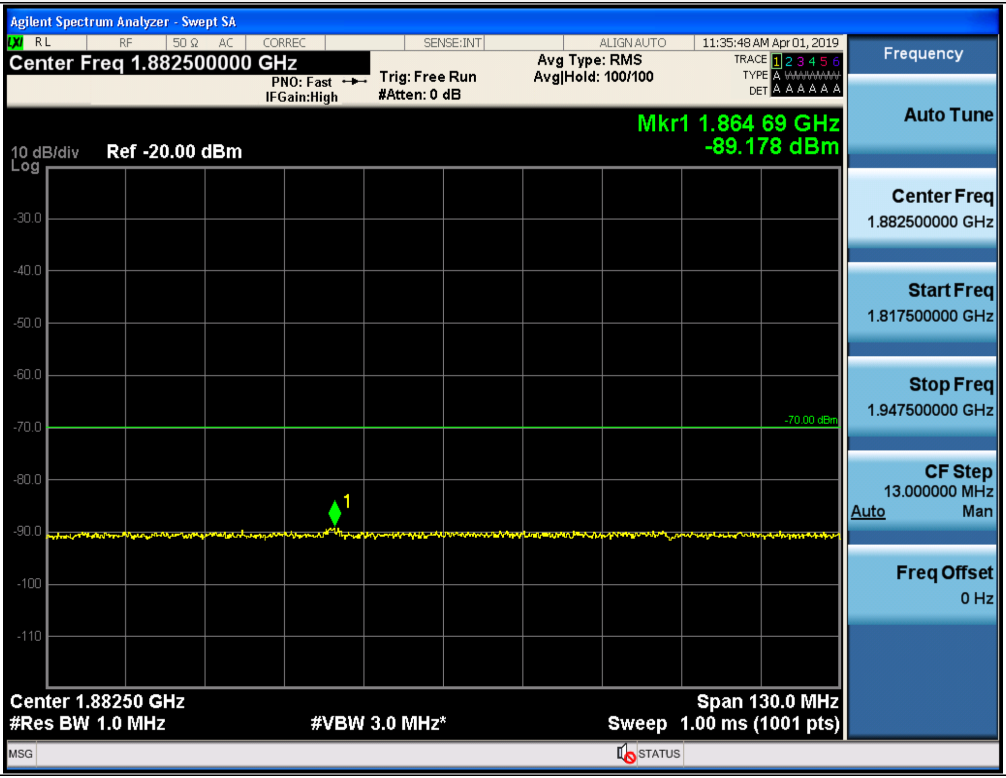
Inactivity Noise Level / Broadband PCS


5.9. VARIABLE BOOSTER GAIN

Test Requirements:

§20.21(e)(8)(i)(C)(1) BOOSTER GAIN LIMITS (Variable gain)

(1) The uplink gain in dB of a consumer booster referenced to its input and output ports shall not exceed −34 dB—RSSI + MSCL.

(i) Where RSSI is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(ii) Where MSCL (Mobile Station Coupling Loss) is the minimum coupling loss in dB between the wireless device and input port of the consumer booster. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(2) The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:

(i) Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log_{10} (Frequency)

(ii) Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

§20.21(e)(8)(i)(H) TRANSMIT POWER OFF MODE (Uplink gain).

When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in “Transmit Power Off Mode.” In this mode of operation, the uplink and downlink noise power shall not exceed −70 dBm/MHz and both uplink and downlink gain shall not exceed the lesser of 23 dB or MSCL.

Test Procedures:

Measurements were in accordance with the test methods section 7.9 of KDB 935210 D03 v04r03.

7.9.1 Variable gain

a) 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.

b) Configure downlink signal generator #1 for AWGN operation with a 99% OBW 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 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.

d) Set RBW = 100 kHz.

e) Set VBW ≥ 300 kHz.

f) Select the CHANNEL POWER measurement mode.

g) Select the power averaging (rms) detector.

h) Affirm that the number of measurement points per sweep ≥ (2 x span)/RBW.

i) Sweep time = auto couple.

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 output to a level from −90 dBm to −20 dBm, as measured at the input port, 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. 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.

l) Repeat b) to k) for all operational uplink bands.

7.9.2 Variable uplink gain timing

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 #1 to the lowest level of the RSSI-dependent gain.

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.

e) Confirm that the uplink gain decreases to the specified levels, within 1 second for mobile devices, and within 3 seconds for fixed devices.

f) Repeat a) to e) for all operational uplink bands.

Note1. Test limit is according to 'Frequency Dependent Limits' line of figure in Note4.

- Limit in -90 dBm to (-34 - (6.5 + 20 $\log_{10}$(f)) + MSCL) dBm, RSSI range
  : 6.5 + 20 $\log_{10}$(f) dB
- Limit in (-34 - (6.5 + 20 $\log_{10}$(f)) + MSCL) dBm to (-34 - 23 + MSCL) dBm RSSI range
  : -34 dB - RSSI + MSCL
- Limit in -30 dBm to -20 dBm RSSI range: 23 dB
- Timing limit is according to fixed devices 3 second limit in section 7.9.2 of KDB 935210 D03

Note2. Minimum MSCL value in this test is calculated according to following formula and table.

Lp = 20 x Log (Uplink Band the Lowest frequency) + 20 x Log (Distance) -27.5

MSCL = Lp - Antenna gain + Cable loss

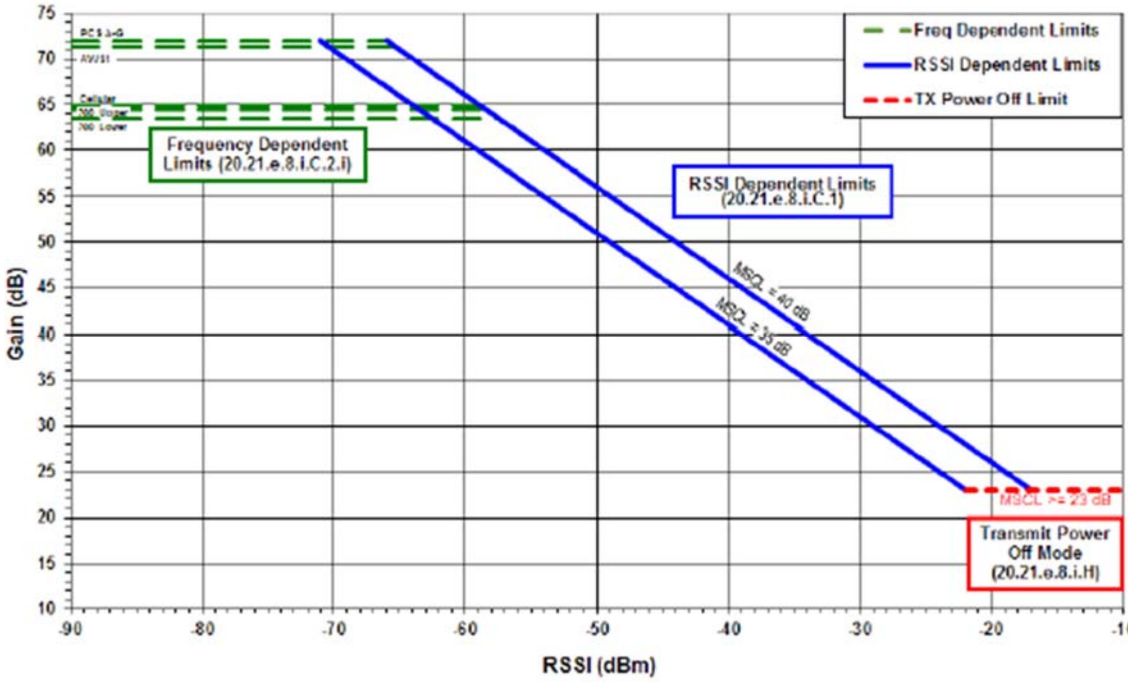
Frequency (MHz)	Server Ant. Gain (dBi)	Sever Cable Loss (dB)	Distance (m)	L_p	MSCL
704	4.27	7.000	2	35.472	38.202
776	4.84	7.750	2	36.318	39.228
824	6.38	7.750	2	36.839	38.209
1710	10.15	10.526	2	43.181	43.557
1850	10.09	10.962	2	43.864	44.736

* Server Antenna gain is quoted from measurements provide by vendor.

* Distance is specified by manufacture and information is provided in the manual.

Note3. RSSI input is corrected by table in Noise limit test note2 of this report.

Note4. Tests refer to following gain limit in appendix D of KDB 935210 D03 v04r03.



Test Result:

Tabulated Result of Variable Booster Gain

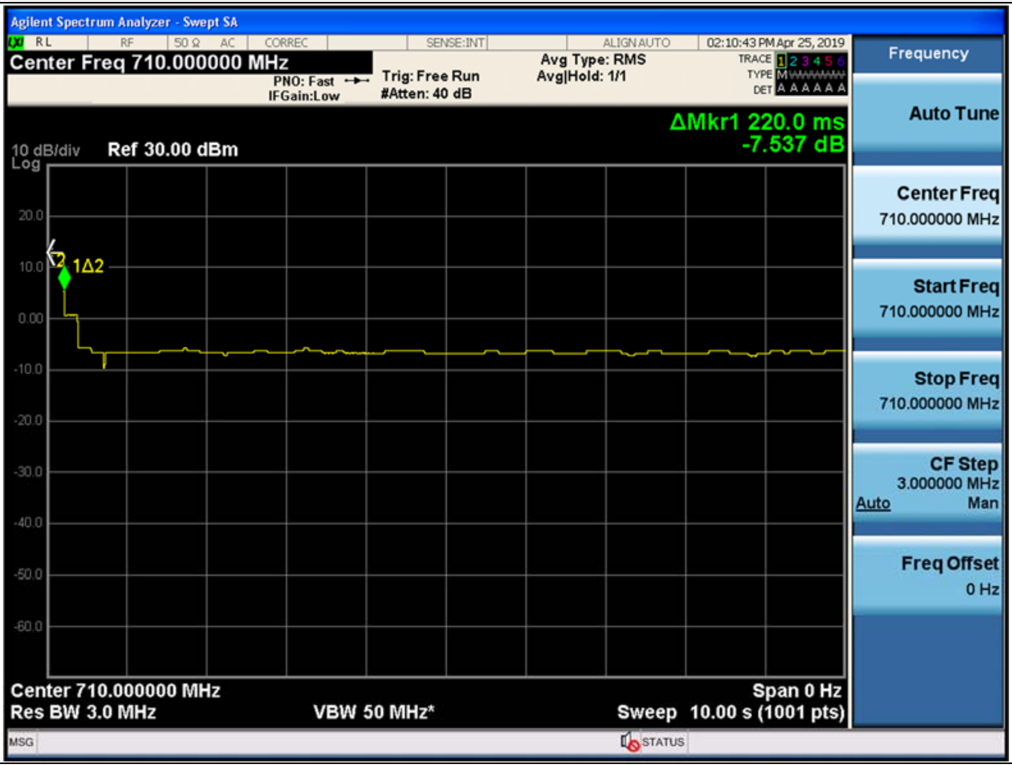
Band	MSCL	RSSI (dBm)	Input Power (dBm)	Output Power (dBm)	Limit (dB)	Variable Gain (dB)
Lower 700 MHz	38.202	-33	-46.20	-9.75	37.53	36.45
		-34		-9.64	38.53	36.56
		-90		14.86	63.53	61.06
		-70		14.86	63.53	61.06
		-80		14.77	63.53	60.97
		-60		14.48	63.53	60.68
Upper 700 MHz	39.228	-32	-45.20	-10.47	37.36	34.73
		-33		-10.44	38.36	34.76
		-34		-10.41	39.36	34.79
		-36		-8.63	41.36	36.57
		-49		4.19	54.36	49.39
		-37		-7.85	42.36	37.35
Cellular	38.209	-35	-45.80	-14.61	38.95	31.19
		-36		-14.66	39.95	31.14
		-90		10.08	64.95	55.88
		-40		-10.98	43.95	34.82
		-42		-9.02	45.95	36.78
		-47		-4.03	50.95	41.77
AWS-1	43.557	-58	-46.00	13.52	67.27	59.52
		-57		12.15	66.27	58.15
		-56		10.63	65.27	56.63
		-59		13.60	68.27	59.60
		-55		9.58	64.27	55.58
		-54		8.19	63.27	54.19
Broadband PCS	44.736	-32	-45.30	-10.05	42.99	35.25
		-33		-10.02	43.99	35.28
		-34		-10.07	44.99	35.23
		-38		-6.68	48.99	38.62
		-35		-9.70	45.99	35.60
		-48		3.25	58.99	48.55

Tabulated Result of Variable Gain Timing

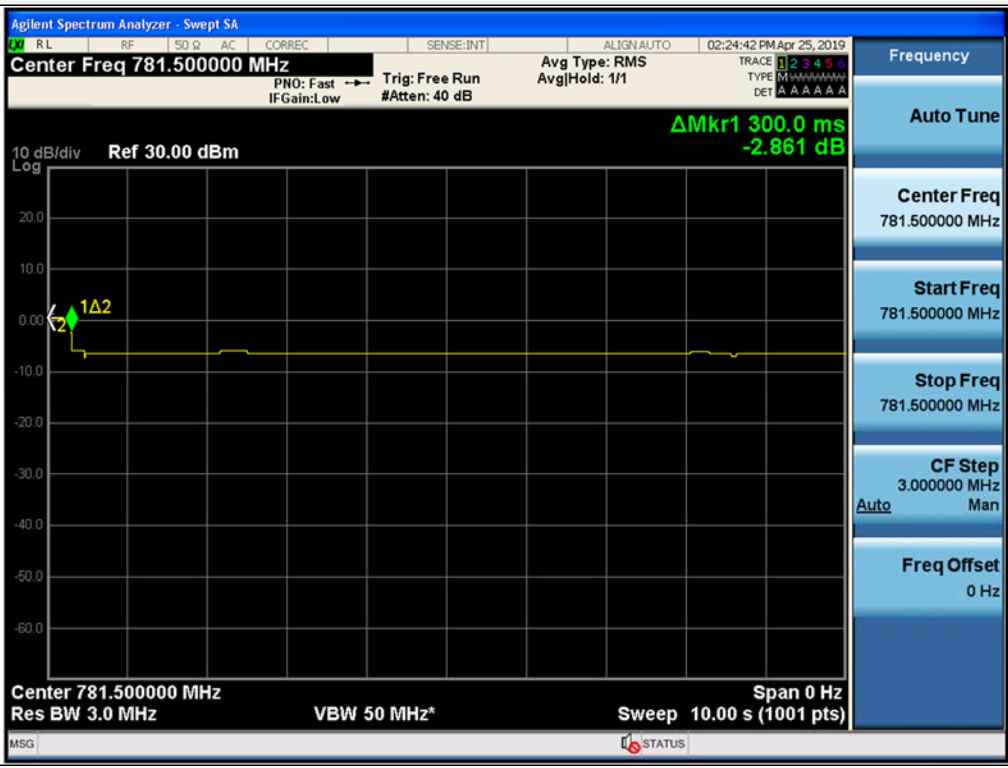
Band	Frequency (MHz)	Limit (ms)	Gain Timing (ms)
Lower 700 MHz	710.00	3 000	220.00
Upper 700 MHz	781.50		300.00
Cellular	836.50		80.00
AWS-1	1732.50		210.00
Broadband PCS	1882.50		80.00

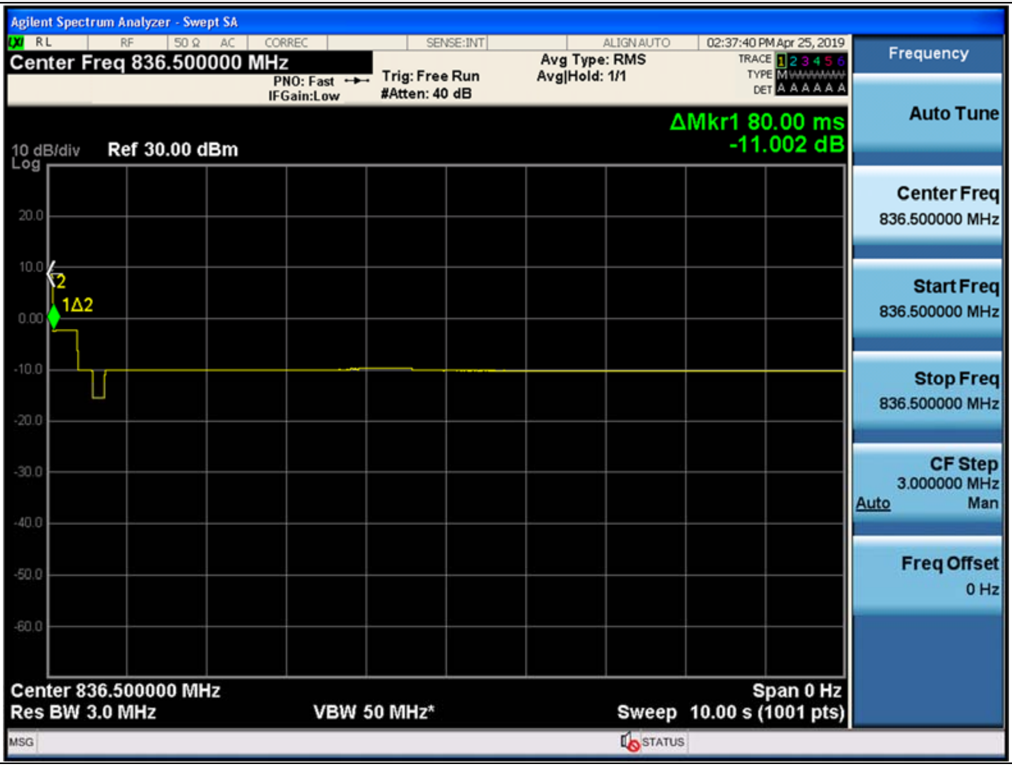
Plot data of Variable Gain Timing

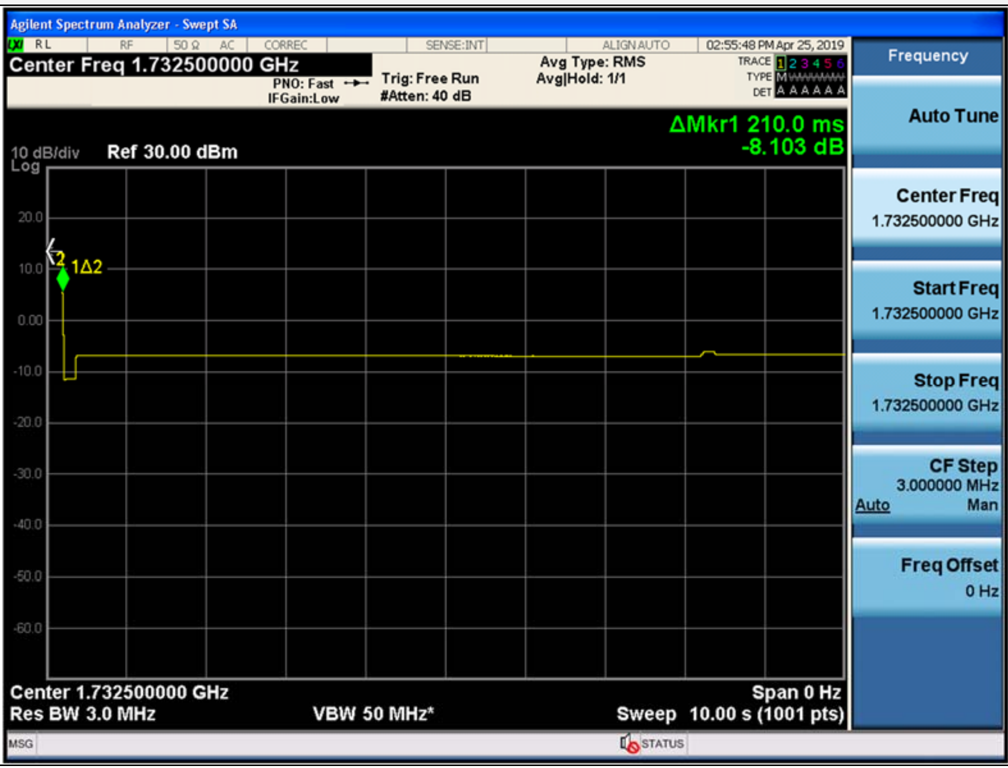
Variable Gain Timing / Lower 700 MHz

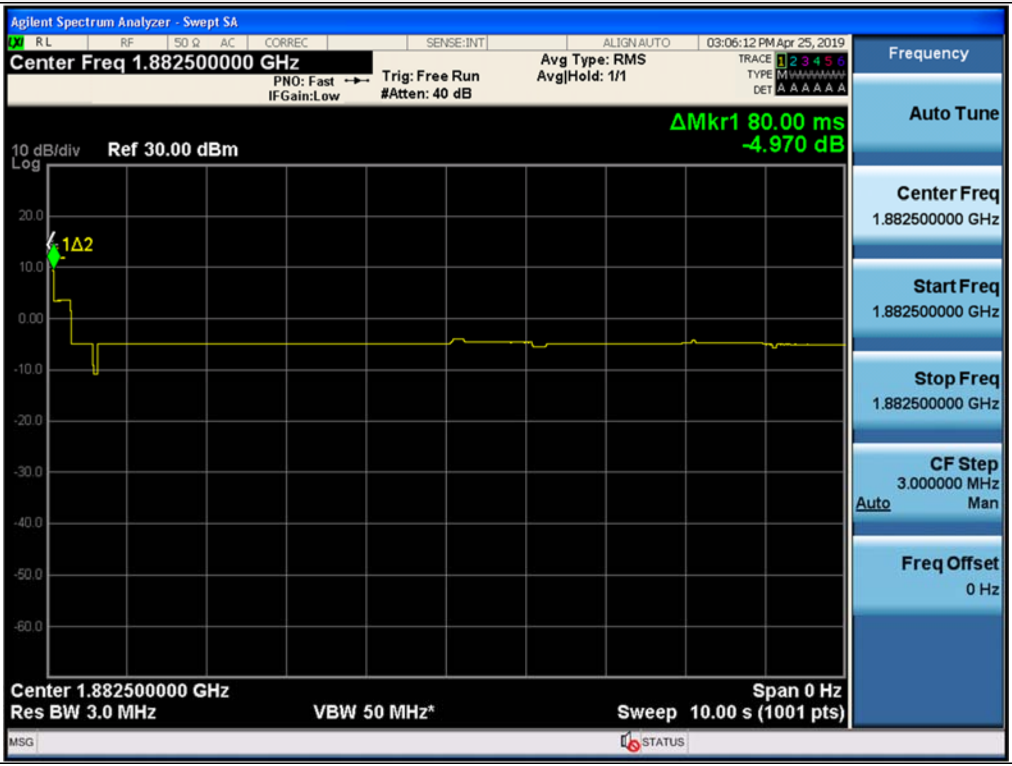


Variable Gain Timing / Upper 700 MHz



Variable Gain Timing / Cellular


Variable Gain Timing / AWS-1


Variable Gain Timing / Broadband PCS


5.10. OCCUPIED BANDWIDTH

Test Requirements:

§ 2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures:

Measurements were in accordance with the test methods section 7.10 of KDB 935210 D03 v04r03.

a) Connect the test equipment to firstly measure the characteristics of the test signals produced by the signal generator.

b) Set VBW ≥ 3 x RBW.

c) 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.

d) Set the signal generator for power level to match the values obtained from the tests of maximum output power measurement.

e) 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.

f) Set the spectrum analyzer RBW for 1% to 5% of the EBW.

g) Capture the spectrum analyzer trace for inclusion in the test report.

h) Repeat c) to g) for CDMA and W-CDMA modulation, adjusting the span as necessary.

i) Repeat c) to h) for all uplink and downlink operational bands.

j) The uplink output (donor) port connected to the spectrum analyzer, and the server port connected to the signal generator.

k) Repeat c) to i) with this EUT uplink path test setup.

l) The downlink output (server) port connected to the spectrum analyzer, and the donor port connected to the signal generator.

m) Repeat c) to i) with this EUT downlink path test setup.

Test Result:

Tabulated Result of Uplink Occupied Bandwidth

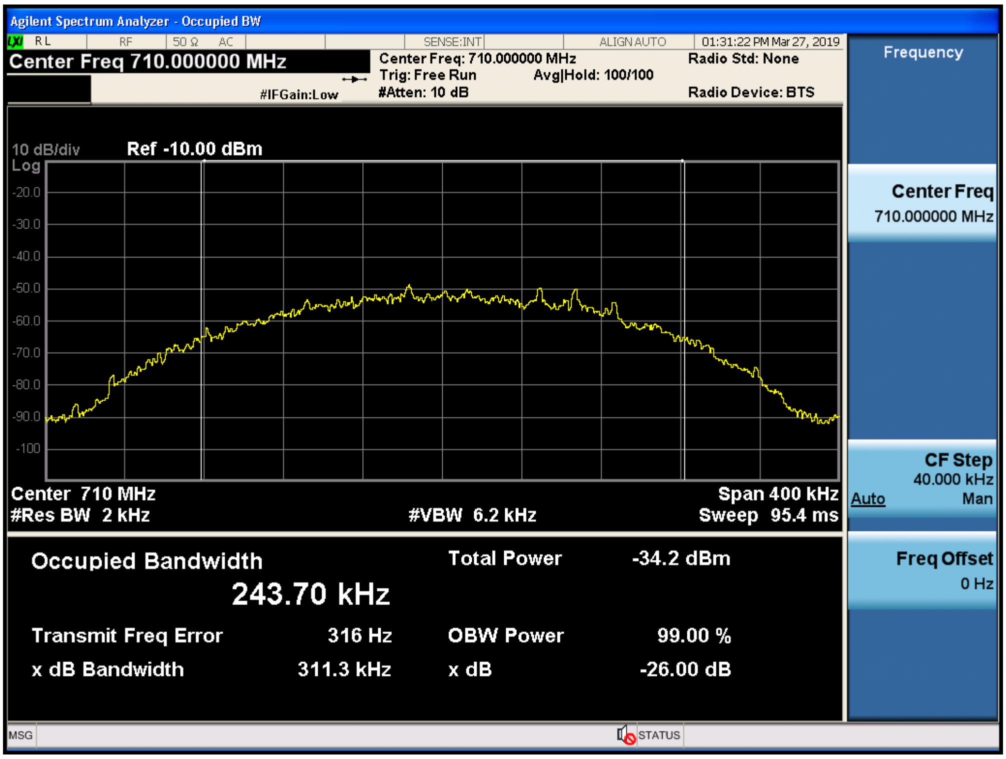
Band	Signal	Frequency (MHz)	Input OBW (kHz)	Output OBW (kHz)	Comparison (%)
Lower 700 MHz	GSM	710.000	243.7	244.2	0.22
Upper 700 MHz		781.500	242.9	243.8	0.35
Cellular		836.500	242.0	242.7	0.29
AWS-1		1 732.500	242.4	242.6	0.10
Broadband PCS		1 882.500	241.4	241.6	0.10
Band	Signal	Frequency (MHz)	Input OBW (MHz)	Output OBW (MHz)	Comparison (%)
Lower 700 MHz	CDMA	710.000	1.234	1.230	-0.27
	WCDMA		4.186	4.183	-0.07
Upper 700 MHz	CDMA	781.500	1.237	1.241	0.29
	WCDMA		4.199	4.178	-0.51
Cellular	CDMA	836.500	1.232	1.237	0.41
	WCDMA		4.203	4.207	0.09
AWS-1	CDMA	1 732.500	1.239	1.236	-0.23
	WCDMA		4.193	4.178	-0.36
Broadband PCS	CDMA	1 882.500	1.239	1.236	-0.22
	WCDMA		4.195	4.200	0.11

Tabulated Result of Downlink Occupied Bandwidth

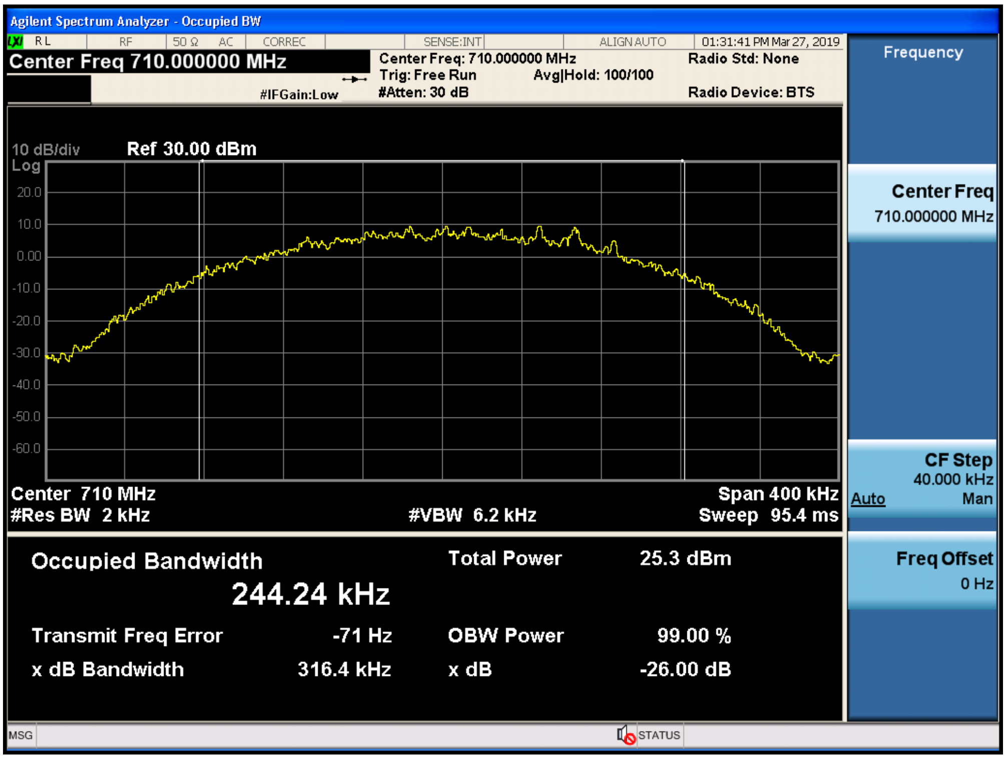
Band	Signal	Frequency (MHz)	Input OBW (kHz)	Output OBW (kHz)	Comparison (%)
Lower 700 MHz	GSM	740.000	244.0	242.4	-0.64
Upper 700 MHz		751.500	244.6	241.4	-1.31
Cellular		881.500	241.5	241.9	0.20
AWS-1		2 132.500	243.3	245.2	0.78
Broadband PCS		1 962.500	243.3	241.2	-0.87
Band	**Signal**	**Frequency (MHz)**	**Input OBW (MHz)**	**Output OBW (MHz)**	**Comparison (%)**
Lower 700 MHz	CDMA	740.000	1.258	1.235	-1.85
	WCDMA		4.206	4.216	0.25
Upper 700 MHz	CDMA	751.500	1.259	1.231	-2.17
	WCDMA		4.211	4.217	0.13
Cellular	CDMA	881.500	1.246	1.237	-0.68
	WCDMA		4.206	4.201	-0.13
AWS-1	CDMA	2 132.500	1.265	1.240	-1.97
	WCDMA		4.214	4.196	-0.44
Broadband PCS	CDMA	1 962.500	1.235	1.236	0.12
	WCDMA		4.221	4.193	-0.66

Plot data of Occupied Bandwidth

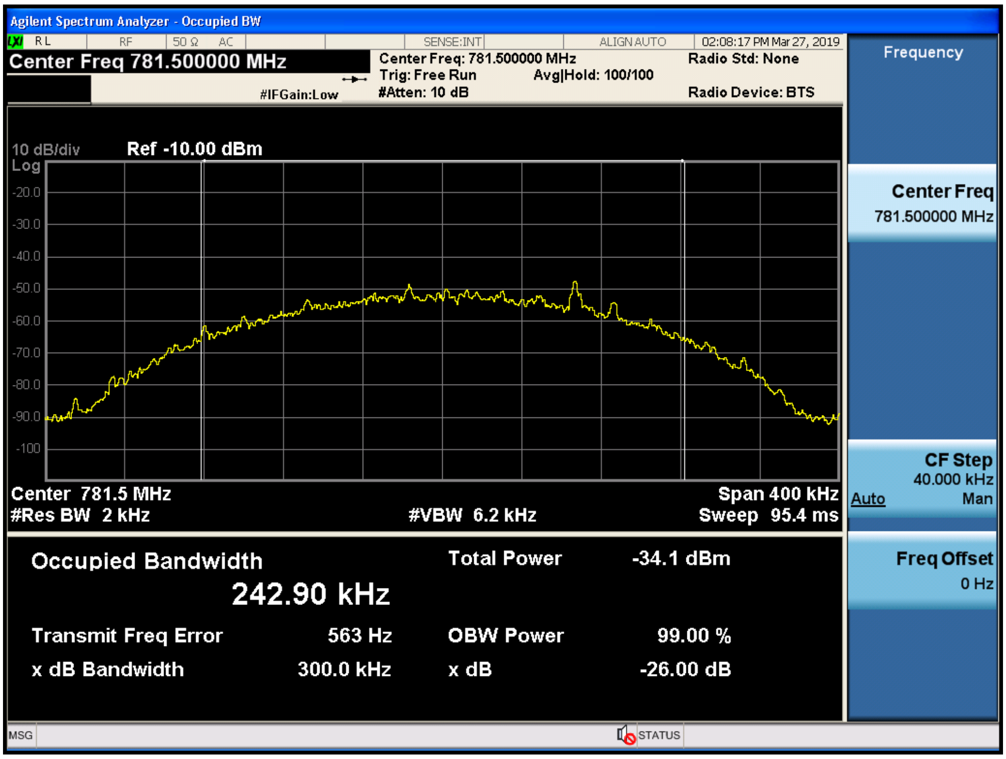
Occupied Bandwidth / Lower 700 MHz / Uplink / GSM / Input



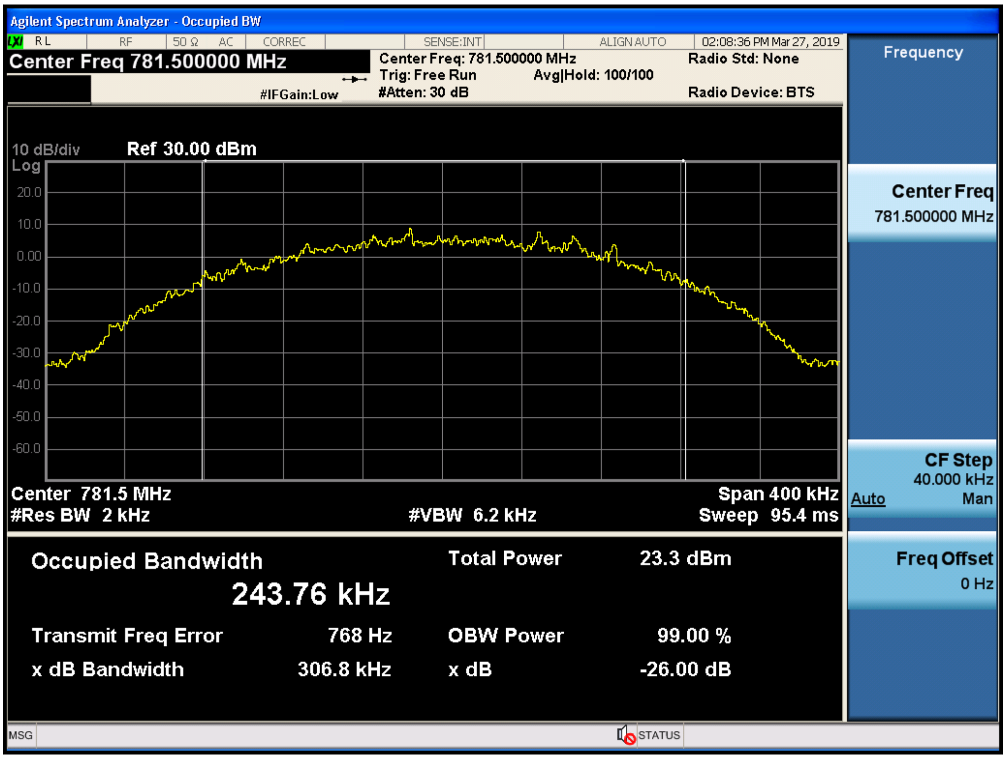
Occupied Bandwidth / Lower 700 MHz / Uplink / GSM / Output



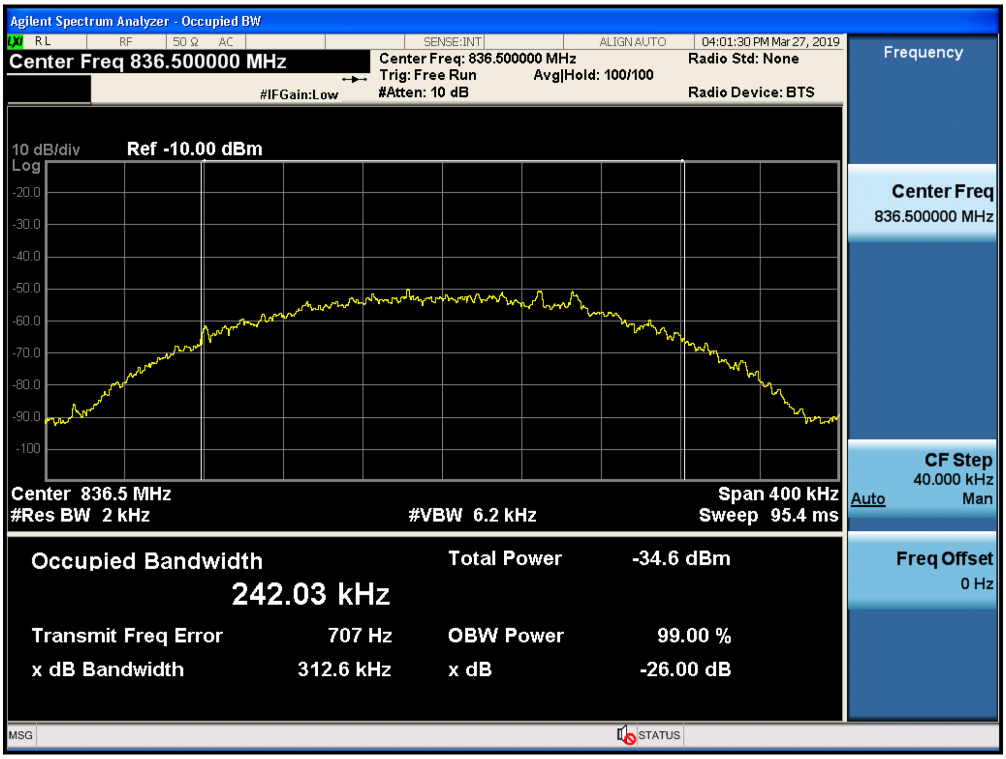
Occupied Bandwidth / Upper 700 MHz / Uplink / GSM / Input



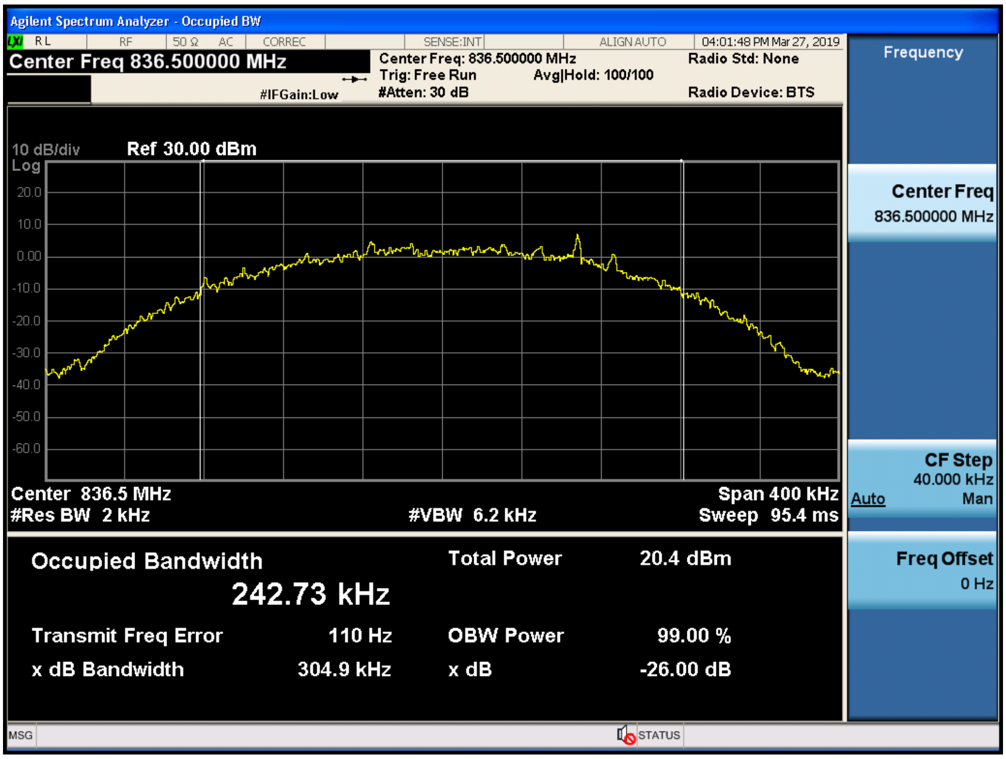
Occupied Bandwidth / Upper 700 MHz / Uplink / GSM / Output



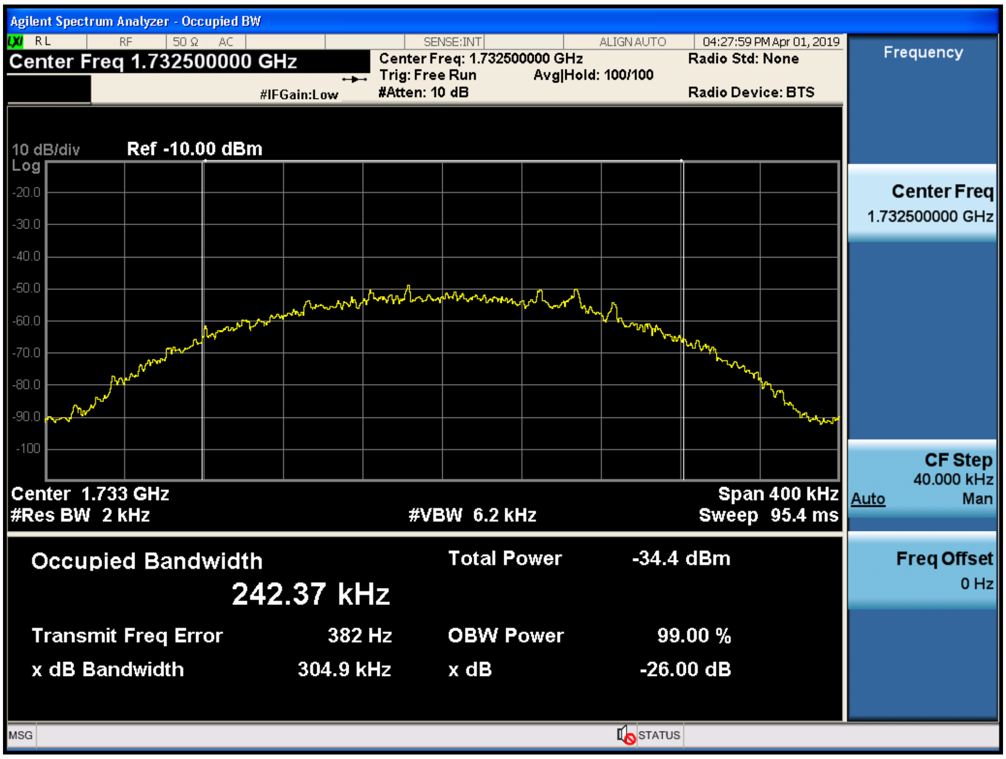
Occupied Bandwidth / Cellular / Uplink / GSM / Input



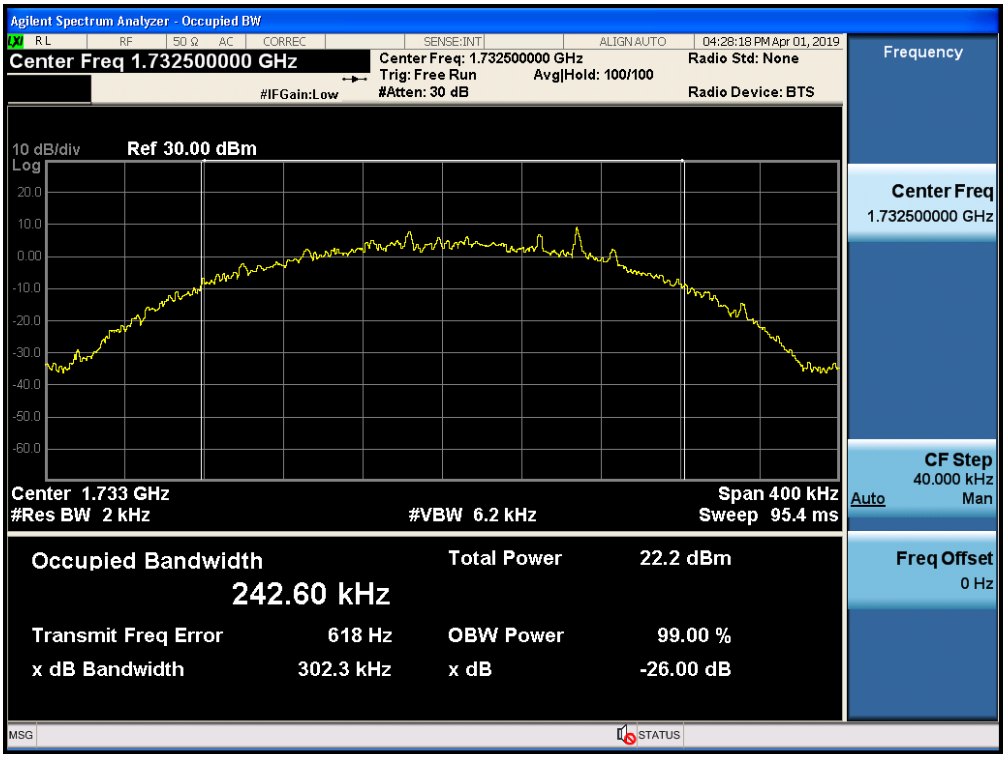
Occupied Bandwidth / Cellular / Uplink / GSM / Output

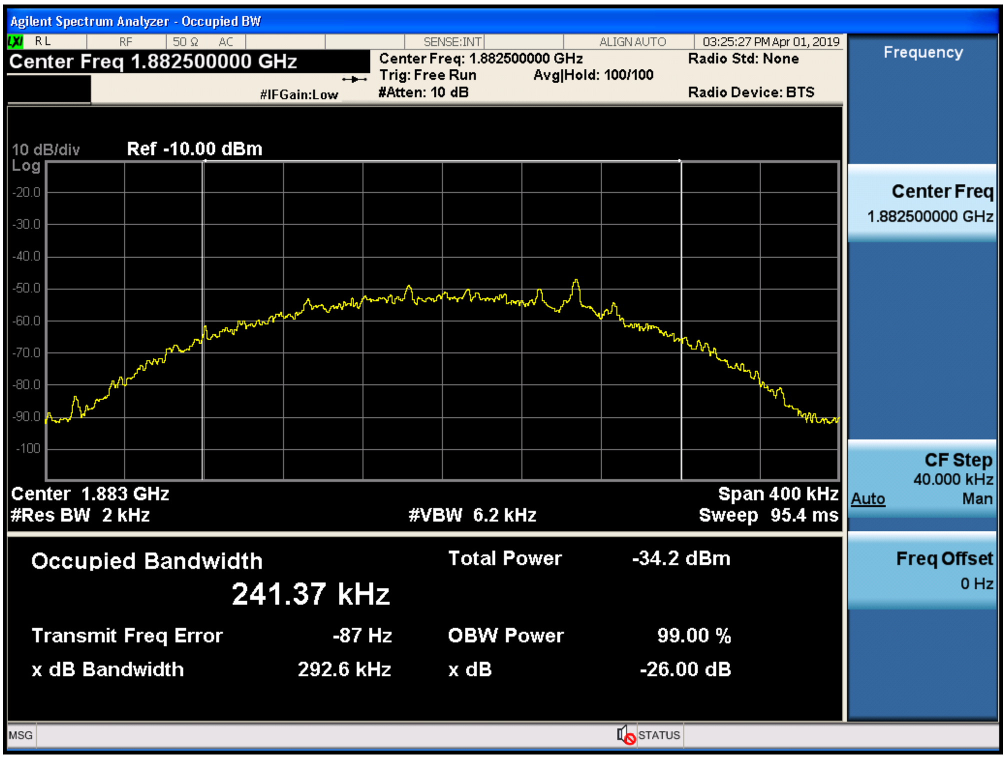


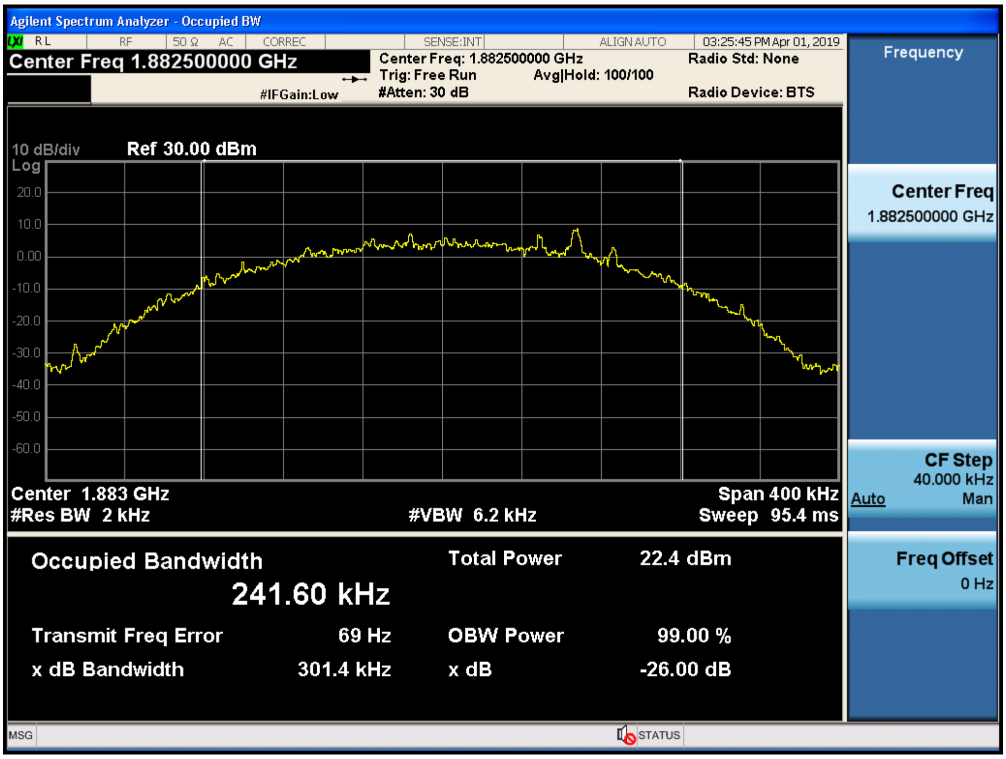
Occupied Bandwidth / AWS-1 / Uplink / GSM / Input



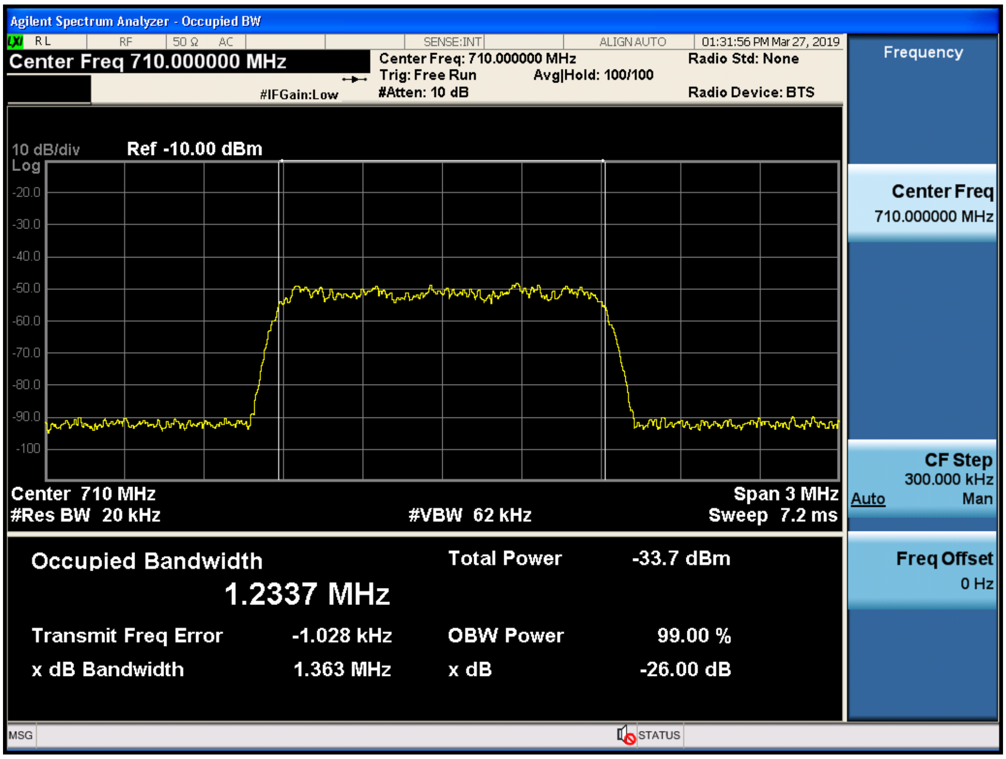
Occupied Bandwidth / AWS-1 / Uplink / GSM / Output



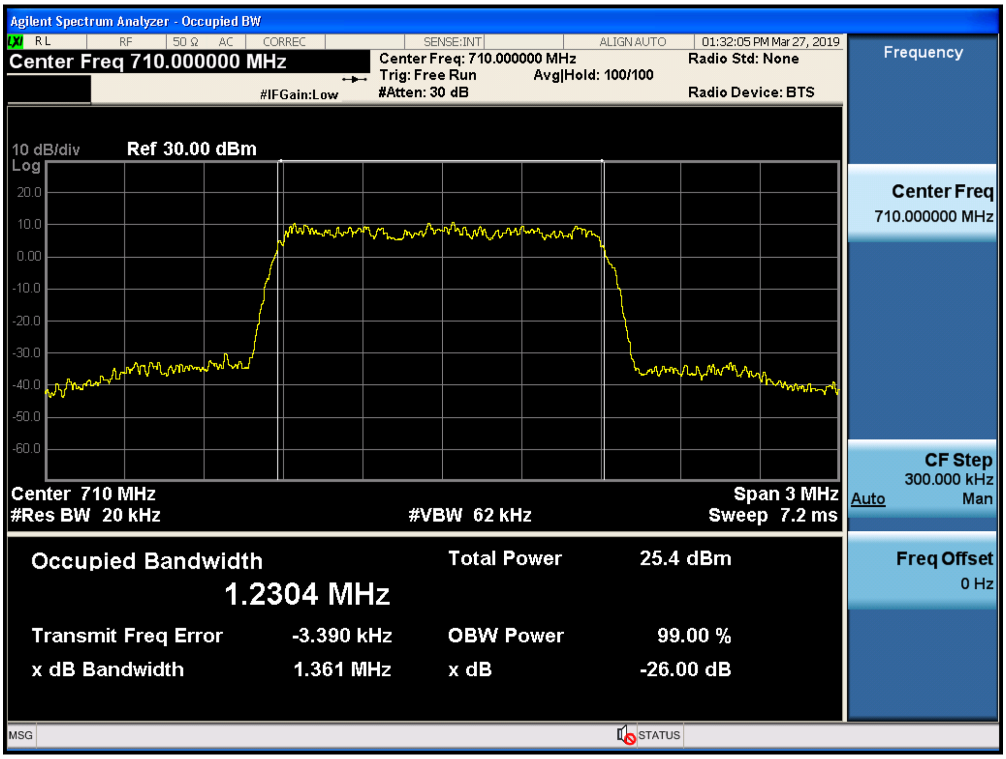
Occupied Bandwidth / Broadband PCS / Uplink / GSM / Input


Occupied Bandwidth / Broadband PCS / Uplink / GSM / Output


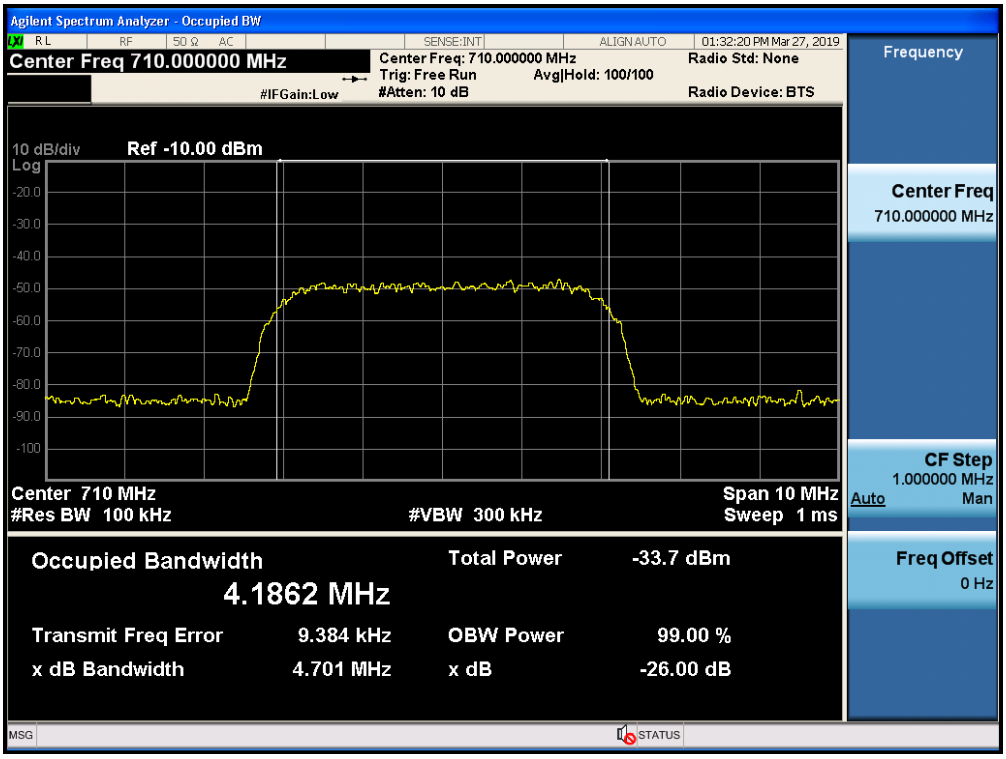
Occupied Bandwidth / Lower 700 MHz / Uplink / CDMA/ Input



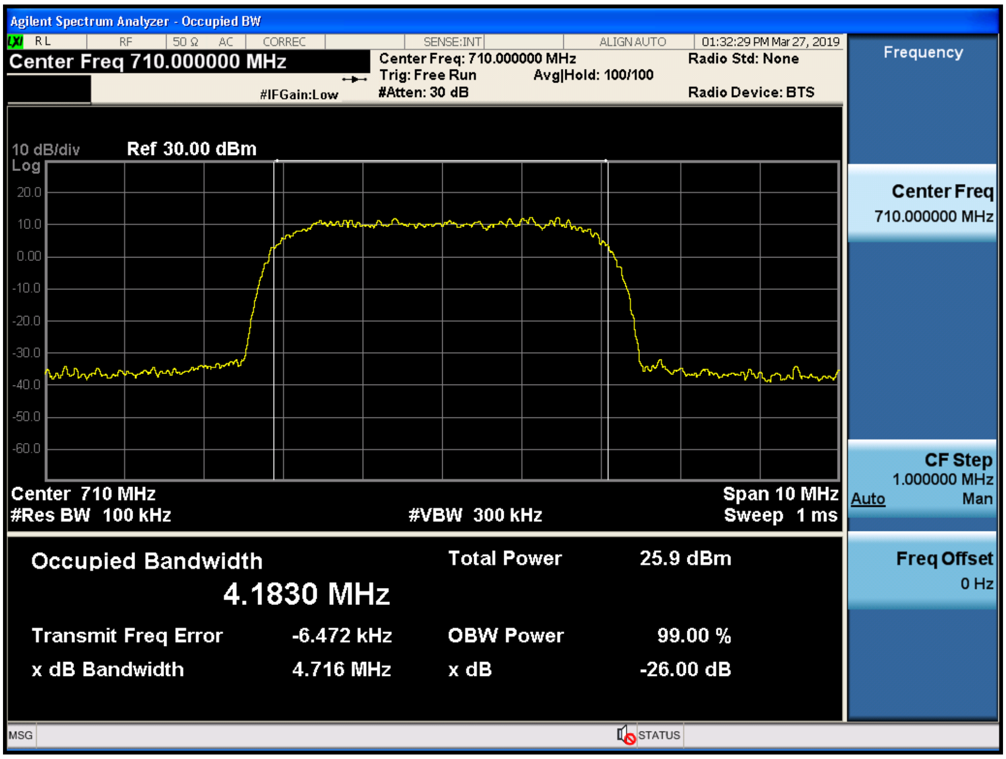
Occupied Bandwidth / Lower 700 MHz / Uplink / CDMA / Output

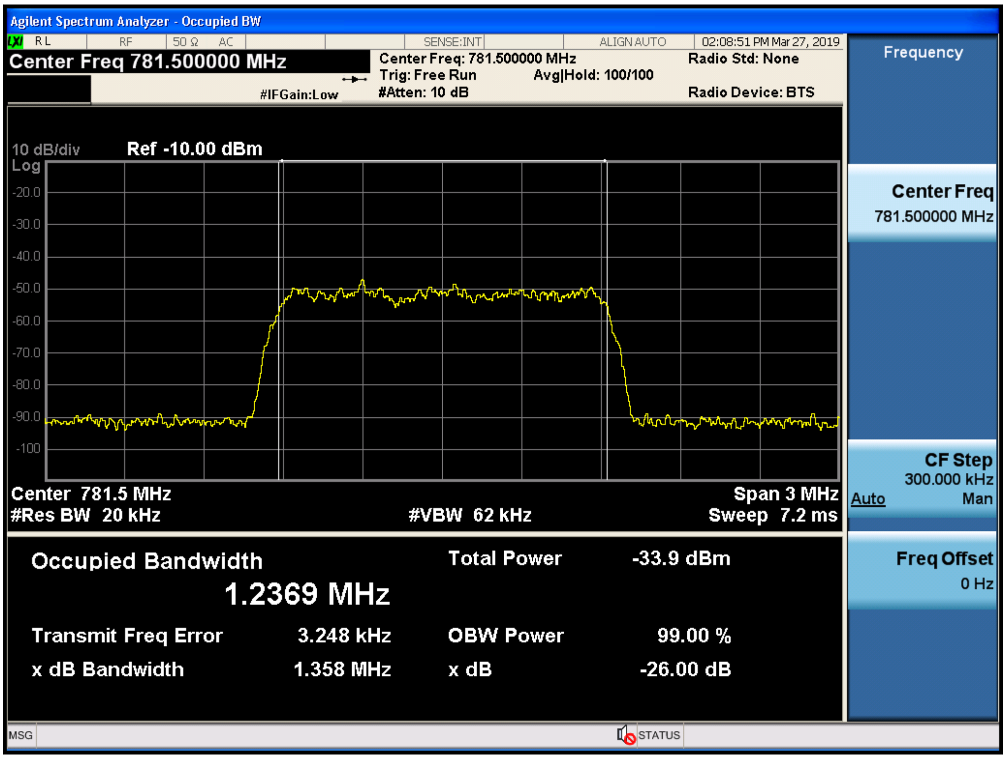


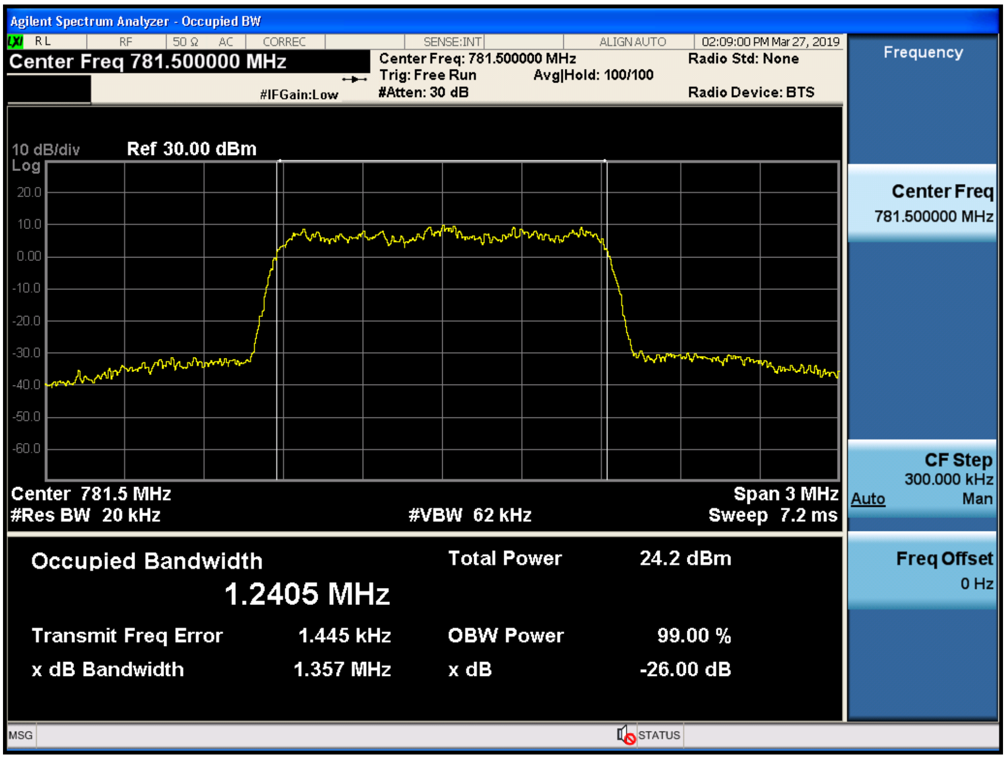
Occupied Bandwidth / Lower 700 MHz / Uplink / WCDMA/ Input



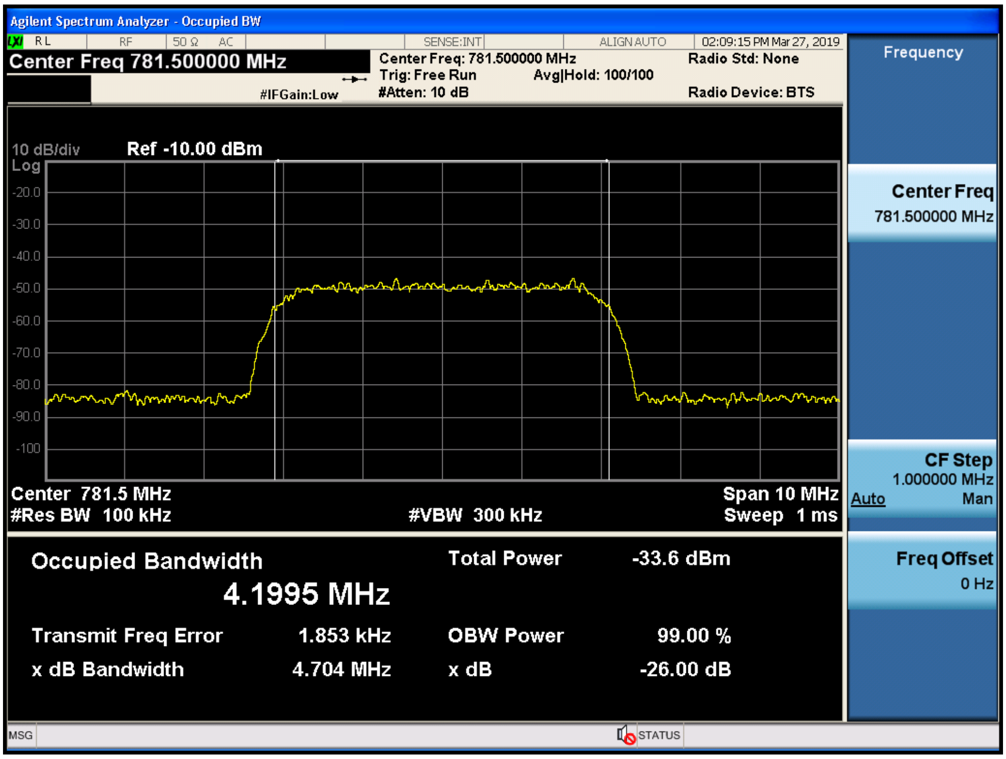
Occupied Bandwidth / Lower 700 MHz / Uplink / WCDMA / Output



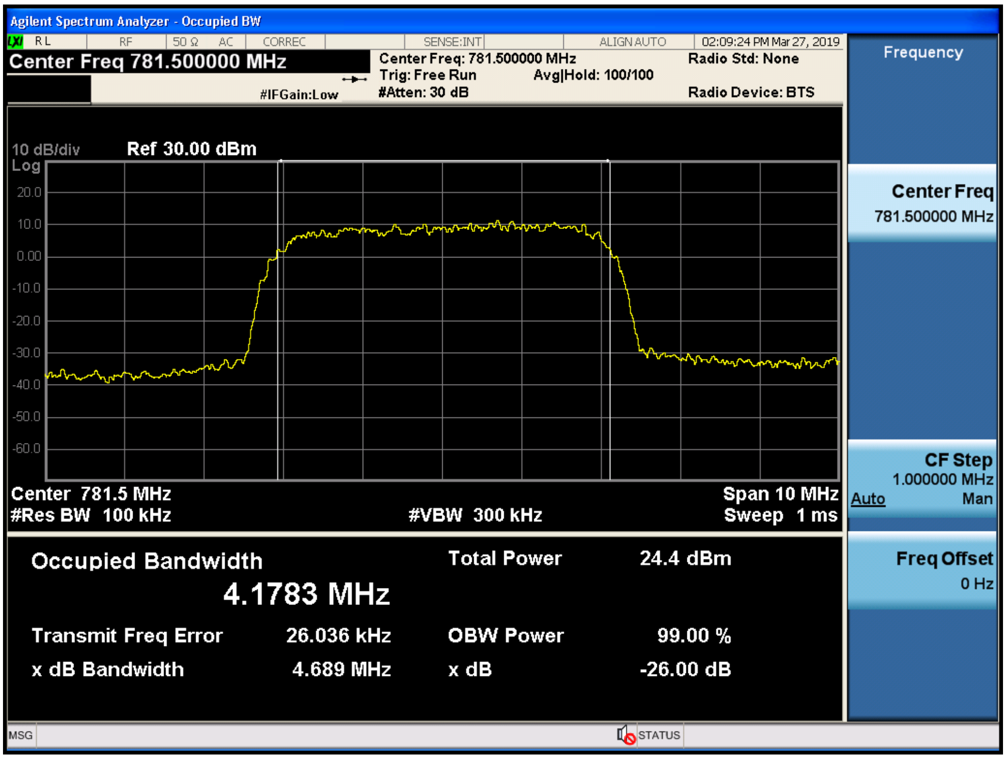
Occupied Bandwidth / Upper 700 MHz / Uplink / CDMA/ Input


Occupied Bandwidth / Upper 700 MHz / Uplink / CDMA / Output


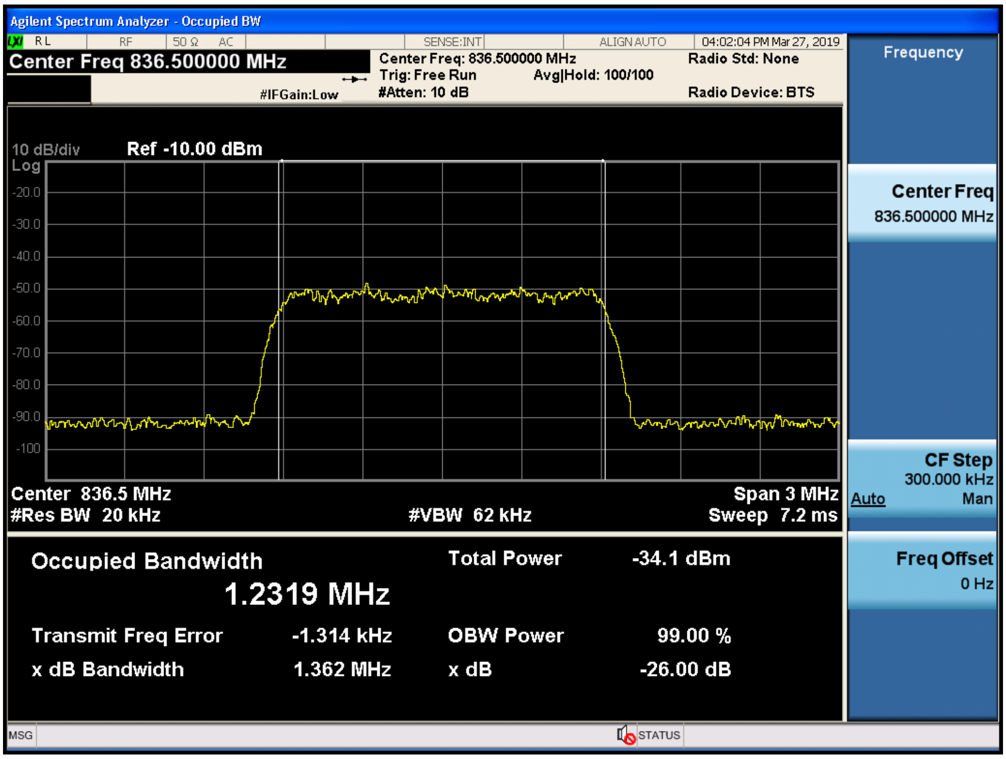
Occupied Bandwidth / Upper 700 MHz / Uplink / WCDMA/ Input



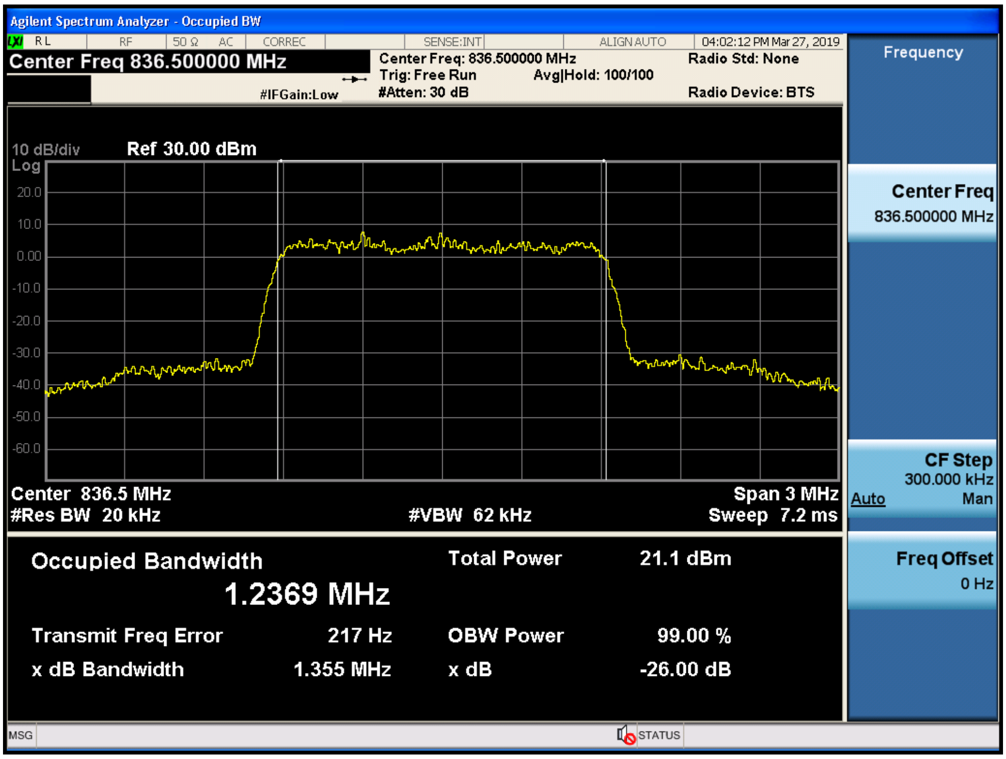
Occupied Bandwidth / Upper 700 MHz / Uplink / WCDMA / Output



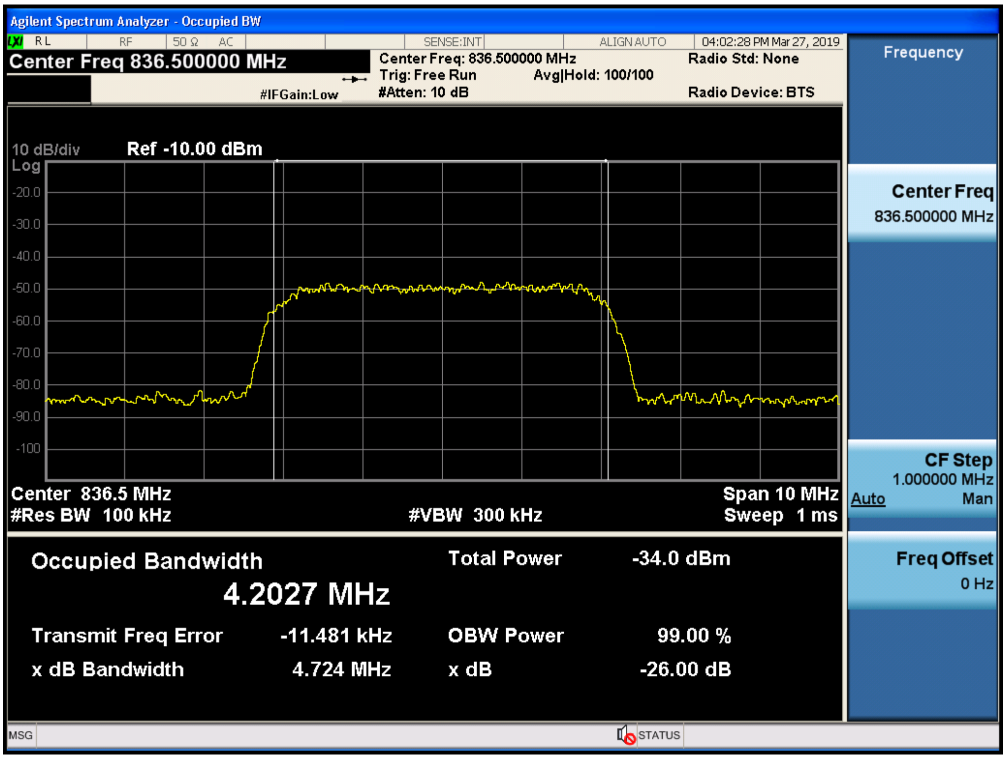
Occupied Bandwidth / Cellular / Uplink / CDMA/ Input



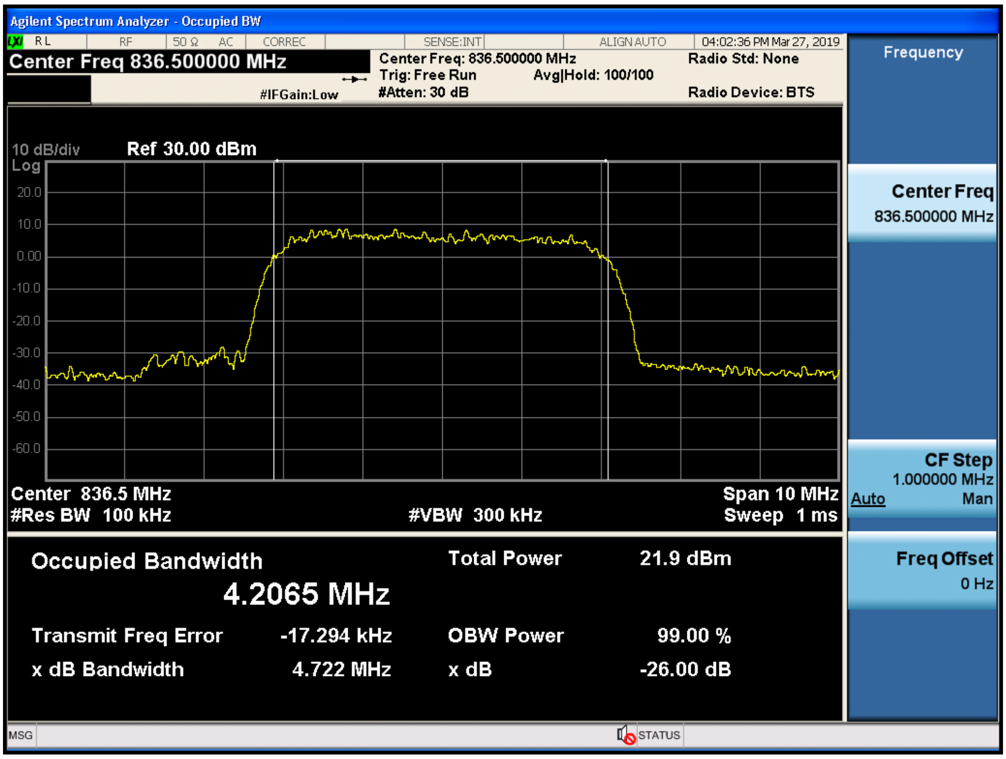
Occupied Bandwidth / Cellular / Uplink / CDMA / Output



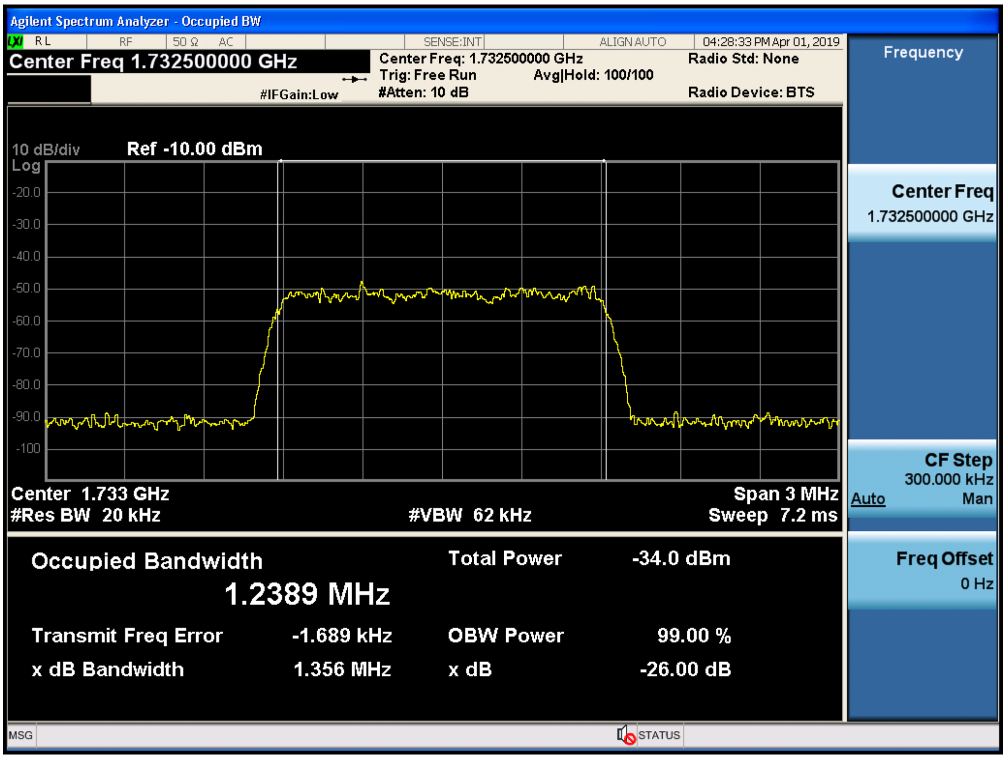
Occupied Bandwidth / Cellular / Uplink / WCDMA/ Input



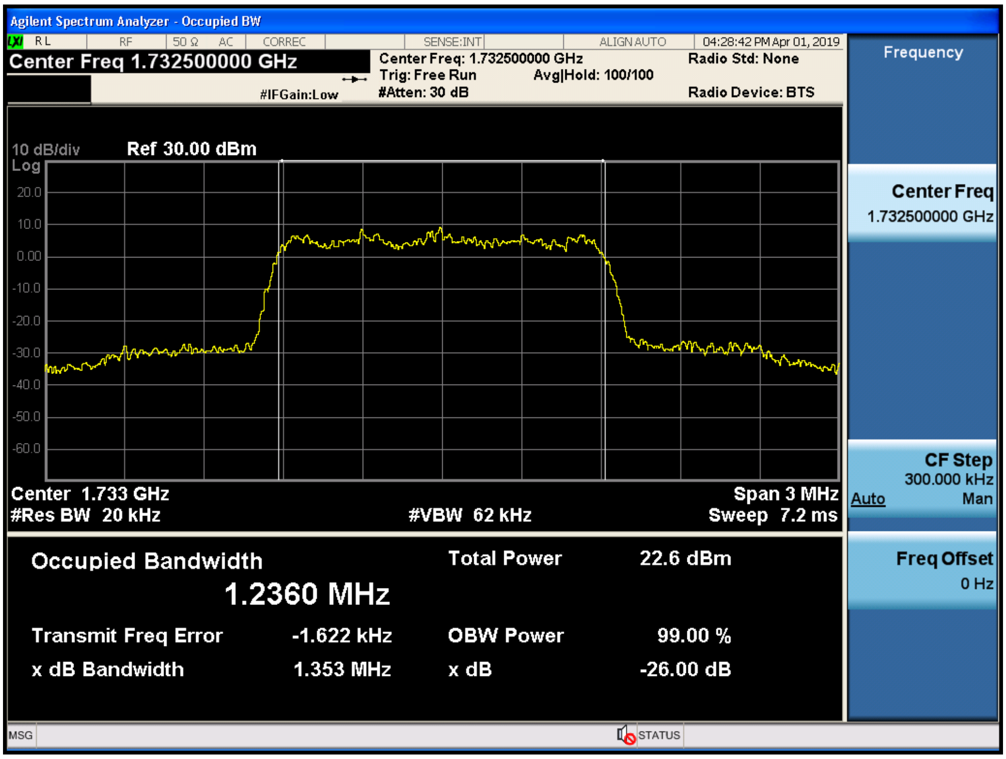
Occupied Bandwidth / Cellular / Uplink / WCDMA / Output



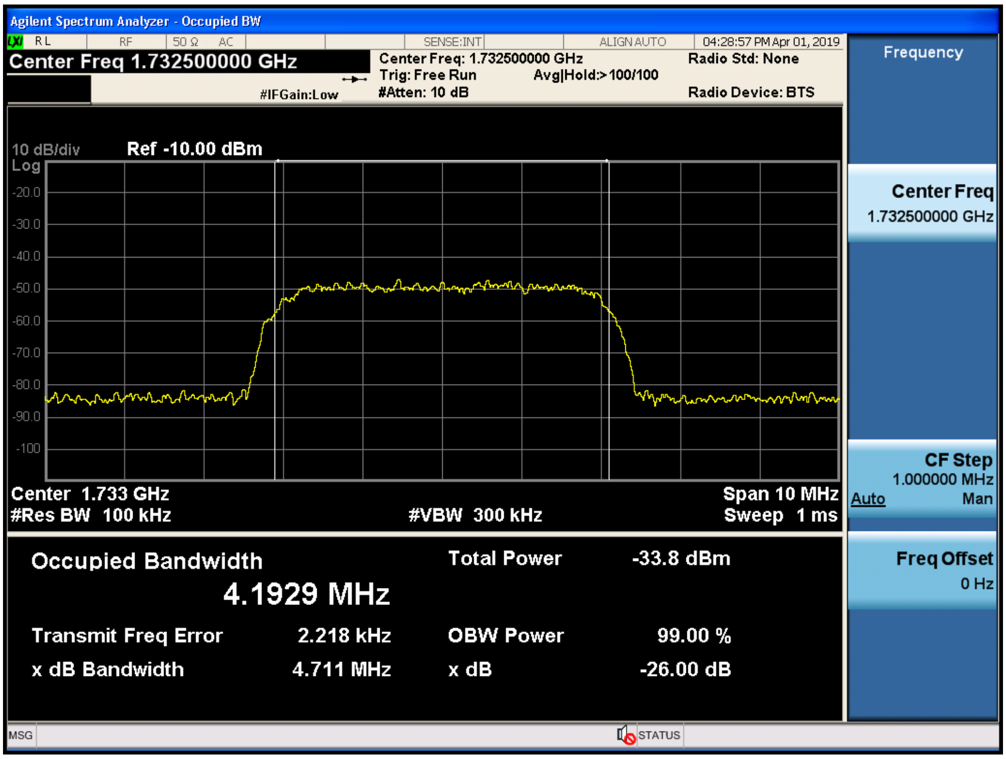
Occupied Bandwidth / AWS-1 / Uplink / CDMA/ Input



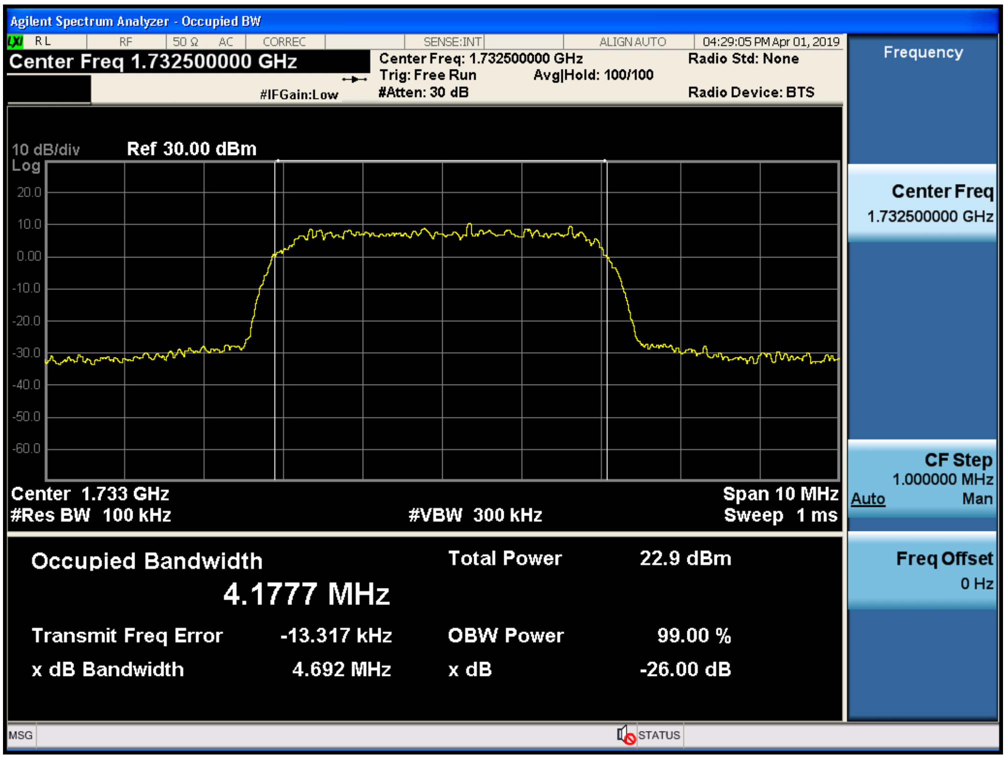
Occupied Bandwidth / AWS-1 / Uplink / CDMA / Output

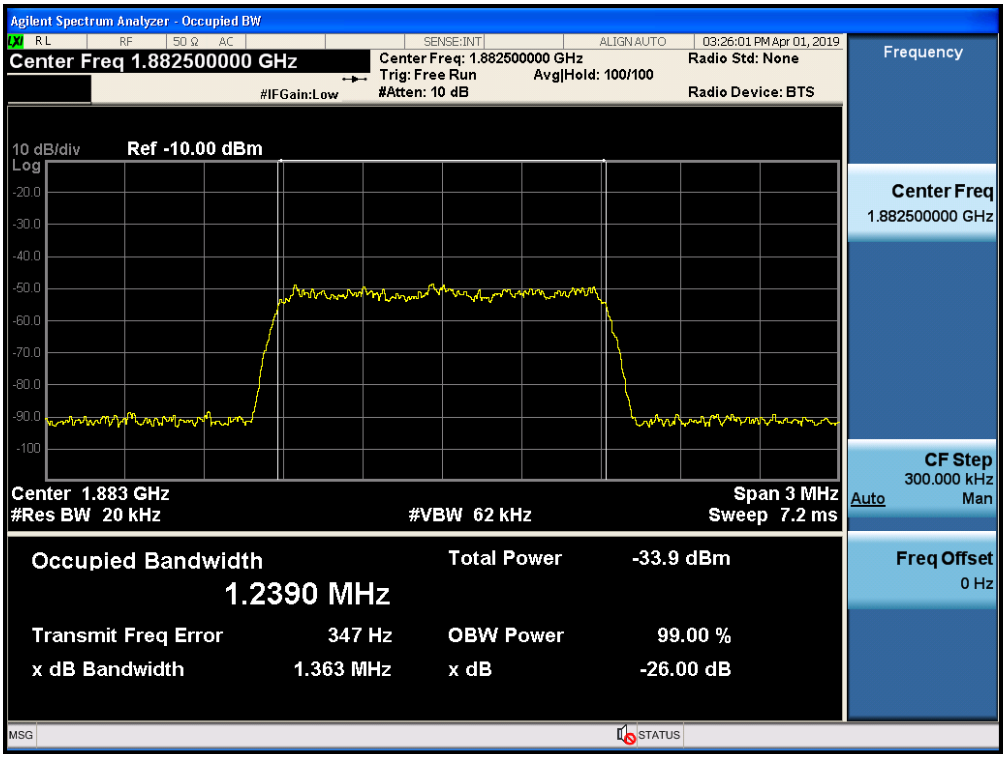


Occupied Bandwidth / AWS-1 / Uplink / WCDMA/ Input



Occupied Bandwidth / AWS-1 / Uplink / WCDMA / Output



Occupied Bandwidth / Broadband PCS / Uplink / CDMA/ Input


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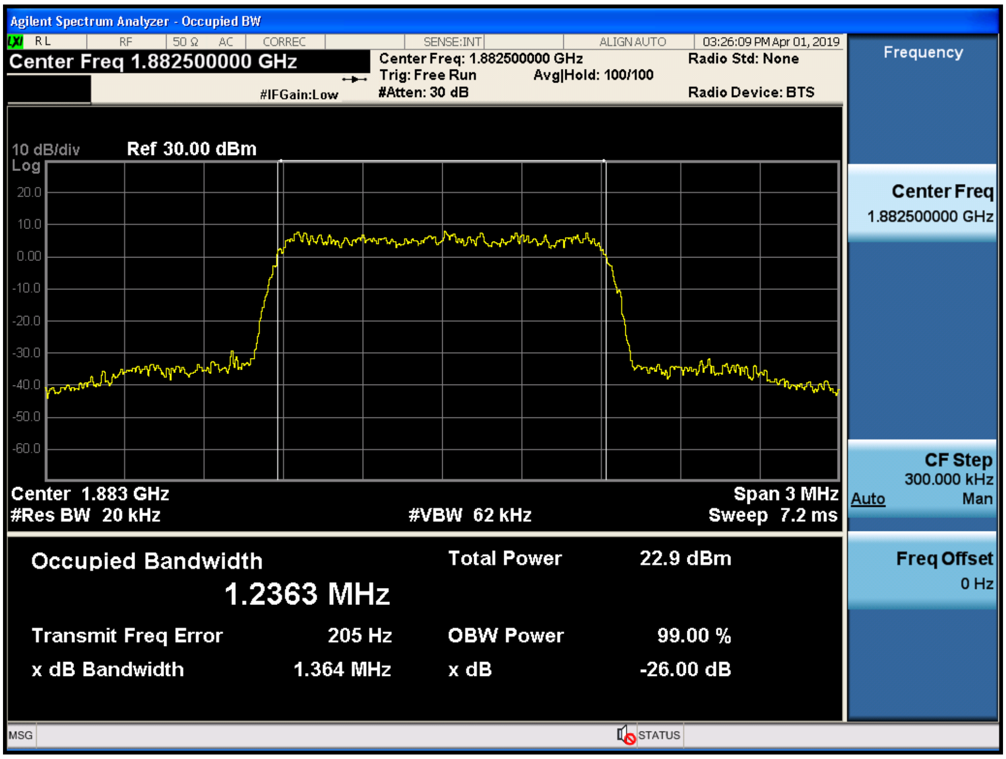
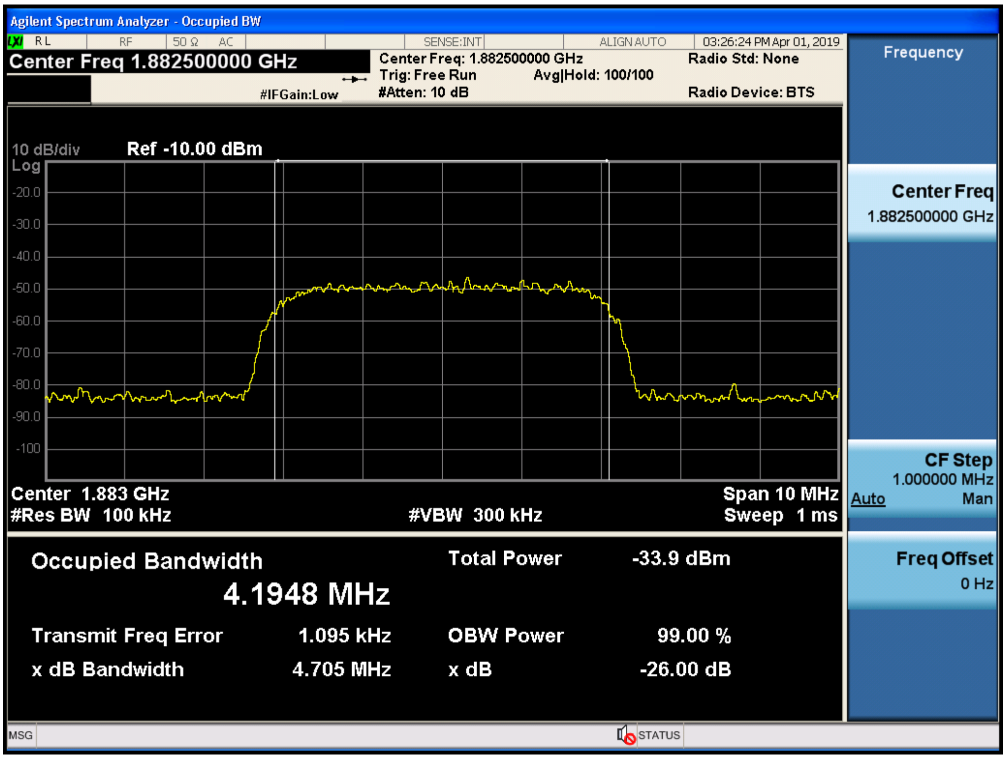
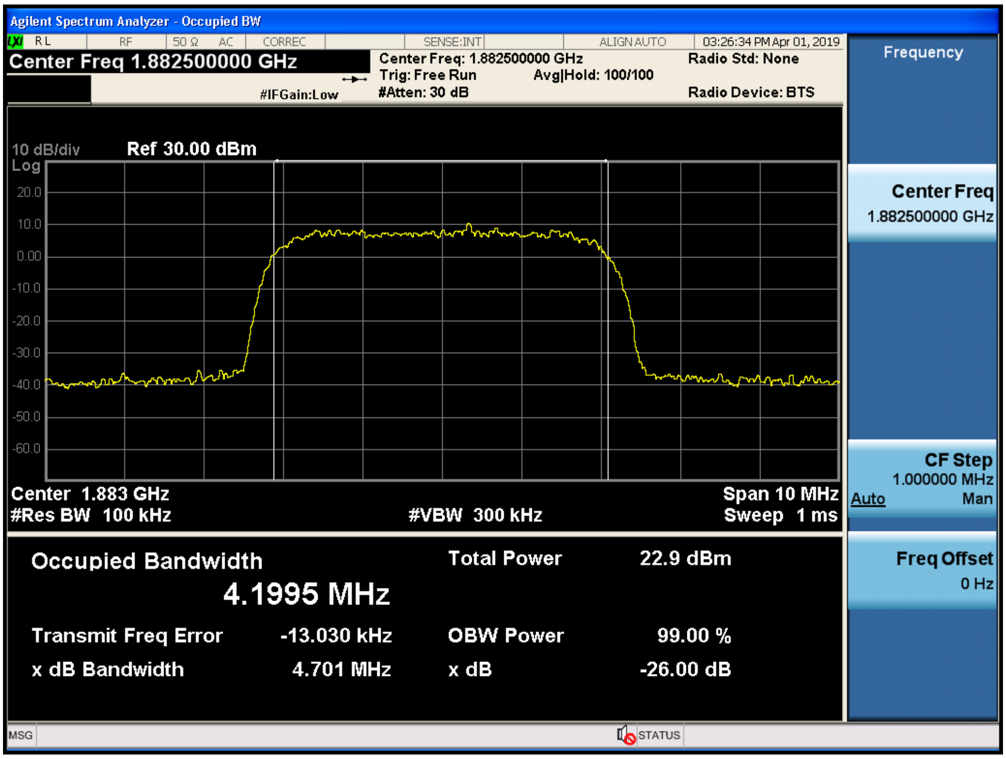
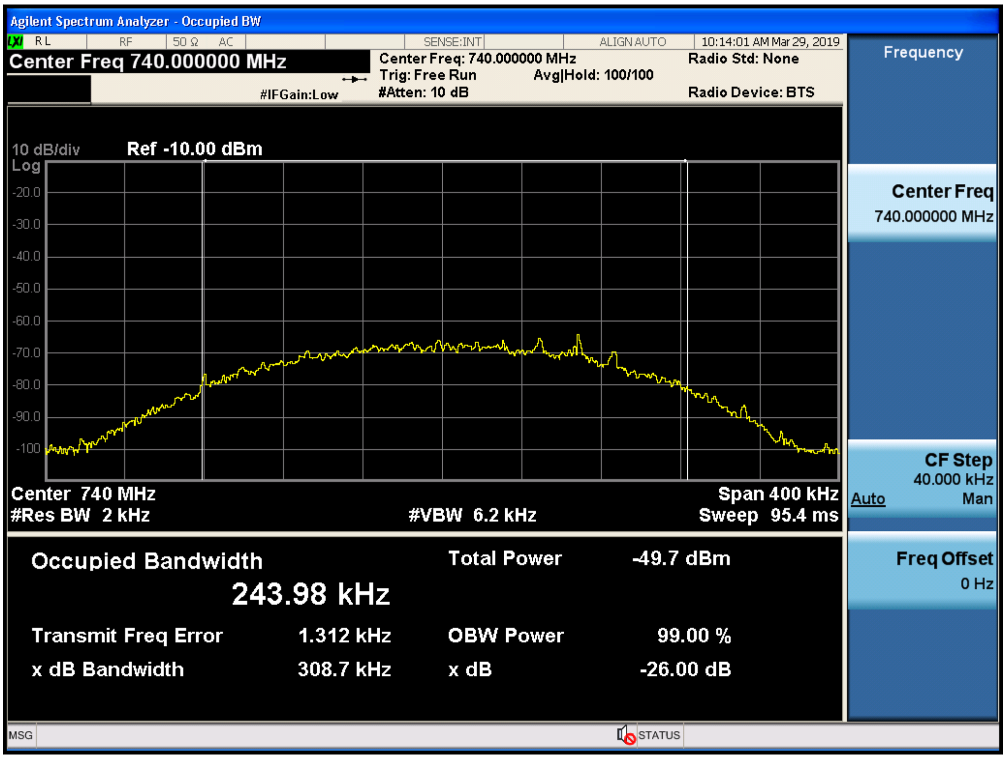


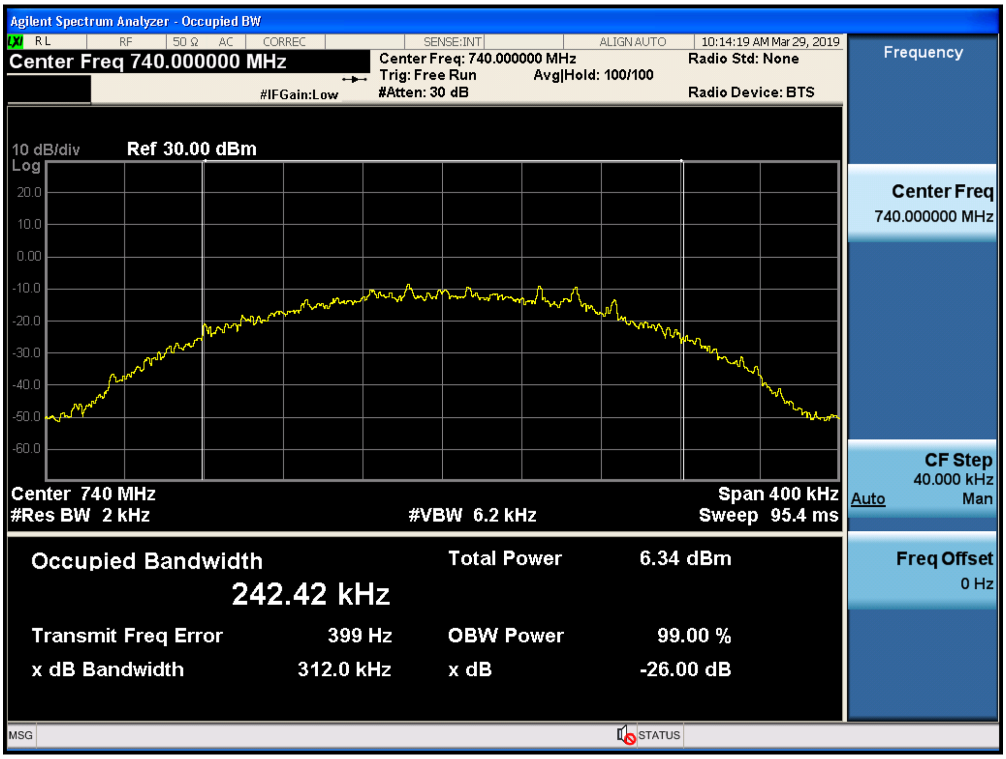
Occupied Bandwidth / Broadband PCS / Uplink / WCDMA/ Input

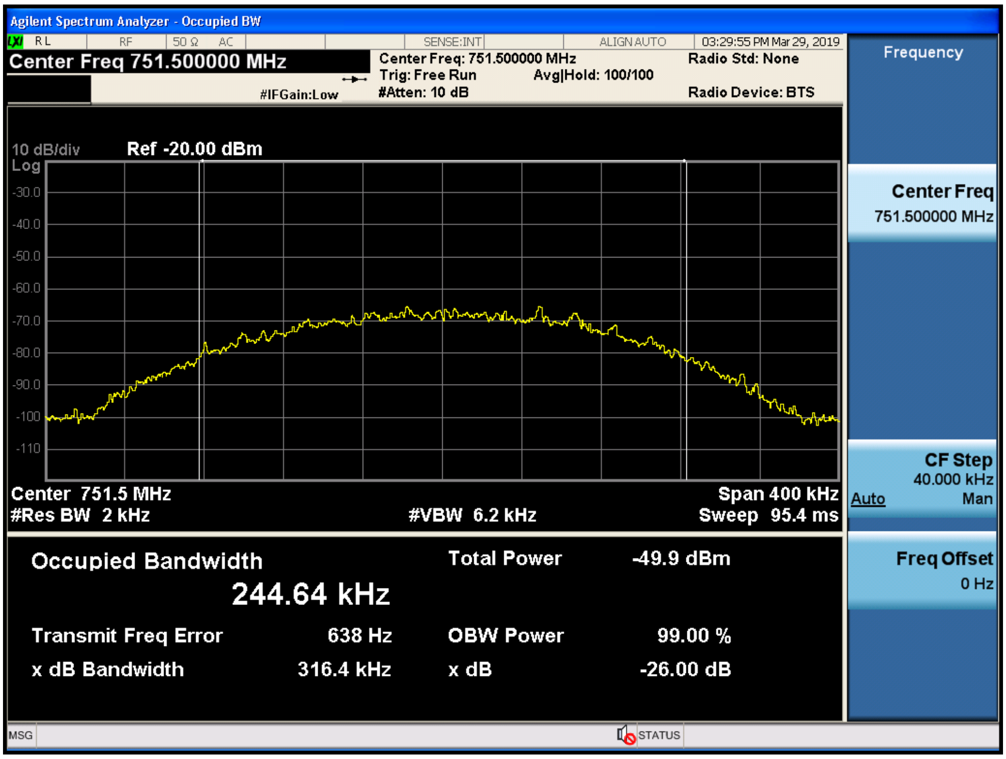


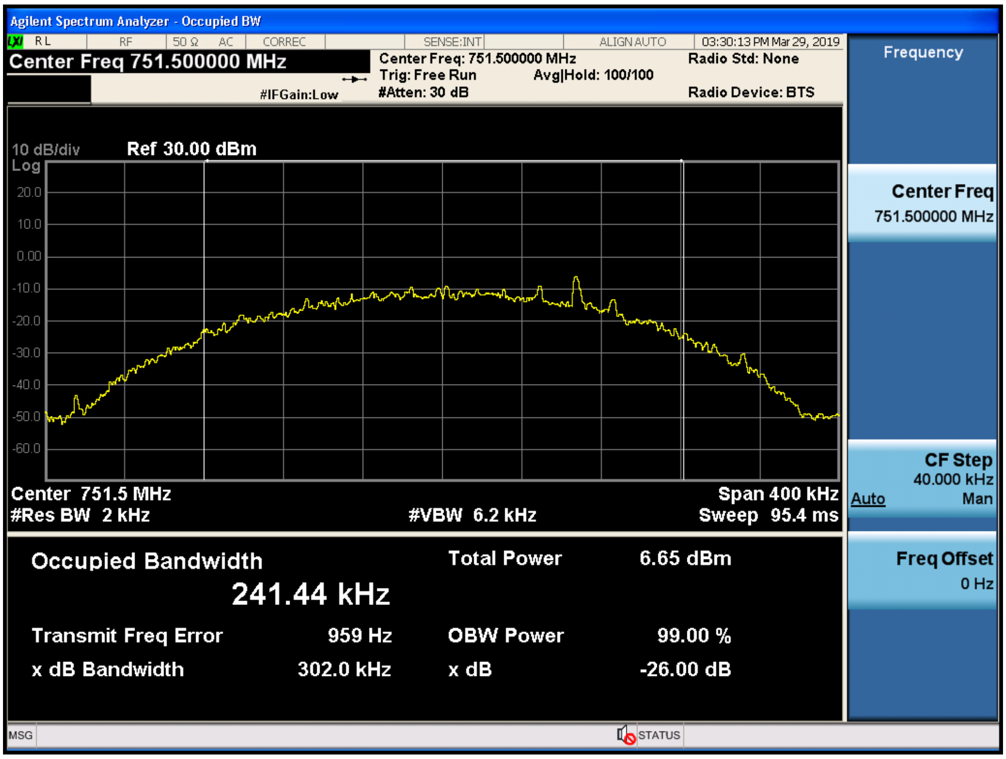
Occupied Bandwidth / Broadband PCS / Uplnik / WCDMA / Output

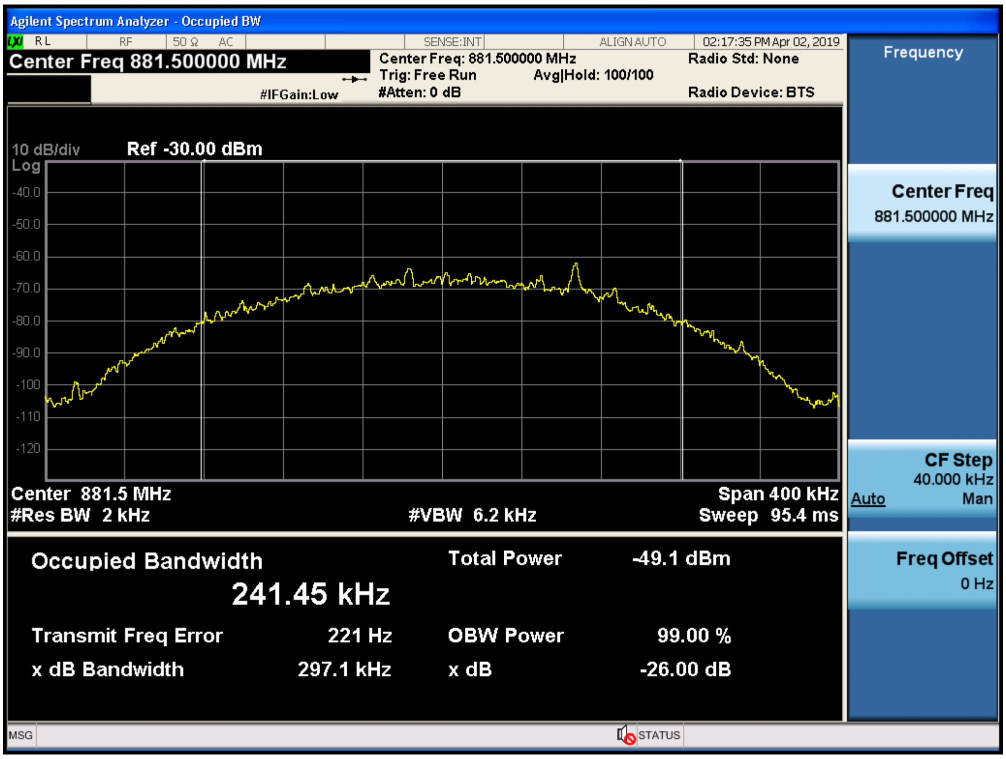


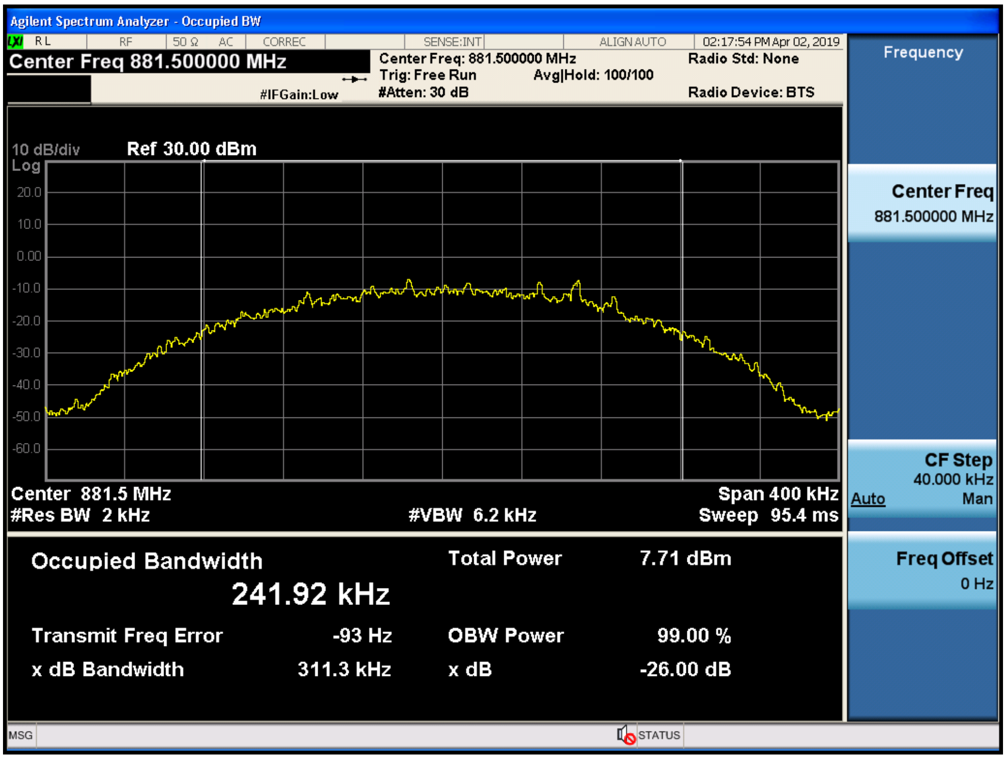
Occupied Bandwidth / Lower 700 MHz / Downlink / GSM / Input


Occupied Bandwidth / Lower 700 MHz / Downlink / GSM / Output


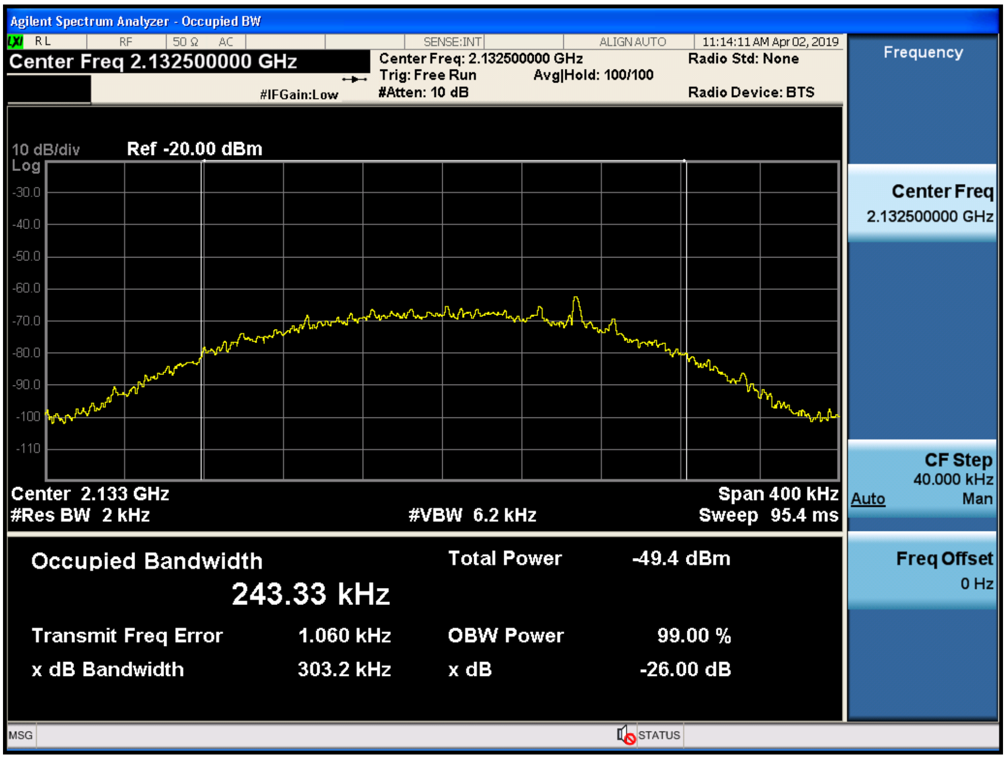
Occupied Bandwidth / Upper 700 MHz / Downlink / GSM / Input


Occupied Bandwidth / Upper 700 MHz / Downlink / GSM / Output


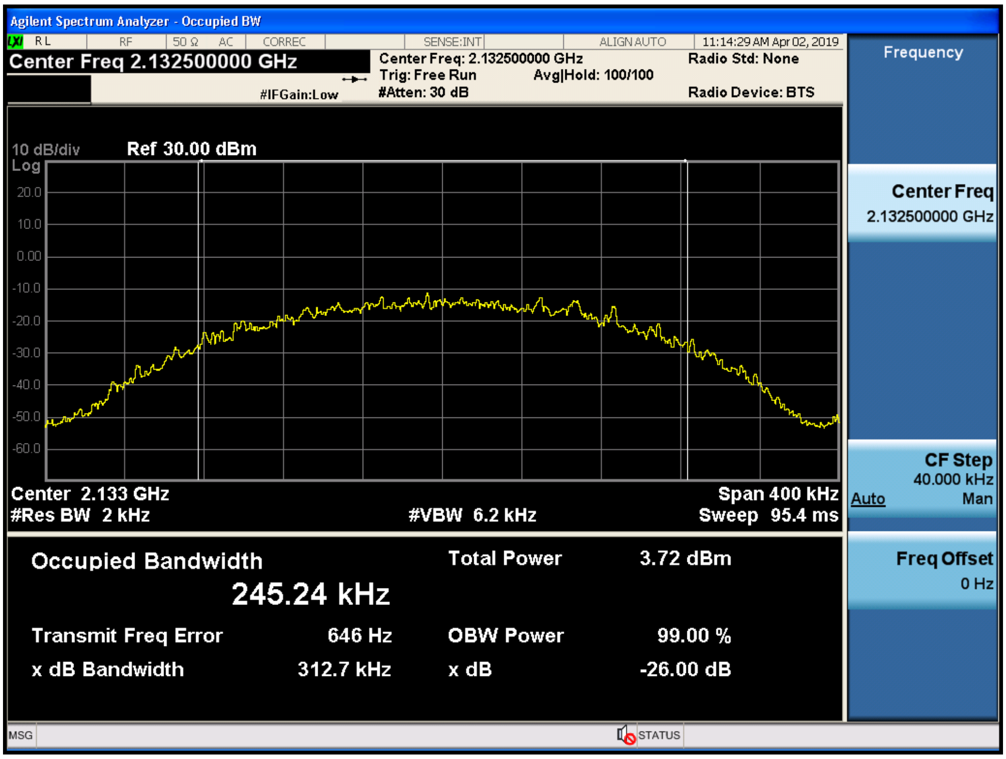
Occupied Bandwidth / Cellular / Downlink / GSM / Input


Occupied Bandwidth / Cellular / Downlink / GSM / Output


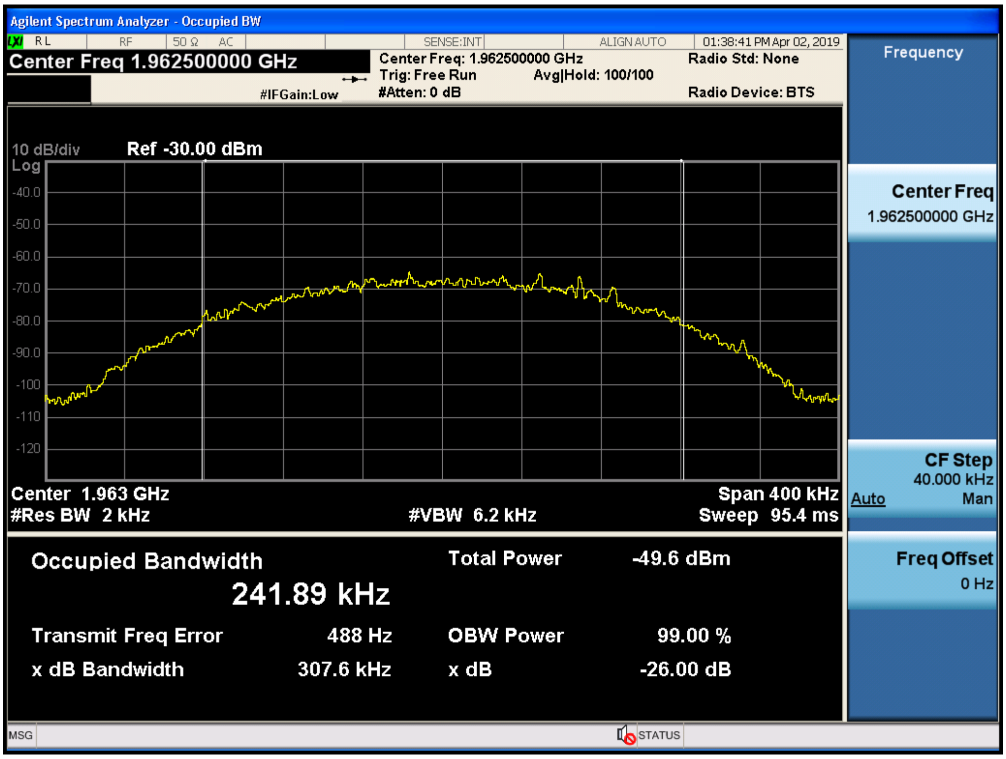
Occupied Bandwidth / AWS-1 / Downlink / GSM / Input



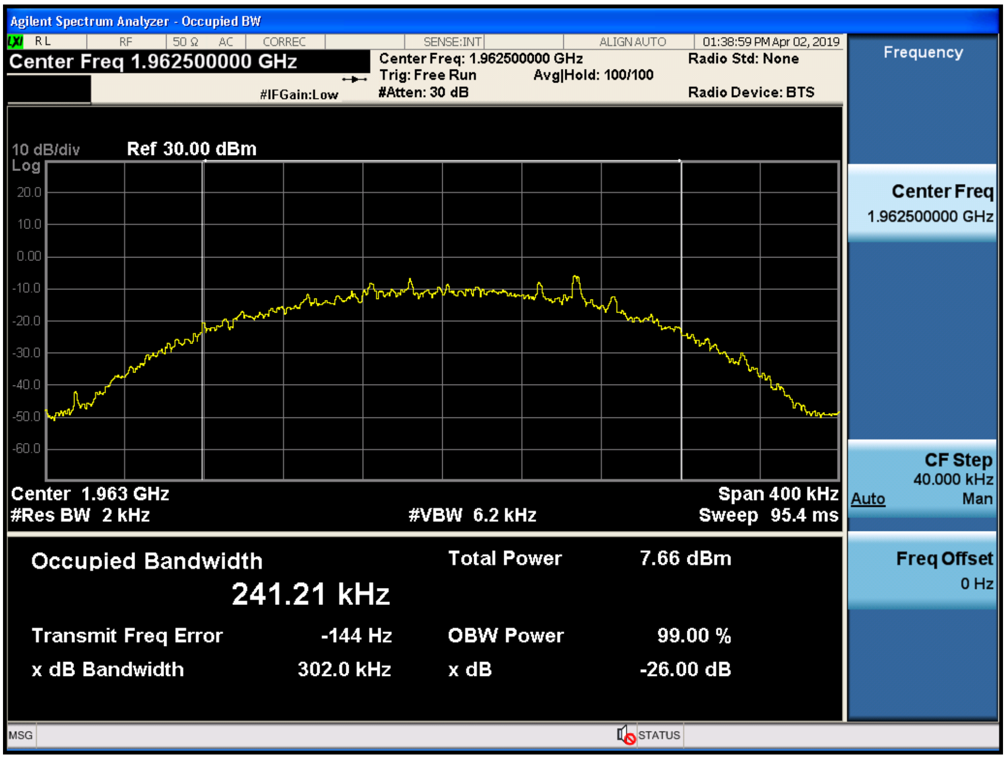
Occupied Bandwidth / AWS-1 / Downlink / GSM / Output



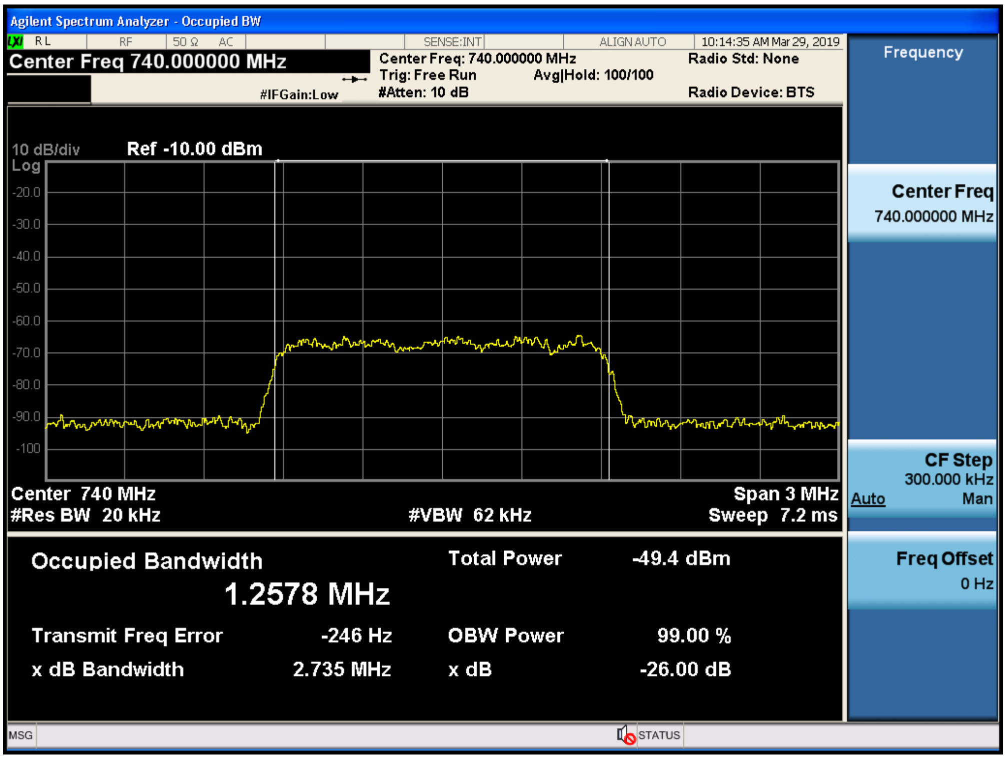
Occupied Bandwidth / Broadband PCS / Downlink / GSM / Input



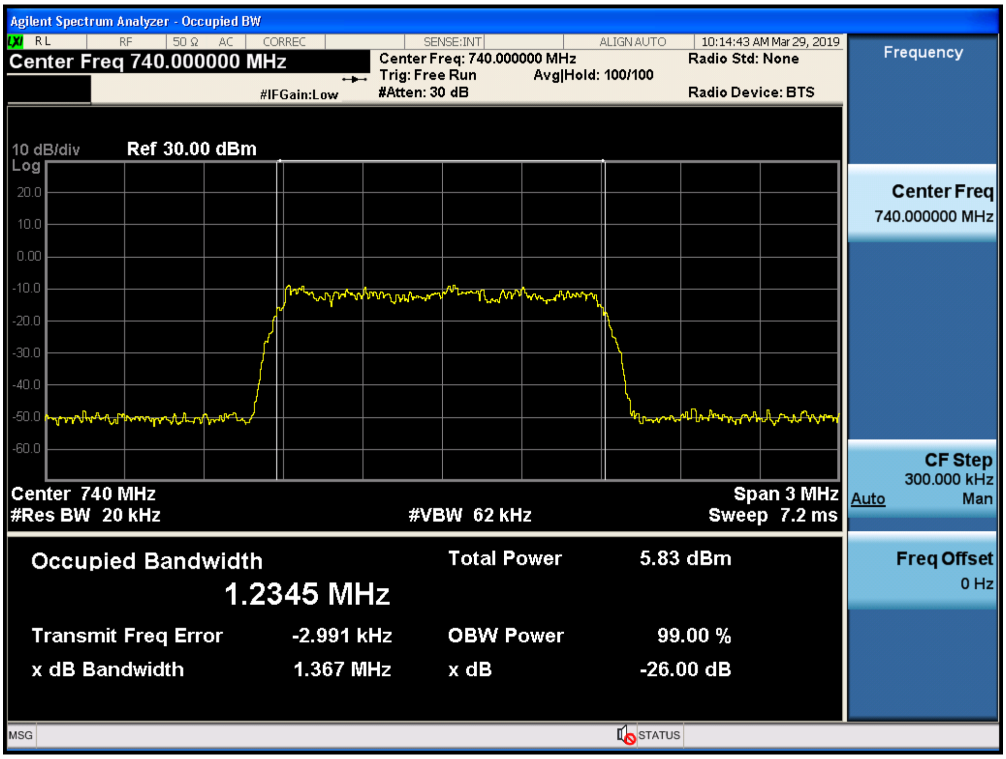
Occupied Bandwidth / Broadband PCS / Downlink / GSM / Output



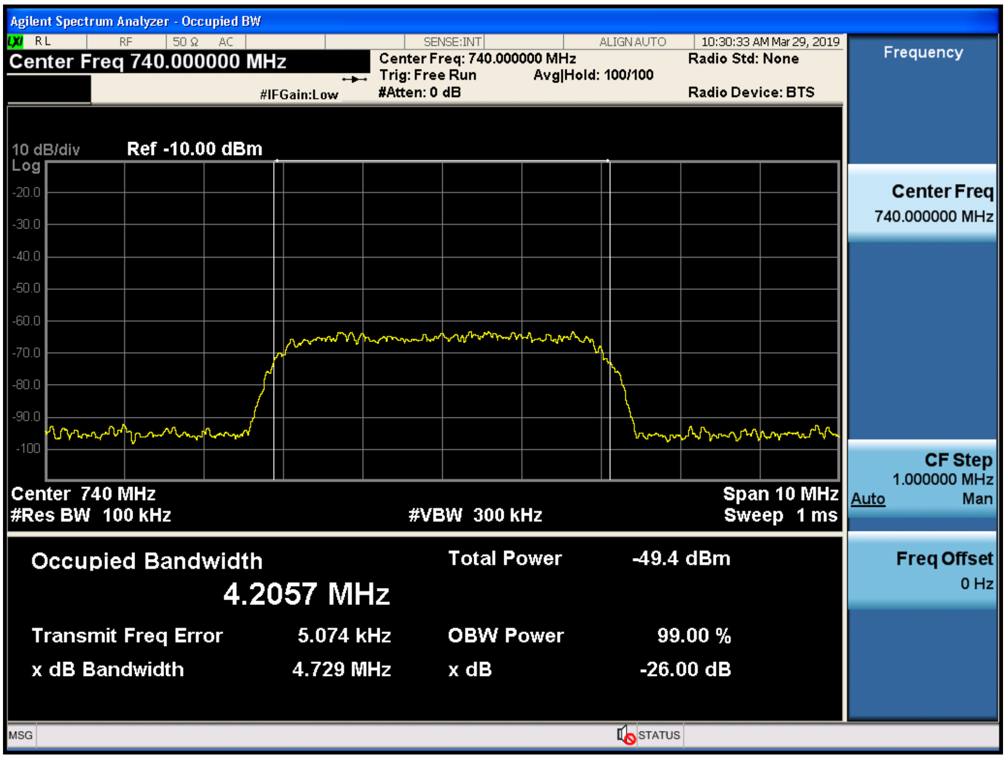
Occupied Bandwidth / Lower 700 MHz / Downlink / CDMA/ Input



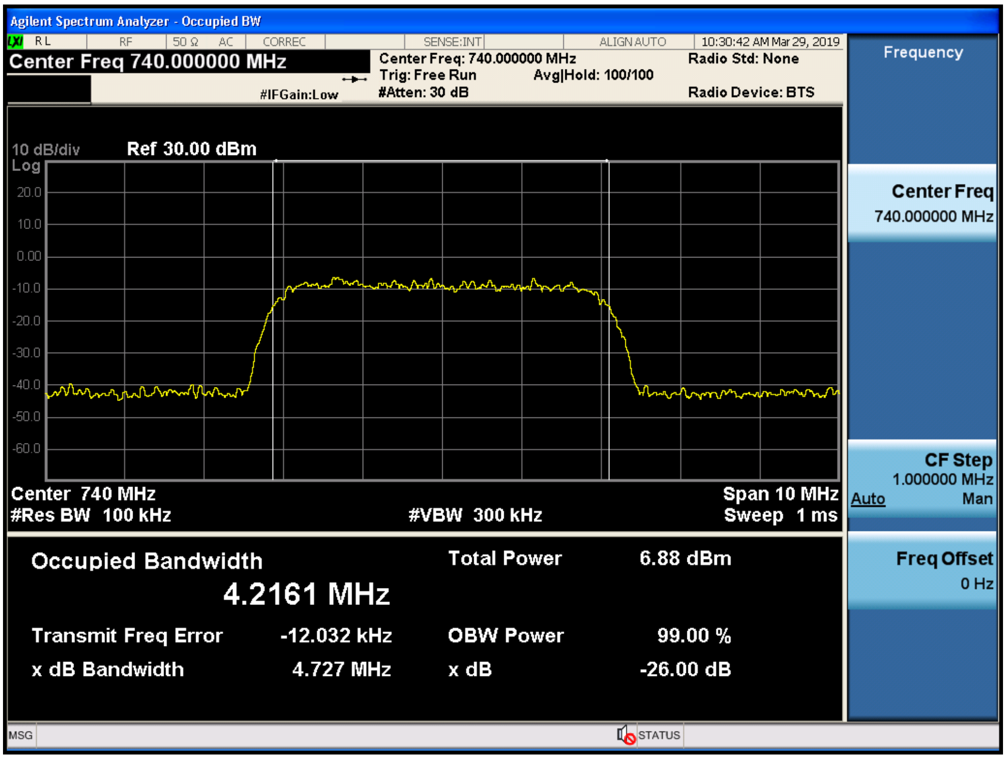
Occupied Bandwidth / Lower 700 MHz / Downlink / CDMA / Output



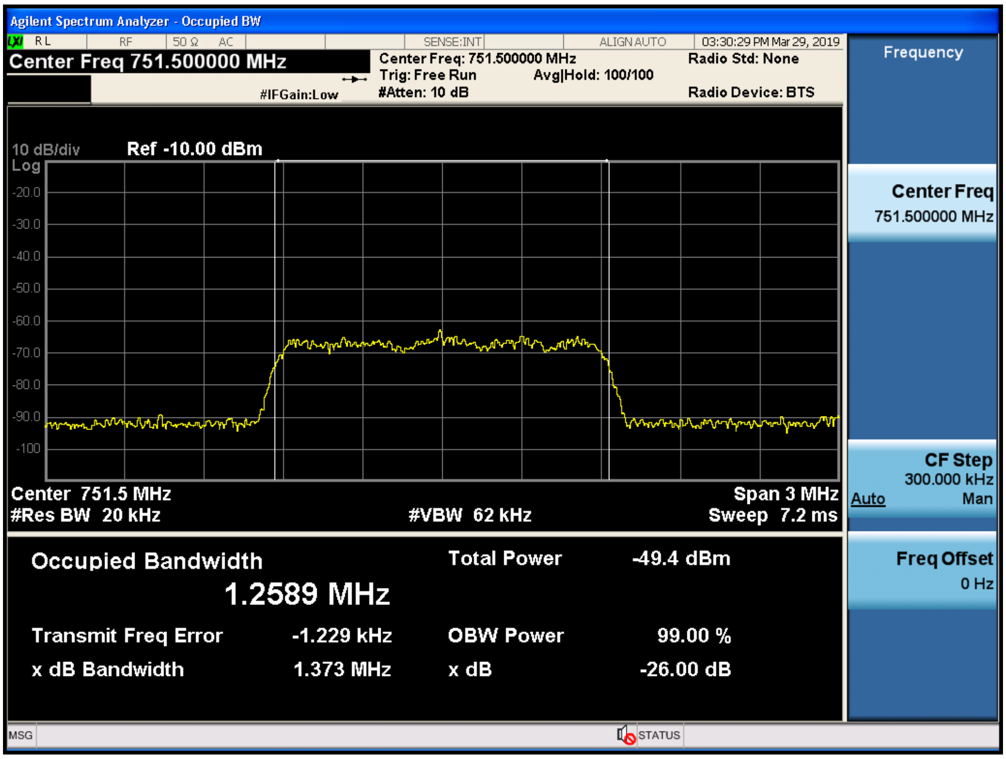
Occupied Bandwidth / Lower 700 MHz / Downlink / WCDMA/ Input



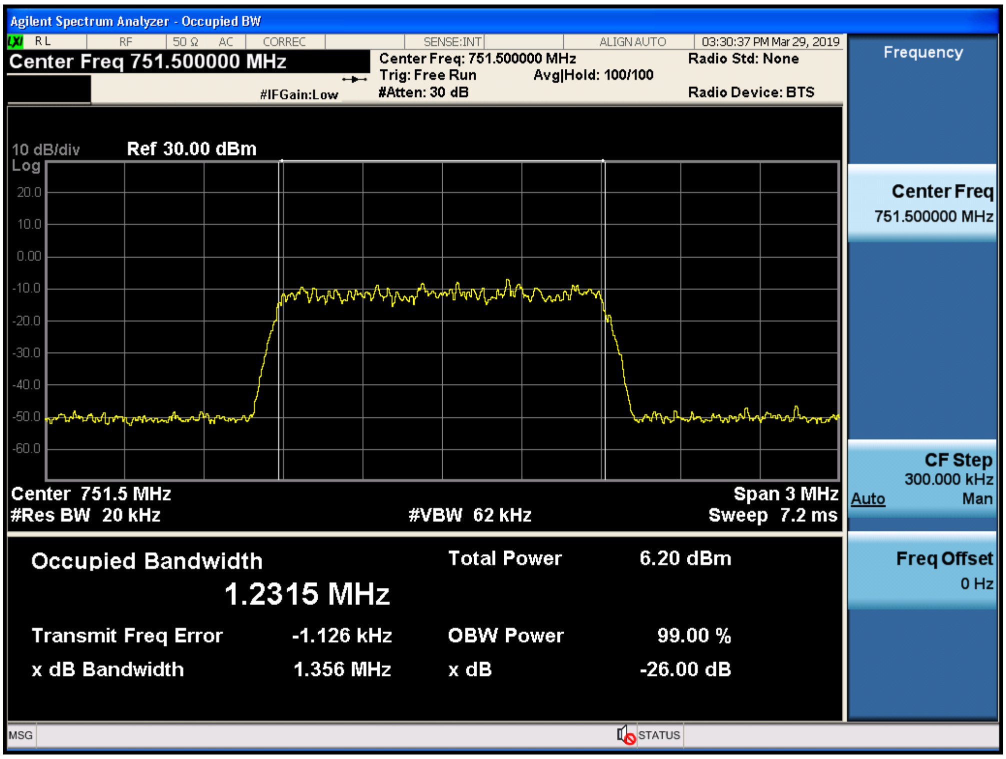
Occupied Bandwidth / Lower 700 MHz / Downlink / WCDMA / Output

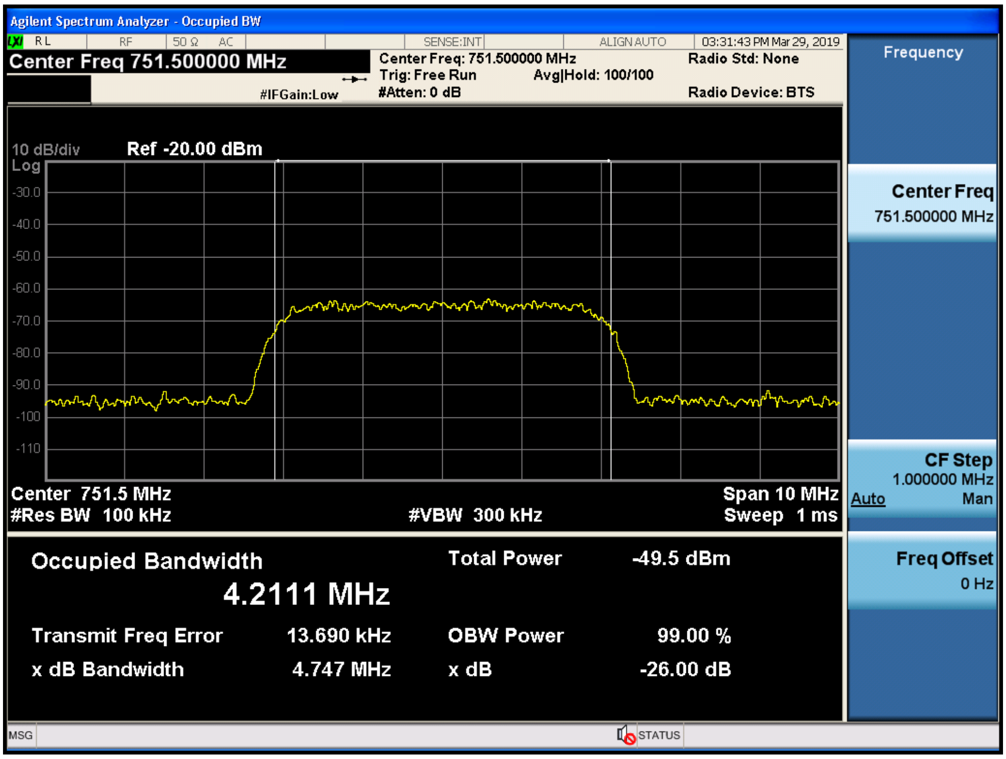


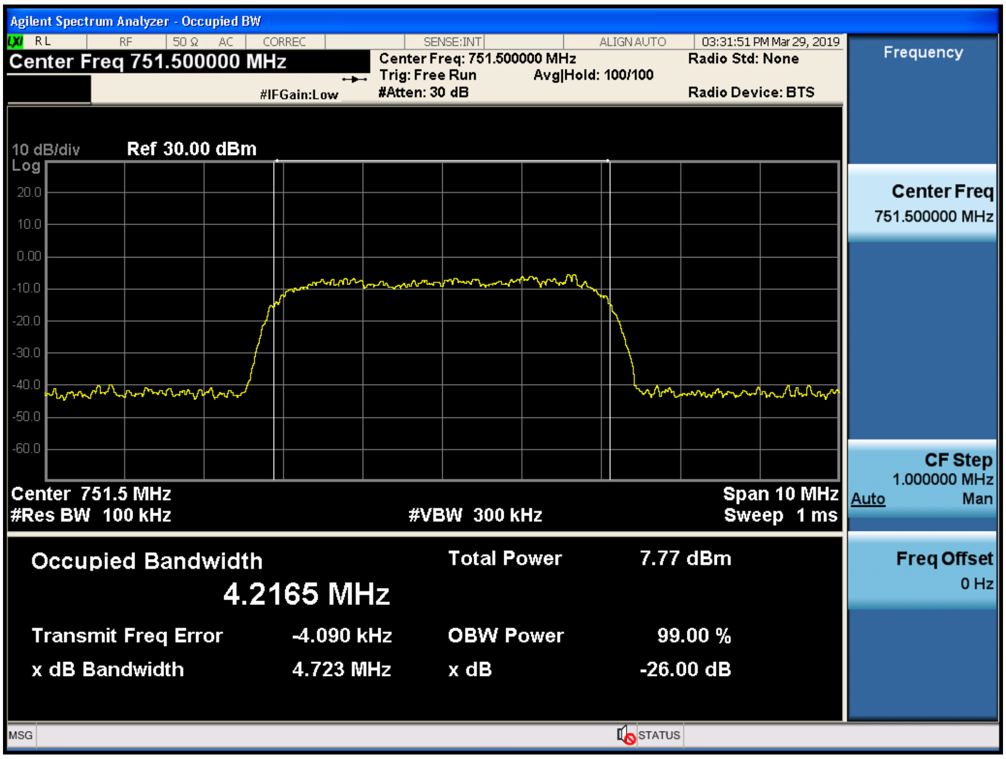
Occupied Bandwidth / Upper 700 MHz / Downlink / CDMA/ Input

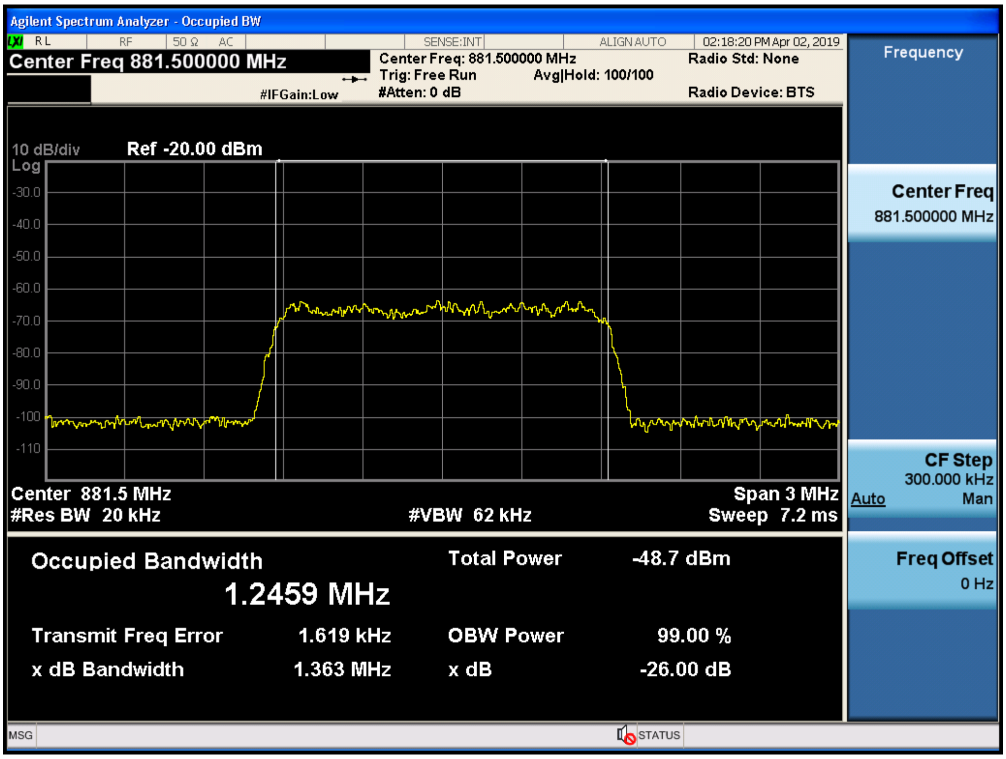


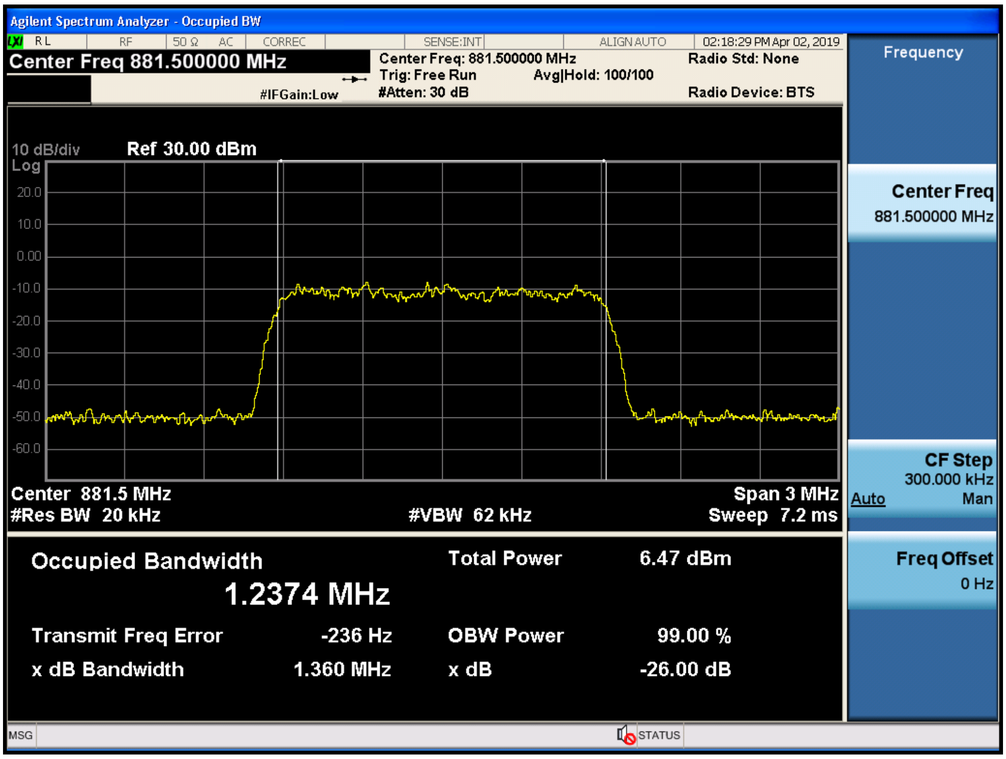
Occupied Bandwidth / Upper 700 MHz / Downlink / CDMA / Output



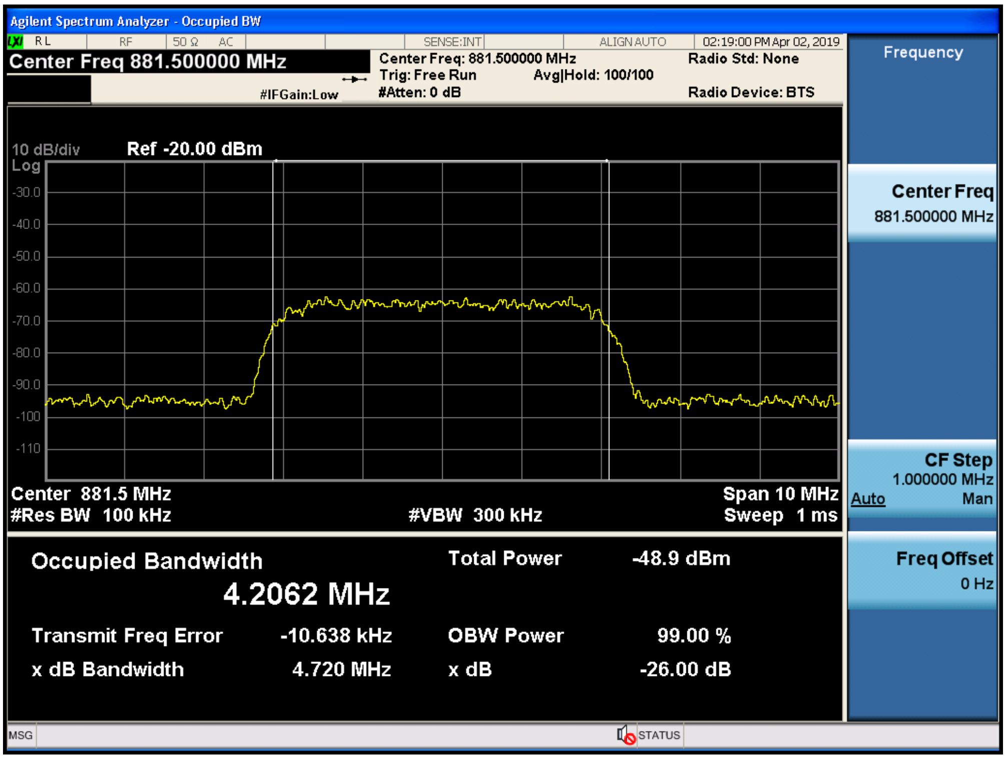
Occupied Bandwidth / Upper 700 MHz / Downlink / WCDMA/ Input


Occupied Bandwidth / Upper 700 MHz / Downlink / WCDMA / Output


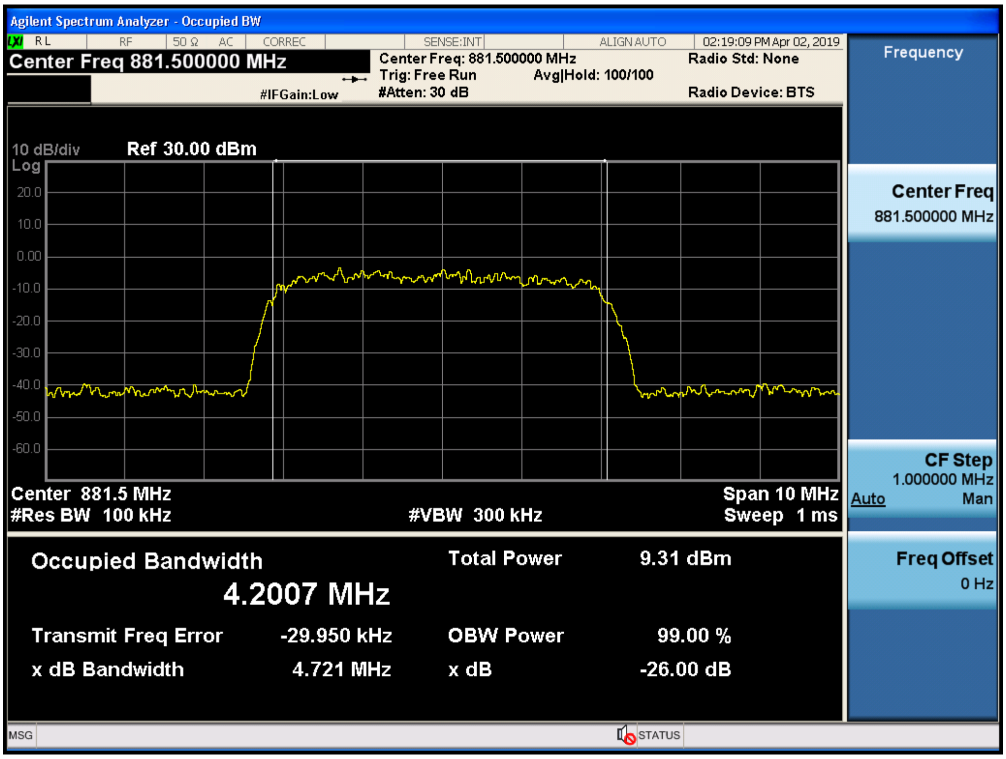
Occupied Bandwidth / Cellular / Downlink / CDMA/ Input


Occupied Bandwidth / Cellular / Downlink / CDMA / Output


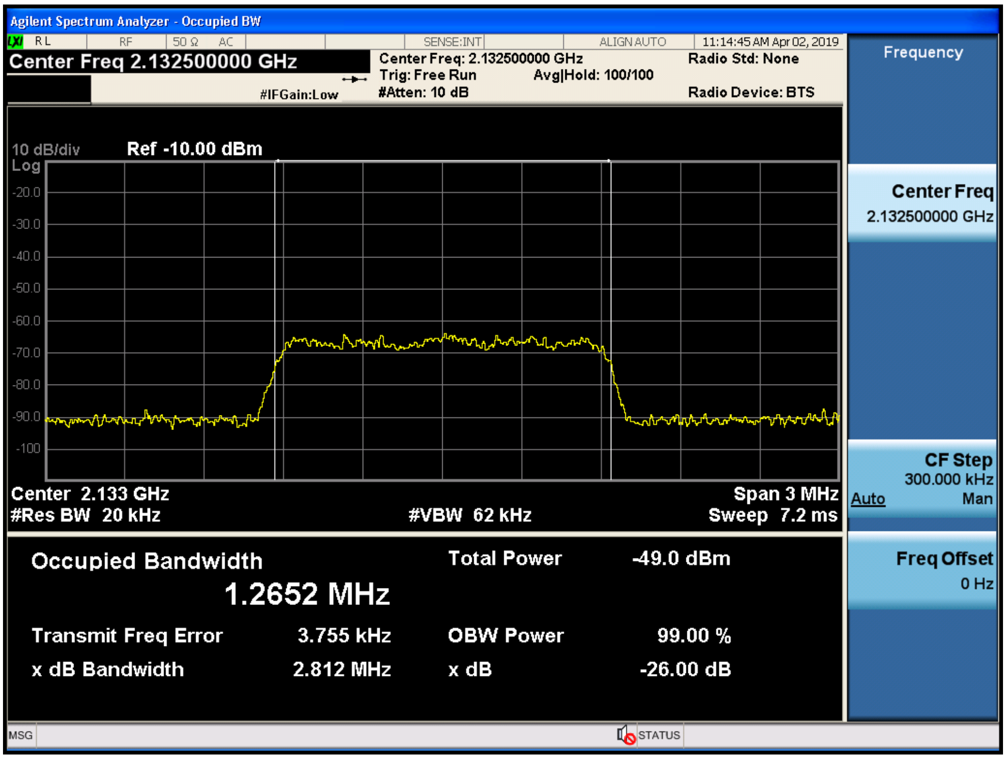
Occupied Bandwidth / Cellular / Downlink / WCDMA/ Input



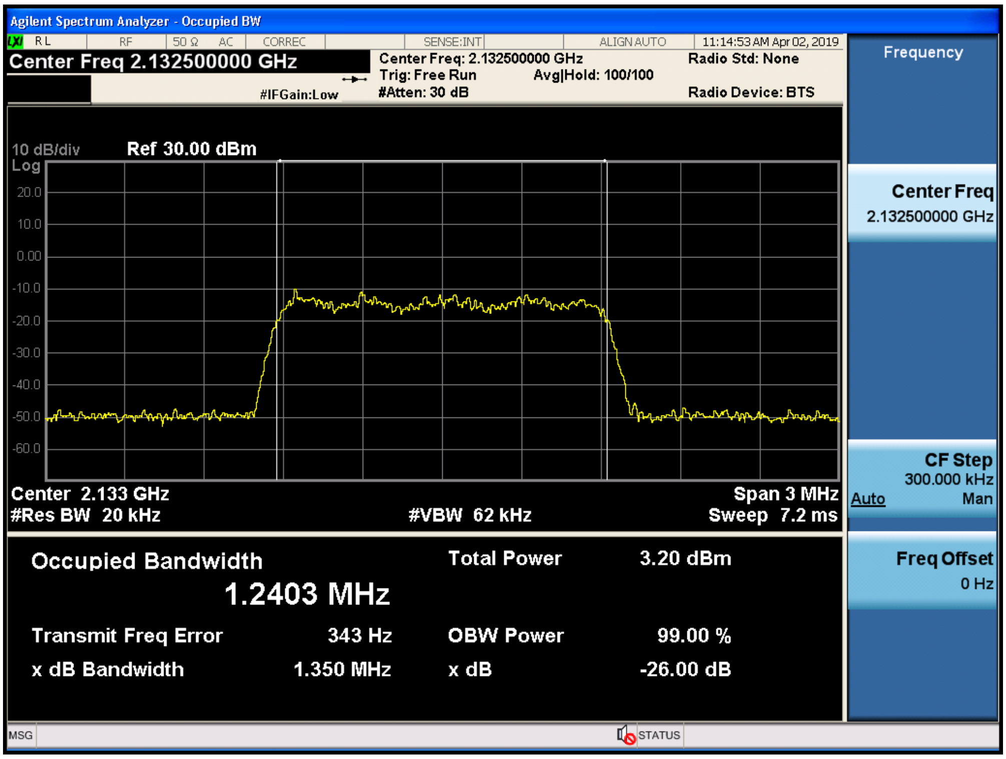
Occupied Bandwidth / Cellular / Downlink / WCDMA / Output



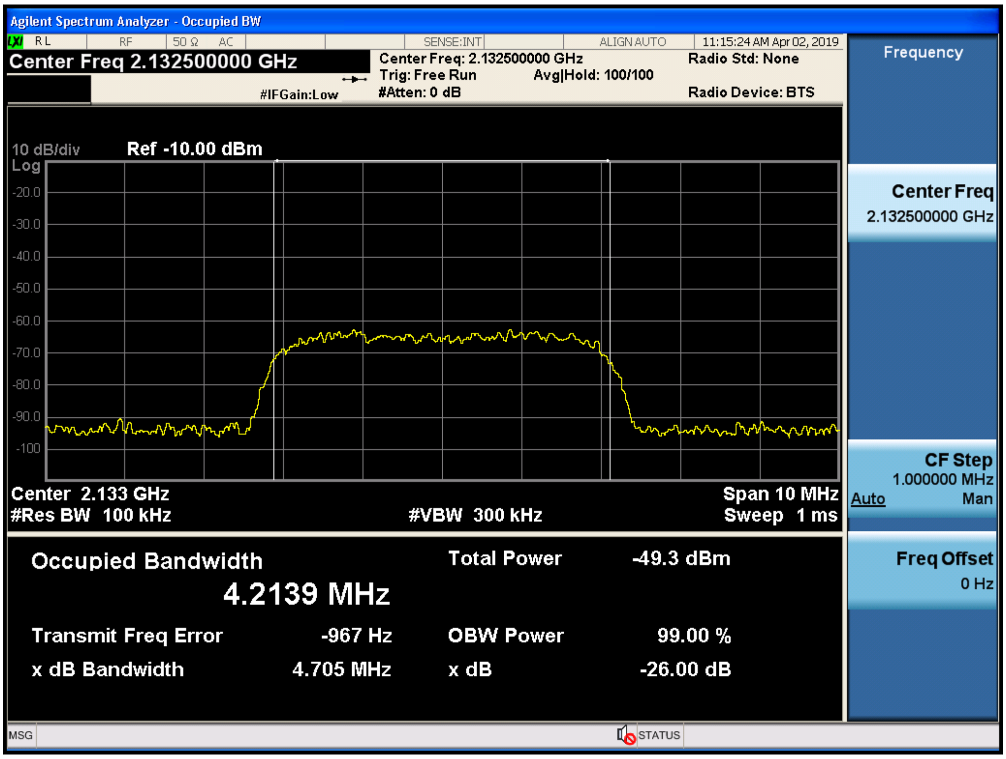
Occupied Bandwidth / AWS-1 / Downlink / CDMA/ Input



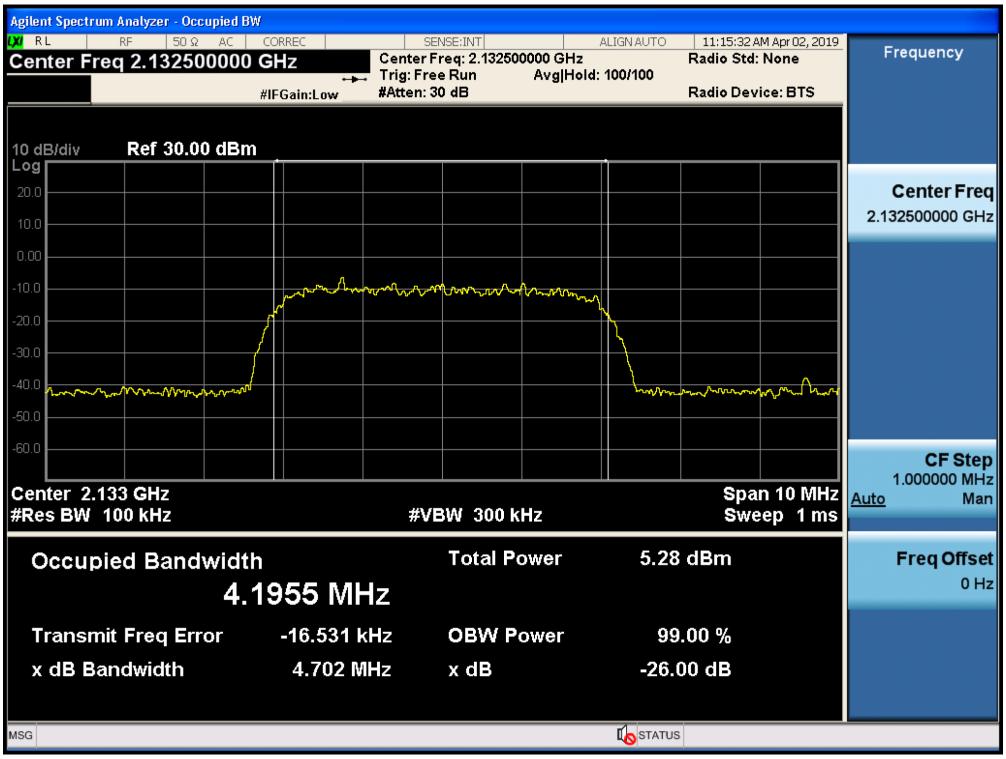
Occupied Bandwidth / AWS-1 / Downlink / CDMA / Output

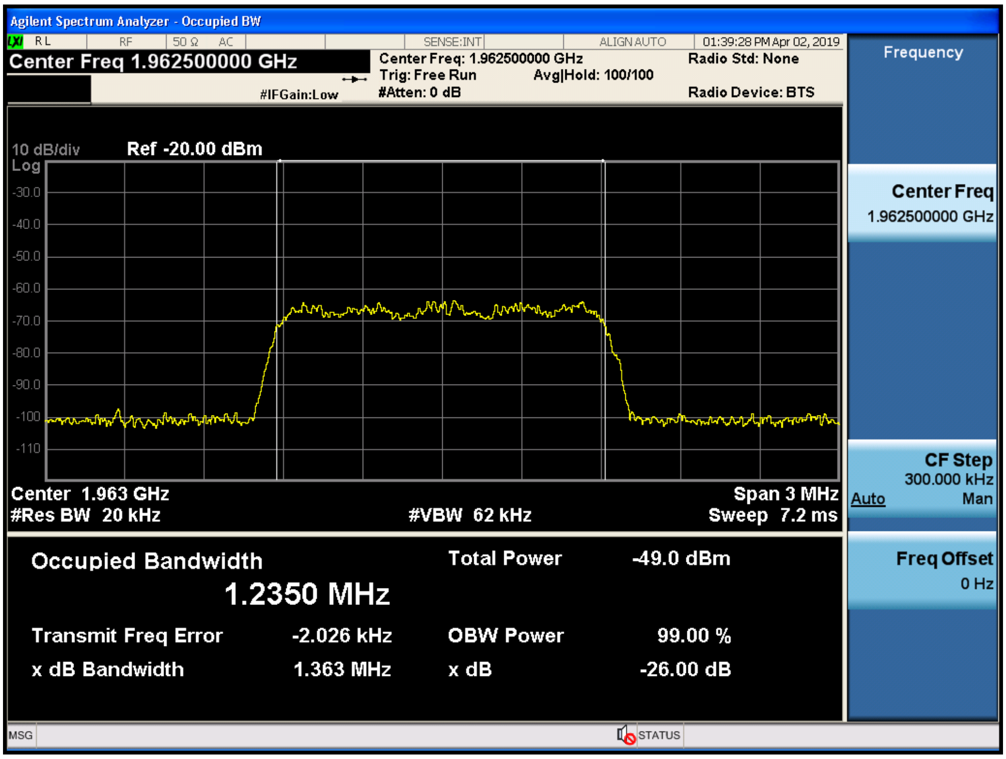


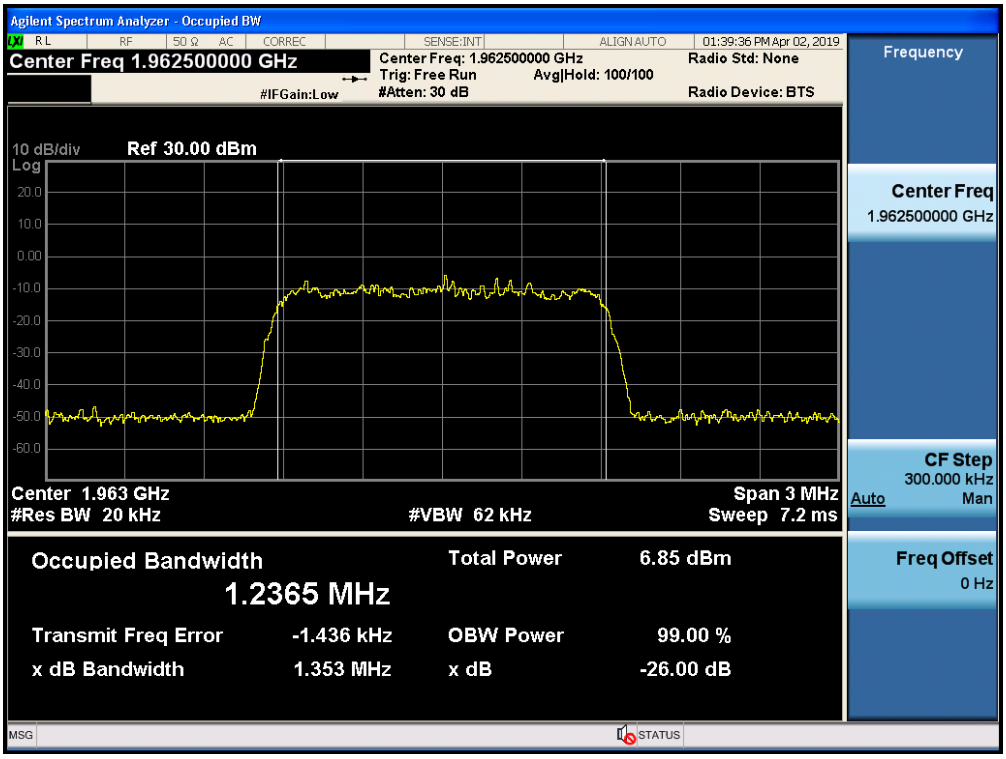
Occupied Bandwidth / AWS-1 / Downlink / WCDMA/ Input



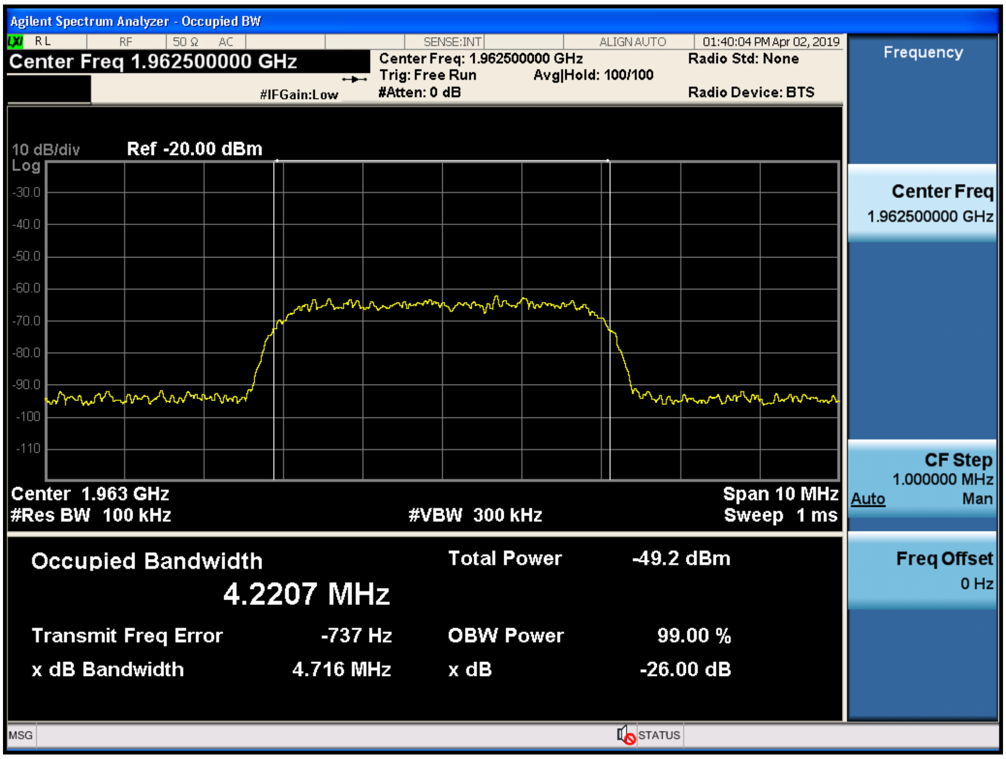
Occupied Bandwidth / AWS-1 / Downlink / WCDMA / Output



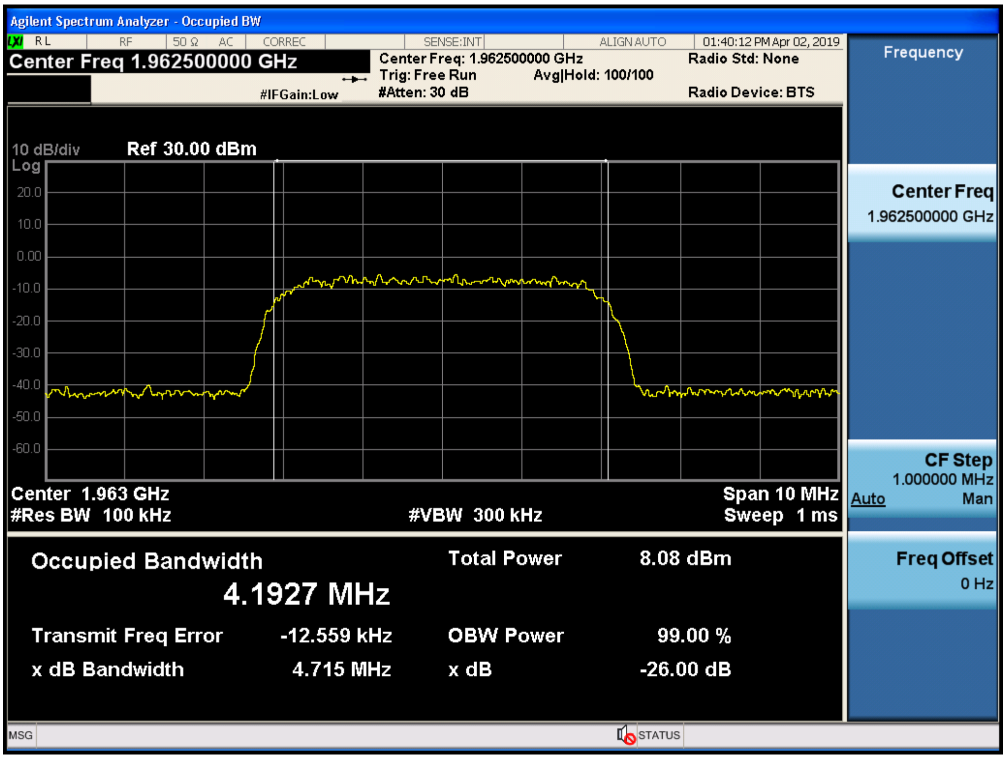
Occupied Bandwidth / Broadband PCS / Downlink / CDMA/ Input


Occupied Bandwidth / Broadband PCS / Downlink / CDMA / Output


Occupied Bandwidth / Broadband PCS / Downlink / WCDMA/ Input



Occupied Bandwidth / Broadband PCS / Downlink / WCDMA / Output



5.11. OSCILLATION

Test Requirements:

§ 20.21(e)(8)(ii)(A) ANTI-OSCILLATION.

Consumer boosters must be able to detect and mitigate (i.e., by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

Test Procedures:

Measurements were in accordance with the test methods section 7.11 of KDB 935210 D03 v04r03.

7.11.2 Oscillation restart tests

a) Beginning with the spectrum analyzer on the uplink output (donor) port. Confirm that the RF coupled path is connected to the spectrum analyzer.

b) Spectrum analyzer settings:

1) Center frequency at the center of the band under test

2) Span equal or slightly exceeding the width of the band under test

3) Continuous sweep, max-hold

4) RBW x 1 MHz, VBW > 3 x RBW

c) Decrease the variable attenuator until the spectrum analyzer displays a signal within the band under test. Using a marker, identify the approximate center frequency of this signal on the max-hold display, increase the attenuation by 10 dB, then reset the EUT (e.g., cycle ac/dc power).

d) Repeat c) twice to ensure that the center of the signal created by the booster remains within 250 kHz of the spectrum analyzer display center frequency. If the frequency of the signal is unstable, confirm that the spectrum analyzer display is centered between the frequency extremes observed. If the signal is wider than 1 MHz, ensure that the spectrum analyzer display is centered on the signal by increasing the RBW. Reset the EUT (e.g., cycle ac/dc power) after each oscillation event, if necessary. Set the spectrum analyzer sweep trigger level to just below the peak amplitude of the displayed EUT oscillation signal.

e) Set the spectrum analyzer to zero-span, with a sweep time of 5 seconds, and single-sweep with max-hold. The spectrum analyzer sweep trigger level in this and the subsequent steps shall be the level identified in d).

f) Decrease the variable attenuator until the spectrum analyzer sweep is triggered, increase the attenuation by 10 dB, then reset the EUT (e.g., cycle ac/dc power).

g) Reset the zero-span trigger of the spectrum analyzer, then repeat f) twice to ensure that the spectrum analyzer is reliably triggered, resetting the EUT (e.g., cycle ac/dc power) after each oscillation event if necessary.

h) Reset the zero-span sweep trigger of the spectrum analyzer, and reset the EUT (e.g., cycle ac/dc power).

i) Force the EUT into oscillation by reducing the attenuation.

j) Use the marker function of the spectrum analyzer to measure the time from the onset of oscillation until the EUT turns off, by setting Marker 1 on the leading edge of the oscillation signal and Marker 2 on the trailing edge. The spectrum analyzer sweep time may be adjusted to improve the time resolution of these cursors.

k) Capture the spectrum analyzer zero-span trace for inclusion in the test report. Report the power level associated with the oscillation separately if it can't be displayed on the trace.

l) Repeat b) to k) for all operational uplink and downlink bands.

m) Set the spectrum analyzer zero-span sweep time for longer than 60 seconds, then measure the restart time for each operational uplink and downlink band.

n) Replace the normal-operating mode EUT with the EUT that supports an anti-oscillation test mode.

o) Set the spectrum analyzer zero-span time for a minimum of 120 seconds, and a single sweep.

p) Manually trigger the spectrum analyzer zero-span sweep, and manually force the booster into oscillation as described in i).

q) When the sweep is complete, place cursors between the first two oscillation detections, and save the plot for inclusion in the test report. The time between restarts must match the manufacturer's timing for the test mode, and there shall be no more than 5 restarts.

r) Repeat m) to q) for all operational uplink and downlink bands.

7.11.3 Test procedure for measuring oscillation mitigation or shutdown

a) Connect the normal-operating mode EUT to the test equipment.

b) Set the spectrum analyzer center frequency to the center of band under test, and use the following settings:

1) RBW=30 kHz, VBW ≥ 3 × RBW,

2) power averaging (rms) detector,

3) trace averages ≥ 100,

4) span ≥ 120% of operational band under test,

5) number of sweep points ≥ 2 × Span/RBW.

c) Configure the signal generator for AWGN operation with a 99% OBW of 4.1 MHz, tuned to the frequency of 2.5 MHz above the lower edge or below the upper edge of the operating band under test. Adjust the RF output level of the signal generator such that the measured power level of the AWGN signal at the output port of the booster is 30 dB less than the maximum power of the booster for the band under test. Affirm that the input signal is not obstructing the measurement of the strongest oscillation peak in the band, and is not included within the span in the measurement.

1) Boosters with operating spectrum passbands of 10 MHz or less may use a CW signal source at the

band edge rather than AWGN.

2) For device passbands greater than 10 MHz, standard CMRS signal sources (i.e., CDMA, W-CDMA, LTE) may be used instead of AWGN at the band edge.

d) Set the variable attenuator to a high attenuation setting such that the booster will operate at maximum gain when powered on. Reset the the EUT (e.g., cycle ac/dc power). Allow the EUT to complete its boot-up process, to reach full operational gain, and to stabilize its operation.

e) Set the variable attenuator such that the insertion loss for the center of the band under test (isolation) between the booster donor port and server port is 5 dB greater than the maximum gain, as recorded in the maximum gain test procedure, for the band under test.

f) Verify the EUT shuts down, i.e., to mitigate the oscillations. If the booster does not shut down, measure and verify the peak oscillation level as follows.

1) Allow the spectrum analyzer trace to stabilize.

2) Place the marker at the highest oscillation level occurring within the span, and record its output level and frequency.

3) Set the spectrum analyzer center frequency to the frequency with the highest oscillation signal level, and reduce the span such that the upper and lower adjacent oscillation peaks are within the span.

4) Use the Minimum Search Marker function to find the lowest output level that is within the span, and within the operational band under test, and record its output level and frequency.

5) Affirm that the peak oscillation level measured in 2), does not exceed by 12.0 dB the minimal output level measured in 4). Record the measurement results of 2) and 4) in tabular format for inclusion in the test report.

6) The procedure of 1) to 5) allows the spectrum analyzer trace to stabilize, and verification of shutdown or oscillation level measurement must occur within 300 seconds.

g) Decrease the variable attenuator in 1 dB steps, and repeat step f) for each 1 dB step. Continue testing to the level when the insertion loss for the center of band under test (isolation) between the booster donor port and server port is 5 dB lower than the maximum gain.

h) Repeat a) to g) for all operational uplink and downlink bands.

Note1. According to § 20.21(e)(8)(ii)(A), limits of oscillation test are as follows.

- Detect and miation time: Uplink 0.3 second, Downlink 1 second.
- Mitigation duration: 1 minute.
- Number of restart: 5 times.
- Oscillation Mitigation limit ‘12 dB’ refers to section 7.11.3 of KDB 935210 D03

Note2. We adjusted the sweep time of test in KDB procedure to show the data.

Note3. 4.1 MHz AWGN Signal is used for mitigation test.

Note4. Because shutdown process did not occur in mitigation test, shutdown time data was not provided in this report

Test Result:

Tabulated Result of Uplink Oscillation Detection

Band	Frequency (MHz)	Limit (ms)	Measured Time (ms)
Lower 700 MHz	710.552	300	1.000
Upper 700 MHz	783.436		2.000
Cellular	847.550		1.000
AWS-1	1 717.560		3.000
Broadband PCS	1 872.555		4.000

Tabulated Result of Downlink Oscillation Detection

Band	Frequency (MHz)	Limit (ms)	Measured Time (ms)
Lower 700 MHz	734.000	1 000	5.000
Upper 700 MHz	753.832		3.000
Cellular	892.050		2.000
AWS-1	2 119.315		4.000
Broadband PCS	1 950.085		4.000

Tabulated Result of Uplink Oscillation Restart

Band	Frequency (MHz)	Time Limit (s)	Restart Limit	Restart Time (s)	Number of Restart
Lower 700 MHz	710.552	60	5	60.00	5
Upper 700 MHz	783.436			60.00	5
Cellular	847.550			60.02	5
AWS-1	1 717.560			60.00	5
Broadband PCS	1 872.555			60.00	5

Tabulated Result of Downlink Oscillation Restart

Band	Frequency (MHz)	Time Limit (s)	Restart Limit	Restart Time (s)	Number of Restart
Lower 700 MHz	734.000	60	5	60.00	5
Upper 700 MHz	753.832			60.00	5
Cellular	892.050			60.02	5
AWS-1	2 119.315			60.02	5
Broadband PCS	1 950.085			60.02	5

Tabulated Result of Uplink Oscillation Mitigation

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Lower 700 MHz	+5	705.098	-33.350	707.820	-38.008	12	4.658
	+4	704.597	-33.548	707.766	-38.241		4.693
	+3	704.758	-33.105	708.056	-38.455		5.350
	+2	704.908	-33.476	708.231	-38.467		4.991
	+1	704.815	-32.955	707.894	-38.523		5.568
	0	704.817	-32.526	708.124	-38.990		6.464
	-1	704.746	-32.569	707.866	-39.810		7.241
	-2	704.916	-32.011	707.966	-39.291		7.280
	-3	704.945	-31.497	707.647	-40.020		8.523
	-4	704.819	-30.721	707.725	-40.506		9.785
	-5	705.022	-30.023	707.547	-40.669		10.646
Upper 700 MHz	+5	779.576	-35.722	776.704	-39.882		4.160
	+4	779.090	-36.014	776.561	-39.997		3.983
	+3	779.002	-35.634	776.597	-40.243		4.609
	+2	779.434	-35.846	776.989	-40.291		4.445
	+1	778.793	-36.059	776.818	-39.862		3.803
	0	778.706	-35.418	776.507	-40.192		4.774
	-1	778.657	-35.431	776.697	-40.157		4.726
	-2	778.005	-35.627	776.543	-40.102		4.475
	-3	777.955	-35.150	776.557	-40.584		5.434
	-4	778.617	-34.699	776.735	-40.894		6.195
	-5	778.441	-34.503	776.593	-41.283		6.780

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Cellular	+5	825.501	-38.853	826.500	-43.341	12	4.488
	+4	828.121	-38.738	826.503	-42.801		4.063
	+3	825.337	-38.258	826.919	-43.412		5.154
	+2	825.079	-38.184	826.506	-43.348		5.164
	+1	825.057	-37.779	826.509	-43.300		5.521
	0	824.860	-37.002	826.493	-43.226		6.224
	-1	828.002	-36.756	826.391	-43.909		7.153
	-2	824.854	-36.468	826.414	-43.980		7.512
	-3	824.884	-35.693	826.653	-44.299		8.606
	-4	824.850	-35.277	826.283	-44.738		9.461
	-5	824.950	-34.149	826.336	-44.930		10.781
AWS-1	+5	1 714.452	-37.500	1 711.75	-42.238		4.738
	+4	1 714.465	-37.542	1 710.80	-42.601		5.059
	+3	1 714.299	-38.378	1 710.77	-43.104		4.726
	+2	1 714.447	-38.175	1 712.10	-43.084		4.909
	+1	1 714.468	-38.241	1 711.24	-42.958		4.717
	0	1 714.368	-39.089	1 711.97	-43.391		4.302
	-1	1 714.500	-40.523	1 711.21	-47.213		6.690
	-2	1 714.395	-40.448	1 712.10	-46.313		5.865
	-3	1 714.483	-41.068	1 711.33	-47.321		6.253
	-4	1 714.462	-41.755	1 711.13	-47.615		5.860
	-5	1 714.446	-42.350	1 711.48	-48.533		6.183

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Broadband PCS	+5	1 853.893	-32.240	1 850.53	-36.754	12	4.514
	+4	1 853.263	-32.173	1 850.96	-36.870		4.697
	+3	1 853.453	-31.986	1 850.91	-37.359		5.373
	+2	1 853.043	-31.716	1 850.76	-37.307		5.591
	+1	1 853.809	-31.320	1 850.53	-37.744		6.424
	0	1 853.994	-31.115	1 850.69	-37.464		6.349
	-1	1 853.823	-30.900	1 850.51	-37.558		6.658
	-2	1 853.467	-30.007	1 850.61	-37.589		7.582
	-3	1 853.912	-29.571	1 850.70	-37.718		8.147
	-4	1 853.549	-29.276	1 850.89	-37.792		8.516
	-5	1 853.725	-28.289	1 850.54	-38.724		10.435

Tabulated Result of Downlink Oscillation Mitigation

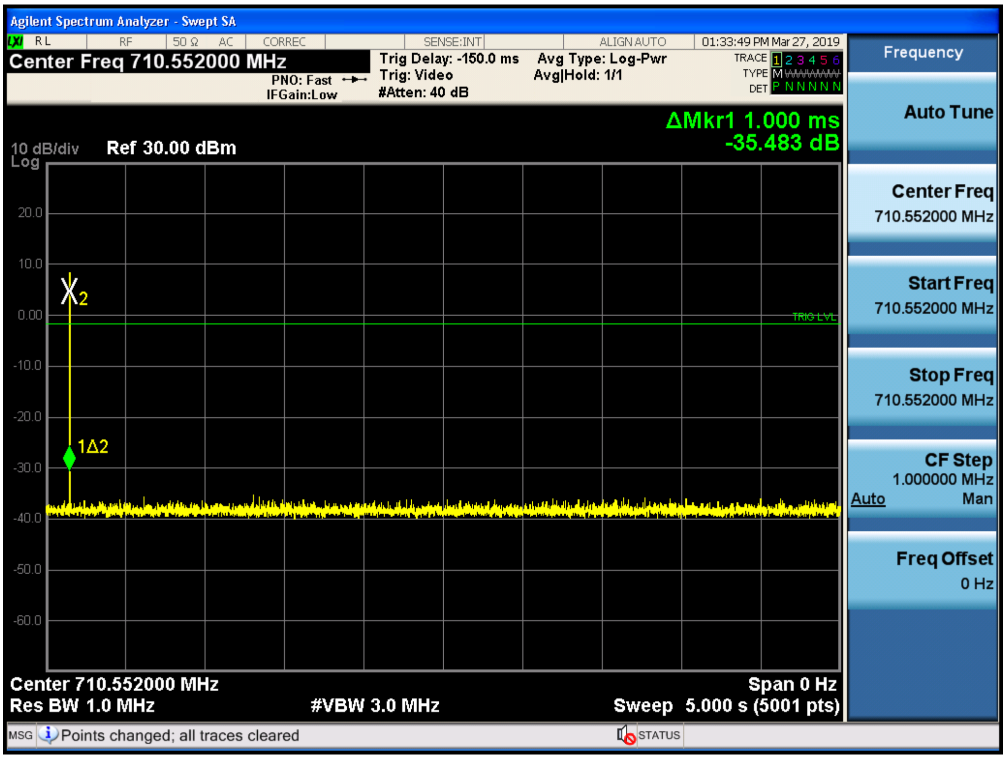
Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Lower 700 MHz	+5	737.571	-45.055	735.248	-51.466	12	6.411
	+4	737.585	-45.032	735.205	-51.148		6.116
	+3	737.865	-44.990	735.031	-51.553		6.563
	+2	737.067	-44.928	735.033	-51.570		6.642
	+1	737.053	-44.935	734.573	-51.484		6.549
	0	737.125	-45.088	734.802	-51.478		6.390
	-1	737.487	-45.127	734.984	-51.702		6.575
	-2	737.384	-44.829	734.989	-51.667		6.838
	-3	736.881	-44.802	735.221	-51.898		7.096
	-4	737.055	-44.217	735.133	-51.736		7.519
	-5	737.090	-44.066	735.405	-52.275		8.209
Upper 700 MHz	+5	749.334	-37.124	746.864	-41.488		4.364
	+4	749.087	-37.047	746.509	-41.645		4.598
	+3	748.746	-37.049	746.784	-41.745		4.696
	+2	748.443	-36.862	746.841	-42.032		5.170
	+1	748.560	-36.374	747.243	-41.852		5.478
	0	748.811	-35.982	746.576	-42.298		6.316
	-1	748.753	-35.644	746.548	-42.559		6.915
	-2	748.608	-35.603	746.743	-42.981		7.378
	-3	748.609	-35.224	746.776	-43.094		7.870
	-4	748.811	-35.087	746.700	-43.594		8.507
	-5	748.636	-34.533	746.573	-44.058		9.525

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Cellular	+5	872.971	-45.007	871.505	-50.181	12	5.174
	+4	872.853	-45.193	871.504	-50.467		5.274
	+3	873.118	-45.004	871.247	-50.333		5.329
	+2	872.816	-44.630	871.496	-50.464		5.834
	+1	873.323	-44.489	871.241	-50.713		6.224
	0	872.889	-44.496	871.499	-50.593		6.097
	-1	873.005	-44.690	871.498	-50.988		6.298
	-2	873.158	-44.065	871.499	-51.249		7.184
	-3	873.076	-43.957	871.495	-51.499		7.542
	-4	872.921	-43.520	871.498	-52.221		8.701
	-5	873.069	-42.650	871.507	-51.968		9.318
AWS-1	+5	2 110.910	-51.894	2 114.29	-55.39		3.493
	+4	2 111.575	-52.737	2 113.54	-55.81		3.075
	+3	2 110.532	-53.288	2 113.89	-57.01		3.726
	+2	2 110.545	-53.386	2 113.55	-56.84		3.450
	+1	2 110.811	-52.981	2 113.57	-57.11		4.133
	0	2 110.503	-52.494	2 114.06	-57.39		4.897
	-1	2 110.649	-51.854	2 114.10	-57.36		5.507
	-2	2 110.542	-51.389	2 114.37	-57.38		5.992
	-3	2 110.586	-51.043	2 114.33	-58.32		7.274
	-4	2 110.557	-55.148	2 114.25	-62.62		7.472
	-5	2 110.595	-55.979	2 114.38	-64.30		8.317

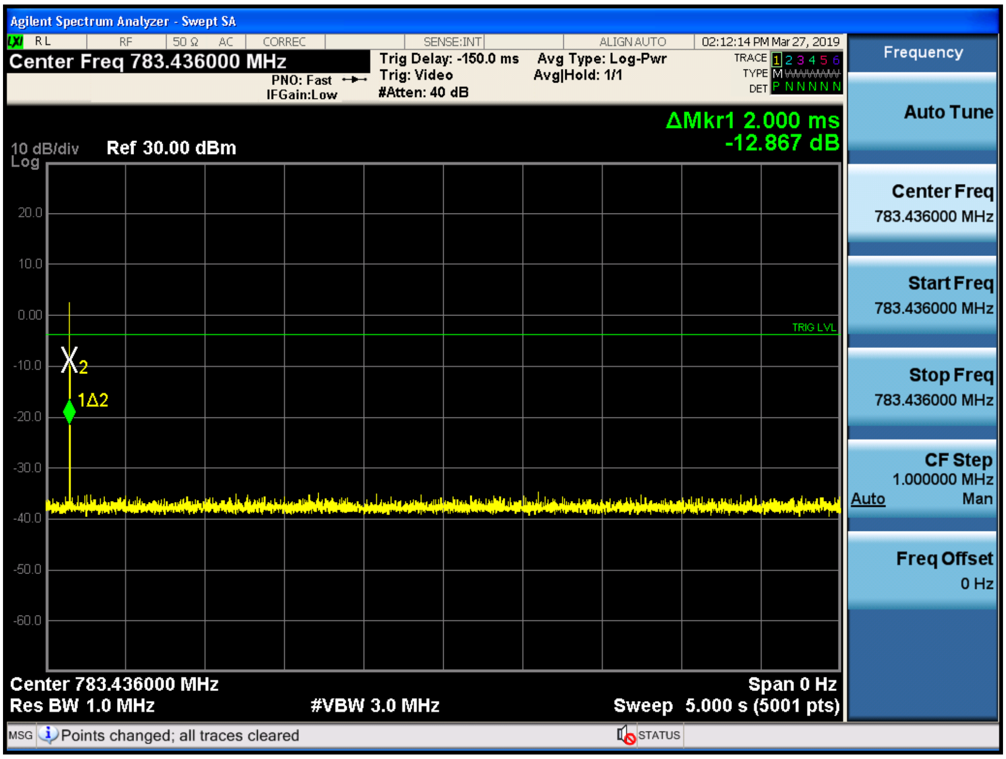
Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Broadband PCS	+5	1 933.617	-56.940	1930.57	-63.30	12	6.357
	+4	1 932.892	-56.872	1930.69	-63.69		6.817
	+3	1 933.098	-56.871	1930.51	-63.94		7.065
	+2	1 933.089	-56.770	1930.54	-63.67		6.895
	+1	1 932.851	-56.469	1930.59	-64.10		7.630
	0	1 932.942	-56.756	1930.54	-63.53		6.772
	-1	1 932.839	-56.427	1930.54	-63.75		7.325
	-2	1 932.569	-56.732	1930.50	-64.01		7.277
	-3	1 933.001	-56.174	1930.51	-64.09		7.918
	-4	1 932.694	-55.650	1930.50	-64.27		8.618
	-5	1 932.931	-54.754	1930.54	-64.46		9.707

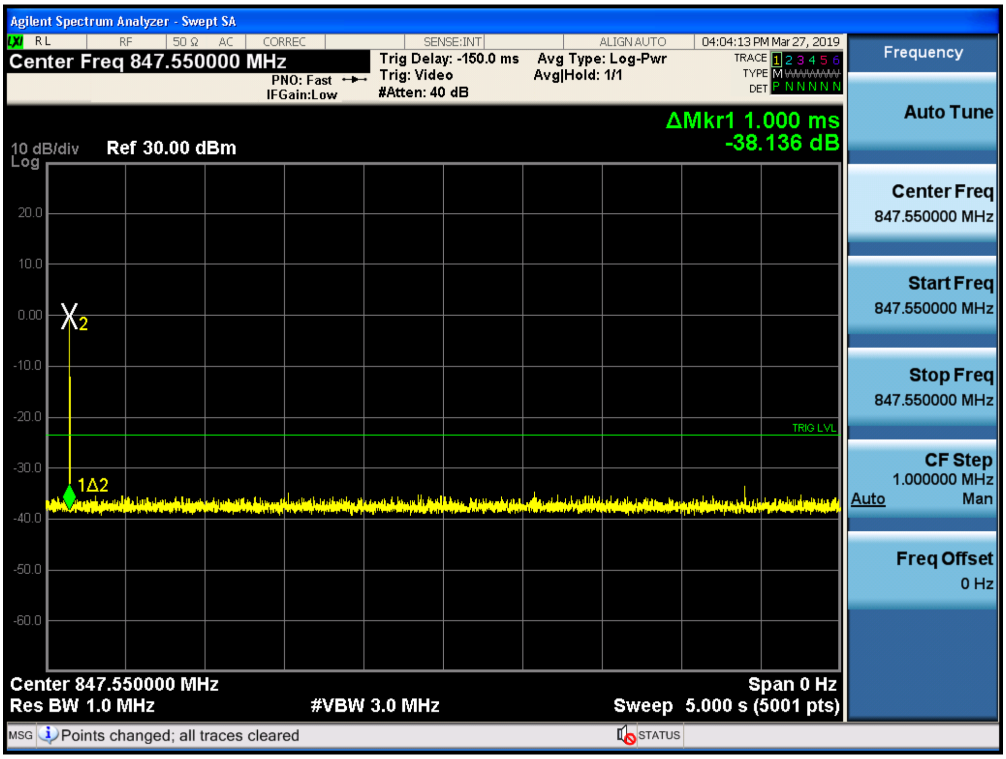
Plot data of Oscillation Detect

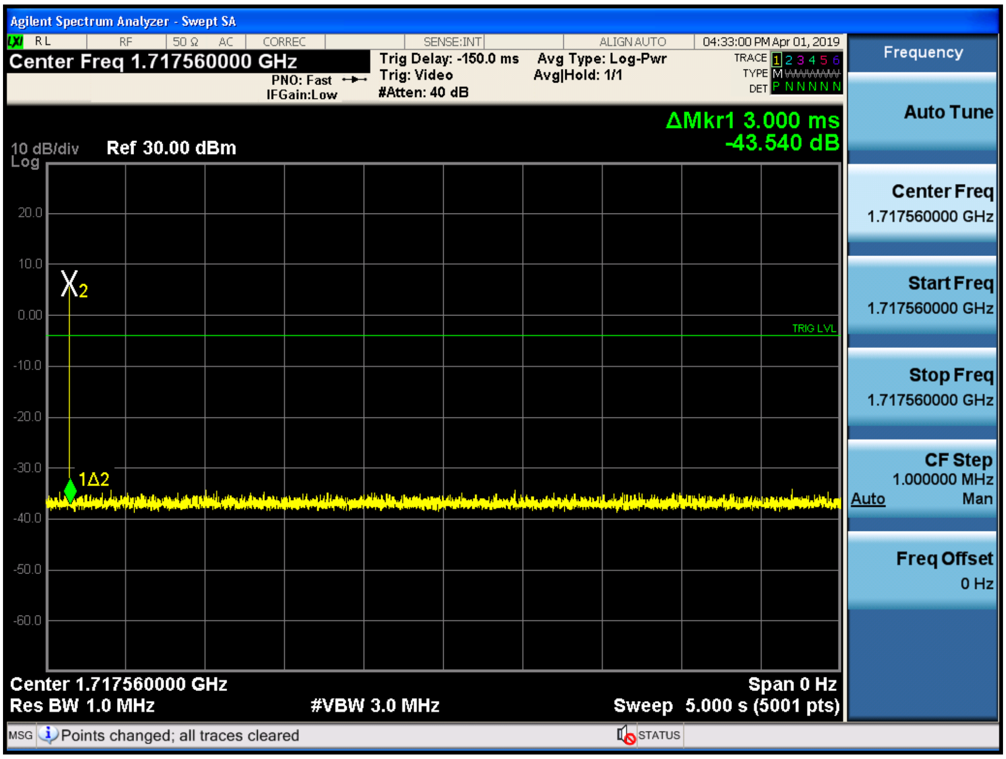
Oscillation Detect / Lower 700 MHz / Uplink

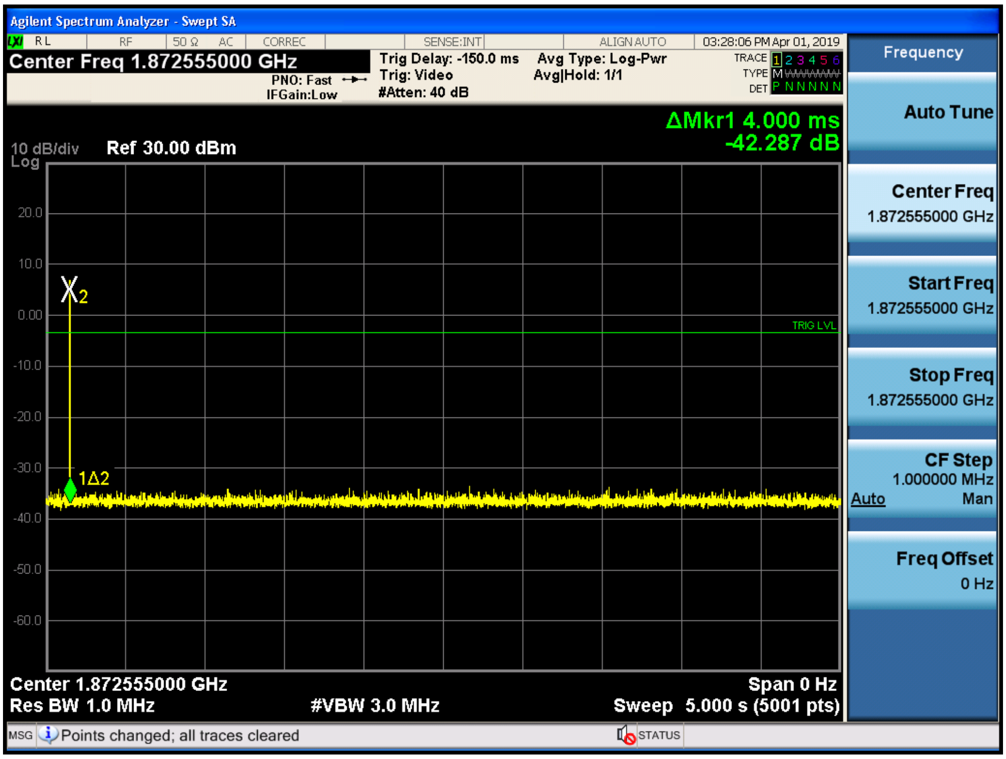


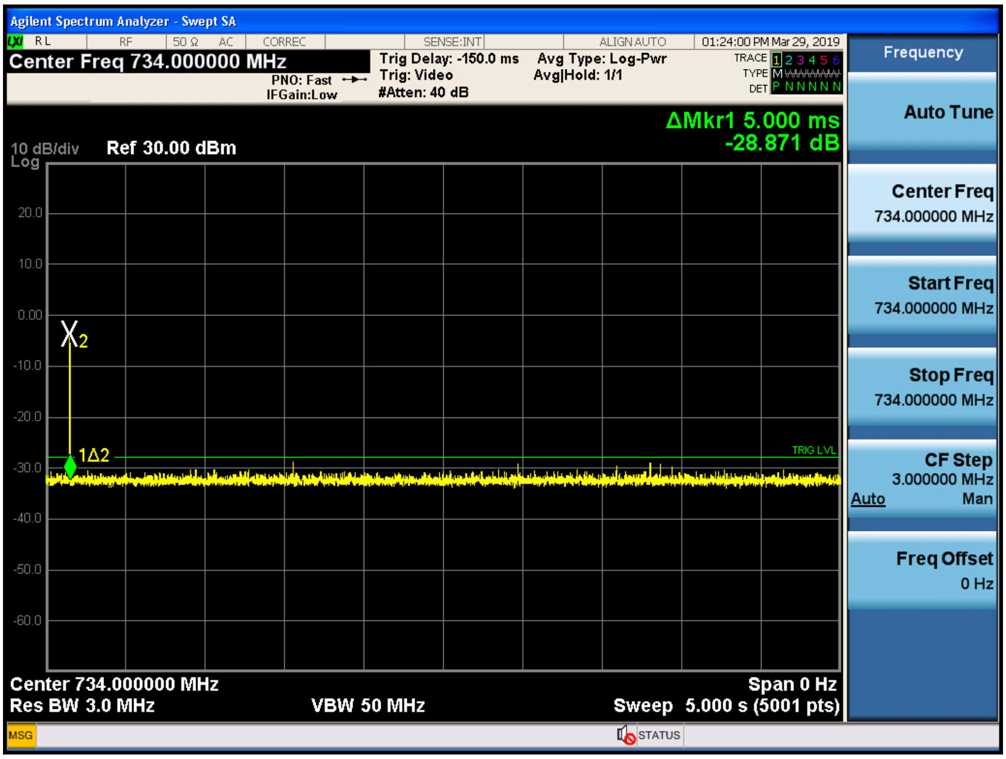
Oscillation Detect / Upper 700 MHz / Uplink

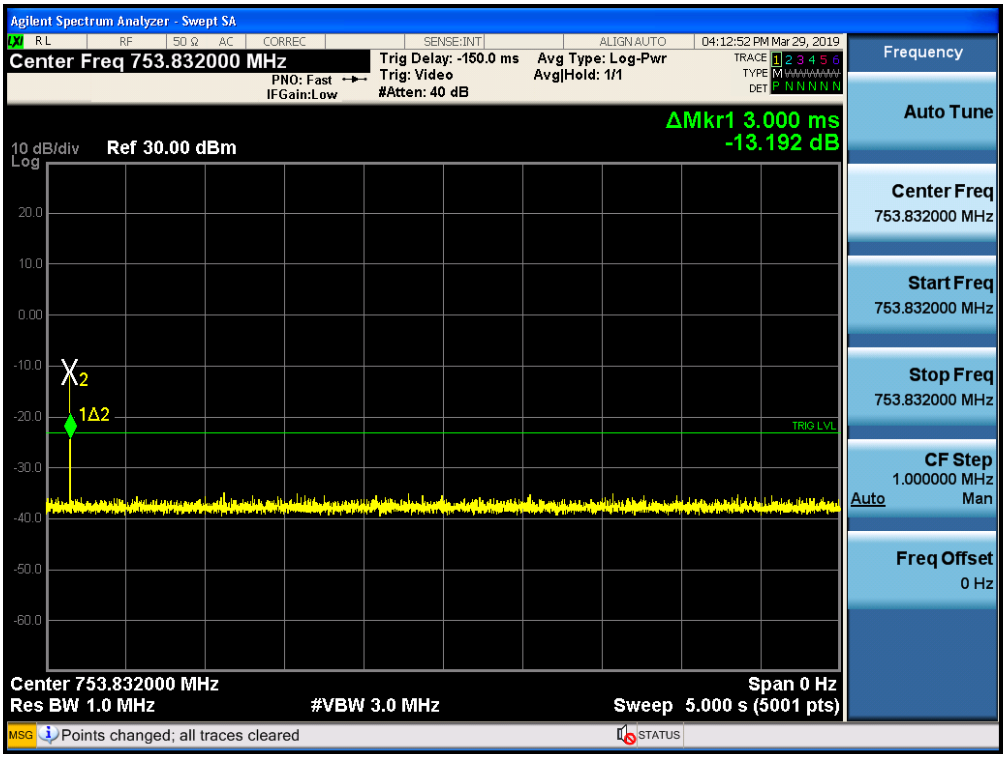


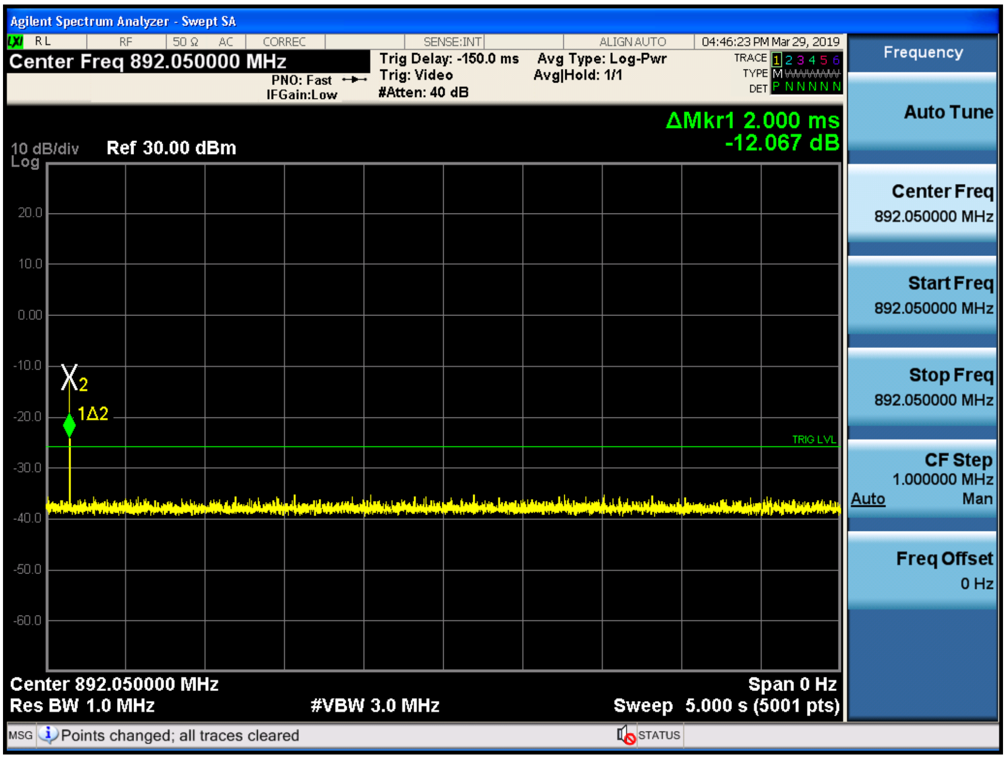
Oscillation Detect / Cellular / Uplink


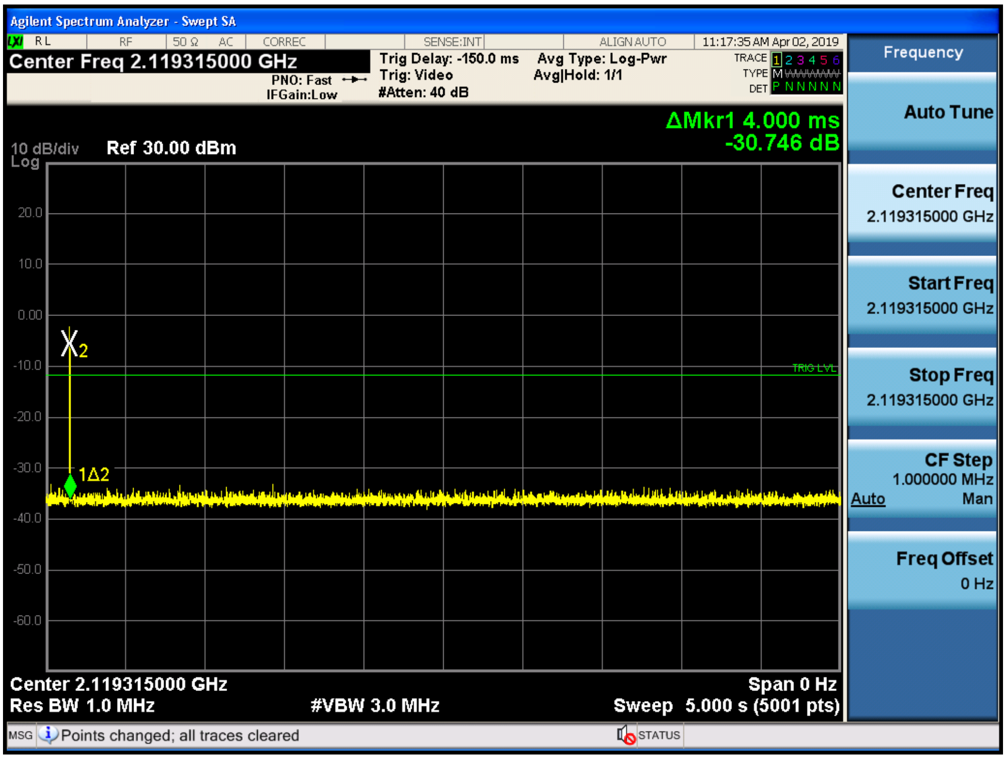
Oscillation Detect / AWS-1 / Uplink


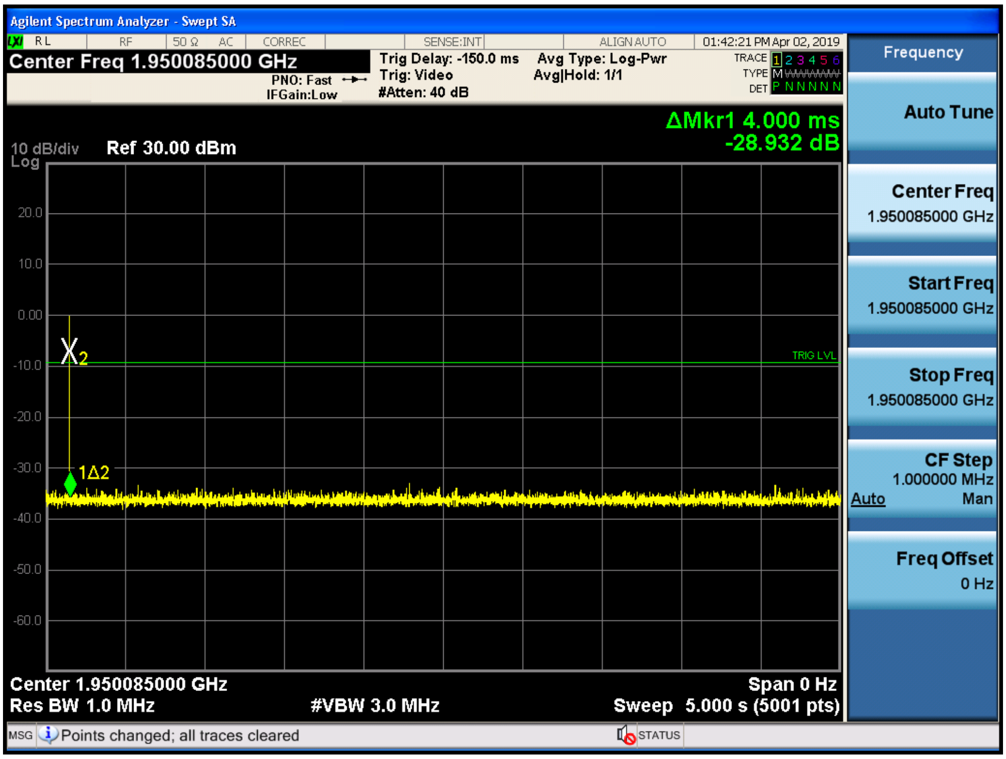
Oscillation Detect / Broadband PCS / Uplink


Oscillation Detect / Lower 700 MHz / Downlink


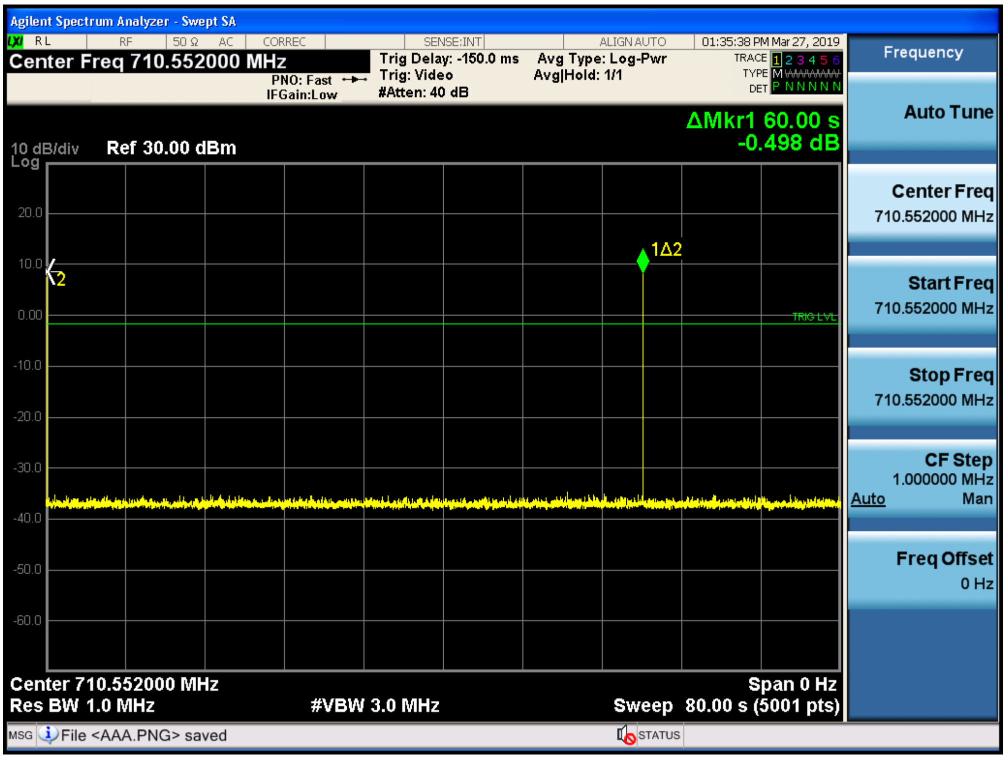
Oscillation Detect / Upper 700 MHz / Downlink


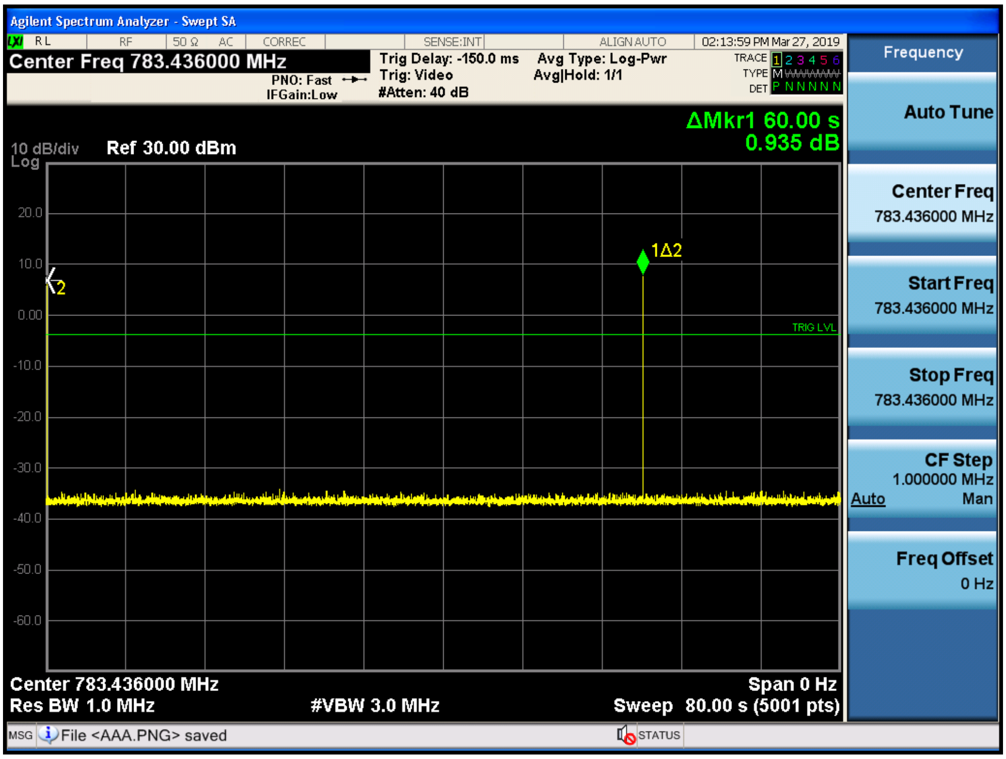
Oscillation Detect / Cellular / Downlink


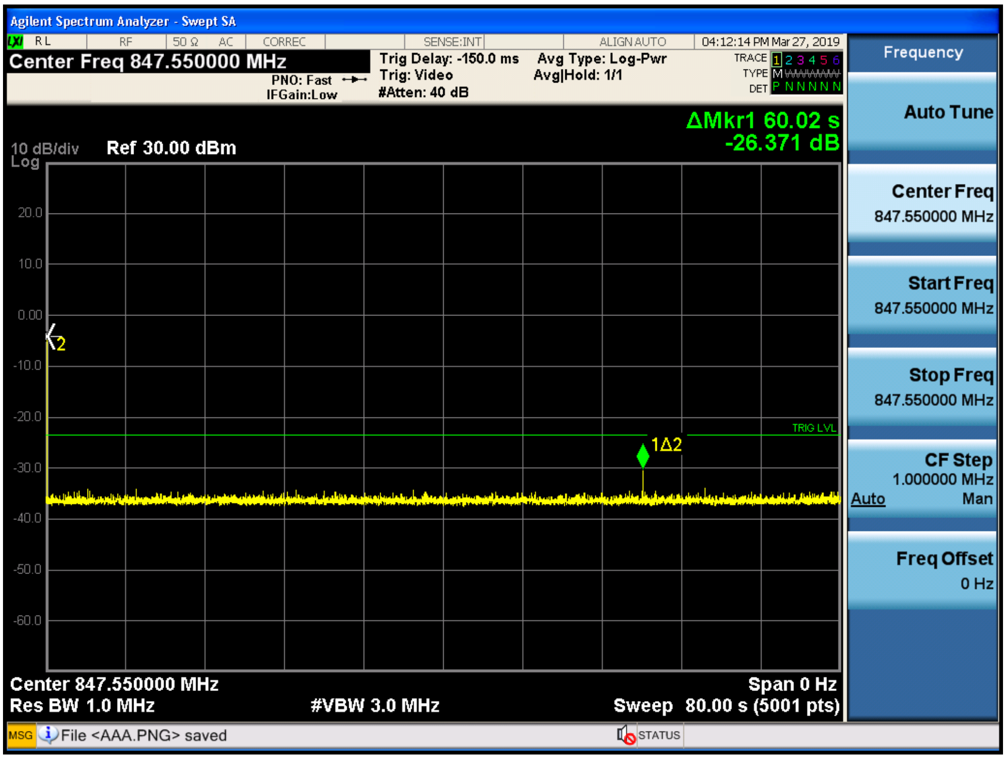
Oscillation Detect / AWS-1 / Downlink


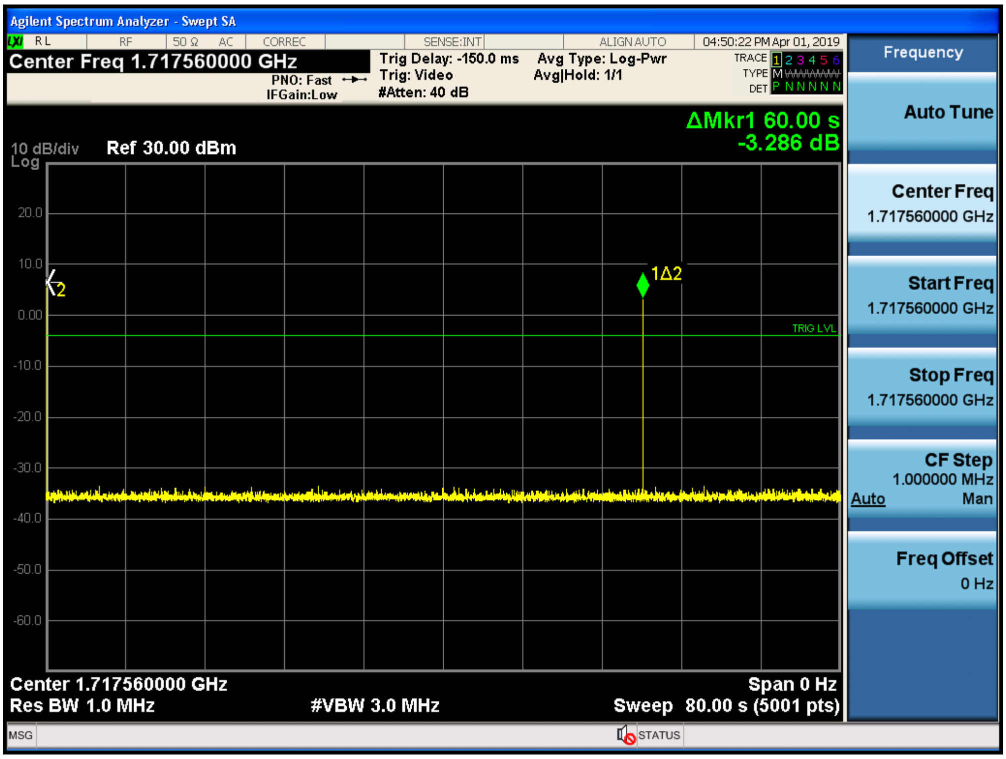
Oscillation Detect / Broadband PCS / Downlink


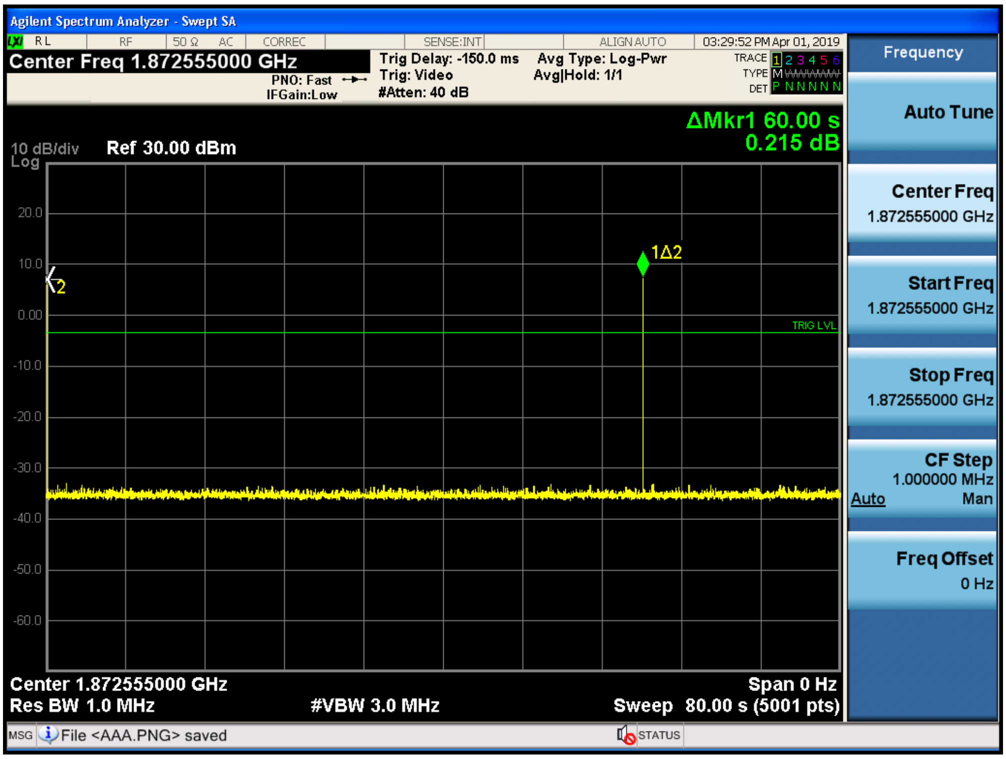
Plot data of Oscillation Restart Time

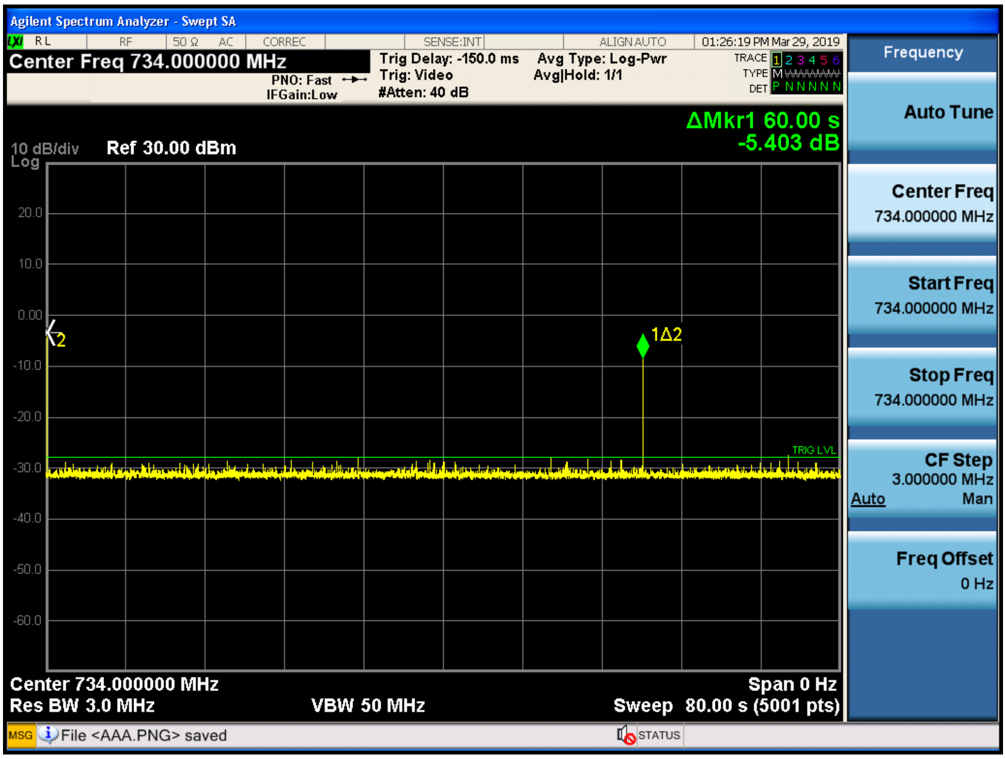
Oscillation Restart Time / Lower 700 MHz / Uplink


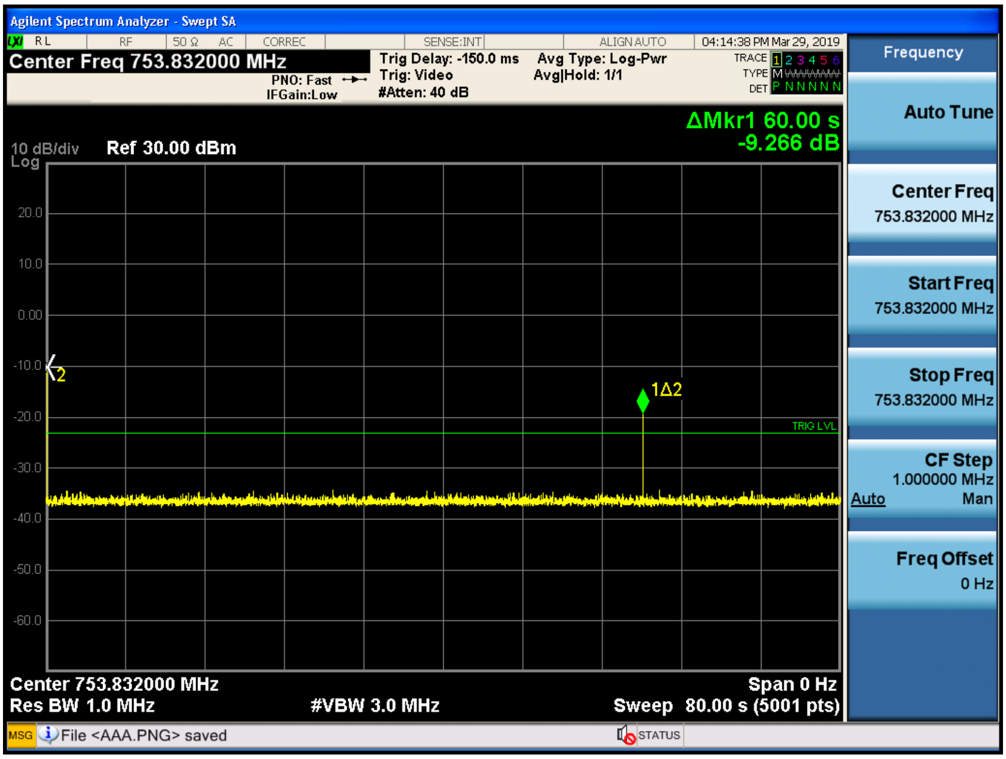
Oscillation Restart Time / Upper 700 MHz / Uplink


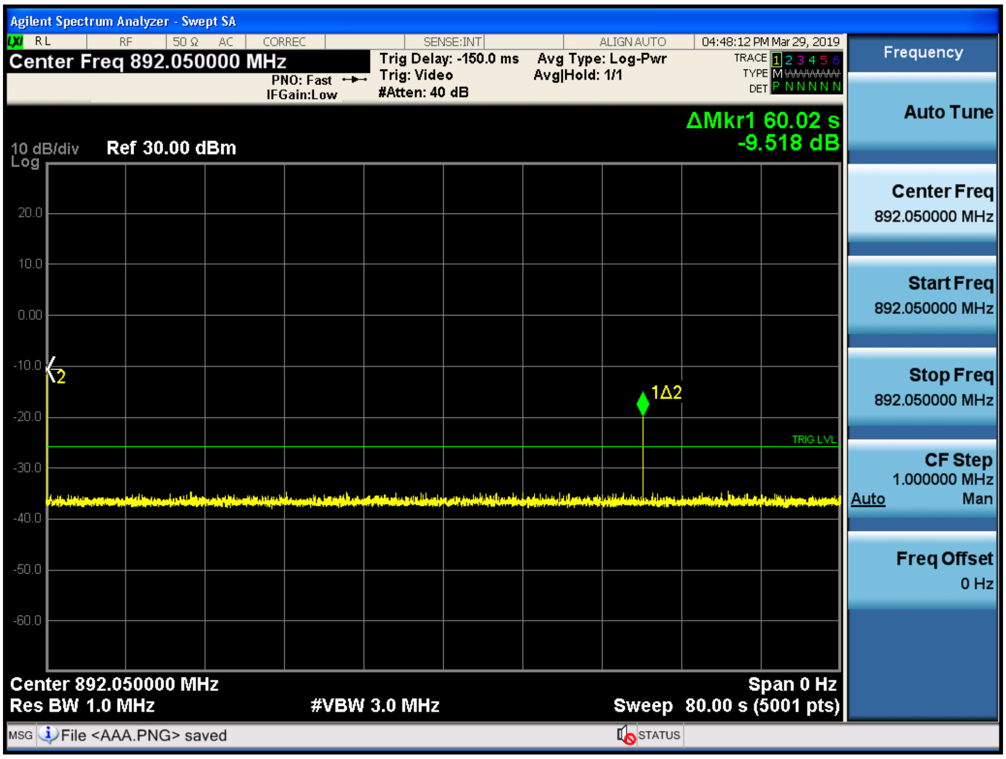
Oscillation Restart Time / Cellular / Uplink


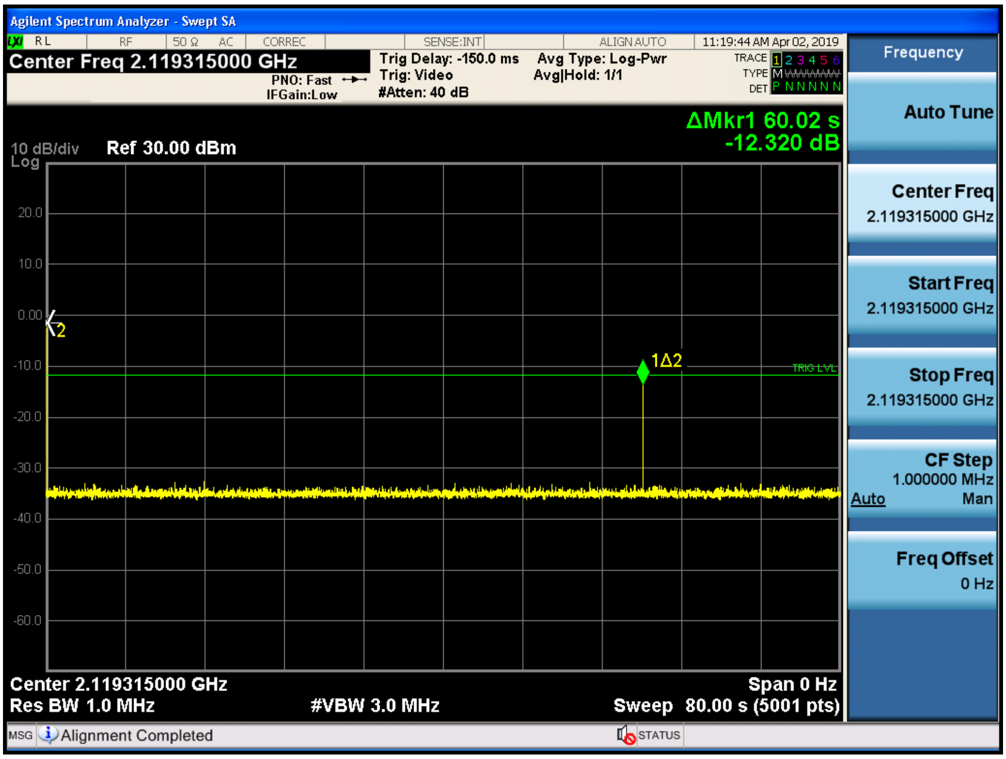
Oscillation Restart Time / AWS-1 / Uplink


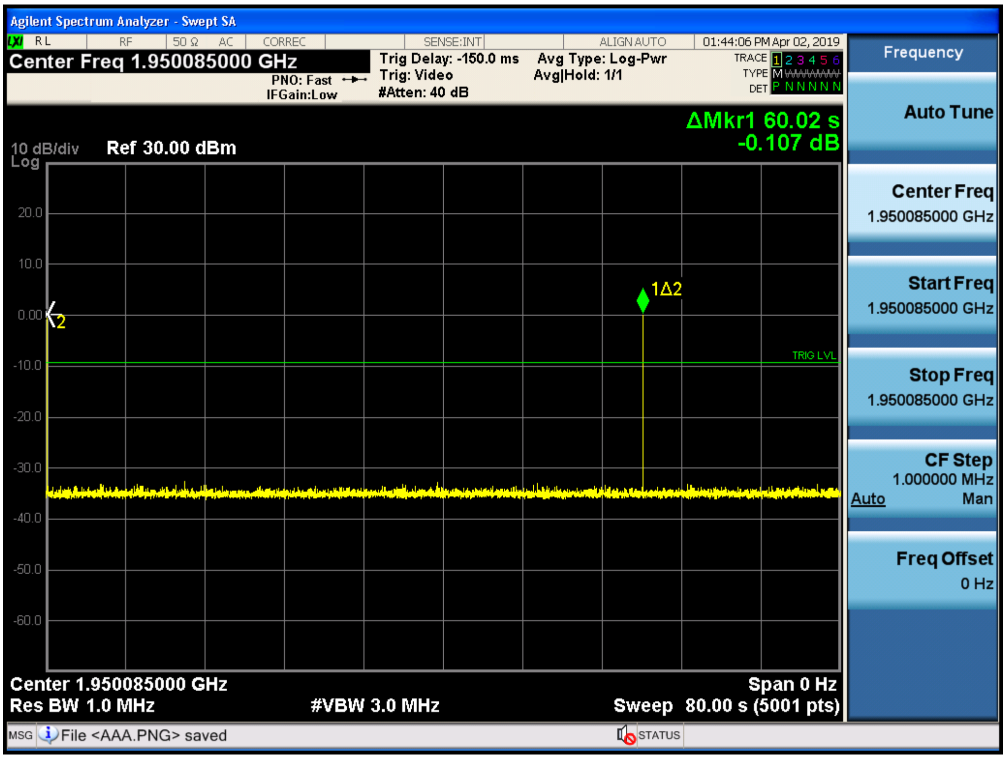
Oscillation Restart Time / Broadband PCS / Uplink


Oscillation Restart Time / Lower 700 MHz / Downlink


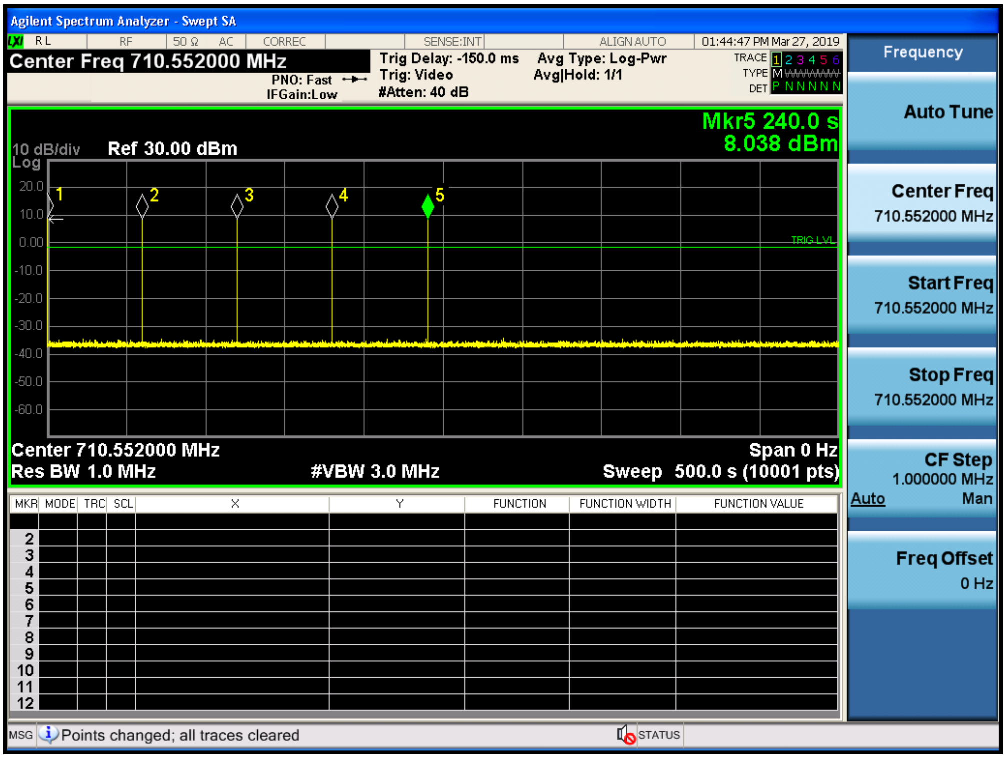
Oscillation Restart Time / Upper 700 MHz / Downlink


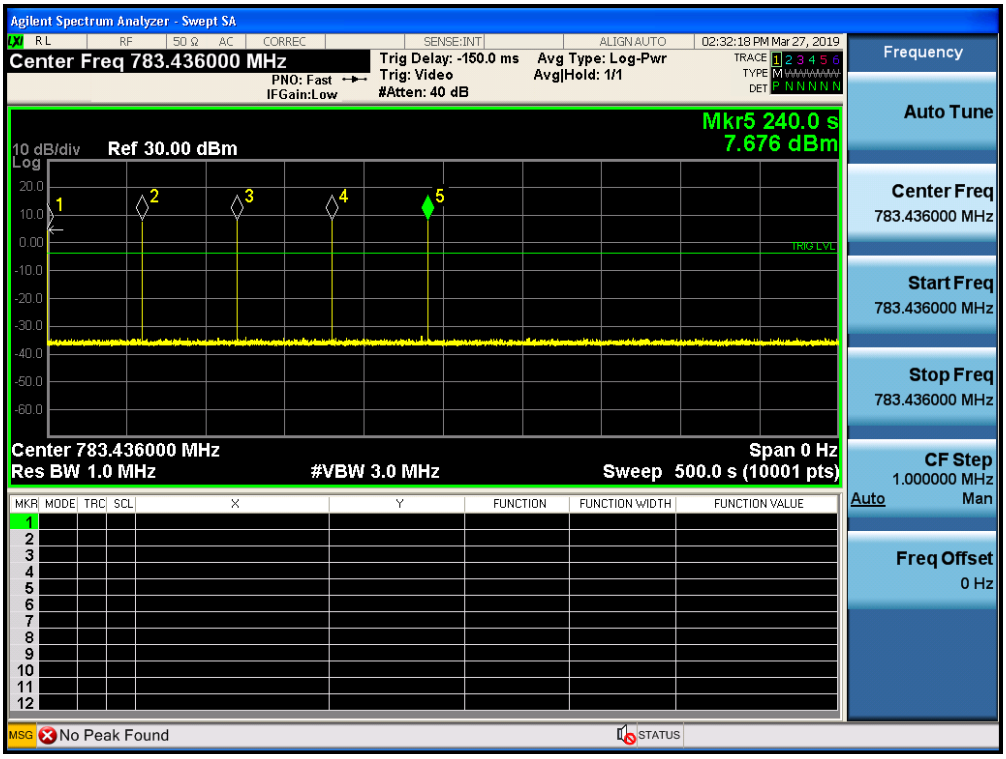
Oscillation Restart Time / Cellular / Downlink


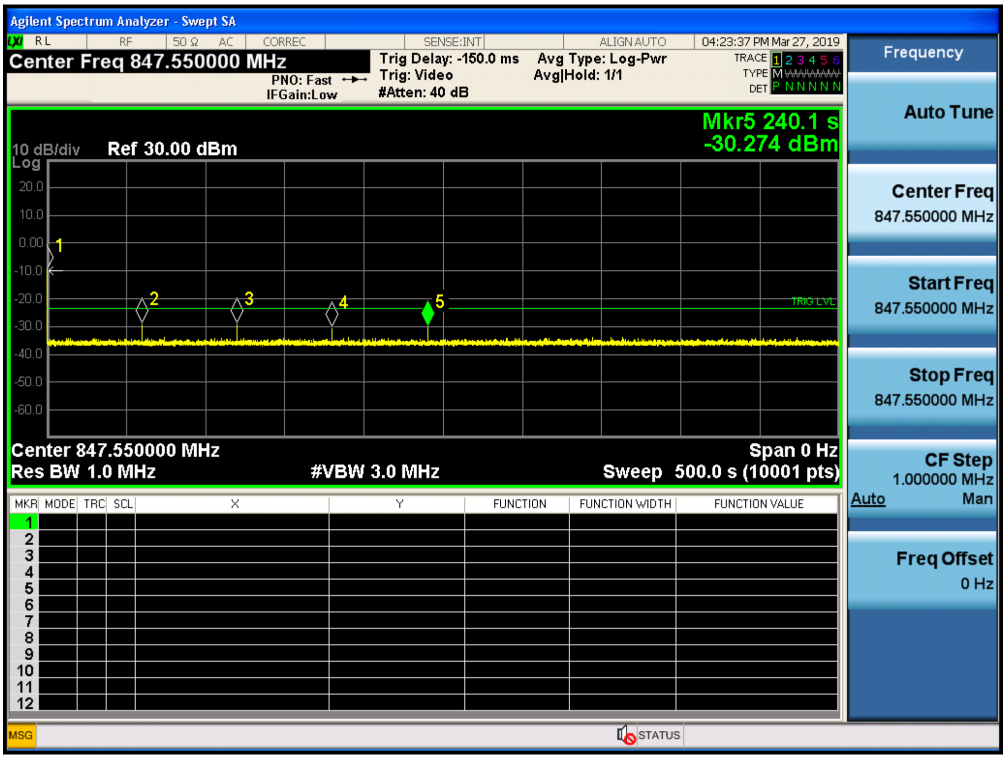
Oscillation Restart Time / AWS-1 / Downlink


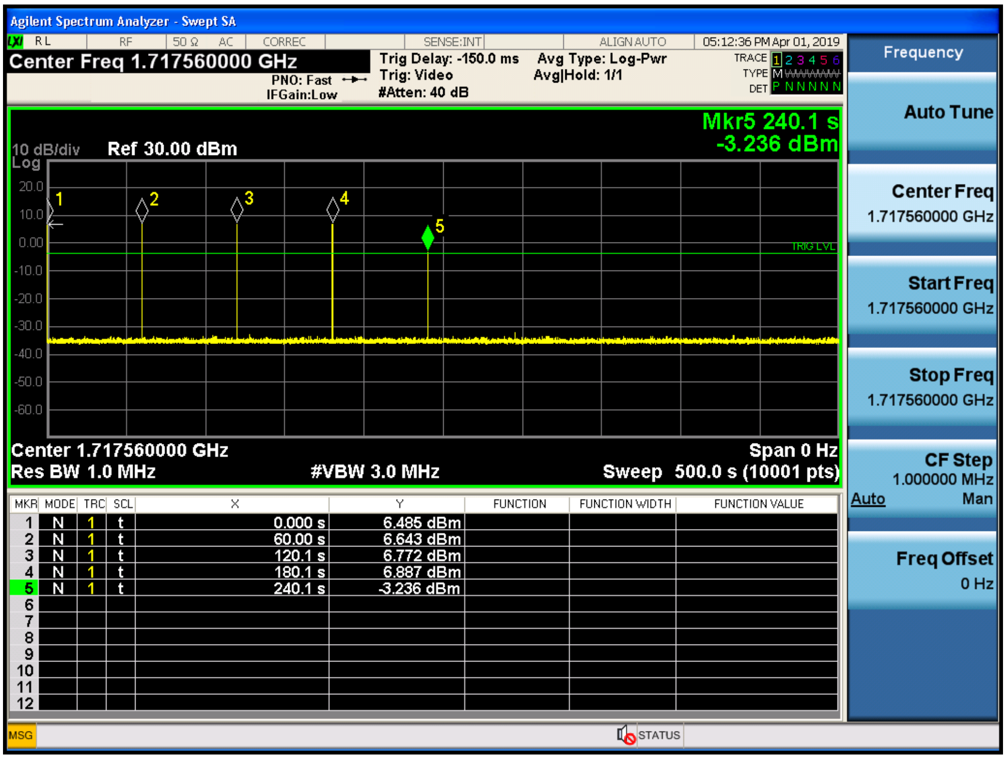
Oscillation Restart Time / Broadband PCS / Downlink


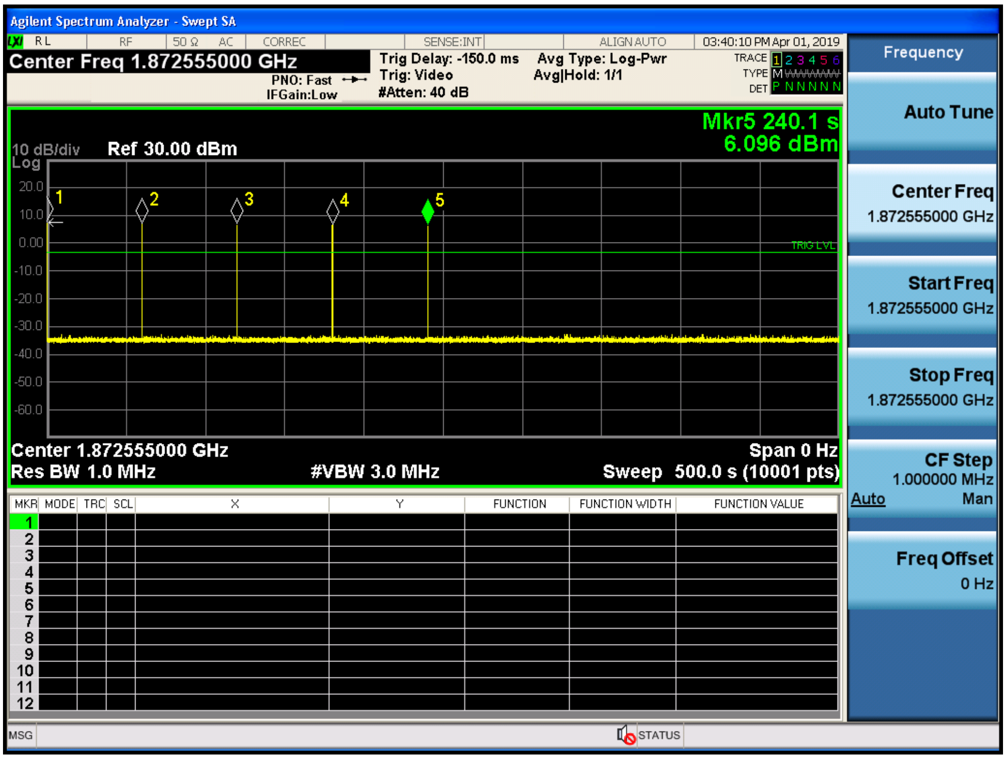
Plot data of Number of Oscillation Restart

Number of Oscillation Restart / Lower 700 MHz / Uplink


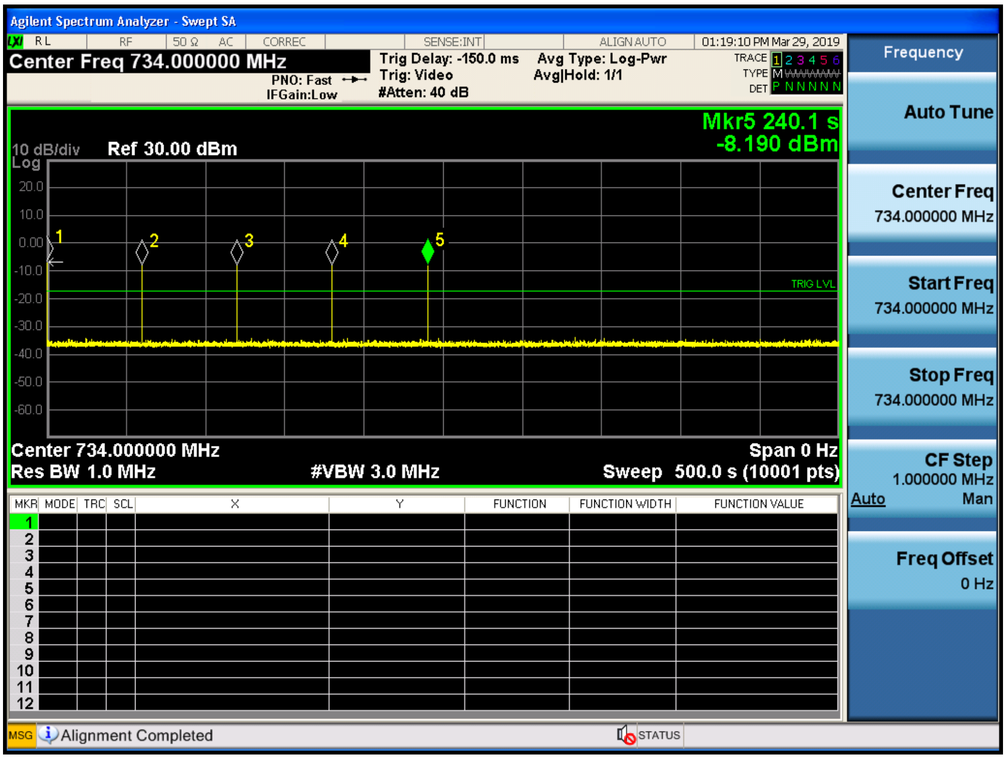
Number of Oscillation Restart / Upper 700 MHz / Uplink


Number of Oscillation Restart / Cellular / Uplink


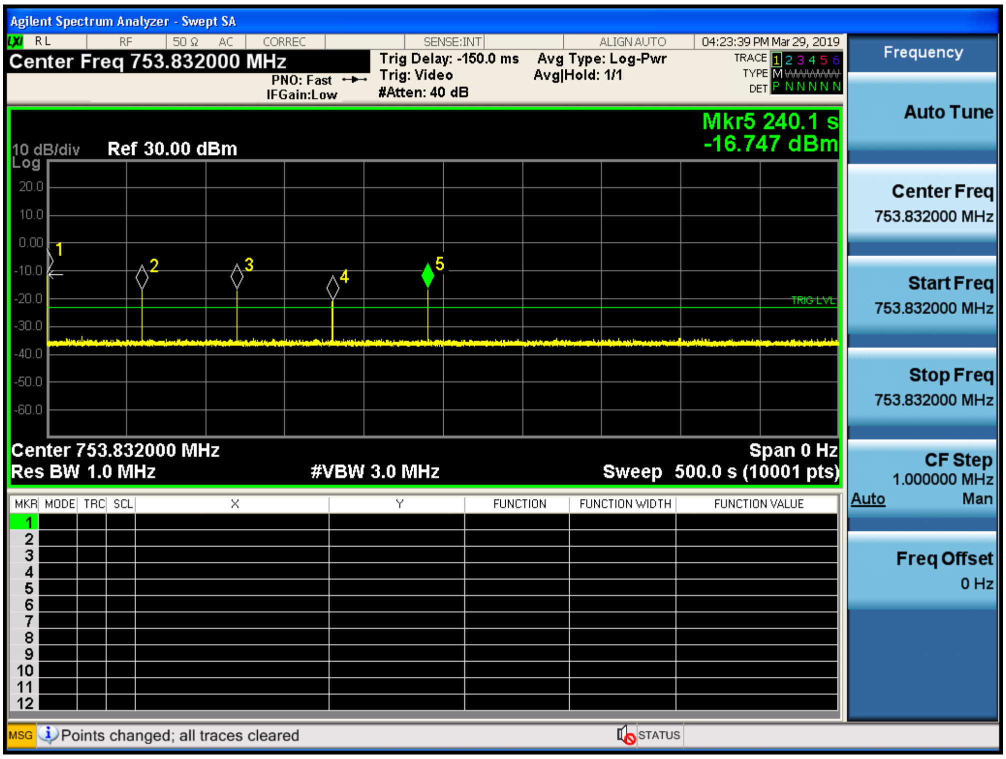
Number of Oscillation Restart / AWS-1 / Uplink


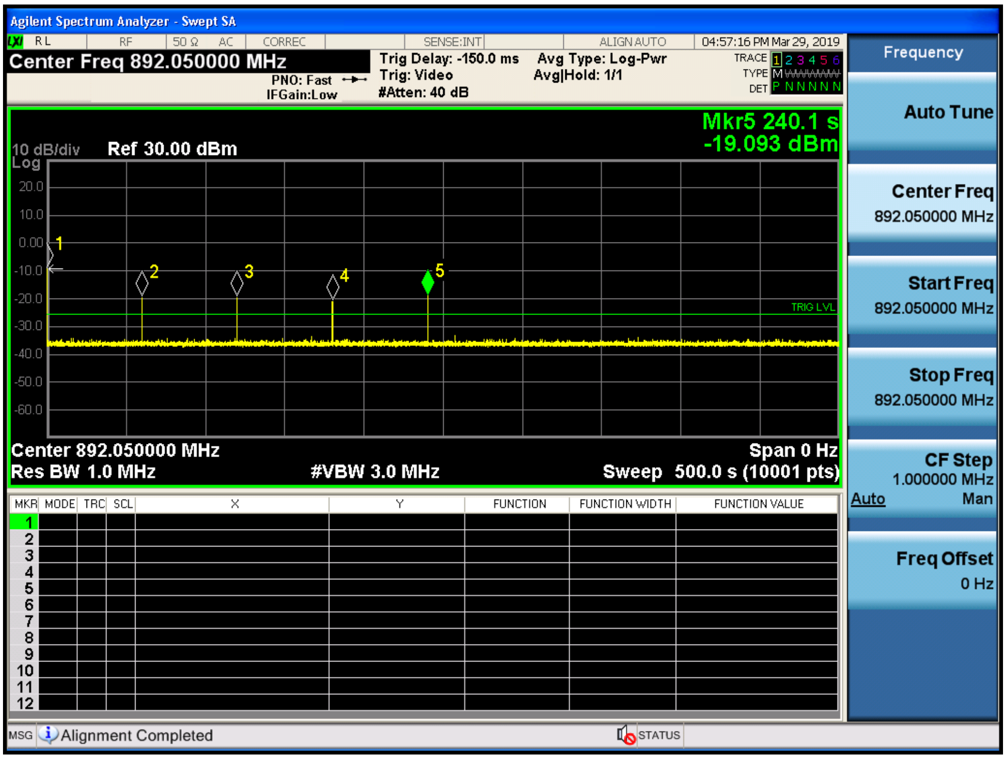
Number of Oscillation Restart / Broadband PCS / Uplink


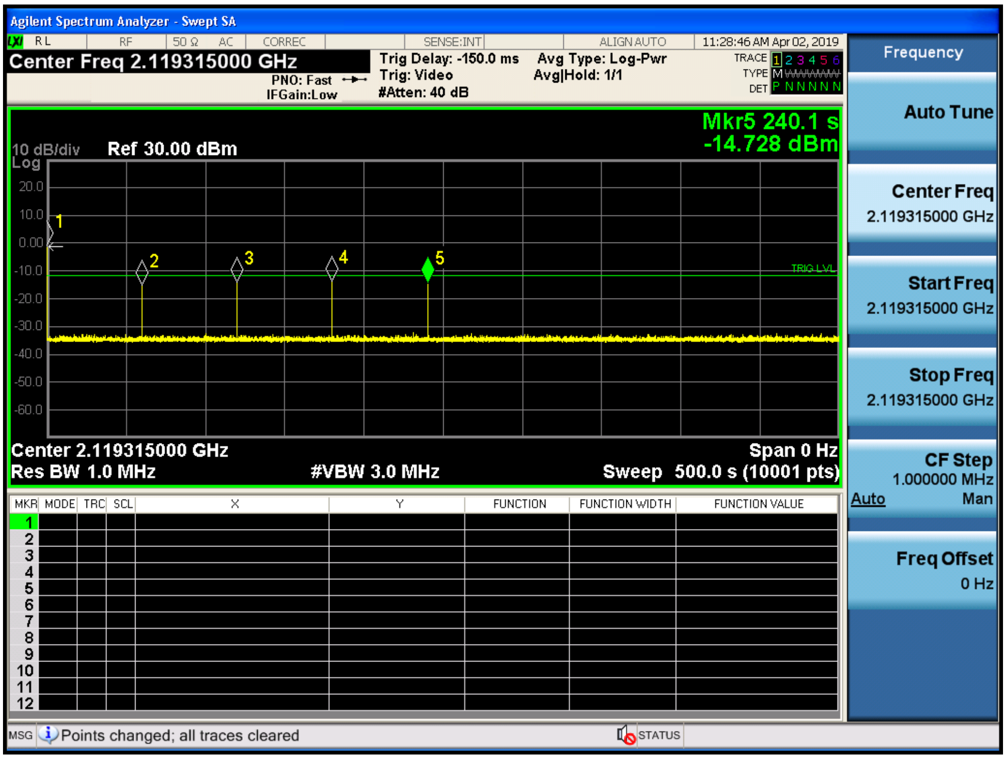
Number of Oscillation Restart / Lower 700 MHz / Downlink

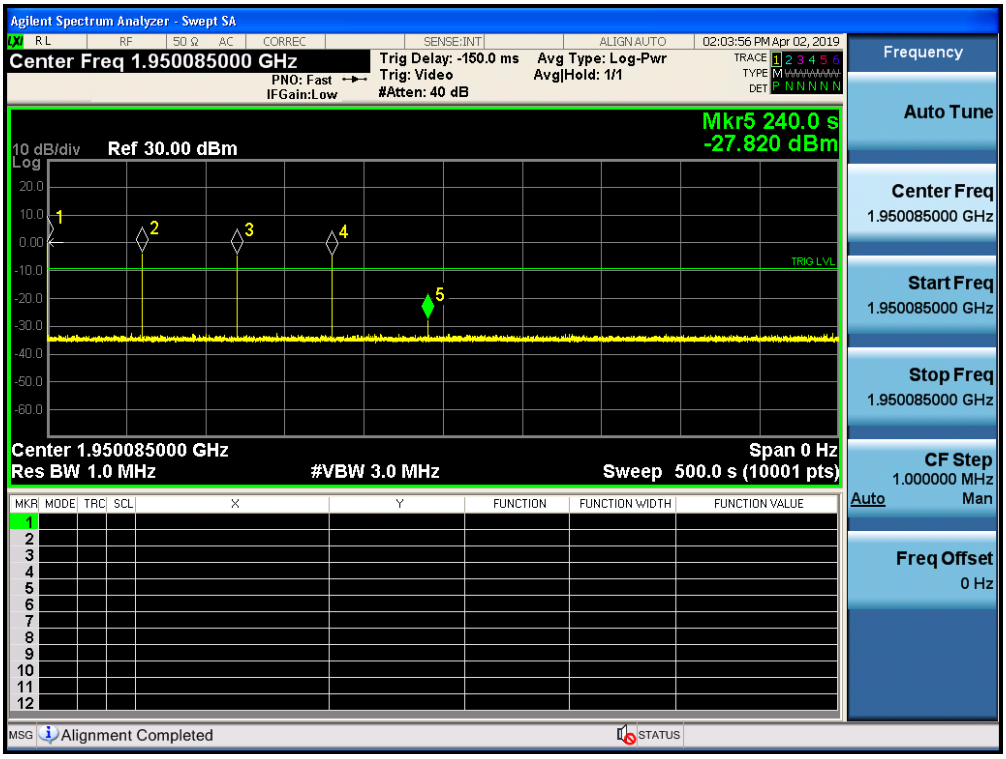


Number of Oscillation Restart / Upper 700 MHz / Downlink



Number of Oscillation Restart / Cellular / Downlink


Number of Oscillation Restart / AWS-1 / Downlink


Number of Oscillation Restart / Broadband PCS / Downlink


5.12. RADIATED SPURIOUS EMISSIONS

Test Requirements:

§ 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

Test Procedures:

Measurements were in accordance with the test methods section 7.12 of KDB 935210 D03 v04r03

a) Place the EUT on an OATS or semi-anechoic chamber turntable 3 m from the receiving antenna.

b) Connect the EUT to the test equipment beginning with the uplink output (donor) port.

c) Set the signal generator to produce a CW signal with the frequency set to the center of the operational band under test, and the power level set at P_{IN} as determined from measurement results per maximum power measurement.

d) Measure the radiated spurious emissions from the EUT from the lowest to the highest frequencies as specified in Section 2.1057. Maximize the radiated emissions by using the procedures described in ANSI C63.26.

e) Capture the peak emissions plots using a peak detector with Max-Hold for inclusion in the test report. Tabular data is acceptable in lieu of spectrum analyzer plots.

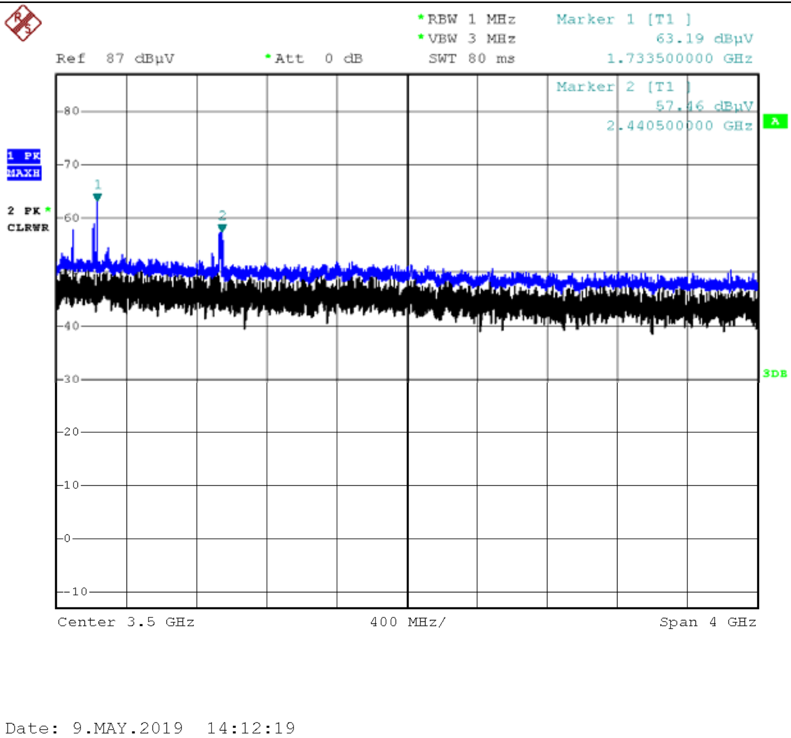
f) Repeat c) through e) for all uplink and downlink operational bands.

Note1. Limit is according to '-13 dBm' of spurious test.

Note2. Test results of below 1 GHz band were not recorded in this report, because its result was in 20 dB lower than limit.

Test Result:

Plot data of radiated spurious emissions

Radiated spurious emissions


Note : Only the worst case plots for Radiated Spurious Emissions.

6. Annex A_EUT AND TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-1905-FC026-P