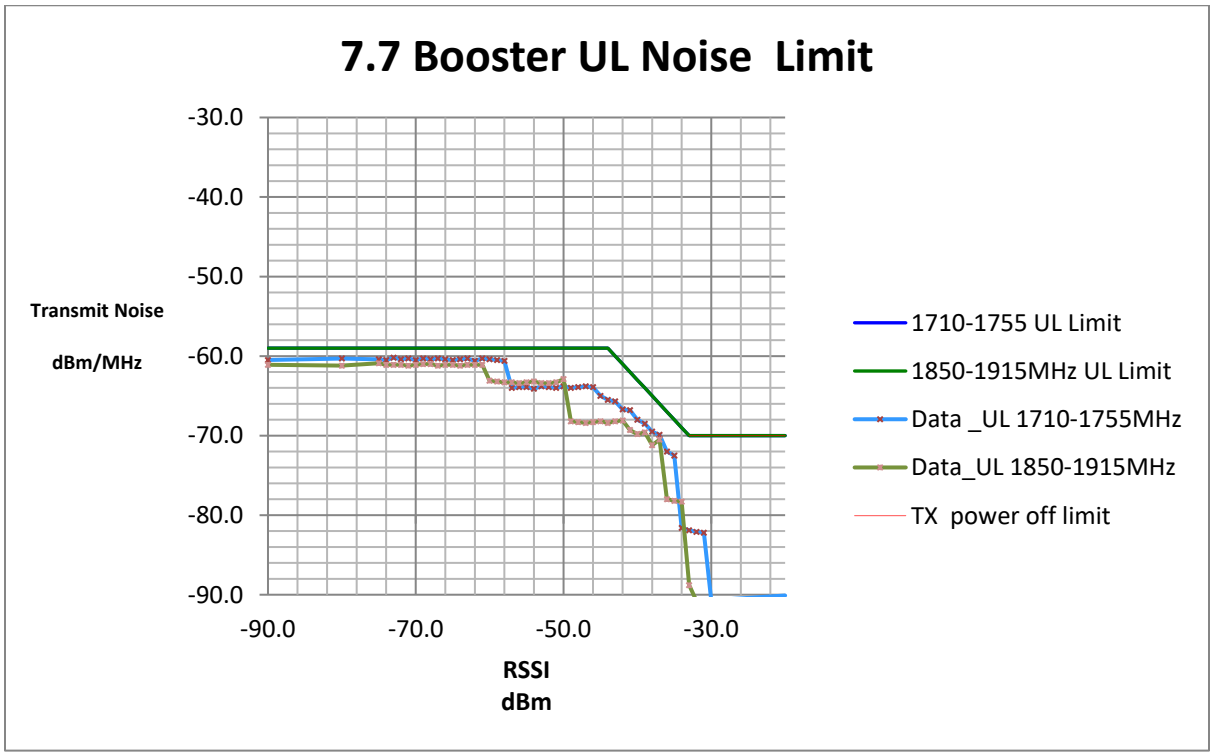
Summary of Results

7.7.1 Maximum transmitter noise power level

- 7.7.1 a-g: Maximum transmitter noise with 50-ohm shielded load

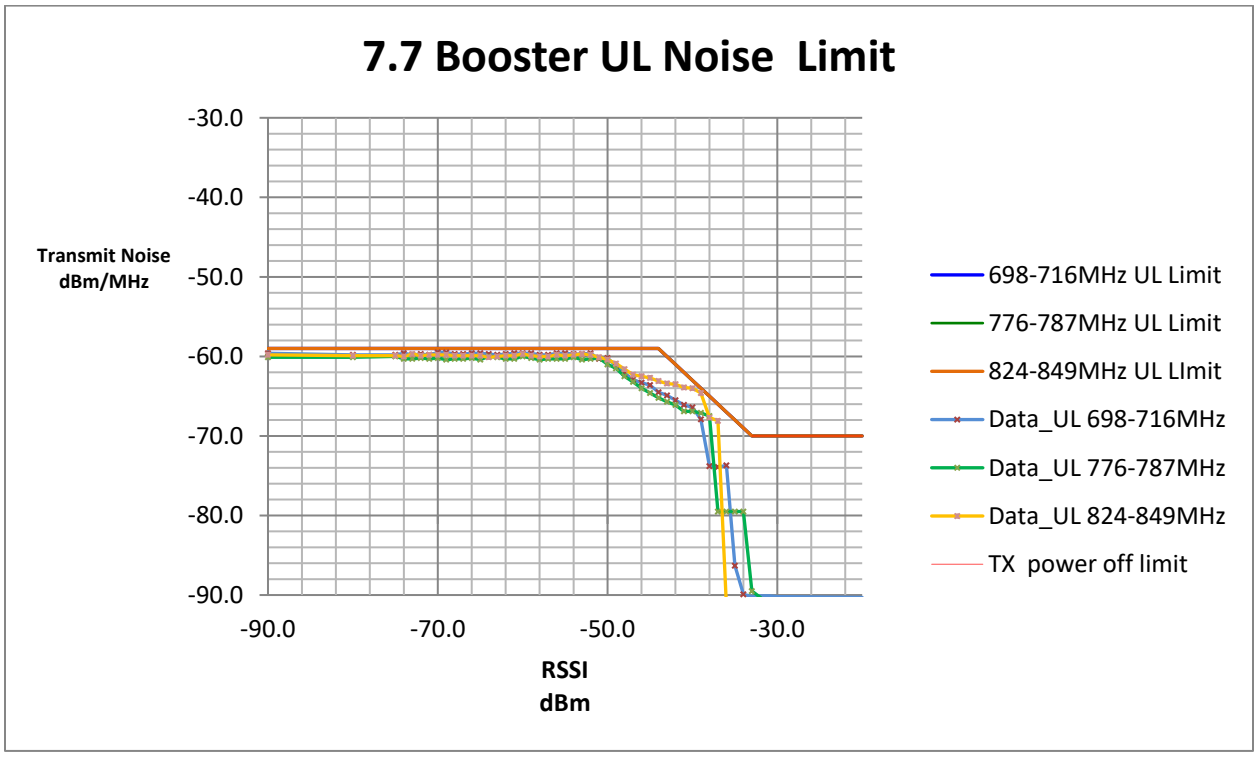
Maximum Noise Power			
Frequency MHz	**Measured dBm./MHz**	**Limit dBm/MHz**	**Margin**
UL 1710-1755	-59.7	-59.0	-0.7
UL 1850-1915	-60.8	-59.0	-1.8
UL 824-849	-59.1	-59.0	-0.1
UL 698-716	-59.0	-59.0	0.0
UL 776-787	-59.8	-59.0	-0.8
DL 2110-2155	-59.0	-59.0	0.0
DL 1930-1995	-59.5	-59.0	-0.5
DL 869-894	-60.4	-59.0	-1.4
DL 728-746	-59.2	-59.0	-0.2
DL 746-757	-59.1	-59.0	-0.1

7.7.1 h-n: Maximum transmitter noise when varying the DL signal generator output level with a 4.1MHz AWGN signal



1710.0 -1755.0MHz					
RSSI (dBm)	Measured Noise (dBm/MHz)	Limit			Margin
		RSSI Dependent	Mobile Booster Limit	TX off	
-80.0	-60.3	-	-59.0	-	-1.3
-75.0	-60.4	-	-59.0	-	-1.4
-37.0	-69.9	-66.0	-59.0	-	-3.9
-35.0	-72.5	-68.0	-59.0	-	-4.5
-32.0	-82.1	-	-	-70	-12.1
-31.0	-82.2	-	-	-70	-12.2

1850.0 - 1915.0MHz					
RSSI (dBm)	Measured Noise (dBm/MHz)	Limit			Margin
		RSSI Dependent	Mobile Booster Limit	TX off	
-75.0	-60.9	-	-59.0	-	-1.9
-69.0	-61.0	-	-59.0	-	-2.0
-39.0	-69.6	-64.0	-59.0	-	-5.6
-37.0	-70.5	-66.0	-59.0	-	-4.5
-32.0	-90.8	-	-	-70	-20.8
-31.0	-90.7	-	-	-70	-20.7



824.0 - 849.0MHz					
RSSI (dBm)	Measured Noise (dBm/MHz)	Limit			Margin
		RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-59.8	-	-59.0	-	-0.8
-80.0	-59.9	-	-59.0	-	-0.9
-40.0	-64.0	-63.0	-59.0	-	-1.0
-39.0	-64.6	-64.0	-59.0	-	-0.6
-30.0	-91.4	-	-	-70	-21.4
-20.0	-91.3	-	-	-70	-21.3

698.0-716.0MHz					
RSSI (dBm)	Measured Noise (dBm/MHz)	Limit			Margin
		RSSI Dependent	Mobile Booster Limit	TX off	
-70.0	-59.5		-59.0		-0.5
-69.0	-59.5		-59.0		-0.5
-40.0	-66.4	-63.0	-59.0		-3.4
-39.0	-67.9	-64.0	-59.0		-3.9
-32.0	-90.1			-70	-20.1
-31.0	-90.1			-70	-20.1

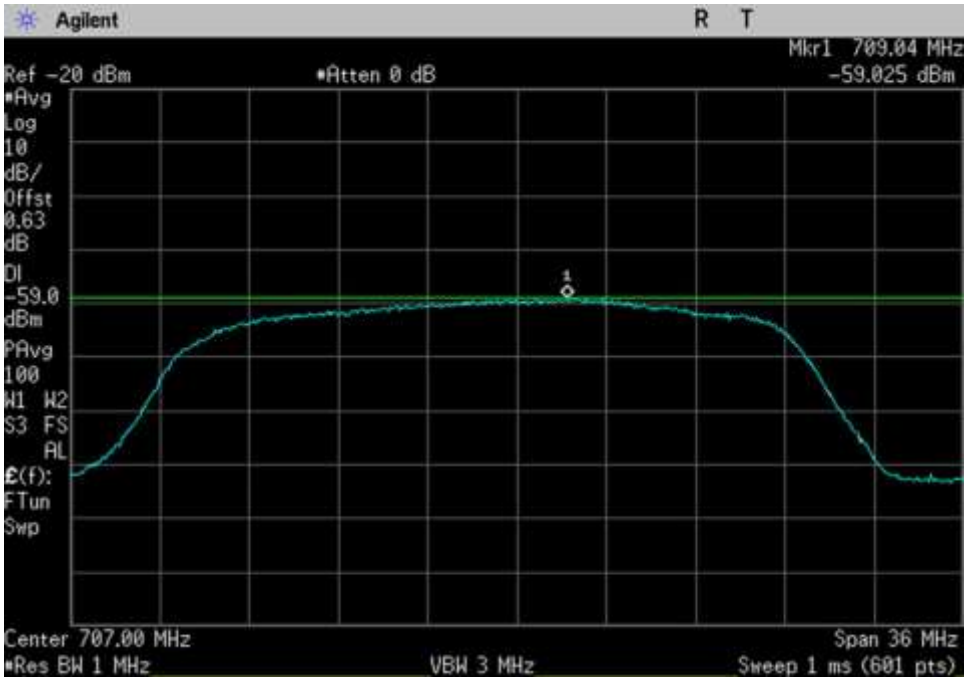
776.0 - 787.0MHz					
RSSI (dBm)		Limit			Margin
	Measured Noise (dBm/MHz)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-60.1		-59.0		-1.1
-80.0	-60.1		-59.0		-1.1
-39.0	-67.1	-64.0	-59.0		-3.1
-38.0	-67.5	-65.0	-59.0		-2.5
-32.0	-90.3			-70	-20.3
-31.0	-91.2			-70	-21.2

7.7.2 Variable uplink noise timing

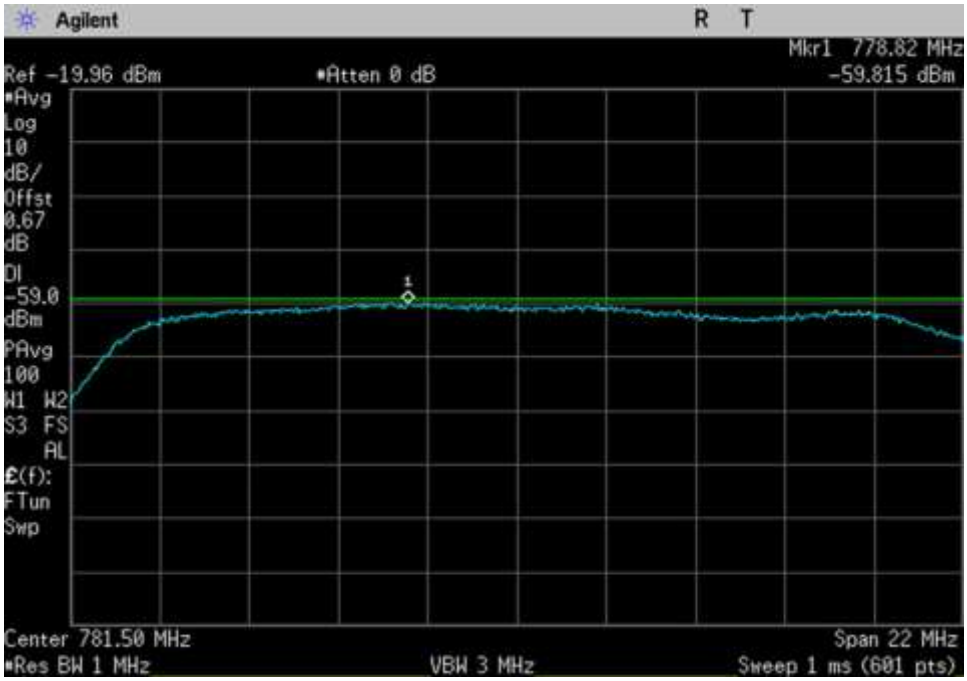
Uplink Noise timing		
Frequency MHz	Measured Sec	Limit sec
UL1710-1755	0.10	1.00
UL1850-1915	0.15	1.00
UL824-849	0.37	1.00
UL 698-716	0.30	1.00
UL776-787	0.25	1.00

7.7.1 Maximum Transmitter Noise Power Level

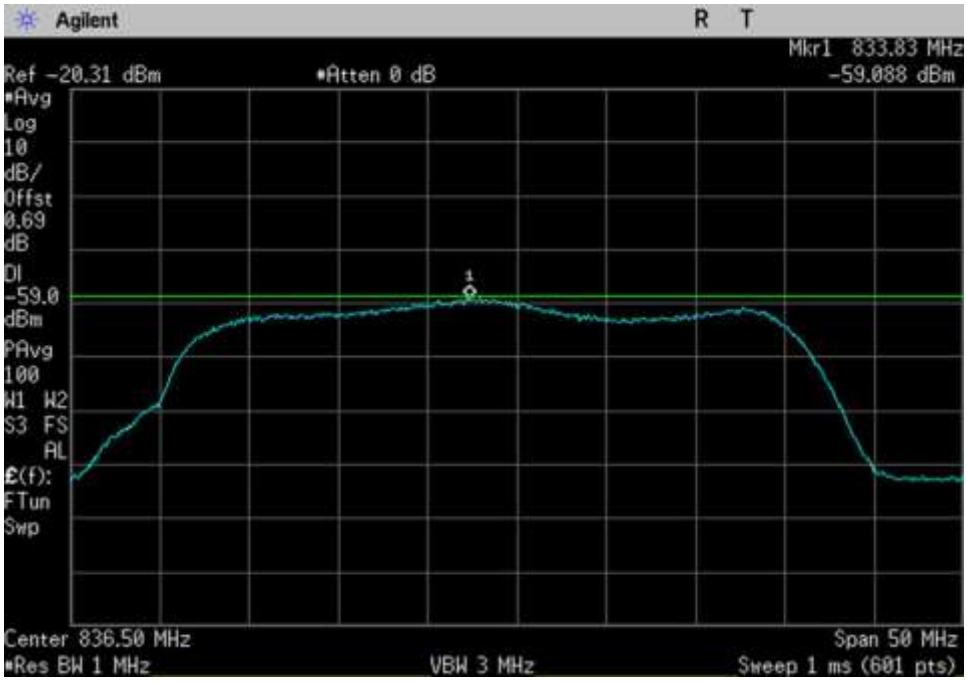
Plots



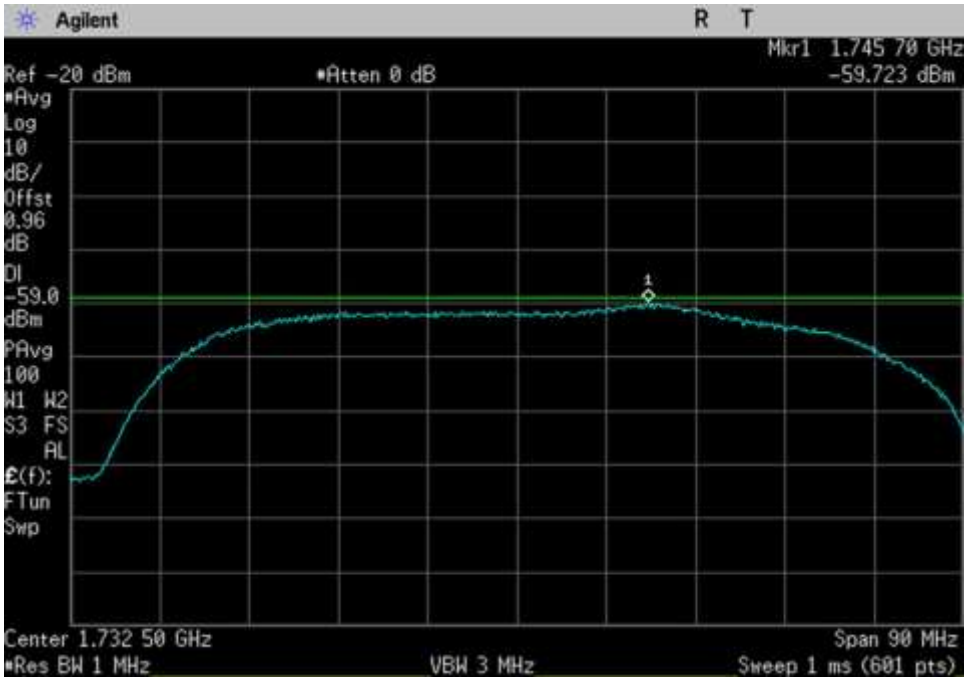
UL_698-716_ 707MHz



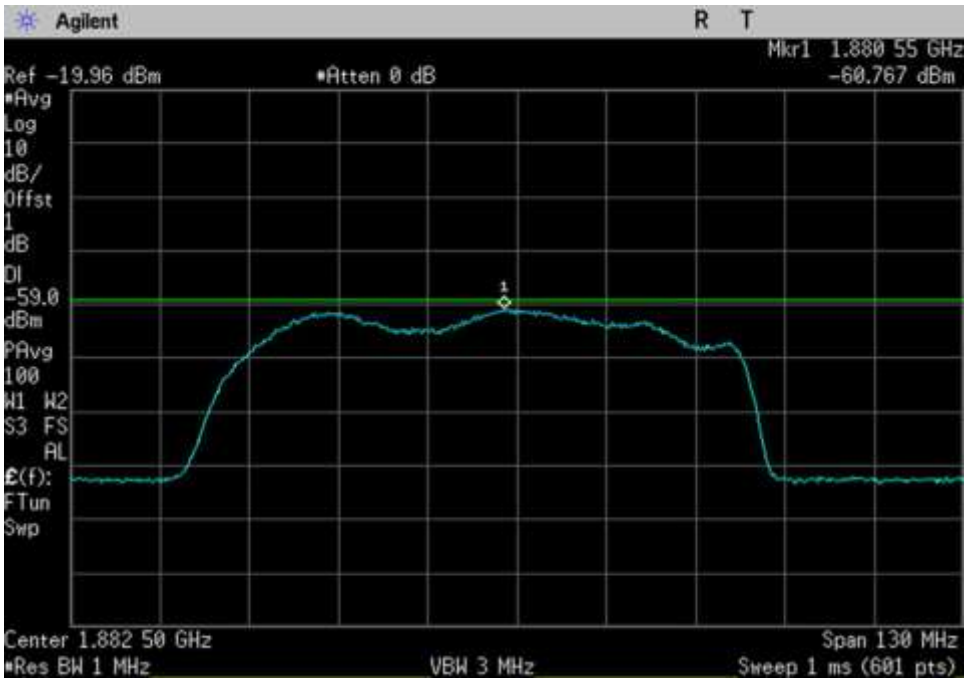
UL_776-787_ 781.5MHz



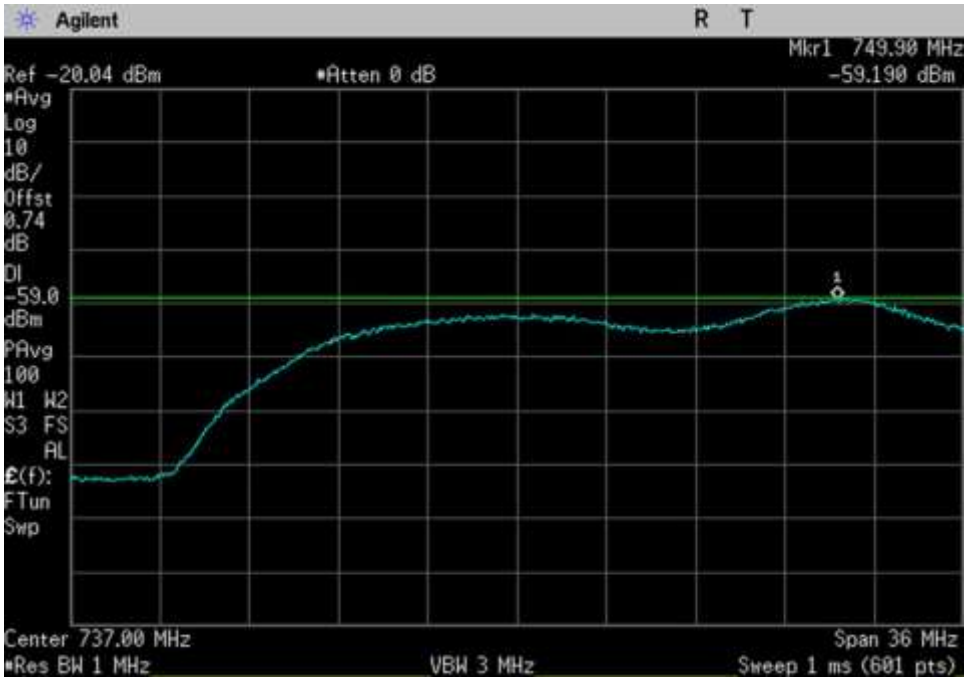
UL_824-849_ 836.5MHz



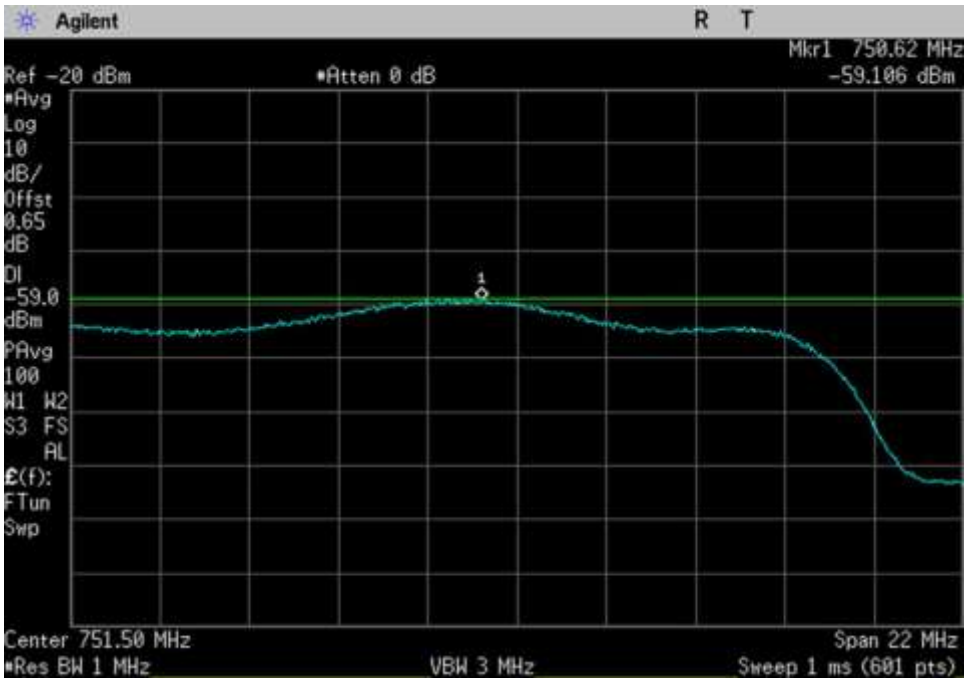
UL_1710-1755_ 1732.5MHz



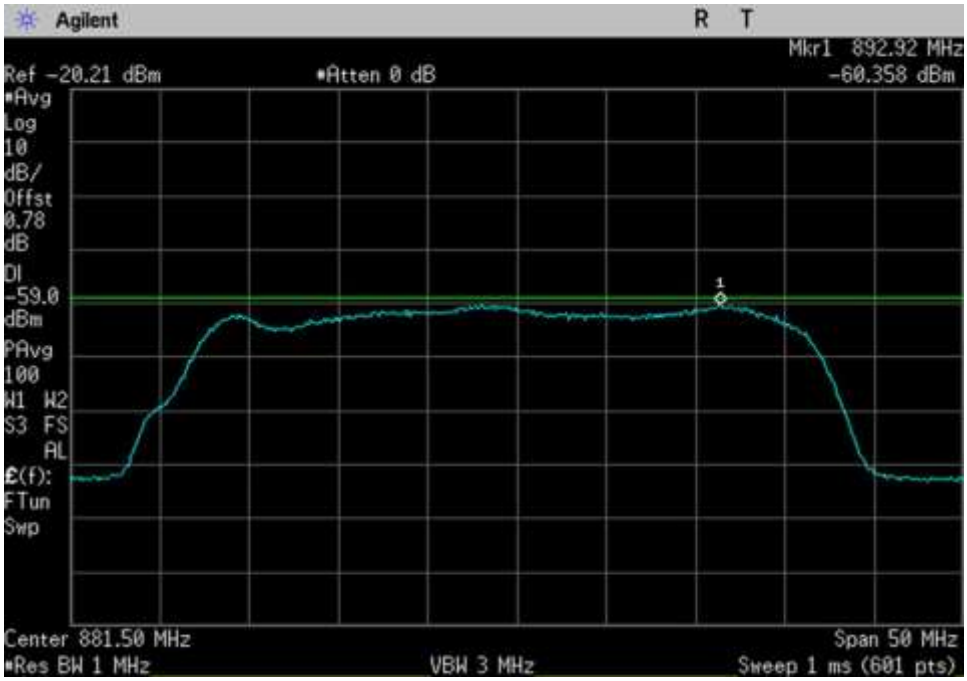
UL_1850-1915_ 1882.5MHz



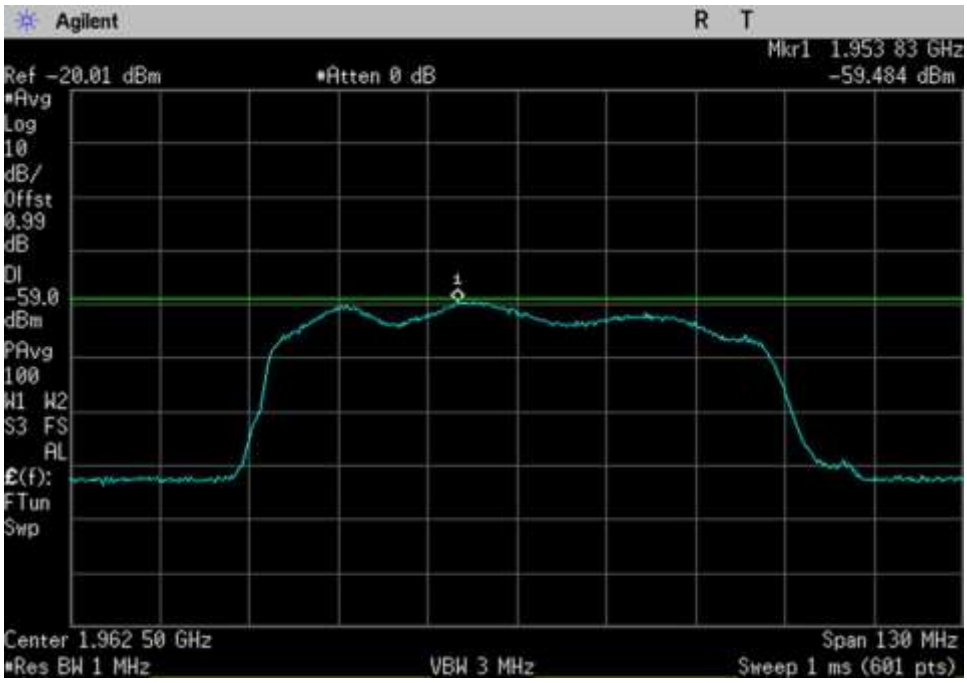
DL_728-746_ 737MHz



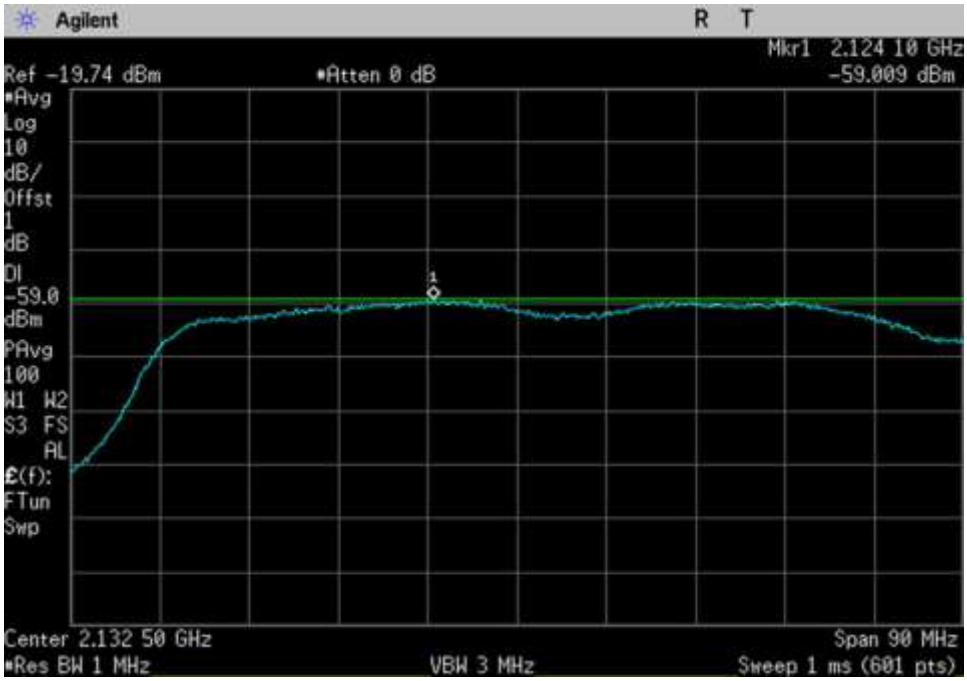
DL_746-757_ 751.5MHz



DL_869-894_ 881.5MHz



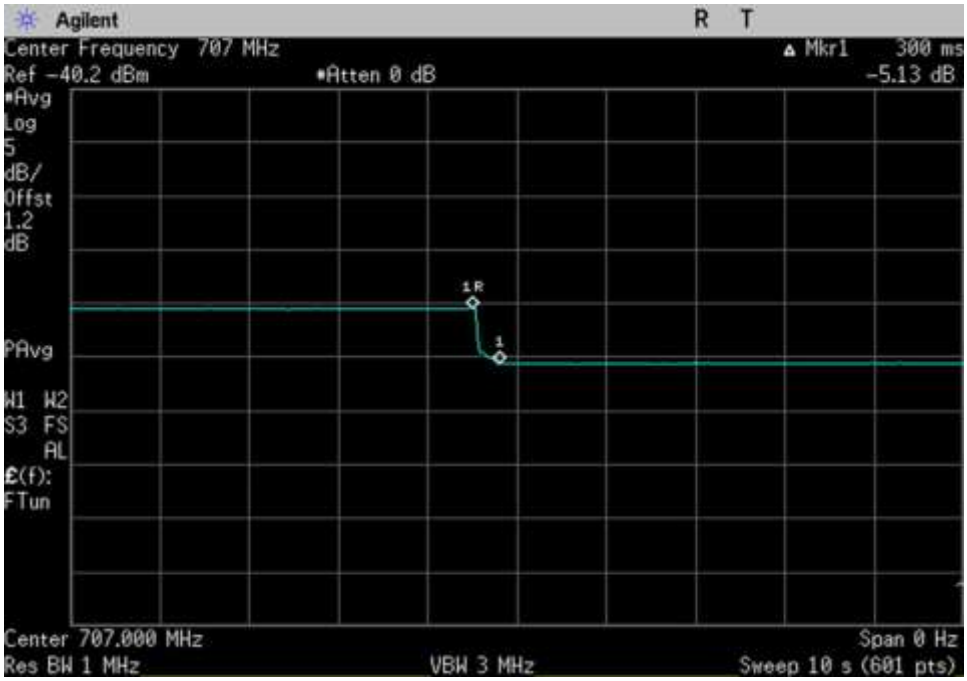
DL_1930-1995_ 1962.5MHz



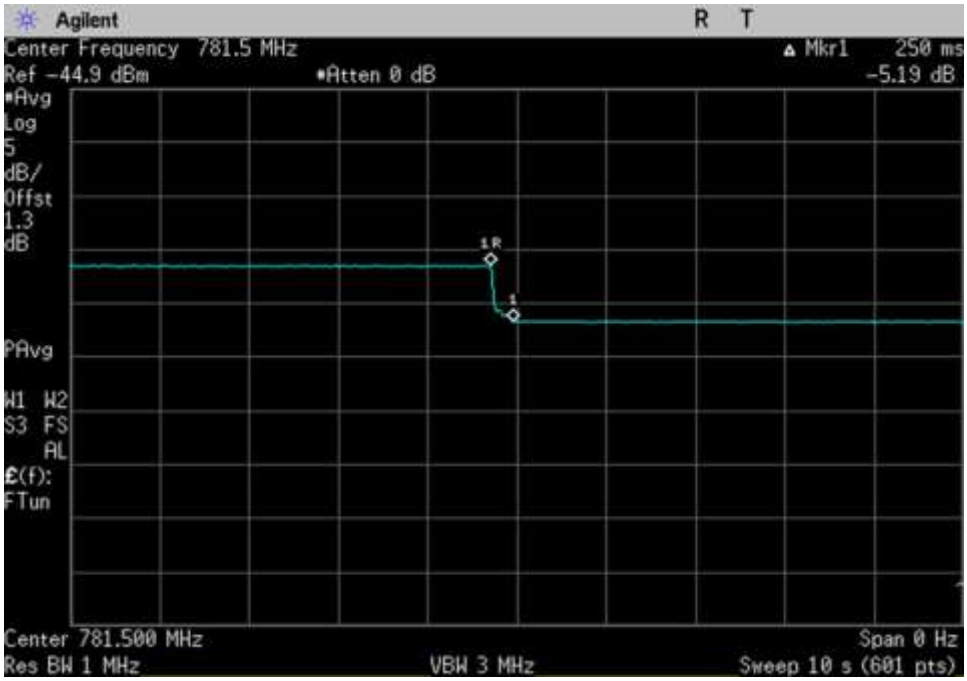
DL_2110-2155_ 2132.5MHz

7.7.2 Variable UL Noise Timing

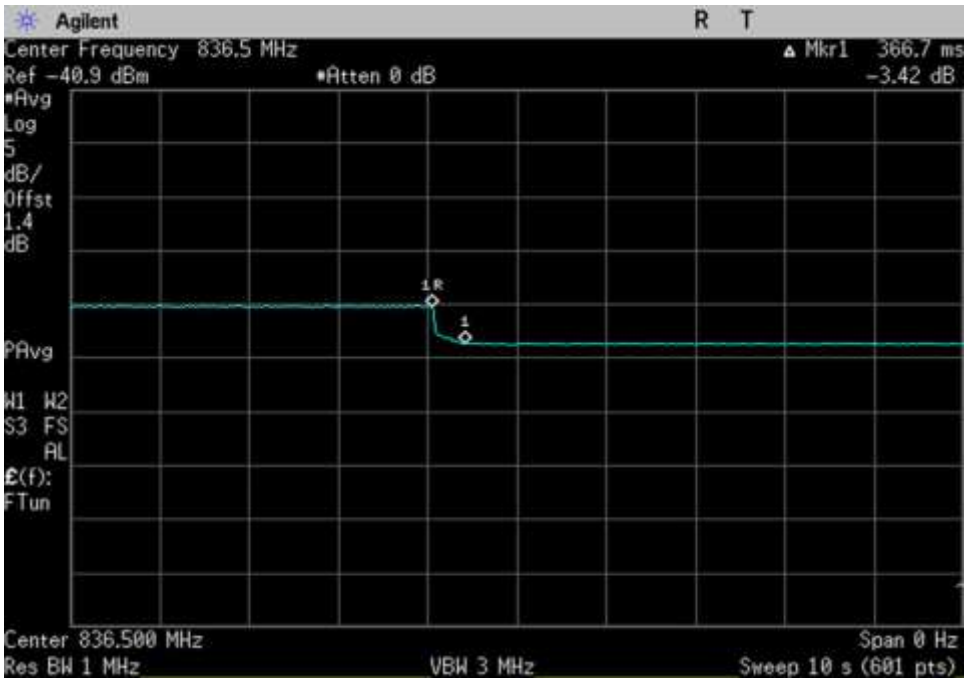
Plots



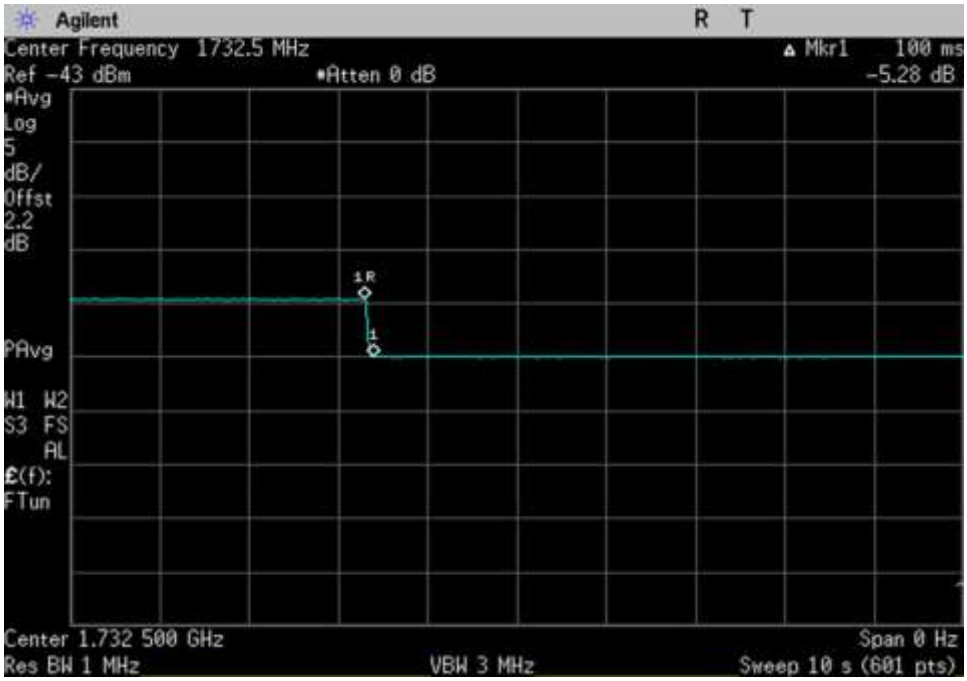
UL_698-716_ 707MHz_Var



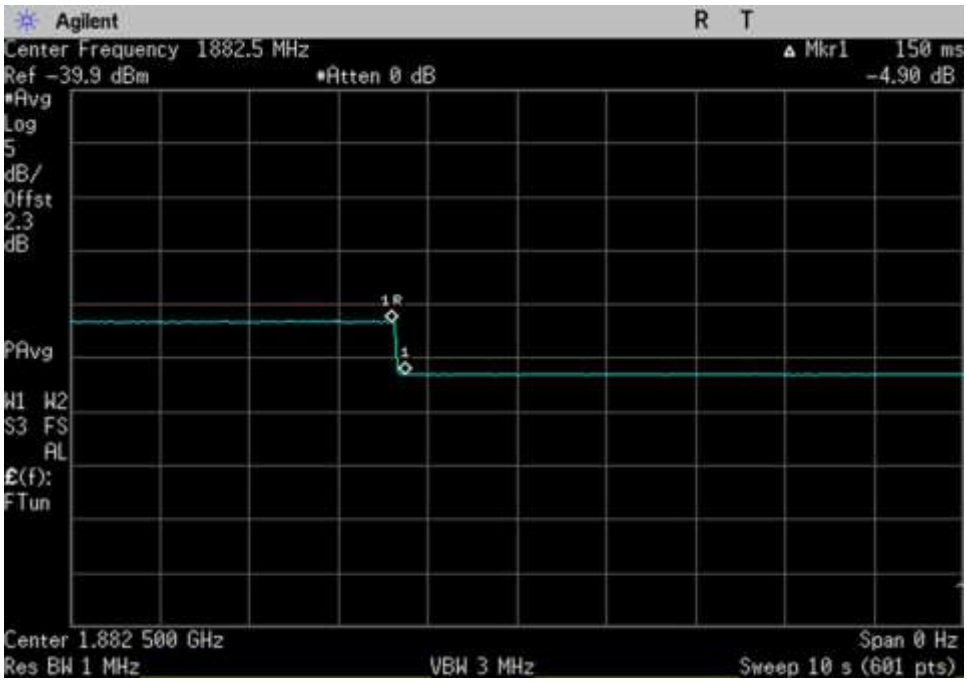
UL_776-787_ 781.5MHz_Var



UL_824-849_ 836.5MHz_Var



UL_1710-1755_ 1732.5MHz_Var



UL_1850-1915_ 1882.5MHz_Var

7.8 Uplink Inactivity

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer: Cellphone-Mate, Inc.
Specification: **7.8 Uplink Inactivity**
Work Order #: **102180** Date: 01/15/2019
Test Type: **Conducted Emissions**

Tested By: **Hieu Song Nguyenpham**
Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test environment conditions: Temperature: 20.6°C, 57.2% relative humidity, Pressure: 102.3kPa

Test Equipment:

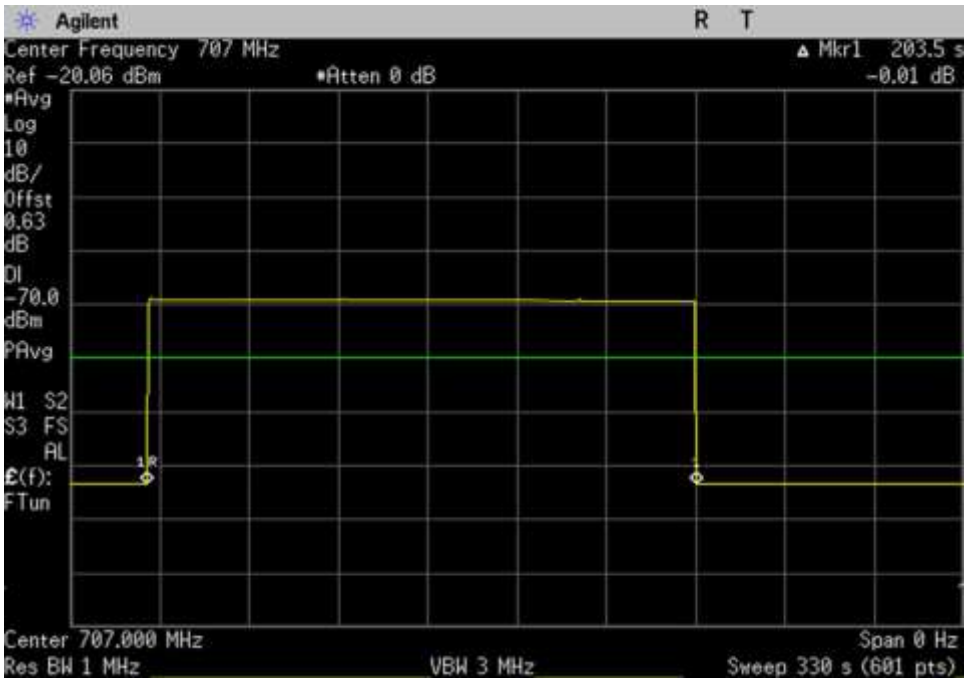
Asset #	Description	Manufacturer	Model	Calibration Date	Cal Due Date
P07192	Cable	Astro	32022-29094K-29094K-48TC	10/9/2017	10/9/2019
P07191	Cable	Astro	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
03418	Signal Generator	Agilent	E4438C	6/19/2017	6/19/2019
03471	Spectrum Analyzer	Agilent	E4440A	1/18/2018	1/18/2020

Summary of Results

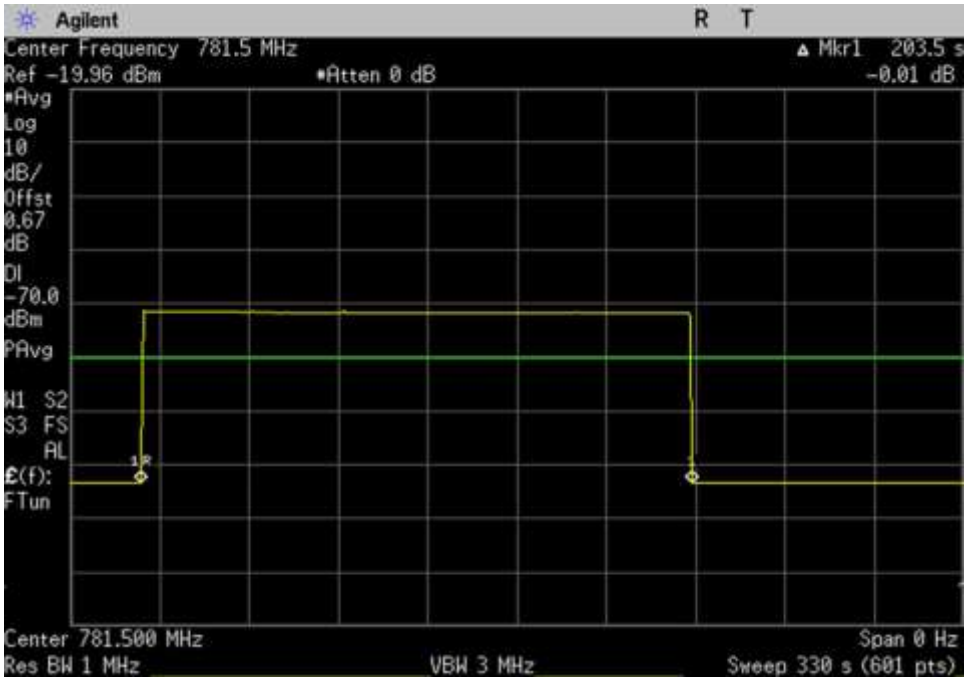
Pass: As demonstrated, when the booster is not serving an active device connection after 5 minutes the uplink noise power does not exceed -70dBm/MHz

Uplink Inactivity		
Frequency MHz	**Measured Min**	**Limit Min**
UL1710-1755	3.4	5.0
UL1850-1915	3.4	5.0
UL824-849	3.4	5.0
UL 698-716	3.4	5.0
UL776-787	3.4	5.0

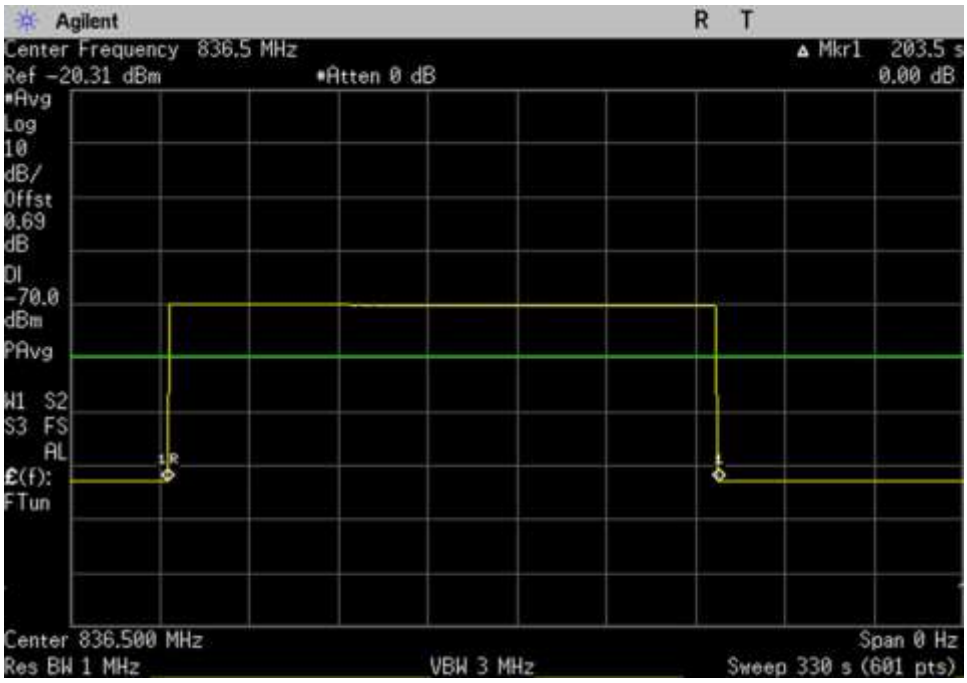
Plots



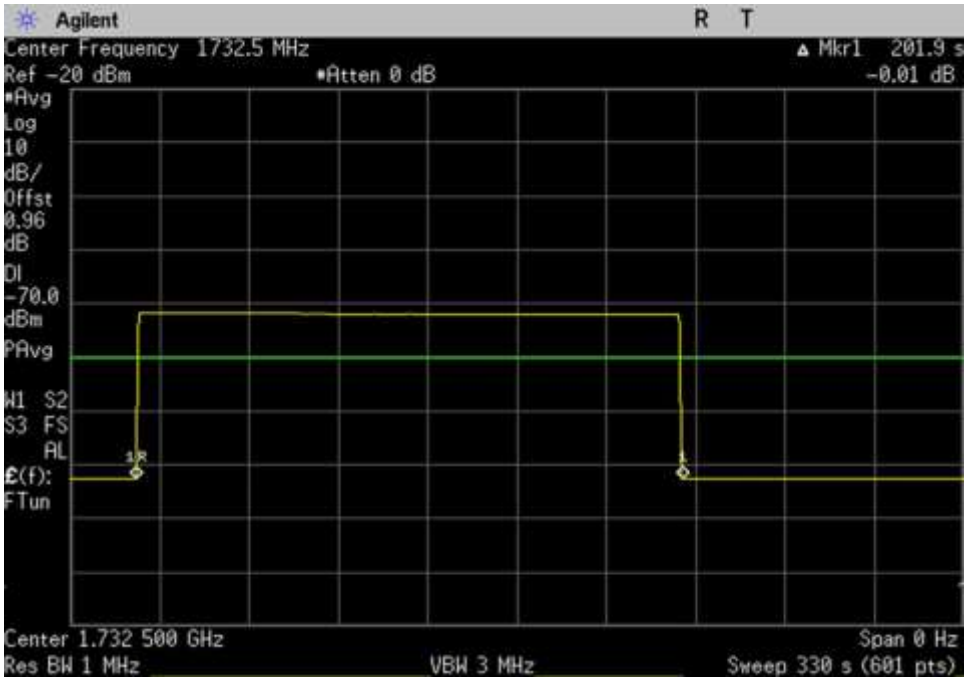
UL_698-716_ 707MHz



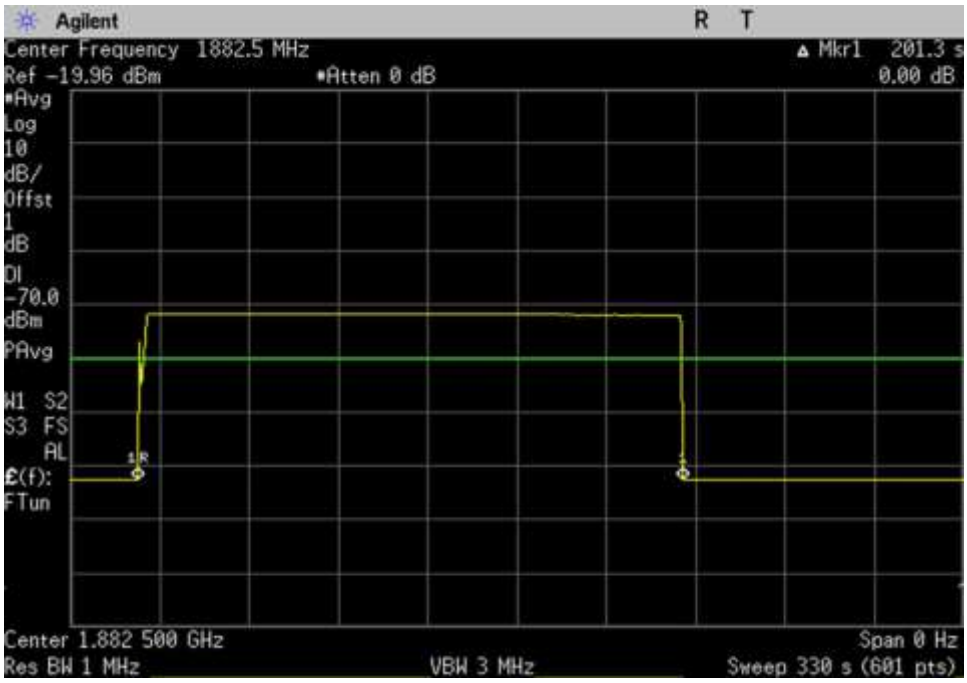
UL_776-787_ 781.5MHz



UL_824-849_ 836.5MHz



UL_1710-1755_ 1732.5MHz



UL_1850-1915_ 1882.5MHz

7.9 Booster Gain Limit

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer: Cellphone-Mate, Inc.
Specification: **7.9 Variable Booster gain(Max Gain / Variable Uplink Gain Timing)**
Work Order #: **102180**
Test Type: **Conducted Emissions** Date 01/28/2019 and 01/29/2019
Tested By: **Hieu Song Nguyenpham**
Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

01/28/2019: Test environment conditions: Temperature: 20.5°C, 38% relative humidity, Pressure: 102.2kPa
01/29/2019: Test environment conditions: Temperature: 20.5°C, 43% relative humidity, Pressure: 101.9kPa

Modification #1 was in place during testing.

Frequency (MHz)	MSCL (dB)
PCS(1850-1915)	37.8
Cellular(824-849)	32.5
LTE(698-716)	30.6
LTE(776-787)	31.5
AWS(1710-1755)	37

Test Equipment:

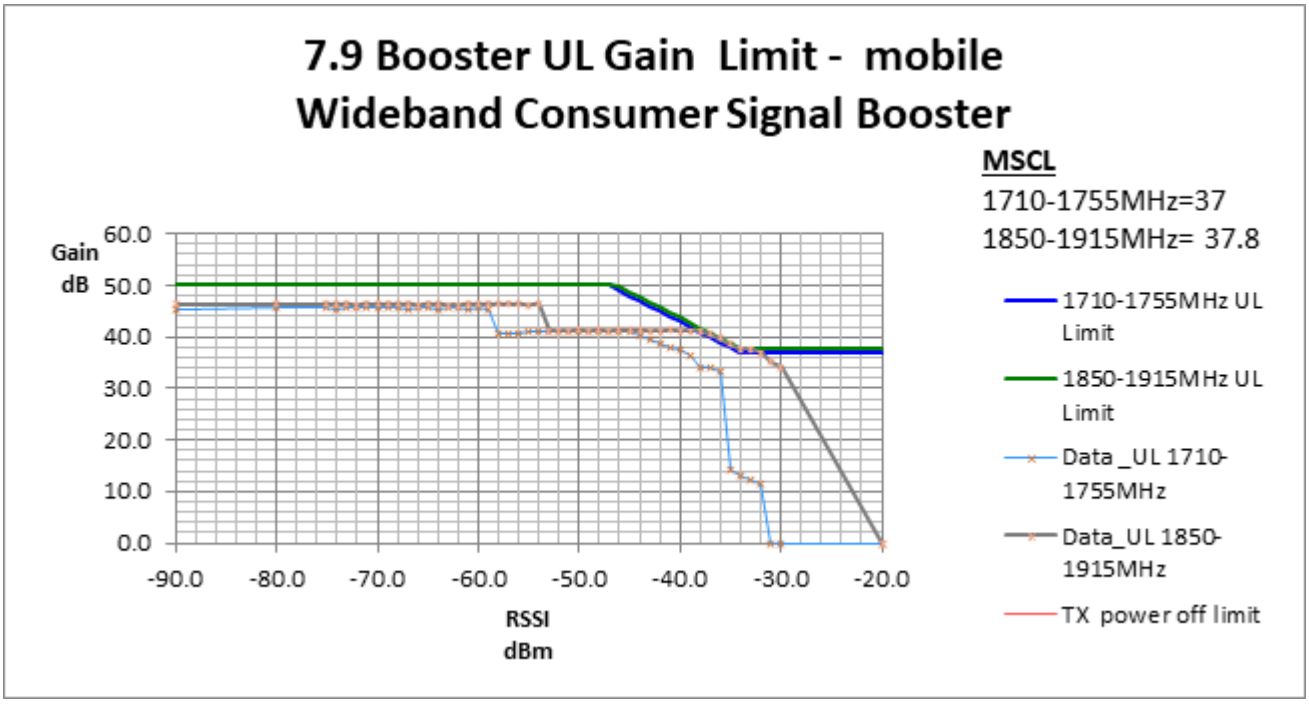
Asset #	Description	Manufacturer	Model	Calibration Date	Cal Due Date
P07192	Cable	Astro	32022-29094K-29094K-48TC	10/9/2017	10/9/2019
P07191	Cable	Astro	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
03418	Signal Generator	Agilent	E4438C	6/19/2017	6/19/2019
03471	Spectrum Analyzer	Agilent	E4440A	1/18/2018	1/18/2020
03360	Cable	Astrolab	32022-2-29094-36TC	6/25/2018	6/25/2020
C00082	Directional Coupler	MECA Electronics, Inc.	722-10-1.500V	9/18/2017	9/18/2019
C00032	Arbitrary Waveform Generator	Agilent	E4433B	3/19/2018	3/19/2020

Summary of Results

Pass: As demonstrated, computed gains are within the gain limit. All maximum variable uplink gain timings are within 1 second limit.

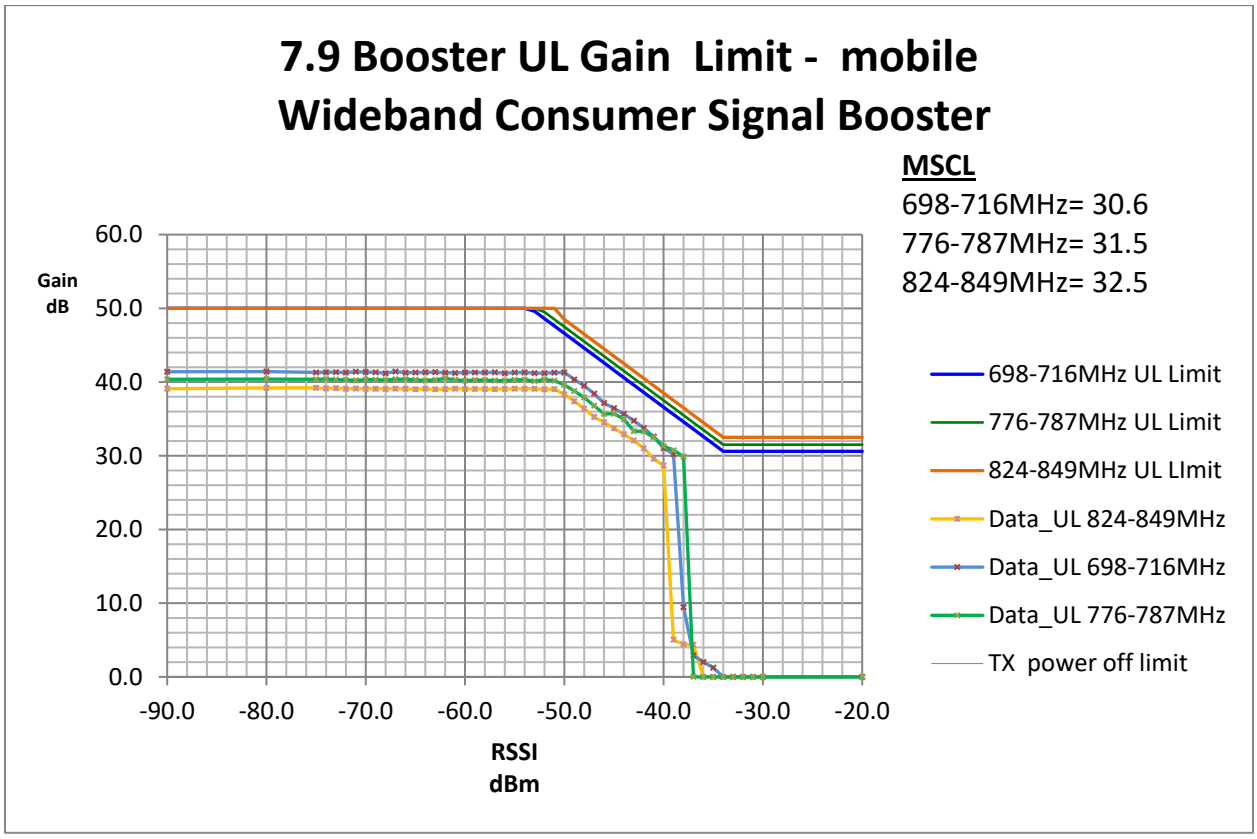
7.9.1 Maximum Gain

7.9.1 Maximum gain



1710.0-1755.0MHz							
RSSI (dBm)				Limit			Margin
	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-32.5	12.937	45.4	-	50.0	-	-4.6
-80.0	-32.5	13.036	45.5	-	50.0	-	-4.5
-40.0	-32.5	5.1	37.6	43.0	-	-	-5.4
-39.0	-32.5	3.9	36.4	42.0	-	-	-5.6
-34.0	-32.5	-19.4	13.1	-	-	37	-23.9
-33.0	-32.5	-20.1	12.4	-	-	37	-24.6

1850.0-1915.0MHz							
RSSI (dBm)				Limit			Margin
	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-30.8	15.6	46.4	-	50.0	-	-3.6
-80.0	-30.8	15.6	46.4	-	50.0	-	-3.6
-36.0	-30.8	8.9	39.7	39.8	-	-	-0.1
-35.0	-30.8	7.9	38.7	38.8	-	-	-0.1
-34.0	-30.8	6.8	37.6	-	-	37.8	-0.2
-33.0	-30.8	6.7	37.5	-	-	37.8	-0.3



824.0-849.0MHz							
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-22.5	16.6	39.1	-	50.0	-	-10.9
-80.0	-22.5	16.7	39.2	-	50.0	-	-10.8
-41.0	-22.5	7.1	29.6	39.5	-	-	-9.9
-40.0	-22.5	6.2	28.7	38.5	-	-	-9.8
-34.0	-22.5	-36.8	0.0	-	-	32.5	-32.5
-33.0	-22.5	-36.8	0.0	-	-	32.5	-32.5

698.0-716.0MHz							
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-24.5	16.9	41.4	-	50.0	-	-8.6
-80.0	-24.5	16.9	41.4	-	50.0	-	-8.6
-43.0	-24.5	10.3	34.8	39.6	-	-	-4.8
-42.0	-24.5	9.3	33.8	38.6	-	-	-4.8
-34.0	-24.5	-36.1	0.0	-	-	30.6	-30.6
-33.0	-24.5	-36.1	0.0	-	-	30.6	-30.6

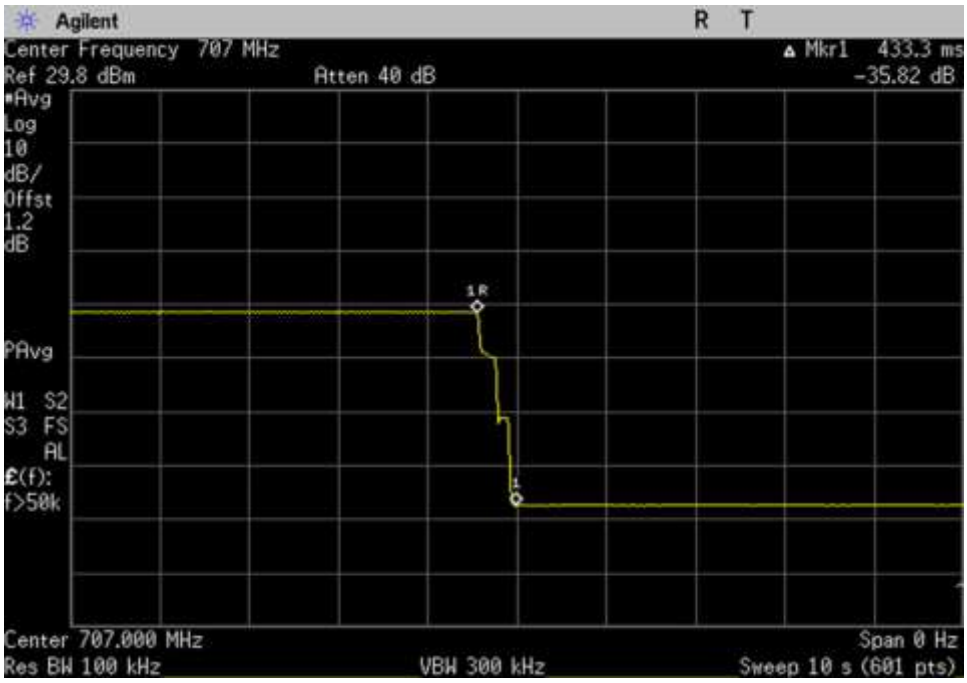
776.0-787.0MHz							
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-22.5	17.9	40.4	-	50.0	-	-9.6
-80.0	-22.5	17.9	40.4	-	50.0	-	-9.6
-39.0	-22.5	8.3	30.8	36.5	-	-	-5.7
-38.0	-22.5	7.4	29.9	35.5	-	-	-5.6
-34.0	-22.5	-25.1	0.0	-	-	31.5	-31.5
-33.0	-22.5	-36.9	0.0	-	-	31.5	-31.5

7.9.2 Variable uplink Gain Timing

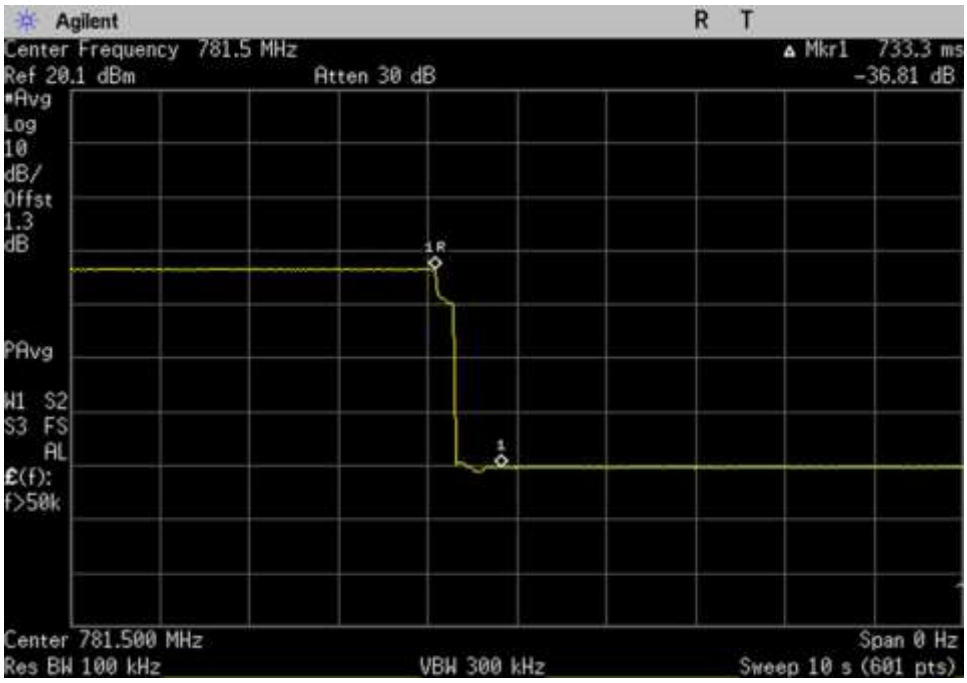
7.9.2 Variable uplink gain timing

Uplink Gain Timing		
Frequency (MHz)	**Measured (Sec)**	**Limit (Sec)**
UL 1710-1755	0.50	1.00
UL 1850-1915	0.22	1.00
UL 824-849	0.43	1.00
UL 698-716	0.43	1.00
UL 776-787	0.50	1.00

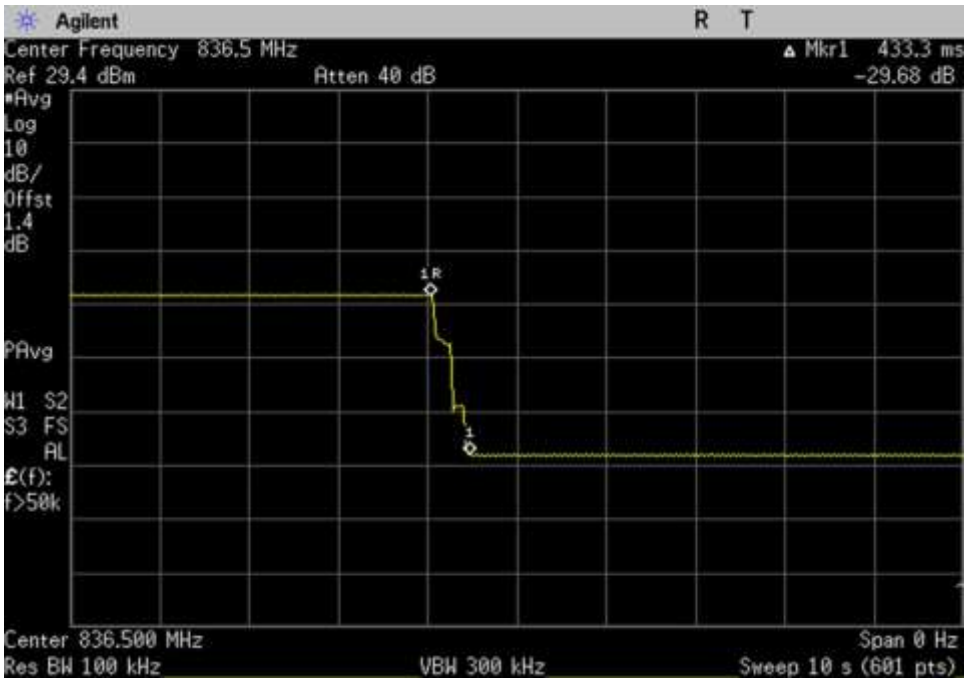
Plots



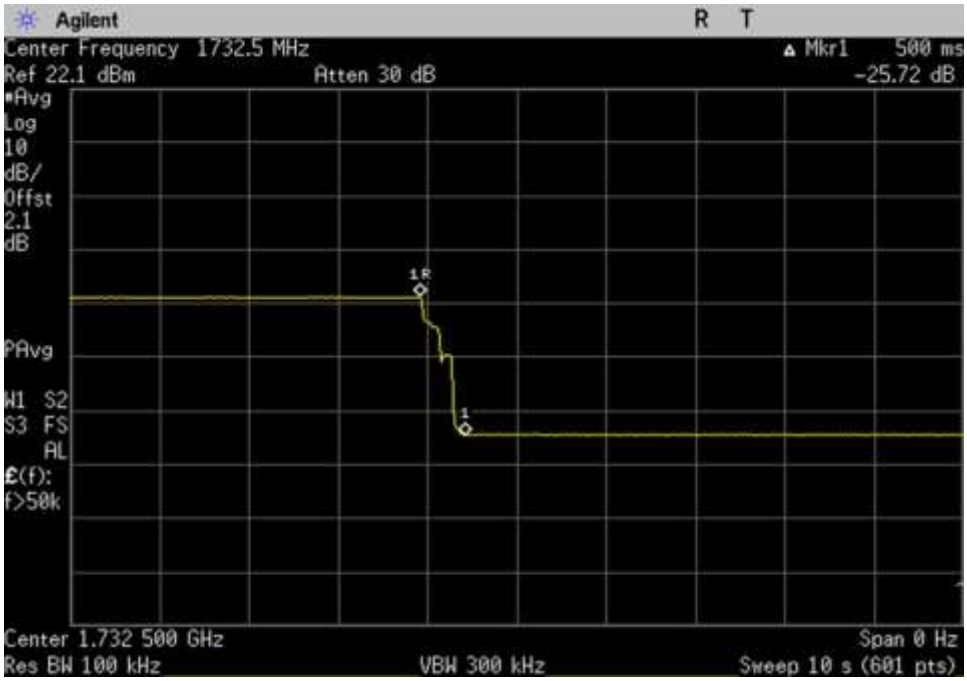
UL_698-716_ 707MHz_Var



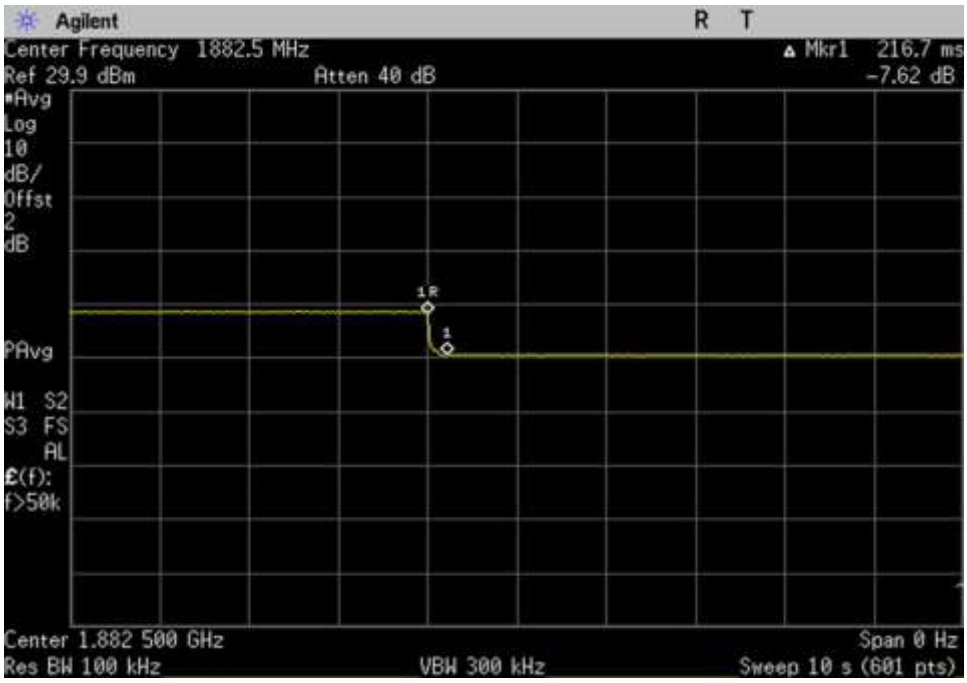
UL_776-787_ 781.5MHz_Var



UL_824-849_ 836.5MHz_Var



UL_1710-1755_ 1732.5MHz_Var



UL_1850-1915_ 1882.5MHz_Var

7.10 Occupied Band Width

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer:	Cellphone-Mate, Inc.
Specification:	**7.10 Occupied Band Width / 47 CFR §2.1049 Occupied Band Width**
Work Order #:	**102180**
Test Type:	**Conducted Emissions** Date 01/15/2019
Tested By:	**Hieu Song Nguyenpham**
Software:	EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test environment conditions: Temperature: 20.6°C, 57.2% relative humidity, Pressure: 102.3kPa

Test Equipment:

Asset #	Description	Manufacturer	Model	Calibration Date	Cal Due Date
P05411	Attenuator	Weinschel	54A-10	1/19/2018	1/19/2020
P07192	Cable	Astro	32022-29094K-29094K-48TC	10/9/2017	10/9/2019
P07191	Cable	Astro	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
03418	Signal Generator	Agilent	E4438C	6/19/2017	6/19/2019
03471	Spectrum Analyzer	Agilent	E4440A	1/18/2018	1/18/2020

Summary of Results

Pass: As summarized in plots and tables below, the uniformity of the output signal relative to the input signal are practically identical. Therefore, the comparison is within limits.

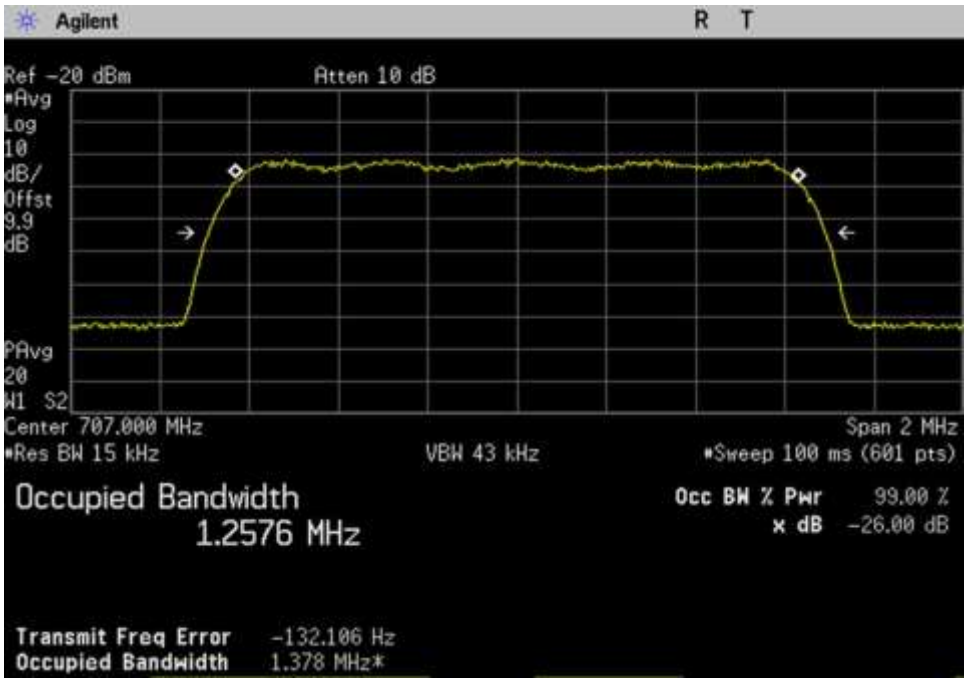
OBW-Input (Hz)				
EDGE	**GSM**	**CDMA**	**AWGN**	**LTE**
245231	245651	1261626	4155264	4453781
245498	245479	1254755	4160895	4459455
244683	247316	1256140	4166527	4453852
246657	245668	1257647	4146057	4456943
247432	246275	1260235	4155387	4456874
247299	245173	1255670	4175460	4457676
247632	247803	1263795	4174980	4452337
247984	246749	1256273	4146534	4453761
245669	247707	1255164	4174207	4443230
246380	247267	1258427	4167112	4454313

OBW-Output (Hz)				
EDGE	**GSM**	**CDMA**	**AWGN**	**LTE**
246198	245170	1249736	4184325	4447599
243051	246645	1259143	4140670	4446215
243380	245037	1259901	4148041	4435560
244054	246352	1255775	4147274	4444254
247020	244271	1259979	4142976	4448120
244685	245847	1256153	4185396	4451502
246718	246416	1253535	4162869	4458725
247071	245621	1256979	4173369	4461225
247501	246415	1251178	4148547	4451604
245249	245944	1260351	4125033	4429476

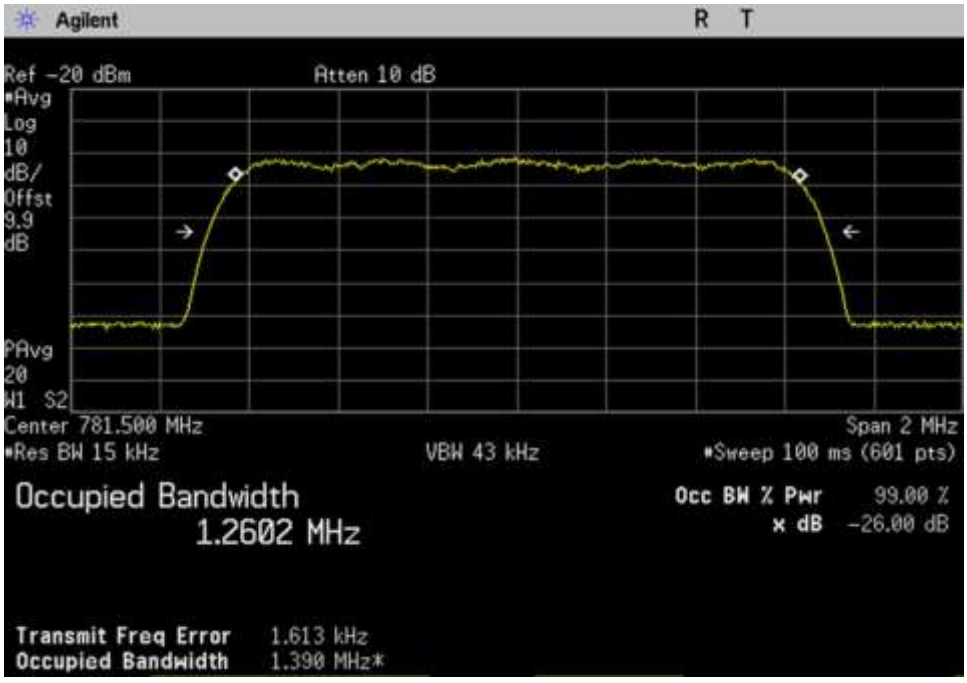
Max Difference In&Out Occ BW 99% Pwr					
Frequency Range	**EDGE**	**GSM**	**CDMA**	**AWGN**	**LTE**
UL_1710-1755MHz	0.39%	0.20%	0.94%	0.70%	0.14%
UL_1850-1915MHz	1.00%	0.47%	0.35%	0.49%	0.30%
UL_824-849MHz	0.53%	0.92%	0.30%	0.44%	0.41%
UL_698-716MHz	1.06%	0.28%	0.15%	0.03%	0.28%
UL_777-787MHz	0.17%	0.81%	0.02%	0.30%	0.20%
DL_2110-2155MHz	1.06%	0.27%	0.04%	0.24%	0.14%
DL_1930-1995MHz	0.37%	0.56%	0.81%	0.29%	0.14%
DL_869-894MHz	0.37%	0.46%	0.06%	0.65%	0.17%
DL_728-746MHz	0.75%	0.52%	0.32%	0.61%	0.19%
DL_746-756MHz	0.46%	0.54%	0.15%	1.01%	0.56%

Plots

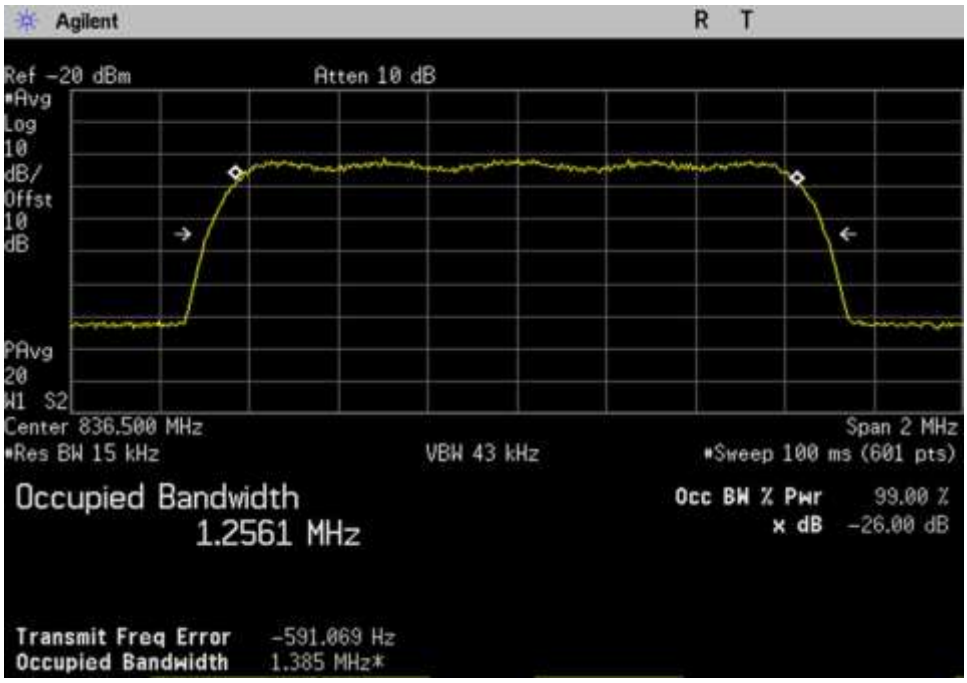
CDMA Input



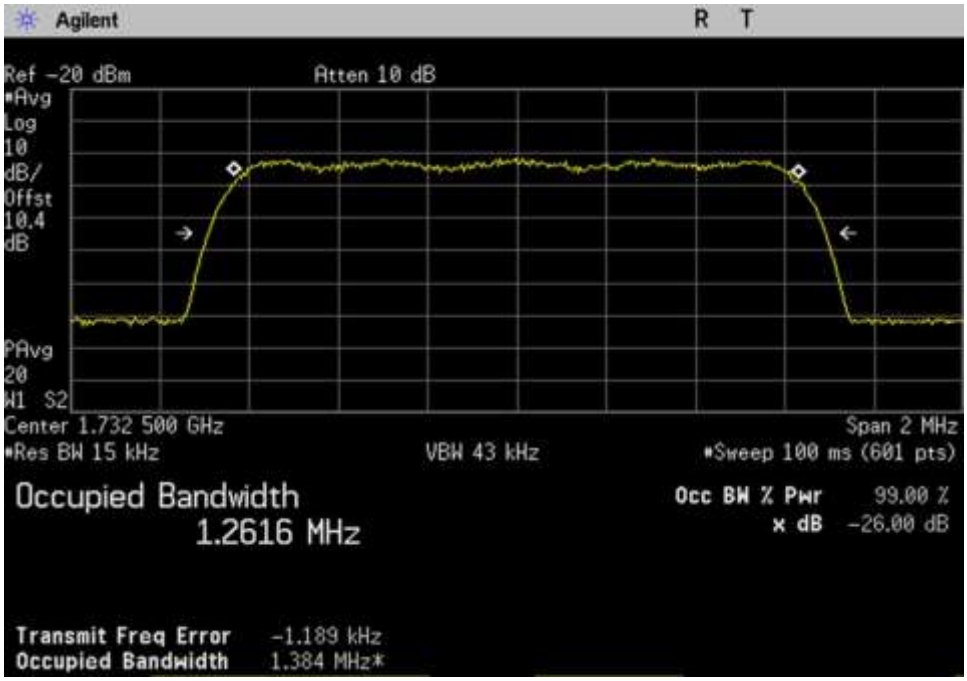
UL_698-716_CDMA_ 707MHz



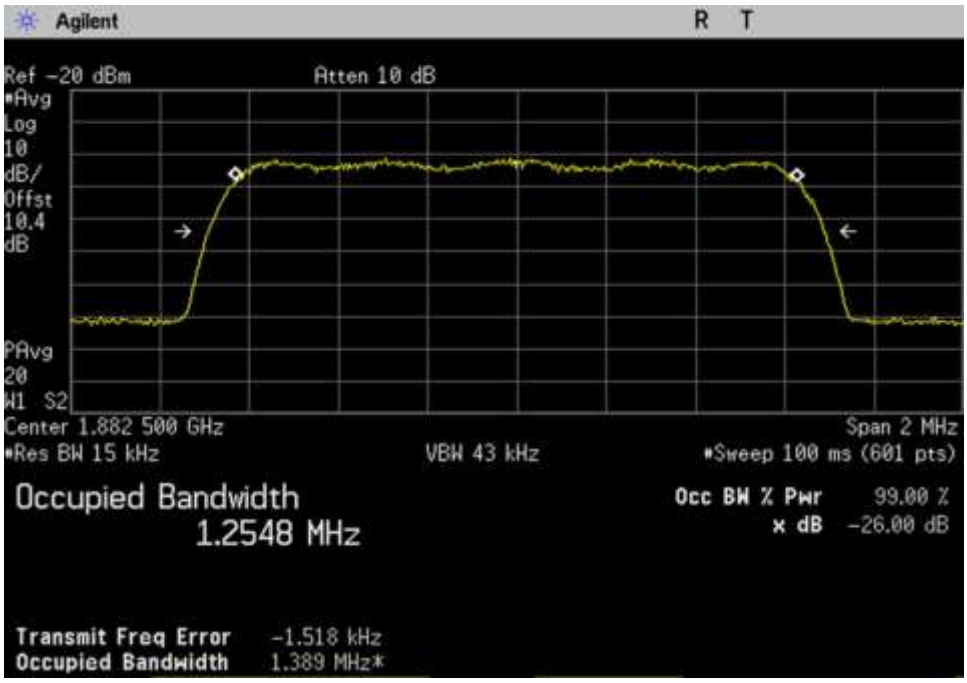
UL_776-787_CDMA_ 781.5MHz



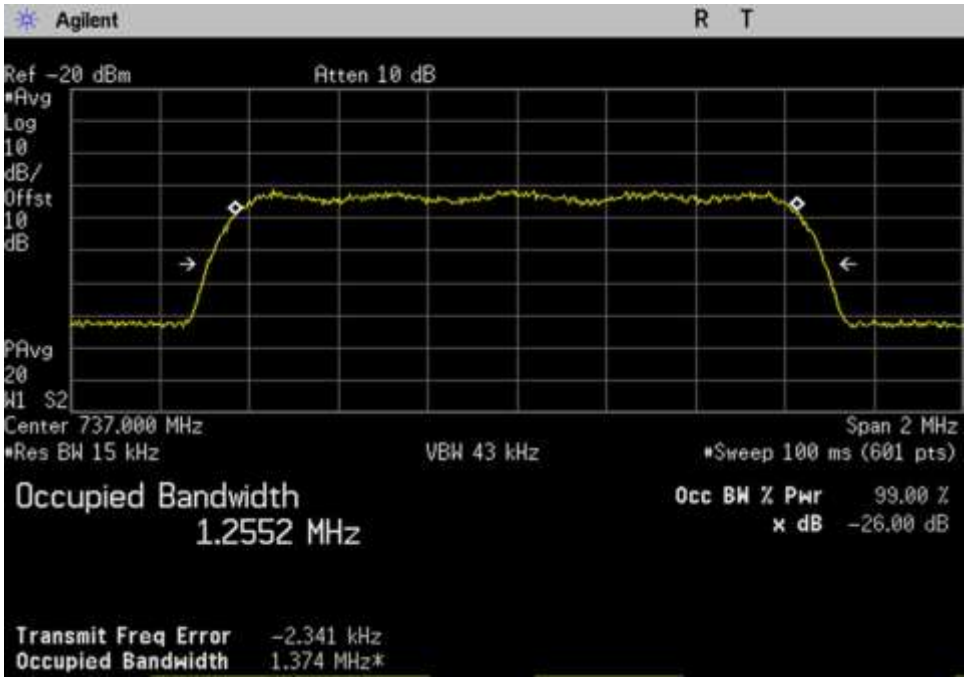
UL_824-849_CDMA_ 836.5MHz



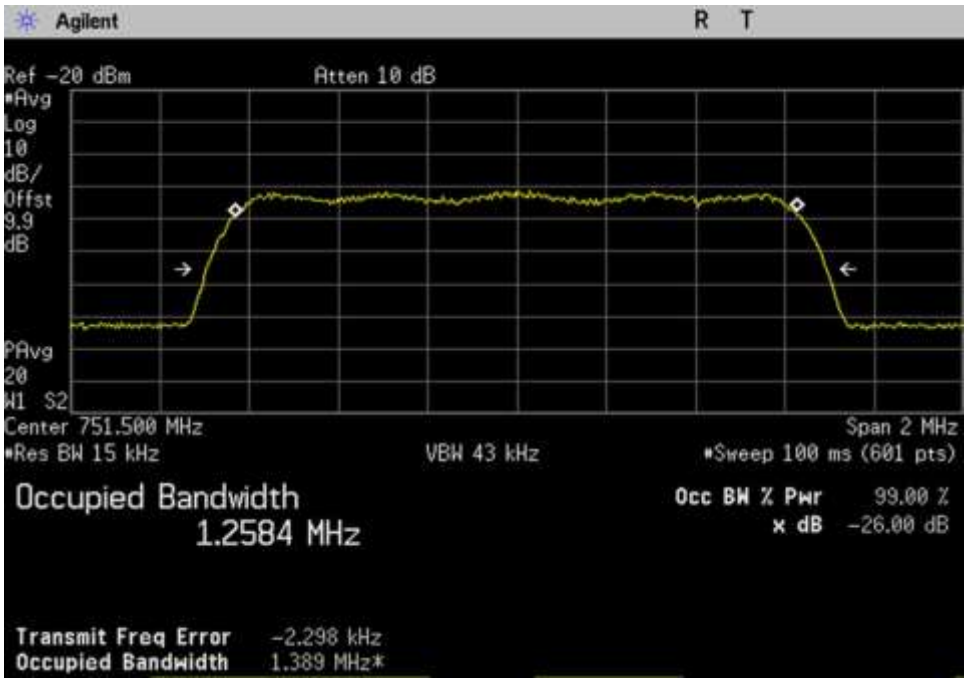
UL_1710-1755_CDMA_ 1732.5MHz



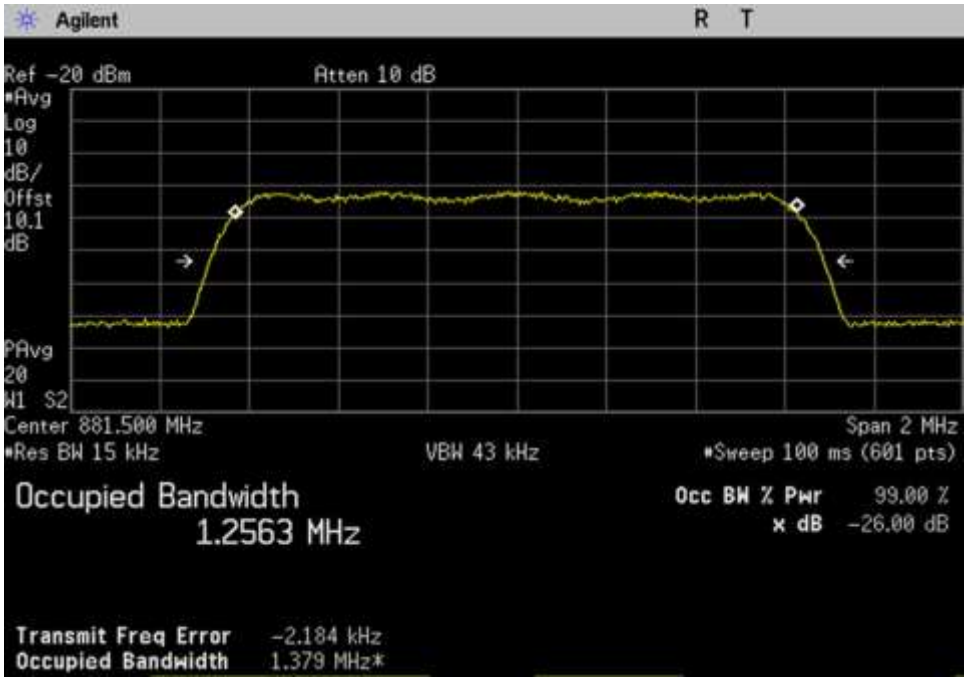
UL_1850-1915_CDMA_ 1882.5MHz



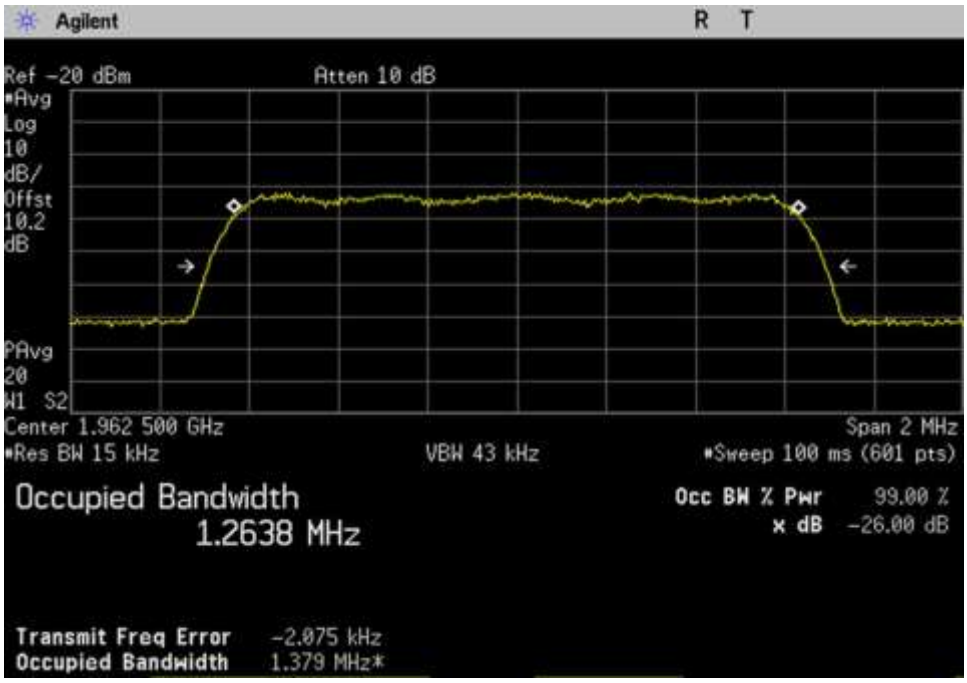
DL_728-746_CDMA_ 737MHz



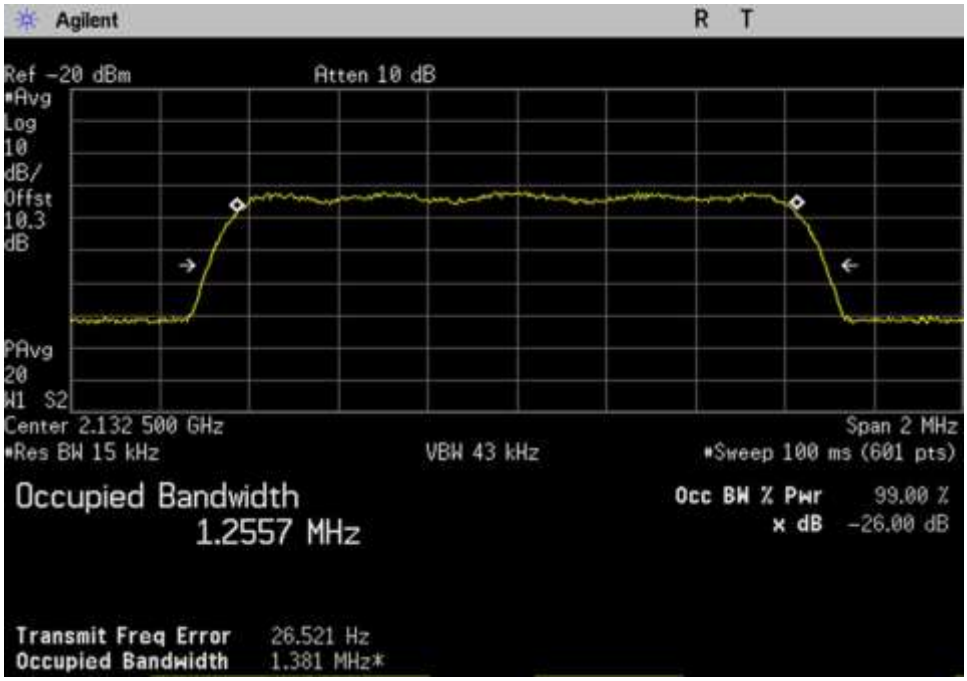
DL_746-757_CDMA_ 751.5MHz



DL_869-894_CDMA_ 881.5MHz

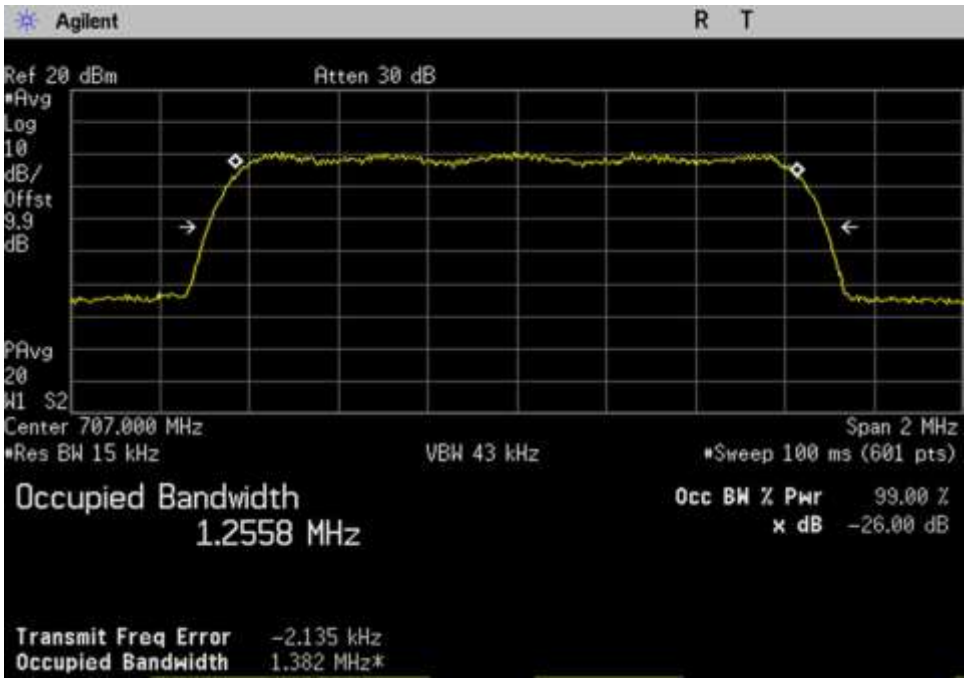


DL_1930-1995_CDMA_ 1962.5MHz

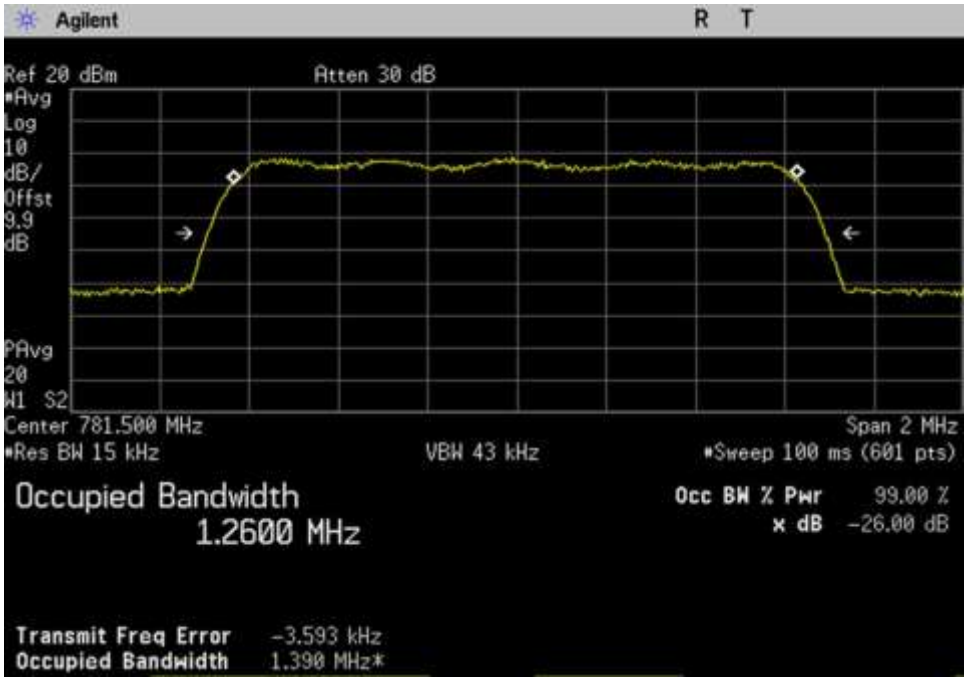


DL_2110-2155_CDMA_ 2132.5MHz

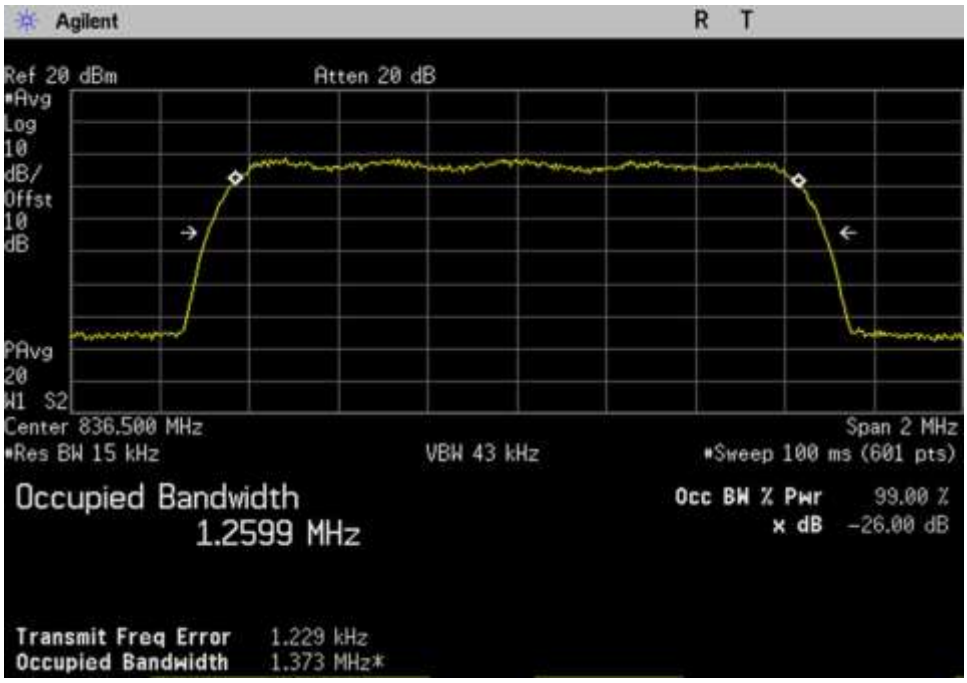
CDMA Output



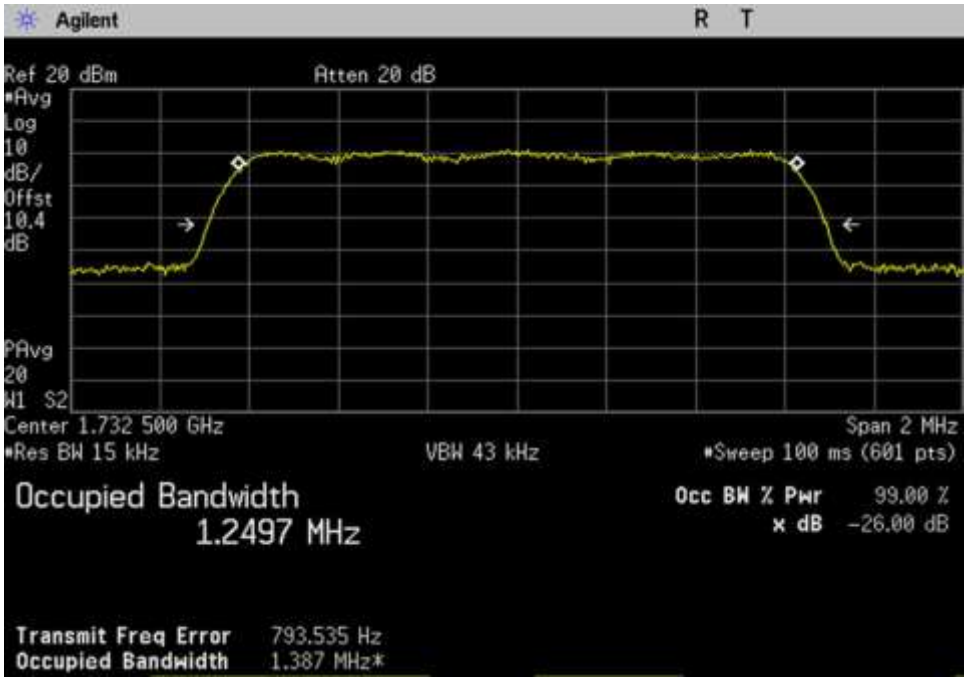
UL_698-716_CDMA_ 707MHz



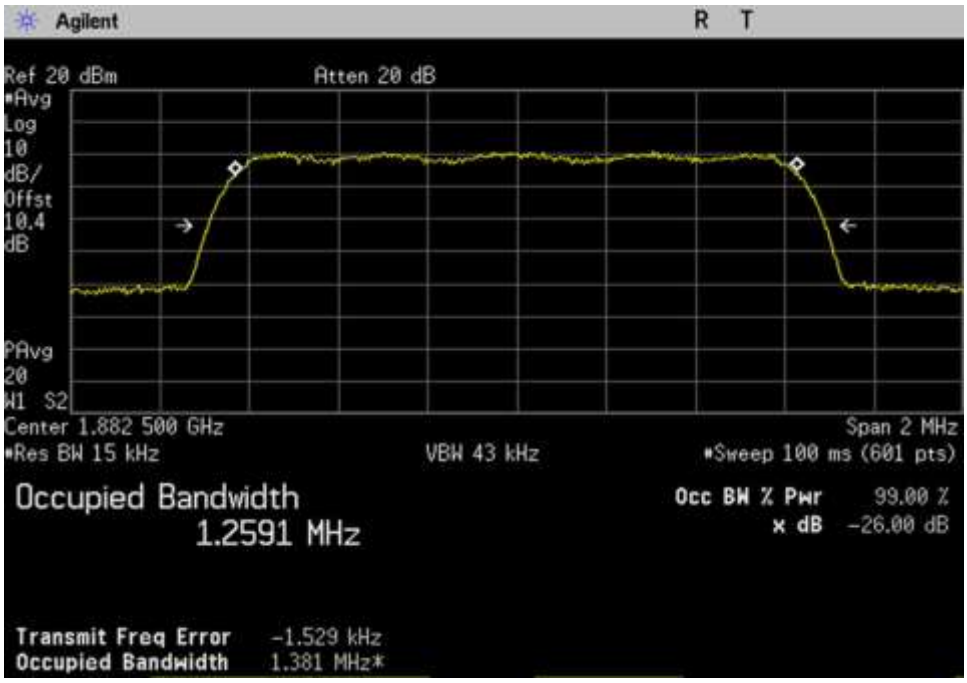
UL_776-787_CDMA_ 781.5MHz



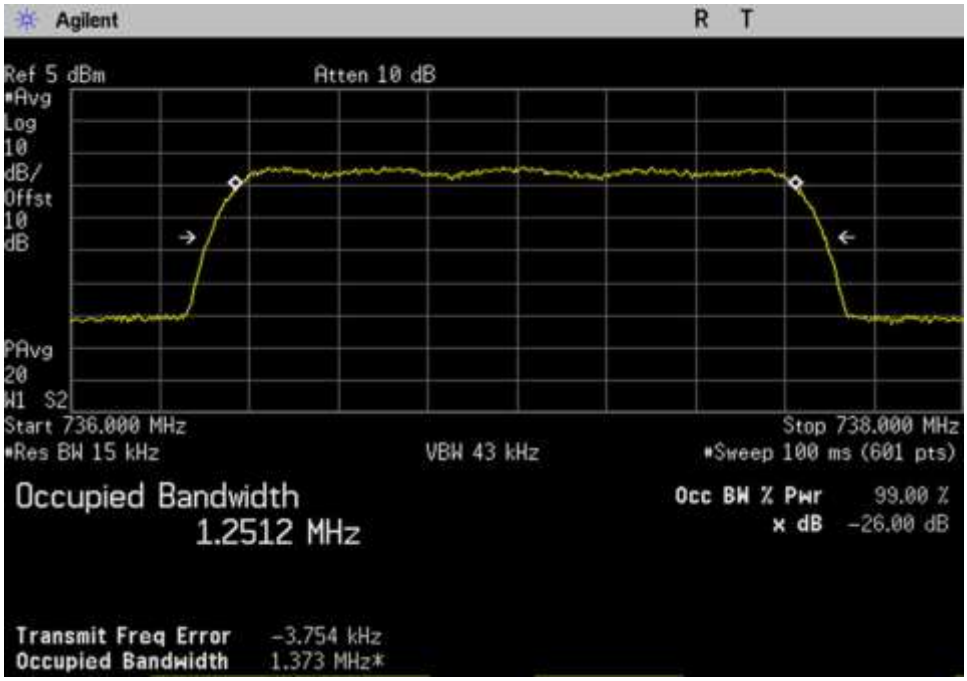
UL_824-849_CDMA_ 836.5MHz



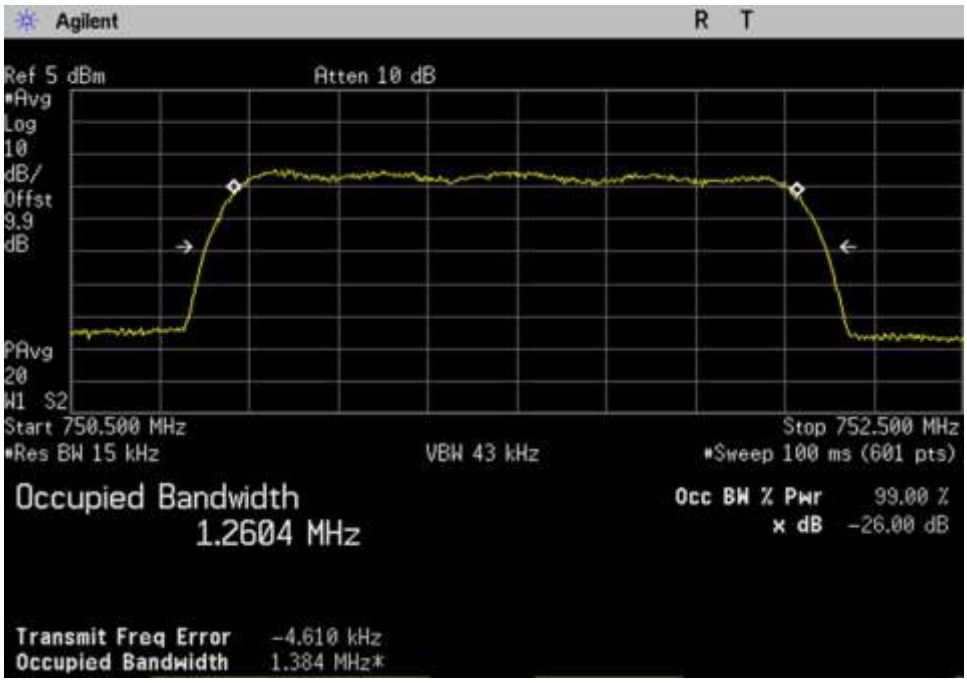
UL_1710-1755_CDMA_ 1732.5MHz



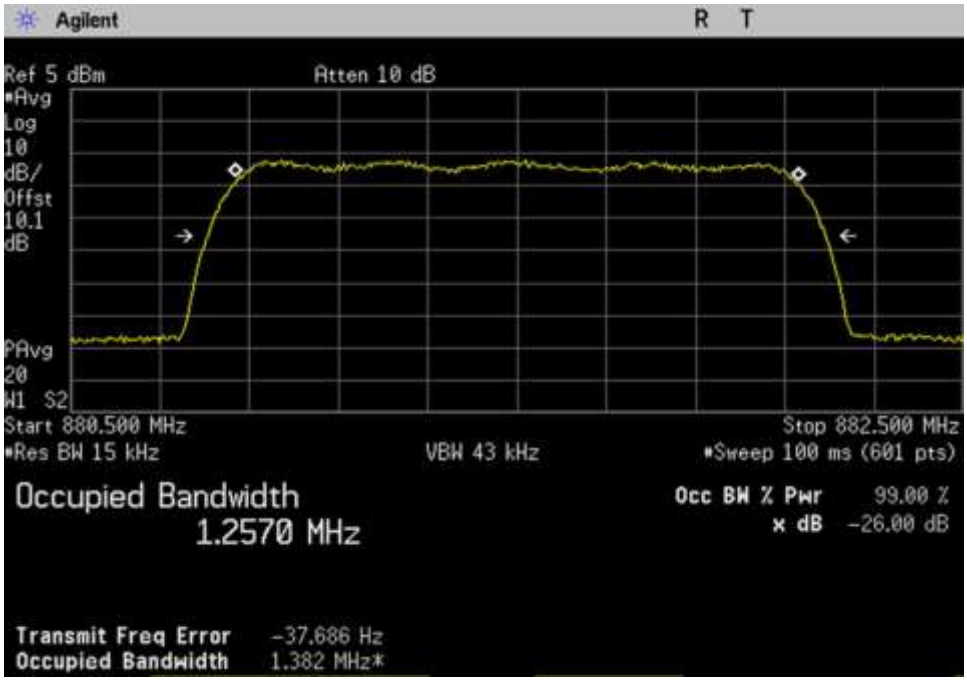
UL_1850-1915_CDMA_ 1882.5MHz



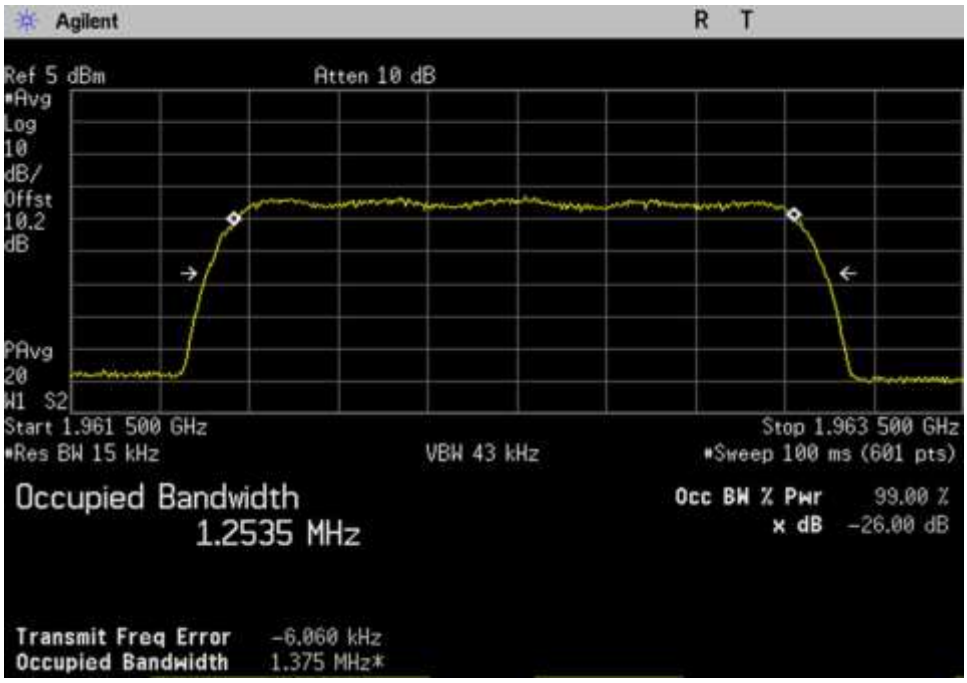
DL_728-746_CDMA_ 737MHz



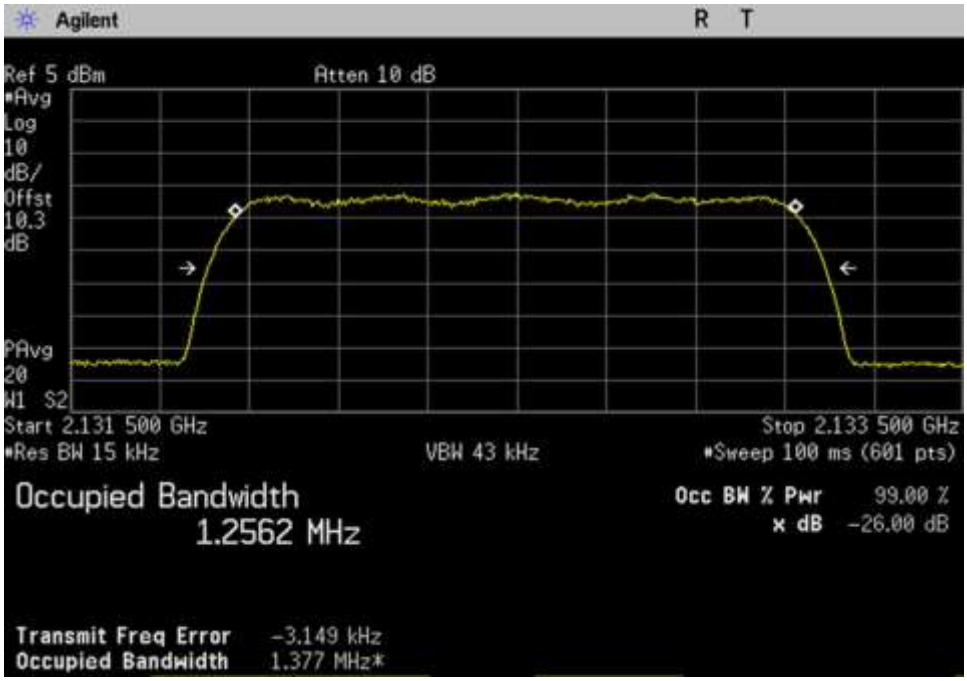
DL_746-757_CDMA_ 751.5MHz



DL_869-894_CDMA_ 881.5MHz

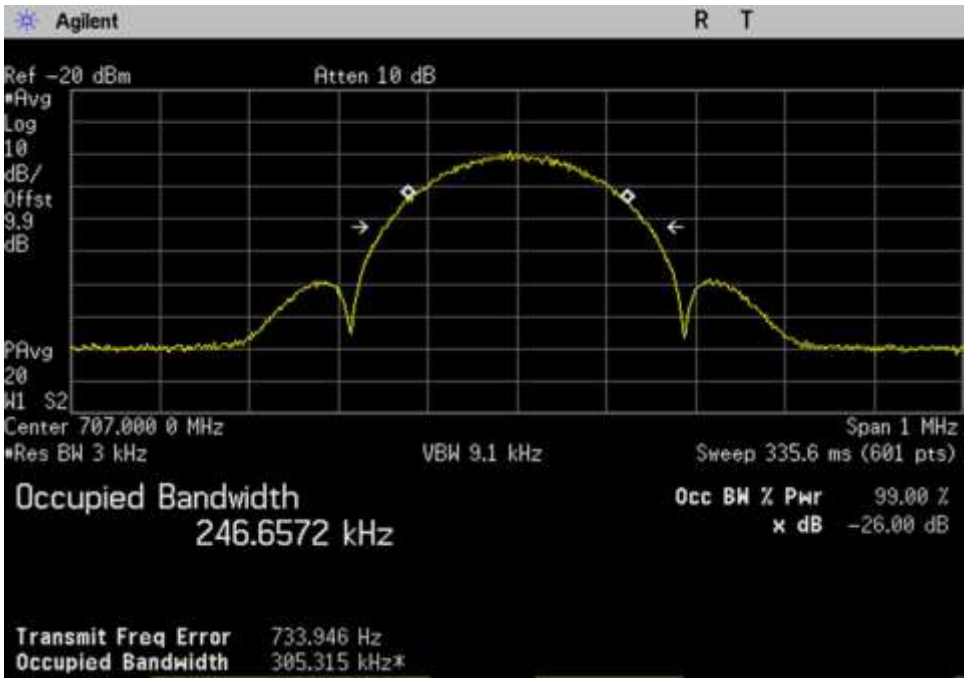


DL_1930-1995_CDMA_ 1962.5MHz

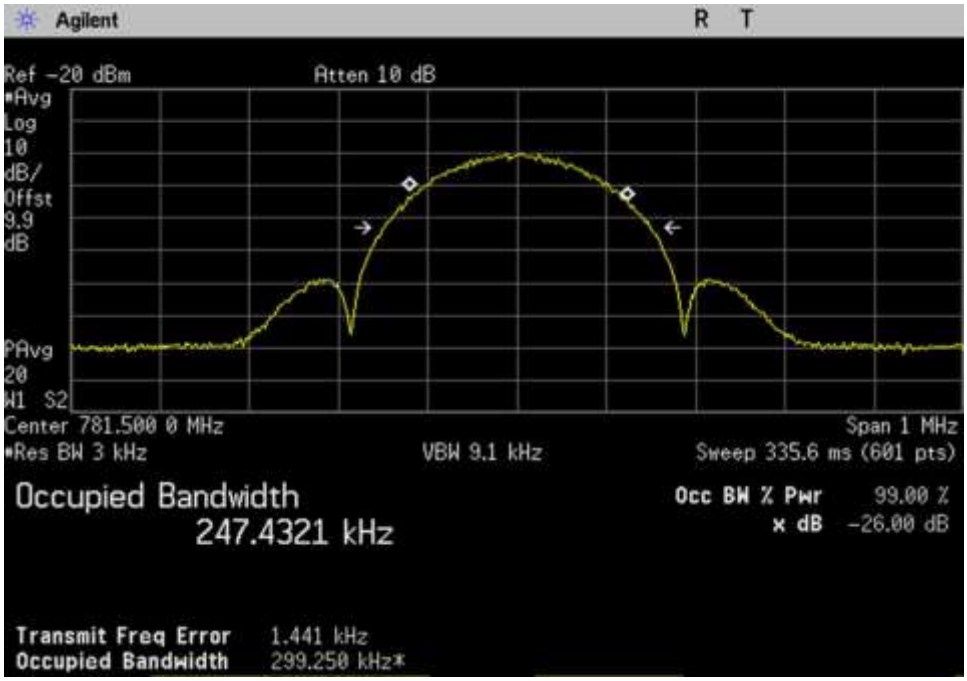


DL_2110-2155_CDMA_ 2132.5MHz

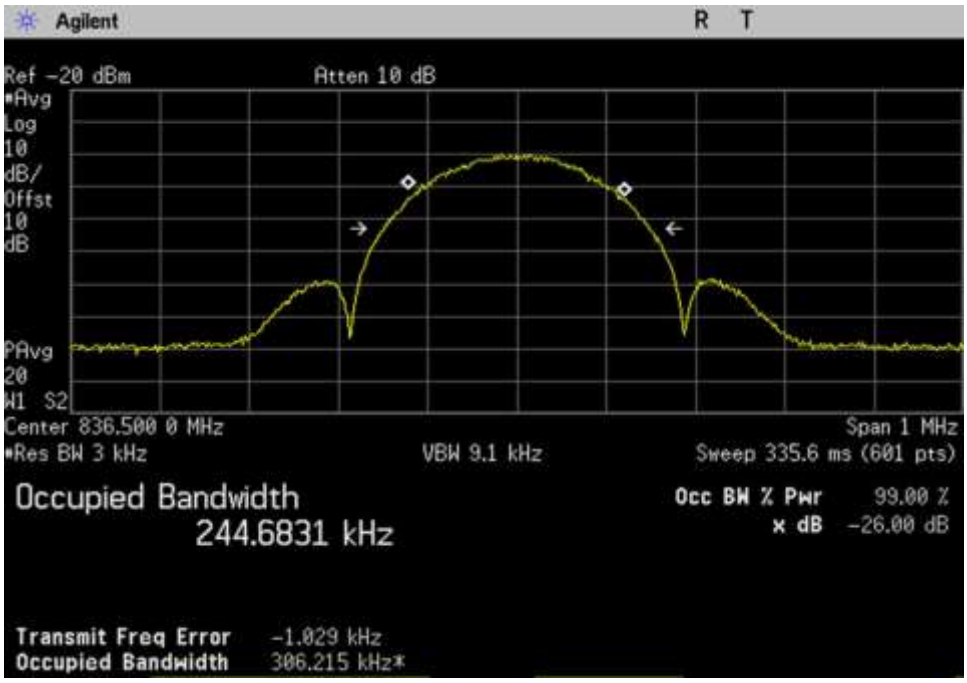
EDGE Input



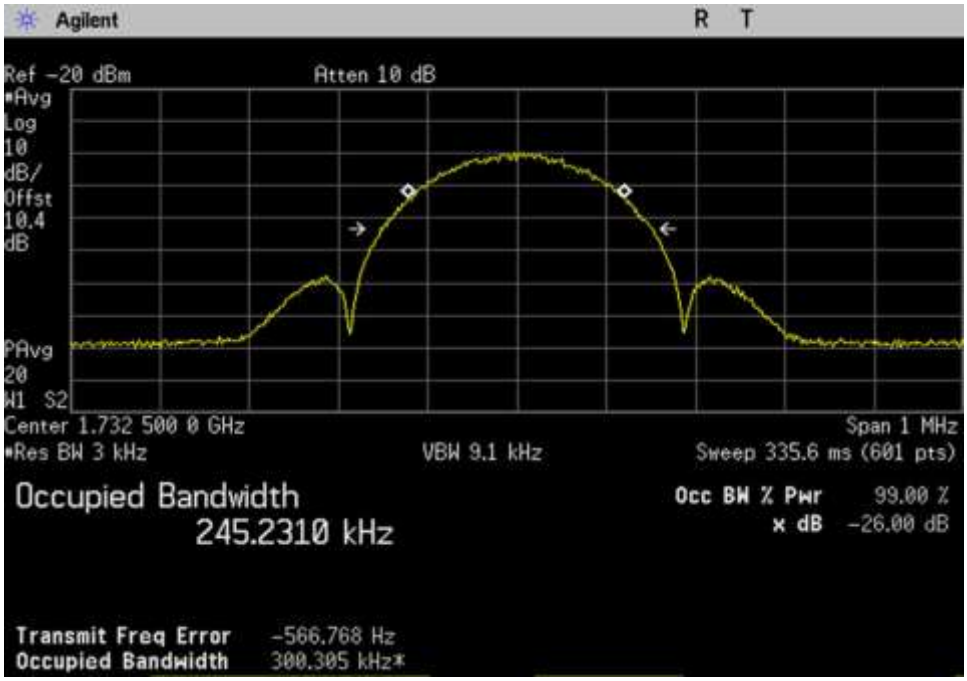
UL_698-716_EDGE_ 707MHz



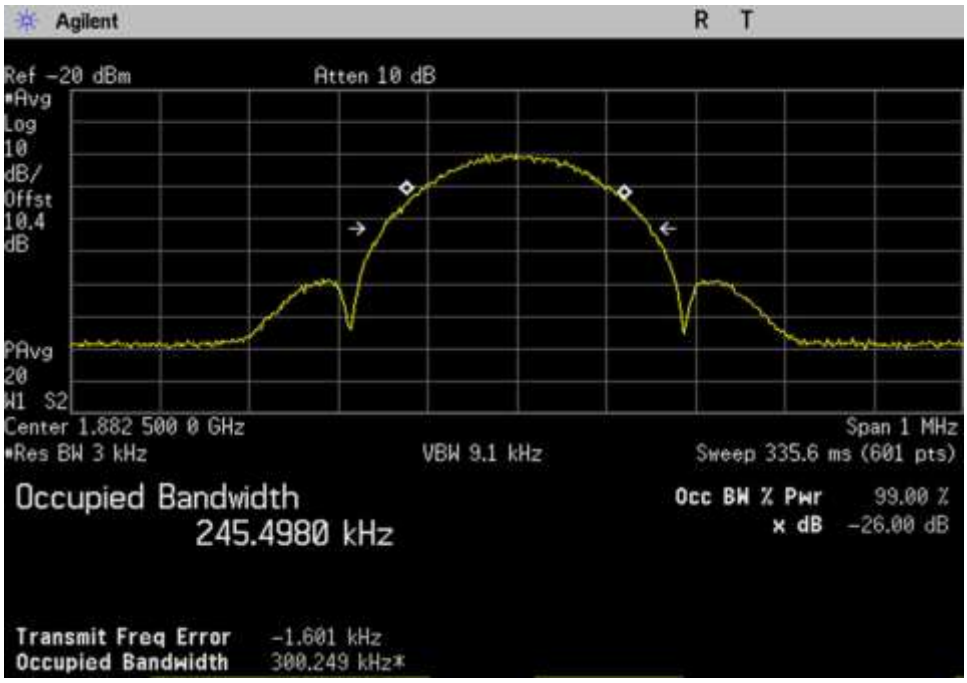
UL_776-787_EDGE_ 781.5MHz



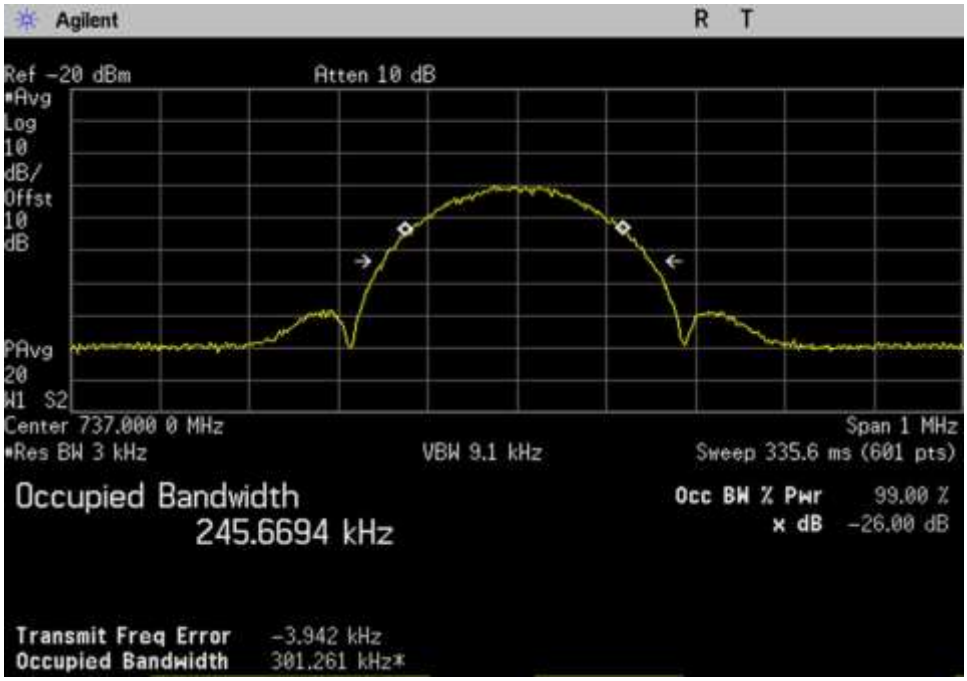
UL_824-849_EDGE_ 836.5MHz



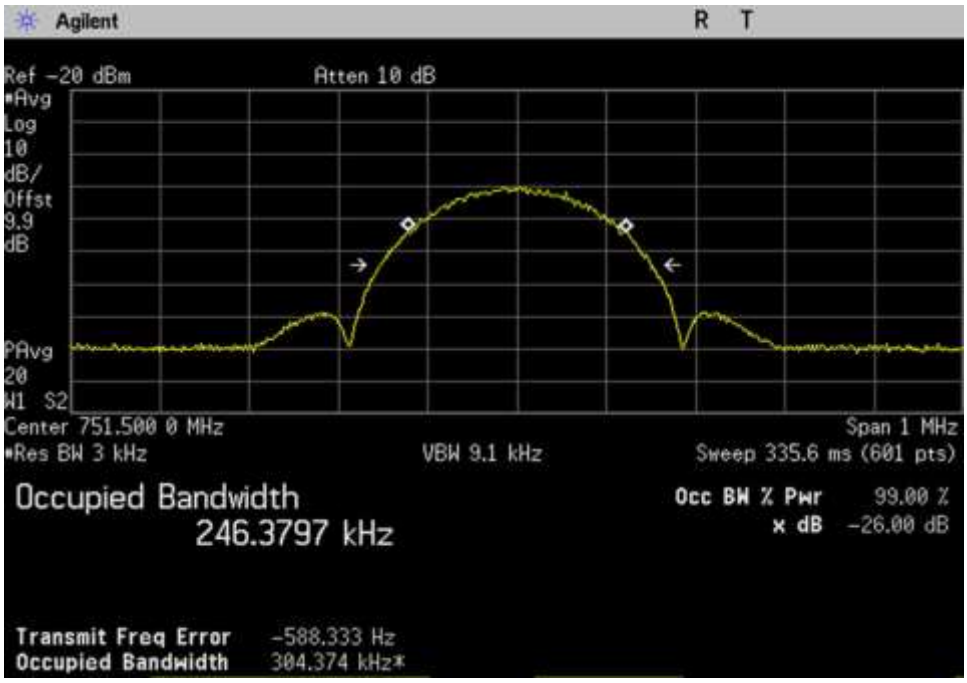
UL_1710-1755_EDGE_ 1732.5MHz



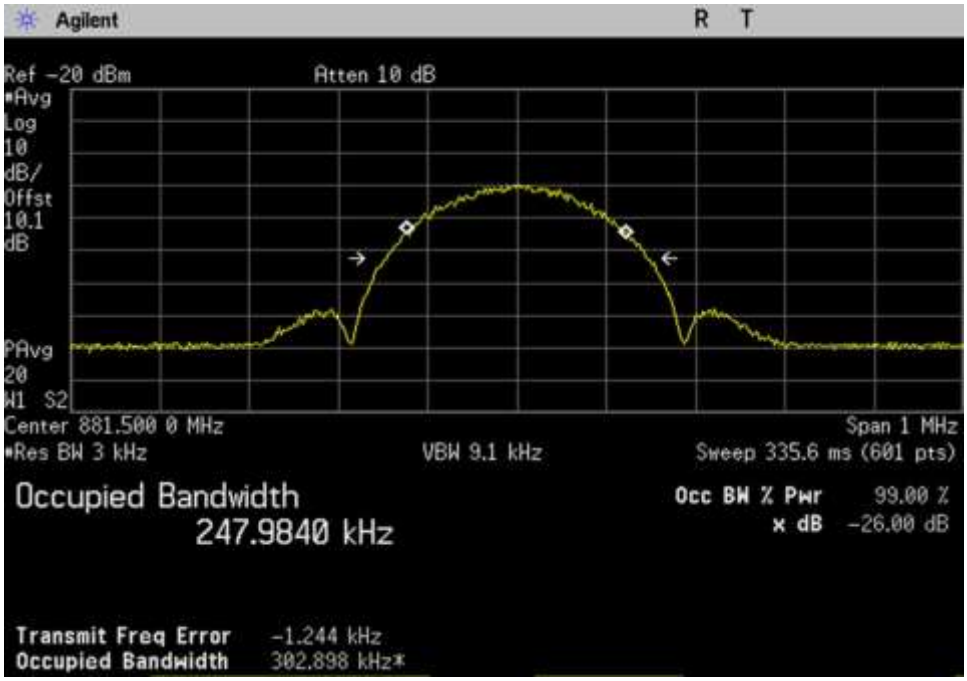
UL_1850-1915_EDGE_ 1882.5MHz



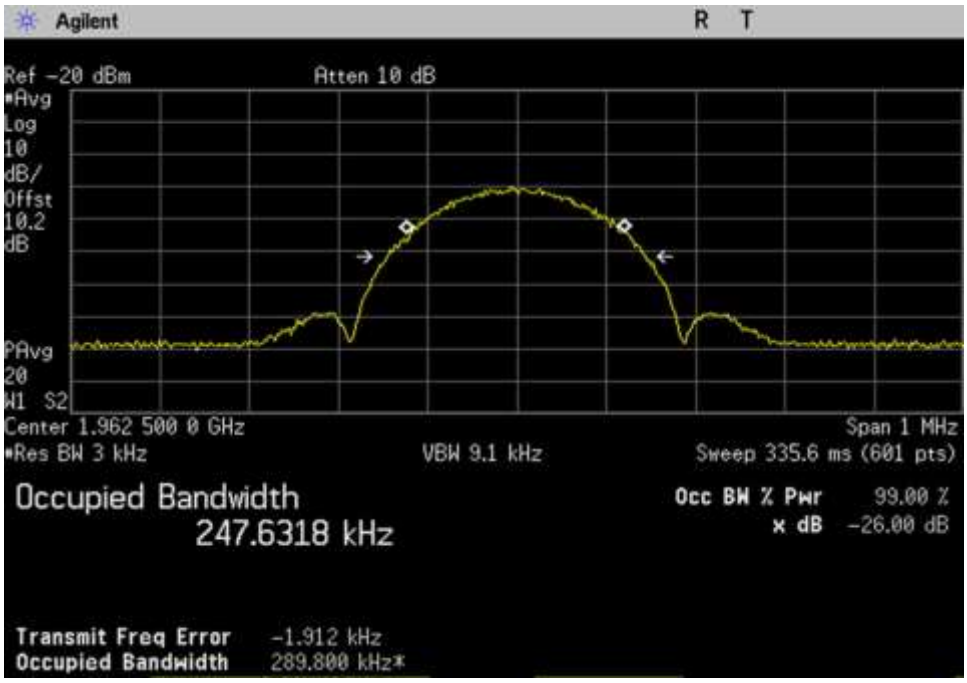
DL_728-746_EDGE_ 737MHz



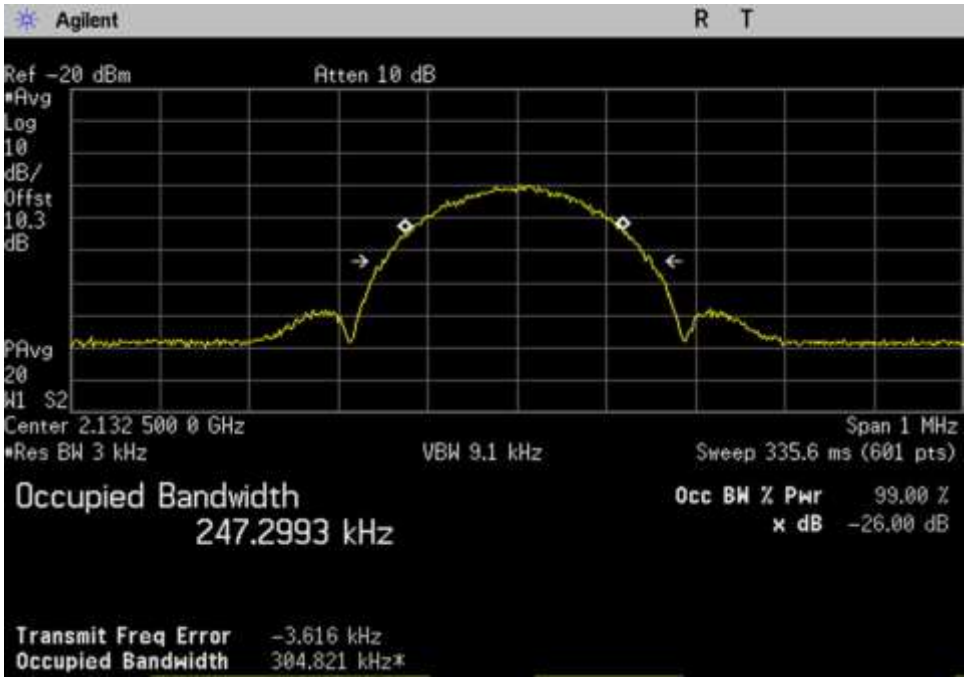
DL_746-757_EDGE_ 751.5MHz



DL_869-894_EDGE_ 881.5MHz

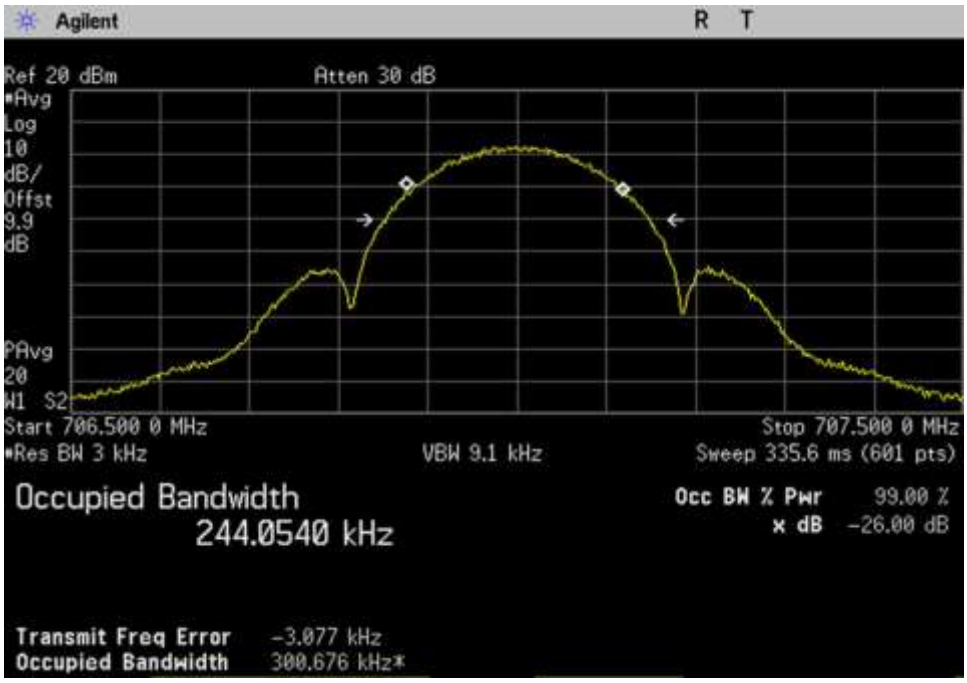


DL_1930-1995_EDGE_ 1962.5MHz

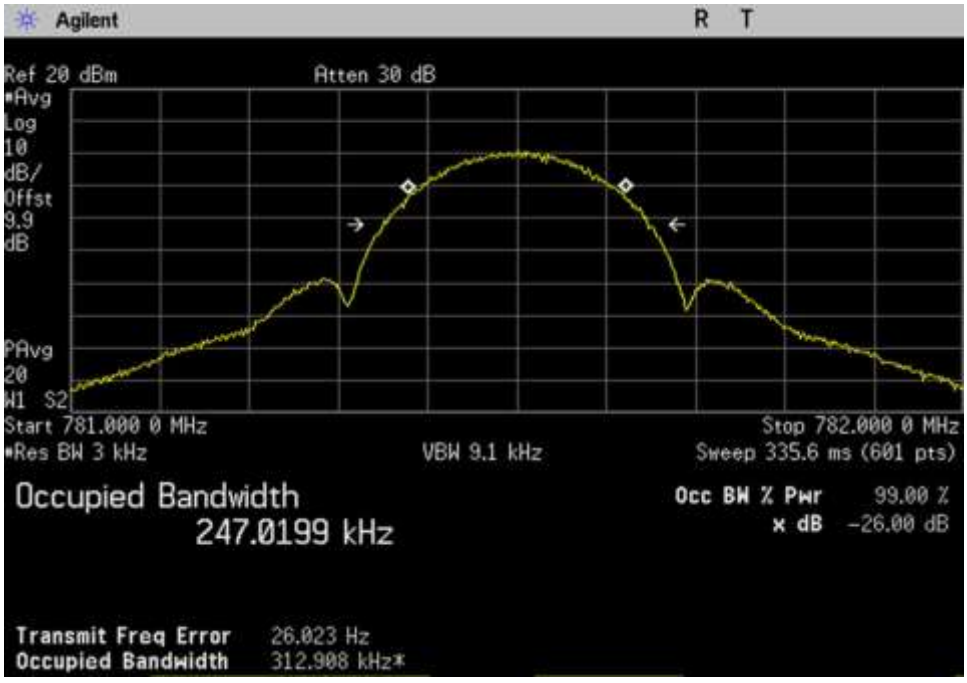


DL_2110-2155_EDGE_ 2132.5MHz

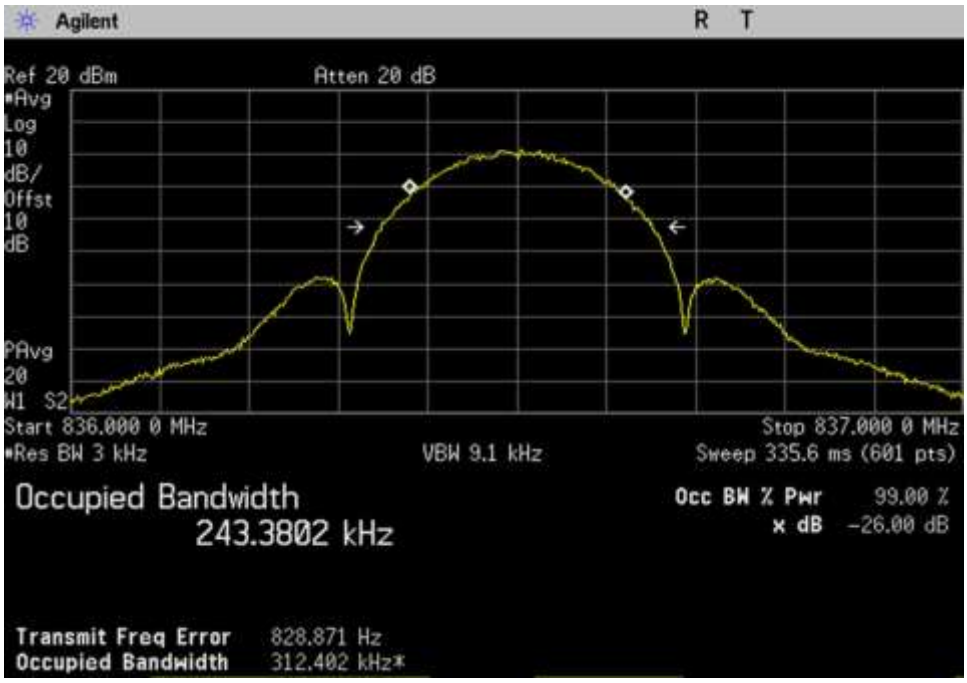
EDGE Output



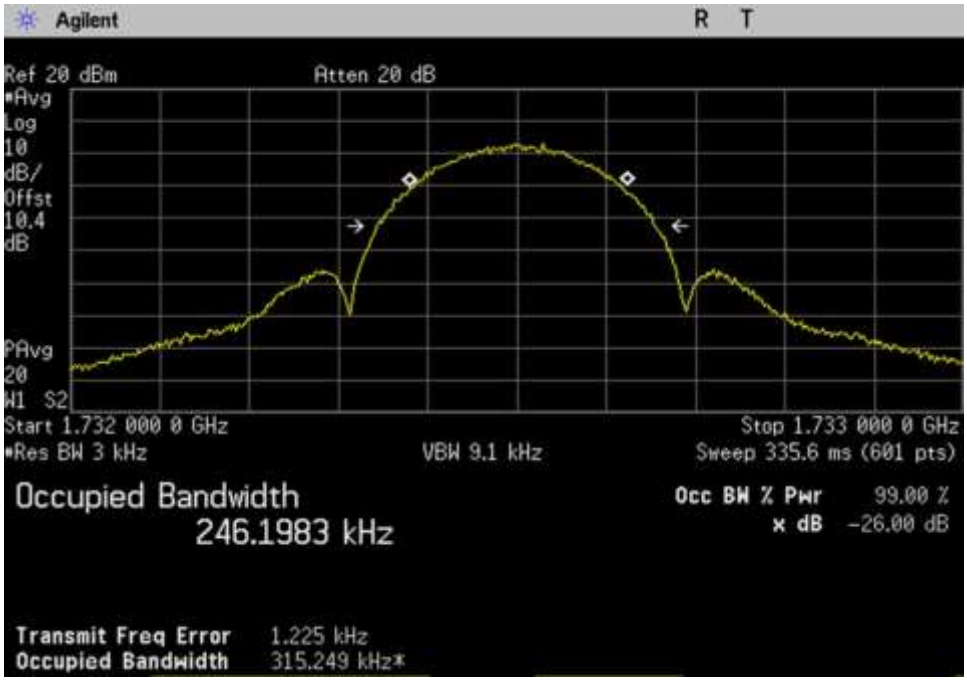
UL_698-716_EDGE_ 707MHz



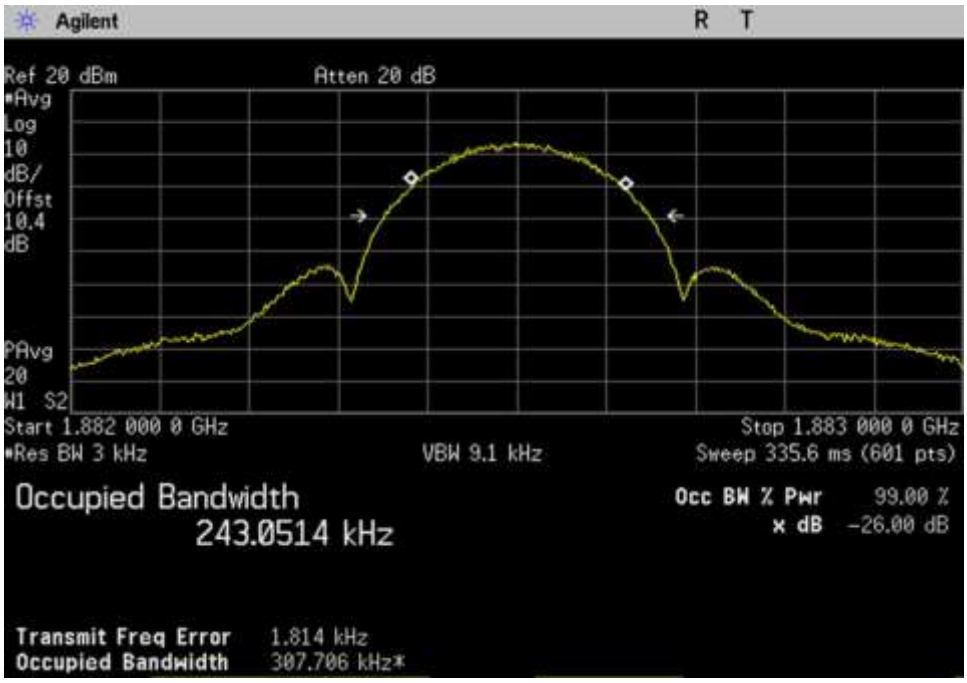
UL_776-787_EDGE_ 781.5MHz



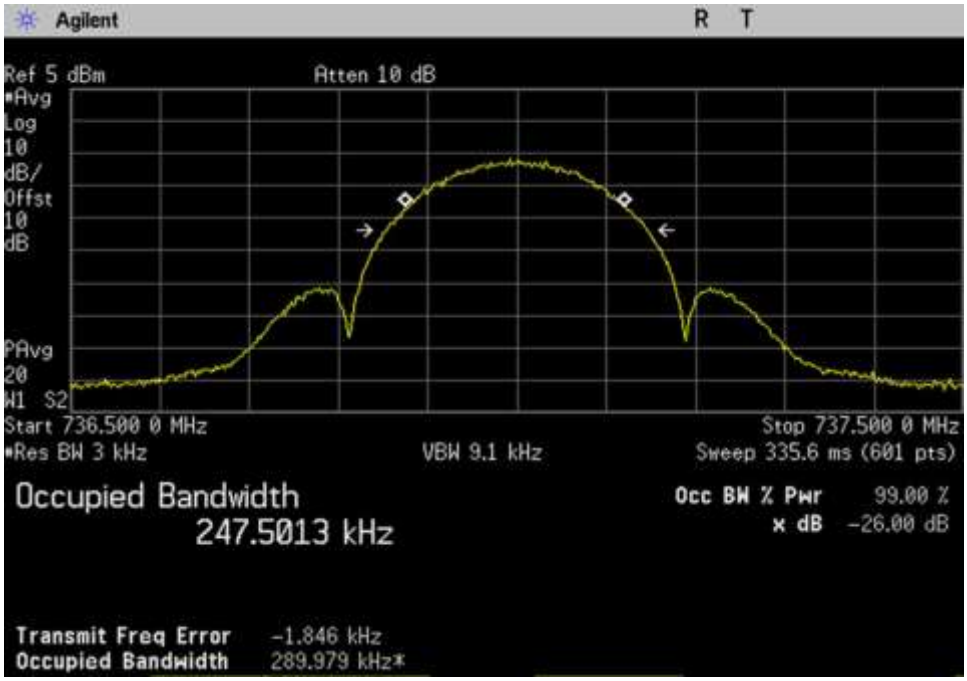
UL_824-849_EDGE_ 836.5MHz



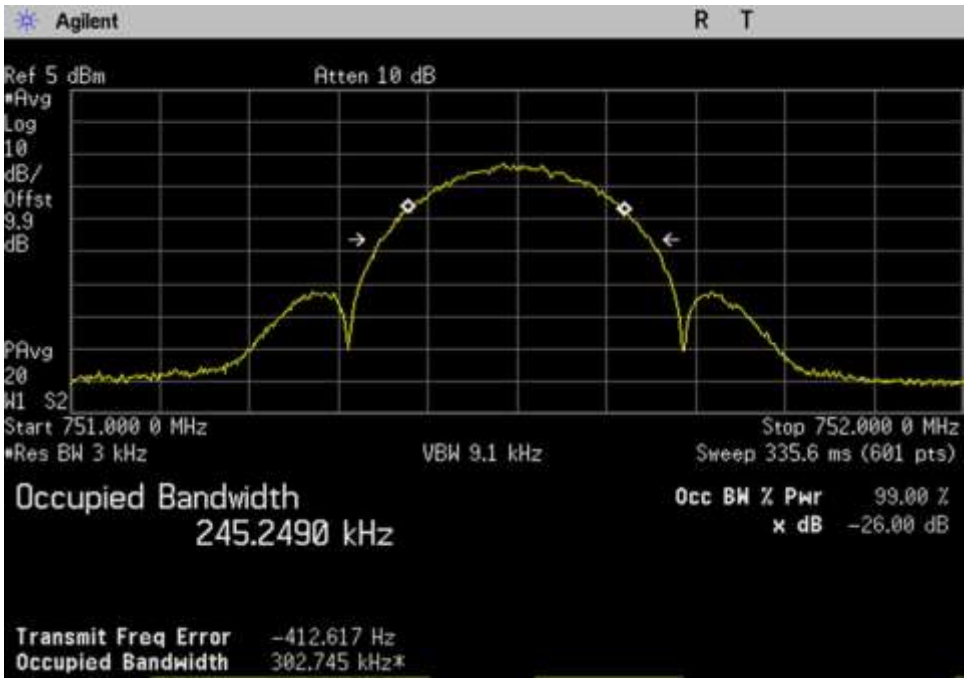
UL_1710-1755_EDGE_ 1732.5MHz



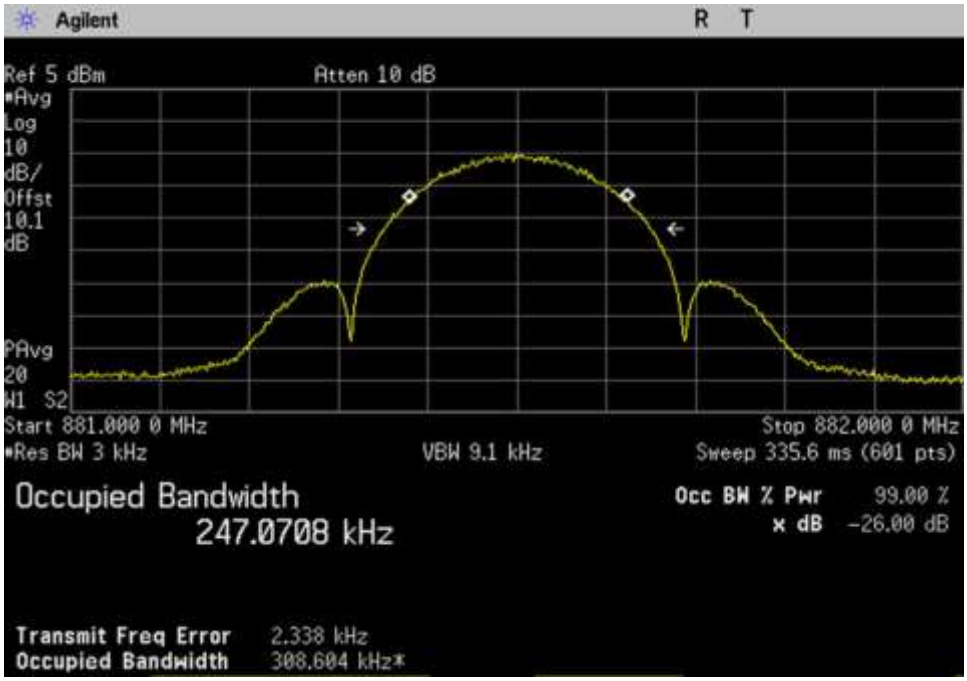
UL_1850-1915_EDGE_ 1882.5MHz



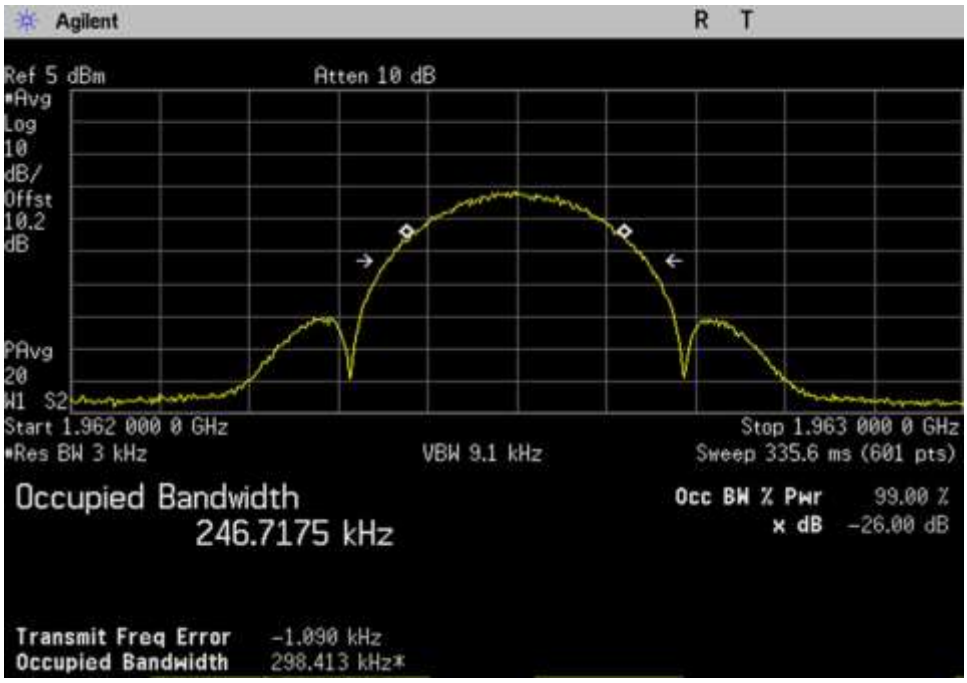
DL_728-746_EDGE_ 737MHz



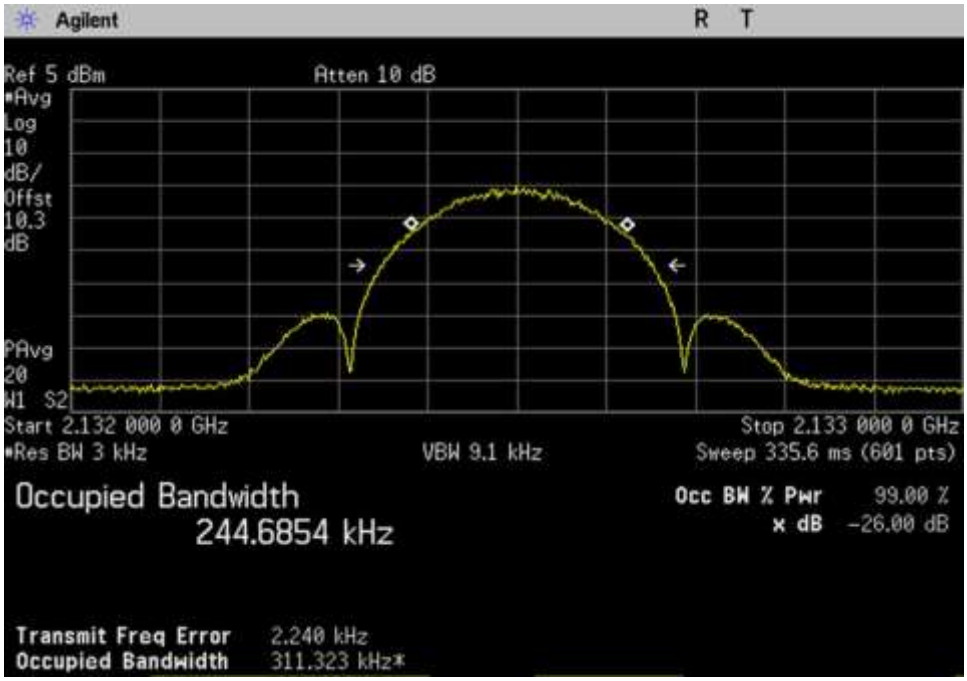
DL_746-757_EDGE_ 751.5MHz



DL_869-894_EDGE_ 881.5MHz

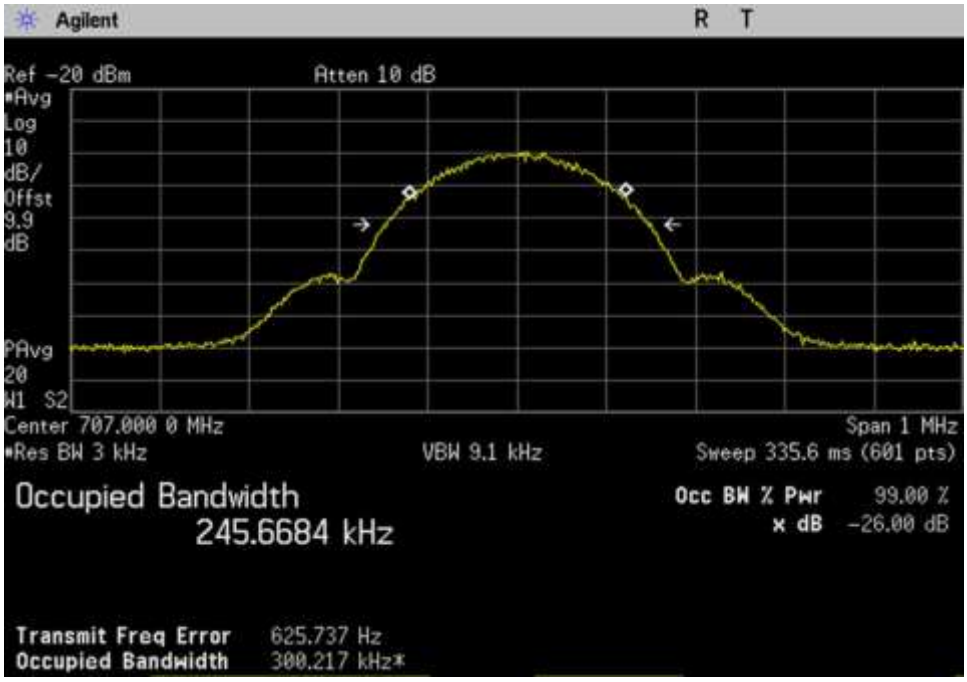


DL_1930-1995_EDGE_ 1962.5MHz

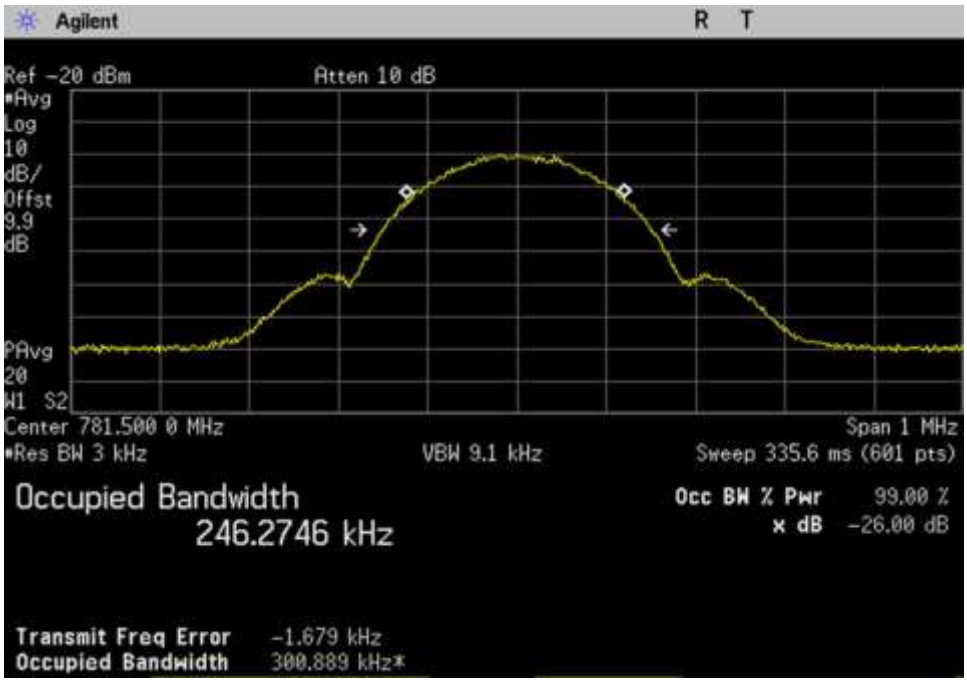


DL_2110-2155_EDGE_ 2132.5MHz

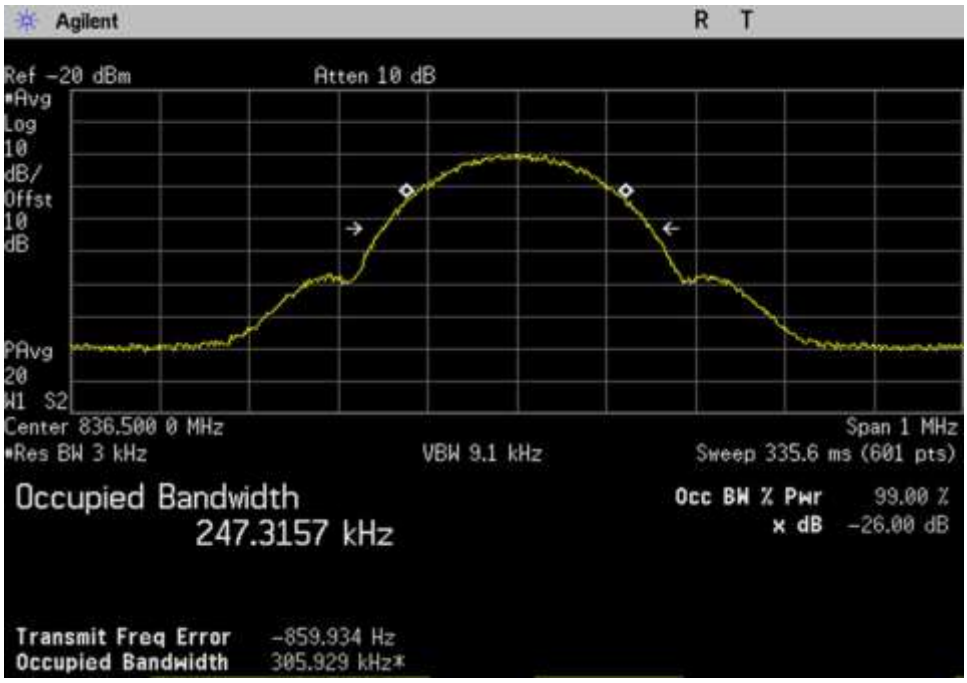
GSM Input



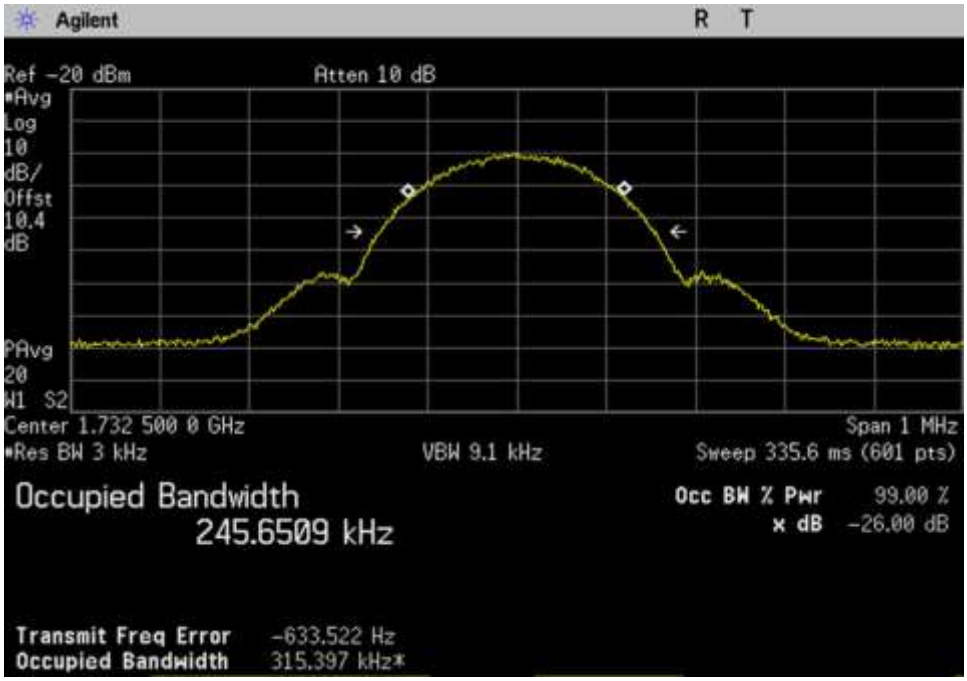
UL_698-716_GSM_ 707MHz



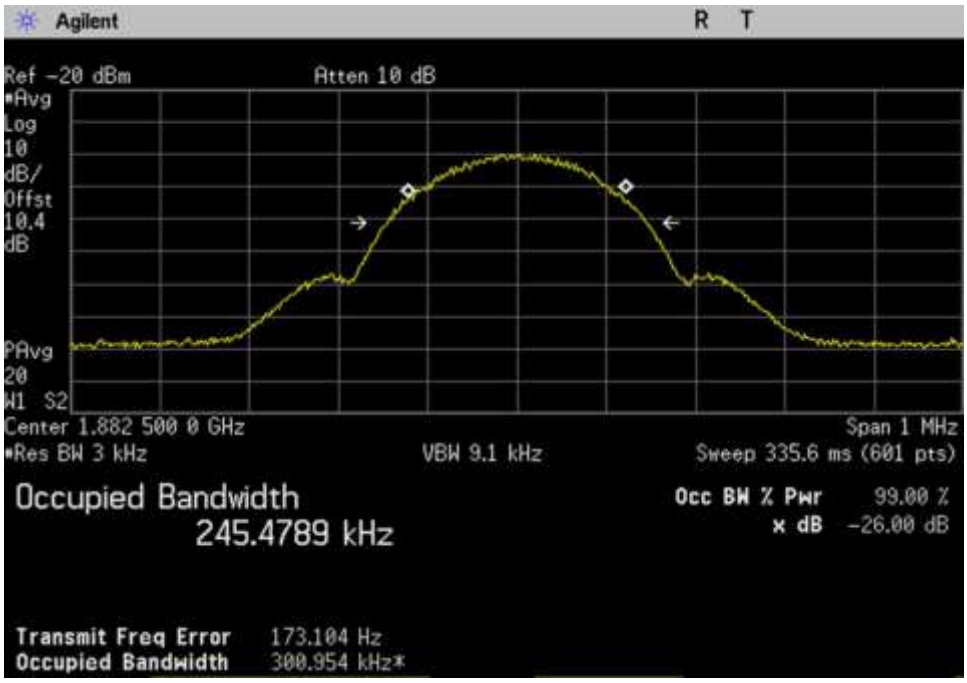
UL_776-787_GSM_ 781.5MHz



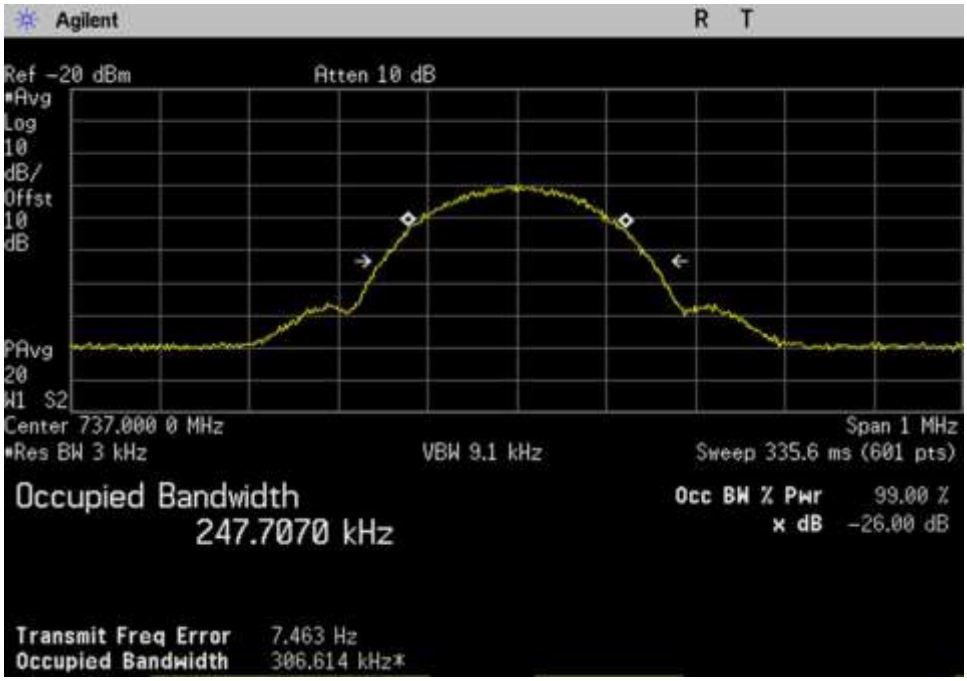
UL_824-849_GSM_ 836.5MHz



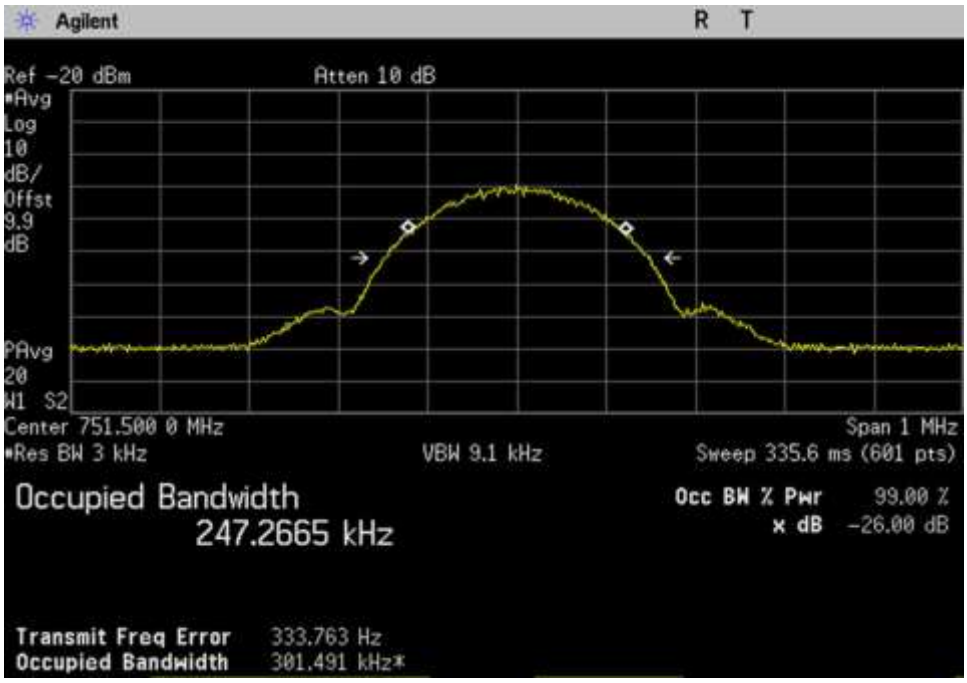
UL_1710-1755_GSM_ 1732.5MHz



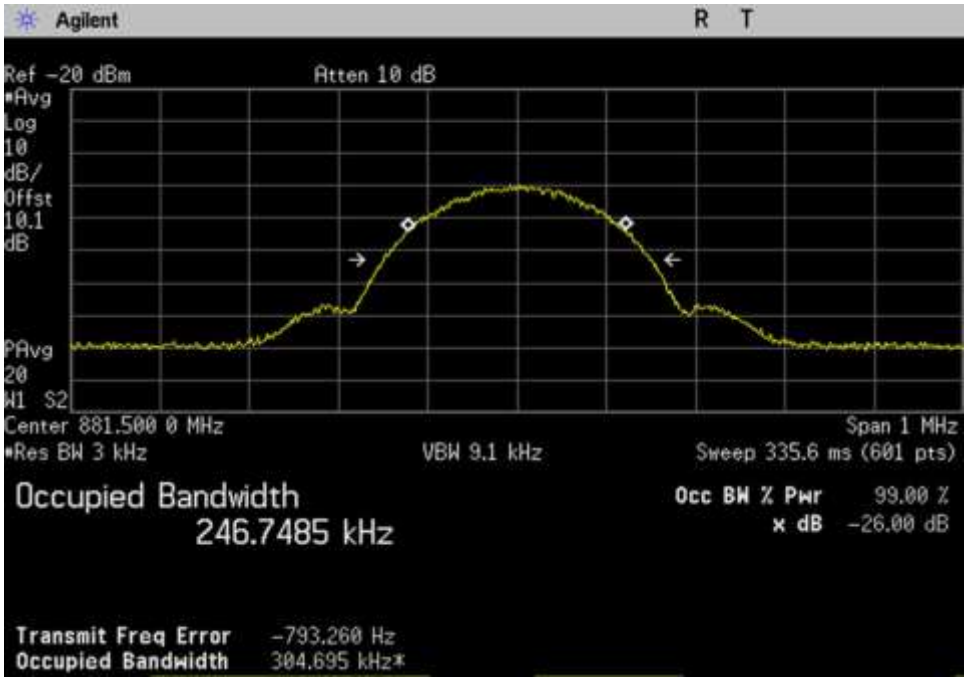
UL_1850-1915_GSM_ 1882.5MHz



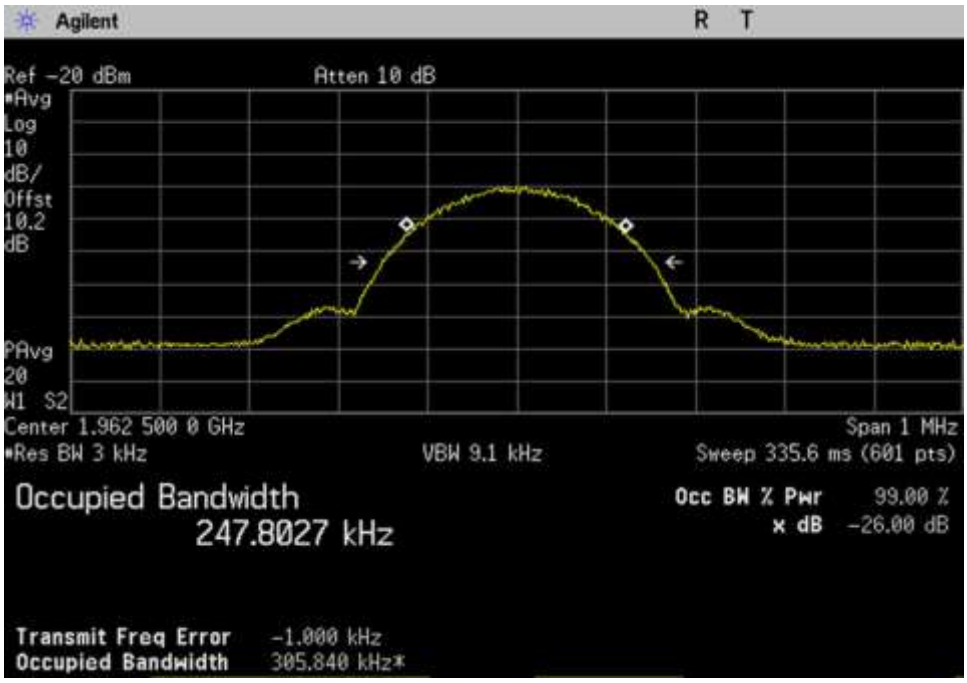
DL_728-746_GSM_ 737MHz



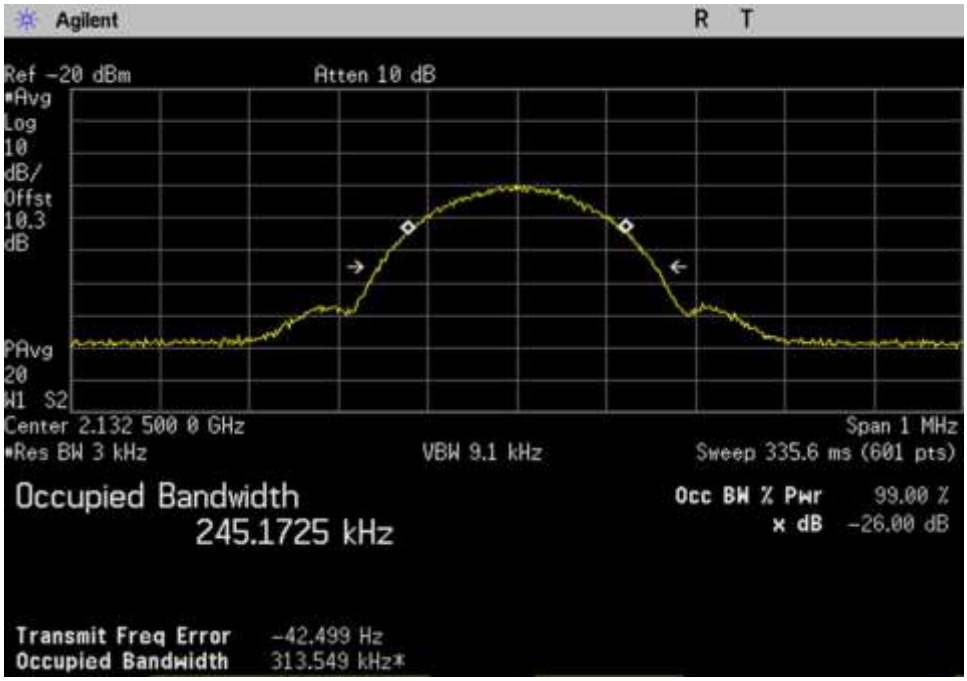
DL_746-757_GSM_ 751.5MHz



DL_869-894_GSM_ 881.5MHz

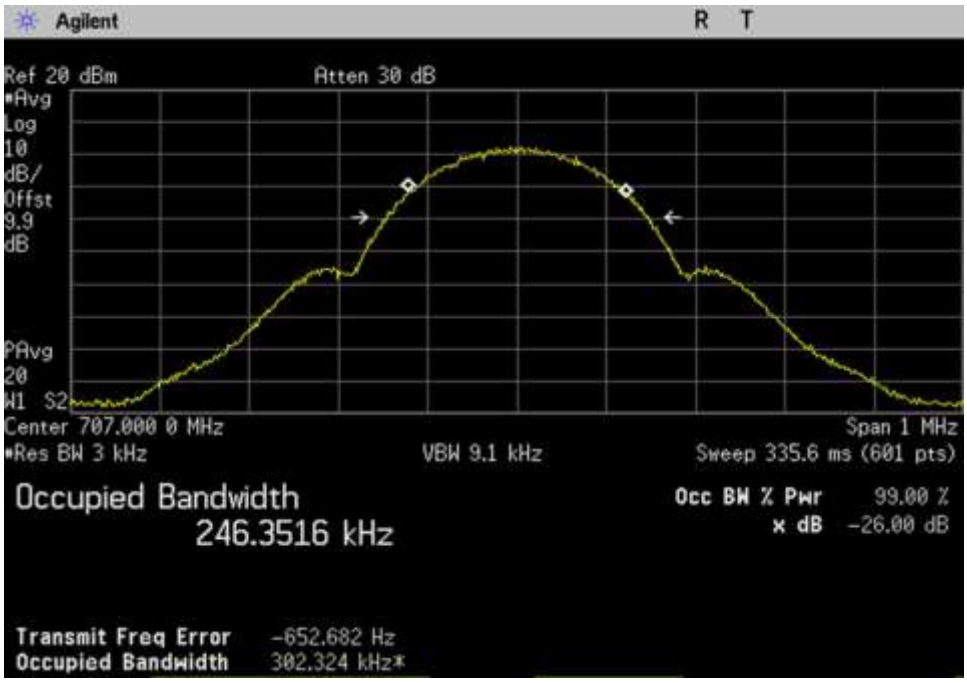


DL_1930-1995_GSM_ 1962.5MHz

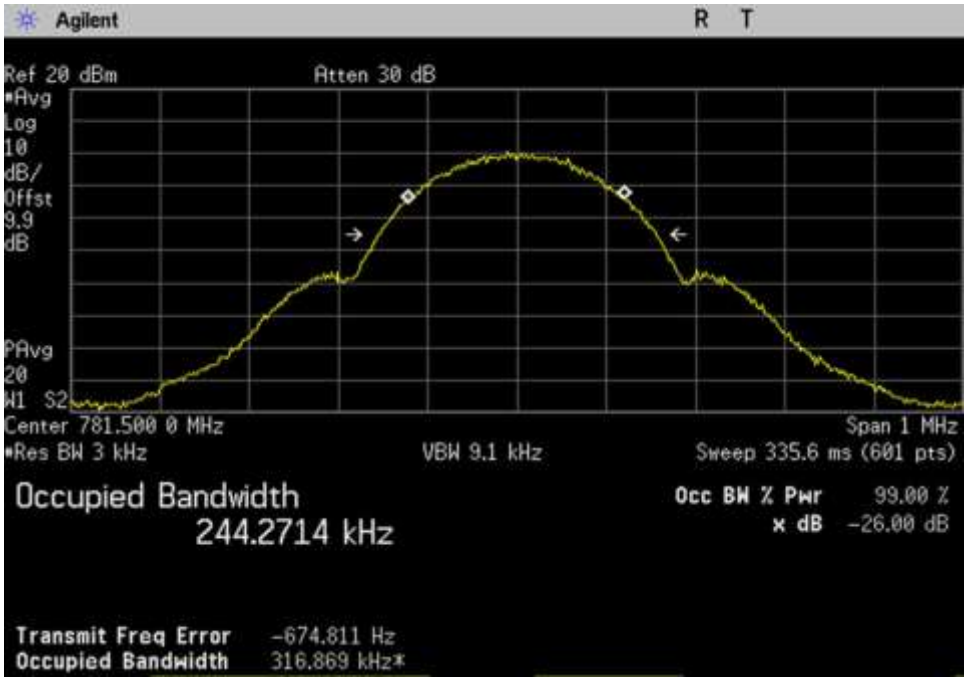


DL_2110-2155_GSM_ 2132.5MHz

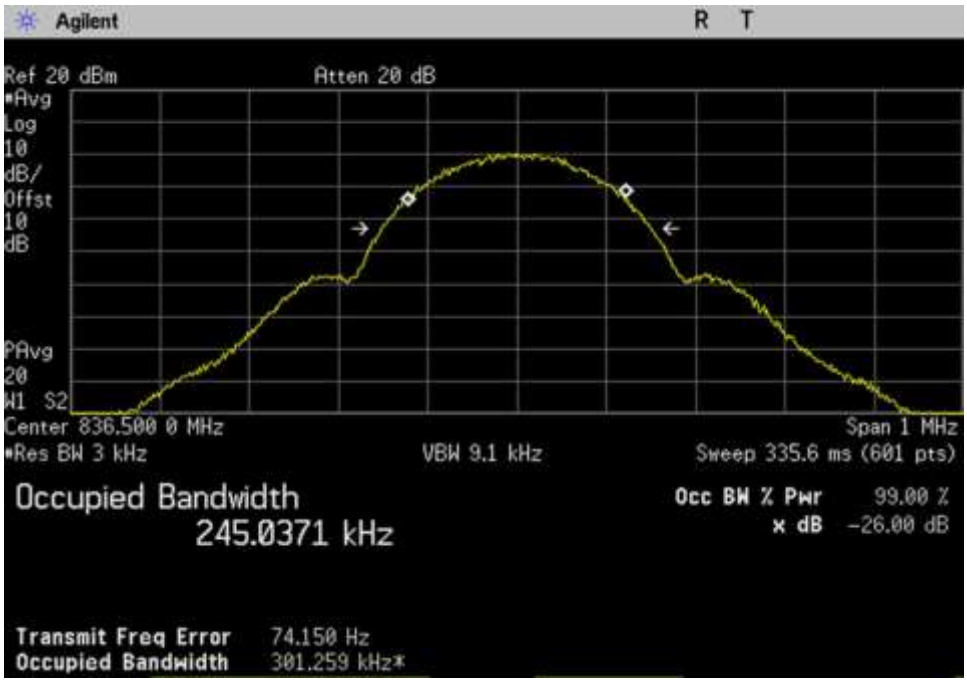
GSM Output



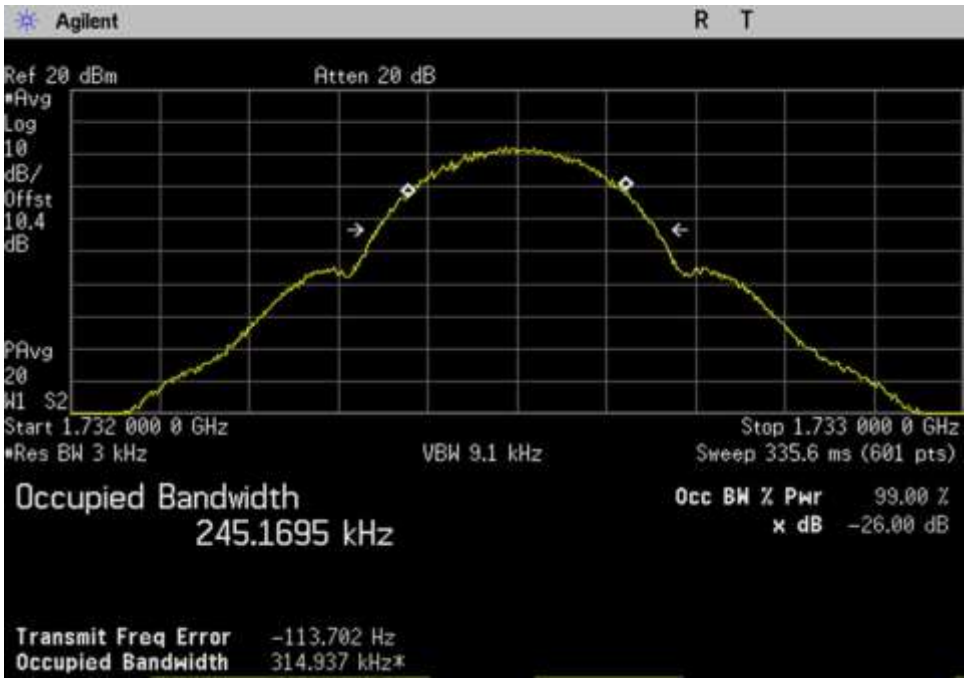
UL_698-716_GSM_ 707MHz



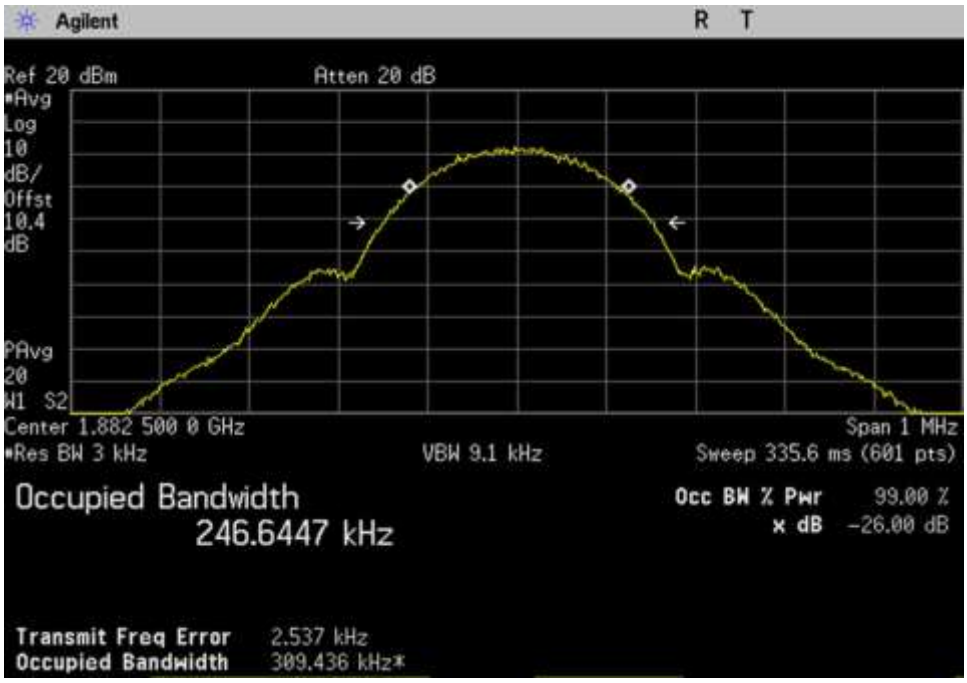
UL_776-787_GSM_ 781.5MHz



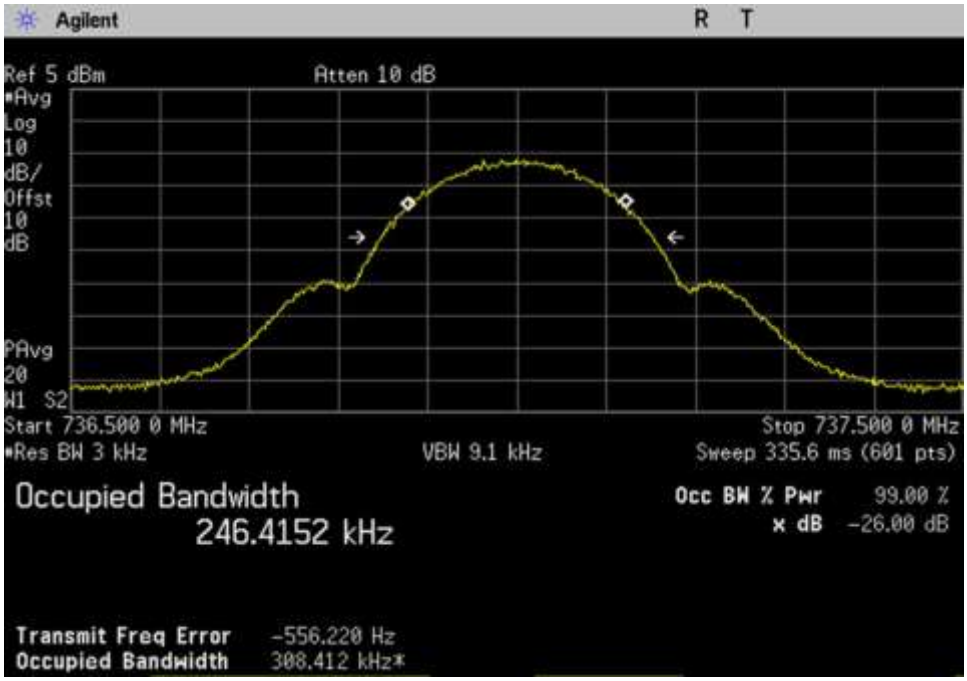
UL_824-849_GSM_ 836.5MHz



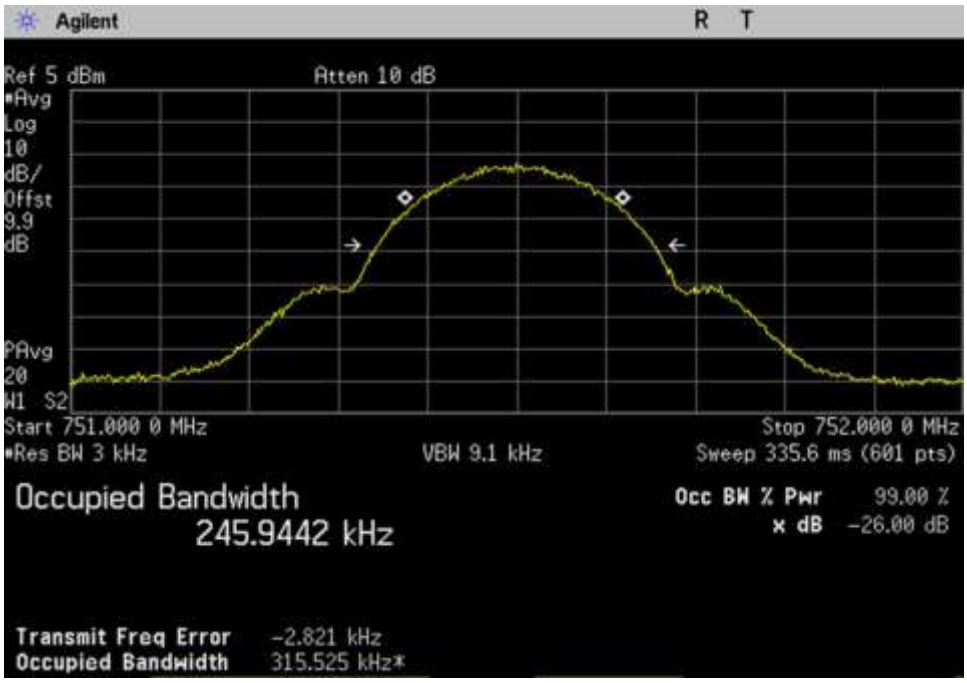
UL_1710-1755_GSM_ 1732.5MHz



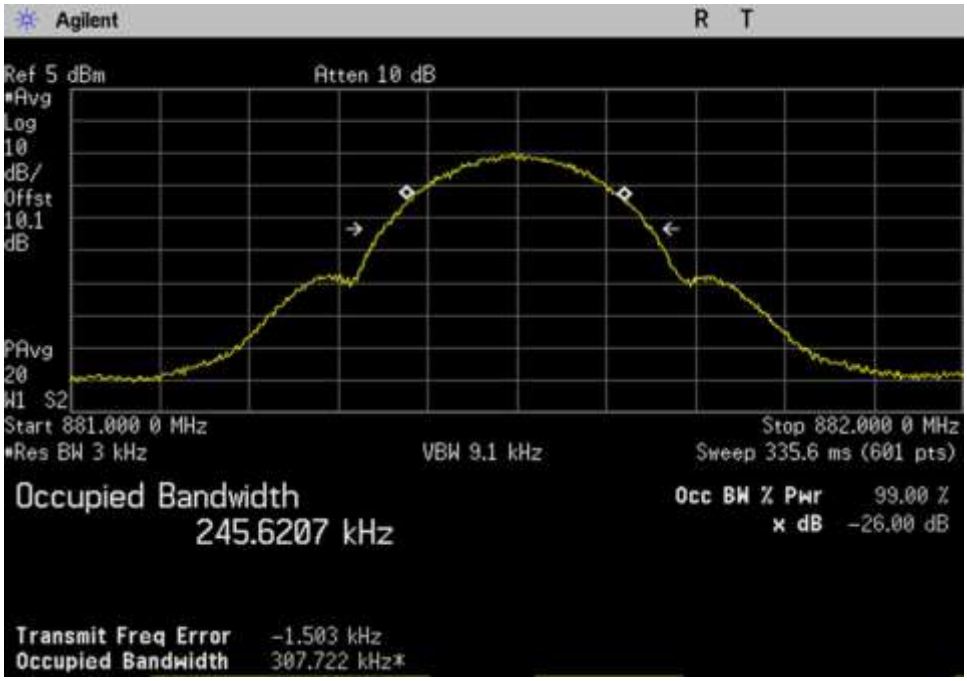
UL_1850-1915_GSM_ 1882.5MHz



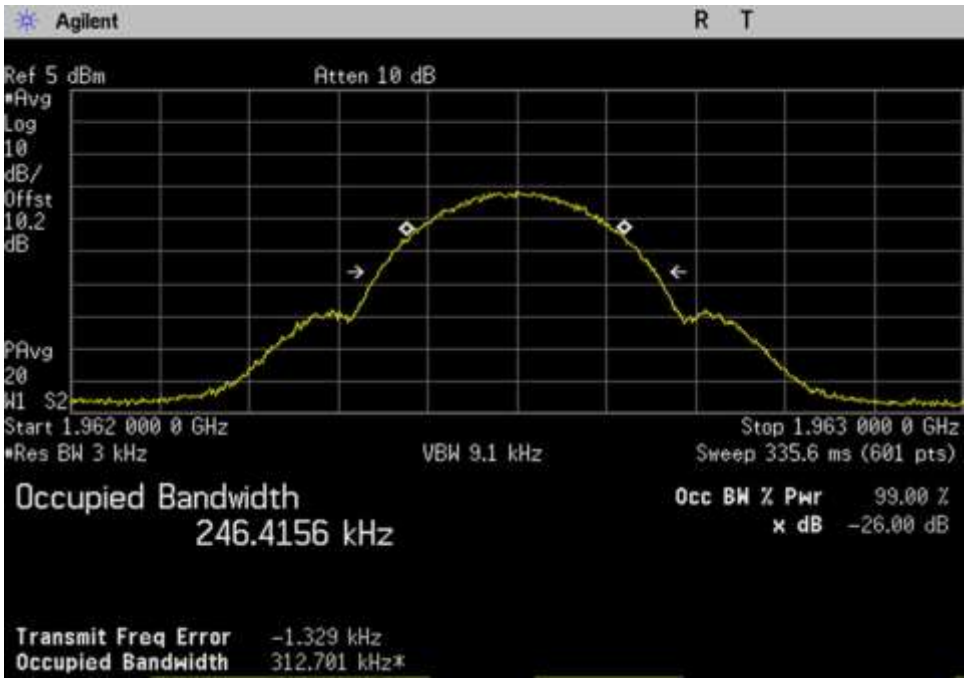
DL_728-746_GSM_ 737MHz



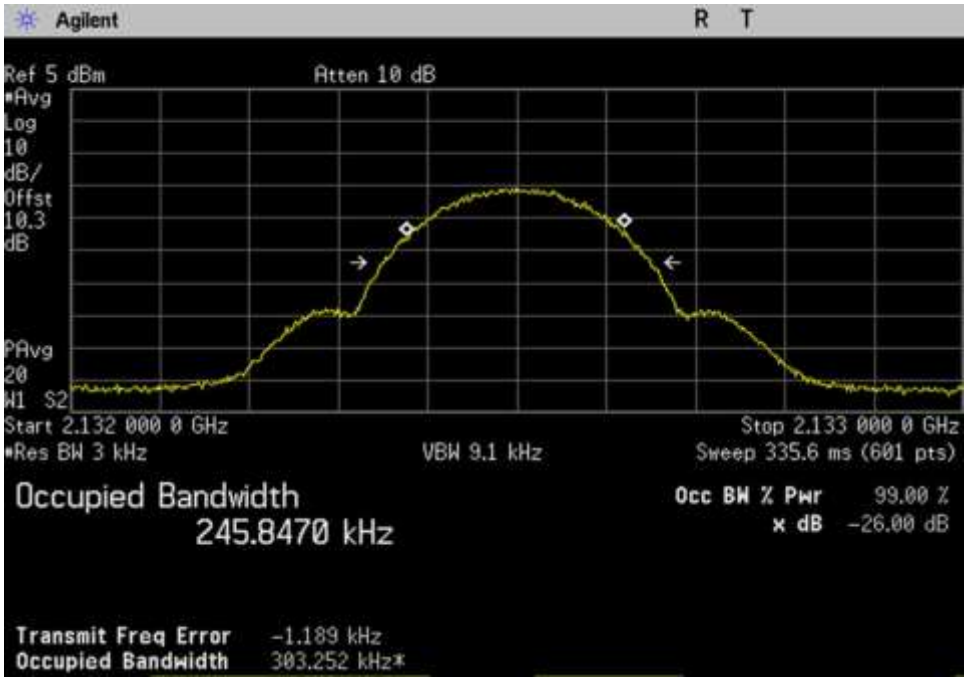
DL_746-757_GSM_ 751.5MHz



DL_869-894_GSM_ 881.5MHz

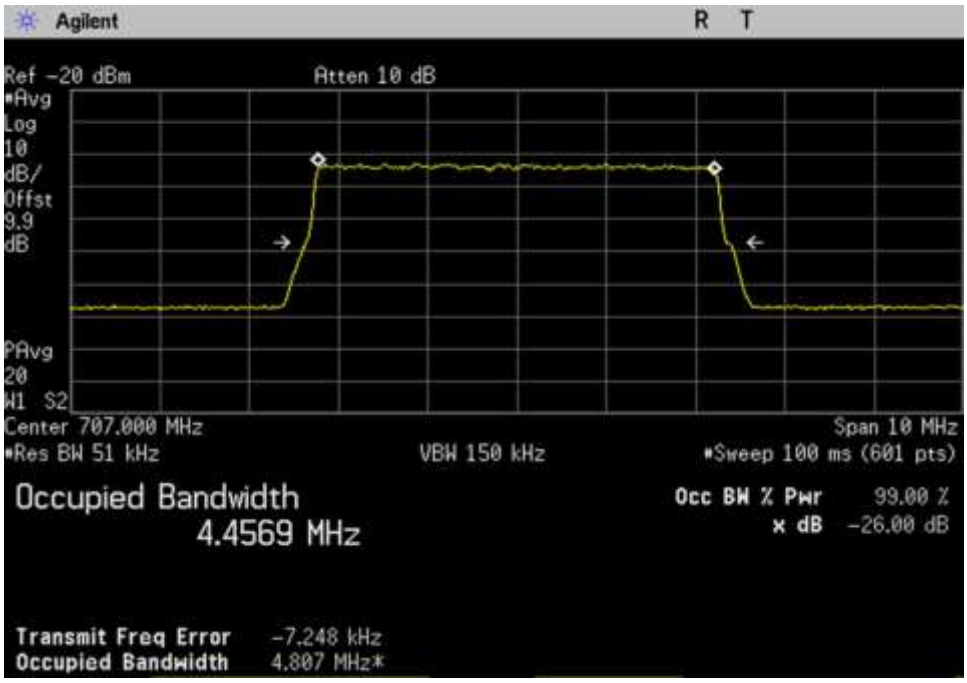


DL_1930-1995_GSM_ 1962.5MHz

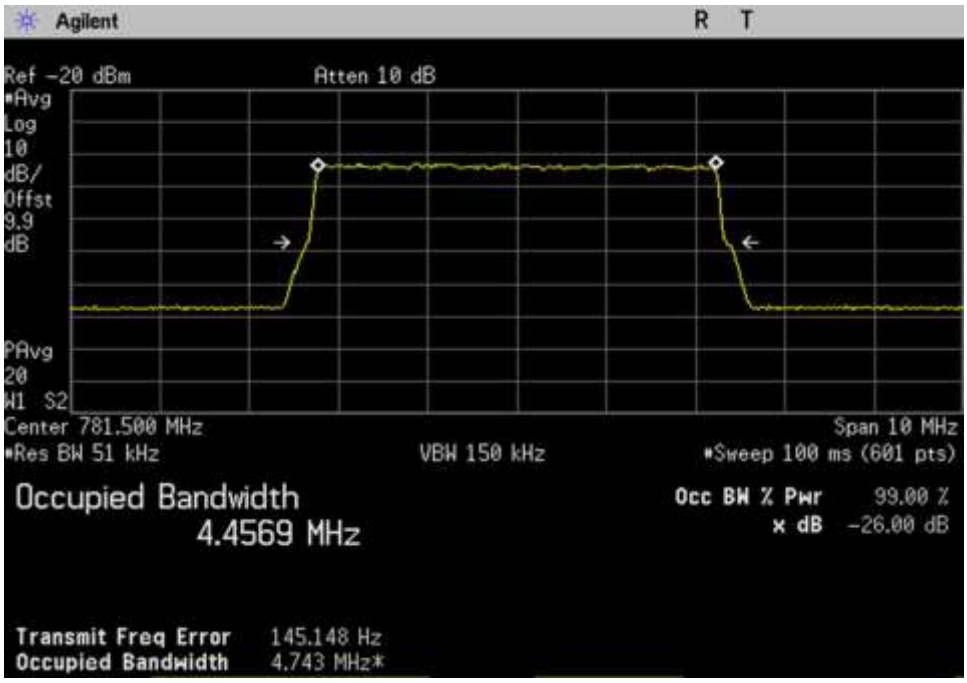


DL_2110-2155_GSM_ 2132.5MHz

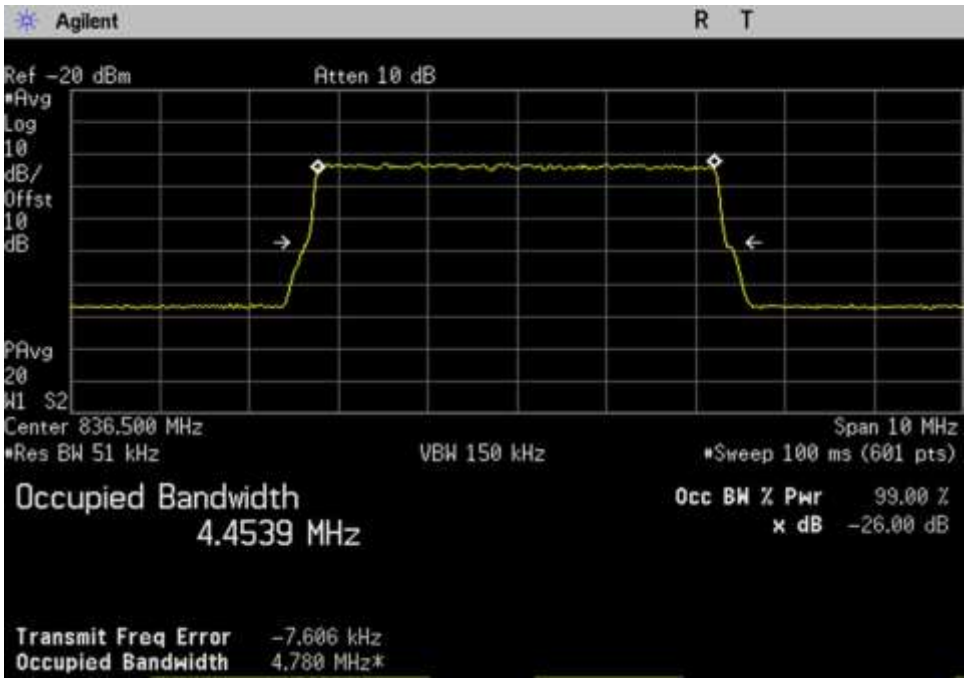
LTE Input



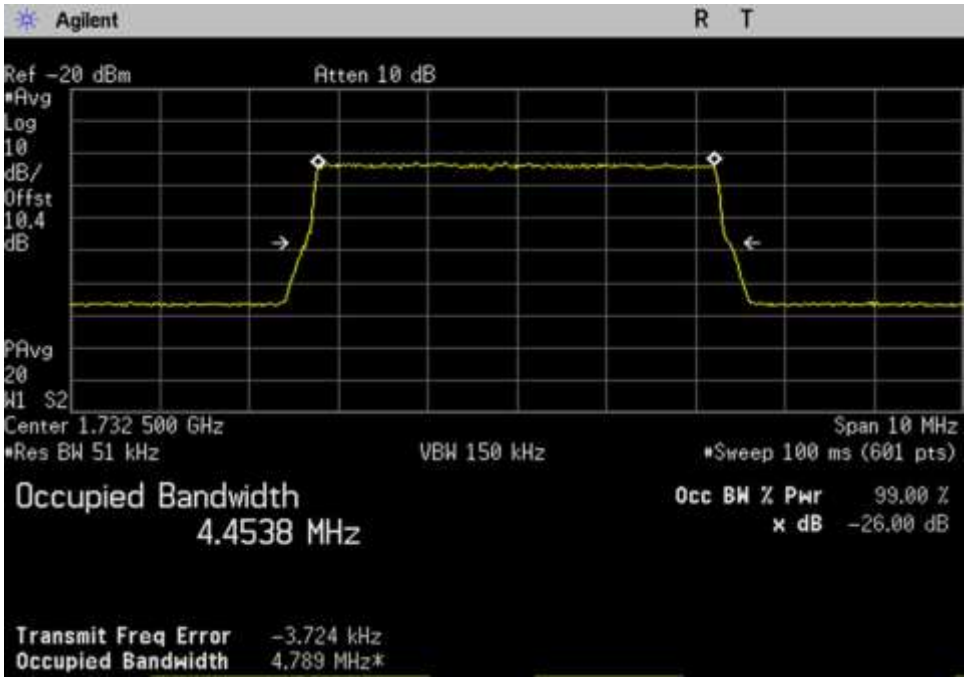
UL_698-716_LTE_ 707MHz



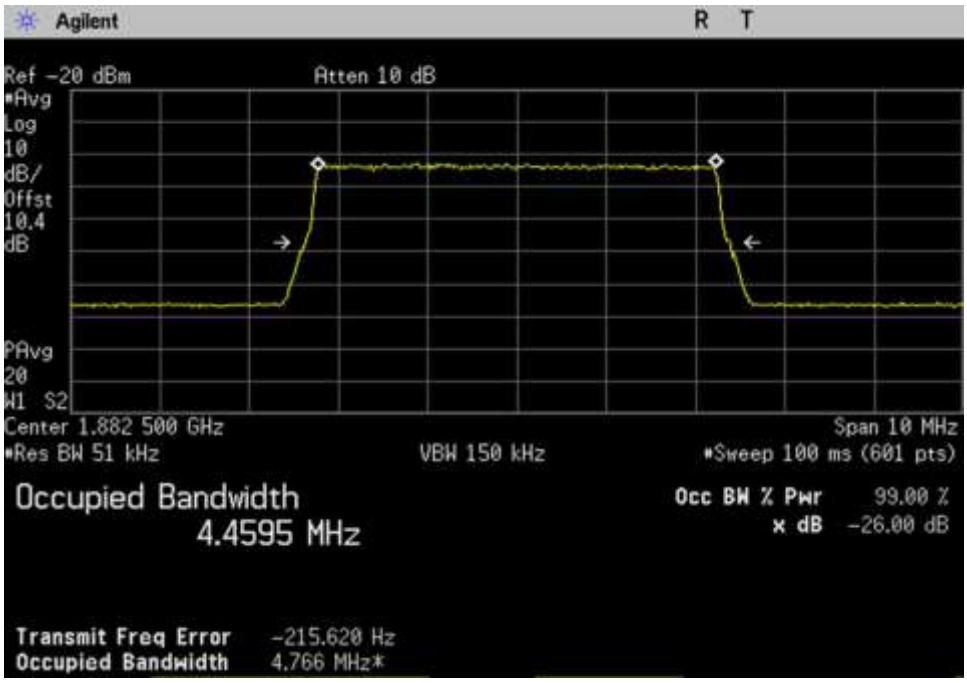
UL_776-787_LTE_ 781.5MHz



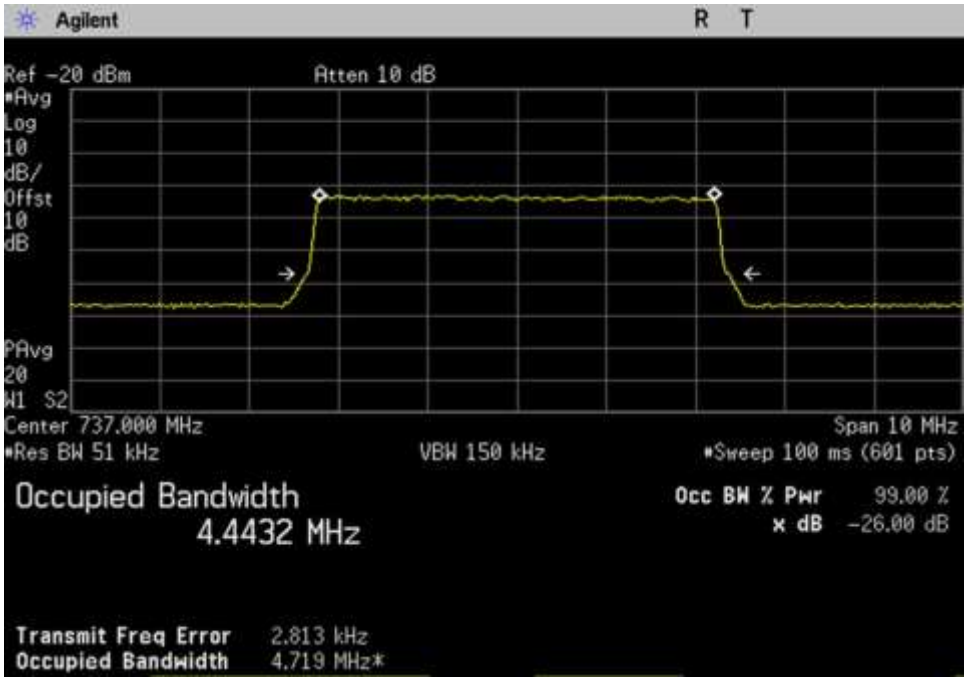
UL_824-849_LTE_ 836.5MHz



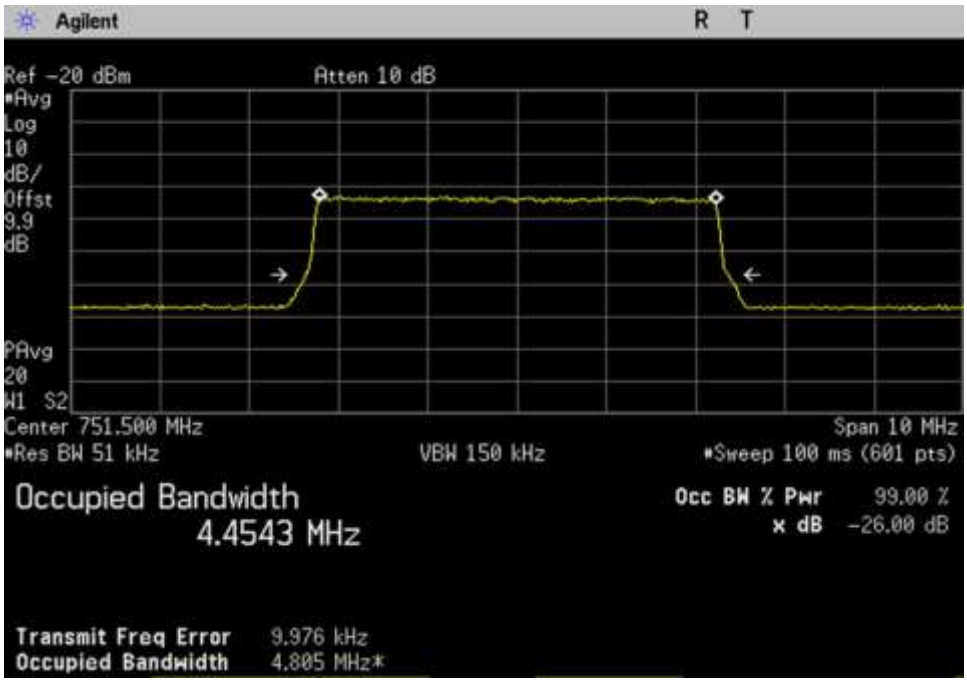
UL_1710-1755_LTE_ 1732.5MHz



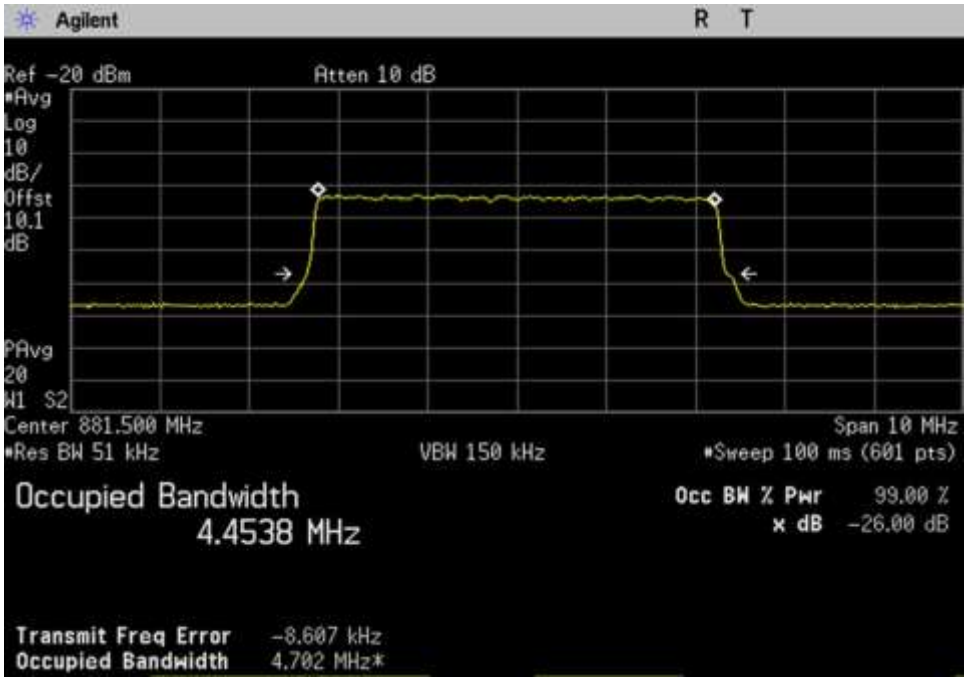
UL_1850-1915_LTE_ 1882.5MHz



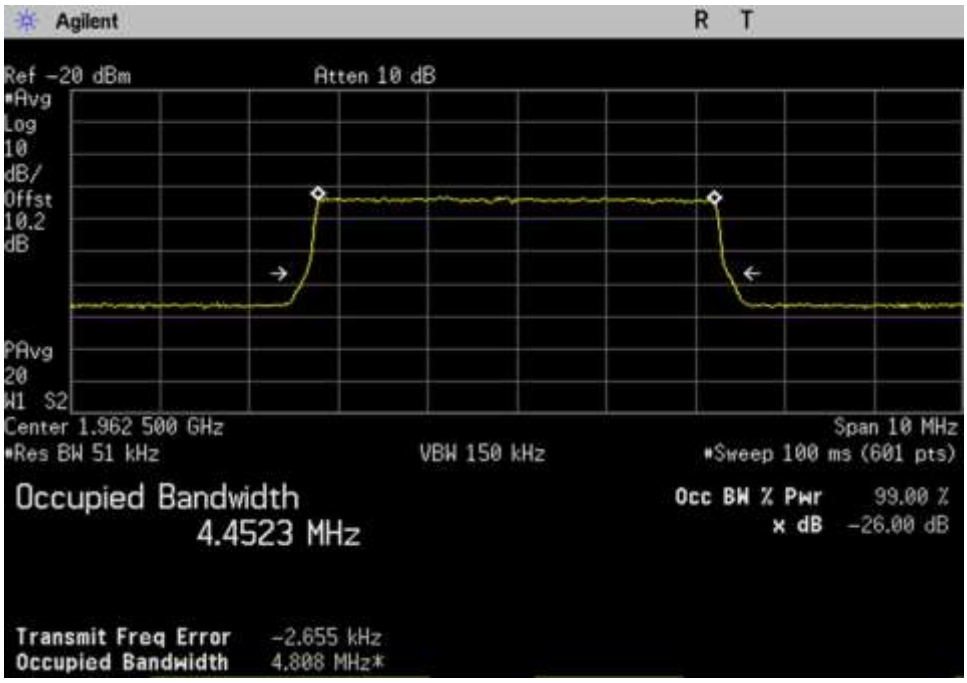
DL_728-746_LTE_ 737MHz



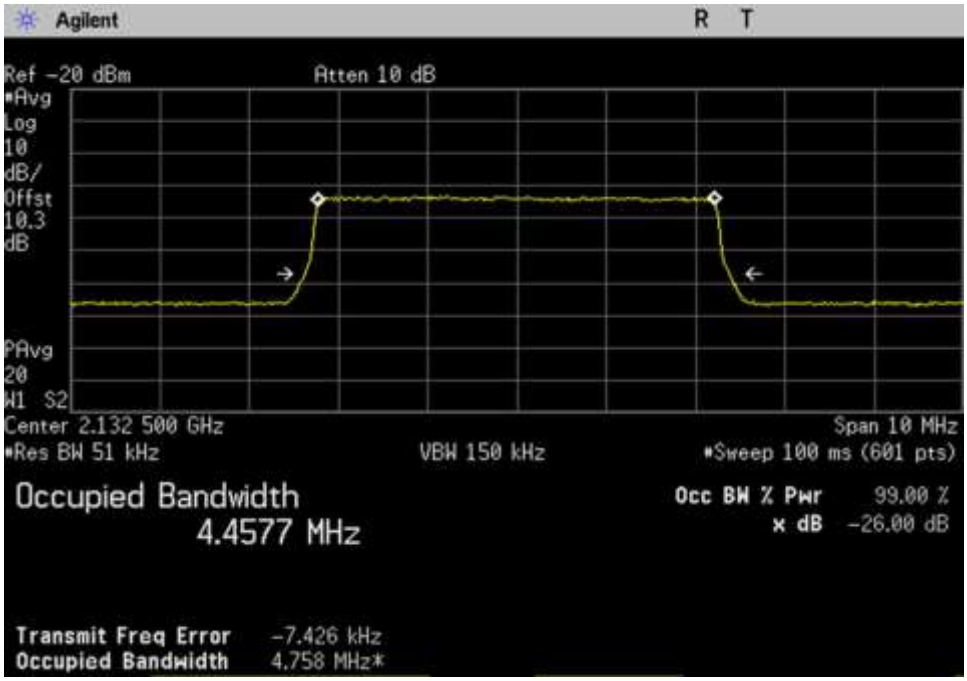
DL_746-757_LTE_ 751.5MHz



DL_869-894_LTE_ 881.5MHz

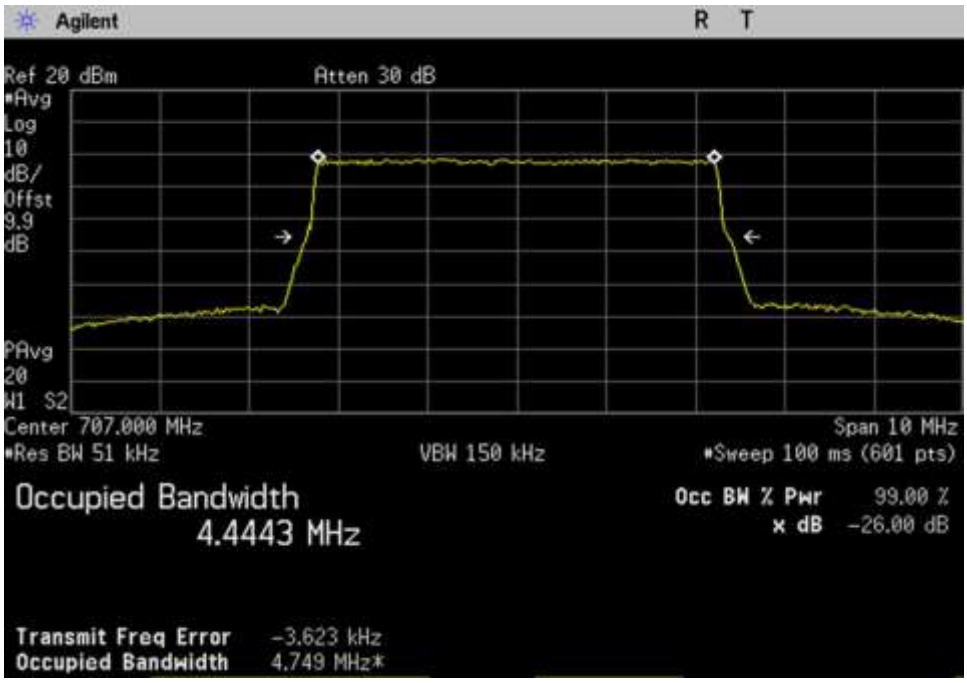


DL_1930-1995_LTE_ 1962.5MHz

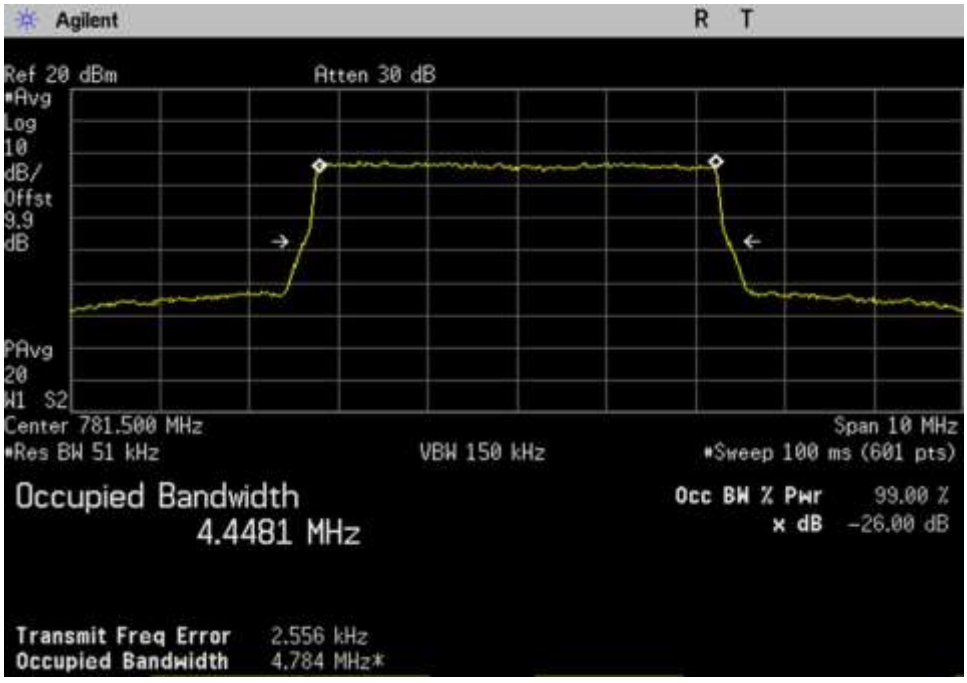


DL_2110-2155_LTE_ 2132.5MHz

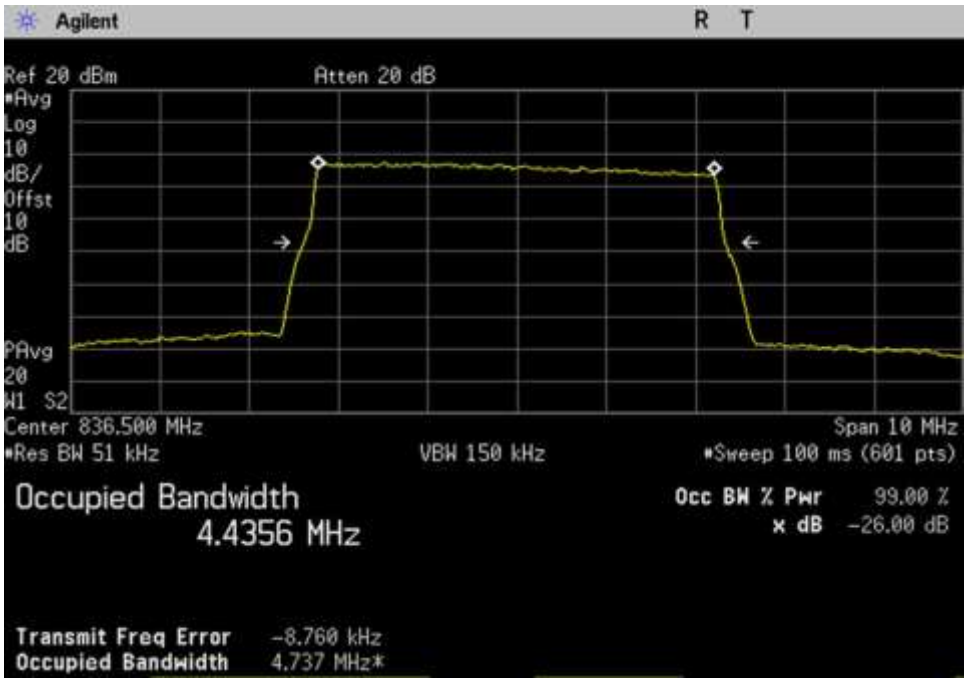
LTE Output



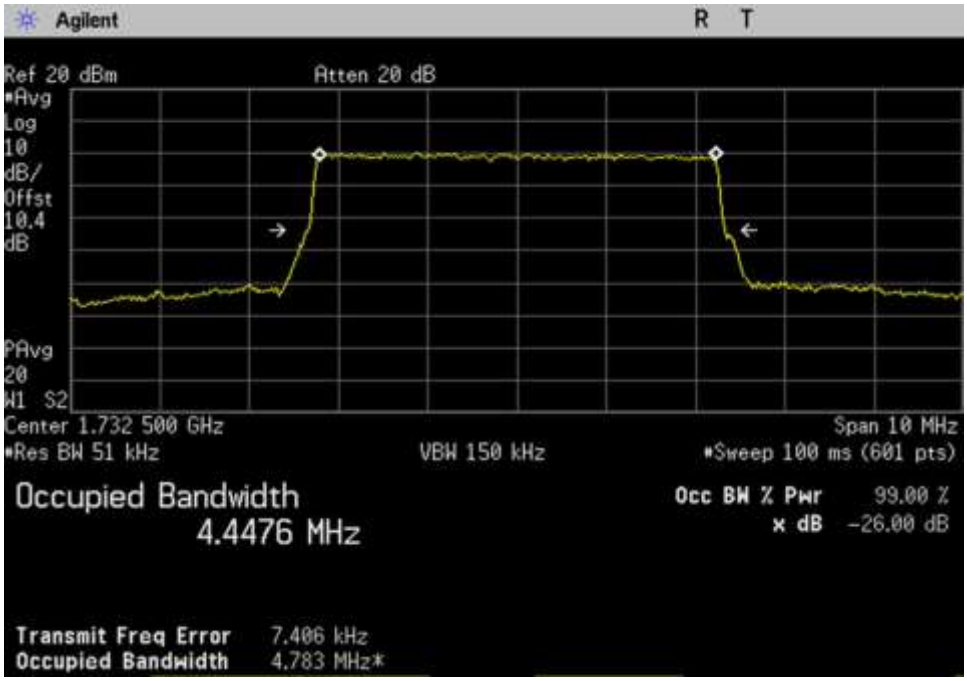
UL_698-716_LTE_ 707MHz



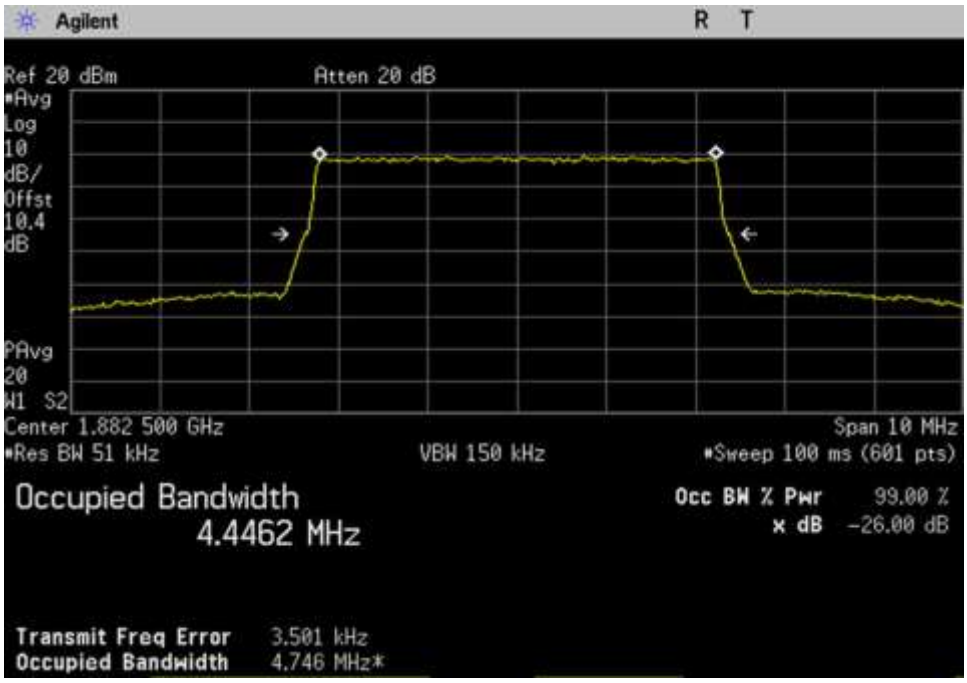
UL_776-787_LTE_ 781.5MHz



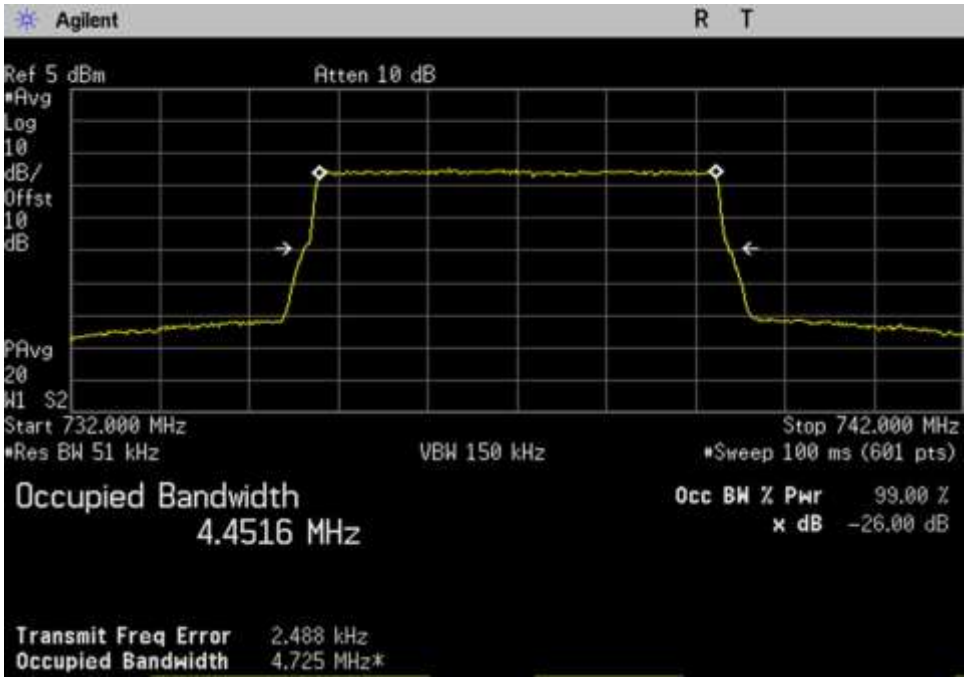
UL_824-849_LTE_ 836.5MHz



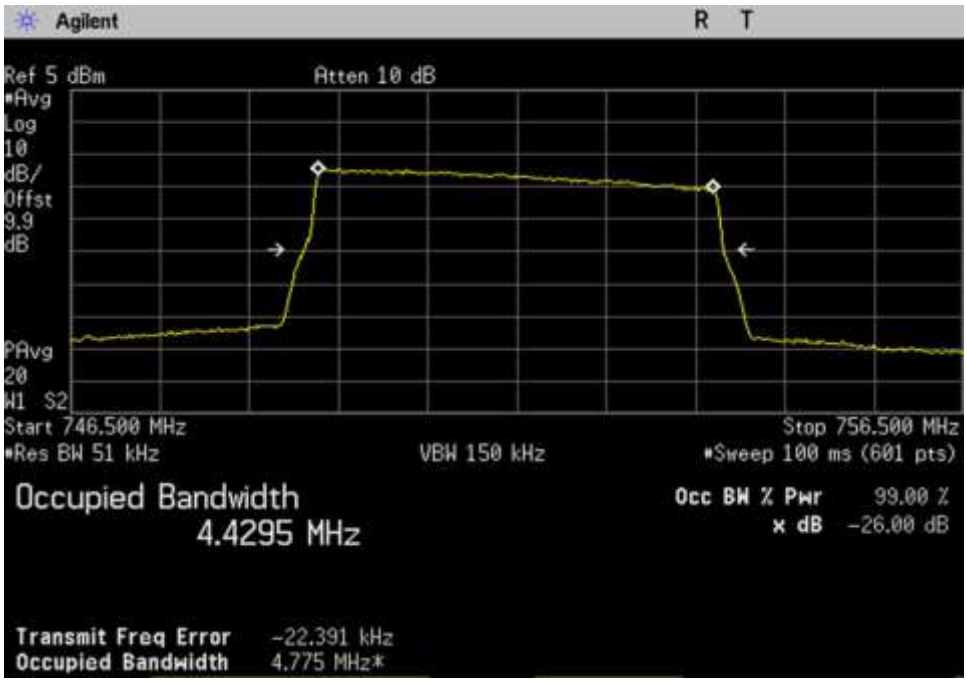
UL_1710-1755_LTE_ 1732.5MHz



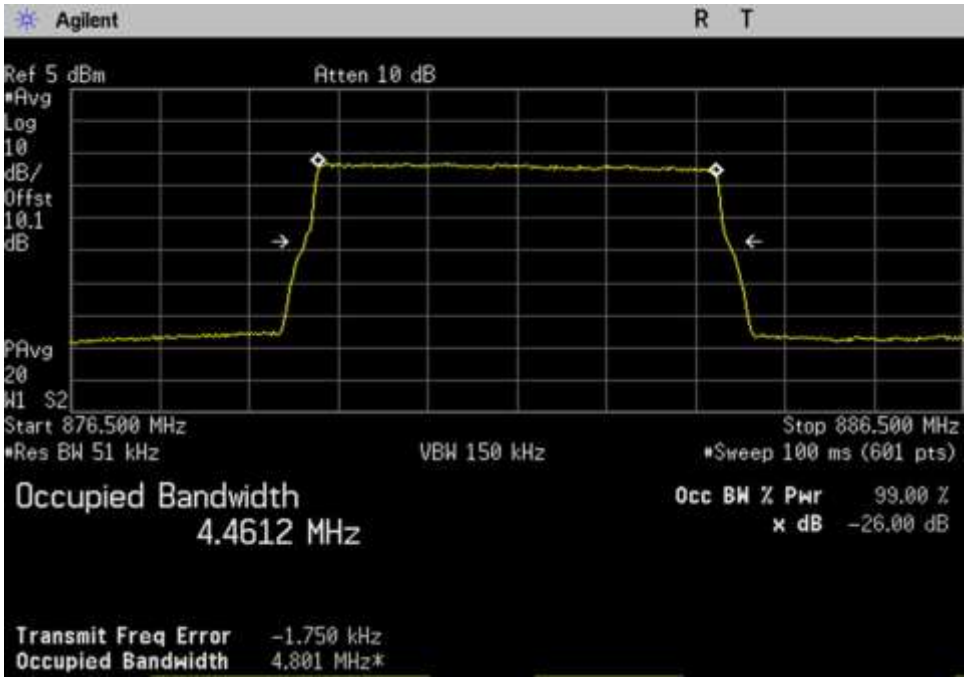
UL_1850-1915_LTE_ 1882.5MHz



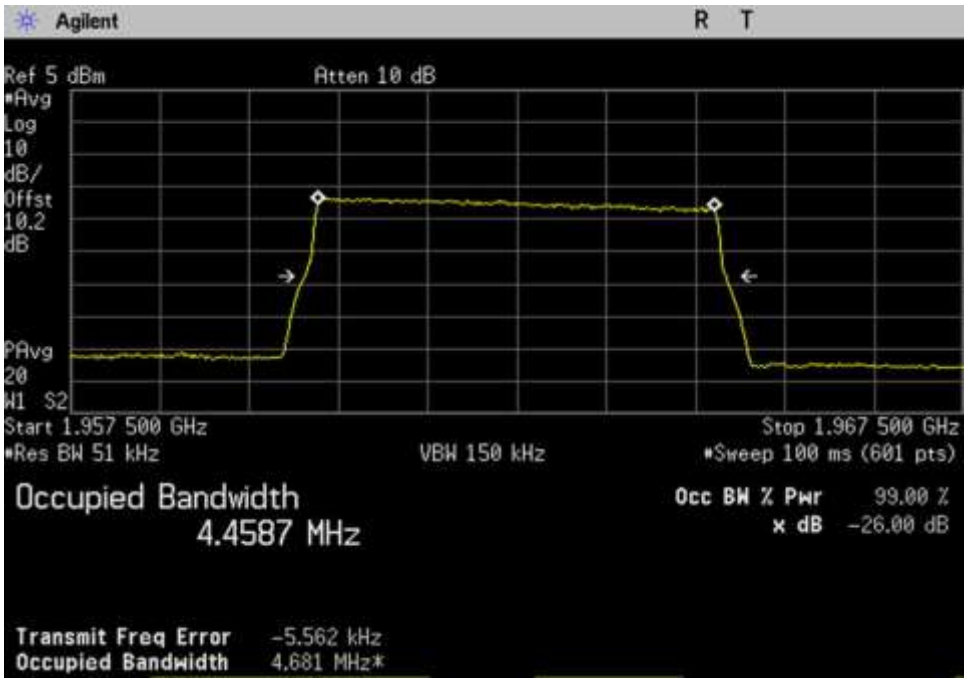
DL_728-746_LTE_ 737MHz



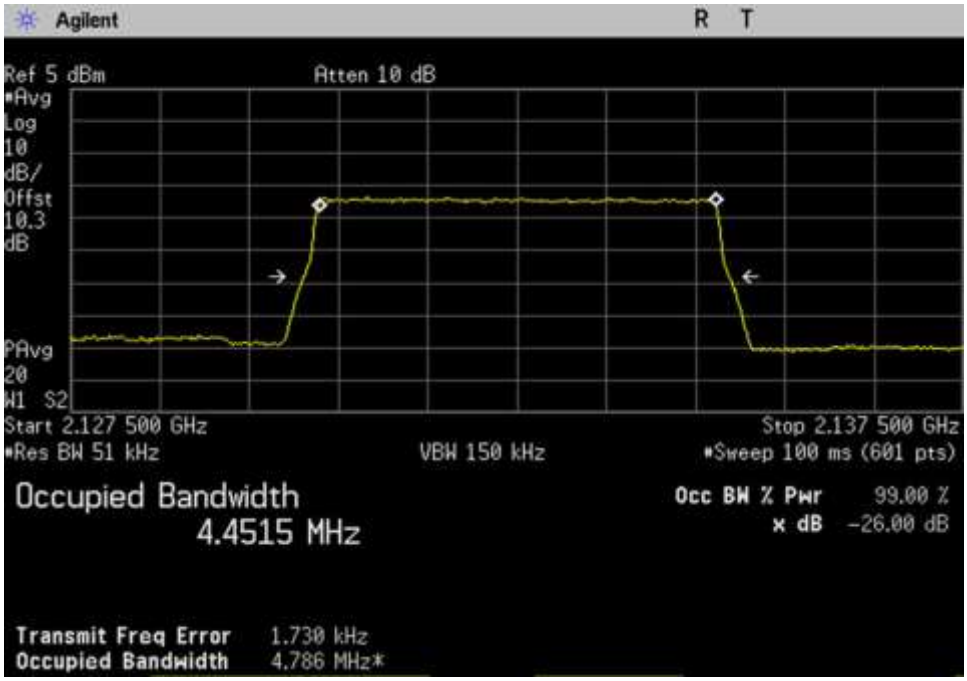
DL_746-757_LTE_ 751.5MHz



DL_869-894_LTE_ 881.5MHz

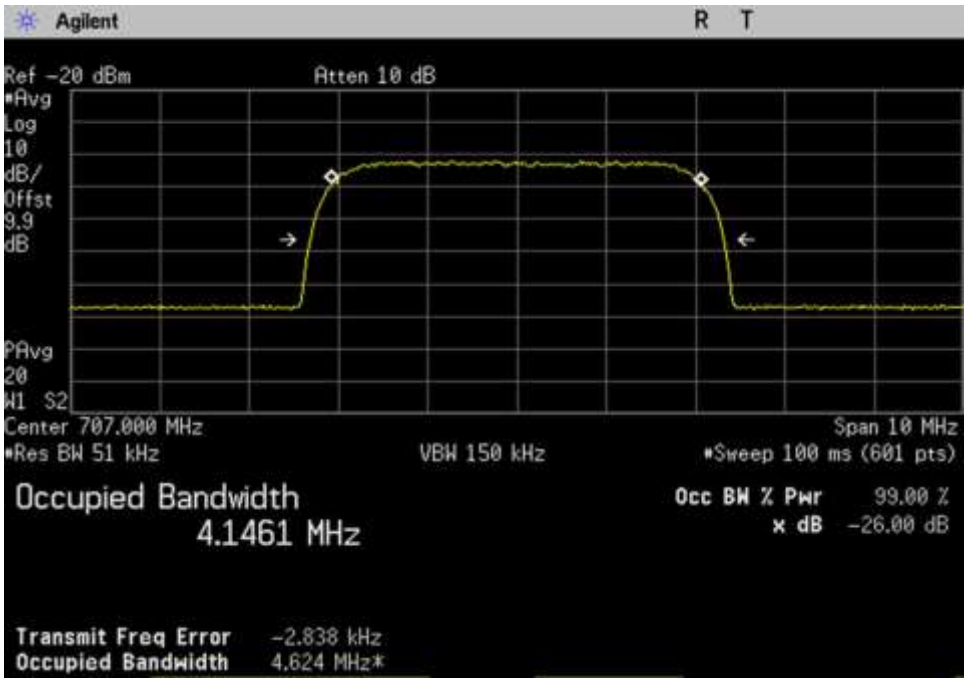


DL_1930-1995_LTE_ 1962.5MHz

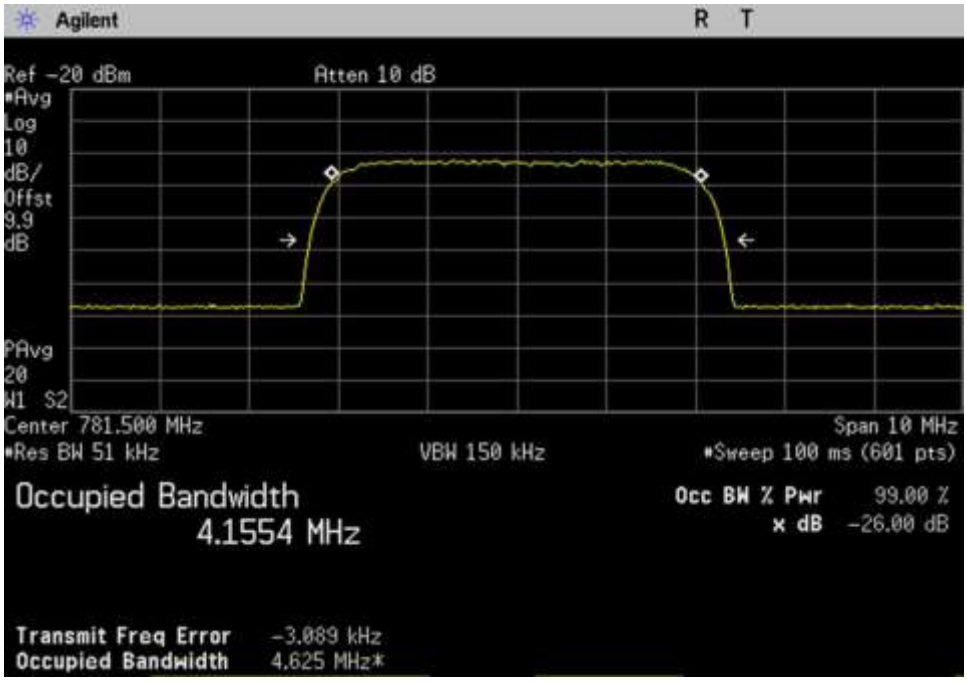


DL_2110-2155_LTE_ 2132.5MHz

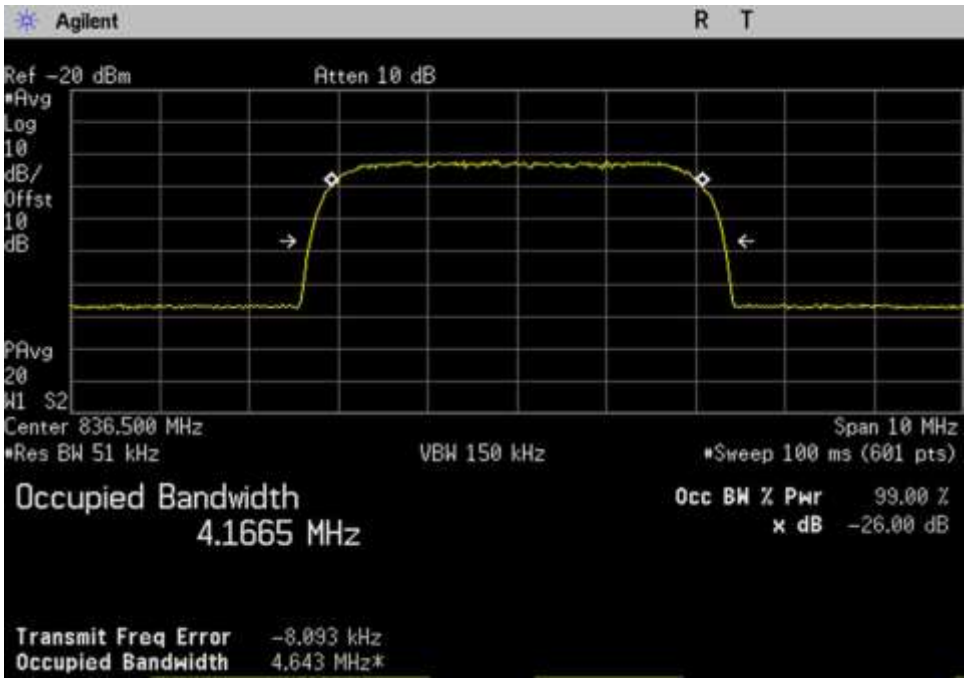
WCDMA Input



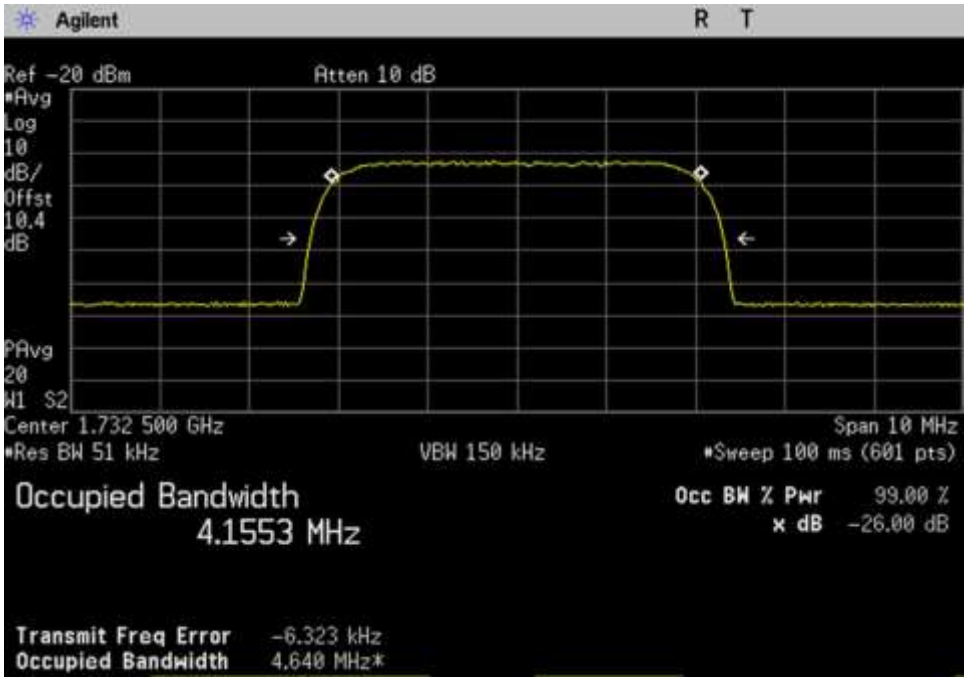
UL_698-716_WCDMA_ 707MHz



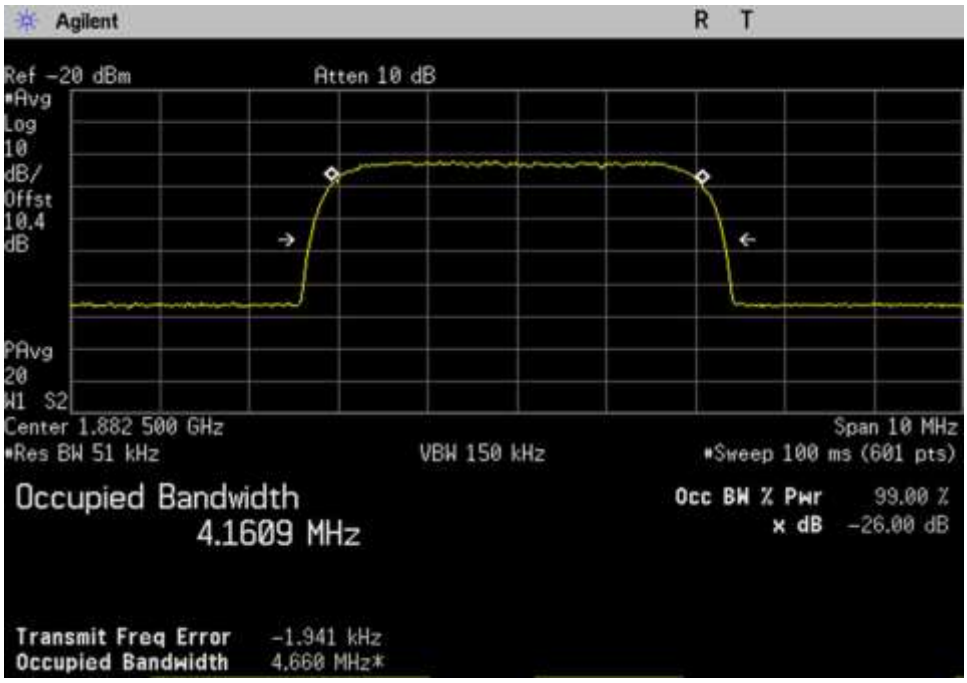
UL_776-787_WCDMA_ 781.5MHz



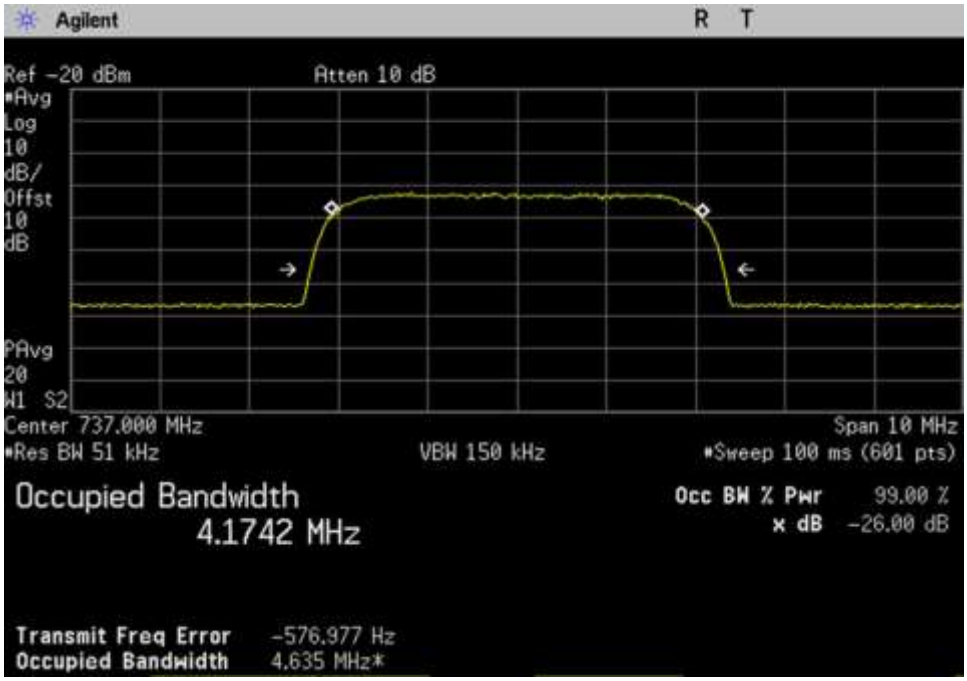
UL_824-849_WCDMA_ 836.5MHz



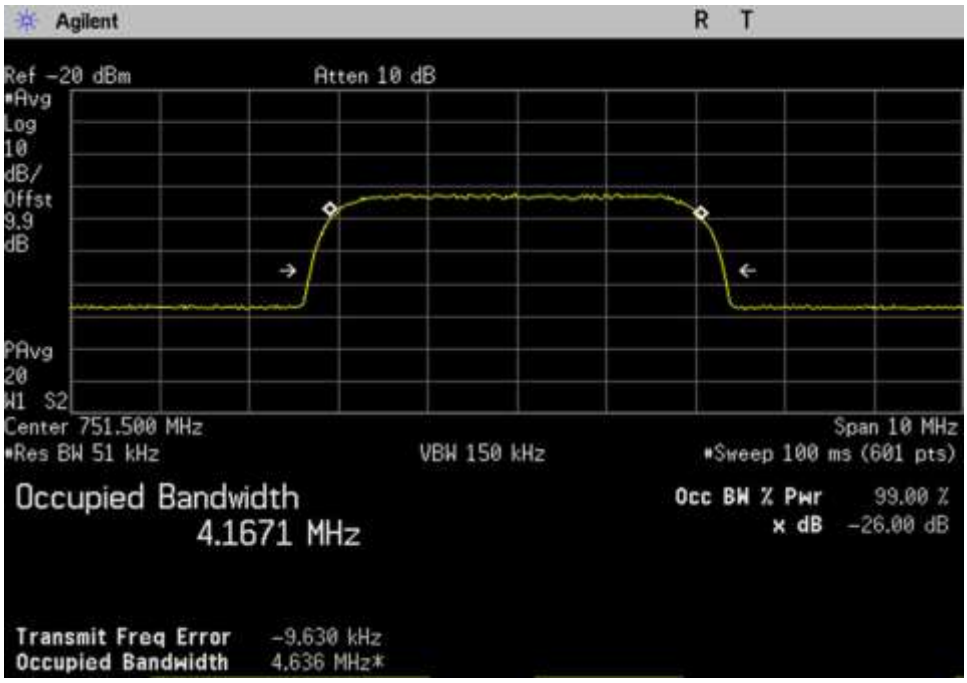
UL_1710-1755_WCDMA_ 1732.5MHz



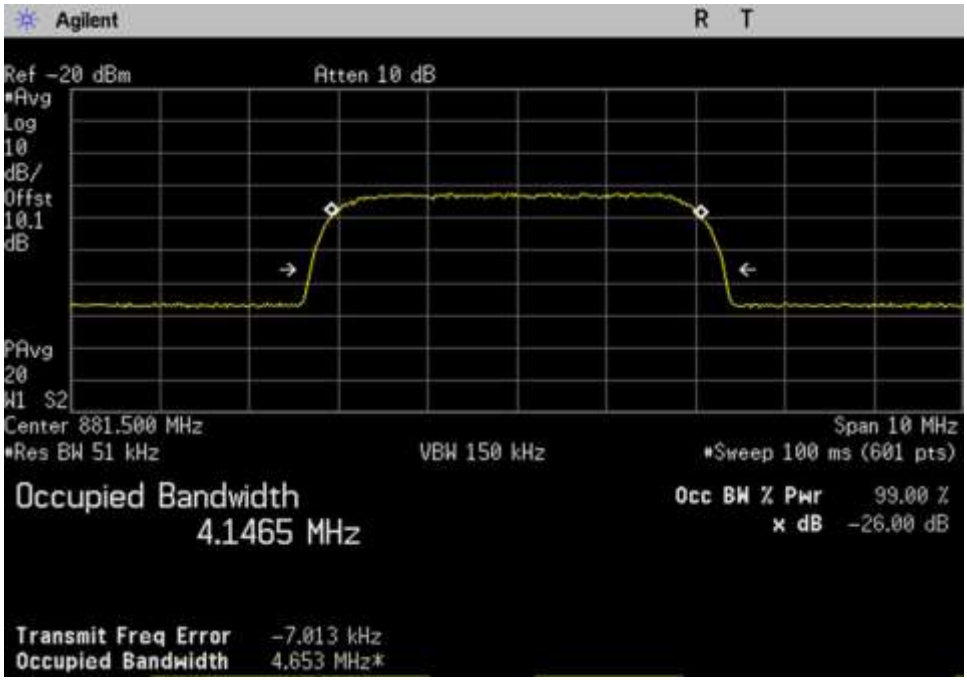
UL_1850-1915_WCDMA_ 1882.5MHz



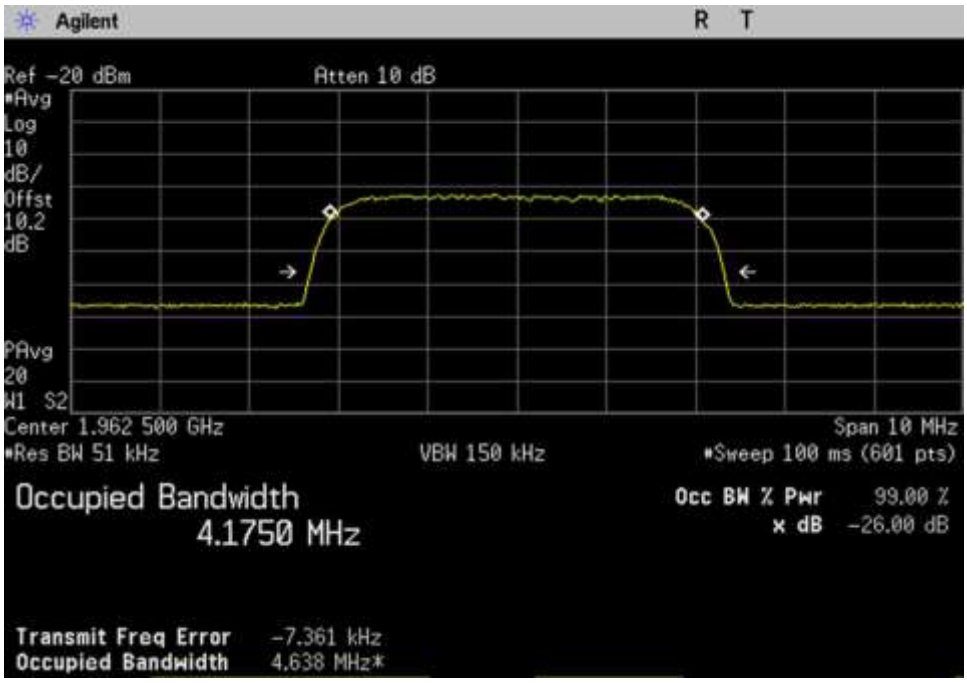
DL_728-746_WCDMA_ 737MHz



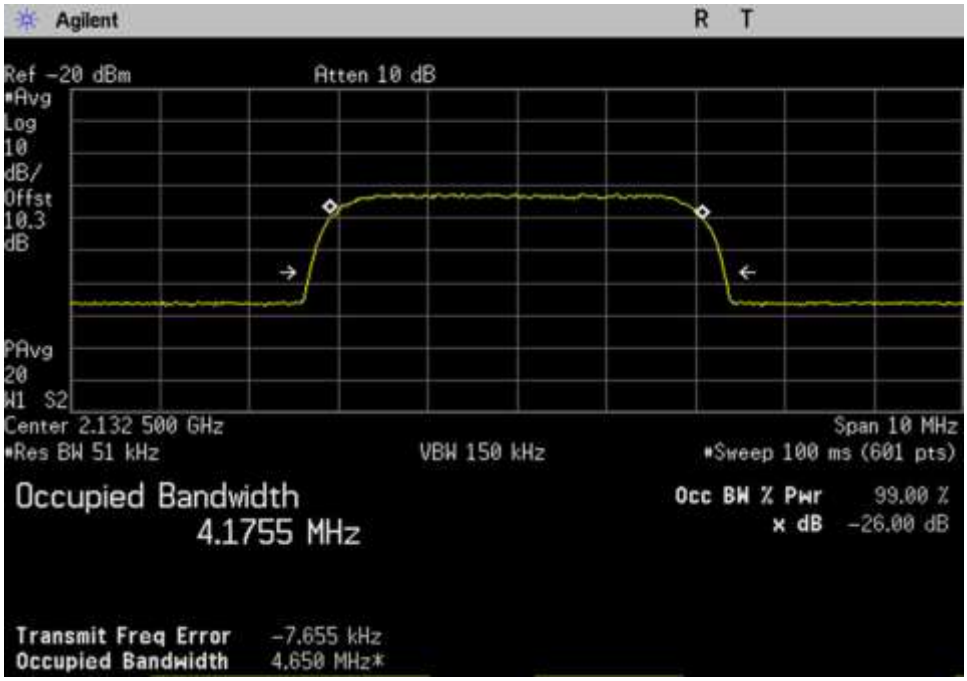
DL_746-757_WCDMA_ 751.5MHz



DL_869-894_WCDMA_ 881.5MHz

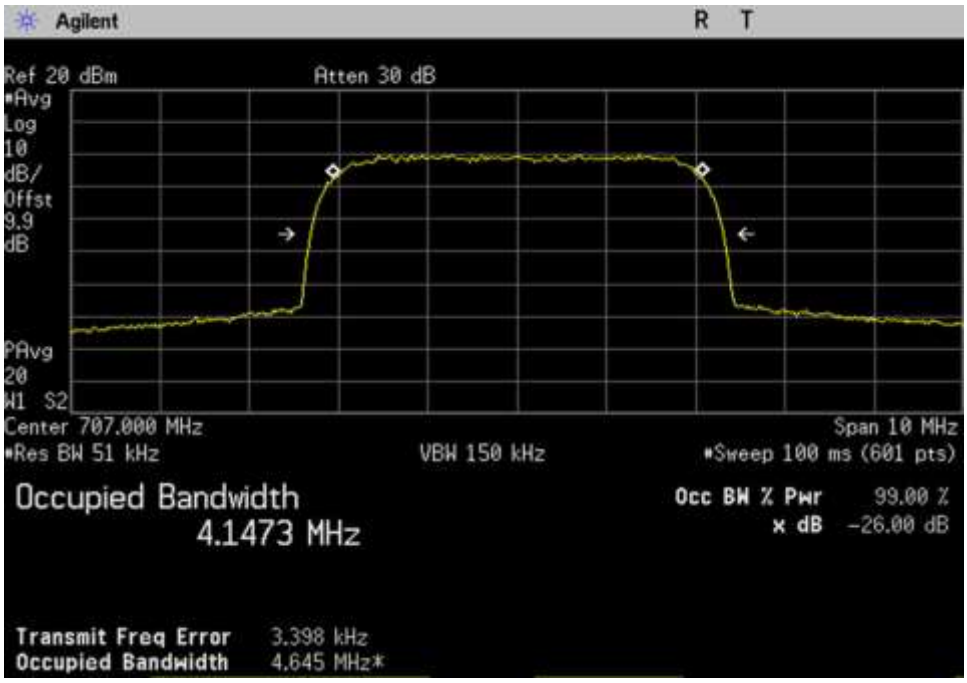


DL_1930-1995_WCDMA_ 1962.5MHz

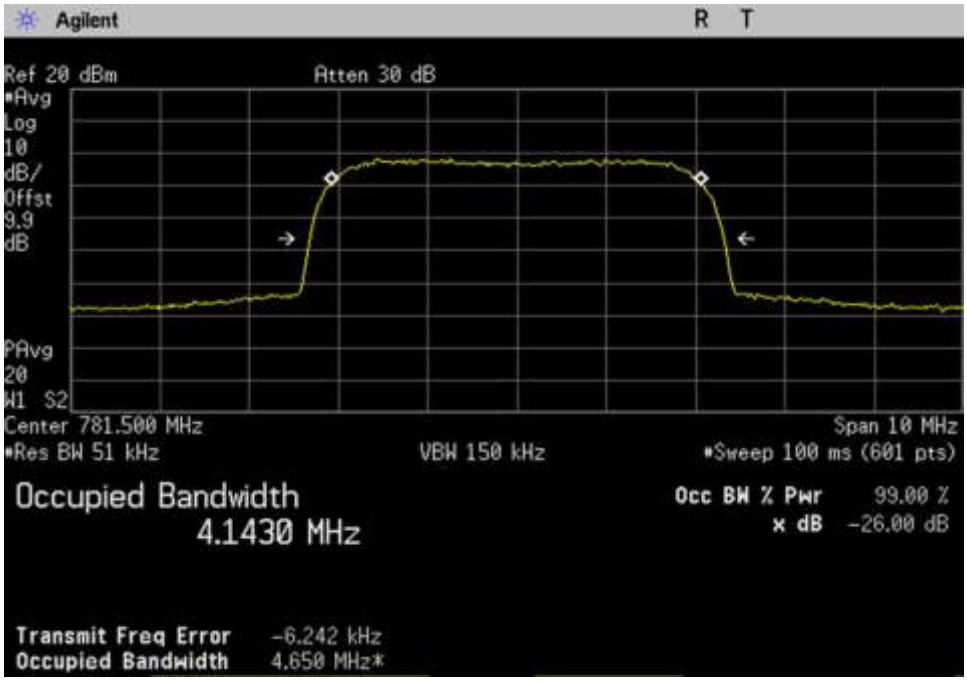


DL_2110-2155_WCDMA_ 2132.5MHz

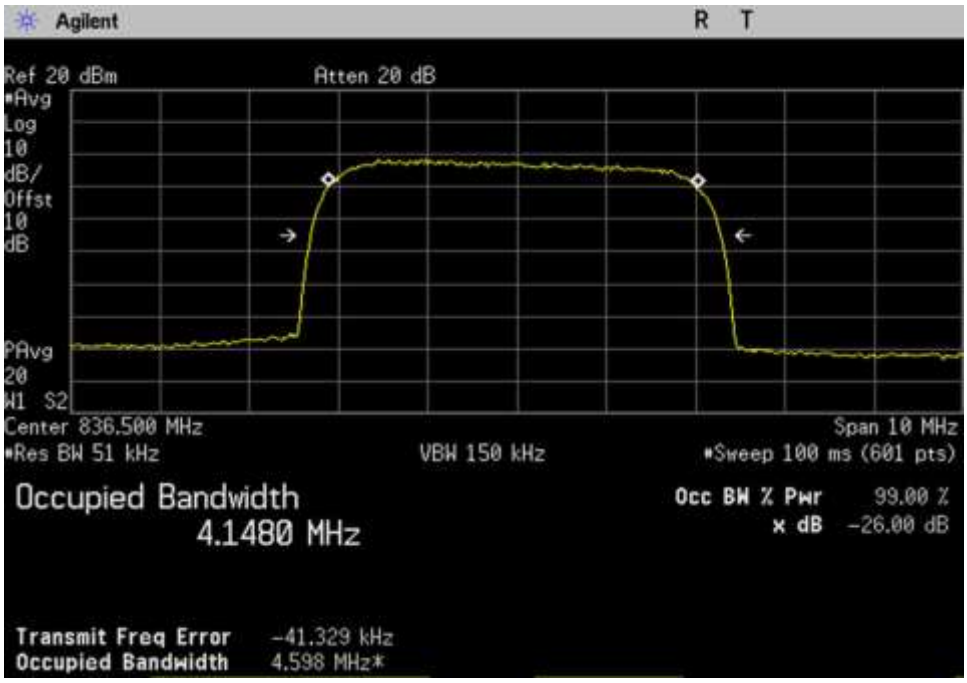
WCDMA Output



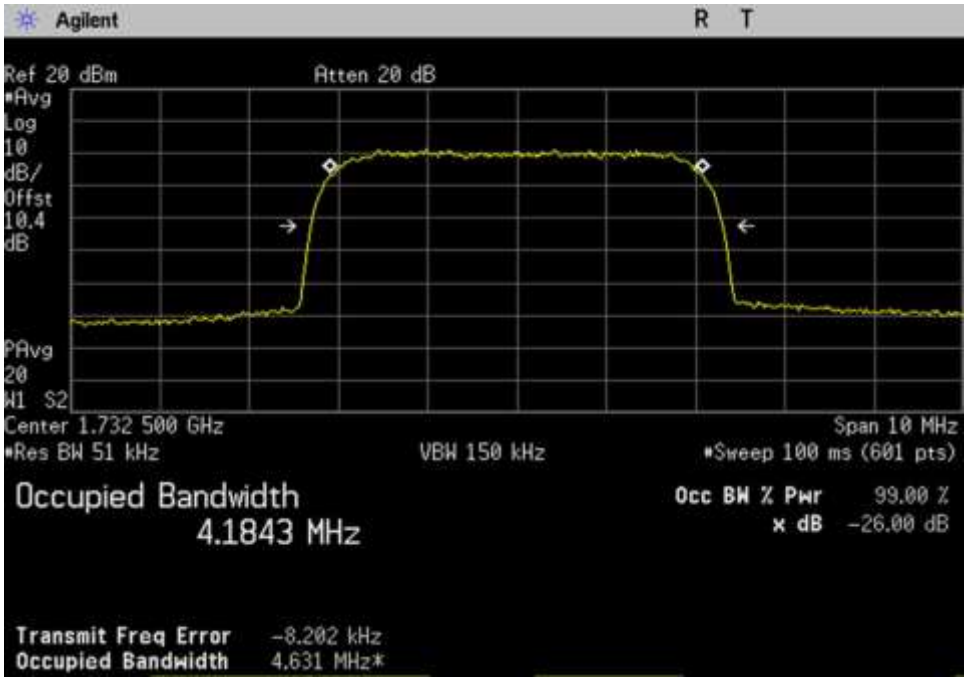
UL_698-716_WCDMA_ 707MHz



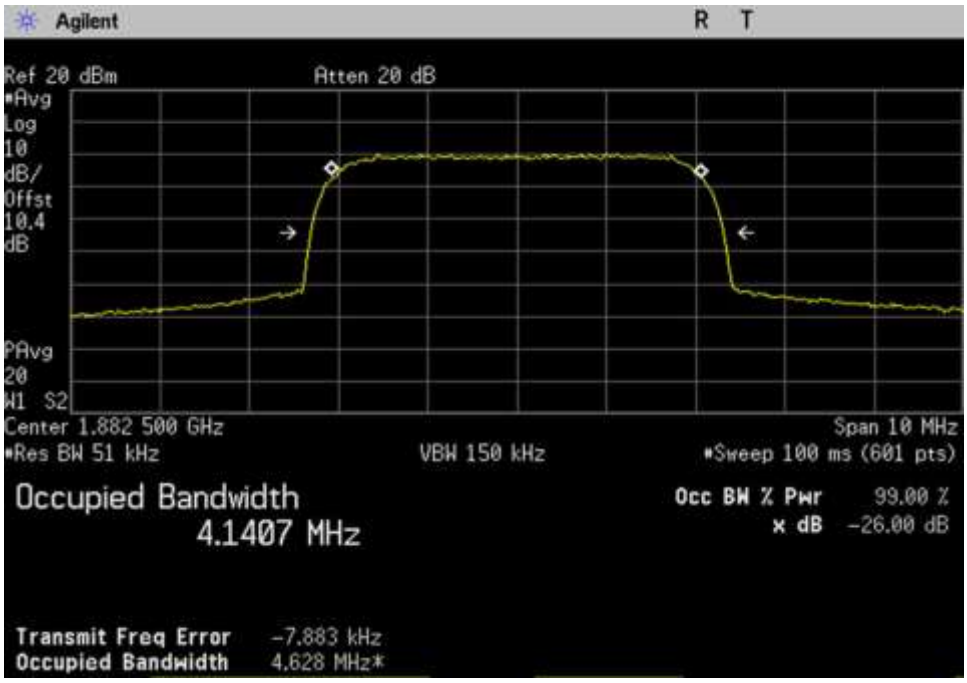
UL_776-787_WCDMA_ 781.5MHz



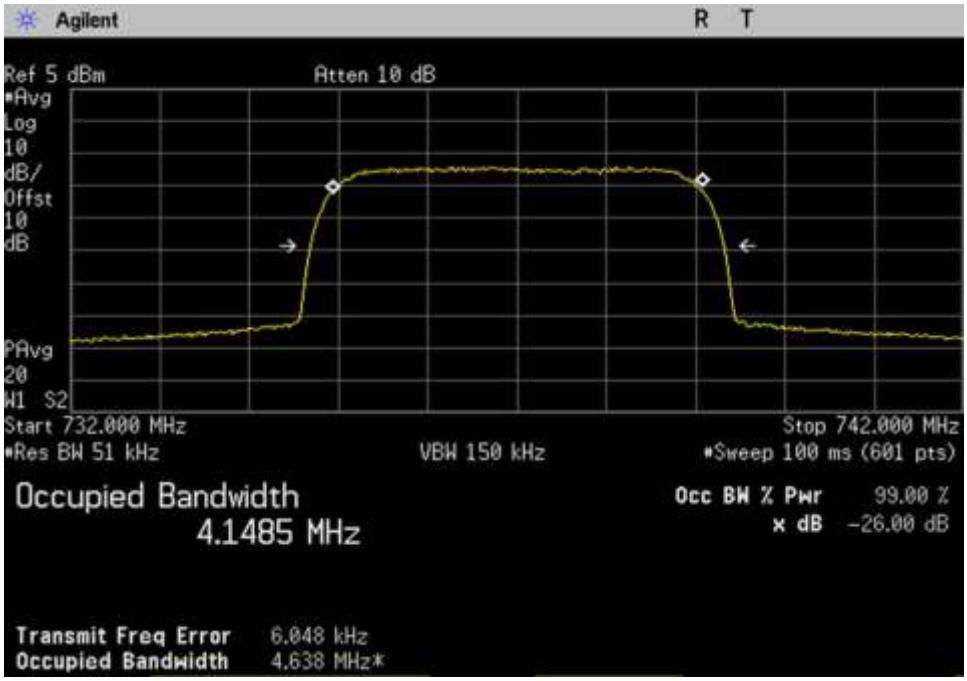
UL_824-849_WCDMA_ 836.5MHz



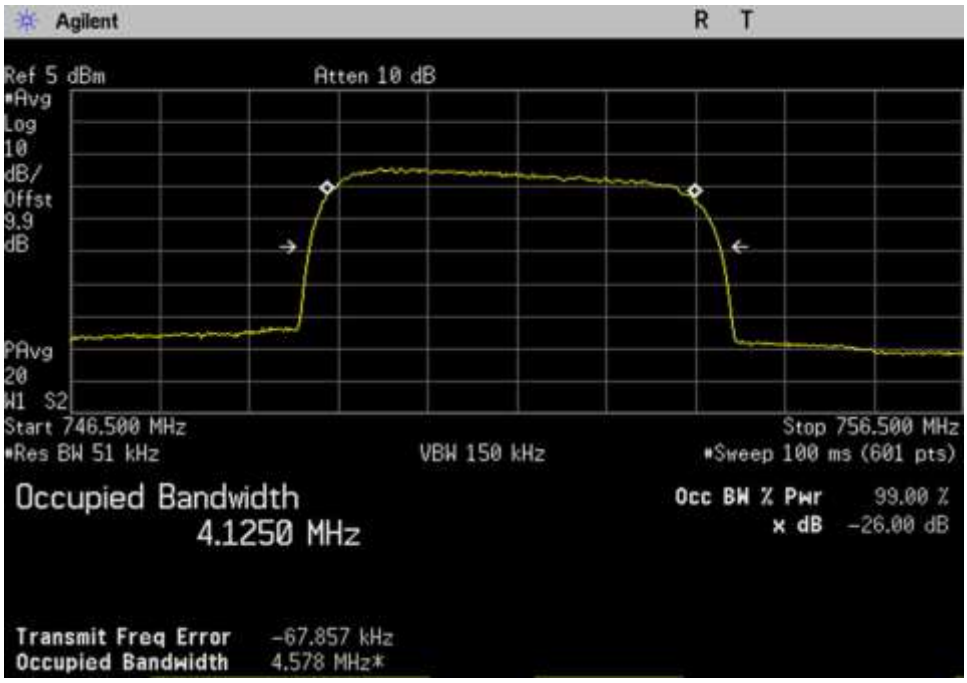
UL_1710-1755_WCDMA_ 1732.5MHz



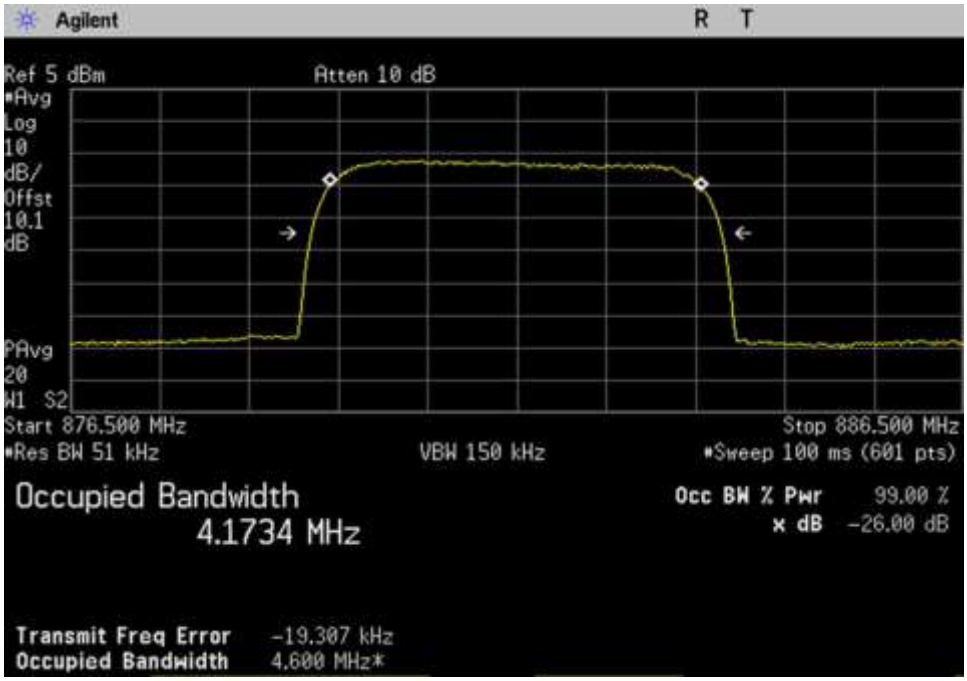
UL_1850-1915_WCDMA_ 1882.5MHz



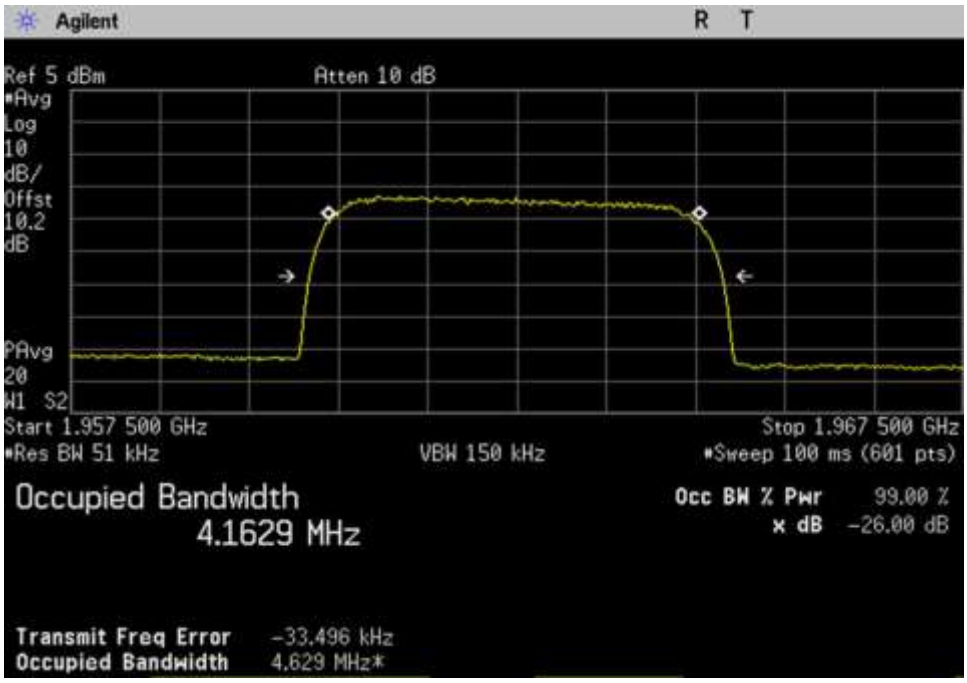
DL_728-746_WCDMA_ 737MHz



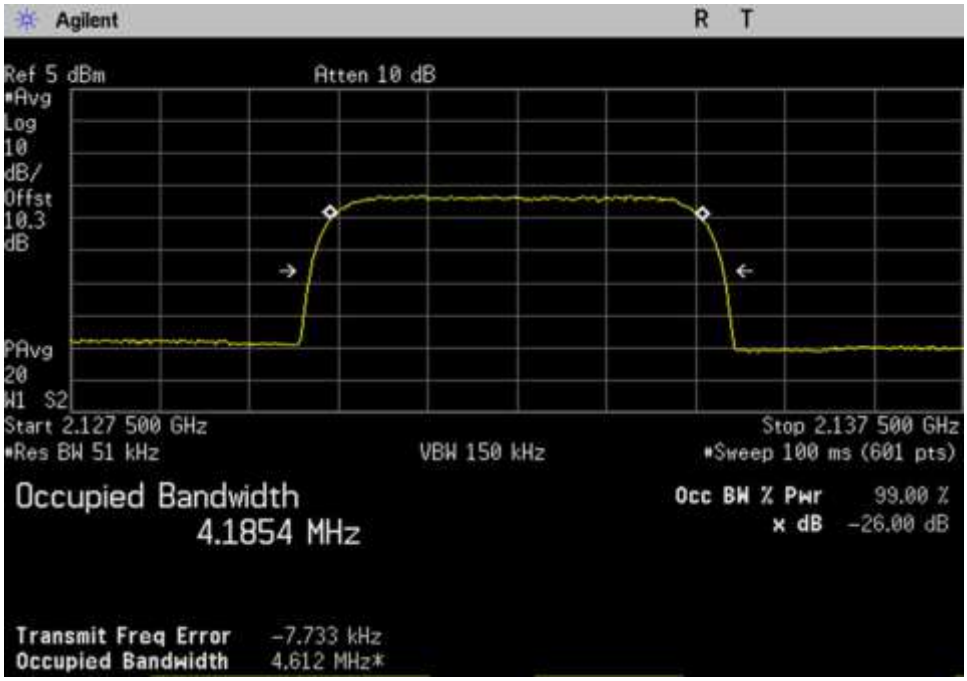
DL_746-757_WCDMA_ 751.5MHz



DL_869-894_WCDMA_ 881.5MHz



DL_1930-1995_WCDMA_ 1962.5MHz



DL_2110-2155_WCDMA_ 2132.5MHz

7.11 Oscillation Detection

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer:	Cellphone-Mate, Inc.
Specification:	**7.11 Anti-Oscillation (Oscillation Restarts / Oscillation mitigation or shutdown)**
Work Order #:	**102180**
Test Type:	**Conducted Emissions** Date 01/29/2019
Tested By:	**Hieu Song Nguyenpham**
Software:	EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

01/29/219: Test environment conditions: Temperature: 20.5°C, 43% relative humidity, Pressure: 101.9kPa

Modification #1 was in place during testing.

Note: UL1850-1915MHz -AWGNL+5:
- AWGNL denotes a 4.1MHz AWGN signal (99% occupied bandwidth) tuned to the frequency of 2.5 MHz above the lower edge of the operating band 1850-1915MHz
- +5 denotes a variable attenuator adjusted such that the insertion loss for center of band under test (isolation) between the booster's donor and server ports is 5 dB greater than the maximum gain, as recorded in the maximum gain test procedure, for the band under test.

Test Equipment:

Asset #	Description	Manufacturer	Model	Calibration Date	Cal Due Date
P07192	Cable	Astro	32022-29094K-29094K-48TC	10/9/2017	10/9/2019
P07191	Cable	Astro	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
03418	Signal Generator	Agilent	E4438C	6/19/2017	6/19/2019
03470	Spectrum Analyzer	Agilent	E4440A	1/3/2018	1/3/2020
P06904	Cable	Astrolab	32022-29094K-29094K-36TC	1/4/2018	1/4/2020
C00082	Directional Coupler	MECA Electronics, Inc.	722-10-1.500V	9/18/2017	9/18/2019
03412	Band Pass Filter	Pasternack	PE8705	8/16/2017	8/16/2019
03413	Band Pass Filter	Pasternack	PE8706	8/16/2017	8/16/2019
03414	Band Pass Filter	Pasternack	PE8707	8/16/2017	8/16/2019
03415	Band Pass Filter	Pasternack	PE8708	8/16/2017	8/16/2019
03447	Band Pass Filter	Pasternack	PE8710	8/16/2017	8/16/2019
03448	Band Pass Filter	Pasternack	PE8711	8/16/2017	8/16/2019
03446	Band Pass Filter	K & L	4FV50-707/H18-O/O	8/16/2017	8/16/2019
03467	High Pass Filter	K & L	4FV50-731/H30-O/O	8/16/2017	8/16/2019
03468	High Pass Filter	K & L	4CS10-781.5/E12.2-O/O	8/16/2017	8/16/2019
03469	High Pass Filter	K & L	4CS10-751.5/E12-O/O	8/16/2017	8/16/2019
02475	Attenuator	HP	8494B	6/8/2017	6/8/2019
03429	Attenuator	HP	8496B	11/8/2017	11/8/2019

Summary of Results

Pass: All oscillations detections and mitigations occur within 0.3 seconds in uplink bands, within 1 second in the downlink bands and the noise level is below the -70dBm/MHz limit.

7.11.2 Oscillation restart tests

Oscillation detection				Time Between restart		Number of restart	
Frequency MHz	Measured Sec	Limit Sec	Peak Level dBm	Measured Sec	Limit At least sec	Measured	Limit
UL1710-1755	0.183	0.3	23.7	69	60	3	5
UL1850-1915	0.192	0.3	24.6	68	60	3	5
UL824-894	0.150	0.3	28.9	69	60	3	5
UL 698-716	0.216	0.3	29.8	66	60	3	5
UL776-787	0.150	0.3	30.2	65	60	3	5
DL2110-2155	0.167	1.0	26.8	68	60	3	5
DL1930-1995	0.216	1.0	25.5	70	60	4	5
DL869-894	0.167	1.0	13.0	69	60	3	5
DL:728-746	0.217	1.0	13.1	66	60	3	5
DL 746-757	0.183	1.0	14.5	70	60	3	5

The booster continues to mitigate at least 1 minute before restarting. The plots demonstrate after 1 restart (the limit is 5 restart), the booster does not resume operation until manually reset.

7.11.3 Test procedure for measuring oscillation mitigation or shutdown

	UL 1710-1755	UL1850-1915	UL 824-894	UL 698-716	UL 776-787	
Max Gain Isolation dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Limit dB
+5dB	8.5	10.2	(12.4) *	9.5	8.2	12.0
+4dB	9.6	11.6	(13.9) *	11.5	10.1	12.0
+3dB	10.5	(12.7) *	(16.5) *	(13.5)*	11.6	12.0
+2dB	(12.1) *	(14.6) *	(19.7) *	(15.5)*	(13.8)*	12.0
+1dB	(13.6) *	(17.3) *	(23.6) *	(18.4)*	(15.8)*	12.0
0dB	(15.2) *	(21.8) *	(40.2) *	(22.4)*	(20.9)*	12.0
-1dB	(18.1) *	(33.2) *	**	(33.1)*	**	12.0
-2dB	(24.3) *	**	**	**	**	12.0
-3dB	(42.1) *	**	**	**	**	12.0
-4dB	**	**	**	**	**	12.0
-5dB	**	**	**	**	**	12.0

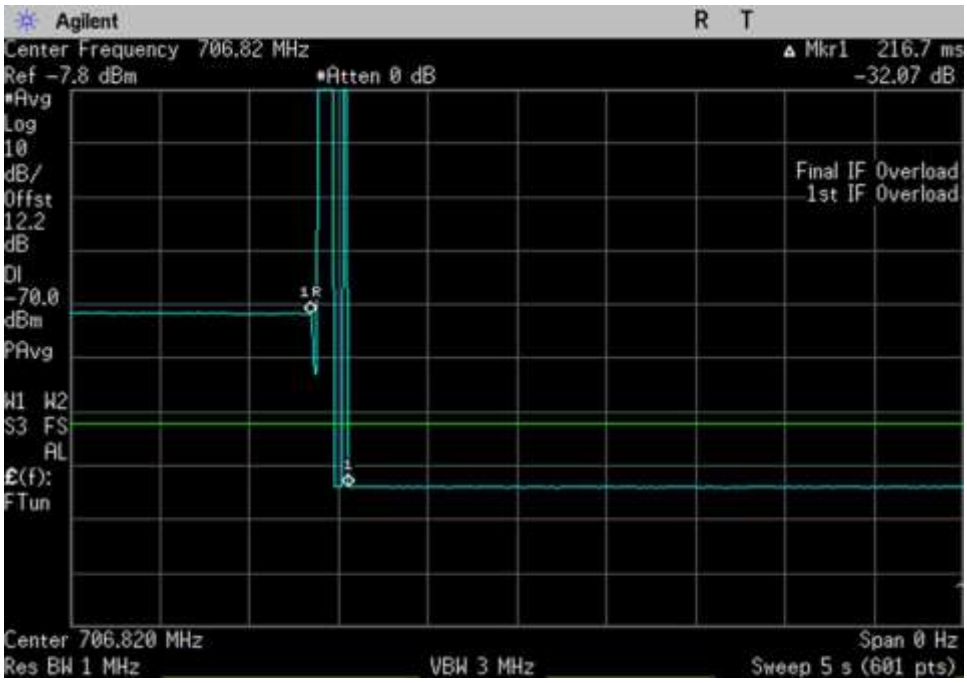
	DL 2110-2155	DL 1930-1995	DL 869-894	DL 728-746	DL 746-775	
Max Gain Isolation dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Limit dB
+5dB	11	10.3	10.9	(12.6)*	8.3	12.0
+4dB	(13.5) *	11.7	(12.5)*	(14.9)*	10.4	12.0
+3dB	(14.5) *	(14.1) *	(14.1)*	(17.0)*	11.4	12.0
+2dB	(16.8) *	(17.2) *	(16.1)*	(21.3)*	(14.3)*	12.0
+1dB	(21.6) *	(19.8) *	(19.4)*	(26.6)*	(16.7)*	12.0
0dB	(26.7) *	(28.1) *	(26.3)*	(70.4)*	(22.1)*	12.0
-1dB	(51.6) *	**	**	**	(36.1)*	12.0
-2dB	**	**	**	**	**	12.0
-3dB	**	**	**	**	**	12.0
-4dB	**	**	**	**	**	12.0
-5dB	**	**	**	**	**	12.0

Note:

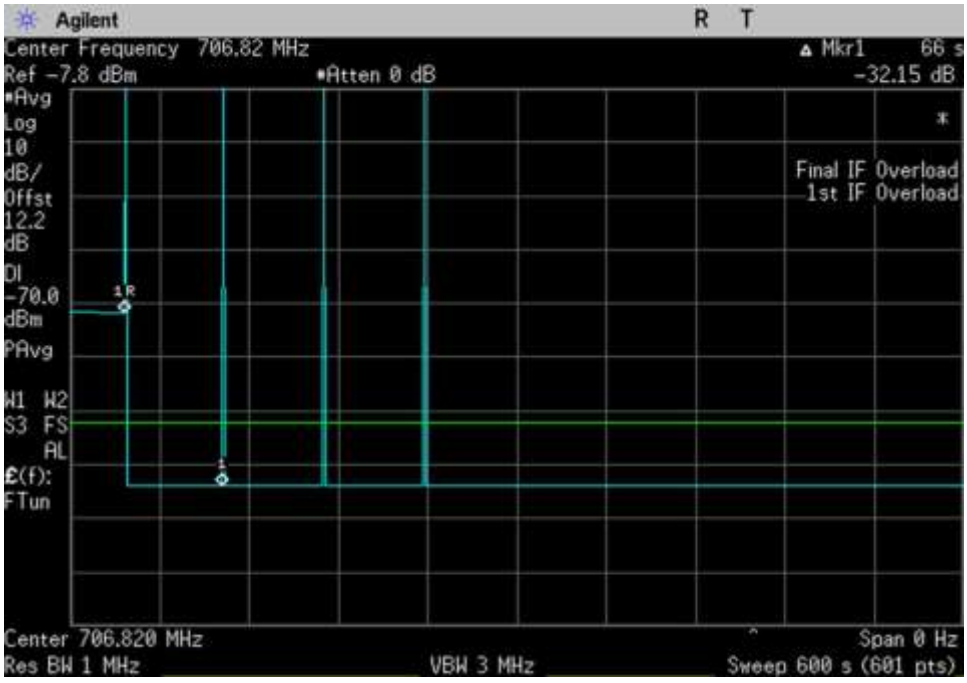
* The measured difference exceeds the limit for a period of less than 300 second before device mitigates or shuts down. The maximum recorded time prior to shutdown was 194 seconds for the Uplink bands and 99 seconds for the Downlink bands.

** The device shuts down immediately.

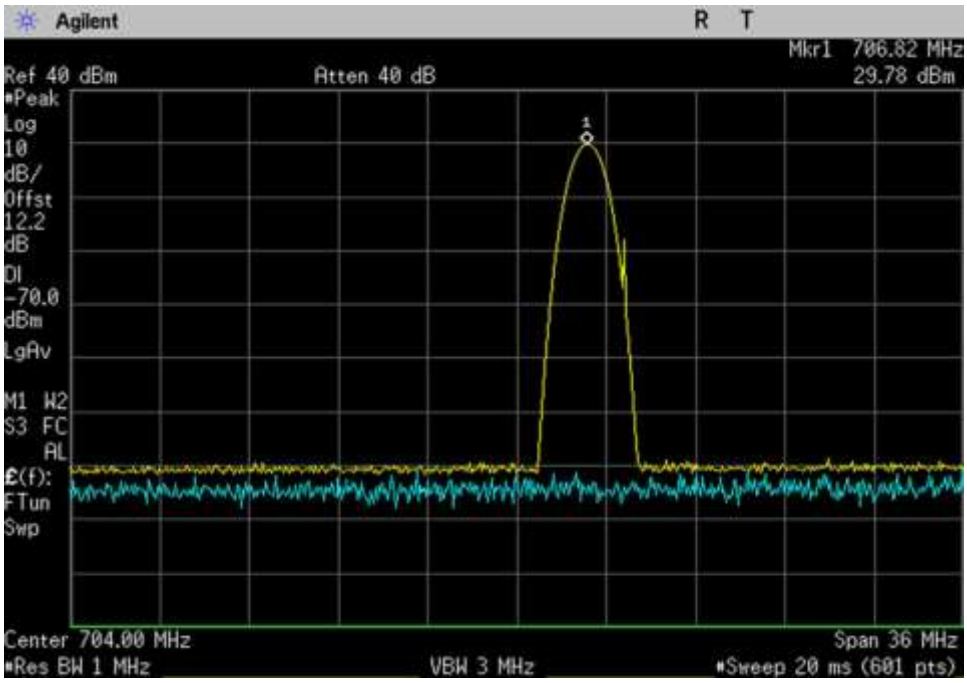
Plot(s)



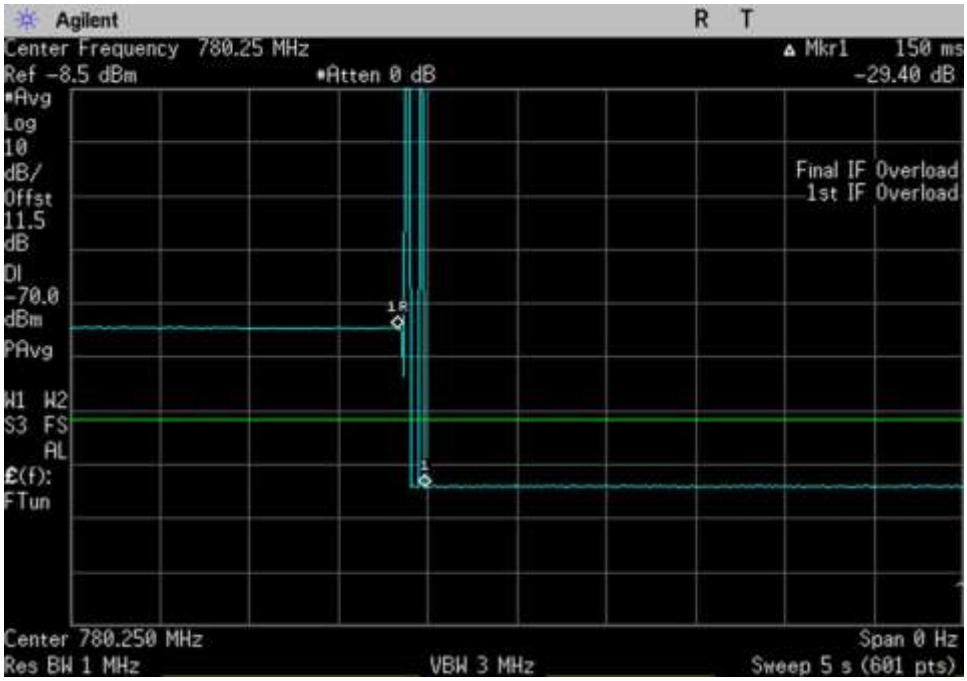
UL_698-716_ 706.82MHz



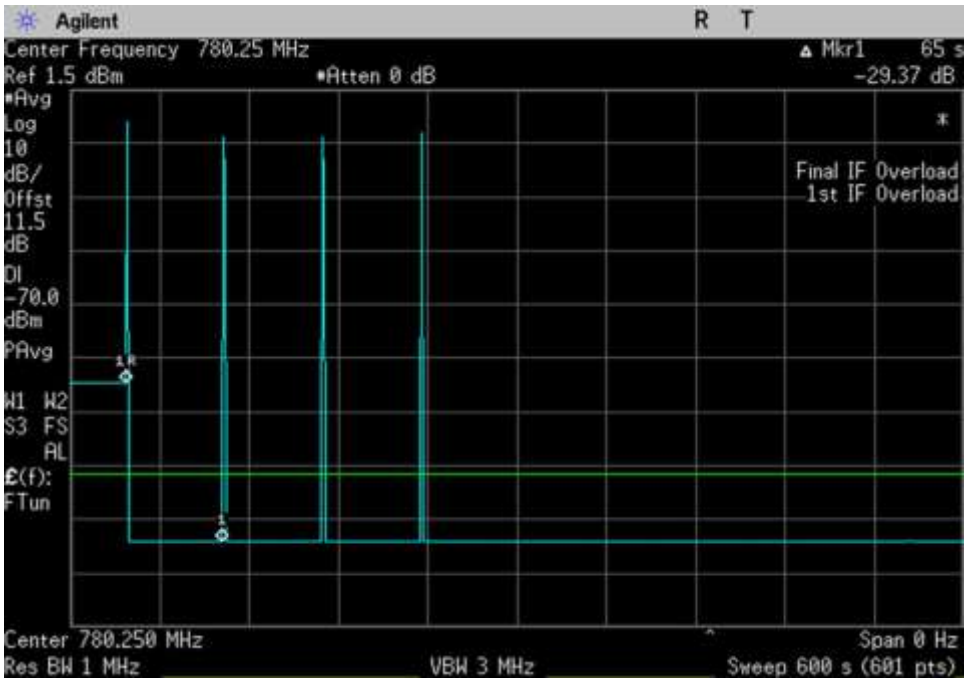
UL_698-716_600sec_ 706.82MHz



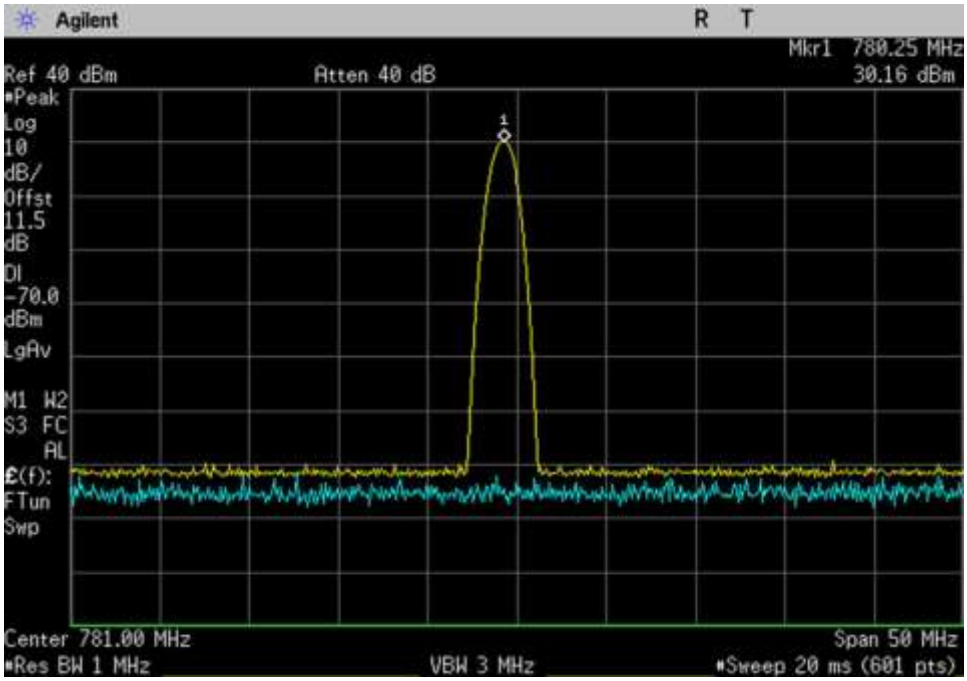
UL_698-716_Pk_ 704MHz



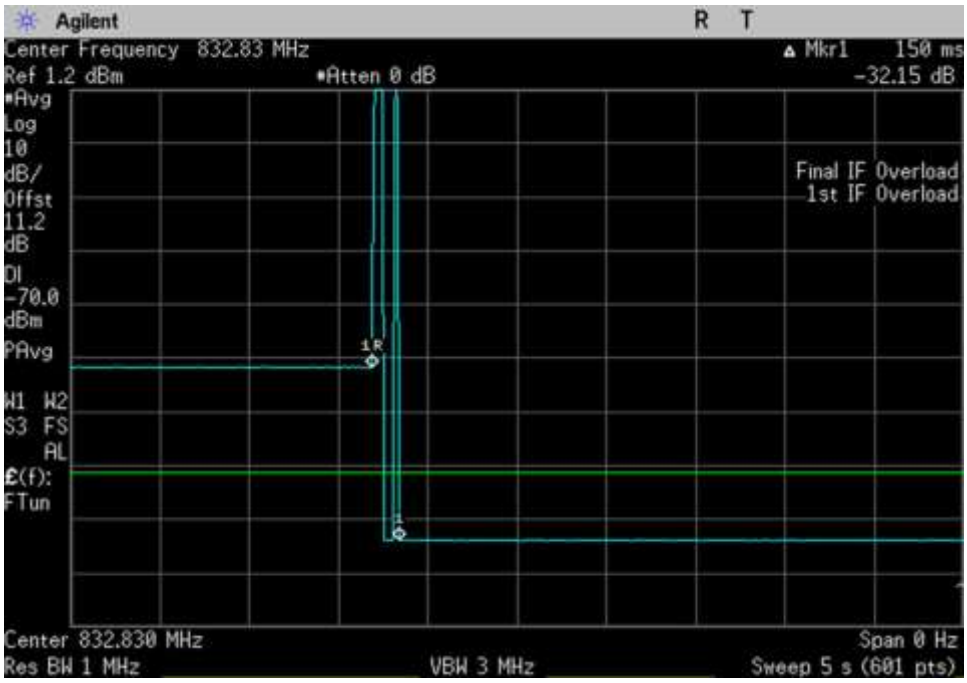
UL_776-787_ 780.25MHz



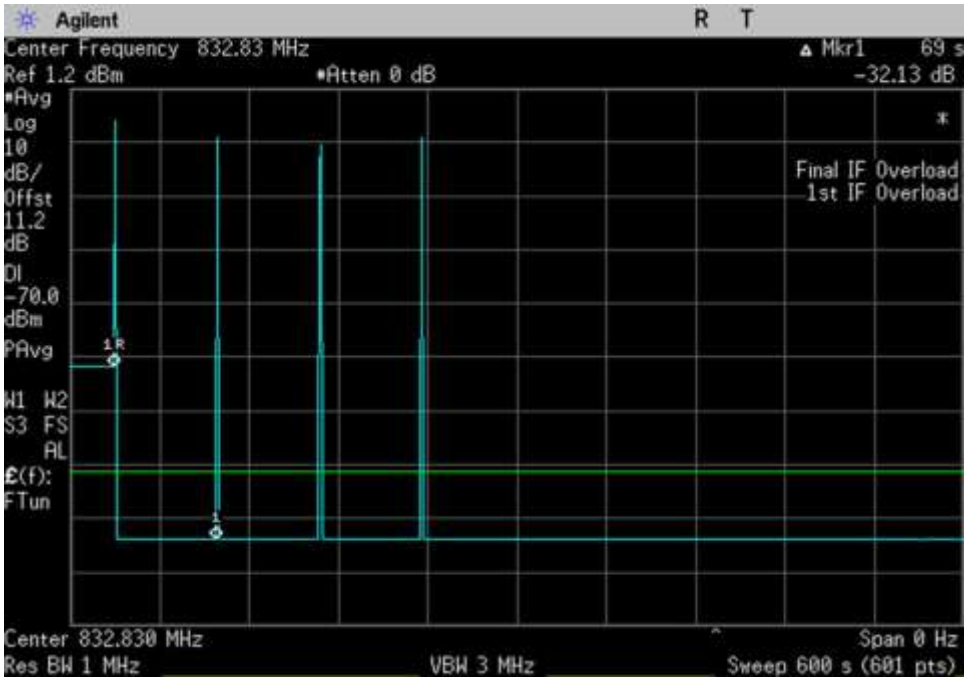
UL_776-787_600sec_ 780.25MHz



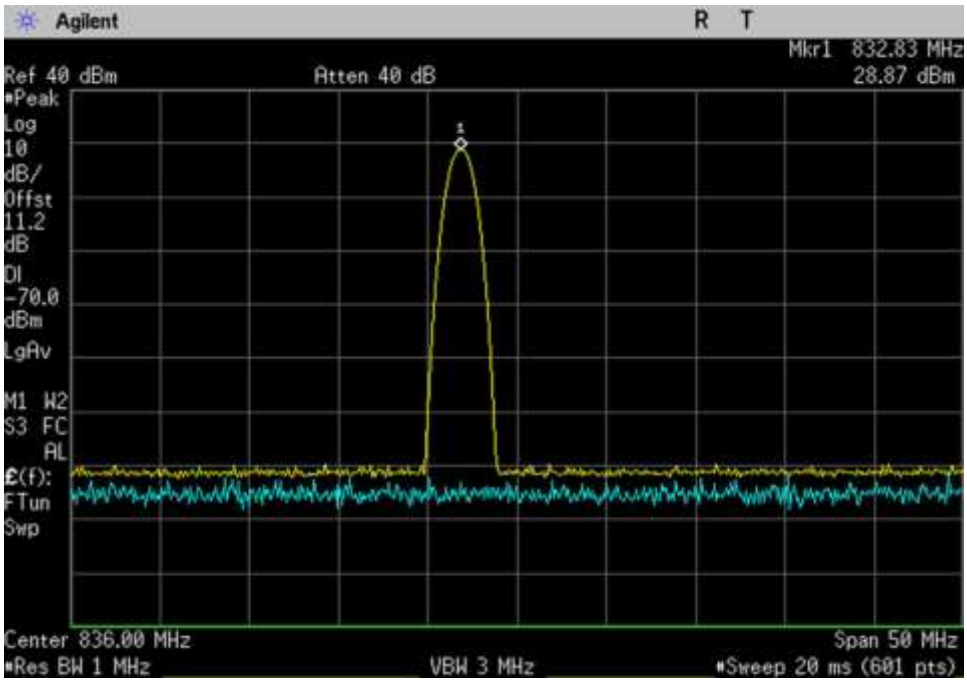
UL_776-787_Pk_ 781MHz



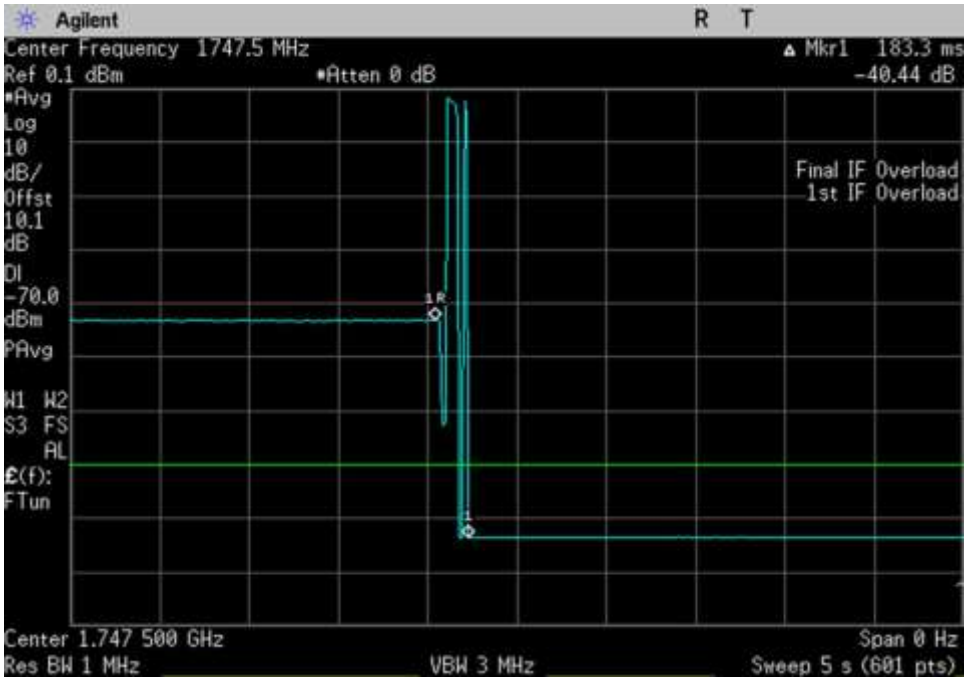
UL_824-849_ 832.83MHz



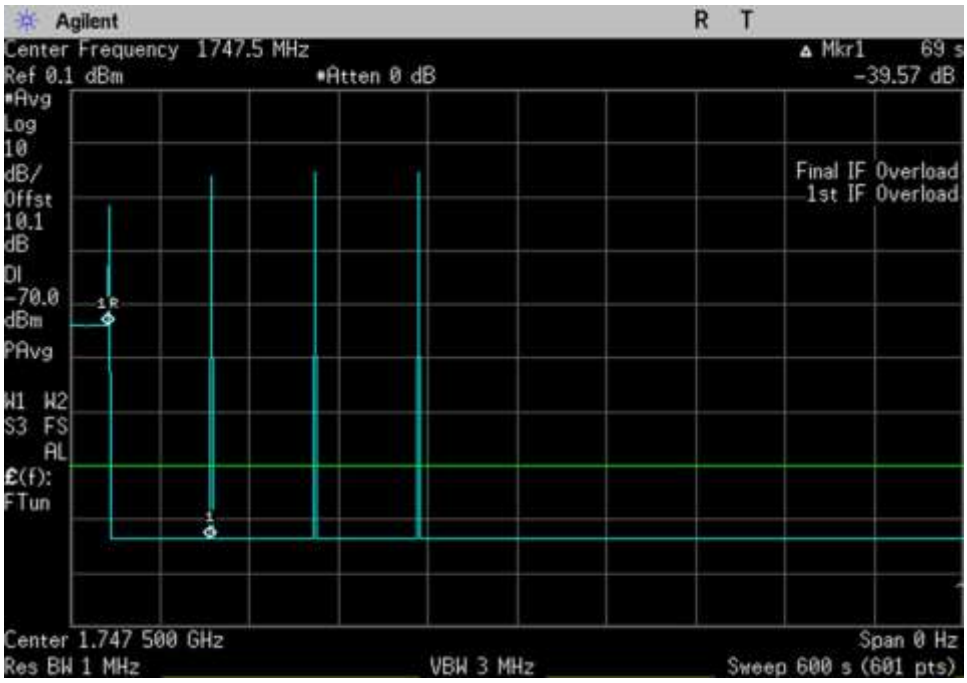
UL_824-849_600sec_ 832.83MHz



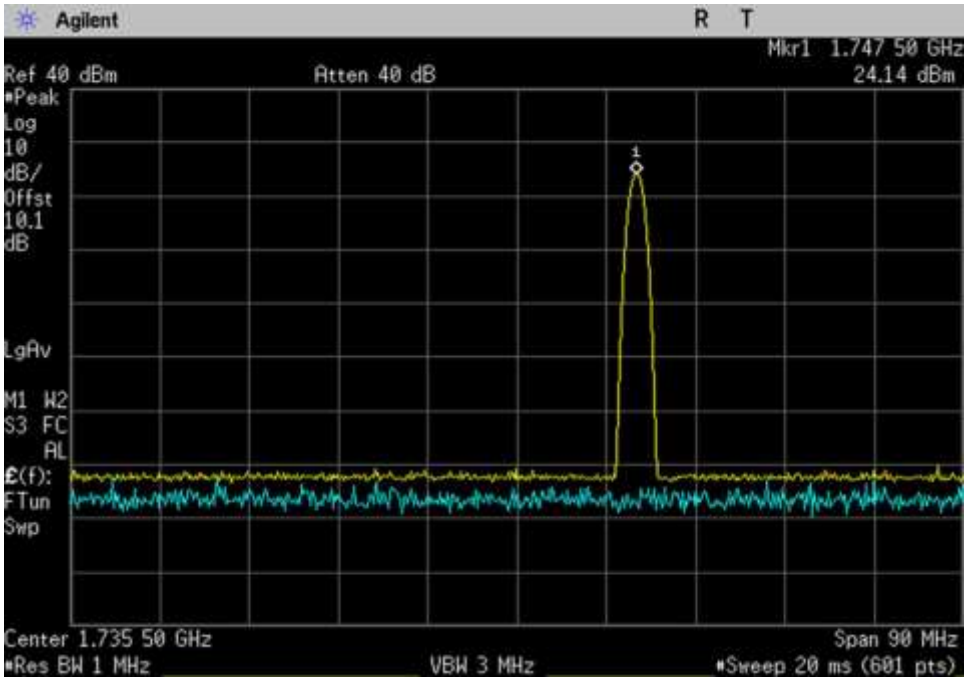
UL_824-849_Pk_ 836MHz



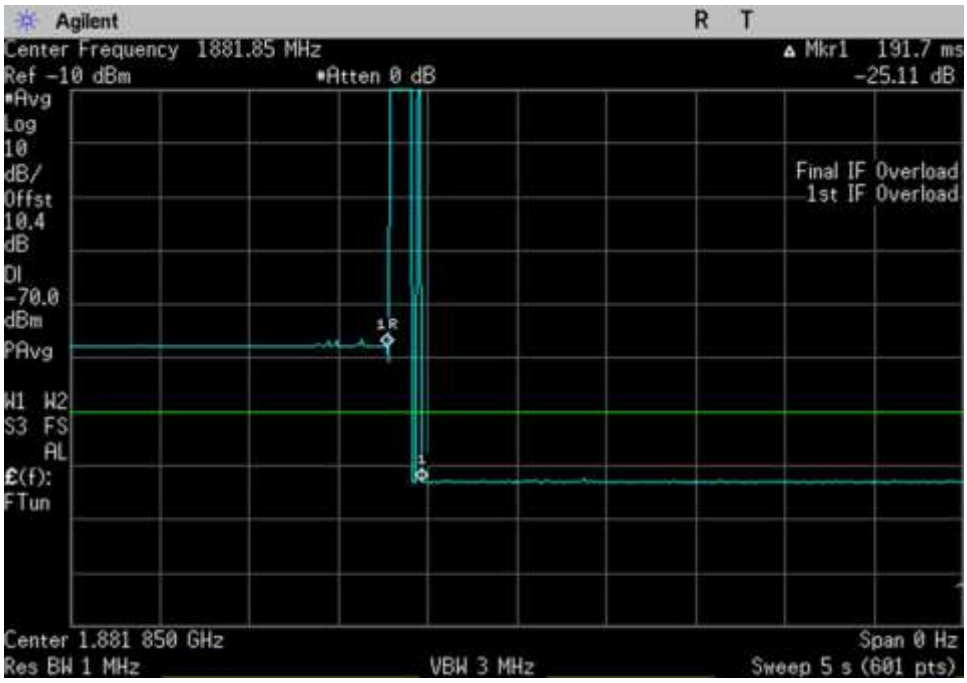
UL_1710-1755_ 1747.5MHz



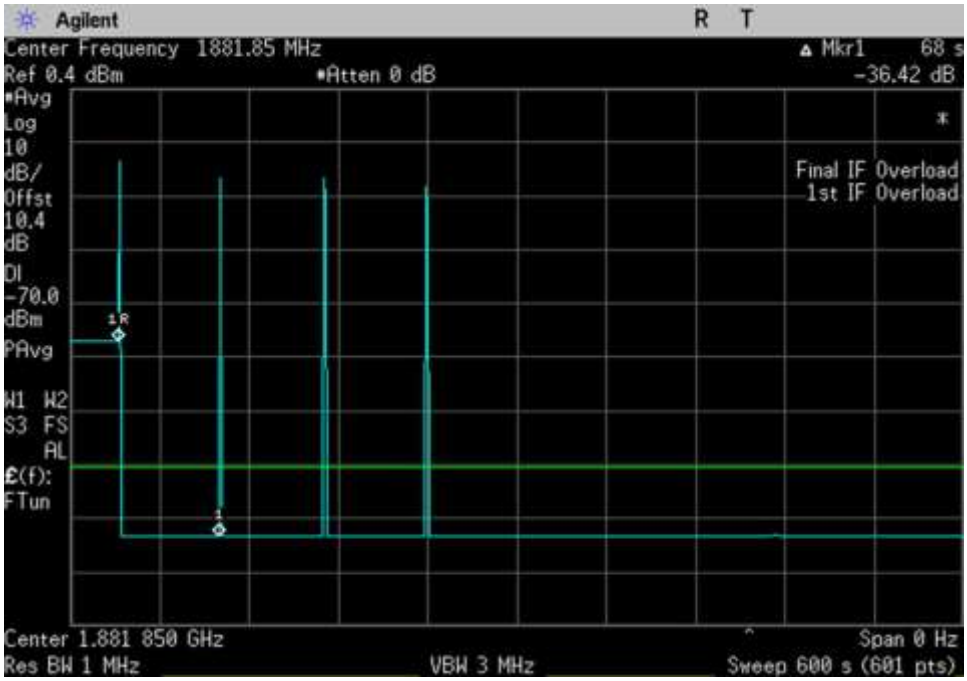
UL_1710-1755_600sec_ 1747.5MHz



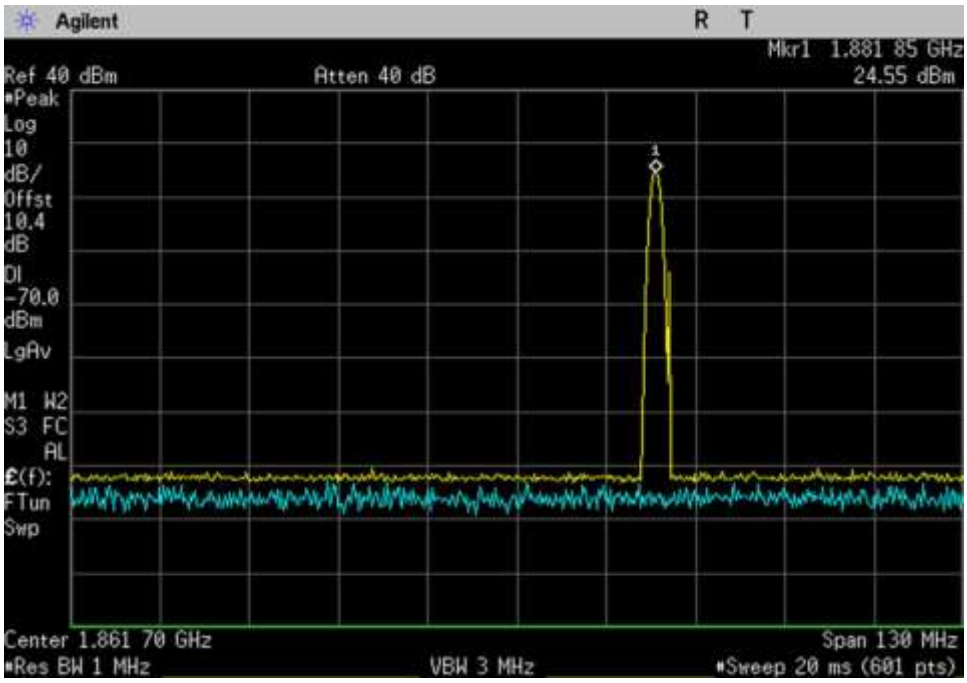
UL_1710-1755_Pk_ 1735.5MHz



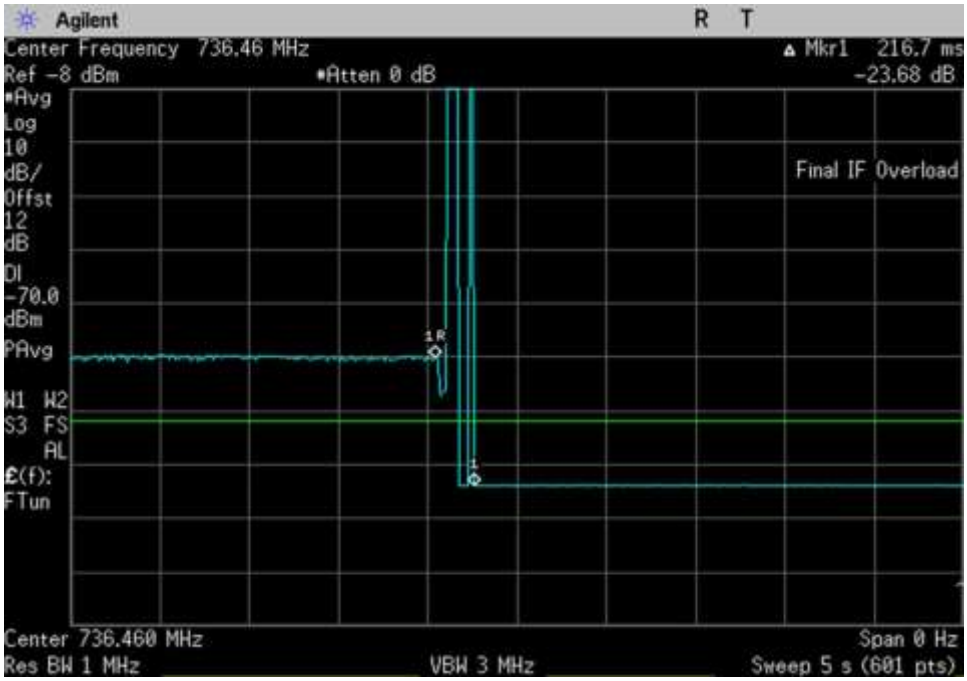
UL_1850-1915_ 1881.85MHz



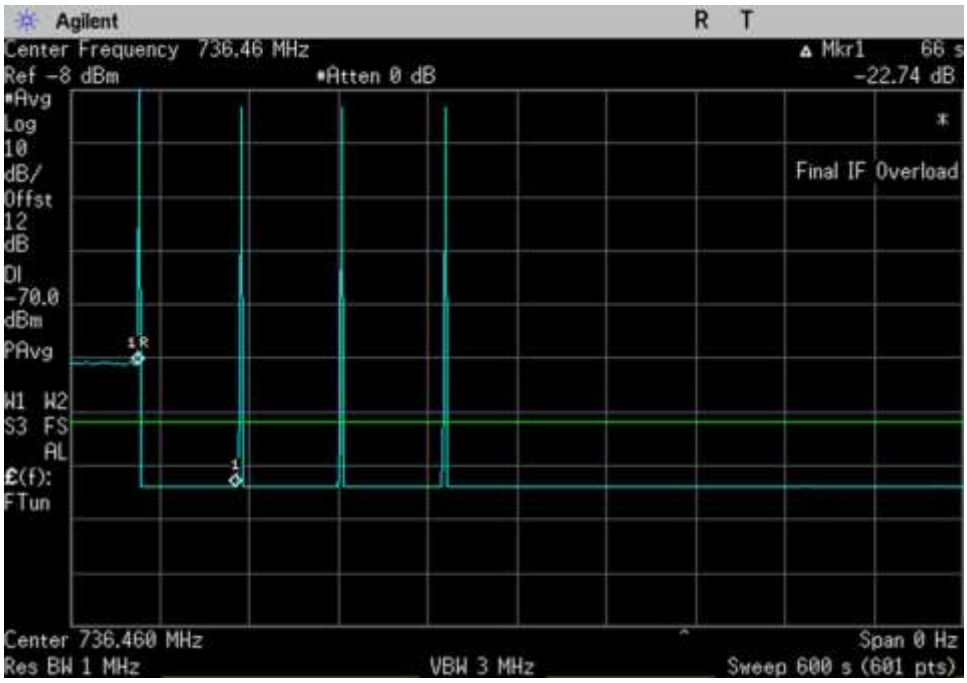
UL_1850-1915_600sec_ 1881.85MHz



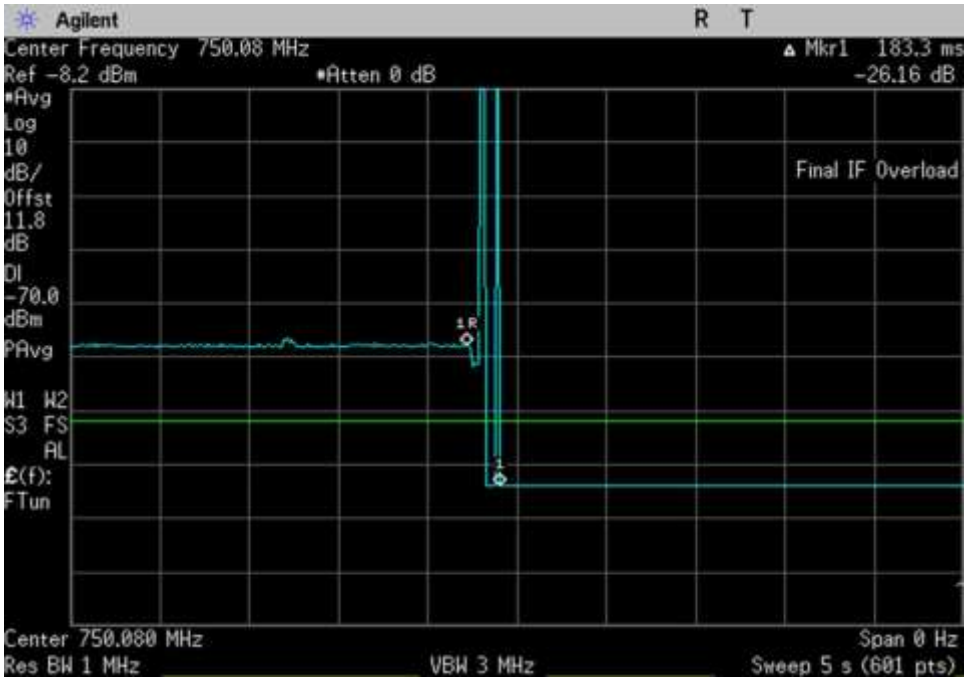
UL_1850-1915_Pk_ 1861.7MHz



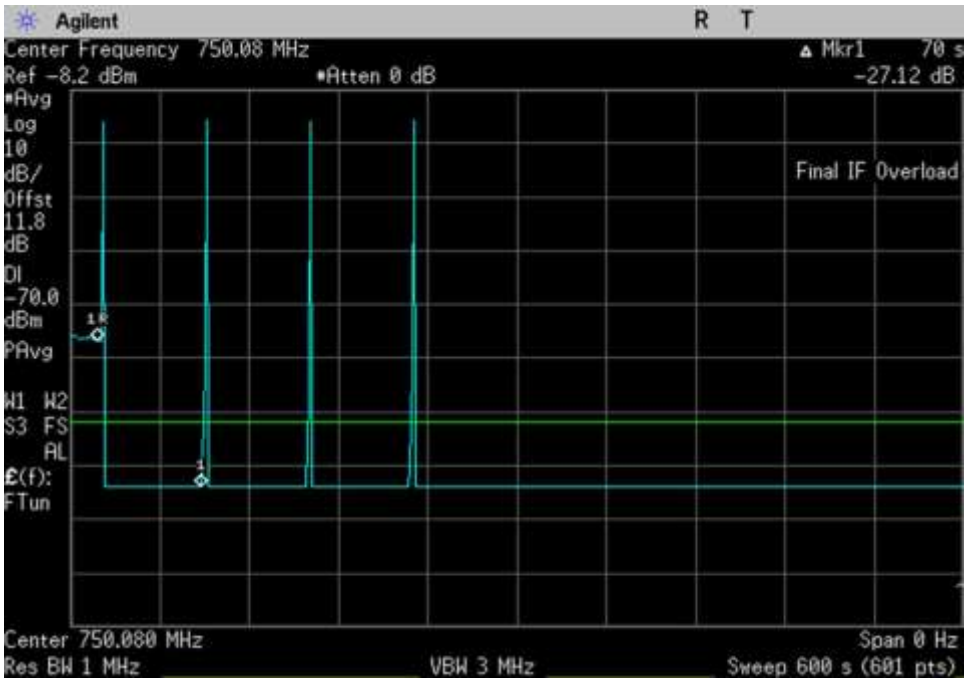
DL_728-746_ 736.46MHz



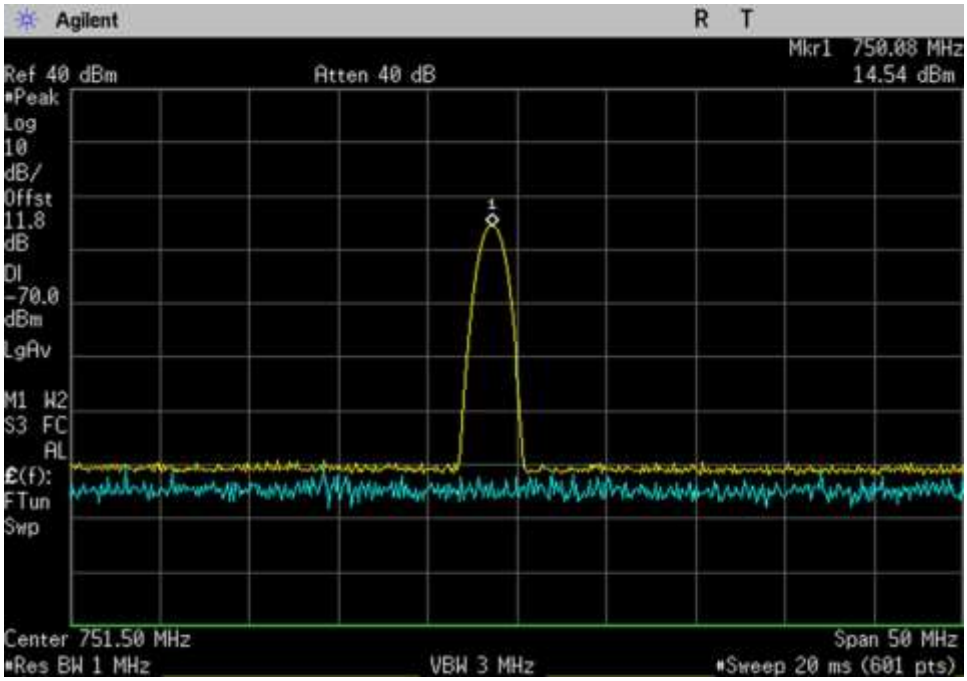
DL_728-746_600sec_ 736.46MHz



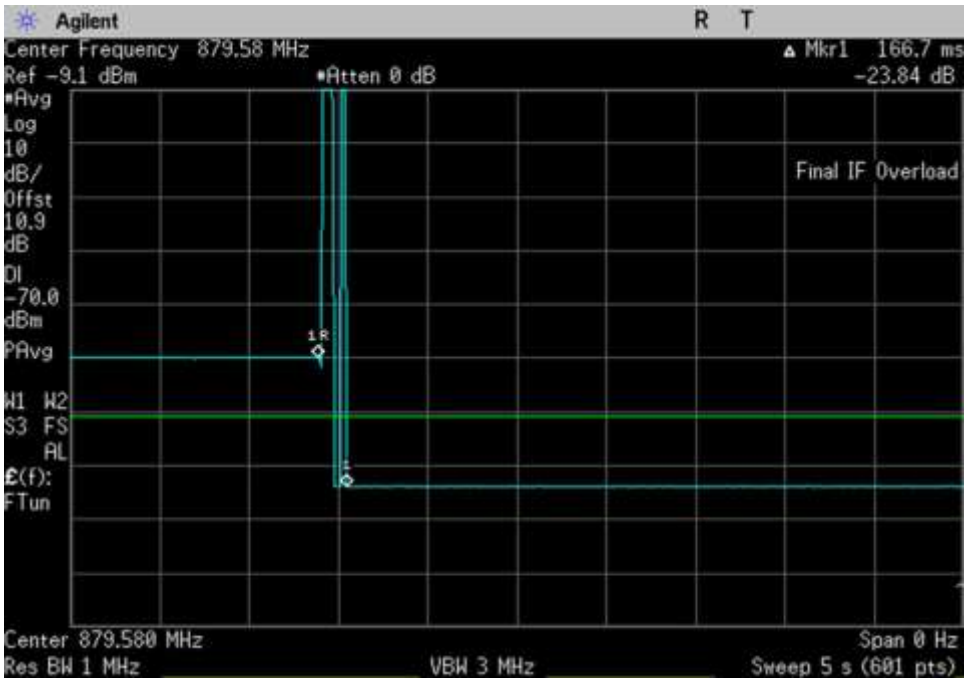
DL_746-757_ 750.08MHz



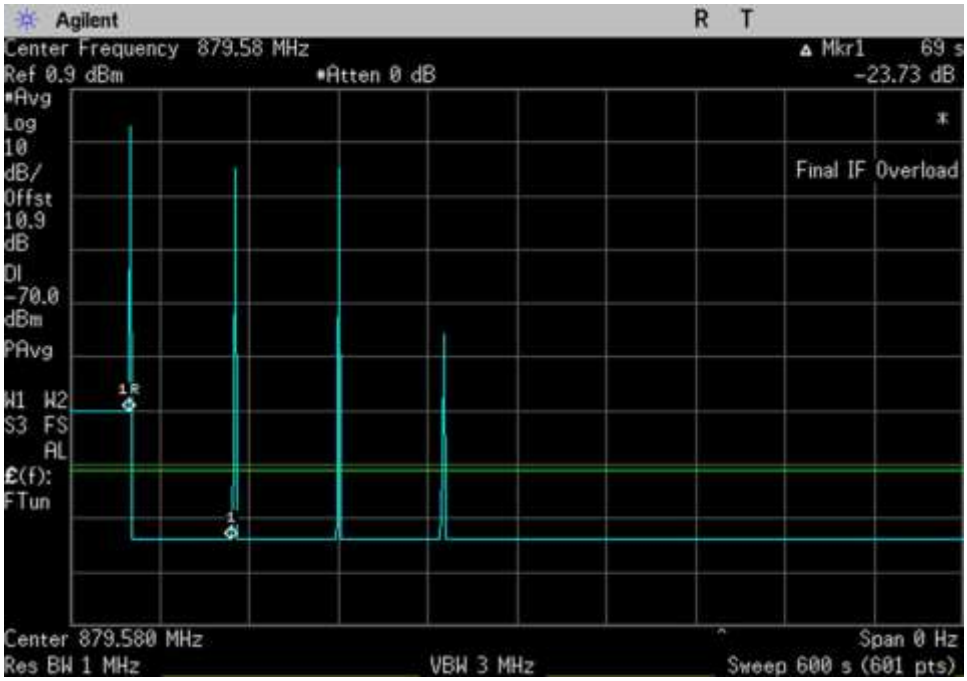
DL_746-757_600sec_ 750.08MHz



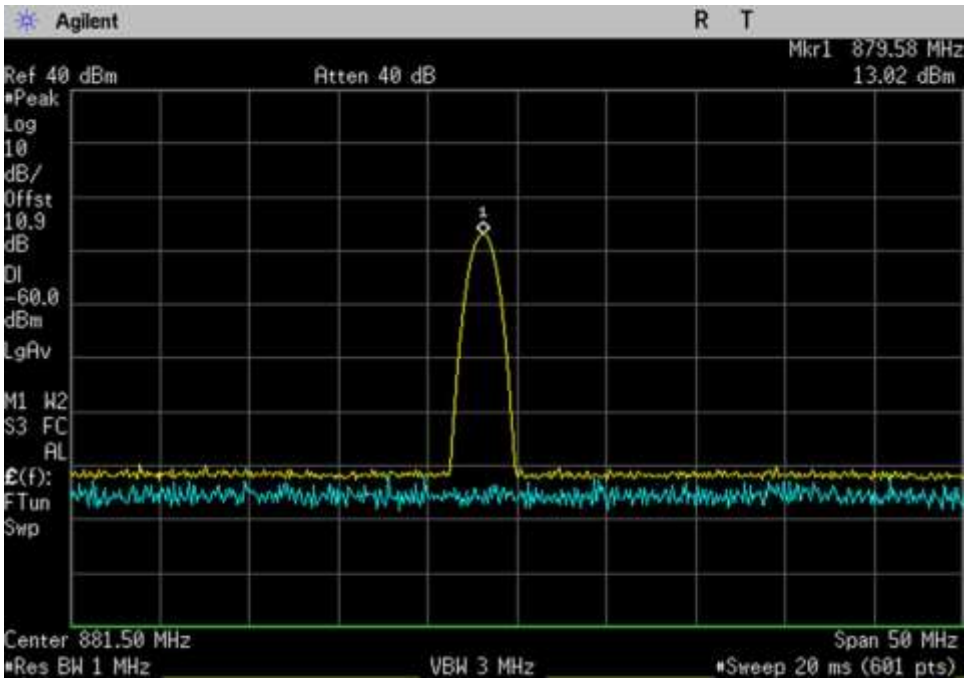
DL_746-757_Pk_ 751.5MHz



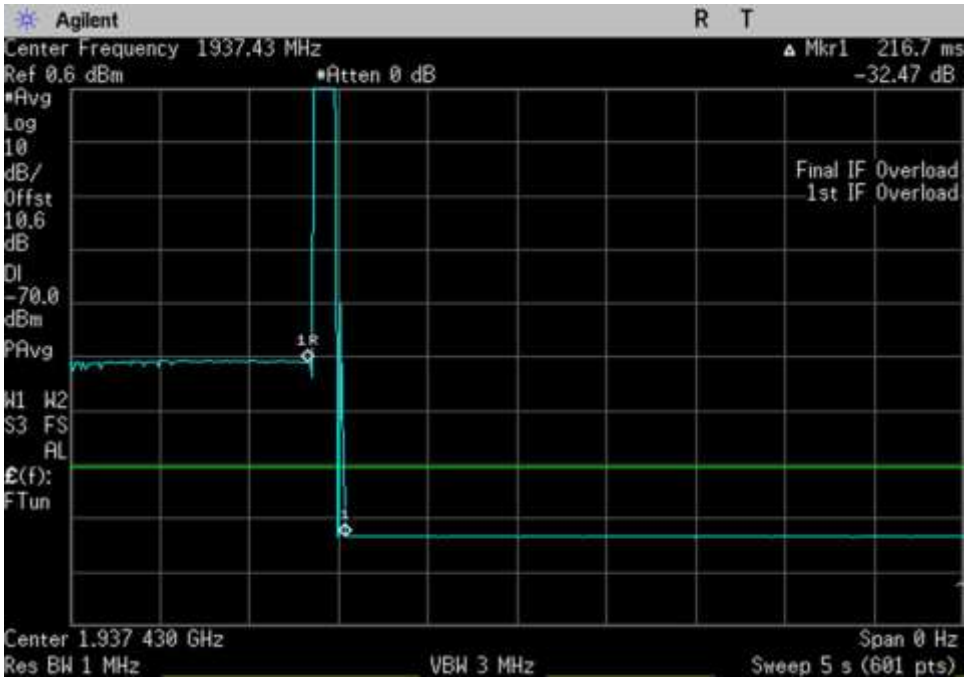
DL_869-894MHz_ 879.58MHz



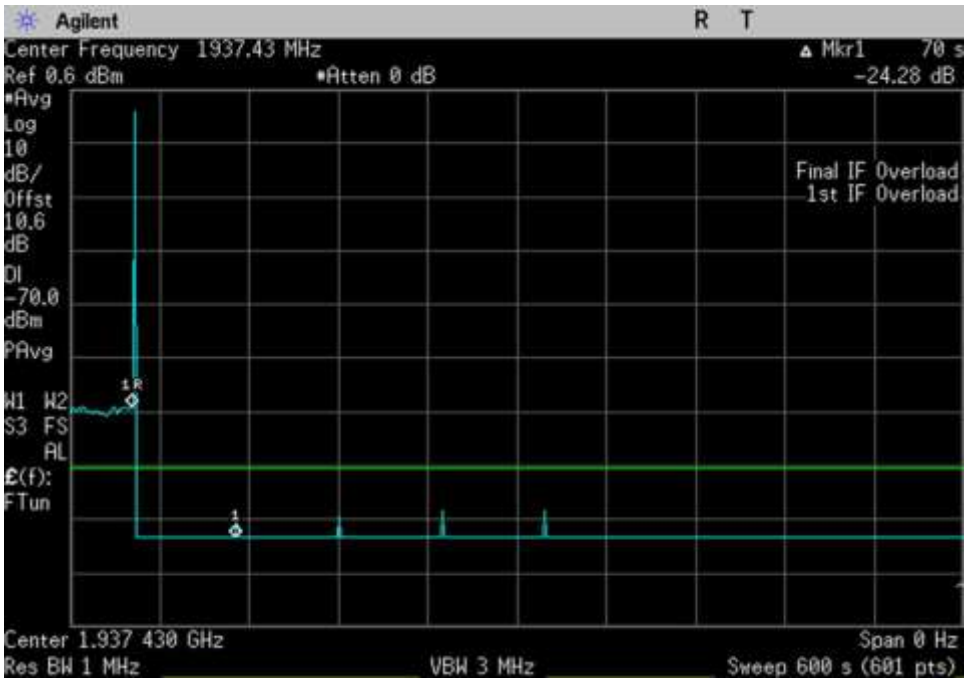
DL_869-894MHz_600sec_ 879.58MHz



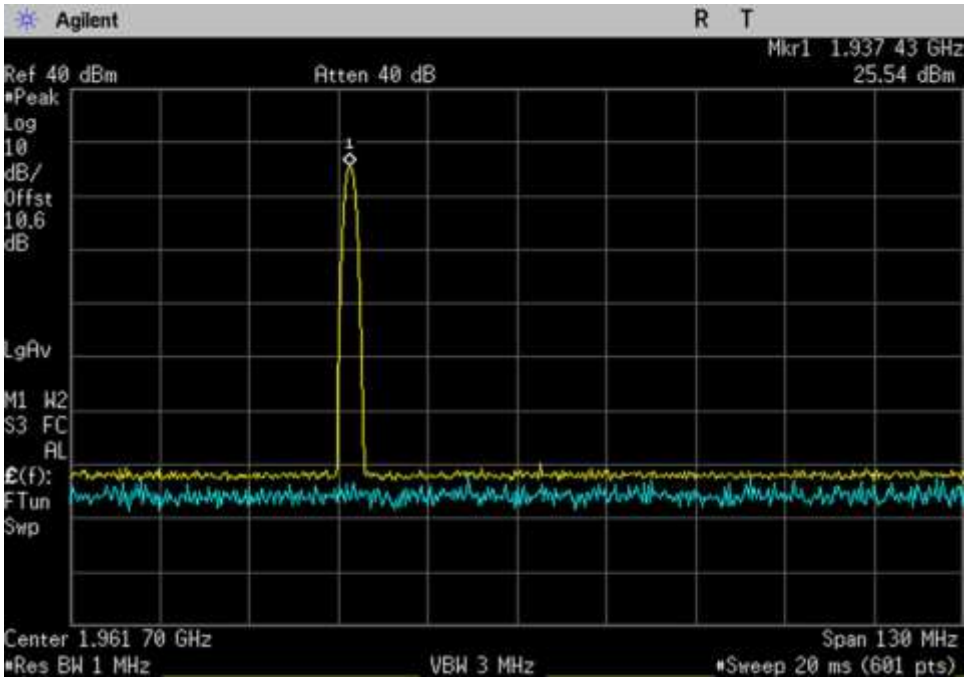
DL_869-894MHz_Pk_ 881.5MHz



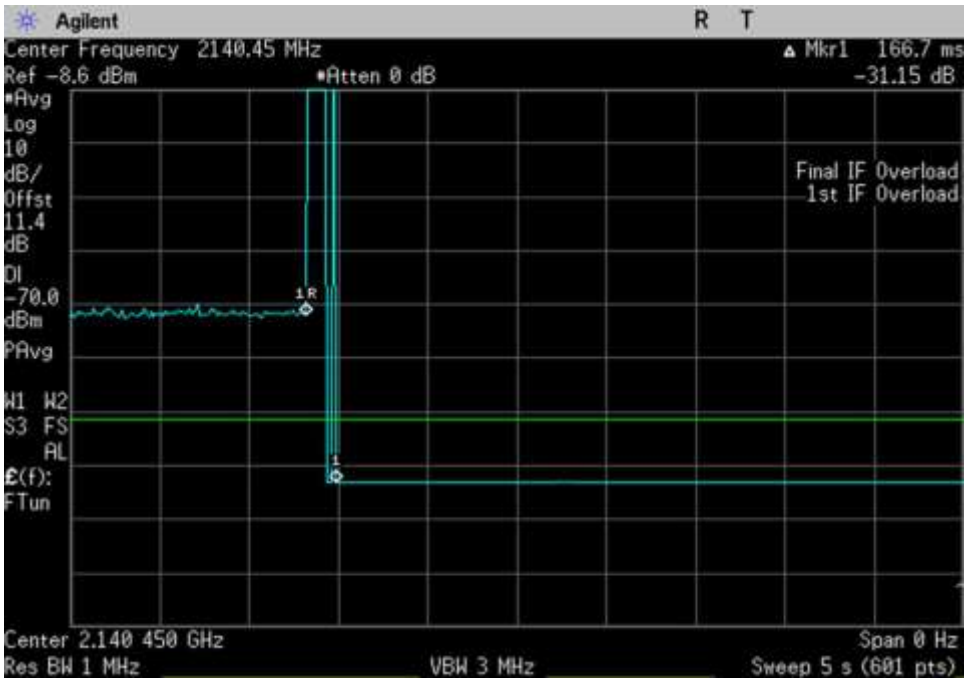
DL_1930-1995_ 1937.43MHz



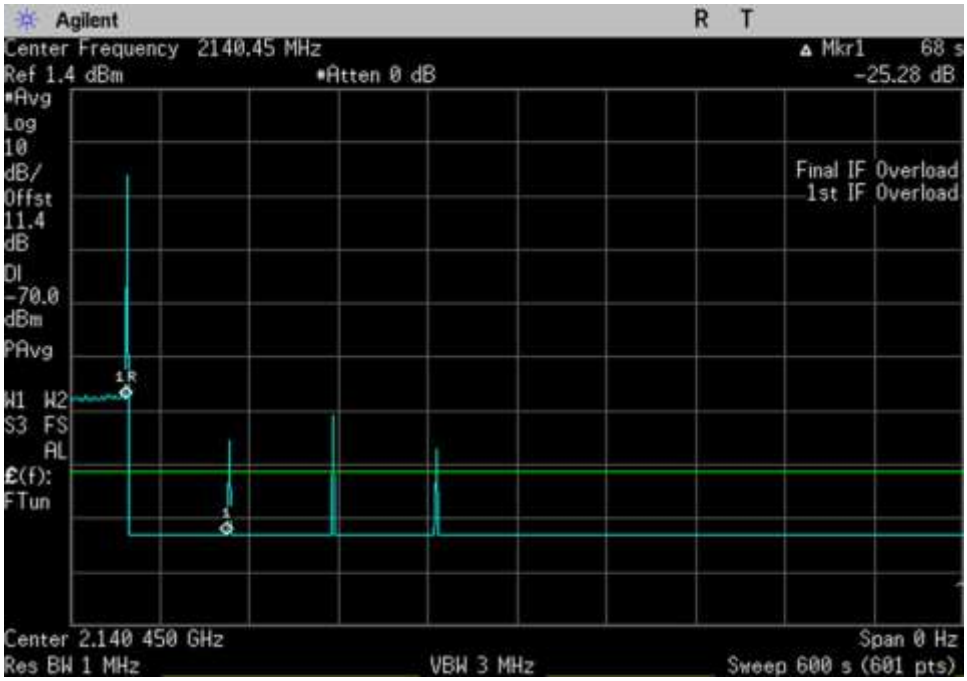
DL_1930-1995_600sec_ 1937.43MHz



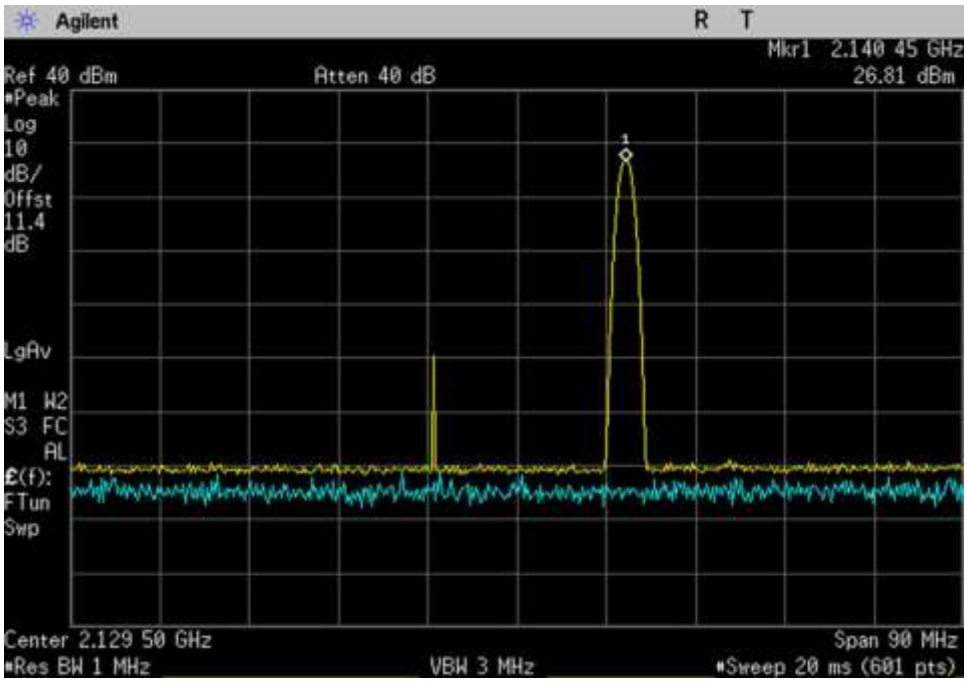
DL_1930-1995_Pk_ 1961.7MHz



DL_2110-2155_ 2140.45MHz



DL_2110-2155_600sec_ 2140.45MHz



DL_2110-2155_Pk_ 2129.5MHz

7.12 Radiated Spurious Emissions

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer:	Cellphone-Mate, Inc.
Specification:	**7.12 Radiated Spurious Emissions**
Work Order #:	**102180** Date: 01/29/2019
Test Type:	**Radiated Emissions**
Tested By:	**Hieu Song Nguyenpham**
Software:	EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test environment conditions: Temperature: 20.5°C, 43% relative humidity, Pressure: 101.9kPa

Modification #1 was in place during testing.

Frequency range of measurement = 9 kHz- 22 GHz.
9 kHz - 150 kHz -> RBW=200 Hz VBW=200 Hz
150 kHz - 30 MHz -> RBW=9 kHz VBW=9 kHz
30 MHz - 1000MHz -> RBW=120 kHz VBW=120 kHz
1000 MHz-22000MHz -> RBW=1 MHz VBW=1 MHz

Note:
No spurious emissions were found within 20dB of the limit line.
Emissions in the band 1559-1610 MHz were investigated and these were not found within 20dB of the limit line.

27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
AN03471	Spectrum Analyzer	E4440A	1/18/2018	1/18/2020
00852	Biconilog Antenna	Schaffner	CBL 6111C	5/1/2018
ANP06049	Attenuator	PE7002-6	5/14/2018	5/14/2020
ANP06691	Cable	PE3062-180	5/14/2018	5/14/2020
ANP00880	Cable	RG214U	5/14/2018	5/14/2020
P07508	Preamp	Sonoma	310N	10/15/2018
ANP01187	Cable	CNT-195	8/8/2016	8/8/2018
AN02157	Horn Antenna-ANSI C63.5	3115	2/6/2017	2/6/2019
AN03302	Cable	32026-29094K-29094K-72TC	1/15/2018	1/15/2020
ANP01210	Cable	FSJ1P-50A-4A	1/16/2017	1/16/2019
ANP06903	Cable	32022-29094K-29094K-36TC	1/4/2018	1/4/2020
AN02693	Active Horn Antenna-ANSI C63.5 3m	AMFW-5F-12001800-20-10P	5/11/2017	5/11/2019
AN02694	Horn Antenna-ANSI C63.5 Calibration	AMFW-5F-18002650-20-10P	5/11/2017	5/11/2019
AN00266	Loop Antenna	6502	6/1/2018	6/1/2020
AN03607	Preamp	AMF-7D-00101800-30-10P	6/6/2017	6/6/2019
P06126	Cable	Astrolab	32022-29094K-29094K-168TC	3/27/2017
P06899	Cable	Astrolab	32022-29094K-29094K-72TC	1/4/2018

Summary of Results

Pass: All Radiated Spurious Emissions were found with more than 20dB margin of the limit line.

Frequency Range of measurement 9kHz –> 22GHz

LIMIT LINE FOR SPURIOUS RADIATED EMISSION

REQUIRED ATTENUATION = 43+10 LOG P (DB)
FOR RADIATED SPURIOUS EMISSION MEASURED AT 3 METER TEST DISTANCE,

Required attenuation = 43+10 Log $P_{t\ at\ 3\ meter}$ dB
Limit line (dBuV) = E_{dBuv} - Attenuation

E_{dBuv} = Measured field strength at 3 meter in dBuV/m

Power Density (Isotropic)

$$P_D = \frac{P_t}{4\pi r^2}$$

P_D = Power Density in Watts /m^2
Pt = Average Transmit Power
r = Test distance

Field Intensity E (V/m)

$$E = \sqrt{P_D \times 377}$$

$$E = \frac{\sqrt{P_t \times 377}}{4\pi r^2}$$

$$E = \sqrt{\frac{P_t \times 30}{r^2}}$$

$$P_t = \left(\frac{E^2 \times r^2}{30} \right)$$

10 Log P_t = 10 Log E^2 (V/m)+ 10 Log r^2 – 10 Log 30
10 Log P_t = 20 Log E (V/m) + 20 Log r – 10 Log 30

At 3 meter, r = 3 m

10 Log P_t = 20 Log E (V/m) + 20 Log 3 – 10 Log 30
10 Log P_t = 20 Log E (V/m) + 9.54 – 14.77
10 Log P_t = 20 Log E (V/m) - 5.23

Since 20 Log E (V/m) = 20 Log E (uV/m) –120

10 Log P_t = 20 Log E (uV/m) - 120 - 5.23
10 Log P_t = 20 Log E (uV/m) –125.23

Limit line (dBuV) at 3 meter = E_{dBuv} – Attenuation

= E_{dBuv} - (43+10 Log $P_{t\ at\ 3\ meter}$)

= E_{dBuv} - 43 - 10 Log $P_{t\ at\ 3\ meter}$

= E_{dBuv} - 43 – (20 Log E (uV/m) –125.23)

= E_{dBuv} - 43 - 20 Log E (uV/m) + 125.23

= E_{dBuv} - 20 Log E (uV/m) + 82.23

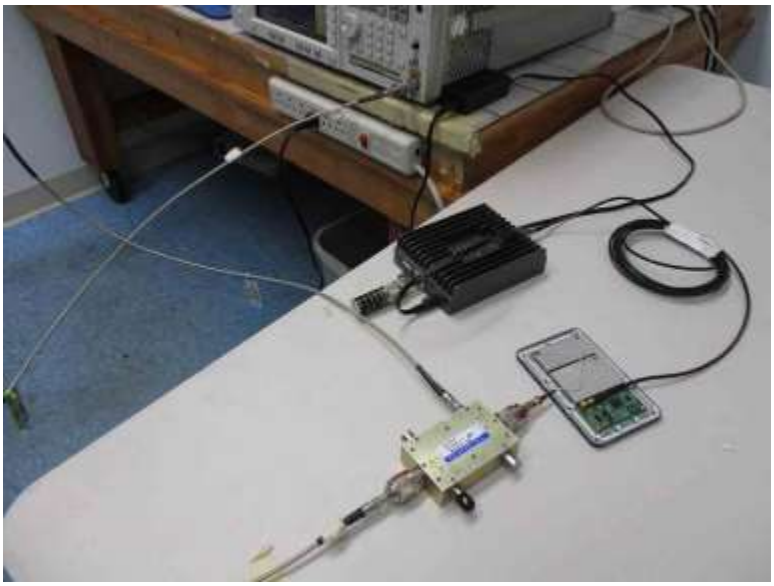
Since 20 Log E (uV/m) = E in dBuV/m= ~~E_{dBuv}~~ - ~~E_{dBuv}~~ + 82.23

Radiated Emission limit 3 meter = 82.23 dBuV at any power level measured in dBuV

EXHIBIT A: TEST SETUP PHOTOS

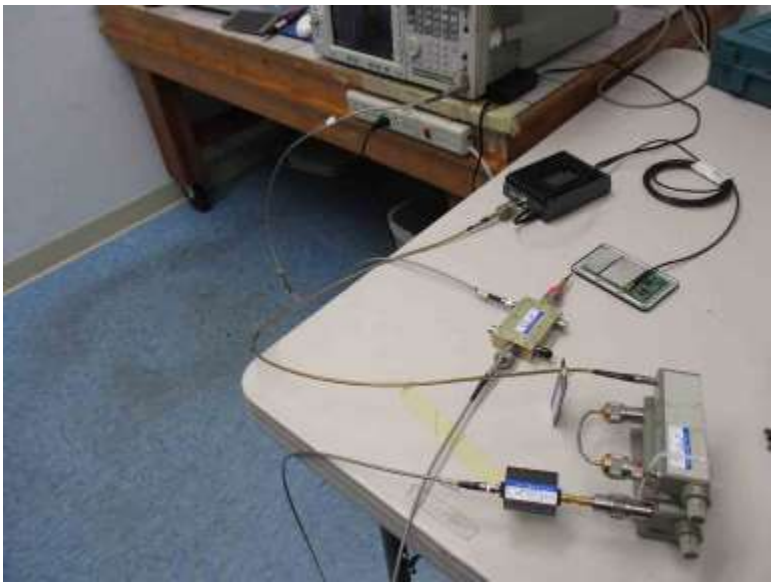
Section 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, and 7.10 Test Setup

Section 7.7 Max Noise, 7.8 Test Setup

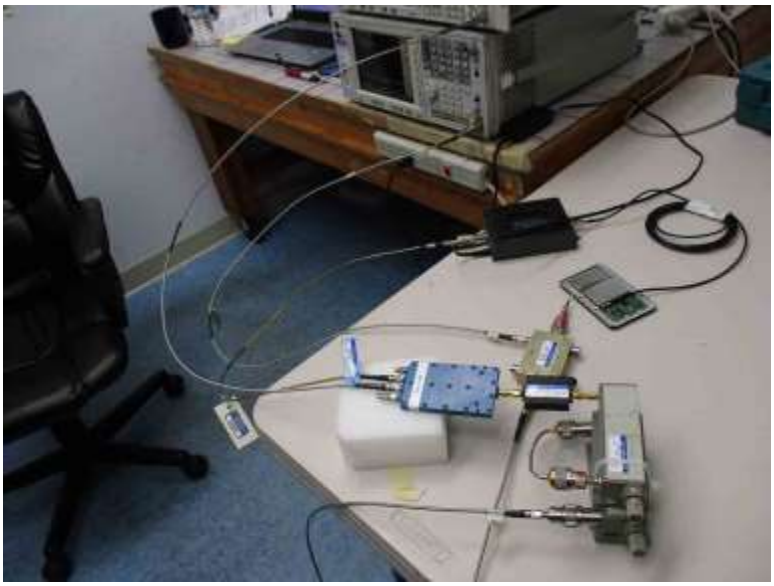


Section 7.7 Var Noise Test Setup

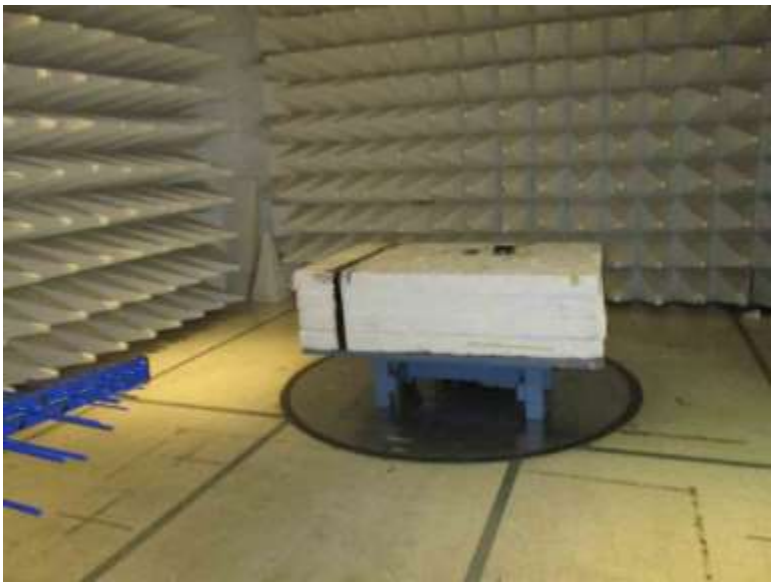
Section 7.9 Test Setup



Section 7.11.2 Test Setup



Section 7.11.3 Test Setup



Section 7.12, Below 1GHz Test Setup

Section 7.12, Below 1GHz Test Setup

Section 7.12, Above 1GHz Cone placement Test Setup

Section 7.12, Above 1GHz Cone placement Test Setup

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret (“^”) was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.