7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §22.917(a) §24.238(a) §27.53(c) §27.53(g) §27.53(h) §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 for Band 41 is as noted in the Test Notes on the following page.

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 v02r02 – 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.

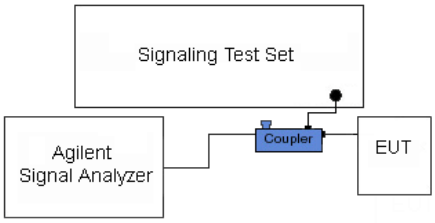

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

Per 22.917(b), 24.238(a), 27.53(c), 27.53(h), 27.53(m) 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.

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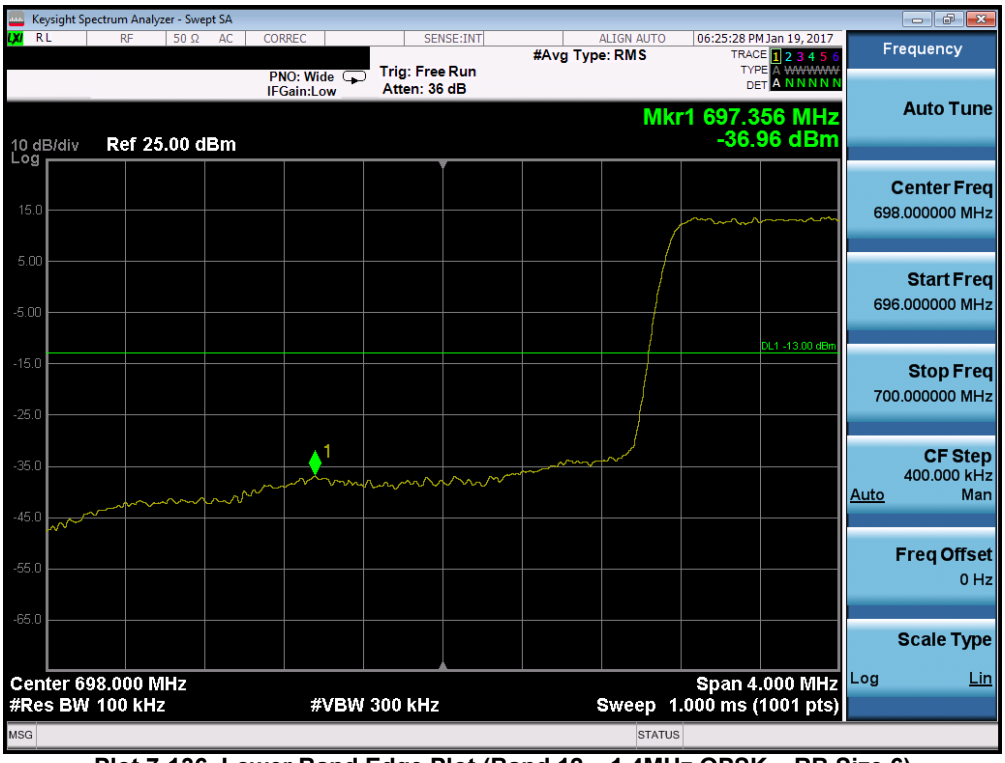
Per 27.53(g) for operations in the 698-746 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

Per 27.53(c.5) for operations in the 776-788 MHz band, in the 100 kHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 30 kHz may be employed to demonstrate compliance with the out-of-band emissions limit.

For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c.4) is 65 + 10log$_{10}$(P) = -35dBm in a 6.25kHz bandwidth.

Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.



Plot 7-136. Lower Band Edge Plot (Band 12 – 1.4MHz QPSK – RB Size 6)

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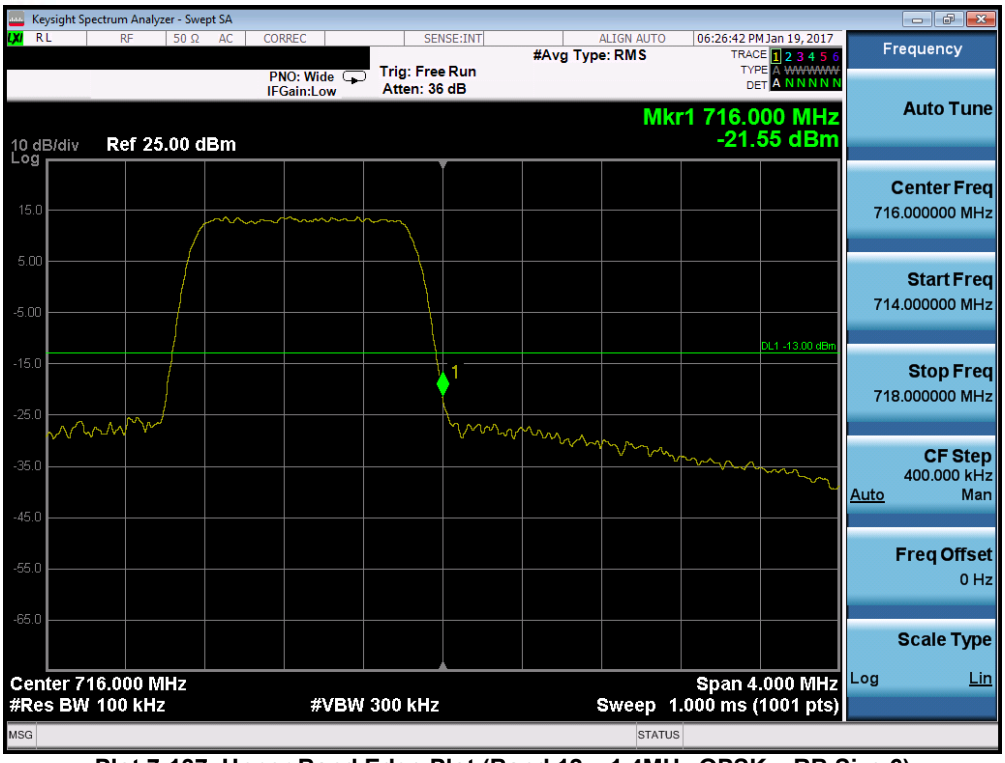
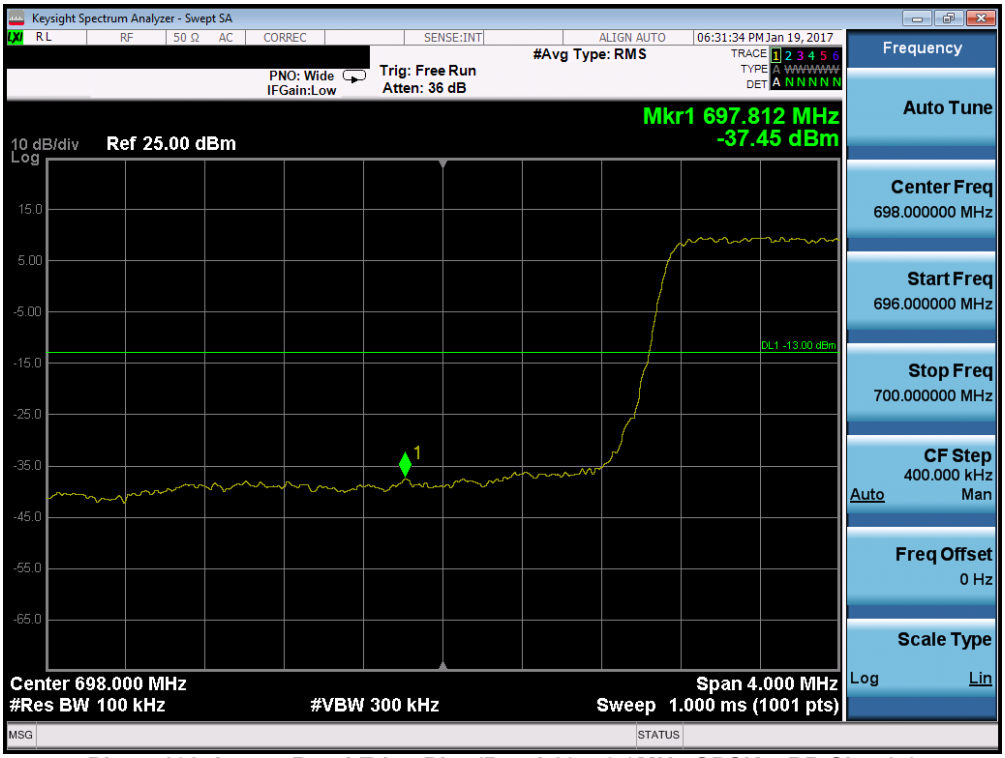


Plot 7-137. Upper Band Edge Plot (Band 12 – 1.4MHz QPSK – RB Size 6)



Plot 7-138. Lower Band Edge Plot (Band 12 – 3.0MHz QPSK – RB Size 15)

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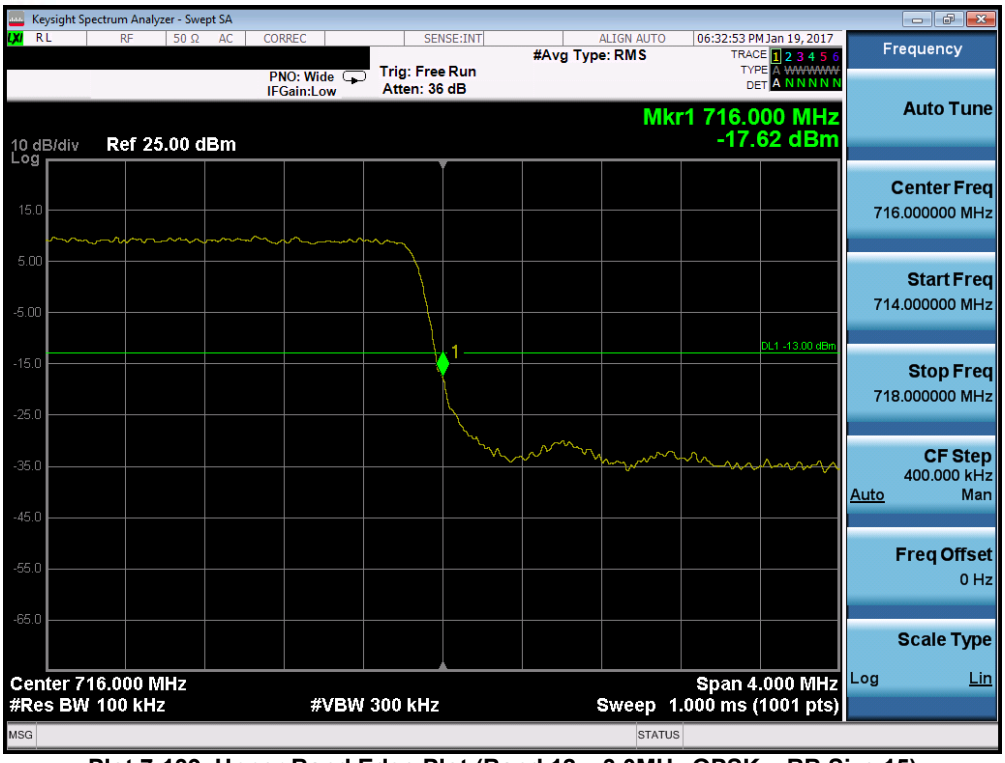
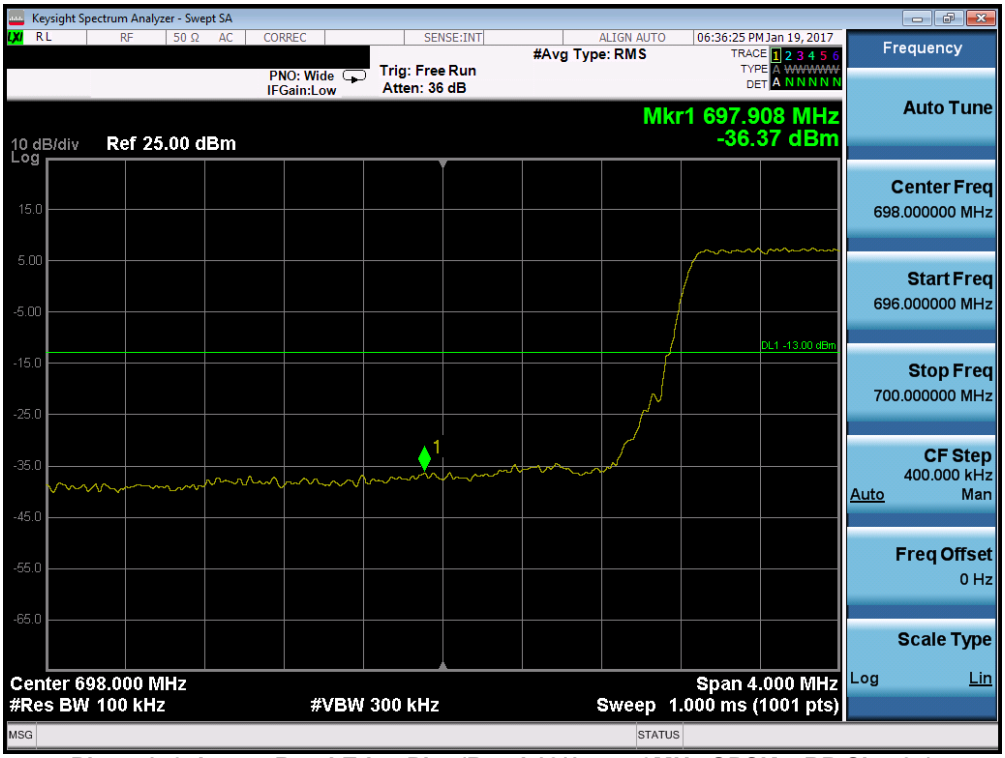


Plot 7-139. Upper Band Edge Plot (Band 12 – 3.0MHz QPSK – RB Size 15)



Plot 7-140. Lower Band Edge Plot (Band 12/17 – 5.0MHz QPSK – RB Size 25)

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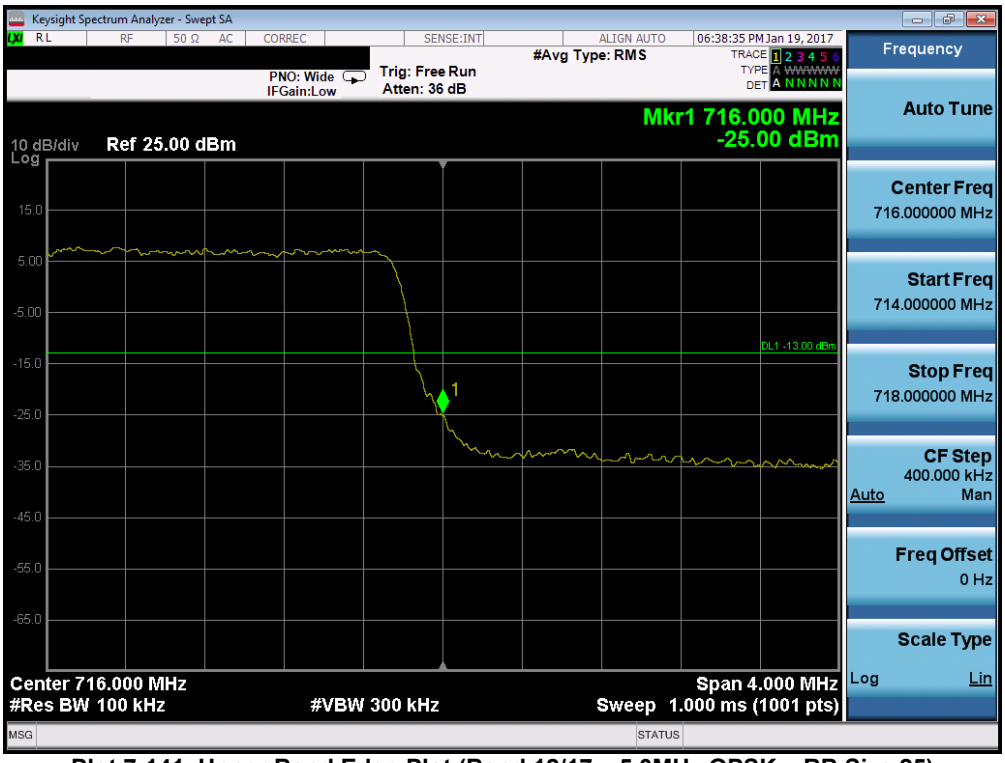
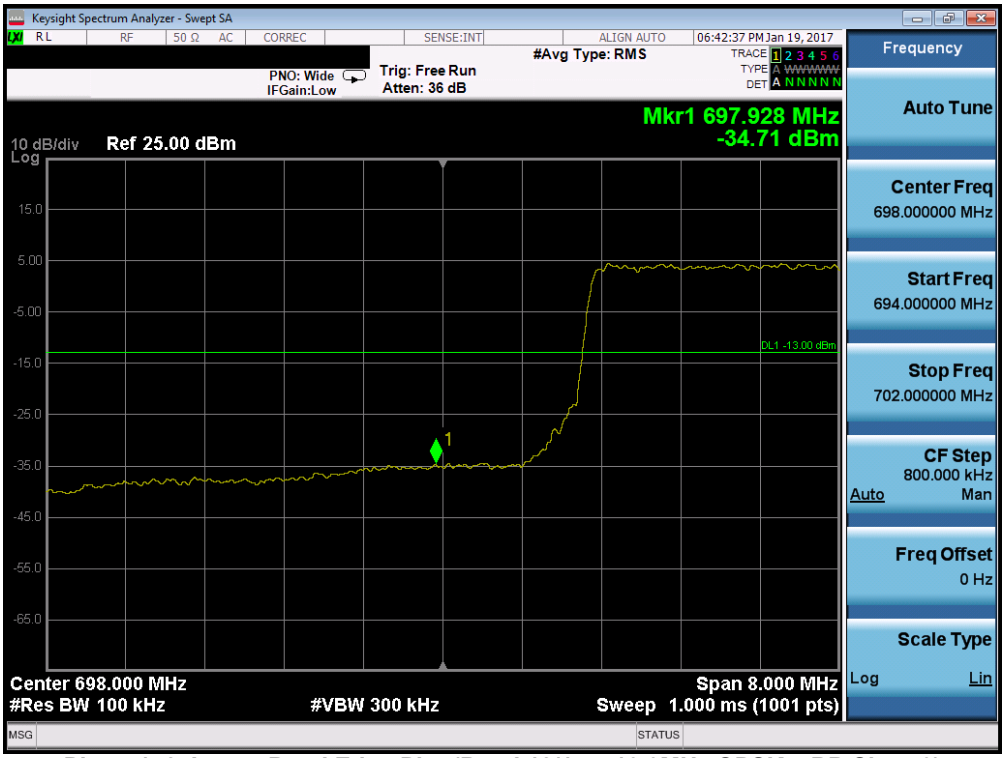


Plot 7-141. Upper Band Edge Plot (Band 12/17 – 5.0MHz QPSK – RB Size 25)



Plot 7-142. Lower Band Edge Plot (Band 12/17 – 10.0MHz QPSK – RB Size 50)

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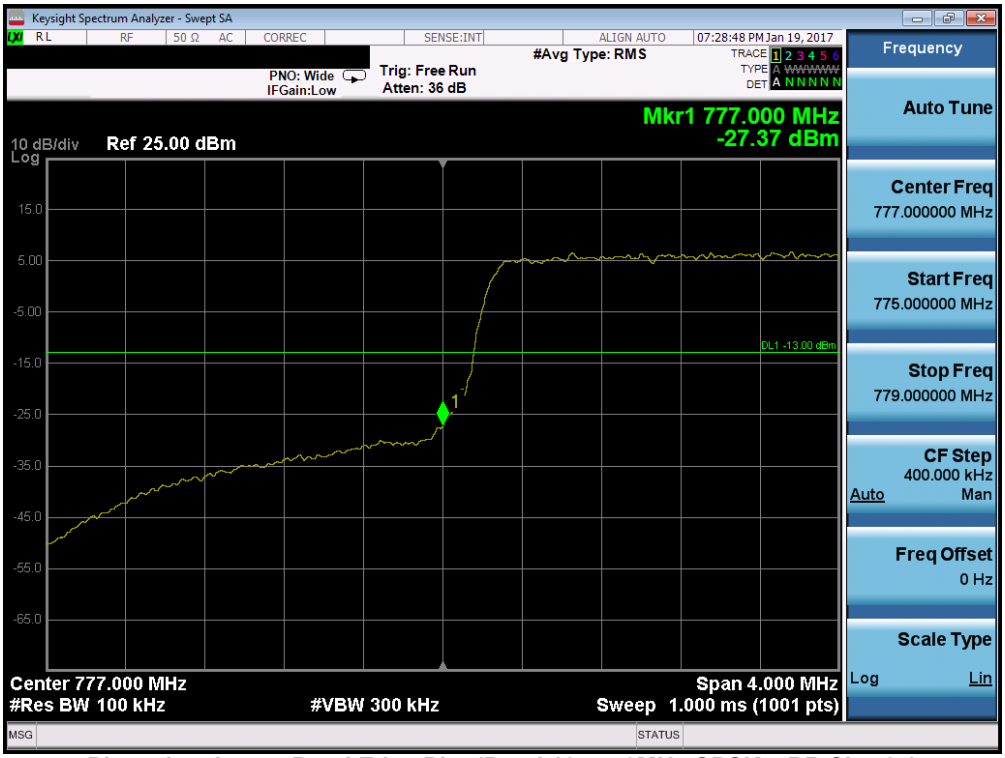
Plot 7-143. Upper Band Edge Plot (Band 12/17 – 10.0MHz QPSK – RB Size 50)



Plot 7-144. Lower Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

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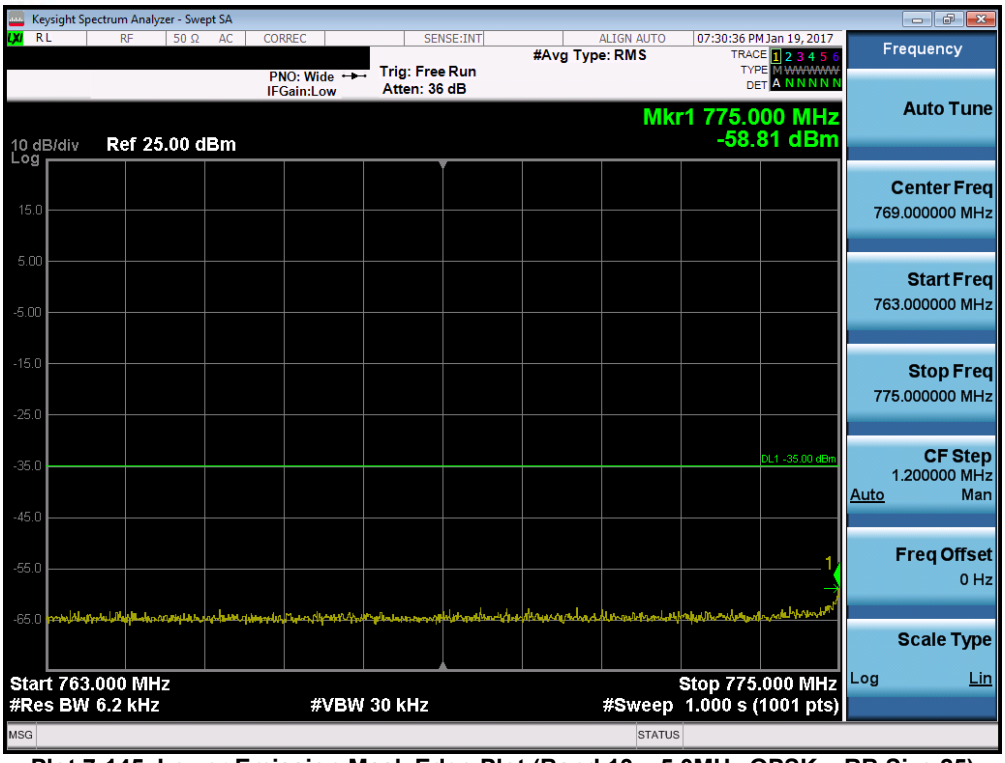

Plot 7-145. Lower Emission Mask Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

Plot 7-146. Upper Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

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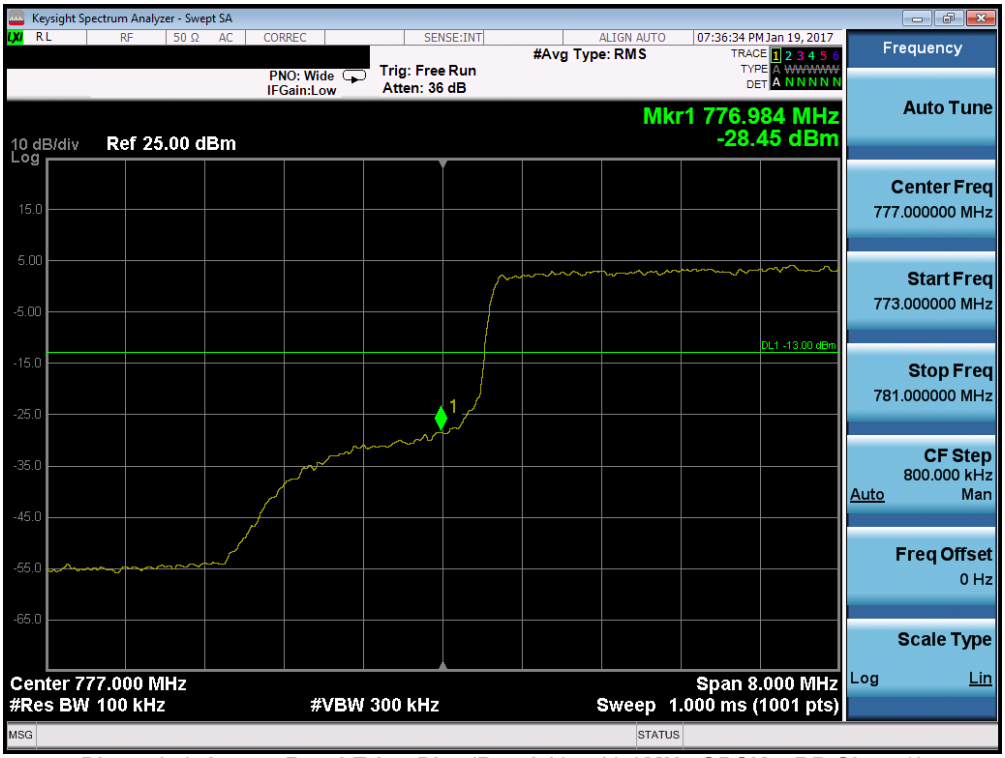
Plot 7-147. Upper Emission Mask Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)



Plot 7-148. Lower Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

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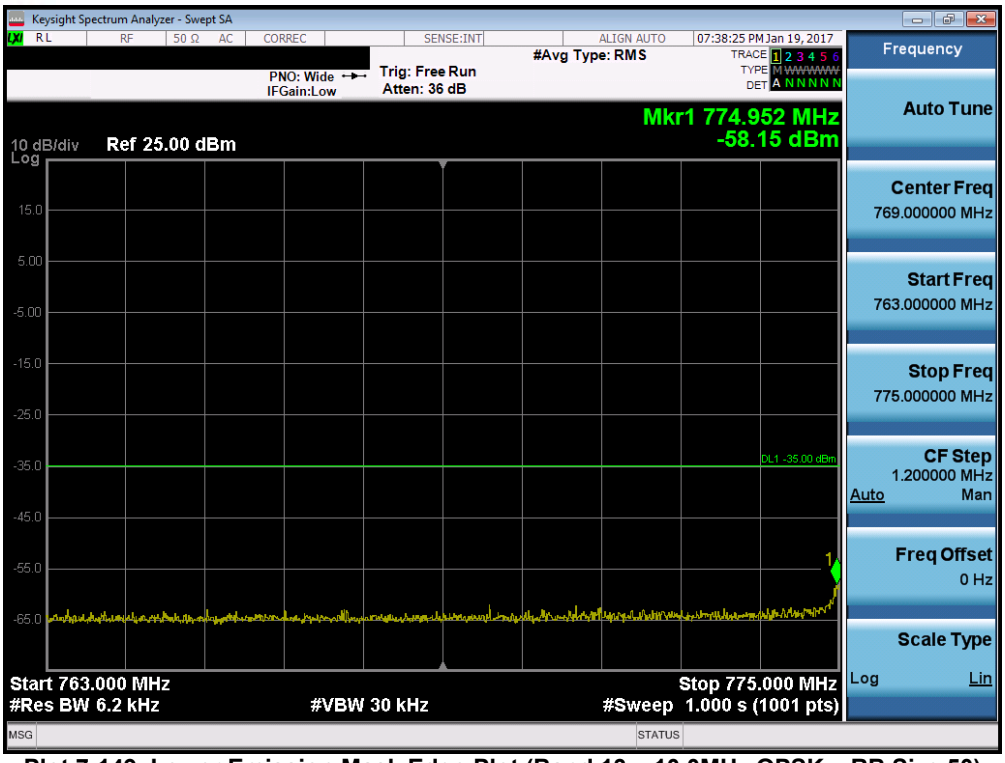
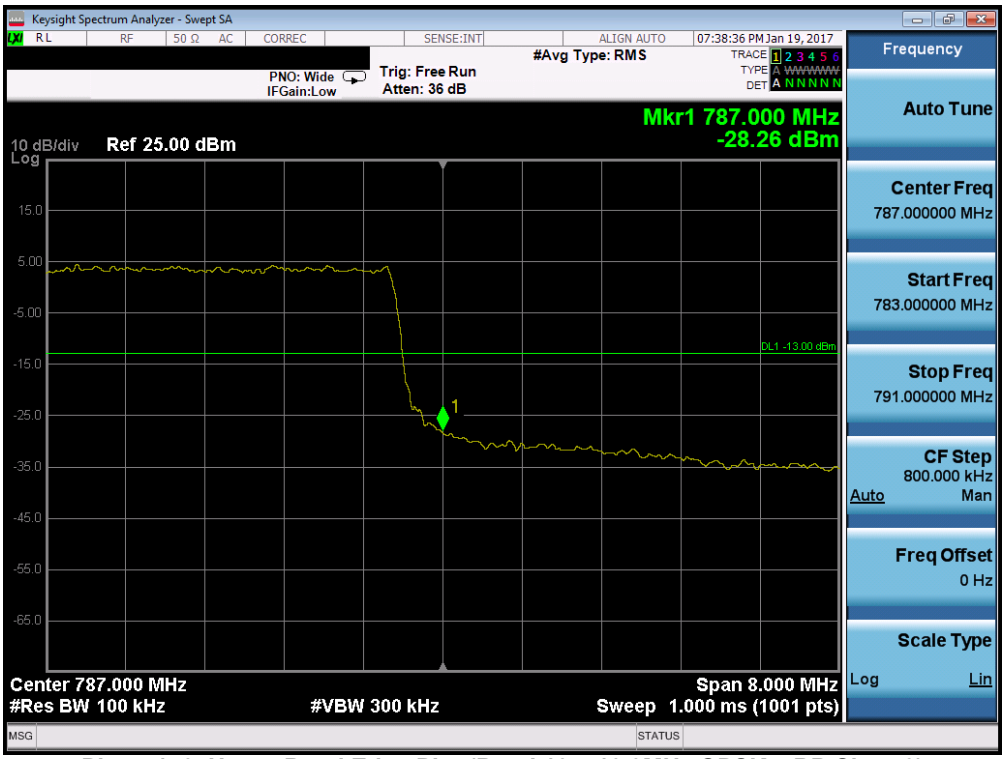


Plot 7-149. Lower Emission Mask Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)



Plot 7-150. Upper Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

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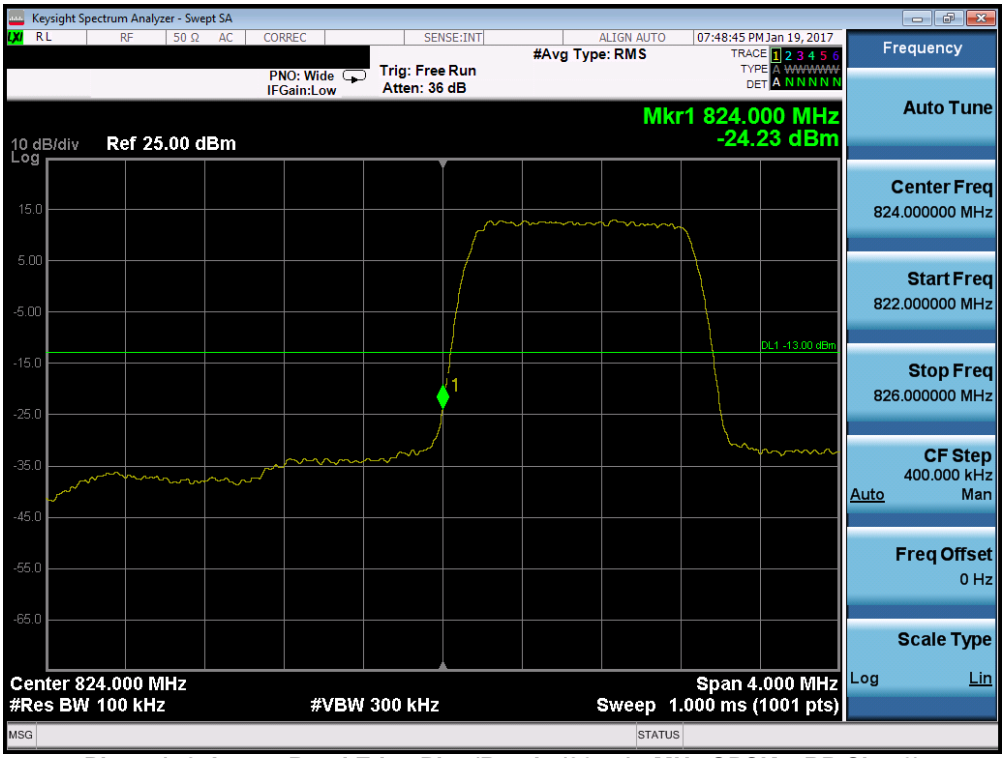
Plot 7-151. Upper Emission Mask Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)



Plot 7-152. Lower Band Edge Plot (Band 5/26 – 1.4MHz QPSK – RB Size 6)

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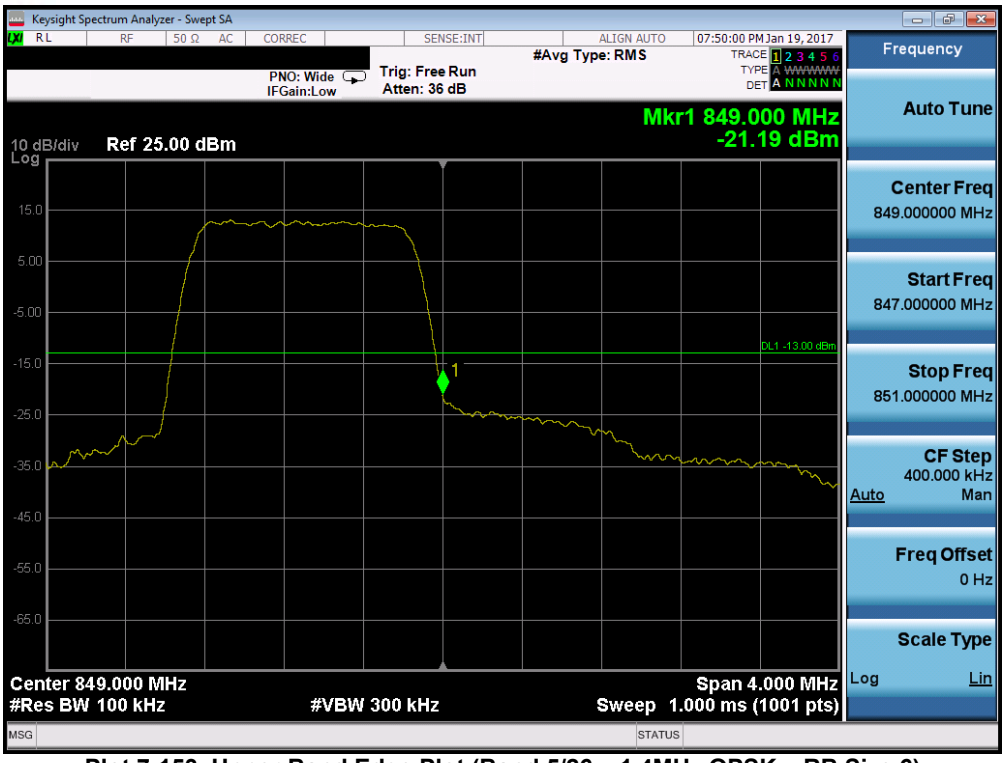
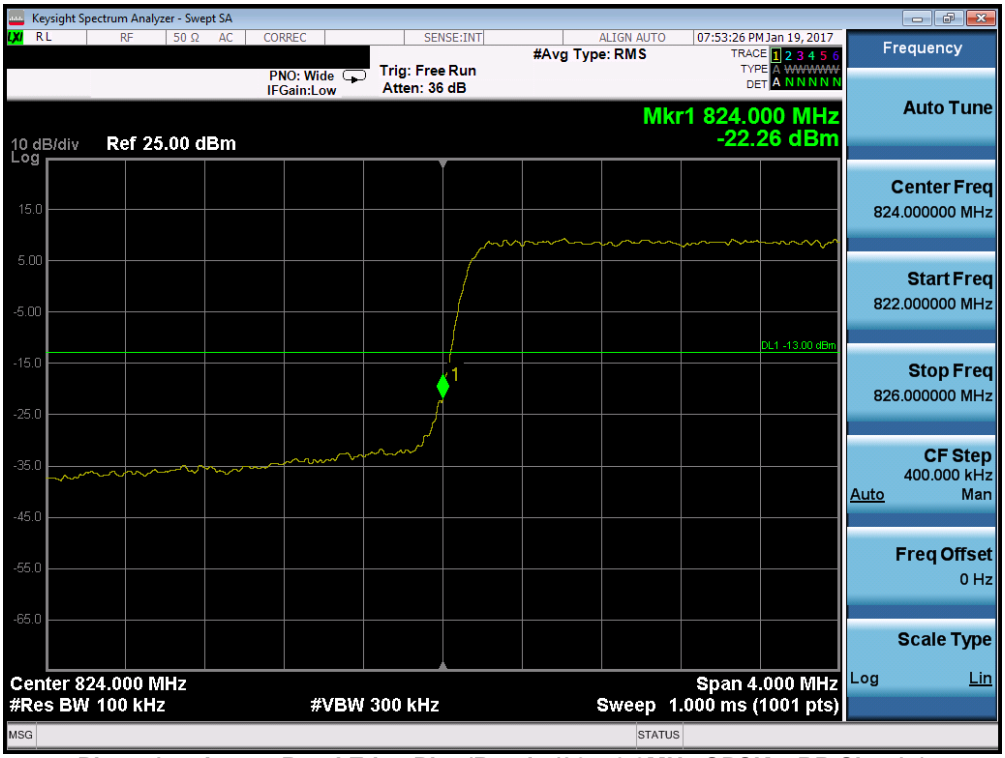


Plot 7-153. Upper Band Edge Plot (Band 5/26 – 1.4MHz QPSK – RB Size 6)



Plot 7-154. Lower Band Edge Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)

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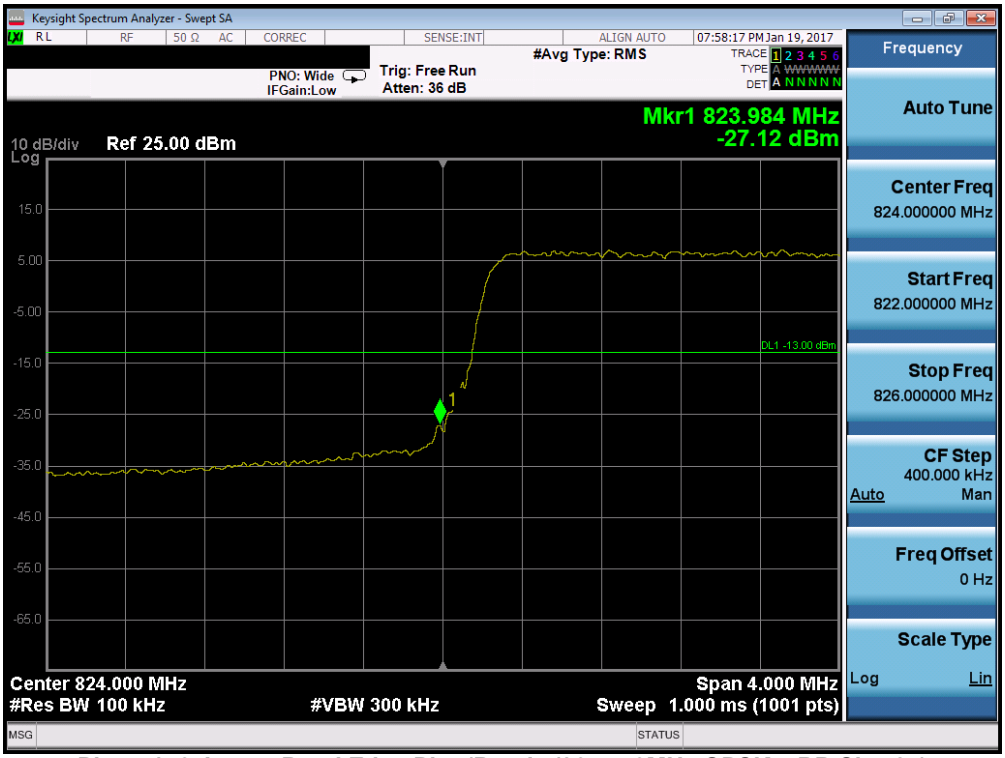
Plot 7-155. Upper Band Edge Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)



Plot 7-156. Lower Band Edge Plot (Band 5/26 – 5.0MHz QPSK – RB Size 25)

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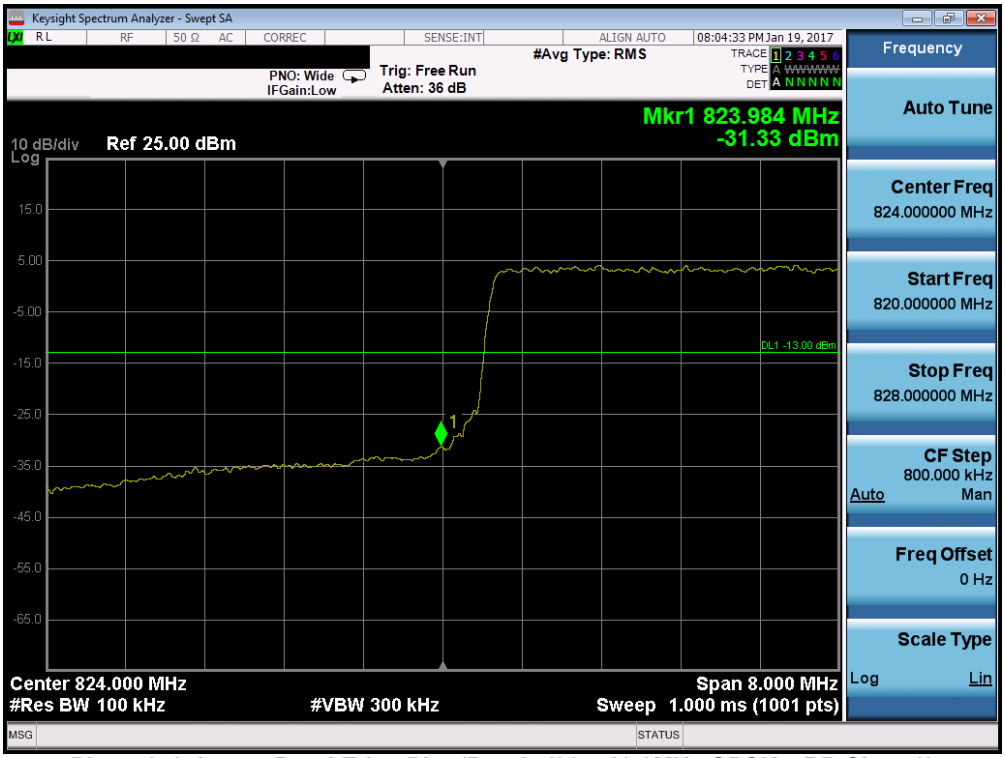
Plot 7-157. Upper Band Edge Plot (Band 5/26 – 5.0MHz QPSK – RB Size 25)



Plot 7-158. Lower Band Edge Plot (Band 5/26 – 10.0MHz QPSK – RB Size 50)

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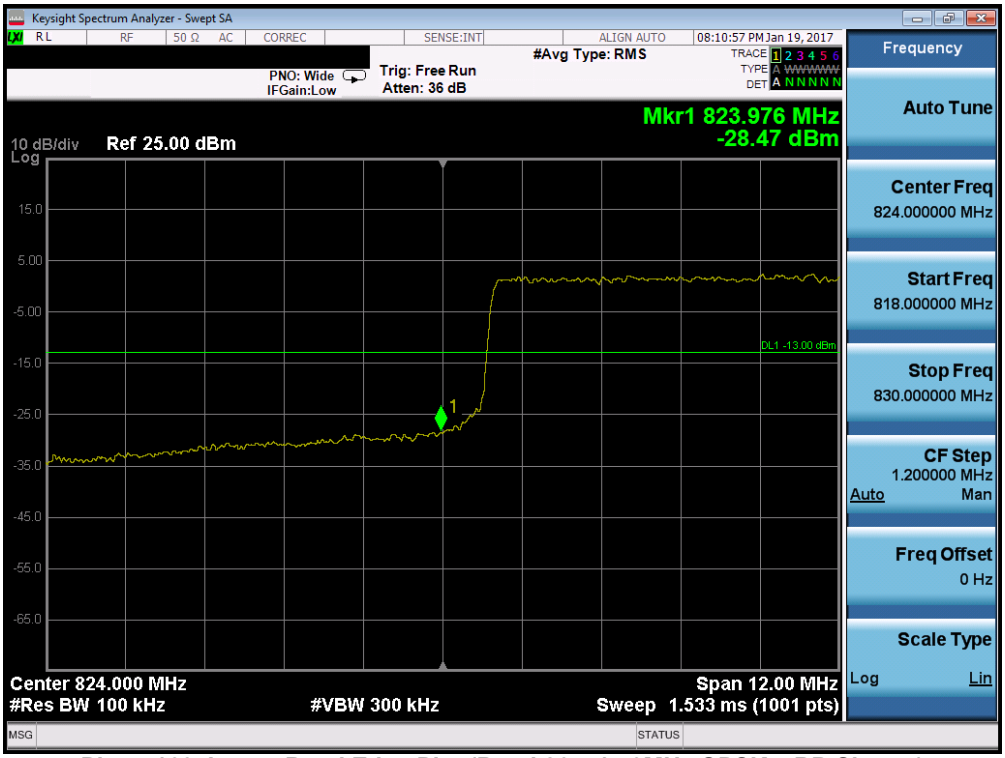
Plot 7-159. Upper Band Edge Plot (Band 5/26 – 10.0MHz QPSK – RB Size 50)



Plot 7-160. Lower Band Edge Plot (Band 26 – 15.0MHz QPSK – RB Size 75)

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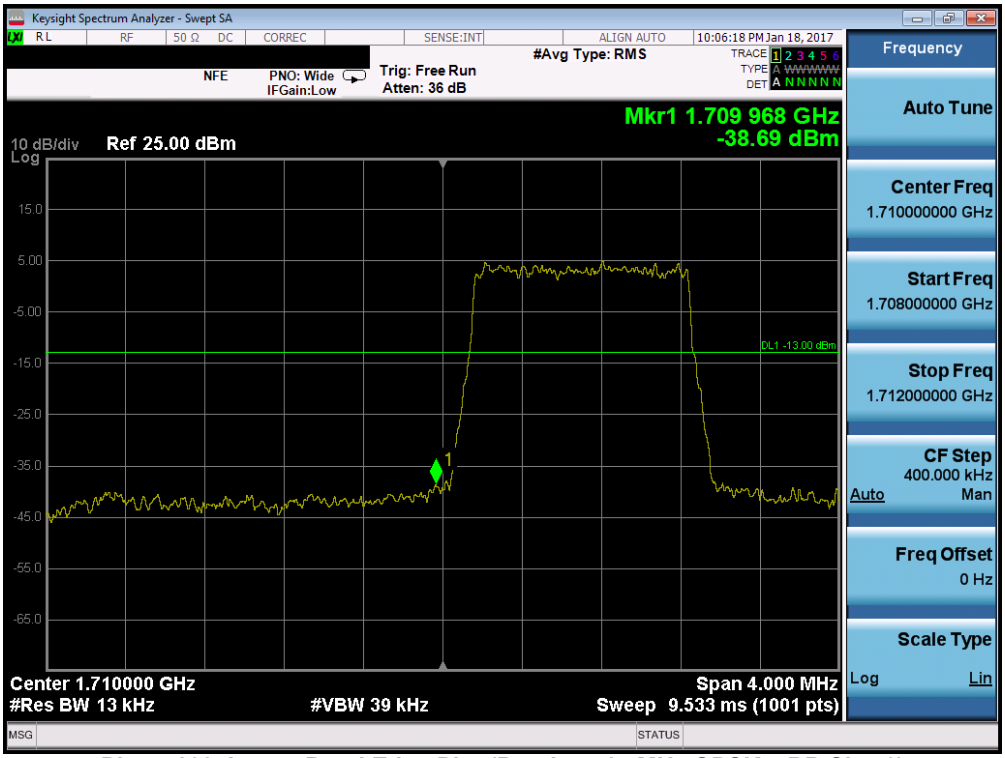
Plot 7-161. Upper Band Edge Plot (Band 26 – 15.0MHz QPSK – RB Size 75)



Plot 7-162. Lower Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

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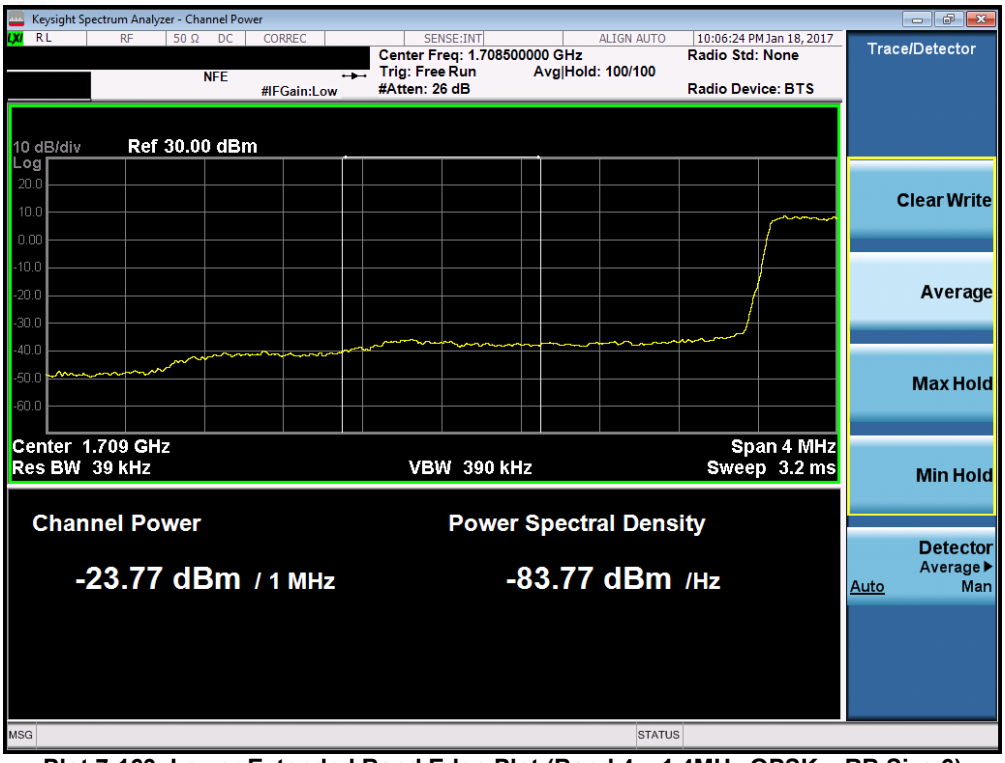
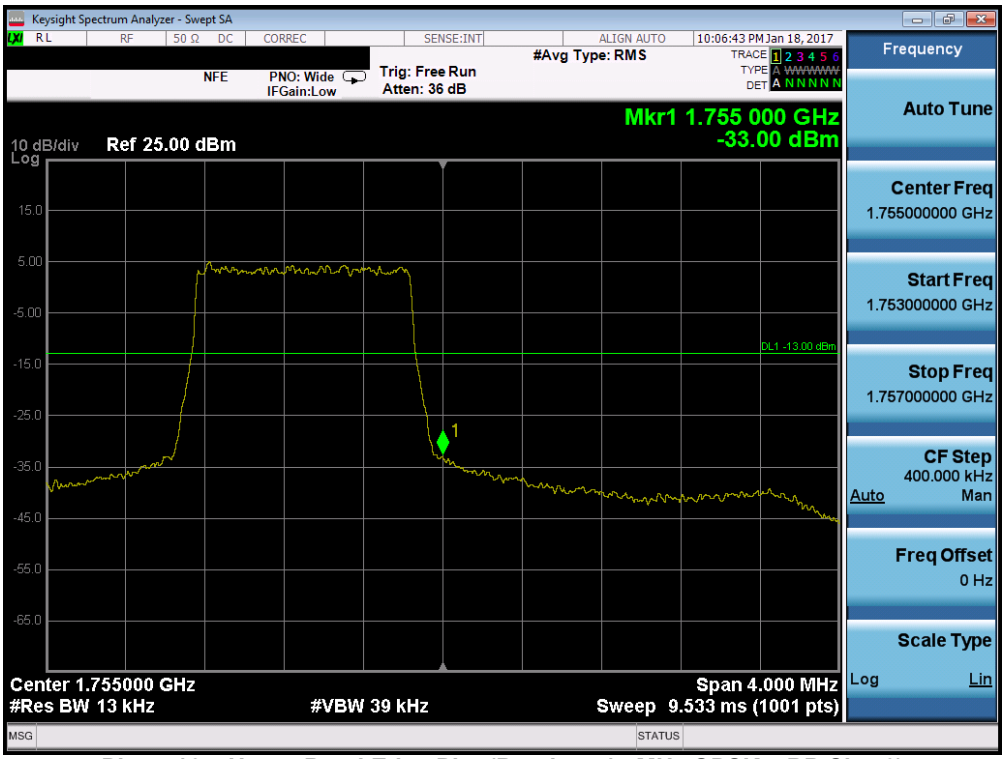


Plot 7-163. Lower Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)



Plot 7-164. Upper Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

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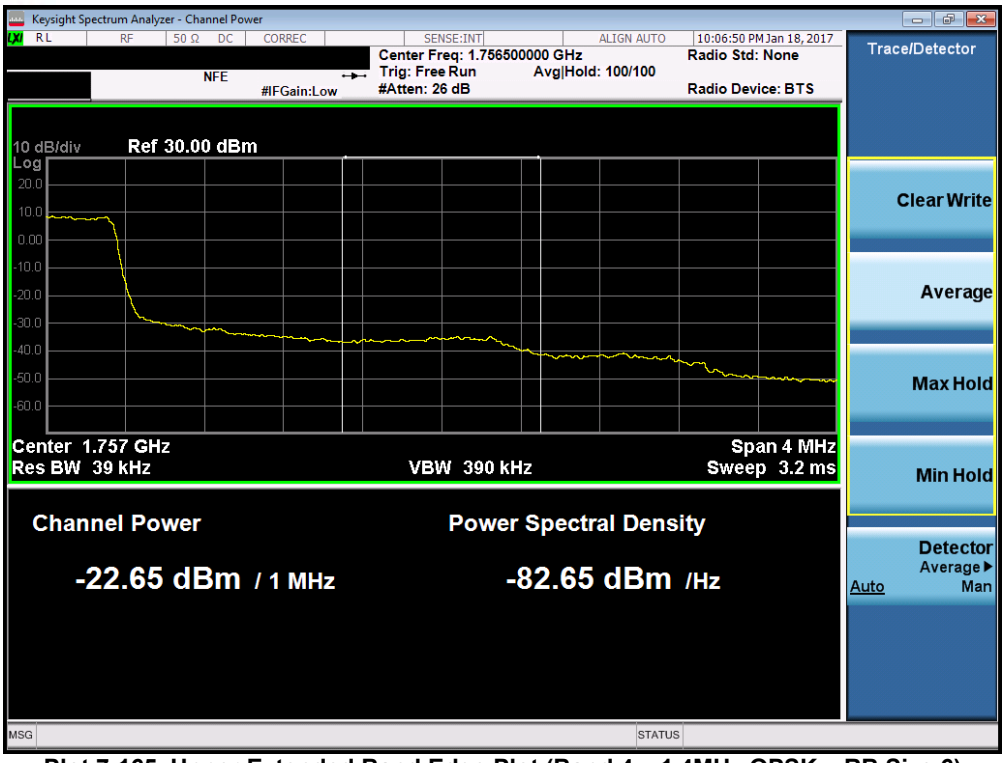
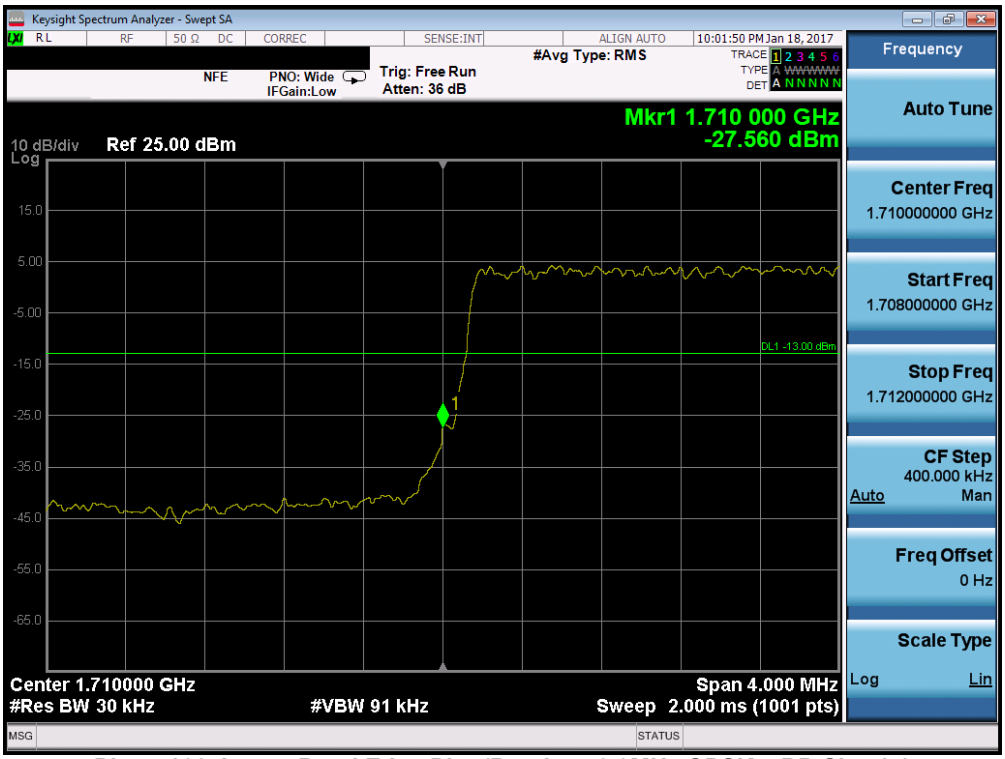


Plot 7-165. Upper Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)



Plot 7-166. Lower Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

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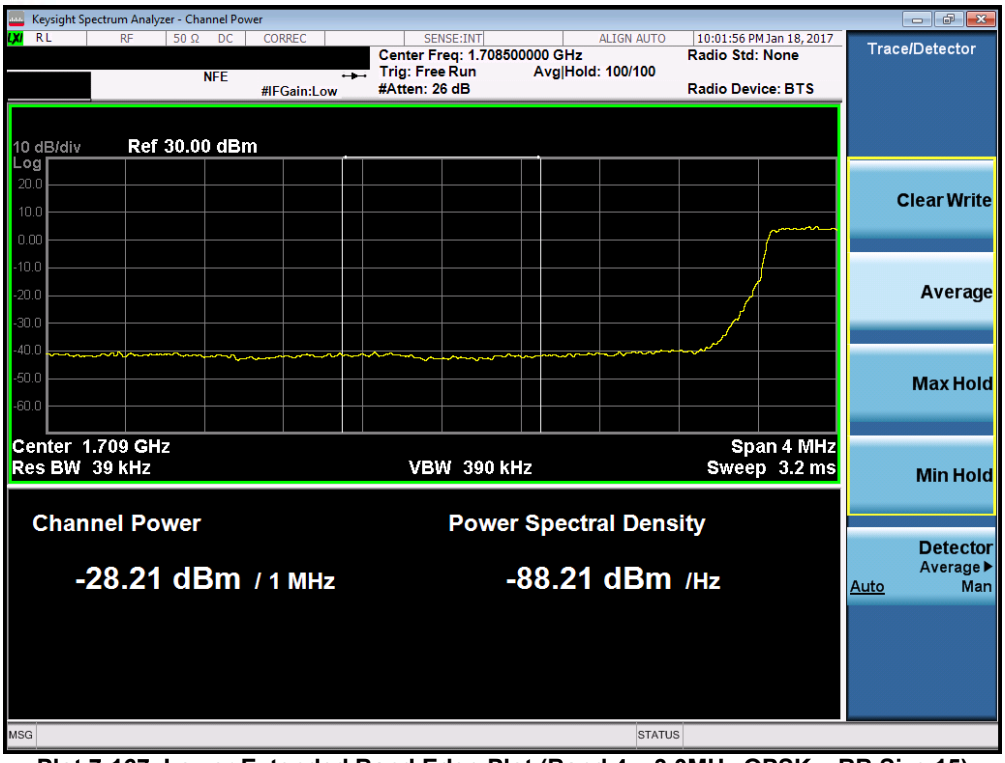
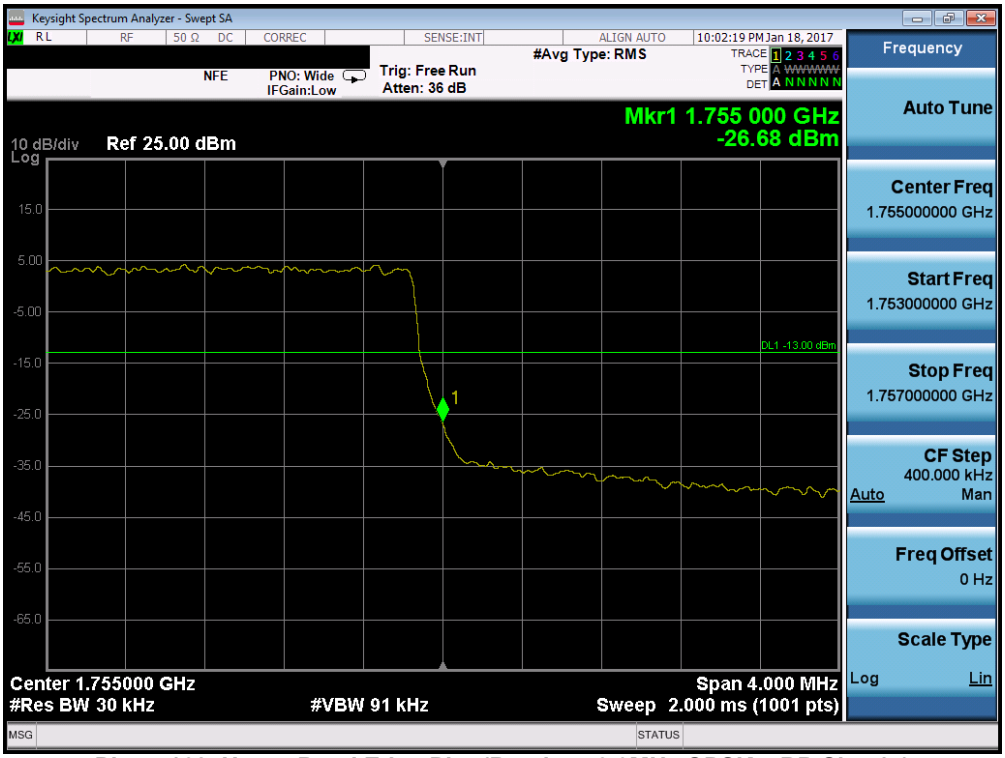


Plot 7-167. Lower Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



Plot 7-168. Upper Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

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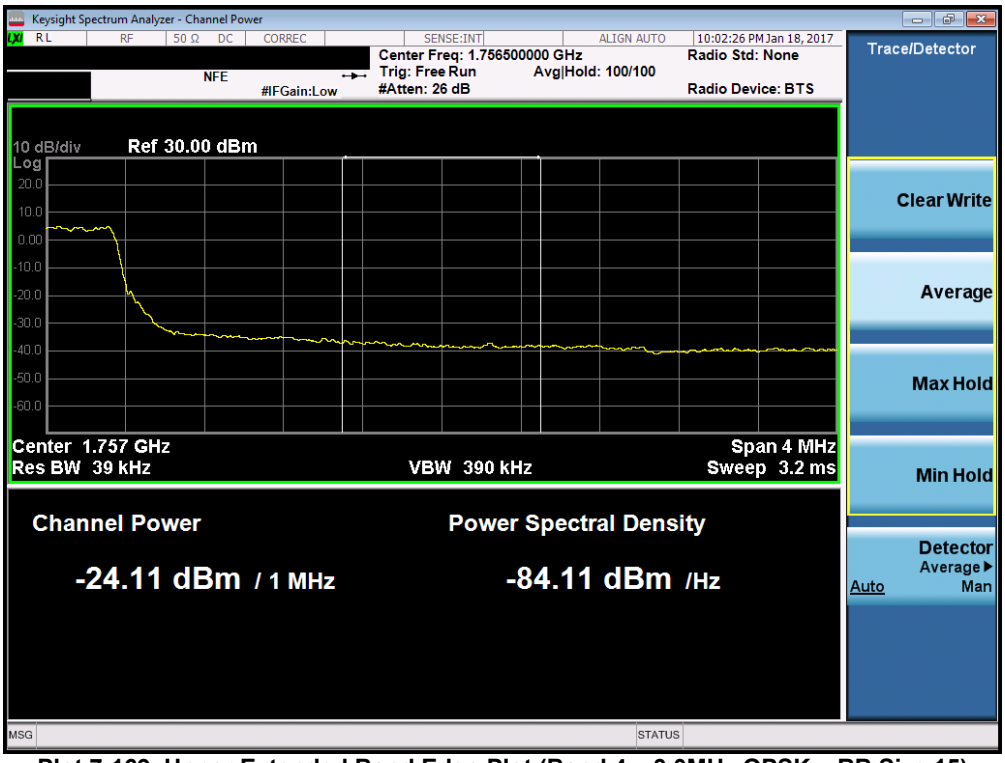
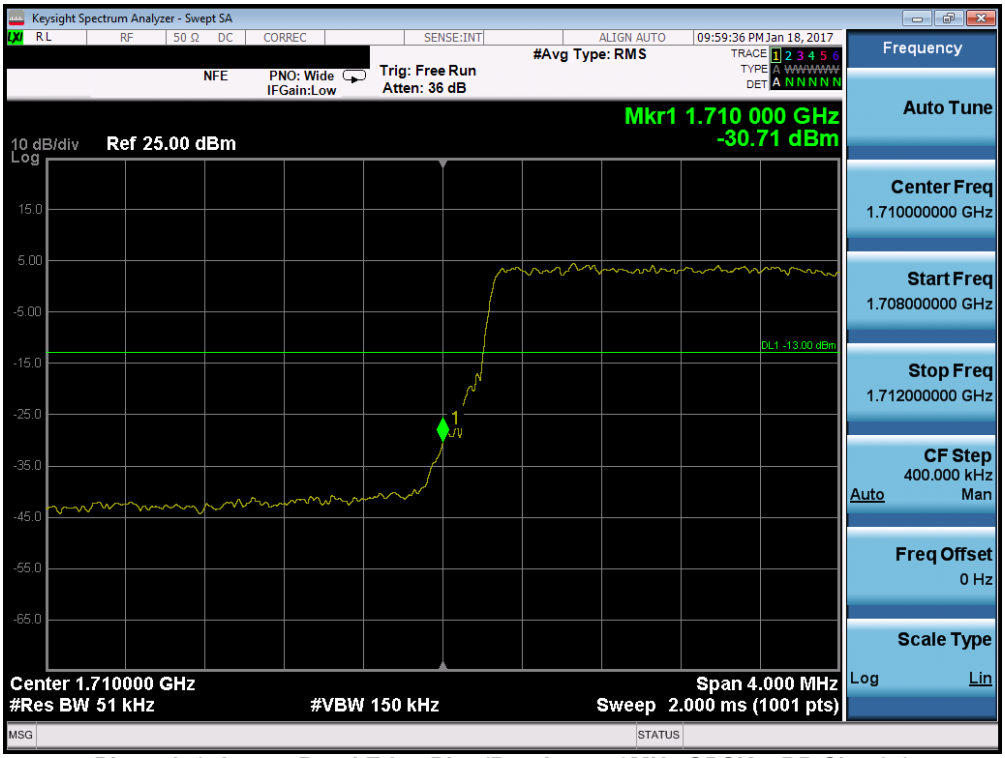


Plot 7-169. Upper Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



Plot 7-170. Lower Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

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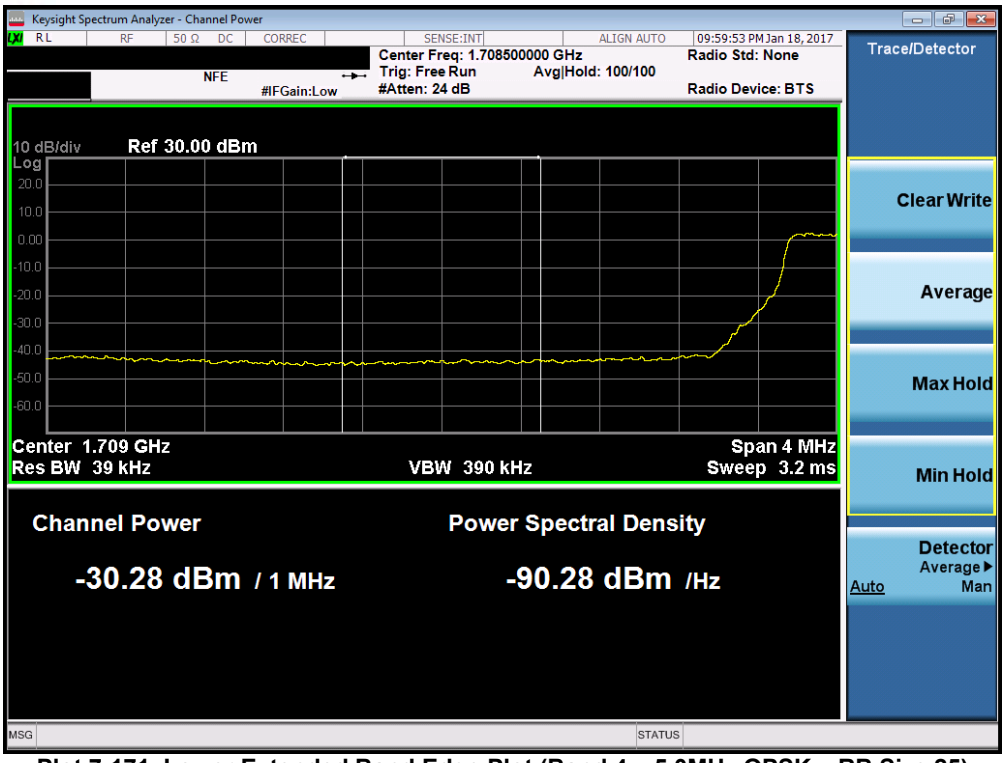
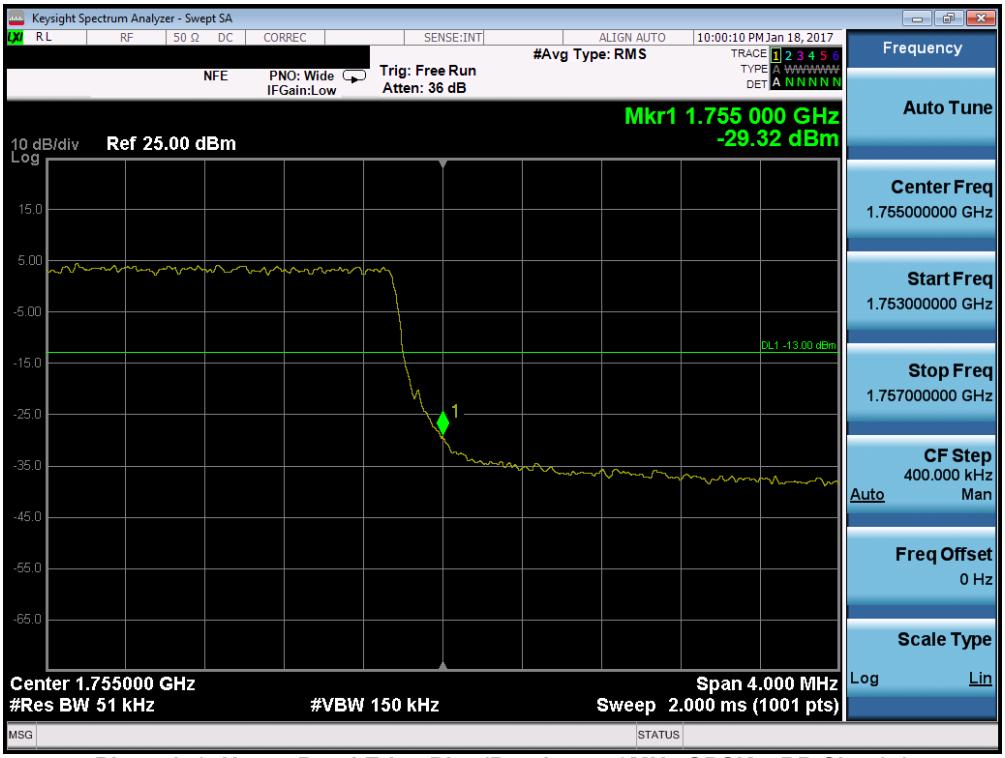


Plot 7-171. Lower Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



Plot 7-172. Upper Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)

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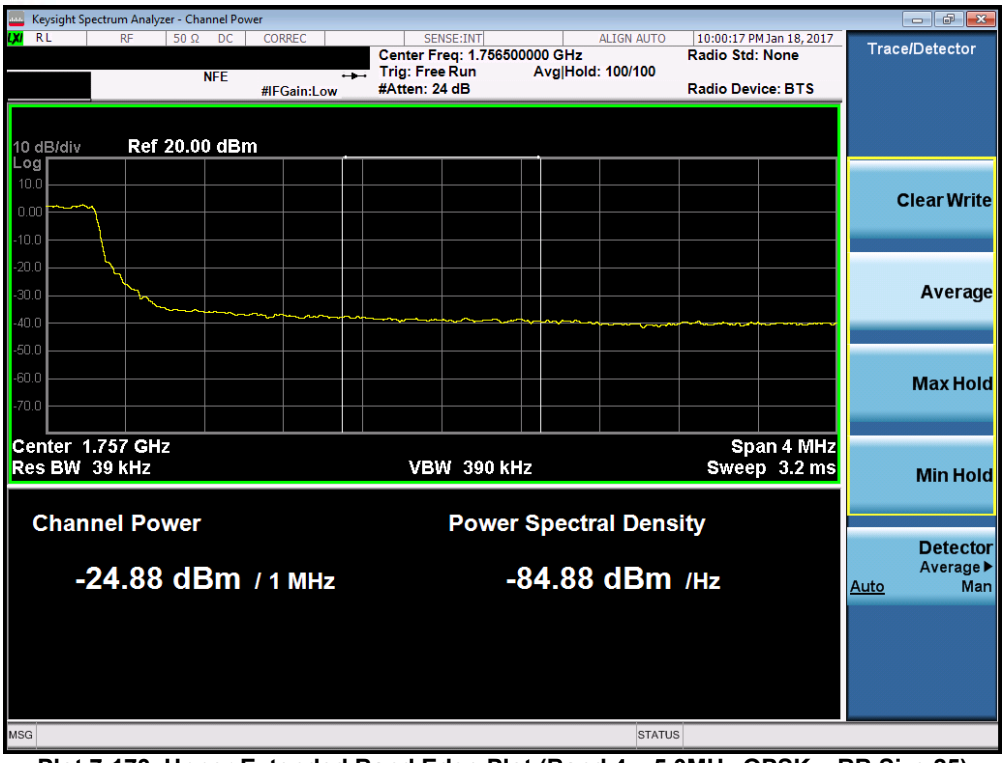
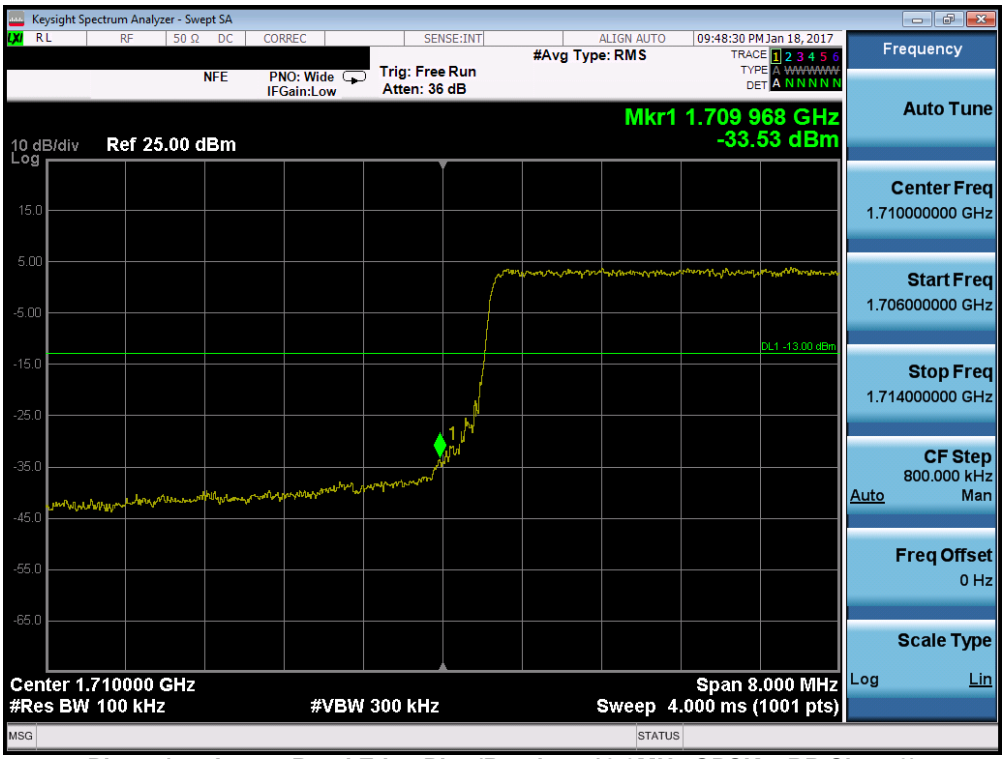


Plot 7-173. Upper Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



Plot 7-174. Lower Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)

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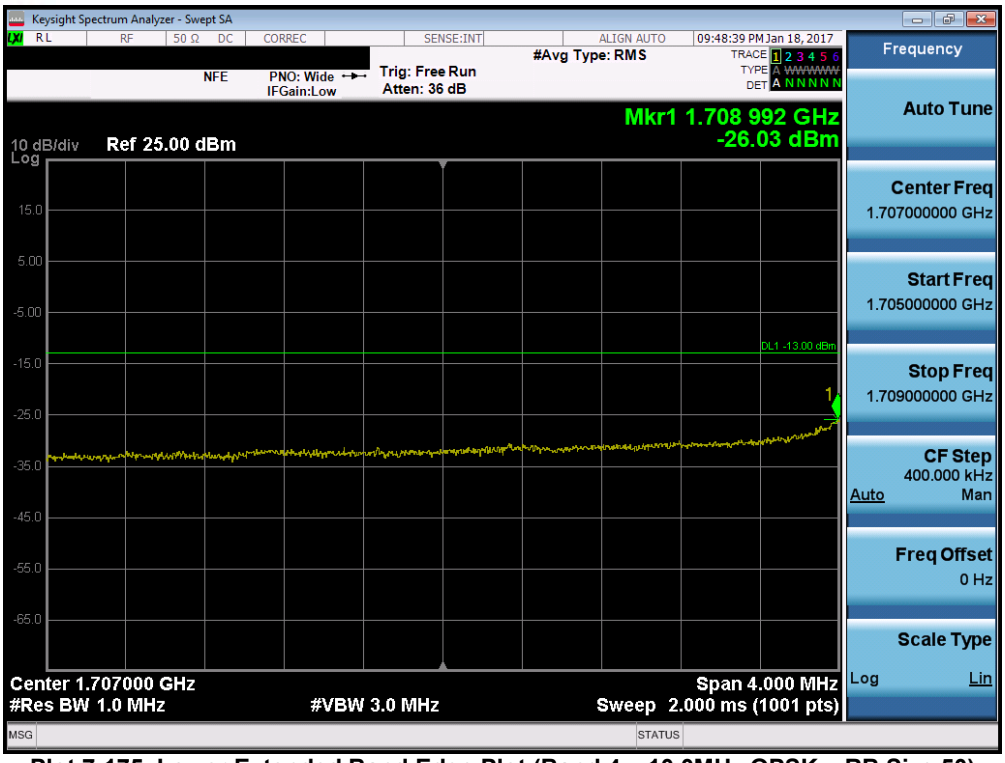
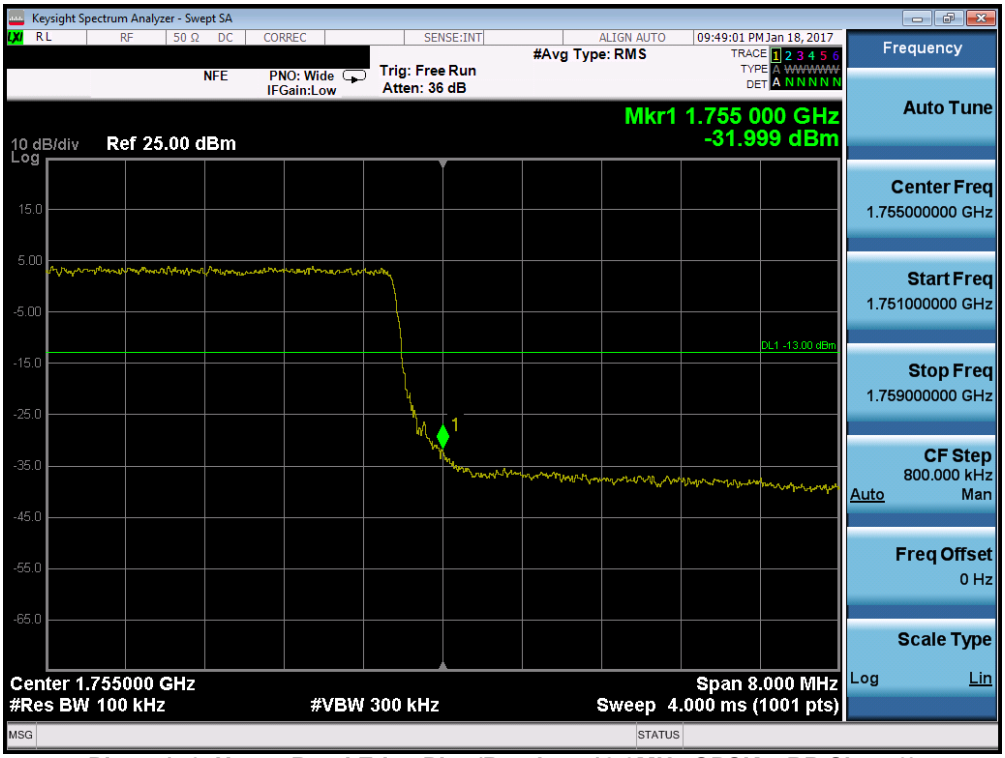


Plot 7-175. Lower Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



Plot 7-176. Upper Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)

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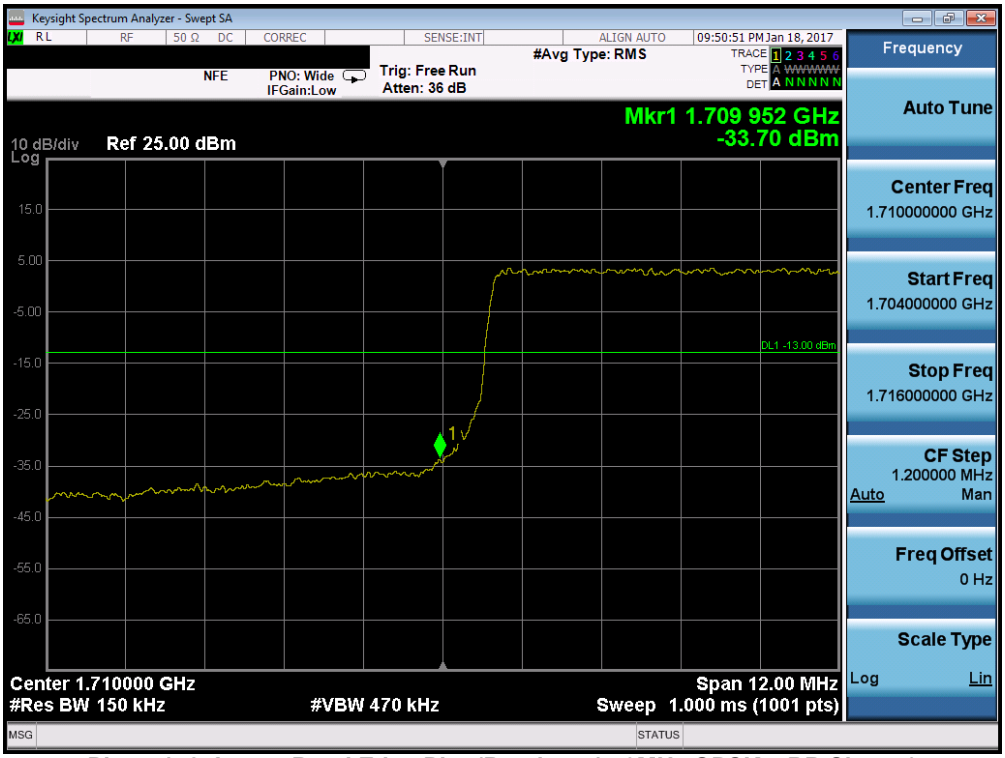
Plot 7-177. Upper Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



Plot 7-178. Lower Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

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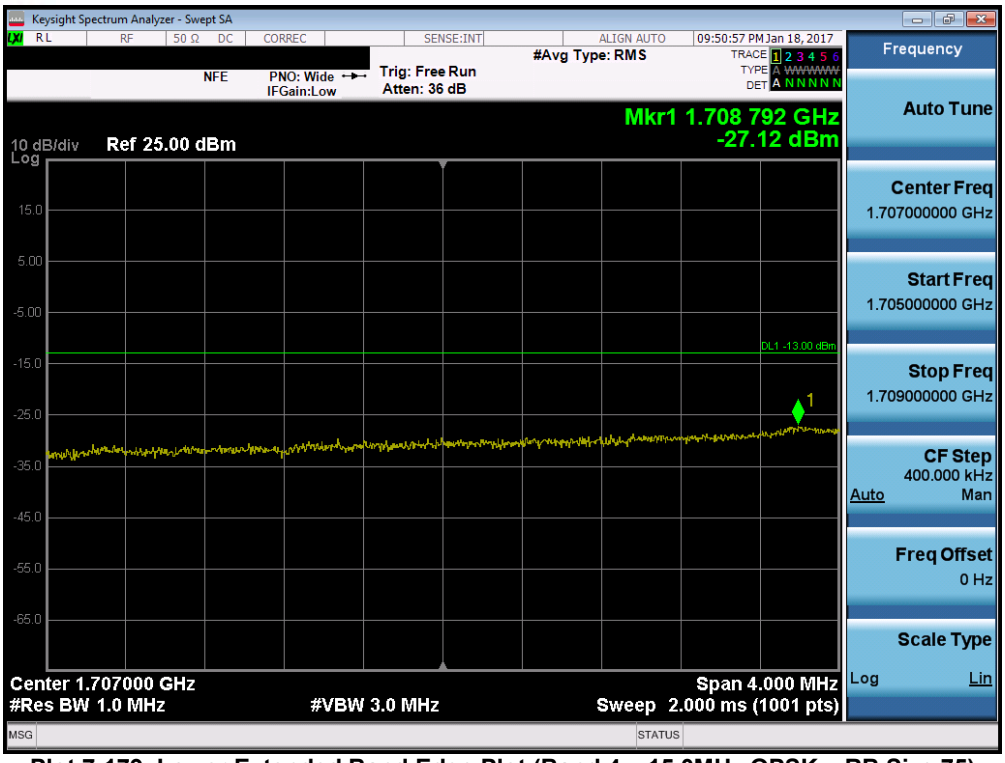
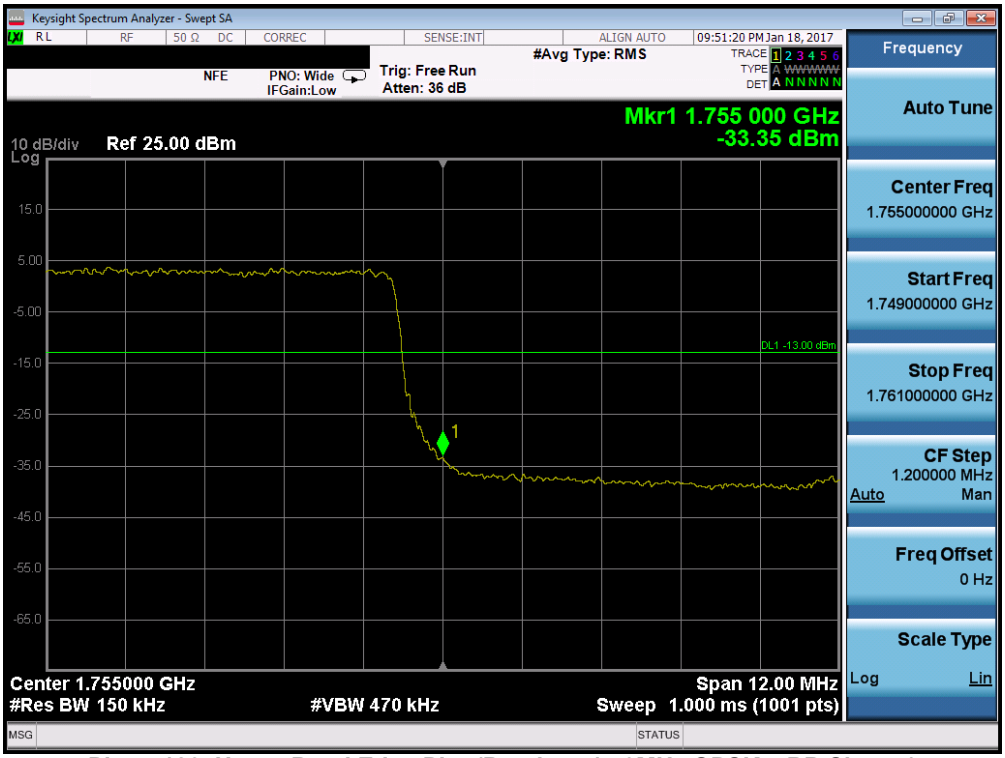


Plot 7-179. Lower Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



Plot 7-180. Upper Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)

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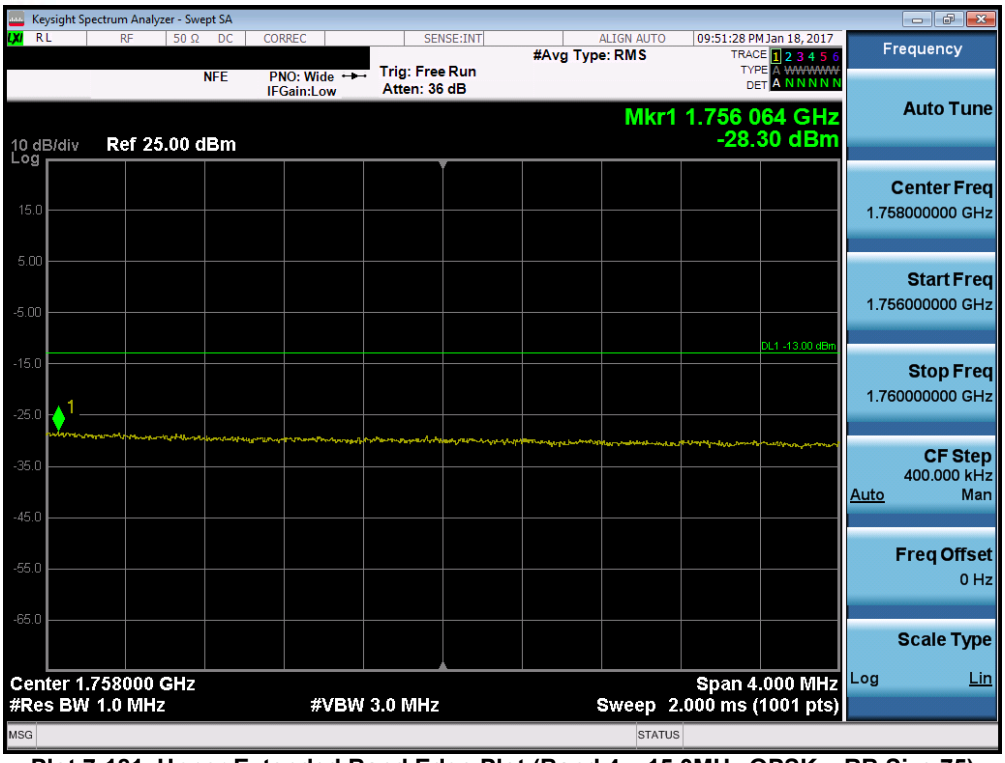
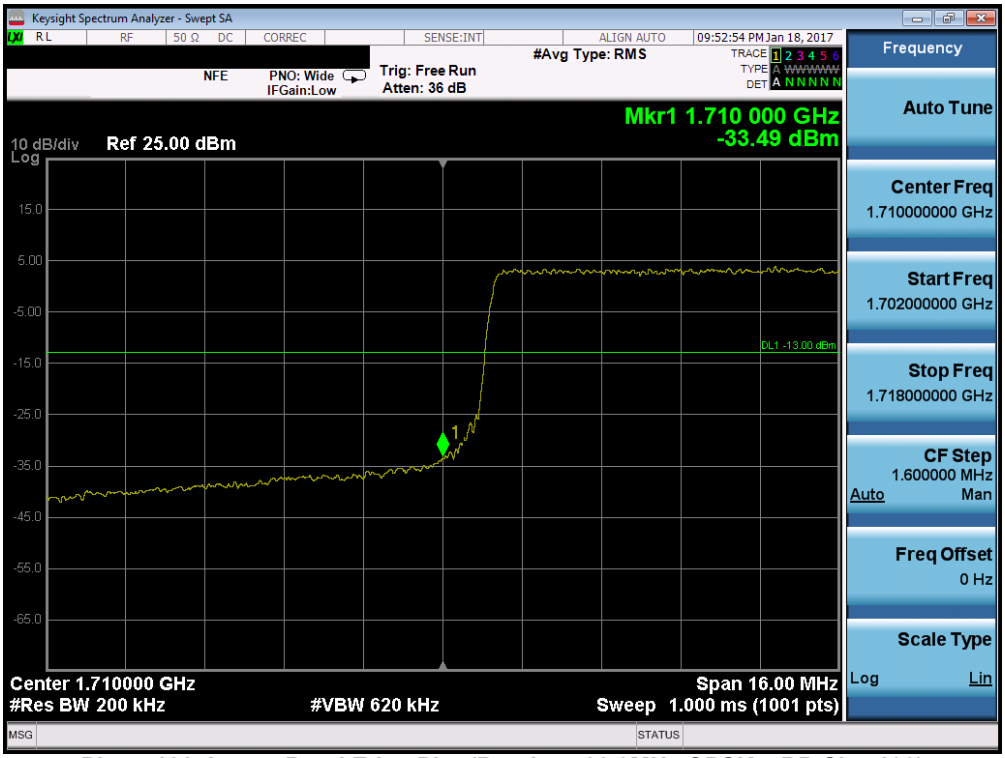


Plot 7-181. Upper Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



Plot 7-182. Lower Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

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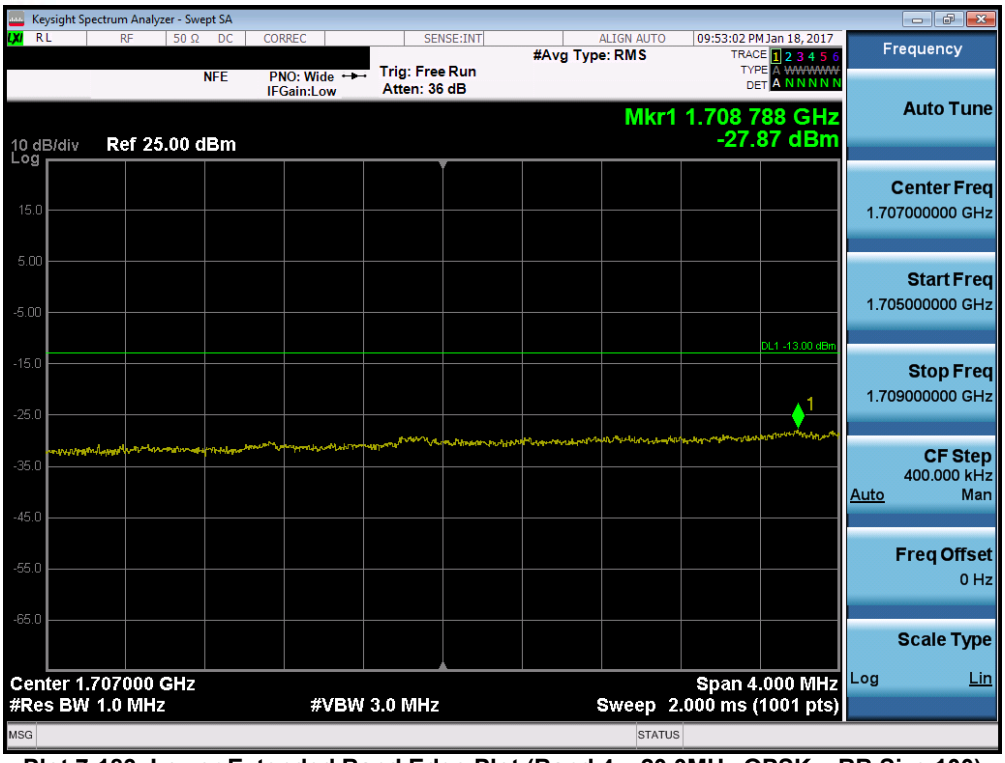
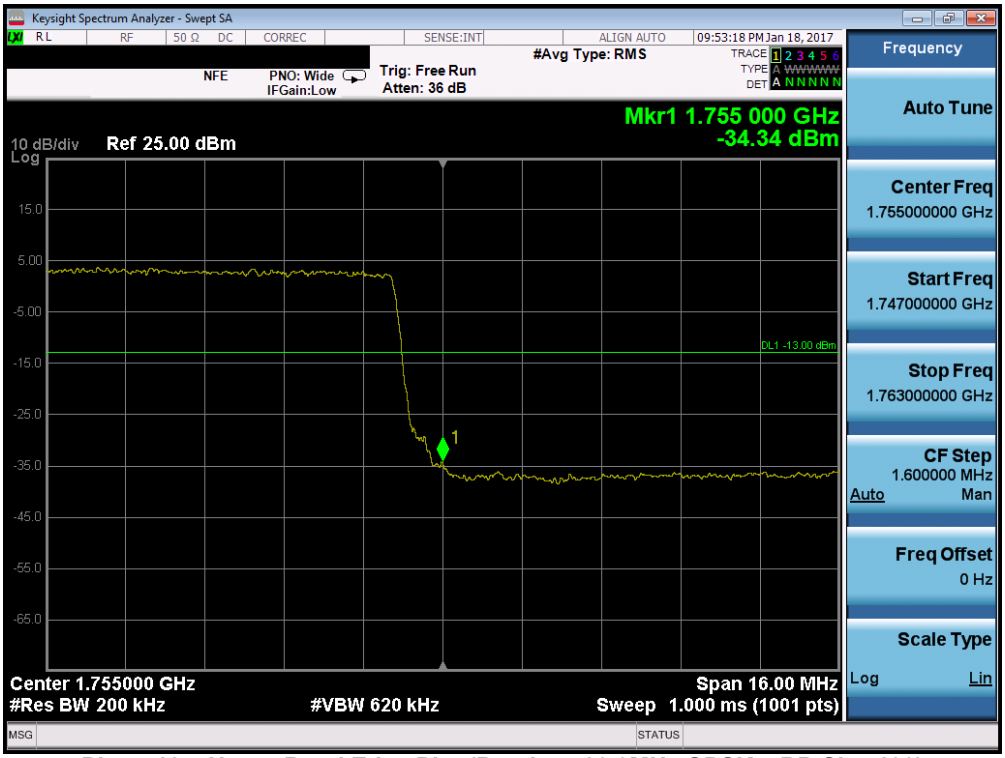


Plot 7-183. Lower Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



Plot 7-184. Upper Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

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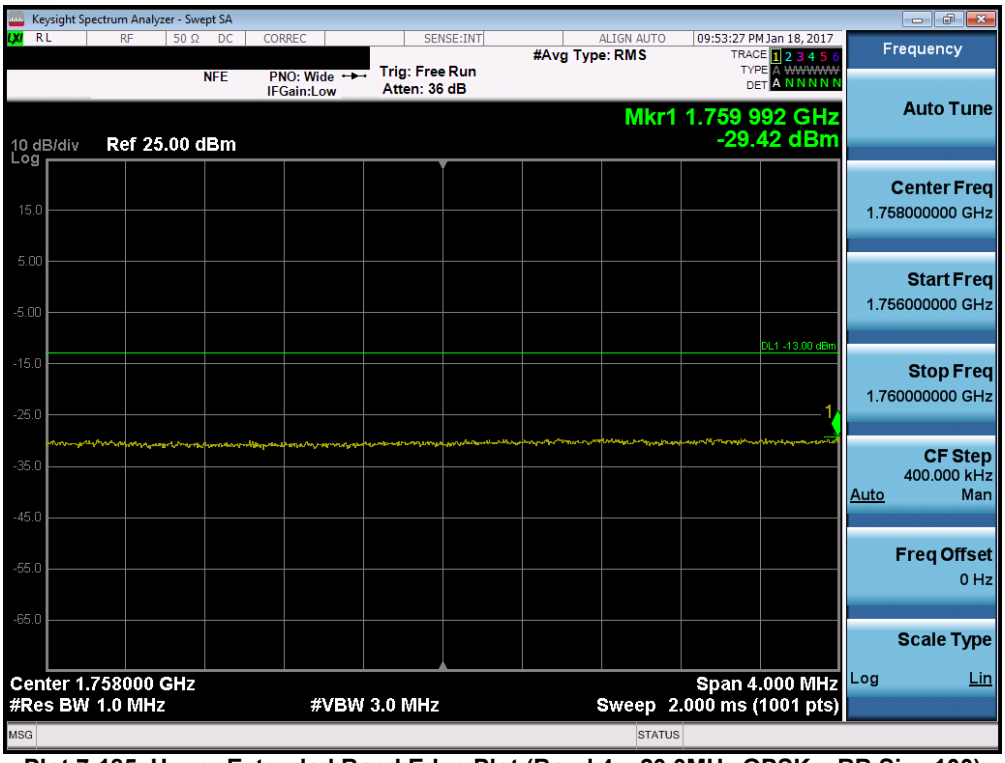
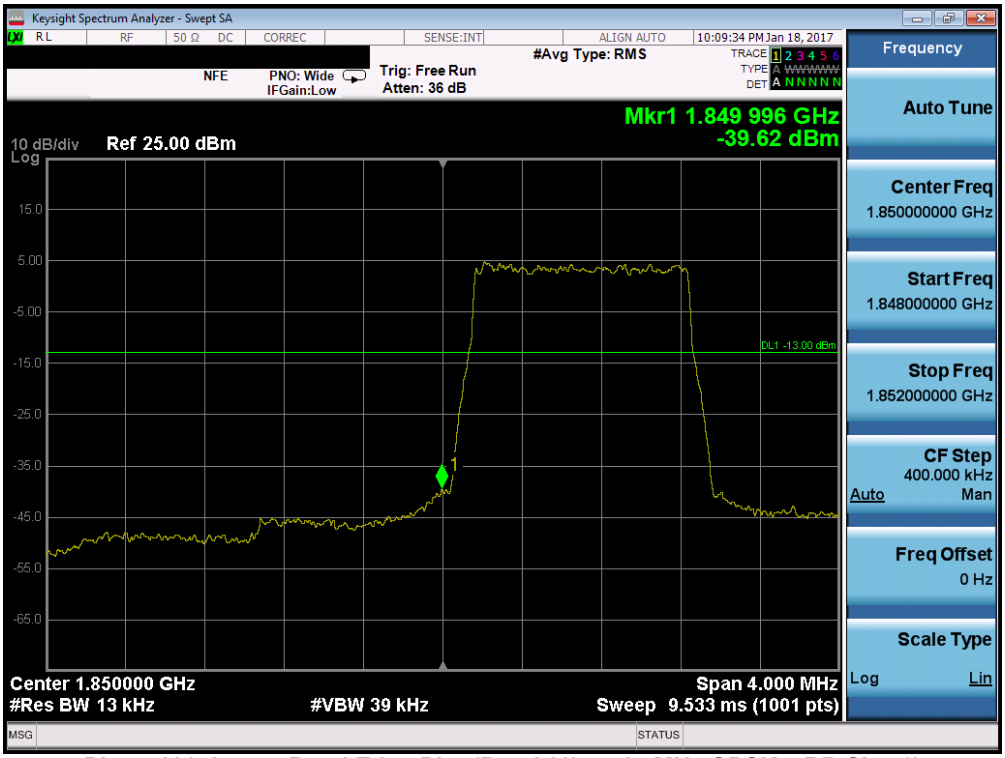


Plot 7-185. Upper Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



Plot 7-186. Lower Band Edge Plot (Band 2/25 – 1.4MHz QPSK – RB Size 6)

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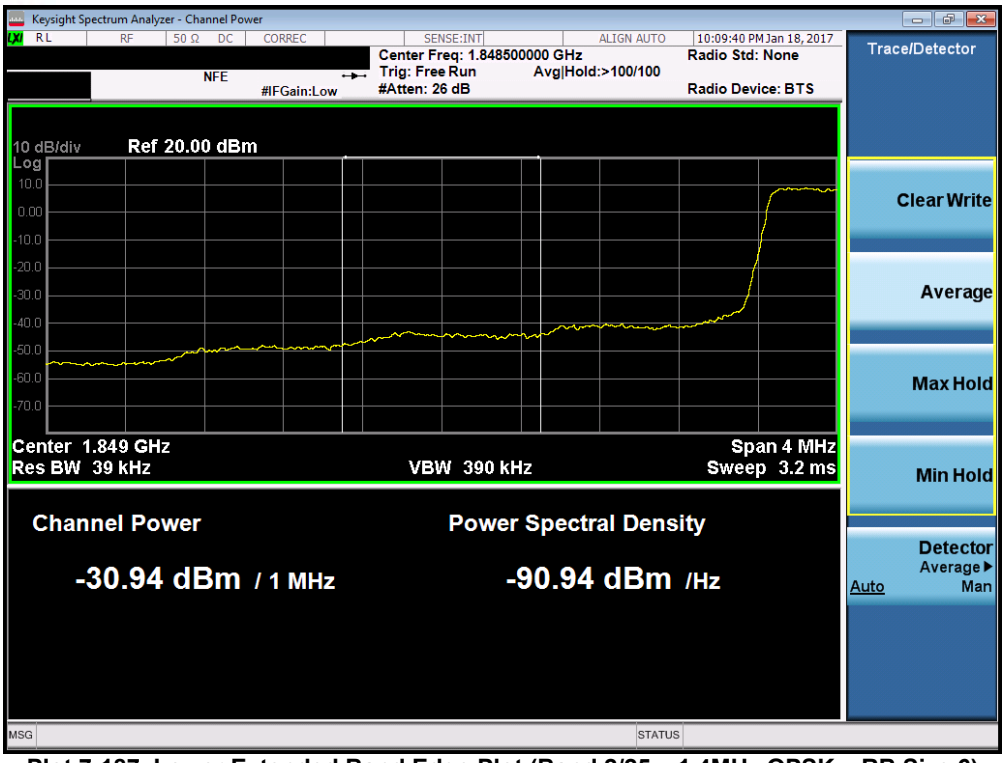
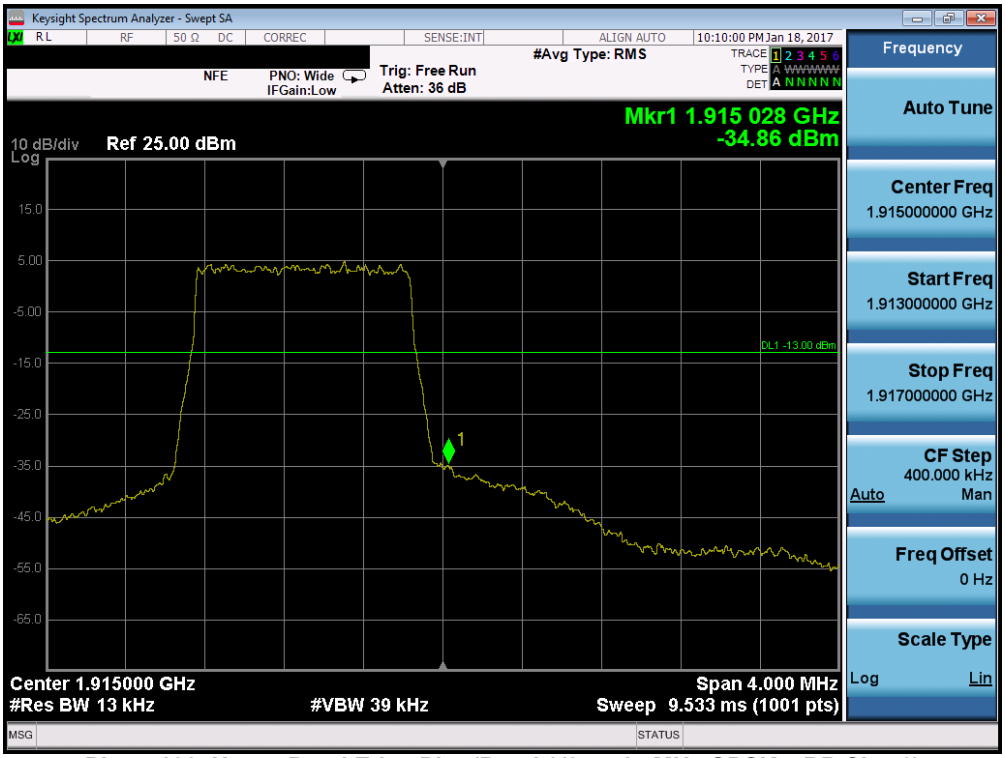


Plot 7-187. Lower Extended Band Edge Plot (Band 2/25 – 1.4MHz QPSK – RB Size 6)



Plot 7-188. Upper Band Edge Plot (Band 2/25 – 1.4MHz QPSK – RB Size 6)

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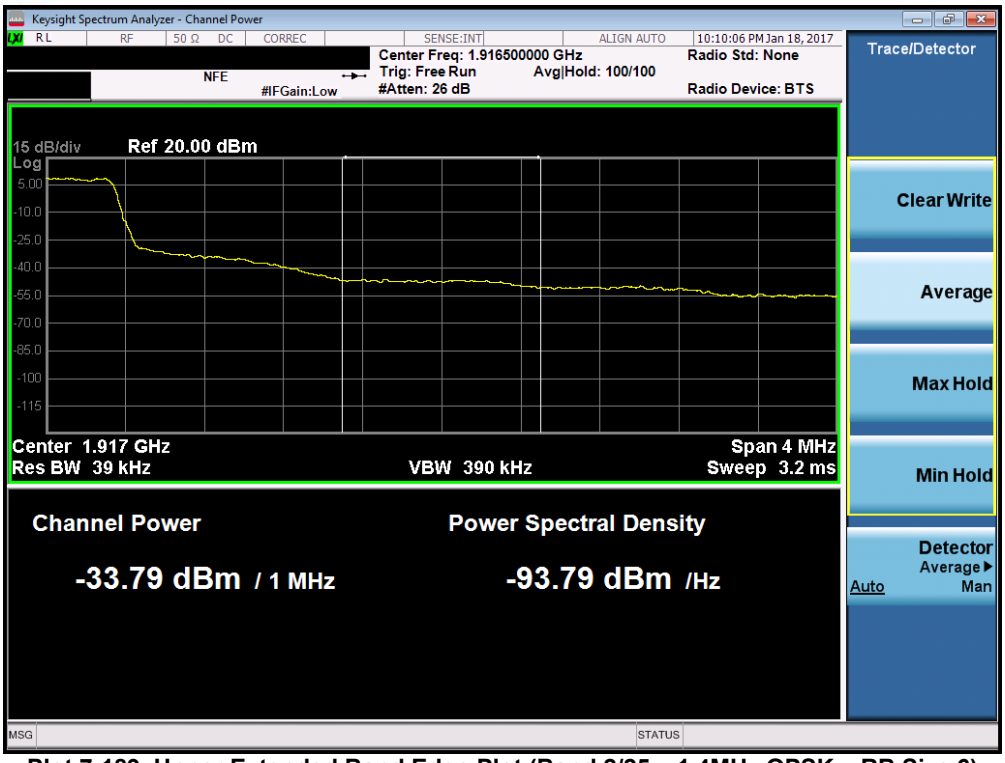
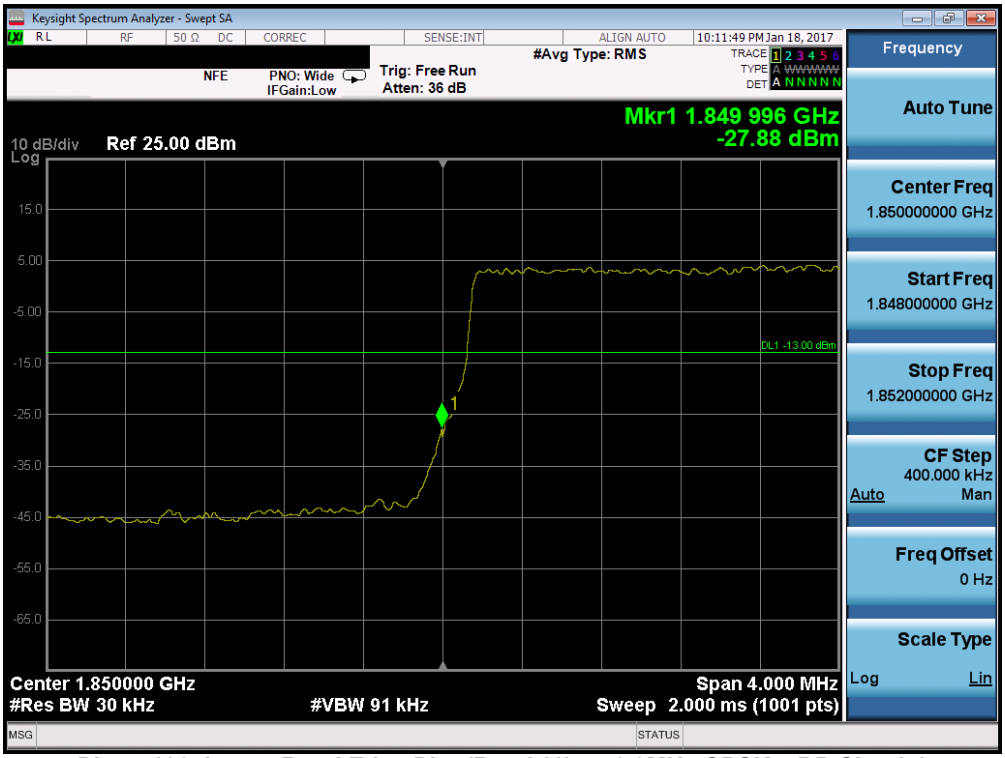


Plot 7-189. Upper Extended Band Edge Plot (Band 2/25 – 1.4MHz QPSK – RB Size 6)



Plot 7-190. Lower Band Edge Plot (Band 2/25 – 3.0MHz QPSK – RB Size 15)

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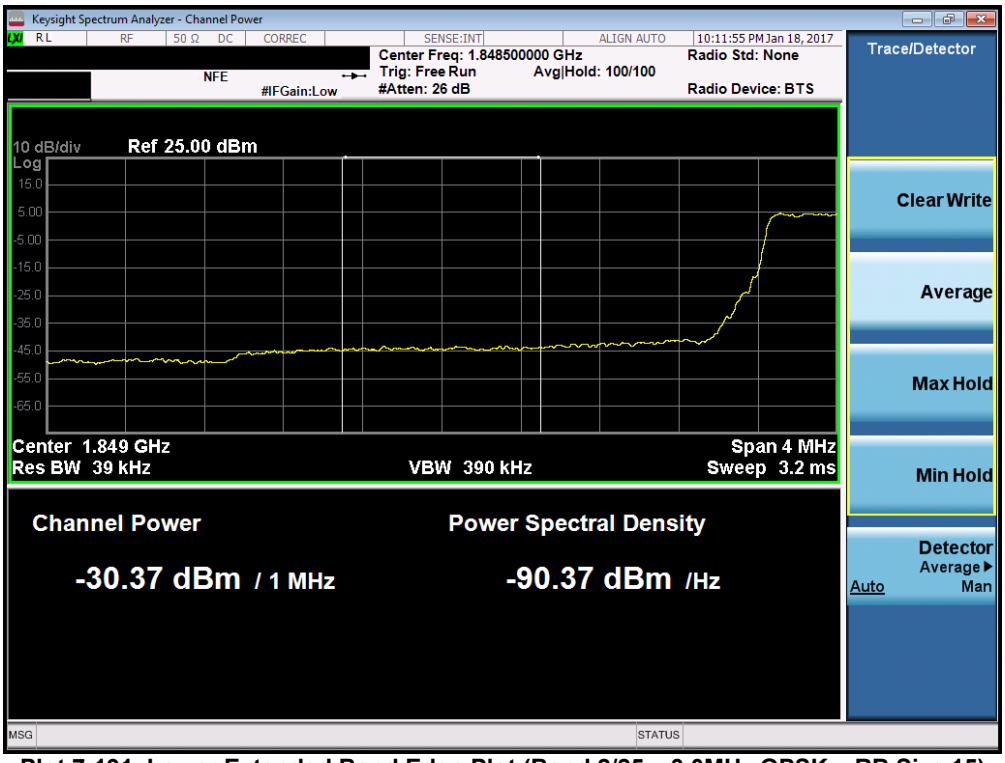
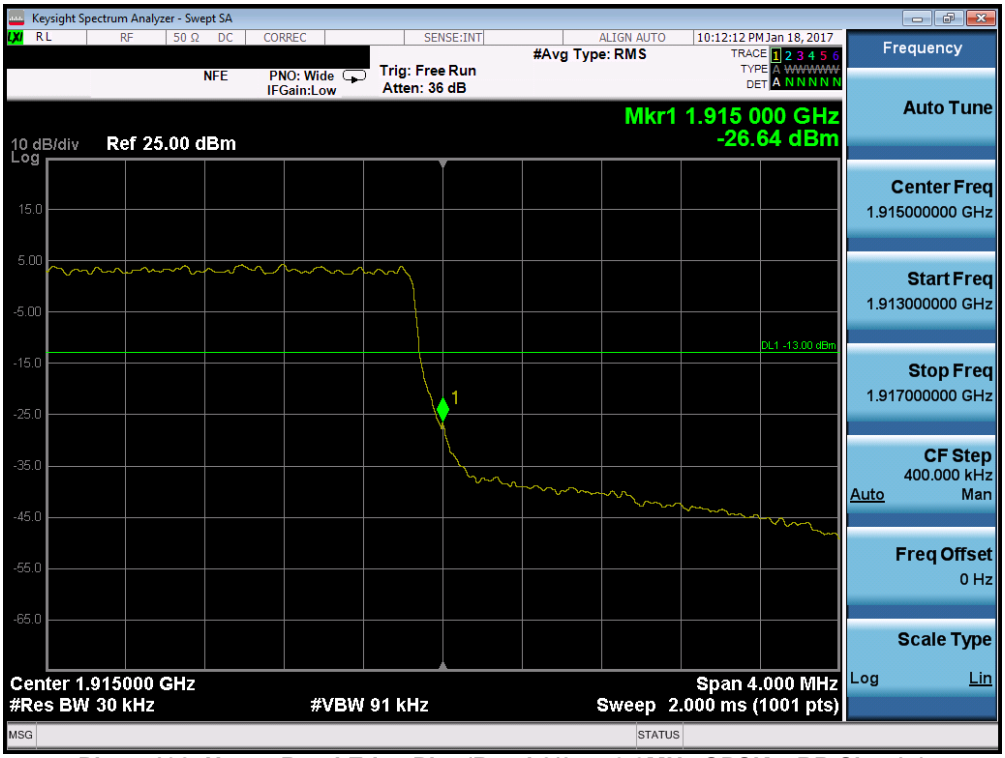


Plot 7-191. Lower Extended Band Edge Plot (Band 2/25 – 3.0MHz QPSK – RB Size 15)



Plot 7-192. Upper Band Edge Plot (Band 2/25 – 3.0MHz QPSK – RB Size 15)

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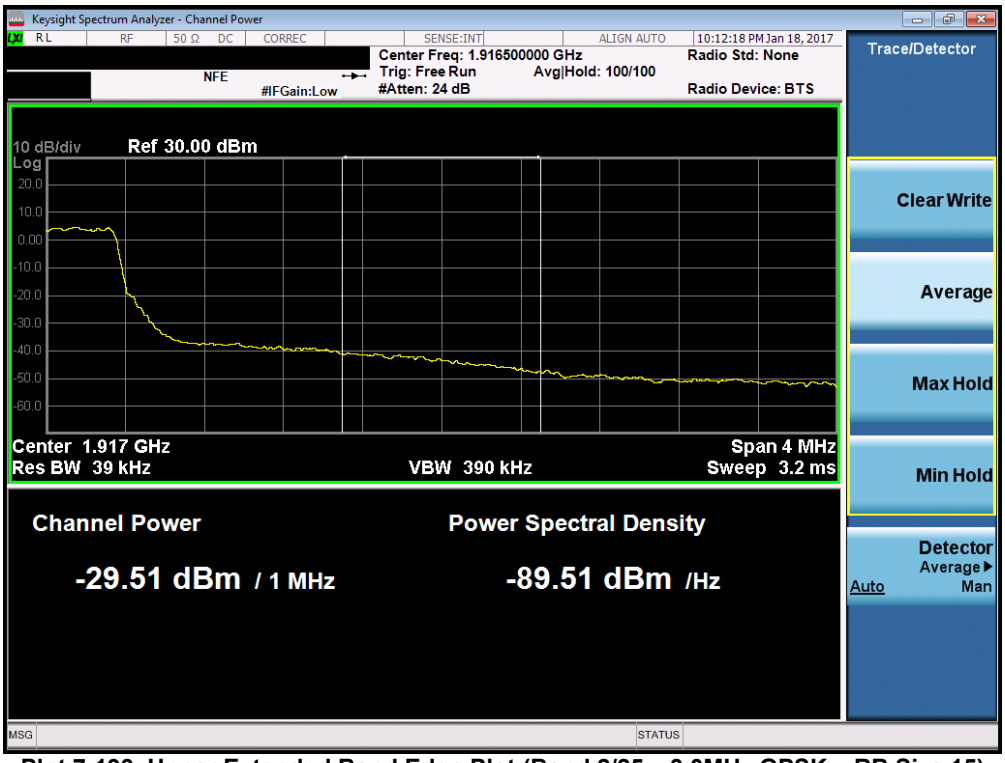
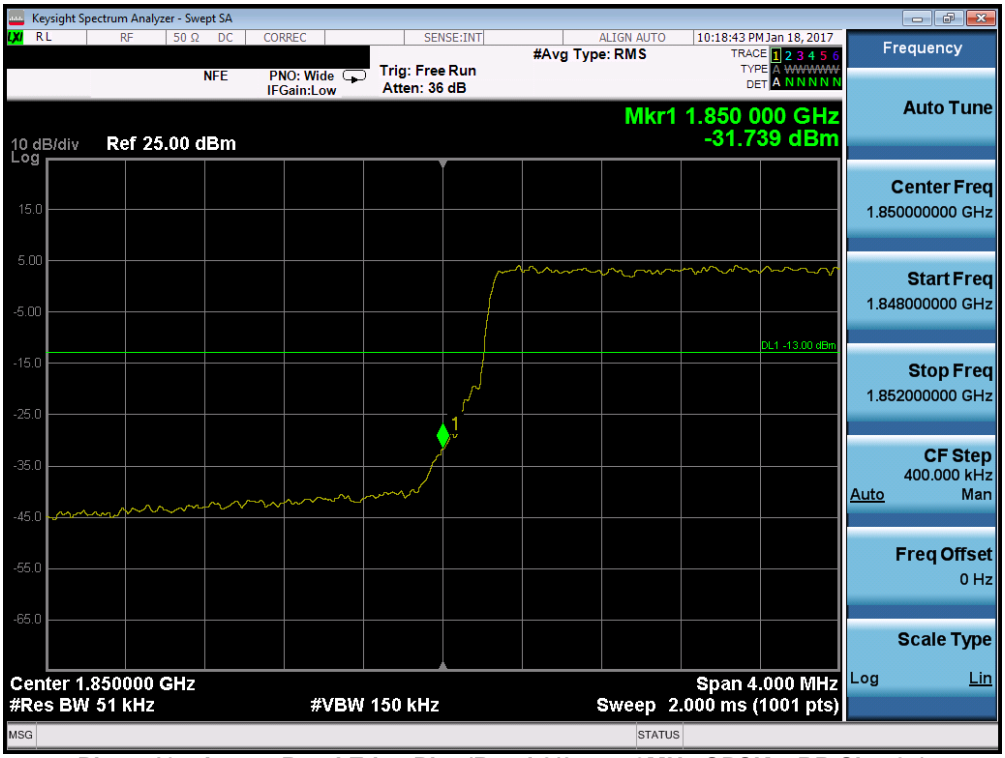


Plot 7-193. Upper Extended Band Edge Plot (Band 2/25 – 3.0MHz QPSK – RB Size 15)



Plot 7-194. Lower Band Edge Plot (Band 2/25 – 5.0MHz QPSK – RB Size 25)

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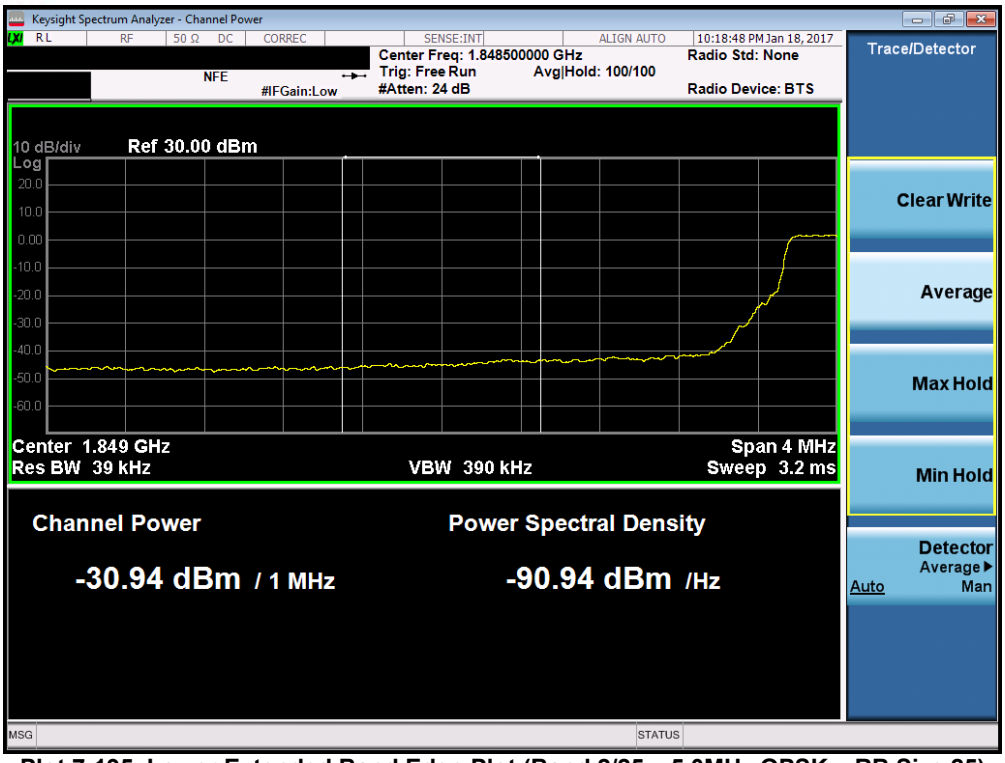
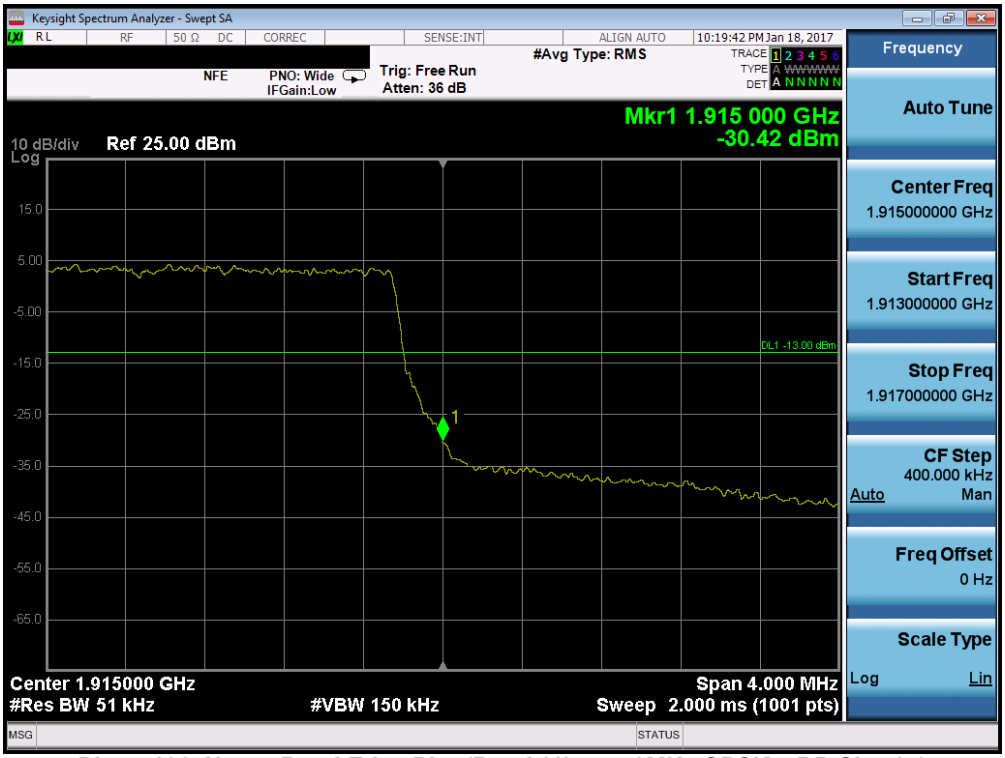


Plot 7-195. Lower Extended Band Edge Plot (Band 2/25 – 5.0MHz QPSK – RB Size 25)



Plot 7-196. Upper Band Edge Plot (Band 2/25 – 5.0MHz QPSK – RB Size 25)

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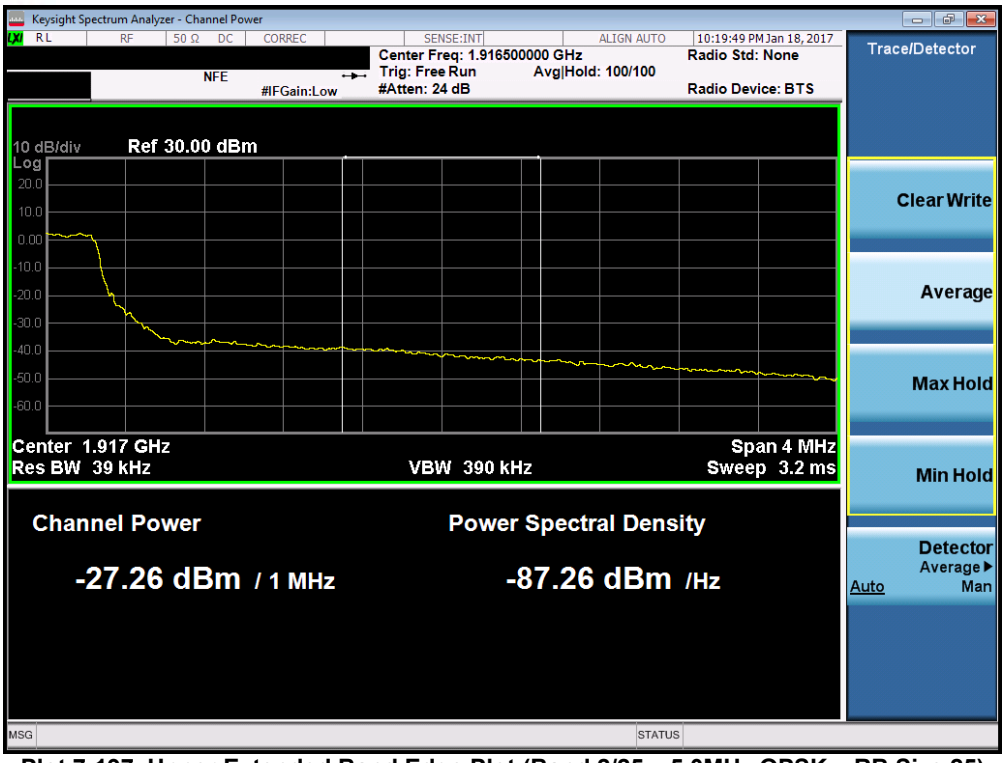
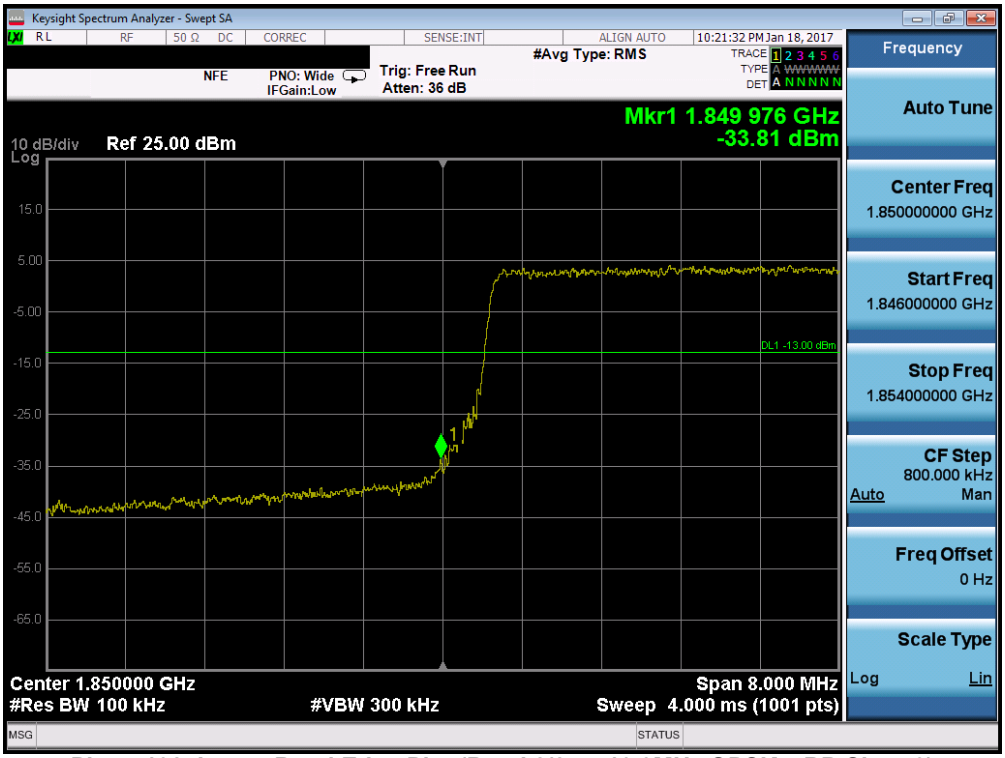


Plot 7-197. Upper Extended Band Edge Plot (Band 2/25 – 5.0MHz QPSK – RB Size 25)



Plot 7-198. Lower Band Edge Plot (Band 2/25 – 10.0MHz QPSK – RB Size 50)

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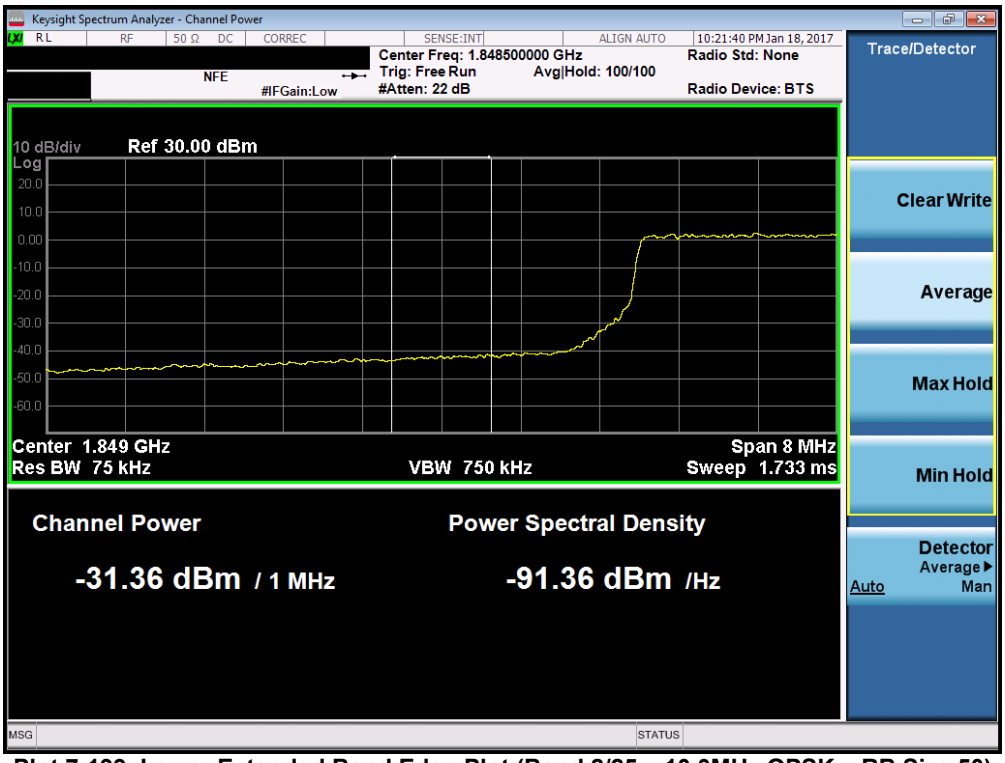
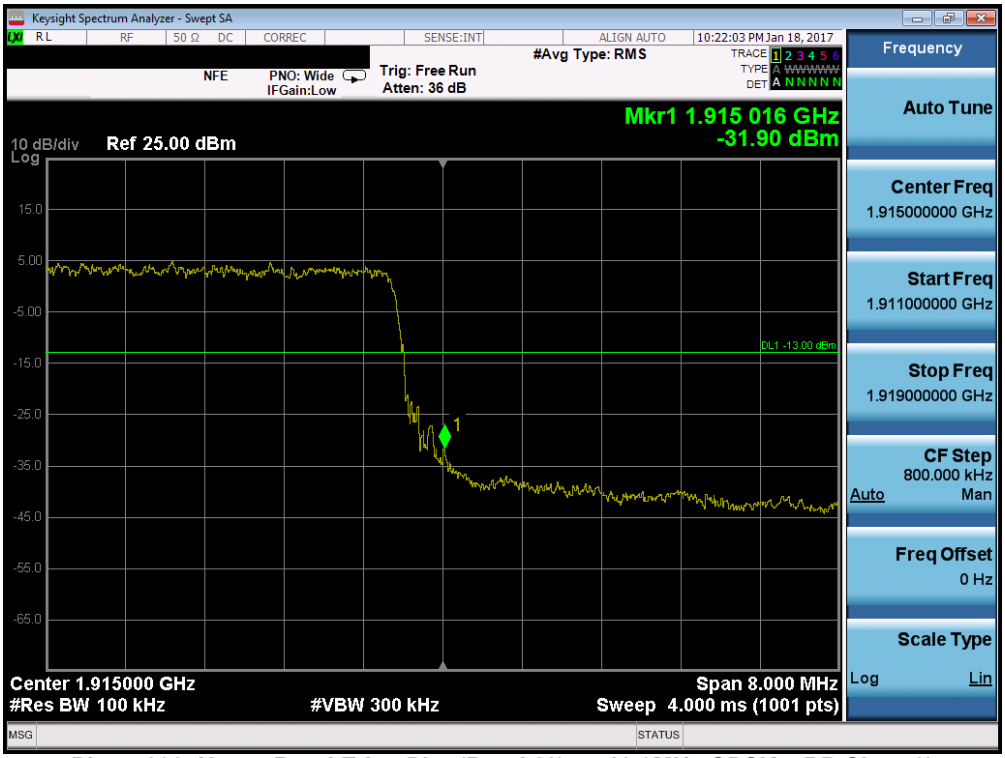


Plot 7-199. Lower Extended Band Edge Plot (Band 2/25 – 10.0MHz QPSK – RB Size 50)



Plot 7-200. Upper Band Edge Plot (Band 2/25 – 10.0MHz QPSK – RB Size 50)

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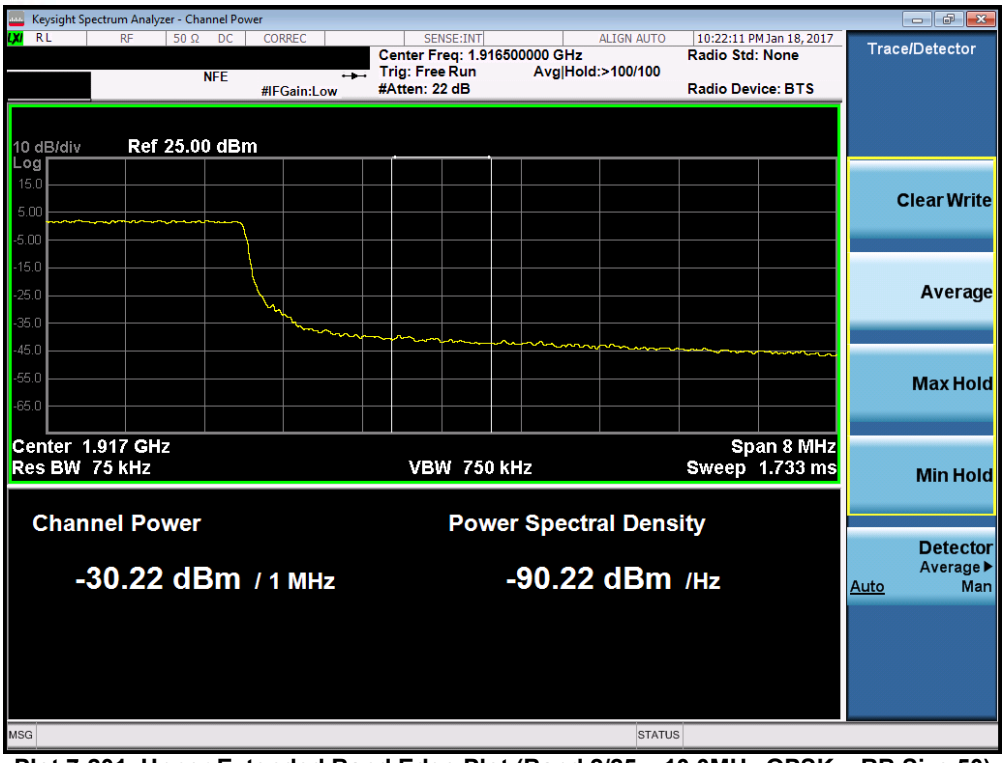
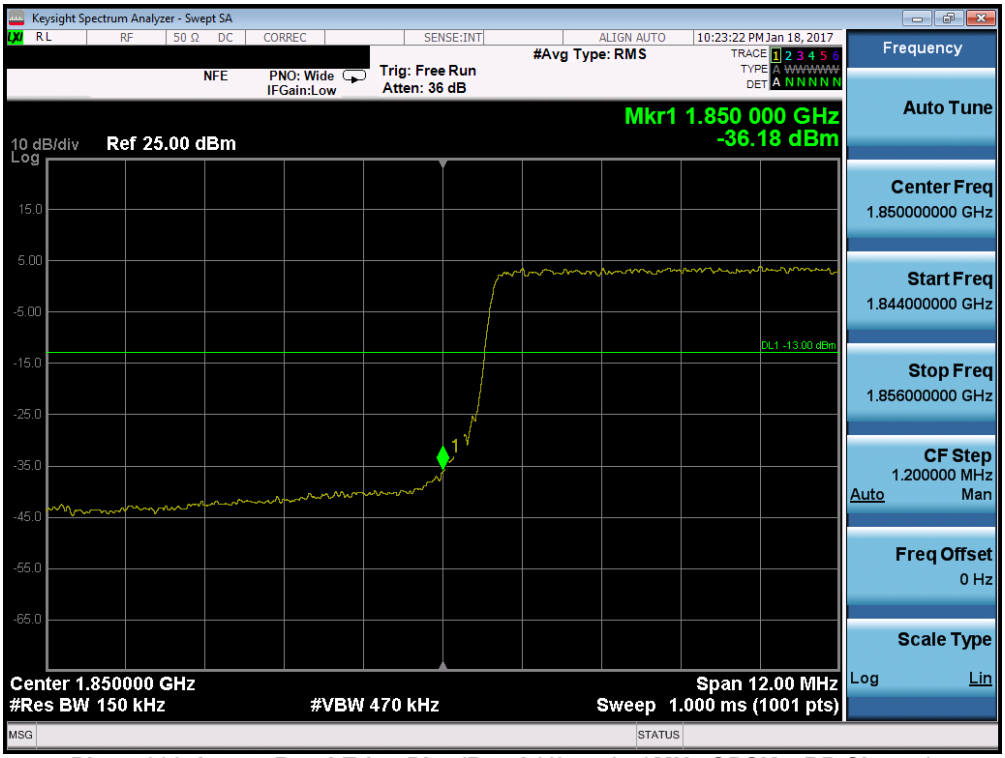


Plot 7-201. Upper Extended Band Edge Plot (Band 2/25 – 10.0MHz QPSK – RB Size 50)



Plot 7-202. Lower Band Edge Plot (Band 2/25 – 15.0MHz QPSK – RB Size 75)

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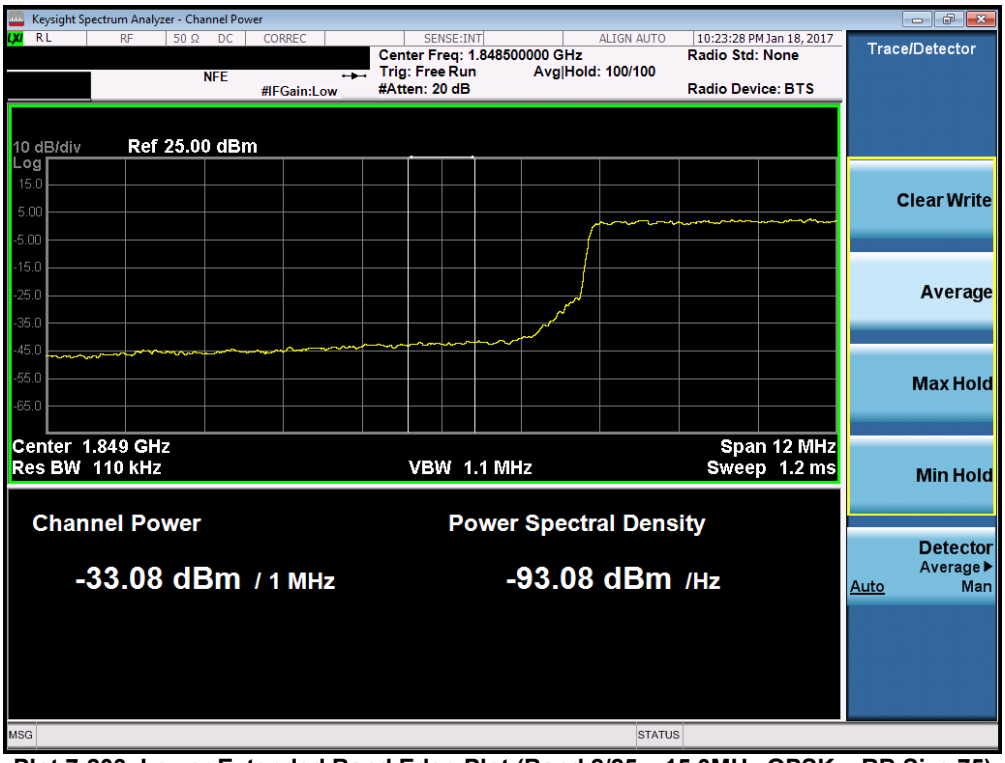
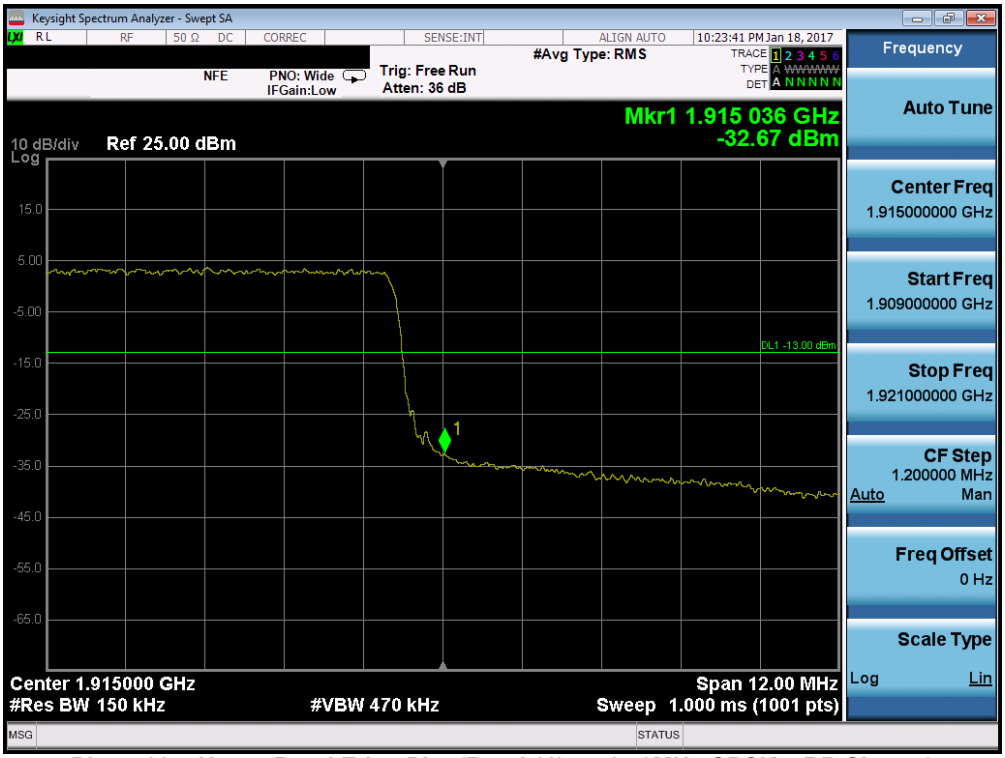


Plot 7-203. Lower Extended Band Edge Plot (Band 2/25 – 15.0MHz QPSK – RB Size 75)



Plot 7-204. Upper Band Edge Plot (Band 2/25 – 15.0MHz QPSK – RB Size 75)

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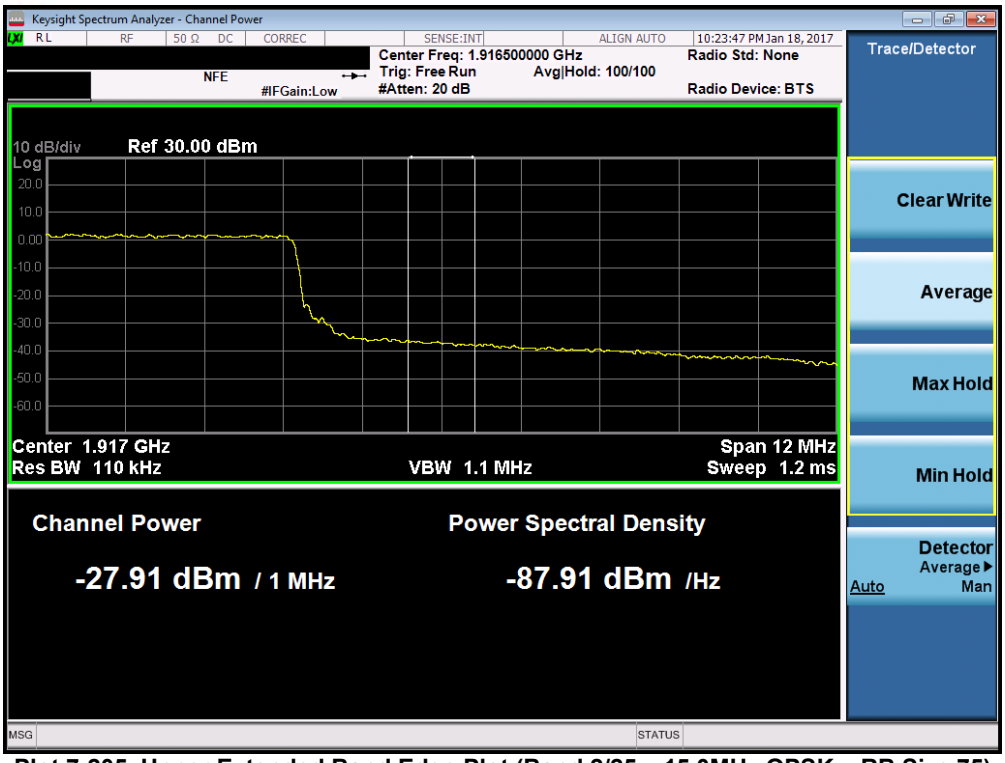
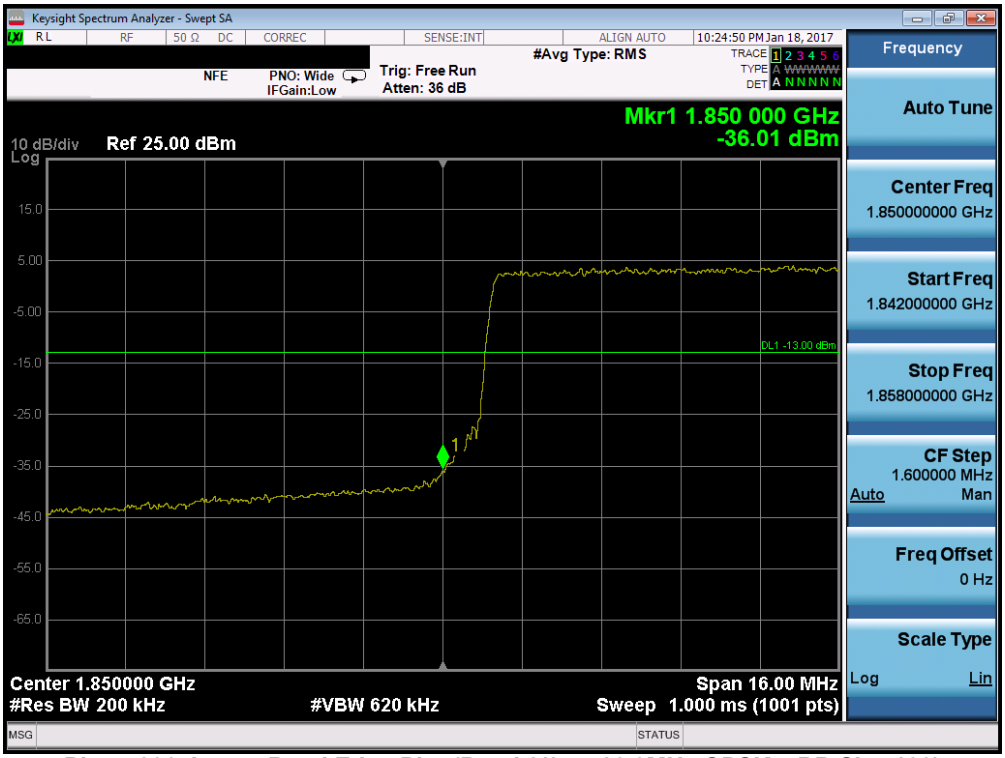


Plot 7-205. Upper Extended Band Edge Plot (Band 2/25 – 15.0MHz QPSK – RB Size 75)



Plot 7-206. Lower Band Edge Plot (Band 2/25 – 20.0MHz QPSK – RB Size 100)

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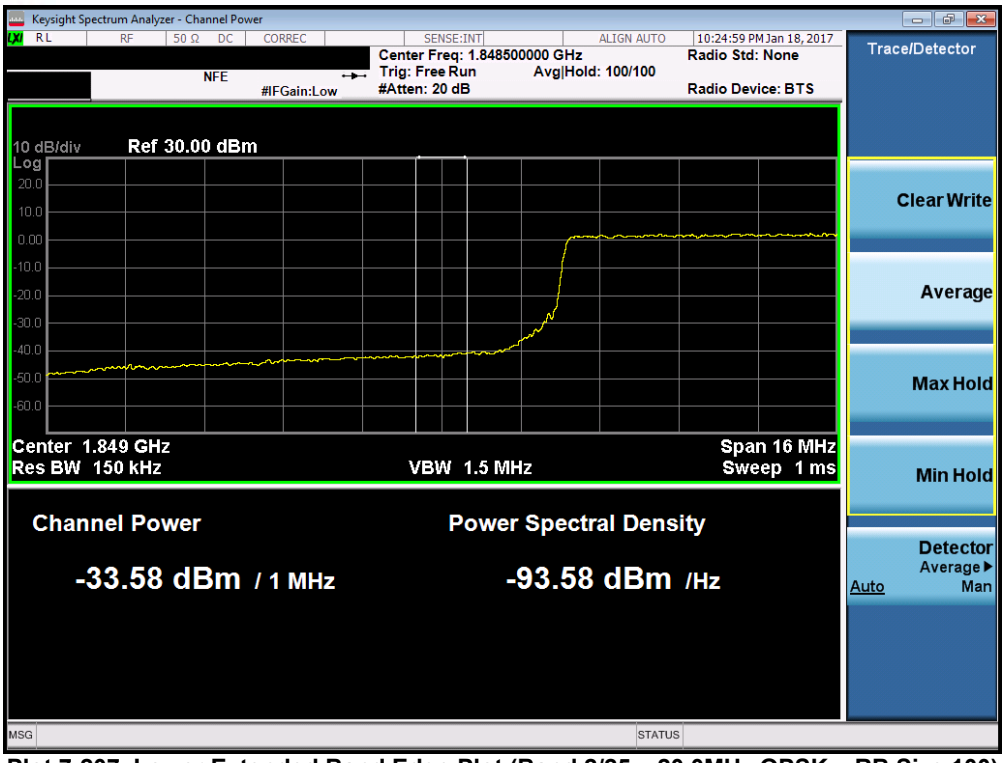
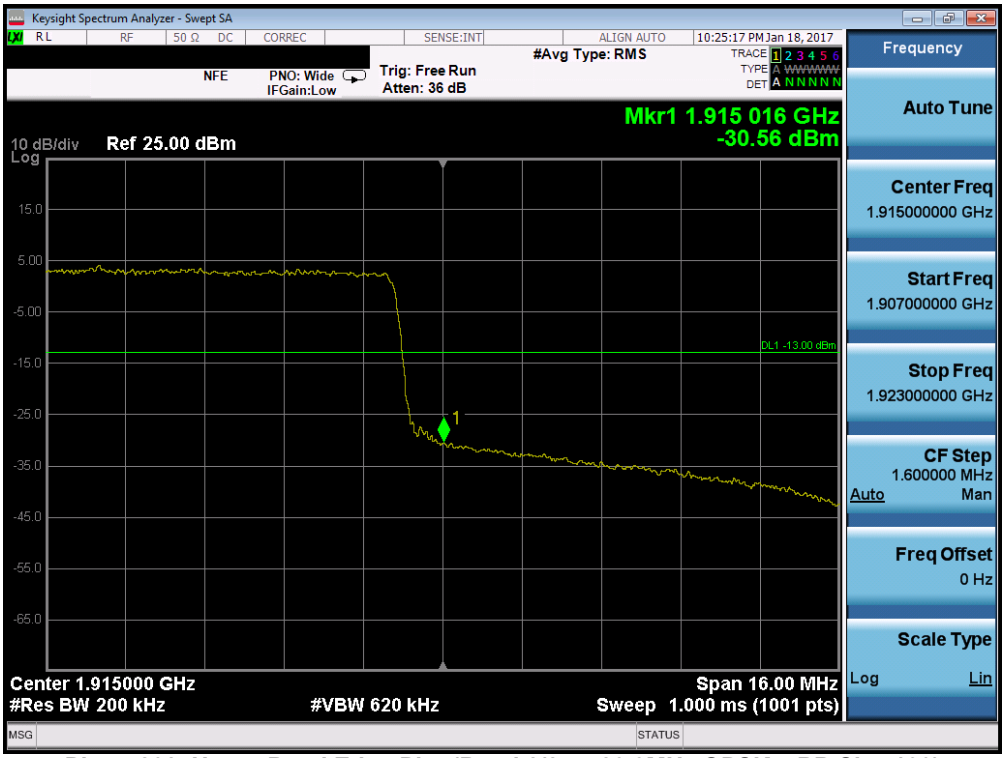


Plot 7-207. Lower Extended Band Edge Plot (Band 2/25 – 20.0MHz QPSK – RB Size 100)



Plot 7-208. Upper Band Edge Plot (Band 2/25 – 20.0MHz QPSK – RB Size 100)

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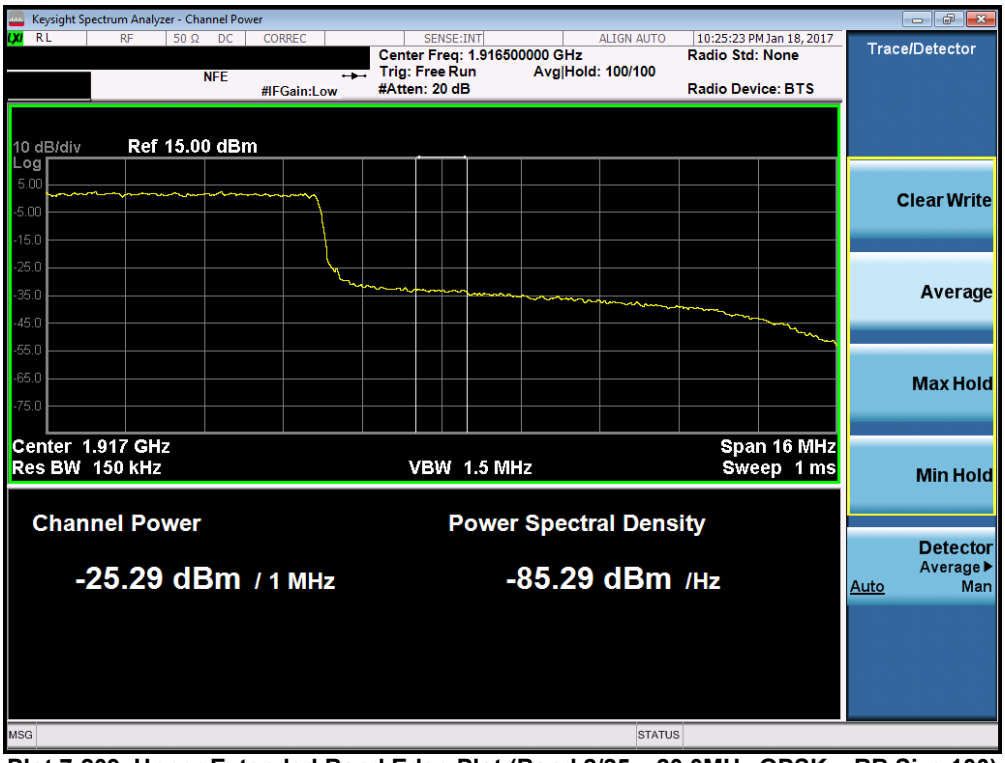
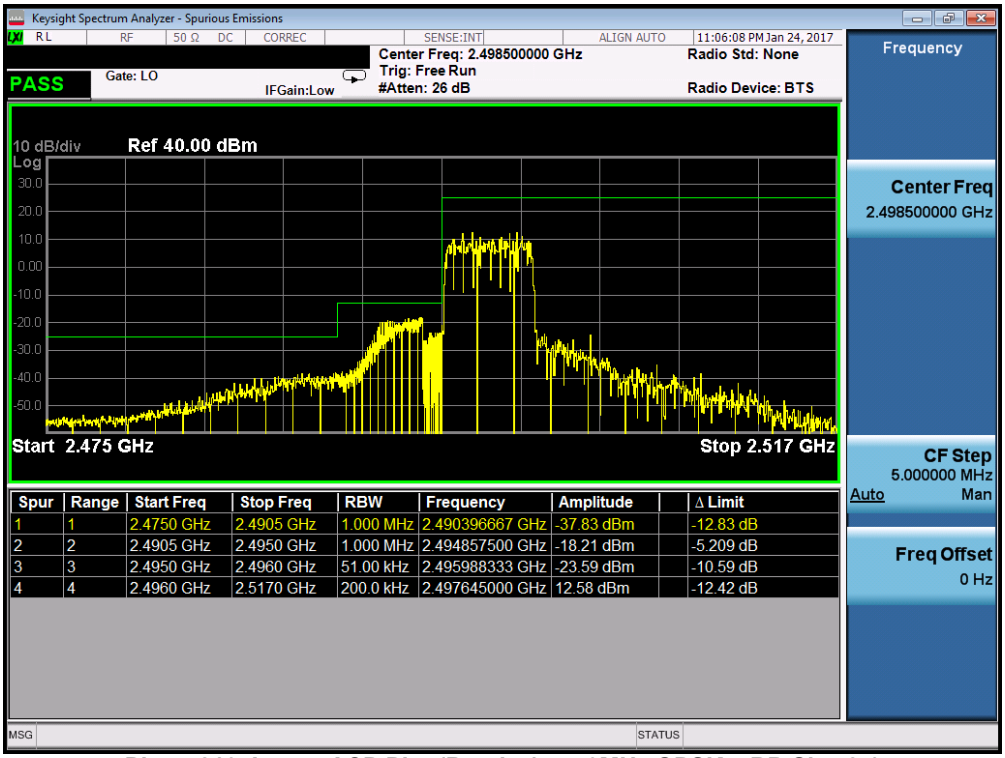


Plot 7-209. Upper Extended Band Edge Plot (Band 2/25 – 20.0MHz QPSK – RB Size 100)



Plot 7-210. Lower ACP Plot (Band 41 – 5.0MHz QPSK – RB Size 25)

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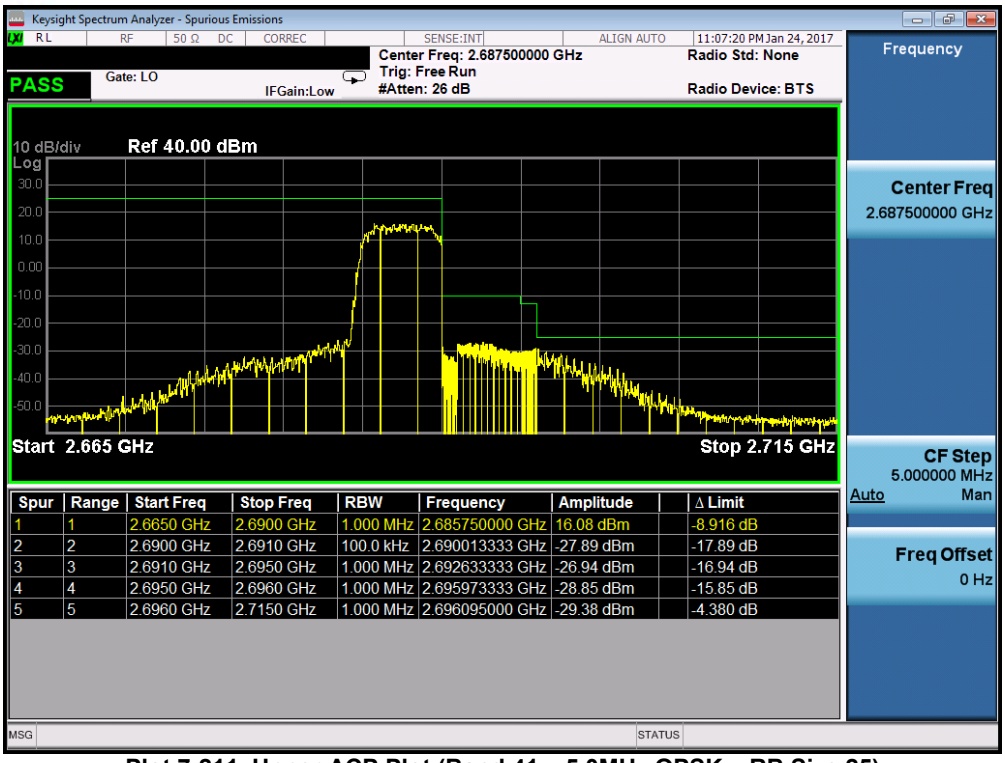
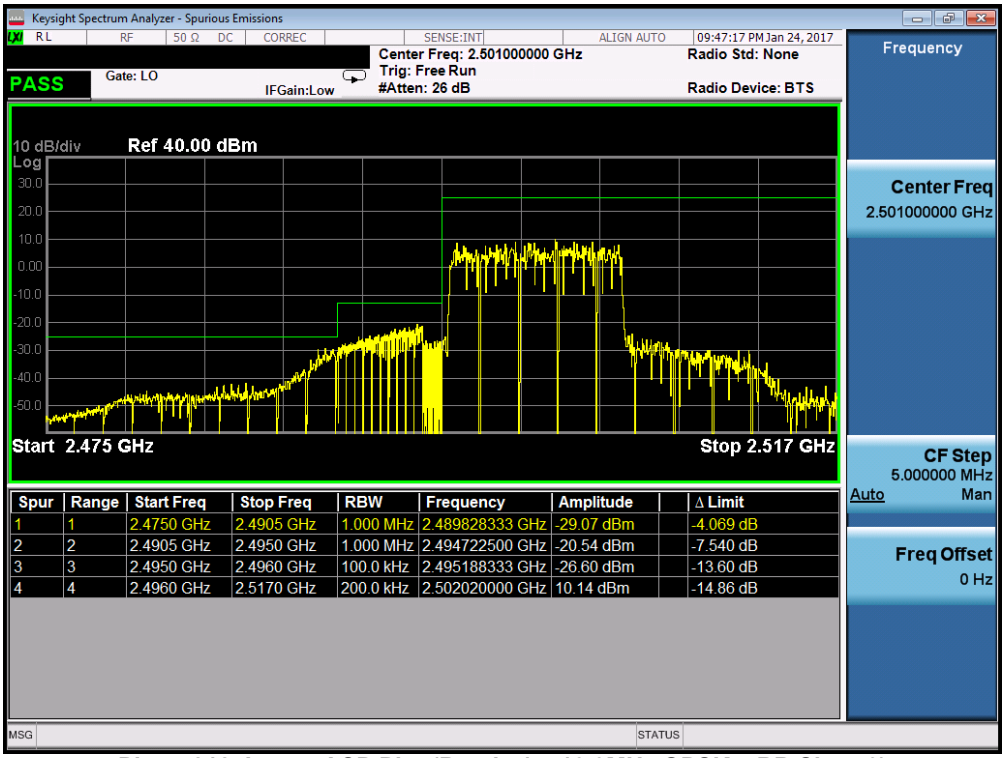


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	2.6650 GHz	2.6900 GHz	1.000 MHz	2.685750000 GHz	16.08 dBm	-8.916 dB
2	2	2.6900 GHz	2.6910 GHz	100.0 kHz	2.690013333 GHz	-27.89 dBm	-17.89 dB
3	3	2.6910 GHz	2.6950 GHz	1.000 MHz	2.692633333 GHz	-26.94 dBm	-16.94 dB
4	4	2.6950 GHz	2.6960 GHz	1.000 MHz	2.695973333 GHz	-28.85 dBm	-15.85 dB
5	5	2.6960 GHz	2.7150 GHz	1.000 MHz	2.696095000 GHz	-29.38 dBm	-4.380 dB

Plot 7-211. Upper ACP Plot (Band 41 – 5.0MHz QPSK – RB Size 25)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	2.4750 GHz	2.4905 GHz	1.000 MHz	2.489828333 GHz	-29.07 dBm	-4.069 dB
2	2	2.4905 GHz	2.4950 GHz	1.000 MHz	2.494722500 GHz	-20.54 dBm	-7.540 dB
3	3	2.4950 GHz	2.4960 GHz	100.0 kHz	2.495188333 GHz	-26.60 dBm	-13.60 dB
4	4	2.4960 GHz	2.5170 GHz	200.0 kHz	2.502020000 GHz	10.14 dBm	-14.86 dB

Plot 7-212. Lower ACP Plot (Band 41 – 10.0MHz QPSK – RB Size 50)

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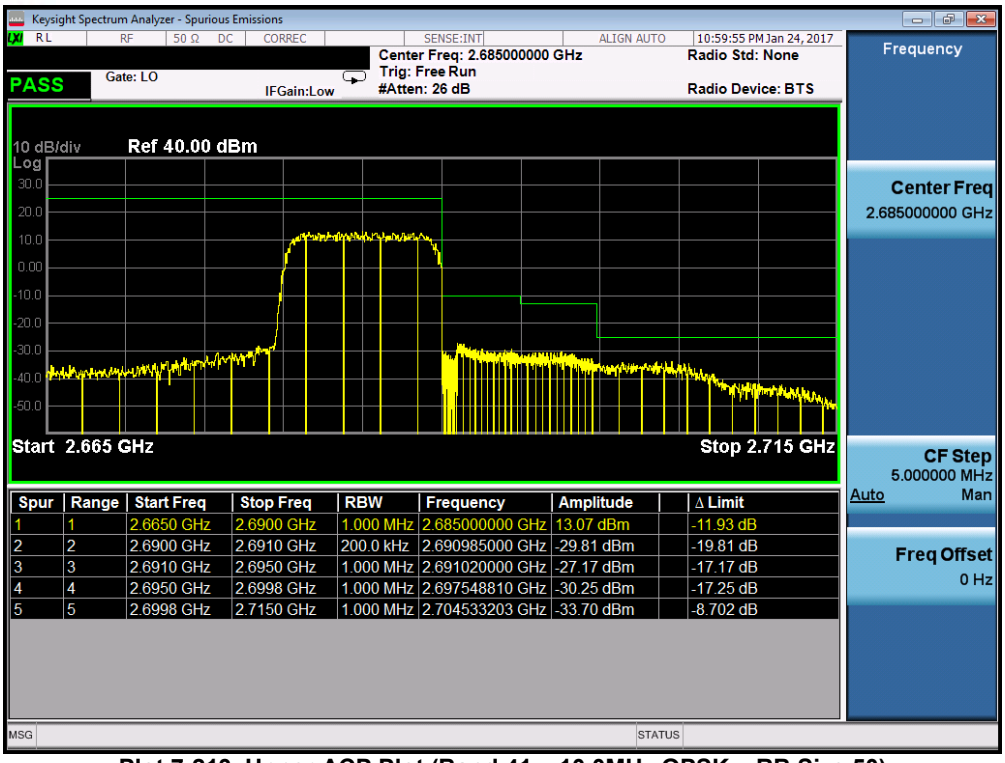
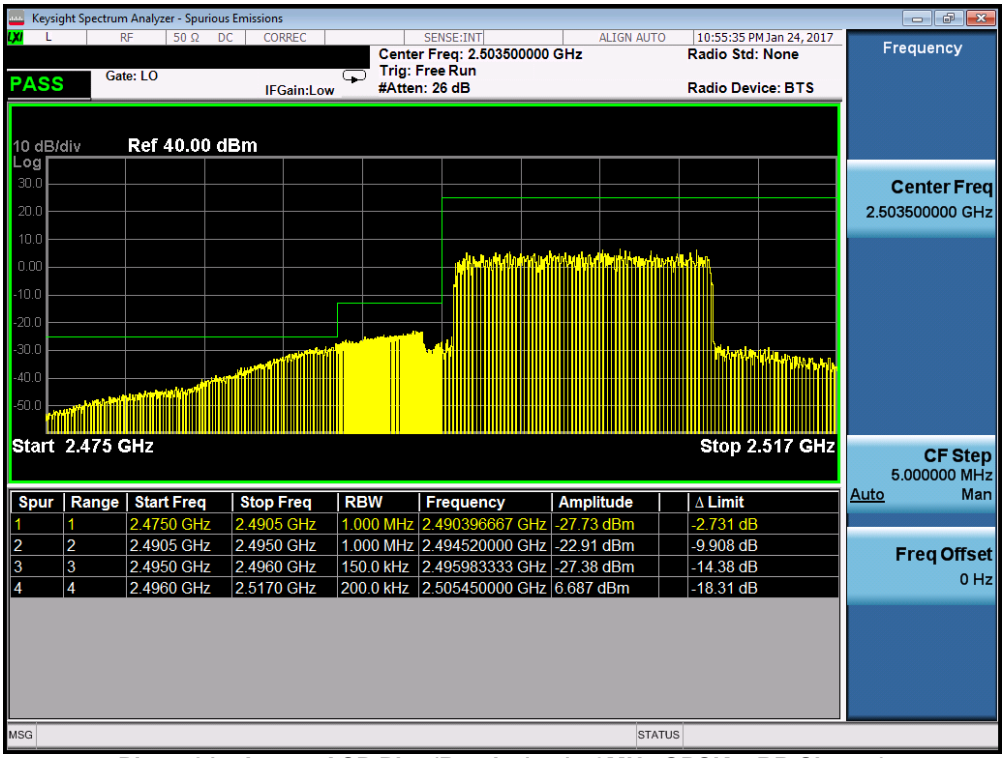


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	2.6650 GHz	2.6900 GHz	1.000 MHz	2.685000000 GHz	13.07 dBm	-11.93 dB
2	2	2.6900 GHz	2.6910 GHz	200.0 kHz	2.690985000 GHz	-29.81 dBm	-19.81 dB
3	3	2.6910 GHz	2.6950 GHz	1.000 MHz	2.691020000 GHz	-27.17 dBm	-17.17 dB
4	4	2.6950 GHz	2.6998 GHz	1.000 MHz	2.697548810 GHz	-30.25 dBm	-17.25 dB
5	5	2.6998 GHz	2.7150 GHz	1.000 MHz	2.704533203 GHz	-33.70 dBm	-8.702 dB

Plot 7-213. Upper ACP Plot (Band 41 – 10.0MHz QPSK – RB Size 50)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	2.4750 GHz	2.4905 GHz	1.000 MHz	2.490396667 GHz	-27.73 dBm	-2.731 dB
2	2	2.4905 GHz	2.4950 GHz	1.000 MHz	2.494520000 GHz	-22.91 dBm	-9.908 dB
3	3	2.4950 GHz	2.4960 GHz	150.0 kHz	2.495983333 GHz	-27.38 dBm	-14.38 dB
4	4	2.4960 GHz	2.5170 GHz	200.0 kHz	2.505450000 GHz	6.687 dBm	-18.31 dB

Plot 7-214. Lower ACP Plot (Band 41 – 15.0MHz QPSK – RB Size 75)

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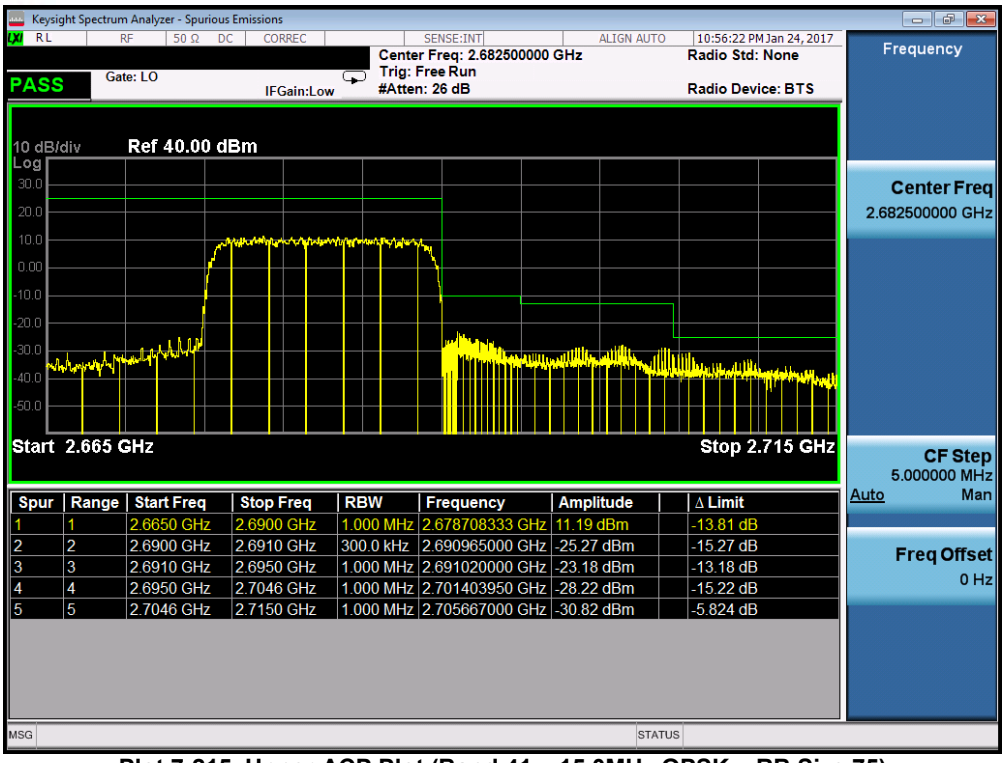
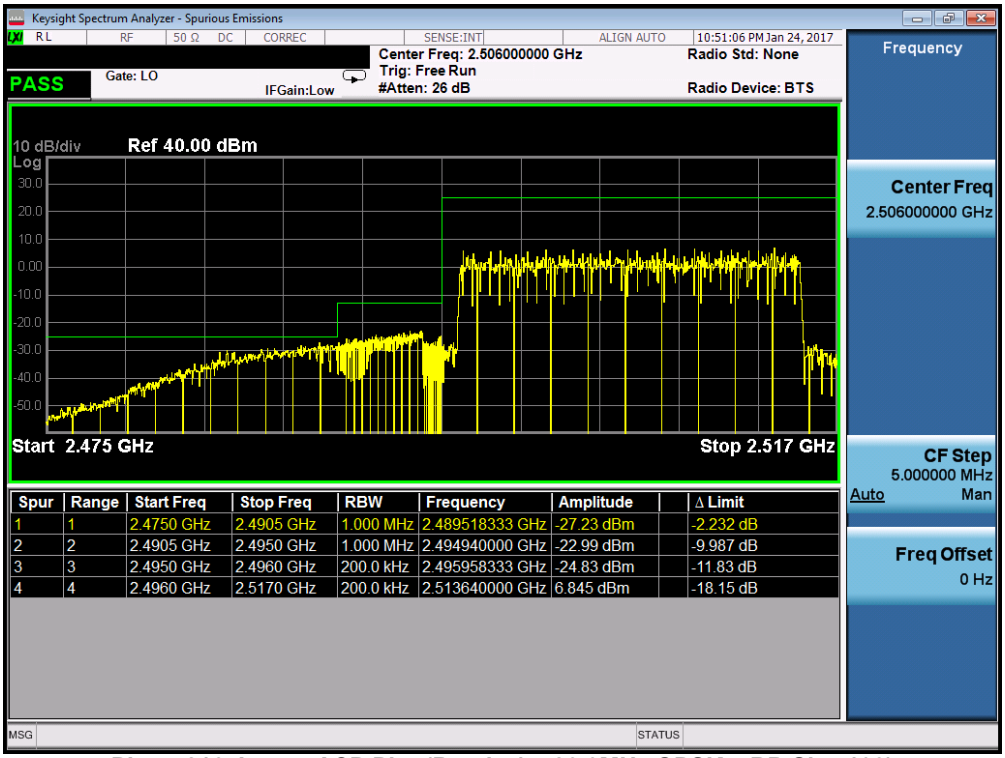


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	2.6650 GHz	2.6900 GHz	1.000 MHz	2.678708333 GHz	11.19 dBm	-13.81 dB
2	2	2.6900 GHz	2.6910 GHz	300.0 kHz	2.690965000 GHz	-25.27 dBm	-15.27 dB
3	3	2.6910 GHz	2.6950 GHz	1.000 MHz	2.691020000 GHz	-23.18 dBm	-13.18 dB
4	4	2.6950 GHz	2.7046 GHz	1.000 MHz	2.701403950 GHz	-28.22 dBm	-15.22 dB
5	5	2.7046 GHz	2.7150 GHz	1.000 MHz	2.705667000 GHz	-30.82 dBm	-5.824 dB

Plot 7-215. Upper ACP Plot (Band 41 – 15.0MHz QPSK – RB Size 75)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	2.4750 GHz	2.4905 GHz	1.000 MHz	2.489518333 GHz	-27.23 dBm	-2.232 dB
2	2	2.4905 GHz	2.4950 GHz	1.000 MHz	2.494940000 GHz	-22.99 dBm	-9.987 dB
3	3	2.4950 GHz	2.4960 GHz	200.0 kHz	2.495958333 GHz	-24.83 dBm	-11.83 dB
4	4	2.4960 GHz	2.5170 GHz	200.0 kHz	2.513640000 GHz	6.845 dBm	-18.15 dB

Plot 7-216. Lower ACP Plot (Band 41 – 20.0MHz QPSK – RB Size 100)

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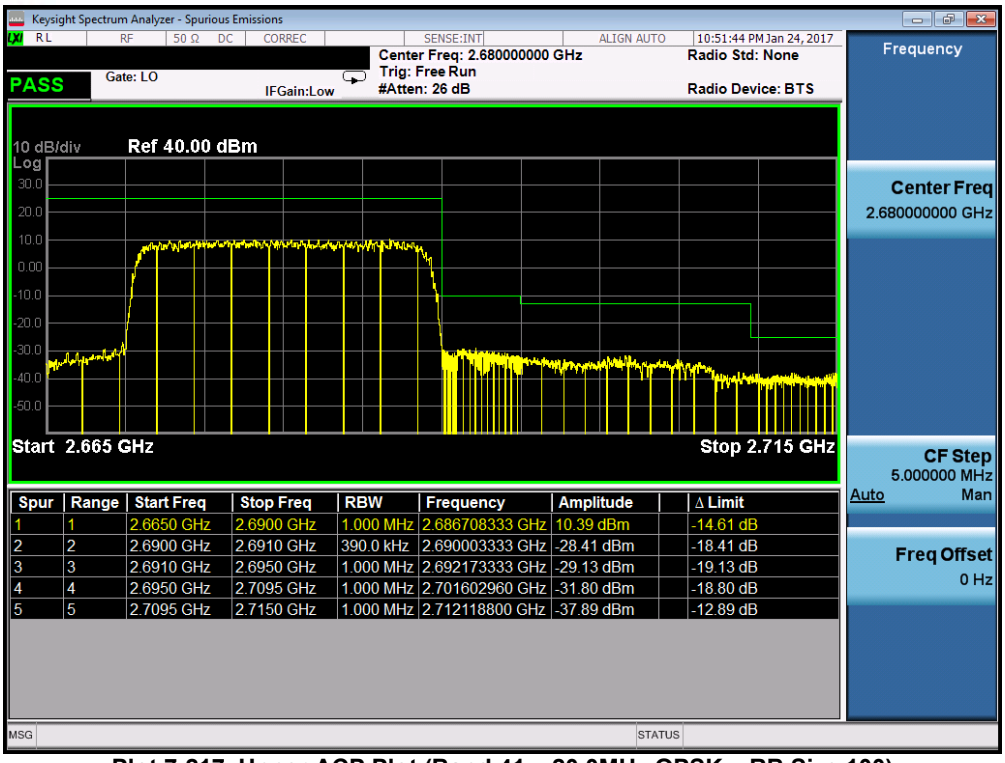

Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude		Δ Limit
1	1	2.6650 GHz	2.6900 GHz	1.000 MHz	2.686708333 GHz	10.39 dBm		-14.61 dB
2	2	2.6900 GHz	2.6910 GHz	390.0 kHz	2.690003333 GHz	-28.41 dBm		-18.41 dB
3	3	2.6910 GHz	2.6950 GHz	1.000 MHz	2.692173333 GHz	-29.13 dBm		-19.13 dB
4	4	2.6950 GHz	2.7095 GHz	1.000 MHz	2.701602960 GHz	-31.80 dBm		-18.80 dB
5	5	2.7095 GHz	2.7150 GHz	1.000 MHz	2.712118800 GHz	-37.89 dBm		-12.89 dB

Plot 7-217. Upper ACP Plot (Band 41 – 20.0MHz QPSK – RB Size 100)

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7.5 Uplink Carrier Aggregation

§27.53(m)

Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers 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.

For Band 41, the minimum permissible attenuation level of any spurious emission is 55 + $log_{10}(P_{[Watts]})$.

Test Procedure Used

KDB 971168 D01 v02r02 – Section 6.0

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.

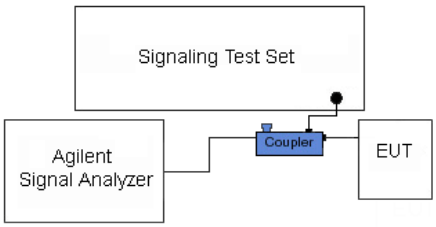

Figure 7-4. Test Instrument & Measurement Setup

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Test Notes

1. Uplink carrier aggregation is only supported in this EUT while operating in Power Class 3.

2. Conducted power and spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device. The worst case (highest) powers were found while operating with QPSK modulation, as shown in Table 7-2 below, with both carriers set to transmit using 1RB.

3. 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.

Power State	PCC							SCC							Power
	PCC Band	PCC Bandwidth [MHz]	PCC (UL) Channel	PCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	SCC Band	SCC Bandwidth [MHz]	SCC (UL) Channel	SCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	ULCA Tx.Power (dBm)
Max	LTE B41	10	40620	2593	QPSK	1	49	LTE B41	15	40740	2605	QPSK	1	0	24.59
Max	LTE B41	10	40620	2593	QPSK	1	49	LTE B41	20	40764	2607.4	QPSK	1	0	23.63
Max	LTE B41	15	40620	2593	QPSK	1	74	LTE B41	15	40770	2608	QPSK	1	0	23.74
Max	LTE B41	15	40620	2593	QPSK	1	74	LTE B41	20	40791	2610.1	QPSK	1	0	24.35
Max	LTE B41	20	40620	2593	QPSK	1	99	LTE B41	10	40764	2607.4	QPSK	1	0	23.66
Max	LTE B41	20	40620	2593	QPSK	1	99	LTE B41	15	40791	2610.1	QPSK	1	0	23.72
Max	LTE B41	20	40620	2593	QPSK	1	99	LTE B41	20	40818	2612.8	QPSK	1	0	**23.29**

Table 7-2. Conducted Powers (B41 – PCC: RB Size 1 Offset Max SCC: RB Size 1 Offset 0)

Power State	PCC							SCC							Power
	PCC Band	PCC Bandwidth [MHz]	PCC (UL) Channel	PCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	SCC Band	SCC Bandwidth [MHz]	SCC (UL) Channel	SCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	ULCA Tx.Power (dBm)
Max	LTE B41	20	39750	2506	QPSK	1	0	LTE B41	20	39948	2525.8	QPSK	1	0	19.23
Max	LTE B41	20	39750	2506	QPSK	1	99	LTE B41	20	39948	2525.8	QPSK	1	99	19.54
Max	LTE B41	20	39750	2506	QPSK	1	0	LTE B41	20	39948	2525.8	QPSK	1	99	15.30
Max	LTE B41	20	39750	2506	QPSK	1	50	LTE B41	20	39948	2525.8	QPSK	1	50	19.78
Max	LTE B41	20	39750	2506	QPSK	1	99	LTE B41	20	39948	2525.8	QPSK	1	0	23.82
Max	LTE B41	20	39750	2506	QPSK	100	0	LTE B41	20	39948	2525.8	QPSK	100	0	22.26
Max	LTE B41	20	39750	2506	16-QAM	100	0	LTE B41	20	39948	2525.8	16-QAM	100	0	21.11
Max	LTE B41	20	39750	2506	64-QAM	100	0	LTE B41	20	39948	2525.8	64-QAM	100	0	20.02

Table 7-3. Conducted Powers (B41 with Various Combinations for 20MHz Channel Bandwidth)

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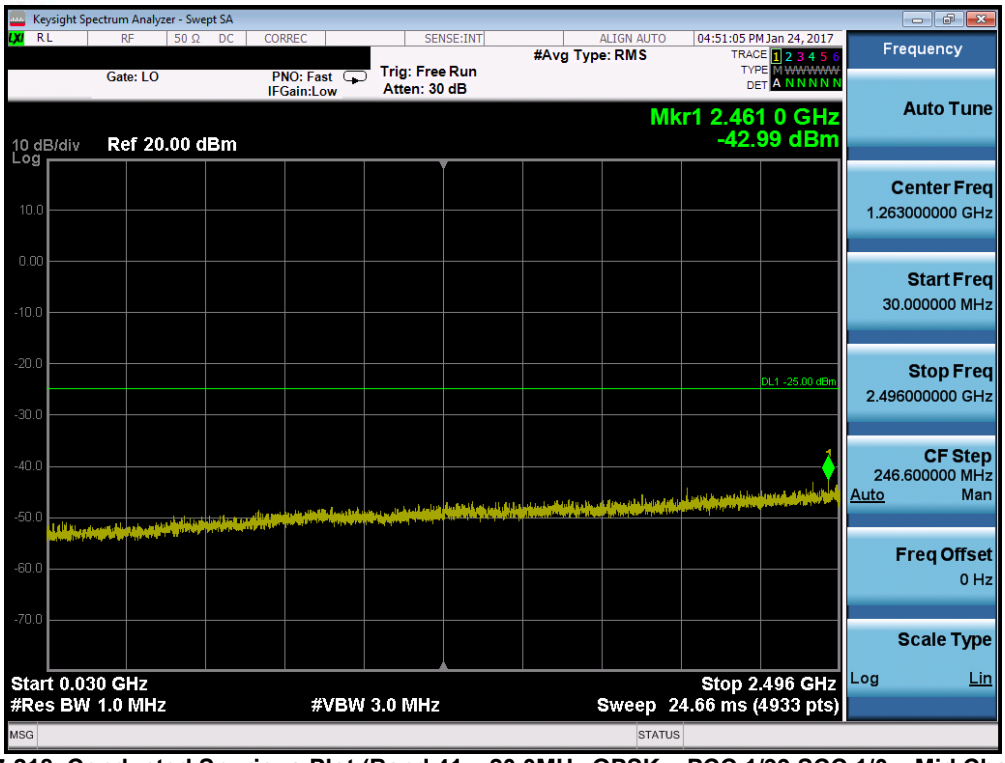
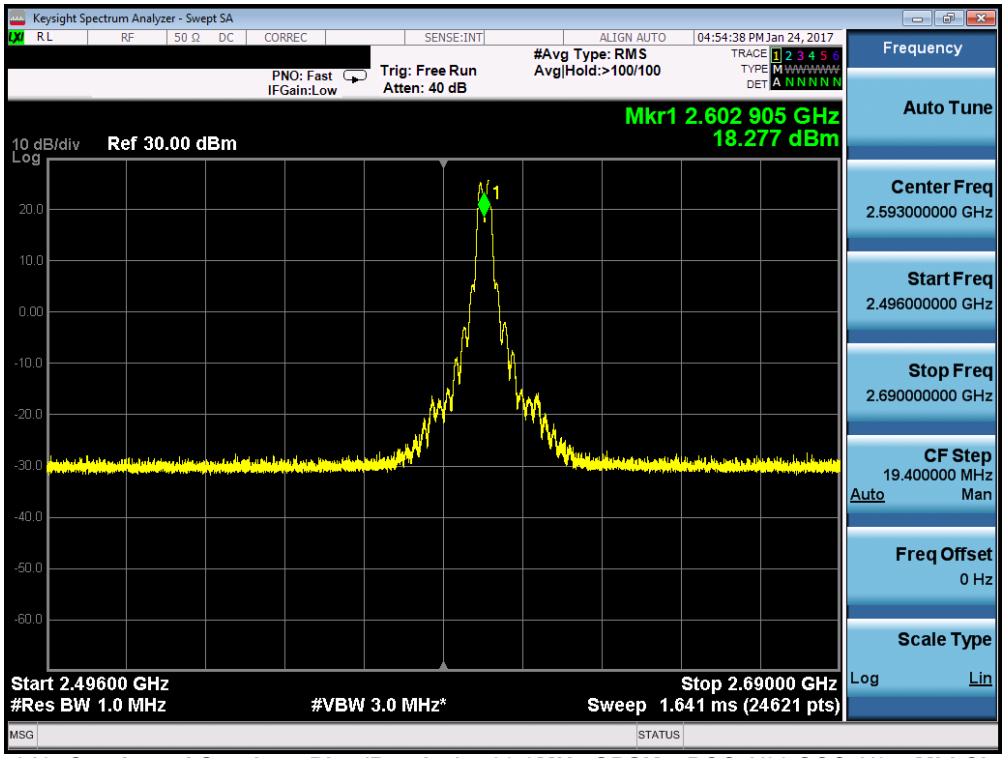


Plot 7-218. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)



Plot 7-219. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

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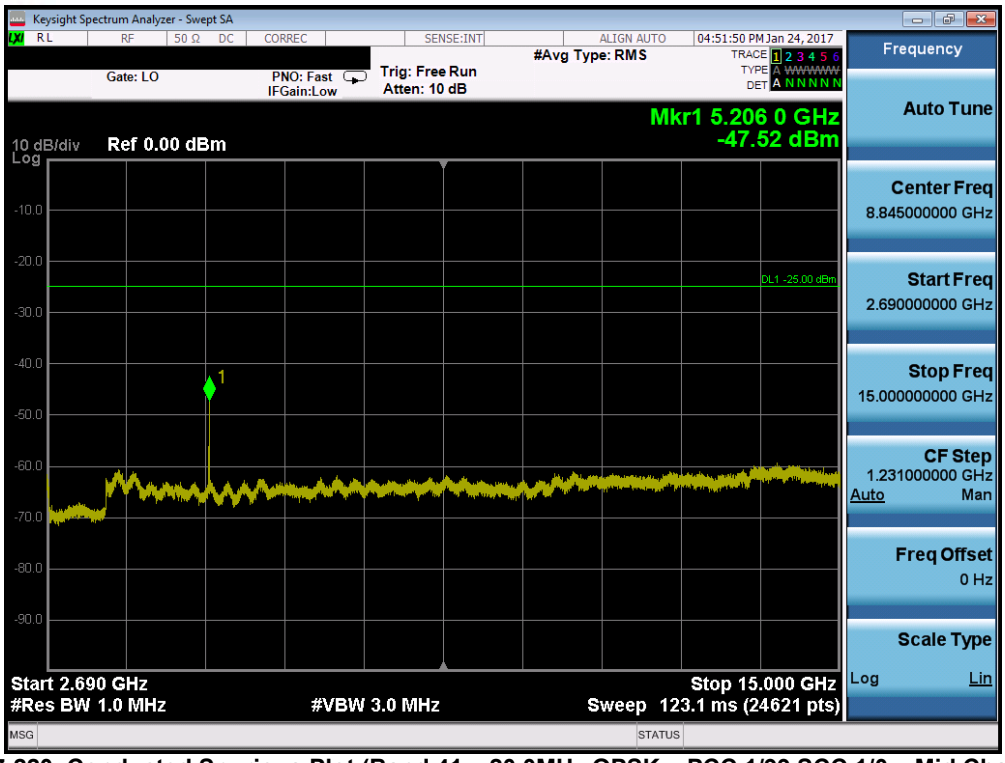
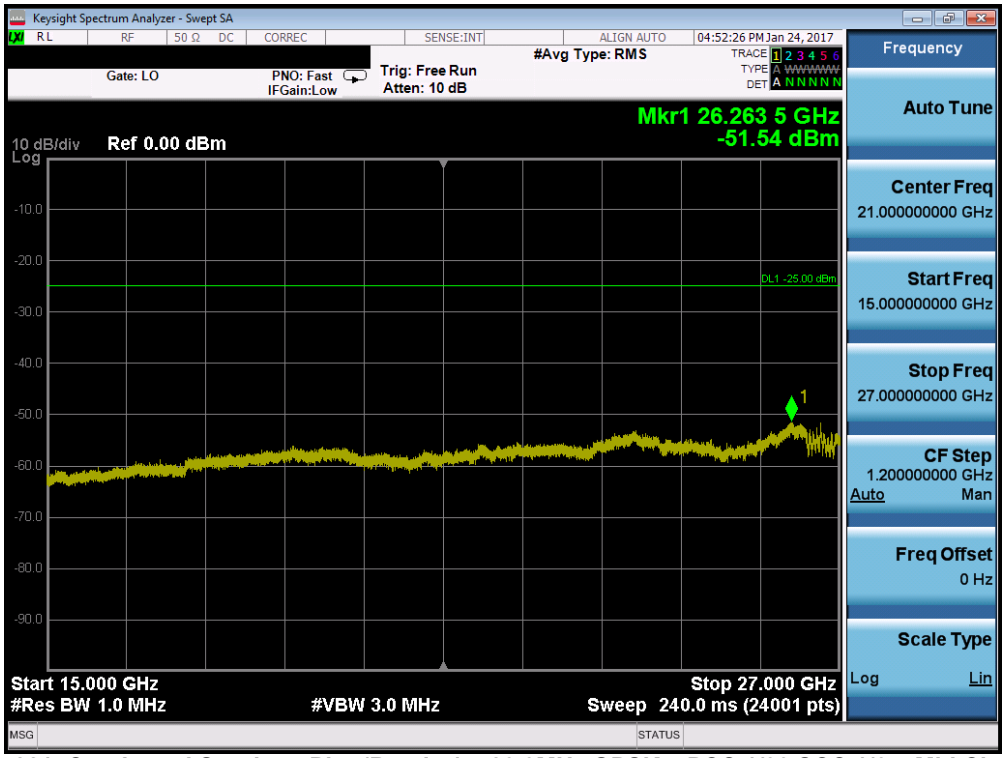


Plot 7-220. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)



Plot 7-221. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 1/99 SCC 1/0 – Mid Channel)

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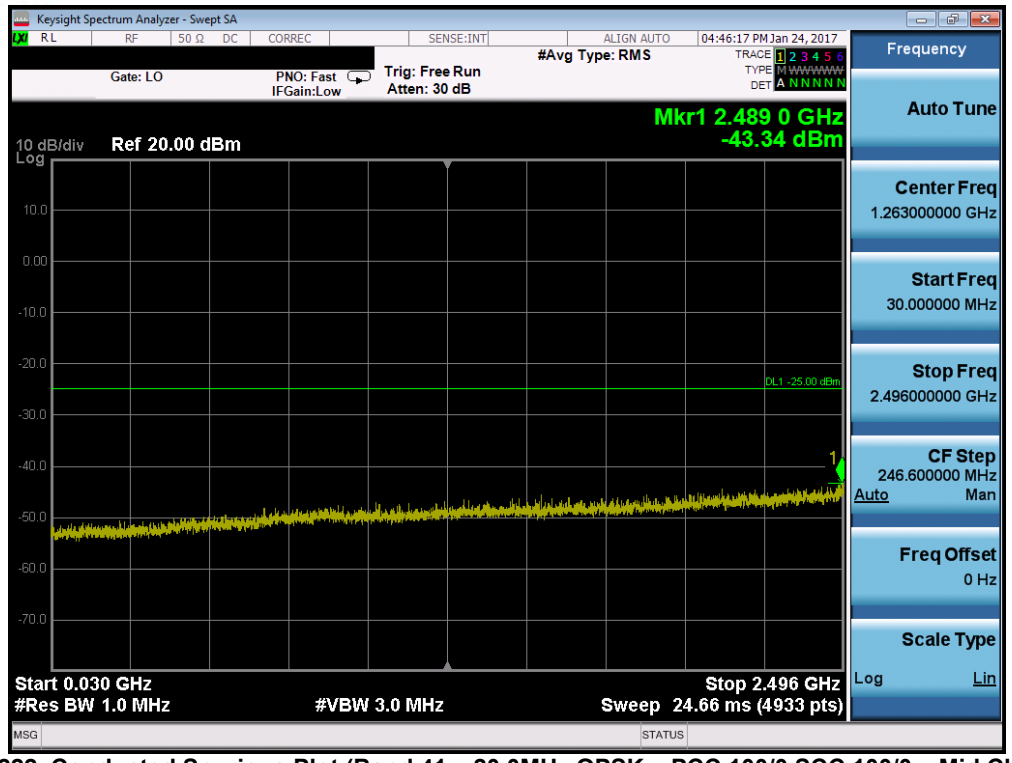
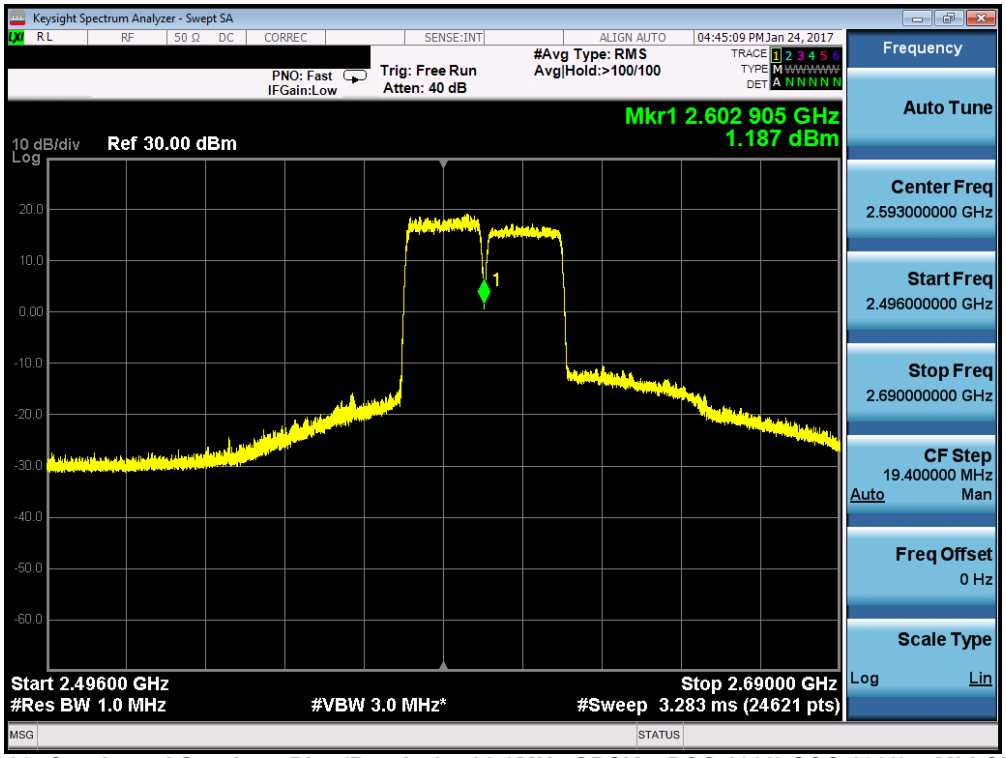


Plot 7-222. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 100/0 SCC 100/0 – Mid Channel)



Plot 7-223. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 100/0 SCC 100/0 – Mid Channel)

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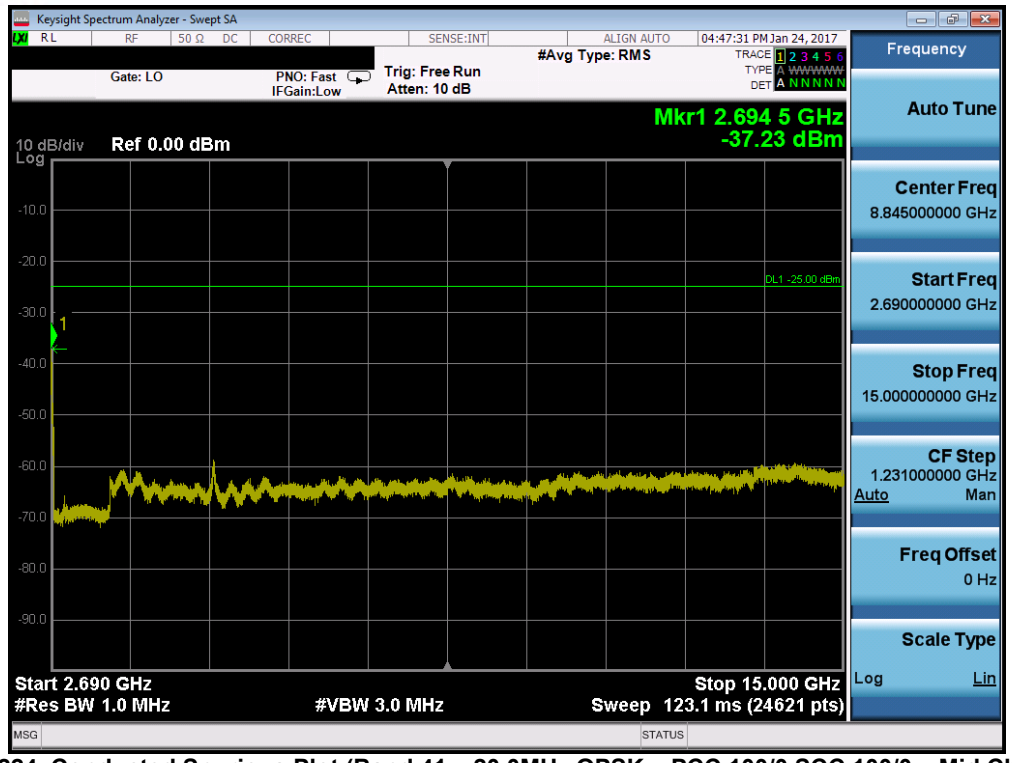

Plot 7-224. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 100/0 SCC 100/0 – Mid Channel)

Plot 7-225. Conducted Spurious Plot (Band 41 – 20.0MHz QPSK – PCC 100/0 SCC 100/0 – Mid Channel)

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7.6 Peak-Average Ratio

§24.232(d)

Test Overview

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.

Test Procedure Used

KDB 971168 D01 v02r02 – Section 5.7.1

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
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.

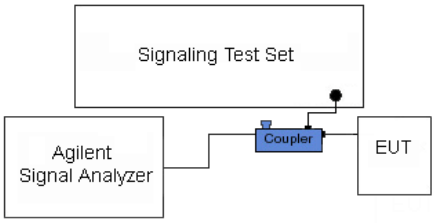

Figure 7-5. Test Instrument & Measurement Setup

Test Notes

None.

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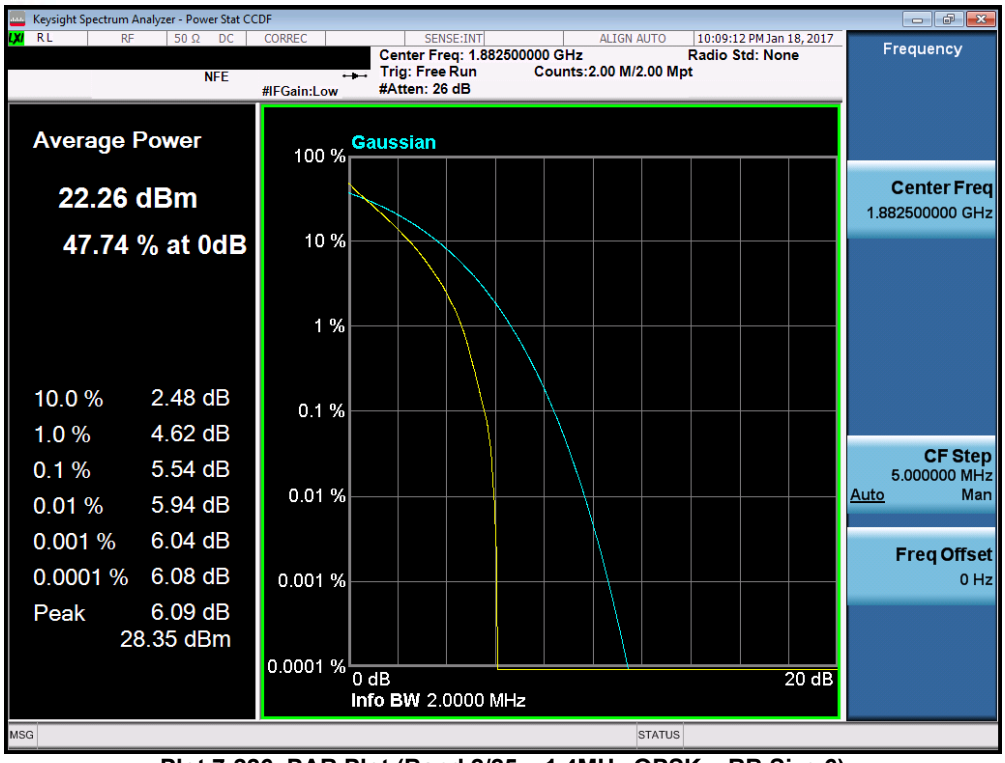
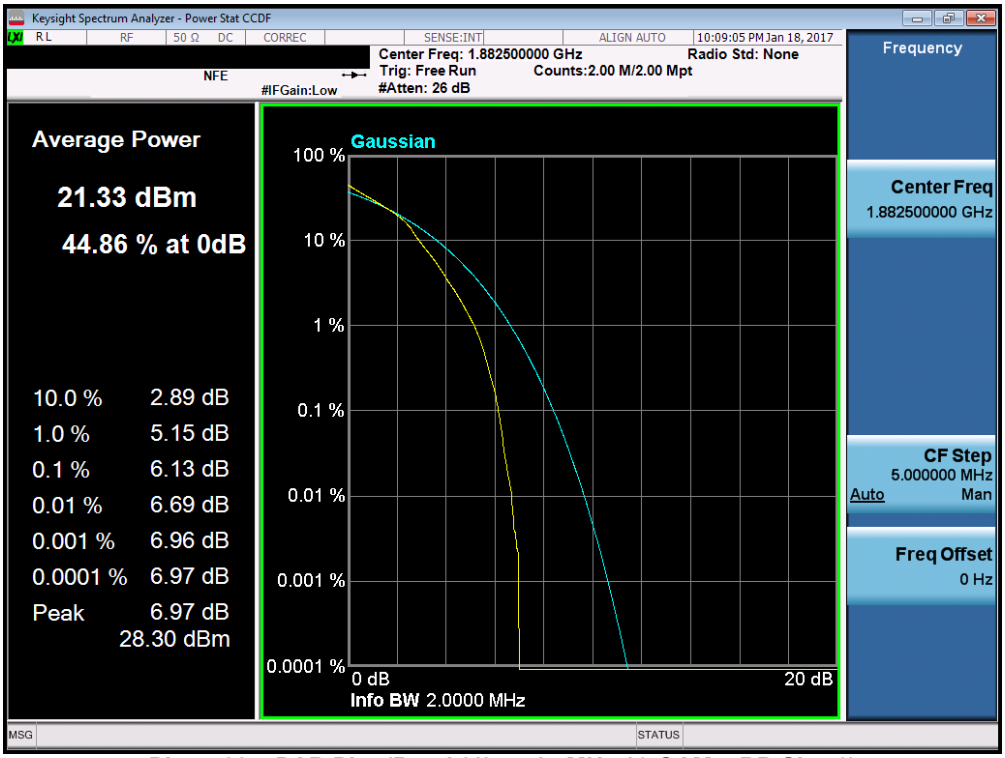


Plot 7-226. PAR Plot (Band 2/25 – 1.4MHz QPSK – RB Size 6)



Plot 7-227. PAR Plot (Band 2/25 – 1.4MHz 16-QAM – RB Size 6)

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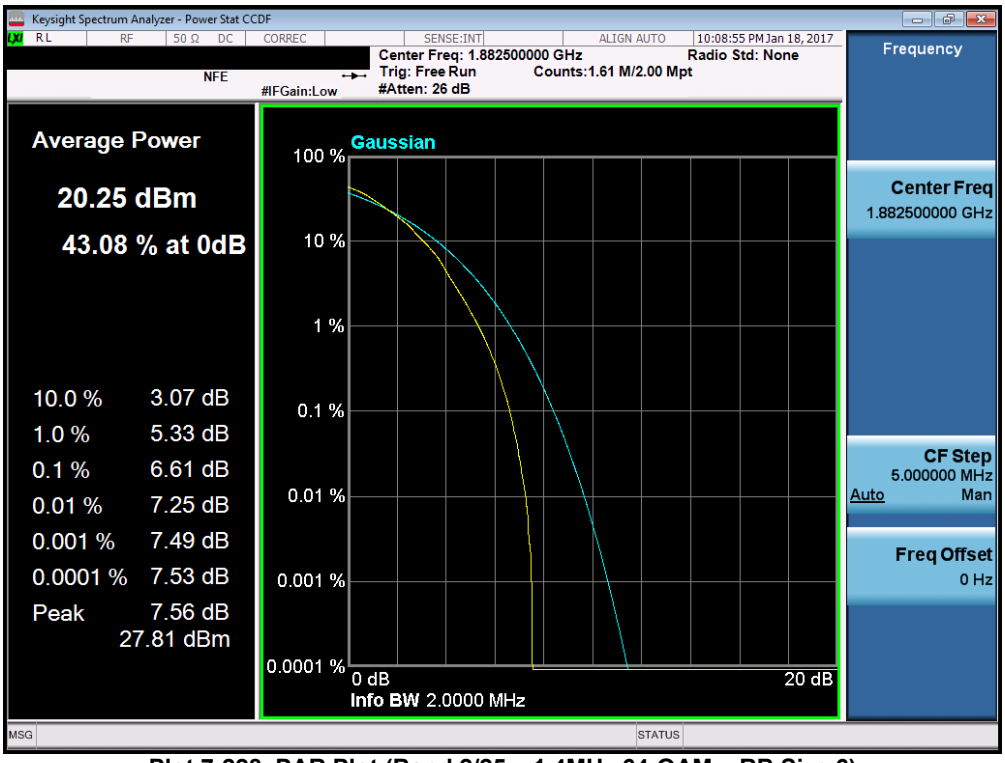
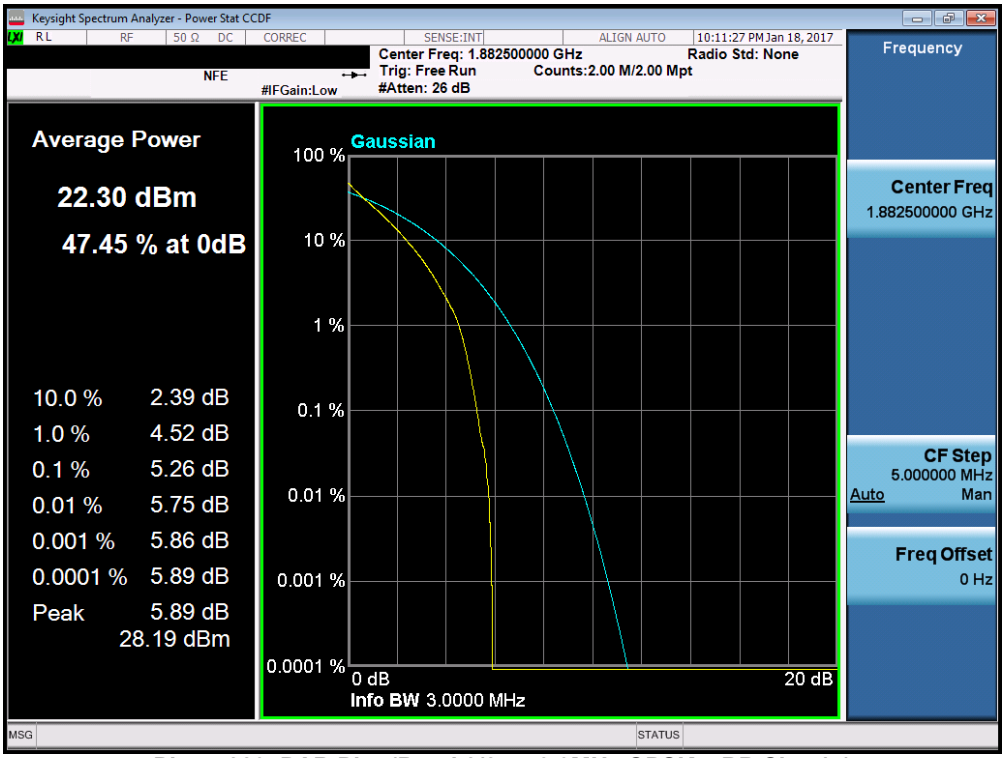


Plot 7-228. PAR Plot (Band 2/25 – 1.4MHz 64-QAM – RB Size 6)



Plot 7-229. PAR Plot (Band 2/25 – 3.0MHz QPSK – RB Size 15)

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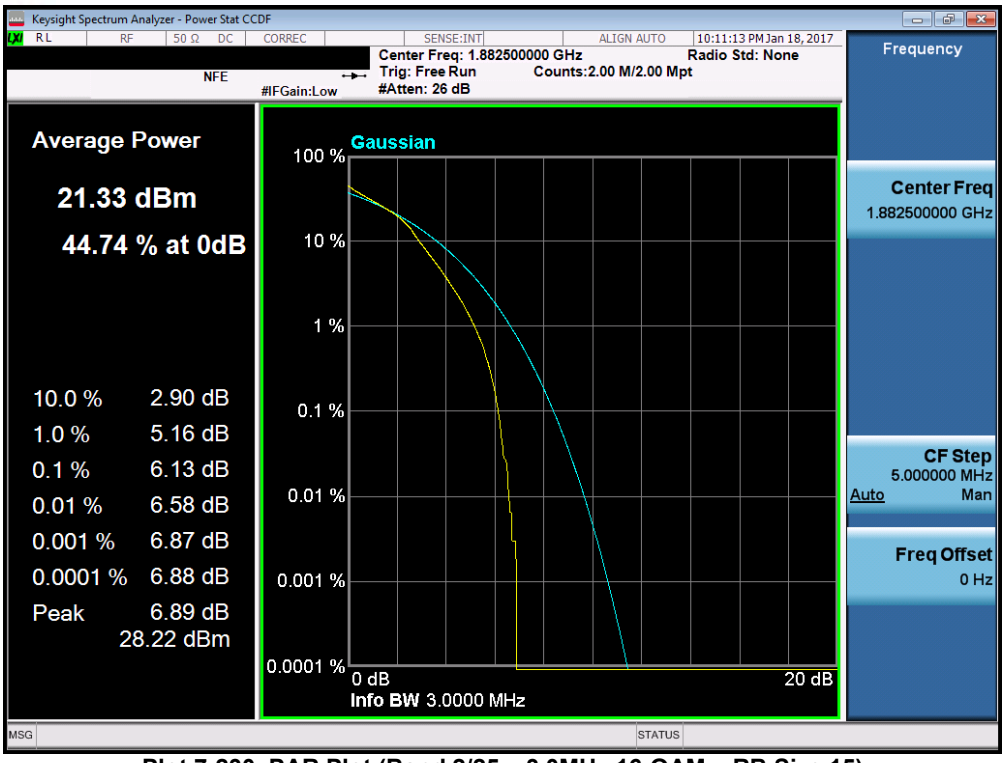
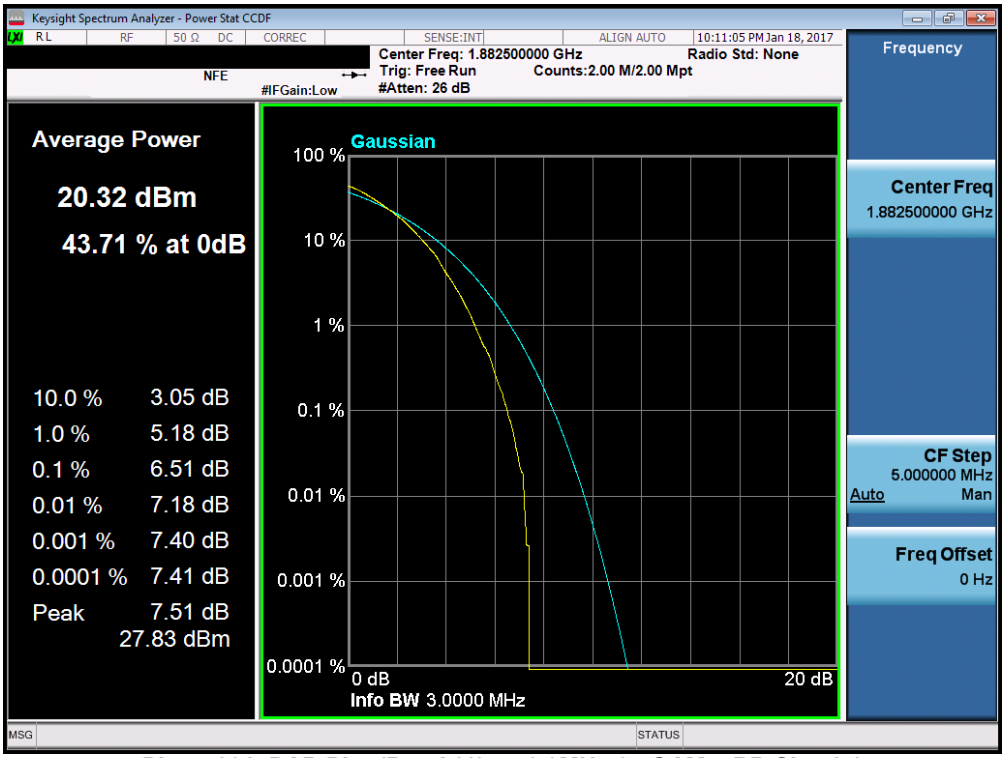


Plot 7-230. PAR Plot (Band 2/25 – 3.0MHz 16-QAM – RB Size 15)



Plot 7-231. PAR Plot (Band 2/25 – 3.0MHz 64-QAM – RB Size 15)

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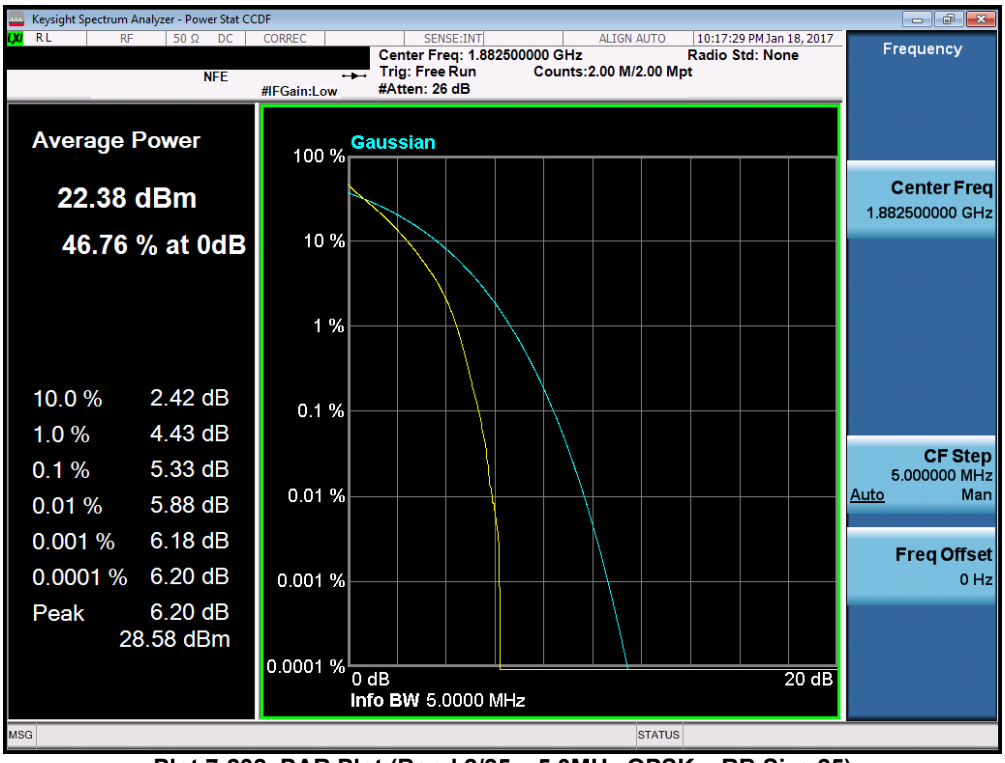
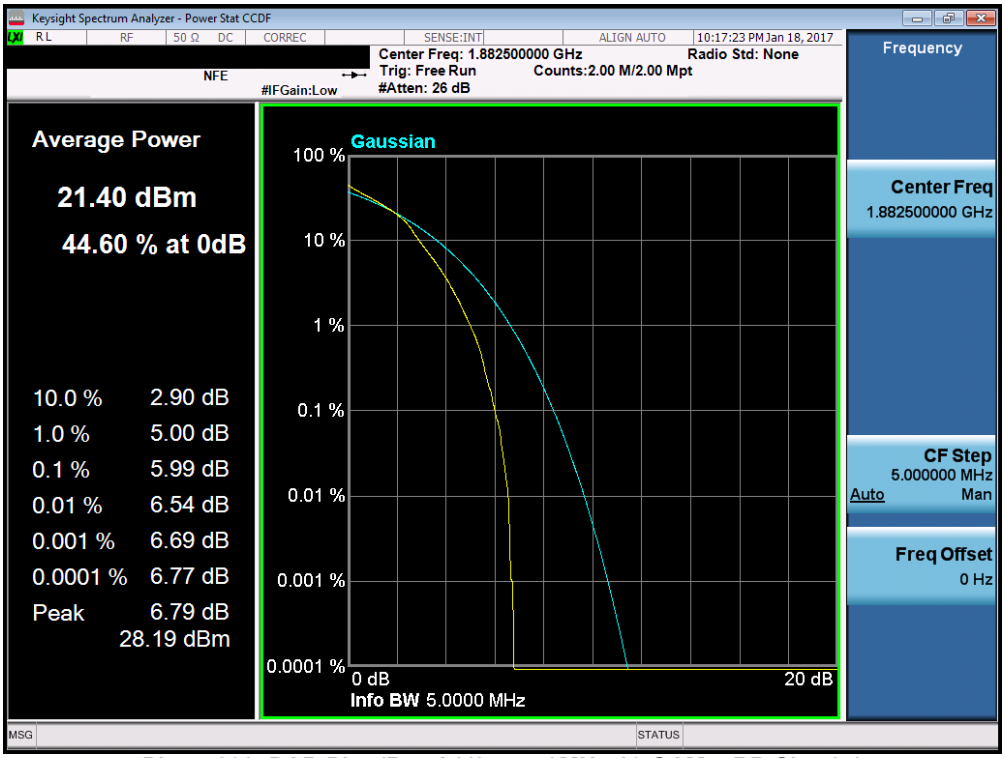


Plot 7-232. PAR Plot (Band 2/25 – 5.0MHz QPSK – RB Size 25)



Plot 7-233. PAR Plot (Band 2/25 – 5.0MHz 16-QAM – RB Size 25)

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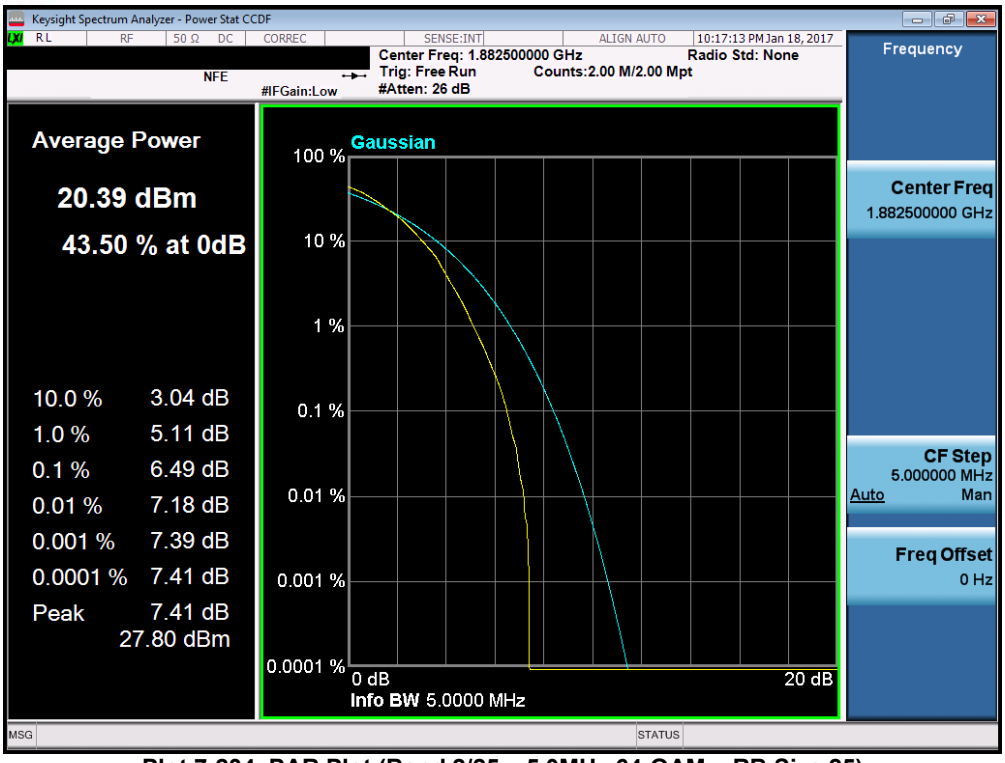
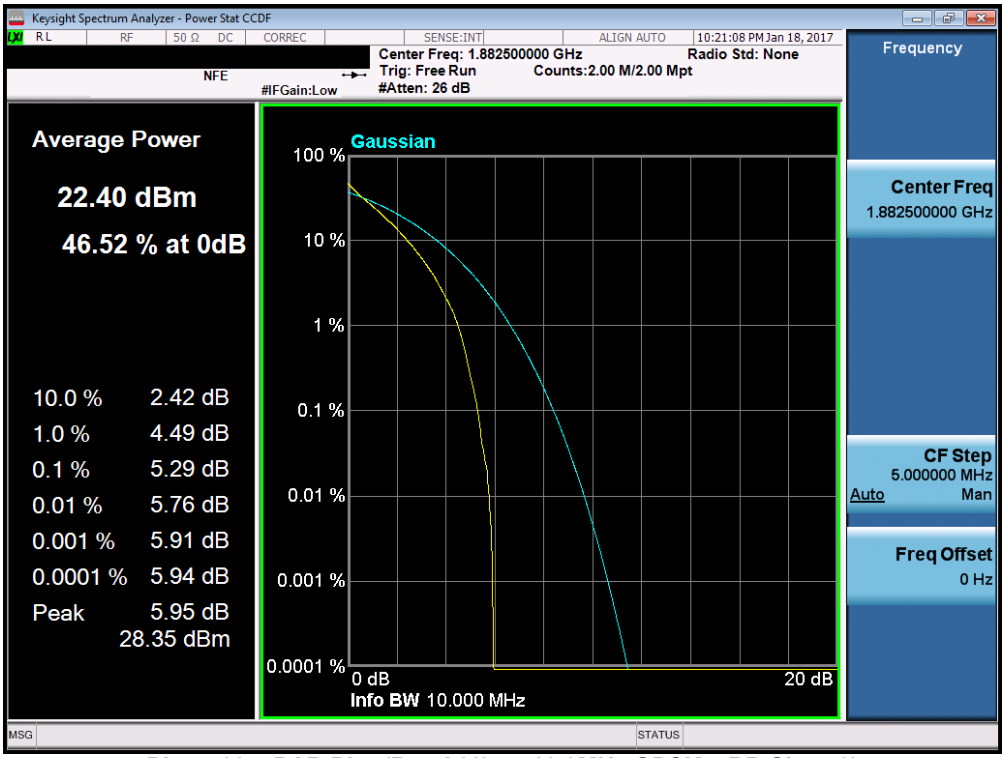


Plot 7-234. PAR Plot (Band 2/25 – 5.0MHz 64-QAM – RB Size 25)



Plot 7-235. PAR Plot (Band 2/25 – 10.0MHz QPSK – RB Size 50)

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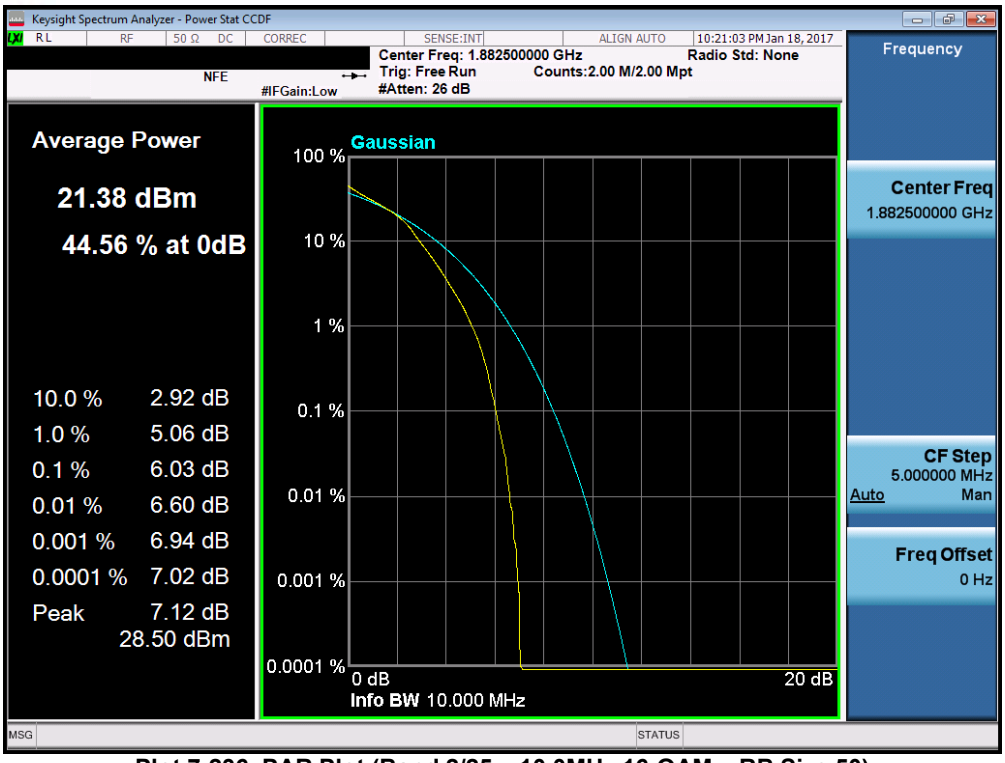
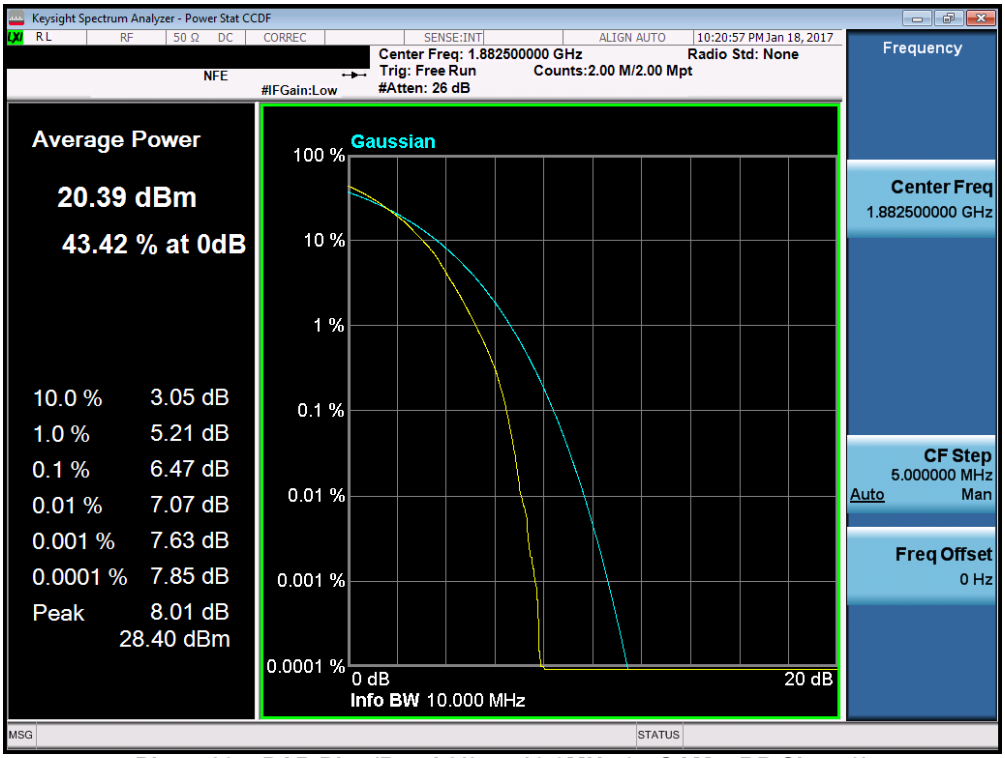


Plot 7-236. PAR Plot (Band 2/25 – 10.0MHz 16-QAM – RB Size 50)



Plot 7-237. PAR Plot (Band 2/25 – 10.0MHz 64-QAM – RB Size 50)

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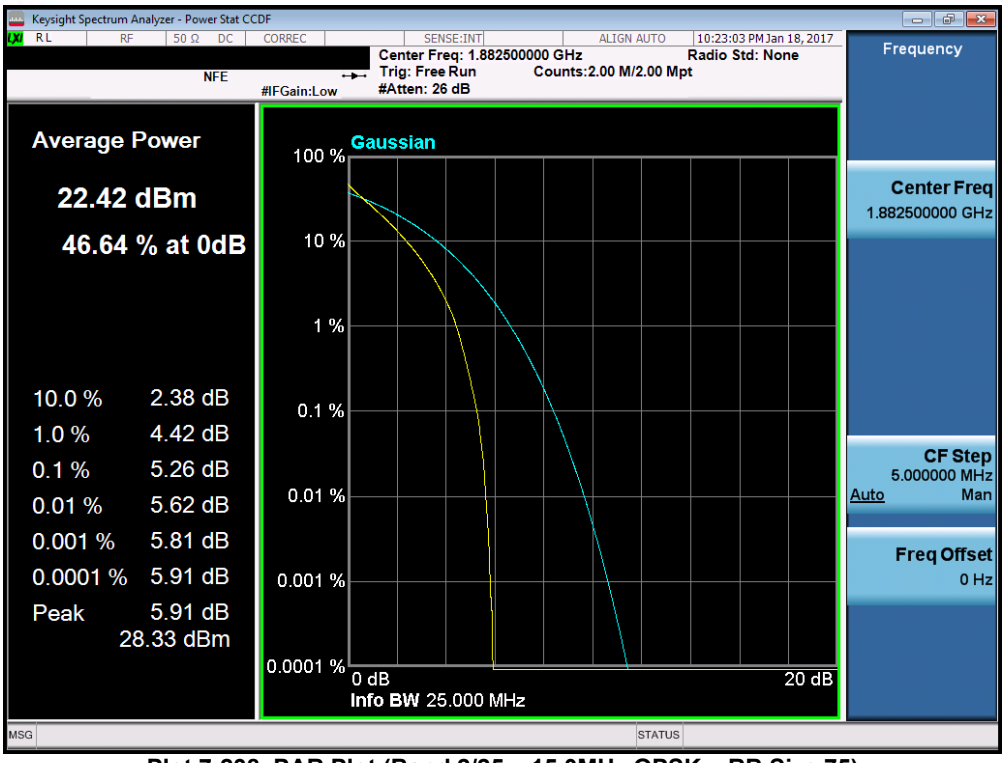
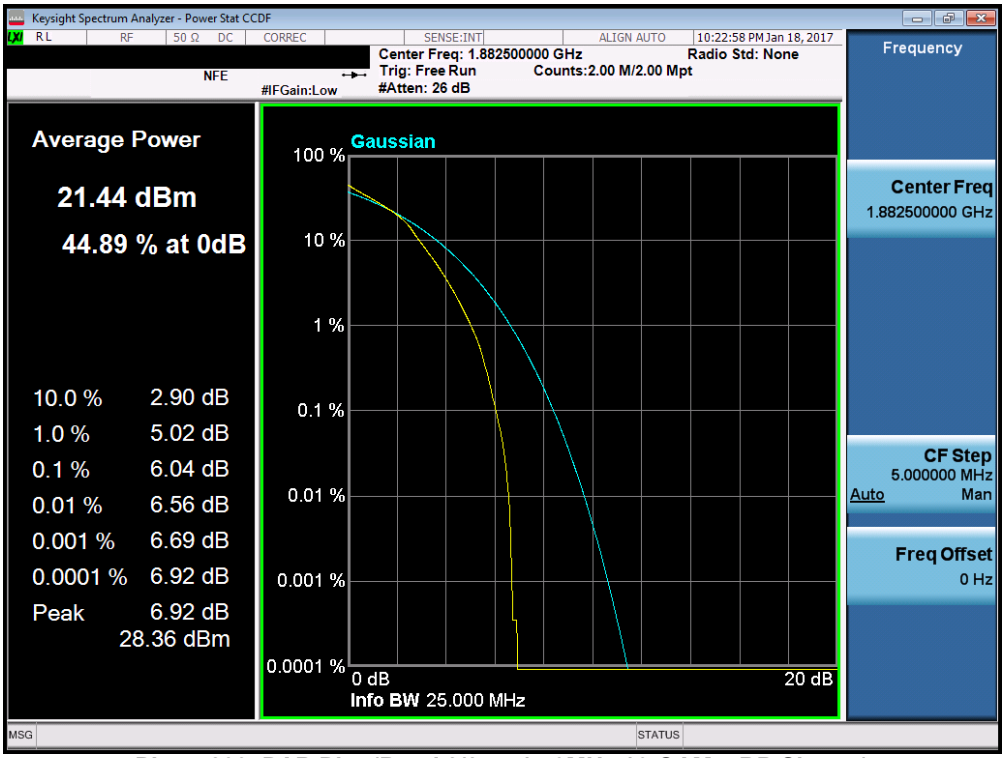


Plot 7-238. PAR Plot (Band 2/25 – 15.0MHz QPSK – RB Size 75)



Plot 7-239. PAR Plot (Band 2/25 – 15.0MHz 16-QAM – RB Size 75)

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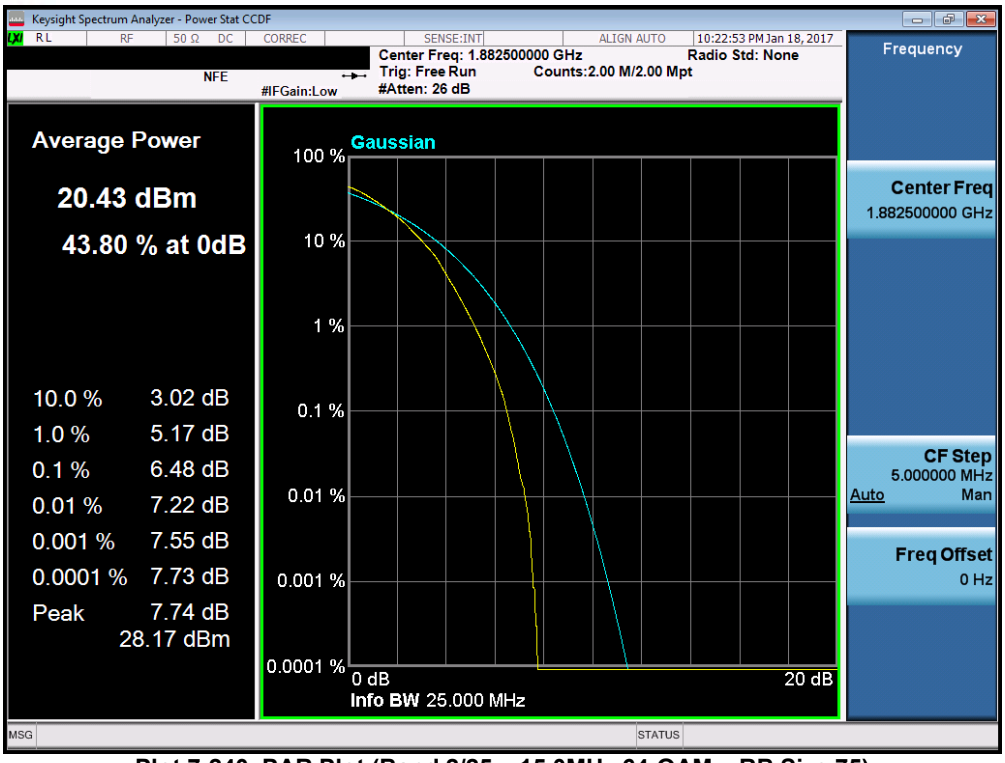
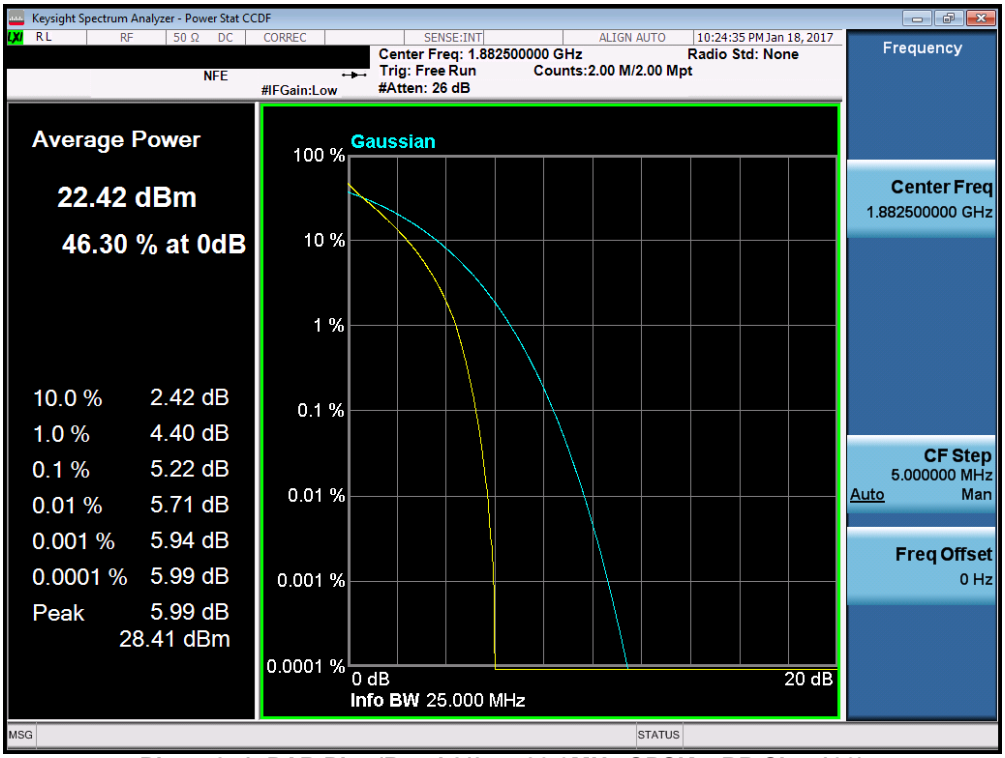


Plot 7-240. PAR Plot (Band 2/25 – 15.0MHz 64-QAM – RB Size 75)



Plot 7-241. PAR Plot (Band 2/25 – 20.0MHz QPSK – RB Size 100)

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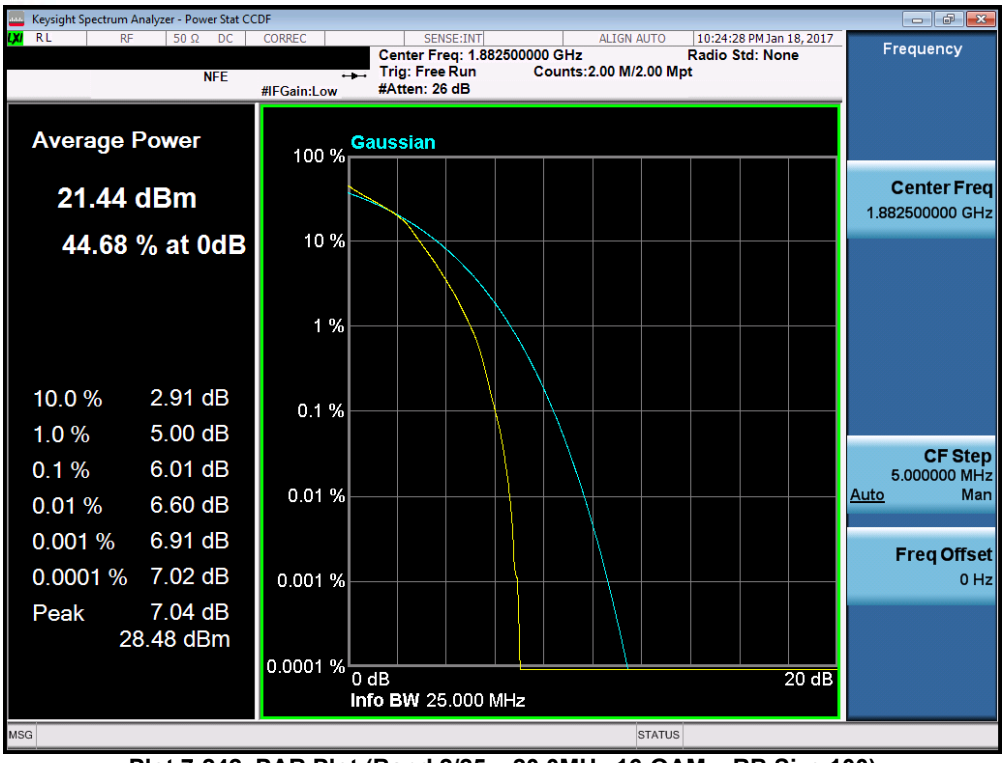
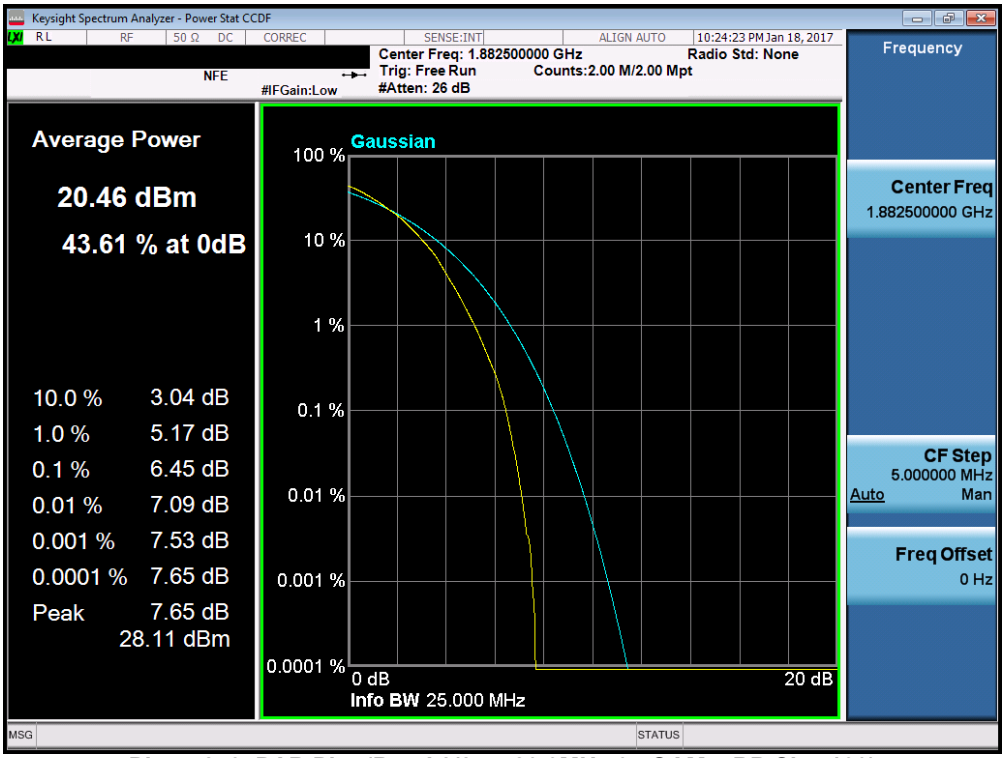


Plot 7-242. PAR Plot (Band 2/25 – 20.0MHz 16-QAM – RB Size 100)



Plot 7-243. PAR Plot (Band 2/25 – 20.0MHz 64-QAM – RB Size 100)

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7.7 Radiated Power (ERP/EIRP)

§22.913(a.2) §24.232(c.2) §27.50(h.2) §27.50(b.10) §27.50(c.10) §27.50(d.4)

Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.2.1

ANSI/TIA-603-D-2010 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer's "time domain power" measurement capability is used
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto". Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the "gating" function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

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Test Setup

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

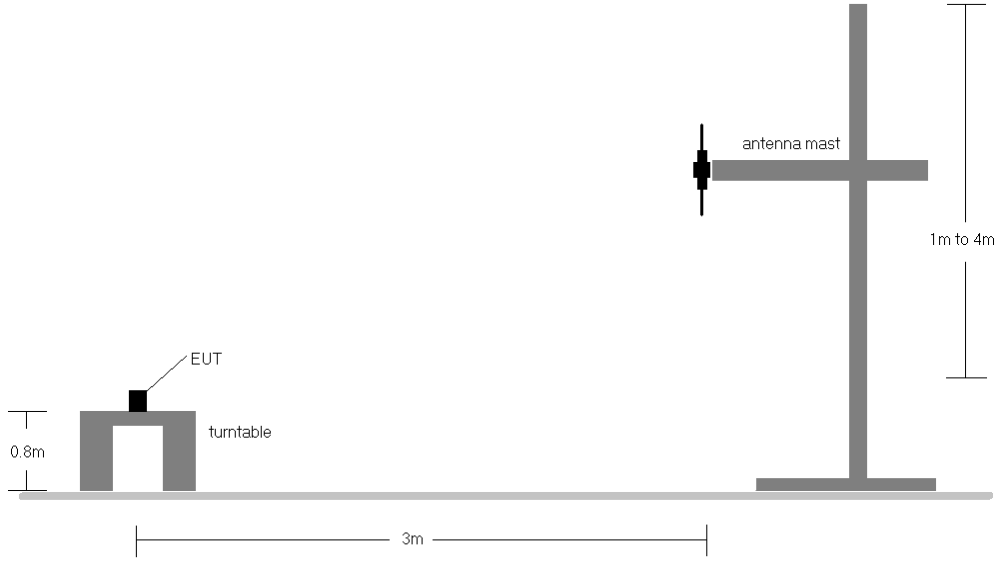

Figure 7-6. Radiated Test Setup <1GHz

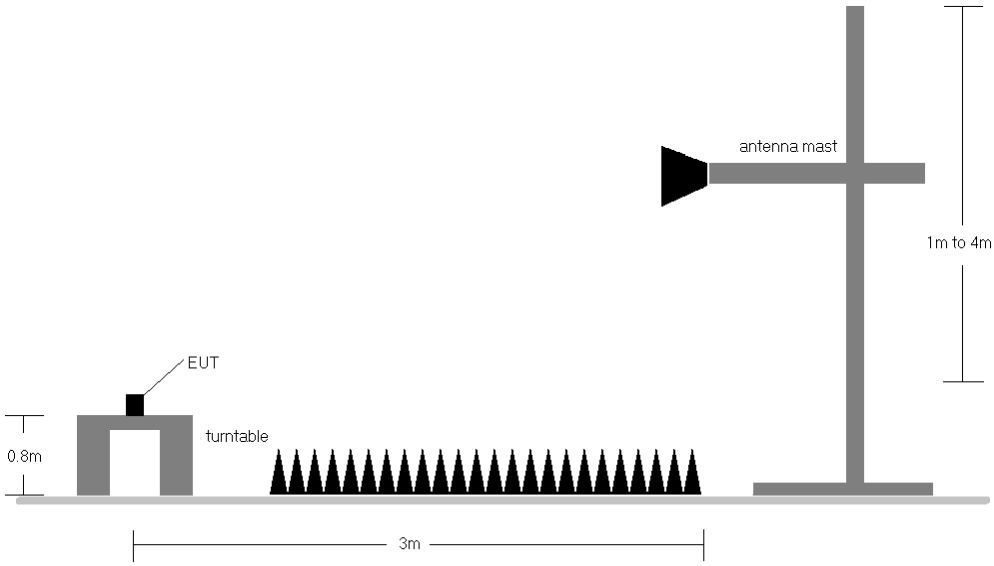

Figure 7-7. Radiated Test Setup >1GHz

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
699.70	1.4	QPSK	H	100	90	1 / 0	14.08	-0.25	13.83	34.77	-20.94
707.50	1.4	QPSK	H	100	87	1 / 5	16.41	-0.28	16.13	34.77	-18.64
715.30	1.4	QPSK	H	100	96	1 / 5	17.23	-0.31	16.92	34.77	-17.85
715.30	1.4	16-QAM	H	100	96	1 / 5	16.51	-0.31	16.20	34.77	-18.57
715.30	1.4	64-QAM	H	100	96	1 / 5	15.41	-0.31	15.10	34.77	-19.67
700.50	3	QPSK	H	100	85	1 / 14	14.37	-0.25	14.12	34.77	-20.65
707.50	3	QPSK	H	100	90	1 / 14	16.53	-0.28	16.25	34.77	-18.52
714.50	3	QPSK	H	100	89	1 / 14	17.42	-0.31	17.11	34.77	-17.66
714.50	3	16-QAM	H	100	89	1 / 14	16.68	-0.31	16.37	34.77	-18.40
714.50	3	64-QAM	H	100	89	1 / 14	15.61	-0.31	15.30	34.77	-19.47

Table 7-4. ERP Data (Band 12)

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
701.50	5	QPSK	H	100	88	1 / 24	15.94	-0.26	15.68	34.77	-19.09
707.50	5	QPSK	H	100	90	1 / 24	16.77	-0.28	16.49	34.77	-18.28
713.50	5	QPSK	H	100	90	1 / 24	17.67	-0.30	17.37	34.77	-17.41
713.50	5	16-QAM	H	100	90	1 / 24	16.93	-0.30	16.63	34.77	-18.15
713.50	5	64-QAM	H	100	90	1 / 24	15.85	-0.30	15.55	34.77	-19.23
704.00	10	QPSK	H	100	90	1 / 49	16.36	-0.27	16.09	34.77	-18.68
707.50	10	QPSK	H	100	89	1 / 0	15.78	-0.28	15.50	34.77	-19.27
711.00	10	QPSK	H	100	88	1 / 49	17.31	-0.29	17.02	34.77	-17.76
711.00	10	16-QAM	H	100	88	1 / 49	16.58	-0.29	16.29	34.77	-18.49
711.00	10	64-QAM	H	100	88	1 / 49	15.50	-0.29	15.21	34.77	-19.57
713.50	5	QPSK	V	104	313	1 / 74	17.64	-1.18	16.46	34.77	-18.31
713.50	5 (WCP)	QPSK	H	100	90	1 / 74	17.31	-0.30	17.01	34.77	-17.77

Table 7-5. ERP Data (Band 12/17)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
779.50	5	QPSK	H	100	98	1 / 24	19.90	-0.57	19.33	34.77	-15.44
782.00	5	QPSK	H	100	97	1 / 0	19.98	-0.58	19.40	34.77	-15.37
784.50	5	QPSK	H	100	99	1 / 0	19.88	-0.59	19.29	34.77	-15.48
782.00	5	16-QAM	H	100	97	1 / 0	19.22	-0.58	18.64	34.77	-16.13
782.00	5	64-QAM	H	100	97	1 / 0	18.12	-0.58	17.54	34.77	-17.23
782.00	10	QPSK	H	100	100	1 / 49	19.44	-0.58	18.86	34.77	-15.91
782.00	10	16-QAM	H	100	100	1 / 49	18.76	-0.58	18.18	34.77	-16.59
782.00	10	64-QAM	H	100	100	1 / 49	17.64	-0.58	17.06	34.77	-17.71
782.00	5	QPSK	V	94	175	1 / 0	18.60	-1.38	17.22	34.77	-17.55
782.00	5 (WCP)	QPSK	H	100	91	1 / 49	19.70	-0.58	19.12	34.77	-15.65

Table 7-6. ERP Data (Band 13)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
824.70	1.4	QPSK	H	350	71	1 / 5	20.47	-0.75	19.72	38.45	-18.73
836.50	1.4	QPSK	H	350	82	1 / 5	21.46	-0.84	20.62	38.45	-17.83
848.30	1.4	QPSK	H	347	87	1 / 0	21.52	-0.94	20.58	38.45	-17.87
836.50	1.4	16-QAM	H	350	82	1 / 5	20.67	-0.84	19.83	38.45	-18.62
836.50	1.4	64-QAM	H	350	82	1 / 5	19.58	-0.84	18.74	38.45	-19.71
825.50	3	QPSK	H	173	66	1 / 14	21.19	-0.75	20.44	38.45	-18.02
836.50	3	QPSK	H	182	75	1 / 14	22.08	-0.84	21.24	38.45	-17.21
847.50	3	QPSK	H	182	74	1 / 0	22.41	-0.93	21.48	38.45	-16.97
847.50	3	16-QAM	H	182	74	1 / 0	21.64	-0.93	20.71	38.45	-17.74
847.50	3	64-QAM	H	182	74	1 / 0	20.56	-0.93	19.63	38.45	-18.82
826.50	5	QPSK	H	171	73	1 / 24	22.28	-0.76	21.52	38.45	-16.93
836.50	5	QPSK	H	173	75	1 / 0	22.71	-0.84	21.87	38.45	-16.58
846.50	5	QPSK	H	188	81	1 / 24	21.14	-0.92	20.22	38.45	-18.23
836.50	5	16-QAM	H	173	75	1 / 0	21.93	-0.84	21.09	38.45	-17.36
836.50	5	64-QAM	H	173	75	1 / 0	20.83	-0.84	19.99	38.45	-18.46
829.00	10	QPSK	H	179	73	1 / 49	21.82	-0.78	21.04	38.45	-17.41
836.50	10	QPSK	H	181	65	1 / 49	21.99	-0.84	21.15	38.45	-17.30
844.00	10	QPSK	H	177	73	1 / 49	22.40	-0.90	21.50	38.45	-16.95
844.00	10	16-QAM	H	177	73	1 / 49	21.69	-0.90	20.79	38.45	-17.66
844.00	10	64-QAM	H	177	73	1 / 49	20.63	-0.90	19.73	38.45	-18.72
831.50	15	QPSK	H	100	83	1 / 74	21.53	-0.80	20.73	38.45	-17.72
836.50	15	QPSK	H	100	84	1 / 74	21.56	-0.84	20.72	38.45	-17.73
841.50	15	QPSK	H	100	89	1 / 0	21.69	-0.88	20.81	38.45	-17.64
841.50	15	16-QAM	H	100	89	1 / 0	20.92	-0.88	20.04	38.45	-18.41
841.50	15	64-QAM	H	100	89	1 / 0	19.85	-0.88	18.97	38.45	-19.48
836.50	5	QPSK	V	100	174	1 / 0	18.10	-1.40	16.70	38.45	-21.75
836.50	5 (WCP)	QPSK	H	100	85	1 / 99	20.54	-0.84	19.70	38.45	-18.75

Table 7-7. ERP Data (Band 5/26)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
1710.70	1.4	QPSK	H	100	82	1 / 5	19.72	5.56	25.28	30.00	-4.72
1732.50	1.4	QPSK	H	100	83	1 / 0	20.04	5.41	25.45	30.00	-4.55
1754.30	1.4	QPSK	H	100	83	1 / 0	20.53	5.26	25.79	30.00	-4.21
1754.30	1.4	16-QAM	H	100	83	1 / 0	19.77	5.26	25.03	30.00	-4.97
1754.30	1.4	64-QAM	H	100	83	1 / 0	18.71	5.26	23.97	30.00	-6.03
1711.50	3	QPSK	H	100	83	1 / 14	19.92	5.55	25.47	30.00	-4.53
1732.50	3	QPSK	H	100	82	1 / 14	20.23	5.41	25.64	30.00	-4.36
1753.50	3	QPSK	H	100	83	1 / 0	20.70	5.26	25.96	30.00	-4.04
1753.50	3	16-QAM	H	100	83	1 / 0	19.95	5.26	25.21	30.00	-4.79
1753.50	3	64-QAM	H	100	83	1 / 0	18.87	5.26	24.13	30.00	-5.87
1712.50	5	QPSK	H	100	82	1 / 0	20.24	5.55	25.79	30.00	-4.21
1732.50	5	QPSK	H	100	82	1 / 24	20.38	5.41	25.79	30.00	-4.21
1752.50	5	QPSK	H	100	79	1 / 0	20.96	5.27	26.23	30.00	-3.77
1752.50	5	16-QAM	H	100	79	1 / 0	20.23	5.27	25.50	30.00	-4.50
1752.50	5	64-QAM	H	100	79	1 / 0	19.16	5.27	24.43	30.00	-5.57
1715.00	10	QPSK	H	100	78	1 / 0	20.10	5.53	25.63	30.00	-4.37
1732.50	10	QPSK	H	100	80	1 / 49	20.39	5.41	25.80	30.00	-4.20
1750.00	10	QPSK	H	100	79	1 / 0	20.73	5.29	26.02	30.00	-3.98
1750.00	10	16-QAM	H	100	79	1 / 0	19.99	5.29	25.28	30.00	-4.72
1750.00	10	64-QAM	H	100	79	1 / 0	18.91	5.29	24.20	30.00	-5.80
1717.50	15	QPSK	H	100	84	1 / 0	20.81	5.51	26.32	30.00	-3.68
1732.50	15	QPSK	H	100	81	1 / 74	20.82	5.41	26.23	30.00	-3.77
1747.50	15	QPSK	H	100	80	1 / 0	21.22	5.31	26.53	30.00	-3.47
1747.50	15	16-QAM	H	100	80	1 / 0	20.38	5.31	25.69	30.00	-4.31
1747.50	15	64-QAM	H	100	80	1 / 0	19.32	5.31	24.63	30.00	-5.37
1720.00	20	QPSK	H	100	82	1 / 0	20.73	5.49	26.22	30.00	-3.78
1732.50	20	QPSK	H	100	84	1 / 99	20.69	5.41	26.10	30.00	-3.90
1745.00	20	QPSK	H	100	83	1 / 99	20.82	5.32	26.14	30.00	-3.86
1720.00	20	16-QAM	H	100	82	1 / 0	19.92	5.49	25.41	30.00	-4.59
1720.00	20	64-QAM	H	100	82	1 / 0	18.83	5.49	24.32	30.00	-5.68
1747.50	15	QPSK	V	100	7	100 / 0	18.91	5.31	24.22	30.00	-5.78
1747.50	15 (WCP)	QPSK	H	118	0	1 / 0	19.22	5.31	24.53	30.00	-5.47

Table 7-8. EIRP Data (Band 4)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
1850.70	1.4	QPSK	V	100	92	1 / 0	18.78	4.79	23.57	33.01	-9.44
1882.50	1.4	QPSK	V	100	93	1 / 0	17.97	4.85	22.82	33.01	-10.19
1914.30	1.4	QPSK	V	103	91	1 / 0	16.21	4.85	21.06	33.01	-11.95
1850.70	1.4	16-QAM	V	100	92	1 / 0	18.01	4.79	22.80	33.01	-10.21
1850.70	1.4	64-QAM	V	100	92	1 / 0	16.98	4.79	21.77	33.01	-11.24
1851.50	3	QPSK	V	100	96	1 / 0	18.77	4.79	23.56	33.01	-9.45
1882.50	3	QPSK	V	102	92	1 / 0	18.19	4.85	23.04	33.01	-9.97
1913.50	3	QPSK	V	100	93	1 / 0	15.92	4.85	20.77	33.01	-12.24
1851.50	3	16-QAM	V	100	96	1 / 0	18.03	4.79	22.82	33.01	-10.19
1851.50	3	64-QAM	V	100	96	1 / 0	16.95	4.79	21.74	33.01	-11.27
1852.50	5	QPSK	V	100	93	1 / 0	19.02	4.79	23.81	33.01	-9.20
1882.50	5	QPSK	V	100	94	1 / 0	18.46	4.85	23.31	33.01	-9.70
1912.50	5	QPSK	V	104	90	1 / 0	16.26	4.85	21.11	33.01	-11.90
1852.50	5	16-QAM	V	100	93	1 / 0	18.30	4.79	23.09	33.01	-9.92
1852.50	5	64-QAM	V	100	93	1 / 0	17.25	4.79	22.04	33.01	-10.97
1855.00	10	QPSK	V	100	93	1 / 0	18.81	4.80	23.61	33.01	-9.40
1882.50	10	QPSK	V	101	93	1 / 0	18.37	4.85	23.22	33.01	-9.79
1910.00	10	QPSK	V	100	92	1 / 0	16.50	4.86	21.36	33.01	-11.65
1855.00	10	16-QAM	V	100	93	1 / 0	18.07	4.80	22.87	33.01	-10.14
1855.00	10	64-QAM	V	100	93	1 / 0	16.99	4.80	21.79	33.01	-11.22
1857.50	15	QPSK	V	100	93	1 / 0	18.82	4.80	23.62	33.01	-9.39
1882.50	15	QPSK	V	100	91	1 / 0	18.42	4.85	23.27	33.01	-9.74
1907.50	15	QPSK	V	103	92	1 / 0	16.91	4.87	21.78	33.01	-11.23
1857.50	15	16-QAM	V	100	93	1 / 0	18.06	4.80	22.86	33.01	-10.15
1857.50	15	64-QAM	V	100	93	1 / 0	16.99	4.80	21.79	33.01	-11.22
1860.00	20	QPSK	V	100	92	1 / 0	18.79	4.81	23.60	33.01	-9.42
1882.50	20	QPSK	V	100	90	1 / 0	18.40	4.85	23.25	33.01	-9.76
1905.00	20	QPSK	V	100	91	1 / 0	17.39	4.87	22.26	33.01	-10.75
1860.00	20	16-QAM	V	100	92	1 / 0	18.03	4.81	22.84	33.01	-10.18
1860.00	20	64-QAM	V	100	92	1 / 0	16.95	4.81	21.76	33.01	-11.26
1852.50	5	QPSK	H	100	36	1 / 0	17.64	4.73	22.37	33.01	-10.64
1852.50	5 (WCP)	QPSK	H	112	18	1 / 0	18.08	4.79	22.87	33.01	-10.14

Table 7-9. EIRP Data (Band 2/25)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
2498.50	5	QPSK	H	356	62	1 / 0	18.00	5.73	23.73	33.01	-9.28
2593.00	5	QPSK	H	355	56	1 / 0	18.33	6.07	24.40	33.01	-8.61
2687.50	5	QPSK	H	352	52	1 / 0	12.92	6.48	19.40	33.01	-13.61
2593.00	5	16-QAM	H	355	56	1 / 0	17.29	6.07	23.36	33.01	-9.65
2593.00	5	64-QAM	H	355	56	1 / 0	16.22	6.07	22.29	33.01	-10.72
2501.00	10	QPSK	H	352	61	1 / 0	17.65	5.73	23.38	33.01	-9.63
2593.00	10	QPSK	H	351	61	1 / 0	18.42	6.07	24.49	33.01	-8.52
2685.00	10	QPSK	H	350	56	1 / 0	16.18	6.47	22.65	33.01	-10.36
2593.00	10	16-QAM	H	351	61	1 / 0	17.49	6.07	23.56	33.01	-9.45
2593.00	10	64-QAM	H	351	61	1 / 0	16.47	6.07	22.54	33.01	-10.47
2503.50	15	QPSK	H	355	57	1 / 0	17.72	5.74	23.46	33.01	-9.55
2593.00	15	QPSK	H	352	60	1 / 0	18.35	6.07	24.42	33.01	-8.59
2682.50	15	QPSK	H	352	58	1 / 0	16.50	6.46	22.96	33.01	-10.05
2593.00	15	16-QAM	H	352	60	1 / 0	17.70	6.07	23.77	33.01	-9.24
2593.00	15	64-QAM	H	352	60	1 / 0	16.64	6.07	22.71	33.01	-10.30
2506.00	20	QPSK	H	227	27	1 / 0	17.50	5.75	23.25	33.01	-9.76
2593.00	20	QPSK	H	348	62	1 / 0	18.22	6.07	24.29	33.01	-8.72
2680.00	20	QPSK	H	351	59	1 / 0	16.22	6.45	22.67	33.01	-10.34
2593.00	20	16-QAM	H	348	62	1 / 0	17.27	6.07	23.34	33.01	-9.67
2593.00	20	64-QAM	H	348	62	1 / 0	16.17	6.07	22.24	33.01	-10.77
2593.00	10	QPSK	V	100	218	1 / 99	14.28	5.63	19.91	33.01	-13.10
2593.00	10 (WCP)	QPSK	H	355	57	1 / 0	17.89	6.07	23.96	33.01	-9.05

Table 7-10. EIRP Data (Band 41)

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7.8 Radiated Spurious Emissions Measurements

§2.1053 §22.917(a) §24.238(a) §27.53(c) §27.53(f) §27.53(g) §27.53(h) §27.53(m)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.8

ANSI/TIA-603-D-2010 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

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Test Setup

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

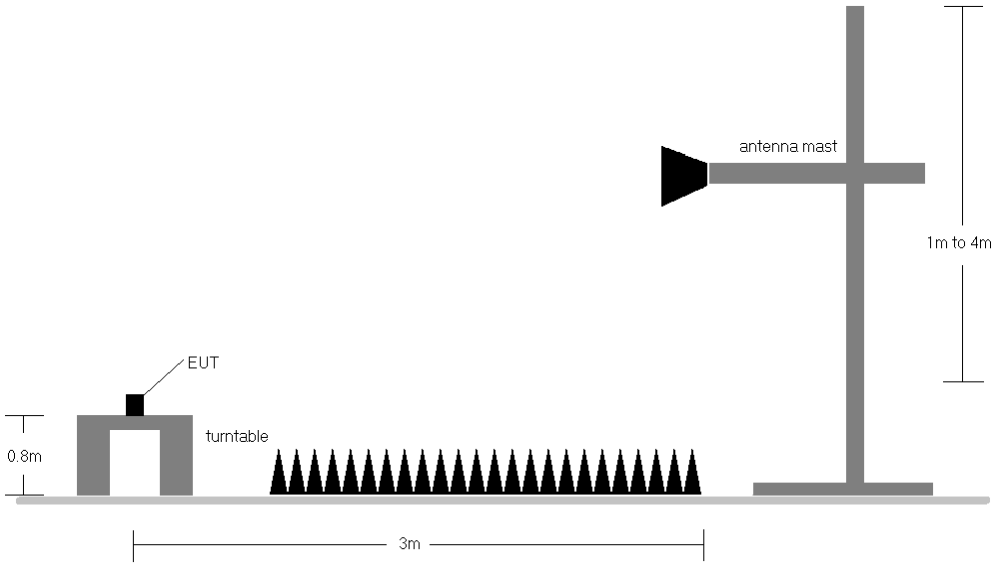

Figure 7-8. Test Instrument & Measurement Setup

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

4) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

5) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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OPERATING FREQUENCY:	701.50	MHz		
CHANNEL:	23035			
MEASURED OUTPUT POWER:	15.68	dBm	=	0.037 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	28.68	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1403.00	H	-	-	-75.37	5.60	-69.77	85.5
2104.50	H	-	-	-73.46	6.67	-66.78	82.5

Table 7-11. Radiated Spurious Data (Band 12/17 – Low Channel)

OPERATING FREQUENCY:	707.50	MHz		
CHANNEL:	23095			
MEASURED OUTPUT POWER:	16.49	dBm	=	0.045 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	29.49	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1415.00	H	-	-	-74.99	5.69	-69.29	85.8
2122.50	H	-	-	-73.59	6.75	-66.84	83.3

Table 7-12. Radiated Spurious Data (Band 12/17 – Mid Channel)

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OPERATING FREQUENCY:	713.50	MHz		
CHANNEL:	23155			
MEASURED OUTPUT POWER:	17.37	dBm	=	0.055 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	30.37	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1427.00	H	-	-	-75.16	5.79	-69.37	86.7
2140.50	H	-	-	-73.64	6.82	-66.82	84.2

Table 7-13. Radiated Spurious Data (Band 12/17 – High Channel)

OPERATING FREQUENCY:	713.50	MHz		
CHANNEL:	23155			
MEASURED OUTPUT POWER:	17.01	dBm	=	0.050 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	30.01	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1427.00	H	-	-	-77.44	5.79	-71.65	88.7
2140.50	H	-	-	-75.62	6.82	-68.80	85.8

Table 7-14. Radiated Spurious Data with WCP (Band 12/17 – High Channel)

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OPERATING FREQUENCY:	779.50	MHz		
CHANNEL:	23205			
MEASURED OUTPUT POWER:	19.33	dBm	=	0.086 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.33	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
2338.50	H	-	-	-75.64	7.35	-68.29	87.6
3118.00	H	-	-	-72.08	7.19	-64.89	84.2

Table 7-15. Radiated Spurious Data (Band 13 – Low Channel)

OPERATING FREQUENCY:	782.00	MHz		
CHANNEL:	23230			
MEASURED OUTPUT POWER:	19.40	dBm	=	0.087 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.40	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
2346.00	H	-	-	-73.67	7.33	-66.34	85.7
3128.00	H	-	-	-70.06	7.20	-62.86	82.3

Table 7-16. Radiated Spurious Data (Band 13 – Mid Channel)

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OPERATING FREQUENCY:	784.50	MHz		
CHANNEL:	23255			
MEASURED OUTPUT POWER:	19.29	dBm	=	0.085 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.29	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
2353.50	H	-	-	-73.34	7.30	-66.04	85.3
3138.00	H	-	-	-70.01	7.21	-62.79	82.1

Table 7-17. Radiated Spurious Data (Band 13 – High Channel)

MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.00	MHz
DISTANCE:	3	meters
NARROWBAND EMISSION LIMIT:	-50	dBm
WIDEBAND EMISSION LIMIT:	-40	dBm/MHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1559.00	H	-	-	-76.08	6.55	-69.53	-29.5
1564.00	H	-	-	-75.94	6.57	-69.37	-29.4
1569.00	H	-	-	-76.00	6.59	-69.42	-29.4

Table 7-18. Radiated Spurious Data (Band 13 – 1559-1610MHz Band)

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OPERATING FREQUENCY:	782.00	MHz		
CHANNEL:	23230			
MEASURED OUTPUT POWER:	19.12	dBm	=	0.082 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.12	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
2346.00	H	-	-	-73.70	7.33	-66.37	85.5
3128.00	H	-	-	-70.12	7.20	-62.92	82.0

Table 7-19. Radiated Spurious Data with WCP (Band 13 – Mid Channel)

MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.00	MHz
DISTANCE:	3	meters
NARROWBAND EMISSION LIMIT:	-50	dBm
WIDEBAND EMISSION LIMIT:	-40	dBm/MHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1564.00	H	-	-	-75.94	6.57	-69.37	-29.4

Table 7-20. Radiated Spurious Data With WCP (Band 13 – 1559-1610MHz Band)

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OPERATING FREQUENCY:	826.50	MHz		
CHANNEL:	26815			
MEASURED OUTPUT POWER:	21.52	dBm	=	0.142 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	34.52	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
1653.00	H	-	-	-77.40	6.70	-70.70	92.2
2479.50	H	-	-	-75.62	7.54	-68.08	89.6

Table 7-21. Radiated Spurious Data (Band 5/26 – Low Channel)

OPERATING FREQUENCY:	836.50	MHz		
CHANNEL:	26915			
MEASURED OUTPUT POWER:	21.87	dBm	=	0.154 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	34.87	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1673.00	H	-	-	-77.83	6.70	-71.13	93.0
2509.50	H	-	-	-75.52	7.63	-67.89	89.8

Table 7-22. Radiated Spurious Data (Band 5/26 – Mid Channel)

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OPERATING FREQUENCY:	846.50	MHz		
CHANNEL:	27015			
MEASURED OUTPUT POWER:	20.22	dBm	=	0.105 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	33.22	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1693.00	H	-	-	-77.16	6.70	-70.47	90.7
2539.50	H	-	-	-75.18	7.60	-67.58	87.8

Table 7-23. Radiated Spurious Data (Band 5/26 – High Channel)

OPERATING FREQUENCY:	836.50	MHz		
CHANNEL:	26915			
MEASURED OUTPUT POWER:	19.70	dBm	=	0.093 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.70	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	[dBc]
1673.00	H	-	-	-77.48	6.70	-70.78	90.5
2509.50	H	-	-	-75.24	7.63	-67.61	87.3

Table 7-24. Radiated Spurious Data with WCP (Band 5/26 – Mid Channel)

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OPERATING FREQUENCY:	1717.50	MHz		
CHANNEL:	20025			
MEASURED OUTPUT POWER:	26.32	dBm	=	0.429 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	15.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	39.32	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3435.00	H	157	303	-66.93	9.88	-57.05	83.4
5152.50	H	-	-	-67.40	10.75	-56.65	83.0

Table 7-25. Radiated Spurious Data (Band 4 – Low Channel)

OPERATING FREQUENCY:	1732.50	MHz		
CHANNEL:	20175			
MEASURED OUTPUT POWER:	26.23	dBm	=	0.420 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	15.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	39.23	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3465.00	H	174	58	-68.64	9.91	-58.73	85.0
5197.50	H	-	-	-66.76	10.75	-56.02	82.2

Table 7-26. Radiated Spurious Data (Band 4 – Mid Channel)

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OPERATING FREQUENCY:	1747.50	MHz		
CHANNEL:	20325			
MEASURED OUTPUT POWER:	26.53	dBm	=	0.449 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	15.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	39.53	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3495.00	H	-	-	-70.11	9.94	-60.17	86.7
5242.50	H	-	-	-67.61	10.72	-56.89	83.4

Table 7-27. Radiated Spurious Data (Band 4 – High Channel)

OPERATING FREQUENCY:	1747.50	MHz		
CHANNEL:	20325			
MEASURED OUTPUT POWER:	24.53	dBm	=	0.284 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	15.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	37.53	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3495.00	H	201	210	-69.60	9.94	-59.66	84.2
5242.50	H	-	-	-67.48	10.72	-56.76	81.3

Table 7-28. Radiated Spurious Data with WCP (Band 4 – High Channel)

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OPERATING FREQUENCY:	1852.50	MHz		
CHANNEL:	26065			
MEASURED OUTPUT POWER:	23.81	dBm	=	0.240 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	36.81	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3705.00	H	-	-	-68.56	9.52	-59.04	82.9
5557.50	H	-	-	-67.28	11.03	-56.25	80.1

Table 7-29. Radiated Spurious Data (Band 2/25 – Low Channel)

OPERATING FREQUENCY:	1882.50	MHz		
CHANNEL:	26365			
MEASURED OUTPUT POWER:	23.31	dBm	=	0.214 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	36.31	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3765.00	H	-	-	-67.86	9.37	-58.49	81.8
5647.50	H	-	-	-67.51	11.23	-56.28	79.6

Table 7-30. Radiated Spurious Data (Band 2/25 – Mid Channel)

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OPERATING FREQUENCY:	1912.50	MHz		
CHANNEL:	26665			
MEASURED OUTPUT POWER:	21.11	dBm	=	0.129 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	34.11	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3825.00	H	-	-	-67.52	9.33	-58.18	79.3
5737.50	H	-	-	-66.91	11.39	-55.52	76.6

Table 7-31. Radiated Spurious Data (Band 2/25 – High Channel)

OPERATING FREQUENCY:	1852.50	MHz		
CHANNEL:	26065			
MEASURED OUTPUT POWER:	22.87	dBm	=	0.194 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	35.87	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
3705.00	H	-	-	-68.53	9.52	-59.01	81.9
5557.50	H	-	-	-67.28	11.03	-56.25	79.1

Table 7-32. Radiated Spurious Data with WCP (Band 2/25 – Low Channel)

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OPERATING FREQUENCY:	2501.00	MHz		
CHANNEL:	39700			
MEASURED OUTPUT POWER:	23.38	dBm	=	0.218 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	10.0	MHz		
DISTANCE:	3	meters		
LIMIT:	55 + 10 log10 (W)	48.38	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
5002.00	H	160	64	-65.38	10.93	-54.45	77.8
7503.00	H	-	-	-58.27	11.06	-47.20	70.6

Table 7-33. Radiated Spurious Data (Band 41 – Low Channel)

OPERATING FREQUENCY:	2593.00	MHz		
CHANNEL:	40620			
MEASURED OUTPUT POWER:	24.49	dBm	=	0.281 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	10.0	MHz		
DISTANCE:	3	meters		
LIMIT:	55 + 10 log10 (W)	49.49	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
5186.00	H	129	37	-56.82	10.75	-46.07	70.6
7779.00	H	-	-	-58.54	11.40	-47.14	71.6

Table 7-34. Radiated Spurious Data (Band 41 – Mid Channel)

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OPERATING FREQUENCY:	2685.00	MHz		
CHANNEL:	41540			
MEASURED OUTPUT POWER:	22.65	dBm	=	0.184 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	10.0	MHz		
DISTANCE:	3	meters		
LIMIT:	55 + 10 log10 (W)	47.65	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
5370.00	H	112	248	-60.16	10.75	-49.41	72.1
8055.00	H	124	280	-56.24	11.15	-45.09	67.7
10740.00	H	-	-	-57.35	12.80	-44.55	67.2

Table 7-35. Radiated Spurious Data (Band 41 – High Channel)

OPERATING FREQUENCY:	2593.00	MHz		
CHANNEL:	40620			
MEASURED OUTPUT POWER:	23.96	dBm	=	0.249 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	10.0	MHz		
DISTANCE:	3	meters		
LIMIT:	55 + 10 log10 (W)	48.96	dBc	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	[dBc]
5186.00	H	151	31	-57.40	10.75	-46.65	70.6
7779.00	H	-	-	-58.32	11.40	-46.92	70.9

Table 7-36. Radiated Spurious Data with WCP (Band 41 – Mid Channel)

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7.9 Uplink Carrier Aggregation Radiated Measurements

§2.1053, §27.53(m)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.8

ANSI/TIA-603-D-2010 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. No. of sweep points ≥ 2 x span / RBW
4. Detector = RMS
5. Trace mode = Max Hold
6. The trace was allowed to stabilize

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Test Setup

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

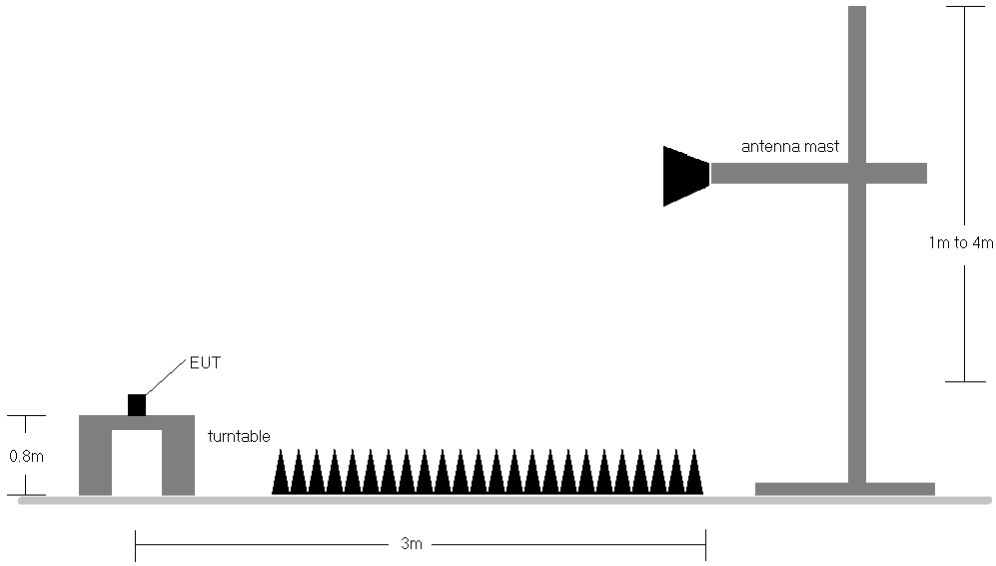

Figure 7-9. Test Instrument & Measurement Setup

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

3) Radiated spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. The worst case (highest) emissions were found while operating with QPSK modulation with both carriers set to transmit using 1RB.

4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

5) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

6) No significant emissions were found as a result of two uplink carriers operating contiguously.

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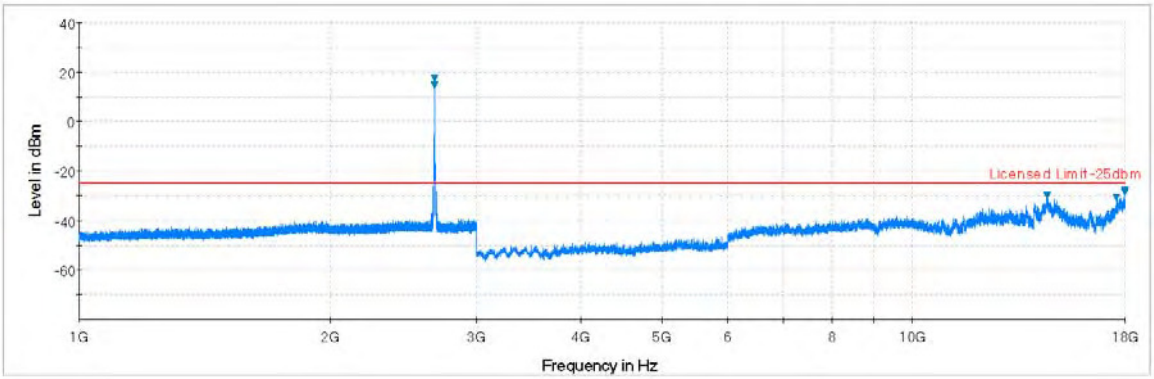
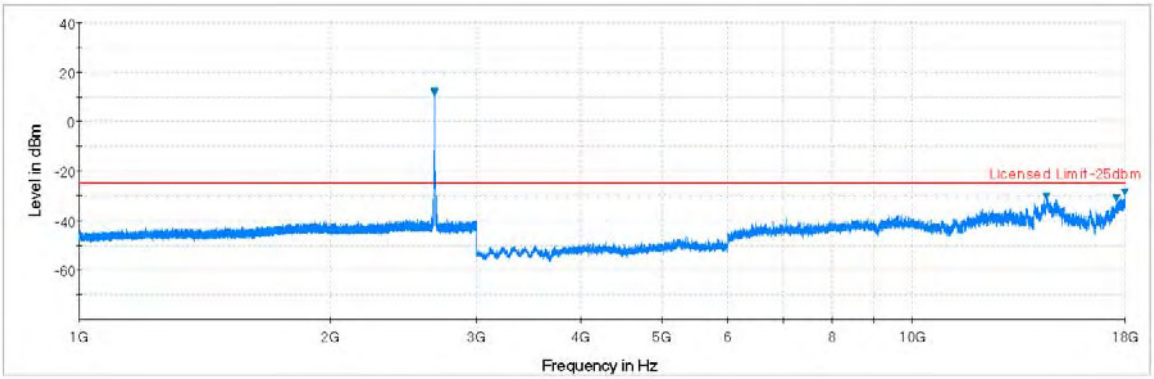
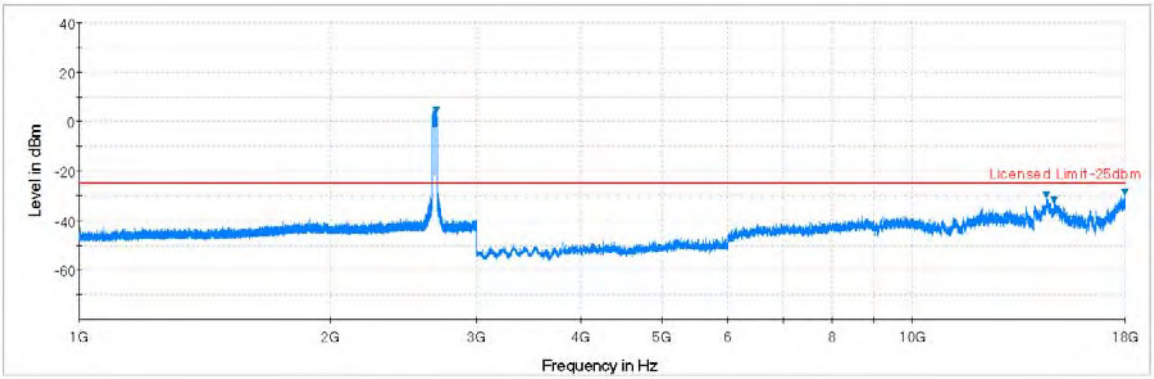


Plot 7-244. Radiated Spruious Plot (ULCA B41 PCC: RB 1 Offset 99, SCC: RB 1 Offset 0, Ant. Pol. H)



Plot 7-245. Radiated Spruious Plot (ULCA B41 PCC: RB 1 Offset 99, SCC: RB 1 Offset 0, Ant. Pol. V)



Plot 7-246. Radiated Spruious Plot (ULCA B41 PCC: RB 100 Offset 0, SCC: RB 100 Offset 0, Ant. Pol. H)

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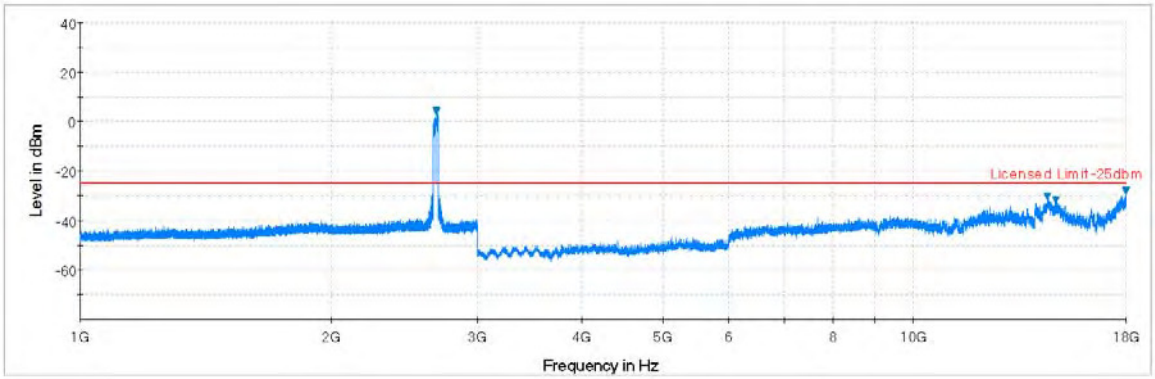

Plot 7-247. Radiated Spruious Plot (ULCA B41 PCC: RB 100 Offset 0, SCC: RB 100 Offset 0, Ant. Pol. V)

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7.10 Frequency Stability / Temperature Variation

§2.1055 §22.355 §24.235 §27.54

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-D-2010. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Part 22, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency. For Part 24 and Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI/TIA-603-D-2010

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

None

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Band 12/17 Frequency Stability Measurements

§2.1055 §27.54

OPERATING FREQUENCY: 707,500,000 Hz

CHANNEL: 23790

REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	707,499,900	-100	-0.0000141
100 %		- 30	707,499,756	-244	-0.0000345
100 %		- 20	707,500,088	88	0.0000124
100 %		- 10	707,500,002	2	0.0000003
100 %		0	707,500,007	7	0.0000010
100 %		+ 10	707,500,011	11	0.0000016
100 %		+ 20	707,500,004	4	0.0000006
100 %		+ 30	707,499,832	-168	-0.0000237
100 %		+ 40	707,499,807	-193	-0.0000273
100 %		+ 50	707,499,852	-148	-0.0000209
BATT. ENDPOINT	3.45	+ 20	707,499,945	-55	-0.0000078

Table 7-37. Frequency Stability Data (Band 12/17)

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Band 12/17 Frequency Stability Measurements

§2.1055 §27.54

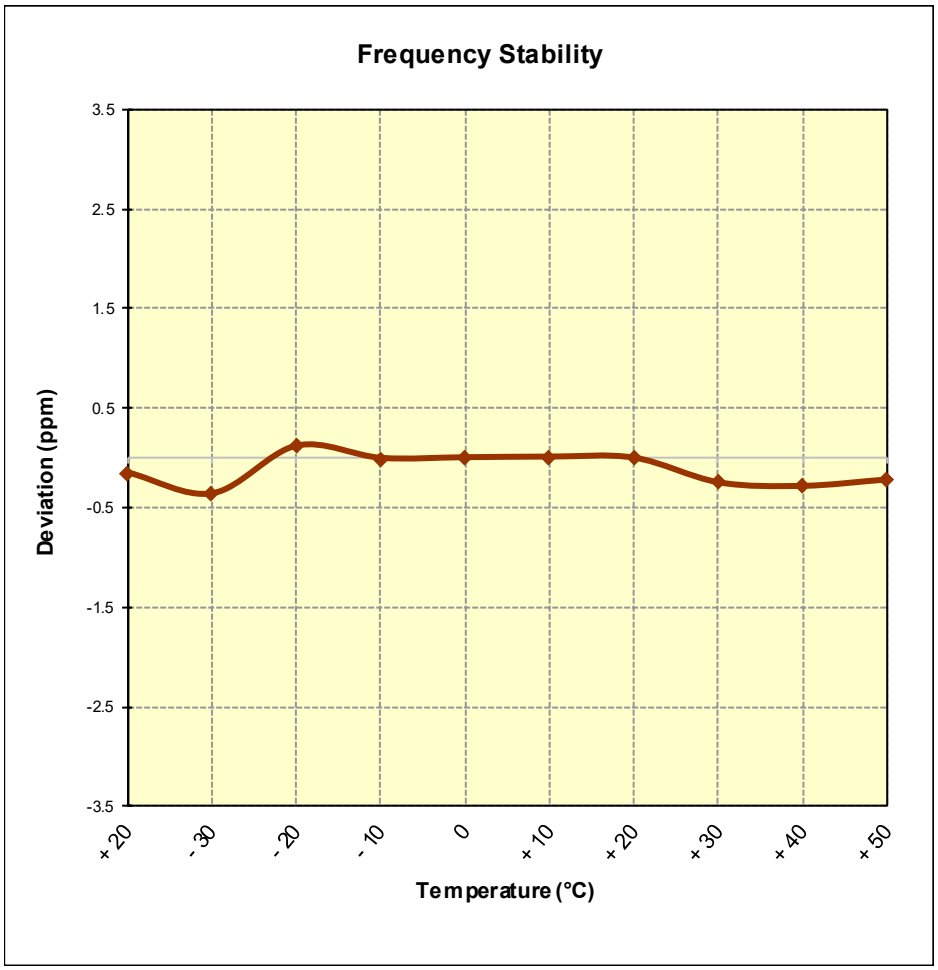

Figure 7-10. Frequency Stability Graph (Band 12/17)

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Band 13 Frequency Stability Measurements

§2.1055 §27.54

OPERATING FREQUENCY:	782,000,000	Hz
CHANNEL:	23230	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	782,000,130	130	0.0000166
100 %		- 30	782,000,024	24	0.0000031
100 %		- 20	781,999,984	-16	-0.0000020
100 %		- 10	782,000,049	49	0.0000063
100 %		0	782,000,006	6	0.0000008
100 %		+ 10	782,000,218	218	0.0000279
100 %		+ 20	782,000,044	44	0.0000056
100 %		+ 30	782,000,111	111	0.0000142
100 %		+ 40	781,999,678	-322	-0.0000412
100 %		+ 50	781,999,970	-30	-0.0000038
BATT. ENDPOINT	3.45	+ 20	781,999,951	-49	-0.0000063

Table 7-38. Frequency Stability Data (Band 13)

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Band 13 Frequency Stability Measurements

§2.1055 §27.54

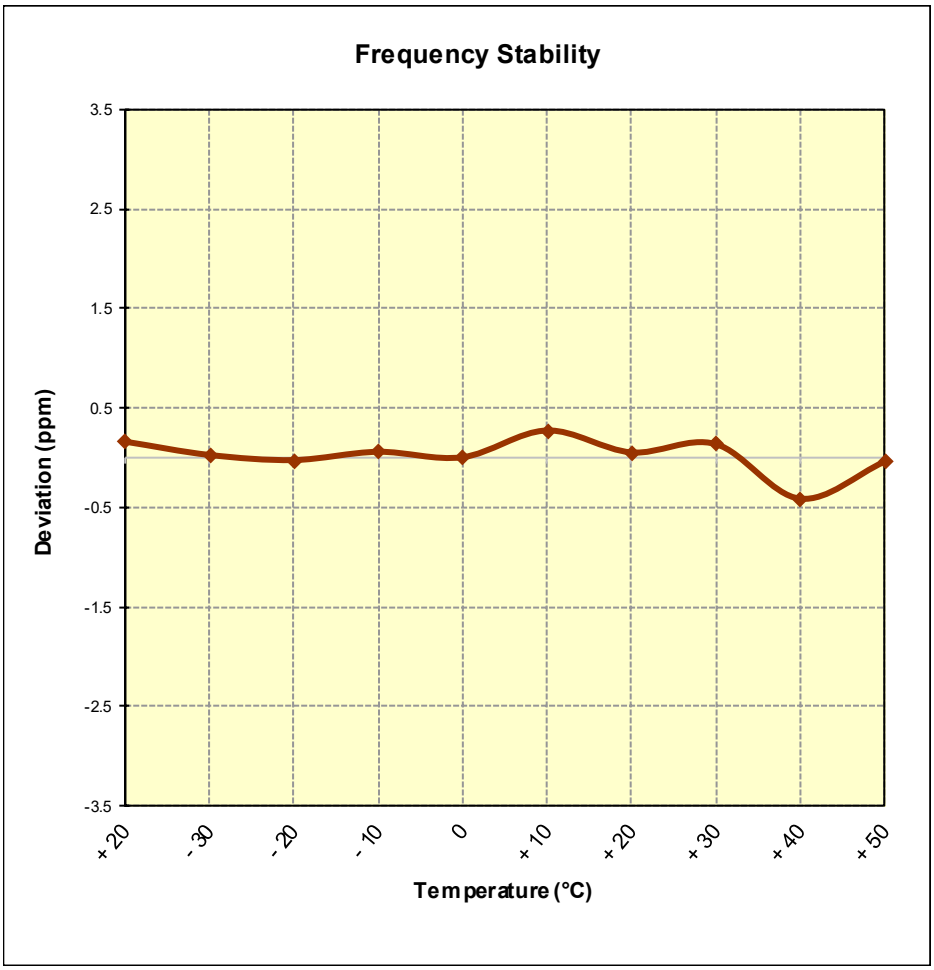

Figure 7-11. Frequency Stability Graph (Band 13)

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Band 5/26 Frequency Stability Measurements

§2.1055 §22.355

OPERATING FREQUENCY:	831,500,000	Hz
CHANNEL:	26865	
REFERENCE VOLTAGE:	3.85	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	831,499,866	-134	-0.0000161
100 %		- 30	831,499,941	-59	-0.0000071
100 %		- 20	831,500,236	236	0.0000284
100 %		- 10	831,500,196	196	0.0000236
100 %		0	831,500,117	117	0.0000141
100 %		+ 10	831,499,592	-408	-0.0000491
100 %		+ 20	831,500,091	91	0.0000109
100 %		+ 30	831,499,785	-215	-0.0000259
100 %		+ 40	831,499,796	-204	-0.0000245
100 %		+ 50	831,500,155	155	0.0000186
BATT. ENDPOINT	3.45	+ 20	831,500,077	77	0.0000093

Table 7-39. Frequency Stability Data (Band 5/26)

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Band 5/26 Frequency Stability Measurements

§2.1055 §22.355

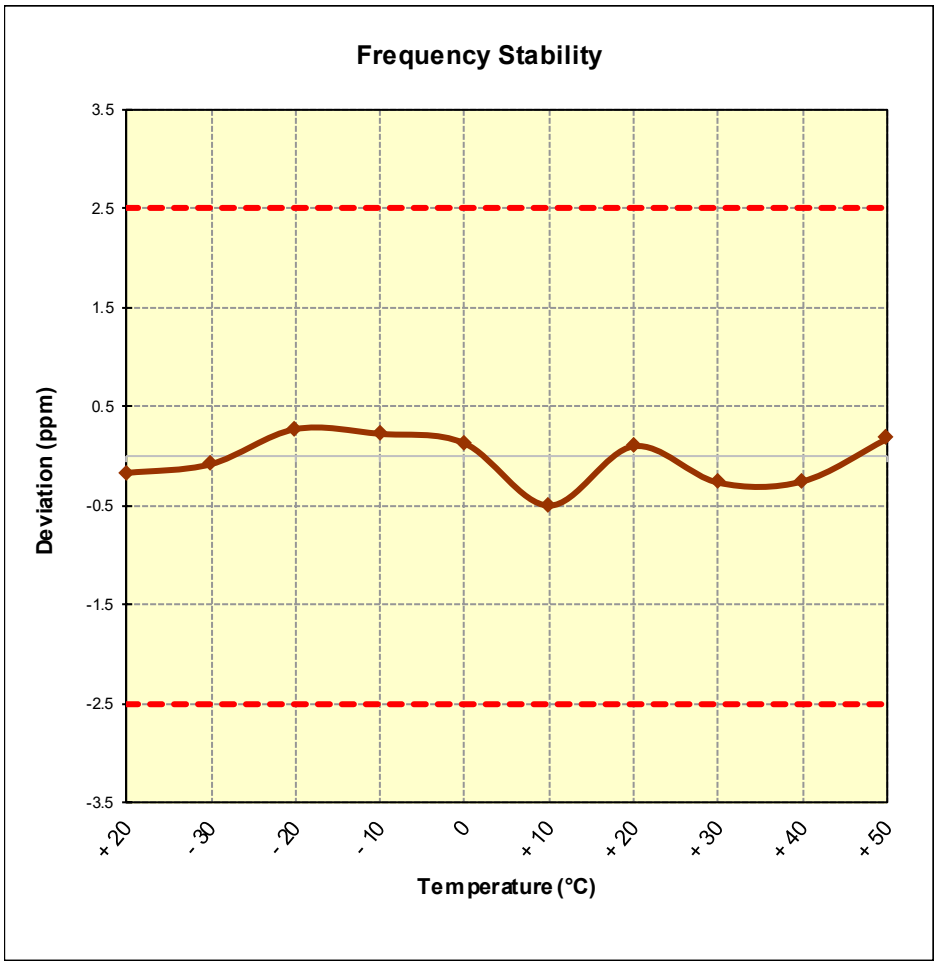

Figure 7-12. Frequency Stability Graph (Band 5/26)

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Band 4 Frequency Stability Measurements

§2.1055 §§27.54

OPERATING FREQUENCY:	1,732,500,000	Hz
CHANNEL:	20175	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	1,732,500,070	70	0.0000040
100 %		- 30	1,732,500,019	19	0.0000011
100 %		- 20	1,732,500,006	6	0.0000003
100 %		- 10	1,732,499,774	-226	-0.0000130
100 %		0	1,732,500,068	68	0.0000039
100 %		+ 10	1,732,499,801	-199	-0.0000115
100 %		+ 20	1,732,500,271	271	0.0000156
100 %		+ 30	1,732,500,357	357	0.0000206
100 %		+ 40	1,732,500,209	209	0.0000121
100 %		+ 50	1,732,499,775	-225	-0.0000130
BATT. ENDPOINT	3.45	+ 20	1,732,500,039	39	0.0000023

Table 7-40. Frequency Stability Data (Band 4)

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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Band 4 Frequency Stability Measurements

§2.1055 §§27.54

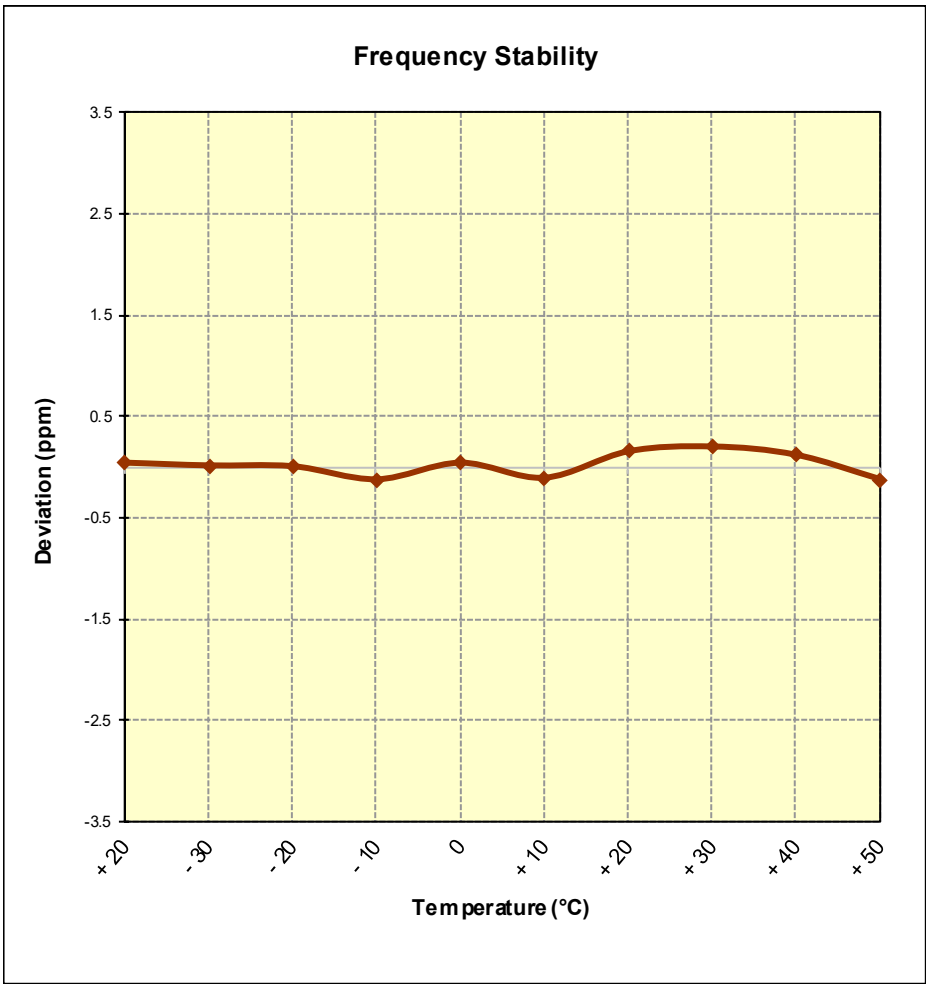

Figure 7-13. Frequency Stability Graph (Band 4)

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Band 2/25 Frequency Stability Measurements

§2.1055 §24.235

OPERATING FREQUENCY:	1,882,500,000	Hz
CHANNEL:	26365	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	1,882,499,999	-1	-0.0000001
100 %		- 30	1,882,499,704	-296	-0.0000157
100 %		- 20	1,882,499,996	-4	-0.0000002
100 %		- 10	1,882,499,962	-38	-0.0000020
100 %		0	1,882,499,962	-38	-0.0000020
100 %		+ 10	1,882,499,587	-413	-0.0000219
100 %		+ 20	1,882,499,850	-150	-0.0000080
100 %		+ 30	1,882,500,378	378	0.0000201
100 %		+ 40	1,882,500,199	199	0.0000106
100 %		+ 50	1,882,499,934	-66	-0.0000035
BATT. ENDPOINT	3.45	+ 20	1,882,499,931	-69	-0.0000037

Table 7-41. Frequency Stability Data (Band 2/25)

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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Band 2/25 Frequency Stability Measurements

§2.1055 §24.235

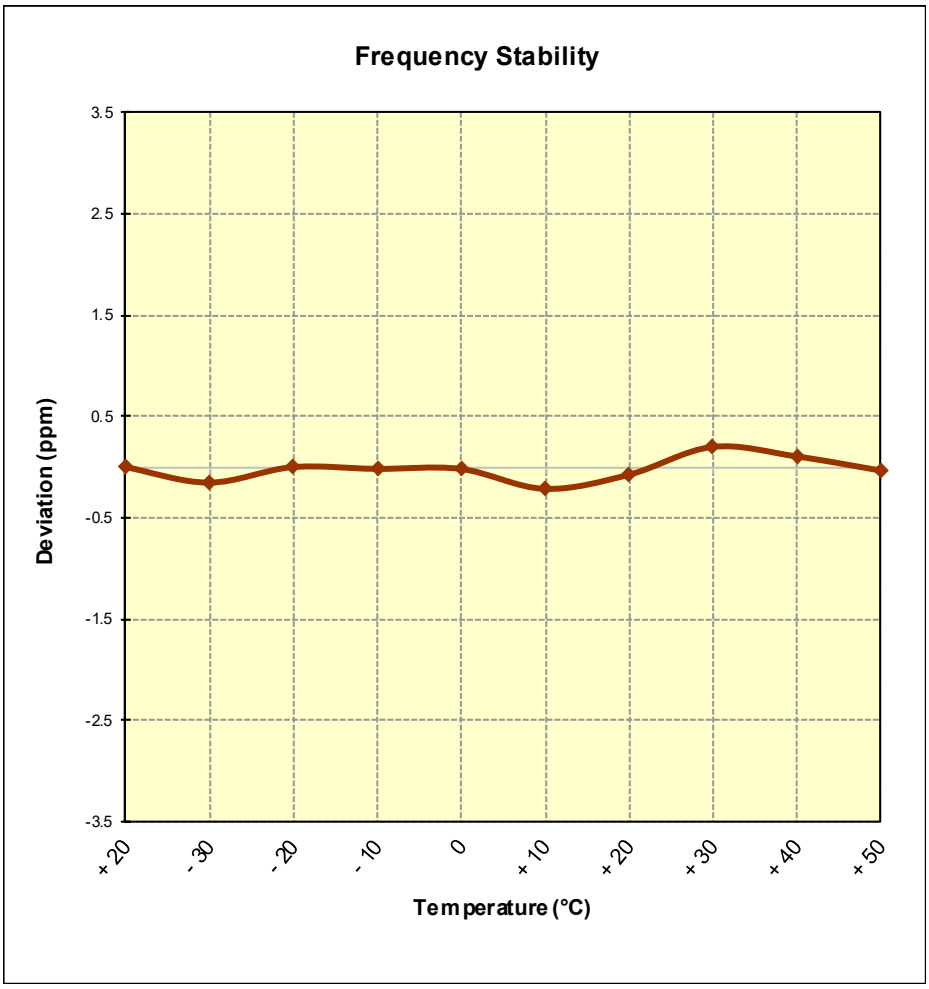

Figure 7-14. Frequency Stability Graph (Band 2/25)

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Band 41 Frequency Stability Measurements

§2.1055 §27.54

OPERATING FREQUENCY:	2,593,000,000	Hz
CHANNEL:	40620	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	2,593,000,115	115	0.0000044
100 %		- 30	2,592,999,942	-58	-0.0000022
100 %		- 20	2,592,999,857	-143	-0.0000055
100 %		- 10	2,592,999,998	-2	-0.0000001
100 %		0	2,592,999,640	-360	-0.0000139
100 %		+ 10	2,593,000,473	473	0.0000182
100 %		+ 20	2,593,000,435	435	0.0000168
100 %		+ 30	2,593,000,045	45	0.0000017
100 %		+ 40	2,593,000,088	88	0.0000034
100 %		+ 50	2,593,000,016	16	0.0000006
BATT. ENDPOINT	3.45	+ 20	2,592,999,945	-55	-0.0000021

Table 7-42. Frequency Stability Data (Band 41)

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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Band 41 Frequency Stability Measurements

§2.1055 §27.54

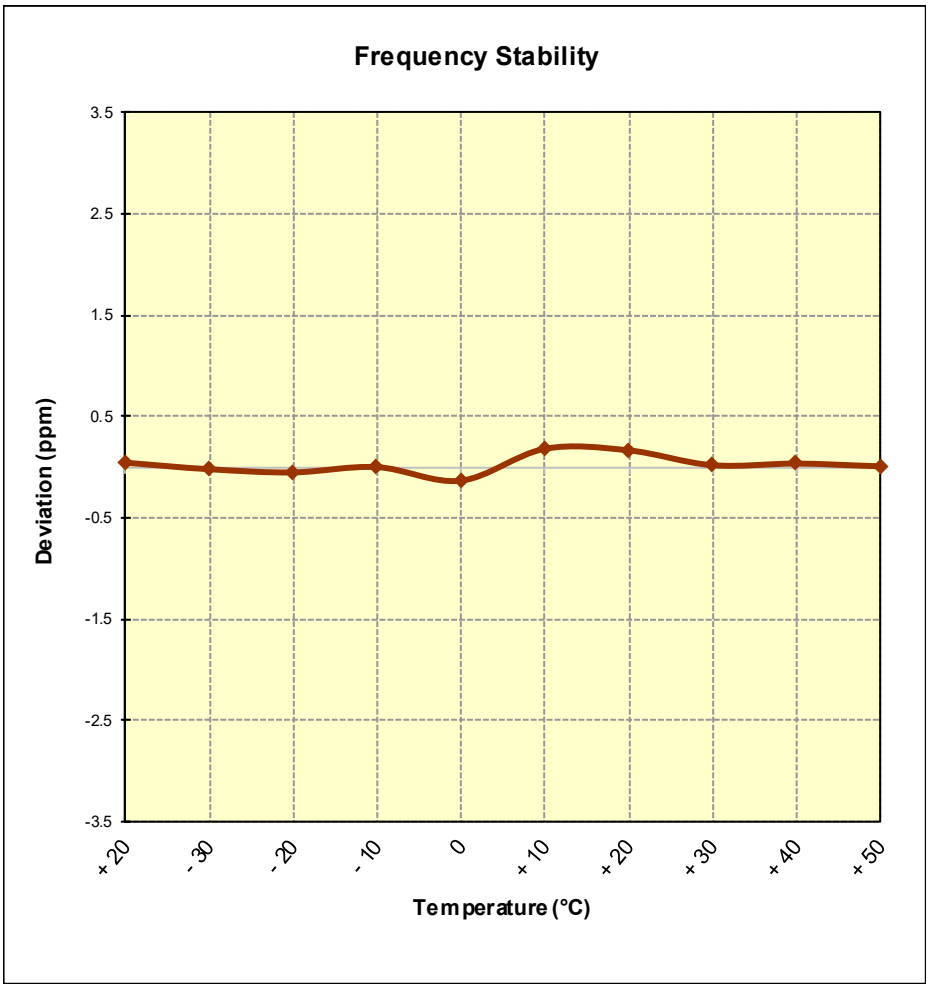

Figure 7-15. Frequency Stability Graph (Band 41)

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMG9500** complies with all the requirements of Parts 22, 24, & 27 of the FCC rules for LTE operation only.

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