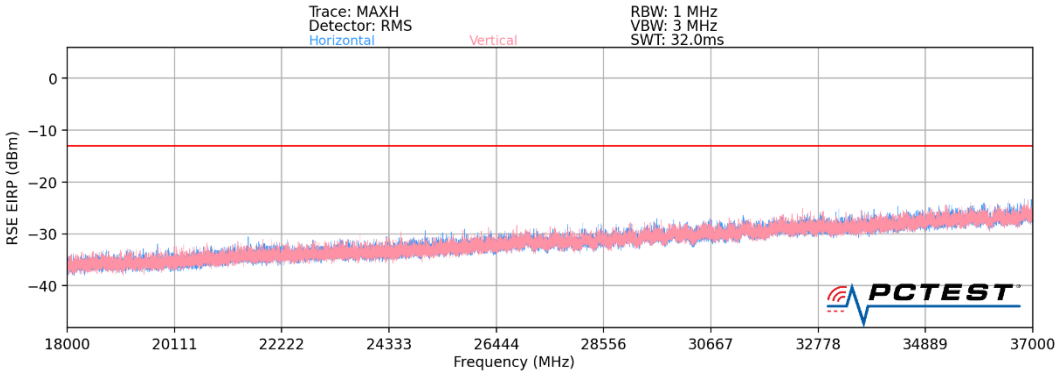
18GHz – 37GHz

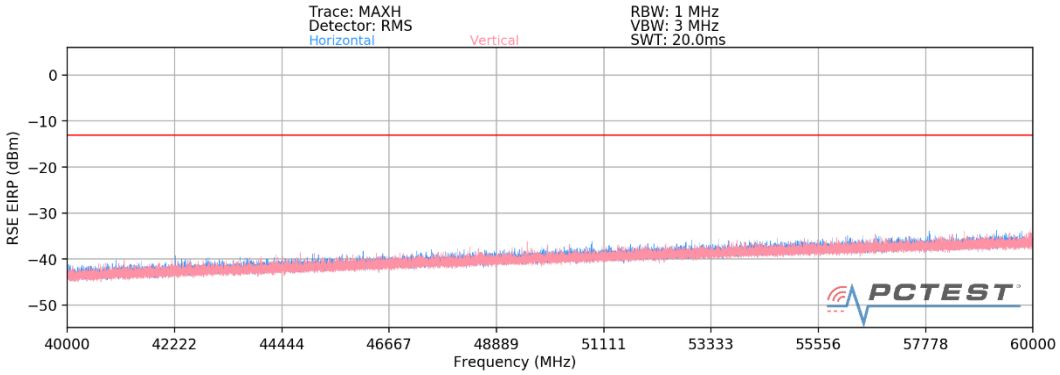


Plot 7-49. Ant 3 - n260 Radiated Spurious Plot (1CC QPSK Mid Channel MIMO)

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
35983.40	Low	50	H + V	QPSK	V	-	-	-27.72	-13.00	-14.72
36247.60	Mid	50	H + V	QPSK	V	-	-	-27.84	-13.00	-14.84
36519.20	High	50	H + V	QPSK	V	-	-	-27.20	-13.00	-14.20

Table 7-43. Ant 3 - Spurious Emissions Table (18GHz - 37GHz)

40GHz - 60GHz

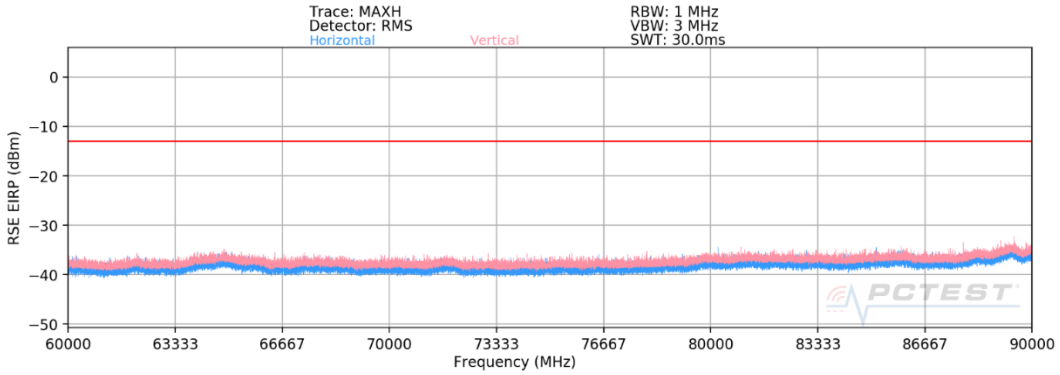


Plot 7-50. Ant 3 - n260 Radiated Spurious Plot (1CC QPSK Mid Channel MIMO)

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
48781.30	Low	50	H + V	QPSK	V	-	-	-38.17	-13.00	-25.17
50960.70	Mid	50	H + V	QPSK	V	-	-	-39.18	-13.00	-26.18
51613.80	High	50	H + V	QPSK	V	-	-	-39.52	-13.00	-26.52

Table 7-43. Ant 3 - Spurious Emissions Table (40GHz - 60GHz)

60GHz - 90GHz

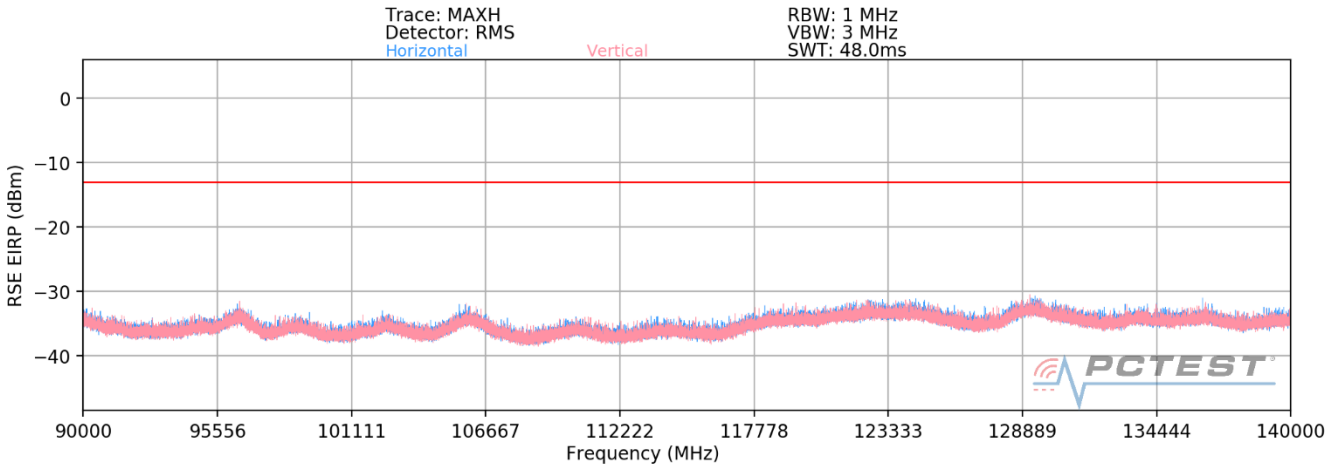


Plot 7-51. Ant 3-n260 Radiated Spurious Plot (1CC QPSK Mid Channel MIMO)

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
74100.00	Low	50	H + V	QPSK	V	-	-	-38.76	-13.00	-25.76
76999.92	Mid	50	H + V	QPSK	V	-	-	-37.72	-13.00	-24.72
79899.84	High	50	H + V	QPSK	V	-	-	-37.42	-13.00	-24.42

Table 7-43. Ant 3 -Spurious Emissions Table (60GHz - 90GHz)

90GHz - 140GHz

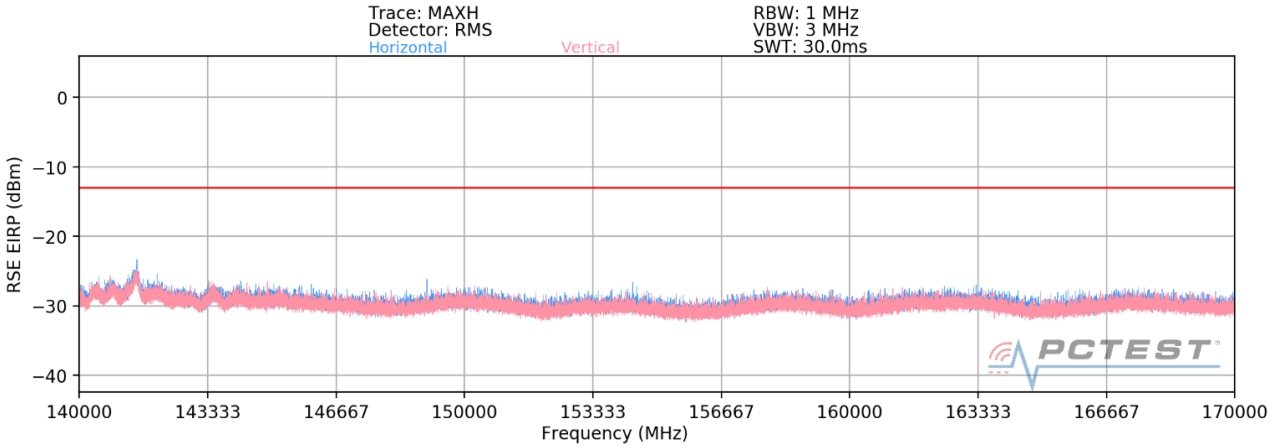


Plot 7-52. Ant 3-n260 Radiated Spurious Plot (1CC QPSK Mid Channel MIMO)

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
111150.00	Low	50	H + V	QPSK	V	-	-	-36.23	-13.00	-23.23
115499.88	Mid	50	H + V	QPSK	V	-	-	-36.08	-13.00	-23.08
119849.76	High	50	H + V	QPSK	V	-	-	-33.37	-13.00	-20.37

Table 7-44. Ant 3 -Spurious Emissions Table (90GHz - 140GHz)

140GHz - 170GHz

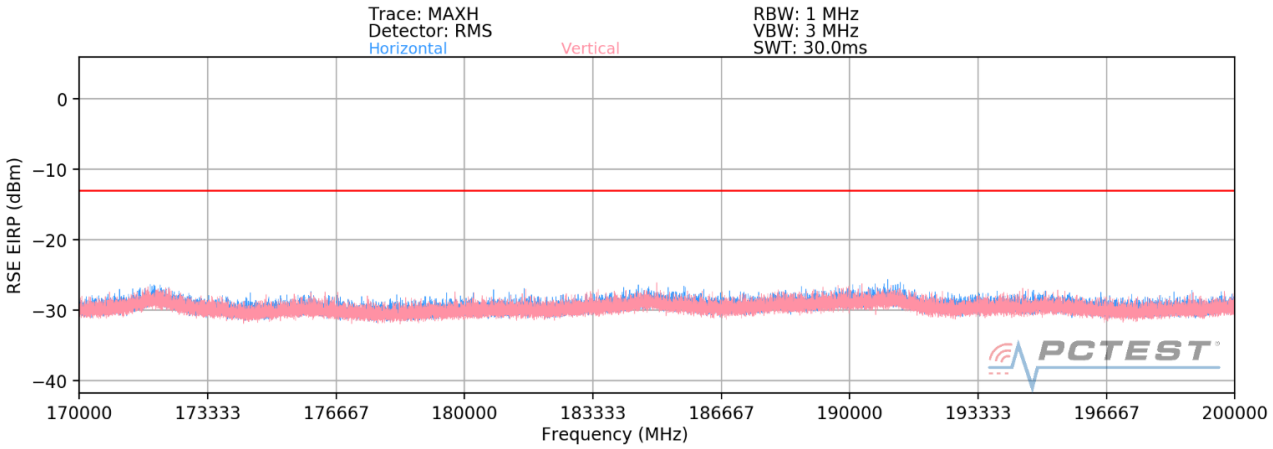


Plot 7-53. Ant 3 - n260 Radiated Spurious Plot (1CC QPSK Mid Channel MIMO)

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
148200.00	Low	50	H + V	QPSK	V	-	-	-29.88	-13.00	-16.88
153999.84	Mid	50	H + V	QPSK	V	-	-	-30.30	-13.00	-17.30
159799.68	High	50	H + V	QPSK	V	-	-	-30.42	-13.00	-17.42

Table 7-43. Ant 3 - Spurious Emissions Table (140GHz - 170GHz)

170GHz - 200GHz



Plot 7-54. Ant 3 - n260 Radiated Spurious Plot (1CC QPSK Mid Channel MIMO)

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
185250.00	Low	50	H + V	QPSK	V	-	-	-30.68	-13.00	-17.68
192499.80	Mid	50	H + V	QPSK	V	-	-	-29.18	-13.00	-16.18
199749.60	High	50	H + V	QPSK	V	-	-	-29.79	-13.00	-16.79

Table 7-43. Ant 3 - Spurious Emissions Table (170GHz - 200GHz)

7.5 Band Edge Emissions

§2.1051, §30.203

Test Overview

All out of band emissions are measured in a radiated setup while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All modulations were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is -13dBm/1MHz. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

Test Procedure Used

ANSI C63.26-2015 Section 5 and ANSI C63.26-2015 Section 6.4
KDB 842590 D01 v01r01 Section 4.4.2.5

Test Settings

1. Start and stop frequency were set such that both upper and lower band edges are measured.
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 1MHz
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning.
2) Band Edge emissions were measured at a 1 meter distance.
3) The spectrum analyzer for each measurement shows an offset value that was determined using the measurement antenna factor, cable loss, far field measurement distance. A sample calculation is shown on the following page.
4) This device supports transmission of H-polarized and V-polarized beams from the antenna array in both CP-OFDM and DFT-s-OFDM transmission schemes. SISO and MIMO operation is also supported for some configurations. As part of the testing, all modes were fully investigated and only the worst case has been included in this report.
5) All combinations of 1CC and 2CC were fully investigated, and only the worst case has been included in this report.
6) All 2CC cases were investigated with PCC prioritization feature, which was the higher PCC at the band edge for the worst case.

Sample Analyzer Offset Calculation (at 27.5GHz)

Measurement Antenna Factor = 40.70dB/m

Cable Loss = 8.82dB

Analyzer Offset (dB) = AF (dB/m) + CL (dB) + 107 + $20\log_{10}(D)$ – 104.8dB, where D = 1m

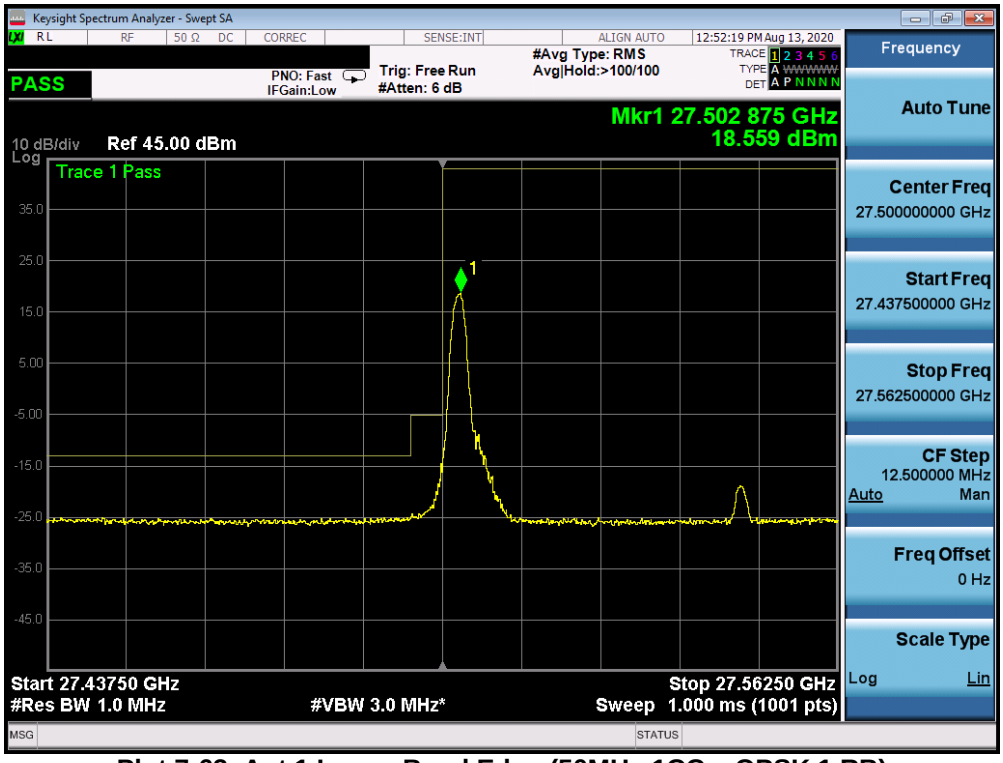
= 40.70dB/m + 8.82dB + 107 + $20\log_{10}(1m)$ – 104.8dB

= 51.72dB

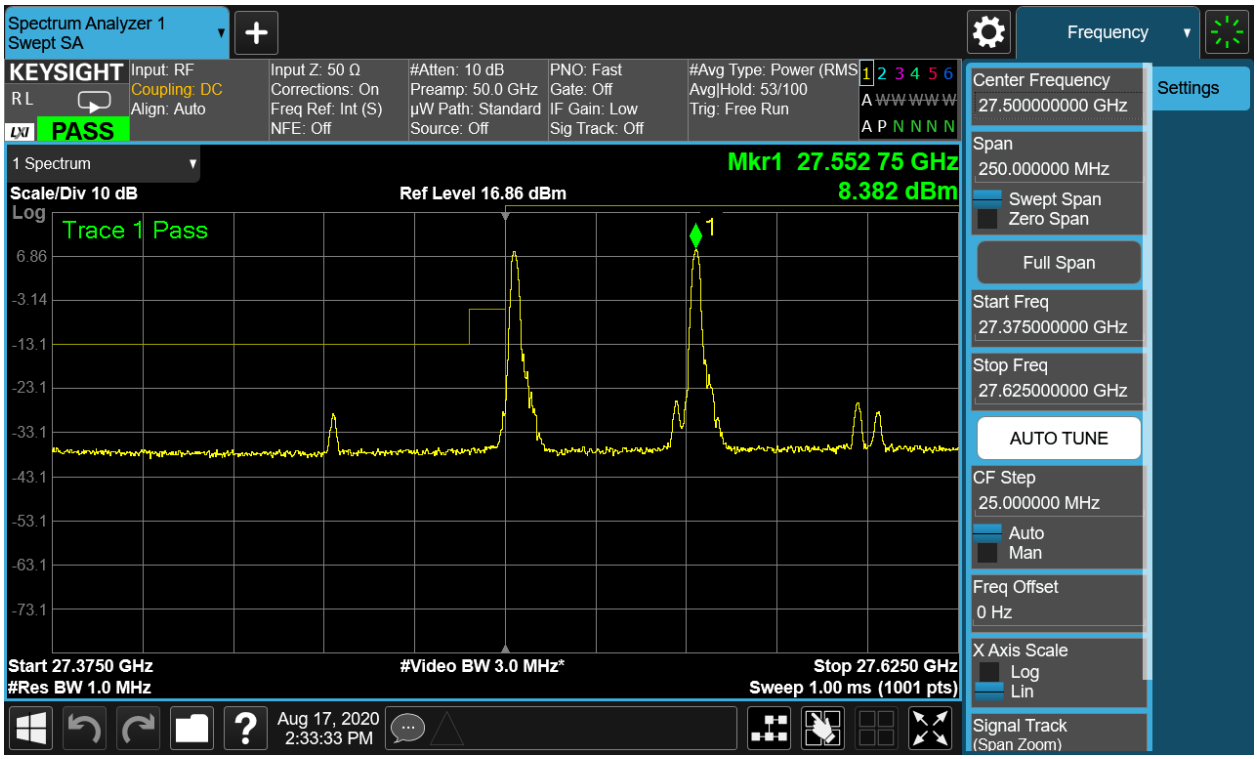
Note:

While it is allowed to use the antenna gain subtraction method in the band edge as it is defined in Part 30, the device meets the requirements via early exit condition as specified in KDB publication 842590 D01.

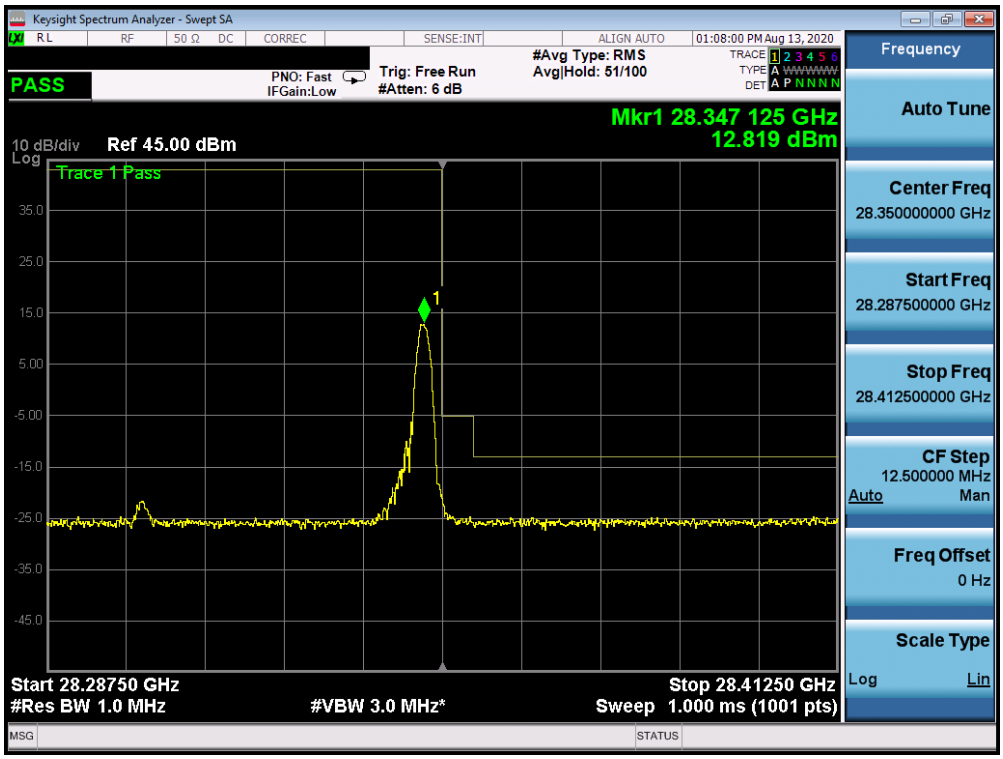
Band n261 – Worst-Case



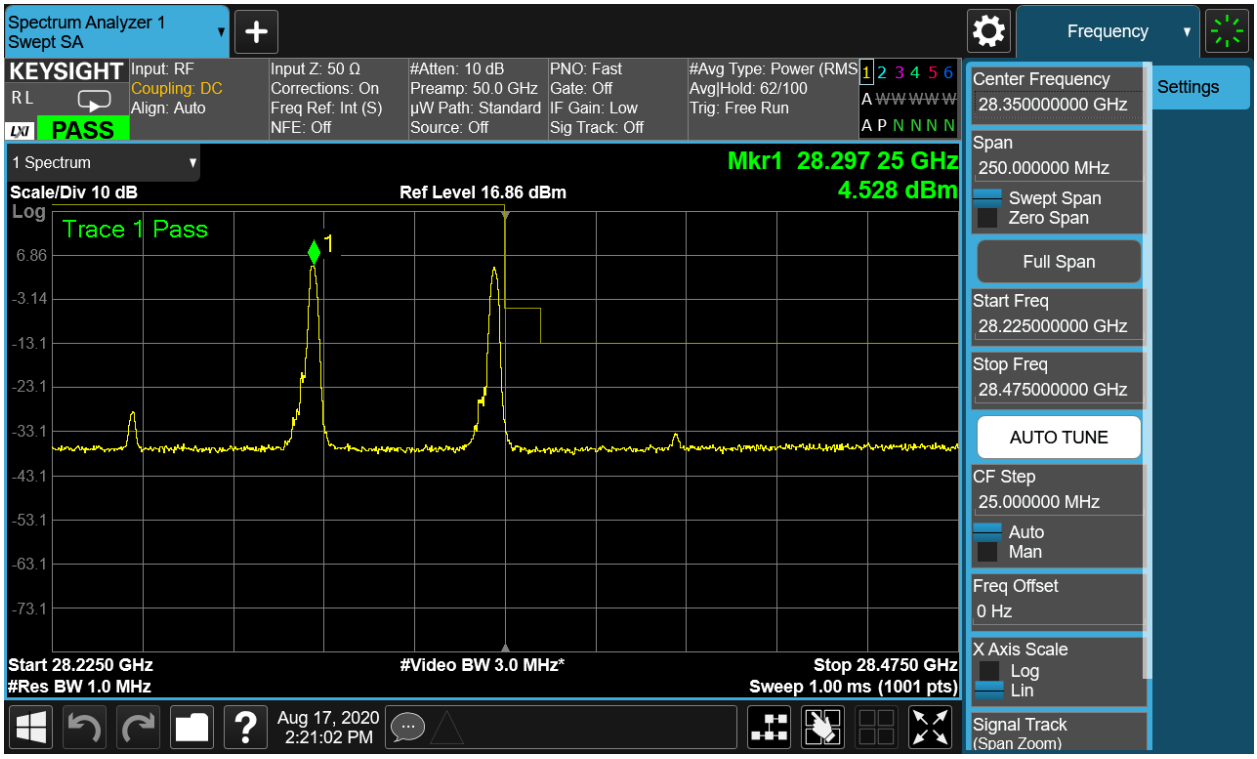
Plot 7-63. Ant 1 Lower Band Edge (50MHz-1CC – QPSK 1 RB)



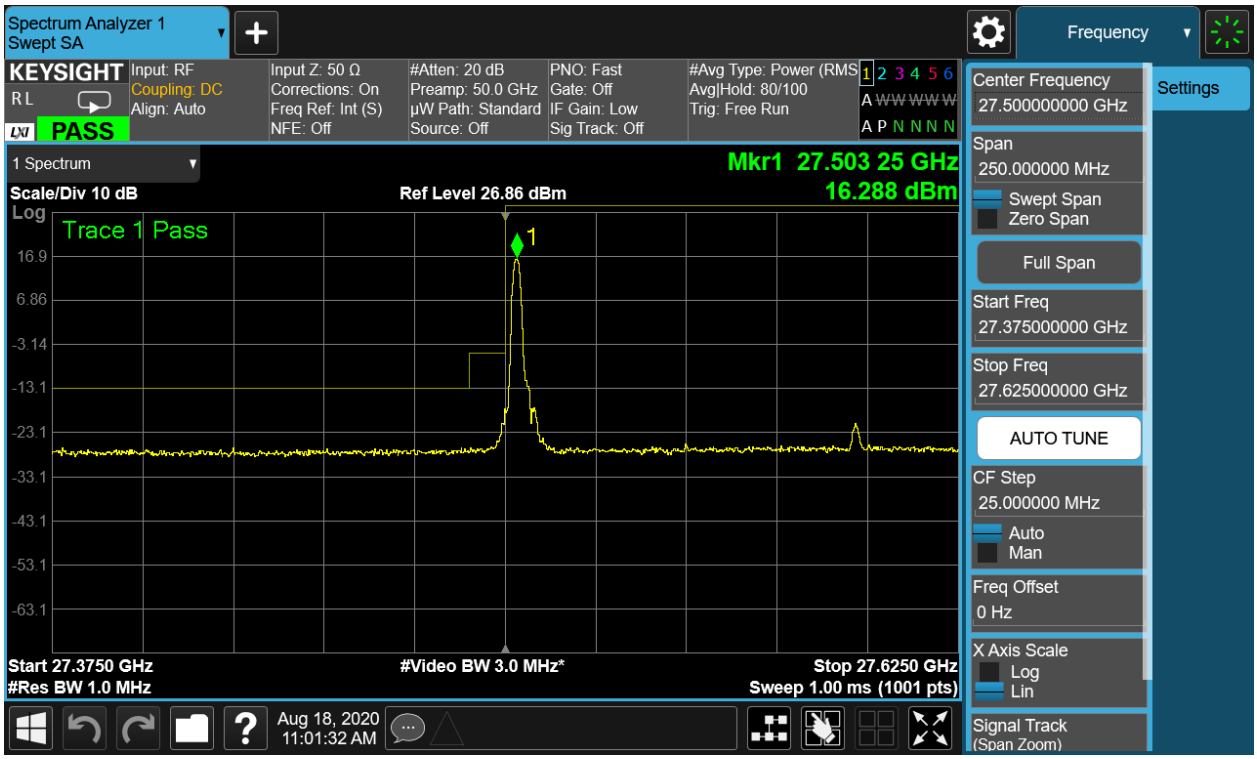
Plot 7-64. Ant 1 Lower Band Edge (50MHz-2CC – QPSK 1 RB)



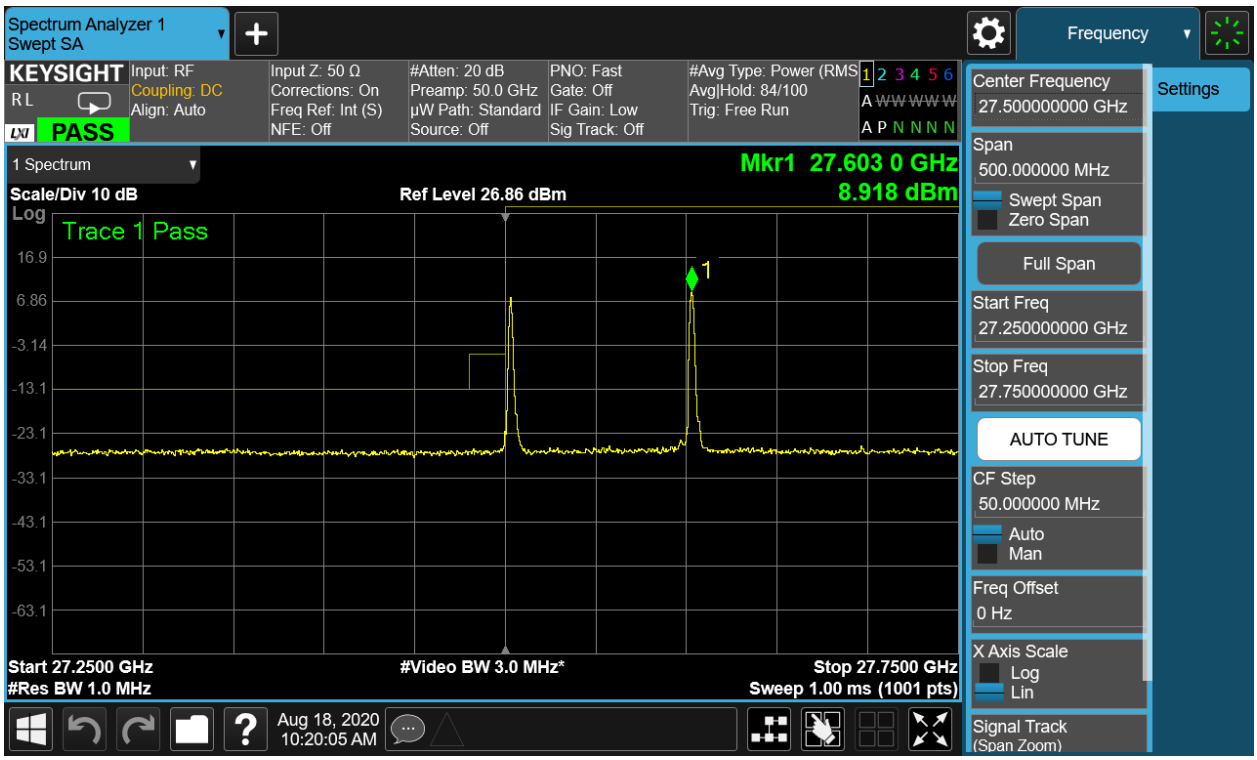
Plot 7-65. Ant 1 Upper Band Edge (50MHz-1CC – QPSK 1 RB)



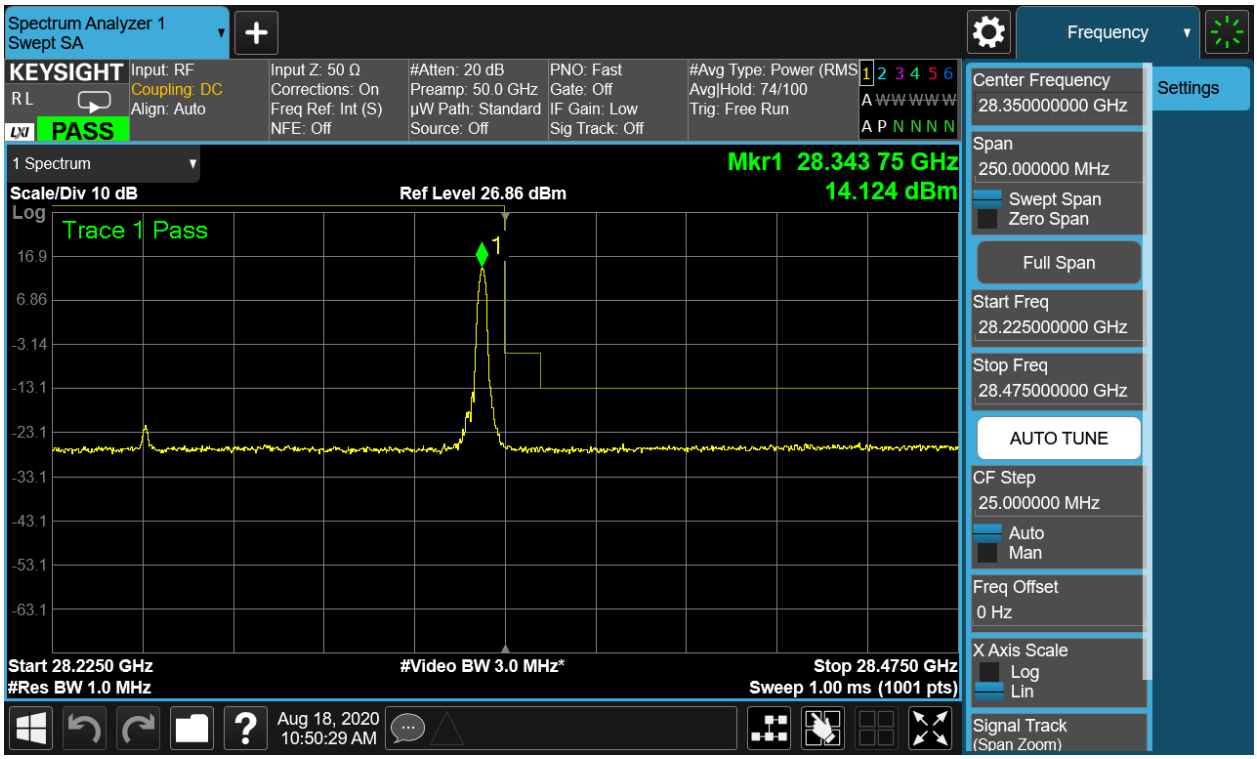
Plot 7-66. Ant 1 Upper Band Edge (50MHz-2CC – QPSK 1 RB)



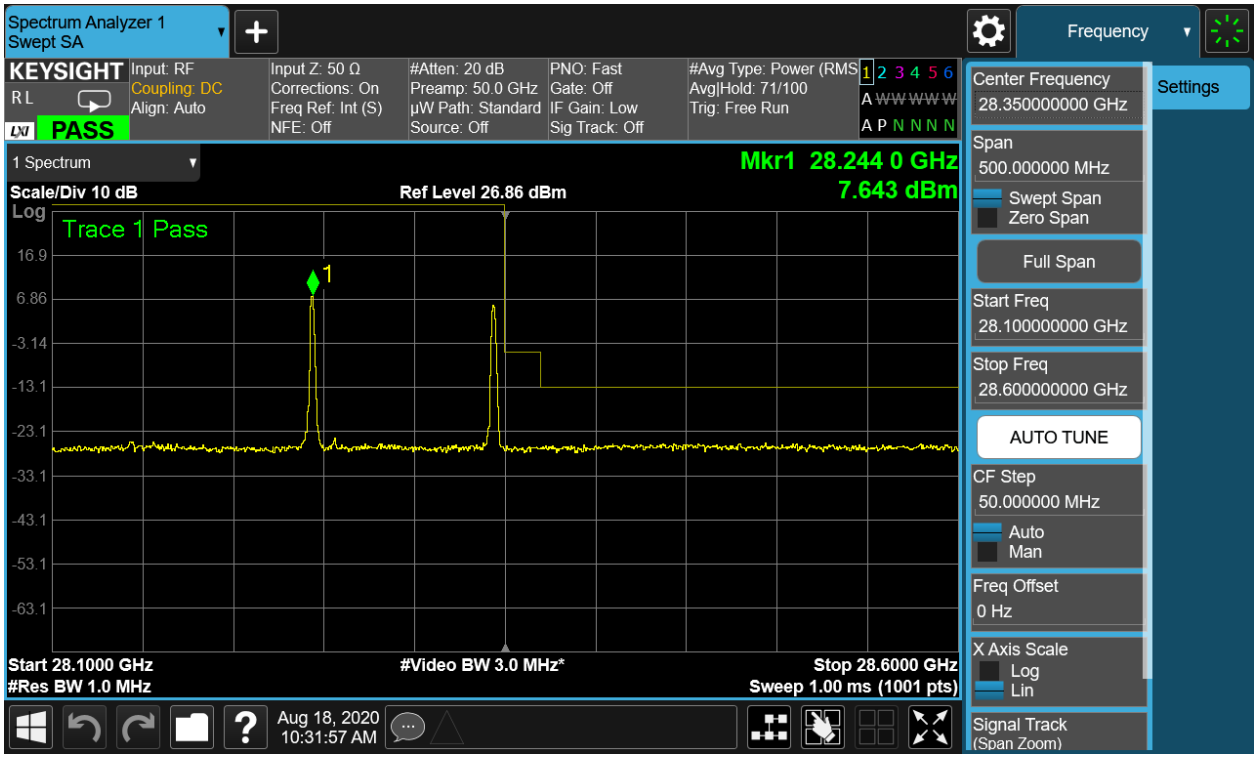
Plot 7-67. Ant 1 Lower Band Edge (100MHz-1CC – QPSK 1 RB)



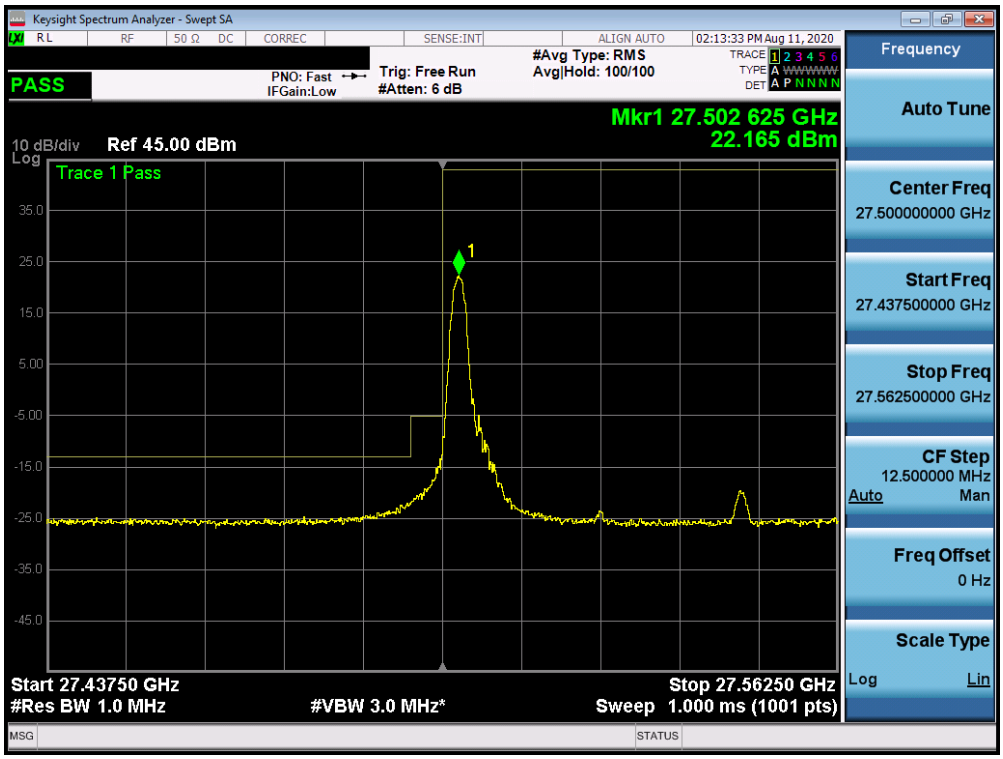
Plot 7-68. Ant 1 Lower Band Edge (100MHz-2CC – QPSK 1 RB)



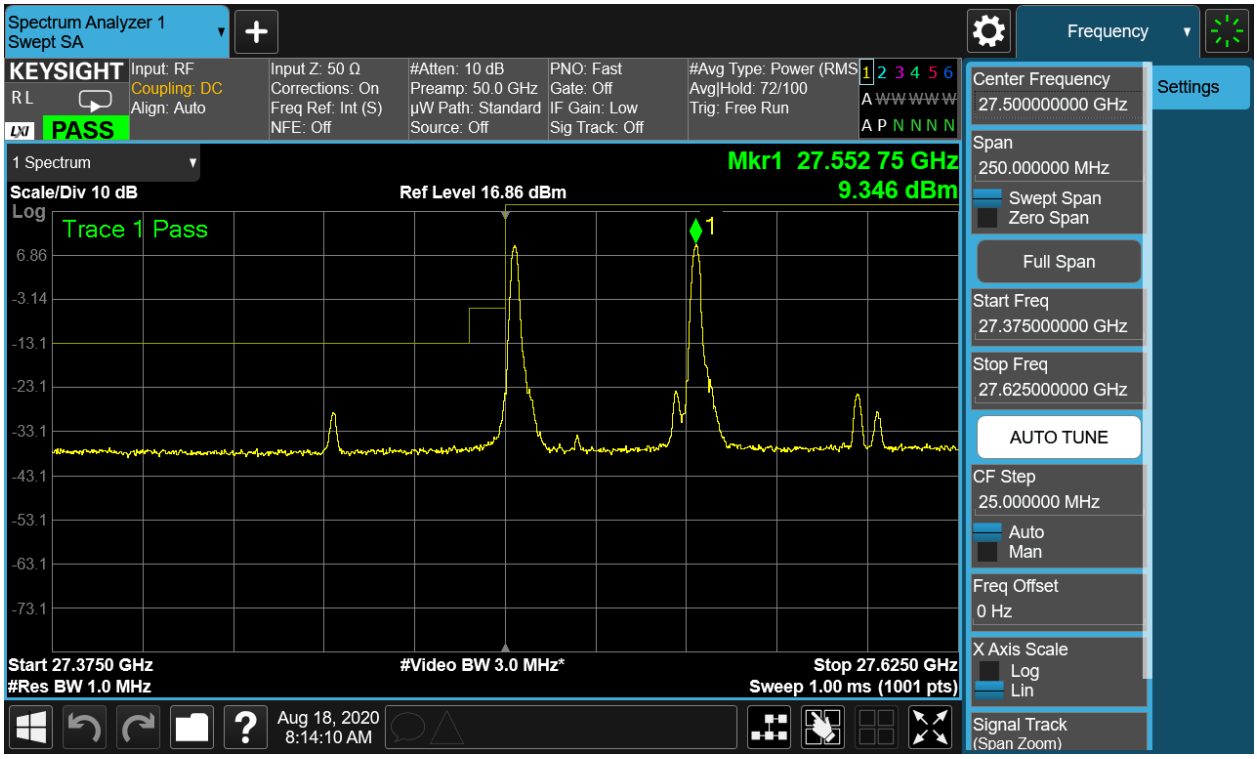
Plot 7-69. Ant 1 Upper Band Edge (100MHz-1CC – QPSK 1 RB)



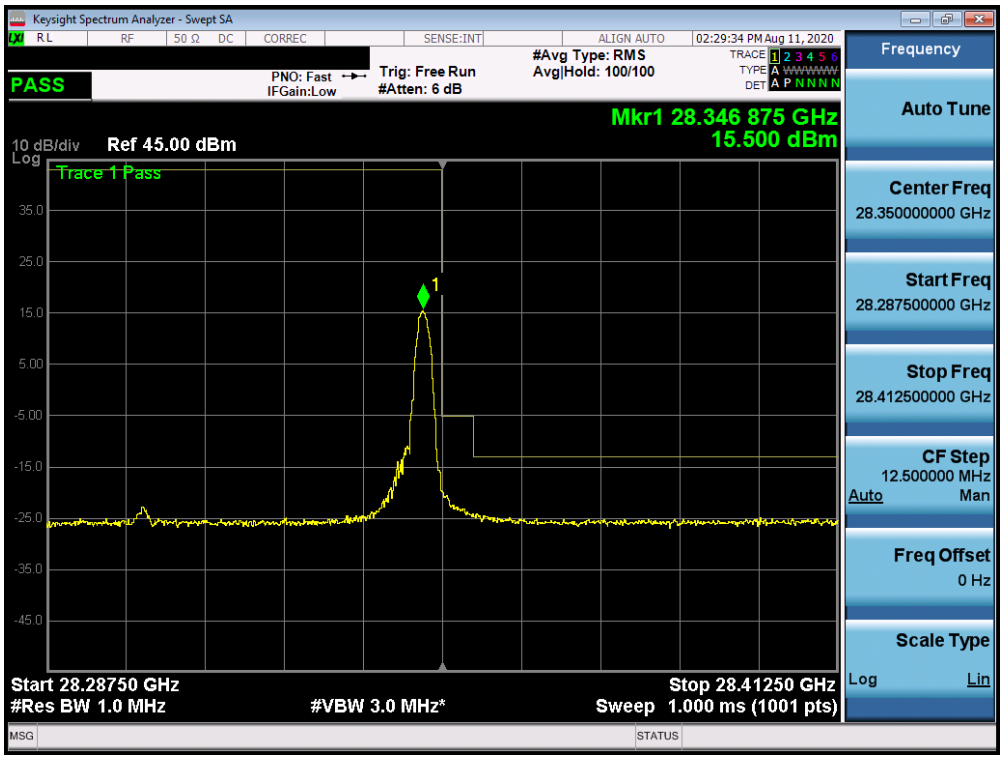
Plot 7-70. Ant 1 Upper Band Edge (100MHz-2CC – QPSK 1 RB)



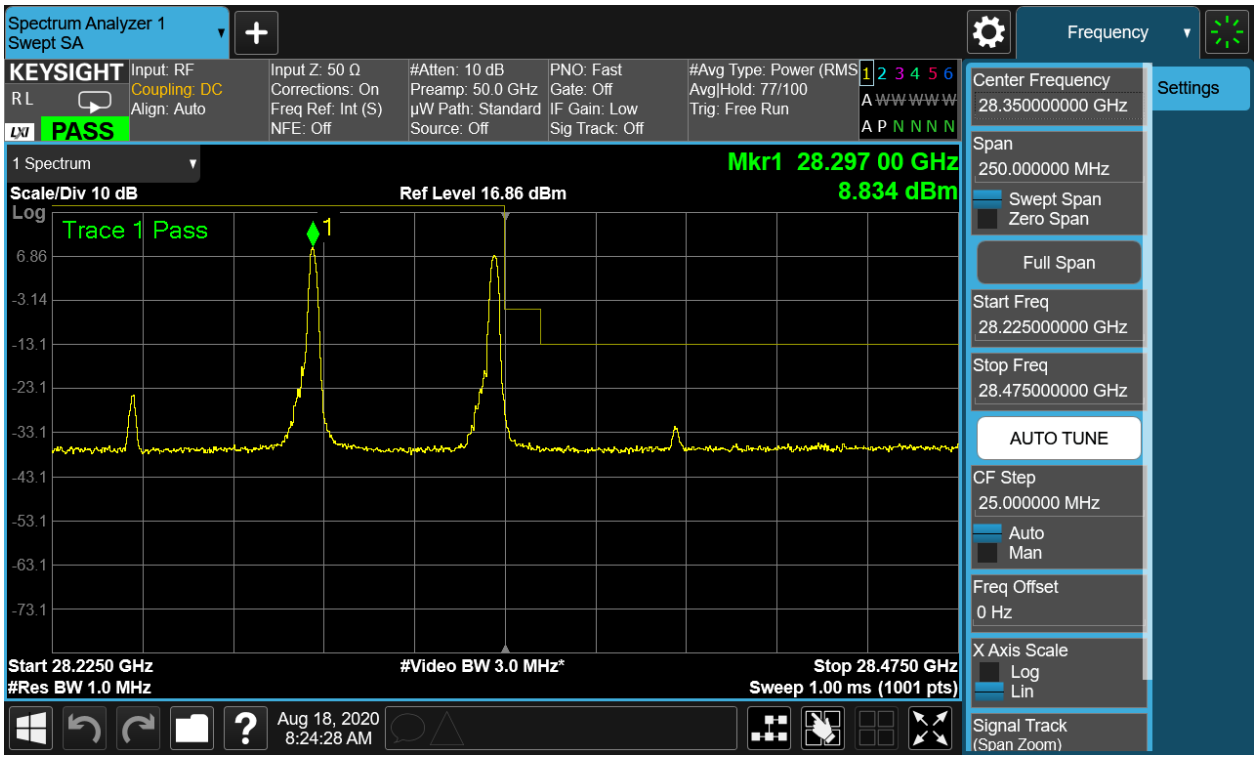
Plot 7-71. Ant 2 Lower Band Edge (50MHz-1CC – QPSK 1 RB)



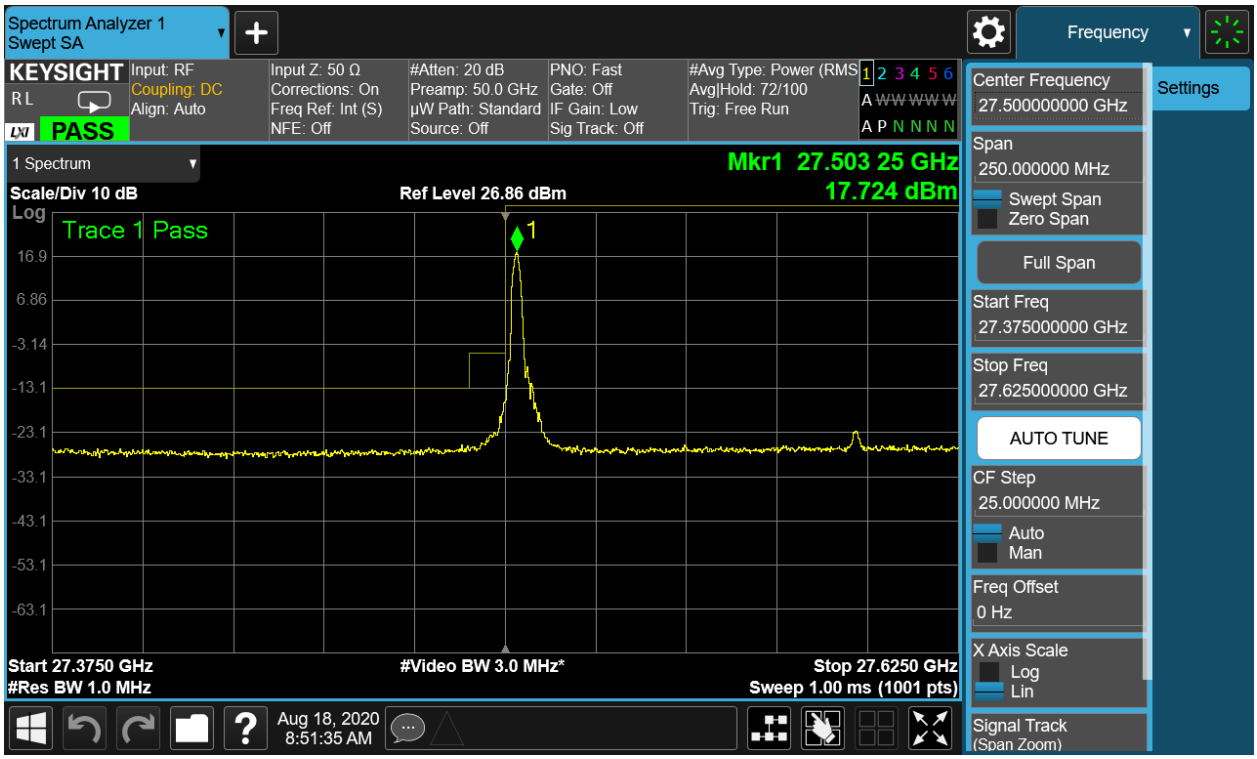
Plot 7-72. Ant 2 Lower Band Edge (50MHz-2CC – QPSK 1 RB)



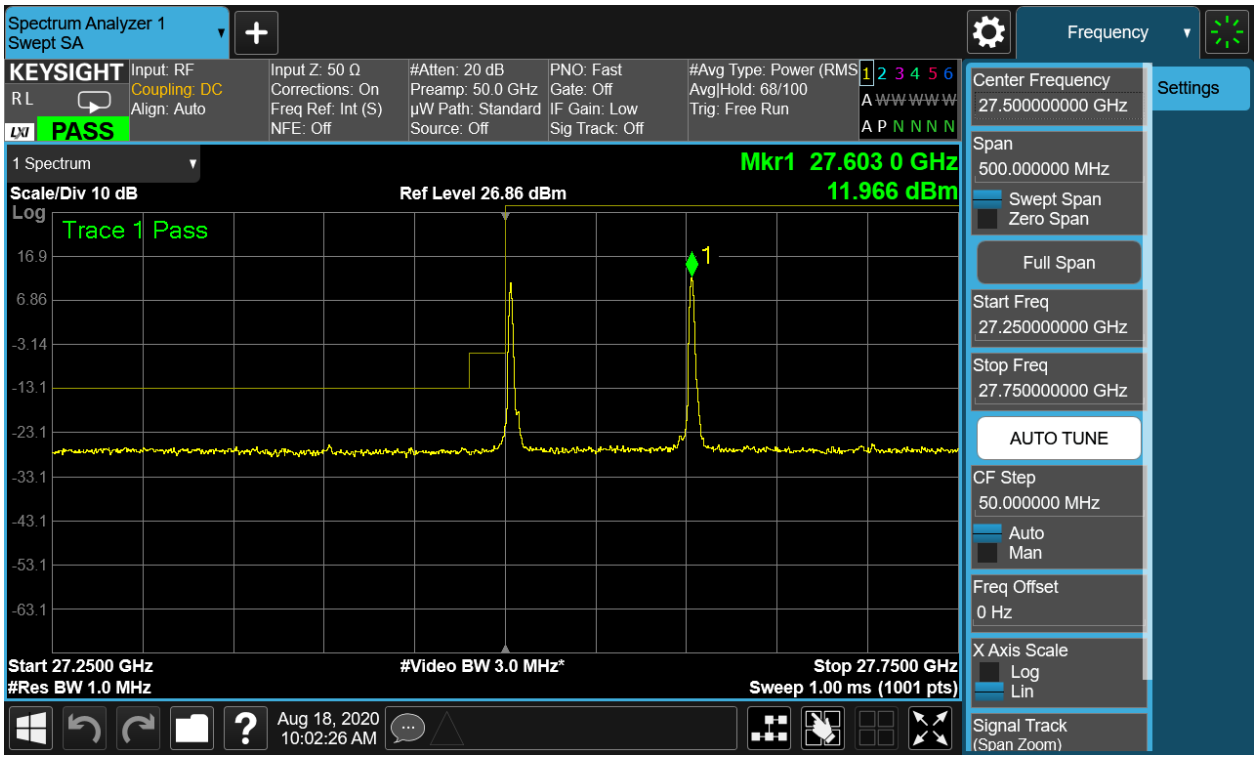
Plot 7-73. Ant 2 Upper Band Edge (50MHz-1CC – QPSK 1 RB)



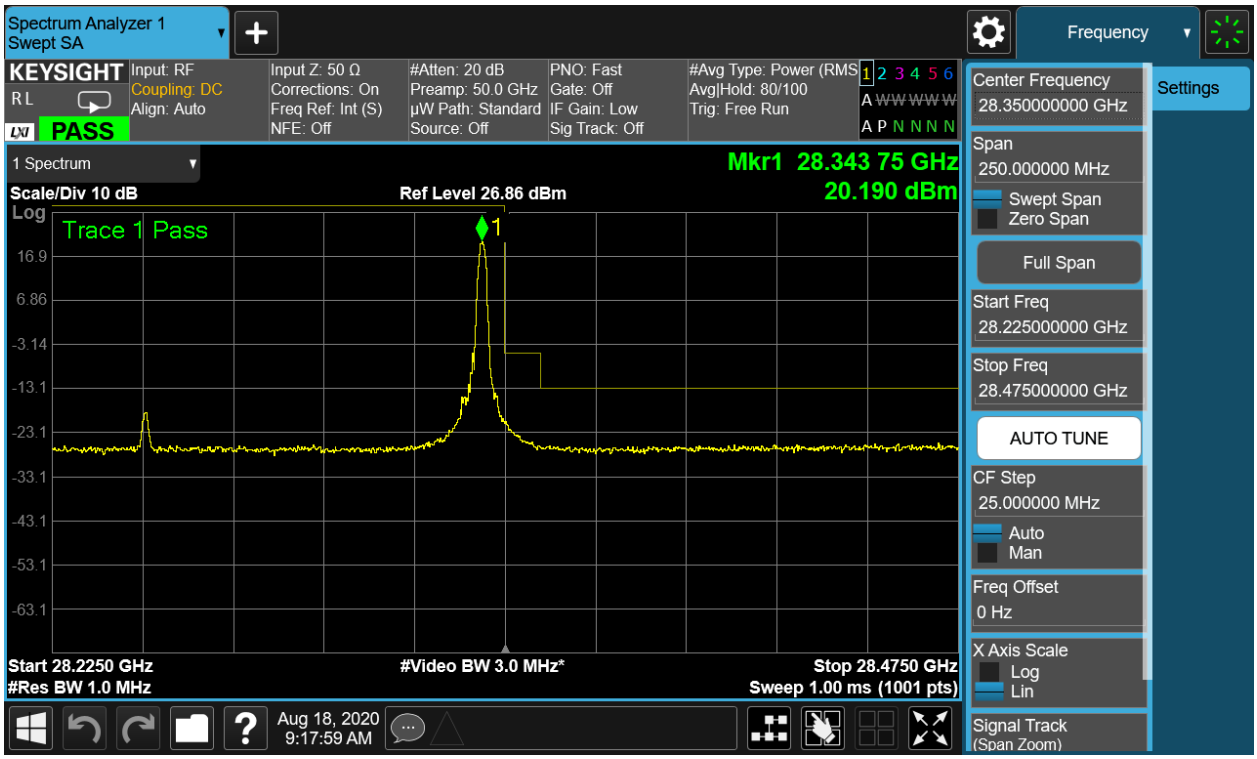
Plot 7-74. Ant 2 Upper Band Edge (50MHz-2CC – QPSK 1 RB)



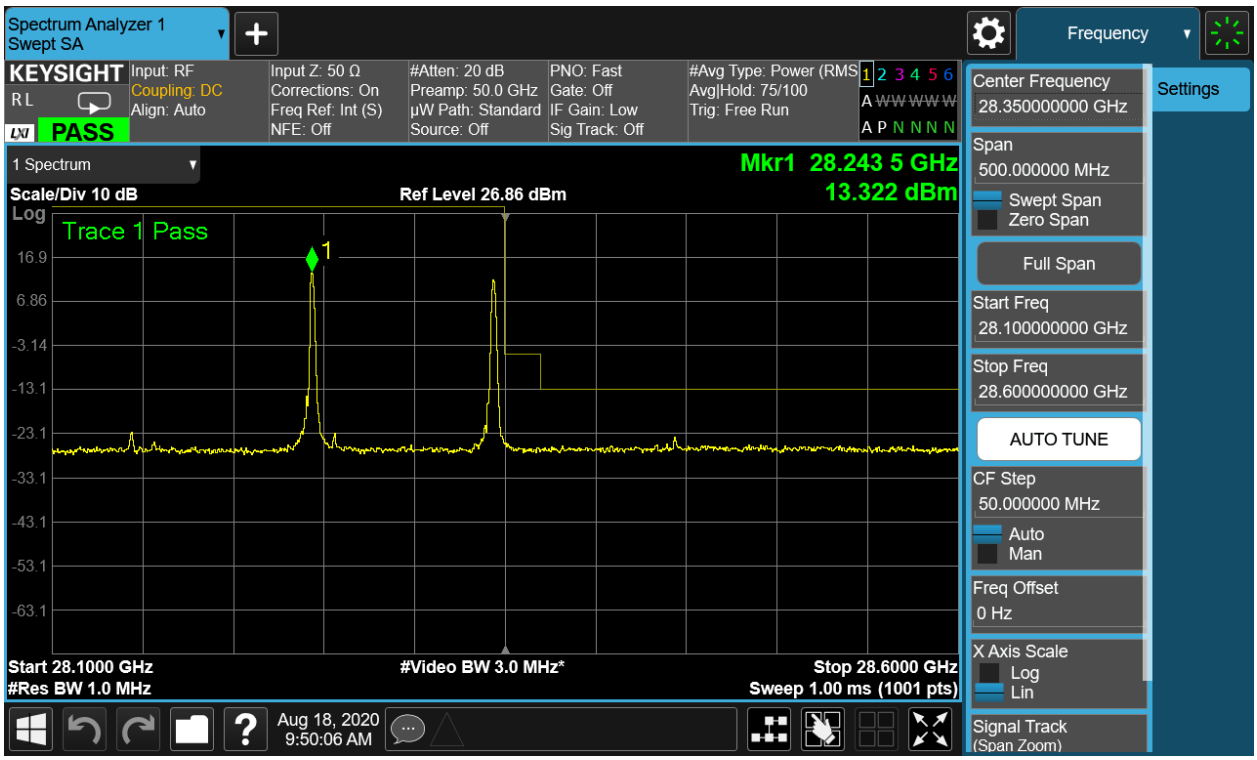
Plot 7-75. Ant 2 Lower Band Edge (100MHz-1CC – QPSK 1 RB)



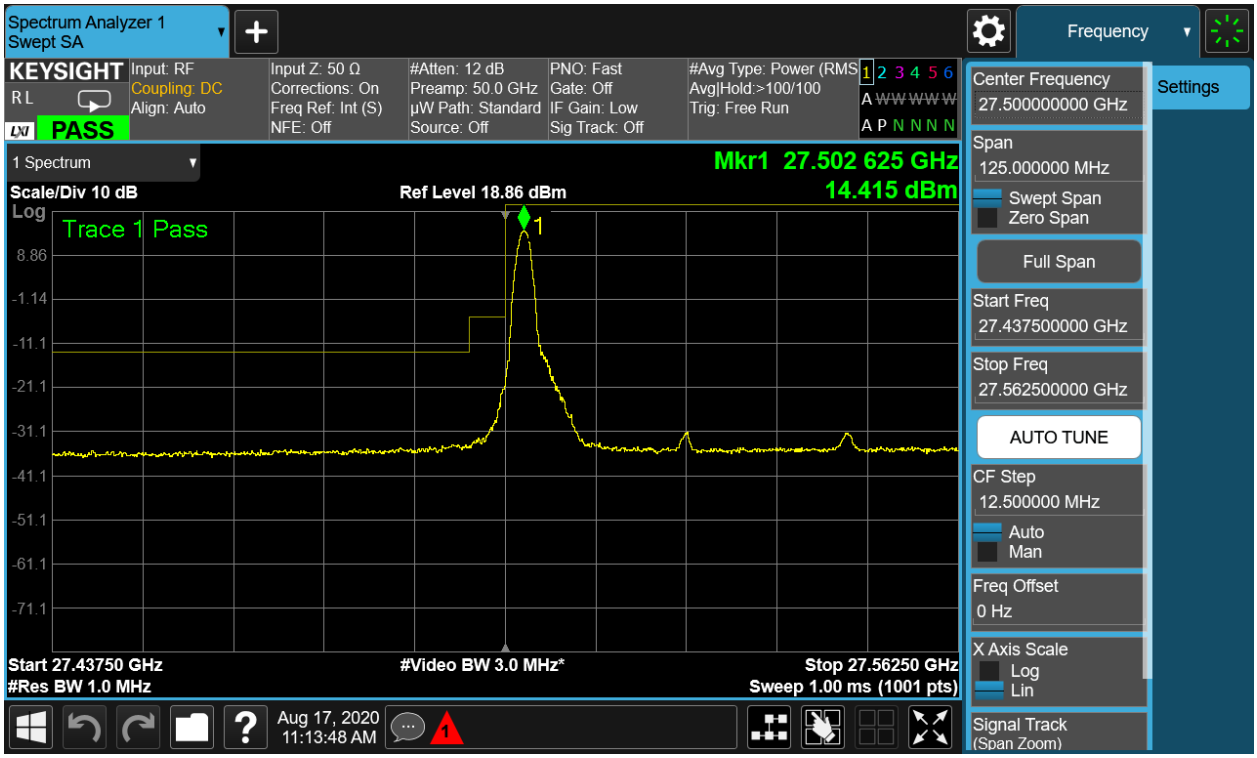
Plot 7-76. Ant 2 Lower Band Edge (100MHz-2CC – QPSK 1 RB)



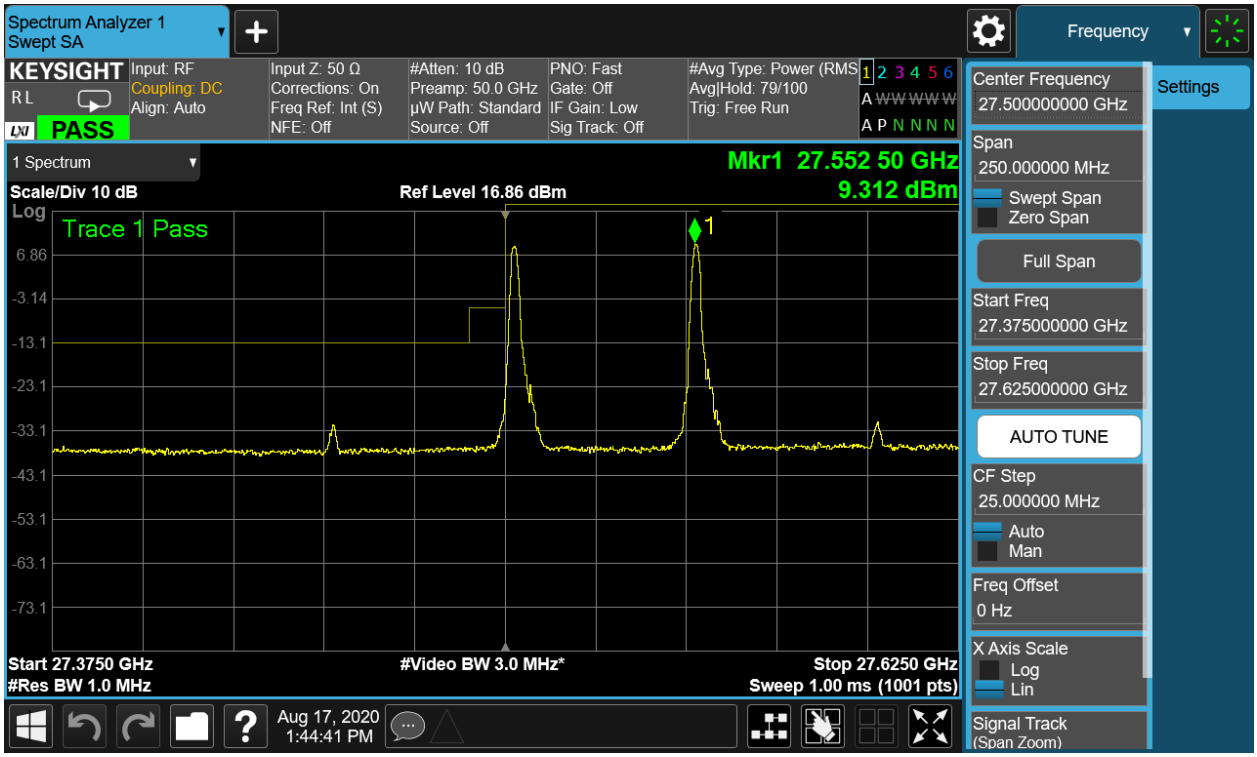
Plot 7-77. Ant 2 Upper Band Edge (100MHz-1CC – QPSK 1 RB)



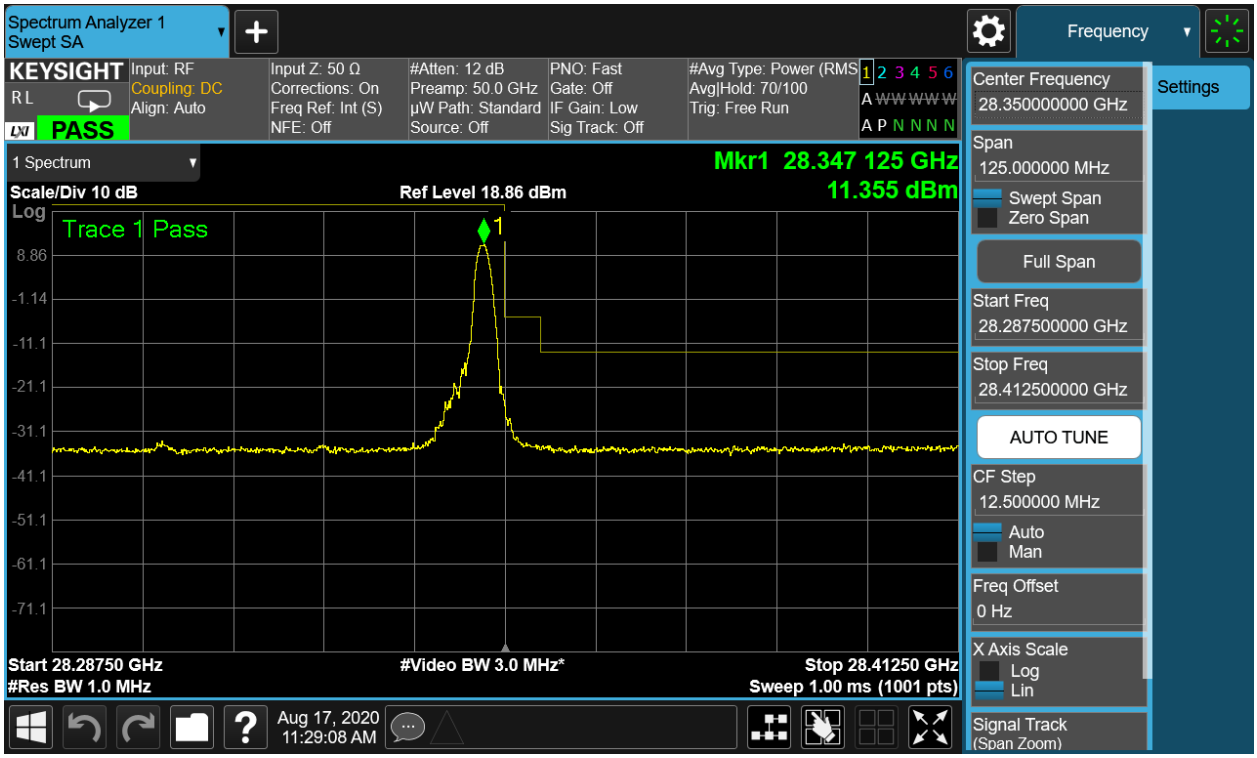
Plot 7-78. Ant 2 Upper Band Edge (100MHz-2CC – QPSK 1 RB)



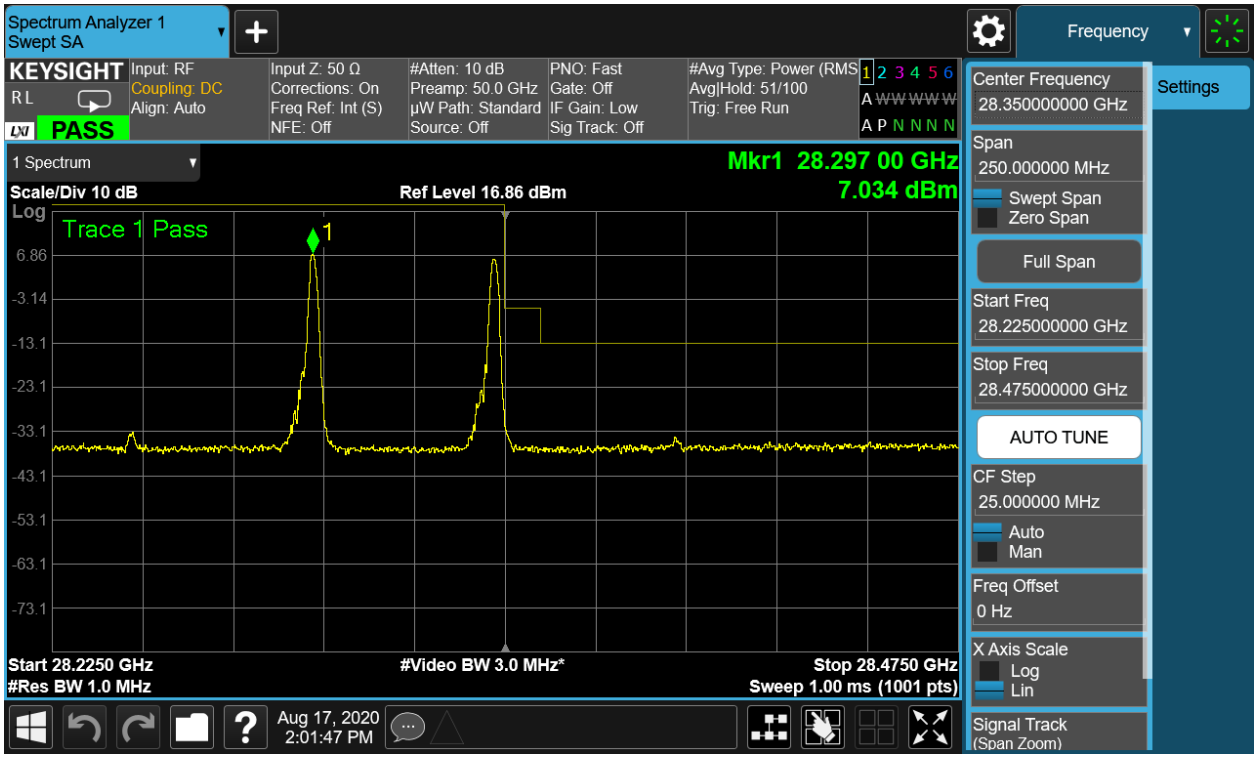
Plot 7-71. Ant 3 Lower Band Edge (50MHz-1CC – QPSK 1 RB)



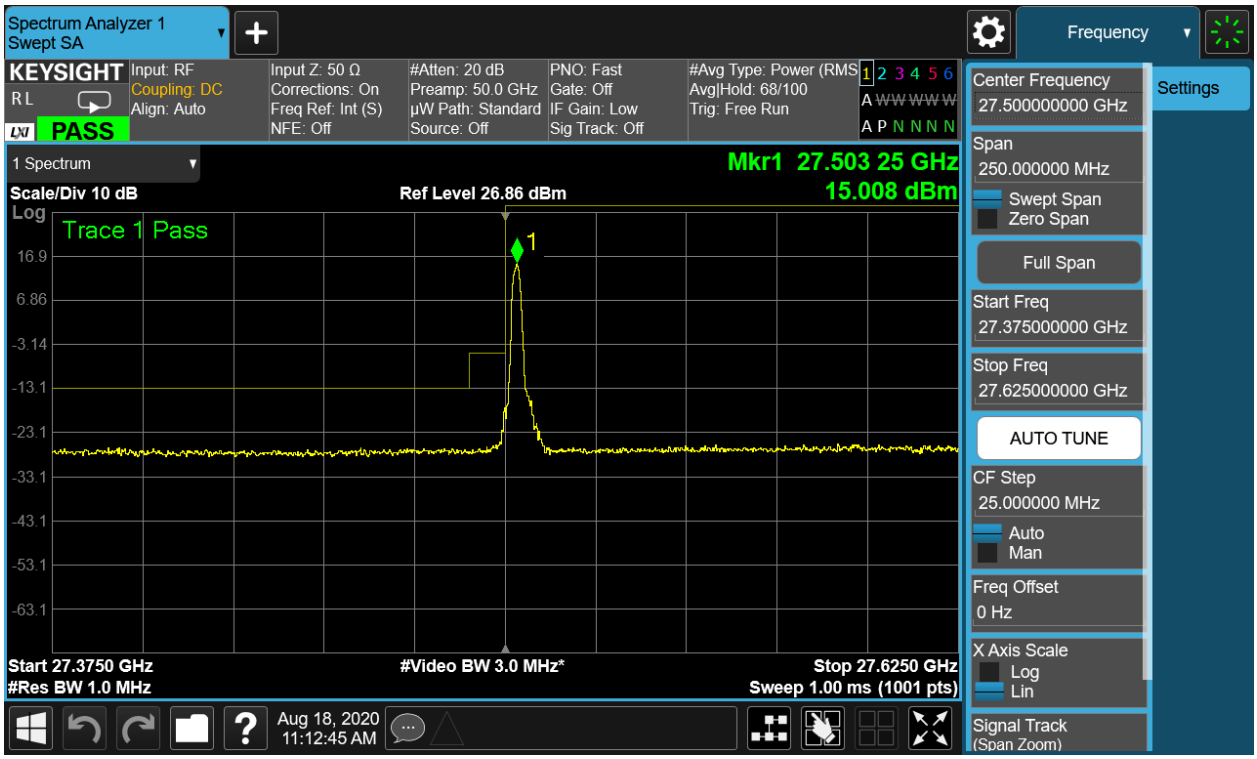
Plot 7-72. Ant 3 Lower Band Edge (50MHz-2CC – QPSK 1 RB)



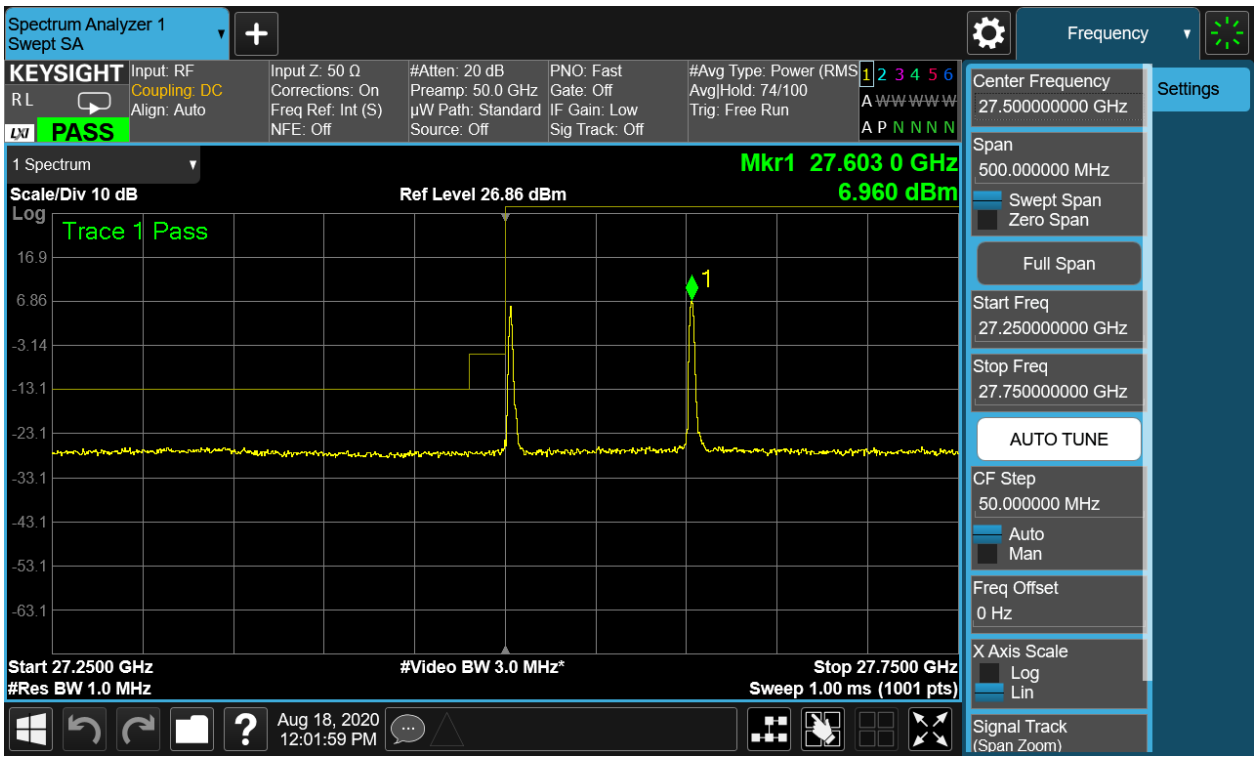
Plot 7-73. Ant 3 Upper Band Edge (50MHz-1CC – QPSK 1 RB)



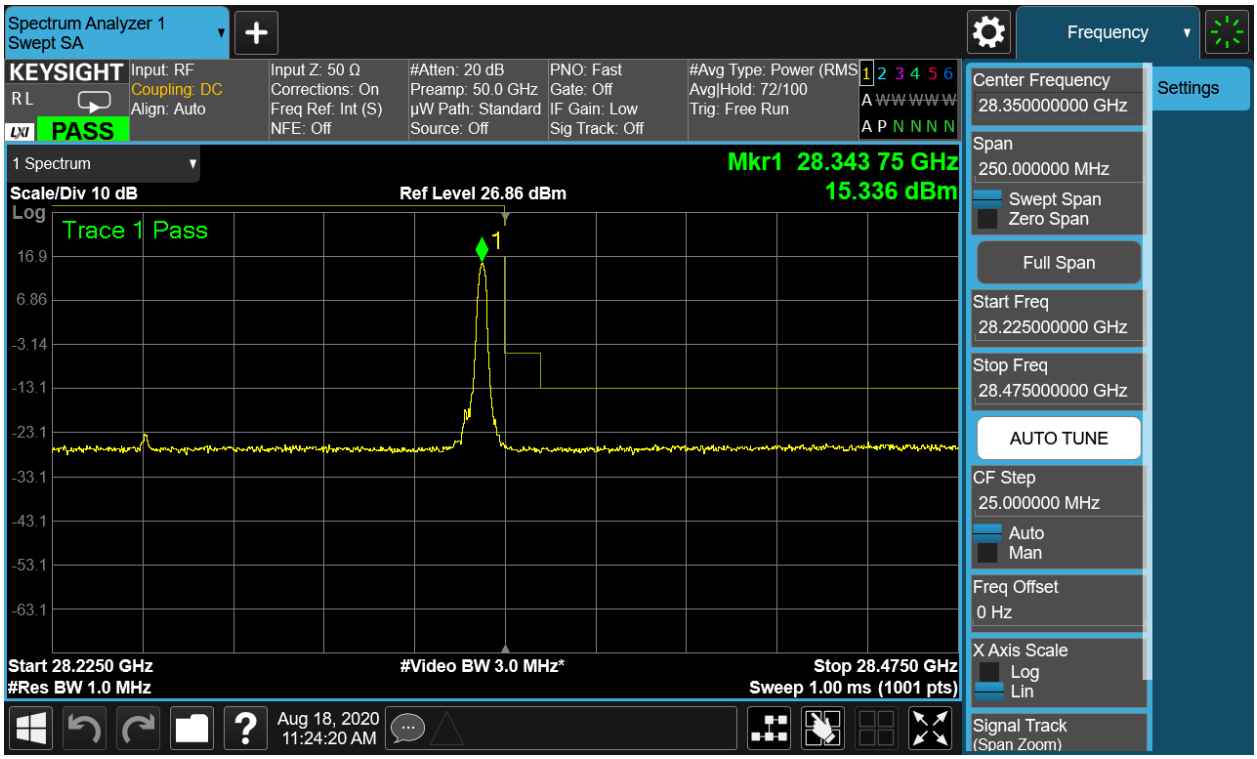
Plot 7-74. Ant 3 Upper Band Edge (50MHz-2CC – QPSK 1 RB)



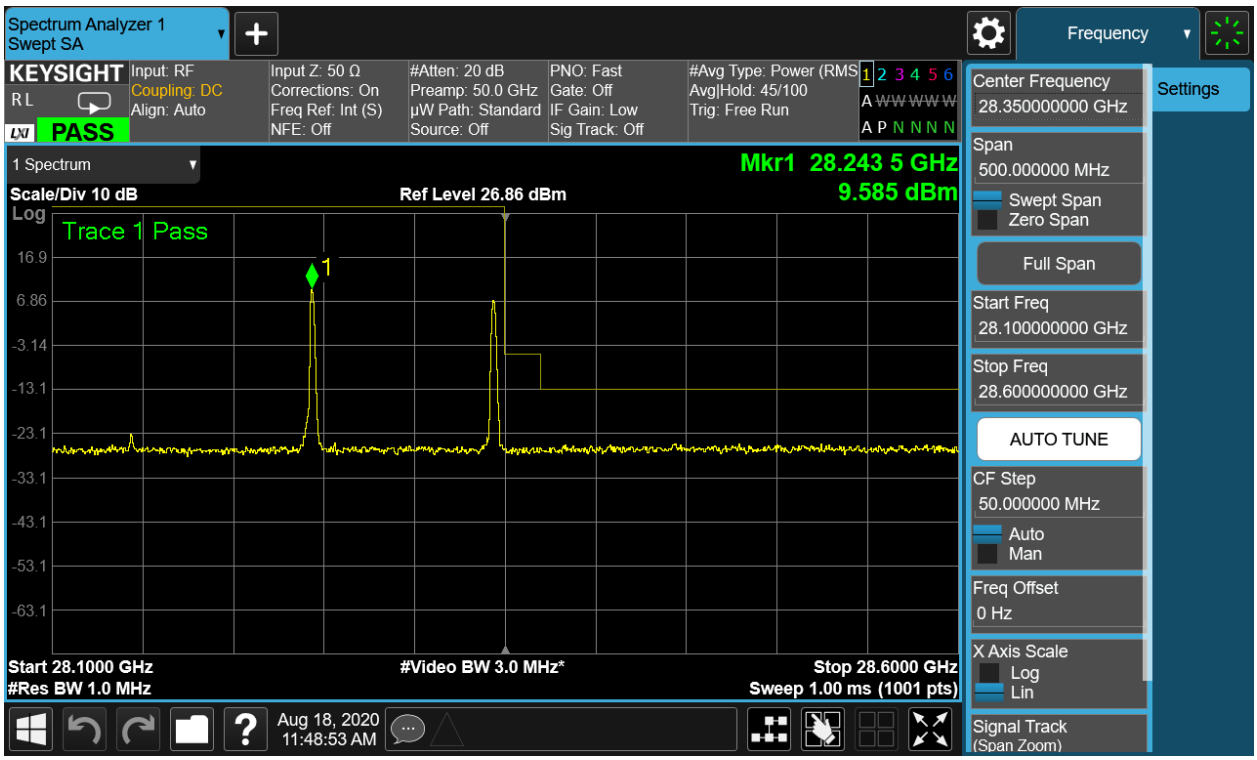
Plot 7-75. Ant 3 Lower Band Edge (100MHz-1CC – QPSK 1 RB)



Plot 7-76. Ant 3 Lower Band Edge (100MHz-2CC – QPSK 1 RB)

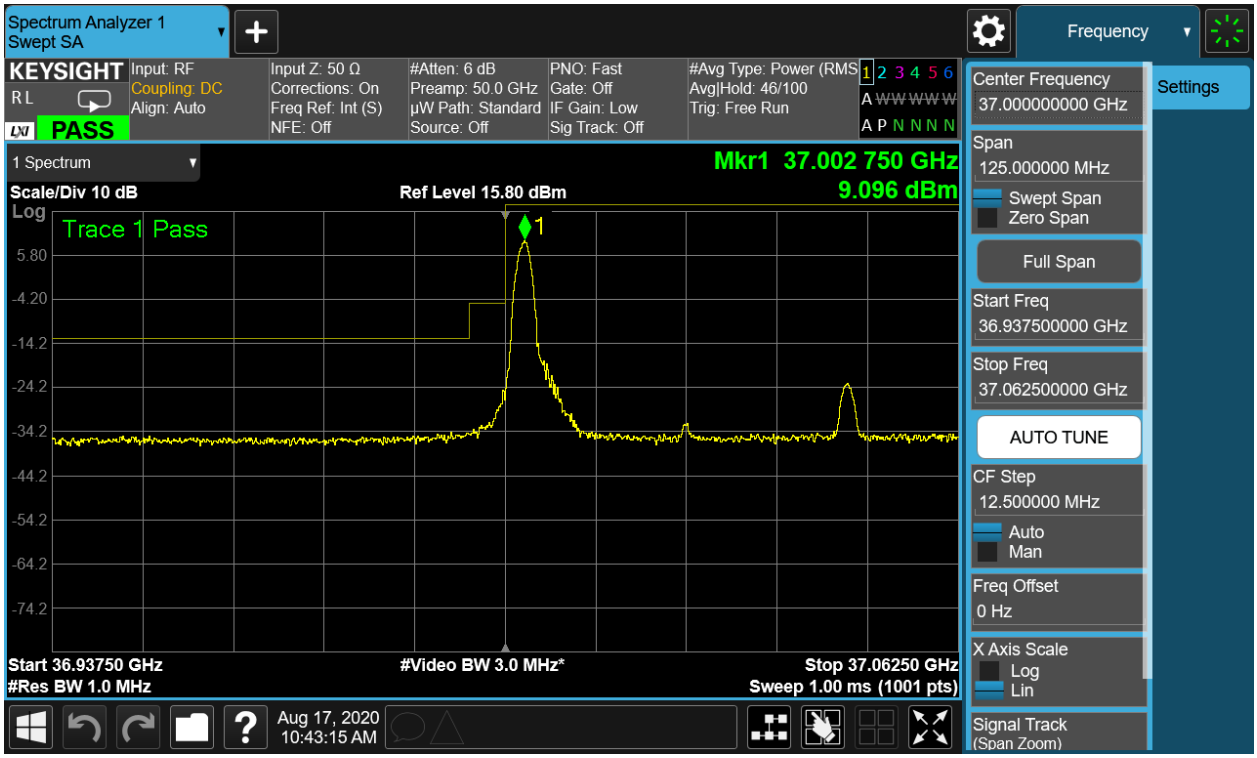


Plot 7-77. Ant 3 Upper Band Edge (100MHz-1CC – QPSK 1 RB)

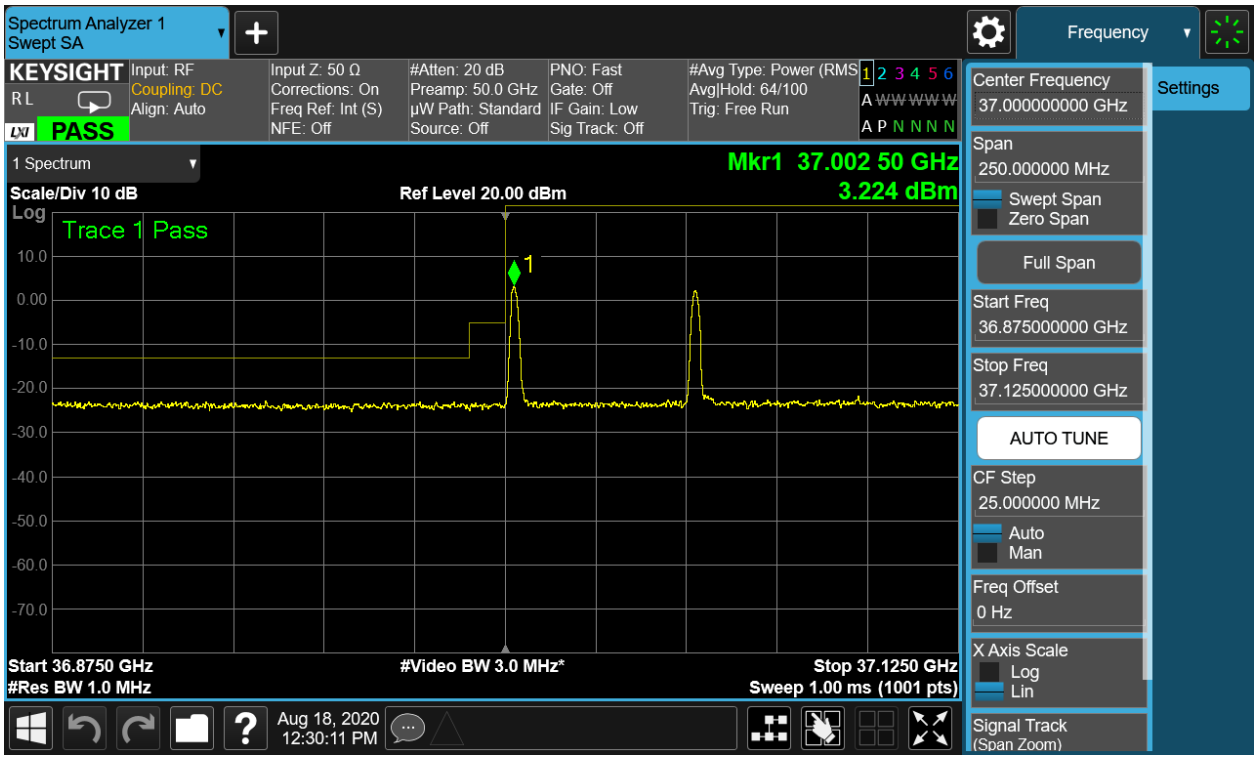


Plot 7-78. Ant 3 Upper Band Edge (100MHz-2CC – QPSK 1 RB)

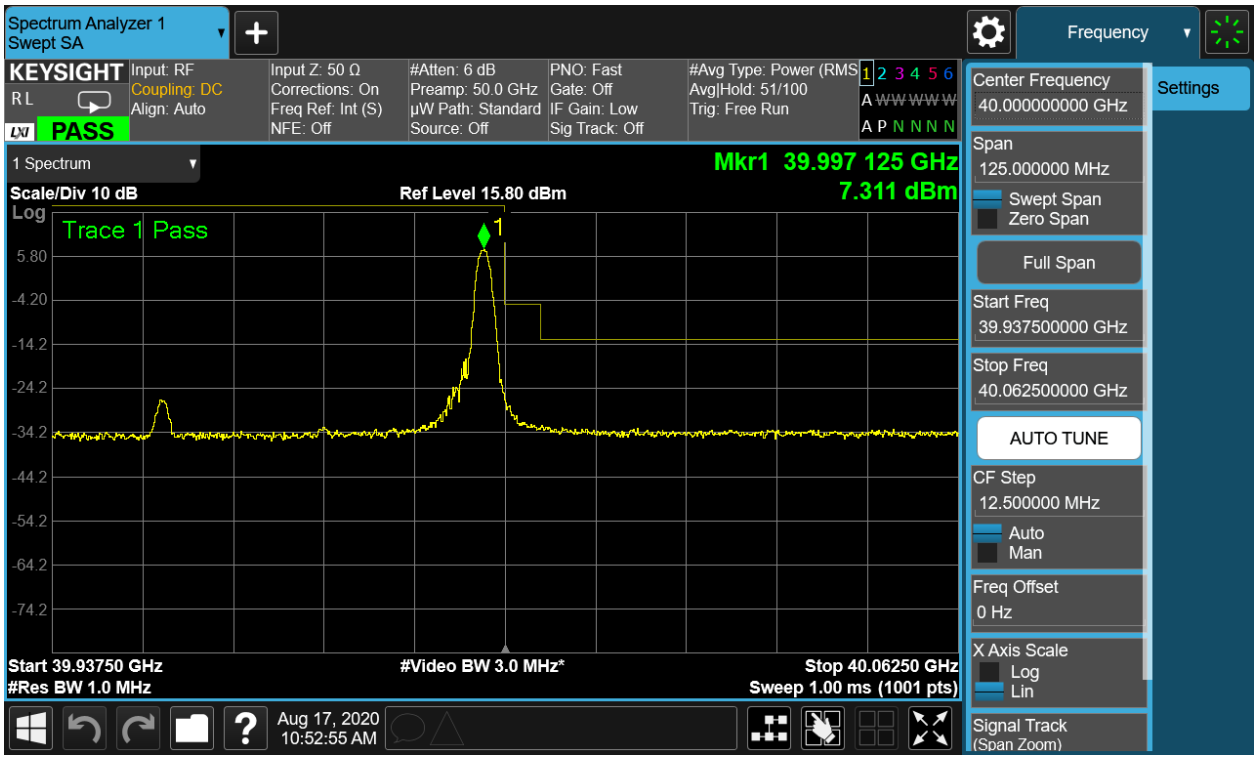
Band n260 – Worst Case



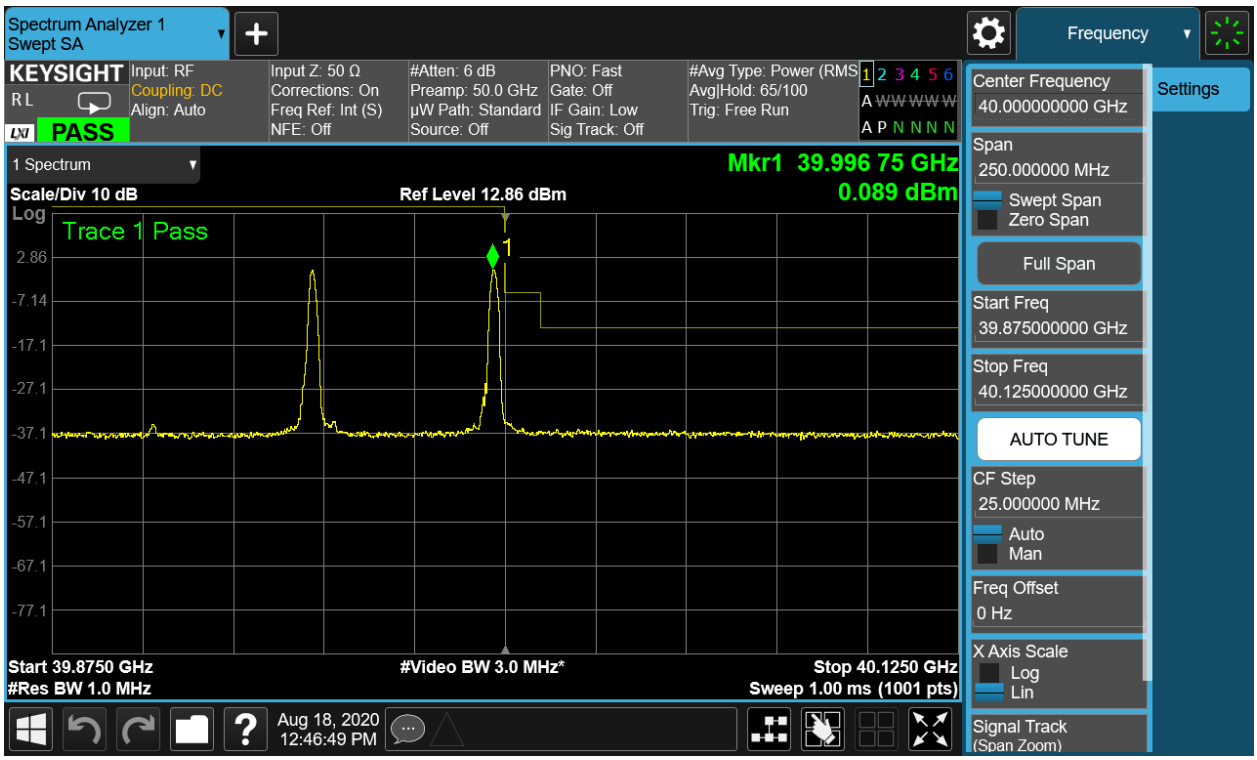
Plot 7-79. Ant 1 Lower Band Edge (50MHz-1CC – QPSK 1 RB)



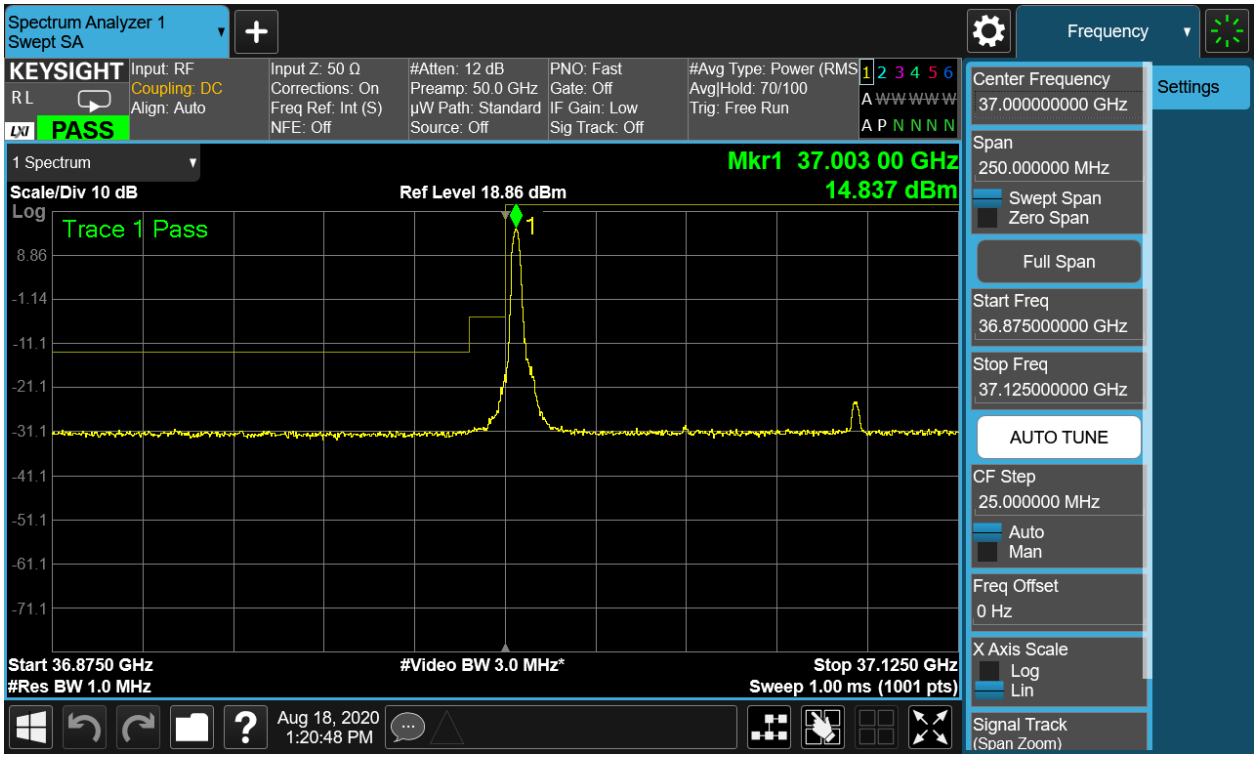
Plot 7-80. Ant 1 Lower Band Edge (50MHz-2CC – QPSK 1 RB)



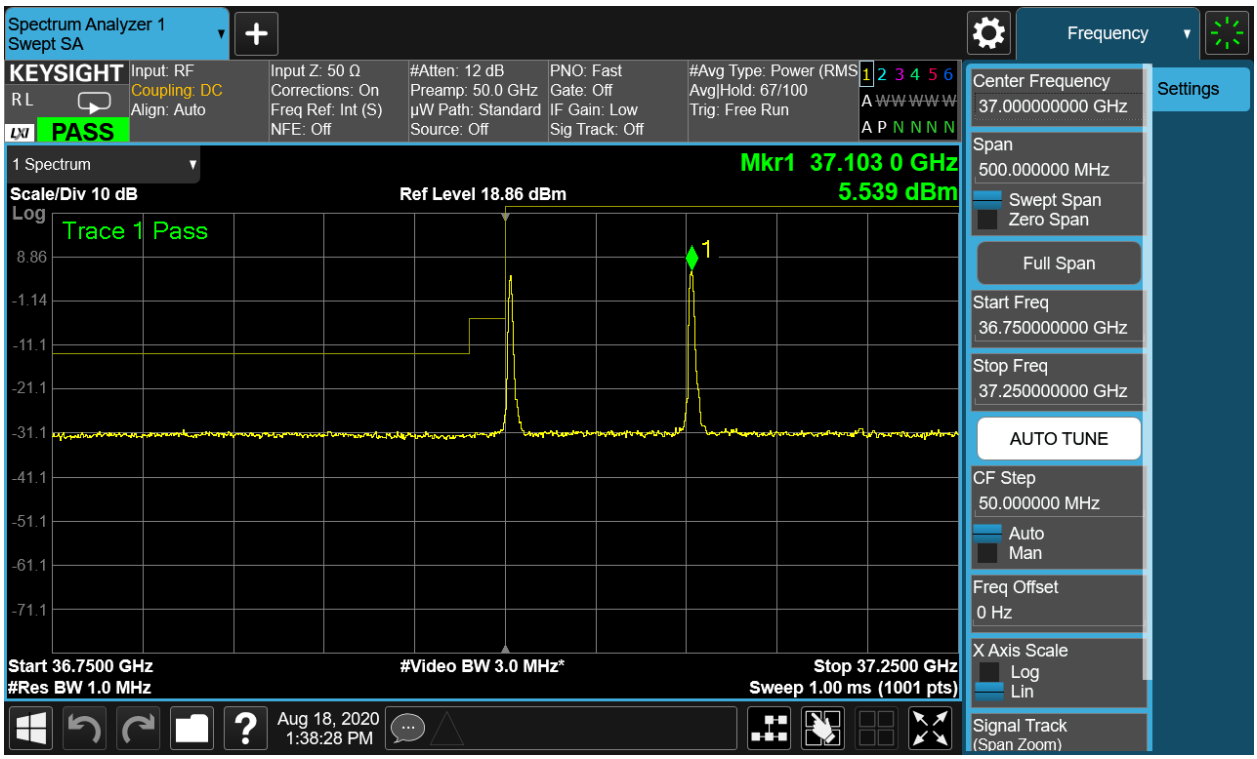
Plot 7-81. Ant 1 Upper Band Edge (50MHz-1CC – QPSK 1 RB)



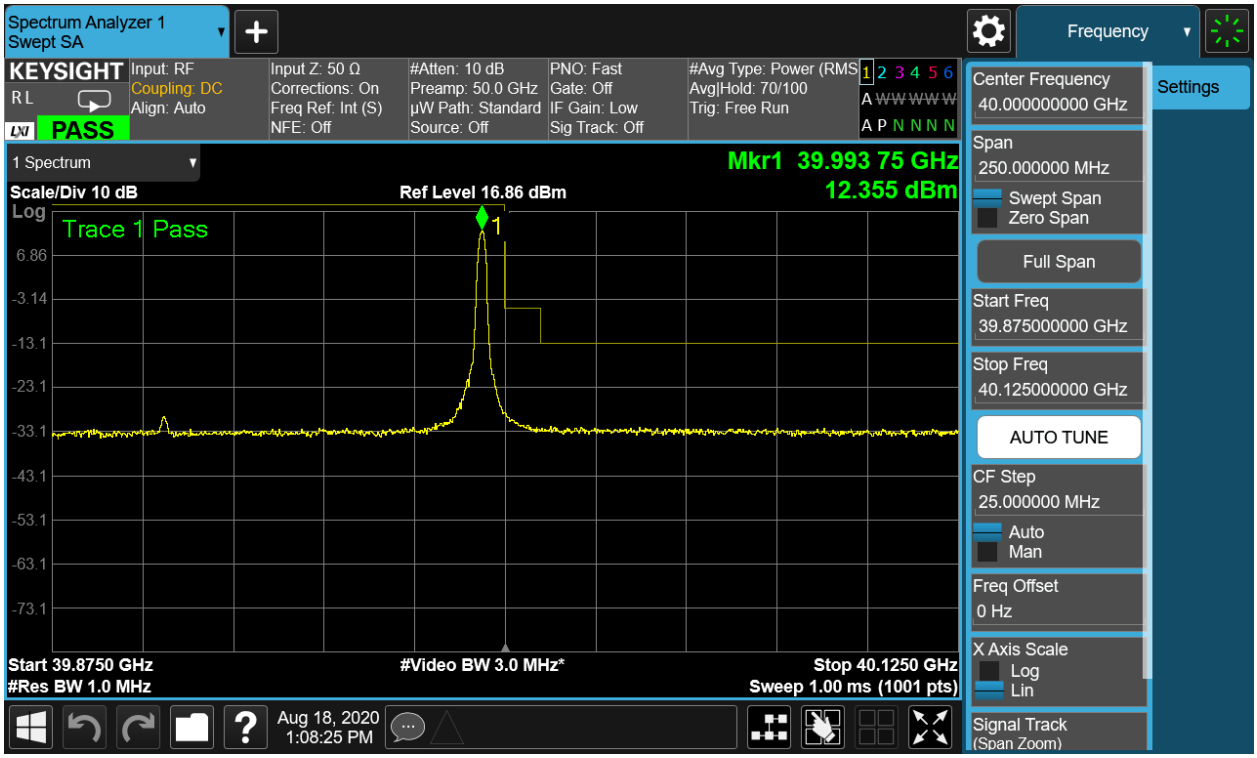
Plot 7-82. Ant 1 Upper Band Edge (50MHz-2CC – QPSK 1 RB)



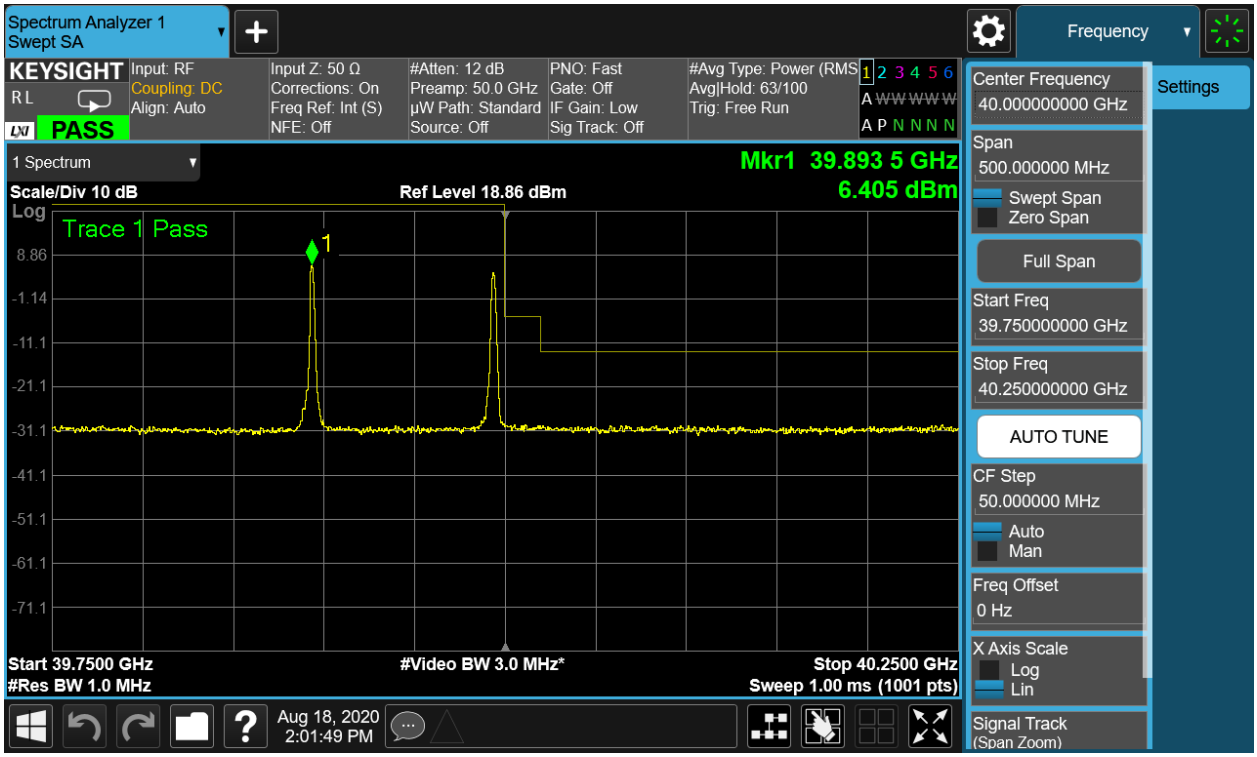
Plot 7-83. Ant 1 Lower Band Edge (100MHz-1CC – QPSK 1 RB)



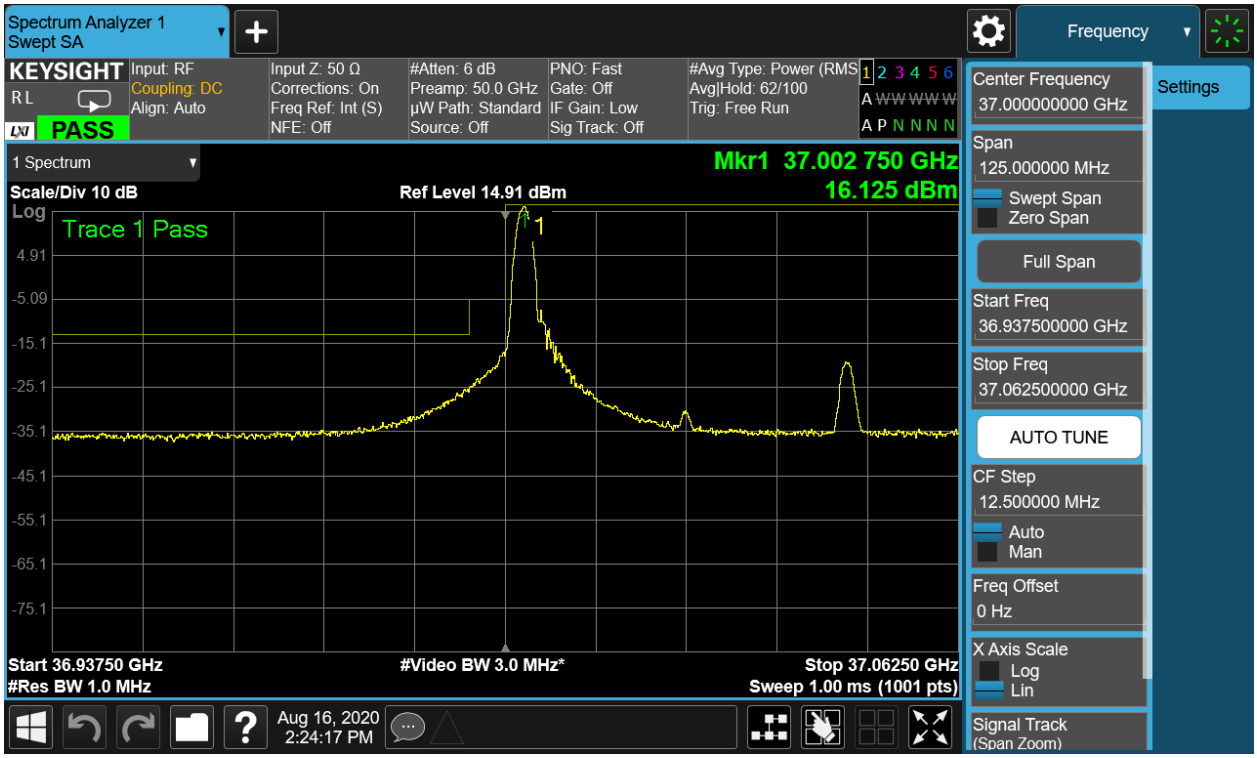
Plot 7-84. Ant 1 Lower Band Edge (100MHz-2CC – QPSK 1 RB)



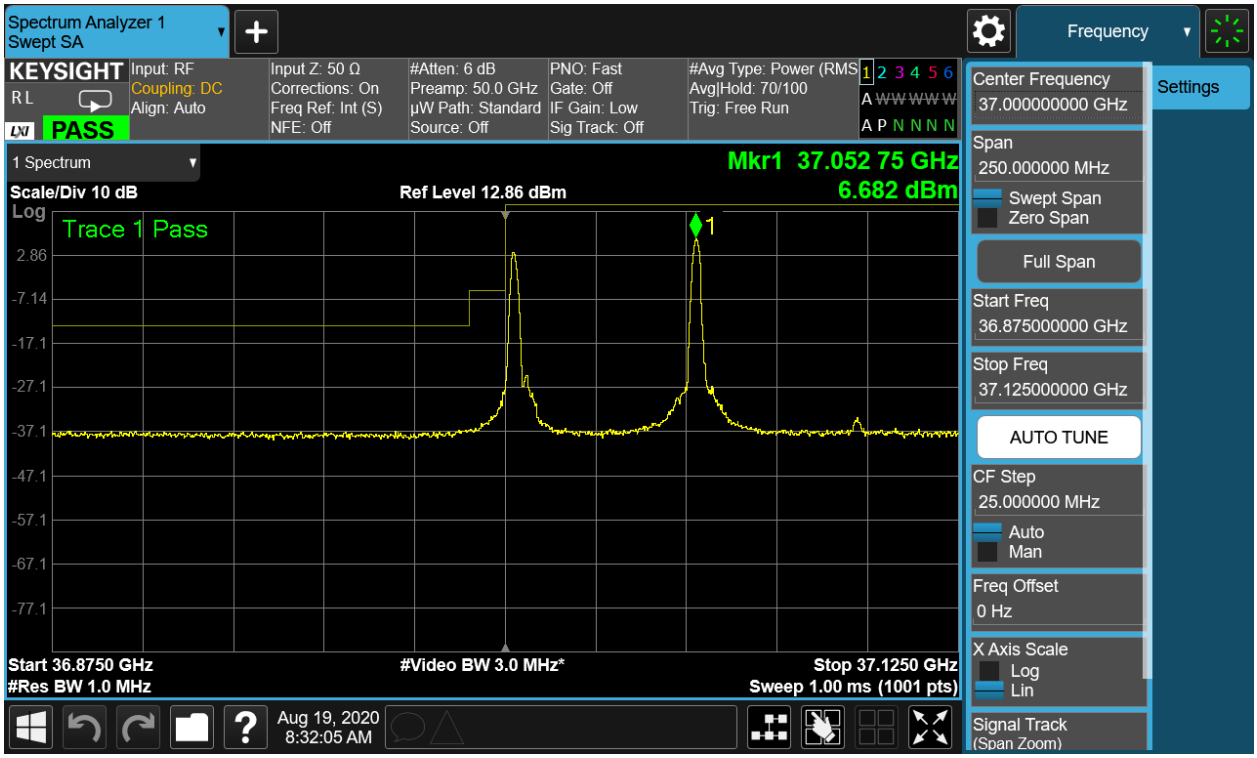
Plot 7-85. Ant 1 Upper Band Edge (100MHz-1CC – QPSK 1 RB)



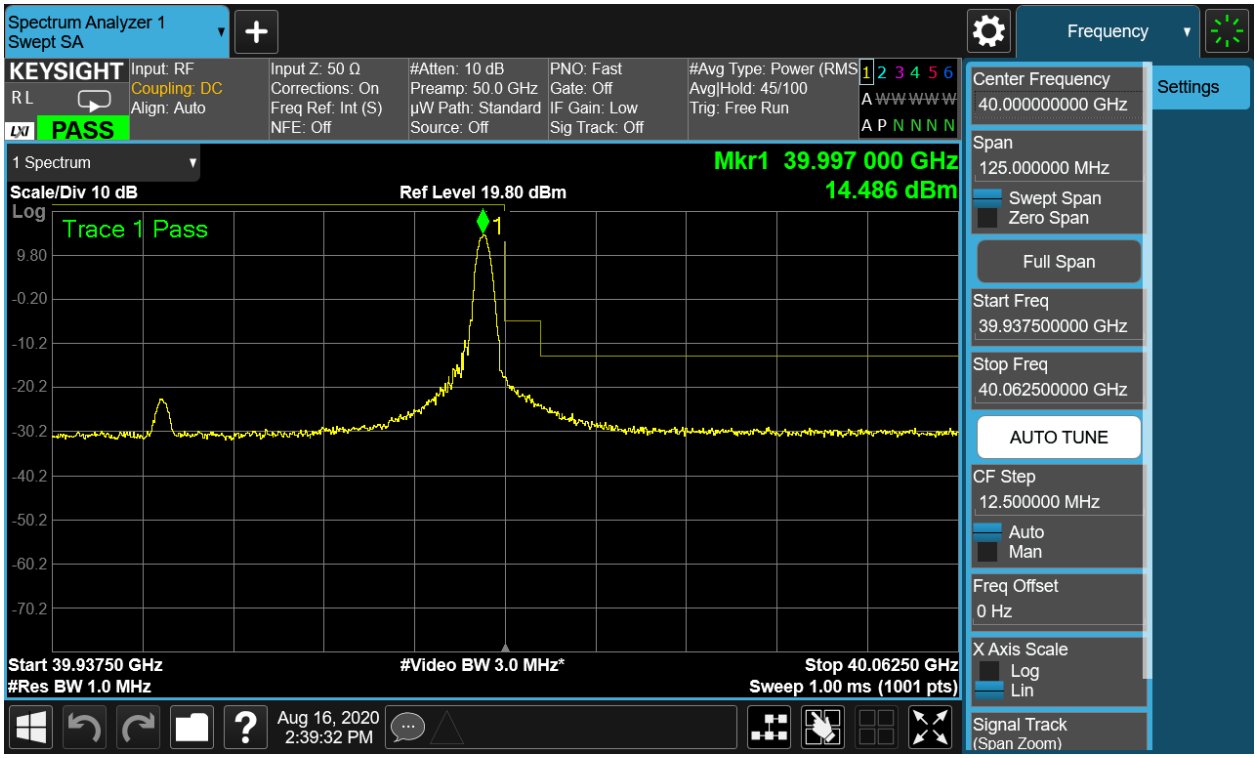
Plot 7-86. Ant 1 Upper Band Edge (100MHz-2CC – QPSK 1 RB)



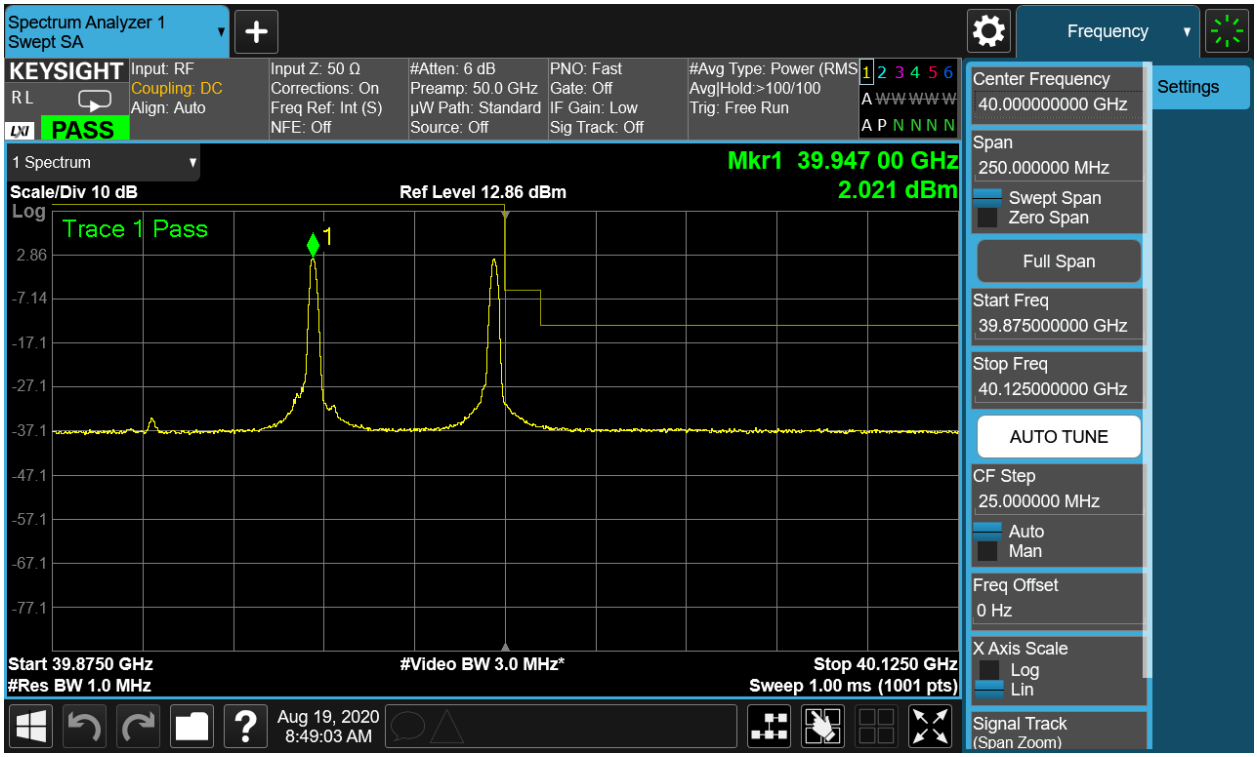
Plot 7-87. Ant 2 Lower Band Edge (50MHz-1CC – QPSK 1 RB)



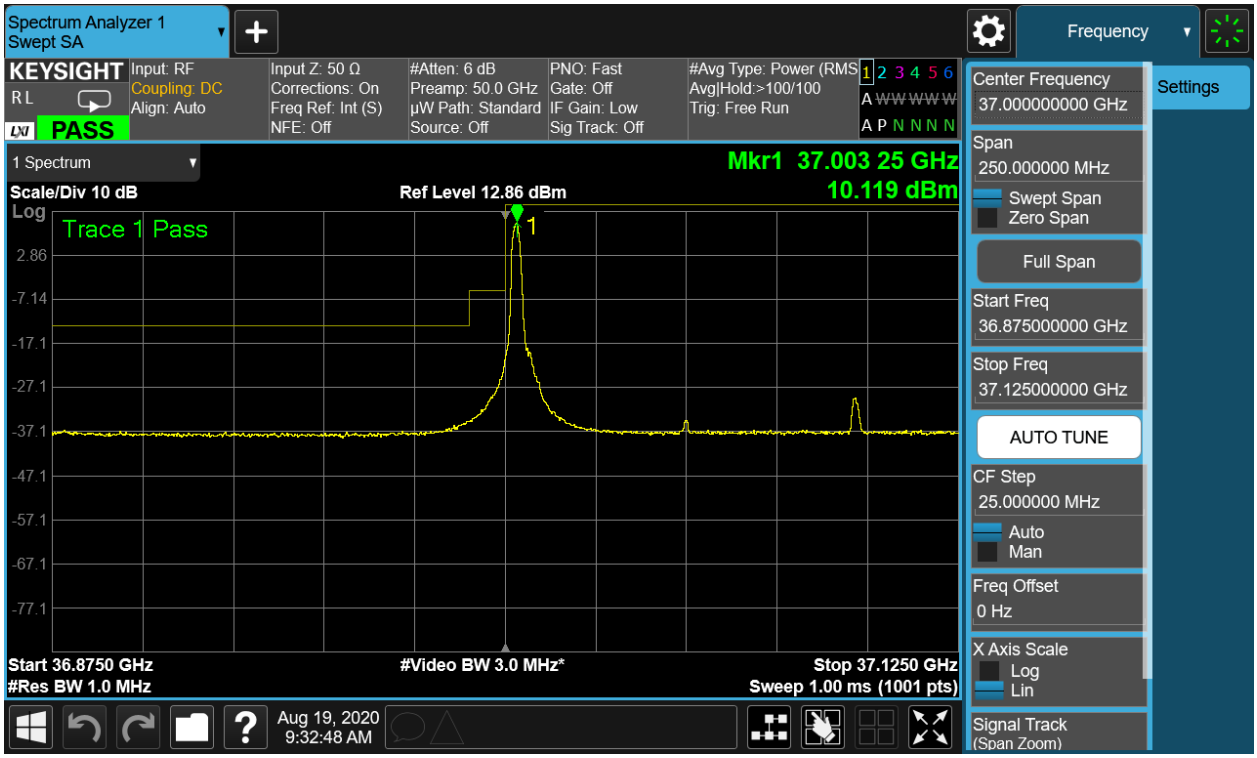
Plot 7-88. Ant 2 Lower Band Edge (50MHz-2CC – QPSK 1 RB)



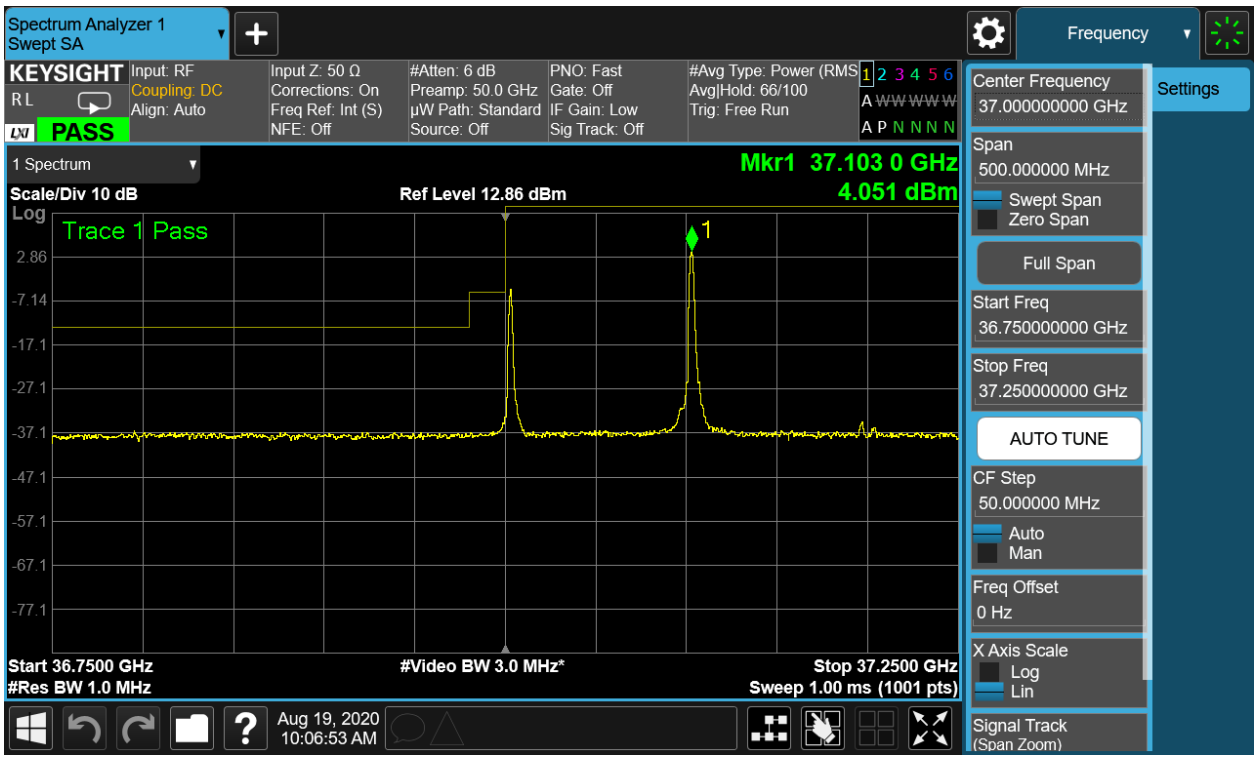
Plot 7-89. Ant 2 Upper Band Edge (50MHz-1CC – QPSK 1 RB)



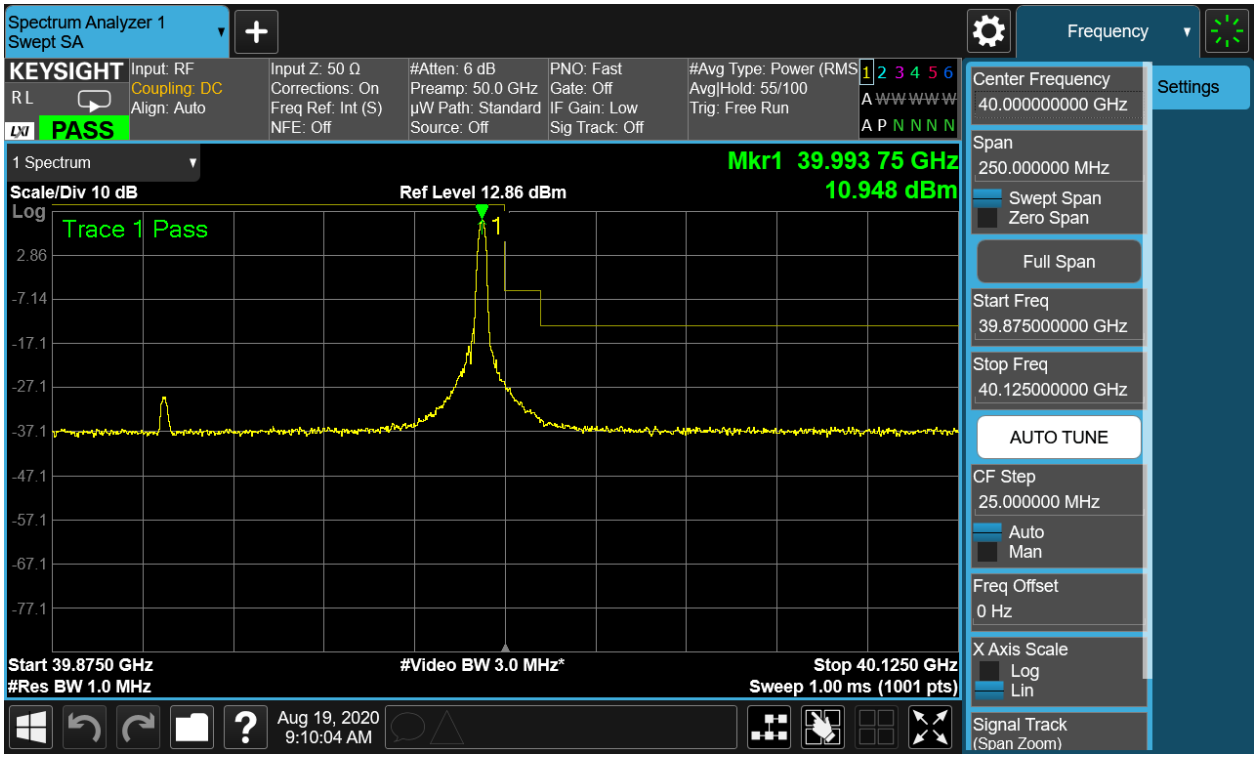
Plot 7-90. Ant 2 Upper Band Edge (50MHz-2CC – QPSK 1 RB)



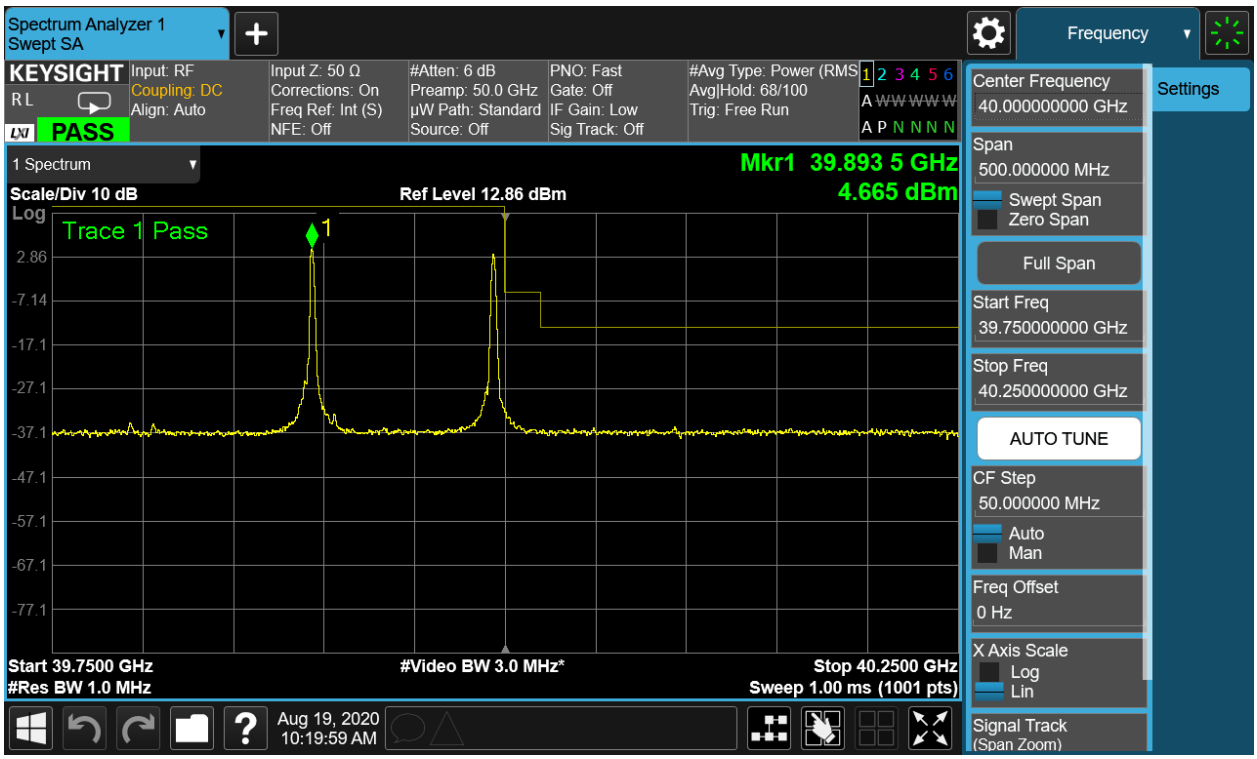
Plot 7-91. Ant 2 Lower Band Edge (100MHz-1CC – QPSK 1 RB)



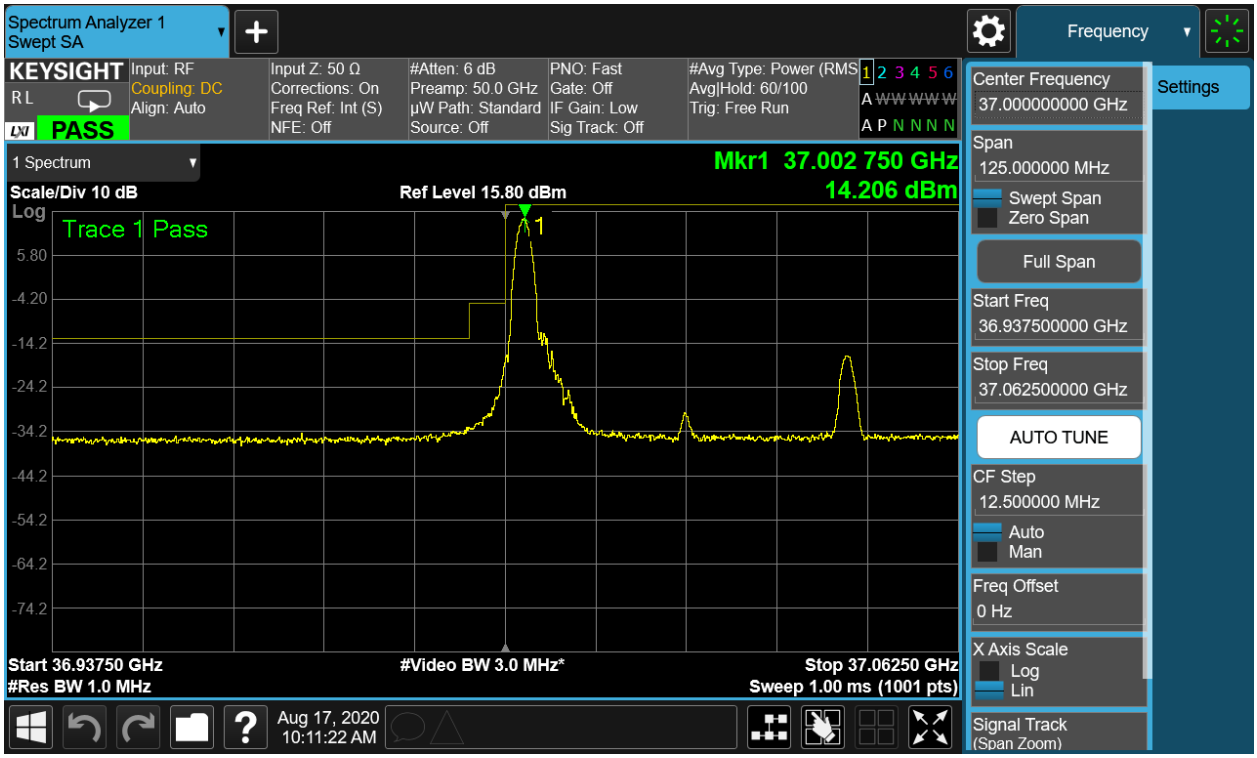
Plot 7-92. Ant 2 Lower Band Edge (100MHz-2CC – QPSK 1 RB)



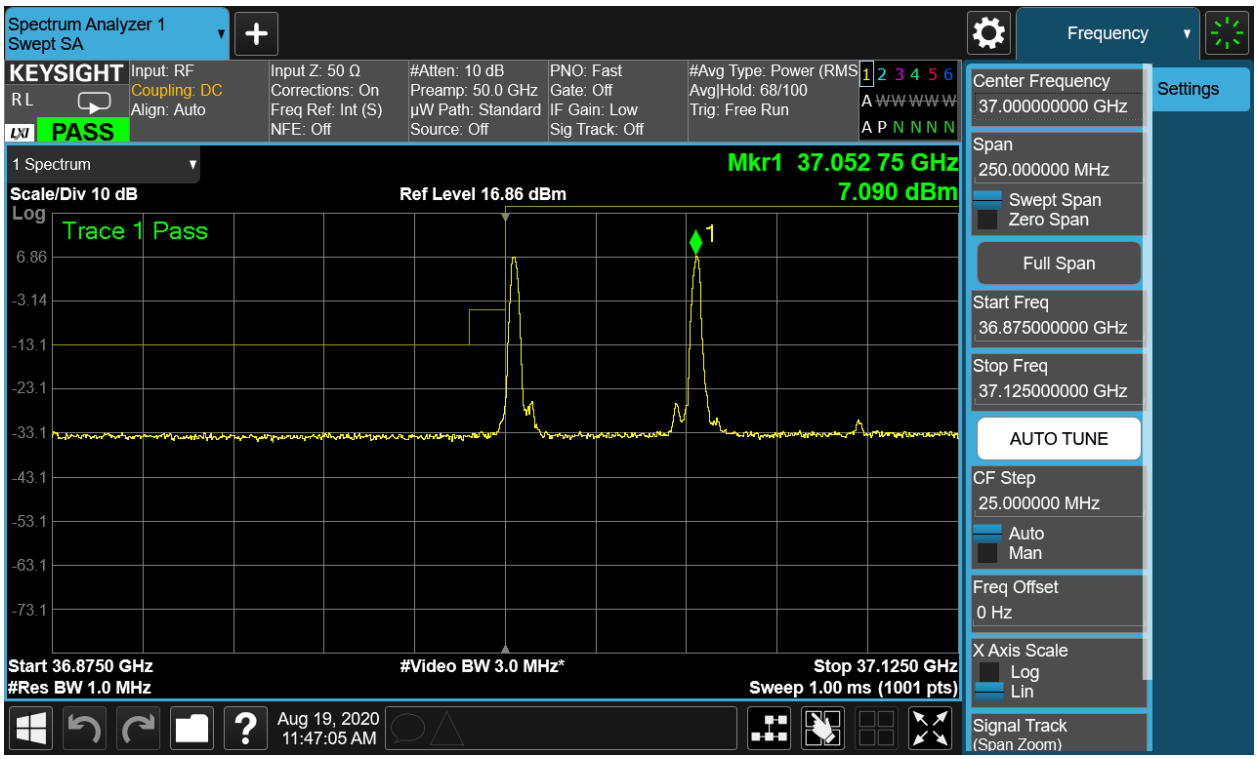
Plot 7-93. Ant 2 Upper Band Edge (100MHz-1CC – QPSK 1 RB)



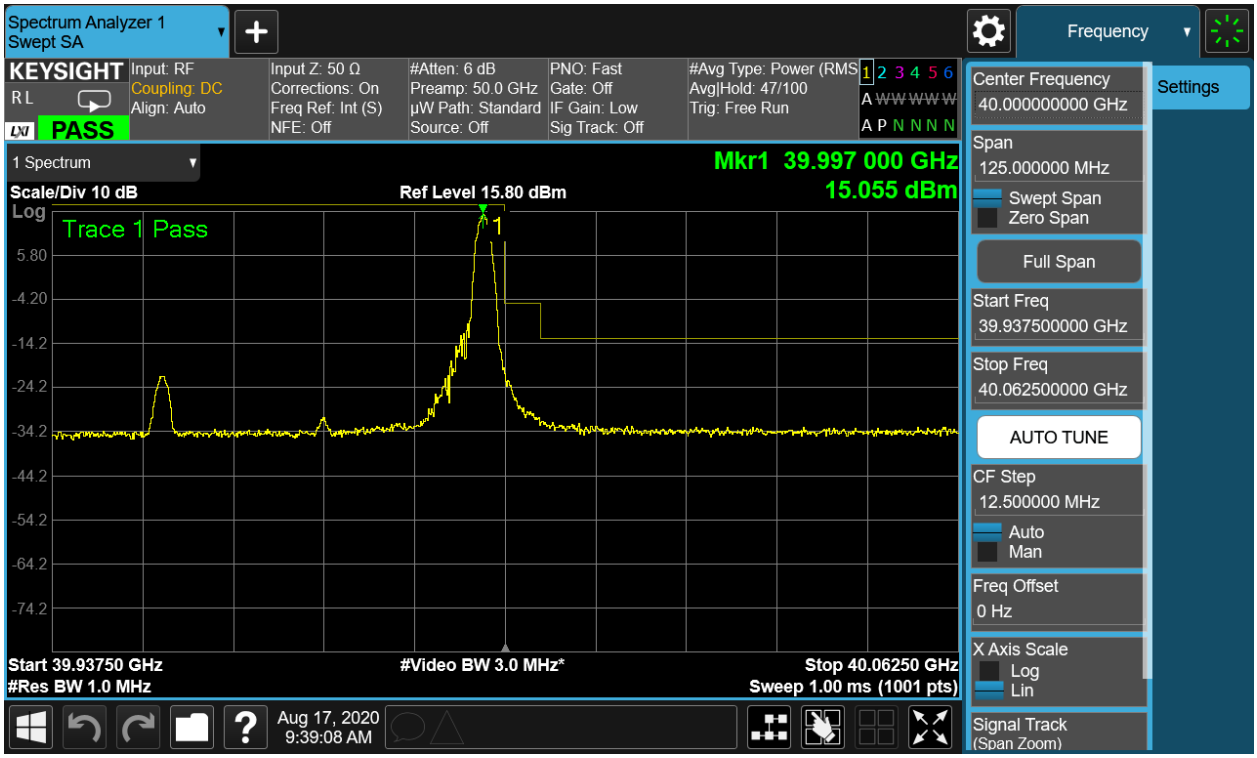
Plot 7-94. Ant 2 Upper Band Edge (100MHz-2CC – QPSK 1 RB)



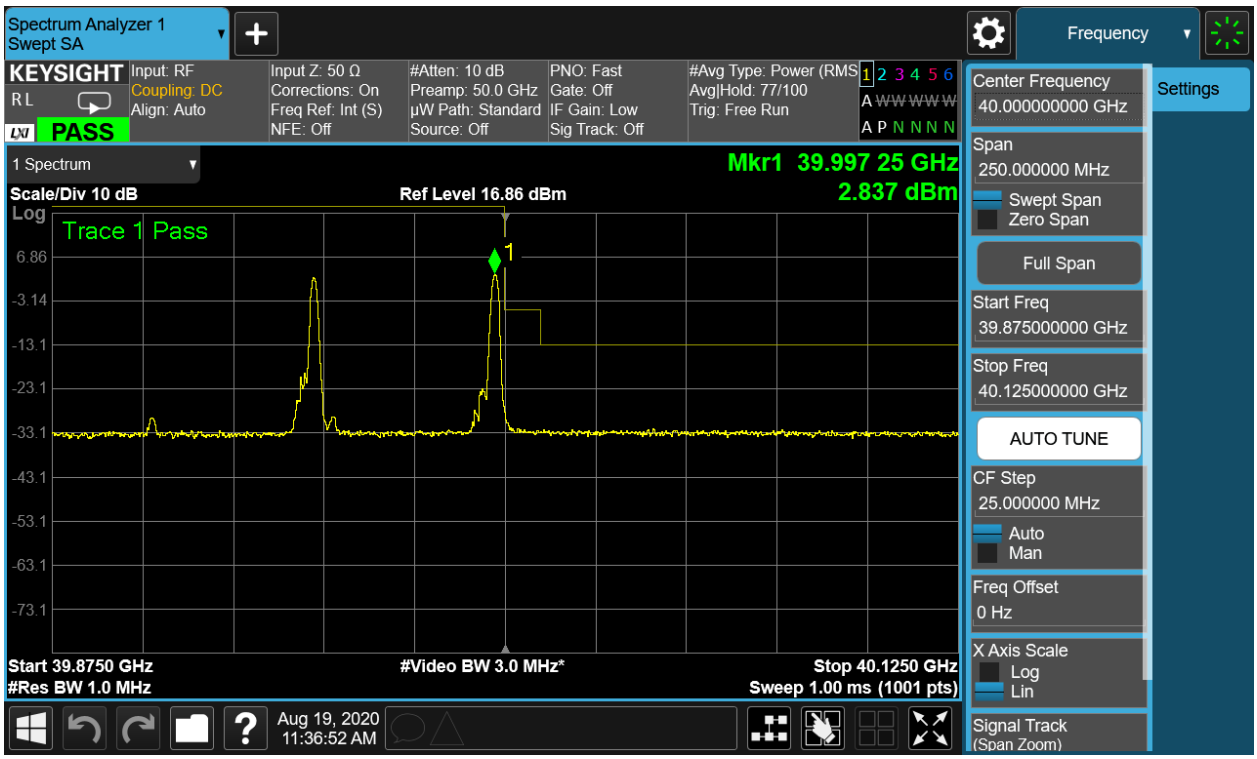
Plot 7-71. Ant 3 Lower Band Edge (50MHz-1CC – QPSK 1 RB)



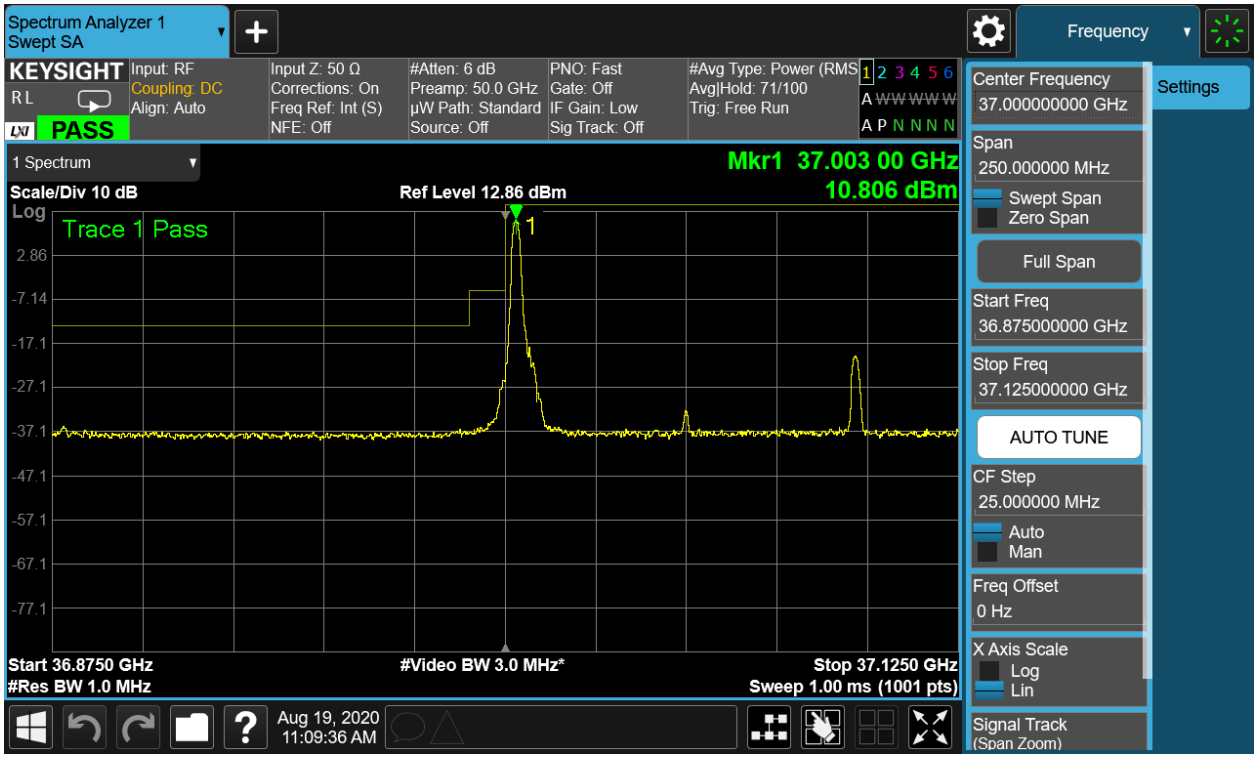
Plot 7-72. Ant 3 Lower Band Edge (50MHz-2CC – QPSK 1 RB)



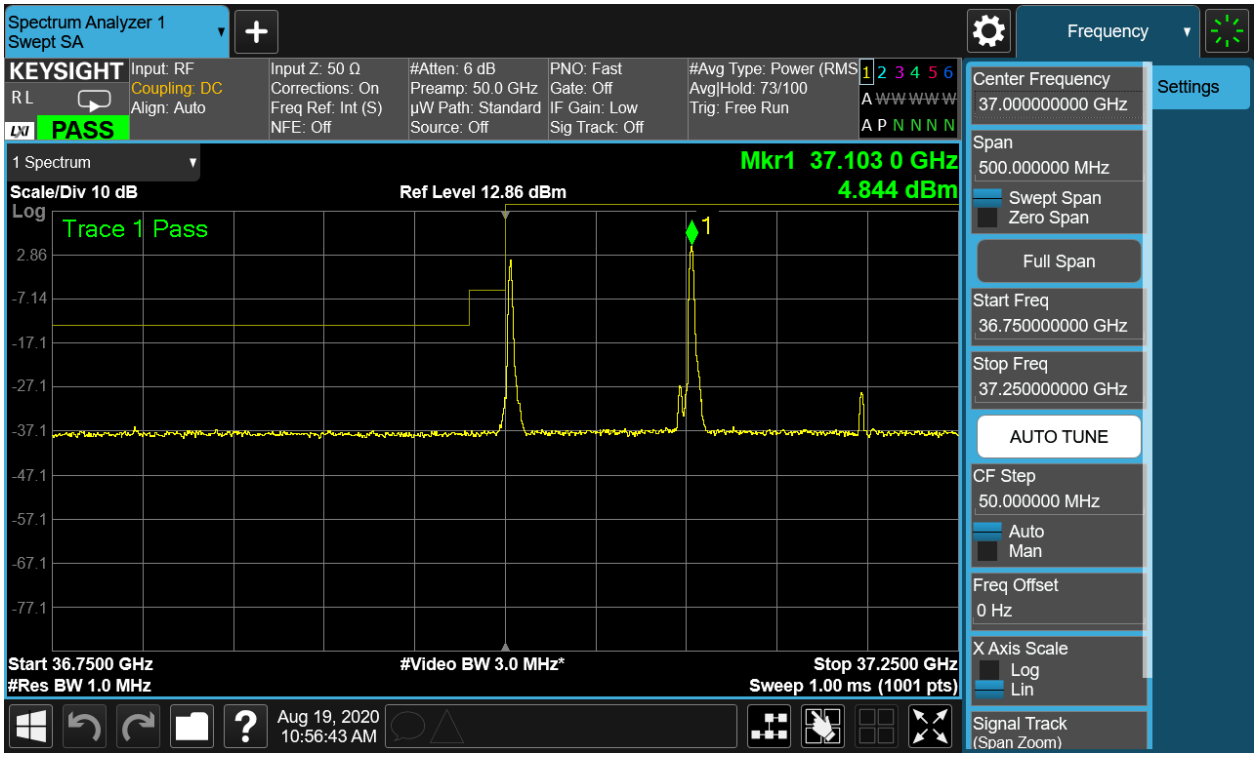
Plot 7-73. Ant 3 Upper Band Edge (50MHz-1CC – QPSK 1 RB)



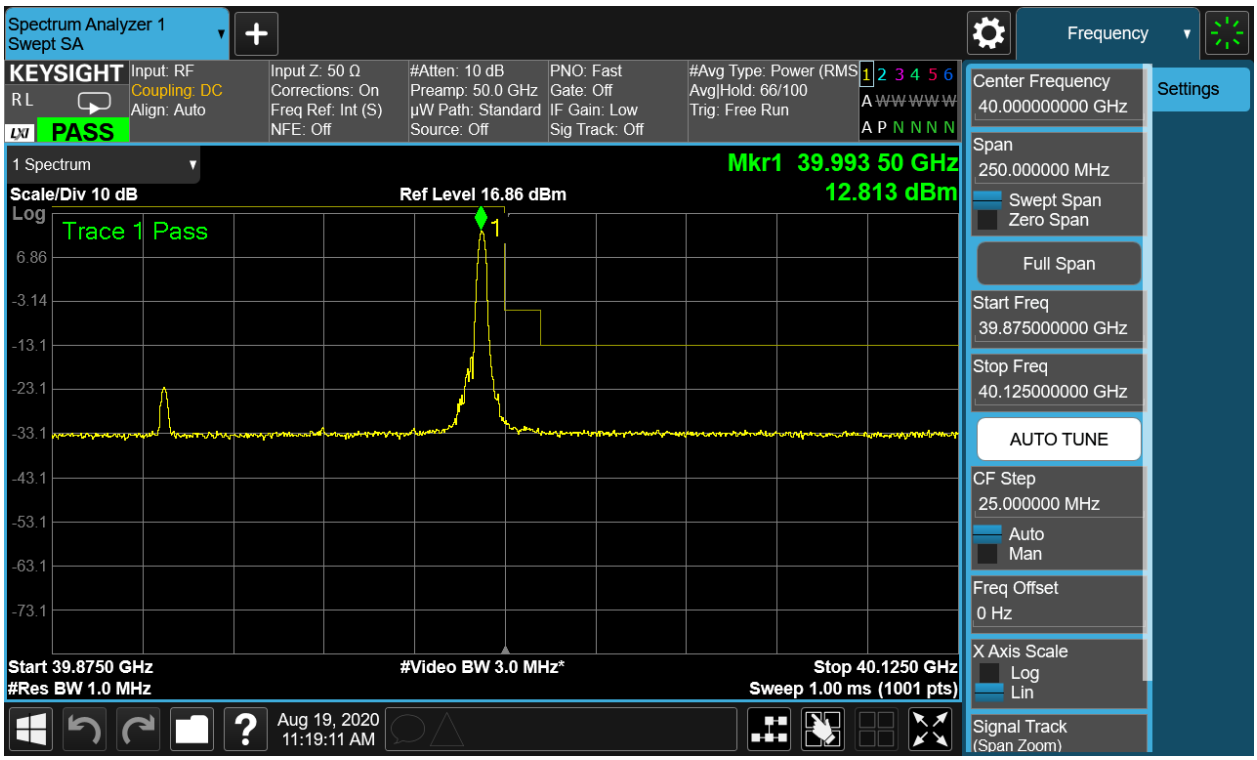
Plot 7-74. Ant 3 Upper Band Edge (50MHz-2CC – QPSK 1 RB)



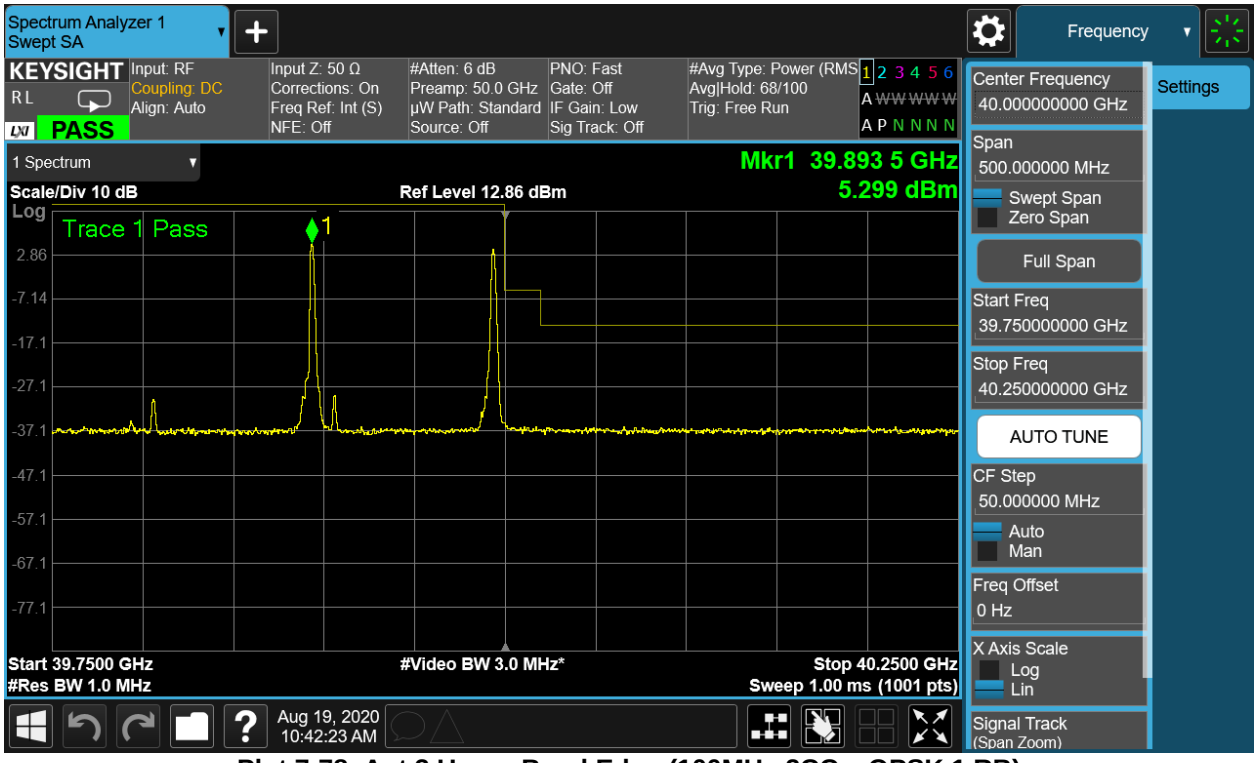
Plot 7-75. Ant 3 Lower Band Edge (100MHz-1CC – QPSK 1 RB)



Plot 7-76. Ant 3 Lower Band Edge (100MHz-2CC – QPSK 1 RB)



Plot 7-77. Ant 3 Upper Band Edge (100MHz-1CC – QPSK 1 RB)



Plot 7-78. Ant 3 Upper Band Edge (100MHz-2CC – QPSK 1 RB)

7.6 Frequency Stability / Temperature Variation

§2.1055

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015. 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.

Test Procedure Used

ANSI C63.5-2015 Section 5.6
KDB 842590 D01 v01r01 Section 4.5

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 measured using horn antenna connected to a spectrum analyzer. The EUT was placed inside an environmental chamber. Using a foam plug, the horn antenna measured the frequency of the fundamental signal.

Test Notes

The Frequency Deviation column in the table below is the amount of deviation measured from the center frequency of the Reference measurement (first row).

Frequency Stability Measurements (Band n261)

§2.1055

OPERATING FREQUENCY:	27,922,080,000	Hz
CHANNEL:	2254091	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	27,922,080,230	0	0.0000000
100 %		- 30	27,922,080,349	-119	-0.0000004
100 %		- 20	27,922,079,821	409	0.0000015
100 %		- 10	27,922,079,939	291	0.0000010
100 %		0	27,922,080,133	97	0.0000003
100 %		+ 10	27,922,080,075	155	0.0000006
100 %		+ 20	27,922,080,070	160	0.0000006
100 %		+ 30	27,922,080,452	-222	-0.0000008
100 %		+ 40	27,922,080,278	-48	-0.0000002
100 %		+ 50	27,922,080,461	-231	-0.0000008
BATT. ENDPOINT	2.90	+ 20	27,922,080,133	97	0.0000003

Table 7-55. Frequency Stability Data (n261)

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.

Frequency Stability Measurements (Band n261)

§2.1055

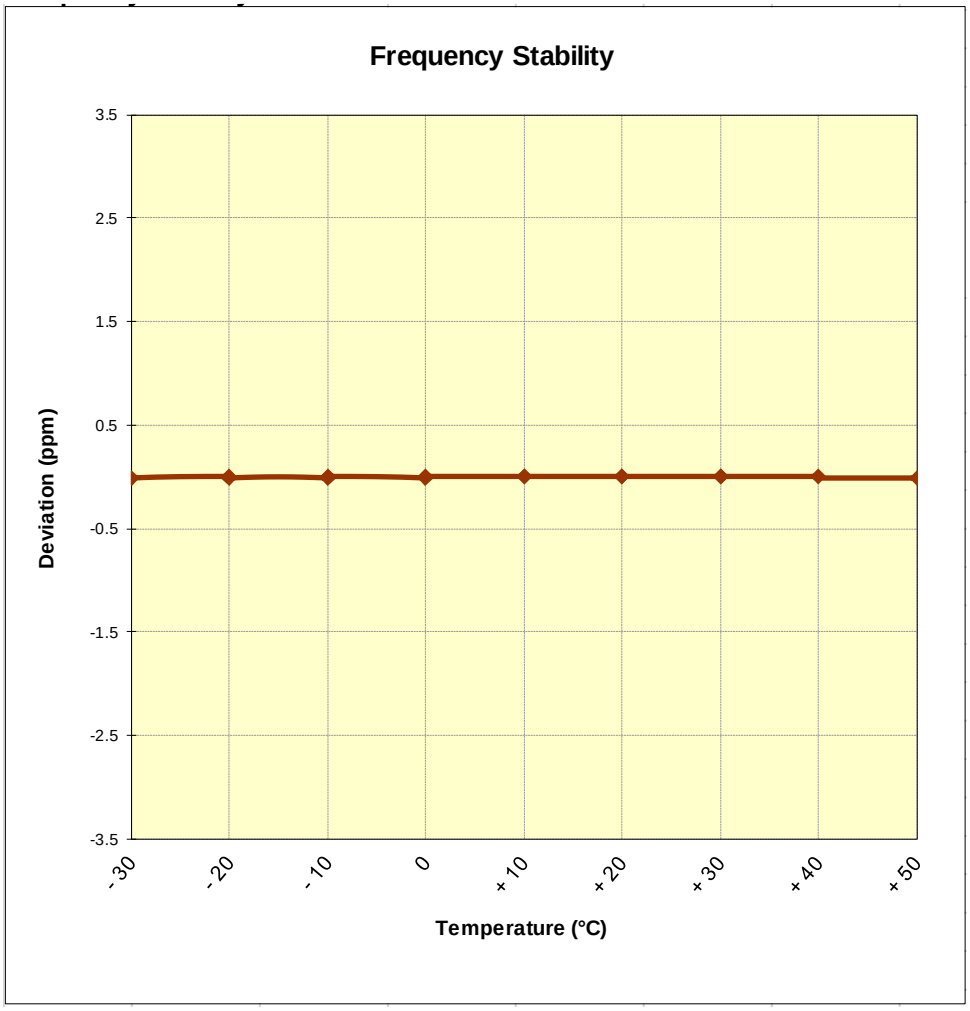


Figure 7-1. Frequency Stability Graph (n261)

Frequency Stability Measurements (Band n260)

§2.1055

OPERATING FREQUENCY:	38,495,520,000	Hz
CHANNEL:	2254091	
REFERENCE VOLTAGE:	3.85	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	38,495,519,840	0	0.0000000
100 %		- 30	38,495,519,690	150	0.0000004
100 %		- 20	38,495,519,603	237	0.0000006
100 %		- 10	38,495,520,240	-400	-0.0000010
100 %		0	38,495,519,848	-8	0.0000000
100 %		+ 10	38,495,519,779	61	0.0000002
100 %		+ 20	38,495,520,400	-560	-0.0000015
100 %		+ 30	38,495,519,651	189	0.0000005
100 %		+ 40	38,495,520,079	-239	-0.0000006
100 %		+ 50	38,495,520,332	-492	-0.0000013
BATT. ENDPOINT	2.90	+ 20	38,495,519,701	139	0.0000004

Table 7-56. Frequency Stability Data (n260)

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.

Frequency Stability Measurements (Band n260)

§2.1055

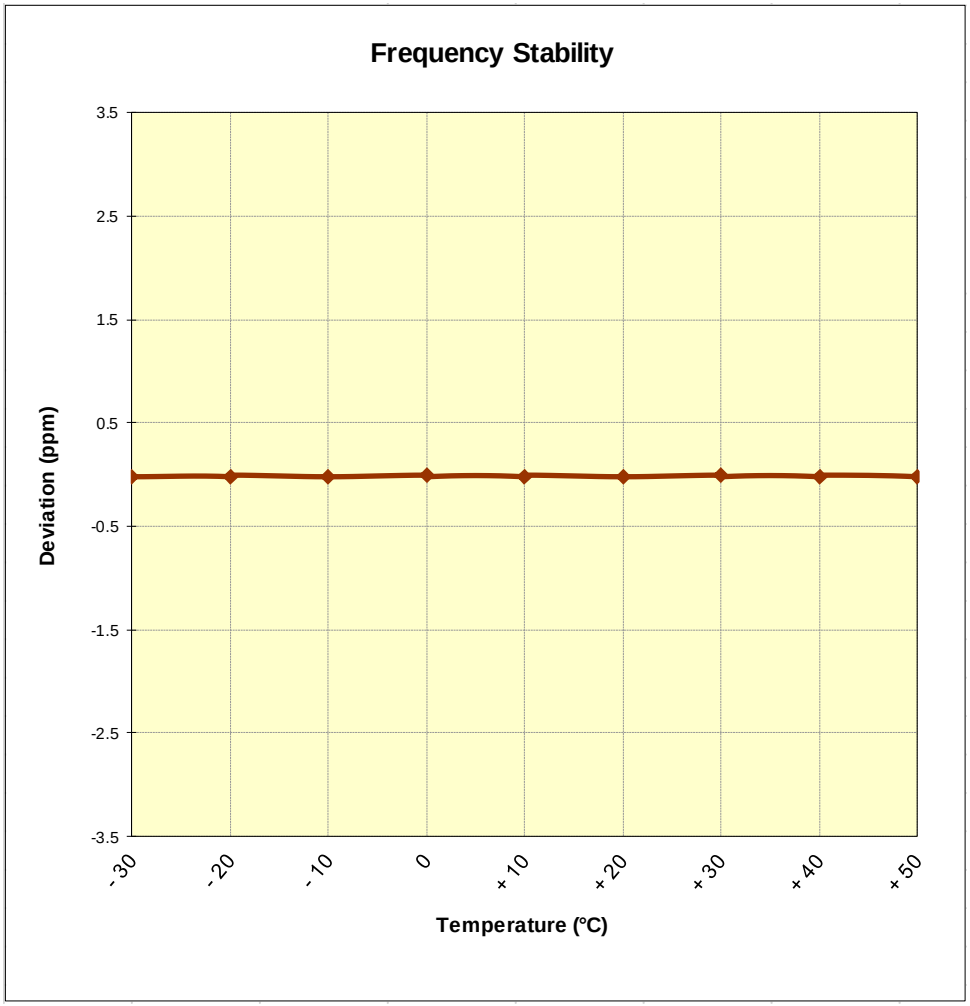


Figure 7-2. Frequency Stability Graph (n260)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFF100VM** complies with all the requirements of Part 30.

9.0 APPENDIX A

9.1 VDI Mixer Verification Certificate

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
7185 Oakland Mills Road
Columbia, MD 21046
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No: 193065 **Today's Date:** 10/02/19

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	VDIWR19.0SAX WR19SAX / SN: SAX 411	19329-01

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

Page 1 of 1

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
6660-B Dobbin Road
Columbia, MD 21045
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Shipping Date: 05/14/18 **Today's Date:** 05/14/18

Quantity Shipped	Unit	Description
1	EA	VDIWR12.0SAX WR12SAX - Spectrum Analyzer Extension Module / SN: SAX 252

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
6660-B Dobbin Road
Columbia, MD 21045
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Shipping Date: 05/08/18 **Today's Date:** 05/08/18

Quantity Shipped	Unit	Description
1	EA	VDIWR8.0SAX WR8.0SAX - Spectrum Analyzer Extension Module; SN: SAX 253.

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
6660-B Dobbin Road
Columbia, MD 21045
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Shipping Date: 05/21/18 **Today's Date:** 05/22/18

Quantity Shipped	Unit	Description
1	EA	VDIWR5.1SAX WR5.1SAX - Spectrum Analyzer Extension Module; SN: SAX 254.

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

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