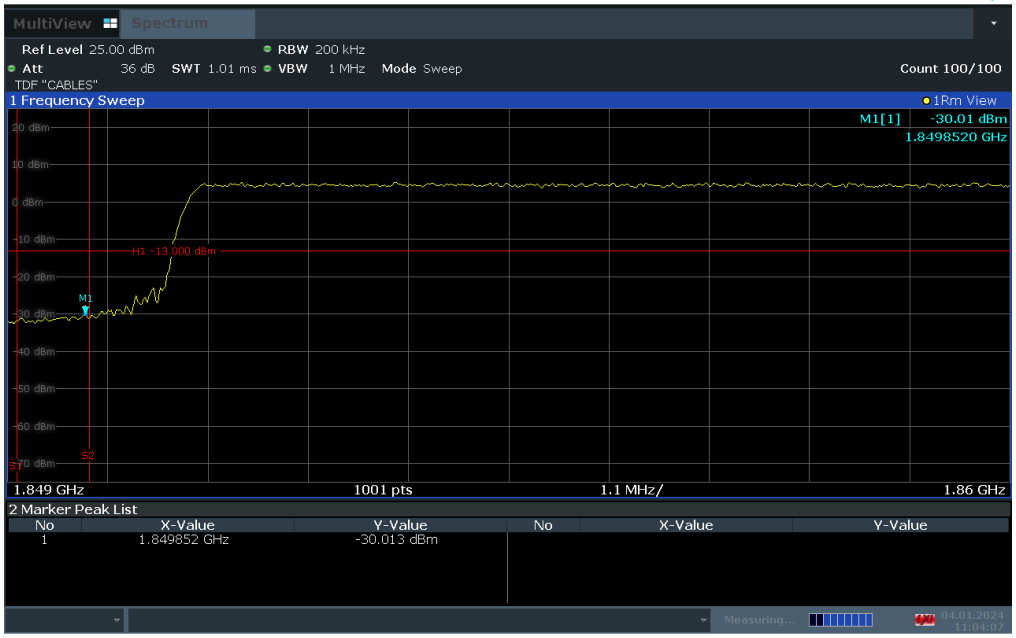
Plot 7-110. Extended Lower Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)



Plot 7-111. Upper Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)

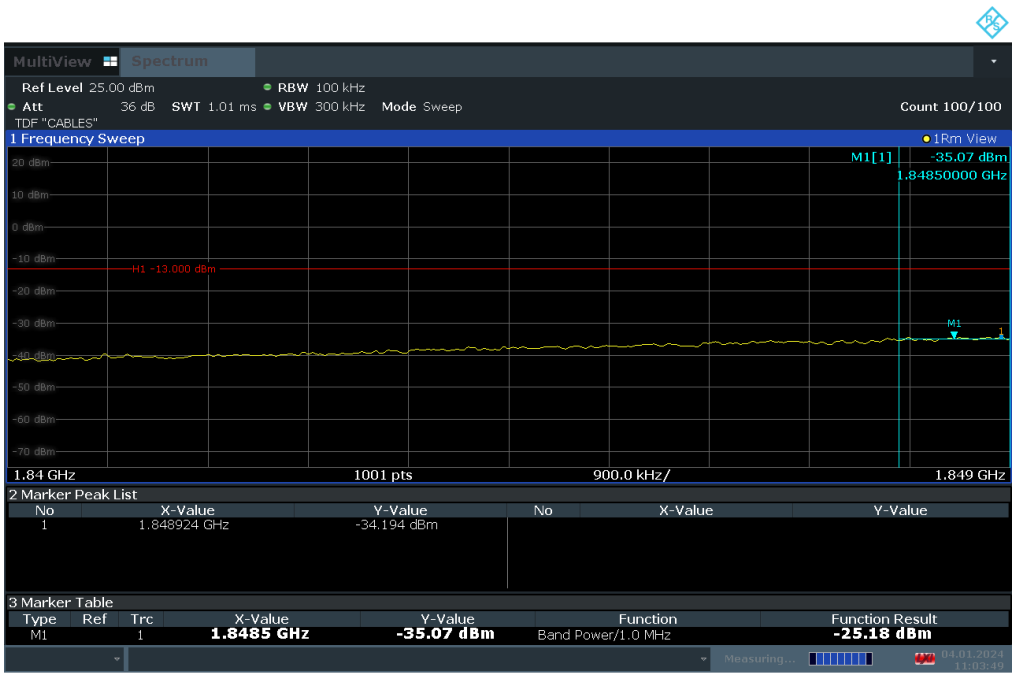


Plot 7-112. Extended Upper Band Edge Plot (LTE Band 25 – 15MHz QPSK – Full RB Configuration)



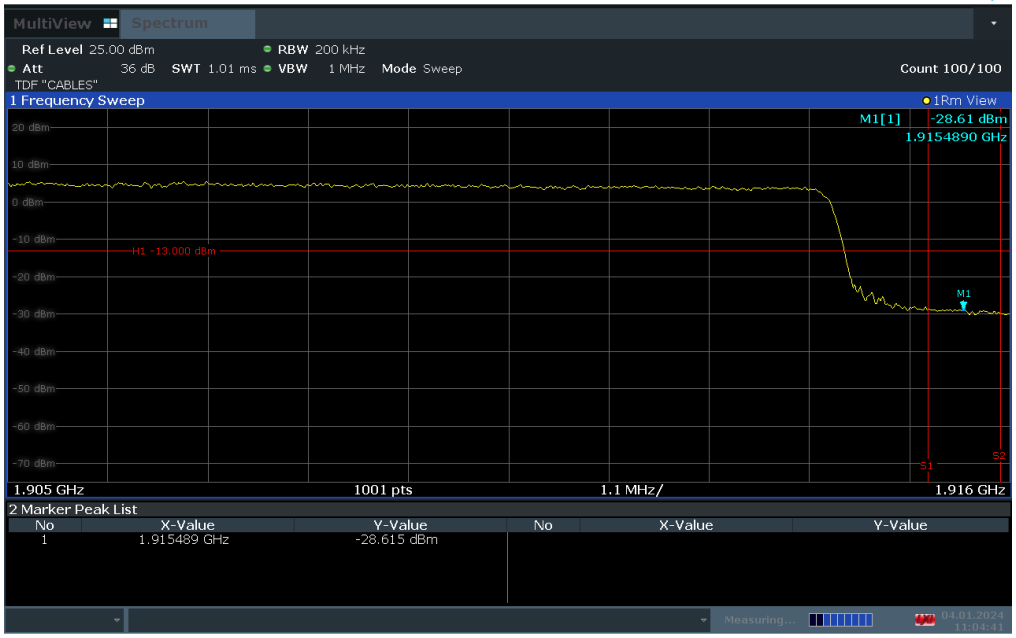
11:04:08 04.01.2024

Plot 7-113. Lower Band Edge Plot (LTE Band 25 – 20MHz QPSK – Full RB Configuration)



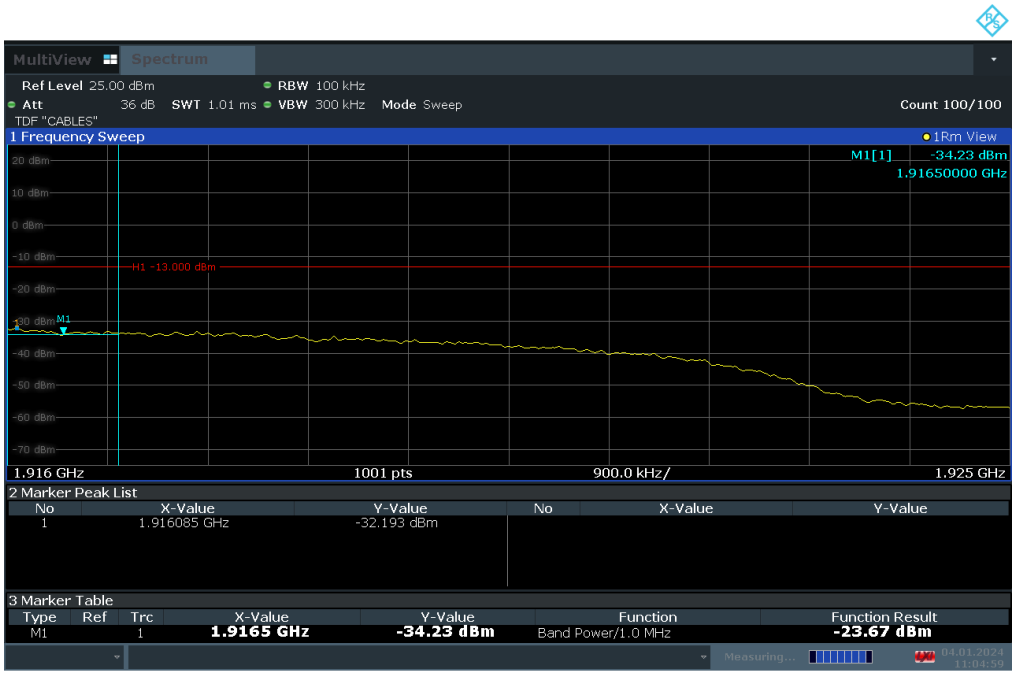
11:03:49 04.01.2024

Plot 7-114. Extended Lower Band Edge Plot (LTE Band 25 – 20MHz QPSK – Full RB Configuration)



11:04:42 04.01.2024

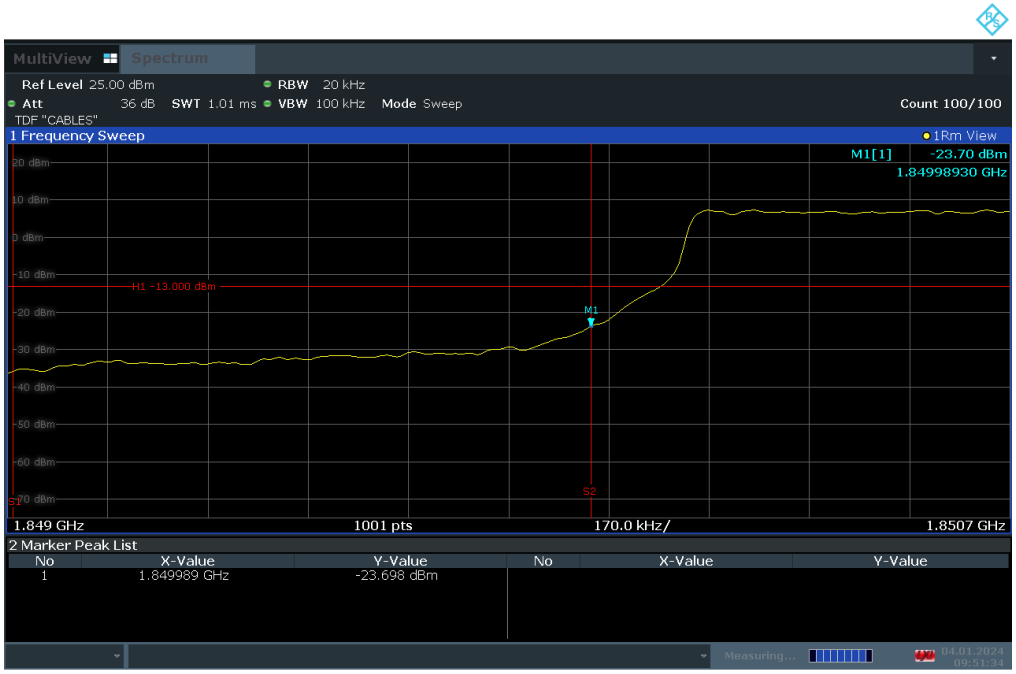
Plot 7-115. Upper Band Edge Plot (LTE Band 25 – 20MHz QPSK – Full RB Configuration)



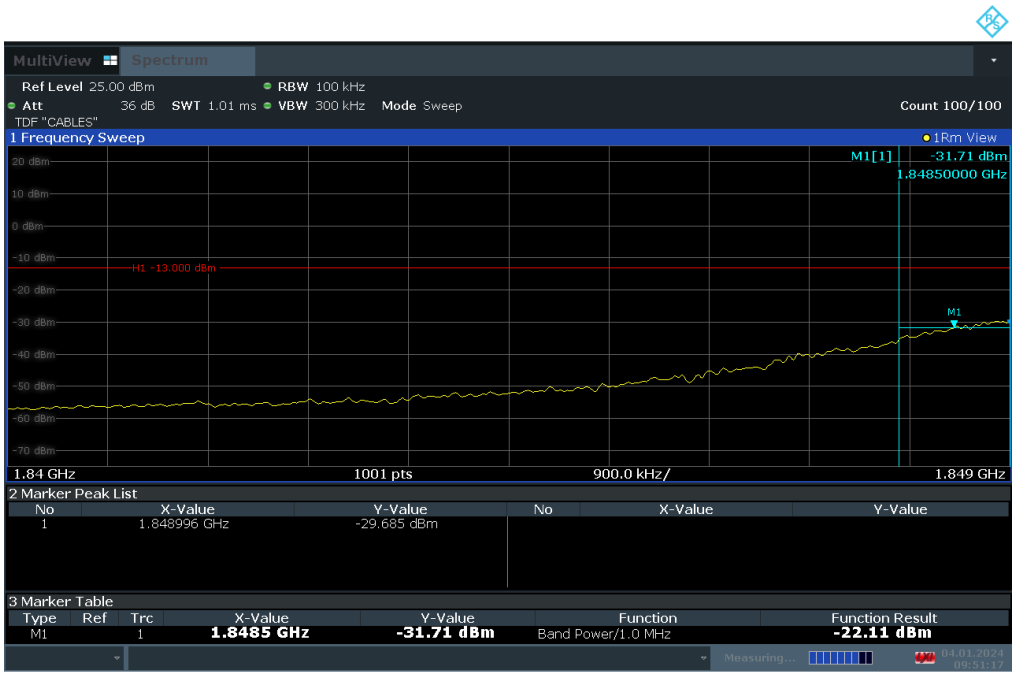
11:05:00 04.01.2024

Plot 7-116. Extended Upper Band Edge Plot (LTE Band 25 – 20MHz QPSK – Full RB Configuration)

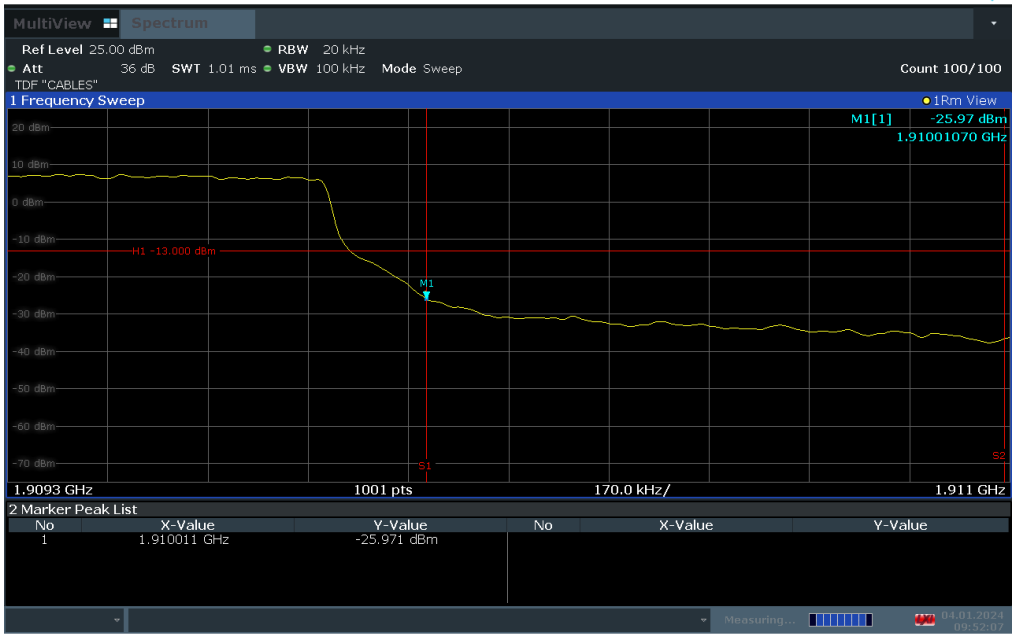
LTE Band 2



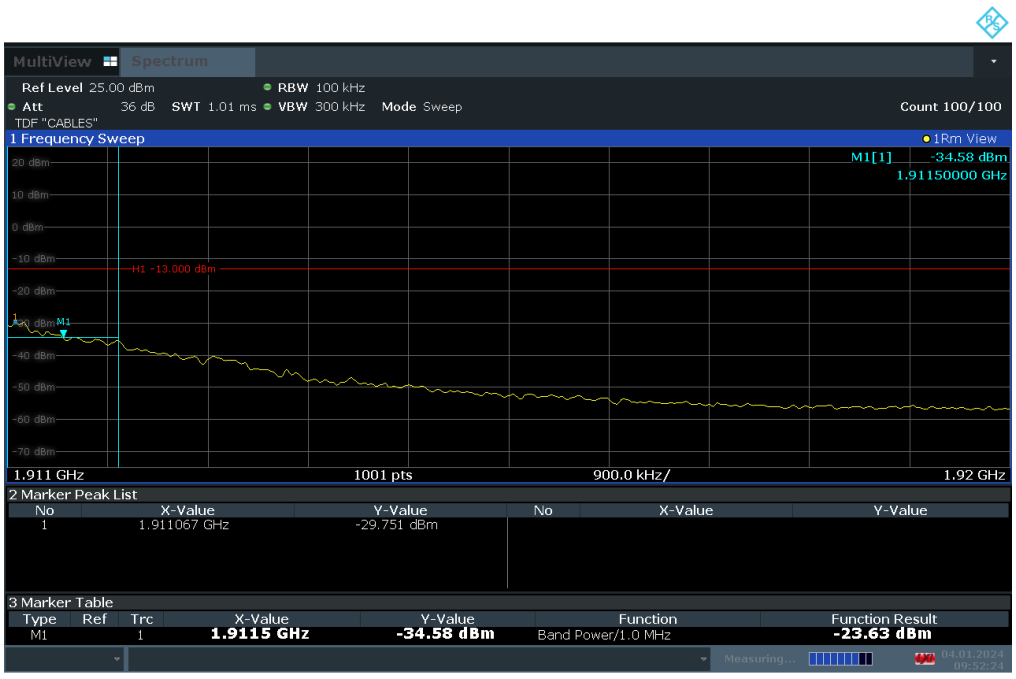
Plot 7-117. Lower Band Edge Plot (LTE Band 2 – 1.4MHz QPSK – Full RB Configuration)



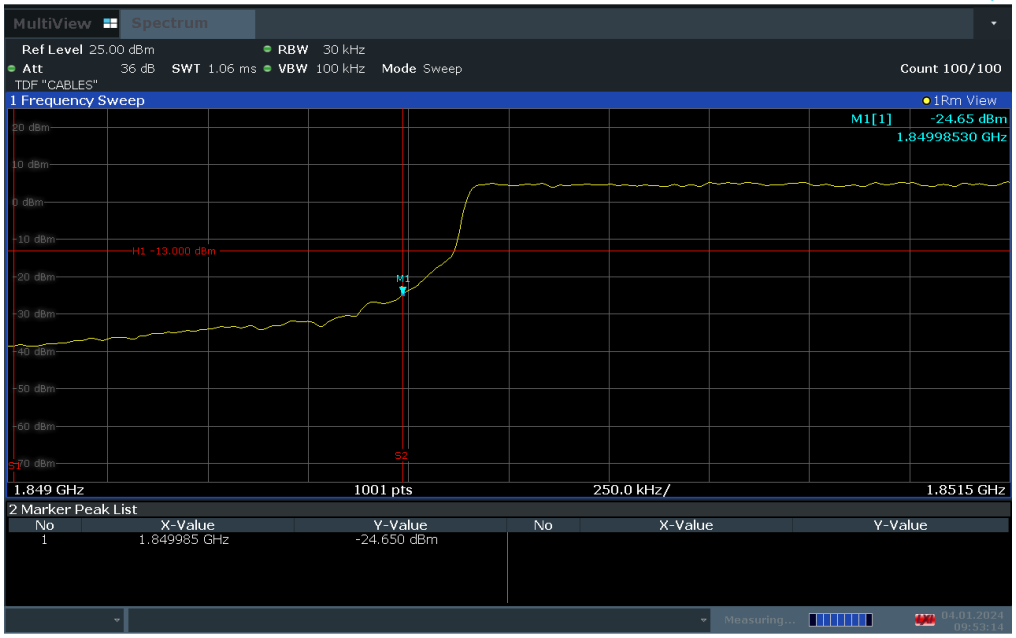
Plot 7-118. Extended Lower Band Edge Plot (LTE Band 2 – 1.4MHz QPSK – Full RB Configuration)



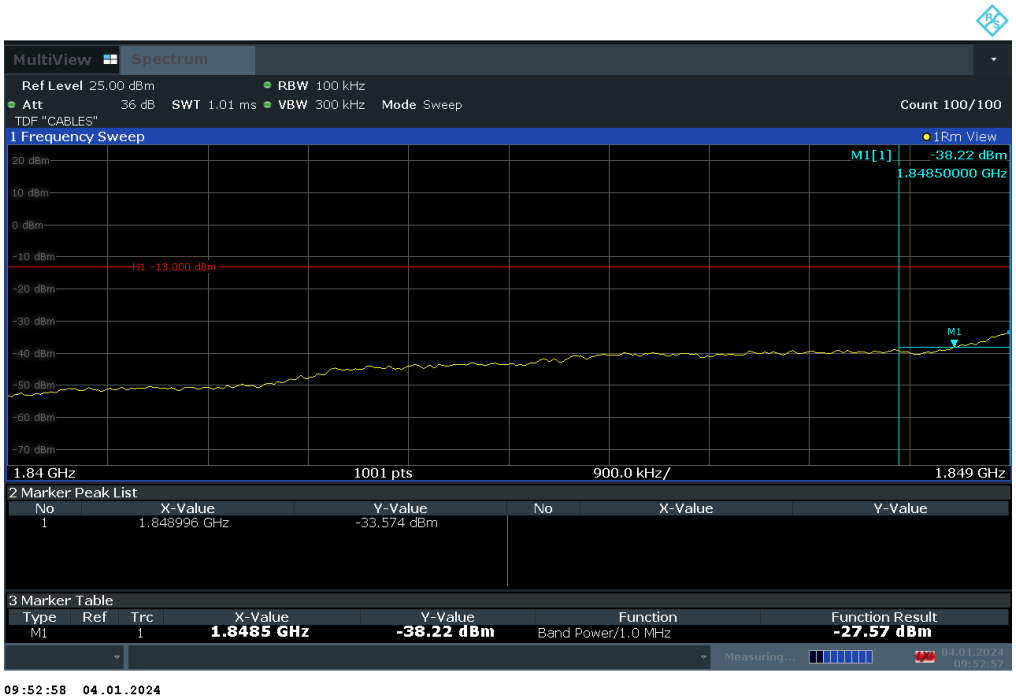
Plot 7-119. Upper Band Edge Plot (LTE Band 2 – 1.4MHz QPSK – Full RB Configuration)



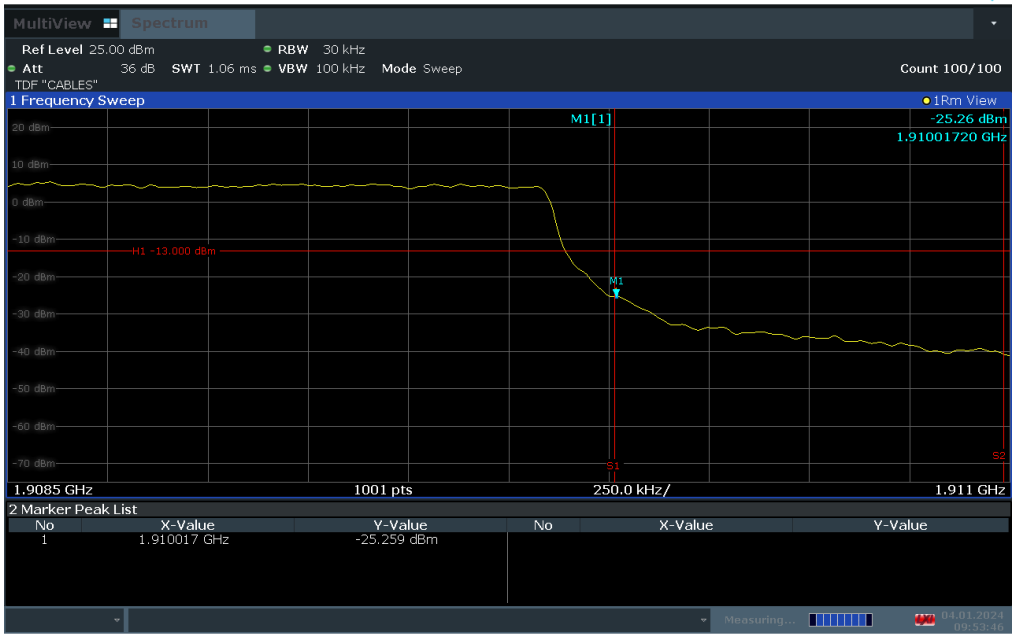
Plot 7-120. Extended Upper Band Edge Plot (LTE Band 2 – 1.4MHz QPSK – Full RB Configuration)



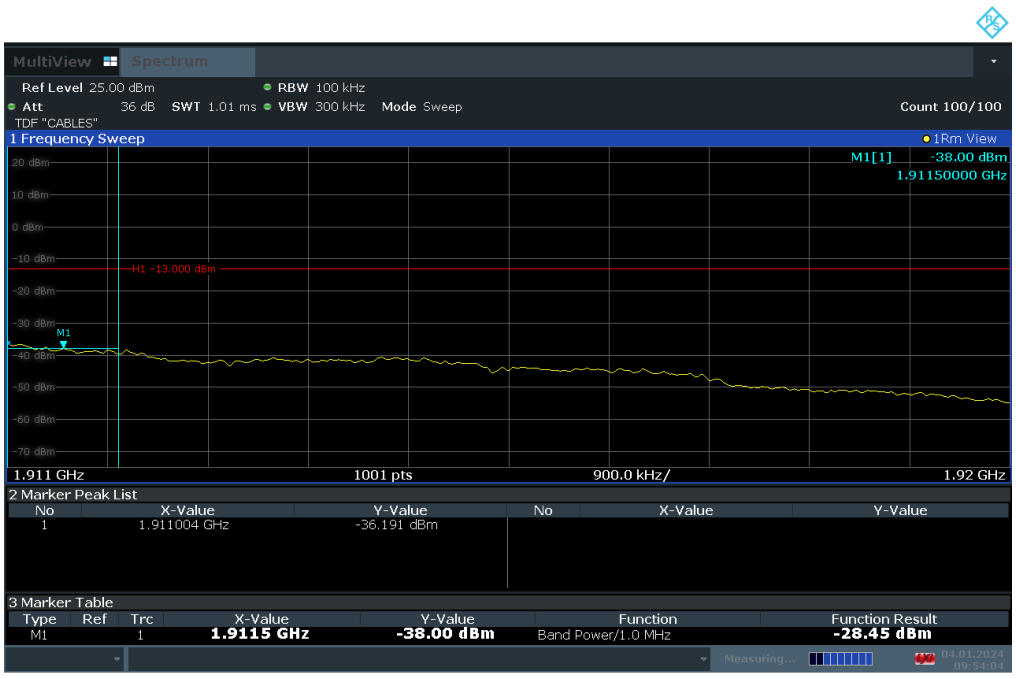
Plot 7-121. Lower Band Edge Plot (LTE Band 2 – 3MHz QPSK – Full RB Configuration)



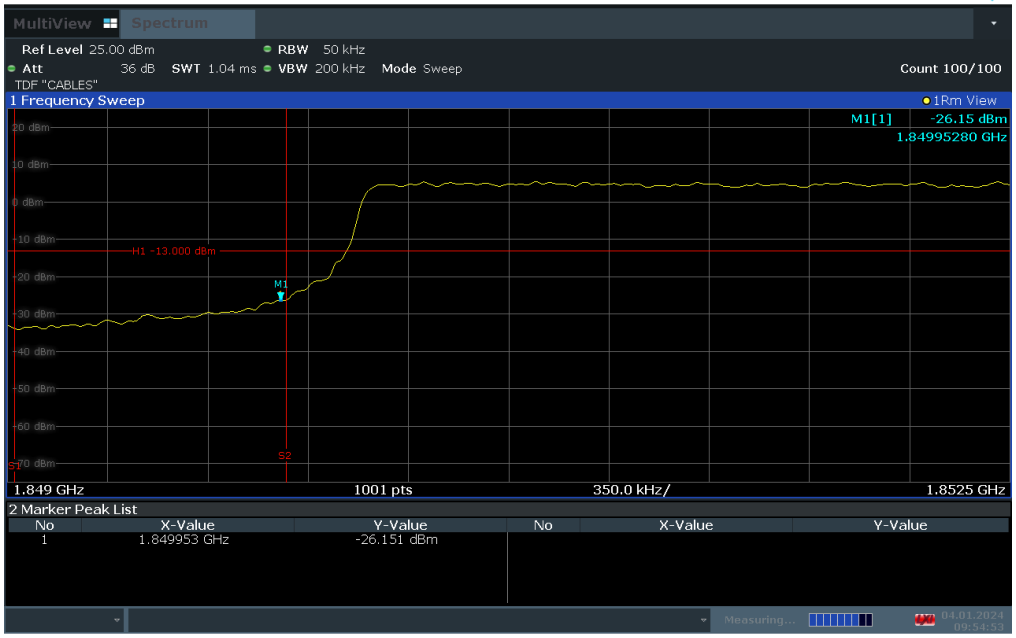
Plot 7-122. Extended Lower Band Edge Plot (LTE Band 2 – 3MHz QPSK – Full RB Configuration)



Plot 7-123. Upper Band Edge Plot (LTE Band 2 – 3MHz QPSK – Full RB Configuration)

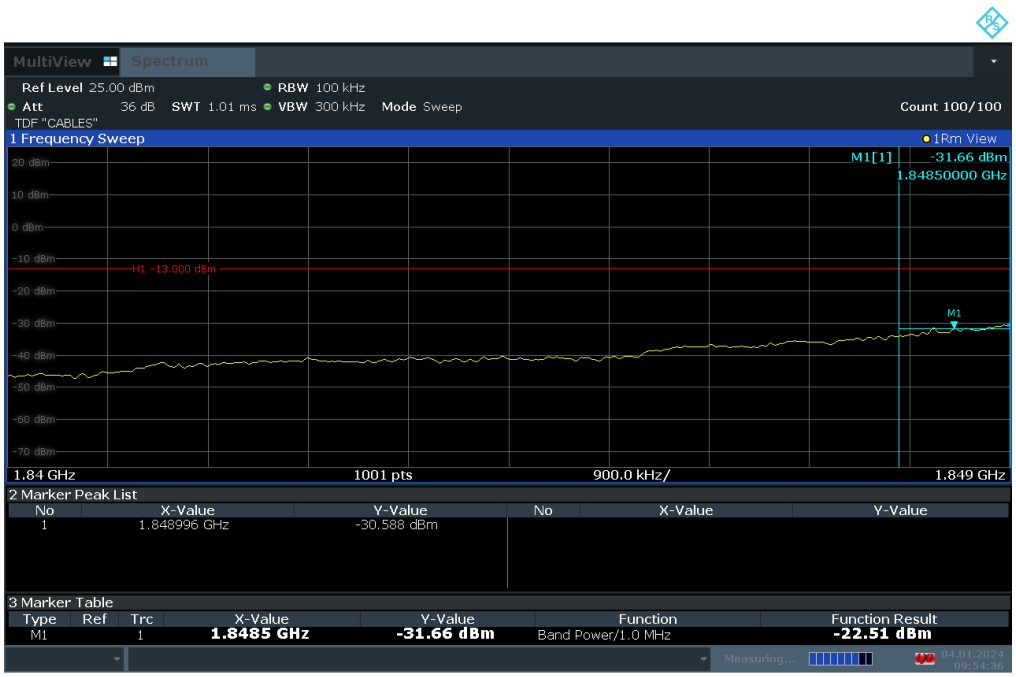


Plot 7-124. Extended Upper Band Edge Plot (LTE Band 2 – 3MHz QPSK – Full RB Configuration)



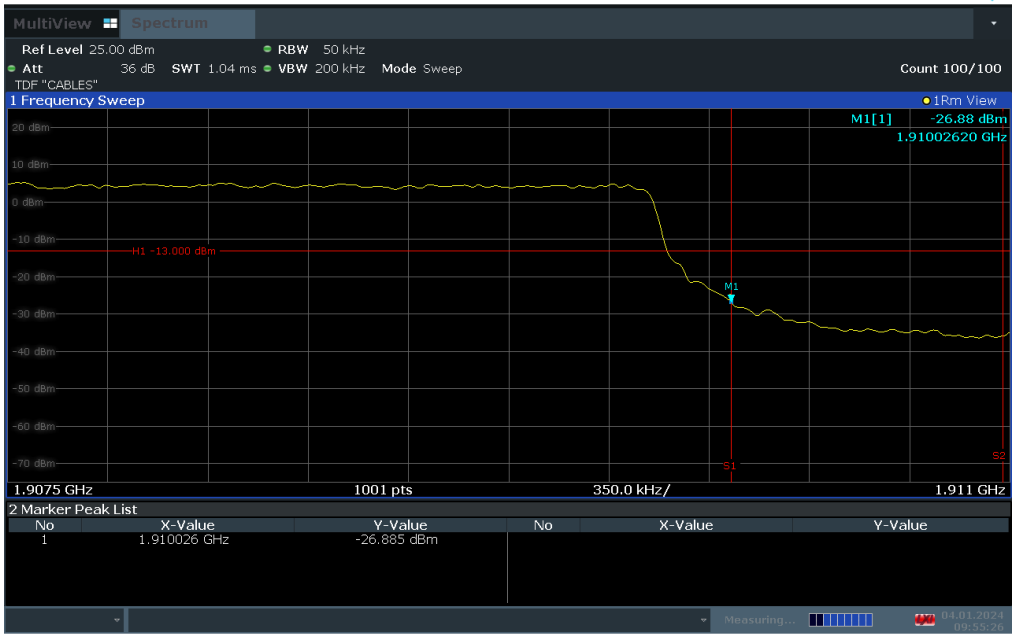
09:54:54 04.01.2024

Plot 7-125. Lower Band Edge Plot (LTE Band 2 – 5MHz QPSK – Full RB Configuration)

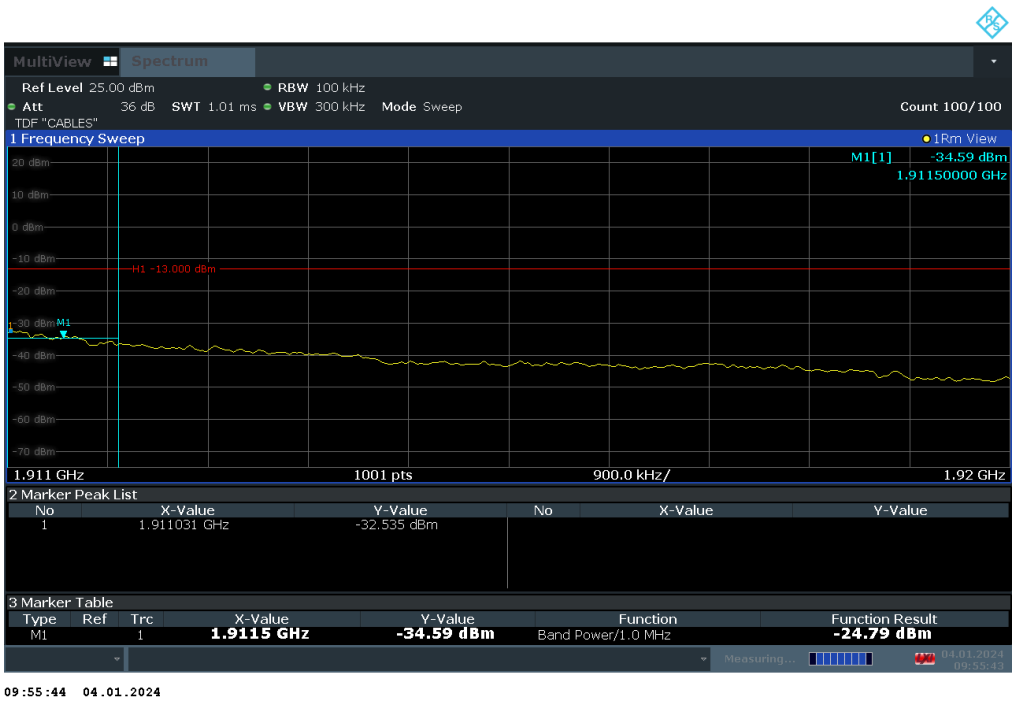


09:54:37 04.01.2024

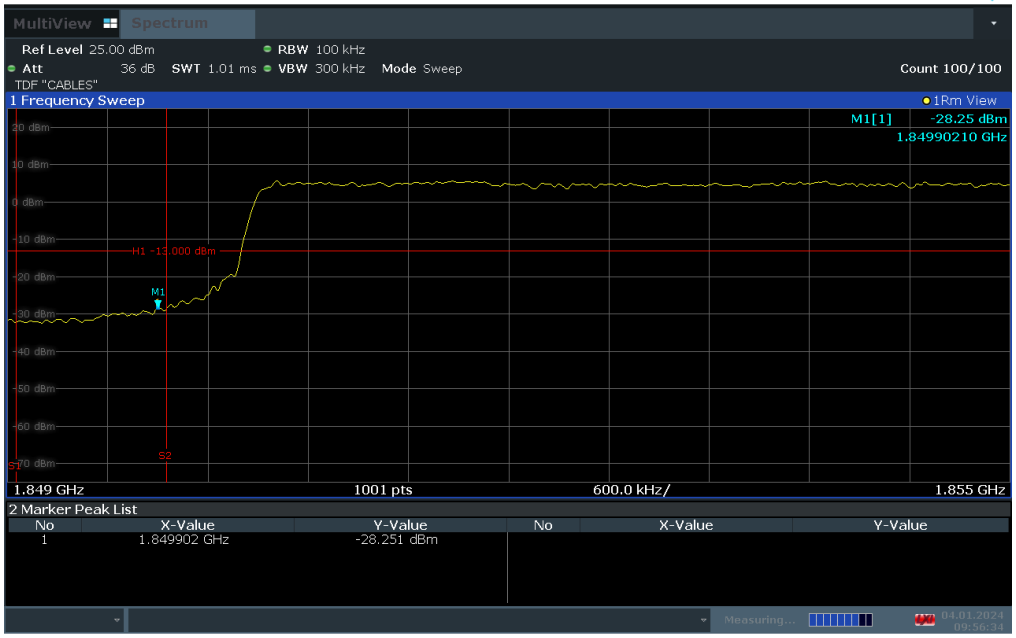
Plot 7-126. Extended Lower Band Edge Plot (LTE Band 2 – 5MHz QPSK – Full RB Configuration)



Plot 7-127. Upper Band Edge Plot (LTE Band 2 – 5MHz QPSK – Full RB Configuration)

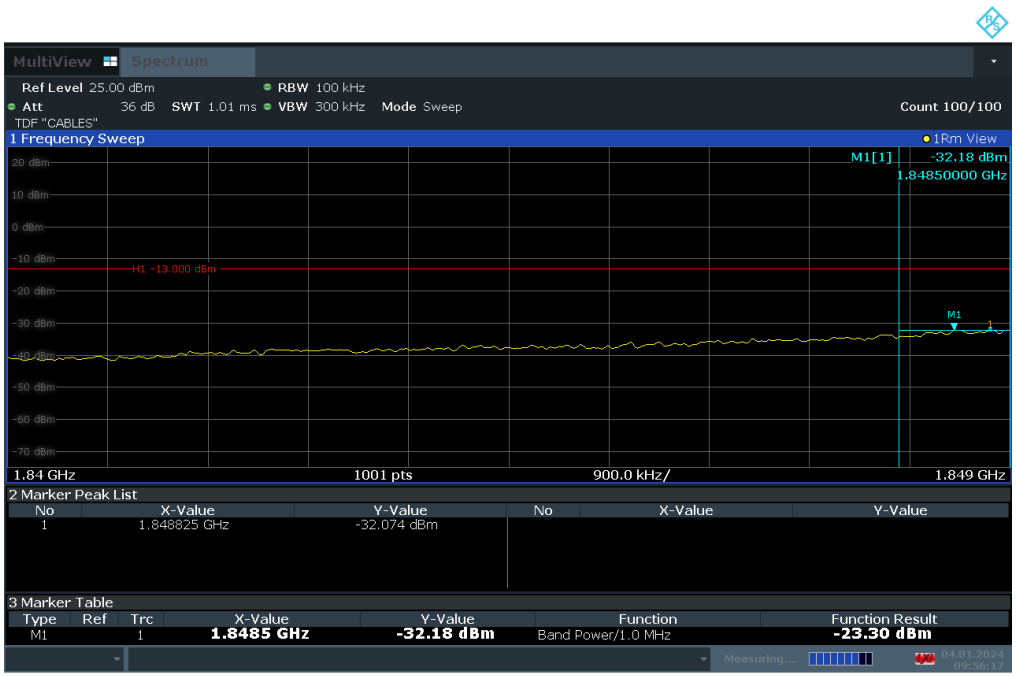


Plot 7-128. Extended Upper Band Edge Plot (LTE Band 2 – 5MHz QPSK – Full RB Configuration)



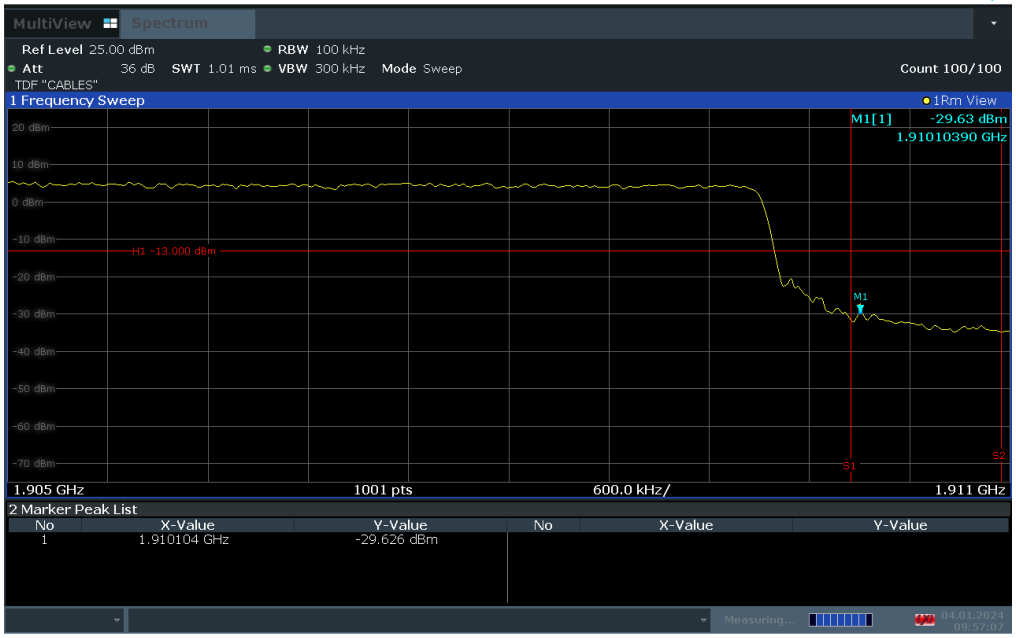
09:56:35 04.01.2024

Plot 7-129. Lower Band Edge Plot (LTE Band 2 – 10MHz QPSK – Full RB Configuration)

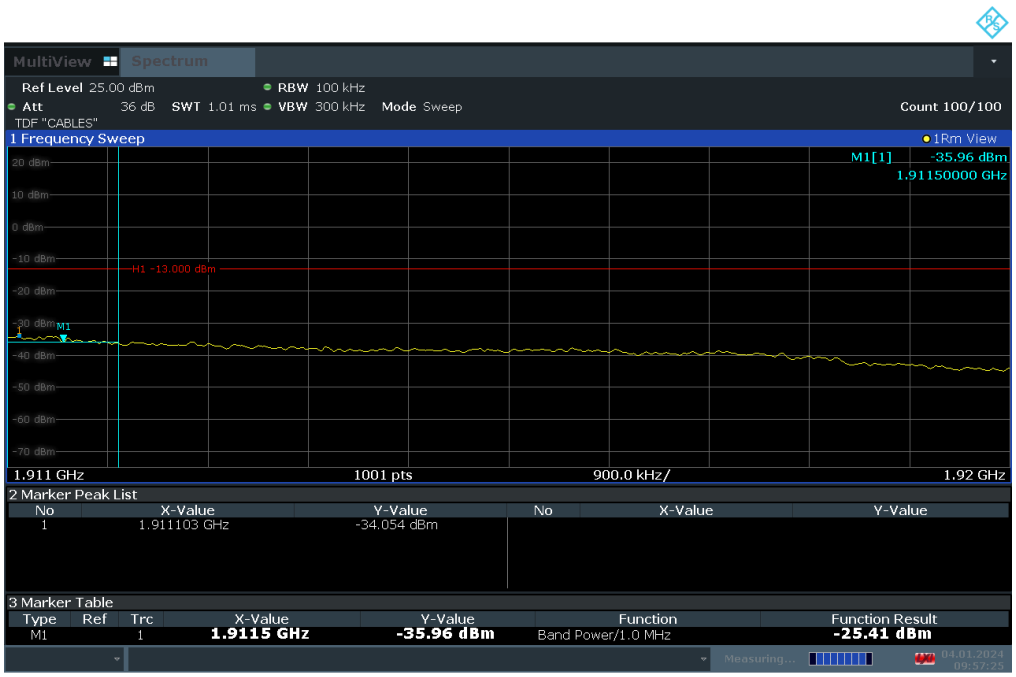


09:56:18 04.01.2024

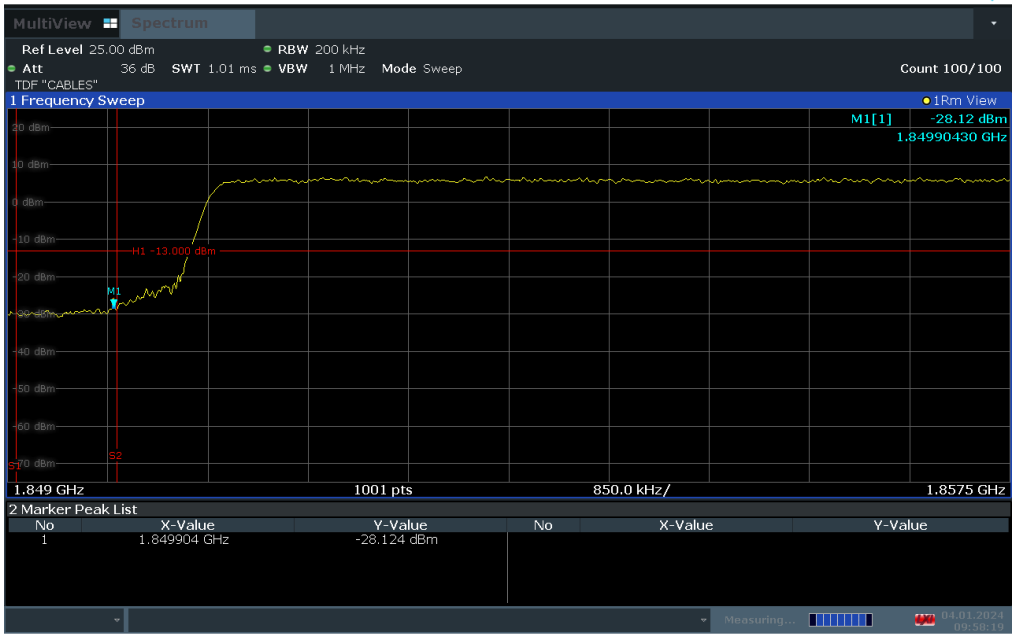
Plot 7-130. Extended Lower Band Edge Plot (LTE Band 2 – 10MHz QPSK – Full RB Configuration)



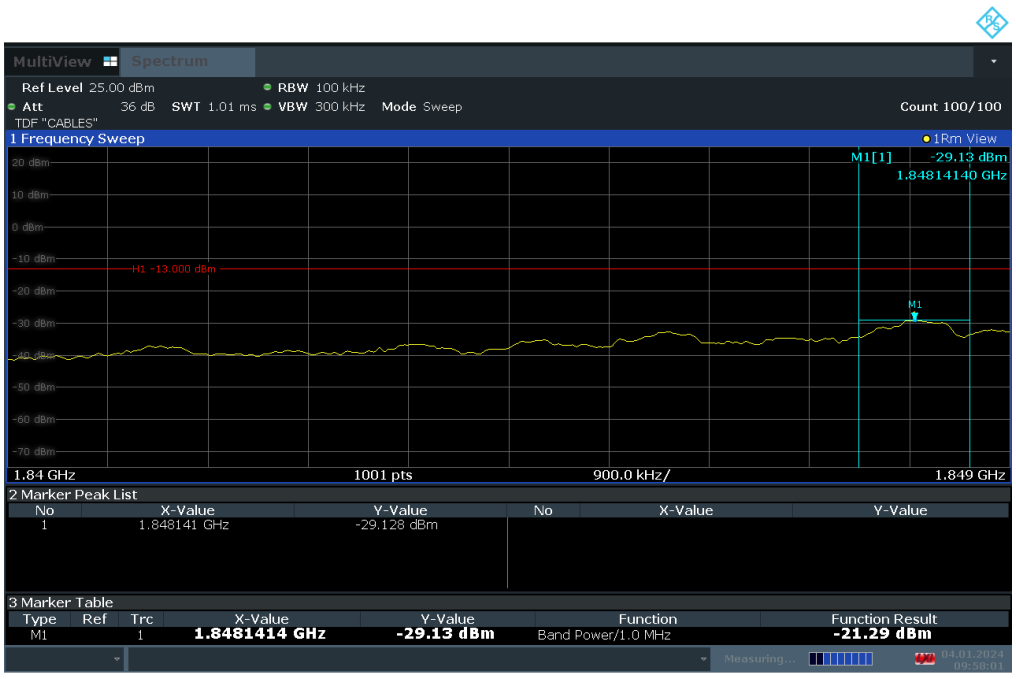
Plot 7-131. Upper Band Edge Plot (LTE Band 2 – 10MHz QPSK – Full RB Configuration)



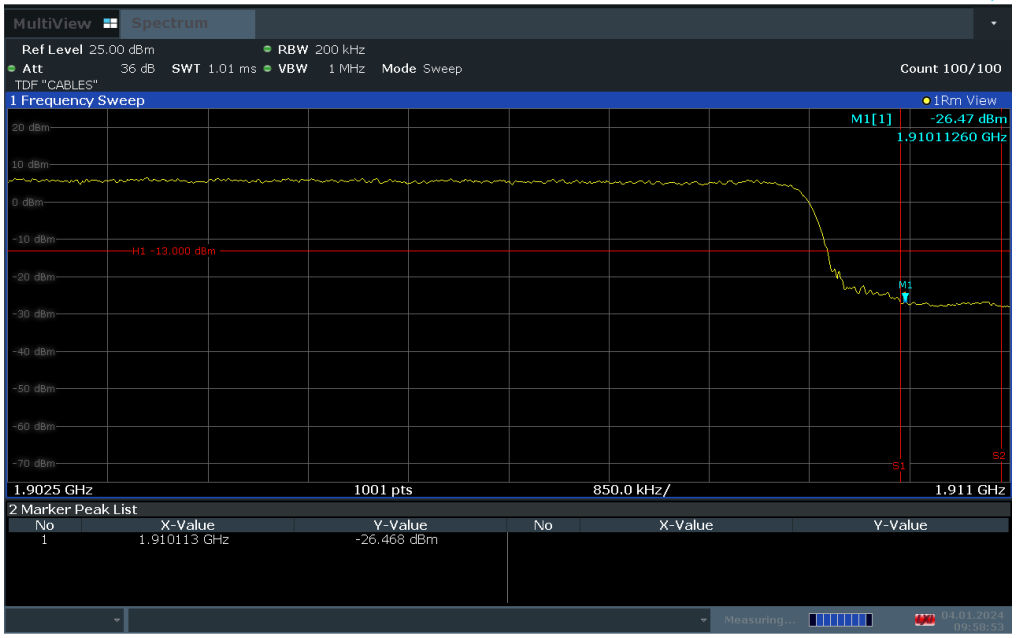
Plot 7-132. Extended Upper Band Edge Plot (LTE Band 2 – 10MHz QPSK – Full RB Configuration)



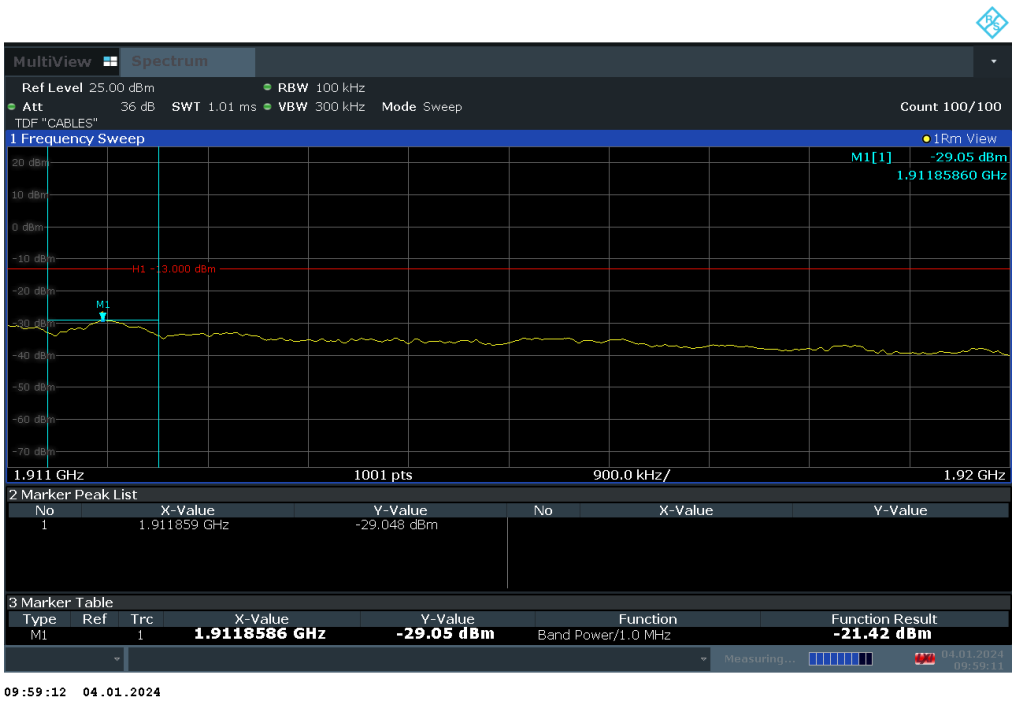
Plot 7-133. Lower Band Edge Plot (LTE Band 2 – 15MHz QPSK – Full RB Configuration)



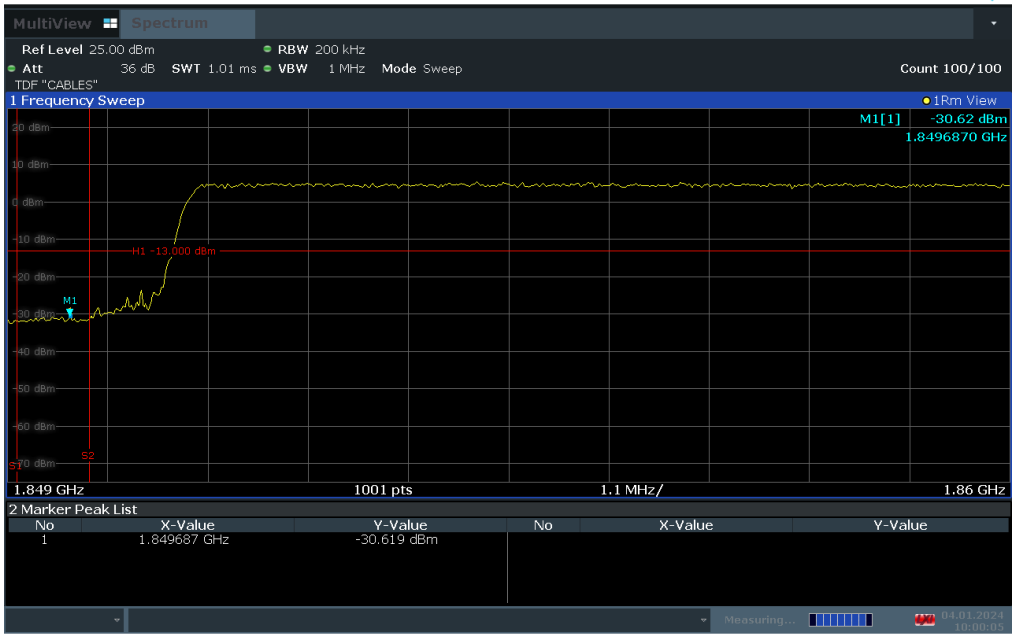
Plot 7-134. Extended Lower Band Edge Plot (LTE Band 2 – 15MHz QPSK – Full RB Configuration)



Plot 7-135. Upper Band Edge Plot (LTE Band 2 – 15MHz QPSK – Full RB Configuration)

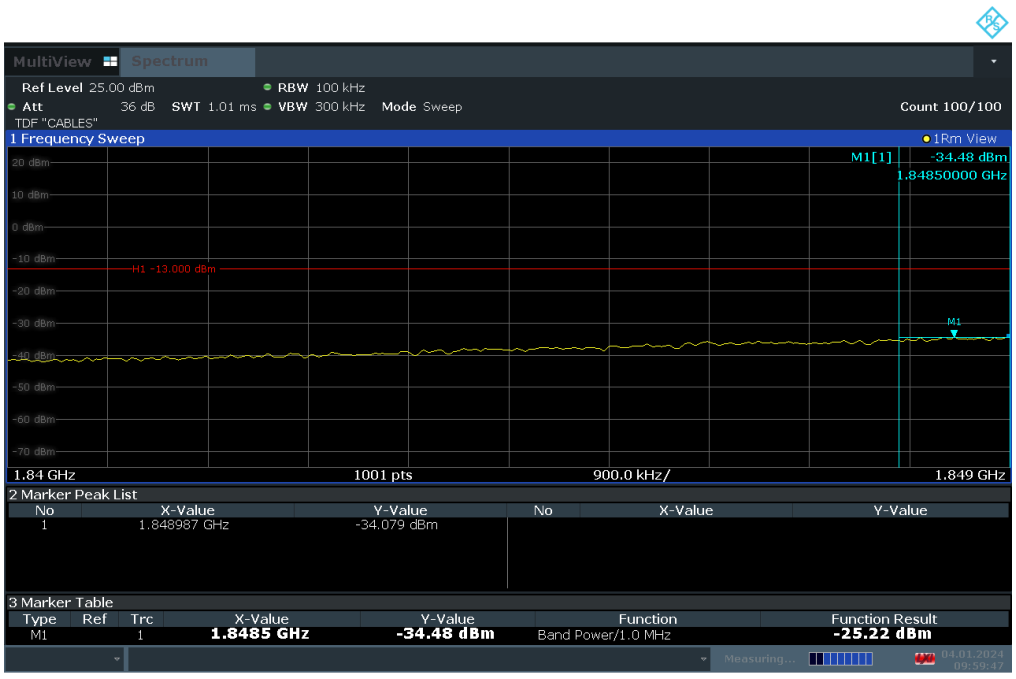


Plot 7-136. Extended Upper Band Edge Plot (LTE Band 2 – 15MHz QPSK – Full RB Configuration)



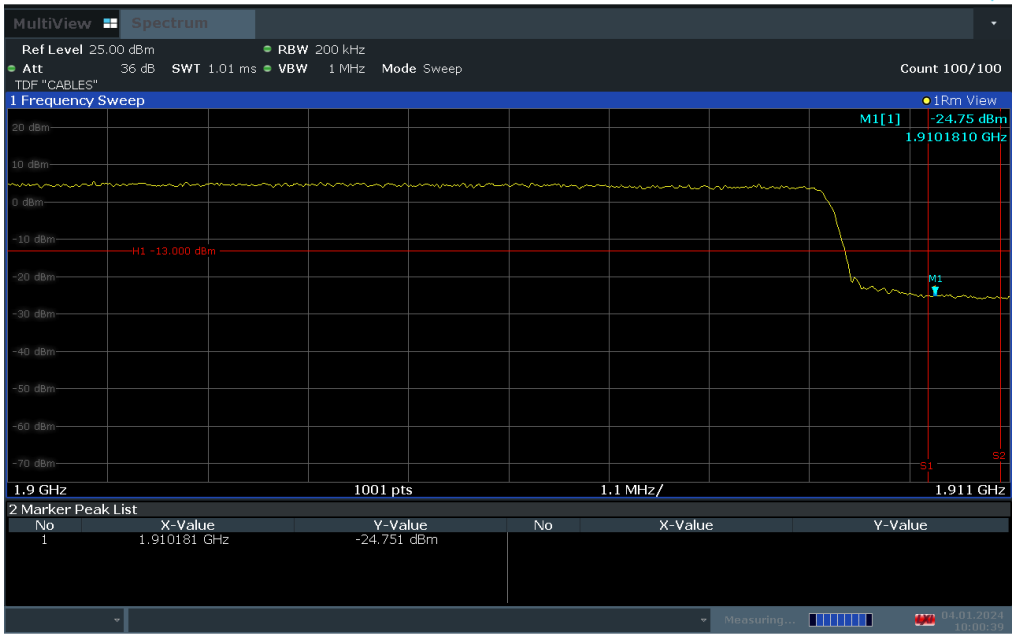
10:00:06 04.01.2024

Plot 7-137. Lower Band Edge Plot (LTE Band 2 – 20MHz QPSK – Full RB Configuration)



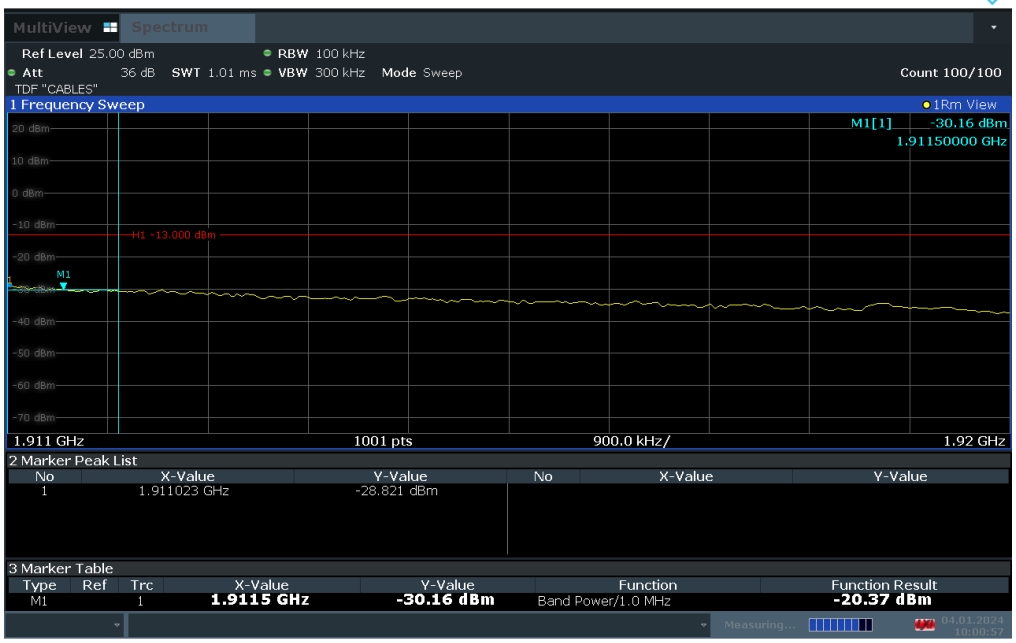
09:59:48 04.01.2024

Plot 7-138. Extended Lower Band Edge Plot (LTE Band 2 – 20MHz QPSK – Full RB Configuration)



10:00:40 04.01.2024

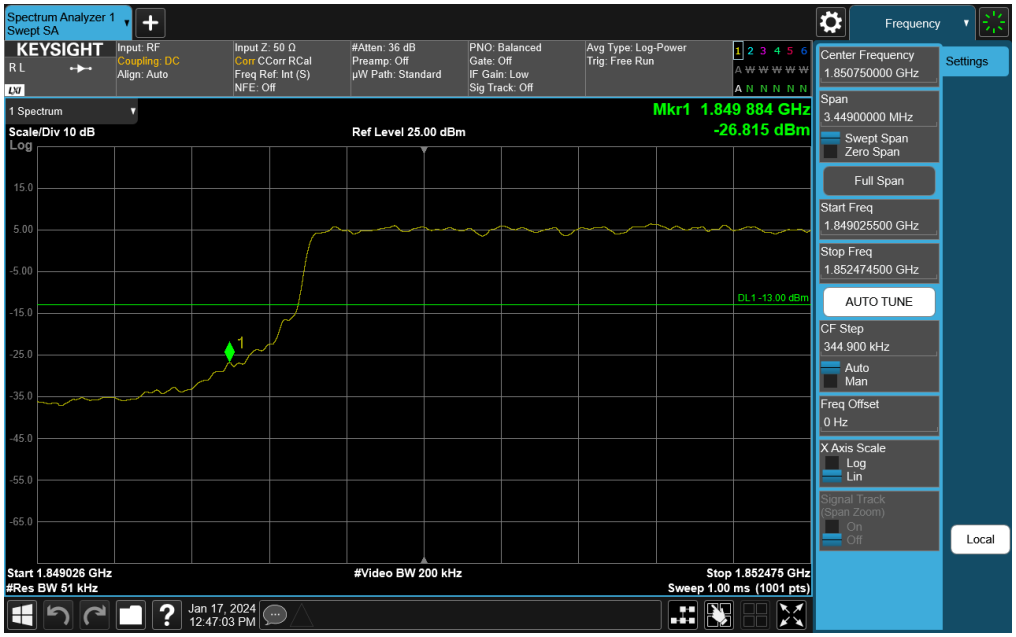
Plot 7-139. Upper Band Edge Plot (LTE Band 2 – 20MHz QPSK – Full RB Configuration)



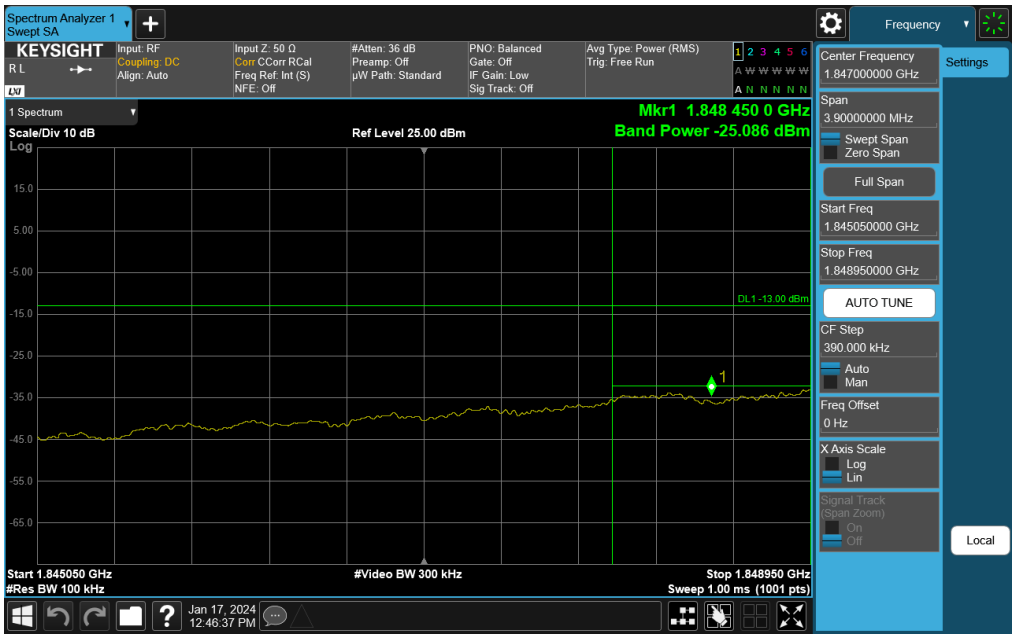
10:00:58 04.01.2024

Plot 7-140. Extended Upper Band Edge Plot (LTE Band 2 – 20MHz QPSK – Full RB Configuration)

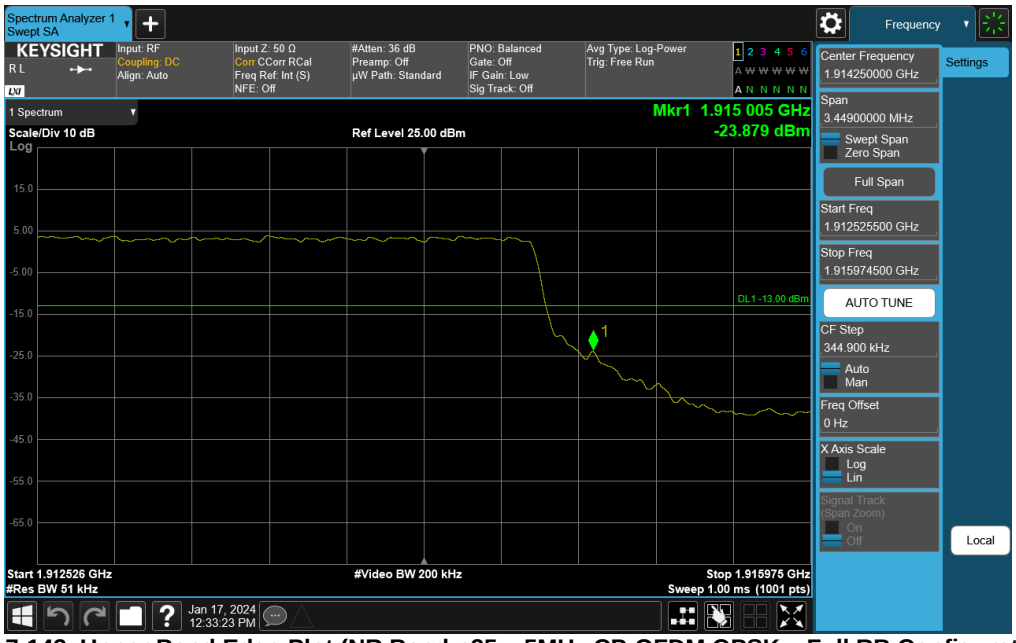
NR Band n25



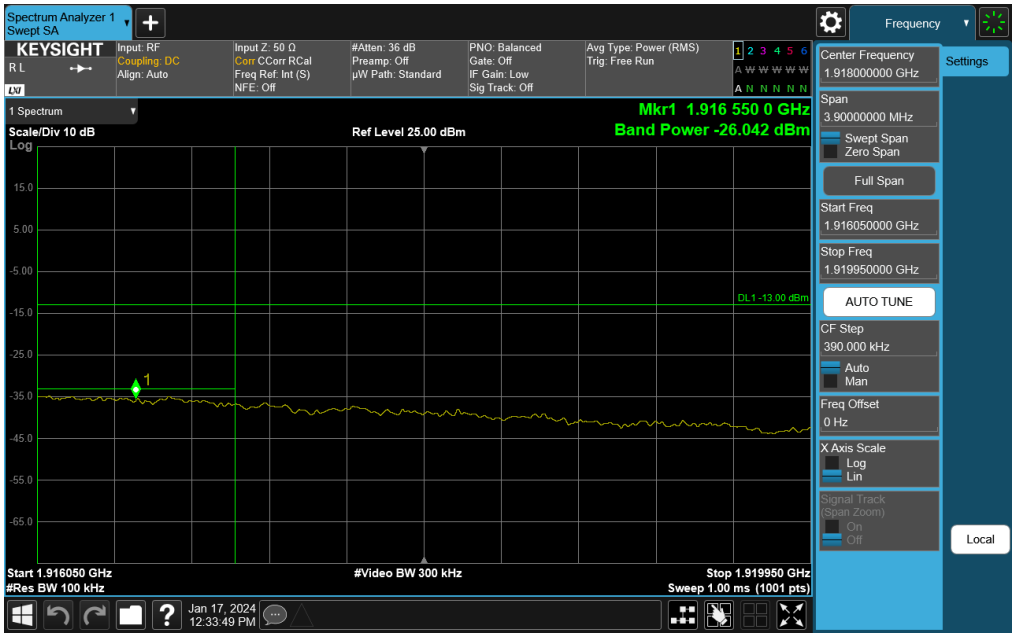
Plot 7-141. Lower Band Edge Plot (NR Band n25 – 5MHz DFT-s-OFDM QPSK – Full RB Configuration)



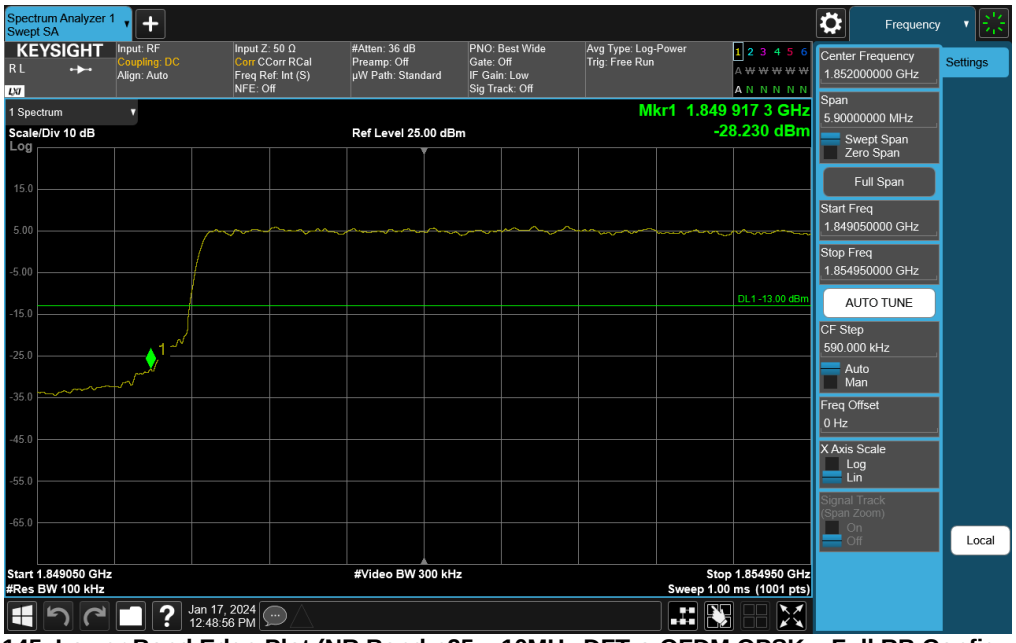
Plot 7-142. Extended Lower Band Edge Plot (NR Band n25 – 5MHz DFT-s-OFDM QPSK – Full RB Configuration)



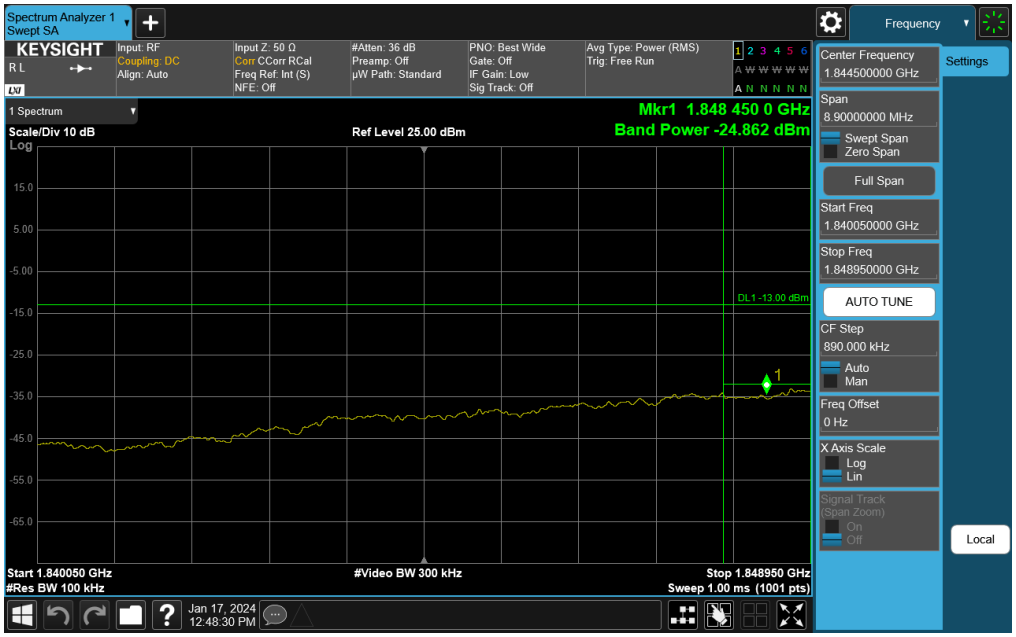
Plot 7-143. Upper Band Edge Plot (NR Band n25 – 5MHz CP-OFDM QPSK – Full RB Configuration)



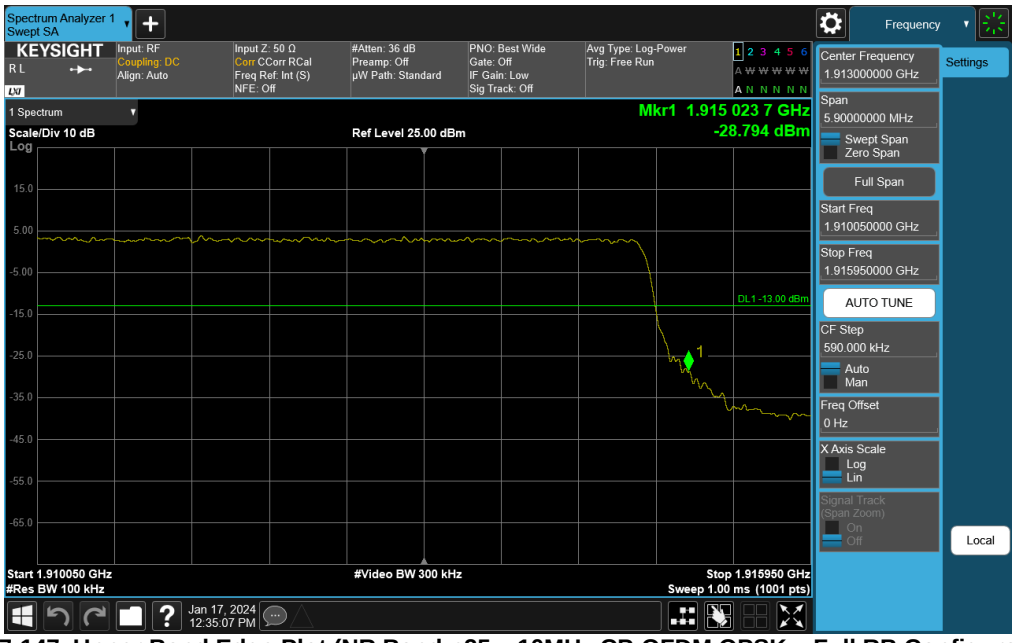
Plot 7-144. Extended Upper Band Edge Plot (NR Band n25 – 5MHz CP-OFDM QPSK – Full RB Configuration)



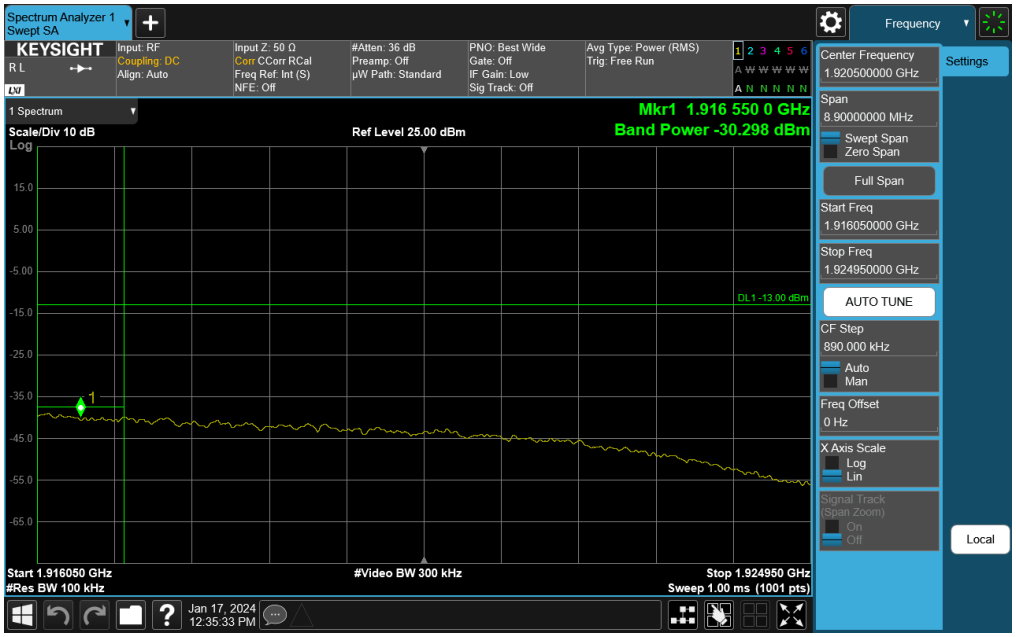
Plot 7-145. Lower Band Edge Plot (NR Band n25 – 10MHz DFT-s-OFDM QPSK – Full RB Configuration)



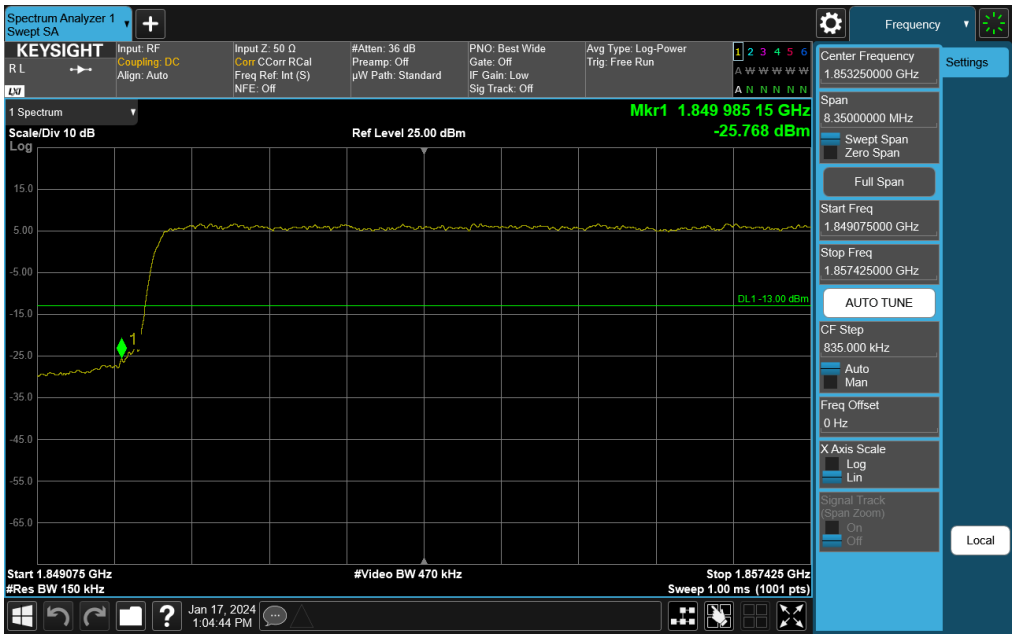
Plot 7-146. Extended Lower Band Edge Plot (NR Band n25 – 10MHz DFT-s-OFDM QPSK – Full RB Configuration)



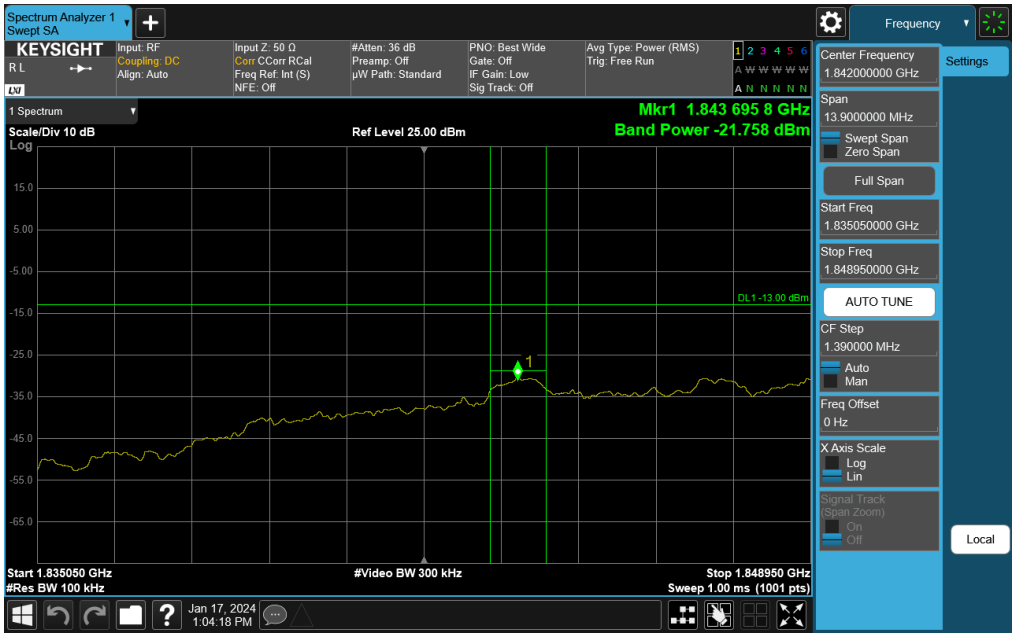
Plot 7-147. Upper Band Edge Plot (NR Band n25 – 10MHz CP-OFDM QPSK – Full RB Configuration)



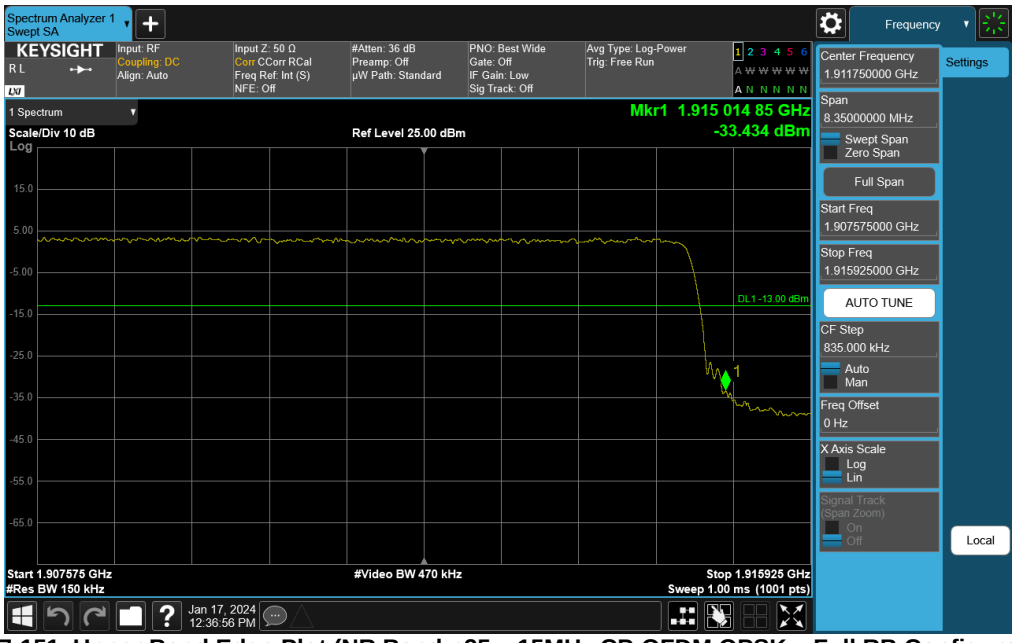
Plot 7-148. Extended Upper Band Edge Plot (NR Band n25 – 10MHz CP-OFDM QPSK – Full RB Configuration)



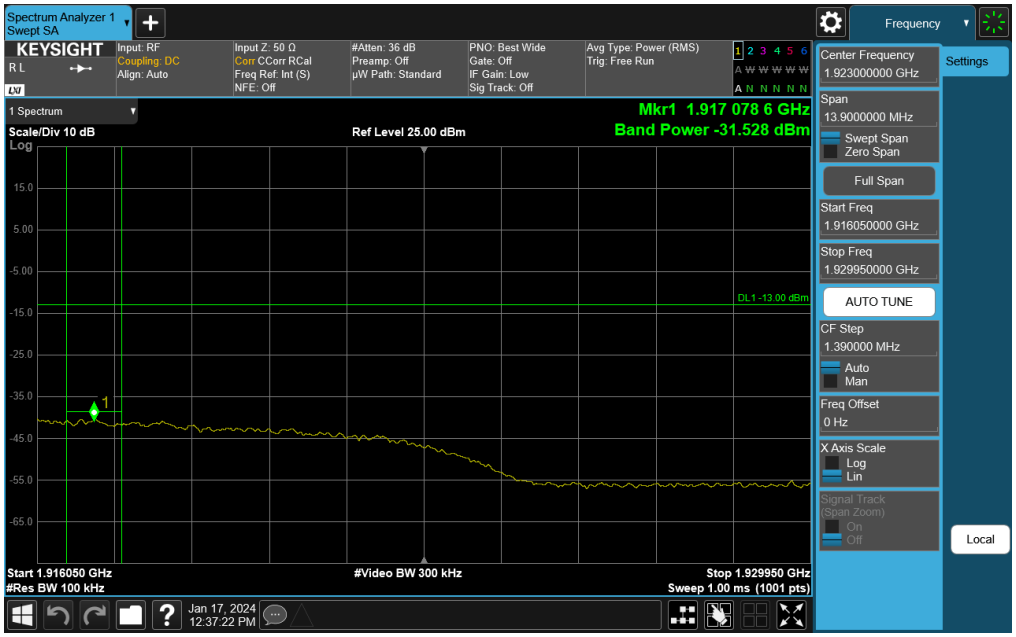
Plot 7-149. Lower Band Edge Plot (NR Band n25 – 15MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



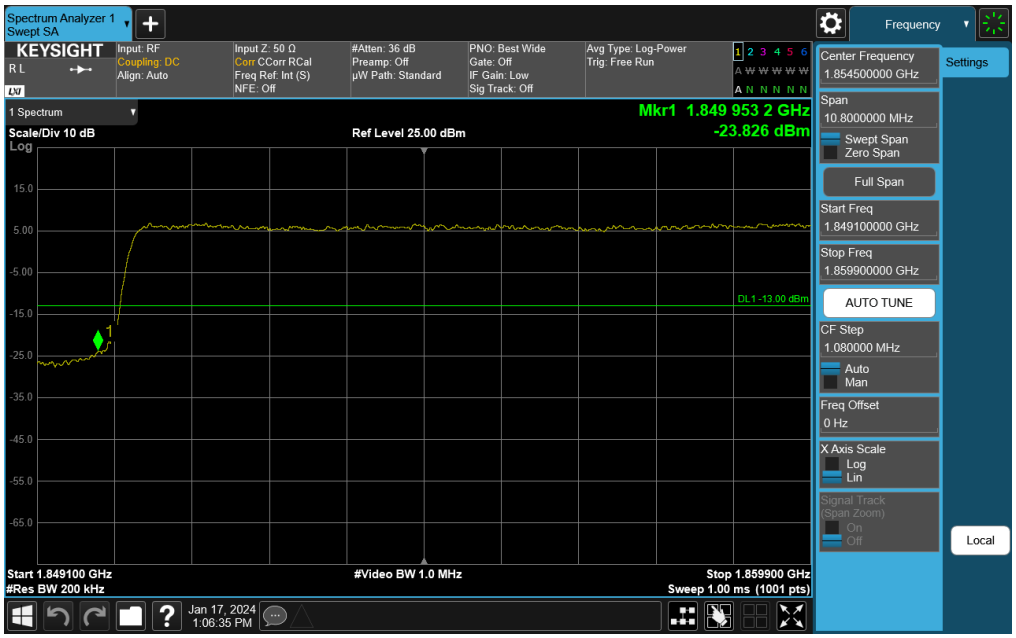
Plot 7-150. Extended Lower Band Edge Plot (NR Band n25 – 15MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



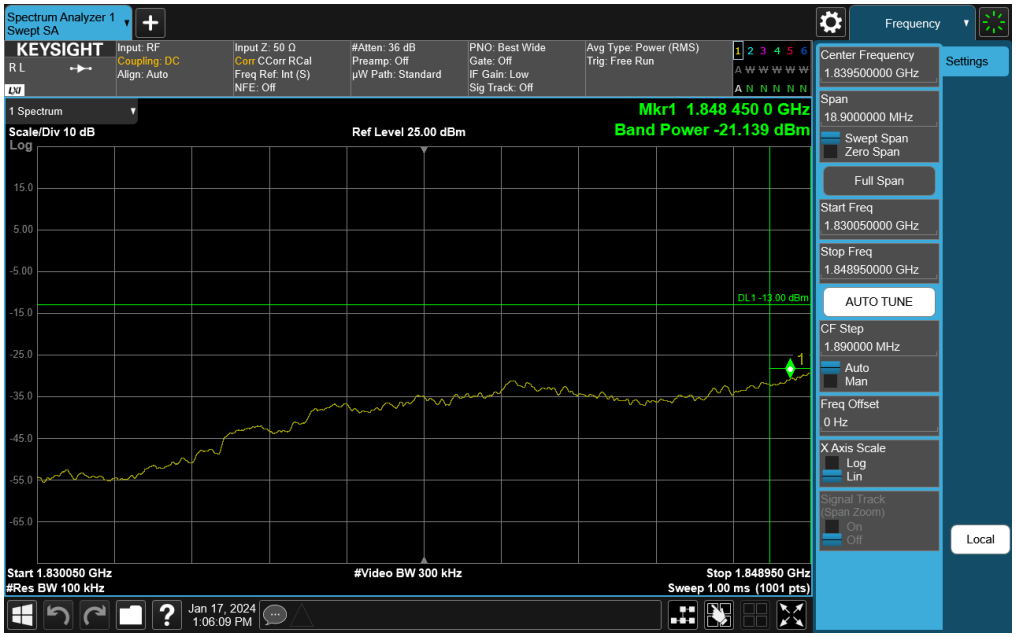
Plot 7-151. Upper Band Edge Plot (NR Band n25 – 15MHz CP-OFDM QPSK – Full RB Configuration)



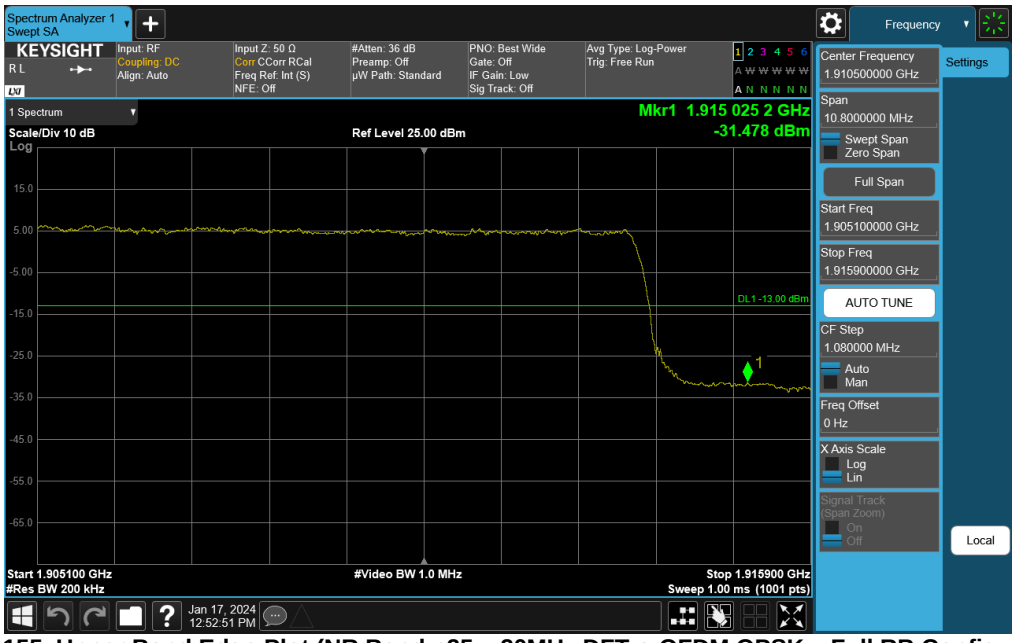
Plot 7-152. Extended Upper Band Edge Plot (NR Band n25 – 15MHz CP-OFDM QPSK – Full RB Configuration)



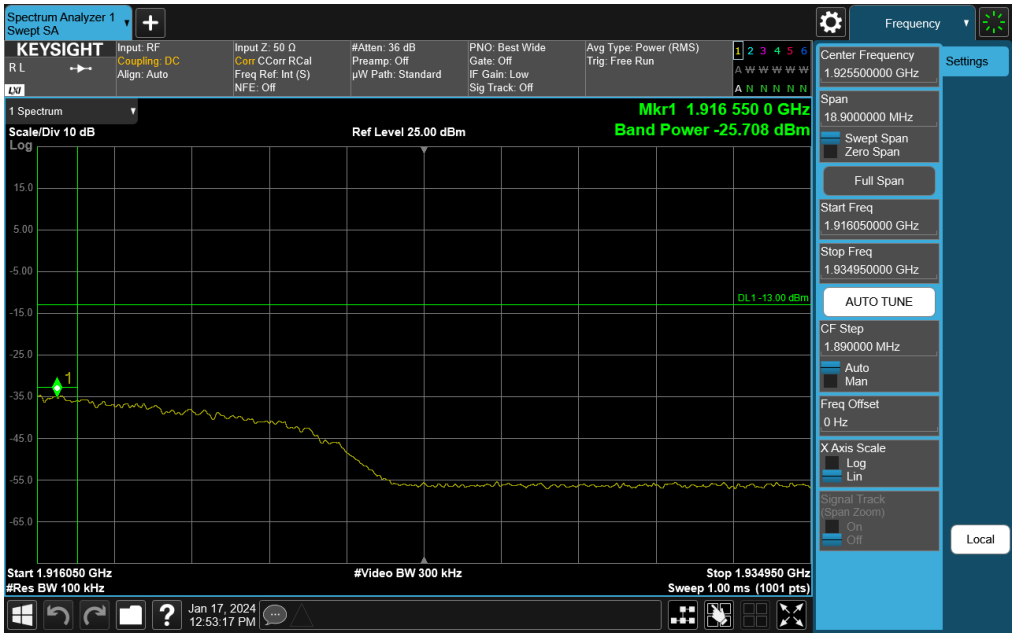
Plot 7-153. Lower Band Edge Plot (NR Band n25 – 20MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



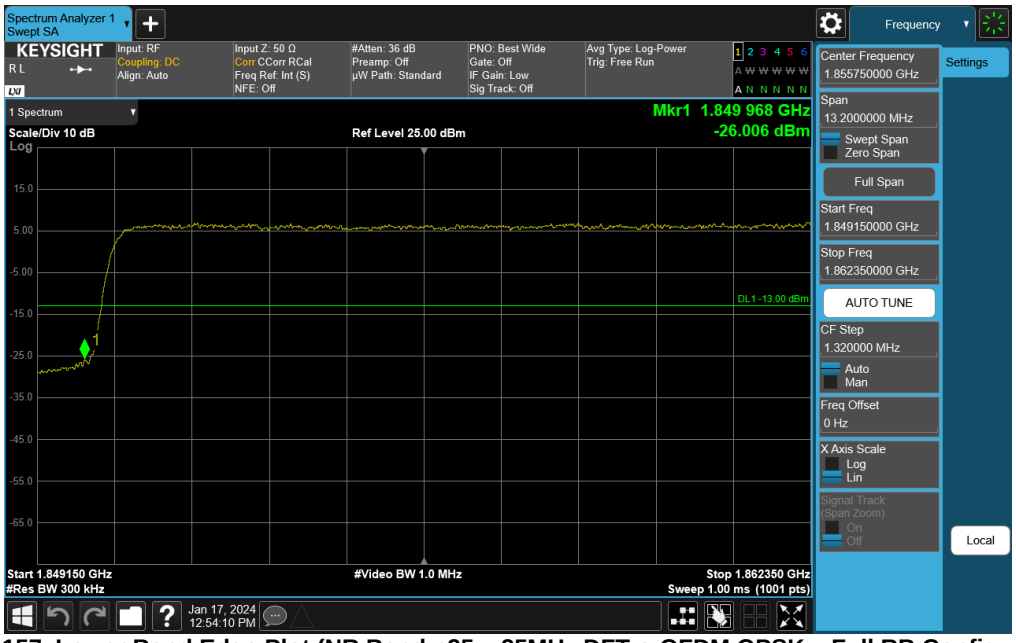
Plot 7-154. Extended Lower Band Edge Plot (NR Band n25 – 20MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



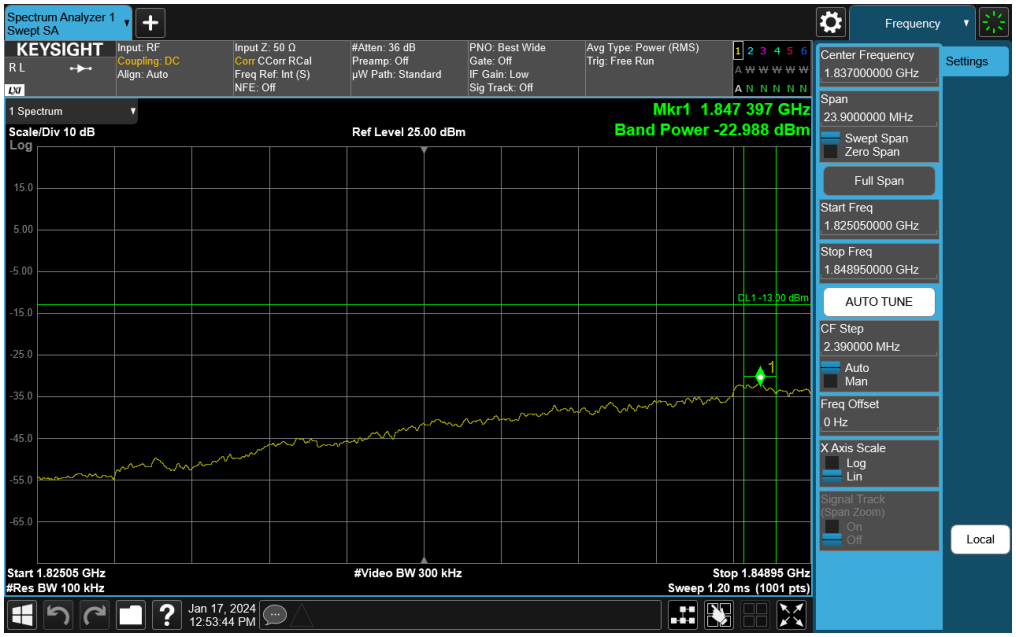
Plot 7-155. Upper Band Edge Plot (NR Band n25 – 20MHz DFT-s-OFDM QPSK – Full RB Configuration)



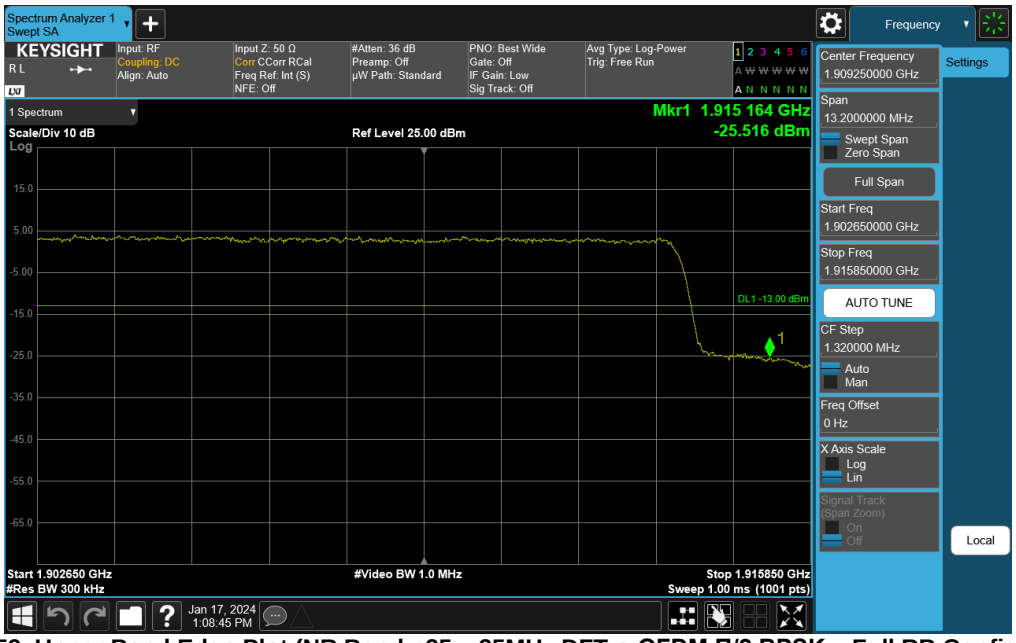
Plot 7-156. Extended Upper Band Edge Plot (NR Band n25 – 20MHz DFT-s-OFDM QPSK – Full RB Configuration)



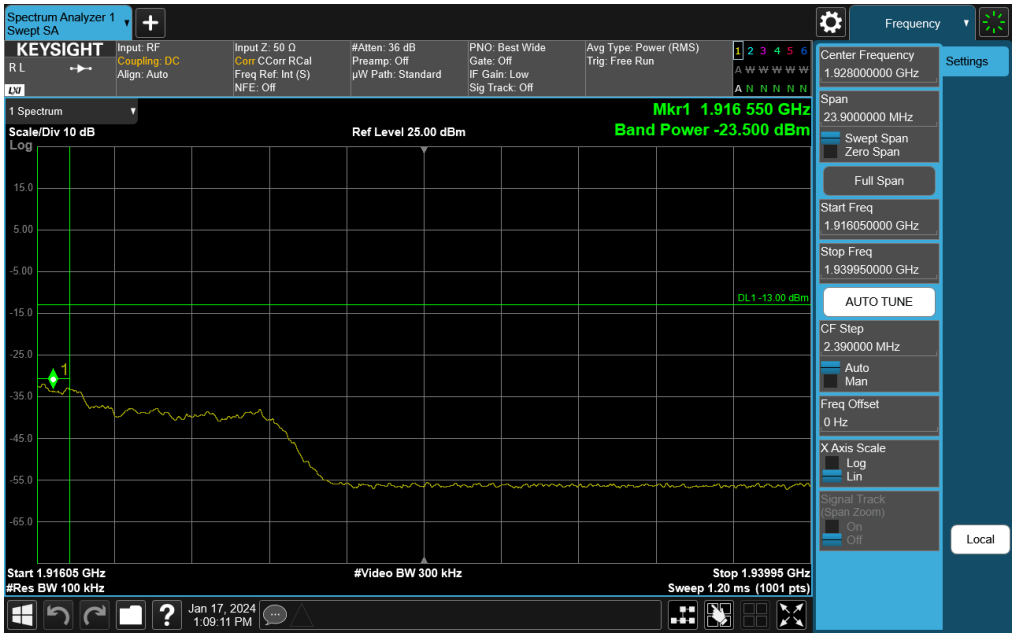
Plot 7-157. Lower Band Edge Plot (NR Band n25 – 25MHz DFT-s-OFDM QPSK – Full RB Configuration)



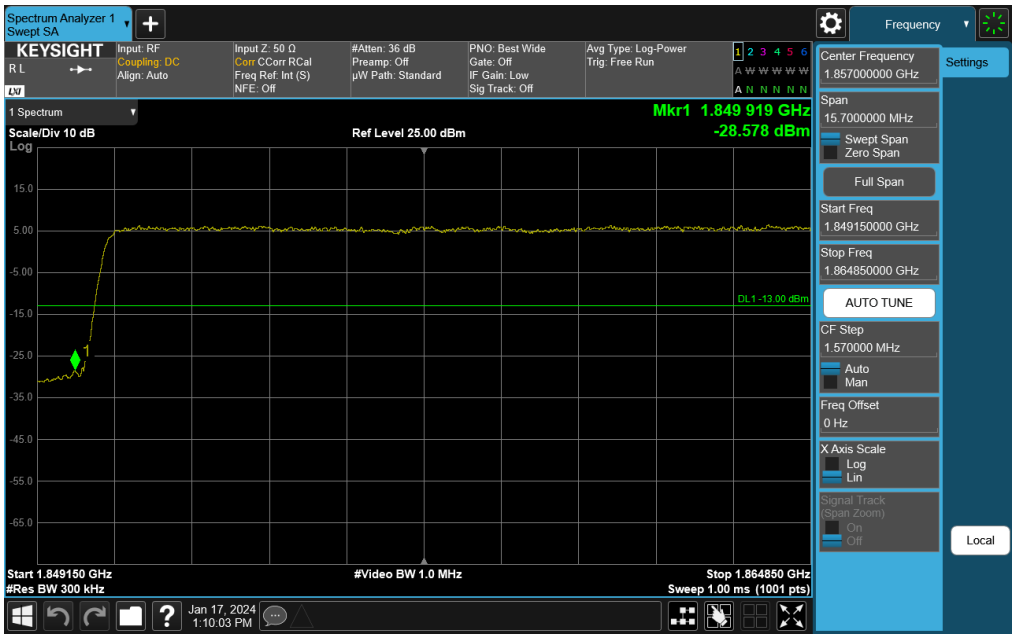
Plot 7-158. Extended Lower Band Edge Plot (NR Band n25 – 25MHz DFT-s-OFDM QPSK – Full RB Configuration)



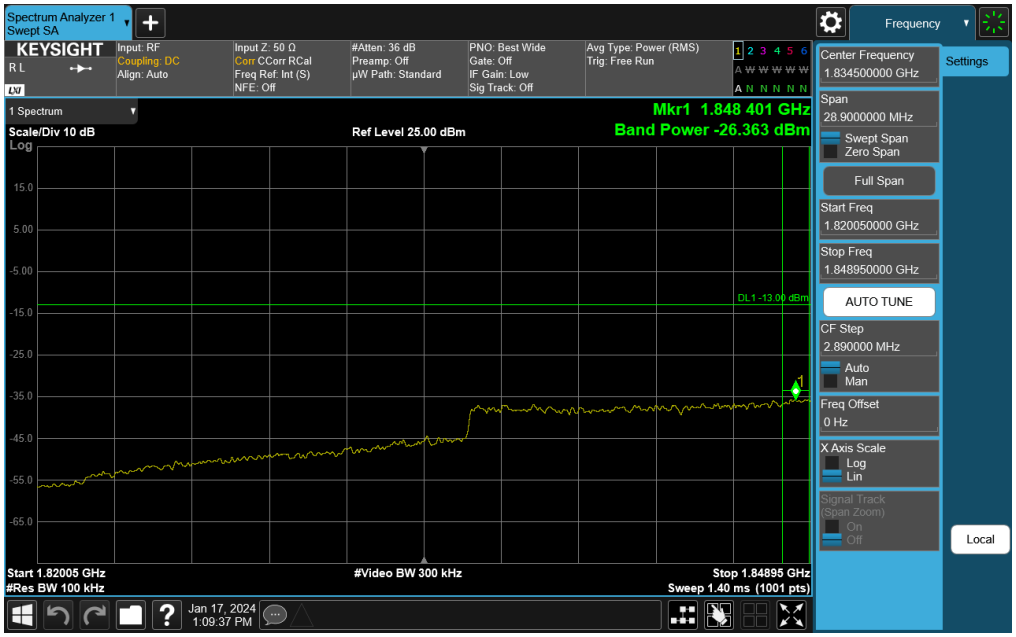
Plot 7-159. Upper Band Edge Plot (NR Band n25 – 25MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



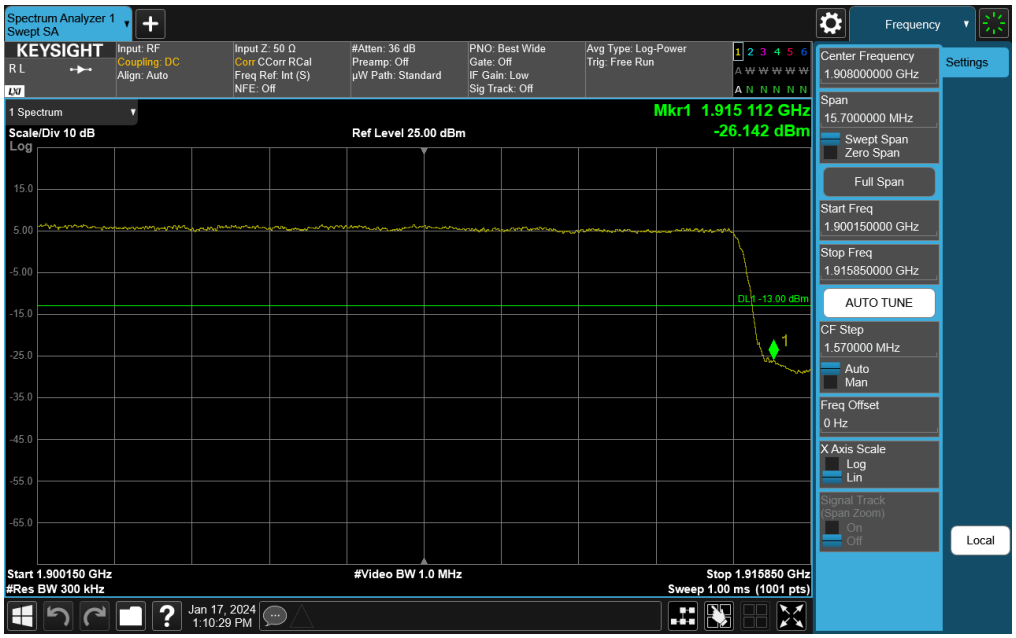
Plot 7-160. Extended Upper Band Edge Plot (NR Band n25 – 25MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



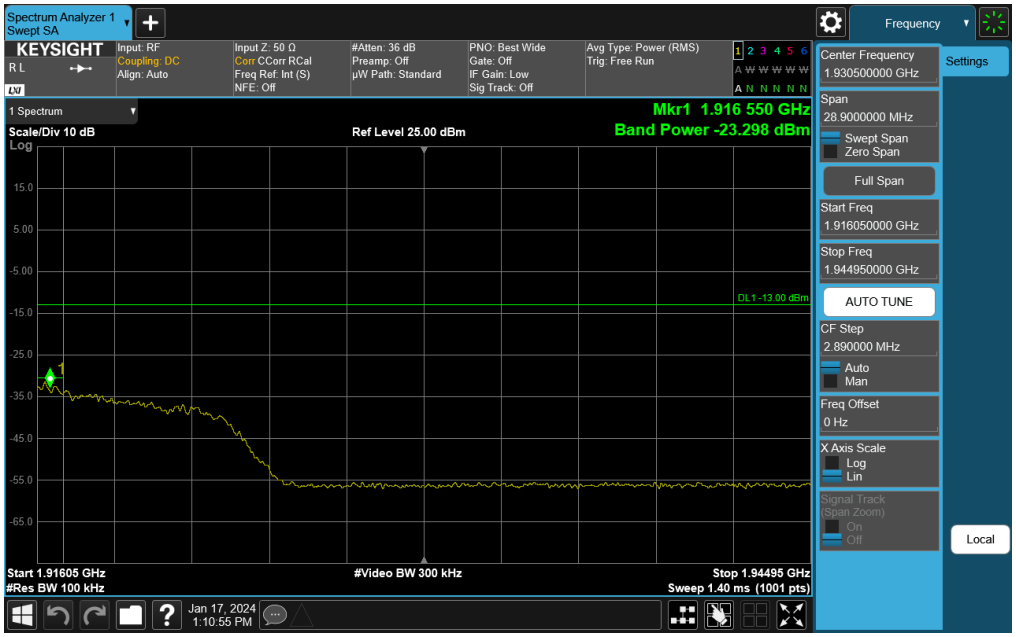
Plot 7-161. Lower Band Edge Plot (NR Band n25 – 30MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



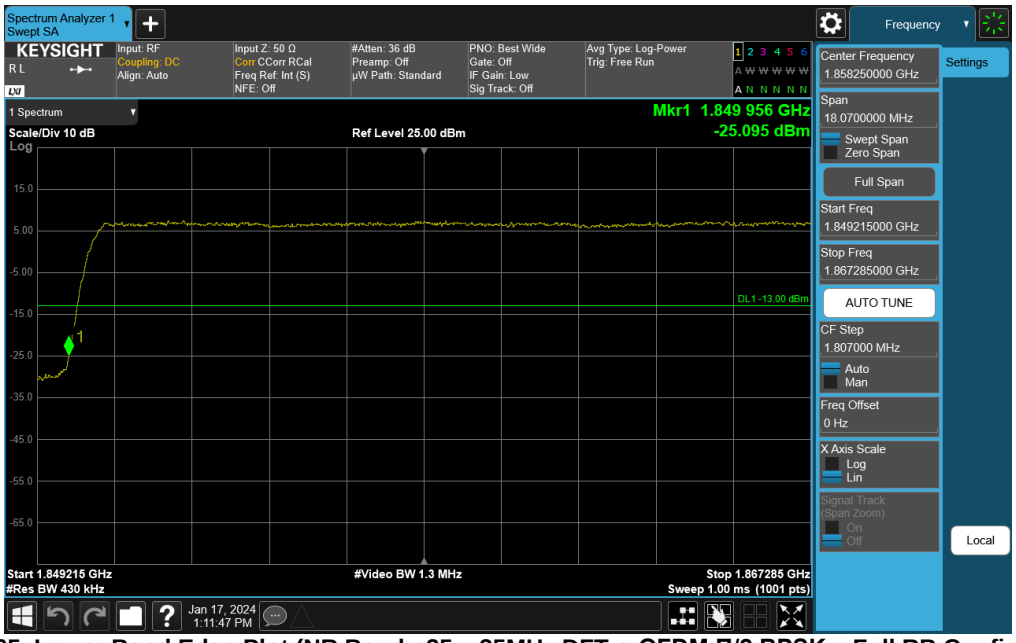
Plot 7-162. Extended Lower Band Edge Plot (NR Band n25 – 30MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



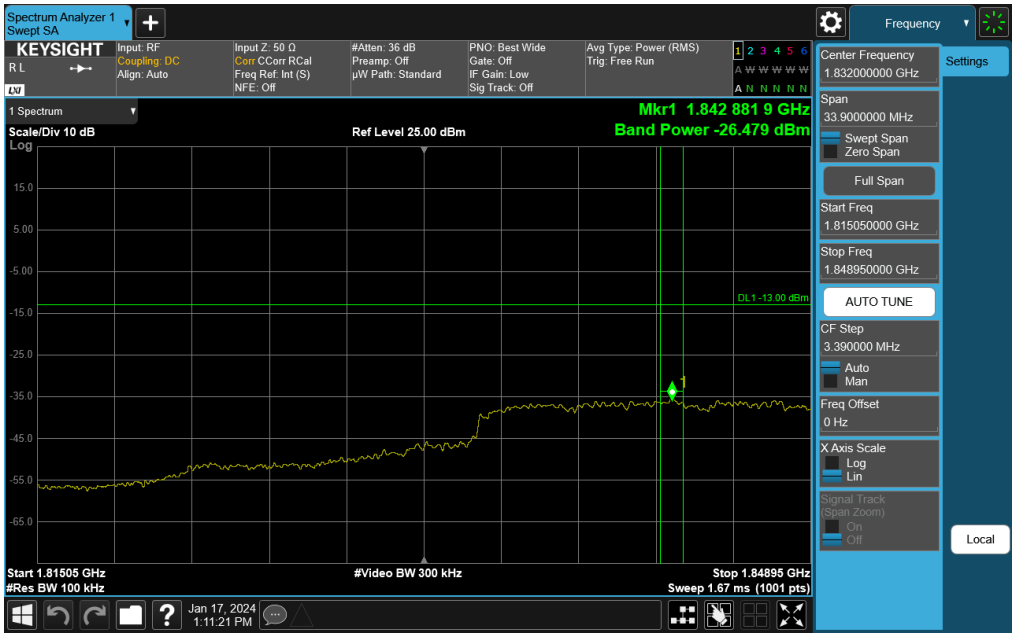
Plot 7-163. Upper Band Edge Plot (NR Band n25 – 30MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



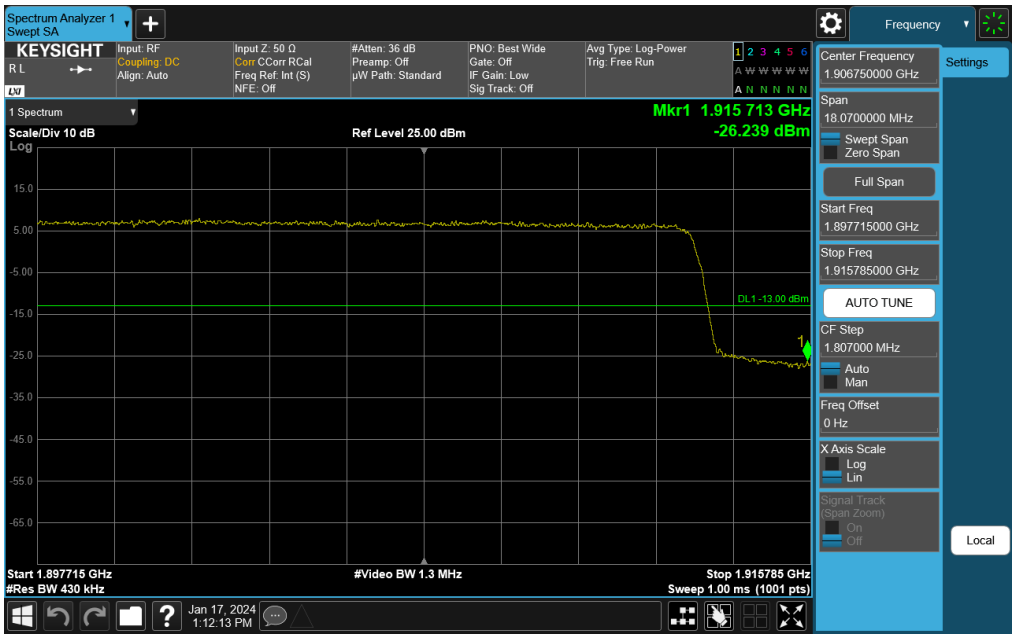
Plot 7-164. Extended Upper Band Edge Plot (NR Band n25 – 30MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



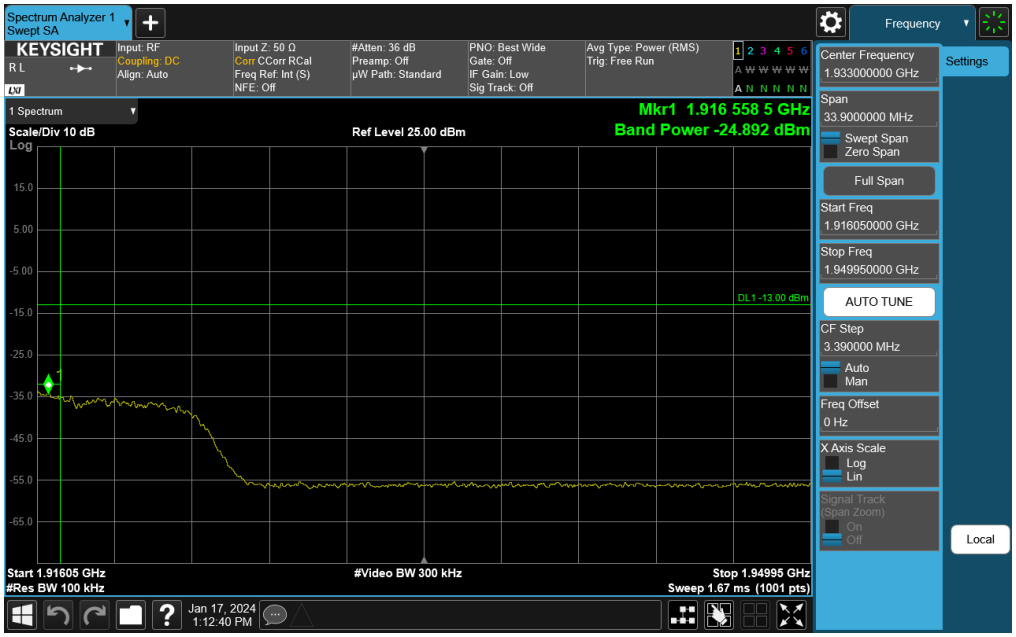
Plot 7-165. Lower Band Edge Plot (NR Band n25 – 35MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



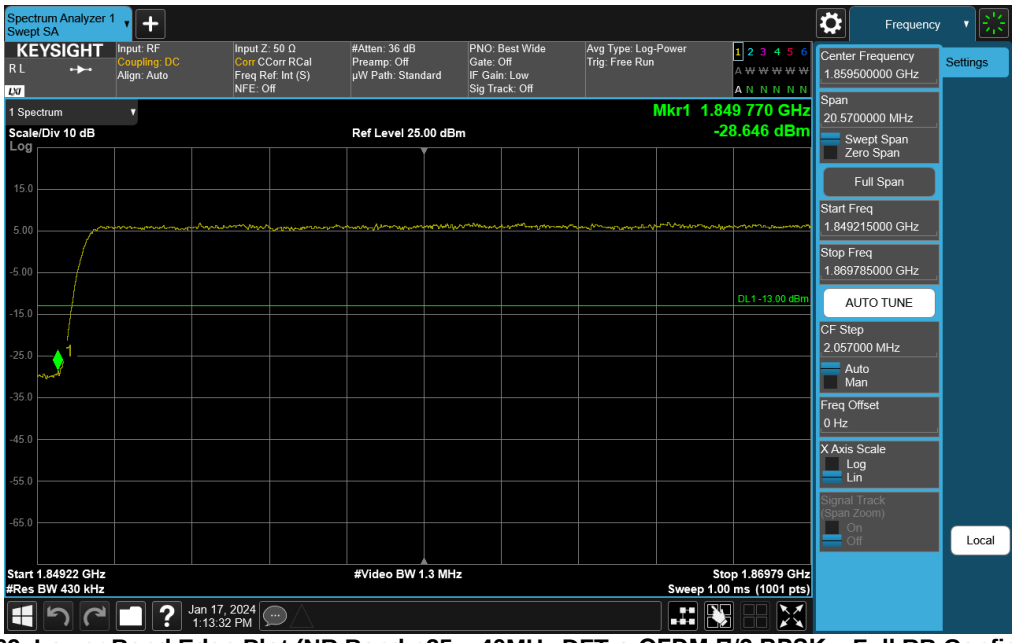
Plot 7-166. Extended Lower Band Edge Plot (NR Band n25 – 35MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



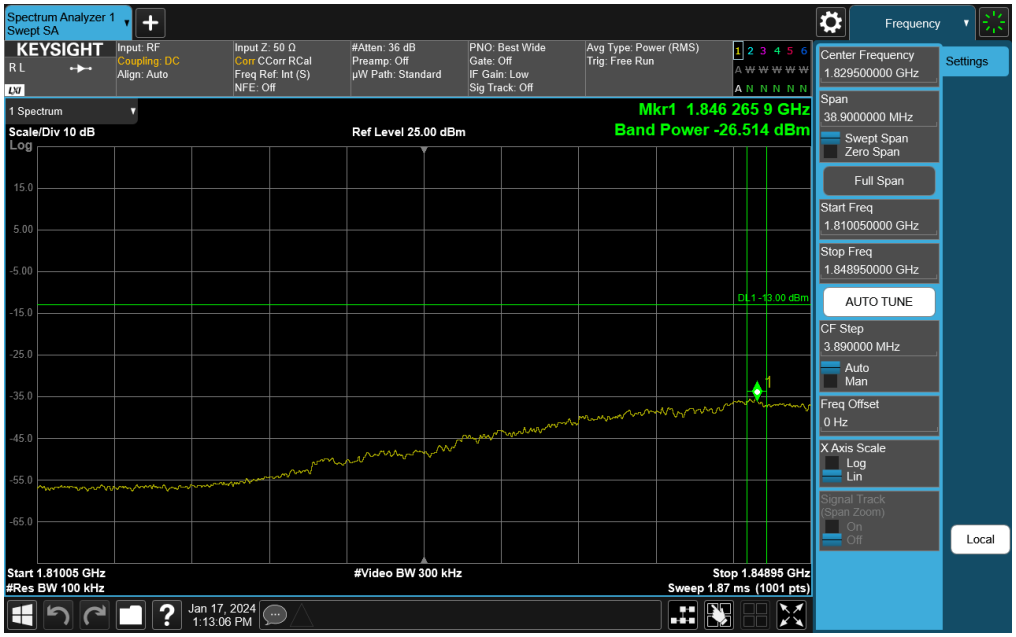
Plot 7-167. Upper Band Edge Plot (NR Band n25 – 35MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



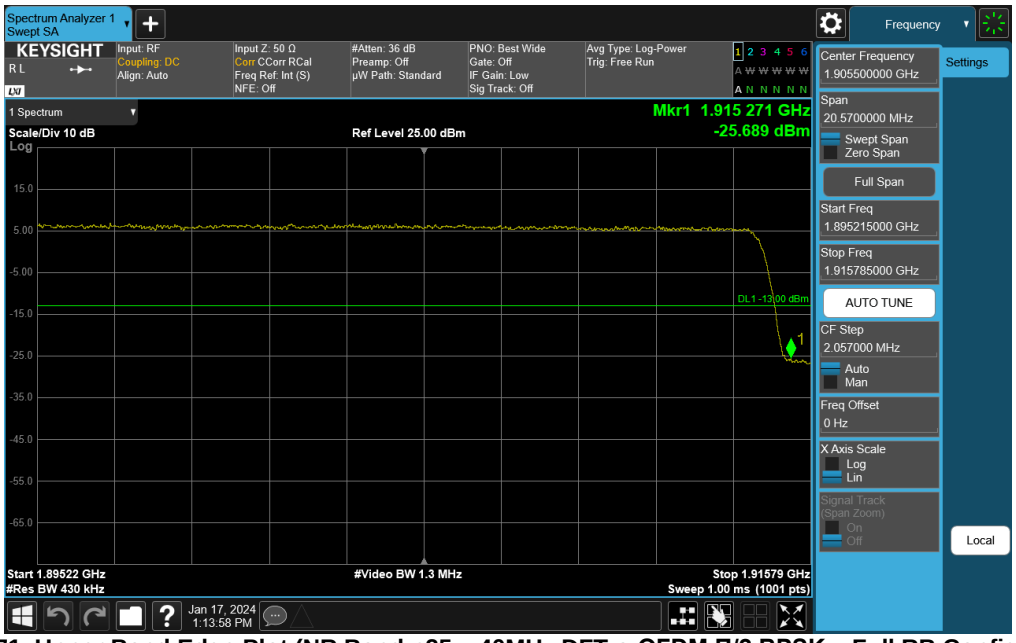
Plot 7-168. Extended Upper Band Edge Plot (NR Band n25 – 35MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



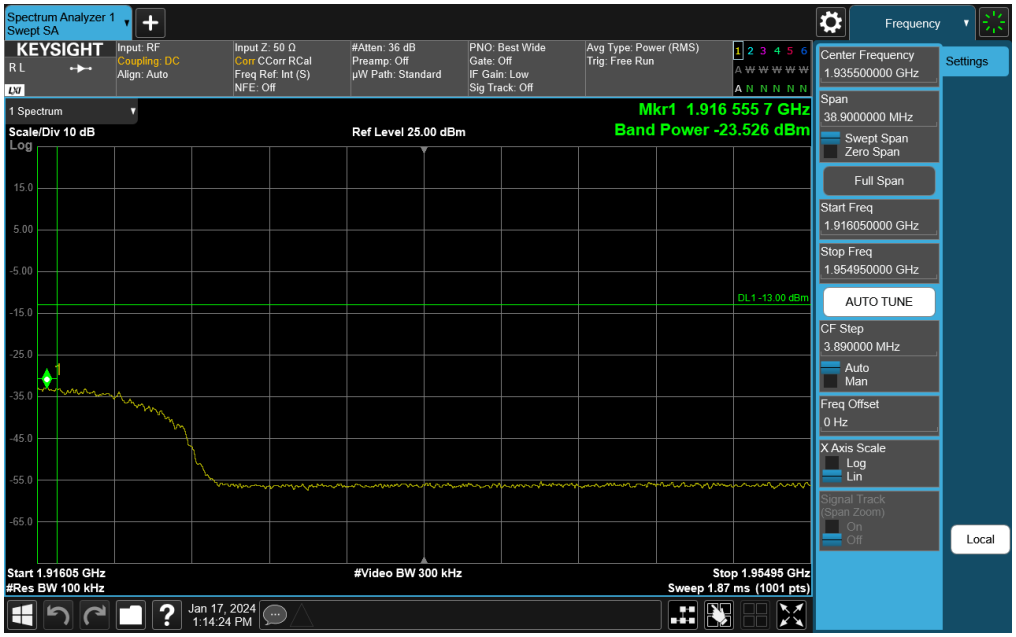
Plot 7-169. Lower Band Edge Plot (NR Band n25 – 40MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)



Plot 7-170. Extended Lower Band Edge Plot (NR Band n25 – 40MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)

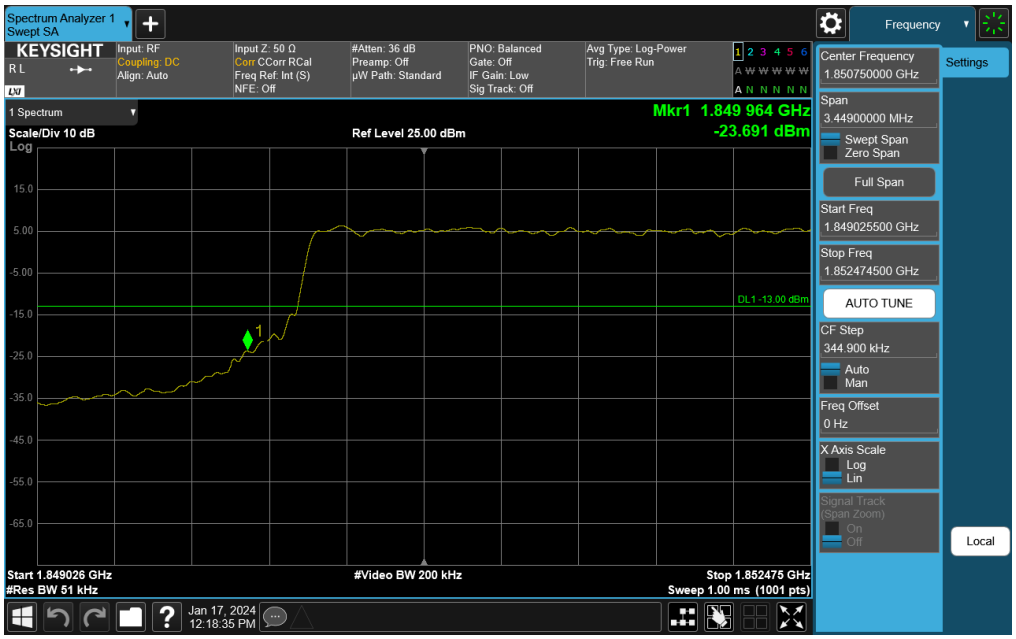


Plot 7-171. Upper Band Edge Plot (NR Band n25 – 40MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)

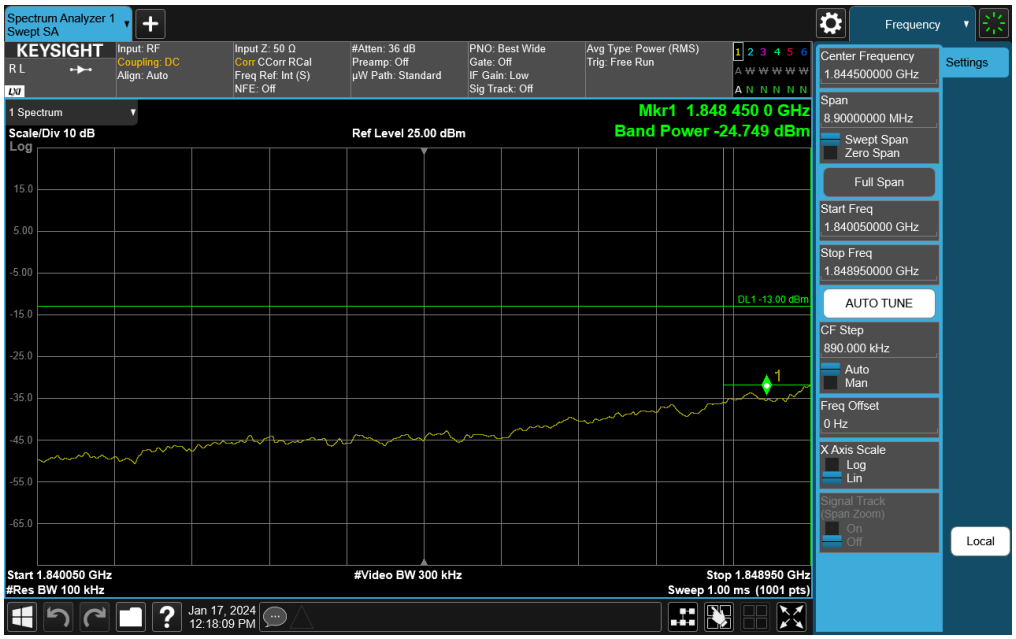


Plot 7-172. Extended Upper Band Edge Plot (NR Band n25 – 40MHz DFT-s-OFDM Π/2 BPSK – Full RB Configuration)

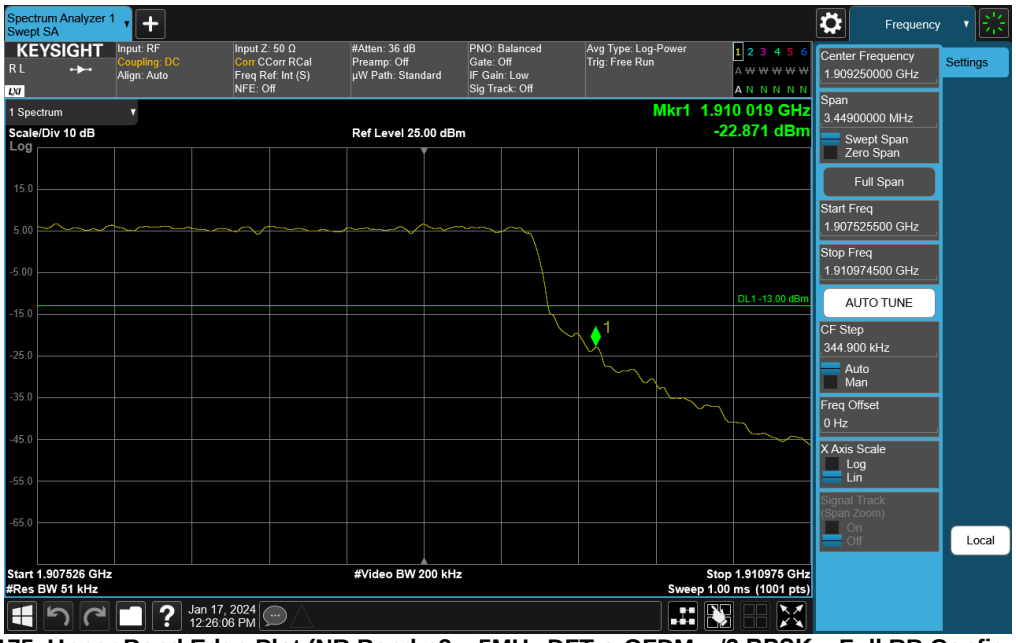
NR Band n2



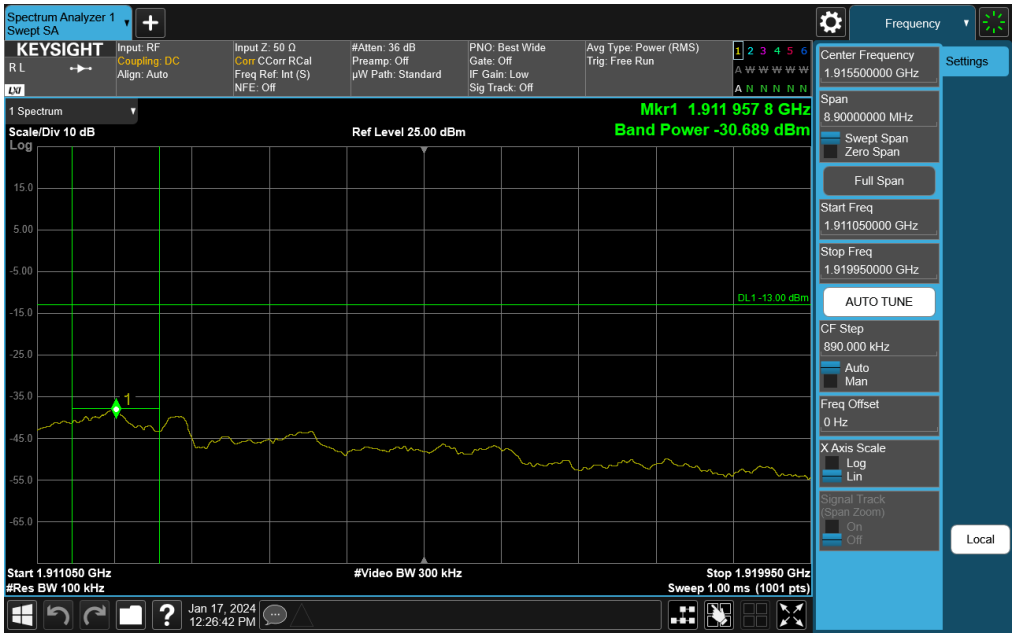
Plot 7-173. Lower Band Edge Plot (NR Band n2 – 5MHz DFT-s-OFDM QPSK – Full RB Configuration)



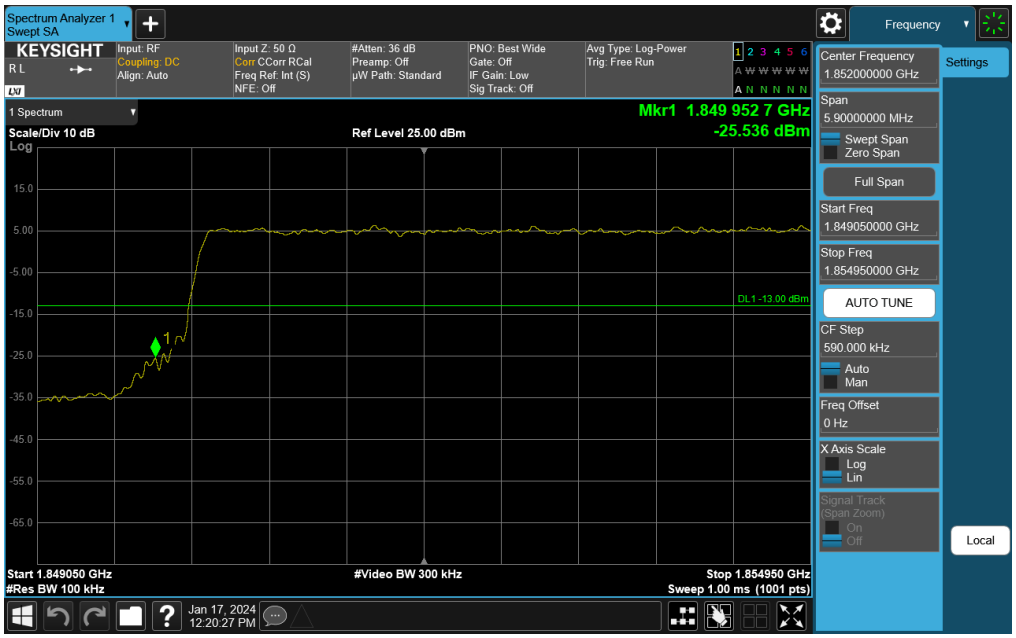
Plot 7-174. Extended Lower Band Edge Plot (NR Band n2 – 5MHz DFT-s-OFDM QPSK – Full RB Configuration)



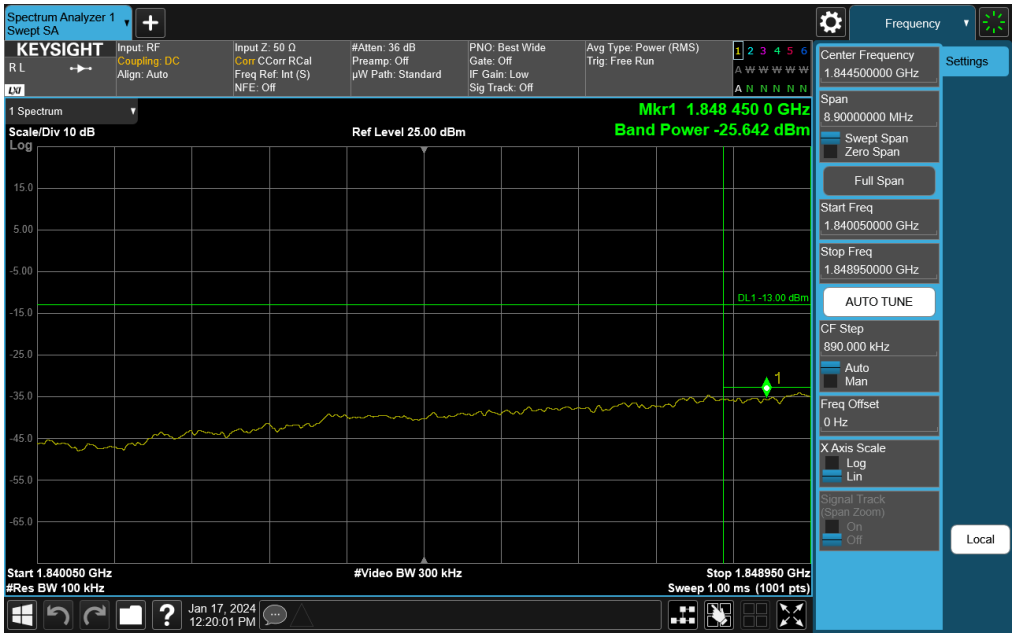
Plot 7-175. Upper Band Edge Plot (NR Band n2 – 5MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



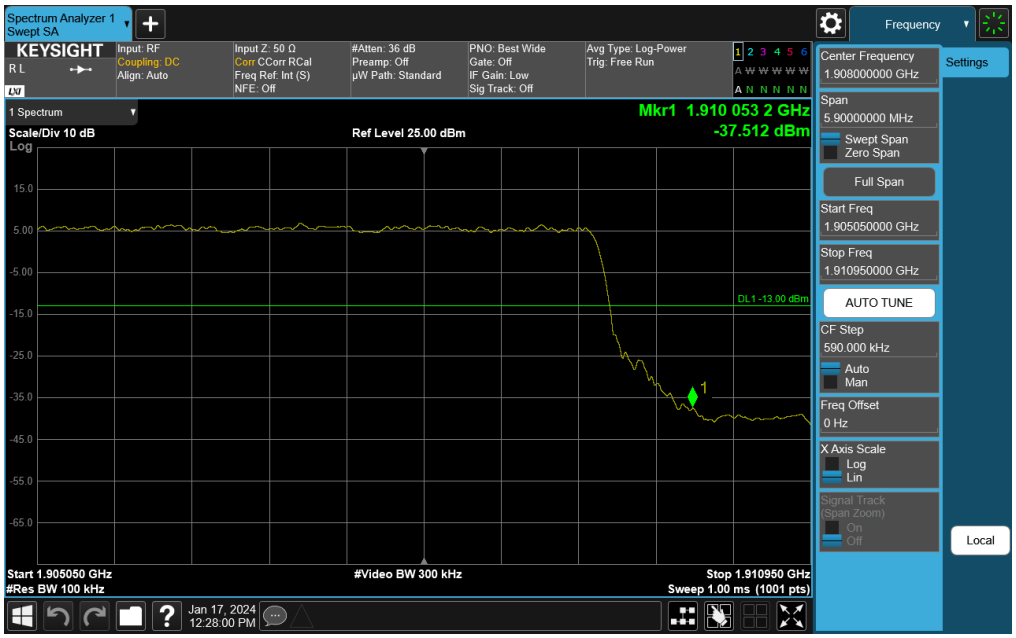
Plot 7-176. Extended Upper Band Edge Plot (NR Band n2 – 5MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



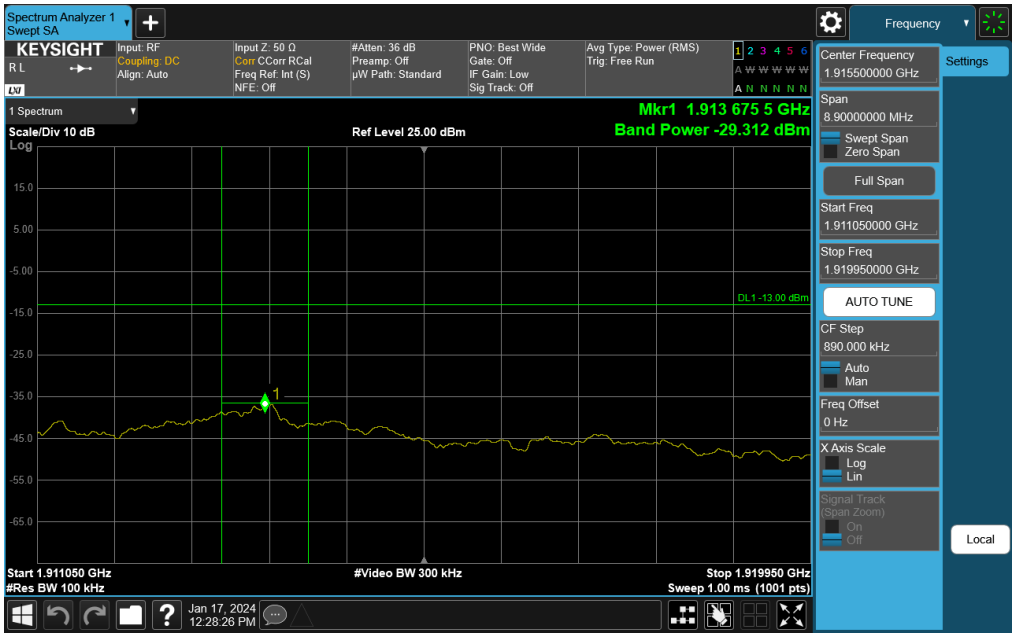
Plot 7-177. Lower Band Edge Plot (NR Band n2 – 10MHz DFT-s-OFDM QPSK – Full RB Configuration)



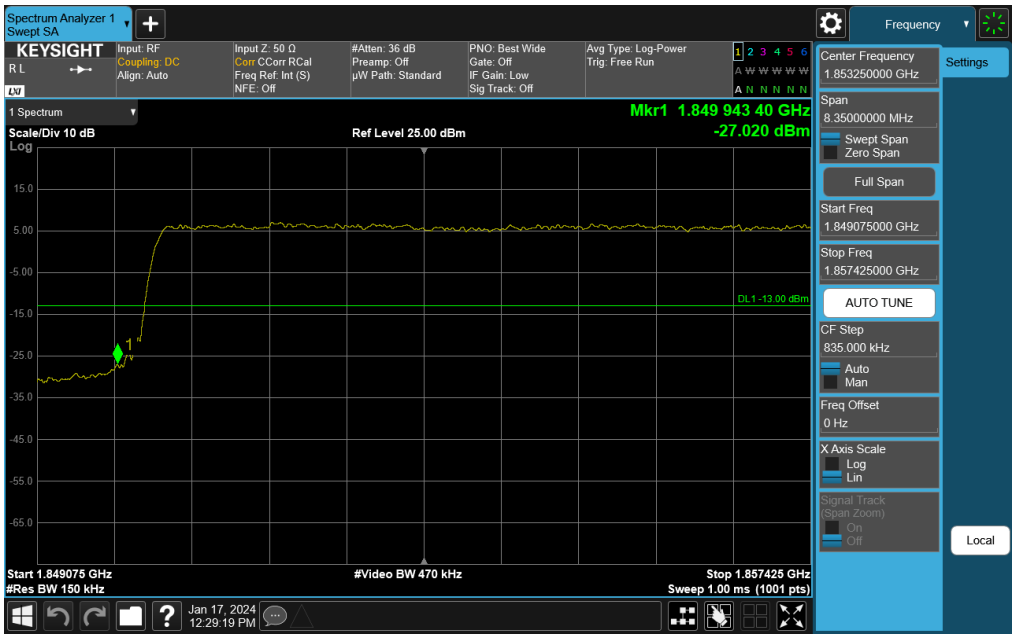
Plot 7-178. Extended Lower Band Edge Plot (NR Band n2 – 10MHz DFT-s-OFDM QPSK – Full RB Configuration)



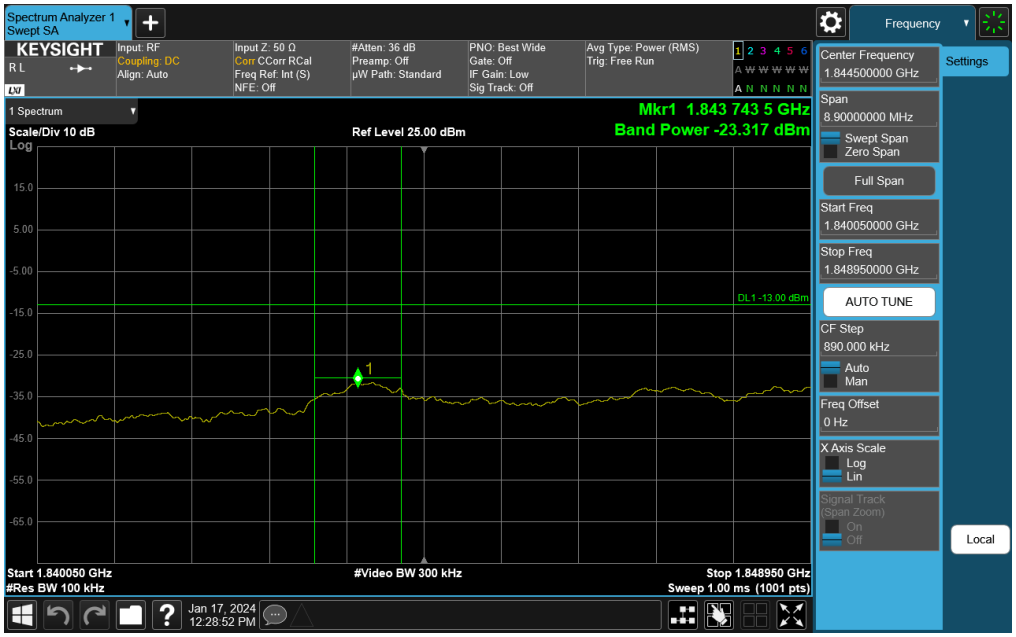
Plot 7-179. Upper Band Edge Plot (NR Band n2 – 10MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



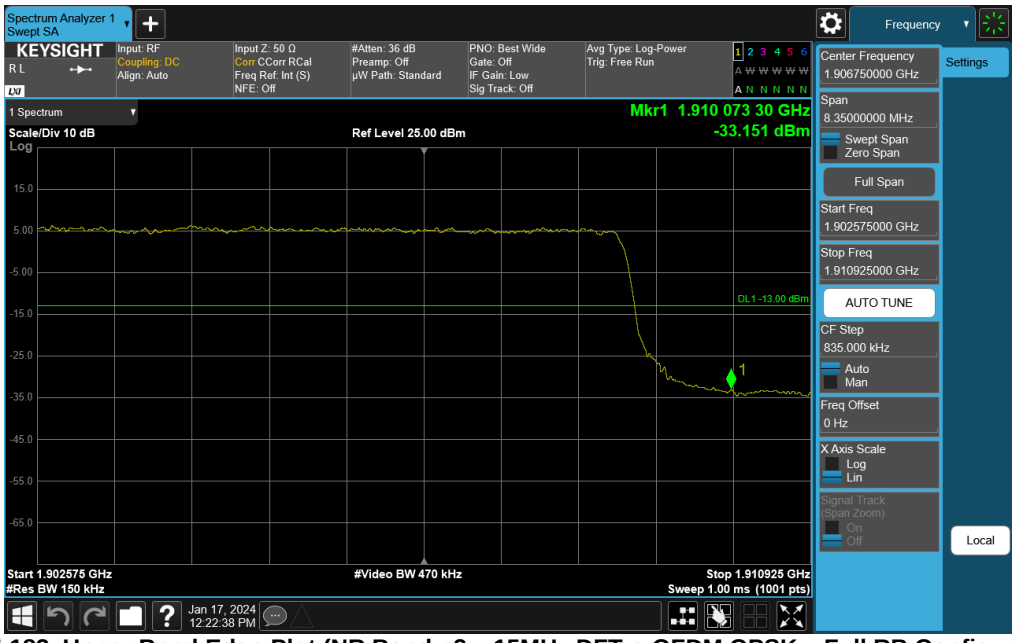
Plot 7-180. Extended Upper Band Edge Plot (NR Band n2 – 10MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



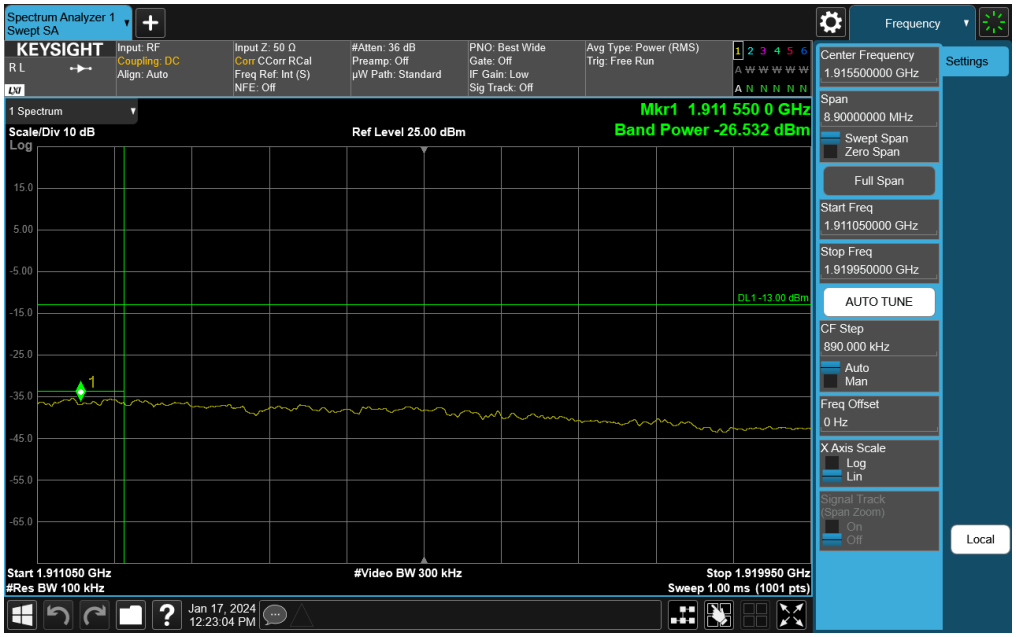
Plot 7-181. Lower Band Edge Plot (NR Band n2 – 15MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



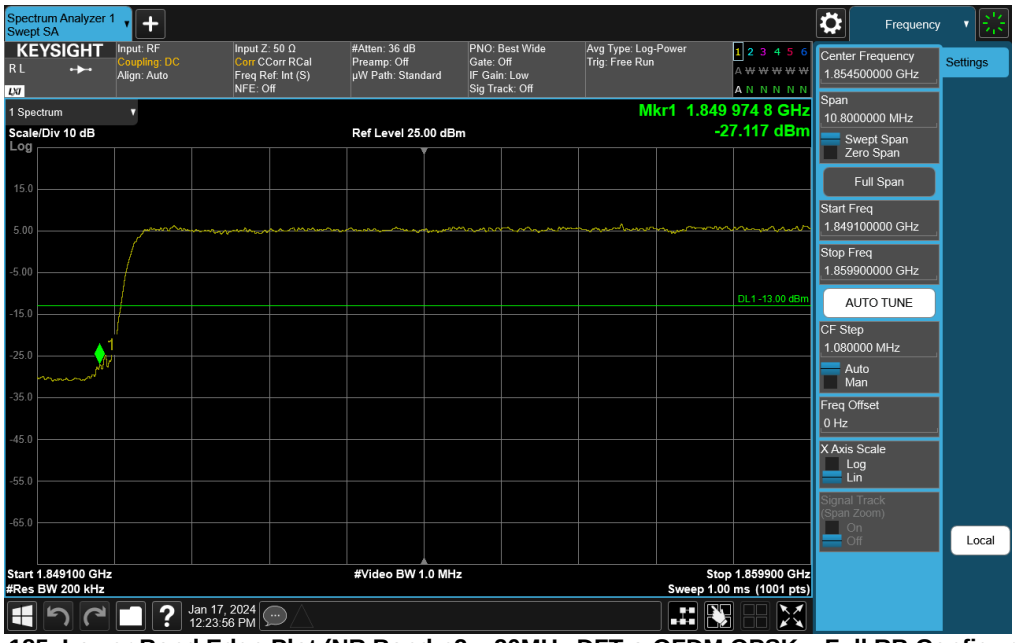
Plot 7-182. Extended Lower Band Edge Plot (NR Band n2 – 15MHz DFT-s-OFDM π/2 BPSK – Full RB Configuration)



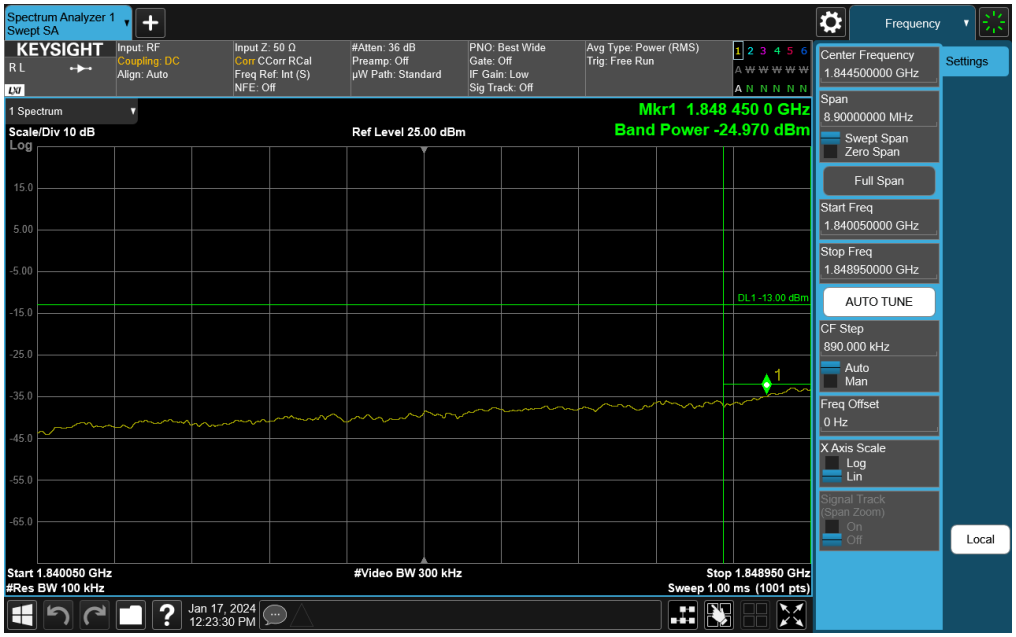
Plot 7-183. Upper Band Edge Plot (NR Band n2 – 15MHz DFT-s-OFDM QPSK – Full RB Configuration)



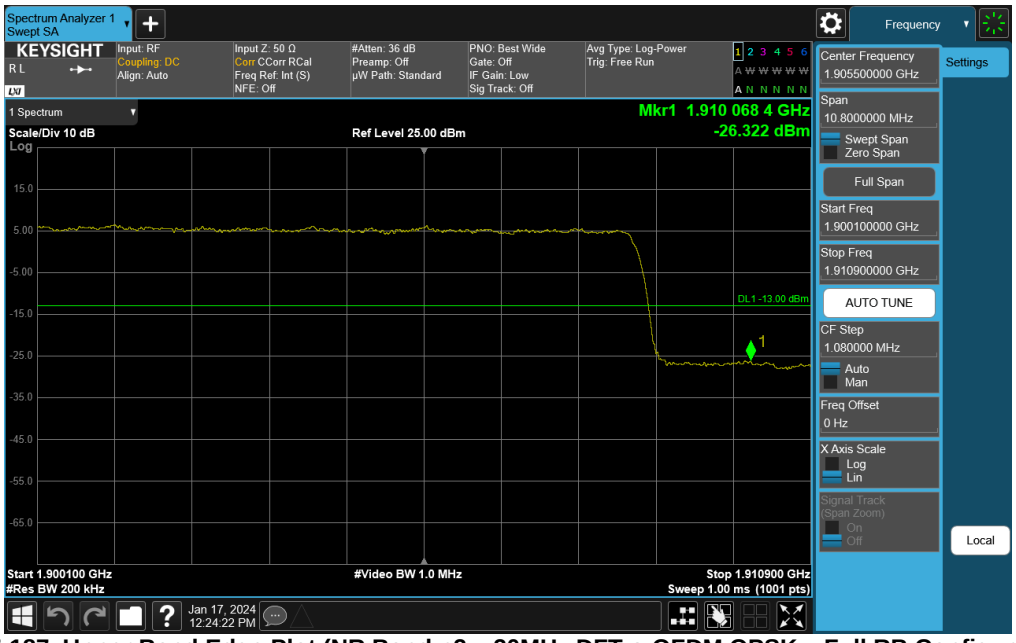
Plot 7-184. Extended Upper Band Edge Plot (NR Band n2 – 15MHz DFT-s-OFDM QPSK – Full RB Configuration)



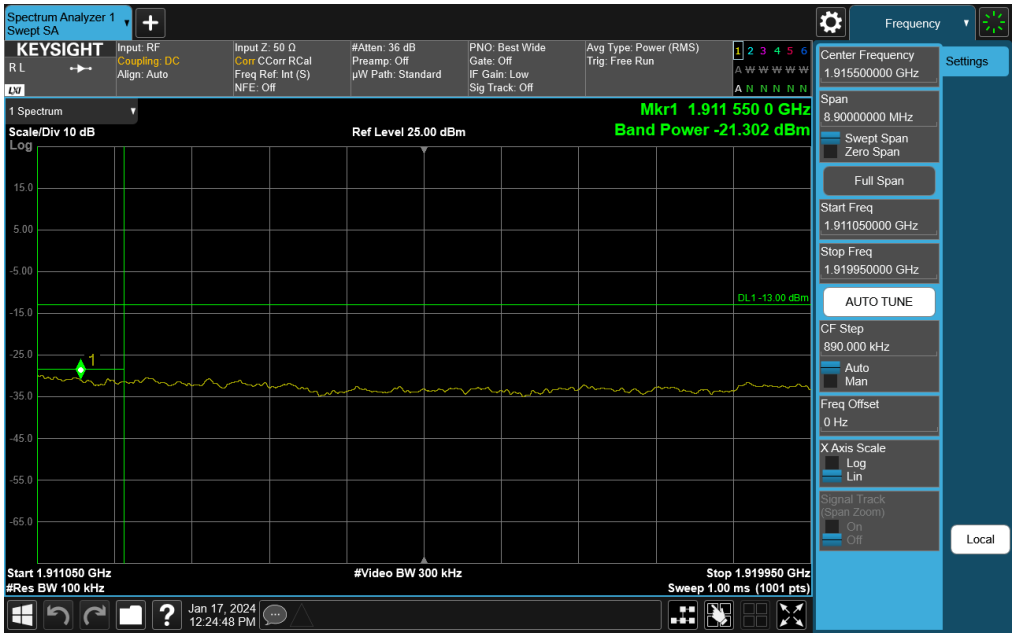
Plot 7-185. Lower Band Edge Plot (NR Band n2 – 20MHz DFT-s-OFDM QPSK – Full RB Configuration)



Plot 7-186. Extended Lower Band Edge Plot (NR Band n2 – 20MHz DFT-s-OFDM QPSK – Full RB Configuration)

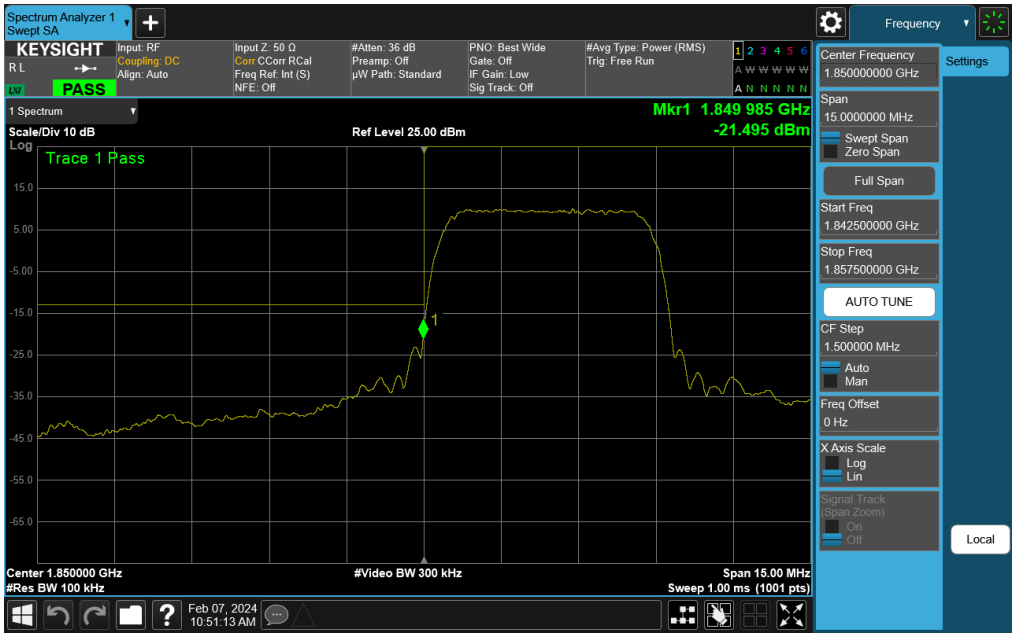


Plot 7-187. Upper Band Edge Plot (NR Band n2 – 20MHz DFT-s-OFDM QPSK – Full RB Configuration)

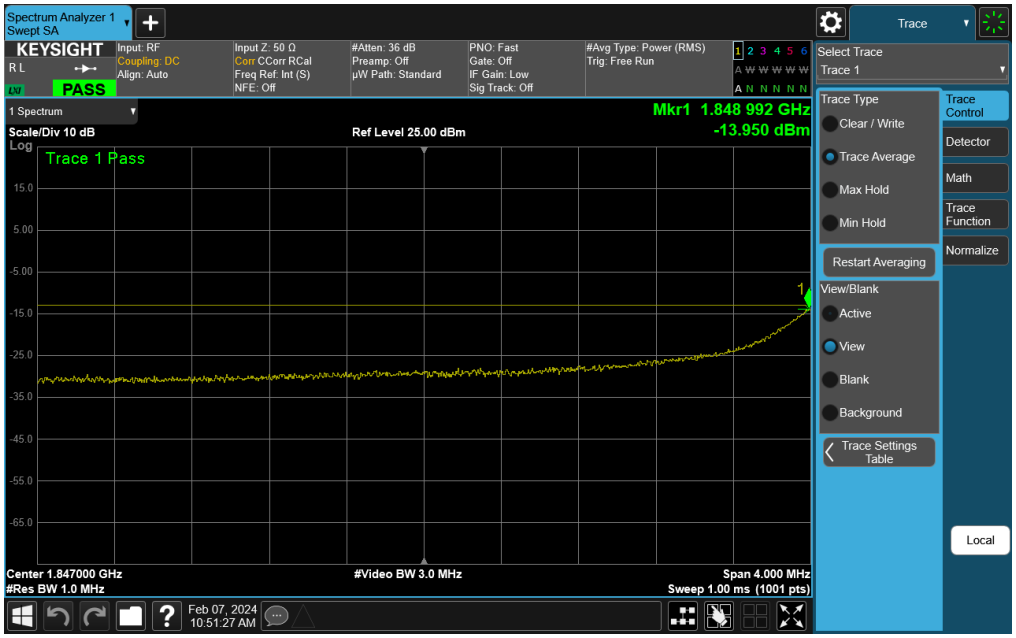


Plot 7-188. Extended Upper Band Edge Plot (NR Band n2 – 20MHz DFT-s-OFDM QPSK – Full RB Configuration)

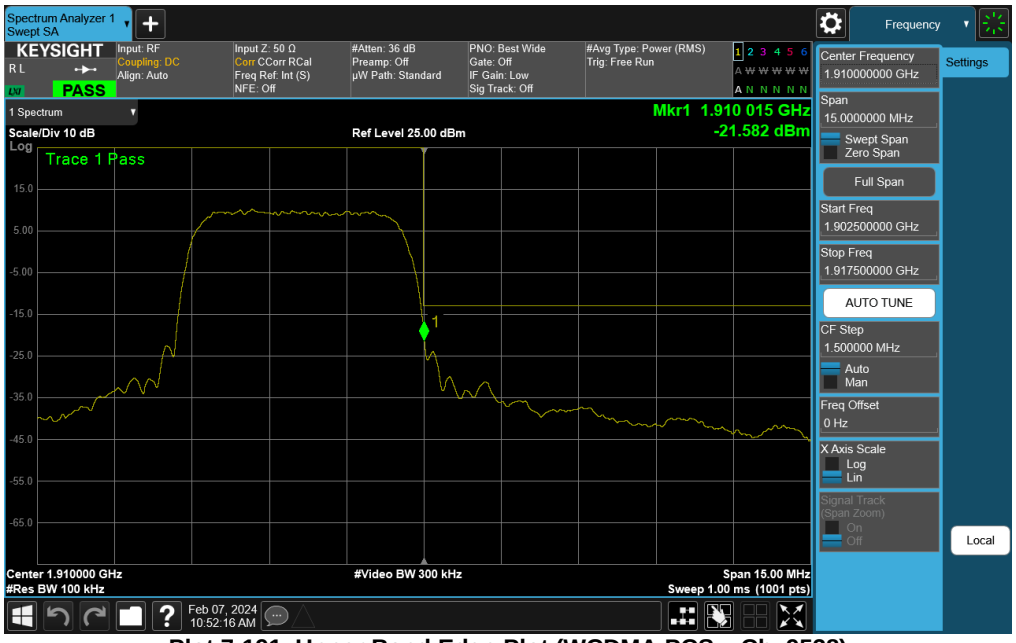
WCDMA PCS



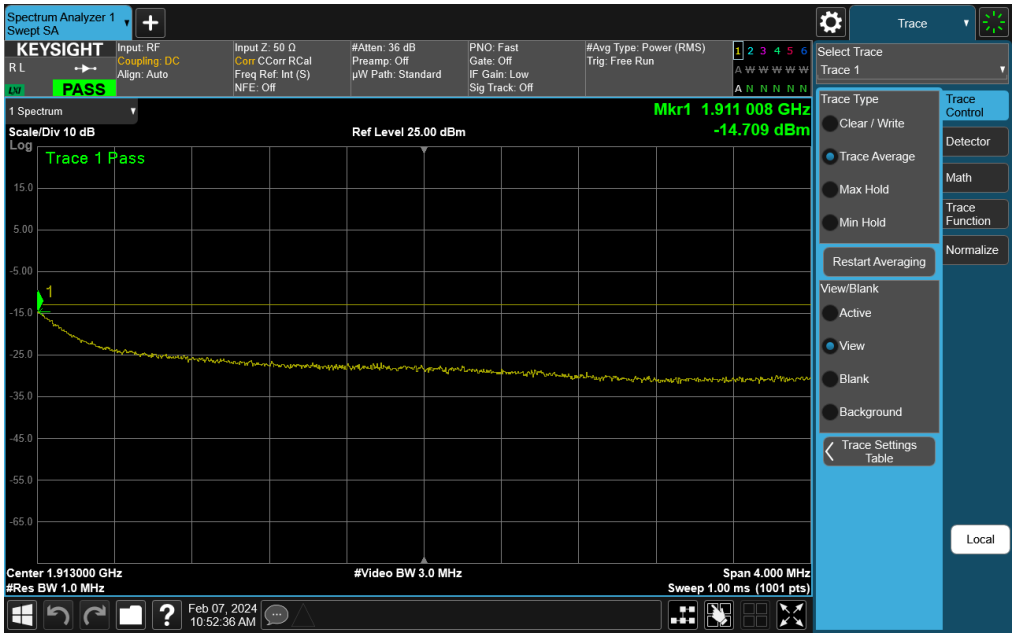
Plot 7-189. Lower Band Edge Plot (WCDMA PCS – Ch. 9262)



Plot 7-190. Extended Lower Band Edge Plot (WCDMA PCS – Ch. 9262)



Plot 7-191. Upper Band Edge Plot (WCDMA PCS – Ch. 9538)



Plot 7-192. Extended Upper Band Edge Plot (WCDMA PCS – Ch. 9538)

7.5 Peak-Average Ratio

§24.232(d)

Test Overview and Limit

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. All ports were tested and only the worst case data were reported.

The peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.7.1

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW ≥ OBW or specified reference bandwidth
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Test Setup

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

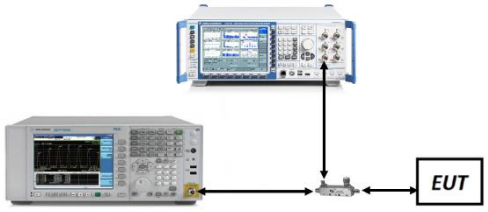
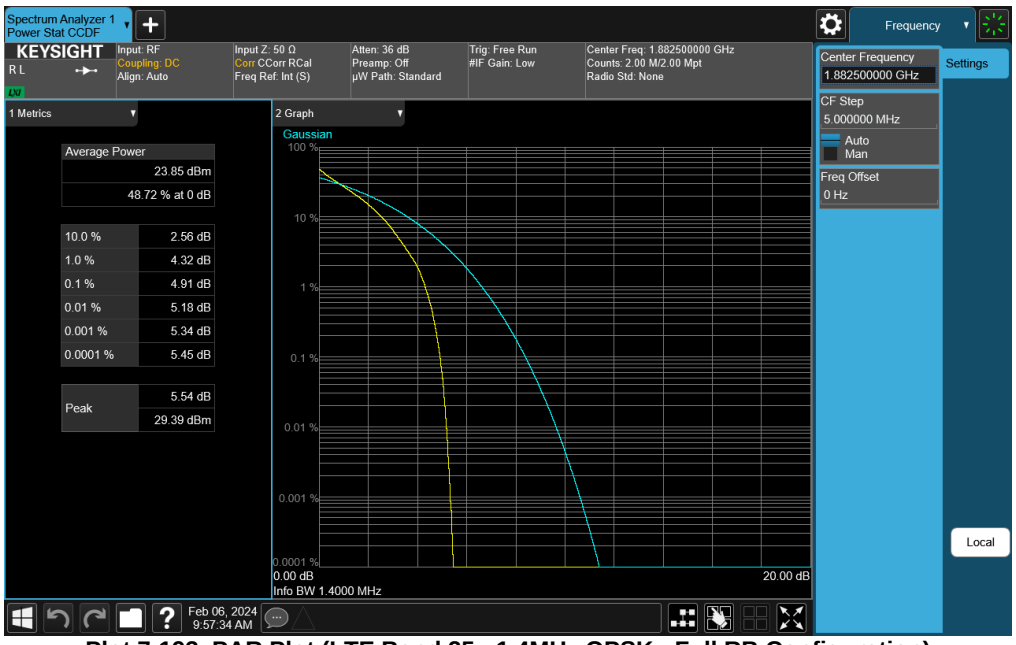


Figure 7-4. Test Instrument & Measurement Setup

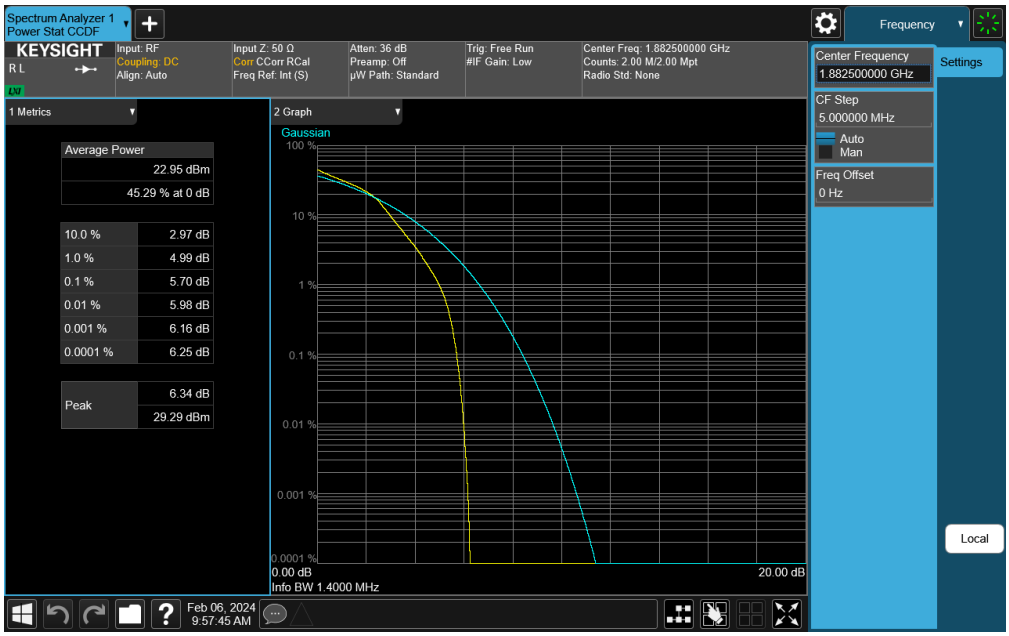
Test Notes

None.

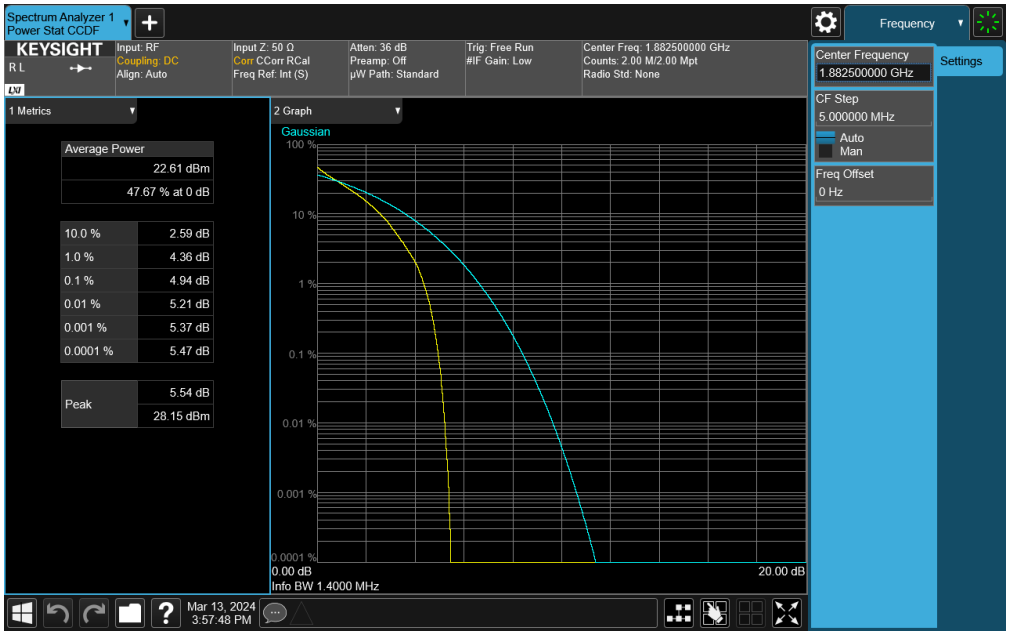
LTE Band 25



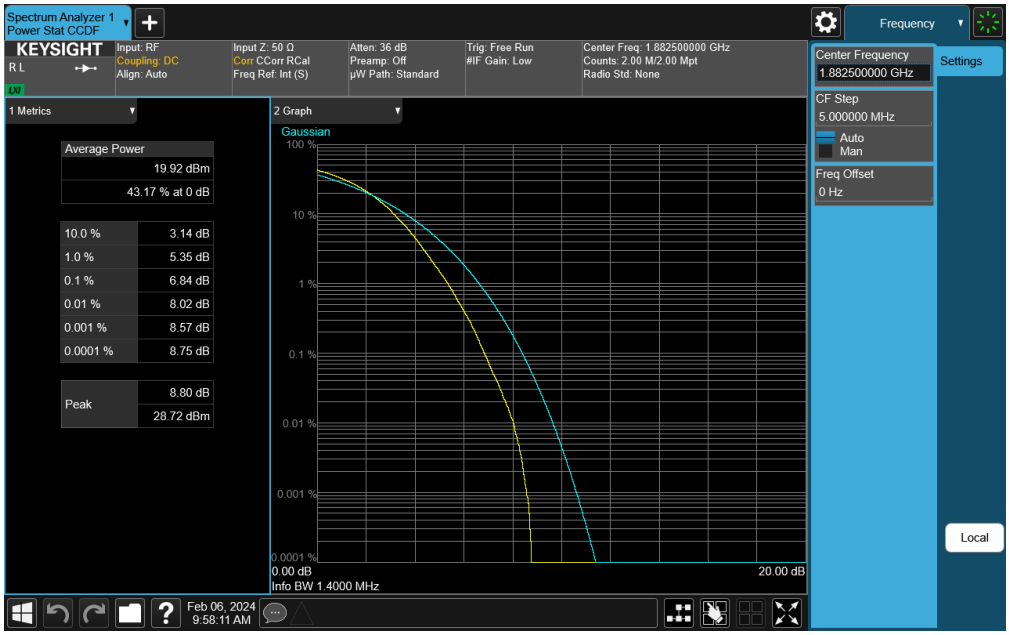
Plot 7-193. PAR Plot (LTE Band 25 - 1.4MHz QPSK - Full RB Configuration)



Plot 7-194. PAR Plot (LTE Band 25 - 1.4MHz 16-QAM - Full RB Configuration)



Plot 7-195. PAR Plot (LTE Band 25 - 1.4MHz 64-QAM - Full RB Configuration)



Plot 7-196. PAR Plot (LTE Band 25 - 1.4MHz 256-QAM - Full RB Configuration)