7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §22.917(a) §24.238(a) §27.53(c) §27.53(h)

Test Overview

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

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

Test Procedure Used

KDB 971168 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
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.

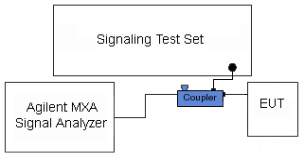


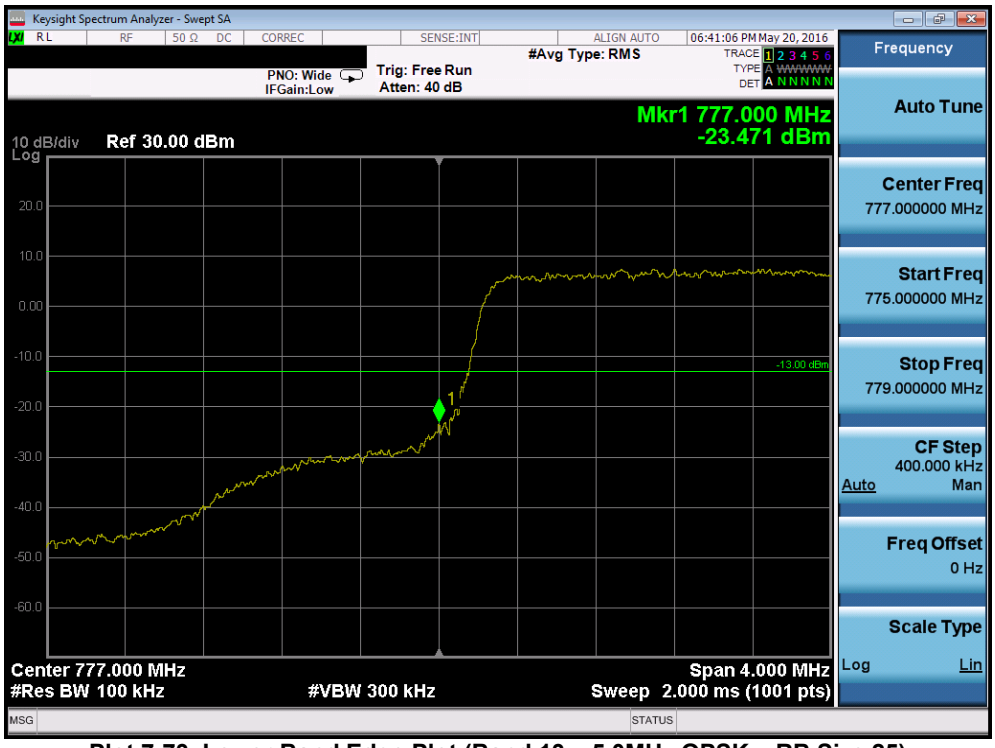
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

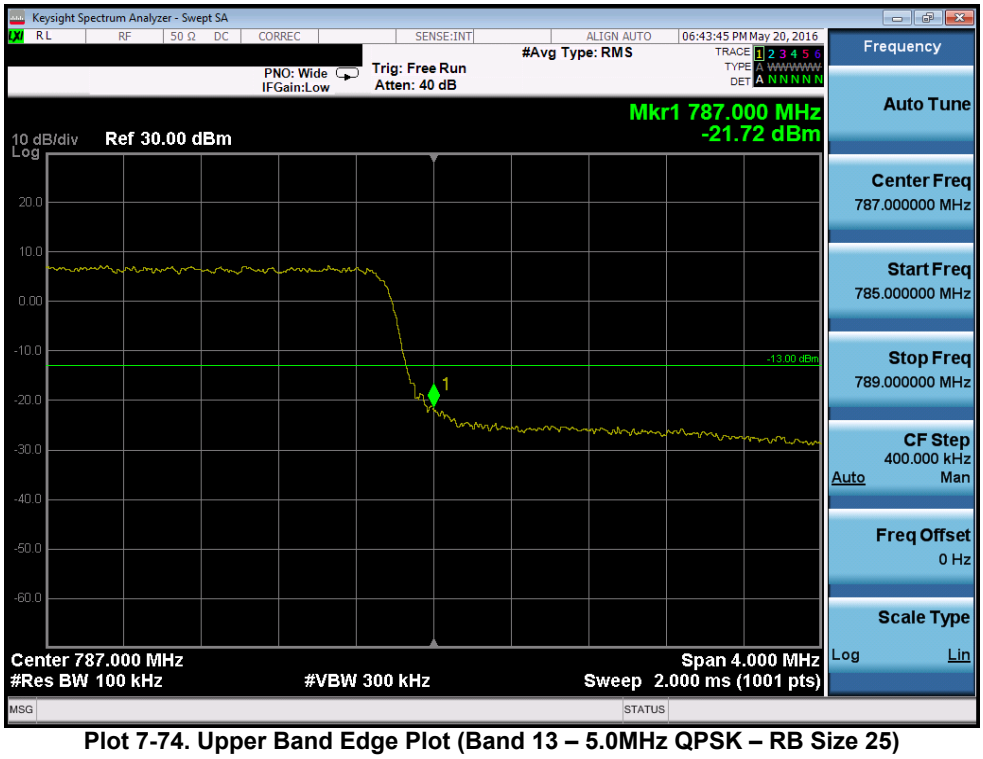
Per 22.917(b) 24.238(a) 27.53(h) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

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.

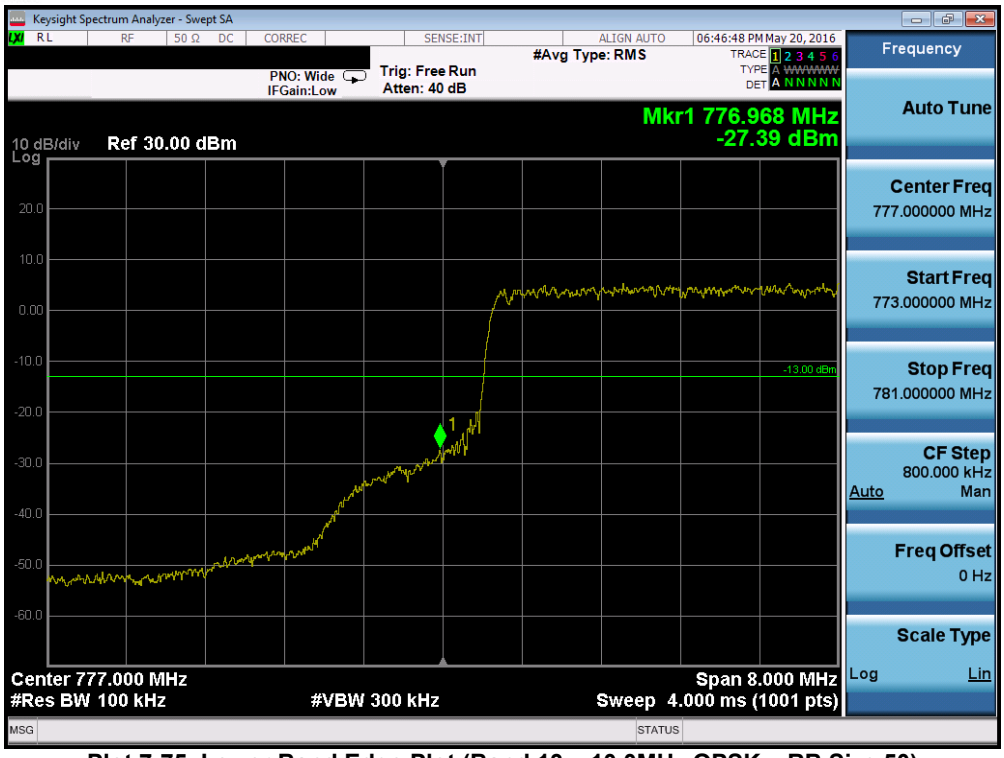
For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c.4) is 65 + $10\log_{10}(P)$ = -35dBm in a 6.25kHz bandwidth.



Plot 7-73. Lower Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

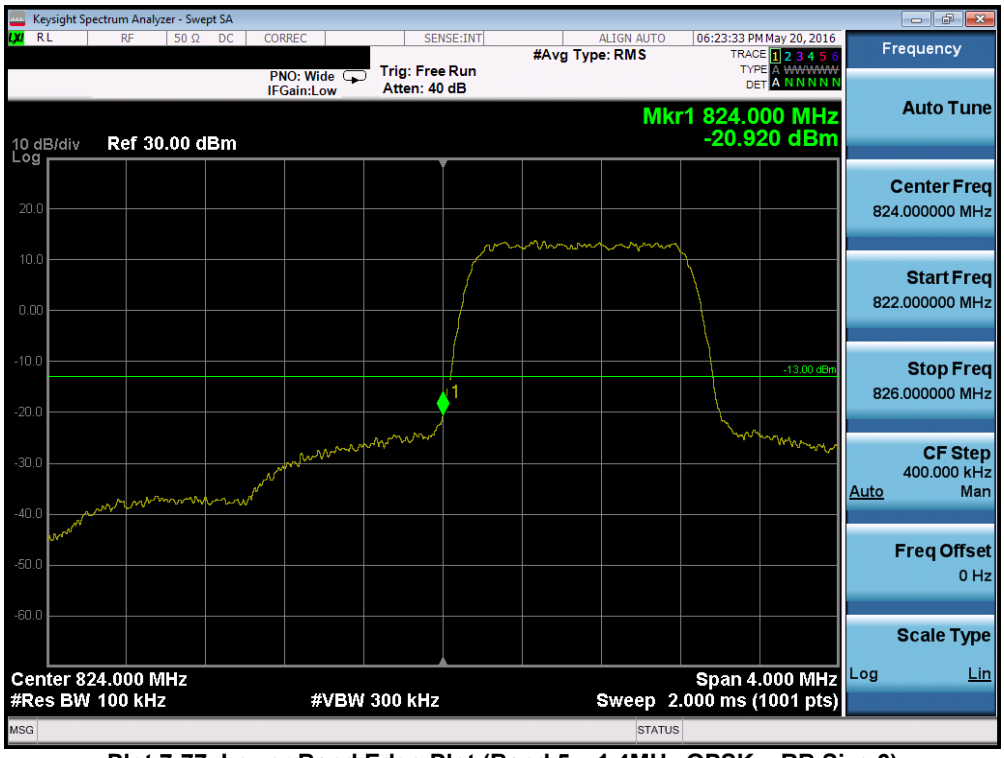


Plot 7-74. Upper Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)



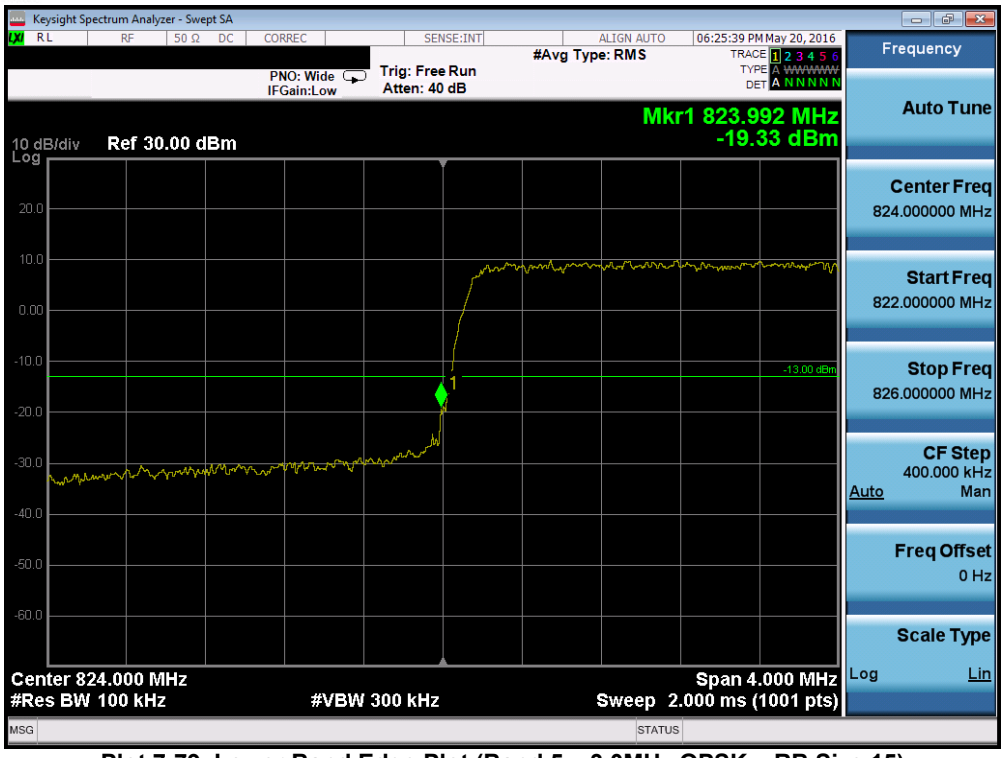
Plot 7-75. Lower Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)

Plot 7-76. Upper Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)



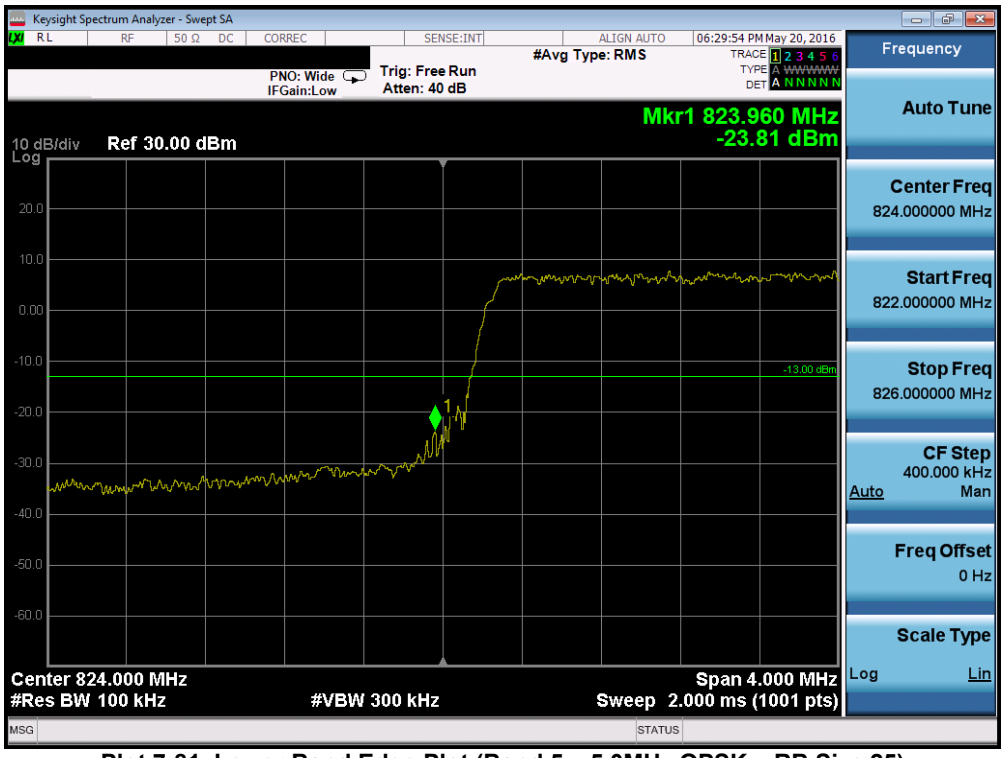
Plot 7-77. Lower Band Edge Plot (Band 5 – 1.4MHz QPSK – RB Size 6)

Plot 7-78. Upper Band Edge Plot (Band 5 – 1.4MHz QPSK – RB Size 6)



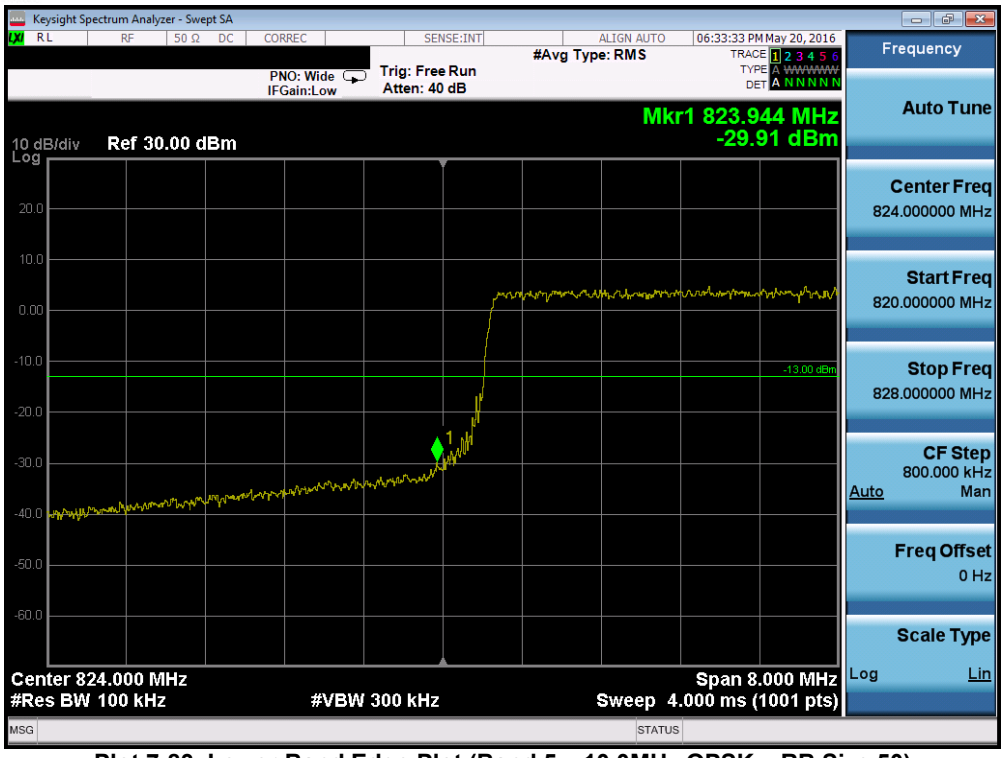
Plot 7-79. Lower Band Edge Plot (Band 5 – 3.0MHz QPSK – RB Size 15)

Plot 7-80. Upper Band Edge Plot (Band 5 – 3.0MHz QPSK – RB Size 15)

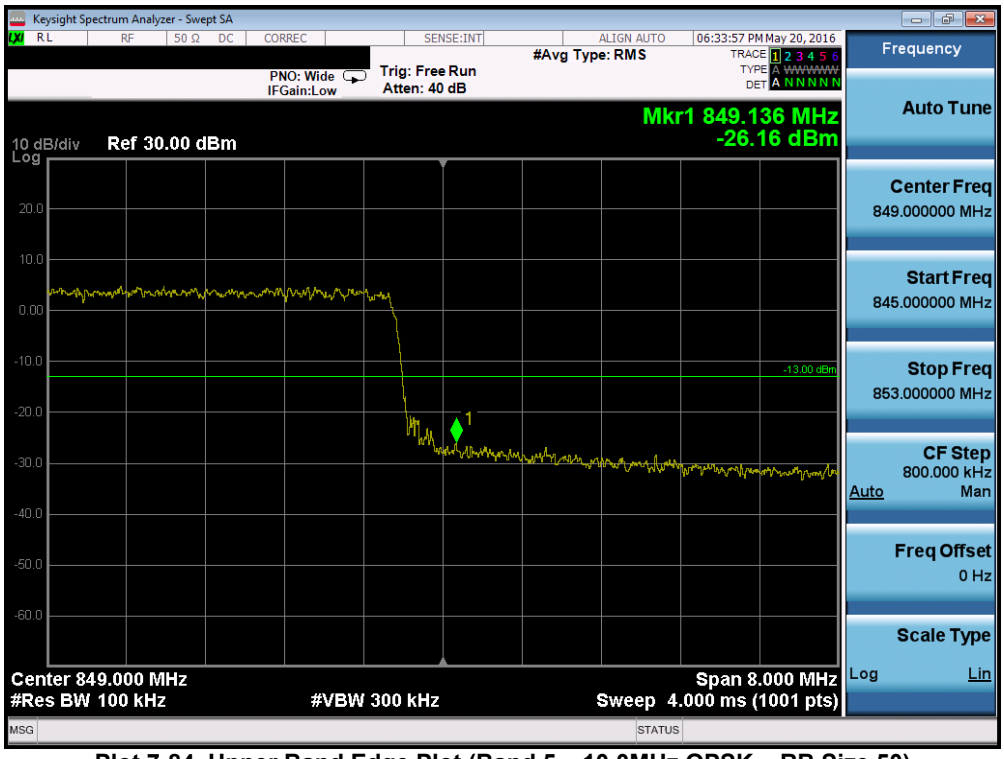


Plot 7-81. Lower Band Edge Plot (Band 5 – 5.0MHz QPSK – RB Size 25)

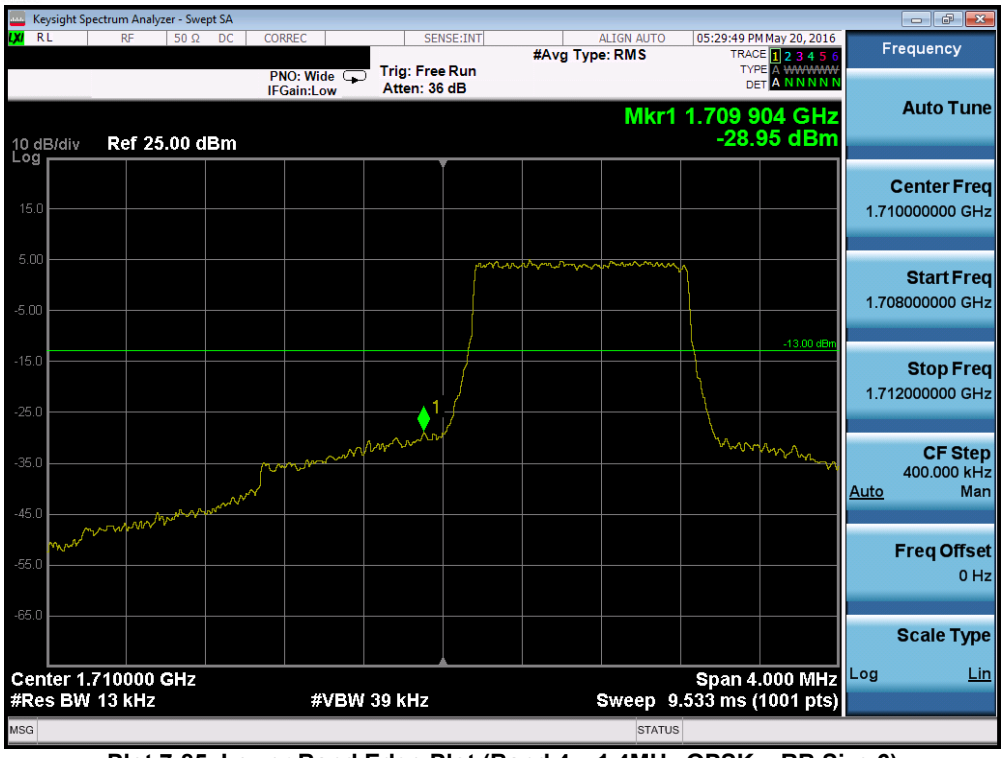
Plot 7-82. Upper Band Edge Plot (Band 5 – 5.0MHz QPSK – RB Size 25)



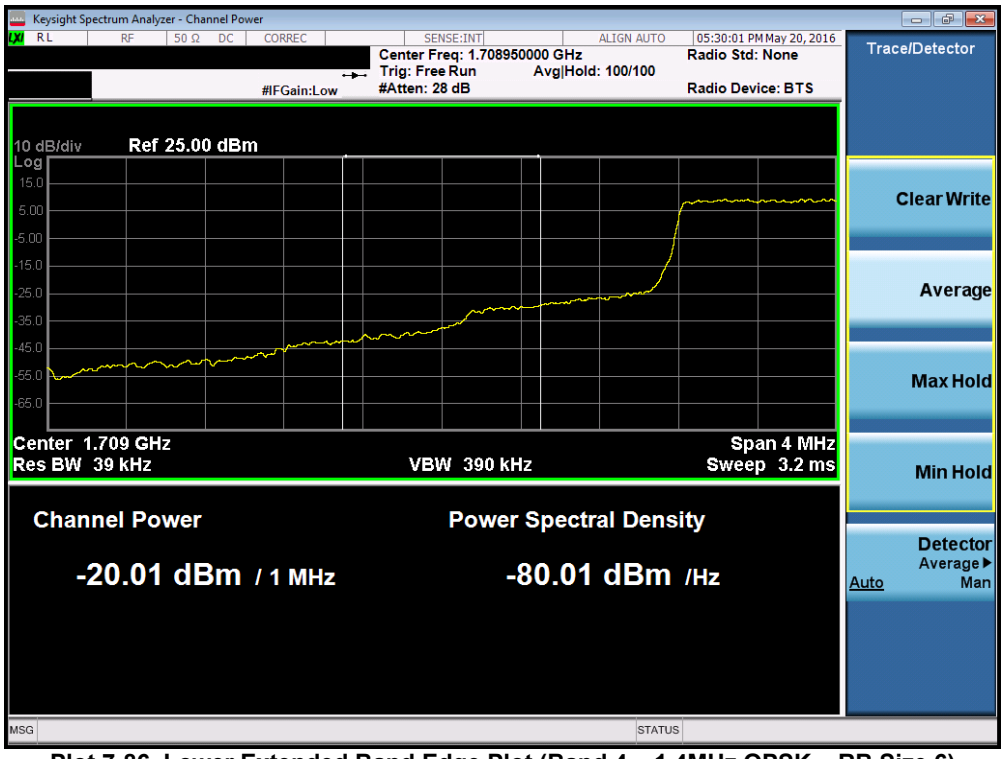
Plot 7-83. Lower Band Edge Plot (Band 5 – 10.0MHz QPSK – RB Size 50)



Plot 7-84. Upper Band Edge Plot (Band 5 – 10.0MHz QPSK – RB Size 50)

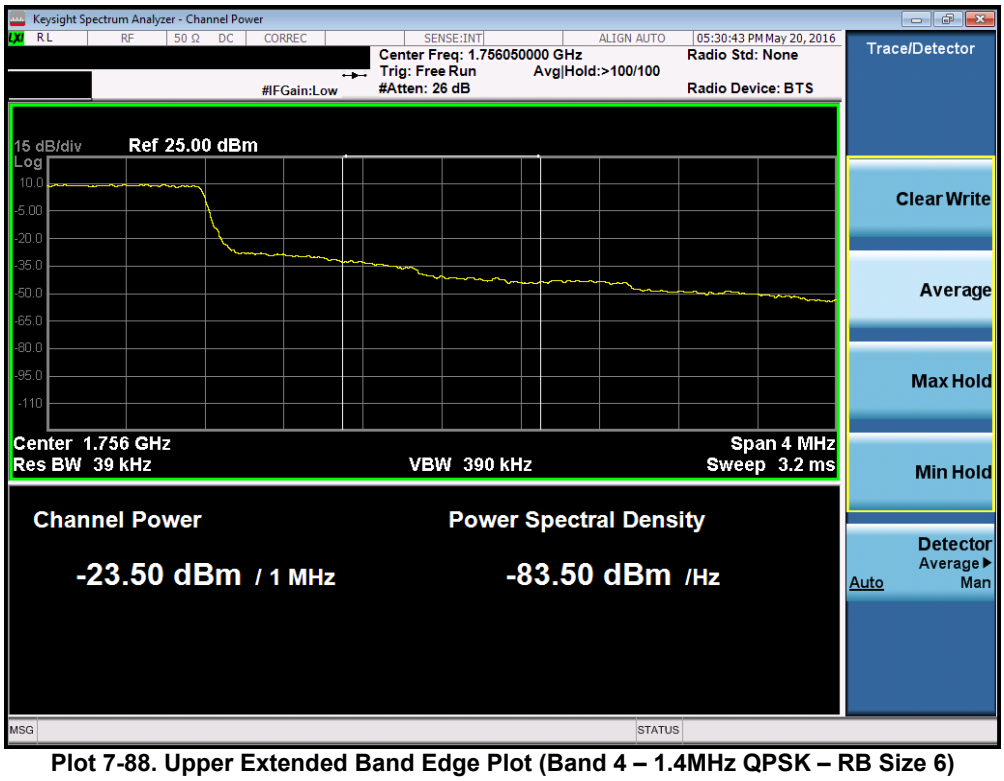


Plot 7-85. Lower Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

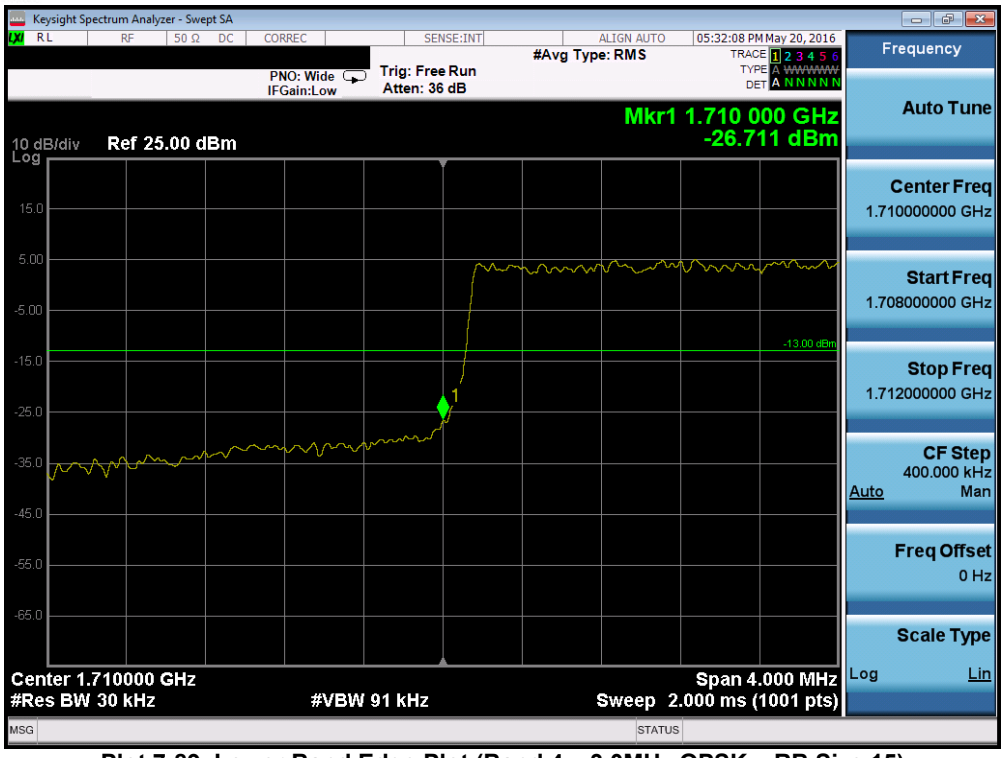


Plot 7-86. Lower Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)

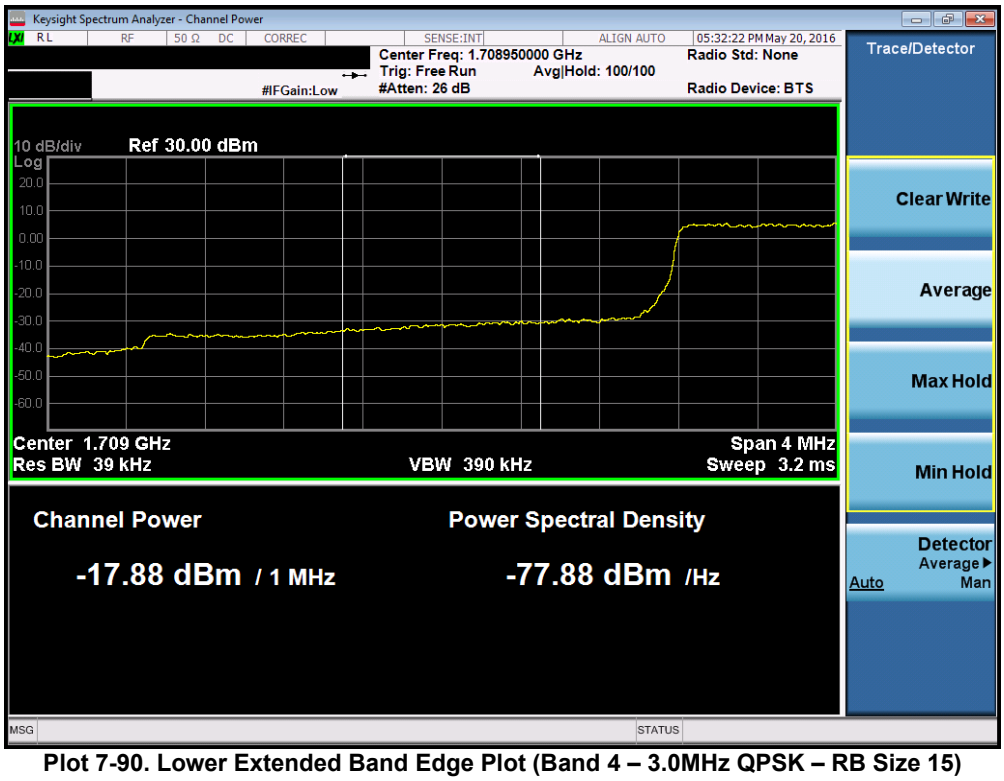
Plot 7-87. Upper Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)



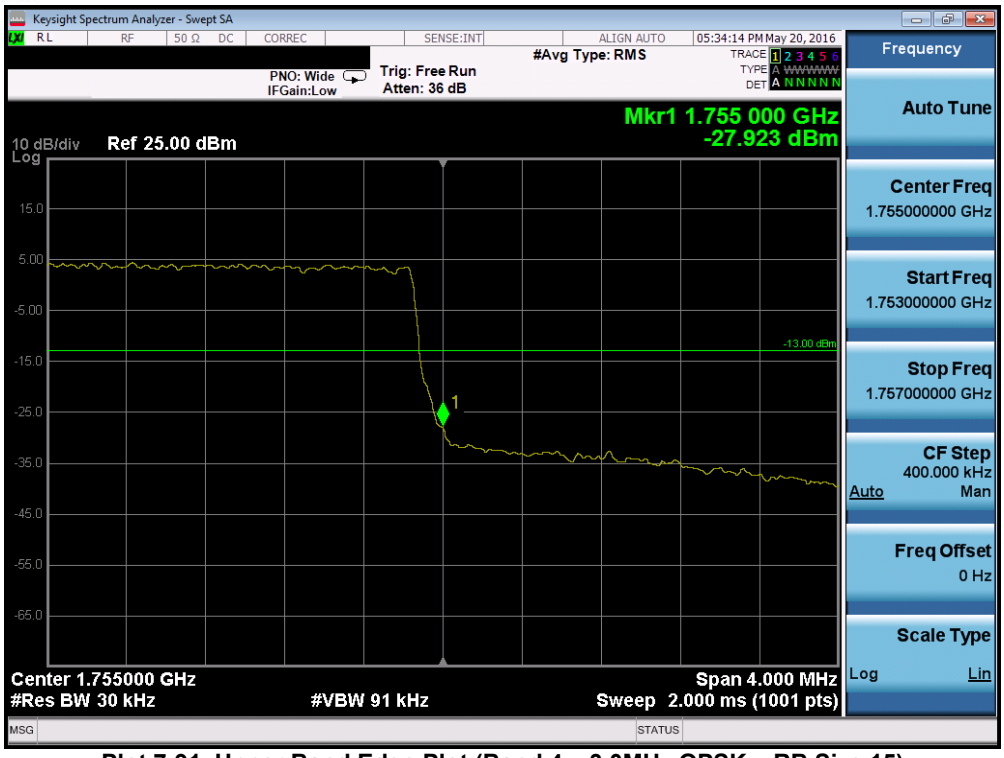
Plot 7-88. Upper Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)



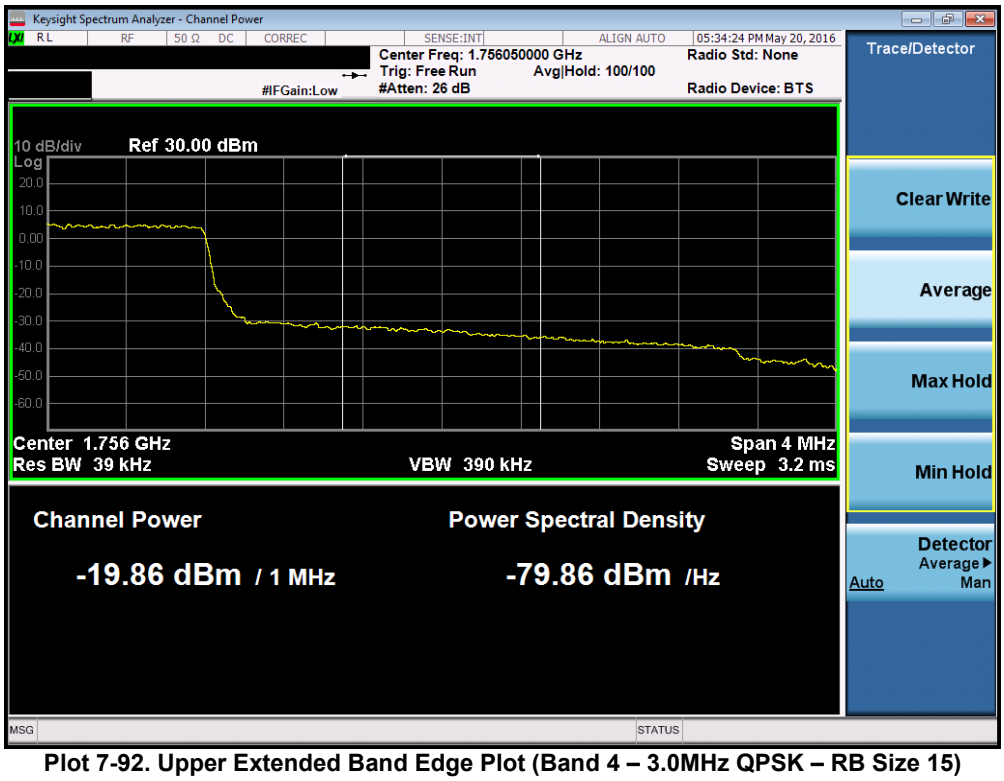
Plot 7-89. Lower Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



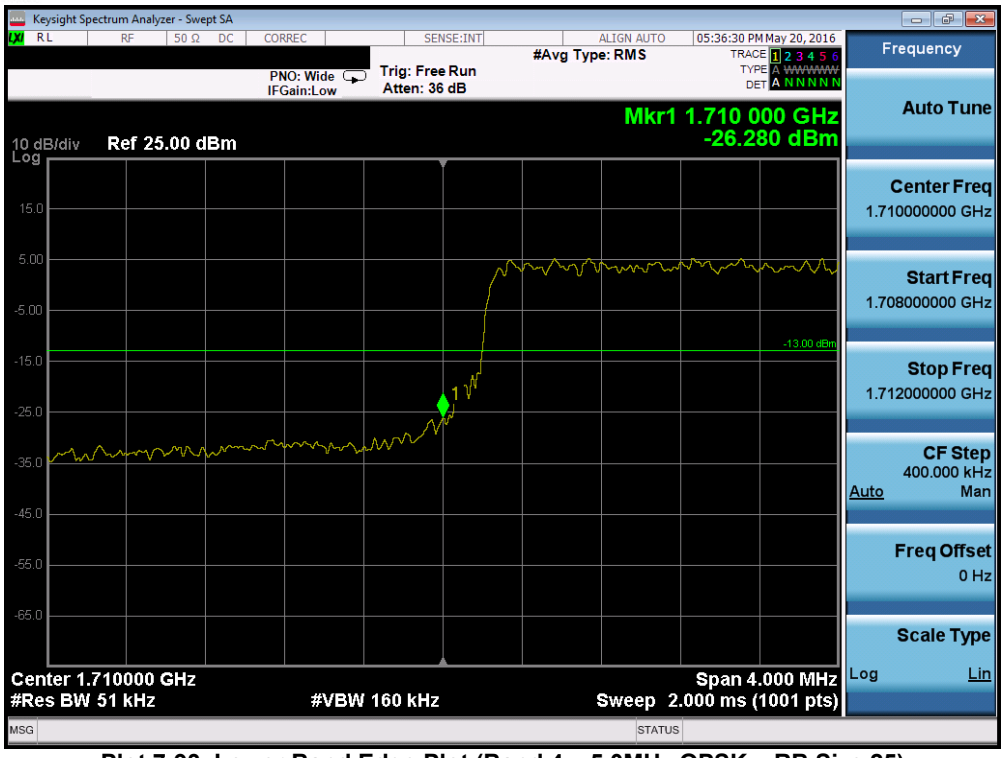
Plot 7-90. Lower Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



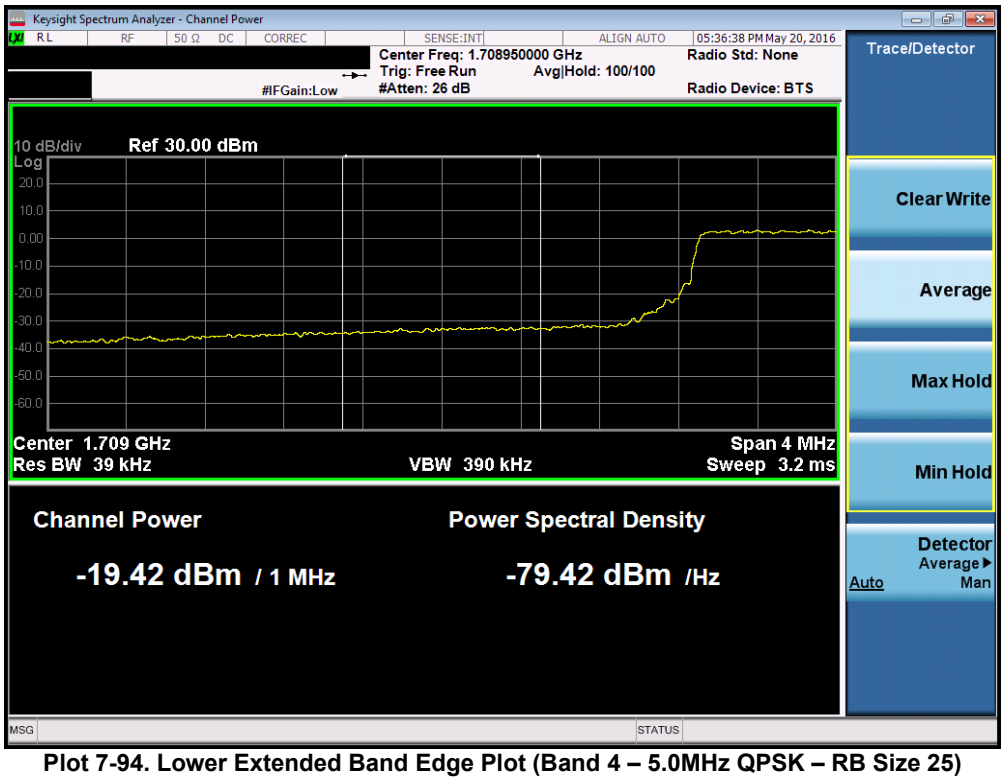
Plot 7-91. Upper Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



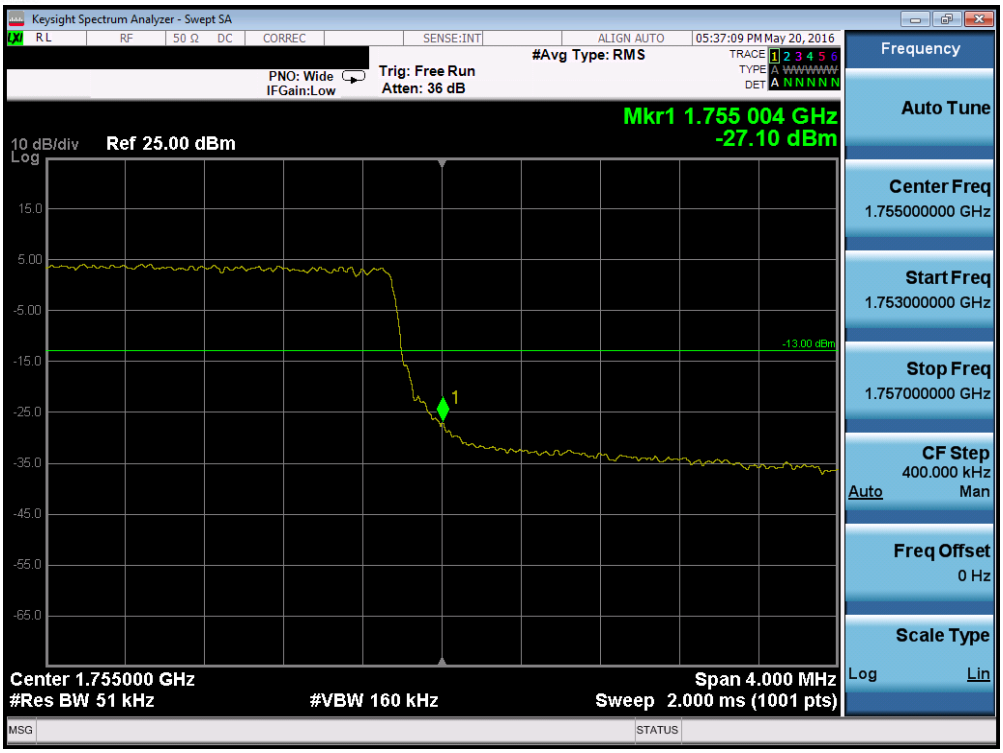
Plot 7-92. Upper Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)



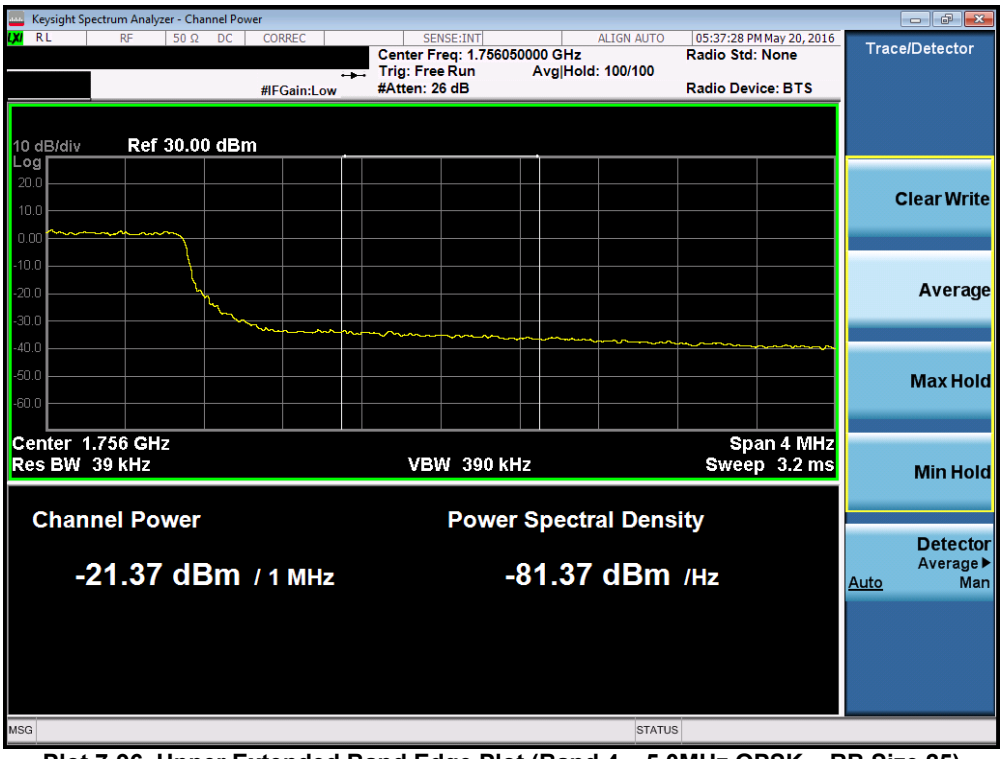
Plot 7-93. Lower Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



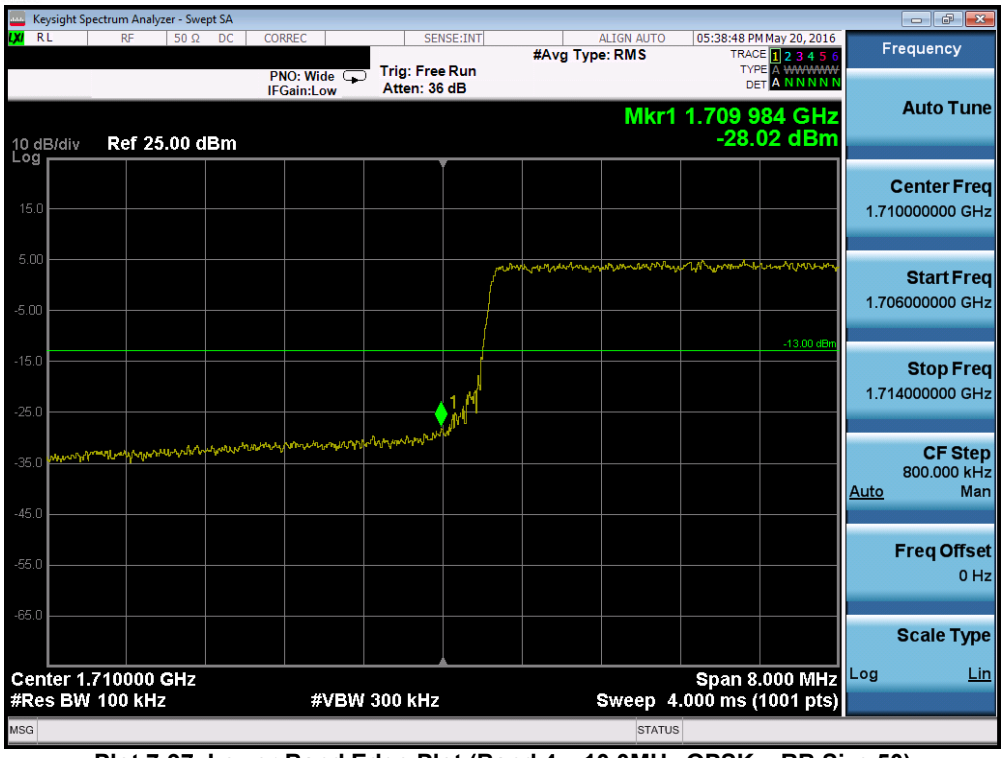
Plot 7-94. Lower Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



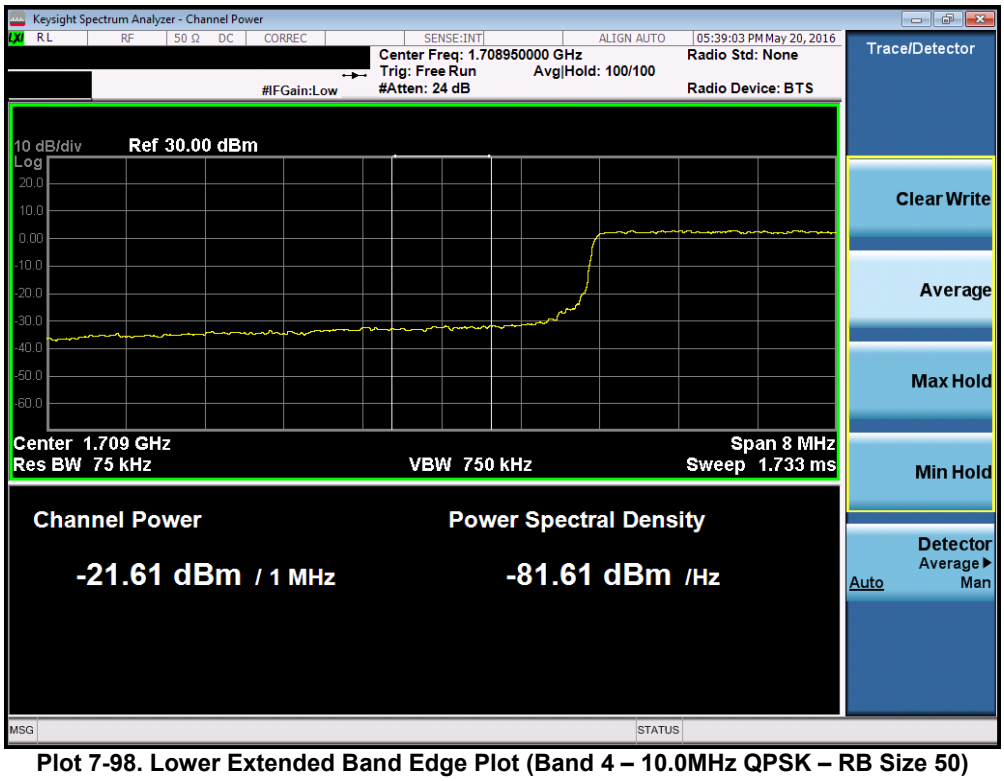
Plot 7-95. Upper Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



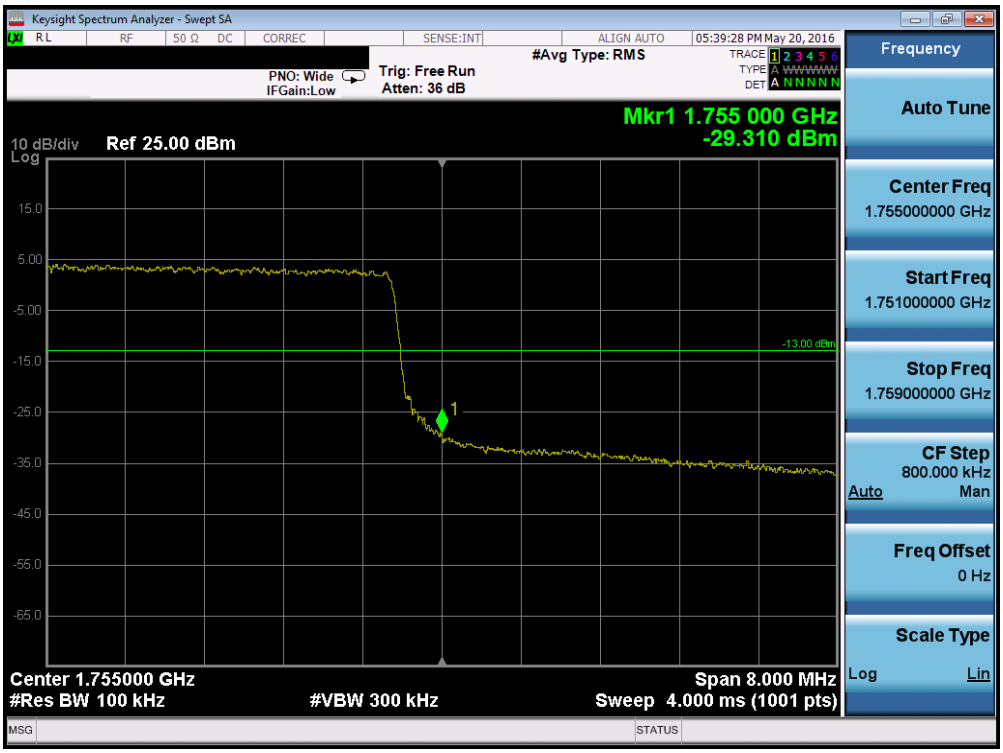
Plot 7-96. Upper Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



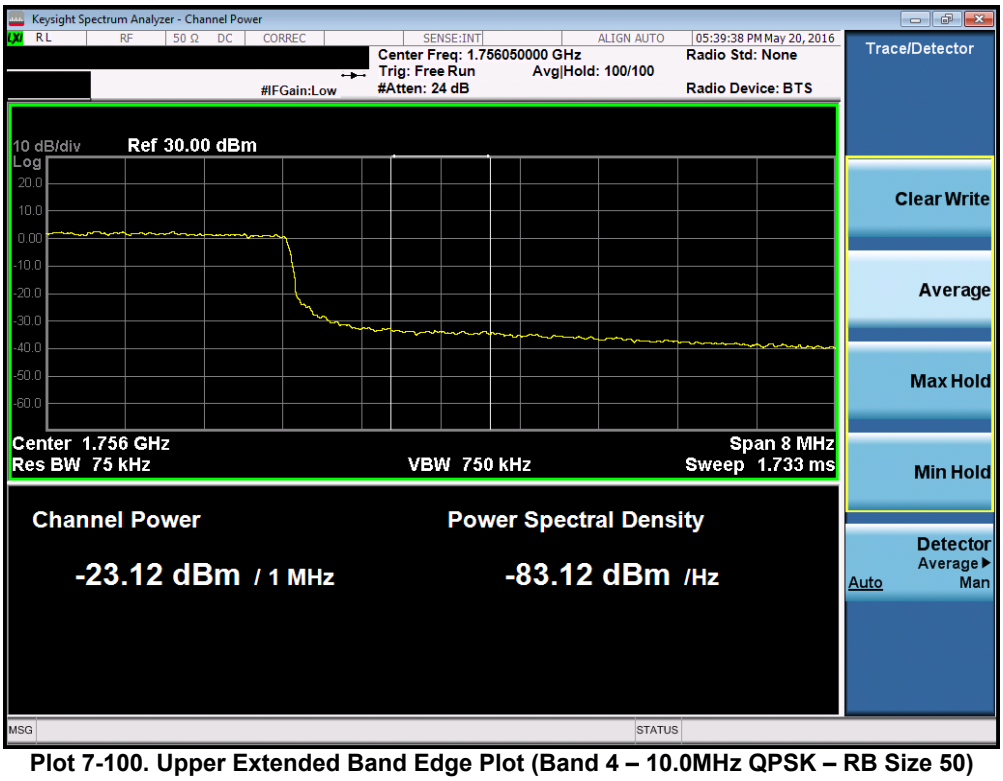
Plot 7-97. Lower Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



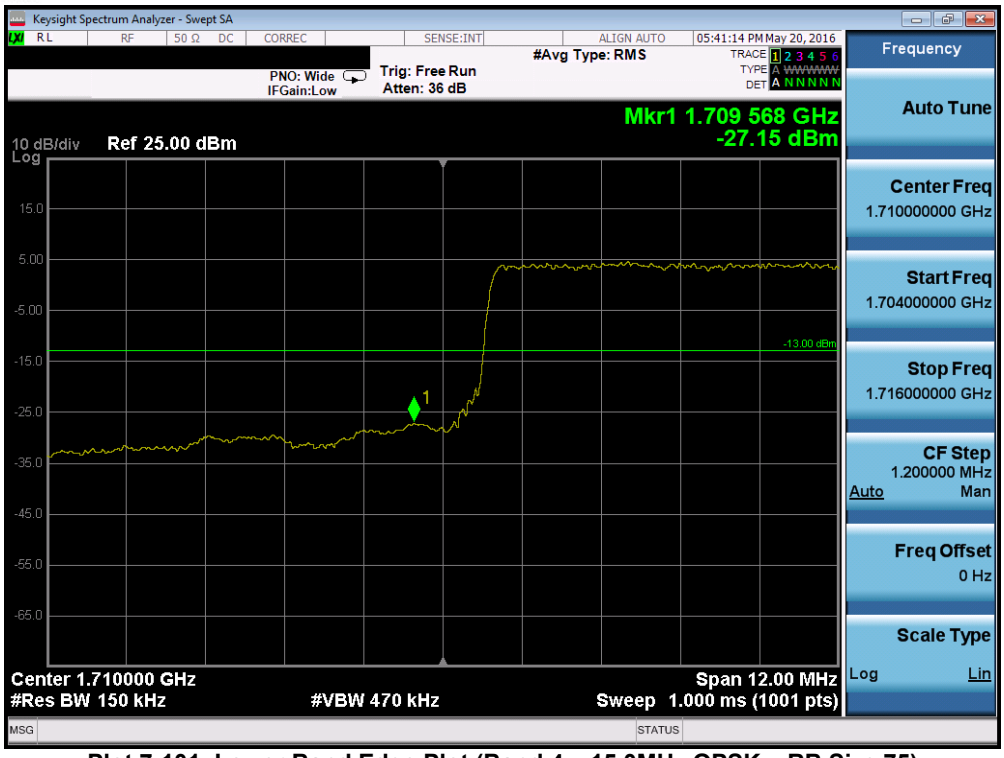
Plot 7-98. Lower Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



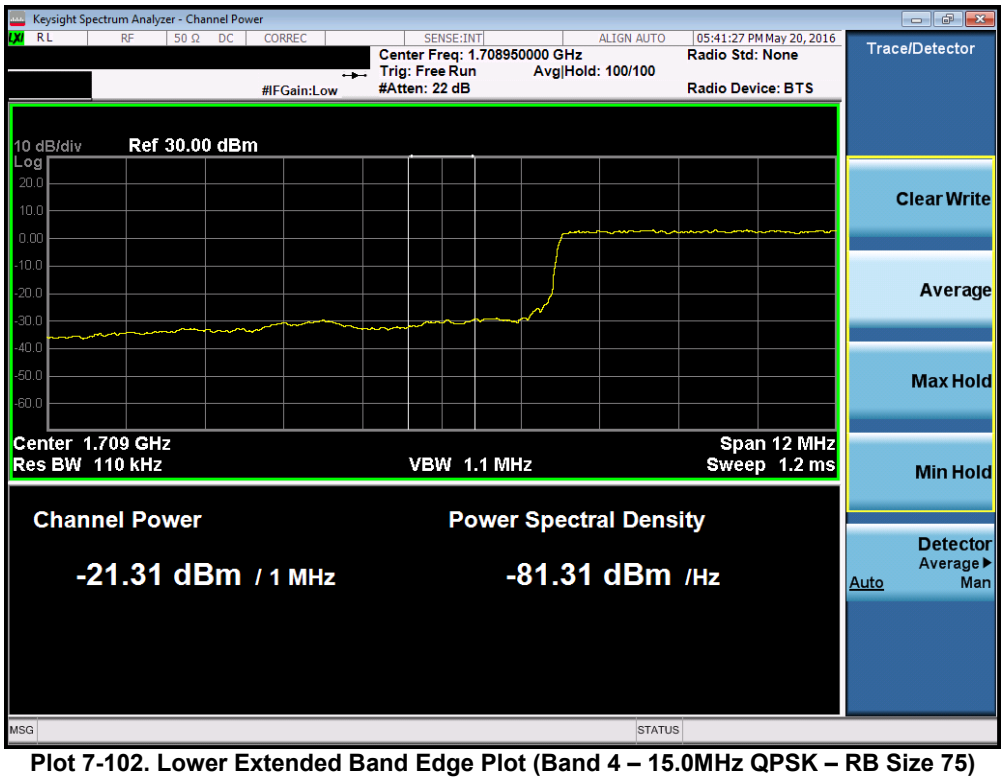
Plot 7-99. Upper Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



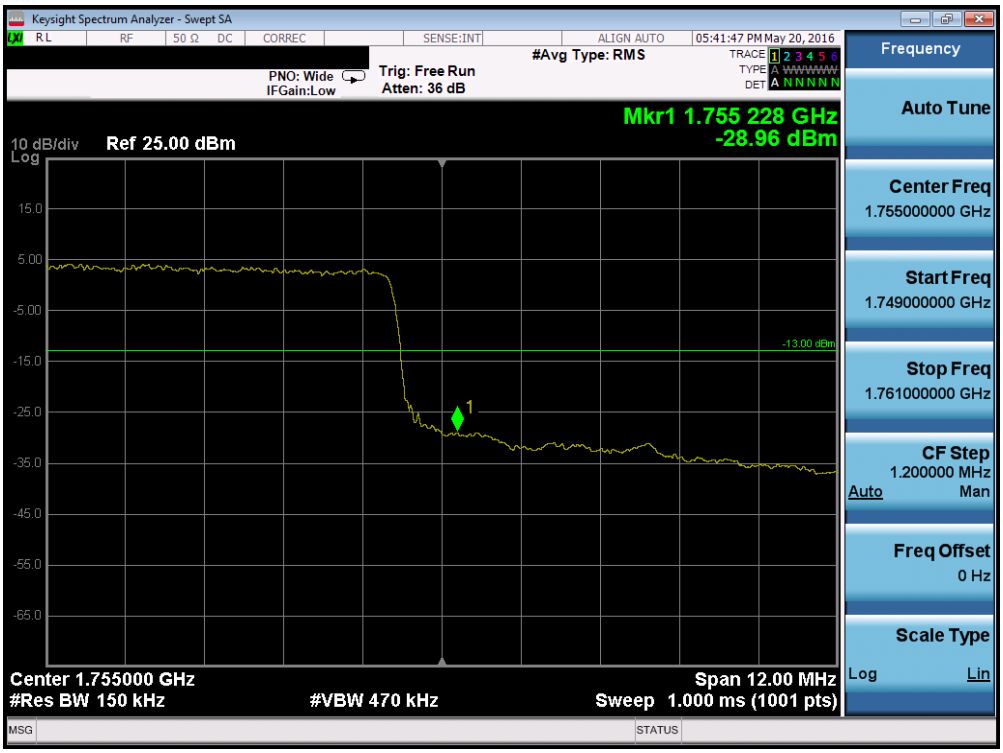
Plot 7-100. Upper Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)



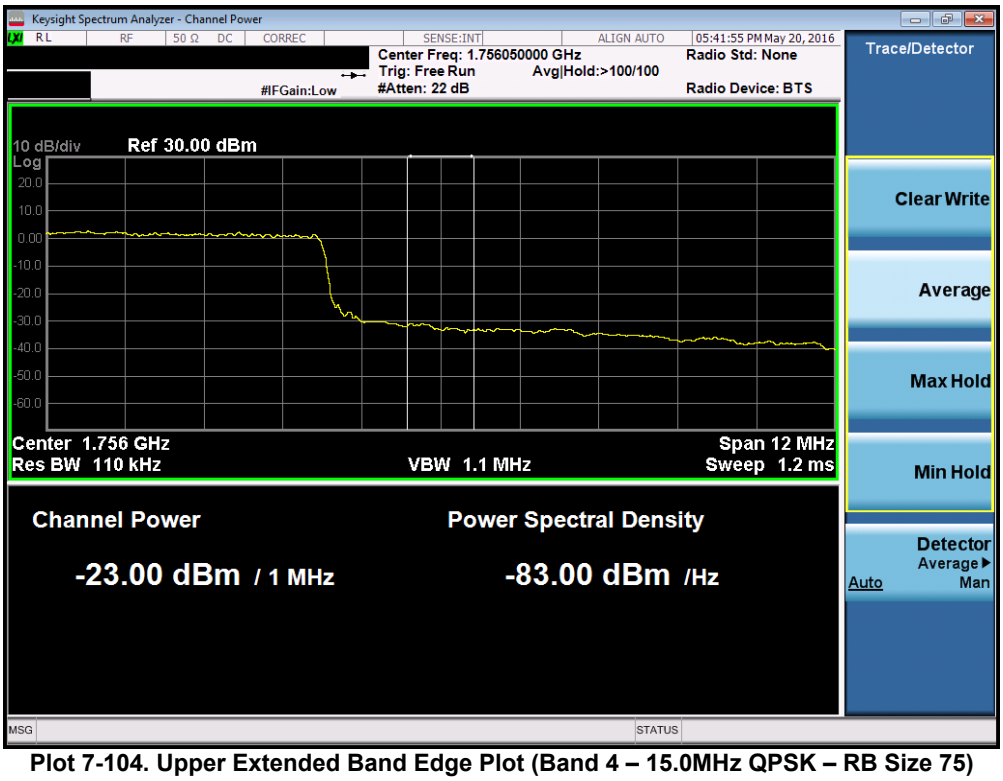
Plot 7-101. Lower Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



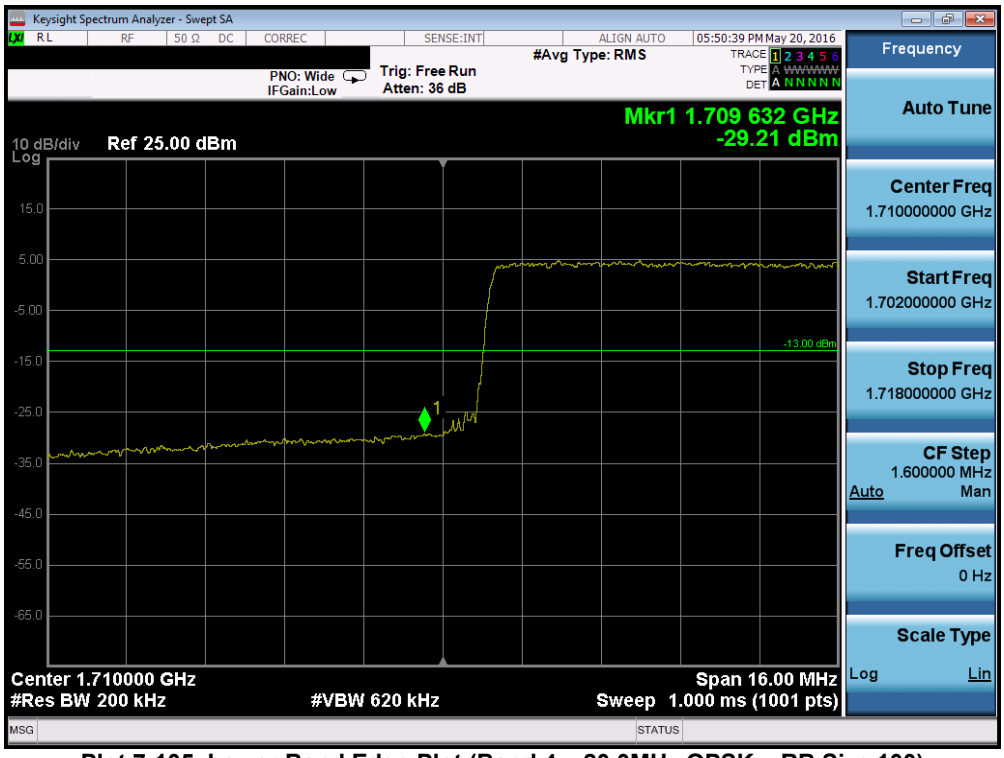
Plot 7-102. Lower Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



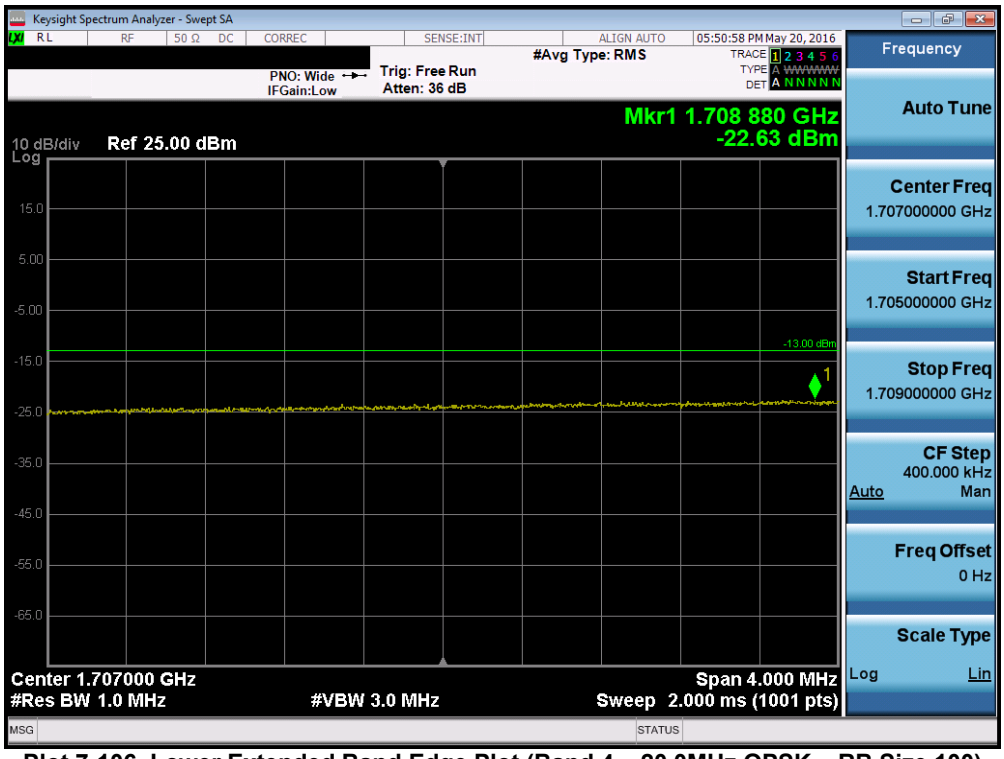
Plot 7-103. Upper Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



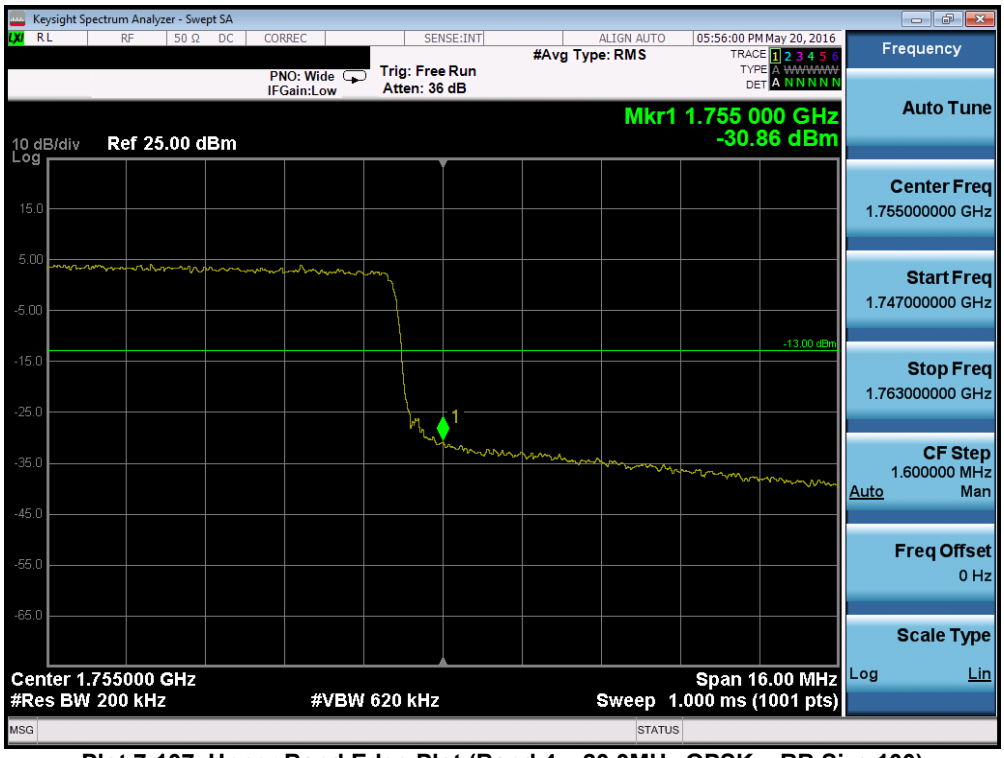
Plot 7-104. Upper Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



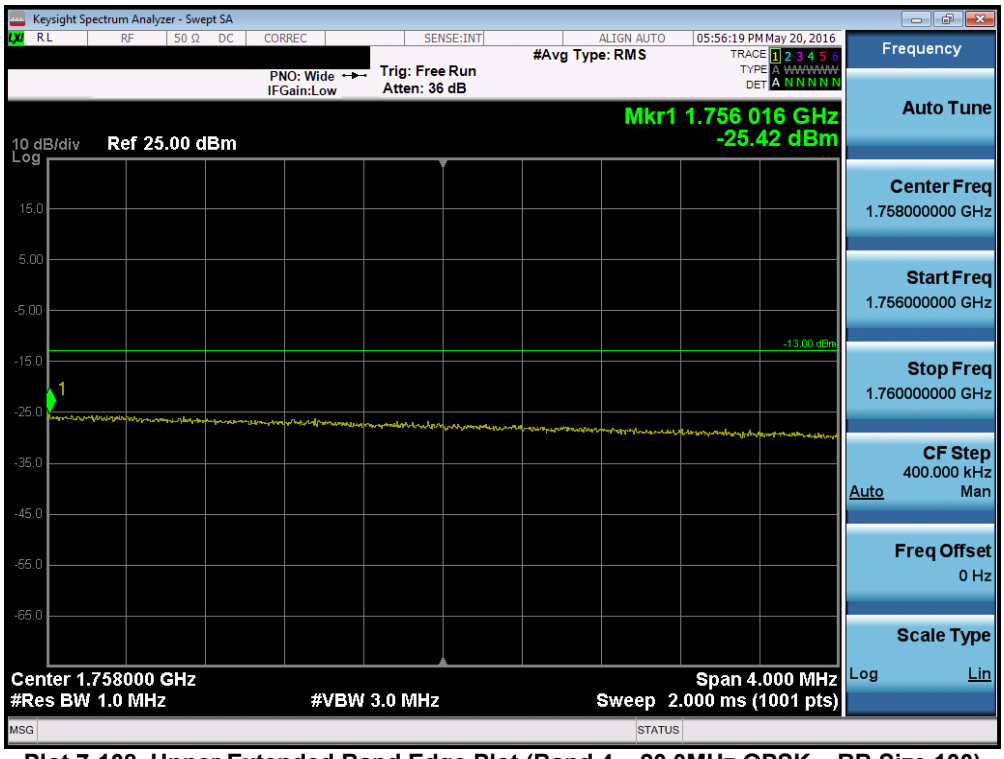
Plot 7-105. Lower Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



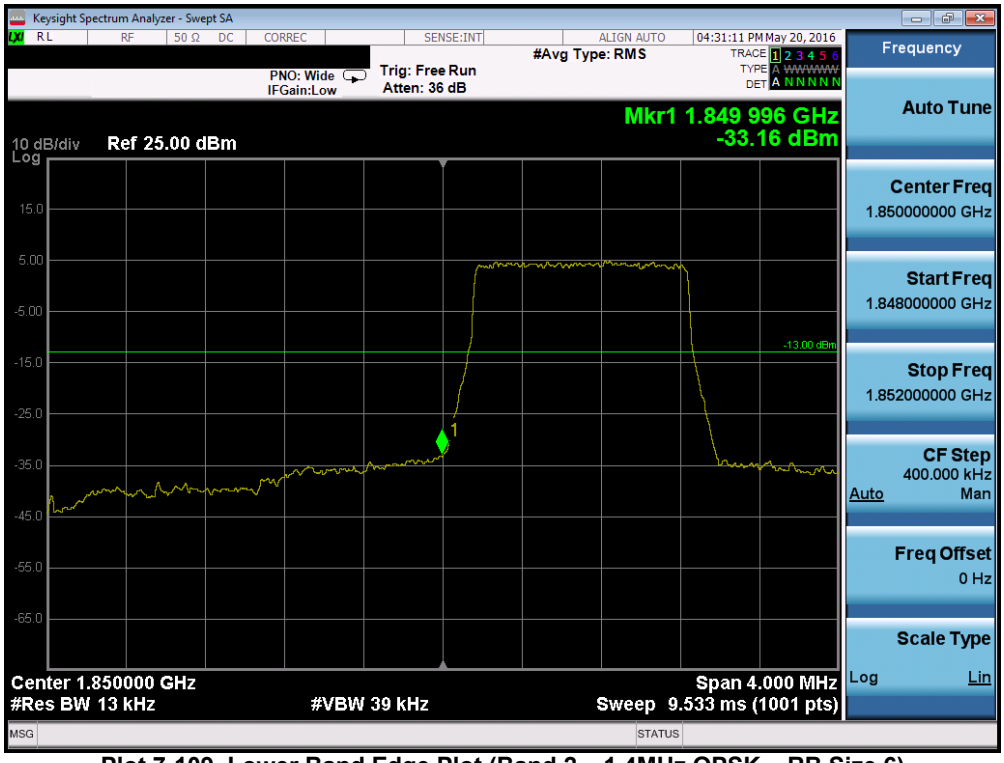
Plot 7-106. Lower Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



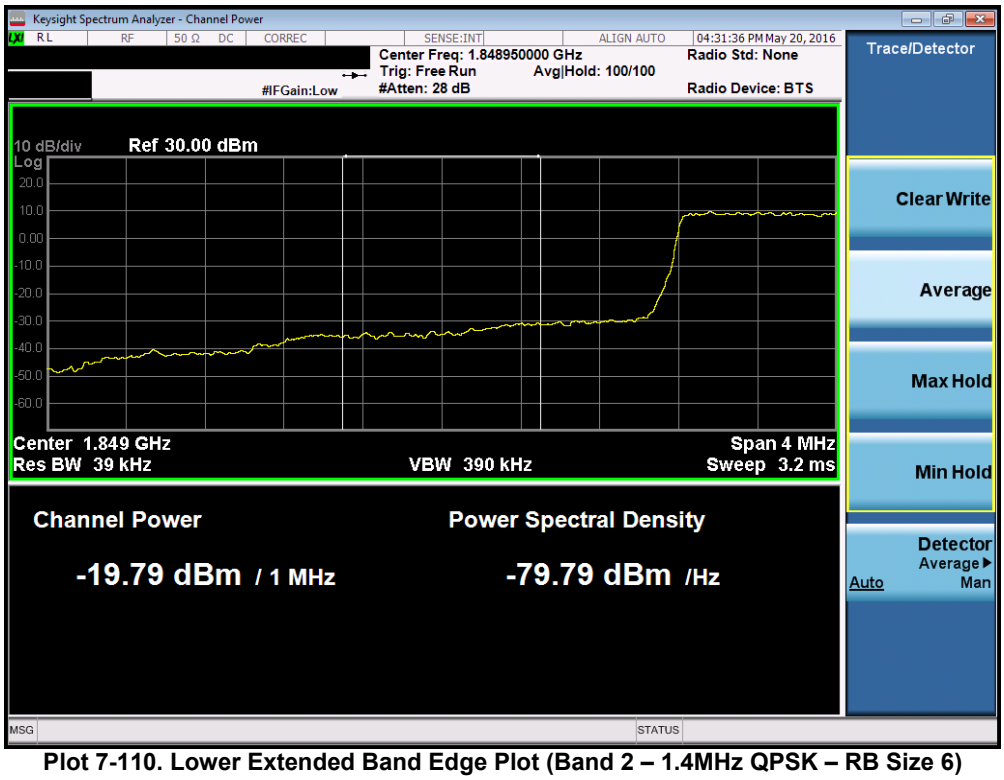
Plot 7-107. Upper Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



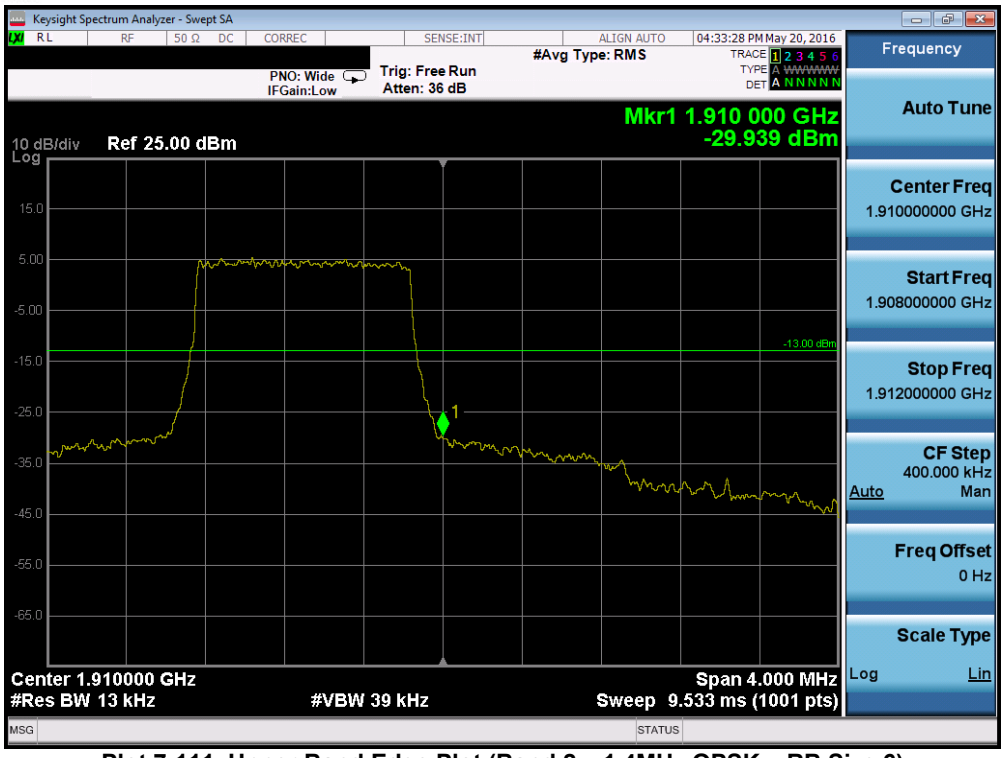
Plot 7-108. Upper Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)



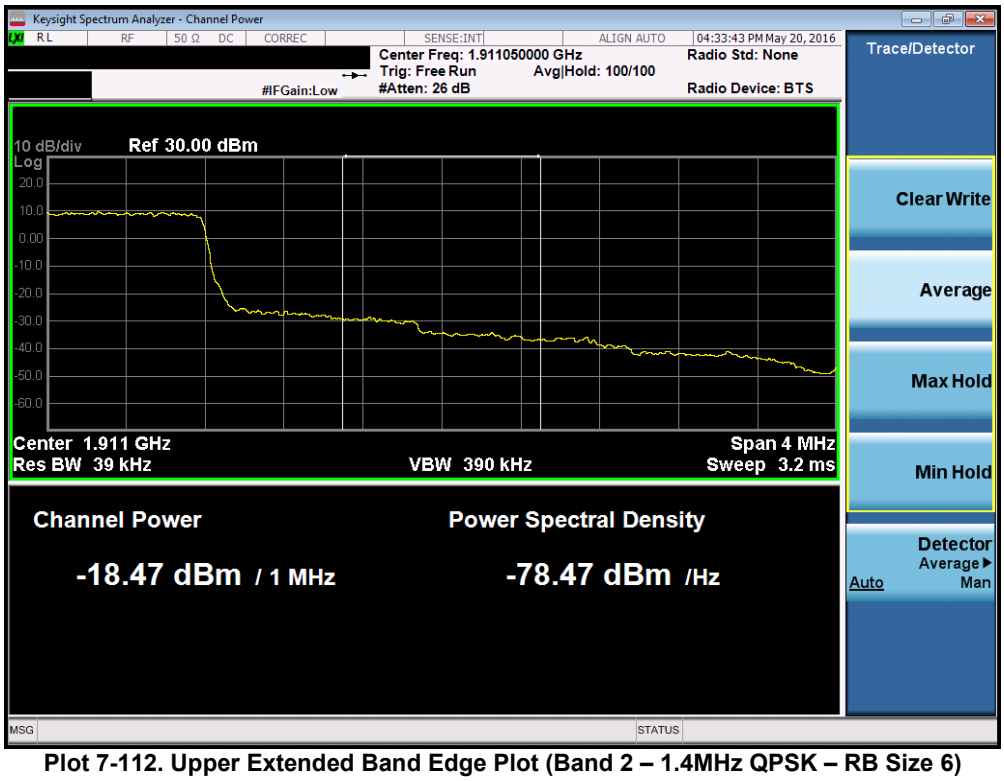
Plot 7-109. Lower Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)



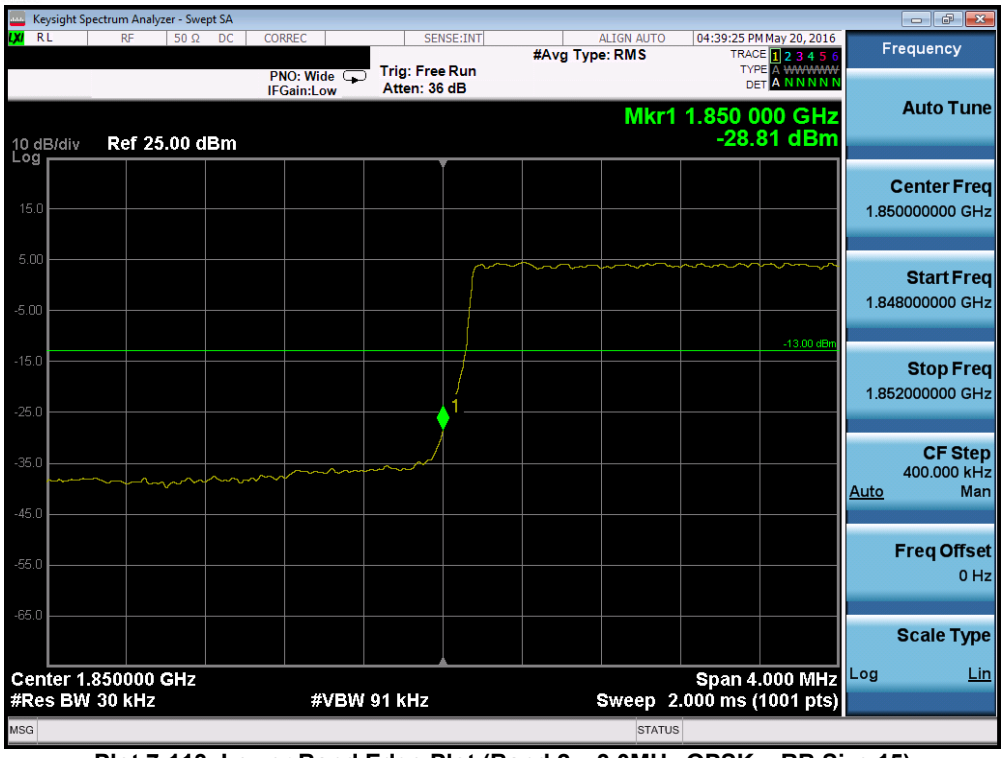
Plot 7-110. Lower Extended Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)



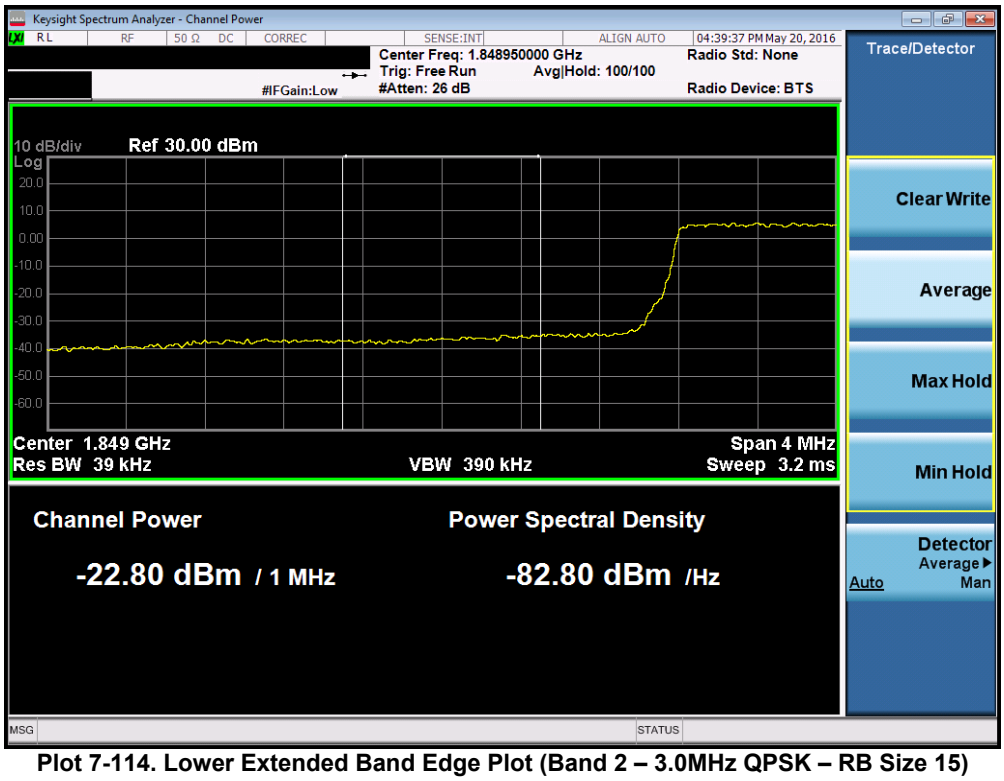
Plot 7-111. Upper Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)



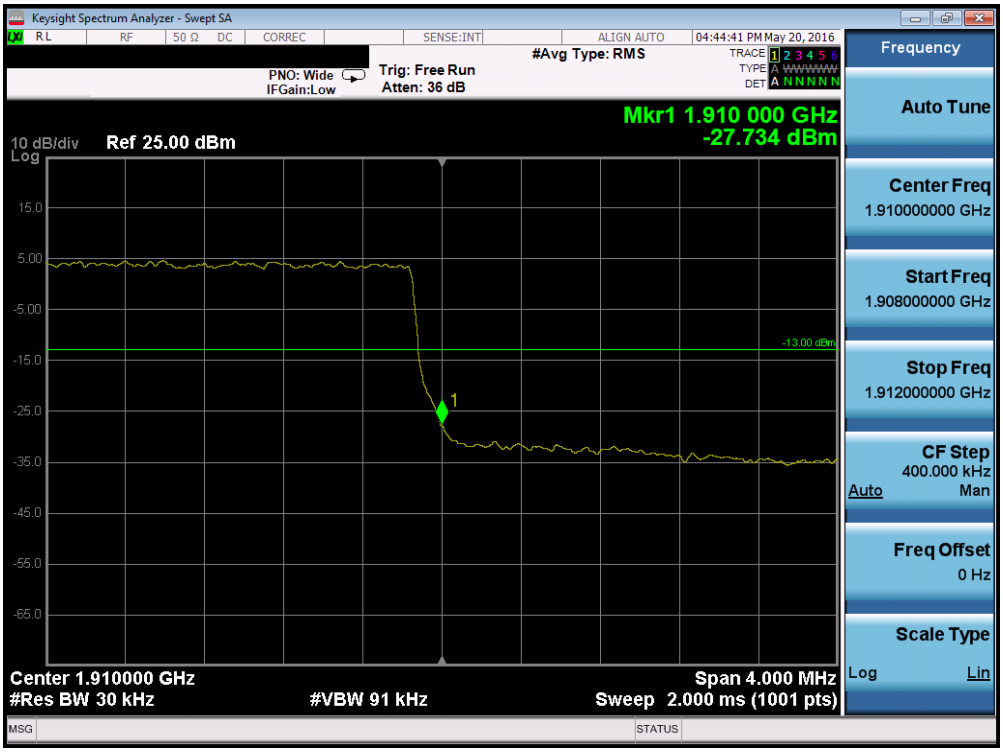
Plot 7-112. Upper Extended Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)



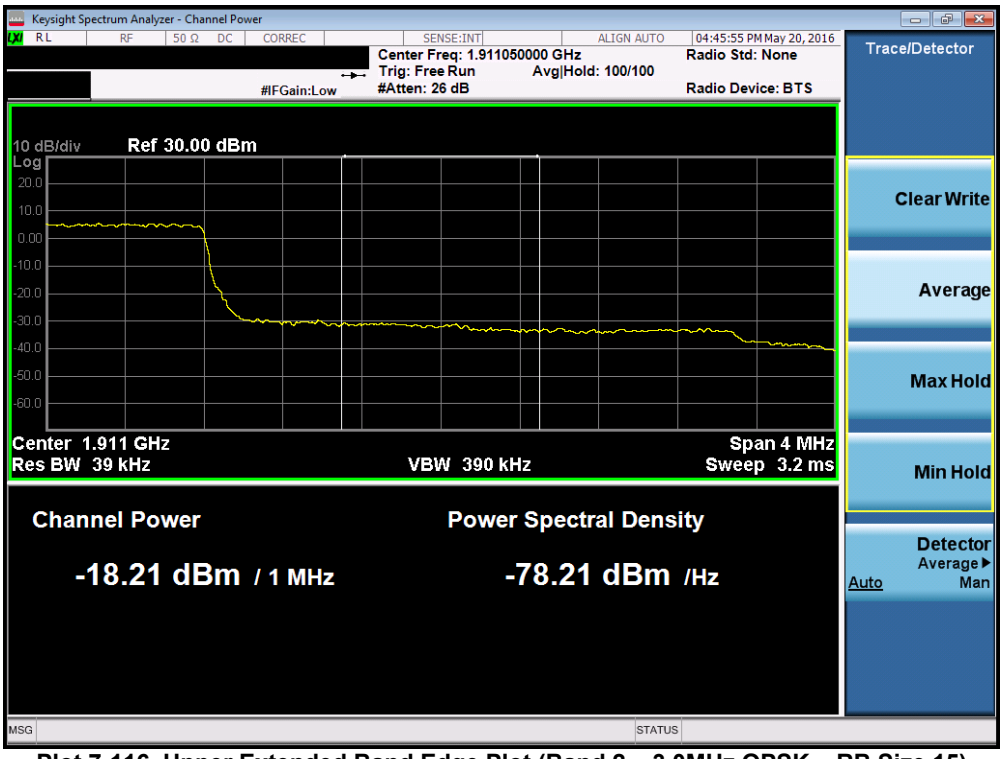
Plot 7-113. Lower Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)



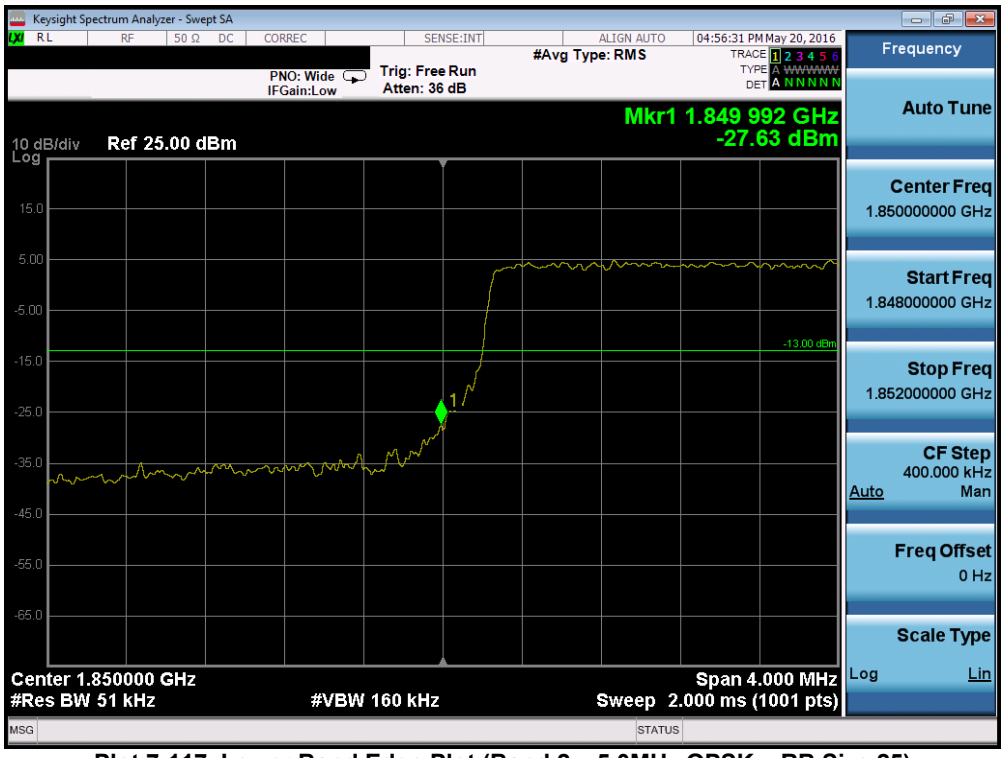
Plot 7-114. Lower Extended Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)



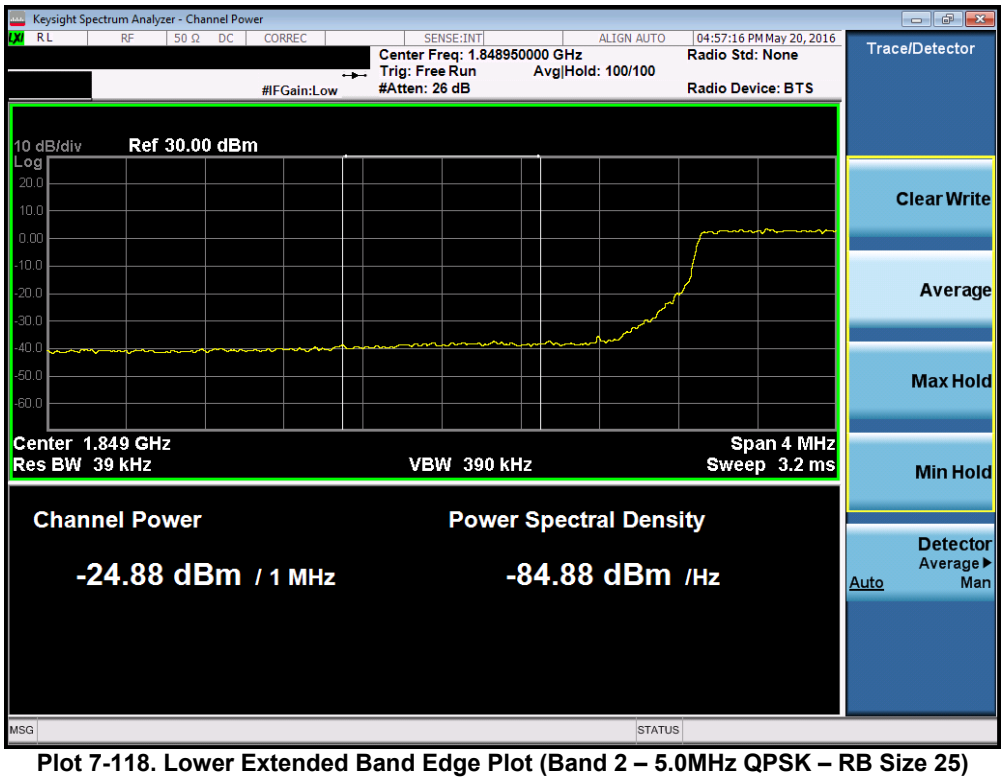
Plot 7-115. Upper Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)



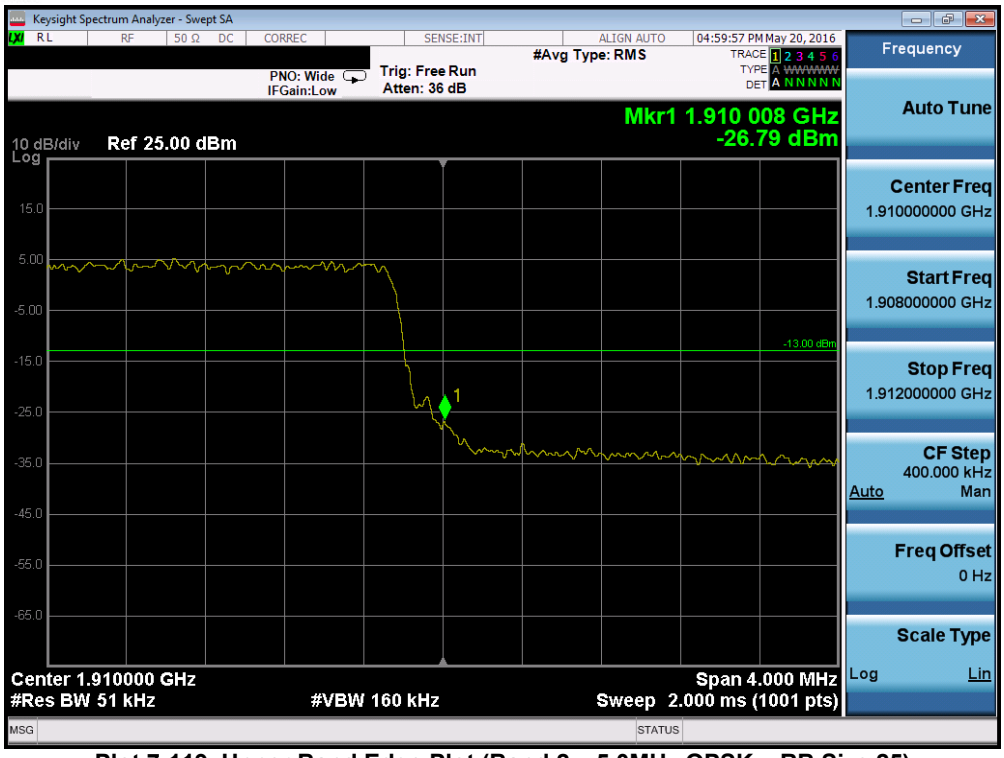
Plot 7-116. Upper Extended Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)



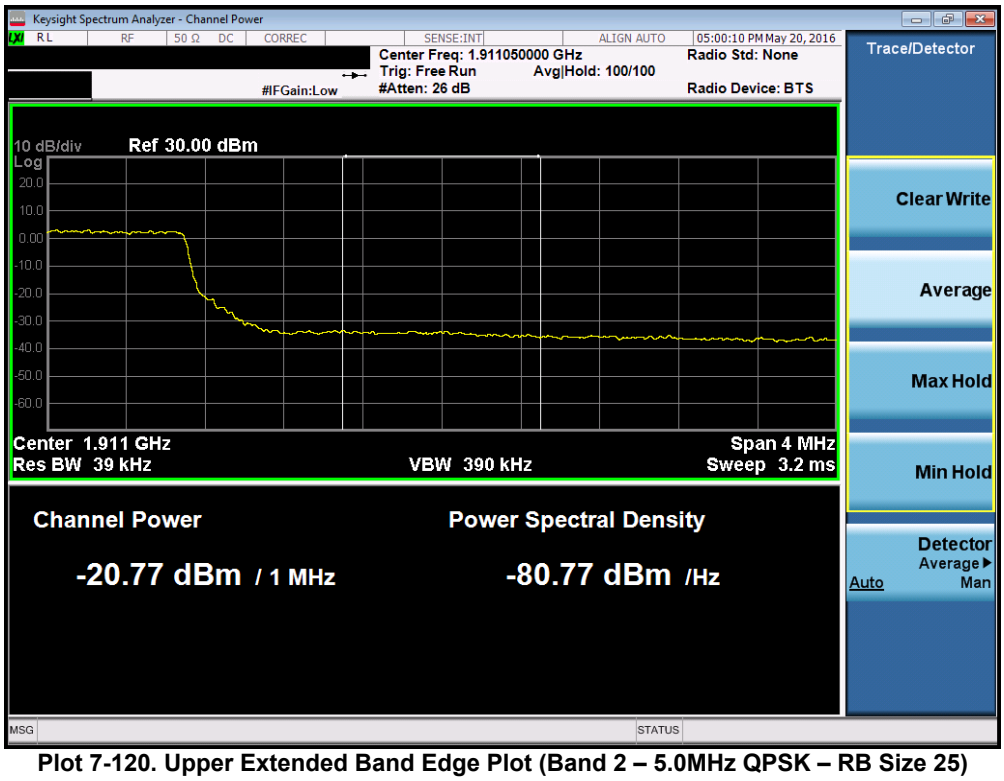
Plot 7-117. Lower Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)



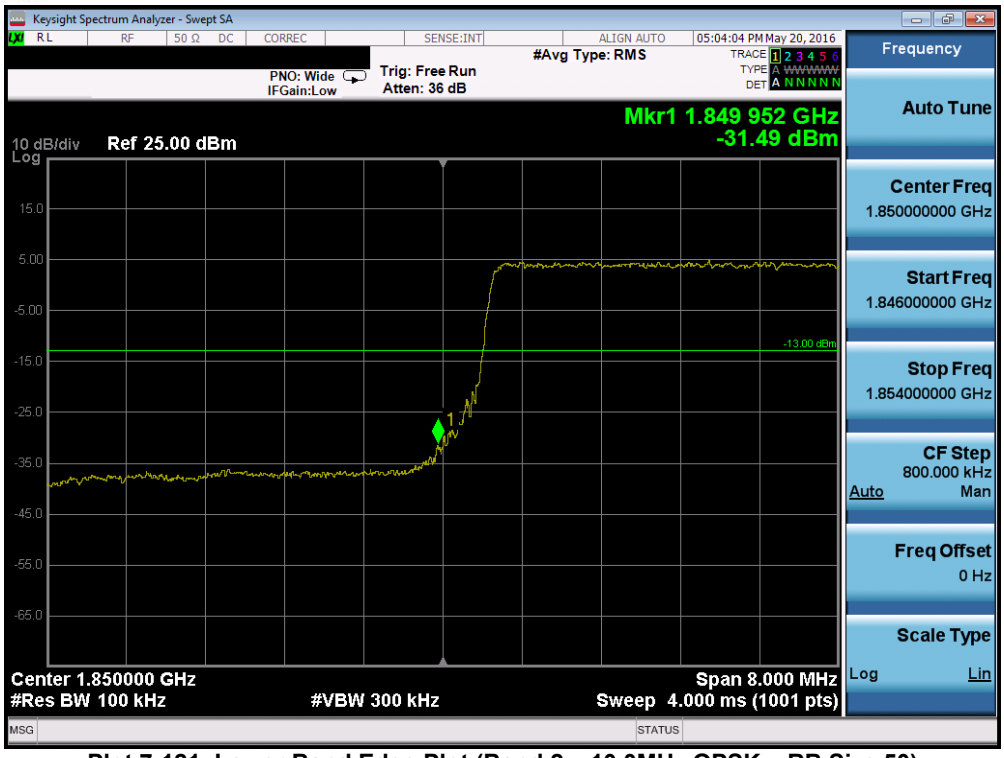
Plot 7-118. Lower Extended Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)



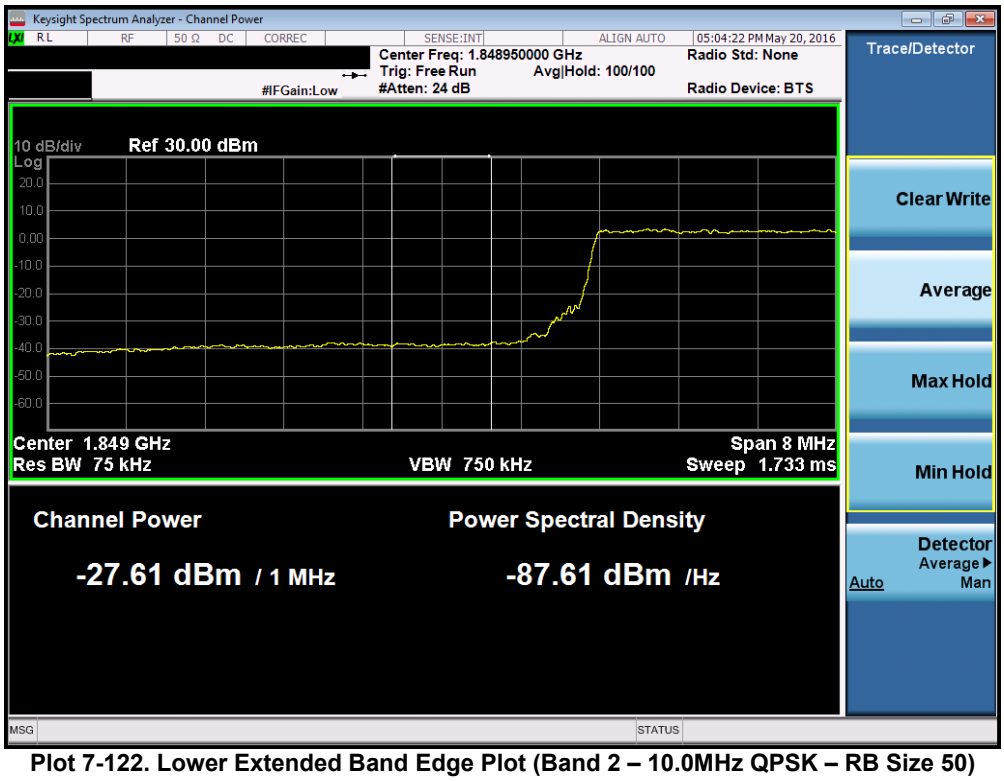
Plot 7-119. Upper Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)



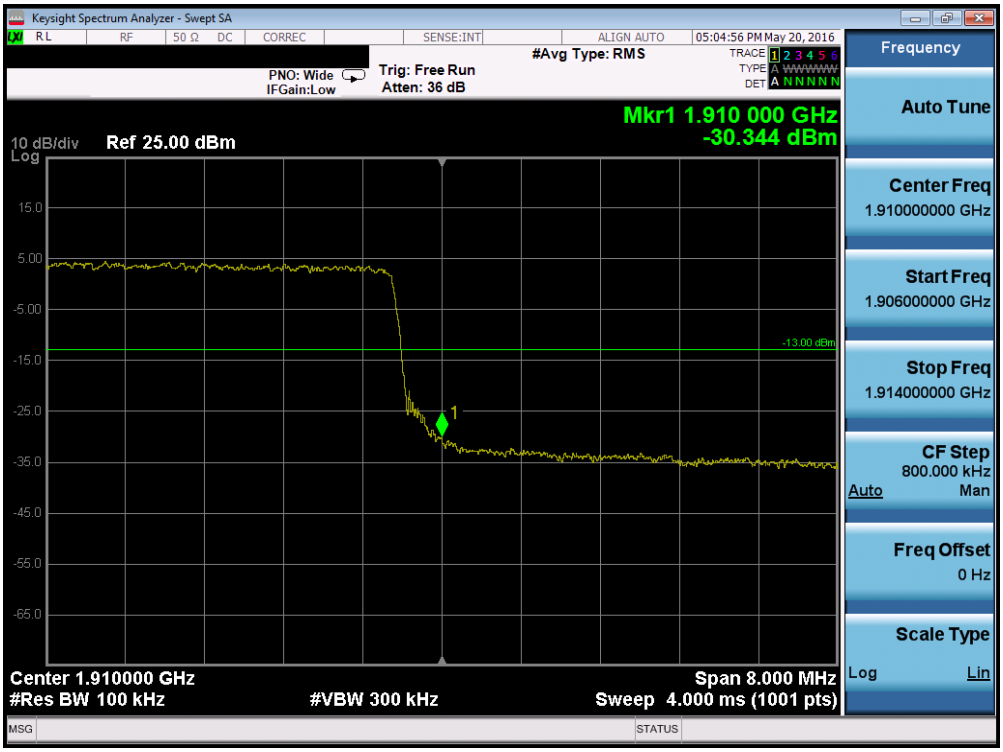
Plot 7-120. Upper Extended Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)



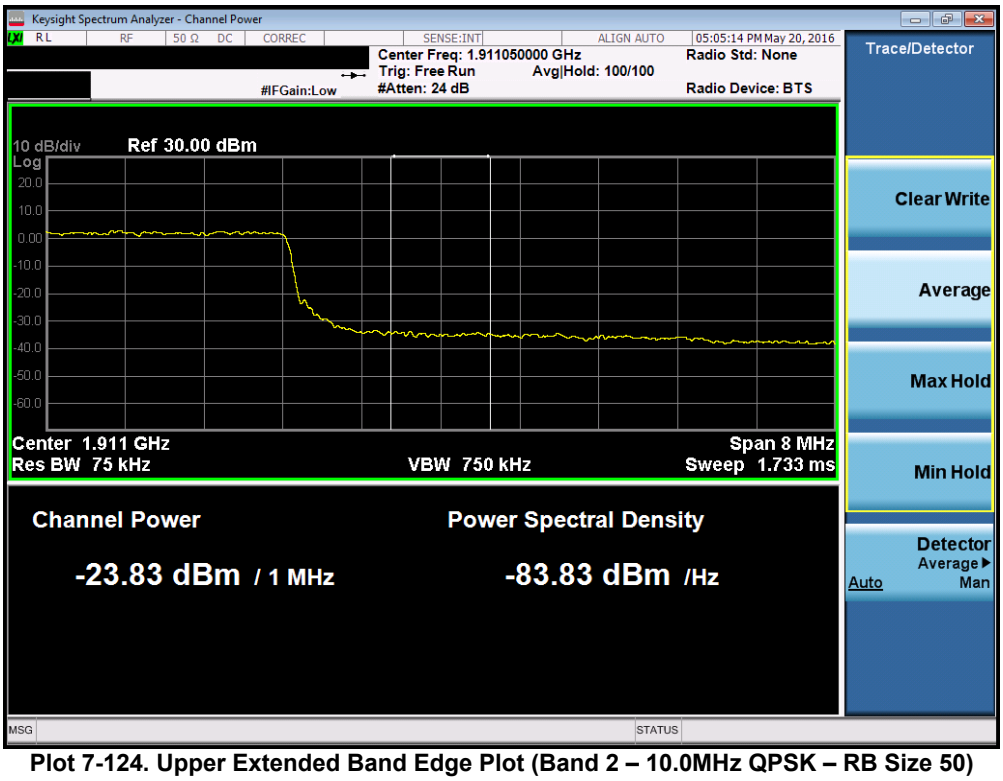
Plot 7-121. Lower Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



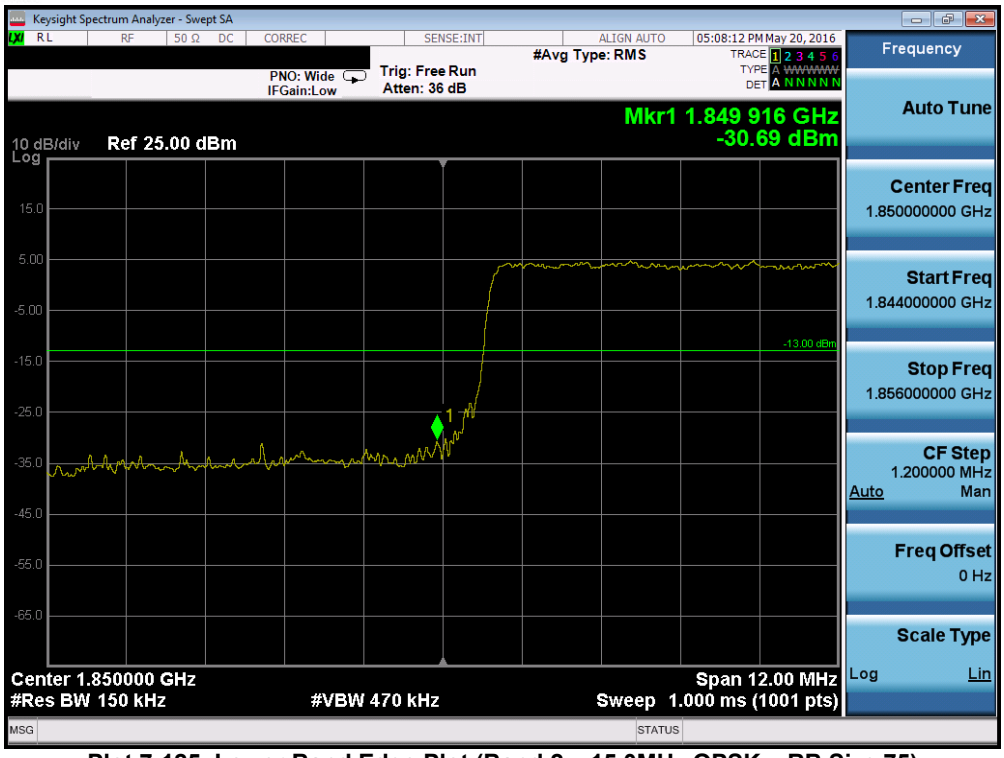
Plot 7-122. Lower Extended Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



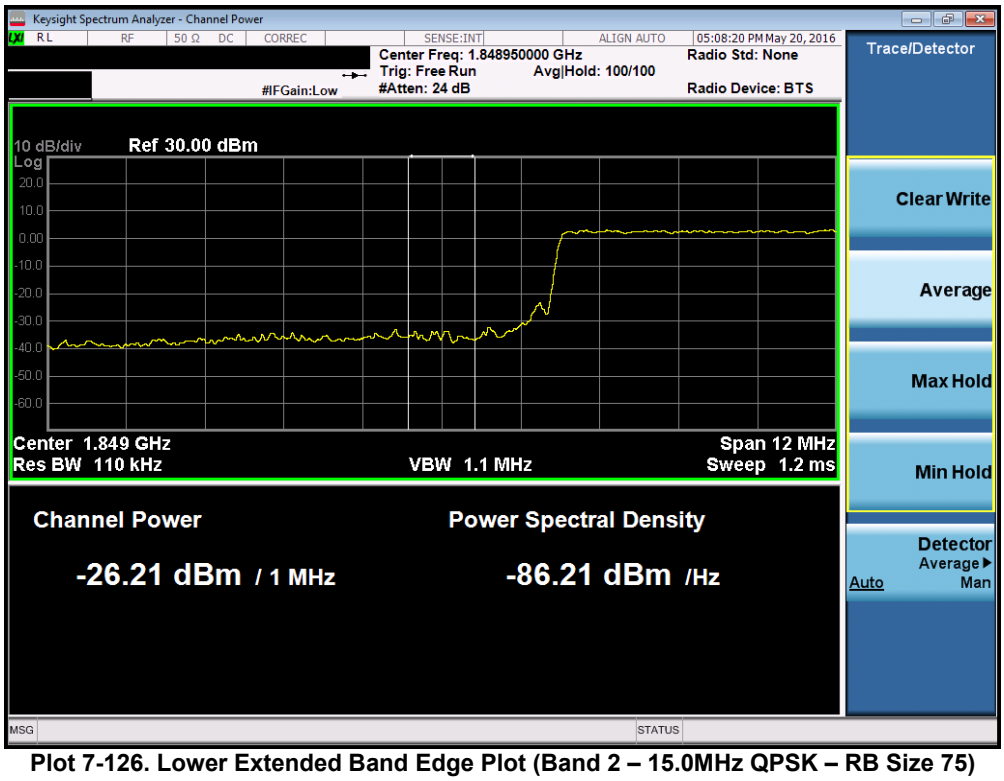
Plot 7-123. Upper Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



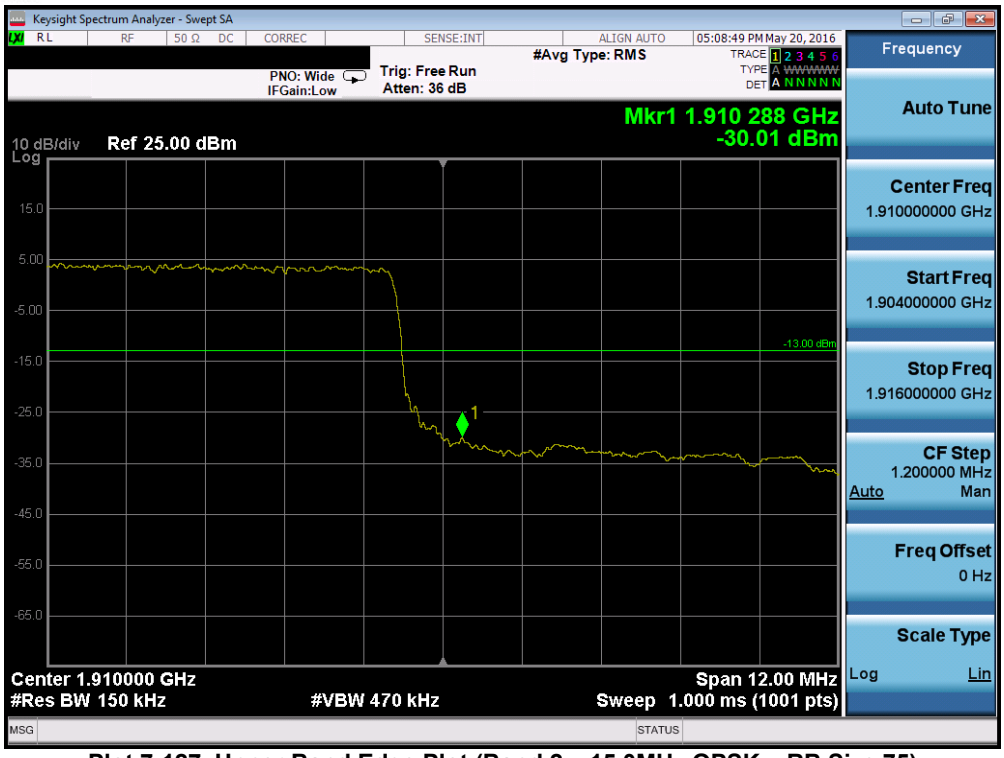
Plot 7-124. Upper Extended Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



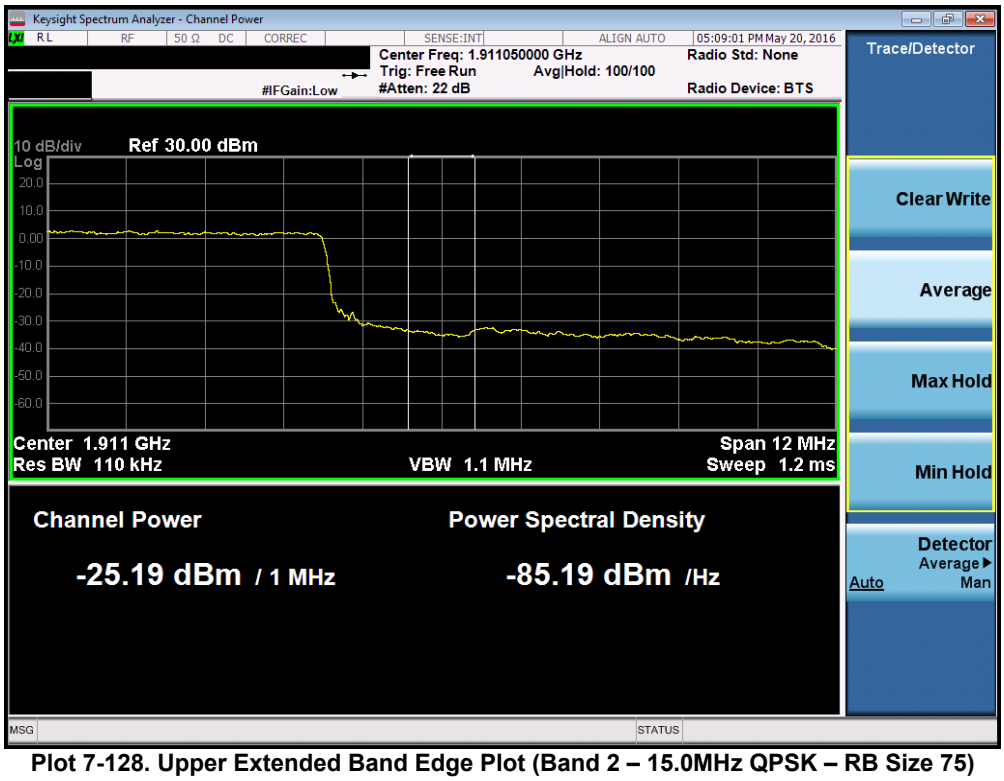
Plot 7-125. Lower Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)



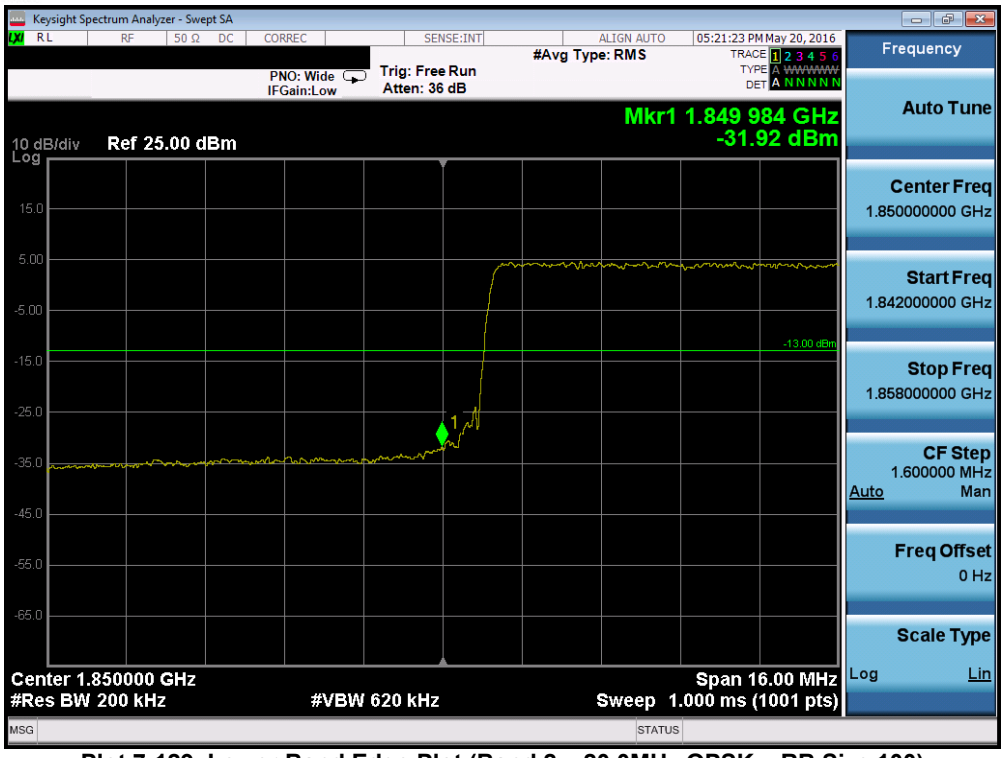
Plot 7-126. Lower Extended Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)



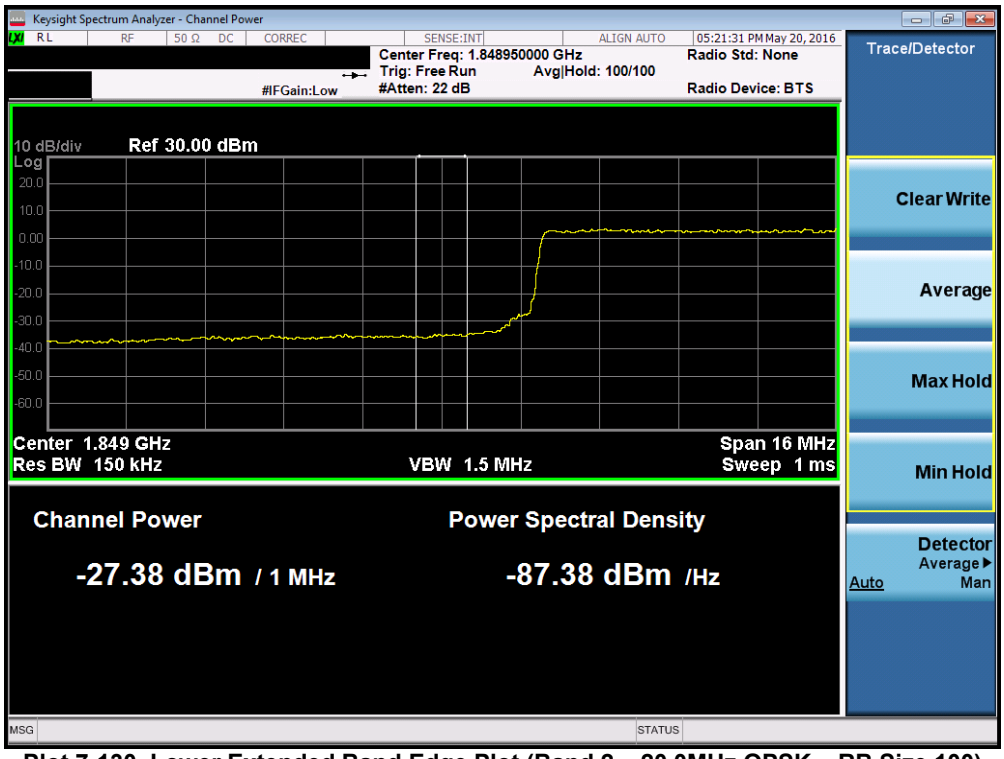
Plot 7-127. Upper Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)



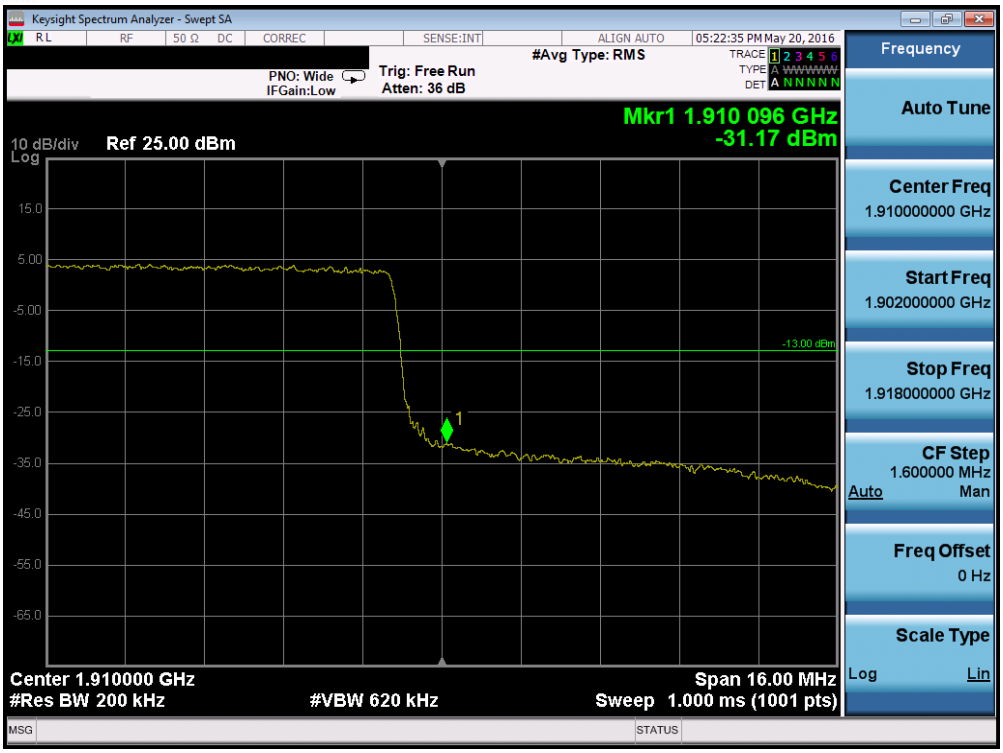
Plot 7-128. Upper Extended Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)



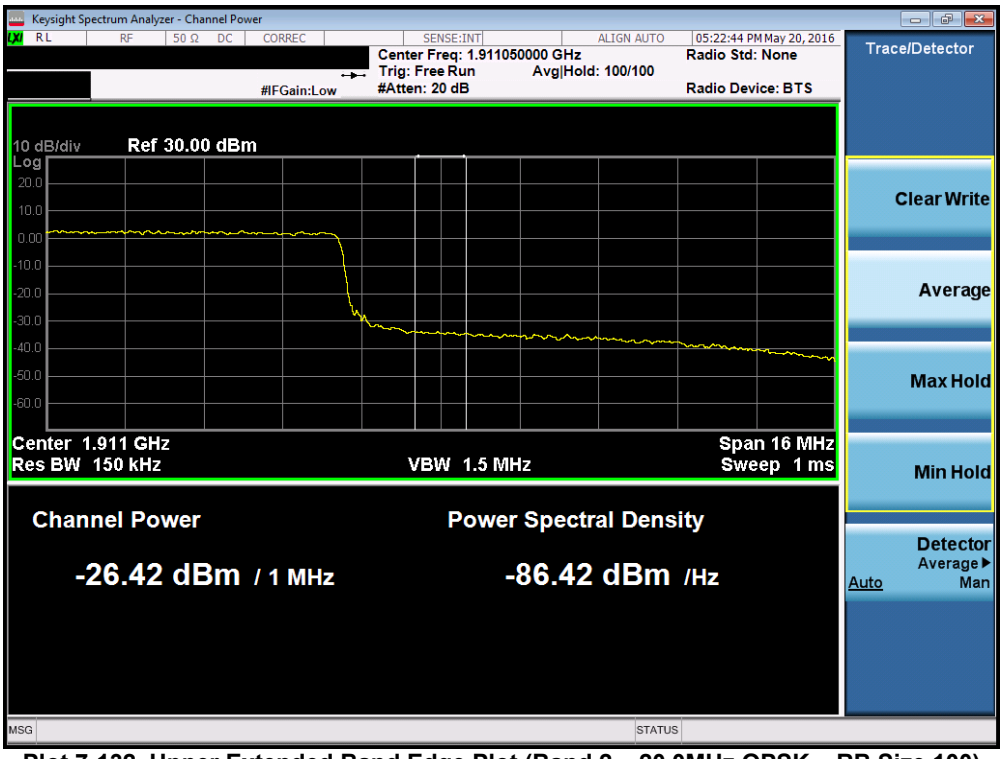
Plot 7-129. Lower Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-130. Lower Extended Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-131. Upper Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-132. Upper Extended Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)

7.5 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 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.

Test Setup

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

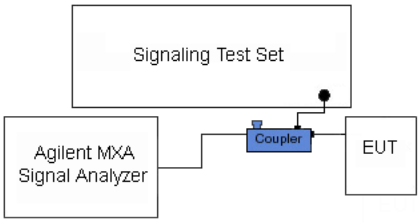
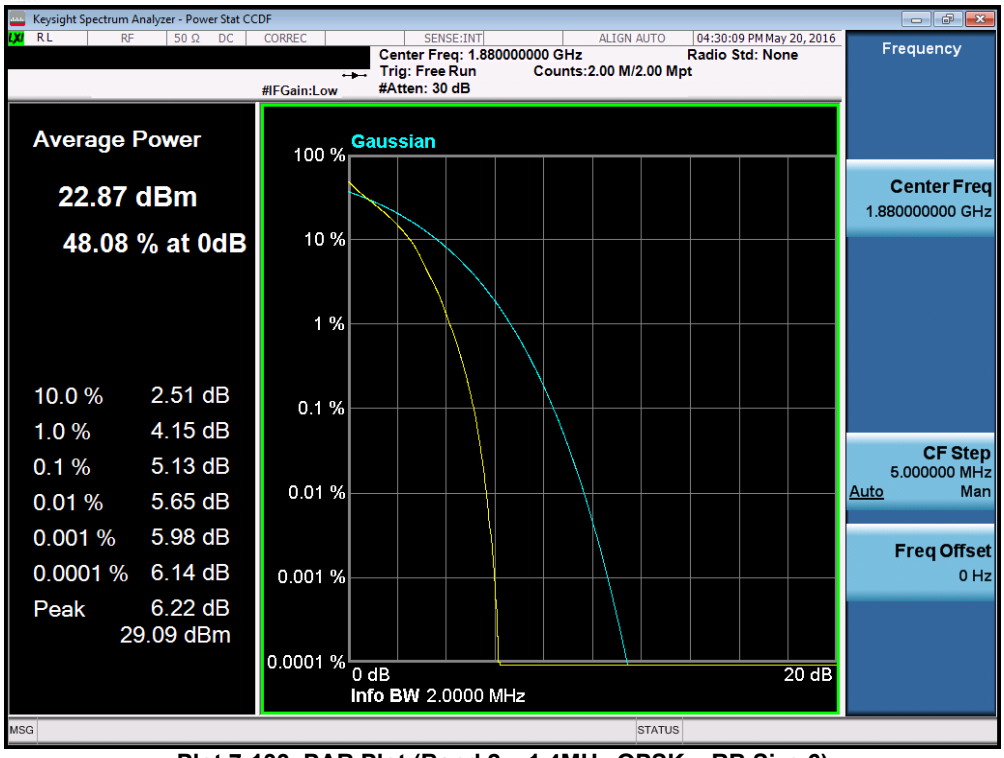


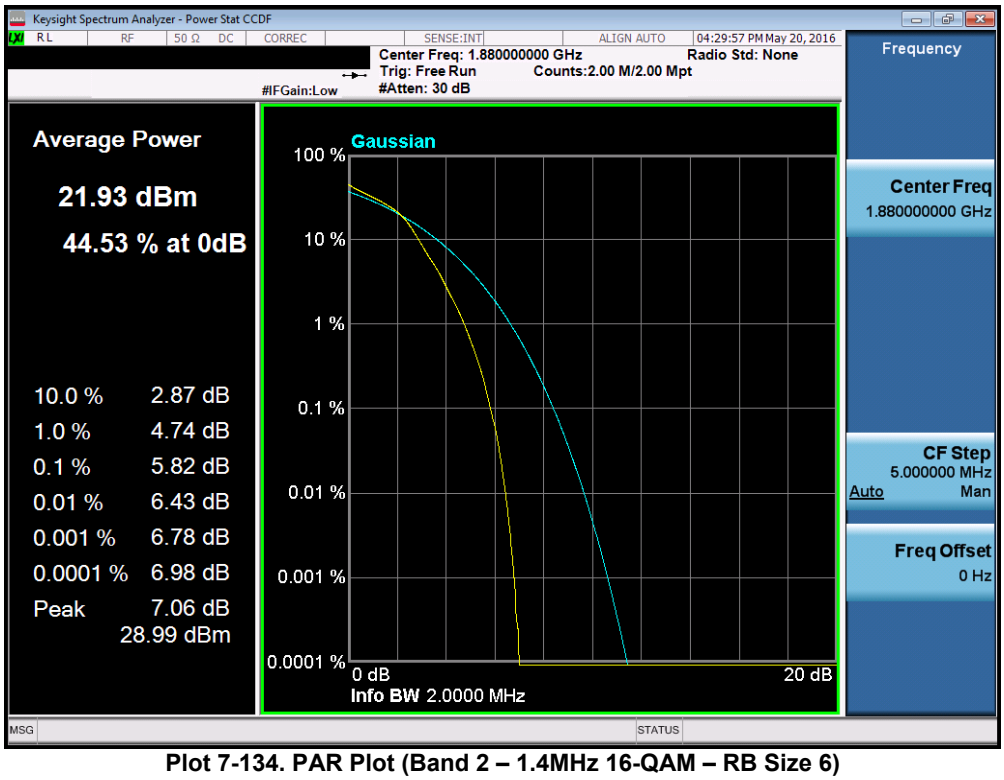
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

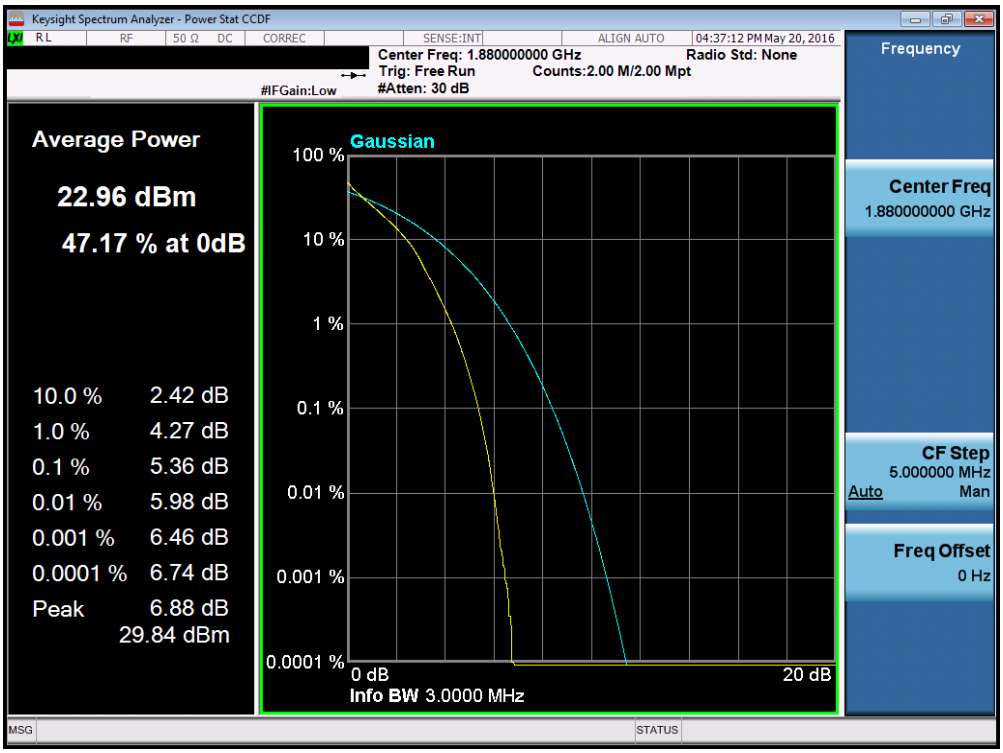
None.



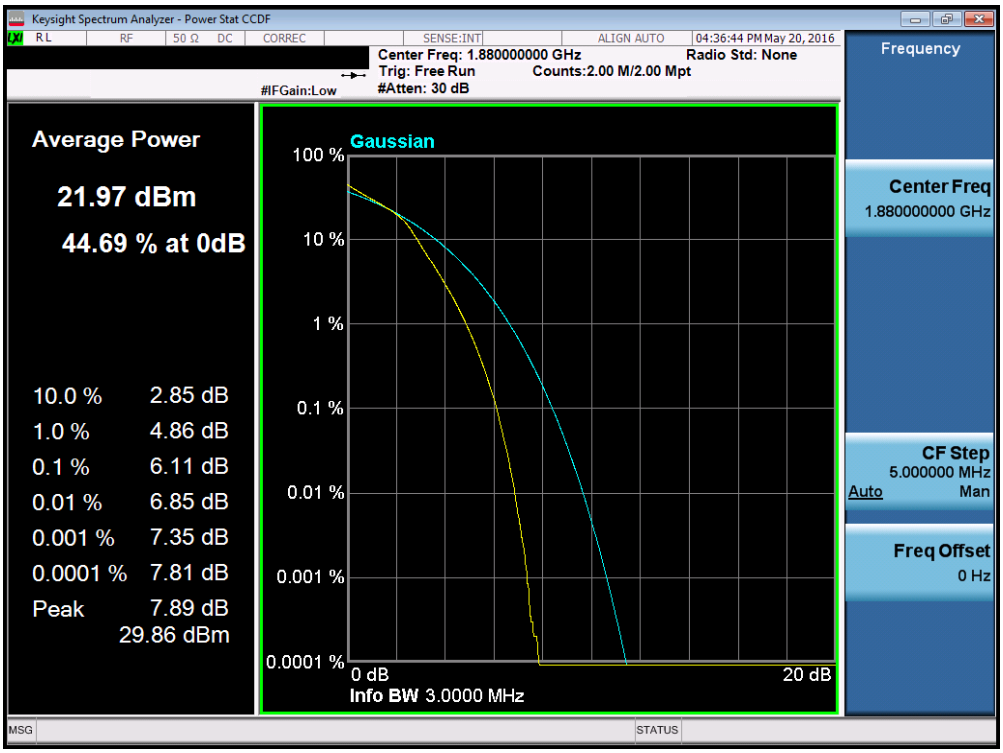
Plot 7-133. PAR Plot (Band 2 – 1.4MHz QPSK – RB Size 6)



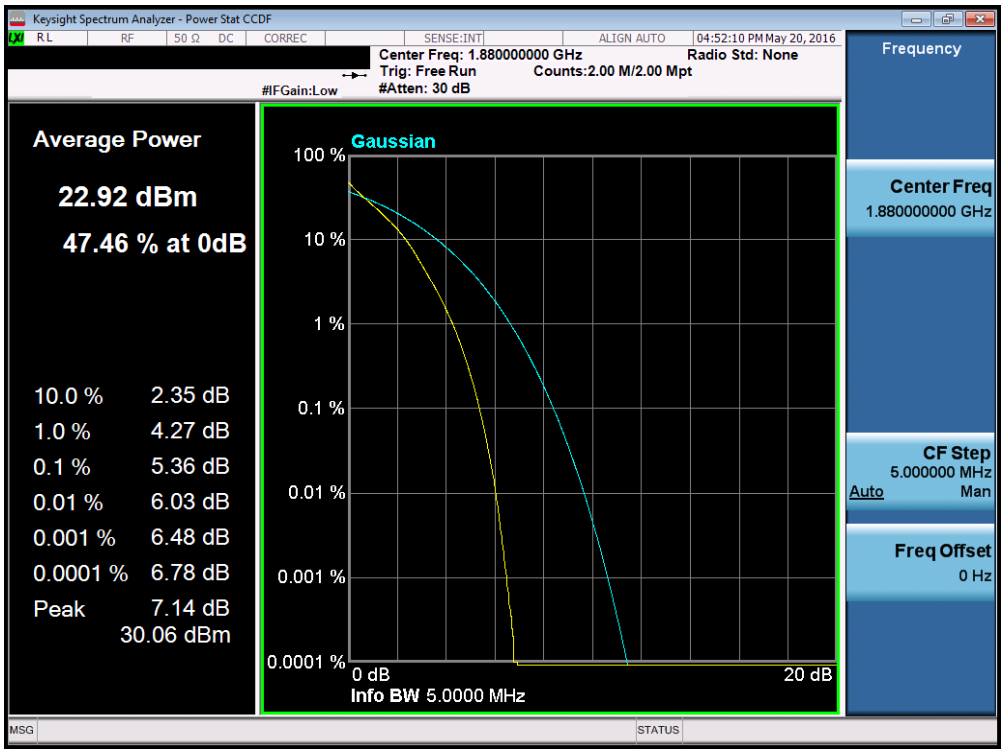
Plot 7-134. PAR Plot (Band 2 – 1.4MHz 16-QAM – RB Size 6)



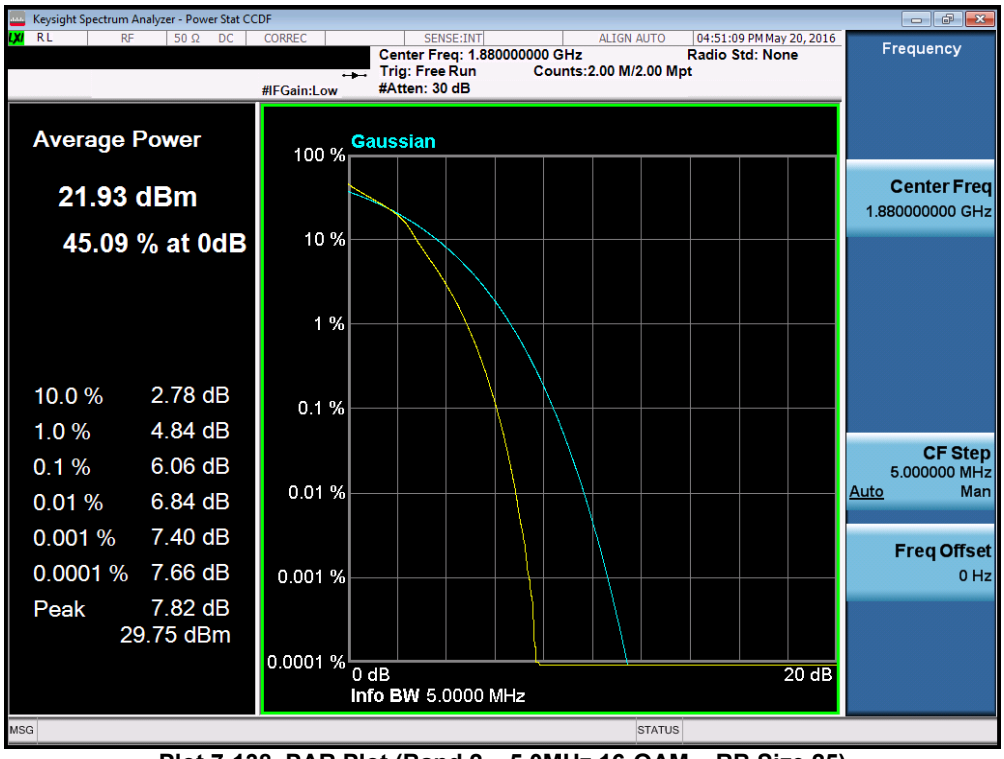
Plot 7-135. PAR Plot (Band 2 – 3.0MHz QPSK – RB Size 15)



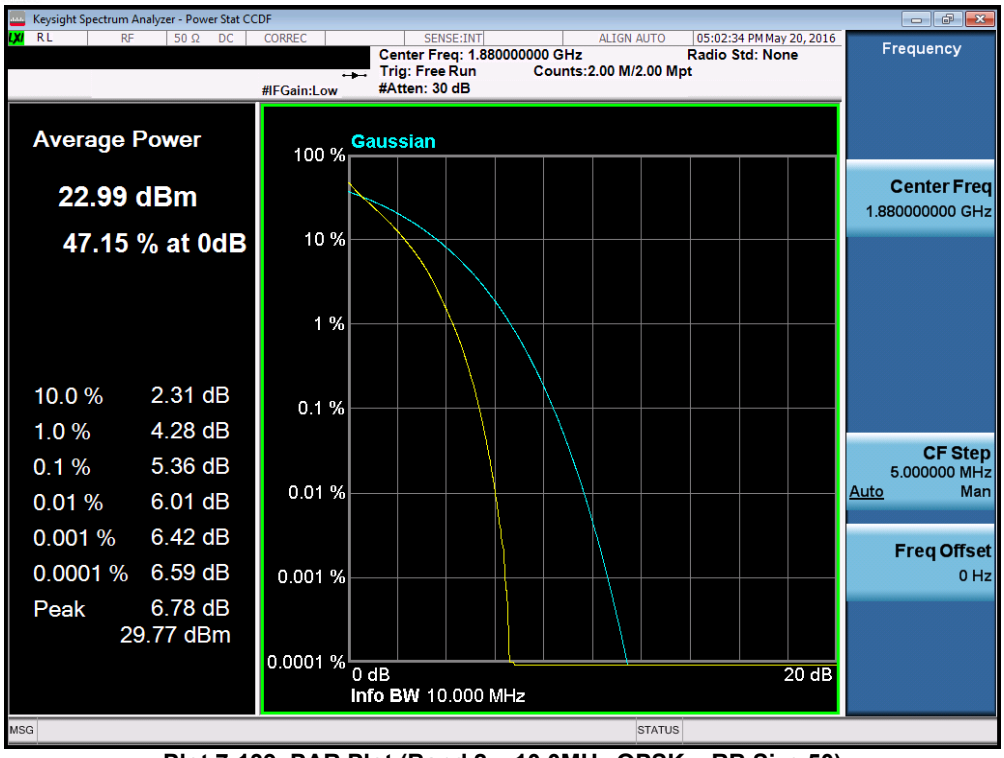
Plot 7-136. PAR Plot (Band 2 – 3.0MHz 16-QAM – RB Size 15)



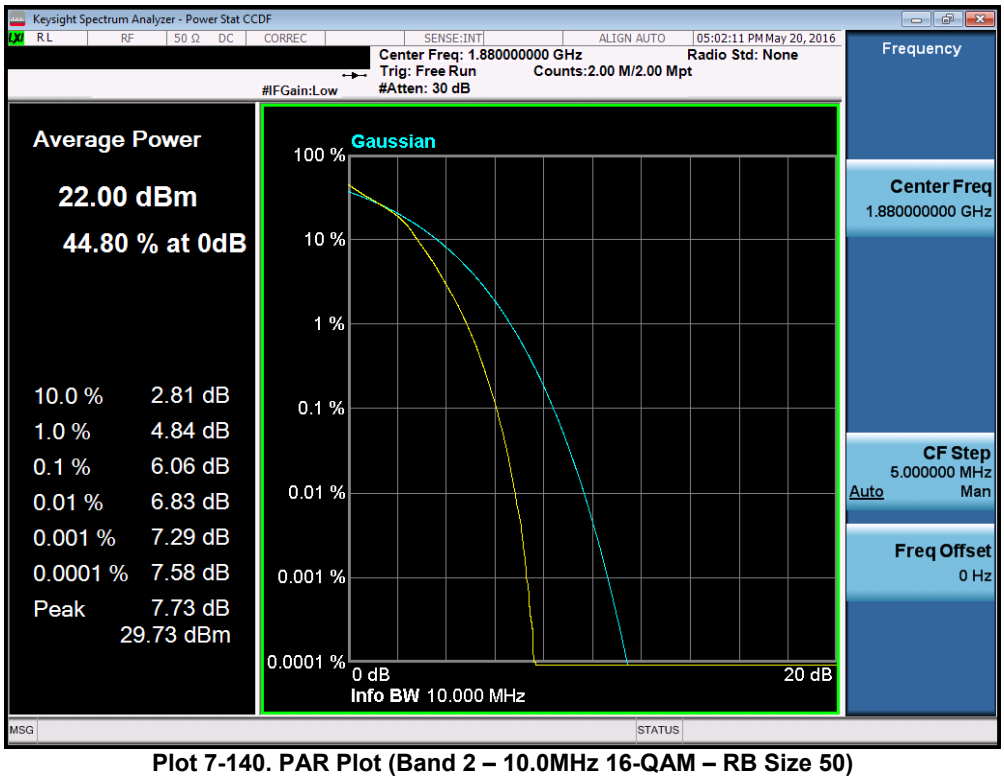
Plot 7-137. PAR Plot (Band 2 – 5.0MHz QPSK – RB Size 25)



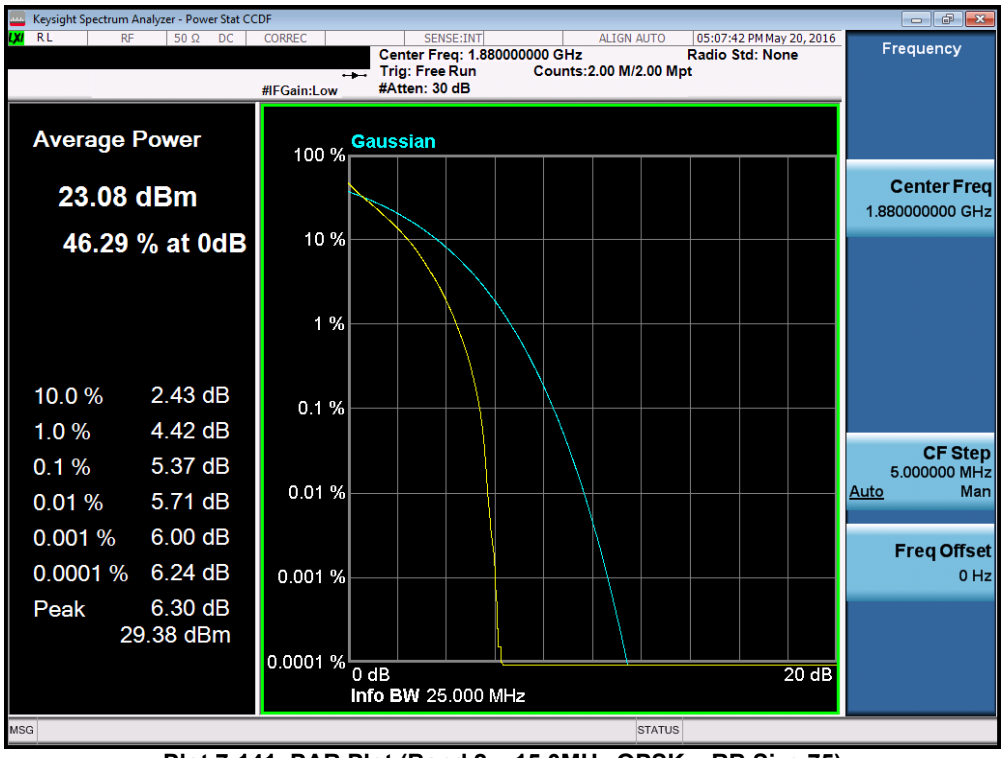
Plot 7-138. PAR Plot (Band 2 – 5.0MHz 16-QAM – RB Size 25)



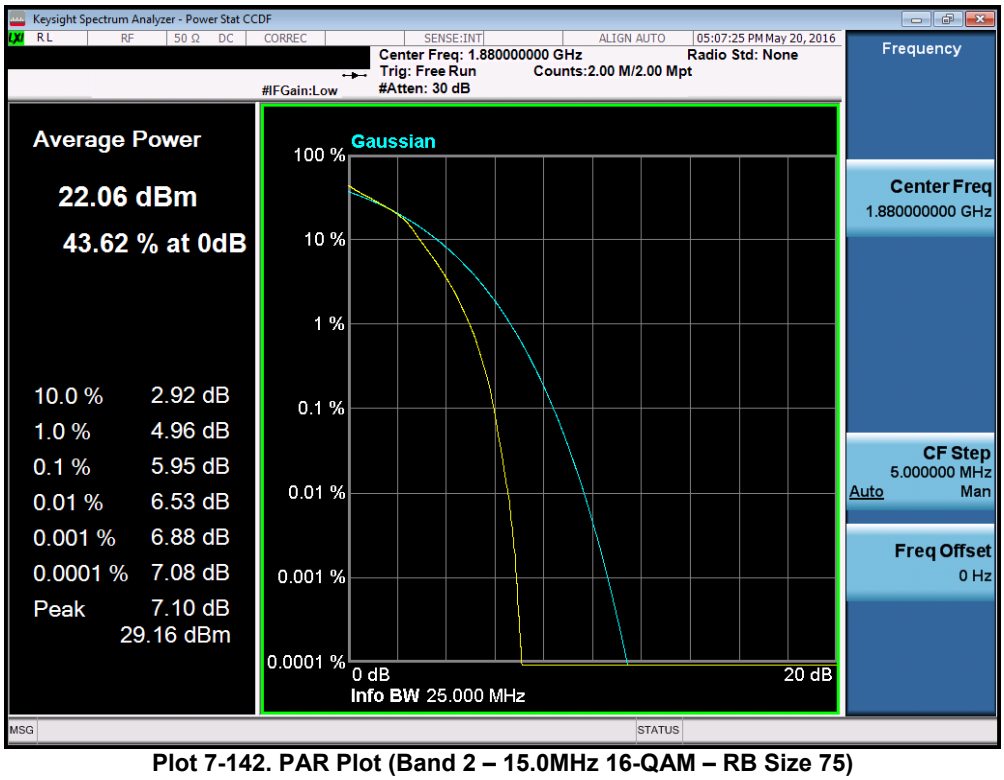
Plot 7-139. PAR Plot (Band 2 – 10.0MHz QPSK – RB Size 50)



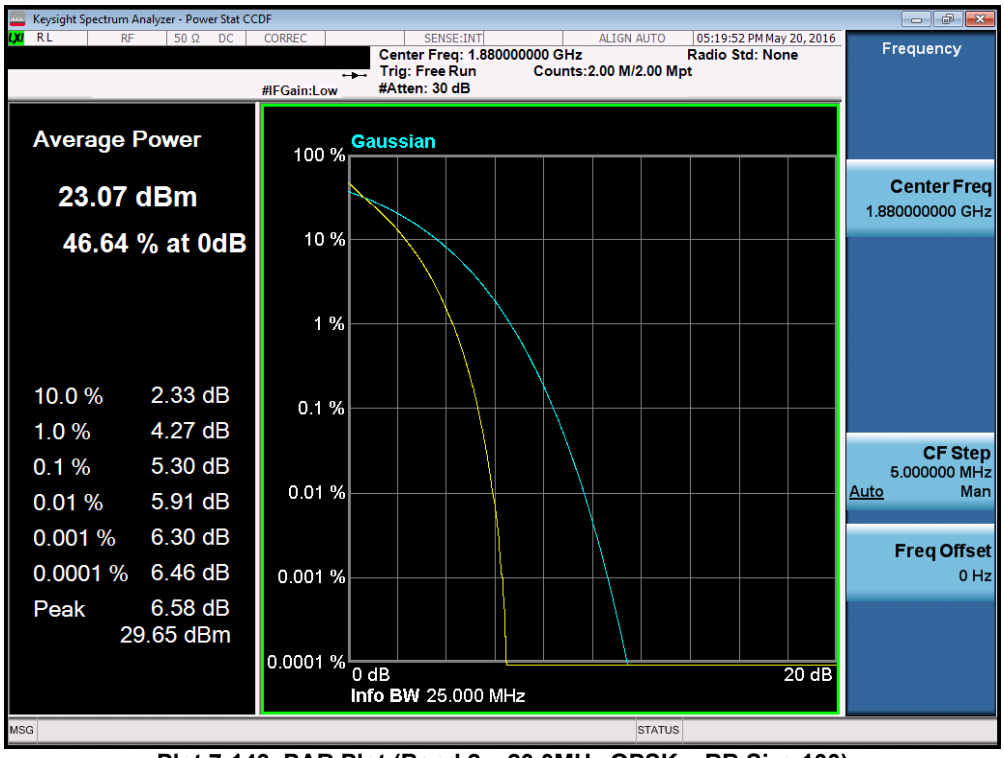
Plot 7-140. PAR Plot (Band 2 – 10.0MHz 16-QAM – RB Size 50)



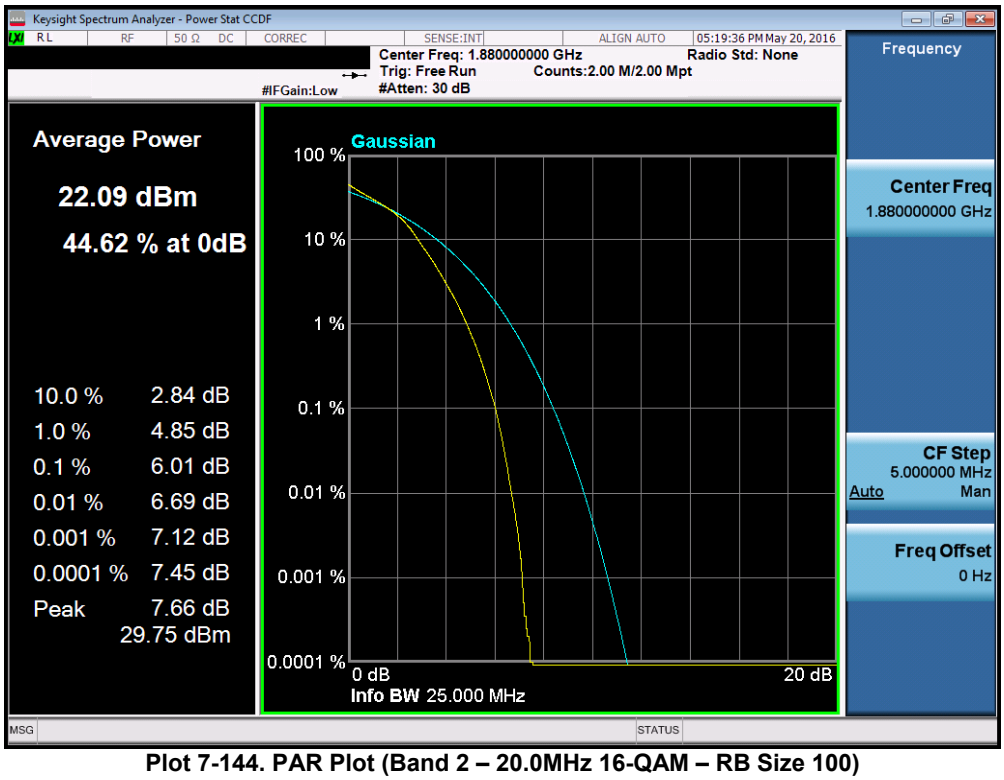
Plot 7-141. PAR Plot (Band 2 – 15.0MHz QPSK – RB Size 75)



Plot 7-142. PAR Plot (Band 2 – 15.0MHz 16-QAM – RB Size 75)



Plot 7-143. PAR Plot (Band 2 – 20.0MHz QPSK – RB Size 100)



Plot 7-144. PAR Plot (Band 2 – 20.0MHz 16-QAM – RB Size 100)

7.6 Radiated Power (ERP/EIRP)

§22.913(a.2) §24.232(c.2) §27.50(b.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 horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using horizontally and vertically 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 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.
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".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Setup

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

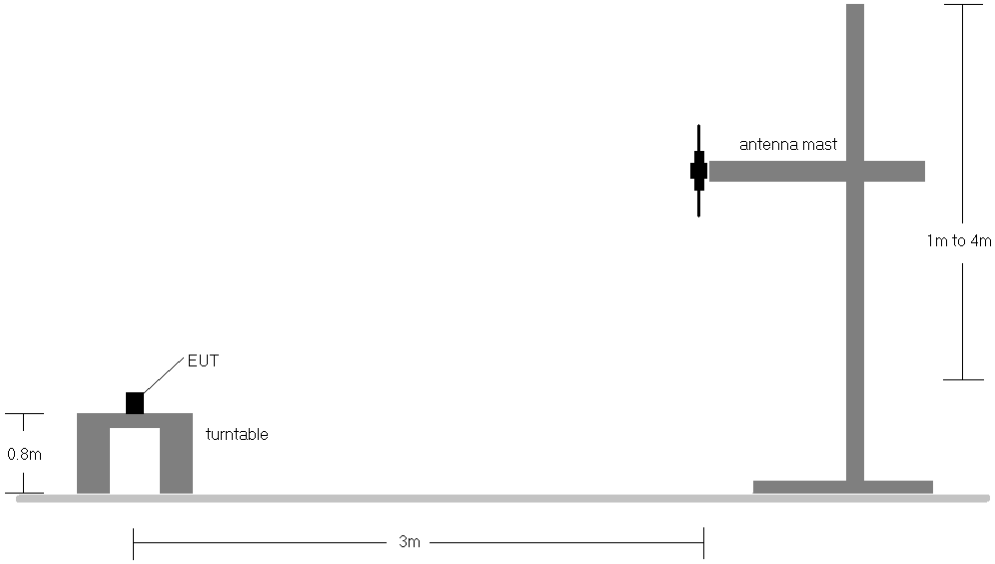


Figure 7-5. Radiated Test Setup <1GHz

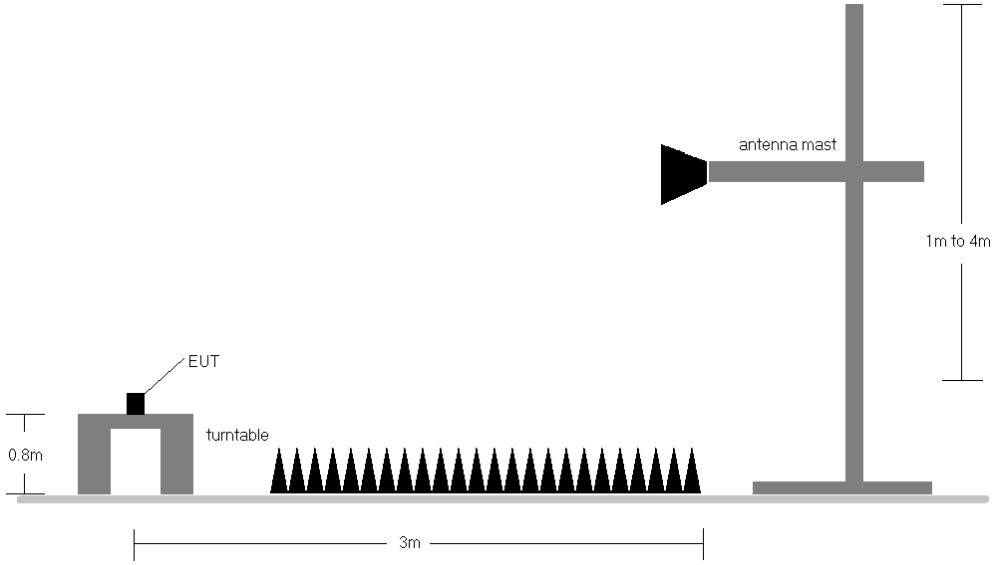


Figure 7-6. Radiated Test Setup >1GHz

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.

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	10	1 / 0	15.13	4.19	19.32	34.77	-15.45
782.00	5	QPSK	H	100	10	1 / 0	15.07	4.25	19.32	34.77	-15.45
784.50	5	QPSK	H	221	6	1 / 24	15.44	4.32	19.76	34.77	-15.01
779.50	5	16QAM	H	100	10	1 / 0	14.14	4.19	18.33	34.77	-16.44
782.00	5	16QAM	H	100	10	1 / 0	14.38	4.25	18.63	34.77	-16.14
784.50	5	16QAM	H	221	6	1 / 24	14.56	4.32	18.88	34.77	-15.89
782.00	10	QPSK	H	242	10	1 / 0	14.74	4.25	18.99	34.77	-15.78
782.00	10	16QAM	H	242	10	1 / 0	13.80	4.25	18.05	34.77	-16.72
784.50	5	QPSK	V	138	226	1 / 0	15.30	4.25	19.55	34.77	-15.22

Table 7-2. ERP Data (Band 13)

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	214	35	3 / 2	15.95	5.01	20.96	38.45	-17.49
836.50	1.4	QPSK	H	224	41	3 / 2	15.97	5.16	21.13	38.45	-17.32
848.30	1.4	QPSK	H	234	42	3 / 2	15.24	5.30	20.54	38.45	-17.91
824.70	1.4	16-QAM	H	214	35	3 / 2	15.05	5.01	20.06	38.45	-18.39
836.50	1.4	16-QAM	H	224	41	3 / 2	15.00	5.16	20.16	38.45	-18.29
848.30	1.4	16-QAM	H	234	42	3 / 2	14.26	5.30	19.56	38.45	-18.89
825.50	3	QPSK	H	223	35	1 / 14	16.18	5.02	21.20	38.45	-17.25
836.50	3	QPSK	H	220	40	1 / 0	16.23	5.16	21.39	38.45	-17.06
847.50	3	QPSK	H	219	29	1 / 0	15.27	5.29	20.56	38.45	-17.89
825.50	3	16-QAM	H	223	35	1 / 14	15.48	5.02	20.50	38.45	-17.95
836.50	3	16-QAM	H	220	40	1 / 0	15.47	5.16	20.63	38.45	-17.82
847.50	3	16-QAM	H	219	29	1 / 0	14.44	5.29	19.73	38.45	-18.72
826.50	5	QPSK	H	218	39	1 / 24	16.20	5.03	21.23	38.45	-17.22
836.50	5	QPSK	H	219	26	1 / 0	16.18	5.16	21.34	38.45	-17.11
846.50	5	QPSK	H	219	35	1 / 0	15.56	5.28	20.84	38.45	-17.61
826.50	5	16-QAM	H	218	39	1 / 24	15.51	5.03	20.54	38.45	-17.91
836.50	5	16-QAM	H	219	26	1 / 0	15.35	5.16	20.51	38.45	-17.94
846.50	5	16-QAM	H	219	35	1 / 0	14.28	5.28	19.56	38.45	-18.89
829.00	10	QPSK	H	218	33	1 / 49	15.98	5.06	21.04	38.45	-17.41
836.50	10	QPSK	H	224	27	1 / 0	15.76	5.16	20.92	38.45	-17.53
844.00	10	QPSK	H	224	34	1 / 0	15.98	5.25	21.23	38.45	-17.22
829.00	10	16-QAM	H	218	33	1 / 49	15.16	5.06	20.22	38.45	-18.23
836.50	10	16-QAM	H	224	27	1 / 0	14.94	5.16	20.10	38.45	-18.35
844.00	10	16-QAM	H	224	34	1 / 0	15.31	5.25	20.56	38.45	-17.89
836.50	3	QPSK	V	148	10	1 / 0	15.79	5.00	20.79	38.45	-17.66

Table 7-3. ERP Data (Band 5)

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	298	0	3 / 2	15.57	9.66	25.23	30.00	-4.77
1732.50	1.4	QPSK	H	301	0	1 / 0	15.32	9.61	24.93	30.00	-5.07
1754.30	1.4	QPSK	H	383	360	3 / 2	15.24	9.57	24.81	30.00	-5.19
1710.70	1.4	16-QAM	H	298	0	1 / 0	14.77	9.66	24.43	30.00	-5.57
1732.50	1.4	16-QAM	H	301	0	1 / 0	14.44	9.61	24.05	30.00	-5.95
1754.30	1.4	16-QAM	H	383	360	3 / 2	14.43	9.57	24.00	30.00	-6.00
1711.50	3	QPSK	H	298	360	1 / 0	15.91	9.65	25.56	30.00	-4.44
1732.50	3	QPSK	H	300	359	1 / 0	16.13	9.61	25.74	30.00	-4.26
1753.50	3	QPSK	H	381	360	1 / 0	15.70	9.57	25.27	30.00	-4.73
1711.50	3	16-QAM	H	298	360	1 / 0	15.02	9.65	24.67	30.00	-5.33
1732.50	3	16-QAM	H	300	359	1 / 0	15.05	9.61	24.66	30.00	-5.34
1753.50	3	16-QAM	H	381	360	1 / 0	14.76	9.57	24.33	30.00	-5.67
1712.50	5	QPSK	H	300	360	1 / 0	15.86	9.65	25.51	30.00	-4.49
1732.50	5	QPSK	H	300	360	1 / 0	16.39	9.61	26.00	30.00	-4.00
1752.50	5	QPSK	H	381	360	1 / 24	15.83	9.57	25.40	30.00	-4.60
1712.50	5	16-QAM	H	300	360	1 / 0	14.99	9.65	24.64	30.00	-5.36
1732.50	5	16-QAM	H	300	360	1 / 0	15.41	9.61	25.02	30.00	-4.98
1752.50	5	16-QAM	H	381	360	1 / 24	15.07	9.57	24.64	30.00	-5.36
1715.00	10	QPSK	H	300	4	1 / 0	15.40	9.65	25.05	30.00	-4.95
1732.50	10	QPSK	H	300	0	1 / 0	16.04	9.61	25.65	30.00	-4.35
1750.00	10	QPSK	H	289	364	1 / 0	15.54	9.58	25.12	30.00	-4.88
1715.00	10	16-QAM	H	300	4	1 / 0	14.49	9.65	24.14	30.00	-5.86
1732.50	10	16-QAM	H	300	0	1 / 0	15.23	9.61	24.84	30.00	-5.16
1750.00	10	16-QAM	H	289	364	1 / 0	14.55	9.58	24.13	30.00	-5.87
1717.50	15	QPSK	H	301	360	1 / 74	15.57	9.64	25.21	30.00	-4.79
1732.50	15	QPSK	H	301	360	1 / 0	15.87	9.61	25.48	30.00	-4.52
1747.50	15	QPSK	H	400	2	1 / 0	16.20	9.58	25.78	30.00	-4.22
1717.50	15	16-QAM	H	301	360	1 / 74	14.57	9.64	24.21	30.00	-5.79
1732.50	15	16-QAM	H	301	360	1 / 0	15.03	9.61	24.64	30.00	-5.36
1747.50	15	16-QAM	H	400	2	1 / 0	15.14	9.58	24.72	30.00	-5.28
1720.00	20	QPSK	H	300	360	1 / 99	15.67	9.64	25.31	30.00	-4.69
1732.50	20	QPSK	H	300	359	1 / 0	16.17	9.61	25.78	30.00	-4.22
1745.00	20	QPSK	H	400	359	1 / 0	15.94	9.59	25.53	30.00	-4.47
1720.00	20	16-QAM	H	300	360	1 / 99	14.72	9.64	24.36	30.00	-5.64
1732.50	20	16-QAM	H	300	359	1 / 0	15.27	9.61	24.88	30.00	-5.12
1745.00	20	16-QAM	H	400	359	1 / 0	14.75	9.59	24.34	30.00	-5.66
1732.50	5	QPSK	V	110	42	1 / 0	12.29	7.38	19.67	30.00	-10.33

Table 7-4. EIRP Data (Band 4)

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	H	106	360	1 / 0	16.73	9.35	26.08	33.01	-6.93
1880.00	1.4	QPSK	H	100	5	1 / 0	15.28	9.27	24.55	33.01	-8.46
1909.30	1.4	QPSK	H	110	354	1 / 5	15.26	9.25	24.51	33.01	-8.50
1850.70	1.4	16-QAM	H	106	360	1 / 0	15.81	9.35	25.16	33.01	-7.85
1880.00	1.4	16-QAM	H	100	5	1 / 0	14.52	9.27	23.79	33.01	-9.22
1909.30	1.4	16-QAM	H	110	354	1 / 5	14.41	9.25	23.66	33.01	-9.35
1851.50	3	QPSK	H	272	0	1 / 14	15.51	9.35	24.86	33.01	-8.15
1880.00	3	QPSK	H	116	357	1 / 0	15.16	9.27	24.43	33.01	-8.58
1908.50	3	QPSK	H	110	355	1 / 14	15.53	9.25	24.78	33.01	-8.23
1851.50	3	16-QAM	H	272	0	1 / 14	14.47	9.35	23.82	33.01	-9.19
1880.00	3	16-QAM	H	116	357	1 / 0	14.28	9.27	23.55	33.01	-9.46
1908.50	3	16-QAM	H	110	355	1 / 14	14.59	9.25	23.84	33.01	-9.17
1852.50	5	QPSK	H	106	360	1 / 0	16.95	9.34	26.29	33.01	-6.72
1880.00	5	QPSK	H	156	5	1 / 0	15.53	9.27	24.80	33.01	-8.21
1907.50	5	QPSK	H	259	360	1 / 24	14.51	9.24	23.75	33.01	-9.26
1852.50	5	16-QAM	H	106	360	1 / 0	16.19	9.34	25.53	33.01	-7.48
1880.00	5	16-QAM	H	156	5	1 / 0	14.74	9.27	24.01	33.01	-9.00
1907.50	5	16-QAM	H	259	360	1 / 24	13.97	9.24	23.21	33.01	-9.80
1855.00	10	QPSK	H	104	8	1 / 0	16.61	9.34	25.95	33.01	-7.06
1880.00	10	QPSK	H	100	360	1 / 0	15.15	9.27	24.42	33.01	-8.59
1905.00	10	QPSK	H	202	360	1 / 0	14.82	9.24	24.06	33.01	-8.95
1855.00	10	16-QAM	H	104	8	1 / 0	15.72	9.34	25.06	33.01	-7.95
1880.00	10	16-QAM	H	100	360	1 / 0	14.36	9.27	23.63	33.01	-9.38
1905.00	10	16-QAM	H	202	360	1 / 0	14.33	9.24	23.57	33.01	-9.44
1857.50	15	QPSK	H	106	7	1 / 0	16.61	9.33	25.94	33.01	-7.07
1880.00	15	QPSK	H	208	5	1 / 0	14.65	9.27	23.92	33.01	-9.09
1902.50	15	QPSK	H	202	2	1 / 0	14.79	9.23	24.02	33.01	-8.99
1857.50	15	16-QAM	H	106	7	1 / 0	15.68	9.33	25.01	33.01	-8.00
1880.00	15	16-QAM	H	208	5	1 / 0	14.01	9.27	23.28	33.01	-9.73
1902.50	15	16-QAM	H	202	2	1 / 0	13.90	9.23	23.13	33.01	-9.88
1860.00	20	QPSK	H	103	360	1 / 0	16.38	9.32	25.70	33.01	-7.31
1880.00	20	QPSK	H	152	360	1 / 0	15.03	9.27	24.30	33.01	-8.71
1900.00	20	QPSK	H	202	2	1 / 0	14.39	9.22	23.61	33.01	-9.40
1860.00	20	16-QAM	H	103	360	1 / 0	15.39	9.32	24.71	33.01	-8.30
1880.00	20	16-QAM	H	152	360	1 / 0	14.28	9.27	23.55	33.01	-9.46
1900.00	20	16-QAM	H	202	2	1 / 0	13.37	9.22	22.59	33.01	-10.42
1852.50	5	QPSK	V	266	346	1 / 0	13.32	7.07	20.39	33.01	-12.62

Table 7-5. EIRP Data (Band 2)

7.7 Radiated Spurious Emissions Measurements

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

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 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 = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

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

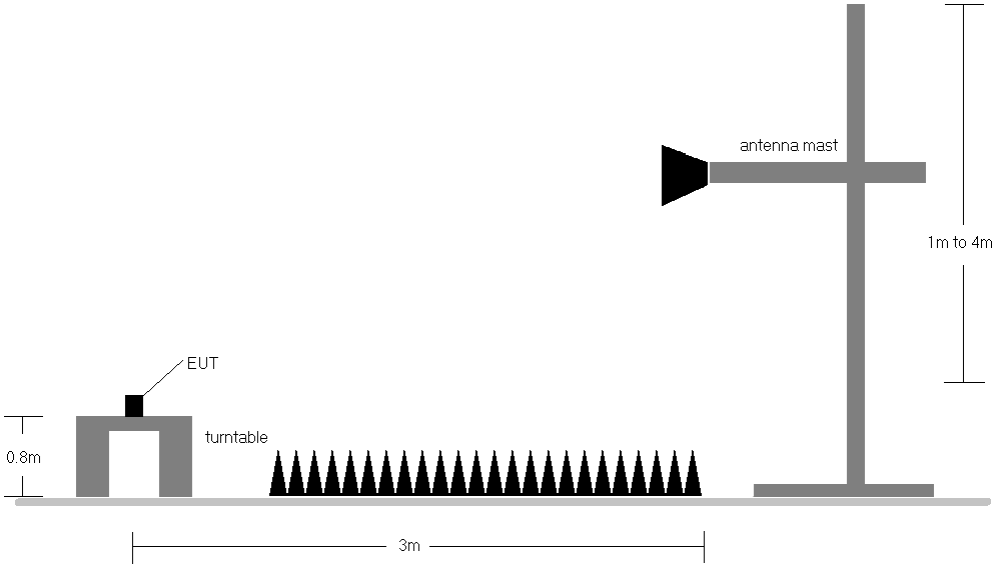


Figure 7-7. Test Instrument & Measurement Setup

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.

OPERATING FREQUENCY:	779.50	MHz		
CHANNEL:	23205			
MEASURED OUTPUT POWER:	19.32	dBm	=	0.086 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.32	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	-	-	-58.34	3.64	-54.70	74.0
3118.00	H	-	-	-56.44	4.98	-51.46	70.8

Table 7-6. Radiated Spurious Data (Band 13 – Low Channel)

OPERATING FREQUENCY:	782.00	MHz		
CHANNEL:	23230			
MEASURED OUTPUT POWER:	19.32	dBm	=	0.086 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.32	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	-	-	-57.15	3.63	-53.51	72.8
3128.00	H	-	-	-53.70	4.95	-48.75	68.1

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

OPERATING FREQUENCY:	784.50	MHz		
CHANNEL:	23255			
MEASURED OUTPUT POWER:	19.76	dBm	=	0.095 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	32.76	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	-	-	-56.47	3.63	-52.84	72.6
3138.00	H	-	-	-56.13	4.92	-51.20	71.0

Table 7-8. 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	311	269	-60.81	3.79	-57.03	-17.0
1564.00	H	399	308	-60.02	3.80	-56.22	-16.2
1569.00	H	355	320	-61.01	3.82	-57.19	-17.2

Table 7-9. Wideband Radiated Spurious Data (Band 13 – 1559-1610MHz Band)

OPERATING FREQUENCY:	825.50	MHz		
CHANNEL:	20415			
MEASURED OUTPUT POWER:	21.20	dBm	=	0.132 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	3.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	34.20	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]
1651.00	H	248	287	-58.90	3.63	-55.26	76.5
2476.50	H	-	-	-56.42	3.56	-52.85	74.1
3302.00	H	-	-	-56.86	5.82	-51.04	72.2

Table 7-10. Radiated Spurious Data (Band 5 – Low Channel)

OPERATING FREQUENCY:	836.50	MHz		
CHANNEL:	20525			
MEASURED OUTPUT POWER:	21.39	dBm	=	0.138 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	3.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	34.39	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	335	2	-57.49	3.52	-53.97	75.4
2509.50	H	-	-	-55.92	3.59	-52.33	73.7
3346.00	H	-	-	-57.42	5.87	-51.55	72.9

Table 7-11. Radiated Spurious Data (Band 5 – Mid Channel)

OPERATING FREQUENCY:	847.50	MHz		
CHANNEL:	20635			
MEASURED OUTPUT POWER:	20.56	dBm	=	0.114 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	3.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	33.56	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]
1695.00	H	230	336	-58.22	3.41	-54.82	75.4
2542.50	H	-	-	-56.55	3.73	-52.82	73.4
3390.00	H	-	-	-56.75	5.92	-50.84	71.4

Table 7-12. Radiated Spurious Data (Band 5 – High Channel)

OPERATING FREQUENCY:	1712.50	MHz		
CHANNEL:	19975			
MEASURED OUTPUT POWER:	25.51	dBm	=	0.356 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	38.51	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]
3425.00	H	101	219	-49.24	8.15	-41.10	66.6
5137.50	H	-	-	-56.56	10.37	-46.19	71.7
6850.00	H	-	-	-55.25	11.48	-43.78	69.3

Table 7-13. Radiated Spurious Data (Band 4 – Low Channel)

OPERATING FREQUENCY:	1732.50	MHz		
CHANNEL:	20175			
MEASURED OUTPUT POWER:	26.00	dBm	=	0.398 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	$43 + 10 \log_{10} (W)$ =	39.00	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	100	82	-46.31	8.26	-38.05	64.1
5197.50	H	-	-	-56.72	10.41	-46.30	72.3
6930.00	H	-	-	-54.84	11.53	-43.31	69.3

Table 7-14. Radiated Spurious Data (Band 4 – Mid Channel)

OPERATING FREQUENCY:	1752.50	MHz		
CHANNEL:	20375			
MEASURED OUTPUT POWER:	25.40	dBm	=	0.347 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	$43 + 10 \log_{10} (W)$ =	38.40	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]
3505.00	H	186	35	-51.13	8.36	-42.77	68.2
5257.50	H	-	-	-55.83	10.35	-45.47	70.9
7010.00	H	-	-	-54.12	11.58	-42.53	67.9

Table 7-15. Radiated Spurious Data (Band 4 – High Channel)

OPERATING FREQUENCY:	1852.50	MHz		
CHANNEL:	18625			
MEASURED OUTPUT POWER:	26.29	dBm	=	0.426 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	39.29	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	100	222	-44.82	8.42	-36.40	62.7
5557.50	H	-	-	-56.11	10.52	-45.59	71.9
7410.00	H	-	-	-54.50	12.01	-42.49	68.8

Table 7-16. Radiated Spurious Data (Band 2 – Low Channel)

OPERATING FREQUENCY:	1880.00	MHz		
CHANNEL:	18900			
MEASURED OUTPUT POWER:	24.80	dBm	=	0.302 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	5.0	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	37.80	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]
3760.00	H	206	216	-30.71	8.64	-22.08	46.9
5640.00	H	-	-	-55.91	10.62	-45.29	70.1
7520.00	H	-	-	-53.19	12.04	-41.14	65.9

Table 7-17. Radiated Spurious Data (Band 2 – Mid Channel)

OPERATING FREQUENCY:	1907.50	MHz			
CHANNEL:	19175				
MEASURED OUTPUT POWER:	23.75	dBm	=	0.237	W
MODULATION SIGNAL:	QPSK				
BANDWIDTH:	5.0	MHz			
DISTANCE:	3	meters			
LIMIT:	43 + 10 $\log_{10}$ (W) =	36.75	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]
3815.00	H	221	215	-30.67	8.77	-21.90	45.7
5722.50	H	-	-	-56.15	10.71	-45.45	69.2
7630.00	H	-	-	-54.37	12.17	-42.20	66.0

Table 7-18. Radiated Spurious Data (Band 2 – High Channel)

7.8 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

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)	781,999,884	-116	-0.0000148
100 %		- 30	782,000,042	42	0.0000054
100 %		- 20	782,000,017	17	0.0000022
100 %		- 10	781,999,834	-166	-0.0000212
100 %		0	781,999,842	-158	-0.0000202
100 %		+ 10	781,999,938	-62	-0.0000079
100 %		+ 20	782,000,257	257	0.0000329
100 %		+ 30	782,000,360	360	0.0000460
100 %		+ 40	782,000,207	207	0.0000265
100 %		+ 50	782,000,347	347	0.0000444
BATT. ENDPOINT	3.45	+ 20	782,000,010	10	0.0000013

Table 7-19. Frequency Stability Data (Band 13)

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.

Band 13 Frequency Stability Measurements

§2.1055 §27.54

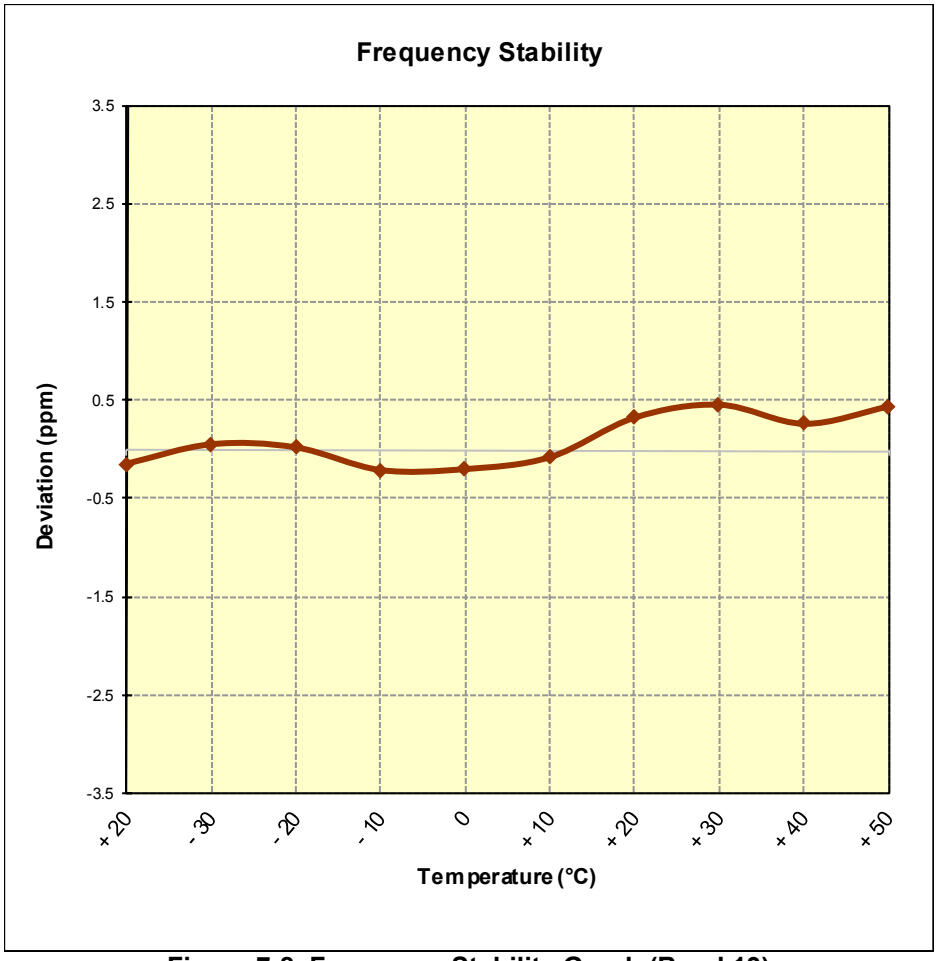


Figure 7-8. Frequency Stability Graph (Band 13)

Band 5 Frequency Stability Measurements

§2.1055 §22.355

OPERATING FREQUENCY:	836,500,000	Hz
CHANNEL:	20525	
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)	836,499,927	-73	-0.0000087
100 %		- 30	836,500,111	111	0.0000133
100 %		- 20	836,499,804	-196	-0.0000234
100 %		- 10	836,500,170	170	0.0000203
100 %		0	836,500,264	264	0.0000316
100 %		+ 10	836,499,797	-203	-0.0000243
100 %		+ 20	836,500,024	24	0.0000029
100 %		+ 30	836,499,997	-3	-0.0000004
100 %		+ 40	836,500,073	73	0.0000087
100 %		+ 50	836,500,199	199	0.0000238
BATT. ENDPOINT	3.45	+ 20	836,500,045	45	0.0000054

Table 7-20. Frequency Stability Data (Band 5)

Band 5 Frequency Stability Measurements

§2.1055 §22.355

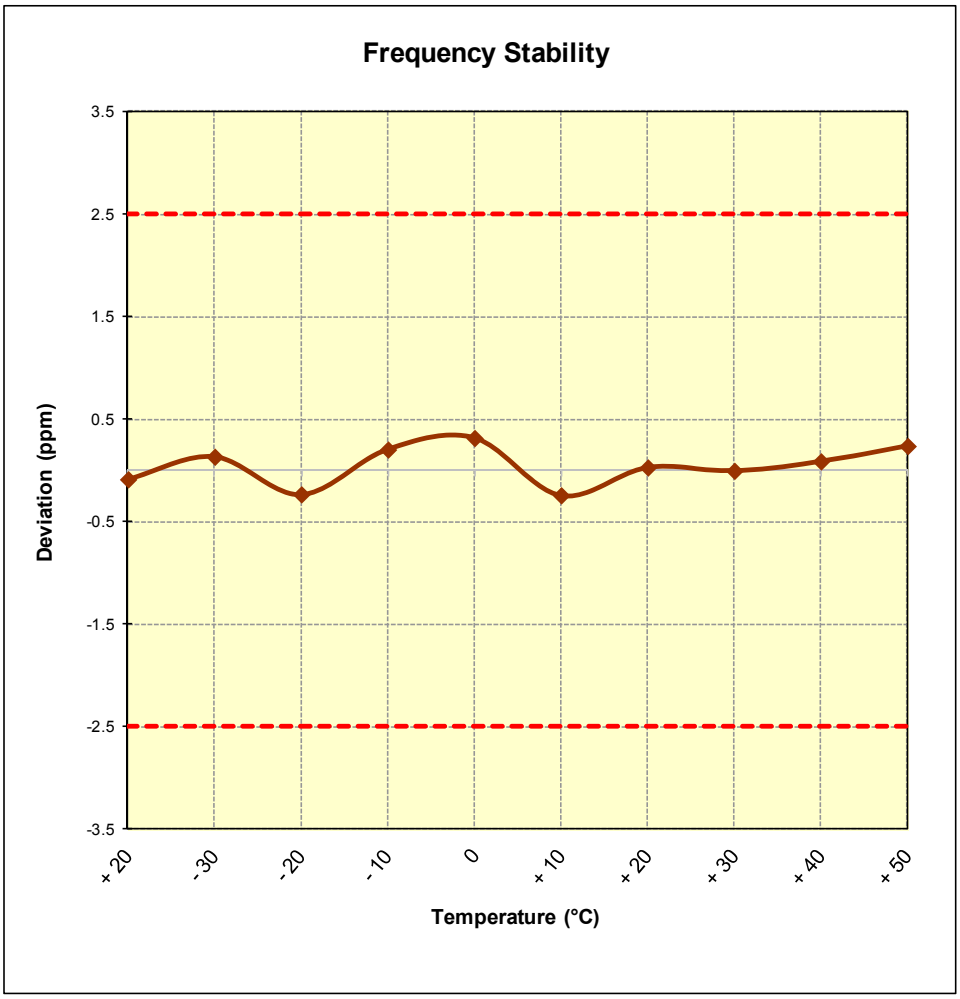


Figure 7-9. Frequency Stability Graph (Band 5)

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)	1,732,500,056	56	0.0000032
100 %		- 30	1,732,499,941	-59	-0.0000034
100 %		- 20	1,732,499,715	-285	-0.0000165
100 %		- 10	1,732,500,031	31	0.0000018
100 %		0	1,732,500,166	166	0.0000096
100 %		+ 10	1,732,500,001	1	0.0000001
100 %		+ 20	1,732,499,711	-289	-0.0000167
100 %		+ 30	1,732,499,866	-134	-0.0000077
100 %		+ 40	1,732,499,704	-296	-0.0000171
100 %		+ 50	1,732,500,325	325	0.0000188
BATT. ENDPOINT	3.45	+ 20	1,732,499,710	-290	-0.0000167

Table 7-21. 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.

Band 4 Frequency Stability Measurements

§2.1055 §§27.54

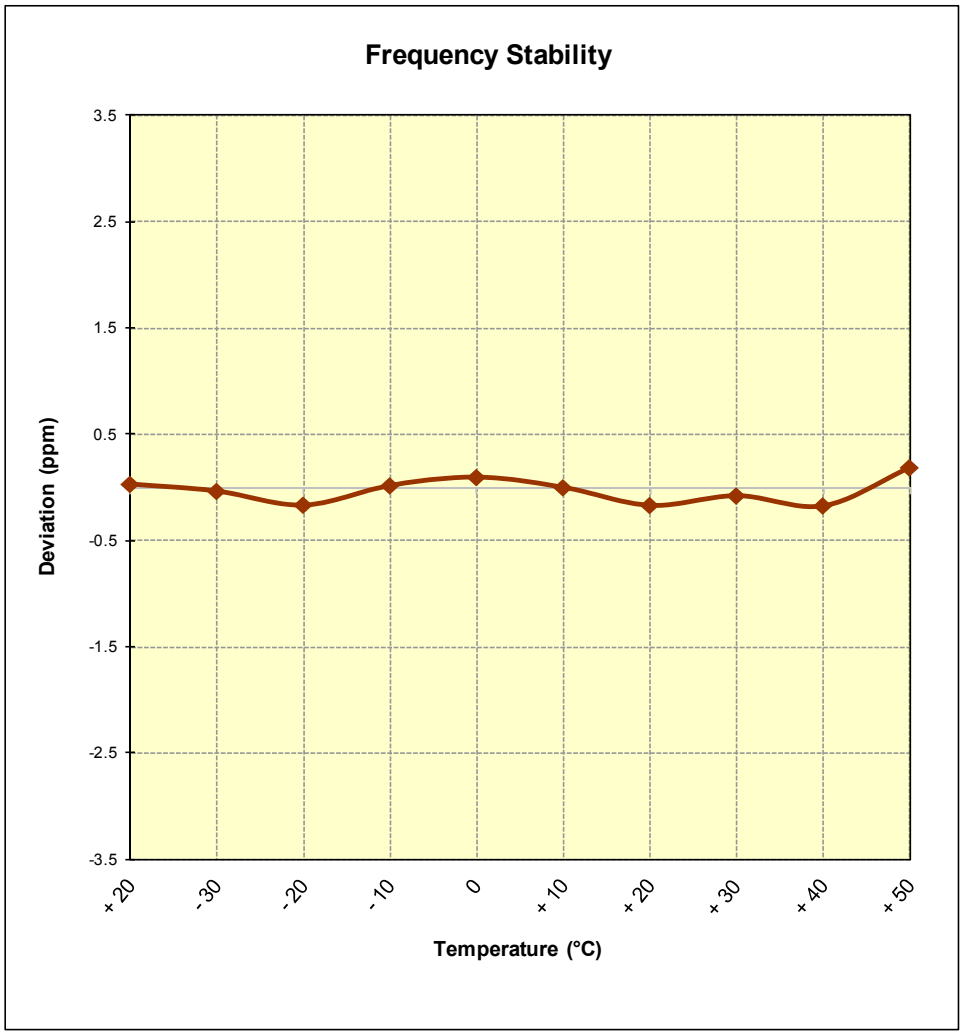


Figure 7-10. Frequency Stability Graph (Band 4)

Band 2 Frequency Stability Measurements

§2.1055 §24.235

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	18900	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	1,880,000,141	141	0.0000075
100 %		- 30	1,879,999,712	-288	-0.0000153
100 %		- 20	1,879,999,917	-83	-0.0000044
100 %		- 10	1,880,000,339	339	0.0000180
100 %		0	1,879,999,760	-240	-0.0000128
100 %		+ 10	1,880,000,155	155	0.0000082
100 %		+ 20	1,879,999,920	-80	-0.0000043
100 %		+ 30	1,880,000,028	28	0.0000015
100 %		+ 40	1,879,999,867	-133	-0.0000071
100 %		+ 50	1,880,000,145	145	0.0000077
BATT. ENDPOINT	3.45	+ 20	1,880,000,075	75	0.0000040

Table 7-22. Frequency Stability Data (Band 2)

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.

Band 2 Frequency Stability Measurements

§2.1055 §24.235

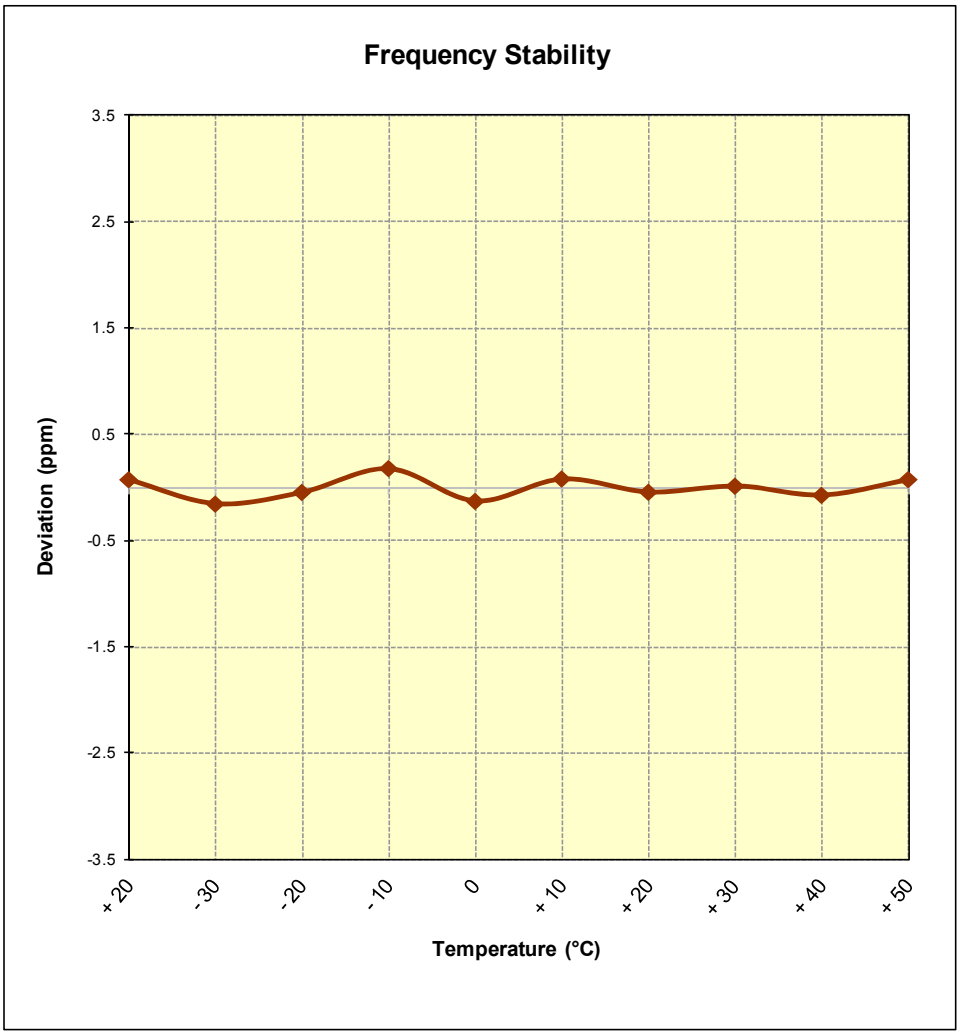


Figure 7-11. Frequency Stability Graph (Band 2)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFVS835** complies with all the requirements of Parts 22, 24, & 27 of the FCC rules for LTE operation only.