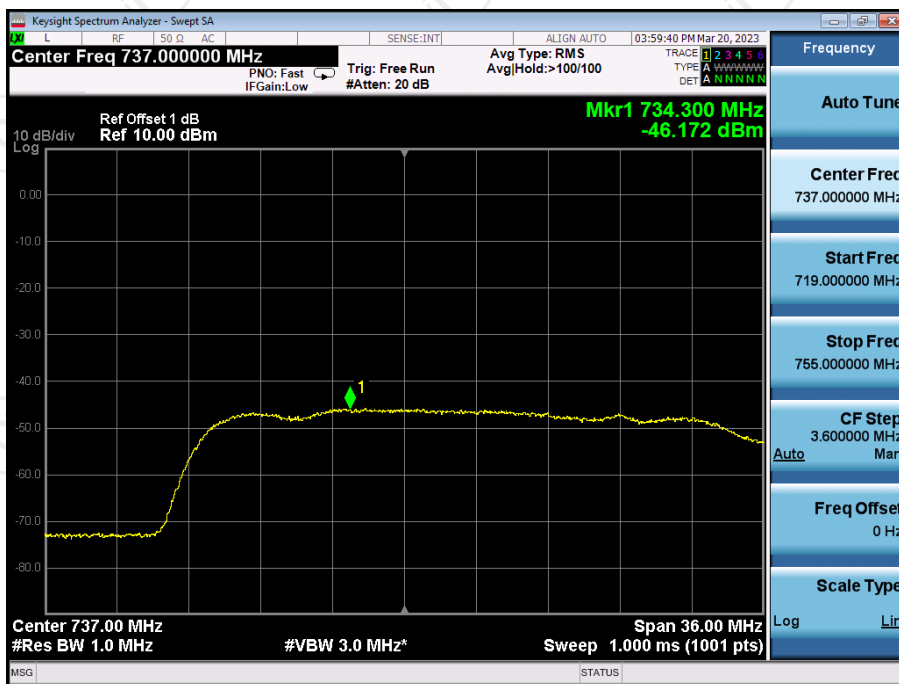


Lower700MHz

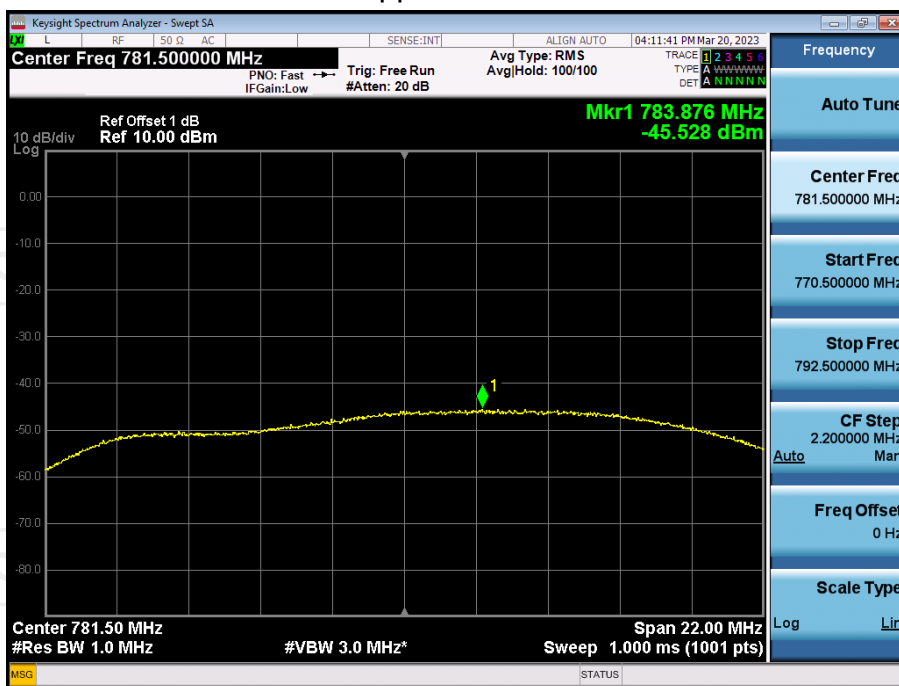


Uplink Noise



Downlink Noise

Upper700MHz



Uplink Noise



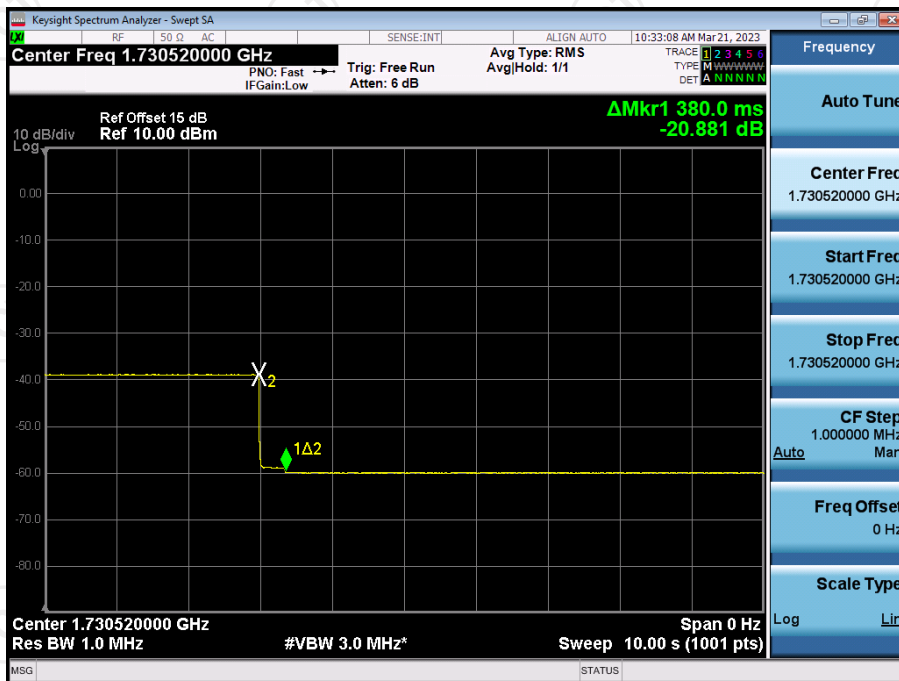
Downlink Noise

Variable Noise Timing Test Plots

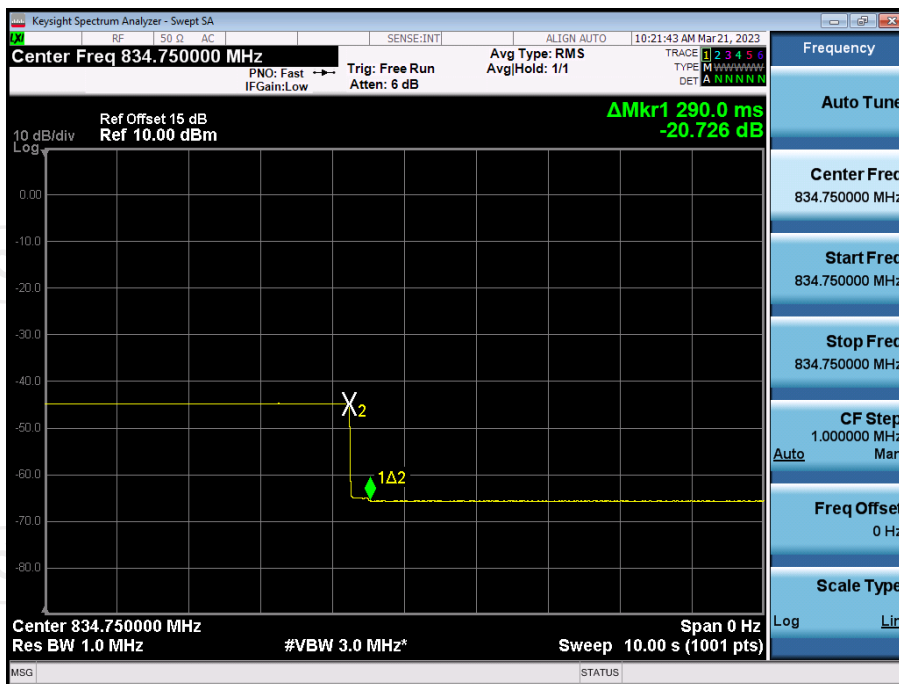
PCS



AWS-1



Cellular



Lower700MHz

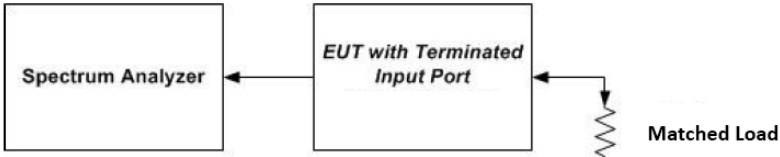


Upper700MHz



5.7. Uplink Inactivity

5.7.1. Test Specification

Test Requirement:	FCC Part20 Section 20.21(e)(8)(i)(I)
Test Method:	KDB935210 D03 Signal Booster Measurements v04r04
Limit:	20.21(e), When a consumer booster is not serving an active device connection after 5 minutes the uplink noise power shall not exceed -70 dBm/MHz.
Test Setup:	 Figure 3 – Noise limit test setup (also used for 7.8)
Test Procedure:	- Connect the EUT to the test equipment as shown in Set-Up with the uplink output connected to the spectrum analyzer. - Select the RMS power averaging detector. - Set the spectrum analyzer RBW for 1 MHz with the VBW $\geq 3X$ RBW. - Set the center frequency of the spectrum analyzer to the center of the uplink operational band. - Set the span for 0 Hz with a single sweep time for a minimum of 330 seconds. - Start to capture a new trace using MAX HOLD. - After approximately 15 seconds turn on the EUT power. - 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. - Ensure the noise level for the squelched signal is below the uplink inactivity noise power limit, as specified by the rules. - Capture the Test Plots for inclusion in the test report. - Measure noise using procedures in a) to e). - Repeat steps c) to k) for all operational uplink bands.
Test Result:	PASS

5.7.2. Test Instruments

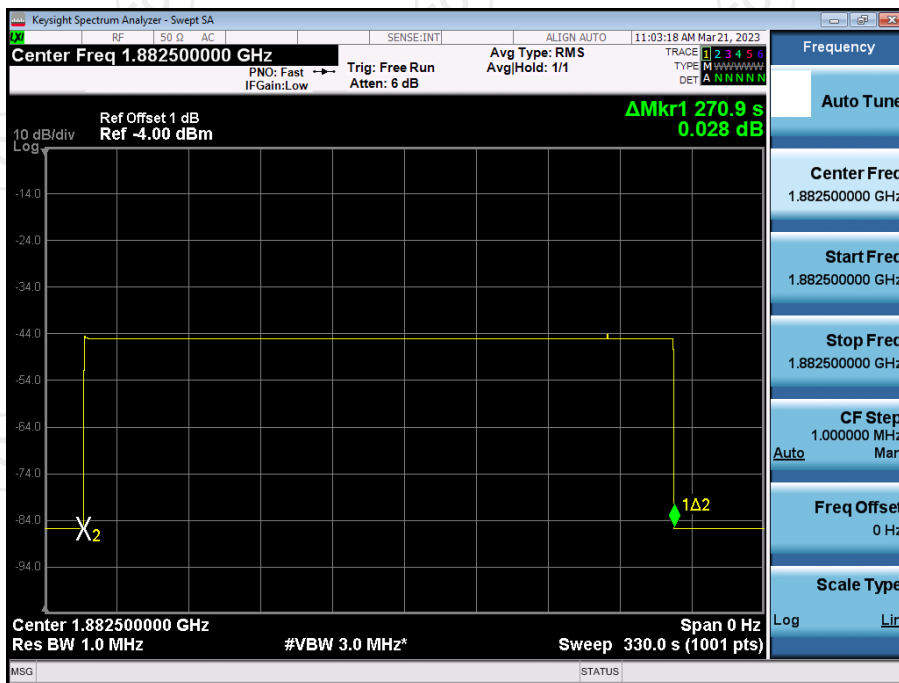
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 05, 2022	Jul. 04, 2023

5.7.3. Test Data

Uplink Inactivity			
Operation Bands	Measured (s)	Limit (s)	Result
PCS	270.9	300.0	PASS
AWS-1	270.9	300.0	PASS
Cellular	270.9	300.0	PASS
Lower700MHz	270.6	300.0	PASS
Upper700MHz	270.9	300.0	PASS

Test Plots

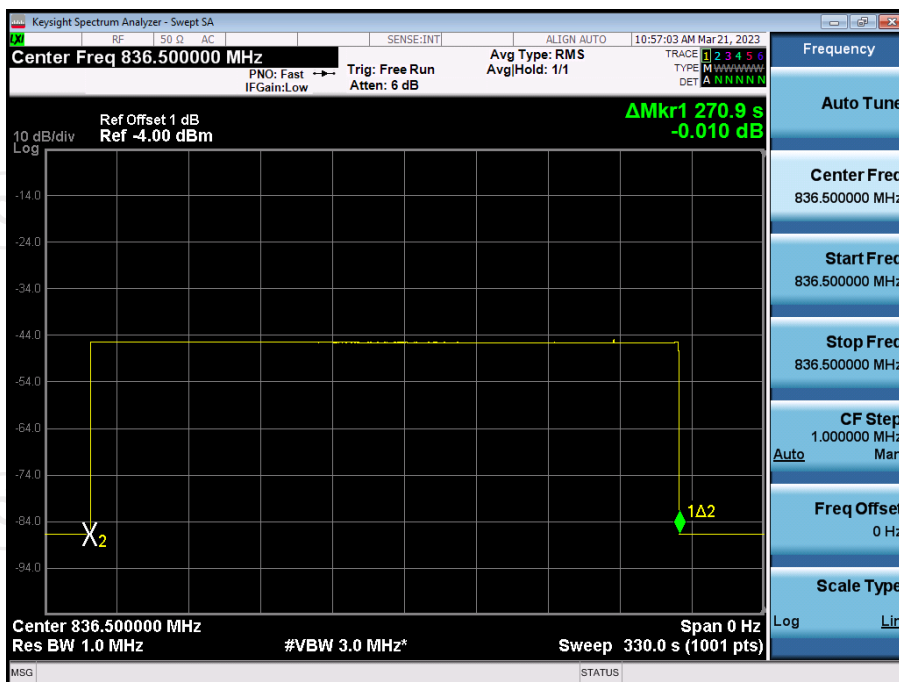
PCS



AWS-1



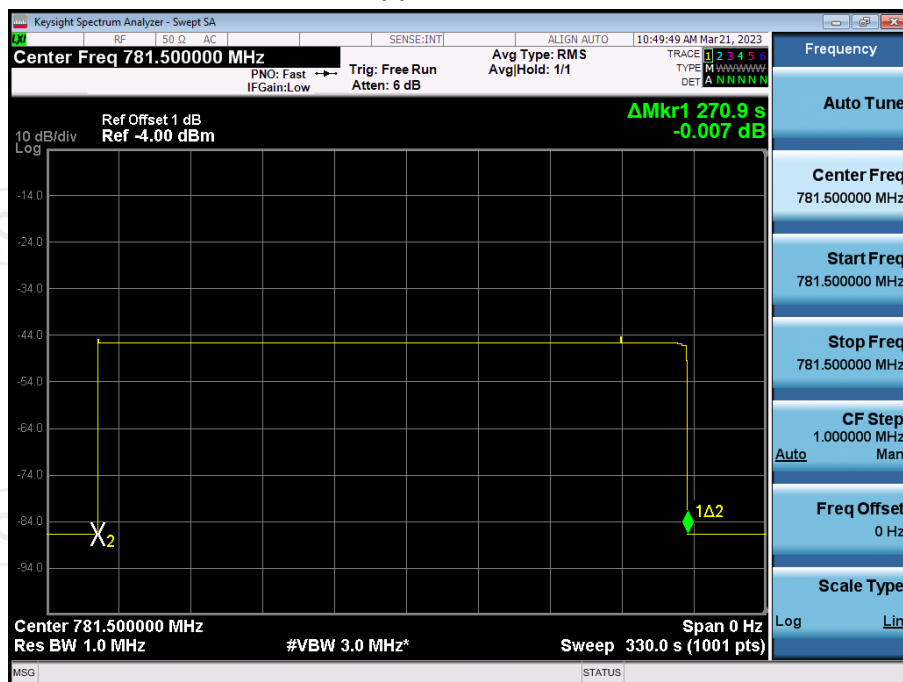
Cellular



Lower700MHz

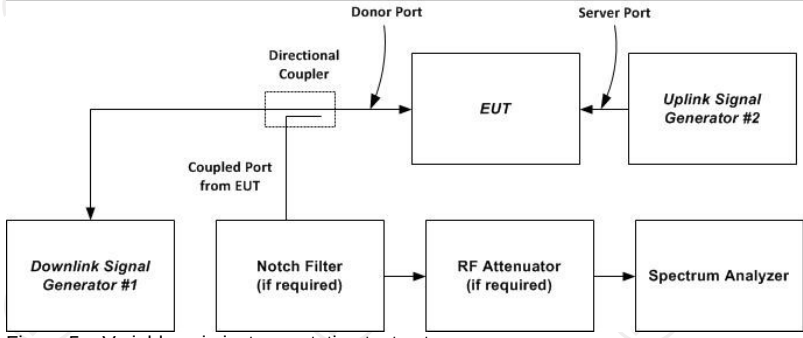


Upper700MHz



5.8. Variable Booster Gain

5.8.1. Test Specification

Test Requirement:	FCC Part20 Section 120.21(e)(8)(i)(C)(1) FCC Part20 Section 120.21(e)(8)(i)(H)
Test Method:	KDB935210 D03 Signal booster Measurements v04r04
Limit:	-34 dB - RSSI + MSCL
Test Setup:	 Figure 5 – Variable gain instrumentation test setup
Test Procedure:	Variable gain: - Connect the EUT to the test equipment as shown in Figure 5 with the uplink output (donor) port connected to signal generator #1. Affirm that the coupled path of the RF coupler is connected to the spectrum analyzer. - Configure downlink signal generator #1 for AWGN operation with a 99% OBW of 4.1 MHz, tuned to the center of the operational band. - Set the power level and frequency of signal generator #2 to a value that is 5 dB below the AGC level determined from 7.2. The signal type is AWGN with a 99% OBW of 4.1 MHz. - Set RBW = 100 kHz. - Set VBW ≥ 300 kHz. - Select the CHANNEL POWER measurement mode. - Select the power averaging (rms) detector. - Affirm that the number of measurement points per sweep ≥ (2 . span)/RBW. - Sweep time = auto couple or as necessary (but no less than auto couple value). - Trace average at least 10 traces in power averaging (i.e., rms) mode. - Measure the maximum channel power and compute maximum gain when varying the signal generator #1 output to a 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 5), 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, including at least two points from within the RSSI-dependent region of operation. See gain limit in charts in Appendix D for uplink gain requirements. Additionally, document that the EUT provides equivalent uplink and downlink gain, and when operating in shutoff mode that the uplink and downlink gain is within the transmit power off mode gain limits. - Repeat 7.9.1b) to 7.9.1k) for all operational uplink bands. Variable uplink gain timing: Variable uplink gain timing is to be measured as follows, using the test setup shown in Figure 5. - 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 #1 to the lowest level of the RSSI-dependent gain [see 7.9.1k)]. d) Select MAX HOLD and increase the power level of signal generator #1 by 10 dB for mobile boosters, and by 20 dB for fixed indoor boosters. Signal generator #2 remains same, as described in 7.9.1c). e) Confirm that the uplink gain decreases to the specified levels, within 1 second for mobile devices, and within 3 seconds for fixed devices.13 f) Repeat 7.9.2a) to 7.9.2e) for all operational uplink bands.
Test Result:	PASS

5.8.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	E4421B	GB39340839	Jul. 05, 2022	Jul. 04, 2023
Signal Generator	Agilent	N5182A	MY47070282	Jul. 04, 2022	Jul. 03, 2023
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 05, 2022	Jul. 04, 2023
RF Combiner	SUNVNDN	SUD-CS 0800	16230009	/	/
Attenuator	50FP-006-H3	JFW	907763	/	/

5.8.3. Test Data

Mobile station coupling loss (MSCL): the minimum coupling loss (in dB) between the wireless device and the input (server) port of the consumer booster. MSCL must be calculated or measured for each band of operation and provided in compliance test reports. MSCL includes the path loss from the wireless device, and the booster's server antenna gain and cable loss. The wireless device is assumed to be an isotropic (0 dBi) antenna reference. Minimum standoff distances from inside wireless devices to the booster's server antenna must be reasonable and specified by the manufacturer in customer provided installation manuals.

MSCL Calculation							
Operation Bands	Frequency (MHz)	Distance (m)	Path loss (dB)	Indoor Antenna Gain(dBi)	Indoor Cable Loss(dB)	Polarity Loss(dB)	MSCL (dB)
PCS	1850	2	43.86	8	2.55	3.01	41.42
AWS-1	1710	2	43.18	8	2.42	3.01	40.61
Cellular	824	2	36.84	6	2.29	3.01	36.14
Lower700 MHz	698	2	35.40	6	2.19	3.01	34.60
Upper700 MHz	777	2	36.33	6	2.19	3.01	35.53

Note : Path loss = $20\log f + 20\log d - 27.5$

Polarity loss = $20\log (1/\sin (45\deg))$ dB = 3.01dB

Variable booster gain							
Operation Band	RSSI (dBm)	Input Power (dBm)	Output Power (dBm)	Measured Gain (dB)	MSCL	Limit	Results
PCS	-66	-50.5	12.09	62.59	41.42	71.98	PASS
	-63	-50.5	10.05	60.55	41.42	70.42	PASS
	-60	-50.5	5.89	56.39	41.42	67.42	PASS
	-57	-50.5	4.10	54.60	41.42	64.42	PASS
	-53	-50.5	0.38	50.88	41.42	60.42	PASS
	-50	-50.5	-3.23	47.27	41.42	57.42	PASS
AWS-1	-68	-49.2	14.61	63.81	40.61	71.27	PASS
	-65	-49.2	12.64	61.84	40.61	71.27	PASS
	-61	-49.2	8.27	57.47	40.61	67.61	PASS
	-57	-49.2	4.45	53.65	40.61	63.61	PASS
	-54	-49.2	1.20	50.40	40.61	60.61	PASS
	-51	-49.2	-1.94	47.26	40.61	57.61	PASS
Cellular	-63	-44.8	13.22	58.02	36.14	64.95	PASS
	-61	-44.8	12.05	56.85	36.14	63.14	PASS
	-59	-44.8	9.36	54.16	36.14	61.14	PASS
	-57	-44.8	7.34	52.14	36.14	59.14	PASS
	-54	-44.8	3.07	47.87	36.14	56.14	PASS
	-51	-44.8	0.91	45.71	36.14	53.14	PASS
	-65	-43.2	14.23	57.43	34.6	63.49	PASS

Lower700M Hz	-63	-43.2	13.22	56.42	34.6	63.49	PASS
	-61	-43.2	8.92	52.12	34.6	61.60	PASS
	-57	-43.2	5.44	48.64	34.6	57.60	PASS
	-55	-43.2	4.28	47.48	34.6	55.60	PASS
	-51	-43.2	0.42	43.62	34.6	51.60	PASS
Upper700M Hz	-62	-43.7	13.42	57.12	35.53	63.53	PASS
	-60	-43.7	11.39	55.09	35.53	61.53	PASS
	-57	-43.7	9.46	53.16	35.53	58.53	PASS
	-55	-43.7	5.83	49.53	35.53	56.53	PASS
	-51	-43.7	2.97	46.67	35.53	52.53	PASS
	-49	-43.7	1.11	44.81	35.53	50.53	PASS

Variable Uplink Gain Timing

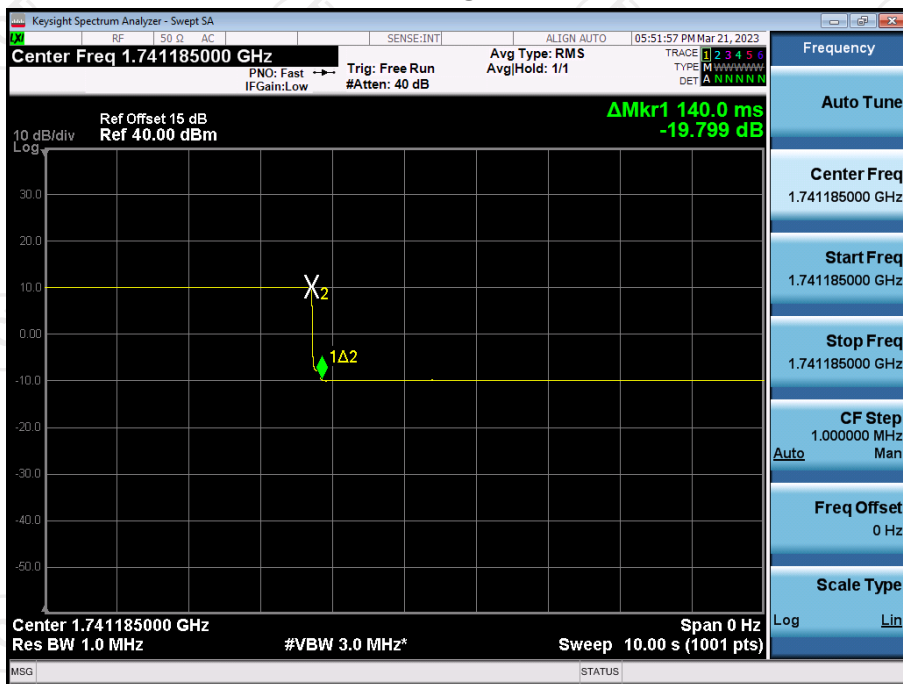
Operation Band	Measured Sec	Limit Sec	Result
PCS	0.470	3.0	PASS
AWS-1	0.140	3.0	PASS
Cellular	0.050	3.0	PASS
Lower700MHz	0.390	3.0	PASS
Upper700MHz	0.060	3.0	PASS

Variable Uplink Gain Timing Test Plots

PCS



AWS-1



Cellular



Lower700MHz

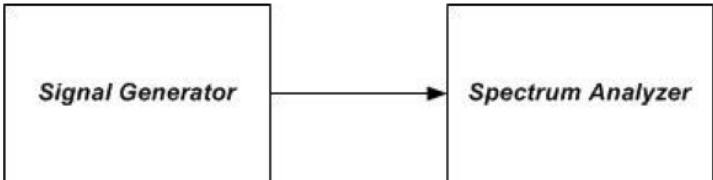


Upper700MHz



5.9. Occupied Bandwidth

5.9.1. Test Specification

Test Requirement:	FCC Part2 Section 2.1049
Test Method:	KDB935210 D03 Signal booster Measurements v04r04
Limit:	N/A
Test setup:	 Figure 6 – Test setup for measuring characteristics of test signals used for subsequent EUT occupied bandwidth testing
Test Procedure:	- Connect the test equipment as shown in Figure 6 to firstly measure the characteristics of the test signals produced by the signal generator. - Set VBW ≥ 3 RBW. - Set the center frequency of the spectrum analyzer to the center of the operational band. The span will be adjusted for each modulation type and OBW as necessary for accurately viewing the signals. - Set the signal generator for power level to match the values obtained from the tests of 7.2. - Set the signal generator modulation type for GSM with a PRBS pattern and allow the trace on the signal generator to stabilize adjusting the span as necessary. - Set the spectrum analyzer RBW for 1% to 5% of the EBW. - Capture the spectrum analyzer trace for inclusion in the test report. - Repeat 7.10c) to 7.10g) for CDMA and W-CDMA modulation, adjusting the span as necessary. AWGN or LTE may be used in place of W-CDMA, as an option. - Repeat 7.10c) to 7.10h) for all uplink and downlink operational bands. - Connect the test equipment as shown in Figure 1, with the uplink output (donor) port connected to the spectrum analyzer, and the server port connected to the signal generator. - Repeat 7.10c) to 7.10i) with this EUT uplink path test setup. - Connect the test equipment as shown in Figure 1, with the downlink output (server) port connected to the spectrum analyzer, and the donor port connected to the signal generator. - Repeat 7.10c) to 7.10j) with this EUT downlink path test setup.
Test results:	PASS

5.9.2. Test Instruments

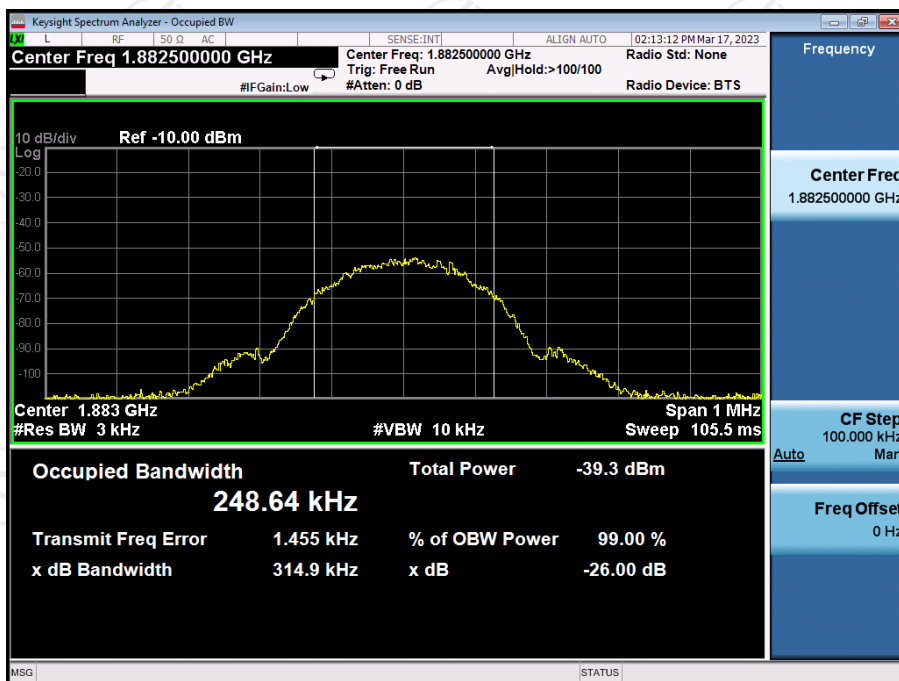
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Generator	Agilent	N5182A	MY47070282	Jul. 04, 2022	Jul. 03, 2023
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 05, 2022	Jul. 04, 2023

5.9.3. Test Data

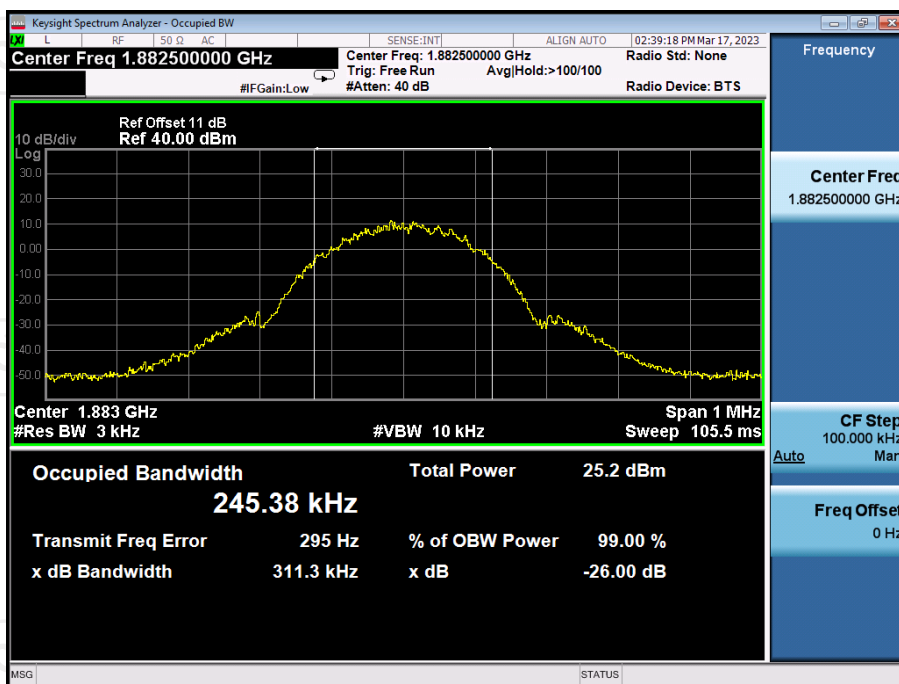
Operation Band		Signal Type	Input OBW [MHz]	Output OBW [MHz]	Results
Uplink	PCS	GSM	0.249	0.245	PASS
		CDMA	1.245	1.269	PASS
		LTE	4.524	4.519	PASS
	AWS-1	GSM	0.245	0.246	PASS
		CDMA	1.246	1.247	PASS
		LTE	4.513	4.525	PASS
	Cellular	GSM	0.246	0.246	PASS
		CDMA	1.245	1.247	PASS
		LTE	4.524	4.505	PASS
	Lower700M Hz	GSM	0.246	0.248	PASS
		CDMA	1.242	1.243	PASS
		LTE	4.528	4.518	PASS
	Upper700M Hz	GSM	0.245	0.246	PASS
		CDMA	1.248	1.267	PASS
		LTE	4.518	4.505	PASS
Downlink	PCS	GSM	0.246	0.246	PASS
		CDMA	1.246	1.242	PASS
		LTE	4.548	4.507	PASS
	AWS-1	GSM	0.247	0.245	PASS
		CDMA	1.247	1.243	PASS
		LTE	4.558	4.525	PASS
	Cellular	GSM	0.248	0.245	PASS
		CDMA	1.246	1.244	PASS
		LTE	4.534	4.516	PASS
	Lower700M Hz	GSM	0.248	0.247	PASS
		CDMA	1.245	1.236	PASS
		LTE	4.530	4.498	PASS
	Upper700M Hz	GSM	0.249	0.243	PASS
		CDMA	1.247	1.244	PASS
		LTE	4.534	4.489	PASS

Test Plots

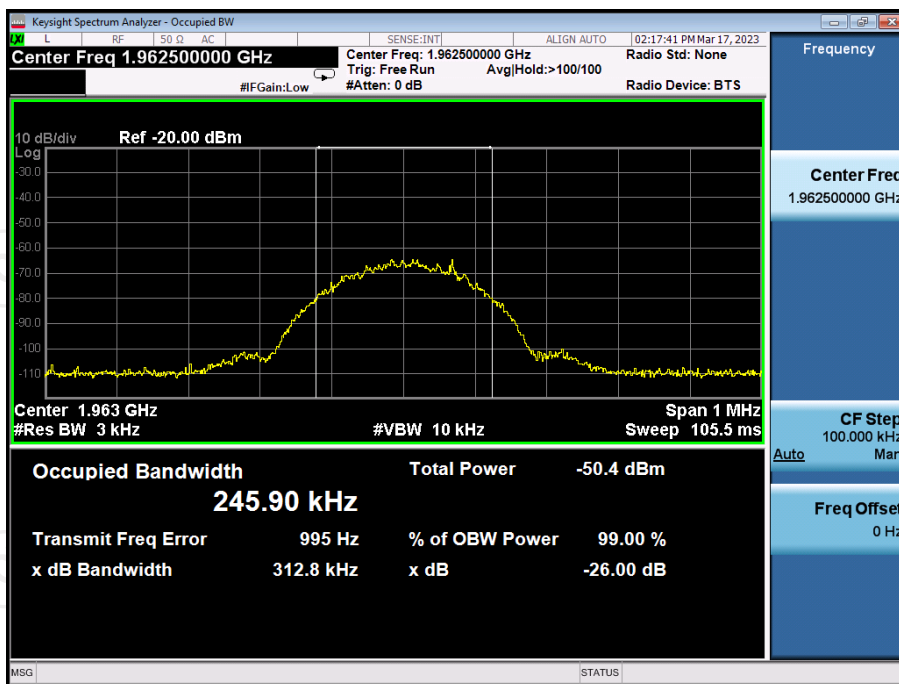
PCS GSM UL Input



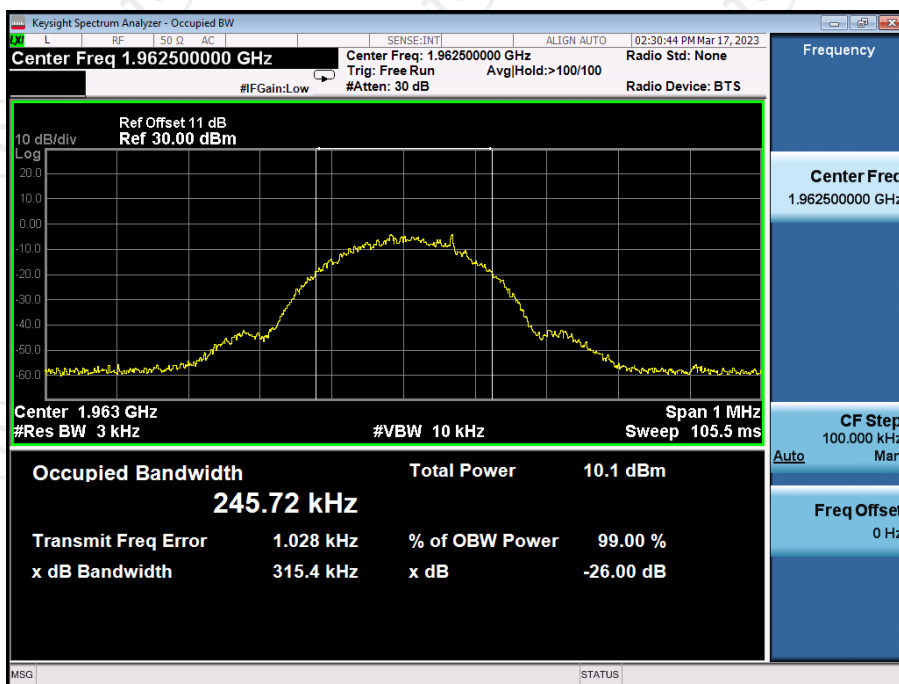
PCS GSM UL output



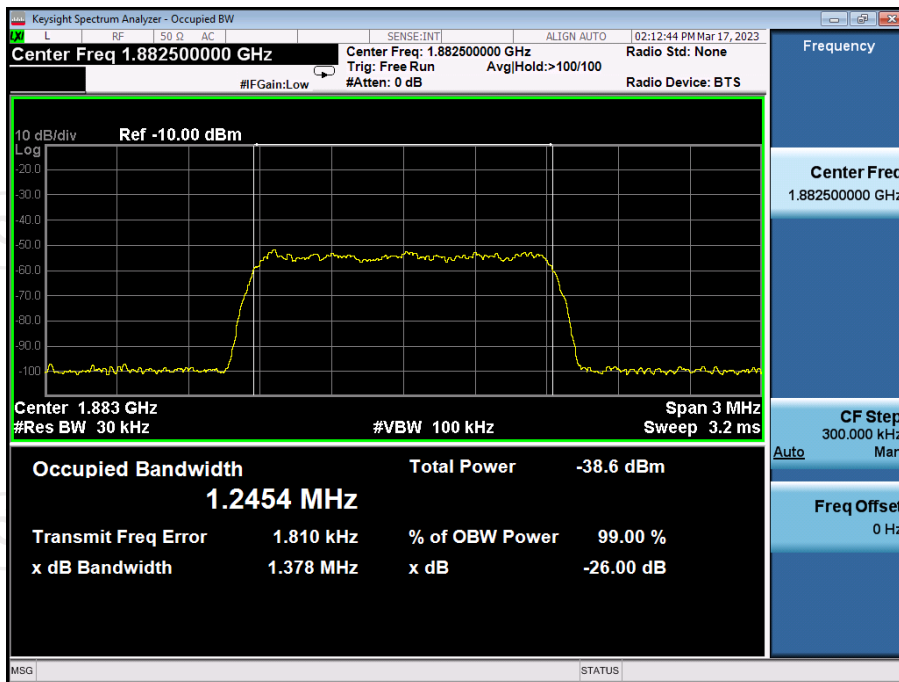
PCS GSM DL Input



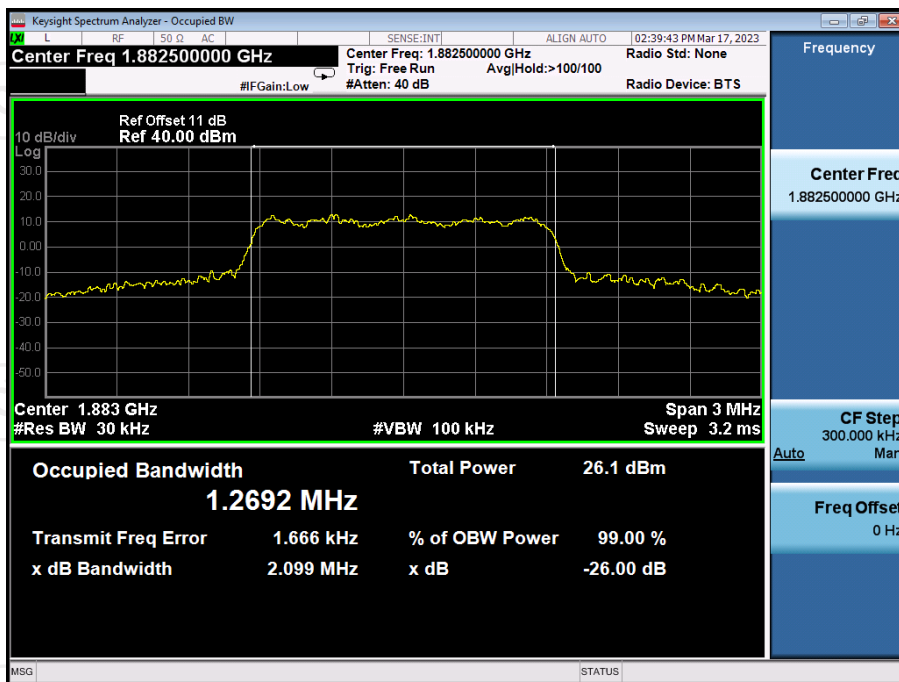
PCS GSM DL Output



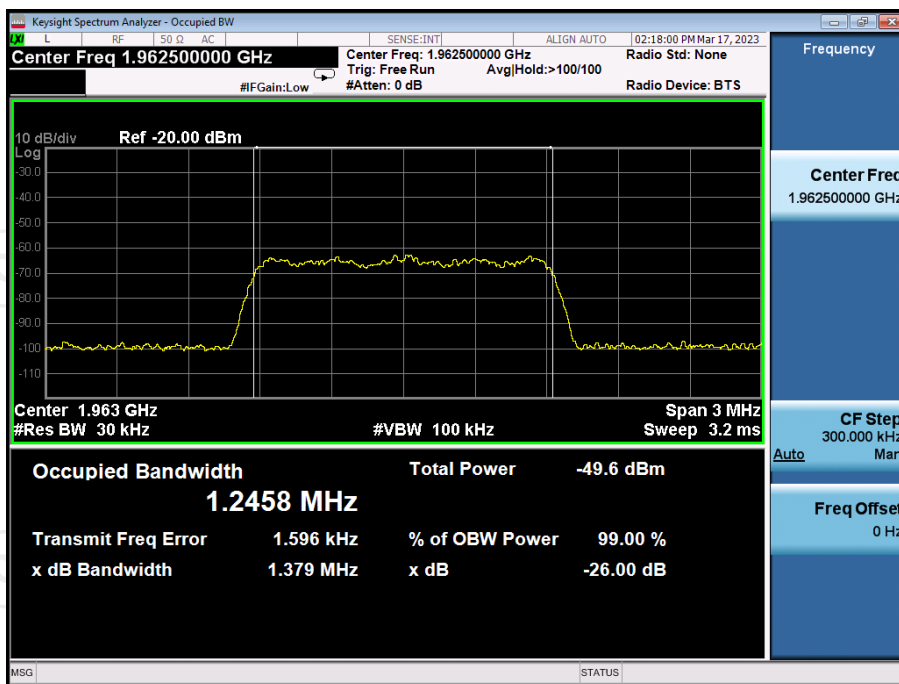
PCS CDMA UL Input



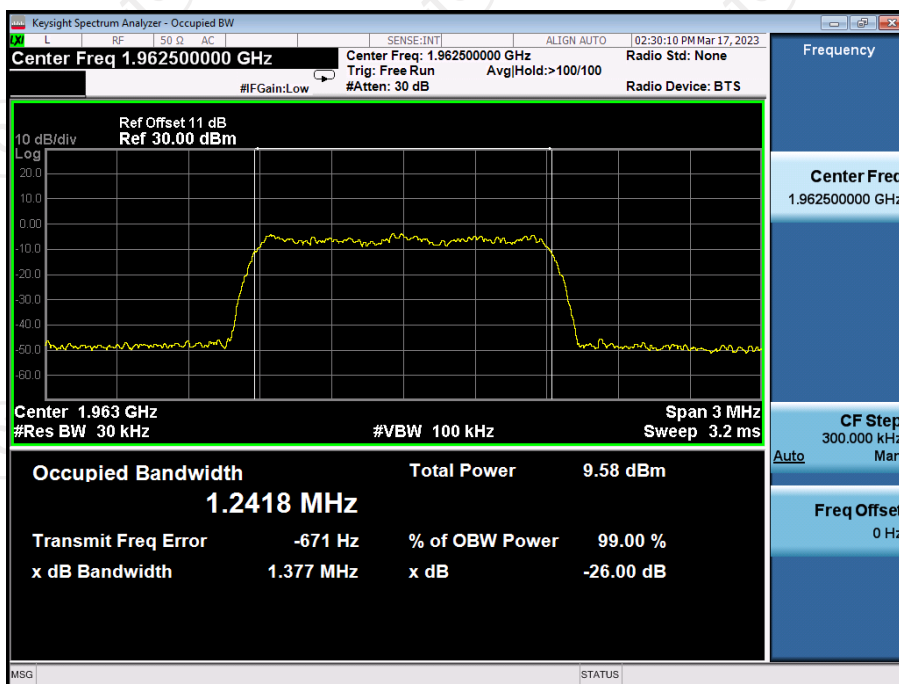
PCS CDMA UL output



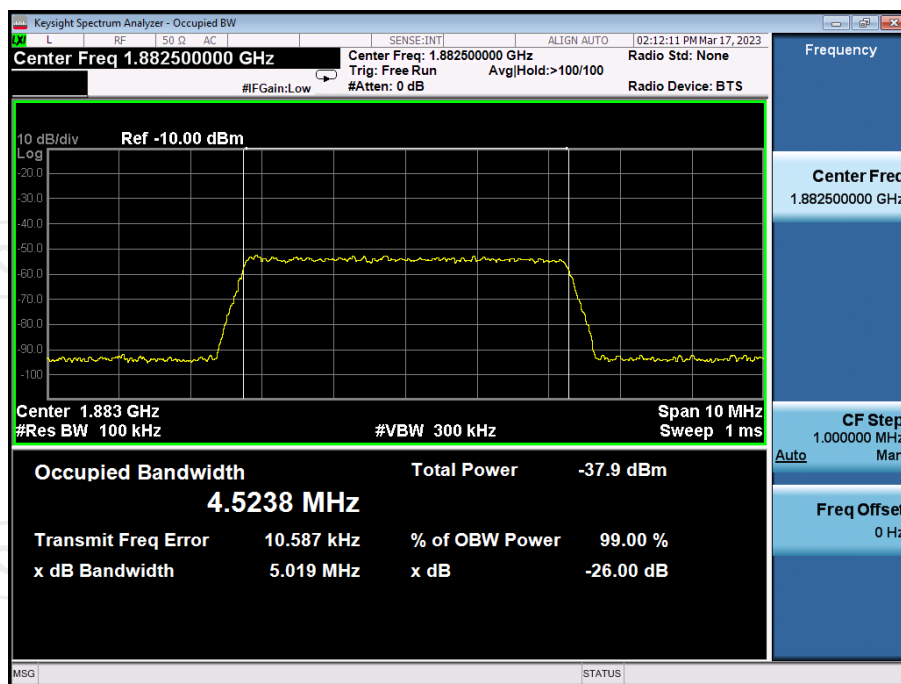
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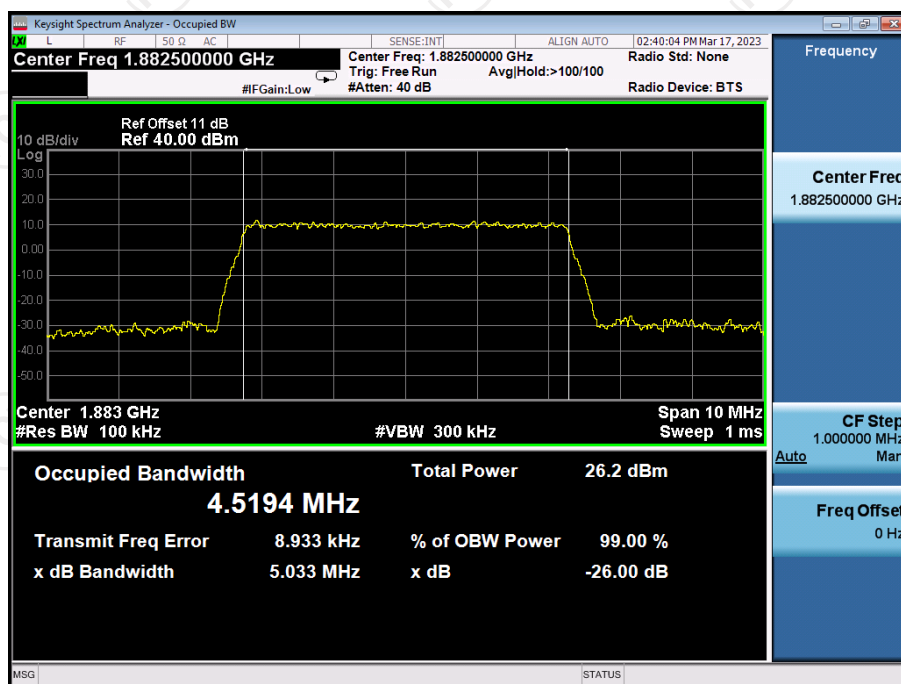
PCS CDMA DL Output



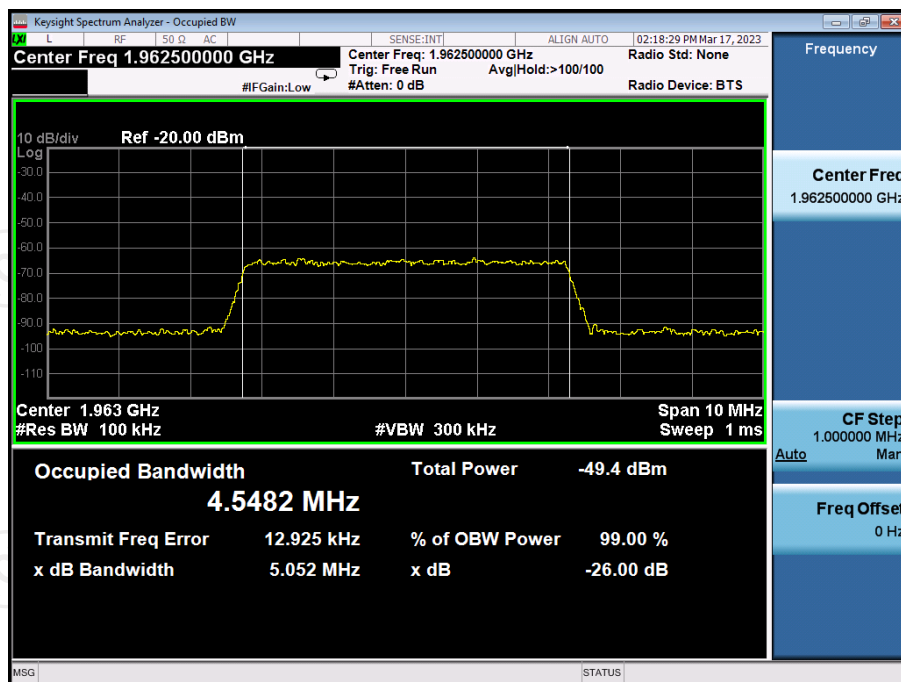
PCS LTE UL Input



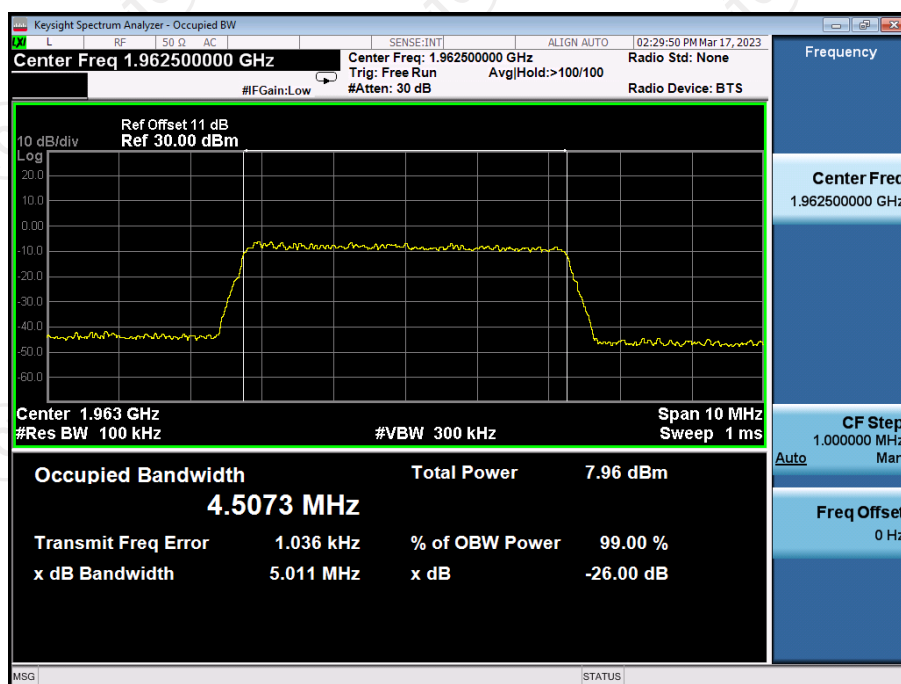
PCS LTE UL output



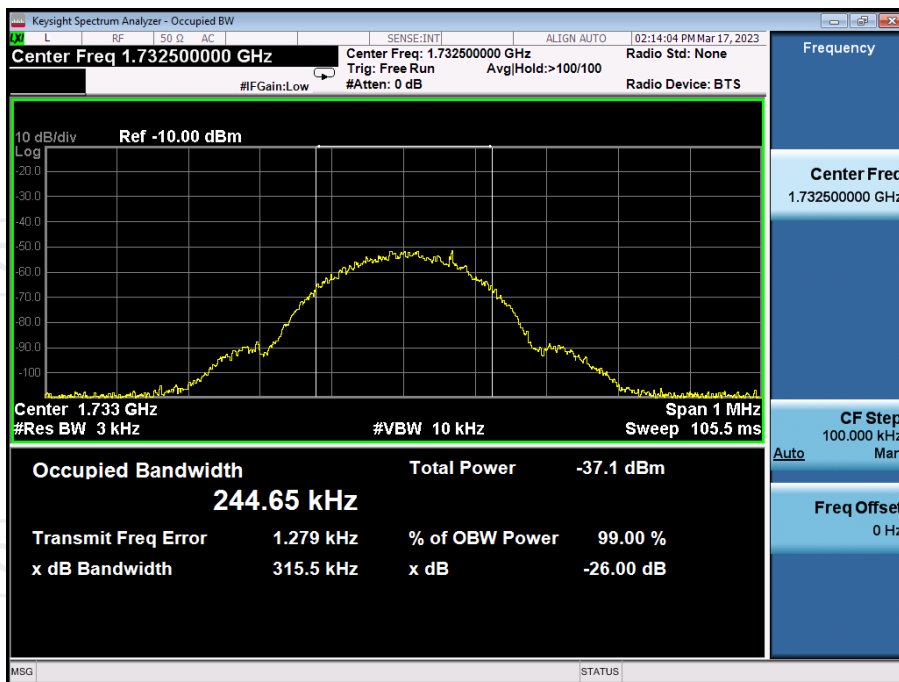
PCS LTE DL Input



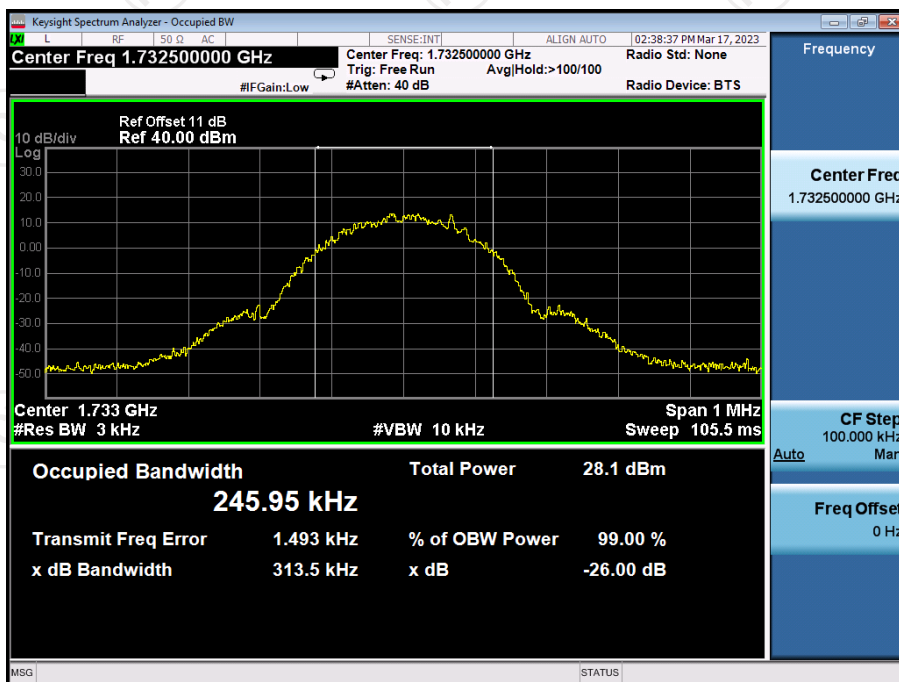
PCS LTE DL Output



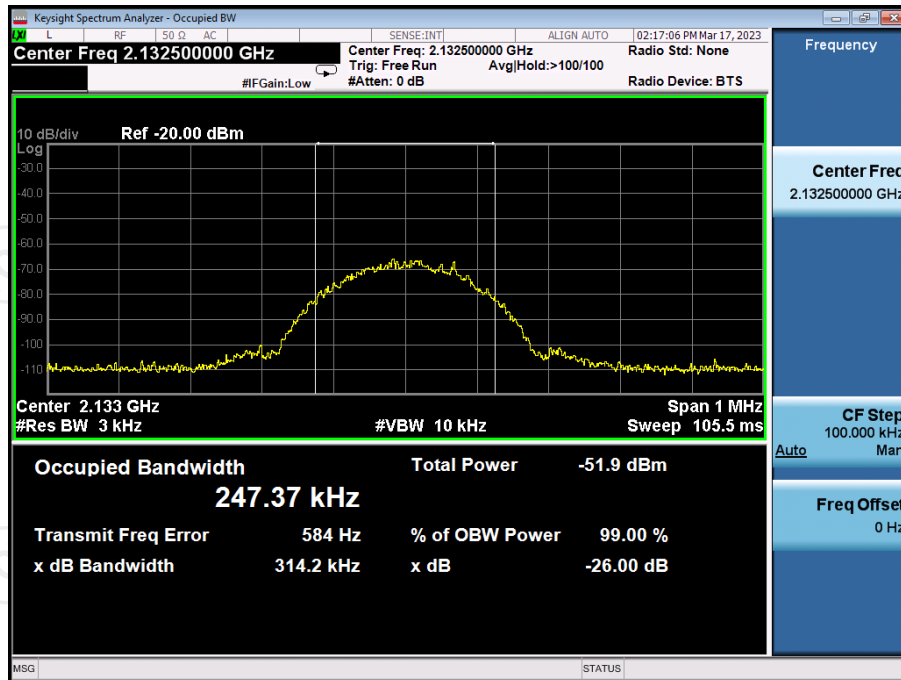
AWS-1 GSM UL Input



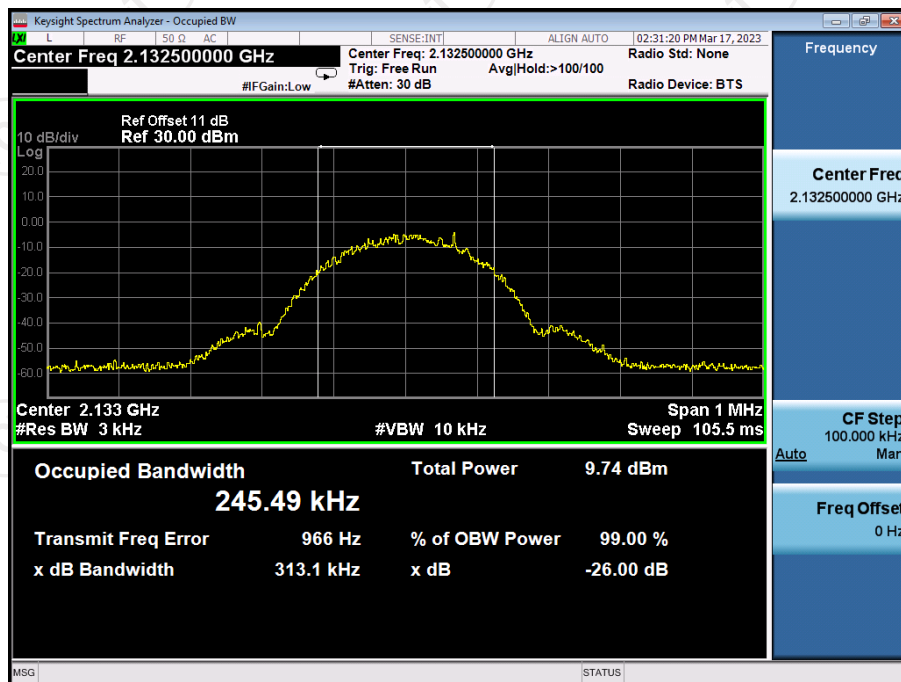
AWS-1 GSM UL output



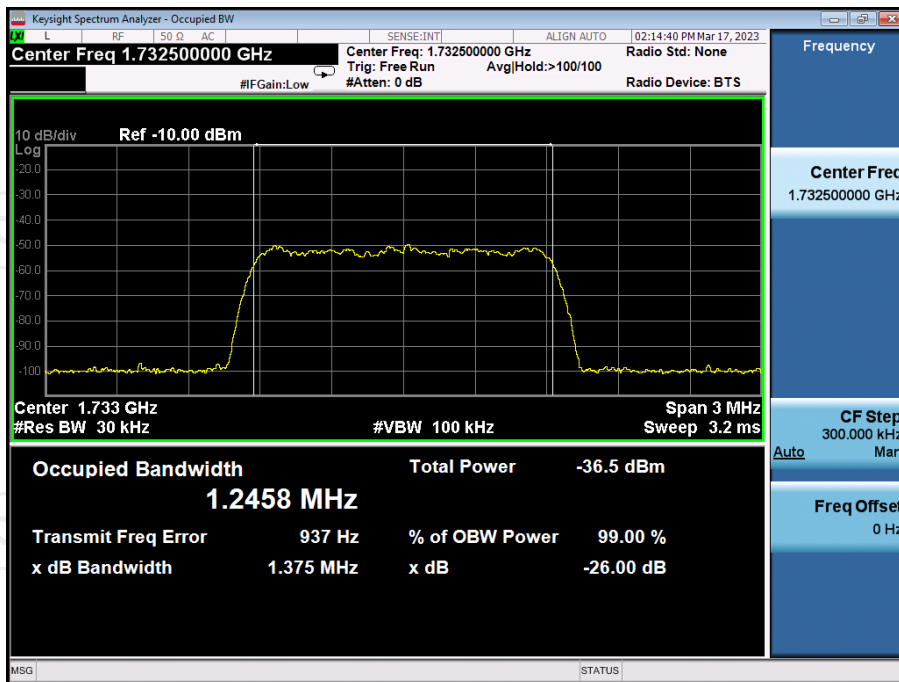
AWS-1 GSM DL Input



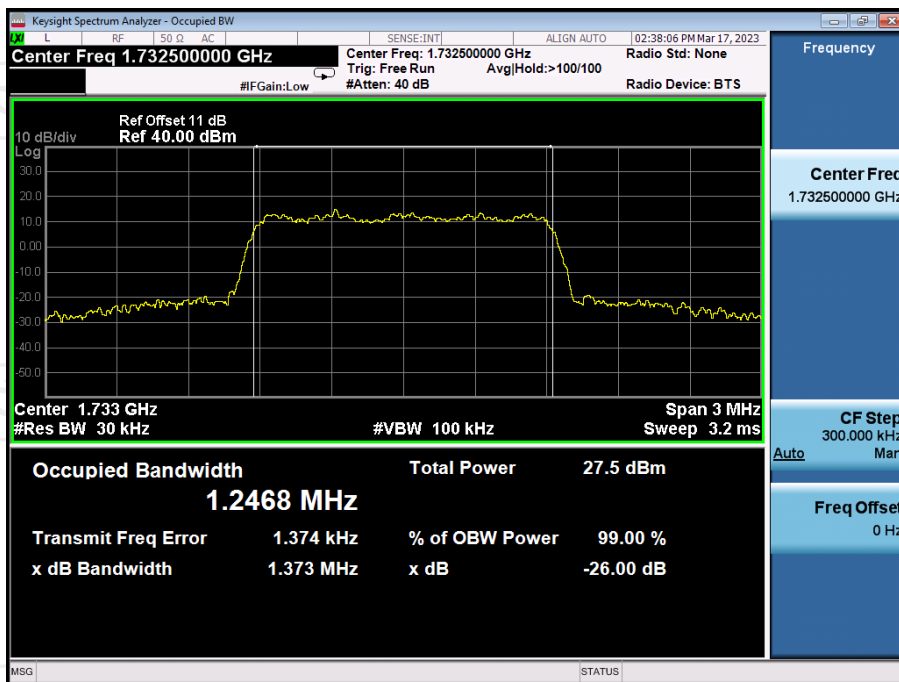
AWS-1 GSM DL Output



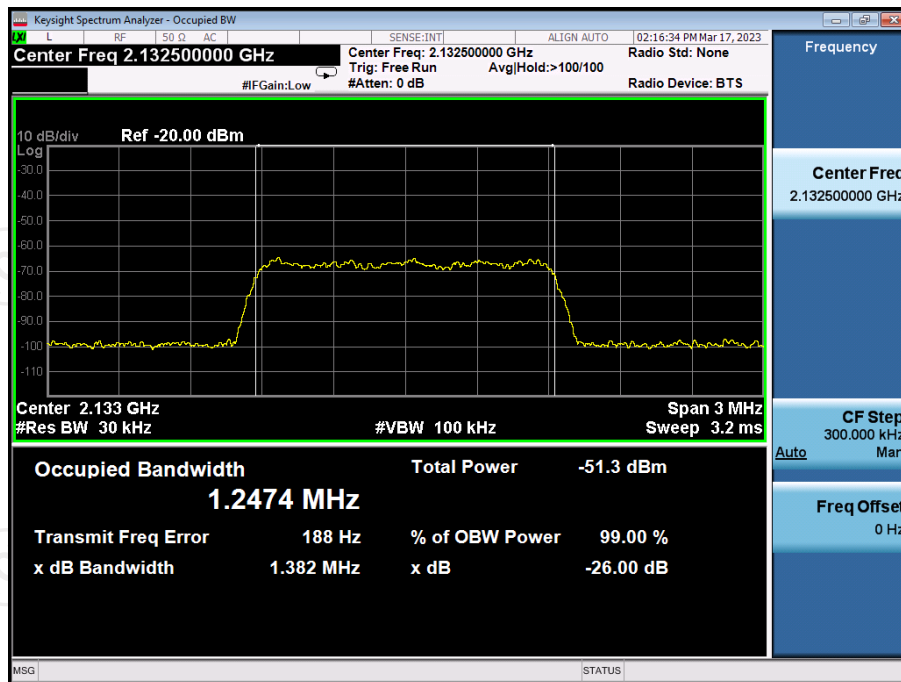
AWS-1 CDMA UL Input



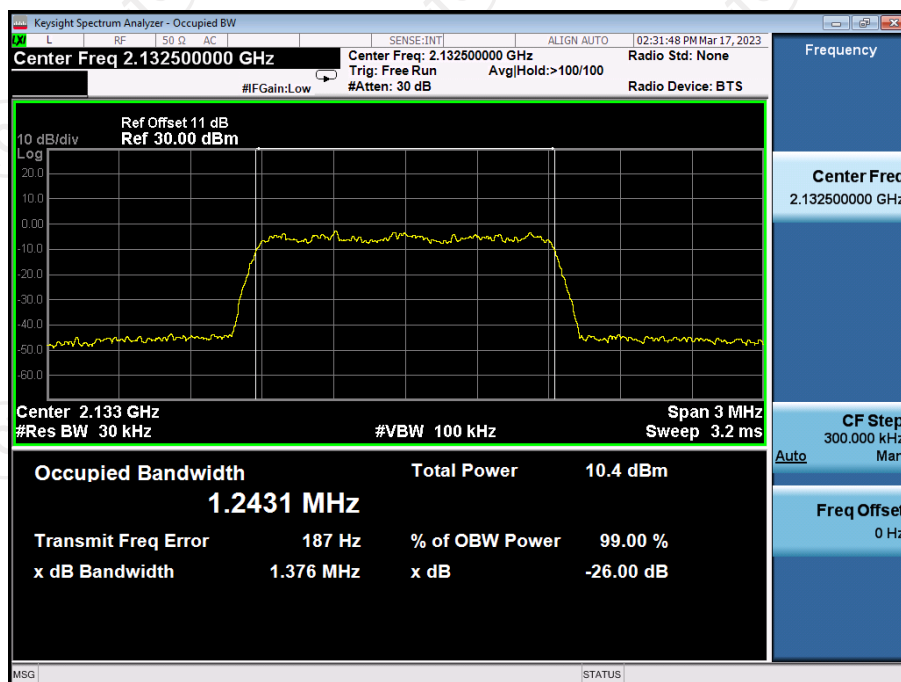
AWS-1 CDMA UL output



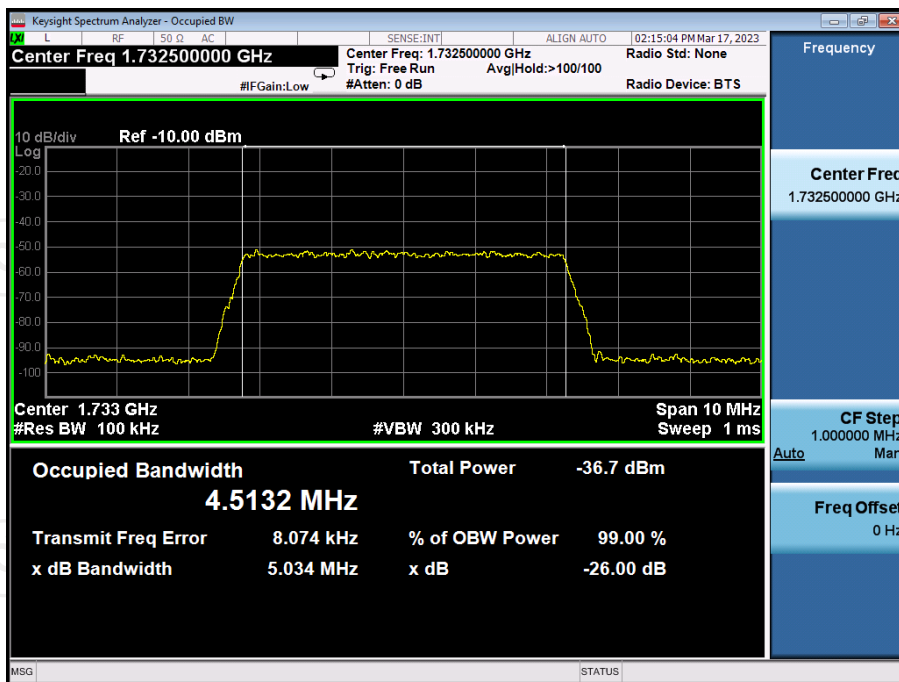
AWS-1 CDMA DL Input



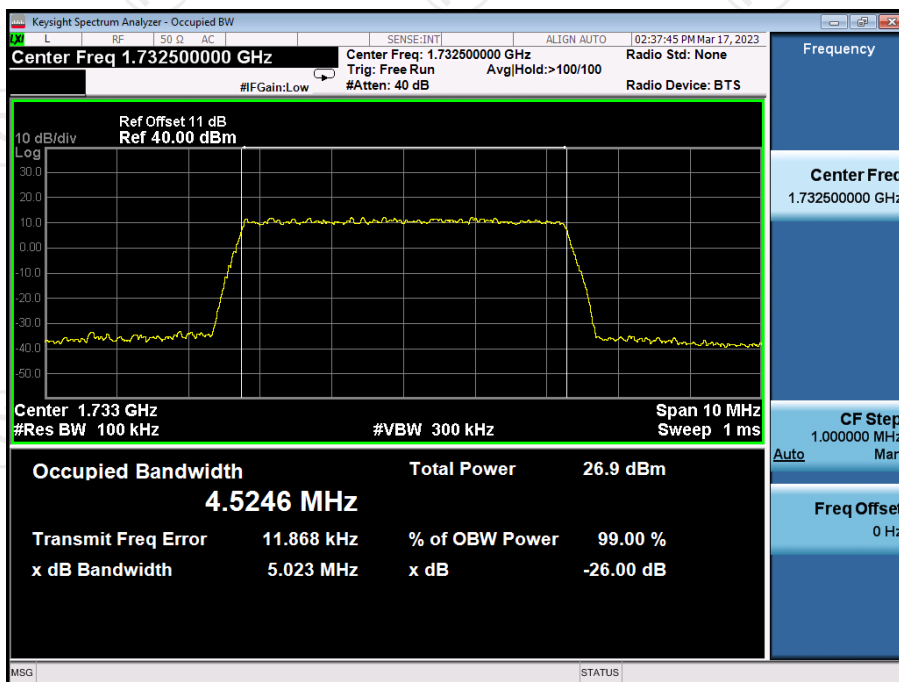
AWS-1 CDMA DL Output



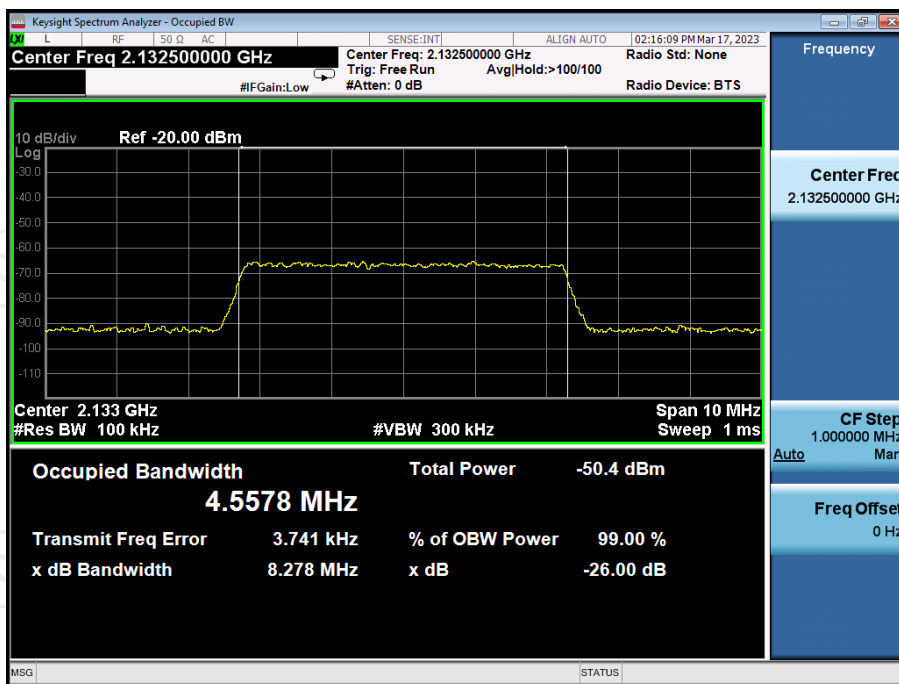
AWS-1 LTE UL Input



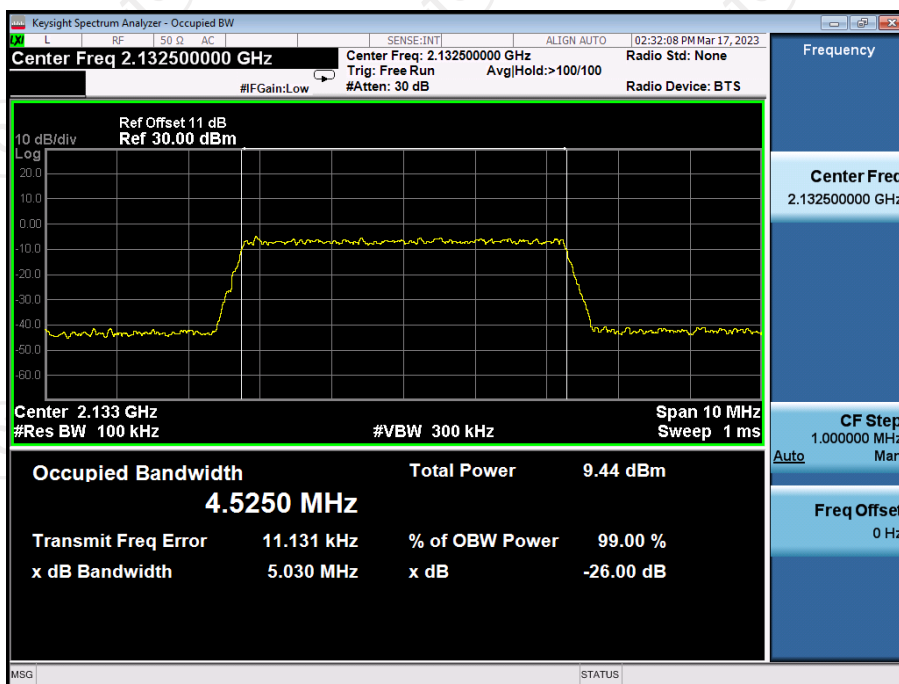
AWS-1 LTE UL output



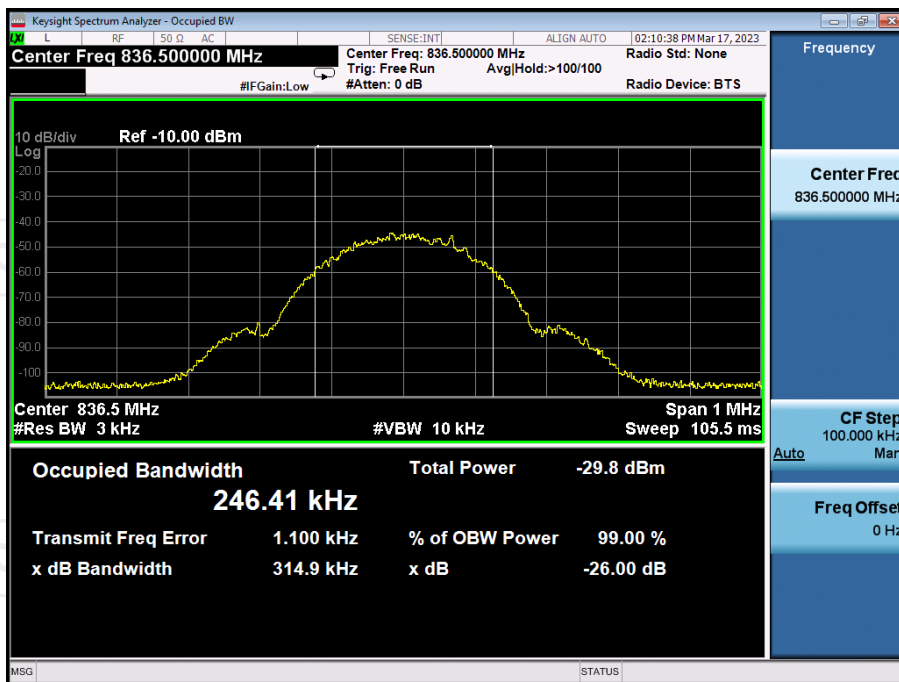
AWS-1 LTE DL Input



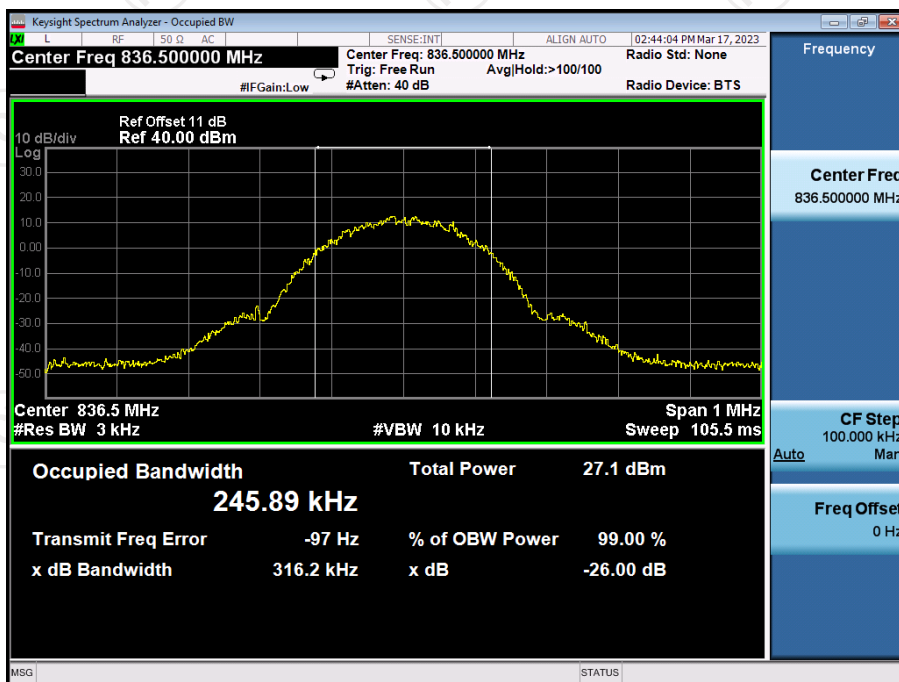
AWS-1 LTE DL Output



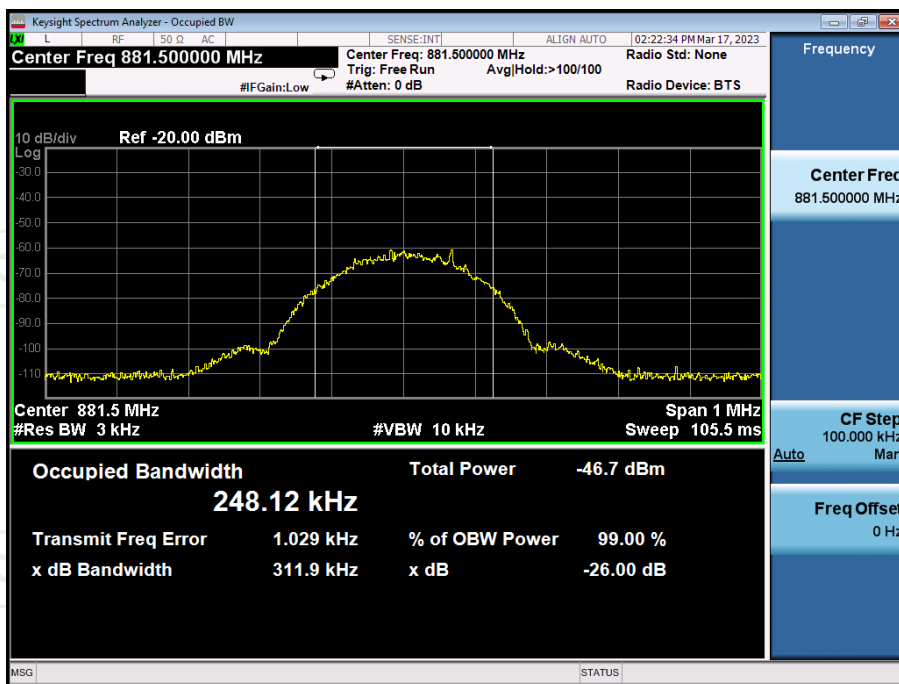
Cellular GSM UL Input



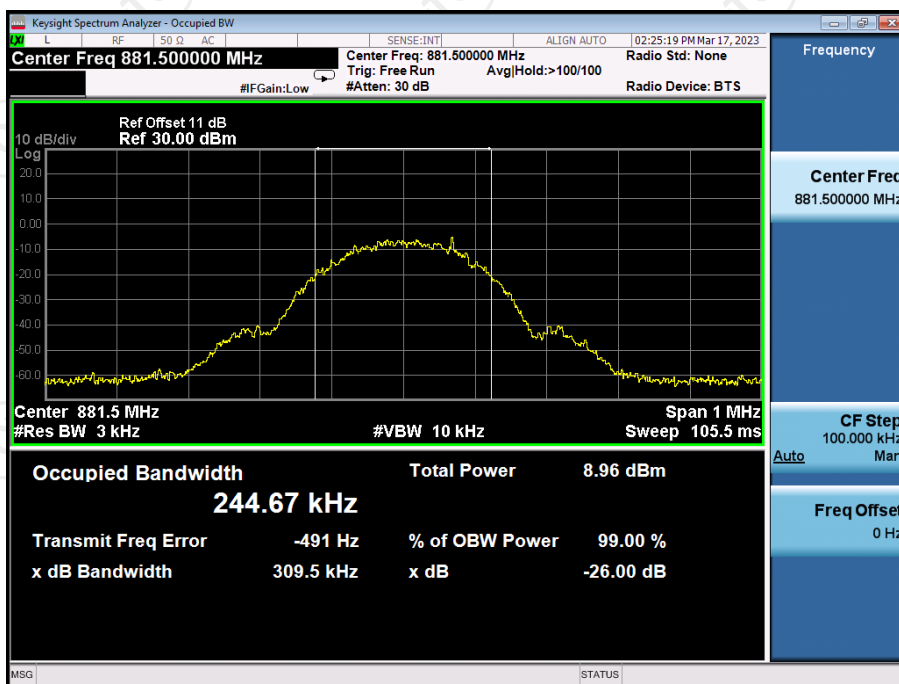
Cellular GSM UL output



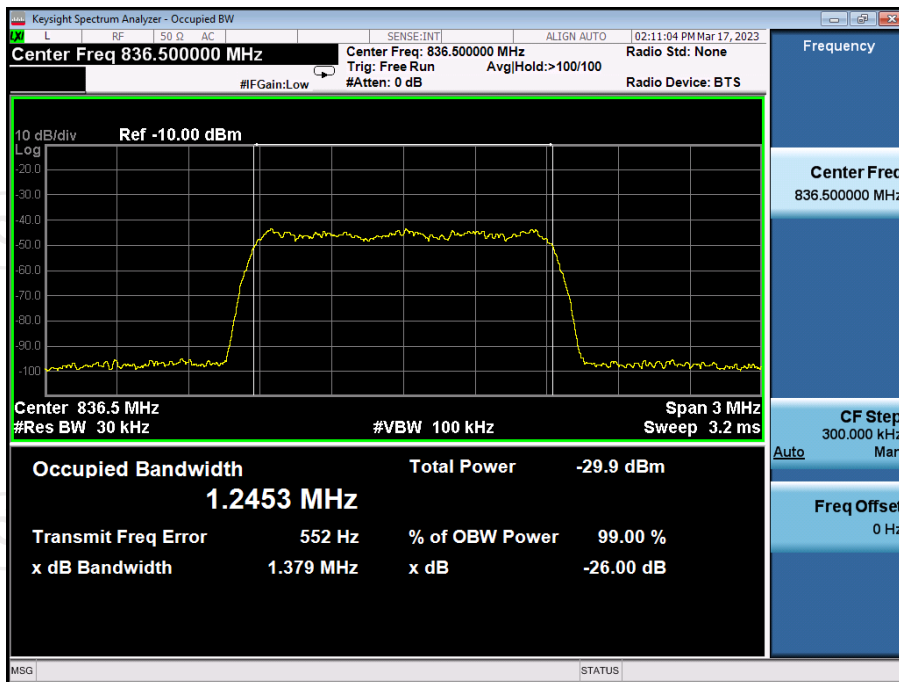
Cellular GSM DL Input



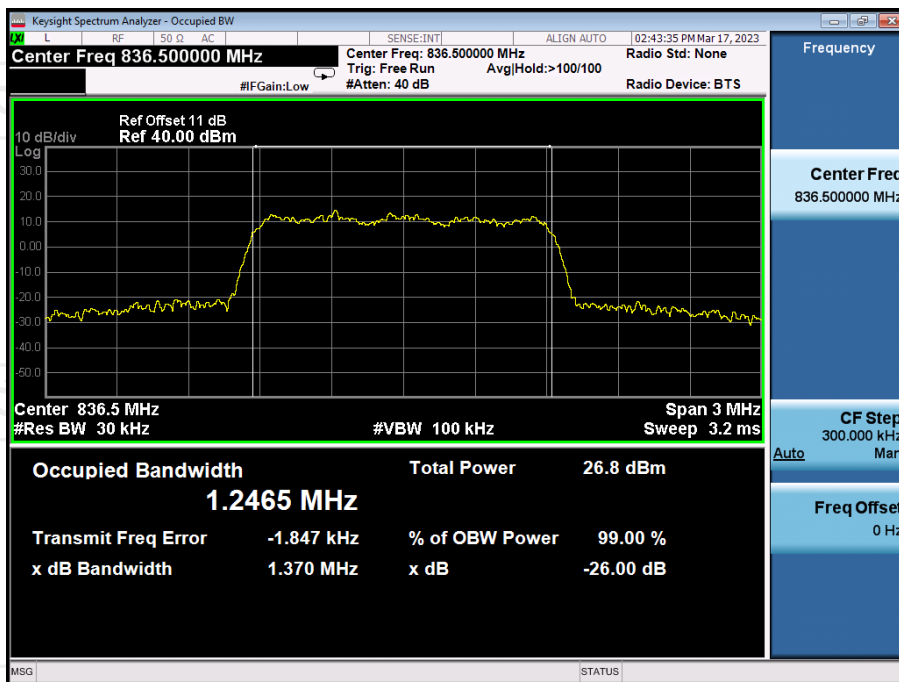
Cellular GSM DL Output



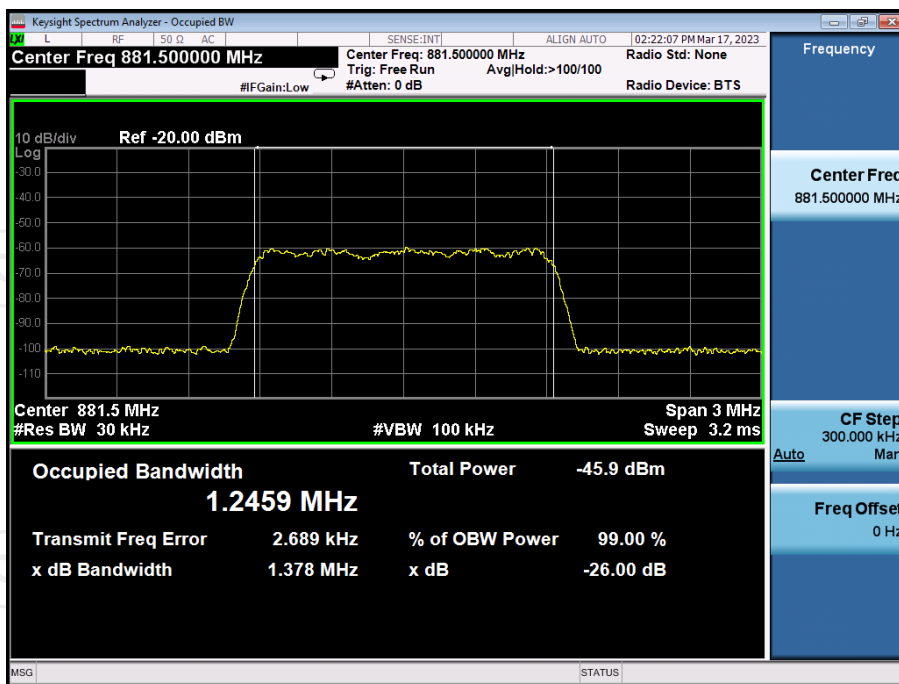
Cellular CDMA UL Input



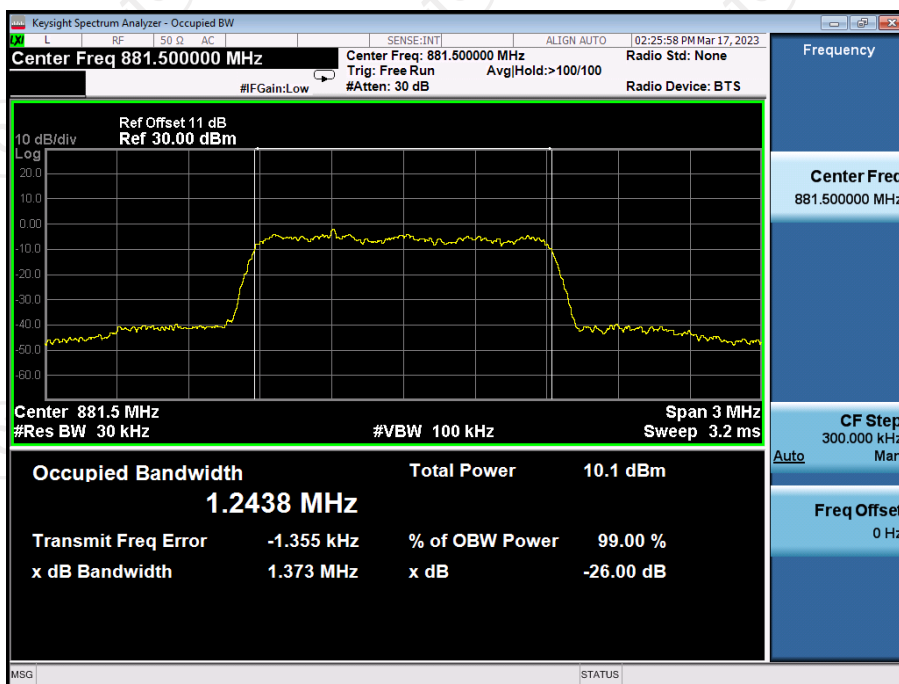
Cellular CDMA UL output



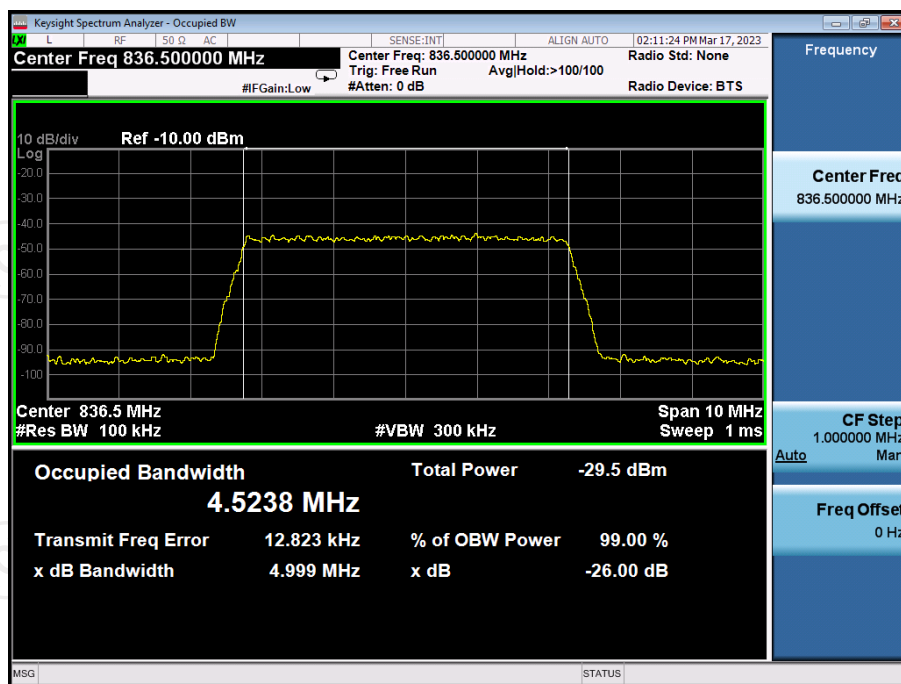
Cellular CDMA DL Input



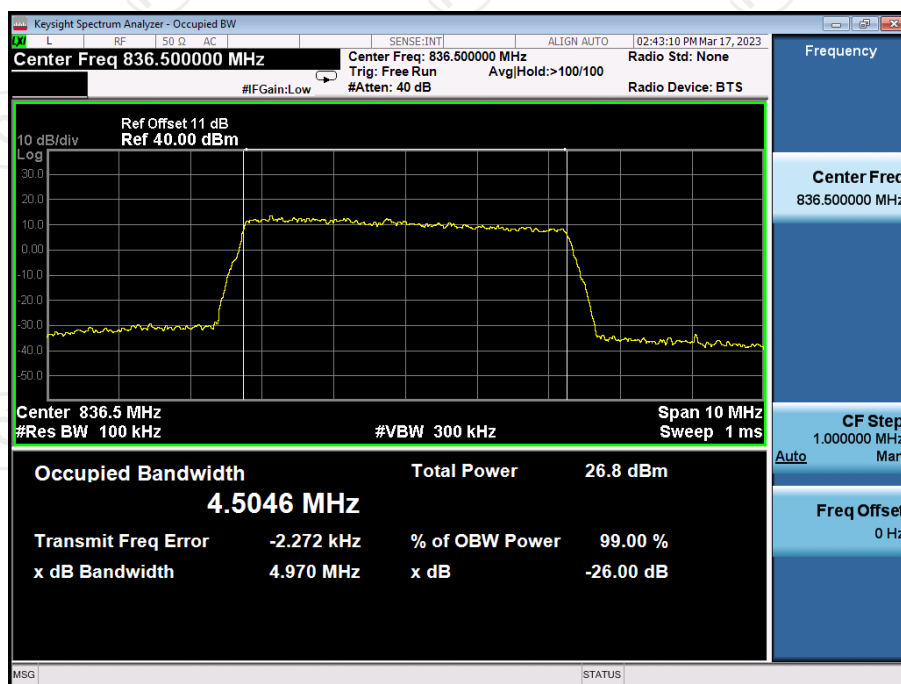
Cellular CDMA DL Output



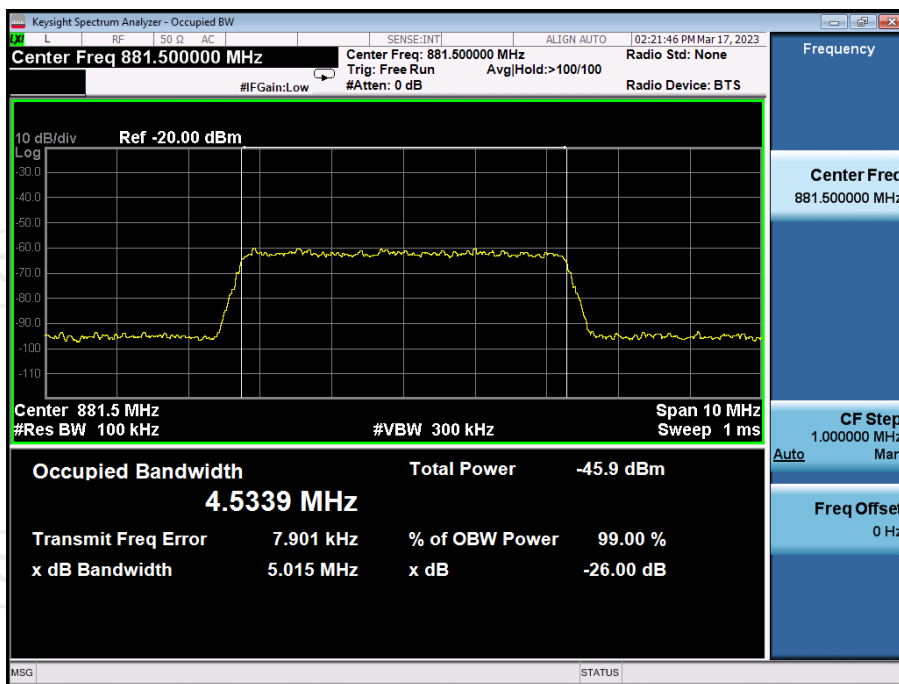
Cellular LTE UL Input



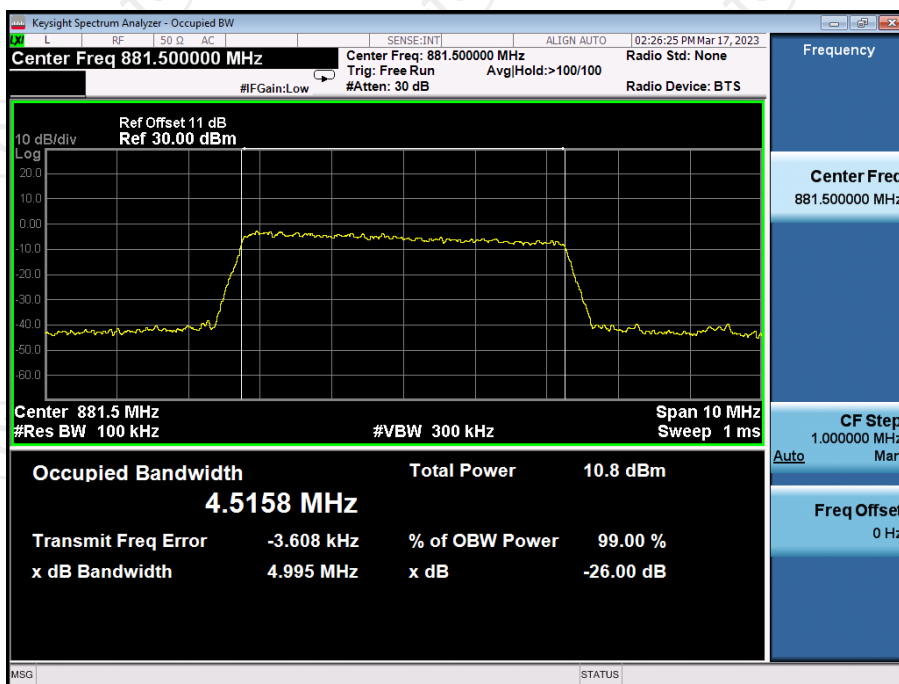
Cellular LTE UL output



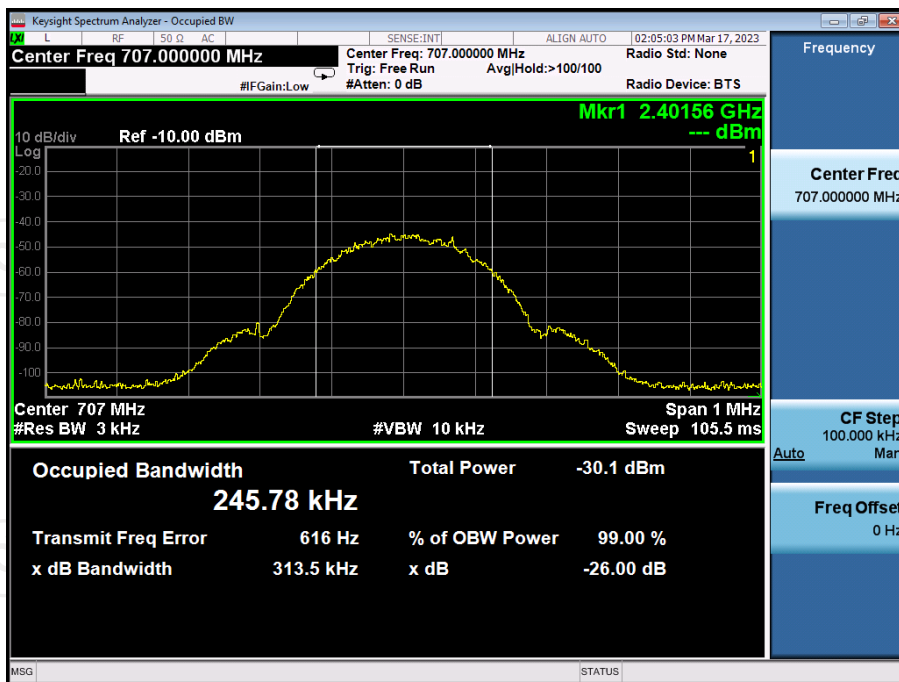
Cellular LTE DL Input



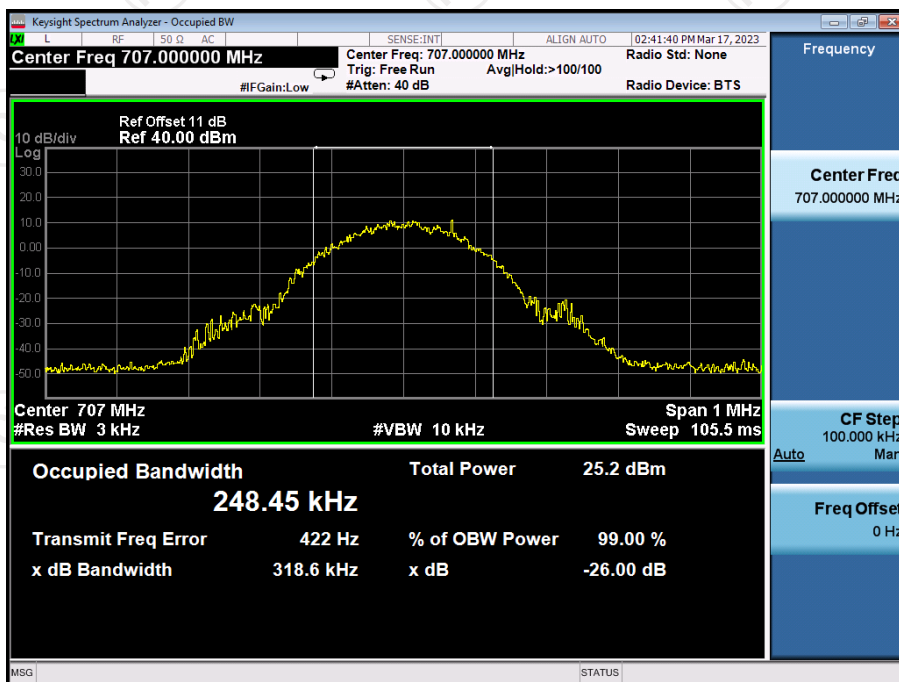
Cellular LTE DL Output



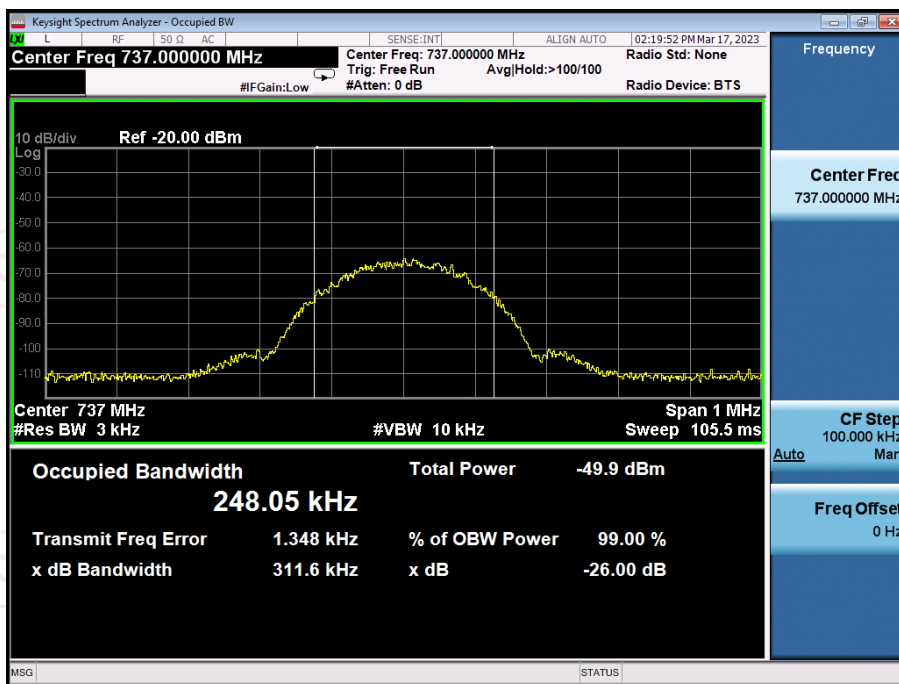
Lower700MHz GSM UL Input



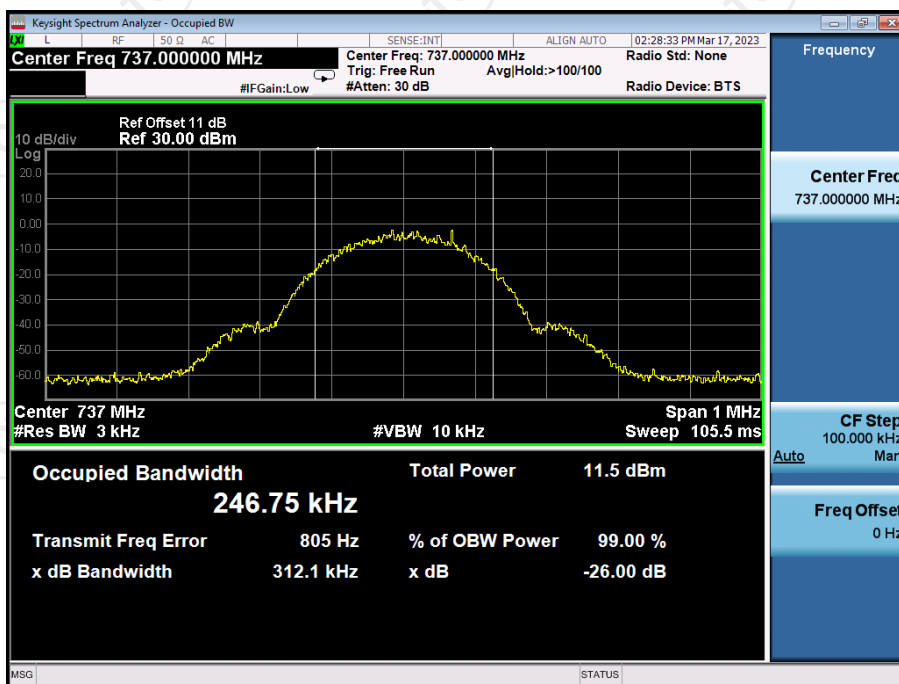
Lower700MHz GSM UL output



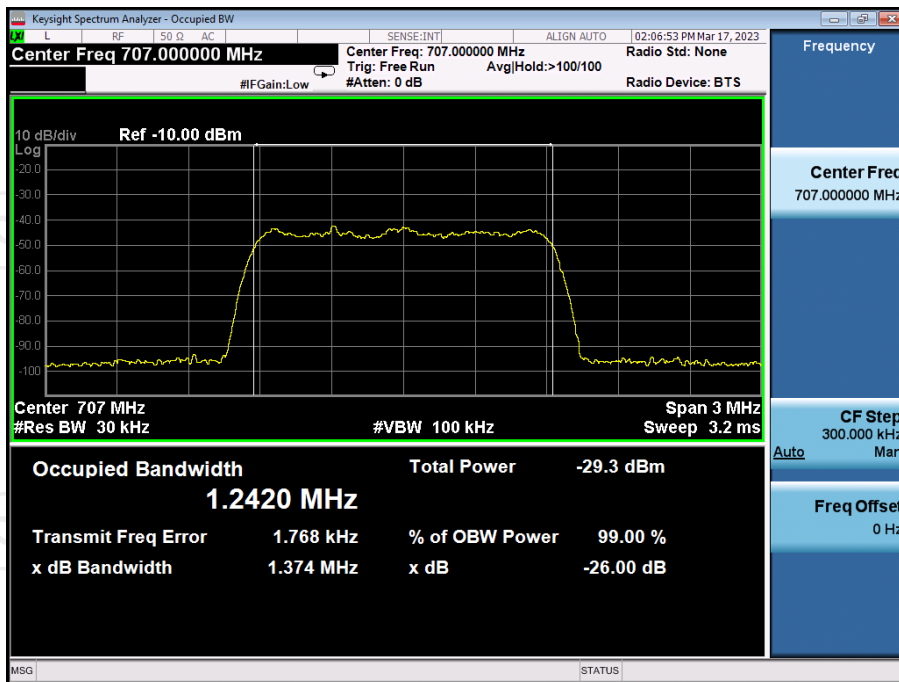
Lower700MHz GSM DL Input



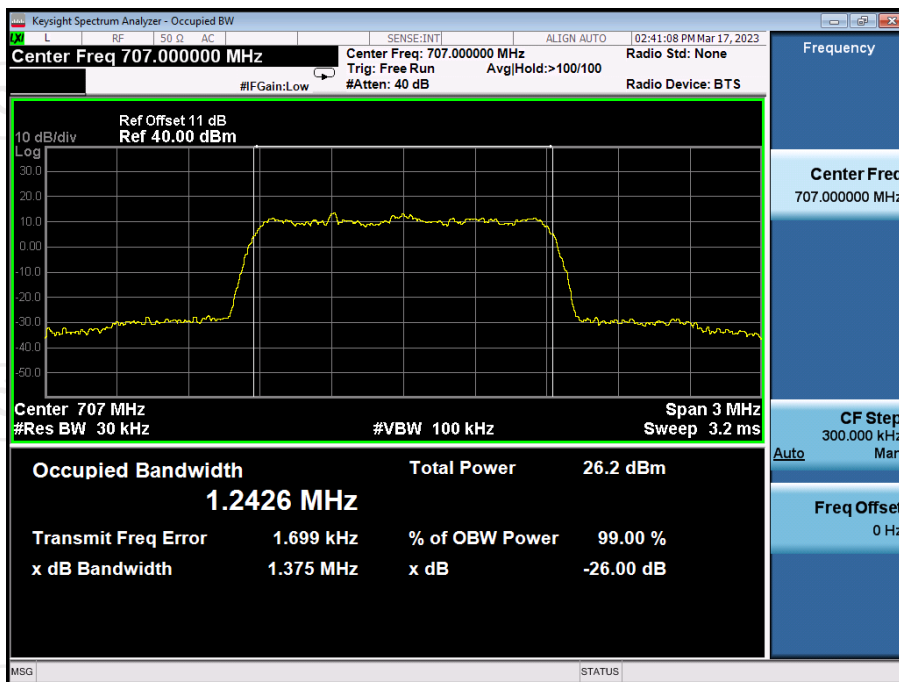
Lower700MHz GSM DL Output



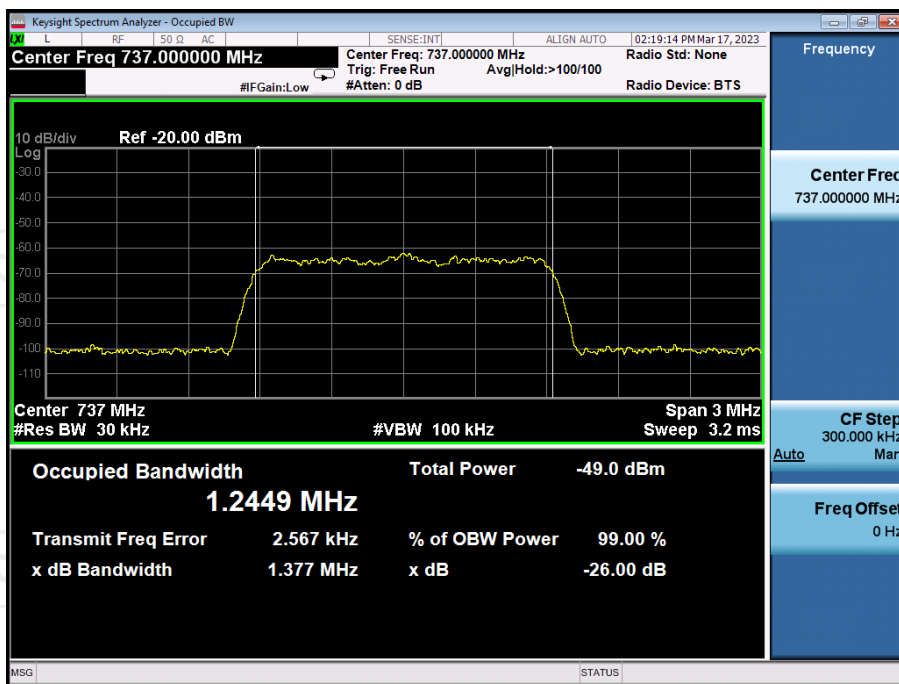
Lower700MHz CDMA UL Input



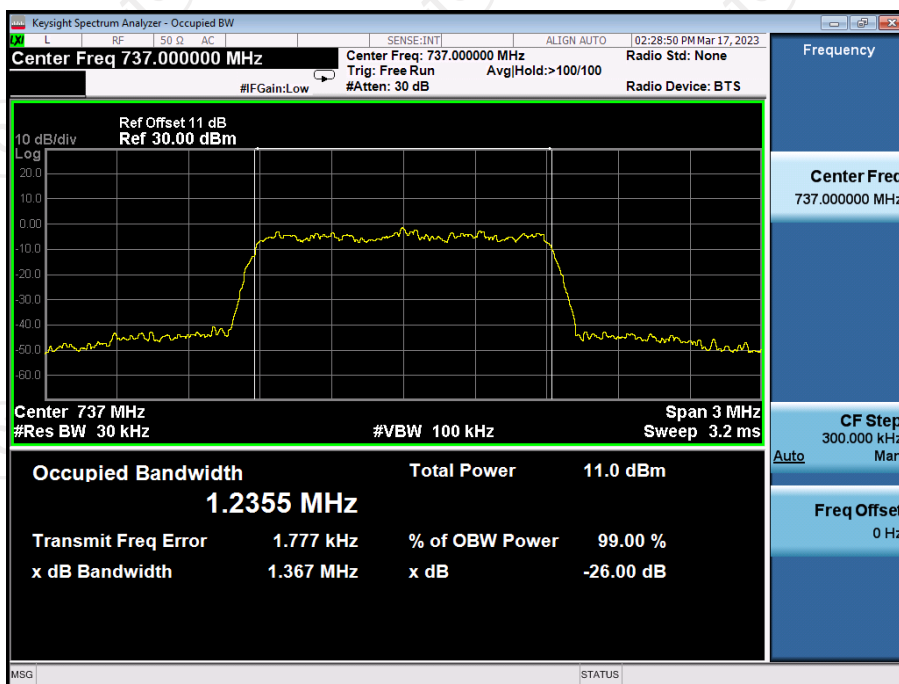
Lower700MHz CDMA UL output



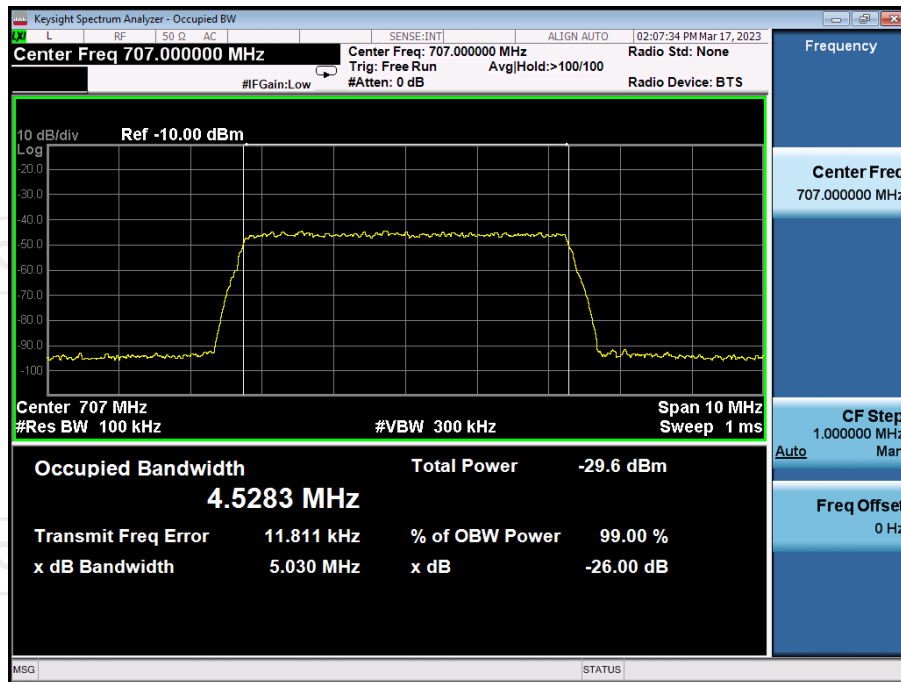
Lower700MHz CDMA DL Input



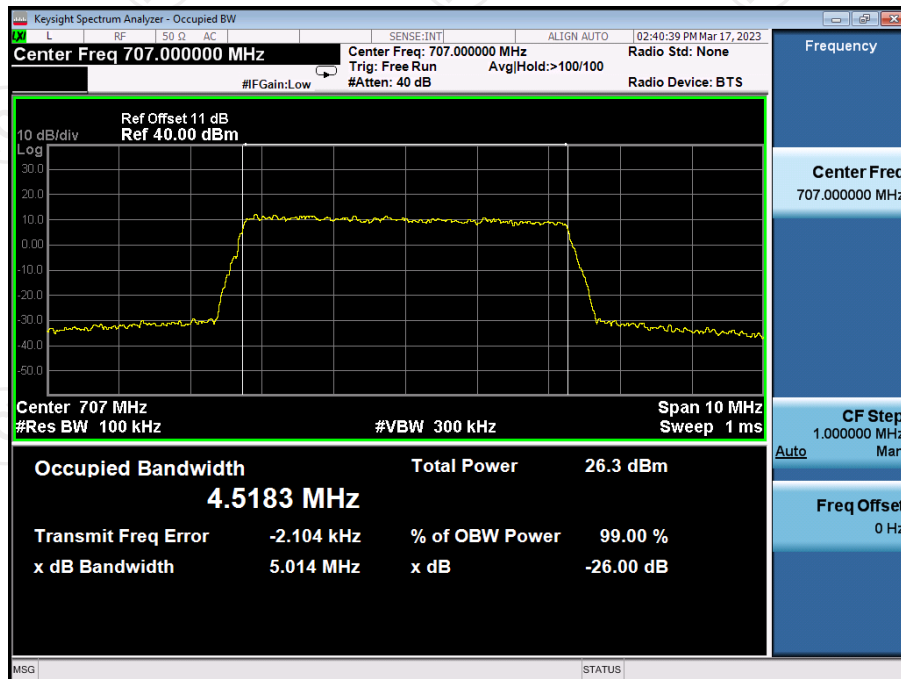
Lower700MHz CDMA DL Output



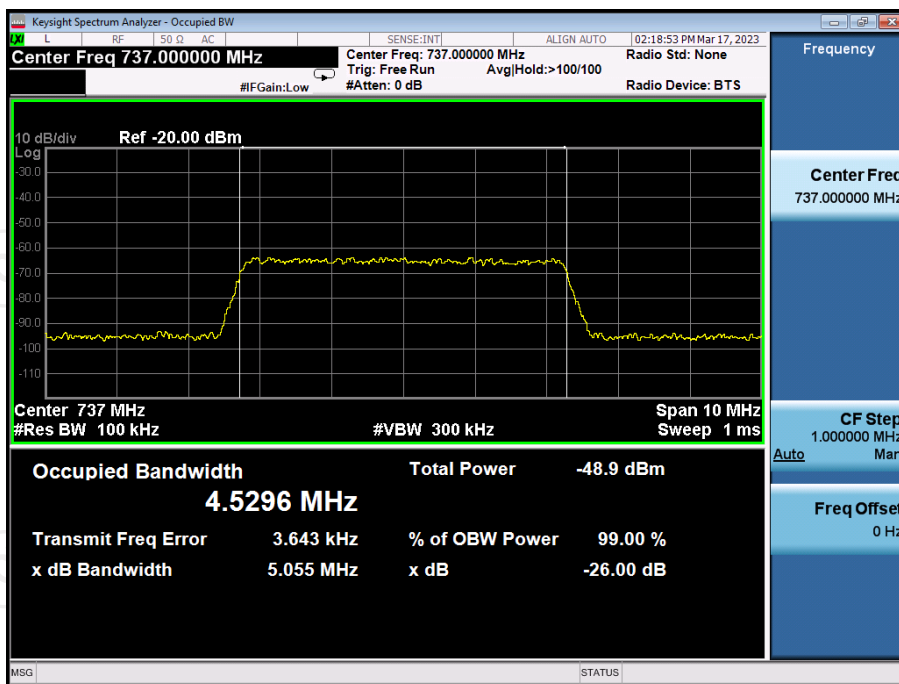
Lower700MHz LTE UL Input



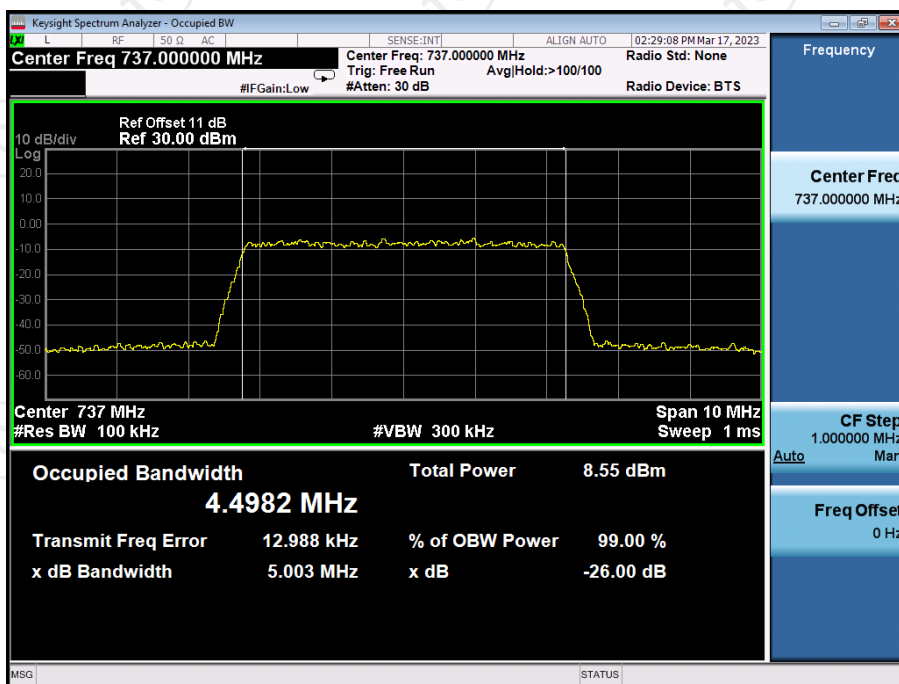
Lower700MHz LTE UL output



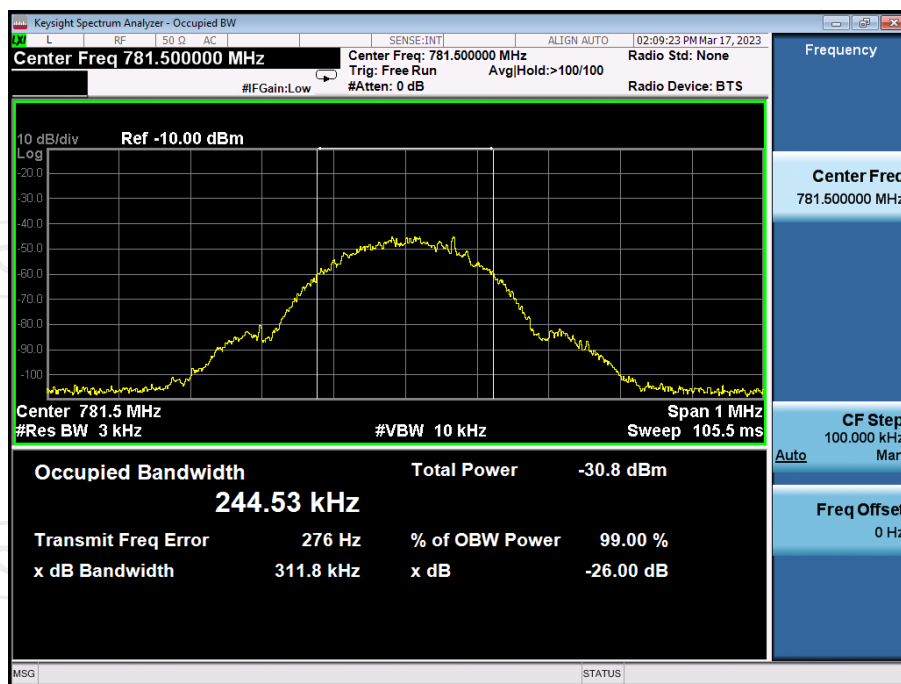
Lower700MHz LTE DL Input



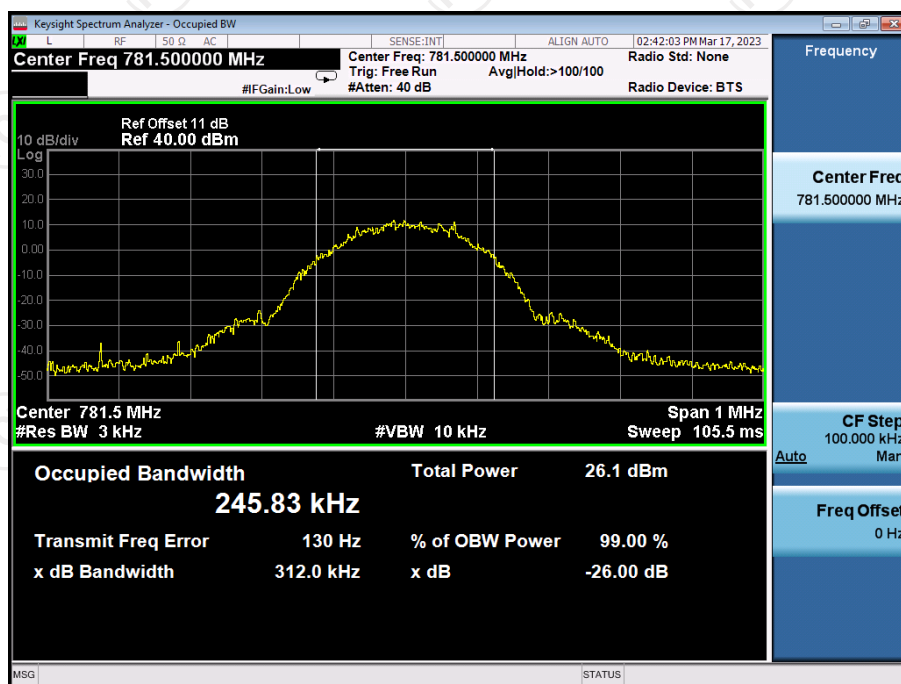
Lower700MHz LTE DL Output



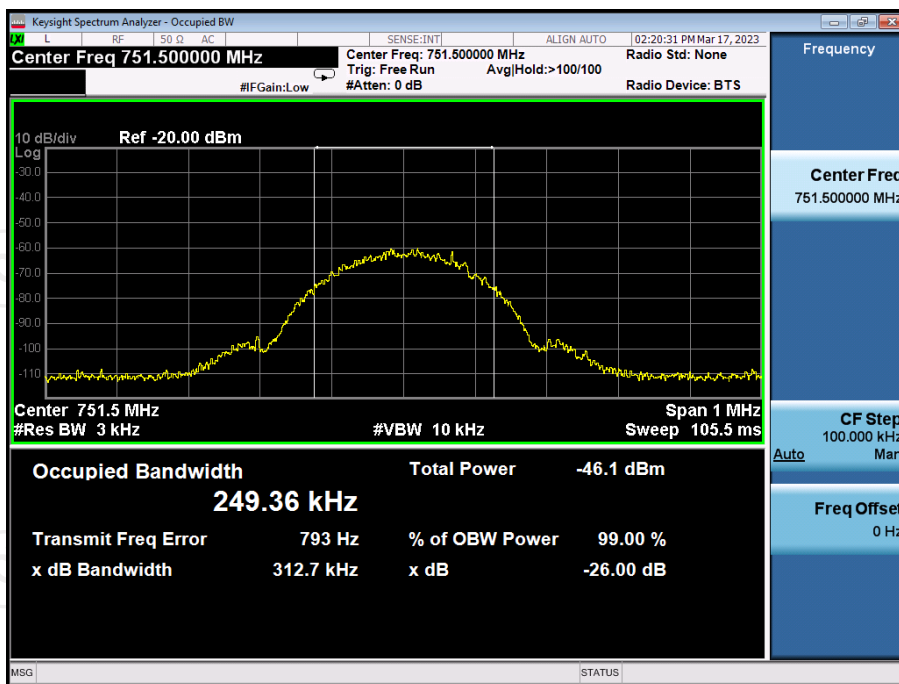
Upper700MHz GSM UL Input



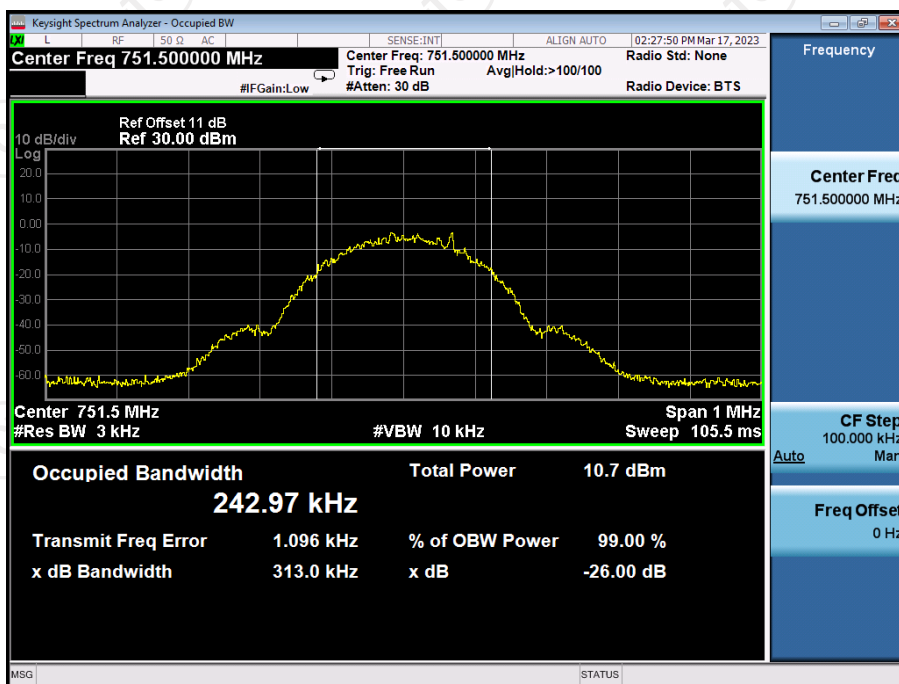
Upper700MHz GSM UL output



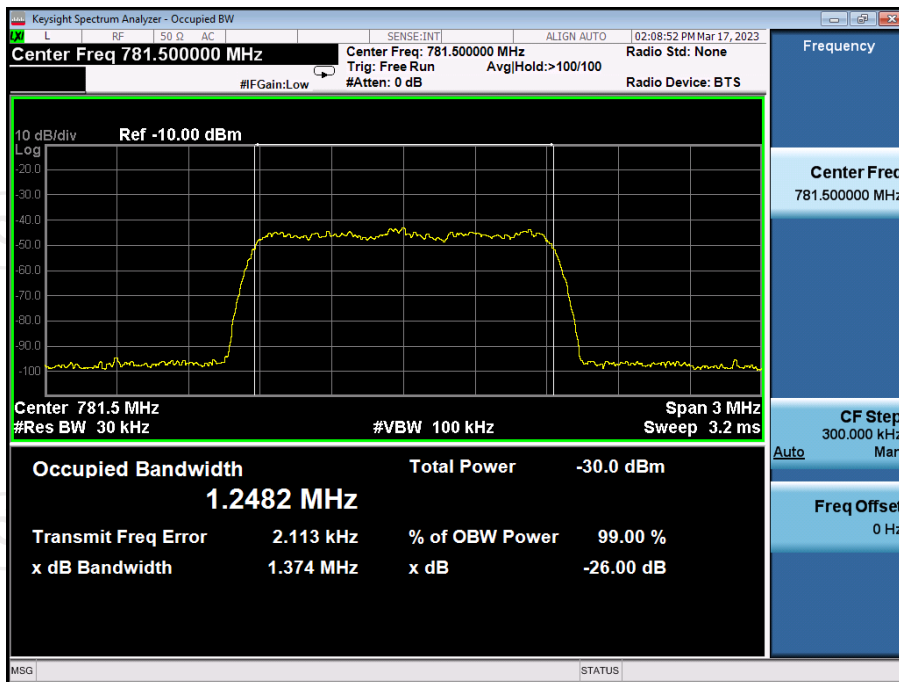
Upper700MHz GSM DL Input



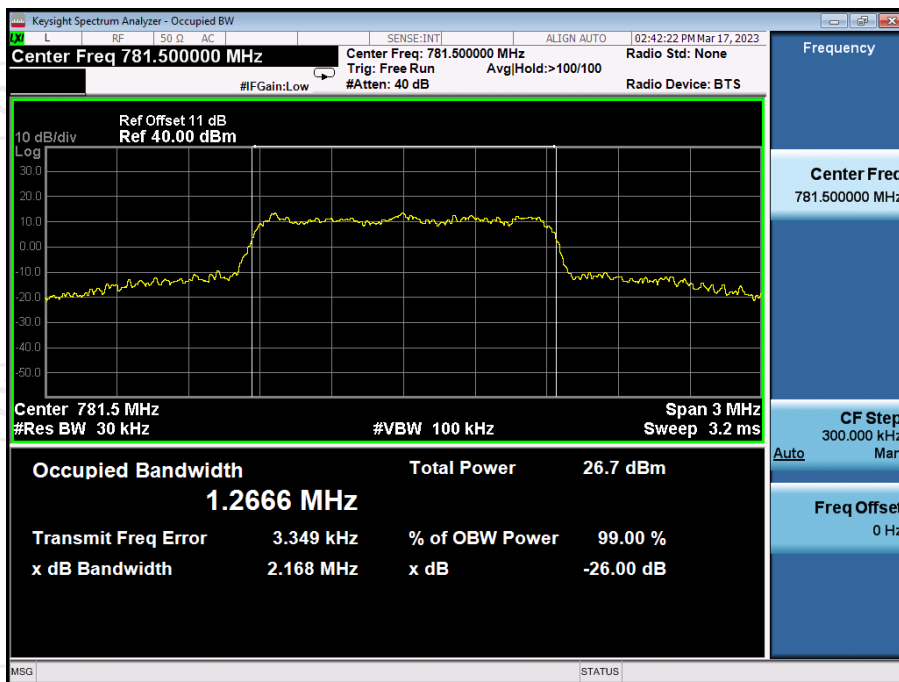
Upper700MHz GSM DL Output



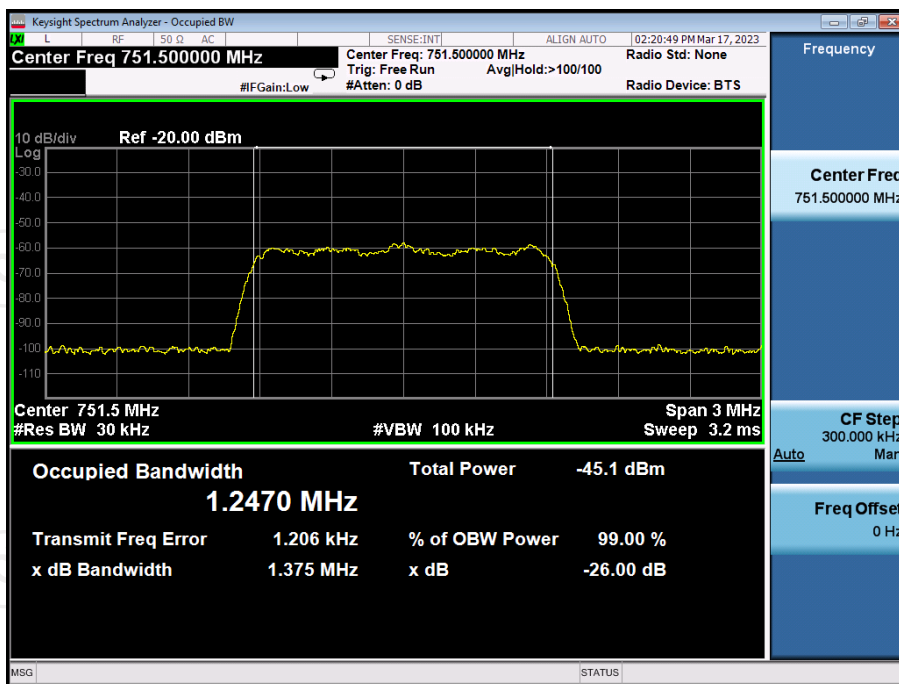
Upper700MHz CDMA UL Input



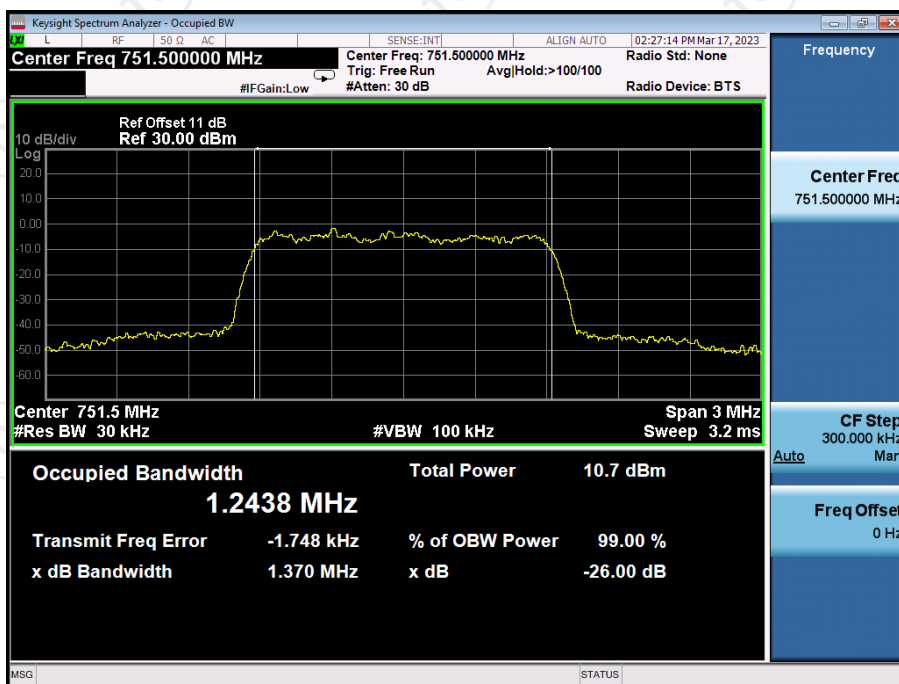
Upper700MHz CDMA UL output



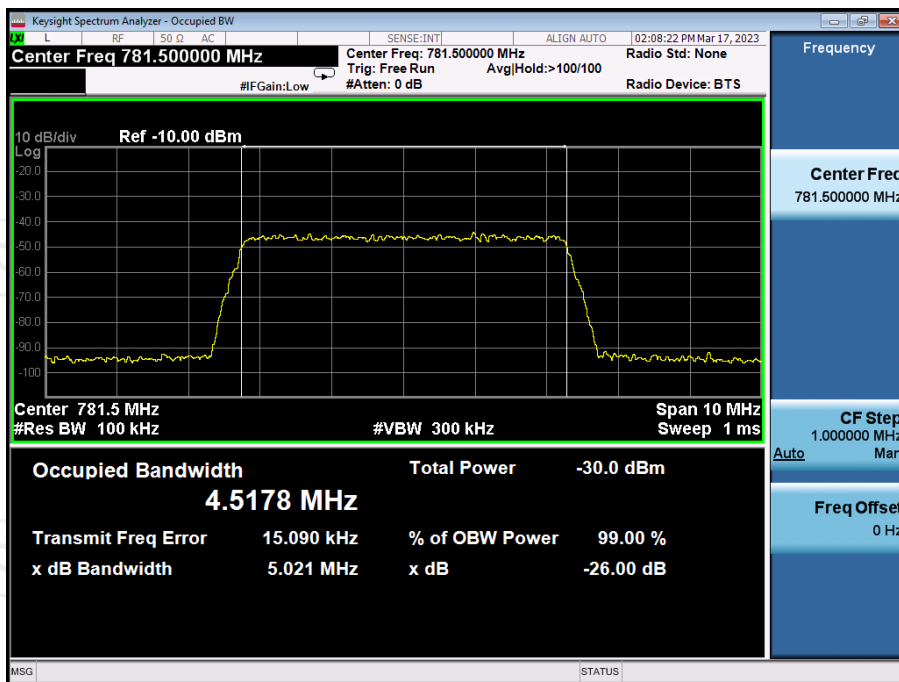
Upper700MHz CDMA DL Input



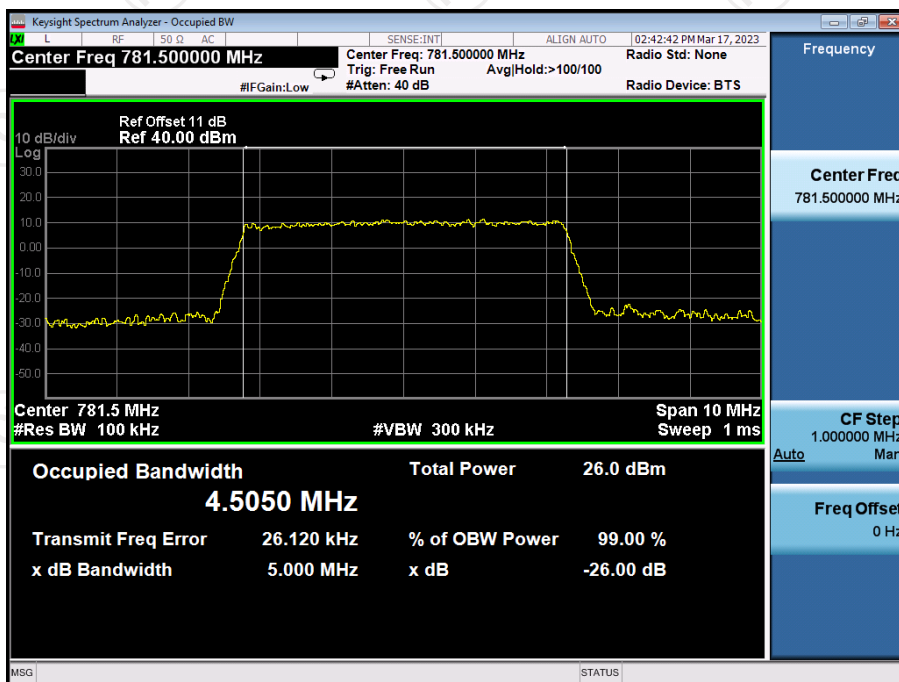
Upper700MHz CDMA DL Output



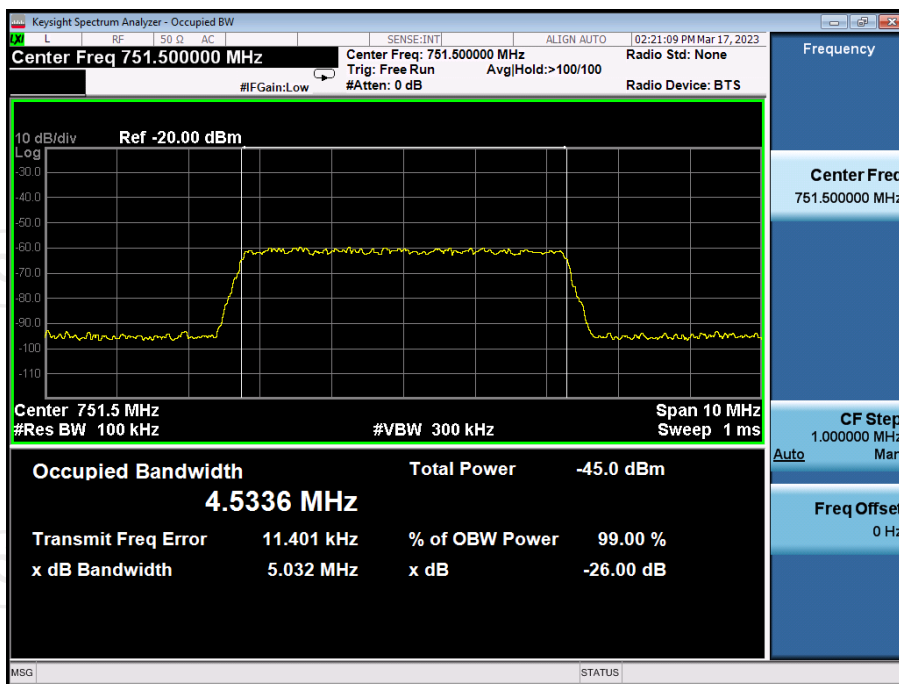
Upper700MHz LTE UL Input



Upper700MHz LTE UL output



Upper700MHz LTE DL Input



Upper700MHz LTE DL Output

