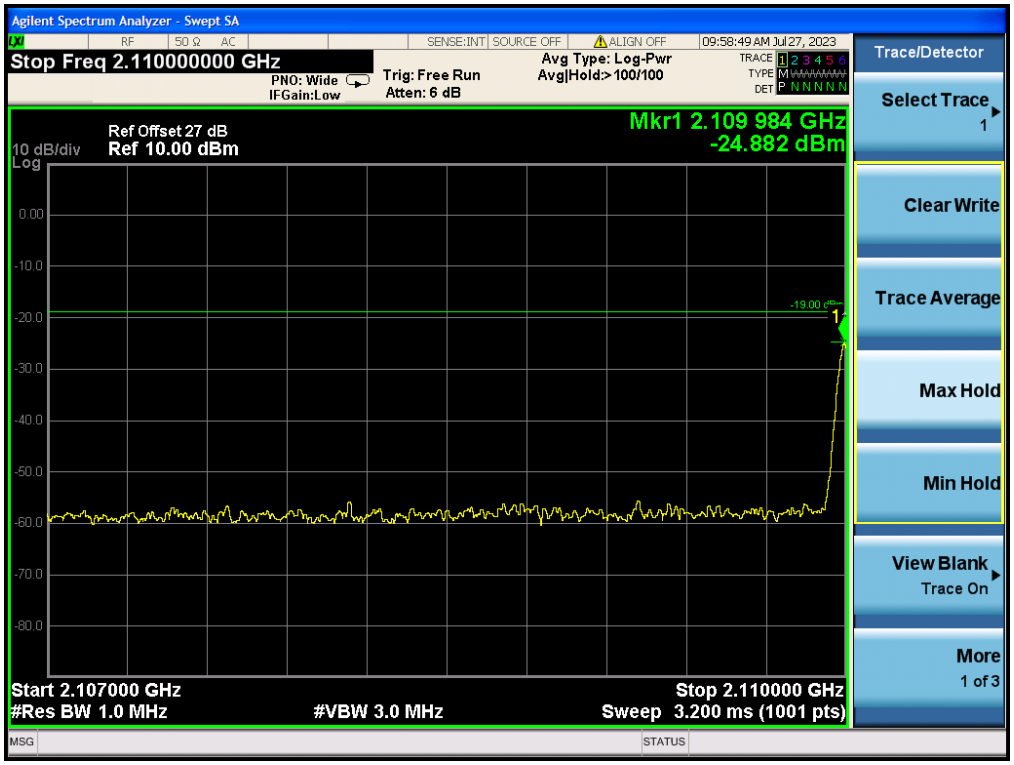
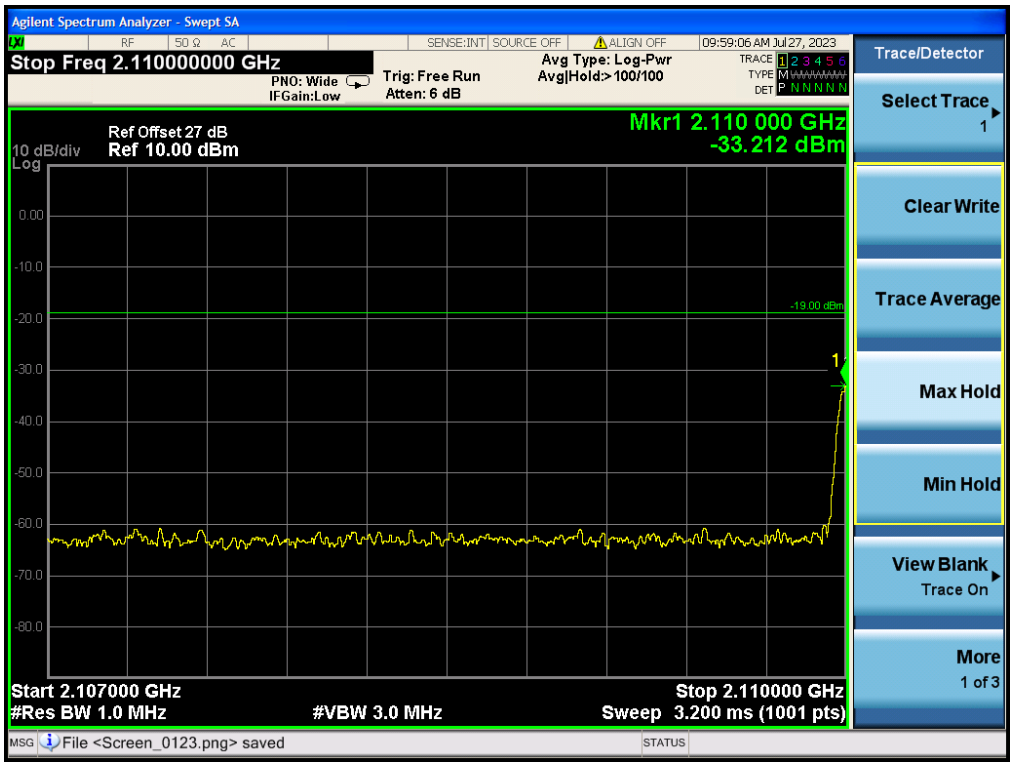
AWS-1 DL Left Side Pre AGC



AWS-1 DL Left Side Max Input



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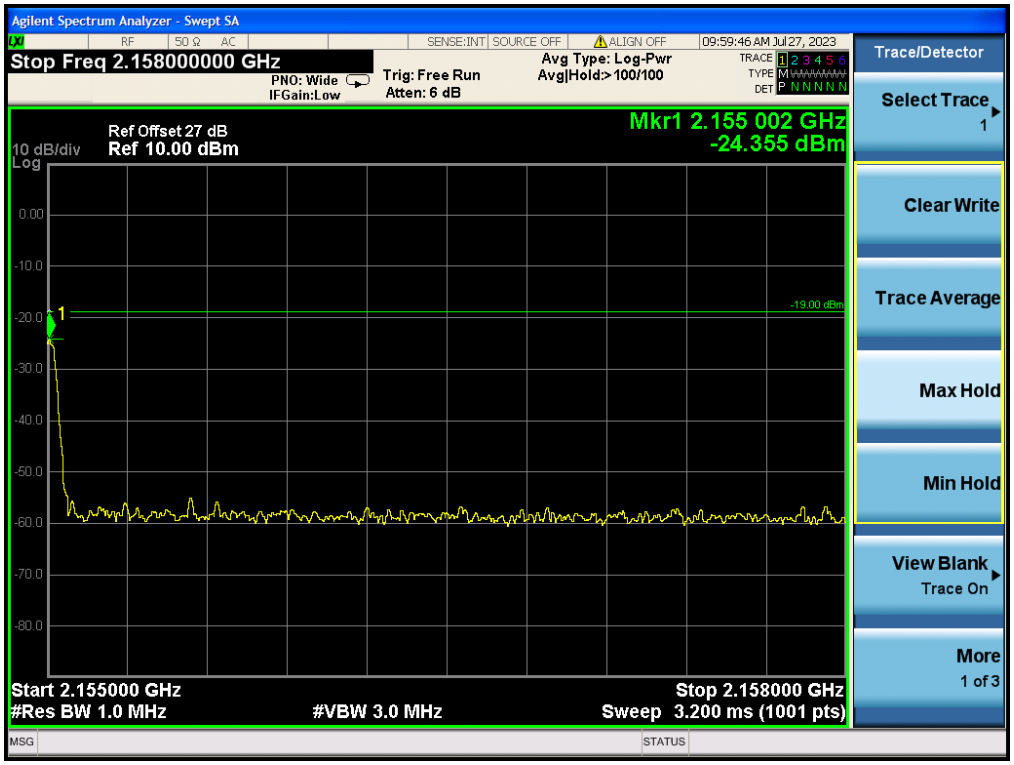
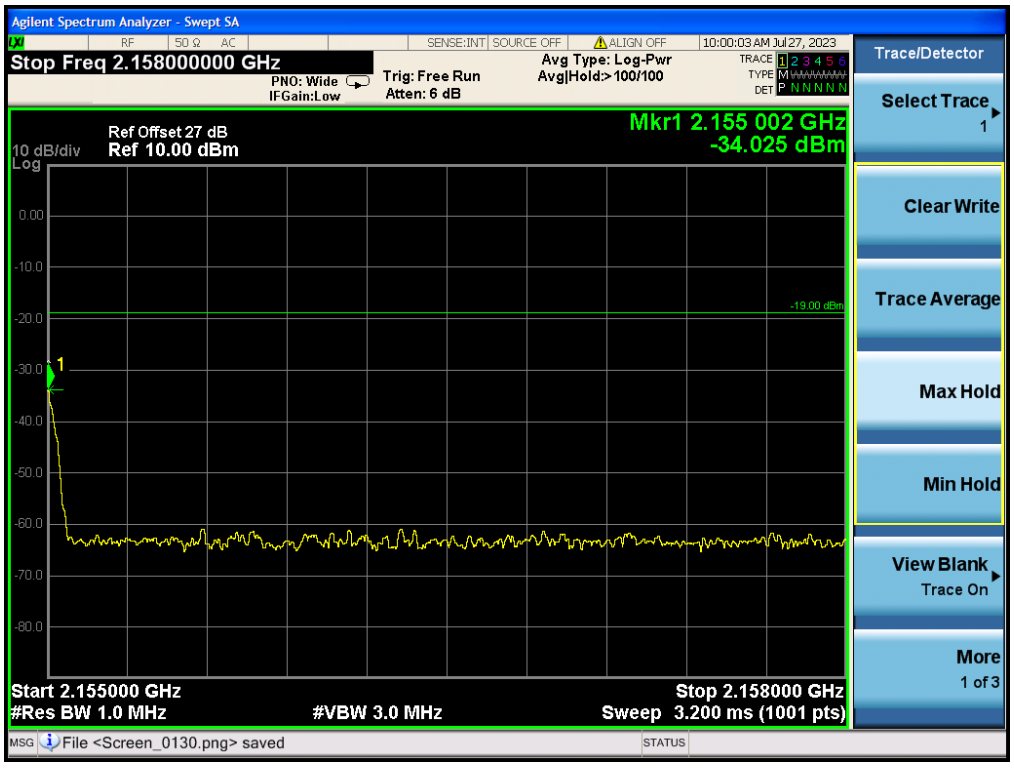
AWS-1 DL Right Side Pre AGC



AWS-1 DL Right Side Max Input



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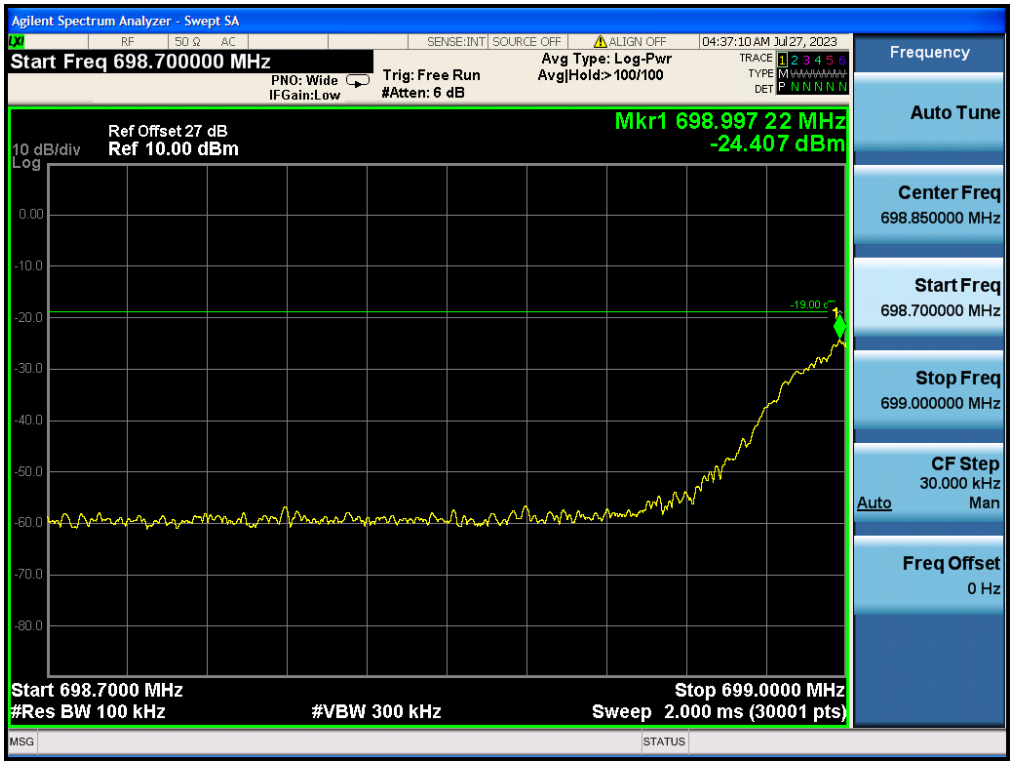
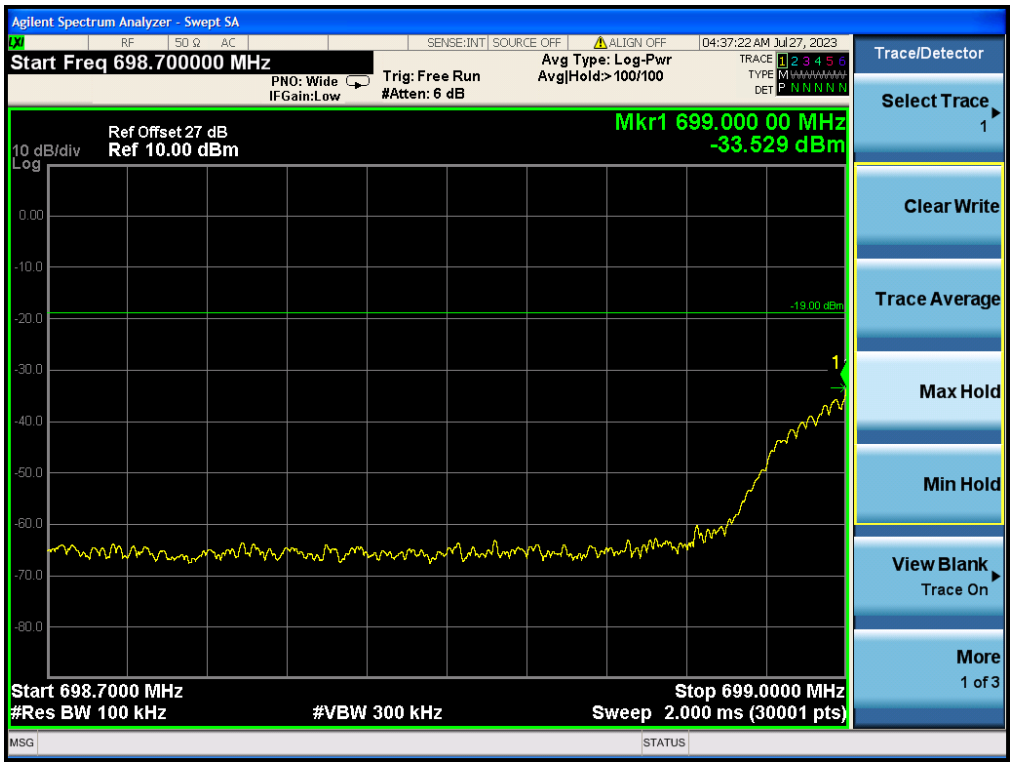
Low A-E Blocks LTE UL Left Side Pre AGC



Low A-E Blocks LTE UL Left Side Max Input



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Low A-E Blocks LTE UL Right Side Pre AGC

Low A-E Blocks LTE UL Right Side Max Input

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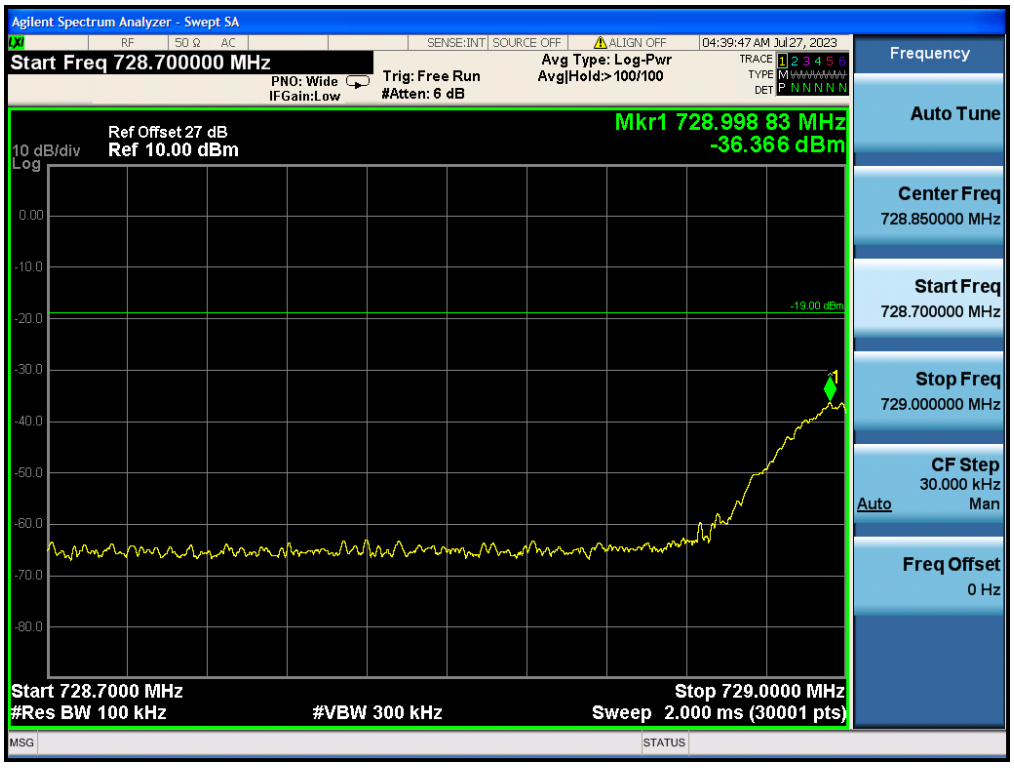
Low A-E Blocks LTE DL Left Side Pre AGC

Low A-E Blocks LTE DL Left Side Max Input



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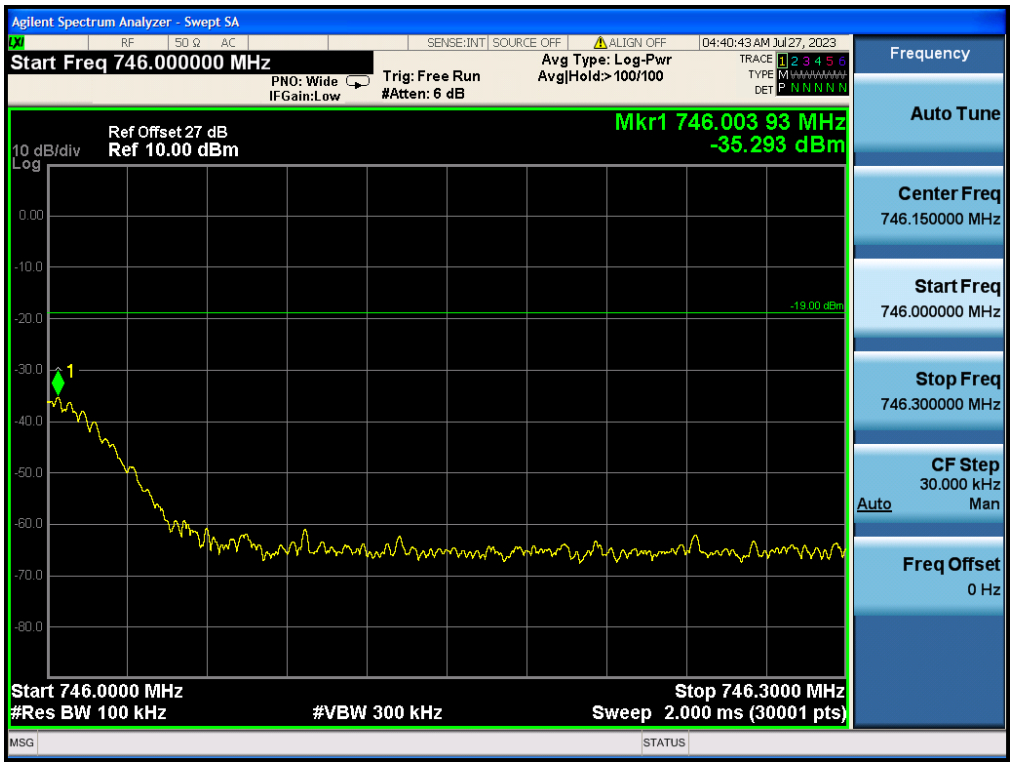
Low A-E Blocks LTE DL Right Side Pre AGC

Low A-E Blocks LTE DL Right Side Max Input



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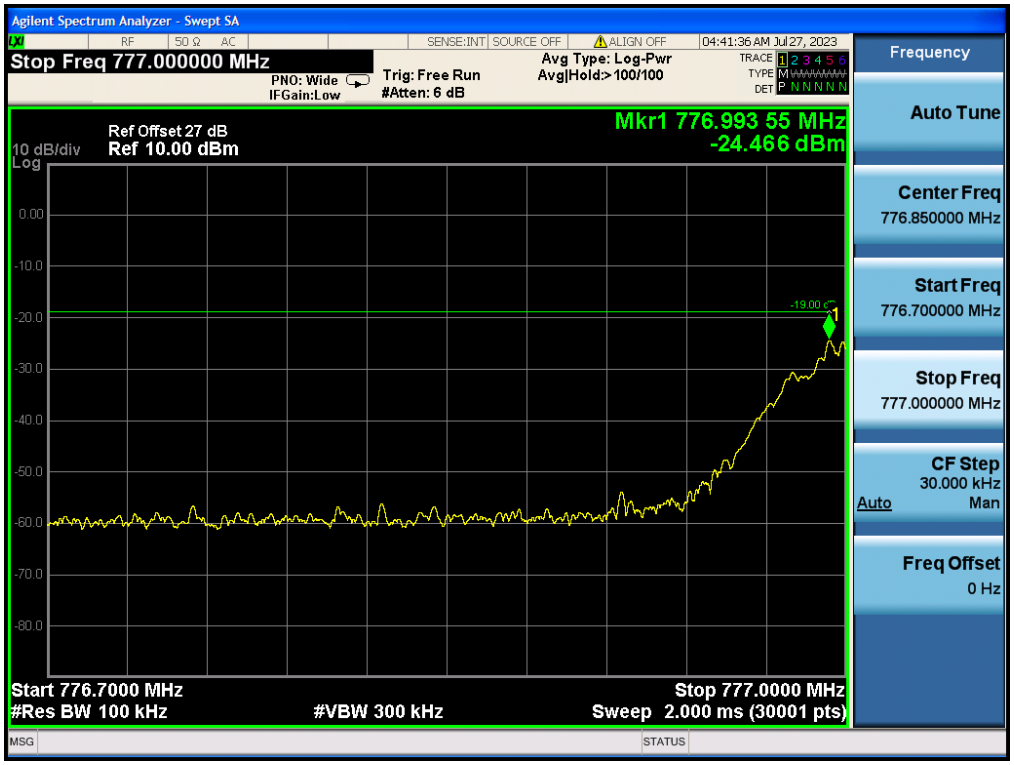
700 MHz Upper C Block UL Left Side Pre AGC



700 MHz Upper C Block UL Left Side Max Input

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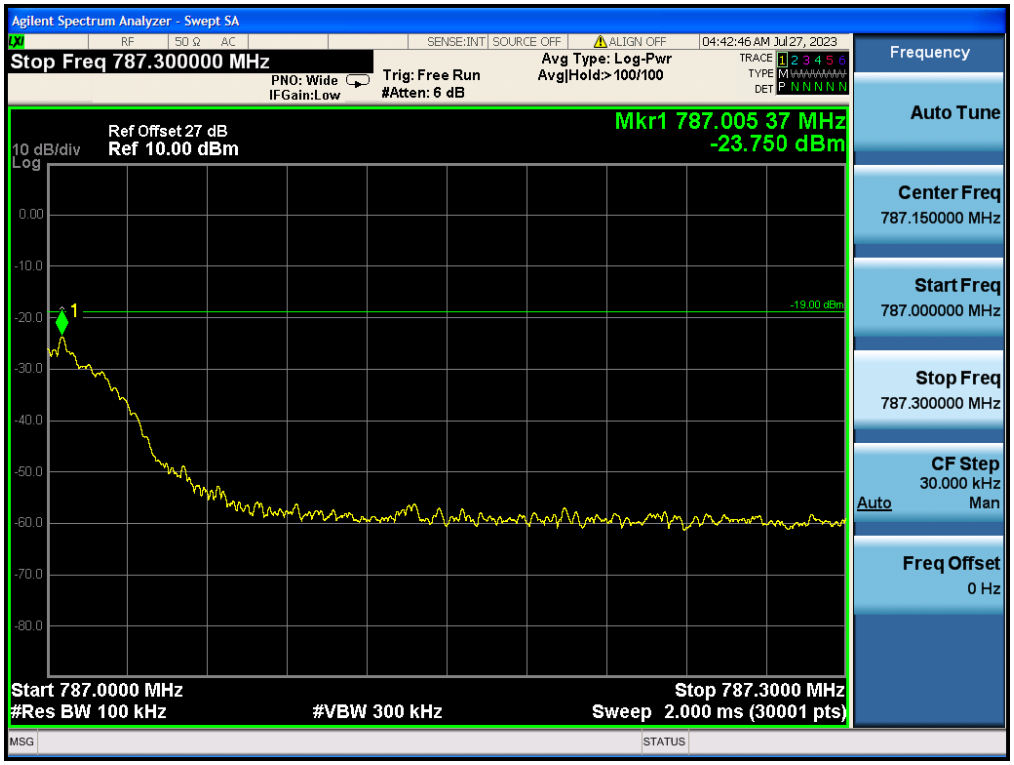
700 MHz Upper C Block UL Right Side Pre AGC



700 MHz Upper C Block UL Right Side Max Input

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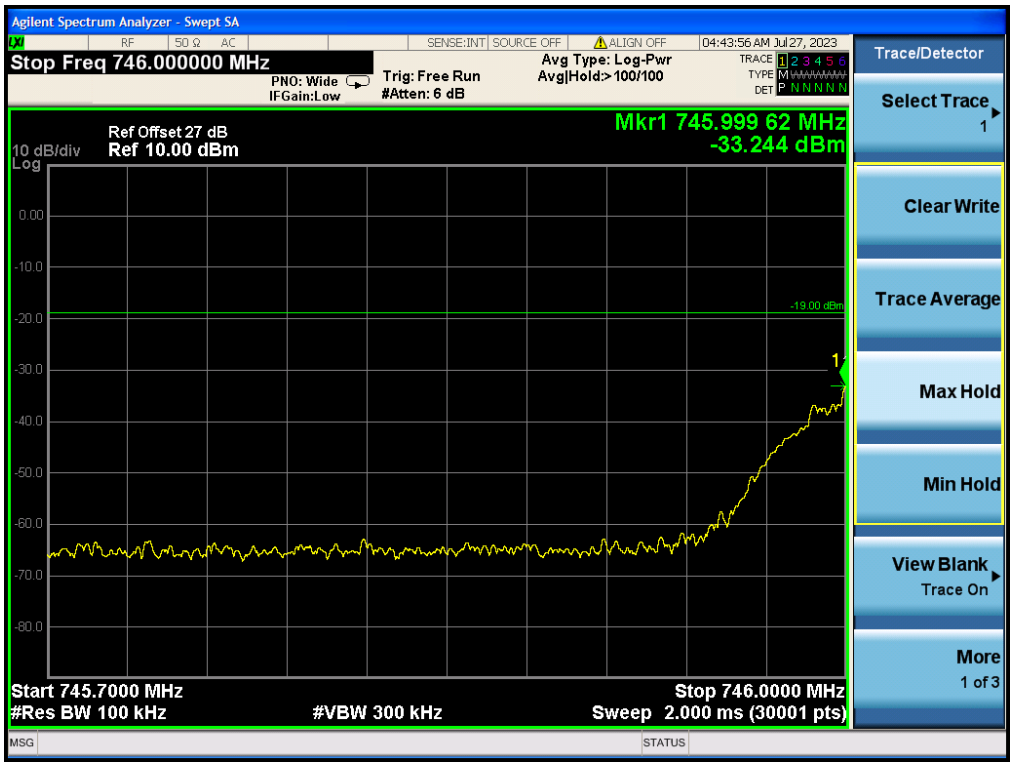
700 MHz Upper C Block DL Left Side Pre AGC

700 MHz Upper C Block DL Left Side Max Input



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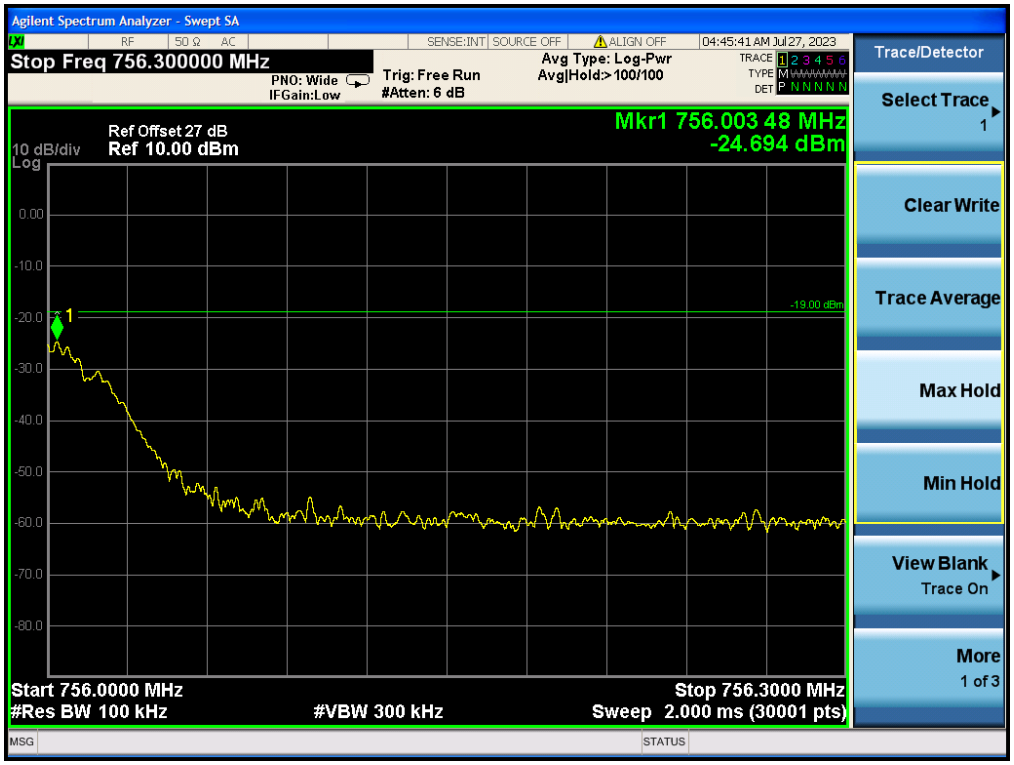
700 MHz Upper C Block DL Right Side Pre AGC



700 MHz Upper C Block DL Right Side Max Input

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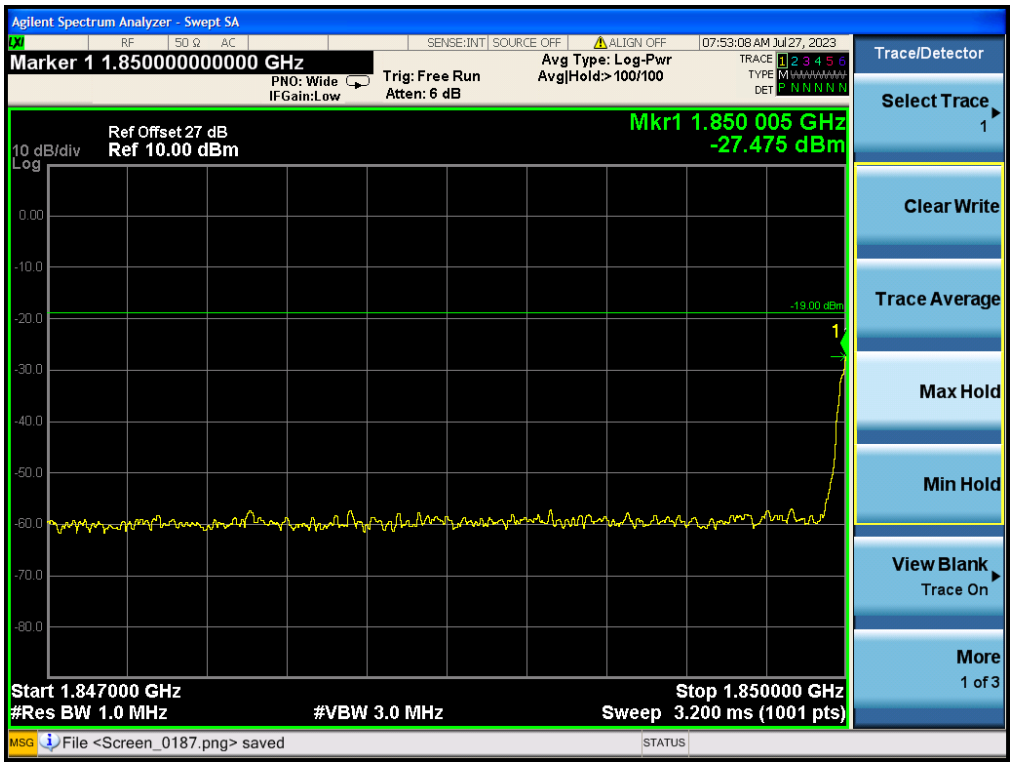
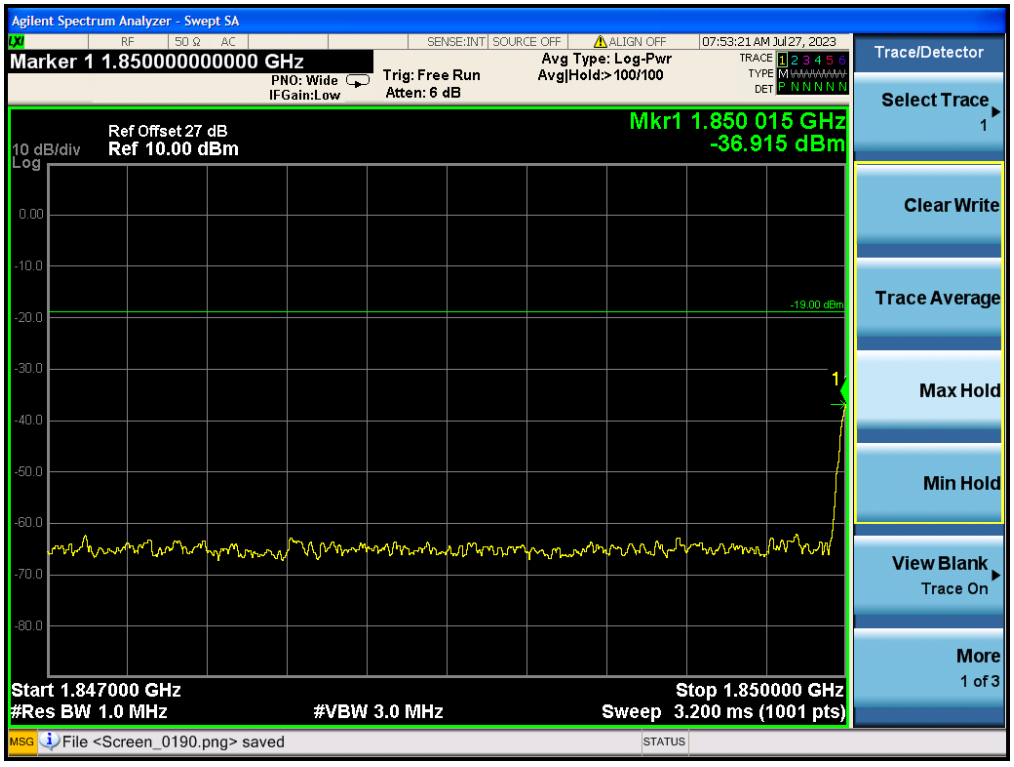
Broadband PCS UL Left Side Pre AGC



Broadband PCS UL Left Side Max Input



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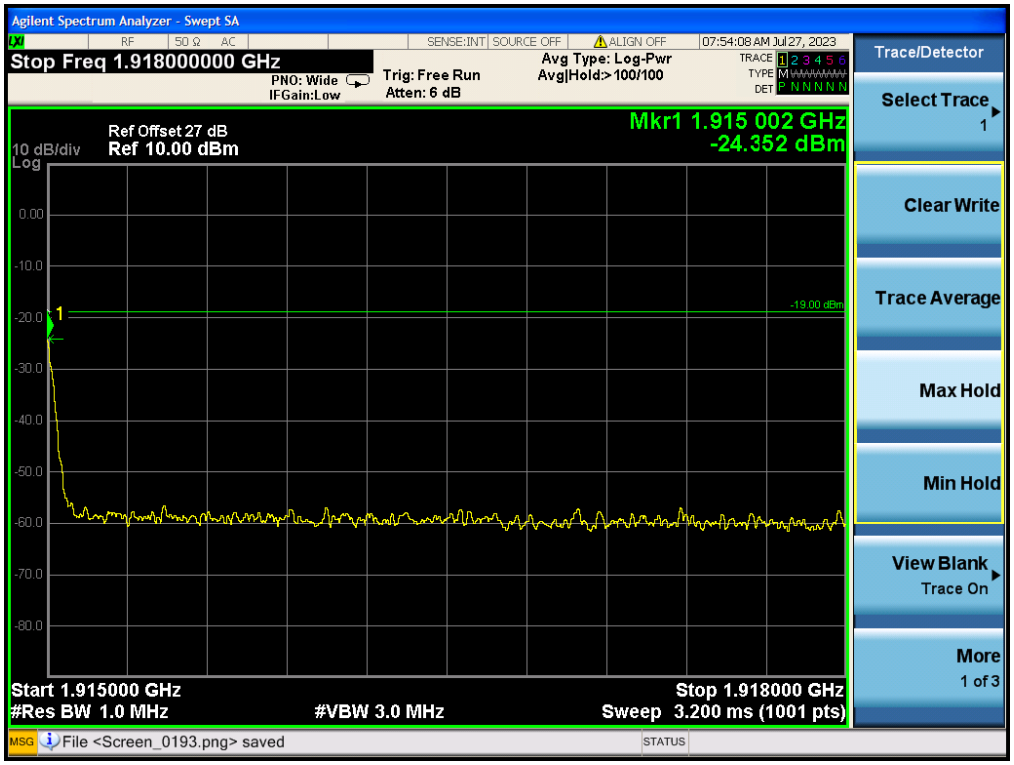
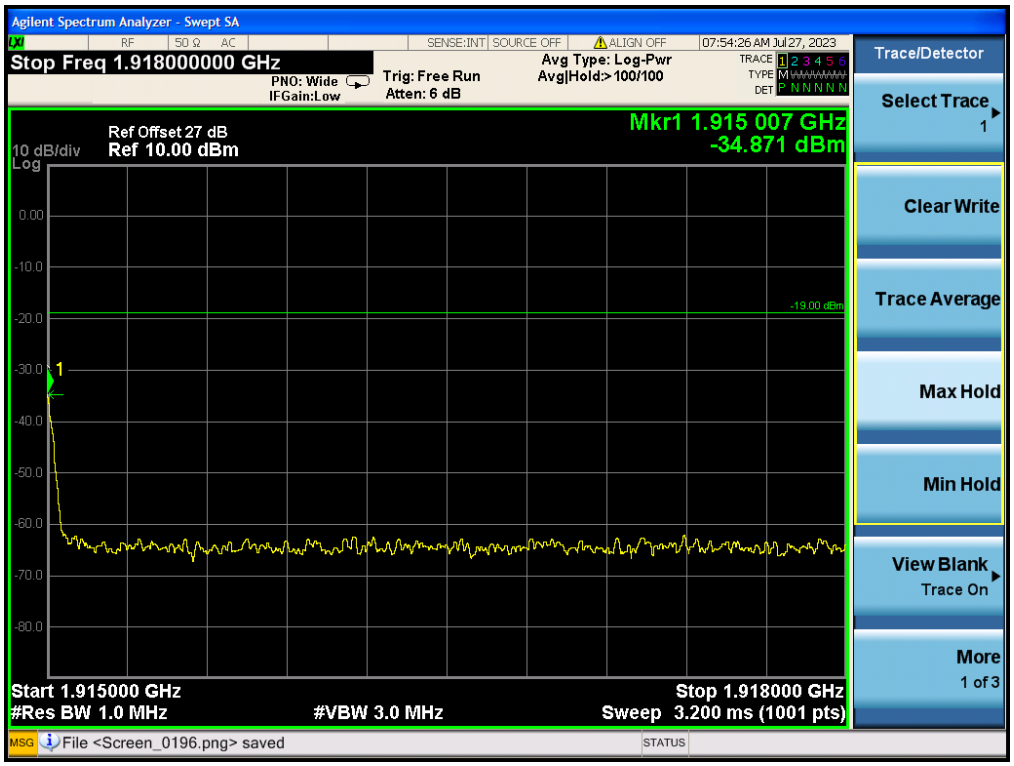
Broadband PCS UL Right Side Pre AGC



Broadband PCS UL Right Side Max Input



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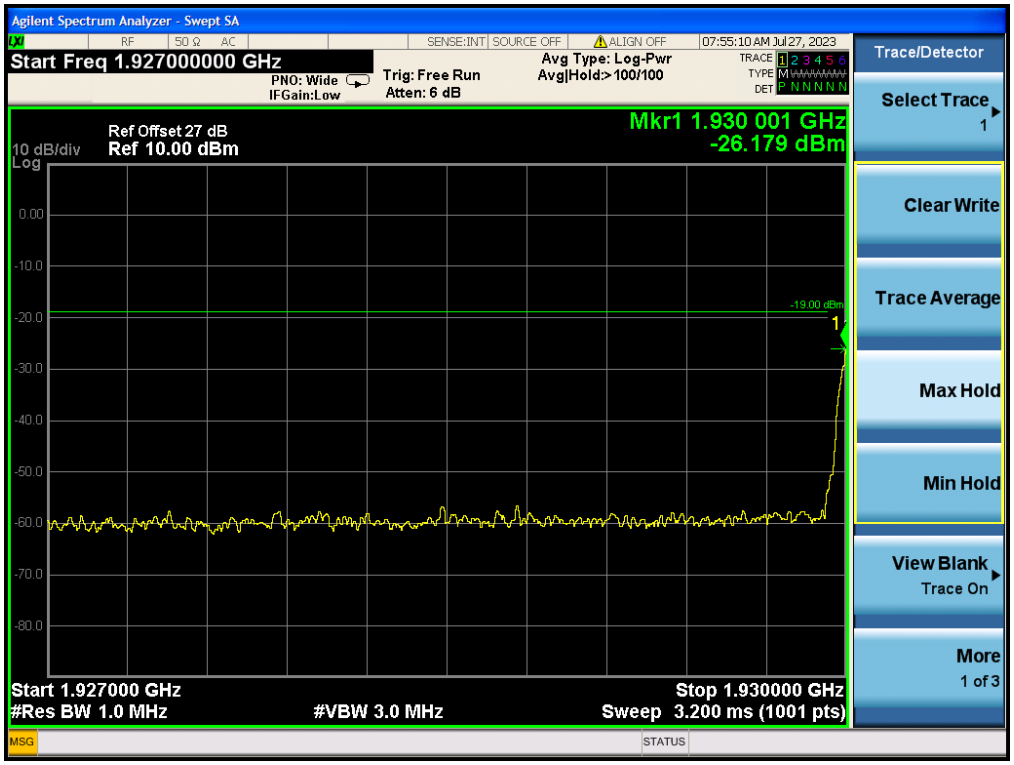
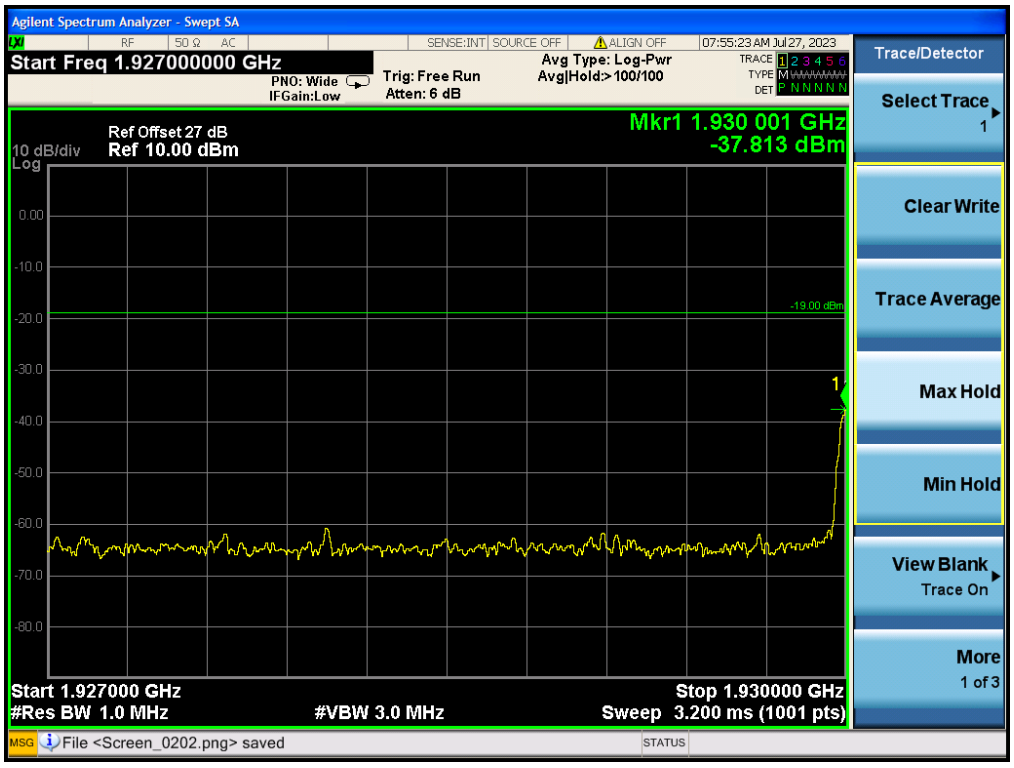
Broadband PCS DL Left Side Pre AGC



Broadband PCS DL Left Side Max Input



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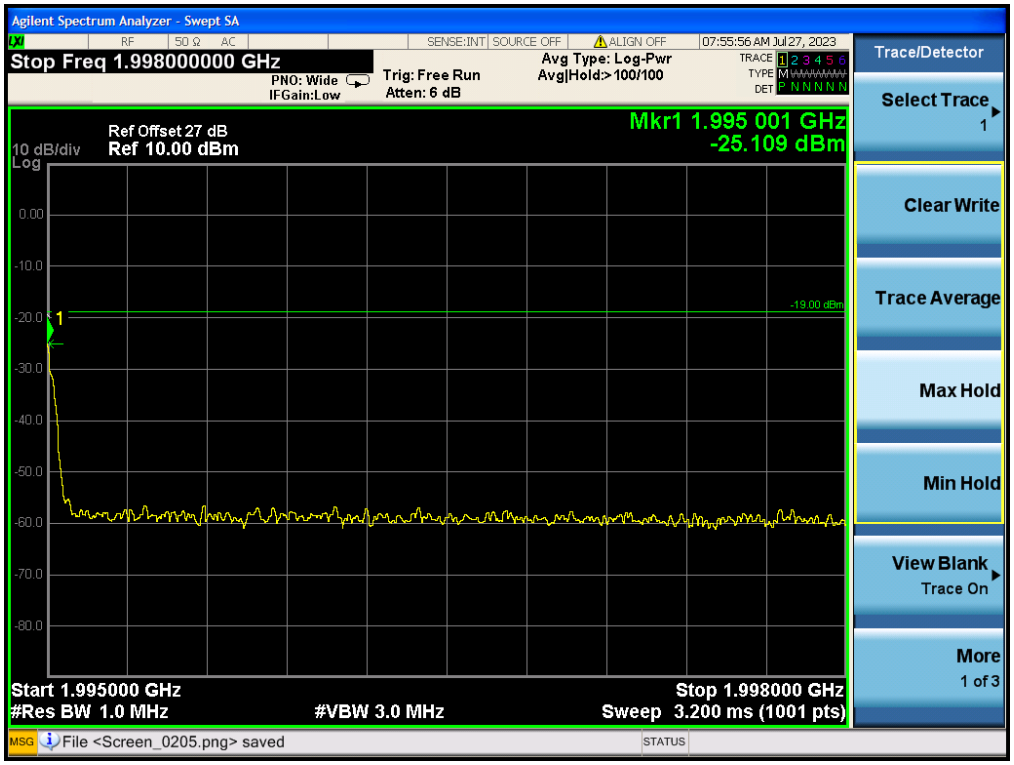
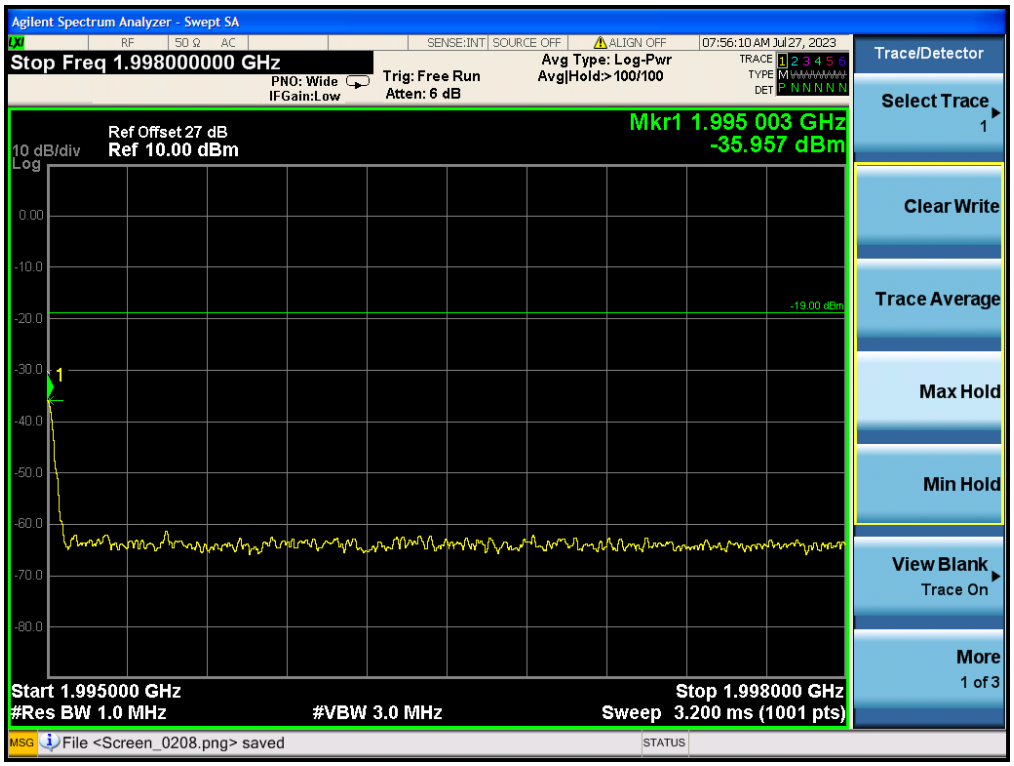
Broadband PCS DL Right Side Pre AGC



Broadband PCS DL Right Side Max Input



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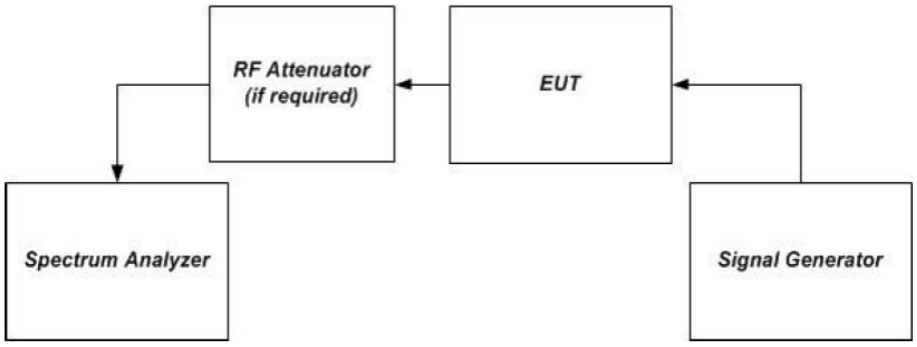
5.6 Spurious Emissions At Antenna Terminals

Test Requirement:	This measurement is intended to demonstrate compliance to the limit specified in §20.21(e)(8)(i)(E), which specifies that out-of-band emissions generated by a Wideband Signal Booster shall be at least 6 dB below the mobile emission limit applicable to the supported band of operation. The mobile emission limit applicable to the supported band of operation can be determined from the applicable rule part which is referenced in Annex A for each authorized operating band.
Limit:	-19dBm
Test Setup:	
Procedure:	a) Connect the EUT to the test equipment as shown in figure 1. Begin with the uplink output connected to the spectrum analyzer. b) Configure the signal generator for the appropriate operation for all uplink and downlink bands: 1) GSM: 0.2 MHz from upper and lower band edges. 2) LTE (5 MHz): 2.5 MHz from upper and lower band edges. 3) CDMA: 1.25 MHz from upper and lower band edges, except for cellular band as follows (only the upper and lower frequencies need to be tested): 824.88 MHz, 845.73 MHz, 836.52 MHz, 848.10 MHz, 869.88 MHz, 890.73 MHz, 881.52 MHz, 893.10 MHz. c) Set the signal generator amplitude to the maximum power level prior to AGC similar to the procedures in 7.2.4 to 7.2.6 of power measurement procedure for appropriate modulations. d) Set RBW = measurement bandwidth specified in the applicable rule section for the supported frequency band (see Annex A for cross-reference to applicable rule section). e) Set VBW = 3 X RBW. f) Select the RMS (power averaging) detector. g) Sweep time = auto-couple. h) Set the analyzer start frequency to the upper band/block edge frequency and the stop frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, per applicable rule part. i) Trace average at least 100 traces in power averaging (i.e., RMS) mode. j) Use peak marker function to find the maximum power level. k) Capture the Spectrum Analyzer trace of the power level for inclusion in the test report. l) Increase the signal generator amplitude to the saturation level indicated in 5.4. Ensure that the EUT maintains compliance with the OOBE limits. m) Reset the analyzer start frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as per applicable rule part, and the stop frequency to the lower band/block edge frequency and repeat steps 7.5.10-7.5.12. n) Repeat steps 7.5.2 through 7.5.14 for each uplink and downlink operational band.

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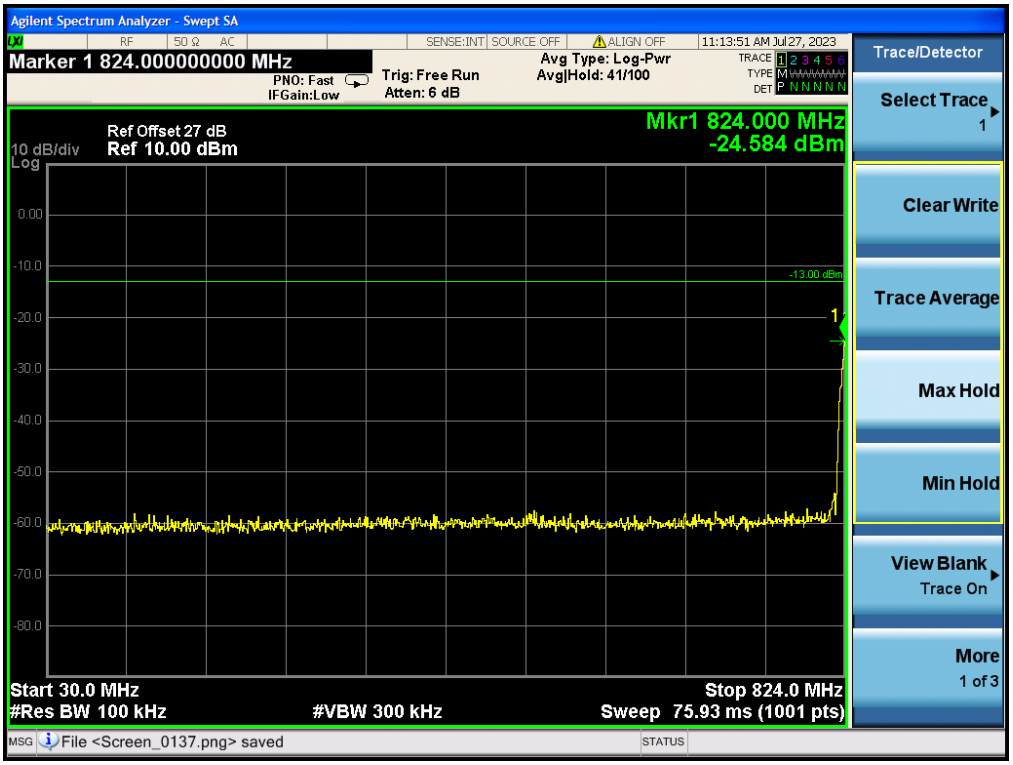
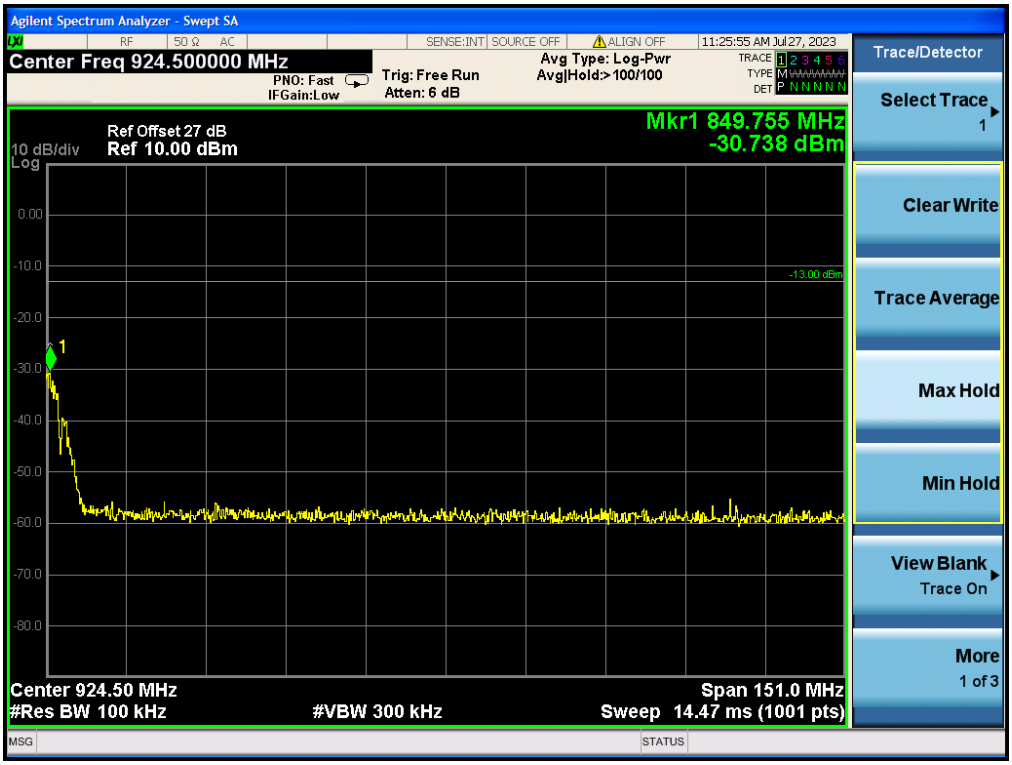
5.6.1 E.U.T. Operation:

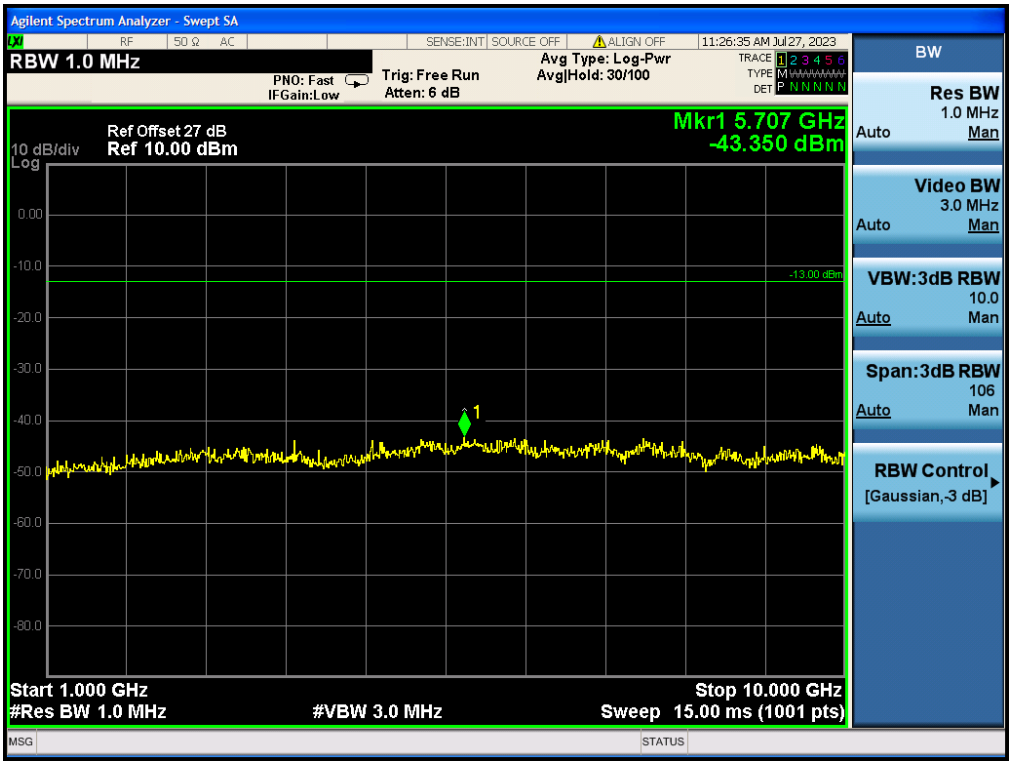
Operating Environment:	
Temperature:	22.1 °C
Humidity:	46.3 %
Atmospheric Pressure:	1010 mbar

5.6.2 Test Data:

Cellular Uplink







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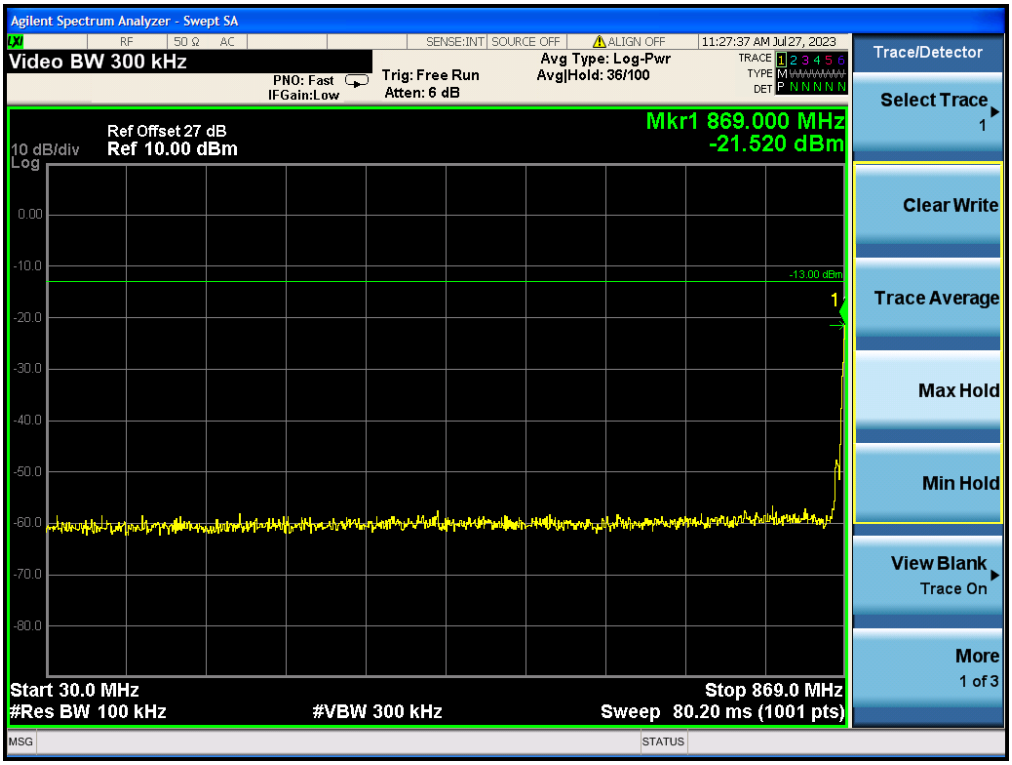
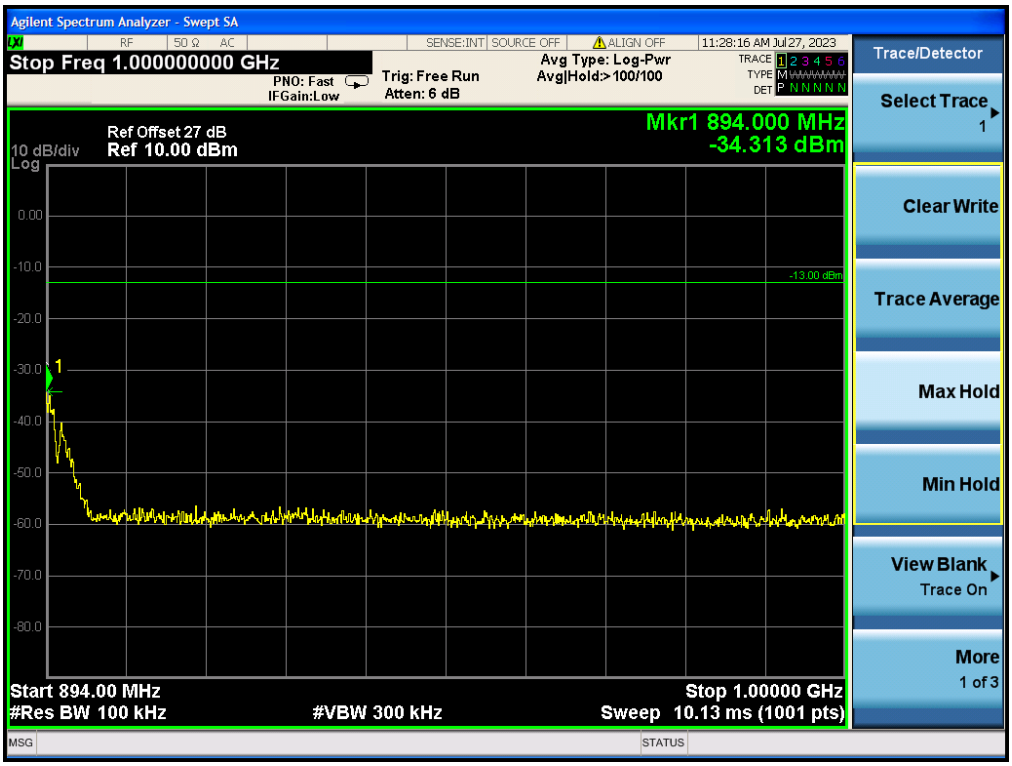
Cellular Downlink





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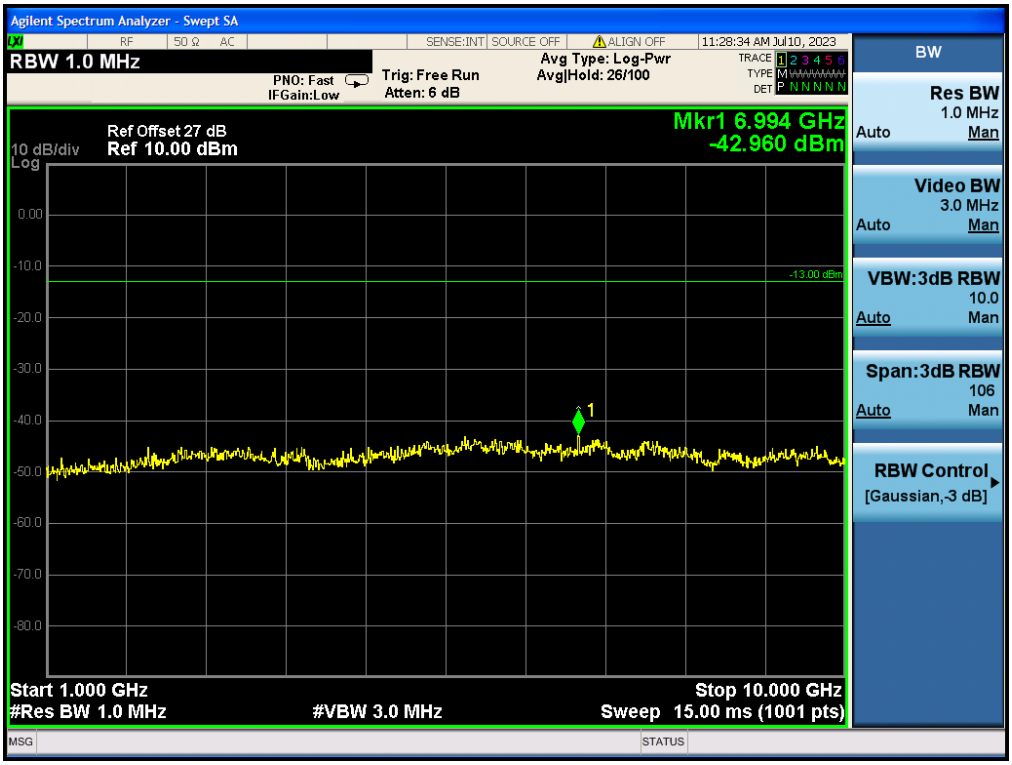
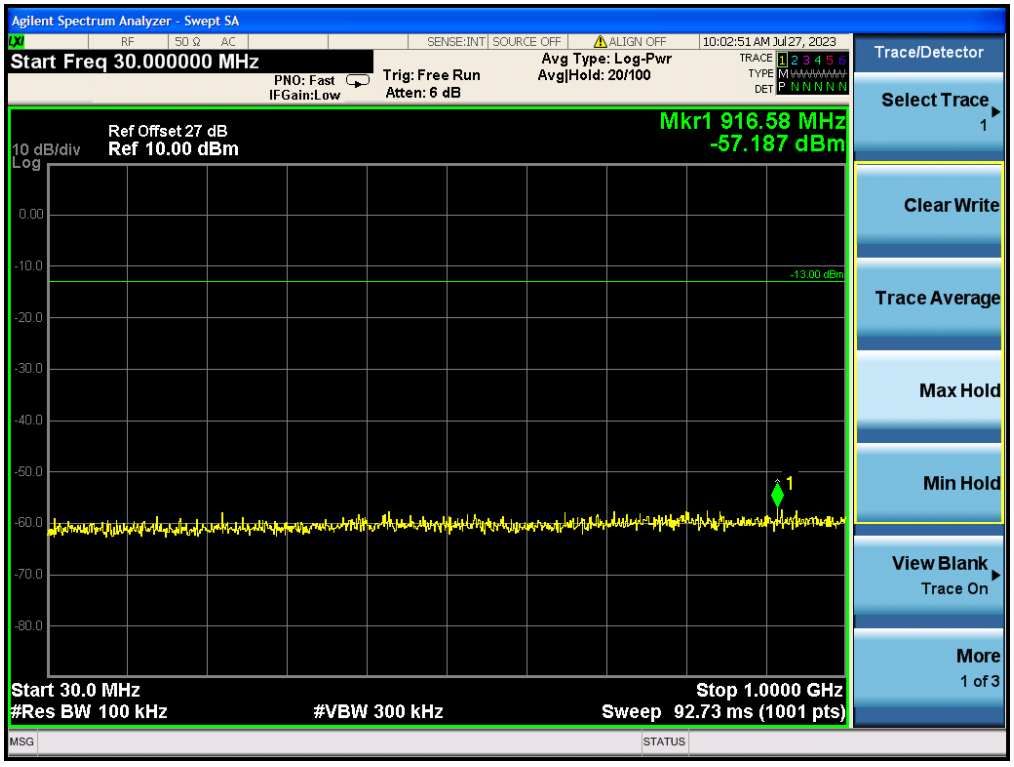


AWS-1 Uplink



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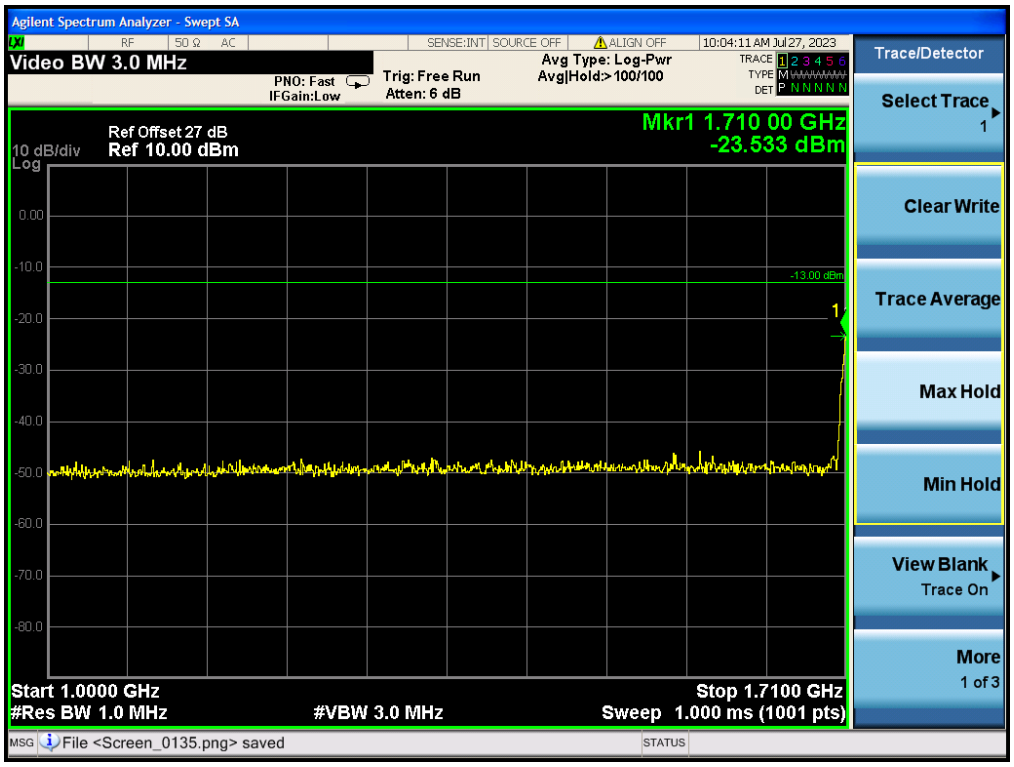

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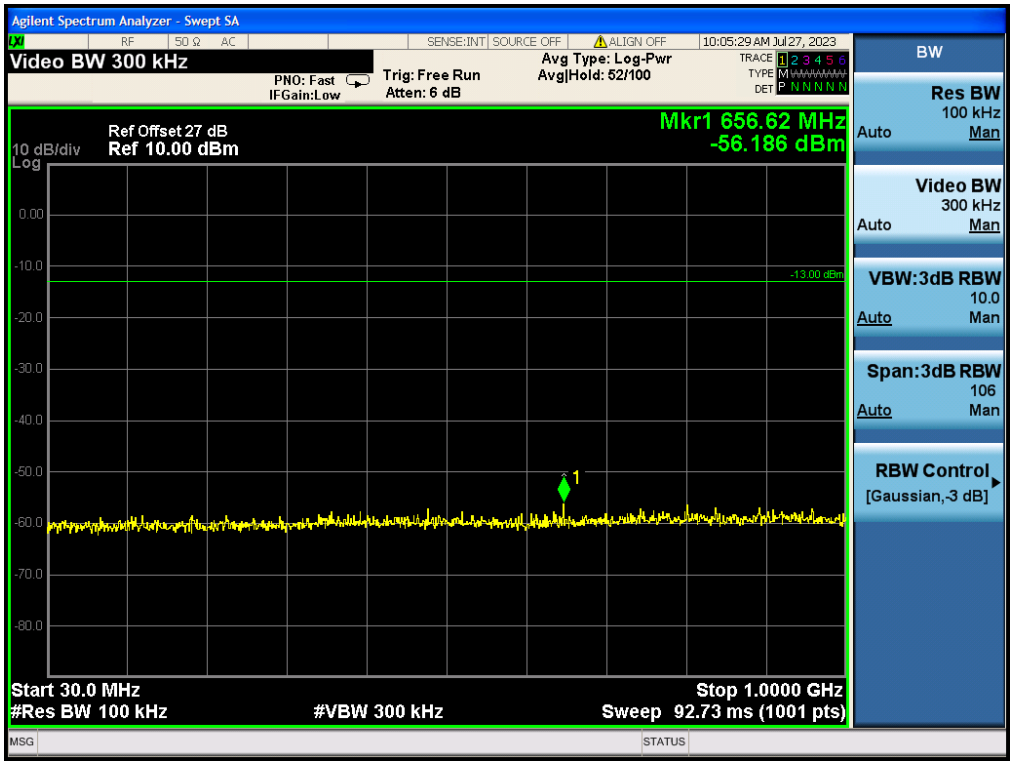
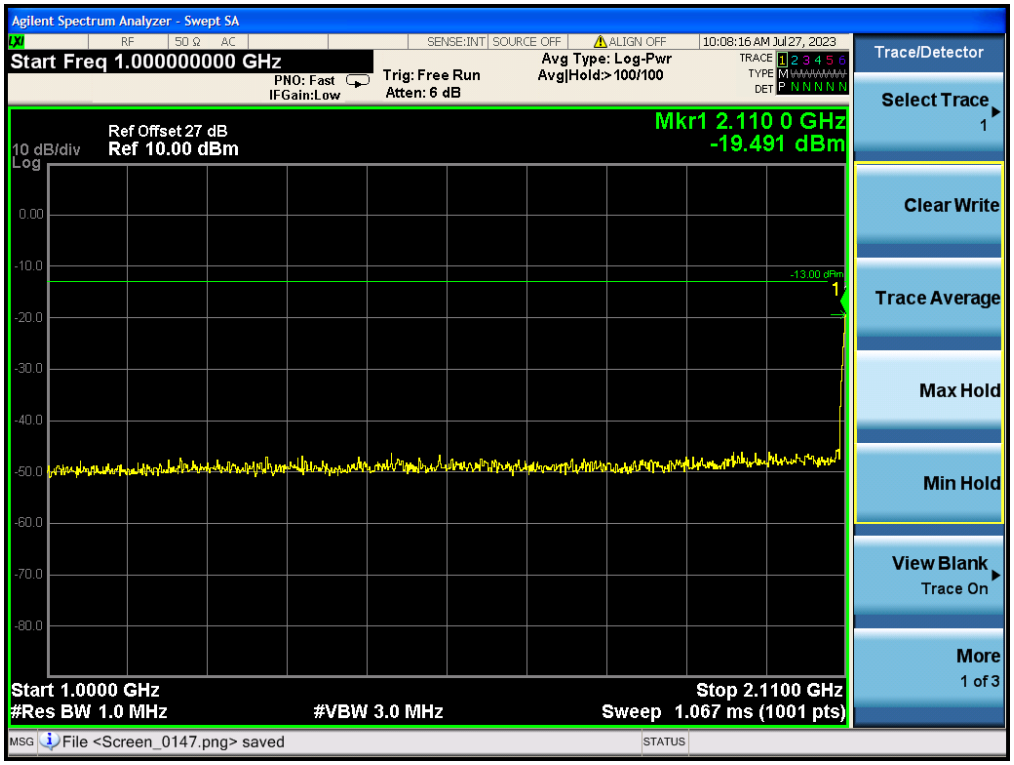
AWS-1 Downlink





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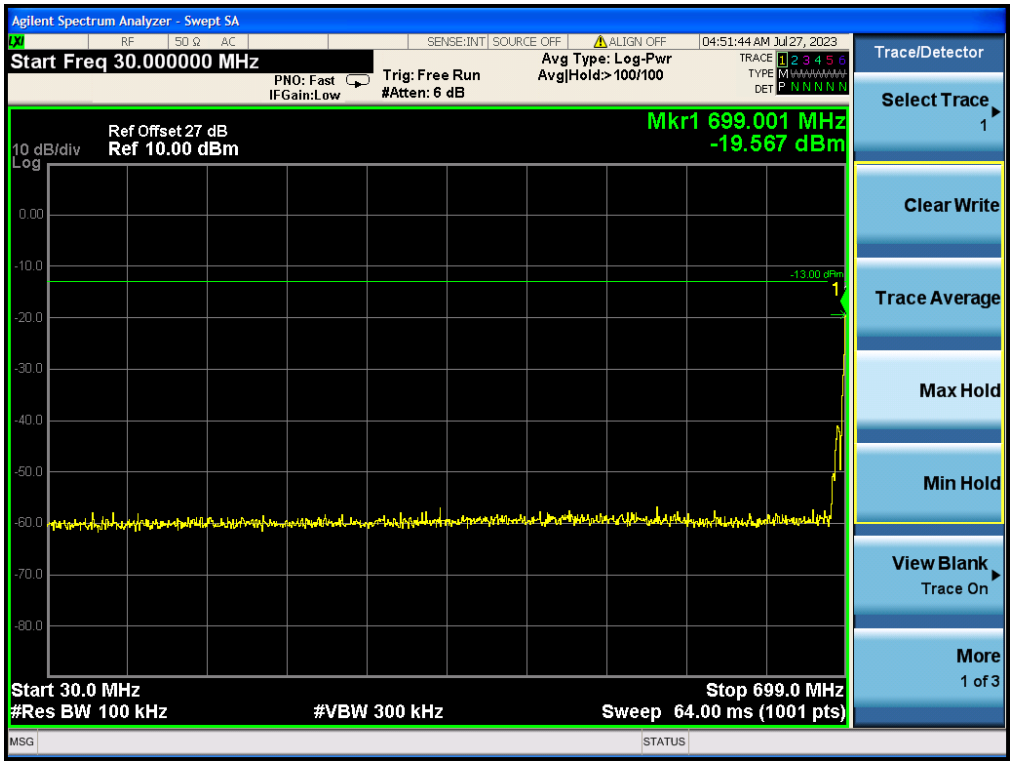
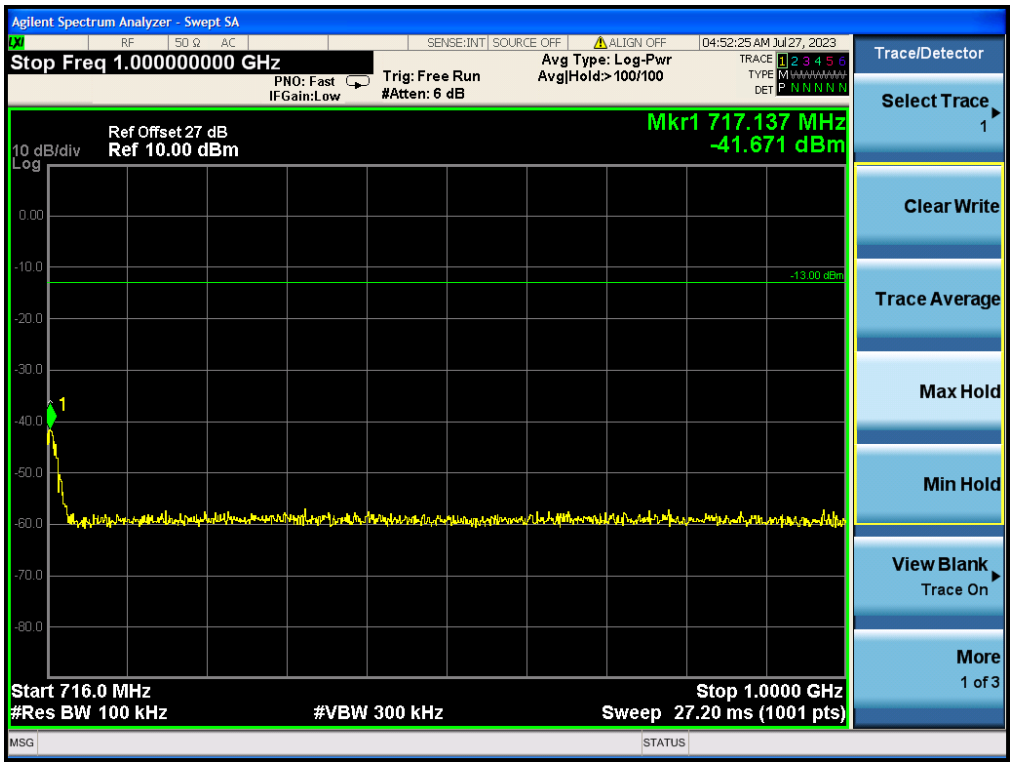
Low A-E Blocks Uplink





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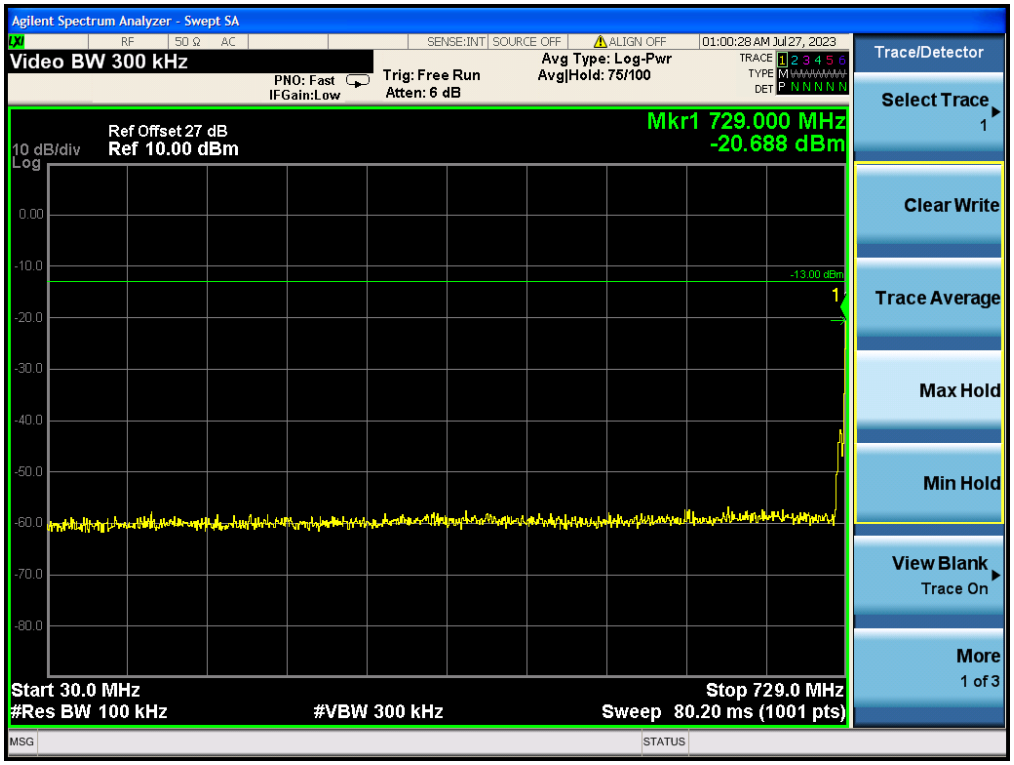
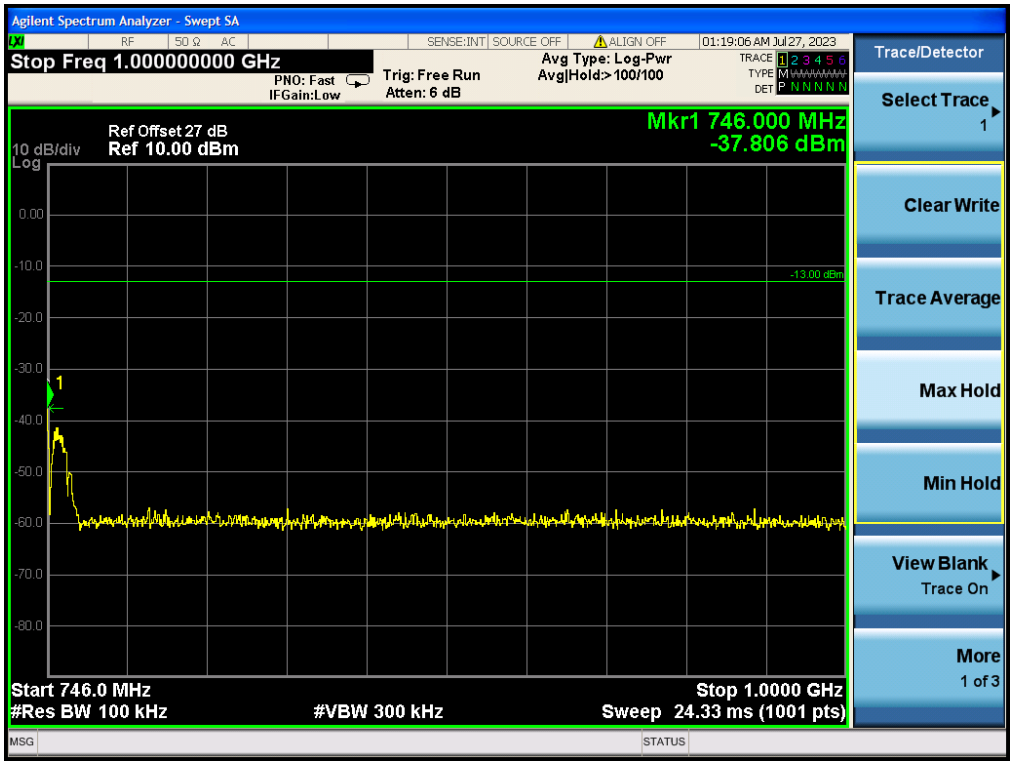
Low A-E Blocks Downlink





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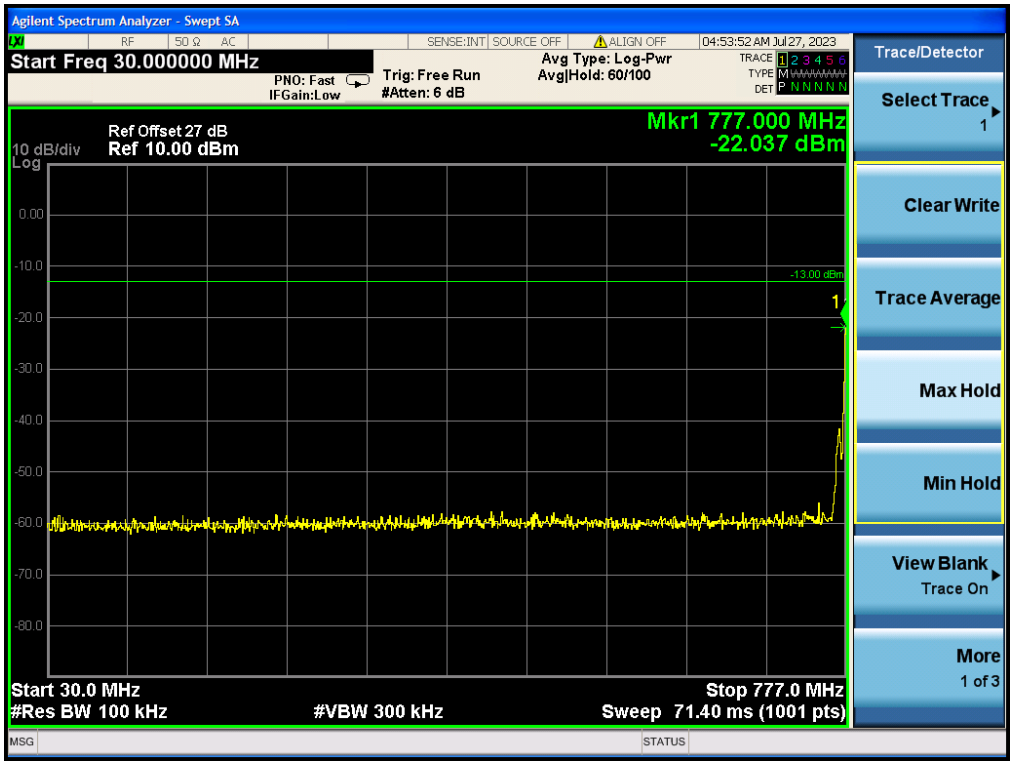
700 MHz Upper C Block Uplink



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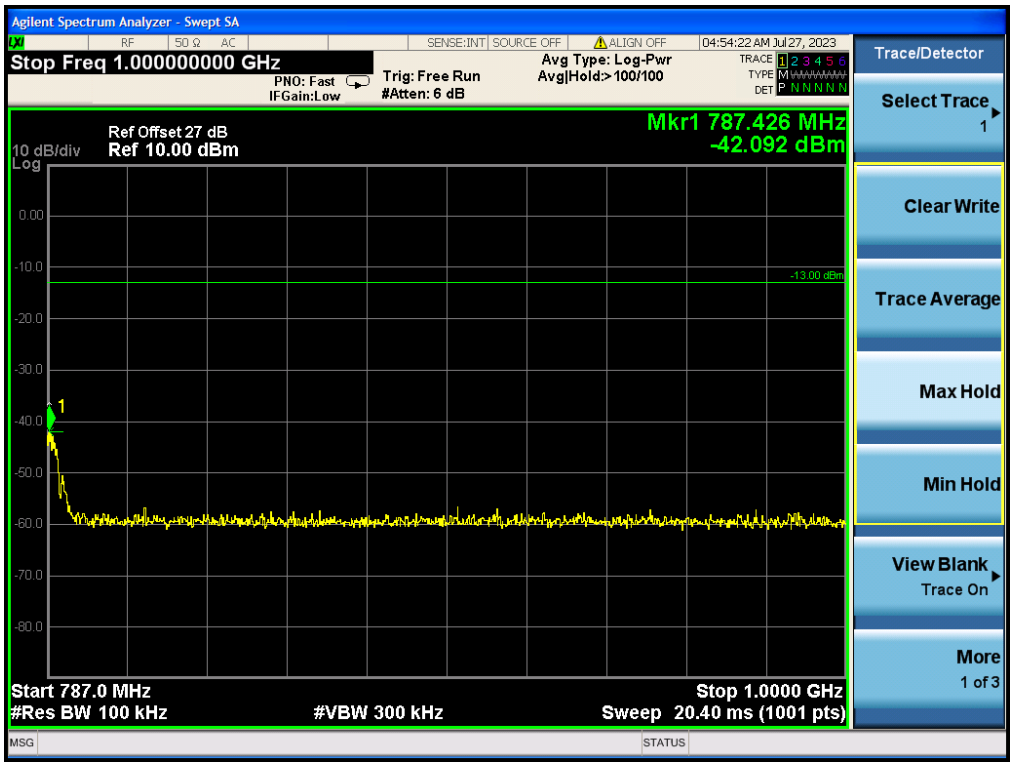

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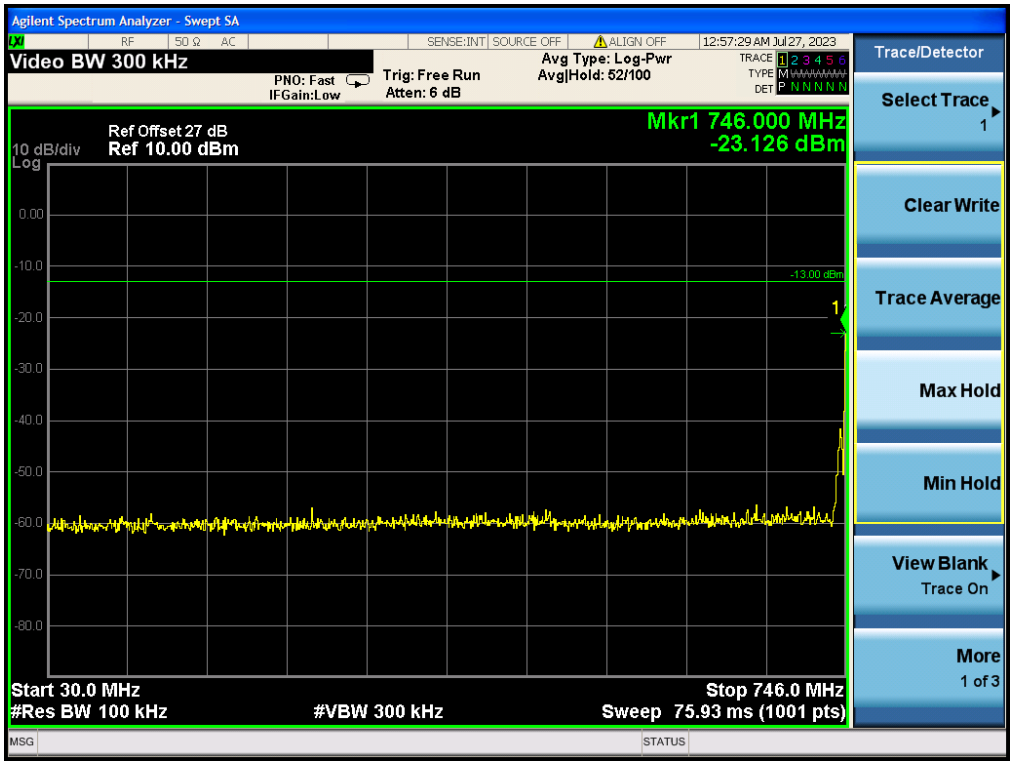
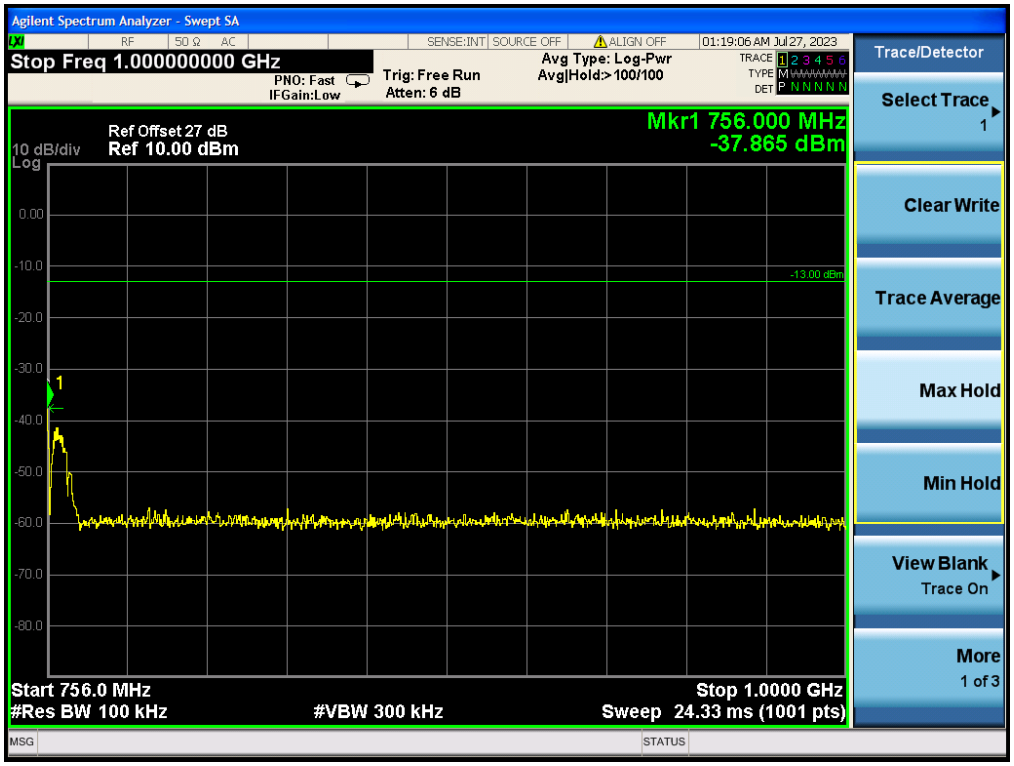
700 MHz Upper C Block Downlink





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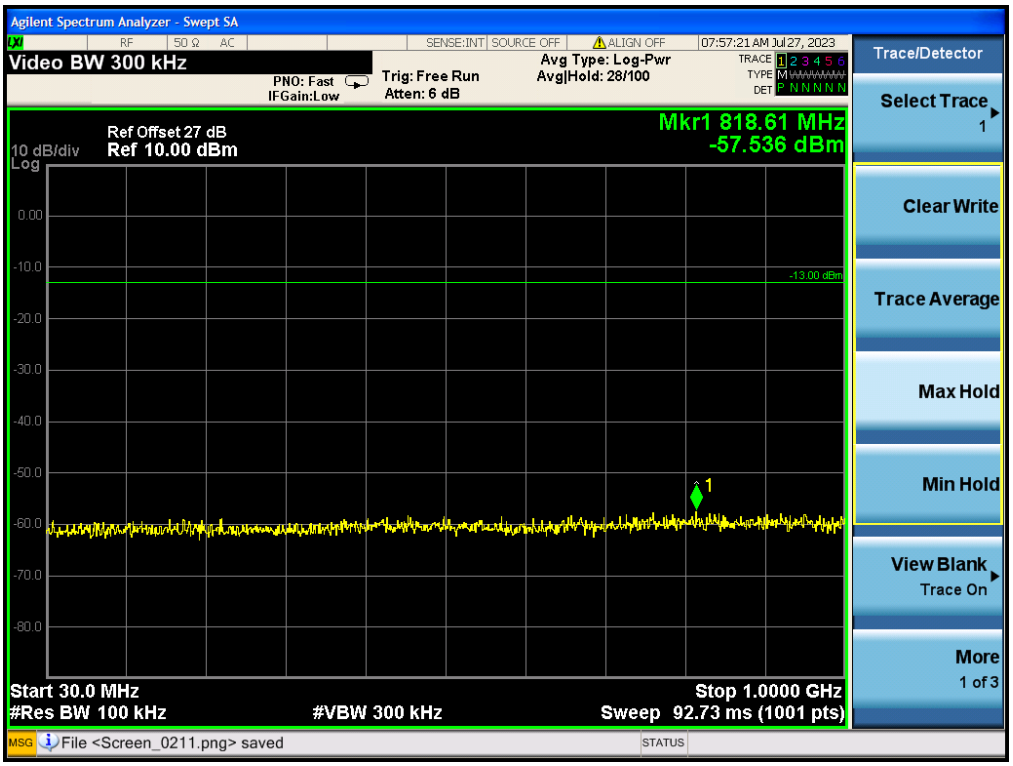
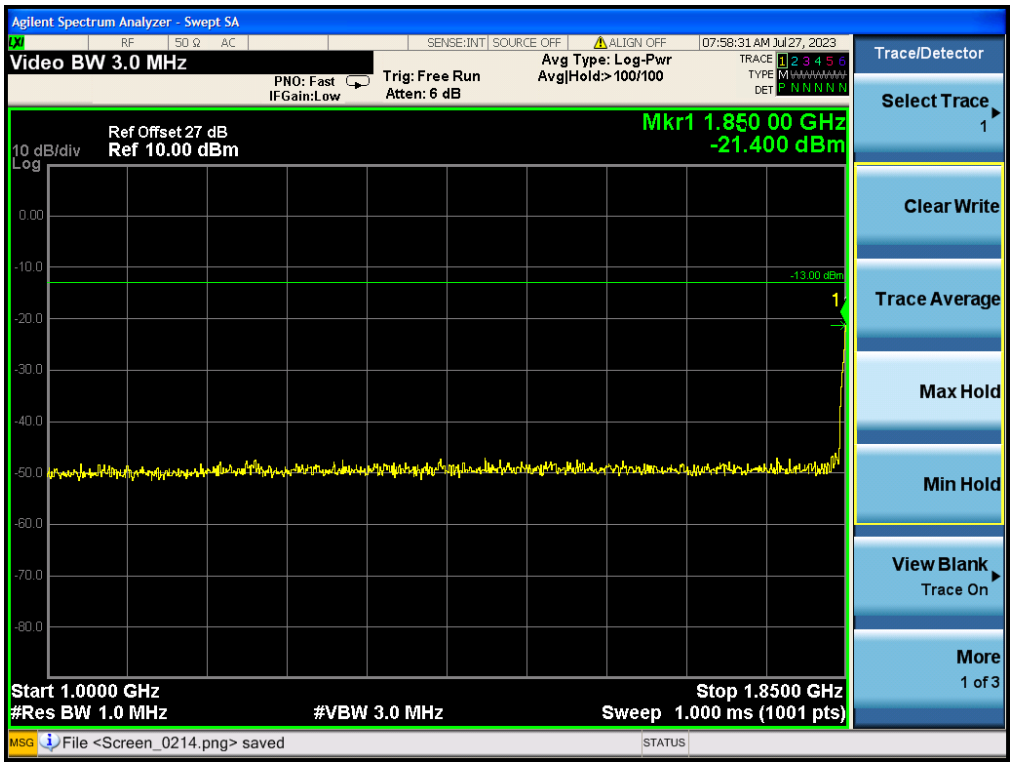
Broadband PCS Uplink





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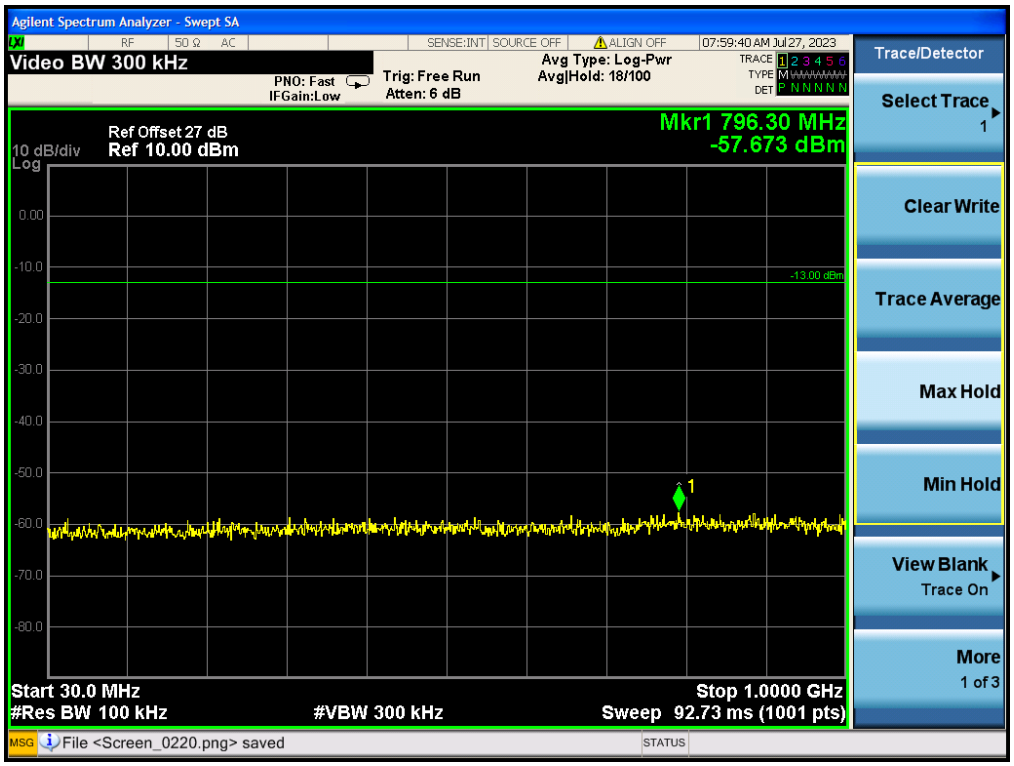
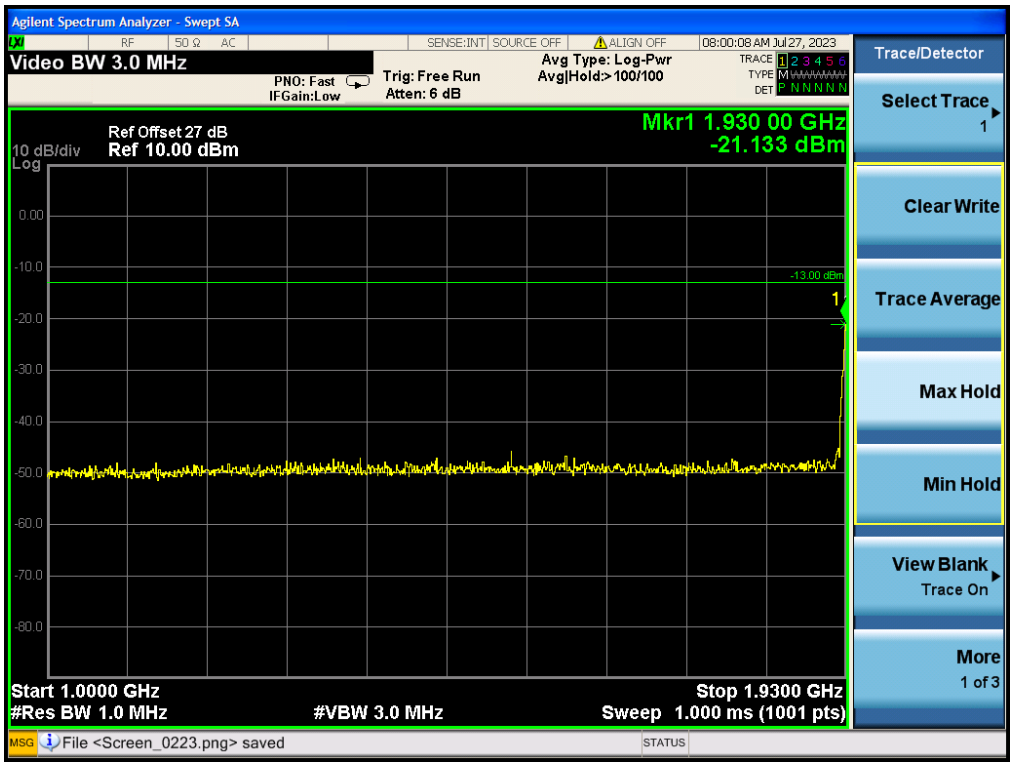
Broadband PCS Downlink





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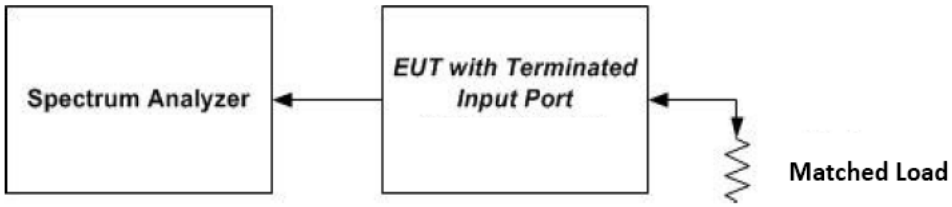
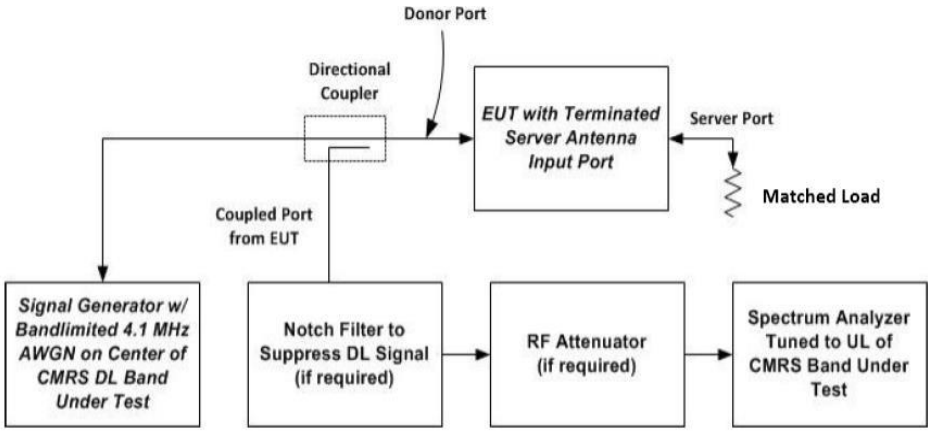
5.7 Noise Limits

Test Requirement:	This procedure provides a measurement methodology for demonstrating compliance to the noise limits specified in §20.21(e)(8)(i)(A) for Wideband Consumer Signal Boosters.
Limit:	not exceed −103 dBm/MHz—RSSI. not exceed−102.5 dBm/MHz + 20 log (F), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
Test Setup:	 Figure 3 – Noise limit test setup (also used for 7.8)  Figure 4 – Test setup for uplink noise power measurement in the presence of a downlink signal
Procedure:	a) Connect the EUT to the test equipment as shown in Figure 3. Begin with the uplink output connected to the spectrum analyzer. b) Set the spectrum analyzer RBW to 1 MHz with the VBW ⩾ 3X RBW c) Select the power averaging (RMS) detector and trace average over at least 100 traces. d) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span ⩾ 2X the CMRS band. e) Measure the maximum Transmitter Noise Power Level. f) Save the spectrum analyzer plot as necessary for inclusion in the final test report. g) Repeat steps 7.7.2 to 7.7.6 for all operational uplink and downlink bands. h) Connect the EUT to the test equipment as shown in Figure 4 for uplink and Figure 5 for downlink. Ensure the coupled path of the RF coupler is connected to the spectrum analyzer. i) Configure the signal generator for 4.1 MHz AWGN operation for uplink test and 200 kHz 99% OBW AWGN for downlink test. j) Set the spectrum analyzer RBW for 1 MHz with the VBW ⩾3X the RBW with an

	RMS AVERAGE detector with at least 100 trace averages. k) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span ⩾ 2X the CMRS band. This shall include all spectrum blocks in the particular CMRS band under test (see Annex A). For uplink noise measurements, set the spectrum analyzer center frequency for the uplink band under test and tune the signal generator to the center of the paired downlink band. For downlink noise measurements, set the spectrum analyzer to the center of the downlink band and tune the signal generator to the upper or lower band-edge of the same band, ensuring that the maximum noise power is being measured. l) Measure the maximum Transmitter Noise Power Level when varying the downlink signal generator level from -90 to -10 dBm in 1 dB steps inside the RSSI dependent region and 10 dB steps outside the RSSI dependent region, report the six values closest to the limit with at least 2 points within the RSSI dependent region of the limit. m) Repeat 7.7.7 through 7.7.11 for all operational uplink and downlink bands. n) Variable Uplink noise timing is to be measured as follows. o) Set the spectrum analyzer to the uplink frequency to be measured. p) Set the span to 0 Hz with a sweep time of 10 seconds. q) Set the power level of signal generator 1 to the lowest level of the RSSI dependent noise. r) Select MAX HOLD and increase the power level of signal generator 1 by 10 dB for mobile boosters and 20 dB for fixed boosters. s) Ensure that the Uplink noise decrease to the specified levels within 1 second for mobile devices and 3 seconds for fixed devices. t) Repeat 7.7.14 – 7.7.19 for all operational uplink bands Note: Some signal boosters will require a signal generator input as they will not operate unless a signal is received at the input terminals. If this is the case connect a signal generator and cycle the RF output to simulate this function.

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5.7.1 E.U.T. Operation:

Operating Environment:	
Temperature:	−30 °C and +50
Humidity:	46.3 %
Atmospheric Pressure:	1010 mbar

5.7.2 Test Data:

Frequency (MHz)	Max Noise Power Measured dBm/MHz	Limit dBm/MHz	Result (dB)
UL 824-849	-49.976	-44.05	PASS
UL1710-1755	-50.371	-37.72	PASS
UL699-716	-48.959	-45.51	PASS
UL777-787	-50.885	-44.64	PASS
UL1850-1915	-51.808	-37.00	PASS
DL 869-894	-48.562	-44.05	PASS
DL2110-2155	-49.992	-37.72	PASS
DL729-746	-51.033	-45.51	PASS
DL746-756	-50.731	-44.64	PASS
DL1930-1995	-51.873	-37.00	PASS

Note: Fixed booster maximum noise power shall not exceed − 102.5 dBm/MHz + 20 log (F), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

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Operation Bands	RSSI dBm	Variable Uplink Noise Measured dBm/MHz	Limit dBm/MHz	Result (dB)
Cellular	-90	-52.58	-44.05	PASS
	-80	-52.01	-44.05	PASS
	-70	-53.47	-44.05	PASS
	-45	-62.31	-58.00	PASS
	-41	-65.25	-62.00	PASS
	-40	-65.17	-63.00	PASS
AWS-1	-90	-52.86	-37.72	PASS
	-80	-52.78	-37.72	PASS
	-70	-53.23	-37.72	PASS
	-45	-62.86	-58.00	PASS
	-41	-65.72	-62.00	PASS
	-40	-65.10	-63.00	PASS
Low A-E Blocks	-90	-59.75	-45.51	PASS
	-80	-58.38	-45.51	PASS
	-70	-58.02	-45.51	PASS
	-46	-59.18	-57.00	PASS
	-41	-64.86	-62.00	PASS
	-40	-66.04	-63.00	PASS
700 MHz Upper C Block	-90	-52.28	-44.64	PASS
	-80	-55.17	-44.64	PASS
	-70	-56.26	-44.64	PASS
	-45	.-59.21	-58.00	PASS
	-41	-64.01	-62.00	PASS
	-40	-66.14	-63.00	PASS
	-40	-66.30	-63.00	PASS
Broadband PCS	-90	-52.49	-37.00	PASS
	-80	-56.38	-37.00	PASS
	-70	-57.27	-37.00	PASS
	-45	-59.14	-58.00	PASS
	-41	-63.43	-62.00	PASS

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Note: According to the KDB 935210 D03 Signal Booster Measurements v04r04 APPENDIX D, when outside of RSSI Dependent limit (20.21.e.8.1.A.1),fixed booster maximum noise power shall not exceed −102.5 dBm/MHz + 20 log (F).RSSI limit not exceed −103 dBm/MHz-RSSI.

Variable Uplink Noise Timing

Operation Bands	Measured Sec	Limit Sec	Results
Cellular	1.51	3	PASS
AWS-1	0.75	3	PASS
Low A-E Blocks	1.38	3	PASS
700 MHz Upper C Block	1.52	3	PASS
Broadband PCS	1.25	3	PASS

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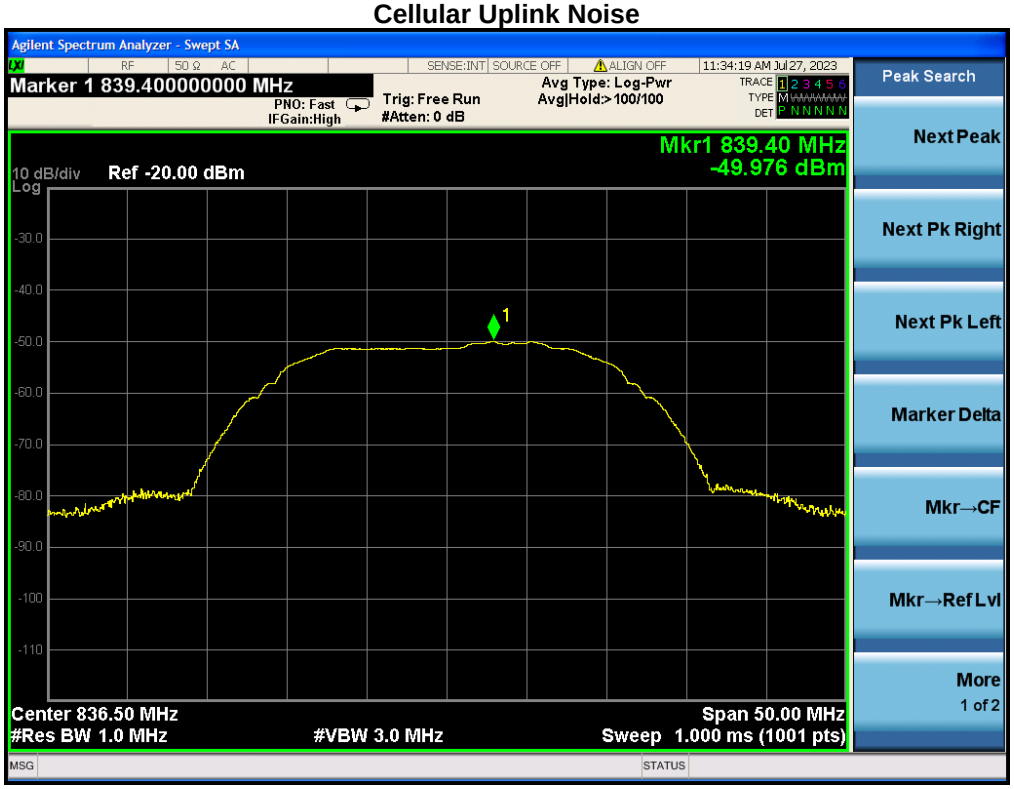
Cellular Uplink Noise



Cellular Downlink Noise

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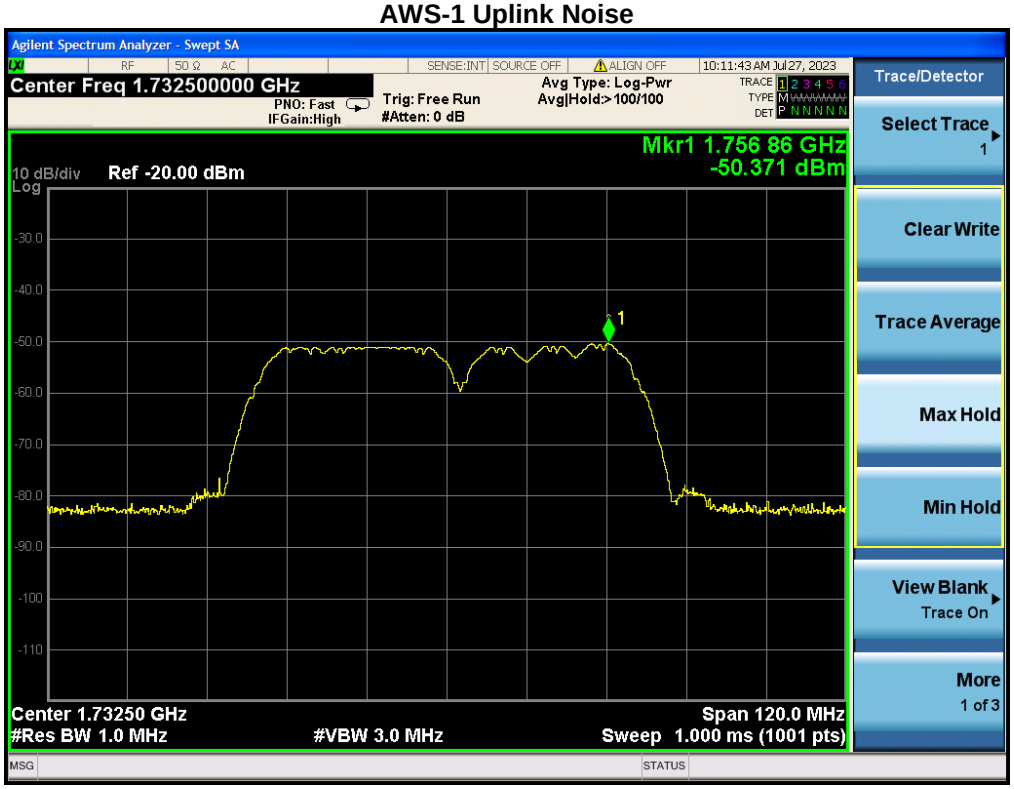
AWS-1 Uplink Noise



AWS-1 Downlink Noise

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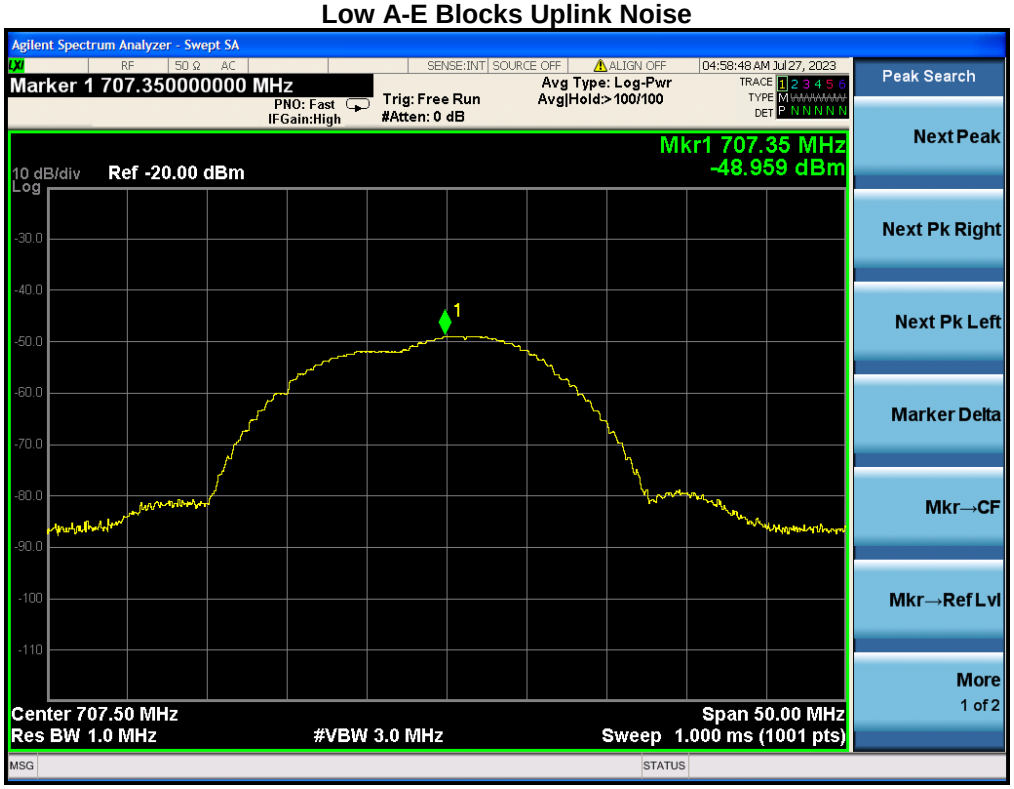
Low A-E Blocks Uplink Noise



Low A-E Blocks Downlink Noise

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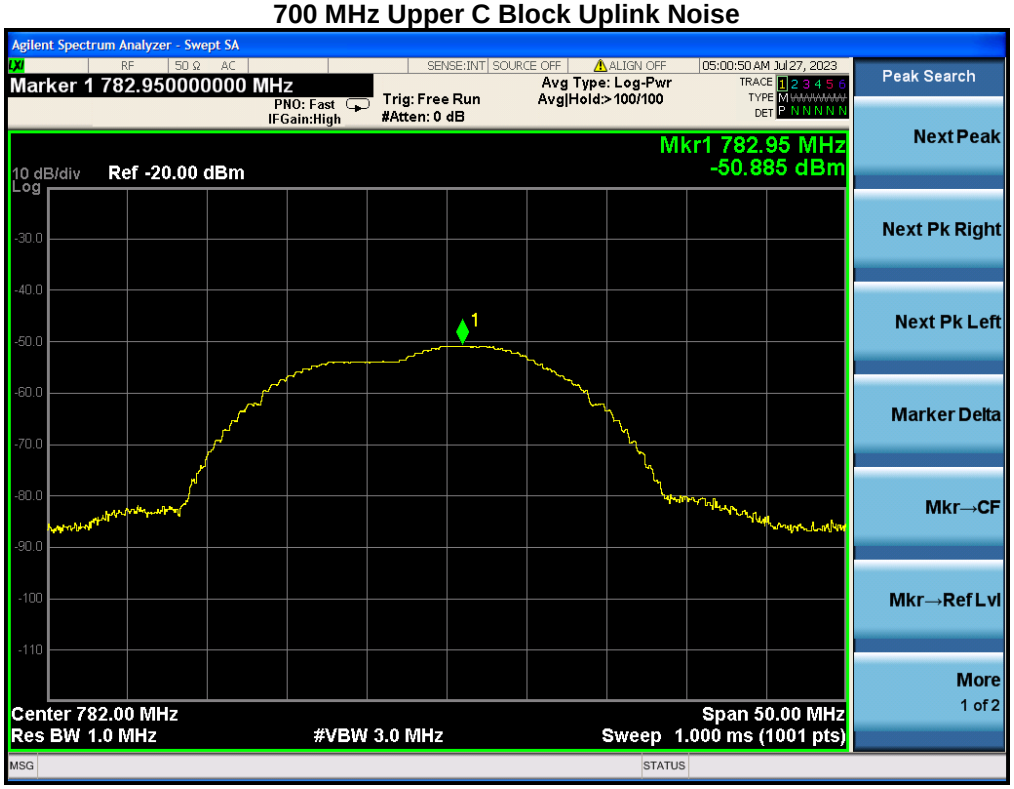
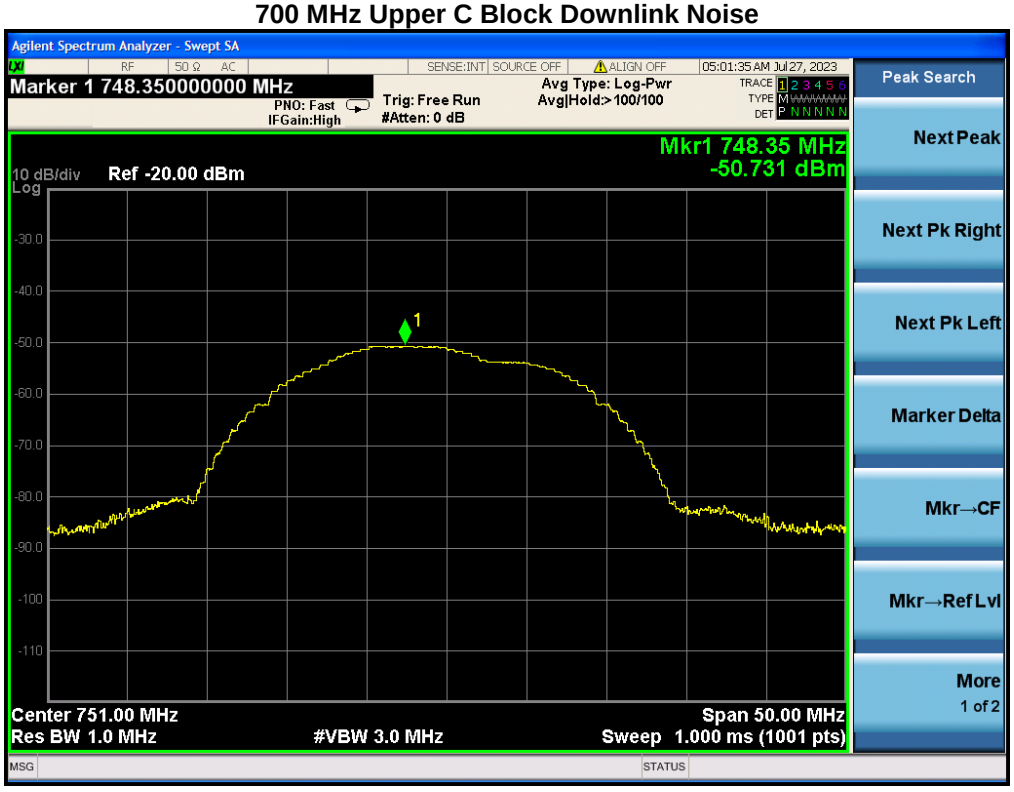
700 MHz Upper C Block Uplink Noise



700 MHz Upper C Block Downlink Noise



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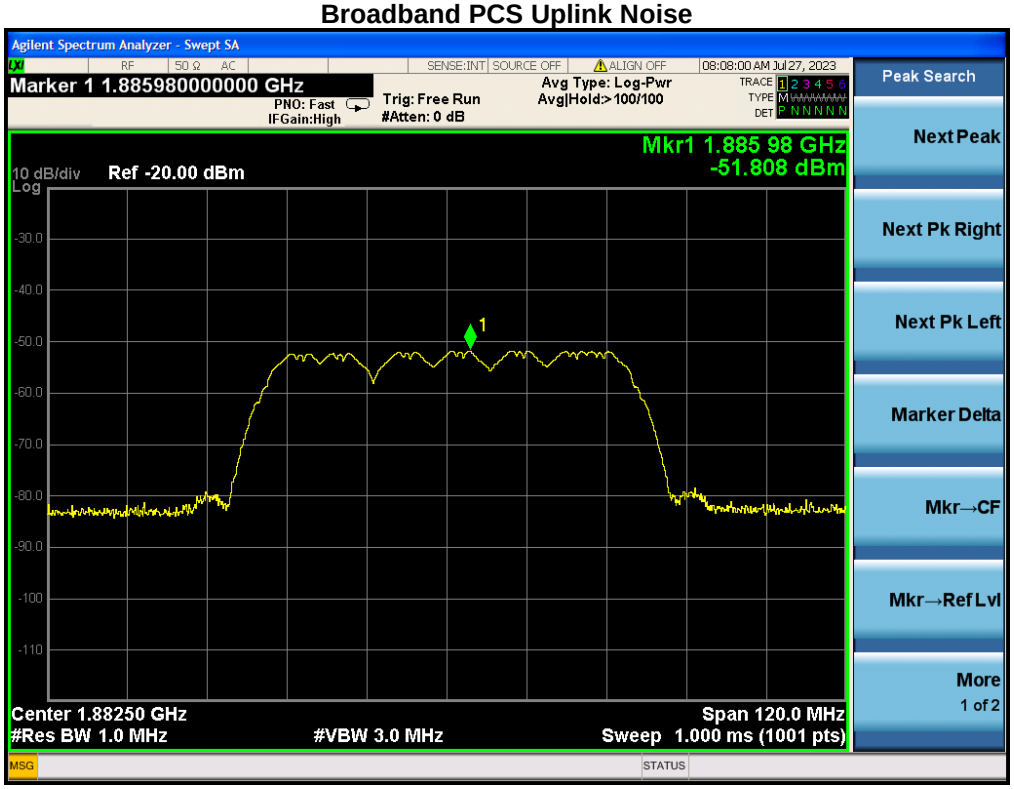
Broadband PCS Uplink Noise



Broadband PCS Downlink Noise

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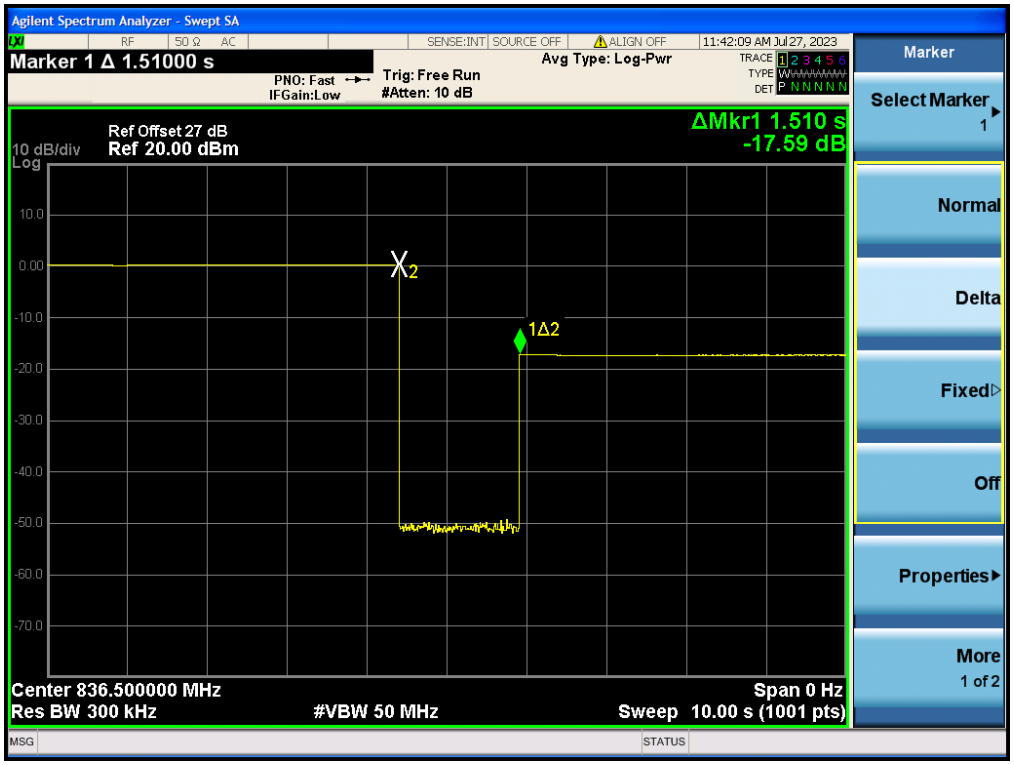
Variable Noise Timing Test Plots

Cellular



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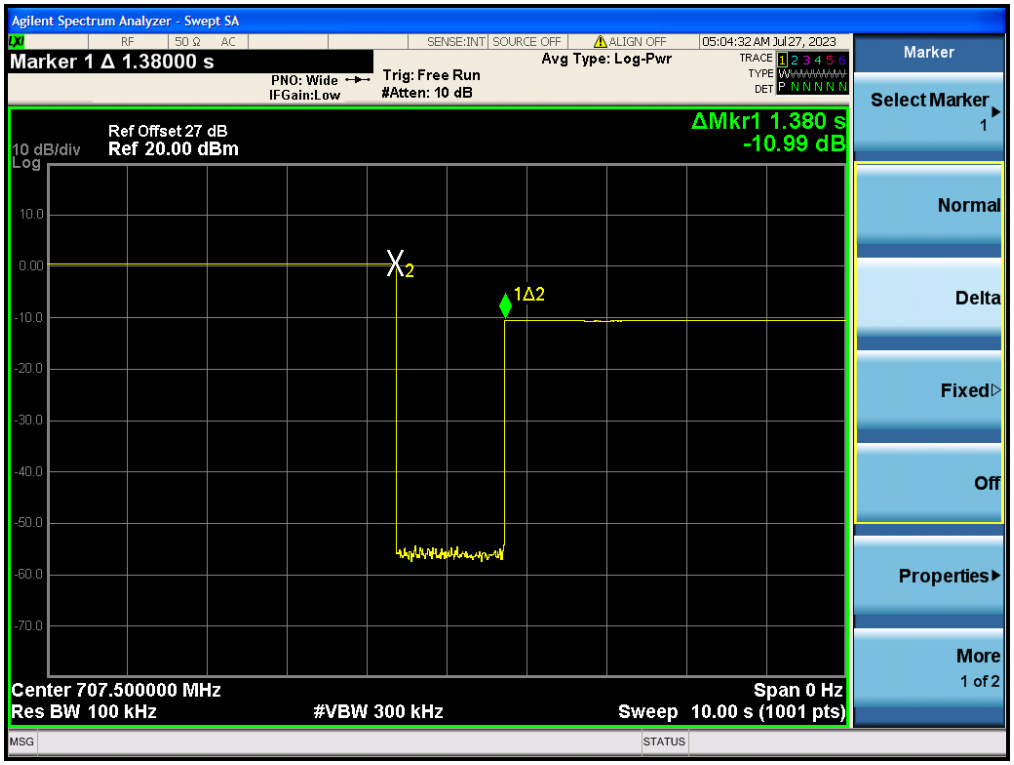
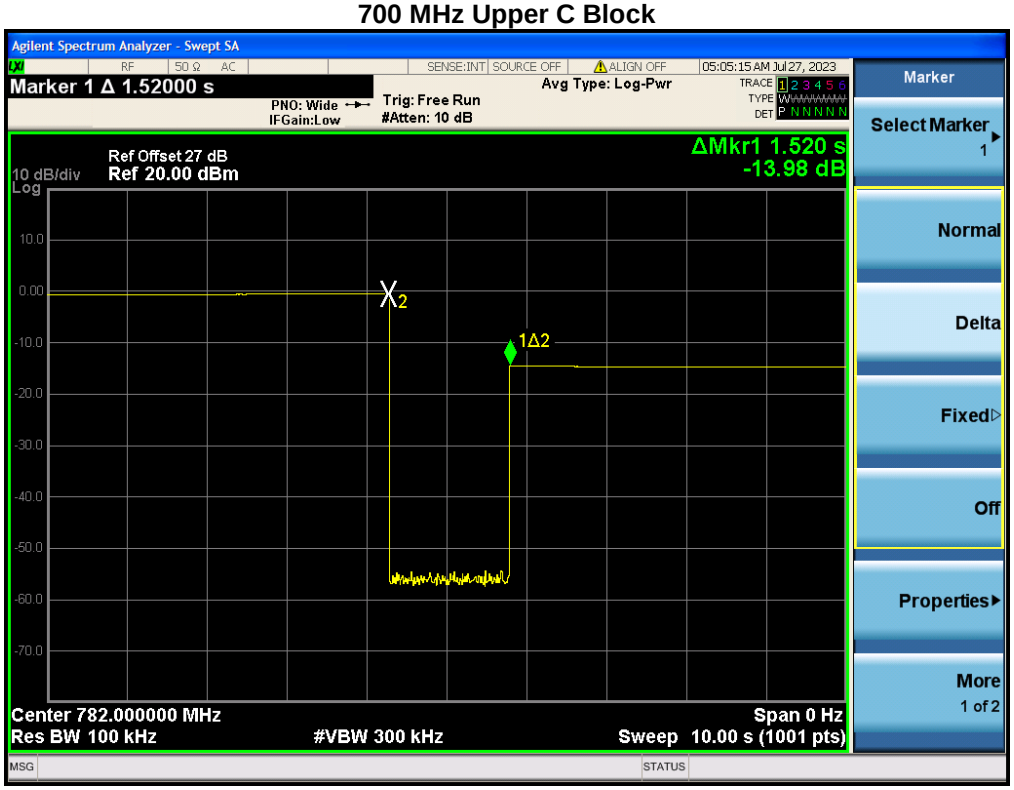
Low A-E Blocks



700 MHz Upper C Block



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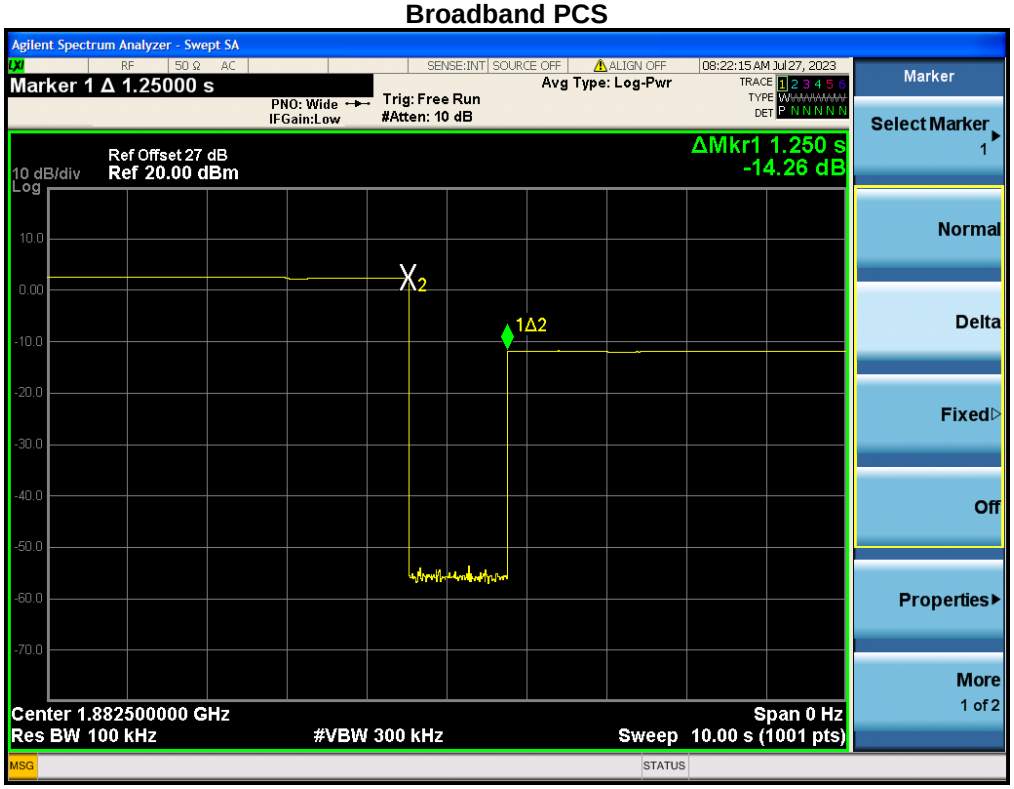
Broadband PCS



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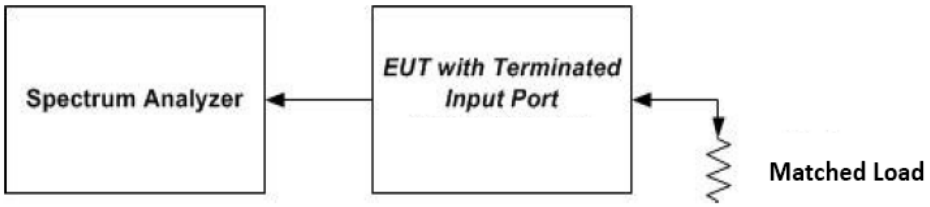
5.8 Uplink Inactivity

Test Requirement:	This measurement procedure is intended to demonstrate compliance to the uplink inactivity requirements specified for Wideband Consumer Signal Boosters in §20.21(e)(8)(i)(I).
Limit:	20.21(e), When a consumer booster is not serving an active device connection after 5 minutes the uplinknoise power shall not exceed -70 dBm/MHz.
Test Setup:	 Figure 3 – Noise limit test setup (also used for 7.8)
Procedure:	a) Connect the EUT to the test equipment as shown in Figure 3 with the uplink output connected to the spectrum analyzer. b) Select the RMS power averaging detector. c) Set the spectrum analyzer RBW for 1 MHz with the VBW ⩾ 3X RBW. d) Set the center frequency of the spectrum analyzer to the center of the uplink operational band. e) Set the span for 0 Hz with a single sweep time for a minimum of 330 seconds. f) Start to capture a new trace using MAX HOLD. g) After approximately 15 seconds turn on the EUT power. h) Once the full spectrum analyzer trace is complete place a MARKER on the leading edge of the pulse and use the DELTA MARKER METHOD to measure the time until the uplink was squelched. i) Ensure the noise level for the squelched signal is below the uplink inactivity noise power limit, as specified by the rules. j) Capture the plot for inclusion in the test report. k) Measure noise using procedures in sections 7.7.1- 7.7.5. l) Repeat steps 7.8.3 to 7.8.10 for all operational uplink bands. Note: Some signal boosters will require a signal generator input as they will not operate unless a signal is received at the input terminals. If this is the case connect a signal generator and cycle the RF output to simulate this function.

5.8.1 E.U.T. Operation:

Operating Environment:	
Temperature:	−30 °C and +50
Humidity:	46.3 %
Atmospheric Pressure:	1010 mbar

5.8.2 Test Data:

Operation Bands			
	Uplink Inactivity Measured(s)	Limit(s)	Result
Cellular	286.6	300.0	PASS
AWS-1	281.2	300.0	PASS
Low A-E Blocks	279.2	300.0	PASS
700 MHz Upper C Block	278.5	300.0	PASS
Broadband PCS	275.9	300.0	PASS

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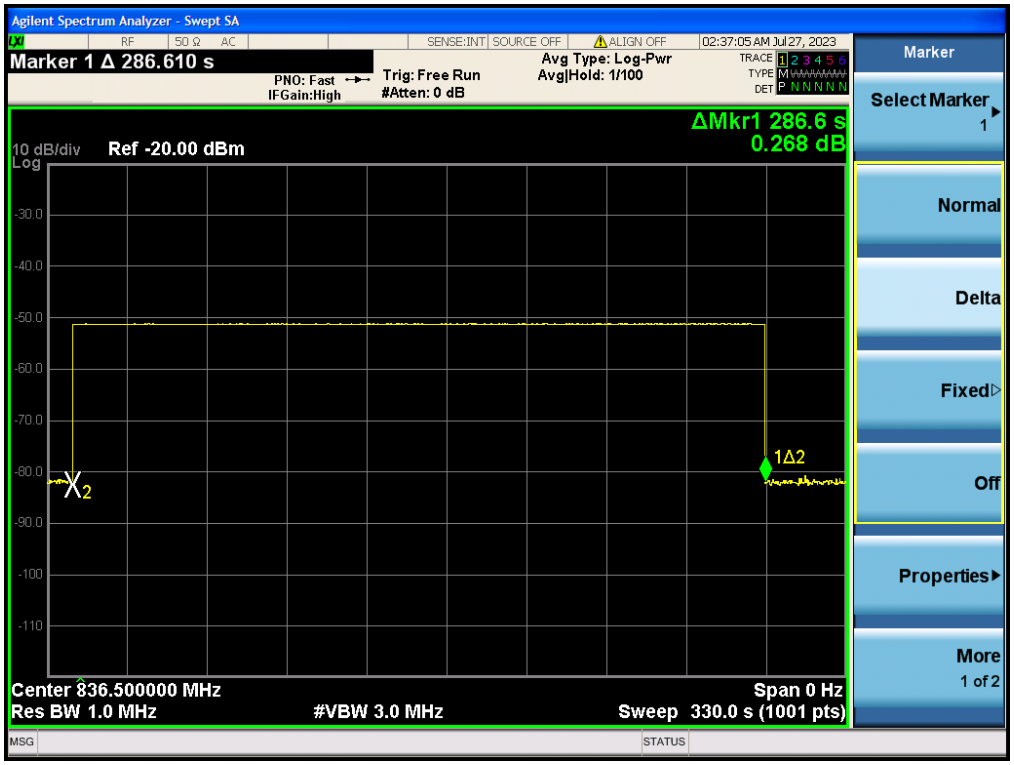
Cellular



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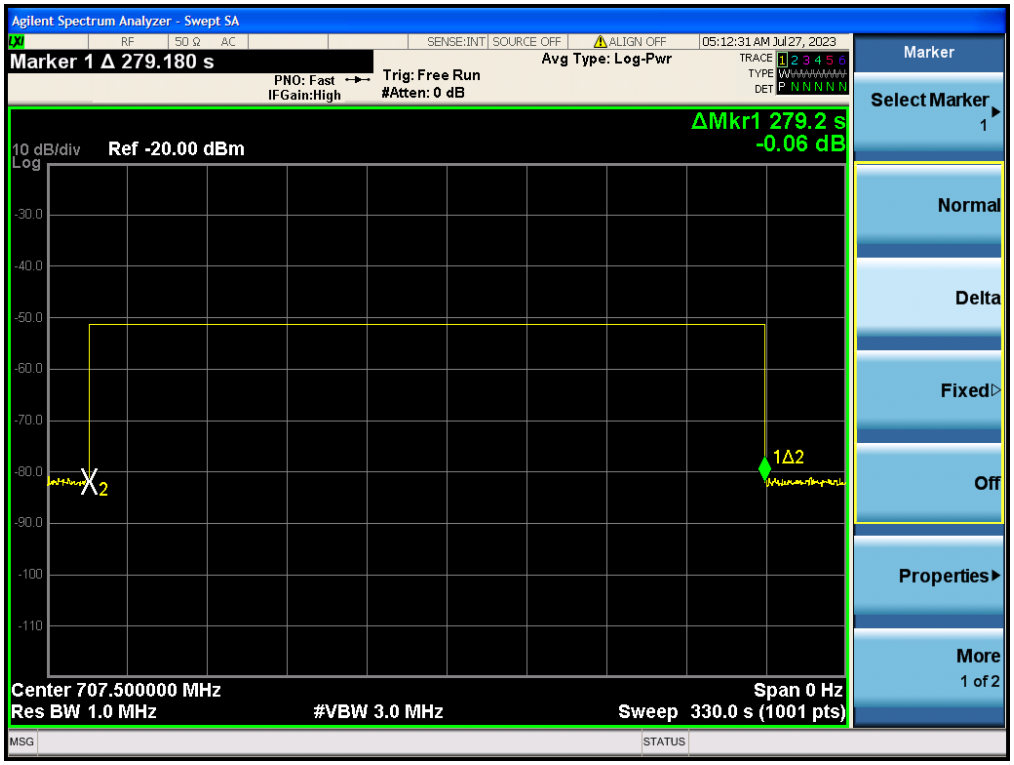
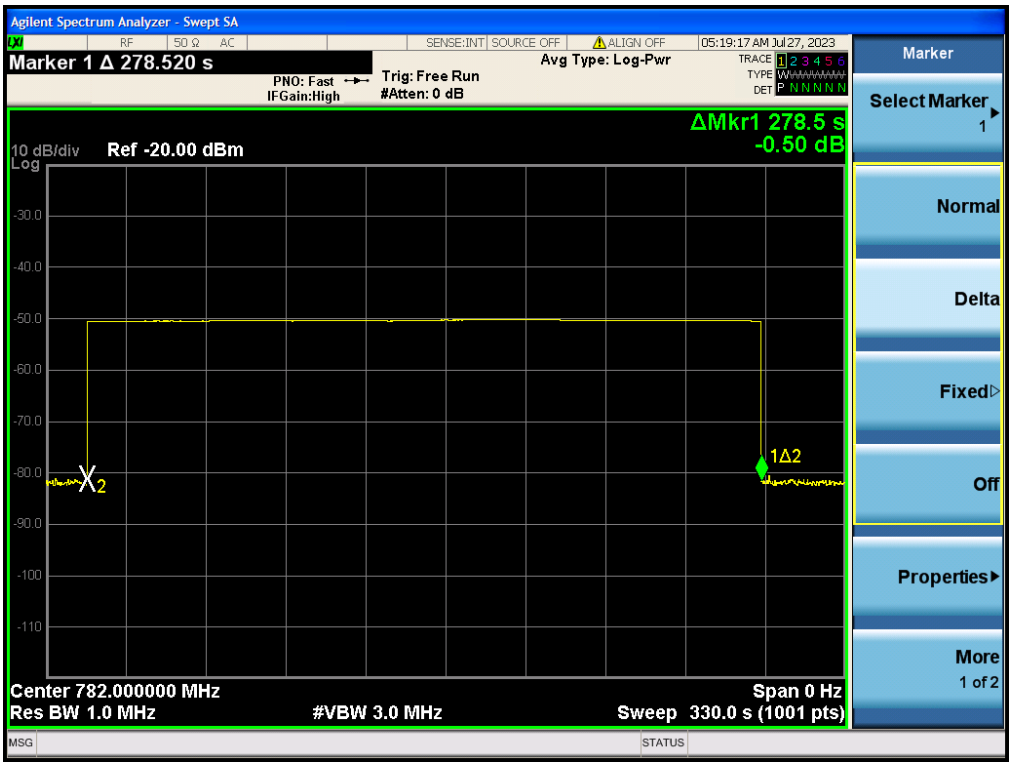
Low A-E Blocks



700 MHz Upper C Block



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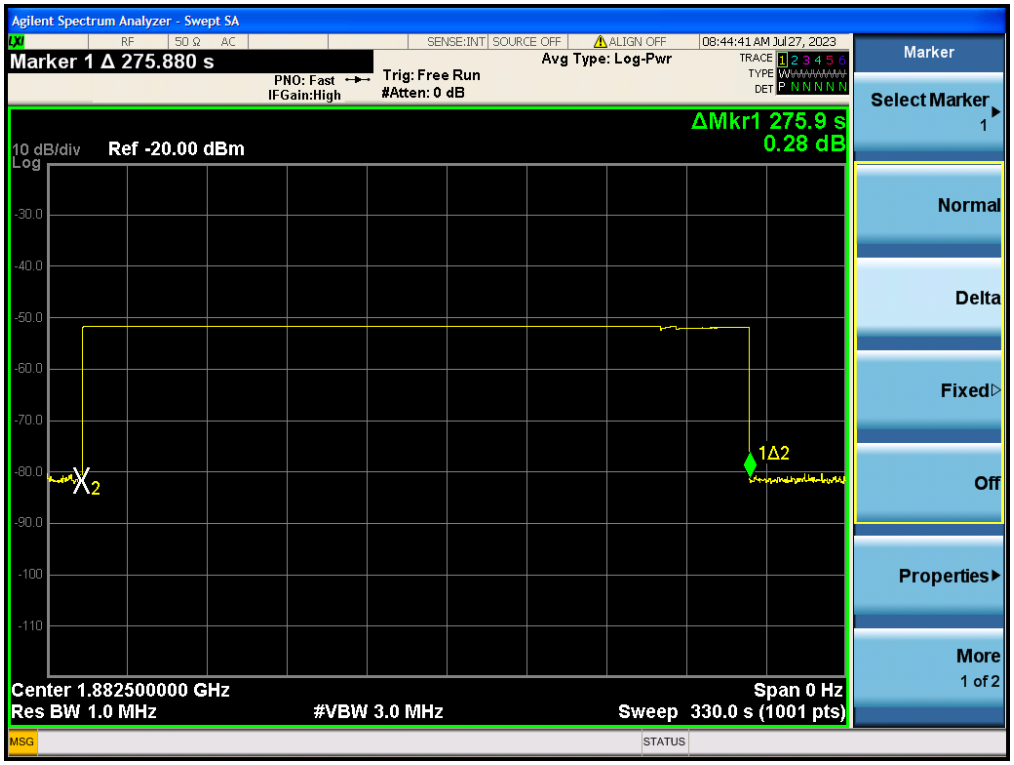
Broadband PCS



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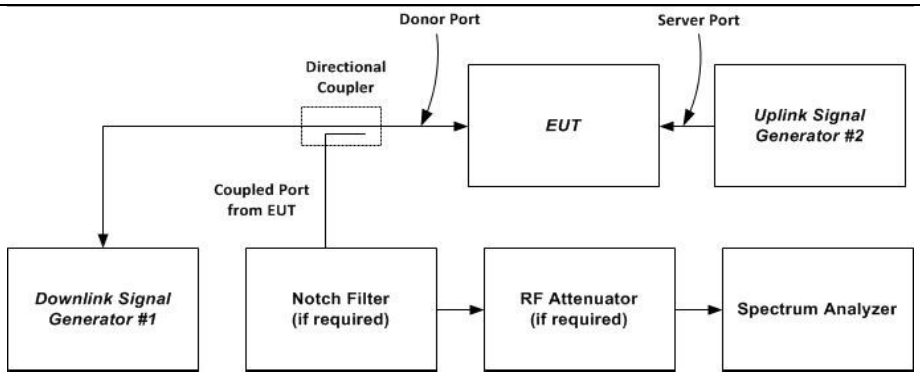
5.9 Variable Booster Gain

Test Requirement:	This procedure shall be used to demonstrate compliance to the Booster Gain Limits specified for Wideband Consumer Signal Boosters in §21(e)(8)(i)(C). The variable booster gain limits are expressed as a function of RSSI and MSCL. The RSSI is varied over a range of values as specified within the procedure. Refer to Annex B of this document for guidance with respect to determining the applicable MSCL value.
Limit:	-34 dB -RSSI + MSCL
Test Setup:	
Procedure:	a) Connect the EUT to the test equipment as shown in Figure 6 with the uplink output connected to signal generator 1. Ensure the coupled path of the RF coupler is connected to the spectrum analyzer. b) Configure downlink signal generator #1 for AWGN operation with an 99% occupied bandwidth of 4.1 MHz tuned to the center of the operational band. c) Set the power level and frequency of signal generator # 2 to a value 5 dB below the AGC level from section 7.2. The signal type is AWGN with a 99% OBW of 4.1 MHz. d) Set RBW = 100 kHz. e) Set VBW ⩾ 300 kHz. f) Select the CHANNEL POWER measurement tool. g) Select the RMS (power averaging) detector. h) Ensure that the number of measurement points per sweep ⩾ (2 x span)/RBW. i) Sweep time = auto couple or as necessary. j) Trace average at least 10 traces in power averaging (i.e., RMS) mode. k) Measure the maximum channel power and compute maximum gain when varying the signal generator 1 to a level from -90 to -10 dBm in 1 dB steps inside the RSSI dependent region and 10 dB steps outside the RSSI dependent region and report the six values closest to the limit, including at least two points from within the RSSI dependent region of operation. l) Repeat 7.9.3 – 7.9.11 for all operational uplink bands. m) Variable Uplink gain timing is to be measured as follows. n) Set the spectrum analyzer to the uplink frequency to be measured. o) Set the span to 0 Hz with a sweep time of 10 seconds. p) Set the power level of signal generator 1 to the lowest level of the RSSI dependent gain. q) Select MAX HOLD and increase the power level of signal generator 1 by 10 dB for mobile booster and 20 dB for fixed indoor boosters. r) Ensure that the Uplink gain decrease to the specified levels within 1 second for mobile devices and 3 seconds for fixed devices. s) Repeat 7.9.13 – 7.9.18 for all operational uplink bands.

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