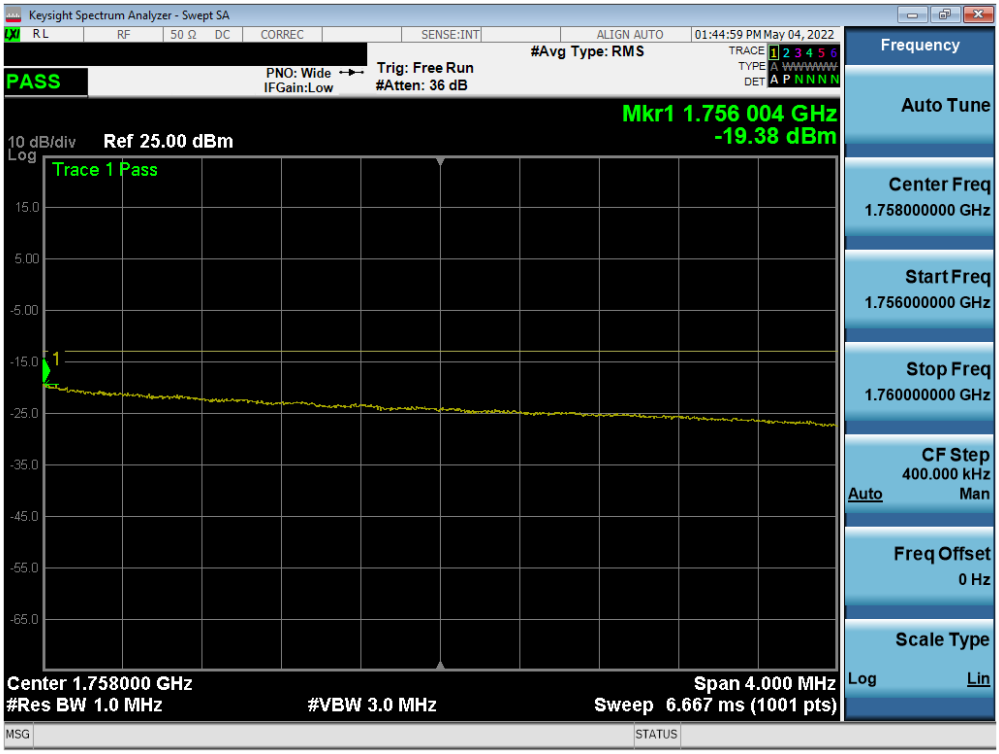
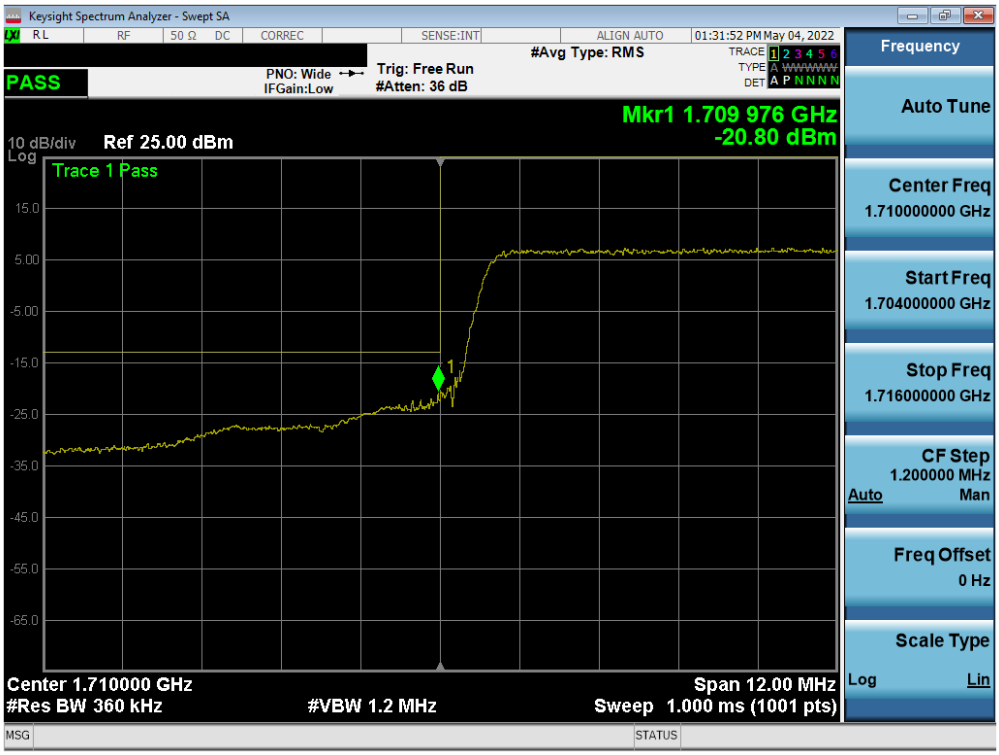
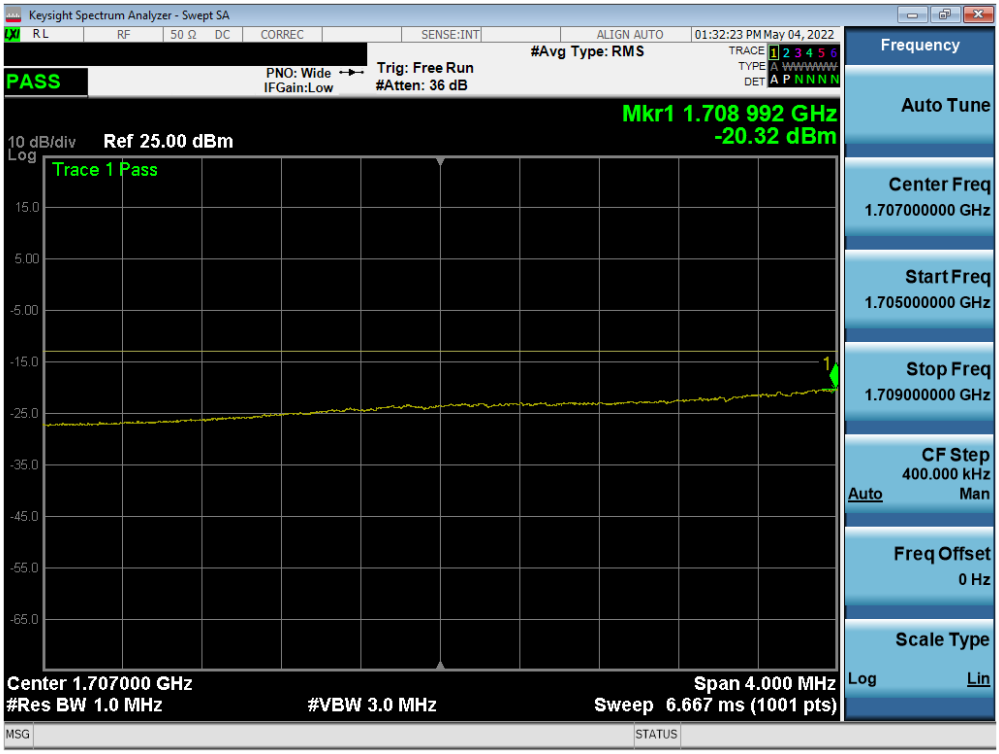
Plot 7-94. Upper Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)



Plot 7-95. Upper Extended Band Edge Plot (LTE Band 4 - 10MHz QPSK – Full RB)

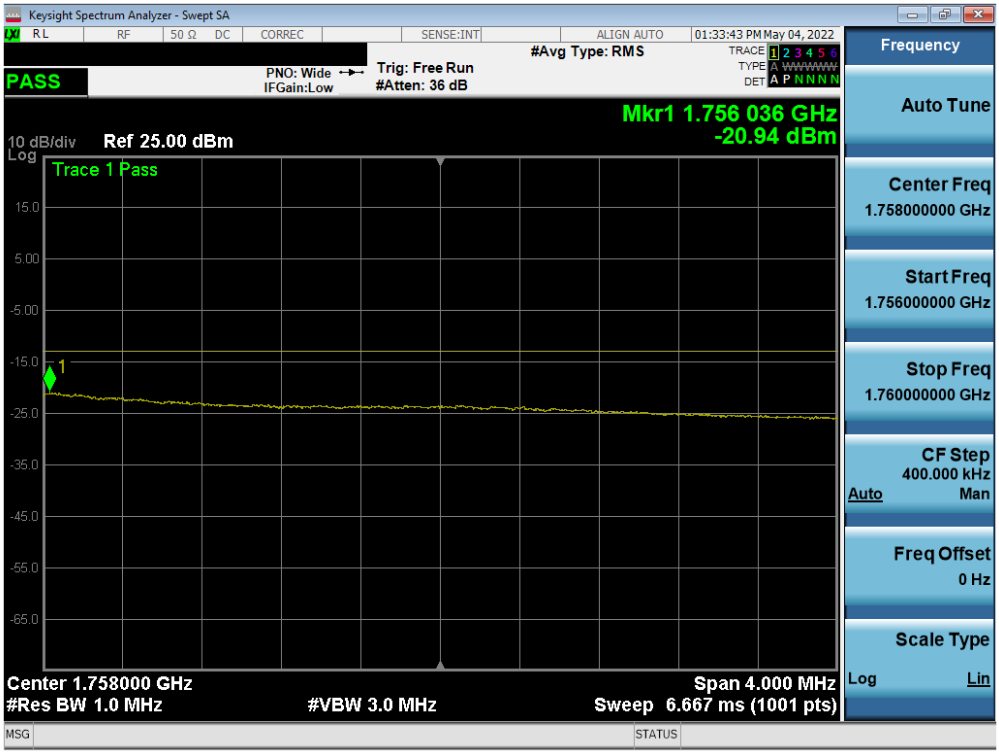


Plot 7-96. Lower Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

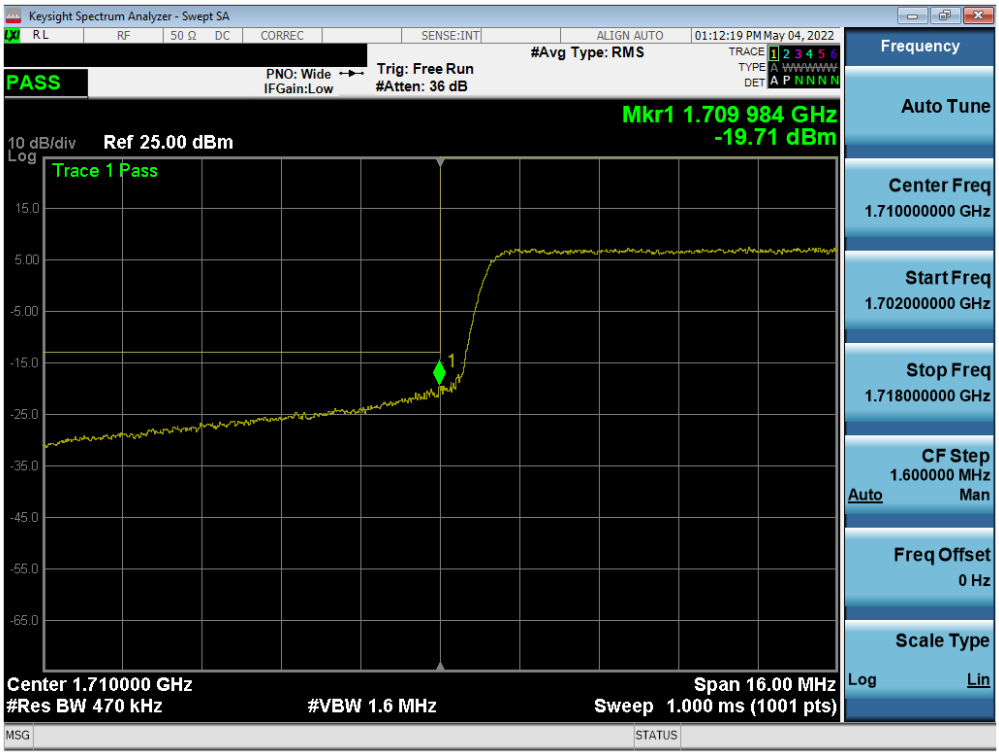


Plot 7-97. Lower Extended Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)

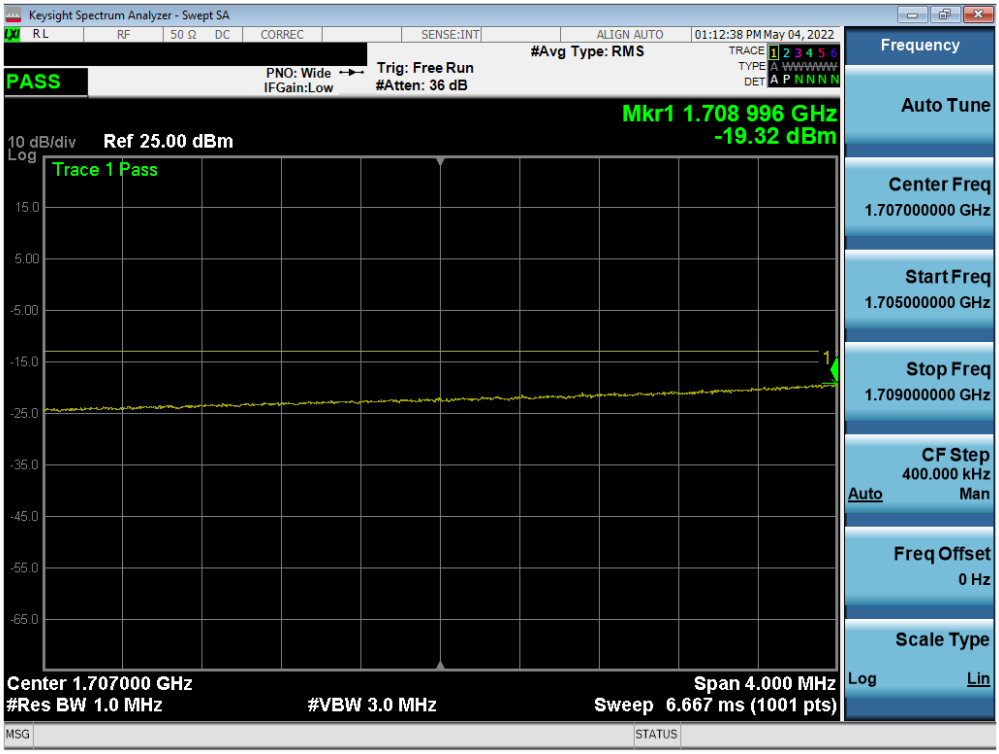
Plot 7-98. Upper Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)



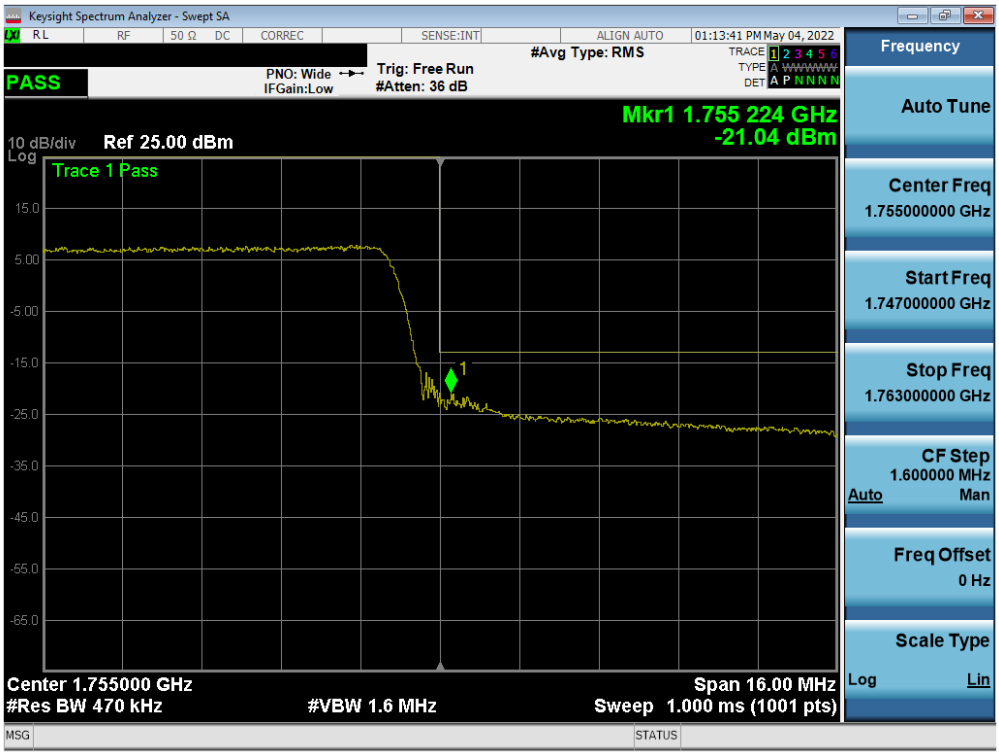
Plot 7-99. Upper Extended Band Edge Plot (LTE Band 4 - 15MHz QPSK – Full RB)



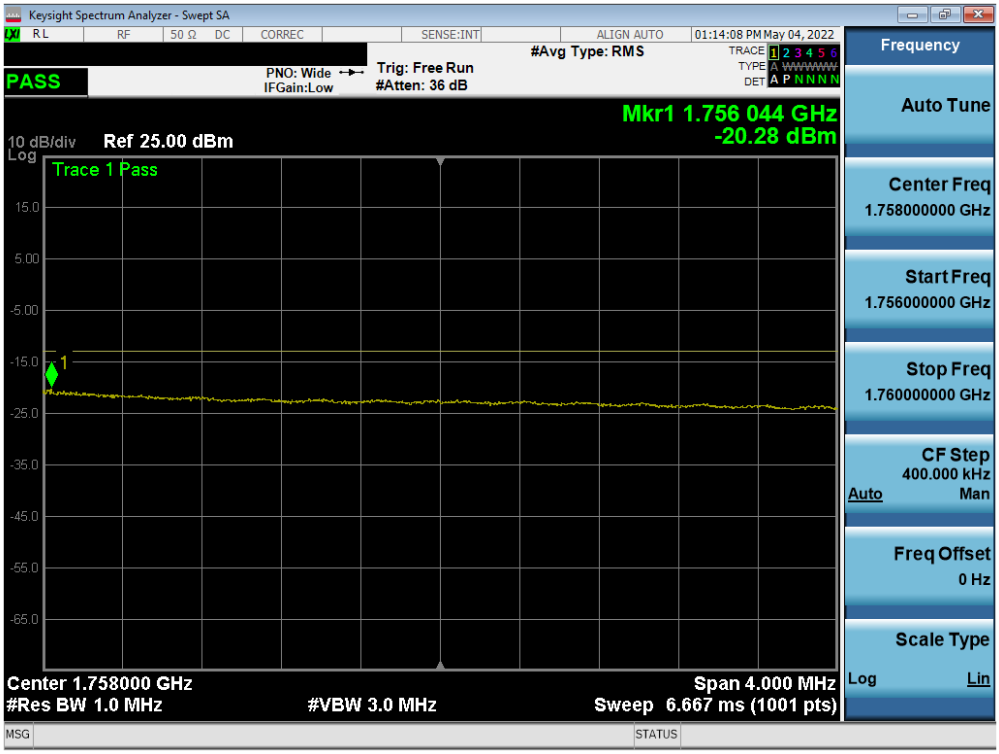
Plot 7-100. Lower Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)



Plot 7-101. Lower Extended Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

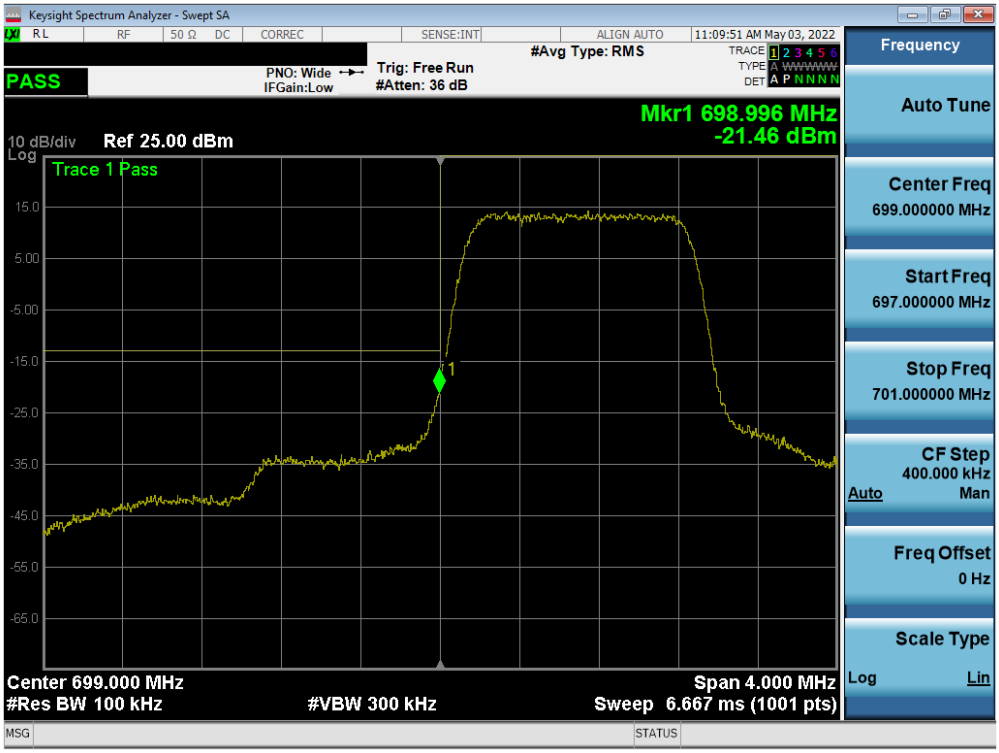


Plot 7-102. Upper Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)



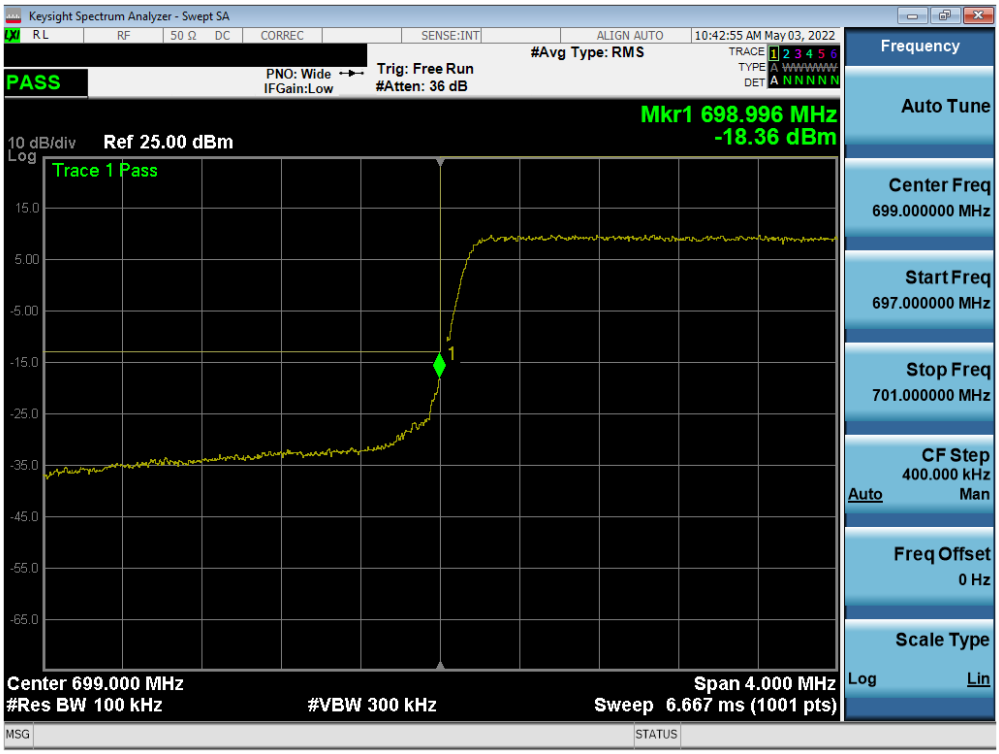
Plot 7-103. Upper Extended Band Edge Plot (LTE Band 4 - 20MHz QPSK – Full RB)

LTE Band 12

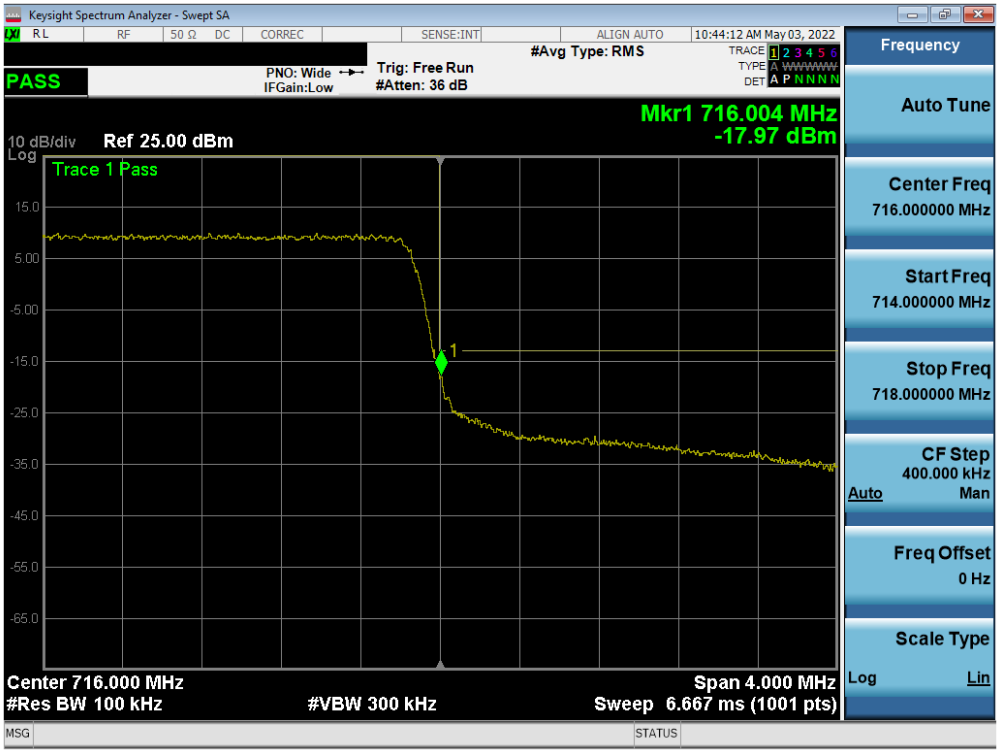


Plot 7-104. Lower Band Edge Plot (LTE Band 12 – 1.4MHz QPSK – Full RB)

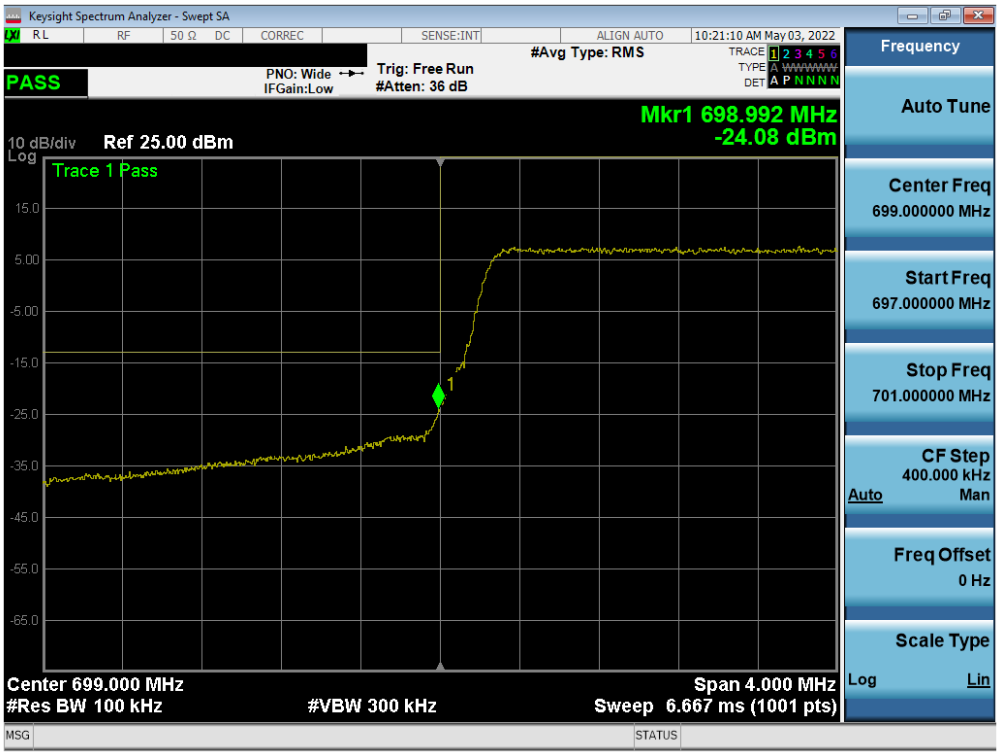
Plot 7-105. Upper Band Edge Plot (LTE Band 12 – 1.4MHz QPSK – Full RB)



Plot 7-106. Lower Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)

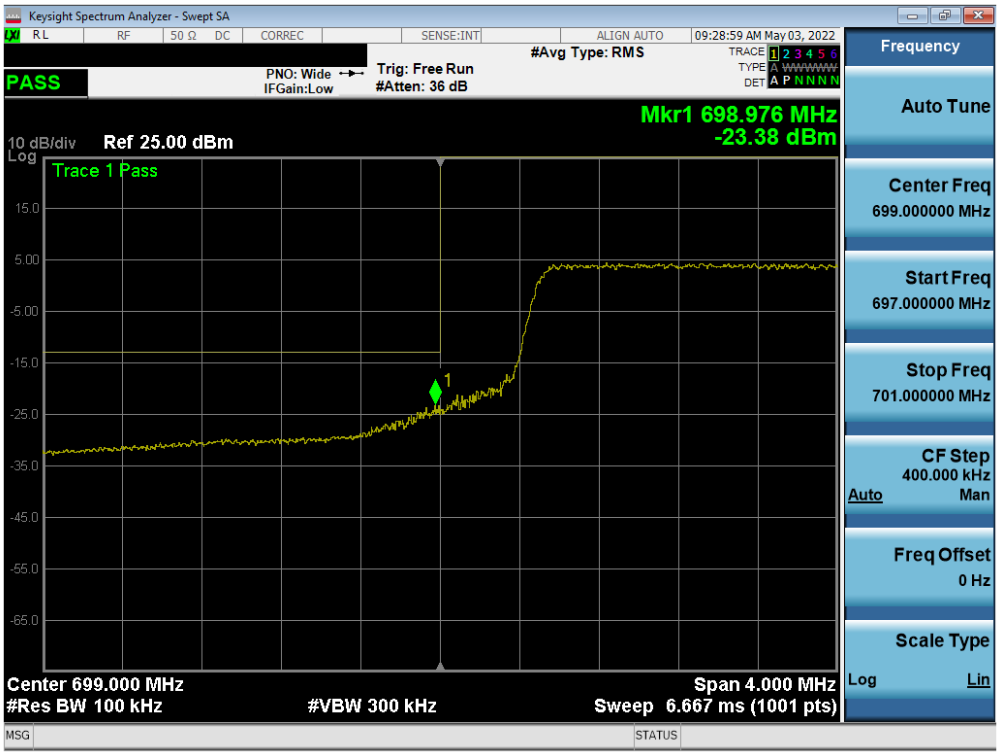


Plot 7-107. Upper Band Edge Plot (LTE Band 12 - 3MHz QPSK – Full RB)

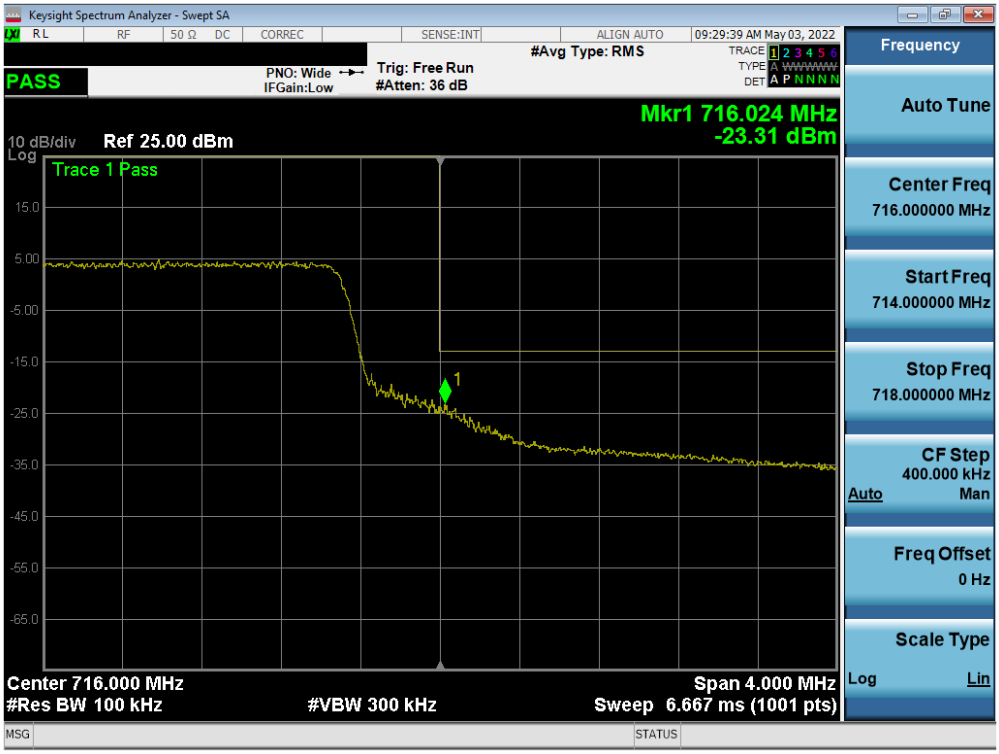


Plot 7-108. Lower Band Edge Plot (LTE Band 12 - 5MHz QPSK – Full RB)

Plot 7-109. Upper Band Edge Plot (LTE Band 12 - 5MHz QPSK – Full RB)

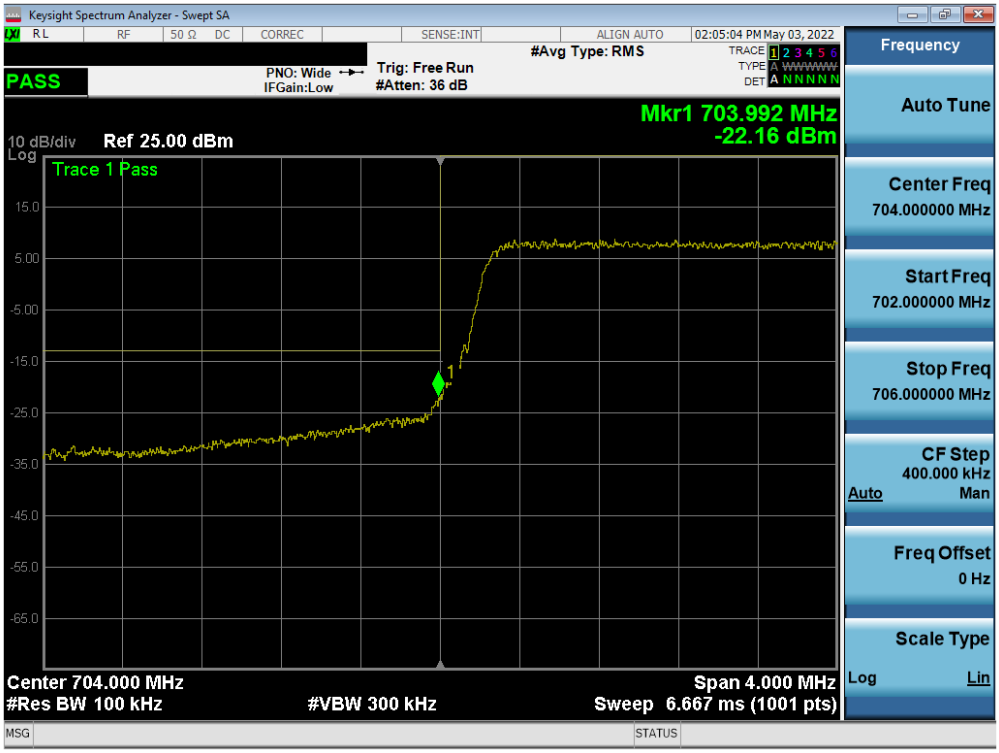


Plot 7-110. Lower Band Edge Plot (LTE Band 12 - 10MHz QPSK – Full RB)



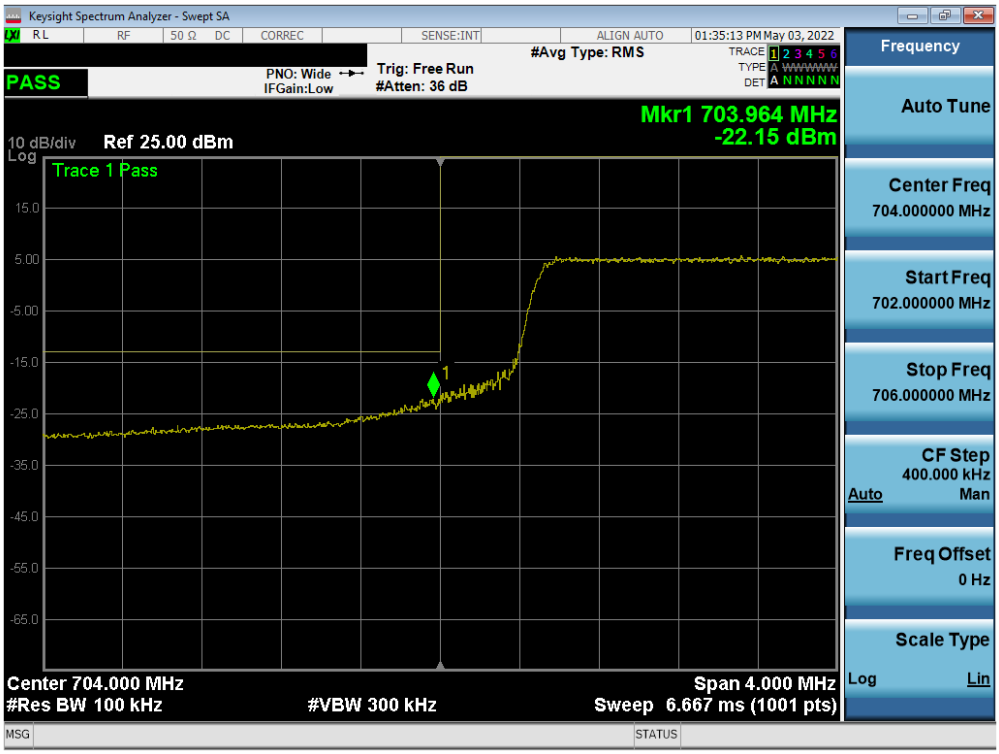
Plot 7-111. Upper Band Edge Plot (LTE Band 12 - 10MHz QPSK – Full RB)

LTE Band 17

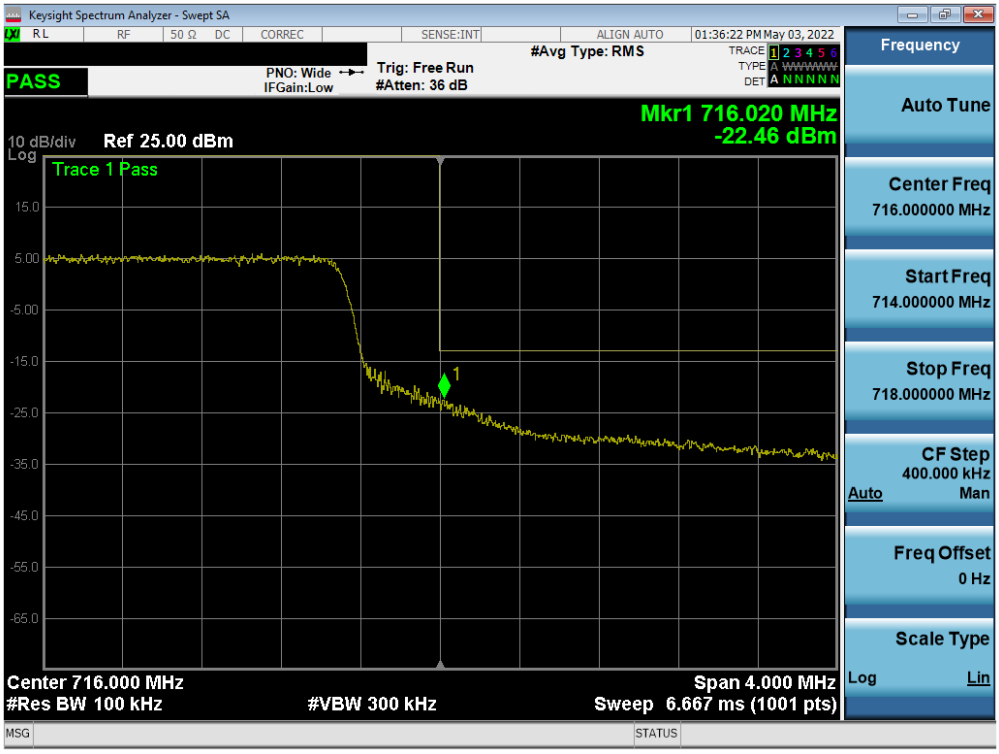


Plot 7-112. Lower Band Edge Plot (LTE Band 17 - 5MHz QPSK – Full RB)

Plot 7-113. Upper Band Edge Plot (LTE Band 17 - 5MHz QPSK – Full RB)



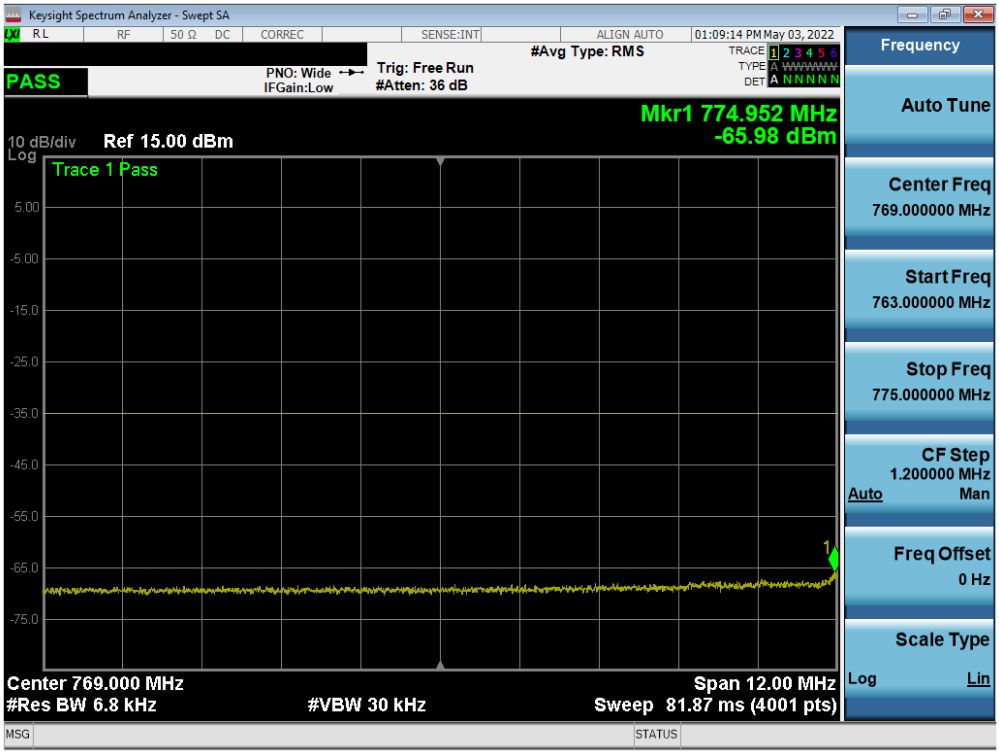
Plot 7-114. Lower Band Edge Plot (LTE Band 17 - 10MHz QPSK – Full RB)



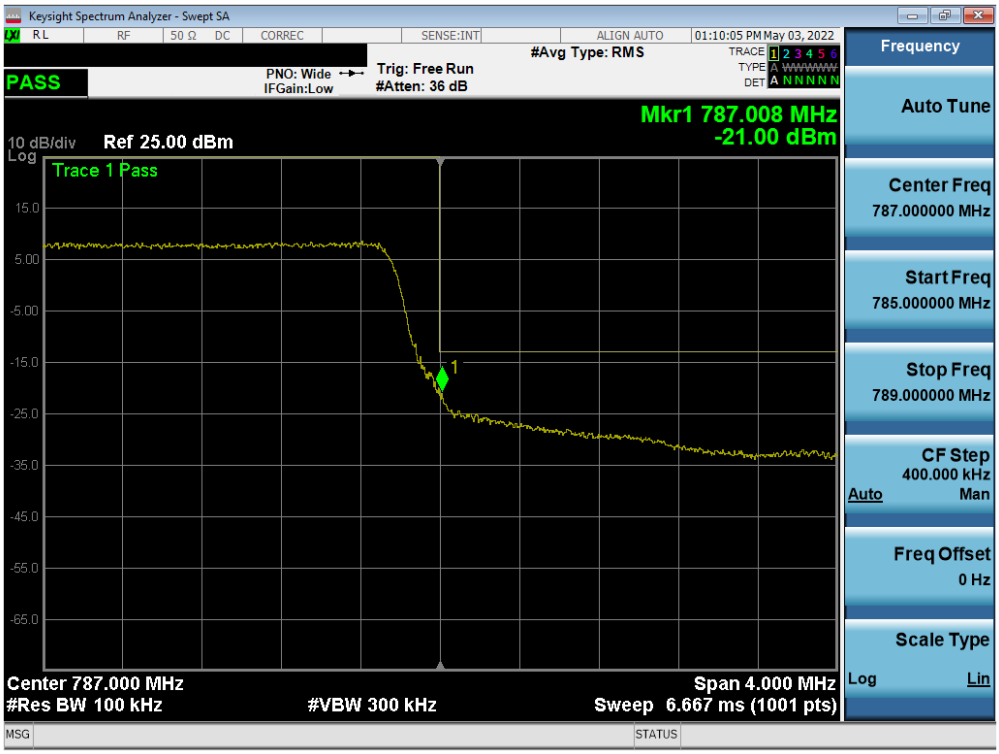
Plot 7-115. Upper Band Edge Plot (LTE Band 17 - 10MHz QPSK – Full RB)

LTE Band 13

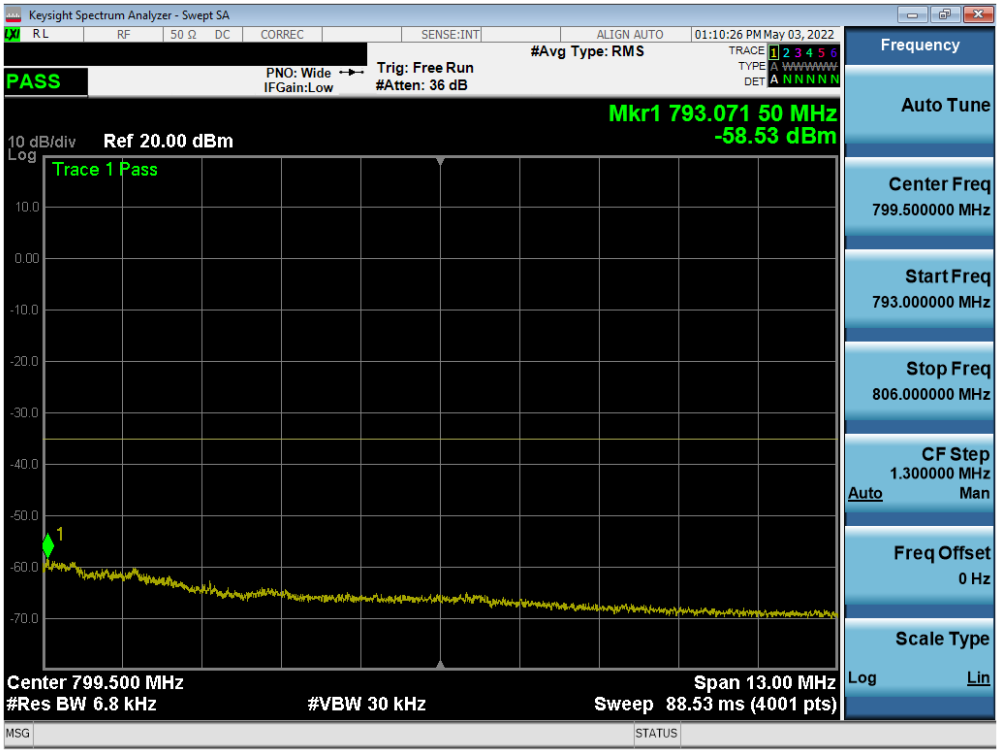
Plot 7-116. Lower Band Edge Plot (LTE Band 13 - 5MHz QPSK – Full RB)



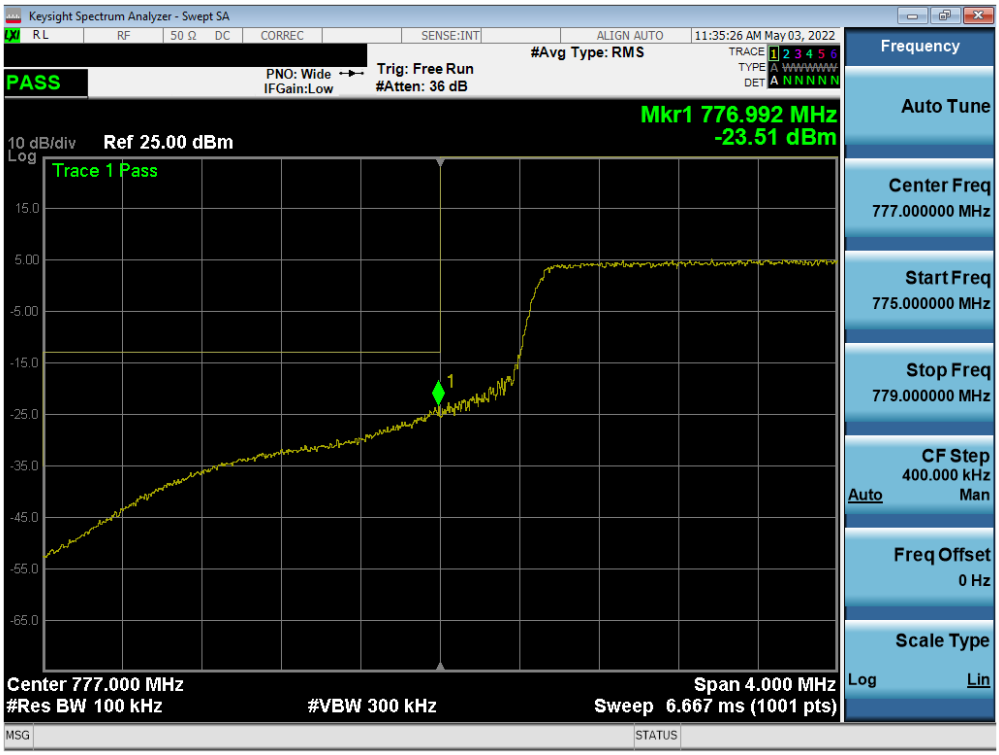
Plot 7-117. Lower Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)



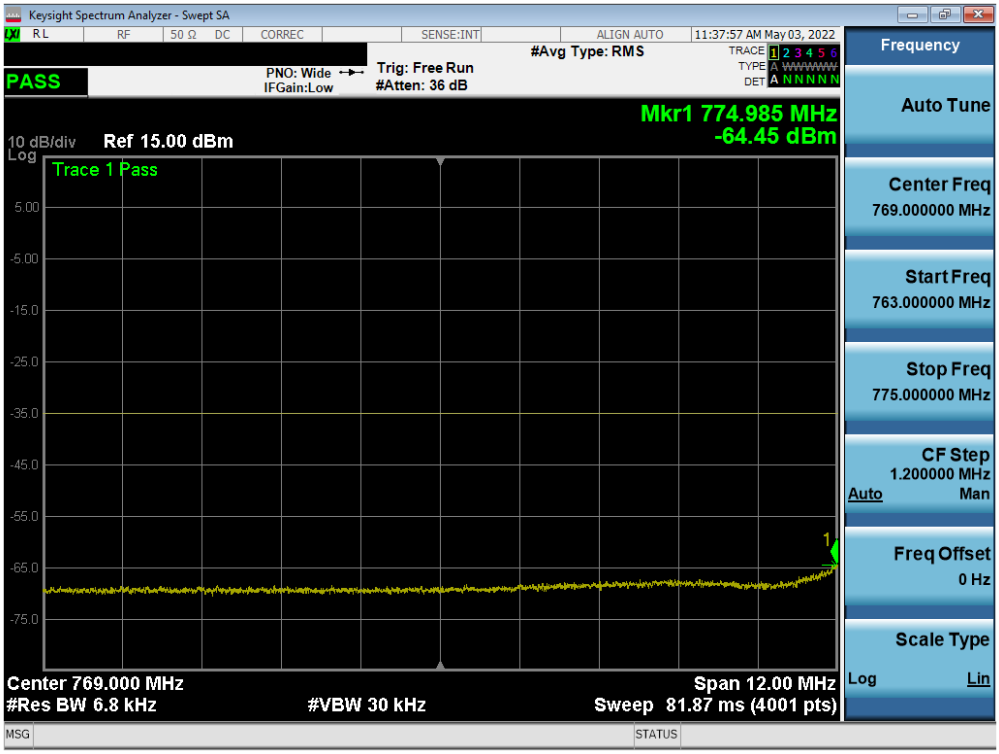
Plot 7-118. Upper Band Edge Plot (LTE Band 13 - 5MHz QPSK – Full RB)



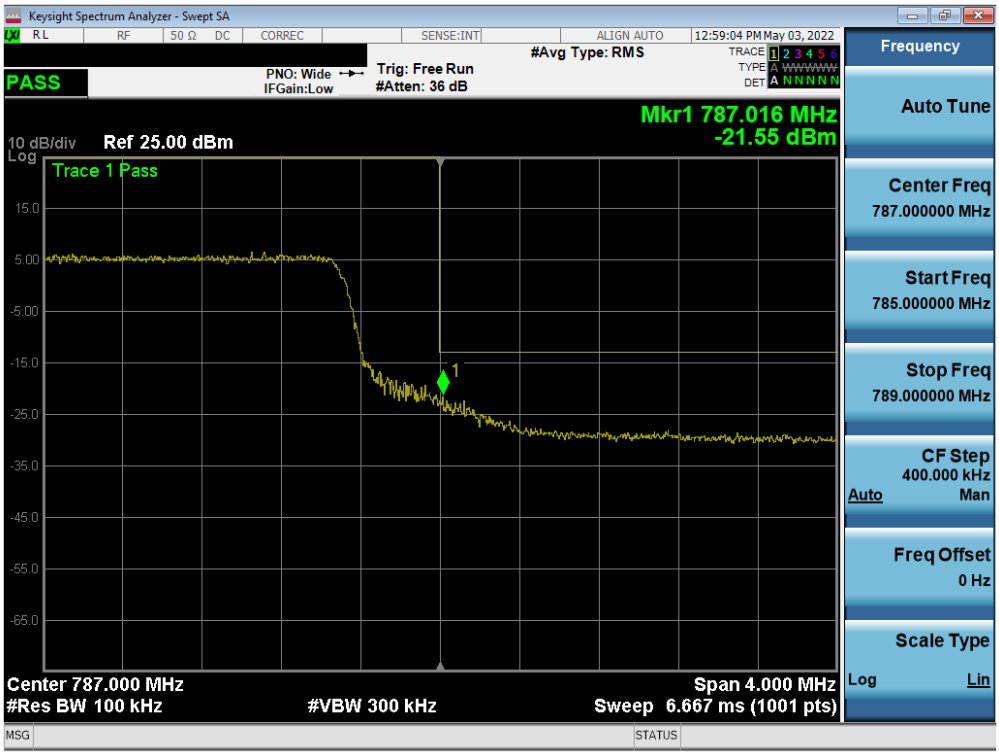
Plot 7-119. Upper Emission Mask Plot (LTE Band 13 - 5MHz QPSK – Full RB)



Plot 7-120. Lower Band Edge Plot (LTE Band 13 - 10MHz QPSK – Full RB)



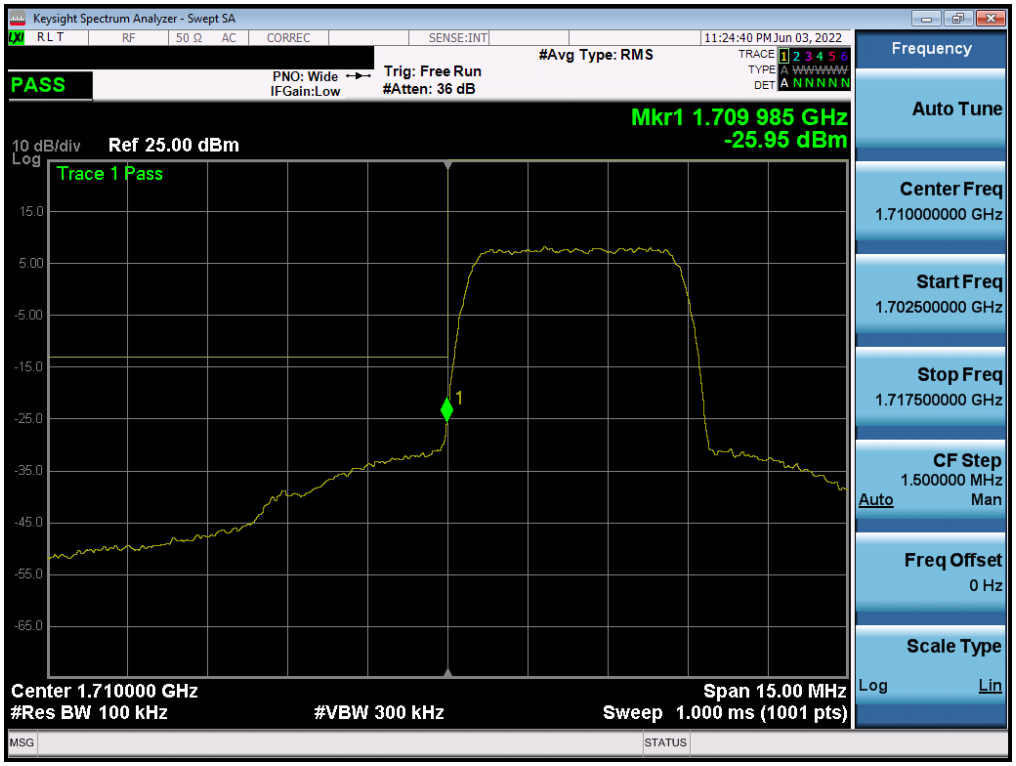
Plot 7-121. Lower Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)



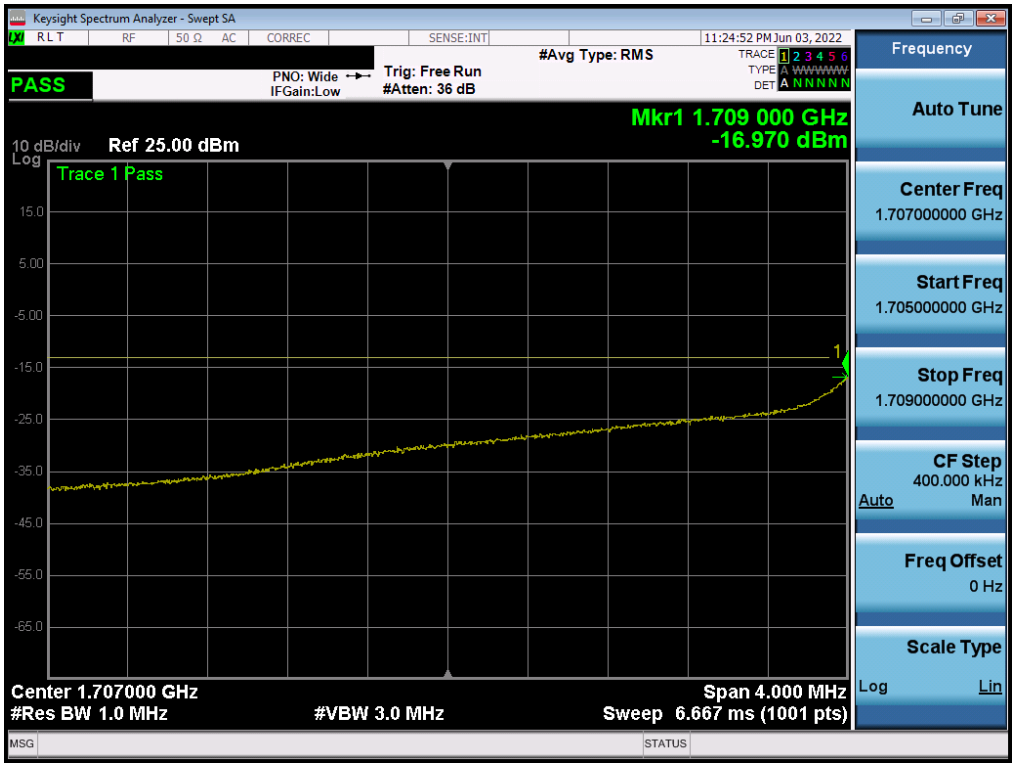
Plot 7-122. Upper Band Edge Plot (LTE Band 13 - 10MHz QPSK – Full RB)

Plot 7-123. Upper Emission Mask Plot (LTE Band 13 - 10MHz QPSK – Full RB)

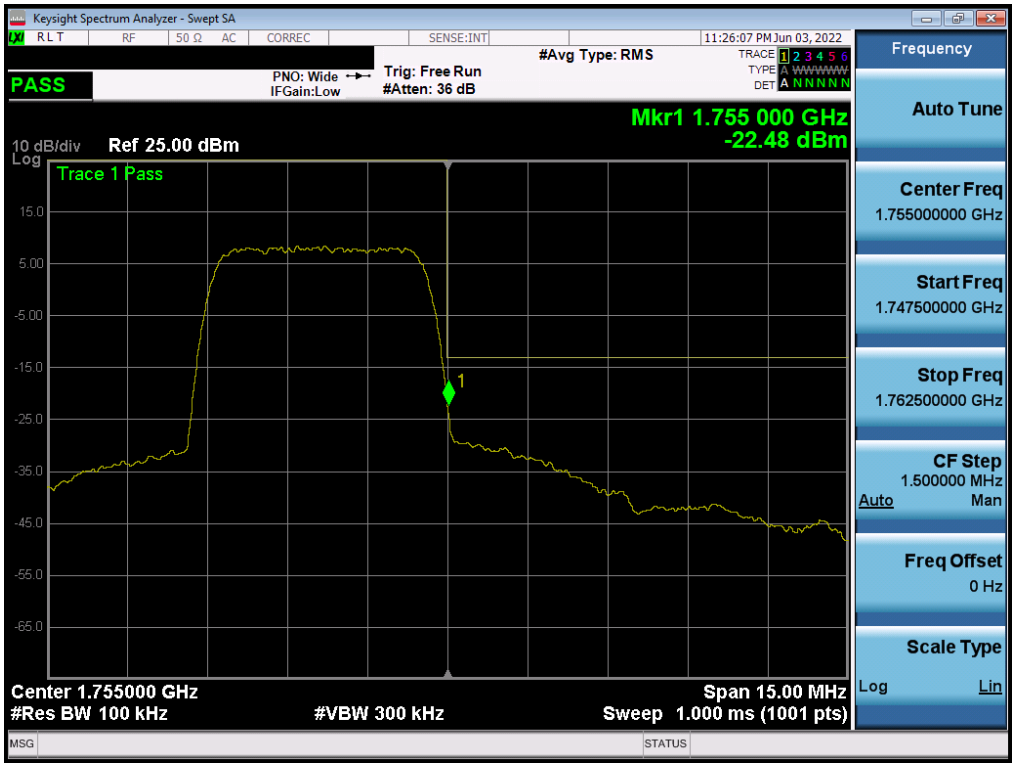
WCDMA AWS



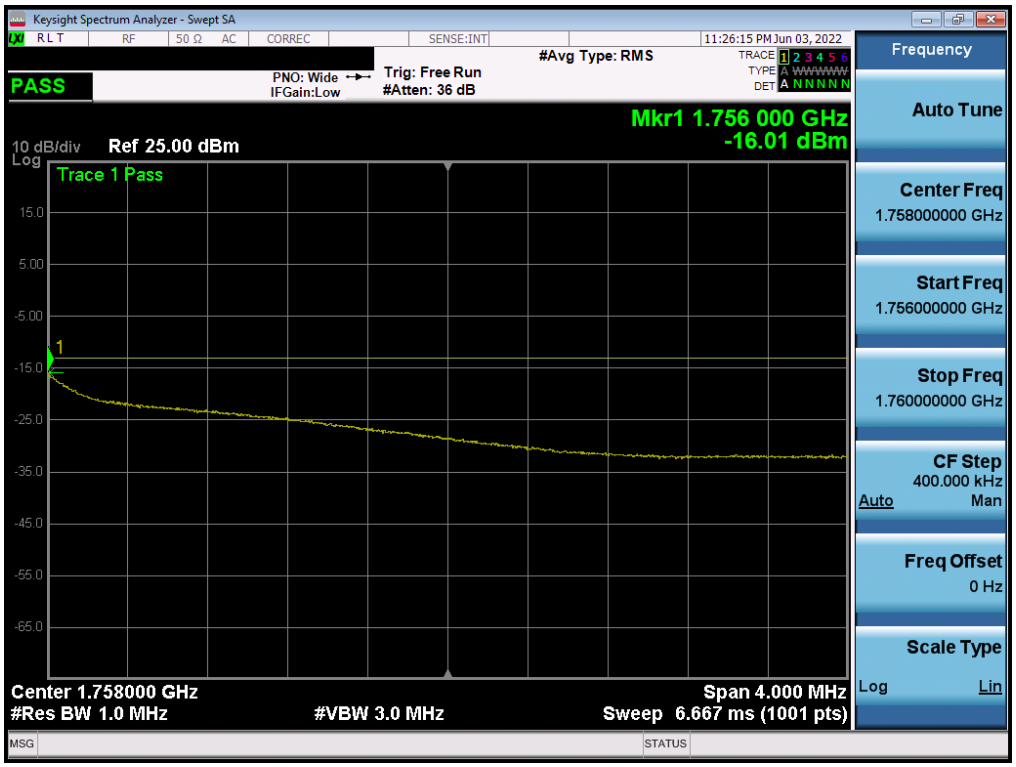
Plot 7-124. Lower Band Edge Plot (WCDMA AWS – Ch. 1312)



Plot 7-125. Lower Extended Band Edge Plot (WCDMA AWS – Ch. 1312)



Plot 7-126. Upper Band Edge Plot (WCDMA AWS – Ch. 1513)



Plot 7-127. Upper Extended Band Edge Plot (WCDMA AWS – Ch. 1513)

7.5 Peak-Average Ratio

§27.50(d)(5)

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 v03r01 – Section 5.7.1

Test Settings

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

Test Setup

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

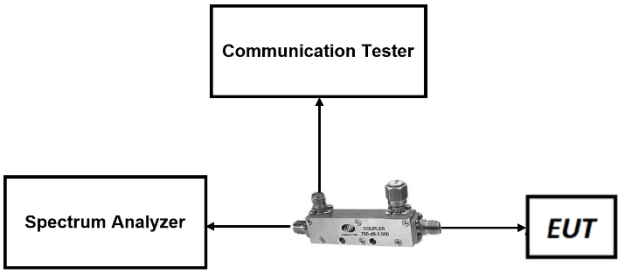
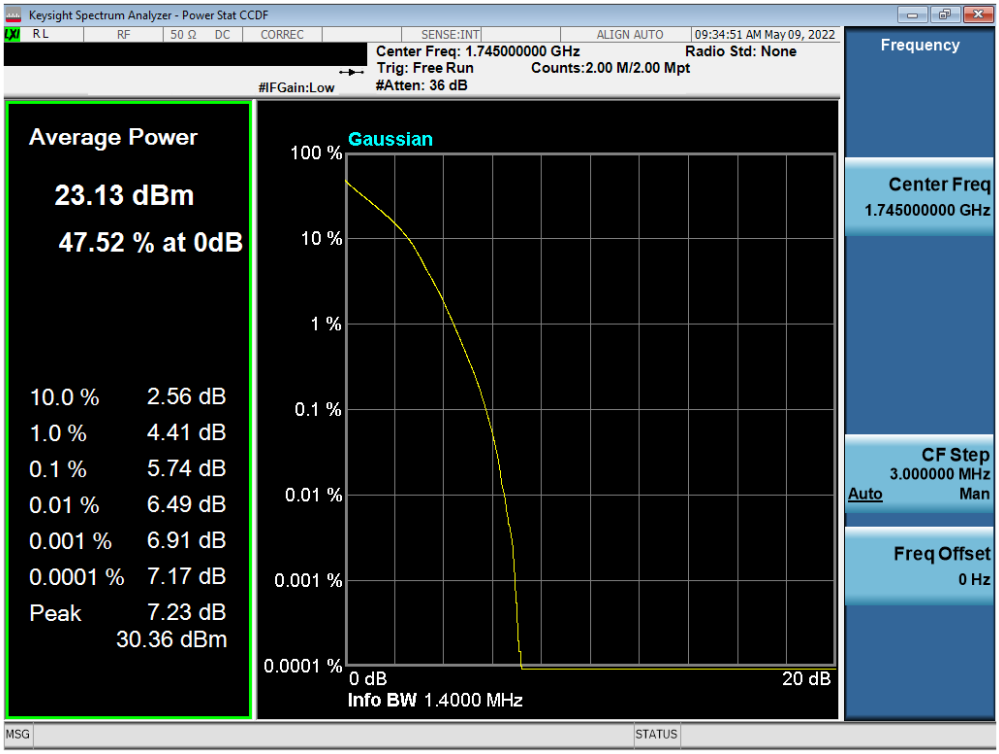


Figure 7-4. Test Instrument & Measurement Setup

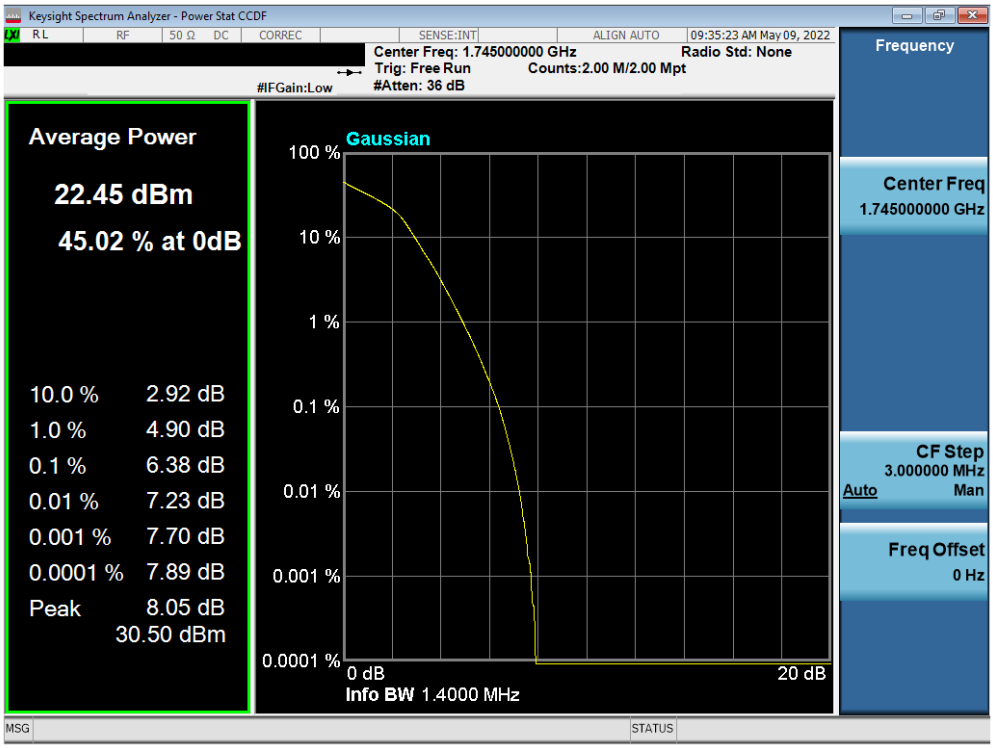
Test Notes

None.

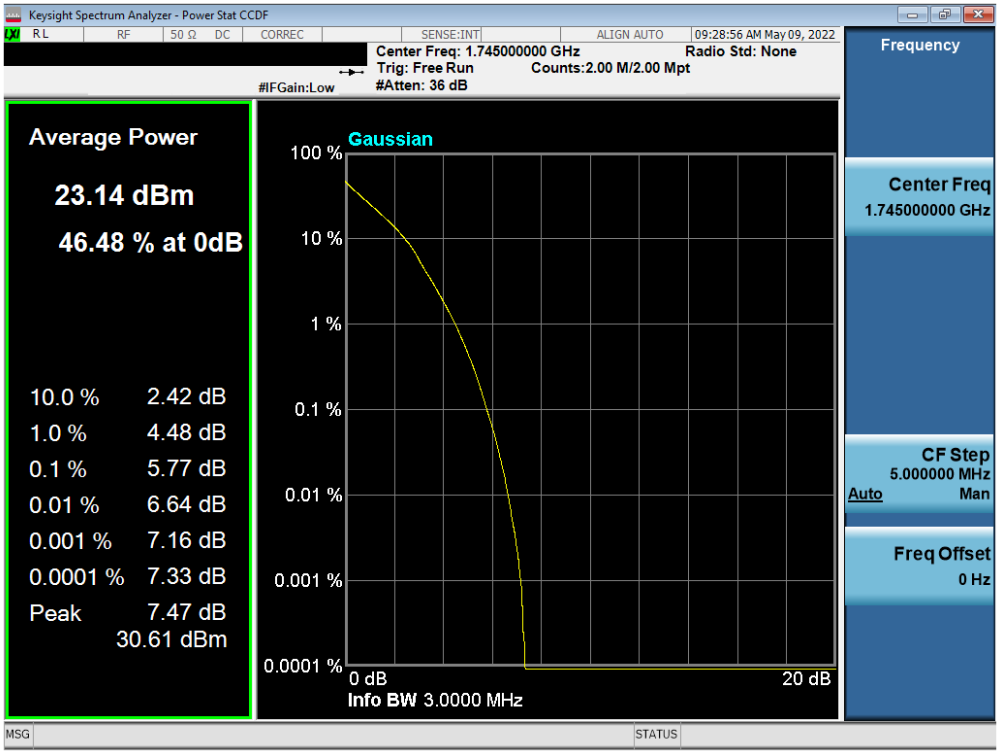
LTE Band 66



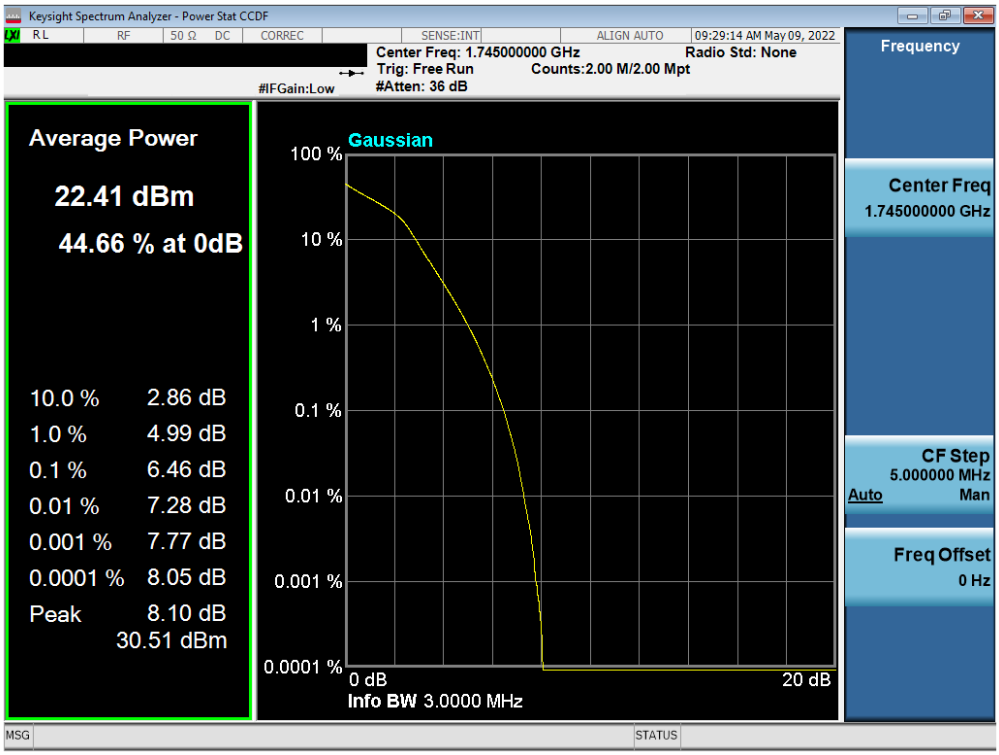
Plot 7-128. PAR Plot (LTE Band 66 - 1.4MHz QPSK - Full RB)



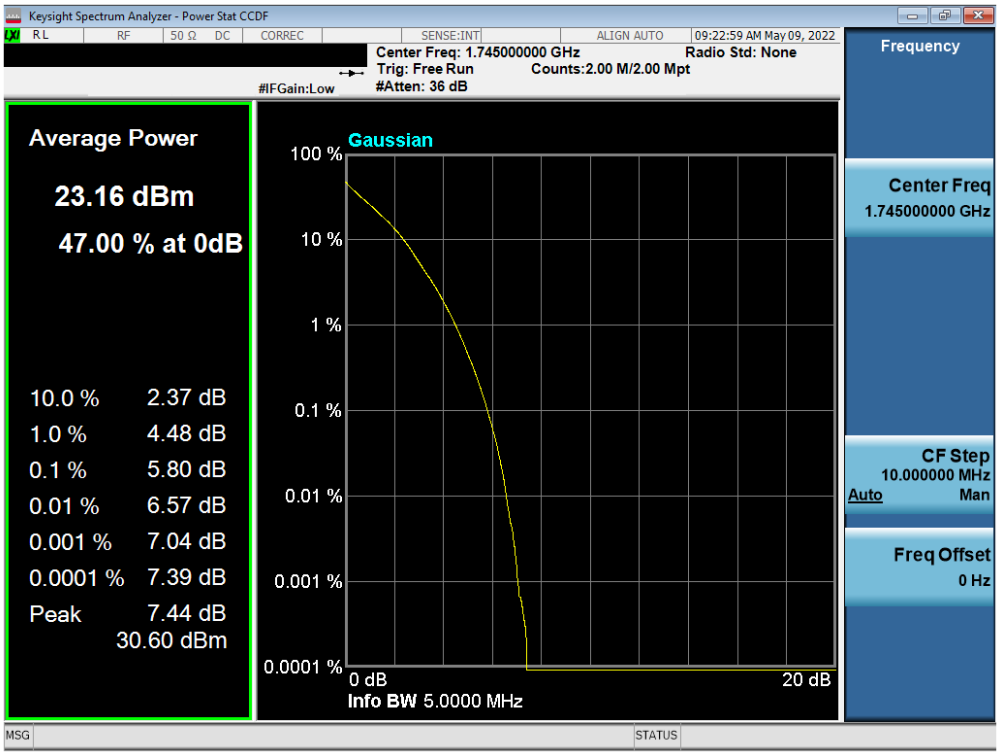
Plot 7-129. PAR Plot (LTE Band 66 - 1.4MHz 16-QAM - Full RB)



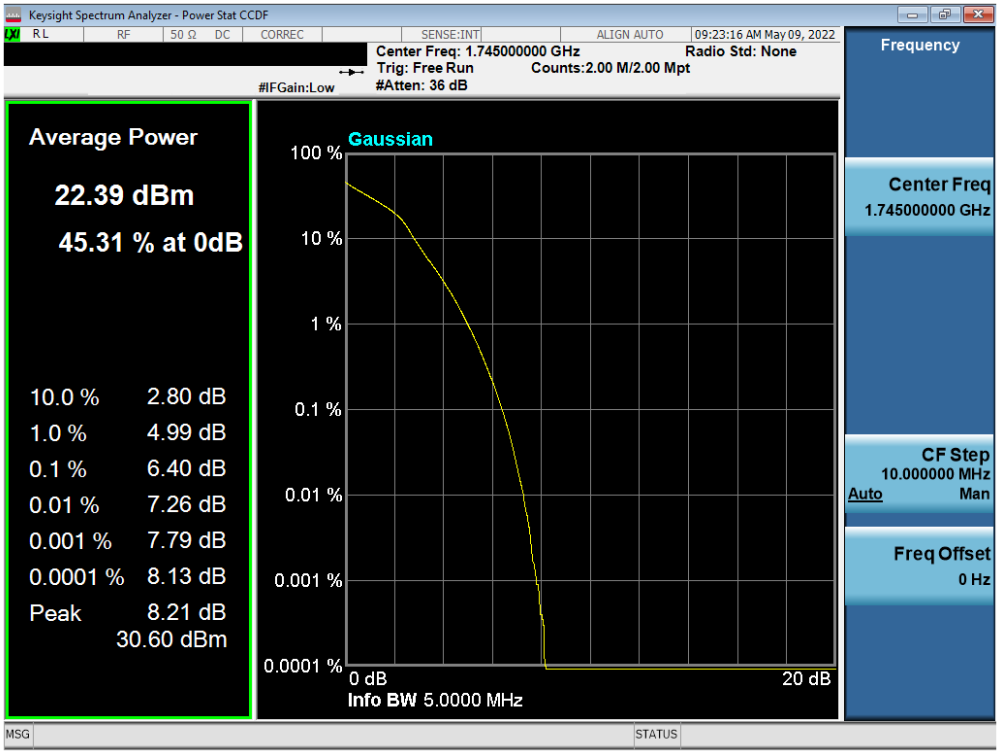
Plot 7-130. PAR Plot (LTE Band 66 - 3MHz QPSK - Full RB)



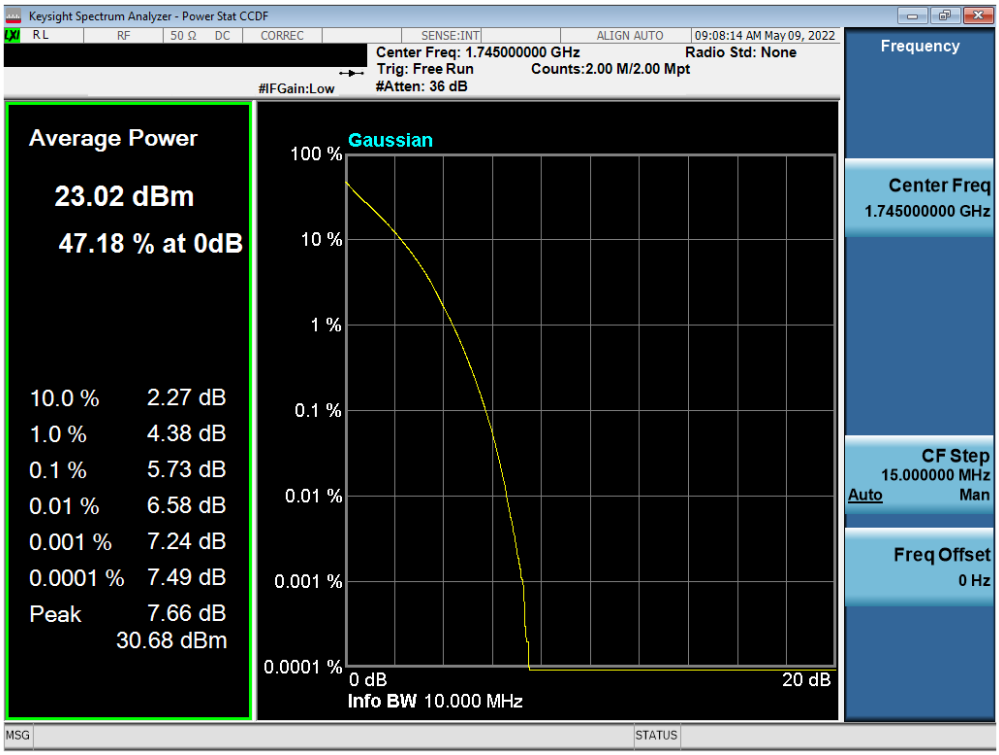
Plot 7-131. PAR Plot (LTE Band 66 - 3MHz 16-QAM - Full RB)



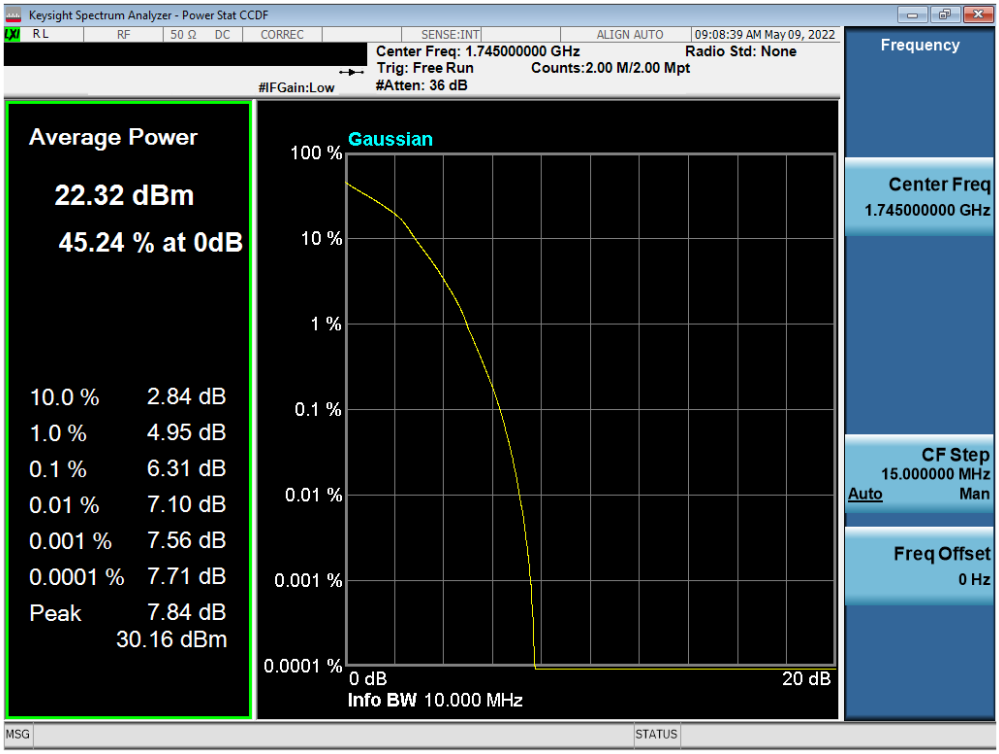
Plot 7-132. PAR Plot (LTE Band 66 - 5MHz QPSK - Full RB)



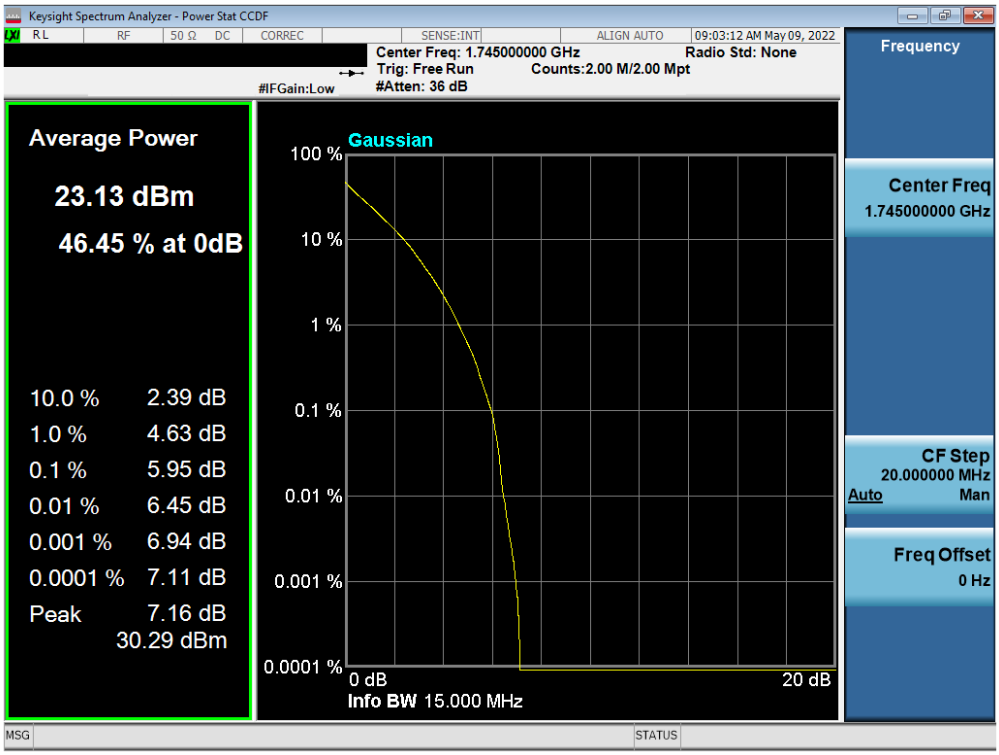
Plot 7-133. PAR Plot (LTE Band 66 - 5MHz 16-QAM - Full RB)



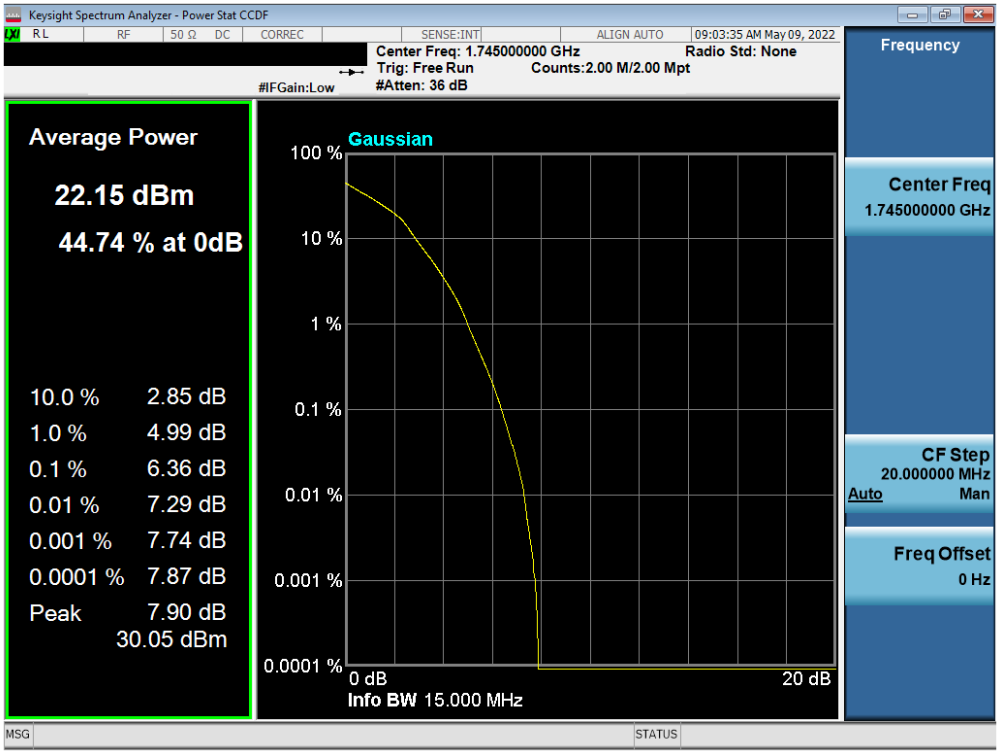
Plot 7-134. PAR Plot (LTE Band 66 - 10MHz QPSK - Full RB)



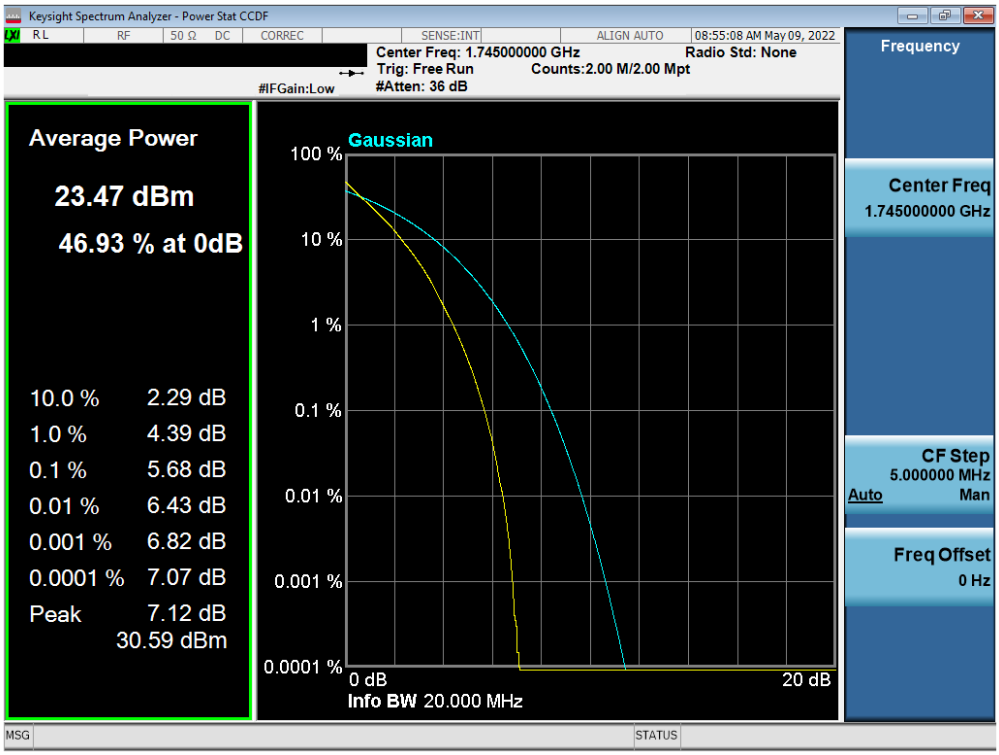
Plot 7-135. PAR Plot (LTE Band 66 - 10MHz 16-QAM - Full RB)



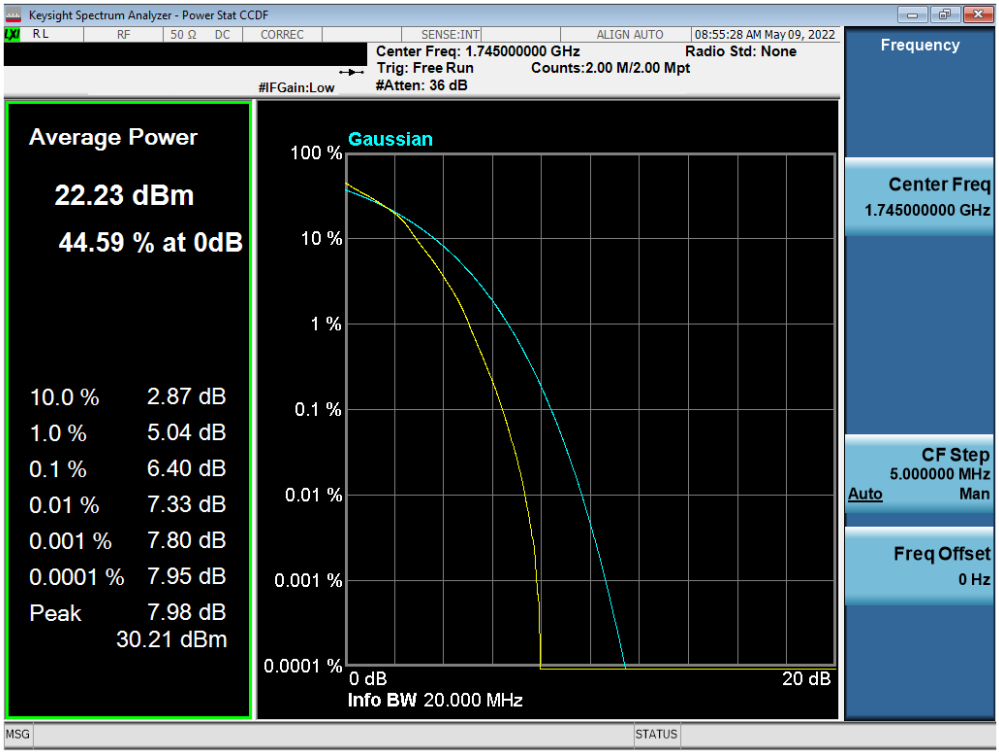
Plot 7-136. PAR Plot (LTE Band 66 - 15MHz QPSK - Full RB)



Plot 7-137. PAR Plot (LTE Band 66 - 15MHz 16-QAM - Full RB)

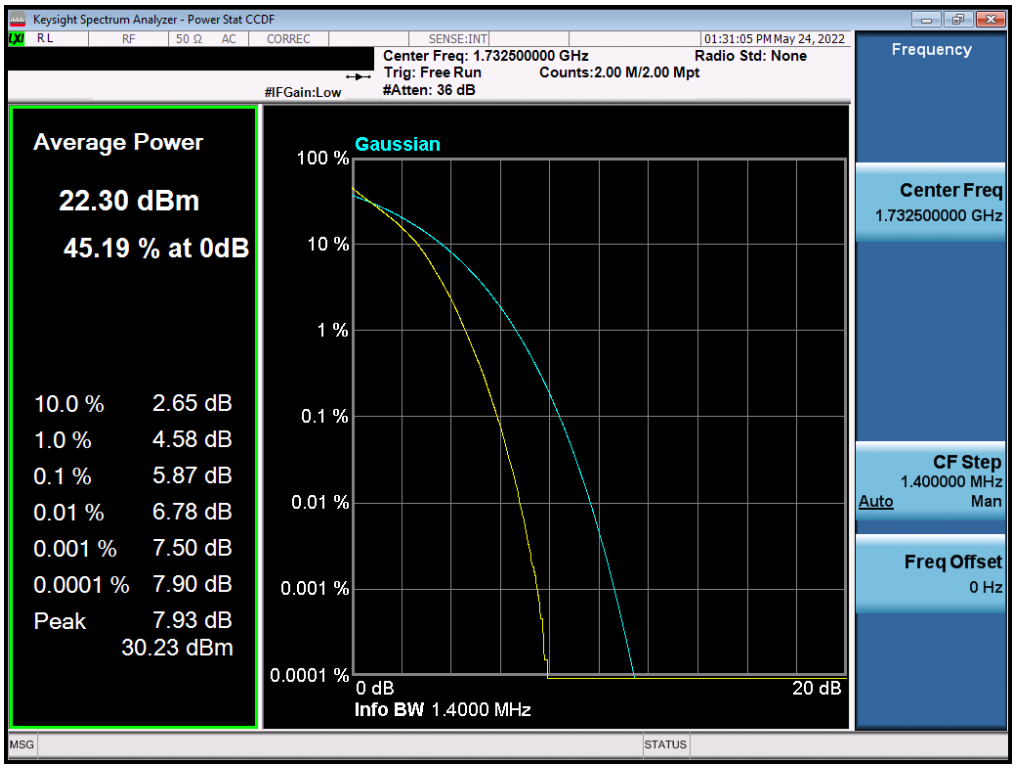


Plot 7-138. PAR Plot (LTE Band 66 - 20MHz QPSK - Full RB)

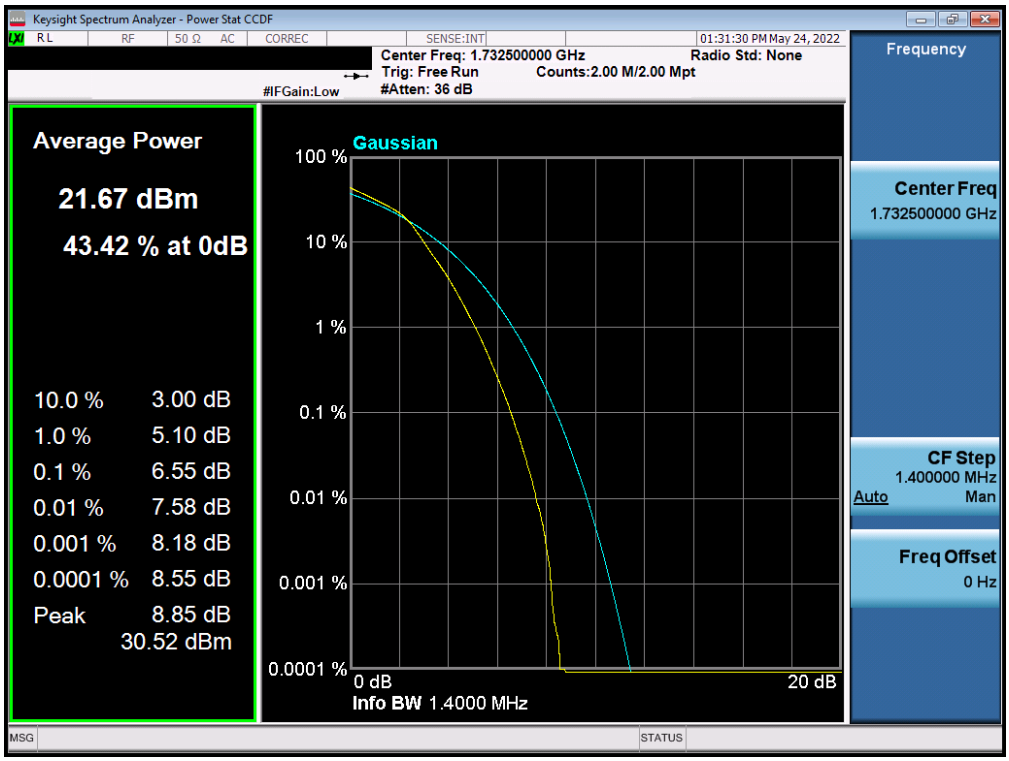


Plot 7-139. PAR Plot (LTE Band 66 - 20MHz 16-QAM - Full RB)

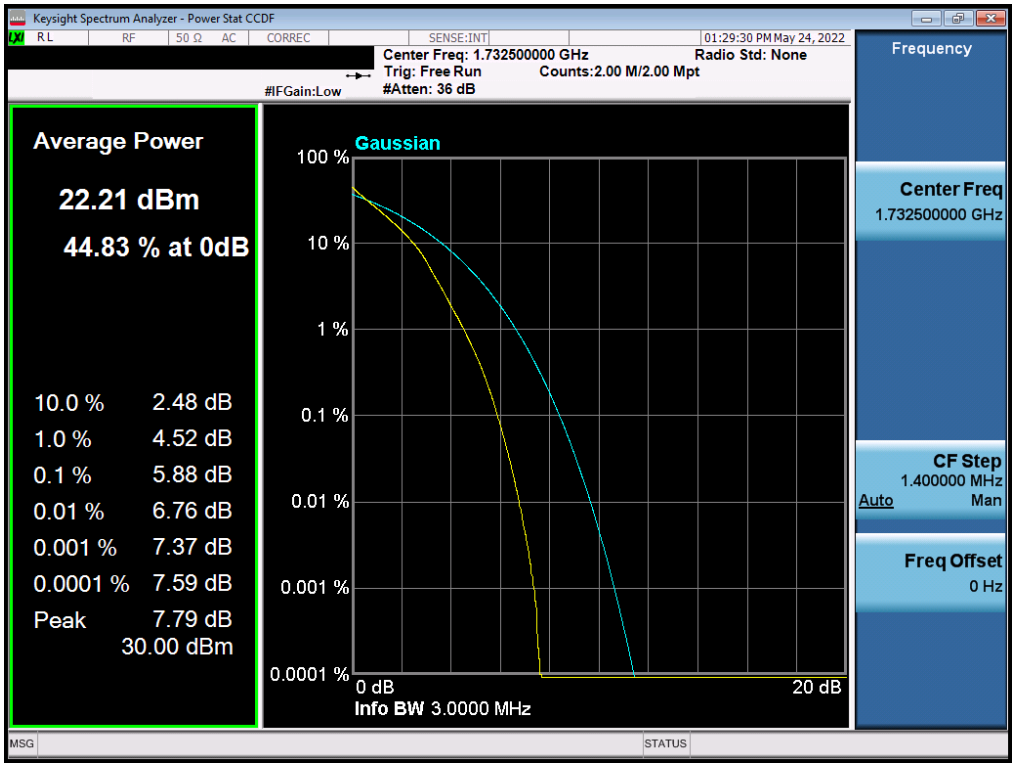
LTE Band 4



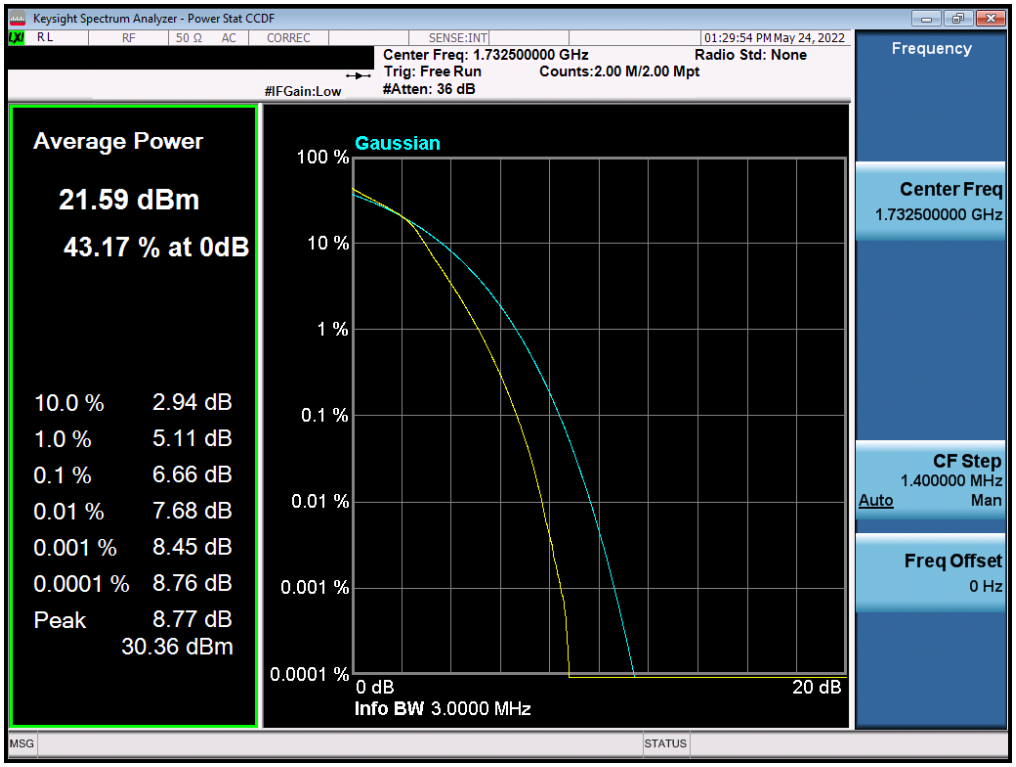
Plot 7-140. PAR Plot (LTE Band 4 - 1.4MHz QPSK - Full RB)



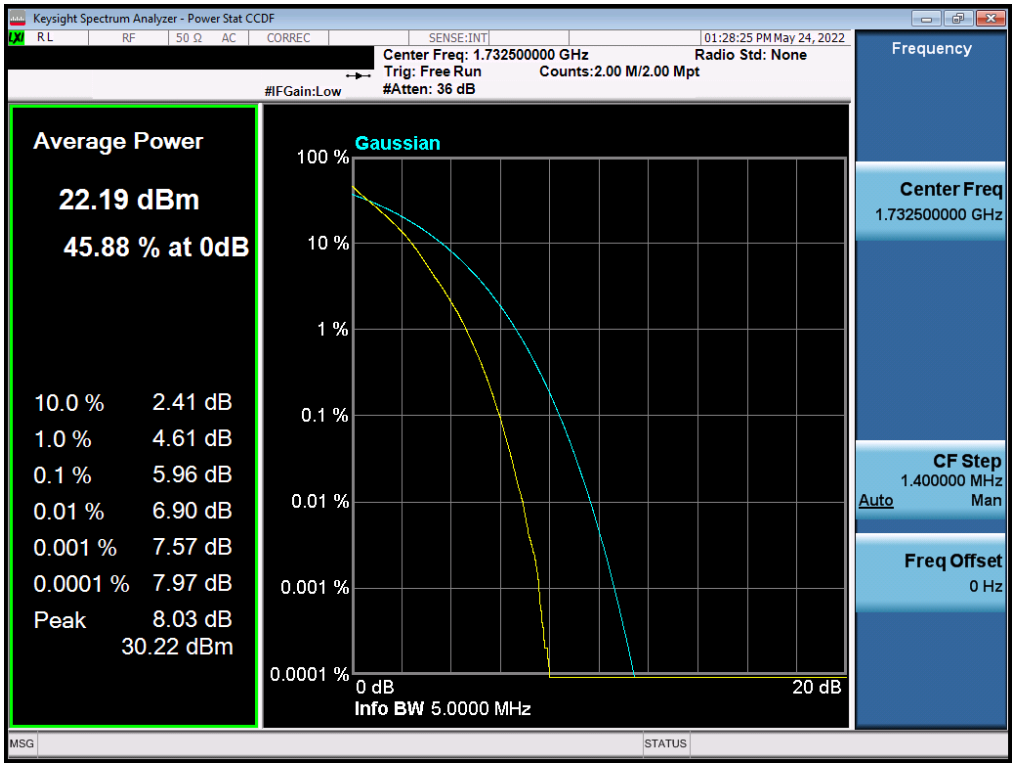
Plot 7-141. PAR Plot (LTE Band 4 - 1.4MHz 16-QAM - Full RB)



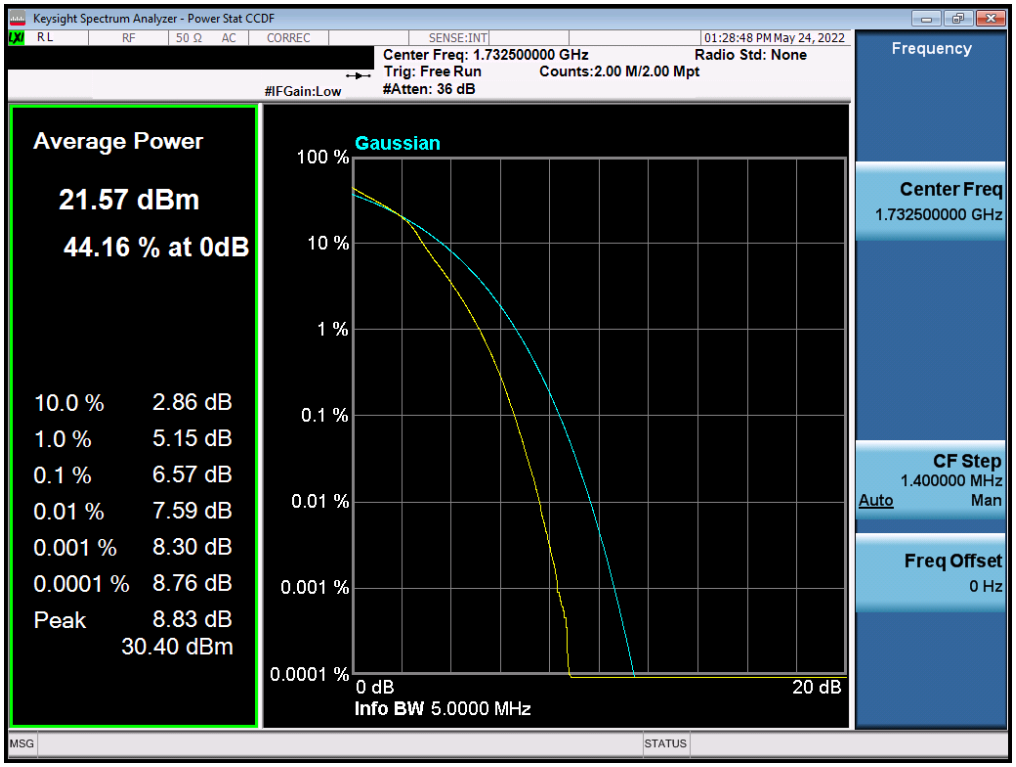
Plot 7-142. PAR Plot (LTE Band 4 - 3MHz QPSK - Full RB)



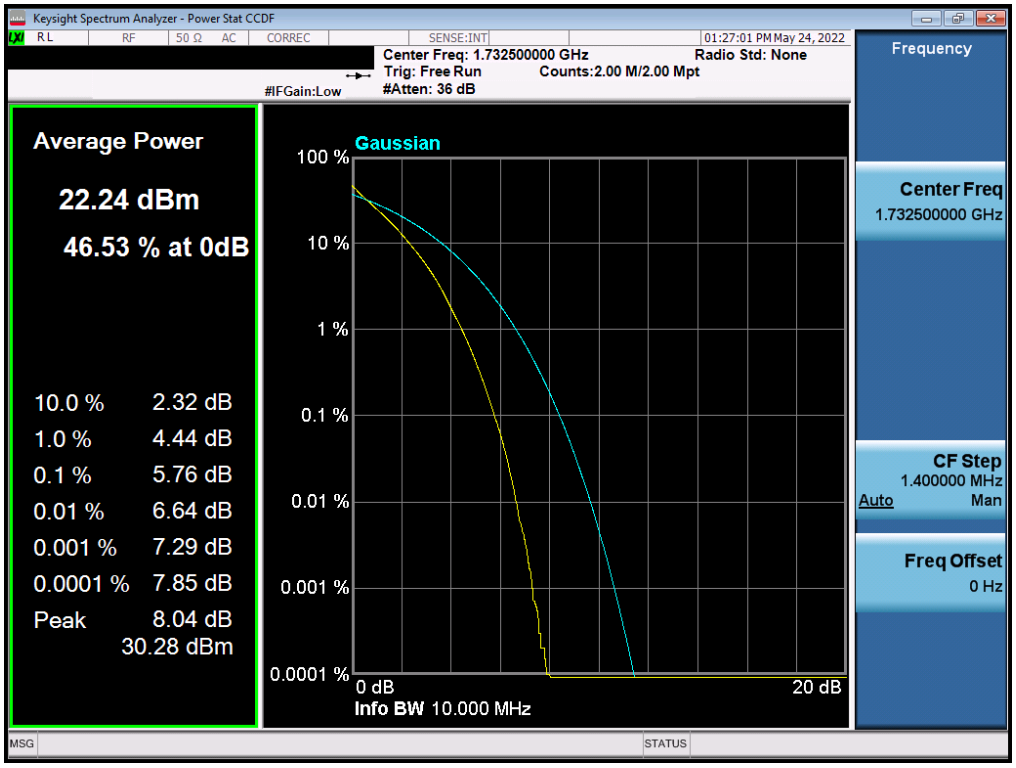
Plot 7-143. PAR Plot (LTE Band 4 - 3MHz 16-QAM - Full RB)



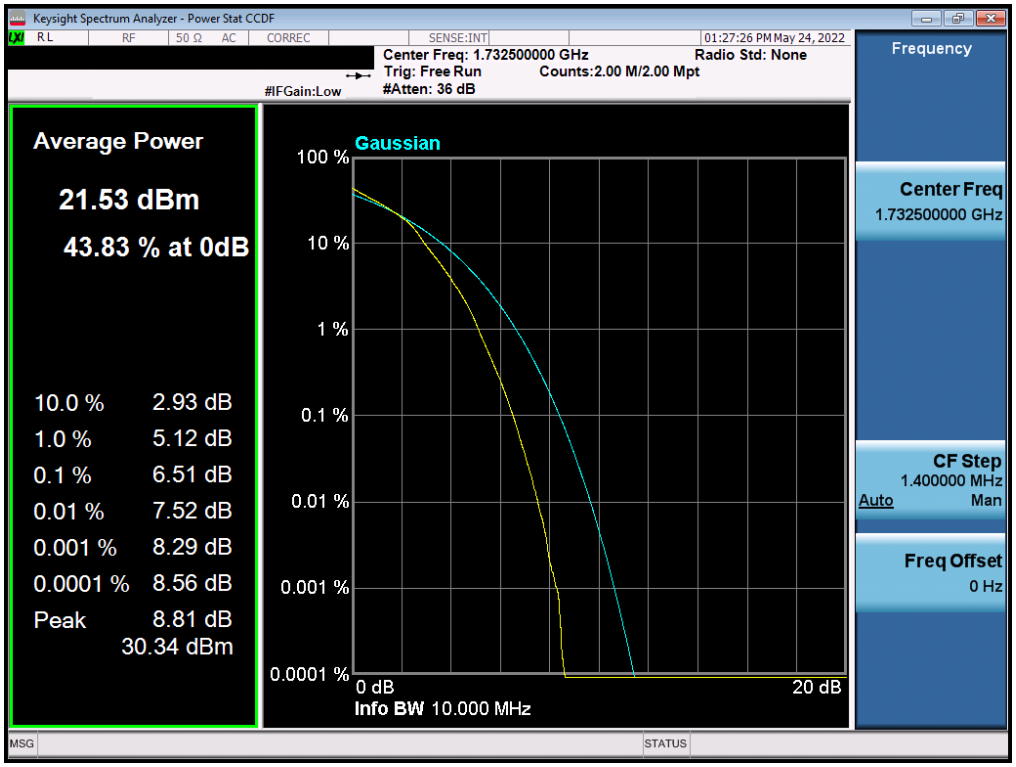
Plot 7-144. PAR Plot (LTE Band 4 - 5MHz QPSK - Full RB)



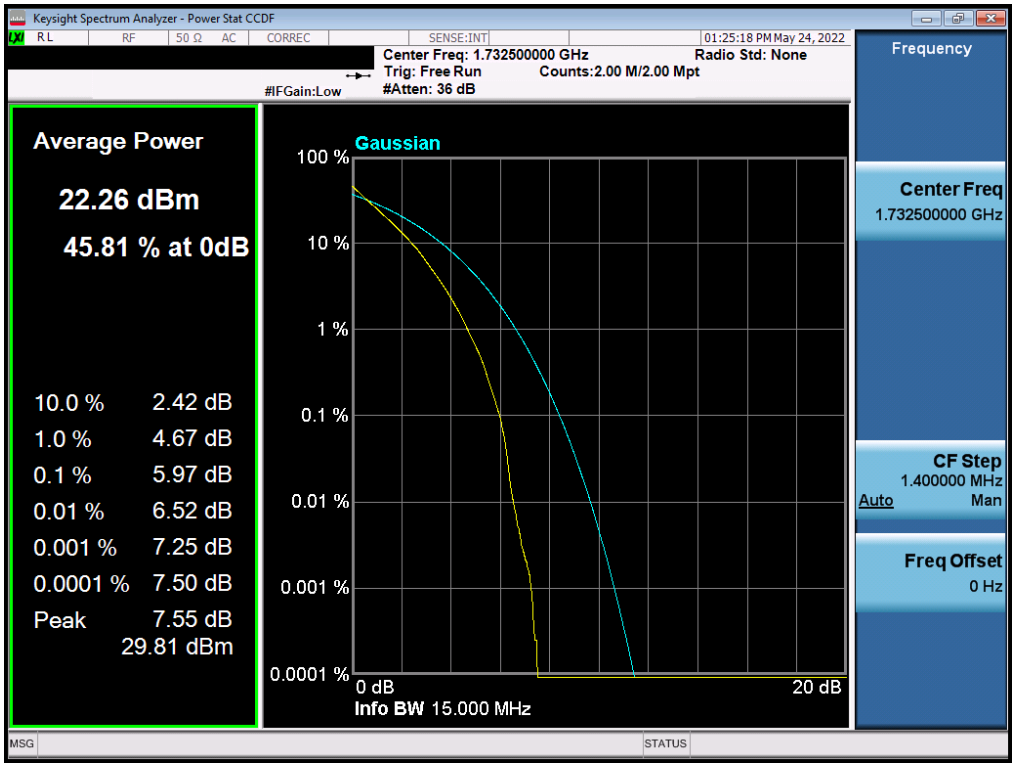
Plot 7-145. PAR Plot (LTE Band 4 - 5MHz 16-QAM - Full RB)



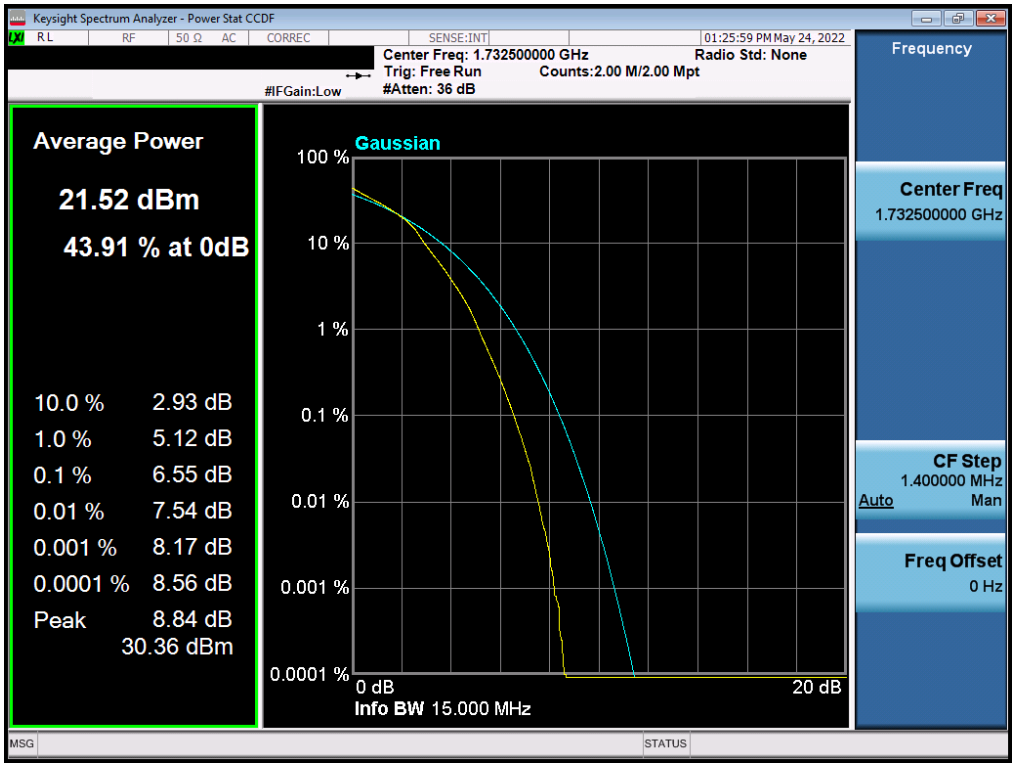
Plot 7-146. PAR Plot (LTE Band 4 - 10MHz QPSK - Full RB)



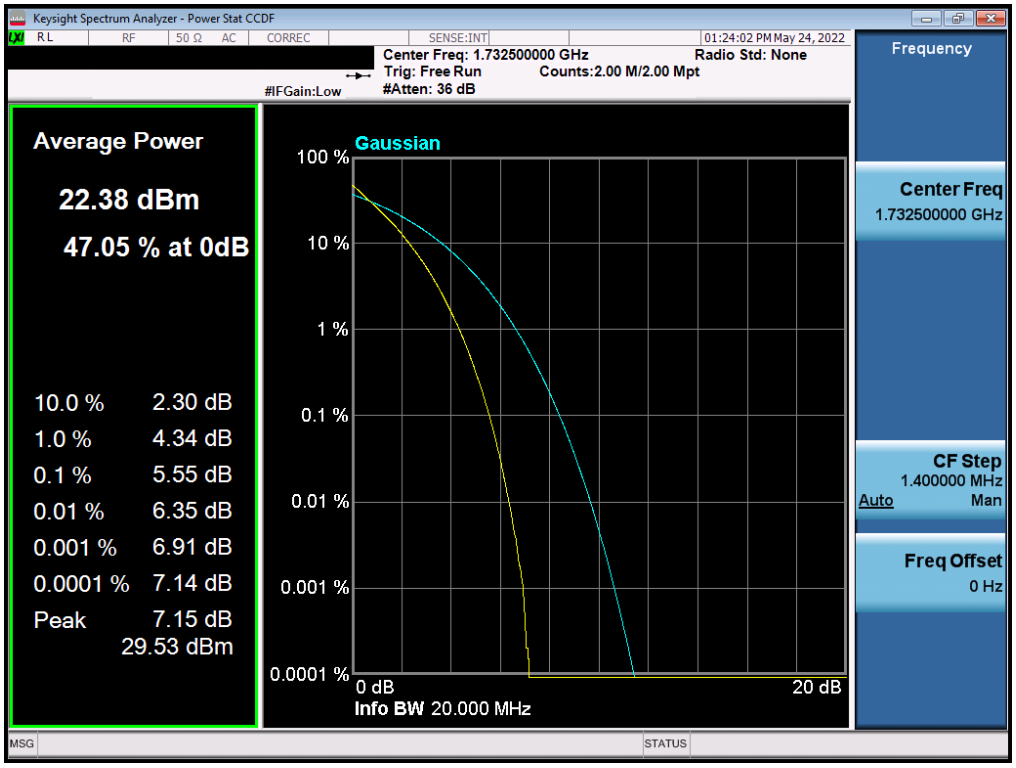
Plot 7-147. PAR Plot (LTE Band 4 - 10MHz 16-QAM - Full RB)



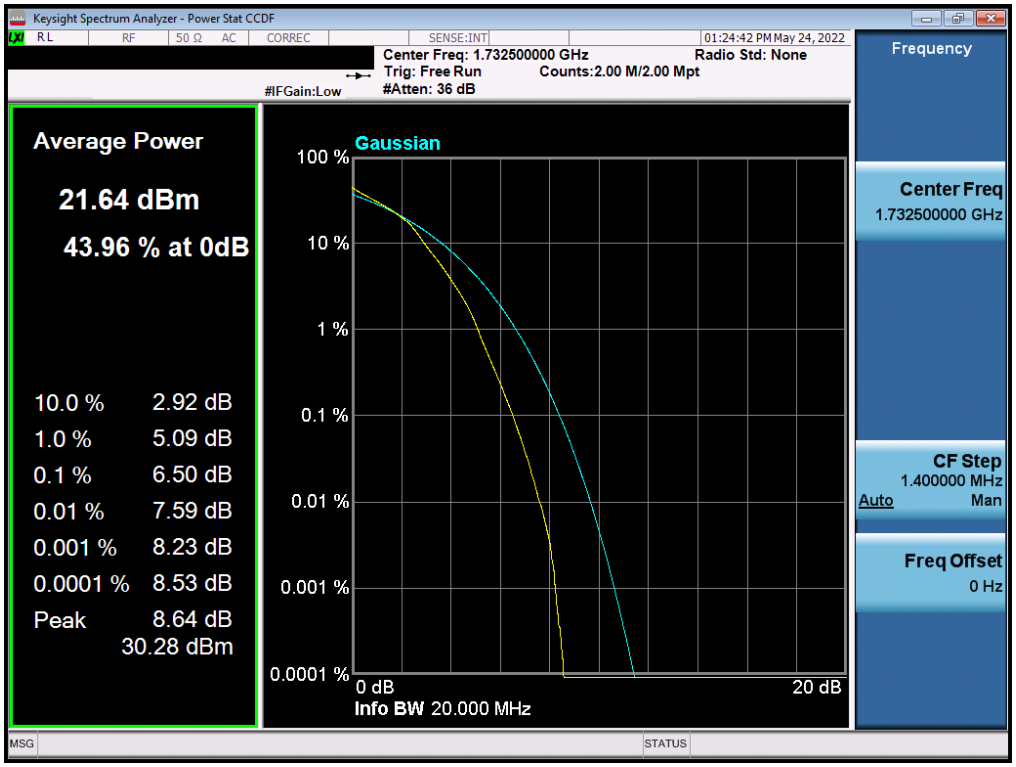
Plot 7-148. PAR Plot (LTE Band 4 - 15MHz QPSK - Full RB)



Plot 7-149. PAR Plot (LTE Band 4 - 15MHz 16-QAM - Full RB)

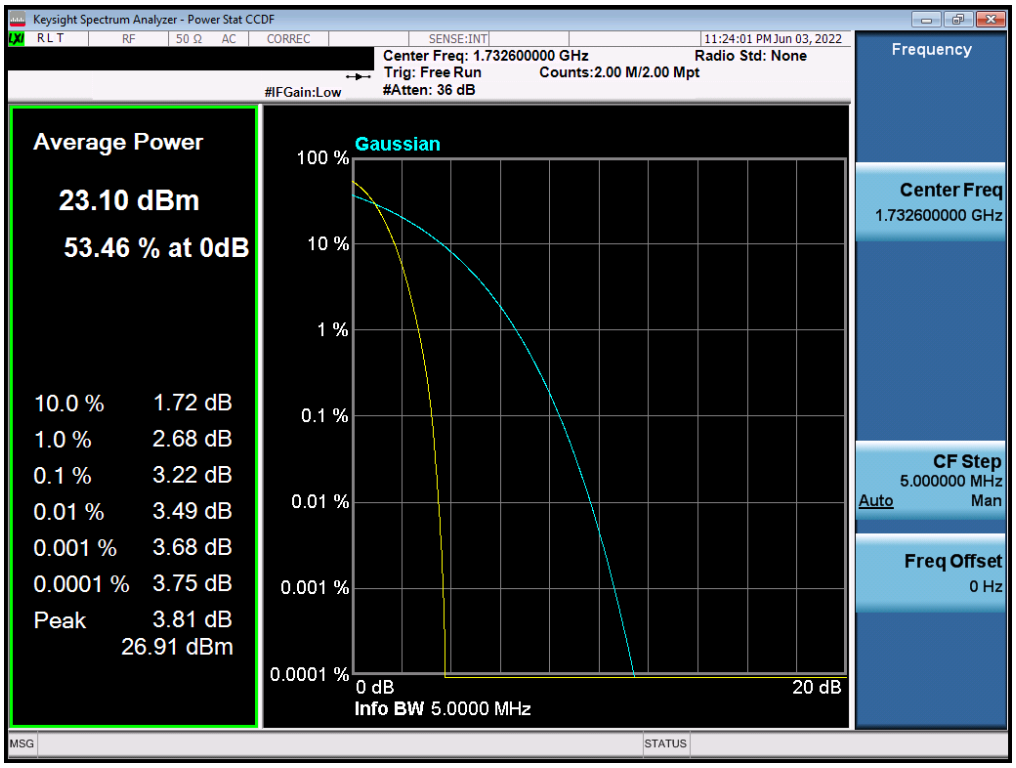


Plot 7-150. PAR Plot (LTE Band 4 - 20MHz QPSK - Full RB)



Plot 7-151. PAR Plot (LTE Band 4 - 20MHz 16-QAM - Full RB)

WCDMA AWS



Plot 7-152. PAR Plot (WCDMA, Ch. 1413)

7.6 Radiated Power (ERP/EIRP)

§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 calculated by adding highest antenna gain to maximum measured conducted output power. 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 v03r01 – Section 5.2.1
ANSI C63.26-2015 – Section 5.2.5.5

Test Settings

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

ERP/EIRP = PMeas – LC + GT

Where:

ERP/EIRP = Effective or Equivalent Isotropic Radiated Power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

Test Setup

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

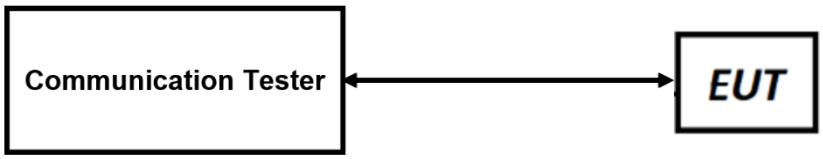


Figure 7-5. ERP/EIRP Measurement Setup

Test Notes

1. The EUT was tested in all possible test configurations. The worst case emissions are reported with the EUT 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 Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.

4. This device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest power is reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to "1."

5. The Ant. Gains (GT) are listed in dBi.

7.6.1 Antenna FCM ERP/EIRP

Antenna FCM LTE Band 66

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
1.4 MHz	QPSK	1710.7	-9.00	1 / 3	24.28	**15.28**	33.729	30.00	-14.72
		1745.0	-9.00	1 / 3	23.91	14.91	30.974	30.00	-15.09
		1779.3	-9.00	1 / 0	23.99	14.99	31.550	30.00	-15.01
	16-QAM	1779.3	-9.00	1 / 5	23.68	14.68	29.376	30.00	-15.32
3 MHz	QPSK	1711.5	-9.00	1 / 7	23.83	14.83	30.409	30.00	-15.17
		1745.0	-9.00	1 / 0	23.66	14.66	29.242	30.00	-15.34
		1778.5	-9.00	1 / 0	24.02	**15.02**	31.769	30.00	-14.98
	16-QAM	1778.5	-9.00	1 / 14	23.59	14.59	28.774	30.00	-15.41
5 MHz	QPSK	1712.5	-9.00	1 / 12	24.05	**15.05**	31.989	30.00	-14.95
		1745.0	-9.00	1 / 12	23.99	14.99	31.550	30.00	-15.01
		1777.5	-9.00	1 / 24	23.96	14.96	31.333	30.00	-15.04
	16-QAM	1777.5	-9.00	1 / 24	23.63	14.63	29.040	30.00	-15.37
10 MHz	QPSK	1715.0	-9.00	1 / 25	24.02	15.02	31.769	30.00	-14.98
		1745.0	-9.00	1 / 25	23.93	14.93	31.117	30.00	-15.07
		1775.0	-9.00	1 / 0	24.10	**15.10**	32.359	30.00	-14.90
	16-QAM	1775.0	-9.00	1 / 0	23.61	14.61	28.907	30.00	-15.39
15 MHz	QPSK	1717.5	-9.00	1 / 37	24.13	**15.13**	32.584	30.00	-14.87
		1745.0	-9.00	1 / 0	23.82	14.82	30.339	30.00	-15.18
		1772.5	-9.00	1 / 0	23.96	14.96	31.333	30.00	-15.04
	16-QAM	1772.5	-9.00	1 / 0	23.55	14.55	28.510	30.00	-15.45
20 MHz	QPSK	1720.0	-9.00	1 / 0	23.97	14.97	31.405	30.00	-15.03
		1745.0	-9.00	1 / 50	24.09	15.09	32.285	30.00	-14.91
		1770.0	-9.00	1 / 0	24.12	**15.12**	32.509	30.00	-14.88
	16-QAM	1745.0	-9.00	1 / 0	23.51	14.51	0.028	30.00	-15.49

Table 7-2. Antenna FCM ERP/EIRP Data (LTE Band 66)

Antenna FCM LTE Band 4

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
1.4 MHz	QPSK	1710.7	-9.00	1 / 3	24.19	**15.19**	33.037	30.00	-14.81
		1732.5	-9.00	1 / 5	24.02	15.02	31.769	30.00	-14.98
		1754.3	-9.00	1 / 3	23.97	14.97	31.405	30.00	-15.03
	16-QAM	1732.5	-9.00	1 / 0	23.46	14.46	27.925	30.00	-15.54
3 MHz	QPSK	1711.5	-9.00	1 / 7	24.01	15.01	31.696	30.00	-14.99
		1732.5	-9.00	1 / 0	24.13	**15.13**	32.584	30.00	-14.87
		1753.5	-9.00	1 / 0	23.89	14.89	30.832	30.00	-15.11
	16-QAM	1711.5	-9.00	1 / 0	23.51	14.51	28.249	30.00	-15.49
5 MHz	QPSK	1712.5	-9.00	1 / 12	23.95	14.95	31.261	30.00	-15.05
		1732.5	-9.00	1 / 24	24.13	**15.13**	32.584	30.00	-14.87
		1752.5	-9.00	1 / 12	23.74	14.74	29.785	30.00	-15.26
	16-QAM	1712.5	-9.00	1 / 24	23.52	14.52	28.314	30.00	-15.48
10 MHz	QPSK	1715.0	-9.00	1 / 25	24.00	15.00	31.623	30.00	-15.00
		1732.5	-9.00	1 / 0	24.08	**15.08**	32.211	30.00	-14.92
		1750.0	-9.00	1 / 49	23.83	14.83	30.409	30.00	-15.17
	16-QAM	1715.0	-9.00	1 / 0	23.49	14.49	28.119	30.00	-15.51
15 MHz	QPSK	1717.5	-9.00	1 / 37	24.30	**15.30**	33.884	30.00	-14.70
		1732.5	-9.00	1 / 0	24.20	15.20	33.113	30.00	-14.80
		1747.5	-9.00	1 / 37	23.92	14.92	31.046	30.00	-15.08
	16-QAM	1732.5	-9.00	1 / 37	23.56	14.56	28.576	30.00	-15.44
20 MHz	QPSK	1720.0	-9.00	1 / 50	24.50	**15.50**	35.481	30.00	-14.50
		1732.5	-9.00	1 / 0	24.40	15.40	34.674	30.00	-14.60
		1745.0	-9.00	1 / 50	24.49	15.49	35.400	30.00	-14.51
	16-QAM	1720.0	-9.00	1 / 50	23.53	14.53	28.379	30.00	-15.47

Table 7-3. Antenna FCM ERP/EIRP Data (LTE Band 4)

Antenna FCM WCDMA AWS

Frequency [MHz]	Mode	Conducted Power [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
1712.40	WCDMA1700	23.79	-9.00	**14.79**	30.130	30.00	-15.21
1732.60	WCDMA1700	23.84	-9.00	**14.84**	**30.479**	30.00	-15.16
1752.60	WCDMA1700	23.64	-9.00	14.64	29.107	30.00	-15.36

Table 7-4. Antenna FCM ERP/EIRP Data (WCDMA AWS)

7.6.2 Antenna BCM ERP/EIRP

Antenna BCM LTE Band 12

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
1.4 MHz	QPSK	699.7	-30.40	1 / 3	25.32	**-7.23**	0.189	34.77	-42.00	**-5.08**	0.310	36.99	-42.07
		707.5	-30.40	1 / 3	25.19	-7.36	0.184	34.77	-42.13	-5.21	0.301	36.99	-42.20
		715.3	-30.40	1 / 3	25.34	**-7.21**	0.190	34.77	-41.98	**-5.06**	0.312	36.99	-42.05
	16-QAM	699.7	-30.40	1 / 5	24.55	-8.00	0.158	34.77	-42.77	-5.85	0.260	36.99	-42.84
3 MHz	QPSK	700.5	-30.40	1 / 0	25.37	**-7.18**	0.191	34.77	-41.95	**-5.03**	0.314	36.99	-42.02
		707.5	-30.40	1 / 7	25.03	-7.52	0.177	34.77	-42.29	-5.37	0.290	36.99	-42.36
		714.5	-30.40	1 / 0	25.14	-7.41	0.182	34.77	-42.18	-5.26	0.298	36.99	-42.25
	16-QAM	700.5	-30.40	1 / 0	24.56	-7.99	0.159	34.77	-42.76	-5.84	0.261	36.99	-42.83
5 MHz	QPSK	701.5	-30.40	1 / 24	25.37	**-7.18**	0.191	34.77	-41.95	**-5.03**	0.314	36.99	-42.02
		707.5	-30.40	1 / 12	25.34	-7.21	0.190	34.77	-41.98	-5.06	0.312	36.99	-42.05
		713.5	-30.40	1 / 0	25.04	-7.51	0.177	34.77	-42.28	-5.36	0.291	36.99	-42.35
	16-QAM	701.5	-30.40	1 / 0	24.72	-7.83	0.165	34.77	-42.60	-5.68	0.270	36.99	-42.67
10 MHz	QPSK	704.0	-30.40	1 / 0	25.08	-7.47	0.179	34.77	-42.24	-5.32	0.294	36.99	-42.31
		707.5	-30.40	1 / 25	25.24	-7.31	0.186	34.77	-42.08	-5.16	0.305	36.99	-42.15
		711.0	-30.40	1 / 49	25.32	**-7.23**	0.189	34.77	-42.00	**-5.08**	0.310	36.99	-42.07
	16-QAM	704.0	-30.40	1 / 0	24.64	-7.91	0.162	34.77	-42.68	-5.76	0.265	36.99	-42.75

Table 7-5. Antenna BCM ERP/EIRP Data (LTE Band 12)

Antenna BCM LTE Band 17

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
5 MHz	QPSK	706.5	-30.40	1 / 0	25.31	**-7.24**	0.189	34.77	-42.01	**-5.09**	0.310	36.99	-42.08
		710.0	-30.40	1 / 24	25.29	**-7.26**	0.188	34.77	-42.03	**-5.11**	0.308	36.99	-42.10
		713.5	-30.40	1 / 12	25.03	-7.52	0.177	34.77	-42.29	-5.37	0.290	36.99	-42.36
	16-QAM	706.5	-30.40	1 / 12	24.54	-8.01	0.158	34.77	-42.78	-5.86	0.259	36.99	-42.85
10 MHz	QPSK	709.0	-30.40	1 / 49	25.23	-7.32	0.185	34.77	-42.09	-5.17	0.304	36.99	-42.16
		710.0	-30.40	1 / 49	25.34	**-7.21**	0.190	34.77	-41.98	**-5.06**	0.312	36.99	-42.05
		711.0	-30.40	1 / 49	25.04	-7.51	0.177	34.77	-42.28	-5.36	0.291	36.99	-42.35
	16-QAM	709.0	-30.40	1 / 49	24.58	-7.97	0.160	34.77	-42.74	-5.82	0.262	36.99	-42.81

Table 7-6. Antenna BCM ERP/EIRP Data (LTE Band 17)

Antenna BCM LTE Band 13

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	ERP [dBm]	ERP [mW]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [mW]	EIRP Limit [dBm]	Margin [dB]
5 MHz	QPSK	779.5	-27.70	1 / 0	25.40	**-4.45**	0.359	34.77	-39.22	**-2.30**	0.589	36.99	-39.29
		782.0	-27.70	1 / 12	25.31	**-4.54**	0.352	34.77	-39.31	**-2.39**	0.577	36.99	-39.38
		784.5	-27.70	1 / 0	25.04	-4.81	0.330	34.77	-39.58	-2.66	0.542	36.99	-39.65
	16-QAM	782.0	-27.70	1 / 12	24.68	-5.17	0.304	34.77	-39.94	-3.02	0.499	36.99	-40.01
10 MHz	QPSK	782.0	-27.70	1 / 0	25.19	**-4.66**	0.342	34.77	-39.43	**-2.51**	0.561	36.99	-39.50
	16-QAM	782.0	-27.70	1 / 25	24.58	-5.27	0.297	34.77	-40.04	-3.12	0.488	36.99	-40.11

Table 7-7. Antenna BCM ERP/EIRP Data (LTE Band 13)

7.7 Radiated Spurious Emissions

§2.1053, §27.53(f)

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized broadband hybrid antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed while the EUT is operating at maximum power and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI C63.26-2015, TIA-603-E-2016 – 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

Test Setup

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

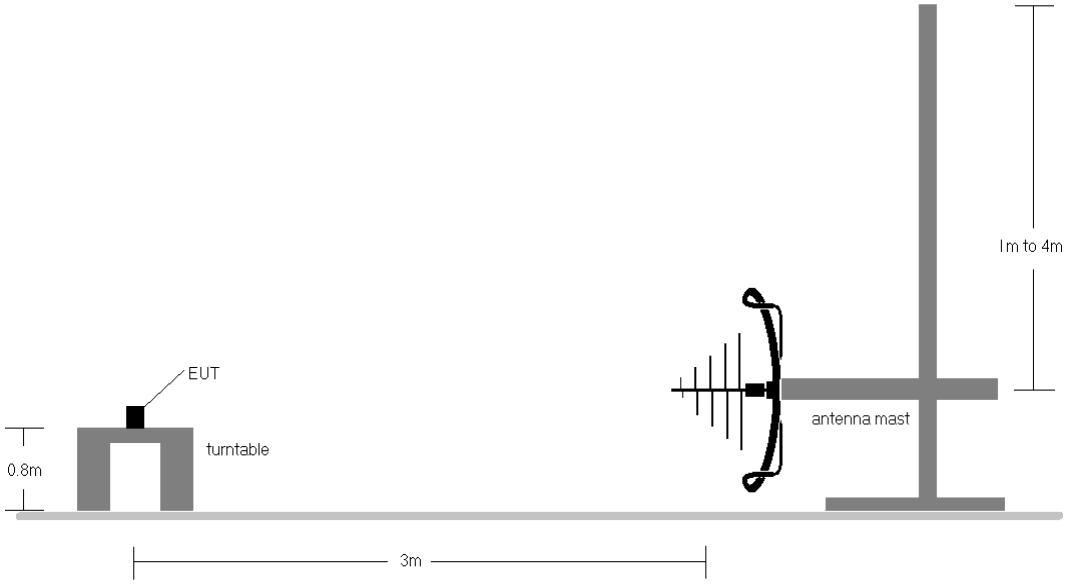


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

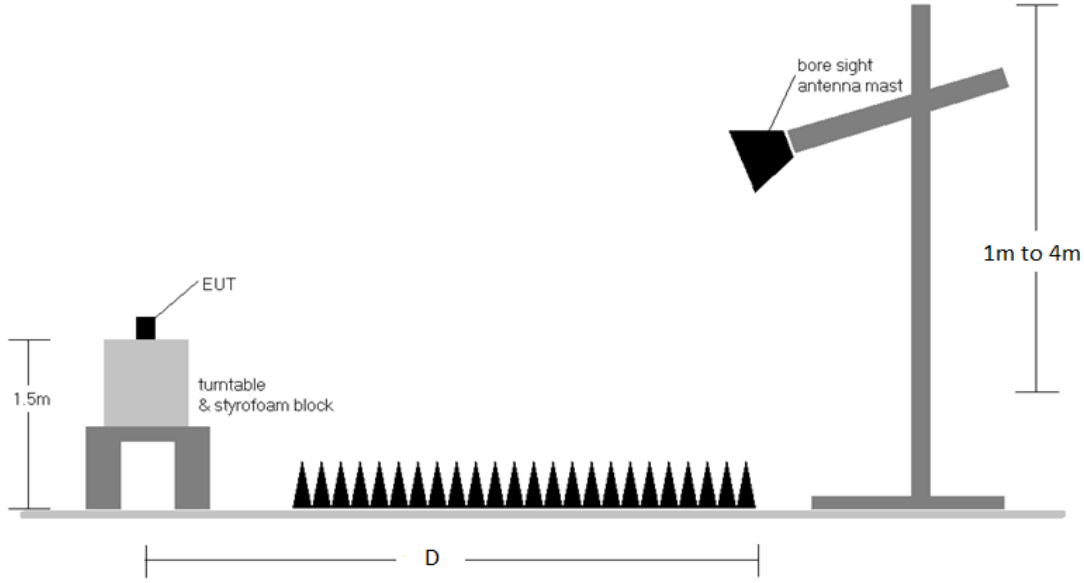


Figure 7-7. Test Instrument & Measurement Setup > 1GHz

Test Notes

1. Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
    a. E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
    b. EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2. 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.

3. This unit was tested with its standard battery.

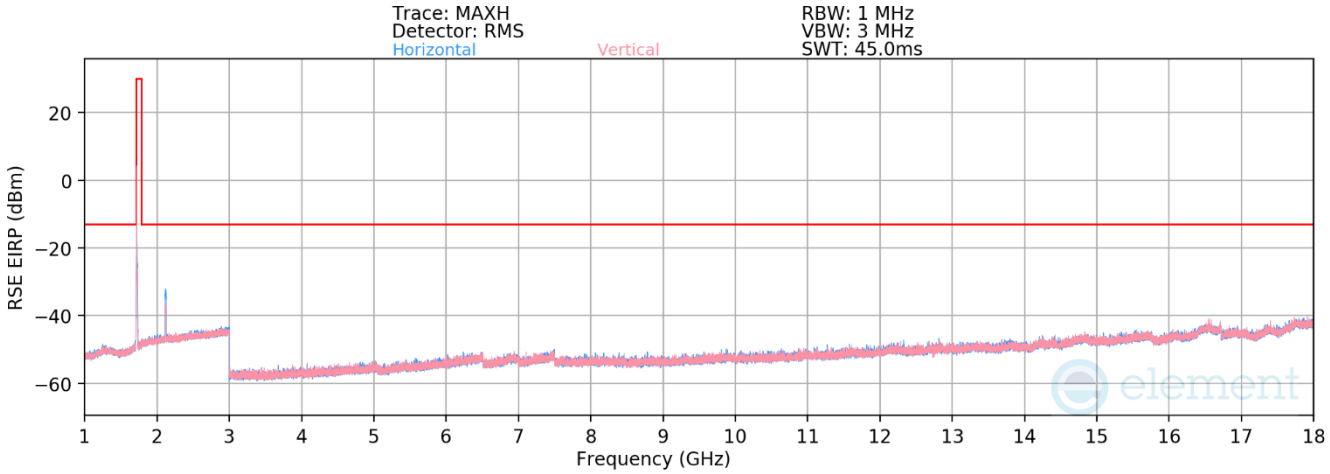
4. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

5. D is the measurement test distance and emissions 1-18GHz were measured at a 3 meters test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

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

7.7.1 Radiated Spurious Emission Measurement

Antenna FCM LTE Band 66/4



Plot 7-153. Antenna FCM Radiated Spurious Emission above 1GHz (LTE Band 66/4)

Bandwidth (MHz):	20
Frequency (MHz):	1720.0
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3440.0	V	106	336	-78.45	4.01	32.56	-62.69	-13.00	-49.69
5160.0	V	106	168	-79.26	7.28	35.02	-60.23	-13.00	-47.23
6880.0	-	-	-	-81.97	9.74	34.77	-60.49	-13.00	-47.49
8600.0	-	-	-	-83.61	11.25	34.64	-60.61	-13.00	-47.61
10320.0	-	-	-	-83.14	13.61	37.47	-57.79	-13.00	-44.79

Table 7-8. Antenna FCM Radiated Spurious Data (LTE Band 66/4 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	1745.0
RB / Offset:	1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3490.0	V	-	-	-79.94	3.92	30.98	-64.28	-13.00	-51.28
5235.0	V	364	73	-77.76	7.94	37.18	-58.07	-13.00	-45.07
6980.0	V	-	-	-81.78	9.49	34.71	-60.55	-13.00	-47.55
8725.0	V	-	-	-83.72	11.09	34.37	-60.89	-13.00	-47.89

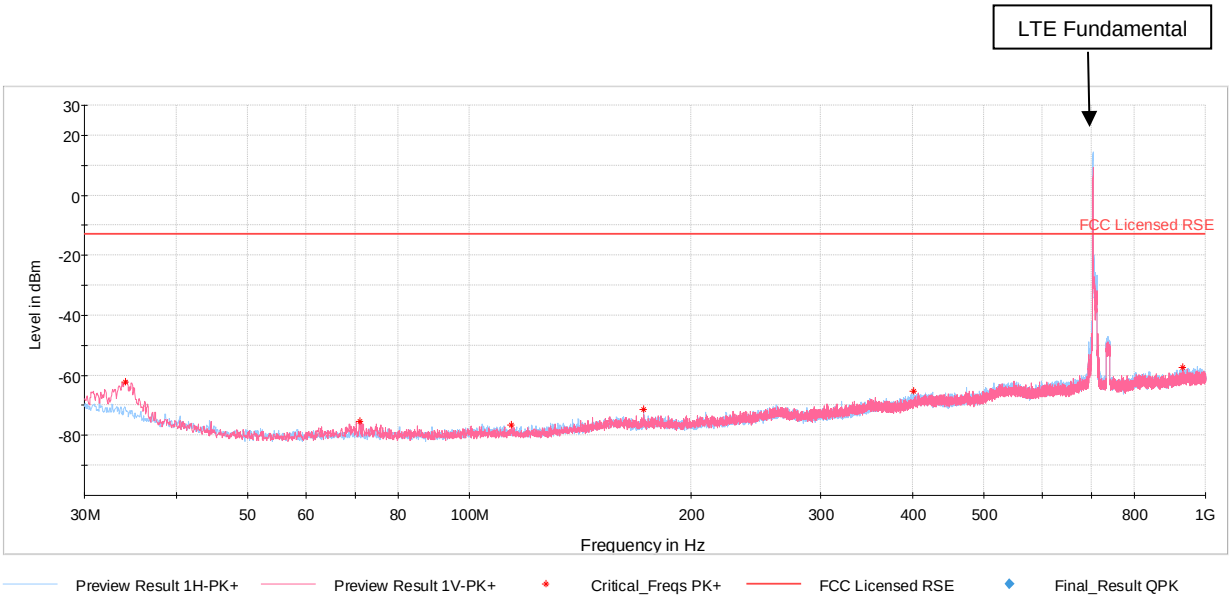
Table 7-9. Antenna FCM Radiated Spurious Data (LTE Band 66/4 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	1770.0
RB / Offset:	1 / 50

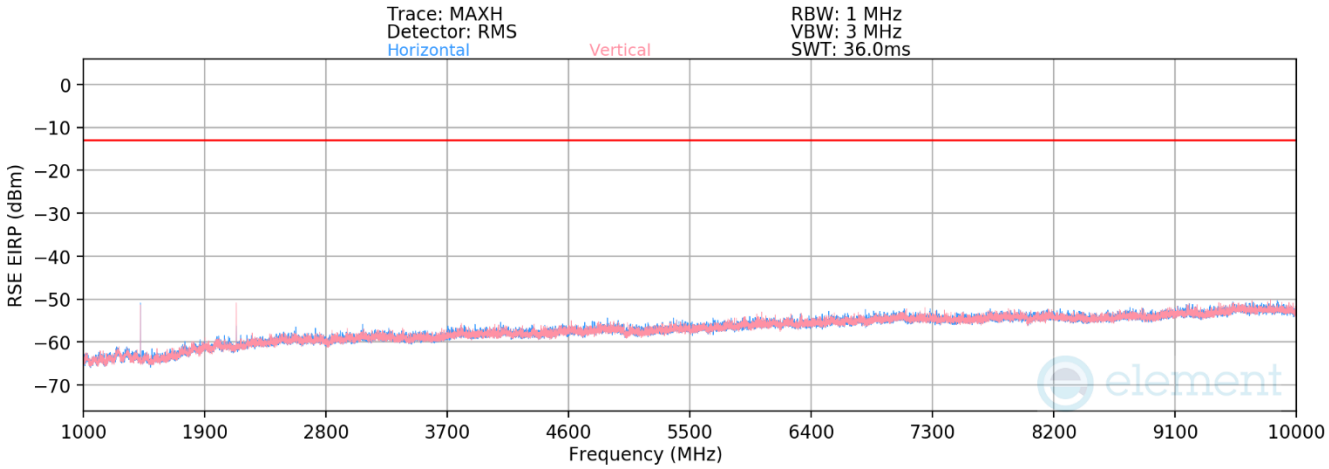
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3540.0	-	-	-	-79.56	4.20	31.64	-63.62	-13.00	-50.62
5310.0	V	253	156	-79.54	8.54	36.00	-59.26	-13.00	-46.26
7080.0	-	-	-	-81.88	10.06	35.18	-60.07	-13.00	-47.07
8850.0	-	-	-	-82.82	11.34	35.52	-59.74	-13.00	-46.74
10620.0	-	-	-	-83.15	14.05	37.90	-57.36	-13.00	-44.36

Table 7-10. Antenna FCM Radiated Spurious Data (LTE Band 66/4 – High Channel)

Antenna BCM LTE Band 12/17



Plot 7-154. Antenna BCM Radiated Spurious Emission below 1GHz (LTE Band 12/17)



Plot 7-155. Antenna BCM Radiated Spurious Emission above 1GHz (LTE Band 12/17)

Bandwidth (MHz):	10
Frequency (MHz):	704.0
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1408.0	H	117	310	-71.12	-1.38	34.50	-60.76	-13.00	-47.76
2112.0	H	242	121	-78.15	2.54	31.39	-63.87	-13.00	-50.87
2816.0	H	-	-	-77.98	5.12	34.14	-61.12	-13.00	-48.12
3520.0	H	-	-	-76.43	5.71	36.28	-58.97	-13.00	-45.97
4224.0	H	-	-	-76.61	7.02	37.41	-57.85	-13.00	-44.85

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

Bandwidth (MHz):	10
Frequency (MHz):	707.5
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1415.0	H	113	273	-68.72	-1.38	36.90	-58.35	-13.00	-45.35
2122.5	H	193	346	-78.71	2.50	30.79	-64.47	-13.00	-51.47
2830.0	H	-	-	-75.44	5.17	36.73	-58.53	-13.00	-45.53
3537.5	H	-	-	-74.91	5.86	37.95	-57.31	-13.00	-44.31
4245.0	H	-	-	-73.37	6.88	40.51	-54.75	-13.00	-41.75

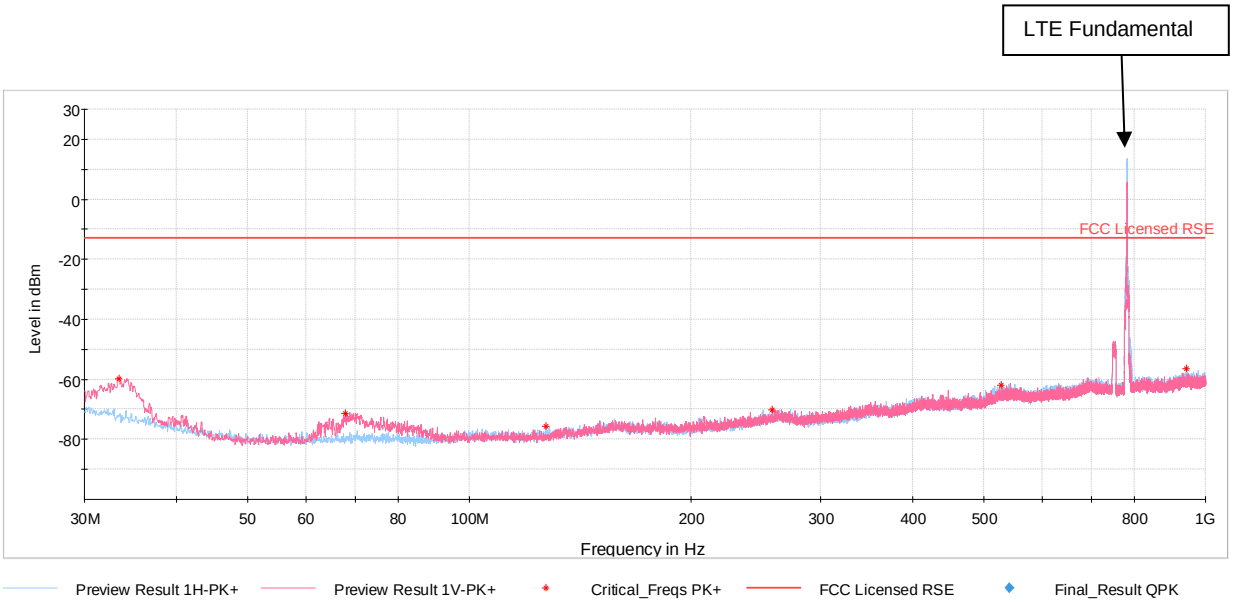
Table 7-12. Antenna BCM Radiated Spurious Data (LTE Band 12/17 – Mid Channel)

Bandwidth (MHz):	10
Frequency (MHz):	711.0
RB / Offset:	1 / 25

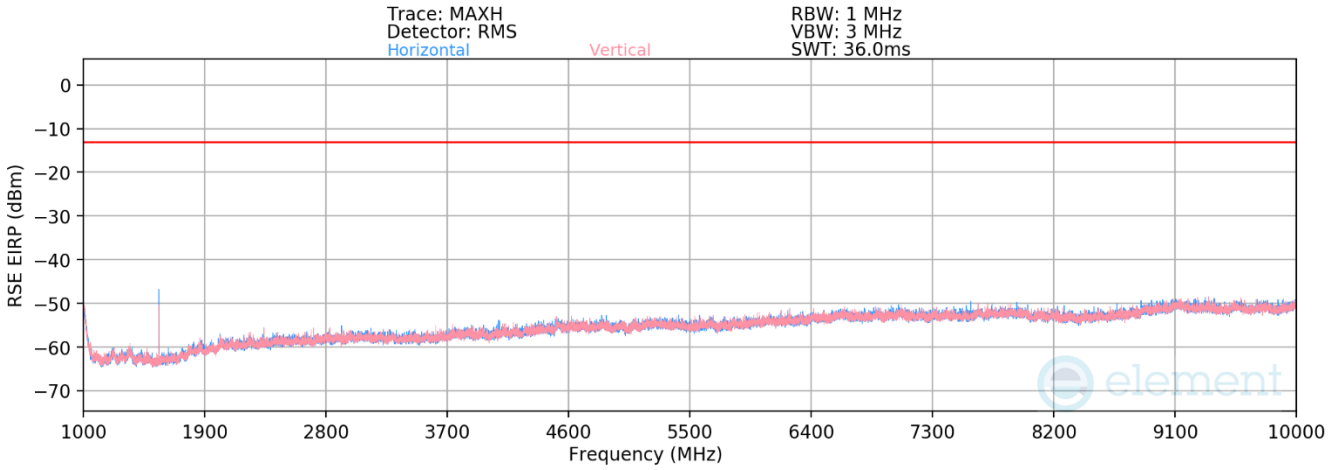
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1422.0	H	262	275	-71.71	-1.38	33.91	-61.34	-13.00	-48.34
2133.0	H	274	17	-78.90	2.52	30.62	-64.64	-13.00	-51.64
2844.0	H	-	-	-74.59	5.02	37.43	-57.83	-13.00	-44.83
3555.0	H	-	-	-75.09	5.89	37.80	-57.46	-13.00	-44.46
4266.0	H	-	-	-74.92	7.00	39.08	-56.18	-13.00	-43.18

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

Antenna BCM LTE Band 13



Plot 7-156. Antenna BCM Radiated Spurious Emission below 1GHz (LTE Band 13)



Plot 7-157. Antenna BCM Radiated Spurious Emission above 1GHz (LTE Band 13)

Bandwidth (MHz):	5
Frequency (MHz):	779.5
RB / Offset:	1/12

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1559.0	H	139	300	-67.72	-1.89	37.39	-57.87	-40.00	-17.87
2338.5	V	127	365	-76.52	3.08	33.56	-61.70	-13.00	-48.70
3118.0	V	-	-	-80.31	5.10	31.79	-63.47	-13.00	-50.47
3897.5	V	-	-	-80.89	6.34	32.45	-62.81	-13.00	-49.81
4677.0	V	-	-	-81.32	8.64	34.32	-60.94	-13.00	-47.94

Table 7-14. Antenna BCM Radiated Spurious Data (LTE Band 13 – Low Channel)

Bandwidth (MHz):	10
Frequency (MHz):	782.0
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1564.0	H	209	282	-70.95	-1.89	34.16	-61.10	-40.00	-21.10
2346.0	V	181	123	-79.14	3.08	30.94	-64.32	-13.00	-51.32
3128.0	V	-	-	-80.13	5.10	31.97	-63.29	-13.00	-50.29
3910.0	V	-	-	-80.56	6.34	32.78	-62.48	-13.00	-49.48
4692.0	V	-	-	-80.39	8.64	35.25	-60.01	-13.00	-47.01

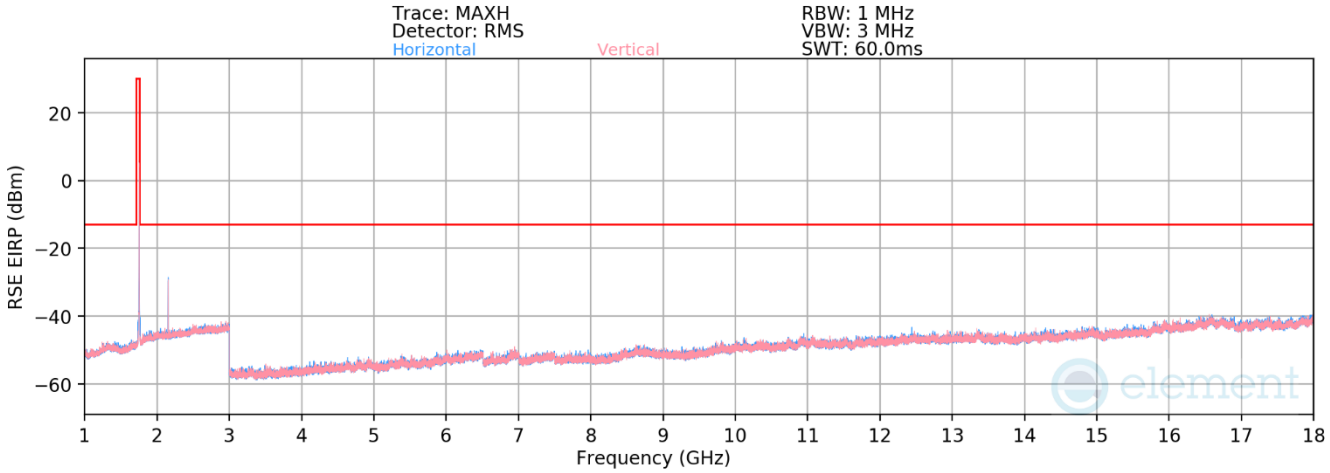
Table 7-15. Antenna BCM Radiated Spurious Data (LTE Band 13 – Mid Channel)

Bandwidth (MHz):	5
Frequency (MHz):	784.5
RB / Offset:	1 / 12

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1569.0	H	-	-	-78.38	-1.89	26.73	-68.53	-40.00	-28.53
2353.5	H	-	-	-79.50	3.08	30.58	-64.68	-13.00	-51.68
3138.0	H	-	-	-80.44	5.10	31.66	-63.60	-13.00	-50.60

Table 7-16. Antenna BCM Radiated Spurious Data (LTE Band 13 – High Channel)

Antenna FCM WCDMA AWS



Plot 7-158. Antenna FCM Radiated Spurious Emission above 1GHz (WCDMA AWS)

Mode:	WCDMA RMC
Channel:	1312
Frequency (MHz):	1712.4

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3424.8	H	-	-	-78.92	4.06	32.14	-63.12	-13.00	-50.12
5137.2	H	-	-	-78.75	6.72	34.97	-60.29	-13.00	-47.29
6849.6	H	-	-	-79.94	8.74	35.80	-59.46	-13.00	-46.46

7-17. Antenna FCM Radiated Spurious Data (WCDMA AWS – Low Channel)

Mode:	WCDMA RMC
Channel:	1413
Frequency (MHz):	1732.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3465.2	H	-	-	-78.21	3.73	32.52	-62.74	-13.00	-49.74
5197.8	H	-	-	-79.34	6.80	34.46	-60.79	-13.00	-47.79
6930.4	H	-	-	-80.03	9.41	36.38	-58.88	-13.00	-45.88

Table 7-18. Antenna FCM Radiated Spurious Data (WCDMA AWS – Mid Channel)

Mode:	WCDMA RMC
Channel:	1513
Frequency (MHz):	1752.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3505.2	H	116	176	-75.48	3.75	35.27	-59.98	-13.00	-46.98
5257.8	H	-	-	-79.81	7.60	34.79	-60.47	-13.00	-47.47
7010.4	H	-	-	-79.75	9.11	36.36	-58.90	-13.00	-45.90
8763.0	H	-	-	-81.02	11.03	37.01	-58.25	-13.00	-45.25

Table 7-19. Antenna FCM Radiated Spurious Data (WCDMA AWS – High Channel)

7.8 Frequency Stability / Temperature Variation

§2.1053, §27.53

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. 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 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI C63.26-2015

TIA-603-E-2016

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

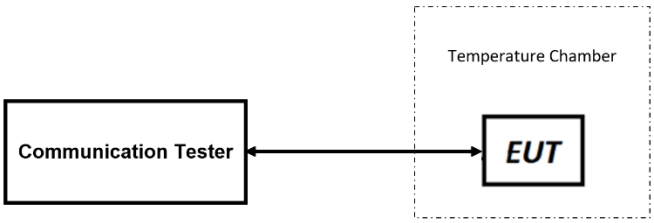


Figure 7-8. Test Instrument & Measurement Setup

Test Notes

None

Frequency Stability / Temperature Variation

LTE Band 66/4

Low Channel Frequency (Hz):	1,720,000,000
High Channel Frequency (Hz):	1,770,000,000
Ref. Voltage (VDC):	3.80

Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	1,719,999,998	1,770,000,000	-1.11	0.39	-0.0000001
		- 20	1,719,999,999	1,770,000,000	-0.62	0.89	0.0000001
		- 10	1,719,999,999	1,769,999,998	-0.75	-0.89	-0.0000001
		0	1,719,999,999	1,769,999,999	-0.40	-0.37	0.0000000
		+ 10	1,719,999,999	1,769,999,999	-0.67	-0.52	0.0000000
		+ 20 (Ref)	1,719,999,999	1,769,999,999	0.00	0.00	0.0000000
		+ 30	1,719,999,999	1,769,999,998	-0.84	-1.02	-0.0000001
		+ 40	1,720,000,000	1,770,000,000	0.82	0.47	0.0000000
		+ 50	1,719,999,998	1,769,999,998	-1.02	-0.74	-0.0000001
Battery Endpoint	3.40	+ 20	1,720,000,000	1,769,999,998	0.62	-0.92	-0.0000001

Table 7-20. LTE Band 66/4 Frequency Stability Data

Frequency Stability / Temperature Variation

LTE Band 12/17

Low Channel Frequency (Hz):	704,000,000
High Channel Frequency (Hz):	711,000,000
Ref. Voltage (VDC):	3.80

Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	704,000,001	711,000,001	0.87	0.95	0.0000001
		- 20	704,000,001	711,000,001	0.75	0.94	0.0000001
		- 10	704,000,001	711,000,001	0.62	0.79	0.0000001
		0	704,000,001	711,000,001	0.45	0.67	0.0000001
		+ 10	704,000,001	711,000,001	0.87	0.64	0.0000001
		+ 20 (Ref)	704,000,000	711,000,000	0.00	0.00	0.0000000
		+ 30	704,000,001	711,000,000	0.41	-0.64	-0.0000001
		+ 40	704,000,002	711,000,001	1.17	0.70	0.0000002
		+ 50	704,000,002	711,000,001	1.45	0.86	0.0000001
Battery Endpoint	3.40	+ 20	704,000,001	711,000,001	0.93	0.26	0.0000001

Table 7-21. LTE Band 12/17 Frequency Stability Data

Frequency Stability / Temperature Variation

LTE Band 13

Low Channel Frequency (Hz):	779,500,000
High Channel Frequency (Hz):	784,500,000
Ref. Voltage (VDC):	3.80

Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	779,500,005	784,500,007	3.68	3.99	0.0000005
		- 20	779,500,004	784,500,007	3.19	3.77	0.0000005
		- 10	779,500,003	784,500,005	1.45	2.25	0.0000003
		0	779,500,002	784,500,005	1.19	2.18	0.0000003
		+ 10	779,500,002	784,500,005	1.17	2.50	0.0000003
		+ 20 (Ref)	779,500,001	784,500,003	0.00	0.00	0.0000000
		+ 30	779,500,002	784,500,004	1.14	1.02	0.0000001
		+ 40	779,500,003	784,500,004	1.76	0.62	0.0000002
		+ 50	779,500,004	784,500,006	3.32	2.89	0.0000002
Battery Endpoint	3.40	+ 20	779,500,003	784,500,004	2.17	1.33	0.0000001

Table 7-22. LTE Band 13 Frequency Stability Data

Frequency Stability / Temperature Variation

WCDMA AWS

Low Channel Frequency (Hz):	1,712,400,000
High Channel Frequency (Hz):	1,752,600,000
Ref. Voltage (VDC):	3.80

Voltage (%)	Power (VDC)	Temp (°C)	Low Freq. (Hz)	High Freq. (Hz)	Low Freq. Dev. (Hz)	High Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	- 30	1,712,400,000	1,752,599,999	0.46	-0.28	0.0000000
		- 20	1,712,399,999	1,752,600,000	-0.37	0.50	0.0000000
		- 10	1,712,399,999	1,752,599,999	-0.52	0.35	0.0000000
		0	1,712,400,000	1,752,599,999	0.45	0.32	0.0000000
		+ 10	1,712,399,999	1,752,600,000	-0.95	1.37	0.0000001
		+ 20 (Ref)	1,712,400,000	1,752,599,999	0.00	0.00	0.0000000
		+ 30	1,712,400,000	1,752,599,998	0.44	-0.62	0.0000000
		+ 40	1,712,399,999	1,752,599,999	-0.17	-0.29	0.0000000
		+ 50	1,712,400,000	1,752,599,998	0.84	-0.63	0.0000000
Battery Endpoint	3.40	+ 20	1,712,400,001	1,752,600,000	1.87	1.21	0.0000001

Table 7-23. WCDMA AWS Frequency Stability Data

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Apple Watch FCC ID: BCG-A2774** complies with all the requirements of Part 27 of the FCC rules.

9.0 APPENDIX A

Antenna gains provided by manufacturer:

Cellular Antenna Gain (FCM), Type: IFA			
Band	**Frequency (MHz)**	**Horizontal (dBi)**	**Vertical (dBi)**
1	1921.6	-10.6	-10.5
1	1950.0	-10.4	-10.6
1	1978.4	-10.7	-10.5
3	1711.6	-12.5	-9.0
3	1747.5	-12.7	-10.3
3	1783.4	-12.7	-10.8
7	2502.6	-6.8	-6.7
7	2535.0	-8.9	-8.6
7	2567.4	-9.1	-9.0
25	1851.0	-10.8	-10.4
25	1882.4	-10.7	-10.2
25	1914.0	-10.3	-10.2
39	1882.6	-10.8	-10.4
39	1900.0	-10.3	-10.3
39	1917.4	-10.6	-10.4
40	2302.6	-7.3	-7.5
40	2350.0	-7.9	-7.9
41	2498.6	-6.8	-6.7
41	2593.0	-8.8	-9.0
41	2687.4	-8.4	-8.1

Cellular Antenna Gain (BCM), Type: LDS			
Band	**Frequency (MHz)**	**Horizontal (dBi)**	**Vertical (dBi)**
12	700.0	-34.1	-31.1
12	707.4	-33.5	-30.6
12	715.0	-33.1	-30.4
13	778.6	-32.5	-27.9
13	782.0	-32.7	-28.2
13	785.4	-32.4	-27.7
26	815.0	-33.2	-28.6
26	831.4	-32.2	-27.3
26	848.0	-31.9	-26.9
40	2397.4	-13.0	-12.8