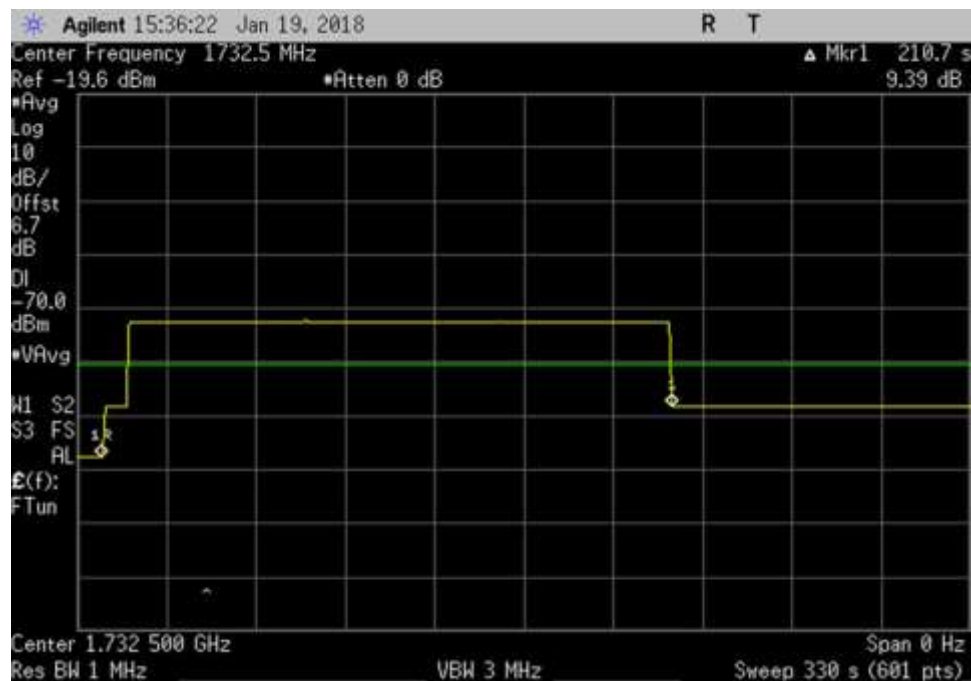
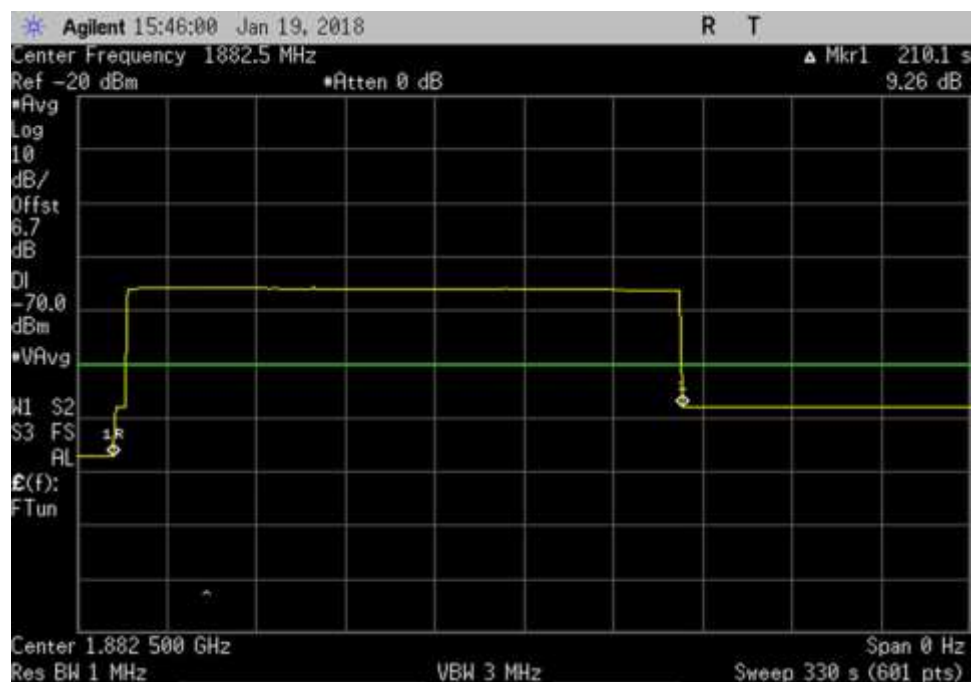




UL_ 1732.5MHz



UL_ 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 #: **100825** 1/20/2018-1/25/2018
 Test Type: **Conducted Emissions**
 Tested By: **Hieu Song Nguyenpham/Eddie Wong**
 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 - 22°C
 Relative Humidity: 40%
 Pressure: 101.5 kPa -102kPa

Modification #1 and #2 were in place during testing.

Note:

Used MSCL provided by the manufacturer's antenna kitting.

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

$$L P = 20 \log f + 20 \log d - 27.5$$

Where:

L P = basic free space path loss,
 f = Center frequency,
 d = 0.6 meters.

Frequency (MHz)	MSCL (dB)
PCS(1850-1915)	42.8
Cellular(824-849)	36.8
LTE(698-716)	35.8
LTE(776-787)	36.8
AWS(1710-1755)	42.1

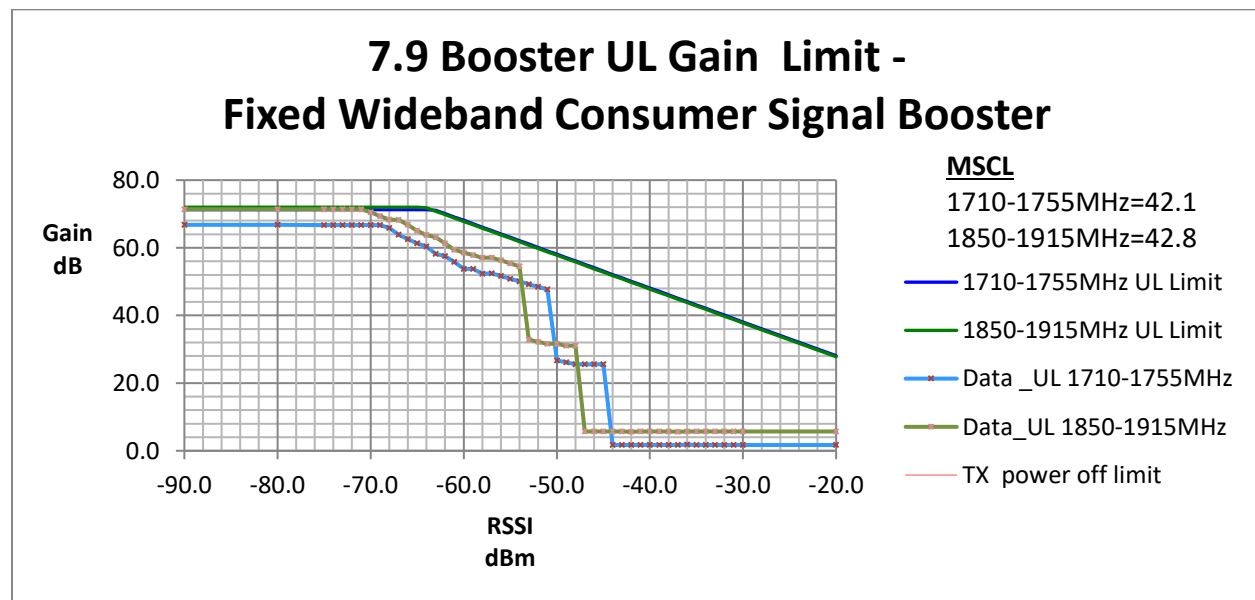
Test Equipment:

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
P06909	Attenuator	Pasternack	PE7083	12/20/2017	12/20/2019
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
C00032	Arbitrary Waveform Generator	Agilent	E4433B	2/26/2016	2/26/2018

Summary of Results

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

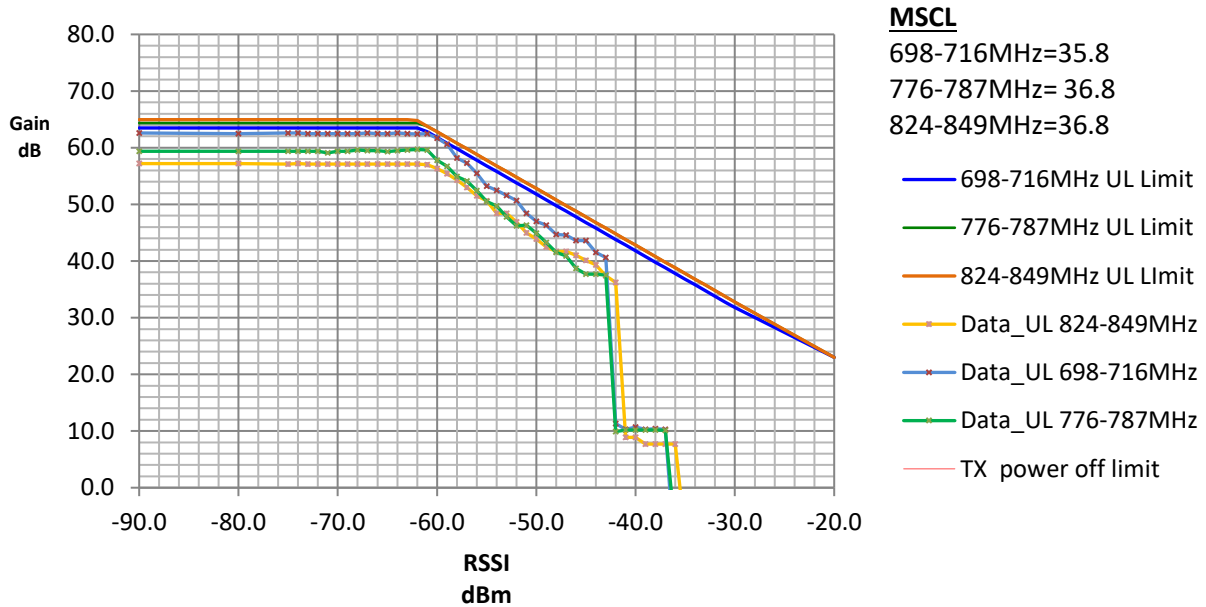
7.9.1 Maximum gain



1710.0 - 1755.0 MHz							
				Limit			Margin
RSSI	Input	Measured	Measured	RSSI	Fixed Booster	TX off	
(dBm)	(dBm)	Output (dBm)	Gain (dBm)	Dependent	Limit		
-90.0	-50	16.8	66.8	-	71.3	-	-4.5
-80.0	-50	16.8	66.8	-	71.3	-	-4.5
-75.0	-50	16.7	66.7	-	71.3	-	-4.5
-53.0	-50	-0.8	49.2	61.1	-	-	-11.9
-52.0	-50	-1.5	48.5	60.1	-	-	-11.6
-51.0	-50	-2.3	47.7	59.1	-	-	-11.4

1850.0 - 1915.0 MHz							
				Limit			Margin
RSSI	Input	Measured	Measured	RSSI	Fixed Booster	TX off	
(dBm)	(dBm)	Output (dBm)	Gain (dBm)	Dependent	Limit		
-90.0	-54.8	16.6	71.4	-	72.0	-	-0.6
-80.0	-54.8	16.6	71.4	-	72.0	-	-0.6
-75.0	-54.8	16.6	71.4	-	72.0	-	-0.6
-56.0	-54.8	1.5	56.3	63.8	-	-	-7.5
-55.0	-54.8	0.6	55.4	62.8	-	-	-7.4
-54.0	-54.8	-0.3	54.5	61.8	-	-	-7.3

7.9 Booster UL Gain Limit - Fixed Wideband Consumer Signal Booster



824.0-849.0MHz							
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	Limit			Margin
				RSSI Dependent	Fixed Booster Limit	TX off	
-90.0	-42.0	15.2	57.2		64.9		-7.7
-80.0	-42.0	15.2	57.2		64.9		-7.7
-74.0	-42.0	15.2	57.2		64.9		-7.7
-60.0	-42.0	14.3	56.3	62.8			-6.5
-59.0	-42.0	13.4	55.4	61.8			-6.4
-58.0	-42.0	12.3	54.3	60.8			-6.5

698.0-716.0MHz							
				Limit			Margin
RSSI	Input	Measured	Measured	RSSI	Fixed Booster	TX off	
(dBm)	(dBm)	Output (dBm)	Gain (dBm)	Dependent	Limit		
-90.0	-42.1	20.5	62.6		63.5		-0.9
-75.0	-42.1	20.5	62.6		63.5		-0.9
-74.0	-42.1	20.5	62.6		63.5		-0.9
-61.0	-42.1	20.4	62.5	62.8			-0.3
-60.0	-42.1	19.6	61.7	61.8			-0.1
-59.0	-42.1	18.5	60.6	60.8			-0.2

776.0 - 787.0MHz							
				Limit			Margin
RSSI	Input	Measured	Measured	RSSI	Fixed Booster	TX off	
(dBm)	(dBm)	Output (dBm)	Gain (dBm)	Dependent	Limit		
-68.0	-43.4	16.2	59.6		64.4		-4.8
-67.0	-43.4	16.1	59.5		64.4		-4.9
-62.0	-43.4	16.3	59.7		64.4		-4.7
-61.0	-43.4	16.2	59.6	63.8			-4.2
-60.0	-43.4	14.4	57.8	62.8			-5.0
-59.0	-43.4	13.3	56.7	61.8			-5.1

7.9.2 Variable uplink gain timing

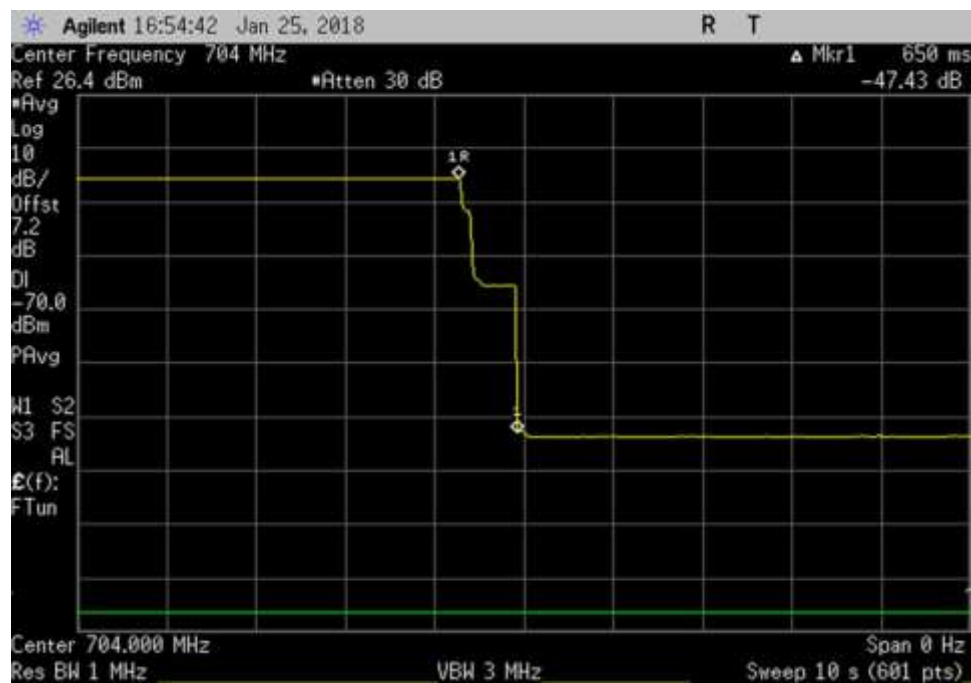
Uplink Gain Timing		
Frequency (MHz)	Measured (Sec)	Limit (Sec)
UL 1710-1755	0.90	3
UL 1850-1915	0.67	3
UL 824-849	0.90	3
UL 698-716	0.65	3
UL 776-787	0.57	3

7.9.1 Maximum Gain

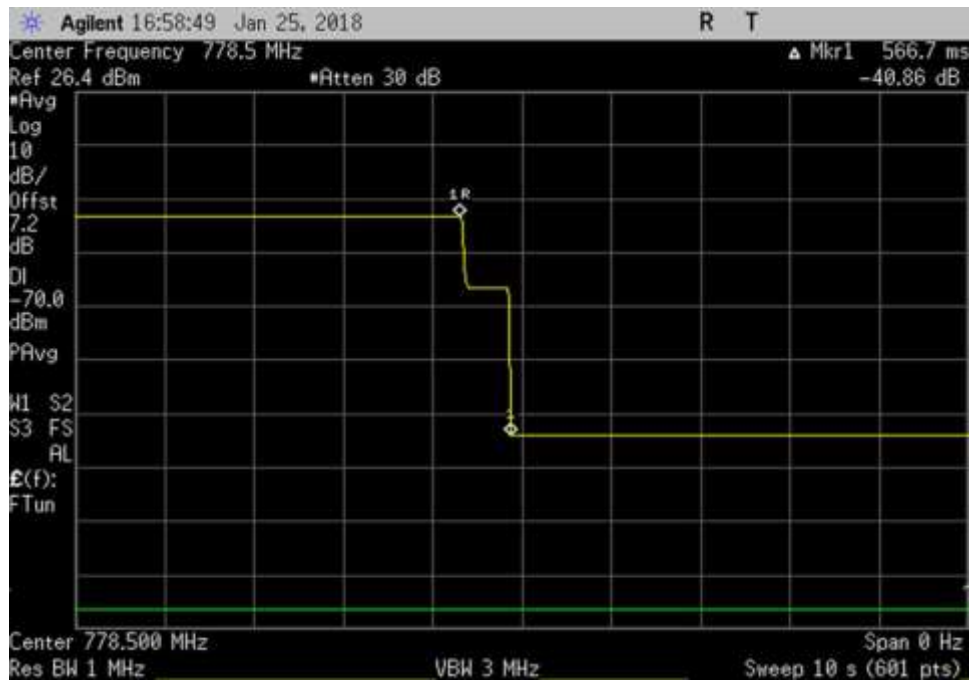
For this subsection, see summary of results of 7.9
7.9.1 Maximum gain

7.9.2 Variable uplink Gain Timing

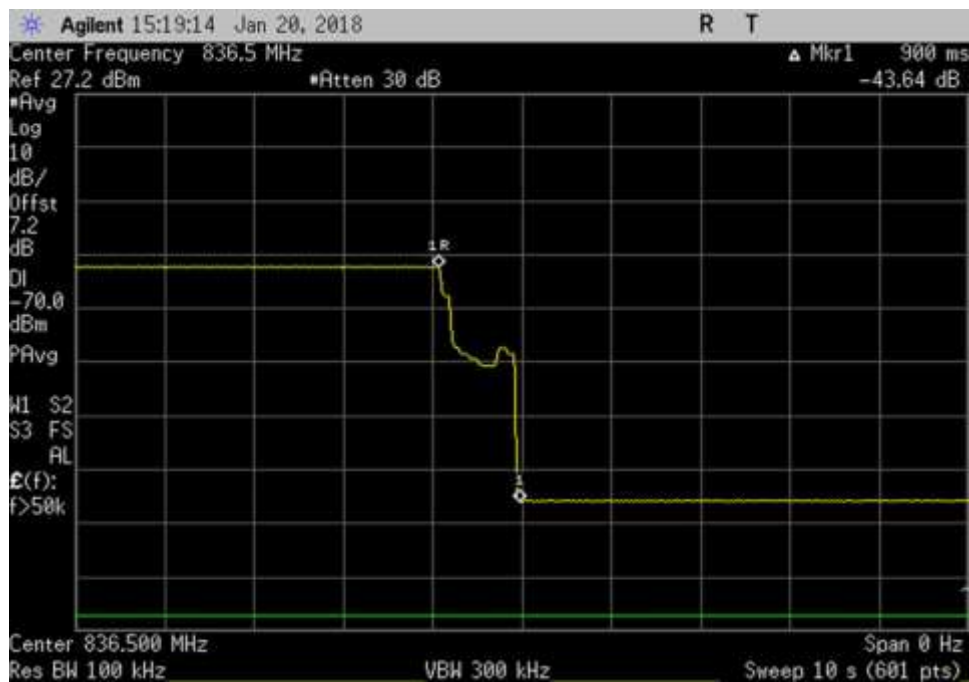
Plots



UL_ 704MHz__TIME



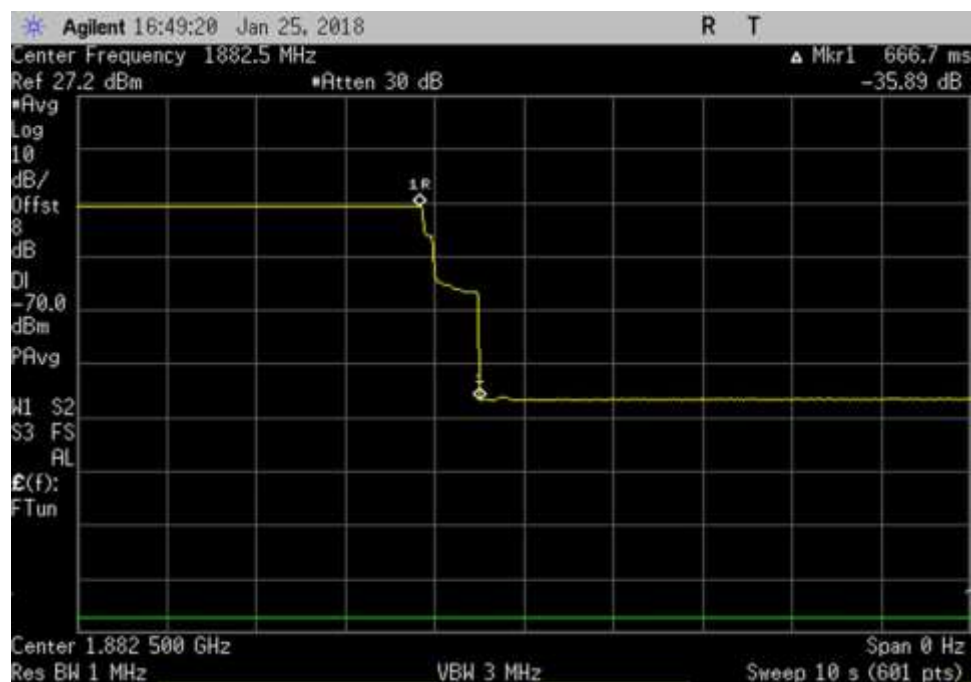
UL_778.5MHz__TIME



UL_836.5MHz__TIME



UL_1732.5MHz__TIME



UL_1882.5MHz__TIME

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 #: **100825** 1/25/2018
 Test Type: **Conducted Emissions**
 Tested By: **Hieu Song Nguyenpham/Eddie Wong**
 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: 22°C
 Relative Humidity: 40%
 Pressure: 102 kPa

Modification #1 and #2 were in place during testing.

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
03470	Spectrum Analyzer	Agilent	E4440A	1/3/2018	1/3/2020
P06909	Attenuator	Pasternack	PE7083	12/20/2017	12/20/2019

Summary of Results

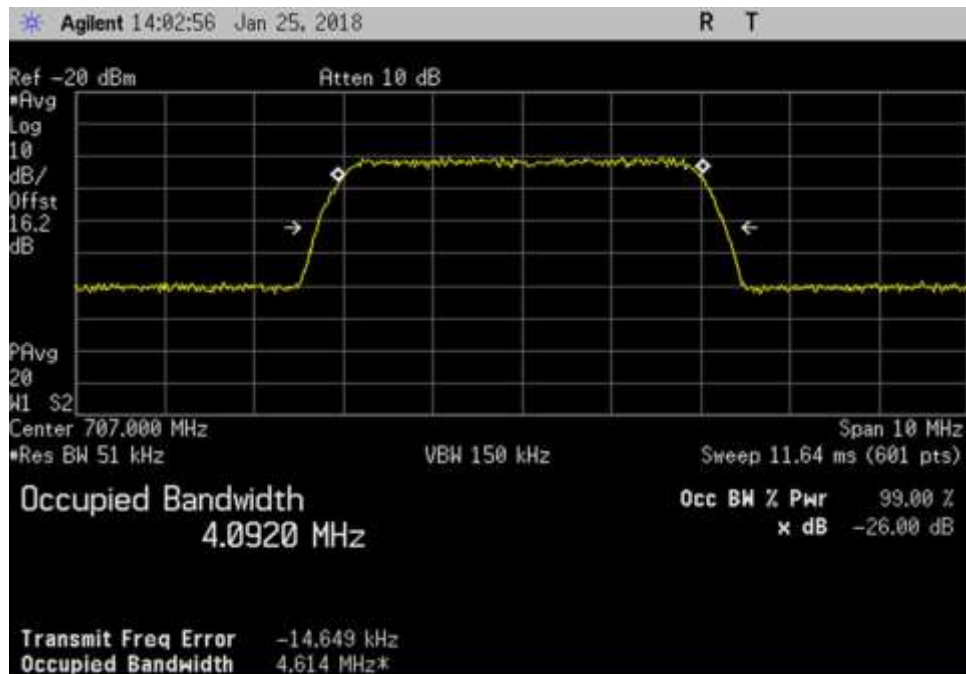
Pass: As summarized in plots and tables below, the uniformity of the output signal relative to the input signal are practically identical. Therefore, the comparison is within limits.

OBW-Input (Hz)					OBW-Output (Hz)				
EDGE	GSM	CDMA	AWGN	LTE	EDGE	GSM	CDMA	AWGN	LTE
254657	251609	1257200	4219900	4515700	244003	246506	1256300	4080100	4480500
246752	247354	1258700	4200000	4467800	238859	247120	1247500	4102700	4434500
247865	244782	1262800	4090400	4457400	244134	248585	1272900	4085200	4453200
246306	242094	1247700	4092000	4429600	245073	245525	1268500	4073700	4438900
242994	245012	1259500	4089100	4451600	241231	246740	1243300	4104800	4460200
251888	253592	1271800	4147500	4437300	248363	250879	1259700	4120200	4395900
256607	259908	1259800	4181500	4455400	247595	253248	1255800	4075900	4435300
248818	249432	1272300	4209900	4497800	247356	248878	1246800	4093000	4433700
254236	244551	1252200	4181000	4478100	249606	243766	1245800	4110900	4433000
254452	240218	1266800	4115900	4461900	248584	240412	1261600	4112900	4452700

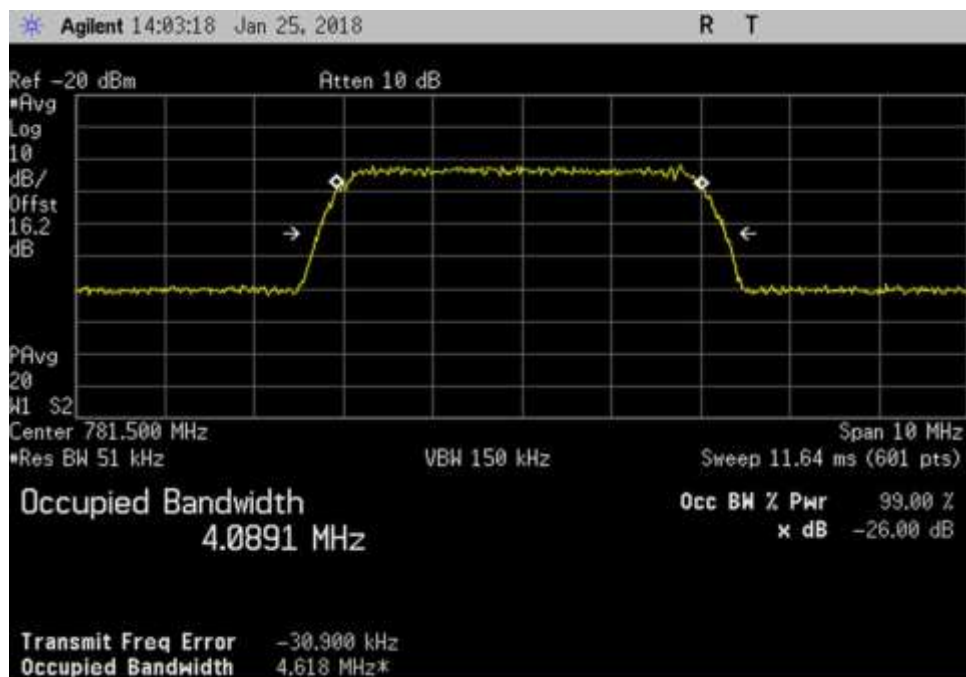
Frequency Range	Max Difference In&Out Occ BW 99% Pwr				
	EDGE	GSM	CDMA	AWGN	LTE
UL_1710-1755MHz	4.18%	2.03%	0.07%	3.31%	0.78%
UL_1850-1915MHz	3.20%	0.09%	0.89%	2.32%	0.75%
UL_824-849MHz	1.51%	1.55%	0.80%	0.13%	0.09%
UL_698-716MHz	0.50%	1.42%	1.67%	0.45%	0.21%
UL_777-787MHz	0.73%	0.71%	1.29%	0.38%	0.19%
DL_2110-2155MHz	1.40%	1.07%	0.95%	0.66%	0.93%
DL_1930-1995MHz	3.51%	2.56%	0.32%	2.53%	0.45%
DL_869-894MHz	0.59%	0.22%	2.00%	2.78%	1.43%
DL_728-746MHz	1.82%	0.32%	0.51%	1.68%	1.01%
DL_746-756MHz	2.31%	0.08%	0.41%	0.07%	0.21%

Plots

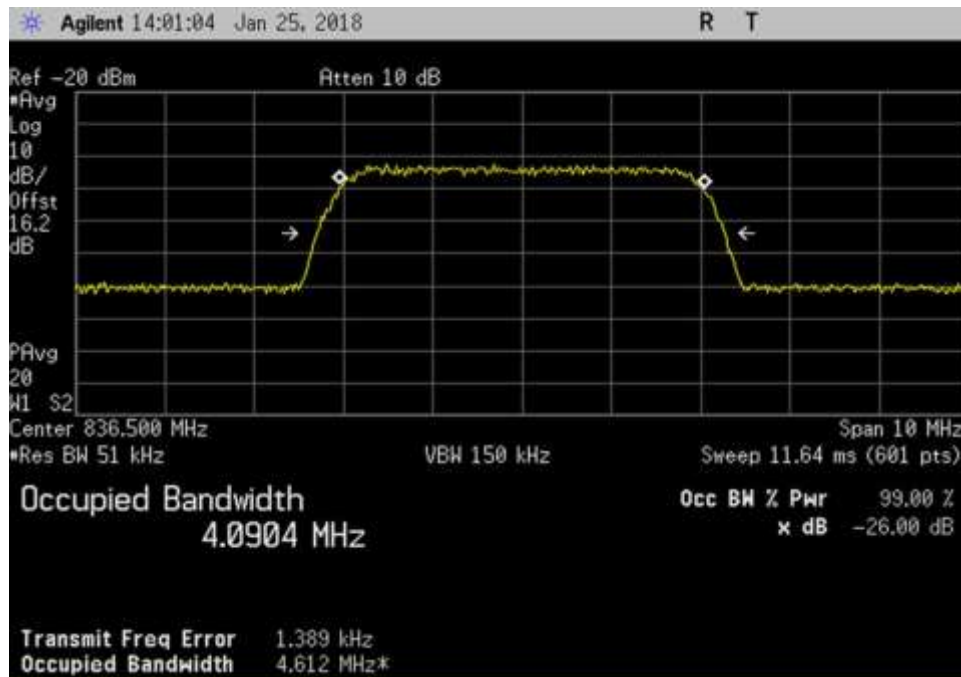
AWGN Input



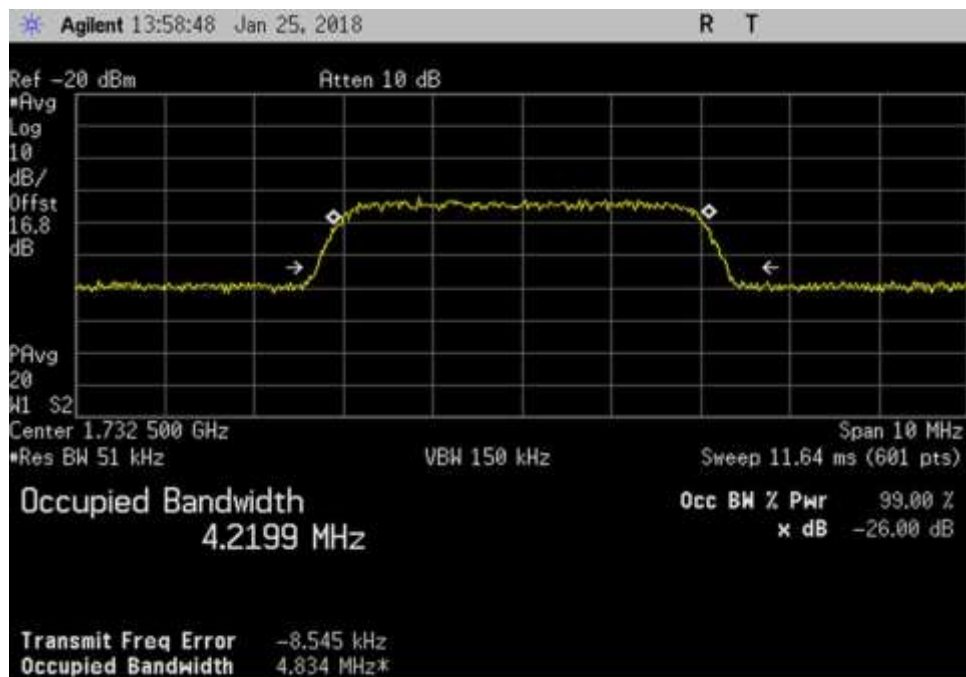
UL_707MHz_AWGN



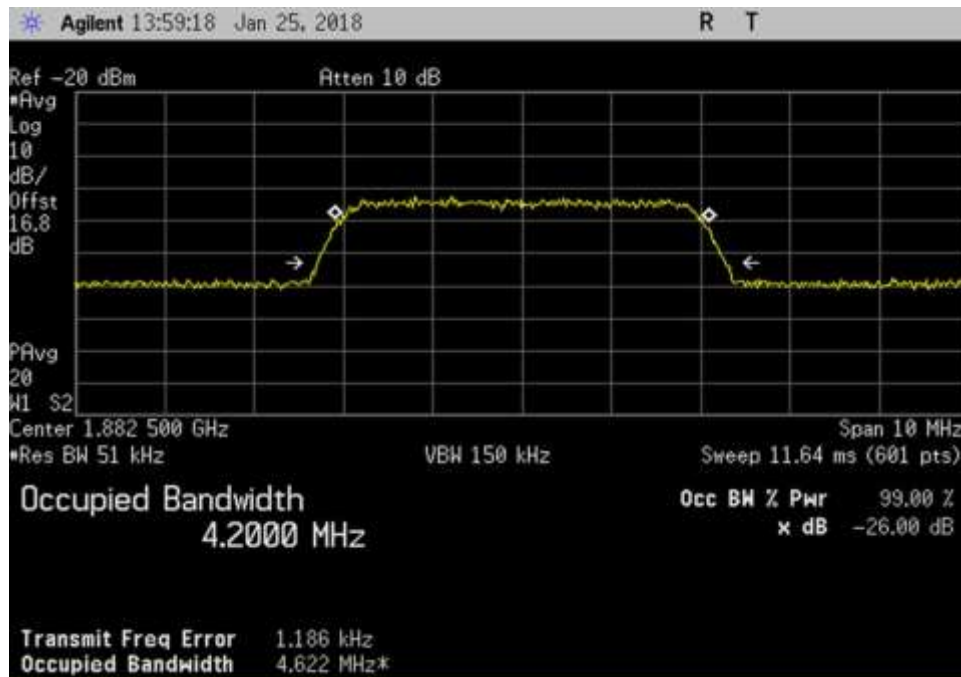
UL_781.5MHz_AWGN



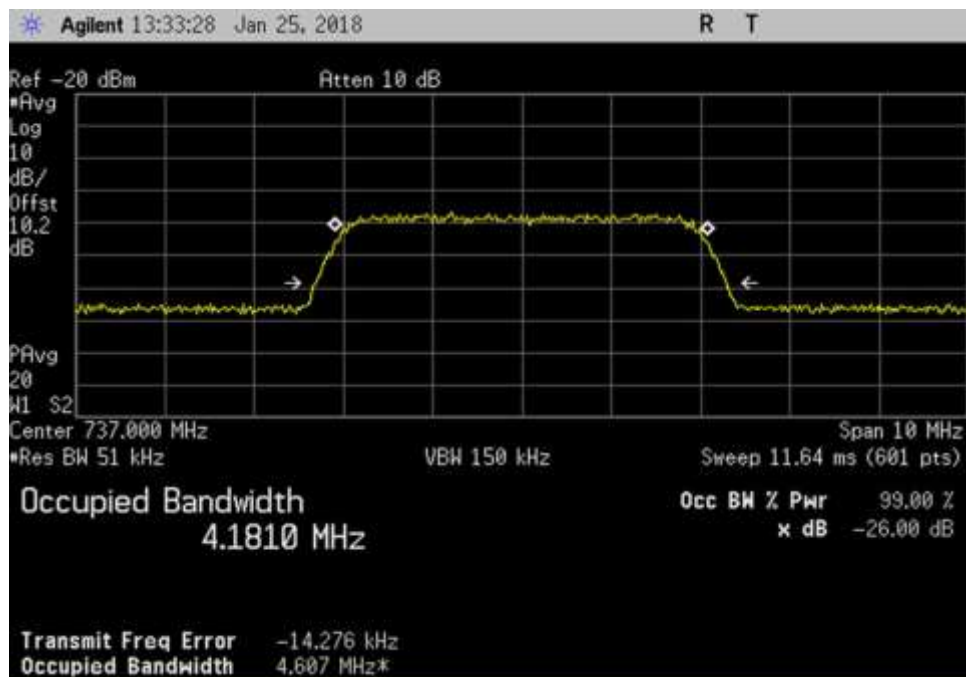
UL_836.5MHz_AWGN



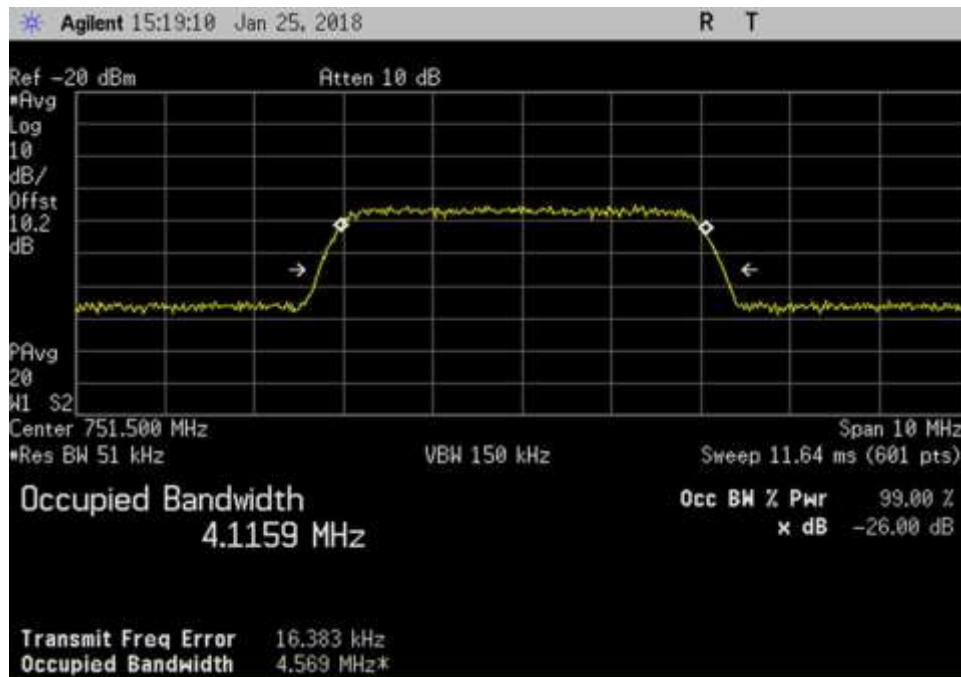
UL_1732.5MHz_AWGN



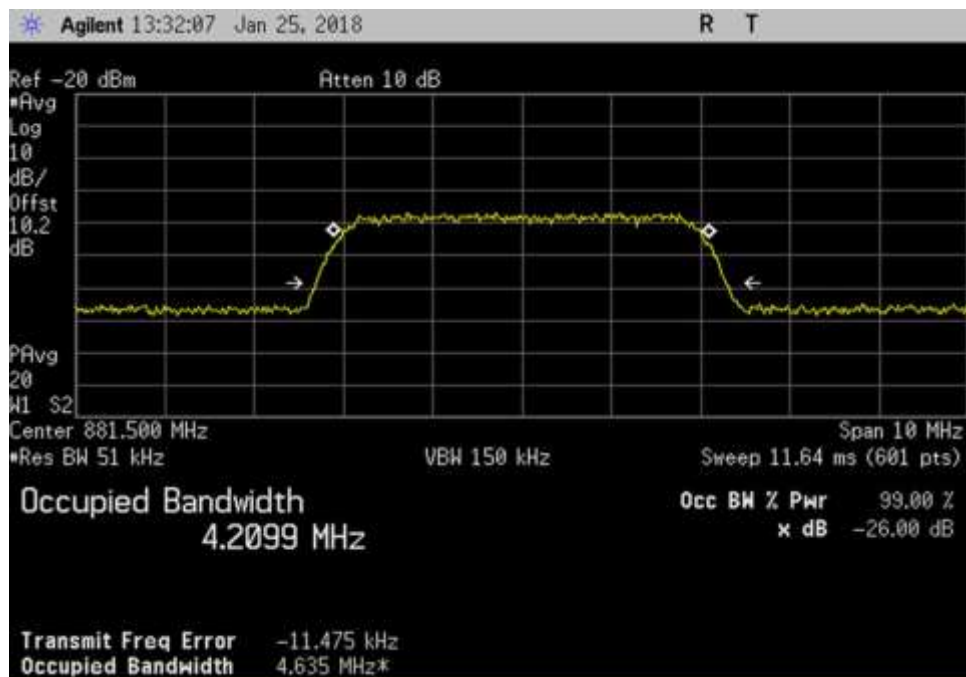
UL_1882.5MHz_AWGN



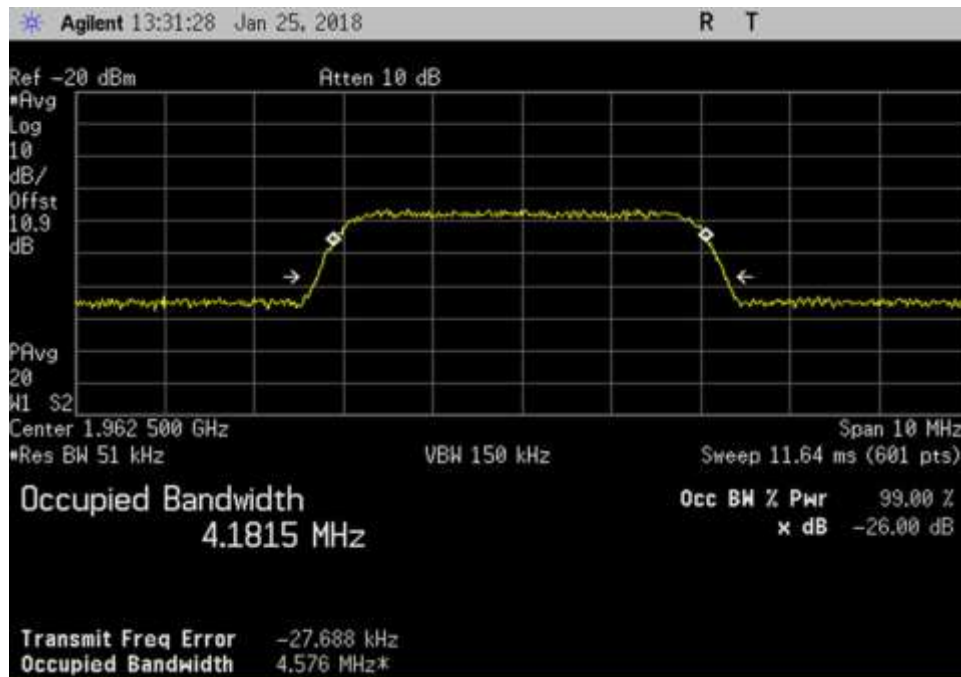
DL_737MHz_AWGN



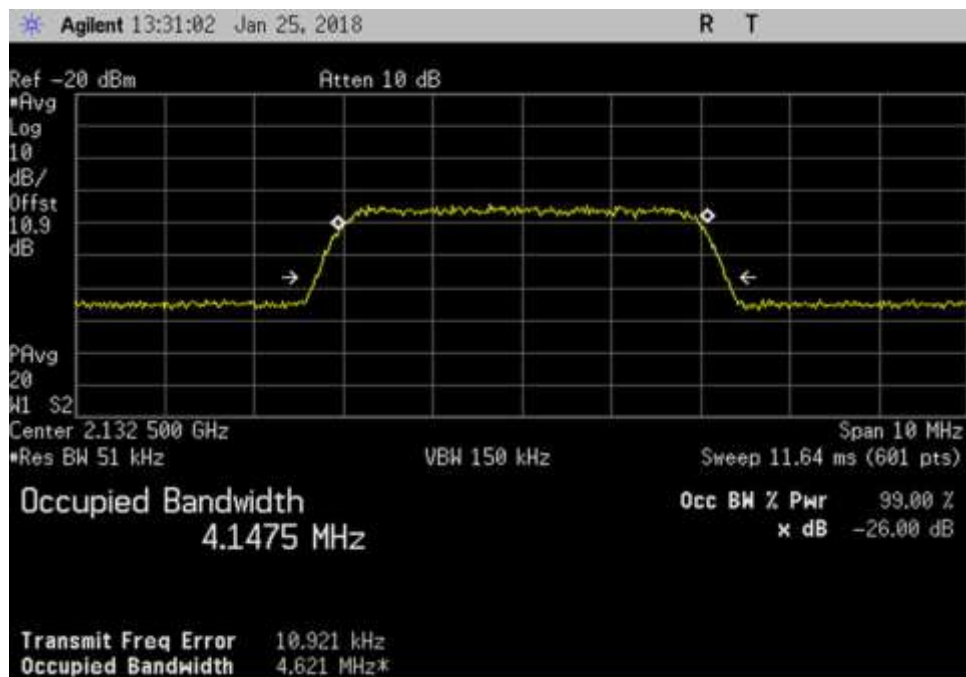
DL_751.5MHz_AWGN



DL_881.5MHz_AWGN

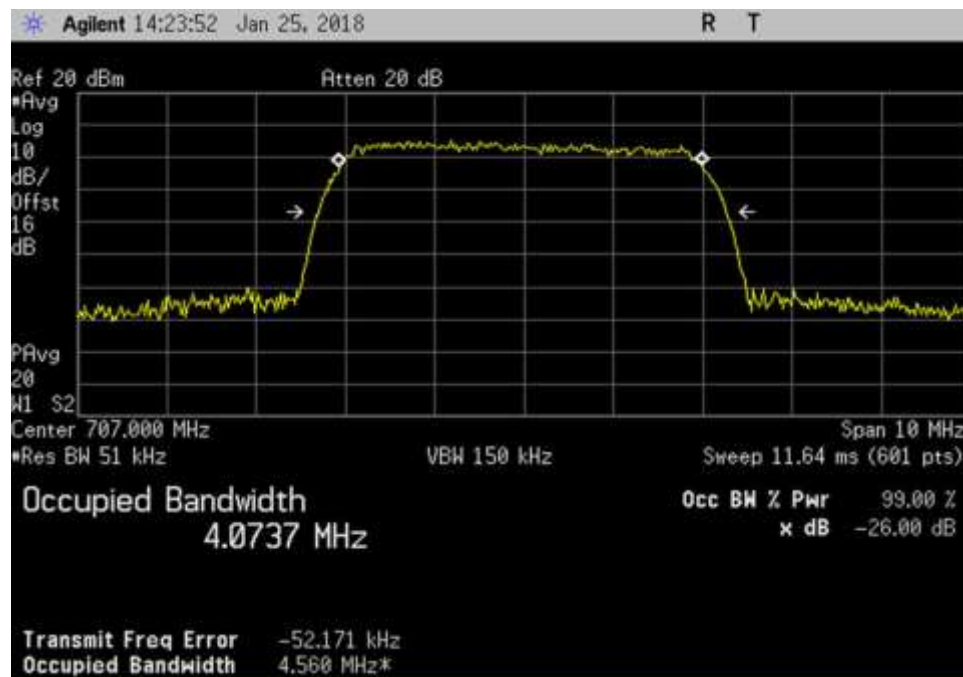


DL_1962.5MHz_AWGN

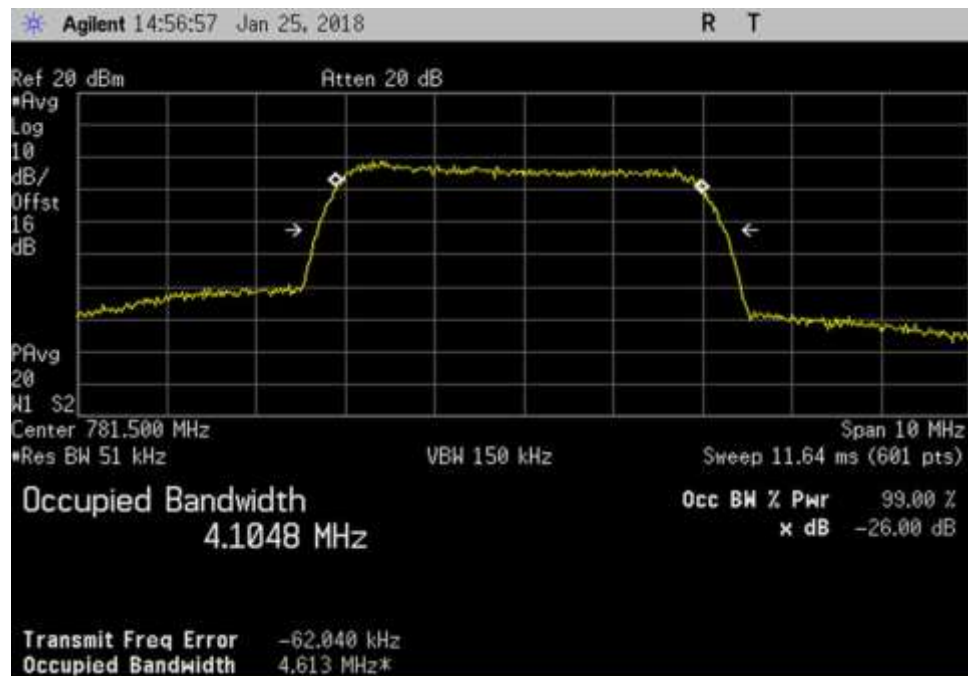


DL_2132.5MHz_AWGN

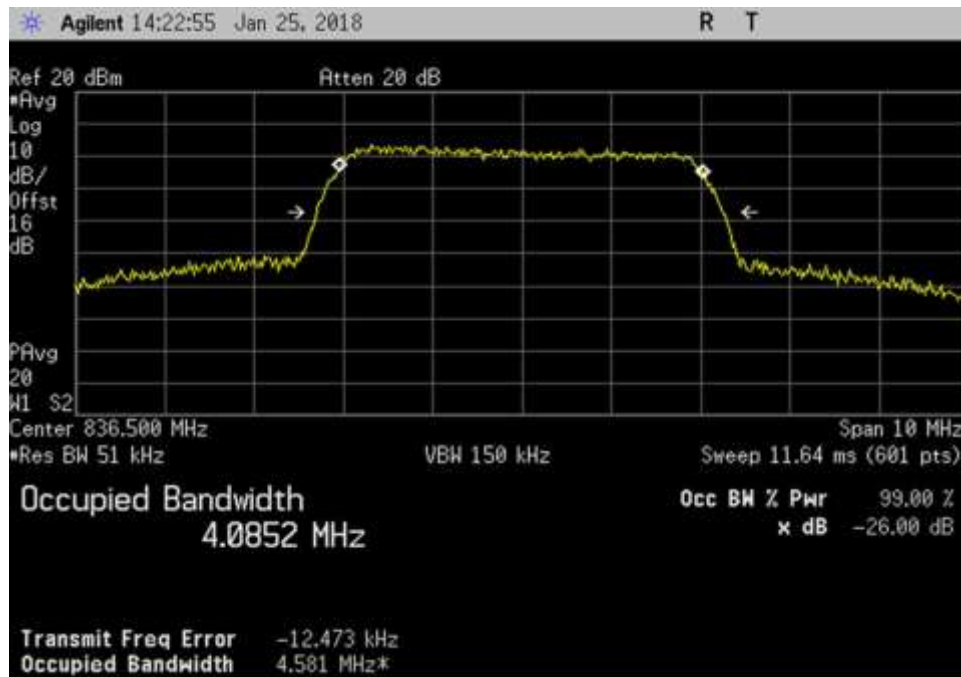
AWGN Output



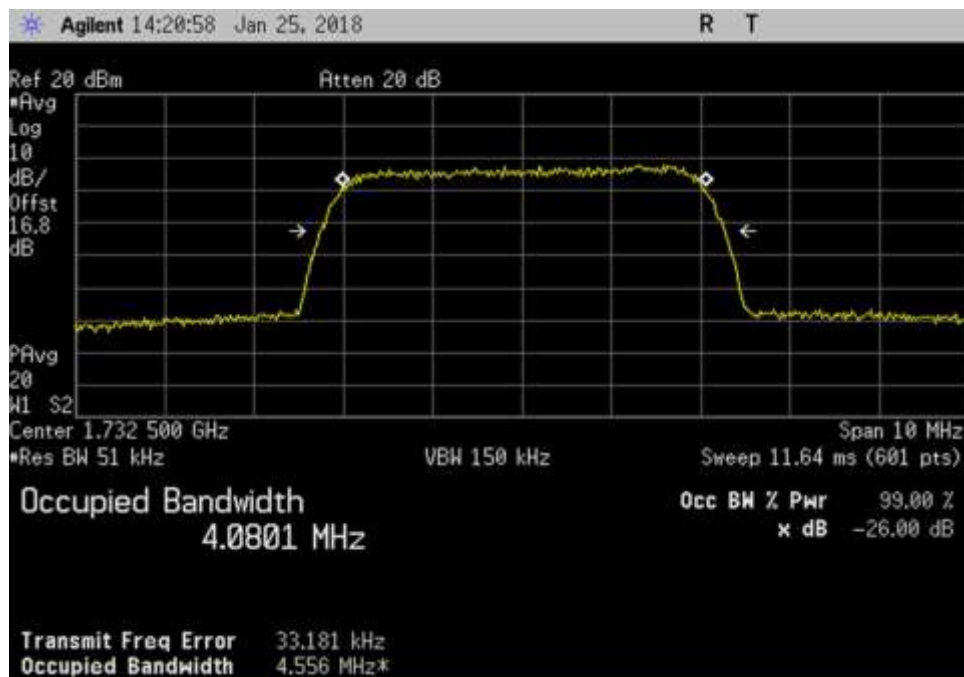
UL_707MHz_AWGN



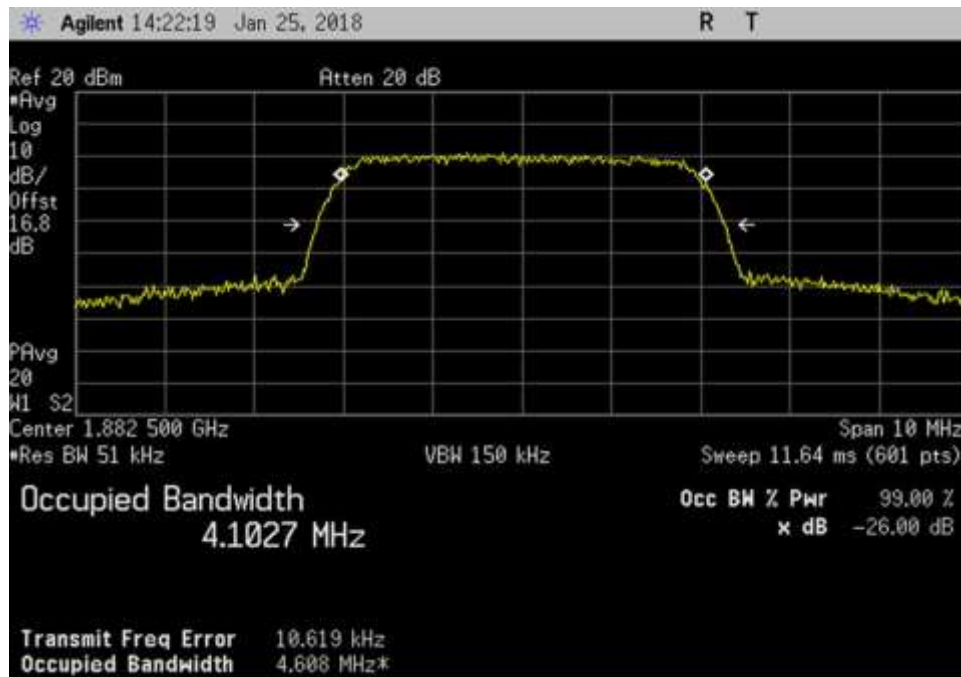
UL_781.5MHz_AWGN



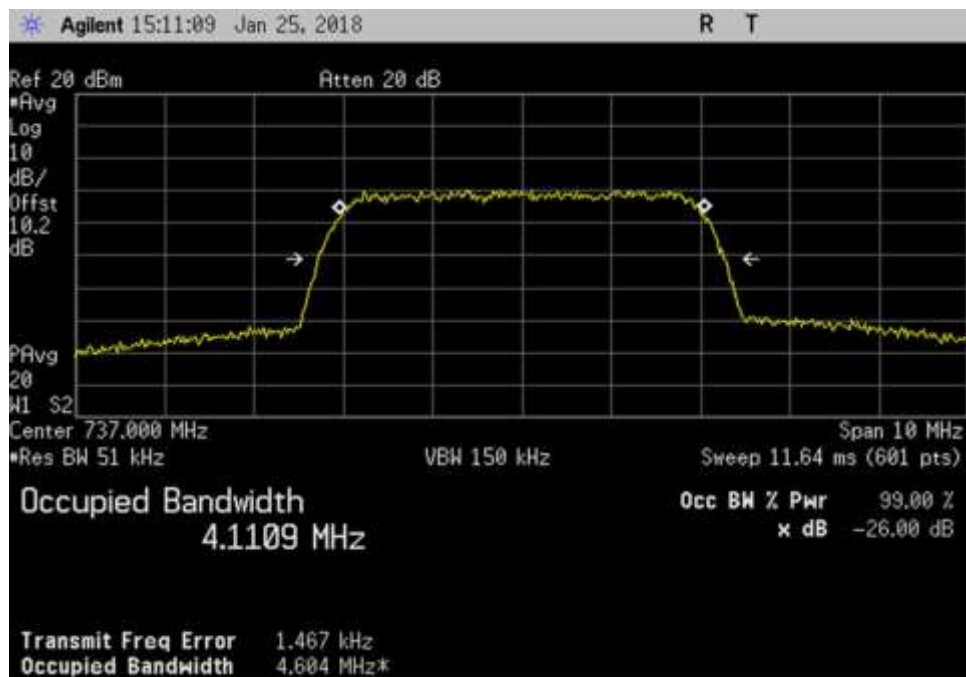
UL_836.5MHz_AWGN



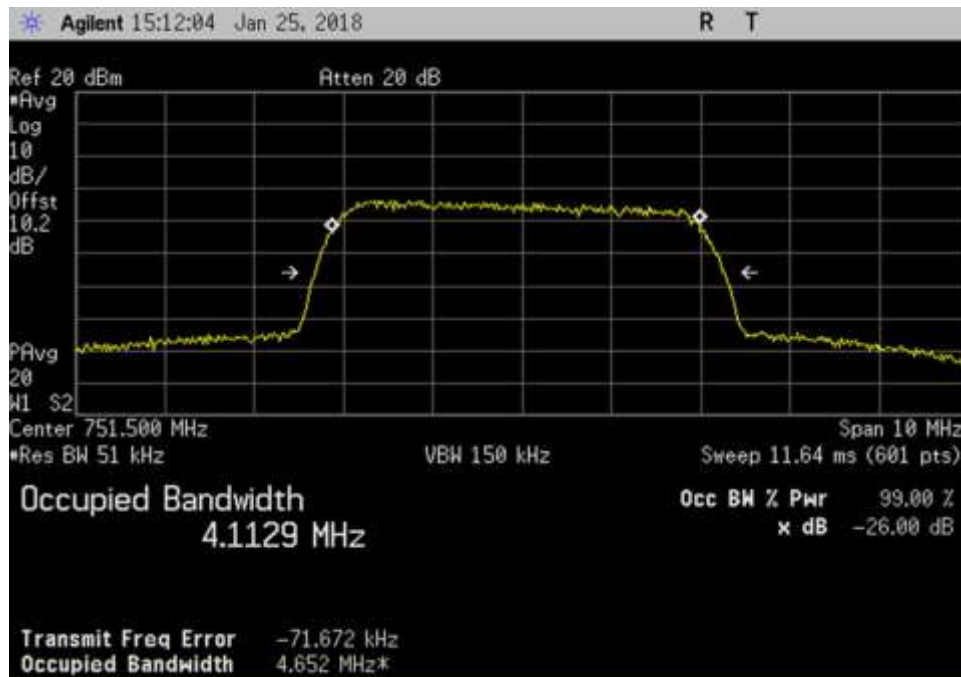
UL_1732.5MHz_AWGN



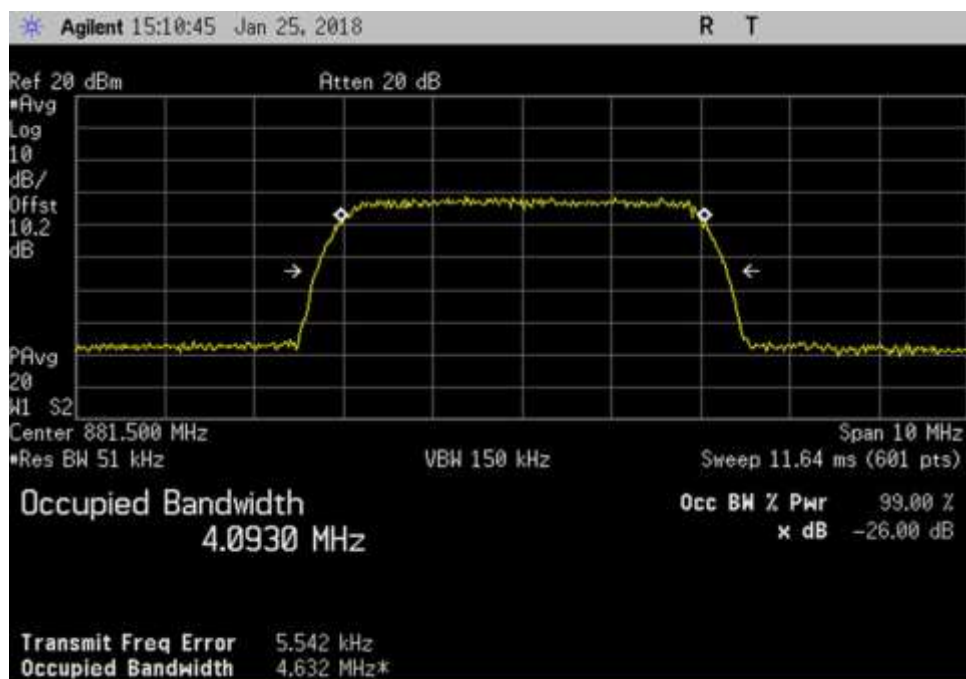
UL_1882.5MHz_AWGN



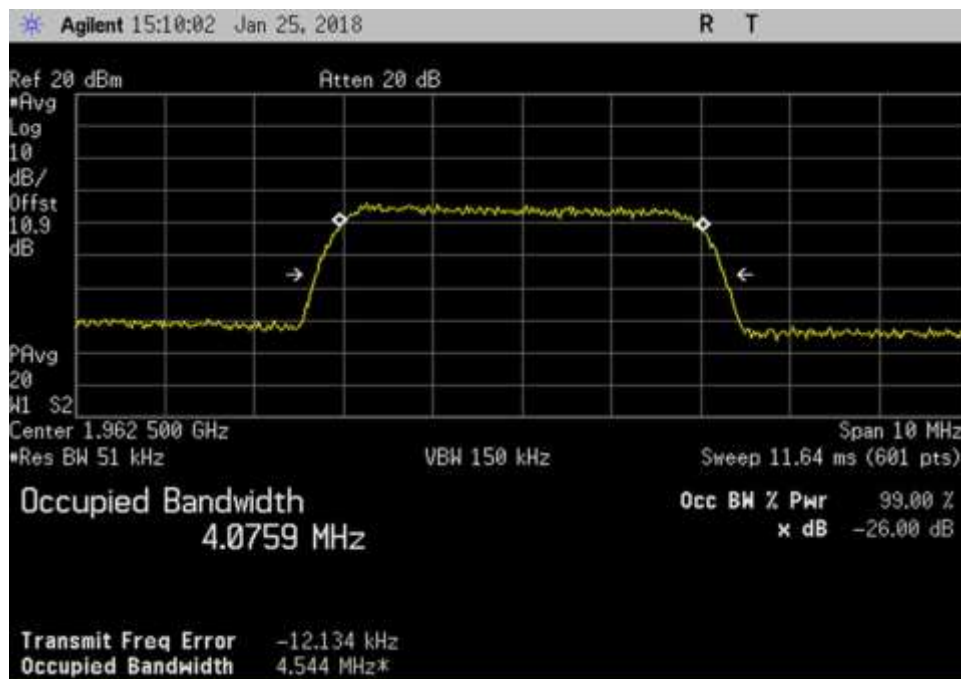
DL_737MHz_AWGN



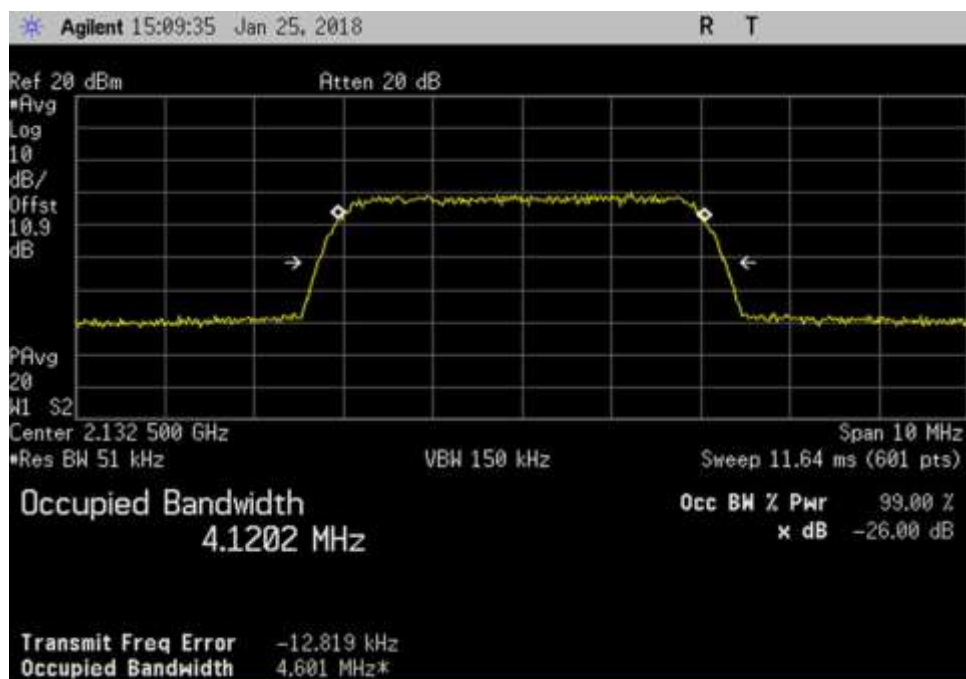
DL_751.5MHz_AWGN



DL_881.5MHz_AWGN

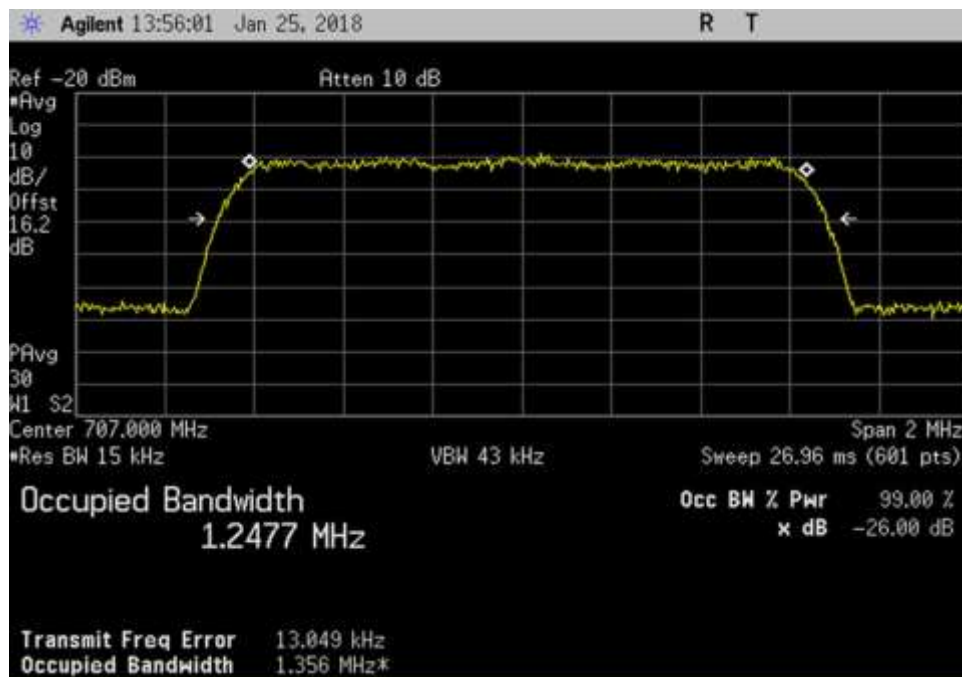


DL_1962.5MHz_AWGN

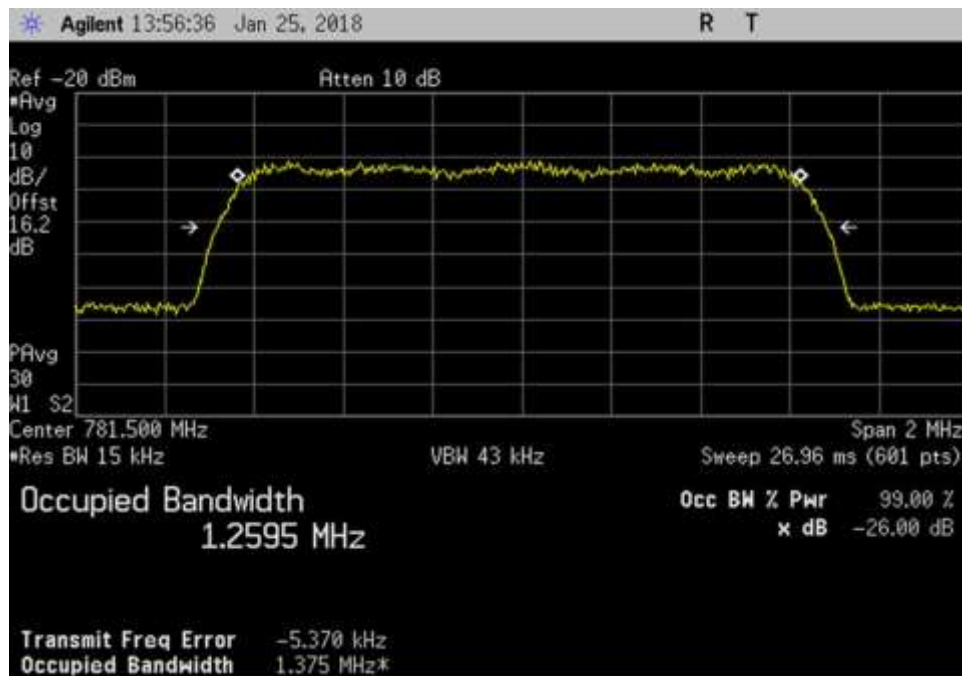


DL_2132.5MHz_AWGN

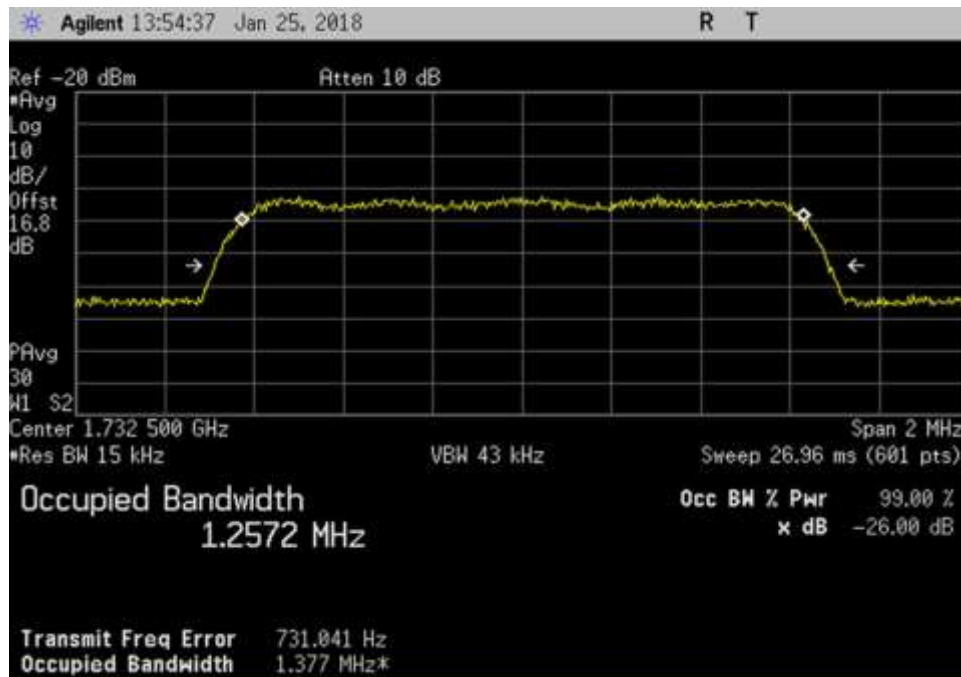
CDMA Input



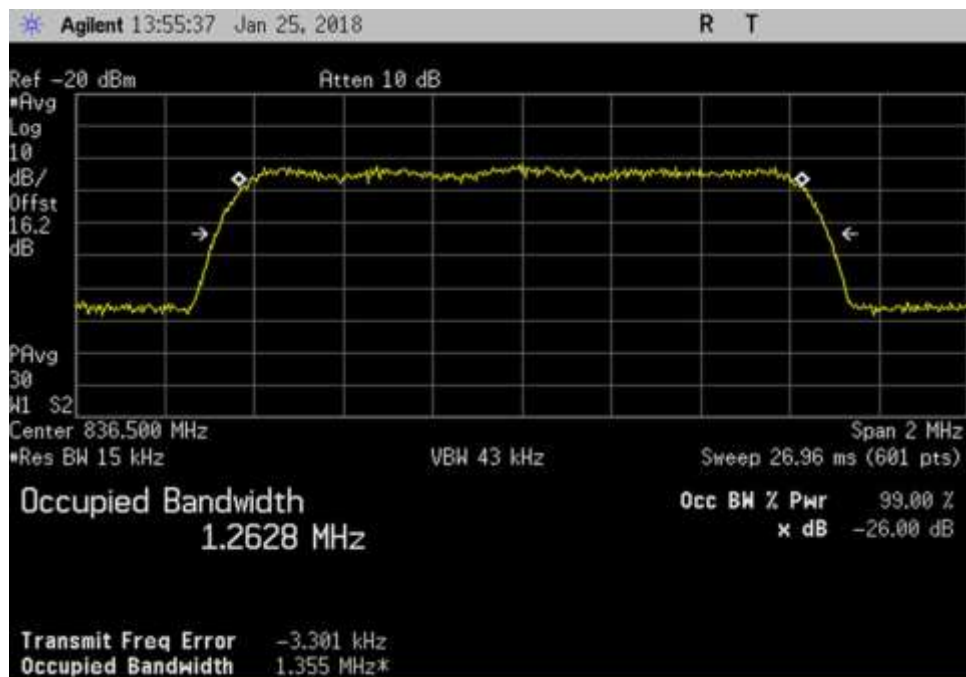
UL_ 707MHz_CDMA



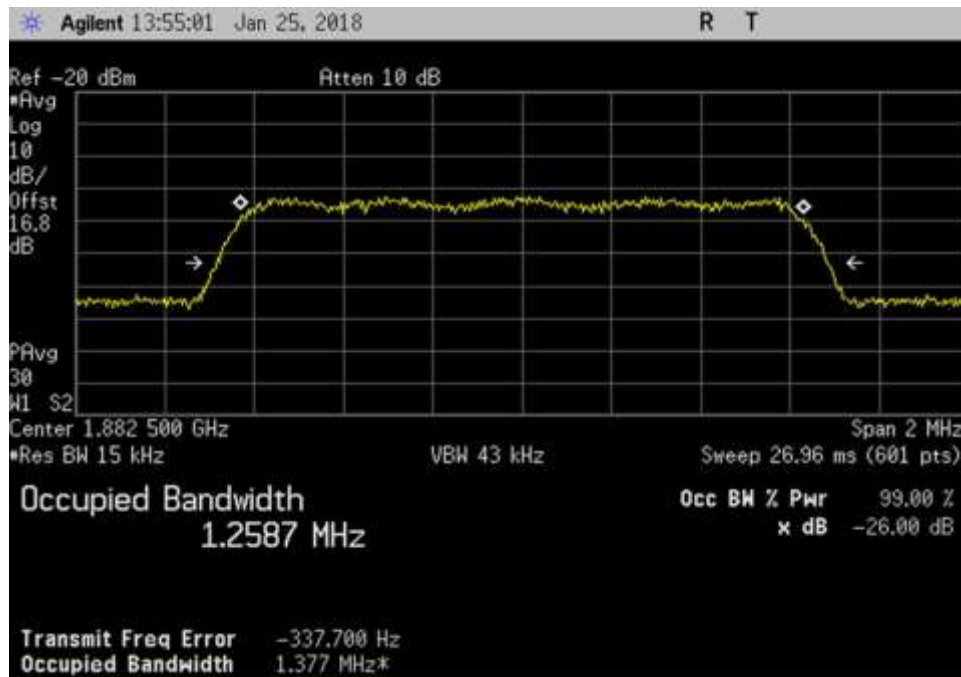
UL_ 781.5MHz_CDMA



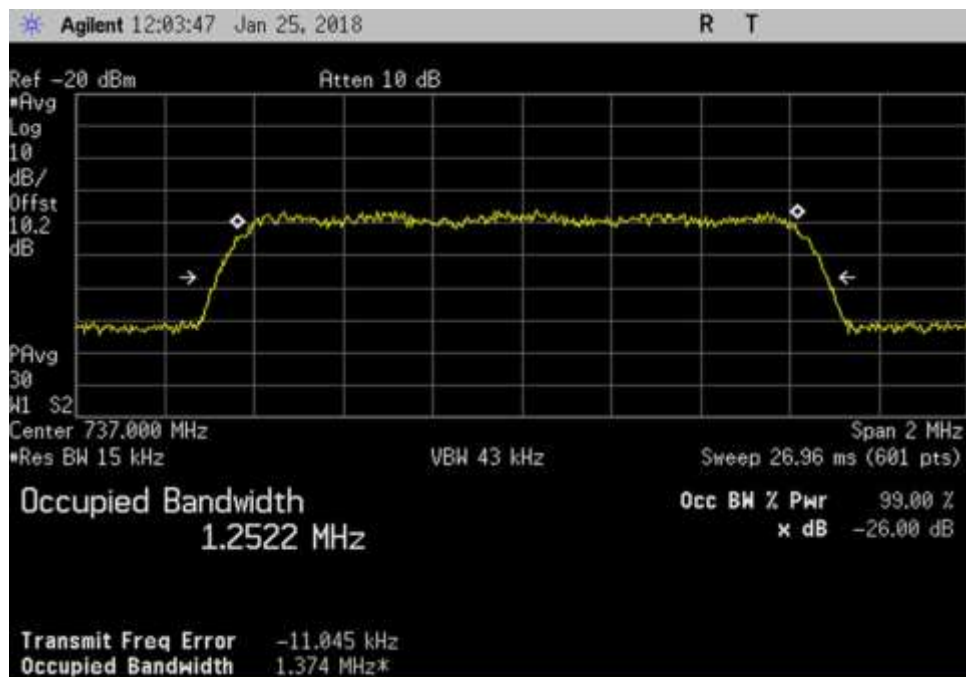
UL_ 836.5MHz_CDMA



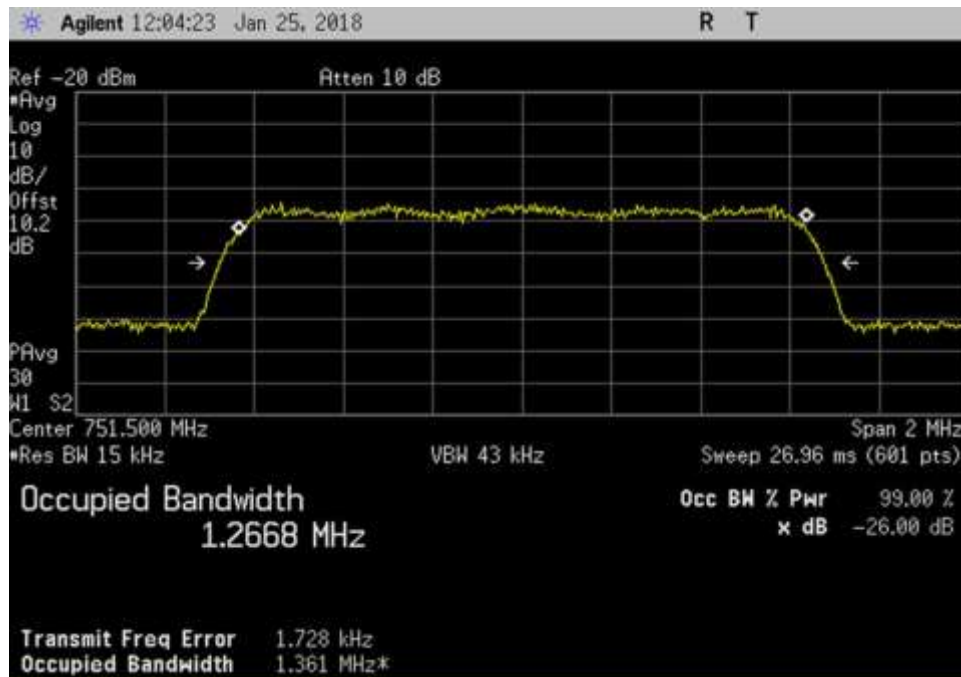
UL_ 1732.5MHz_CDMA



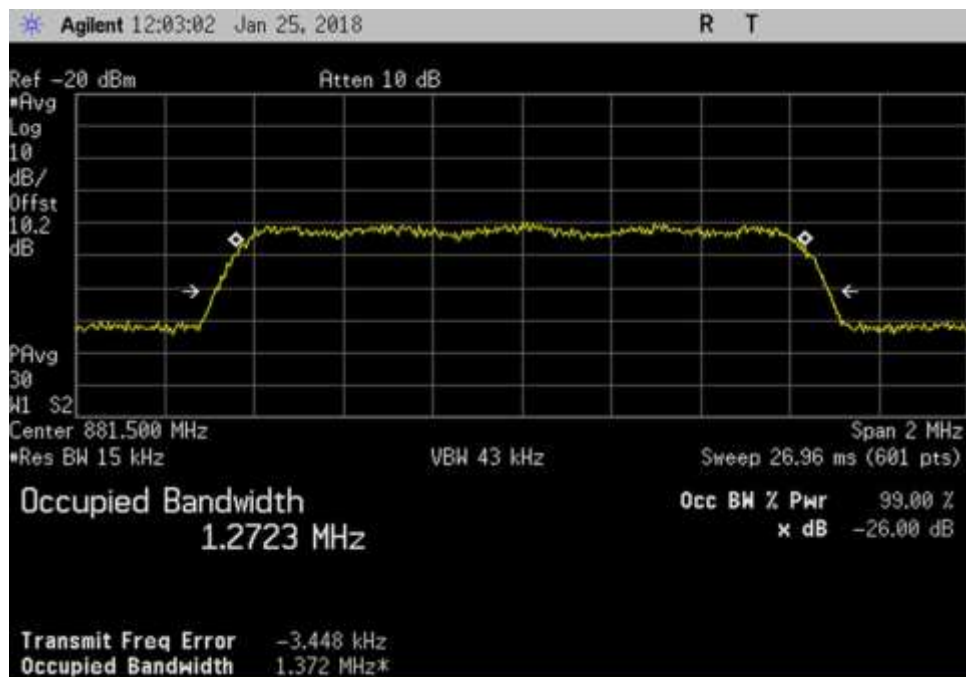
UL_1882.5MHz_CDMA



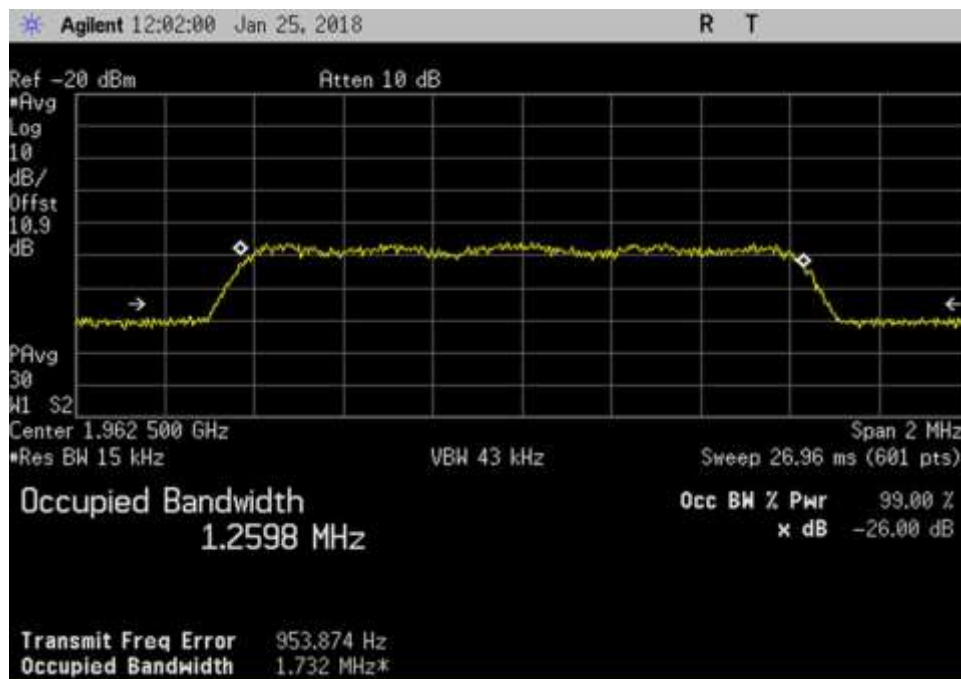
DL_737MHz_CDMA



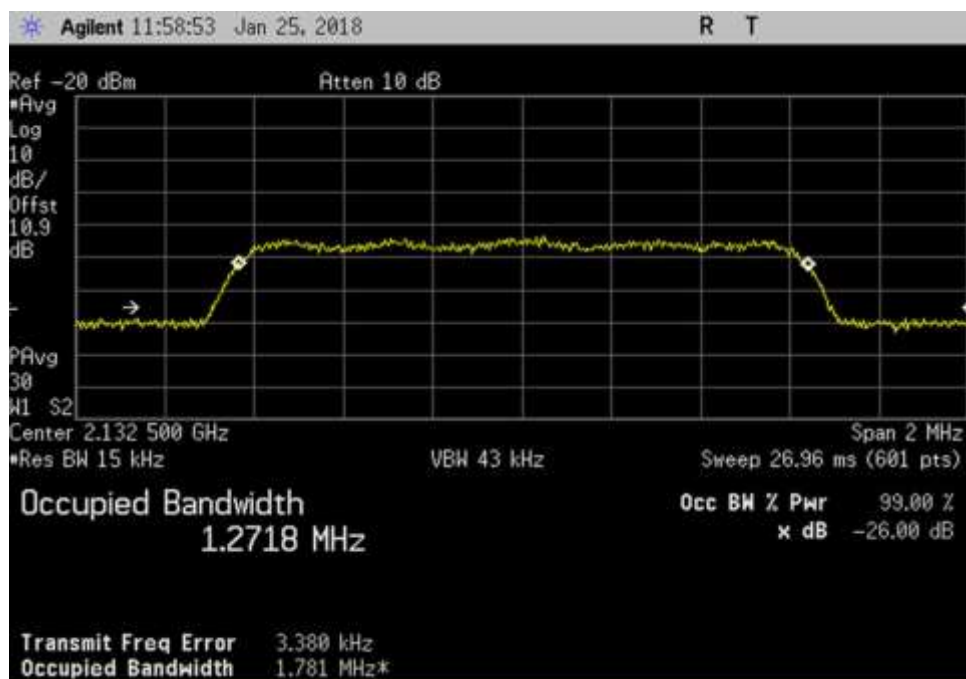
DL_751.5MHz_CDMA



DL_881.5MHz_CDMA

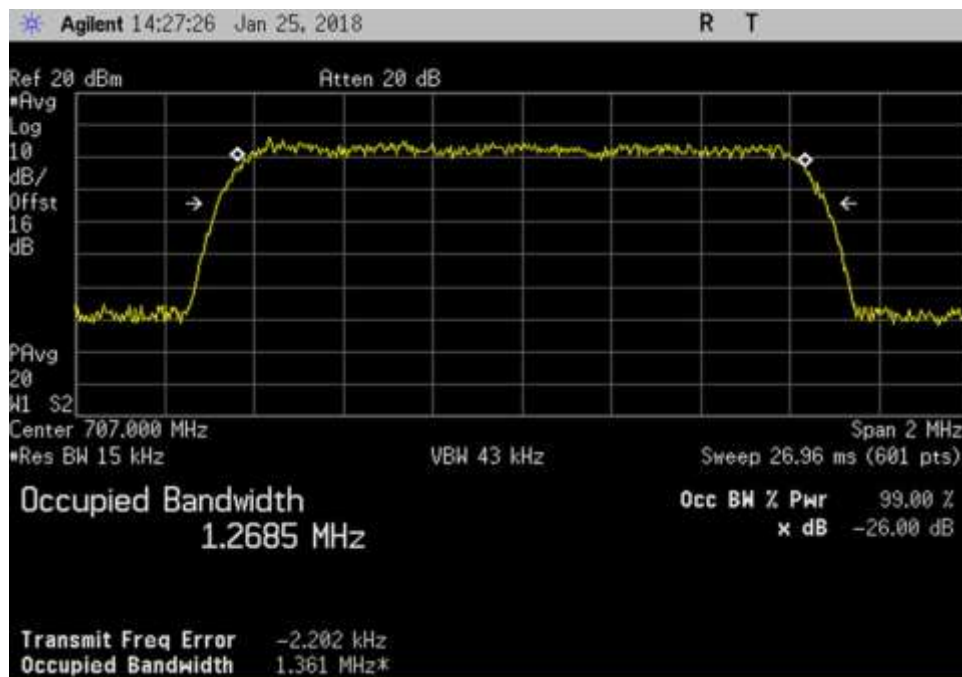


DL_1962.5MHz_CDMA

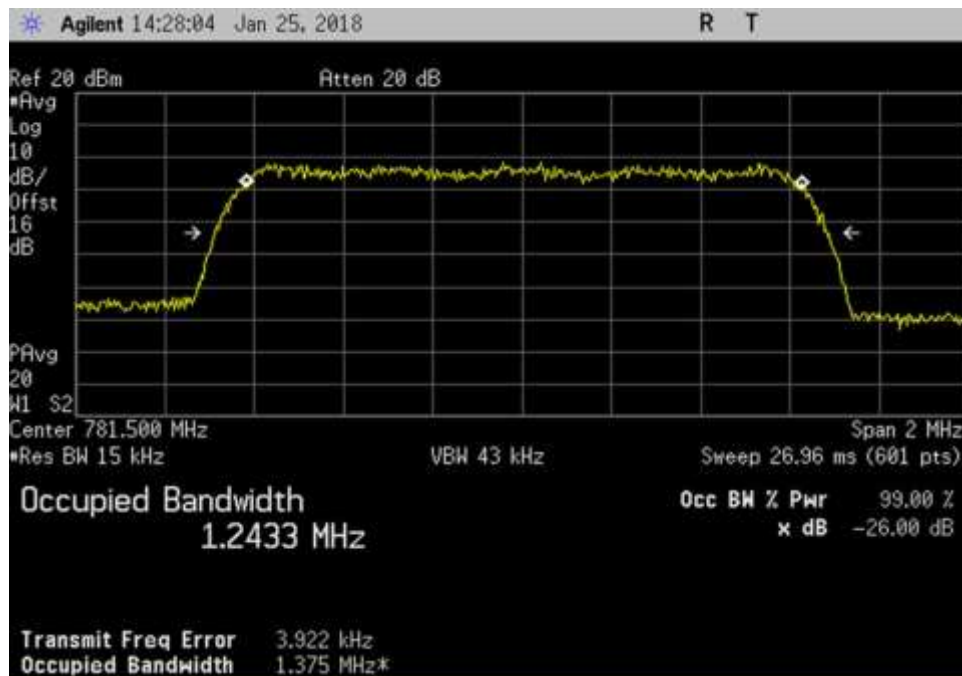


DL_2132.5MHz_CDMA

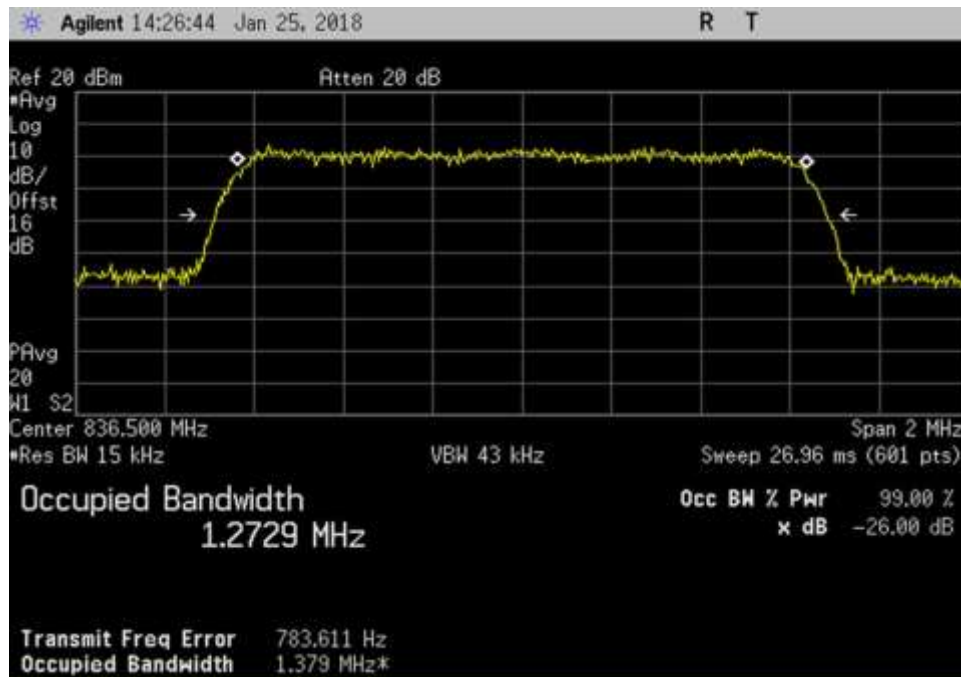
CDMA Output



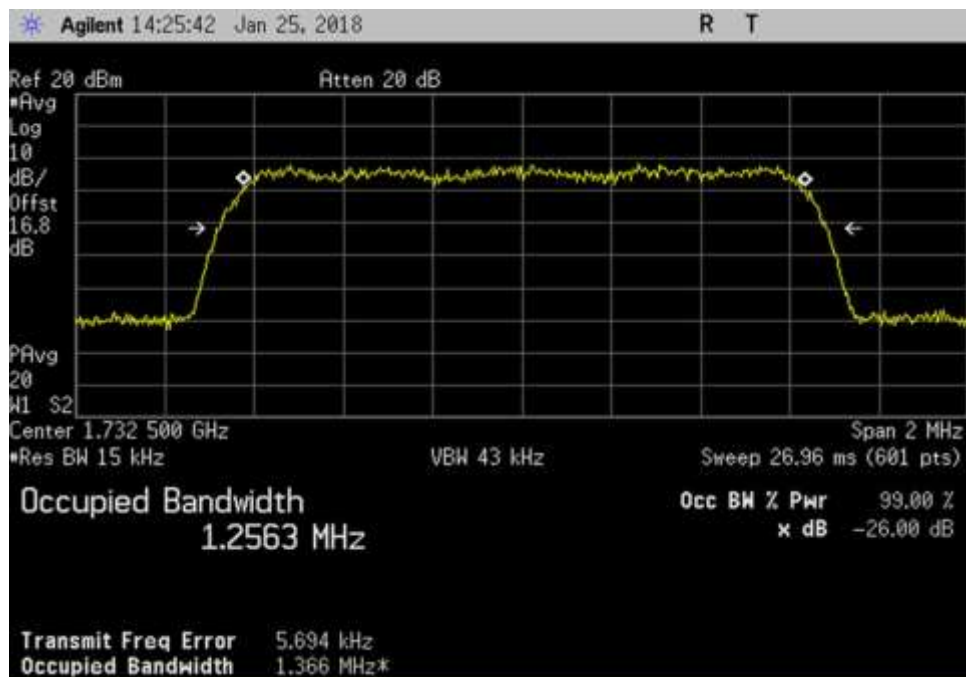
UL_ 707MHz_CDMA



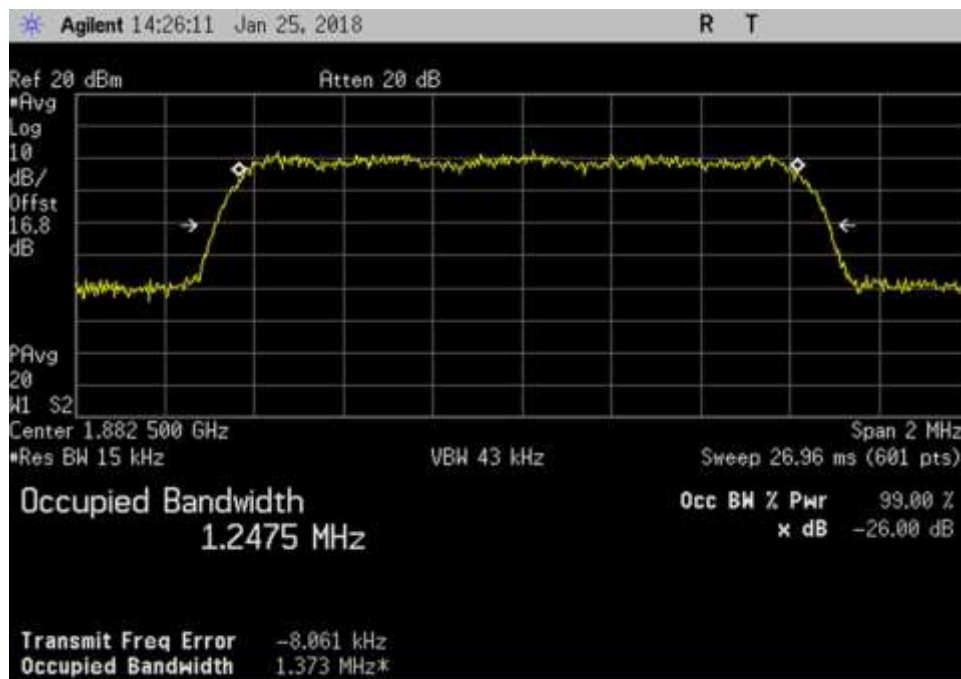
UL_ 781.5MHz_CDMA



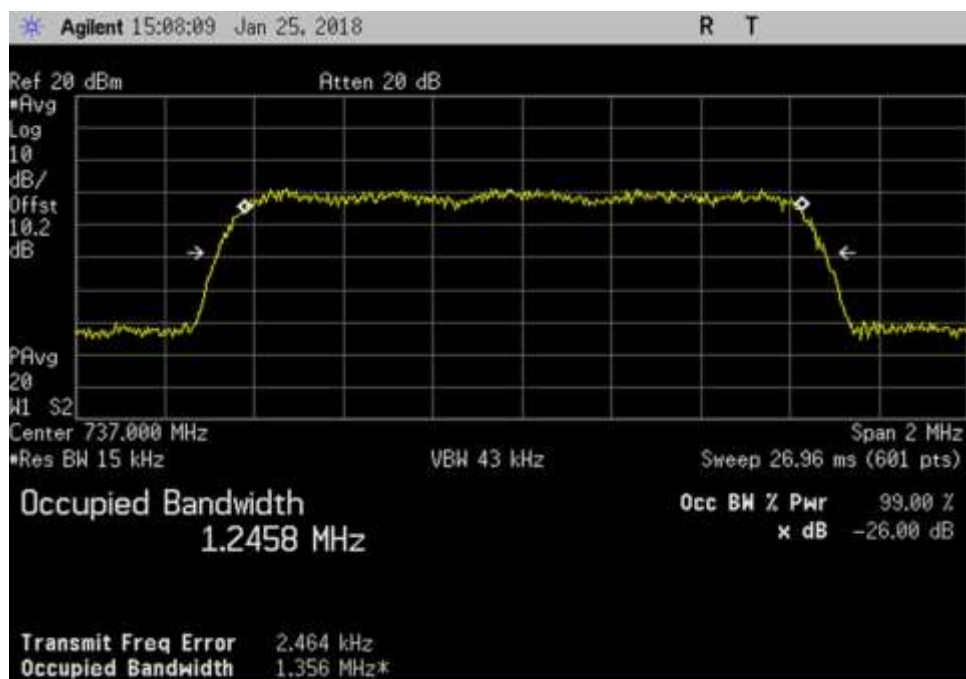
UL_ 836.5MHz_CDMA



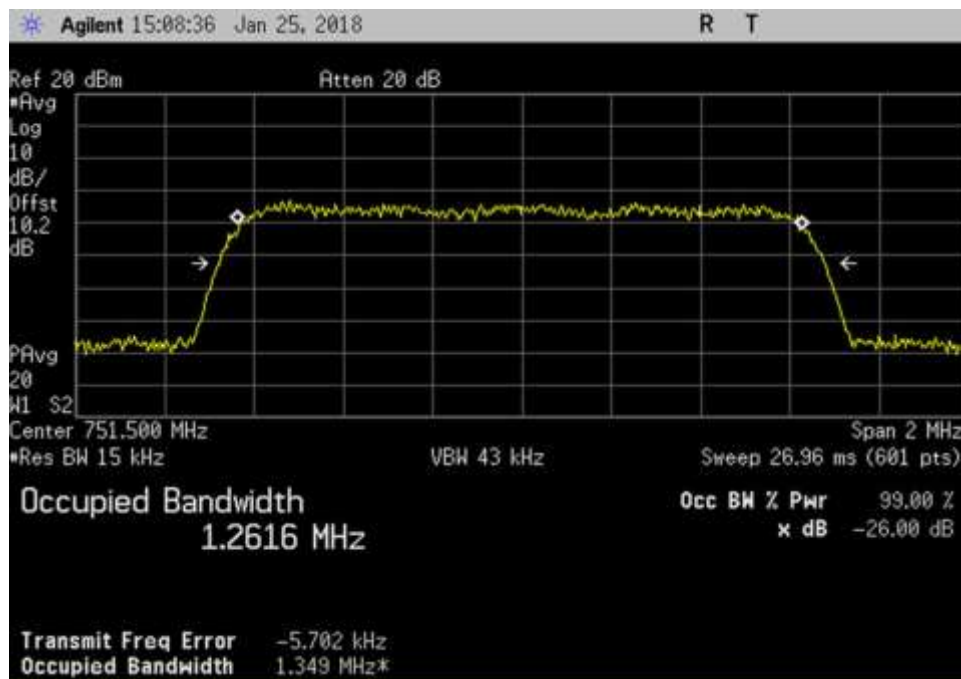
UL_ 1732.5MHz_CDMA



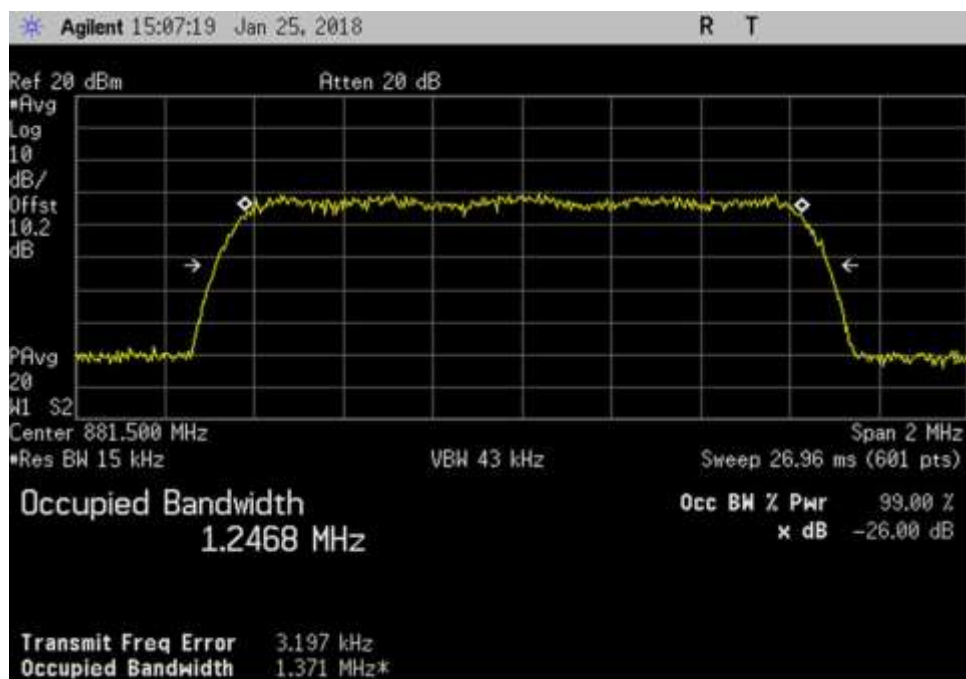
UL_1882.5MHz_CDMA



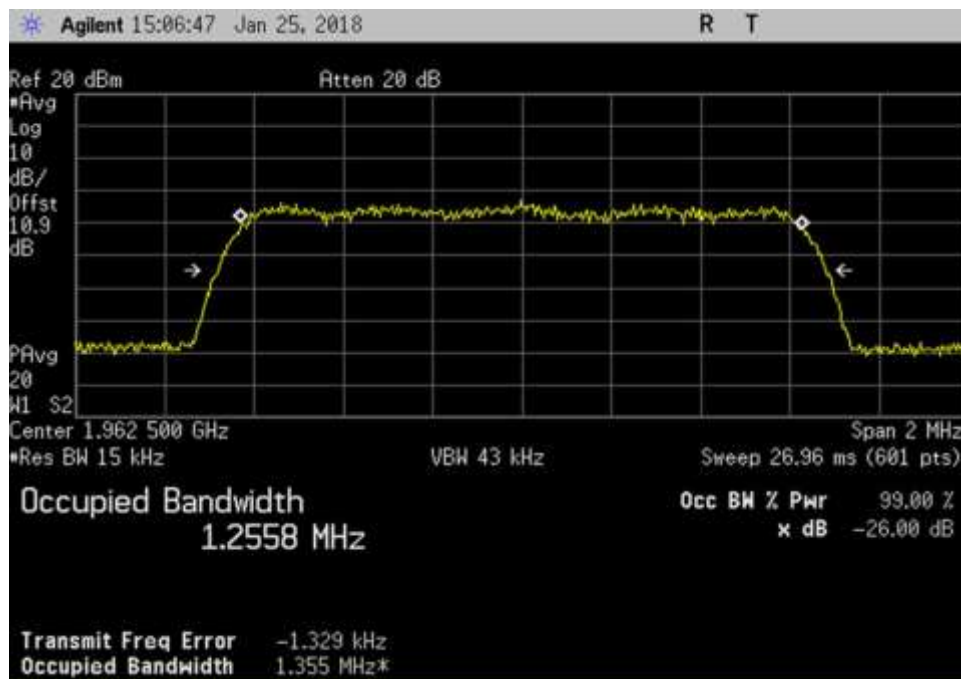
DL_737MHz_CDMA



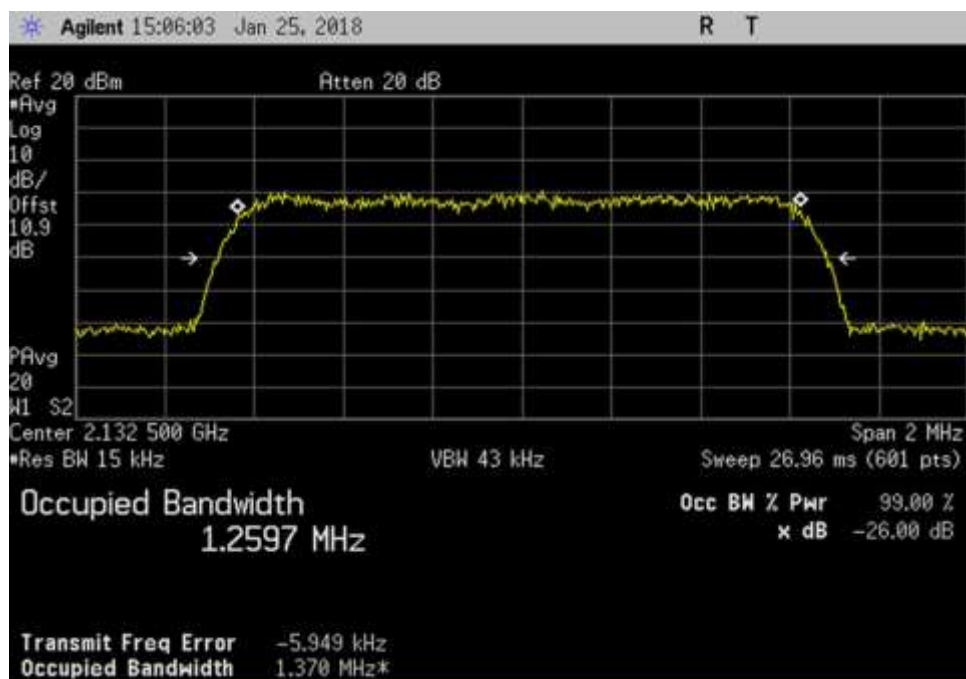
DL_751.5MHz_CDMA



DL_881.5MHz_CDMA

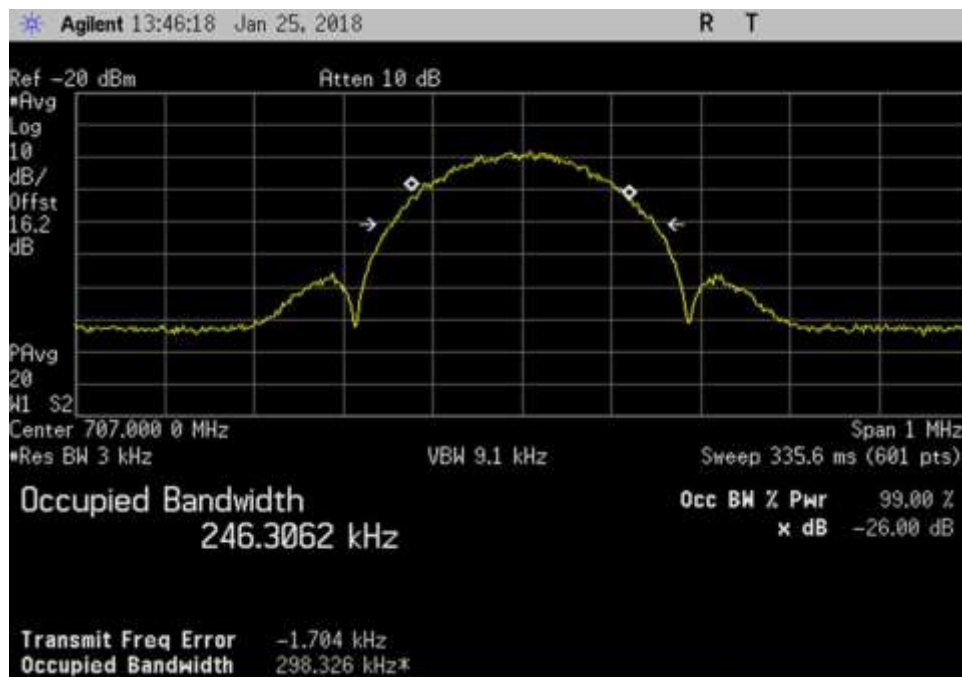


DL_1962.5MHz_CDMA

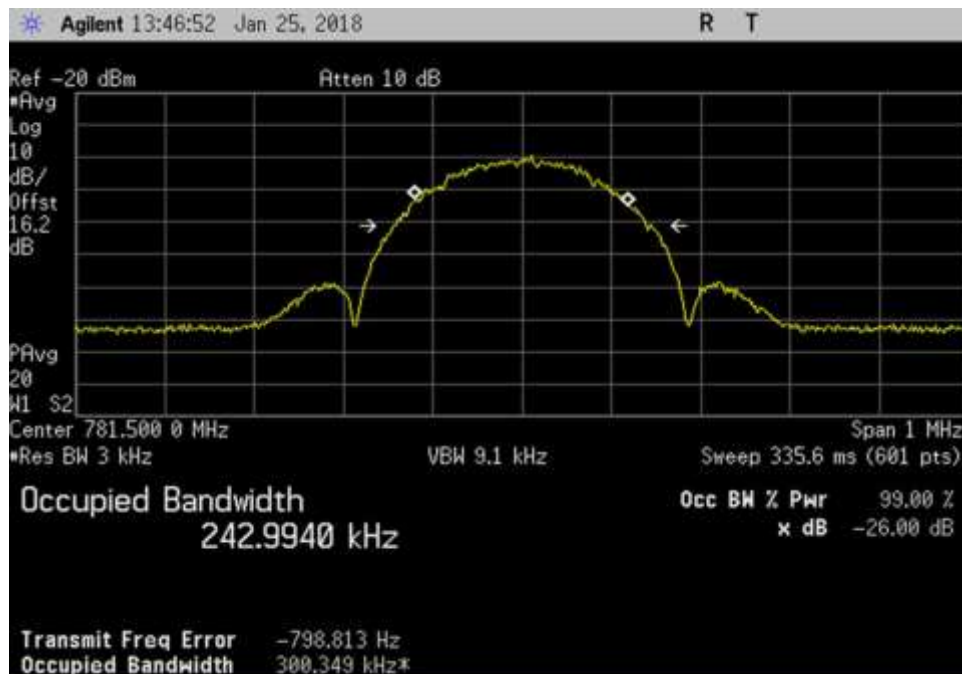


DL_2132.5MHz_CDMA

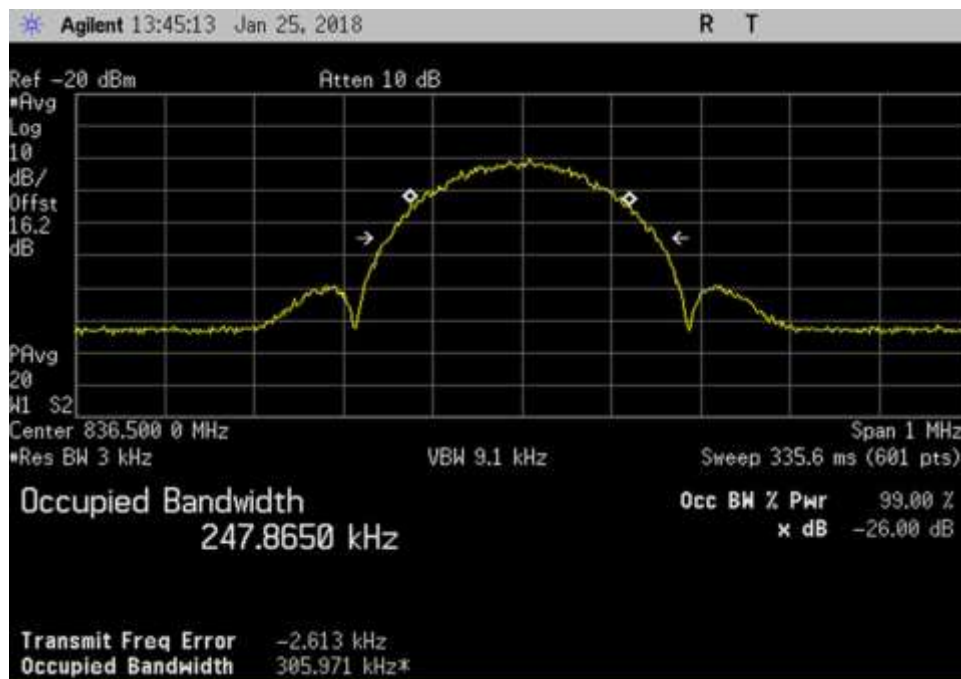
EDGE Input



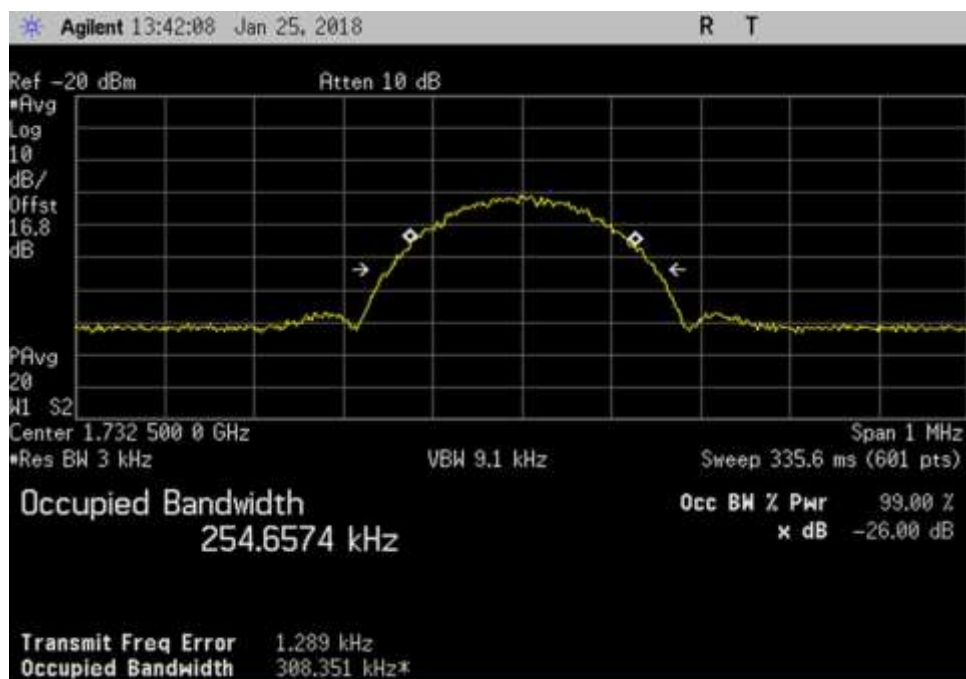
UL_707MHz_EDGE



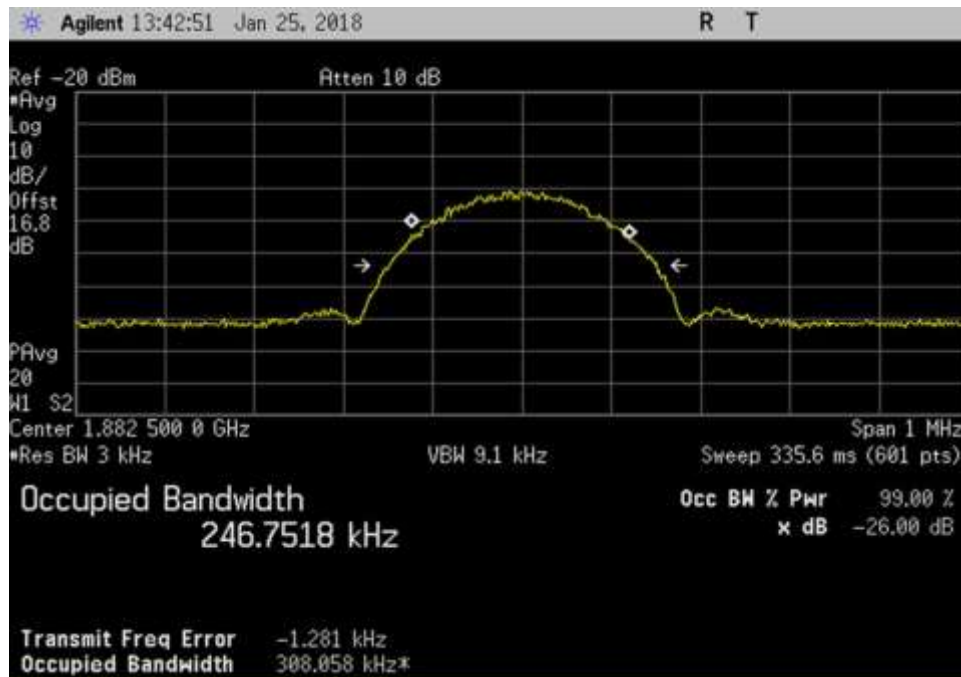
UL_781.5MHz_EDGE



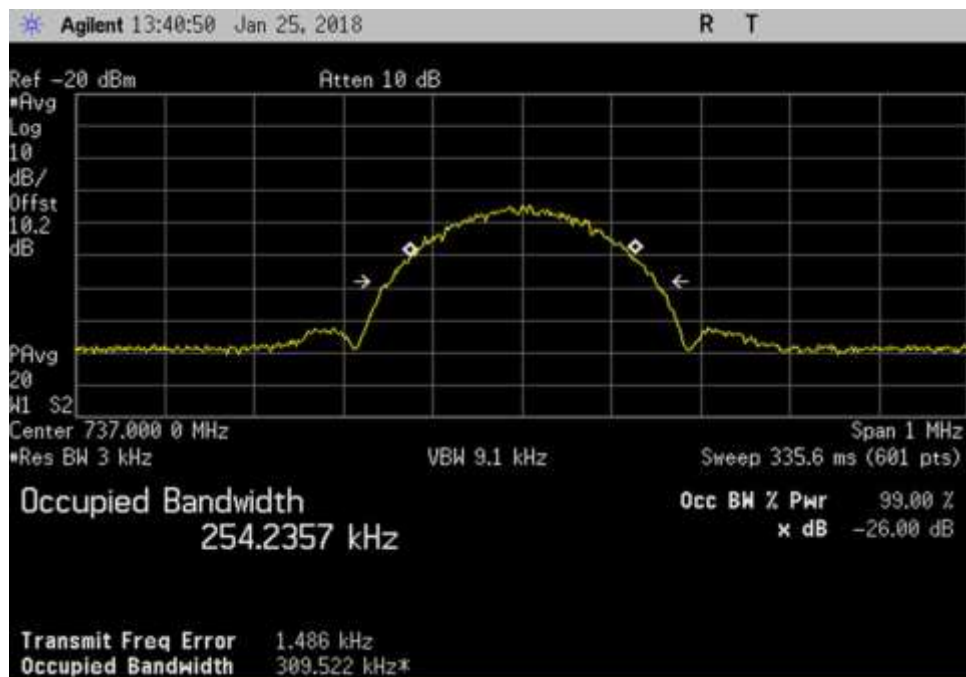
UL_836.5MHz_EDGE



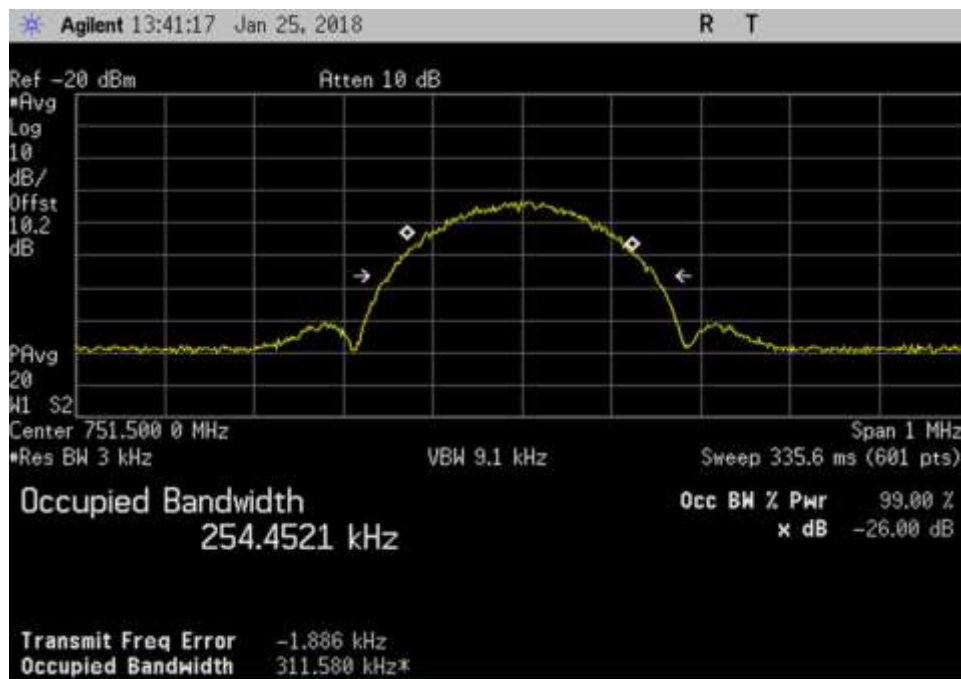
UL_1732.5MHz_EDGE



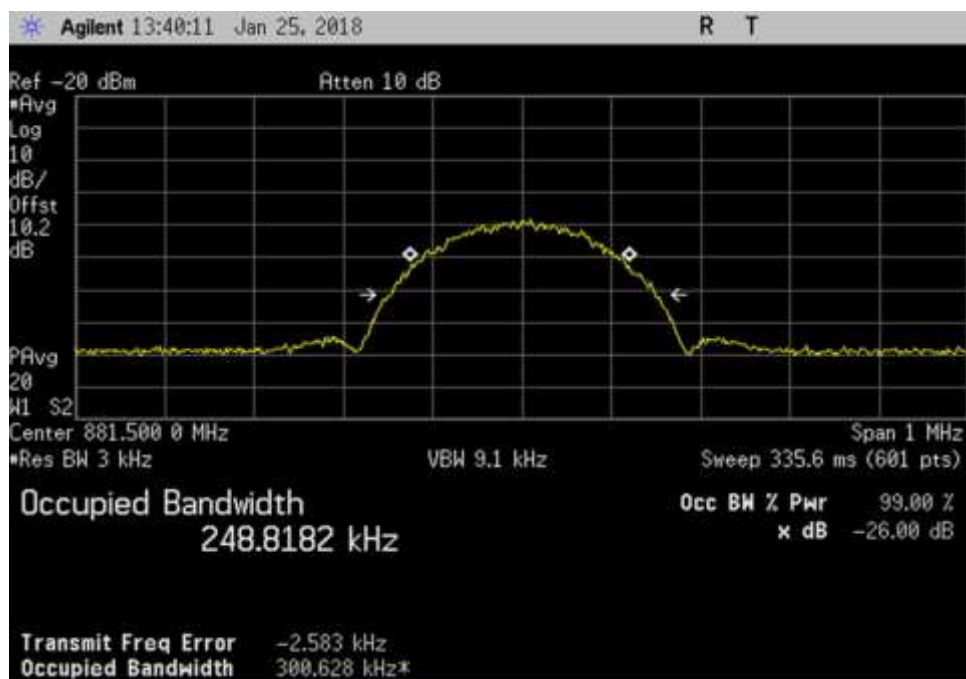
UL_1882.5MHz_EDGE



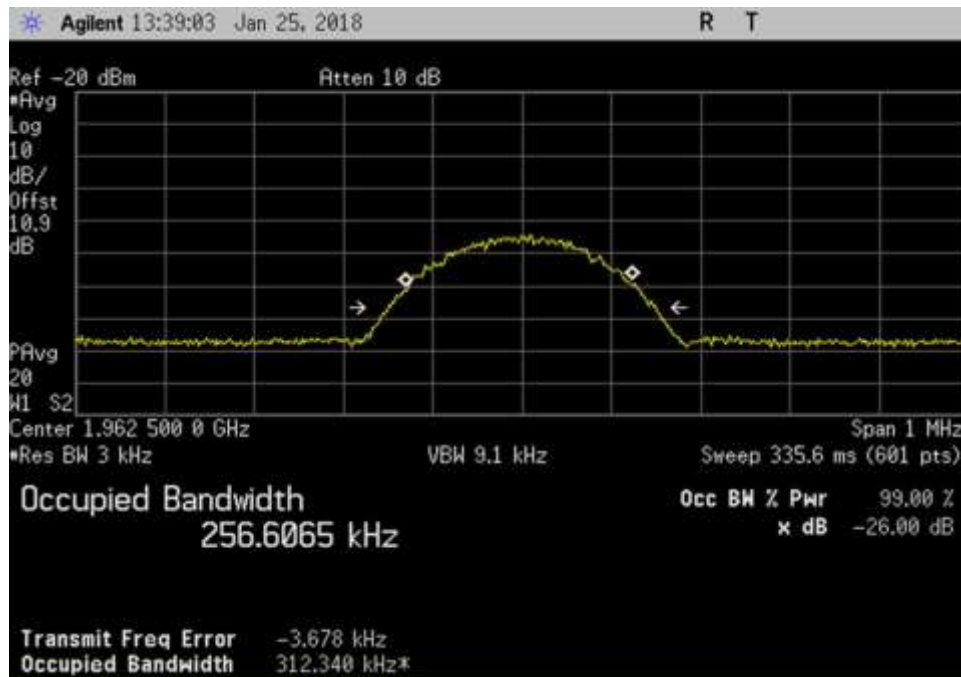
DL_737MHz_EDGE



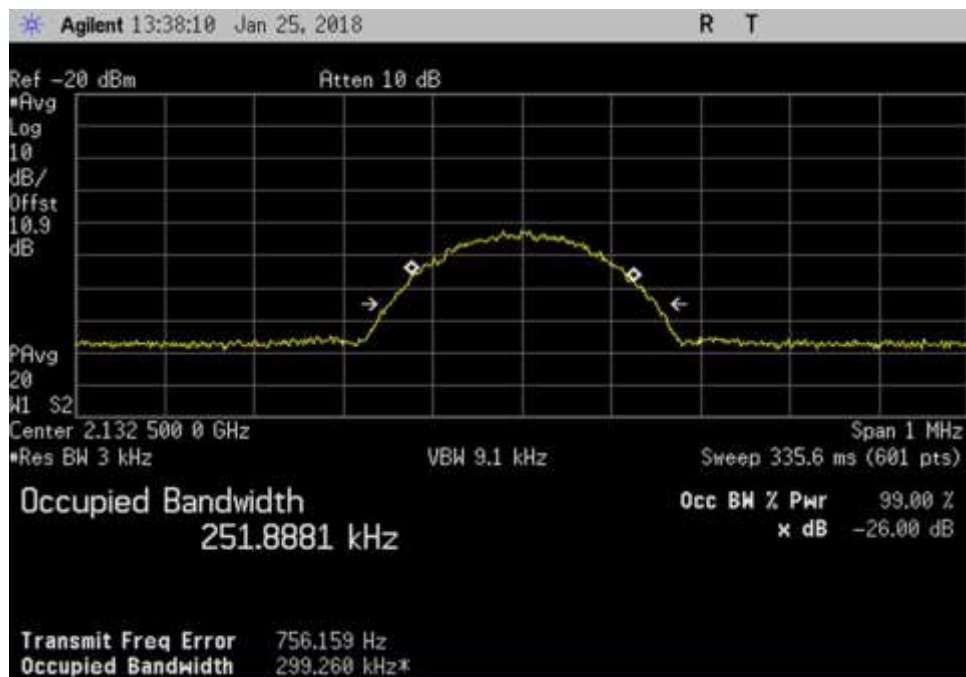
DL_751.5MHz_EDGE



DL_881.5MHz_EDGE

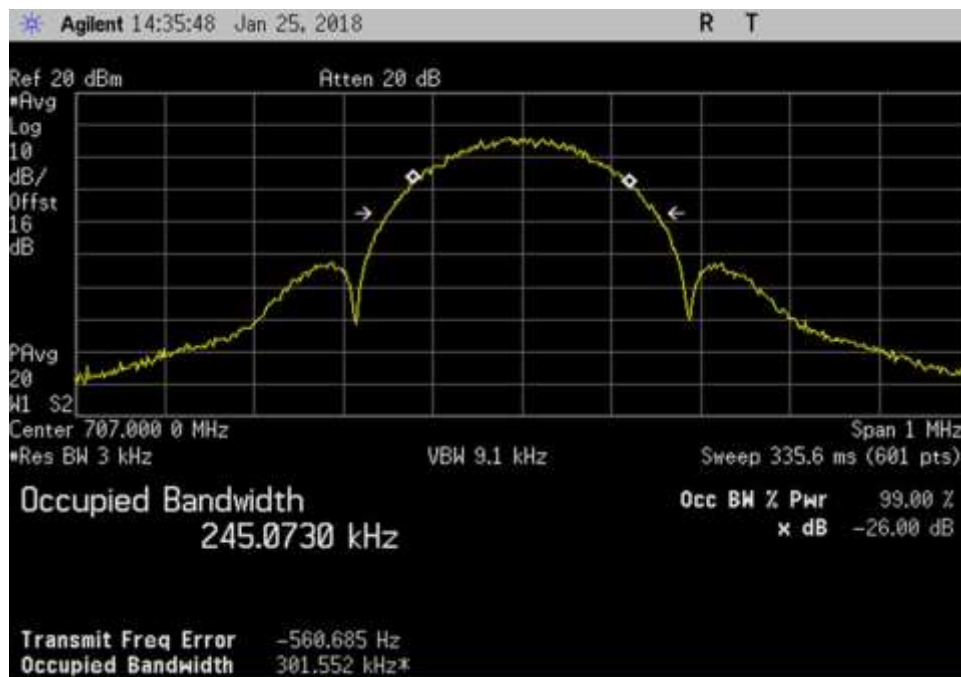


DL_1962.5MHz_EDGE

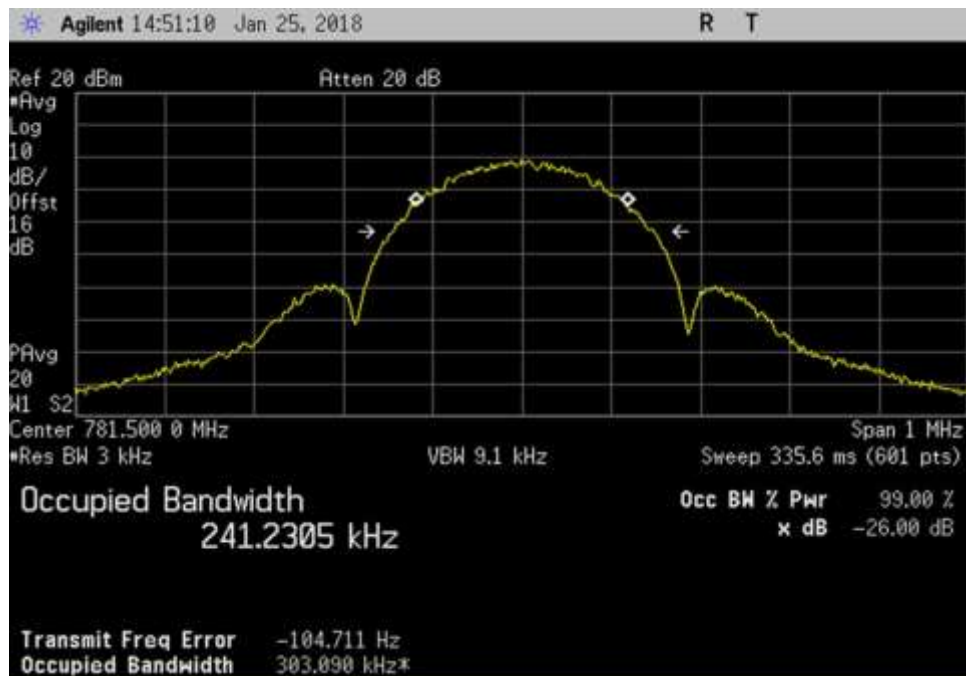


DL_2132.5MHz_EDGE

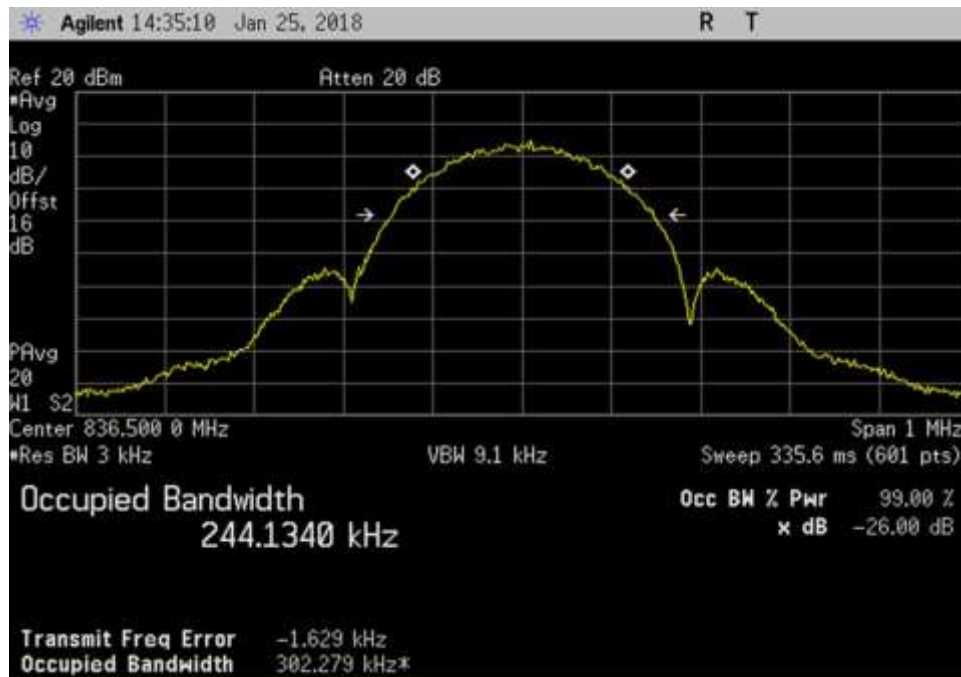
EDGE Output



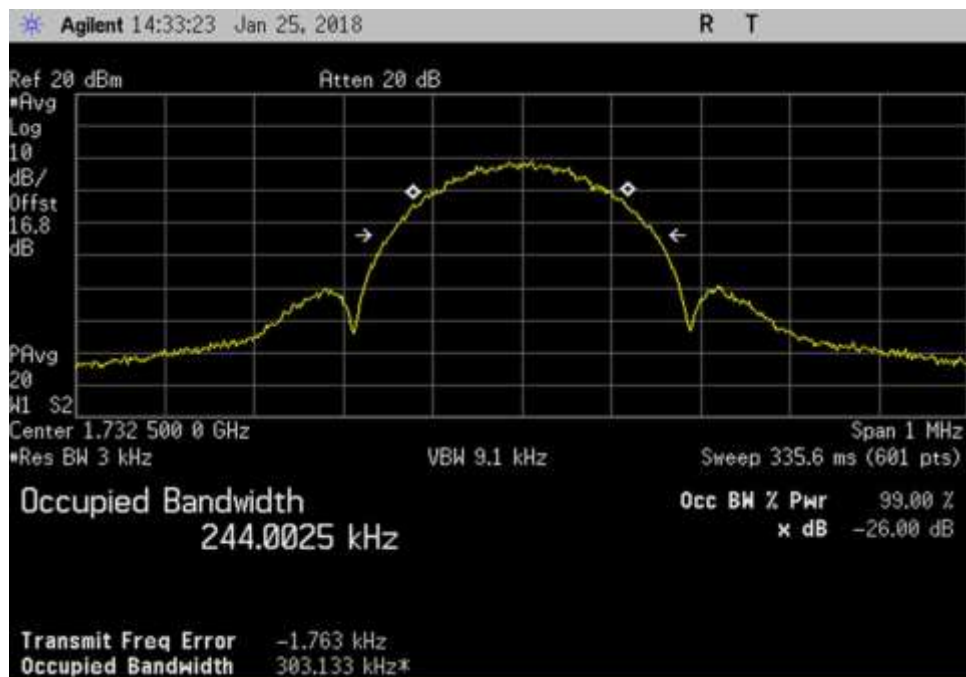
UL_707MHz_EDGE



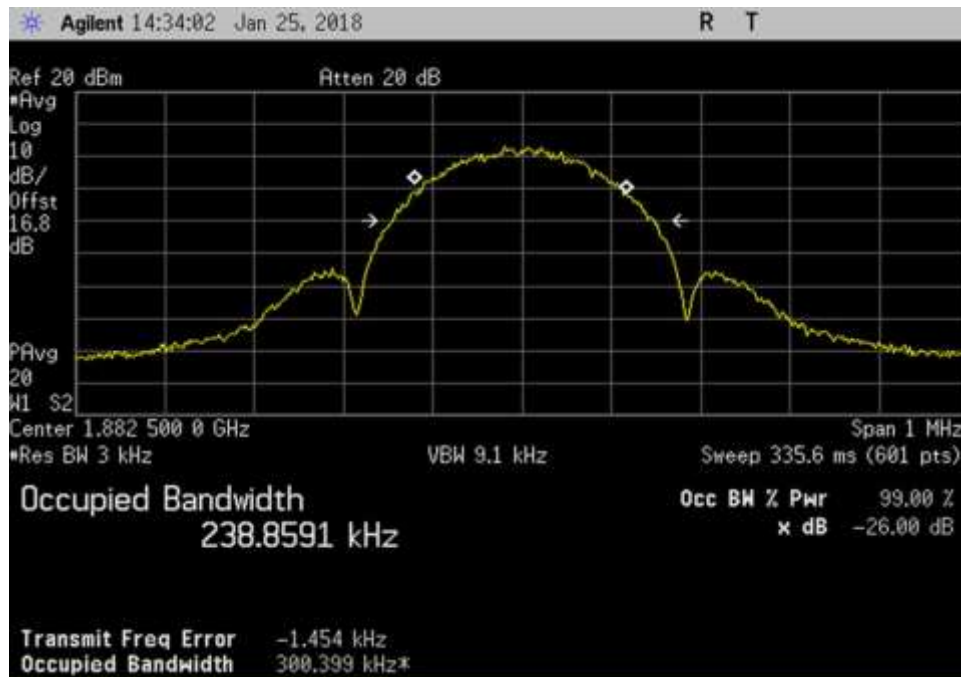
UL_781.5MHz_EDGE



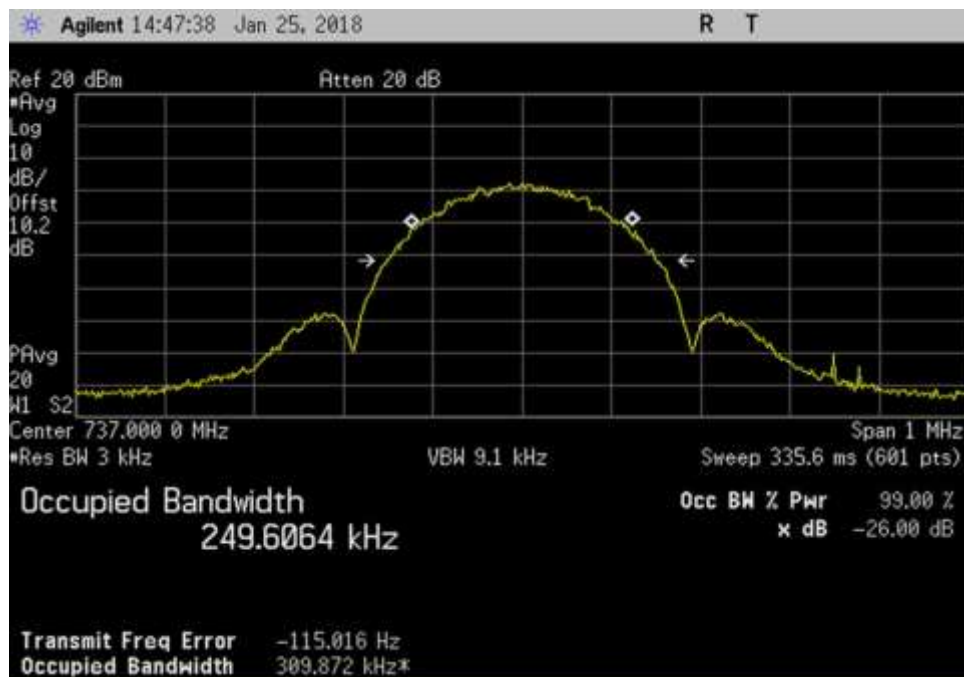
UL_836.5MHz_EDGE



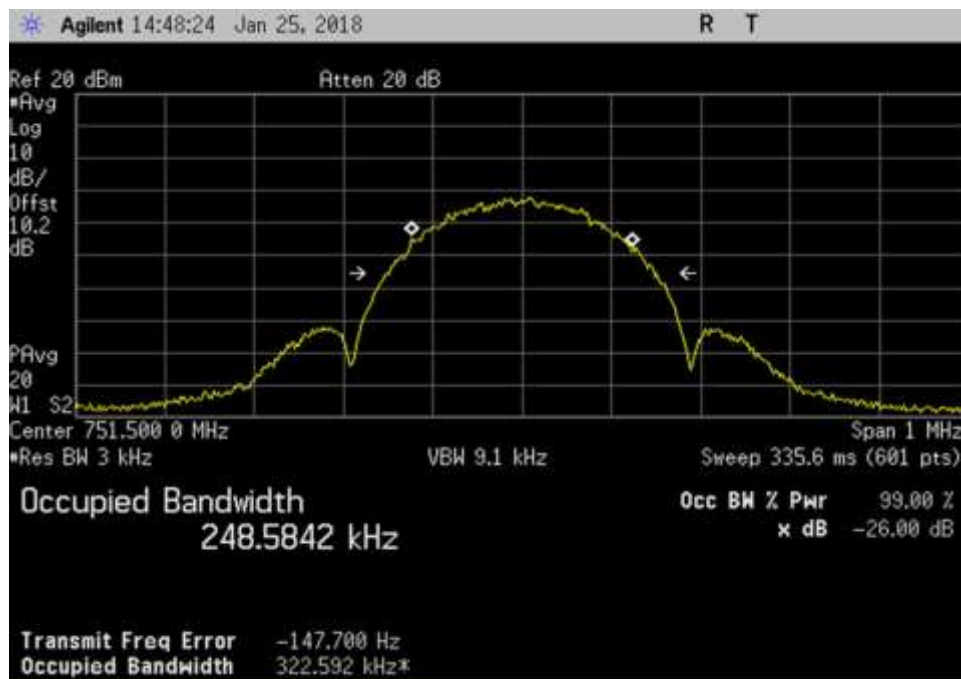
UL_1732.5MHz_EDGE



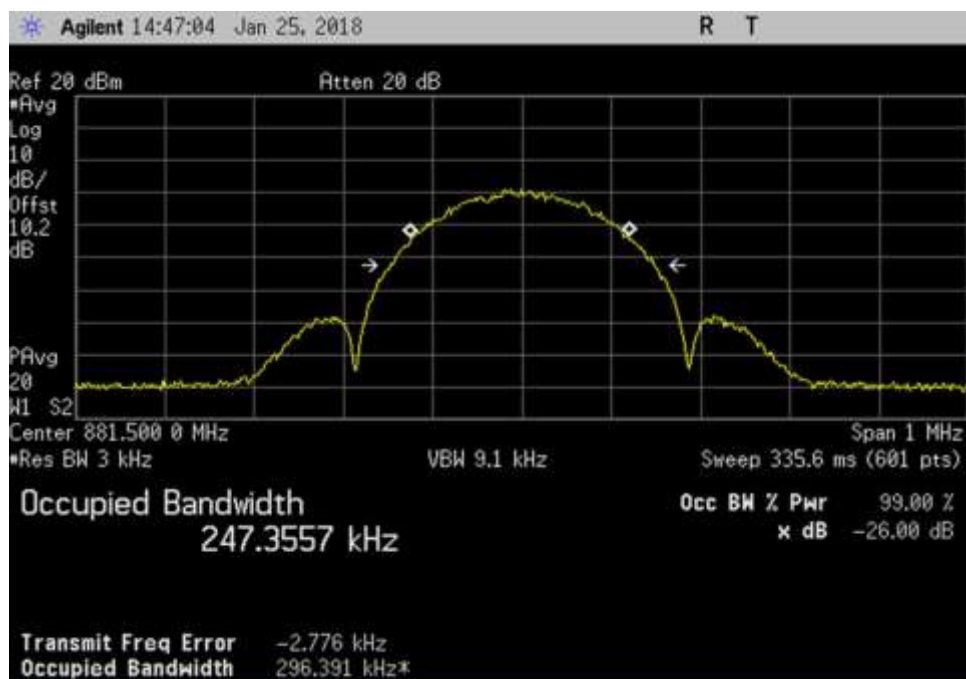
UL_1882.5MHz_EDGE



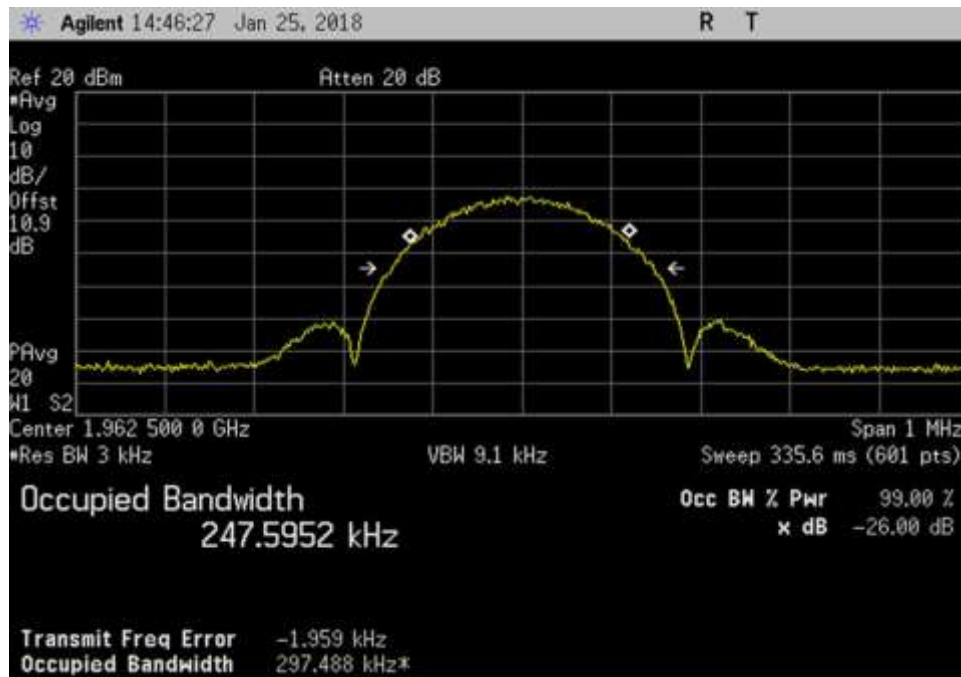
DL_737MHz_EDGE



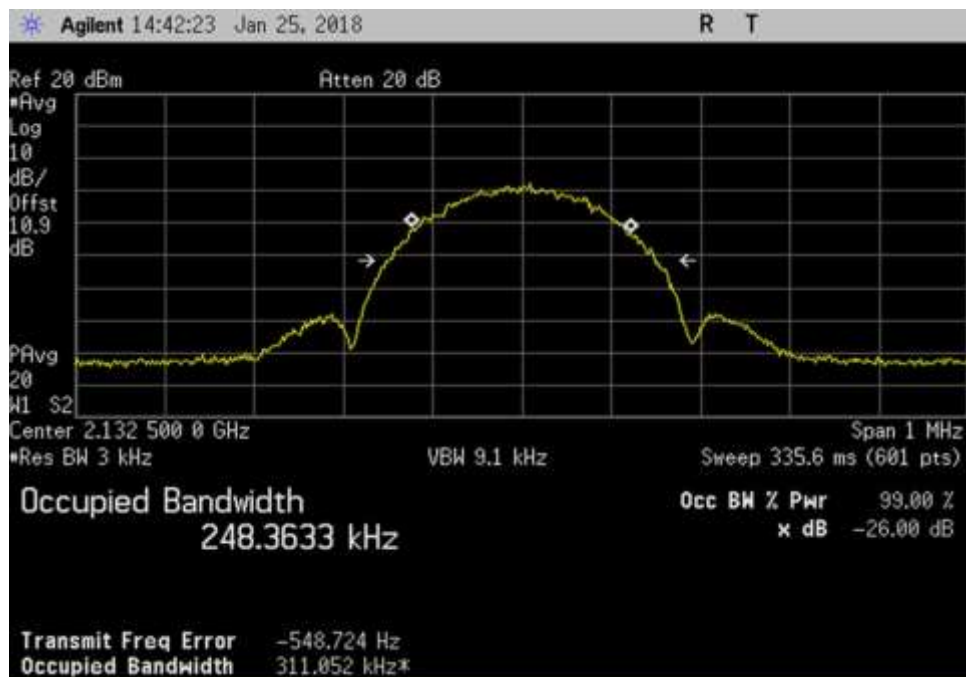
DL_751.5MHz_EDGE



DL_881.5MHz_EDGE

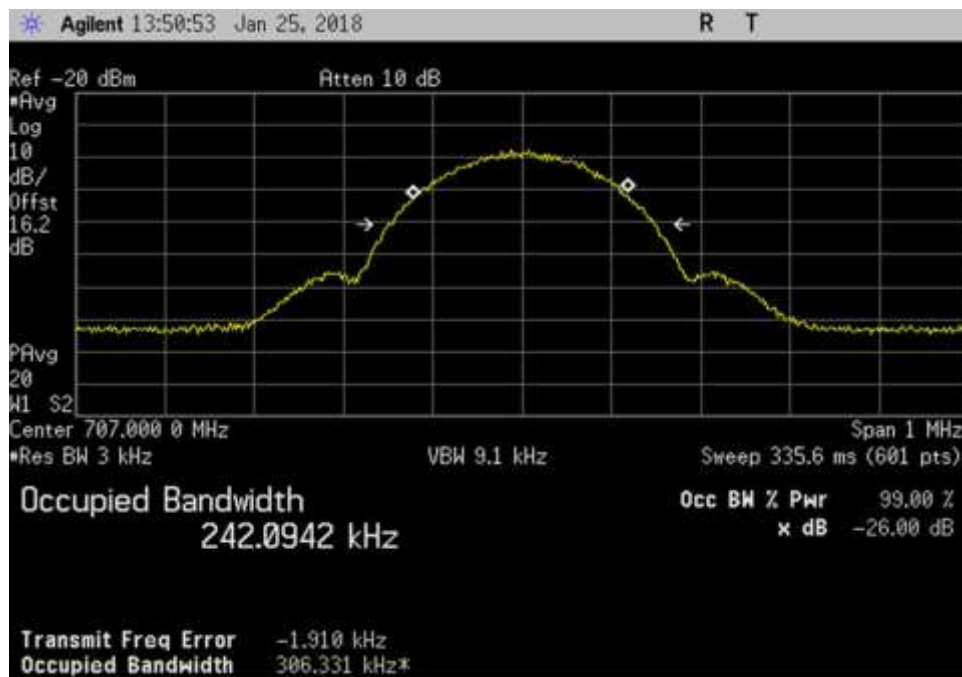


DL_1962.5MHz_EDGE

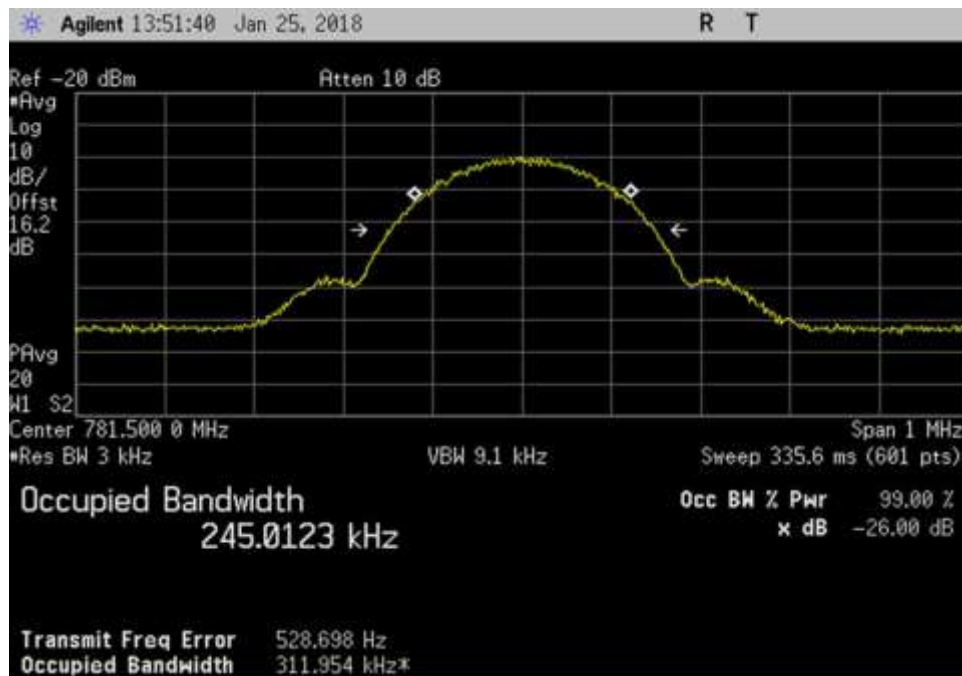


DL_2132.5MHz_EDGE

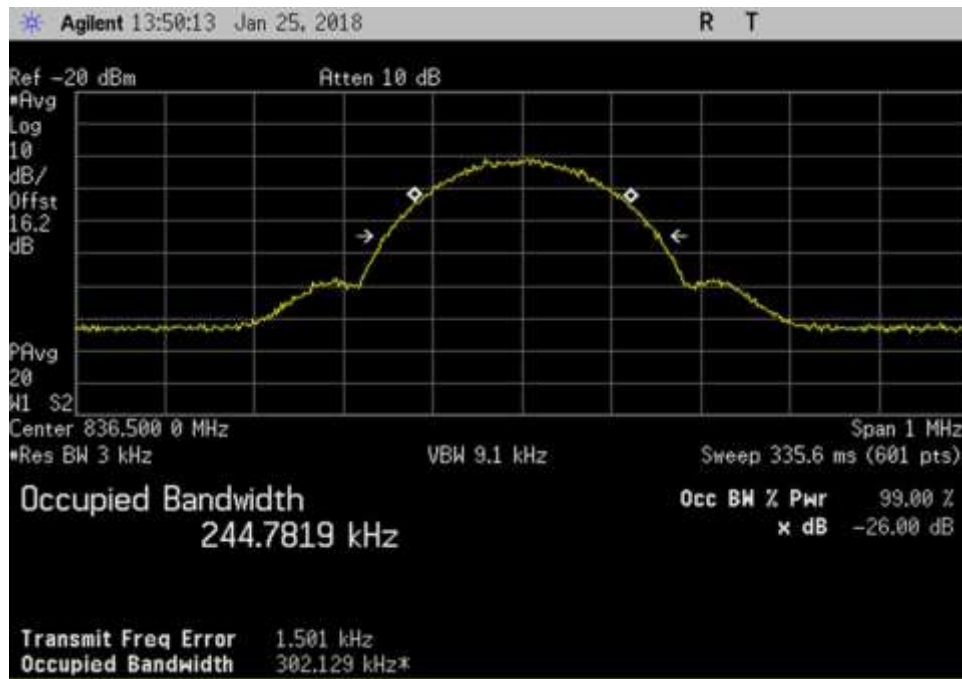
GSM Input



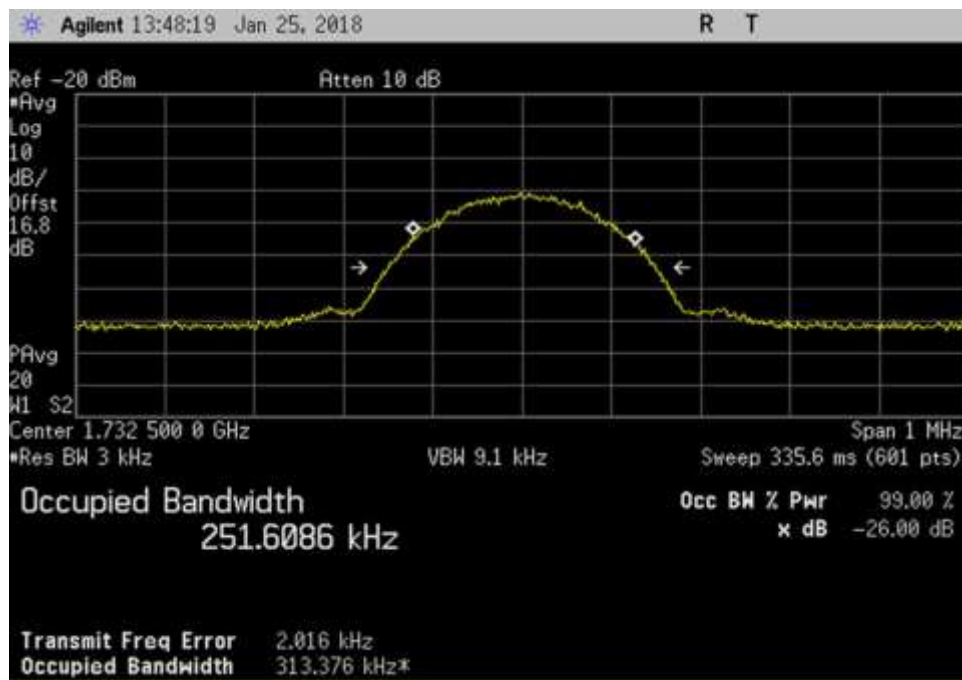
UL_707MHz_GSM



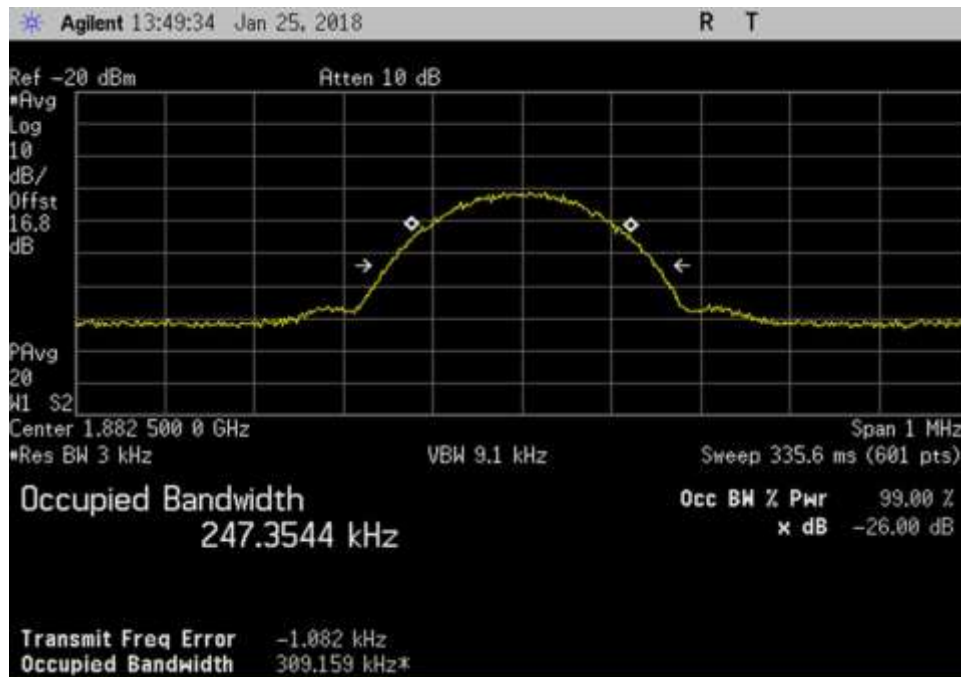
UL_781.5MHz_GSM



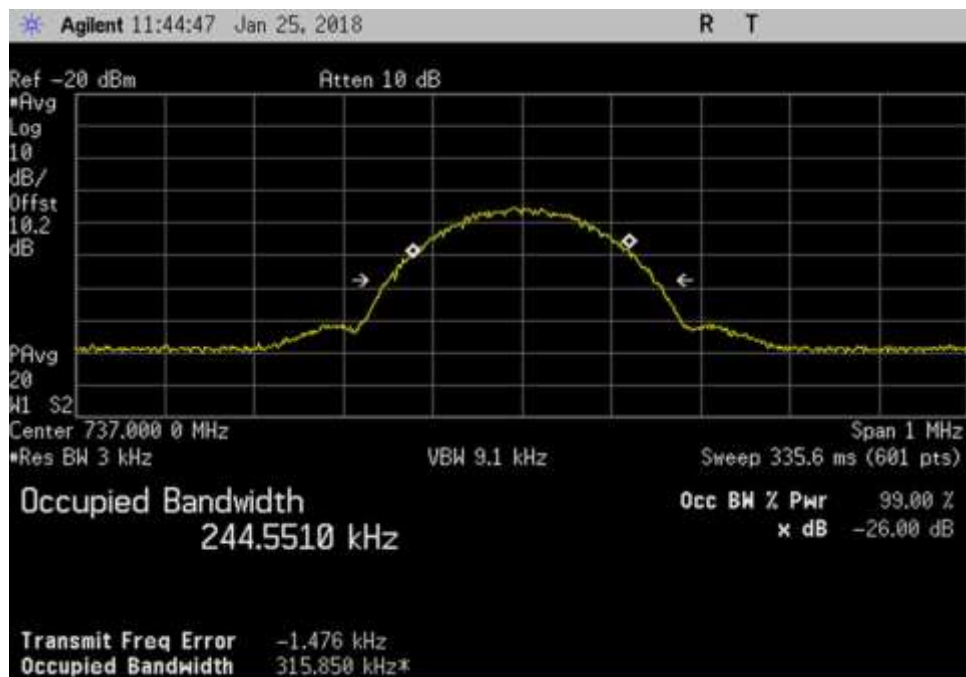
UL_ 836.5MHz_GSM



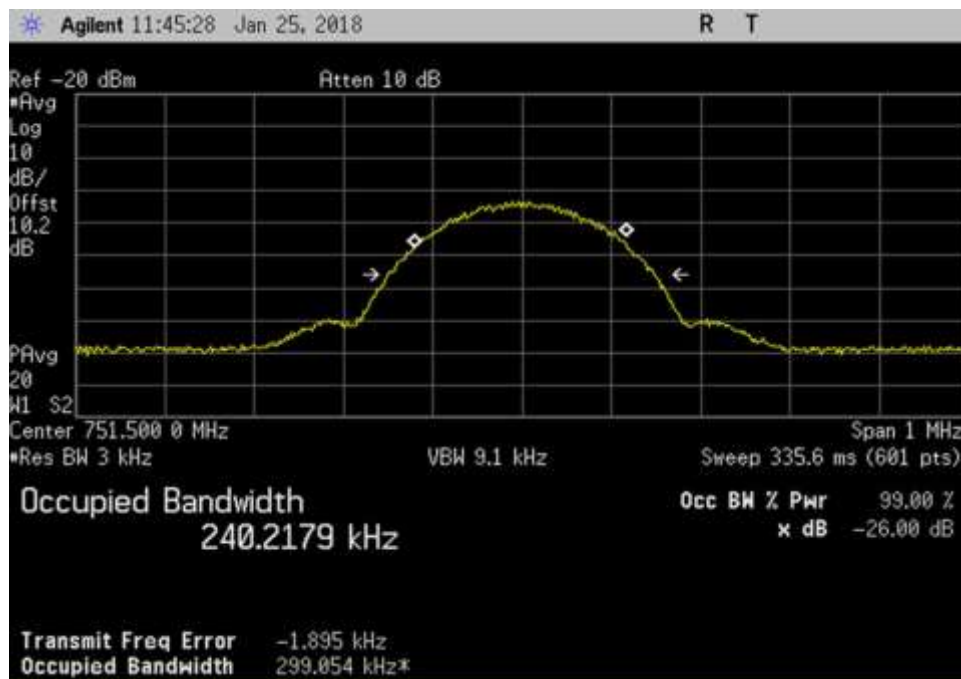
UL_ 1732.5MHz_GSM



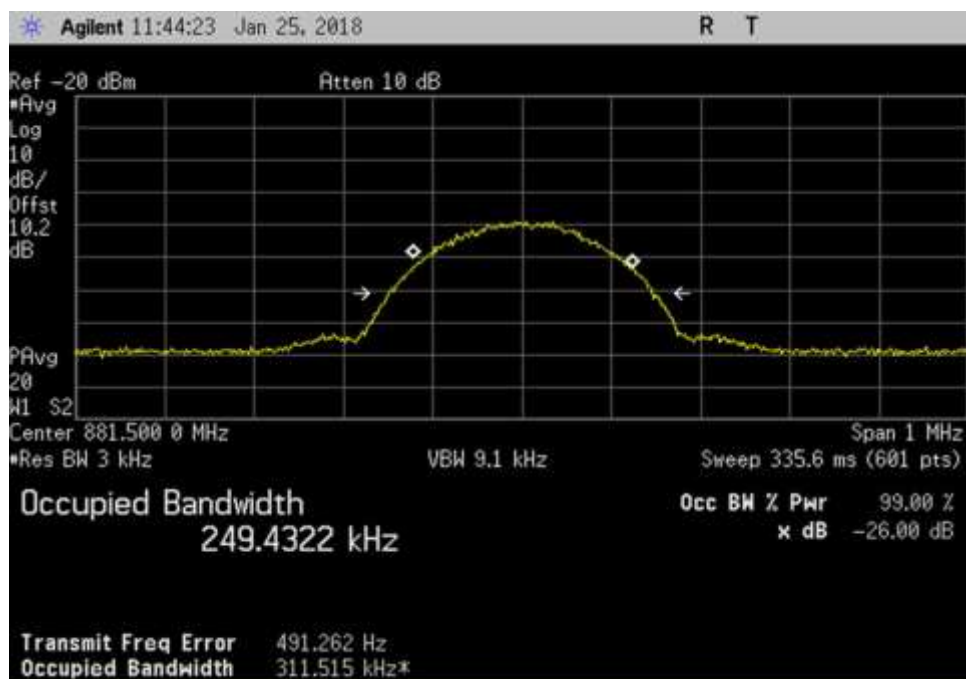
UL_1882.5MHz_GSM



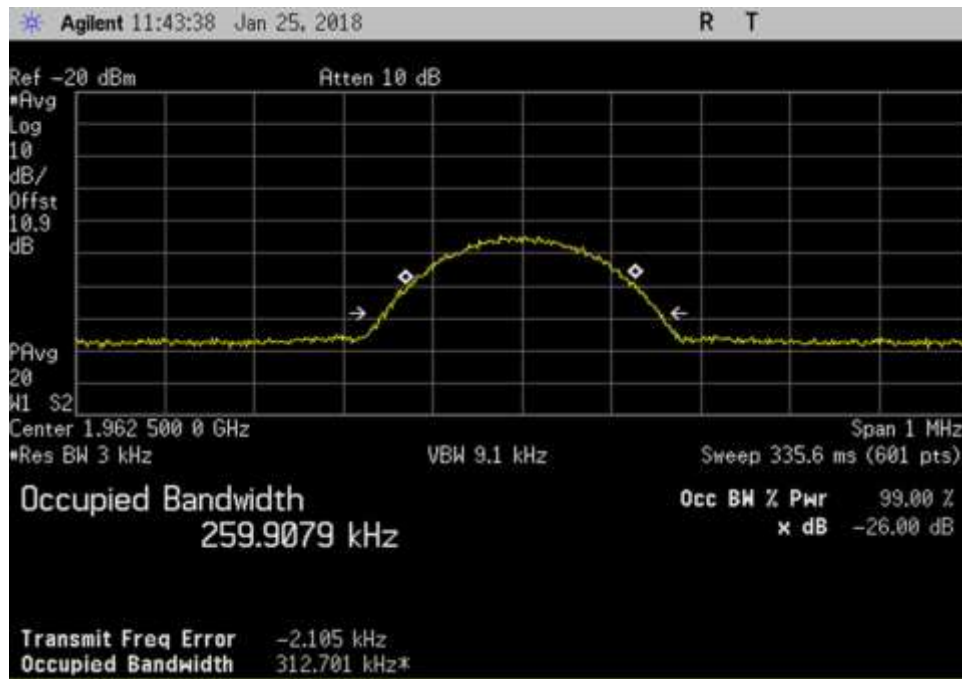
DL_737MHz_GSM



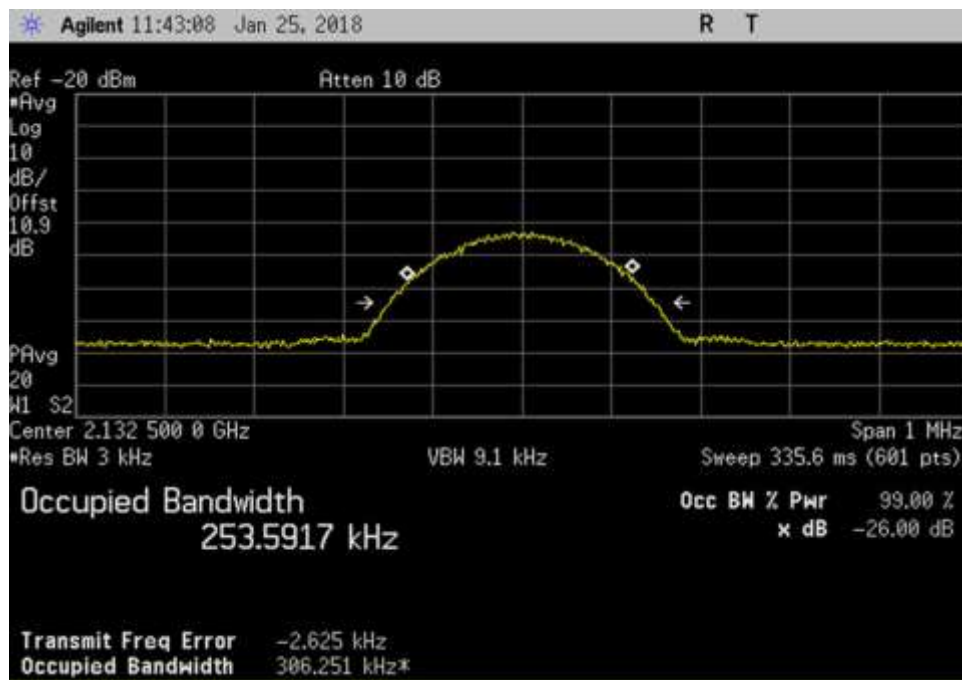
DL_751.5MHz_GSM



DL_881.5MHz_GSM

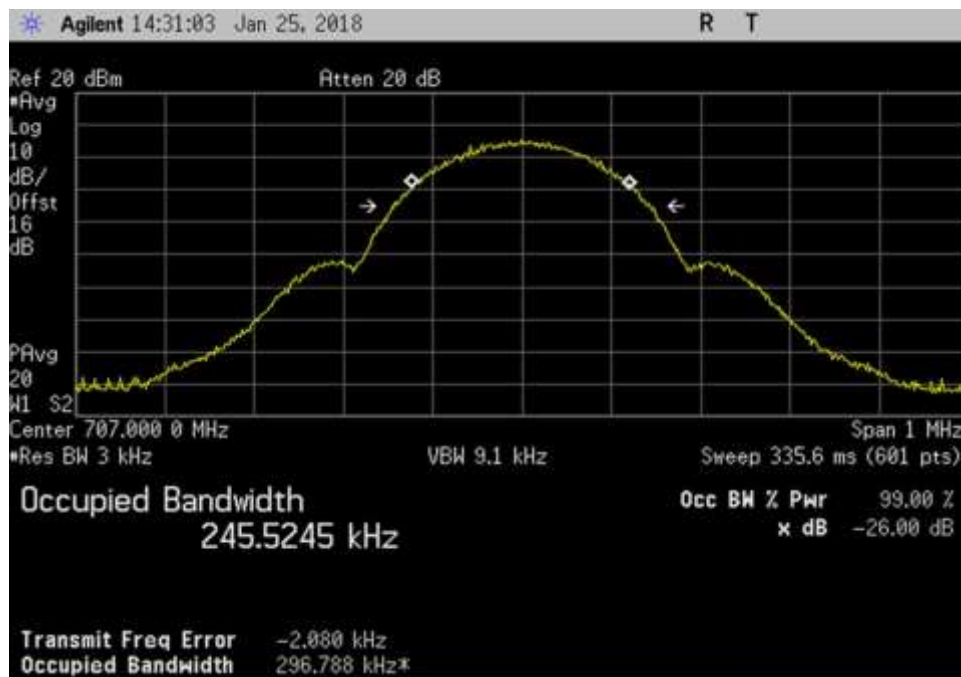


DL_1962.5MHz_GSM

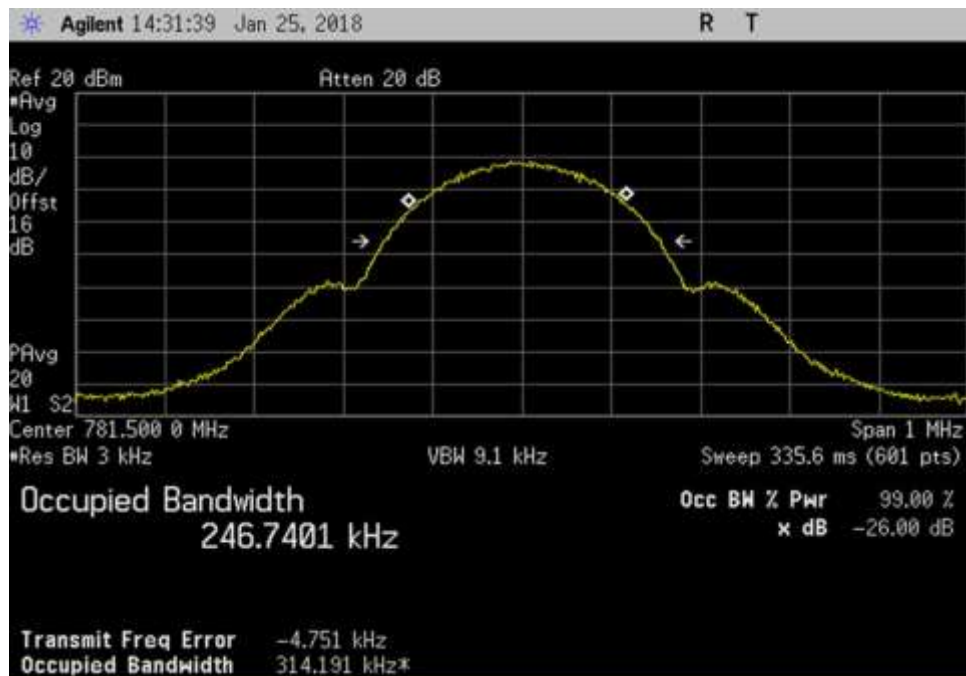


DL_2132.5MHz_GSM

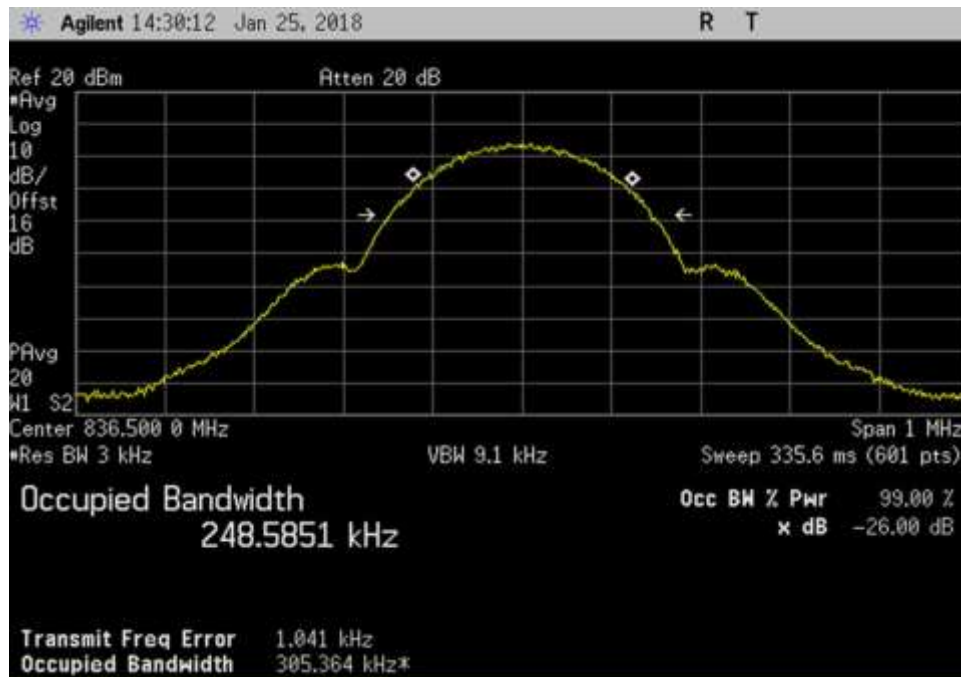
GSM Output



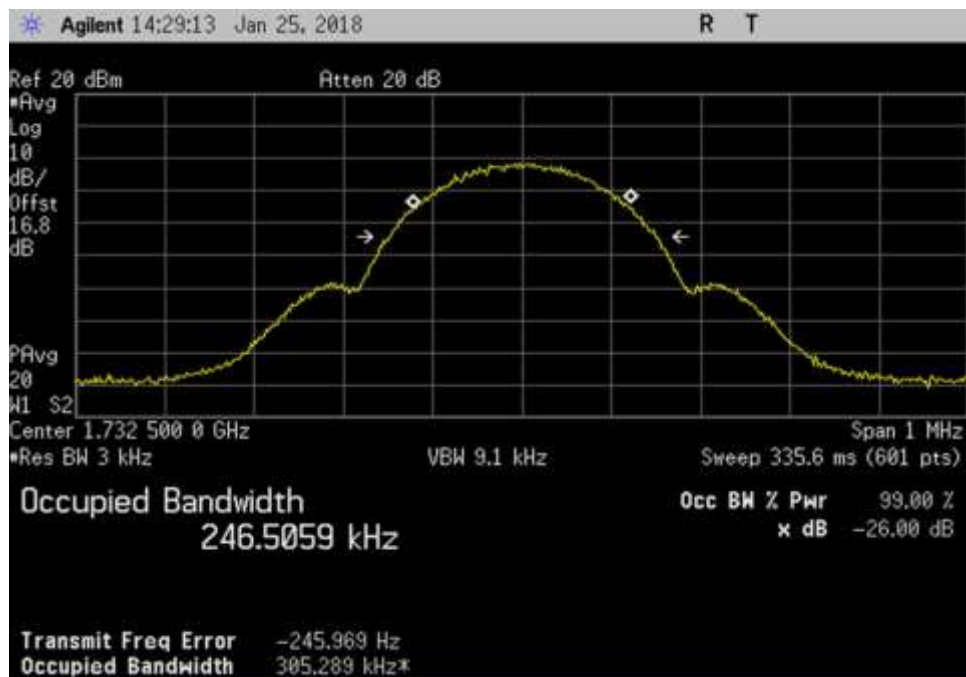
UL_707MHz_GSM



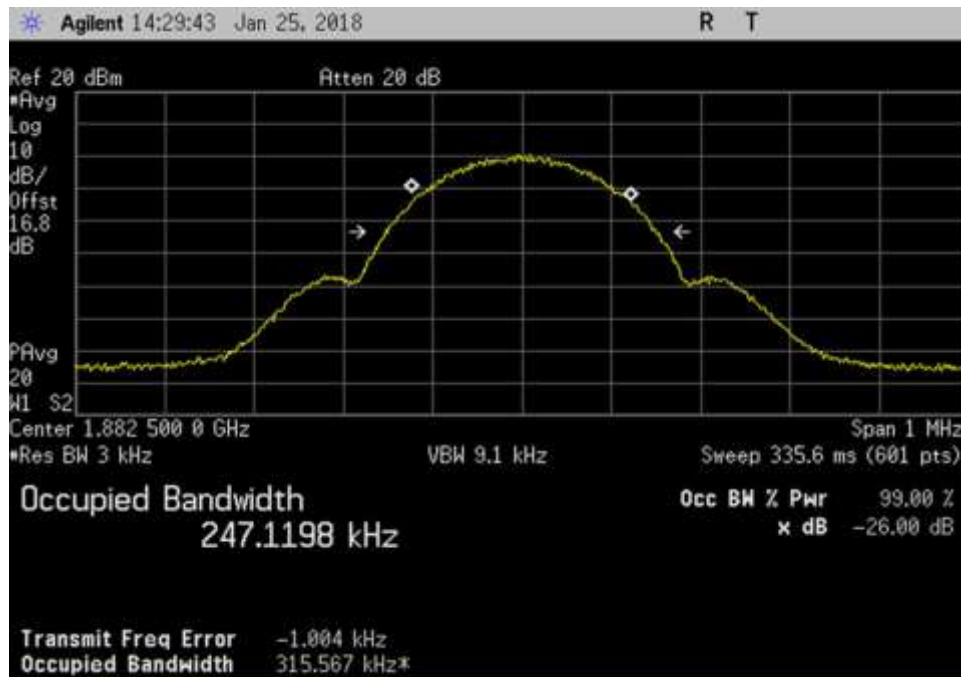
UL_781.5MHz_GSM



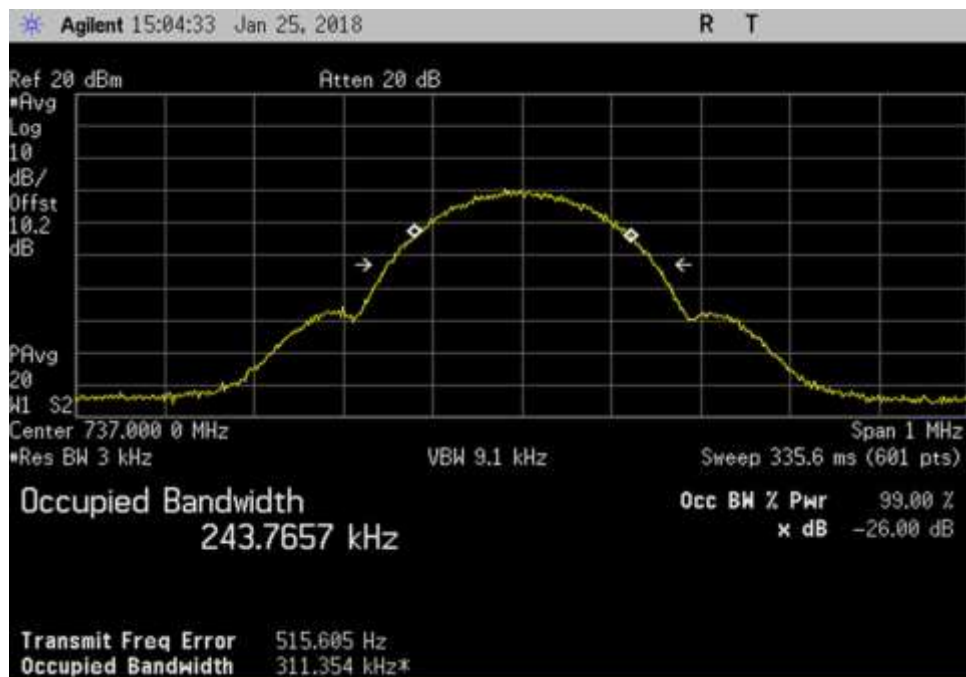
UL_ 836.5MHz_GSM



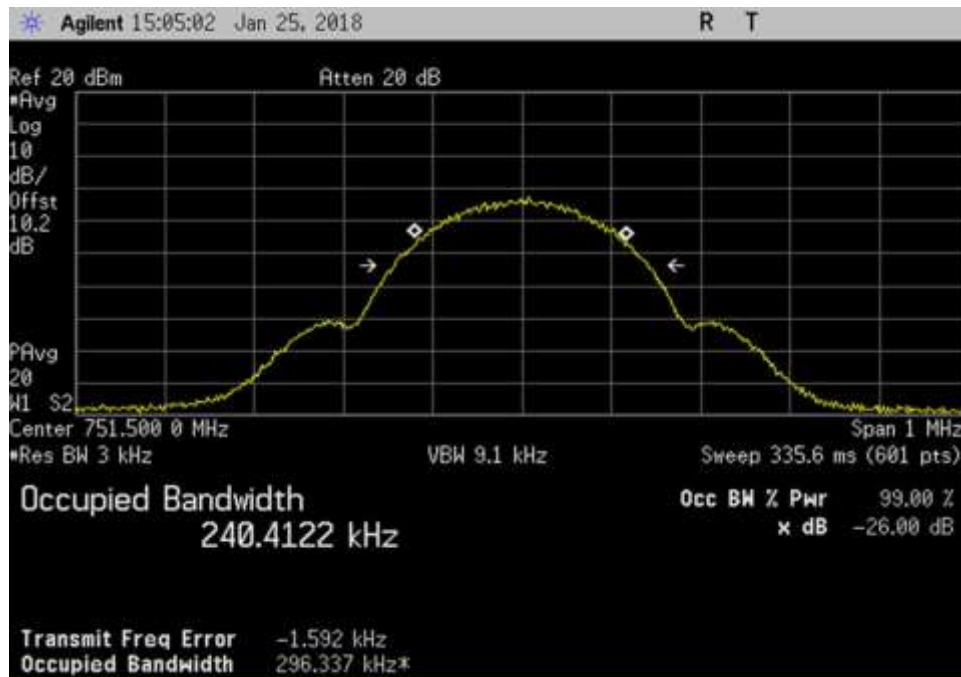
UL_ 1732.5MHz_GSM



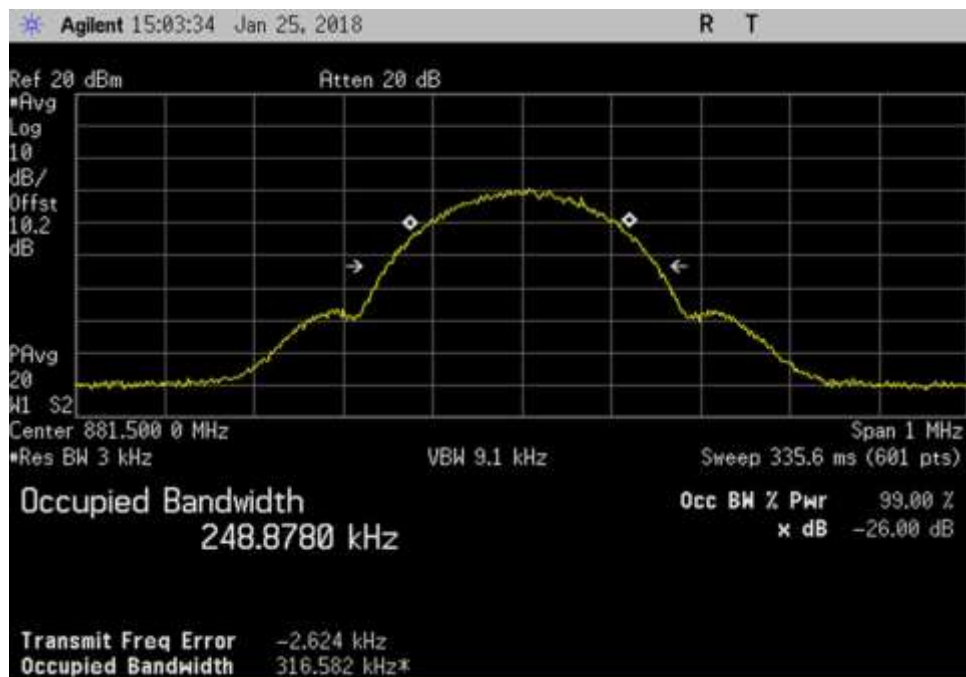
UL_1882.5MHz_GSM



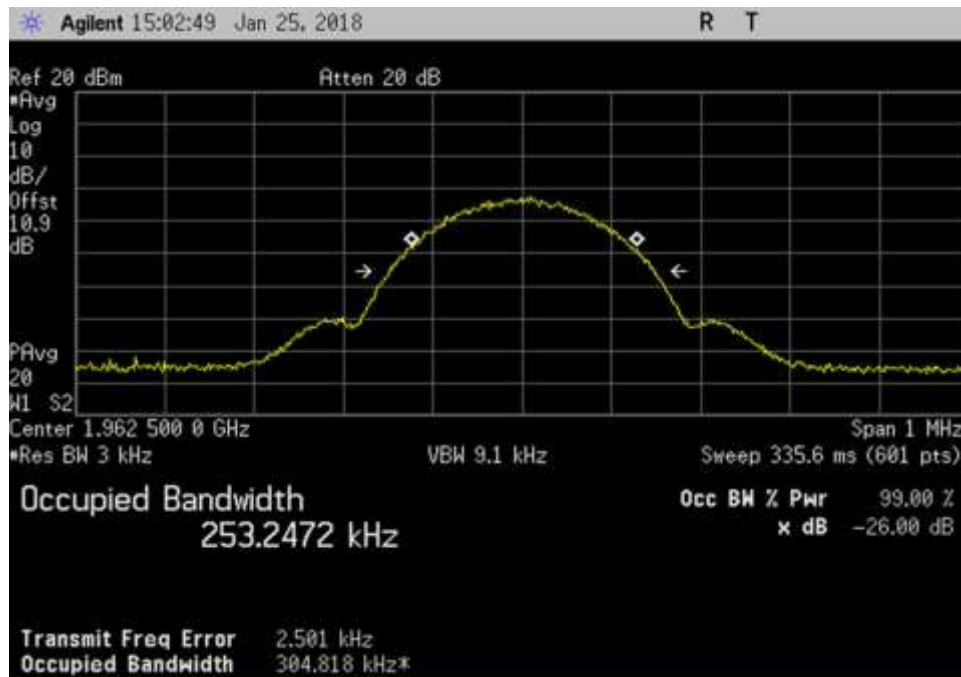
DL_737MHz_GSM



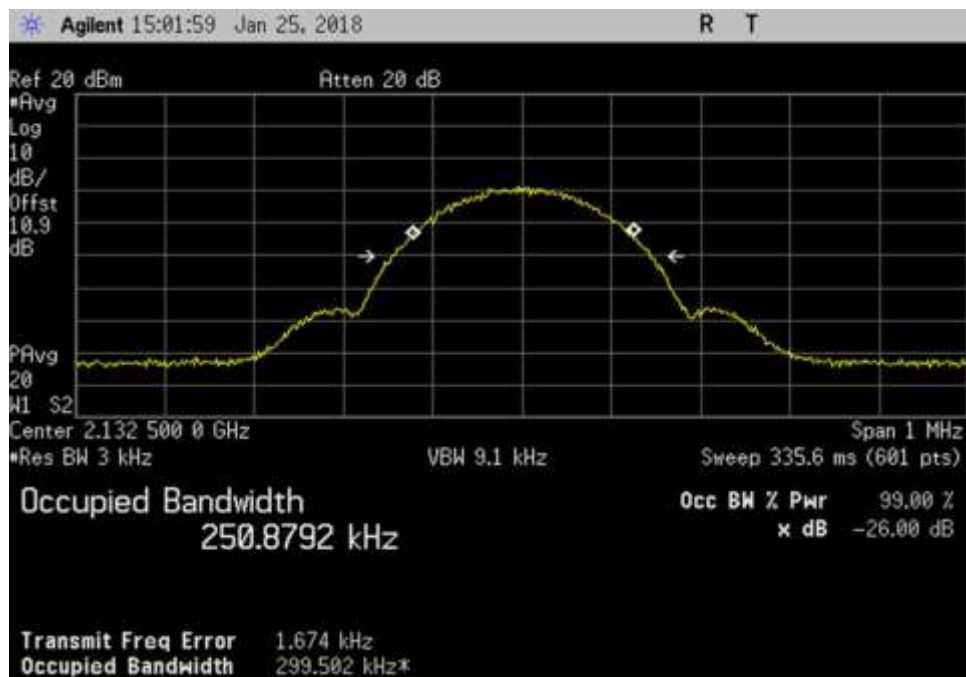
DL_ 751.5MHz_GSM



DL_ 881.5MHz_GSM

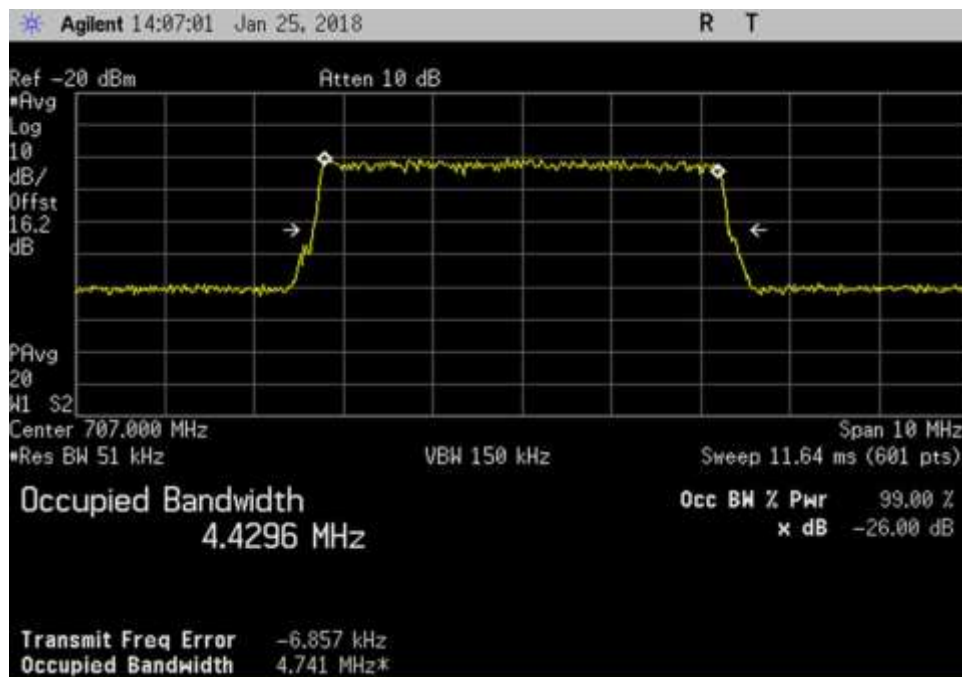


DL_1962.5MHz_GSM

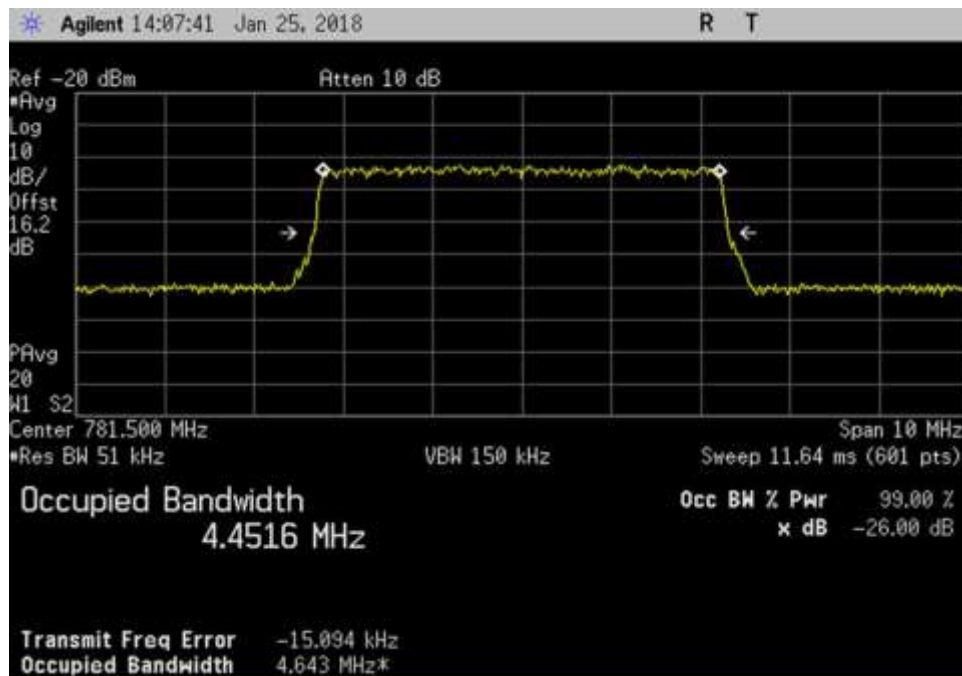


DL_2132.5MHz_GSM

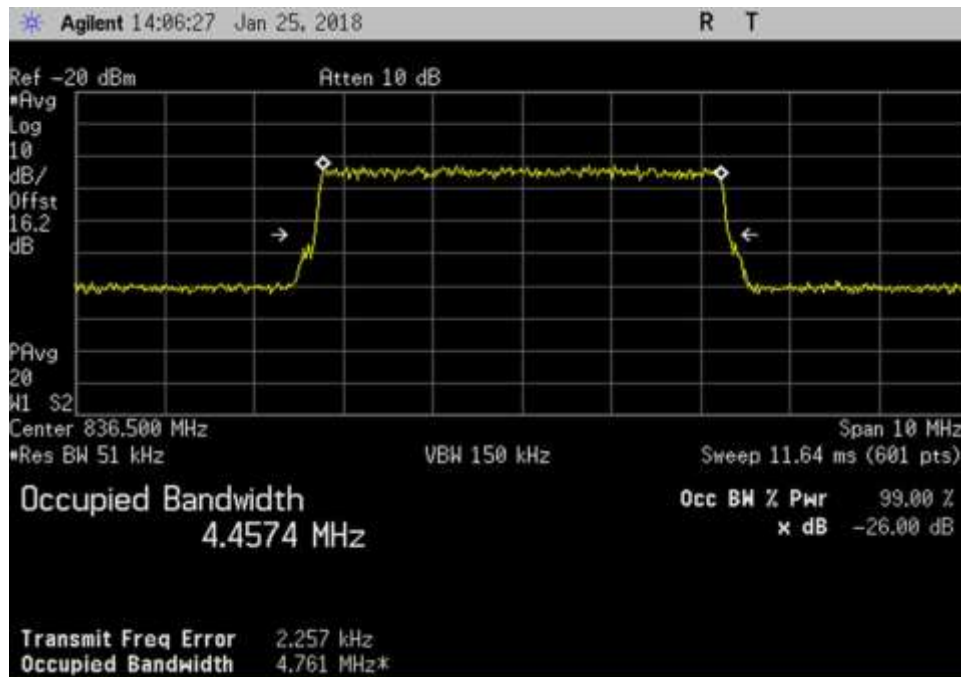
LTE Input



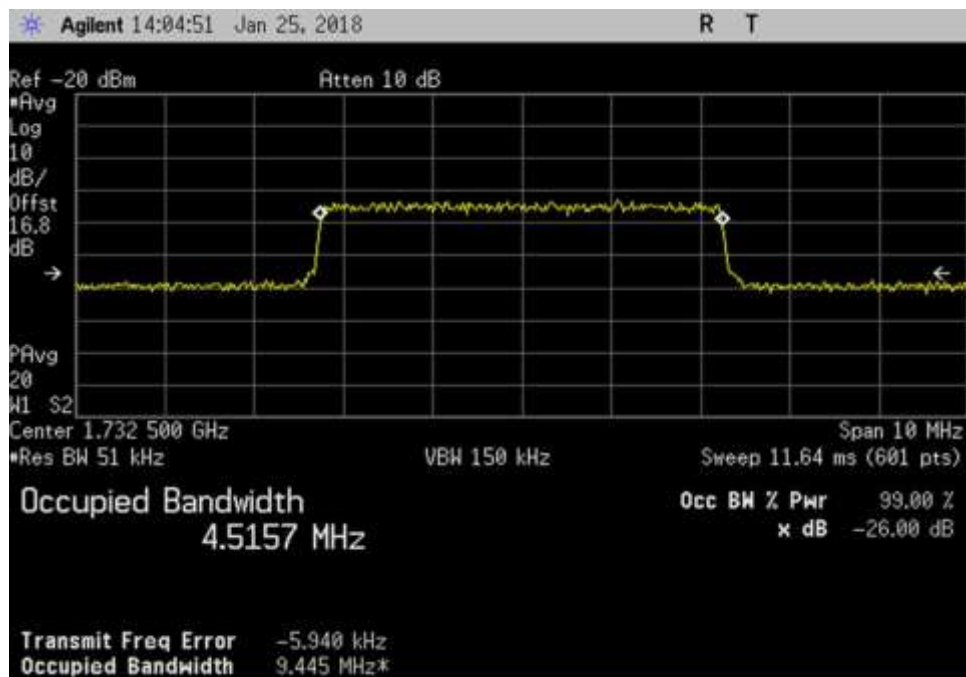
UL_ 707MHz_LTE



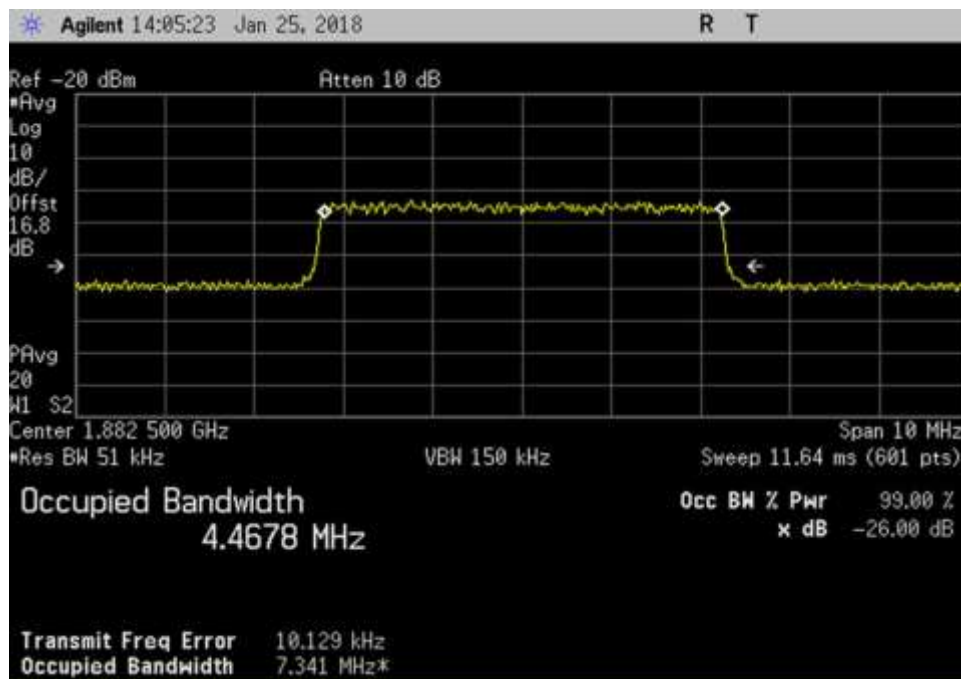
UL_ 781.5MHz_LTE



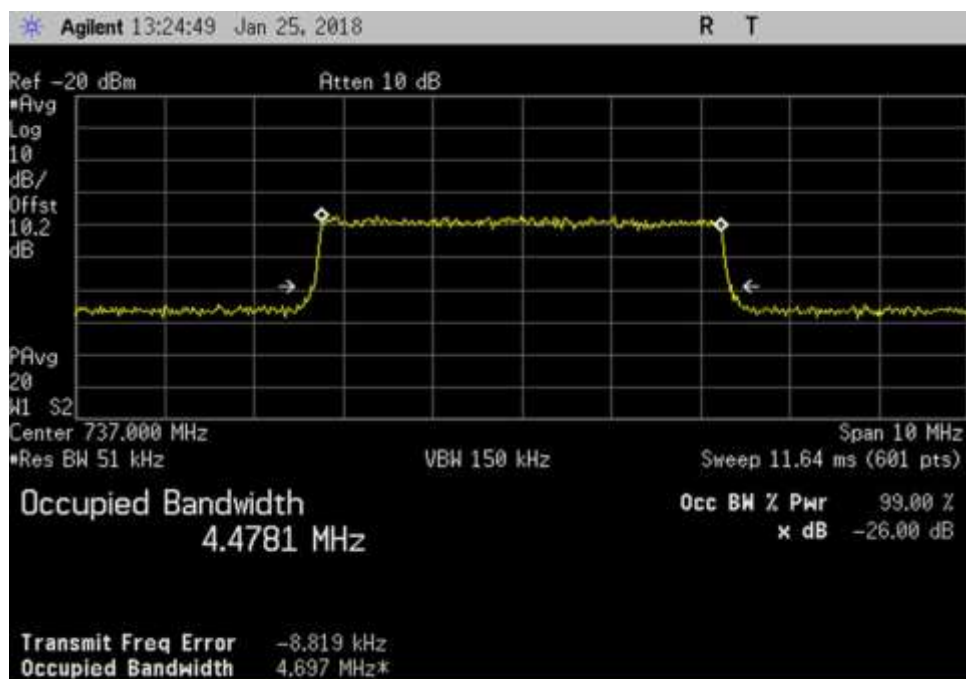
UL_ 836.5MHz_LTE



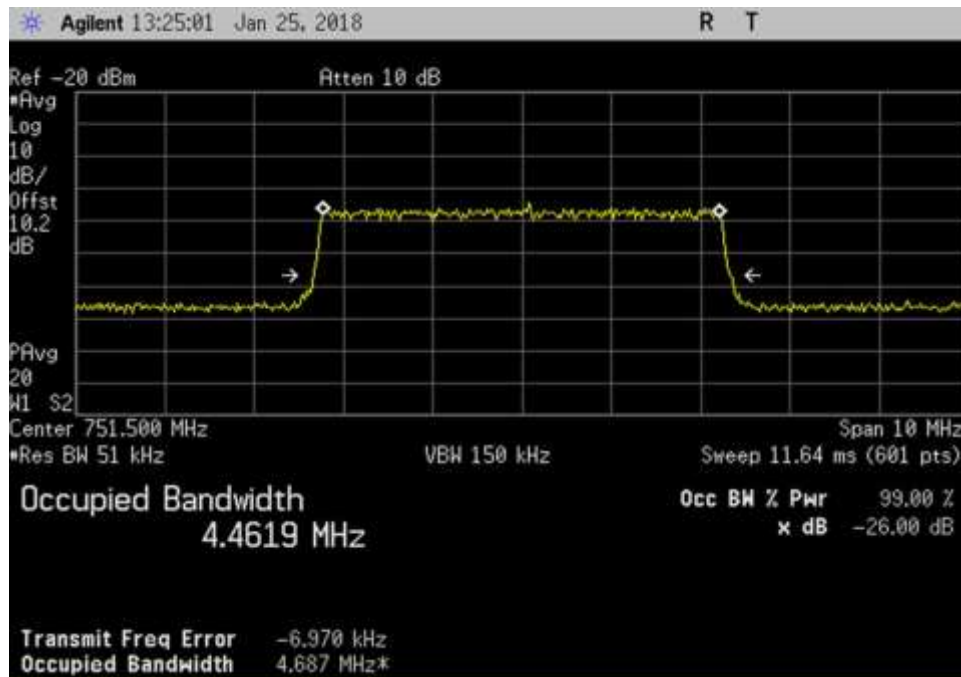
UL_ 1732.5MHz_LTE



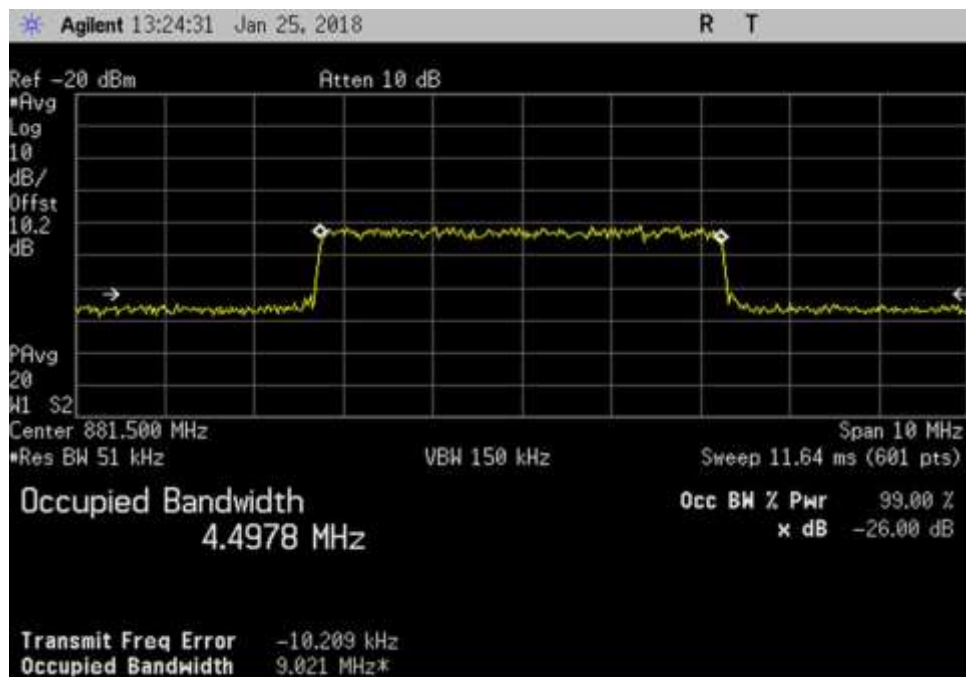
UL_1882.5MHz_LTE



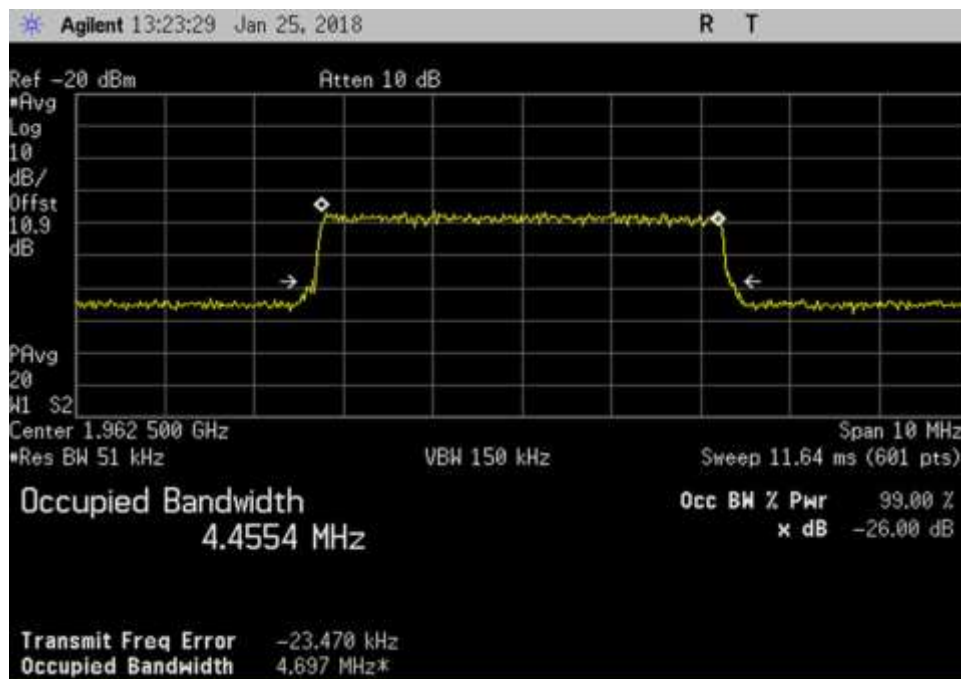
DL_737MHz_LTE



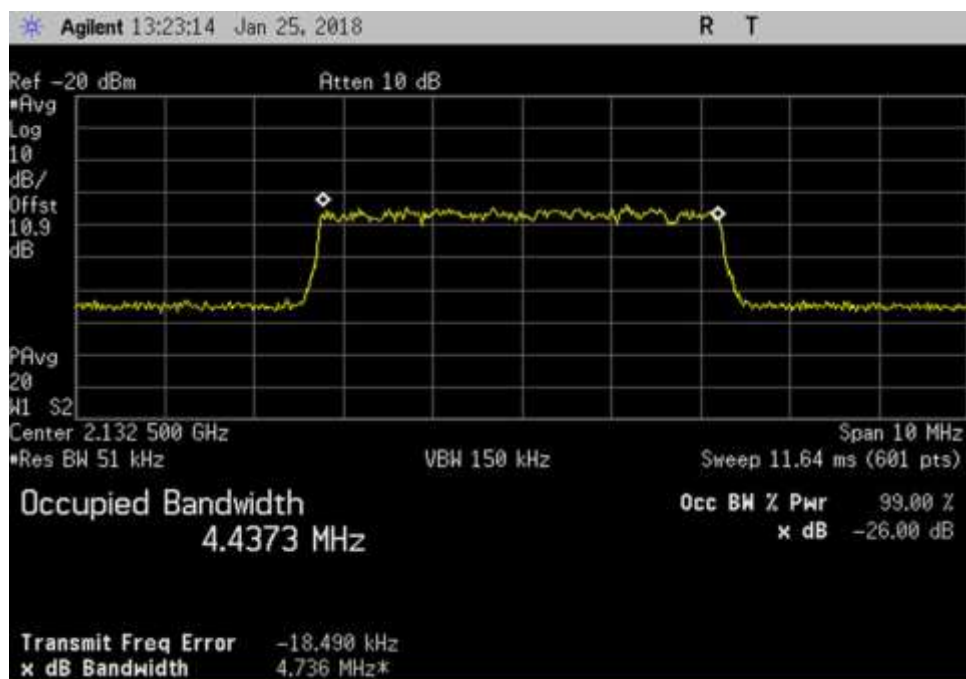
DL_751.5MHz_LTE



DL_881.5MHz_LTE

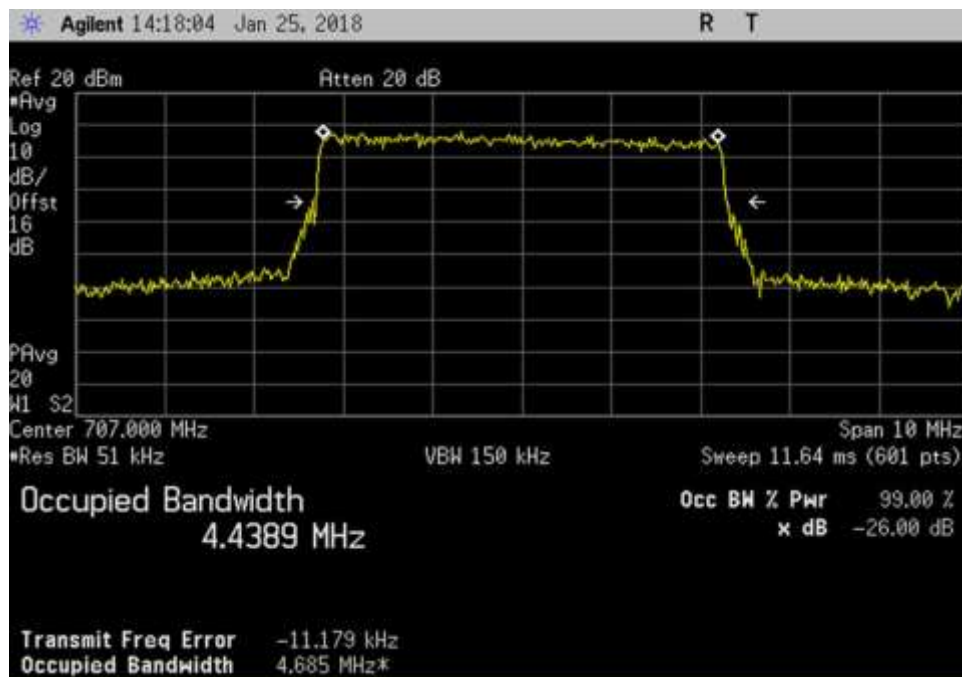


DL_ 1962.5MHz_LTE

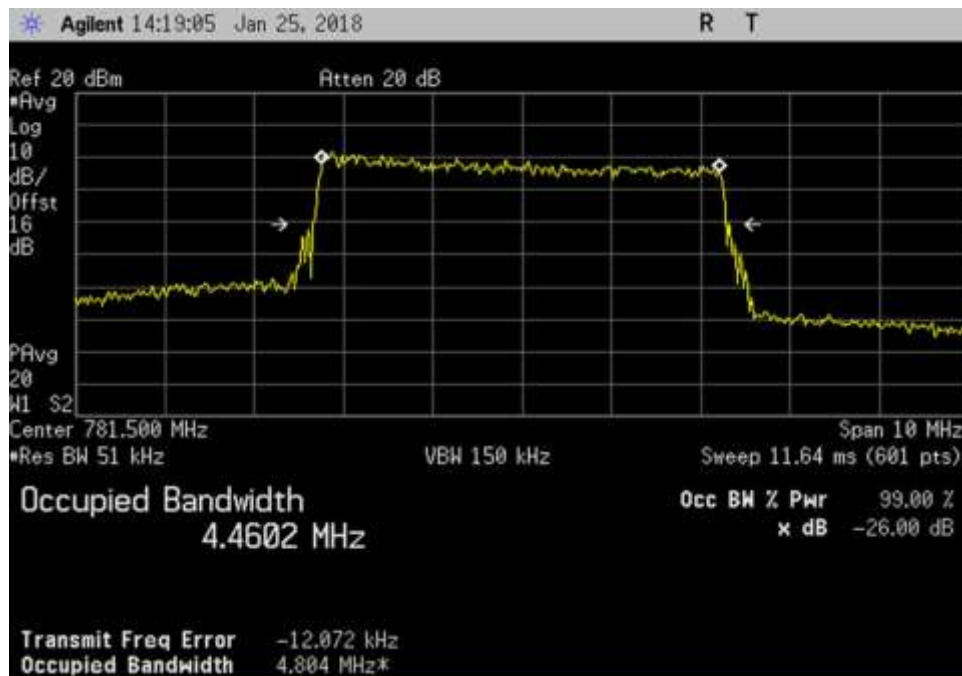


DL_ 2132.5MHz_LTE

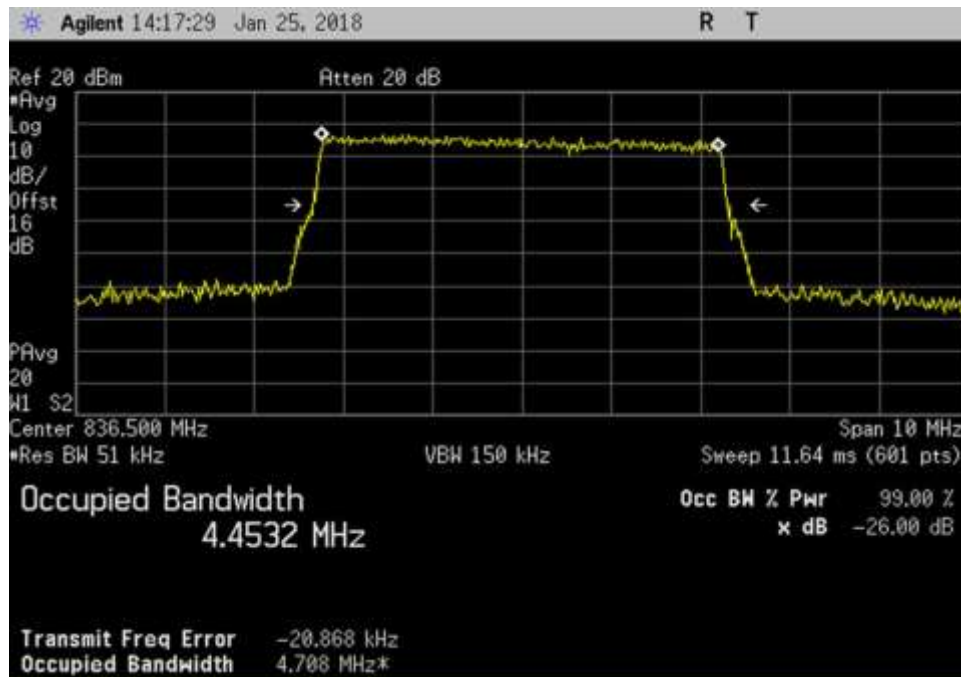
LTE Output



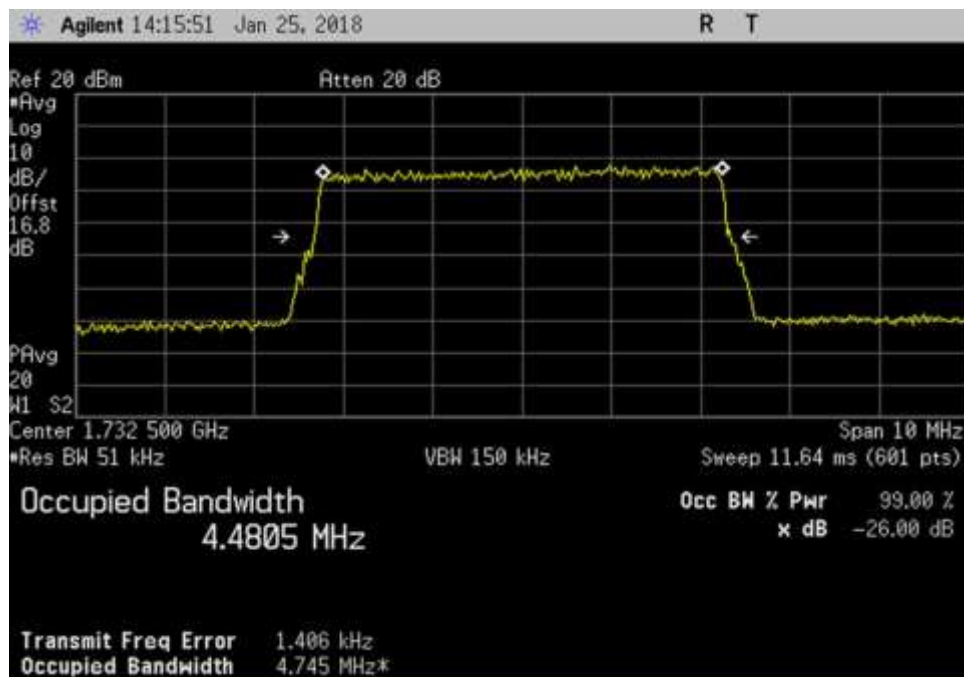
UL_ 707MHz_LTE



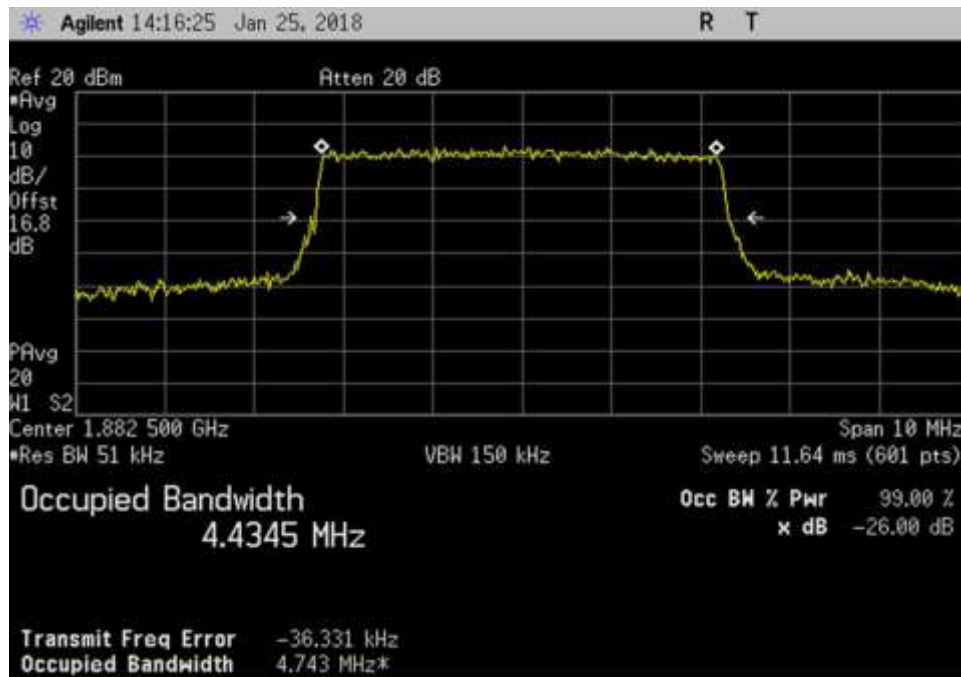
UL_ 781.5MHz_LTE



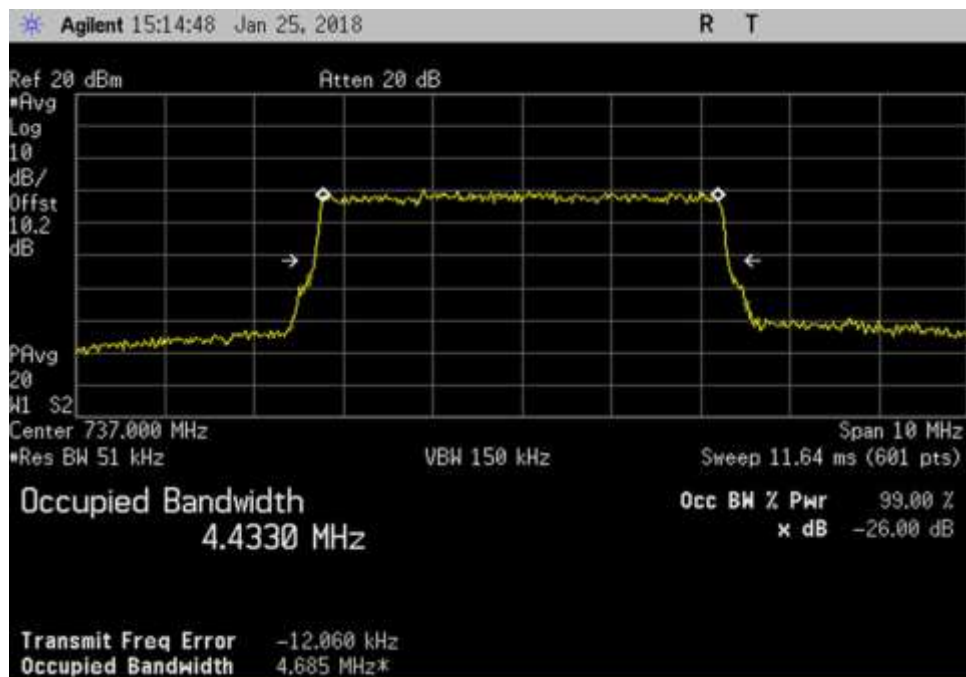
UL_ 836.5MHz_LTE



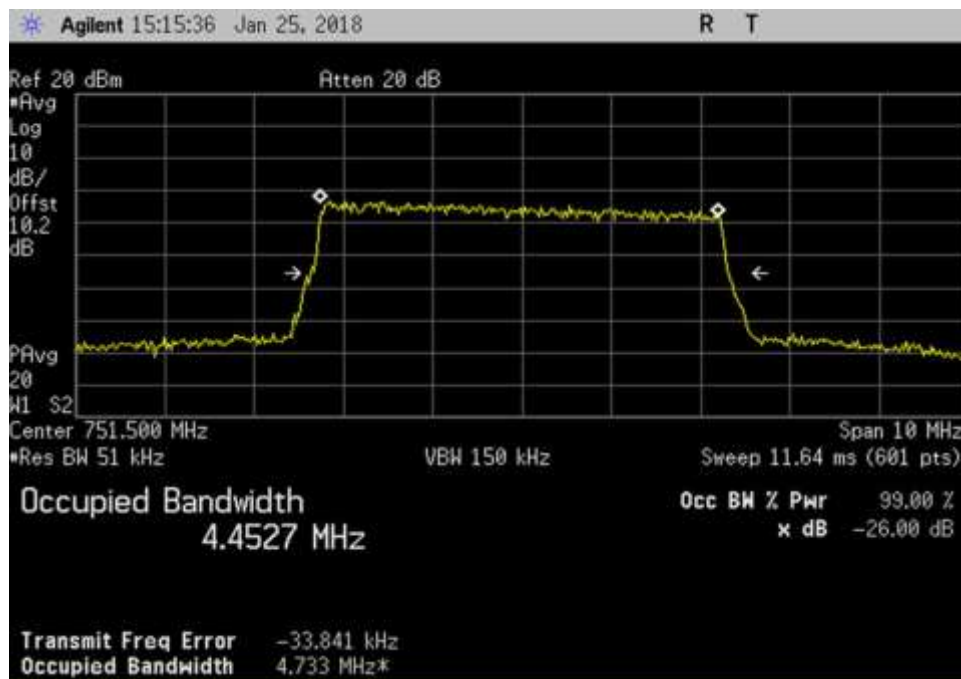
UL_ 1732.5MHz_LTE



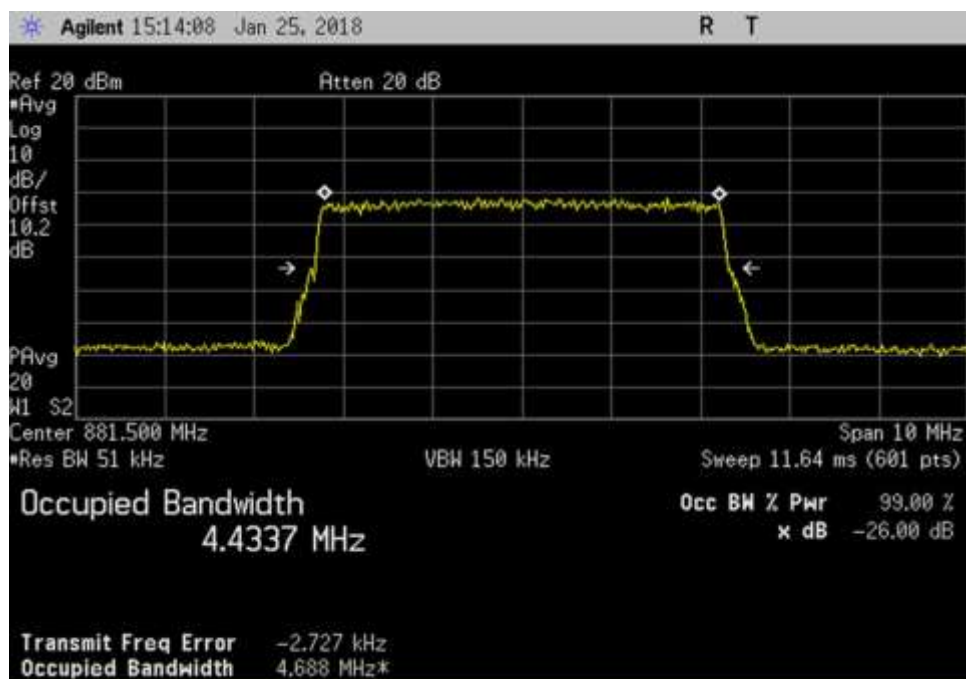
UL_1882.5MHz_LTE



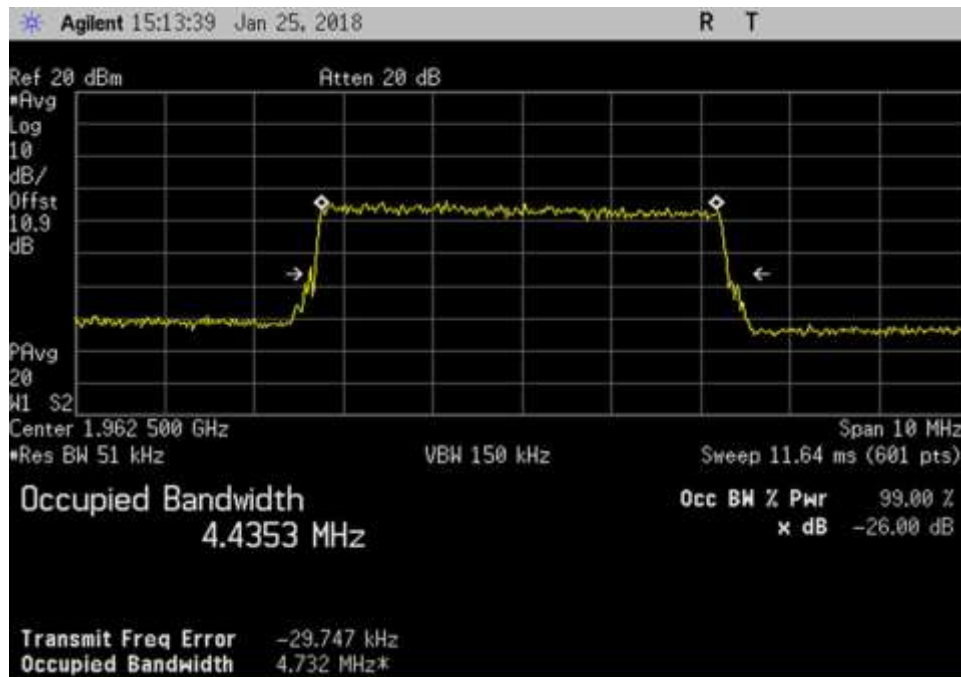
DL_737MHz_LTE



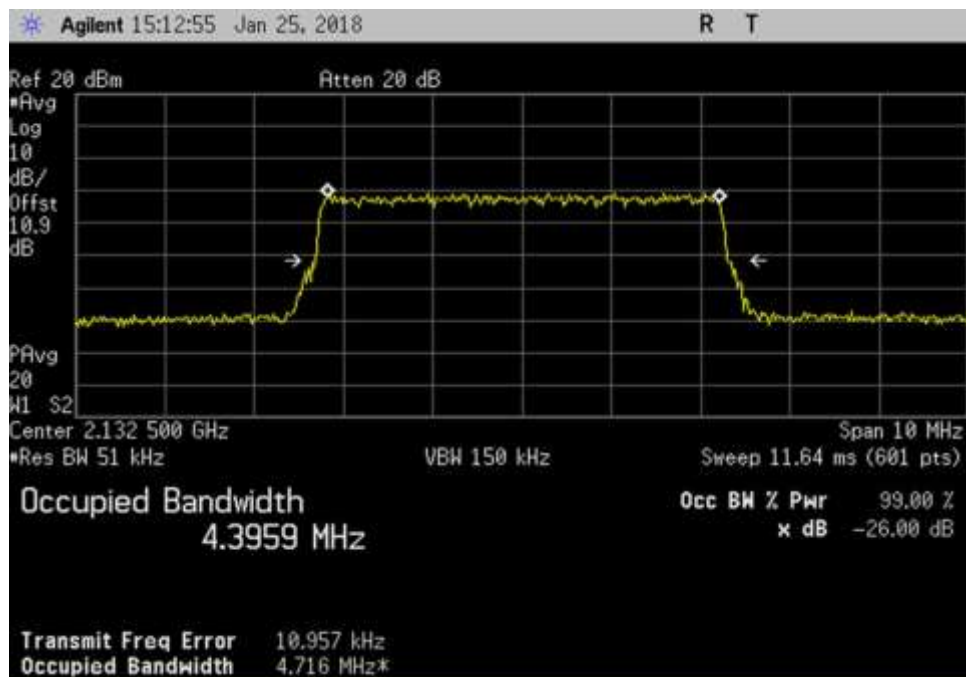
DL_751.5MHz_LTE



DL_881.5MHz_LTE



DL_1962.5MHz_LTE



DL_2132.5MHz_LTE

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 #: **100825** 1/21/2018
 Test Type: **Conducted Emissions**
 Tested By: **Hieu Song Nguyenpham/Eddie Wong**
 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: 21.3°C
 Relative Humidity: 48%
 Pressure: 101.3 kPa

Modification #1 and #2 were 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
P06909	Attenuator	Pasternack	PE7083	12/20/2017	12/20/2019
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	Measured	Limit	Peak Level	Measured	Limit	Measured	Limit
MHz	Sec	Sec	dBm	Sec	At least sec		
UL1710-1755	0.236	0.3	23.2	70	60	2	5
UL1850-1915	0.283	0.3	24.5	70	60	2	5
UL824-894	0.266	0.3	30.2	70	60	2	5
UL 698-716	0.183	0.3	29.09	70	60	2	5
UL776-787	0.267	0.3	25.2	67	60	2	5
DL2110-2155	0.2	1.0	25.96	74	60	2	5
DL1930-1995	0.22	1.0	26.25	70	60	2	5
DL869-894	0.5	1.0	25.32	73	60	2	5
DL:728-746	0.425	1.0	22.84	66	60	2	5
DL 746-757	0.225	1.0	19.1	70	60	2	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	Pk-Pk Difference	Pk-Pk Difference	Pk-Pk Difference	Pk-Pk Difference	Pk-Pk Difference	Limit
dB	dB	dB	dB	dB	dB	dB
+5dB	15.8*	15.0*	6.0	7.0	5.0	12.0
+4dB	18.0*	15.9*	7.0	9.0	6.2	12.0
+3dB	29.0*	18.0*	7.2	9.4	6.4	12.0
+2dB	56.0*	20.0*	7.9	10.0	7.6	12.0
+1dB	**	22.0*	10.0	11.0	7.4	12.0
0dB	**	26.0*	11.0	13.0*	8.0	12.0
-1dB	**	39.0*	11.0	15.0*	9.0	12.0
-2dB	**	69.0*	13.0*	17.0*	11.0	12.0
-3dB	**	**	16.0*	21.0*	12.5*	12.0
-4dB	**	**	20.0*	25.0*	14.0*	12.0
-5dB	**	**	24.0*	**	**	12.0

	DL 2110-2155	DL 1930-1995	DL 869-894	DL 728-746	DL 746-775	
Max Gain Isolation	Pk-Pk Difference	Pk-Pk Difference	Pk-Pk Difference	Pk-Pk Difference	Pk-Pk Difference	Limit
dB	dB	dB	dB	dB	dB	dB
+5dB	12.0*	12.4*	9.0	7.0	10.0	12.0
+4dB	14.6*	19.0*	11.0	8.3	11.0	12.0
+3dB	18.0*	19.0*	12.3*	9.6	13*	12.0
+2dB	24.0*	19.0*	13.4*	9.7	15*	12.0
+1dB	53.0*	26.0*	16.0*	11.0	18*	12.0
0dB	**	**	21.0*	12.7*	25*	12.0
-1dB	**	**	29.0*	14.8*	44*	12.0
-2dB	**	**	**	17.0*	**	12.0
-3dB	**	**	**	19.0*	**	12.0
-4dB	**	**	**	30.0*	**	12.0
-5dB	**	**	**	**	**	12.0

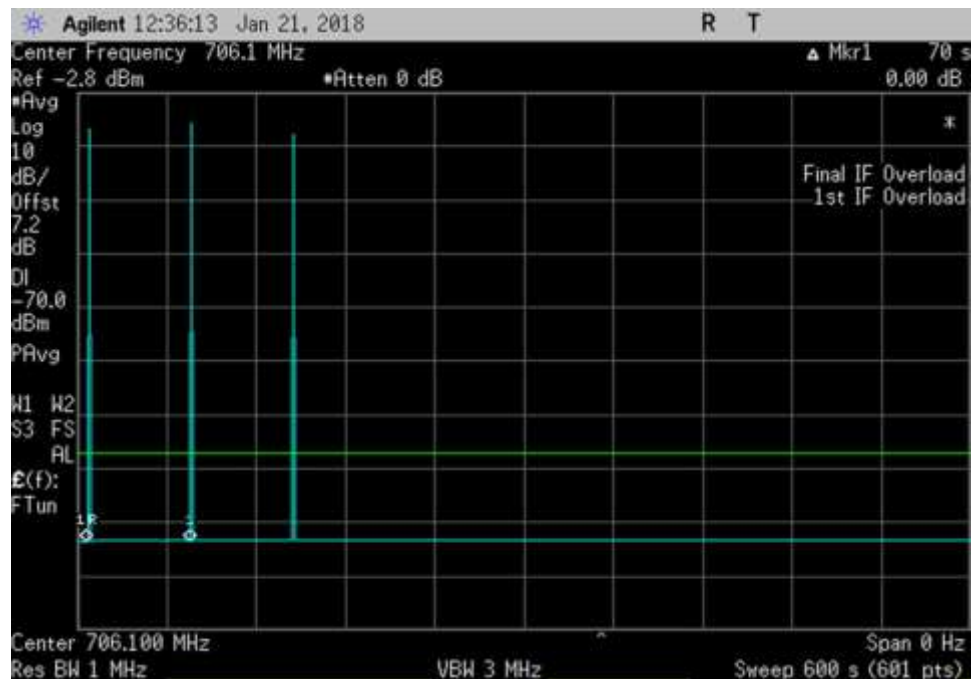
Note:

* 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 66 seconds for the Uplink bands and 63 seconds for the Downlink bands.

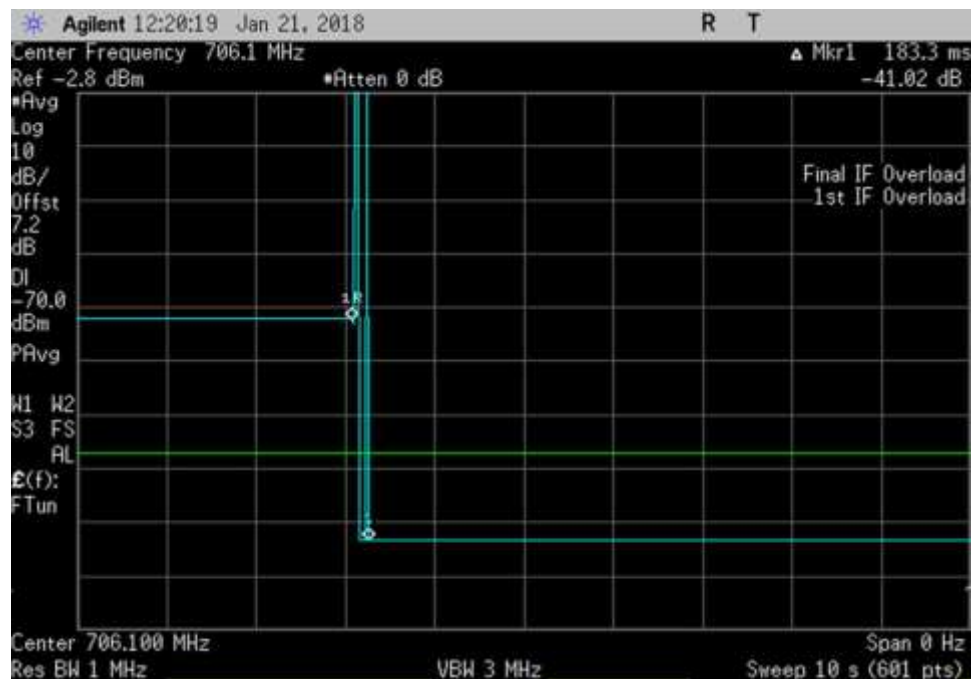
** The device shuts down immediately.

7.11.2 Oscillation Restart Tests

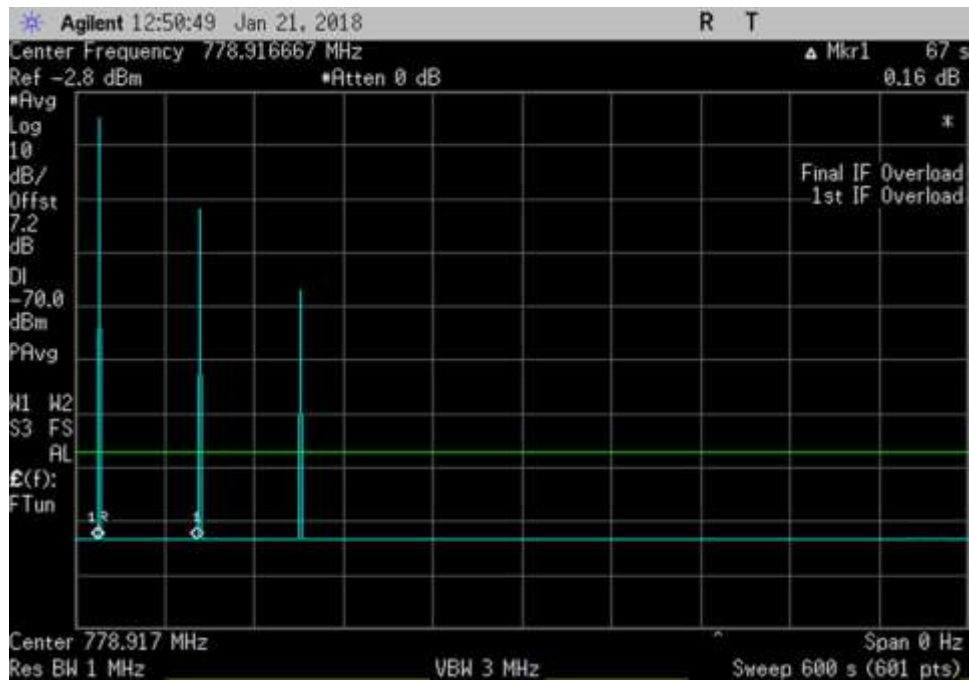
Plots



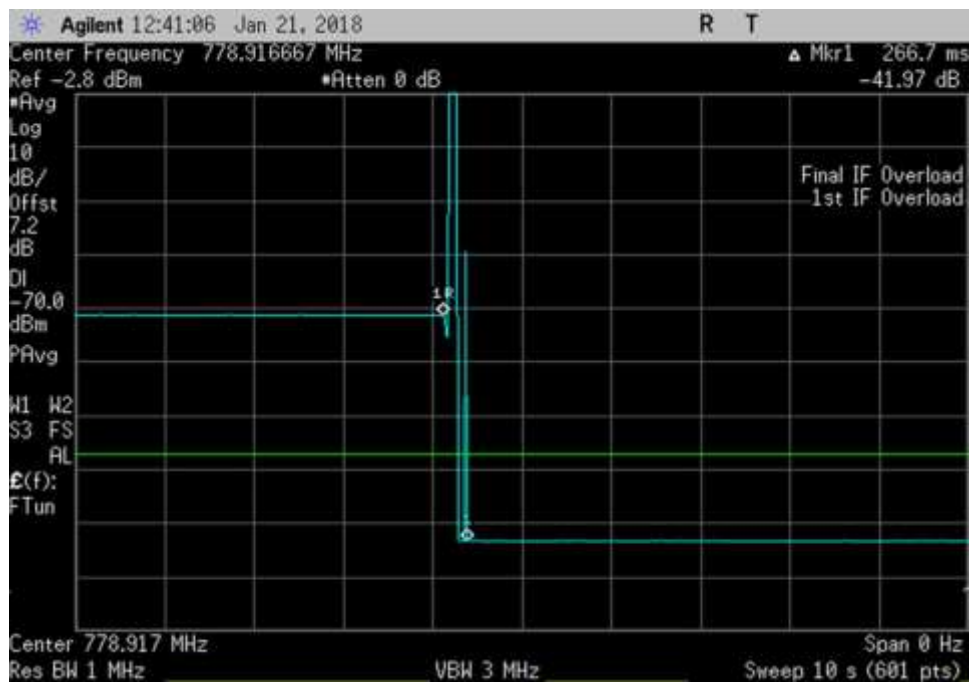
UL_ 706.1MHz_600sec



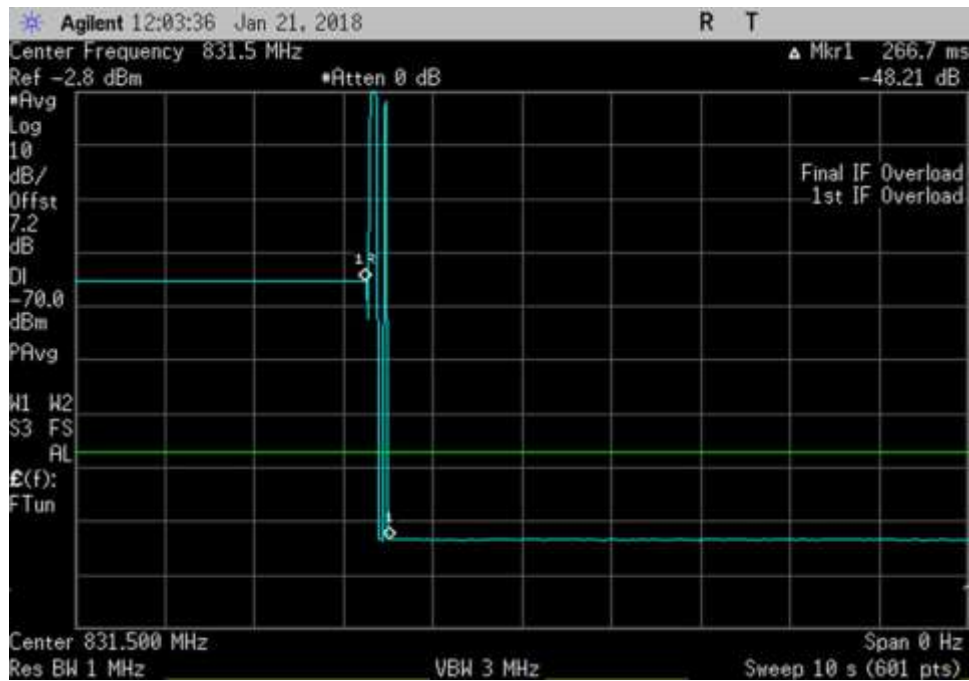
UL_ 706.1MHz_time



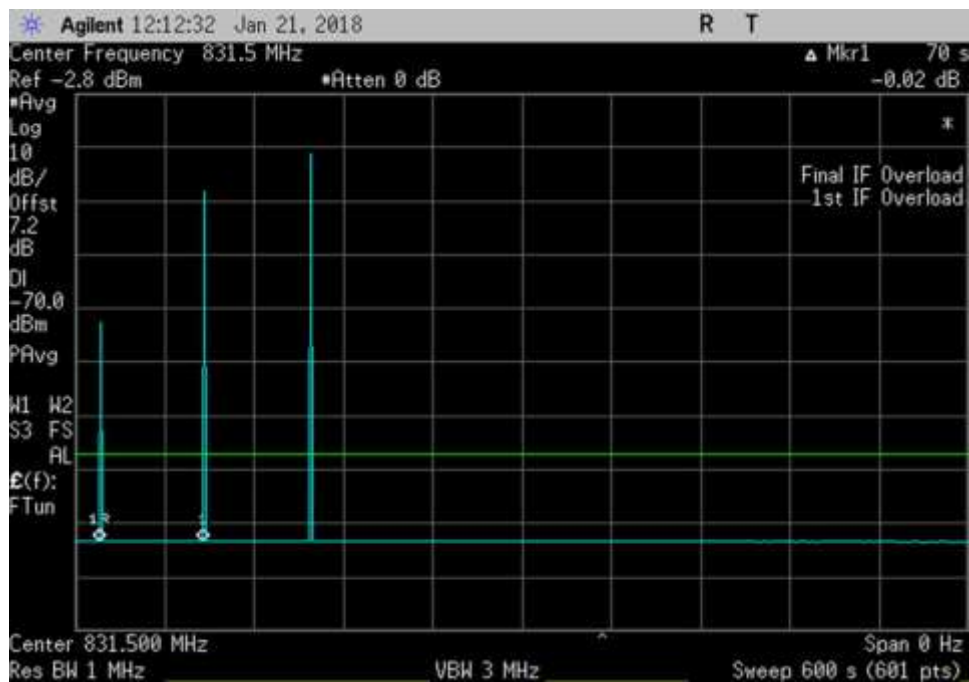
UL_ 778.916667MHz_600sec



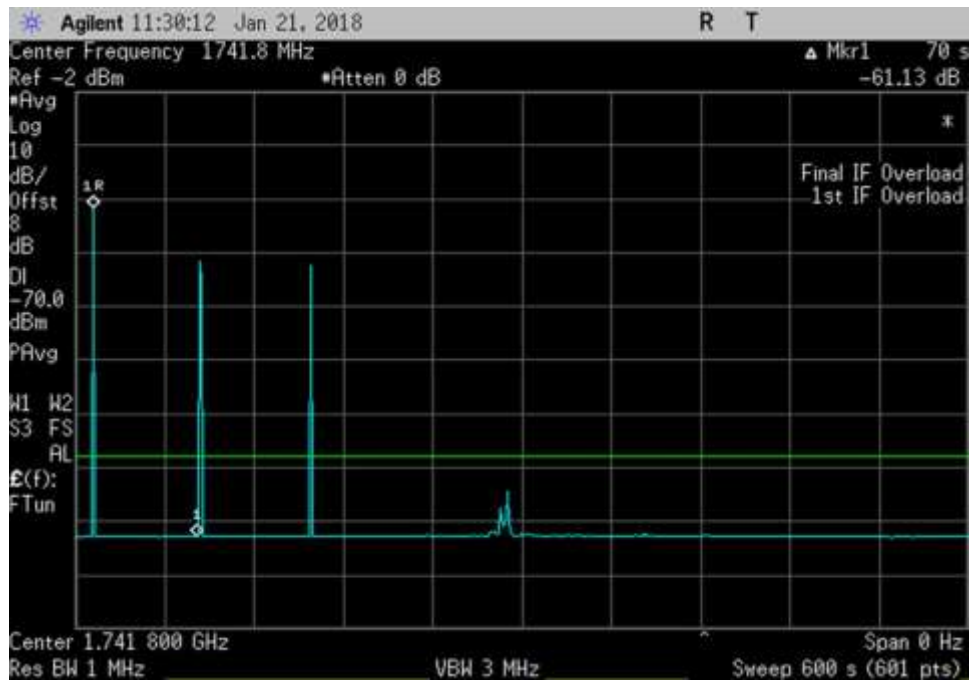
UL_ 778.916667MHz_time



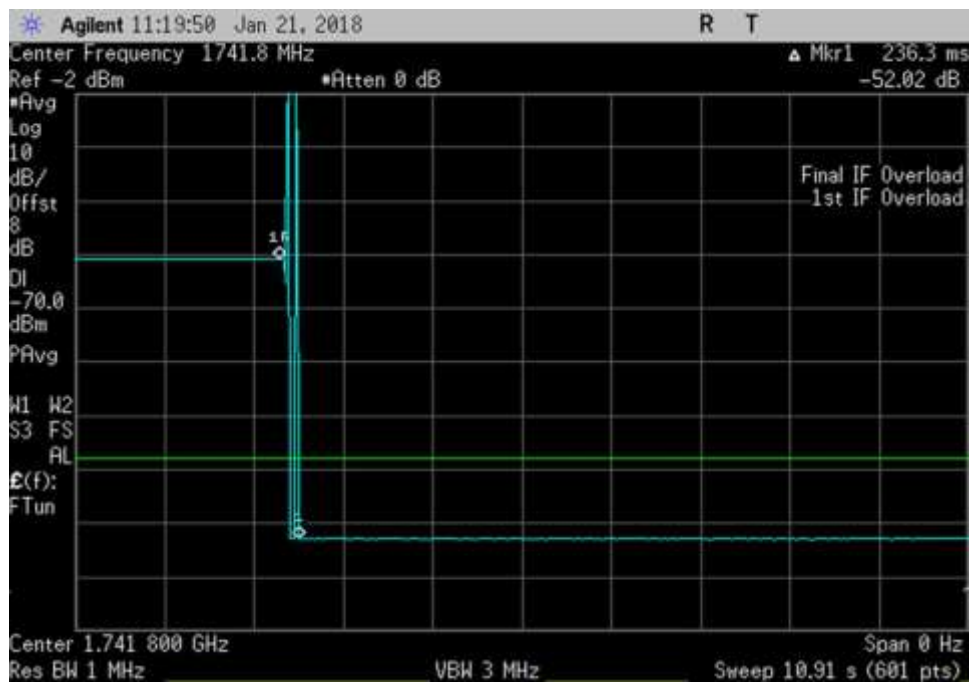
UL_831.5MHz_time



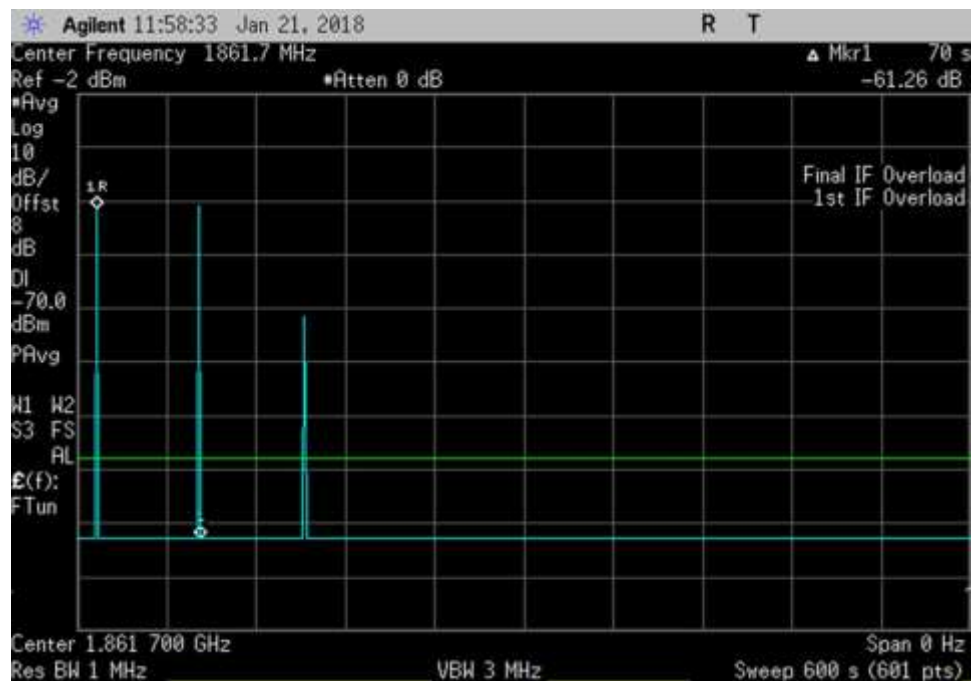
UL_831.5MHz_time_600sed



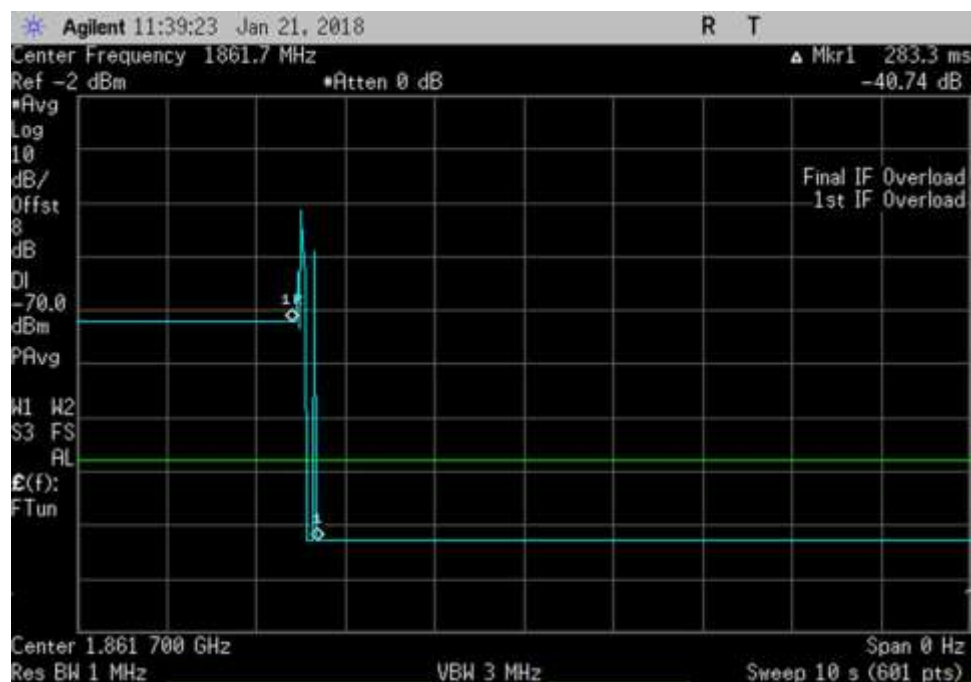
UL_1741.8MHz_600sec



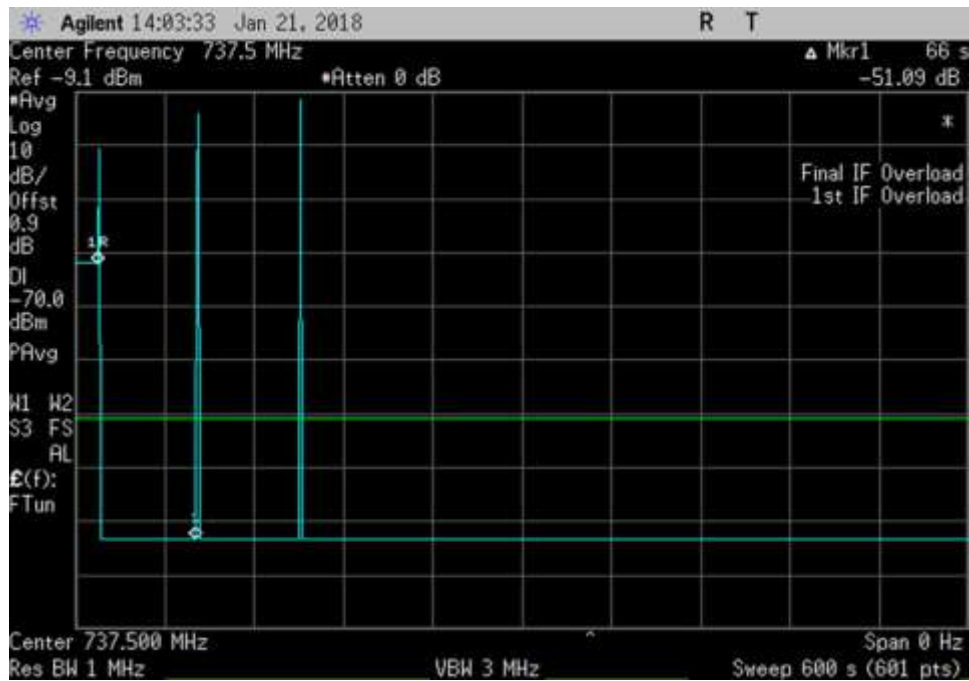
UL_1741.8MHz_time



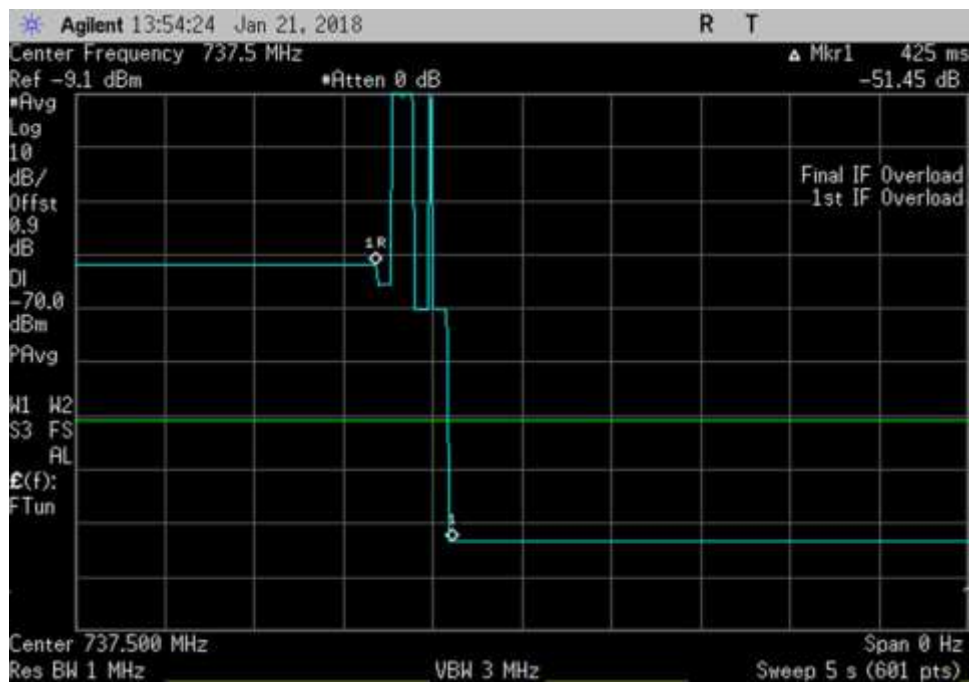
UL_1861.7MHz_600sec_time



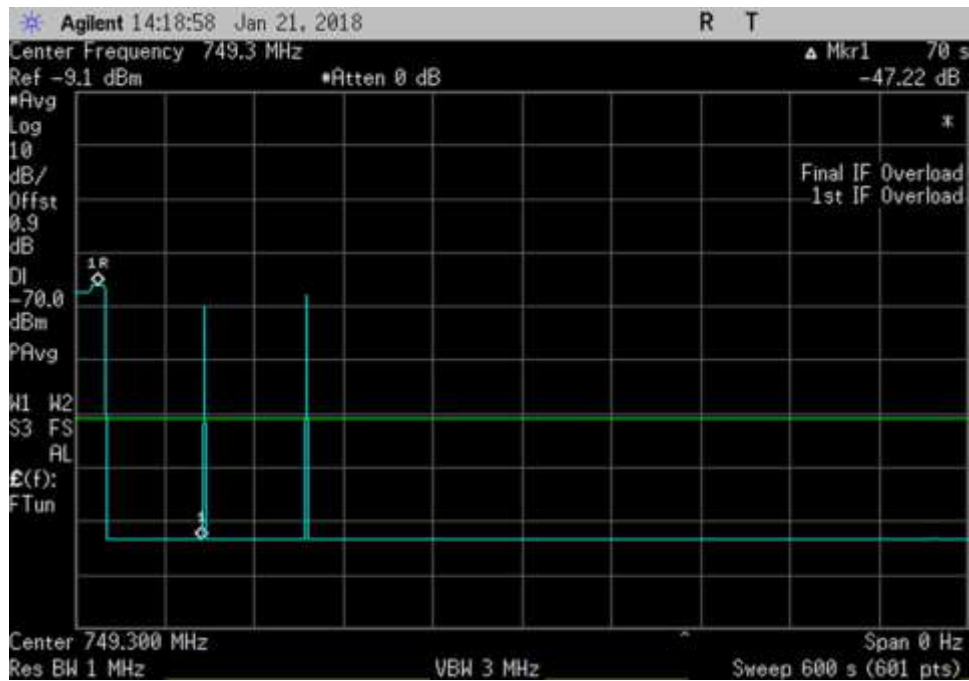
UL_1861.7MHz_time



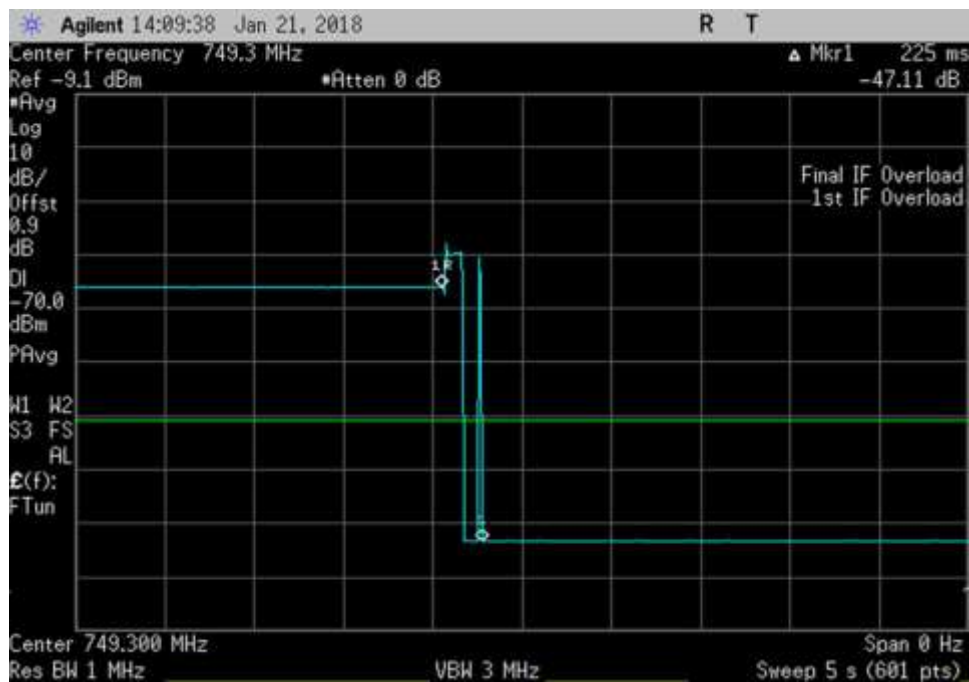
DL_ 737.5MHz_600sec



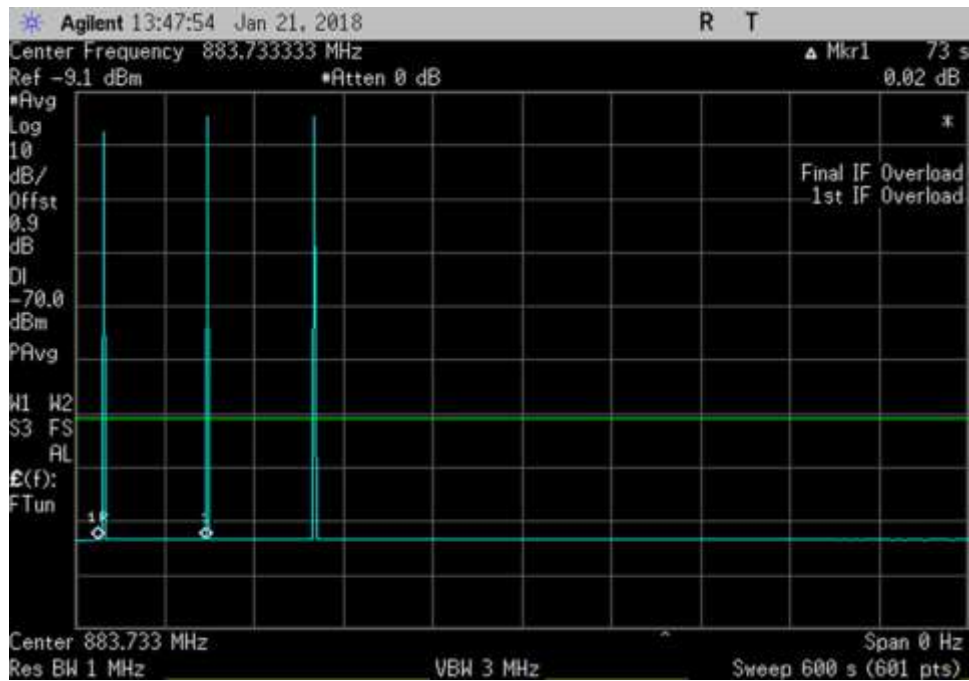
DL_ 737.5MHz_time



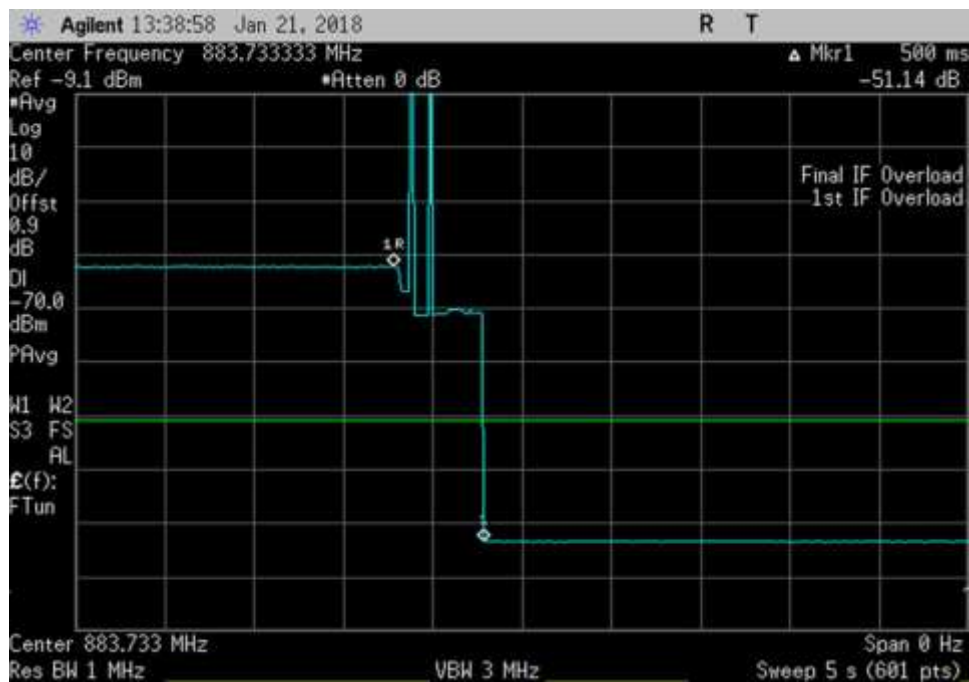
DL_ 749.3MHz_600sec



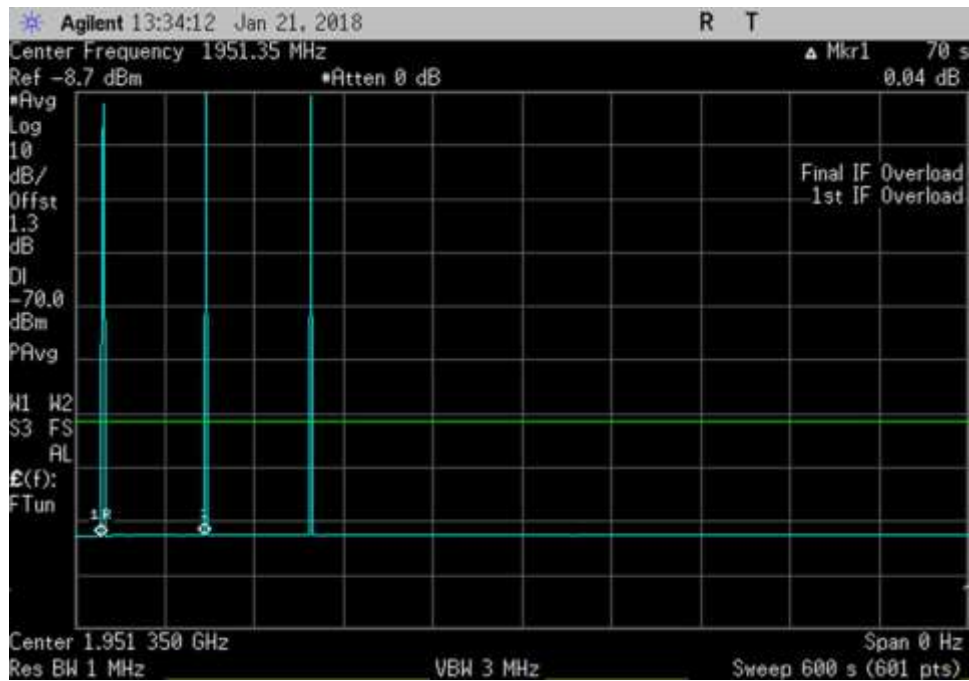
DL_ 749.3MHz_time



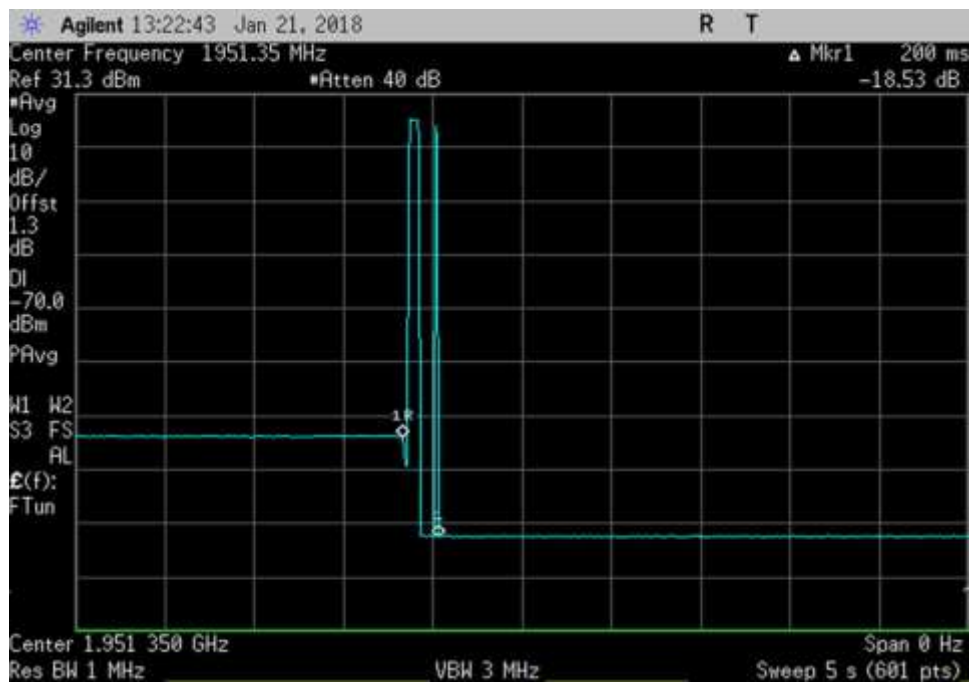
DL_883.733333MHz_600sec



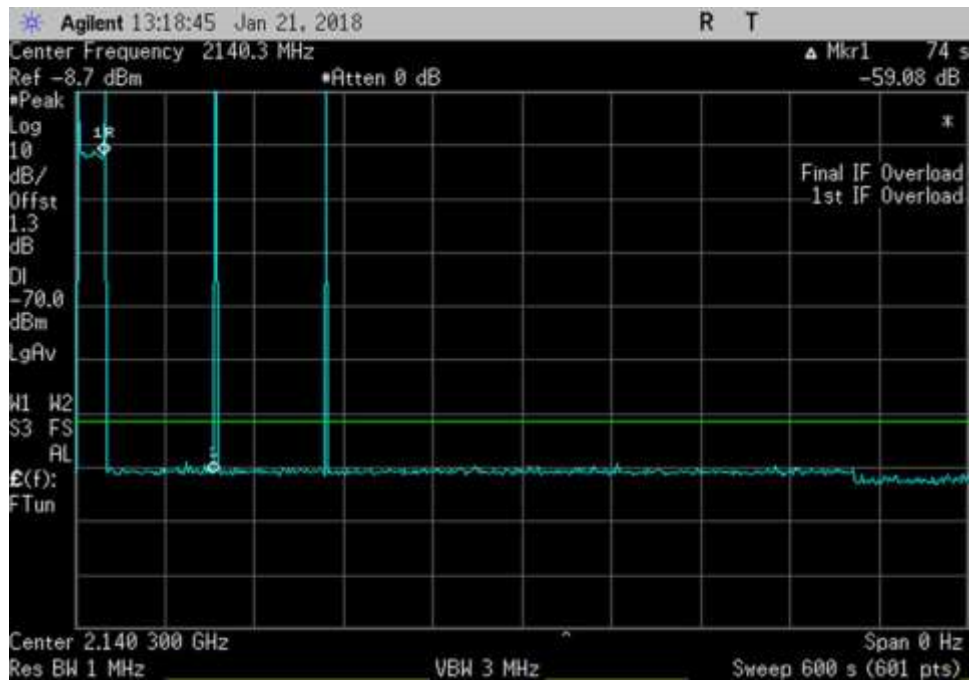
DL_883.733333MHz_time



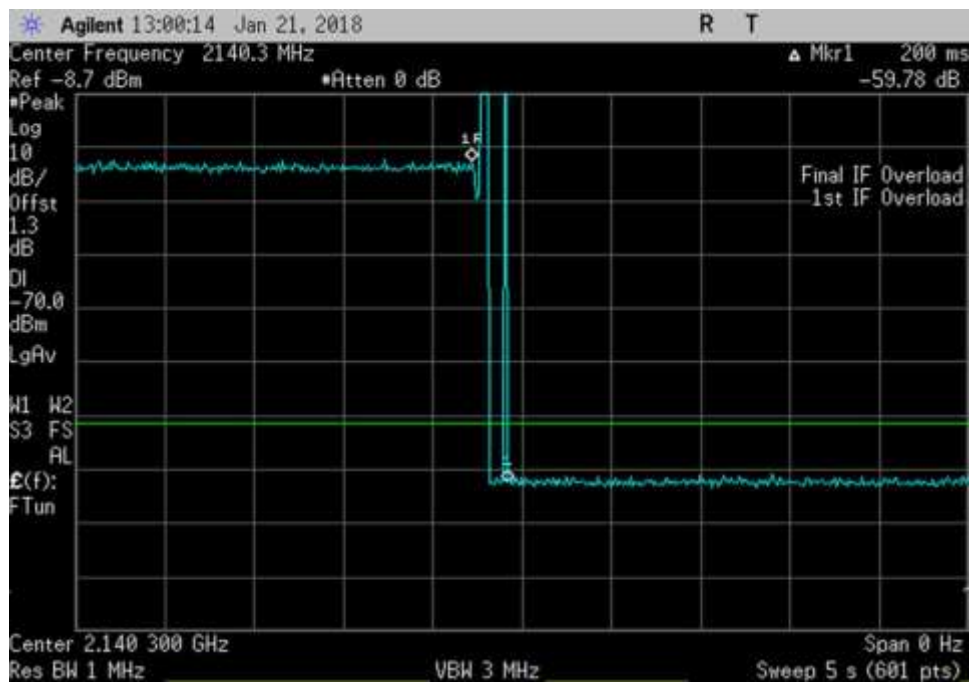
DL_ 1951.35MHz_600sec



DL_ 1951.35MHz_time



DL_2140.3MHz_600sec



DL_2140.3MHz_time

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 / 2.1053 Radiated Spurious Emissions**
47 CFR §22.917(a) Radiated Spurious Emissions
47 CFR §24.238(a) Radiated Spurious Emissions
47 CFR §27.53(c), (f), (g) and (h) Spurious Emissions

Work Order #: **100825** Date: 1/26/2018
 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: 21.5°C

Relative Humidity: 58%

Pressure: 101.9 kPa

Modification #1 and #2 were in place during testing.

TX Freq = > Center frequency of above listed bands.

Modulation=> CW

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: This equipment list was used for injecting the signal to the EUT.

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
P06909	Attenuator	Pasternack	PE7083	12/20/2017	12/20/2019

Test Equipment: This equipment list was used for measuring equipment.

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
01996	Biconilog Antenna	Chase	CBL6111C	11/1/2016	11/1/2018
P06049	Attenuator	Pasternack	PE7002-6	5/9/2016	5/9/2018
P00880	Cable	Pasternack	RG214U	5/10/2016	5/10/2018
P01187	Cable	Andrews	CNT-195	8/8/2016	8/8/2018
00971A	Preamp	HP	8447D	1/8/2018	1/8/2020
02870	Spectrum Analyzer	Agilent	E4440A	3/31/2016	3/31/2018
02113	Horn Antenna	EMC Test Systems	3115	2/6/2017	2/6/2019
03607	Preamp	Miteq	AMF-7D-00101800-30-10P	6/6/2017	6/6/2019
P01210	Cable	Andrews	FSJ1P-50A-4A	1/16/2017	1/16/2019
03362	Cable	Astrolab	32022-2-29094-48TC	1/10/2017	1/10/2019
03302	Cable	Astrolab	32026-29094K-29094K-72TC	1/29/2016	1/29/2018
P06138	Cable	Astrolab	32022-29094K-29094K-72TC	3/27/2017	3/27/2019
P00928	Cable	various	various	1/15/2018	1/15/2020
P06126	Cable	Astrolab	32022-29094K-29094K-168TC	3/27/2017	3/27/2019
02693	Active Horn Antenna	Miteq	AMFW-5F-12001800-20-10P	5/11/2017	5/11/2019
02694	Horn Antenna	Miteq	AMFW-5F-18002650-20-10P	5/11/2017	5/11/2019
02695	Active Horn Antenna	Miteq	AMFW-5F-260400-33-8P	5/11/2017	5/11/2019
P00929	Cable	various	various	1/15/2018	1/15/2020
00432	Loop Antenna	EMCO	6502	5/30/2017	5/30/2019

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 $P_{t \text{ at 3 meter}}$ dB

Limit line (dBuV) = $E_{dBuV} - \text{Attenuation}$

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 /m²

P_t = Average Transmit Power

r = Test distance

Field Intensity E (V/m)

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

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

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

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

$$10 \log P_t = 10 \log E^2 (\text{V/m}) + 10 \log r^2 - 10 \log 30$$

$$10 \log P_t = 20 \log E (\text{V/m}) + 20 \log r - 10 \log 30$$

At 3 meter, $r = 3 \text{ m}$

$$10 \log P_t = 20 \log E (\text{V/m}) + 20 \log 3 - 10 \log 30$$

$$10 \log P_t = 20 \log E (\text{V/m}) + 9.54 - 14.77$$

$$10 \log P_t = 20 \log E (\text{V/m}) - 5.23$$

$$\text{Since } 20 \log E (\text{V/m}) = 20 \log E (\mu\text{V/m}) - 120$$

$$10 \log P_t = 20 \log E (\mu\text{V/m}) - 120 - 5.23$$

$$10 \log P_t = 20 \log E (\mu\text{V/m}) - 125.23$$

$$\begin{aligned} \text{Limit line (dBuV) at 3 meter} &= E_{\text{dBuV}} - \text{Attenuation} \\ &= E_{\text{dBuV}} - (43 + 10 \log P_t \text{ at 3 meter}) \\ &= E_{\text{dBuV}} - 43 - 10 \log P_t \text{ at 3 meter} \\ &= E_{\text{dBuV}} - 43 - (20 \log E (\mu\text{V/m}) - 125.23) \\ &= E_{\text{dBuV}} - 43 - 20 \log E (\mu\text{V/m}) + 125.23 \\ &= E_{\text{dBuV}} - 20 \log E (\mu\text{V/m}) + 82.23 \end{aligned}$$

$$\text{Since } 20 \log E (\mu\text{V/m}) = E \text{ in dBuV/m} = E_{\text{dBuV}} - E_{\text{dBuV}} + 82.23$$

$$\text{Radiated Emission limit 3 meter} = 82.23 \text{ dBuV at any power level measured in dBuV}$$

EXHIBIT A: TEST SETUP PHOTOS



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



Section 7.7 Variable UL Noise



Section 7.7 Max UL Noise



Section 7.7 Max DL Noise



Section 7.8



Section 7.9



Section 7.11.2



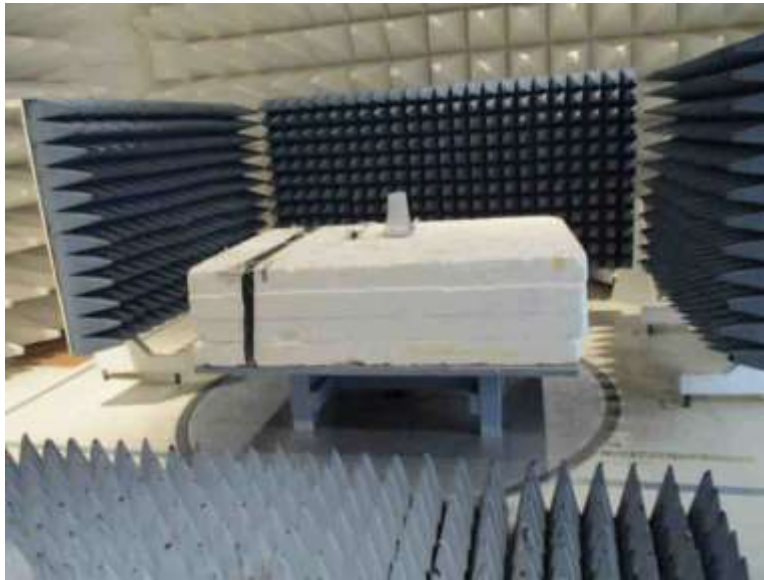
Section 7.11.3



Section 7.12 Below 1GHz



Section 7.12 Below 1GHz



Section 7.12 Above 1GHz Cone placement



Section 7.12 Above 1GHz Cone placement

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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ 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	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

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.