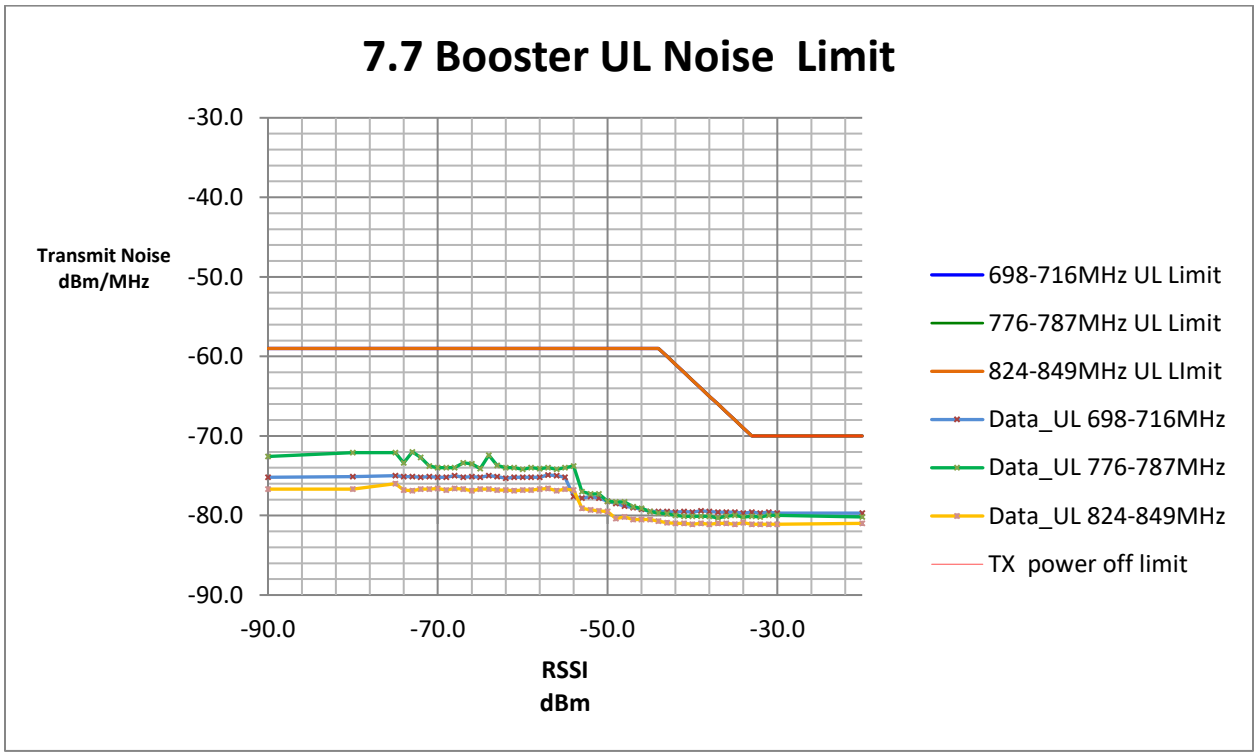
1710.0	1755.0	MHz			
		Limit			Margin
RSSI (dBm)	Measured Noise (dBm/MHz)	RSSI Dependent	Mobile Booster Limit	TX off	
-68.0	-76.8		-59.0		-17.8
-66.0	-76.8		-59.0		-17.8
-34.0	-79.1	-69.0			-10.1
-33.0	-79.1	-70.0			-9.1
-30.0	-79.3			-70	-9.3
-20.0	-79.2			-70	-9.2

1850.0	1915.0	MHz			
		Limit			Margin
RSSI (dBm)	Measured Noise (dBm/MHz)	RSSI Dependent	Mobile Booster Limit	TX off	
-69.0	-76.7		-59.0		-17.7
-68.0	-77.1		-59.0		-18.1
-34.0	-78.7	-69.0			-9.7
-33.0	-78.6	-70.0			-8.6
-32.0	-78.5			-70	-8.5
-31.0	-78.6			-70	-8.6



824.0	849.0	MHz			
		Limit			Margin
RSSI (dBm)	Measured Noise (dBm/MHz)	RSSI Dependent	Mobile Booster Limit	TX off	
-70.0	-76.6		-59.0		-17.6
-68.0	-76.6		-59.0		-17.6
-34.0	-80.9	-69.0			-11.9
-33.0	-81.1	-70.0			-11.1
-30.0	-81.1			-70	-11.1
-20.0	-81.0			-70	-11.0

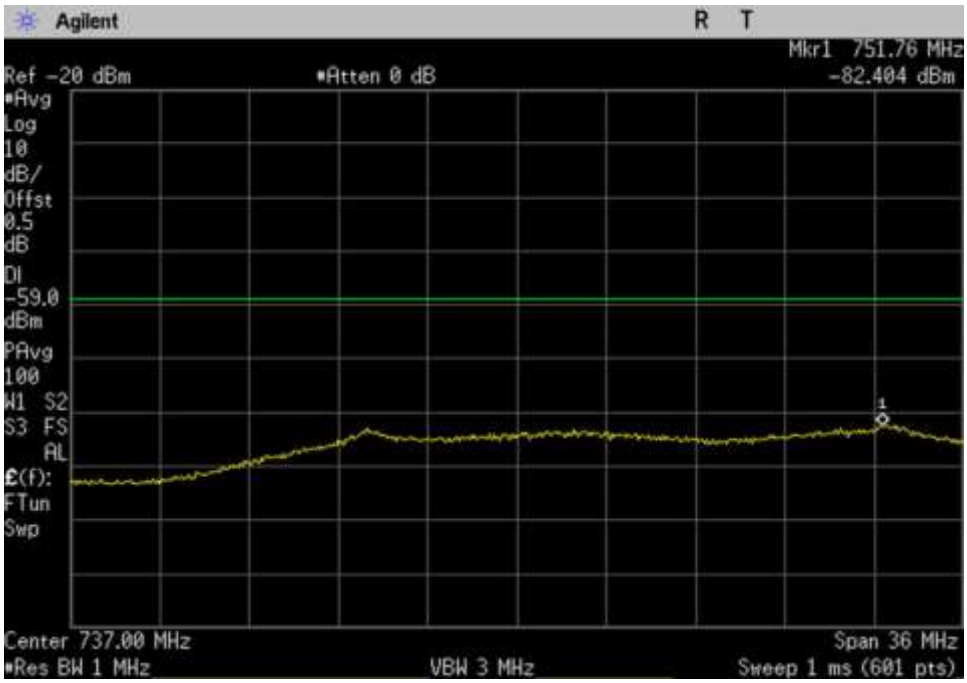
698.0	716.0	MHz			
		Limit			Margin
RSSI (dBm)	Measured Noise (dBm/MHz)	RSSI Dependent	Mobile Booster Limit	TX off	
-80.0	-75.1		-59.0		-16.1
-75.0	-75.0		-59.0		16.0
-34.0	-79.7	-69.0			-10.7
-33.0	-79.6	-70.0			-9.6
-32.0	-79.7			-70	-9.7
-31.0	-79.6			-70	-9.6

776.0	787.0	MHz			
		Limit			Margin
RSSI (dBm)	Measured Noise (dBm/MHz)	RSSI Dependent	Mobile Booster Limit	TX off	
-75.0	-72.1		-59.0		-13.1
-73.0	-72.0		-59.0		-13.0
-34.0	-80.2	-69.0	-59.0		-11.2
-33.0	-80.1	-70.0	-59.0		-10.1
-32.0	-80.2			-70	-10.2
-31.0	-80.0			-70	-10.0

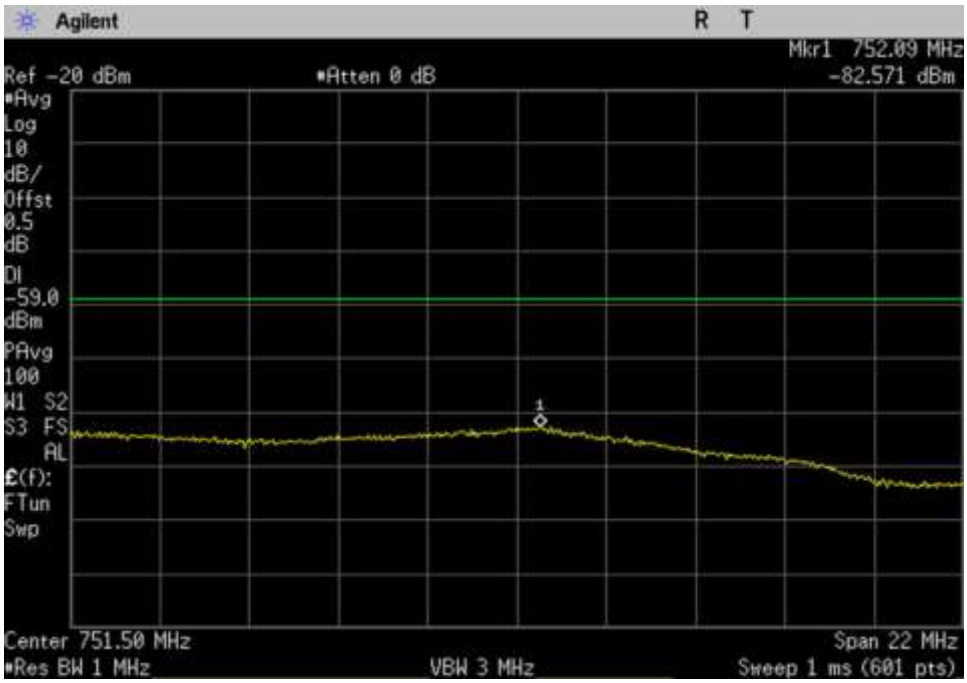
7.7.2 Variable uplink noise timing

Uplink Noise timing		
Freq	Measured	Limit
MHz	Sec	sec
UL1710-1755	0.33	1.00
UL1850-1915	0.28	1.00
UL824-849	0.62	1.00
UL 698-716	0.50	1.00
UL776-787	0.50	1.00

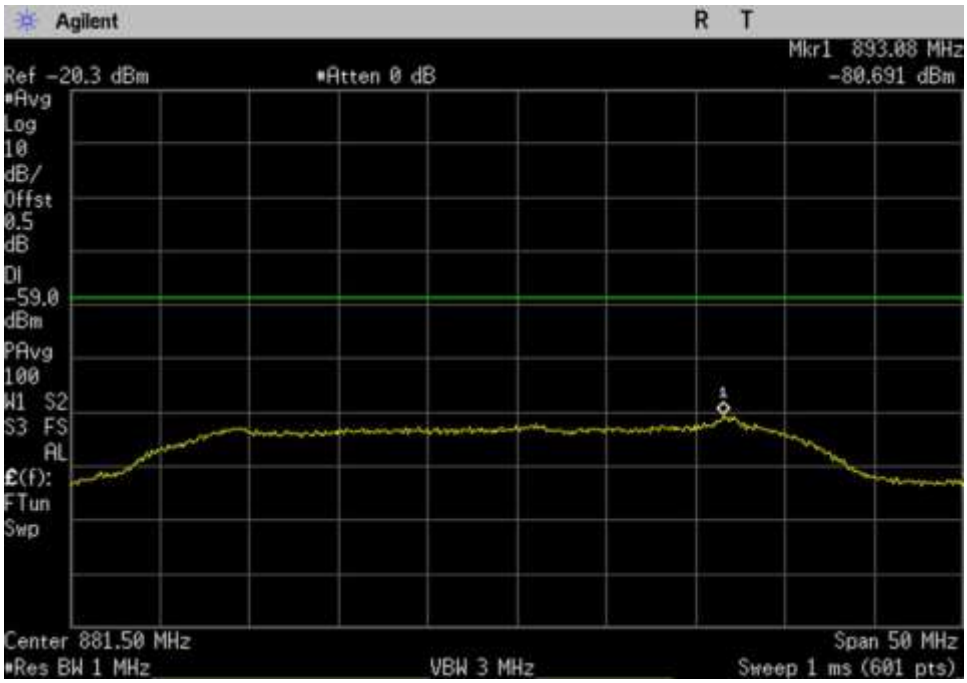
7.7.1 Maximum Transmitter Noise Power Level Plots



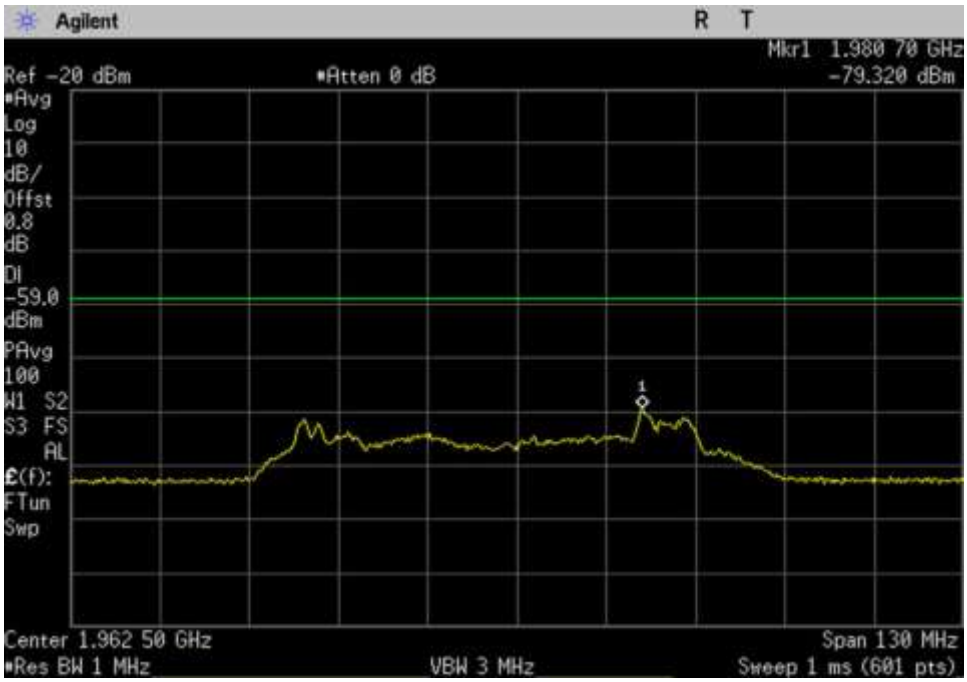
7.7 Noise_DL_728-746_ 737MHz



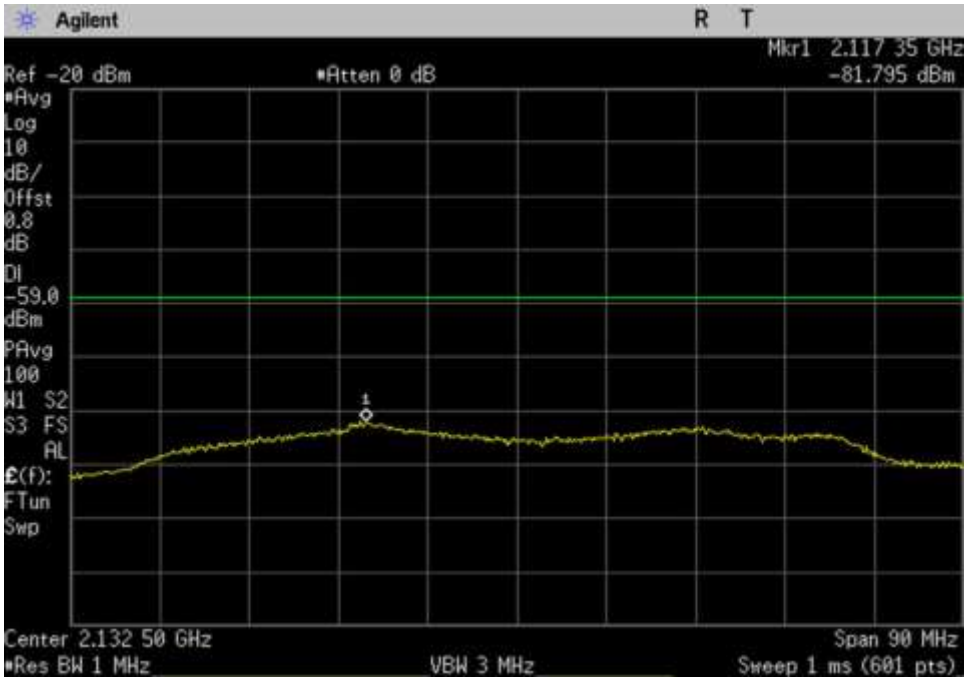
7.7 Noise_DL_746-757_ 751.5MHz



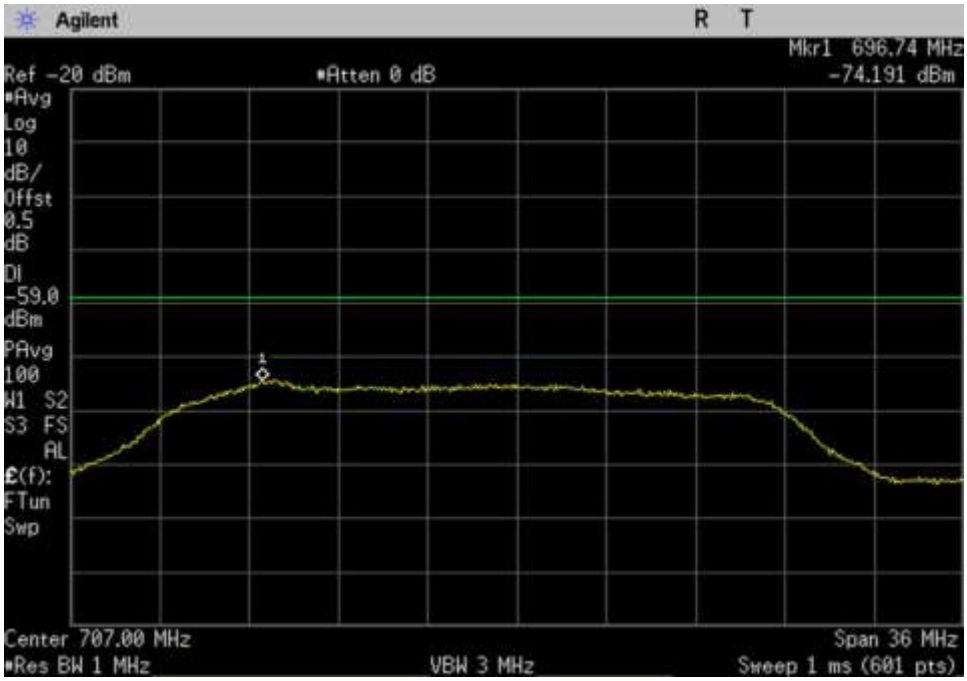
7.7 Noise_DL_869-894_ 881.5MHz



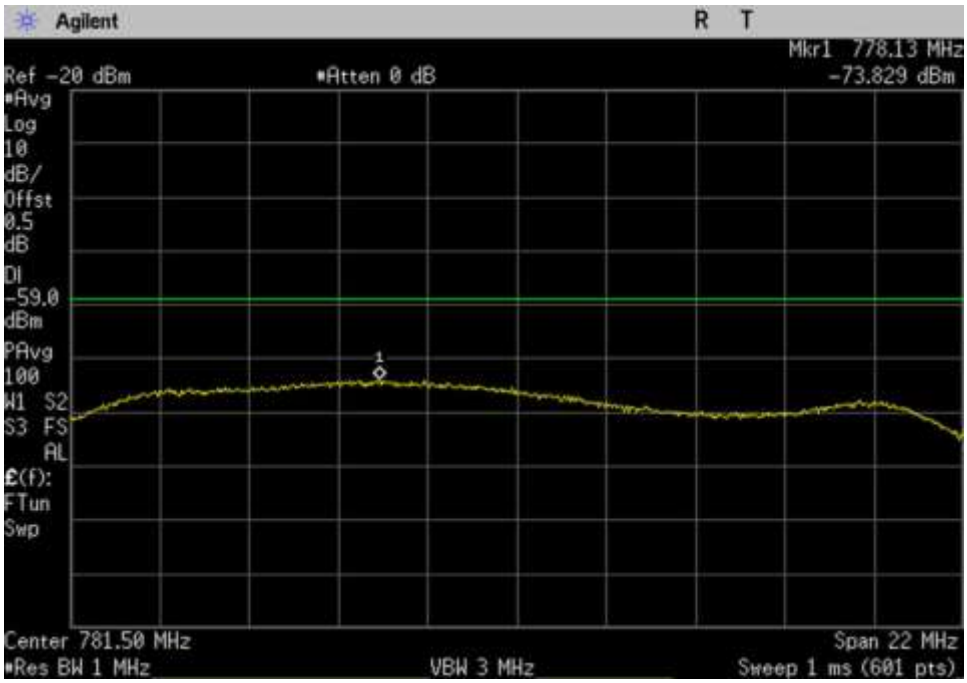
7.7 Noise_DL_1930-1995_ 1962.5MHz



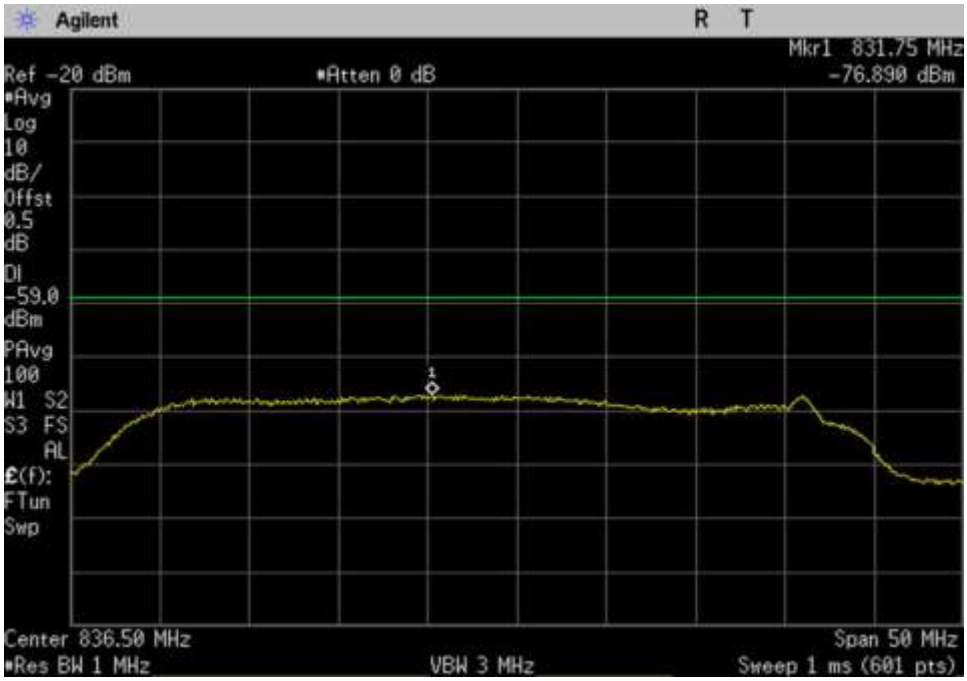
7.7 Noise_DL_2110-2155_ 2132.5MHz



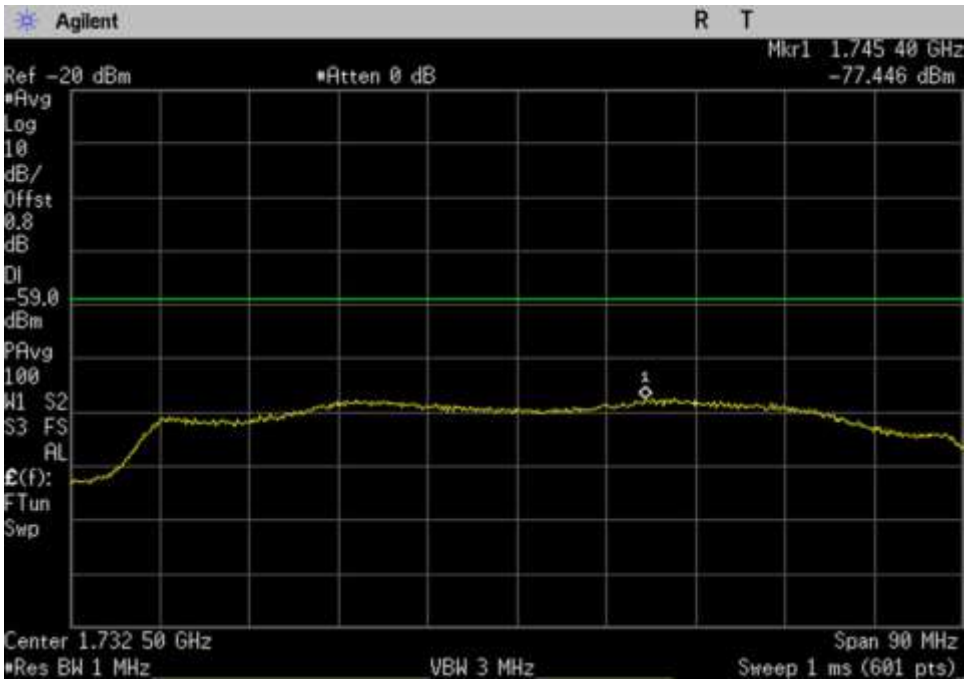
7.7 Noise_UL_698-716_ 707MHz



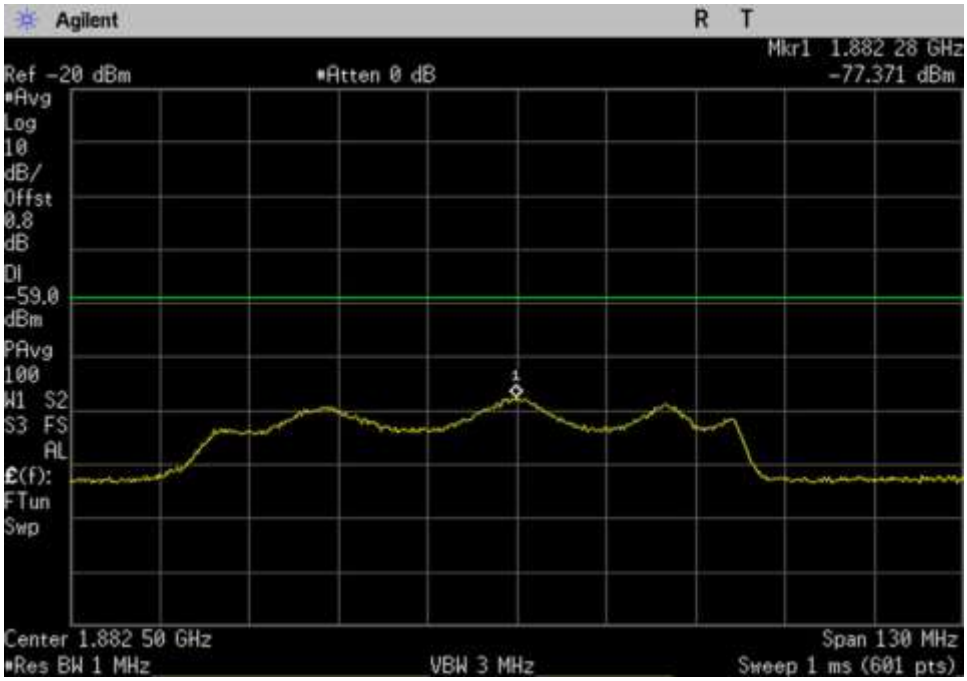
7.7 Noise_UL_776-787_ 781.5MHz



7.7 Noise_UL_824-849_ 836.5MHz

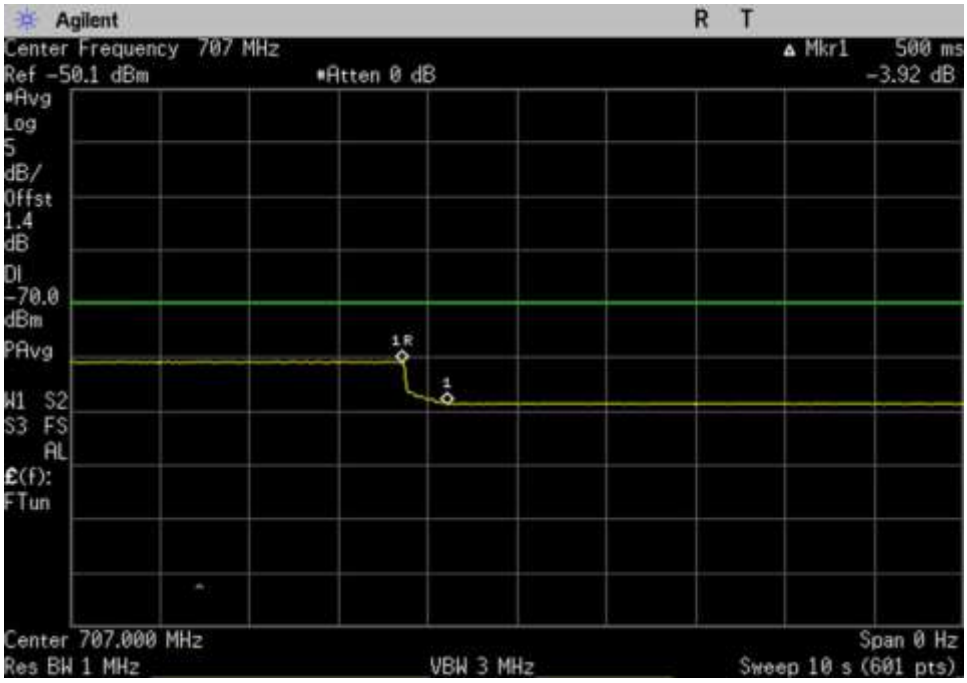


7.7 Noise_UL_1710-1755_ 1732.5MHz

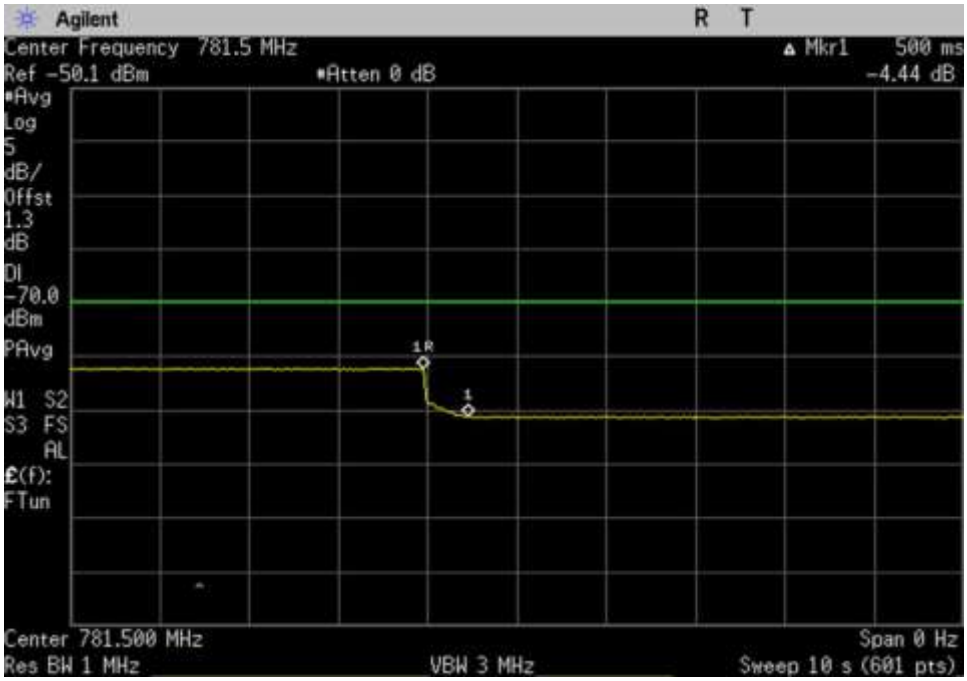


7.7 Noise_UL_1850-1915_ 1882.5MHz

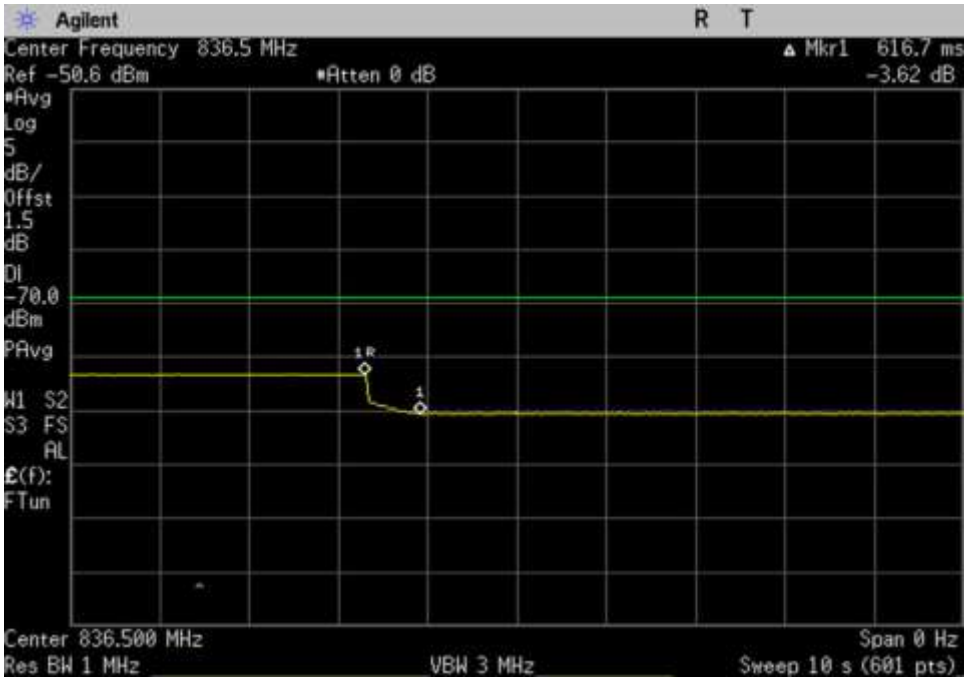
7.7.2 Variable UL Noise Timing Plots



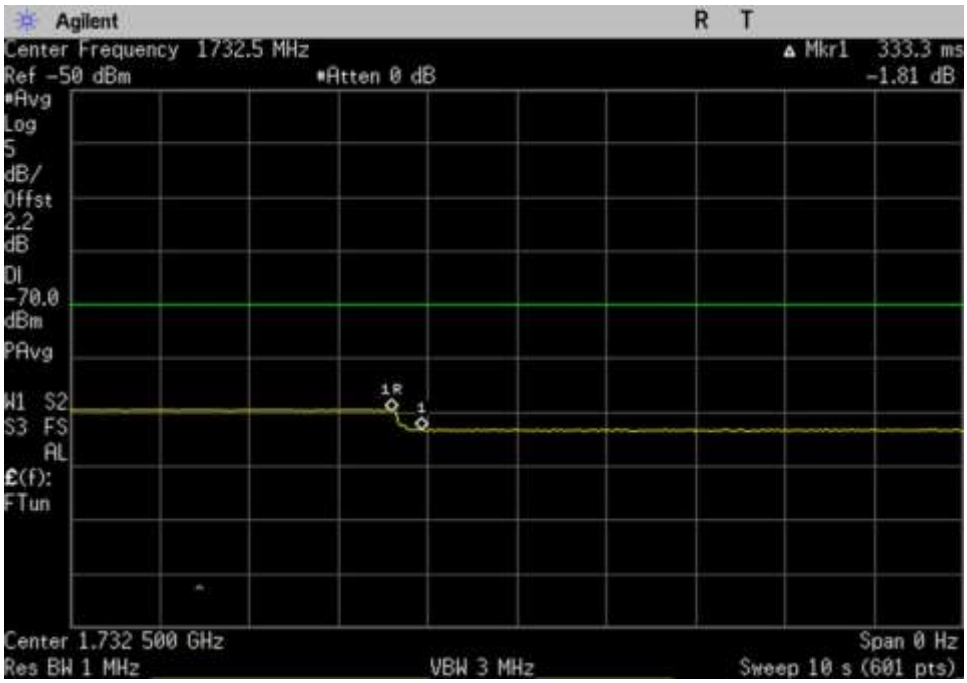
7.7 Noise_UL_698-716_ 707MHz_Timing



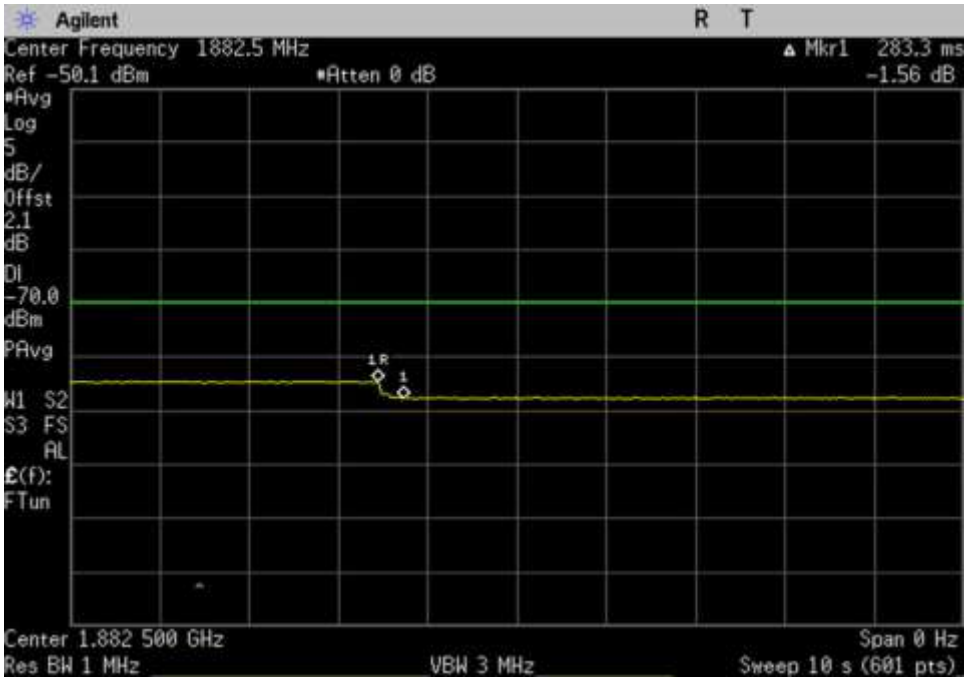
7.7 Noise_UL_776-787_ 781.5MHz_Timing



7.7 Noise_UL_824-849_ 836.5MHz_Timing



7.7 Noise_UL_1710-1755_ 1732.5MHz_Timing



7.7 Noise_UL_1850-1915_ 1882.5MHz_Timing

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 #: **101463** Date: 07/06/18
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

Test Conditions / Notes:

Test environment conditions: 21.8°C, 44.5% relative humidity,102.5kPa

Test Equipment:

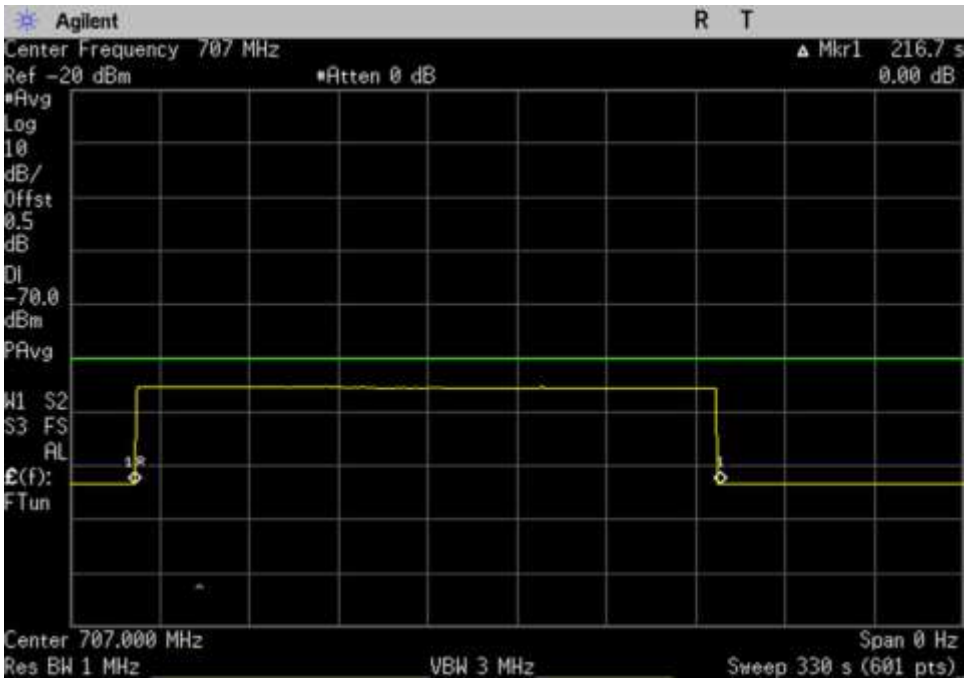
Asset #	Description	Manufacturer	Model	Calibration Date	Cal Due Date
P07192	Cable	Astro	32022-29094K-29094K-48TC	10/9/2017	10/9/2019
P07191	Cable	Astro	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
03418	Signal Generator	Agilent	E4438C	6/19/2017	6/19/2019
03470	Spectrum Analyzer	Agilent	E4440A	1/3/2018	1/3/2020

Summary of Results

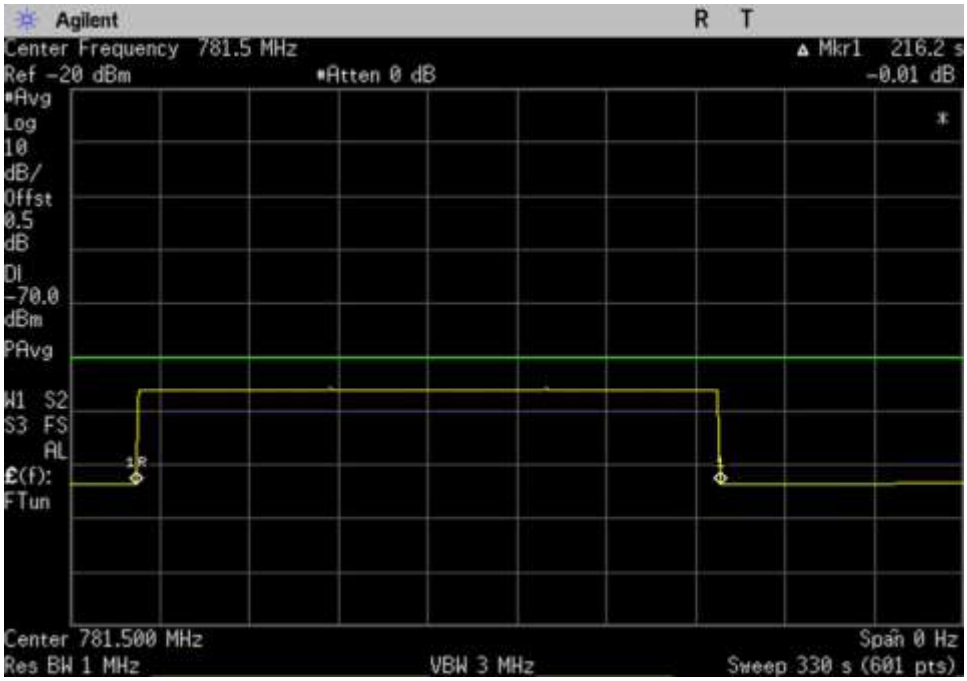
Pass: As demonstrated, when the booster is not serving an active device connection after 5 minutes the uplink noise power does not exceed -70dBm/MHz

Uplink Inactivity		
Freq	**Measured**	**Limit**
MHz	**Min**	**Min**
UL1710-1755	3.6	5.0
UL1850-1915	3.6	5.0
UL824-849	3.6	5.0
UL 698-716	3.6	5.0
UL776-787	3.6	5.0

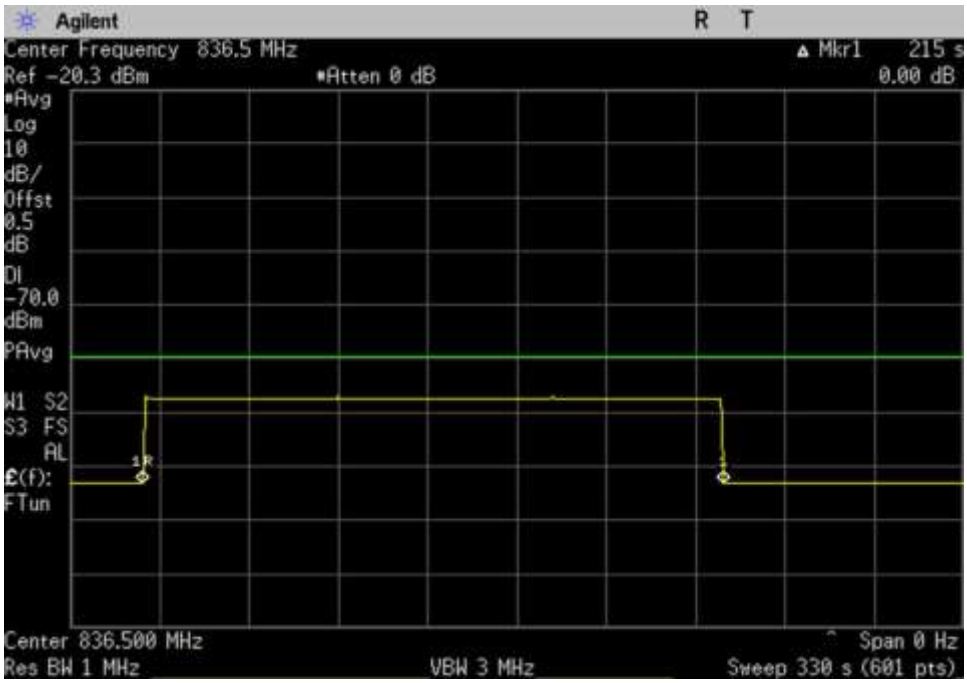
Plots



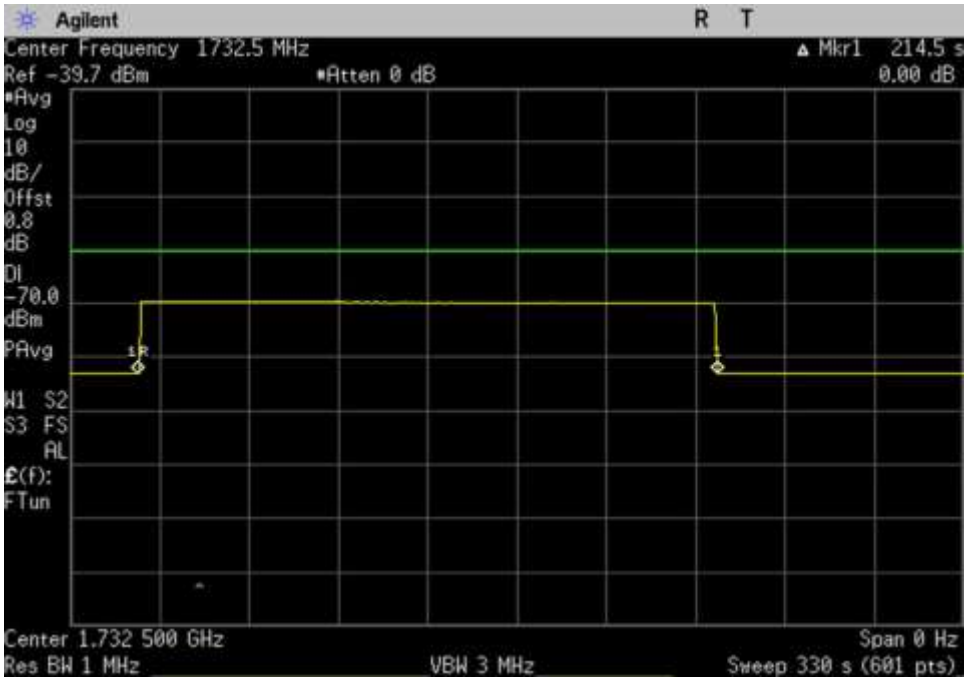
7.8 Inact_UL_698-716_ 707MHz



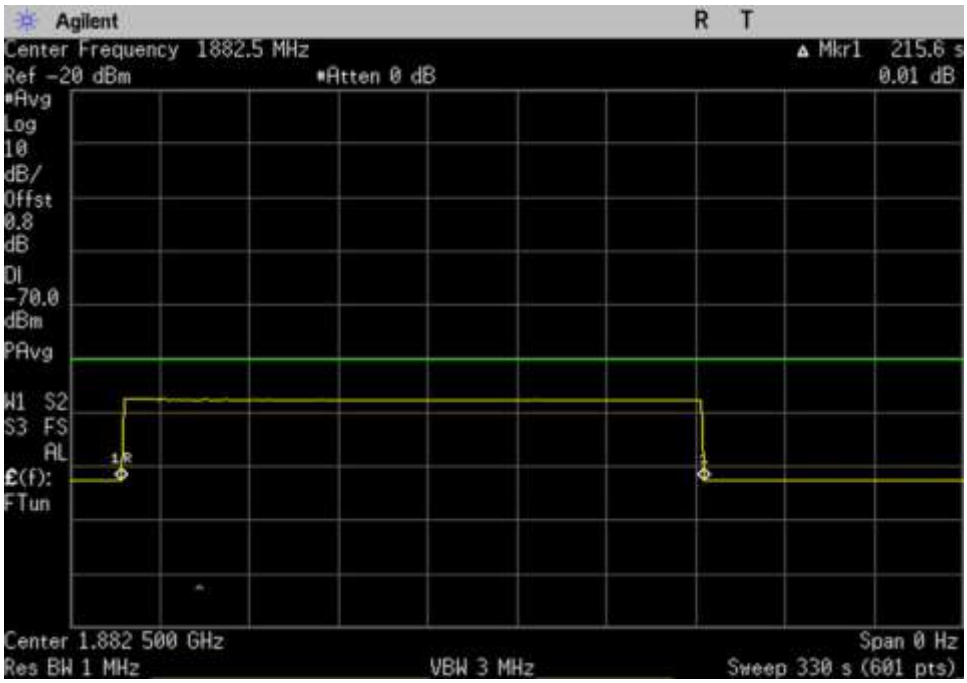
7.8 Inact_UL_776-787_ 781.5MHz



7.8 Inact_UL_824-849_ 836.5MHz



7.8 Inact_UL_1710-1755_ 1732.5MHz



7.8 Inact_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 #:	**101463**		
Test Type:	**Conducted Emissions**	Date	07/06/18
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

Test Conditions / Notes:

Test environment conditions: 21.8°C, 44.5% relative humidity,102.5kPa

Note:
Used MSCL provided by the manufacture'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.*

Frequency (MHz)	MSCL (dB)
PCS(1850-1915)	7
Cellular(824-849)	7
LTE(698-716)	7
LTE(776-787)	7
AWS(1710-1755)	7

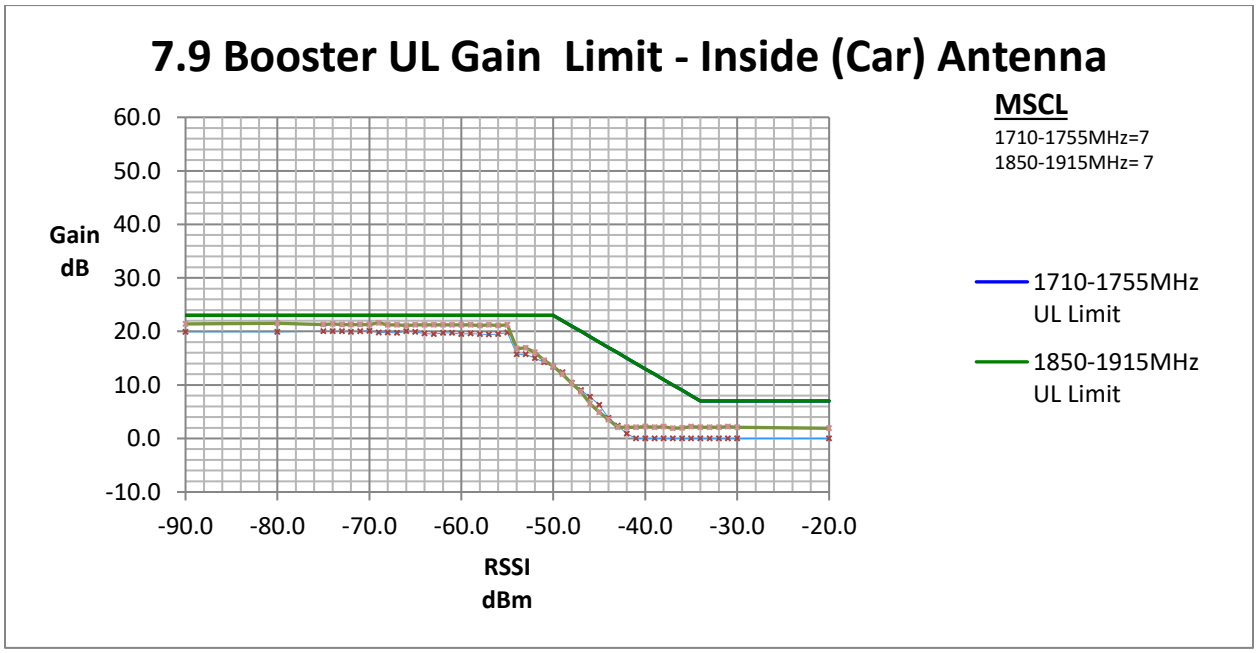
Test Equipment:

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
C00032	Arbitrary Waveform Generator	Agilent	E4433B	2/26/2016	2/26/2018

Summary of Results

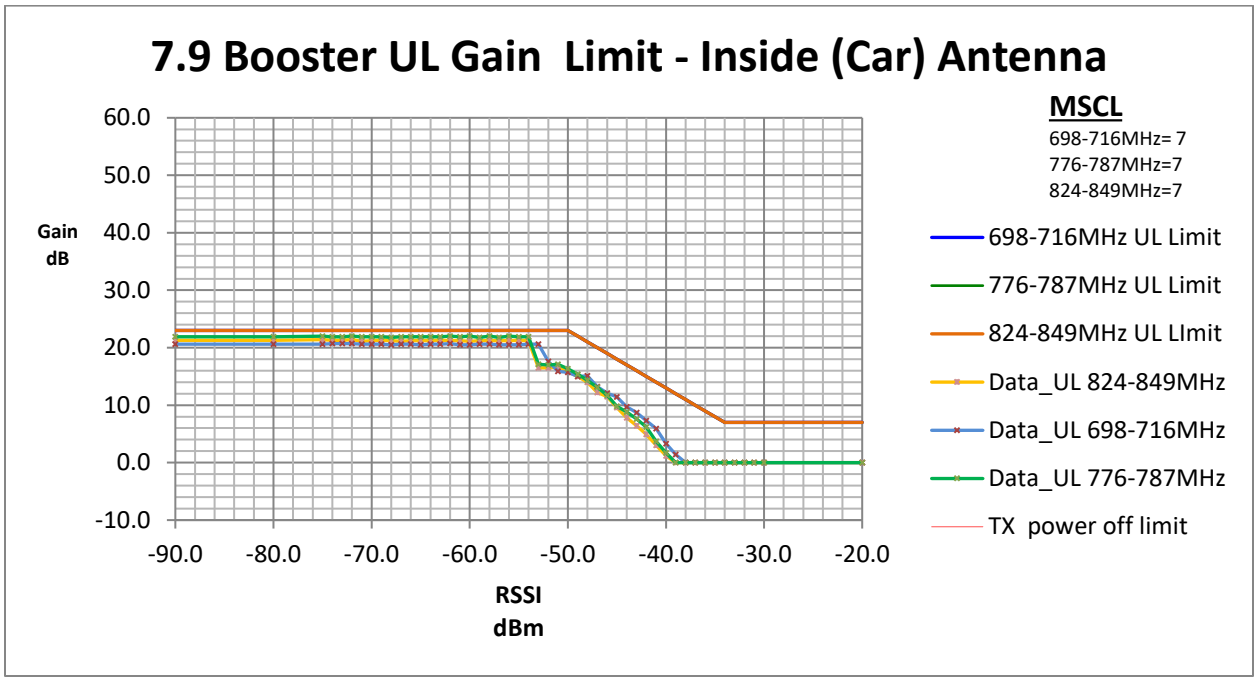
Pass: As demonstrated, computed gains are within the gain limit. All maximum variable uplink gain timings are within 1 second limit.

7.9.1 Maximum gain



1710.0			1755.0 MHz				
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-75.0	-3.5	16.5	20.0		23.0		-3.0
-74.0	-3.5	16.5	20.0		23.0		-3.0
-73.0	-3.5	16.5	20.0		23.0		-3.0
-46.0	-3.5	4.3	7.8	19.0			-11.2
-45.0	-3.5	2.8	6.3	18.0			-11.7
-44.0	-3.5	0.3	3.8	17.0			-13.2

1850.0			1915.0 MHz				
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-80.0	-1.8	19.7	21.5		23.0		-1.5
-69.0	-1.8	19.8	21.6		23.0		-1.4
-36.0	-1.8	0.2	2.0	9.0			-7.0
-35.0	-1.8	0.4	2.2	8.0			-5.8
-34.0	-1.8	0.3	2.1			7	-4.9
-31.0	-1.8	0.4	2.2			7	-4.8


7.9 Booster UL Gain Limit - Inside (Car) Antenna
MSCL
698-716MHz= 7
776-787MHz=7
824-849MHz=7
Gain dB
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
-90.0
-80.0
-70.0
-60.0
-50.0
-40.0
-30.0
-20.0
RSSI dBm
698-716MHz UL Limit
776-787MHz UL Limit
824-849MHz UL LImit
Data_UL 824-849MHz
Data_UL 698-716MHz
Data_UL 776-787MHz
TX power off limit

824.0			849.0 MHz				
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-90.0	-2.5	18.8	21.3		23.0		-1.7
-80.0	-2.5	18.8	21.3		23.0		-1.7
-75.0	-2.5	18.9	21.4		23.0		-1.6
-49.0	-2.5	12.5	15.0	22.0			-7.0
-48.0	-2.5	11.5	14.0	21.0			-7.0
-46.0	-2.5	9.0	11.5	19.0			-7.5

698.0			716.0 MHz				
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-74.0	-3.2	17.5	20.7		23.0		-2.3
-73.0	-3.2	17.5	20.7		23.0		-2.3
-72.0	-3.2	17.5	20.7		23.0		-2.3
-48.0	-3.2	11.9	15.1	21.0			-5.9
-47.0	-3.2	10.0	13.2	20.0			-6.8
-46.0	-3.2	8.9	12.1	19.0			-6.9

776.0			787.0 MHz				
				Limit			Margin
RSSI (dBm)	Input (dBm)	Measured Output (dBm)	Measured Gain (dBm)	RSSI Dependent	Mobile Booster Limit	TX off	
-80.0	-3.4	18.5	21.9		23.0		-1.1
-75.0	-3.4	18.6	22.0		23.0		-1.0
-74.0	-3.4	18.5	21.9		23.0		-1.1
-50.0	-3.4	12.9	16.3	23.0			-6.7
-49.0	-3.4	12.0	15.4	22.0			-6.6
-48.0	-3.4	10.9	14.3	21.0			-6.7

7.9.2 Variable uplink gain timing

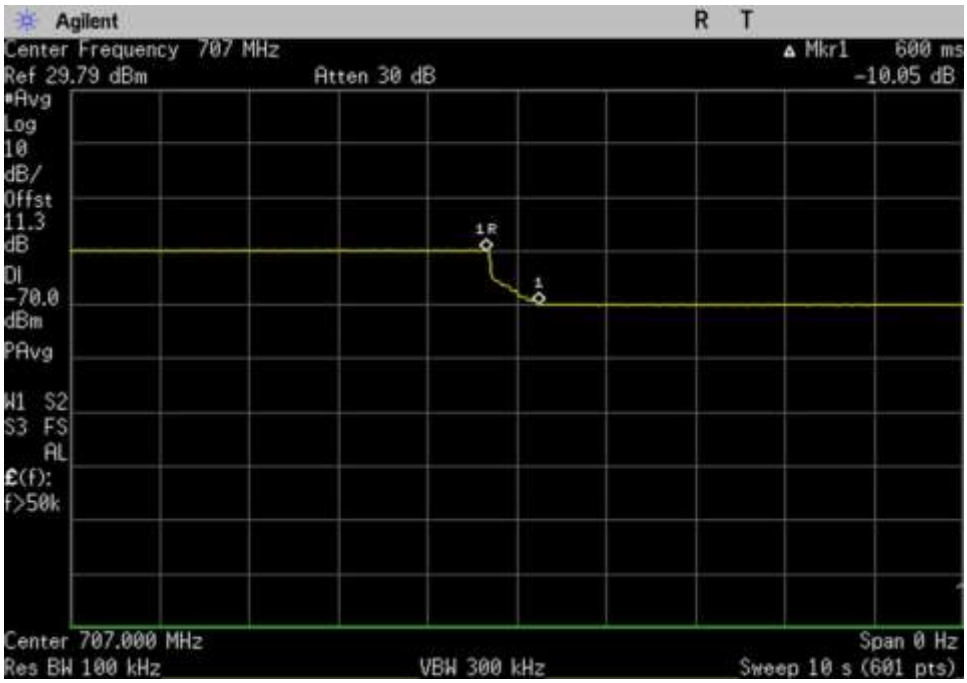
Uplink Gain Timing		
Frequency (MHz)	**Measured (Sec)**	**Limit (Sec)**
UL 1710-1755	0.62	1.00
UL 1850-1915	0.55	1.00
UL 824-849	0.60	1.00
UL 698-716	0.60	1.00
UL 776-787	0.42	1.00

7.9.1 Maximum Gain

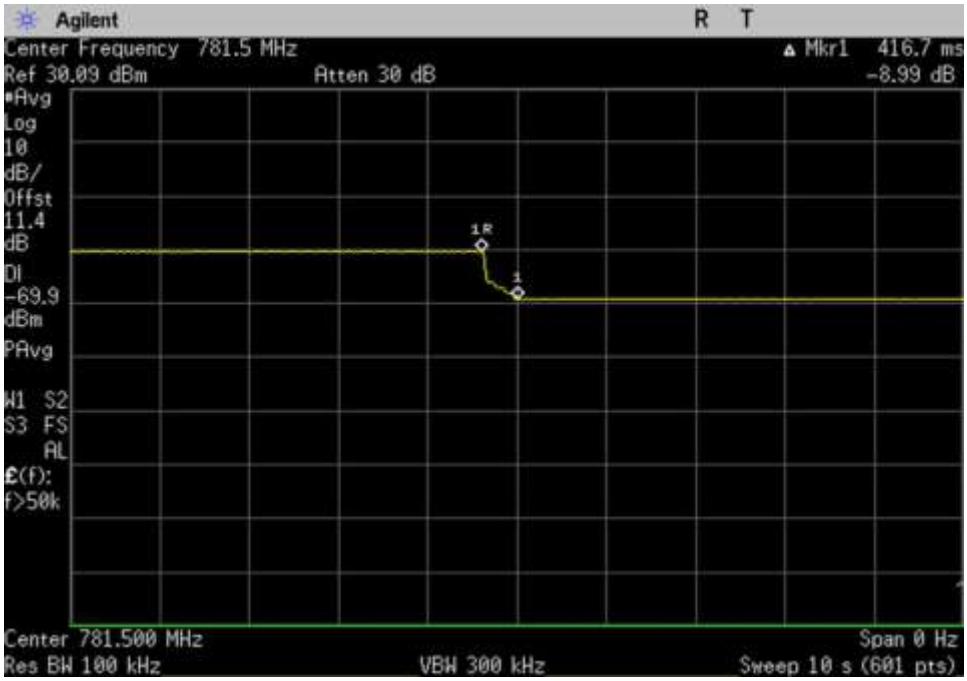
For this subsection, see summary of results of 7.9
7.9.1 Maximum gain

7.9.2 Variable uplink Gain Timing

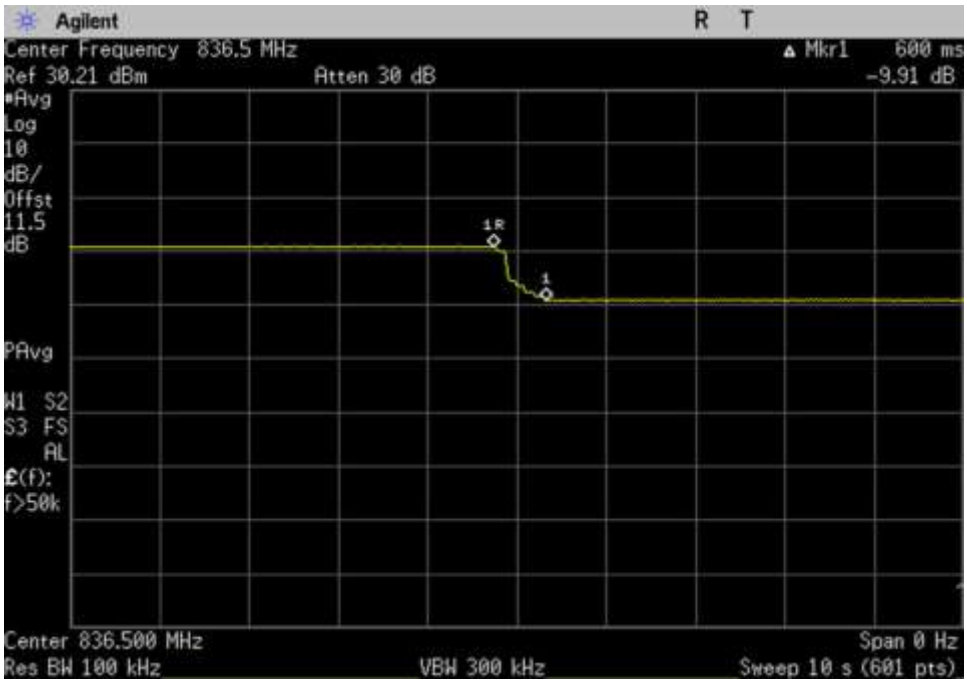
Plots



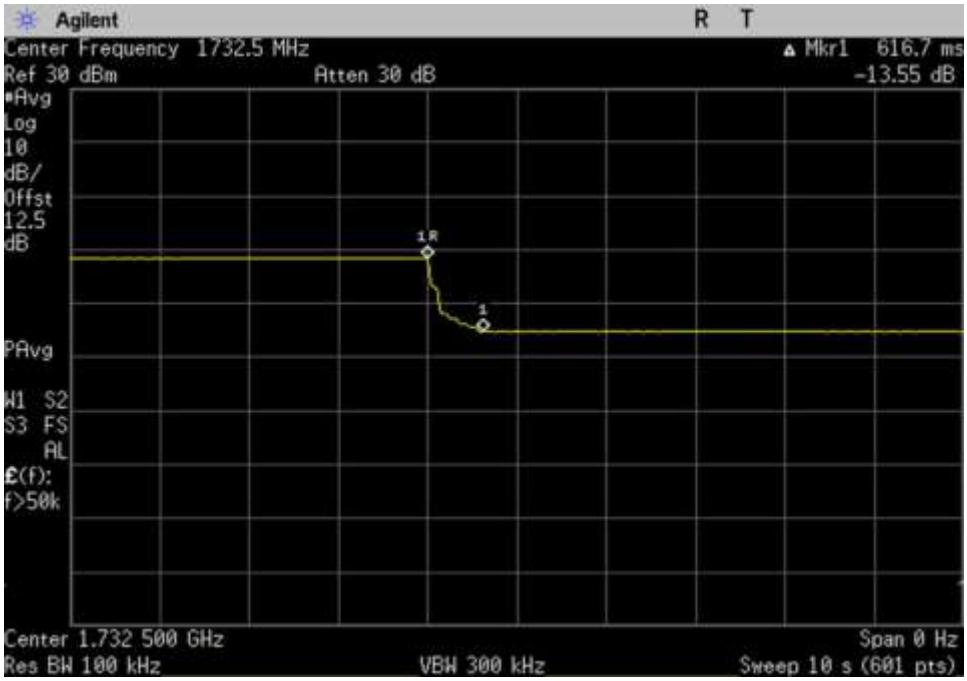
7.9 Var Gain_UL_698-716_ 707MHz_Var



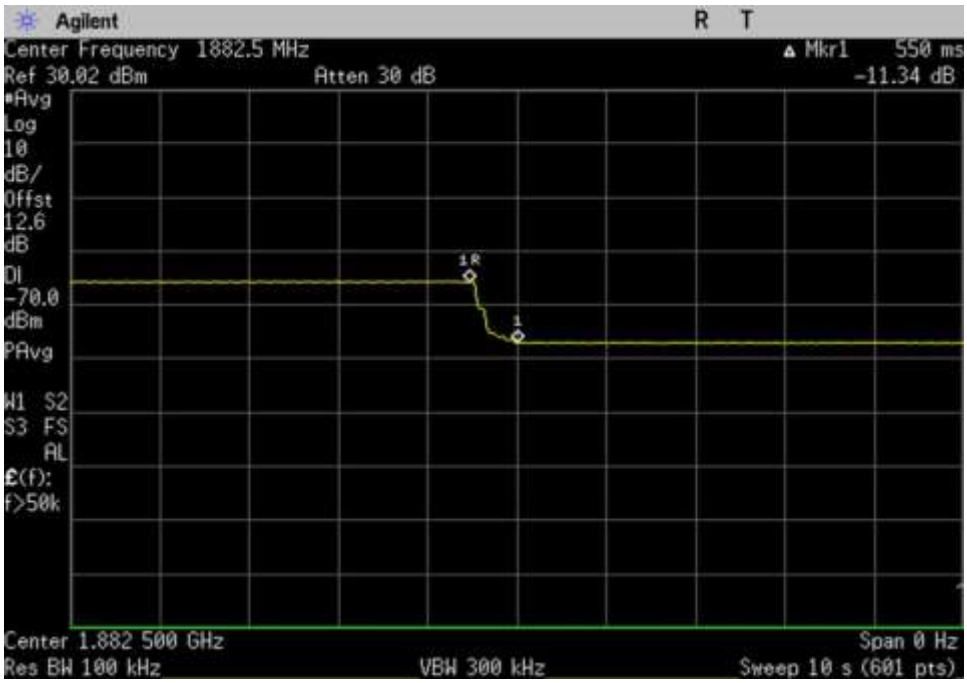
7.9 Var Gain_UL_776-787_ 781.5MHz_Var



7.9 Var Gain_UL_824-849_ 836.5MHz_Var



7.9 Var Gain_UL_1710-1755_ 1732.5MHz_Var



7.9 Var Gain_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 #:	**101463**
Test Type:	**Conducted Emissions** Date 07/10/18
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

Test Conditions / Notes:

Test environment conditions: 23.9°C, 46% relative humidity,101.9kPa

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

Summary of Results

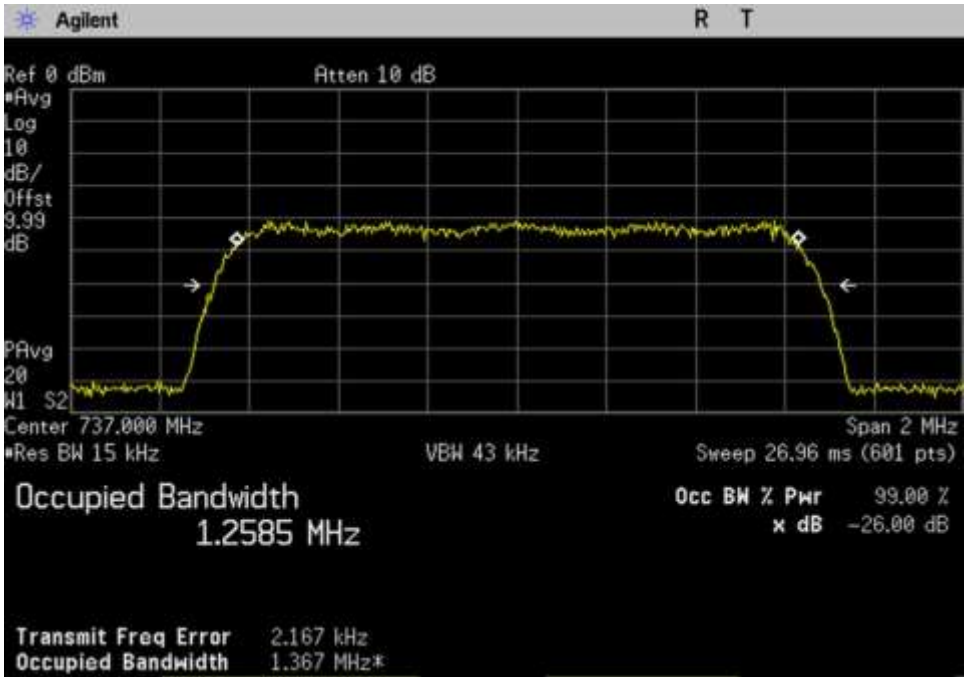
Pass: As summarized in plots and tables below, the uniformity of the output signal relative to the input signal are practically identical. Therefore, the comparison is within limits.

OBW-Input (Hz)					OBW-Output (Hz)				
EDGE	GSM	CDMA	AWGN	LTE	EDGE	GSM	CDMA	AWGN	LTE
245461	244151	1249305	4167145	4446278	243258	244614	1262157	4211399	4464776
241976	240176	1244558	4152724	4426412	240849	244623	1247575	4182348	4438415
242175	245173	1255295	4116809	4467293	244773	244640	1247841	4222341	4402352
243293	245885	1258281	4168580	4446532	248994	245552	1247175	4201055	4427509
244966	243286	1250541	4164167	4466757	242086	246919	1257860	4107351	4411073
245433	241848	1245845	4183136	4467066	243592	240360	1257443	4186825	4438055
244663	245573	1258663	4198207	4446108	242640	244559	1248592	4170353	4452404
247634	248254	1239315	4144524	4461650	245929	240062	1252774	4178935	4458583
244530	247667	1258468	4154954	4447303	241605	244759	1251997	4184004	4449115
243464	242590	1251101	4182874	4420702	245541	246085	1255455	4182685	4472862

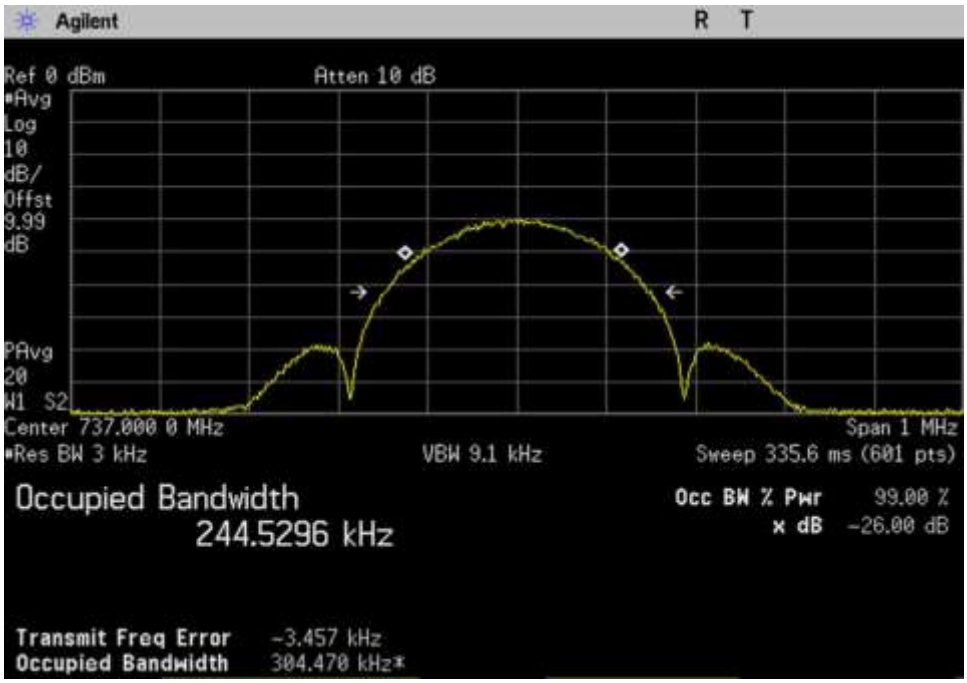
	Max Difference In & Out Occupied BW 99% Power				
Frequency Range	EDGE	GSM	CDMA	AWGN	LTE
UL_1710-1755MHz	0.90%	0.19%	1.03%	1.06%	0.42%
UL_1850-1915MHz	0.47%	1.85%	0.24%	0.71%	0.27%
UL_824-849MHz	1.07%	0.22%	0.59%	2.56%	1.45%
UL_698-716MHz	2.34%	0.14%	0.88%	0.78%	0.43%
UL_777-787MHz	1.18%	1.49%	0.59%	1.36%	1.25%
DL_2110-2155MHz	0.75%	0.62%	0.93%	0.09%	0.33%
DL_1930-1995MHz	0.83%	0.41%	0.80%	0.66%	0.28%
DL_869-894MHz	0.69%	3.30%	1.09%	0.83%	0.07%
DL_728-746MHz	1.20%	1.17%	0.51%	0.70%	0.04%
DL_746-756MHz	0.85%	1.44%	0.35%	0.00%	1.18%

Plots

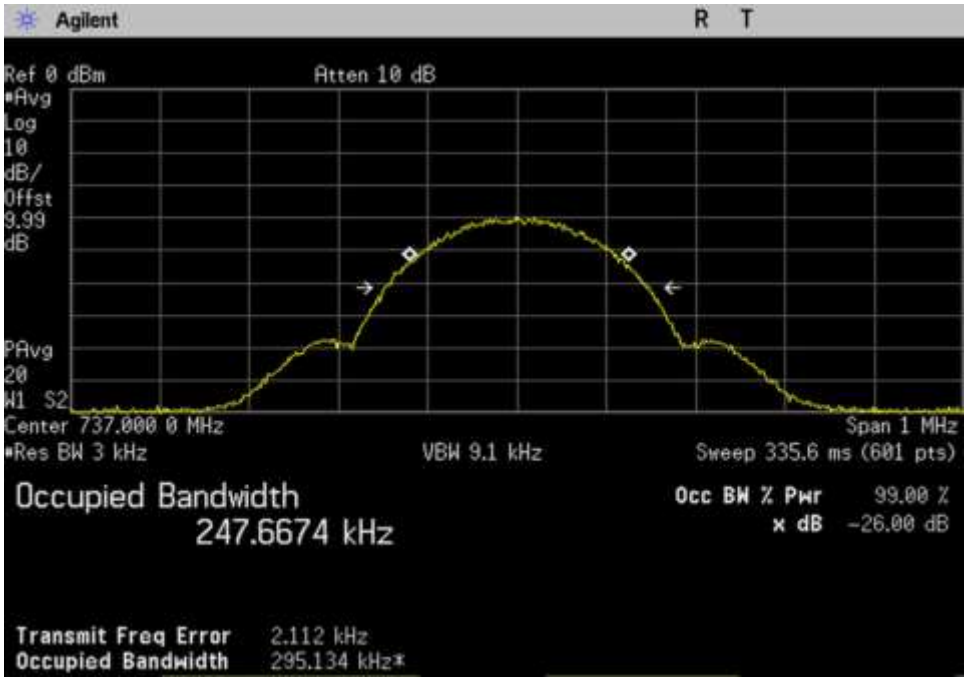
Input



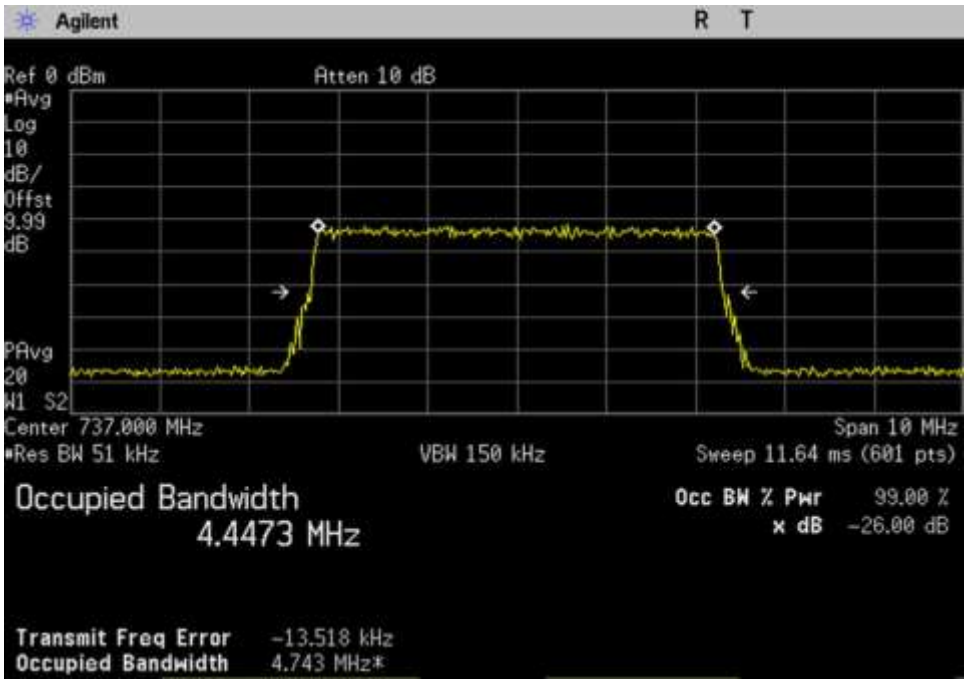
7.10 OBW-In_DL_728-746_CDMA_ 737MHz



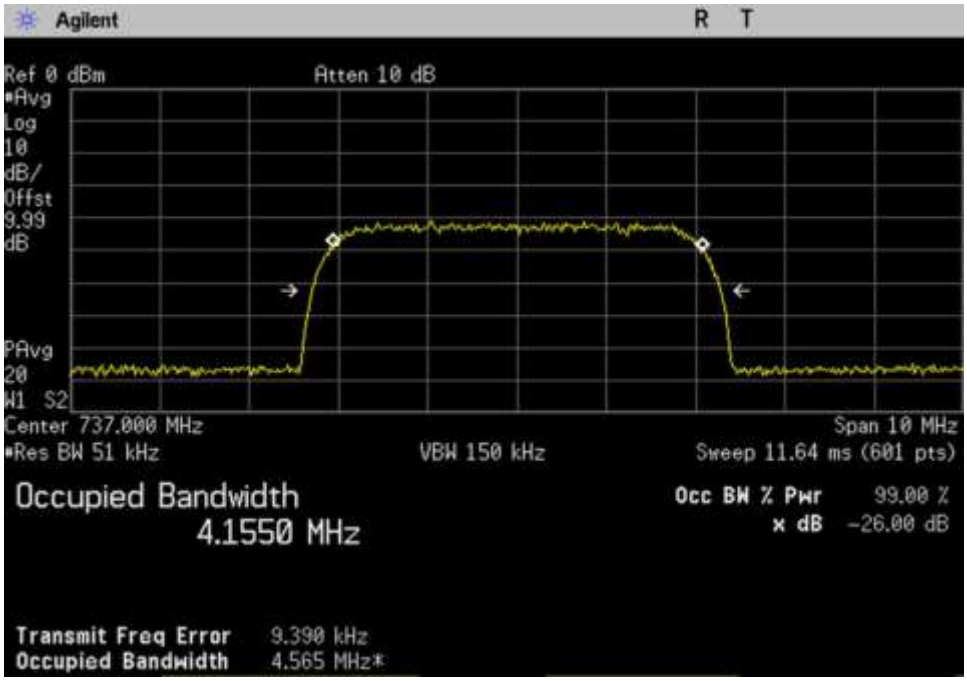
7.10 OBW-In_DL_728-746_EDGE_ 737MHz



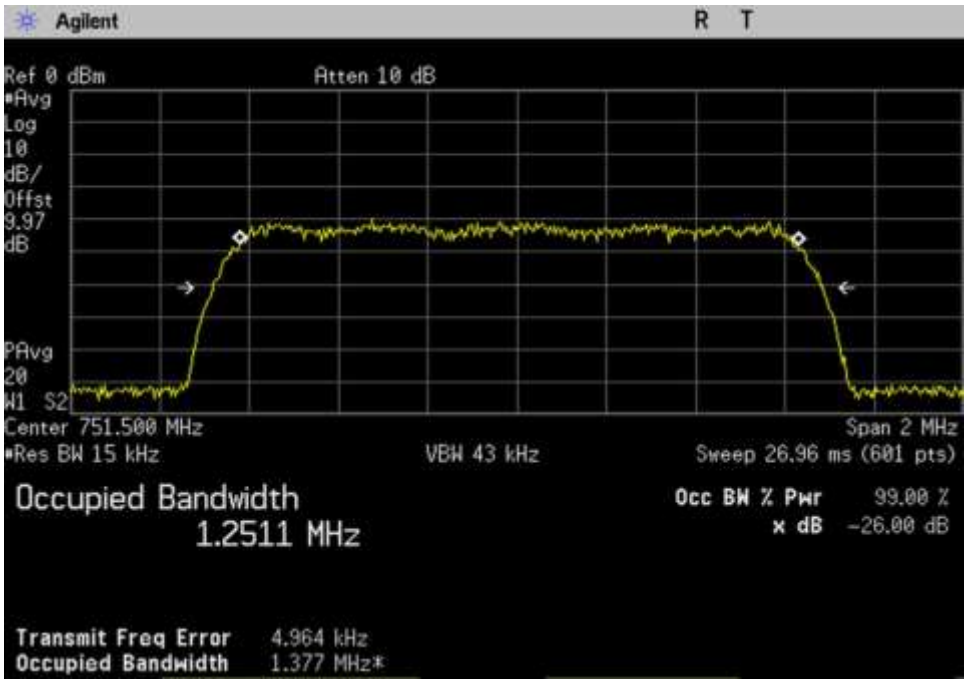
7.10 OBW-In_DL_728-746_GSM_ 737MHz



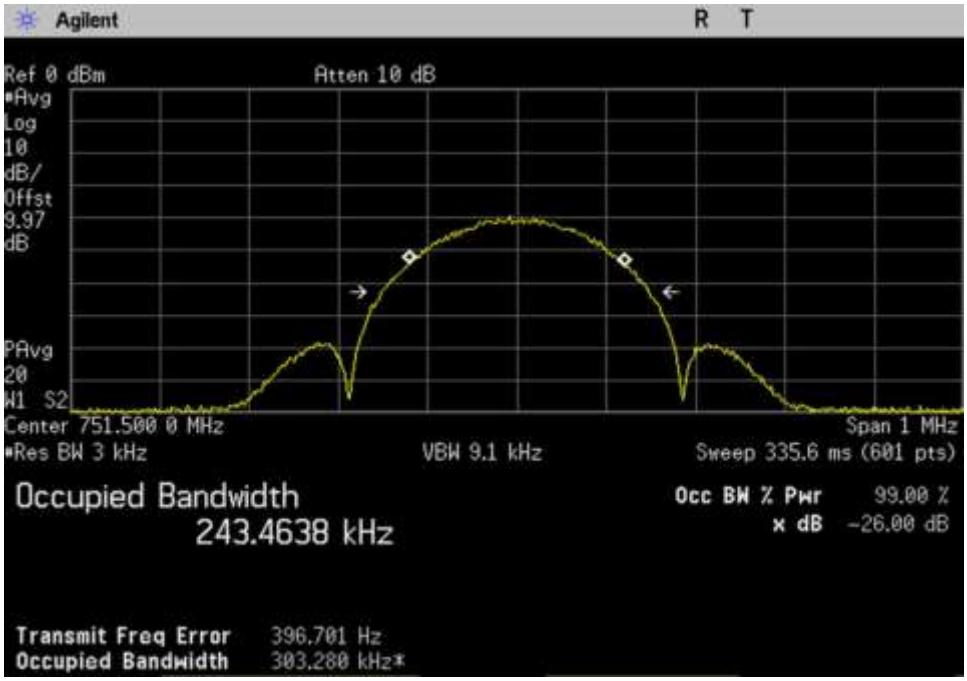
7.10 OBW-In_DL_728-746_LTE_ 737MHz



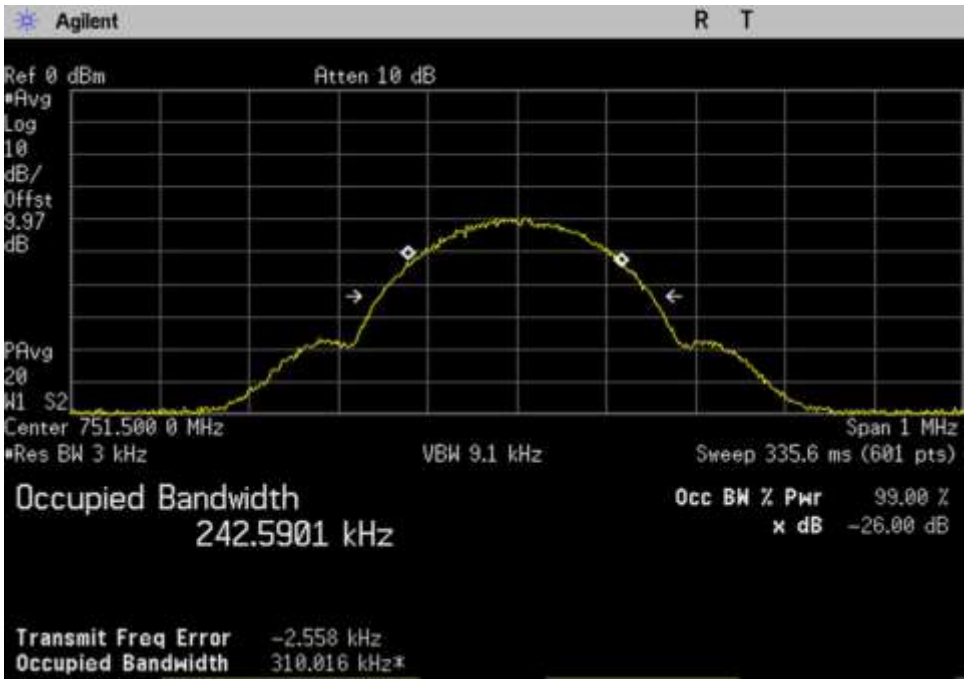
7.10 OBW-In_DL_728-746_WCDMA_ 737MHz



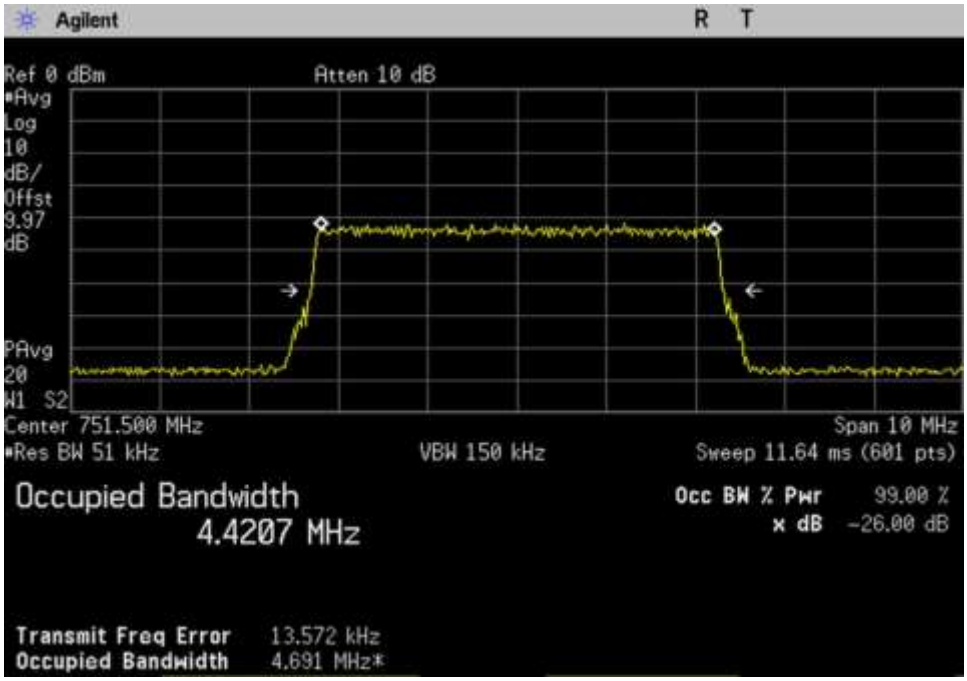
7.10 OBW-In_DL_746-757_CDMA_ 751.5MHz



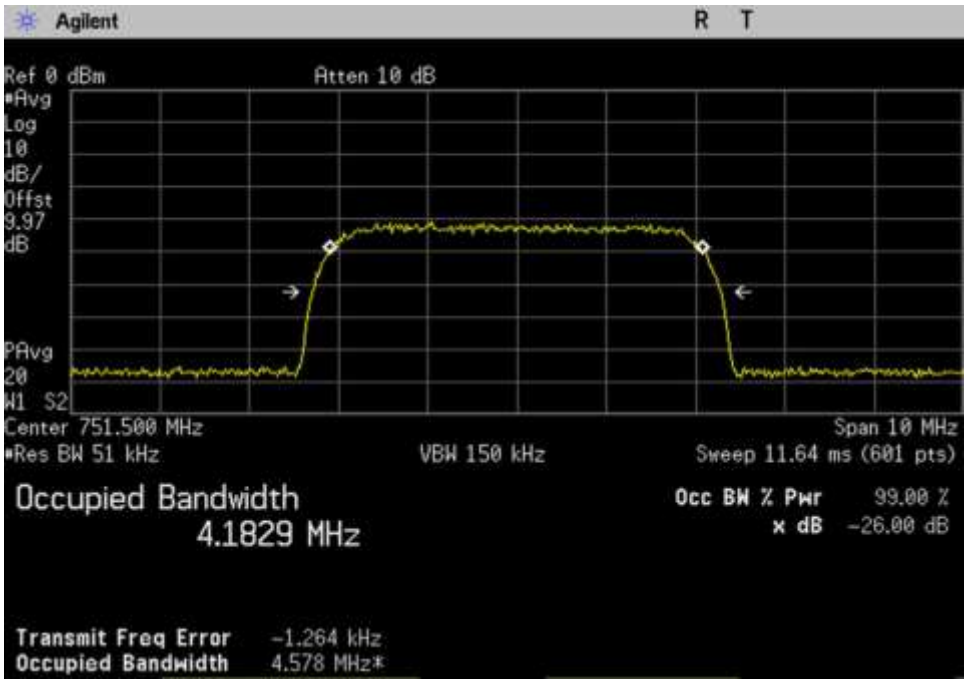
7.10 OBW-In_DL_746-757_EDGE_ 751.5MHz



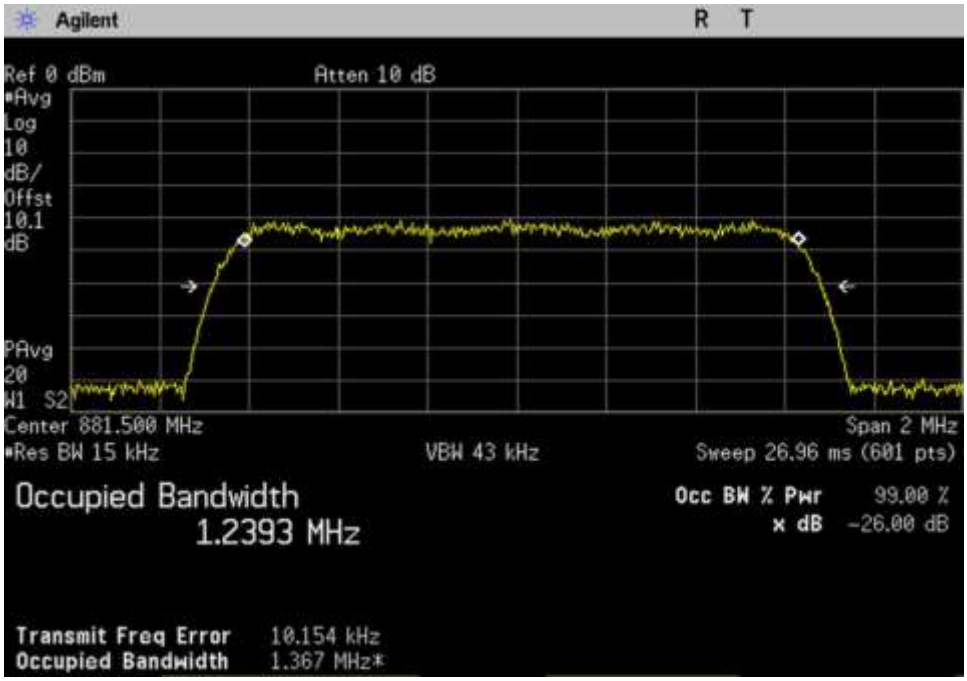
7.10 OBW-In_DL_746-757_GSM_ 751.5MHz



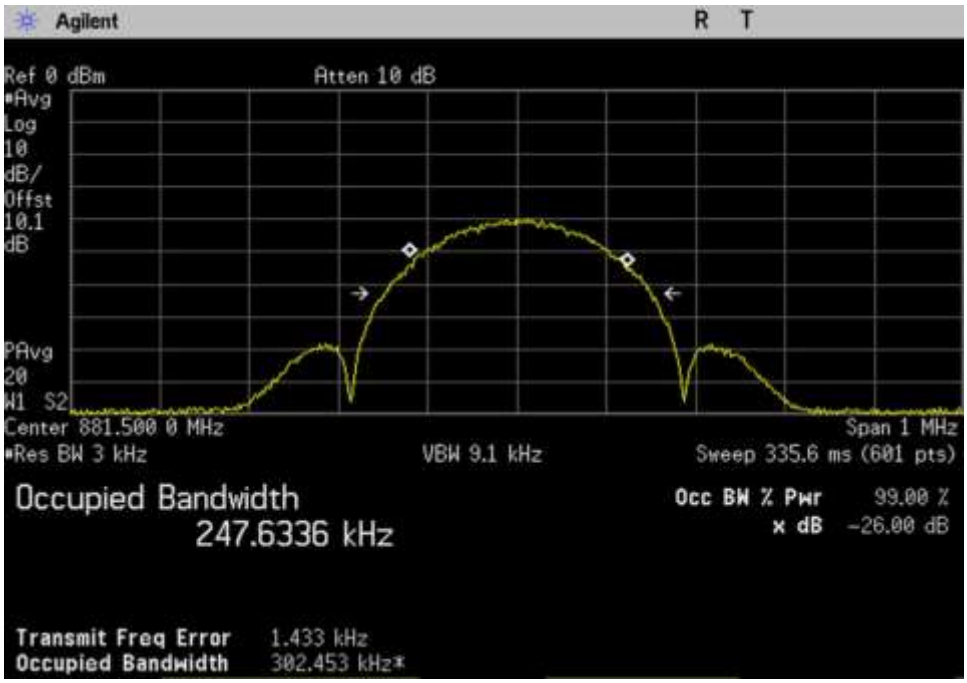
7.10 OBW-In_DL_746-757_LTE_ 751.5MHz



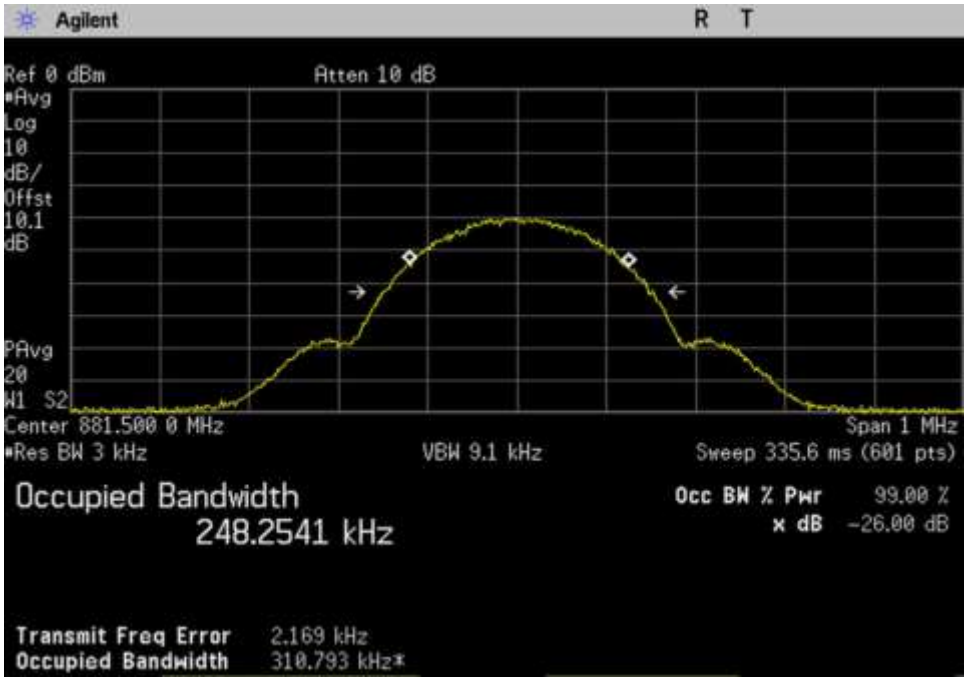
7.10 OBW-In_DL_746-757_WCDMA_ 751.5MHz



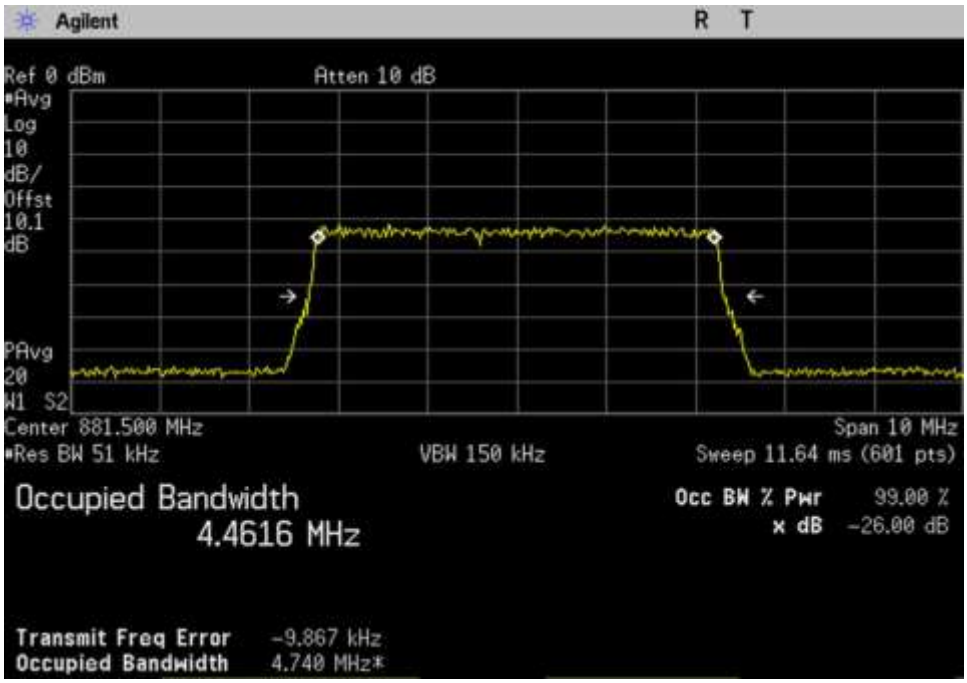
7.10 OBW-In_DL_869-894_CDMA_ 881.5MHz



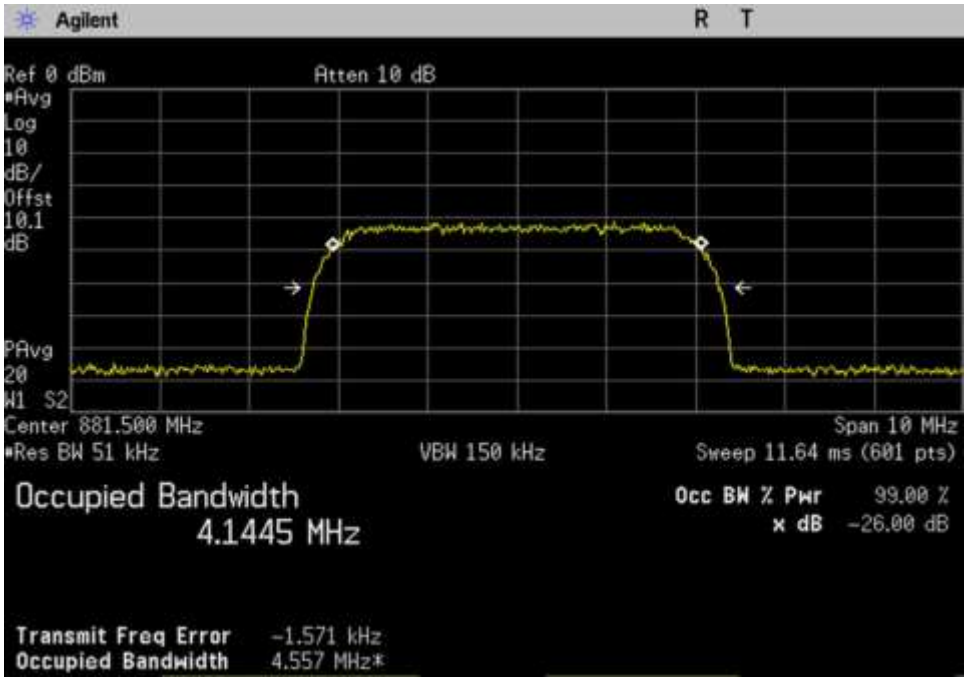
7.10 OBW-In_DL_869-894_EDGE_ 881.5MHz



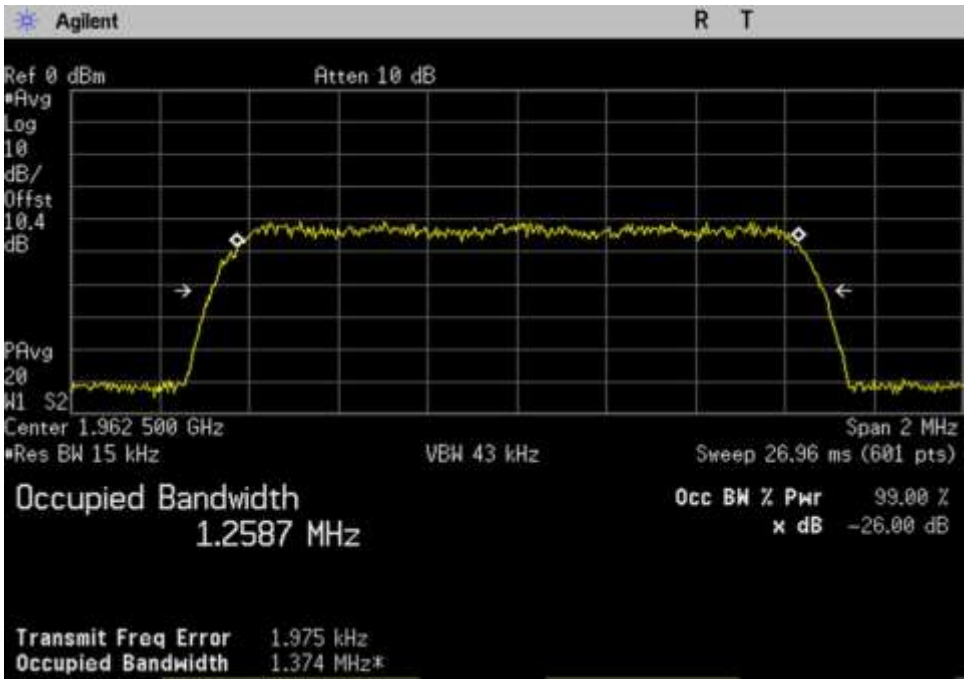
7.10 OBW-In_DL_869-894_GSM_ 881.5MHz



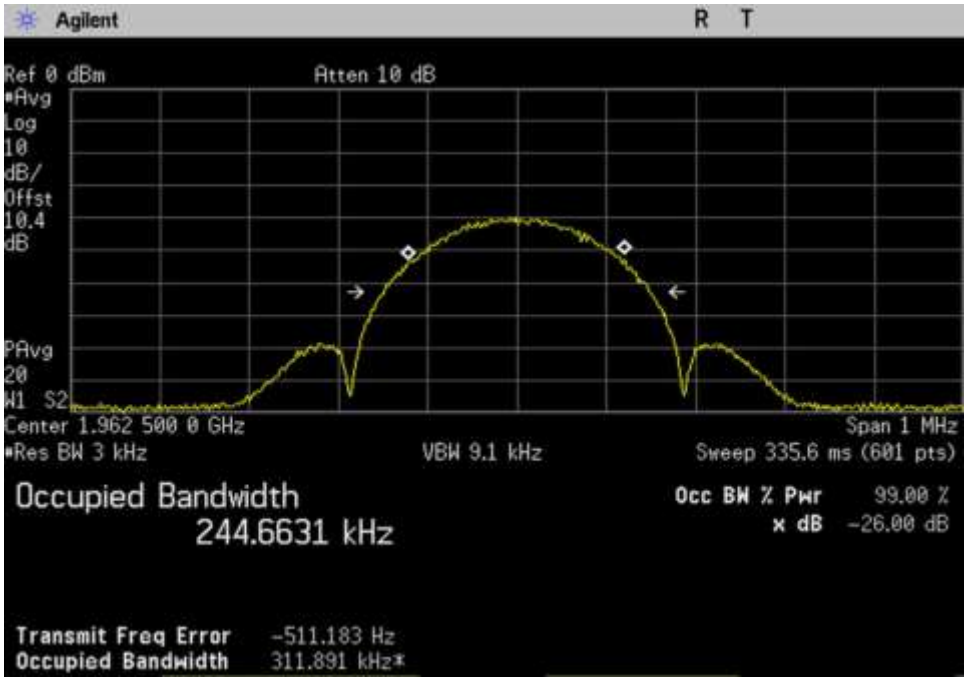
7.10 OBW-In_DL_869-894_LTE_ 881.5MHz



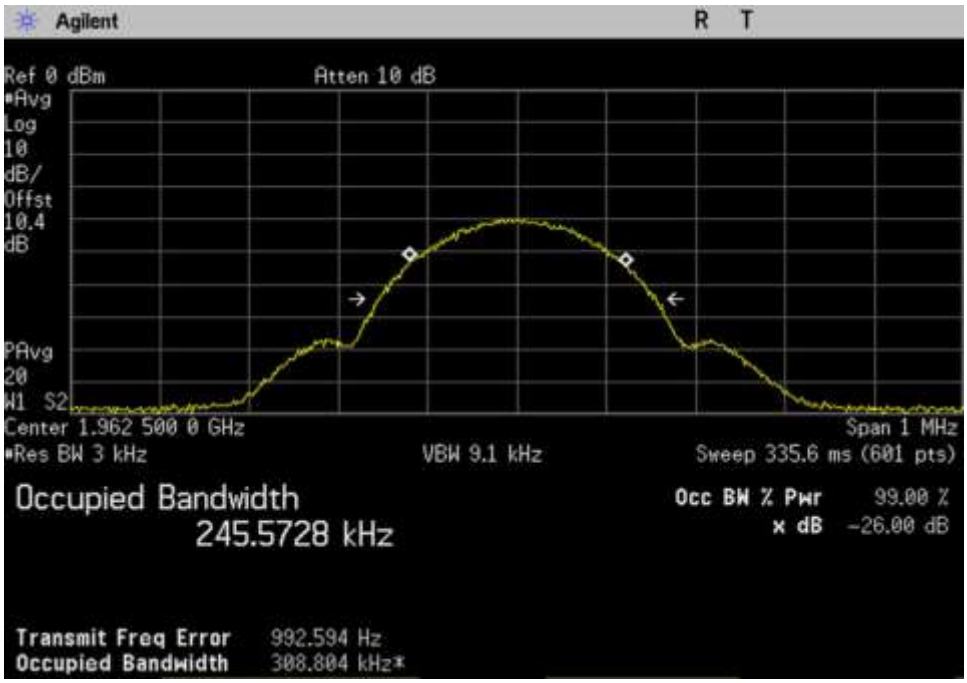
7.10 OBW-In_DL_869-894_WCDMA_ 881.5MHz



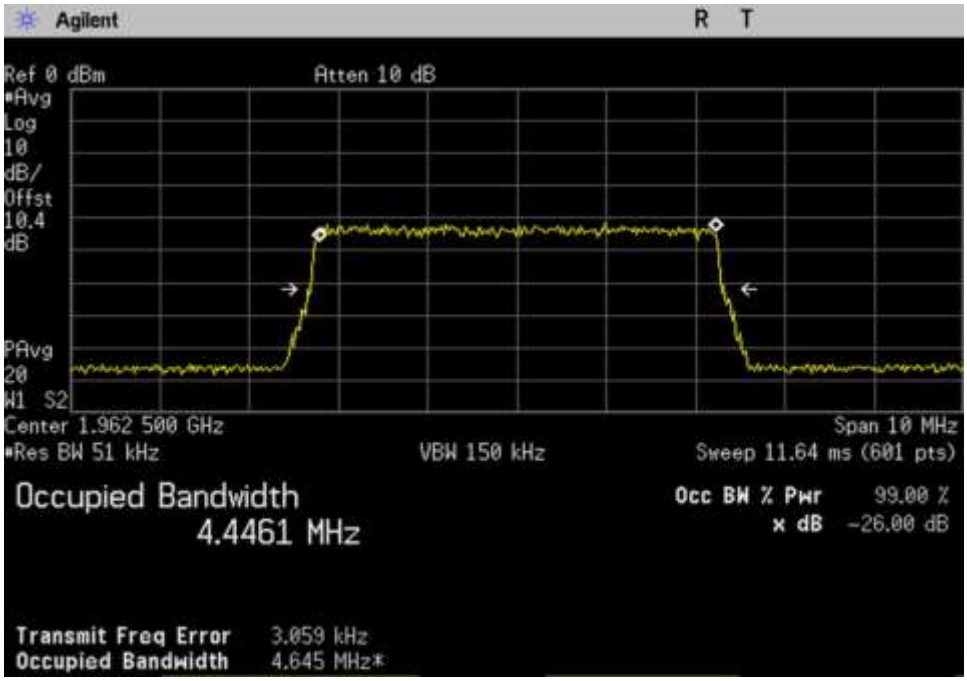
7.10 OBW-In_DL_1930-1995_CDMA_ 1962.5MHz



7.10 OBW-In_DL_1930-1995_EDGE_ 1962.5MHz



7.10 OBW-In_DL_1930-1995_GSM_ 1962.5MHz



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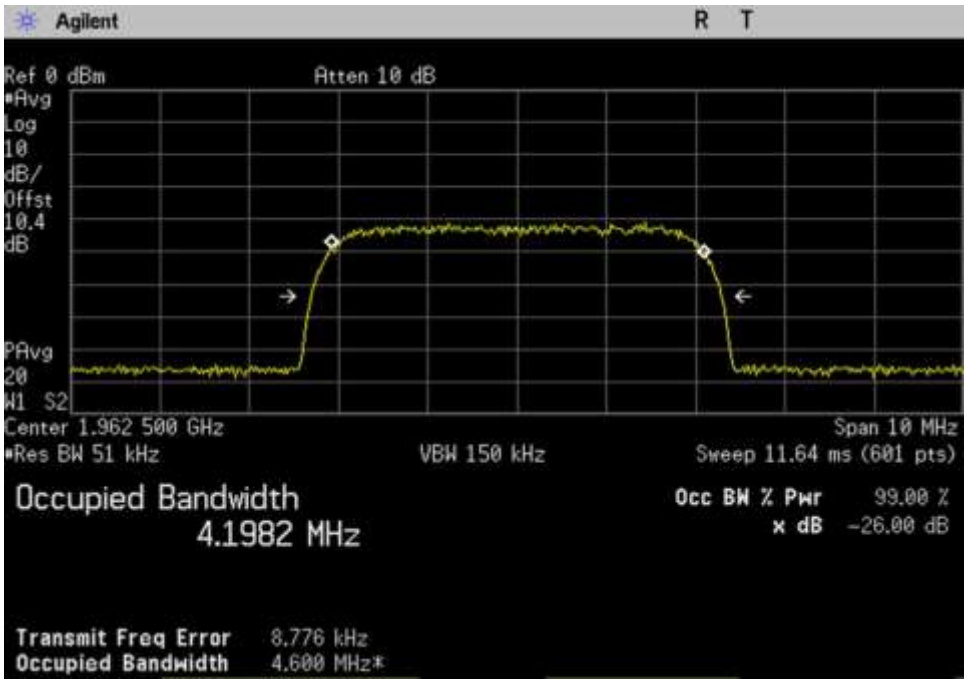
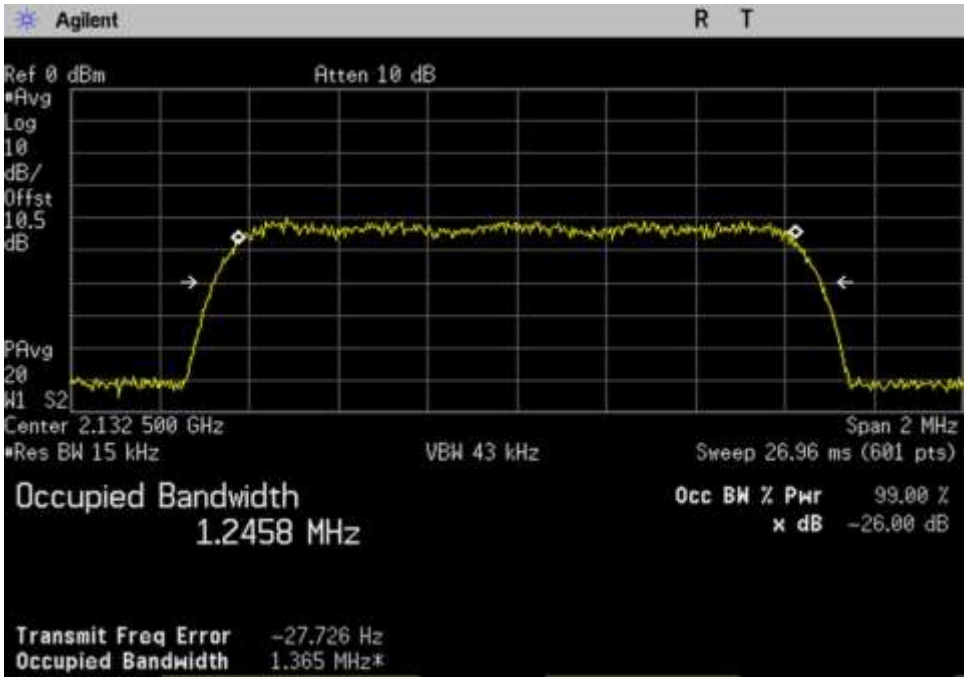
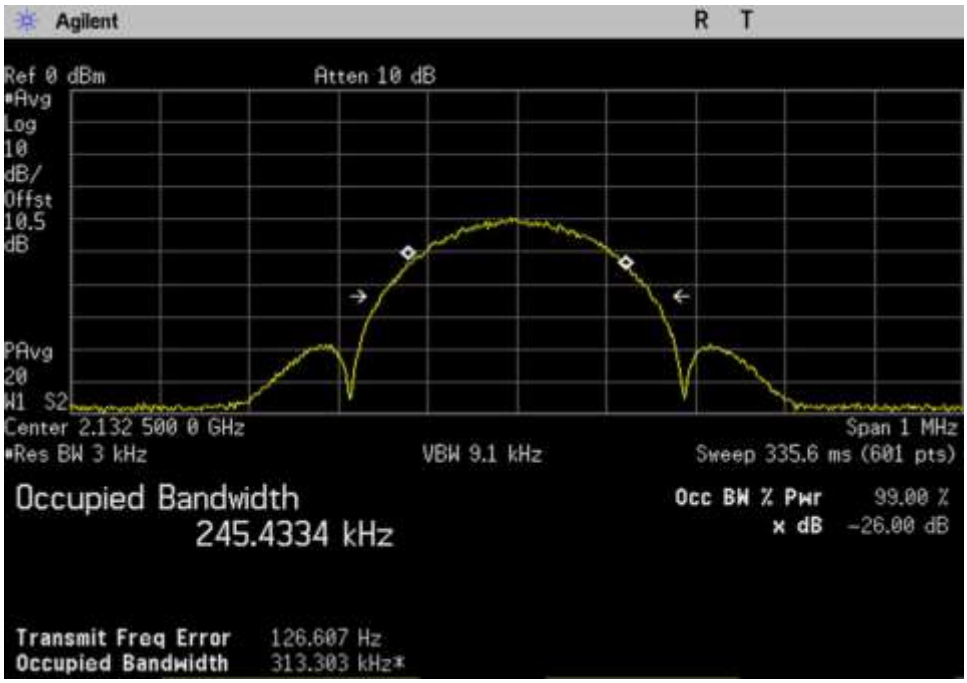


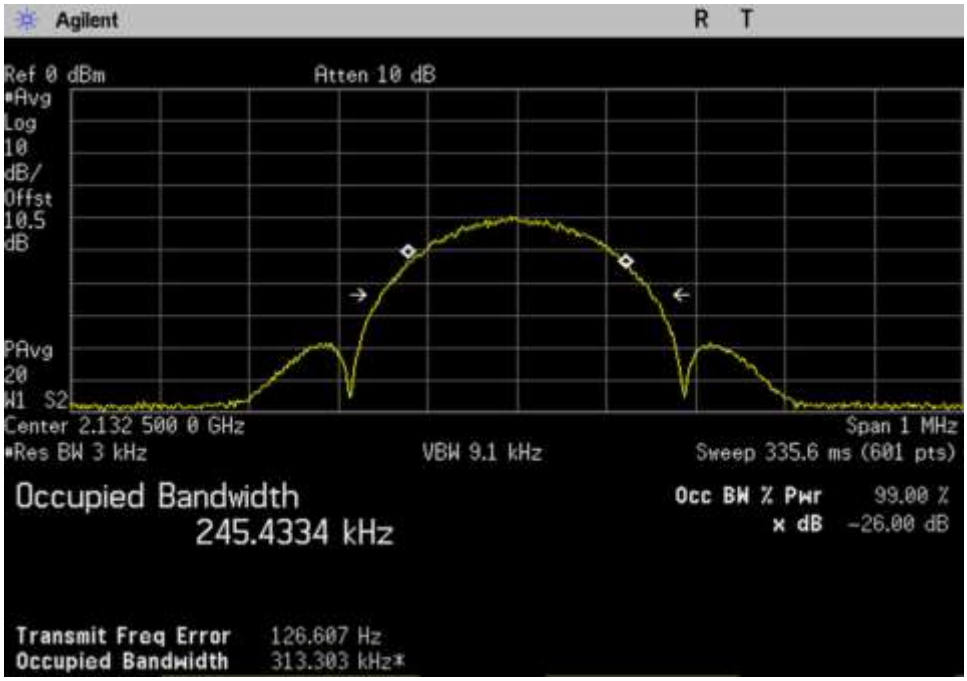
7.10 OBW-In_DL_1930-1995_WCDMA_ 1962.5MHz



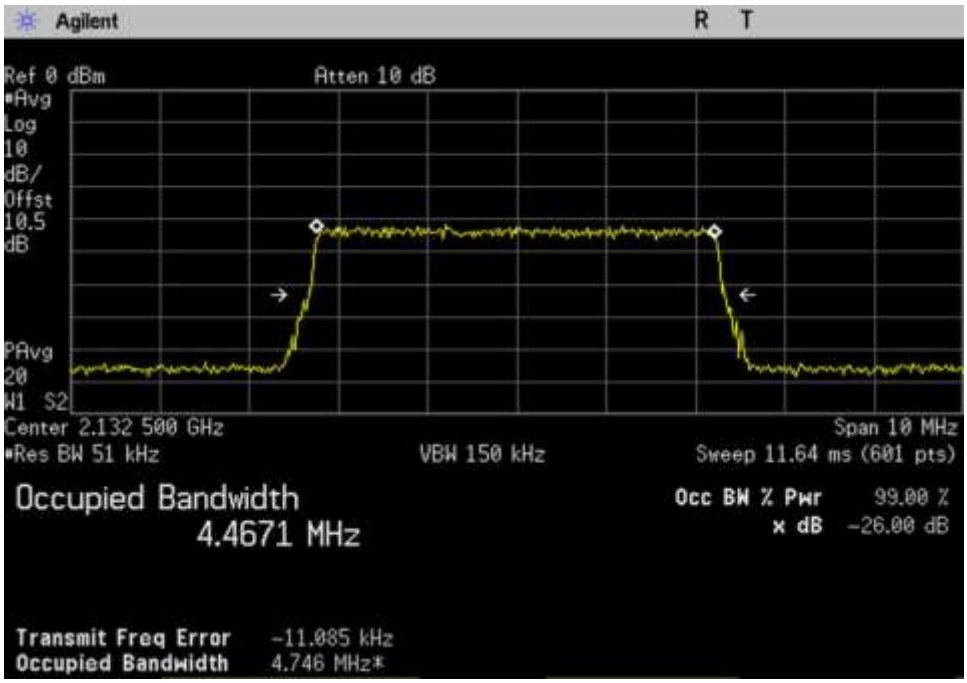
7.10 OBW-In_DL_2110-2155_CDMA_ 2132.5MHz



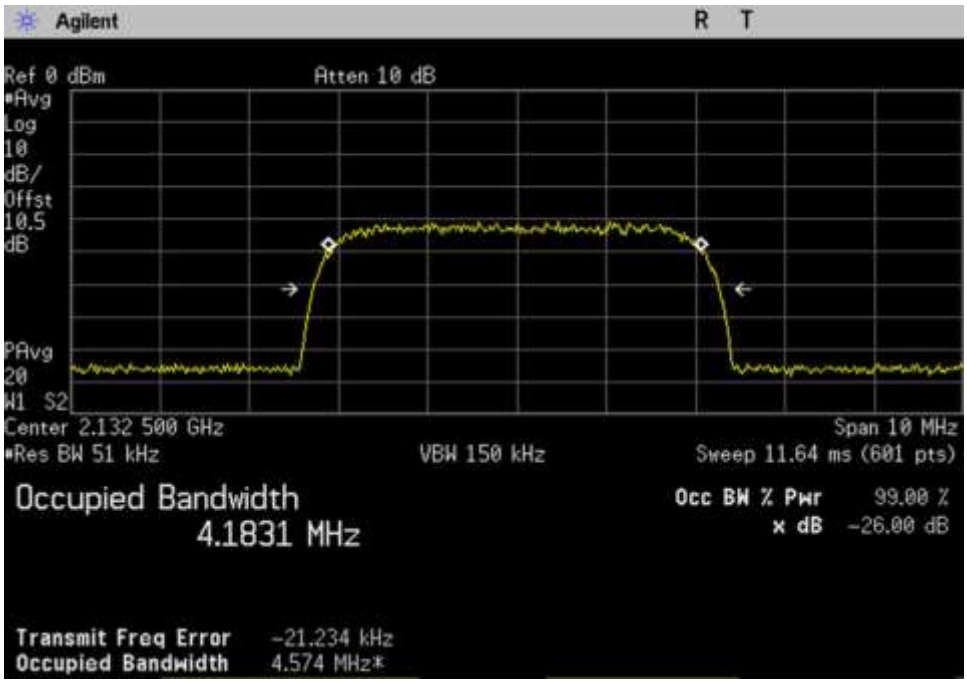
7.10 OBW-In_DL_2110-2155_EDGE_ 2132.5MHz



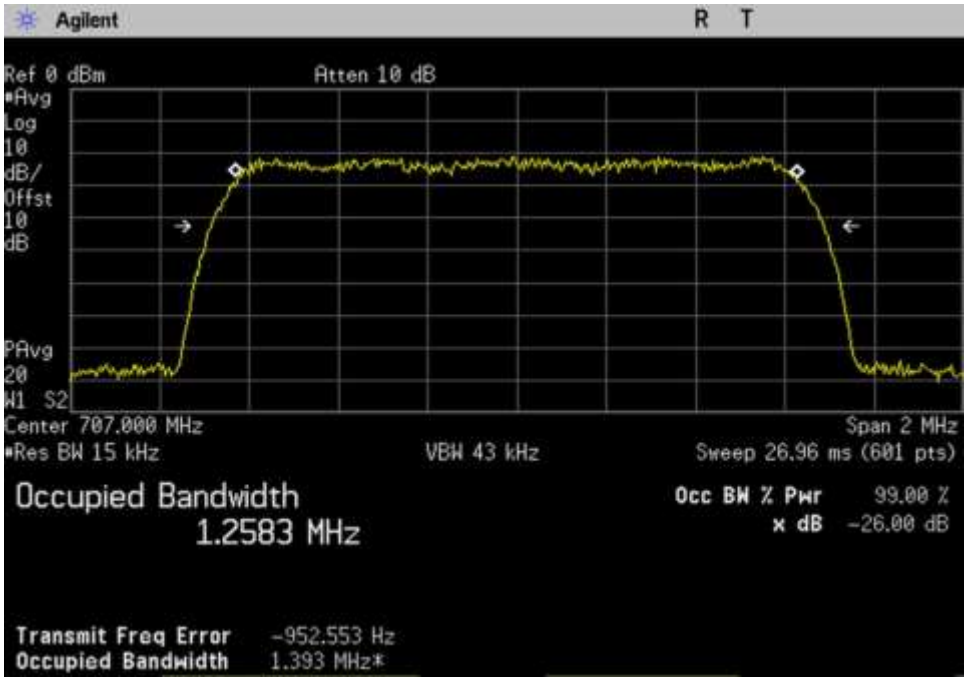
7.10 OBW-In_DL_2110-2155_GSM_ 2132.5MHz



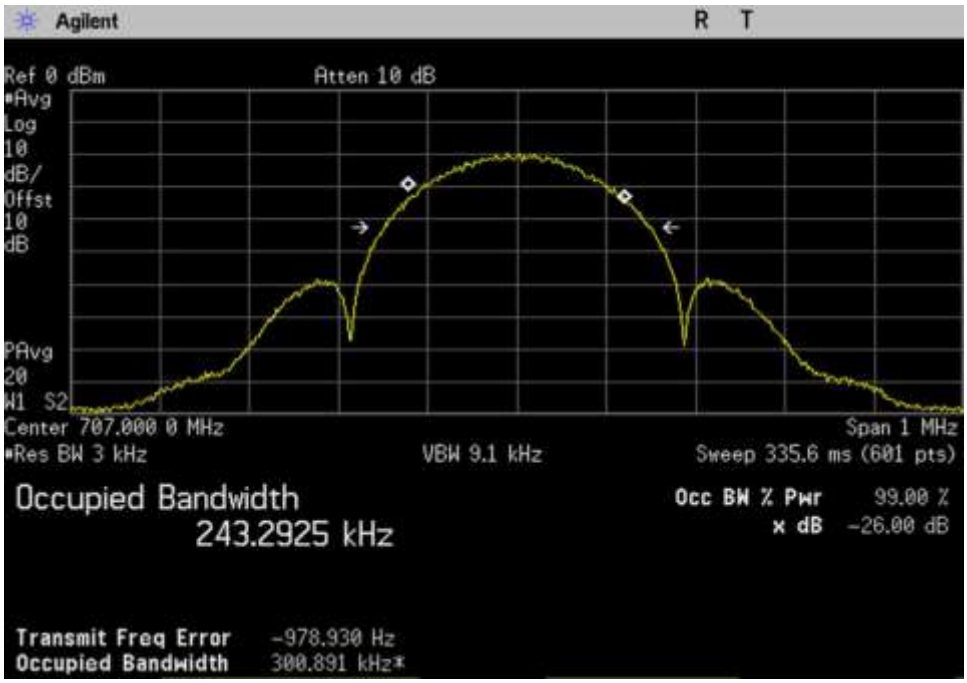
7.10 OBW-In_DL_2110-2155_LTE_ 2132.5MHz



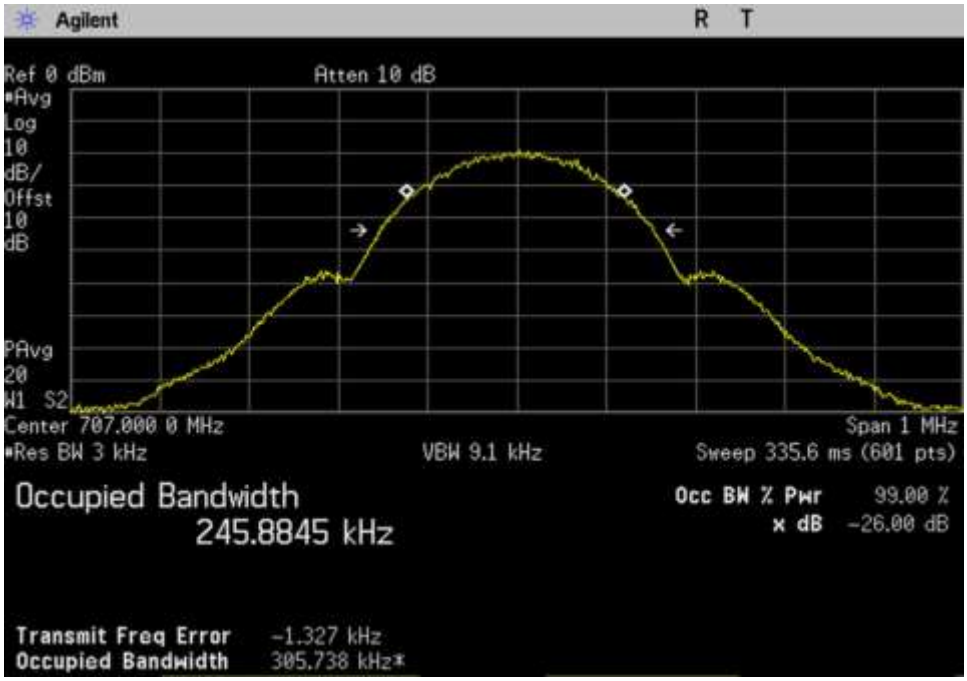
7.10 OBW-In_DL_2110-2155_WCDMA_ 2132.5MHz



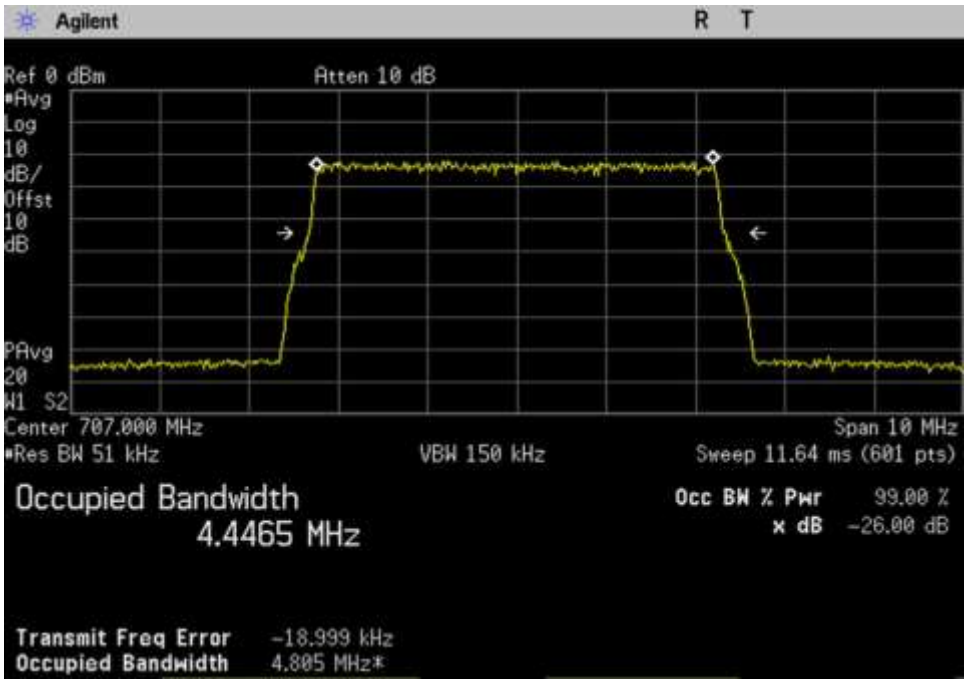
7.10 OBW-In_UL_698-716_CDMA_ 707MHz



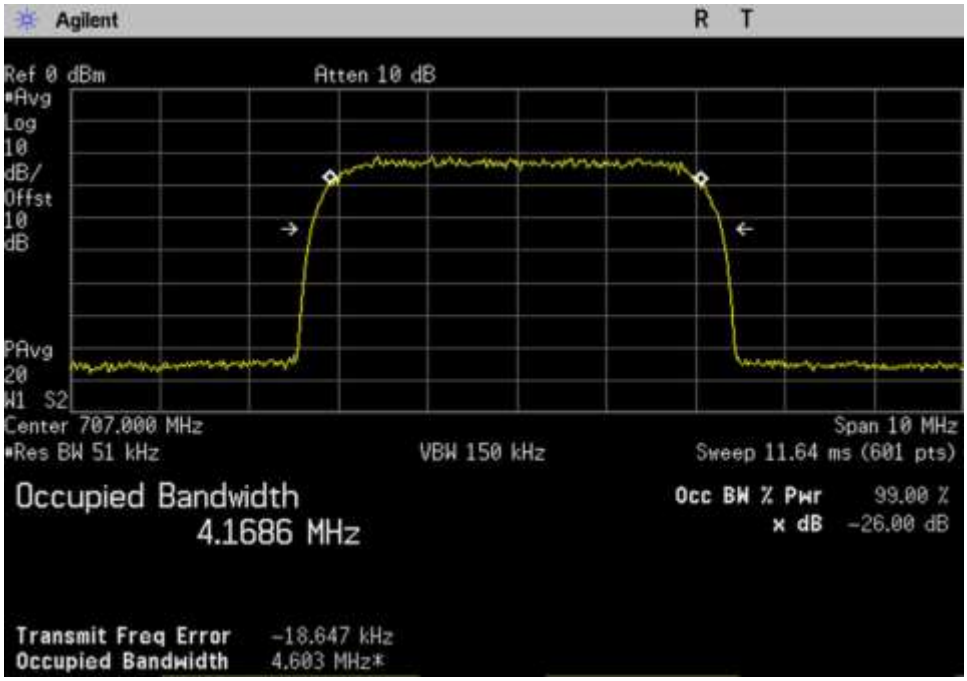
7.10 OBW-In_UL_698-716_EDGE_ 707MHz



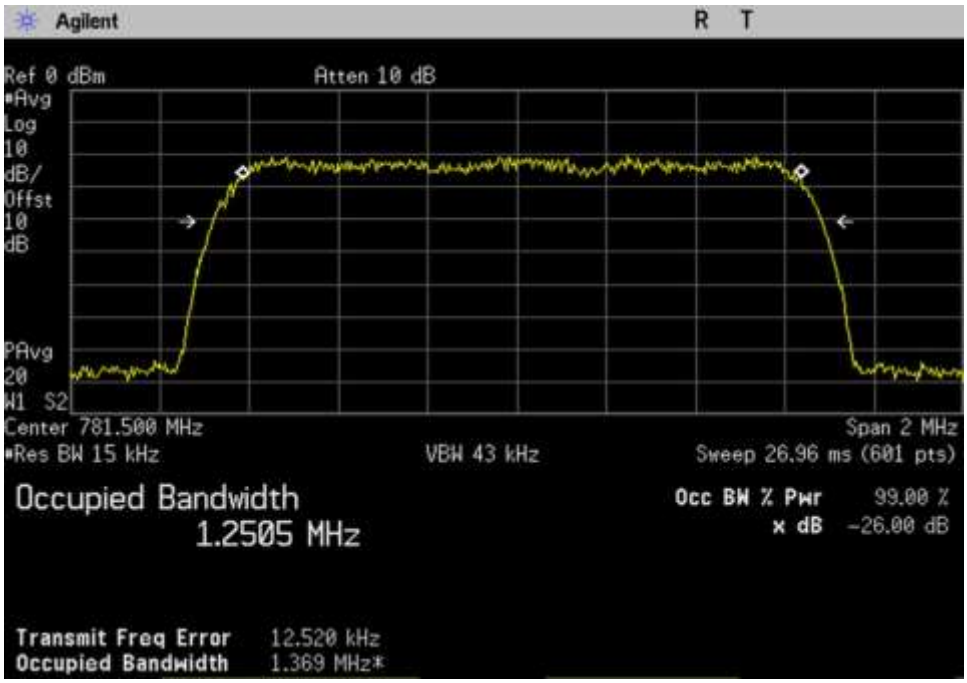
7.10 OBW-In_UL_698-716_GSM_ 707MHz



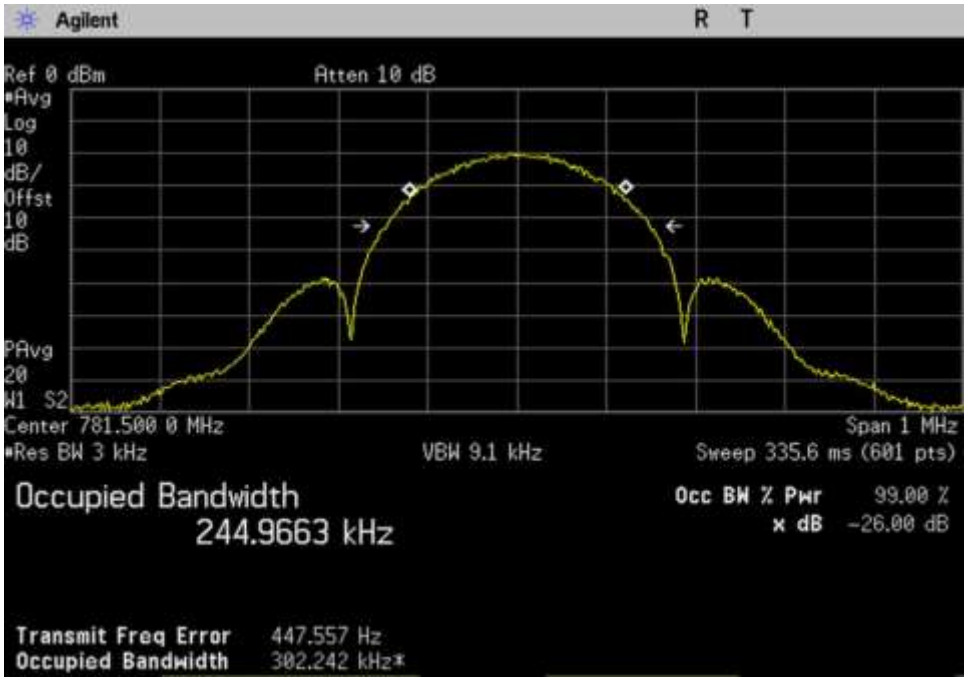
7.10 OBW-In_UL_698-716_LTE_ 707MHz



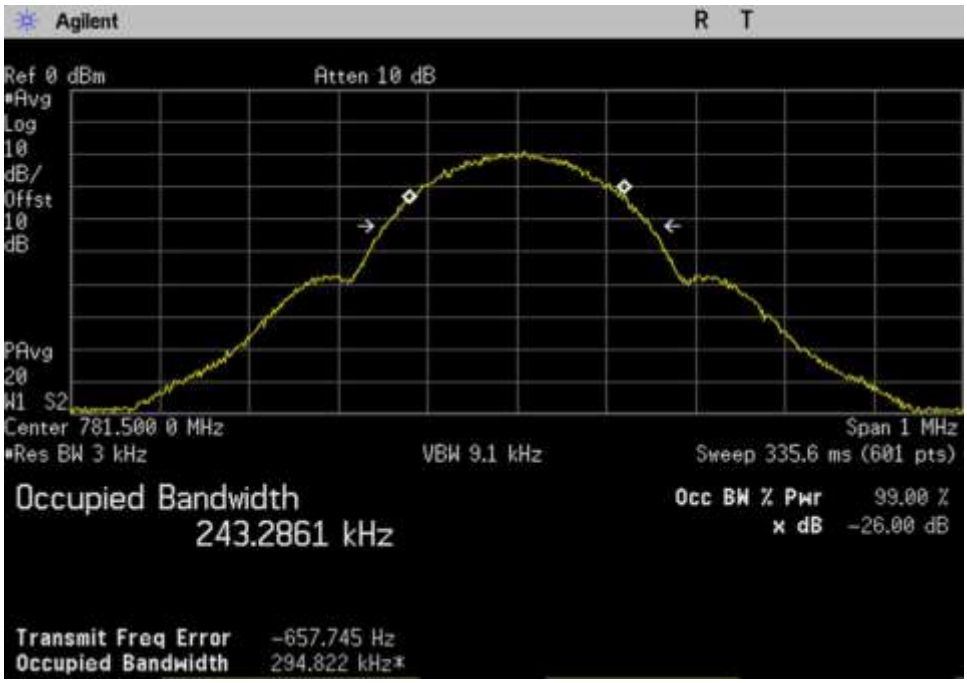
7.10 OBW-In_UL_698-716_WCDMA_ 707MHz



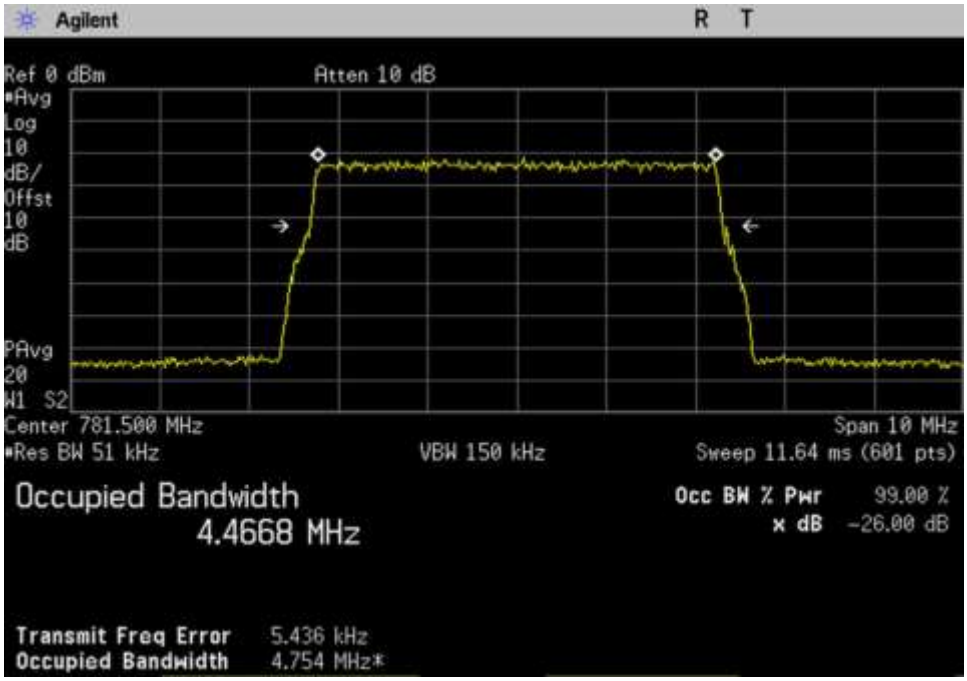
7.10 OBW-In_UL_776-787_CDMA_ 781.5MHz



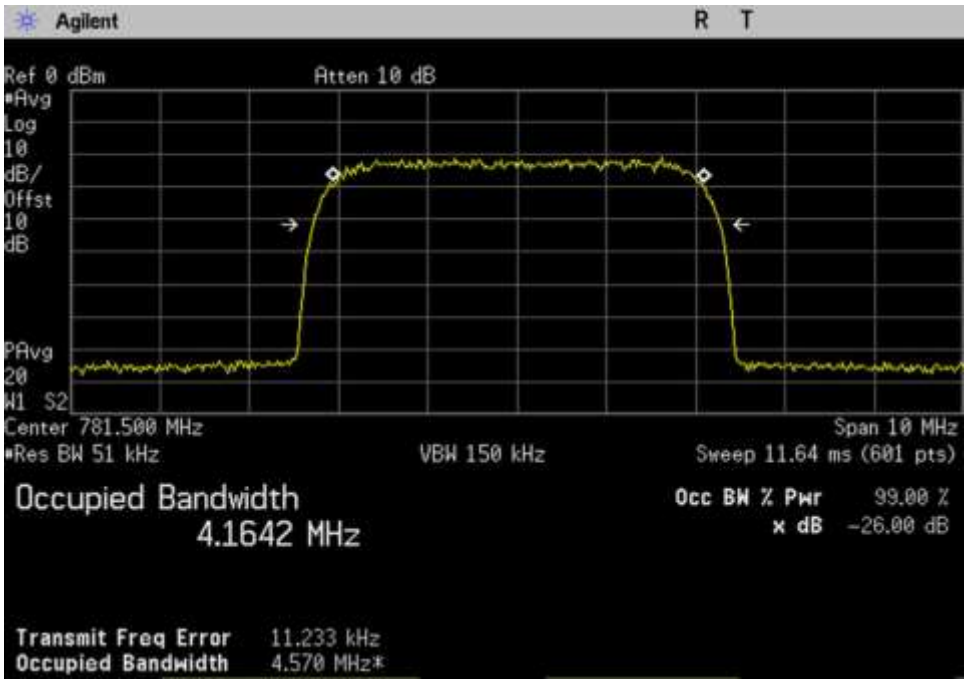
7.10 OBW-In_UL_776-787_EDGE_ 781.5MHz



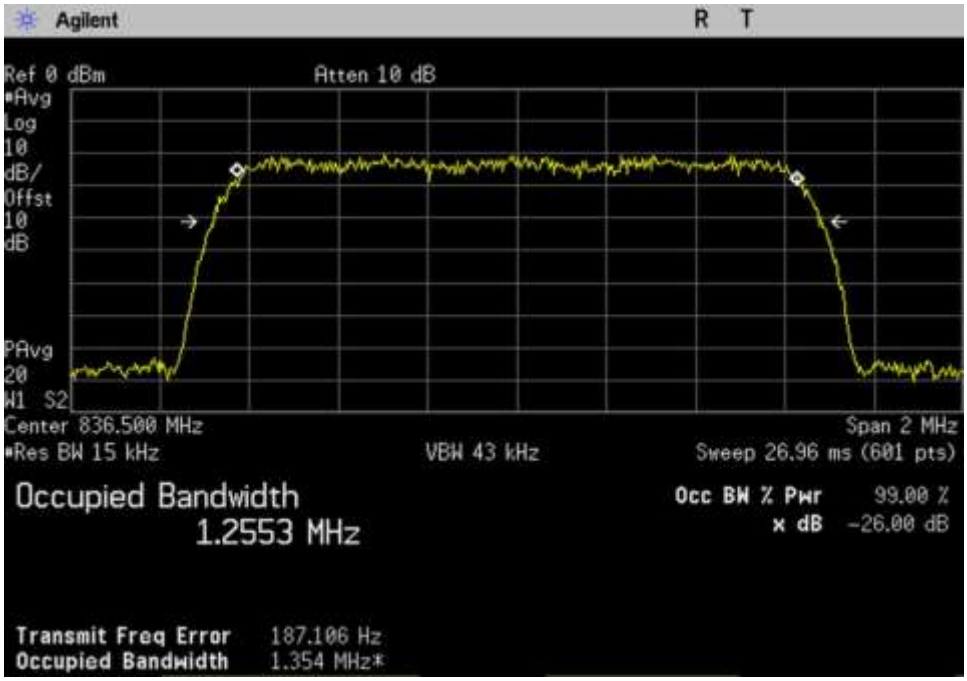
7.10 OBW-In_UL_776-787_GSM_ 781.5MHz



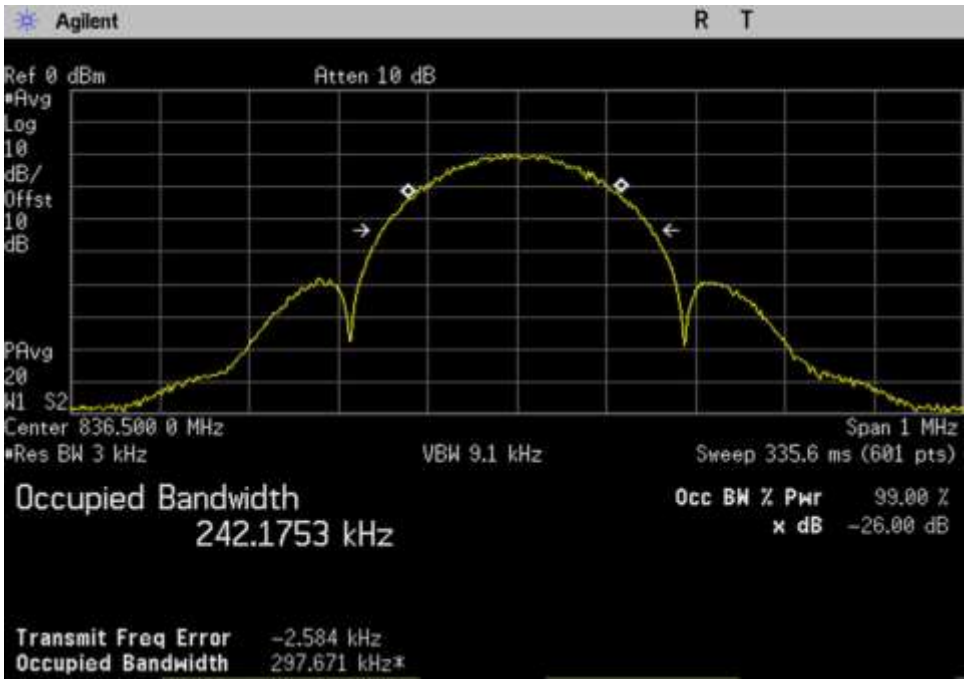
7.10 OBW-In_UL_776-787_LTE_ 781.5MHz



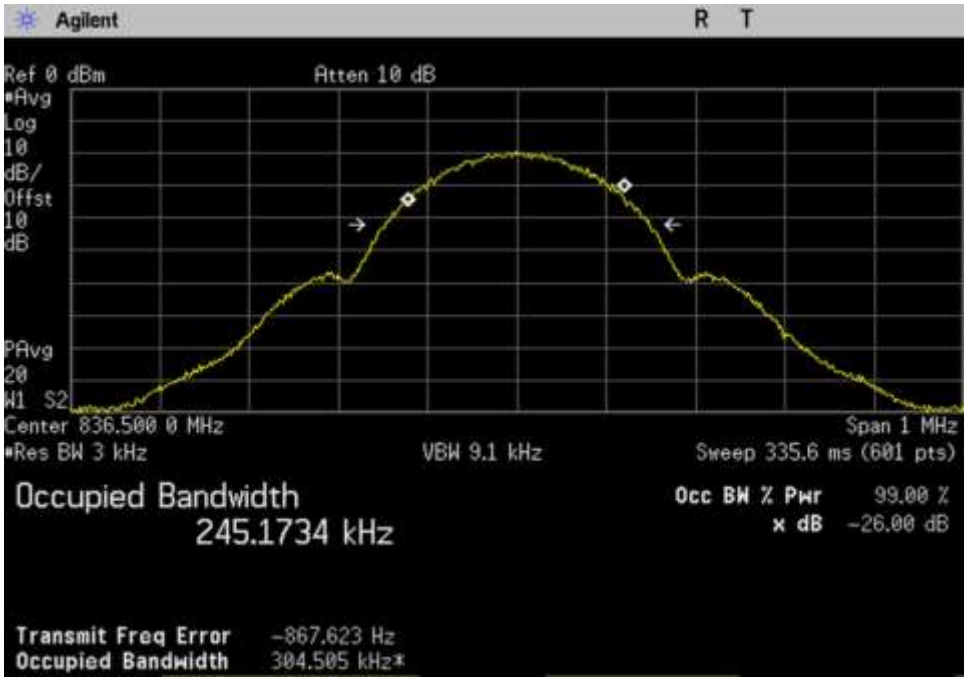
7.10 OBW-In_UL_776-787_WCDMA_ 781.5MHz



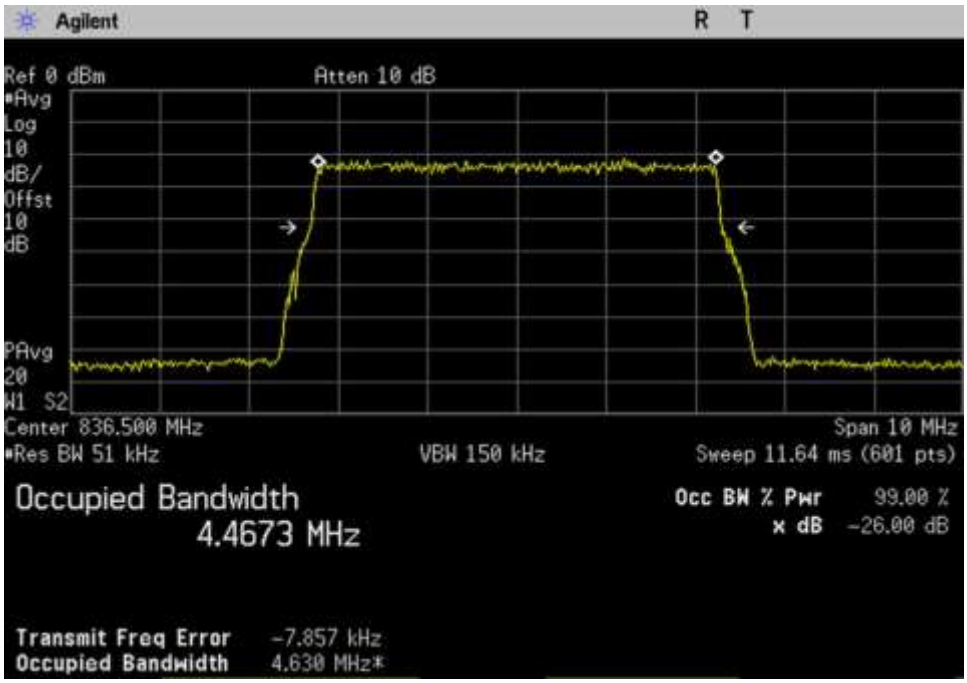
7.10 OBW-In_UL_824-849_CDMA_ 836.5MHz



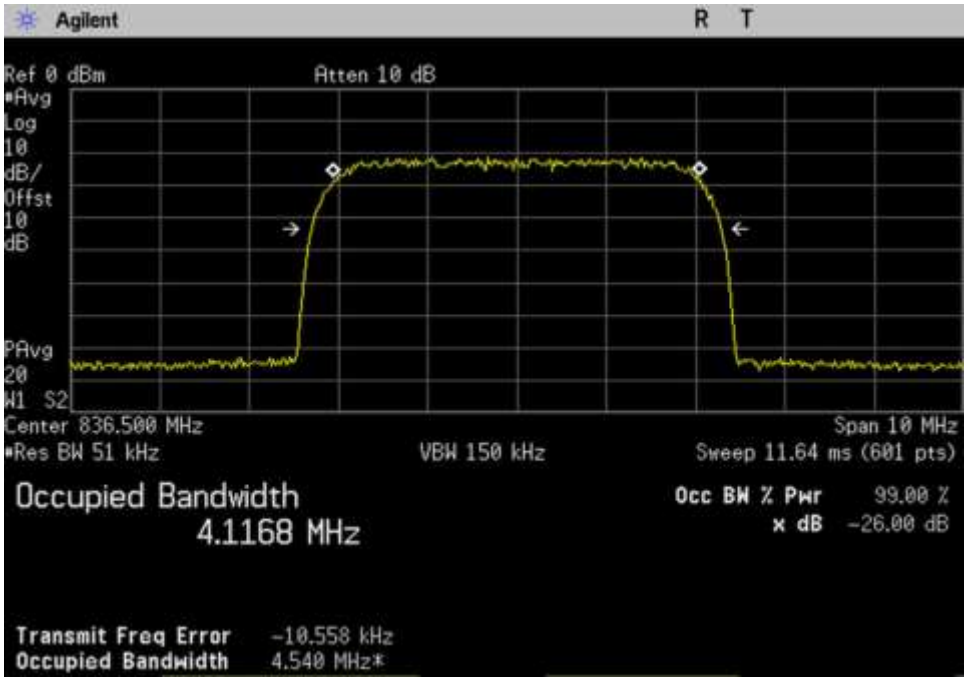
7.10 OBW-In_UL_824-849_EDGE_ 836.5MHz



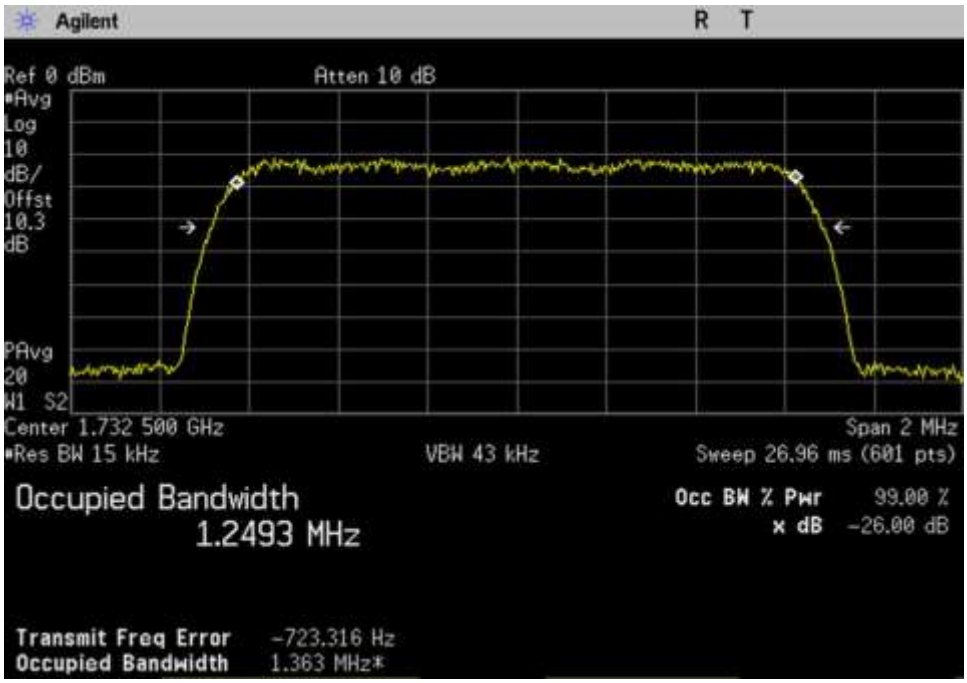
7.10 OBW-In_UL_824-849_GSM_ 836.5MHz



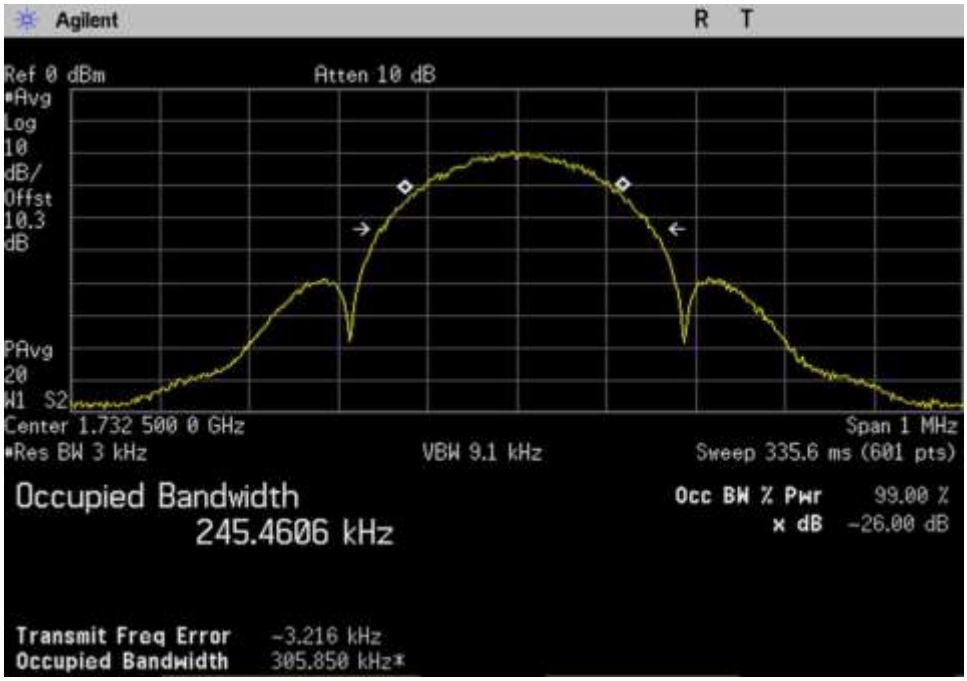
7.10 OBW-In_UL_824-849_LTE_ 836.5MHz



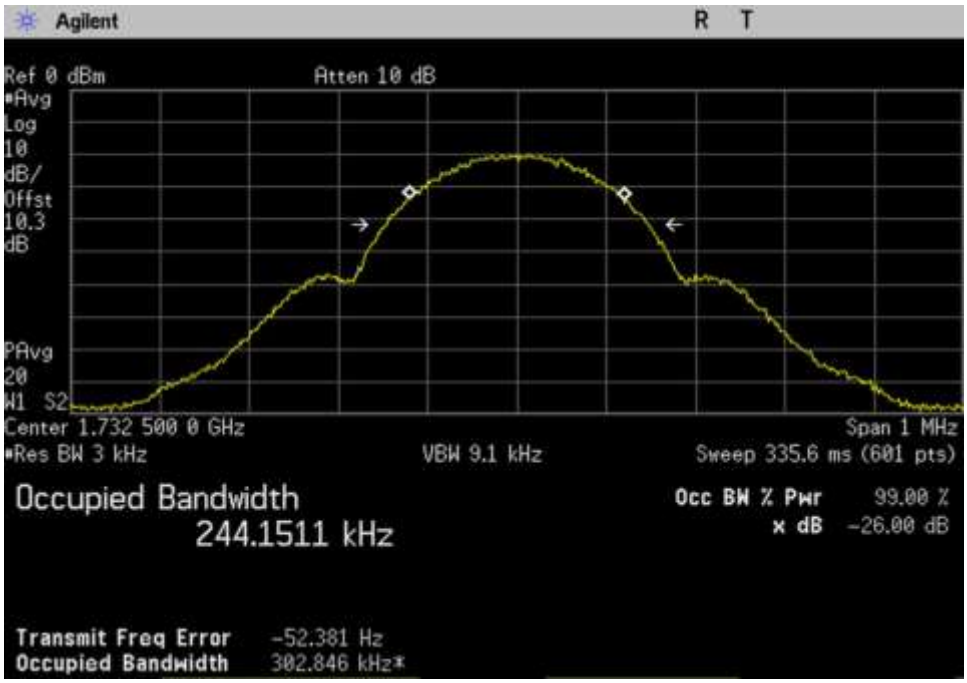
7.10 OBW-In_UL_824-849_WCDMA_ 836.5MHz



7.10 OBW-In_UL_1710-1755_CDMA_ 1732.5MHz



7.10 OBW-In_UL_1710-1755_EDGE_ 1732.5MHz



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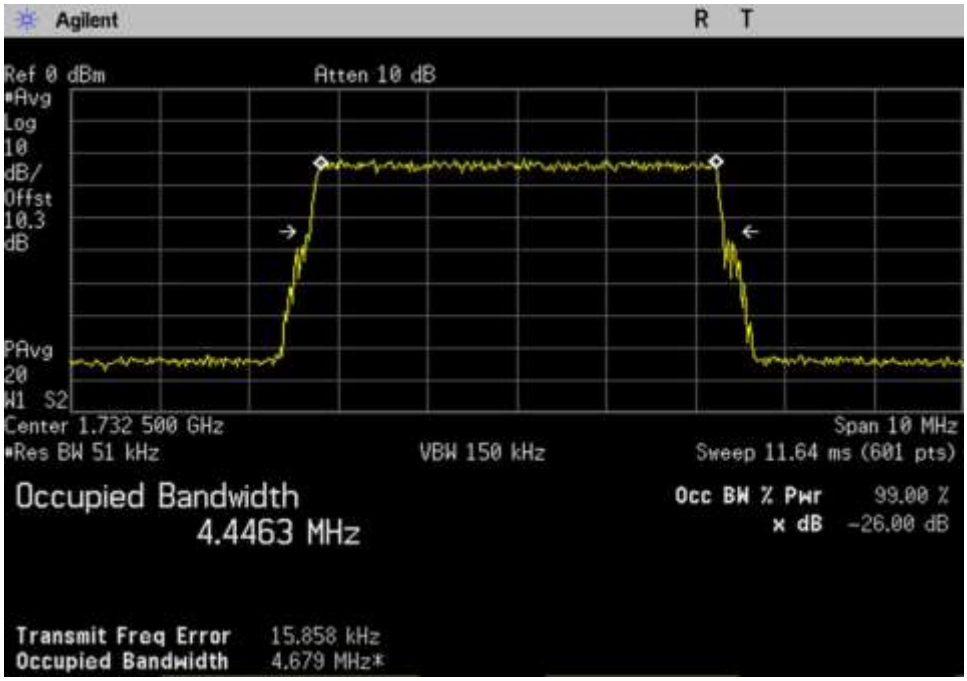

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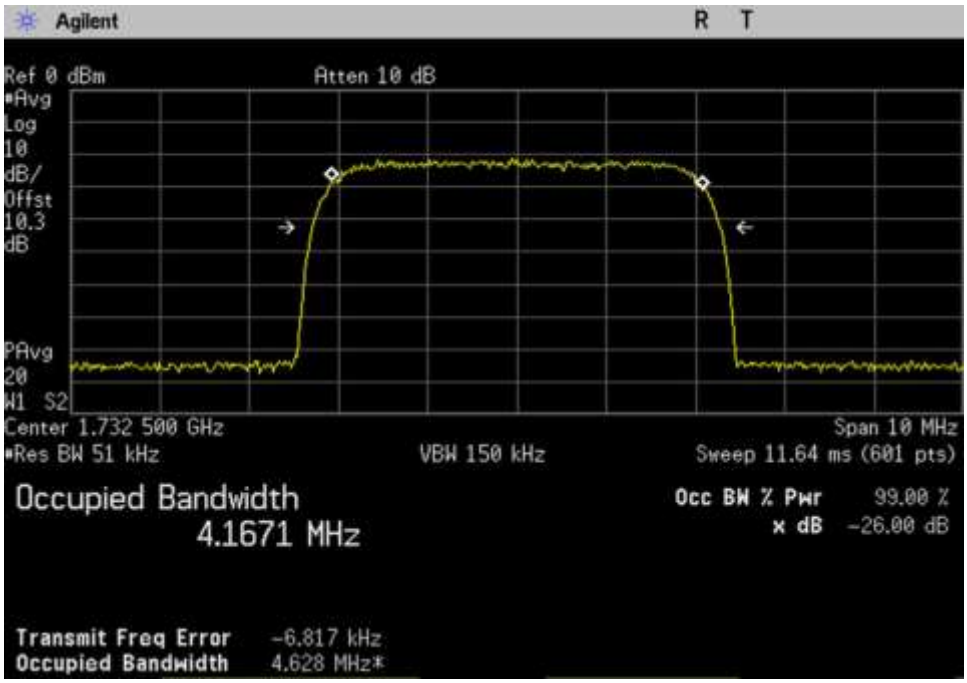

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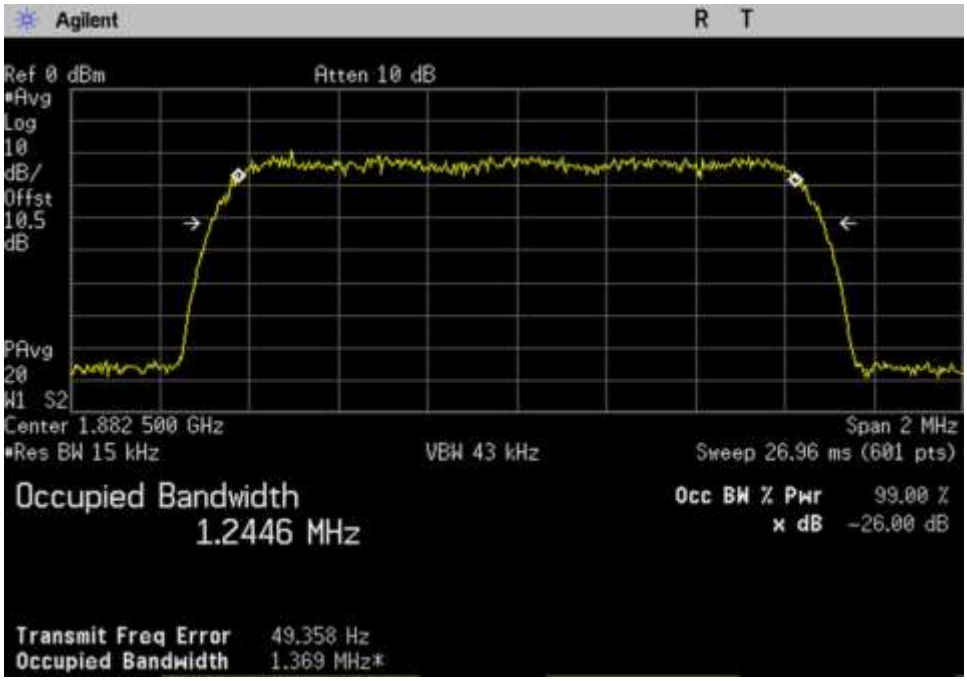
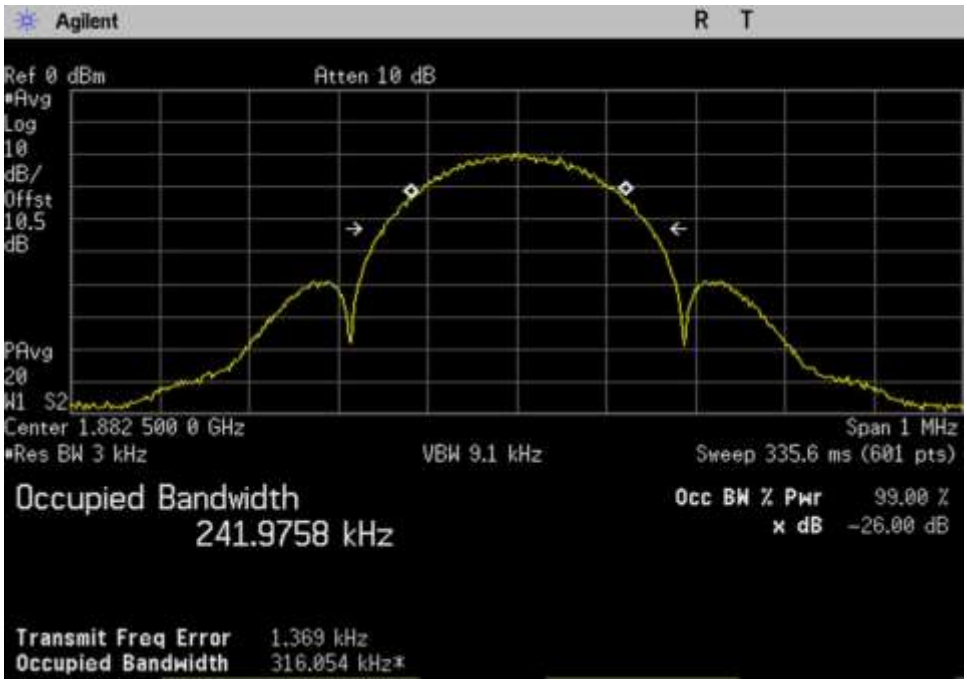


7.10 OBW-In_UL_1850-1915_CDMA_ 1882.5MHz



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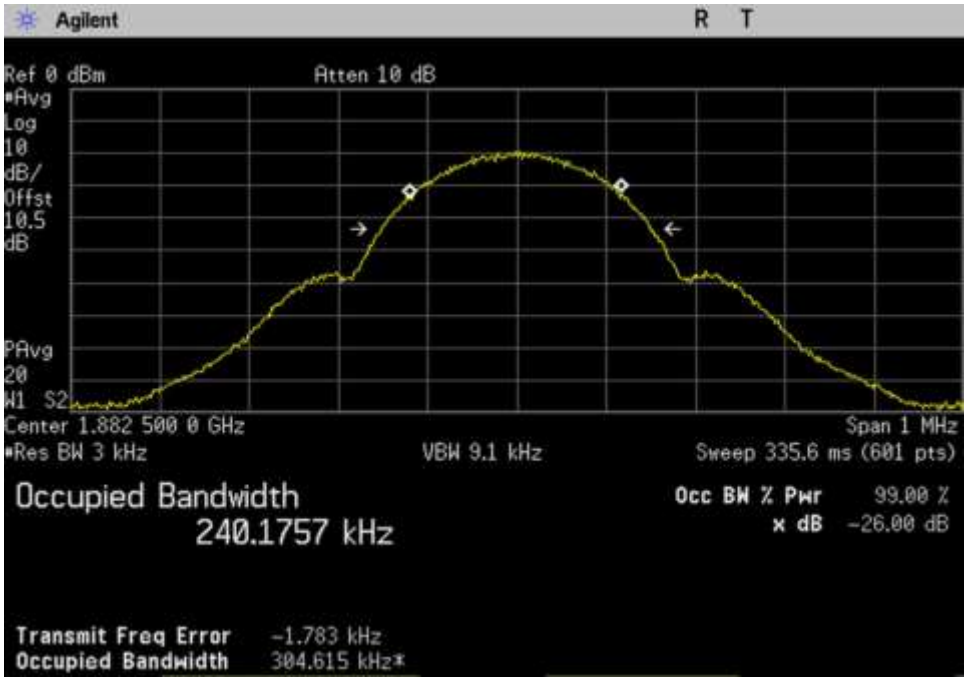

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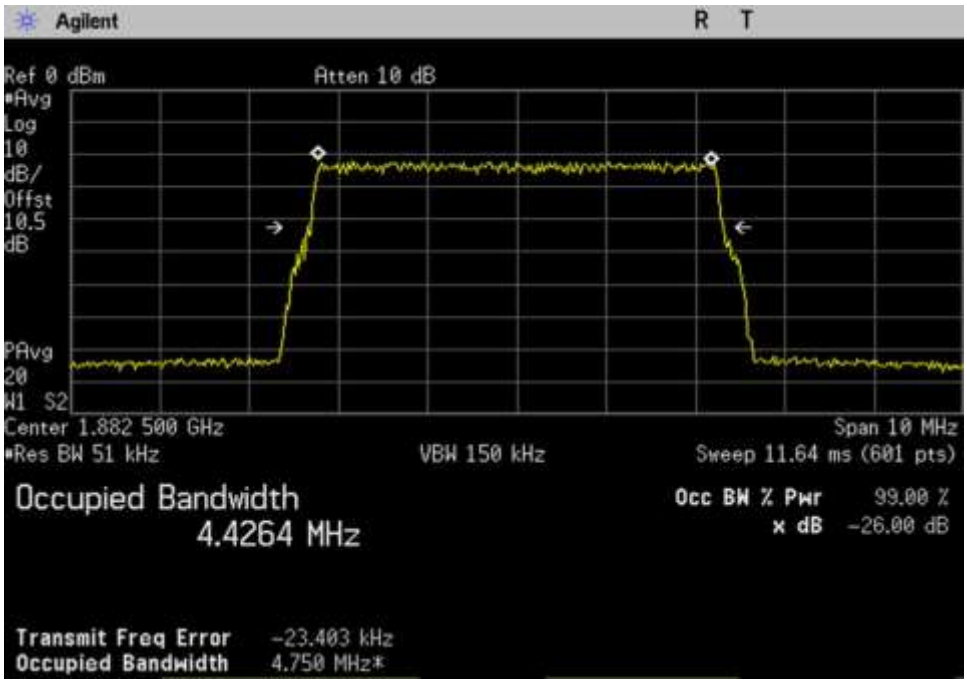

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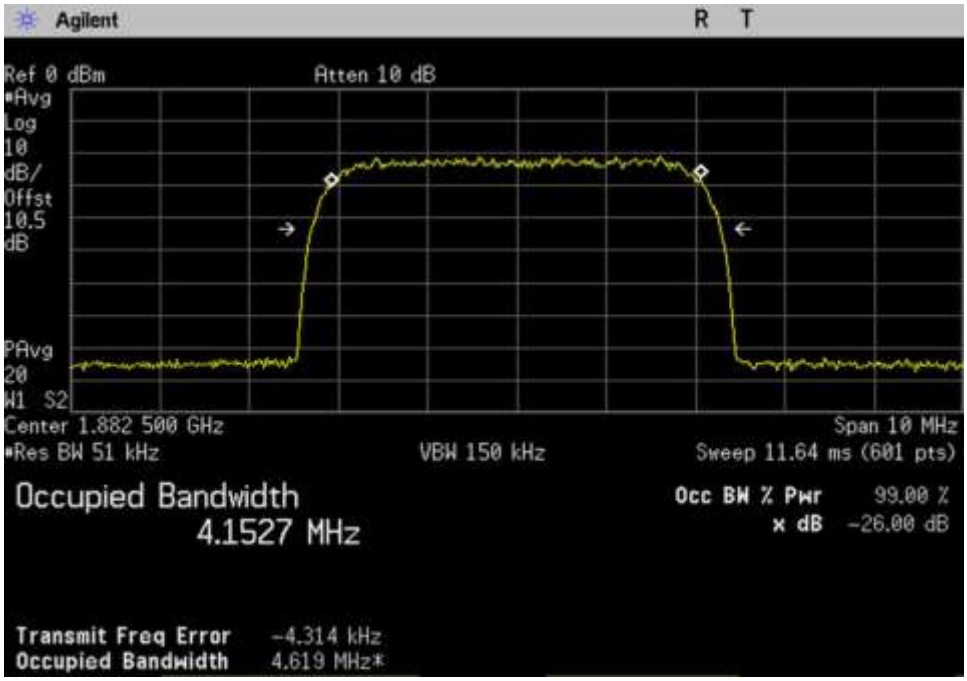
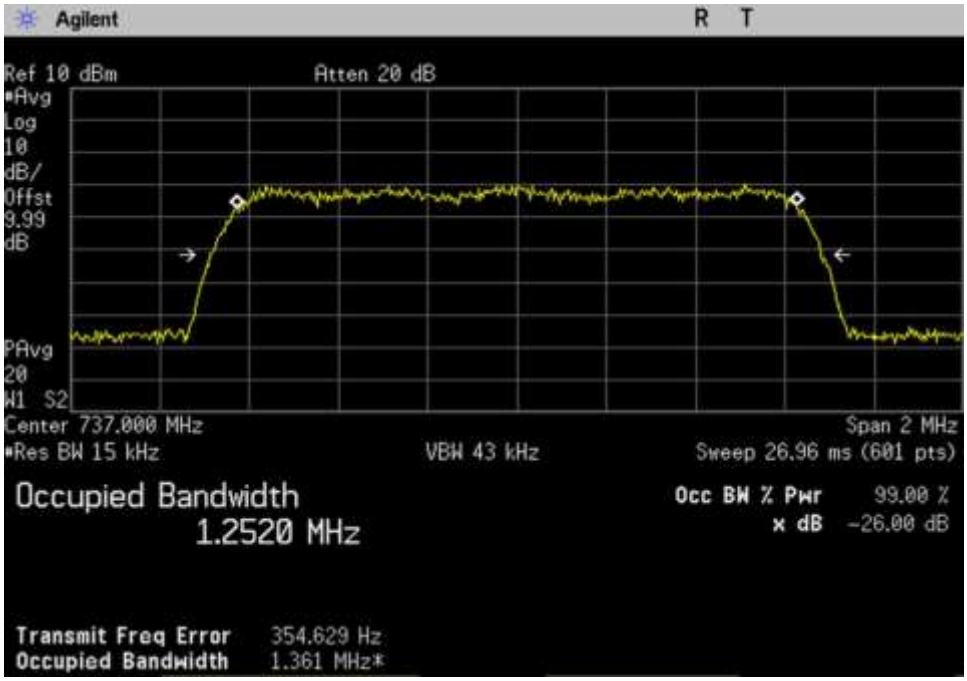
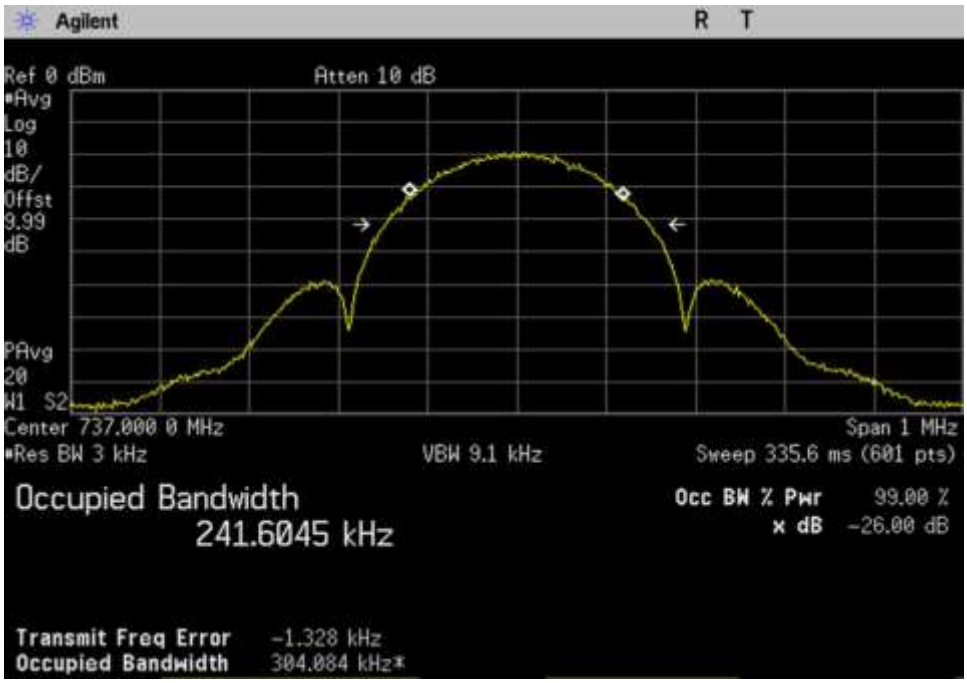


7.10 OBW-In_UL_1850-1915_WCDMA_ 1882.5MHz

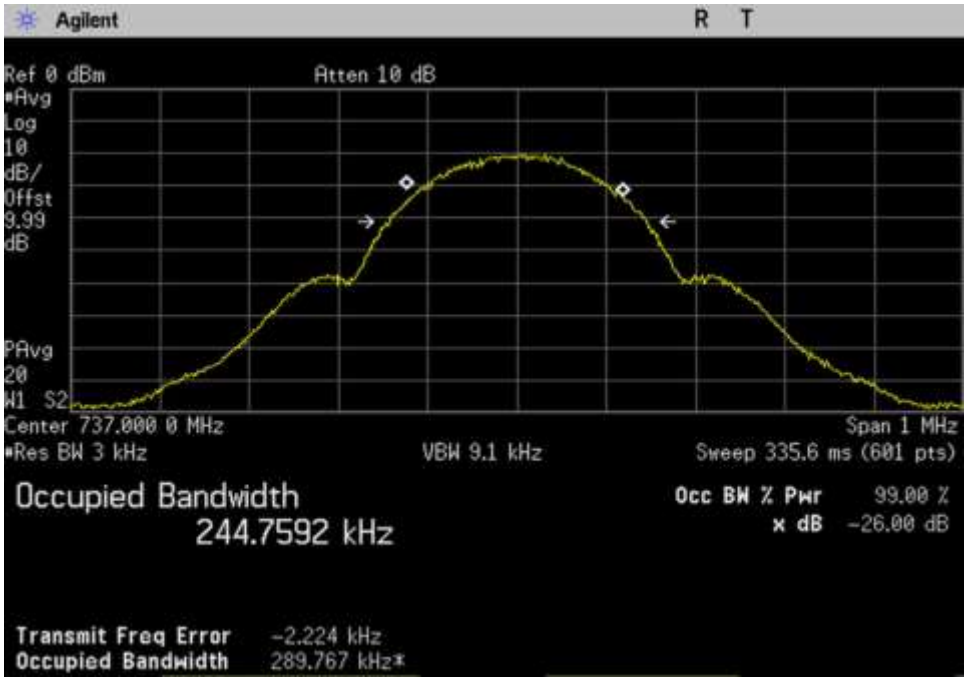
Output



7.10 OBW-Out_DL_728-746_CDMA_ 737MHz



7.10 OBW-Out_DL_728-746_EDGE_ 737MHz



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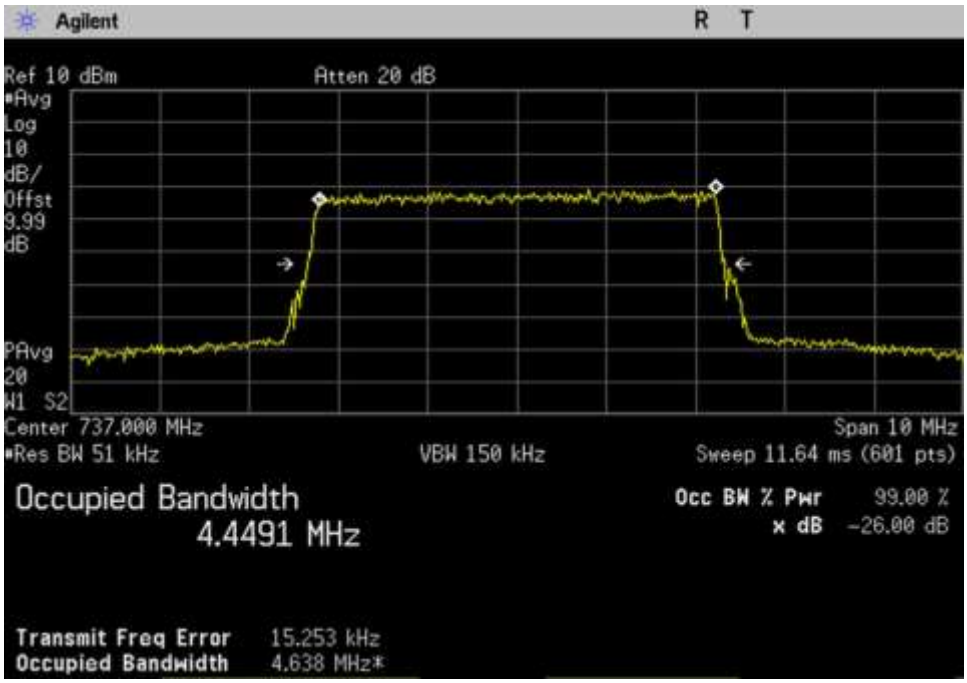

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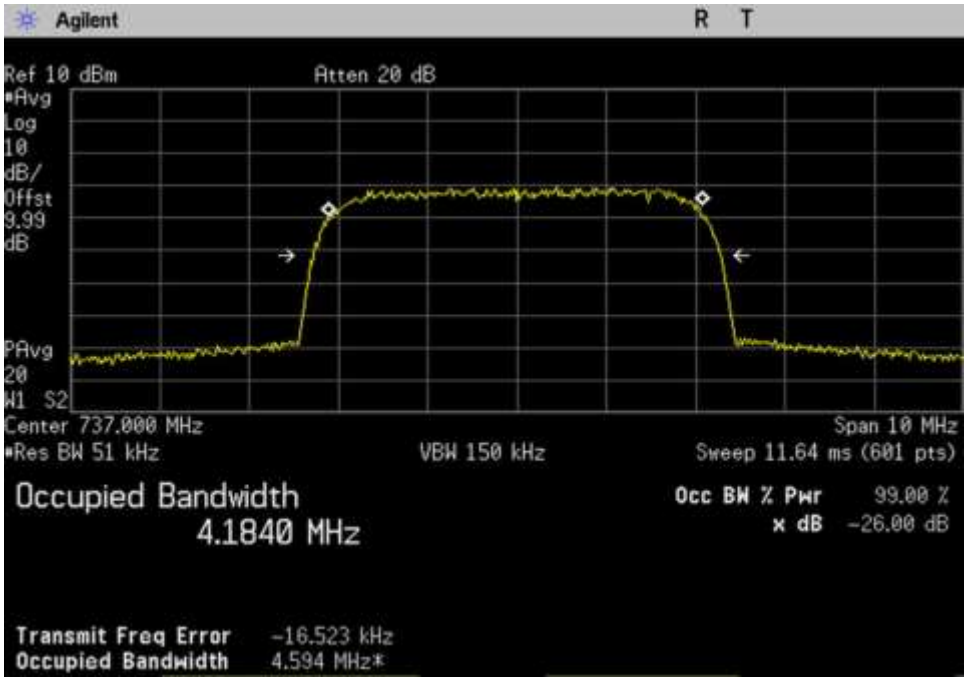
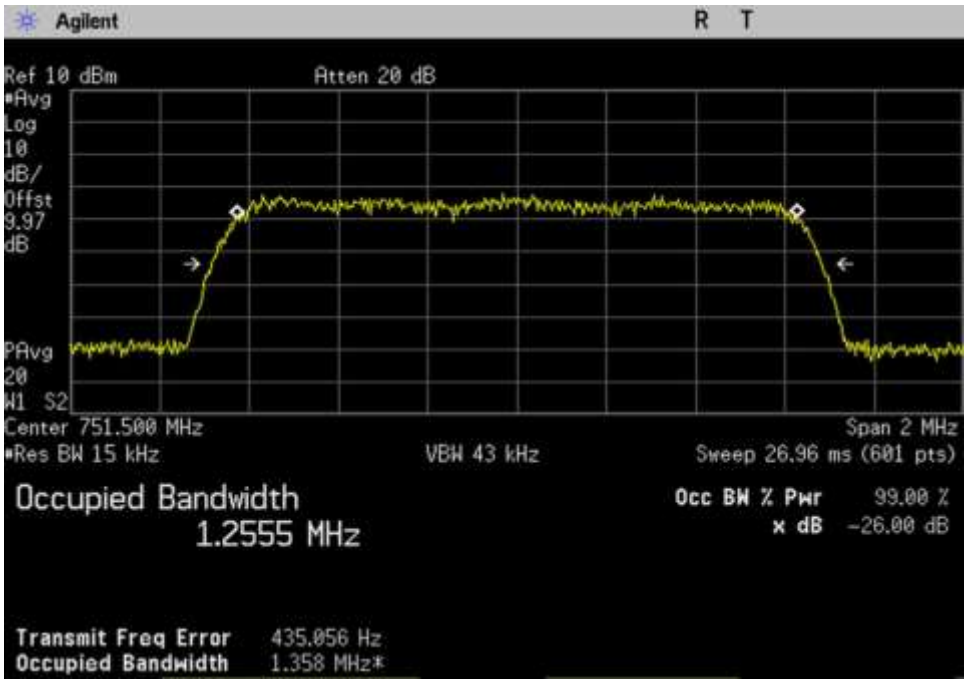
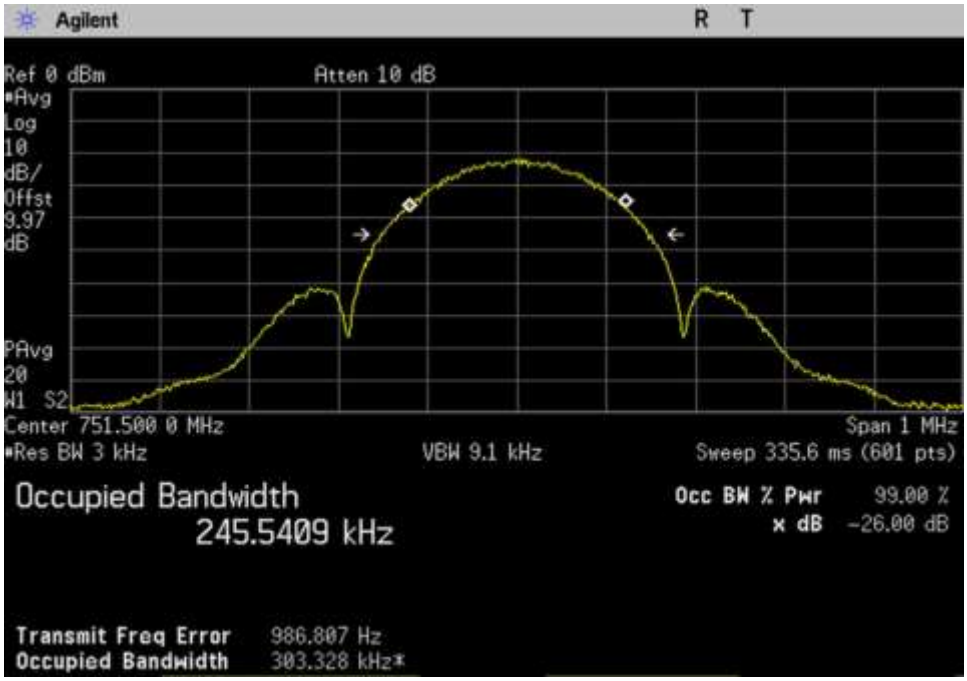


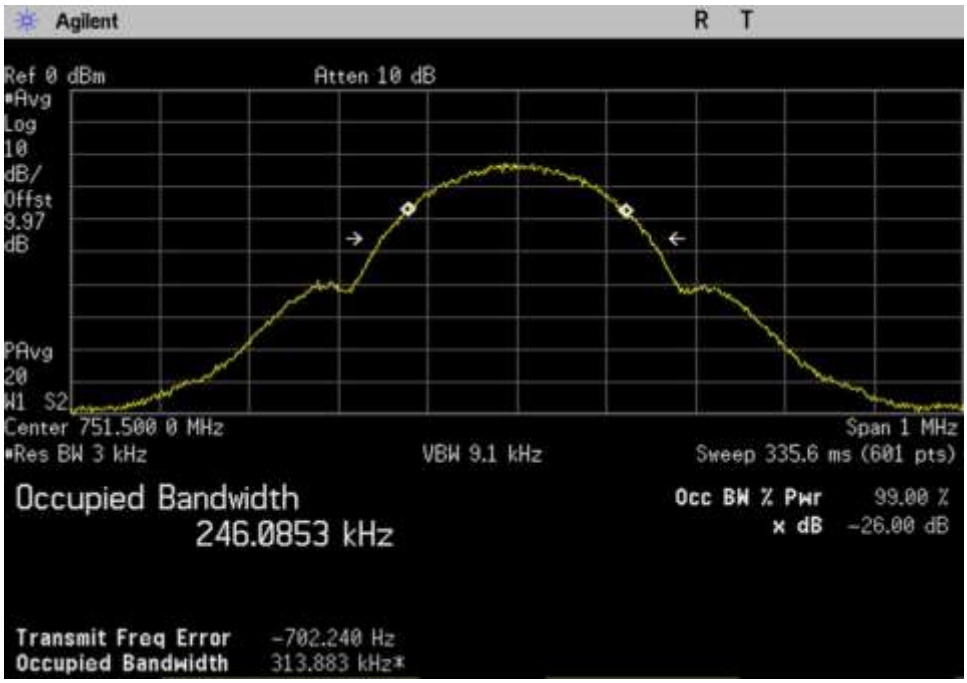
7.10 OBW-Out_DL_728-746_WCDMA_ 737MHz



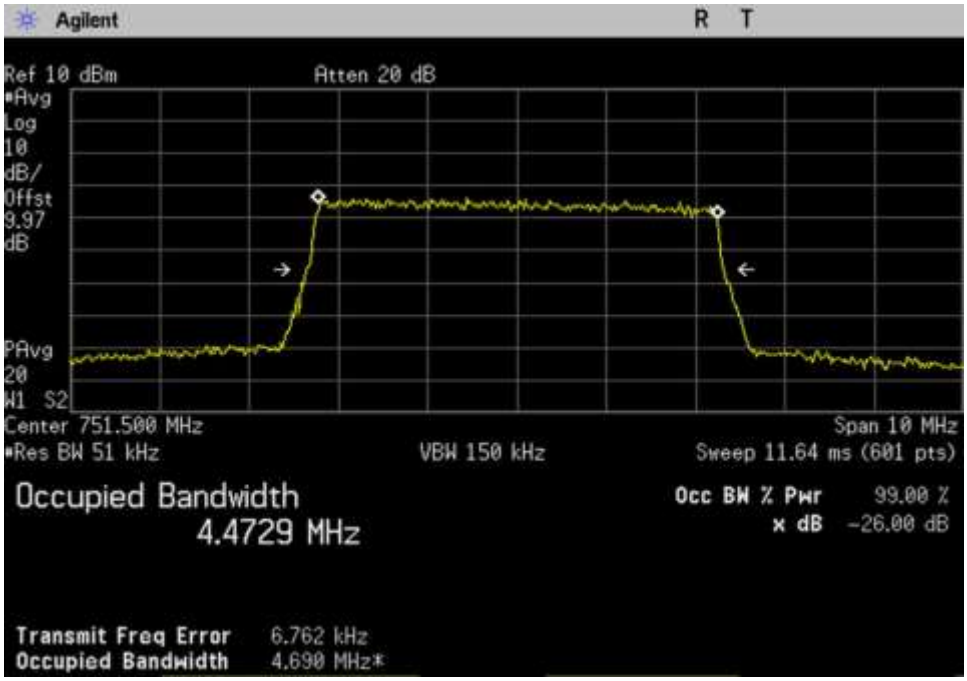
7.10 OBW-Out_DL_746-757_CDMA_ 751.5MHz



7.10 OBW-Out_DL_746-757_EDGE_ 751.5MHz



7.10 OBW-Out_DL_746-757_GSM_ 751.5MHz



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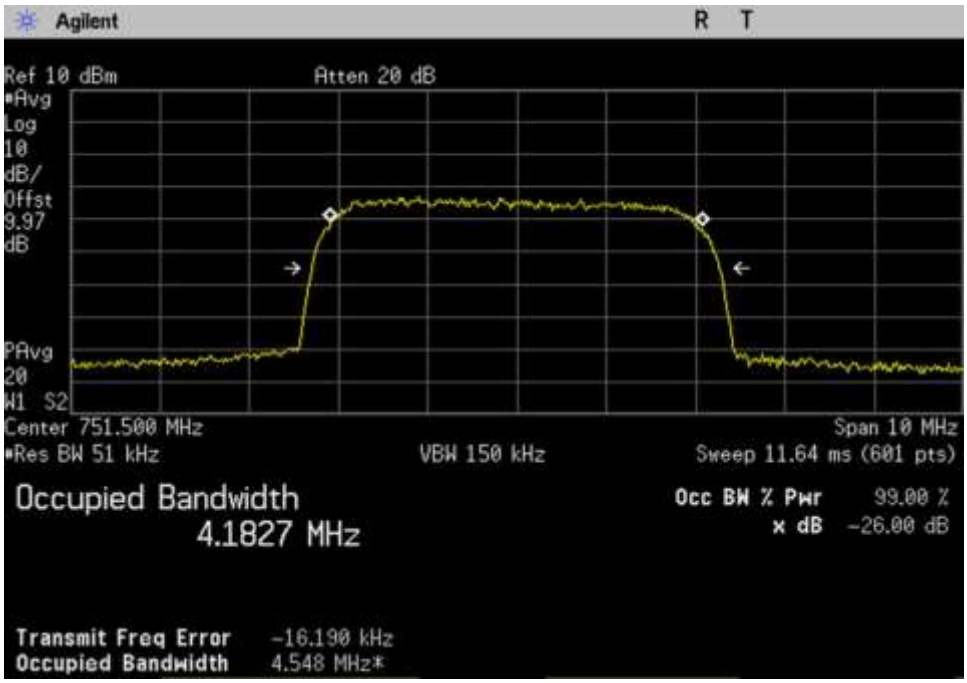
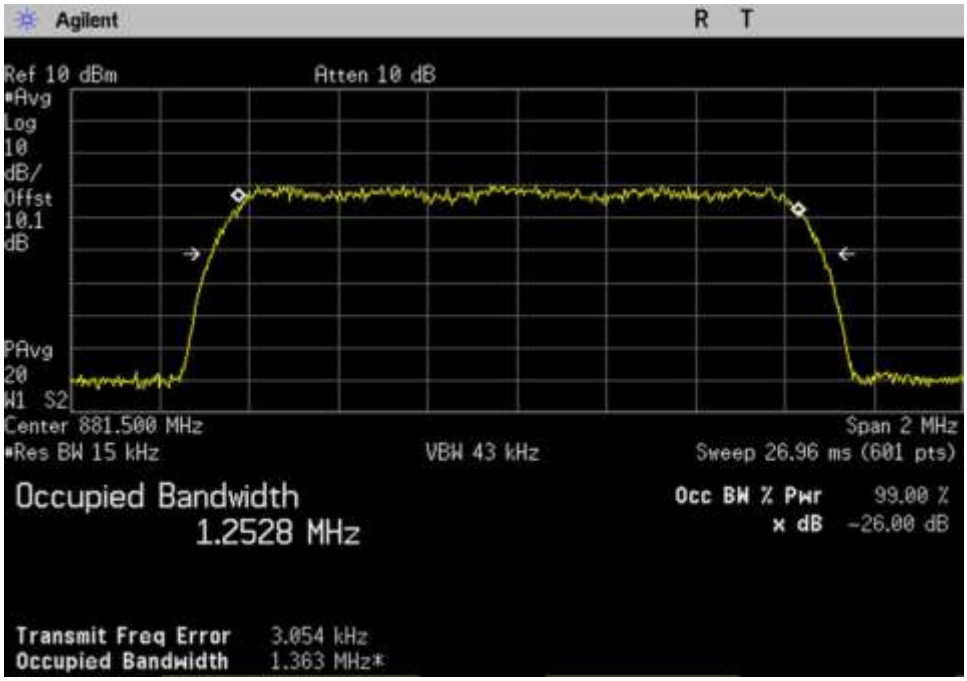
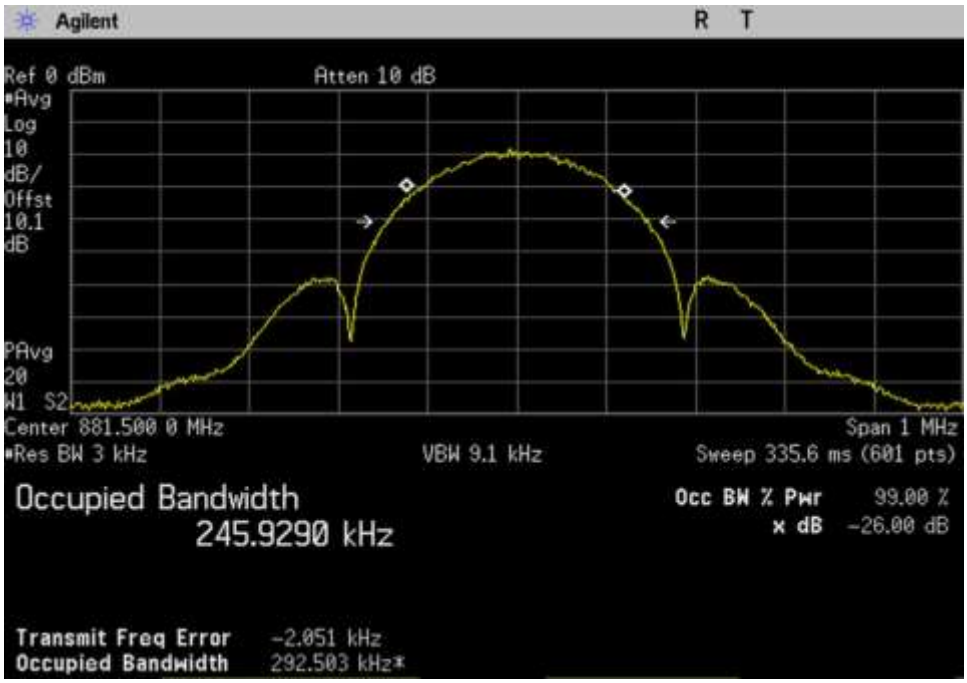


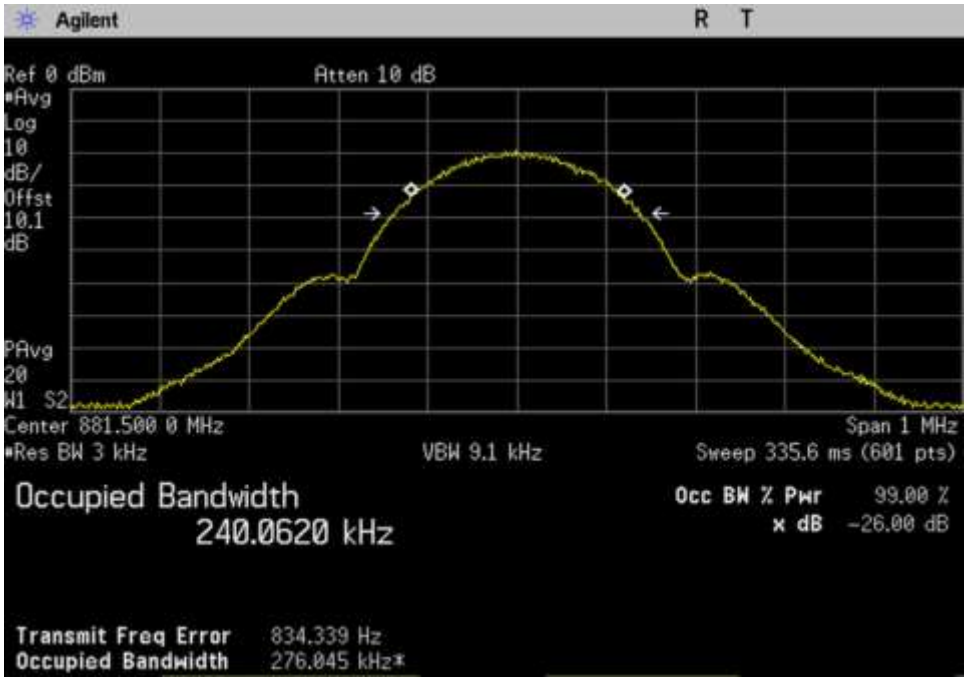
7.10 OBW-Out_DL_746-757_WCDMA_ 751.5MHz



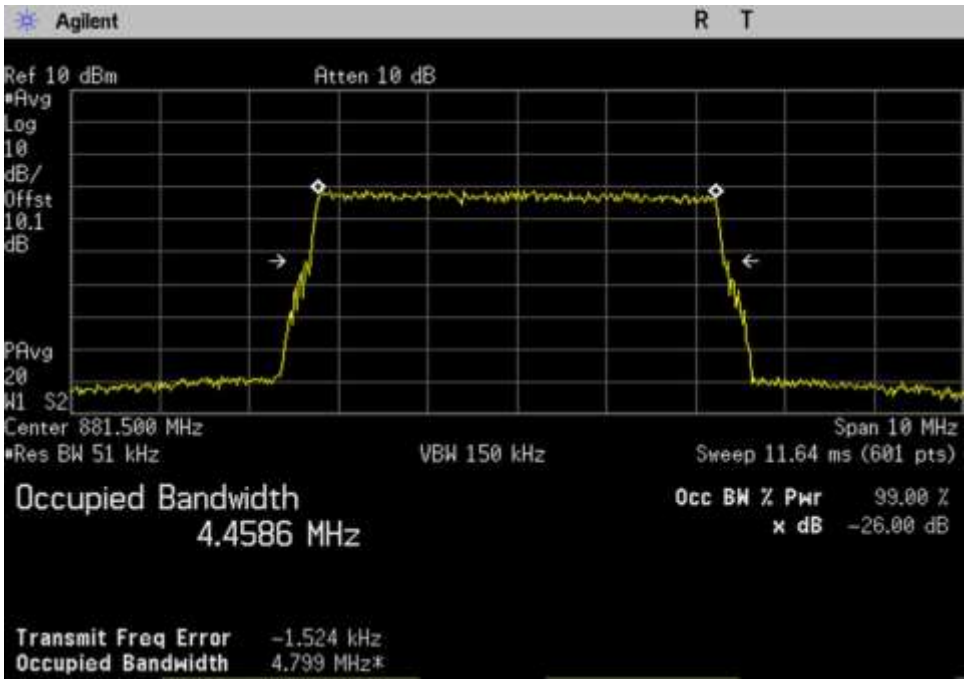
7.10 OBW-Out_DL_869-894_CDMA_ 881.5MHz



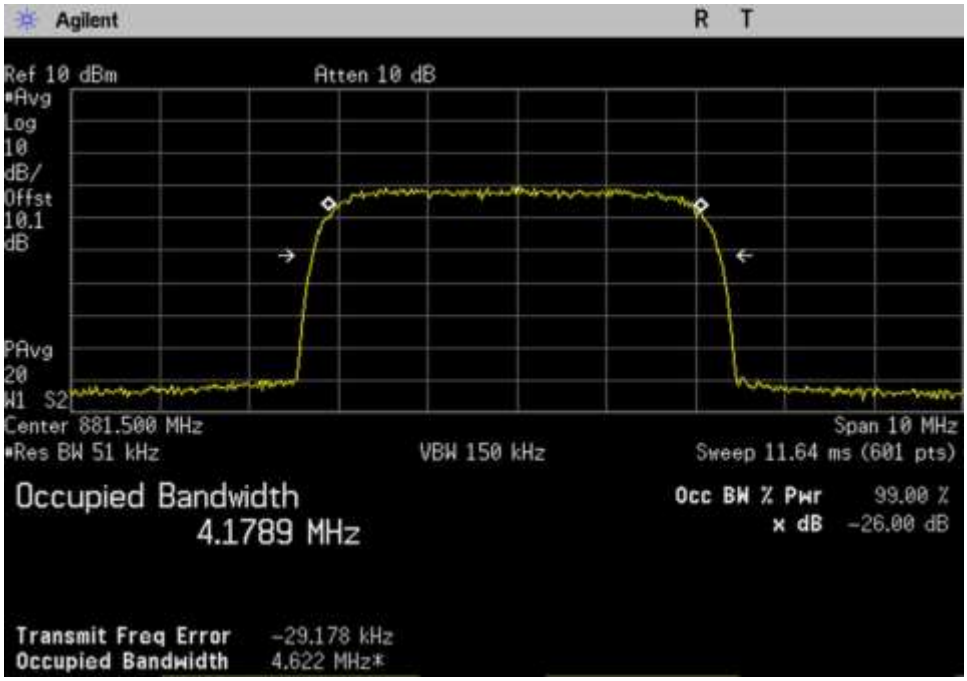
7.10 OBW-Out_DL_869-894_EDGE_ 881.5MHz



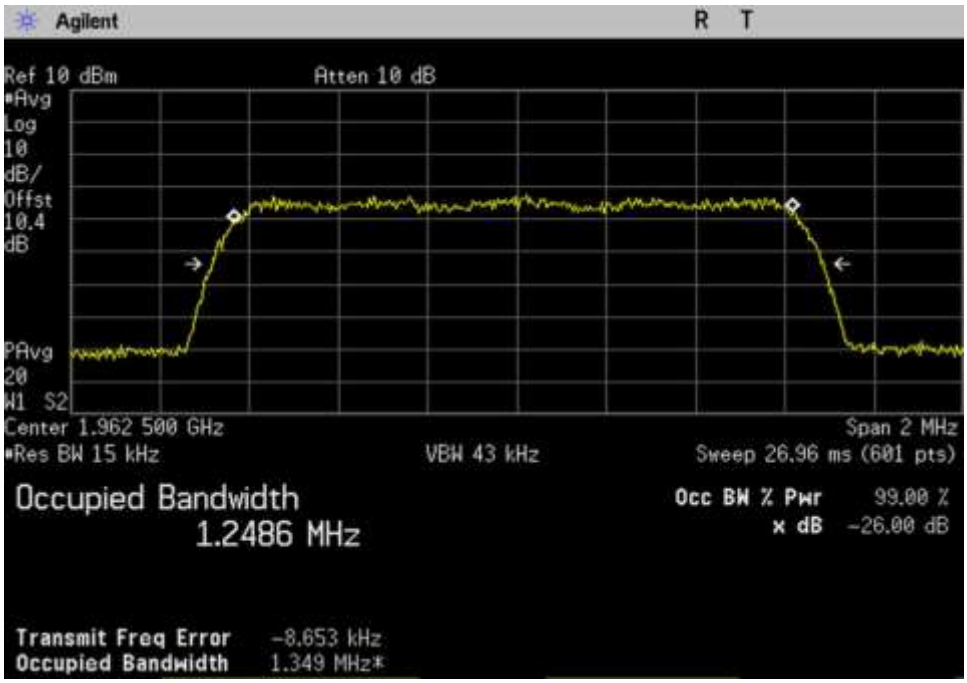
7.10 OBW-Out_DL_869-894_GSM_ 881.5MHz



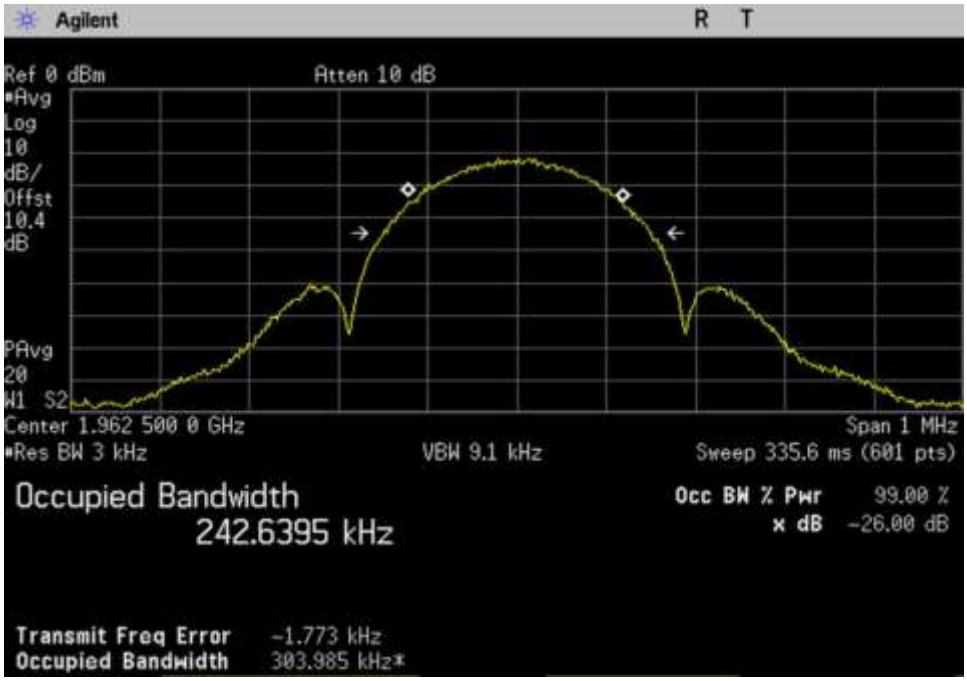
7.10 OBW-Out_DL_869-894_LTE_ 881.5MHz



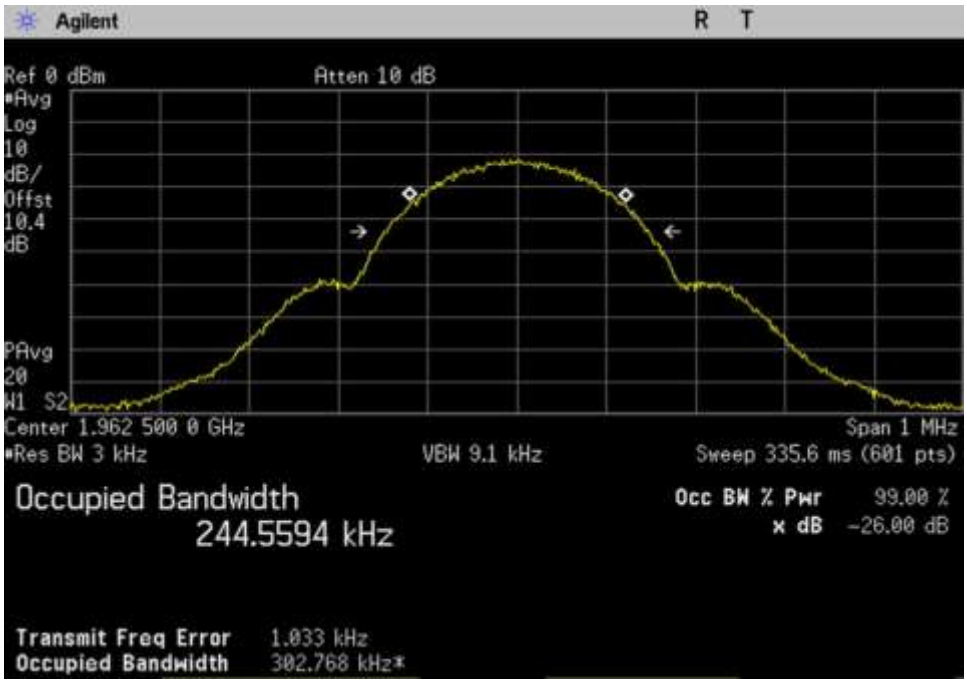
7.10 OBW-Out_DL_869-894_WCDMA_ 881.5MHz



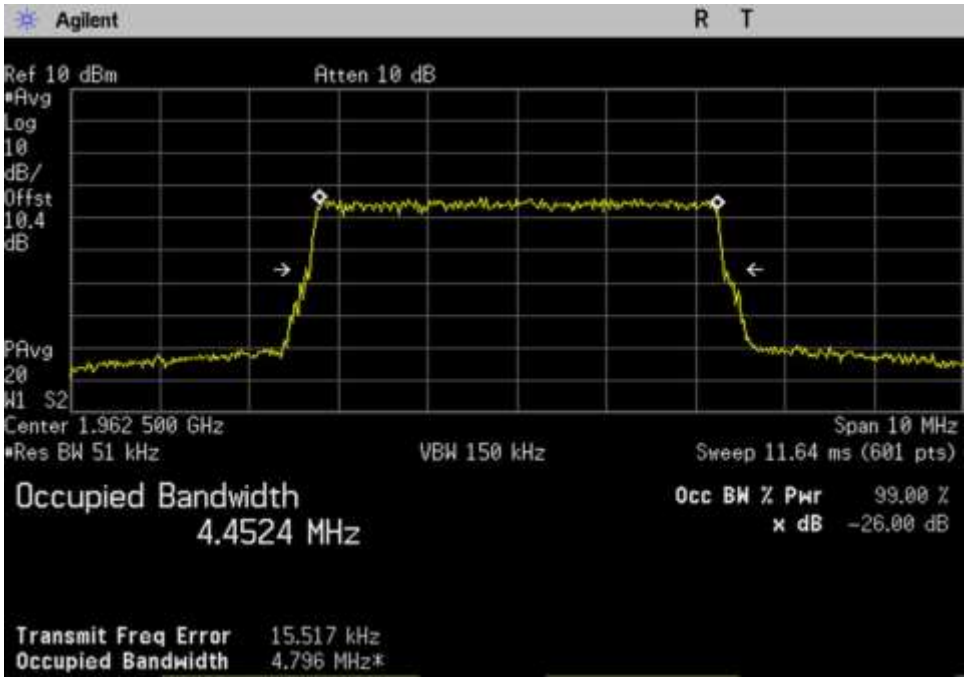
7.10 OBW-Out_DL_1930-1995_CDMA_ 1962.5MHz



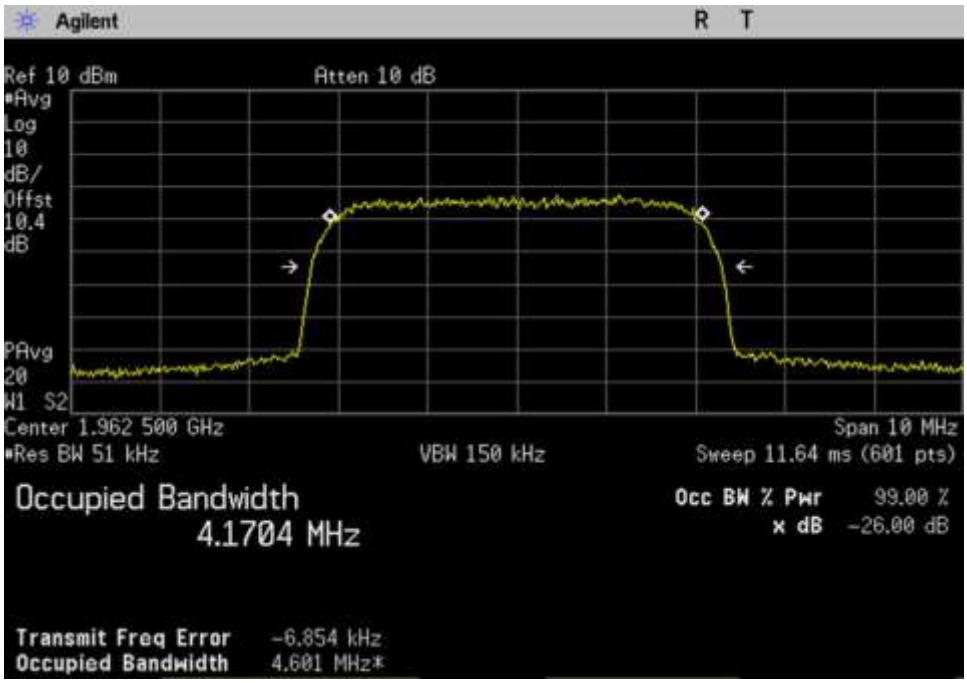
7.10 OBW-Out_DL_1930-1995_EDGE_ 1962.5MHz



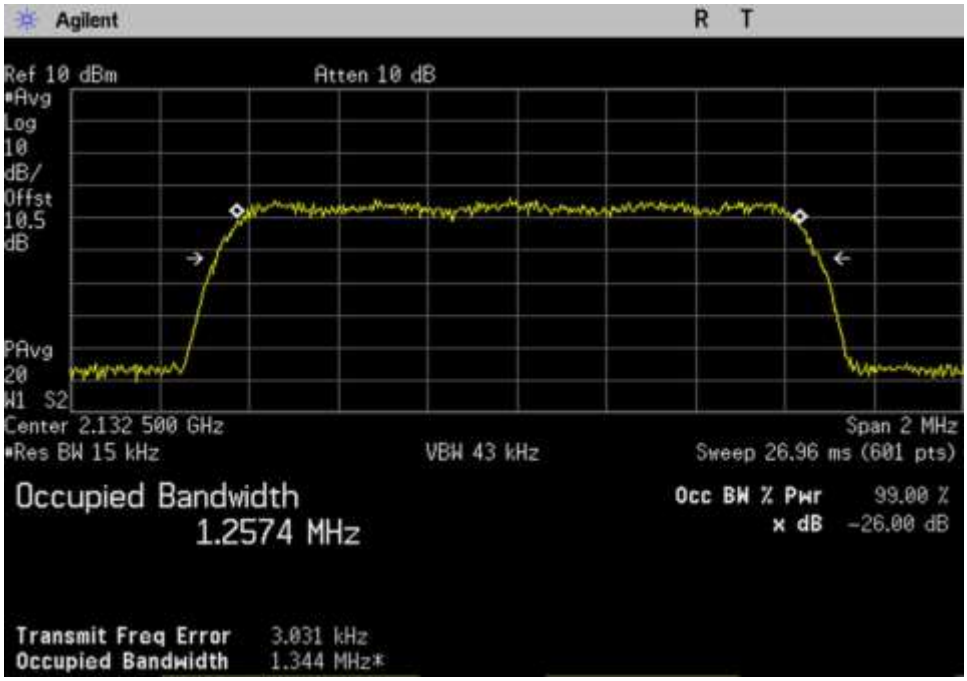
7.10 OBW-Out_DL_1930-1995_GSM_ 1962.5MHz



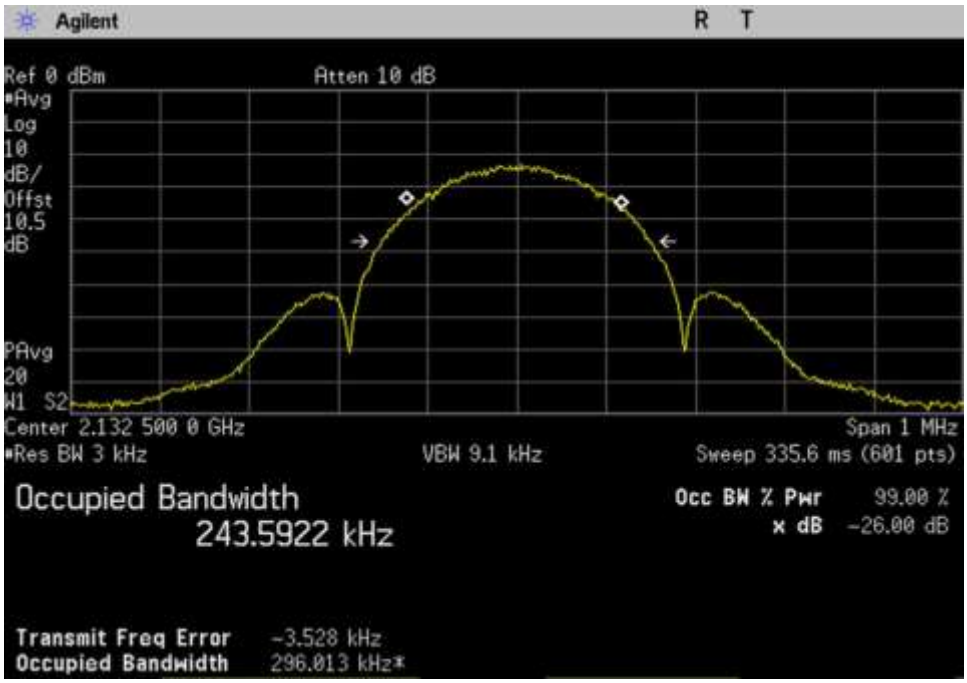
7.10 OBW-Out_DL_1930-1995_LTE_ 1962.5MHz



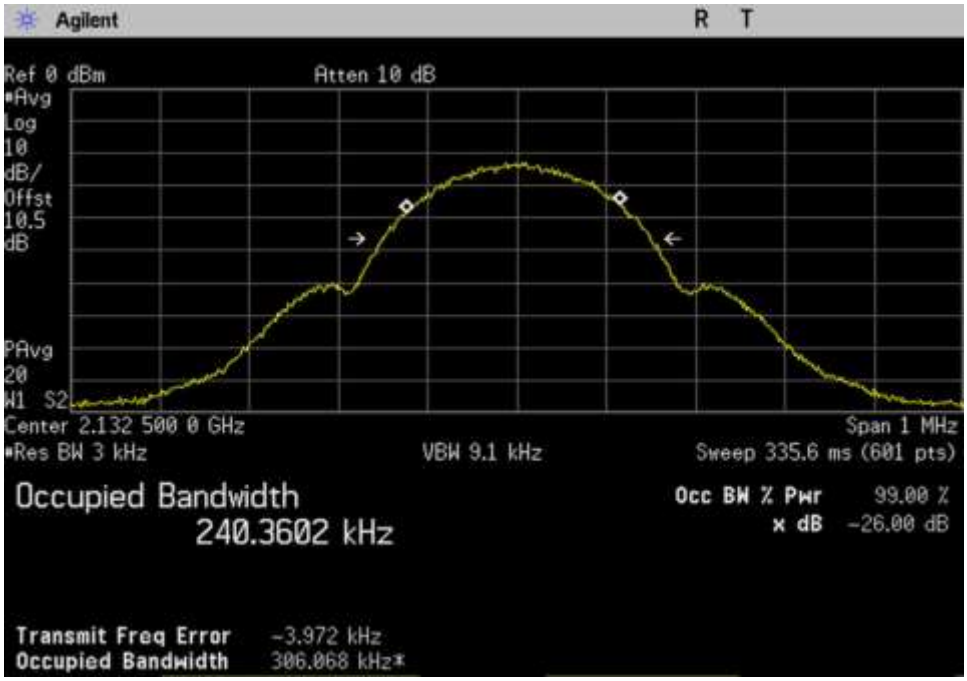
7.10 OBW-Out_DL_1930-1995_WCDMA_ 1962.5MHz



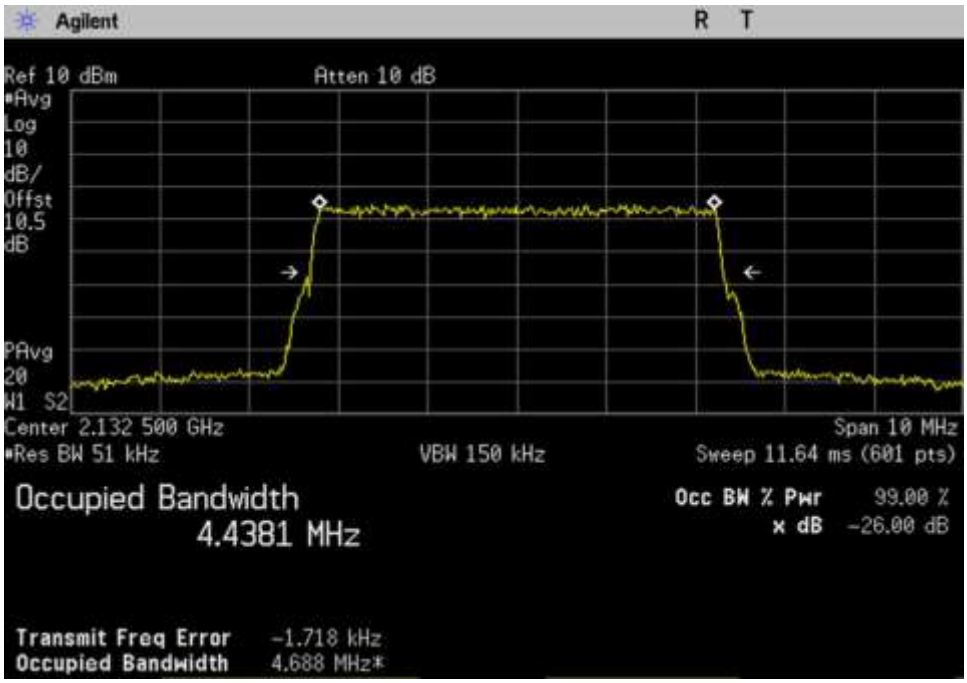
7.10 OBW-Out_DL_2110-2155_CDMA_ 2132.5MHz



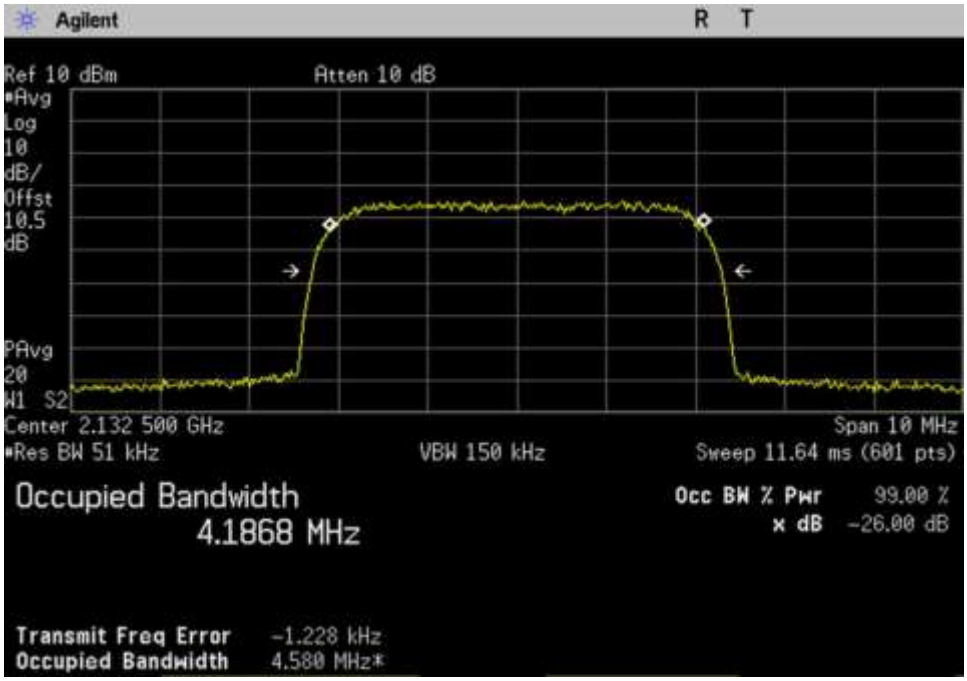
7.10 OBW-Out_DL_2110-2155_EDGE_ 2132.5MHz



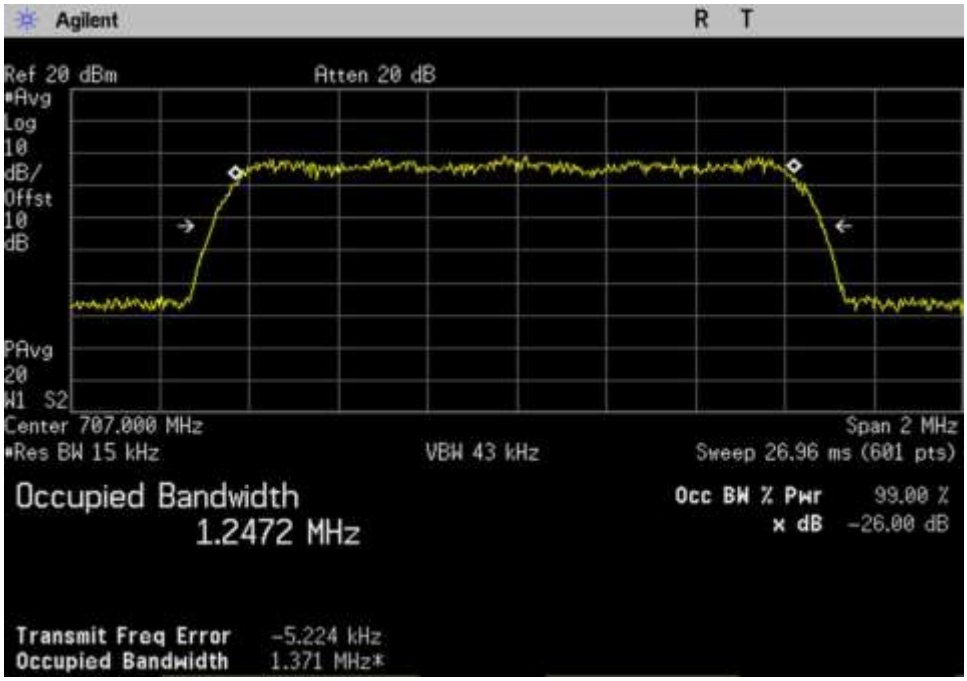
7.10 OBW-Out_DL_2110-2155_GSM_ 2132.5MHz



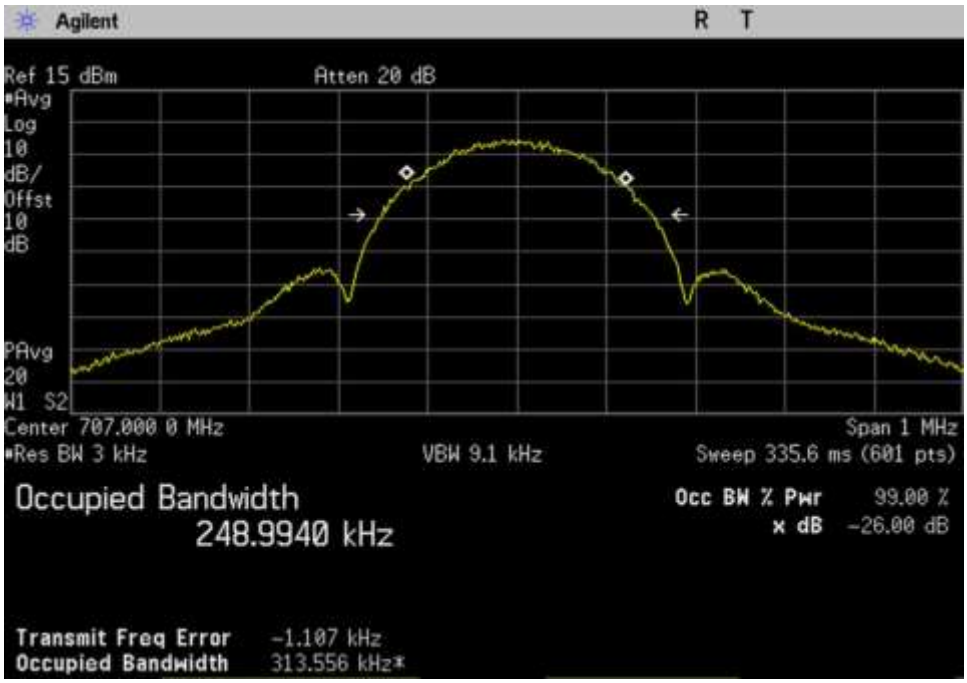
7.10 OBW-Out_DL_2110-2155_LTE_ 2132.5MHz



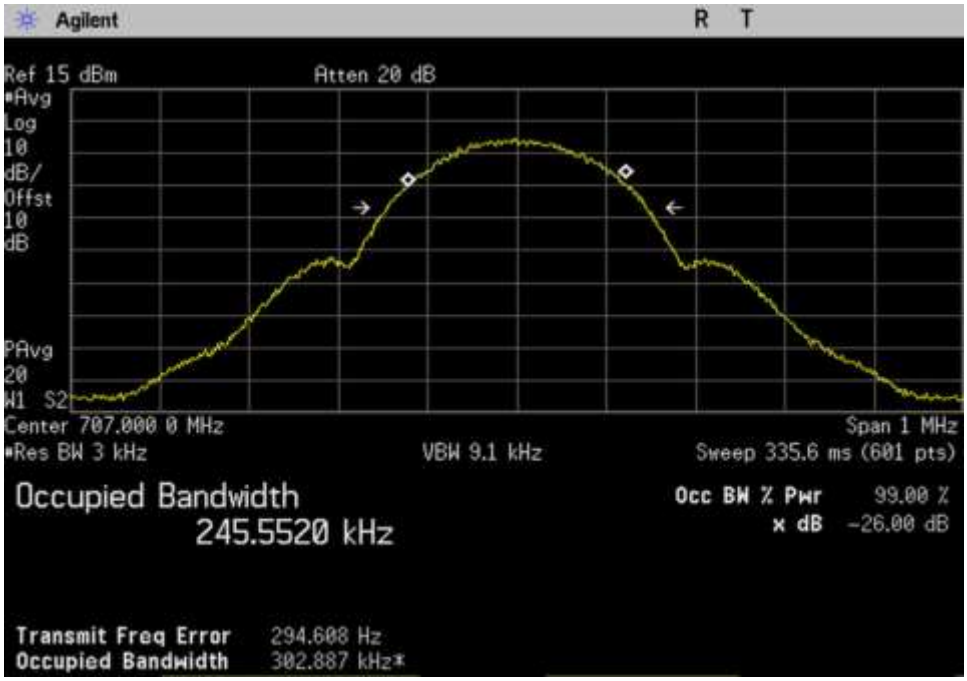
7.10 OBW-Out_DL_2110-2155_WCDMA_ 2132.5MHz



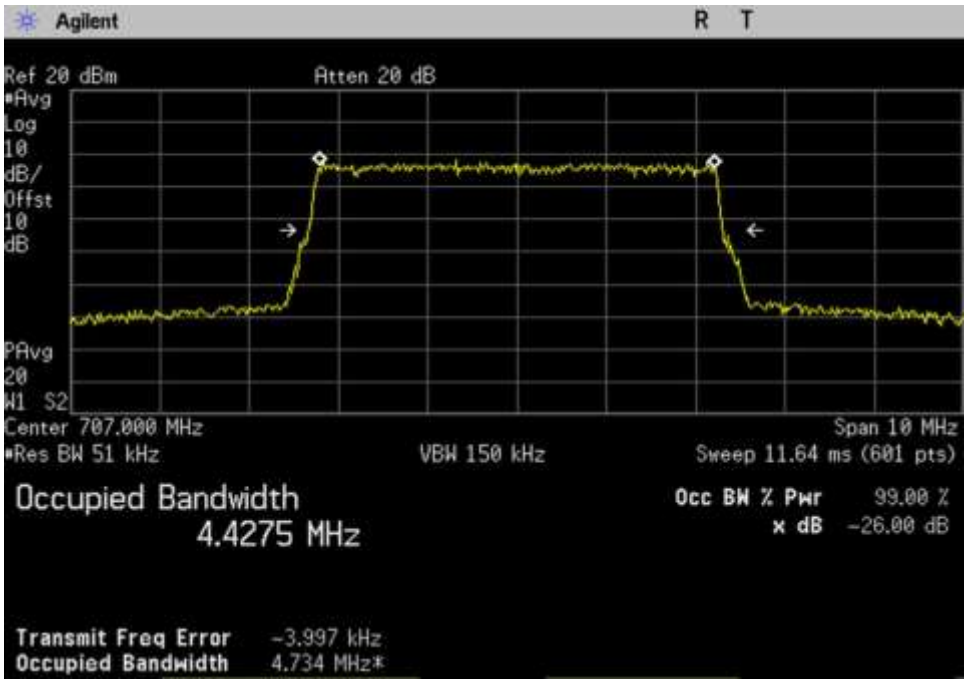
7.10 OBW-Out_UL_698-716_CDMA_ 707MHz



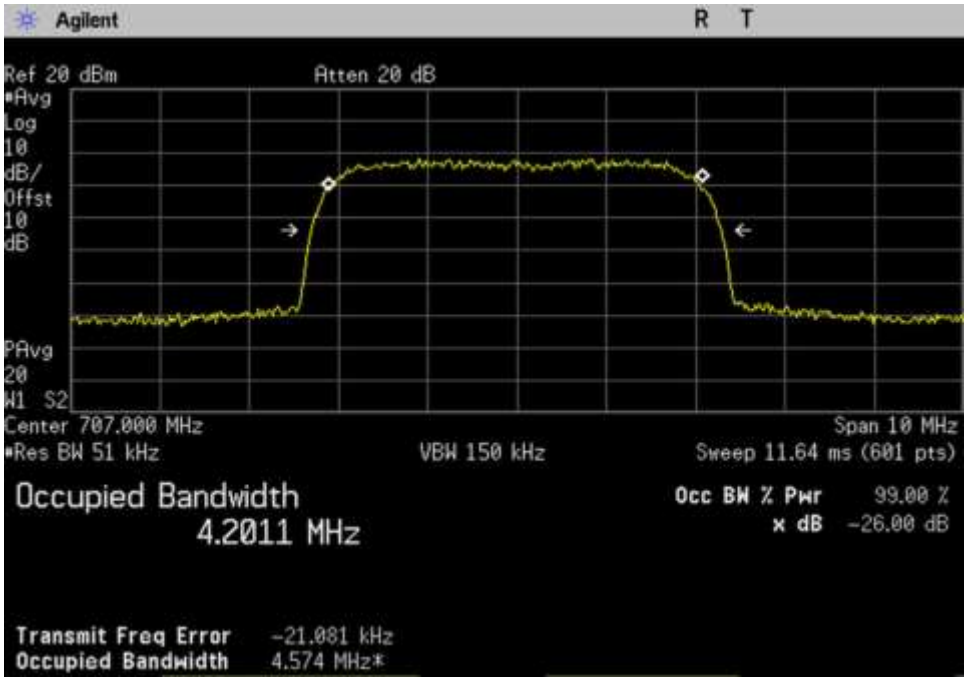
7.10 OBW-Out_UL_698-716_EDGE_ 707MHz



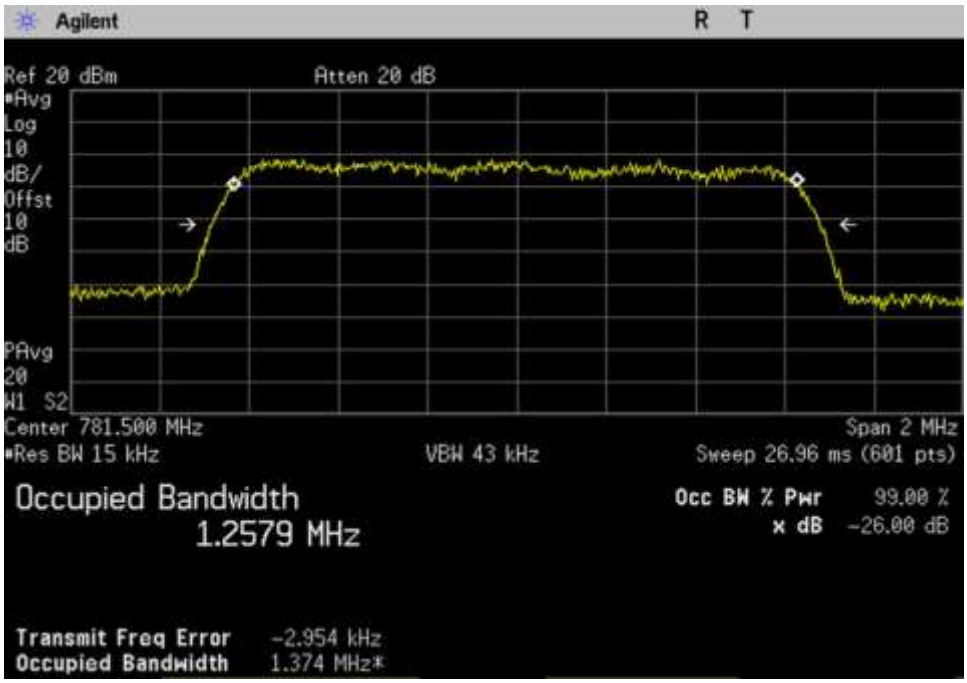
7.10 OBW-Out_UL_698-716_GSM_ 707MHz



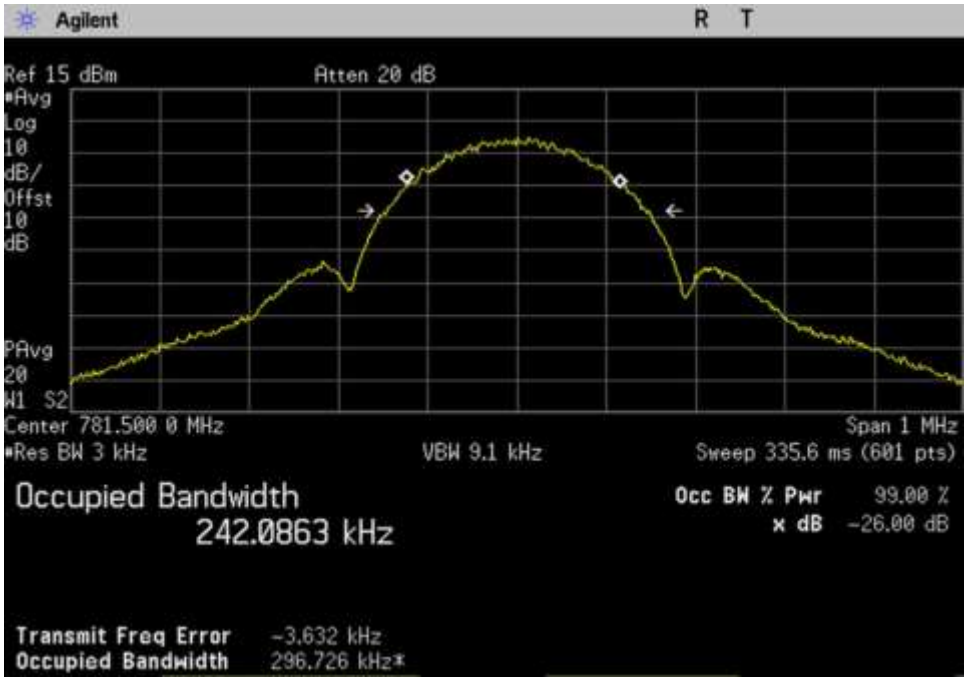
7.10 OBW-Out_UL_698-716_LTE_ 707MHz



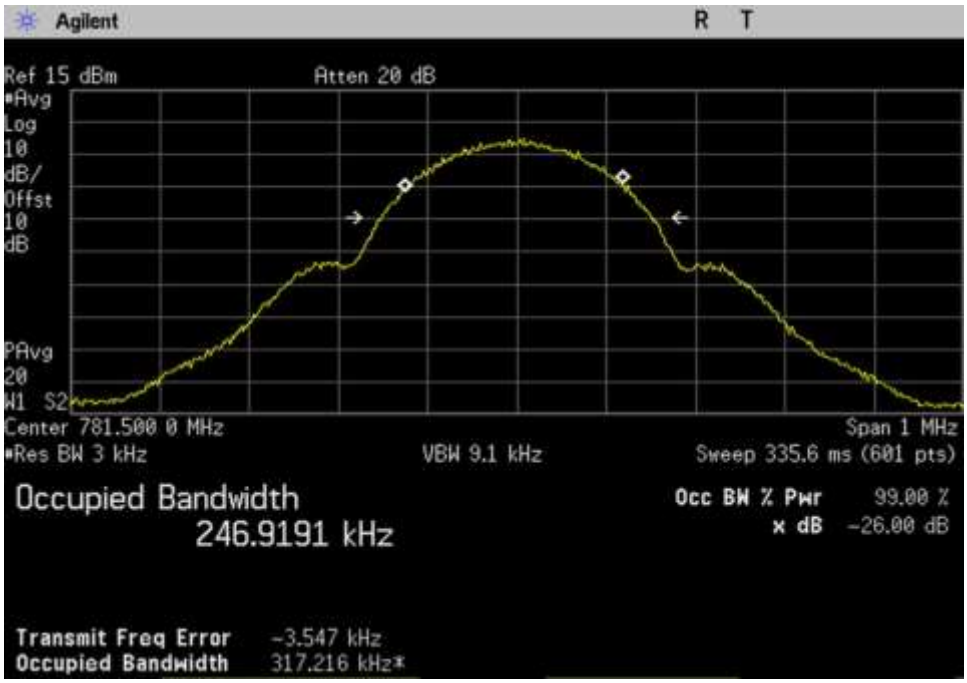
7.10 OBW-Out_UL_698-716_WCDMA_ 707MHz



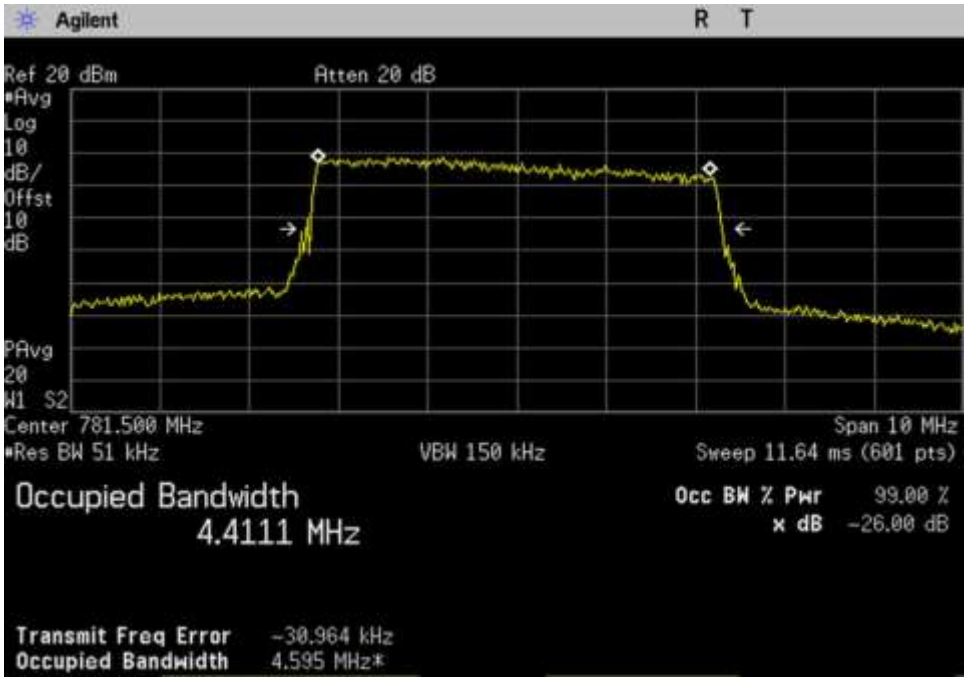
7.10 OBW-Out_UL_776-787_CDMA_ 781.5MHz



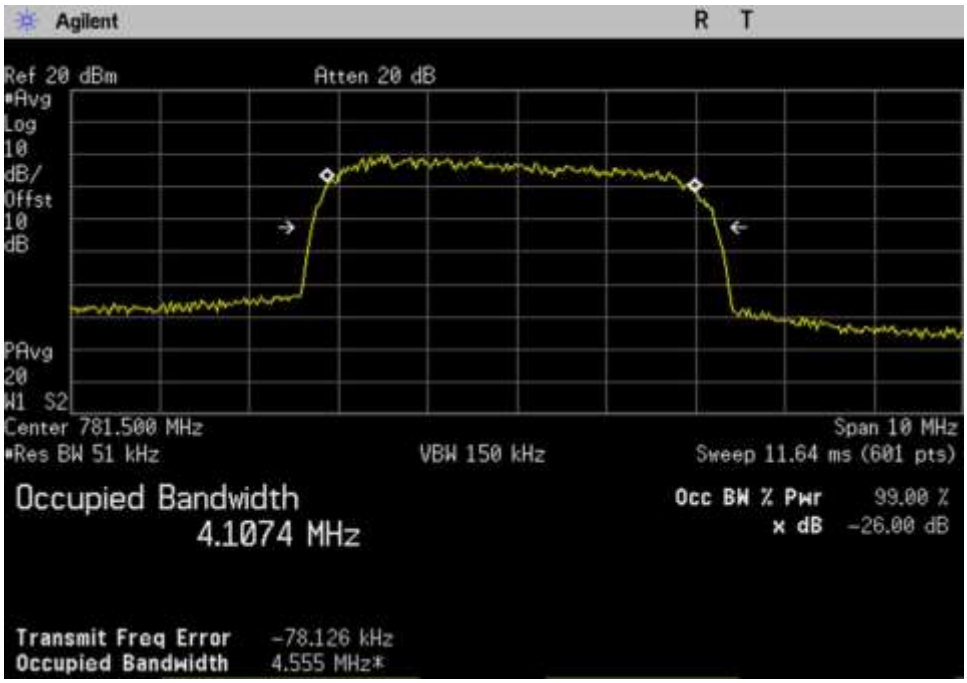
7.10 OBW-Out_UL_776-787_EDGE_ 781.5MHz



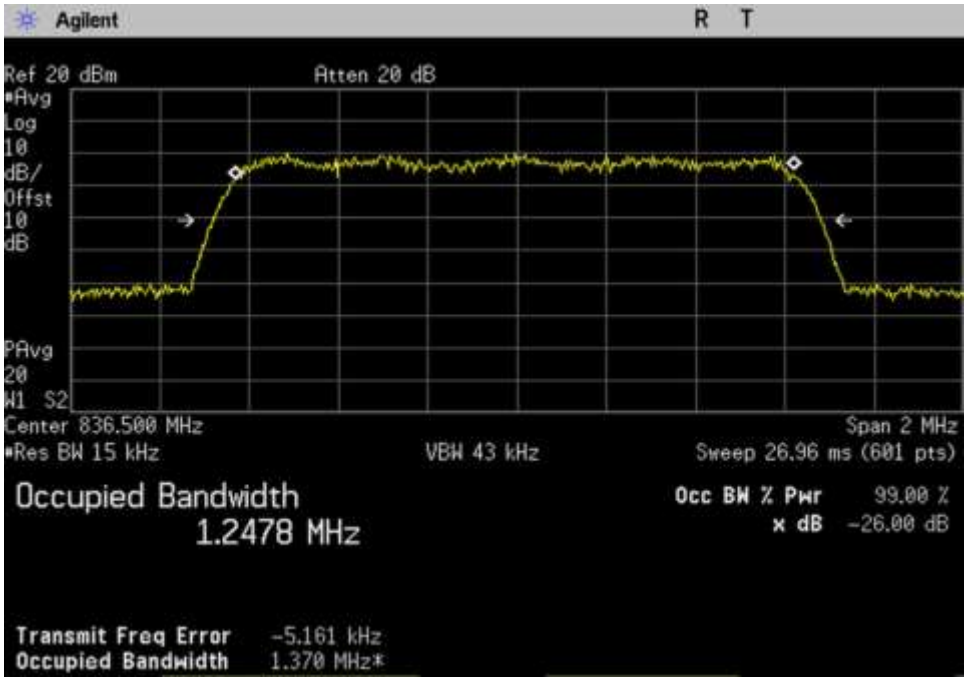
7.10 OBW-Out_UL_776-787_GSM_ 781.5MHz



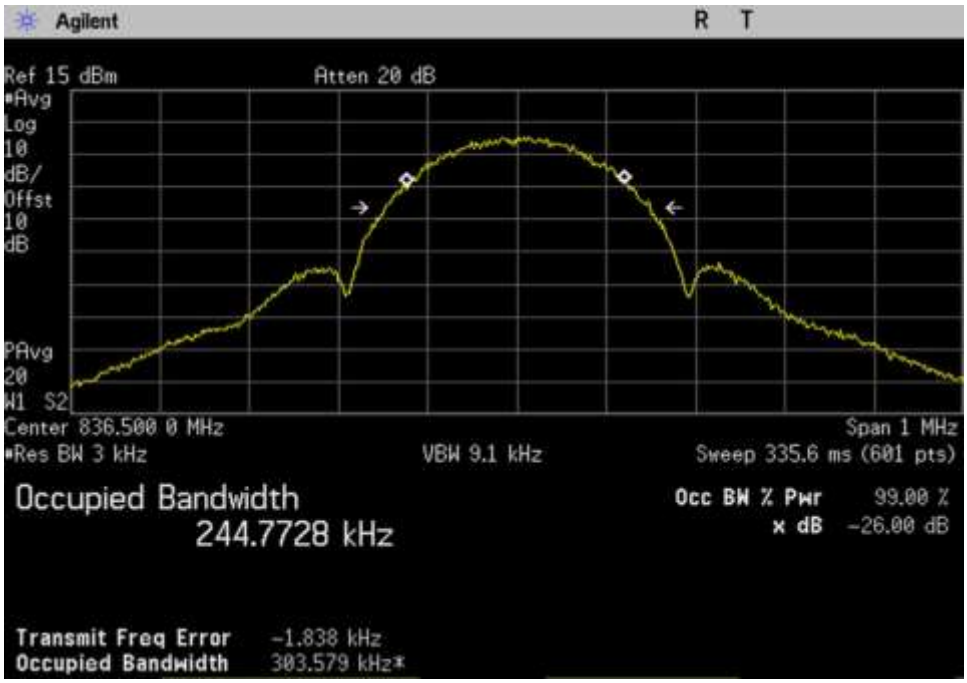
7.10 OBW-Out_UL_776-787_LTE_ 781.5MHz



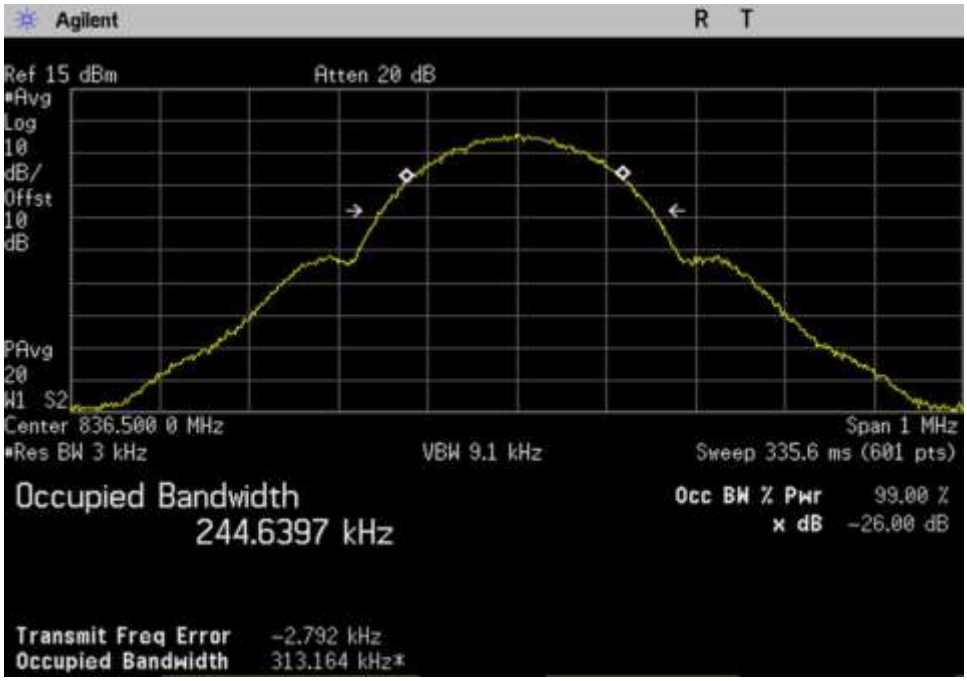
7.10 OBW-Out_UL_776-787_WCDMA_ 781.5MHz



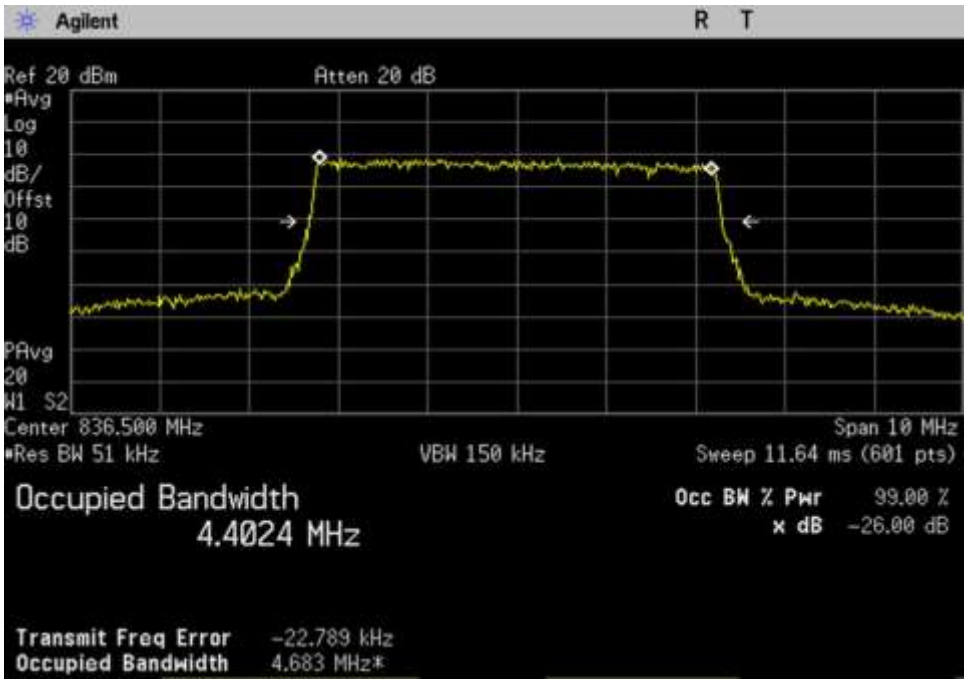
7.10 OBW-Out_UL_824-849_CDMA_ 836.5MHz



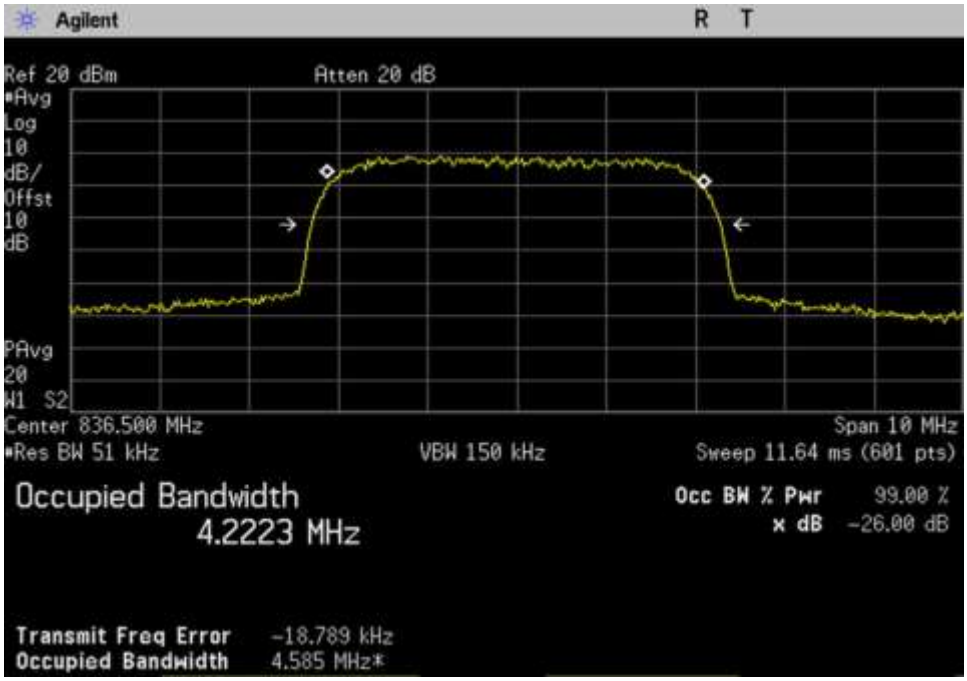
7.10 OBW-Out_UL_824-849_EDGE_ 836.5MHz



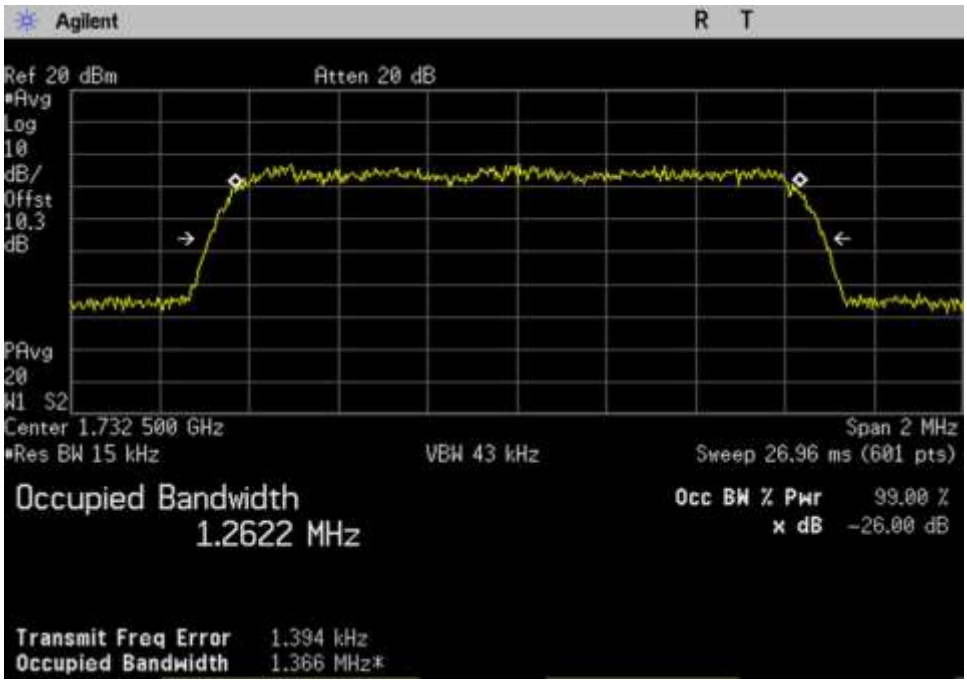
7.10 OBW-Out_UL_824-849_GSM_ 836.5MHz



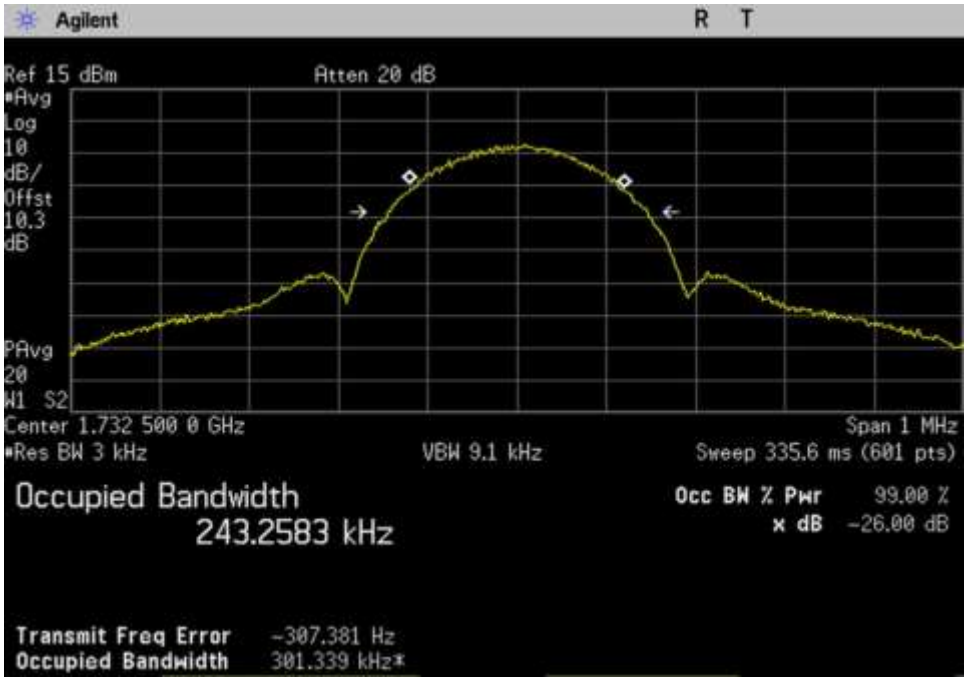
7.10 OBW-Out_UL_824-849_LTE_ 836.5MHz



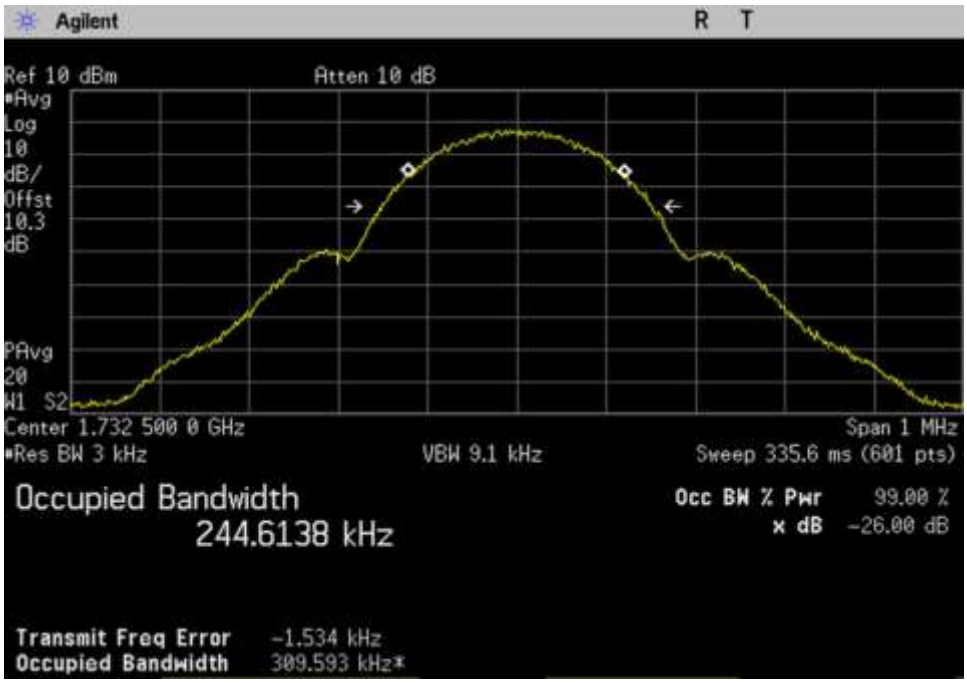
7.10 OBW-Out_UL_824-849_WCDMA_ 836.5MHz



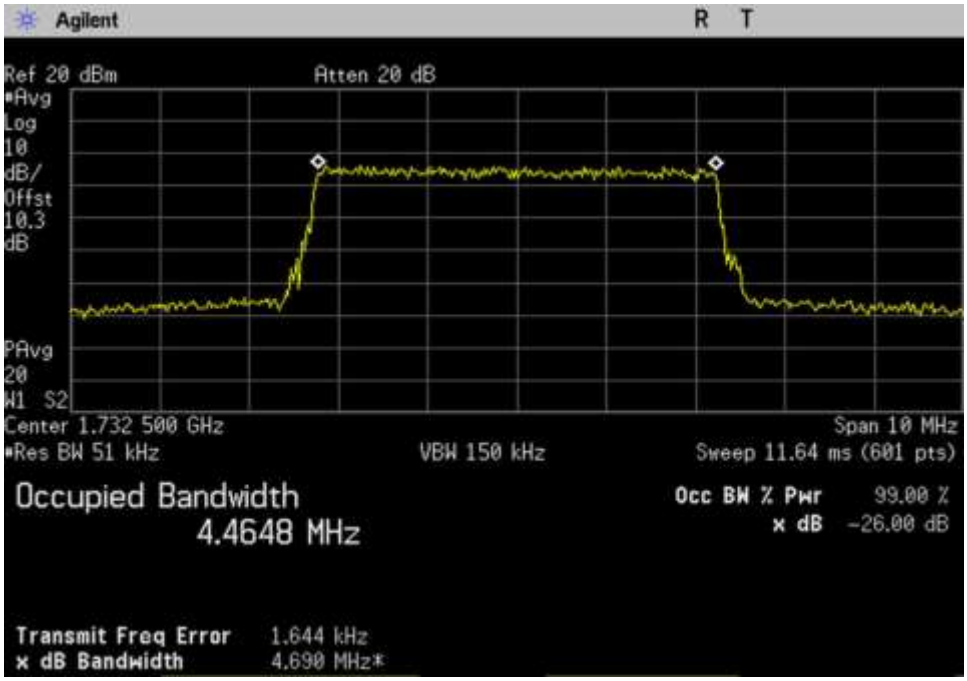
7.10 OBW-Out_UL_1710-1755_CDMA_ 1732.5MHz



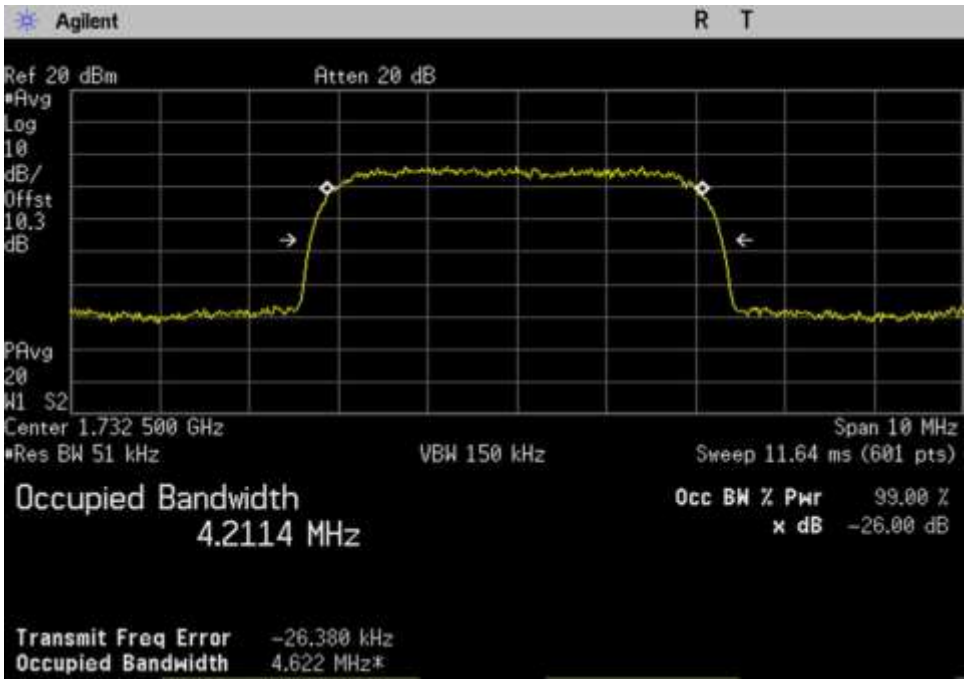
7.10 OBW-Out_UL_1710-1755_EDGE_ 1732.5MHz



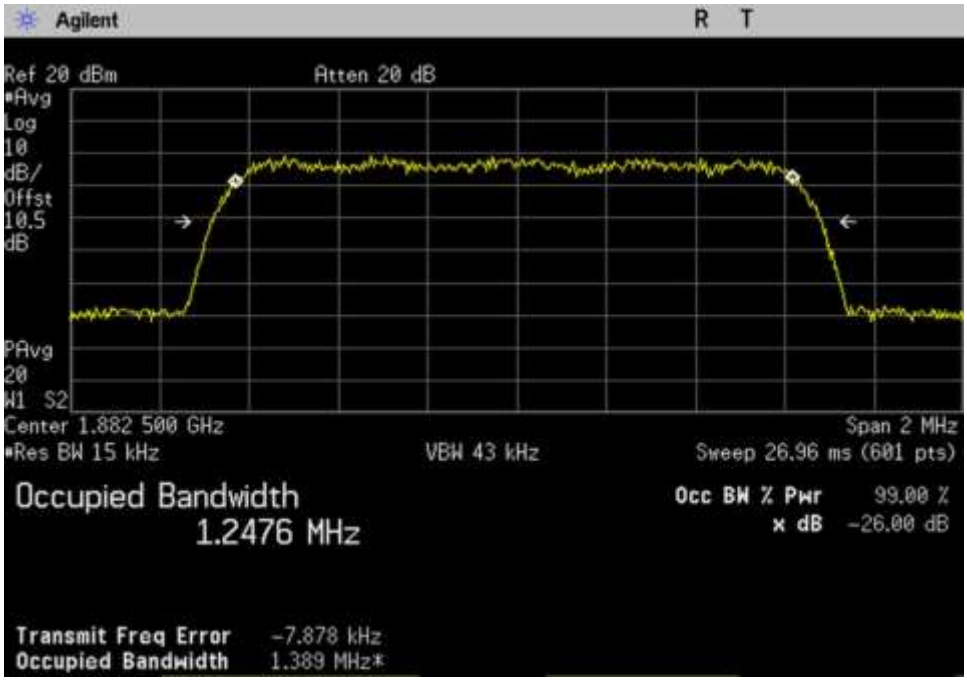
7.10 OBW-Out_UL_1710-1755_GSM_ 1732.5MHz



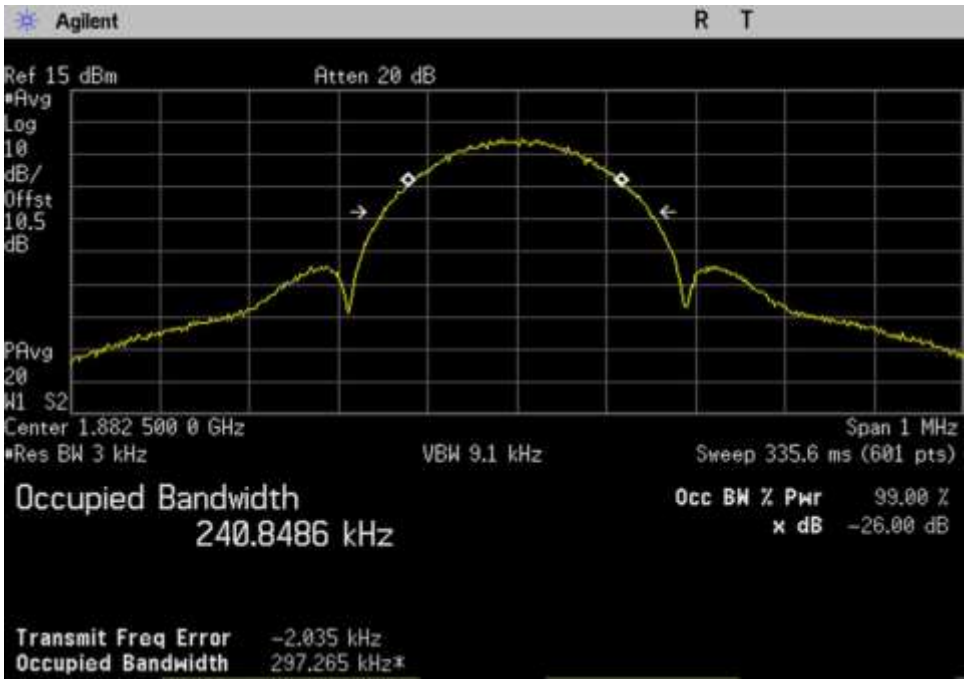
7.10 OBW-Out_UL_1710-1755_LTE_ 1732.5MHz



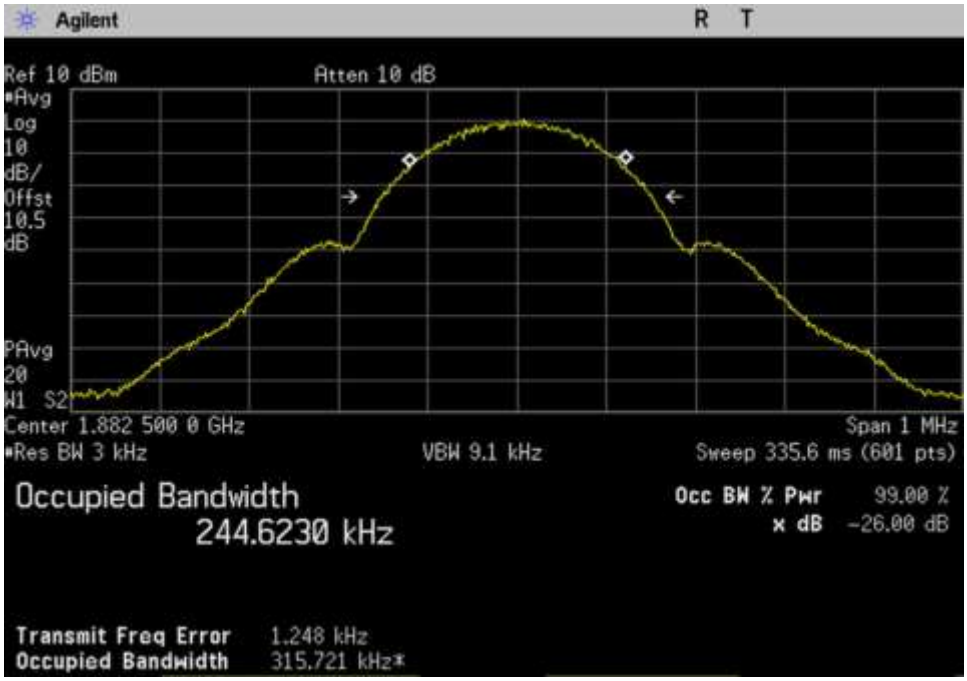
7.10 OBW-Out_UL_1710-1755_WCDMA_ 1732.5MHz



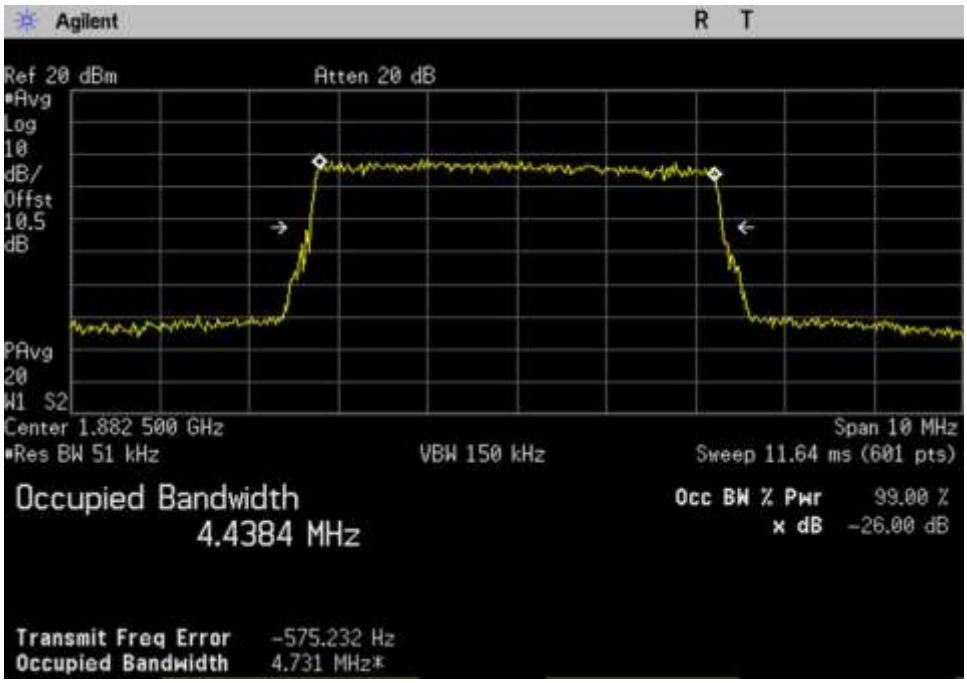
7.10 OBW-Out_UL_1850-1915_CDMA_ 1882.5MHz



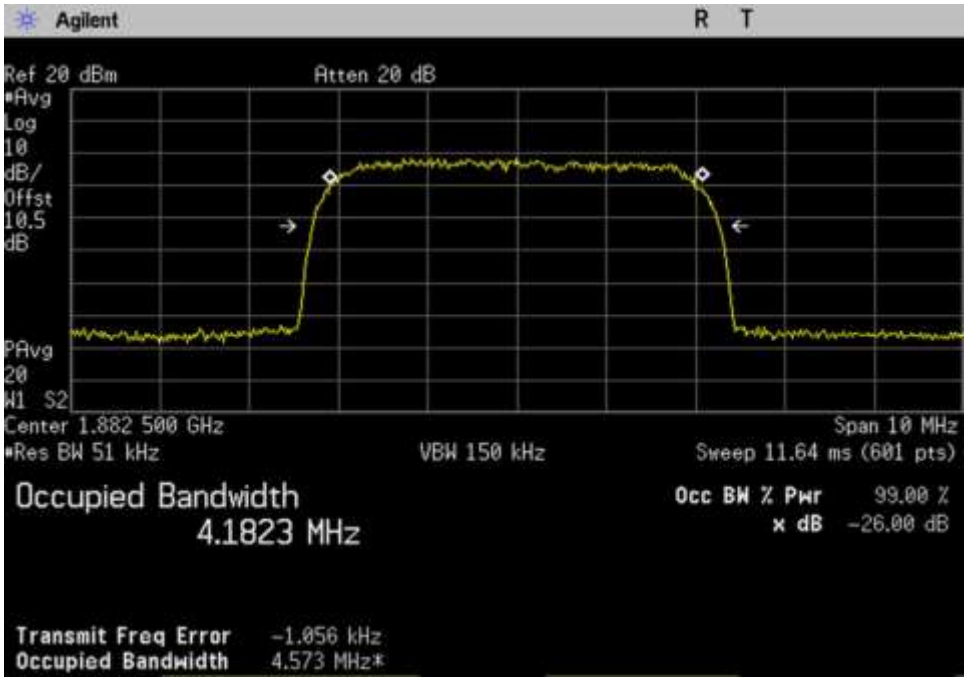
7.10 OBW-Out_UL_1850-1915_EDGE_ 1882.5MHz



7.10 OBW-Out_UL_1850-1915_GSM_ 1882.5MHz



7.10 OBW-Out_UL_1850-1915_LTE_ 1882.5MHz



7.10 OBW-Out_UL_1850-1915_WCDMA_ 1882.5MHz

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 #:	**101463**
Test Type:	**Conducted Emissions** Date 07/11/18 and 07/12/18
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

Test Conditions / Notes:

07/11/18: Test environment conditions: 23.2°C, 44% relative humidity,101.9kPa

07/12/18: Test environment conditions: 21.8°C, 47% relative humidity,102.0kPa

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	
Freq	**Measured**	**Limit**	**Peak Level**	**Measured**	**Limit**	**Measured**	**Limit**
MHz	Sec	Sec	dBm	Sec	At least sec		
UL1710-1755	0.125	0.3	27.5	72	60	2	5
UL1850-1915	0.175	0.3	25.6	71	60	2	5
UL824-894	0.200	0.3	26.1	71	60	2	5
UL 698-716	0.166	0.3	27.7	70	60	2	5
UL776-787	0.166	0.3	26.1	70	60	2	5
DL2110-2155	0.133	1	10.8	74	60	2	5
DL1930-1995	0.167	1	8.0	71	60	2	5
DL869-894	0.133	1	11.1	70	60	2	5
DL:728-746	0.183	1	10.4	70	60	2	5
DL 746-757	0.150	1	18.6	69	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

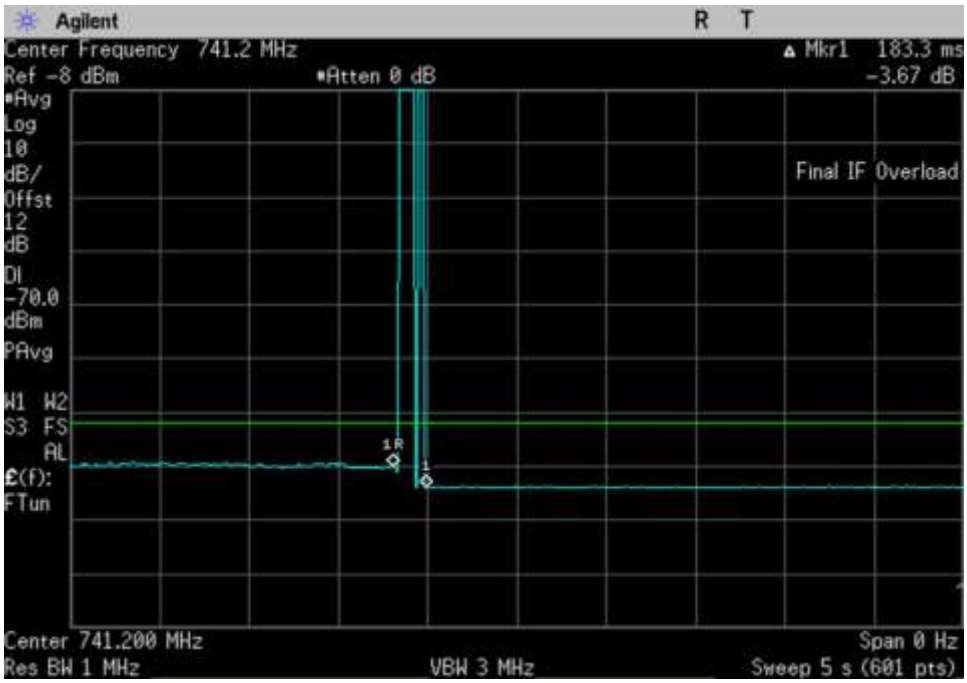
	UL 1710-1755	UL1850-1915	UL 824-894	UL 698-716	UL 776-787	
Max Gain Isolation dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Limit dB
+5dB	8.6	9.1	10.6	8.8	8.4	12.0
+4dB	10.1	9.8	(12.4) *	10.2	9.8	12.0
+3dB	(12.1) *	11.7	(15.3) *	(12.5) *	11.8	12.0
+2dB	(13.8) *	(12.6) *	(19.8) *	(15.2) *	(13.9) *	12.0
+1dB	(16.8) *	(16.5) *	(29.1) *	(18.1) *	(16.3) *	12.0
0dB	(23.3) *	(22.1) *	**	(26.7) *	(20.9) *	12.0
-1dB	(90.5) *	(32.6) *	**	**	(32.2) *	12.0
-2dB	**	**	**	**	**	12.0
-3dB	**	**	**	**	**	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	5.8	5.8	9.1	6.5	5.2	12.0
+4dB	7.1	6.4	10.8	7.7	6.0	12.0
+3dB	7.3	9.7	(12.5) *	9.5	7.5	12.0
+2dB	9.9	10.1	(13.7) *	(13.7) *	10.1	12.0
+1dB	(12.6) *	(13.8) *	(17.8) *	(22.1) *	(12.2) *	12.0
0dB	(16.3) *	(15.7) *	(39.7) *	**	(19.1) *	12.0
-1dB	**	**	**	**	**	12.0
-2dB	**	**	**	**	**	12.0
-3dB	**	**	**	**	**	12.0
-4dB	**	**	**	**	**	12.0
-5dB	**	**	**	**	**	12.0

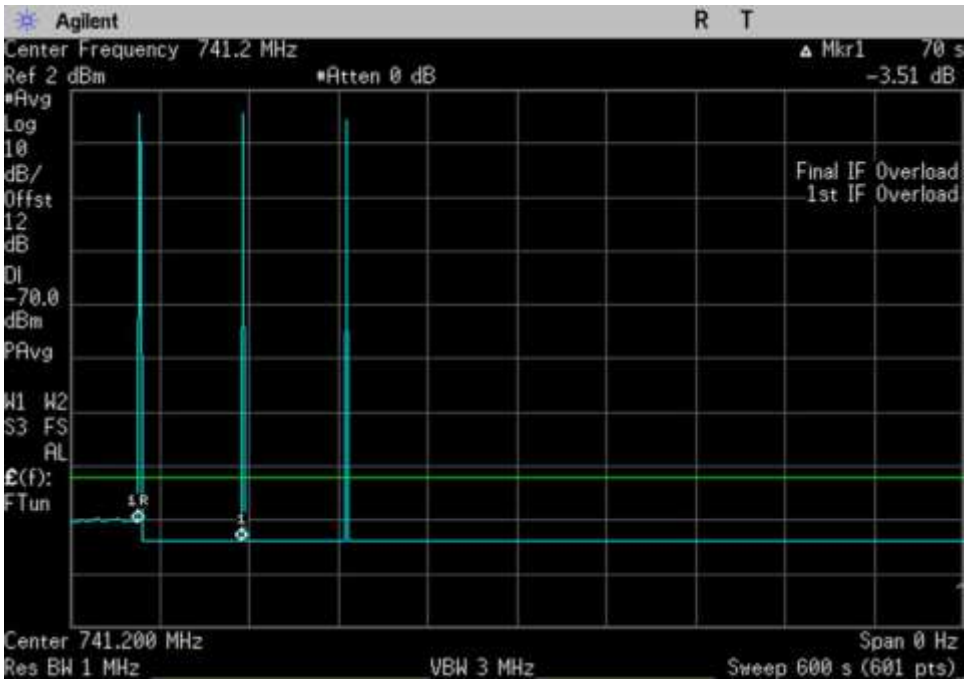
Note:
* The measured difference exceeds the limit for a period of less than 300 second before device mitigates or shuts down. The maximum recorded time prior to shutdown was 63 seconds for the Uplink bands and 72 seconds for the Downlink bands.

** The device shuts down immediately.

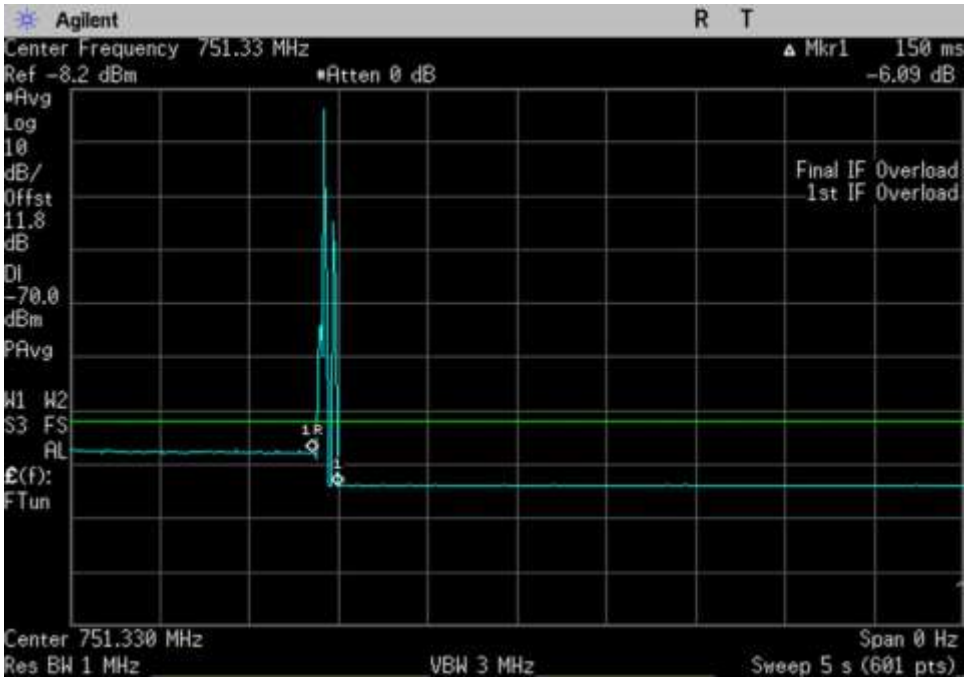
7.11.2 Oscillation Restart Plots



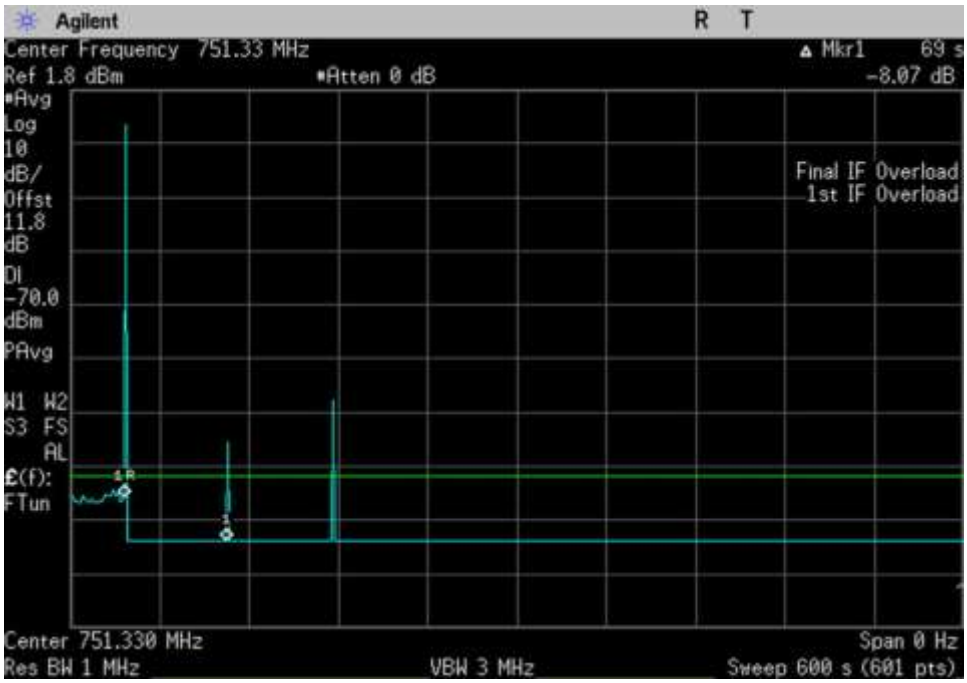
7.11.2 Osc_DL_728-746_ 741.2MHz



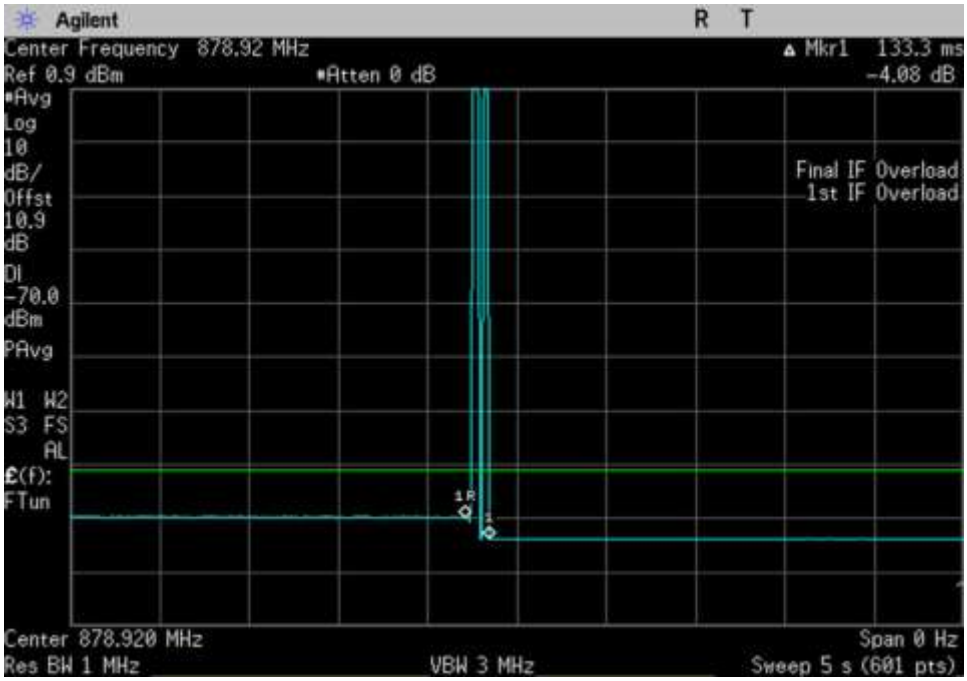
7.11.2 Osc_DL_728-746_600sec_ 741.2MHz



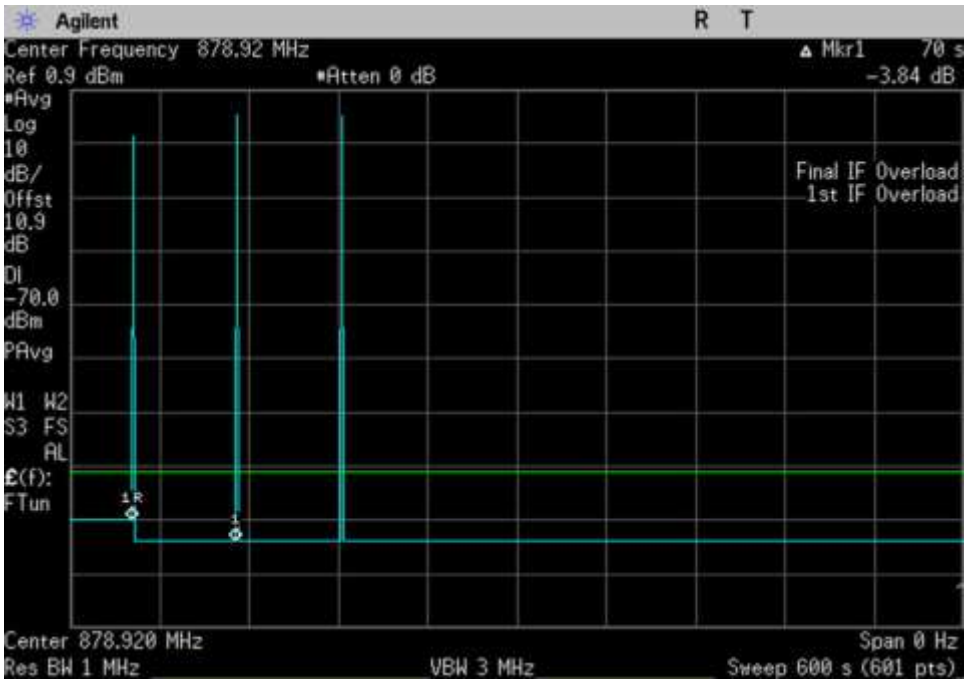
7.11.2 Osc_DL_746-757_ 751.33MHz



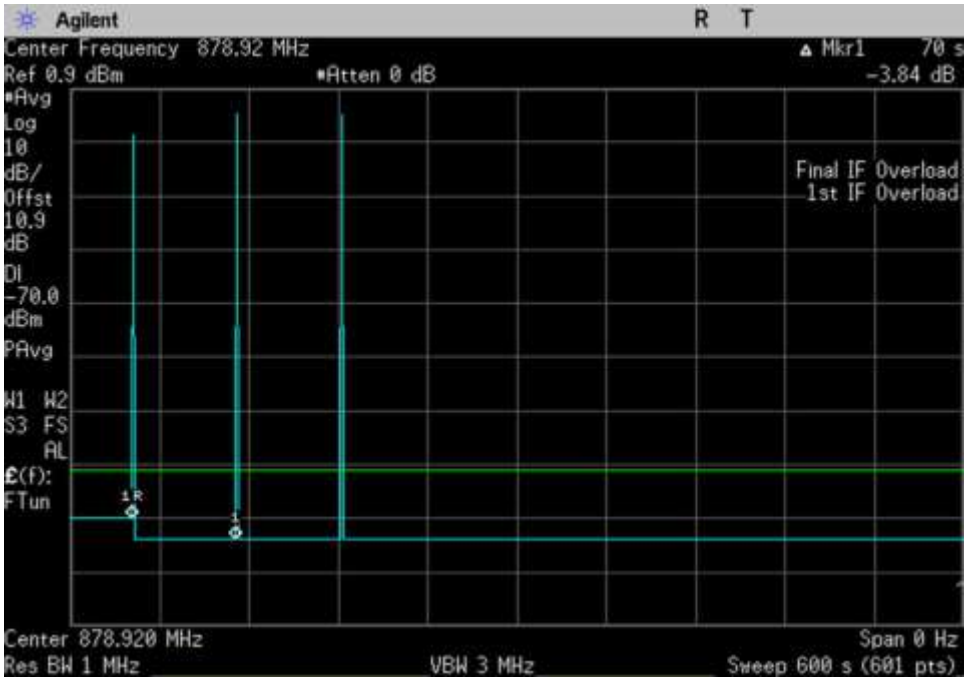
7.11.2 Osc_DL_746-757_600sec_ 751.33MHz



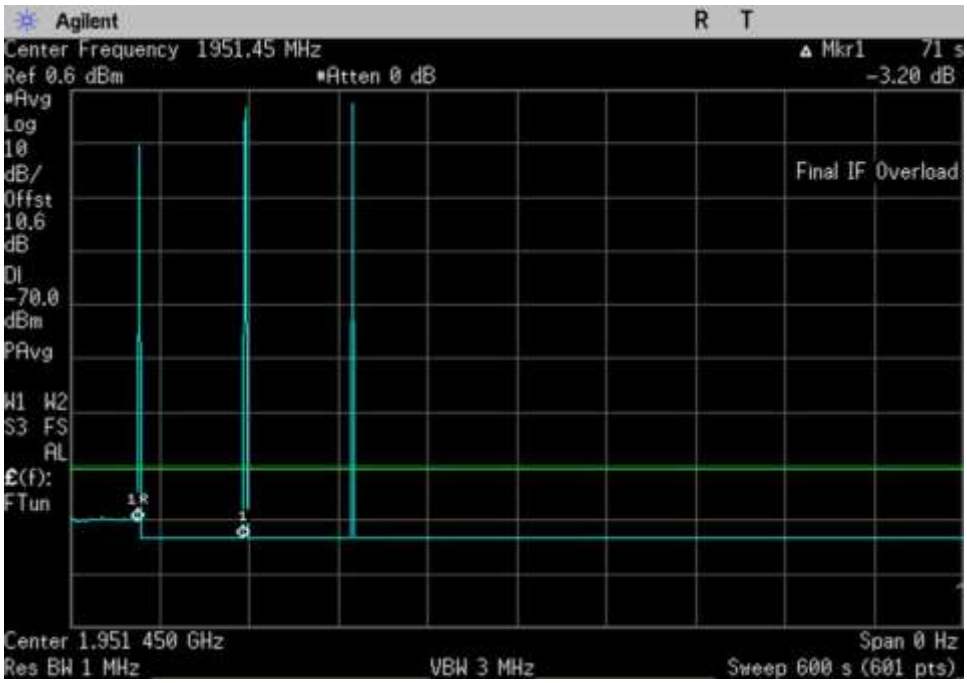
7.11.2 Osc_DL_869-894_ 878.92MHz



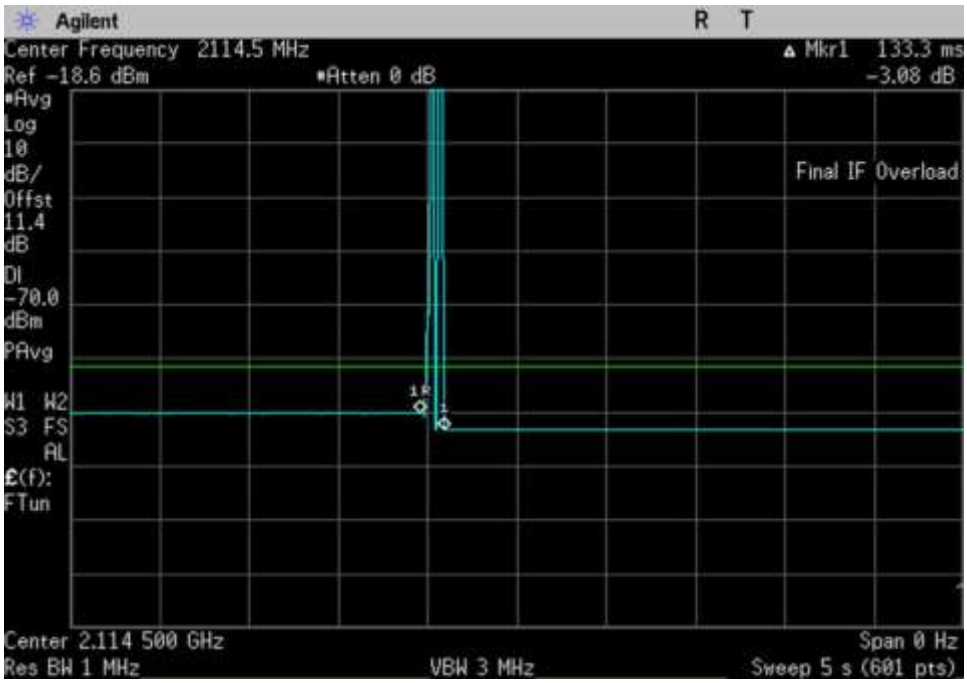
7.11.2 Osc_DL_869-894_600sec_ 878.92MHz



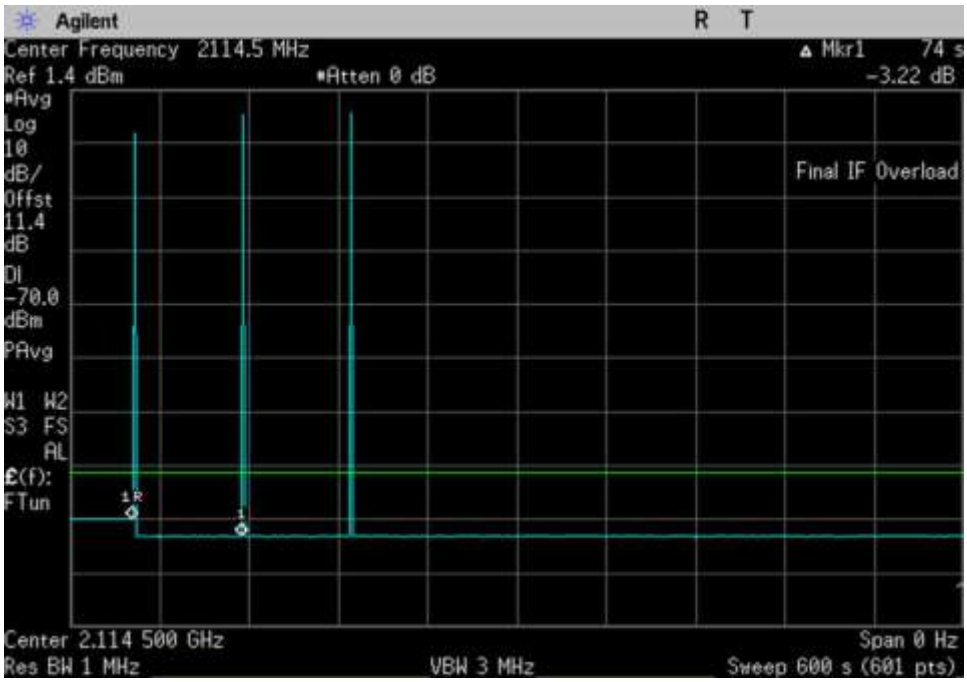
7.11.2 Osc_DL_1930-1995_ 1951.45MHz



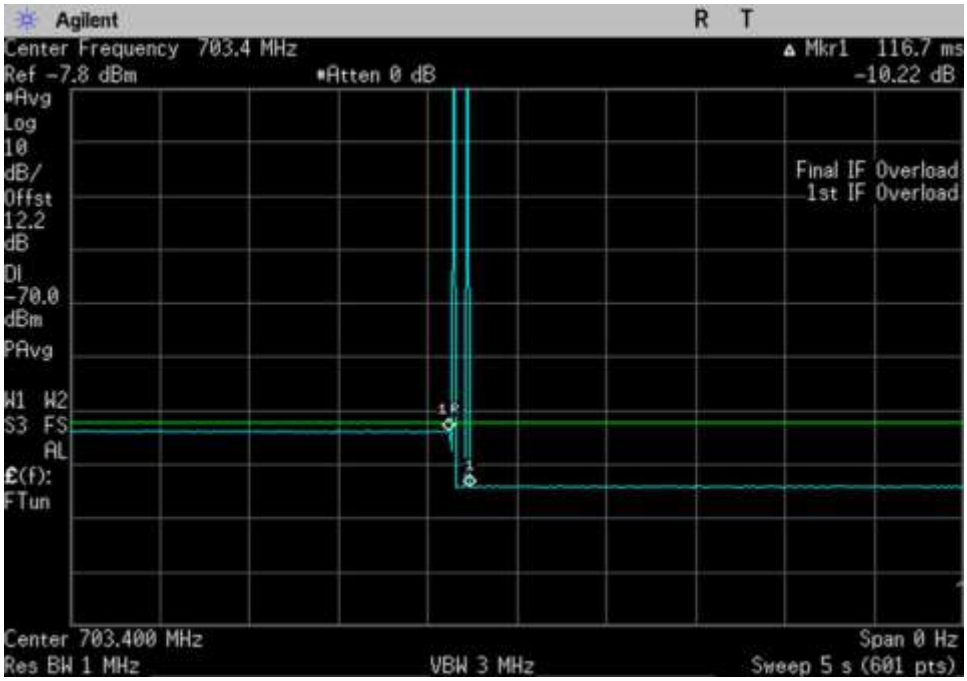
7.11.2 Osc_DL_1930-1995_600sec_ 1951.45MHz



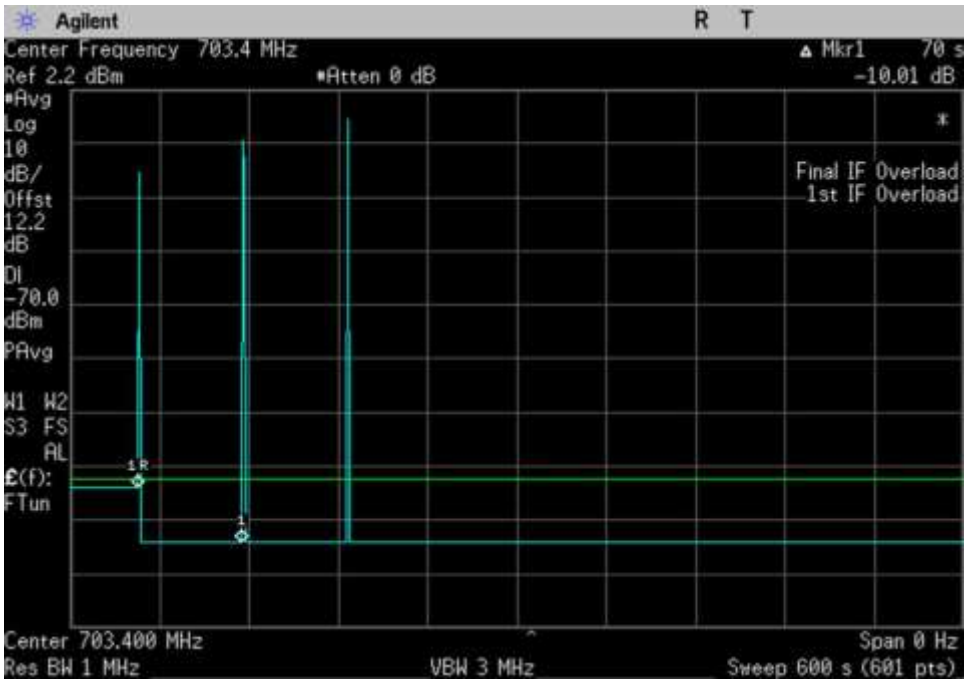
7.11.2 Osc_DL_2110-2155_ 2114.5MHz



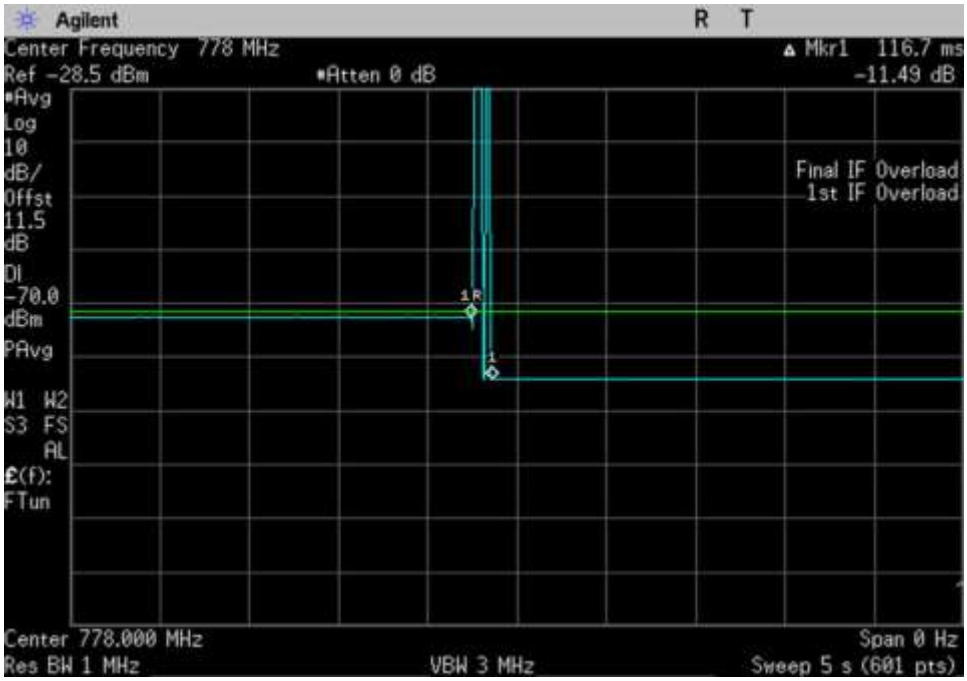
7.11.2 Osc_DL_2110-2155_600sec_ 2114.5MHz



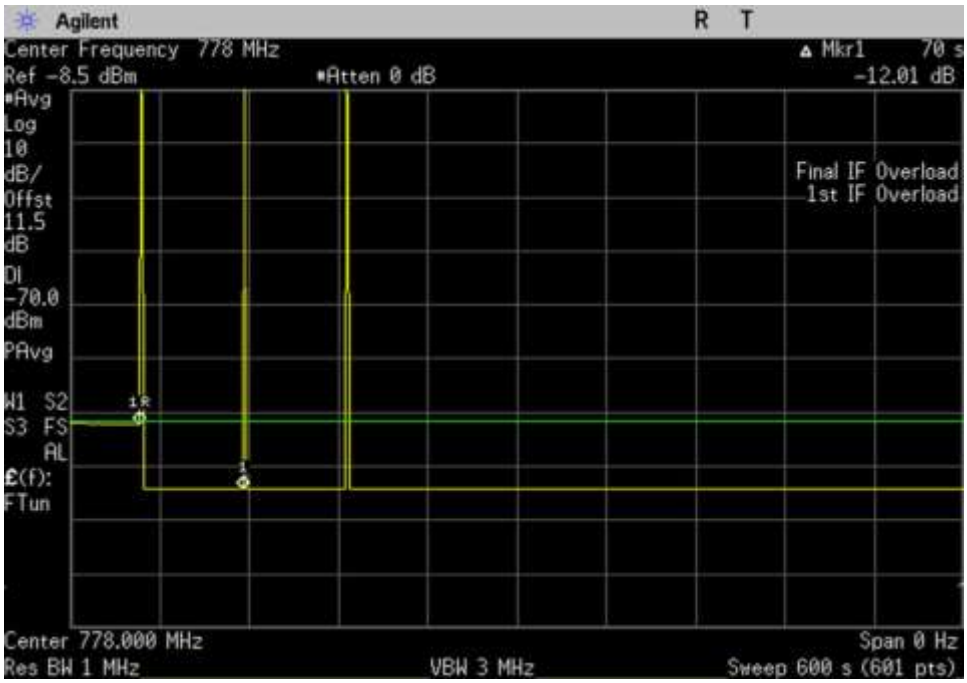
7.11.2 Osc_UL_698-716_ 703.4MHz



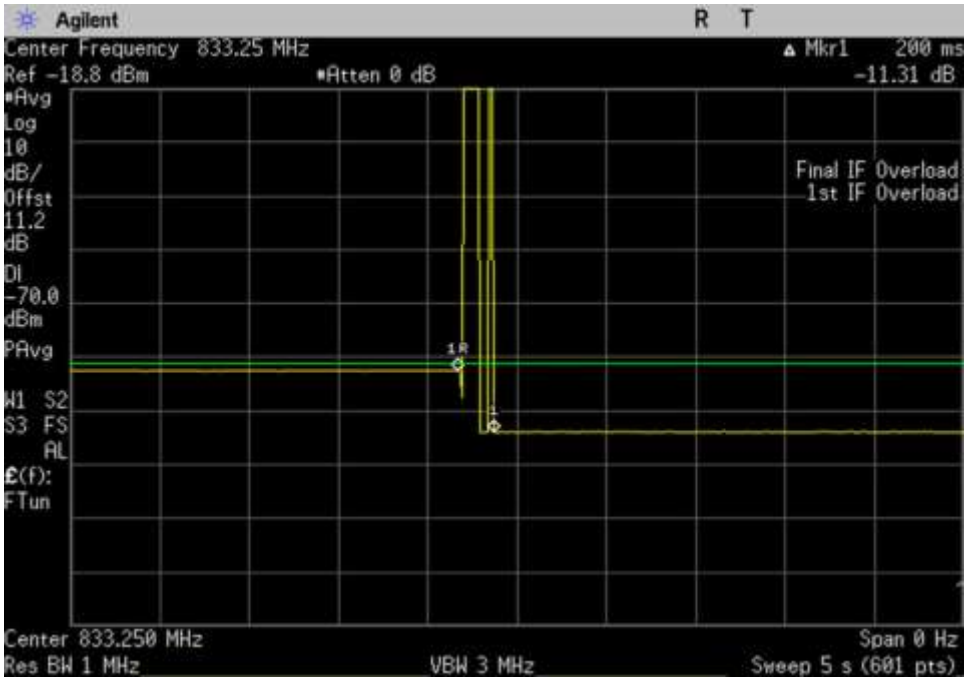
7.11.2 Osc_UL_698-716_600sec_ 703.4MHz



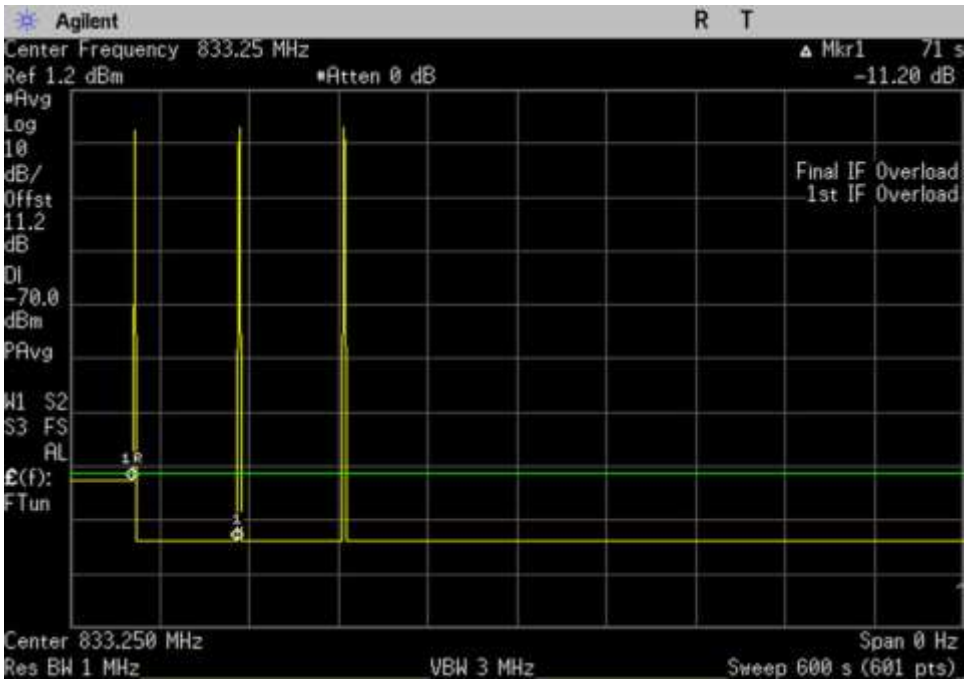
7.11.2 Osc_UL_776-787_ 778MHz



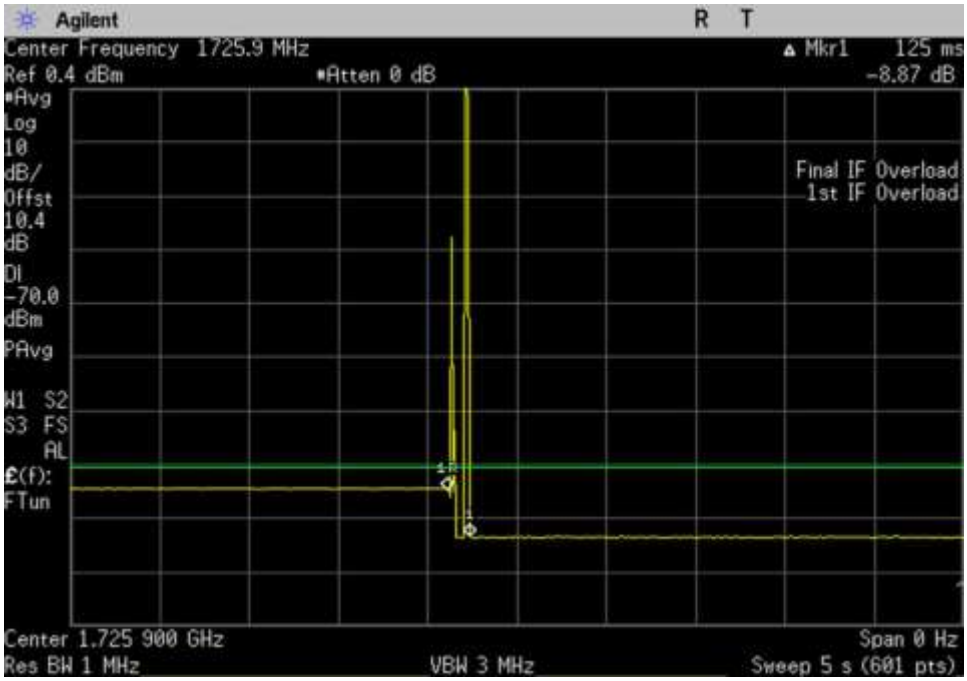
7.11.2 Osc_UL_776-787_600sec_ 778MHz



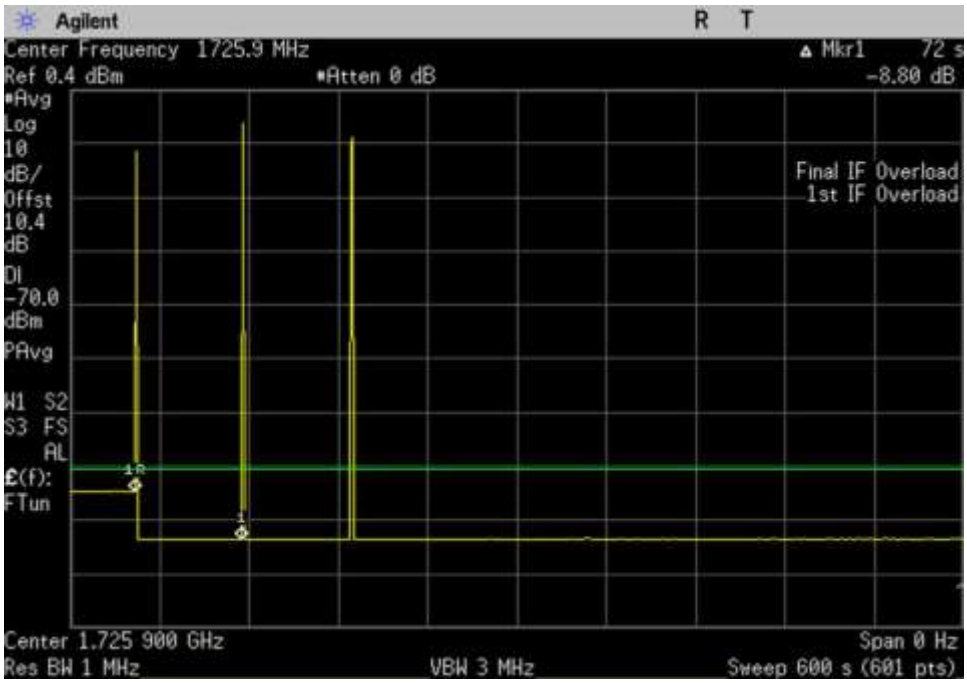
7.11.2 Osc_UL_824-849_ 833.25MHz



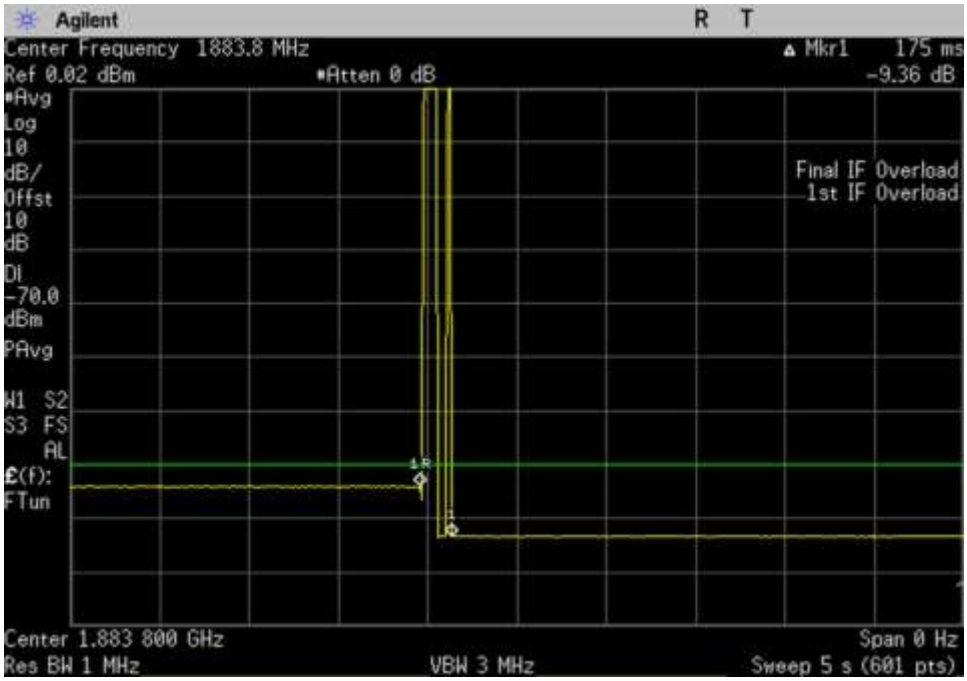
7.11.2 Osc_UL_824-849_600sec_ 833.25MHz



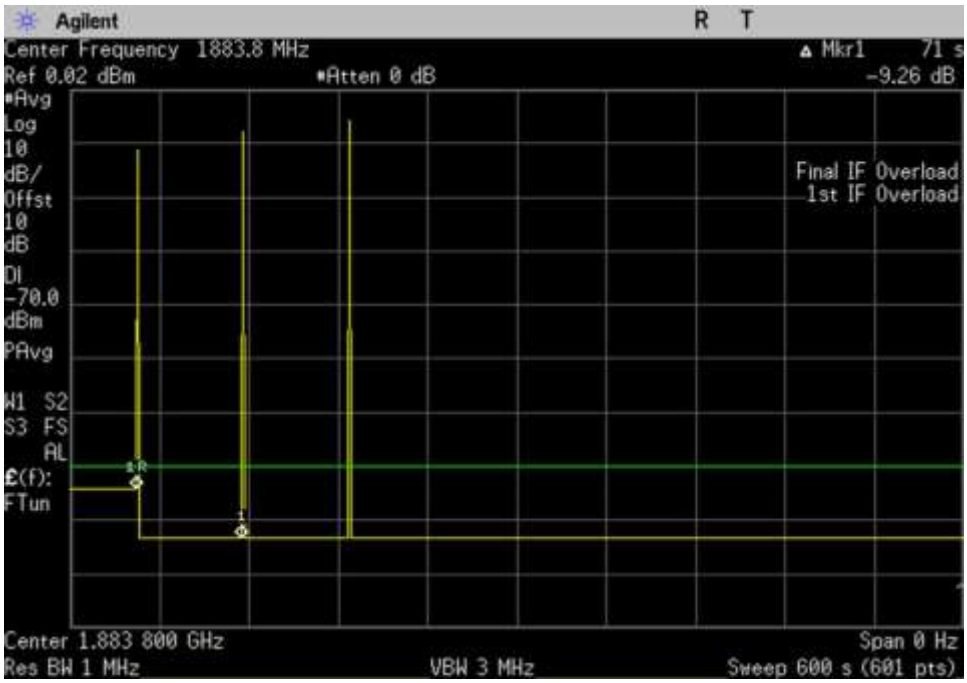
7.11.2 Osc_UL_1710-1755_ 1725.9MHz



7.11.2 Osc_UL_1710-1755_600sec_ 1725.9MHz



7.11.2 Osc_UL_1850-1915_ 1883.8MHz



7.11.2 Osc_UL_1850-1915_600sec_ 1883.8MHz

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 #: **100463** Date: 7/19/18
Test Type: **Radiated Emissions**
Tested By: **E. Wong**
Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N

Test Conditions / Notes:

Test environment conditions: 24.5°C, 50.6% relative humidity, 101.9kPa

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 #/Serial #	Description	Model	Calibration Date	Cal Due Date
AN03470	Spectrum Analyzer	E4440A	1/3/2018	1/3/2020
AN01996	Biconilog Antenna	CBL6111C	11/1/2016	11/1/2018
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
AN00501	Preamp-TOP AMP	8447F	1/6/2017	1/6/2019
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

Summary of Results

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

<u>Frequency Range of measurement 9kHz –> 22GHz</u>

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)

$$E = \sqrt{P_D \text{ x } 377}$$

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

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

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

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

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

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

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

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

$10 \text{ Log } P_t = 20 \text{ Log } E \text{ (uV/m)} - 120 - 5.23$

$10 \text{ Log } P_t = 20 \text{ Log } E \text{ (uV/m)} - 125.23$

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

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

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

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

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

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

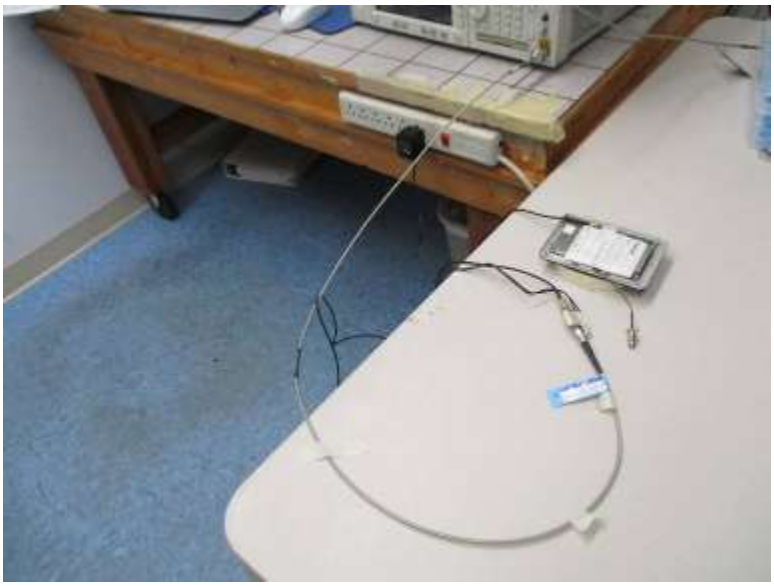
Since 20 Log E (uV/m) = E in dBuV/m = $\cancel{E_{dBuv}} - \cancel{E_{dBuv}} + 82.23$

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

EXHIBIT A: TEST SETUP PHOTOS

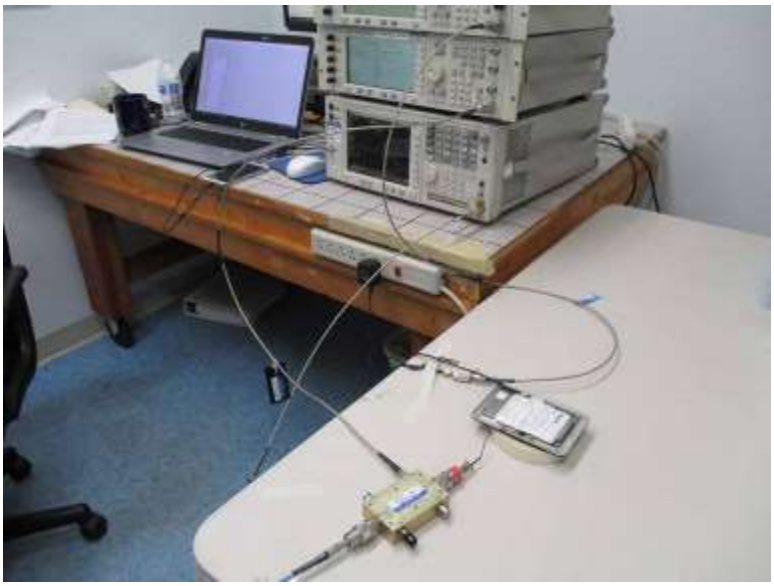
Sections 7.1, 7.2, 7.3, 7.5, 7.6, 7.10

Section 7.4

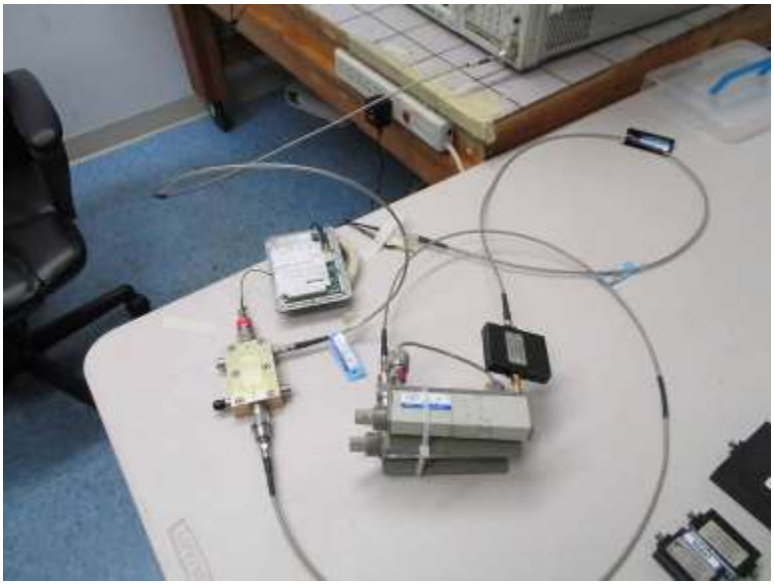


Sections 7.7, 7.8Max Noise

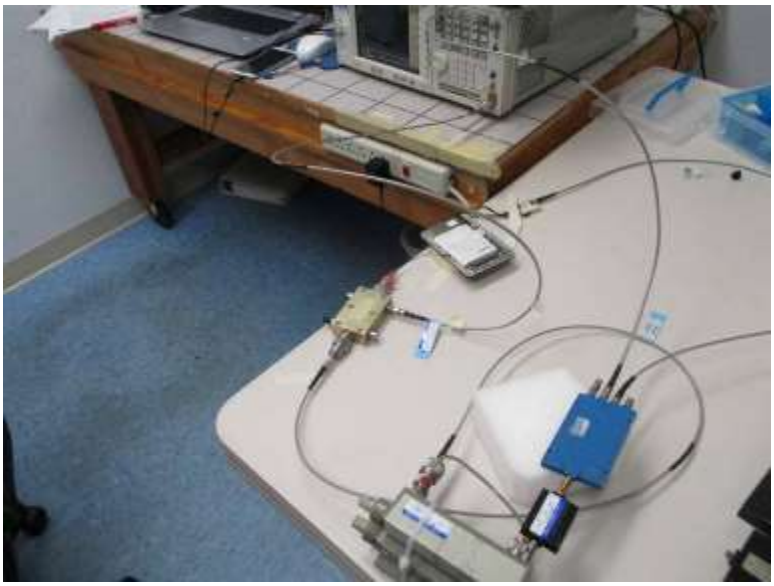
Section 7.7 Variable UL Noise



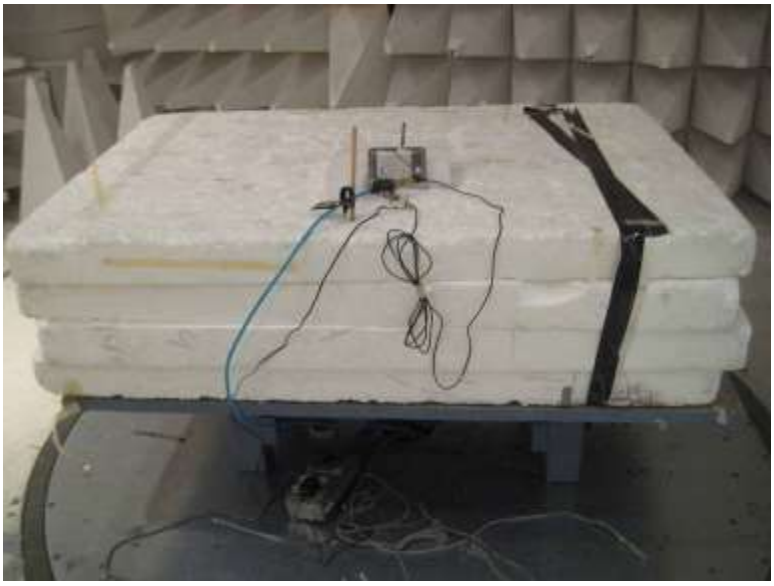
Section 7.9



Section 7.11.2

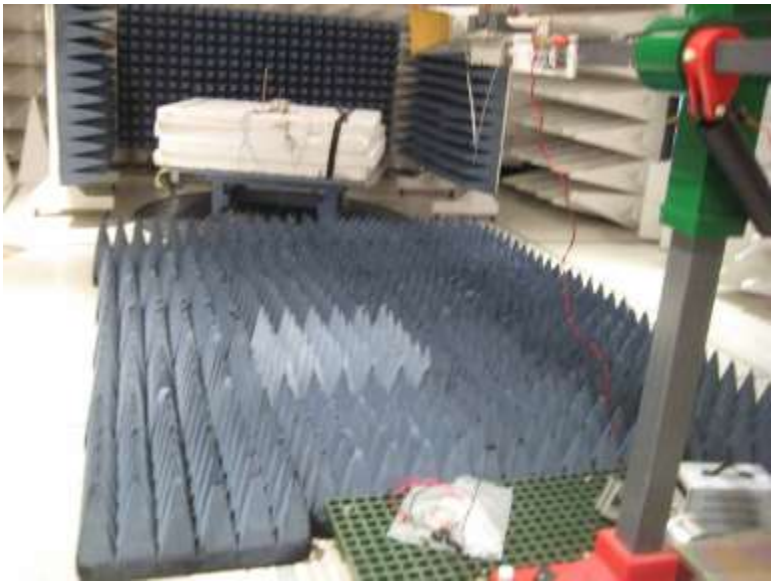


Section 7.11.3

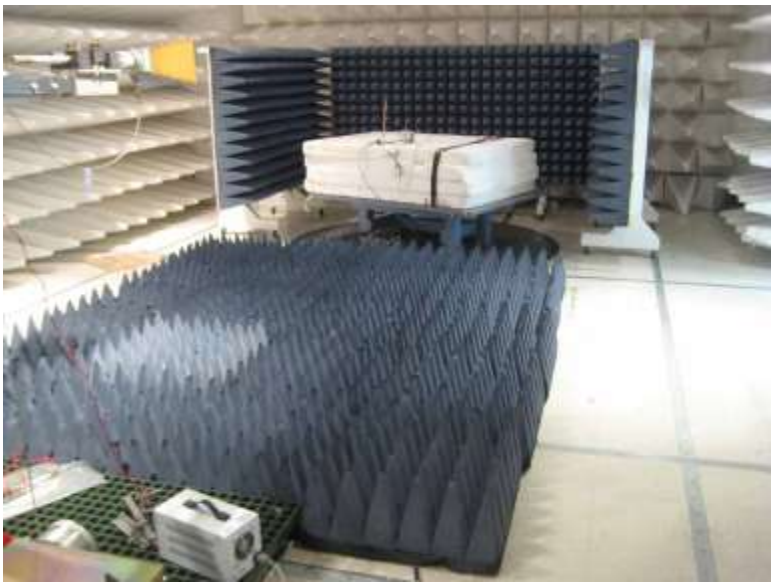


Section 7.12 Setup Below 1GHz

Section 7.12 Setup Below 1GHz



Section 7.12 Setup Above 1GHz



Section 7.12 Setup Above 1GHz

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.