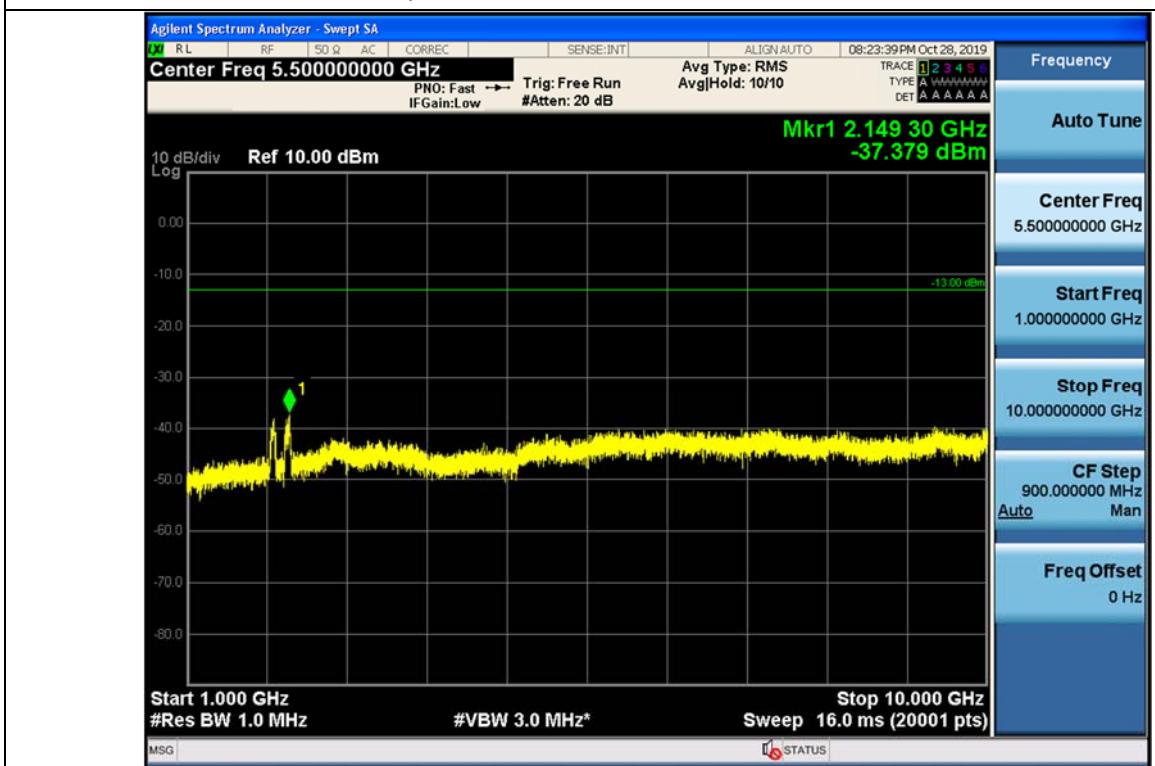
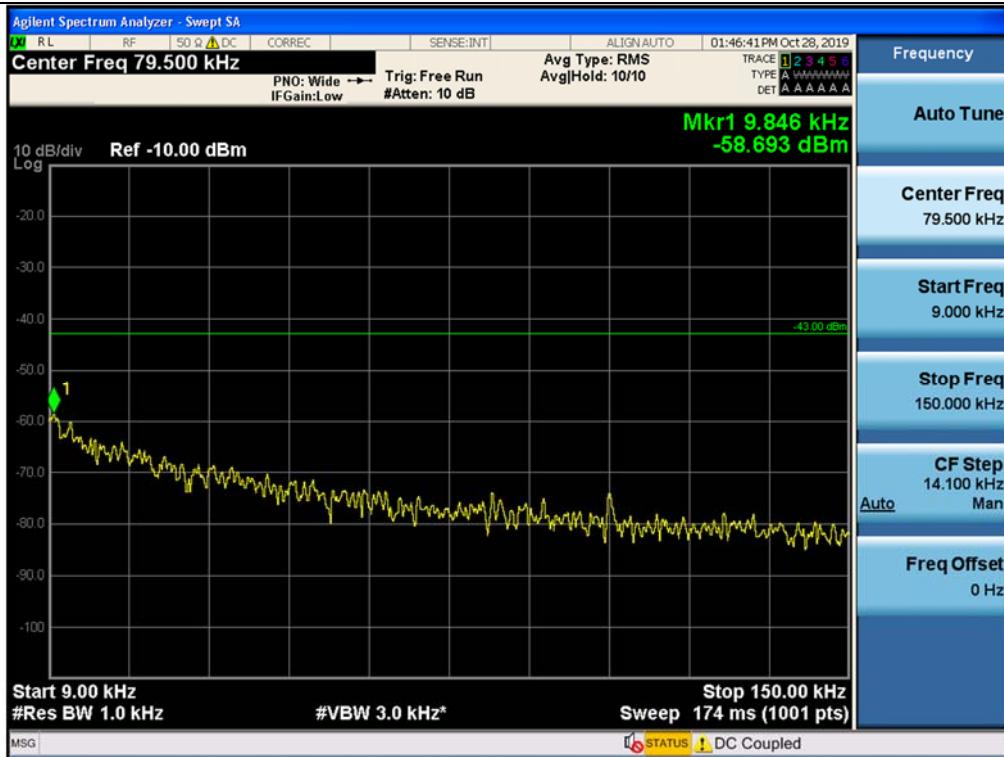


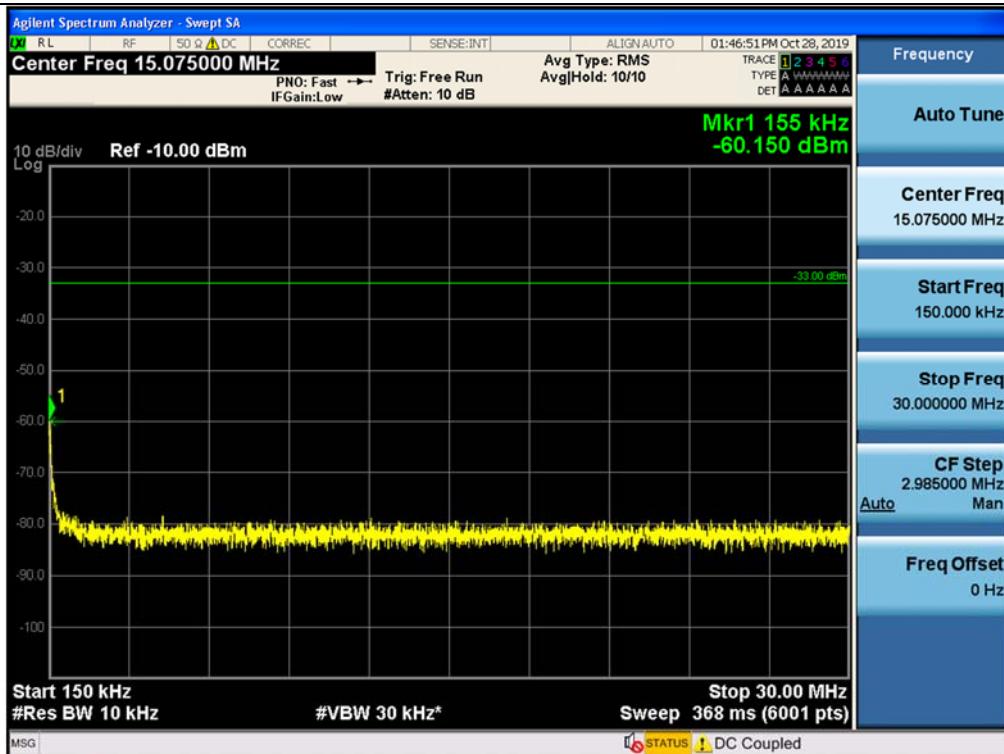
## Conducted Spurious Emissions / Cellular / Downlink / 1 GHz ~ 10 GHz



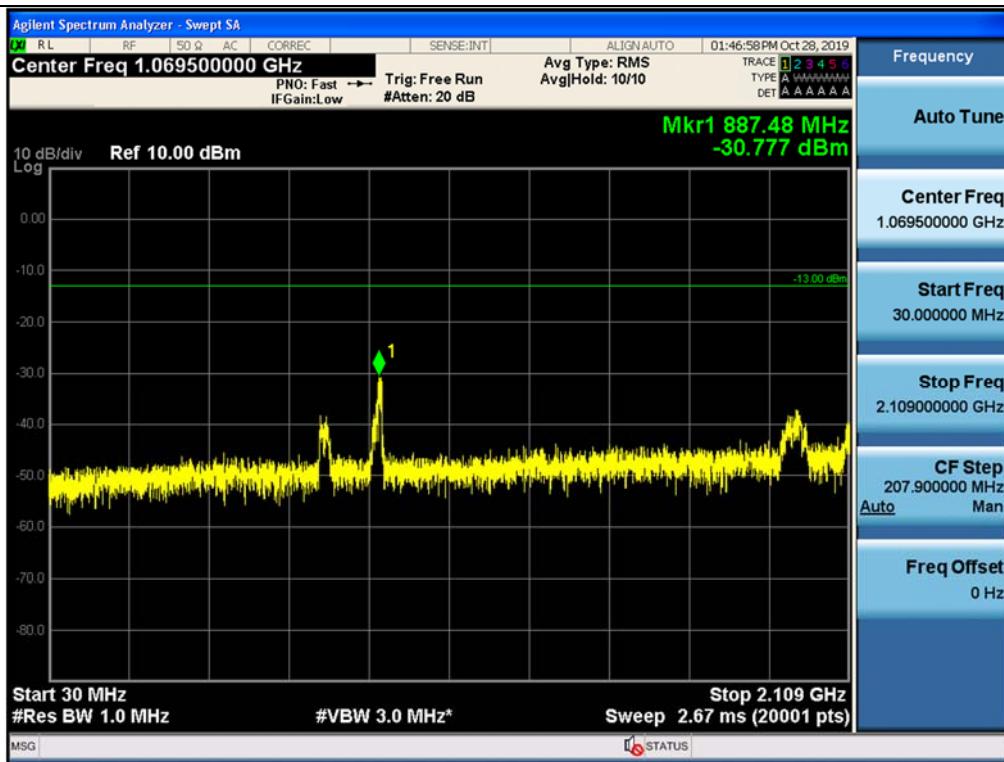
## Conducted Spurious Emissions / AWS-1 / Downlink / 9 kHz ~ 150 kHz



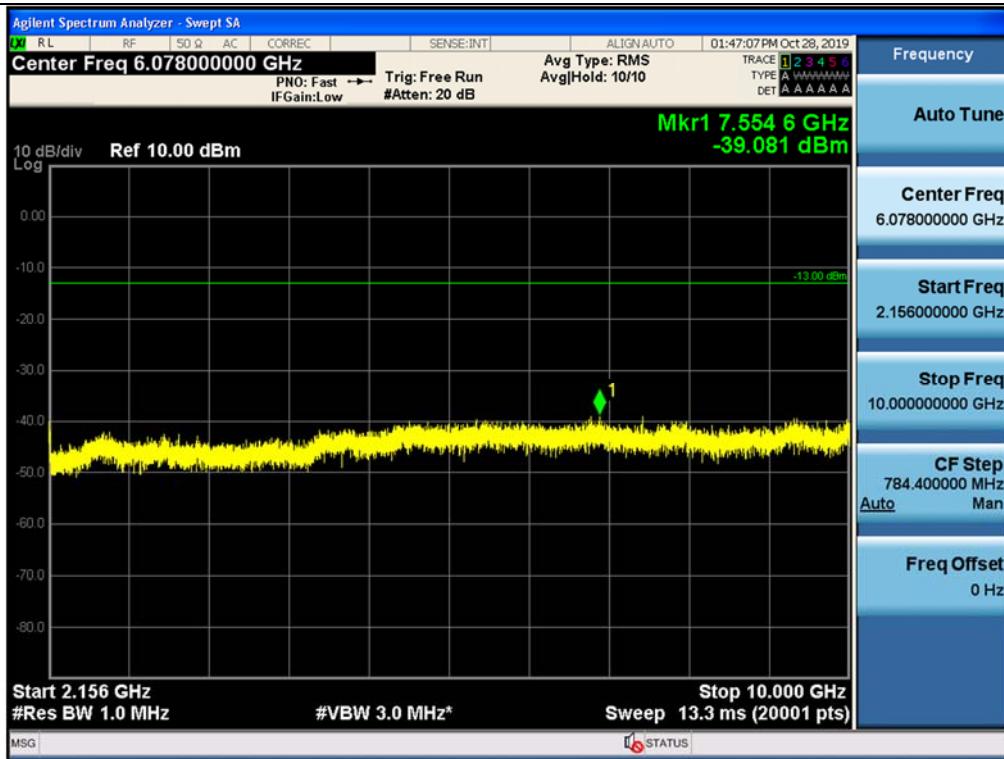
## Conducted Spurious Emissions / AWS-1 / Downlink / 150 kHz ~ 30 MHz



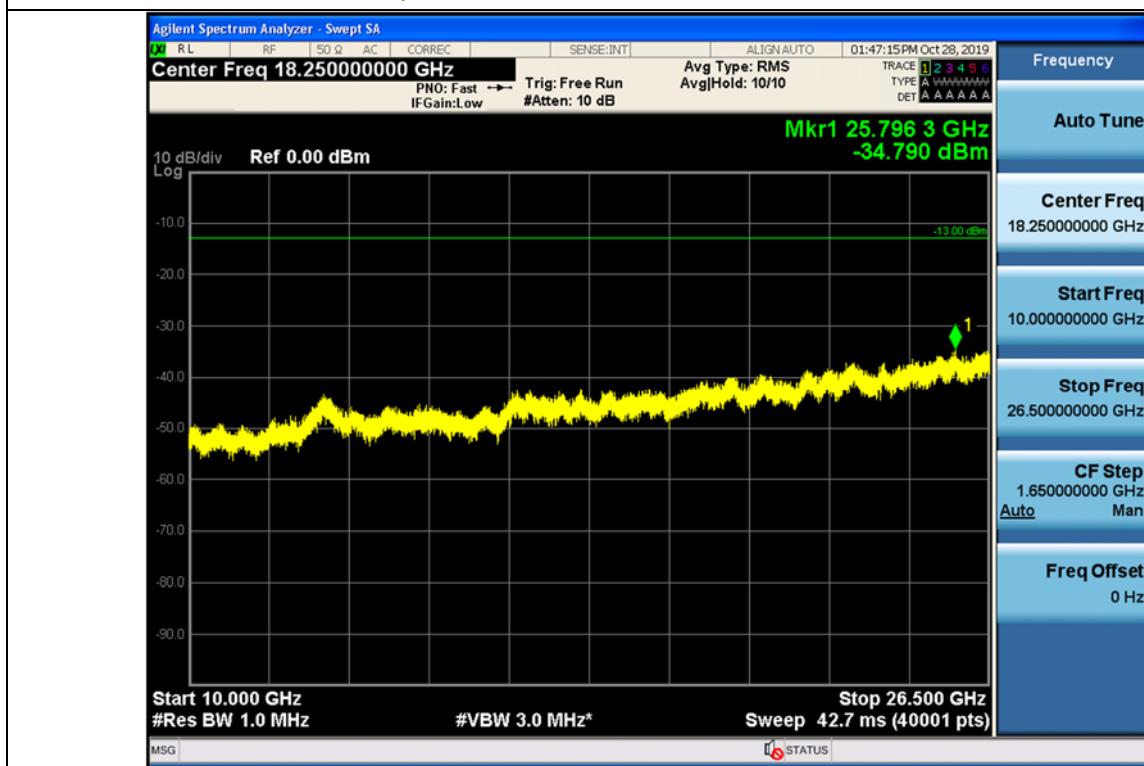
## Conducted Spurious Emissions / AWS-1 / Downlink / 30 MHz ~ 2.109 GHz



## Conducted Spurious Emissions / AWS-1 / Downlink / 2.156 GHz ~ 10 GHz



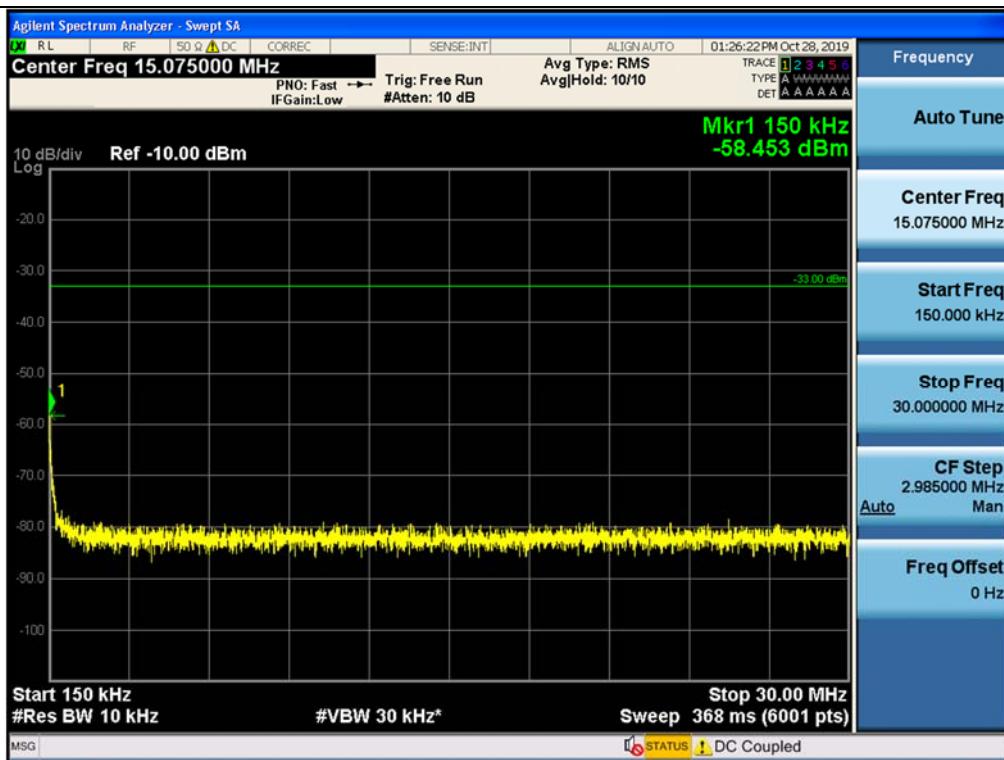
## Conducted Spurious Emissions / AWS-1 / Downlink / 10 GHz ~ 26.5 GHz



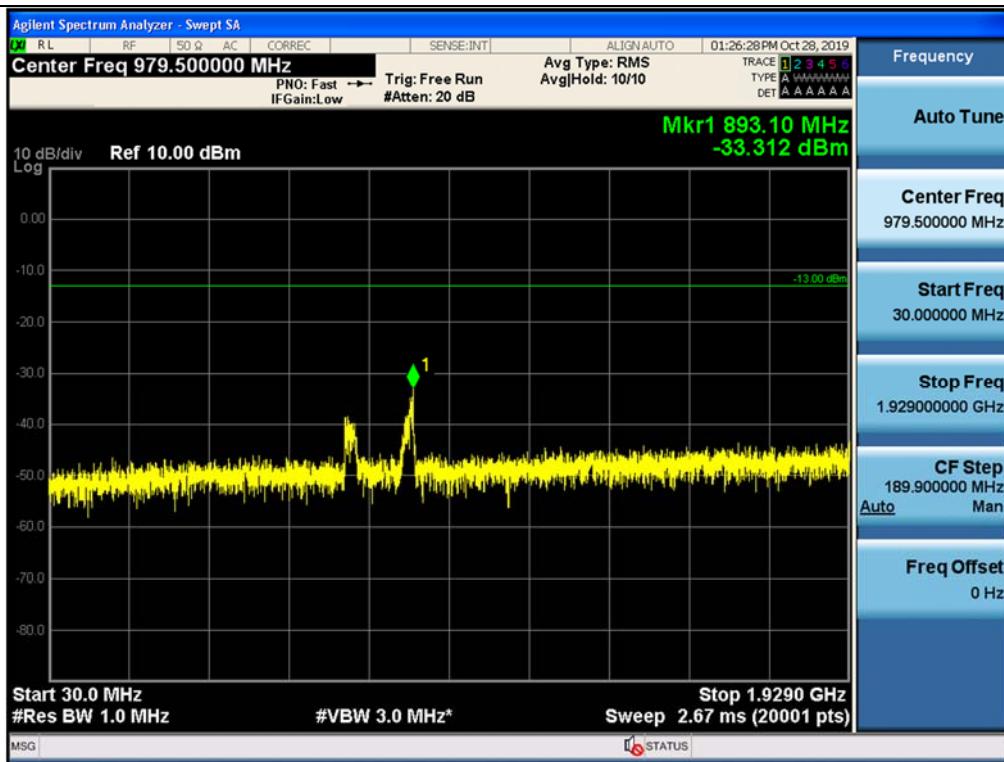
## Conducted Spurious Emissions / Broadband PCS / Downlink / 9 kHz ~ 150 kHz



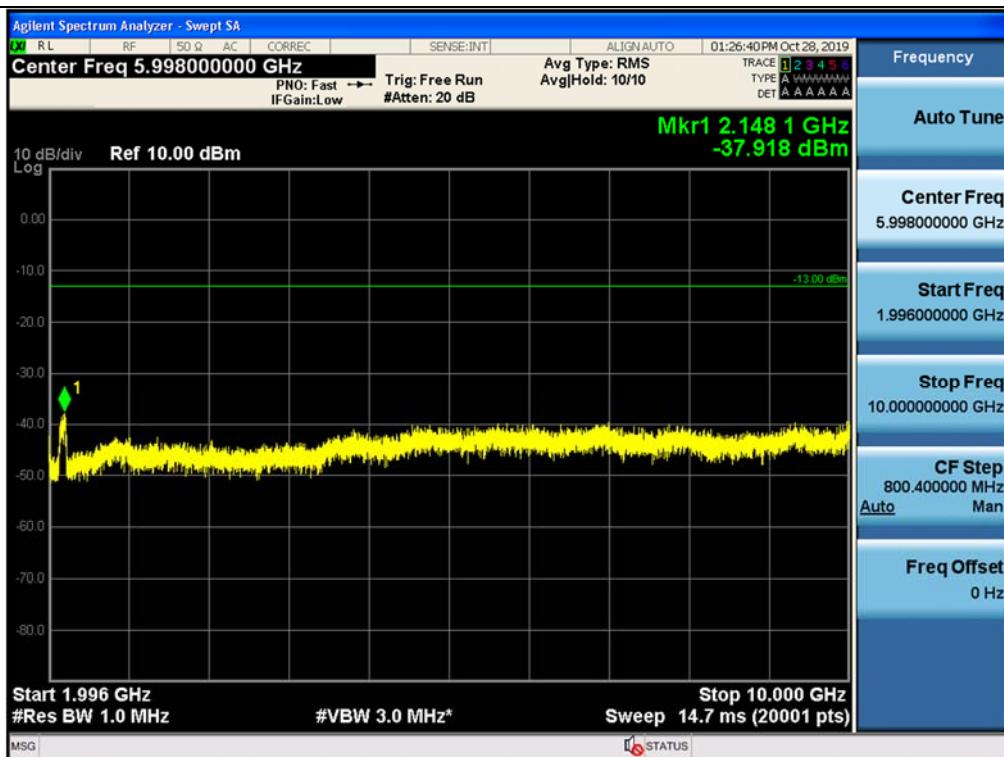
## Conducted Spurious Emissions / Broadband PCS / Downlink / 150 kHz ~ 30 MHz



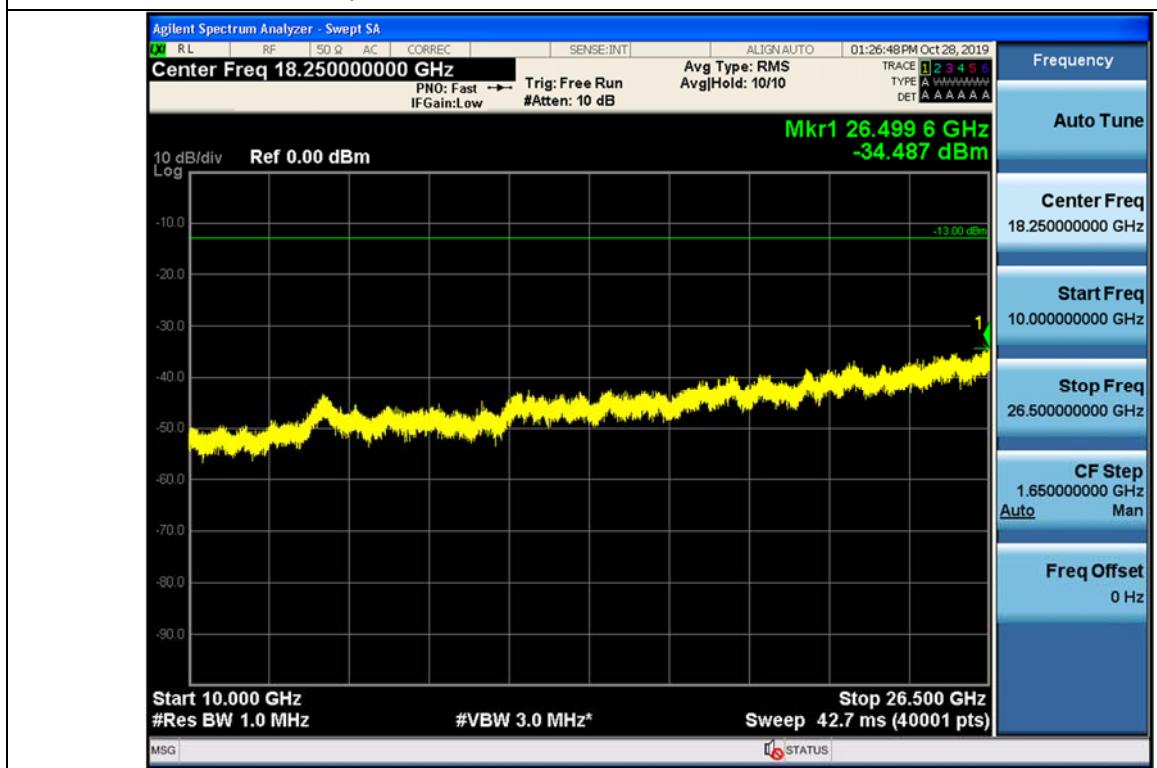
## Conducted Spurious Emissions / Broadband PCS / Downlink / 30 MHz ~ 1.929 GHz



## Conducted Spurious Emissions / Broadband PCS / Downlink / 1.996 GHz ~ 10 GHz



## Conducted Spurious Emissions / Broadband PCS / Downlink / 10 GHz ~ 26.5 GHz



## 5.7. NOISE LIMITS

### Test Requirements:

#### § 20.21(e)(8)(i)(A) NOISE LIMITS.

- (1) The transmitted noise power in dBm/MHz of consumer boosters at their uplink port shall not exceed  $-103$  dBm/MHz—RSSI. RSSI (received signal strength indication expressed in negative dB units relative to 1 mW) is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation.
- (2) The transmitted maximum noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed the following limits:
- (i) Fixed booster maximum noise power shall not exceed  $-102.5$  dBm/MHz +  $20 \log_{10}$  (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
  - (ii) Mobile booster maximum noise power shall not exceed  $-59$  dBm/MHz.
  - (iii) Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

#### § 20.21(e)(8)(i)(H) Transmit Power Off Mode (uplink and downlink noise power).

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 7.7 of KDB 935210 D03 v04r03.

#### 7.7.1 Maximum transmitter noise power level

- a) Begin with the uplink output (donor) port connected to the spectrum analyzer.
- b) Set the spectrum analyzer RBW to 1 MHz with the VBW  $\geq 3$  RBW.
- c) Select the power averaging (rms) detector and trace average over at least 100 traces.
- d) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test with the span  $\geq 2$  the CMRS band.
- e) Measure the maximum transmitter noise power level.
- f) Save the spectrum analyzer plot as necessary for inclusion in the final test report.
- g) Repeat b) to f) for all operational uplink and downlink bands.
- h) Connect the EUT 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.
- i) Configure the signal generator for AWGN operation with a 99% OBW of 4.1 MHz.
- j) Set the spectrum analyzer RBW for 1 MHz, VBW  $\geq 3$  RBW, with a power averaging (rms) detector with at least 100 trace averages.
- k) Set the center frequency of the spectrum analyzer to the center of the CMRS band under test, with the span  $\geq 2$  the CMRS band. This shall include all spectrum blocks in the particular CMRS band under.
- 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, 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.
- n) Repeat h) through m) for all operational uplink bands.

### 7.7.2 Variable uplink noise timing

- Set the spectrum analyzer to the uplink frequency to be measured.
- Set the span to 0 Hz, with a sweep time of 10 seconds.
- Set the power level of signal generator to the lowest level of the RSSI-dependent noise.
- Select MAX HOLD and increase the power level of signal generator by 10 dB for mobile boosters, and 20 dB for fixed boosters.
- Confirm that the uplink noise decreases to the specified level within 1 second for mobile devices, and within 3 seconds for fixed devices.
- Repeat a) to e) for all operational uplink bands.
- Include plots and summary table in test report.

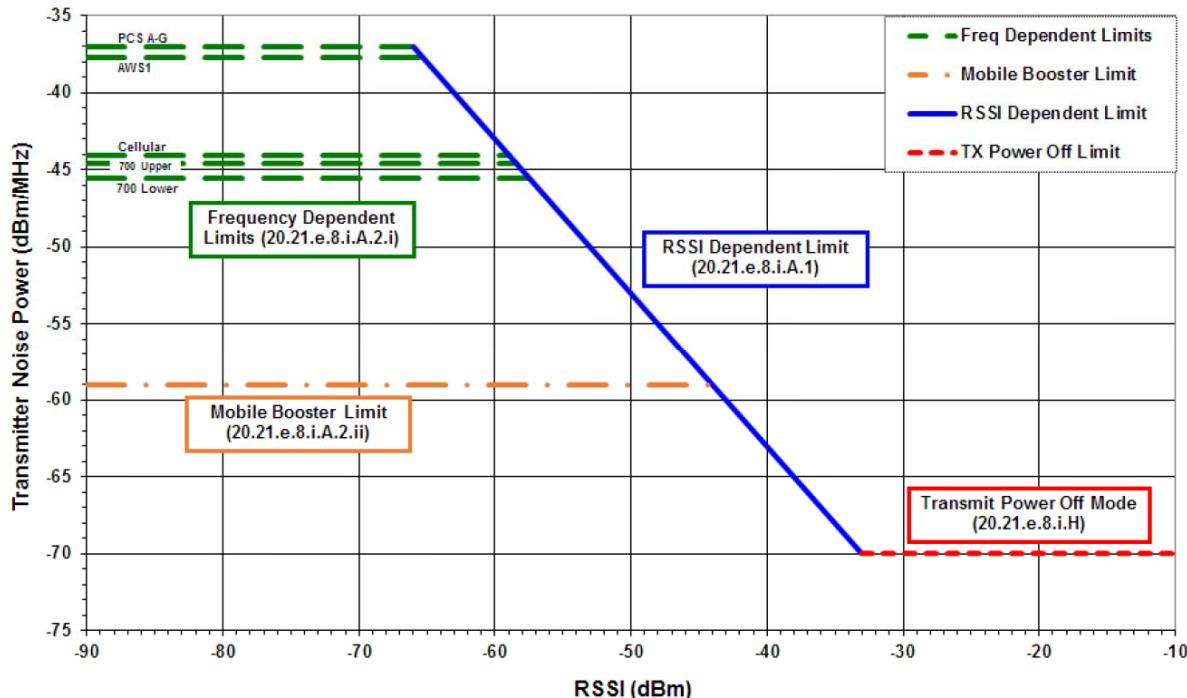
**Note1.** Test limit is according to ‘Frequency Dependent Limits’ line of figure in Note3.

- Limit in -90 dBm to -103 dBm/MHz - (-102.5 dBm/MHz + 20 log<sub>10</sub>(f)), RSSI range : -102.5 dBm/MHz + 20 log<sub>10</sub>(f)
- Limit in -103 dBm/MHz - (-102.5 dBm/MHz + 20 log<sub>10</sub>(f)) to -33 dBm, RSSI range : -103 dBm/MHz—RSSI
- Limit in -33 dBm to -10 dBm RSSI range: -70 dBm/MHz
- Timing limit is according to fixed devices 3 second limit in section 7.7.2 of KDB 935210 D03
- \* (f) is the uplink mid-band frequency of the operating frequency bands (in MHz).

**Note2.** Following switch coupled loss is corrected in signal generating.

Band	Uplink generating loss (dB)	Downlink generating loss (dB)
Lower 700 MHz	3.46	4.62
Upper 700 MHz	4.04	3.96
Cellular	4.53	4.78
AWS-1	4.97	5.13
Broadband PCS	8.17	5.16

**Note3.** Tests refer to following noise limit in appendix D of KDB 935210 D03 v04r03.



**Test Result:****Tabulated Result of Uplink Maximum Transmitter Noise Power Level**

Band	Frequency (MHz)	Limit (dBm/MHz)	Noise Level (dBm/MHz)
Lower 700 MHz	700.784	-45.47	-47.70
Upper 700 MHz	781.192	-44.64	-46.38
Cellular	829.900	-44.05	-44.20
AWS-1	1 733.400	-37.73	-40.75
Broadband PCS	1 901.740	-37.01	-42.48

**Tabulated Result of Downlink Maximum Transmitter Noise Power Level**

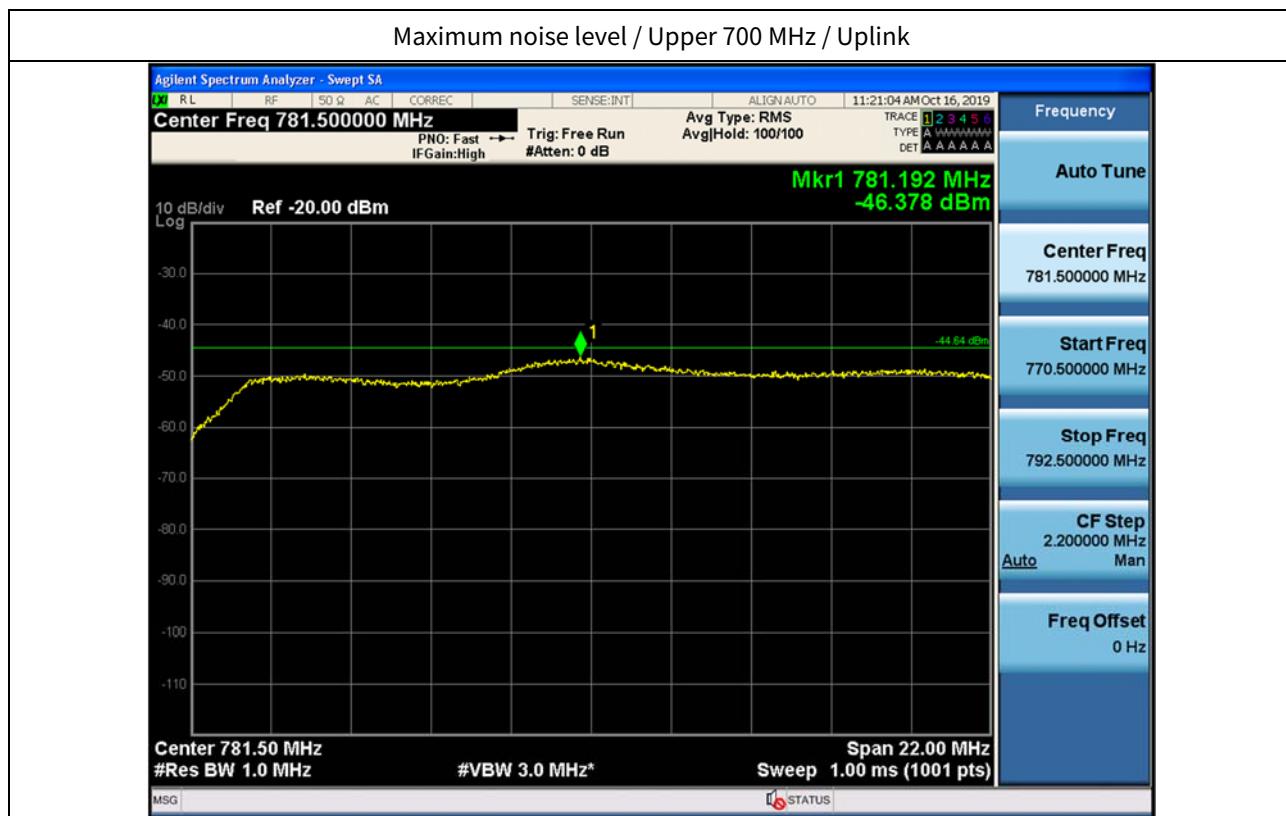
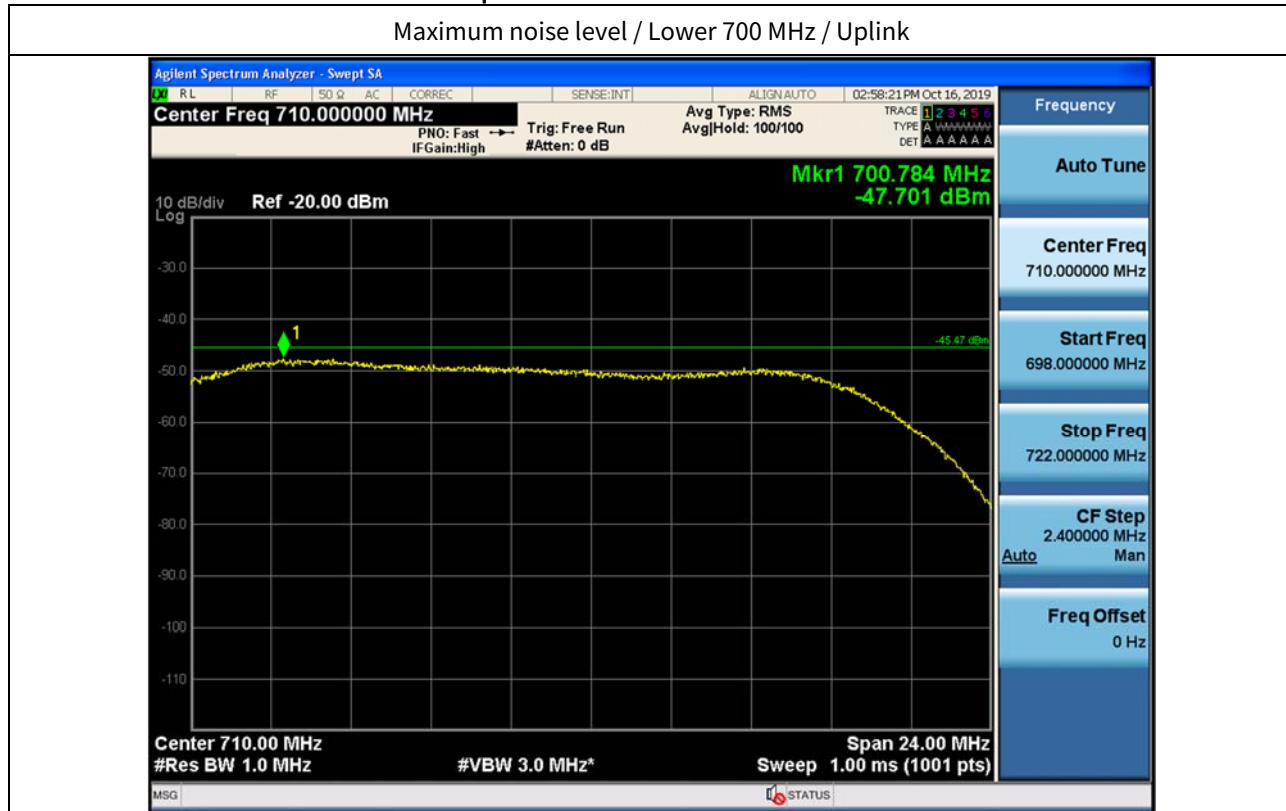
Band	Frequency (MHz)	Limit (dBm/MHz)	Noise Level (dBm/MHz)
Lower 700 MHz	733.304	-45.12	-45.22
Upper 700 MHz	733.352	-45.12	-46.69
Cellular	879.900	-43.60	-43.87
AWS-1	2 148.610	-35.92	-39.40
Broadband PCS	1 974.850	-36.64	-39.37

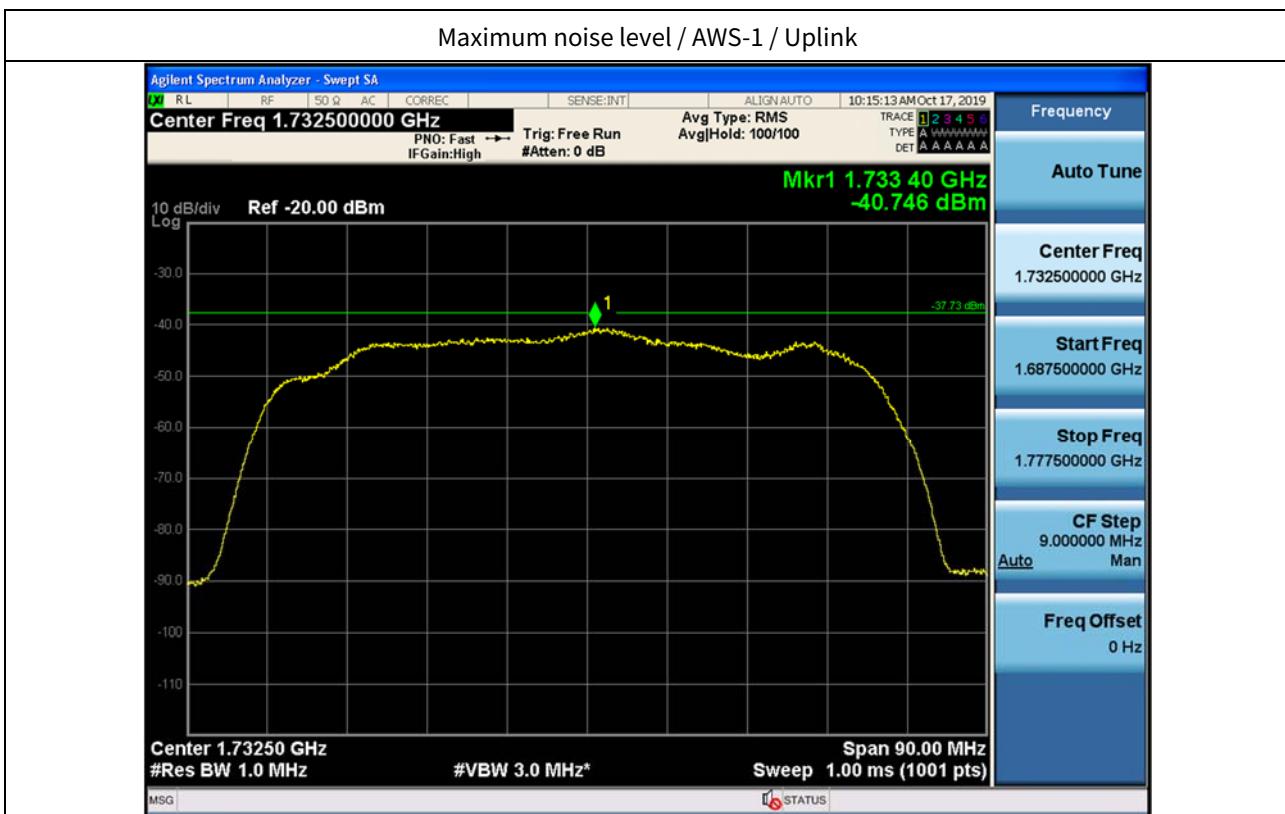
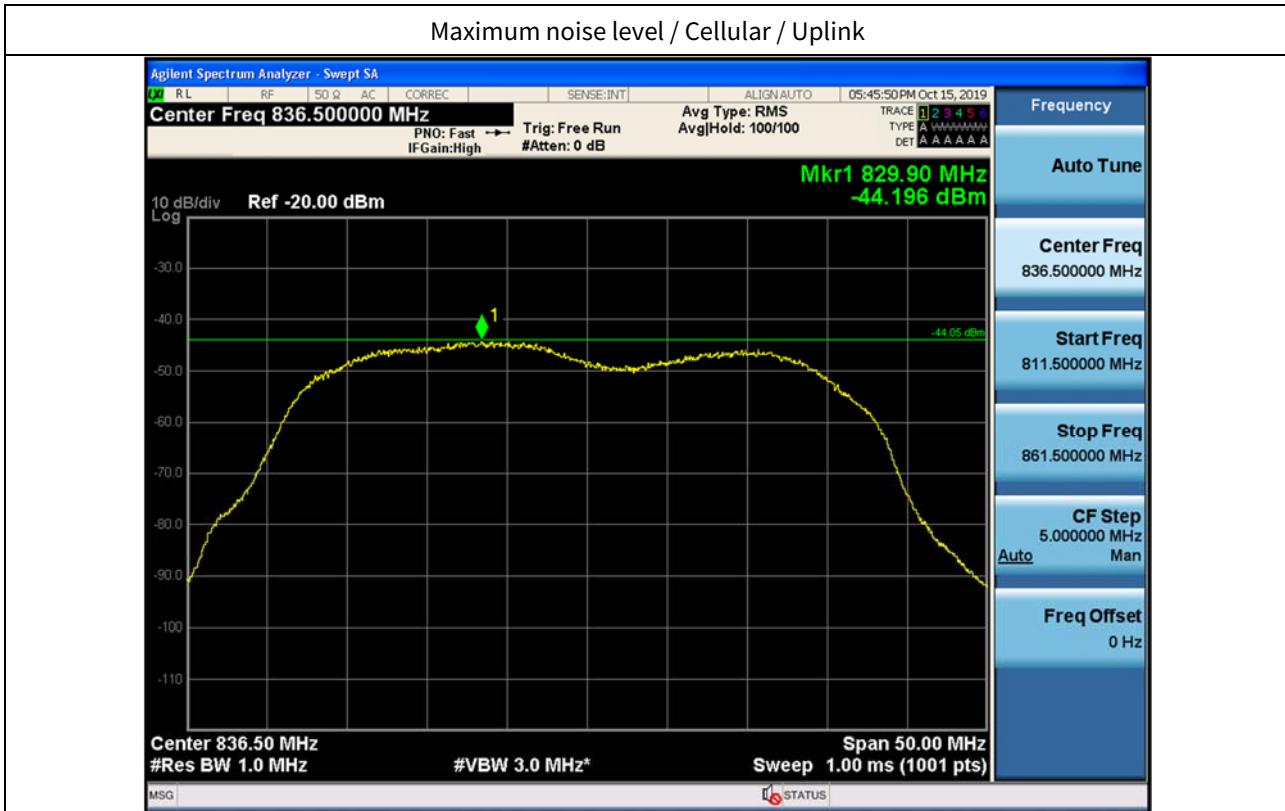
**Tabulated Result of Variable Uplink Noise Power**

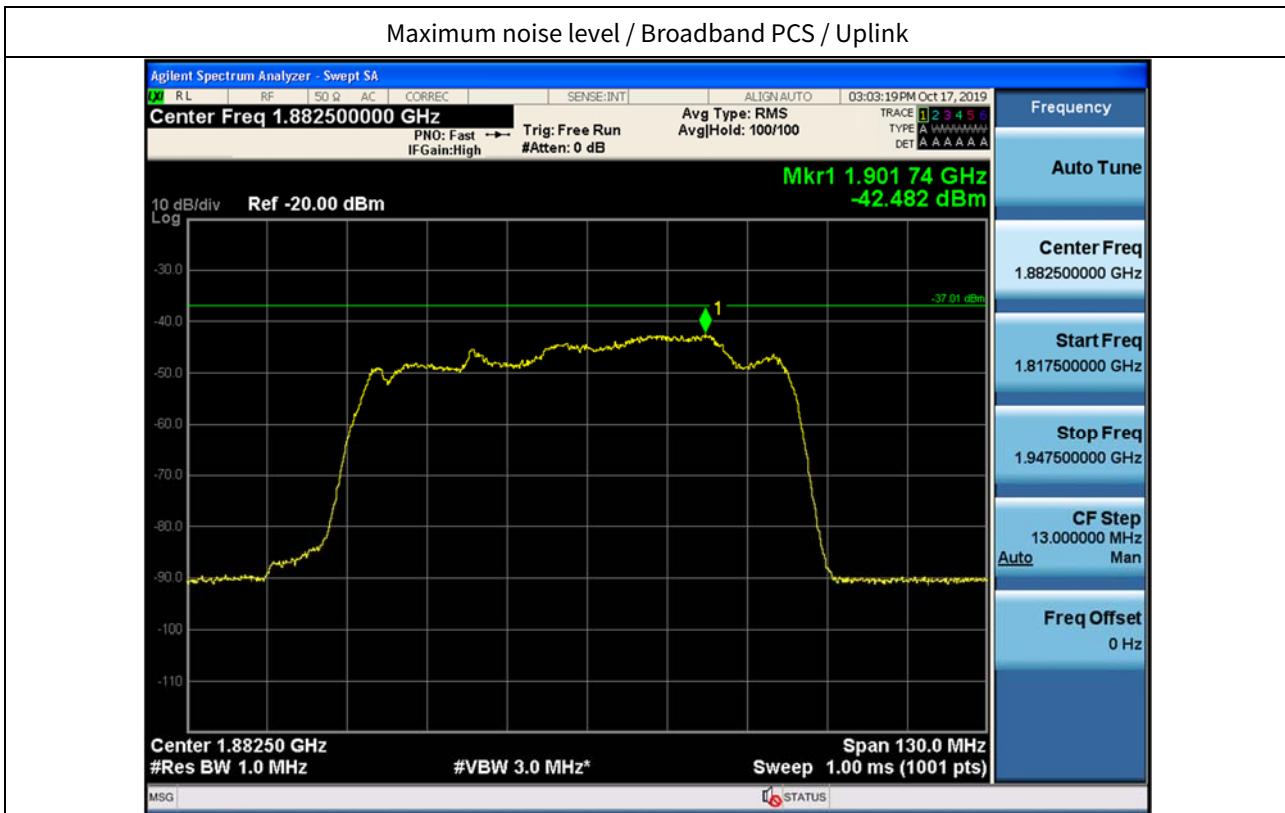
Band	RSSI (dBm)	Frequency (MHz)	Limit (dBm/MHz)	Noise Level (dBm/MHz)
Lower 700 MHz	-90	704.480	-45.47	-47.655
	-80	705.008	-45.47	-47.717
	-70	705.032	-45.47	-47.727
	-60	705.680	-45.47	-52.843
	-40	706.160	-63.47	-70.887
	-42	706.232	-61.47	-69.557
Upper 700 MHz	-70	780.950	-44.64	-45.236
	-90	780.840	-44.64	-45.450
	-80	781.104	-44.64	-45.456
	-36	780.884	-66.64	-69.578
	-60	780.906	-44.64	-47.954
	-37	780.972	-65.64	-69.452
Cellular	-80	826.250	-44.05	-44.122
	-70	826.100	-44.05	-44.204
	-90	826.450	-44.05	-44.272
	-37	827.650	-66.05	-66.555
	-38	827.800	-65.05	-66.896
	-39	826.400	-64.05	-66.163
AWS-1	-90	1 733.580	-37.73	-40.439
	-80	1 733.130	-37.73	-40.444
	-70	1 731.690	-37.73	-40.736
	-40	1 732.410	-62.73	-66.552
	-49	1 734.480	-53.73	-57.715
	-62	1 734.030	-40.73	-44.733
Broadband PCS	-38	1 864.170	-65.01	-66.882
	-61	1 898.620	-42.01	-44.740
	-60	1 899.140	-43.01	-45.856
	-57	1 899.010	-46.01	-48.928
	-39	1 897.060	-64.01	-66.962
	-63	1 899.270	-40.01	-42.977

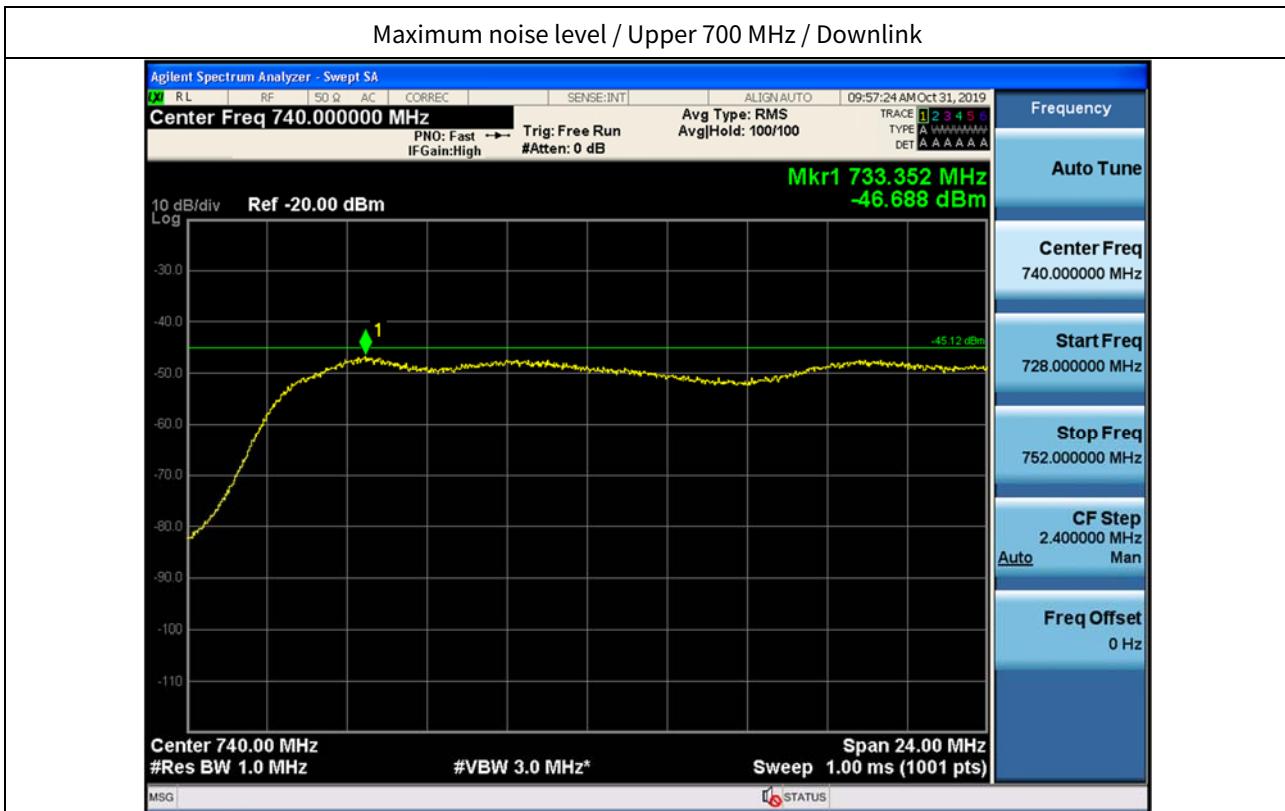
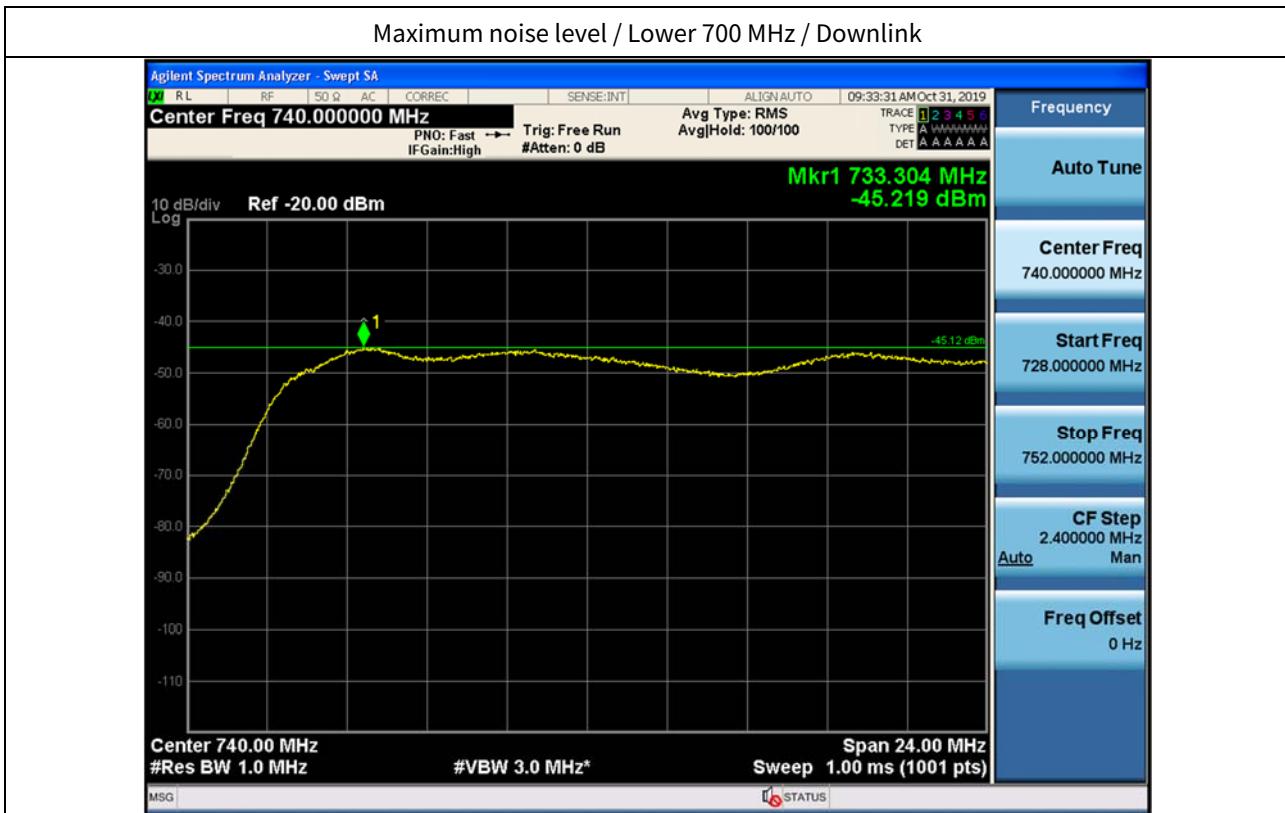
**Tabulated Result of Variable Uplink Noise Timing**

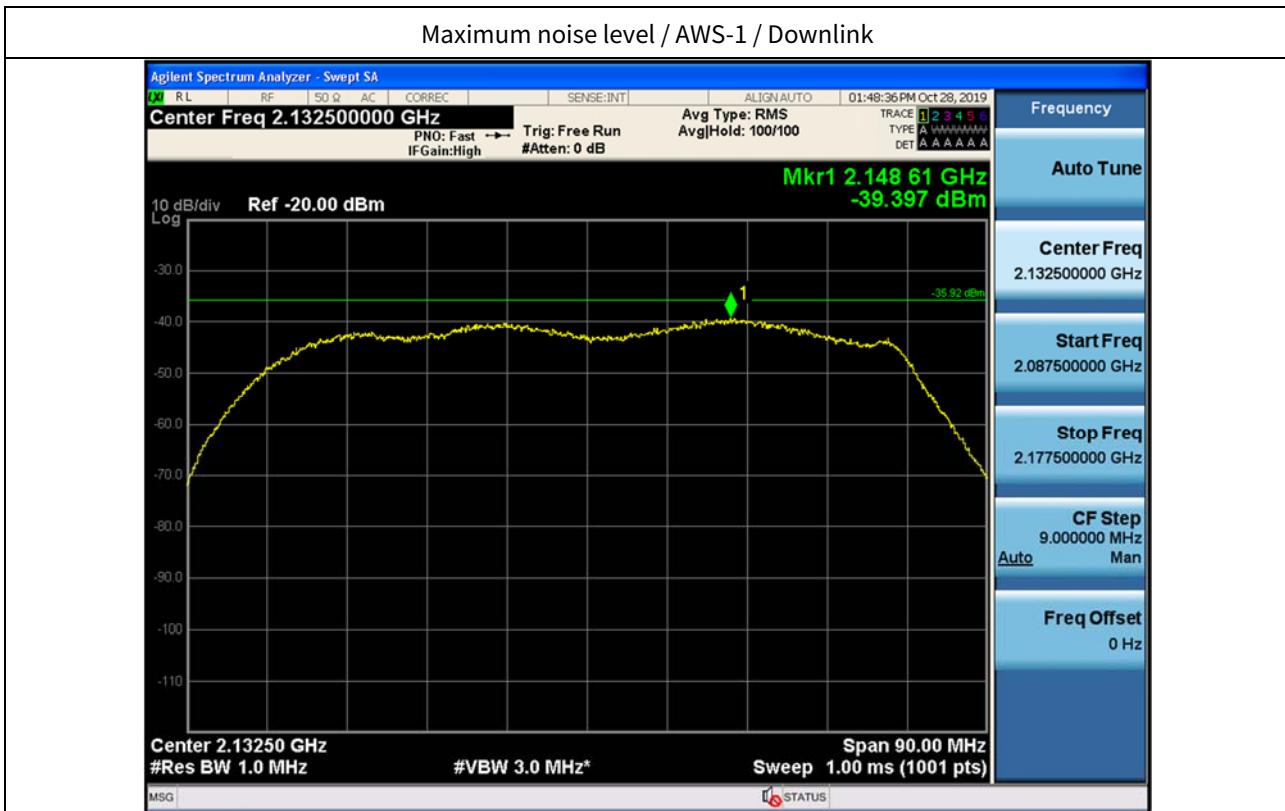
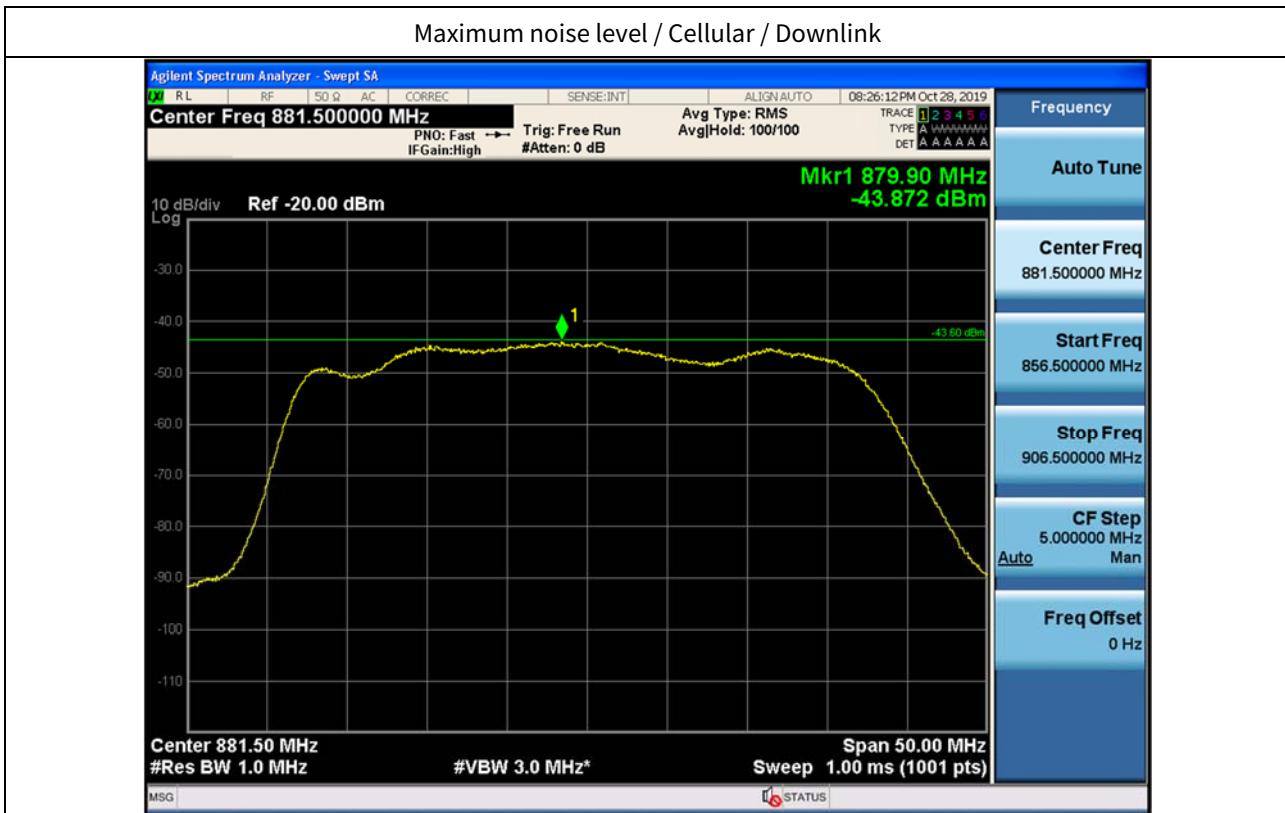
Band	Frequency (MHz)	Limit (ms)	Noise Timing (ms)
Lower 700 MHz	710.000	3 000	90
Upper 700 MHz	781.500		280
Cellular	836.500		150
AWS-1	1 732.500		230
Broadband PCS	1 882.500		250

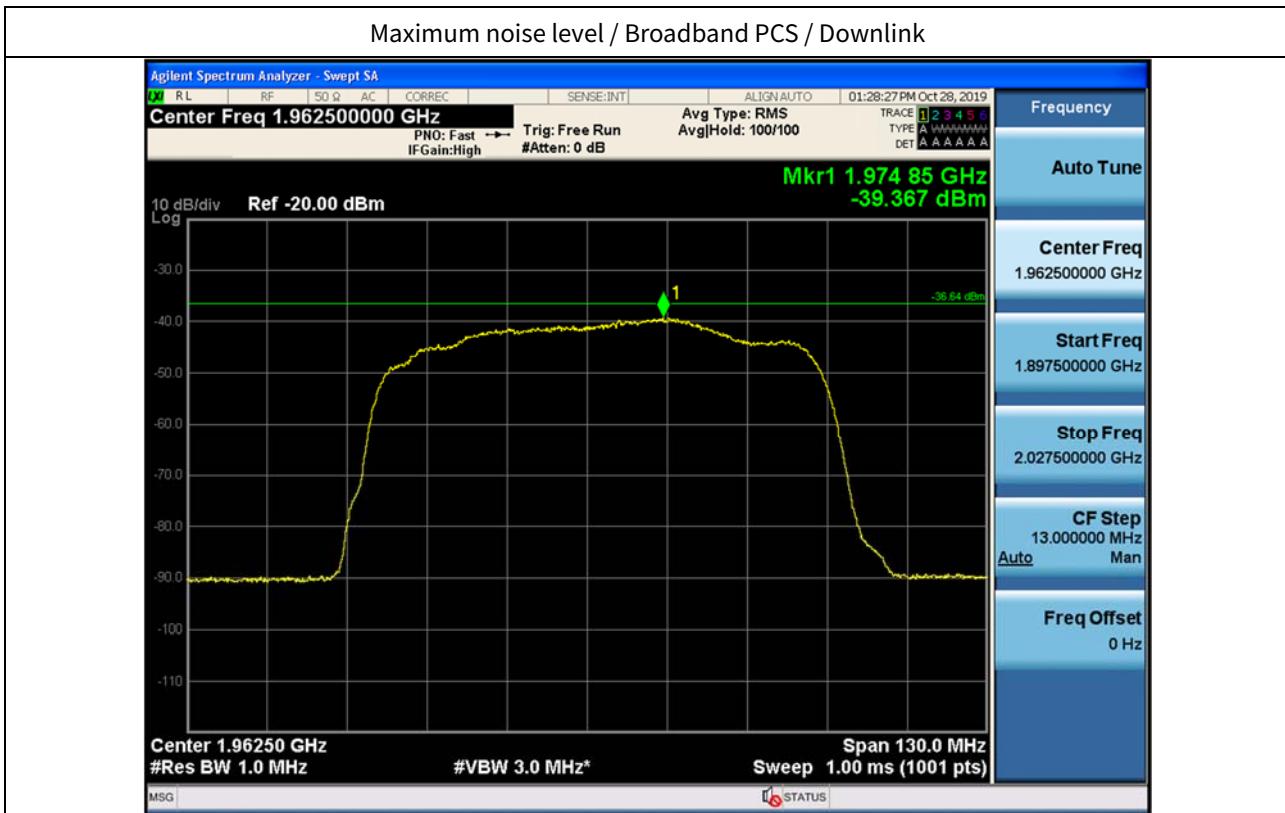
**Plot data of Maximum transmitter noise power level**


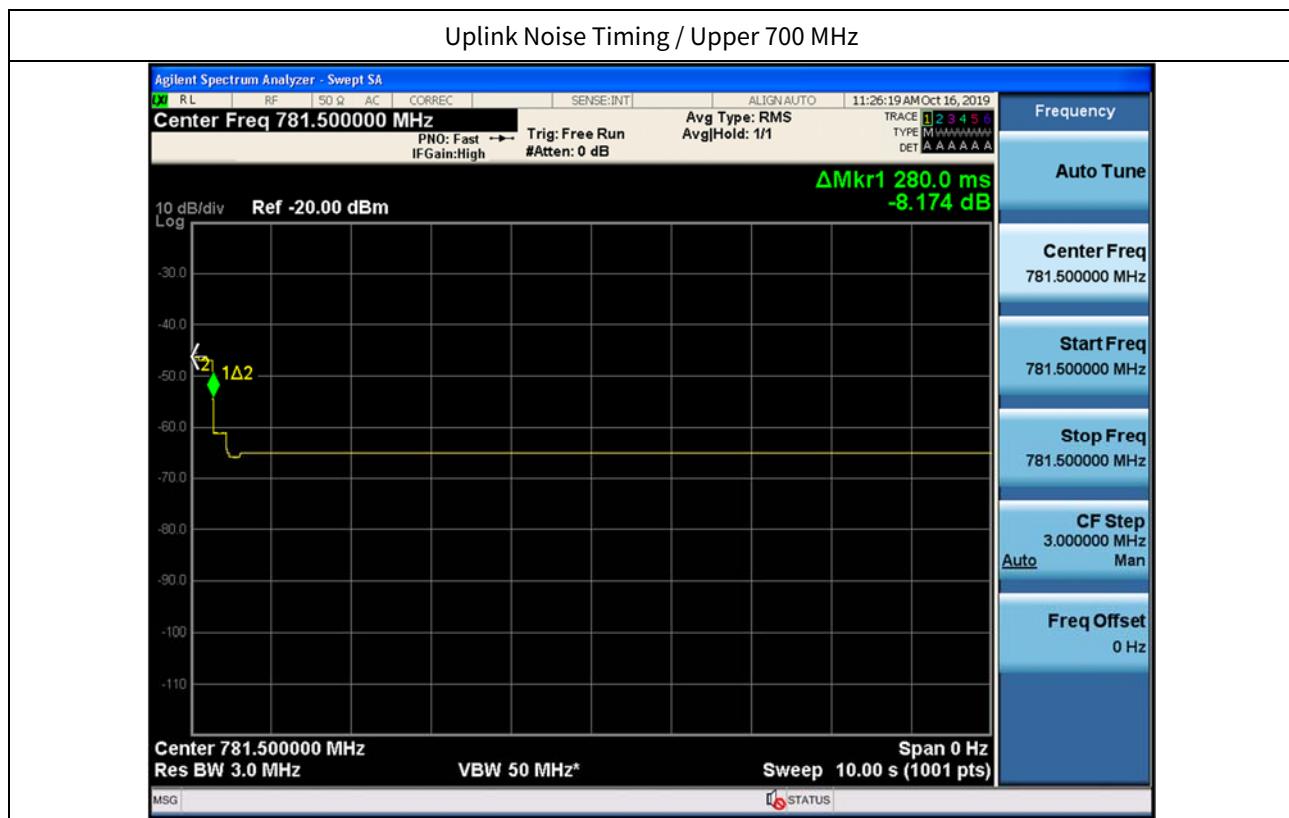
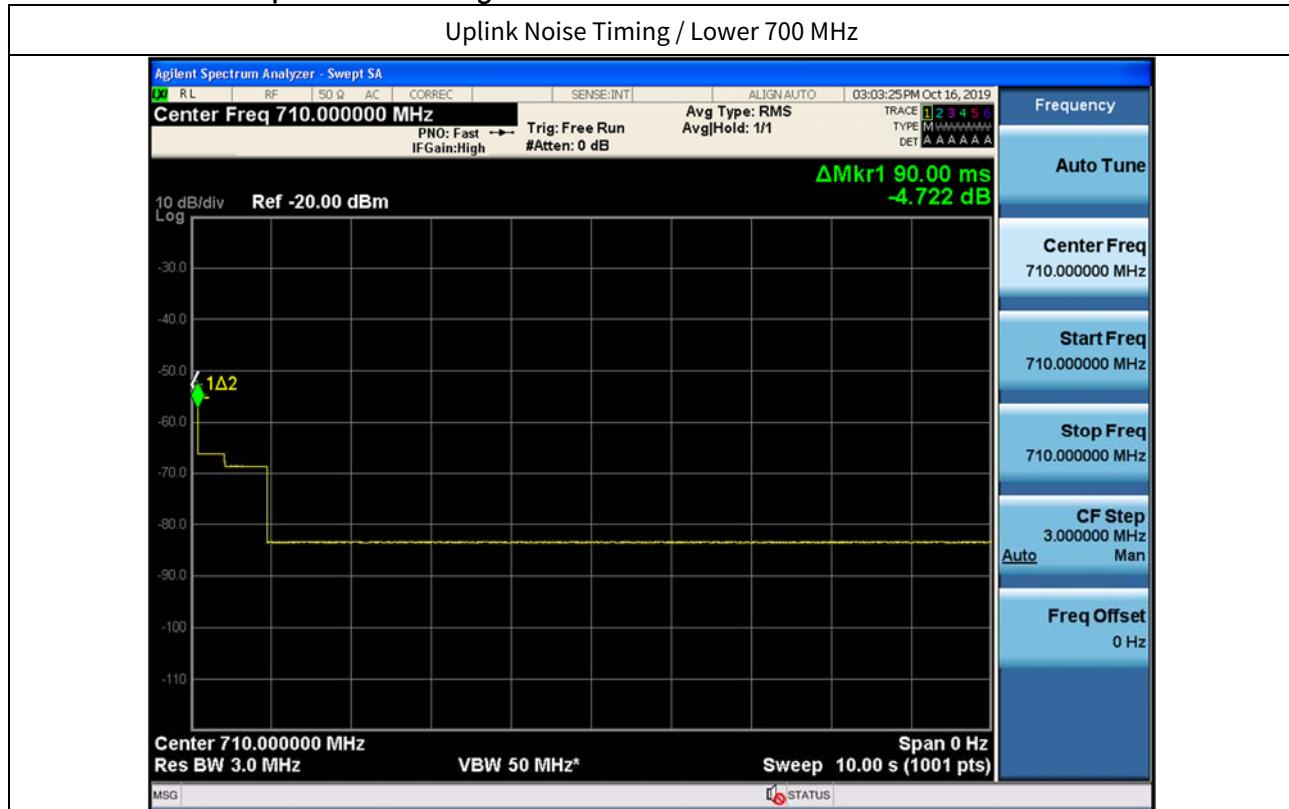


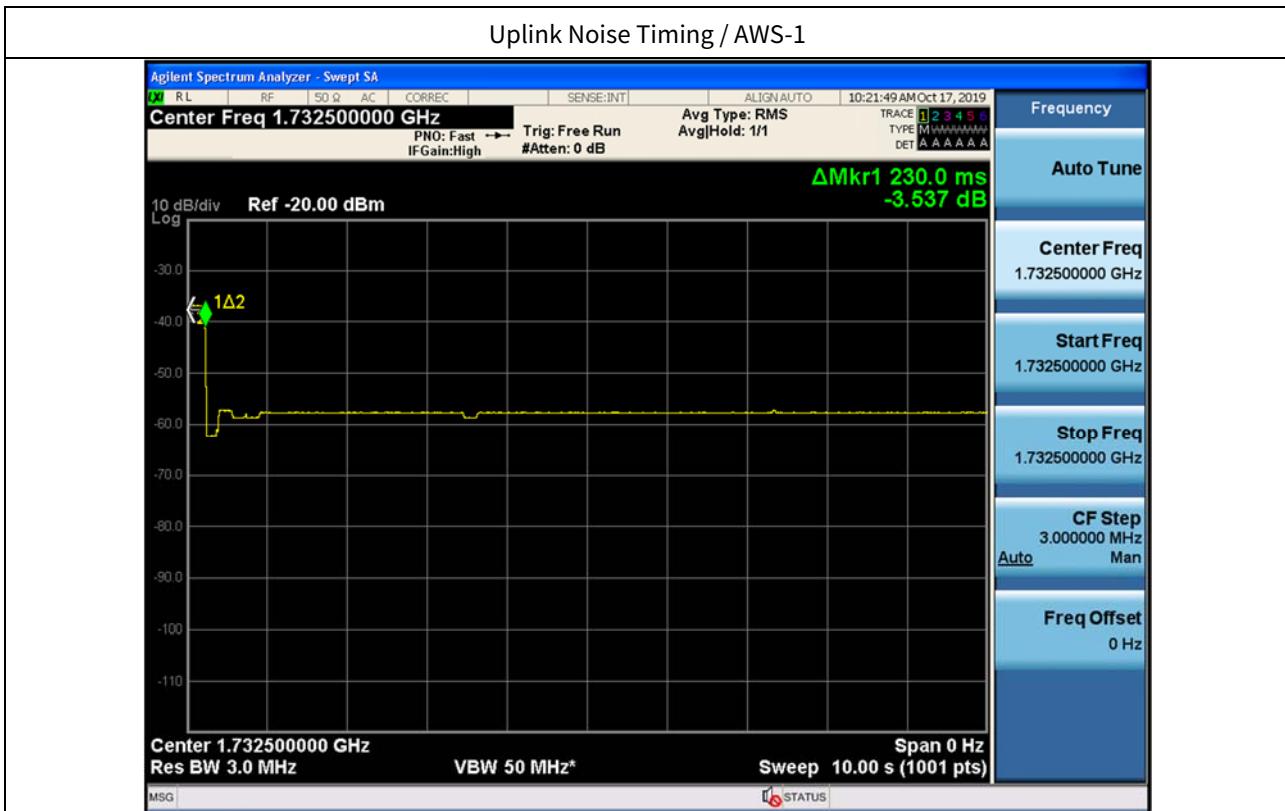
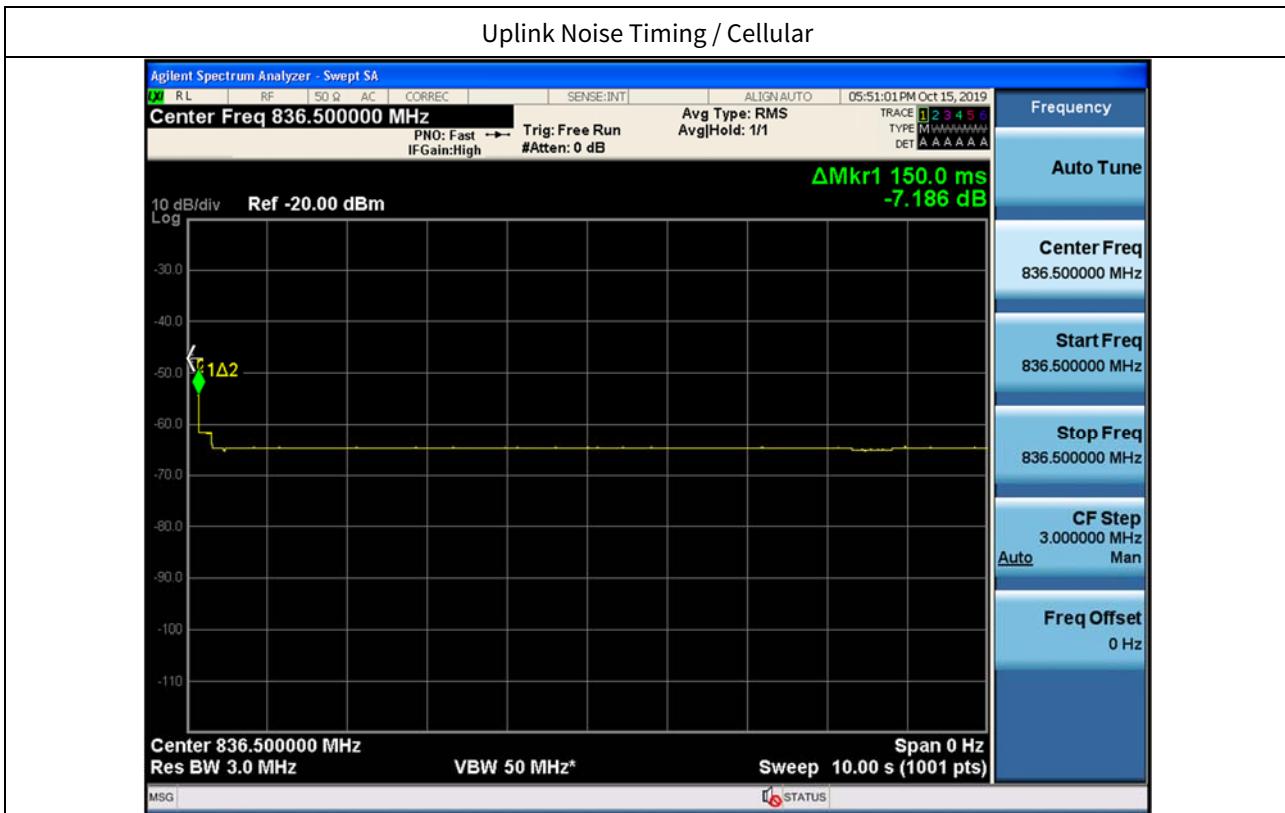


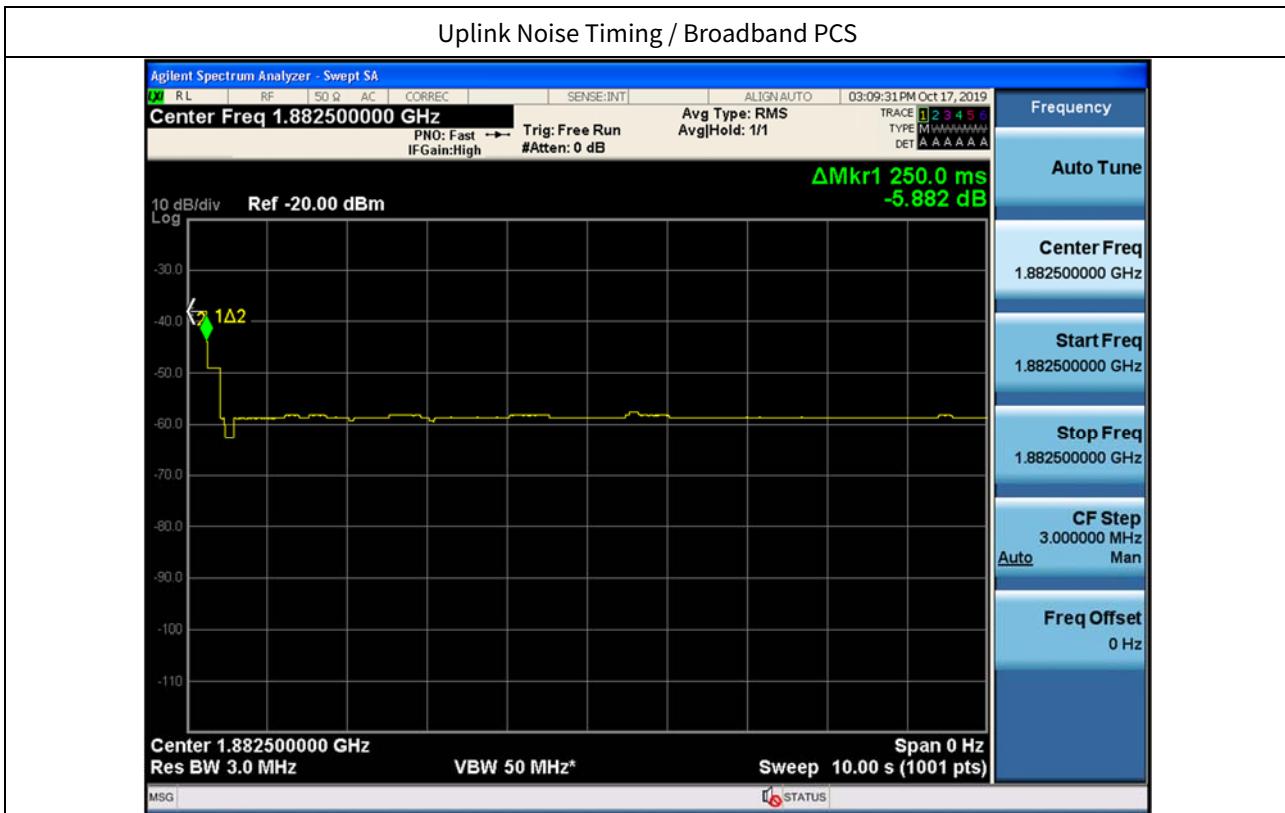






**Plot data of Variable Uplink Noise Timing**






## 5.8. UPLINK INACTIVITY

### Test Requirements:

#### § 20.21(e)(8)(i)(A) NOISE LIMITS (Uplink).

When a consumer booster is not serving an active device connection after 5 minutes the uplink noise power shall not exceed  $-70 \text{ dBm/MHz}$ .

### Test Procedures:

Measurements were in accordance with the test methods section 7.8 of KDB 935210 D03 v04r03.

- a) The uplink output (donor) port connected to the spectrum analyzer.
- b) Select the power averaging (rms) detector.
- c) Set the spectrum analyzer RBW for 1 MHz with the VBW  $\geq 3 \text{ RBW}$ .
- d) Set the center frequency of the spectrum analyzer to the center of the uplink operational band.
- e) Set the span for 0 Hz with a single sweep time for a minimum of 330 seconds.
- f) Start to capture a new trace using MAX HOLD.
- g) After approximately 15 seconds, turn on the EUT power.
- h) After the full spectrum analyzer trace is complete, place a MARKER on the leading edge of the pulse, then use the DELTA MARKER METHOD to measure the time until the uplink becomes inactive.
- i) Affirm that the noise level is below the uplink inactivity noise power limit, as specified by the rules.
- j) Capture the plot for inclusion in the test report.
- k) Measure noise using procedures in a) to f).
- l) Repeat d) through k) for all operational uplink bands.

**Note1.** Test limit is applied both time (5 minutes) and level (-70 dBm/MHz) in § 20.21(e)(8)(i)(A)

**Test Result:****Tabulated Result of Uplink Inactivity**

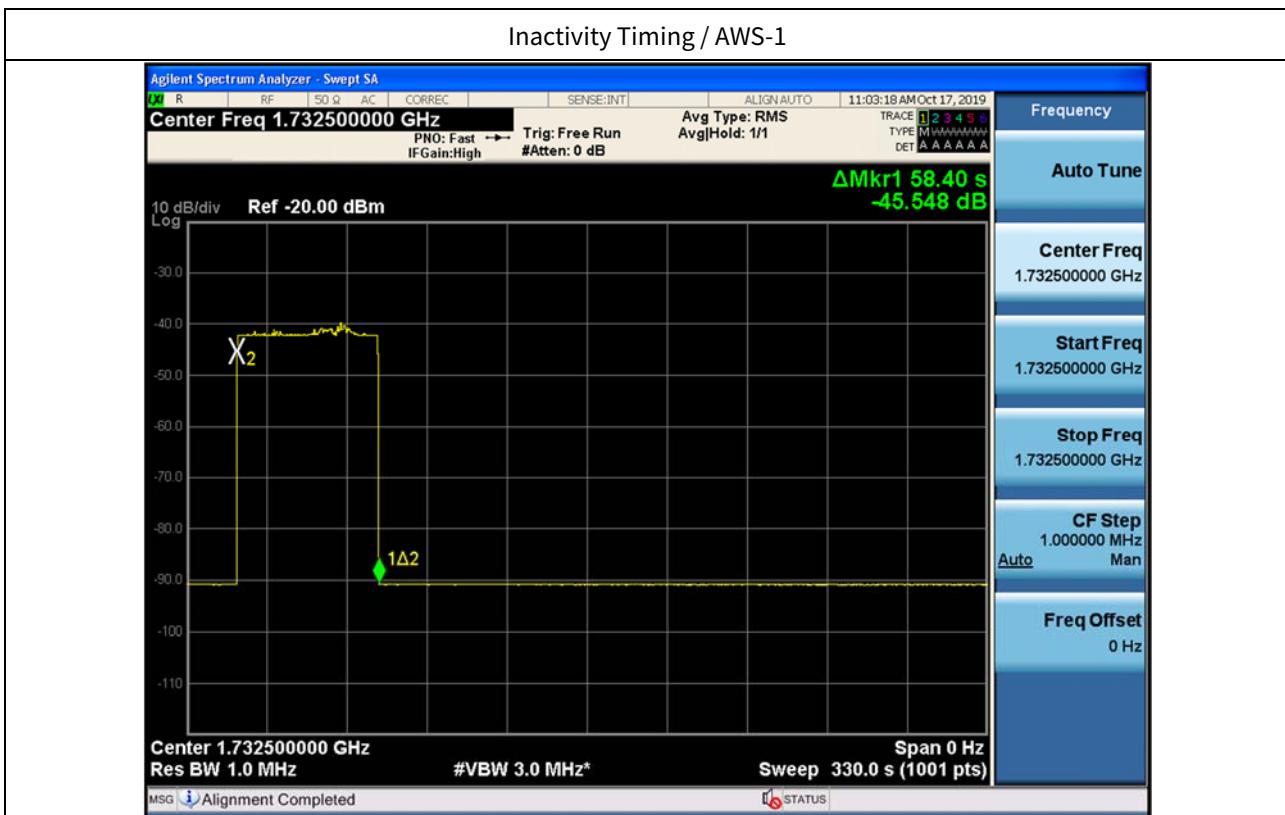
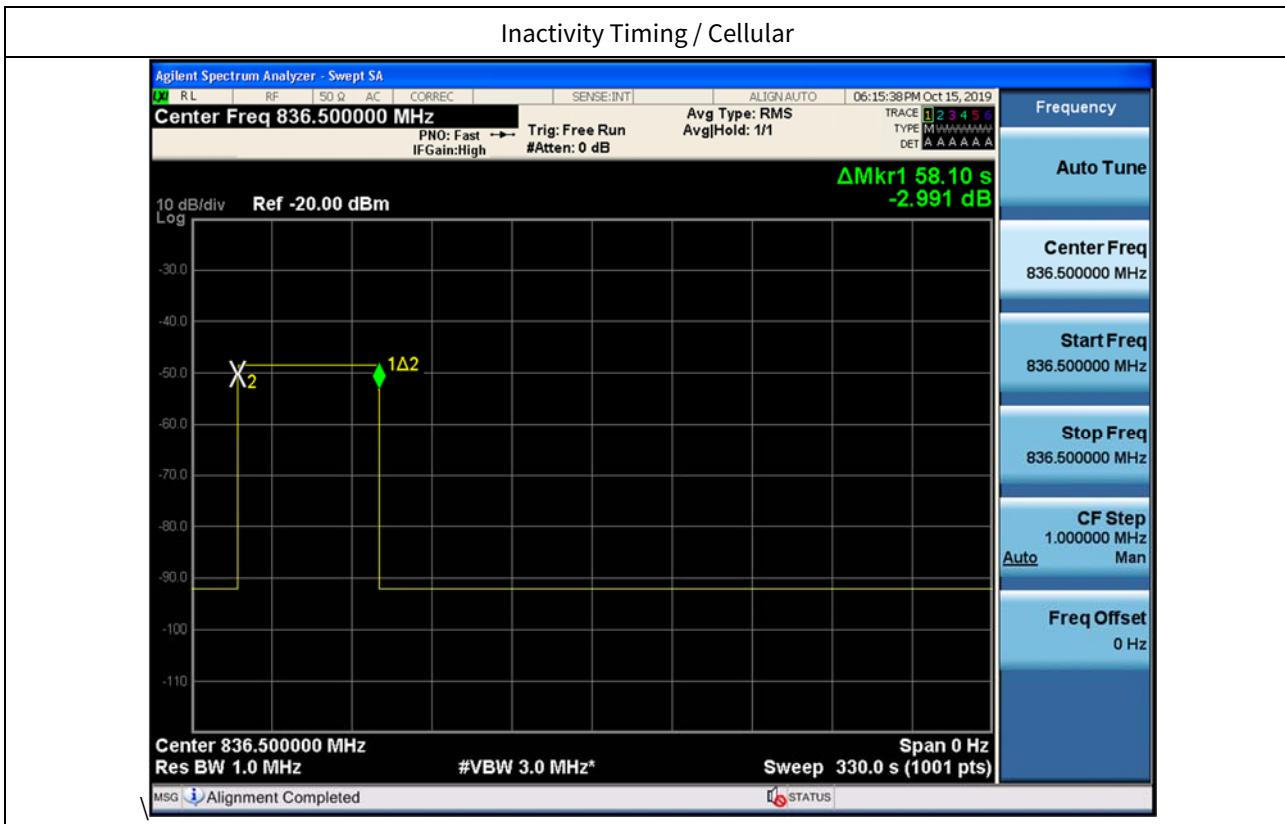
Band	Frequency (MHz)	Time Limit (s)	Inactivity Timing (s)
Lower 700 MHz	710.00	3 000	58.40
Upper 700 MHz	781.50		58.10
Cellular	836.50		58.10
AWS-1	1 732.50		58.40
Broadband PCS	1 882.50		58.10

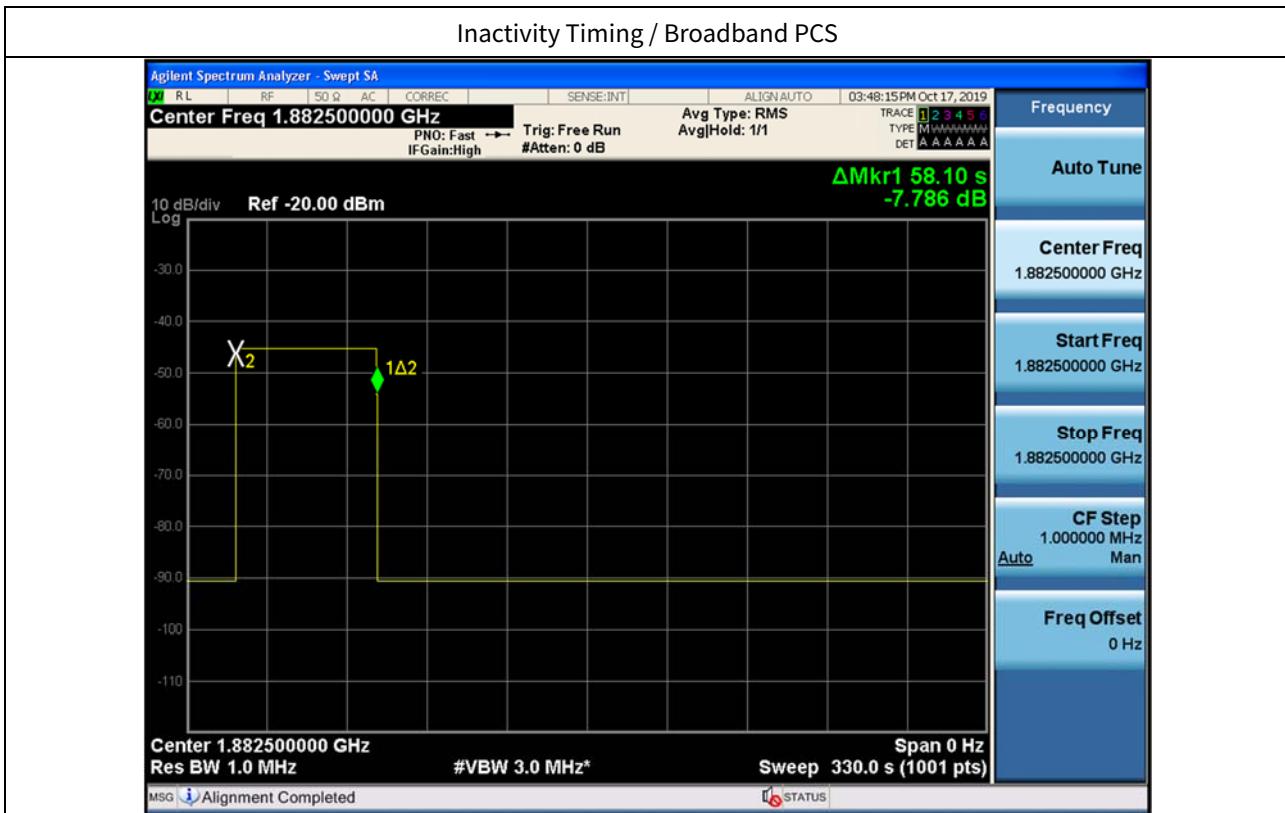
**Tabulated Result of Uplink Inactivity Noise**

Band	Frequency (MHz)	Noise Limit (dBm/MHz)	Noise Level (dBm/MHz)
Lower 700 MHz	717.06	-70	-91.16
Upper 700 MHz	789.22		-90.86
Cellular	812.35		-91.06
AWS-1	1 771.11		-89.92
Broadband PCS	1 842.85		-87.95

## Plot data of Inactivity timing

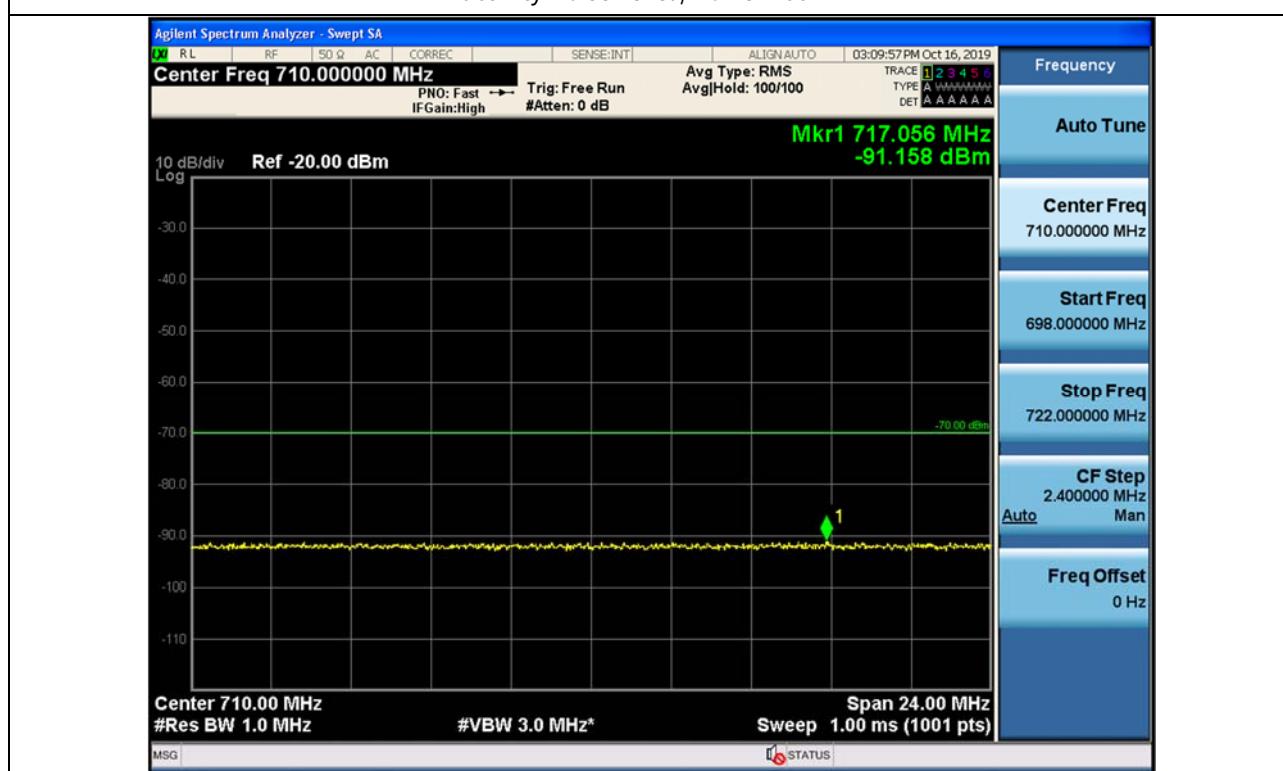




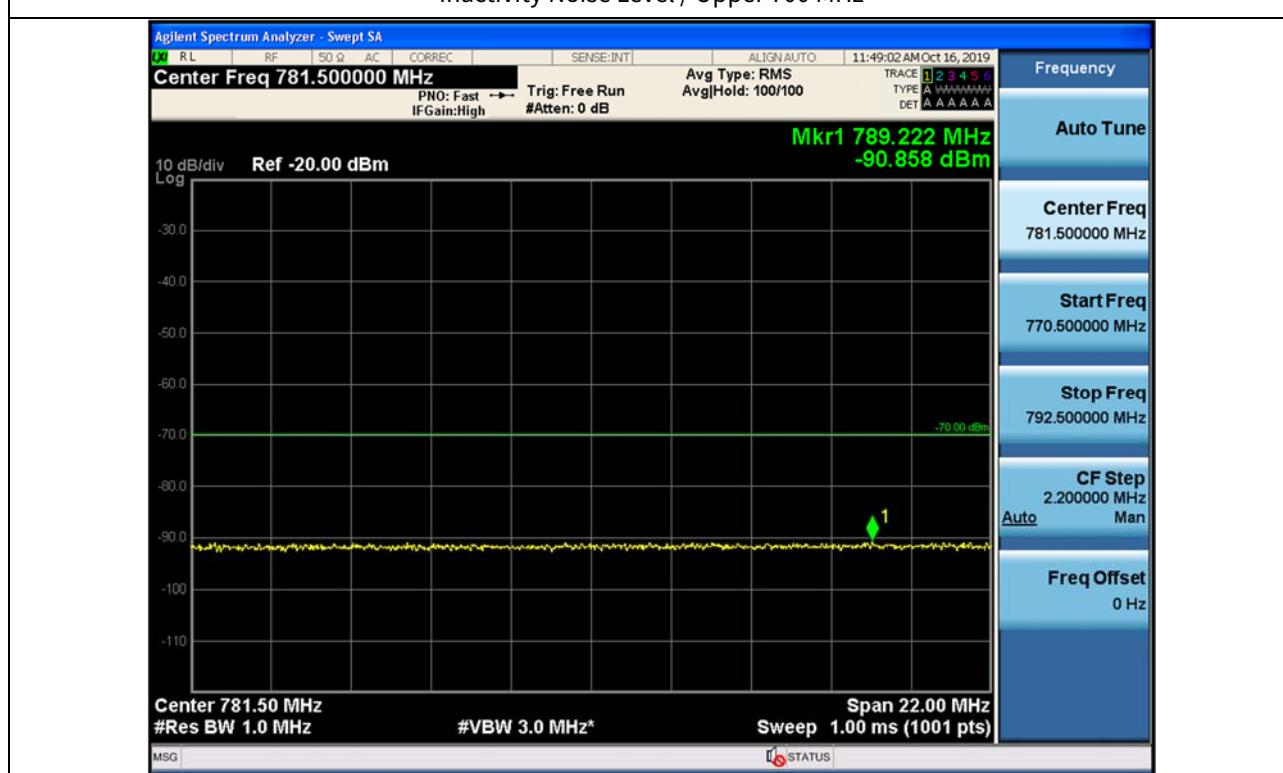


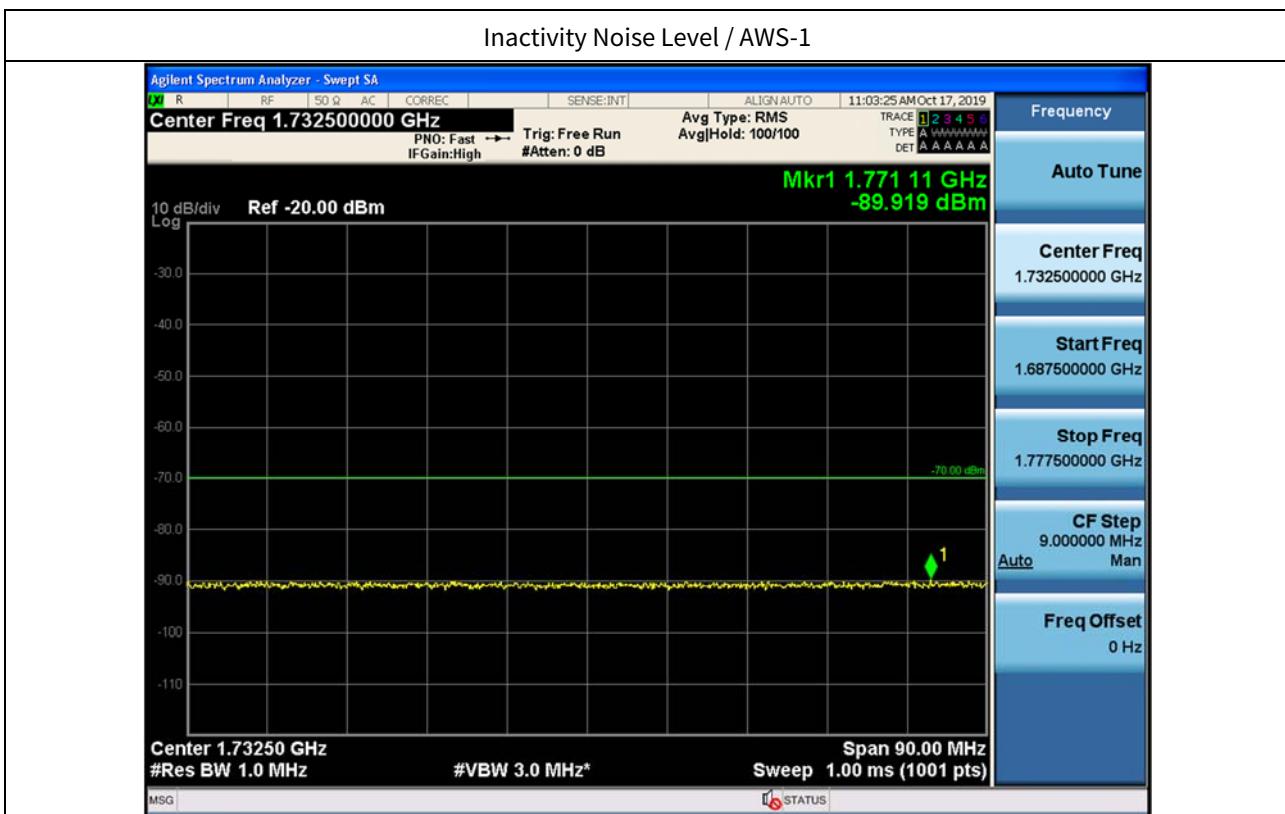
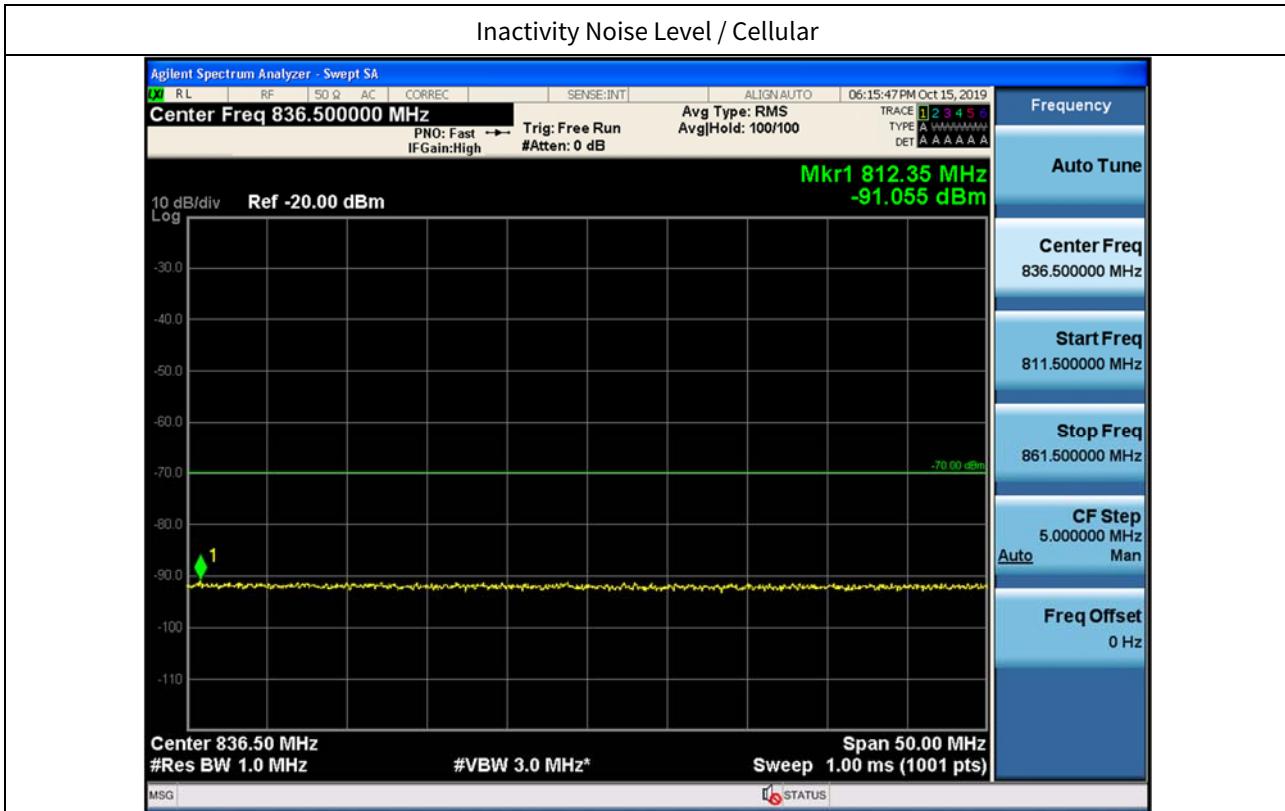
## Plot data of Inactivity Noise Level

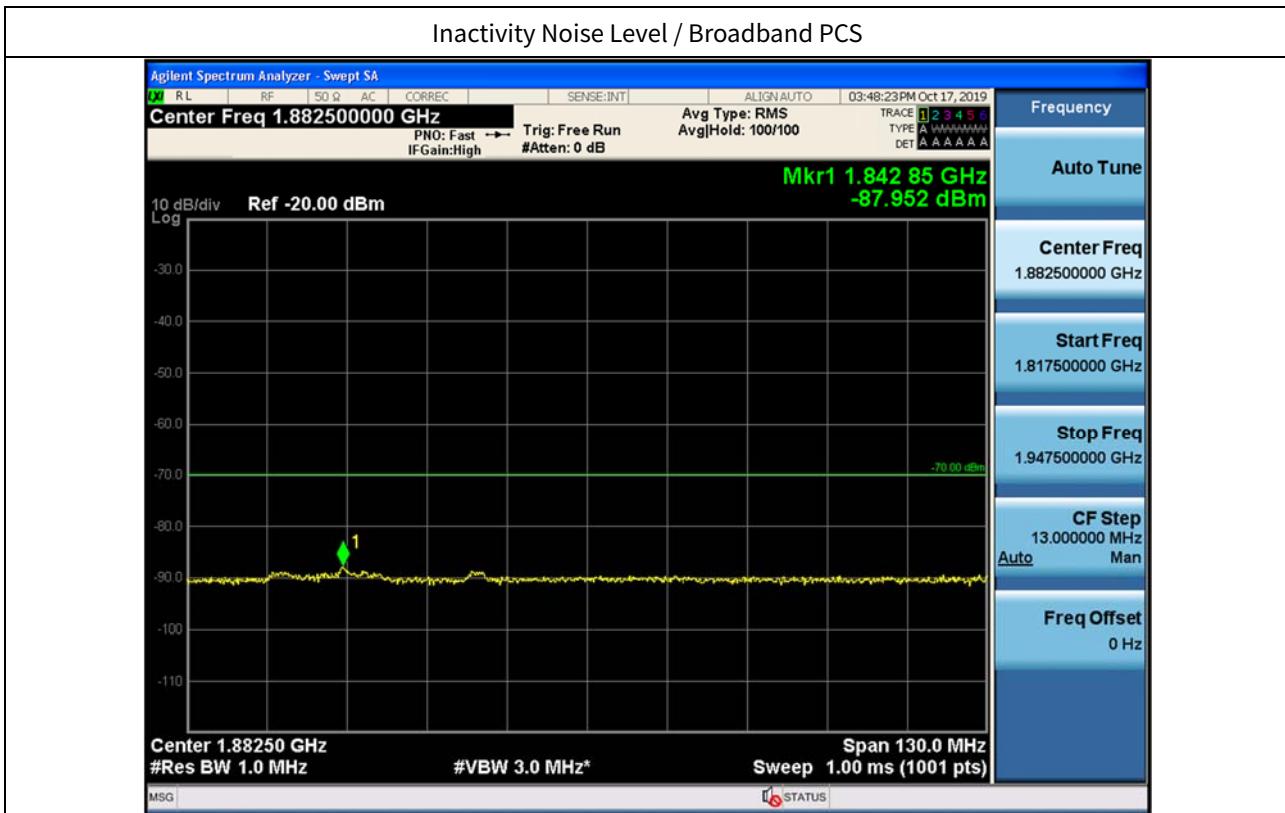
Inactivity Noise Level / Lower 700 MHz



Inactivity Noise Level / Upper 700 MHz







## 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  $-34 \text{ dB} - \text{RSSI} + \text{MSCL}$ .

- (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  $6.5 \text{ dB} + 20 \log_{10}(\text{Frequency})$
- (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  $-70 \text{ dBm/MHz}$  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  $\geq$  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  $\geq (2 \times \text{span})/\text{RBW}$ .
- 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  $-90 \text{ dBm}$  to  $-20 \text{ dBm}$ , 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.

$$L_p = 20 \times \log(Uplink Band the Lowest frequency) + 20 \times \log( Distance ) - 27.5$$
$$MSCL = L_p - Antenna gain + Cable loss$$

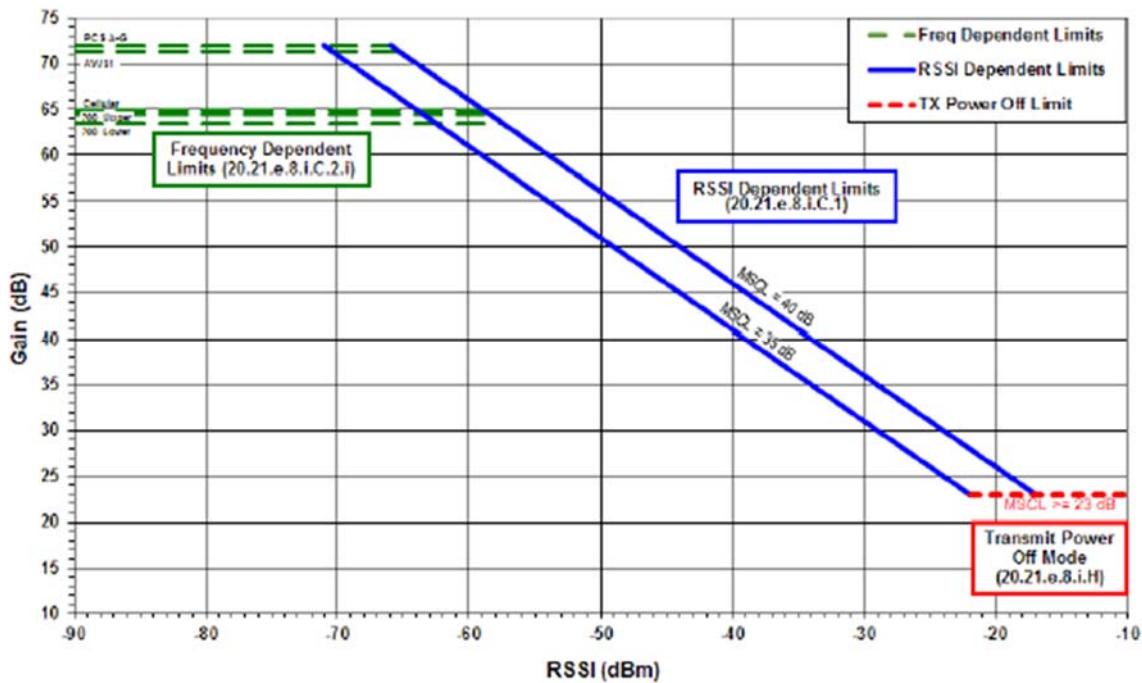
Frequency (MHz)	Server Ant. Gain (dBi)	Sever Cable Loss (dB)	Distance (m)	$L_p$	MSCL
704	4.27	2.160	2	35.472	33.362
776	4.84	2.225	2	36.318	33.703
824	6.38	2.225	2	36.839	32.684
1710	10.15	2.815	2	43.181	35.846
1850	10.09	3.060	2	43.864	36.834

\* 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.

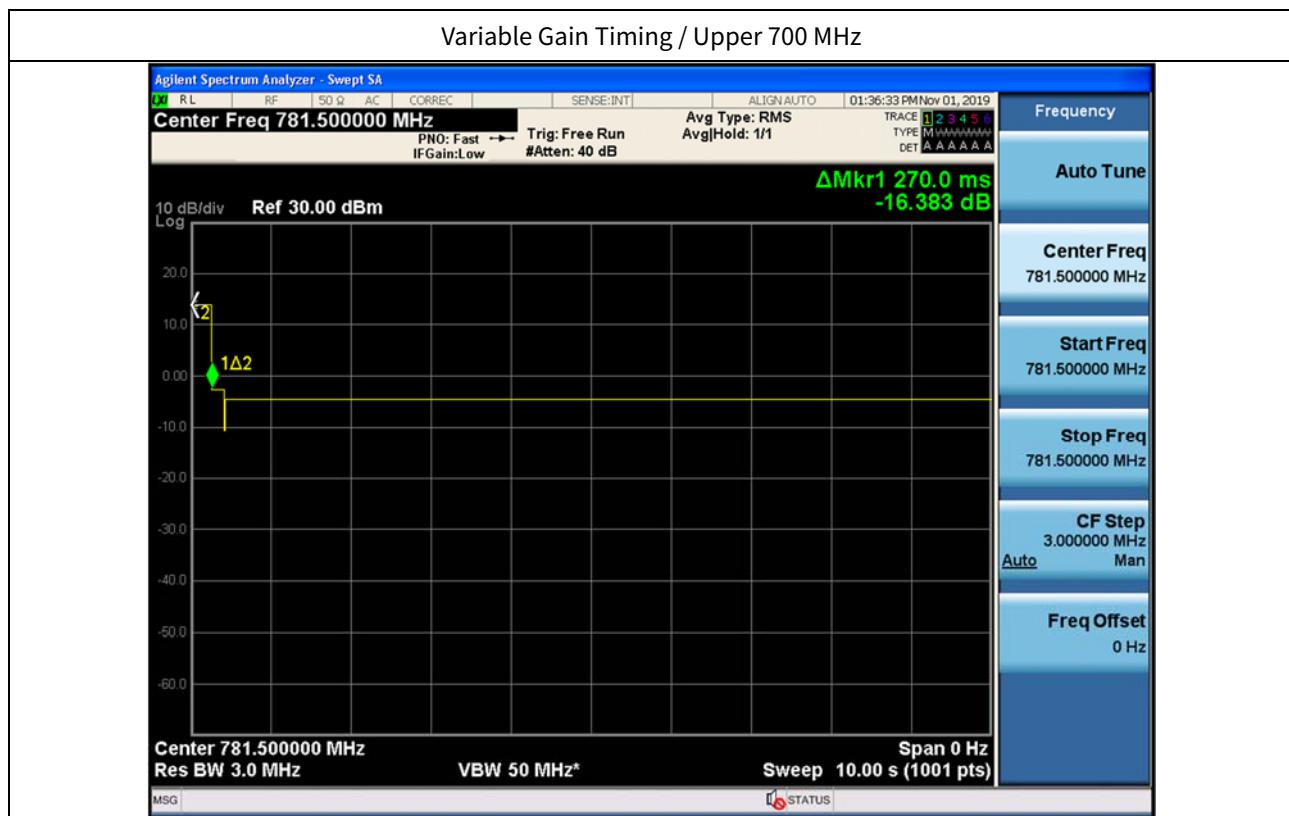
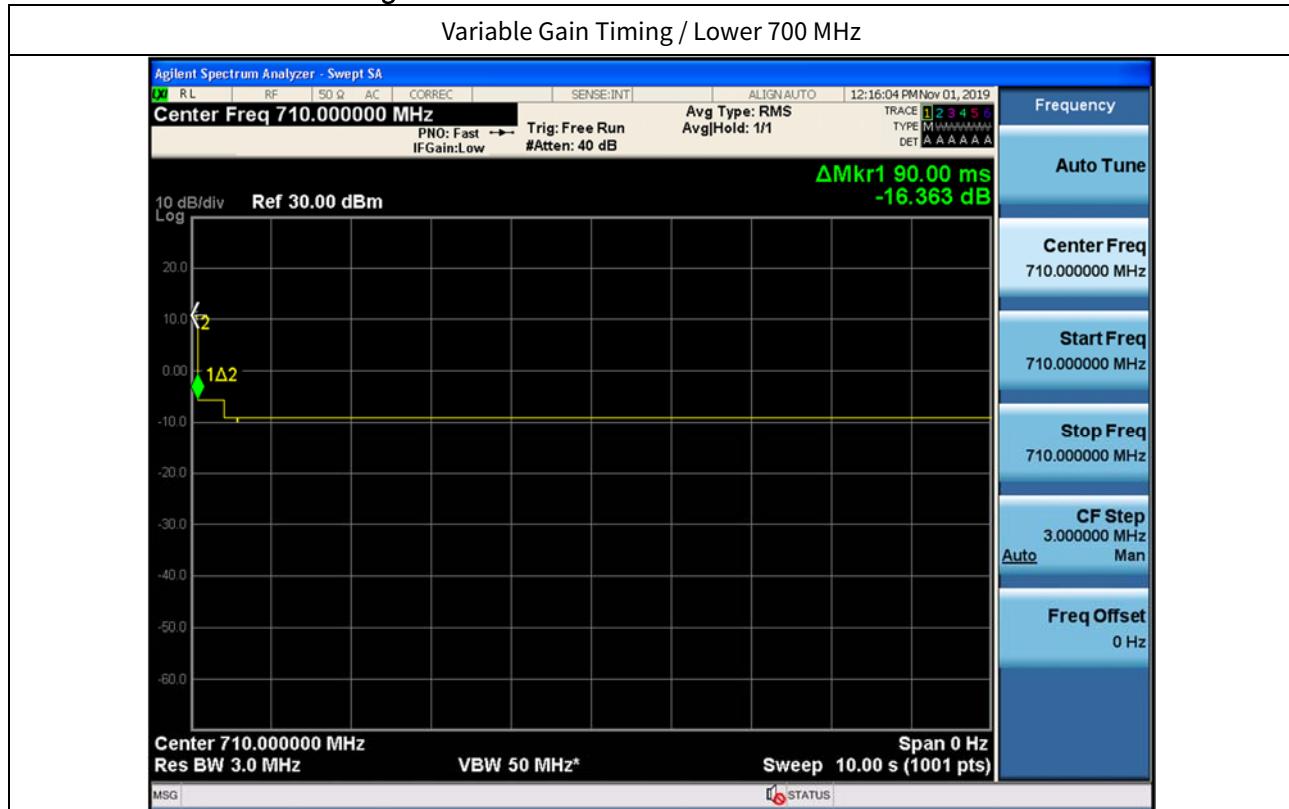


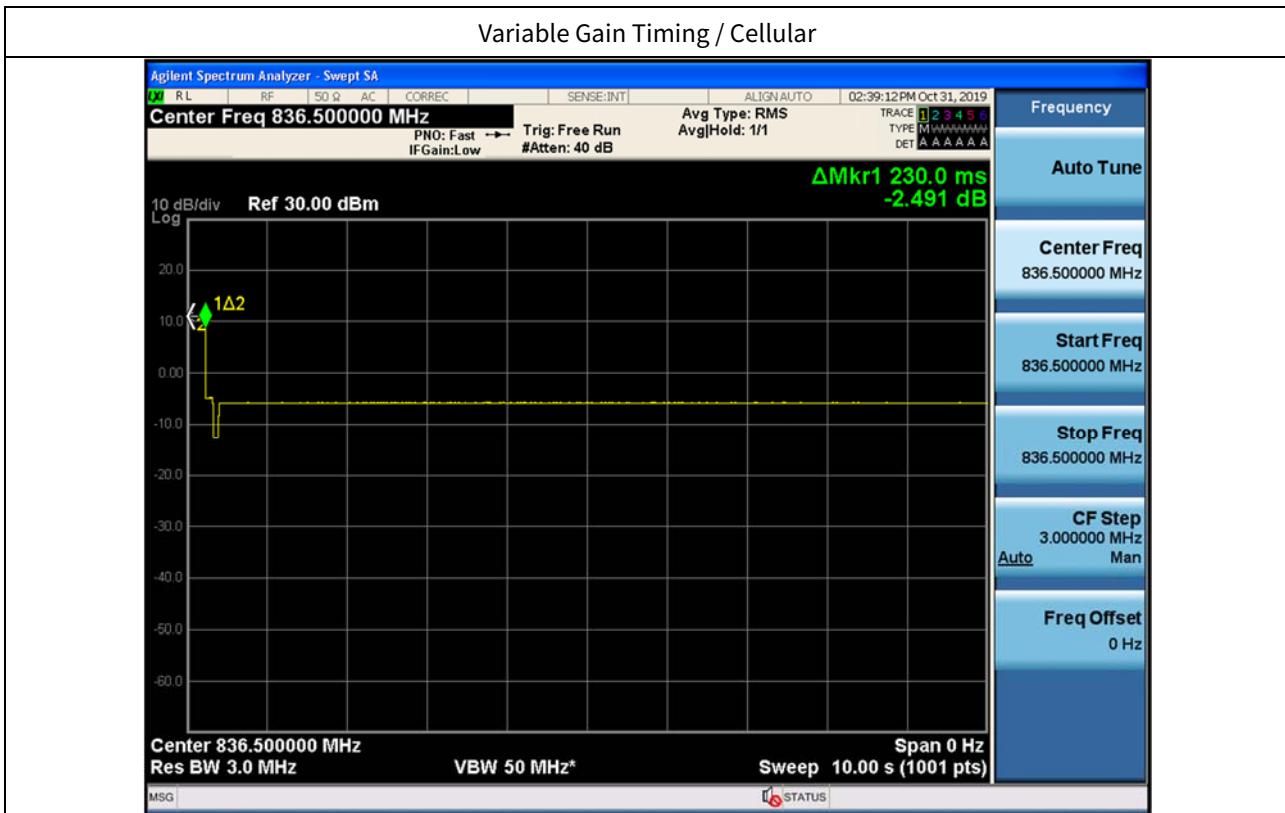
**Test Result:**
**Tabulated Result of Variable Booster Gain**

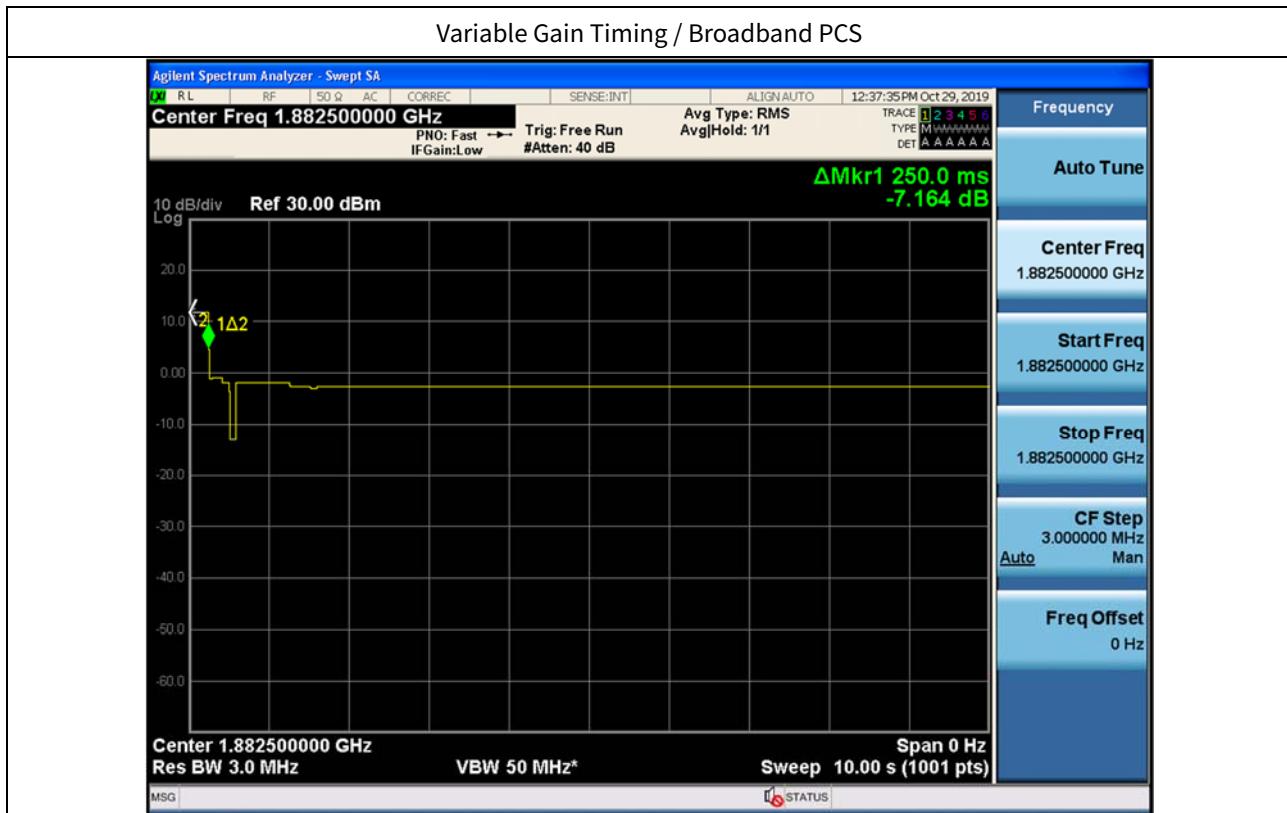
Band	MSCL	RSSI (dBm)	Input Power (dBm)	Output Power (dBm)	Limit (dB)	Variable Gain (dB)
Lower 700 MHz	38.202	-80	-47.70	12.83	63.53	60.53
		-39		-12.22	38.53	35.48
		-70		12.77	63.53	60.47
		-90		12.72	63.53	60.42
		-41		-10.63	40.53	37.07
		-45		-6.65	44.53	41.05
Upper 700 MHz	39.228	-38	-46.88	-9.90	37.36	36.98
		-40		-8.33	39.36	38.55
		-43		-5.39	42.36	41.49
		-39		-9.40	38.36	37.48
		-46		-2.40	45.36	44.48
		-44		-4.45	43.36	42.43
Cellular	38.209	-38	-46.30	-11.54	36.95	34.76
		-45		-5.47	43.95	40.83
		-47		-3.48	45.95	42.82
		-39		-11.49	37.95	34.81
		-41		-9.49	39.95	36.81
		-40		-10.52	38.95	35.78
AWS-1	43.557	-52	-52.10	2.06	54.27	54.16
		-53		3.02	55.27	55.12
		-44		-6.00	46.27	46.10
		-56		5.94	58.27	58.04
		-48		-2.08	50.27	50.02
		-54		3.91	56.27	56.01
Broadband PCS	44.736	-49	-51.10	-0.59	51.99	50.51
		-41		-8.68	43.99	42.42
		-39		-10.69	41.99	40.41
		-48		-1.69	50.99	49.41
		-46		-3.76	48.99	47.34
		-45		-4.76	47.99	46.34

**Tabulated Result of Variable Gain Timing**

Band	Frequency (MHz)	Limit (ms)	Gain Timing (ms)
Lower 700 MHz	710.00	3 000	160.00
Upper 700 MHz	781.50		210.00
Cellular	836.50		210.00
AWS-1	1 732.50		160.00
Broadband PCS	1 882.50		240.00

**Plot data of Variable Gain Timing**






## 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  $\geq 3 \times$  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	241.20	245.41	1.75
Upper 700 MHz		781.500	242.11	243.70	0.66
Cellular		836.500	242.26	242.26	0.00
AWS-1		1 732.500	241.34	241.59	0.10
Broadband PCS		1 882.500	242.20	241.26	-0.39
Band	Signal	Frequency (MHz)	Input OBW (MHz)	Output OBW (MHz)	Comparison (%)
Lower 700 MHz	CDMA	710.000	1.2579	1.2581	0.01
Upper 700 MHz		781.500	1.2613	1.2549	-0.51
Cellular		836.500	1.2607	1.2588	-0.15
AWS-1		1 732.500	1.2612	1.2568	-0.35
Broadband PCS		1 882.500	1.2669	1.2588	-0.64
Lower 700 MHz	WCDMA	710.000	4.1806	4.1882	0.18
Upper 700 MHz		781.500	4.2218	4.1385	-1.97
Cellular		836.500	4.1917	4.1774	-0.34
AWS-1		1 732.500	4.2697	4.2035	-1.55
Broadband PCS		1 882.500	4.2146	4.1908	-0.56

**Tabulated Result of Downlink Occupied Bandwidth**

Band	Signal	Frequency (MHz)	Input OBW (kHz)	Output OBW (kHz)	Comparison (%)
Lower 700 MHz	GSM	740.000	242.42	241.43	-0.41
Upper 700 MHz		751.500	242.66	242.52	-0.06
Cellular		881.500	243.32	241.89	-0.59
AWS-1		2 132.500	244.96	242.85	-0.86
Broadband PCS		1 962.500	243.86	241.63	-0.91
Band	Signal	Frequency (MHz)	Input OBW (MHz)	Output OBW (MHz)	Comparison (%)
Lower 700 MHz	CDMA	740.000	1.2672	1.26	-0.66
Upper 700 MHz		751.500	1.2652	1.27	0.15
Cellular		881.500	1.2630	1.2605	-0.20
AWS-1		2 132.500	1.2761	1.2605	-1.23
Broadband PCS		1 962.500	1.2707	1.2605	-0.81
Lower 700 MHz	WCDMA	740.000	4.2393	4.1538	-2.02
Upper 700 MHz		751.500	4.2307	4.2041	-0.63
Cellular		881.500	4.2496	4.1693	-1.89
AWS-1		2 132.500	4.2176	4.1950	-0.54
Broadband PCS		1 962.500	4.1958	4.1982	0.06