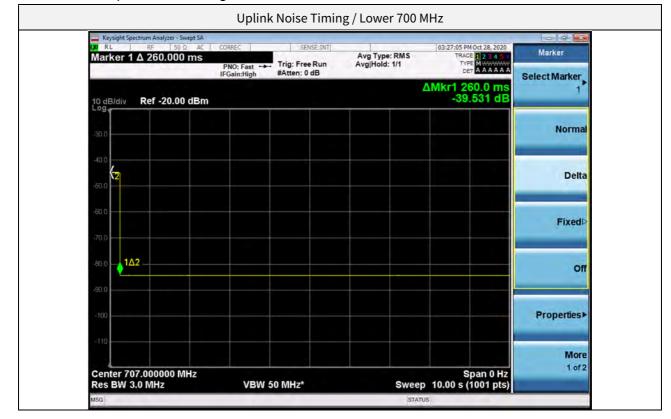




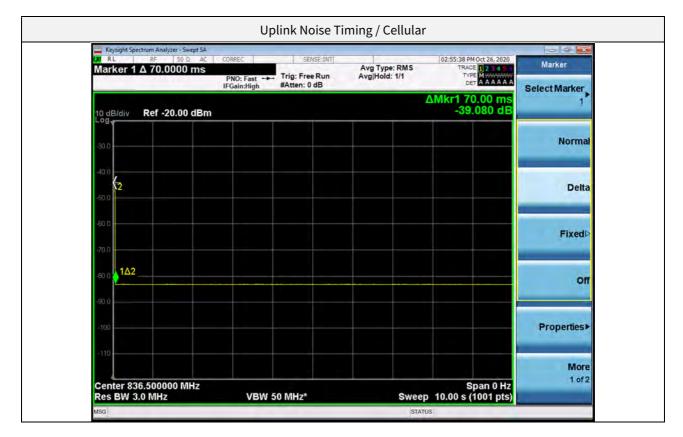
# Plot data of Variable Uplink Noise Timing



Keysight Spectrum Analyzer - Swept SA W RL RF 50 SP AC Center Freq 781.500000	CORREC SENSE:INT MHZ PNO: Fast IFGain:High #Atten: 0 dB	Avg Type: RMS Avg Hold: 1/1	07:08:59 PM Oct 28, 2020 TRACE 2 2 3 4 5 5 TYPE M MANAGE DET A A A A A A	Frequency
10 dB/div Ref -20.00 dBm			ΔMkr1 250.0 ms -6.710 dB	Auto Tune
-30.0				Center Freq 781.500000 MHz
-40.0 -50.0 <b>1∆2</b>				Start Freq 781.500000 MHz
-60.0 -70.0				Stop Freq 781.500000 MHz
-80.0				CF Step 3.000000 MHz Auto Man
-100				Freq Offset 0 Hz
-110				Scale Type







Keysight Spectrum Analyzer - Swept SA	CORREC SENSE:INT	1	04:12:12 PM Oct 16, 2020	6
Center Freq 1.732500000 C	PNO: Fast Trig: Free Run	Avg Type: RMS Avg Hold: 1/1		Frequency
	IFGain:High #Atten: 0 dB	-	kr1 600.0 ms	Auto Tune
10 dB/div Ref -20.00 dBm			-2.333 dB	
102				Center Freq
-30.0				1.732500000 GHz
-40.0				Start Freq
-50.0				1.732500000 GHz
-60.0				-
-00,0				Stop Freq 1.732500000 GHz
-70.0				
-80.0				CF Step 3.000000 MHz
-90.0				<u>Auto</u> Man
100				Freq Offset
-100				0 Hz
-110				Scale Type
Center 1.732500000 GHz			Span 0 Hz	Log Lin





Keysight Spectrum Analyzer - Swept SA	CORREC SENSE:INT		100000000000000000000000000000000000000	
Center Freq 1.88250000		Avg Type: RMS Avg Hold: 1/1	12:30:01 PM Oct 16, 2020 TRACE 1 2 3 4 5 0 TYPE M	Frequency
10 dB/div Ref -20.00 dBn	1	Δ	Mkr1 450.0 ms -15.170 dB	Auto Tune
-30.0				Center Freq 1.882500000 GHz
-40.0 -50.0				Start Freq 1.882500000 GHz
-60.0				Stop Freq 1.882500000 GHz
-80.0				CF Step 3.000000 MHz <u>Auto</u> Man
-100				Freq Offset 0 Hz
-110				Scale Type
Center 1.882500000 GHz Res BW 3.0 MHz	VBW 50 MHz*	Surces	Span 0 Hz 10.00 s (1001 pts)	Log <u>Lin</u>





# **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 dBm/MHz.

## **Test Procedures:**

Measurements were in accordance with the test methods section 7.8 of KDB 935210 D03 v04r04.

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 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	707.00		293.00
Upper 700 MHz	781.50		293.00
Cellular	836.50	300	291.40
AWS-1	1 732.50		274.90
Broadband PCS	1 882.50		271.60

# Tabulated Result of Uplink Inactivity Noise

Band	Frequency (MHz)	Noise Limit (dBm/MHz)	Noise Level (dBm/MHz)
Lower 700 MHz	722.52		-91.66
Upper 700 MHz	777.45		-90.97
Cellular	847.10	-70	-90.94
AWS-1	1 764.81		-89.81
Broadband PCS	1 947.11		-89.32





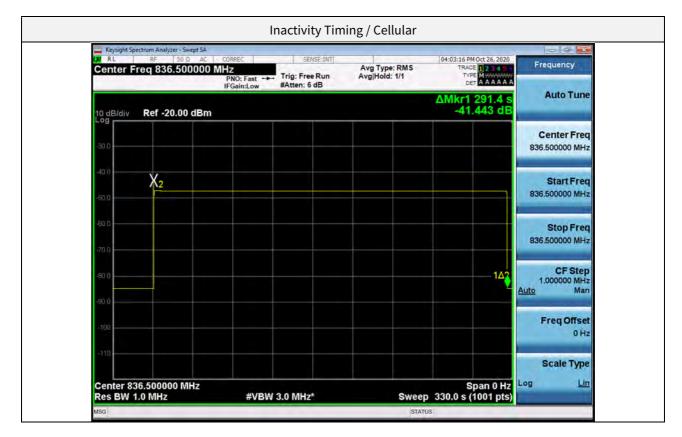
# Plot data of Inactivity timing



Keysight Spectrum Analyzer - Swept SA	connec I I objectivel	1	12.52.54.00.000.000	0 8 3
Marker 1 ∆ 293.040 s	PNO: Fast Trig: Free Run IFGain:Low #Atten: 6 dB	Avg Type: RMS Avg Hold: 1/1	12:53:56 PM Oct 29, 2020 TRACE 1 2 3 4 5 0 TYPE MULTING DET A A A A A A	Marker Select Marker
10 dB/div Ref -20.00 dBm			ΔMkr1 293.0 s -33.570 dB	Select Marker
-30.0				Normal
-40.0				Delta
-50.0 X2				
-70.0				Fixed
-60.0				Off
-100				Properties►
-110				More
Center 781.500000 MHz			Span 0 Hz	1 of 2







Keysight Spectrum Analyzer - Swept SA           Keysight Spectrum Analyzer - Swept SA           Keysight Spectrum Analyzer - Swept SA           Keysight Spectrum Analyzer - Swept SA	CORREC SENSE:INT		04:20:43 PM Oct 16, 2020	Marker
Marker 1 ∆ 274.850 s	PNO: Fast Trig: Free Run IFGain:Low #Atten: 6 dB	Avg Type: RMS Avg Hold: 1/1	TRACE 1 2 3 4 5 6 TYPE M	Select Marker
10 dB/div Ref -20.00 dBm			ΔMkr1 274.9 s -38.763 dB	1
30.0				Norma
-40.0 -50.0				Delta
-60 Ó				Fixed
-80.0			1Δ2	Off
-100				Properties
Center 1.732500000 GHz			Span 0 Hz	More 1 of 2



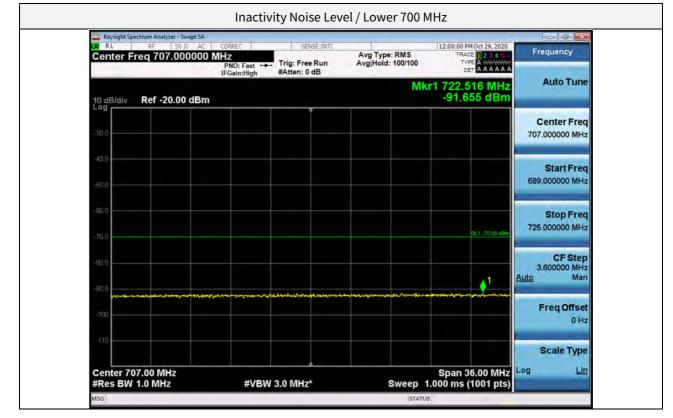


Keysight Spectrum Analyzer - Swept SA				00
Center Freq 1.882500000 (	CORREC SENSE:INT GHZ PNO: Fast Trig: Free Run IFGain:Low #Atten: 6 dB	Avg Type: RMS Avg Hold: 1/1	12:49:43 PM Oct 16, 2020 TRACE 1 2 3 4 5 0 TYPE M	Frequency
10 dB/div Ref -20.00 dBm			ΔMkr1 271.6 s -42.943 dB	Auto Tune
-30.0				Center Freq 1.882500000 GHz
-40.0 X2				Start Freq 1.882500000 GHz
-6a û				Stop Freq 1.882500000 GHz
-90.0			1Δ2	CF Step 1.000000 MHz Auto Man
-90.0				Freq Offset 0 Hz
-110				Scale Type
Center 1.882500000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz*		Span 0 Hz p 330.0 s (1001 pts)	Log Lin





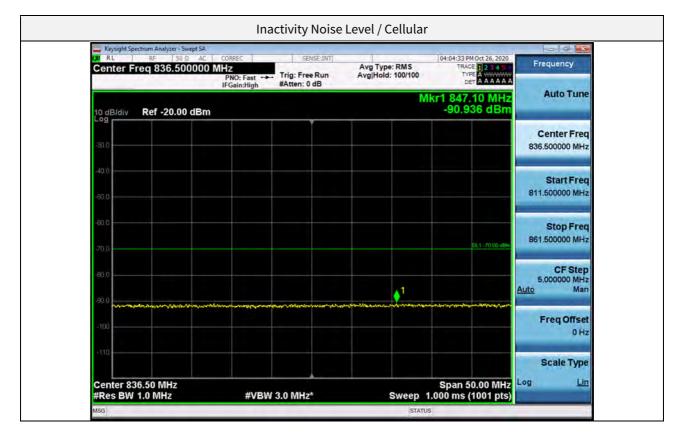
# Plot data of Inactivity Noise Level



Keysight Spectrum Analyzer - Swept SA	CORREC	SENSE:INT	1	12:54:17 PM Oct 29, 2020	00
Center Freq 781.500000		: Free Run	Avg Type: RMS Avg Hold: 100/100	TRACE 1 2 3 4 5 TYPE A	
10 dB/div Ref -20.00 dBm			Mk	r1 777.452 MHz -90.971 dBm	Auto Tune
-30.0		Ì			Center Freq 781.500000 MHz
-40.0					Start Freq 770.500000 MHz
-60.0				DL1 -70.00 dBm	Stop Freq 792.500000 MHz
-80.0	i.				CF Step 2.200000 MHz <u>Auto</u> Man
-90.0		-venter marten			Freq Offset 0 Hz
-110					Scale Type







Keysight Spectrum Analyzer - Swept SA				00
Center Freq 1.732500000	CORREC SENSE:INT GHz PNO: Fast Trig: Free Run	Avg Type: RMS Avg Hold: 100/100	04:23:30 PM Oct 16, 2020 TRACE 2 2 4 5 5 TYPE A CONTRACT OF A A A A A A	Frequency
	IFGain:High #Atten: 0 dB			Auto Tune
10 dB/div Ref -20.00 dBm		MK	1 1.764 81 GHz -89.809 dBm	
				Center Freq
-30.0				1.732500000 GHz
-40.0				Start Freq
-50.0				1.687500000 GHz
-6a.á				Stop Freq
-70,0			DL1 -70.00 dBm	1.777500000 GHz
-80.0				CF Step
			<b>≬</b> 1	9.000000 MHz Auto Man
-90.0 material and a second se	the second s		water for a start of the start	Freq Offset
-100				0 Hz
-110				Scale Type
Center 1.73250 GHz			Span 90.00 MHz	





Keysight Spectrum Analyzer - Swept SA				0 6
Center Freq 1.882500000	CORREC SENSE:INT GHZ PNO: Fast Trig: Free Run IFGain:High #Atten: 0 dB	Avg Type: RMS Avg Hold: 100/100	12:49:50 PM Oct 16, 2020 TRACE 1 2 3 4 5 0 TYPE A WAAAAA DET A A A A A A	Frequency
10 dB/div Ref -20.00 dBm		Mk	r1 1.947 11 GHz -89.316 dBm	Auto Tune
-30.0				Center Freq 1.882500000 GHz
-40.0				Start Freq 1.817500000 GHz
-60.0			DL1 -70 00 dBm	Stop Freq 1.947500000 GHz
-80.0			1	CF Step 13.000000 MHz Auto Man
-80.0	unaireann "nersinger ar an hair an	1999 (n. 1997 (n. 1997 (n. 1976 (n. 19		Freq Offset 0 Hz
-110				Scale Type
Center 1.88250 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz*	Cuiroan	Span 130.0 MHz 1.000 ms (1001 pts)	Log <u>Lin</u>



# **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.

# § 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 v04r04.

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  $\geq (2 \text{ x span})/\text{RBW}$ .
- 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 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 log10(f)) + MSCL) dBm, RSSI range: 6.5 + 20 log10(f) dB
- Limit in (-34 (6.5 + 20 log10(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 = Lp - Antenna gain + Cable loss

Frequency (MHz)	Server Ant. Gain (dBi)	Sever Cable Loss (dB)	Distance (m)	Lp	MSCL
698	5	2.53	2	35.398	32.928
776	5	2.73	2	36.318	34.048
824	5	2.73	2	36.839	34.569
1710	5	4.13	2	43.181	42.311
1850	5	4.33	2	43.864	43.194

\* 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.



CUSTOMER SECRET

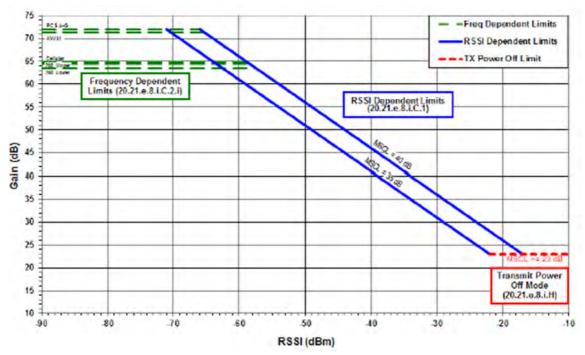
비

밀

객

ъ





34.048	-42		-2.27	42.36	42.29
	-43		-2.35	43.36	42.21
24.040	-44	-44.56 -44.00 -49.80	-2.31	44.36	42.25
34.048	-45	-44.56	-2.03	44.36         45.36         49.36         51.36         40.95         41.95         42.95         54.95         46.95         52.95         56.27         71.27         71.27         71.27         61.27         57.99         65.99         65.99         64.99         56.99         56.99         56.99	42.53
	-49		1.95		46.51
	-51		3.76		48.32
	-40		-1.20	40.95	39.80
	-41		-1.24	2.31 $44.36$ $42$ $2.03$ $45.36$ $42$ $1.95$ $49.36$ $46$ $3.76$ $51.36$ $48$ $1.20$ $40.95$ $39$ $1.24$ $41.95$ $39$ $0.28$ $42.95$ $40$ $1.33$ $54.95$ $52$ $3.27$ $46.95$ $44$ $9.26$ $52.95$ $50$ $3.64$ $56.27$ $52$ $8.42$ $71.27$ $67$ $8.38$ $71.27$ $67$ $8.28$ $71.27$ $67$ $8.28$ $71.27$ $67$ $8.28$ $71.27$ $67$ $8.34$ $68.99$ $66$ $4.29$ $64.99$ $62$ $6.22$ $56.99$ $54$	39.76
24 5 60	-42	44.00	-0.28		40.72
34.369	-54	-44.00	11.33		52.33
	-46		3.27		44.27
	-52		9.26		50.26
	-48		3.64	56.27	52.64
	-80		18.42	71.27	67.42
42 211	-90		18.38	71.27	67.38
42.311	-70	-49.80	18.28	33       45.36         5       49.36         6       51.36         60       40.95         20       40.95         24       41.95         28       42.95         33       54.95         7       46.95         6       52.95         4       56.27         42       71.27         38       71.27         28       71.27         0       57.27         0       61.27         6       52.99         34       65.99         34       68.99         29       64.99         2       56.99         1       58.99	67.28
	-49		3.60	57.27	52.60
	-53		7.40	44.36       42.         45.36       42.         49.36       46.         51.36       48.         40.95       39.         41.95       39.         42.95       40.         54.95       52.         46.95       44.         52.95       50.         56.27       52.         71.27       67.         71.27       67.         71.27       67.         57.27       52.         61.27       56.         52.99       50.         61.27       56.         52.99       50.         61.27       56.         52.99       50.         63.99       63.         64.99       62.         56.99       54.         58.99       56.	56.40
	-44		2.86	52.99	50.86
	-57		15.34	44.36         45.36         49.36         51.36         40.95         41.95         42.95         54.95         46.95         52.95         56.27         71.27         71.27         71.27         61.27         52.99         65.99         68.99         64.99         56.99         58.99	63.34
42.104	-60	47.00	18.34	68.99	66.34
43.194	-56	-47.00	14.29	2.03       45.36         1.95       49.36         3.76       51.36         1.20       40.95         1.24       41.95         0.28       42.95         1.33       54.95         3.27       46.95         9.26       52.95         3.64       56.27         8.42       71.27         8.38       71.27         8.38       71.27         3.60       57.27         7.40       61.27         2.86       52.99         5.34       65.99         8.34       68.99         4.29       64.99         6.22       56.99	62.29
	-48		6.22	56.99	54.22
	-50		3.7651.36-1.2040.95-1.2441.95-0.2842.9511.3354.953.2746.959.2652.953.6456.2718.4271.2718.3871.2718.2871.273.6057.277.4061.272.8652.9915.3465.9914.2964.996.2256.99	56.21	

Input Power

(dBm)

-40.8

# **Test Result:**

Band

Lower

700 MHz

Upper 700 MHz

Cellular

AWS-1

Broadband PCS

# **Tabulated Result of Variable Booster Gain**

MSCL

32.928

RSSI (dBm)

-41

-51

-45

-42

-53

-49

**Output Power** 

(dBm)

-7.61

1.55

-4.56

-7.60

3.35

-0.68

Report No. HCT-RF-2011-FC030

Limit

(dB)

39.49

49.49

43.49

40.49

51.49

47.49

밀

Variable Gain

(dB)

36.89

46.05

39.94

36.90

47.85

43.82





# Tabulated Result of Variable Gain Timing

Band	Frequency (MHz)	Limit (ms)	Gain Timing (ms)
Lower 700 MHz	707.000		80
Upper 700 MHz	781.500		210
Cellular	836.500	1 000	460
AWS-1	1 732.500		280
Broadband PCS	1 882.500		760





# Plot data of Variable Gain Timing

Keysight Spectrum Analyzer - Swept SA	CORREC SENSE:INT		03:41:23 PM Oct 28, 2020	0 6 0
Center Freq 707.000000 M		Avg Type: RMS Avg Hold: 1/1	TRACE 2 3 4 5 0 TYPE MUSAN	
10 dB/div Ref 30.00 dBm		1	Mkr1 80.00 ms -53.918 dB	Auto Tune
20.0				Center Freq 707.000000 MHz
0.00				Start Freq 707.000000 MHz
-10.0				Stop Freq 707.000000 MHz
-20.0				CF Step 3.000000 MHz Auto Man
-40.0 1Δ2				Freq Offset
-60.0				0 Hz Scale Type
Center 707.000000 MHz Res BW 3.0 MHz	VBW 50 MHz*		Span 0 Hz 10.00 s (1001 pts)	Log <u>Lin</u>

Keysight Spectrum Analyzer - Swept SA				06 赵
Center Freq 781.500000 N	CORREC SENSE:INT PNO: Fast IFGain:Low #Atten: 40 dB	Avg Type: RMS Avg Hold: 1/1	07:43:18 PM Oct 28, 2020 TRACE 2 3 4 5 5 TYPE M	Frequency
10 dB/div Ref 30.00 dBm	PGain:Low Writen: 40 db		ΔMkr1 210.0 ms -4.183 dB	Auto Tune
Log				Center Freq
20.0				781.500000 MHz
10.0 102				Start Freq
0.00				781.500000 MHz
-10.0				Stop Freq 781,500000 MHz
-20.0				
-30.0				CF Step 3.000000 MHz Auto Man
-40.0				
-50.0				Freq Offset 0 Hz
-60.0				Scale Type
Center 781.500000 MHz			Span 0 Hz	1.0





Keysight Spectrum Analyzer - Swept SA					00
Marker 1 Δ 460.000 ms	PNO: Fast	SENSE:INT Trig: Free Run #Atten: 22 dB	Avg Type: RMS Avg Hold: 1/1	03:26:44 PM Oct 26, 2020 TRACE 2 3 4 5 0 TYPE M	Marker
10 dB/div Ref 12.00 dBm	IP Gam.LOW			ΔMkr1 460.0 ms -17.329 dB	Select Marker
2.00					Normal
-8.00					Delta
-18.0					Della
38.0					Fixed
-48.0					on
-68.0 1Δ2					Properties►
-76.0					Properdes
Center 836.500000 MHz				Span 0 Hz	More 1 of 2

Keysight Spectrum Analyzer - Swept SA				- 0 - ×
RL RF 50Ω AC	CORREC SENSE:INT	Avg Type: RMS	02:44:24 PM Oct 19, 2020 TRACE 1 2 3 4 5 6	Frequency
Center Freq 1.732500000	PNO: Fast Trig: Free Run	Avg Hold: 1/1	TYPE MWWWWWW	
	IFGain:Low #Atten: 40 dB	^	Mkr1 280.0 ms	Auto Tune
10 dB/div Ref 30.00 dBm			-15.234 dB	
Log				Center Freq
20.0		_		1.732500000 GHz
10.0 2				
				Start Freq
0.00				1.732500000 GHz
10.0				
410.01				Stop Freq 1.732500000 GHz
-20.0				1.752500000 6112
30.0				CF Step
50,0				3.000000 MHz Auto Man
-40.0				-
-50.0				Freq Offset
				0 Hz
-60.0				Scale Type
Center 1.732500000 GHz Res BW 3.0 MHz	VBW 50 MHz*		Span 0 Hz 10.00 s (1001 pts)	Log Lin





Keysight Spectrum Analyzer - Swept SA				0 6 ×	
		Avg Type: RMS Avg Hold: 1/1	01:34:26 PM Oct 16, 2020 TRACE 1 2 3 4 5 0 TYPE M WARNEY DET A A A A A A	Frequency	
10 dB/div Ref 30.00 dBm		Δ	Mkr1 760.0 ms -15.723 dB	Auto Tune	
20.0				Center Freq 1.882500000 GHz	
10.0 0.00 1Δ2				Start Freq 1.882500000 GHz	
-10.0				Stop Freq 1.882500000 GHz	
\$0.0				CF Step 3.000000 MHz Auto Man	
-40.0				Freq Offset	
-60 û				Scale Type	
Center 1.882500000 GHz Res BW 3.0 MHz	VBW 50 MHz*		Span 0 Hz 10.00 s (1001 pts)	Log <u>Lin</u>	



# **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 v04r04.

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

b) Set VBW  $\geq$  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 (-26 dB OBW)

Band	Signal	Frequency	Input OBW	Output OBW	Comparison
Band	Signal	(MHz)	(kHz)	(kHz)	(%)
Lower 700 MHz		707.000	242.84	243.24	0.17
Upper 700 MHz		781.500	243.82	243.33	-0.20
Cellular	GSM	836.500	243.62	242.88	-0.30
AWS-1		1 732.500	242.56	242.23	-0.14
Broadband PCS		1 882.500	243.76	241.91	-0.76
Dond	Cignal	Frequency	Input OBW	Output OBW	Comparison
Band	Signal	(MHz)	(MHz)	(MHz)	(%)
Lower 700 MHz		707.000	1.2379	1.2400	0.17
Upper 700 MHz		781.500	1.2366	1.2359	-0.06
Cellular	CDMA	836.500	1.2382	1.2386	0.03
AWS-1		1 732.500	1.2429	1.2383	-0.37
Broadband PCS		1 882.500	1.2432	1.2392	-0.32
Lower 700 MHz		710.000	4.1847	4.1995	0.35
Upper 700 MHz		781.500	4.1976	4.1862	-0.27
Cellular	WCDMA	836.500	4.1888	4.1876	-0.03
AWS-1		1 732.500	4.1878	4.1883	0.01
Broadband PCS		1 882.500	4.2141	4.2040	-0.24



# 고 객 비 밀 CUSTOMER SECRET

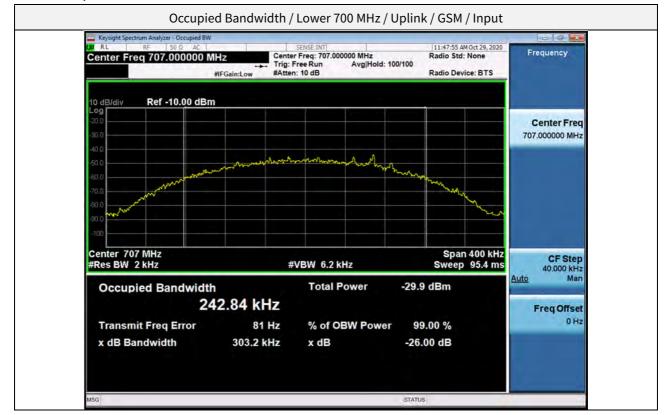
Report No. HCT-RF-2011-FC030

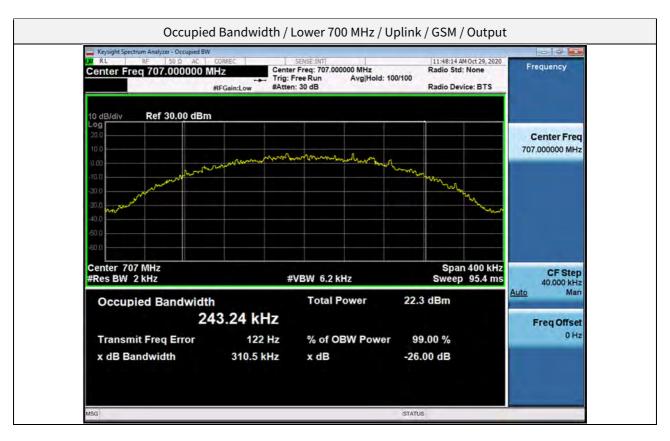
# Tabulated Result of Downlink Occupied Bandwidth (-26 dB OBW)

Band	Signal	Frequency	Input OBW	Output OBW	Comparison
		(MHz)	(kHz)	(kHz)	(%)
Lower 700 MHz		737.000	248.56	245.04	-1.42
Upper 700 MHz		751.500	249.74	243.89	-2.34
Cellular	GSM	881.500	247.37	243.36	-1.62
AWS-1		2132.500	249.23	243.85	-2.16
Broadband PCS		1962.500	246.27	248.59	0.94
David	Circul	Frequency	Input OBW	Output OBW	Comparison
Band	Signal	(MHz)	(MHz)	(MHz)	(%)
Lower 700 MHz		737.000	1.2640	1.2451	-1.49
Upper 700 MHz		751.500	1.2449	1.2442	-0.06
Cellular	CDMA	881.500	1.2626	1.2409	-1.72
AWS-1		2132.500	1.2941	1.2418	-4.04
Broadband PCS		1962.500	1.2584	1.2389	-1.55
Lower 700 MHz		737.000	4.3355	4.2746	-1.40
Upper 700 MHz		751.500	4.3317	4.2485	-1.92
Cellular	WCDMA	881.500	4.3433	4.1977	-3.35
AWS-1		2132.500	4.3709	4.2510	-2.74
Broadband PCS		1962.500	4.2490	4.2292	-0.47

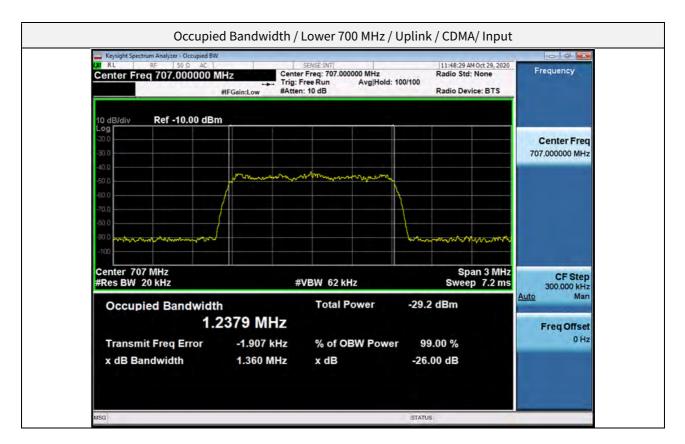


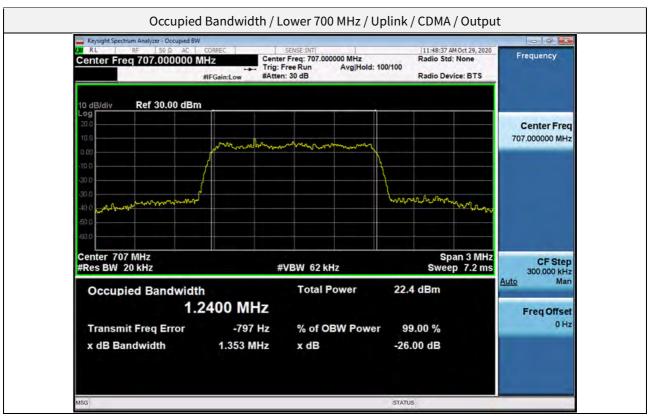
# Plot data of Occupied Bandwidth



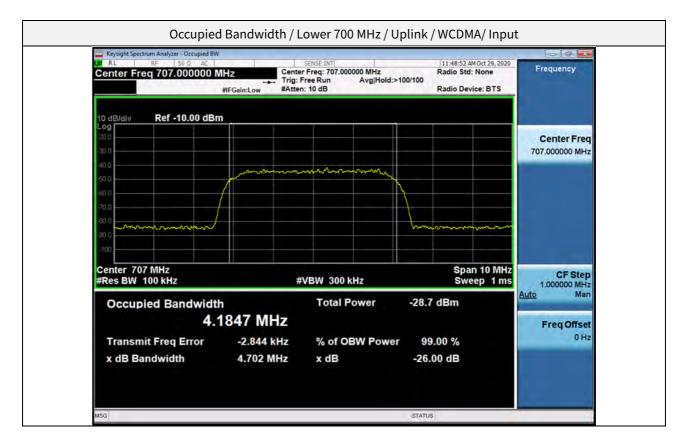


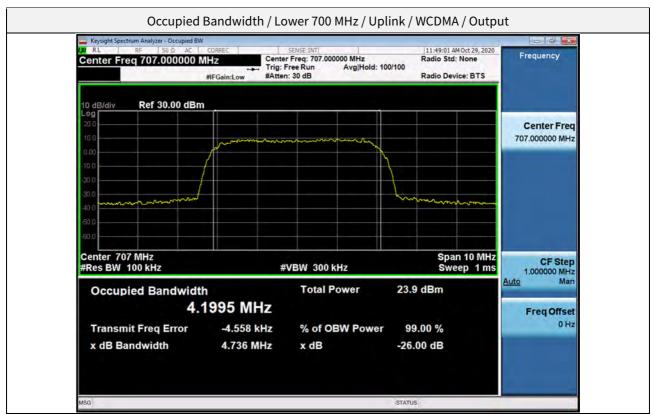






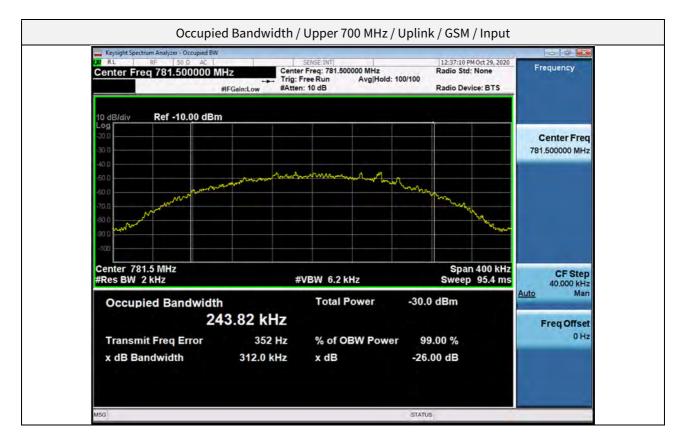


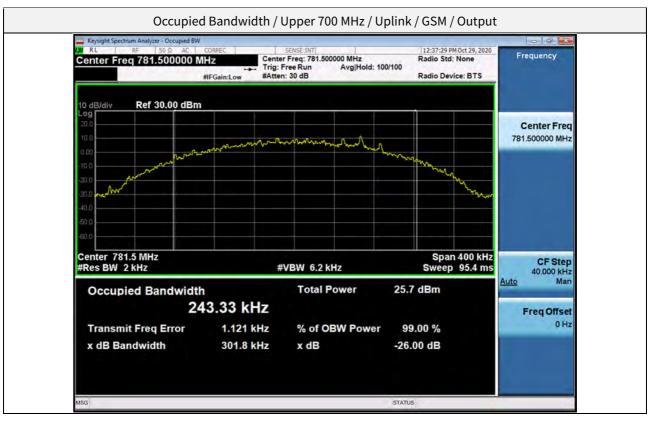




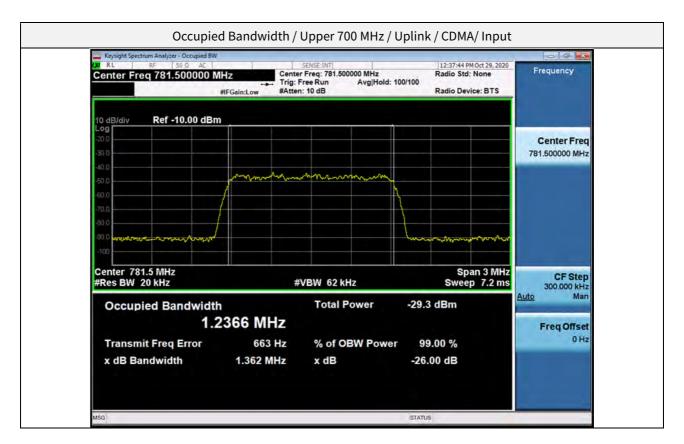


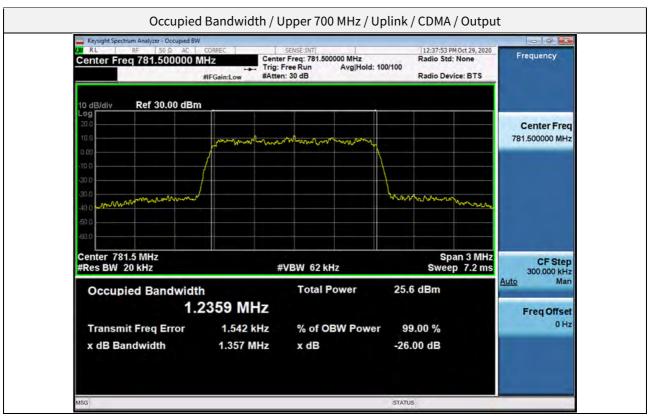




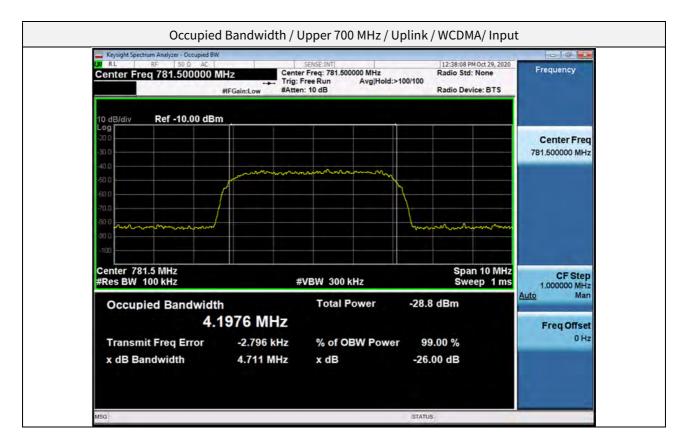


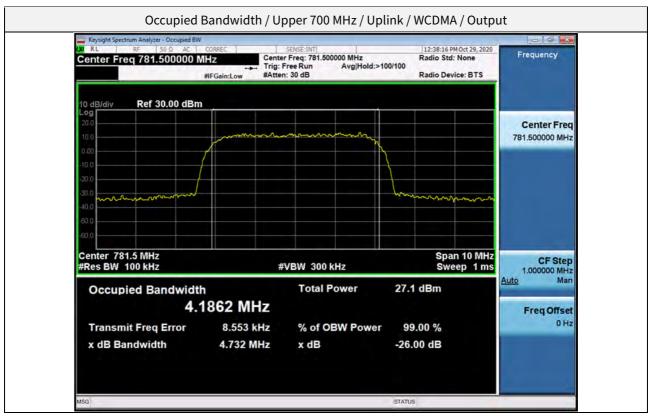






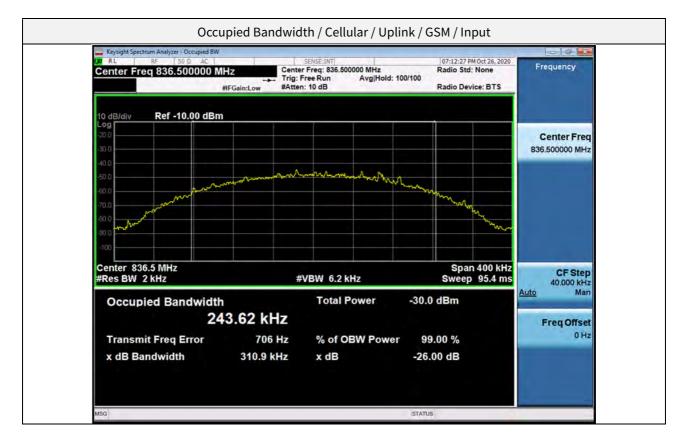


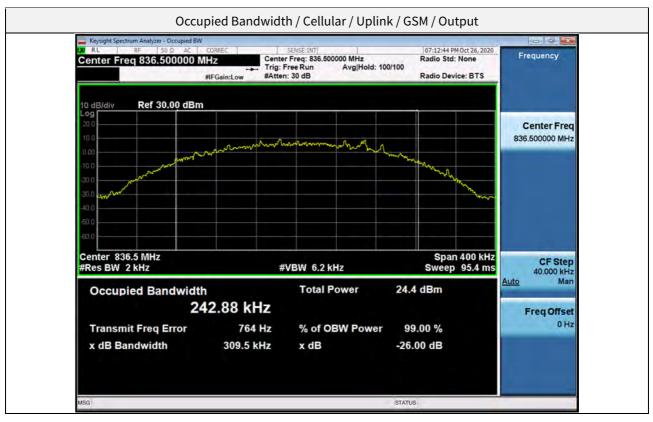






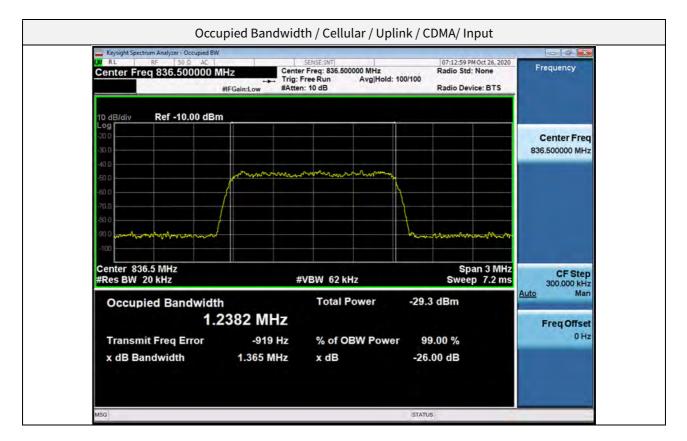


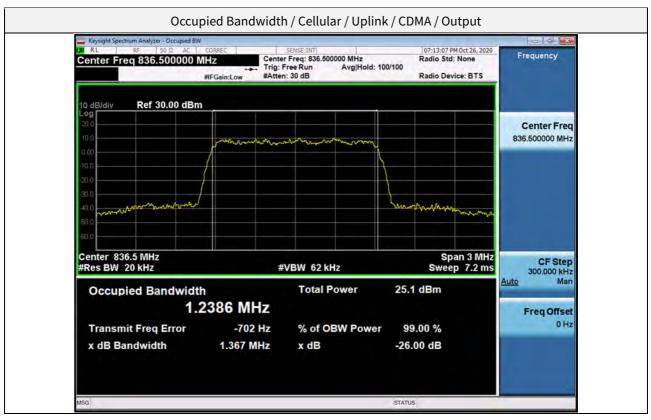




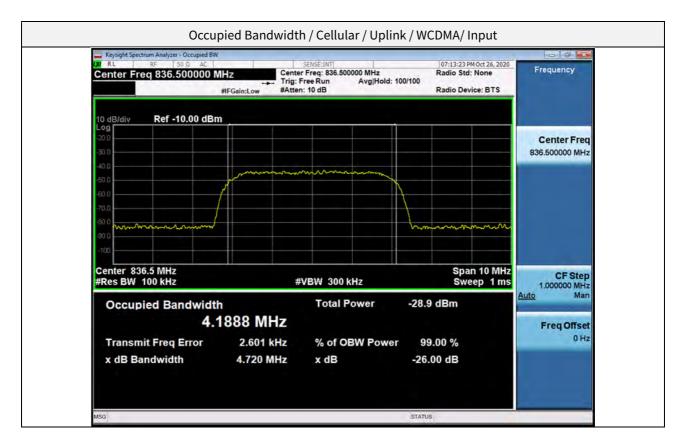


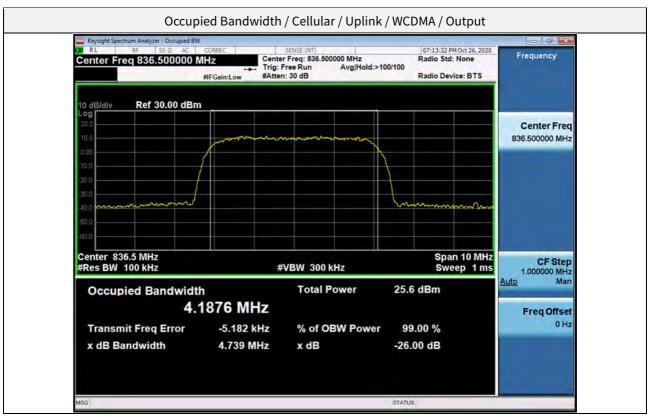






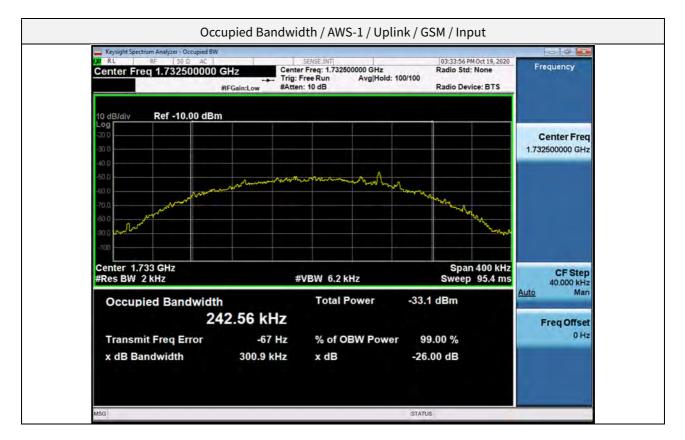


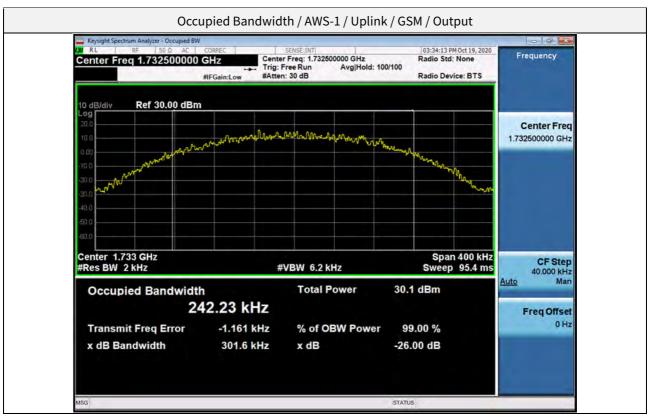






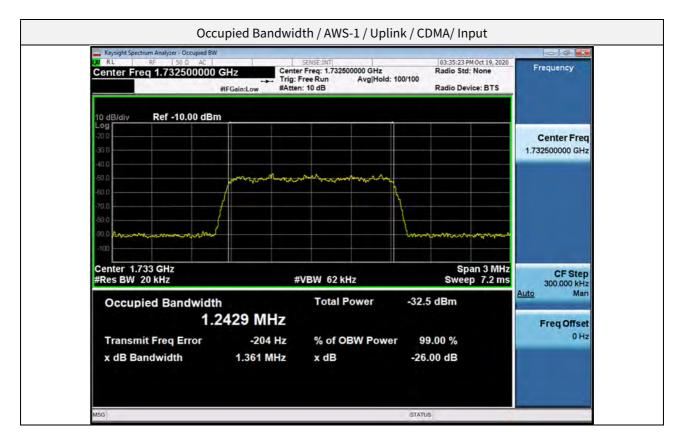


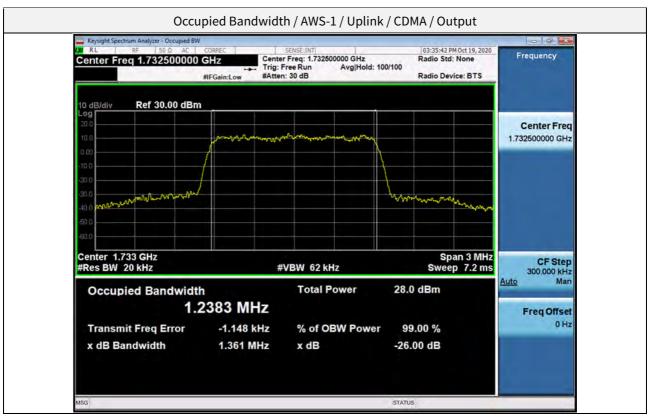






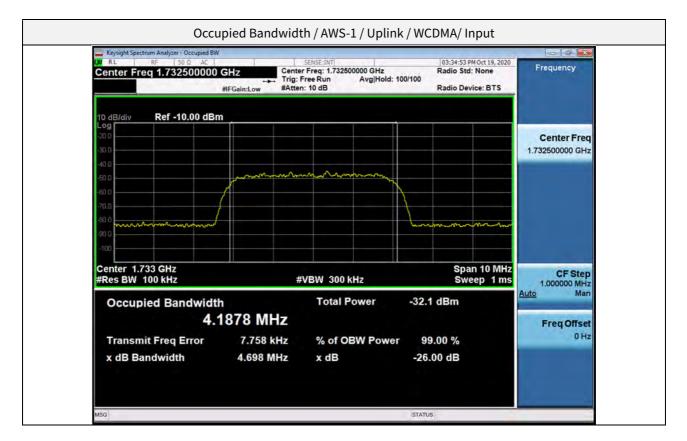


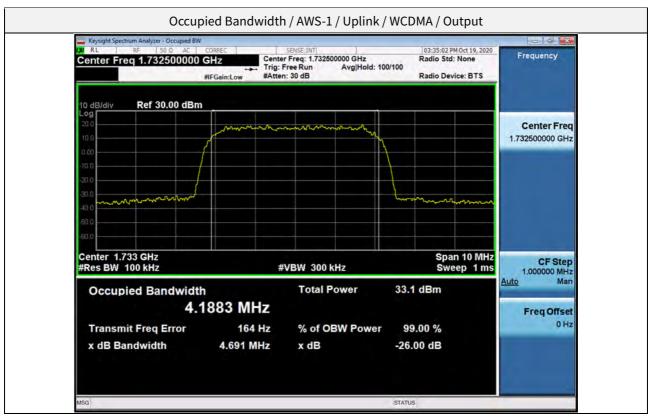




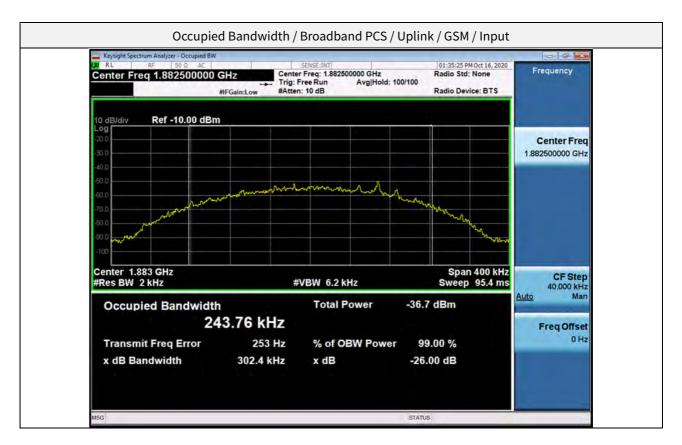


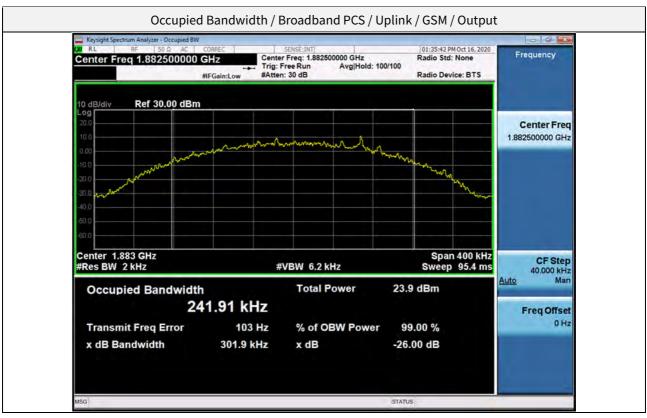




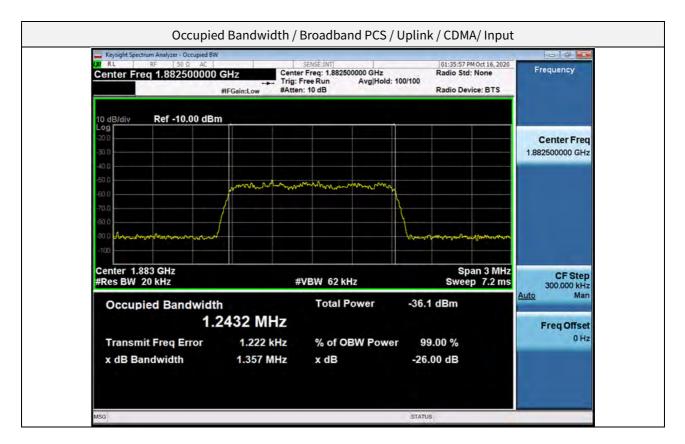


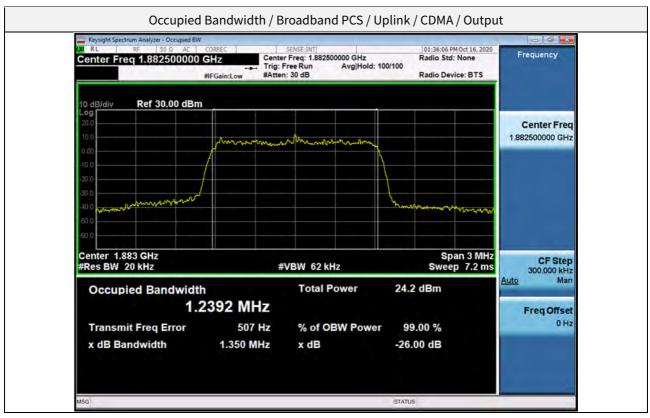




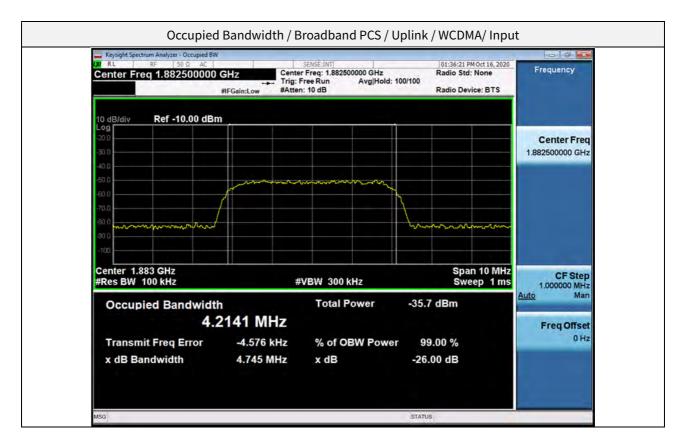


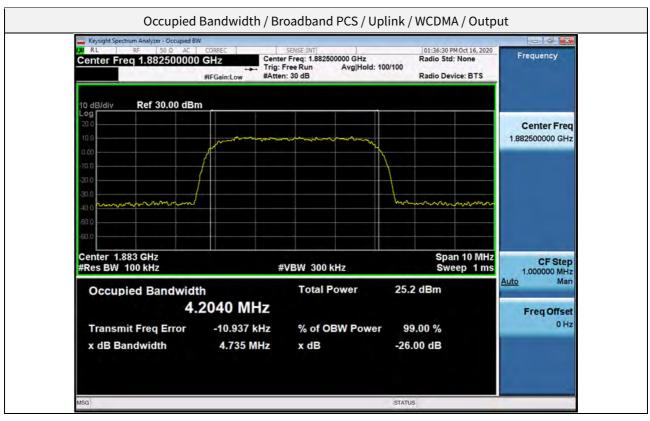




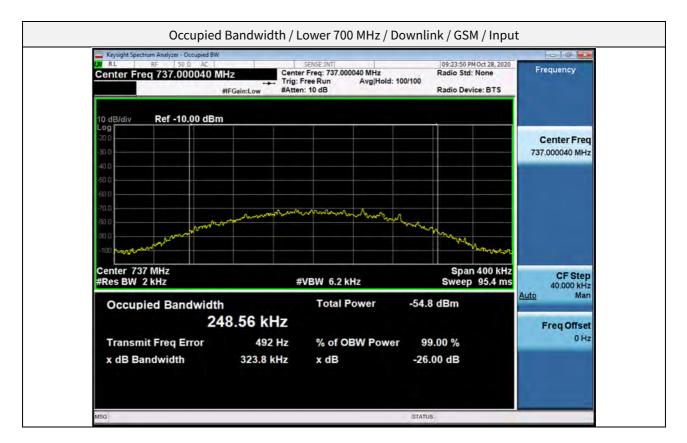


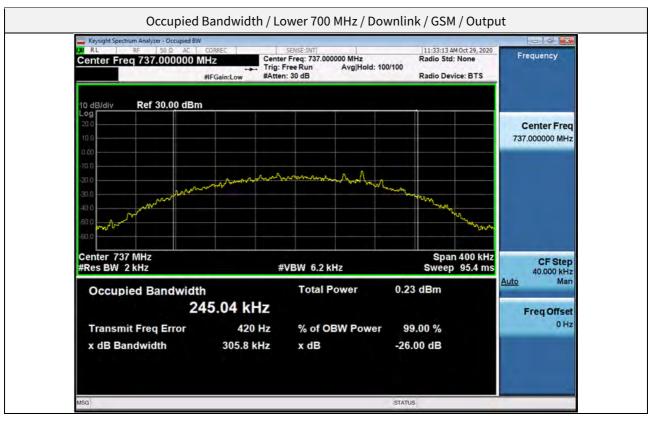




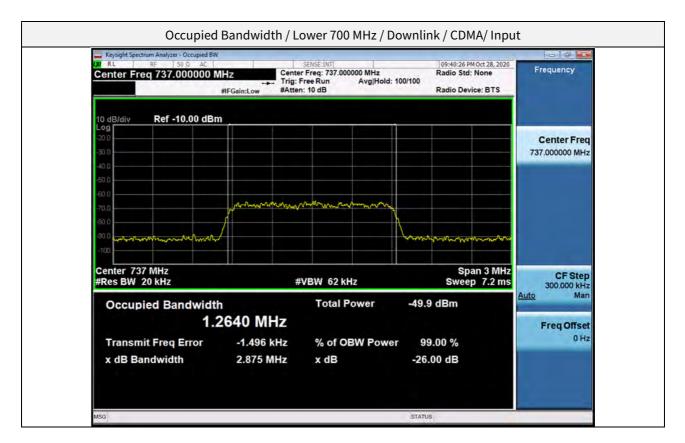


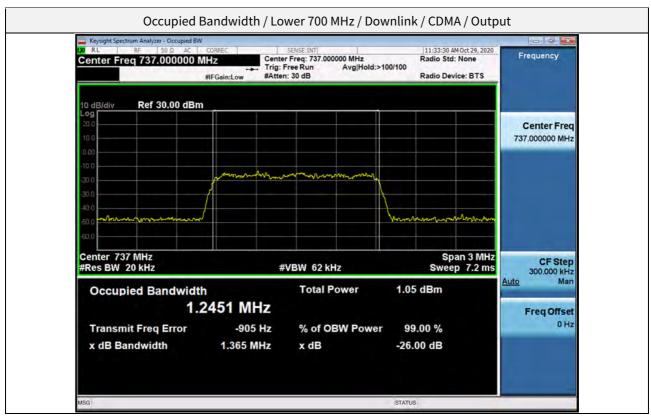




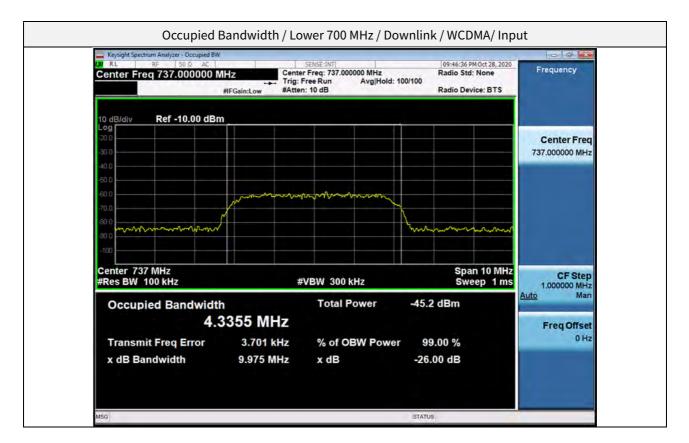


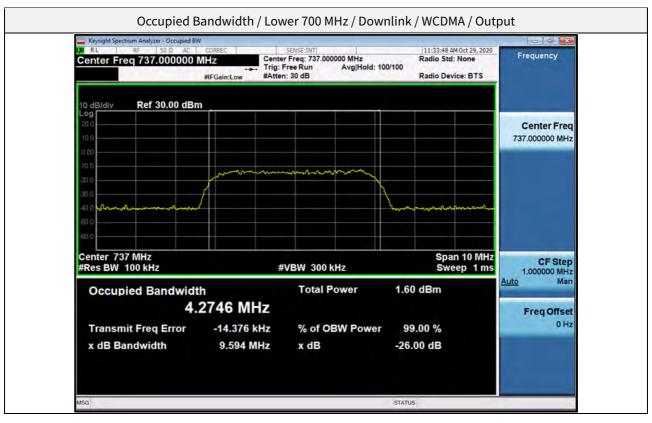




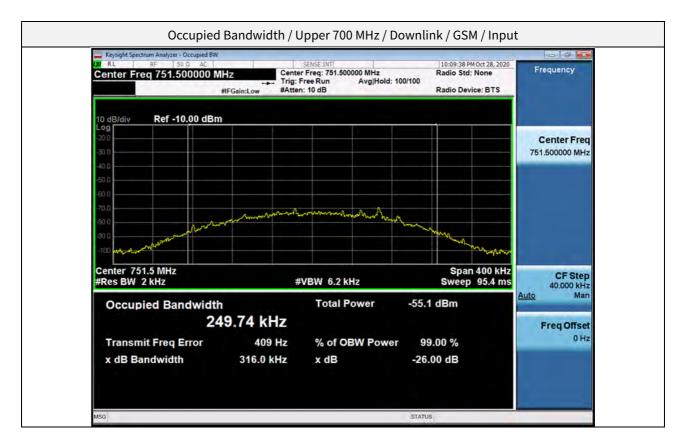


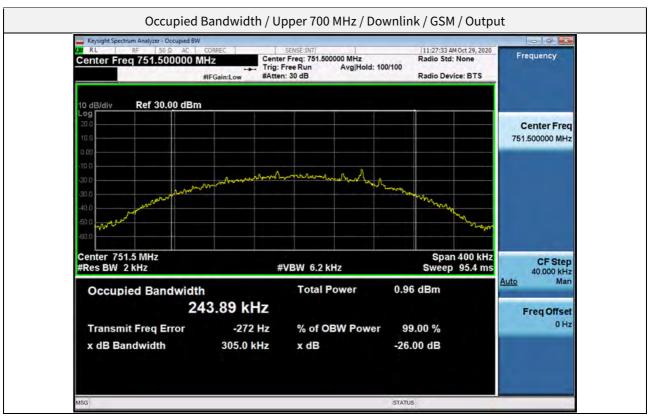




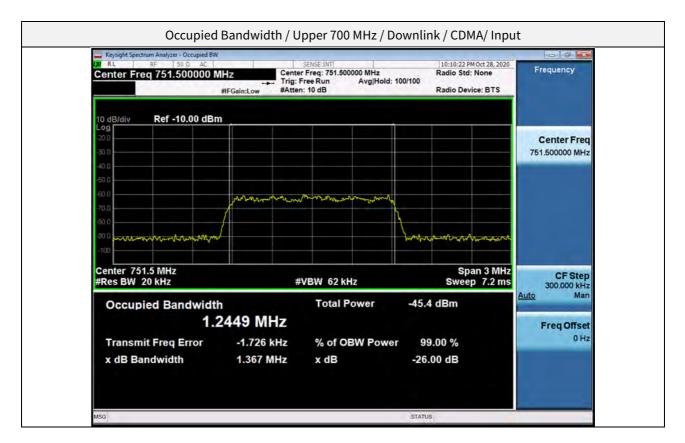


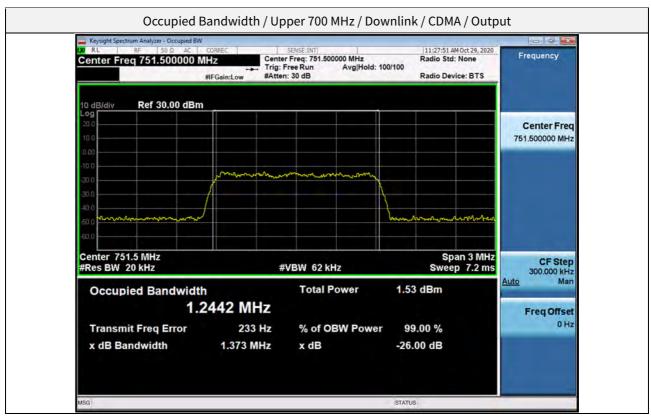




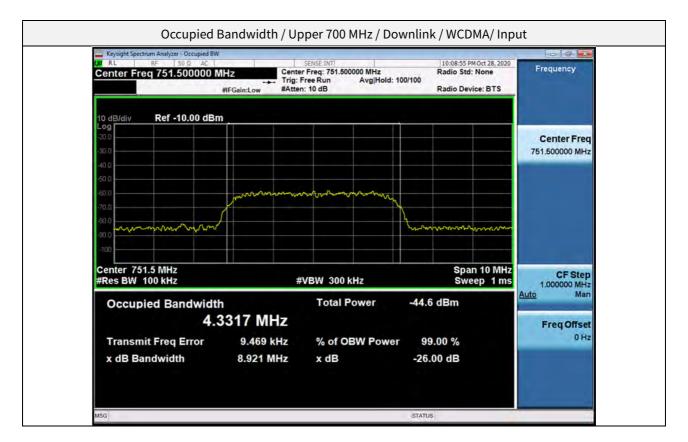


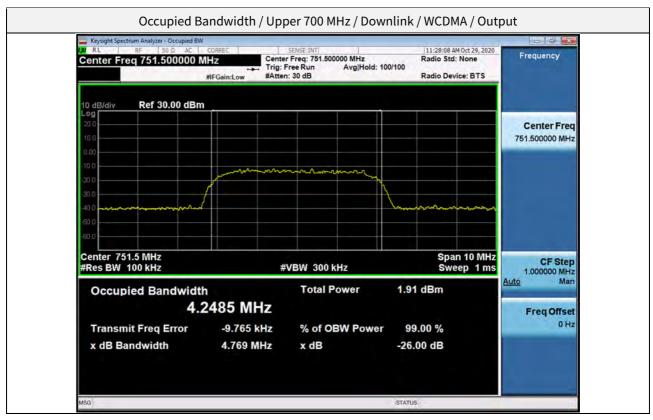




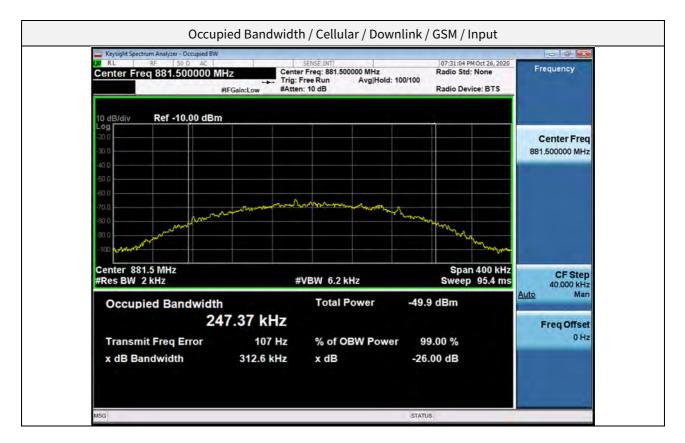


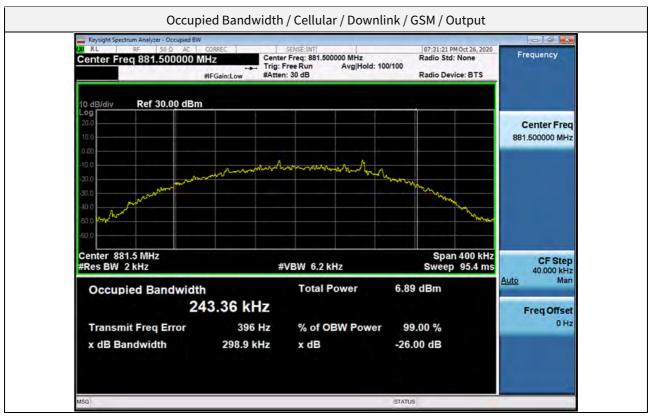




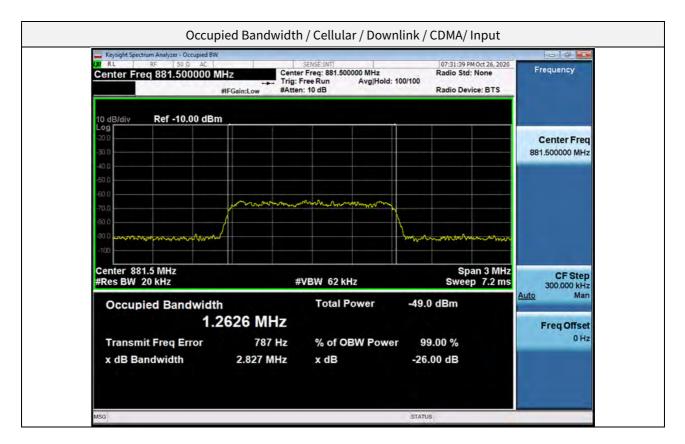


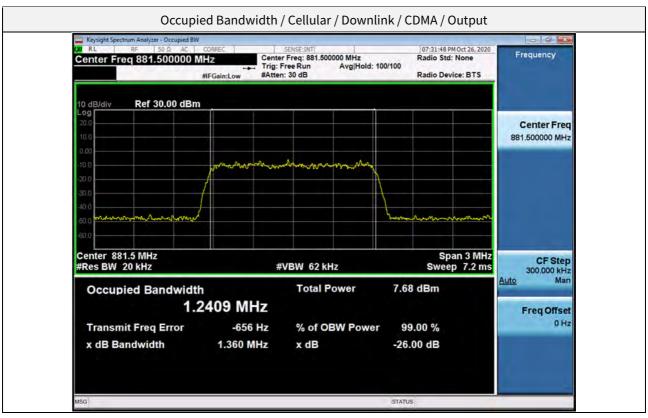




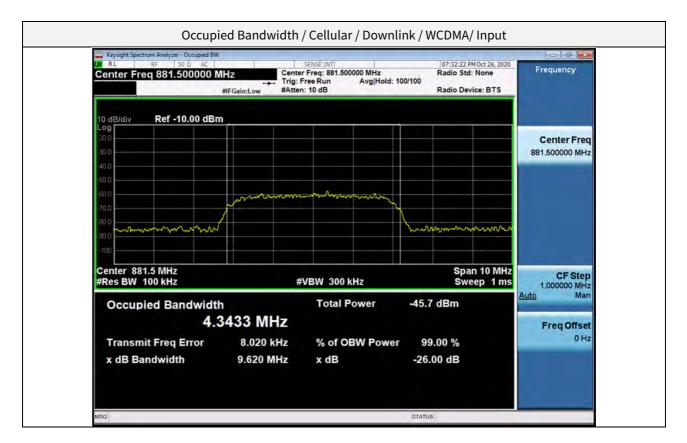


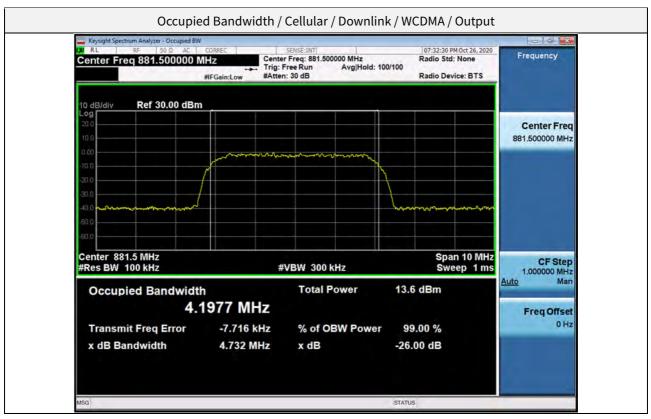






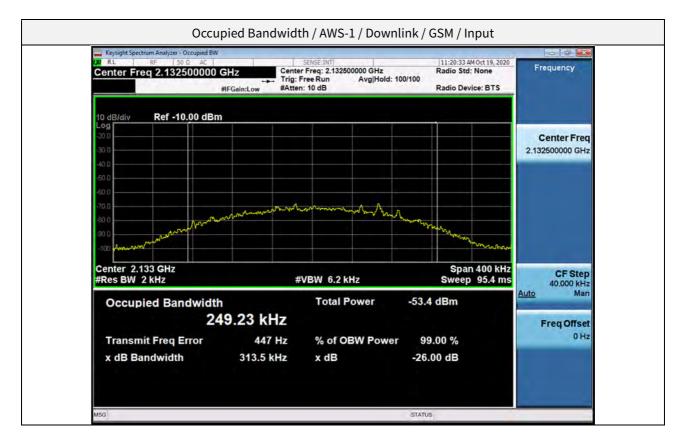


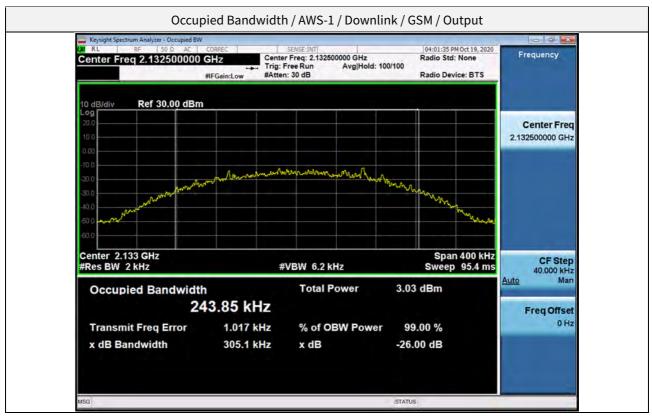




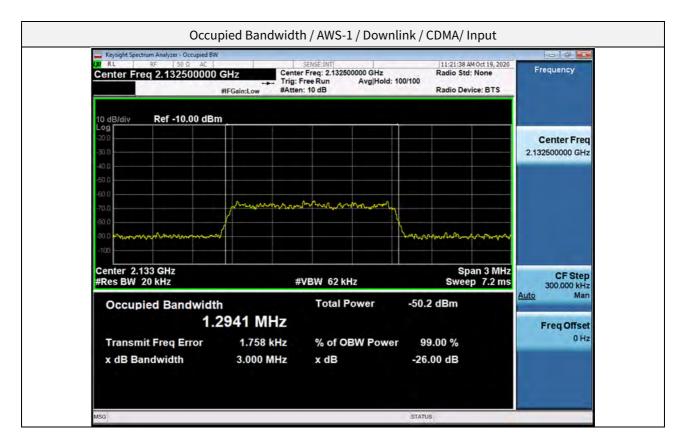


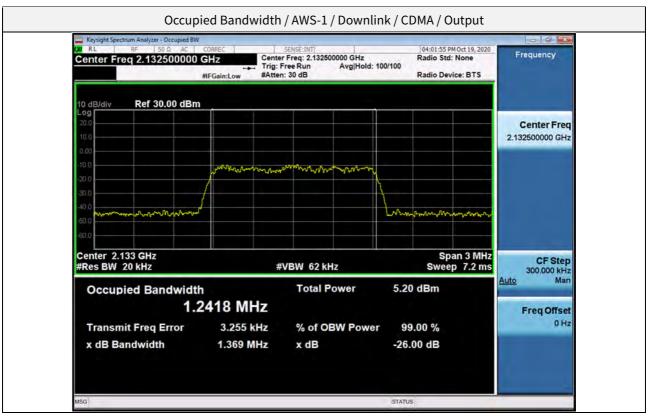




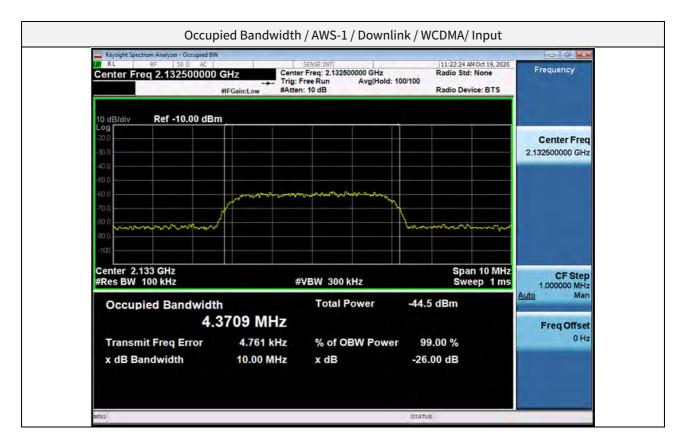


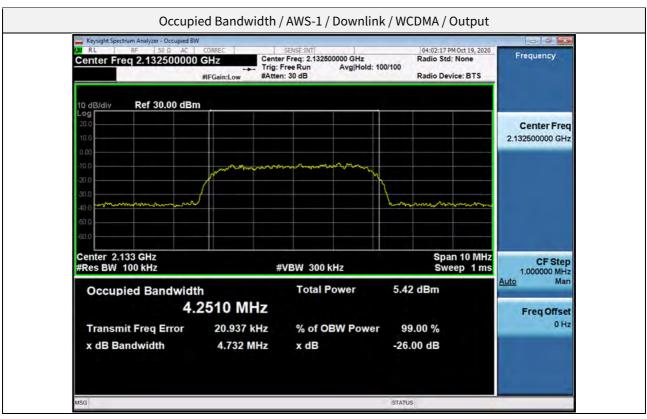




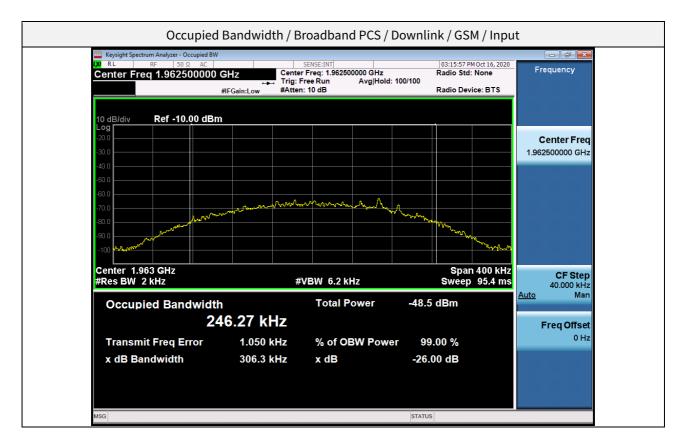


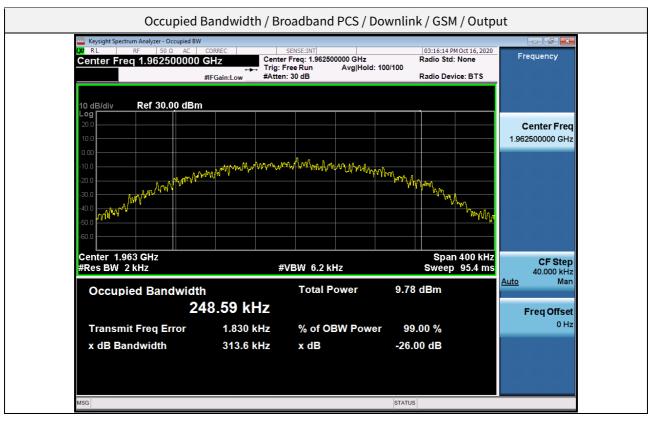




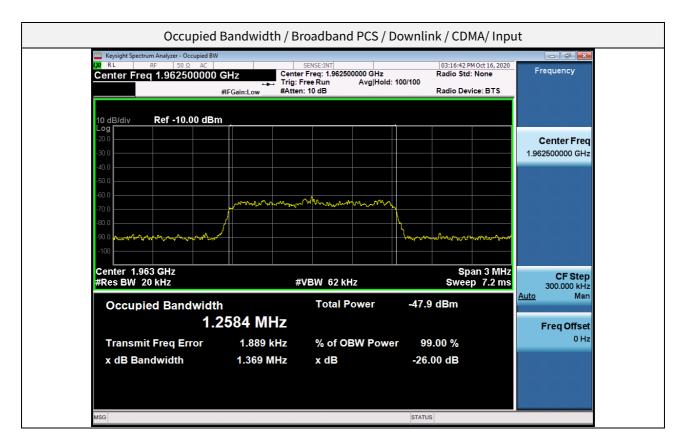


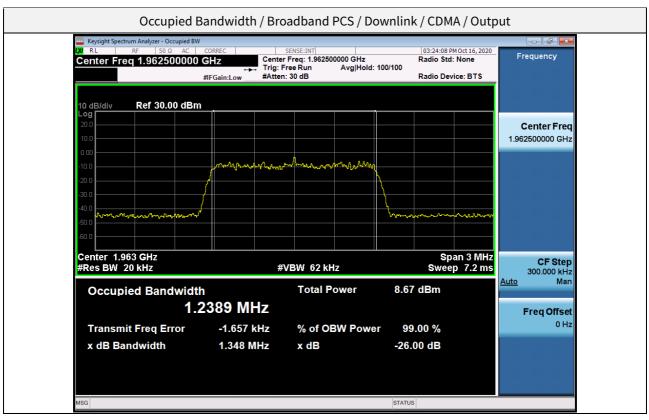




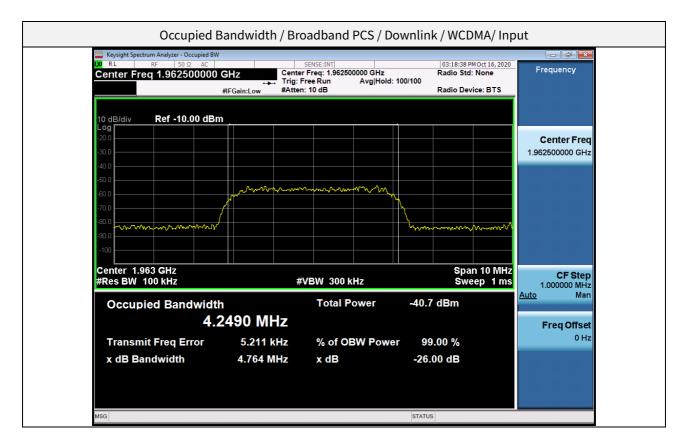


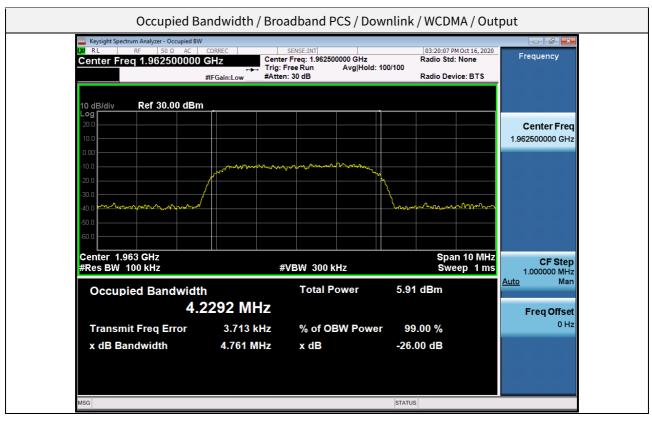














### 5.11. OSCILLATION

### **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 v04r04.

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  $\geq$  3 × RBW,

2) power averaging (rms) detector,

3) trace averages  $\geq$  100,

4) span  $\geq$  120% of operational band under test,

5) number of sweep points  $\geq 2 \times \text{Span/RBW}$ .

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 migration time: Uplink 0.3 second, Downlink 1 second.
- Migration duration: 1 minute.
- Number of restart: 5 times.
- Oscillation Migration 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 migration test.

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



고 객 비 밀 CUSTOMER SECRET

# Test Result:

# Tabulated Result of Uplink Oscillation Detection

Band	Frequency (MHz)	Limit (ms)	Measured Time (ms)
Lower 700 MHz	707.504		65.000
Upper 700 MHz	781.500		224.000
Cellular	827.550	300	244.000
AWS-1	1 749.150		165.000
Broadband PCS	1 873.075		284.000

# Tabulated Result of Downlink Oscillation Detection

Band	Frequency (MHz)	Limit (ms)	Measured Time (ms)
Lower 700 MHz	728.288		119.000
Upper 700 MHz	750.730		287.000
Cellular	888.225	1 000	245.000
AWS-1	2 147.215		149.000
Broadband PCS	1 971.210		263.000



# Tabulated Result of Uplink Oscillation Restart

Band	Frequency (MHz)	Time Limit (s)	Restart Limit	Restart Time (s)	Number of Restart
Lower 700 MHz	707.504			66.27	4
Upper 700 MHz	781.500			66.85	4
Cellular	827.550	60	5	66.29	5
AWS-1	1 749.150			64.93	4
Broadband PCS	1 873.075			64.08	4

# Tabulated Result of Downlink Oscillation Restart

Band	Frequency (MHz)	Time Limit (s)	Restart Limit	Restart Time (s)	Number of Restart
Lower 700 MHz	728.288			65.58	4
Upper 700 MHz	750.730			65.57	4
Cellular	888.225	60	5	65.97	4
AWS-1	2 147.215			65.20	4
Broadband PCS	1 971.210			64.75	4



# 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				Shut down			

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Upper				Shut down			
700 MHz				Shut down			

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Cellular				Shut down			

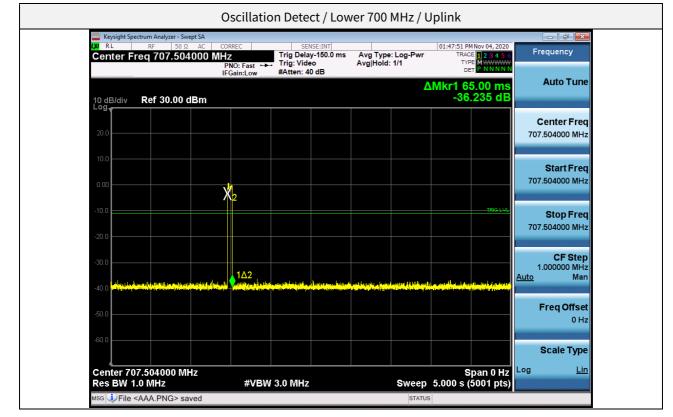
Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
AWS-1				Shut down			

Band	Variable Att. (dB)	Max Freq. (MHz)	Max Level (dBm)	Min Freq. (MHz)	Min Level (dBm)	Limit (dB)	Difference (dB)
Broadband				Shut down			
PCS				Shut down			





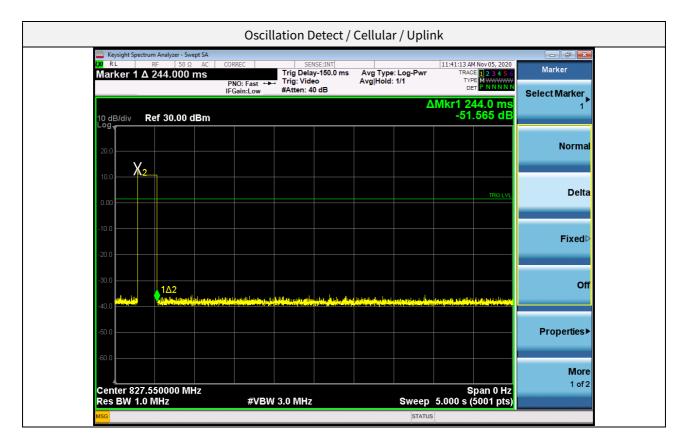
# Plot data of Oscillation Detect



Keysight Spectrum Analyzer - Swept SA     KE RF 50 Ω AC C	ORREC SENSE:INT		:19:31 PM Nov 04, 2020	
Center Freq 781.500000 MH			TRACE 1 2 3 4 5 6 TYPE MWWWW DET P NNNN	Frequency
10 dB/div Ref -20.00 dBm	- canningh	ΔΜ	(r1 224.0 ms -22.823 dB	Auto Tune
Log				Center Freq
-30.0				781.500000 MHz
-40.0				Start Freq
-50.0				781.500000 MHz
-60.0 X2				Stop Freq
-70.0				781.500000 MHz
-80.0 4444 4444 444 444 444 444 444 444 44	i the first dama by the store of the state of the state of the state of the first state of the	e e constituit de la constituir de la const	TRIG LVL	CF Step
-90.0				1.000000 MHz <u>Auto</u> Man
				Freq Offset
-100				0 Hz
-110				Scale Type
Center 781.500000 MHz			Span 0 Hz	Log <u>Lin</u>







The sectrum Analyzer - Swept SA	CORREC	SENSE:INT		10:53:42 AM Nov 05, 2020	Marker
Marker 1 Δ 165.000 ms	PNO: Fast ↔→ IFGain:Low	Trig Delay-150.0 ms Trig: Video #Atten: 40 dB	Avg Type: Log-Pwr Avg Hold: 1/1	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	
	IFGain:Low	writen. 40 ub		∆Mkr1 165.0 ms	Select Marker
10 dB/div Ref 30.00 dBm				-44.524 dB	
20.0					Normal
20.0					
10.0	X2				Dutte
0.00					Delta
-10.0					
				TRIG LVL	Fixed⊵
-20.0					
-30.0	1Δ2				Off
-40.0	artindasa Natada dinak		n hen mels alle alle an den ste de state de state An en state de state de state de state de state de state de s	n de la la la companya de la la companya de la la companya de la companya de la companya de la companya de la c	
-50.0					Properties►
50.0					Toperaese
-60.0					More
Center 1.749150000 GHz				Span 0 Hz	1 of 2

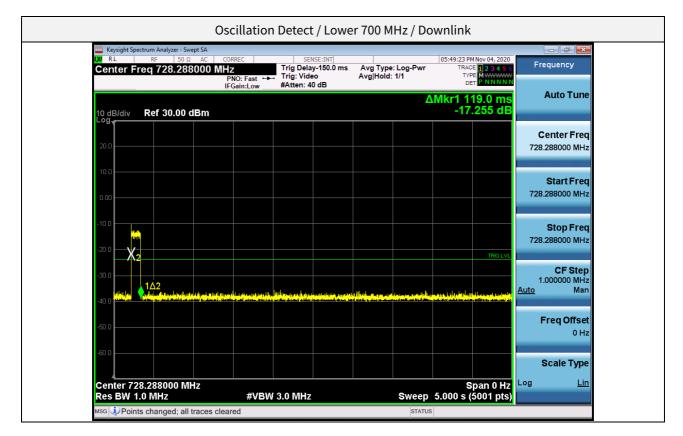




	Oscillation Detect / Br	oadband PCS / I	Uplink	
Keysight Spectrum Analyzer - Swept SA     RL	CORREC SENSE:INT ) CHZ Trig Delay-150.0 m PNO: Fast → Trig: Video IFGain:Low #Atten: 40 dB	s Avg Type: Log-Pwr Avg Hold: 1/1	11:23:02 AM Nov 05, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N	Frequency
10 dB/div Ref 30.00 dBm		L	Mkr1 284.0 ms -39.376 dB	Auto Tune
20.0				Center Freq 1.873075000 GHz
10.0 0.00 X2			TRIG LVL	Start Freq 1.873075000 GHz
-10.0				<b>Stop Freq</b> 1.873075000 GHz
	ng the design and the set of the problem of the star of the sector of the sector of the sector of the sector of	nij, operati jeli postaljanja jeli stati dra da postalja je stati stati je se	ka sheey ka shi ka ka jara shee si ki ka sa ya	<b>CF Step</b> 1.000000 MHz <u>Auto</u> Man
-40.0				Freq Offset 0 Hz
-60.0				Scale Type
Center 1.873075000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep	Span 0 Hz 5.000 s (5001 pts)	Log <u>Lin</u>



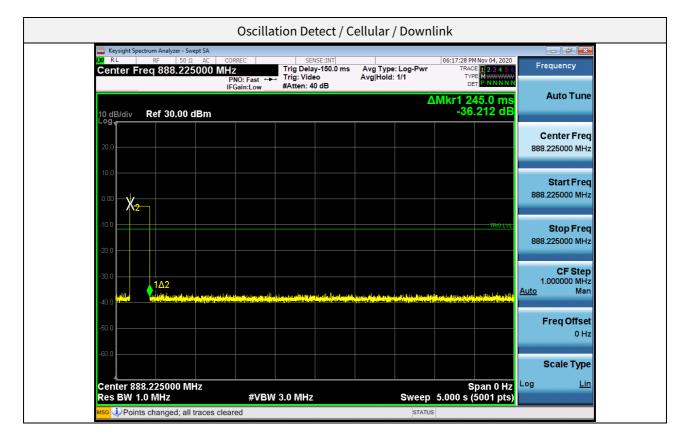




Keysight Spectrum					NSE:INT	er 700 M			M Nov 04, 2020	
Center Freq		000 MHz	O: Fast ↔	Trig Dela Trig: Vid	iy-150.0 ms eo	Avg Type Avg Hold:	: Log-Pwr 1/1	TRAC	DE 1 2 3 4 5 6 PE MWWWW ET P N N N N N	Frequency
		IFO	Gain:Low	#Atten: 4	0 dB		Δ		87.0 ms	Auto Tune
10 dB/div Re	f 30.00 di	Bm				1		-18	.090 dB	
20.0										Center Freq
20.0										750.730000 MHz
10.0										Start Freq
0.00										750.730000 MHz
-10.0										Stop Freq
-20.0 X2									TRIG LVL	750.730000 MHz
										CF Step
-30.0	1 <u></u> 1 <u></u>	والأوالي والمروانية والمرو	il man de comme de disco		ومن أن من الم ومن مسالة		a la stale a stale de la constale d	والتبر الموجوا بالرا	الارباني ويقرونه والم	1.000000 MHz <u>Auto</u> Man
-40.0	iye ve slek ki cavy	an fan it fan de senere tek	n seen tobi di abuta te	n har dett bjede och Med els	and a second	er etildeningen en fe	and the provident of the state	A notes of the part	e, staling the pick security	
-50.0										Freq Offset 0 Hz
-60.0										
										Scale Type
Center 750.73 Res BW 1.0 N		z	#\/D\\	/ 3.0 MHz			Swoon	5 000 ~	Span 0 Hz (5001 pts)	Log <u>Lin</u>







Keysight Spectrum Analyzer - Swept SA     RL RF 50 Ω AC CC	RREC SENSE:INT	09:59:58 AM Nov 0	
Center Freq 2.147215000 G	Trig Delay-150.0 ms Trig: Video	Avg Type: Log-Pwr TRACE 2 Avg Hold: 1/1 TYPE	3 4 5 6
	Gain:Low #Atten: 40 dB	DET P N	
10 dB/div Ref 30.00 dBm		ΔMkr1 149.0 -21.004	INS
Log			Center Freq
20.0			2.147215000 GHz
10.0			
0.00			Start Freq 2.147215000 GHz
0.00		т	RIG LVL
-10.0			Stop Freq
-20.0 X2			2.147215000 GHz
-30.0			CF Step
	وروما ومراحة والمتحرين والمتراجع والفراح والمتأور والمتحققة والمتحر ومأخطوه والمت	d an shout hit is a stated any sound is possibly the balance for the state in possible spectrum of the state of the spectrum of the state of the spectrum of the state of the spectrum of the	1.000000 MHz Auto Man
-40.0		a (helen in den de Lehl indig nigelie i net sie blies voor) in den de sterre sier om nie pieren zo	
-50.0			Freq Offset
~			0 Hz
-60.0			Scale Type
Center 2.147215000 GHz		Span	0 Hz Log Lin



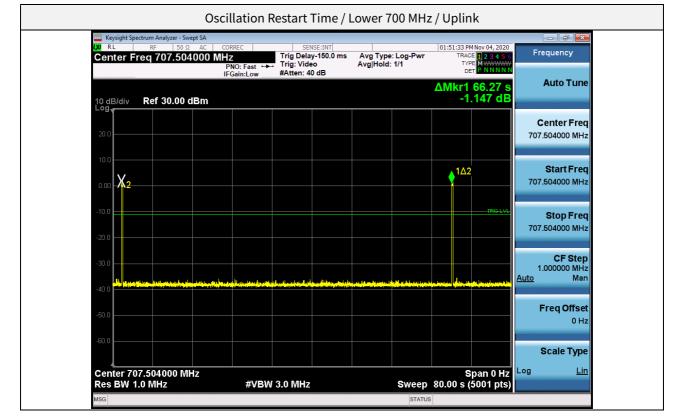


🤐 Keysight Spectrum Analyzer - Swept SA				
IX         RL         RF         50 Ω         AC           Center Freq 1.971210000	CORREC SENSE:INT GHz PNO: Fast ↔ IFGain:Low #Atten: 40 dB	ns Avg Type: Log-Pwr Avg Hold: 1/1	06:34:46 PM Nov 04, 2020 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	Frequency
10 dB/div Ref 30.00 dBm		Δ	Mkr1 263.0 ms -18.997 dB	Auto Tune
20.0				Center Freq 1.971210000 GHz
0.00			TRIG LVL	Start Freq 1.971210000 GHz
-10.0 -20.0 X2				<b>Stop Freq</b> 1.971210000 GHz
-30.0	n e yn de mei de gester fan here de state gebier de state gebier de state gebier de state gebier de state gebie	andres little data ini ini ini ini ini ini ini ini ini in	a de porte de la forma de la completa de se de la defenda de	CF Step 1.000000 MHz <u>Auto</u> Man
-50.0				<b>Freq Offset</b> 0 Hz
-60.0				Scale Type
Center 1.971210000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Succes	Span 0 Hz 5.000 s (5001 pts)	Log <u>Lin</u>



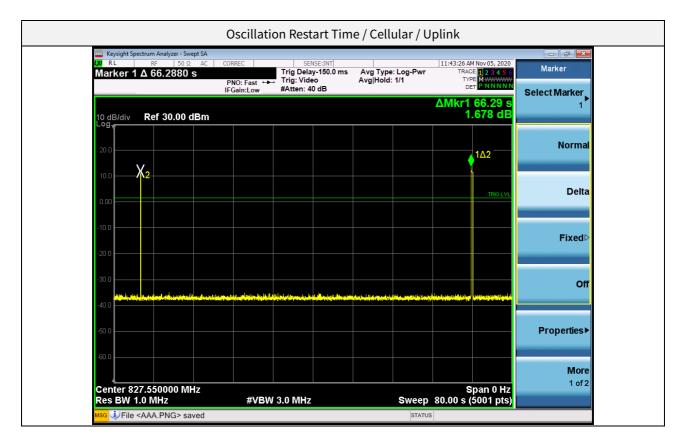


### Plot data of Oscillation Restart Time



Keysight Spectrum Analyzer - Swept S     X     RL RF 50 Ω A		SE:INT	02:25:25 PM Nov 04, 2020	
Center Freq 781.50000		-150.0 ms Avg Type: Log o Avg Hold: 1/1		Frequency
10 dB/div Ref 0.00 dBm			∆Mkr1 66.85 9 40.272 dE	Auto Tune
-10.0			↓1∆2	Center Freq 781.500000 MHz
-20.0				Start Freq 781.500000 MHz
-40.0				<b>Stop Freq</b> 781.500000 MHz
-60.0	an ser ben de san se se de ser bier de se se de se se de ser se se de ser se s	, ng ang kana sa ang kana ang	TRIG L V	CF Step 1.000000 MHz <u>Auto</u> Man
-80.0				<b>Freq Offset</b> 0 Hz
-90.0			Span 0 H;	Scale Type





Keysight Spectrum Analyzer - Swept SA     K     RL     RF     50 Ω AC	CORREC SENSE:INT		10:55:59 AM Nov 05, 2020	
Center Freq 1.749150000		Avg Type: Log-Pwr Avg Hold: 1/1	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNNN	Frequency
10 dB/div Ref 30.00 dBm			ΔMkr1 64.93 s 1.077 dB	Auto Tune
				Center Freq
20.0				1.749150000 GHz
10.0			1∆2	
<sup>10.0</sup> X2				Start Freq
0.00				1.749150000 GHz
-10.0				Stop Freq
-20.0			TRIG LVL	1.749150000 GHz
-20.0				
-30.0				CF Step 1.000000 MHz
-40.0	en son di devet de sense ante de a Managar de di Salistite des des des verbelle par	e hitten skapt das it ut betrekter til ste om	a a seral dal a da segna a la caletta attenta da attenta	<u>Auto</u> Man
50.0				Freq Offset
-50.0				0 Hz
-60.0				Scale Type
Center 1.749150000 GHz			Span 0 Hz	Log <u>Lin</u>

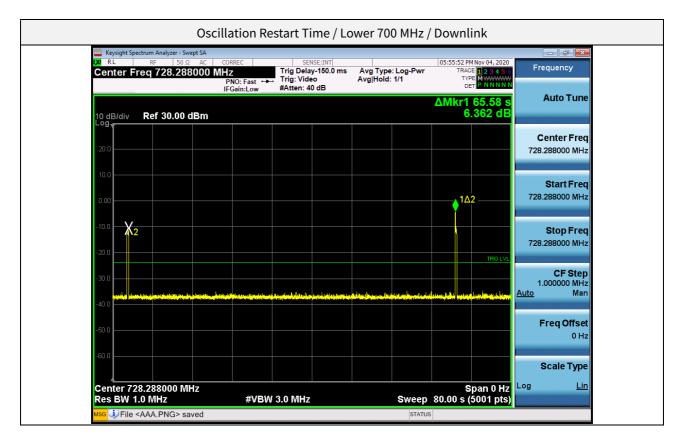


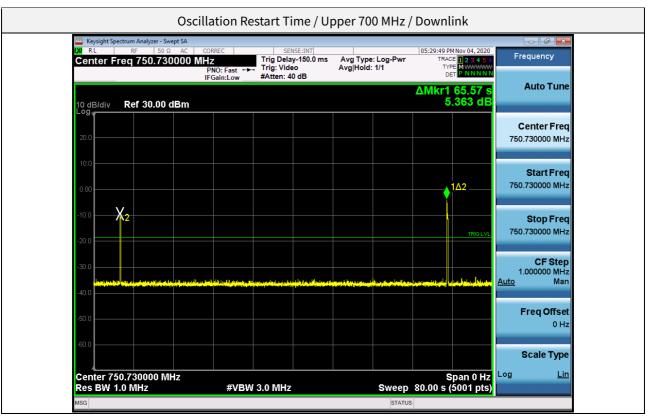


Keysight Spectrum Analyzer - Swept S           RL         RF         50 Ω         A           Center Freq 1.8730750	AC CORREC Trig De DOO GHZ Trig De PNO: Fast ↔ Trig: V		11:26:17 AM Nov 05, 2020 J-Pwr TRACE 123456 TYPE MWAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	Frequency
10 dB/div Ref 30.00 dBi	IFGain:Low #Atten:	40 dB	ΔMkr1 64.08 s -1.743 dB	Auto Tune
20.0				<b>Center Freq</b> 1.873075000 GHz
10.0 X2				<b>Start Freq</b> 1.873075000 GHz
-10.0				<b>Stop Freq</b> 1.873075000 GHz
-30.0	fanning same and a solar an stig motion of the state of the billion	ng diga yang kanalaya ya kanala yang malanda ang kanala yang daga	smertur da native de tetre a definisticado de la	<b>CF Step</b> 1.000000 MHz <u>Auto</u> Man
-50.0				Freq Offset 0 Hz
-60.0				Scale Type



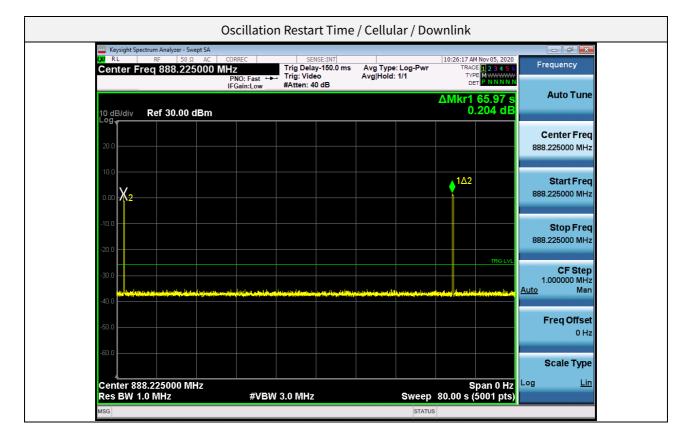


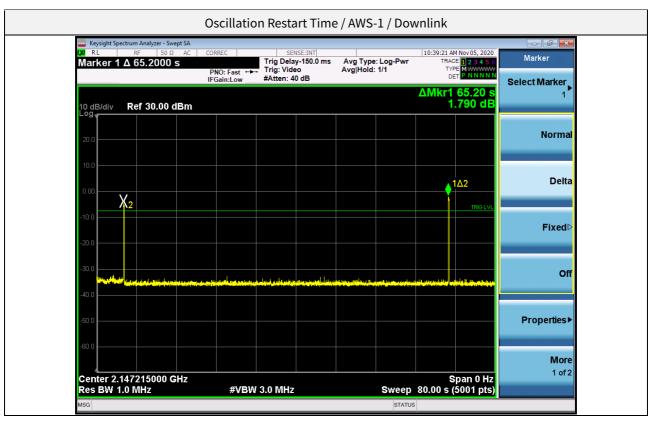














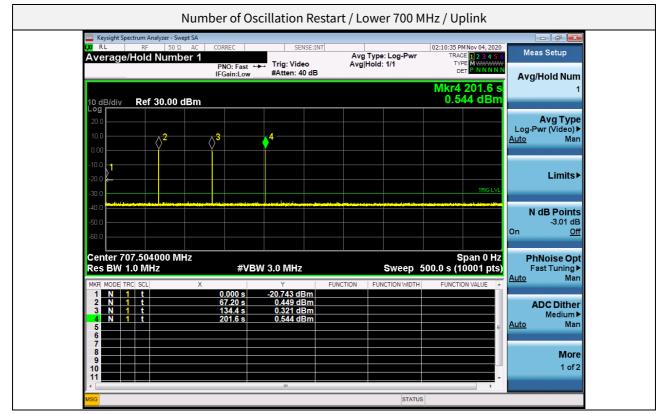


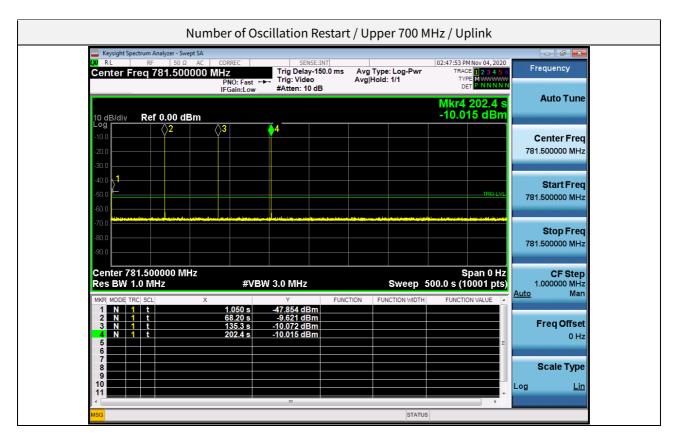
	llation Restart Time / B	roadband PCS /	<sup>/</sup> Downlink	
Keysight Spectrum Analyzer - Swept SA (χ) RL RF 50 Ω AC Marker 1 Δ 64.7520 s	CORREC SENSE:INT Trig Delay-150.0 ms PNO: Fast ↔→ IFGain:Low #Atten: 24 dB	Avg Type: Log-Pwr Avg Hold: 1/1	11:50:13 PM Oct 19, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P NNNNN	Peak Search
10 dB/div Ref 6.00 dBm			ΔMkr1 64.75 s 8.904 dB	Next Peak
-4.00			1∆2	Next Pk Right
-14.0 X2				Next Pk Left
-34.0				Marker Delta
-54.0	andreid an teaming and a United an an an team of Marca Inc. An advantation	n ann ann a' Marshan ann an Shara Na Lainn ann an Ann ann an Ann ann an Ann ann a	TRIG LVL	Mkr→CF
-74.0				Mkr→RefLvl
-84.0				More 1 of 2
Center 1.971210000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep	Span 0 Hz 80.00 s (5001 pts)	





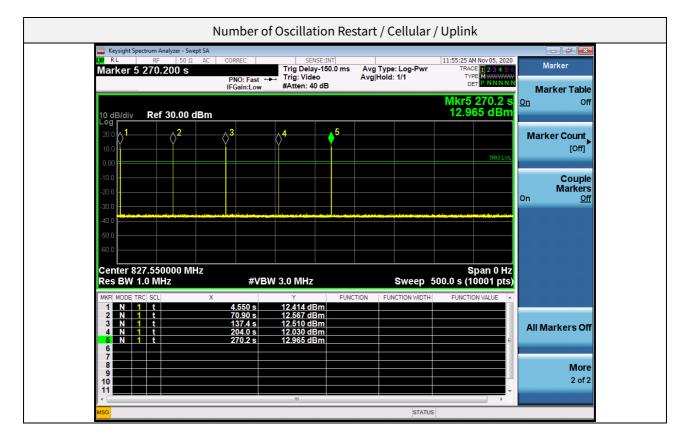
### Plot data of Number of Oscillation Restart

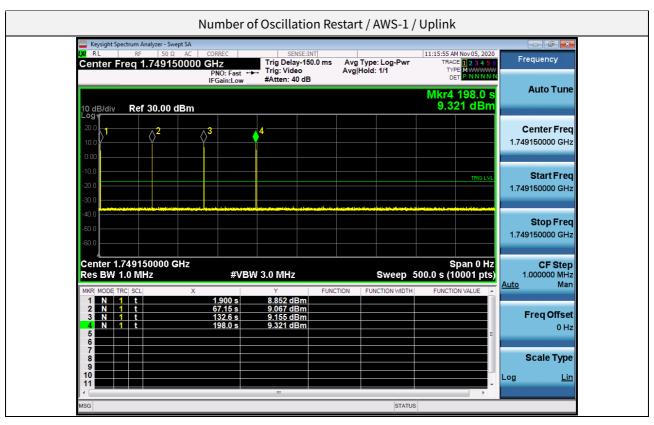






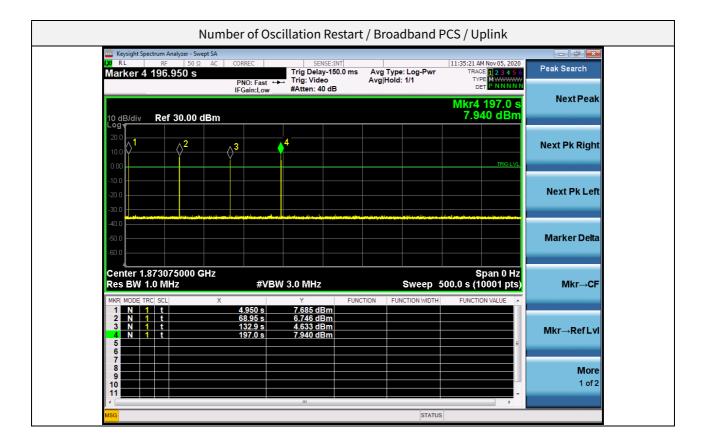






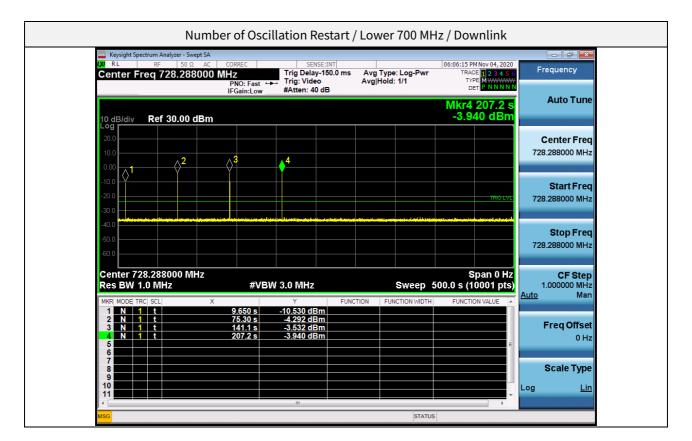


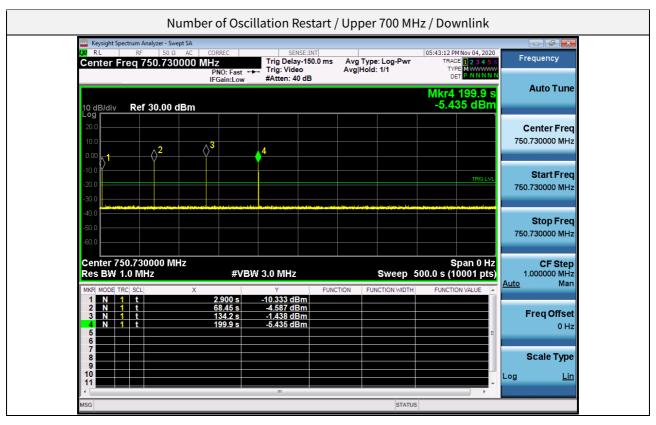






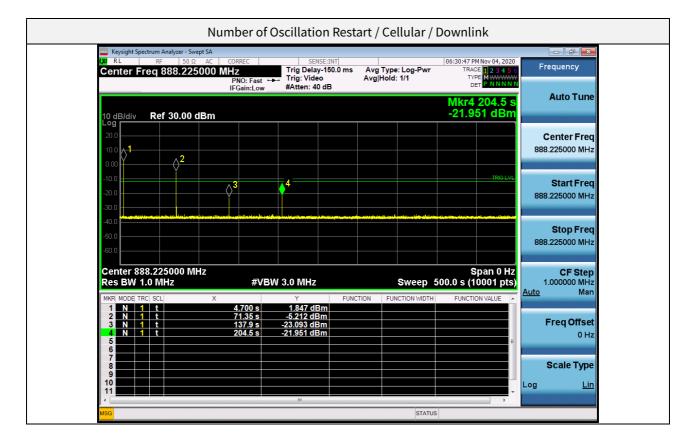


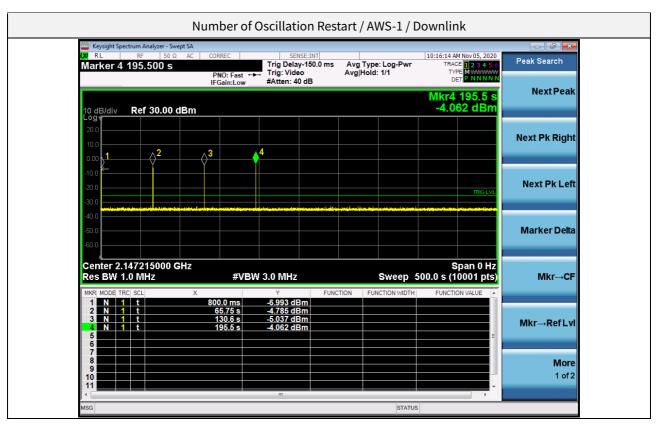






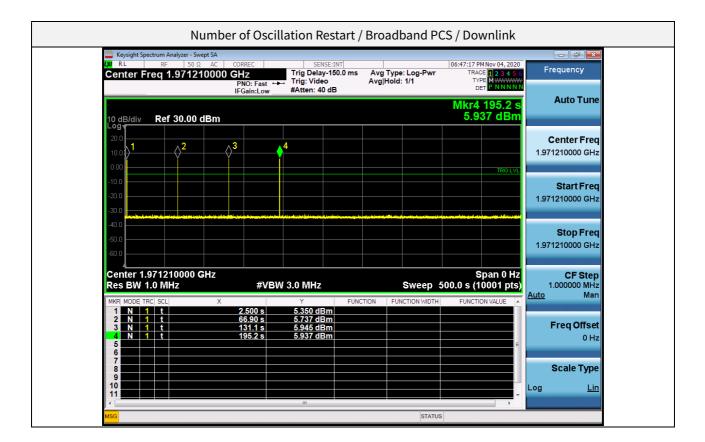














### **5.12. RADIATED SPURIOUS EMISSIONS**

#### **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 v04r04

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<sub>IN</sub> 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 Section2.1057. 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:

# Tabulated Result of Uplink Radiated Spurious Emissions

# -Lower 700 MHz-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Del	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	Pol.	(dBm)	(dBm/m)
2 150.00	51.66	27.90	5.96	41.14	Н	-43.54	-50.820
3 720.00	50.86	29.20	8.12	37.76	Н	-44.34	-44.780
2 150.00	55.43	27.90	5.96	41.14	V	-39.77	-47.050
3 720.00	50.61	29.20	8.12	37.76	V	-44.59	-45.030
6 962.00	49.05	35.40	11.49	36.38	V	-46.15	-35.640
7 306.00	48.26	36.20	11.77	36.01	V	-46.94	-34.980

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

# - Upper 700 MHz-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Pol.	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	1 01.	(dBm)	(dBm/m)
2 150.00	55.61	27.90	5.96	41.14	V	-39.59	-46.870
3 720.00	51.04	29.20	8.12	37.76	V	-44.16	-44.600
6 962.00	48.31	35.40	11.49	36.38	V	-46.89	-36.380
7 306.00	48.04	36.20	11.77	36.01	V	-47.16	-35.200
2 150.00	52.10	27.90	5.96	41.14	Н	-43.10	-50.380
3 720.00	51.21	29.20	8.12	37.76	Н	-43.99	-44.430

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m



# - Cellular-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Del	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	Pol.	(dBm)	(dBm/m)
2 150.00	54.72	27.90	5.96	41.14	V	-40.48	-47.760
3 720.00	49.92	29.20	8.12	37.76	V	-45.28	-45.720
6 962.00	48.69	35.40	11.49	36.38	V	-46.51	-36.000
7 306.00	48.49	36.20	11.77	36.01	V	-46.71	-34.750

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

# - AWS-1-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Pol.	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	FUI.	(dBm)	(dBm/m)
3 724.00	49.98	29.20	8.12	37.23	V	-45.22	-45.130
5 001.00	45.17	31.40	9.71	35.67	V	-50.03	-44.590
6 956.00	48.15	35.40	11.49	35.85	V	-47.05	-36.010
7 300.00	48.51	36.20	11.77	35.45	V	-46.69	-34.170

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

# - Broadband PCS-

Frequency (MHz)	Measured Level (dBuV)	Ant. Factor (dB/m)	C.L (dB)	Amp. Gain (+ 1G H.P.F.) (dB)	Pol.	Measured Power (dBm)	Result (dBm/m)
3 724.00	50.28	29.20	8.12	37.23	۷	-44.92	-44.830
5 001.00	46.39	31.40	9.71	35.67	۷	-48.81	-43.370
6 956.00	47.51	35.40	11.49	35.85	V	-47.69	-36.650
7 300.00	48.49	36.20	11.77	35.45	۷	-46.71	-34.190

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m



# Tabulated Result of Downlink Radiated Spurious Emissions

# -Lower 700 MHz-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Pol.	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	POI.	(dBm)	(dBm/m)
2 150.00	54.82	27.90	5.96	41.14	۷	-40.38	-47.660
3 720.00	50.03	29.20	8.12	37.76	V	-45.17	-45.610
6 962.00	48.40	35.40	11.49	36.38	V	-46.80	-36.290
7 306.00	48.32	36.20	11.77	36.01	V	-46.88	-34.920

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

# - Upper 700 MHz-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Pol.	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	POI.	(dBm)	(dBm/m)
2 150.00	54.95	27.90	5.96	41.14	V	-40.25	-47.530
3 720.00	50.44	29.20	8.12	37.76	V	-44.76	-45.200
6 962.00	48.67	35.40	11.49	36.38	V	-46.53	-36.020
7 306.00	48.00	36.20	11.77	36.01	V	-47.20	-35.240

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

# - Cellular-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Del	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	Pol.	(dBm)	(dBm/m)
2 150.00	54.20	27.90	5.96	41.14	V	-41.00	-48.280
3 720.00	50.13	29.20	8.12	37.76	V	-45.07	-45.510
6 962.00	48.56	35.40	11.49	36.38	V	-46.64	-36.130
7 306.00	48.31	36.20	11.77	36.01	V	-46.89	-34.930

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m





#### - AWS-1-

Frequency	Measured Level	Ant. Factor	C.L	Amp. Gain (+ 1G H.P.F.)	Pol.	Measured Power	Result
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	POI.	(dBm)	(dBm/m)
3 724.00	49.84	29.20	8.12	37.23	V	-45.36	-45.270
5 001.00	45.65	31.40	9.71	35.67	V	-49.55	-44.110
6 956.00	48.30	35.40	11.49	35.85	V	-46.90	-35.860
7 300.00	48.37	36.20	11.77	35.45	V	-46.83	-34.310

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

## - Broadband PCS-

Frequency (MHz)	Measured Level (dBuV)	Ant. Factor (dB/m)	C.L (dB)	Amp. Gain (+ 1G H.P.F.) (dB)	Pol.	Measured Power (dBm)	Result (dBm/m)
3 724.00	50.00	29.20	8.12	37.23	V	-45.20	-45.110
5 001.00	45.88	31.40	9.71	35.67	V	-49.32	-43.880
6 956.00	48.06	35.40	11.49	35.85	V	-47.14	-36.100
7 300.00	48.92	36.20	11.77	35.45	V	-46.28	-33.760

\* C.L.: Cable Loss / A.G.: Amp. Gain / H.P.F.: High Pass Filter / Measure distance : 3 m

Note1. We have done horizontal and vertical polarization in detecting antenna.

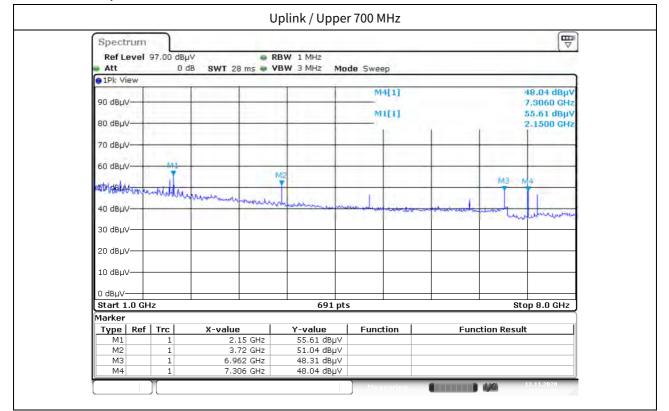
**Note2.** The amplitude of the spurious domain emission attenuated by more than 20 dB over the permissible value was not recorded according to ANSI C63.26, clause 5.1.1., c).

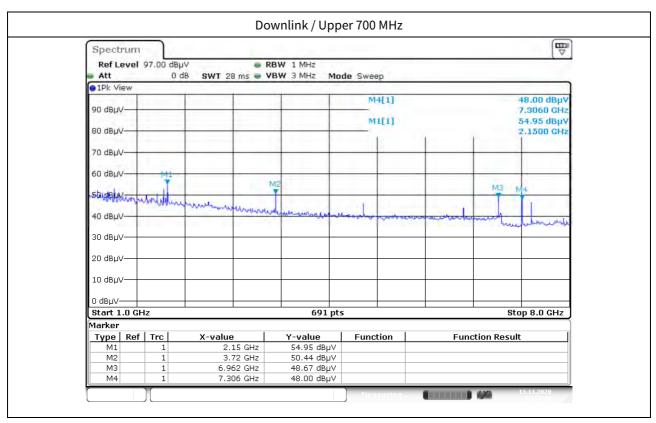
**Note3.** Test data were only the worst case.





### Plot data of 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-2011-FC030-P