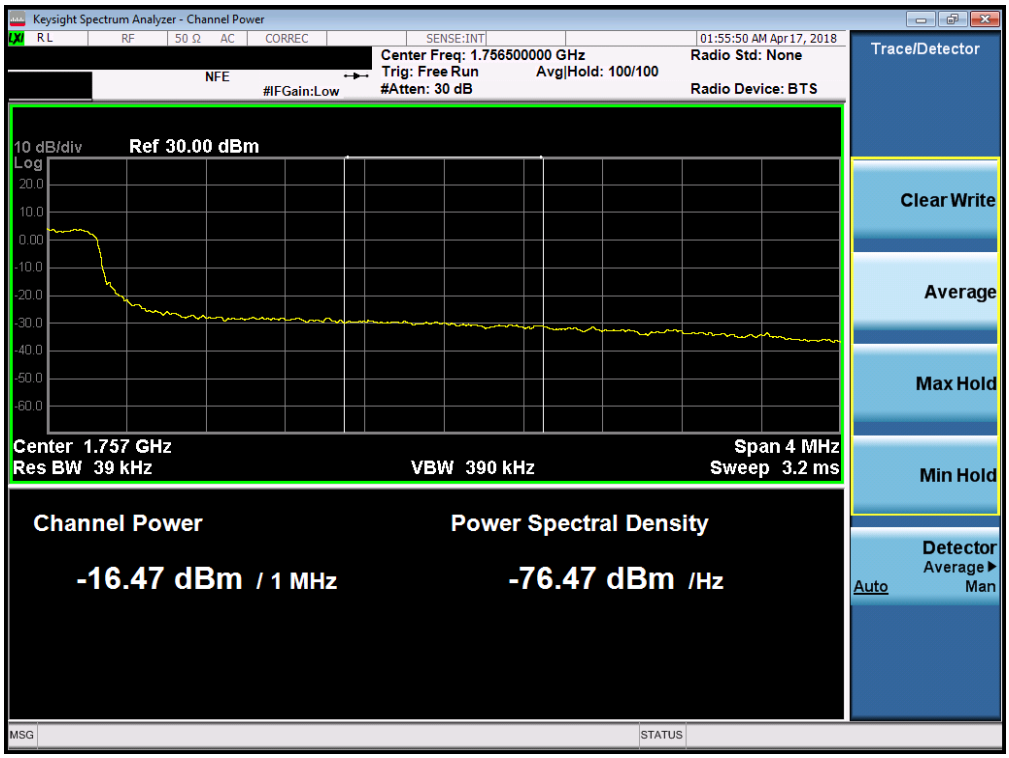
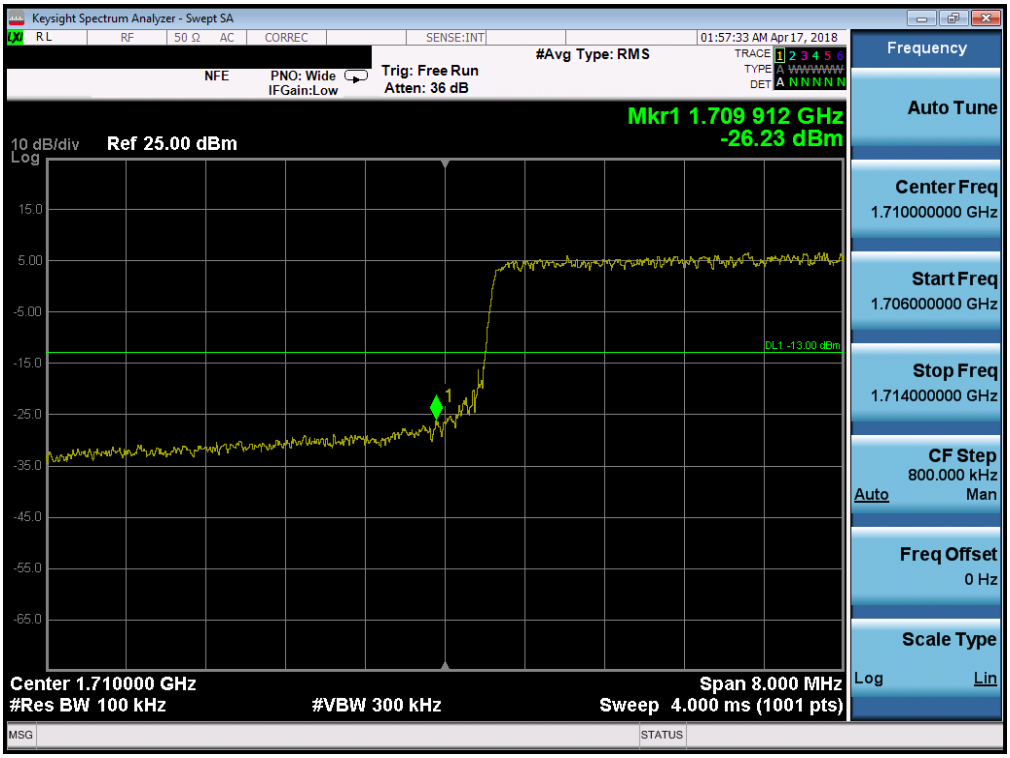
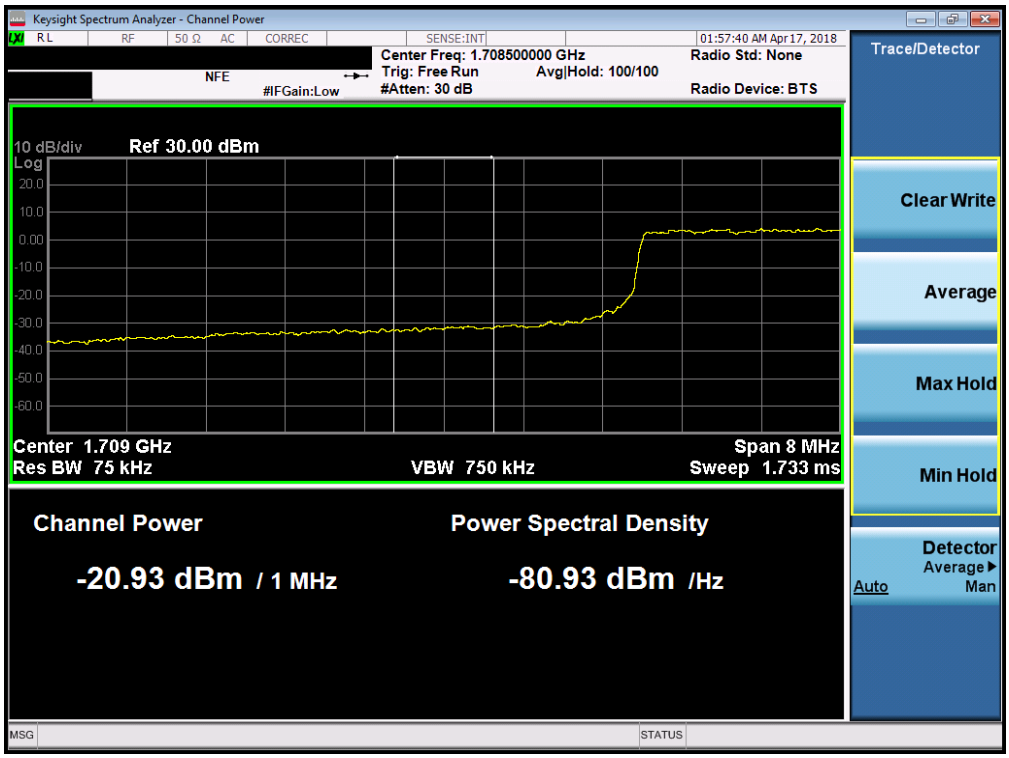
Plot 7-105. Upper Band Edge Plot (Band 4 - 5.0MHz QPSK - Full RB Configuration)



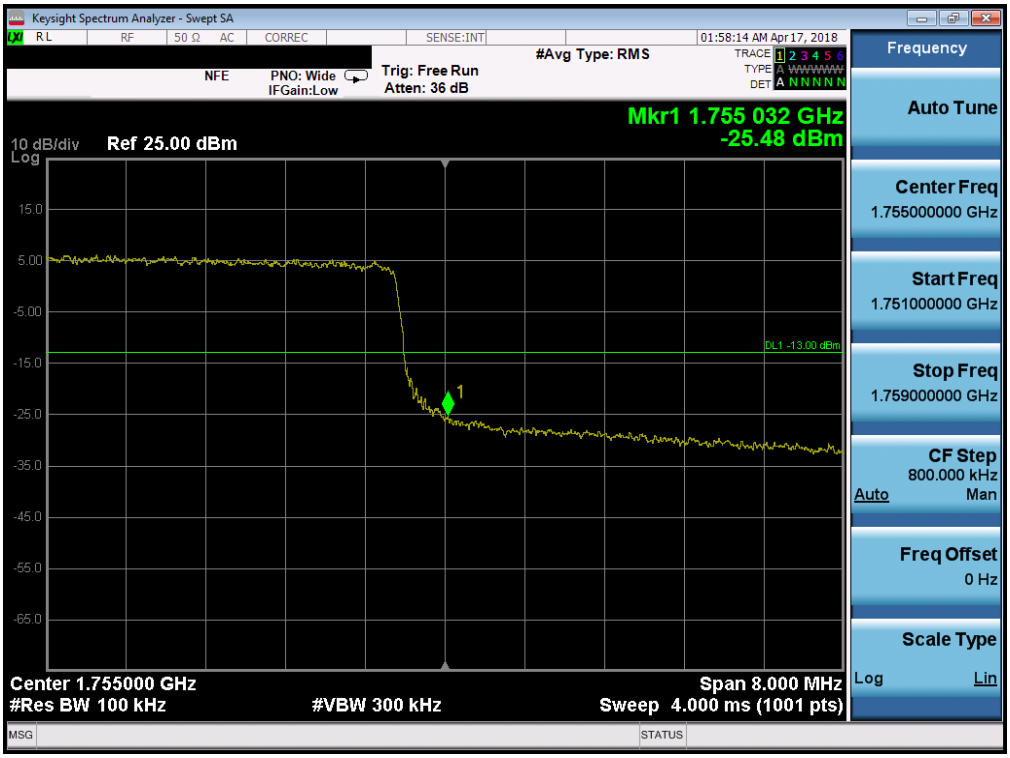
Plot 7-106. Extended Upper Band Edge Plot (Band 4 - 5.0MHz QPSK - Full RB Configuration)



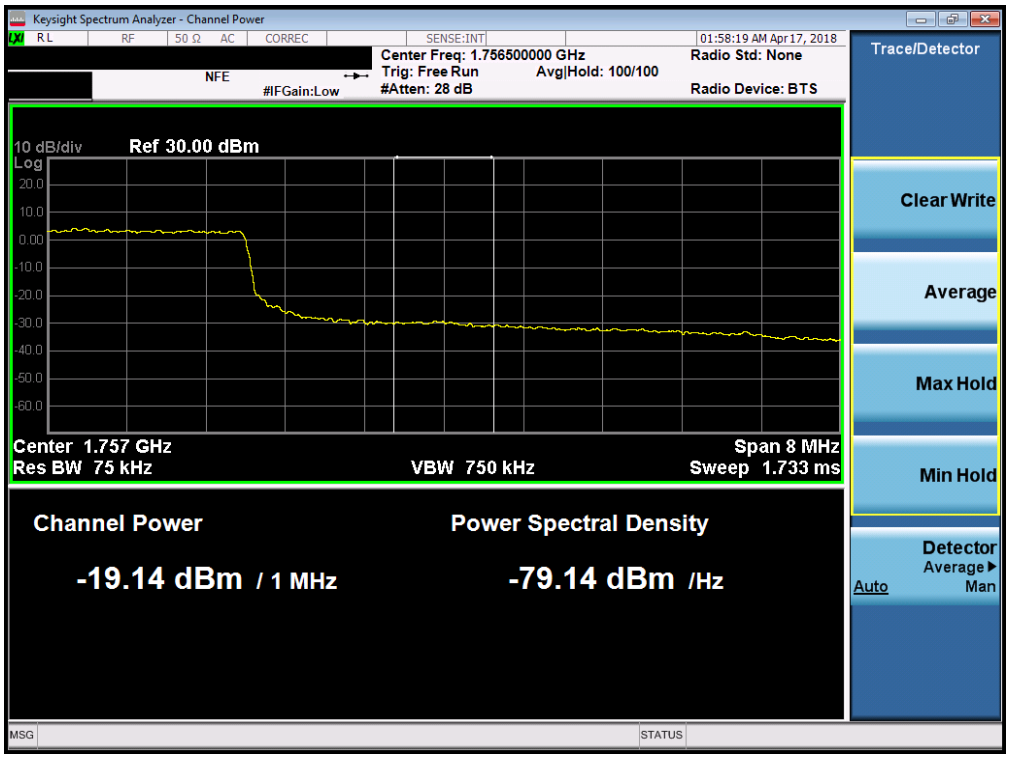
Plot 7-107. Lower Band Edge Plot (Band 4/66 - 10.0MHz QPSK - Full RB Configuration)



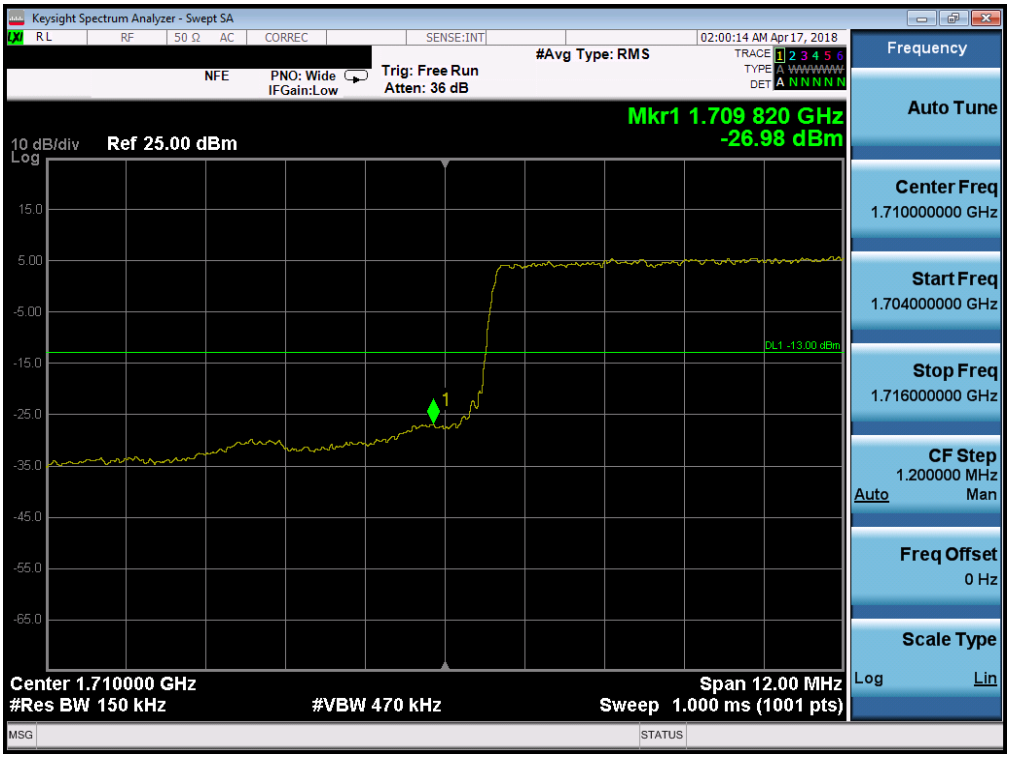
Plot 7-108. Extended Lower Band Edge Plot (Band 4/66 - 10.0MHz QPSK - Full RB Configuration)



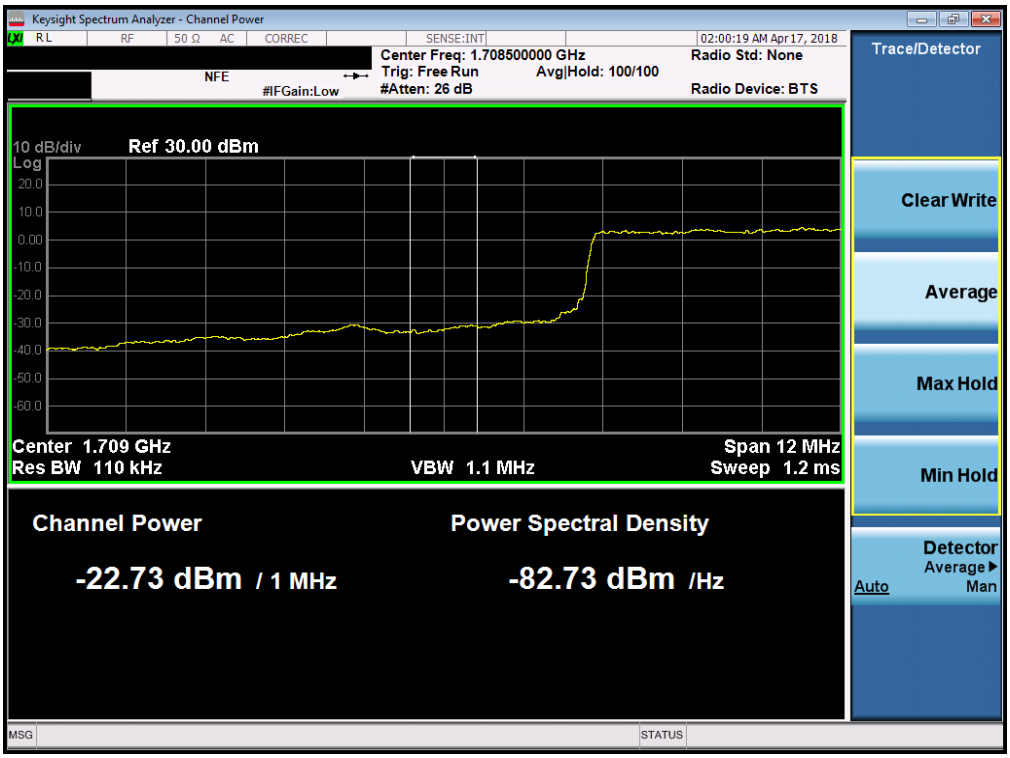
Plot 7-109. Upper Band Edge Plot (Band 4 - 10.0MHz QPSK - Full RB Configuration)



Plot 7-110. Extended Upper Band Edge Plot (Band 4 - 10.0MHz QPSK - Full RB Configuration)

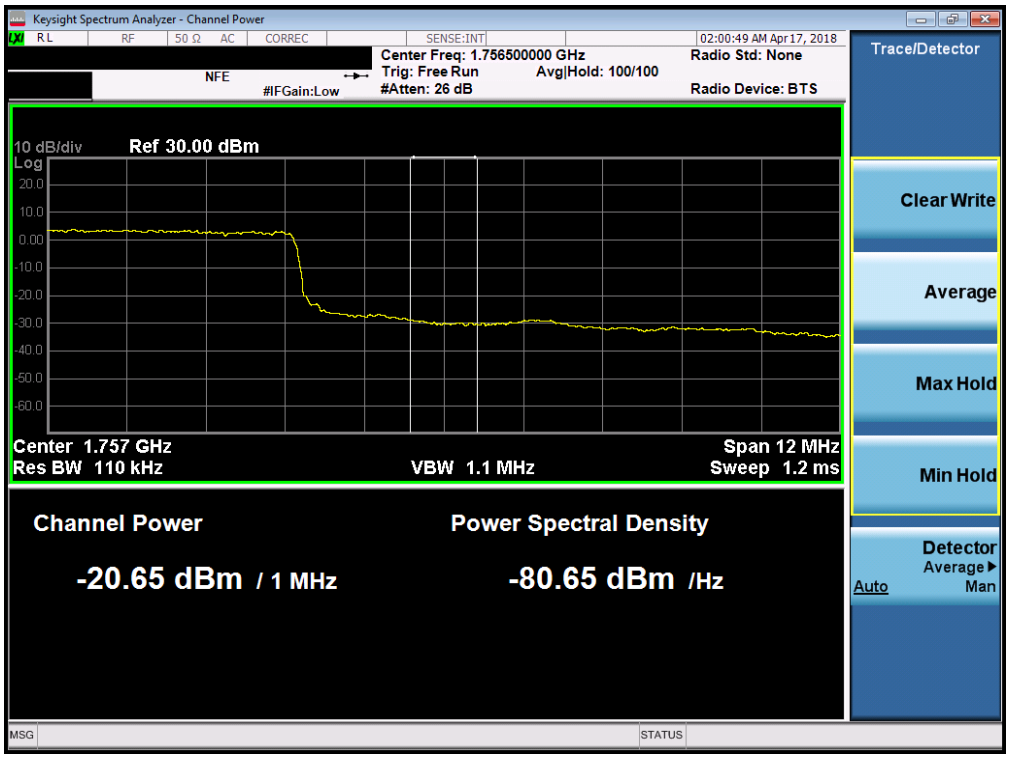


Plot 7-111. Lower Band Edge Plot (Band 4/66 - 15.0MHz QPSK - Full RB Configuration)

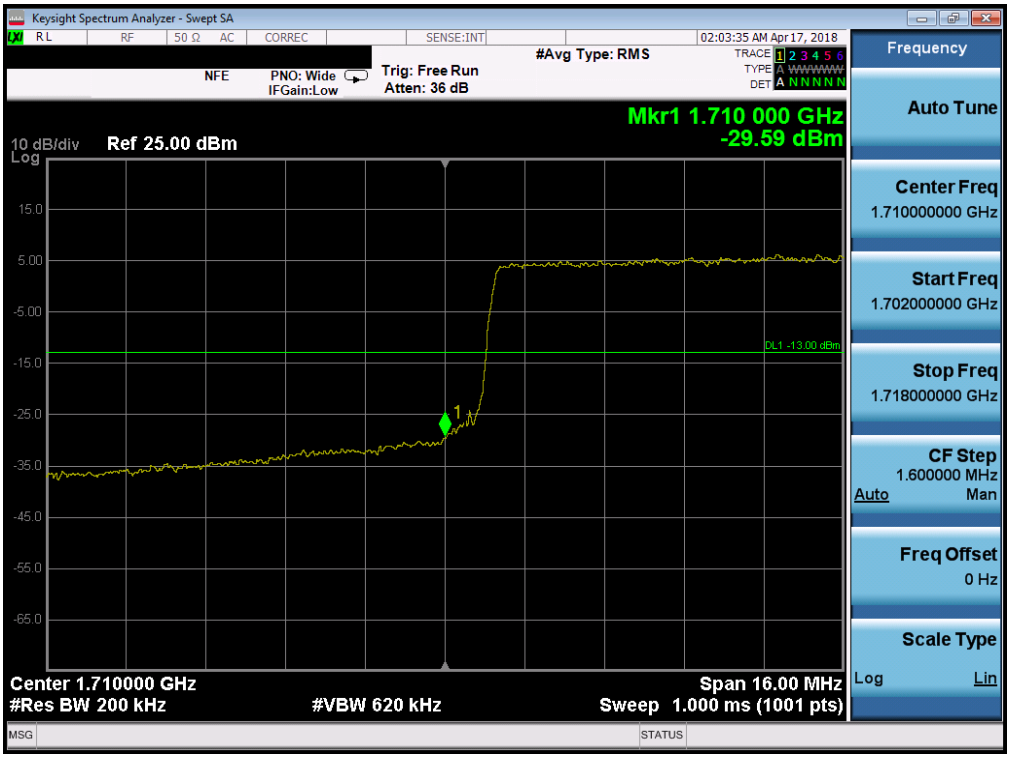


Plot 7-112. Extended Lower Band Edge Plot (Band 4/66 - 15.0MHz QPSK - Full RB Configuration)

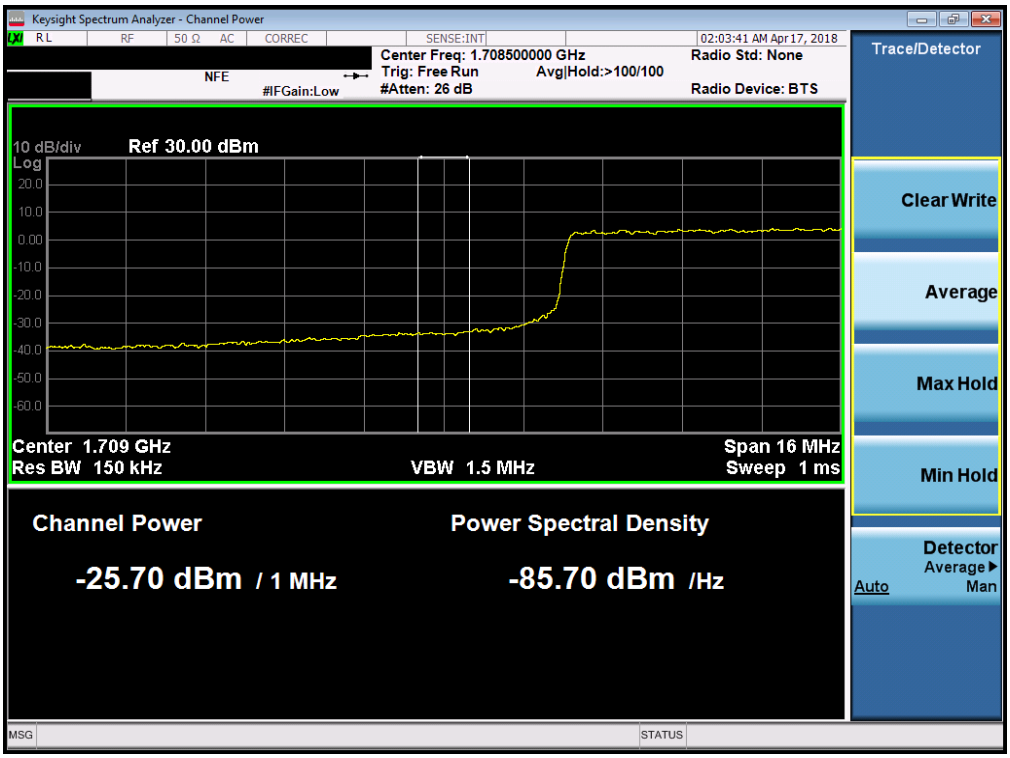
Plot 7-113. Upper Band Edge Plot (Band 4 - 15.0MHz QPSK - Full RB Configuration)



Plot 7-114. Extended Upper Band Edge Plot (Band 4 - 15.0MHz QPSK - Full RB Configuration)

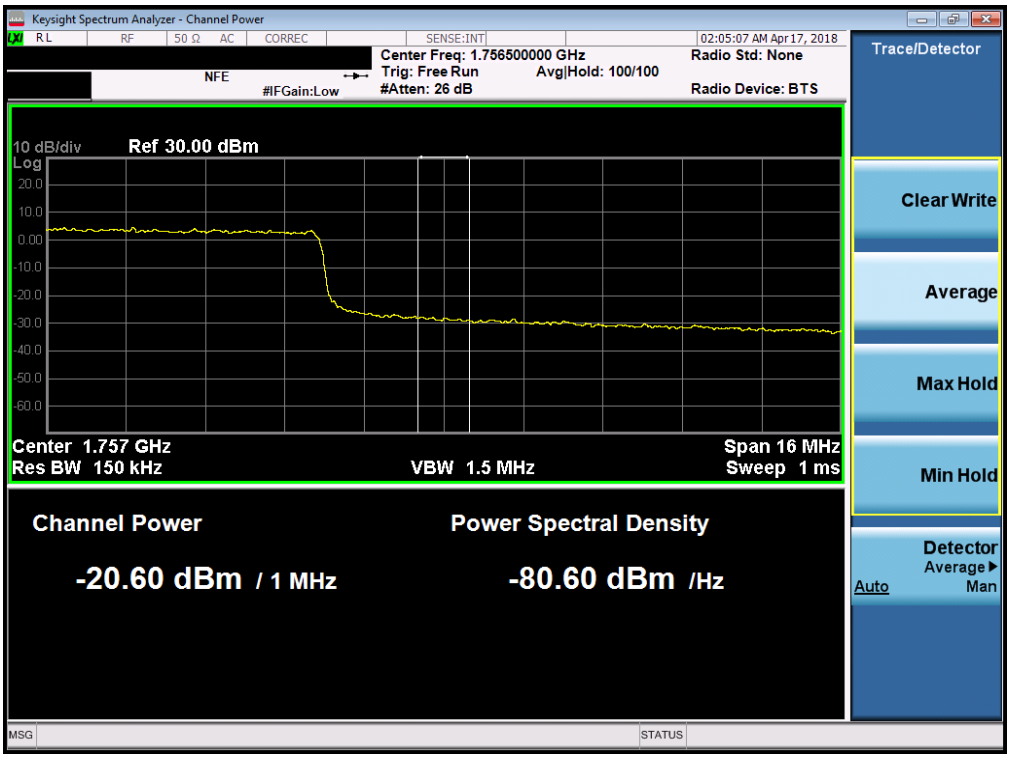


Plot 7-115. Lower Band Edge Plot (Band 4/66 - 20.0MHz QPSK - Full RB Configuration)



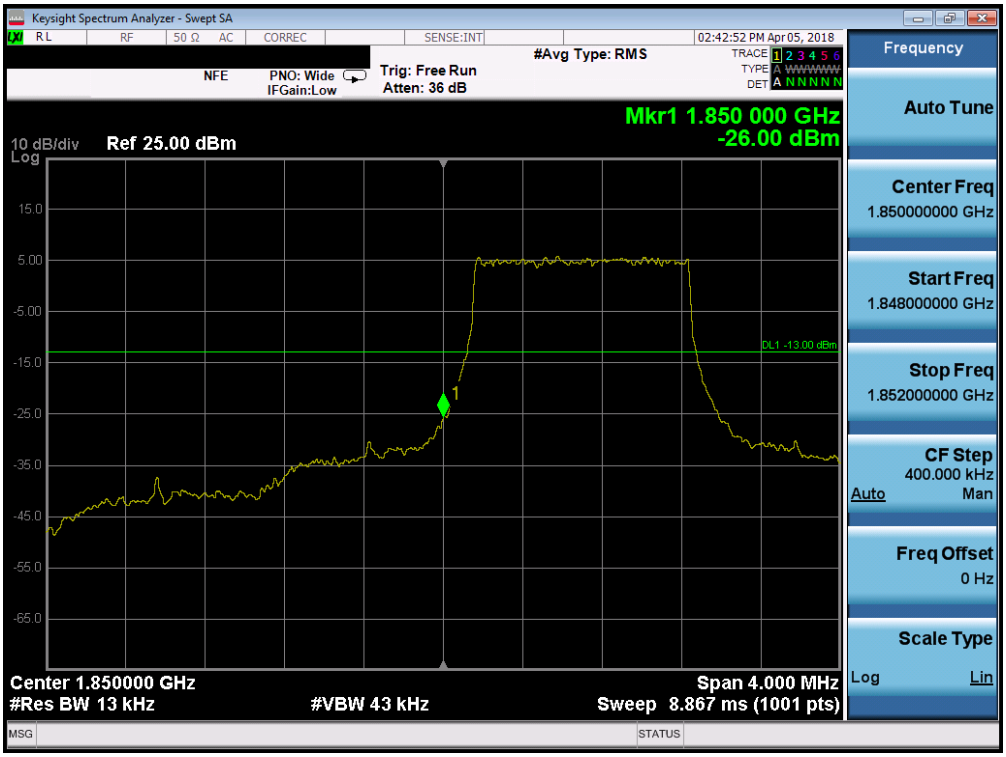
Plot 7-116. Extended Lower Band Edge Plot (Band 4/66 - 20.0MHz QPSK - Full RB Configuration)

Plot 7-117. Upper Band Edge Plot (Band 4 - 20.0MHz QPSK - Full RB Configuration)

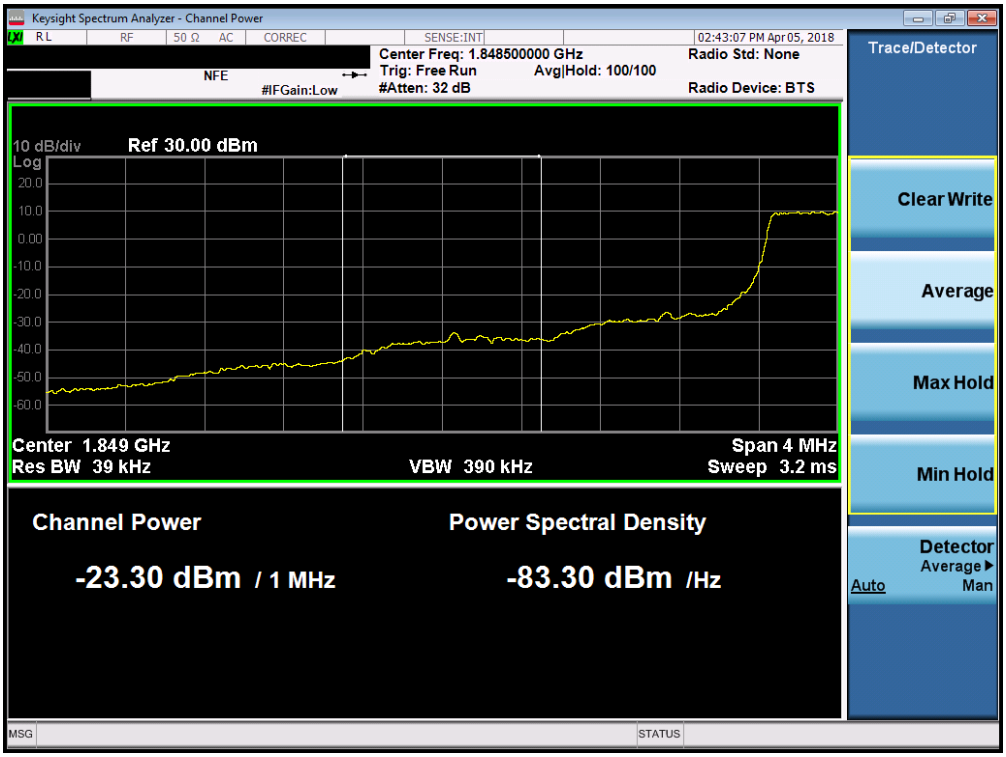


Plot 7-118. Extended Upper Band Edge Plot (Band 4 - 20.0MHz QPSK - Full RB Configuration)

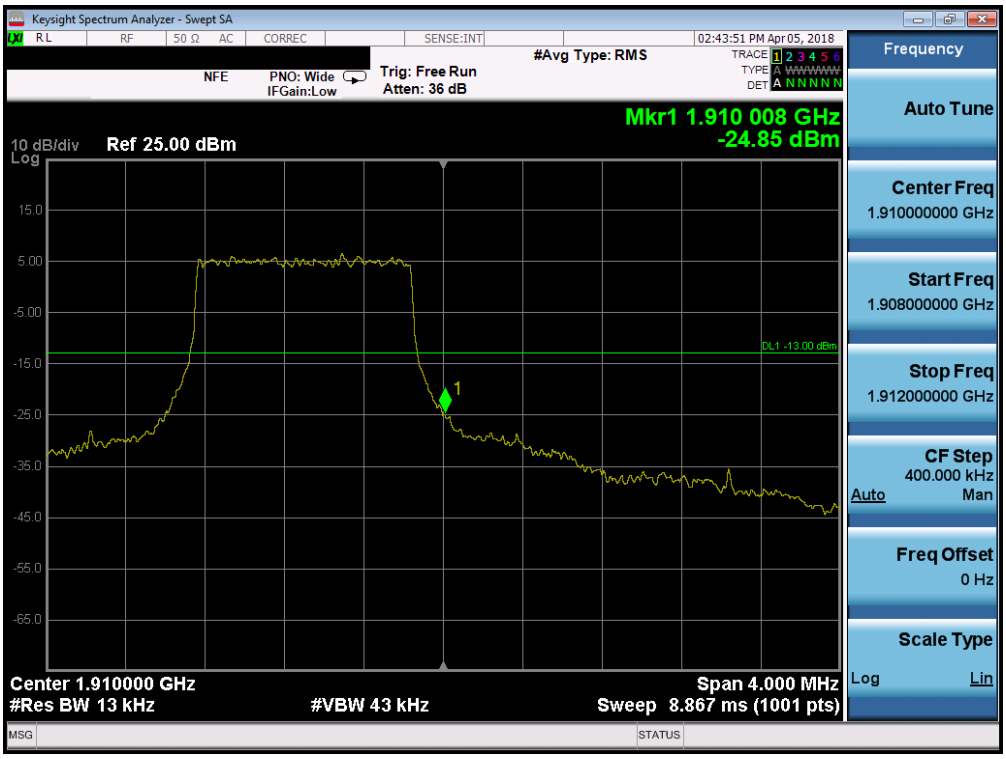
Band 2



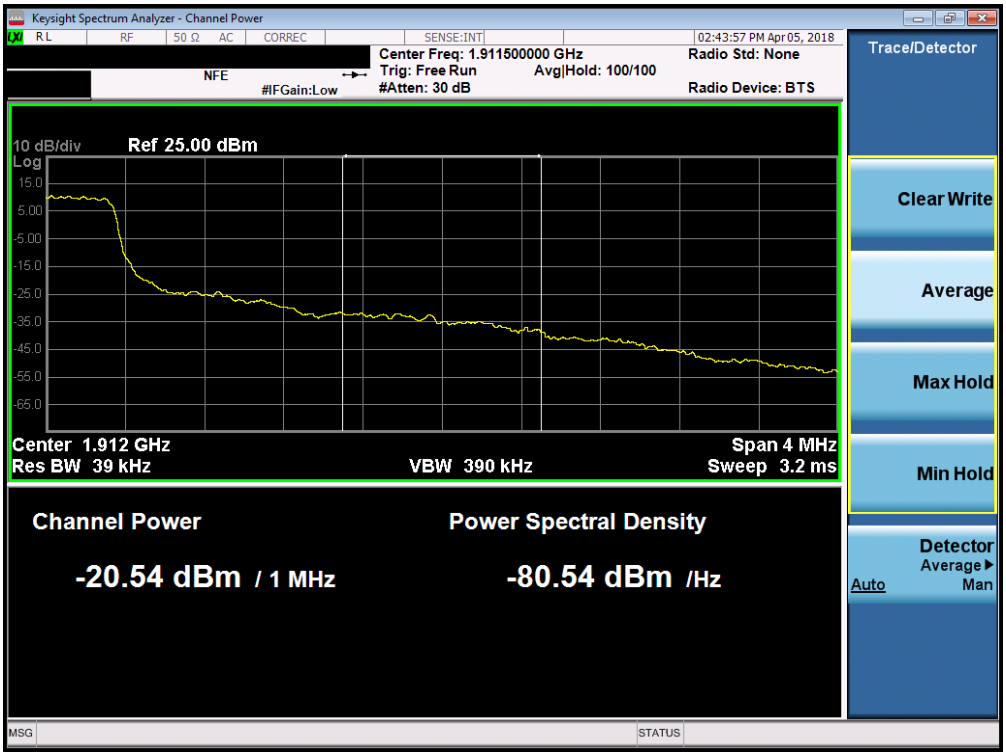
Plot 7-119. Lower Band Edge Plot (Band 2 - 1.4MHz QPSK - Full RB Configuration)



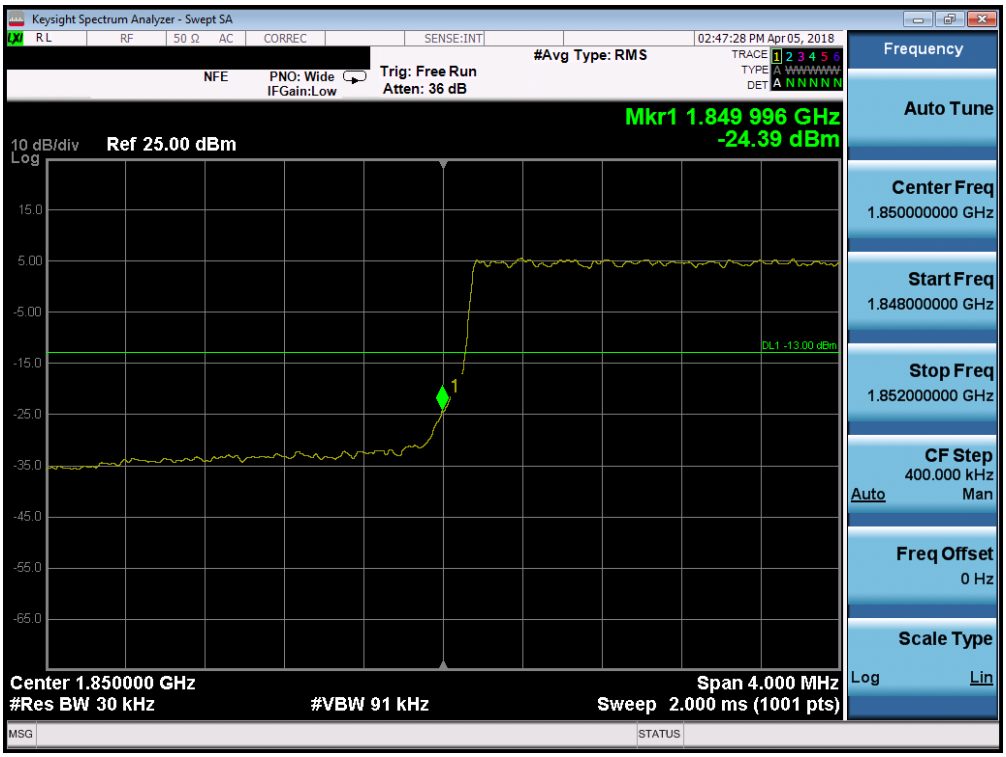
Plot 7-120. Lower Extended Band Edge Plot (Band 2 - 1.4MHz QPSK - Full RB Configuration)



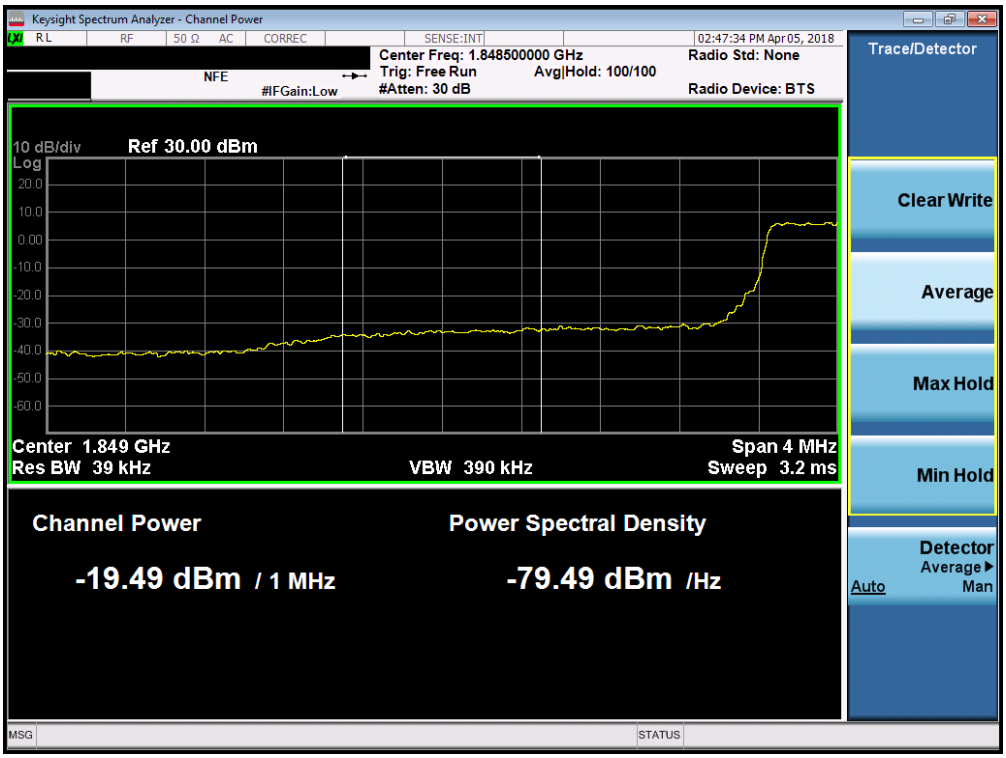
Plot 7-121. Upper Band Edge Plot (Band 2 - 1.4MHz QPSK - Full RB Configuration)



Plot 7-122. Upper Extended Band Edge Plot (Band 2 - 1.4MHz QPSK - Full RB Configuration)

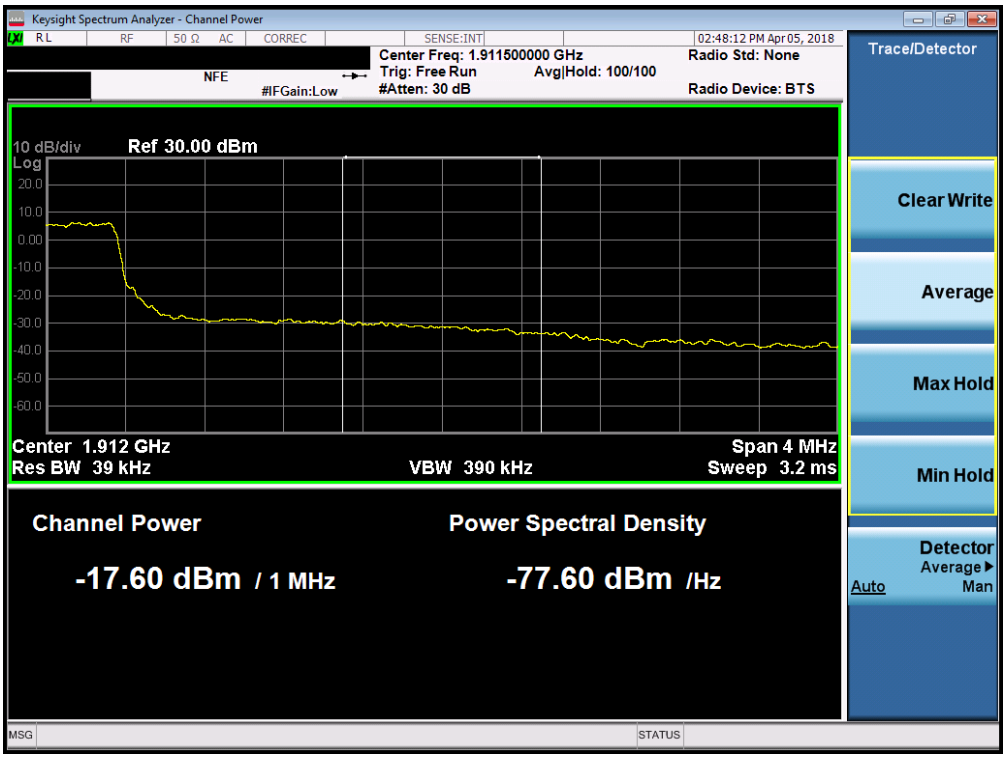


Plot 7-123. Lower Band Edge Plot (Band 2 - 3.0MHz QPSK - Full RB Configuration)

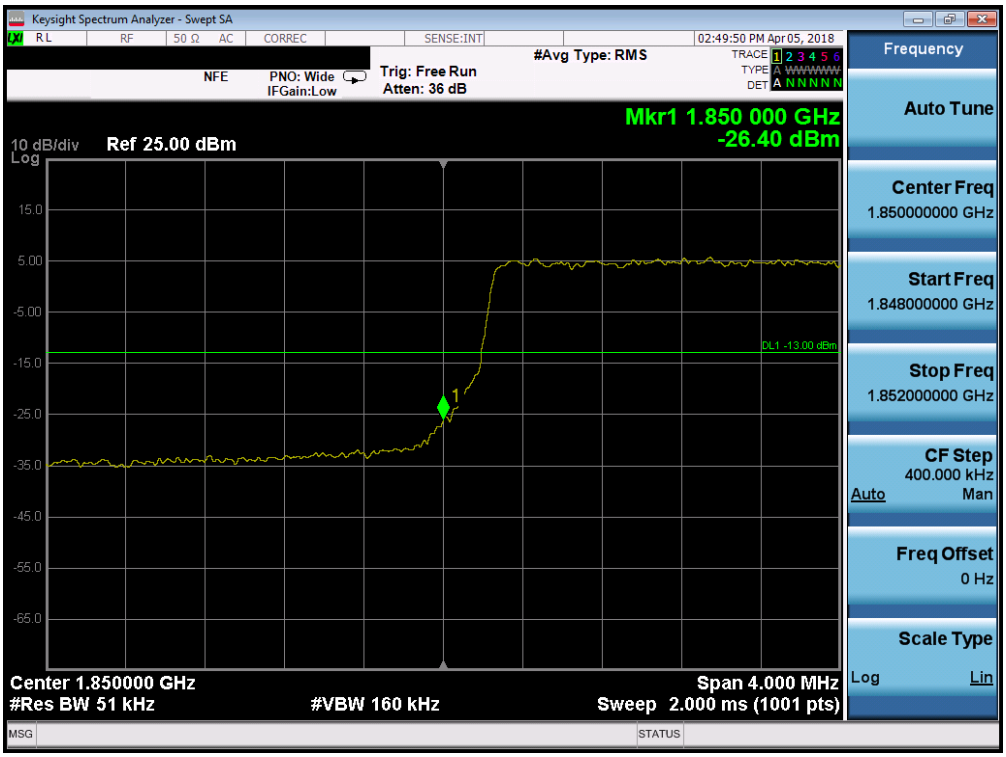


Plot 7-124. Lower Extended Band Edge Plot (Band 2 - 3.0MHz QPSK - Full RB Configuration)

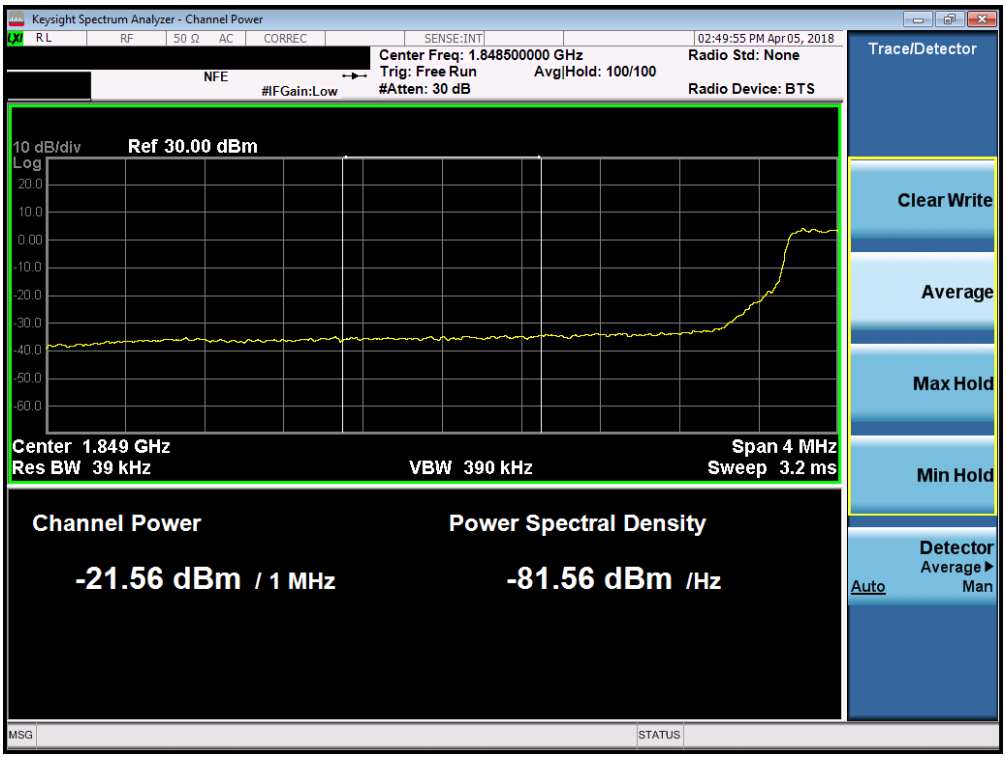
Plot 7-125. Upper Band Edge Plot (Band 2 - 3.0MHz QPSK - Full RB Configuration)



Plot 7-126. Upper Extended Band Edge Plot (Band 2 - 3.0MHz QPSK - Full RB Configuration)

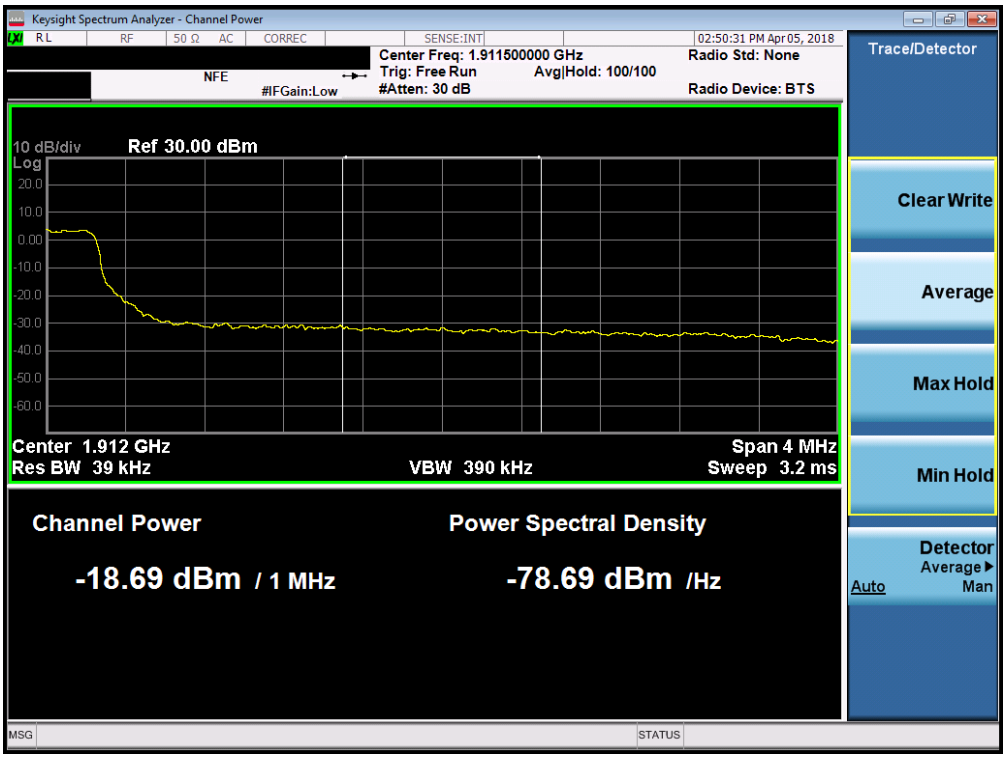


Plot 7-127. Lower Band Edge Plot (Band 2 - 5.0MHz QPSK - Full RB Configuration)

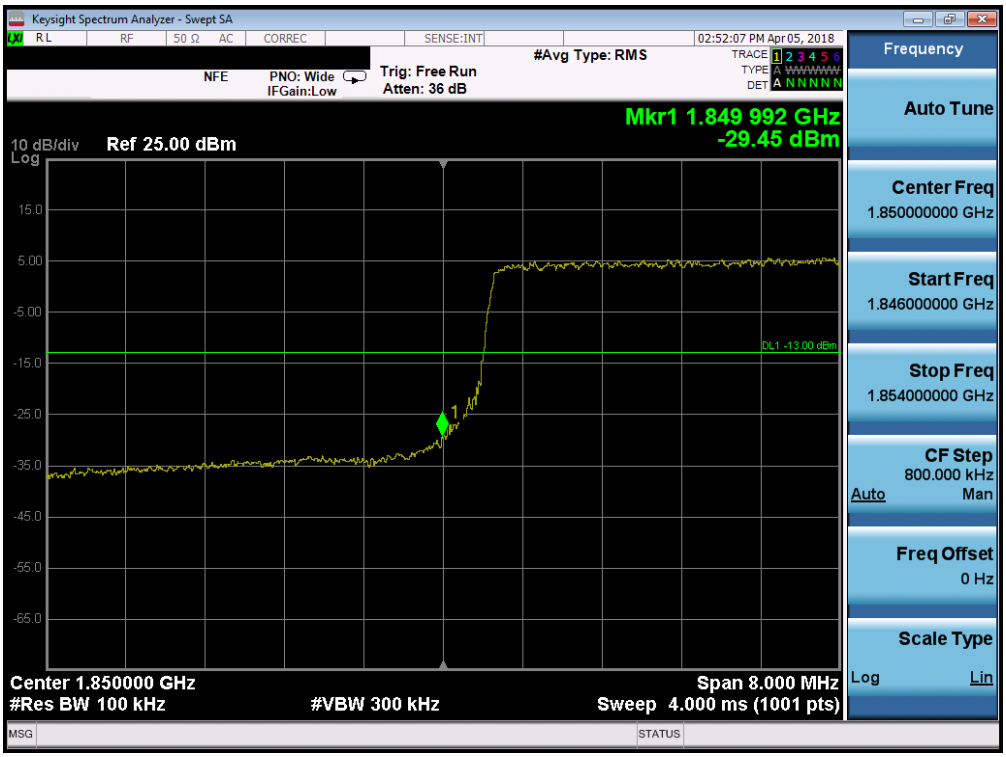


Plot 7-128. Lower Extended Band Edge Plot (Band 2 - 5.0MHz QPSK - Full RB Configuration)

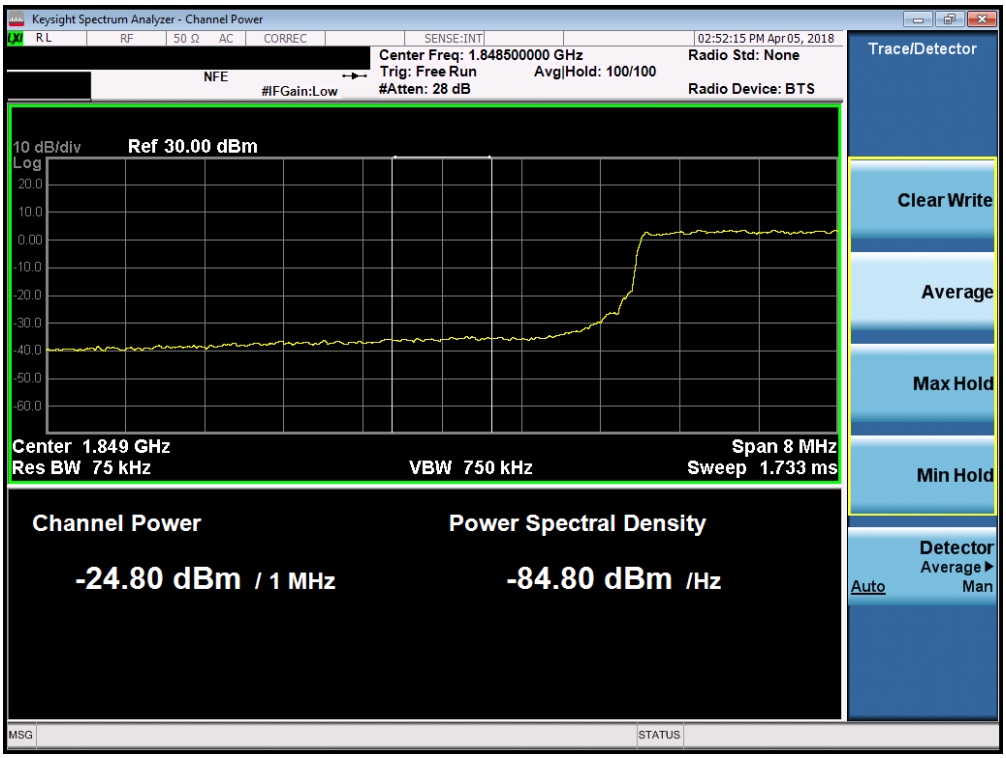
Plot 7-129. Upper Band Edge Plot (Band 2 - 5.0MHz QPSK - Full RB Configuration)



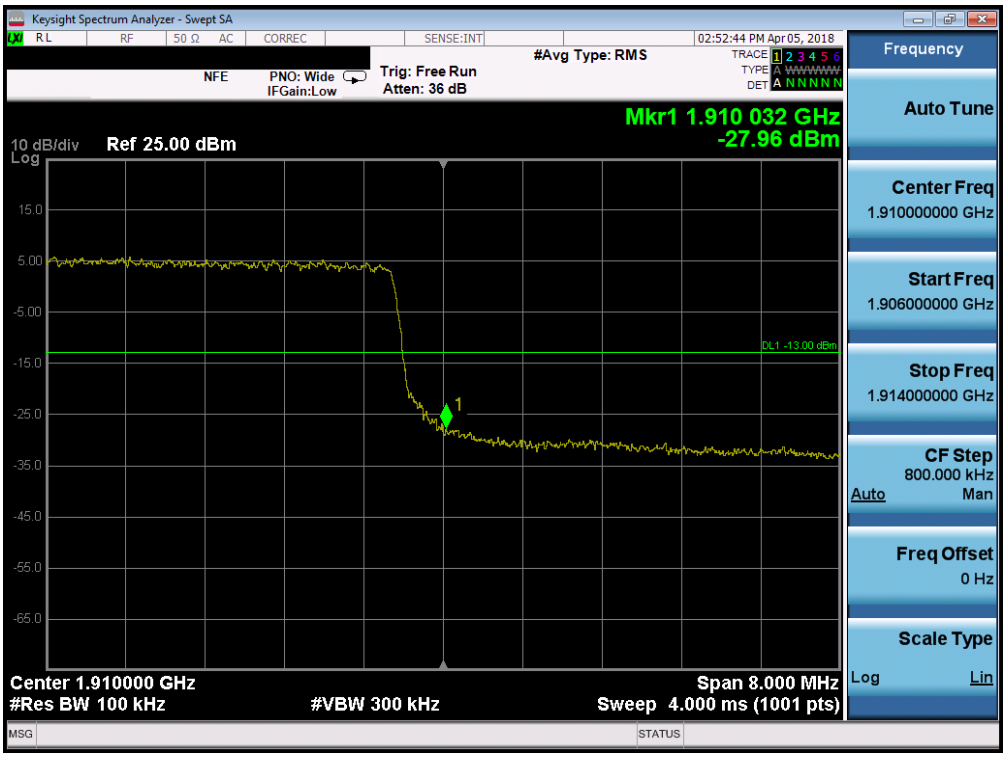
Plot 7-130. Upper Extended Band Edge Plot (Band 2 - 5.0MHz QPSK - Full RB Configuration)



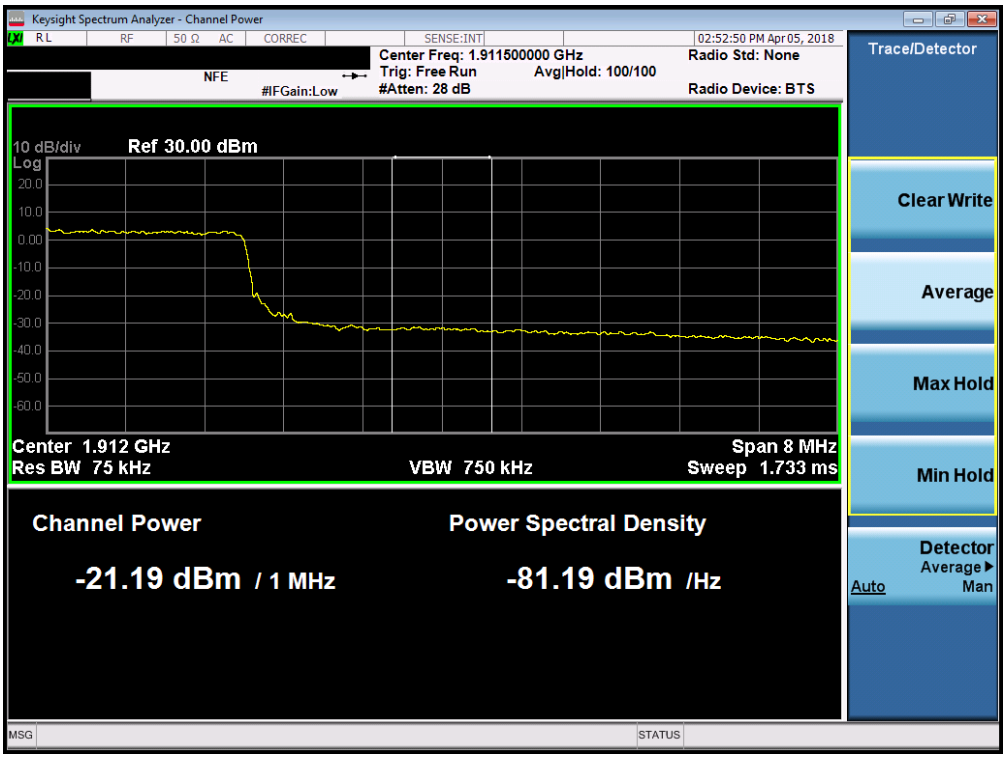
Plot 7-131. Lower Band Edge Plot (Band 2 - 10.0MHz QPSK - Full RB Configuration)



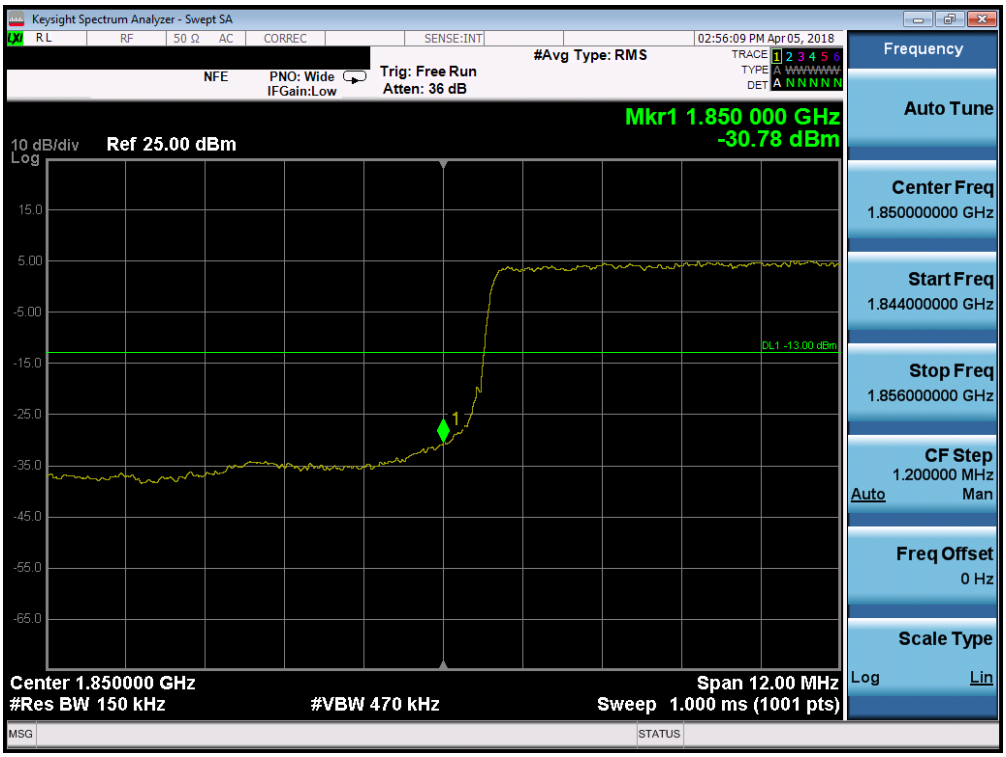
Plot 7-132. Lower Extended Band Edge Plot (Band 2 - 10.0MHz QPSK - Full RB Configuration)



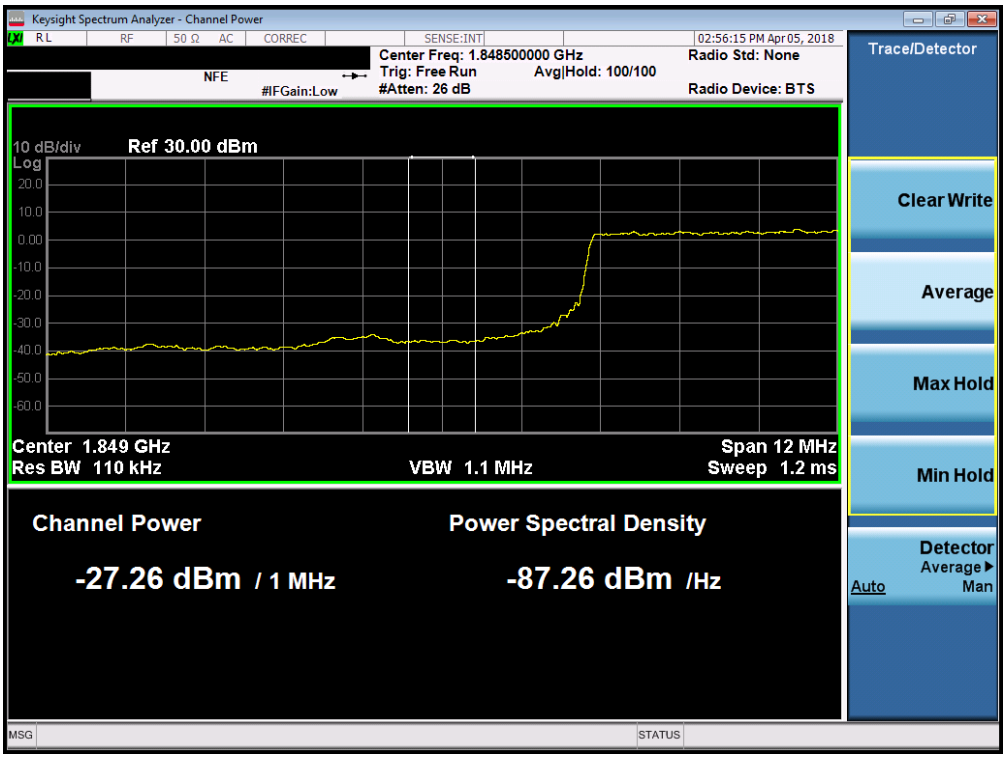
Plot 7-133. Upper Band Edge Plot (Band 2 - 10.0MHz QPSK - Full RB Configuration)



Plot 7-134. Upper Extended Band Edge Plot (Band 2 - 10.0MHz QPSK - Full RB Configuration)

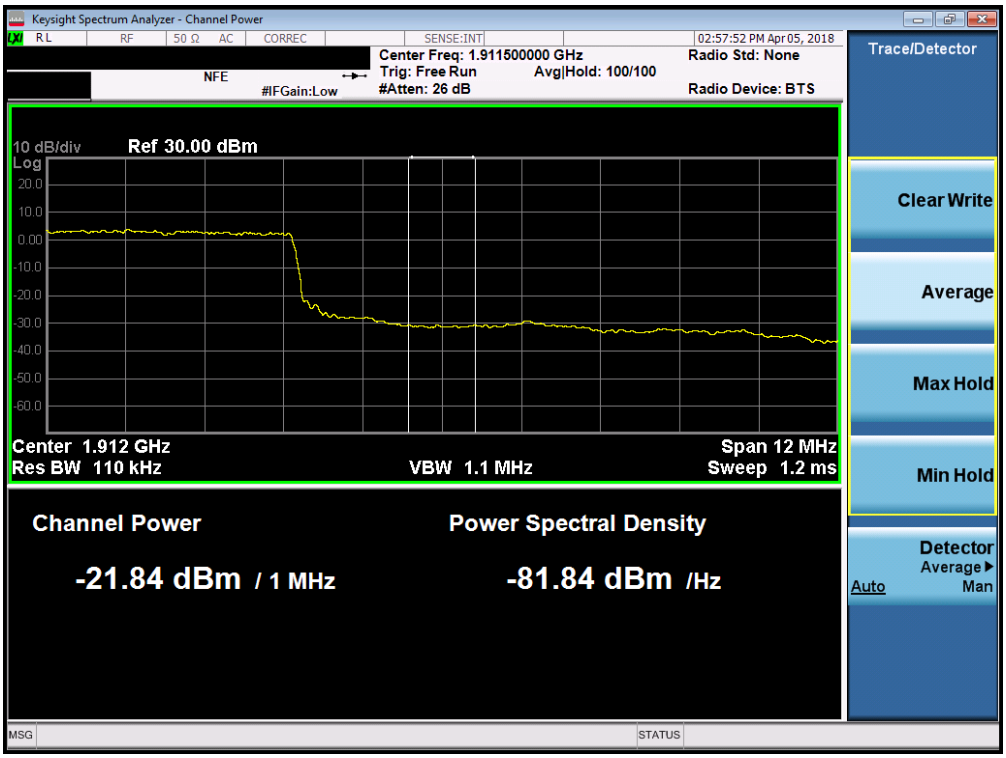


Plot 7-135. Lower Band Edge Plot (Band 2 - 15.0MHz QPSK - Full RB Configuration)

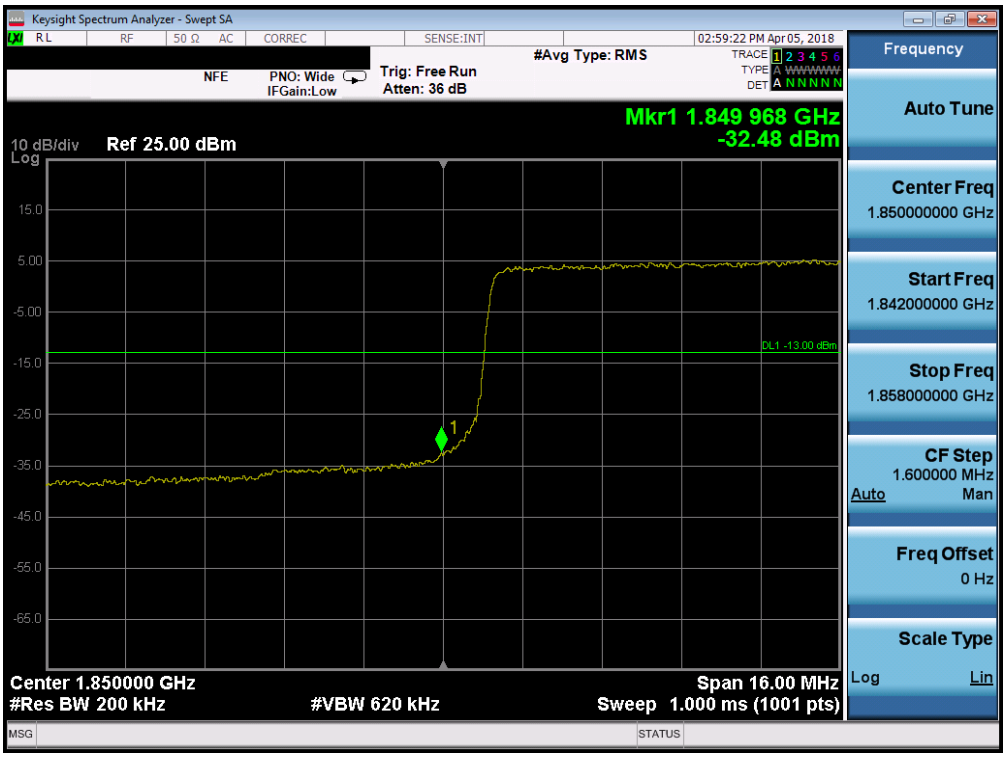


Plot 7-136. Lower Extended Band Edge Plot (Band 2 - 15.0MHz QPSK - Full RB Configuration)

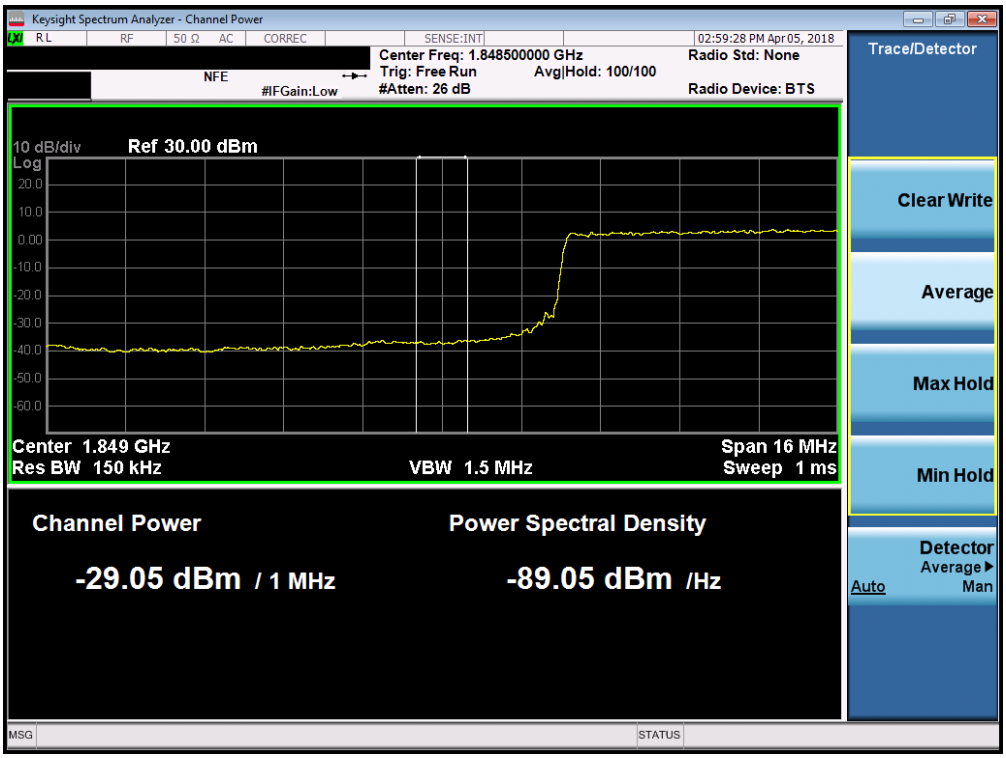
Plot 7-137. Upper Band Edge Plot (Band 2 - 15.0MHz QPSK - Full RB Configuration)



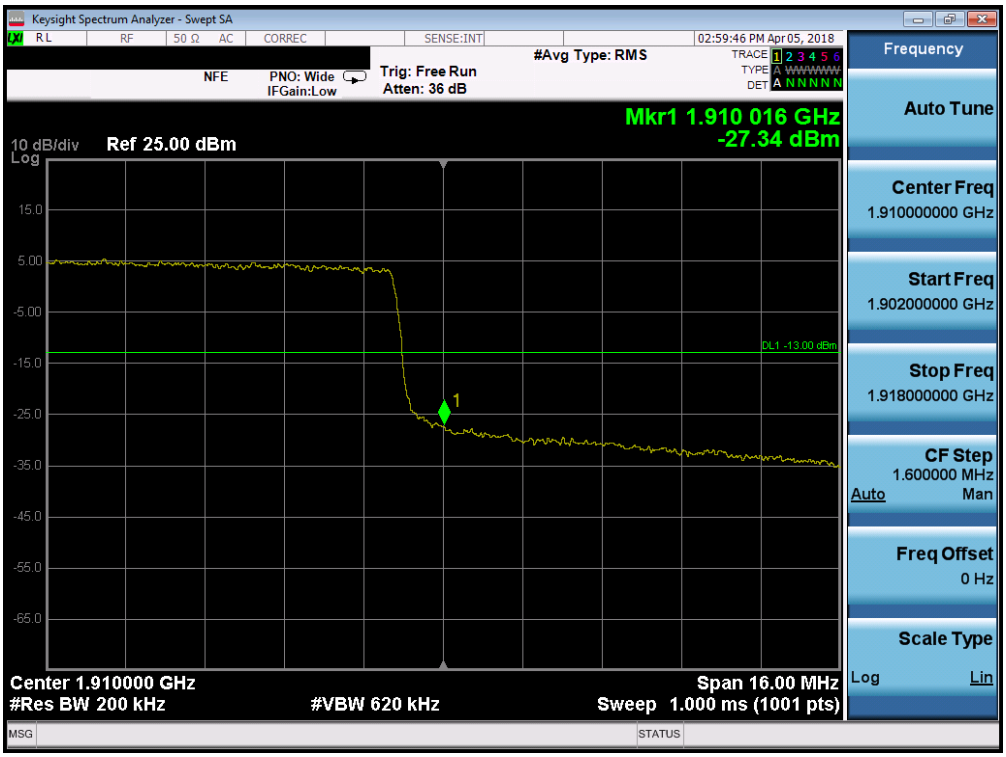
Plot 7-138. Upper Extended Band Edge Plot (Band 2 - 15.0MHz QPSK - Full RB Configuration)



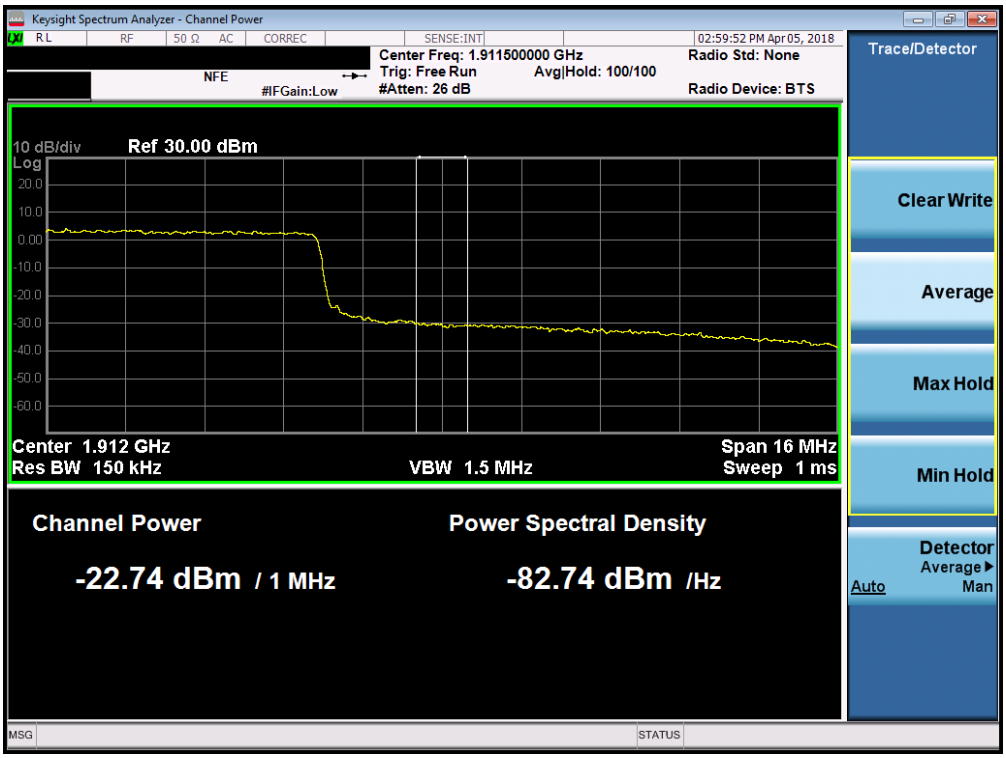
Plot 7-139. Lower Band Edge Plot (Band 2 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-140. Lower Extended Band Edge Plot (Band 2 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-141. Upper Band Edge Plot (Band 2 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-142. Upper Extended Band Edge Plot (Band 2 - 20.0MHz QPSK - Full RB Configuration)

7.5 Peak-Average Ratio

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 v03 – 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.

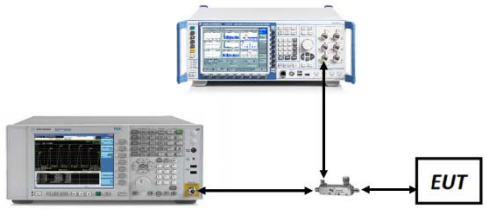
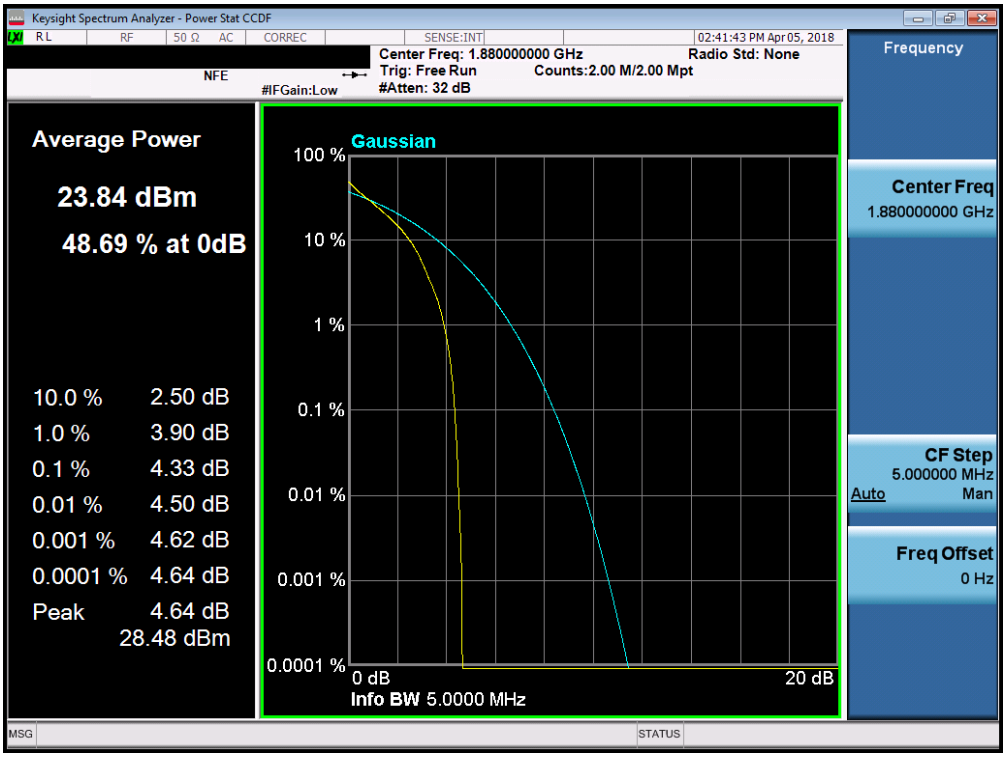


Figure 7-4. Test Instrument & Measurement Setup

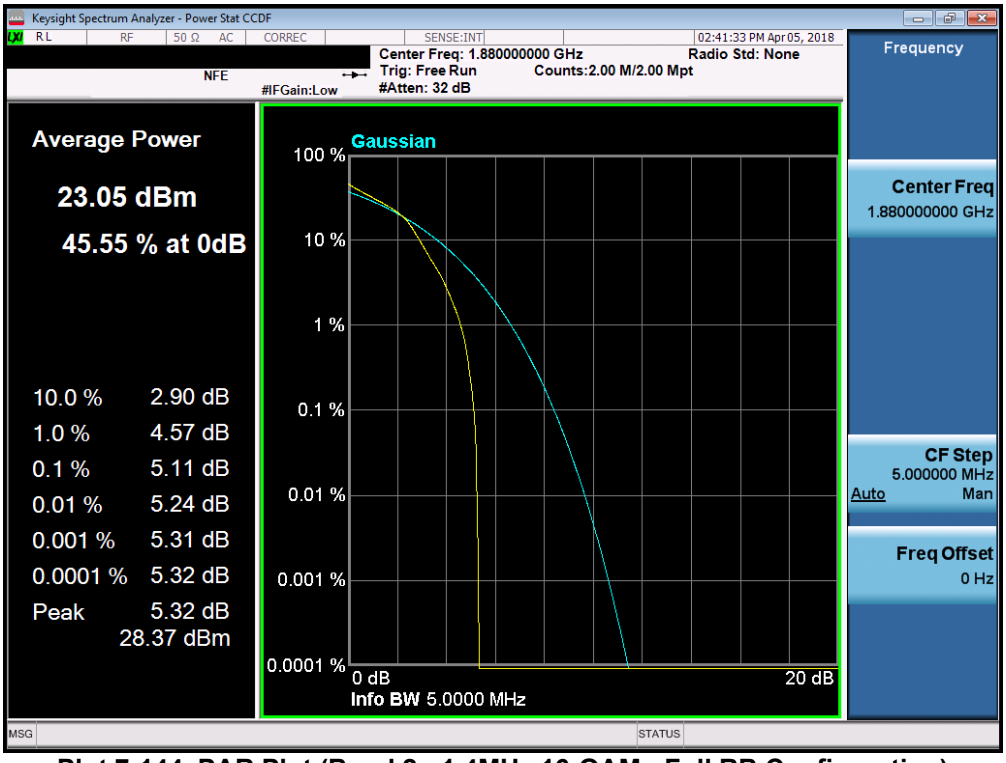
Test Notes

None.

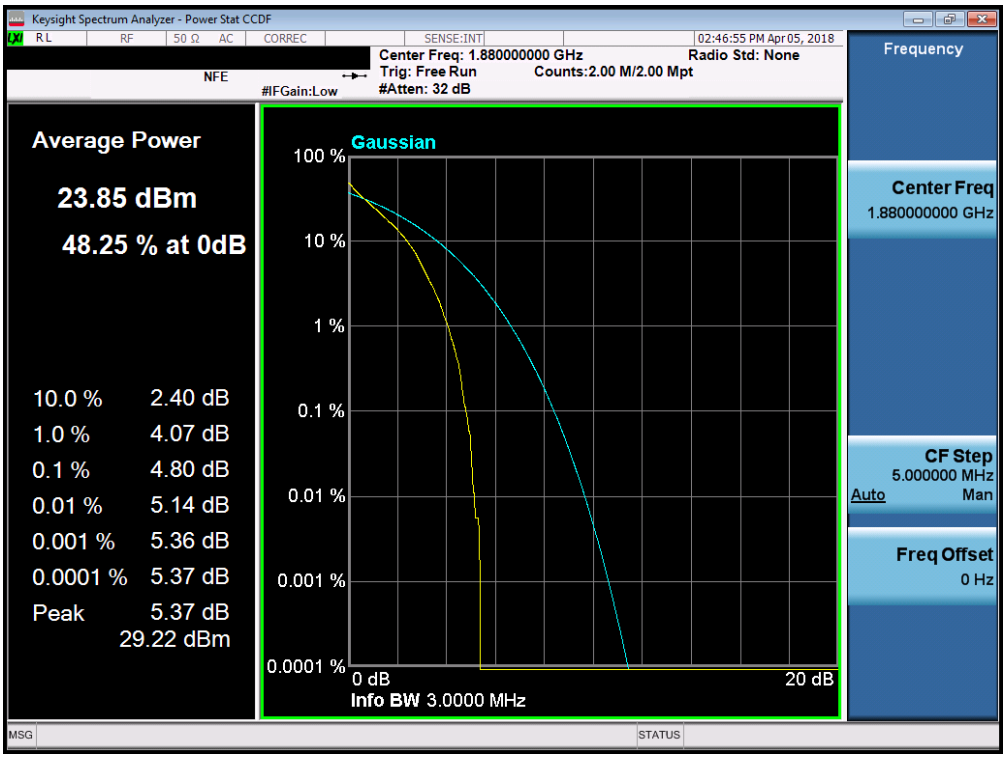
Band 2



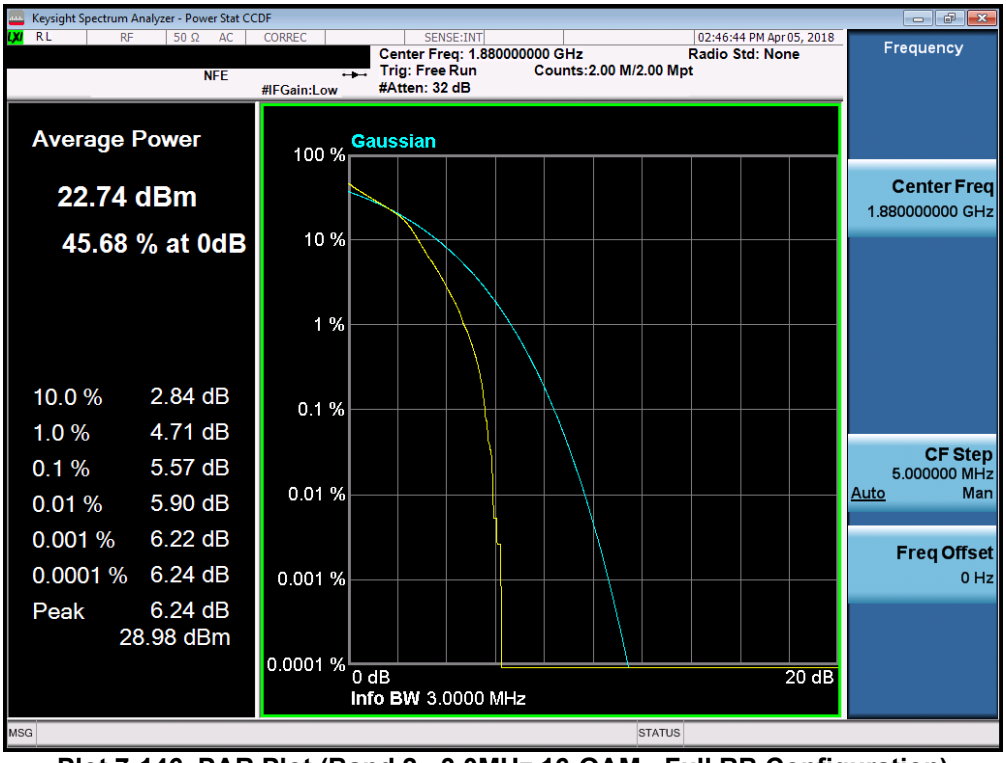
Plot 7-143. PAR Plot (Band 2 - 1.4MHz QPSK - Full RB Configuration)



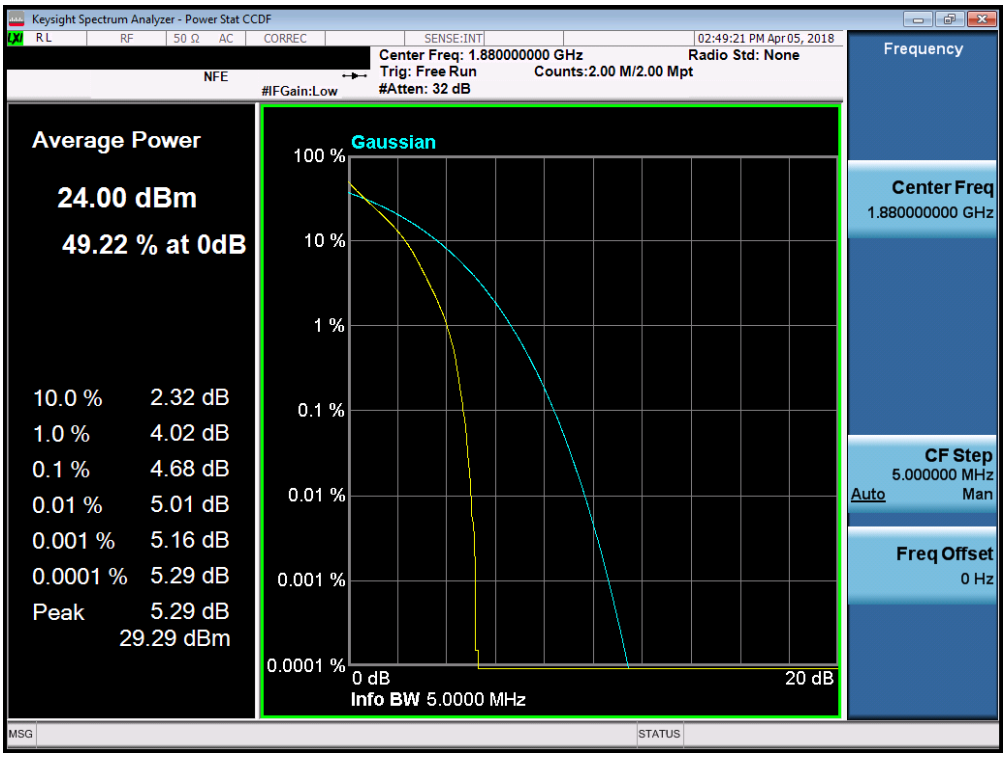
Plot 7-144. PAR Plot (Band 2 - 1.4MHz 16-QAM - Full RB Configuration)



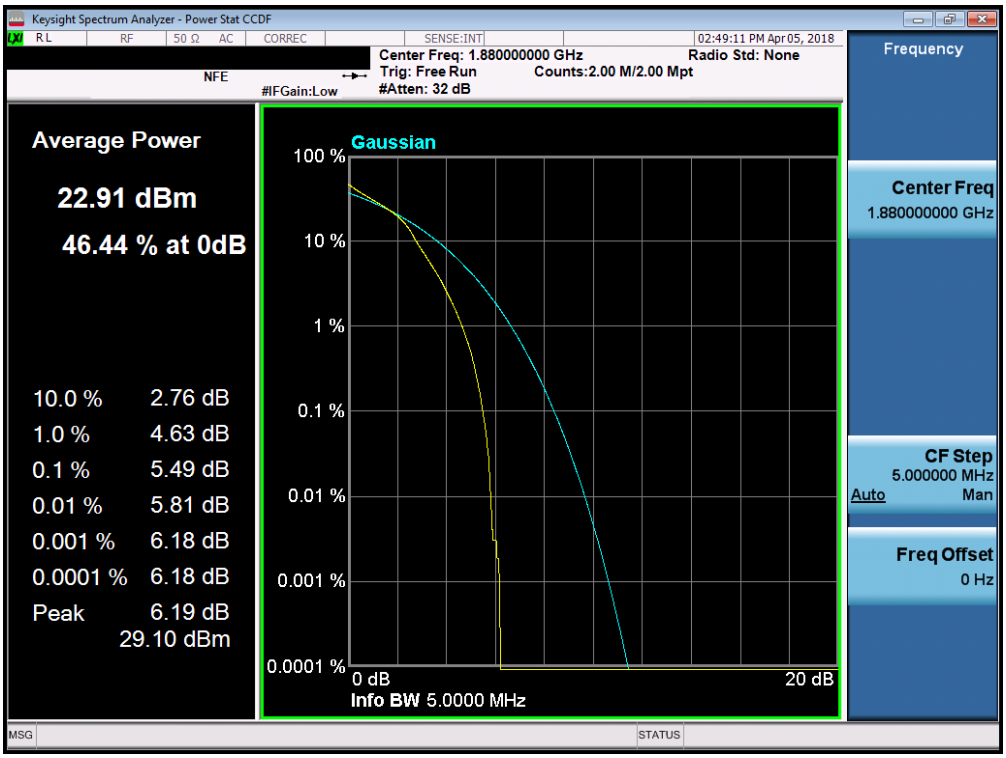
Plot 7-145. PAR Plot (Band 2 - 3.0MHz QPSK - Full RB Configuration)



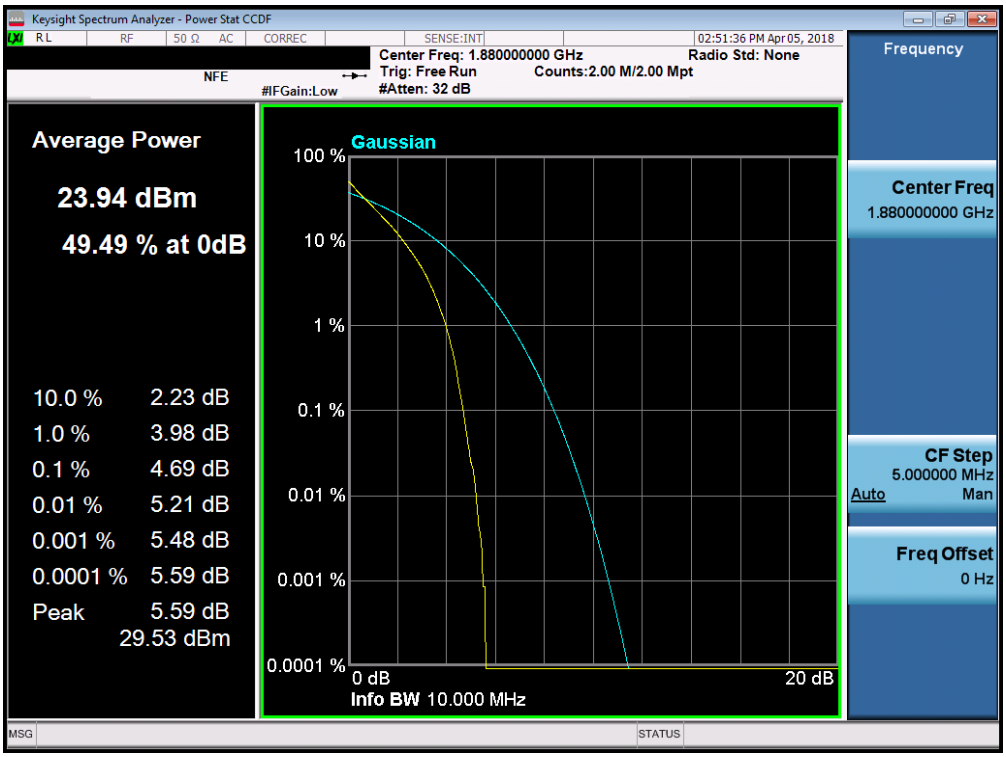
Plot 7-146. PAR Plot (Band 2 - 3.0MHz 16-QAM - Full RB Configuration)



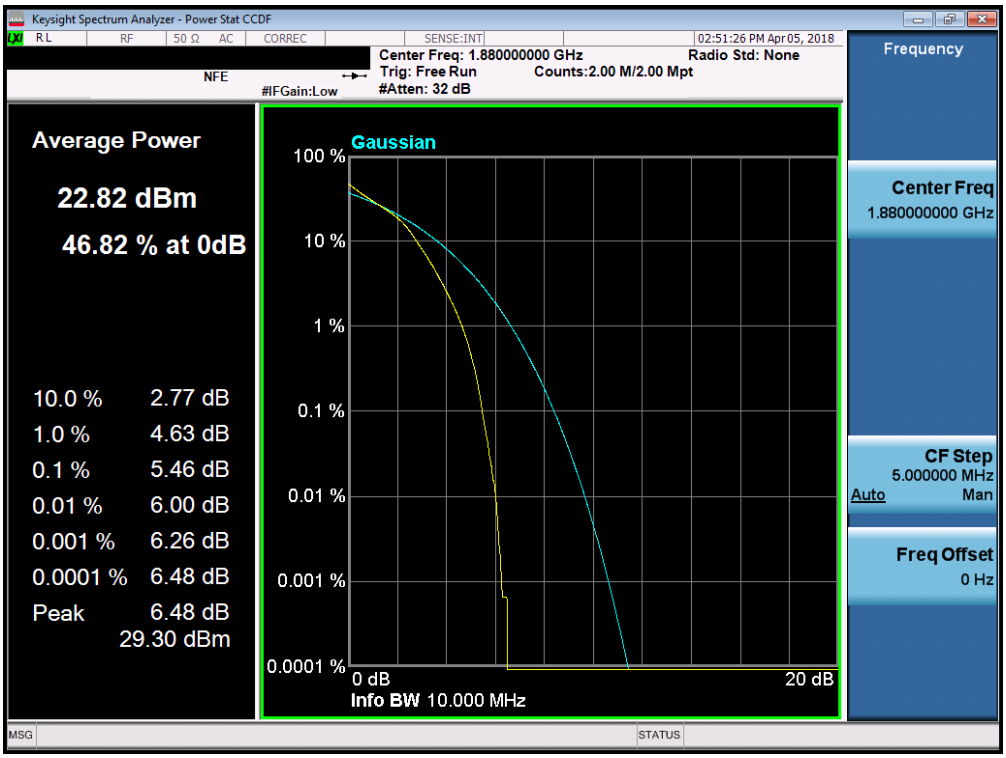
Plot 7-147. PAR Plot (Band 2 - 5.0MHz QPSK - Full RB Configuration)



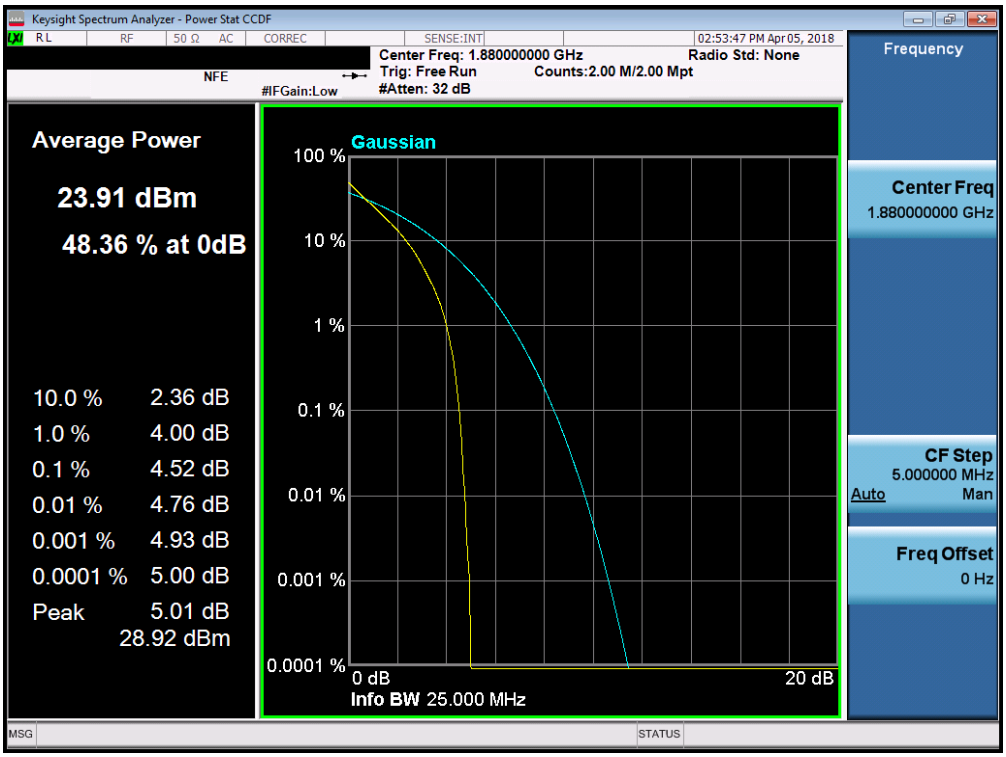
Plot 7-148. PAR Plot (Band 2 - 5.0MHz 16-QAM - Full RB Configuration)



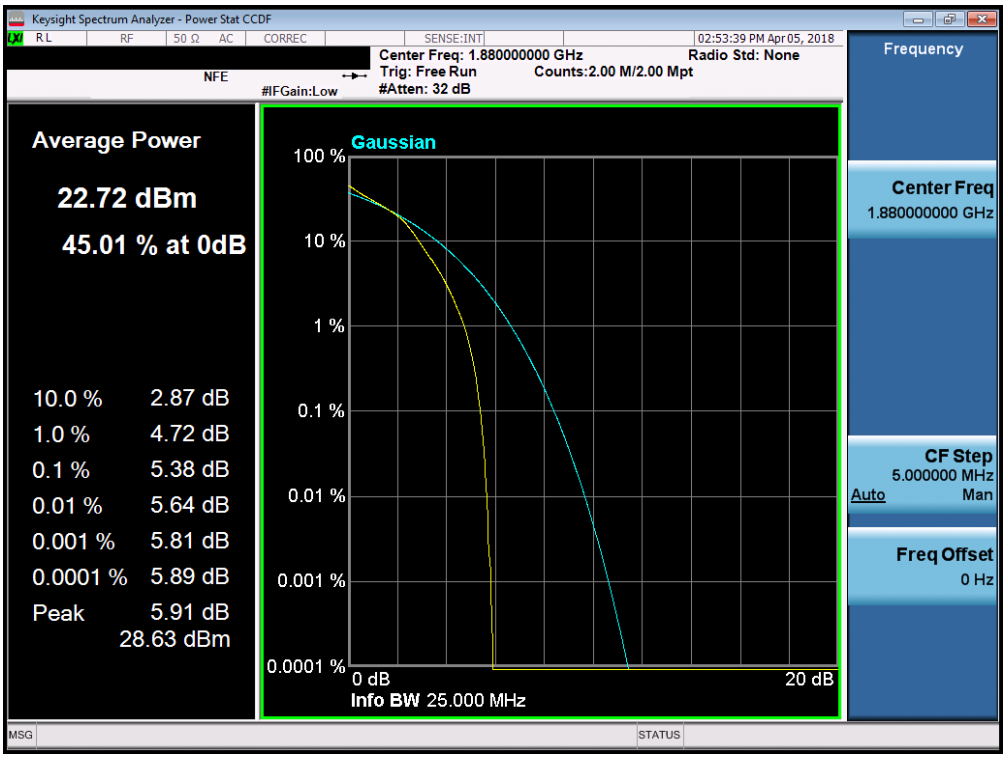
Plot 7-149. PAR Plot (Band 2 - 10.0MHz QPSK - Full RB Configuration)



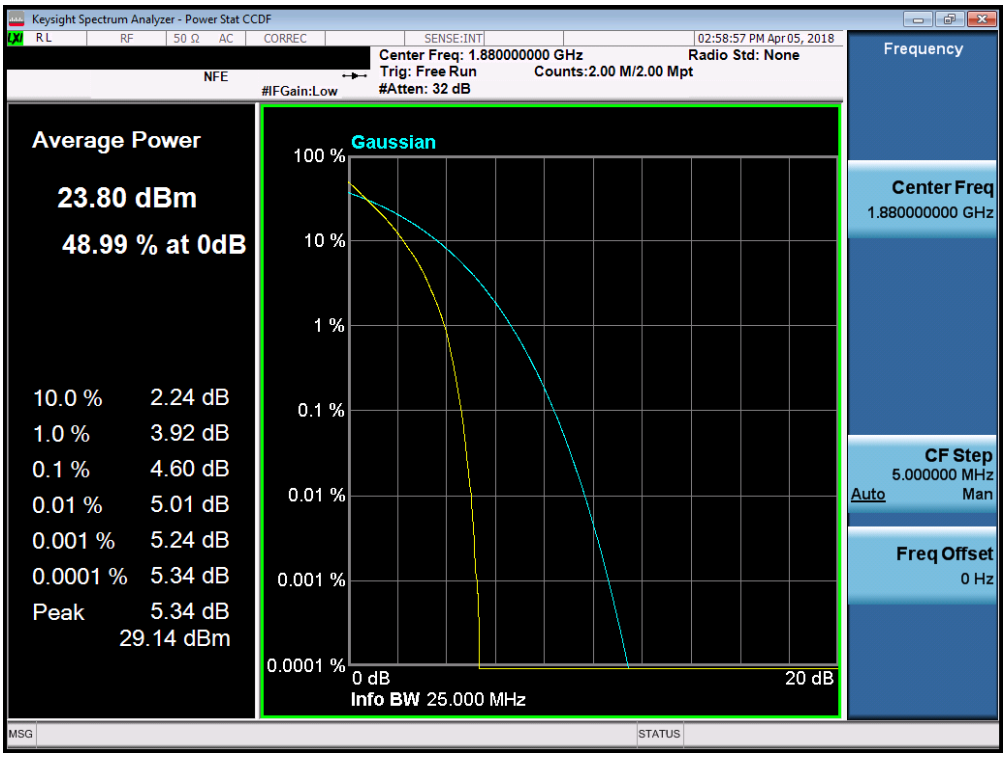
Plot 7-150. PAR Plot (Band 2 - 10.0MHz 16-QAM - Full RB Configuration)



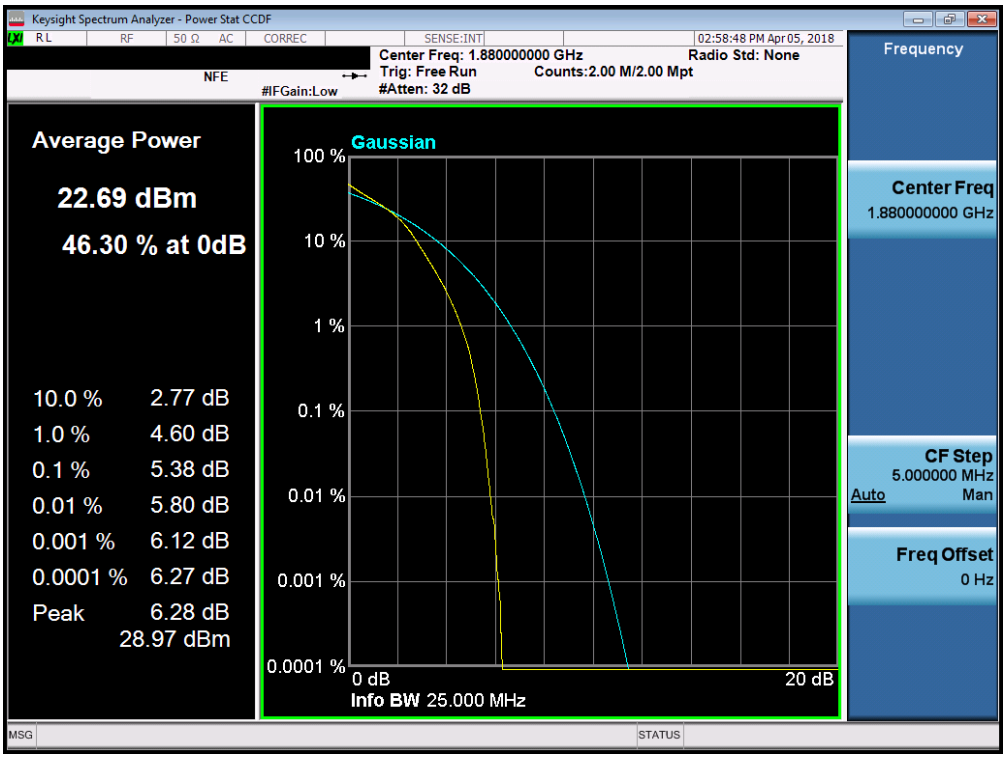
Plot 7-151. PAR Plot (Band 2 - 15.0MHz QPSK - Full RB Configuration)



Plot 7-152. PAR Plot (Band 2 - 15.0MHz 16-QAM - Full RB Configuration)



Plot 7-153. PAR Plot (Band 2 - 20.0MHz QPSK - Full RB Configuration)



Plot 7-154. PAR Plot (Band 2 - 20.0MHz 16-QAM - Full RB Configuration)

7.6 Radiated Power (ERP/EIRP)

Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03 – Section 5.2.1

ANSI/TIA-603-E-2016 – 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.

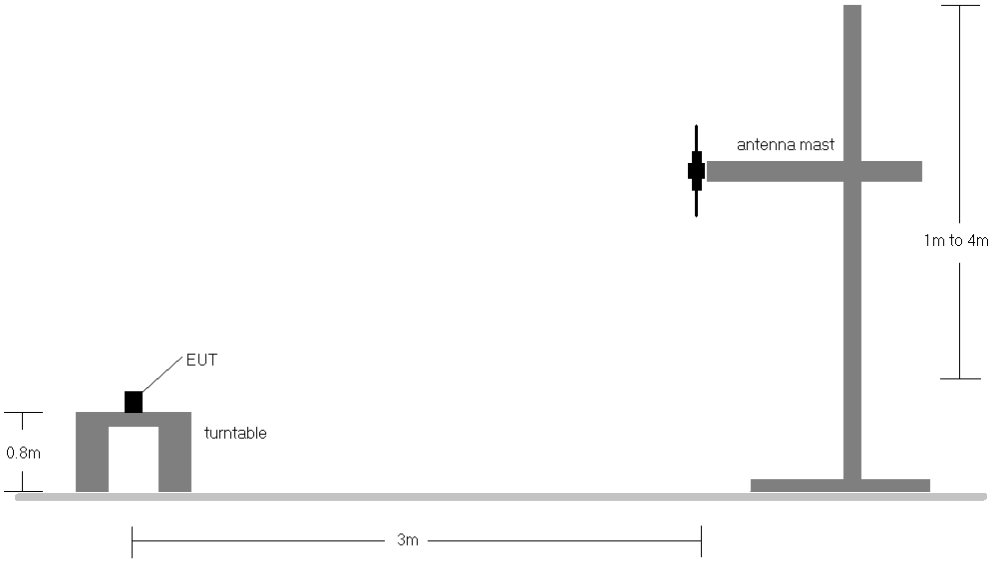


Figure 7-5. Radiated Test Setup <1GHz

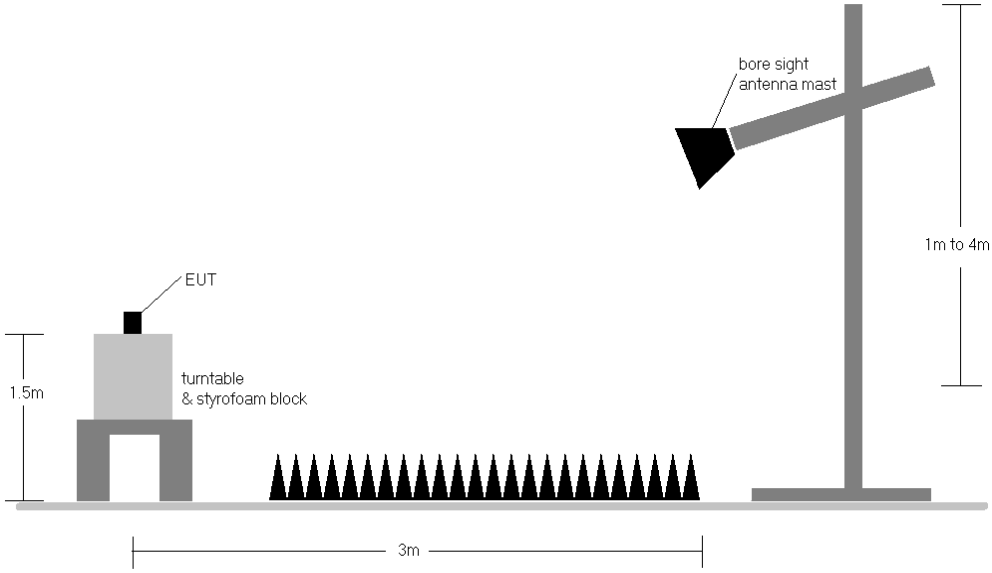


Figure 7-6. Radiated Test Setup >1GHz

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 [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
699.70	1.4	QPSK	H	150	6	1 / 0	18.63	1.96	18.44	0.070	34.77	-16.33	20.59	0.115	36.99	-16.40
707.50	1.4	QPSK	H	150	13	1 / 3	18.81	1.97	18.63	0.073	34.77	-16.15	20.78	0.120	36.99	-16.21
715.30	1.4	QPSK	H	150	20	1 / 3	19.73	1.97	**19.55**	0.090	34.77	-15.23	**21.70**	0.148	36.99	-15.29
699.70	1.4	16-QAM	H	150	6	1 / 0	16.61	1.96	16.42	0.044	34.77	-18.35	18.57	0.072	36.99	-18.42
707.50	1.4	16-QAM	H	150	13	1 / 3	17.63	1.97	17.45	0.056	34.77	-17.33	19.60	0.091	36.99	-17.39
715.30	1.4	16-QAM	H	150	20	1 / 3	17.74	1.97	**17.56**	0.057	34.77	-17.22	**19.71**	0.093	36.99	-17.28
700.50	3	QPSK	H	150	6	1 / 7	18.43	1.97	18.25	0.067	34.77	-16.53	20.40	0.110	36.99	-16.59
707.50	3	QPSK	H	150	18	1 / 7	18.79	1.97	18.61	0.073	34.77	-16.17	20.76	0.119	36.99	-16.23
714.50	3	QPSK	H	150	14	1 / 14	20.03	1.97	**19.85**	**0.097**	34.77	-14.93	**22.00**	**0.158**	36.99	-14.99
700.50	3	16-QAM	H	150	6	1 / 7	16.86	1.97	16.68	0.047	34.77	-18.10	18.83	0.076	36.99	-18.16
707.50	3	16-QAM	H	150	18	1 / 7	17.48	1.97	17.30	0.054	34.77	-17.48	19.45	0.088	36.99	-17.54
714.50	3	16-QAM	H	150	14	1 / 14	18.11	1.97	**17.93**	0.062	34.77	-16.85	**20.08**	0.102	36.99	-16.91
701.50	5	QPSK	H	150	13	1 / 24	18.18	1.97	18.00	0.063	34.77	-16.78	20.15	0.103	36.99	-16.84
707.50	5	QPSK	H	150	22	1 / 24	18.99	1.97	18.81	0.076	34.77	-15.97	20.96	0.125	36.99	-16.03
713.50	5	QPSK	H	150	7	1 / 12	19.36	1.97	**19.18**	0.083	34.77	-15.60	**21.33**	0.136	36.99	-15.66
701.50	5	16-QAM	H	150	13	1 / 24	16.39	1.97	16.21	0.042	34.77	-18.57	18.36	0.068	36.99	-18.63
707.50	5	16-QAM	H	150	22	1 / 24	17.43	1.97	17.25	0.053	34.77	-17.53	19.40	0.087	36.99	-17.59
713.50	5	16-QAM	H	150	7	1 / 12	18.00	1.97	**17.82**	0.060	34.77	-16.96	**19.97**	0.099	36.99	-17.02
704.00	10	QPSK	H	150	23	1 / 25	19.04	1.97	18.86	0.077	34.77	-15.92	21.01	0.126	36.99	-15.98
707.50	10	QPSK	H	150	22	1 / 49	19.26	1.97	19.08	0.081	34.77	-15.70	21.23	0.133	36.99	-15.76
711.00	10	QPSK	H	150	18	1 / 25	19.32	1.97	**19.14**	0.082	34.77	-15.64	**21.29**	0.134	36.99	-15.70
704.00	10	16-QAM	H	150	23	1 / 25	17.75	1.97	17.57	0.057	34.77	-17.21	19.72	0.094	36.99	-17.27
707.50	10	16-QAM	H	150	22	1 / 49	18.78	1.97	**18.60**	0.072	34.77	-16.18	**20.75**	0.119	36.99	-16.24
711.00	10	16-QAM	H	150	18	1 / 25	18.24	1.97	18.06	0.064	34.77	-16.72	20.21	0.105	36.99	-16.78
714.50	3	QPSK	V	150	117	1 / 14	18.18	1.97	18.00	0.063	34.77	-16.78	20.15	0.103	36.99	-16.84

Table 7-3. ERP Data (Band 12)

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
824.70	1.4	QPSK	H	150	353	1 / 0	22.43	2.58	22.86	0.193	38.45	-15.59	25.01	0.317	40.61	-15.60
836.50	1.4	QPSK	H	150	10	1 / 0	21.99	2.77	22.61	0.183	38.45	-15.84	24.76	0.300	40.61	-15.84
848.30	1.4	QPSK	H	150	359	1 / 3	22.67	2.97	**23.49**	0.223	38.45	-14.96	**25.64**	0.366	40.61	-14.97
824.70	1.4	16-QAM	H	150	353	1 / 0	21.55	2.58	21.98	0.158	38.45	-16.47	24.13	0.259	40.61	-16.48
836.50	1.4	16-QAM	H	150	10	1 / 0	20.96	2.77	21.58	0.144	38.45	-16.87	23.73	0.236	40.61	-16.87
848.30	1.4	16-QAM	H	150	359	1 / 3	21.74	2.97	**22.56**	0.180	38.45	-15.89	**24.71**	0.296	40.61	-15.90
825.50	3	QPSK	H	150	350	15 / 0	21.71	2.59	22.15	0.164	38.45	-16.30	24.30	0.269	40.61	-16.31
836.50	3	QPSK	H	150	355	1 / 7	22.12	2.77	22.74	0.188	38.45	-15.71	24.89	0.309	40.61	-15.71
847.50	3	QPSK	H	150	5	1 / 7	22.81	2.95	**23.61**	0.230	38.45	-14.84	**25.76**	0.377	40.61	-14.84
825.50	3	16-QAM	H	150	350	15 / 0	20.79	2.59	21.23	0.133	38.45	-17.22	23.38	0.218	40.61	-17.23
836.50	3	16-QAM	H	150	355	1 / 7	21.70	2.77	22.32	0.171	38.45	-16.13	24.47	0.280	40.61	-16.13
847.50	3	16-QAM	H	150	5	1 / 7	21.88	2.95	**22.68**	0.186	38.45	-15.77	**24.83**	0.304	40.61	-15.77
826.50	5	QPSK	H	150	2	1 / 0	22.57	2.61	23.03	0.201	38.45	-15.42	25.18	0.329	40.61	-15.43
836.50	5	QPSK	H	150	8	1 / 24	22.58	2.77	23.20	0.209	38.45	-15.25	25.35	0.343	40.61	-15.25
846.50	5	QPSK	H	150	10	1 / 12	23.02	2.94	**23.81**	**0.240**	38.45	-14.64	**25.96**	**0.394**	40.61	-14.65
826.50	5	16-QAM	H	150	2	1 / 0	21.13	2.61	21.59	0.144	38.45	-16.86	23.74	0.237	40.61	-16.87
836.50	5	16-QAM	H	150	8	1 / 24	21.54	2.77	22.16	0.165	38.45	-16.29	24.31	0.270	40.61	-16.29
846.50	5	16-QAM	H	150	10	1 / 12	22.36	2.94	**23.15**	0.206	38.45	-15.30	**25.30**	0.339	40.61	-15.31
829.00	10	QPSK	H	150	3	1 / 25	22.35	2.65	22.85	0.193	38.45	-15.60	25.00	0.316	40.61	-15.61
836.50	10	QPSK	H	150	352	50 / 0	21.99	2.77	22.61	0.183	38.45	-15.84	24.76	0.300	40.61	-15.84
844.00	10	QPSK	H	150	6	1 / 0	22.74	2.90	**23.49**	0.223	38.45	-14.96	**25.64**	0.366	40.61	-14.97
829.00	10	16-QAM	H	150	3	1 / 25	22.04	2.65	22.54	0.179	38.45	-15.91	24.69	0.294	40.61	-15.92
836.50	10	16-QAM	H	150	352	50 / 0	20.89	2.77	21.51	0.142	38.45	-16.94	23.66	0.232	40.61	-16.94
844.00	10	16-QAM	H	150	6	1 / 0	22.11	2.90	**22.86**	0.193	38.45	-15.59	**25.01**	0.317	40.61	-15.60
846.50	5	QPSK	V	150	86	1 / 12	20.82	2.94	21.61	0.145	38.45	-16.84	23.76	0.238	40.61	-16.85

Table 7-4. 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 [Watts]	EIRP Limit [dBm]	Margin [dB]
1710.70	1.4	QPSK	V	150	356	1 / 0	17.19	4.33	**21.52**	0.142	30.00	-8.48
1732.50	1.4	QPSK	V	150	1	1 / 0	17.17	4.26	21.43	0.139	30.00	-8.57
1754.30	1.4	QPSK	V	150	6	1 / 0	17.33	4.17	21.50	0.141	30.00	-8.50
1710.70	1.4	16-QAM	V	150	356	1 / 0	16.38	4.33	20.71	0.118	30.00	-9.29
1732.50	1.4	16-QAM	V	150	1	1 / 0	16.13	4.26	20.39	0.109	30.00	-9.61
1754.30	1.4	16-QAM	V	150	6	1 / 0	16.56	4.17	**20.73**	0.118	30.00	-9.27
1711.50	3	QPSK	V	150	2	1 / 0	17.23	4.32	21.55	0.143	30.00	-8.45
1732.50	3	QPSK	V	150	351	1 / 0	17.38	4.26	**21.64**	0.146	30.00	-8.36
1753.50	3	QPSK	V	150	358	1 / 0	17.29	4.18	21.47	0.140	30.00	-8.53
1711.50	3	16-QAM	V	150	2	1 / 0	16.33	4.32	20.65	0.116	30.00	-9.35
1732.50	3	16-QAM	V	150	351	1 / 0	16.50	4.26	**20.76**	0.119	30.00	-9.24
1753.50	3	16-QAM	V	150	358	1 / 0	16.30	4.18	20.48	0.112	30.00	-9.52
1712.50	5	QPSK	V	150	356	1 / 0	17.16	4.32	21.48	0.141	30.00	-8.52
1732.50	5	QPSK	V	150	355	1 / 0	17.35	4.26	**21.61**	0.145	30.00	-8.39
1752.50	5	QPSK	V	150	346	1 / 0	17.39	4.18	21.57	0.144	30.00	-8.43
1712.50	5	16-QAM	V	150	356	1 / 0	16.19	4.32	20.51	0.112	30.00	-9.49
1732.50	5	16-QAM	V	150	355	1 / 0	16.59	4.26	**20.85**	0.122	30.00	-9.15
1752.50	5	16-QAM	V	150	346	1 / 0	16.42	4.18	20.60	0.115	30.00	-9.40
1715.00	10	QPSK	V	150	355	1 / 0	17.25	4.31	21.56	0.143	30.00	-8.44
1732.50	10	QPSK	V	150	348	1 / 0	17.39	4.26	**21.65**	0.146	30.00	-8.35
1750.00	10	QPSK	V	150	348	1 / 49	17.42	4.20	21.62	0.145	30.00	-8.38
1715.00	10	16-QAM	V	150	355	1 / 0	16.34	4.31	20.65	0.116	30.00	-9.35
1732.50	10	16-QAM	V	150	348	1 / 0	16.49	4.26	20.75	0.119	30.00	-9.25
1750.00	10	16-QAM	V	150	348	1 / 49	16.59	4.20	**20.79**	0.120	30.00	-9.21
1717.50	15	QPSK	V	150	345	1 / 0	17.23	4.30	21.53	0.142	30.00	-8.47
1732.50	15	QPSK	V	150	350	1 / 0	17.43	4.26	**21.69**	0.147	30.00	-8.31
1747.50	15	QPSK	V	150	343	1 / 74	17.47	4.21	21.68	0.147	30.00	-8.32
1717.50	15	16-QAM	V	150	345	1 / 0	16.42	4.30	20.72	0.118	30.00	-9.28
1732.50	15	16-QAM	V	150	350	1 / 0	16.50	4.26	20.76	0.119	30.00	-9.24
1747.50	15	16-QAM	V	150	343	1 / 74	16.73	4.21	**20.94**	0.124	30.00	-9.06
1720.00	20	QPSK	V	150	347	1 / 50	17.10	4.30	21.40	0.138	30.00	-8.60
1732.50	20	QPSK	V	150	272	1 / 50	17.58	4.26	**21.84**	**0.153**	30.00	-8.16
1745.00	20	QPSK	V	150	10	1 / 99	17.16	4.22	21.38	0.137	30.00	-8.62
1720.00	20	16-QAM	V	150	347	1 / 50	15.94	4.30	20.24	0.106	30.00	-9.76
1732.50	20	16-QAM	V	150	272	1 / 50	15.95	4.26	20.21	0.105	30.00	-9.79
1745.00	20	16-QAM	V	150	10	1 / 99	16.02	4.22	**20.24**	0.106	30.00	-9.76
1732.50	20	QPSK	H	150	291	1 / 50	16.27	4.26	20.53	0.113	30.00	-9.47

Table 7-5. 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 [Watts]	EIRP Limit [dBm]	Margin [dB]
1850.70	1.4	QPSK	H	150	5	1 / 0	18.88	3.73	22.61	0.182	33.01	-10.40
1880.00	1.4	QPSK	H	150	0	1 / 3	18.46	3.72	22.18	0.165	33.01	-10.83
1909.30	1.4	QPSK	H	150	359	1 / 0	19.29	3.65	**22.94**	0.197	33.01	-10.07
1850.70	1.4	16-QAM	H	150	5	1 / 0	18.08	3.73	**21.81**	0.152	33.01	-11.20
1880.00	1.4	16-QAM	H	150	0	1 / 3	17.45	3.72	21.17	0.131	33.01	-11.84
1909.30	1.4	16-QAM	H	150	359	1 / 0	17.78	3.65	21.43	0.139	33.01	-11.58
1851.50	3	QPSK	H	150	1	1 / 14	19.08	3.73	22.81	0.191	33.01	-10.20
1880.00	3	QPSK	H	150	353	1 / 7	18.53	3.72	22.25	0.168	33.01	-10.76
1908.50	3	QPSK	H	150	2	1 / 0	19.36	3.65	**23.01**	0.200	33.01	-10.00
1851.50	3	16-QAM	H	150	1	1 / 14	17.66	3.73	21.39	0.138	33.01	-11.62
1880.00	3	16-QAM	H	150	353	1 / 7	17.25	3.72	20.97	0.125	33.01	-12.04
1908.50	3	16-QAM	H	150	2	1 / 0	17.85	3.65	**21.50**	0.141	33.01	-11.51
1852.50	5	QPSK	H	150	2	1 / 24	19.03	3.73	22.76	0.189	33.01	-10.25
1880.00	5	QPSK	H	150	0	1 / 12	19.73	3.72	**23.45**	**0.221**	33.01	-9.56
1907.50	5	QPSK	H	150	3	1 / 12	18.92	3.66	22.58	0.181	33.01	-10.43
1852.50	5	16-QAM	H	150	2	1 / 24	17.69	3.73	21.42	0.139	33.01	-11.59
1880.00	5	16-QAM	H	150	0	1 / 12	19.17	3.72	**22.89**	0.194	33.01	-10.12
1907.50	5	16-QAM	H	150	3	1 / 12	17.44	3.66	21.10	0.129	33.01	-11.91
1855.00	10	QPSK	H	150	5	1 / 49	19.00	3.73	22.73	0.187	33.01	-10.28
1880.00	10	QPSK	H	150	358	1 / 25	19.44	3.72	**23.16**	0.207	33.01	-9.85
1905.00	10	QPSK	H	150	355	1 / 25	18.94	3.67	22.61	0.183	33.01	-10.40
1855.00	10	16-QAM	H	150	5	1 / 49	17.86	3.73	21.59	0.144	33.01	-11.42
1880.00	10	16-QAM	H	150	358	1 / 25	17.93	3.72	**21.65**	0.146	33.01	-11.36
1905.00	10	16-QAM	H	150	355	1 / 25	17.70	3.67	21.37	0.137	33.01	-11.64
1857.50	15	QPSK	H	150	2	1 / 74	18.96	3.73	22.69	0.186	33.01	-10.32
1880.00	15	QPSK	H	150	2	1 / 37	19.35	3.72	**23.07**	0.203	33.01	-9.94
1902.50	15	QPSK	H	150	357	1 / 0	18.89	3.69	22.58	0.181	33.01	-10.43
1857.50	15	16-QAM	H	150	2	1 / 74	17.88	3.73	21.61	0.145	33.01	-11.40
1880.00	15	16-QAM	H	150	2	1 / 37	18.16	3.72	**21.88**	0.154	33.01	-11.13
1902.50	15	16-QAM	H	150	357	1 / 0	17.79	3.69	21.48	0.141	33.01	-11.53
1860.00	20	QPSK	H	150	351	1 / 50	19.06	3.73	22.79	0.190	33.01	-10.22
1880.00	20	QPSK	H	150	352	1 / 50	19.19	3.72	**22.91**	0.195	33.01	-10.10
1900.00	20	QPSK	H	150	350	1 / 0	18.79	3.70	22.50	0.178	33.01	-10.52
1860.00	20	16-QAM	H	150	351	1 / 50	18.01	3.73	21.74	0.149	33.01	-11.27
1880.00	20	16-QAM	H	150	352	1 / 50	18.97	3.72	**22.69**	0.186	33.01	-10.32
1900.00	20	16-QAM	H	150	350	1 / 0	17.91	3.70	21.62	0.145	33.01	-11.40
1880.00	5	QPSK	V	150	61	1 / 12	18.31	3.72	22.03	0.159	33.01	-10.98

Table 7-6. EIRP Data (Band 2)

7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 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.

Test Procedures Used

KDB 971168 D01 v03 – Section 5.8

ANSI/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.

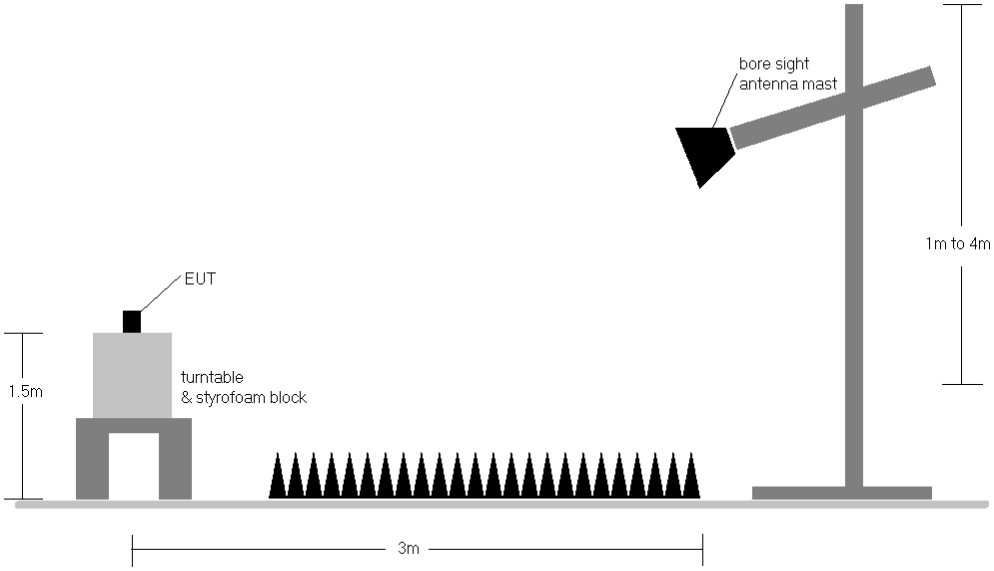


Figure 7-7. Test Instrument & Measurement Setup

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.

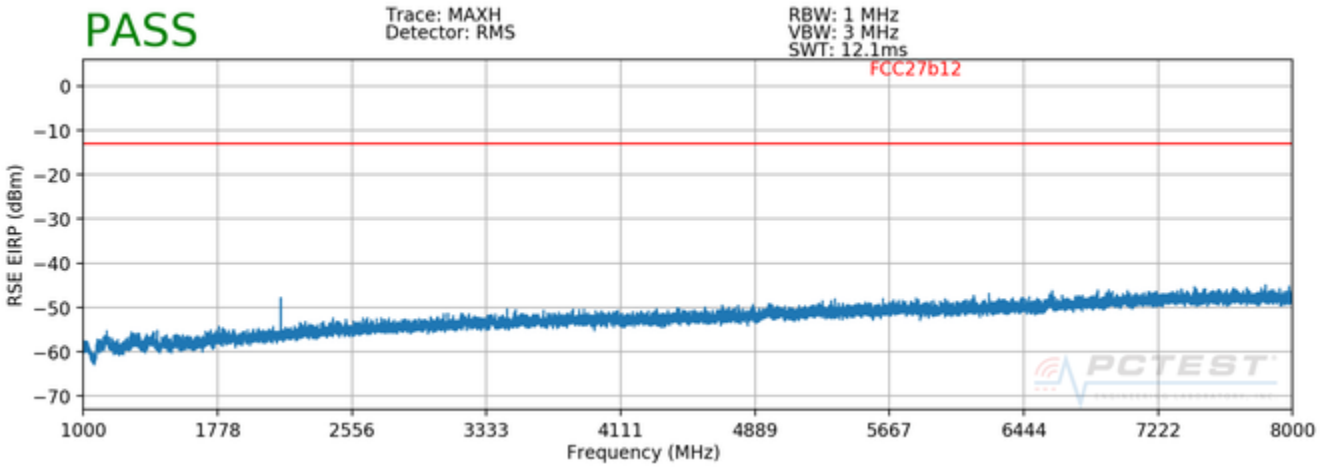
2) This unit was tested with its standard battery.

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.

Band 12



Plot 7-155. Radiated Spurious Plot above 1GHz (Band 12)

OPERATING FREQUENCY:	700.50	MHz
CHANNEL:	23025	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	3.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
1401.00	H	150	353	-60.82	3.78	-57.03	-44.0
2101.50	H	150	134	-54.46	4.80	-49.66	-36.7
2802.00	H	-	-	-63.05	5.64	-57.41	-44.4

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

OPERATING FREQUENCY:	707.50	MHz
CHANNEL:	23095	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	3.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
1415.00	H	150	356	-61.75	3.90	-57.85	-44.8
2122.50	H	150	137	-55.81	4.78	-51.03	-38.0
2830.00	H	-	-	-63.27	5.73	-57.54	-44.5

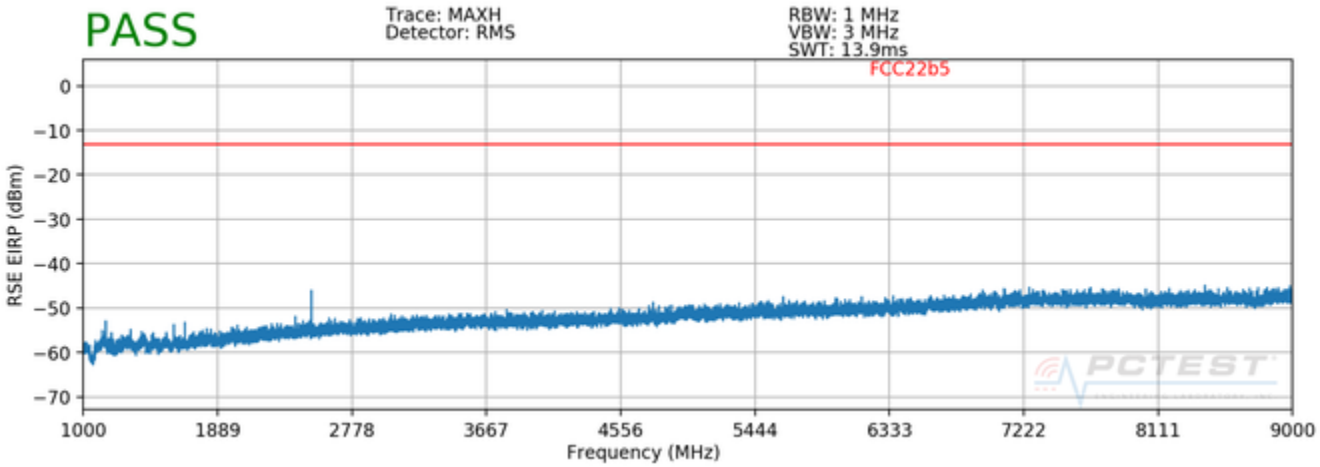
Table 7-8. Radiated Spurious Data (Band 12 – Mid Channel)

OPERATING FREQUENCY:	714.50	MHz
CHANNEL:	23165	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	3.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
1429.00	H	150	358	-62.50	4.03	-58.47	-45.5
2143.50	H	150	134	-55.53	4.77	-50.76	-37.8
2858.00	H	-	-	-63.64	5.79	-57.85	-44.9

Table 7-9. Radiated Spurious Data (Band 12 – High Channel)

Band 5



Plot 7-156. Radiated Spurious Plot above 1GHz (Band 5)

OPERATING FREQUENCY:	826.50	MHz
CHANNEL:	20425	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
1653.00	H	150	354	-63.00	4.82	-58.18	-45.2
2479.50	H	150	357	-52.26	5.01	-47.25	-34.3
3306.00	H	-	-	-61.68	6.25	-55.42	-42.4

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

OPERATING FREQUENCY:	836.50	MHz
CHANNEL:	20525	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
1673.00	H	150	2	-62.56	4.86	-57.69	-44.7
2509.50	H	150	350	-53.08	5.10	-47.98	-35.0
3346.00	H	-	-	-62.04	6.25	-55.78	-42.8

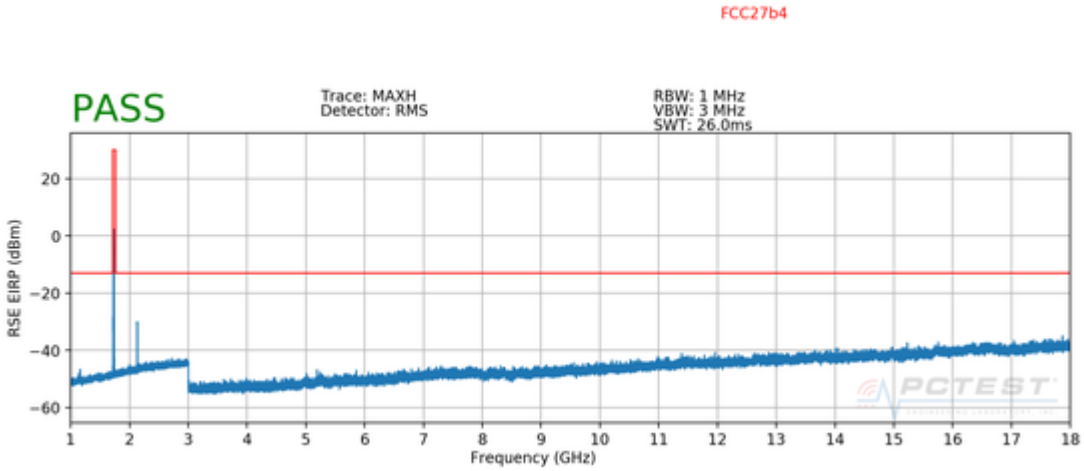
Table 7-11. Radiated Spurious Data (Band 5 – Mid Channel)

OPERATING FREQUENCY:	846.50	MHz
CHANNEL:	20625	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
1693.00	H	150	355	-62.24	4.90	-57.34	-44.3
2539.50	H	150	359	-51.72	5.25	-46.48	-33.5
3386.00	H	-	-	-61.71	6.36	-55.34	-42.3

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

Band 4



Plot 7-157. Radiated Spurious Plot above 1GHz (Band 4)

OPERATING FREQUENCY:	1720.00	MHz
CHANNEL:	20050	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	20.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
3440.00	H	150	221	-56.51	6.51	-49.99	-37.0
5160.00	H	150	51	-62.56	8.44	-54.12	-41.1
6880.00	H	-	-	-63.99	8.71	-55.27	-42.3

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

OPERATING FREQUENCY:	1732.50	MHz
CHANNEL:	20175	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	20.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
3465.00	H	150	216	-58.46	6.56	-51.90	-38.9
5197.50	H	150	62	-61.58	8.45	-53.13	-40.1
6930.00	H	-	-	-64.49	8.67	-55.82	-42.8

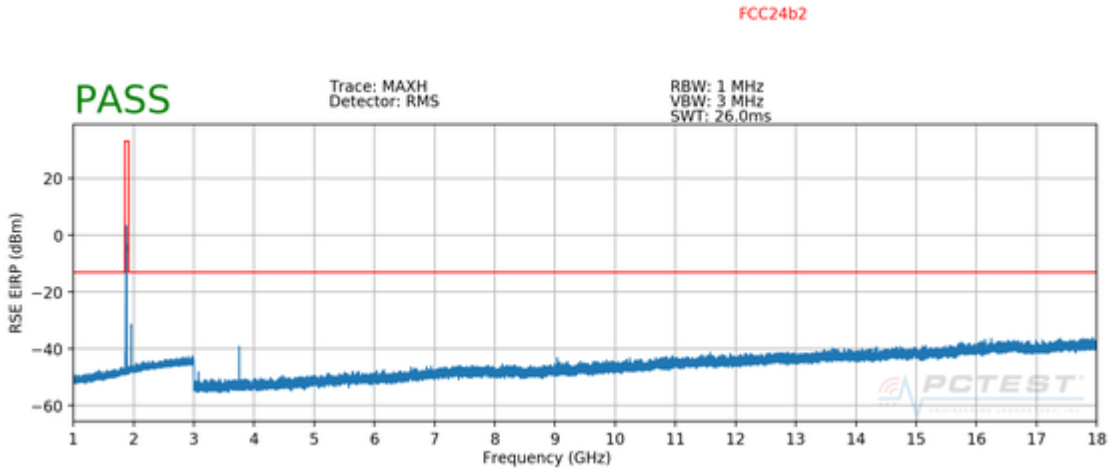
Table 7-14. Radiated Spurious Data (Band 4 – Mid Channel)

OPERATING FREQUENCY:	1745.00	MHz
CHANNEL:	20300	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	20.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
3490.00	H	150	230	-56.50	6.59	-49.91	-36.9
5235.00	H	150	70	-63.05	8.42	-54.63	-41.6
6980.00	H	-	-	-64.37	8.60	-55.76	-42.8

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

Band 2



Plot 7-158. Radiated Spurious Plot above 1GHz (Band 2)

OPERATING FREQUENCY:	1852.50	MHz
CHANNEL:	18625	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
3705.00	H	150	200	-54.64	6.77	-47.87	-34.9
5557.50	H	150	60	-64.18	8.44	-55.75	-42.7
7410.00	H	-	-	-62.49	8.28	-54.22	-41.2

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

OPERATING FREQUENCY:	1880.00	MHz
CHANNEL:	18900	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
3760.00	H	150	206	-53.15	6.84	-46.31	-33.3
5640.00	H	150	52	-59.10	8.52	-50.59	-37.6
7520.00	H	-	-	-62.50	8.44	-54.06	-41.1

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

OPERATING FREQUENCY:	1907.50	MHz
CHANNEL:	19175	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

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]	Margin [dB]
3815.00	H	150	210	-52.75	6.98	-45.77	-32.8
5722.50	H	150	326	-60.51	8.58	-51.93	-38.9
7630.00	H	-	-	-62.35	8.55	-53.80	-40.8

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

7.8 Frequency Stability / Temperature Variation

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/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 22, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency. For Part 24, 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-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

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

Test Notes

None

Band 12 Frequency Stability Measurements

OPERATING FREQUENCY:	707,500,000	Hz
CHANNEL:	23790	
REFERENCE VOLTAGE:	3.80	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	707,500,067	67	0.0000095
100 %		- 30	707,500,143	143	0.0000202
100 %		- 20	707,499,802	-198	-0.0000280
100 %		- 10	707,499,964	-36	-0.0000051
100 %		0	707,500,137	137	0.0000194
100 %		+ 10	707,500,354	354	0.0000500
100 %		+ 20	707,500,424	424	0.0000599
100 %		+ 30	707,499,940	-60	-0.0000085
100 %		+ 40	707,500,125	125	0.0000177
100 %		+ 50	707,499,988	-12	-0.0000017
BATT. ENDPOINT	3.05	+ 20	707,500,308	308	0.0000435

Table 7-19. Frequency Stability Data (Band 12)

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 12 Frequency Stability Measurements

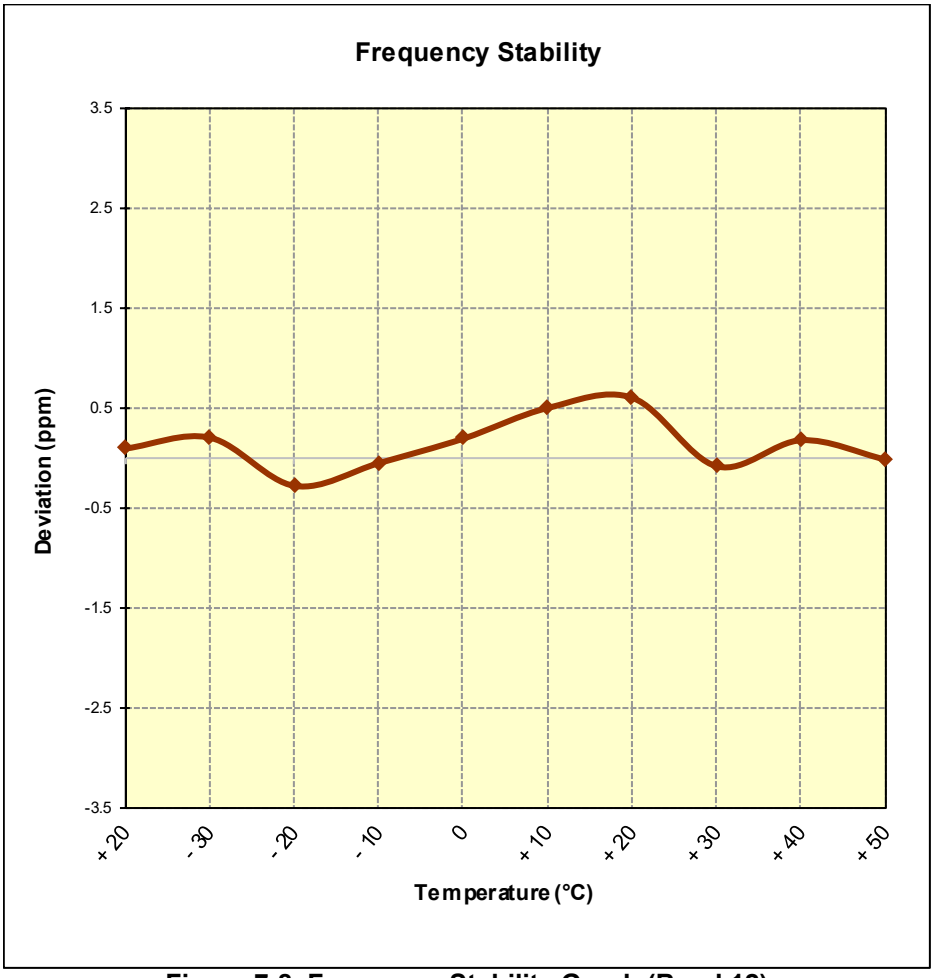


Figure 7-8. Frequency Stability Graph (Band 12)

Band 5 Frequency Stability Measurements

OPERATING FREQUENCY:	836,500,000	Hz
CHANNEL:	20525	
REFERENCE VOLTAGE:	3.80	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	836,499,976	-24	-0.0000029
100 %		- 30	836,500,126	126	0.0000151
100 %		- 20	836,499,834	-166	-0.0000198
100 %		- 10	836,500,184	184	0.0000220
100 %		0	836,499,741	-259	-0.0000310
100 %		+ 10	836,500,011	11	0.0000013
100 %		+ 20	836,500,017	17	0.0000020
100 %		+ 30	836,500,076	76	0.0000091
100 %		+ 40	836,500,327	327	0.0000391
100 %		+ 50	836,500,284	284	0.0000340
BATT. ENDPOINT	3.05	+ 20	836,499,582	-418	-0.0000500

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

Band 5 Frequency Stability Measurements

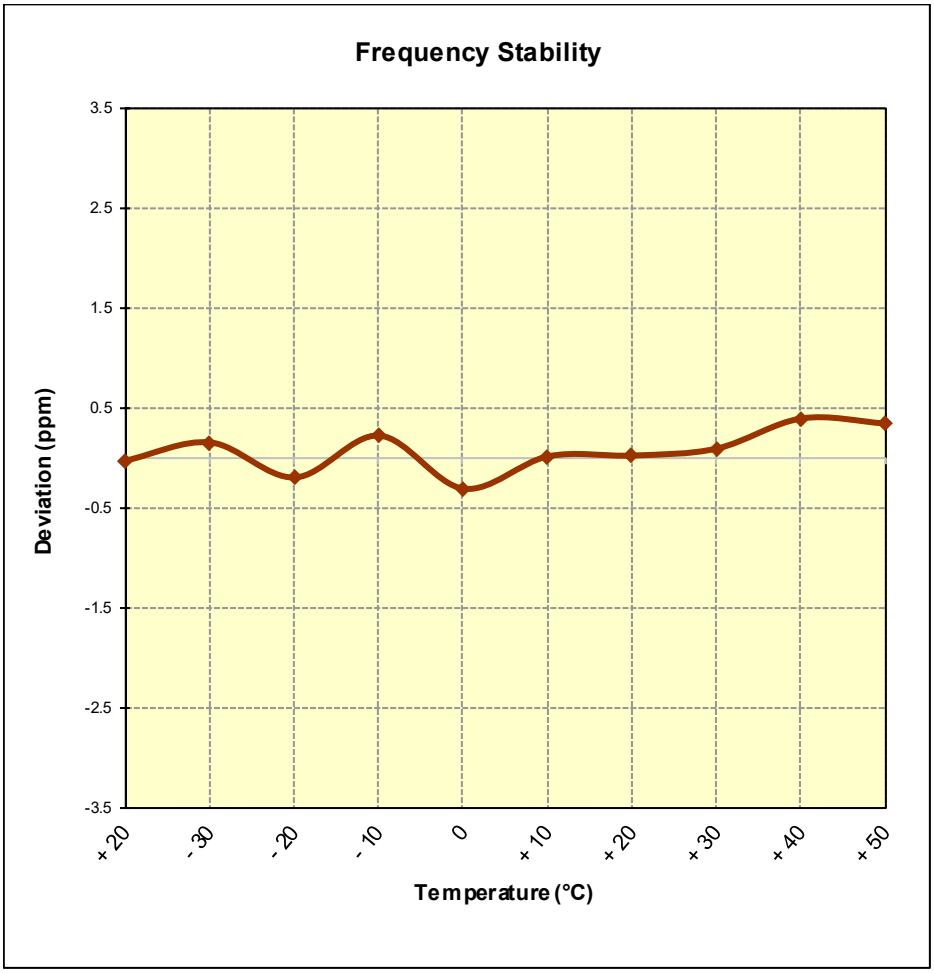


Figure 7-9. Frequency Stability Graph (Band 5)

Band 4 Frequency Stability Measurements

OPERATING FREQUENCY:	1,732,500,000	Hz
CHANNEL:	20175	
REFERENCE VOLTAGE:	3.80	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	1,732,499,753	-247	-0.0000143
100 %		- 30	1,732,499,862	-138	-0.0000080
100 %		- 20	1,732,499,938	-62	-0.0000036
100 %		- 10	1,732,499,975	-25	-0.0000014
100 %		0	1,732,499,967	-33	-0.0000019
100 %		+ 10	1,732,500,031	31	0.0000018
100 %		+ 20	1,732,500,105	105	0.0000061
100 %		+ 30	1,732,500,082	82	0.0000047
100 %		+ 40	1,732,500,389	389	0.0000225
100 %		+ 50	1,732,499,973	-27	-0.0000016
BATT. ENDPOINT	3.05	+ 20	1,732,500,017	17	0.0000010

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

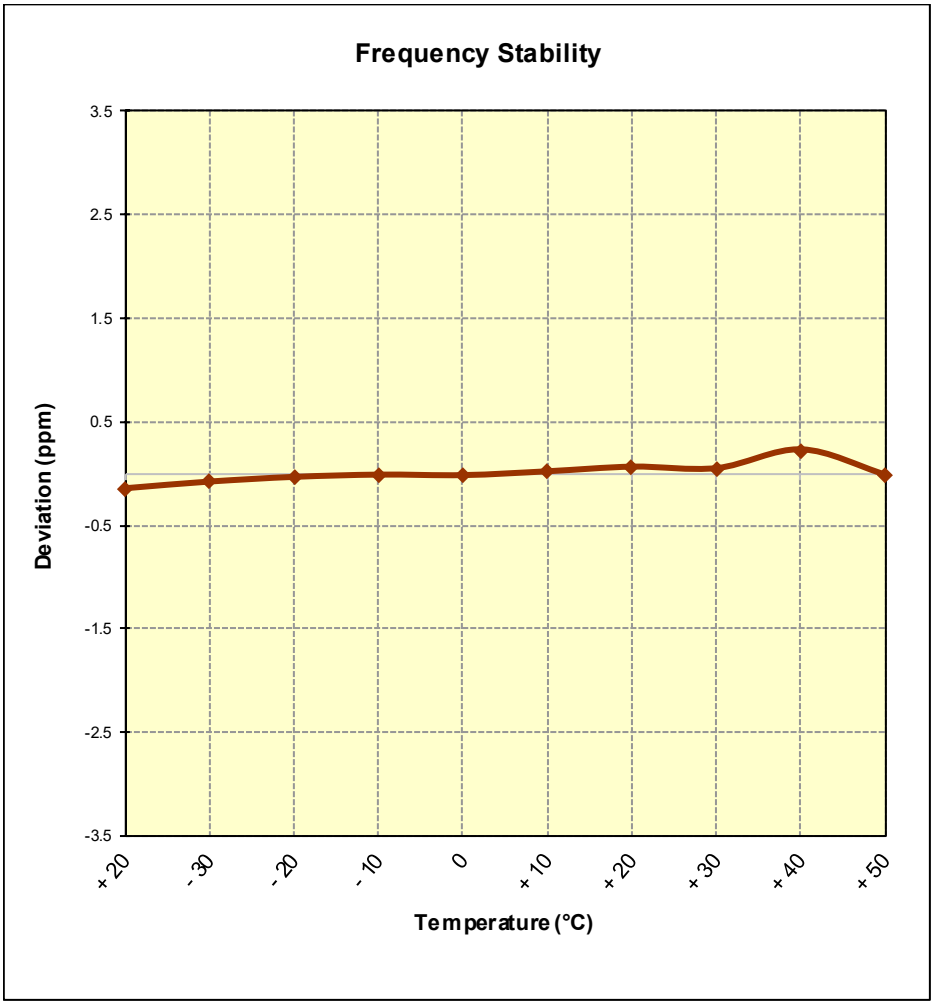


Figure 7-10. Frequency Stability Graph (Band 4)

Band 2 Frequency Stability Measurements

OPERATING FREQUENCY:	1,880,000,000	Hz
CHANNEL:	18900	
REFERENCE VOLTAGE:	3.80	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.80	+ 20 (Ref)	1,880,000,021	21	0.0000011
100 %		- 30	1,879,999,904	-96	-0.0000051
100 %		- 20	1,879,999,980	-20	-0.0000011
100 %		- 10	1,880,000,044	44	0.0000023
100 %		0	1,880,000,082	82	0.0000044
100 %		+ 10	1,880,000,107	107	0.0000057
100 %		+ 20	1,880,000,240	240	0.0000128
100 %		+ 30	1,880,000,067	67	0.0000036
100 %		+ 40	1,880,000,138	138	0.0000073
100 %		+ 50	1,880,000,033	33	0.0000018
BATT. ENDPOINT	3.05	+ 20	1,879,999,946	-54	-0.0000029

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

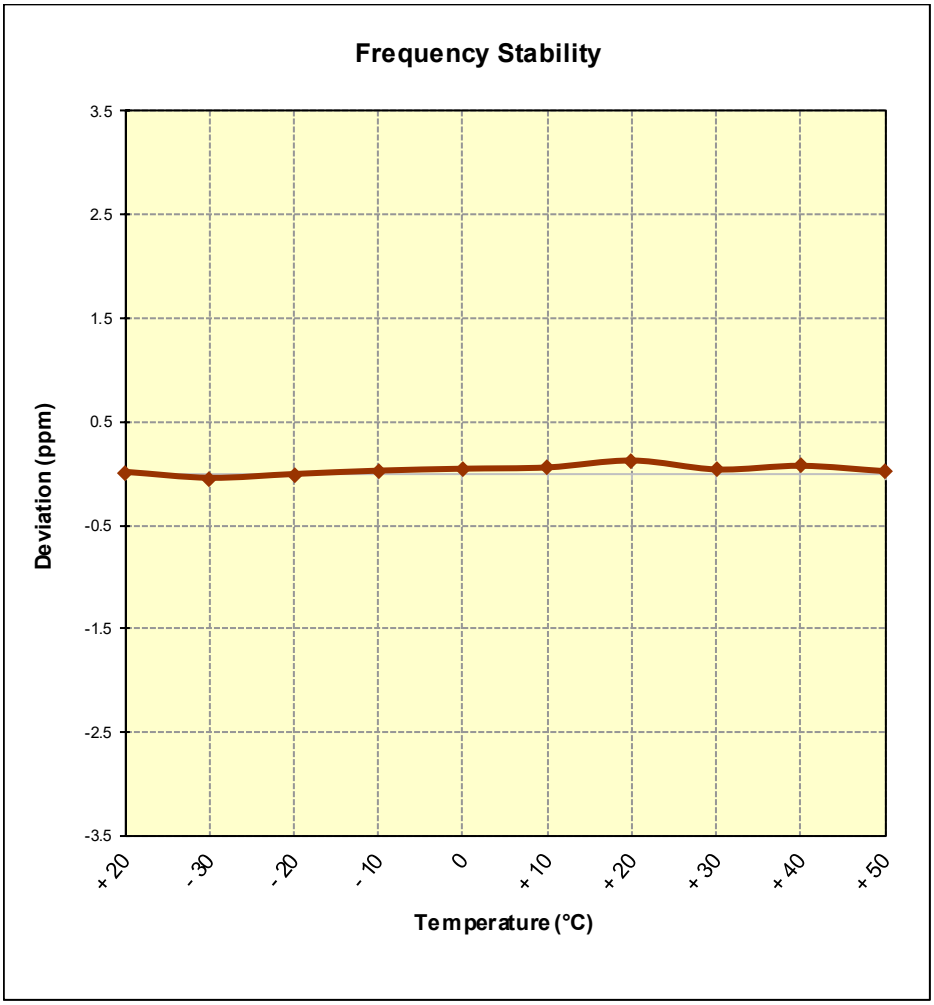


Figure 7-11. Frequency Stability Graph (Band 2)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFX410AS** complies with all the requirements of Part 22, 24, & 27 of the FCC Rules for LTE operation only.