7.4 Out-of-Band Emissions in the Spurious Domain

§2.1051 §27.53(m)

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 its maximum duty cycle, 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 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0
ANSI C63.26-2015 Section 6.4.4.1

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (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.

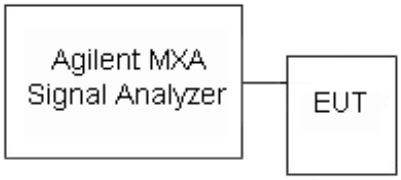


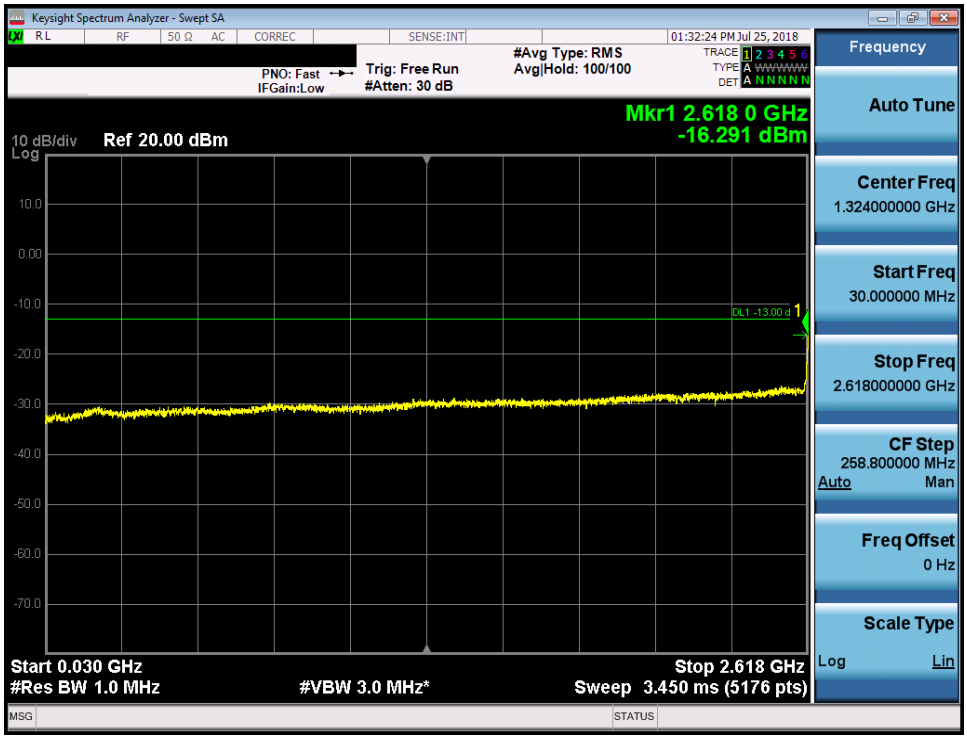
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. 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.

The plots shown in this section address compliance of each individual antenna to the Part 27.53(m) spurious emission limits. Per ANSI C63.26-2015 Section 6.4.4.1, spurious emission compliance for MIMO operation is addressed by the "Measure and add [10 log N] dB" technique where N = 2 and the resulting spurious emission level addition is 3dB.

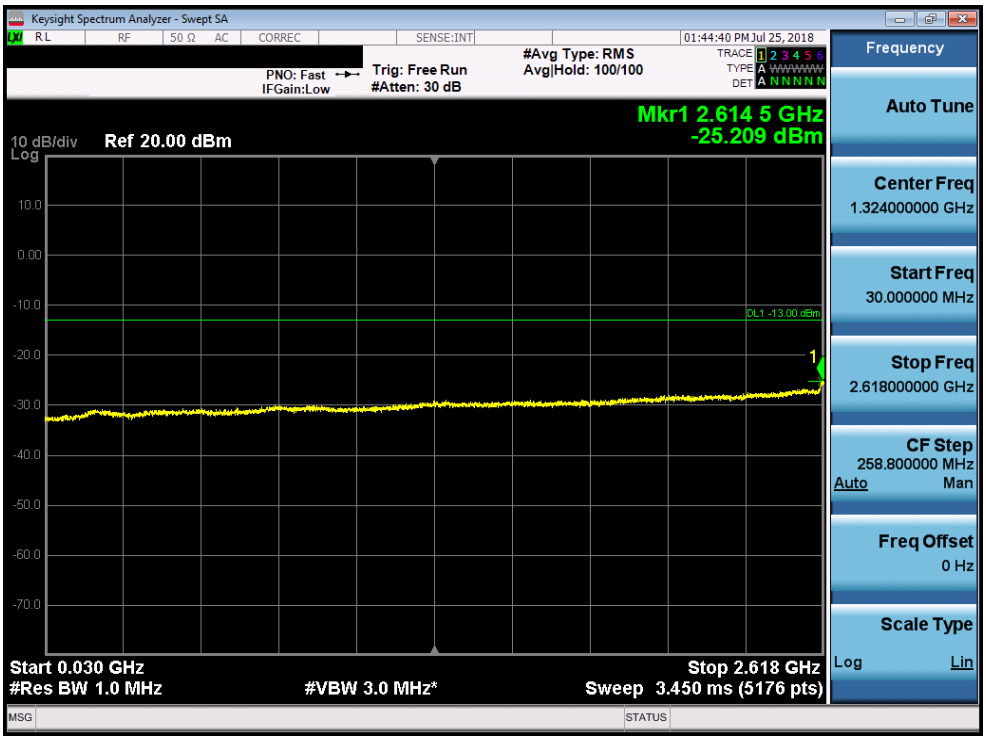
Band 7 – Antenna 1



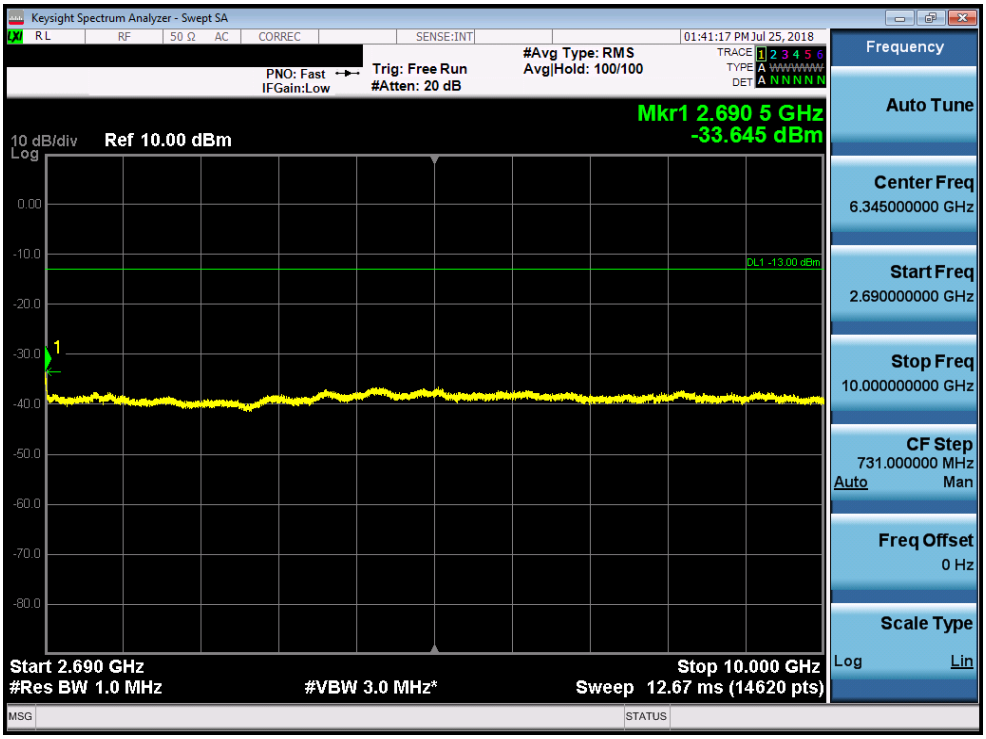
Plot 7-129. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Low Channel)

Plot 7-130. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Low Channel)

Plot 7-131. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Low Channel)

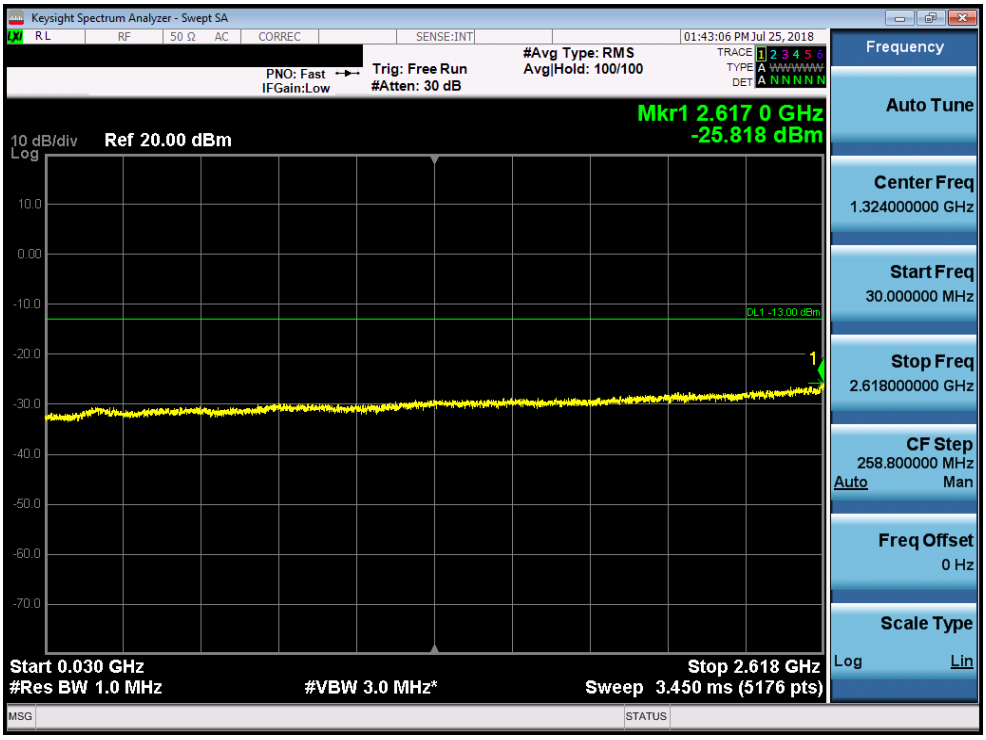


Plot 7-132. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Mid Channel)



Plot 7-133. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Mid Channel)

Plot 7-134. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Mid Channel)

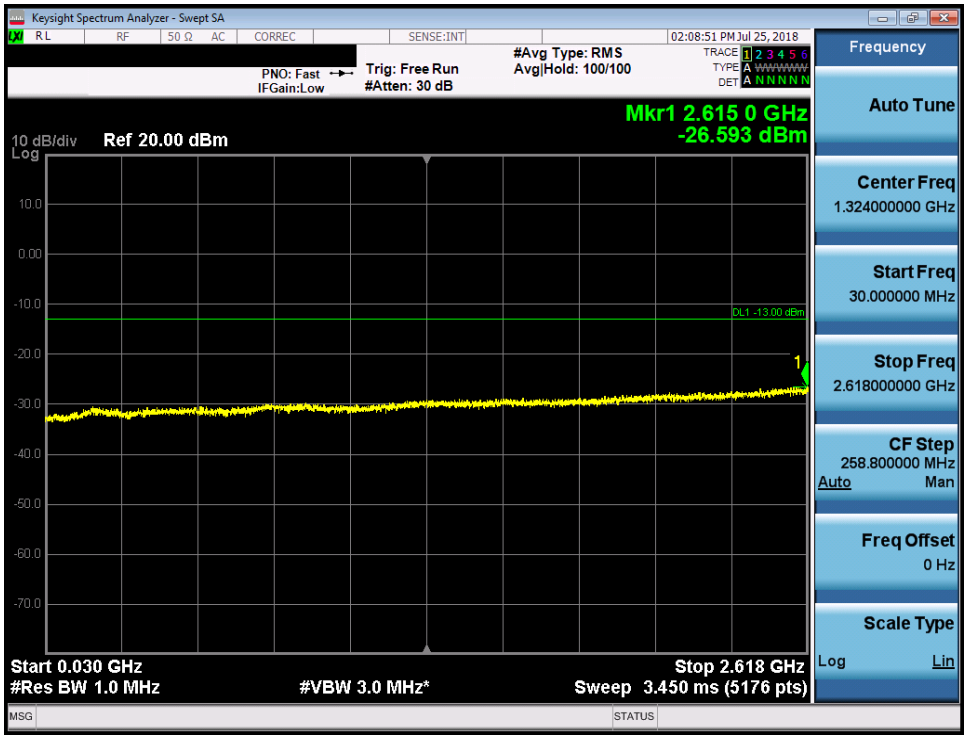


Plot 7-135. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – High Channel)

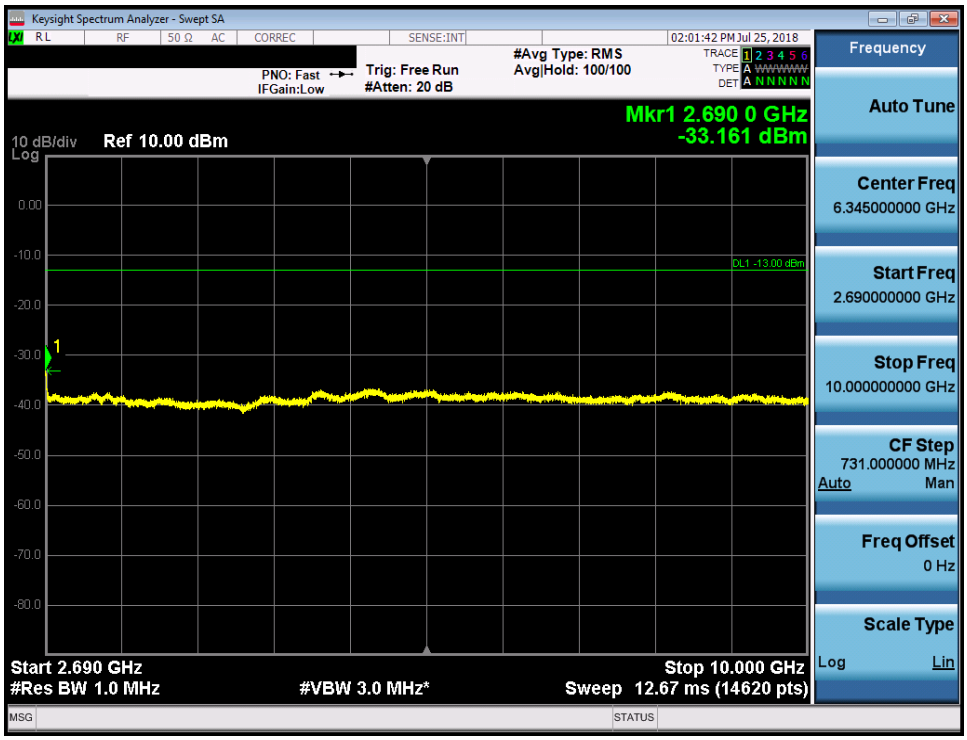
Plot 7-136. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – High Channel)

Plot 7-137. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – High Channel)

Band 7 – Antenna 2

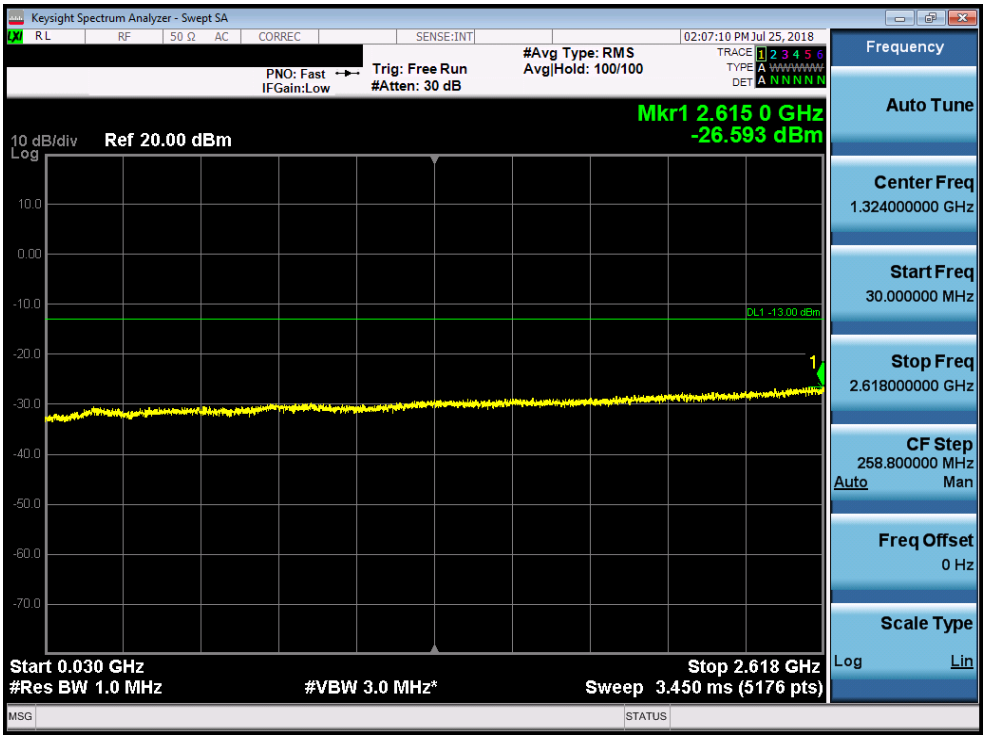


Plot 7-138. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Low Channel)

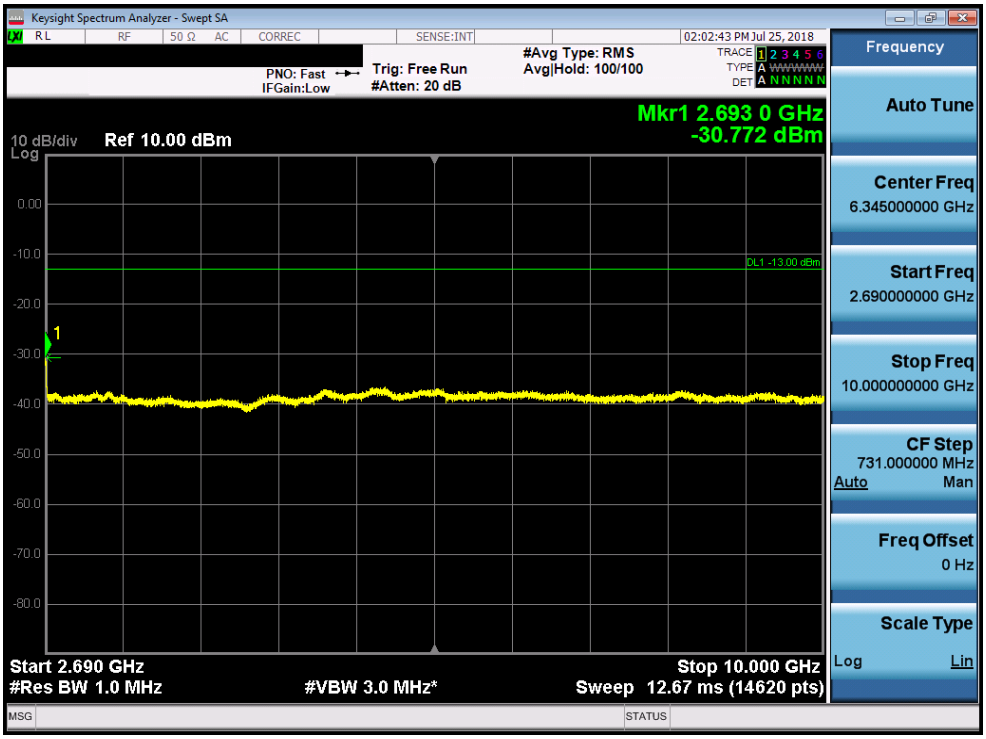


Plot 7-139. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Low Channel)

Plot 7-140. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Low Channel)

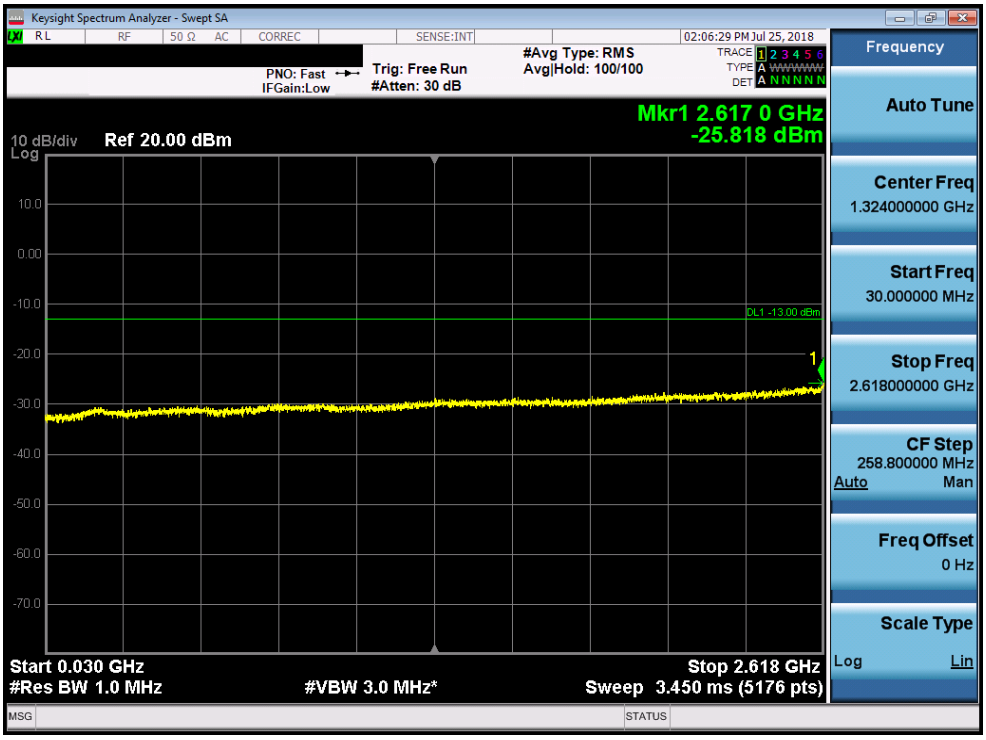


Plot 7-141. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Mid Channel)



Plot 7-142. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Mid Channel)

Plot 7-143. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – Mid Channel)



Plot 7-144. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – High Channel)

Plot 7-145. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – High Channel)

Plot 7-146. Conducted Spurious Plot (Band 7 - 10.0MHz QPSK – High Channel)

7.5 Out-of-Band Emissions at the Band Edge

§2.1051 §27.53(m)

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 its maximum duty cycle, 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 + $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

ANSI C63.26-2015 Section 6.4.4.1

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.

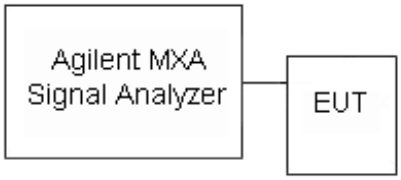


Figure 7-3. Test Instrument & Measurement Setup

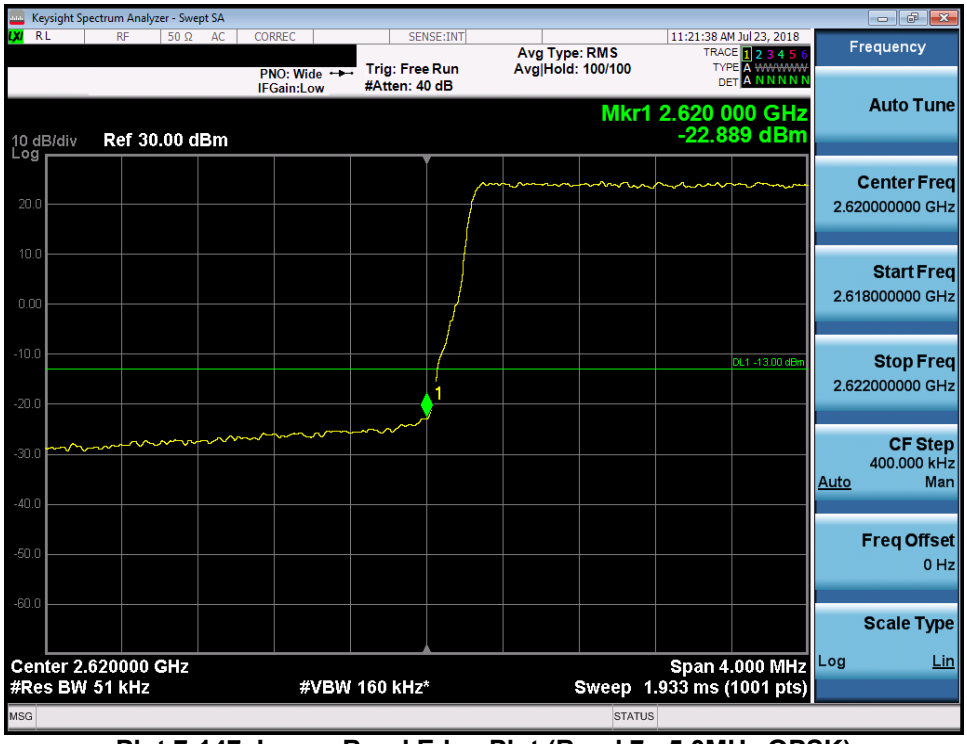
Test Notes

Per 27.53(m)(6) 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.

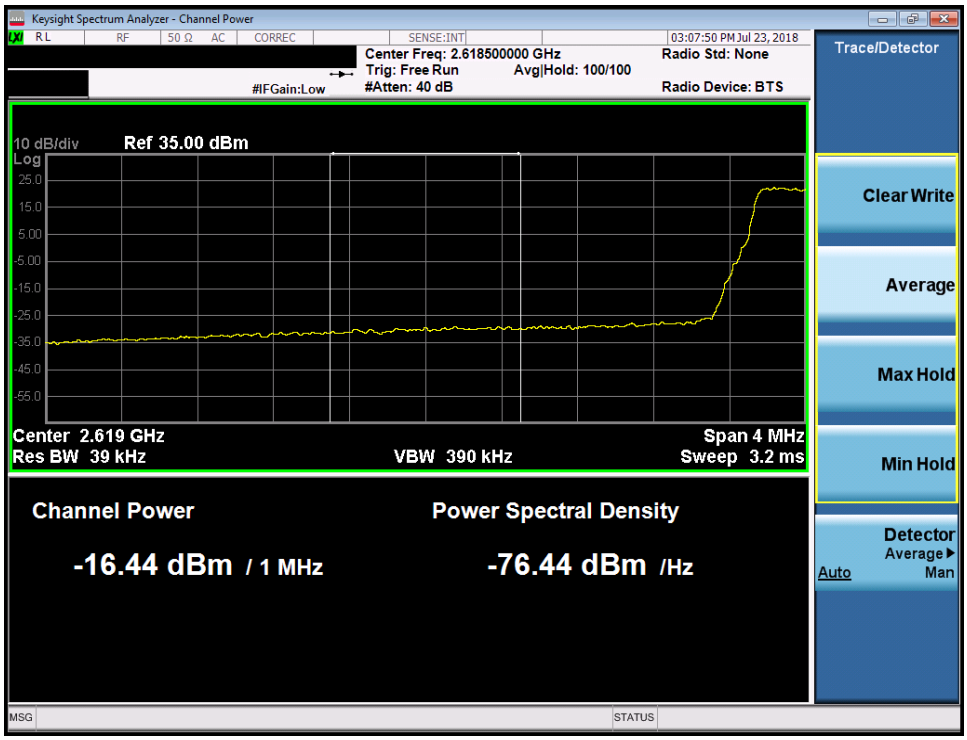
The plots shown in this section address compliance of each individual antenna to the Part 27.53(m) spurious emission limits at the band edge. Per ANSI C63.26-2015 Section 6.4.4.1, spurious emission compliance for MIMO operation is addressed by the "Measure and sum spectral maxima across the outputs" technique. Final MIMO measurement results are shown at the end of this section.

Several of the plots in this section show an “*” next to the VBW measurement. Since the measurements are all performed with an RMS detector, the spectrum analyzer is not using the VBW filters and, thus, the VBW setting is not critical for these measurements.

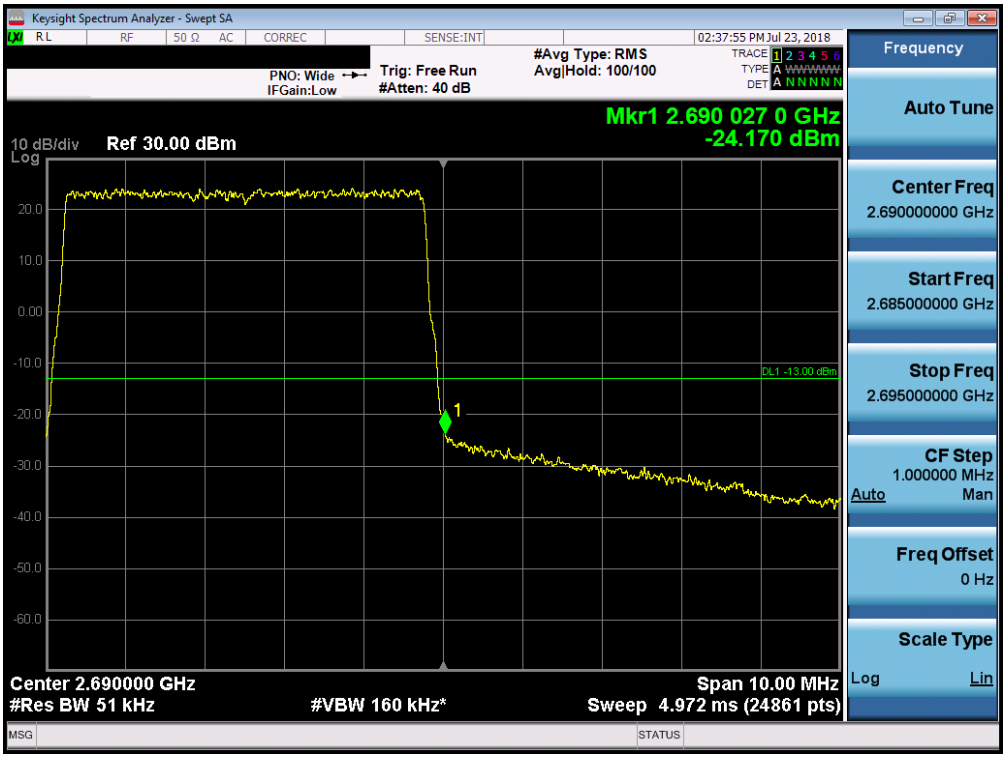
Band 7 – Antenna 1



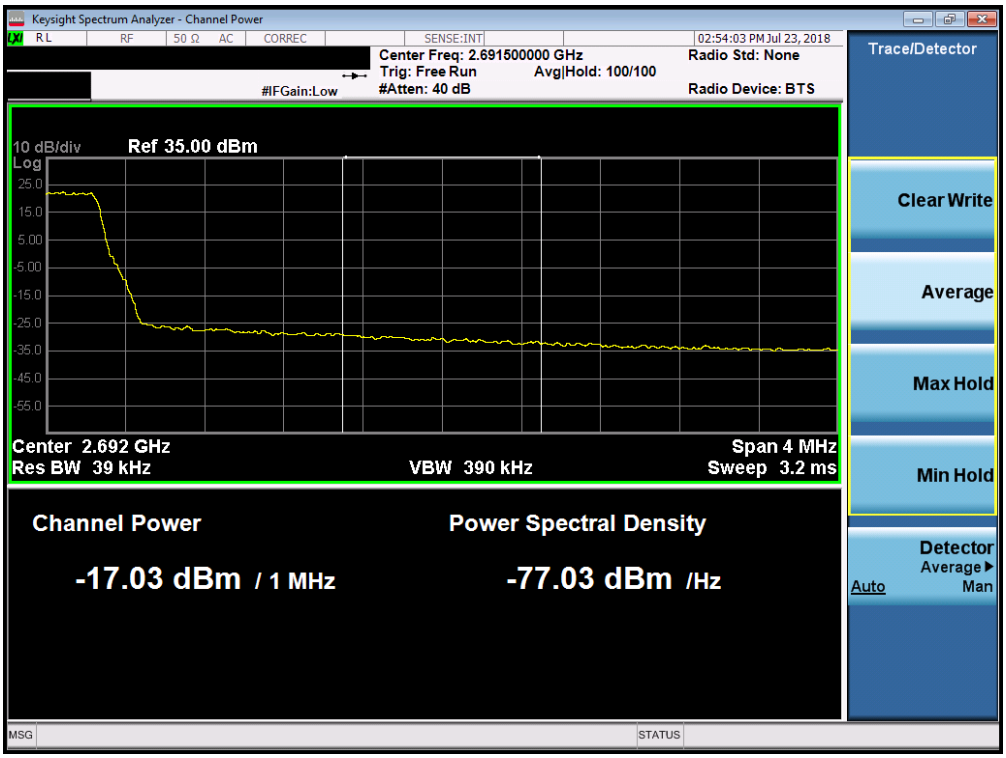
Plot 7-147. Lower Band Edge Plot (Band 7 - 5.0MHz QPSK)



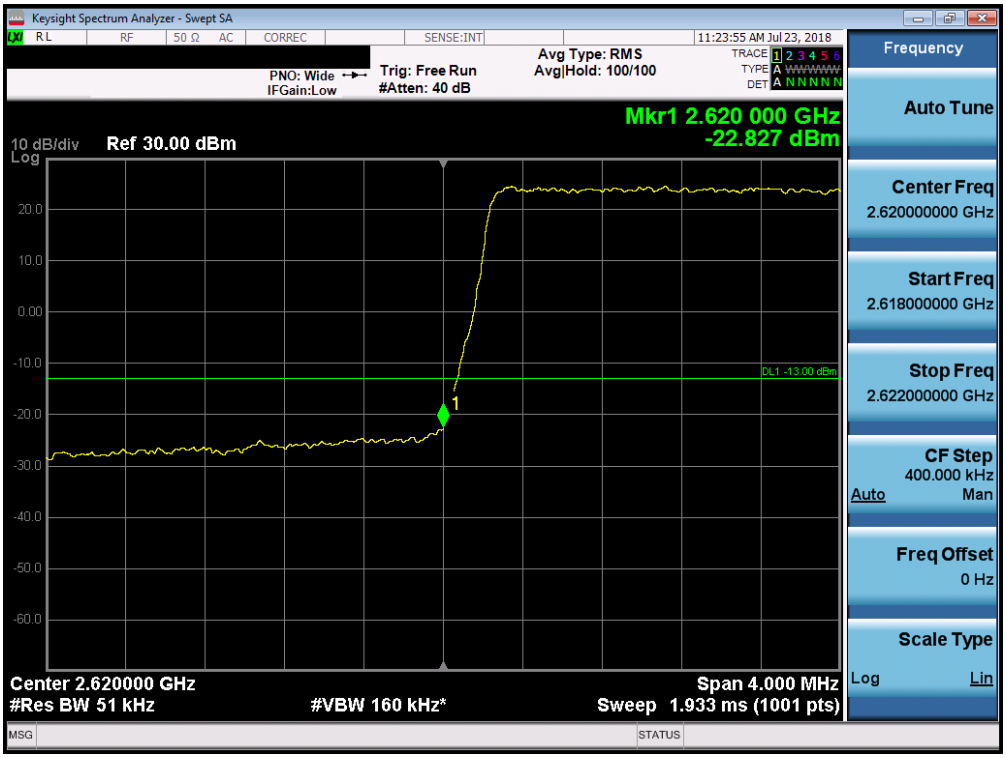
Plot 7-148. Lower Extended Band Edge Plot (Band 7 - 5.0MHz QPSK)



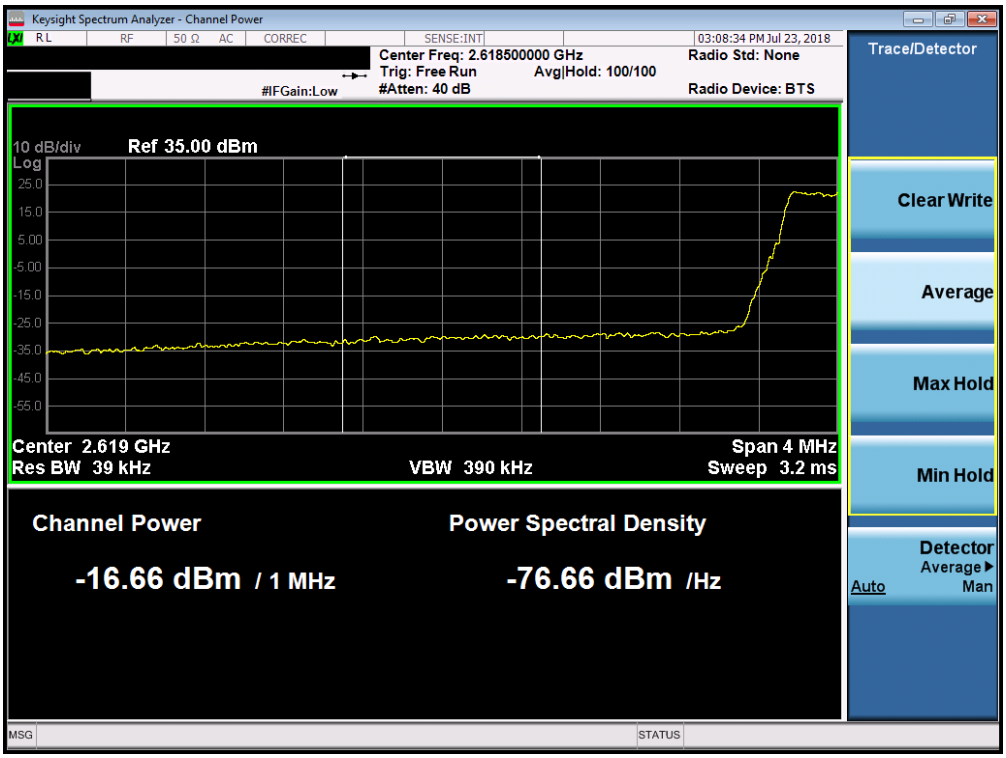
Plot 7-149. Upper Band Edge Plot (Band 7 - 5.0MHz QPSK)



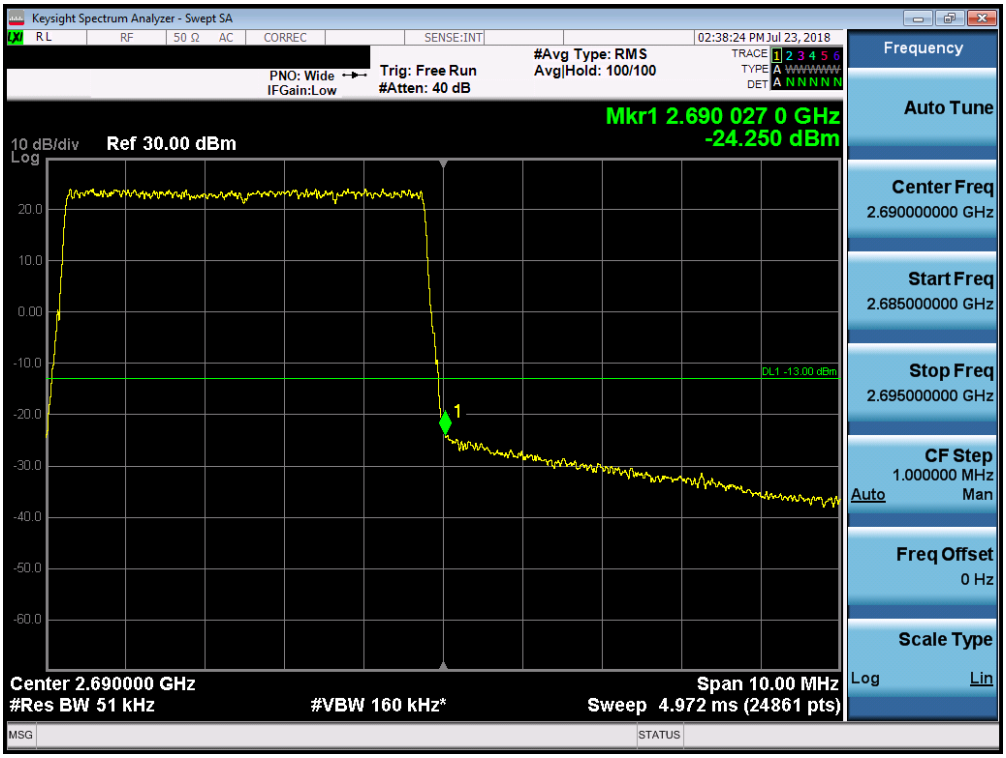
Plot 7-150. Upper Extended Band Edge Plot (Band 7 - 5.0MHz QPSK)



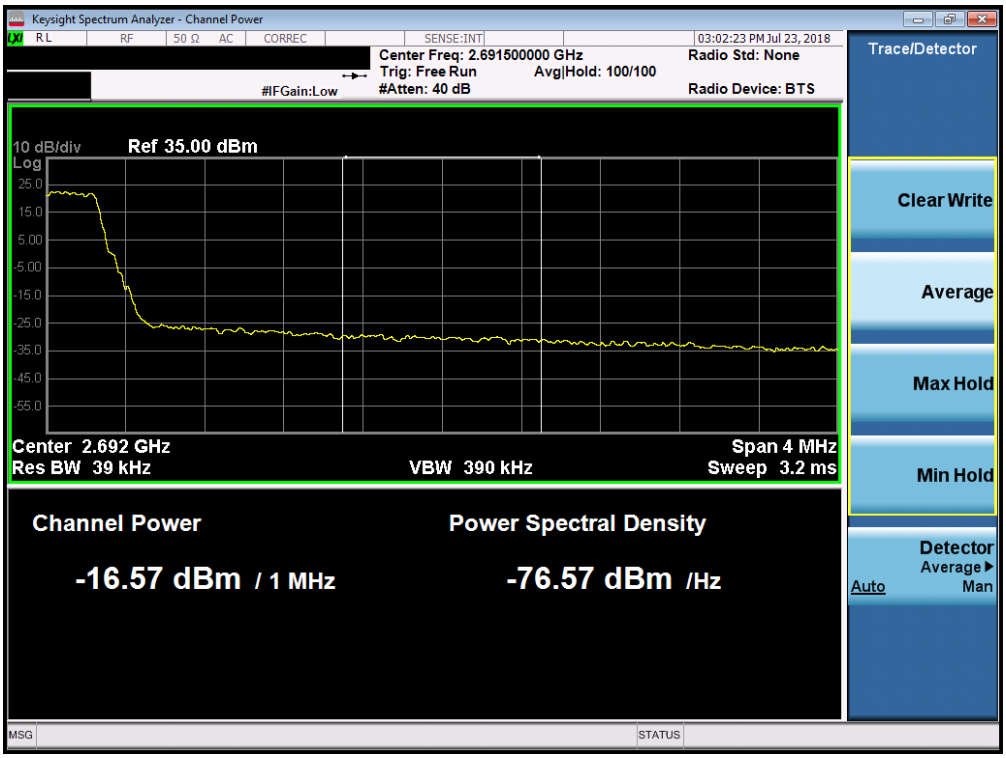
Plot 7-151. Lower Band Edge Plot (Band 7 - 5.0MHz 16-QAM)



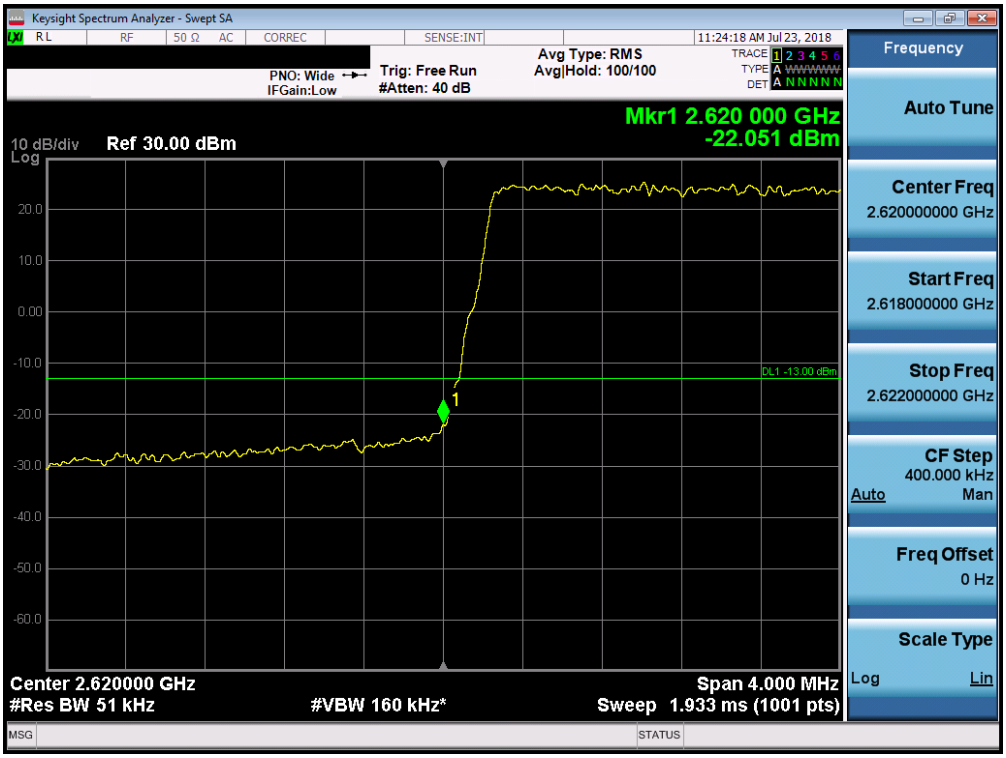
Plot 7-152. Lower Extended Band Edge Plot (Band 7 - 5.0MHz 16-QAM)



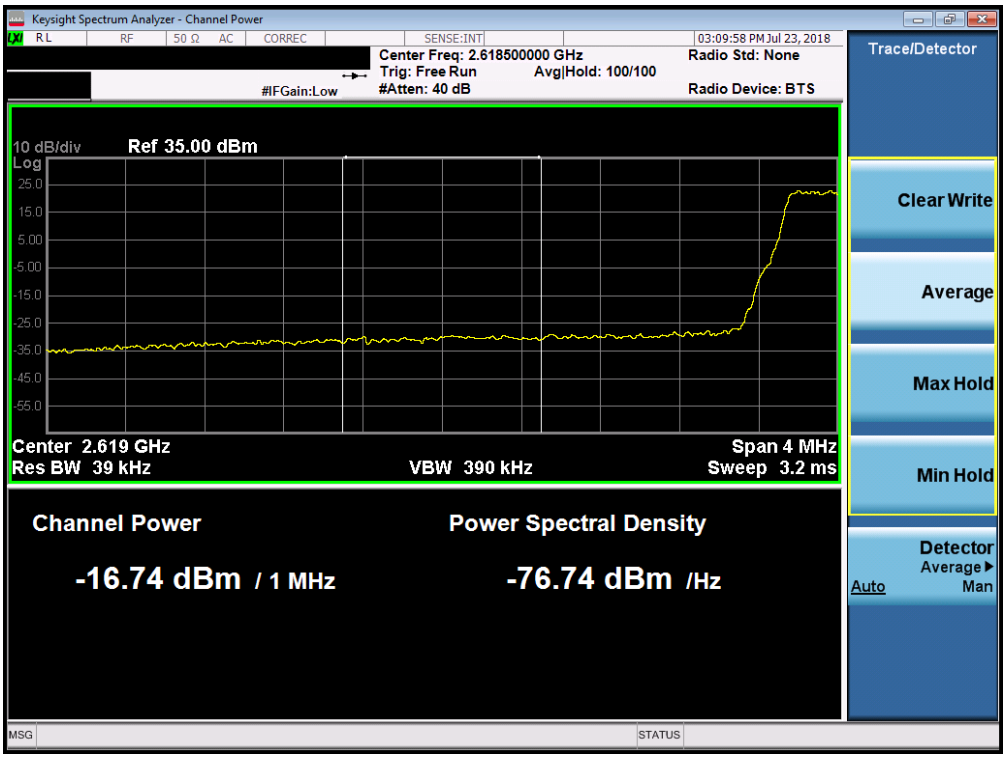
Plot 7-153. Upper Band Edge Plot (Band 7 - 5.0MHz 16-QAM)



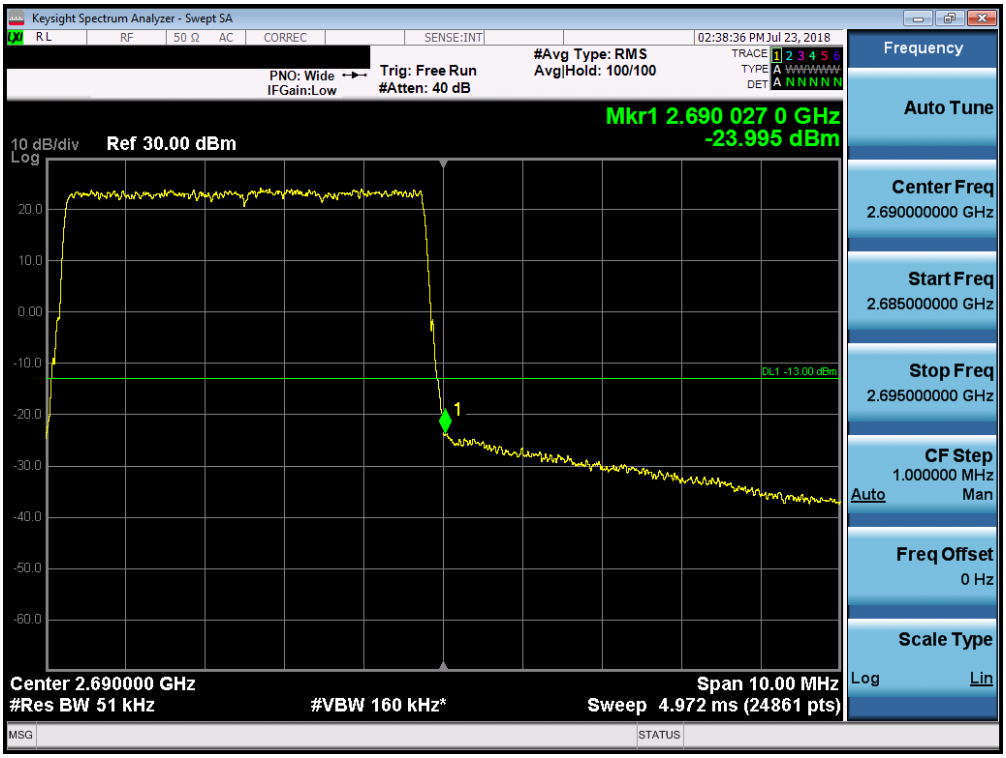
Plot 7-154. Upper Extended Band Edge Plot (Band 7 - 5.0MHz 16-QAM)



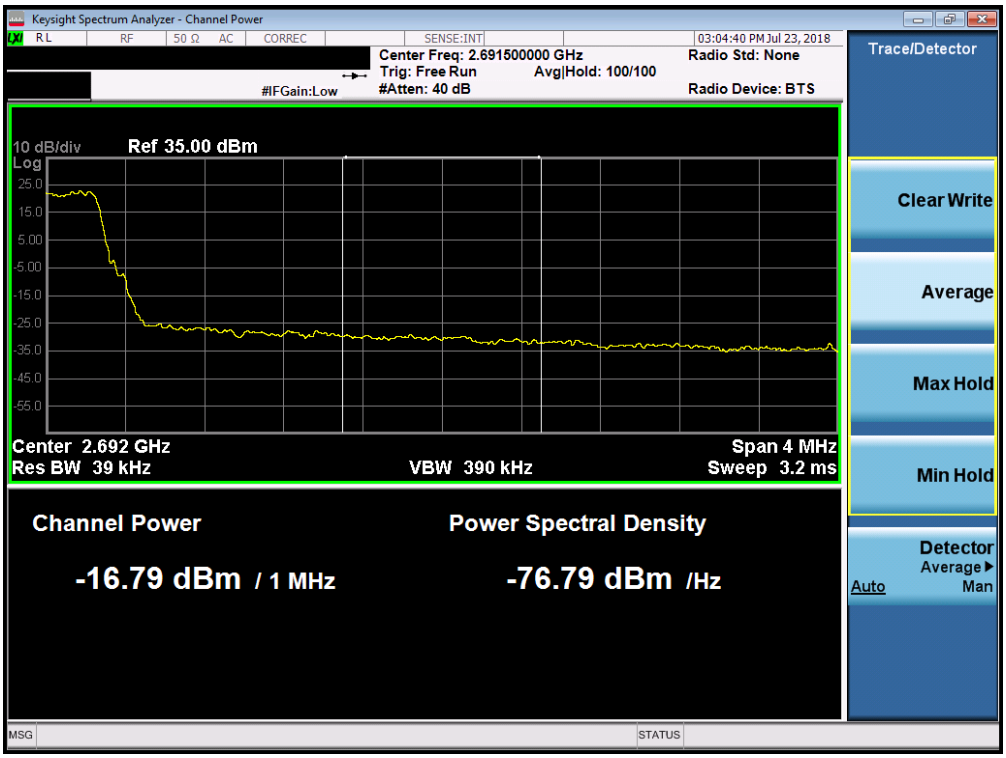
Plot 7-155. Lower Band Edge Plot (Band 7 - 5.0MHz 64-QAM)



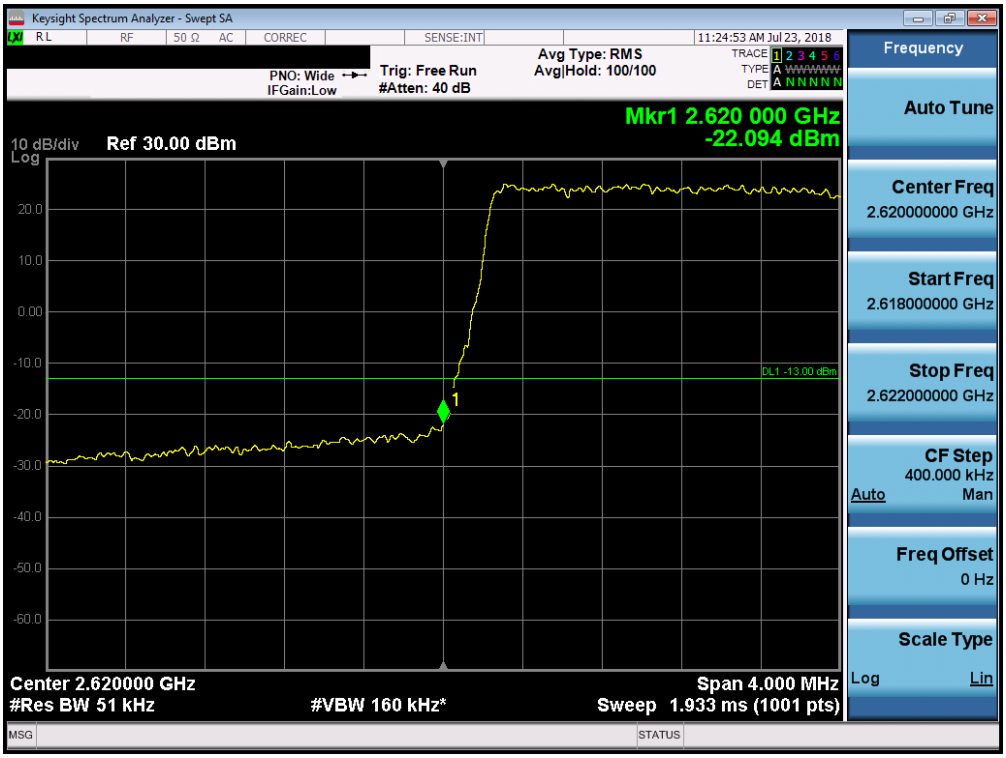
Plot 7-156. Lower Extended Band Edge Plot (Band 7 - 5.0MHz 64-QAM)



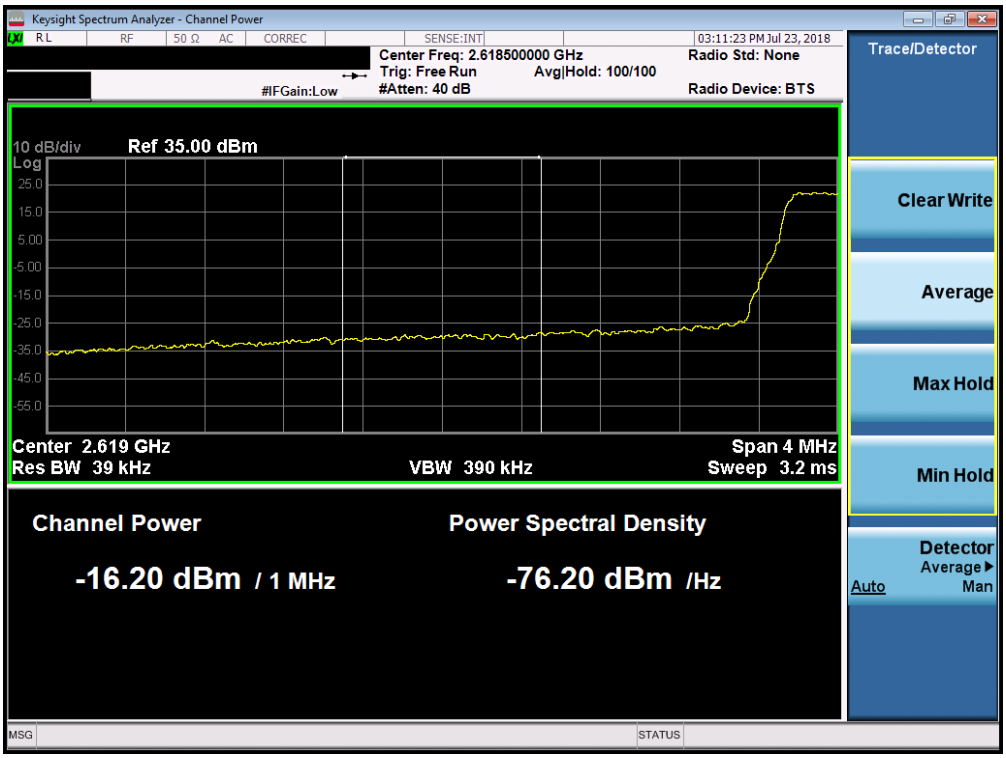
Plot 7-157. Upper Band Edge Plot (Band 7 - 5.0MHz 64-QAM)



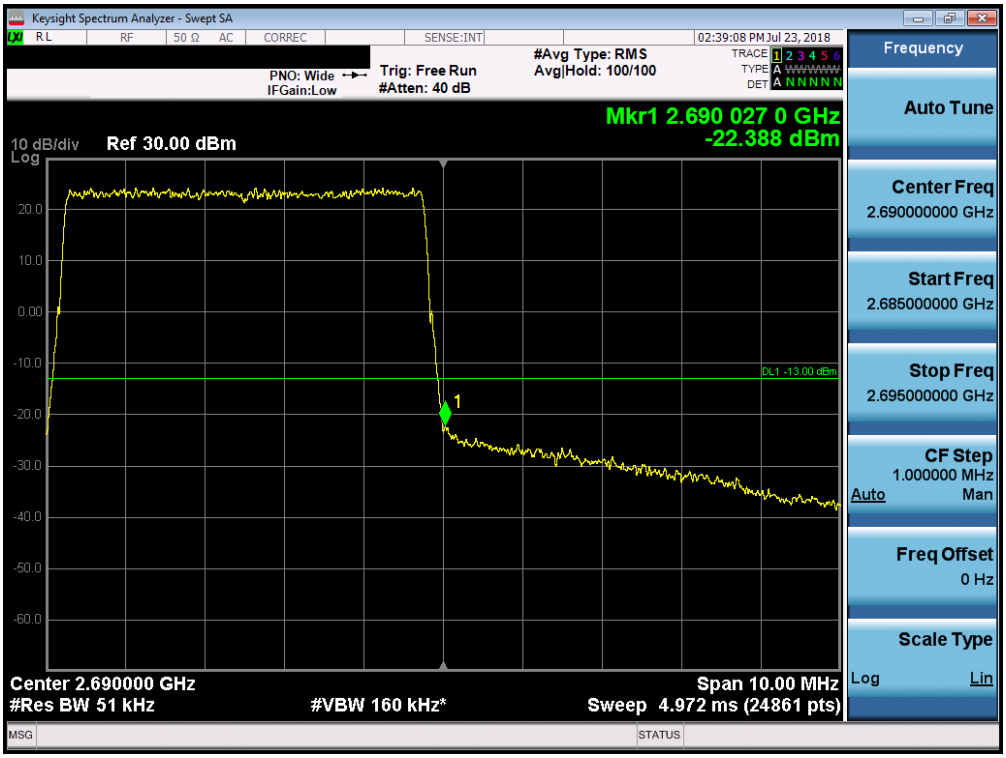
Plot 7-158. Upper Extended Band Edge Plot (Band 7 - 5.0MHz 64-QAM)



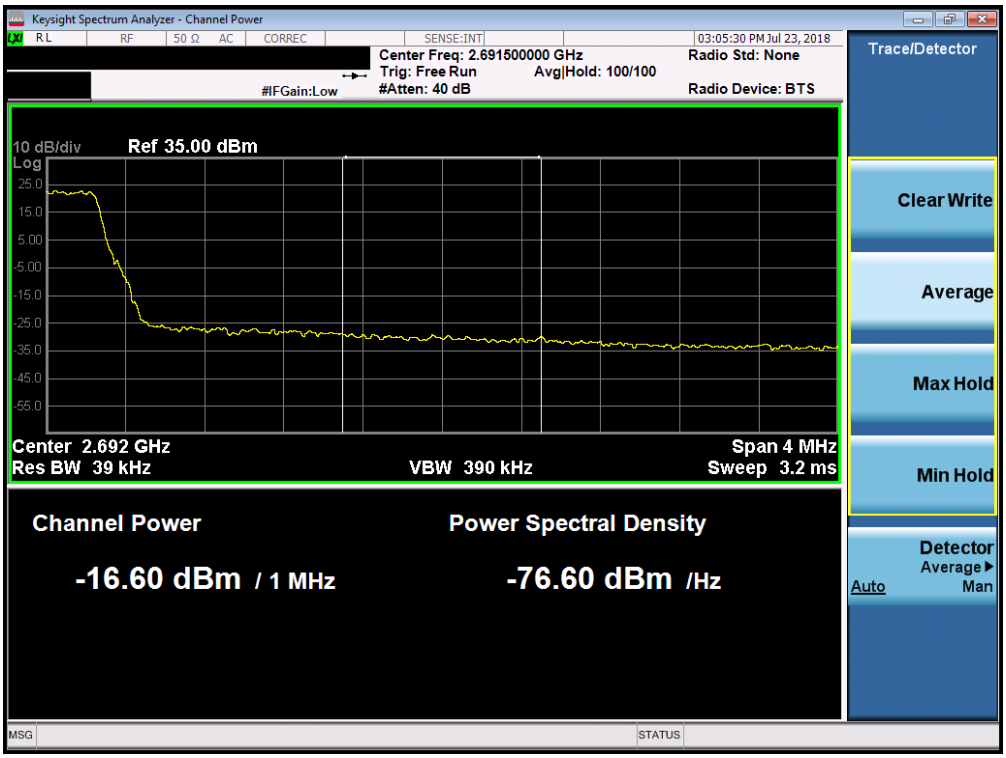
Plot 7-159. Lower Band Edge Plot (Band 7 - 5.0MHz 256-QAM)



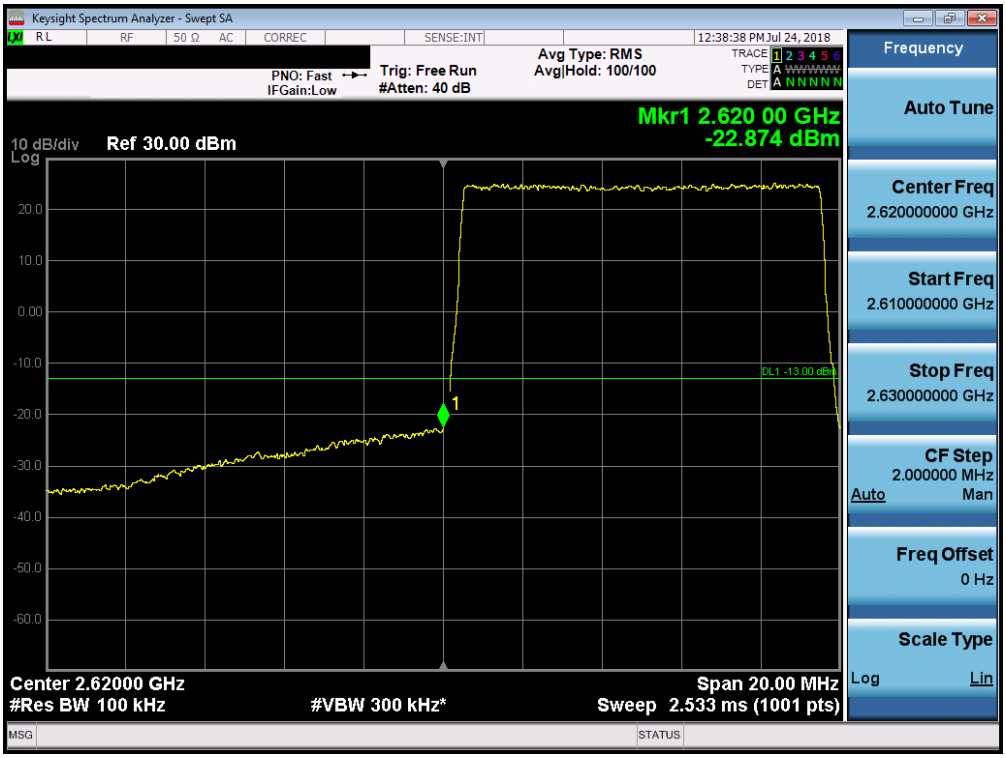
Plot 7-160. Lower Extended Band Edge Plot (Band 7 - 5.0MHz 256-QAM)



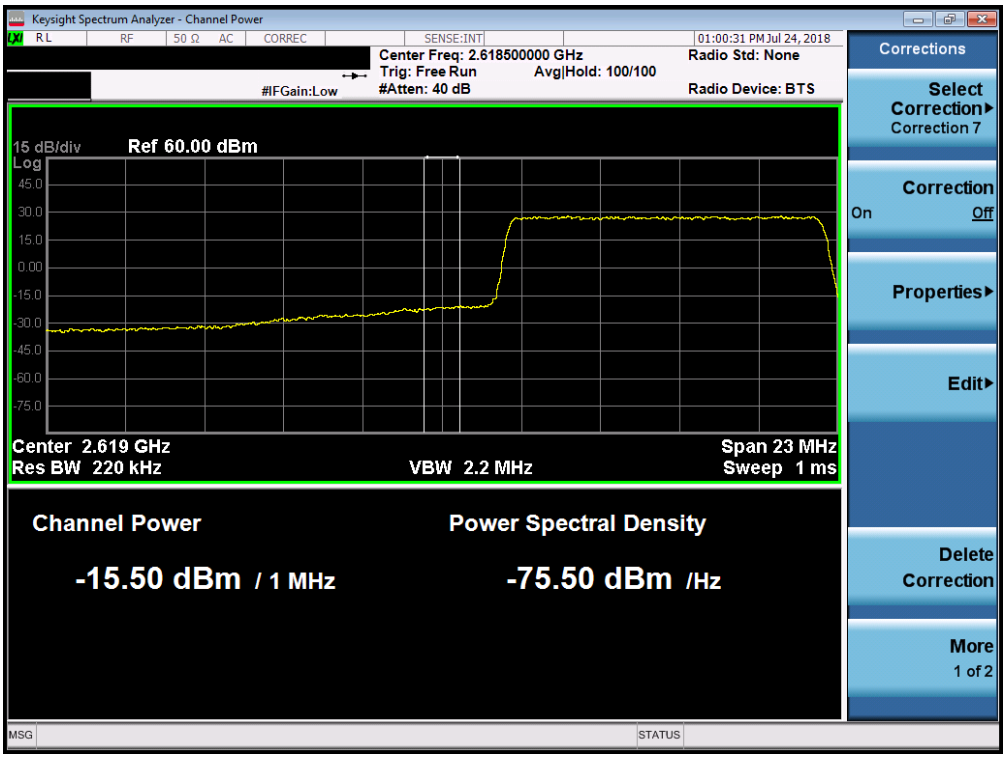
Plot 7-161. Upper Band Edge Plot (Band 7 - 5.0MHz 256-QAM)



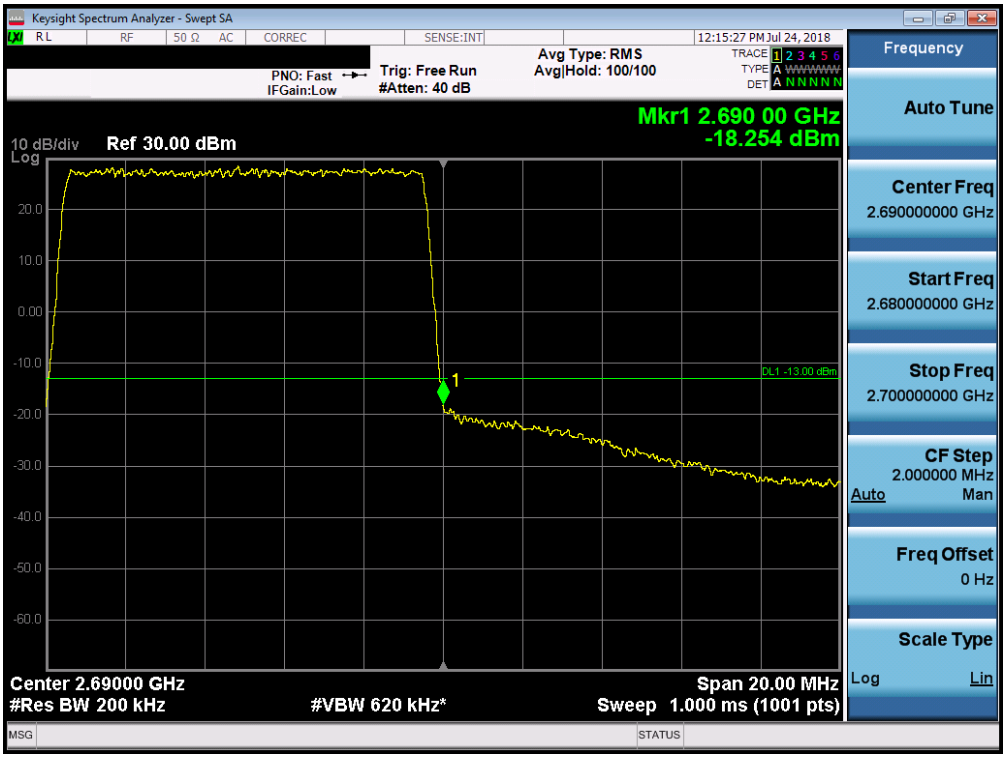
Plot 7-162. Upper Extended Band Edge Plot (Band 7 - 5.0MHz 256-QAM)



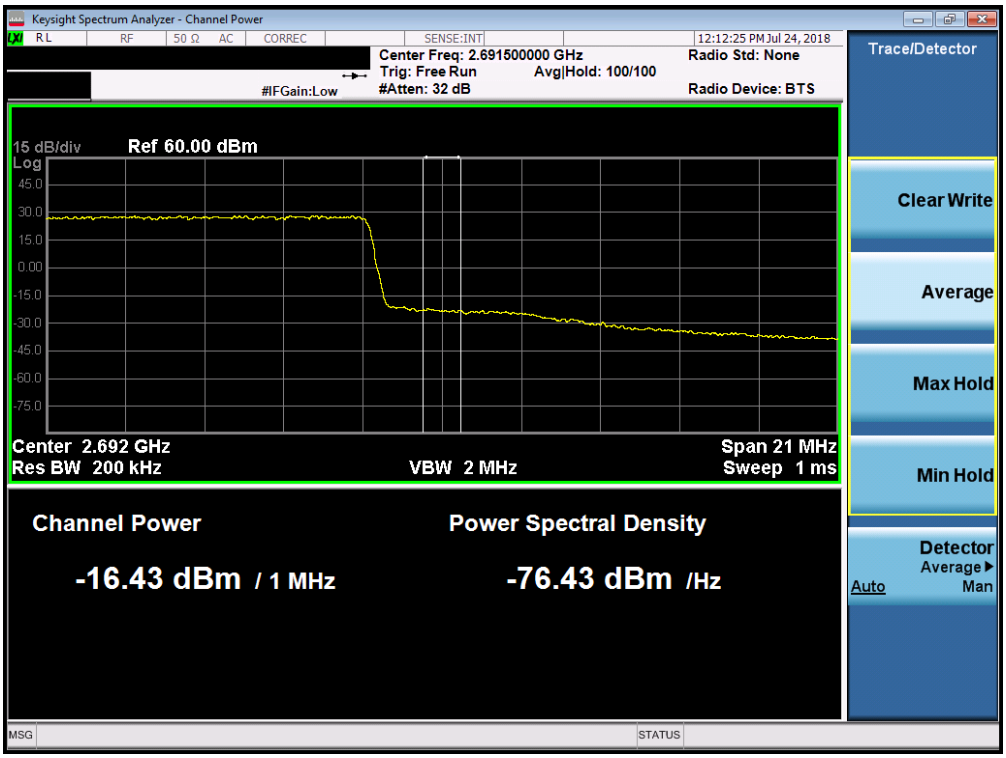
Plot 7-163. Lower Band Edge Plot (Band 7 - 10.0MHz QPSK)



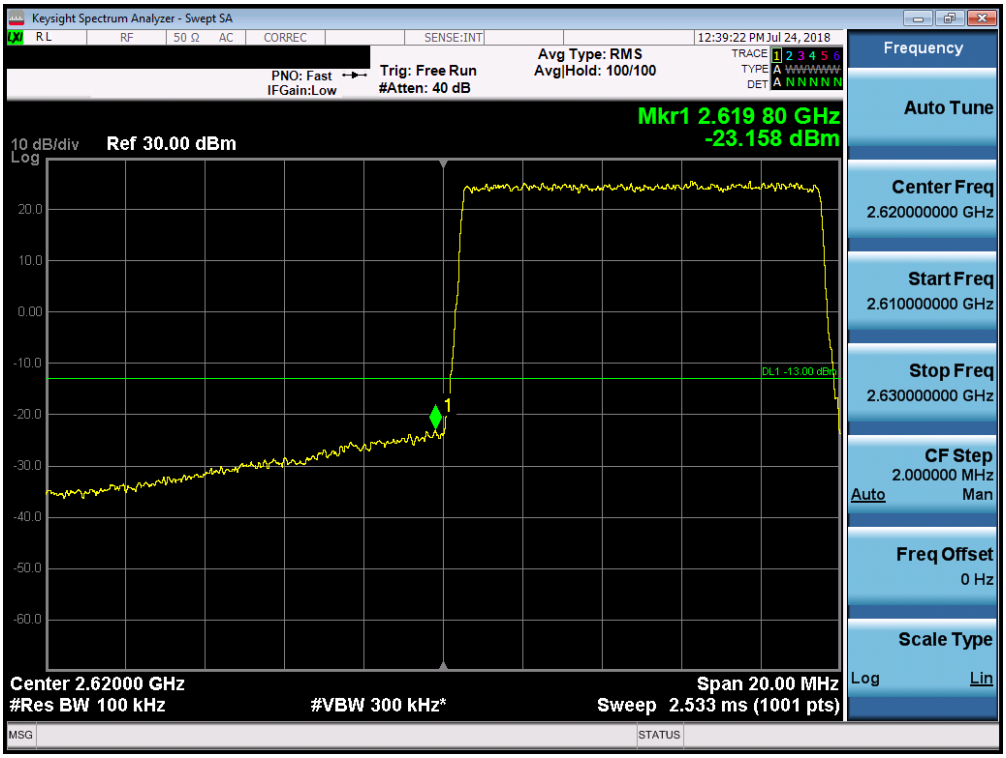
Plot 7-164. Lower Extended Band Edge Plot (Band 7 - 10.0MHz QPSK)



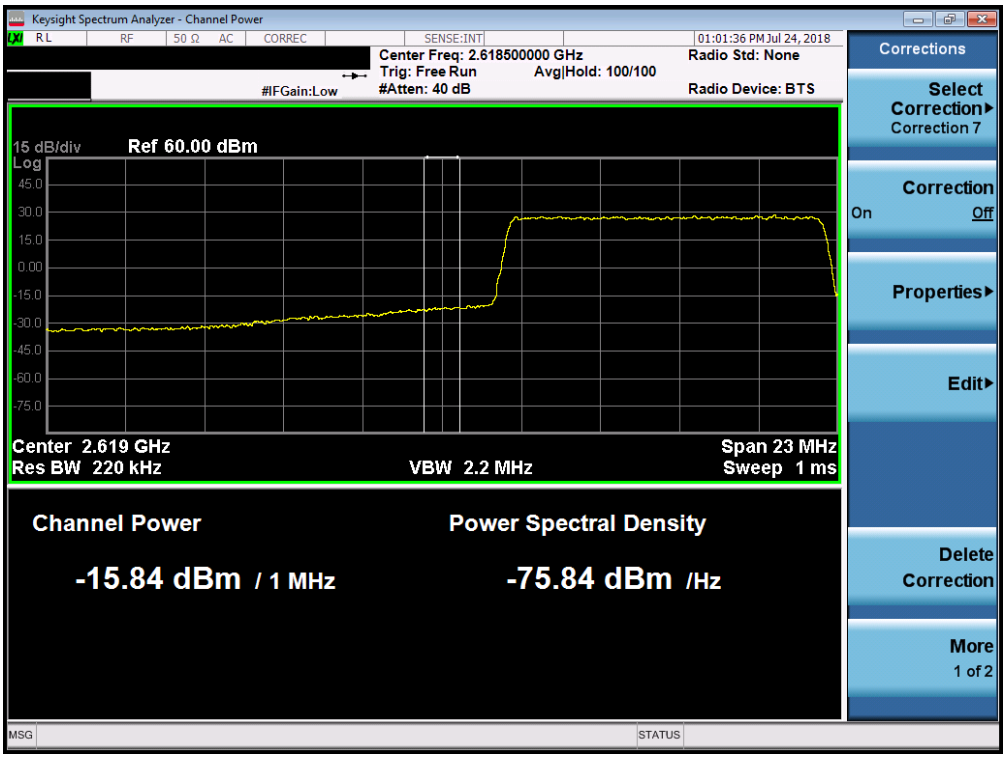
Plot 7-165. Upper Band Edge Plot (Band 7 - 10.0MHz QPSK)



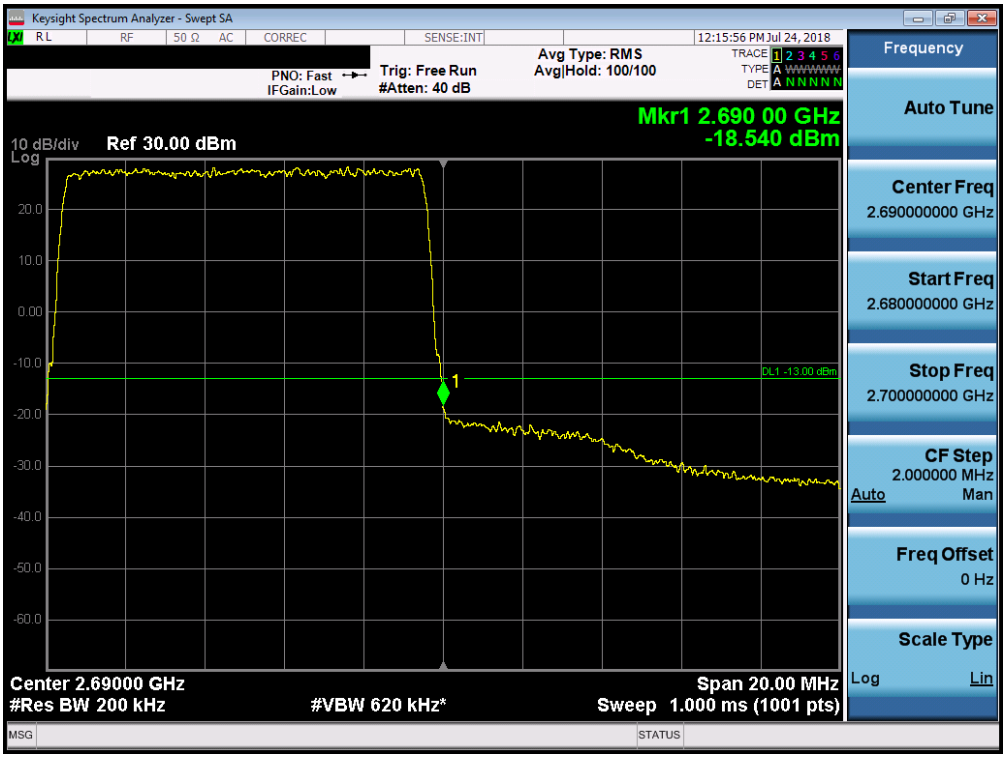
Plot 7-166. Upper Extended Band Edge Plot (Band 7 - 10.0MHz QPSK)



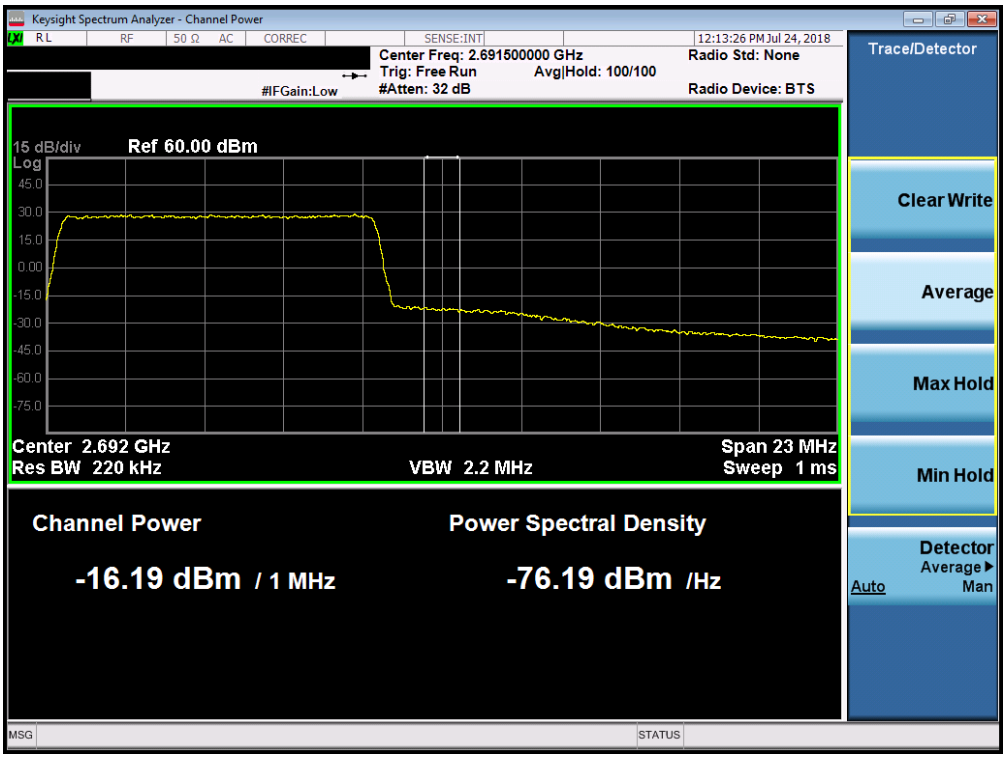
Plot 7-167. Lower Band Edge Plot (Band 7 - 10.0MHz 16-QAM)



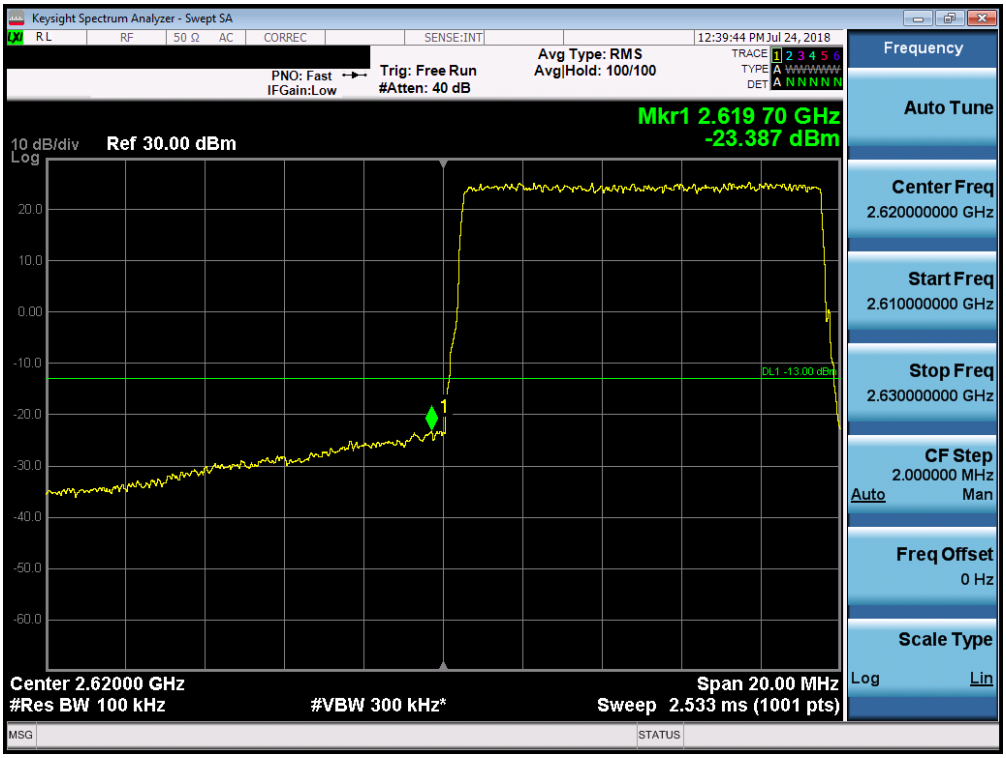
Plot 7-168. Lower Extended Band Edge Plot (Band 7 - 10.0MHz 16-QAM)



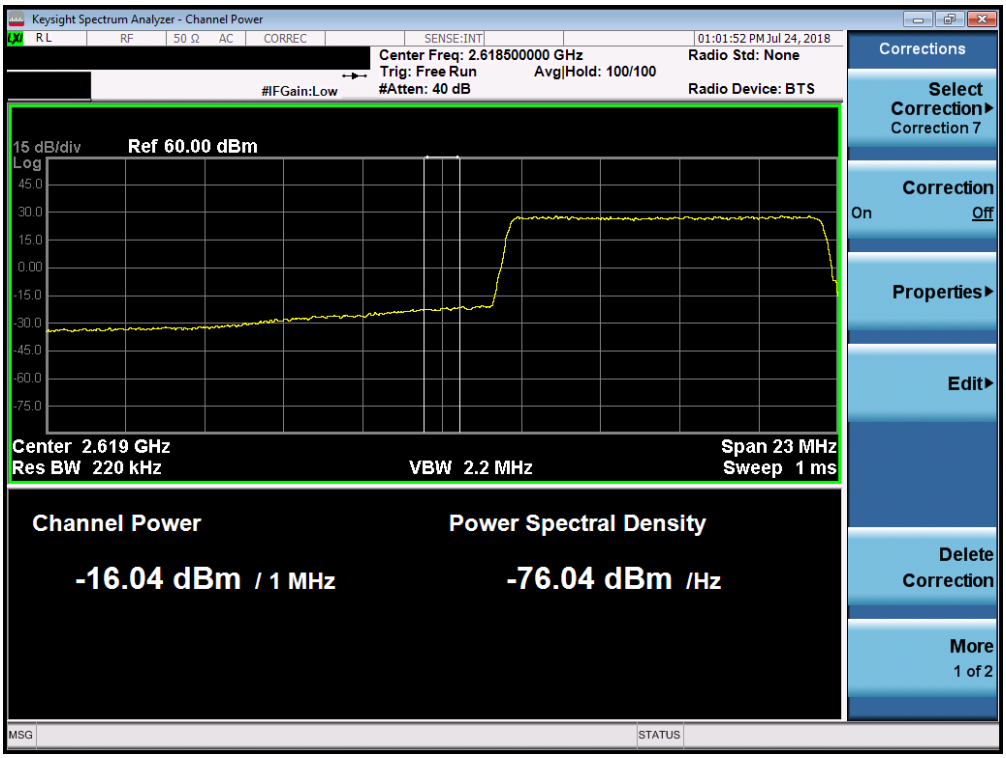
Plot 7-169. Upper Band Edge Plot (Band 7 - 10.0MHz 16-QAM)



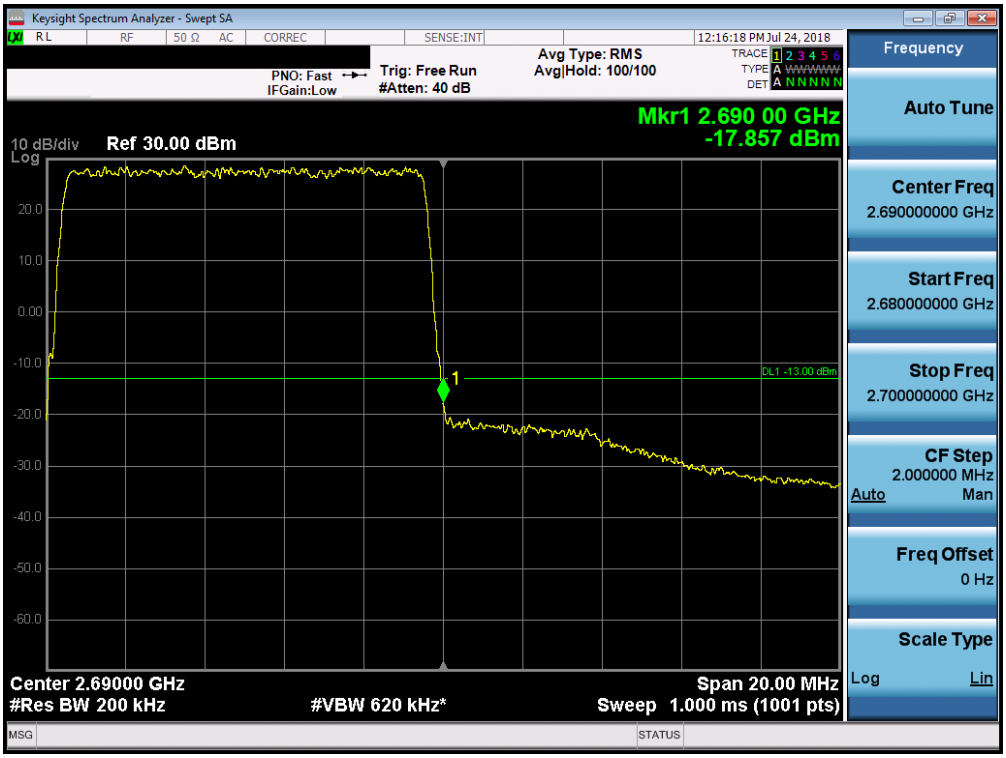
Plot 7-170. Upper Extended Band Edge Plot (Band 7 - 10.0MHz 16-QAM)



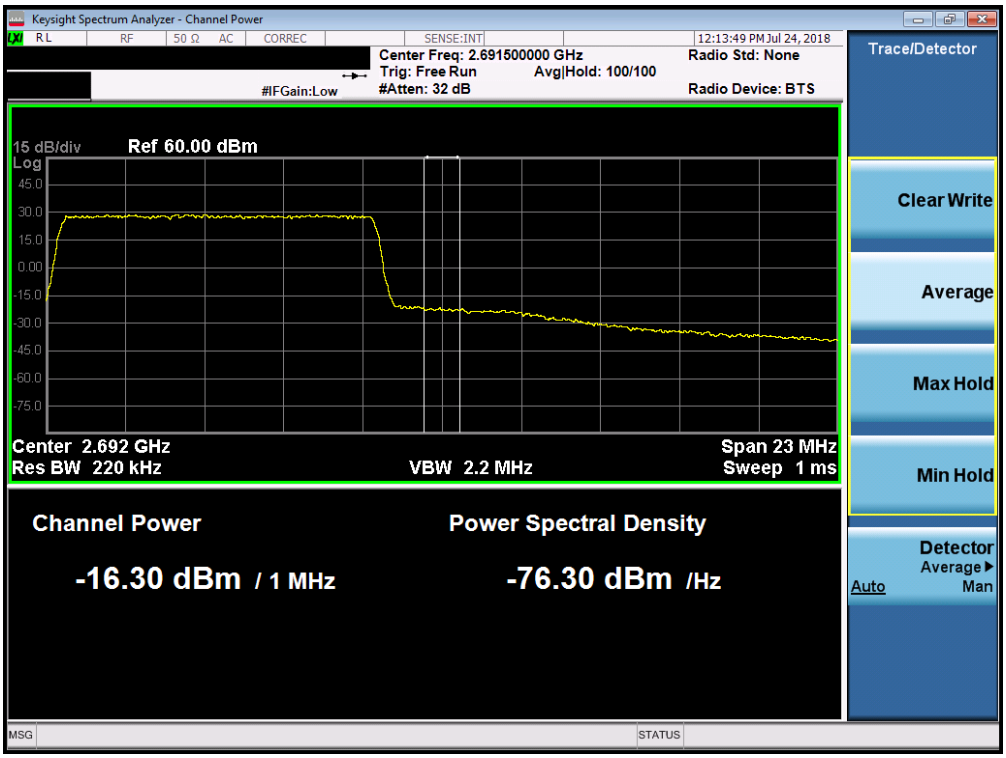
Plot 7-171. Lower Band Edge Plot (Band 7 - 10.0MHz 64-QAM)



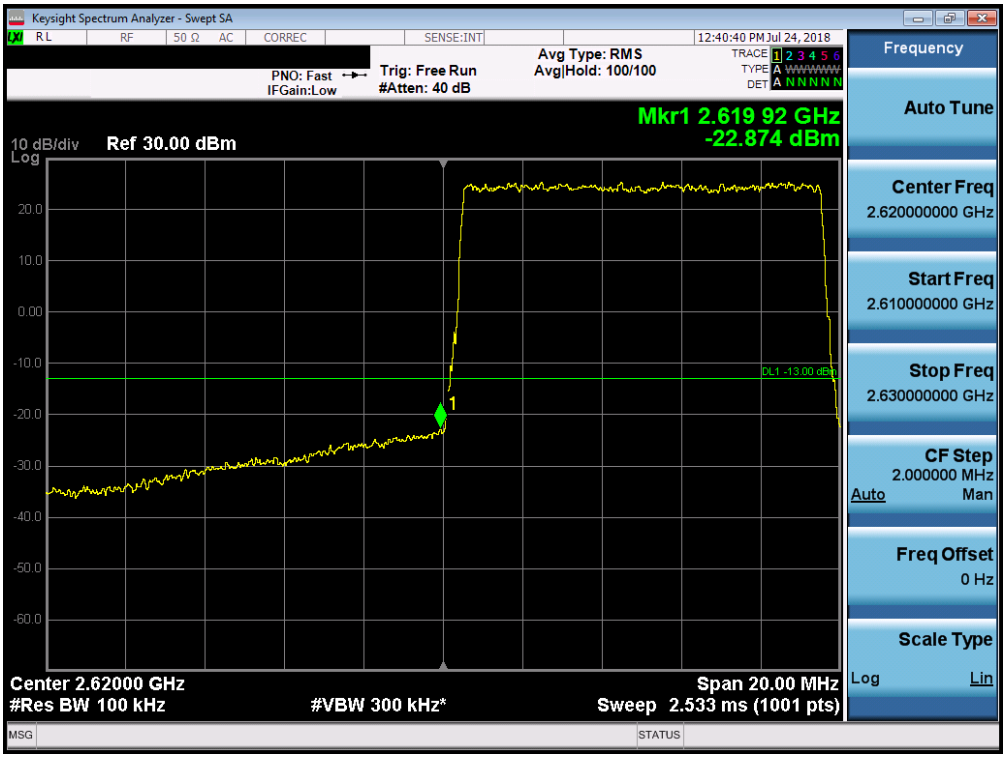
Plot 7-172. Lower Extended Band Edge Plot (Band 7 - 10.0MHz 64-QAM)



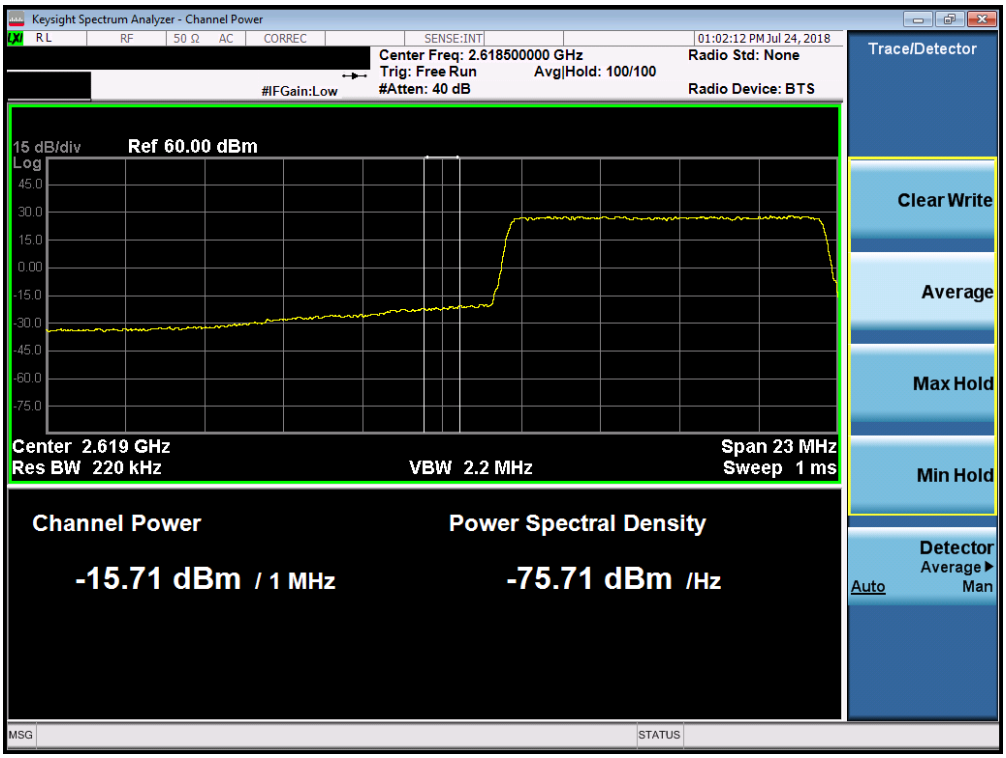
Plot 7-173. Upper Band Edge Plot (Band 7 - 10.0MHz 64-QAM)



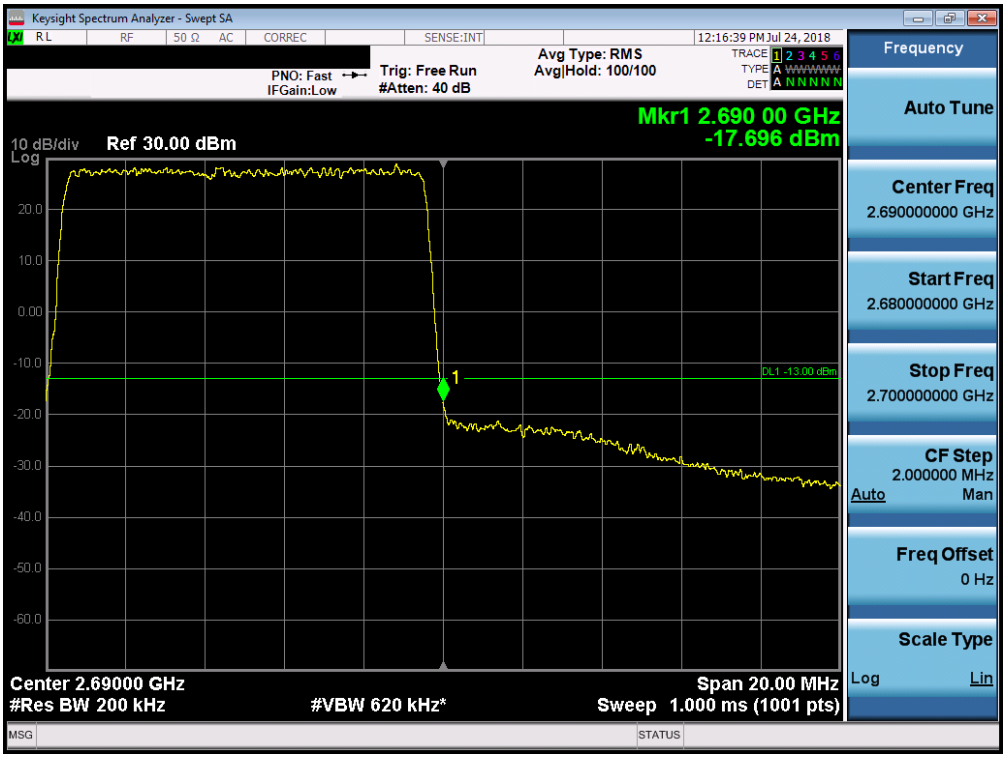
Plot 7-174. Upper Extended Band Edge Plot (Band 7 - 10.0MHz 64-QAM)



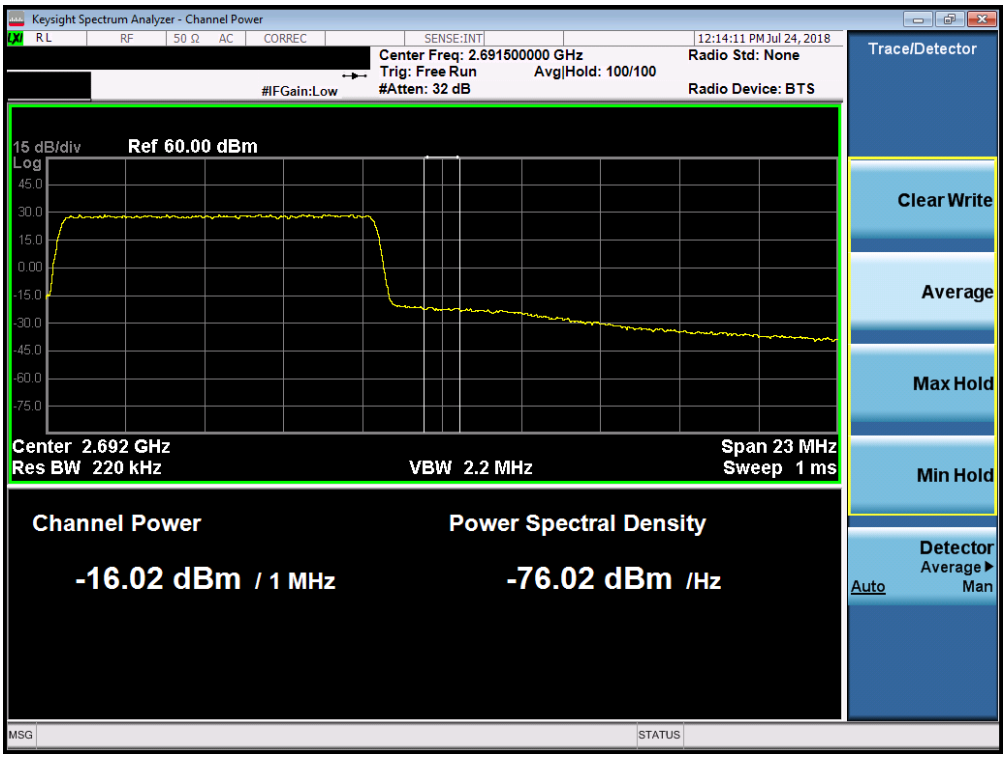
Plot 7-175. Lower Band Edge Plot (Band 7 - 10.0MHz 256-QAM)



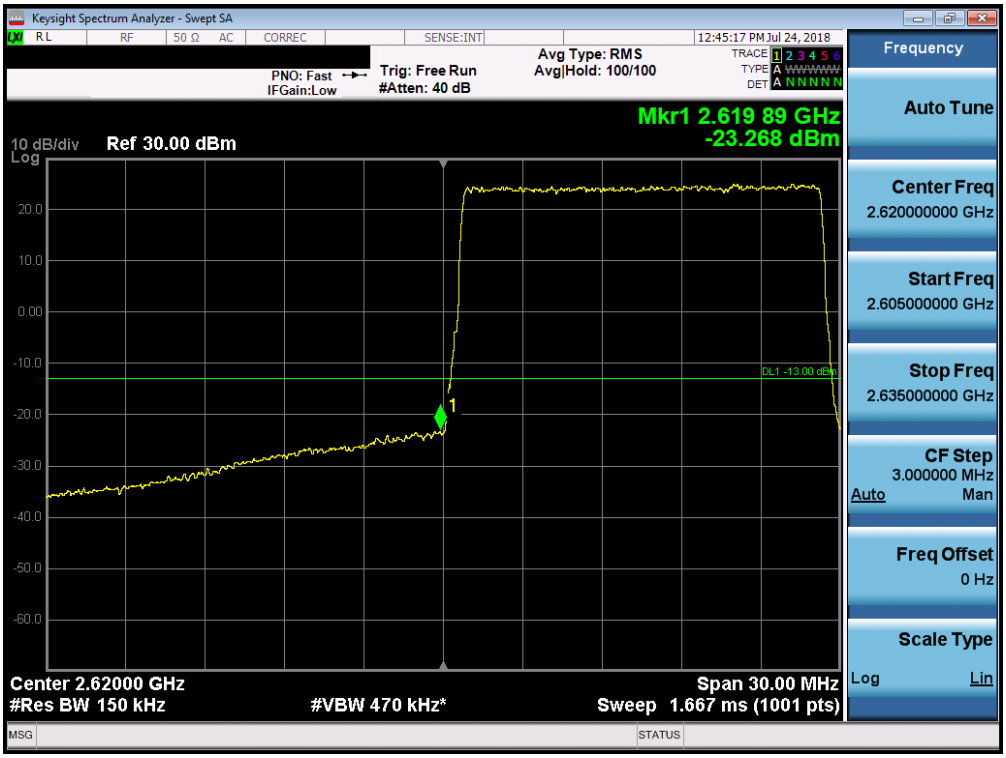
Plot 7-176. Lower Extended Band Edge Plot (Band 7 - 10.0MHz 256-QAM)



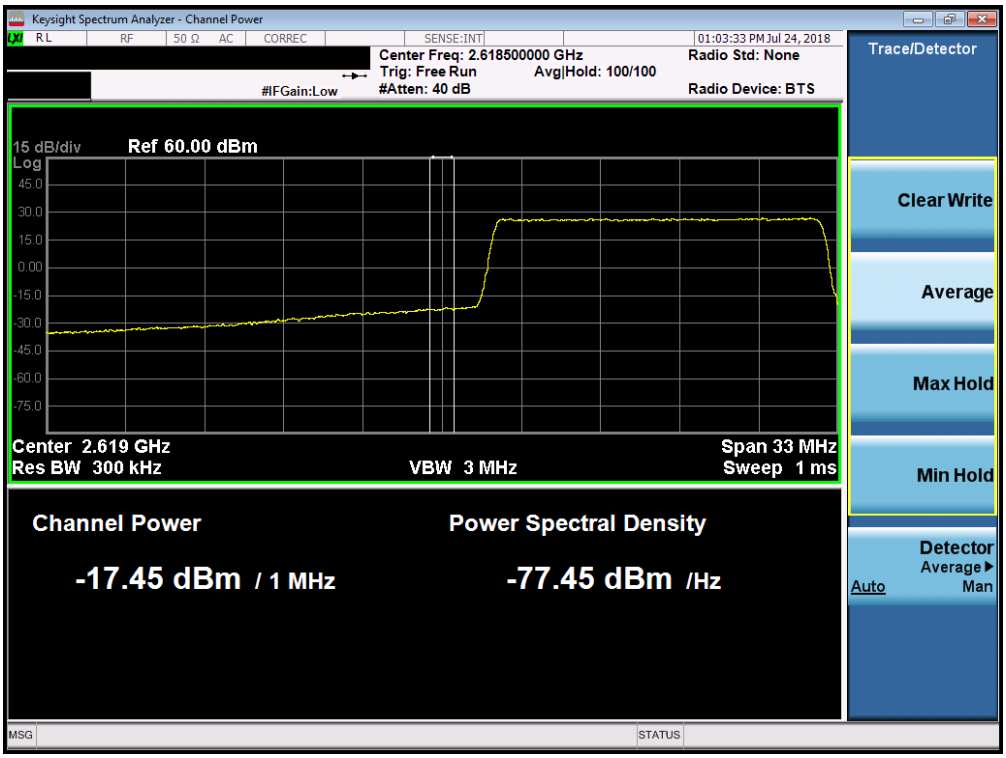
Plot 7-177. Upper Band Edge Plot (Band 7 - 10.0MHz 256-QAM)



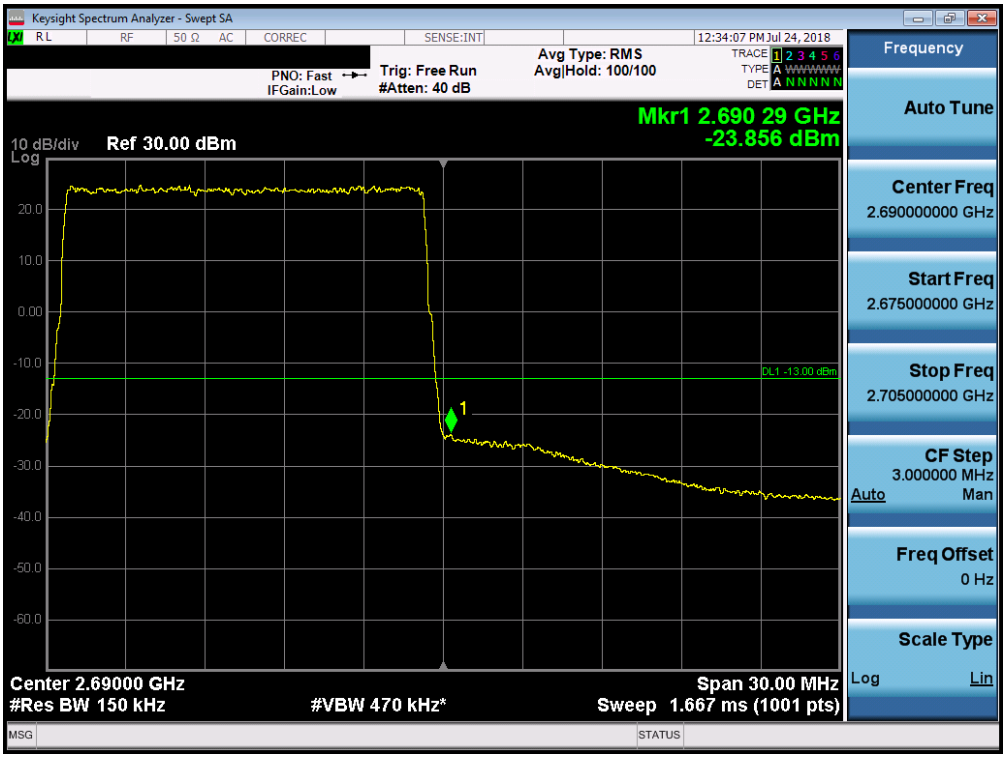
Plot 7-178. Upper Extended Band Edge Plot (Band 7 - 10.0MHz 256-QAM)



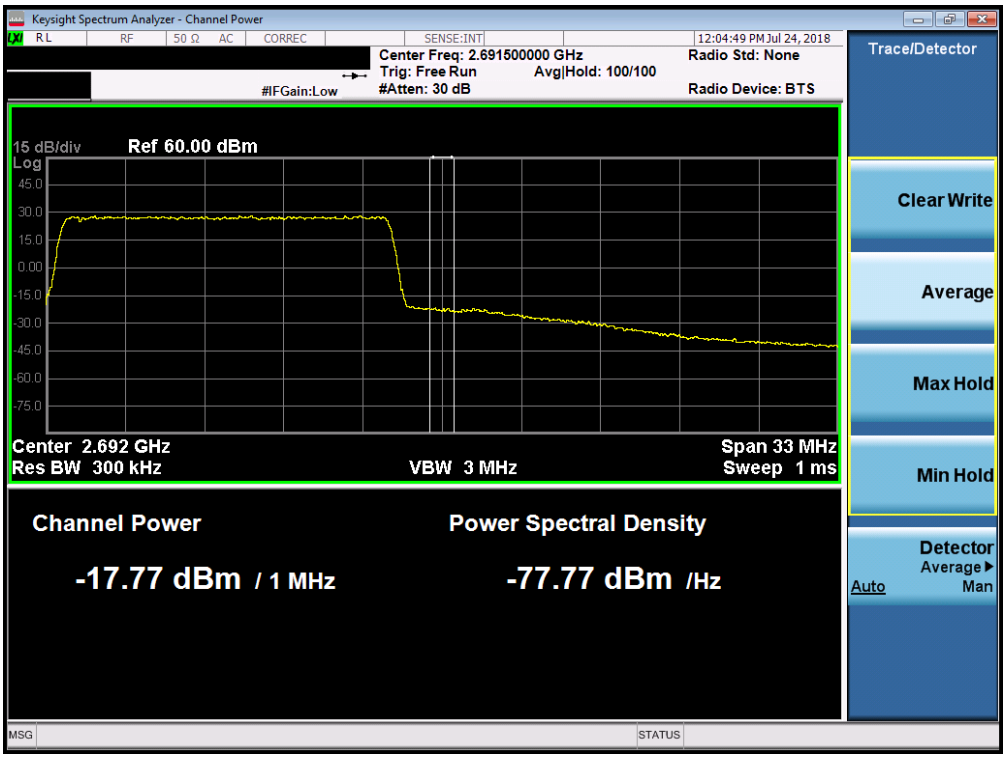
Plot 7-179. Lower Band Edge Plot (Band 7 - 15.0MHz QPSK)



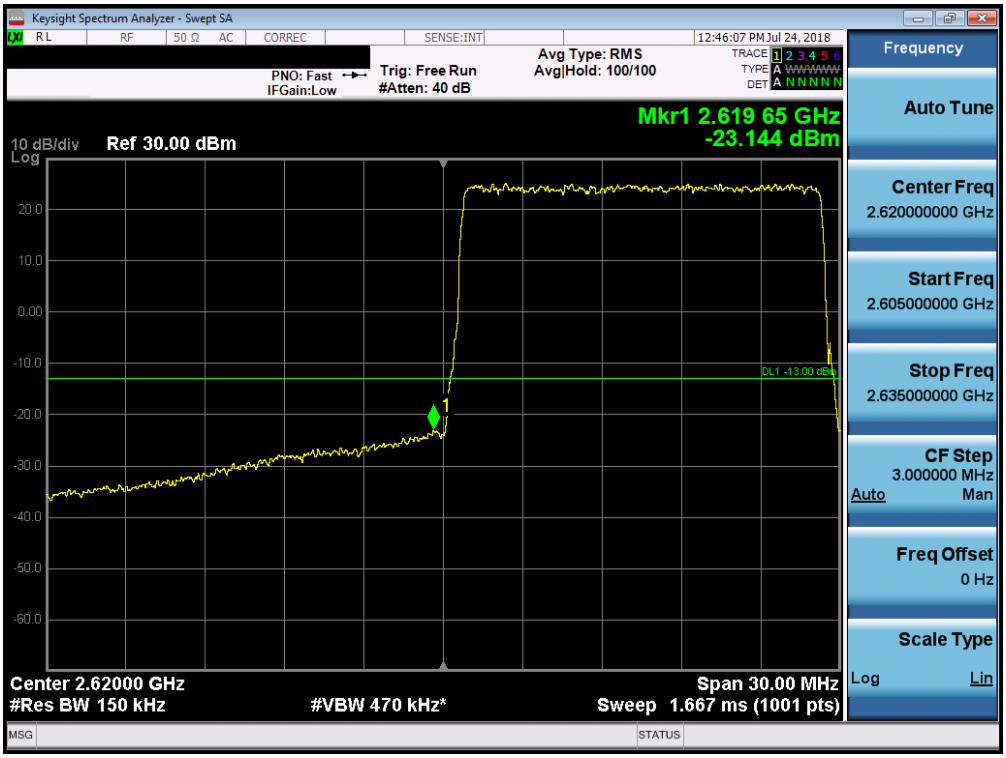
Plot 7-180. Lower Extended Band Edge Plot (Band 7 - 15.0MHz QPSK)



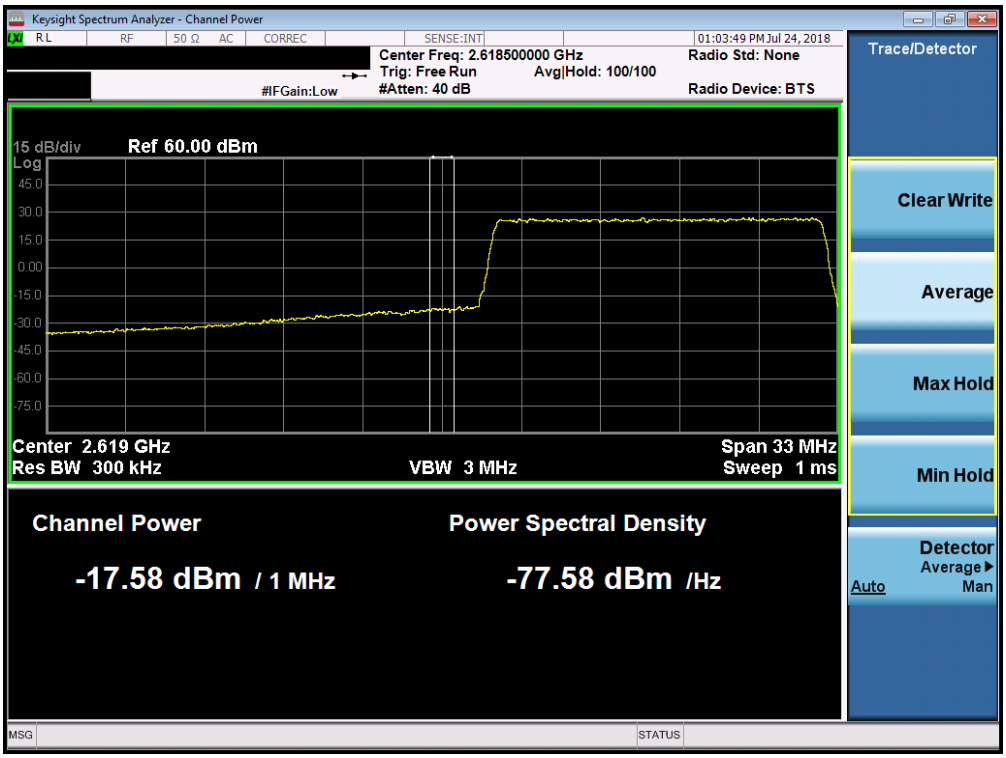
Plot 7-181. Upper Band Edge Plot (Band 7 - 15.0MHz QPSK)



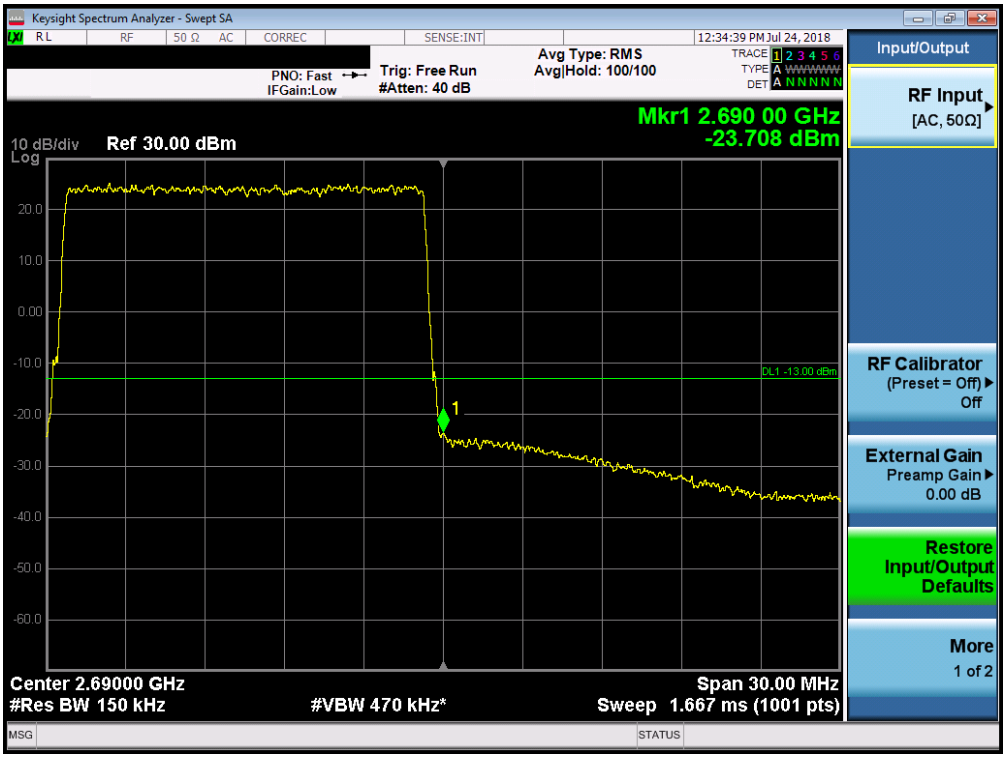
Plot 7-182. Upper Extended Band Edge Plot (Band 7 - 15.0MHz QPSK)



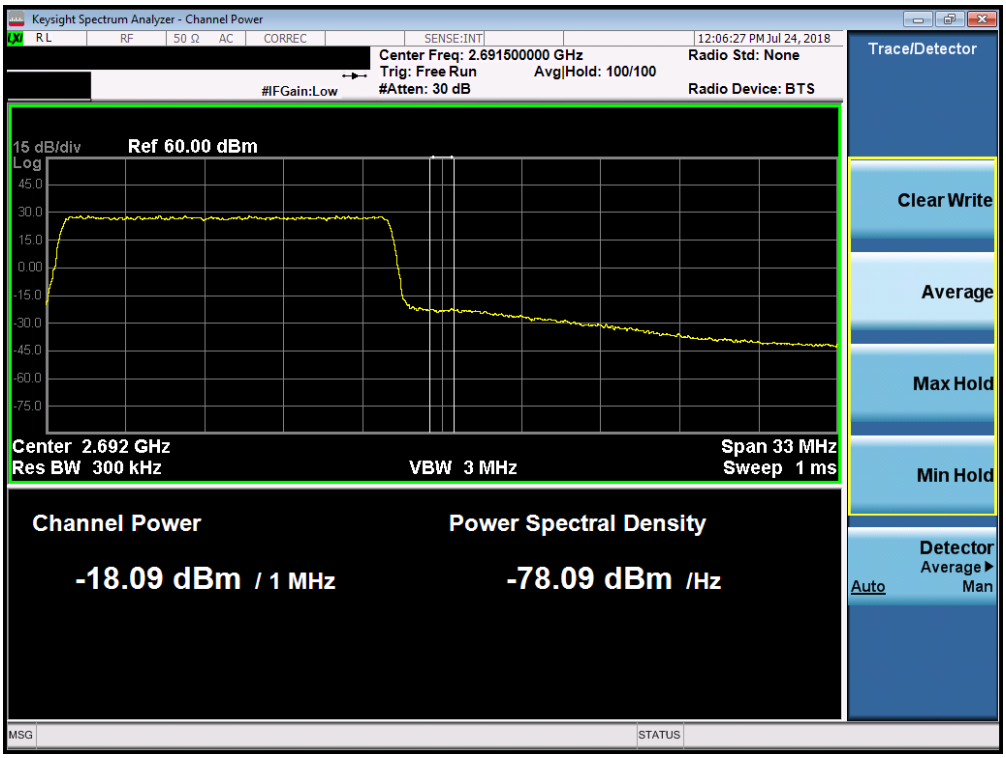
Plot 7-183. Lower Band Edge Plot (Band 7 - 15.0MHz 16-QAM)



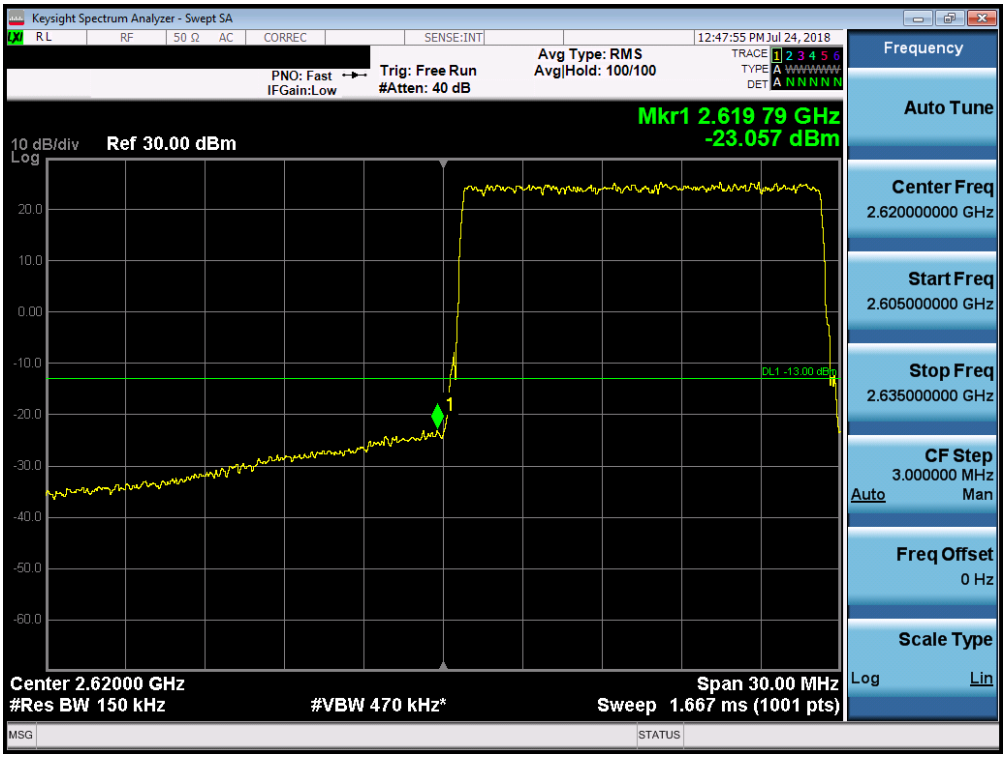
Plot 7-184. Lower Extended Band Edge Plot (Band 7 - 15.0MHz 16-QAM)



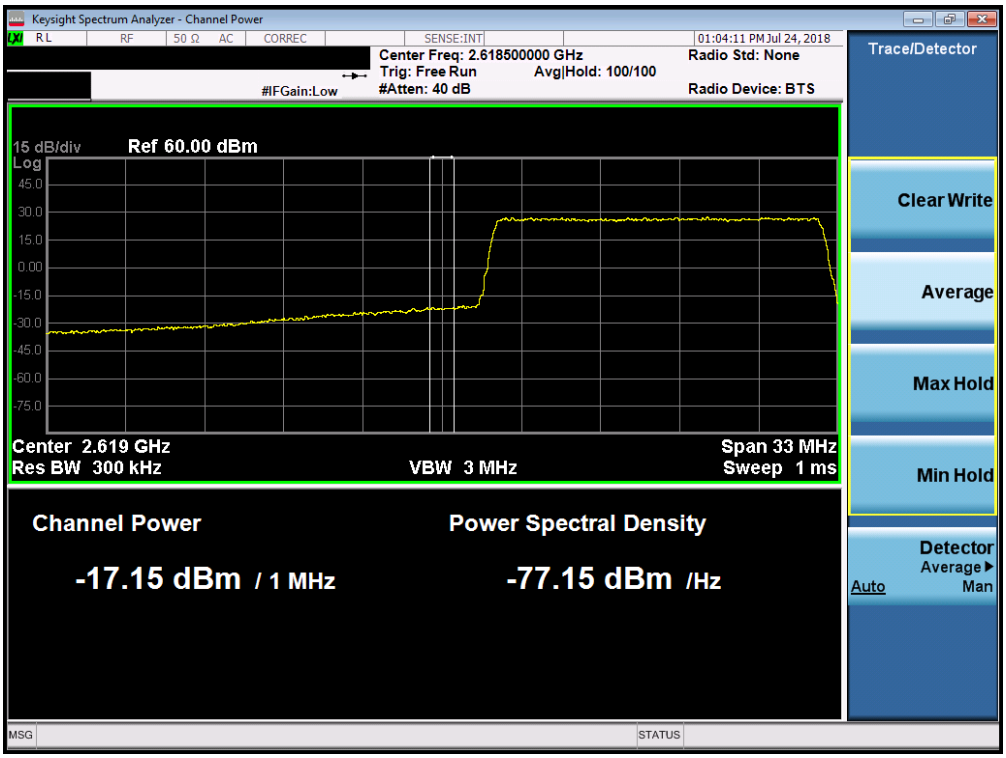
Plot 7-185. Upper Band Edge Plot (Band 7 - 15.0MHz 16-QAM)



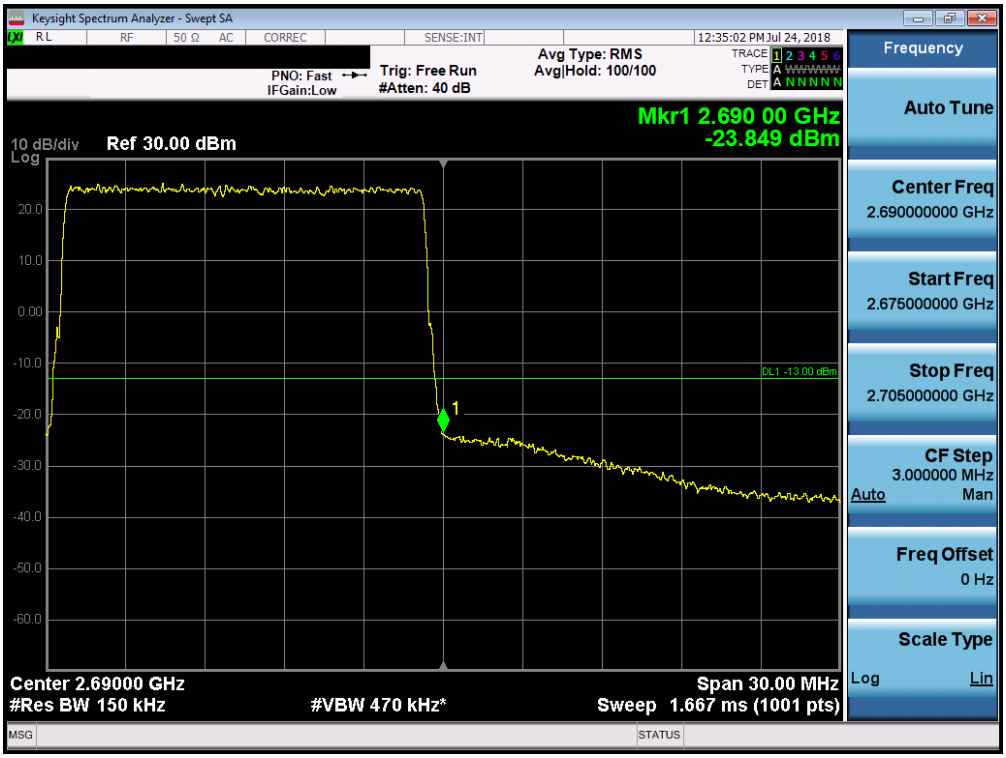
Plot 7-186. Upper Extended Band Edge Plot (Band 7 - 15.0MHz 16-QAM)



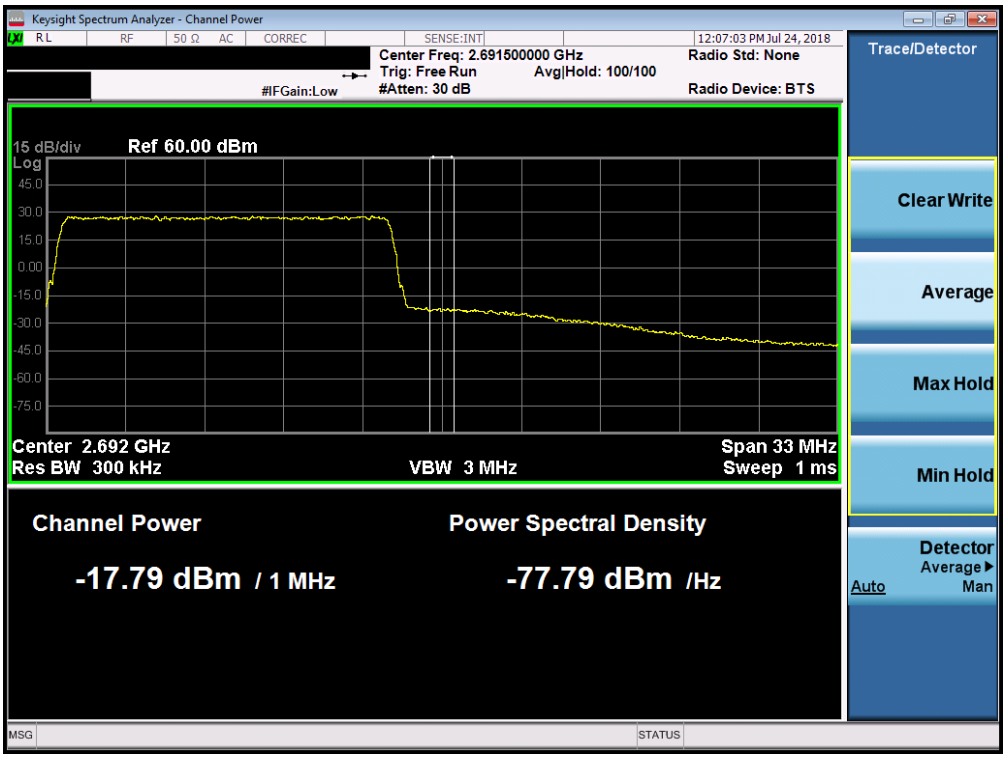
Plot 7-187. Lower Band Edge Plot (Band 7 - 15.0MHz 64-QAM)



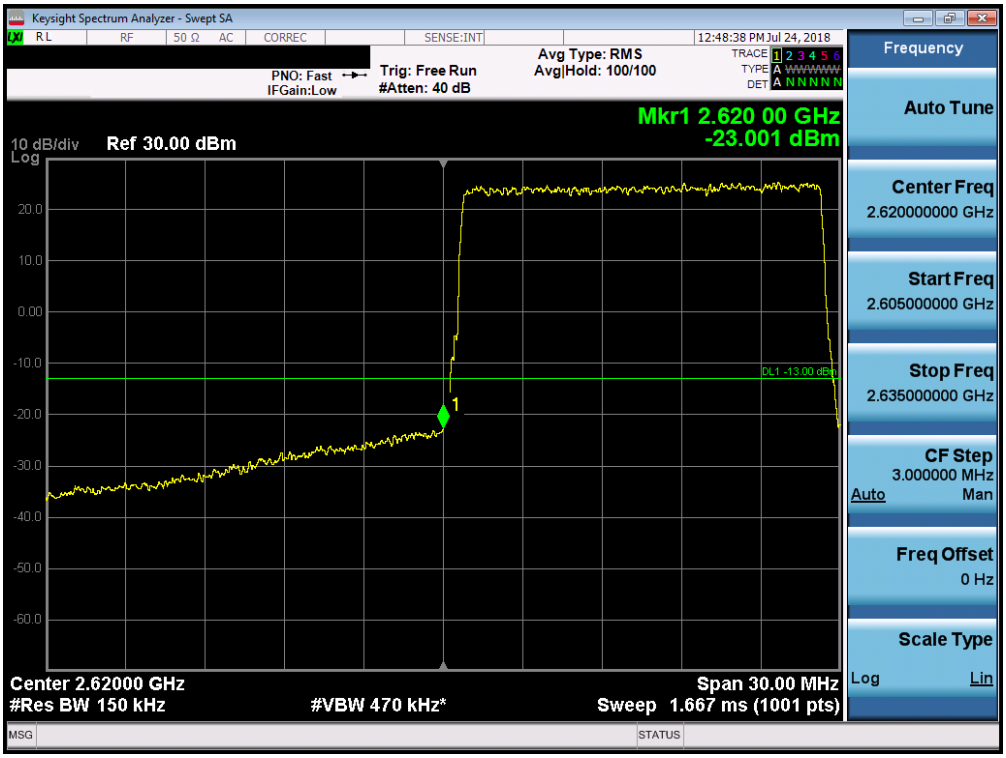
Plot 7-188. Lower Extended Band Edge Plot (Band 7 - 15.0MHz 64-QAM)



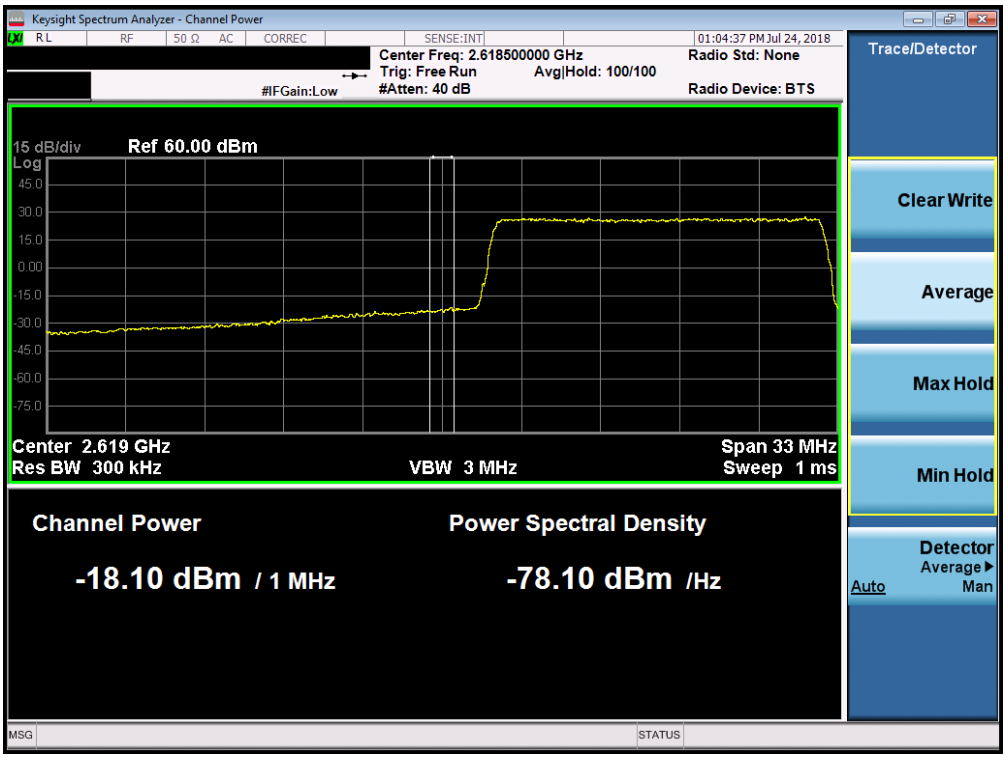
Plot 7-189. Upper Band Edge Plot (Band 7 - 15.0MHz 64-QAM)



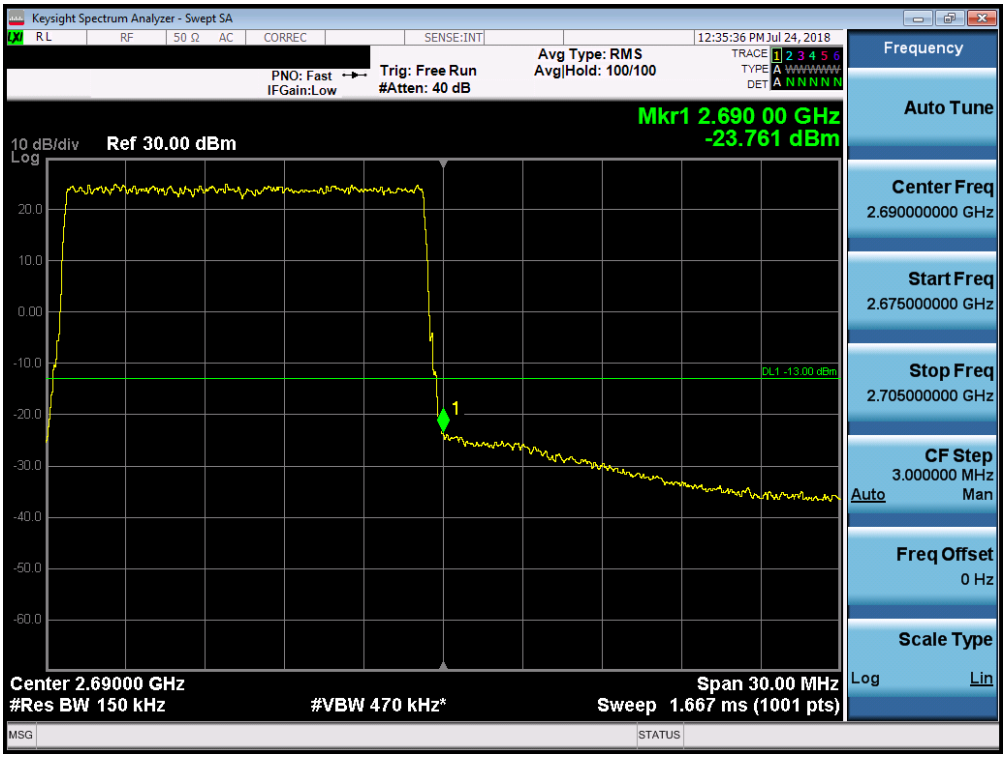
Plot 7-190. Upper Extended Band Edge Plot (Band 7 - 15.0MHz 64-QAM)



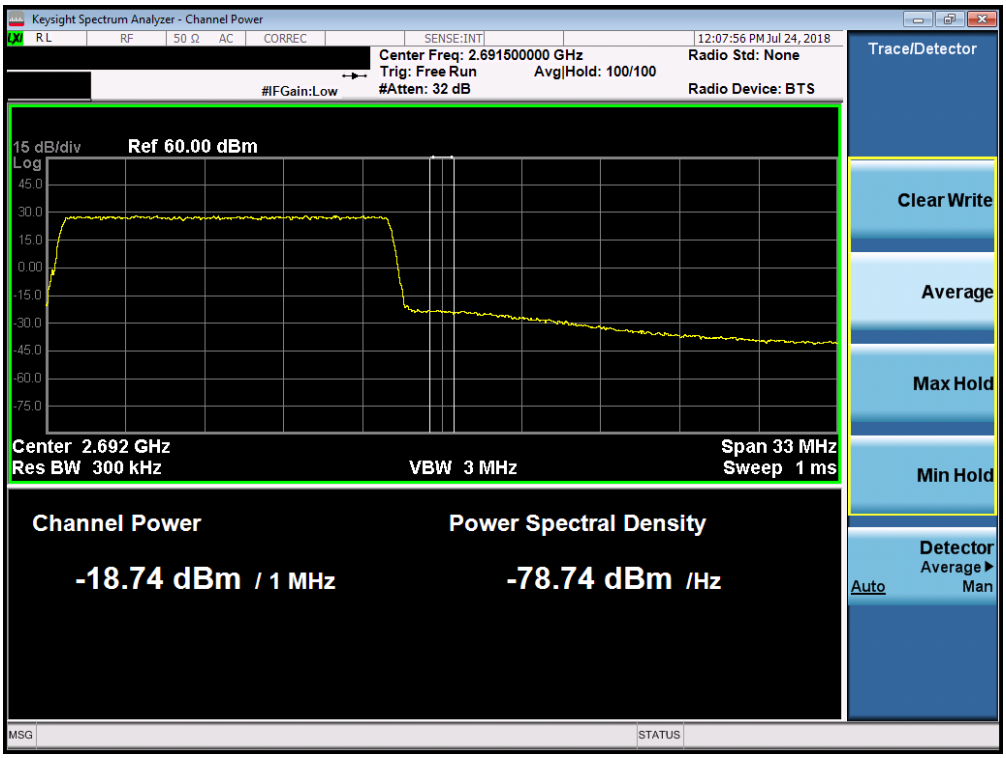
Plot 7-191. Lower Band Edge Plot (Band 7 - 15.0MHz 256-QAM)



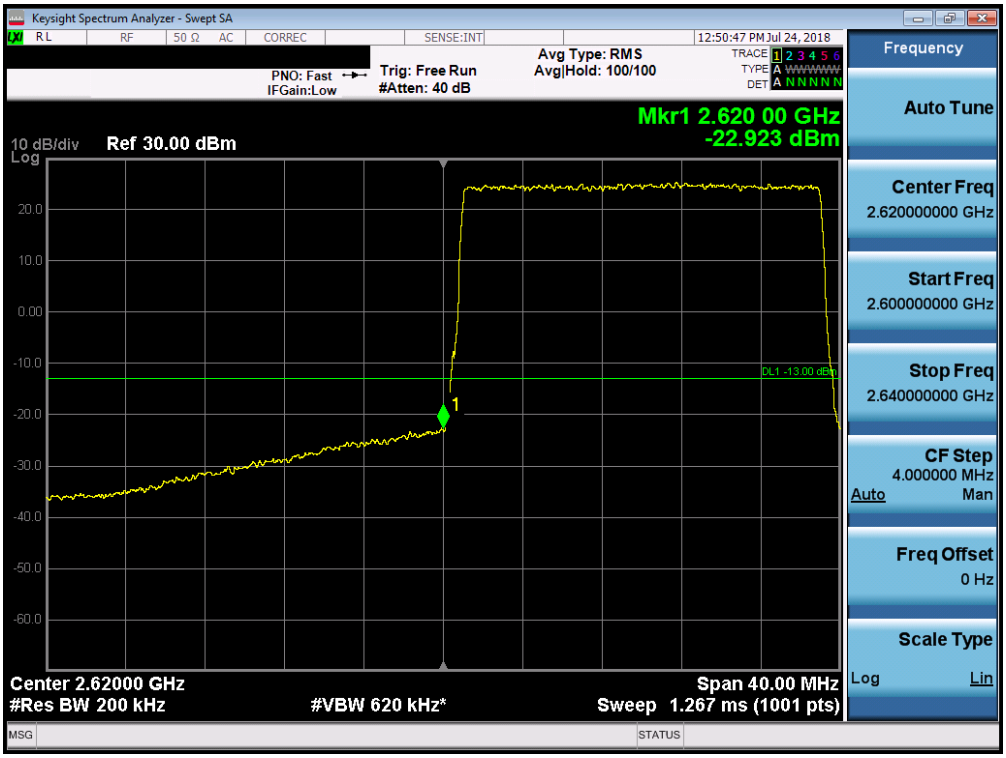
Plot 7-192. Lower Extended Band Edge Plot (Band 7 - 15.0MHz 256-QAM)



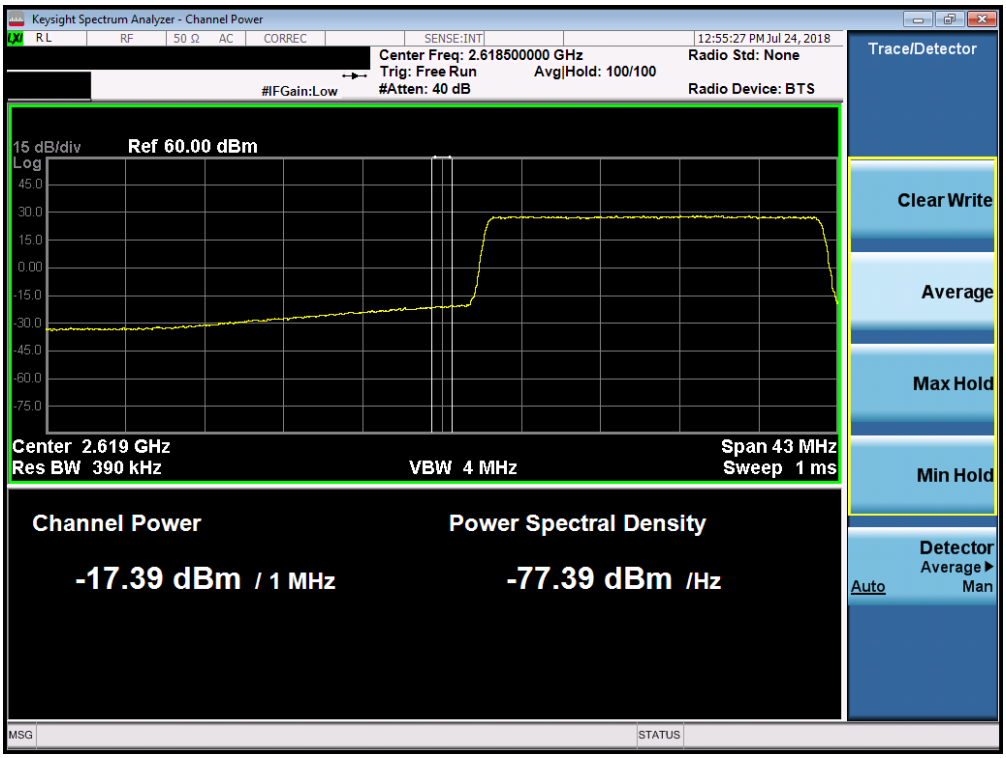
Plot 7-193. Upper Band Edge Plot (Band 7 - 15.0MHz 256-QAM)



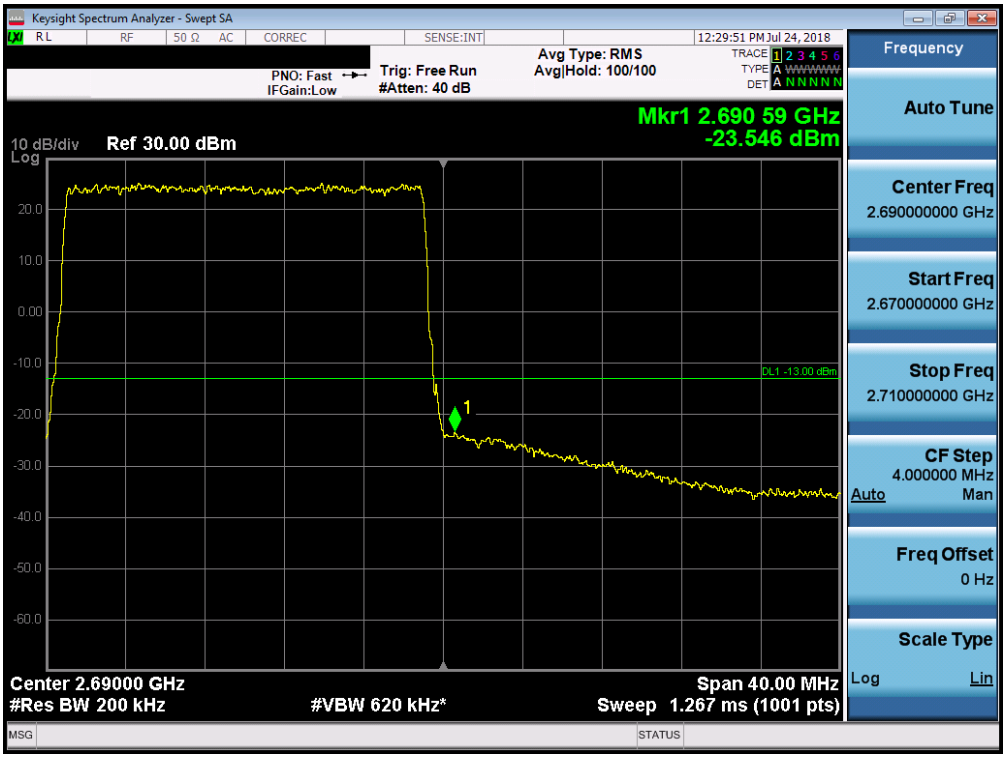
Plot 7-194. Upper Extended Band Edge Plot (Band 7 - 15.0MHz 256-QAM)



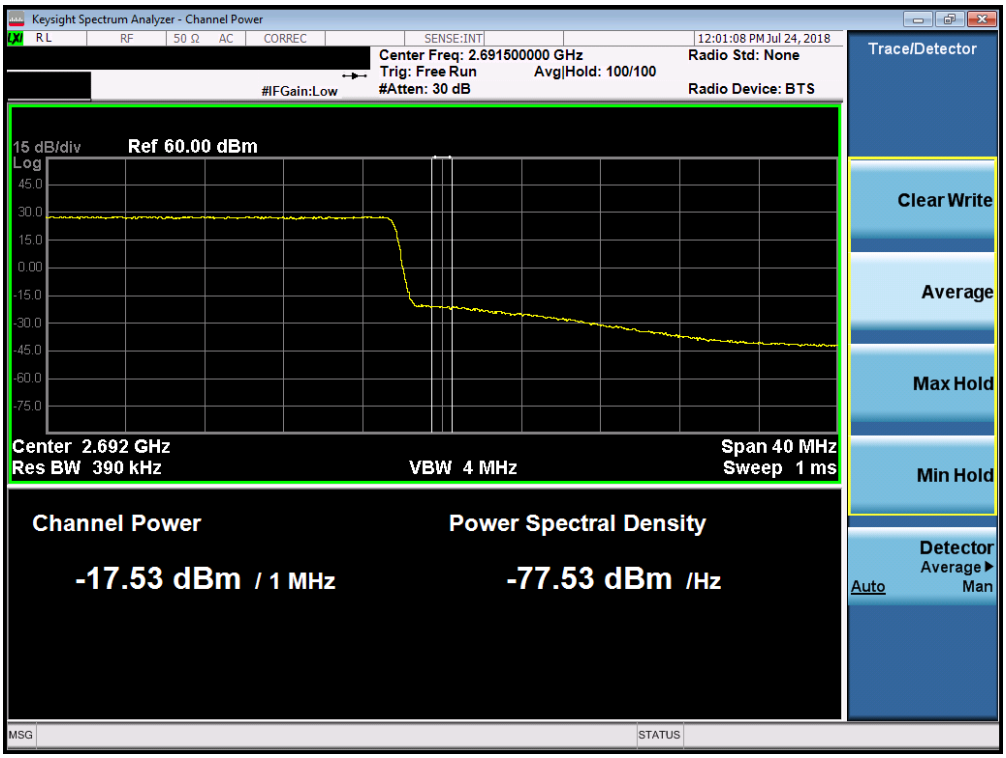
Plot 7-195. Lower Band Edge Plot (Band 7 - 20.0MHz QPSK)



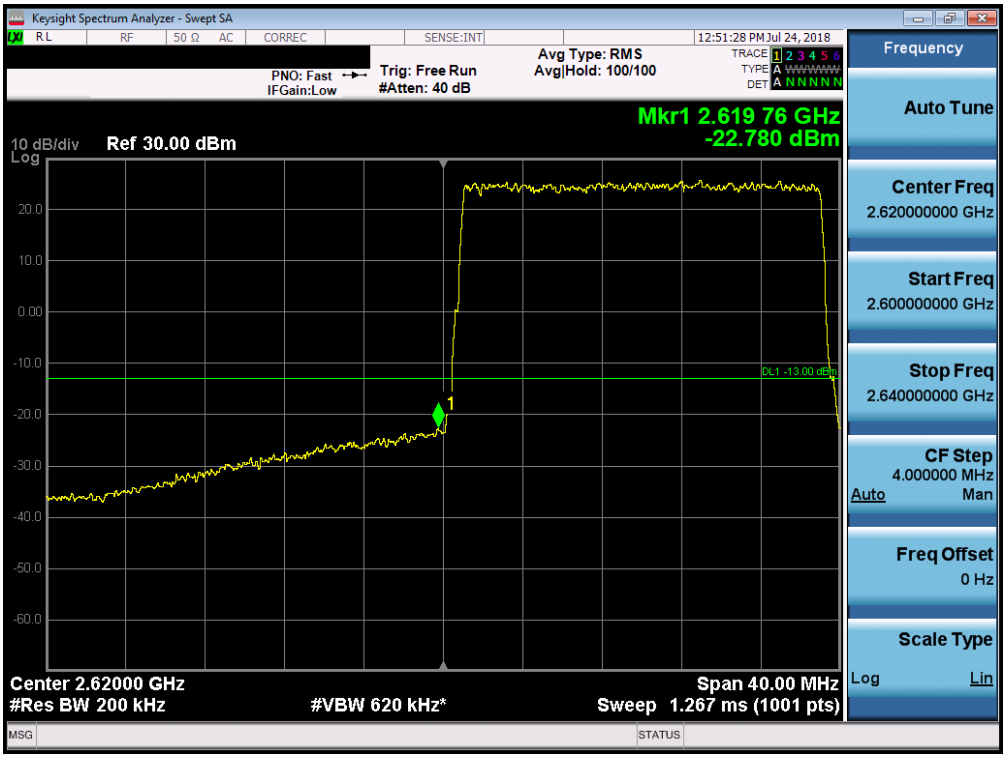
Plot 7-196. Lower Extended Band Edge Plot (Band 7 - 20.0MHz QPSK)



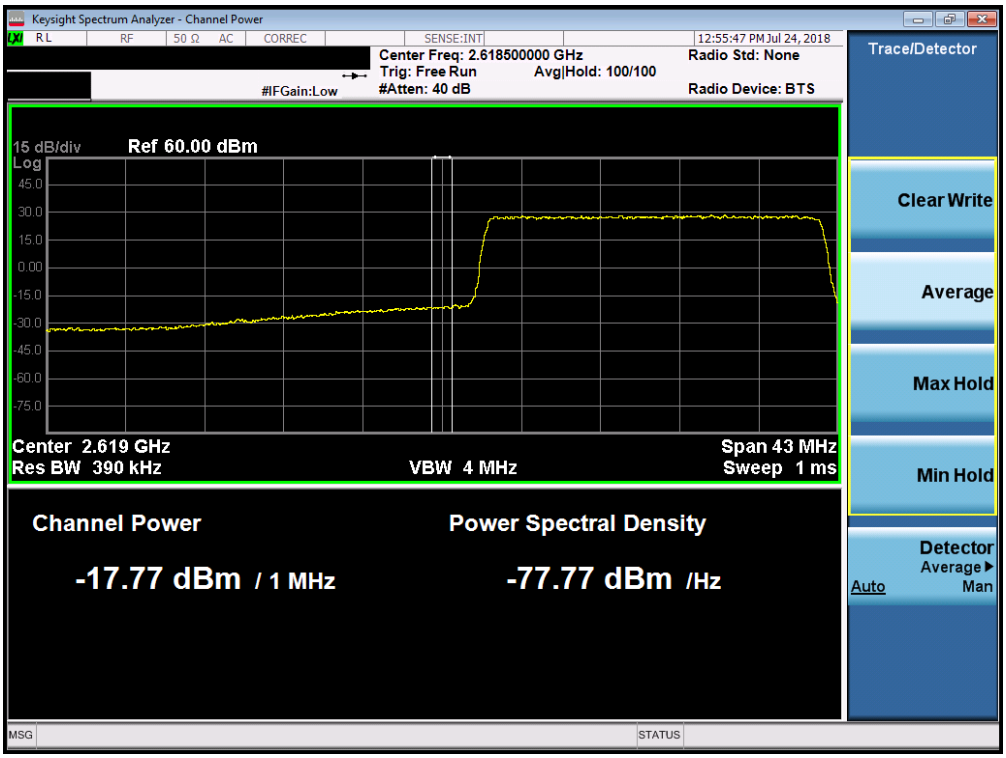
Plot 7-197. Upper Band Edge Plot (Band 7 - 20.0MHz QPSK)



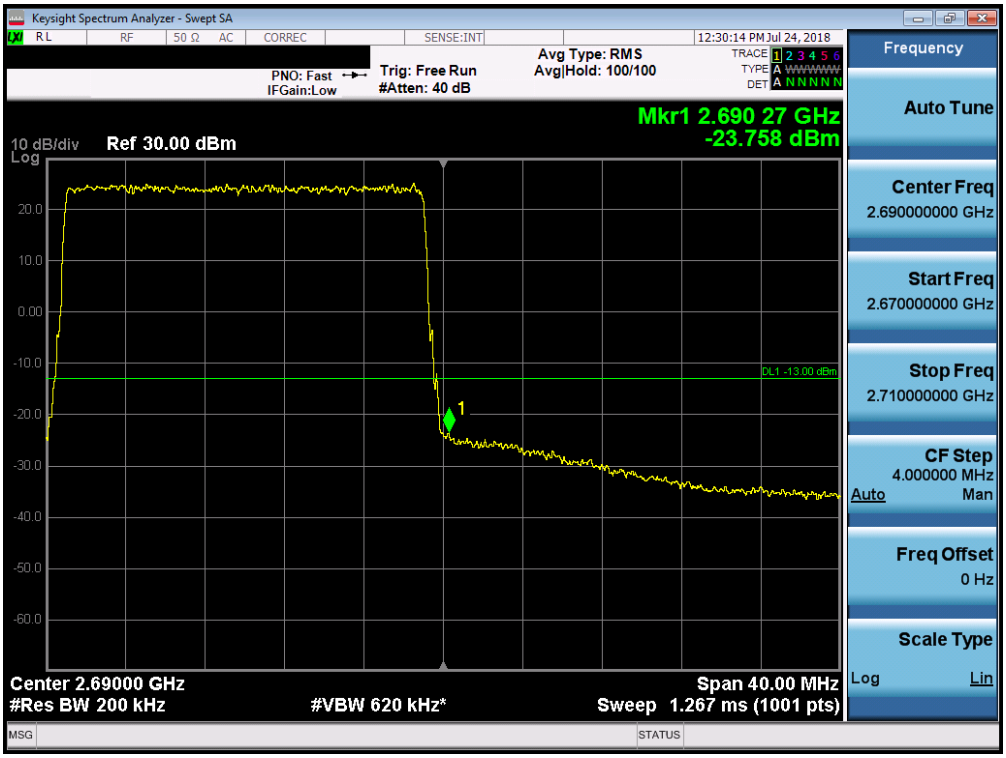
Plot 7-198. Upper Extended Band Edge Plot (Band 7 - 20.0MHz QPSK)



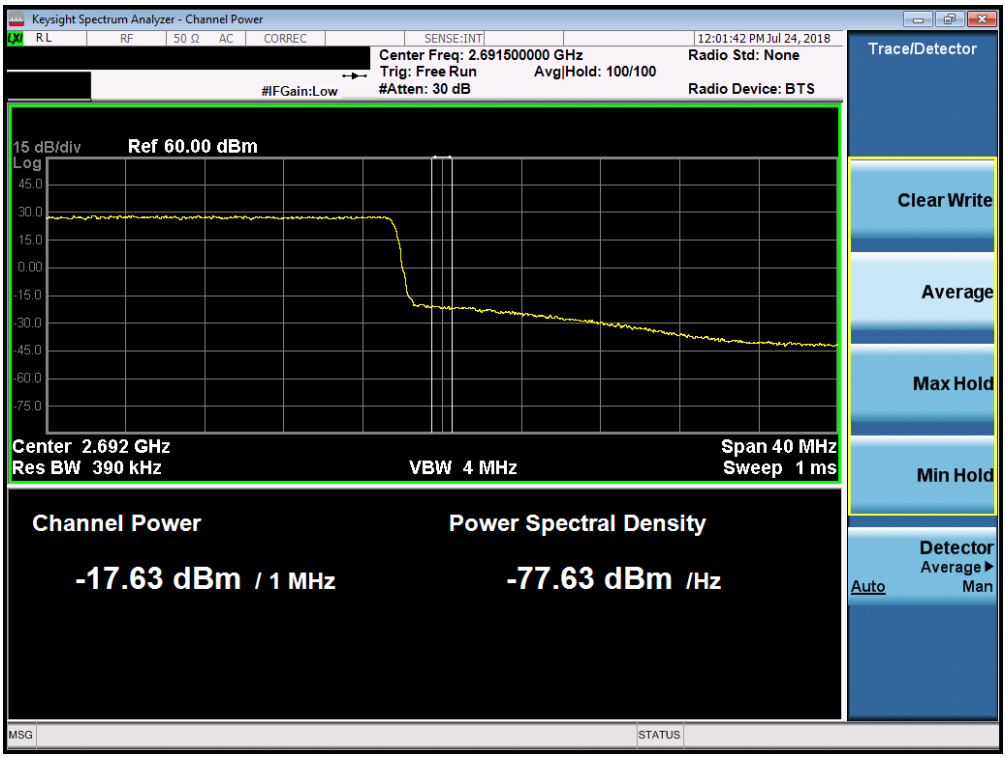
Plot 7-199. Lower Band Edge Plot (Band 7 - 20.0MHz 16-QAM)



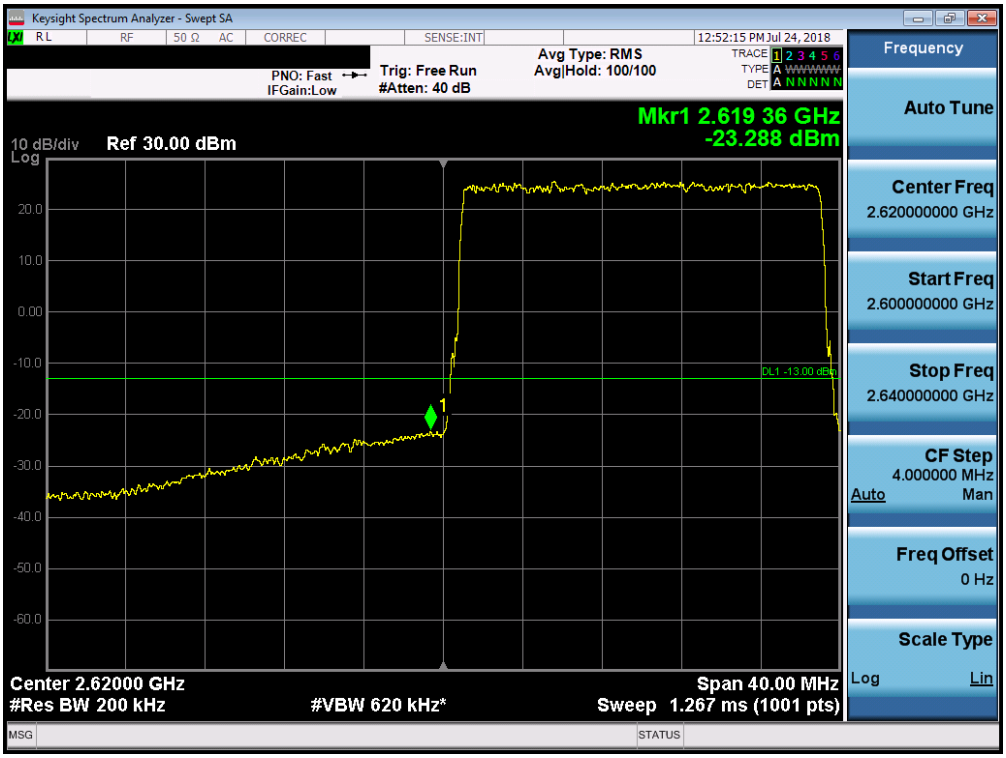
Plot 7-200. Lower Extended Band Edge Plot (Band 7 - 20.0MHz 16-QAM)



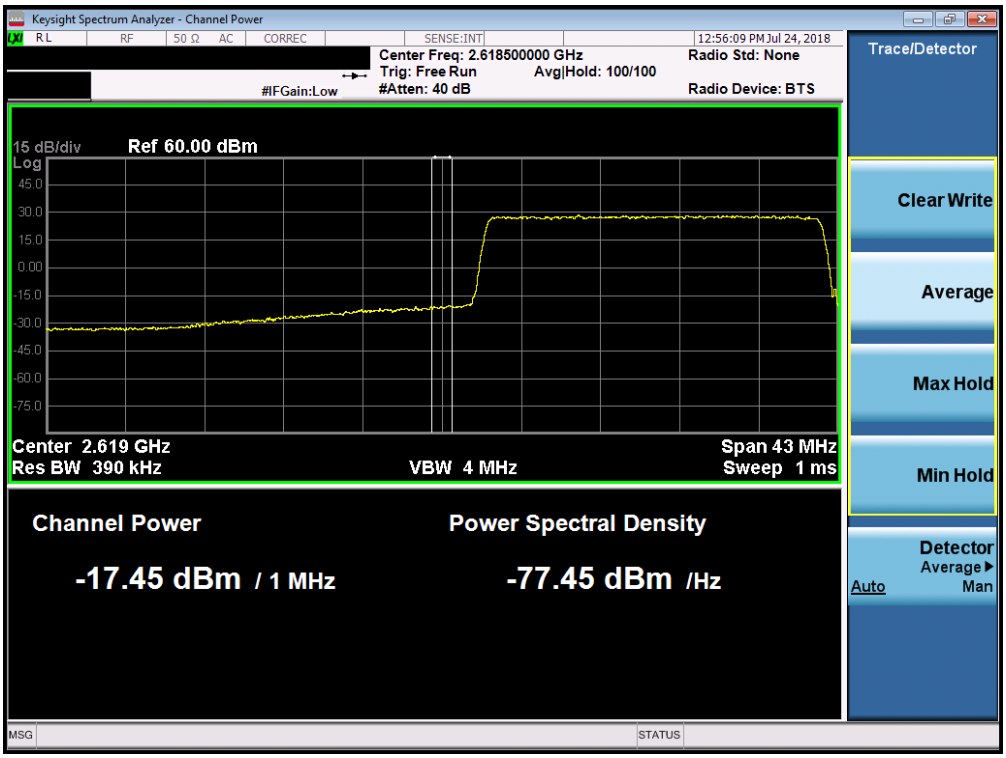
Plot 7-201. Upper Band Edge Plot (Band 7 - 20.0MHz 16-QAM)



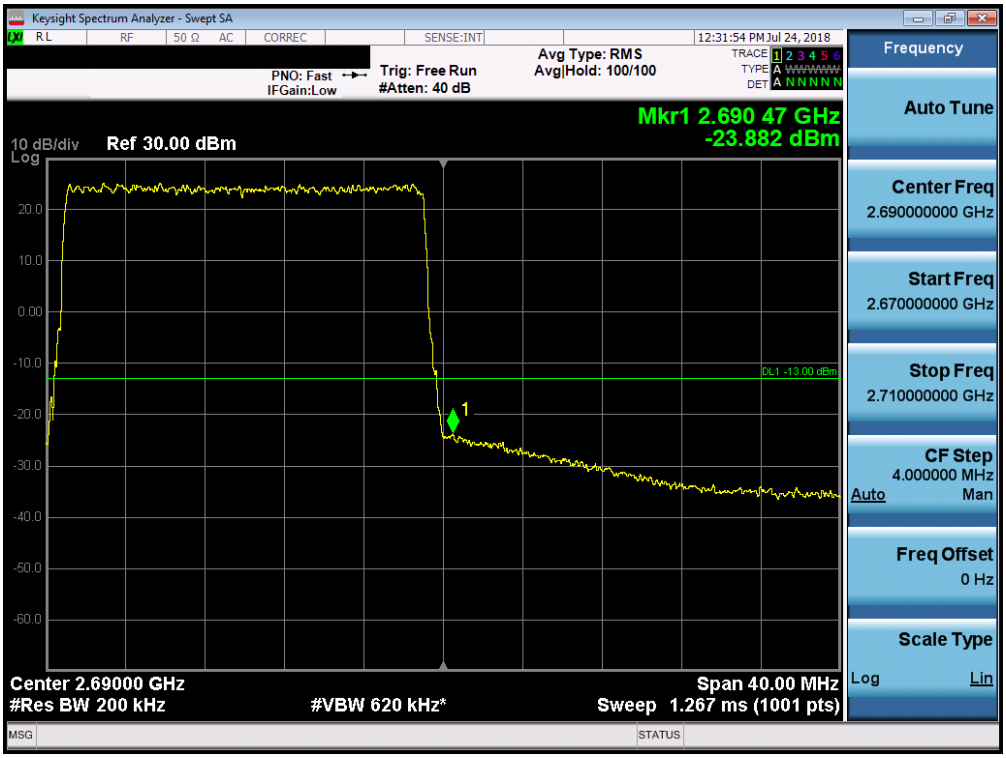
Plot 7-202. Upper Extended Band Edge Plot (Band 7 - 20.0MHz 16-QAM)



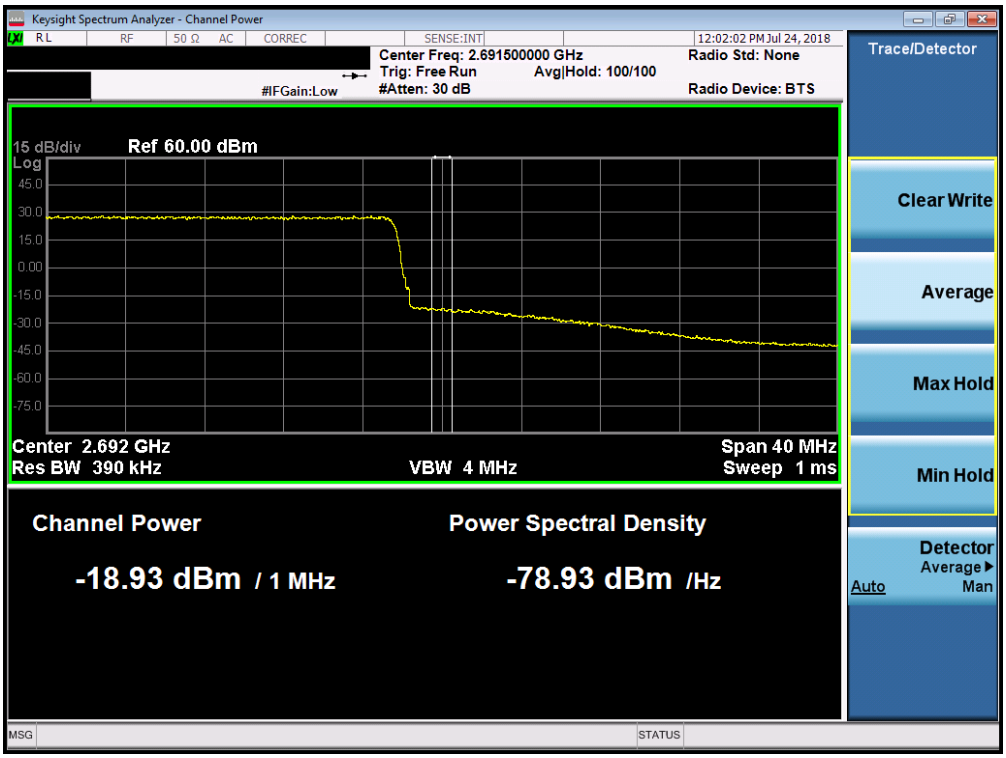
Plot 7-203. Lower Band Edge Plot (Band 7 - 20.0MHz 64-QAM)



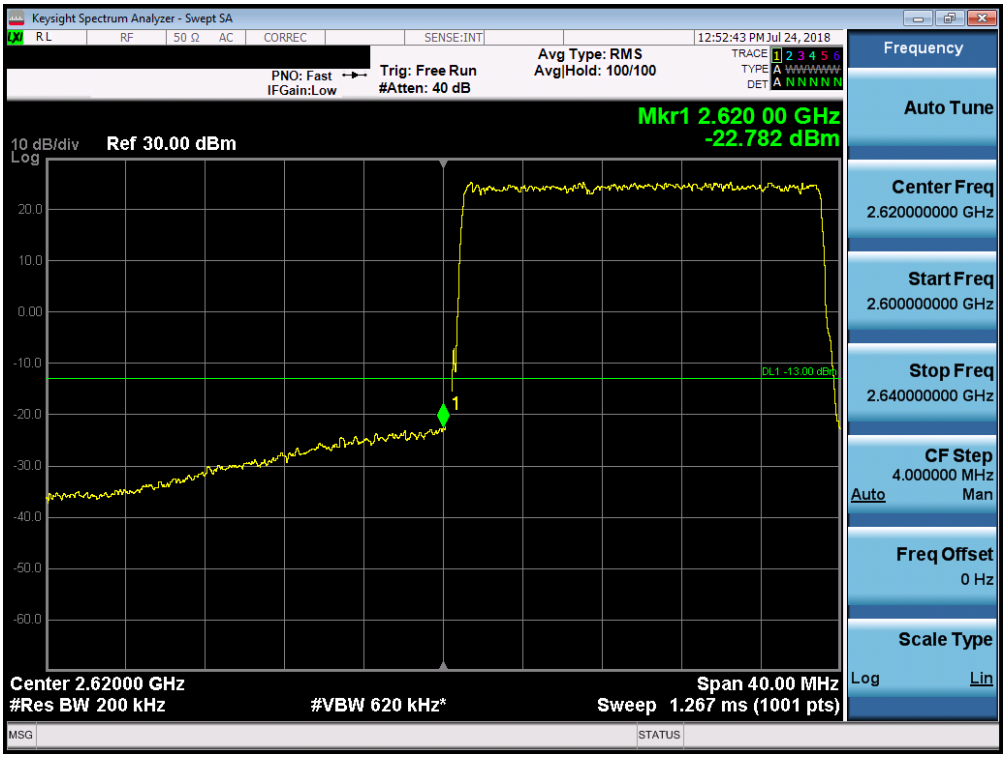
Plot 7-204. Lower Extended Band Edge Plot (Band 7 - 20.0MHz 64-QAM)



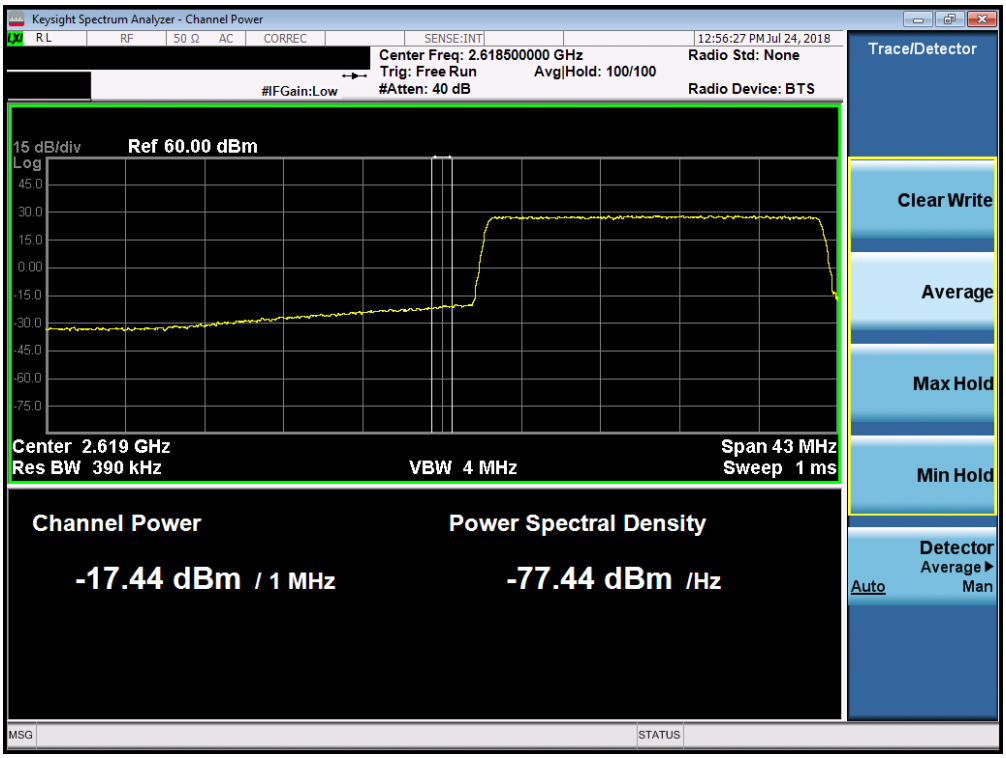
Plot 7-205. Upper Band Edge Plot (Band 7 - 20.0MHz 64-QAM)



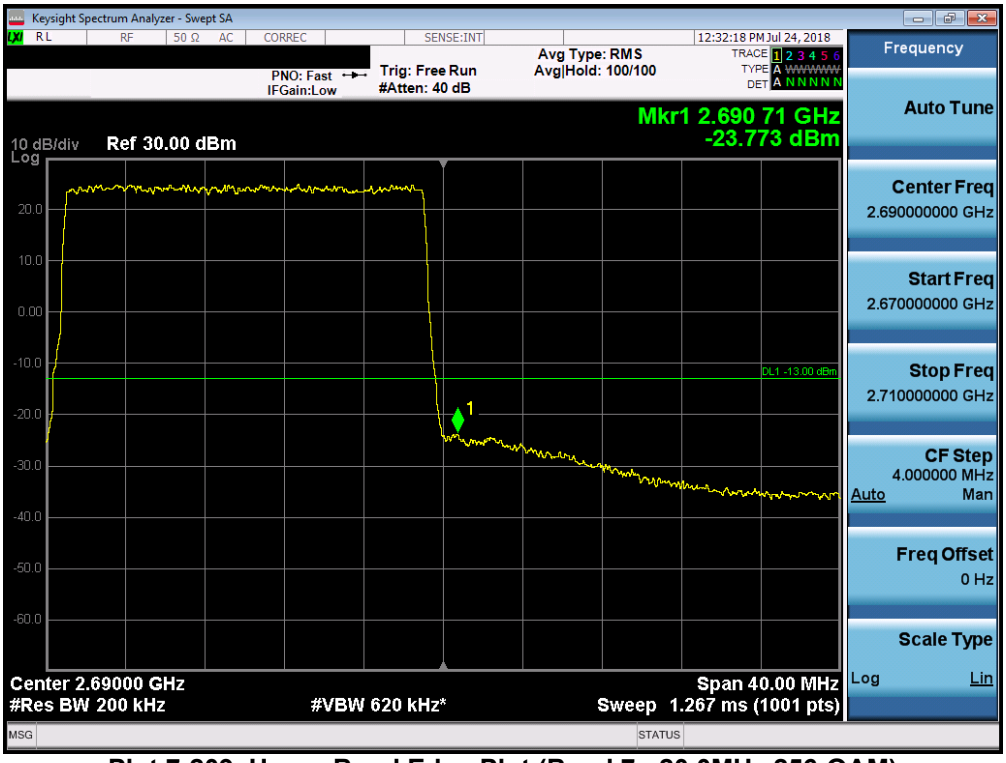
Plot 7-206. Upper Extended Band Edge Plot (Band 7 - 20.0MHz 64-QAM)



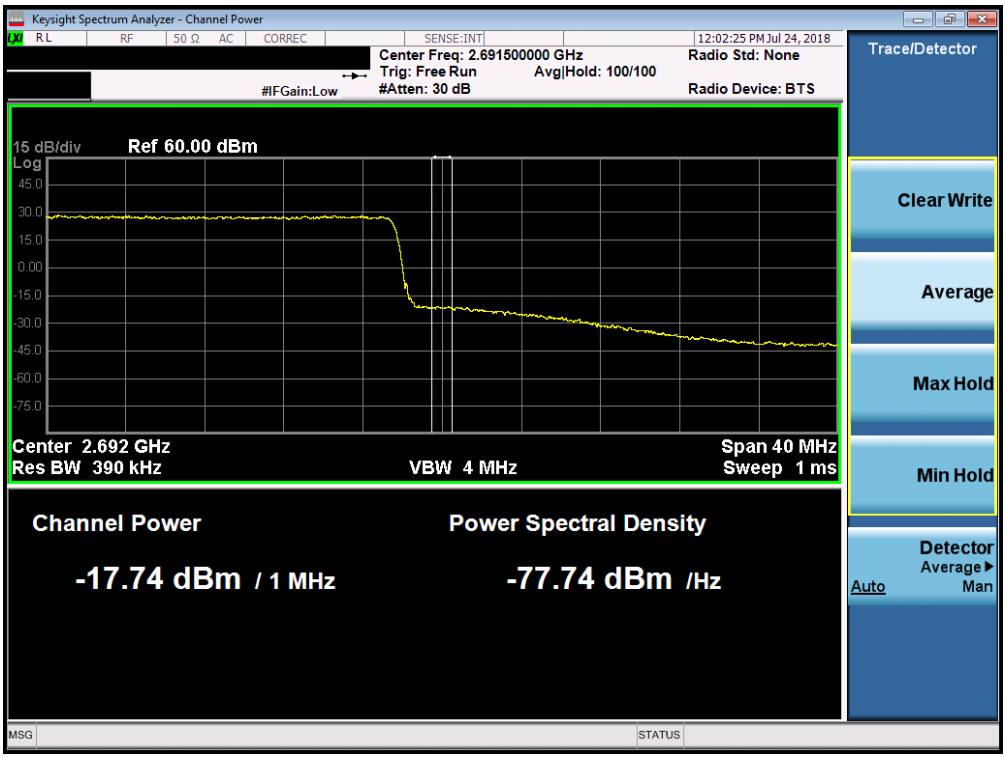
Plot 7-207. Lower Band Edge Plot (Band 7 - 20.0MHz 256-QAM)



Plot 7-208. Lower Extended Band Edge Plot (Band 7 - 20.0MHz 256-QAM)



Plot 7-209. Upper Band Edge Plot (Band 7 - 20.0MHz 256-QAM)



Plot 7-210. Upper Extended Band Edge Plot (Band 7 - 20.0MHz 256-QAM)