

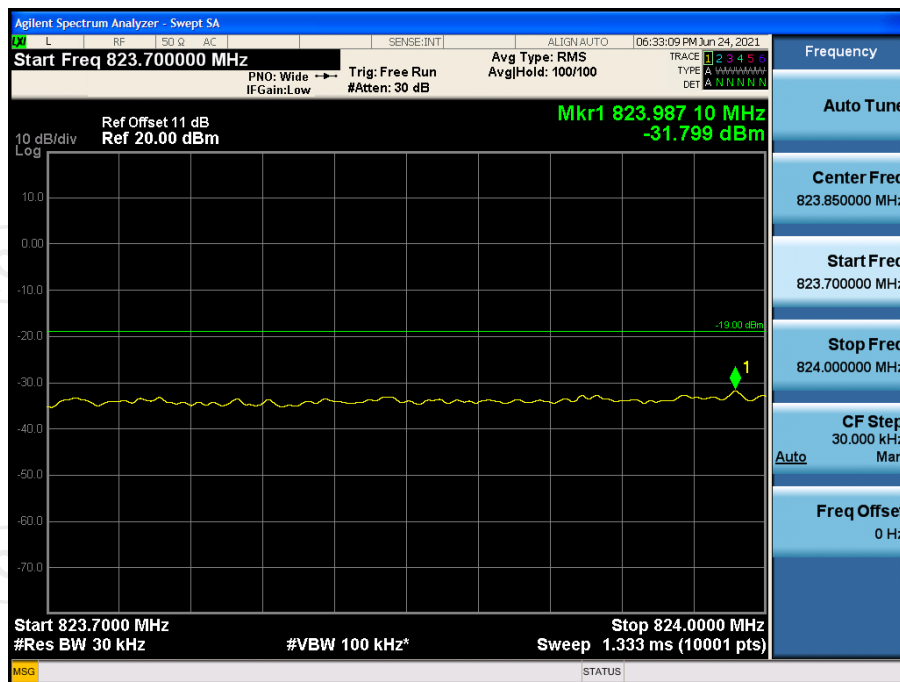
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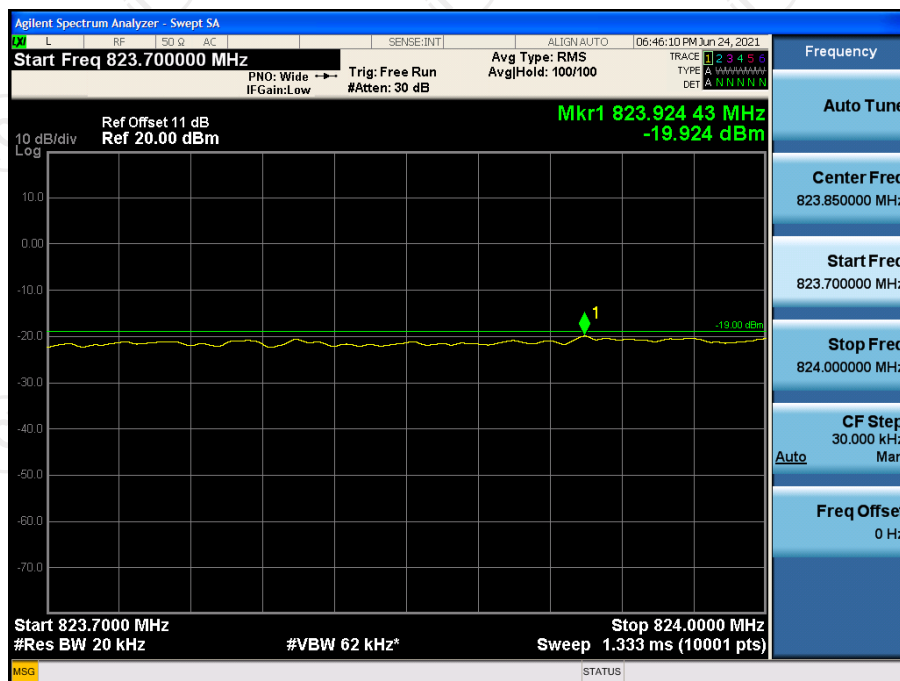
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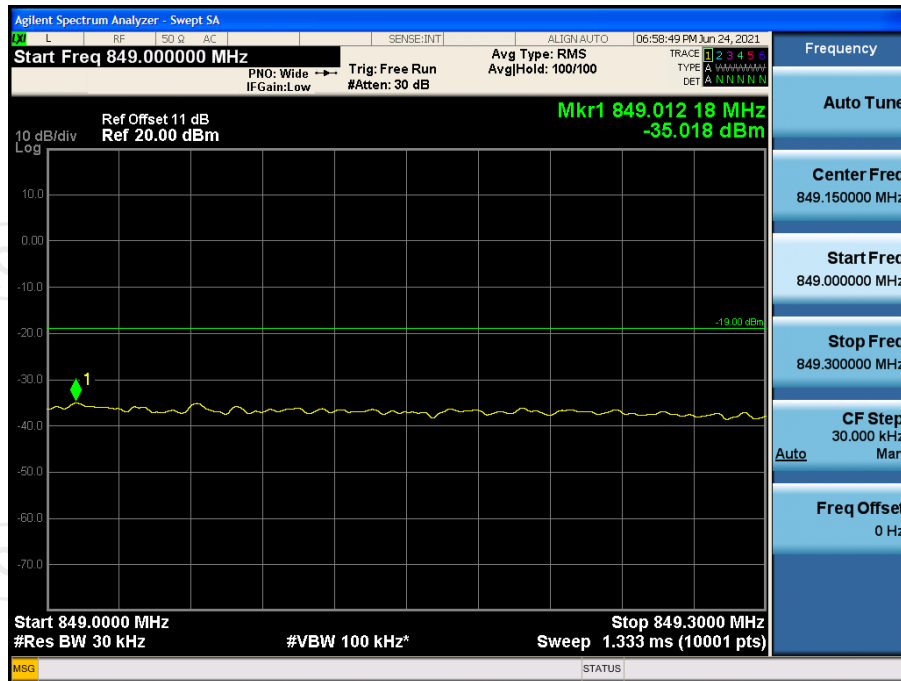
Cellular CDMA UL Left Side Pre AGC



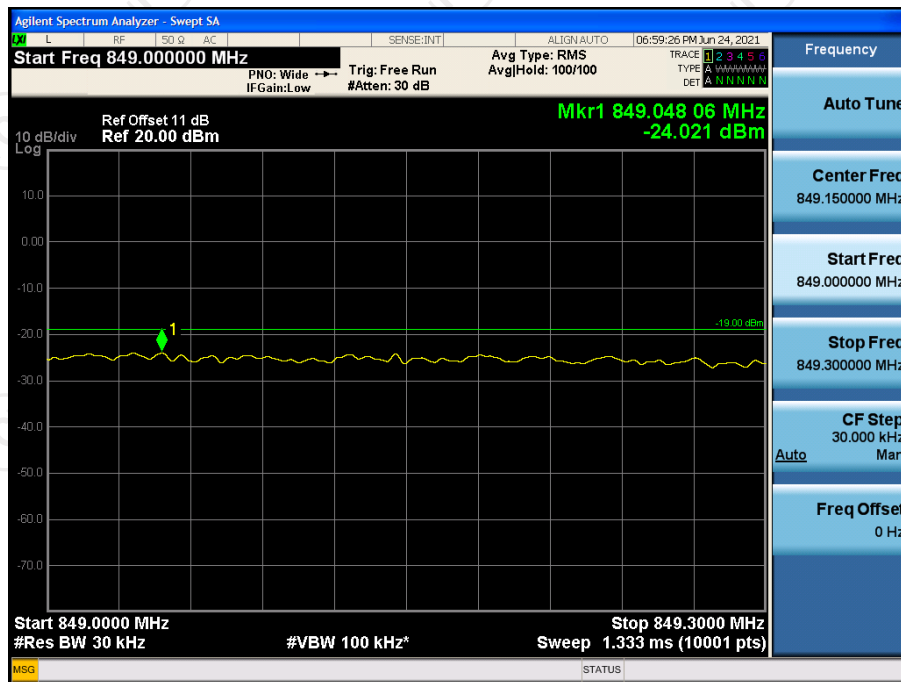
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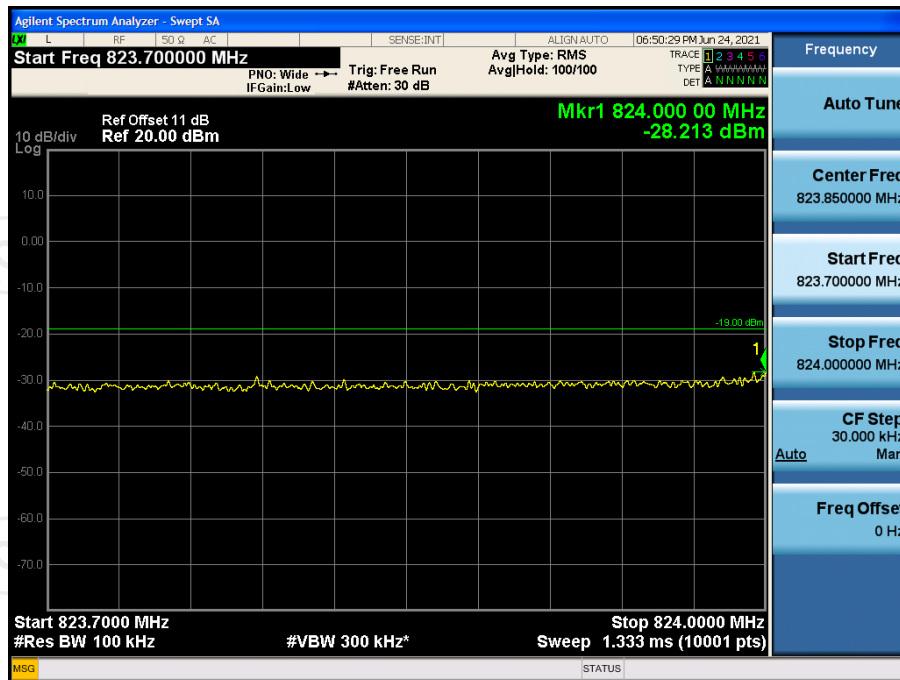
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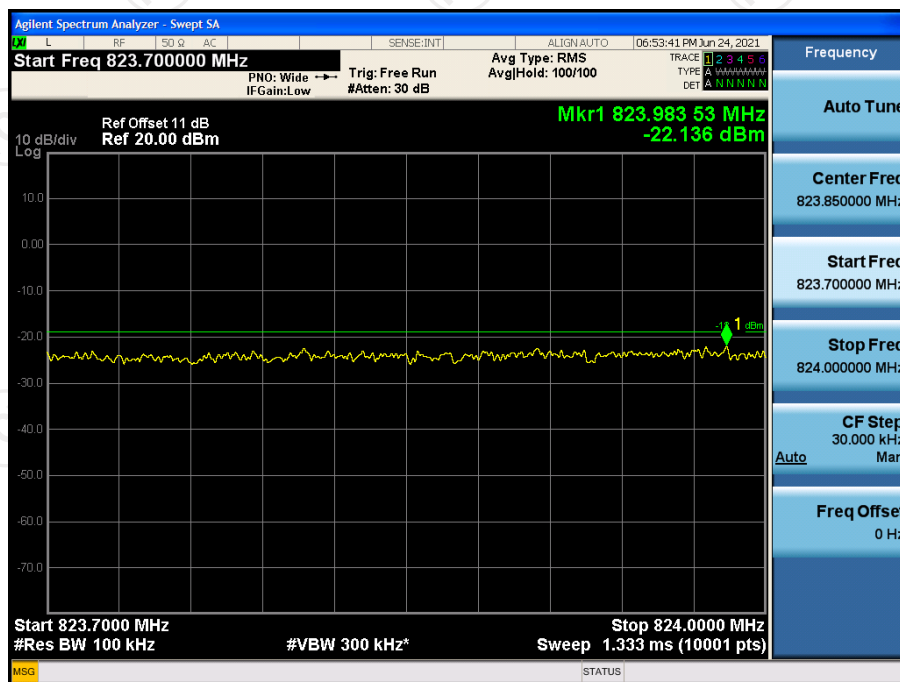
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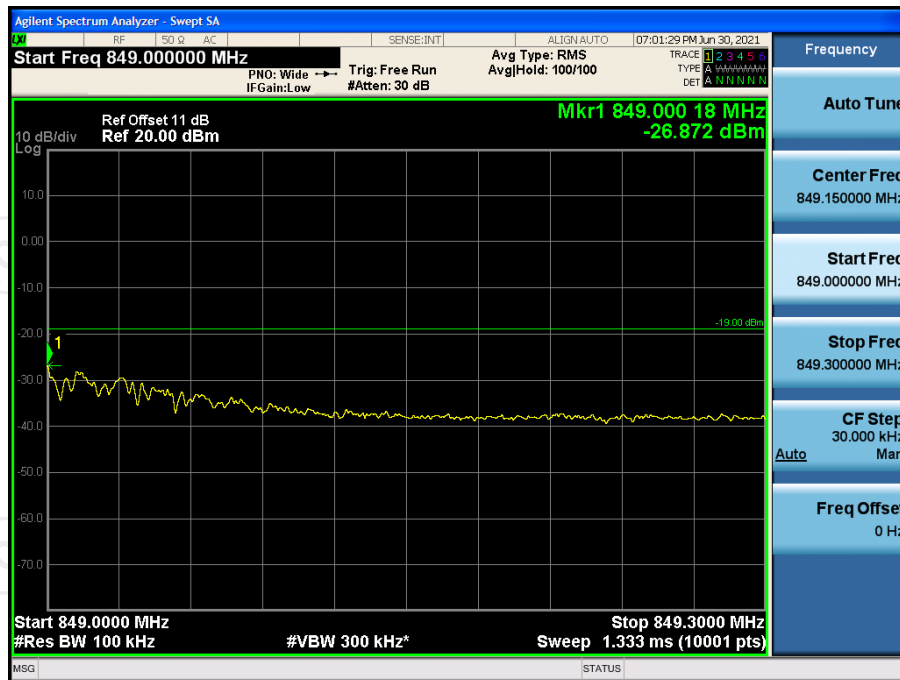
Cellular LTE UL Left Side Pre AGC



Cellular LTE UL Left Side Pre AGC+10dB



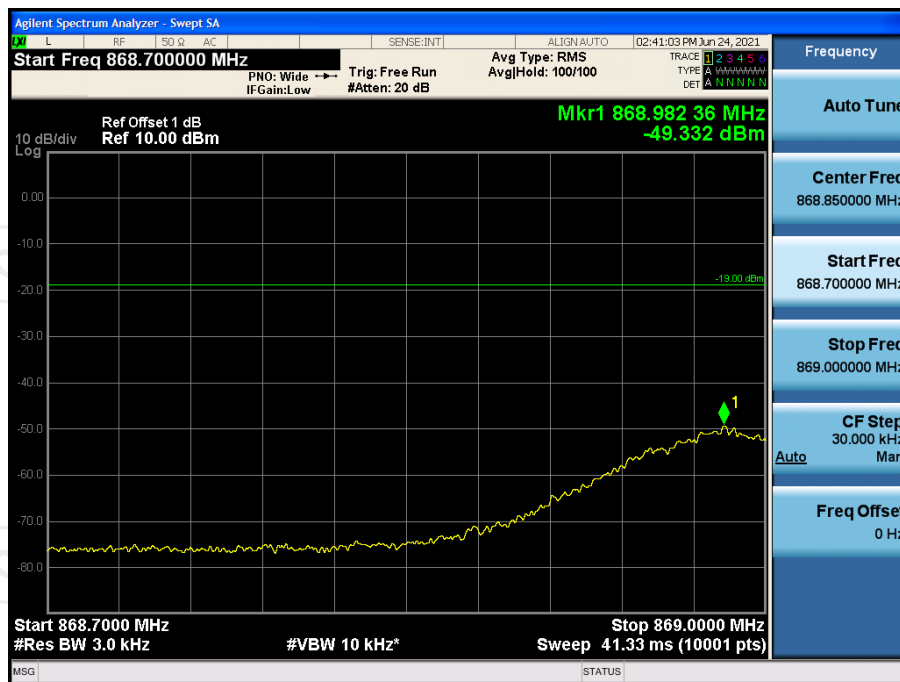
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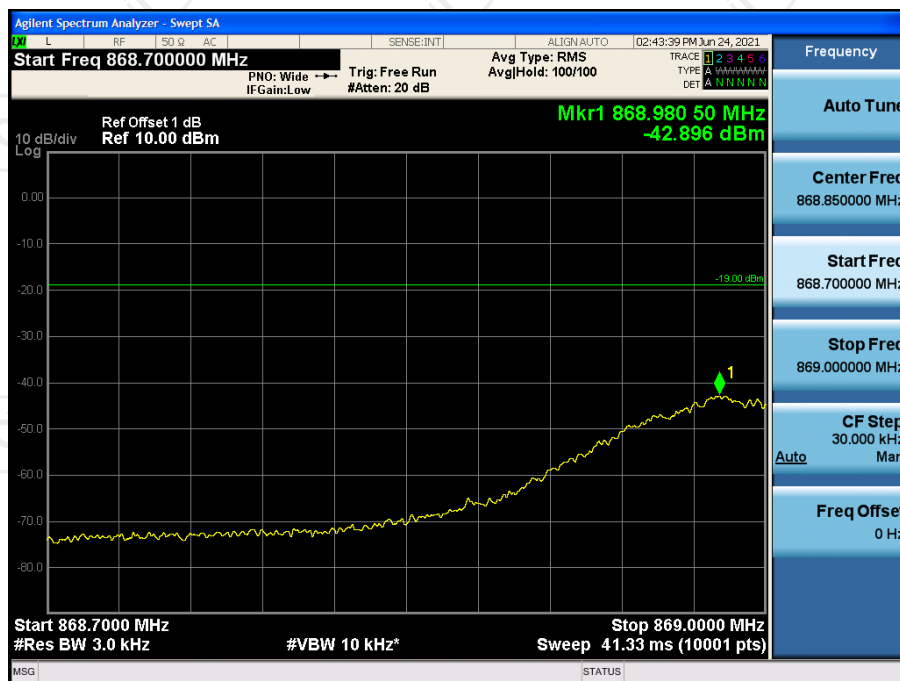
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Cellular GSM DL Left Side Pre AGC



Cellular GSM DL Left Side Pre AGC+10dB



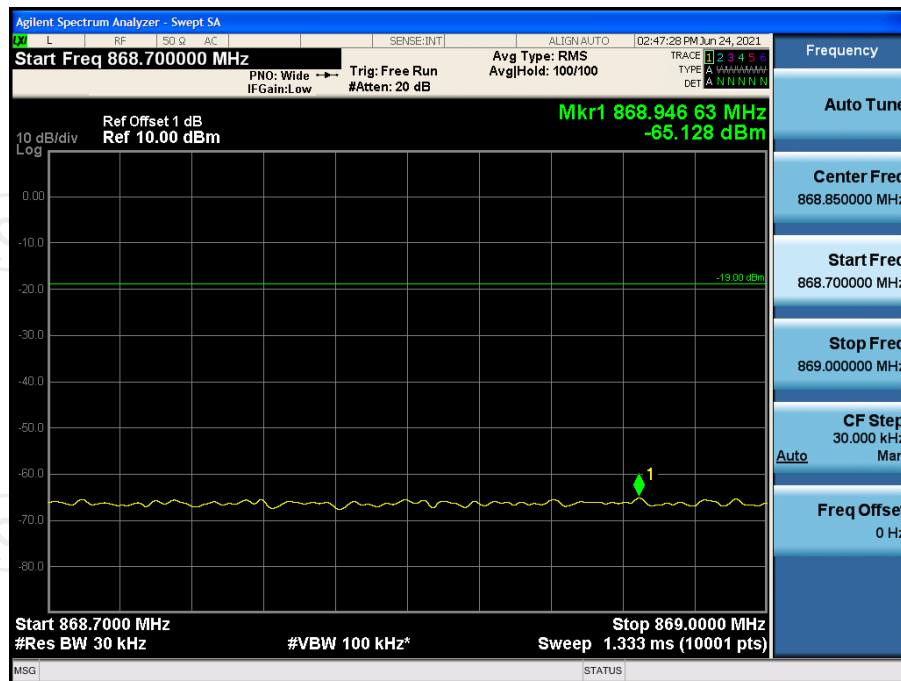
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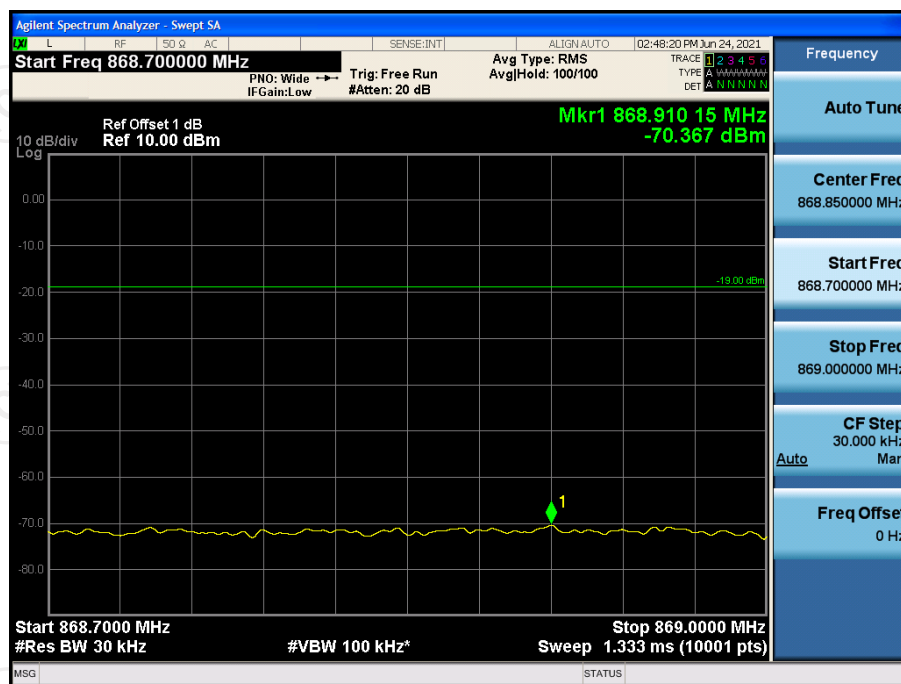
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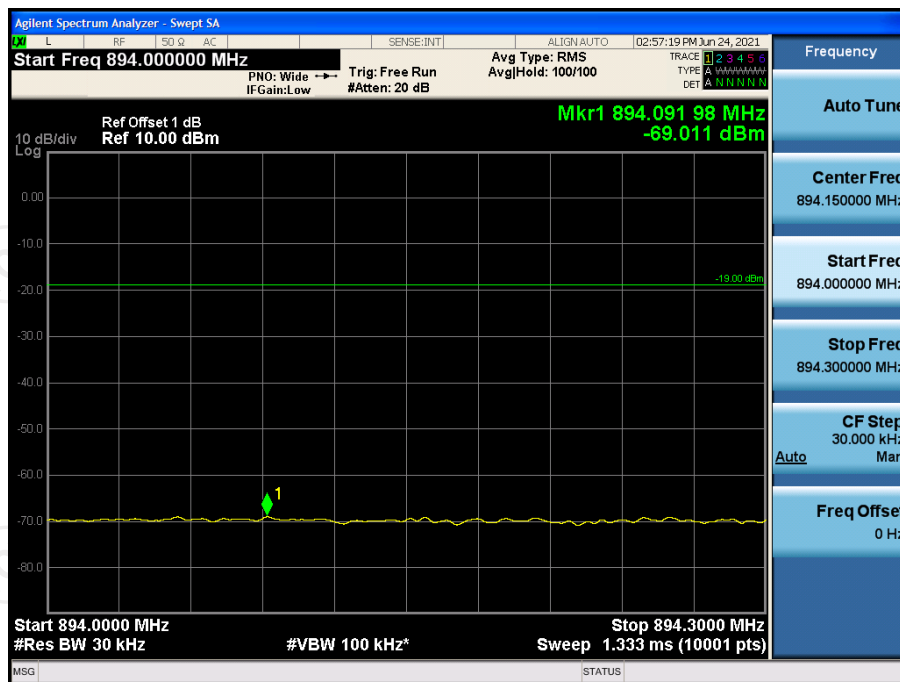
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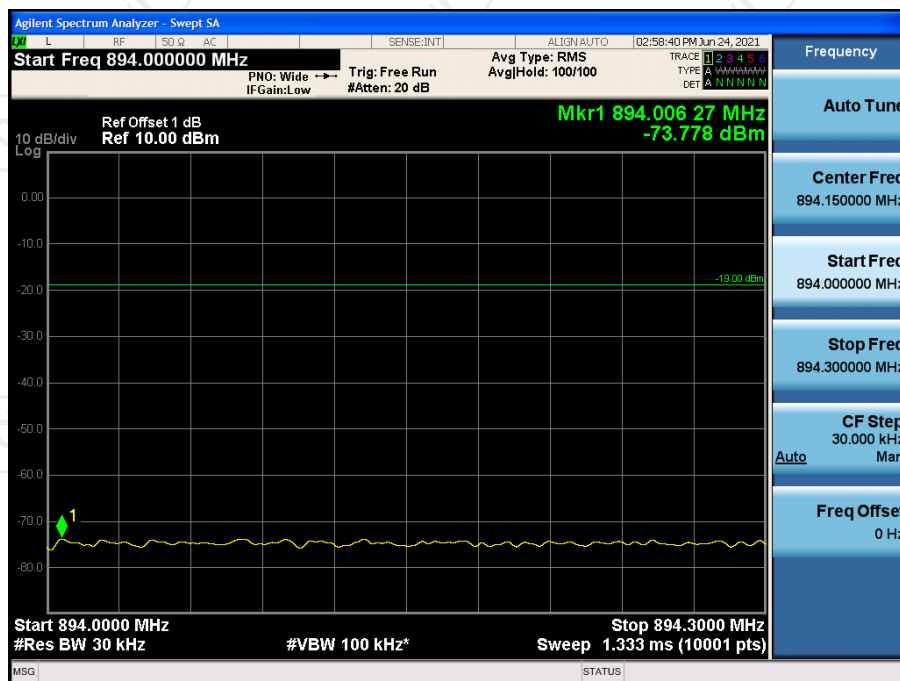
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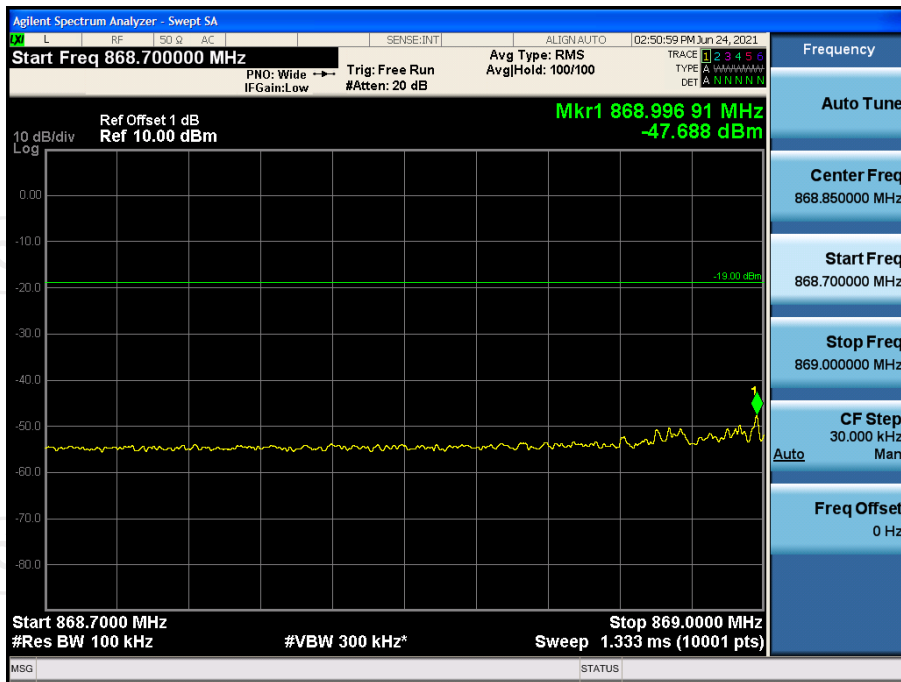
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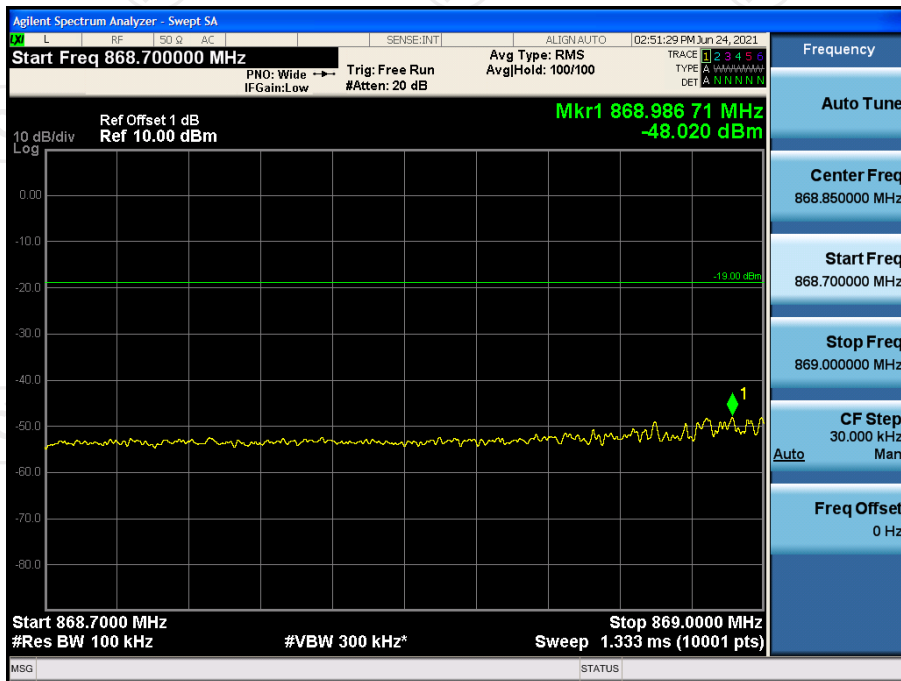
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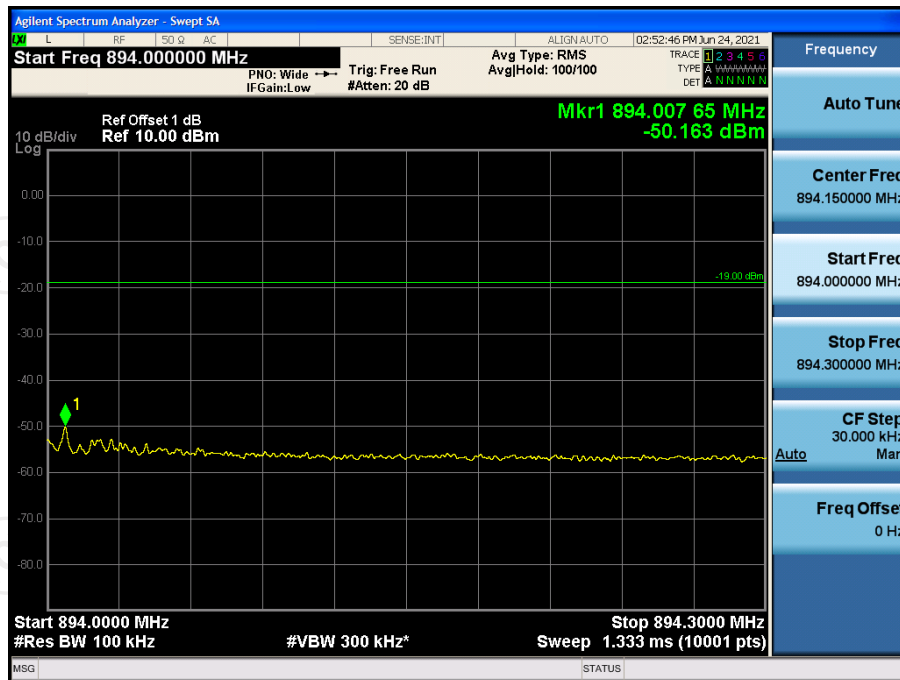
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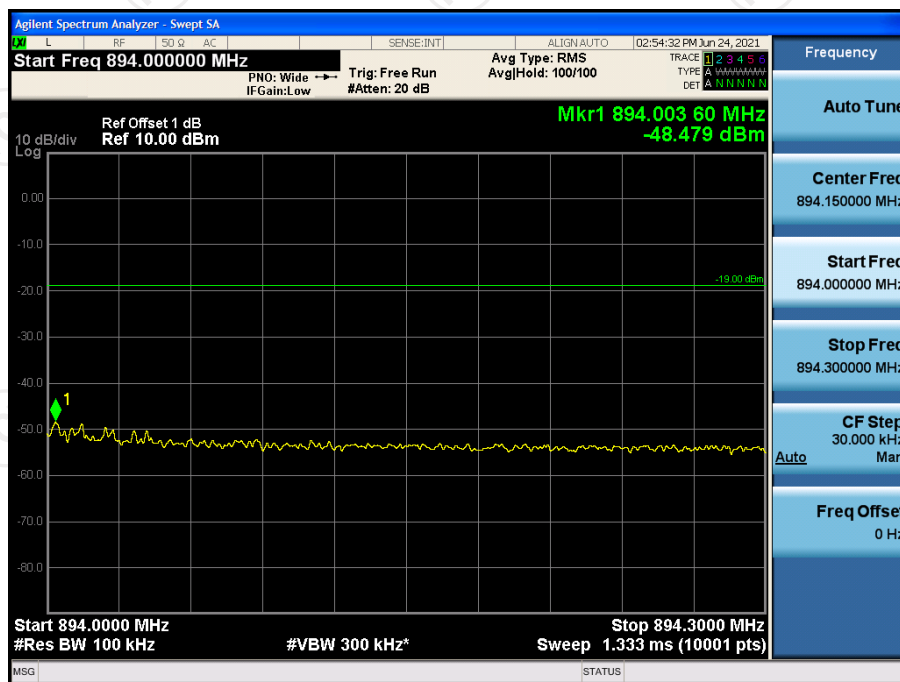
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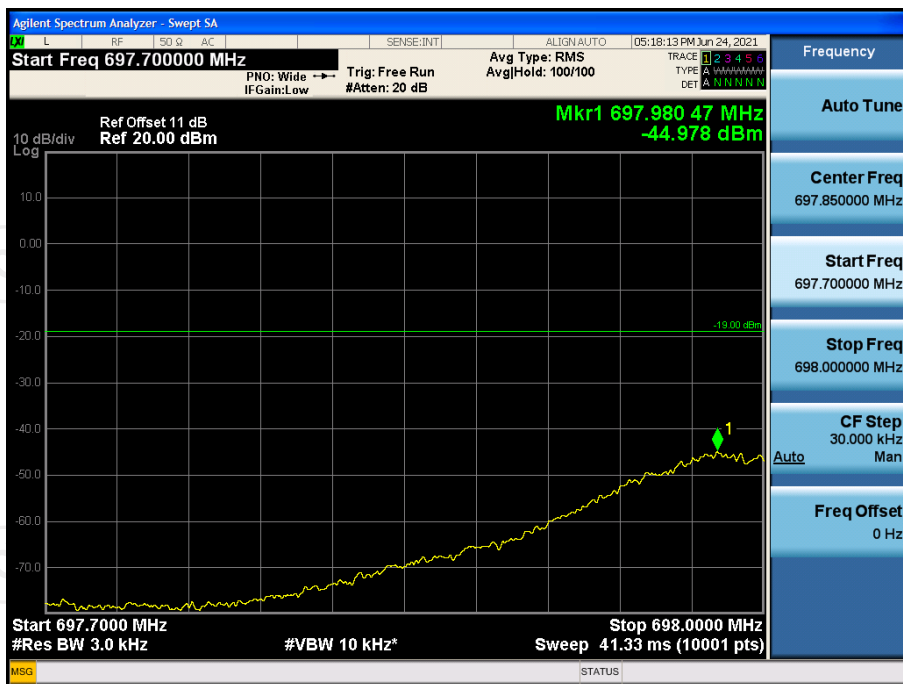
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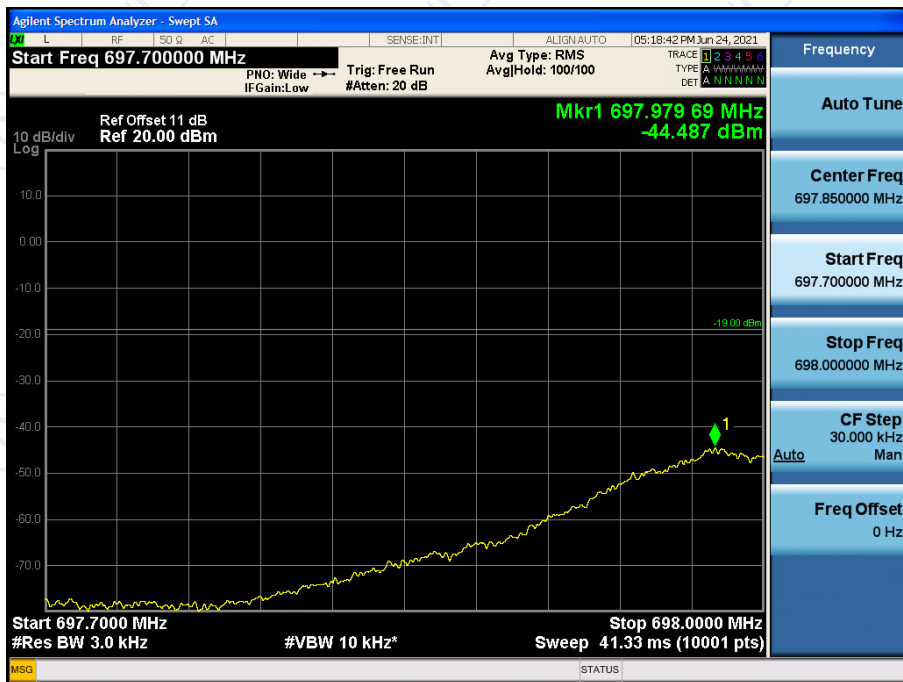
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Lower700MHz GSM UL Left Side Pre AGC



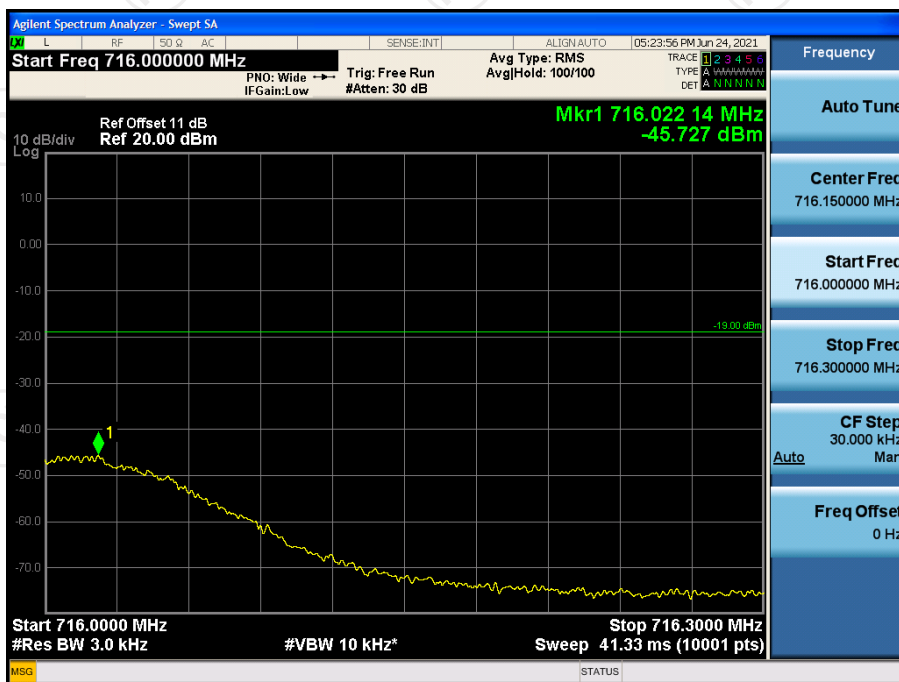
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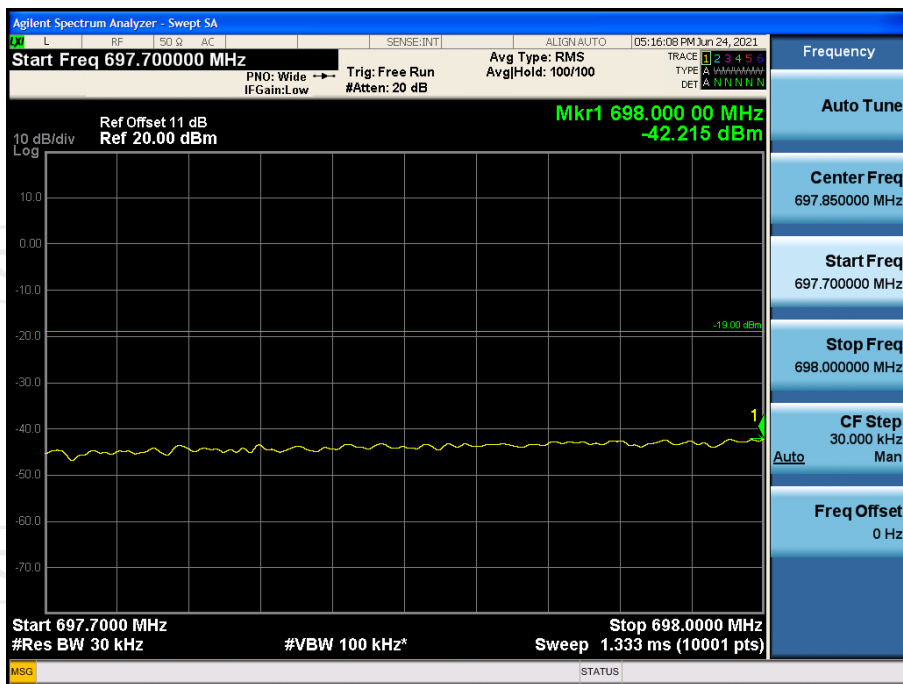
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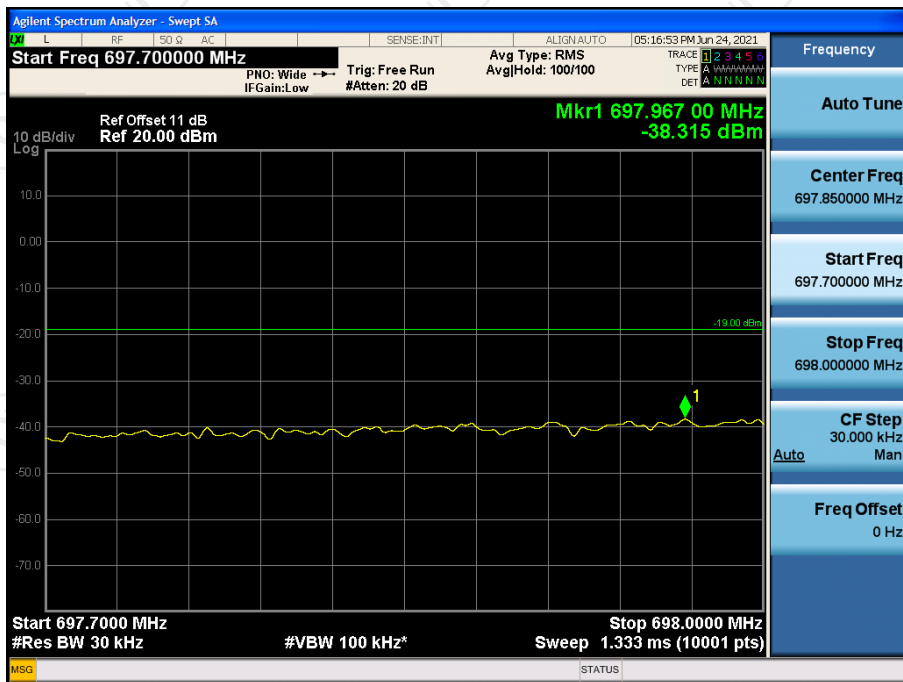
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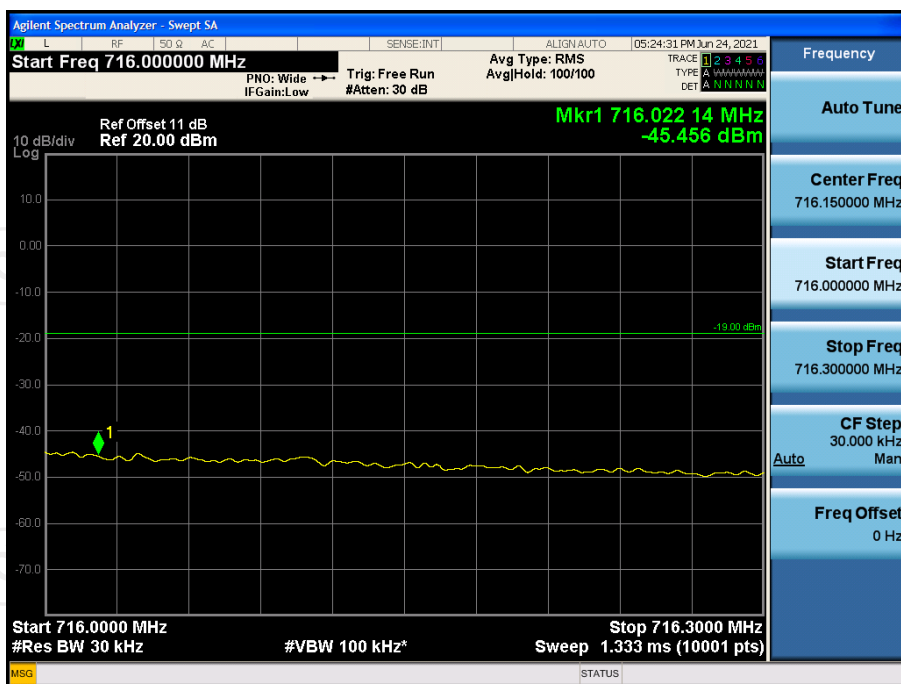
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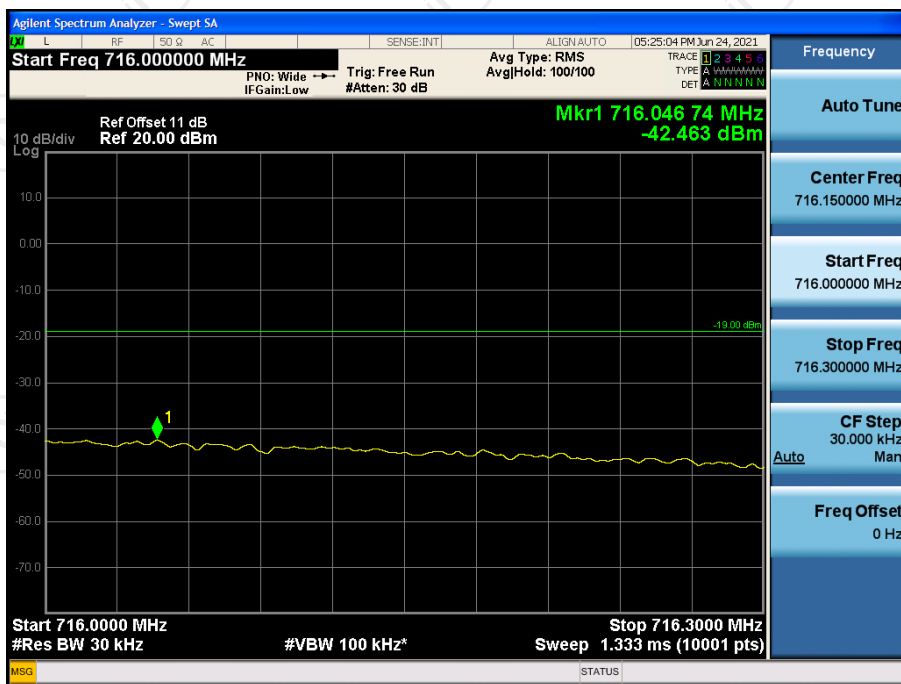
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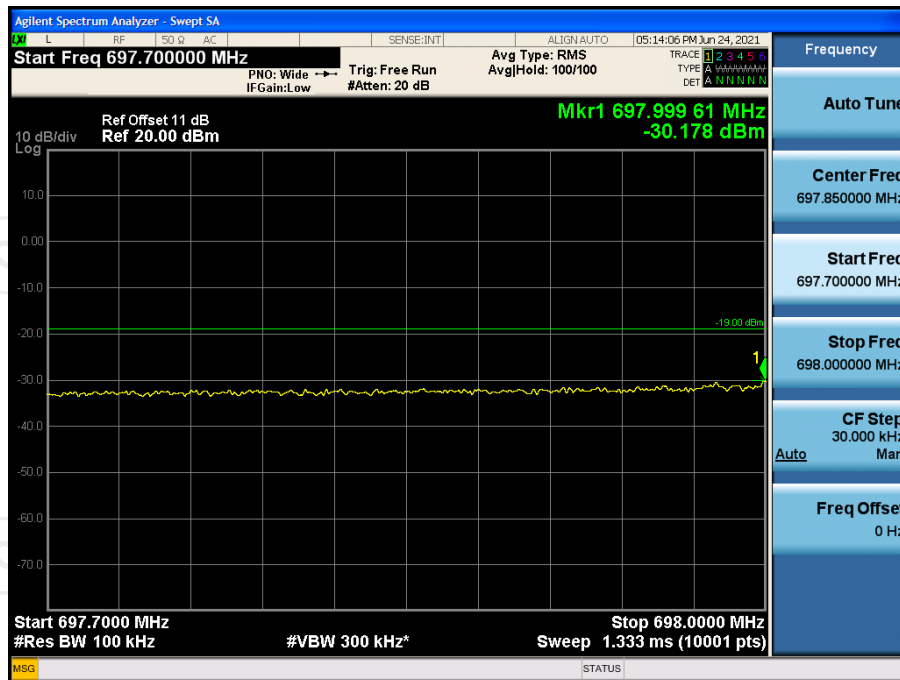
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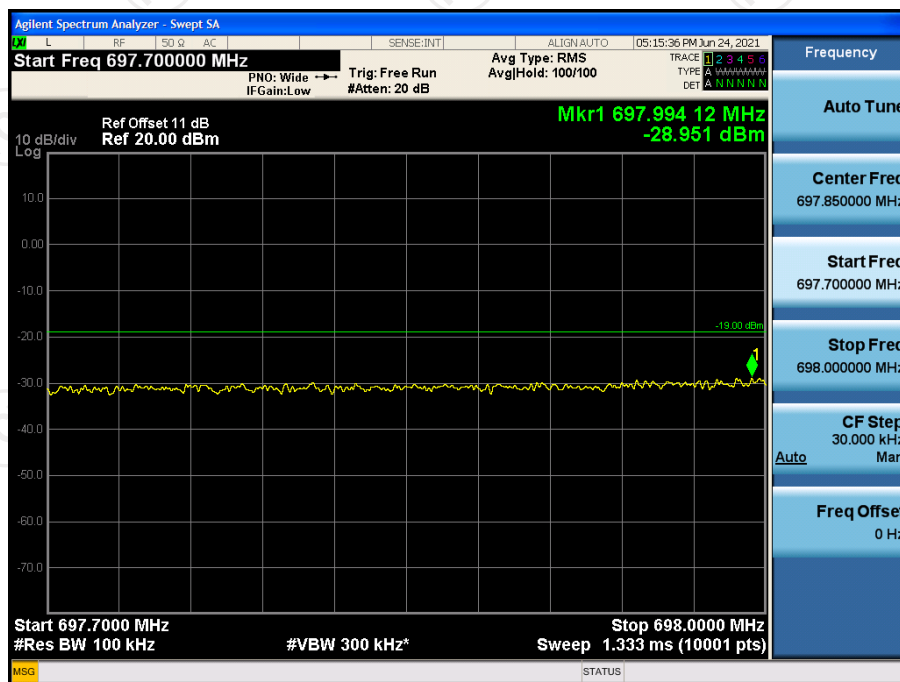
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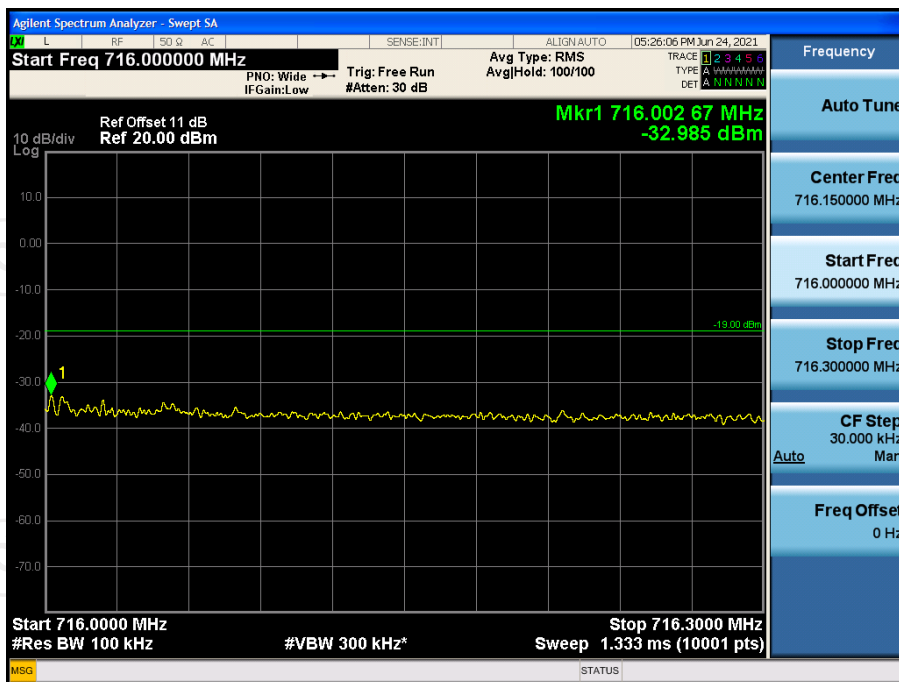
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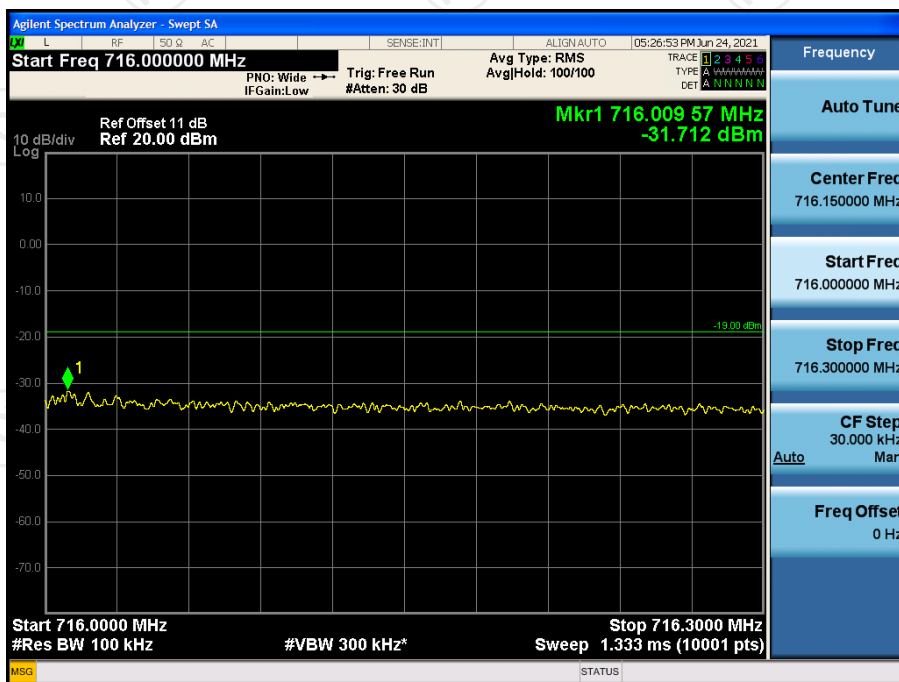
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Lower700MHz LTE UL Right Side Pre AGC



Lower700MHz LTE UL Right Side Pre AGC+10dB



Lower700MHz GSM DL Left Side Pre AGC



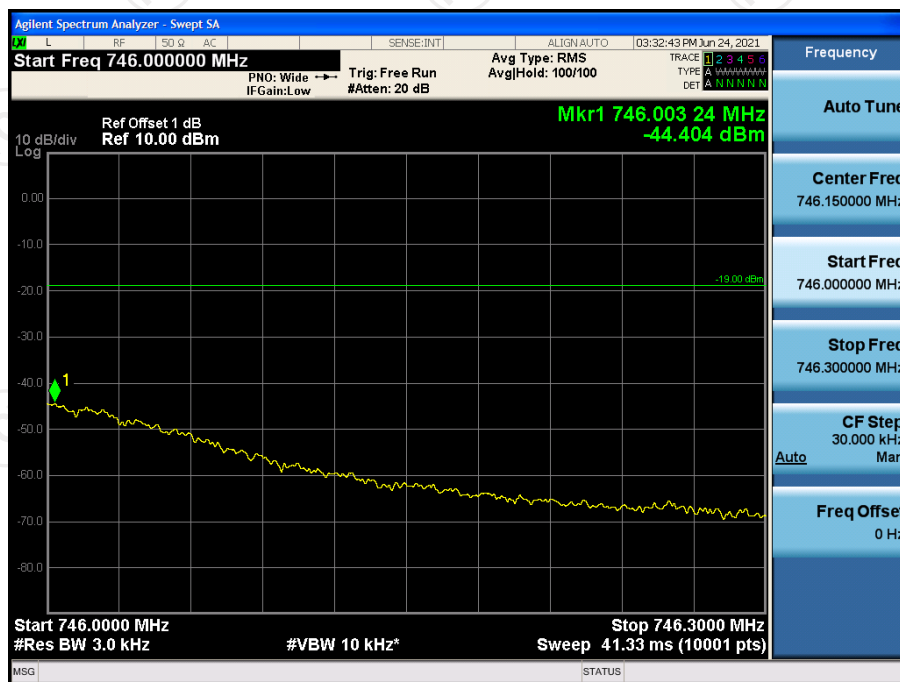
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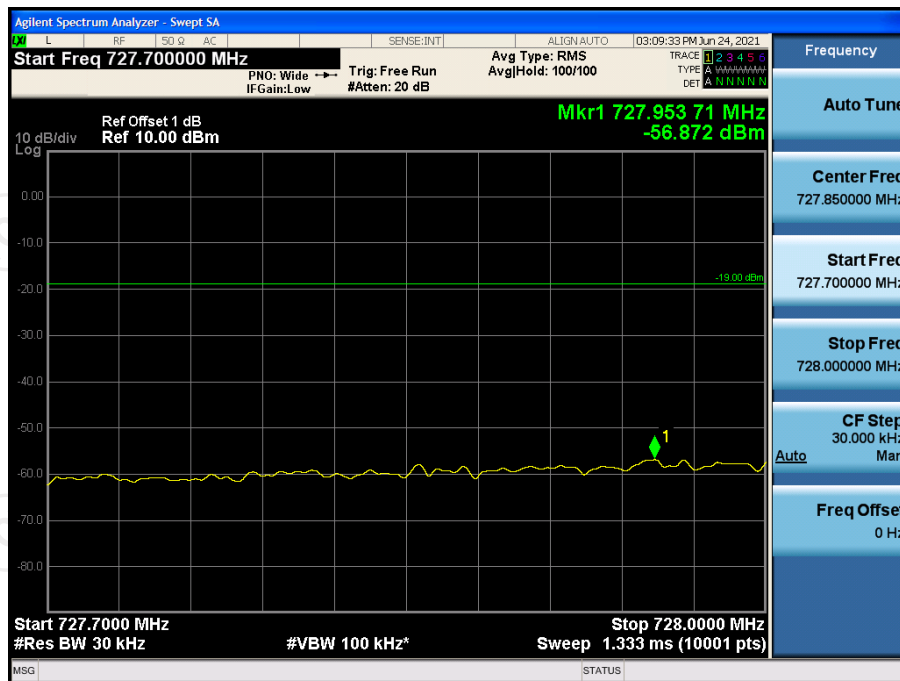
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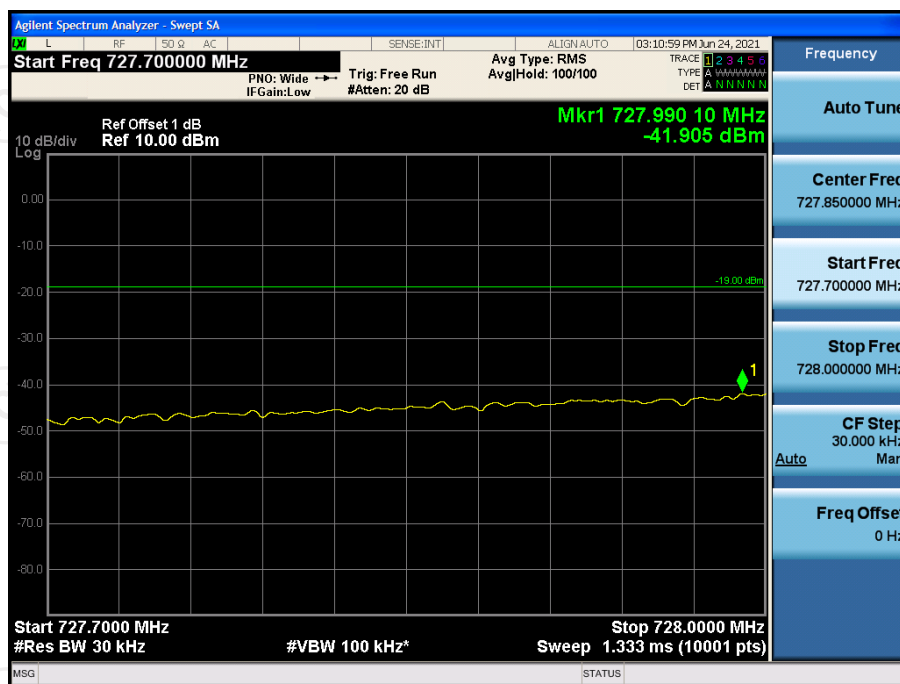
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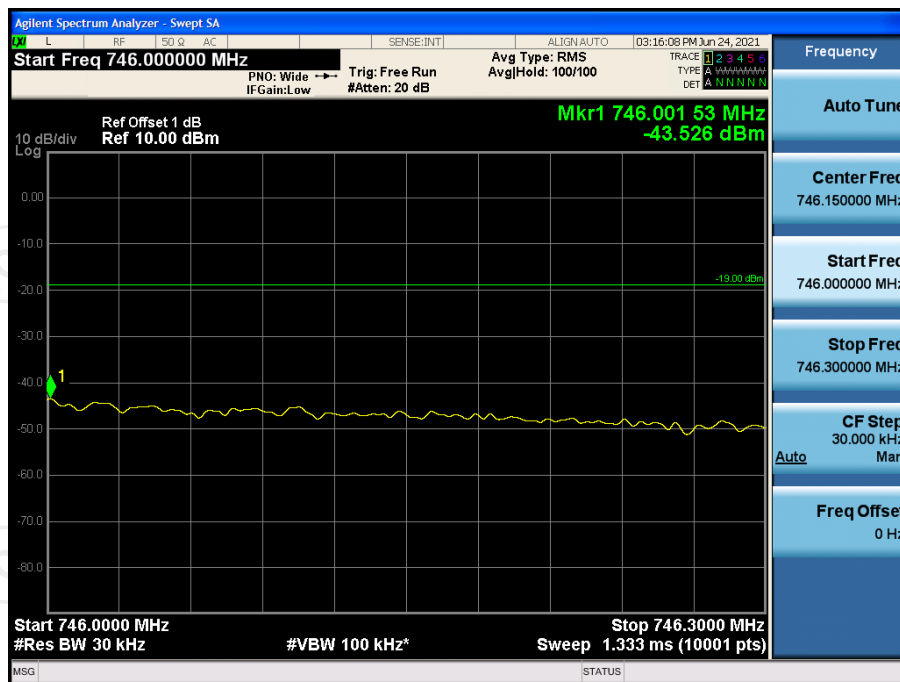
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Lower700MHz CDMA DL Left Side Pre AGC+10dB



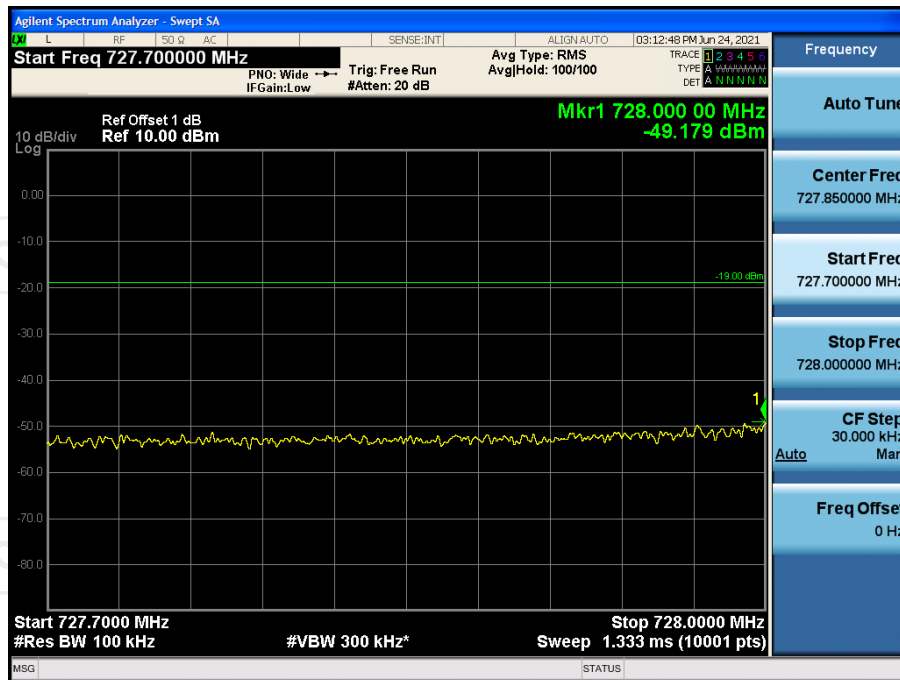
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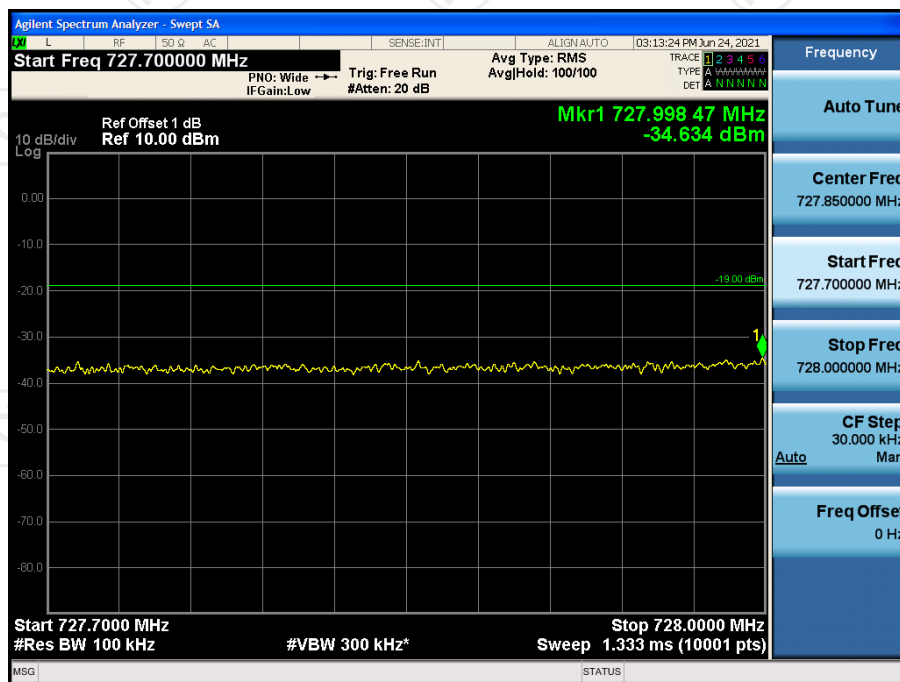
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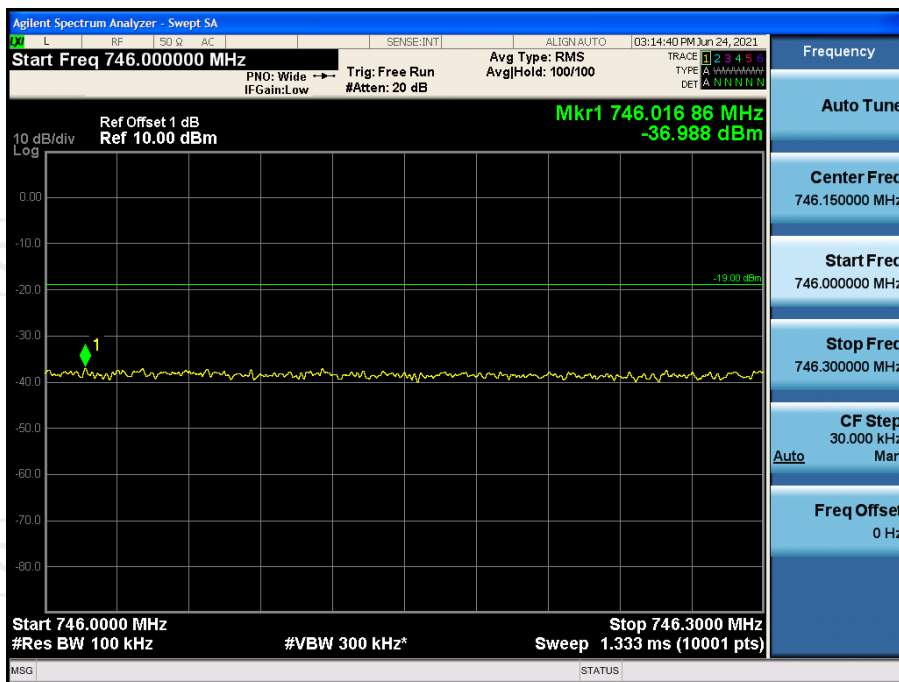
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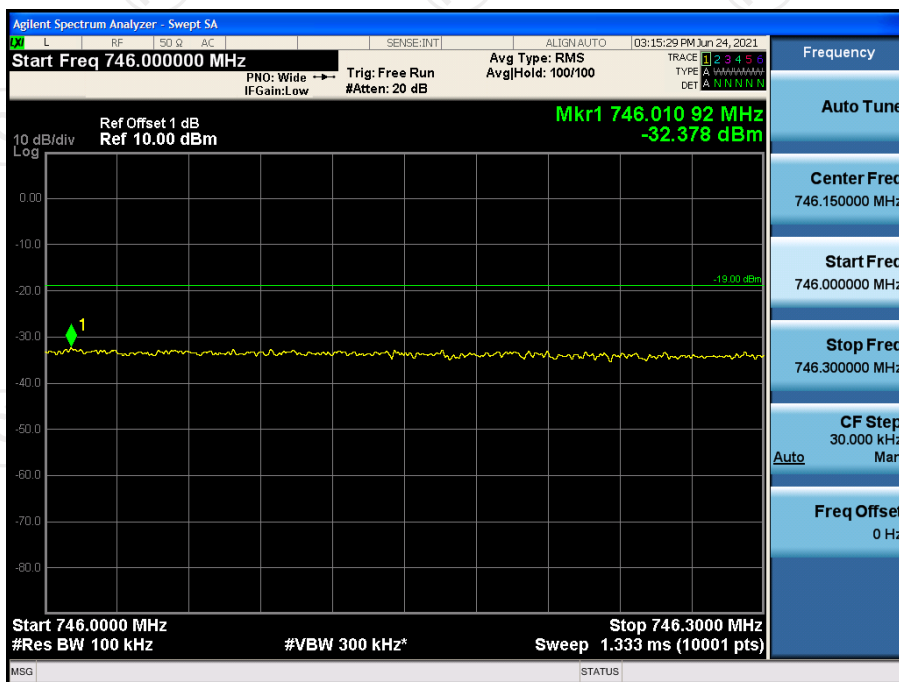
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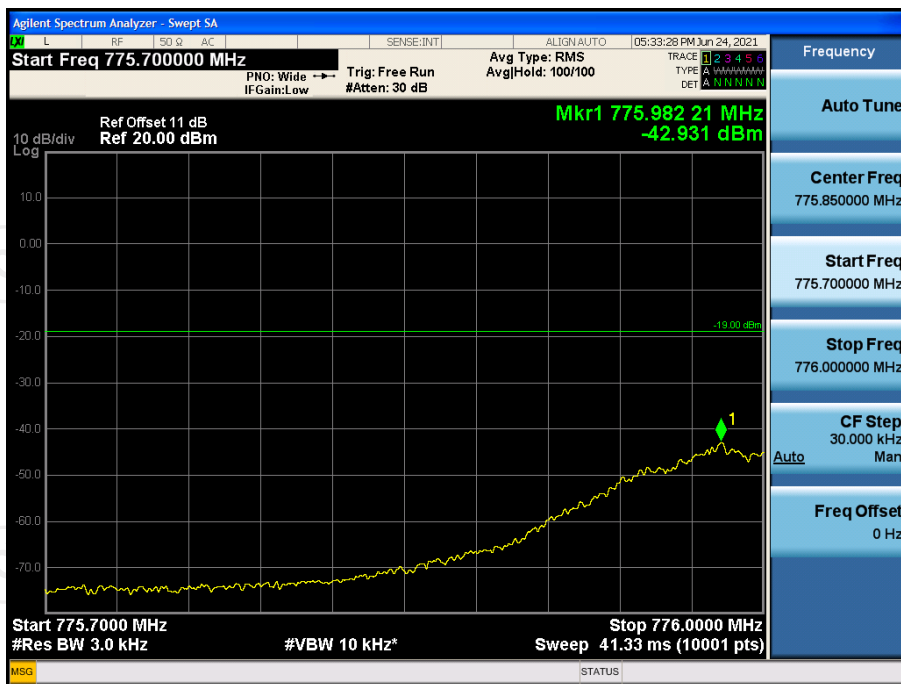
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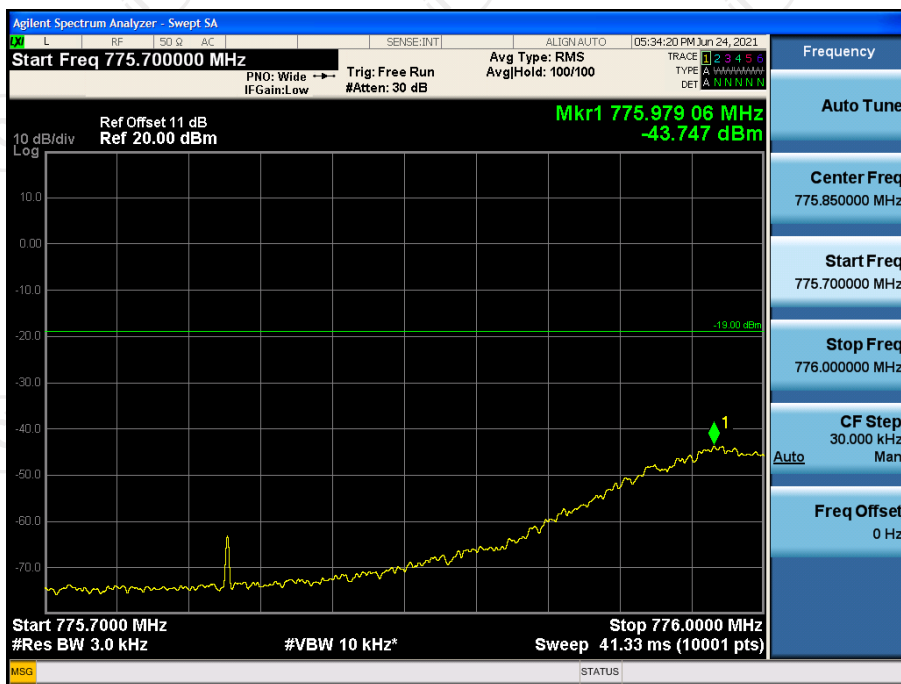
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Upper700MHz GSM UL Left Side Pre AGC



Upper700MHz GSM UL Left Side Pre AGC+10dB



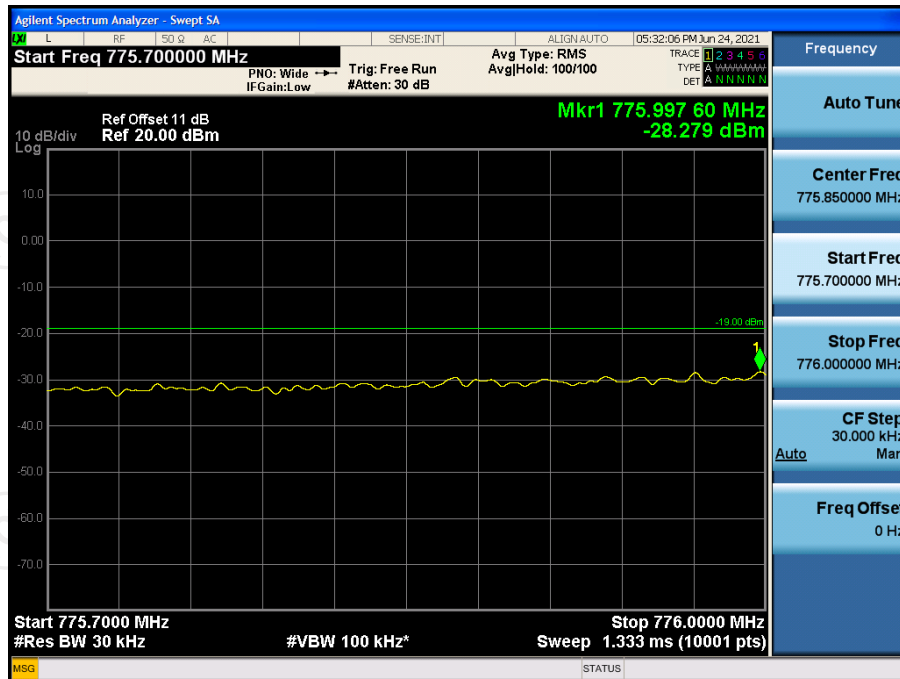
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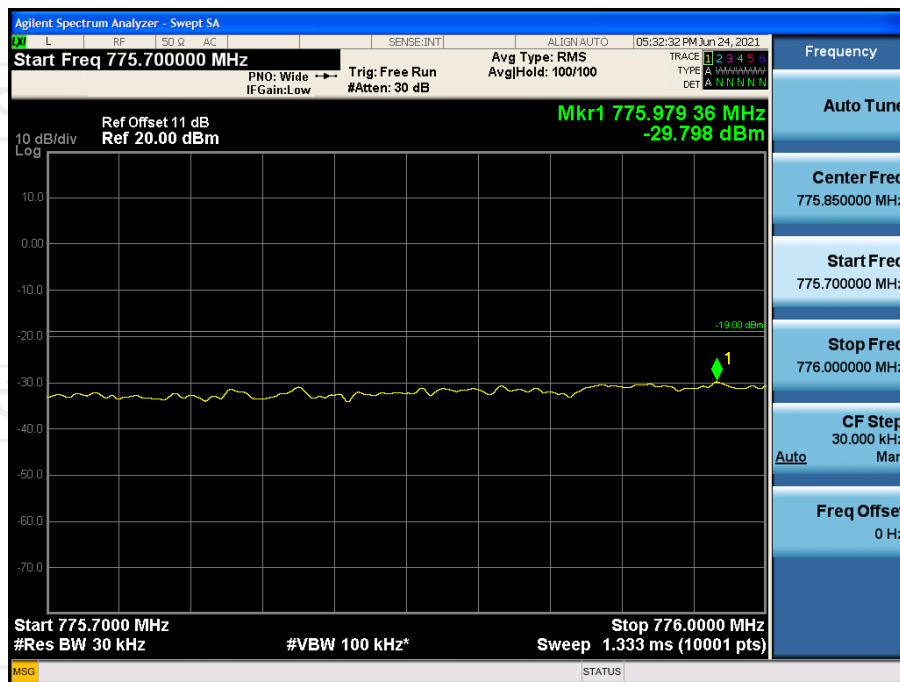
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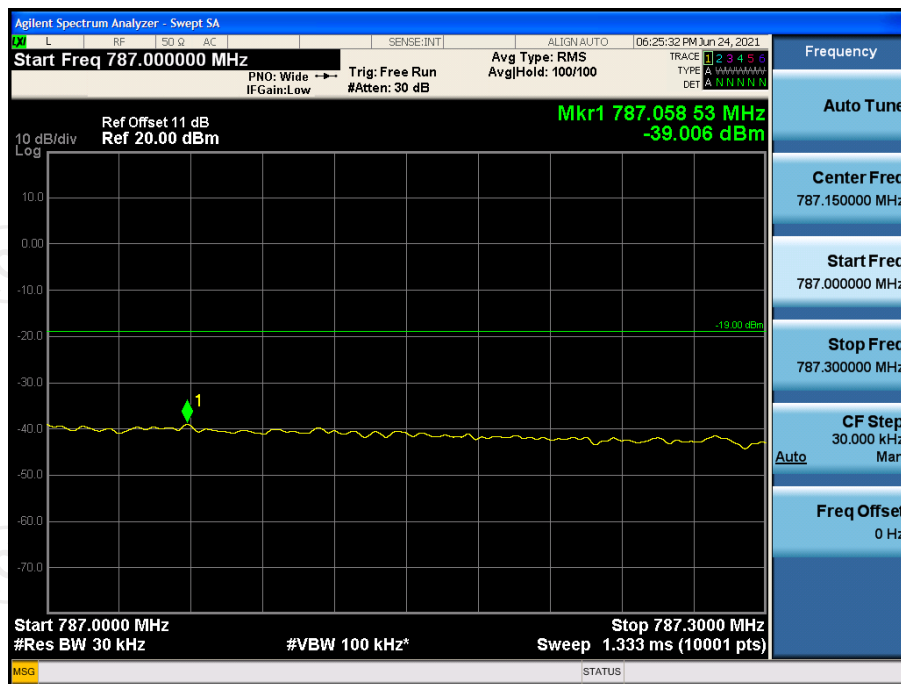
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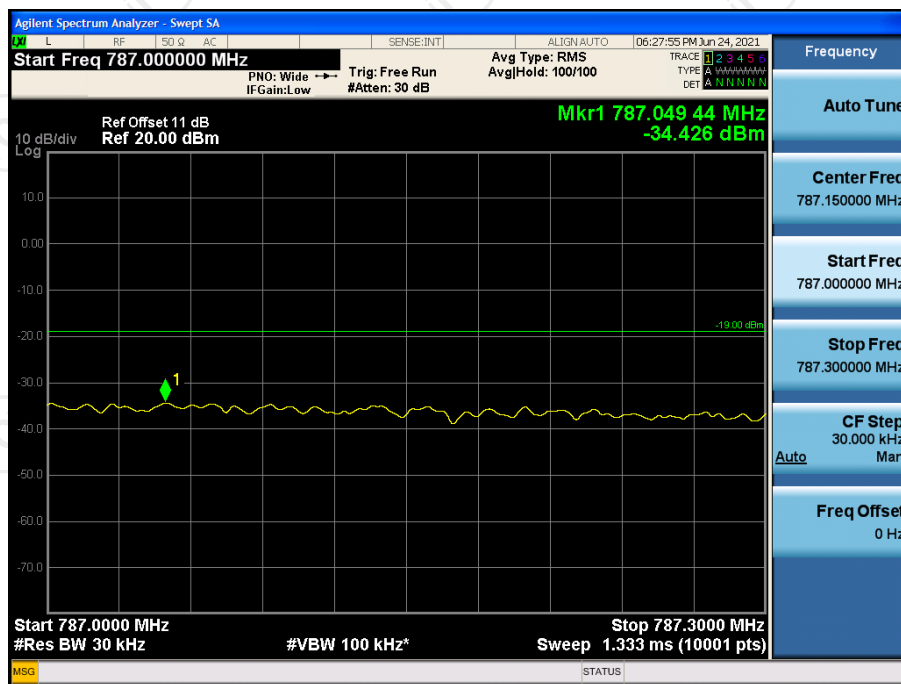
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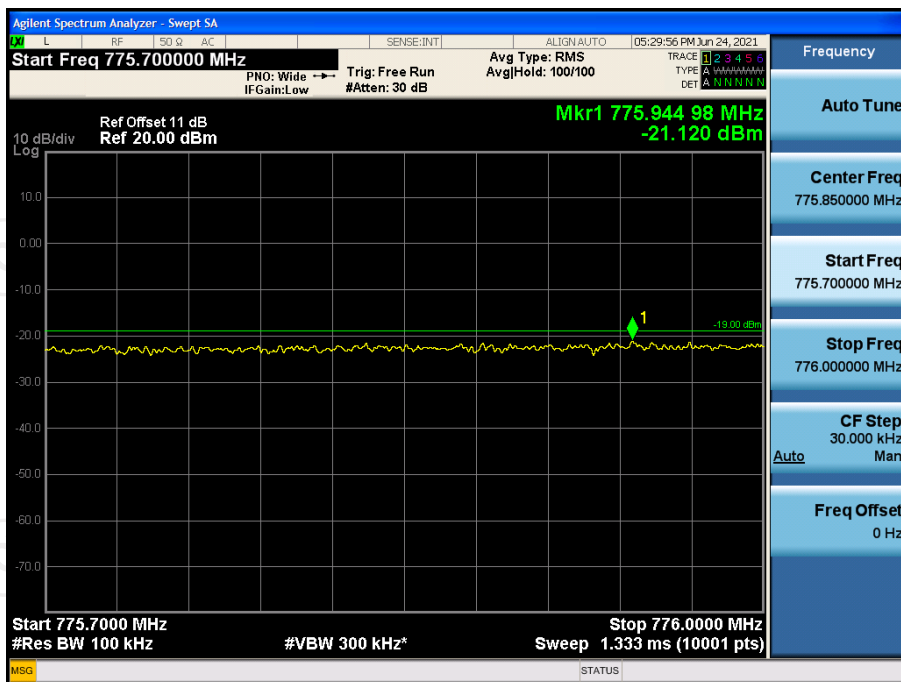
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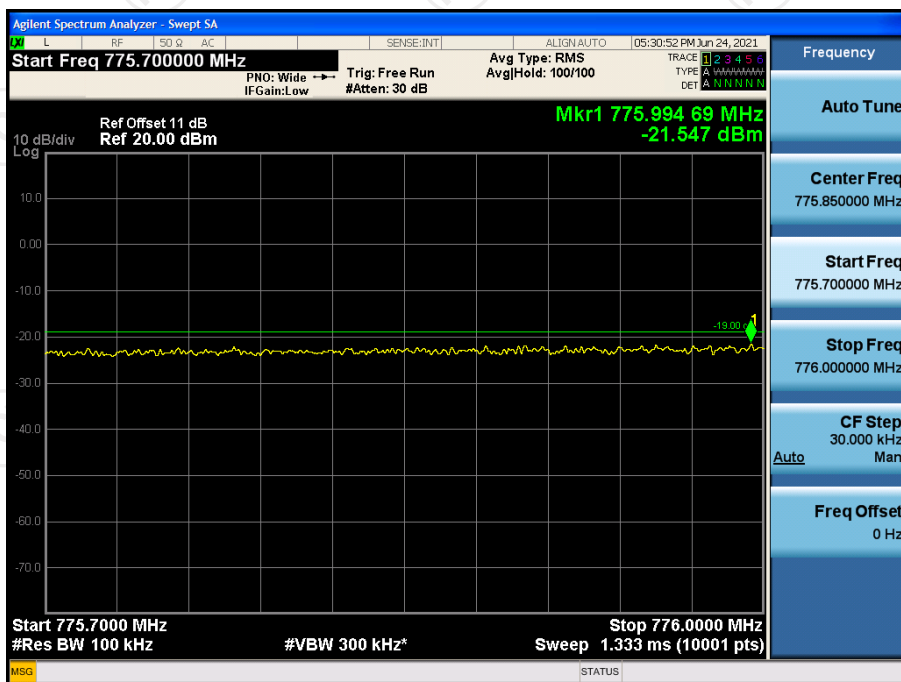
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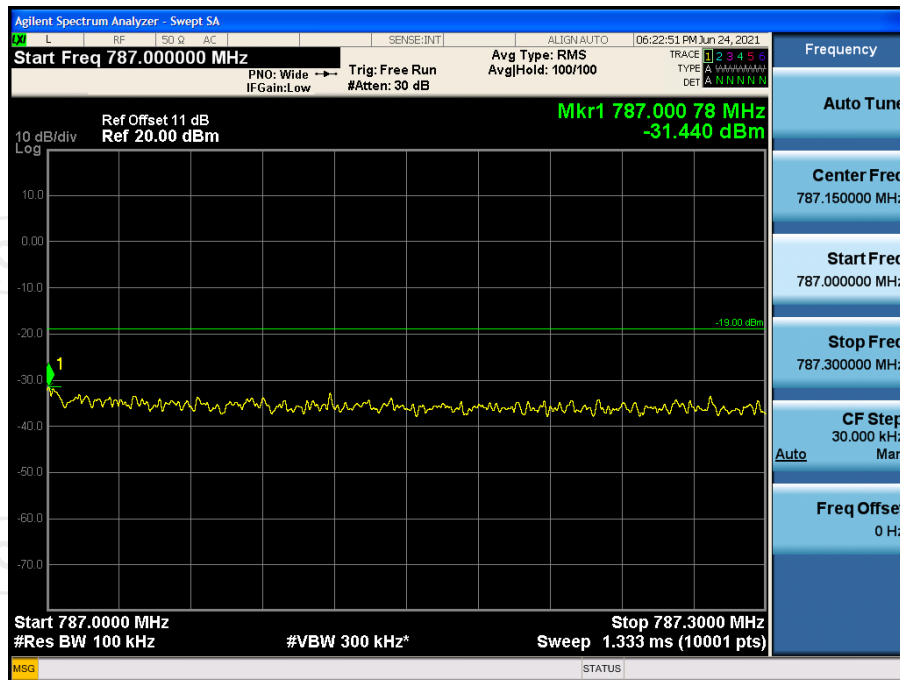
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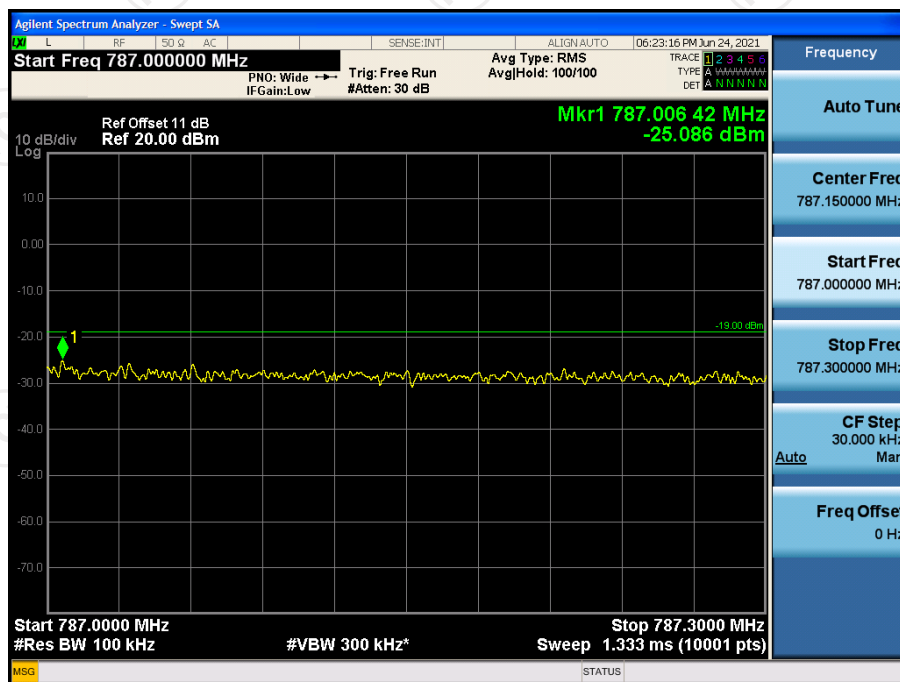
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Upper700MHz LTE UL Right Side Pre AGC



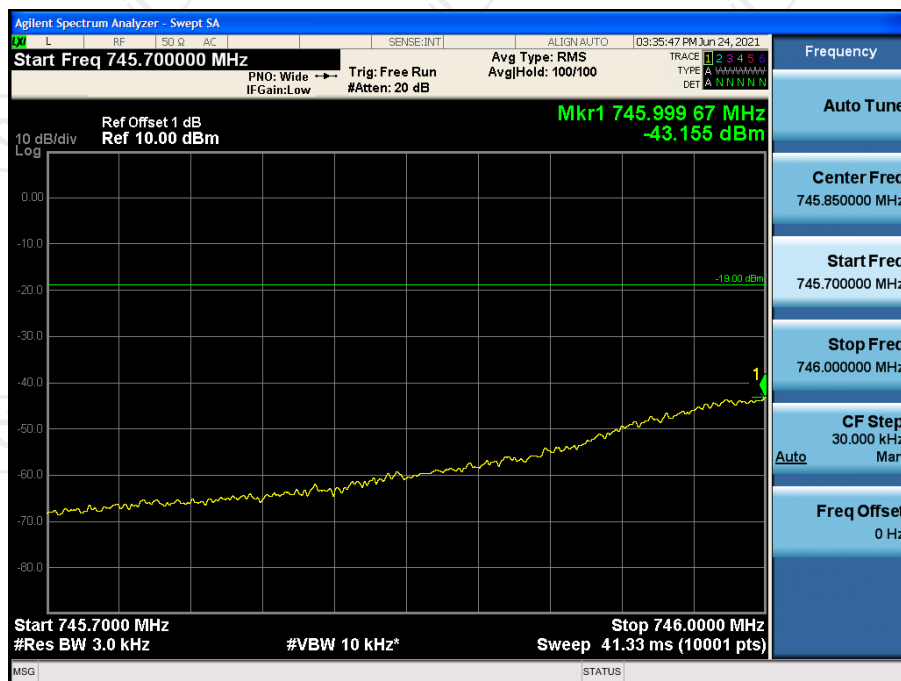
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Upper700MHz GSM DL Left Side Pre AGC



Upper700MHz GSM DL Left Side Pre AGC+10dB



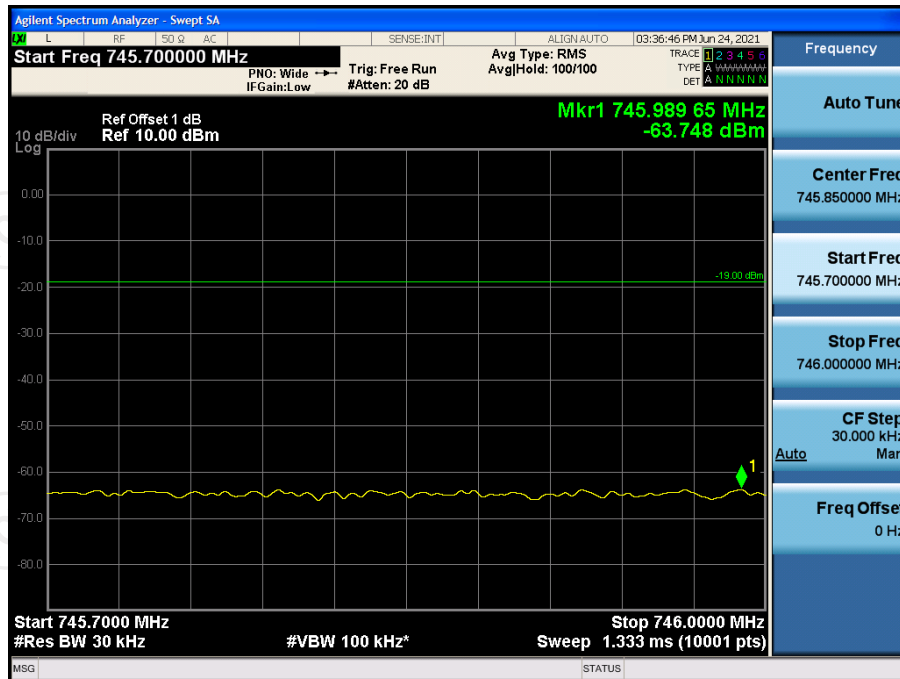
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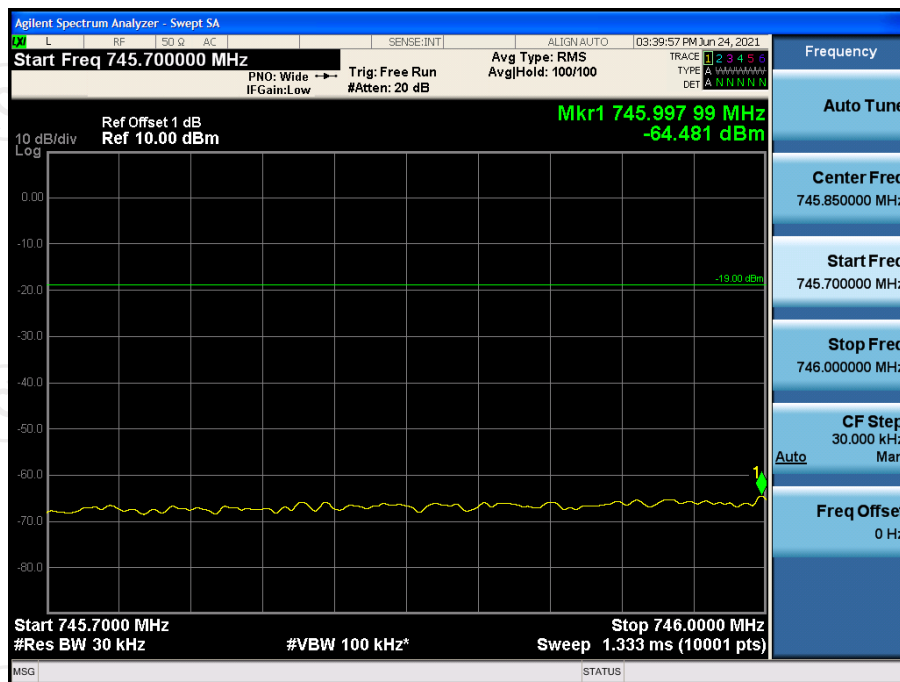
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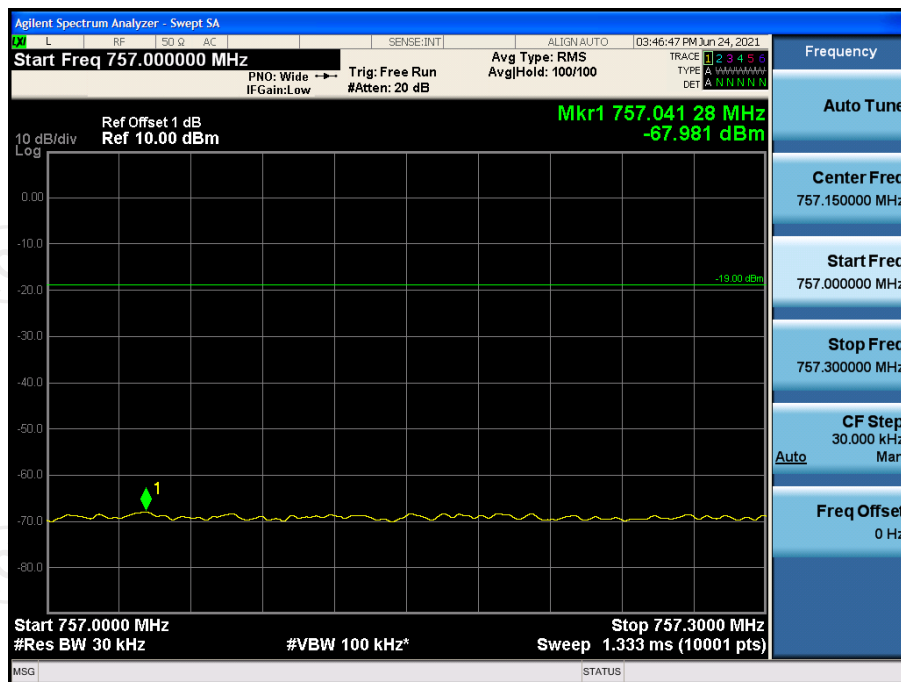
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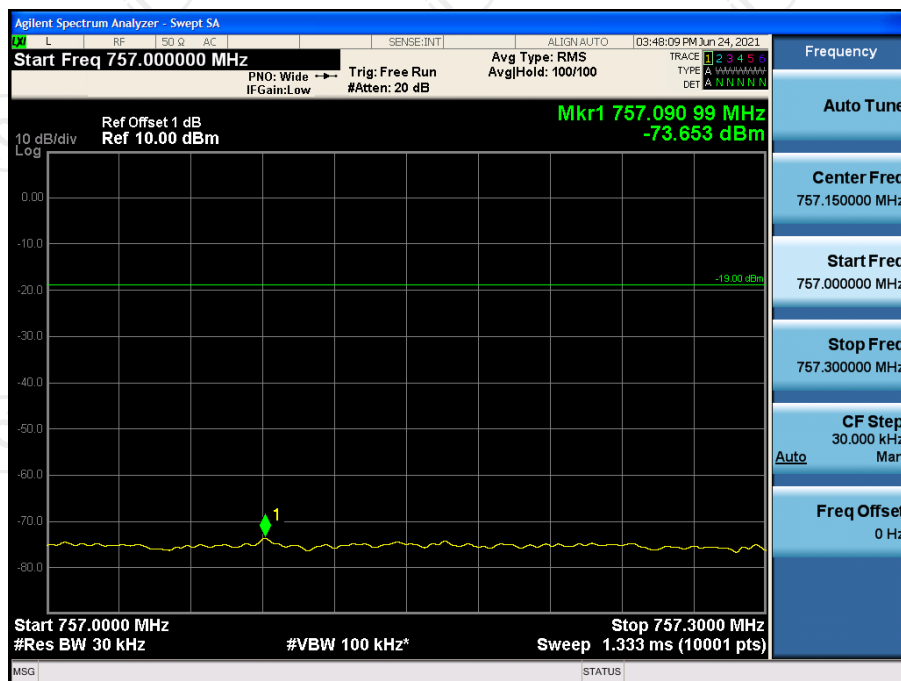
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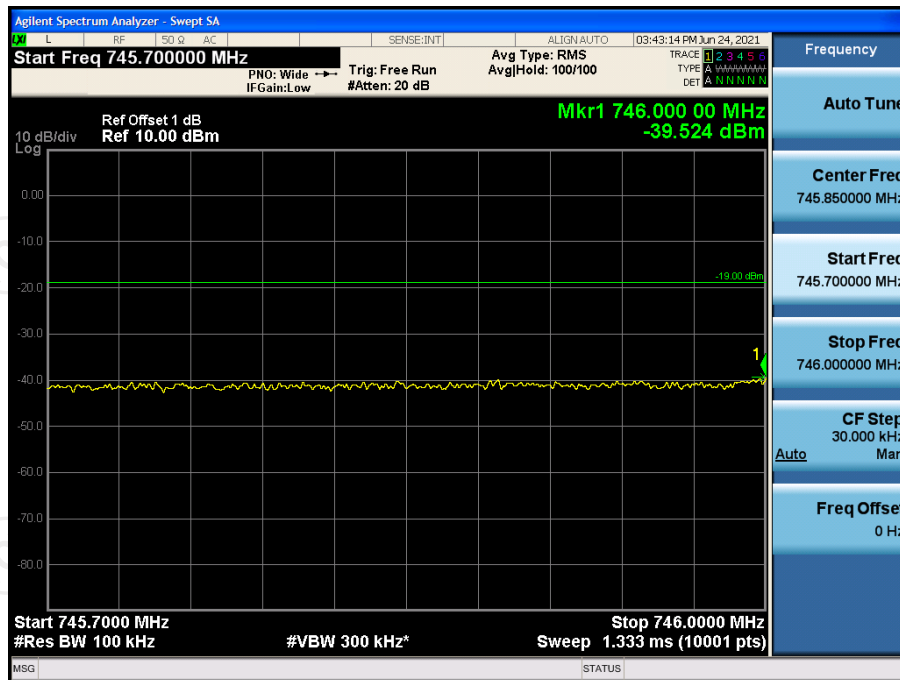
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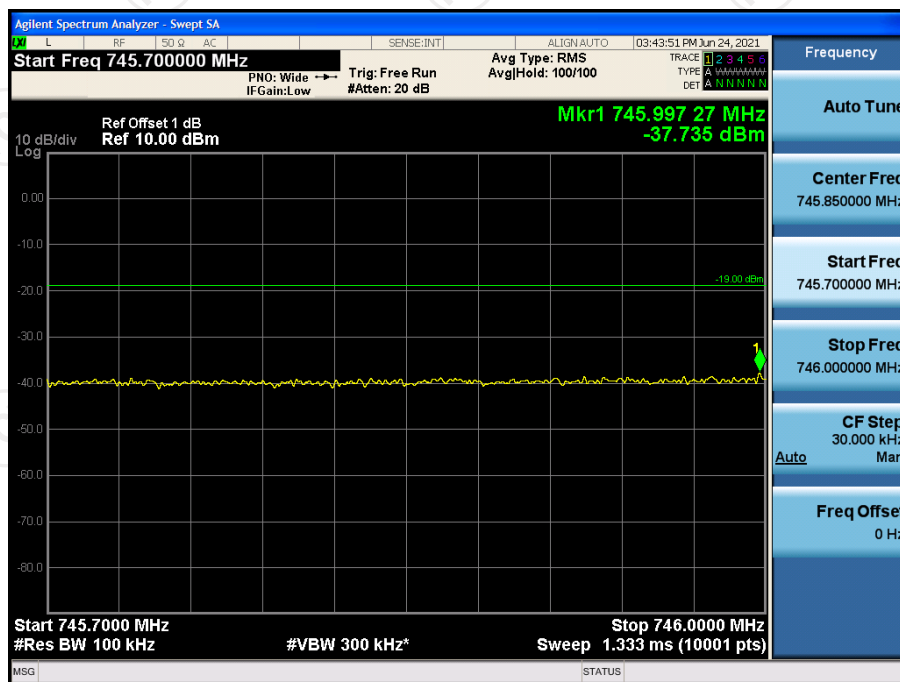
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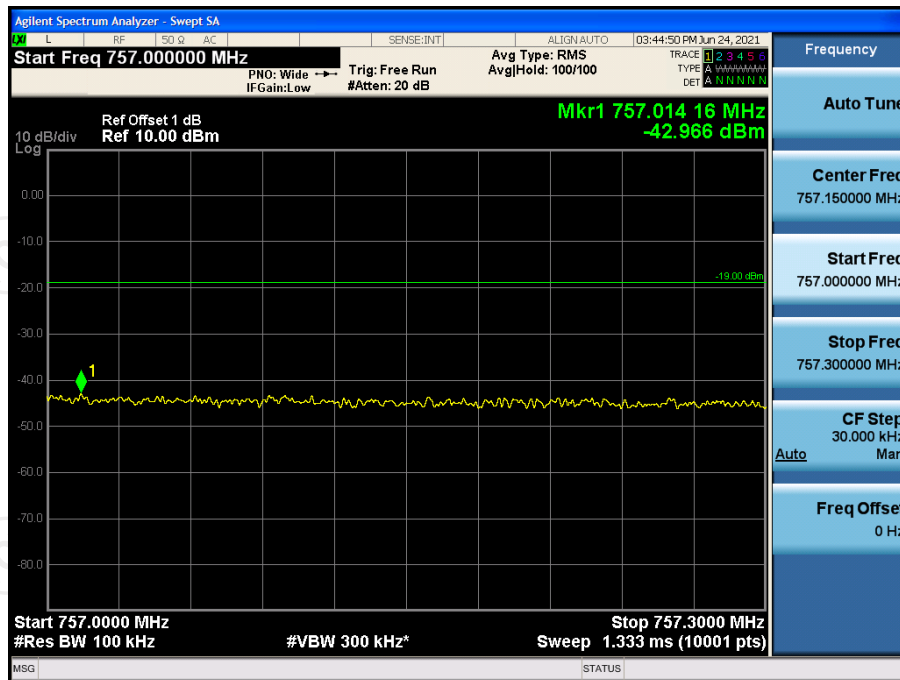
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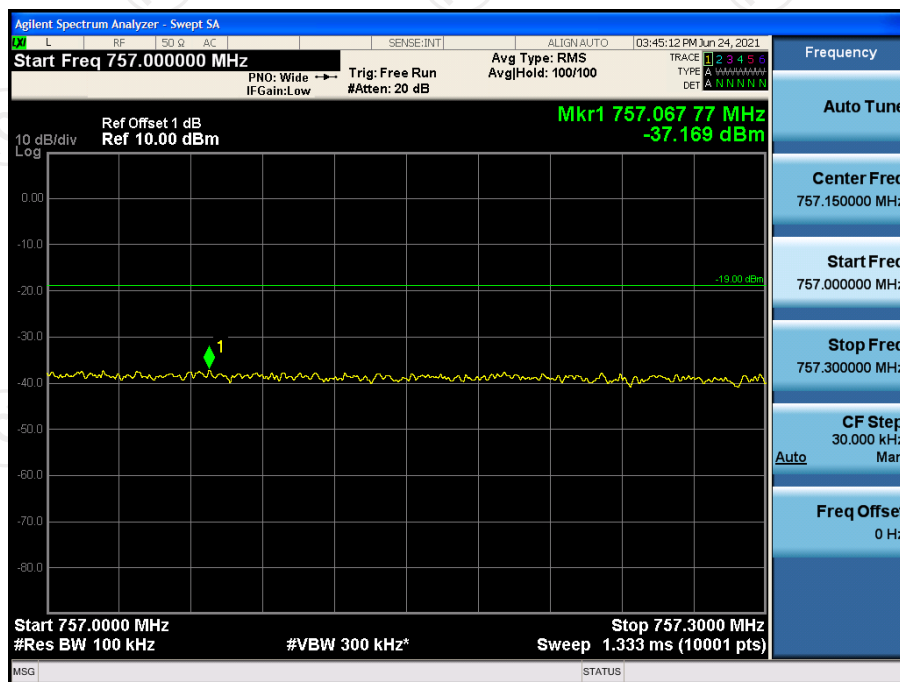
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Upper700MHz LTE DL Right Side Pre AGC

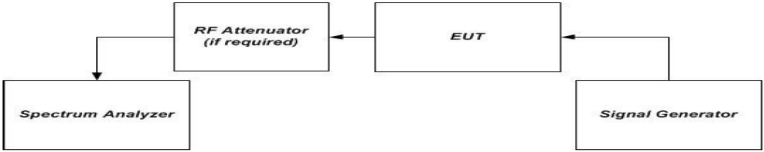


Upper700MHz LTE DL Right Side Pre AGC+10dB



5.5. Conducted Spurious Emission

5.5.1. Test Specification

Test Requirement:	FCC Part2 Section 1051; FCC Rules Part 27 Subpart C, Section 27.53
Test Method:	KDB 935210 D03 Signal Booster Measurements v04r04
Limit:	-13 dBm
Test Setup:	 <pre> graph LR SG[Signal Generator] --> EUT[EUT] EUT --> RA[RF Attenuator (if required)] RA --> SA[Spectrum Analyzer] </pre>
Test Procedure:	a) Connect the EUT to the test equipment as shown in Set-Up. Begin with the uplink output connected to the spectrum analyzer. b) Configure the signal generator for AWGN with a 99% occupied bandwidth of 4.1 MHz operation with a center frequency corresponding to the center of the CMRS band under test. c) Set the signal generator amplitude to the level determined in the power measurement procedure in Maximum power. d) Turn on the signal generator RF output and measure the spurious emission power levels with an appropriate measurement instrument as follows. e) Set RBW = measurement bandwidth specified in the applicable rule section for the operational frequency band under consideration (see Annex A for relevant cross-references). Note that many of the individual rule sections permit the use of a narrower RBW (typically $\geq 1\%$ of the emission bandwidth) to enhance measurement accuracy, but the result must then be integrated over the specified measurement bandwidth. f) Set VBW = 3 X RBW. g) Select the power averaging (RMS) detector. (See above note regarding the use of a peak detector for preliminary measurements.) h) Sweep time = auto-couple. i) Set the analyzer start frequency to the lowest radio frequency signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part. Note that the number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$ which may require that the measurement range defined by the start and stop frequencies above be subdivided, depending on the available number of measurement points provided by the spectrum analyzer. Trace average at least 10 traces in power averaging (i.e., RMS) mode. j) Use the peak marker function to identify the highest amplitude level over each measured frequency range Record the frequency and amplitude and capture a Test Plots for inclusion in the test report. k) Reset the analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the analyzer stop frequency to 10 times the highest frequency of the fundamental emission. Note that the number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$ which may require that the measurement range defined by the start and stop frequencies above be subdivided, depending on the available number of measurement points provided by the

	spectrum analyzer. l) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a Test Plots for inclusion in the test report. m) Repeat steps b) through l) for each supported frequency band of operation.
Test Result:	PASS

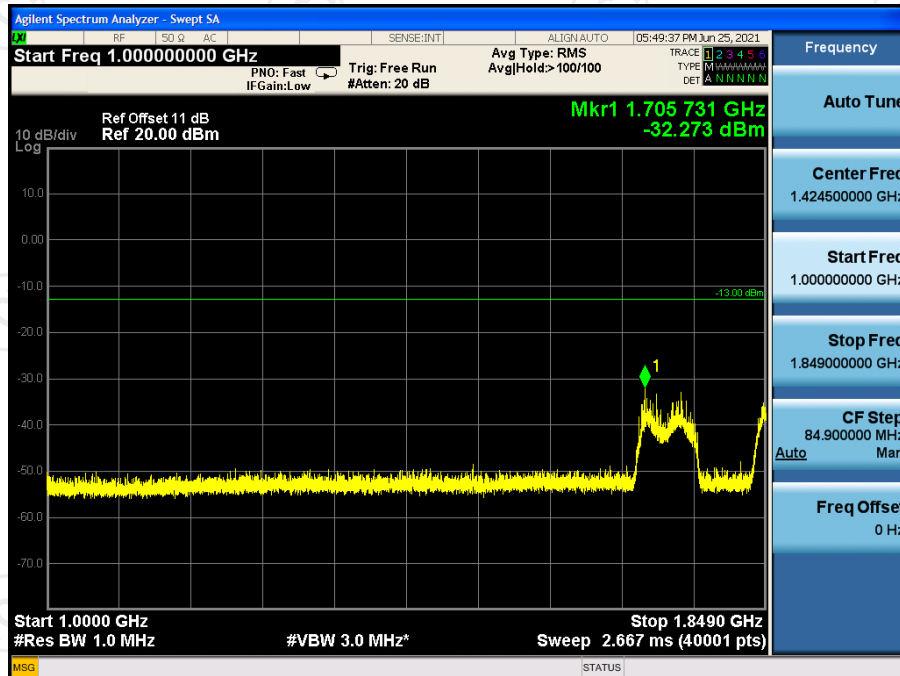
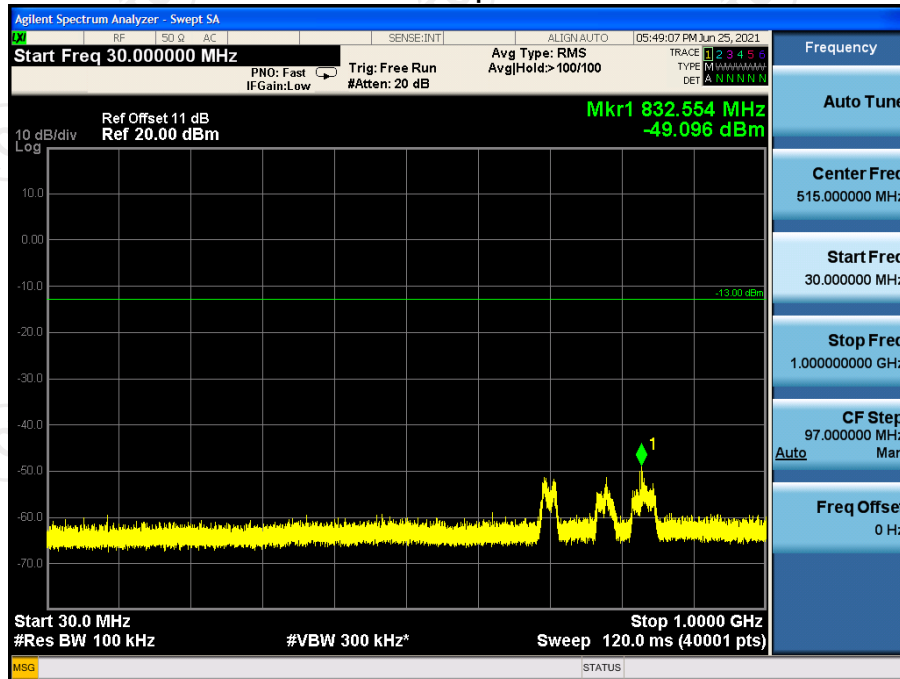
5.5.2. Test Instruments

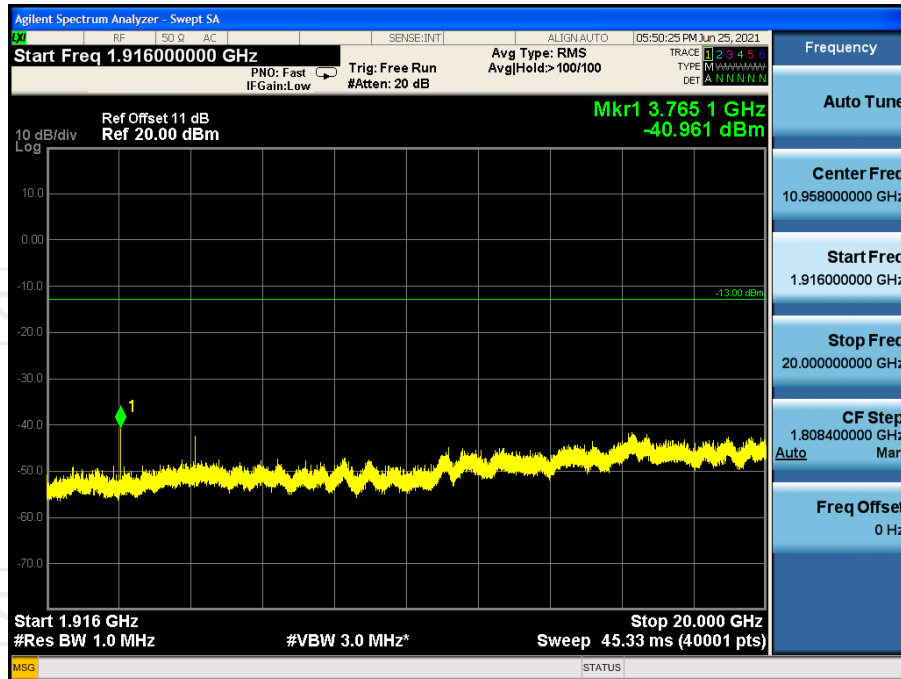
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182A	MY47070282	Sep. 03, 2020	Sep. 02, 2021
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020	Sep. 11, 2021
Attenuator	50FP-006-H3	JFW	907763	Sep. 12, 2020	Sep. 11, 2021

5.5.3. Test data

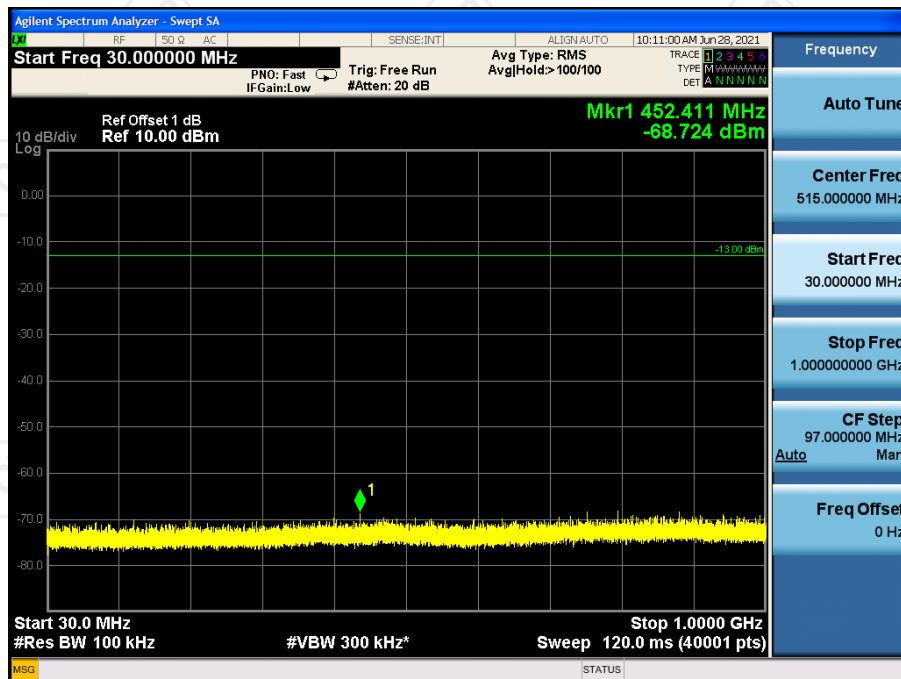
Test Plots

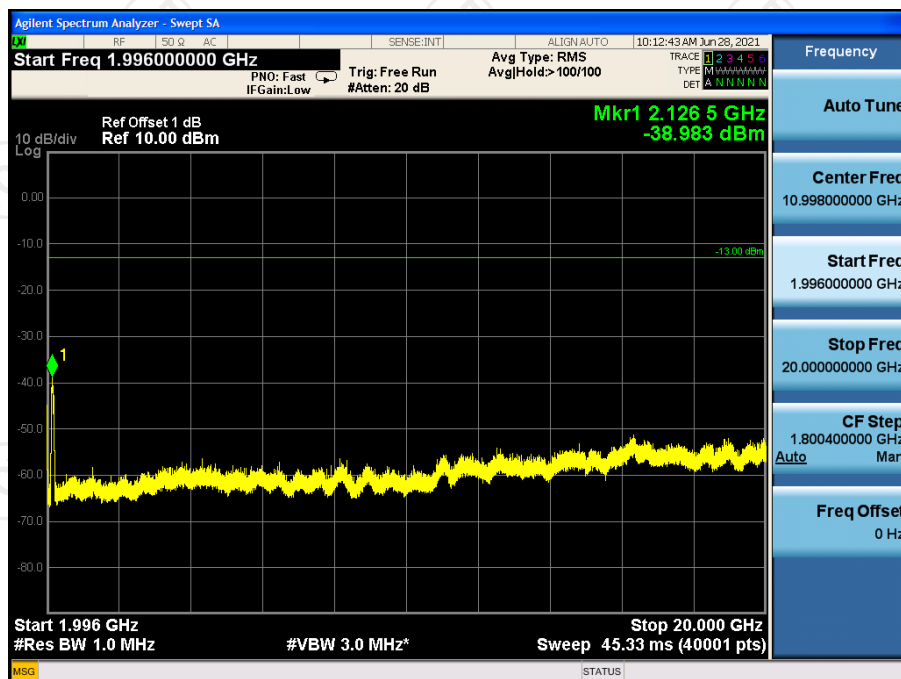
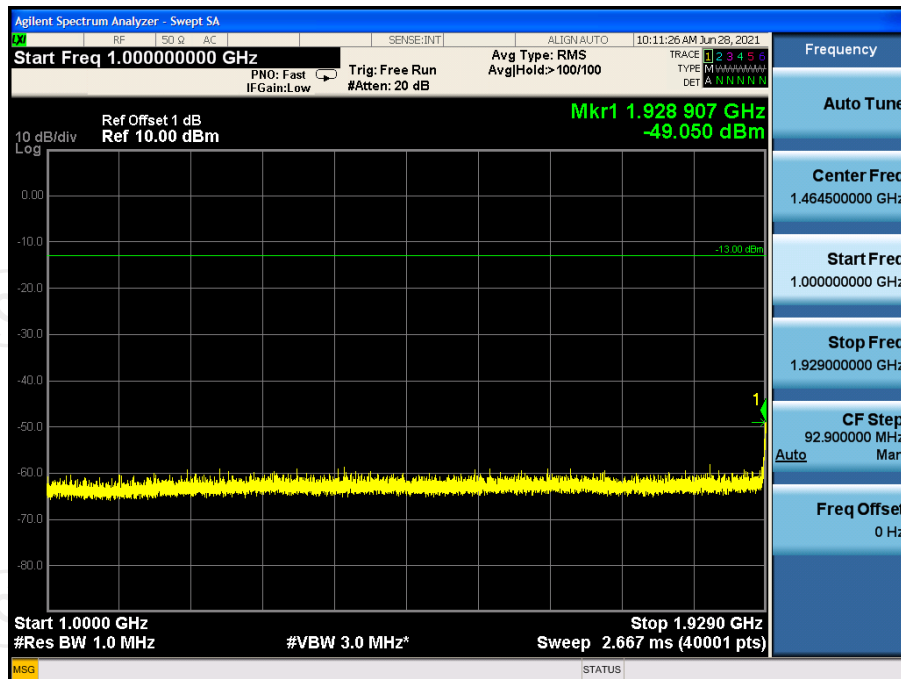
PCS Uplink





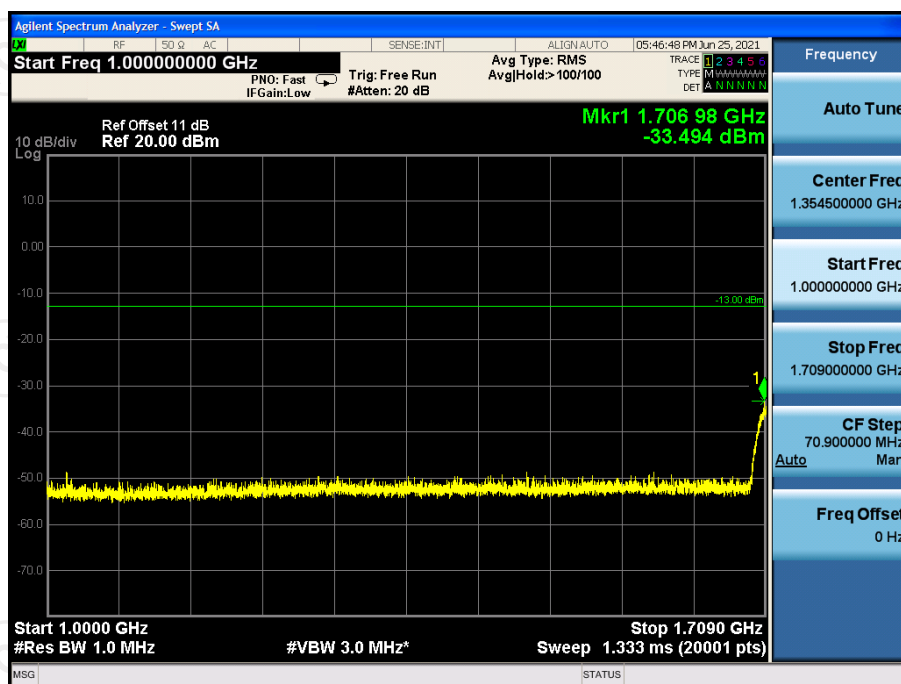
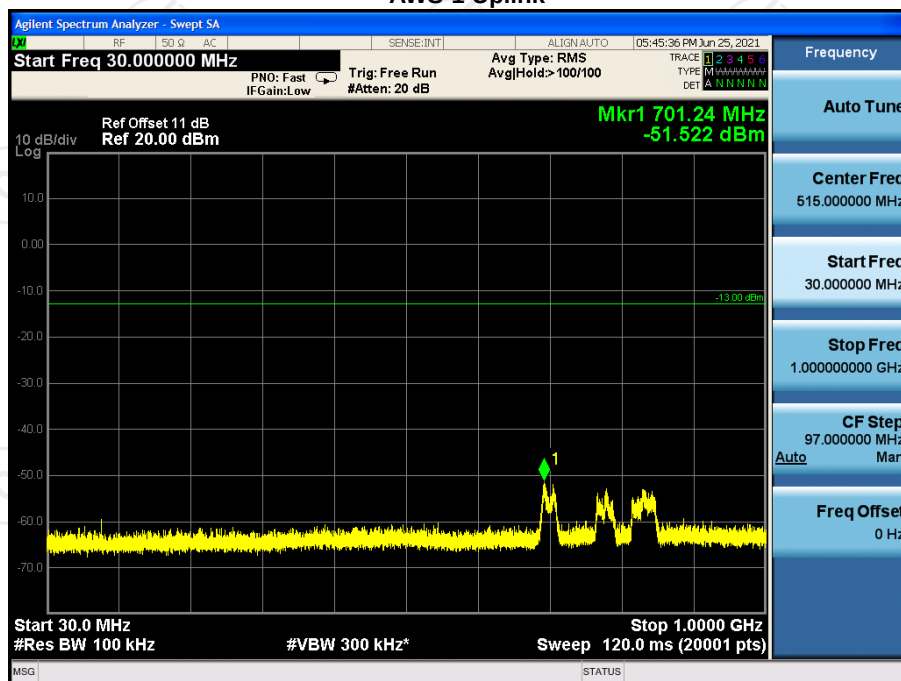
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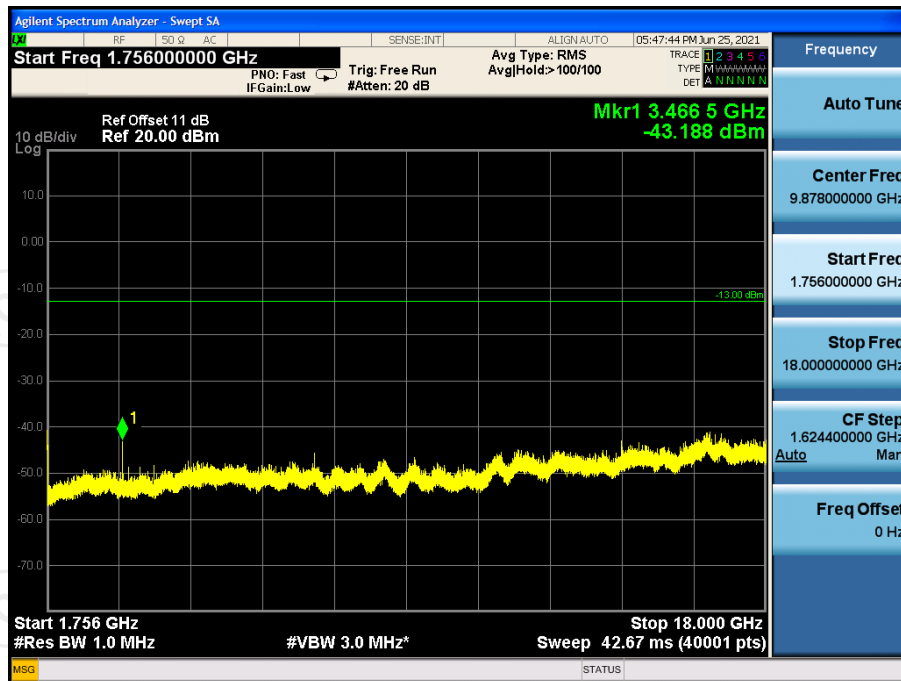




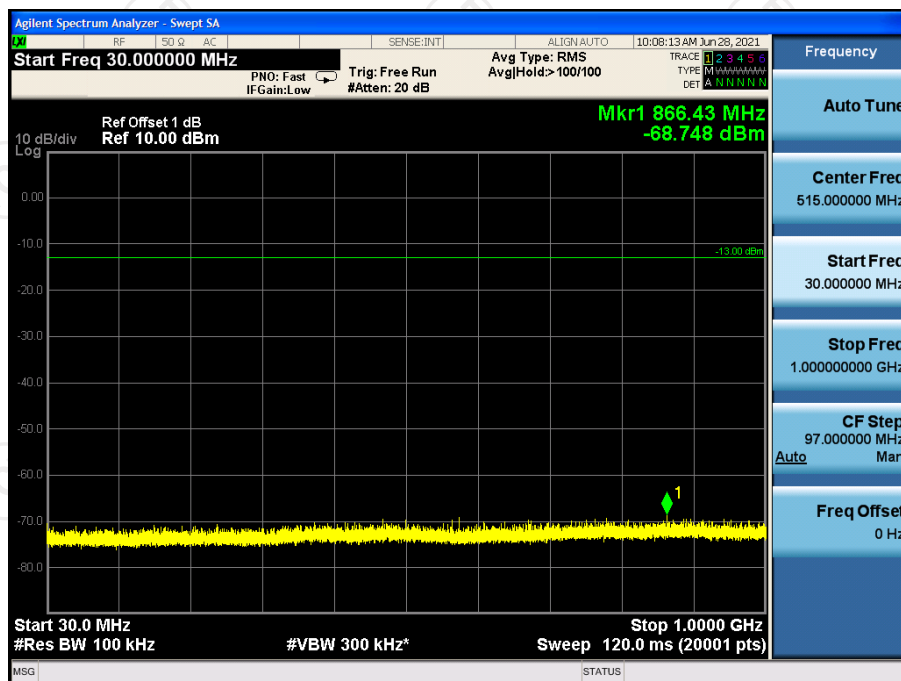
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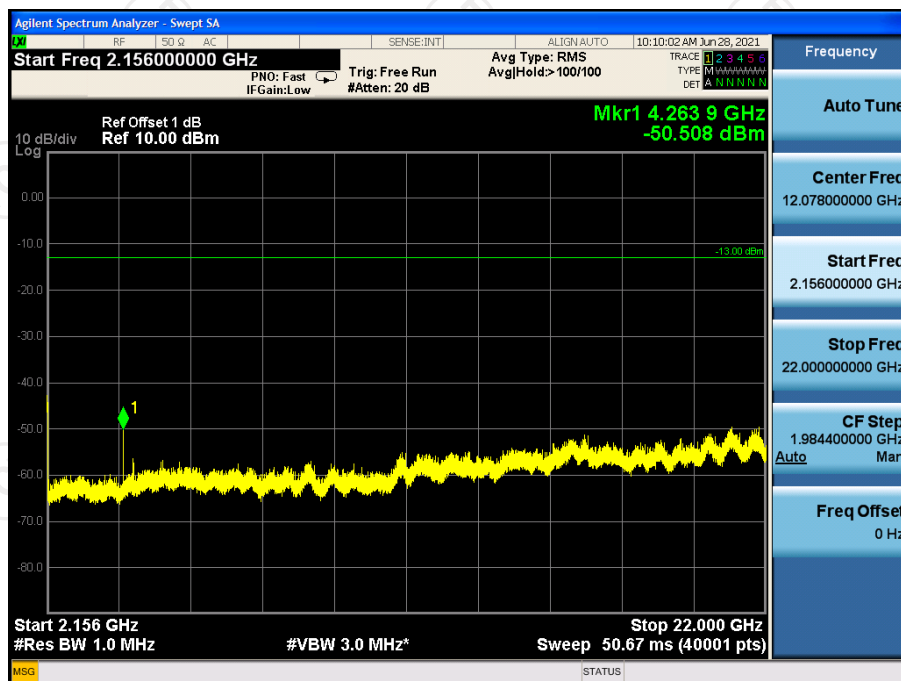
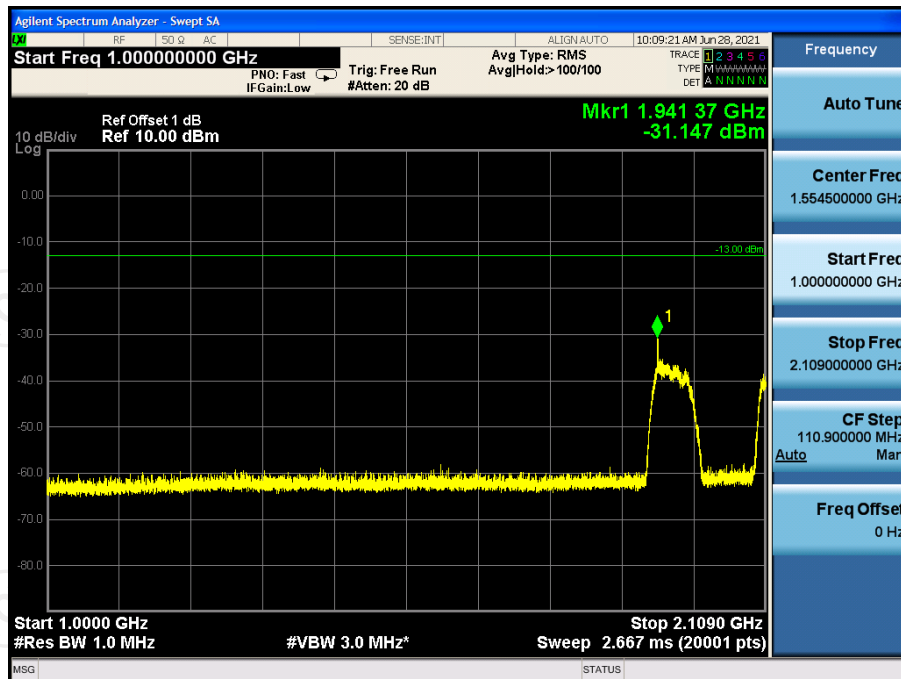
AWS-1 Uplink





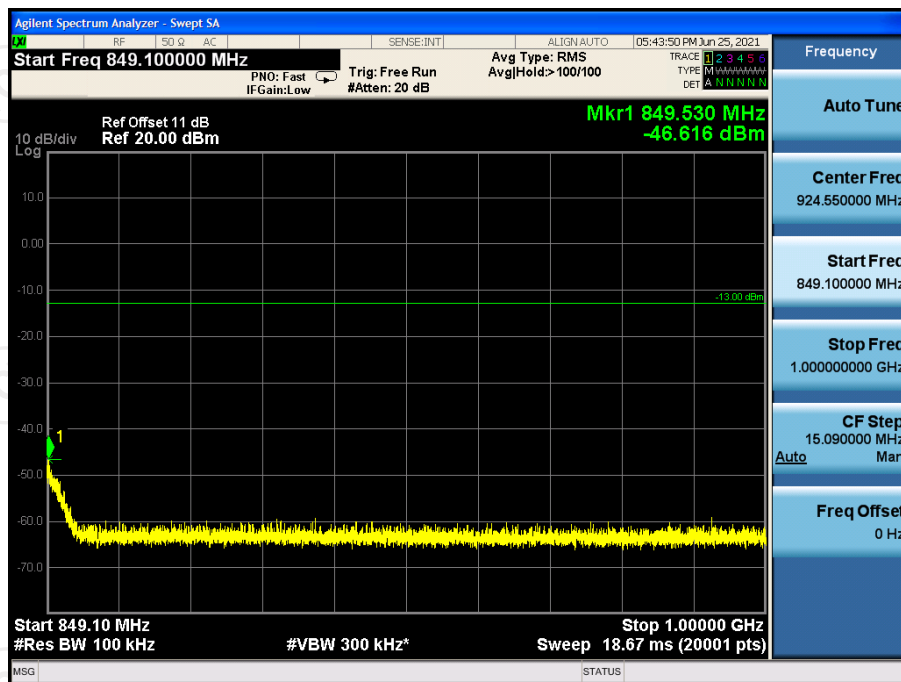
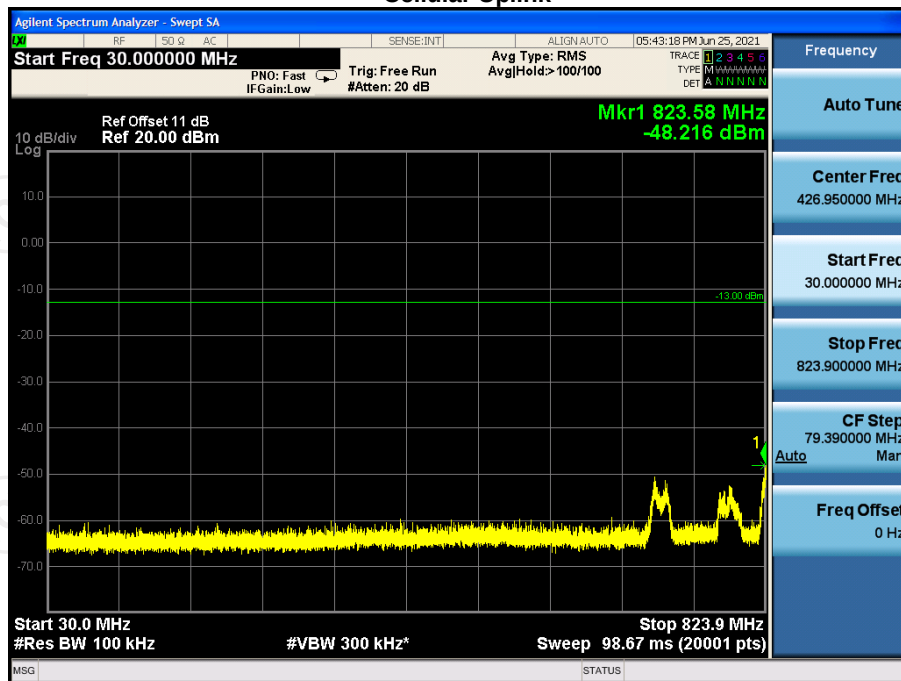
AWS-1 Downlink

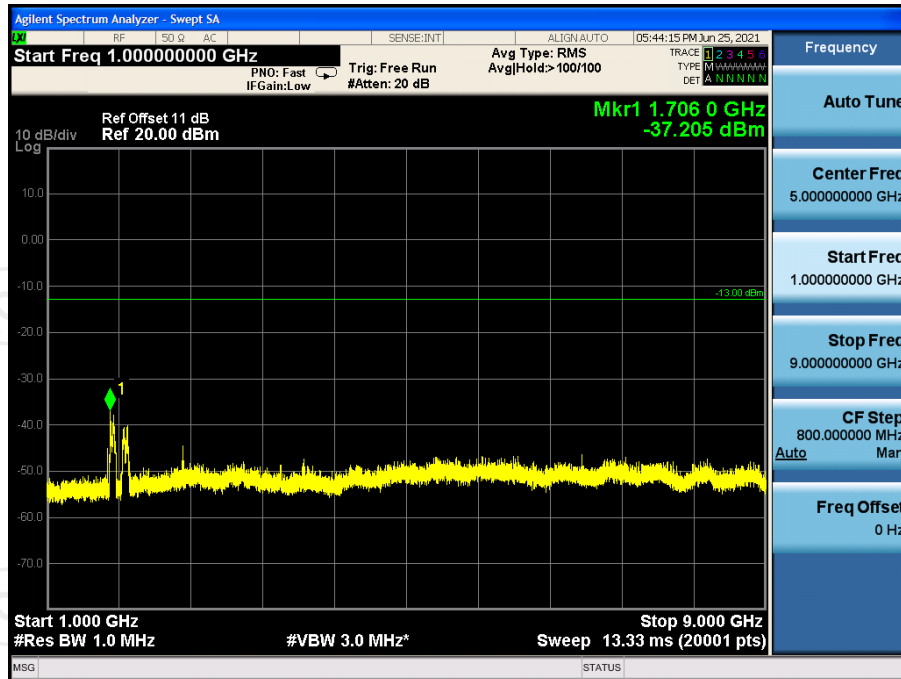




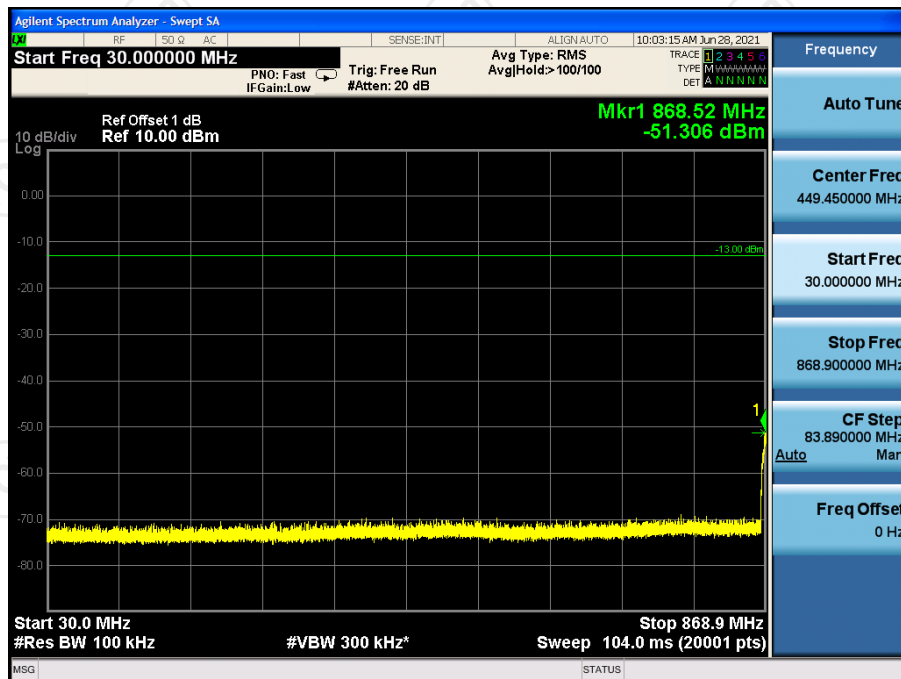
Test Plots

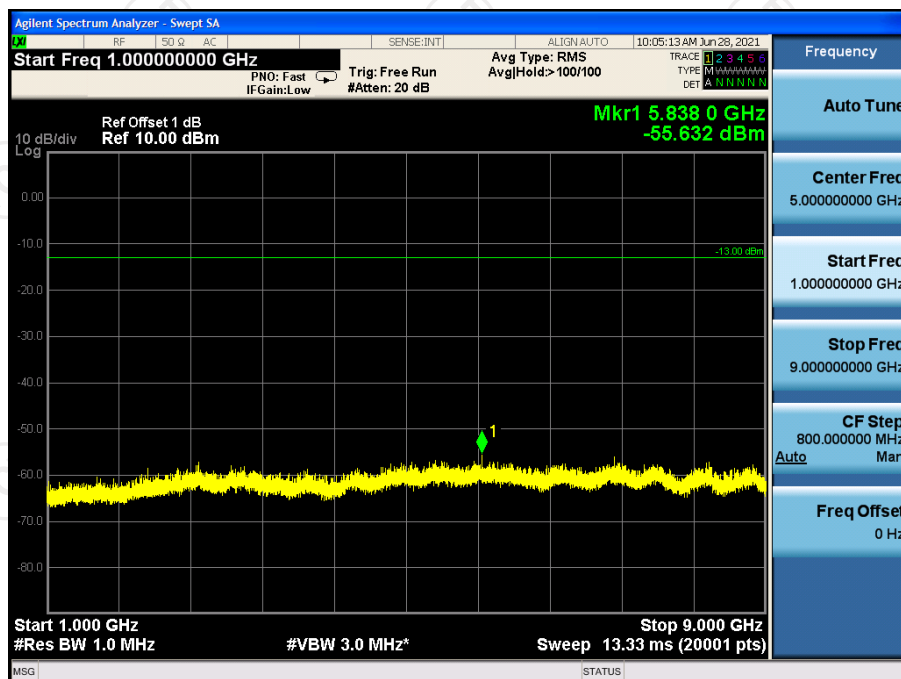
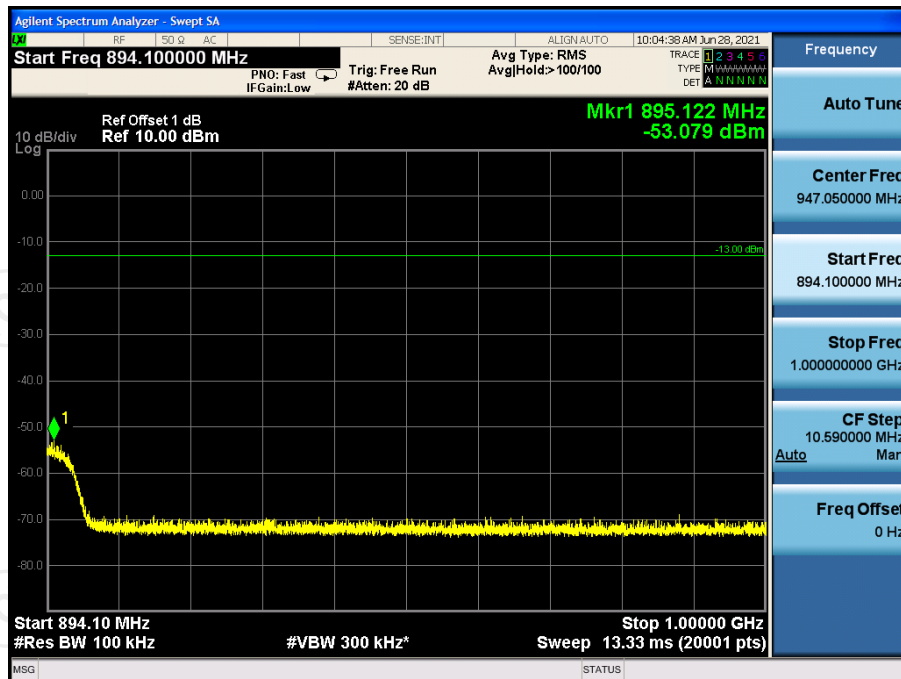
Cellular Uplink





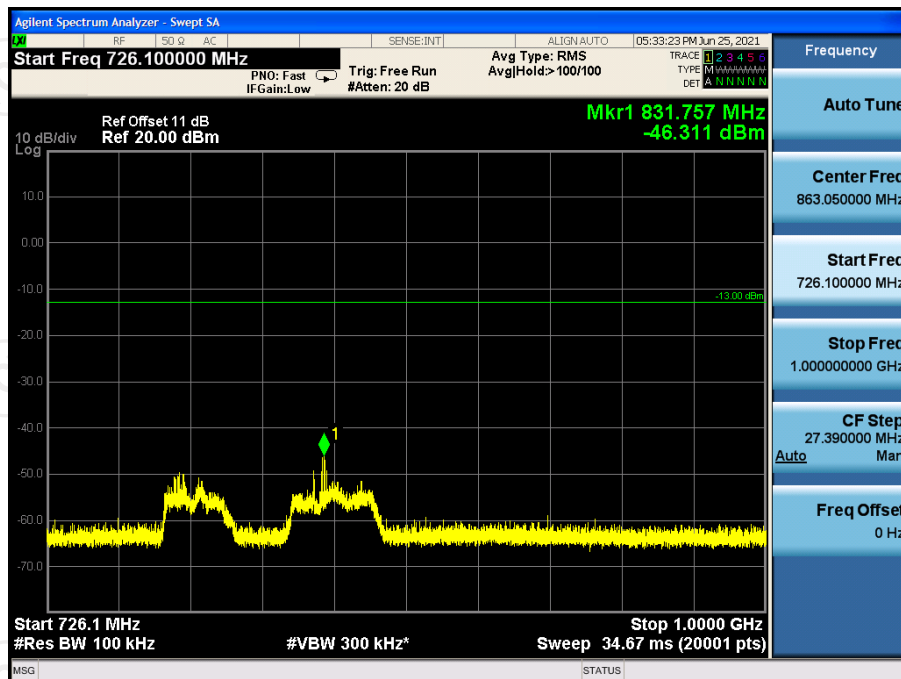
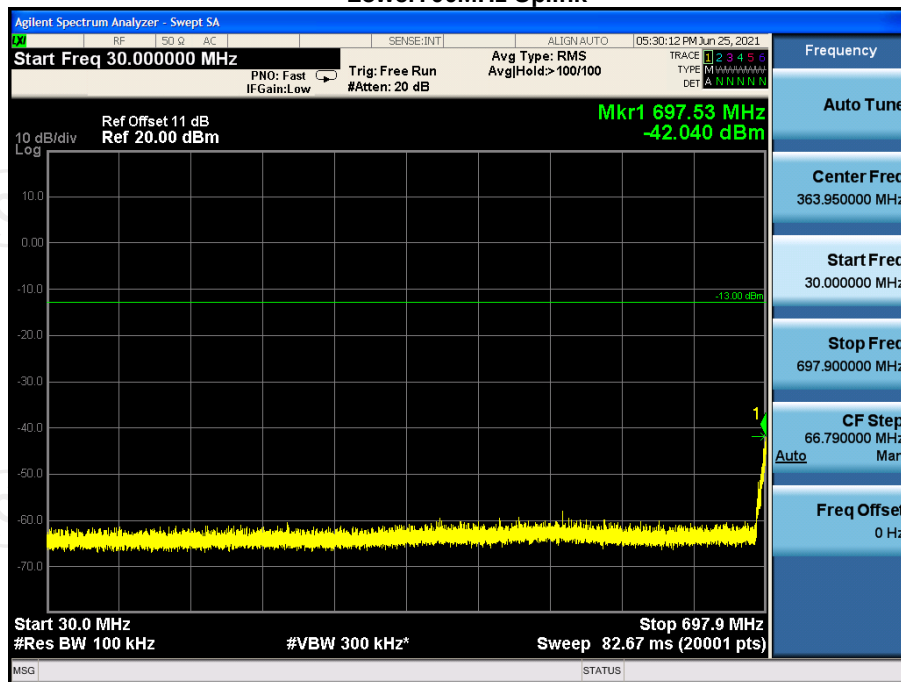
Cellular Downlink

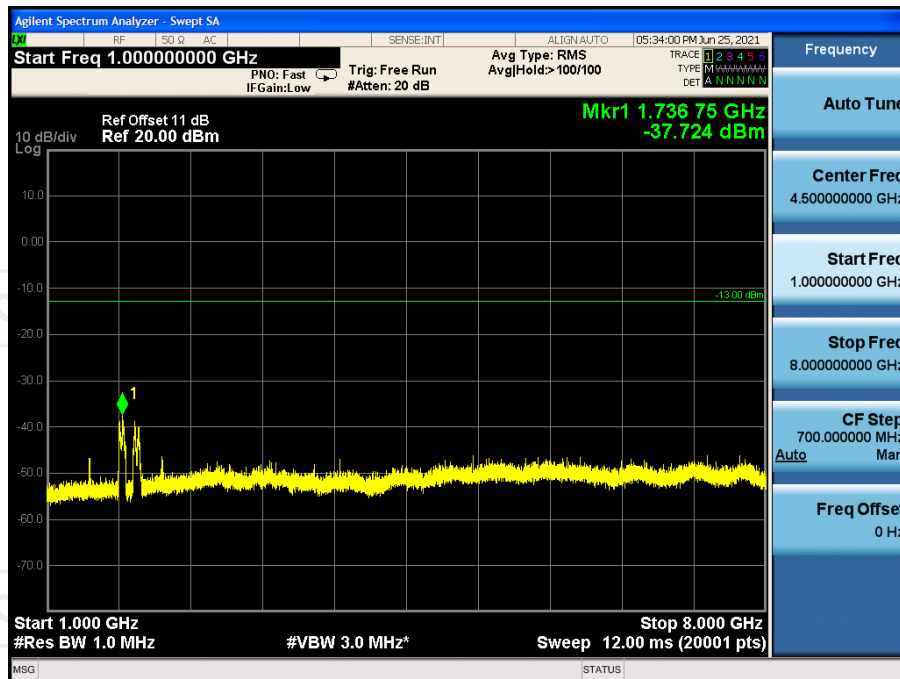




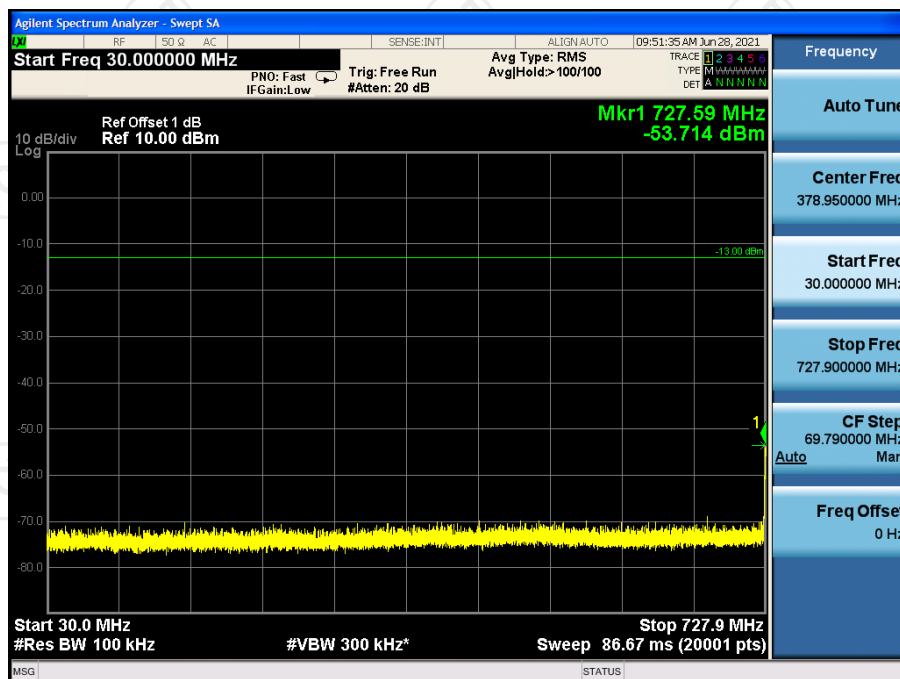
Test Plots

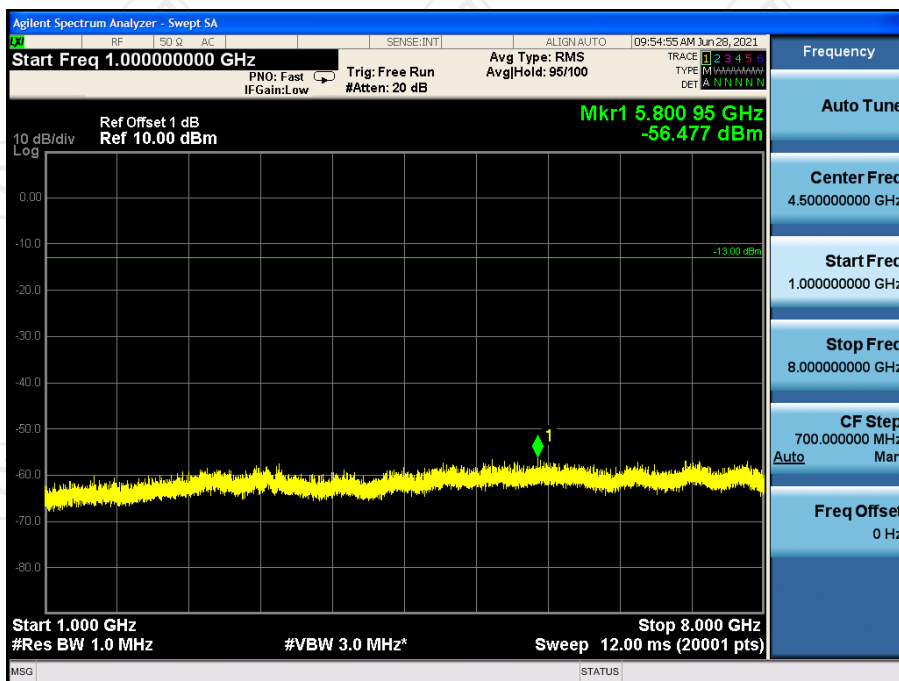
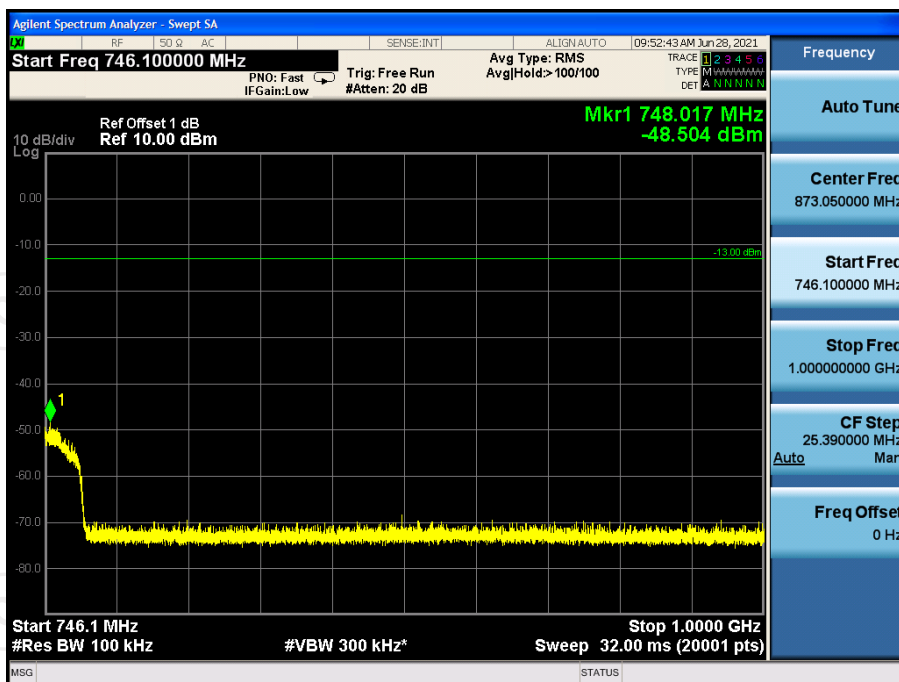
Lower700MHz Uplink





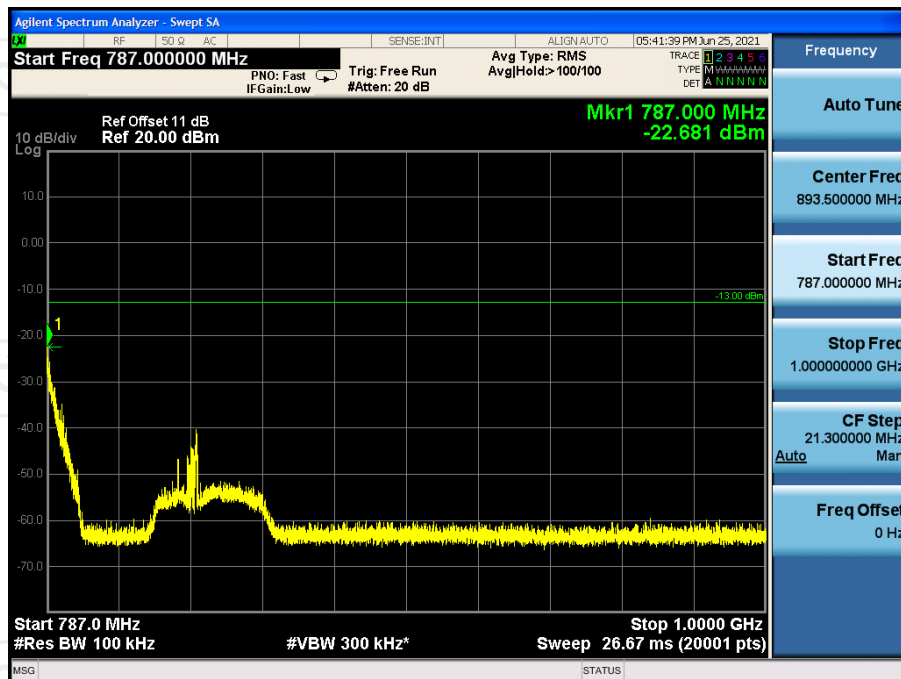
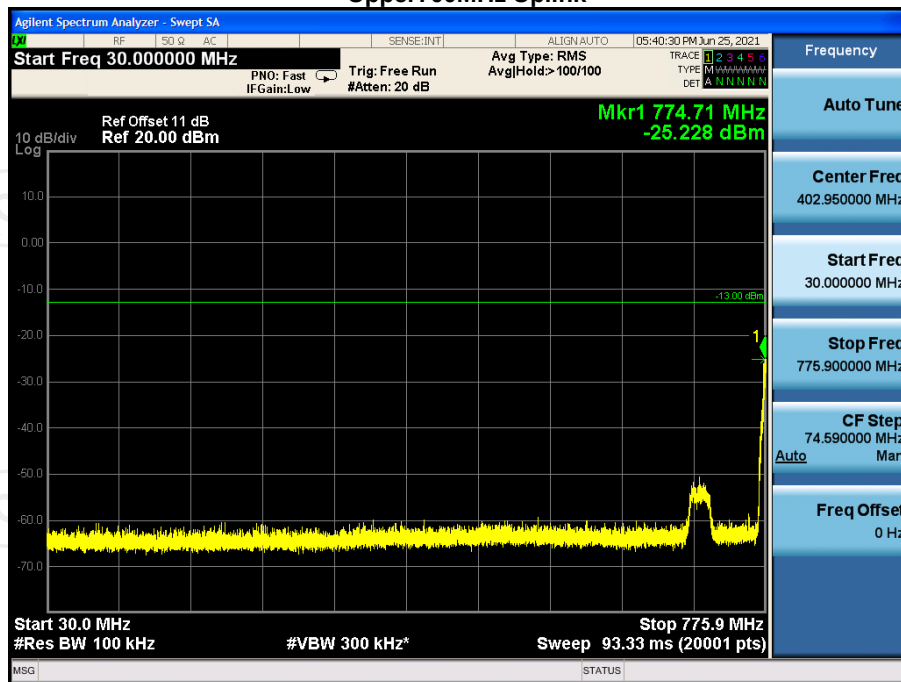
Lower700MHz Downlink

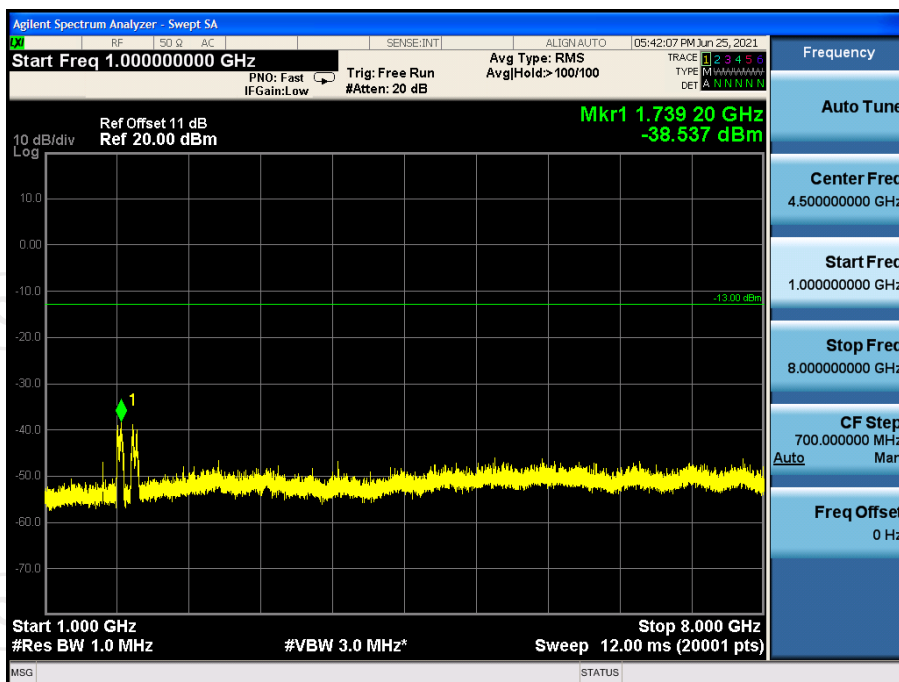




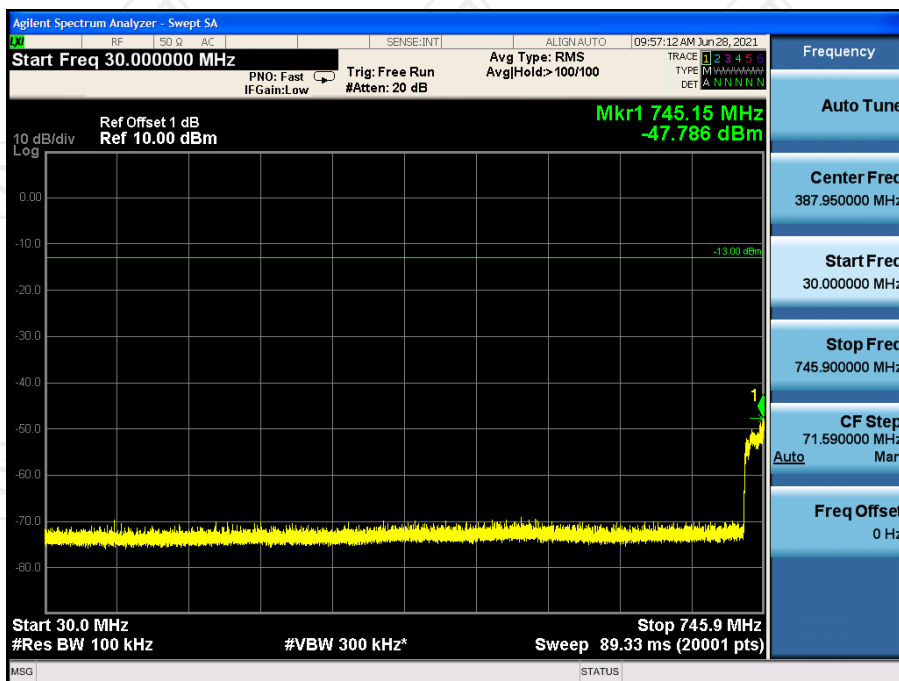
Test Plots

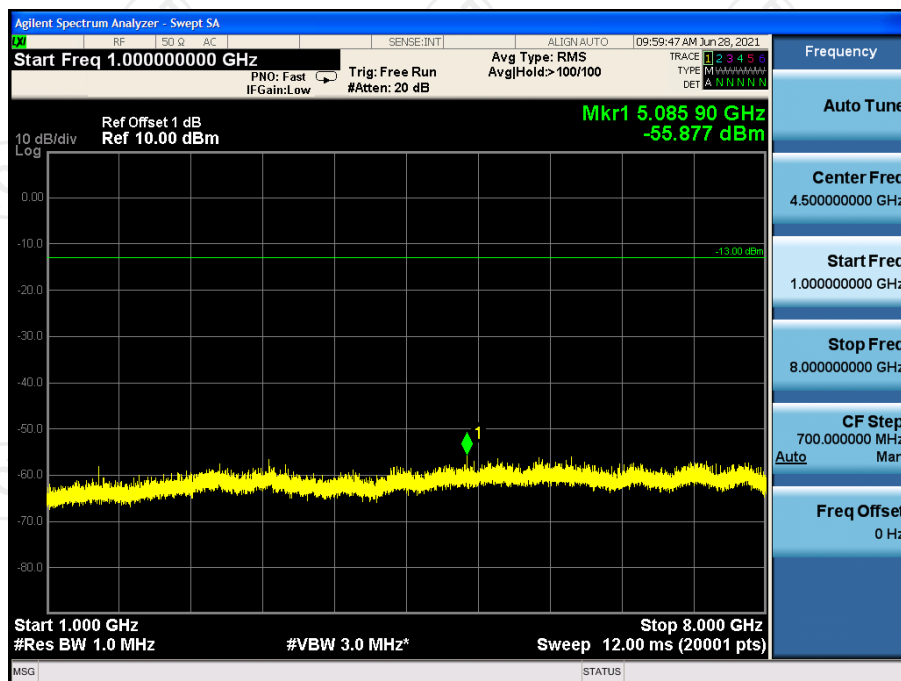
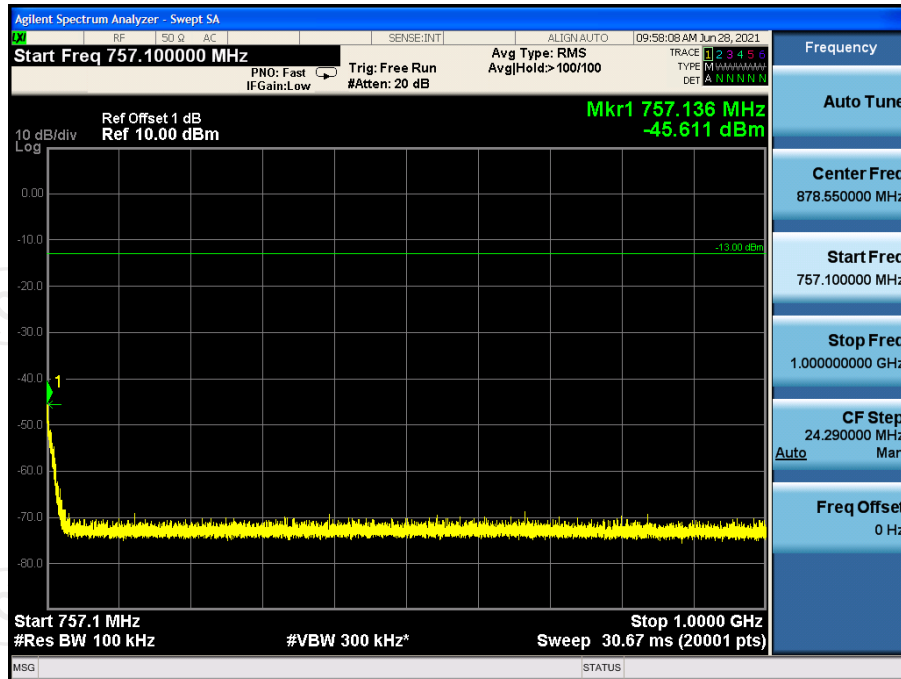
Upper700MHz Uplink





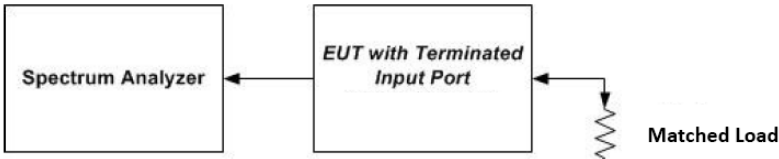
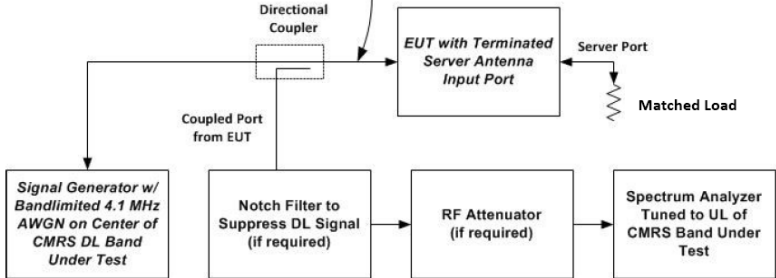
Upper700MHz Downlink





5.6. Noise Limits

5.6.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(8)(i)(A); 20.21(e)(8)(i)(H)
Test Method:	KDB935210 D03 Signal Booster Measurements v04r04
Limit:	not exceed -103 dBm/MHz —RSSI. not exceed $-102.5 \text{ dBm/MHz} + 20 \log (F)$, 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
Test Procedure:	- Connect the EUT to the test equipment as shown in Figure 3. Begin with the uplink output (donor) port connected to the spectrum analyzer. When measuring downlink noise, connect the downlink output (server) port to the spectrum analyzer. - Set the spectrum analyzer RBW to 1 MHz with the VBW $\geq 3 \cdot$ RBW. - Select the power averaging (rms) detector and trace average over at least 100 traces. - Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span $\geq 2 \cdot$ the CMRS band. - Measure the maximum transmitter noise power level. - Save the spectrum analyzer Test Plots as necessary for inclusion in the final test report. - Repeat 7.7b) to 7.7f) for all operational uplink and downlink bands. - Connect the EUT to the test equipment as shown in Figure 4 for uplink noise power measurement in the presence a downlink signal. Affirm the coupled path of the RF coupler is connected to the spectrum analyzer. - Configure the signal generator for AWGN operation with a 99% OBW of 4.1 MHz. - Set the spectrum analyzer RBW for 1 MHz, VBW $\geq 3 \cdot$ RBW, with a power averaging (rms) detector with at least 100 trace averages. - Set the center frequency of the spectrum analyzer to the center of

	the CMRS band under test, with the span ≥ 2 the CMRS band. This shall include all spectrum blocks in the particular CMRS band under test (see Appendix A). l) 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. m) Measure the maximum transmitter noise power level while varying the downlink signal generator output level from -90 dBm to -20 dBm, as measured at the input port (i.e., downlink signal level at the booster donor port node of Figure 4), in 1 dB steps inside the RSSI-dependent region, and in 10 dB steps outside the RSSI-dependent region. Report the six values closest to the limit, with at least two points within the RSSI-dependent region of the limit. See Appendix D for noise limits graphs. n) Repeat 7.7.1h) through 7.7.1m) for all operational uplink bands. Variable uplink noise timing Variable uplink noise timing is to be measured as follows, using the test setup shown in Figure 4. a) Set the spectrum analyzer to the uplink frequency to be measured. b) Set the span to 0 Hz, with a sweep time of 10 seconds. c) Set the power level of signal generator to the lowest level of the RSSI-dependent noise [see 7.7.1m)]. d) Select MAX HOLD and increase the power level of signal generator by 10 dB for mobile boosters, and 20 dB for fixed boosters. e) Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices, and within 3 seconds for fixed devices.¹² f) Repeat 7.7.2a) to 7.7.2e) for all operational uplink bands. g) Include Test Plotss and summary table in test report.
Test Result:	PASS

5.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182A	MY47070282	Sep. 03, 2020	Sep. 02, 2021
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020	Sep. 11, 2021
RF Combiner	SUNVNDN	SUD-CS 0800	16230009	Sep. 12, 2020	Sep. 11, 2021
Attenuator	50FP-006-H3	JFW	907763	Sep. 12, 2020	Sep. 11, 2021

5.6.3. Test Data

Max Noise Power			
Frequency Band (MHz)	Measured dBm/MHz	Limit dBm/MHz	Result (dB)
PCS Uplink	-47.05	-37.02	PASS
AWS-1 Uplink	-45.04	-37.73	PASS
Cellular Uplink	-51.12	-44.05	PASS
Lower700MHz Uplink	-49.62	-45.51	PASS
Upper700MHz Uplink	-51.11	-44.64	PASS
PCS Downlink	-45.18	-37.02	PASS
AWS-1 Downlink	-47.00	-37.73	PASS
Cellular Downlink	-47.24	-44.05	PASS
Lower700MHz Downlink	-48.30	-45.51	PASS
Upper700MHz Downlink	-48.27	-44.64	PASS

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

Variable Uplink Noise				
Operation Bands	RSSI dBm	Measured dBm/MHz	Limit dBm/MHz	Results
PCS	-80	-48.02	-37.02	PASS
	-75	-48.10	-37.02	PASS
	-72	-51.14	-37.02	PASS
	-63	-51.58	-40.00	PASS
	-58	-53.28	-45.00	PASS
	-56	-54.83	-47.00	PASS
AWS-1	-80	-45.78	-37.73	PASS
	-75	-46.30	-37.73	PASS
	-71	-48.90	-37.73	PASS
	-68	-50.72	-37.73	PASS
	-64	-52.35	-39.00	PASS
	-58	-53.60	-45.00	PASS
Cellular	-80	-51.59	-44.05	PASS
	-70	-51.62	-44.05	PASS

	-69	-54.57	-44.05	PASS
	-64	-57.40	-44.05	PASS
	-62	-58.52	-44.05	PASS
	-56	-59.98	-47.00	PASS
Lower700MHz	-80	-49.56	-45.51	PASS
	-73	-59.61	-45.51	PASS
	-68	-52.65	-45.51	PASS
	-63	-55.31	-45.51	PASS
	-57	-57.17	-46.00	PASS
	-51	-57.95	-52.00	PASS
Upper700MHz	-80	-51.14	-44.64	PASS
	-70	-51.66	-44.64	PASS
	-67	-53.60	-44.64	PASS
	-62	-56.40	-44.64	PASS
	-57	-58.18	-46.00	PASS
	-53	-59.03	-50.00	PASS

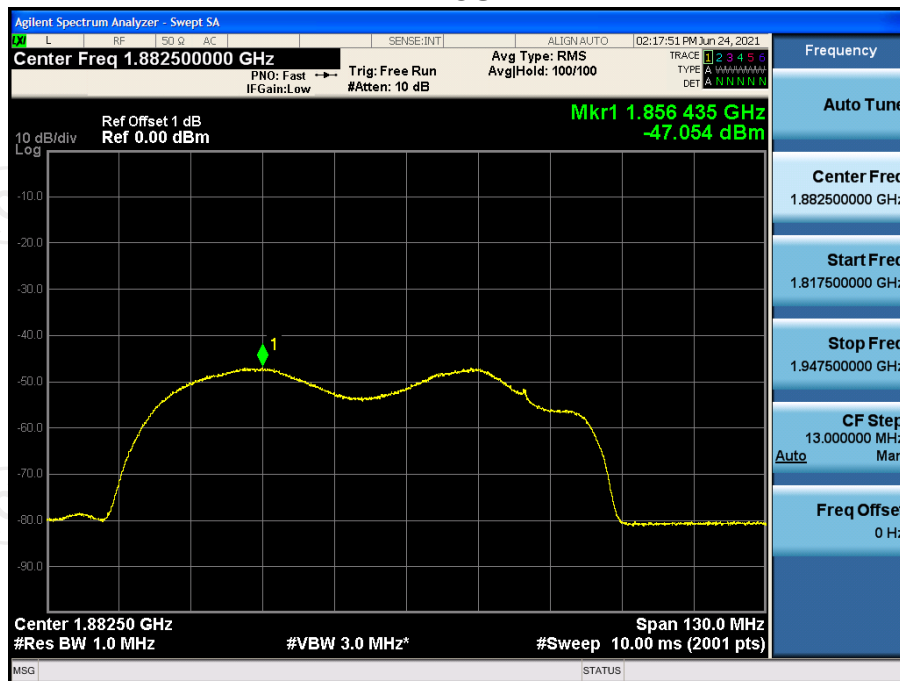
Note: According to the KDB 935210 D03 Signal Booster Measurements v04r04 APPENDIX D, when outside of RSSI Dependent limit (20.21.e.8.1.A.1),fixed booster maximum noise power shall not exceed $-102.5 \text{ dBm/MHz} + 20 \log (F)$.RSSI limit not exceed $-103 \text{ dBm/MHz-RSSI}$.

Variable Uplink Noise Timing

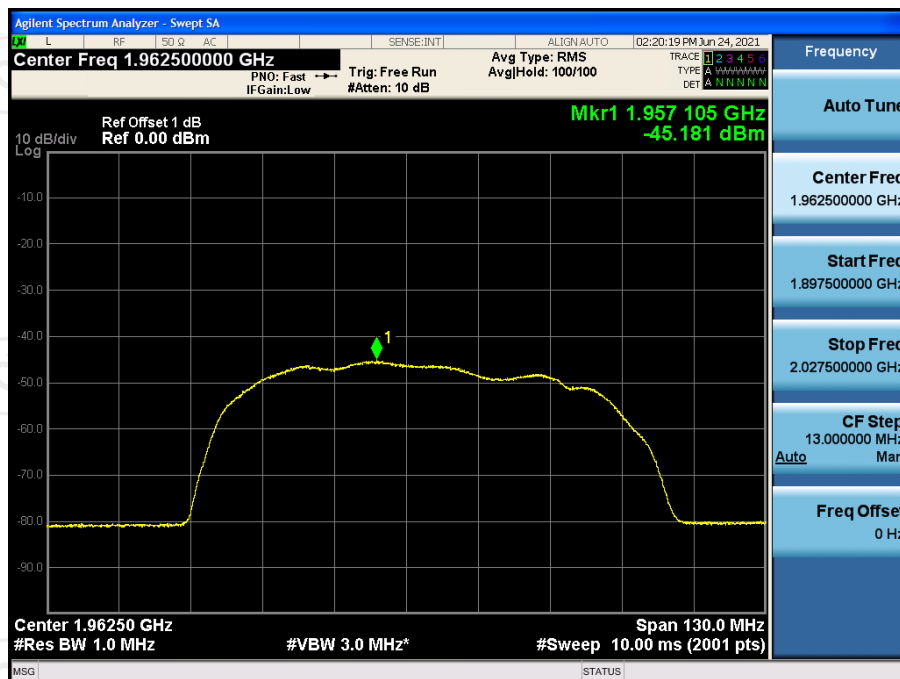
Operation Bands	Measured Sec	Limit Sec	Results
PCS	0.04	3	PASS
AWS-1	0.04	3	PASS
Cellular	0.02	3	PASS
Lower700MHz	0.03	3	PASS
Upper700MHz	0.05	3	PASS

Test Plots

PCS

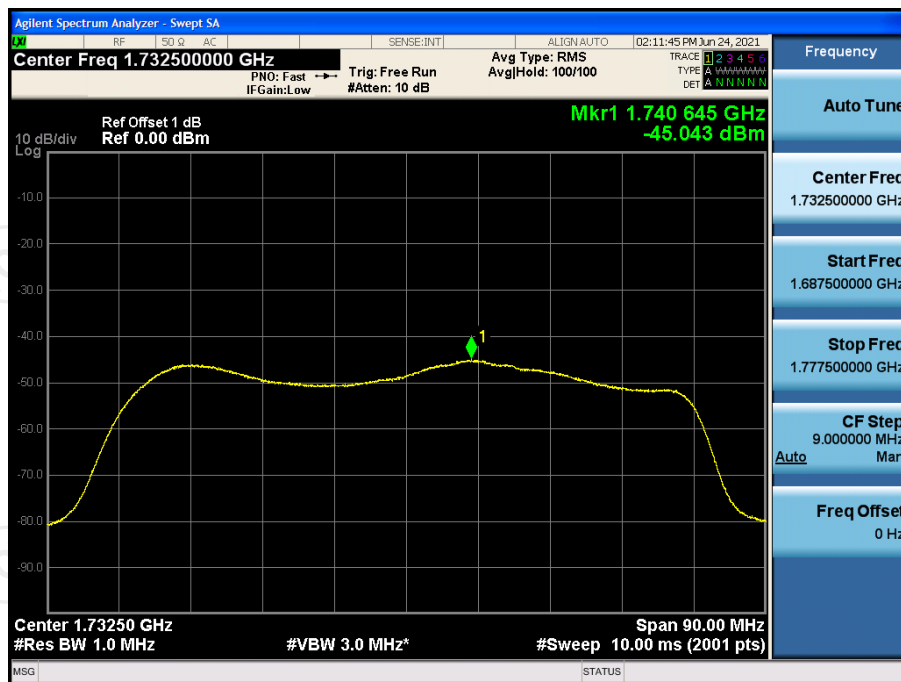


Uplink Noise

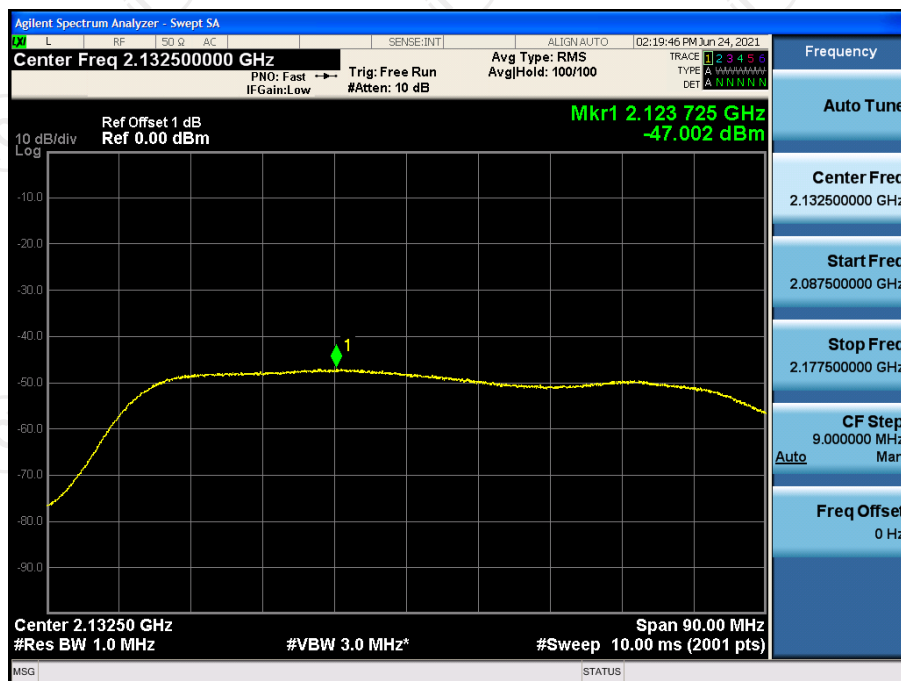


Downlink Noise

AWS-1

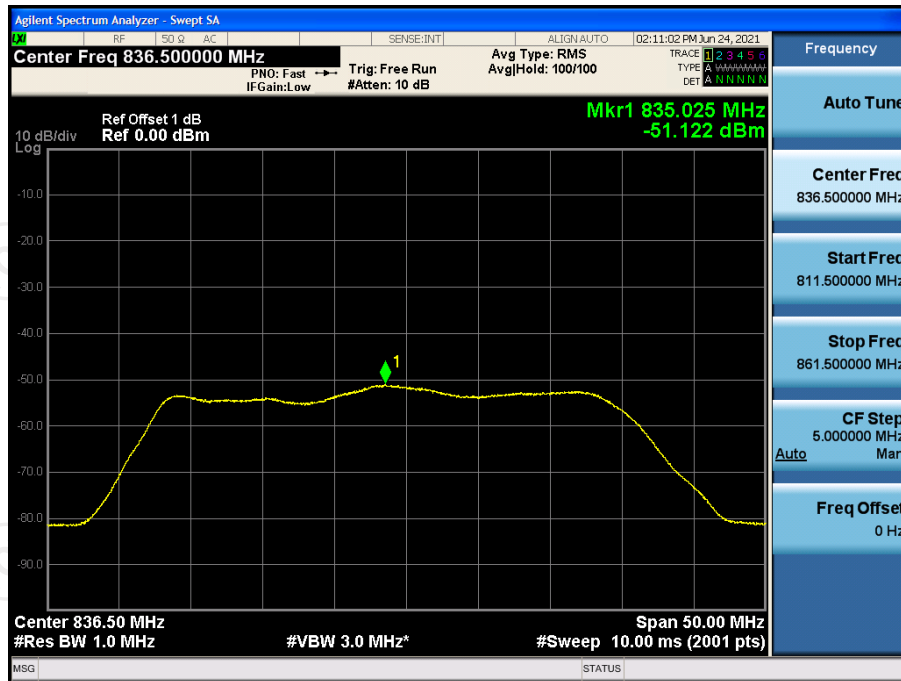


Uplink Noise

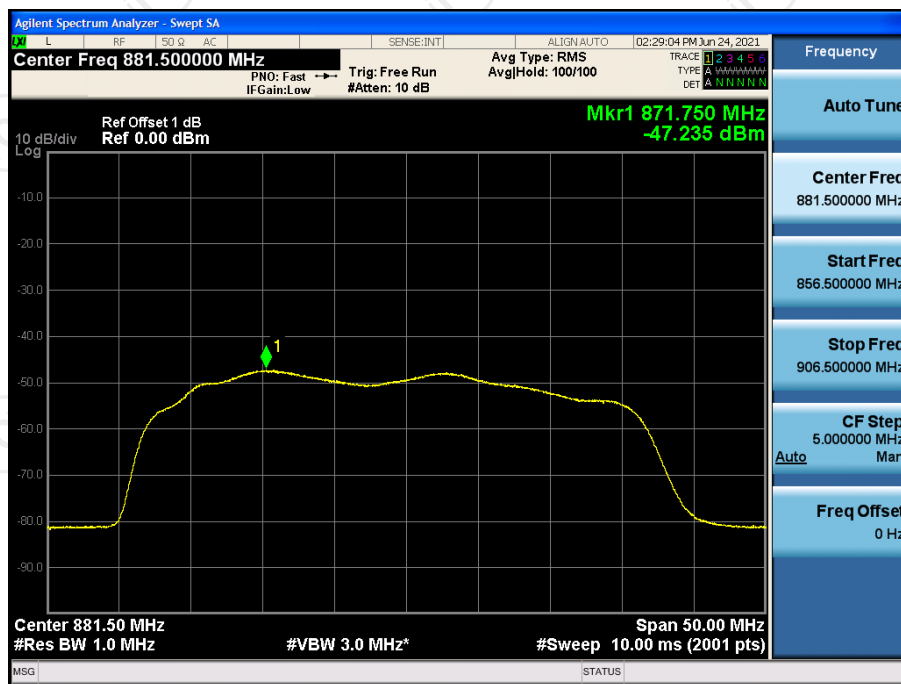


Downlink Noise

Cellular



Uplink Noise



Downlink Noise