Huaptec

TEST REPORT FOR

Dual Band Signal Booster
Model: F17G-CP

Tested to The Following Standard:

FCC Part 20.21 / 22 / 24

Report No.: 100670-8

Date of issue: February 8, 2018

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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Representative: April

REPORT PREPARED BY:

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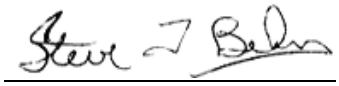
Mariposa, CA 95338

Project Number: 100670

DATE OF EQUIPMENT RECEIPT: December 21, 2017
DATE(S) OF TESTING: December 21, 2017 - January 5, 2018

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

1120 Fulton Place
Fremont, CA 94539

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.11
EMITest Immunity	5.03.10

Site Registration & Accreditation Information

Location	NIST CB #	TAIWAN	CANADA	FCC	JAPAN
Brea D, CA	US0060	SL2-IN-E-1146R	3082D-2	US1025	A-0147
Fremont, CA	US0082	SL2-IN-E-1148R	3082B-1	US1023	A-0149

SUMMARY OF RESULTS

Standard / Specification: FCC Part 20.21/22/24
Wideband Consumer Signal Booster Measurement Guidance: KDB #935210 DO3 v04r01, October 27, 2017

Correlation Matrix & Results					
Guidance Section	**Guidance Description**	**FCC Section**	**FCC Rule Description**	**Mods**	**Results**
7.1 a) - k)	Authorized Frequency Band Verification Test	20.21(e)(3)	Frequency Bands	NA	Pass
7.2.2 a) - k)	Maximum Power Measurement Procedure	2.1046/20.21(e)(8)(i)(D)	Power Limit	NA	Pass
7.3 a) - d)	Maximum Booster Gain Computation	20.21(e)(8)(i)(B)	Bidirectional Capabilities	NA	Pass
7.4 a) - n)	Intermodulation Product	20.21(e)(8)(i)(F)	Intermodulation Limit	NA	Pass
7.5 a) - n)	Out of Band Emissions	20.21(e)(8)(i)(E)	Out of Band Emission	Mod. #1	Pass
7.6 a) - e)	Conducted Spurious Emission	2.1051/22/24/27	Spurious emission	NA	Pass
7.7.1 a) - g) 7.7.1 h) - n) 7.7.2 a) - g)	Noise Limit Procedure Variable Noise Variable Noise Timing	20.21(e)(8)(i)(A)(2)(i) 20.21(e)(8)(i)(A)(1) 20.21(e)(8)(i)(H)	Noise Limits Transmit Power Off Mode	NA	Pass
7.8 a) - l)	Uplink inactivity	20.21(e)(8)(i)(I)	Uplink Inactivity	NA	Pass

NA = Not applicable

Standard / Specification: FCC Part 20.21/22/24 - continued

Correlation Matrix & Results					
Guidance Section	**Guidance Description**	**FCC Section**	**FCC Rule Description**	**Mods**	**Results**
7.9.1 a) - l) 7.9.2 a) - f)	Variable Booster Gain Variable Uplink Gain Timing	20.21(e)(8)(i)(C) (1), (2)(i) 20.21(e)(8)(i)(H)	Booster Gain Transmit Power Off Mode	NA	Pass
7.10.a) - j)	Occupied Band Width	2.1049/22/24/27	Occupied Band Width	NA	Pass
7.11.2 a) - r) 7.11.3 a) - h) 7.11.4 a) - h) (alternate to 7.11.3)	Anti-Oscillation	20.21(e)(8)(ii)(A)	Anti-Oscillation	NA	Pass
7.12a) - f)	Radiated Spurious Emission	2.1053/ 22/24/27	Spurious Emission	NA	Pass
7.13 a) - c)	Spectrum Block Filter	NA	NA	NA	NA1

NA = Not applicable
NA1 = Not applicable because the EUT does not employ spectrum block filter.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
Modification #1: Changed signal gain distribution of the 4 amplifier stages in the 1850-1915 MHz PCS uplink band to reduce OOBE at AGC +10dB. Total gain remains unchanged.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

The following model has been tested by CKC Laboratories: **F17G-CP**

The manufacturer states that the following additional models are identical electrically to the one which was tested, or any differences between them do not affect their EMC characteristics, and therefore they meet the level of testing equivalent to the tested models**.**
F13G-CP
F10G-CP

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Dual Band Signal Booster	Huaptec	F17G-CP	NA
AC/DC Adaptor	Generic	GM50-1203-00-T	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Equipment	Zone Enhancer
Operating Frequency Range:	UL: 824-849MHz DL: 869-894MHz UL: 1850-1915MHz DL: 1930-1995MHz
OBW and Emissions Type(s):	GXW (GSM) G7W (EDGE) F9W(CDMA) F9W(WCDMA) W7D (LTE) G7D (LTE) See table below for OBW
Modulation Type(s):	0.3 GMSK (GSM) 3p/8 8-PSK (EDGE) QPSK (CDMA) BPSK/QPSK (WCDMA) OFDM (LTE)
Number of TX Chains:	1
Antenna Type(s) and Gain:	Dedicated, See antenna kitting information
Beamforming Type:	NA
Antenna Connection Type:	UL: 50 Ohm/ N DL: 50 Ohm/ N
Nominal Input Voltage:	12VDC
Firmware / Software used for Test:	V0122.

FCC PART 20.21/22/24

General Test Setup

Summary of Conditions
General Test Setup The equipment under test (EUT) is a Fixed Wideband Consumer Booster. The EUT is placed on the test bench. Evaluation performed at the Outside (Donor) and Inside (Server) antenna port. The EUT Server port is a type N connector and 50-ohm impedance. The EUT Donor port is type N connector and 50-ohm impedance. All DIP switches are in the off position Part 22 UL: 824-849MHz DL: 869-894MHz Part 24 UL: 1850-1915MHz DL: 1930-1995MHz Firmware: V0122 Test environment conditions: Temperature: 21.2-24°C Relative Humidity: 30-48% Pressure: 100.8-102.5 kPa Test Procedure: 935210 D03 Signal Booster Measurements v04r01, October 27, 2017

7.1 Authorized Frequency Band Verification

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539•		
Customer:	**Huaptec**		
Specification:	7.1 Band verification		
Work Order #:	**100670**	Date:	12/21/2017
Test Type:	**Conducted Emissions**	Time:	09:58:39
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

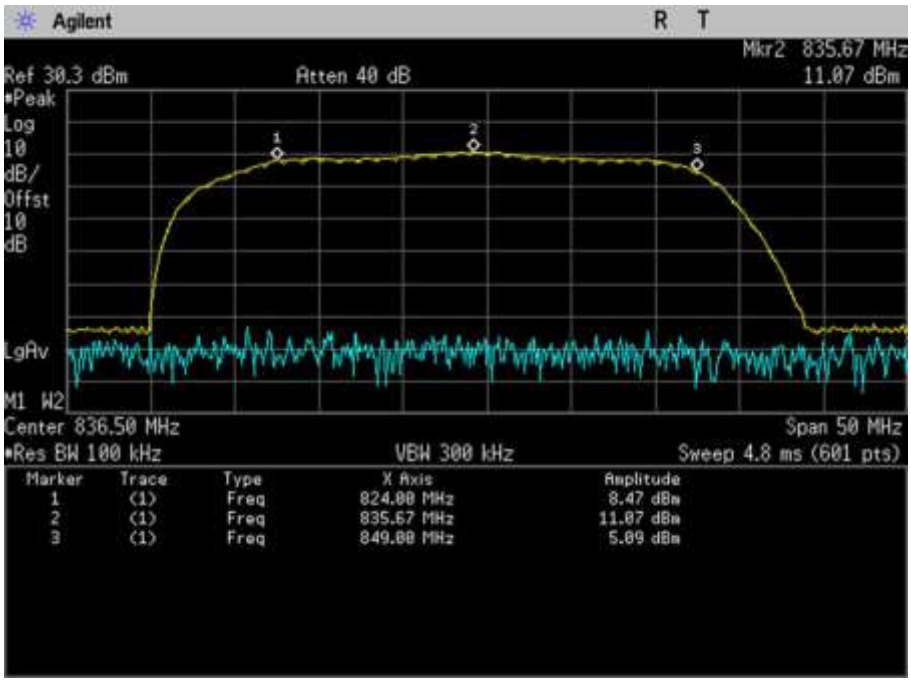
Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
03471	Spectrum Analyzer	E4440A	1/4/2016	1/4/2018
C00032	Arbitrary Waveform Generator	E4433B	2/26/2016	2/26/2018
P07191	Cable	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
P05411	Attenuator	54A-10	1/18/2016	1/18/2018
P07192	Cable	32022-29094K-29094K-48TC	10/9/2017	10/9/2019

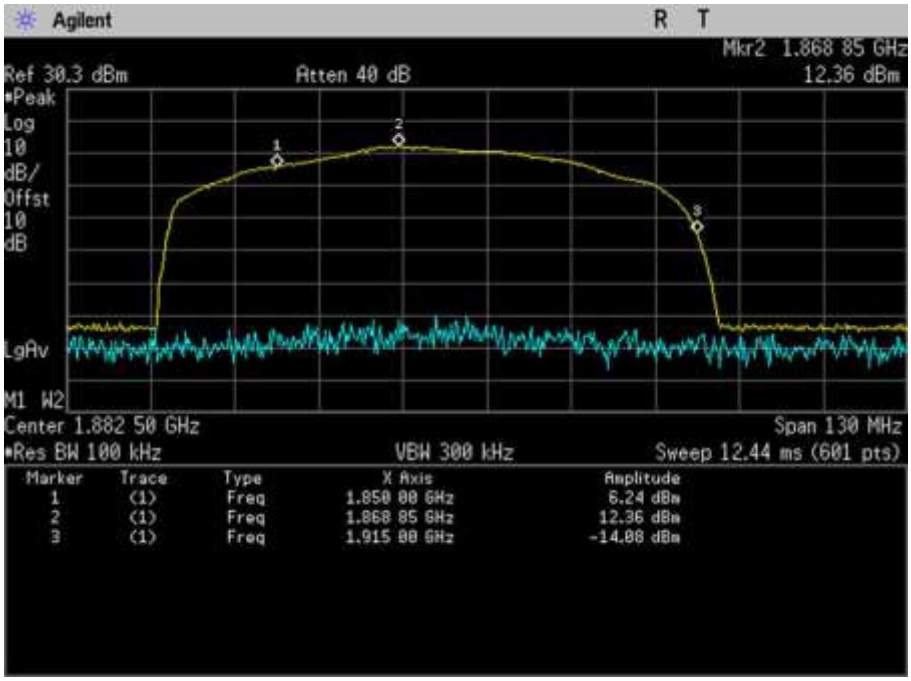
Summary of Results

PASS: The plots below show the device only operates on the CMRS frequency bands authorized for use by the NPS.

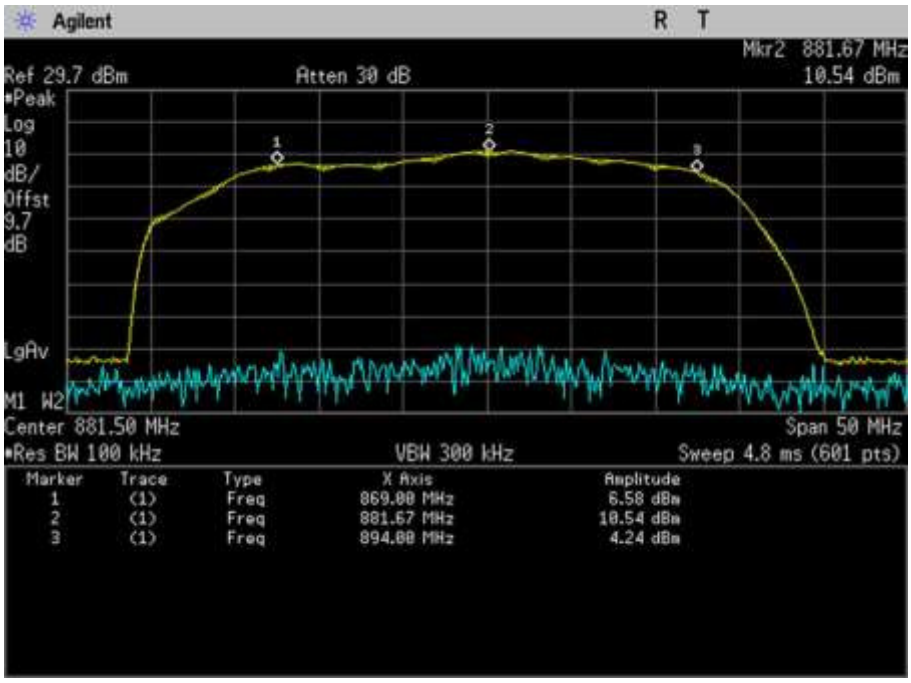
Plots



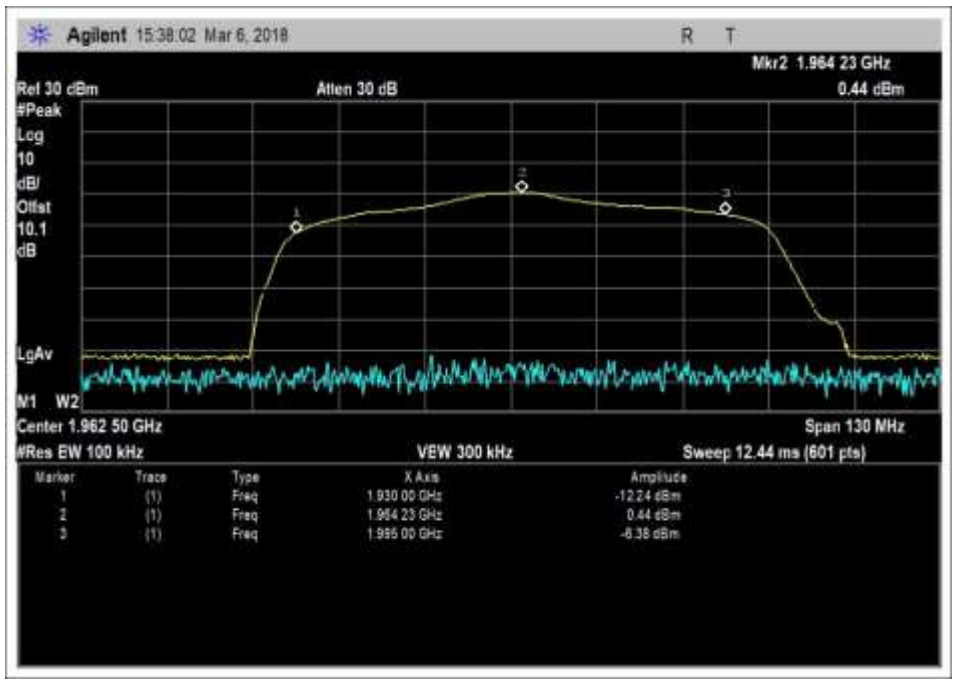
UL_824-849MHz



UL_1850-1915MHz



DL_869-894MHz



DL_1930-1995MHz

7.2 Maximum Power / 7.3 Maximum Gain

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539•		
Customer:	**Huaptec**		
Specification:	**7.2 Maximum Power Measurement** **7.3 Maximum Booster Gain**		
Work Order #:	**100670**	Date:	12/21/2017
Test Type:	**Conducted Emissions**	Time:	14:49:39
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
03471	Spectrum Analyzer	E4440A	1/4/2016	1/4/2018
C00032	Arbitrary Waveform Generator	E4433B	2/26/2016	2/26/2018
P07191	Cable	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
P05411	Attenuator	54A-10	1/18/2016	1/18/2018
P07192	Cable	32022-29094K-29094K-48TC	10/9/2017	10/9/2019

Summary of Results

PASS: as summarized in table below, measured EIRP, Gain and UL/DL gain ratio are within limits.

	Pre AGC			Pre AGC		
	Pulse GSM			4.1 MHz AWGN		
Frequency (MHz)	Input (dBm)	Output (dBm)	Gain (dB)	Input (dBm)	Output (dBm)	Gain (dB)
UL1850-1915	-46.5	19.9	66.4	-48.2	18.3	66.5
UL824-894	-41.2	19.9	61.1	-42.5	18.0	60.5
DL1930-1995	-52.4	14.4	66.8	-51.3	14.6	65.9
DL869-894	-45.2	15.5	60.7	-43.8	15.8	59.6

*Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log10 (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

UL MidBand	Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log_{10} (Frequency UL Midband)	
	Limit	Margin
1882.5	72.0	***-5.5***
836.5	64.9	***-3.8***

Pulsed GSM					Conducted	Conducted and EIRP
Frequency (MHz)	Conducted Output Power (dBm)	Ant Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit Min (dBm)	Limit Max (dBm)
UL1850-1915	19.9	11	1.8	29.1	17	30
UL824-894	19.9	10	1.2	28.7	17	30
DL1930-1995	14.4	3	2.8	14.6	NA	17
DL869-894	15.5	3	1.8	16.7	NA	17
4.1MHz AWGN					**Conducted**	**Conducted and EIRP**
Frequency (MHz)	**Conducted Output Power (dBm)**	**Ant Gain (dB)**	**Cable Loss (dB)**	**EIRP (dBm)**	**Limit Min (dBm)**	**Limit Max (dBm)**
UL1850-1915	18.3	11	1.8	27.5	17	30
UL824-894	18.0	10	1.2	26.8	17	30
DL1930-1995	14.6	3	2.8	14.8	NA	17
DL869-894	15.8	3	1.8	17.0	NA	17

4.Wide Band Directional Antenna 11dbi Antenna with 30' 400 N male Kit numbers: 11-30400

Antenna Gain (dBi)	10	11
Coax Cable Loss (dB)	1.2	1.8
Final Gain Less Loss (dB)	8.8	9.2
Final Output Power (dBm EIRP)	28.7	29.1

136.1 Dome Antenna with 30' 300 N male Kit numbers:3-30300-50

Antenna Gain (dBi)	3	3
Splitter/Coax Loss (dB)	1.8	2.8
Final Gain Less Splitter/Coax Loss (dB)	1.2	0.2
Antenna Gain with Coax Loss Margin (dB)	-0.26	-2.29
Final Output Power (dBm EIRP)	17.00	14.80

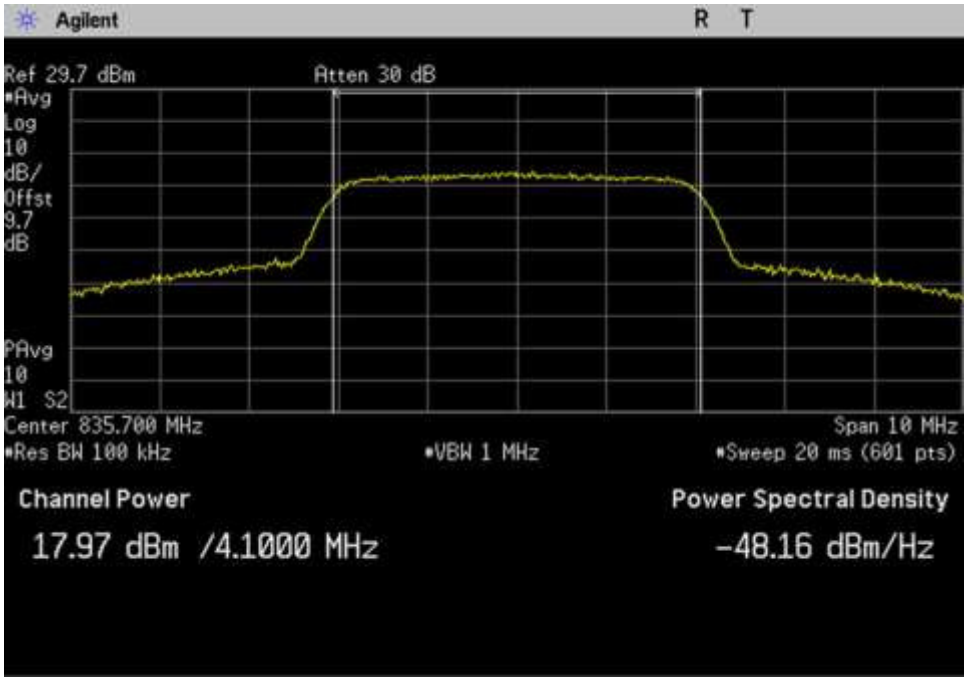
Section 5.5 power						
	Pulse GSM			**4.1 MHz AWGN**		
Frequency (MHz)	**Input (dBm)**	**Output (dBm)**	**Gain (dB)**	**Input (dBm)**	**Output (dBm)**	**Gain (dB)**
UL1850-1915	-40.7	19.9	60.6	-41.4	18.4	59.8
UL824-894	-29.6	20.0	49.6	-41.2	18.4	59.6
DL1930-1995	-41.7	14.3	56.0	-40.7	14.8	55.5
DL869-894	-33.3	15.4	48.7	-40.8	15.7	56.5

Note: The booster went into Transmitter off mode at Max input power in accordance with section 5.5. Results presented on the above table are at 1 dB below the Transmit off RF input level.

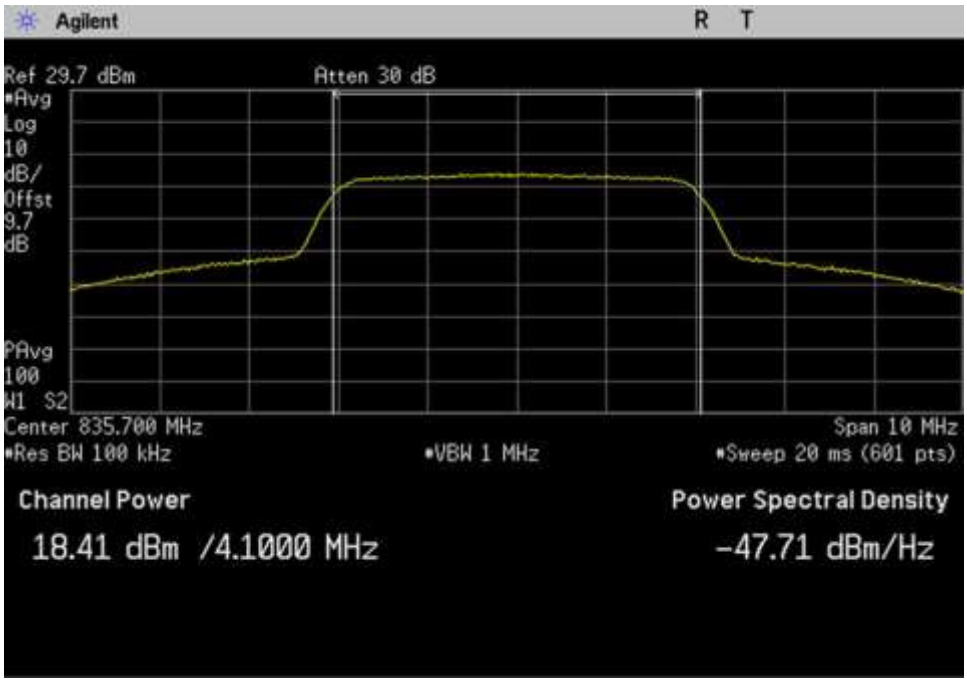
	Pulse GSM	**4.1MHz AWGN**	**Limit (dB)**
UL gain vs DL gain 1850/1930	-0.4	0.6	9.0
UL gain vs DL gain 824/869	0.4	0.9	9.0

Plots

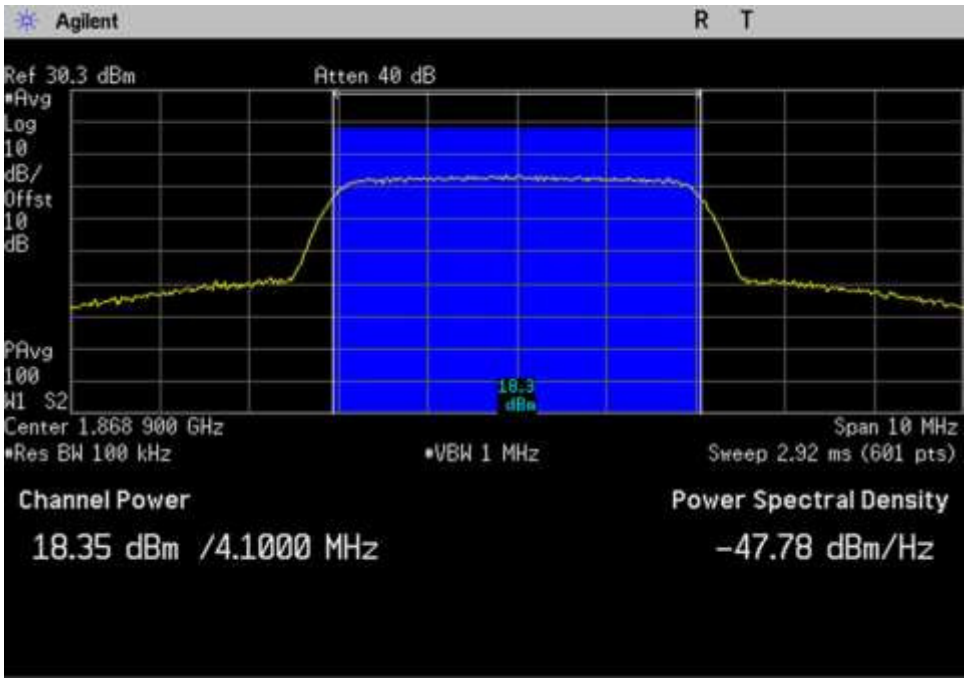
AWGN



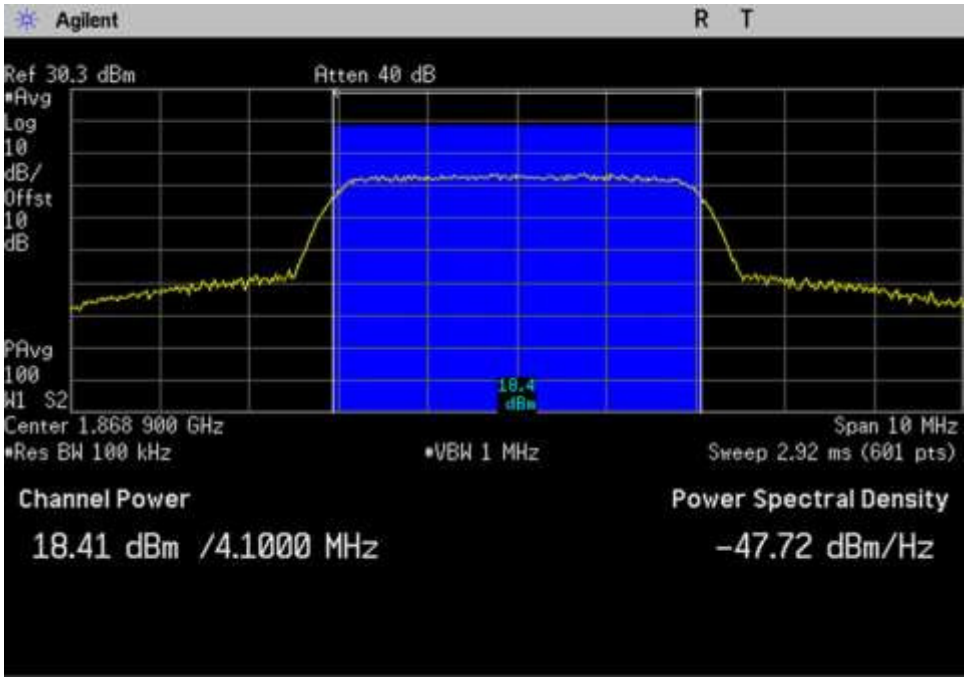
UL_824-849MHz_AWGN



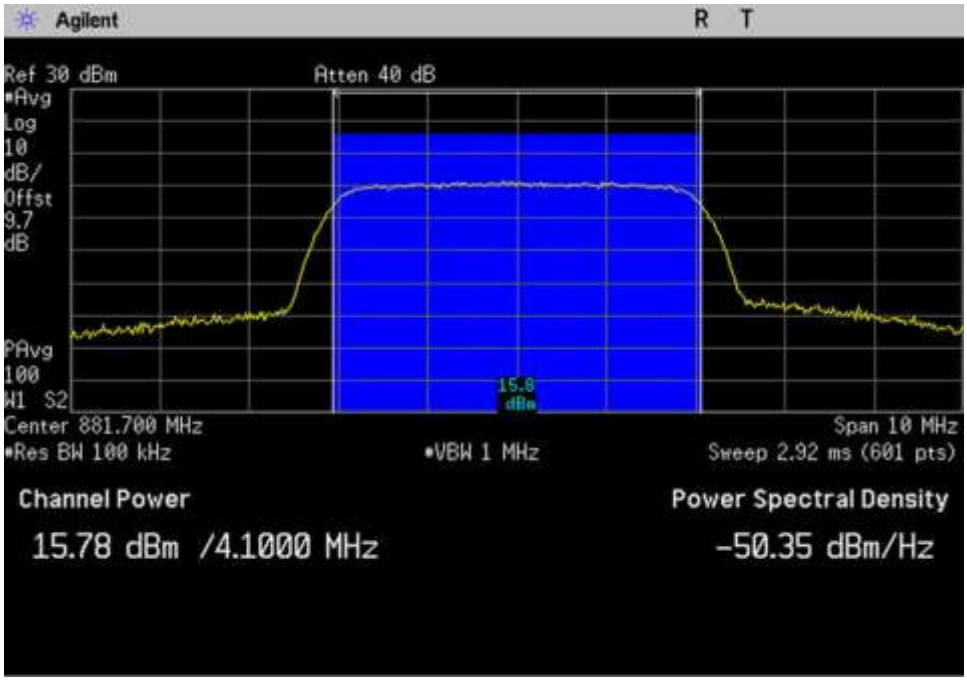
UL_824-849MHz_AWGN_Max



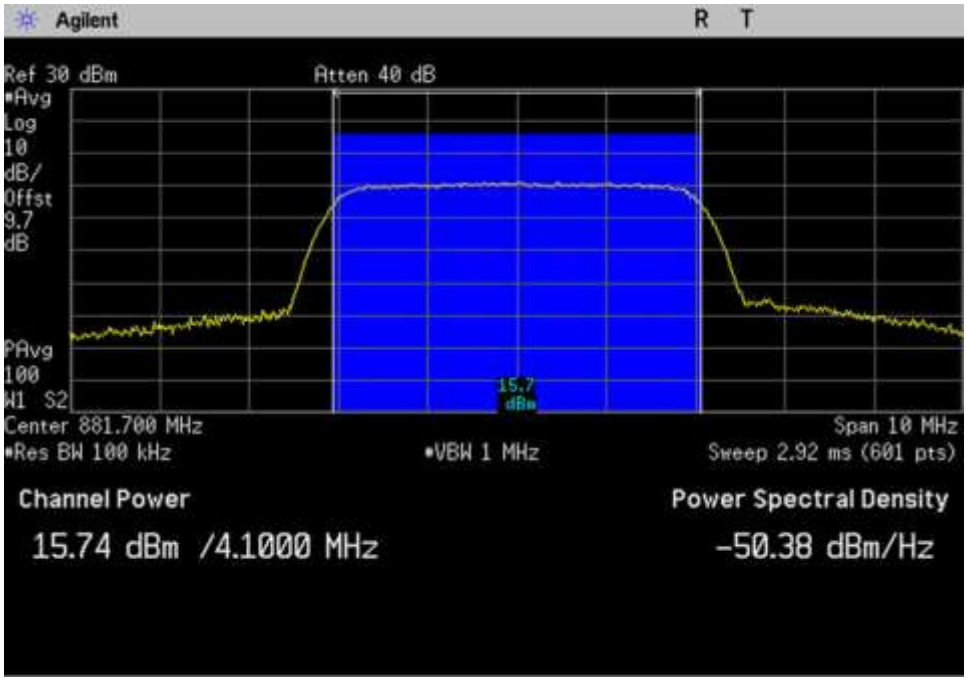
UL_1850-1915MHz_AWGN



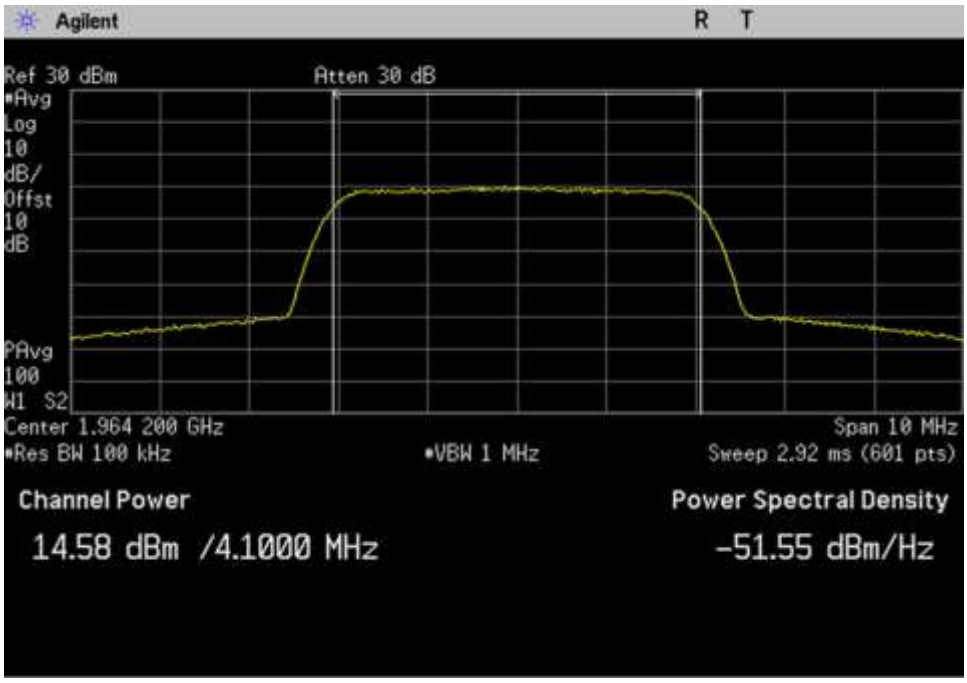
UL_1850-1915MHz_AWGN_Max



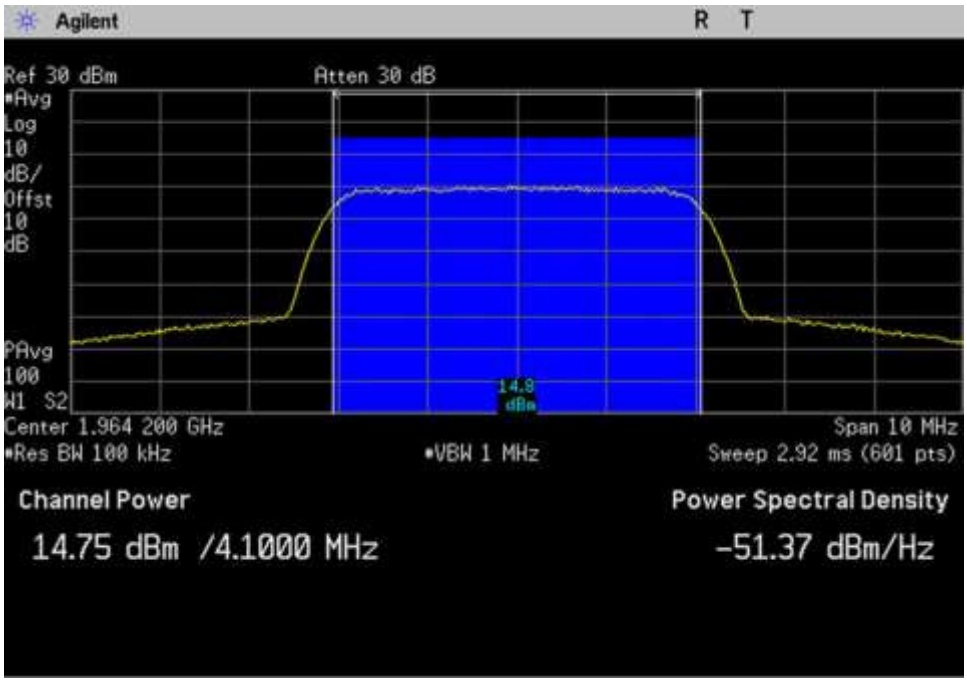
DL_869-894MHz_AWGN



DL_869-894MHz_AWGN_Max

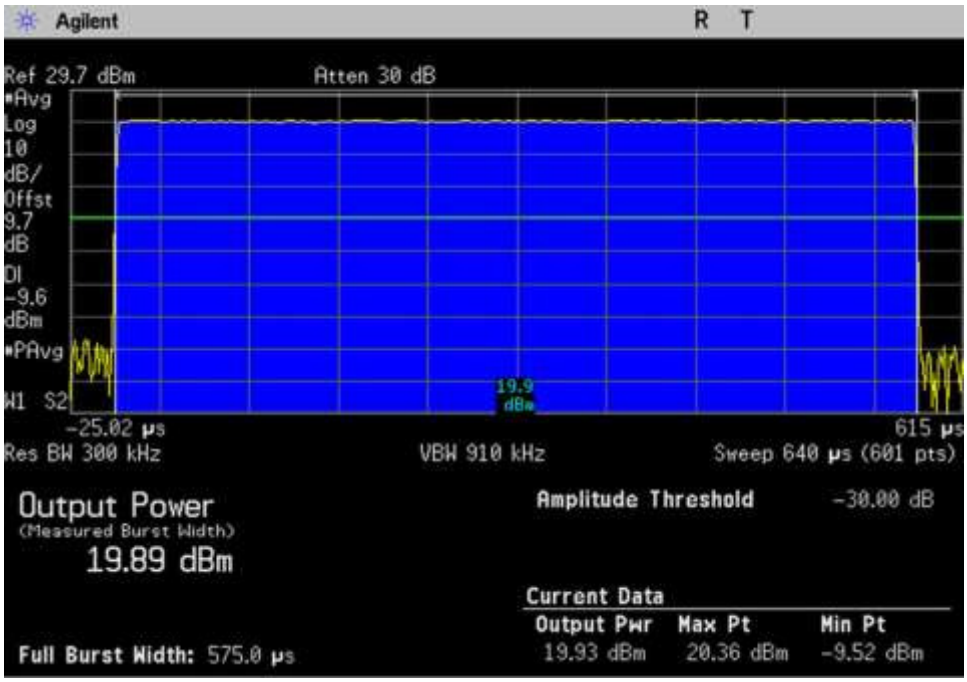


DL_1930-1995MHz_AWGN

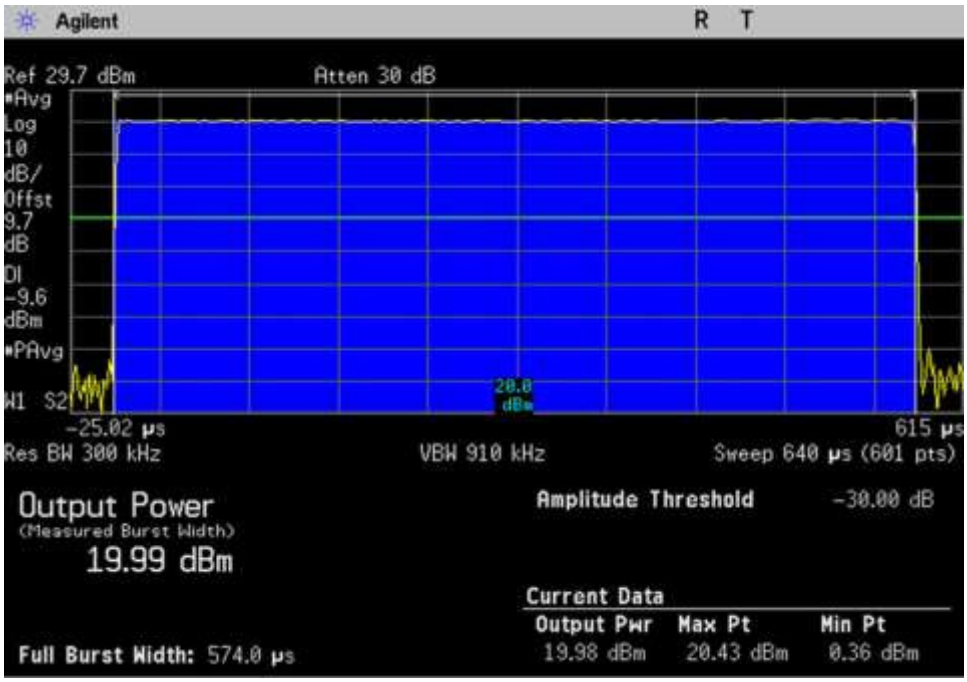


DL_1930-1995MHz_AWGN_Max

GSM



UL_824-849MHz_GSM



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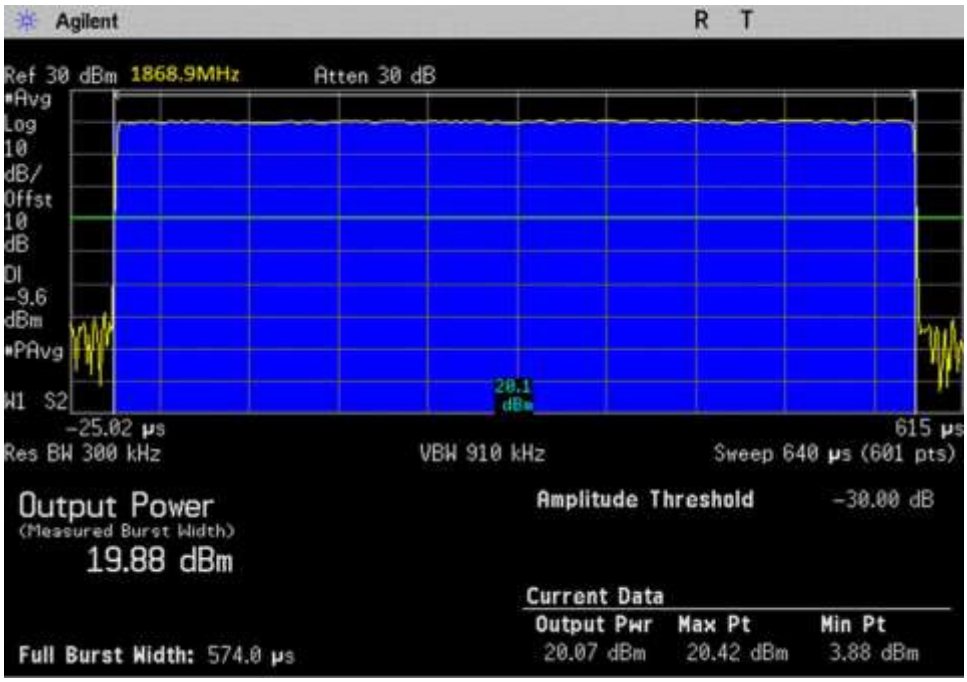
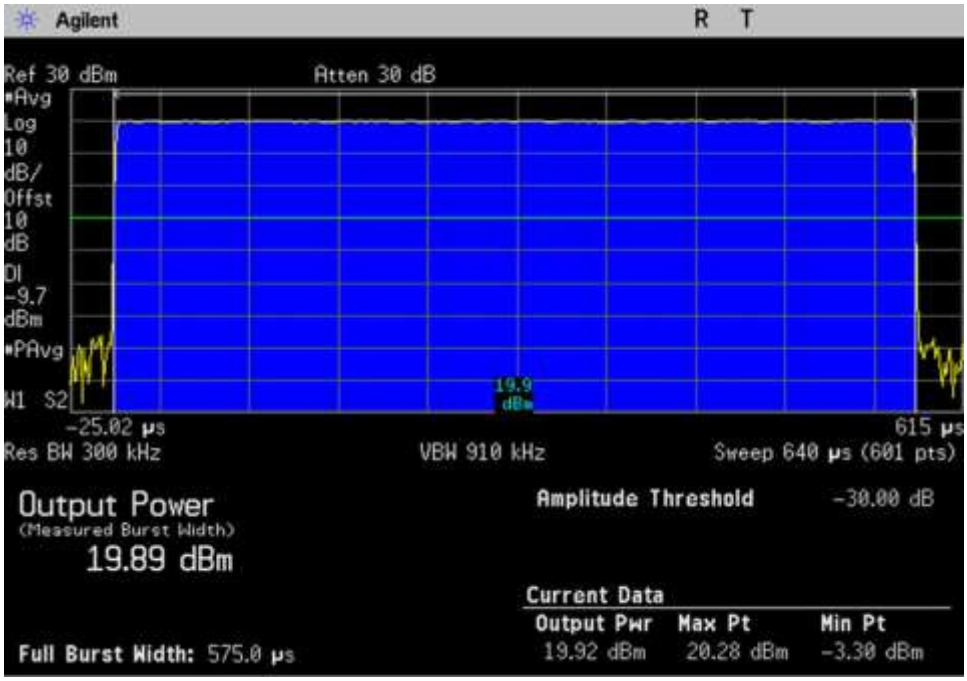


UL_1850-1915MHz_GSM



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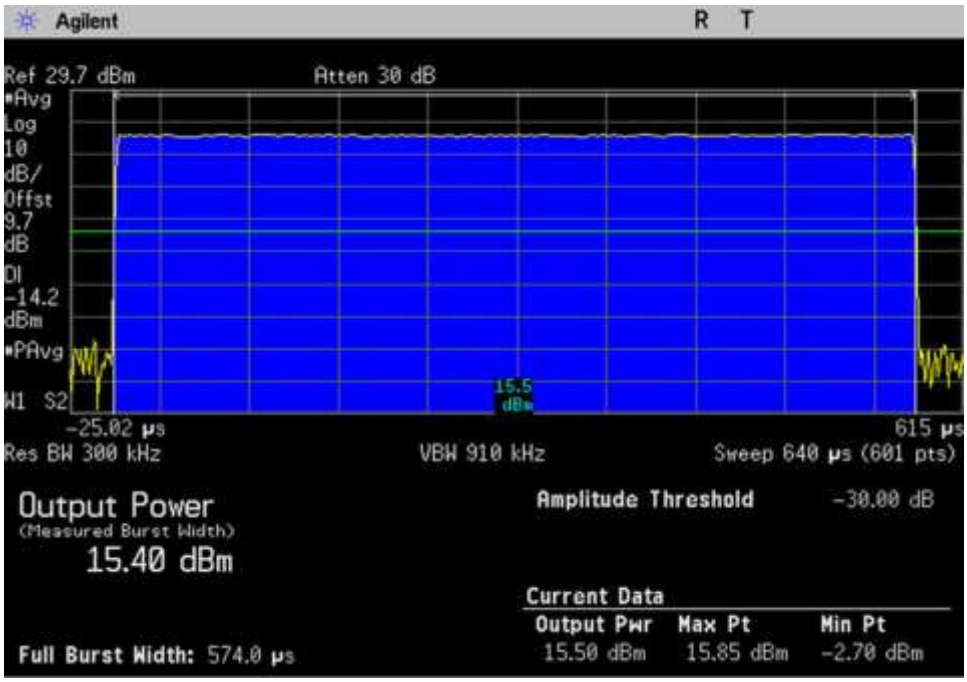
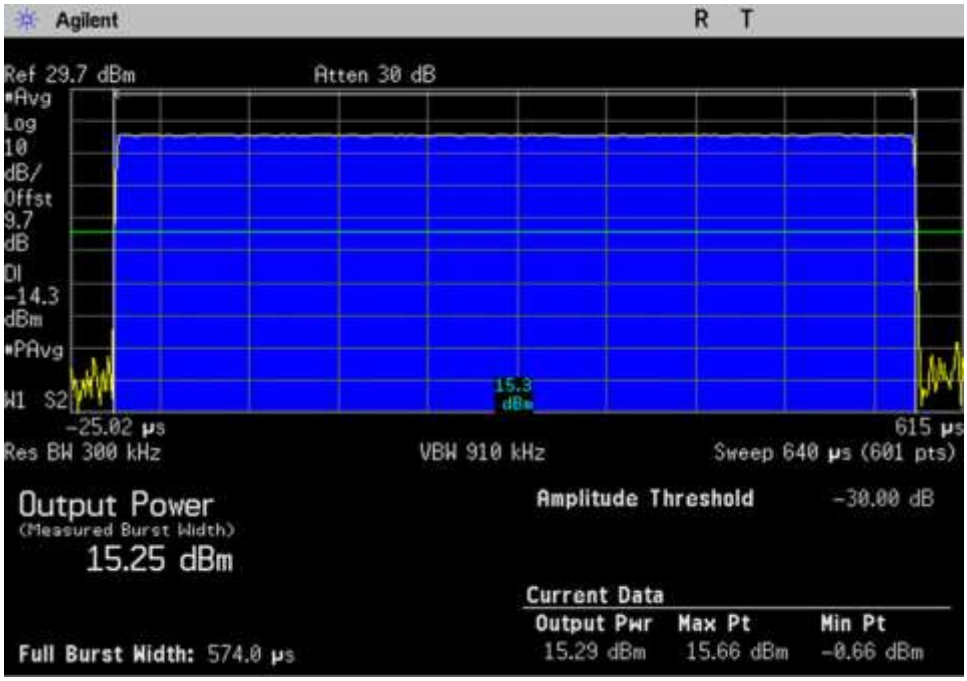
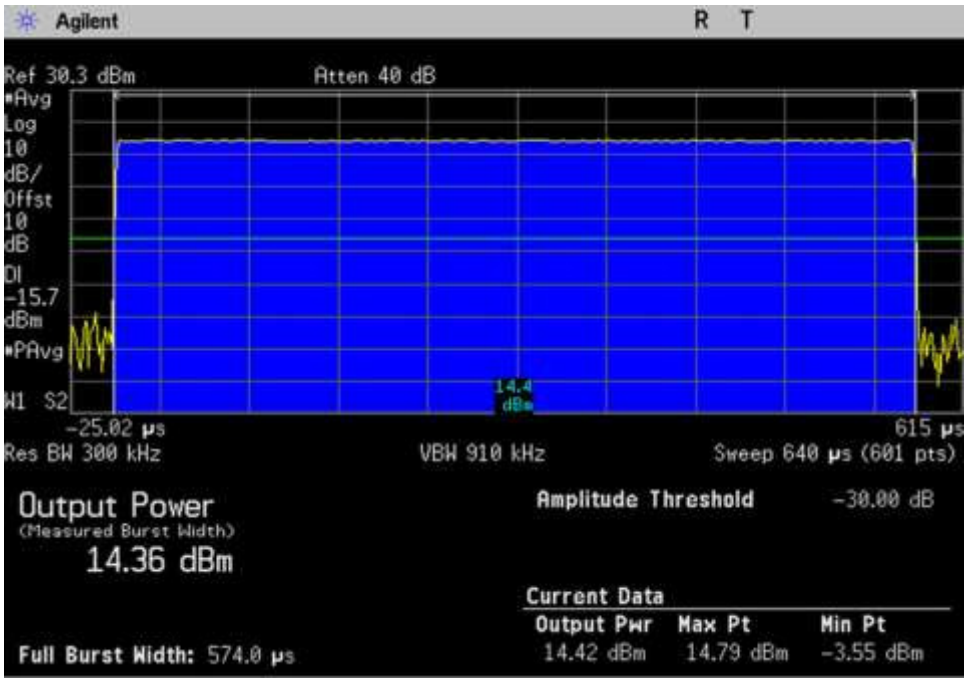


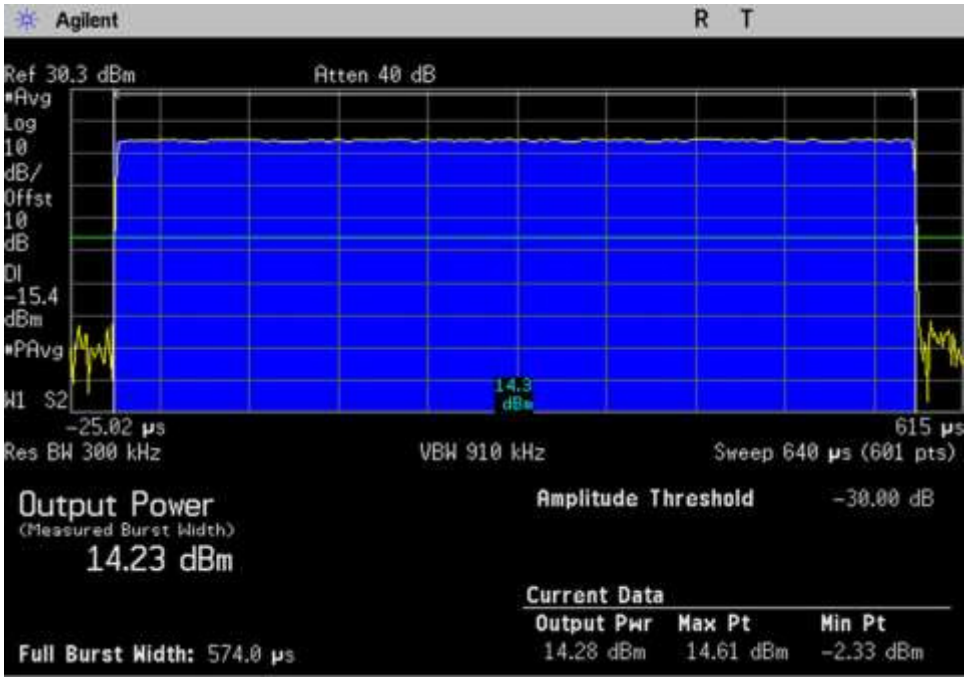
DL_869-894MHz_GSM



DL_869-894MHz_GSM_Max



DL_1930-1995MHz_GSM



DL_1930-1995MHz_GSM_Max

7.4 Intermodulation Product

Test Conditions / Setup

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539•
Customer: **Huaptec**
Specification: **7.4 Intermodulation**
Work Order #: **100670** Date: 12/22/2017
Test Type: **Conducted Emissions** Time: 09:40:39
Tested By: E. Wong Sequence#: 1
Software: EMITest 5.03.11 110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Note: Dual tone from the Signal Generator.

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
03471	Spectrum Analyzer	E4440A	1/4/2016	1/4/2018
C00032	Arbitrary Waveform Generator	E4433B	2/26/2016	2/26/2018
P07191	Cable	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
P05411	Attenuator	54A-10	1/18/2016	1/18/2018
P07192	Cable	32022-29094K-29094K-48TC	10/9/2017	10/9/2019

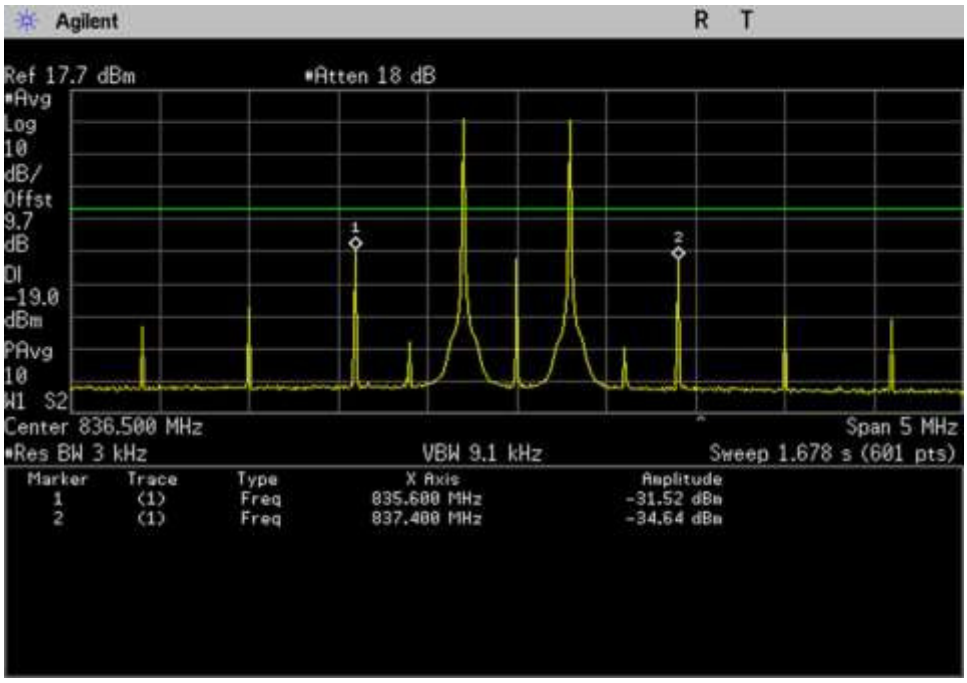
Summary of Results

PASS: As shown on the plots, all intermodulation products are measured below -19dbm limit.

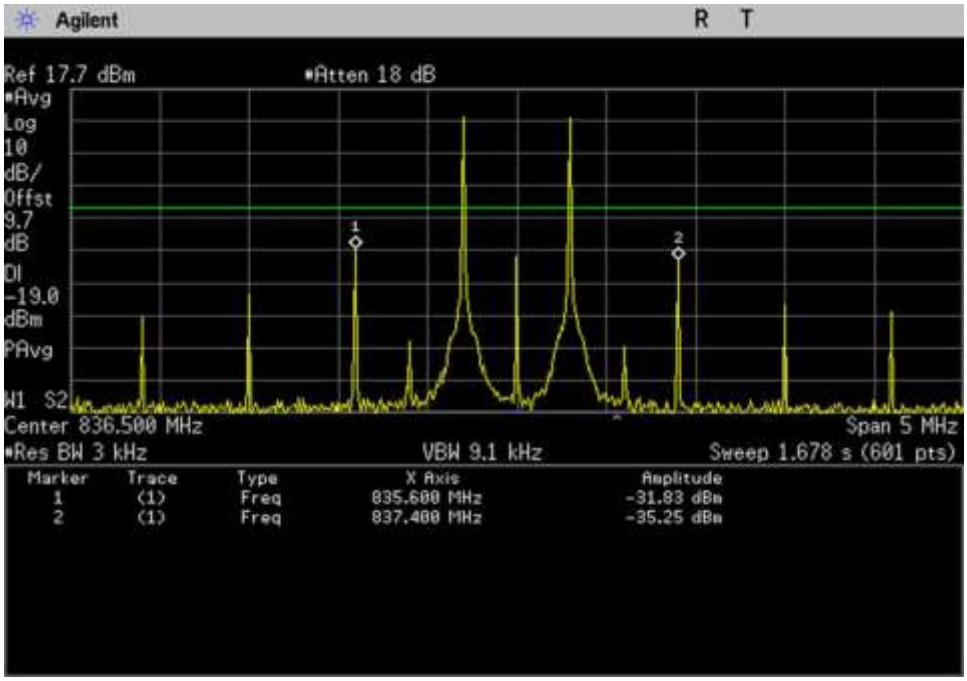
Inter Modulation Product			
Frequency (MHz)	**Pre AGC (dBm)**	**Limit (dBm)**	**Results**
UL 1850-1915	-43.5	-19	Pass
UL 824-894	-31.5	-19	Pass
DL 1930-1995	-32.2	-19	Pass
DL 869-894	-36.2	-19	Pass

Note: The EUT maintains compliance with the intermodulation limit at input power of AGC+10dB

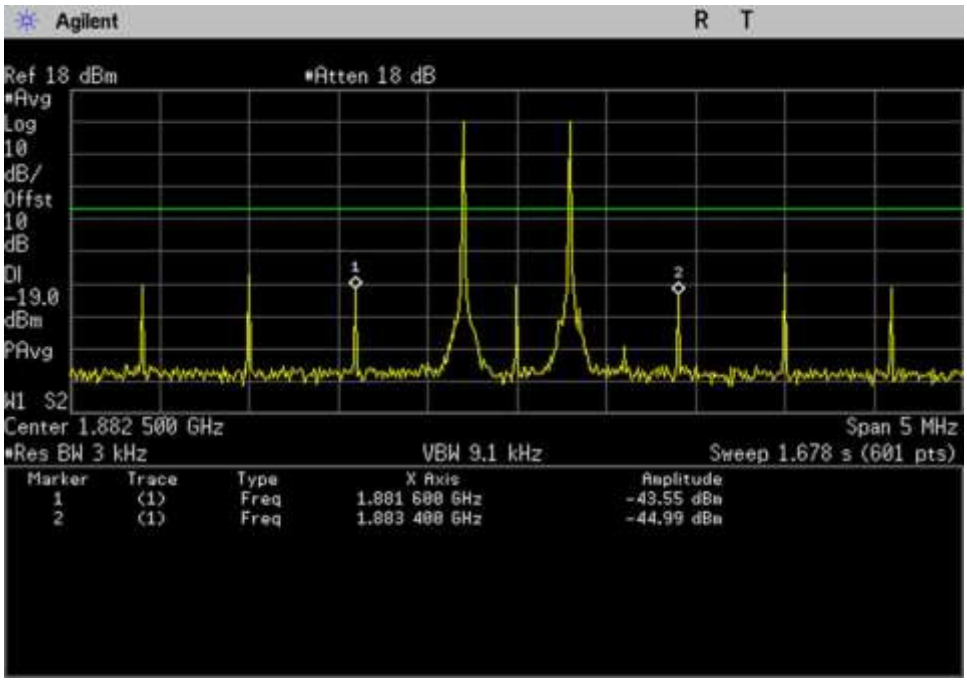
Plots



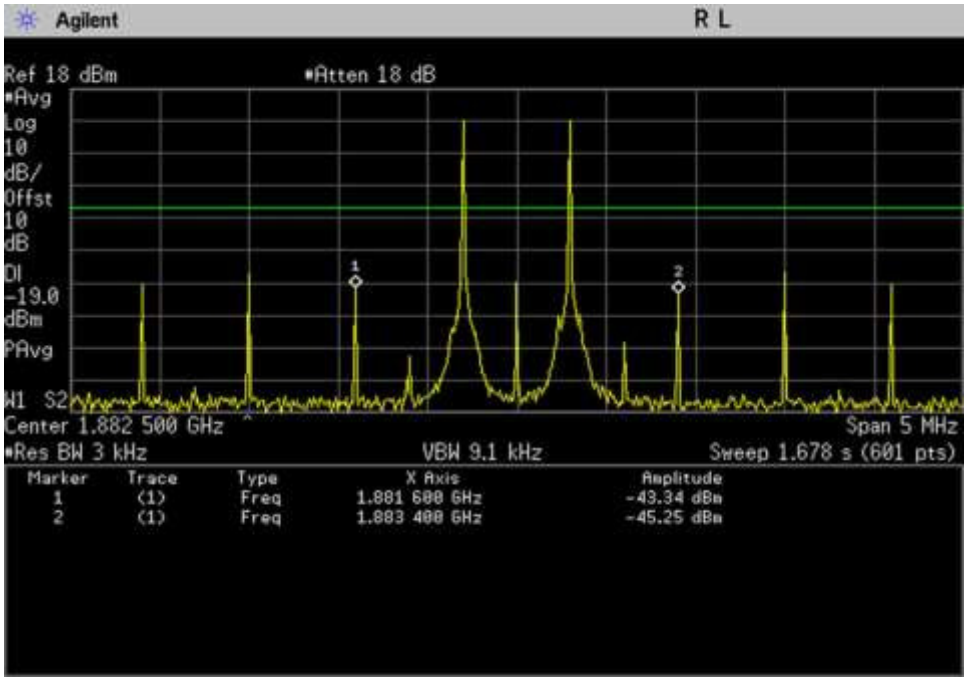
UL_824-849MHz



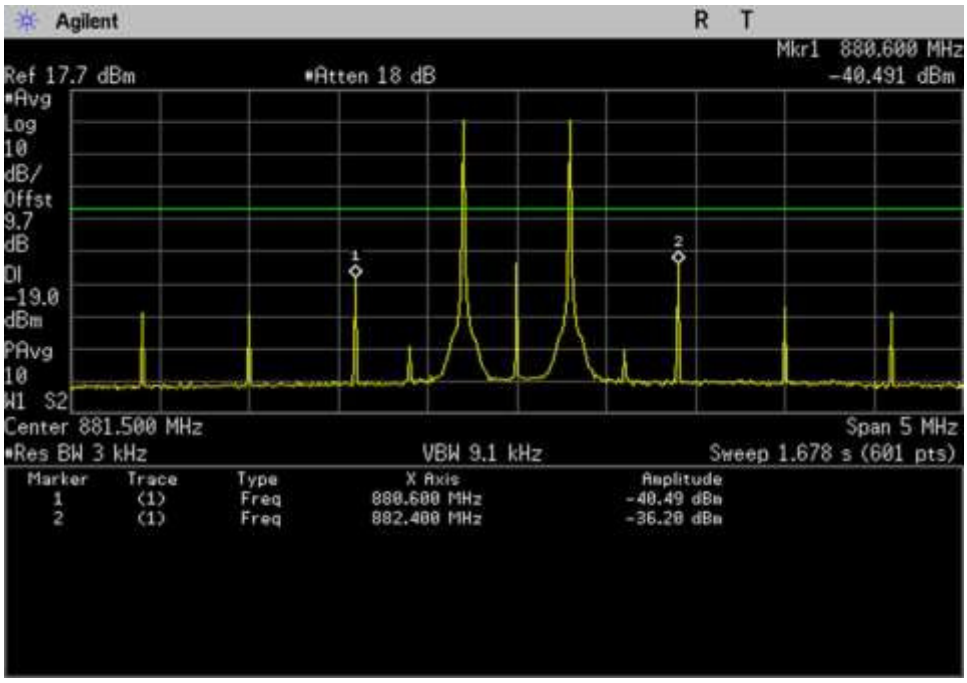
UL_824-849MHz_+10dB



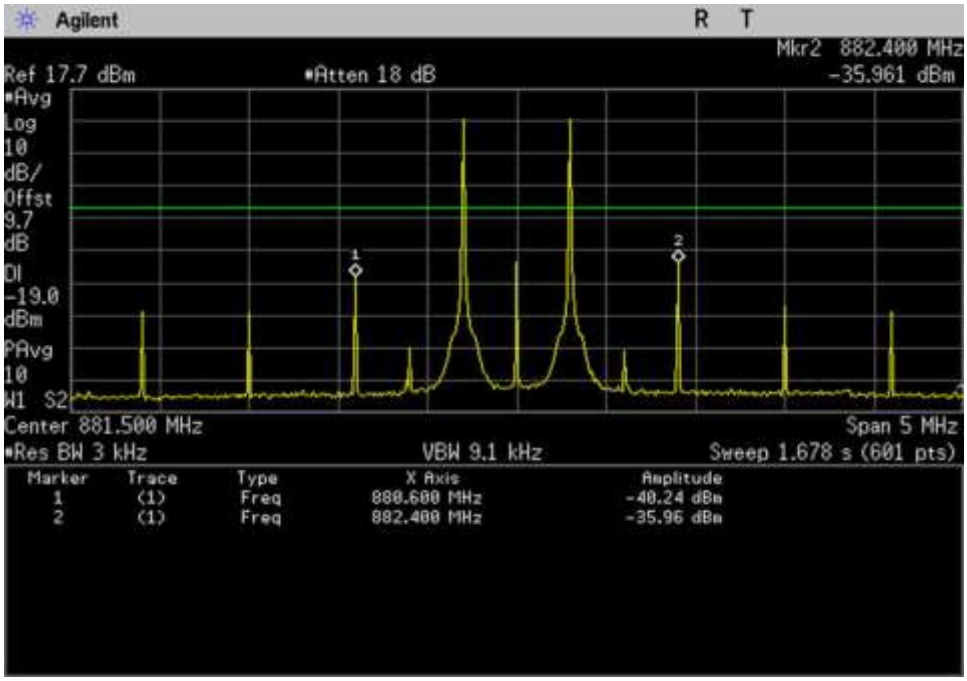
UL_1850-1915MHz



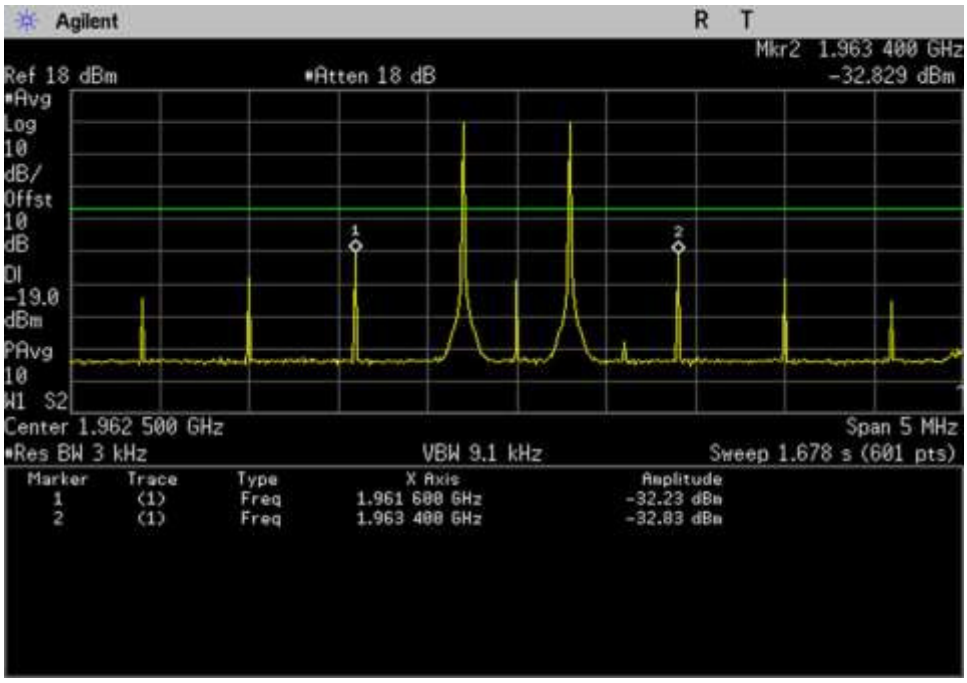
UL_1850-1915MHz_+10dB



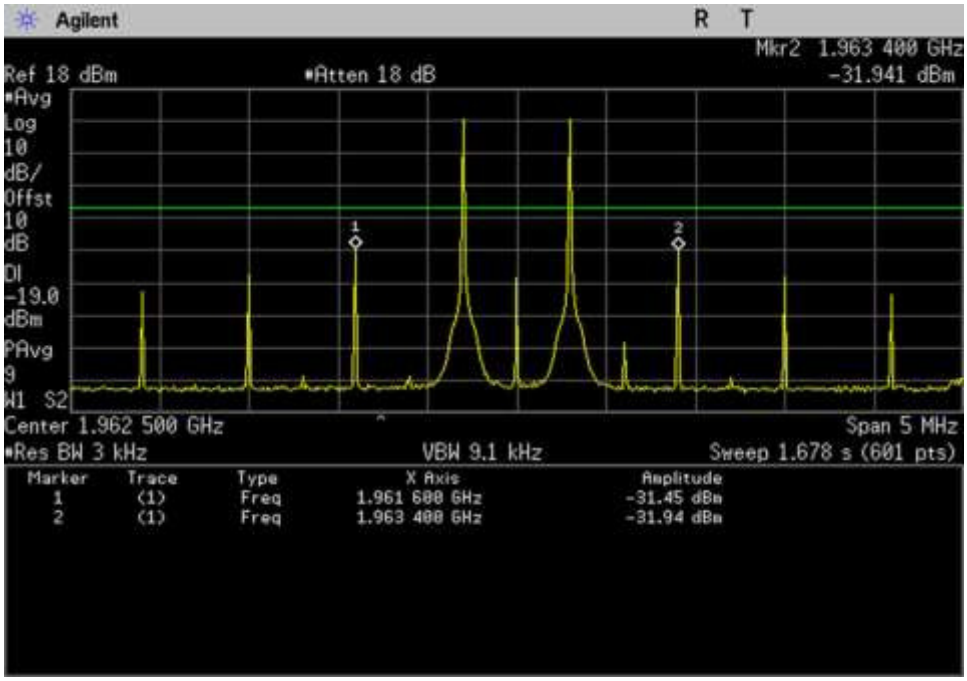
DL_869-894MHz



DL_869-894MHz_+10dB



DL_1930-1995MHz



DL_1930-1995MHz_+10dB

7.5 Out of Band Emissions

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Place • Brea, CA 92821•		
	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539•		
Customer:	**Huaptec**		
Specification:	**7.5 Out of Band Emission**		
Work Order #:	**100670**	Date:	01/02/2018, 01/06/2018*
Test Type:	**Conducted Emissions**	Time:	15:48:00
Tested By:	E. Wong, H.Nguyenpham	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

RBW setting per relevant rule part/ requirement

Below 1 GHz

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 30 kHz or more. In the 60 kHz bands immediately outside and adjacent to the authorized frequency range or channel, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 30 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Above 1 GHz

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Modification #1 was in place during testing.

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
02869	Spectrum Analyzer	E4440A	8/1/2017	8/1/2018
02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
03430	Attenuator	75A-10-12	12/19/2017	12/19/2019
03420	Signal Generator	E4438C	6/9/2017	6/9/2019
P07037	RF Signal Generator	E4432B	10/6/2016	10/6/2018
P06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019

Summary of Results

PASS: as indicated in plots above, all OBE are under the limit of -19dBm.

GSM								
Low					High			
Out of Band Emission					Out of Band Emission			
Frequency (MHz)	Pre AGC	Limit (dBm)	Results		Frequency (MHz)	Pre AGC	Limit (dBm)	Results
UL1850-1915	-38.5	-19	Pass		UL1850-1915	-34.9	-19	Pass
UL824-849	-25.8	-19	Pass		UL824-849	-28.1	-19	Pass
DL1930-1995	-28.6	-19	Pass		DL1930-1995	-29.6	-19	Pass
DL869-894	-30.7	-19	Pass		DL869-894	-32.9	-19	Pass

CDMA								
Low					High			
Out of Band Emission					Out of Band Emission			
Frequency (MHz)	Pre AGC	Limit (dBm)	Results		Frequency (MHz)	Pre AGC	Limit (dBm)	Results
UL1850-1915	-19.5	-19	Pass		UL1850-1915	-38.8	-19	Pass
UL824-849	-27.3	-19	Pass		UL824-849	-32.5	-19	Pass
DL1930-1995	-34.0	-19	Pass		DL1930-1995	-39.9	-19	Pass
DL869-894	-48.3	-19	Pass		DL869-894	-47.7	-19	Pass

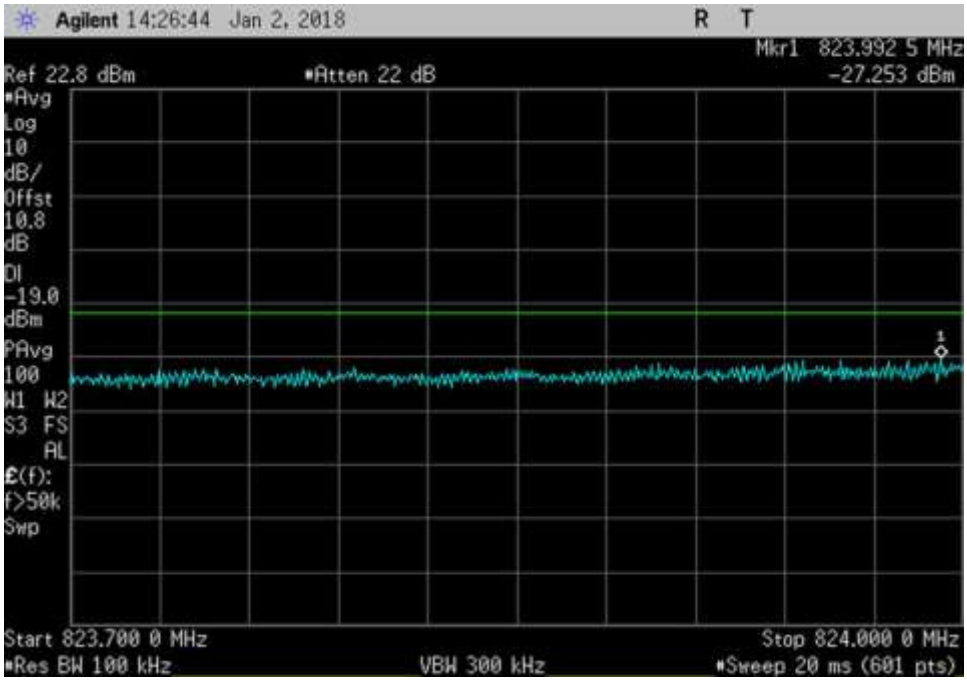
LTE								
Low					High			
Out of Band Emission					Out of Band Emission			
Frequency (MHz)	Pre AGC	Limit (dBm)	Results		Frequency (MHz)	Pre AGC	Limit (dBm)	Results
UL1850-1915	-22.3*	-19	Pass		UL1850-1915	-39.9	-19	Pass
UL824-849	-27.1	-19	Pass		UL824-849	-31.5	-19	Pass
DL1930-1995	-31.5	-19	Pass		DL1930-1995	-37.3	-19	Pass
DL869-894	-34.1	-19	Pass		DL869-894	-34.5	-19	Pass

Note: The EUT also maintains compliance with the out-of-band emissions limit at input power indicated in section 5.5.

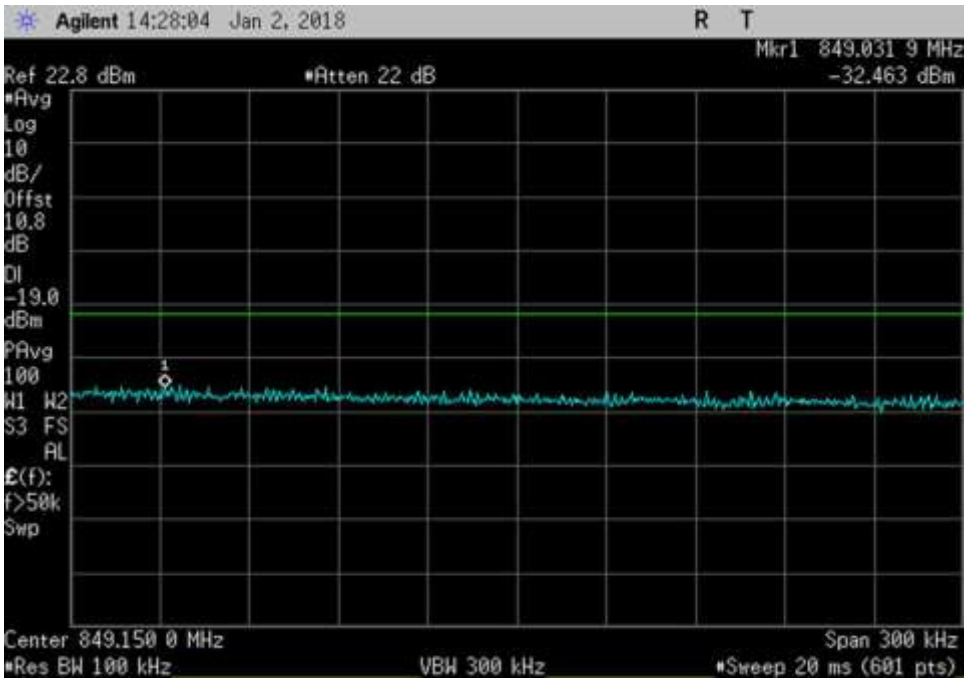
* Modification #1 was in place during testing.

Plots

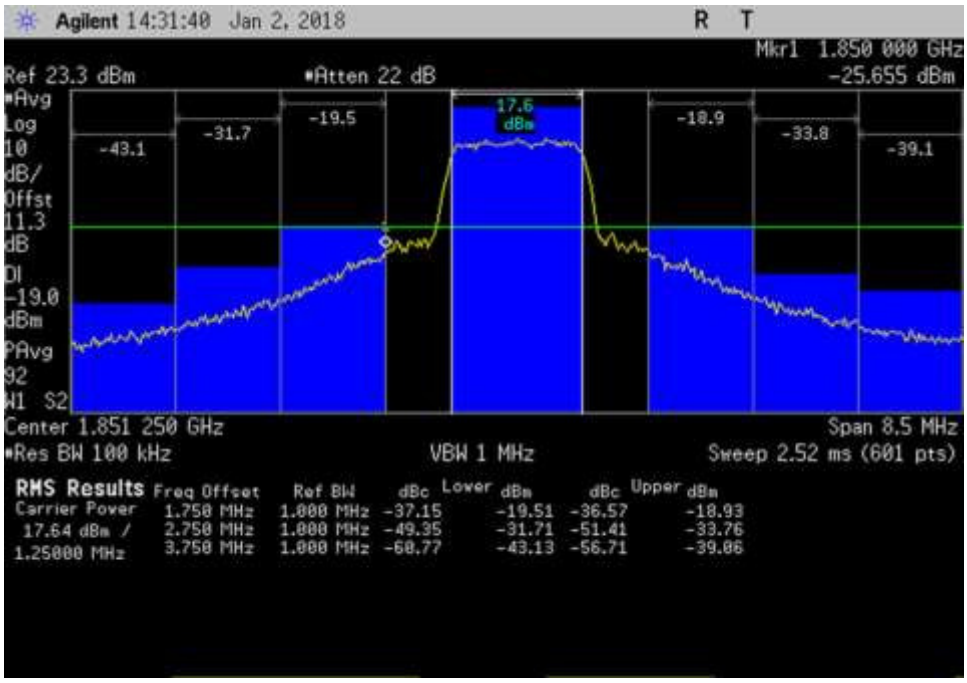
CDMA



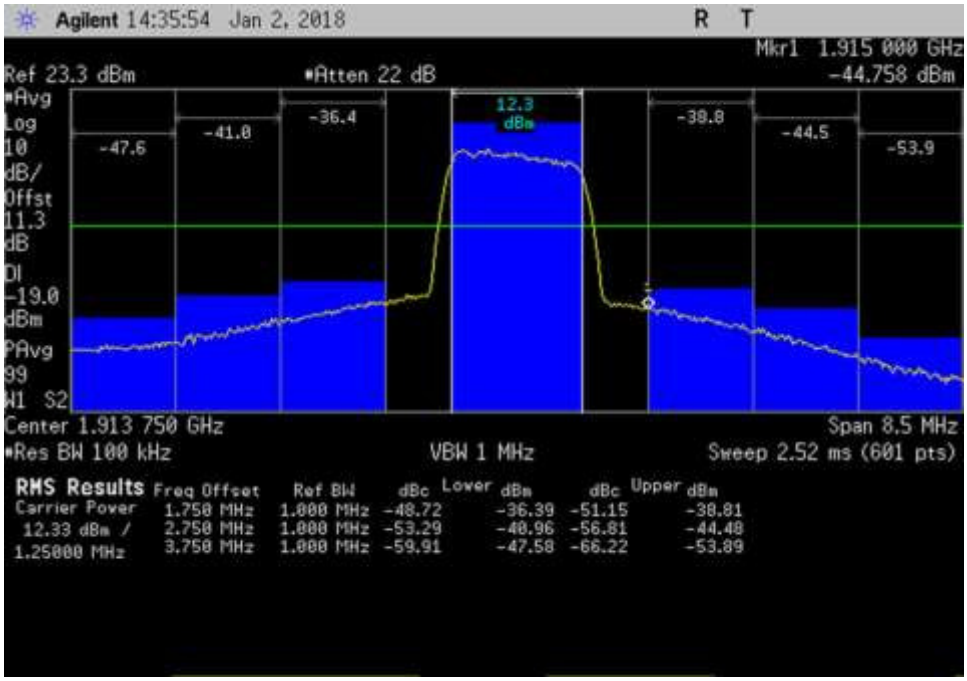
UL_ 823.7- 824MHz_CDMA



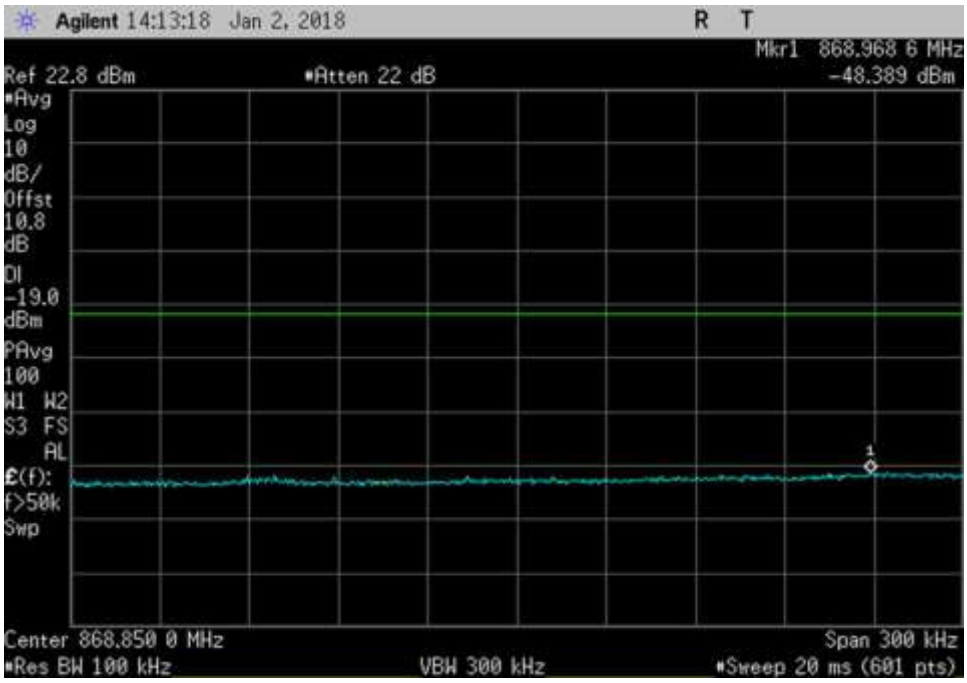
UL_ 849- 849.3MHz_CDMA



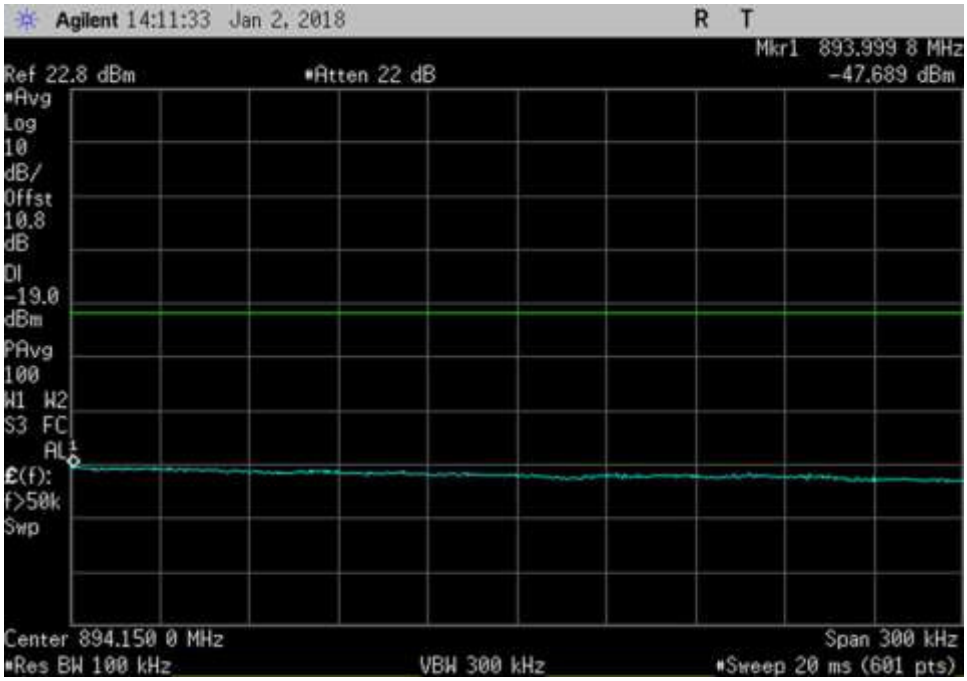
UL_ 1847- 1855.5MHz_CDMA



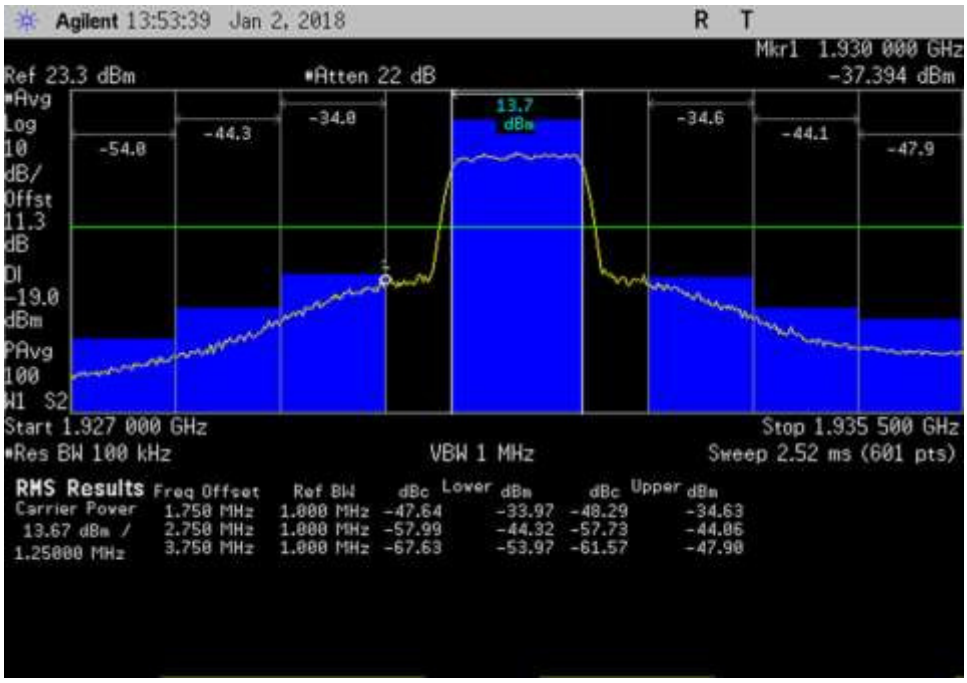
UL_ 1909.5- 1918MHz_CDMA



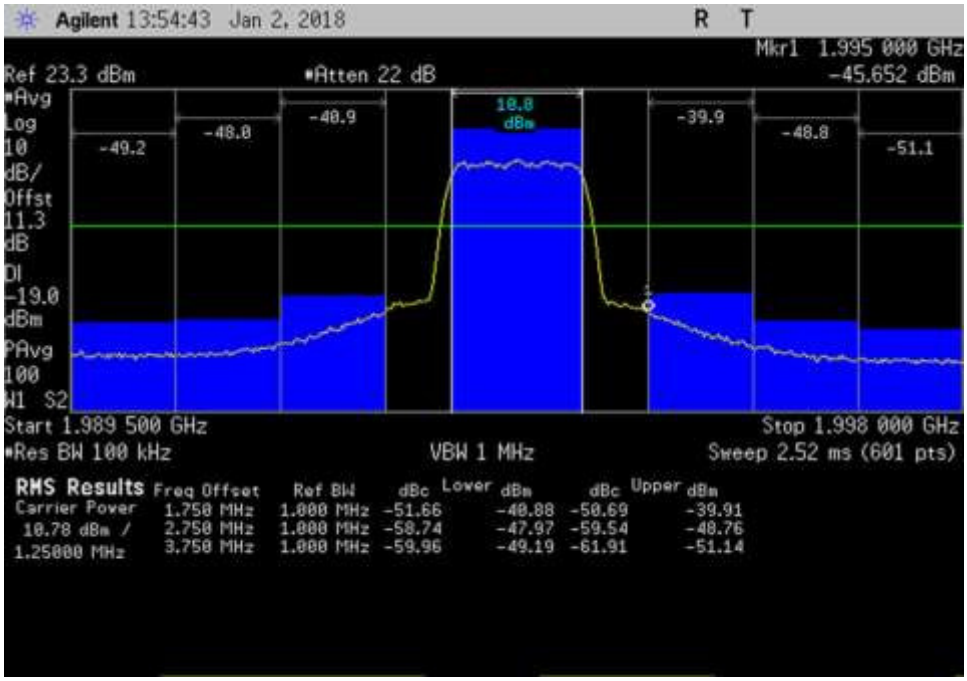
DL_ 868.7- 869MHz_CDMA



DL_ 894- 894.3MHz_CDMA



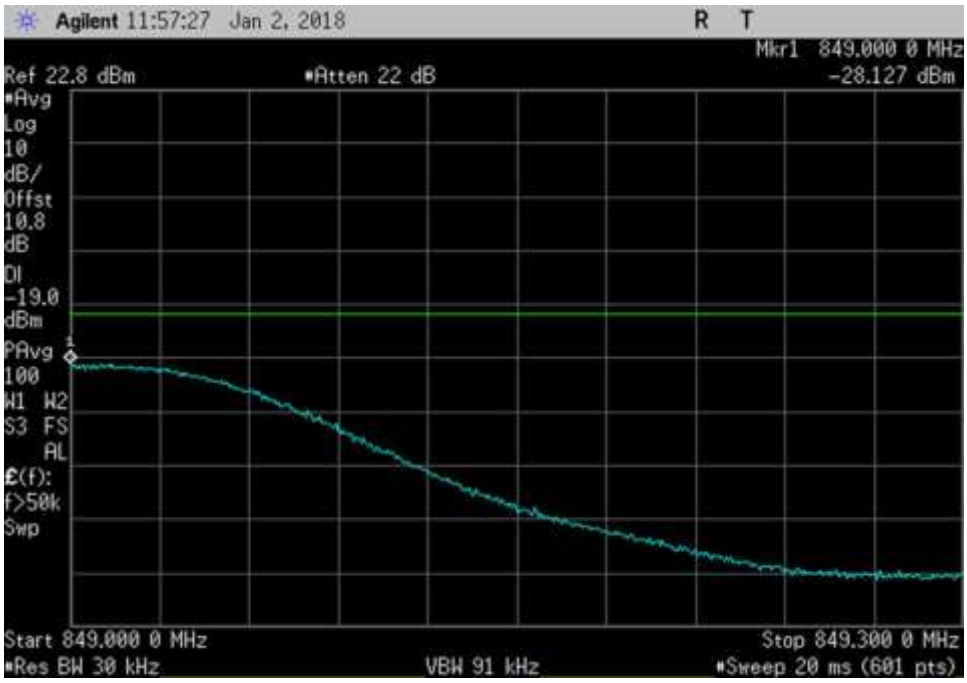
DL_ 1927- 1935.5MHz_CDMA



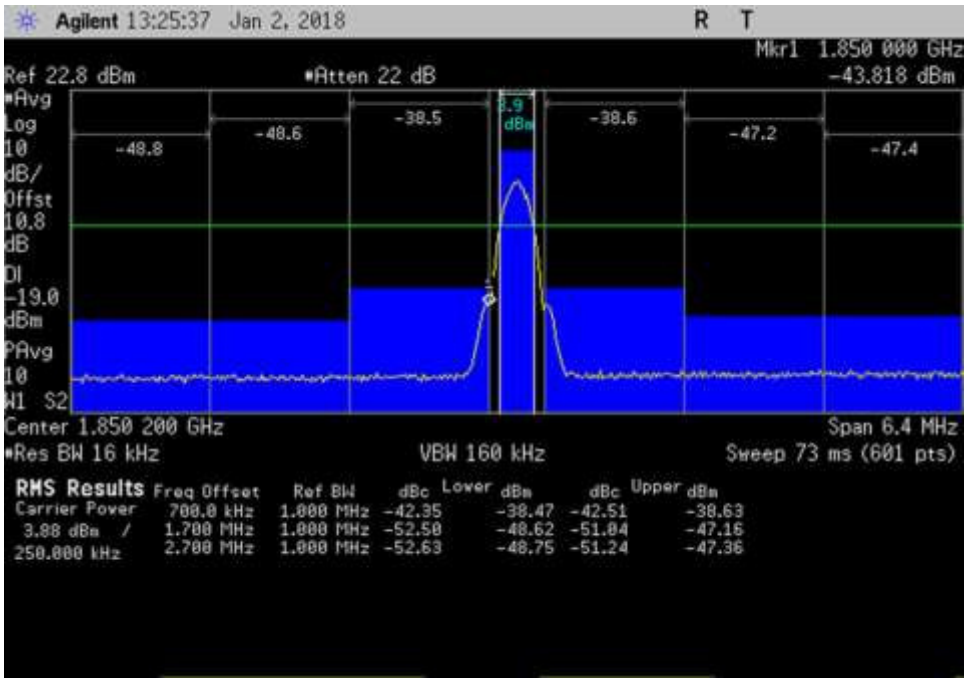
DL_ 1989.5- 1998MHz_CDMA

GSM

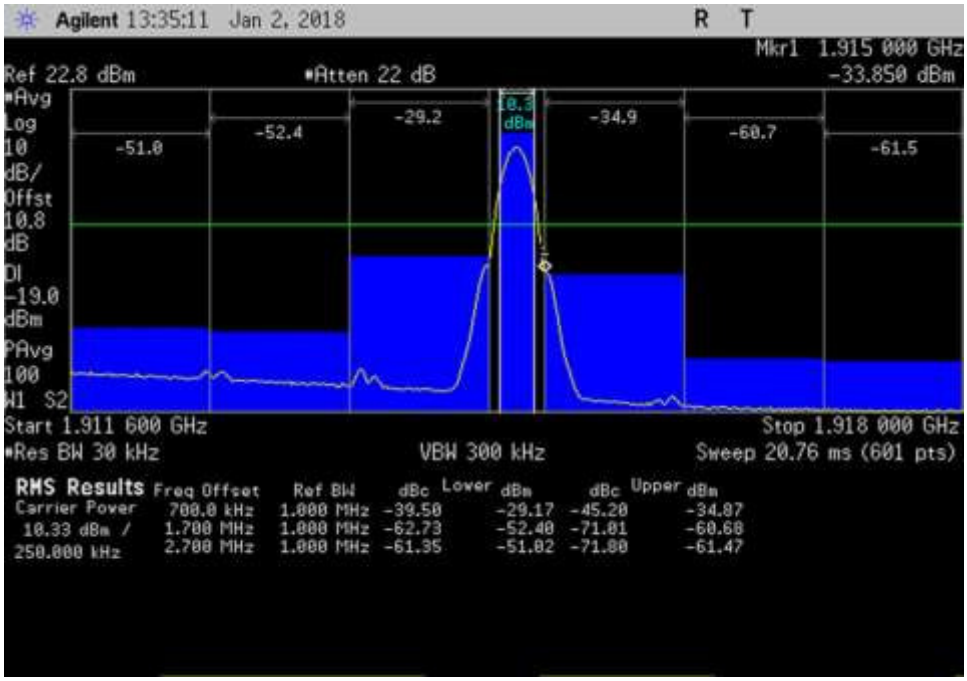
UL_ 823.7- 824MHz_GSM



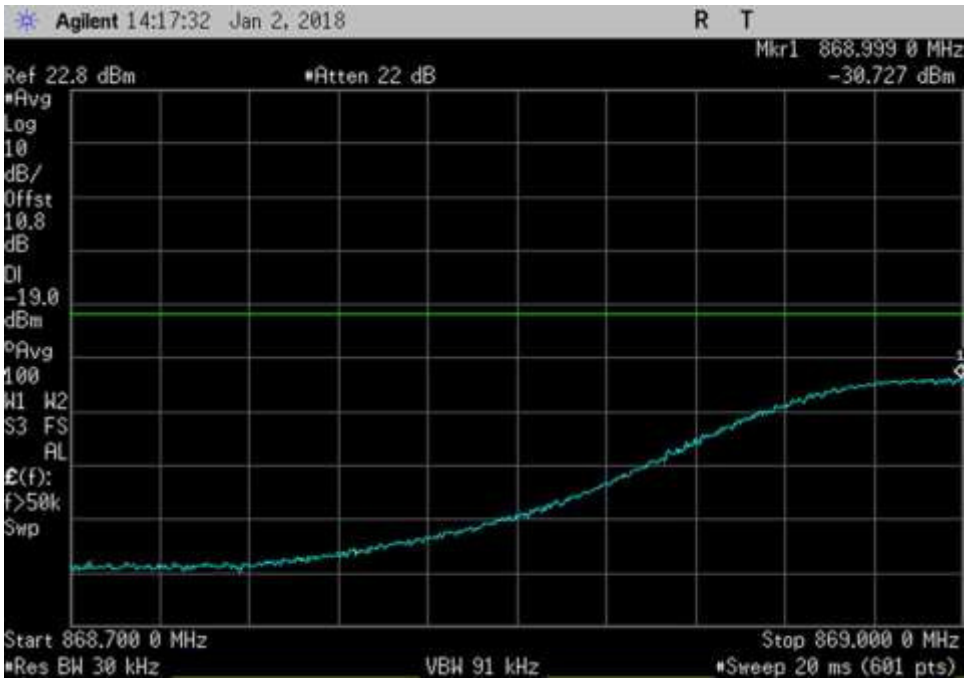
UL_ 849- 849.3MHz_GSM



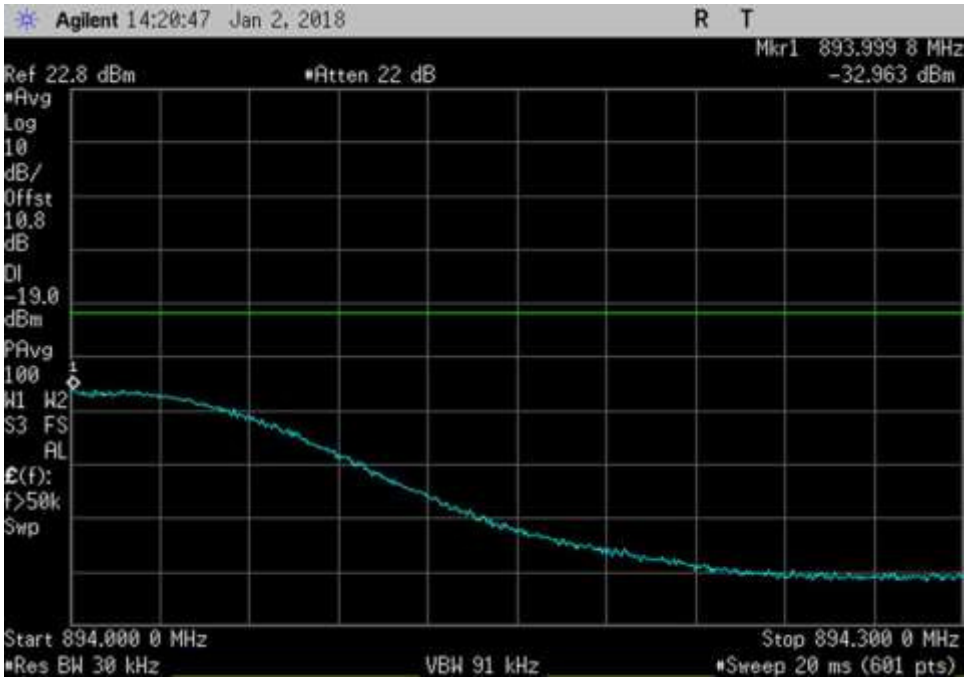
UL_ 1847- 1853.4MHz_GSM



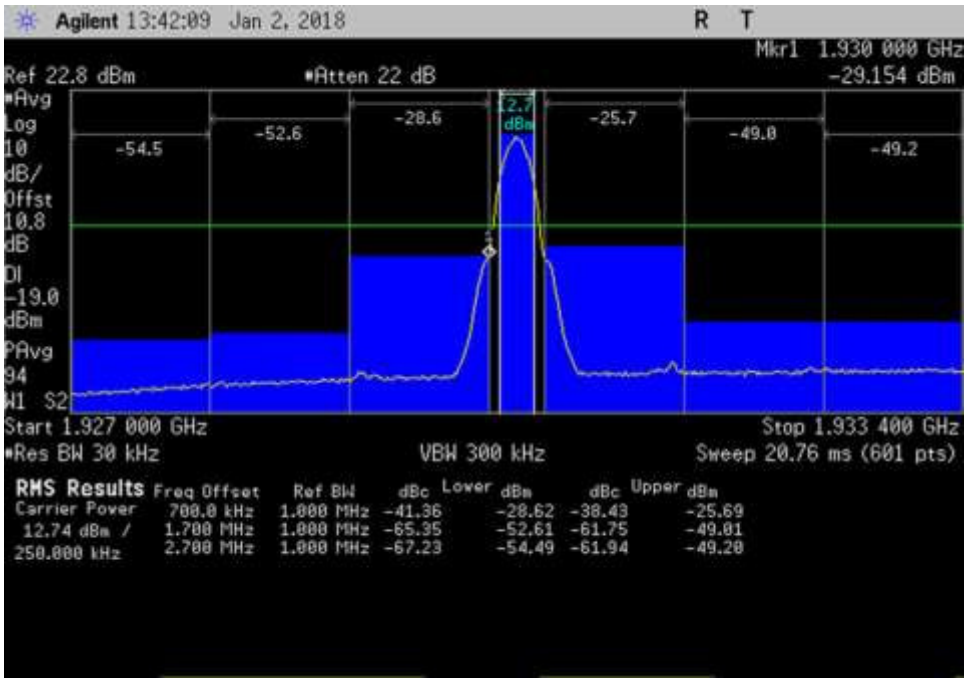
UL_ 1911.6- 1918MHz_GSM



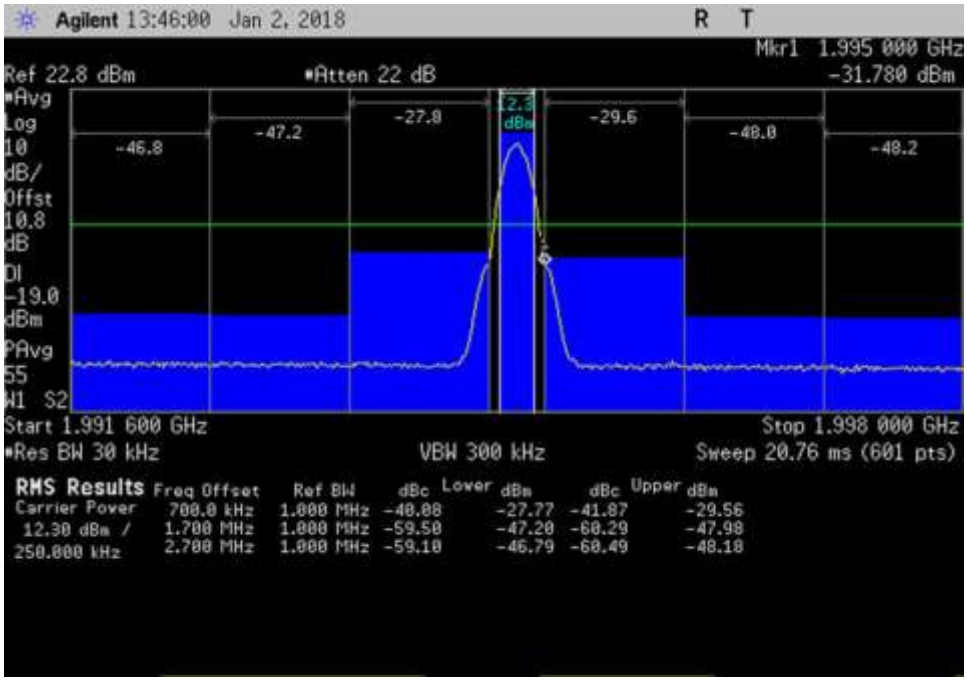
DL_ 868.7- 869MHz_GSM



DL_ 894- 894.3MHz_GSM

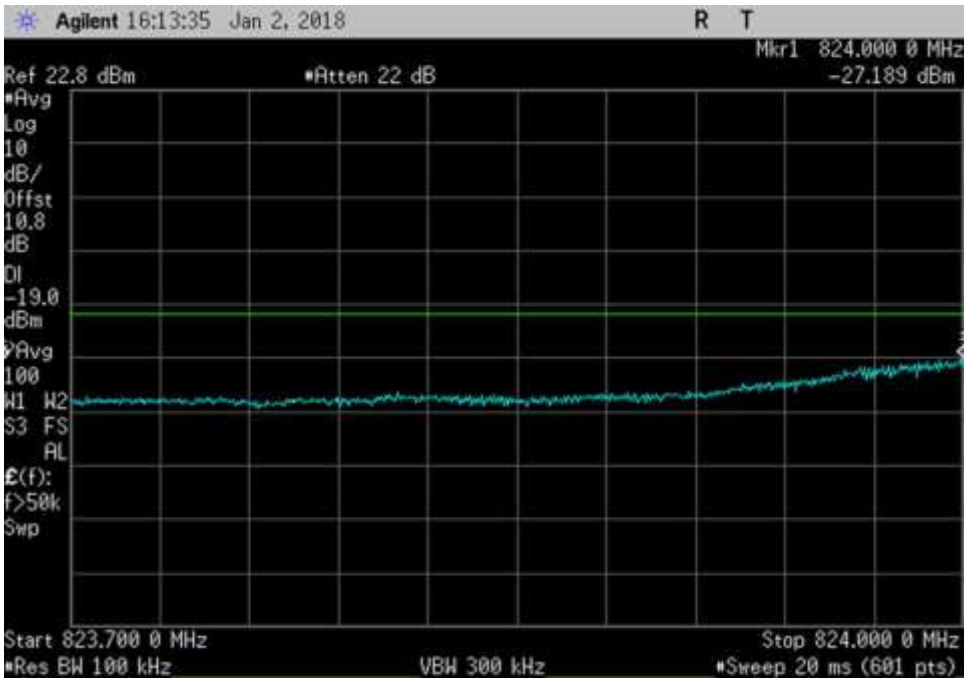


DL_ 1927- 1933.4MHz_GSM

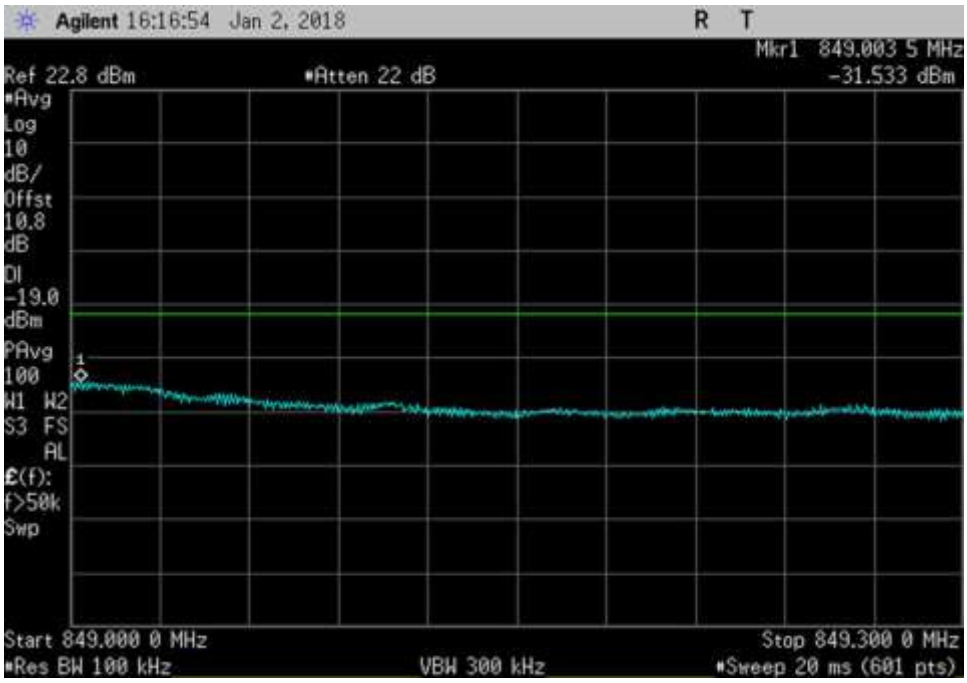


DL_ 1991.6- 1998MHz_GSM

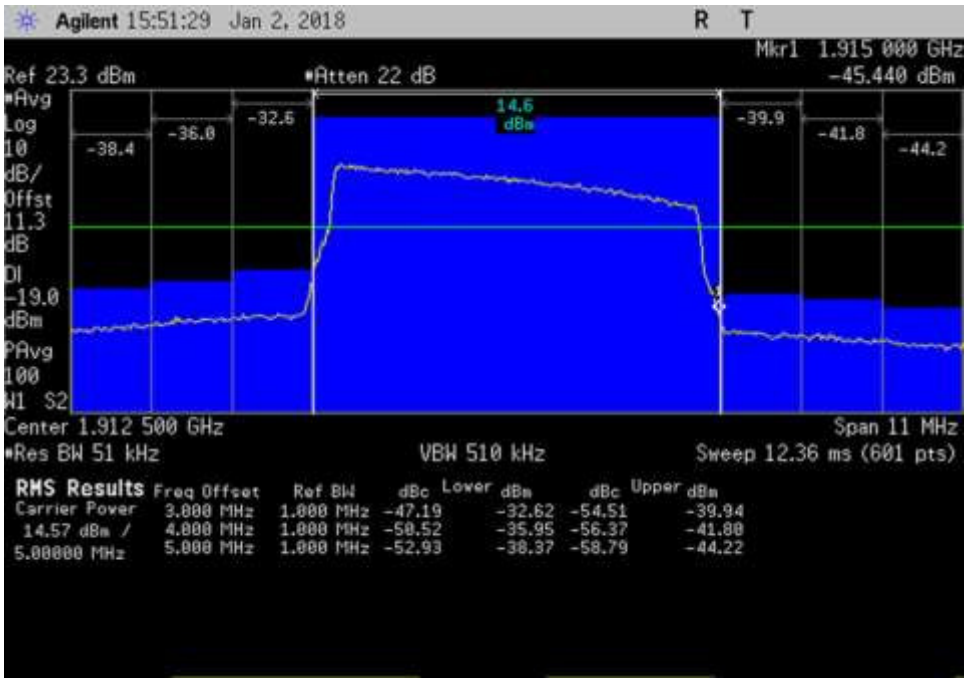
LTE



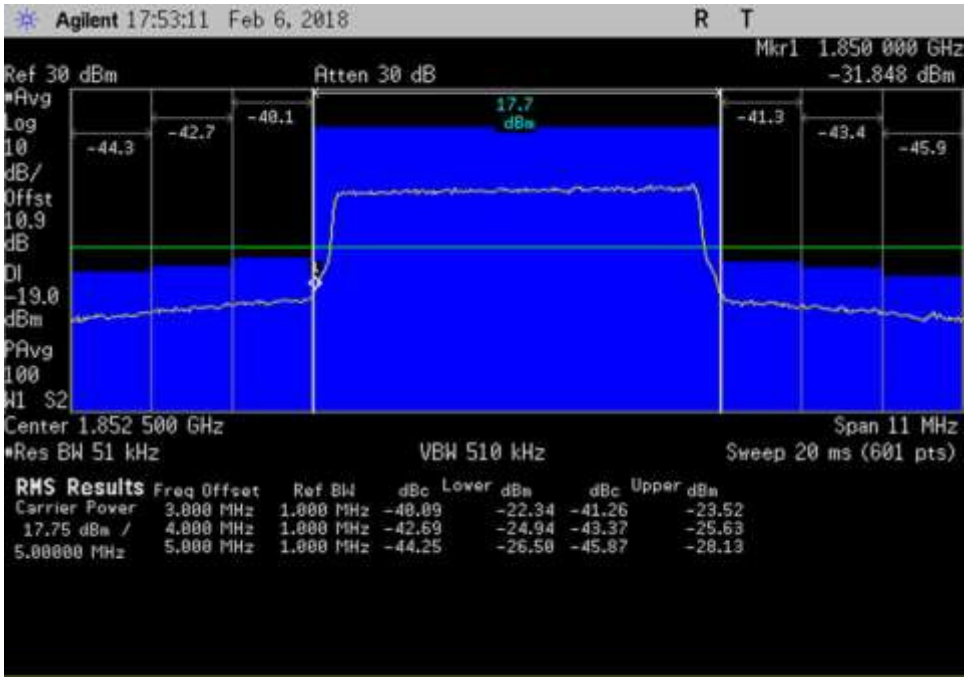
UL_ 823.7- 824MHz_LTE



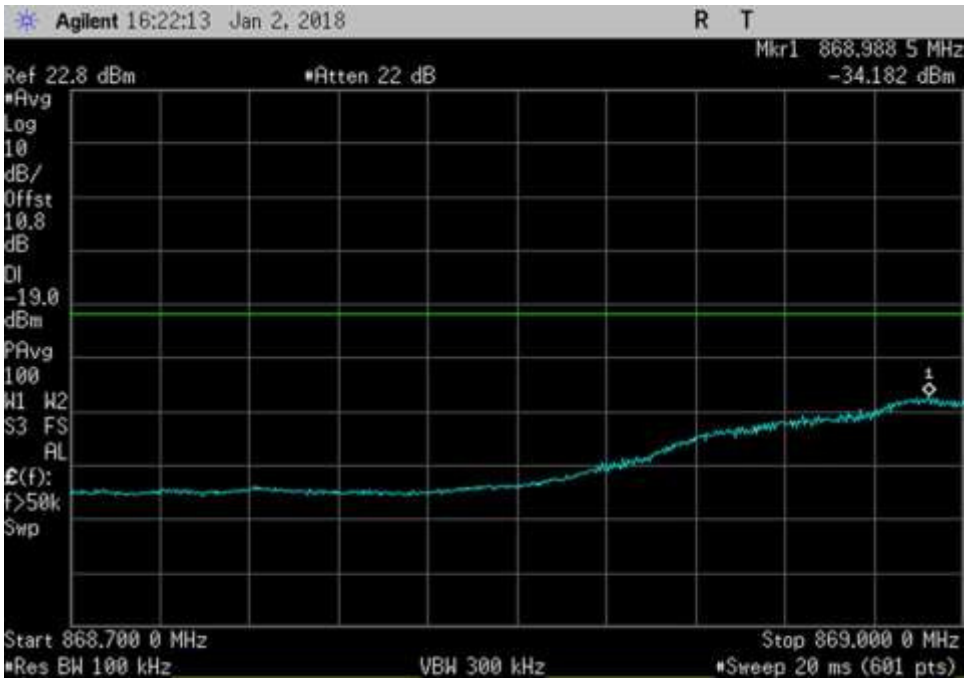
UL_ 849- 849.3MHz_LTE



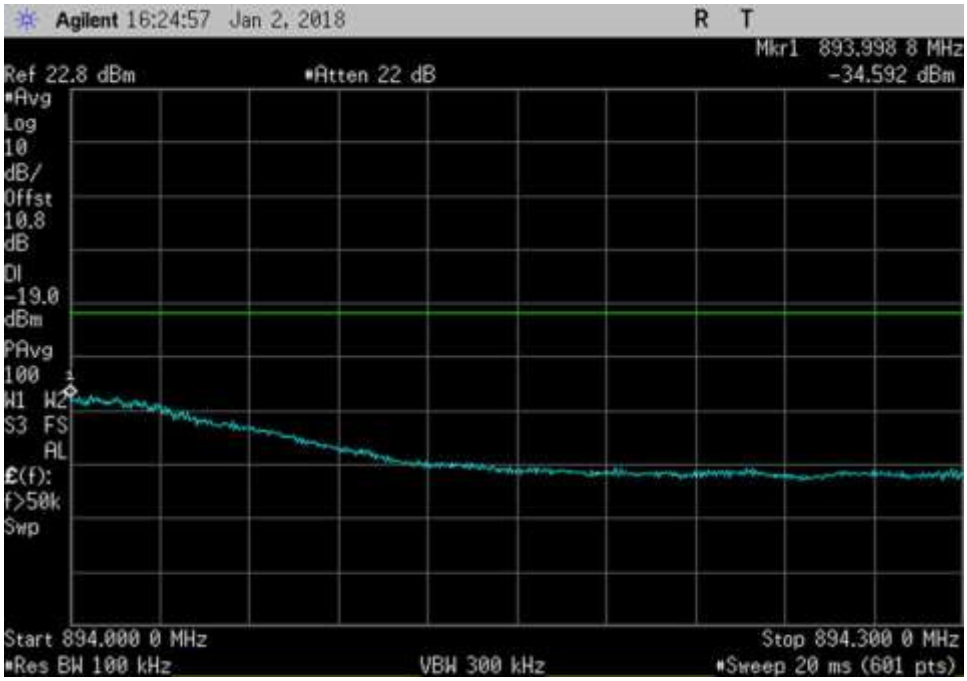
UL_ 1907- 1918MHz_LTE



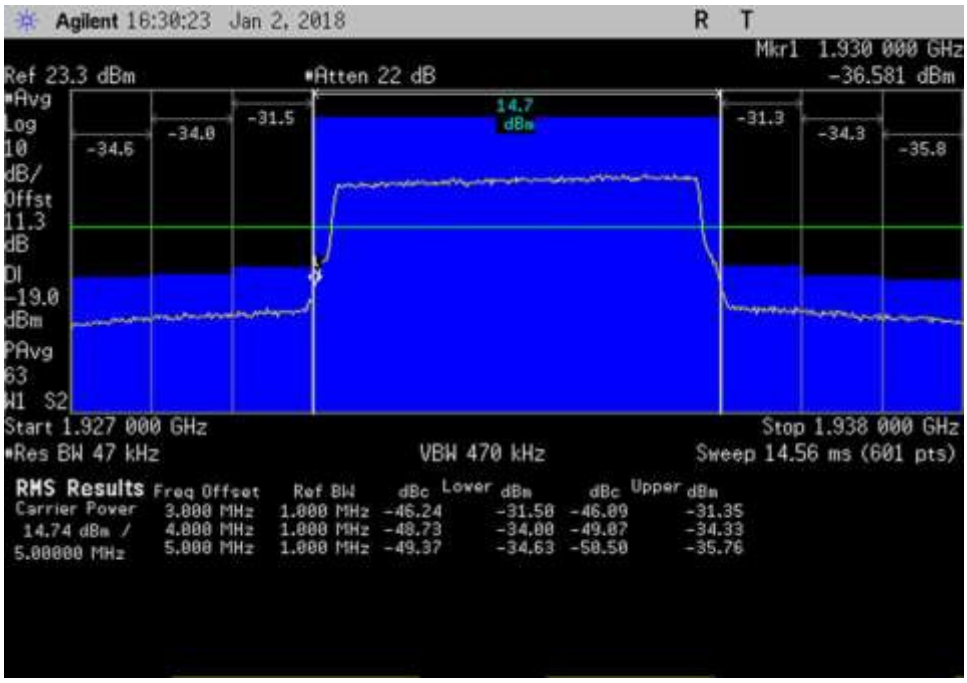
UL_1850-1915_LTE_ 1847- 1858MHz



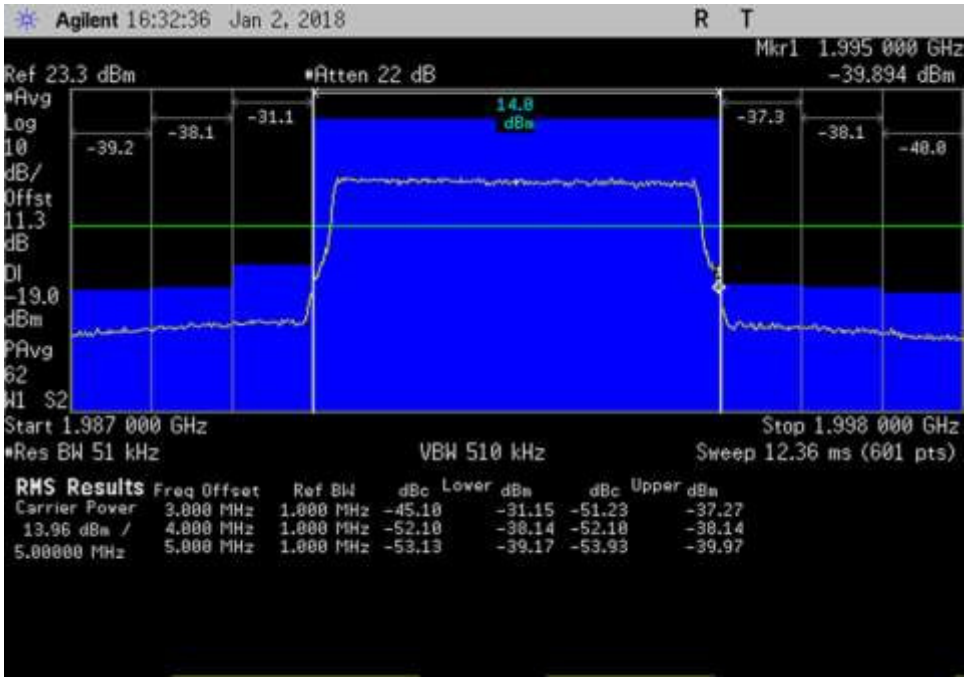
DL_ 868.7- 869MHz_LTE



DL_ 894- 894.3MHz_LTE



DL_ 1927- 1938MHz_LTE



DL_ 1987- 1998MHz_LTE

7.6 Conducted Spurious Emissions

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Place • Brea, CA 92821•		
Customer:	**Huaptec**		
Specification:	**7.6 Conducted Spurious Emissions**		
Work Order #:	**100670**	Date:	01/03/2018
Test Type:	**Conducted Emissions**	Time:	10:00:00
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

*Note: As specified on 7.6 Conducted spurious emissions test procedure, for frequencies below 1 GHz, an RBW of 1 MHz may be used in a preliminary measurement. If non-compliant emissions are detected, a final measurement shall be made with a 100 kHz RBW. Additionally, a peak detector may also be used for the preliminary measurement. If non-compliant emissions are detected, then a final measurement of these emissions shall be made with the power averaging (RMS) detector.

Frequency range of measurement = 9kHz- 22GHz.
9 kHz - 150 kHz -> RBW= 200Hz VBW= 200Hz
150 kHz - 30 MHz -> RBW= 9kHz VBW= 9kHz
30 MHz - 1000MHz -> RBW*= 1MHz VBW= 3MHz
1000 MHz - 22000MHz ->RBW= 1MHz VBW= 3MHz

*As specified on 7.6 Conducted spurious emissions test procedure of 935210 D03 Signal Booster Measurements v04, for frequencies below 1 GHz, an RBW of 1 MHz may be used in a preliminary measurement. If non-compliant emissions are detected, a final measurement shall be made with a 100 kHz RBW. Additionally, a peak detector may also be used for the preliminary measurement. If non-compliant emissions are detected, then a final measurement of these emissions shall be made with the power averaging (RMS) detector.

** visual inspection of analyzer trace from 9kHz-30MHz, no emission found, trace not included in plot.

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
02869	Spectrum Analyzer	E4440A	8/1/2017	8/1/2018
02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
03430	Attenuator	75A-10-12	12/19/2017	12/19/2019
03420	Signal Generator	E4438C	6/9/2017	6/9/2019
P07037	RF Signal Generator	E4432B	10/6/2016	10/6/2018
P06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019

Summary of Results

PASS: As summarized in plots below, the conducted spurious emissions are within limits.

9 kHz-22 GHz

No Conducted Spurious Emissions were found within 20dB of the limit.

LIMIT LINE FOR SPURIOUS CONDUCTED EMISSION

REQUIRED ATTENUATION = 43+10 LOG P DB

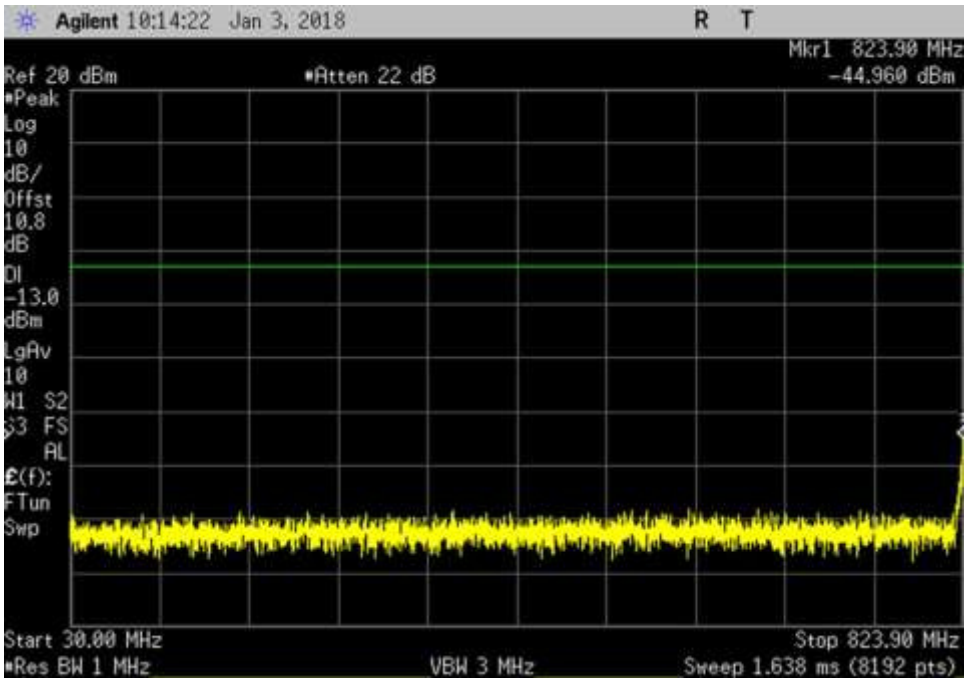
Limit line (dBuV) = V_{dBuv} - Attenuation

$$V_{dBuV} = 20\,\text{Log}\,\frac{V}{1\,x\,10^{-6}}$$
$$= 20\left(\text{Log}\,V - \text{Log}\,1\,x\,10^{-6}\right)$$
$$= 20\,\text{Log}\,V - 20\,\text{Log}1\,x\,10^{-6}$$
$$= 20\,\text{Log}\,V - 20\left(-6\right)$$
$$= 20\,\text{Log}\,V + 120$$

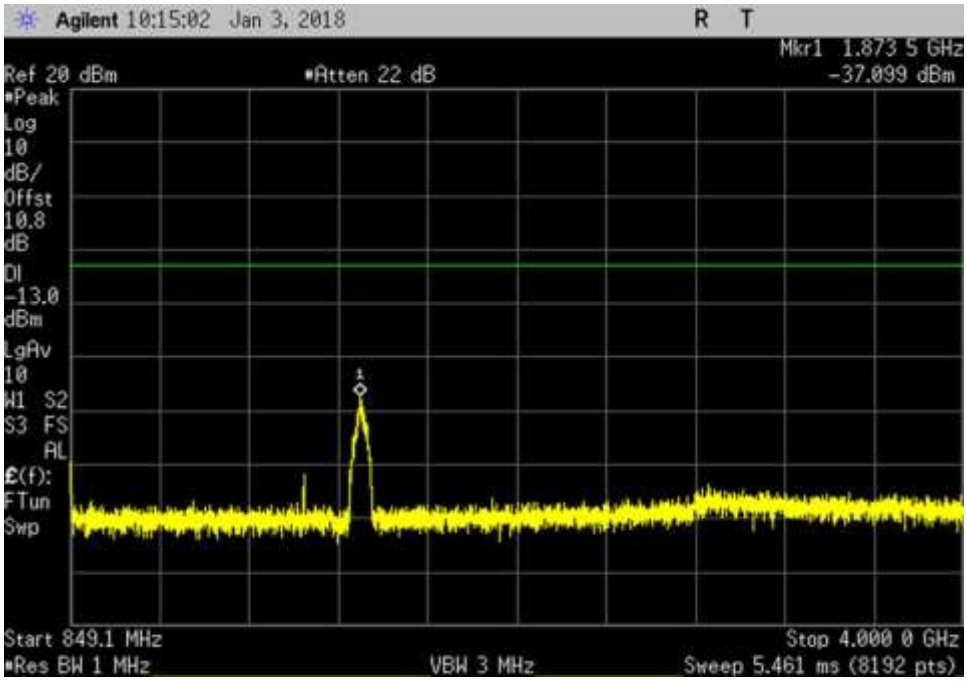
$$\text{Attenuation} = 43 + 10\,\text{Log}\,P$$
$$= 43 + 10\,\text{Log}\,\frac{V^2}{R}$$
$$= 43 + 10\left(\text{Log}\,V^2 - \text{Log}\,R\right)$$
$$= 43 + 10\left(2\,\text{Log}\,V - \text{Log}\,R\right)$$
$$= 43 + 20\,\text{Log}\,V - 10\,\text{Log}\,R$$

Limit line = V_{dBuv} - Attenuation
= 20 Log V + 120 – (43 + 20 Log V – 10Log R)
= 20 Log V + 120 – 43 – 20 Log V + 10Log R
= 20 Log V + 120 – 43 – 20 Log V + 10Log R
= 120 – 43 + 10 Log 50 Note : R = 50 Ω
= 120 –43 + 16.897
= 94 dBuV at any power level

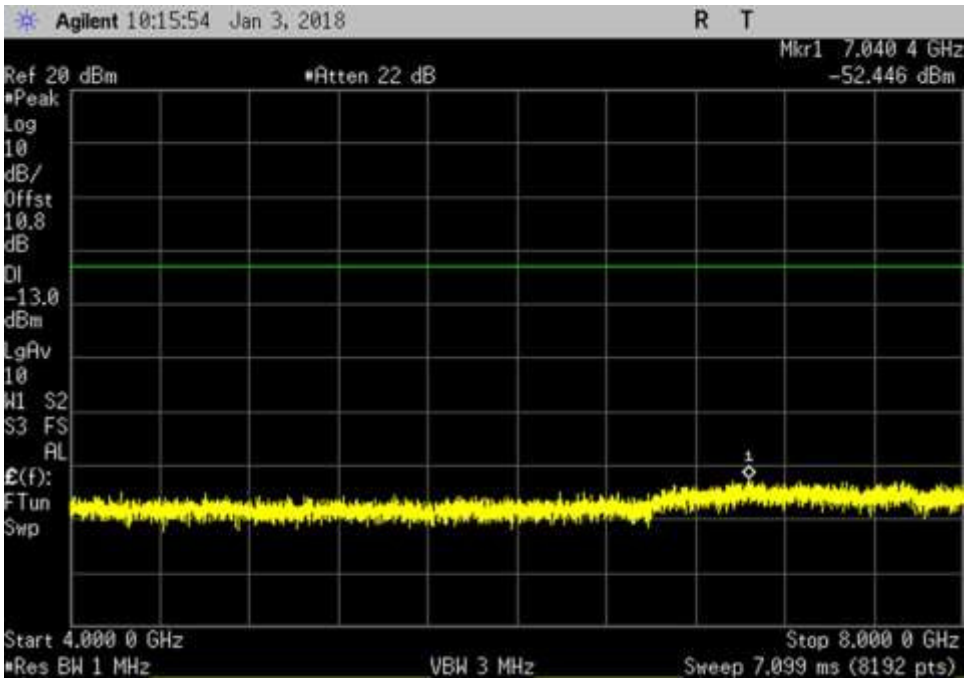
Plots



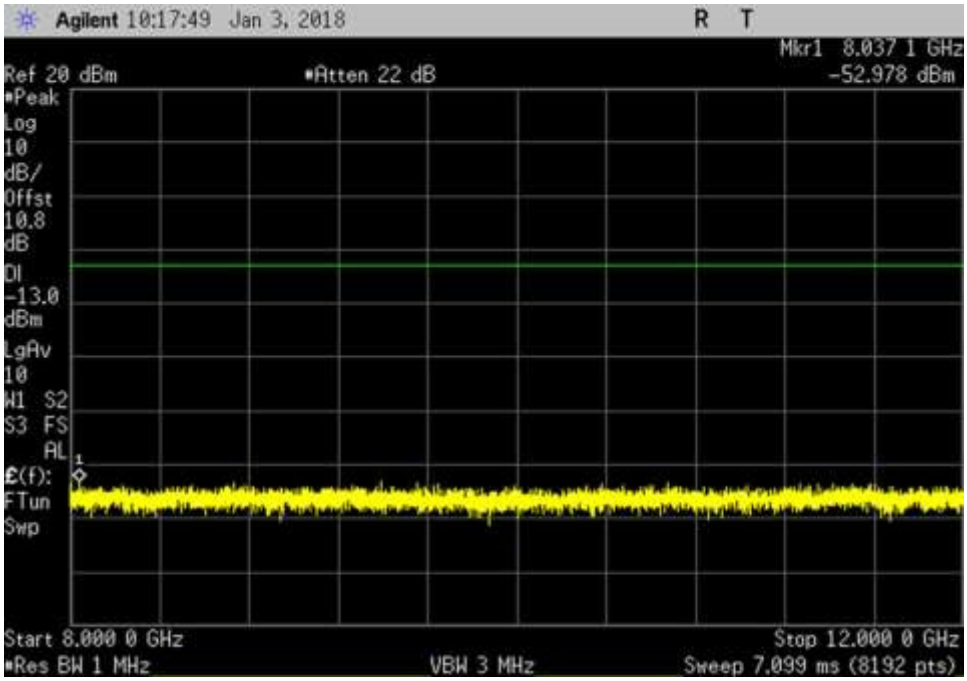
UL_ 30- 823.9MHz_AWGN



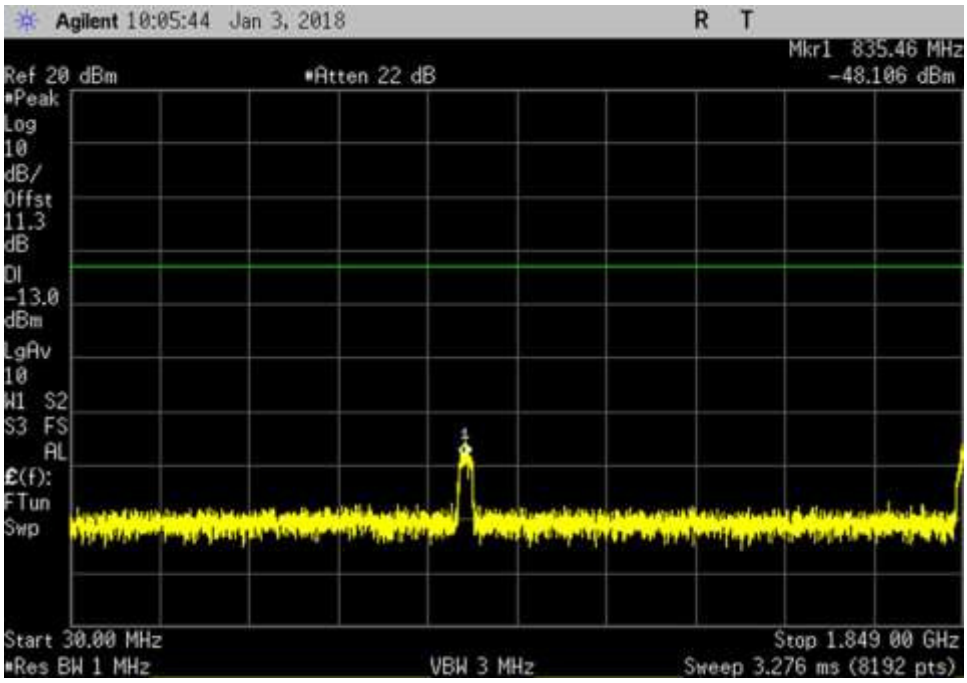
UL_ 849.1- 4000MHz_AWGN



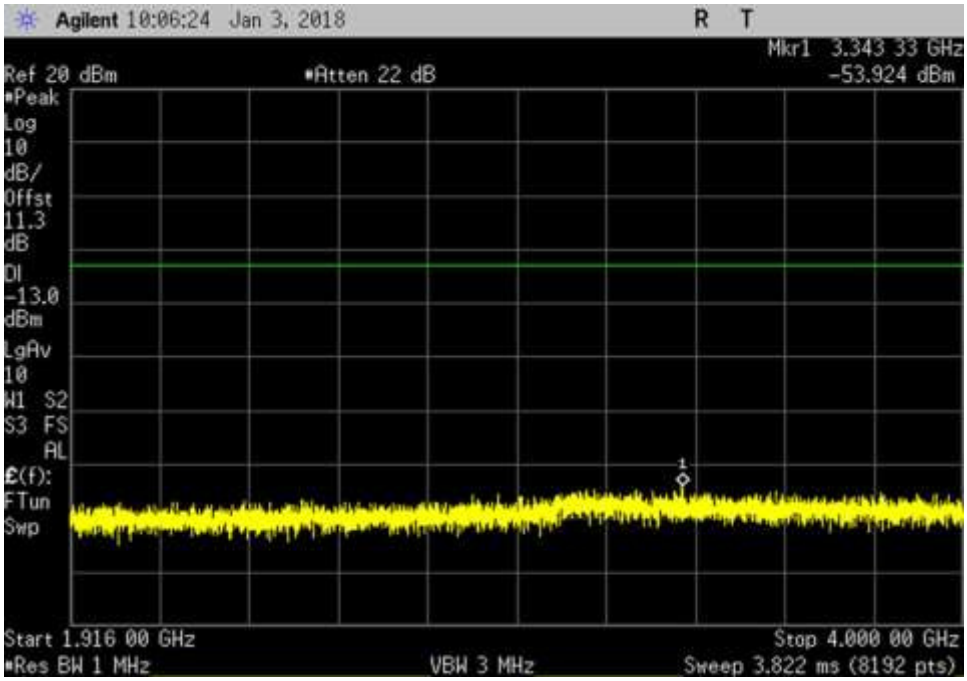
UL_ 4000- 8000MHz_AWGN



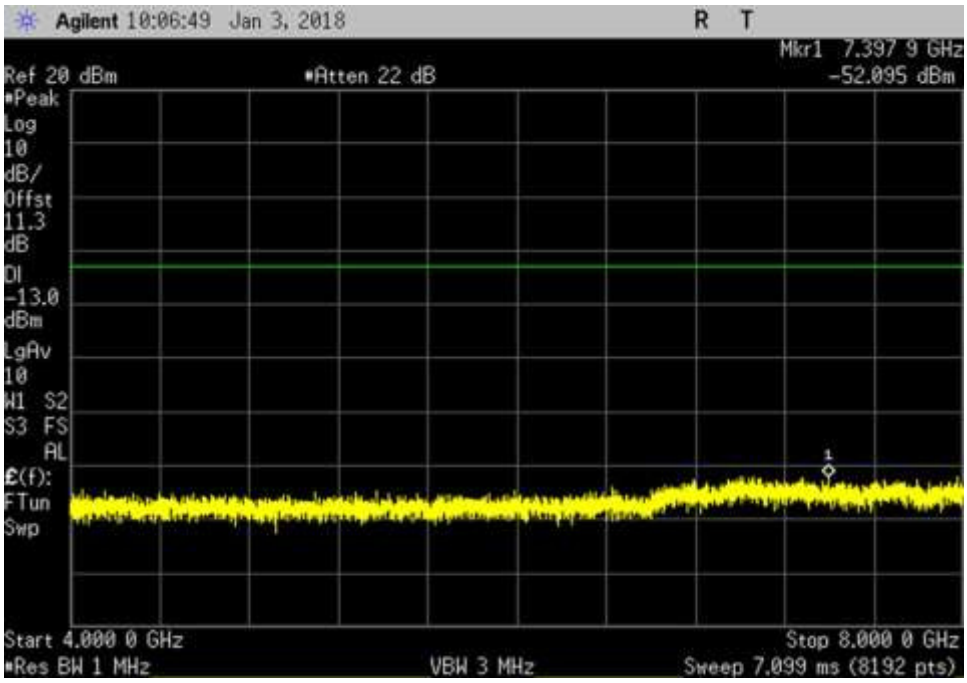
UL_ 8000- 12000MHz_AWGN



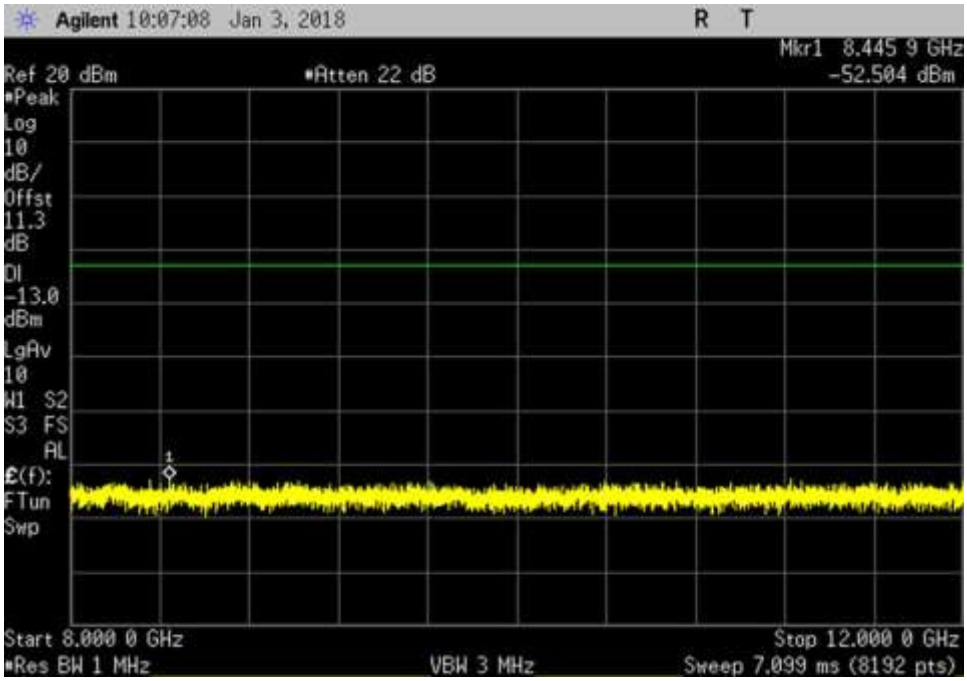
UL_ 29.999999- 1849.000001MHz_AWGN



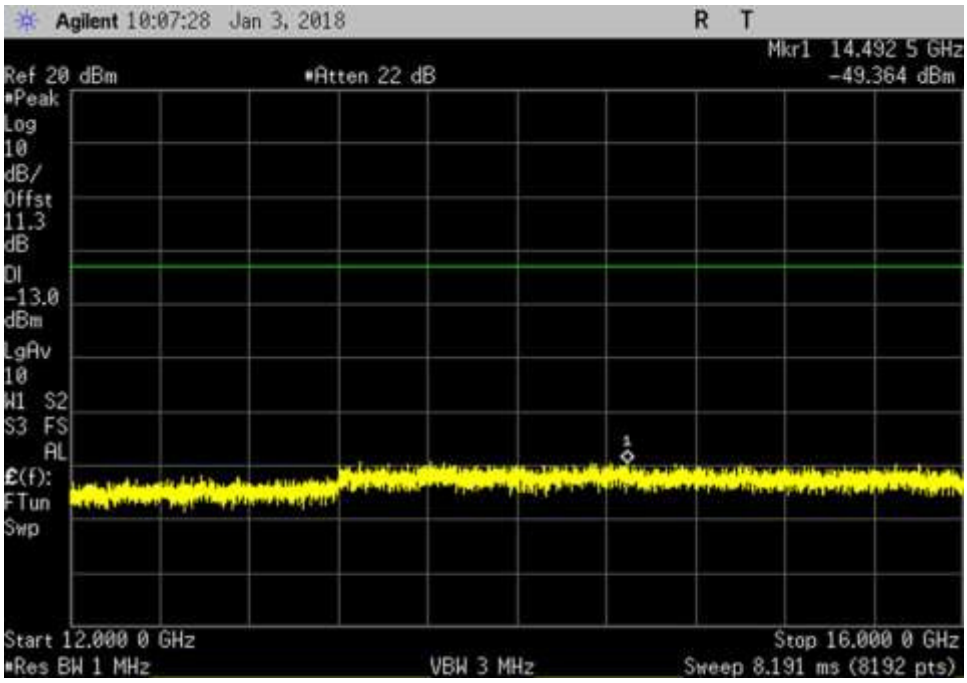
UL_ 1916- 4000MHz_AWGN



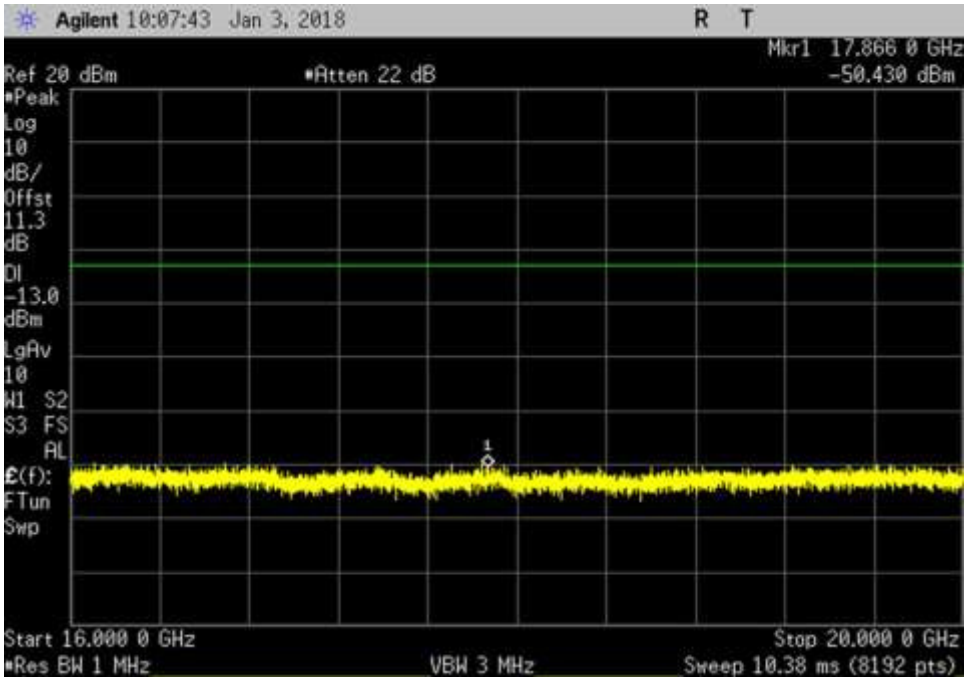
UL_ 4000- 8000MHz_AWGN



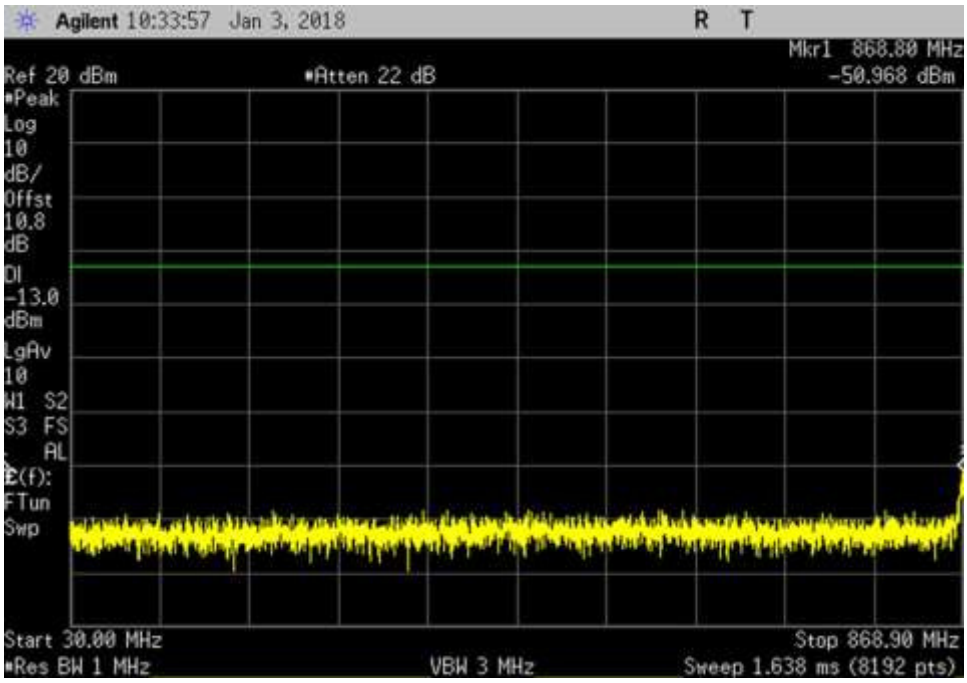
UL_ 8000- 12000MHz_AWGN



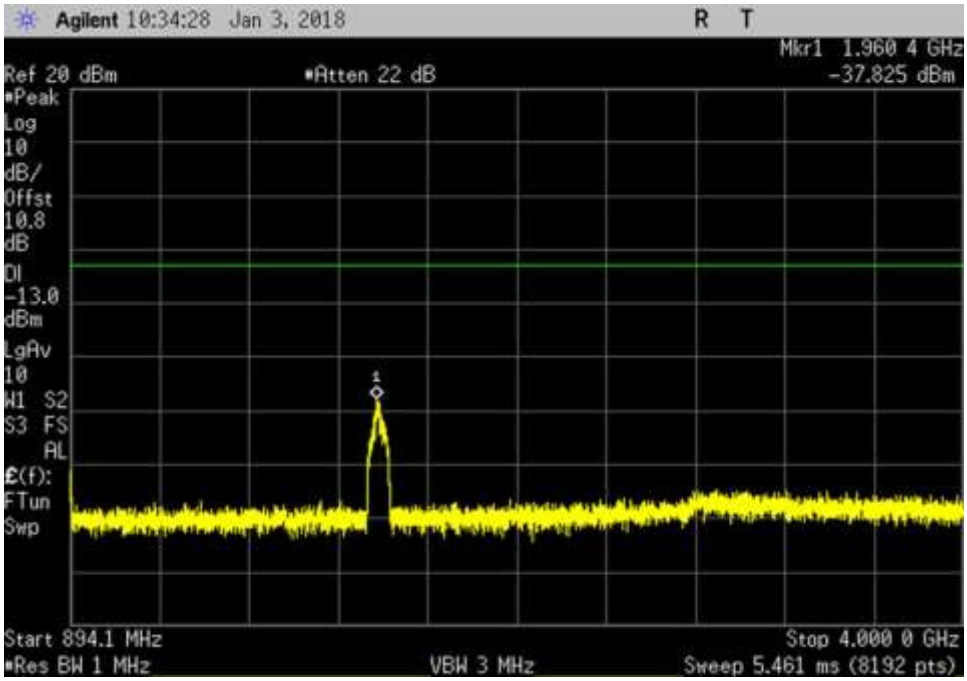
UL_ 12000- 16000MHz_AWGN



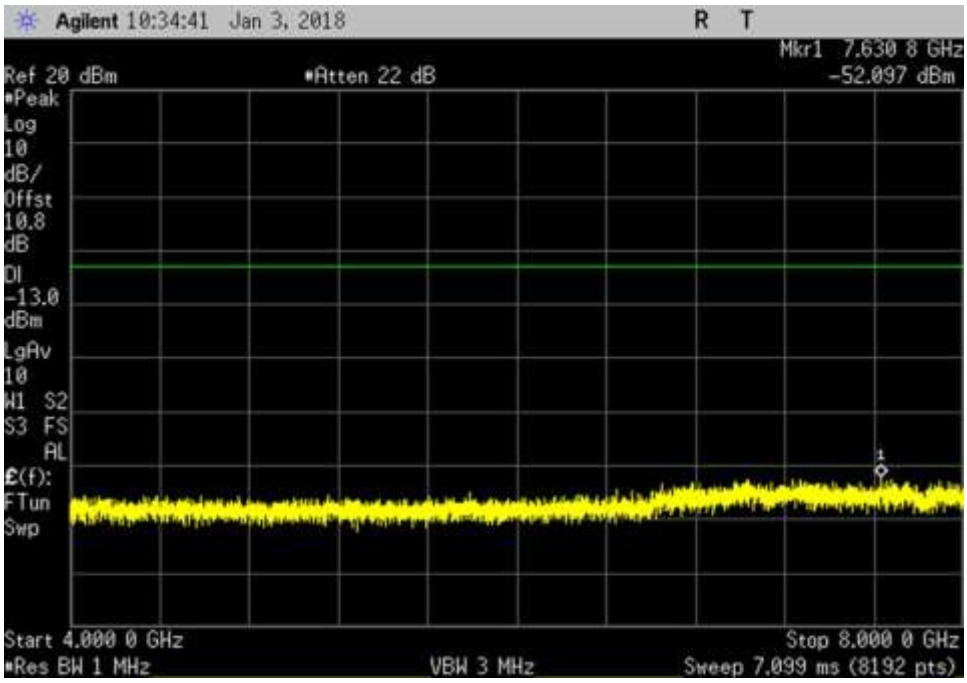
UL_ 16000- 20000MHz_AWGN



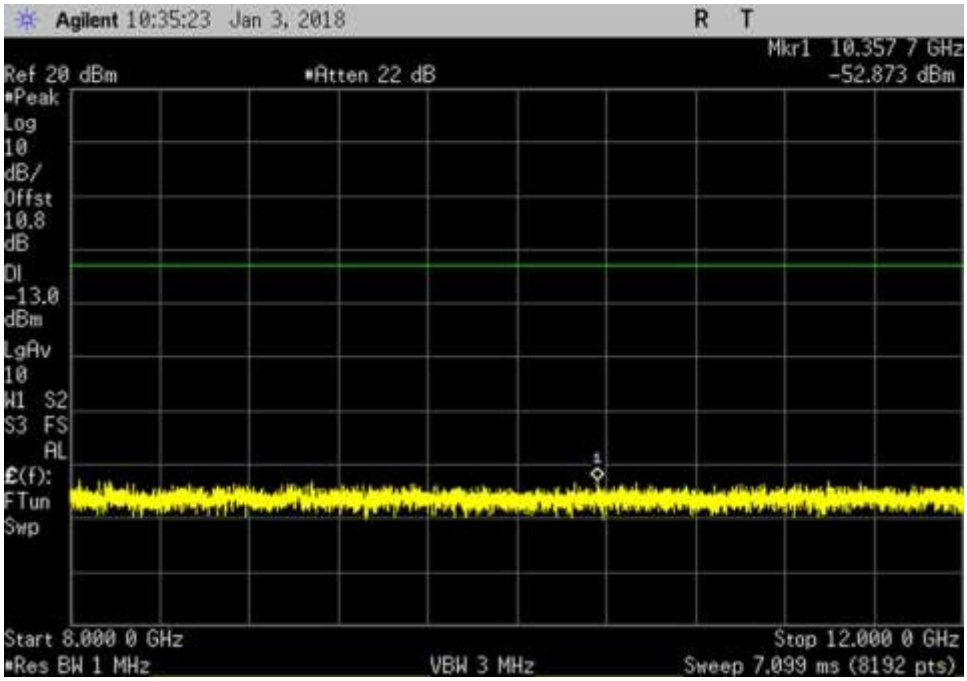
DL_ 30- 868.9MHz_AWGN



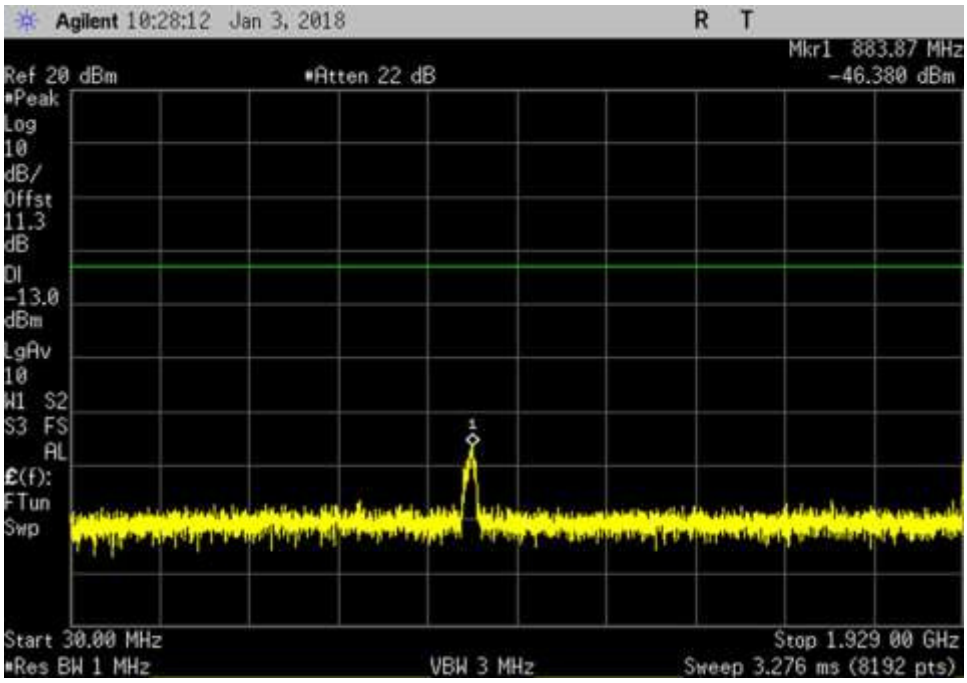
DL_ 894.1- 4000MHz_AWGN



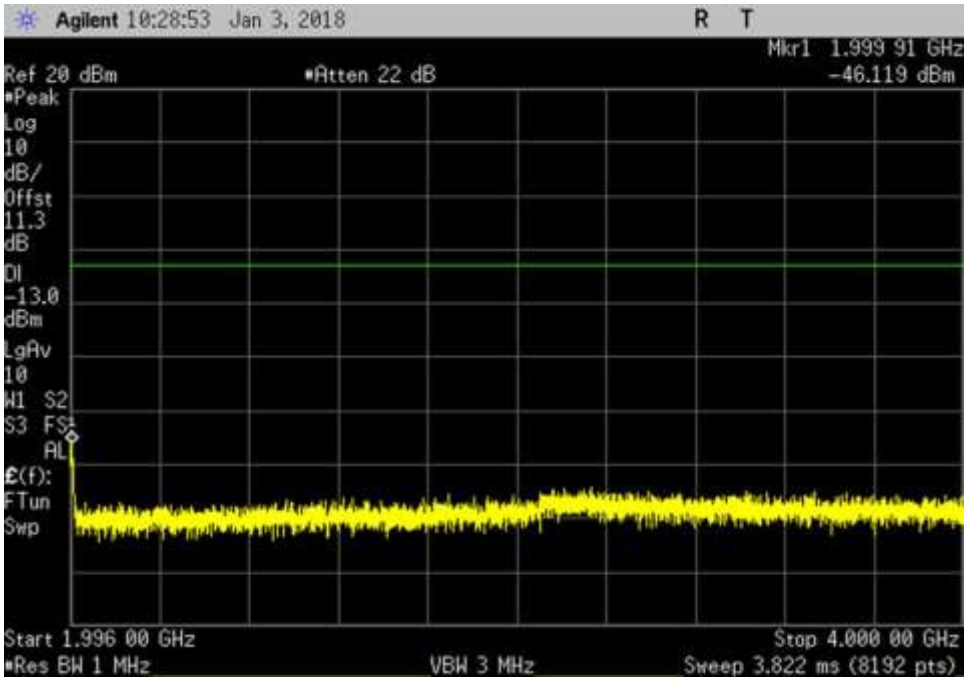
DL_ 4000- 8000MHz_AWGN



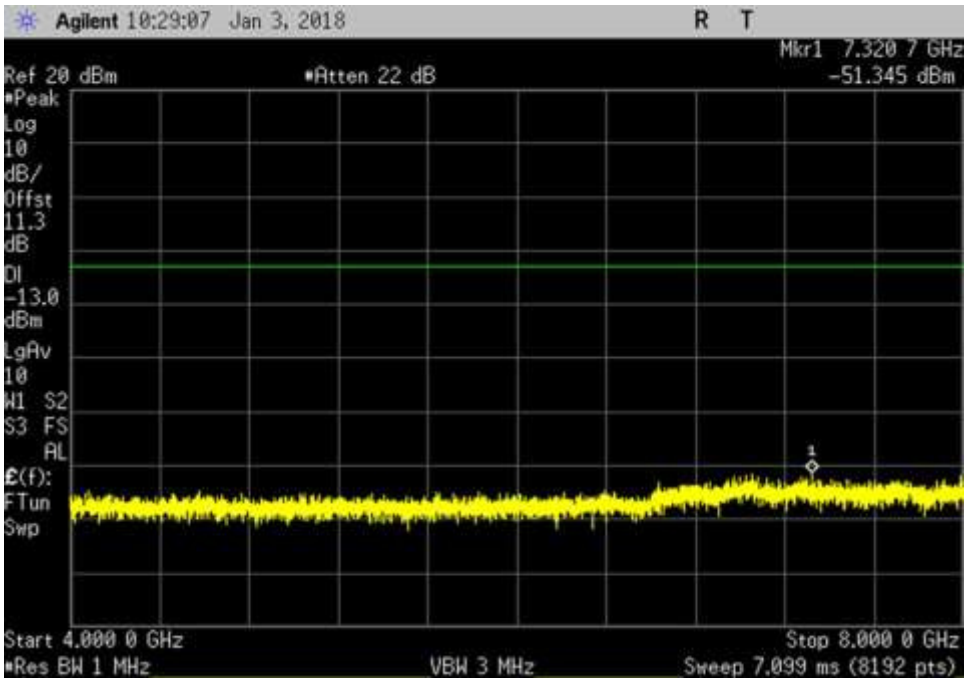
DL_ 8000- 12000MHz_AWGN



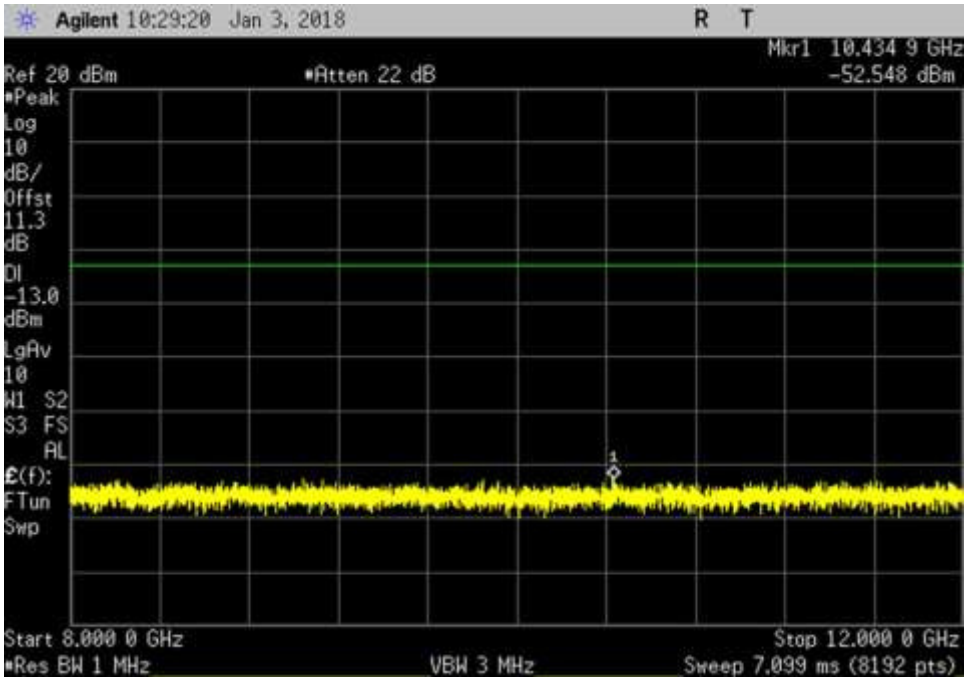
DL_ 30- 1929MHz_AWGN



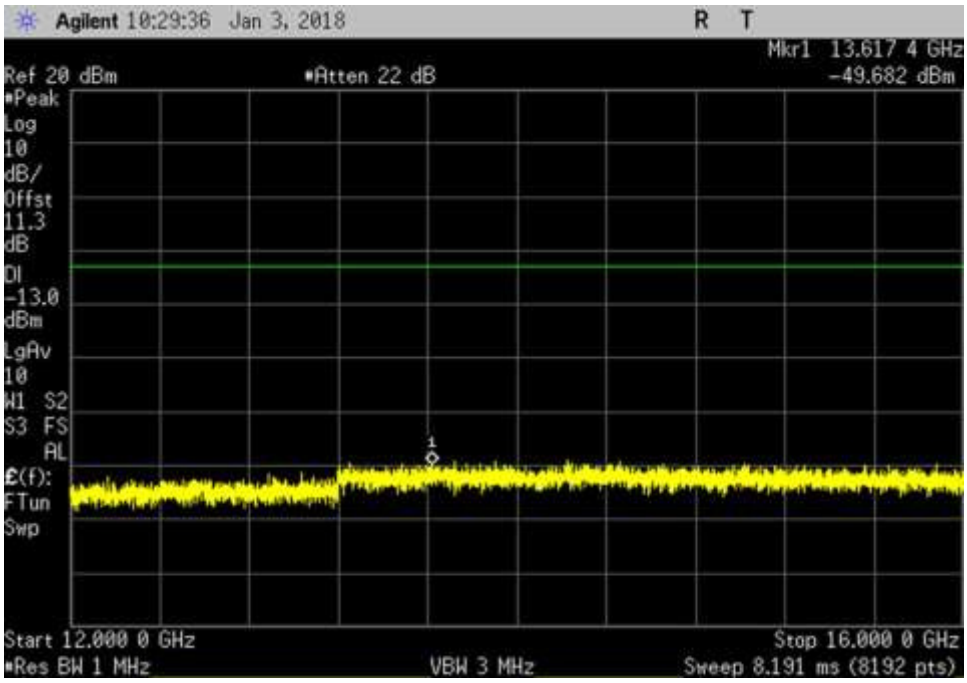
DL_ 1996- 4000MHz_AWGN



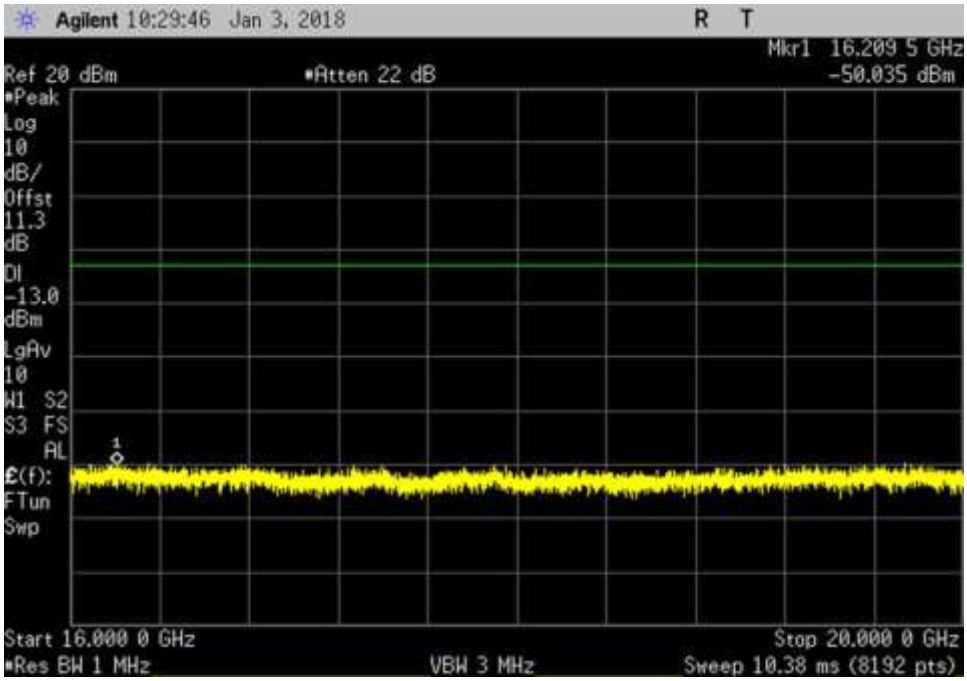
DL_ 4000- 8000MHz_AWGN



DL_ 8000- 12000MHz_AWGN



DL_ 12000- 16000MHz_AWGN



DL_ 16000- 20000MHz_AWGN

7.7 Noise limit

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539•		
	CKC Laboratories, Inc. • 110 N Olinda Place • Brea, CA 92821•		
Customer:	**Huaptec**		
Specification:	**7.7 Noise Limit (Maximum Transmitter Noise Power Level / Variable UL Noise Timing)**		
Work Order #:	**100670**	Date:	12/22/2017, 01/03/2018
Test Type:	**Conducted Emissions**	Time:	11:21:39, 13:52:00
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
03471	Spectrum Analyzer	E4440A	1/4/2016	1/4/2018
P07191	Cable	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
P05411	Attenuator	54A-10	1/18/2016	1/18/2018
02869	Spectrum Analyzer	E4440A	8/1/2017	8/1/2018
02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
03430	Attenuator	75A-10-12	12/19/2017	12/19/2019
P06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
P07037	RF Signal Generator	E4432B	10/6/2016	10/6/2018

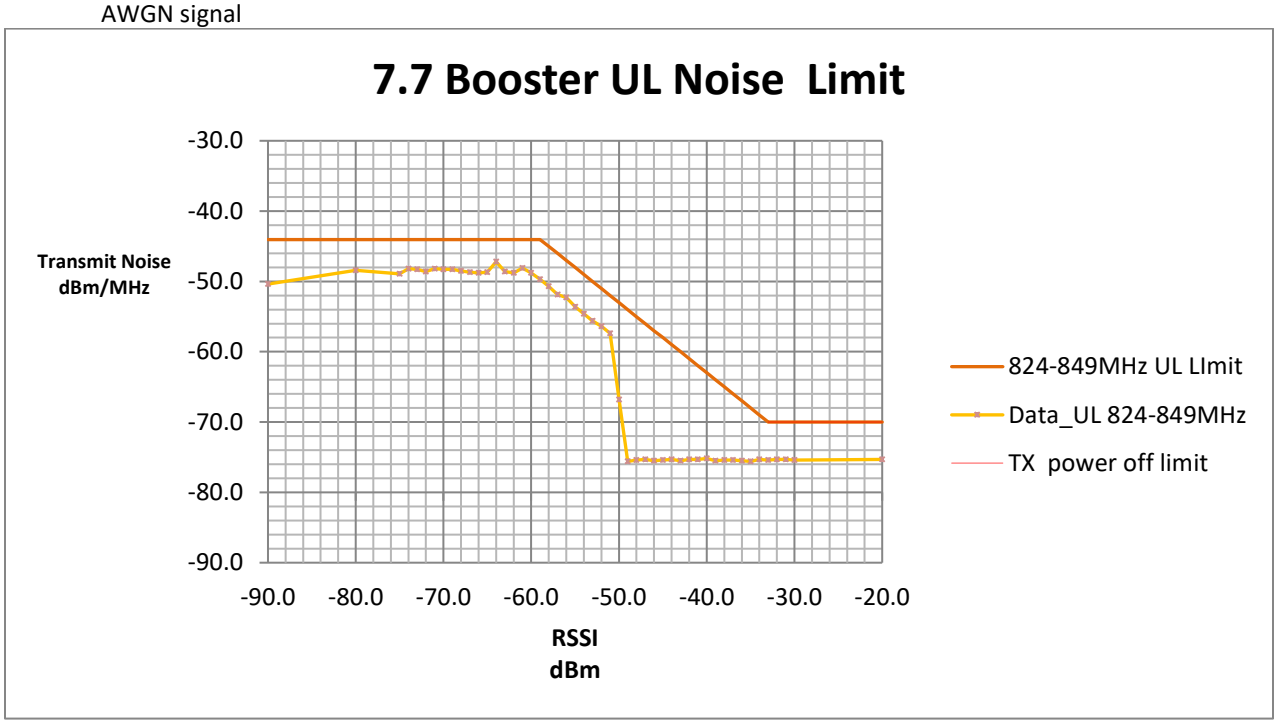
Summary of Results

7.7.1 Maximum transmitter noise power level

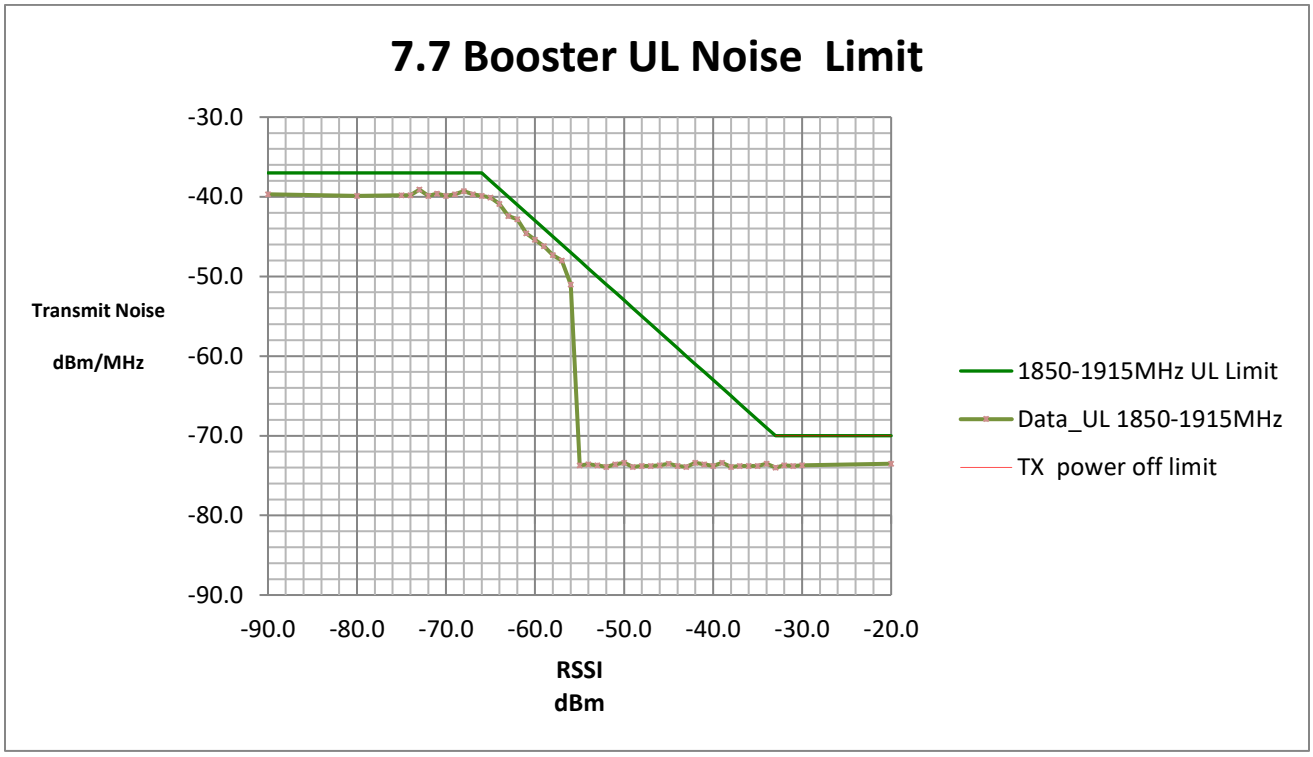
- 7.7.1 a-g: Maximum transmitter noise with 50-ohm shielded load

Maximum Noise Power			
Frequency	**Measured**	**Limit**	**Margin**
MHz	**dBm./MHz**	**dBm/MHz**	
UL1850-1915	-40.6	-37.0	-3.6
UL824-849	-48.4	-44.1	-4.3
DL1930-1995	-41.8	-37.0	-4.8
DL869-894	-47.8	-44.1	-3.7

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



824- 849 MHz					
Limit					Margin
RSSI	Measured	RSSI dependent	Frequency dependent	TX off	Column2
-64.0	-47.2	-	-44.1	-	-3.1
-56.0	-52.3	-47.0	-	-	-5.3
-52.0	-56.4	-51.0	-	-	-5.4
-51.0	-57.4	-52.0	-	-	-5.4
-33.0	-75.4	-70.0	-	-	-5.4
-55.0	-53.6	-48.0	-	-	-5.6
-32.0	-75.3	-	-	-70	-5.3



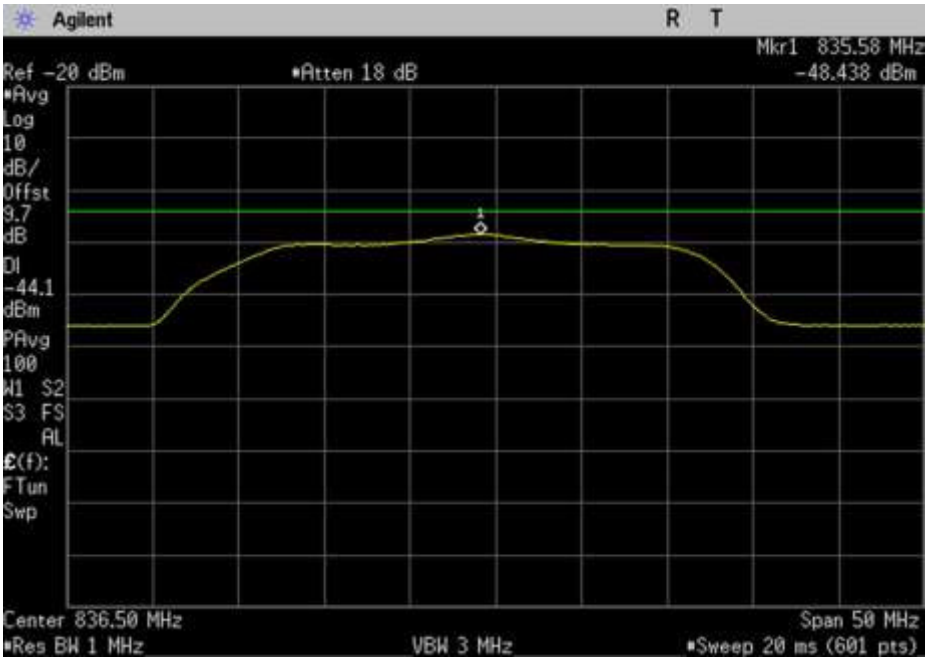
1850 – 1915 MHz					
Limit					Margin
RSSI	Measured	RSSI dependent	Frequency dependent	TX off	Column2
-73.0	-39.1	-	-37.0	-	-2.1
-62.0	-42.8	-41.0	-	-	-1.8
-64.0	-40.9	-39.0	-	-	-1.9
-57.0	-48.0	-46.0	-	-	-2.0
-65.0	-40.1	-38.0	-	-	-2.1
-59.0	-46.2	-44.0	-	-	-2.2
-20.0	-73.5	-20.0	-	-70	-3.5

7.7.2 Variable uplink noise timing

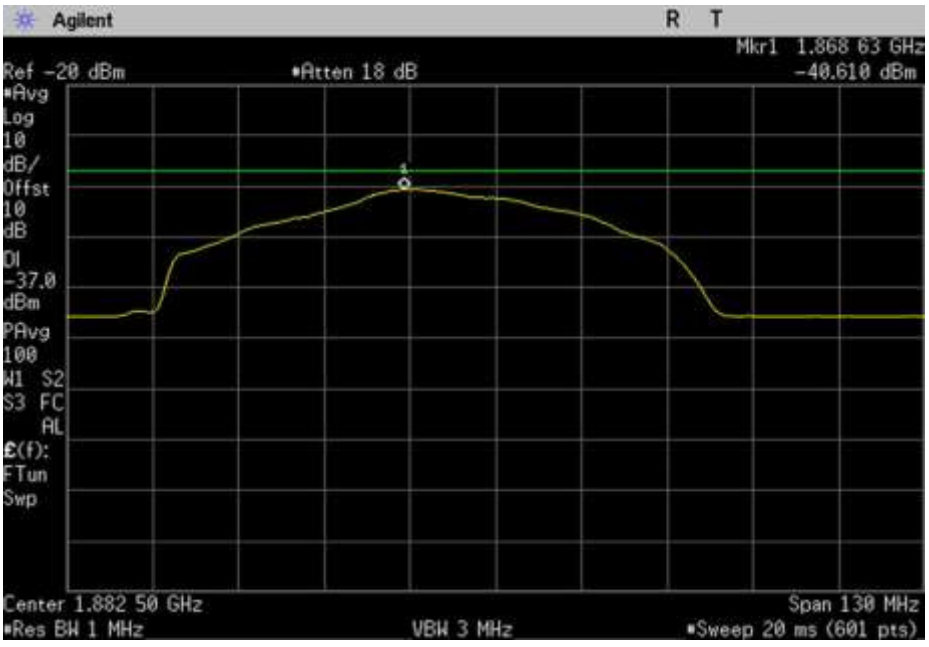
Uplink Noise timing			
Frequency (MHz)	Measured (sec.)	Limit (Mobile) (sec)	Limit (Fixed) (sec)
UL1850-1915	0.30	1.00	3.00
UL824-849	0.20	1.00	3.00

7.7.1 Maximum Transmitter Noise Power Level

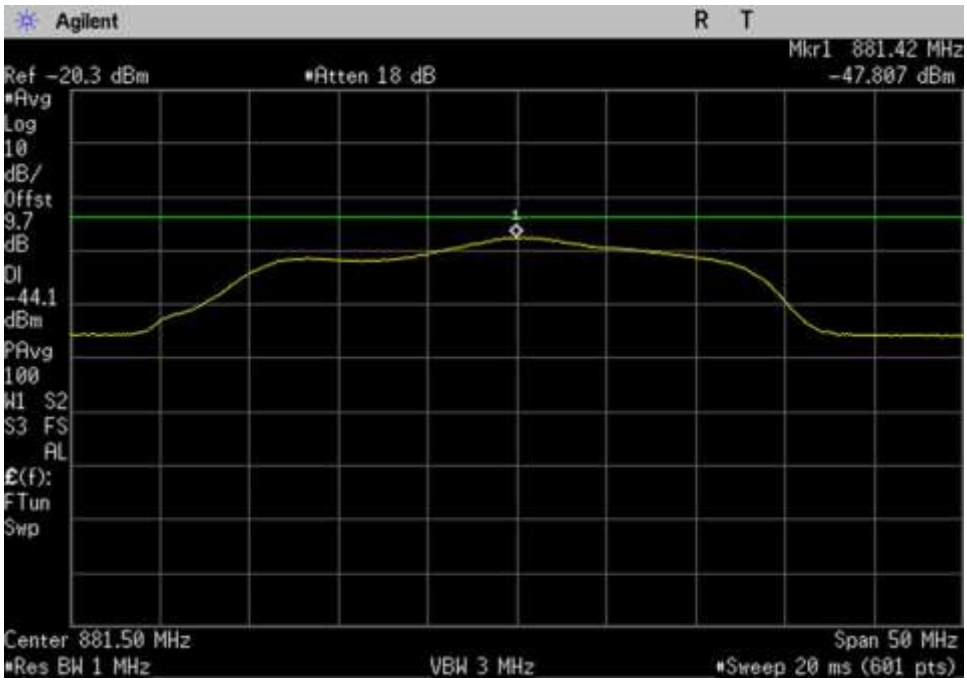
Plots



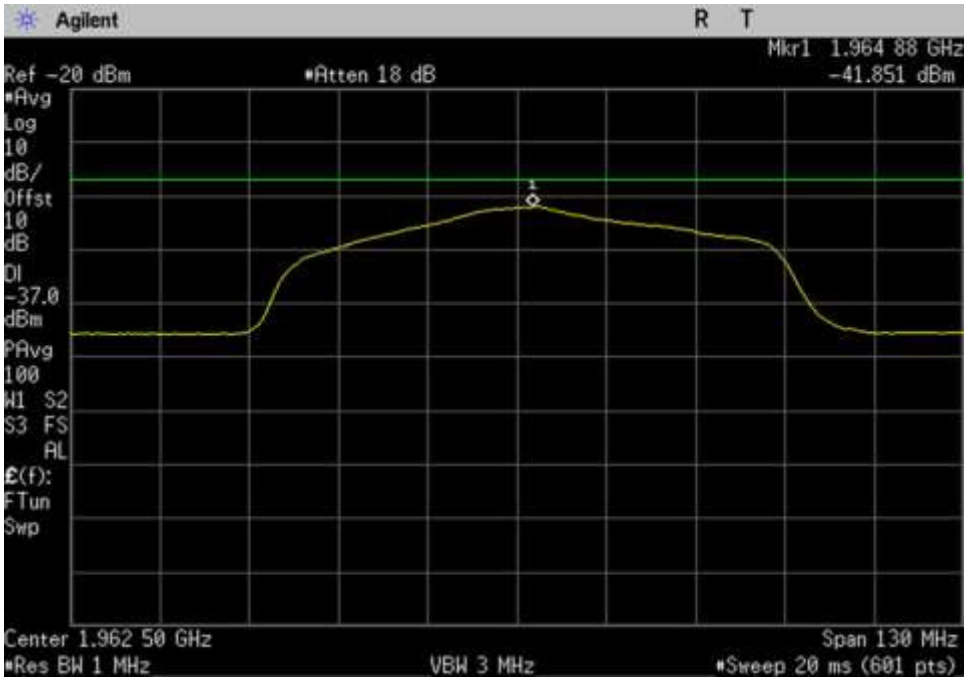
UL_824-849MHz



UL_1850-1915MHz



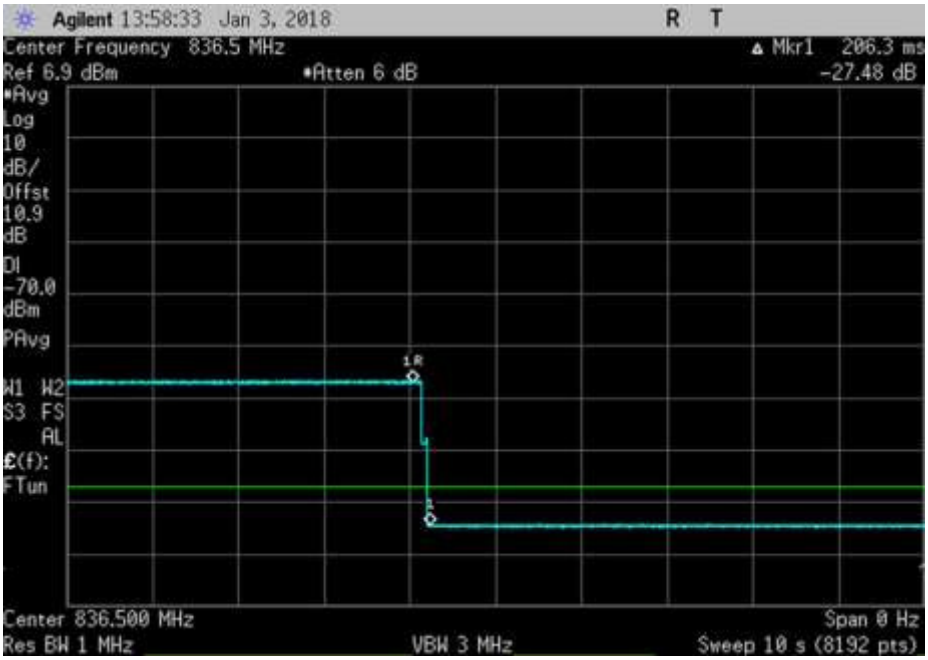
DL_869-894MHz



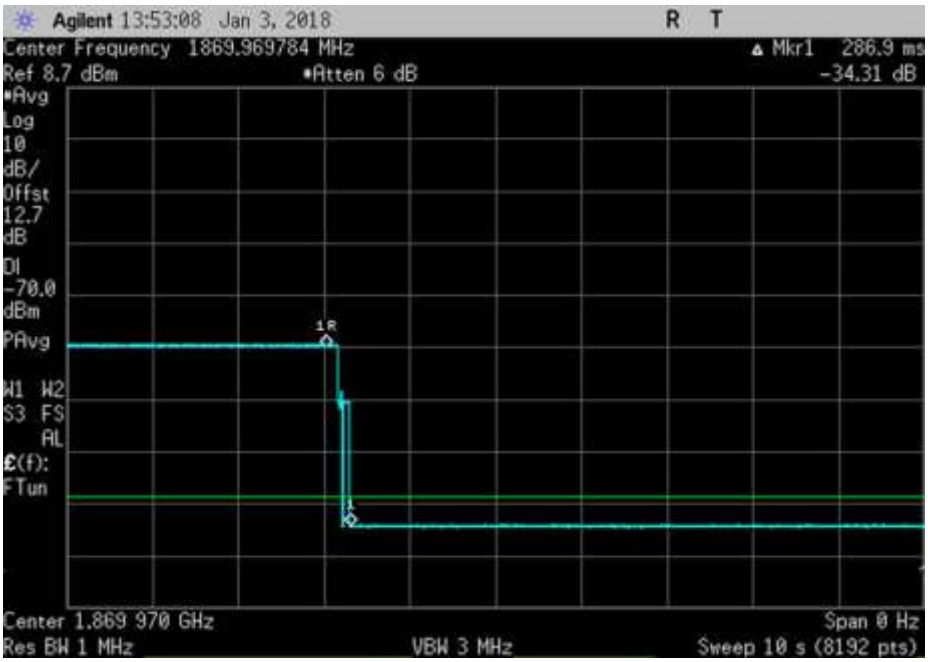
DL_1930-1995MHz

7.7.2 Variable UL Noise Timing

Plots



UL_ 836.5MHz_time



UL_ 1869.969784MHz_time

7.8 Uplink Inactivity

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539•		
Customer:	**Huaptec**		
Specification:	**7.8 Uplink Inactivity**		
Work Order #:	**100670**	Date:	12/22/2017
Test Type:	**Conducted Emissions**	Time:	11:30:39
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Equipment:

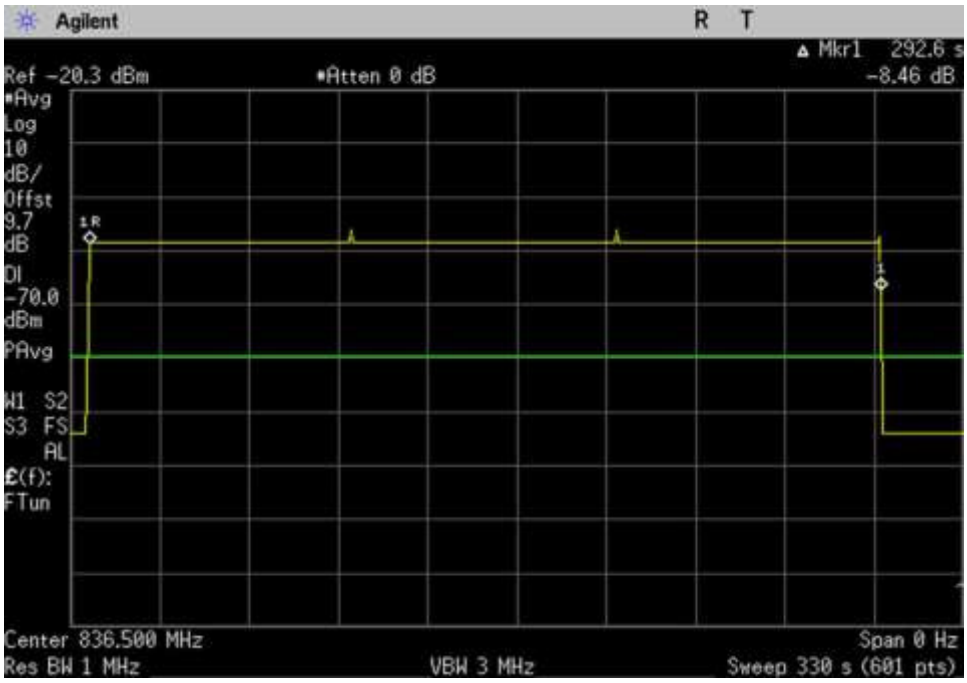
	Asset #	Description	Model	Calibration Date	Cal Due Date
	03471	Spectrum Analyzer	E4440A	1/4/2016	1/4/2018
	P07191	Cable	32022-29094K-29094K-48TC	10/30/2017	10/30/2019
	P05411	Attenuator	54A-10	1/18/2016	1/18/2018

Summary of Results

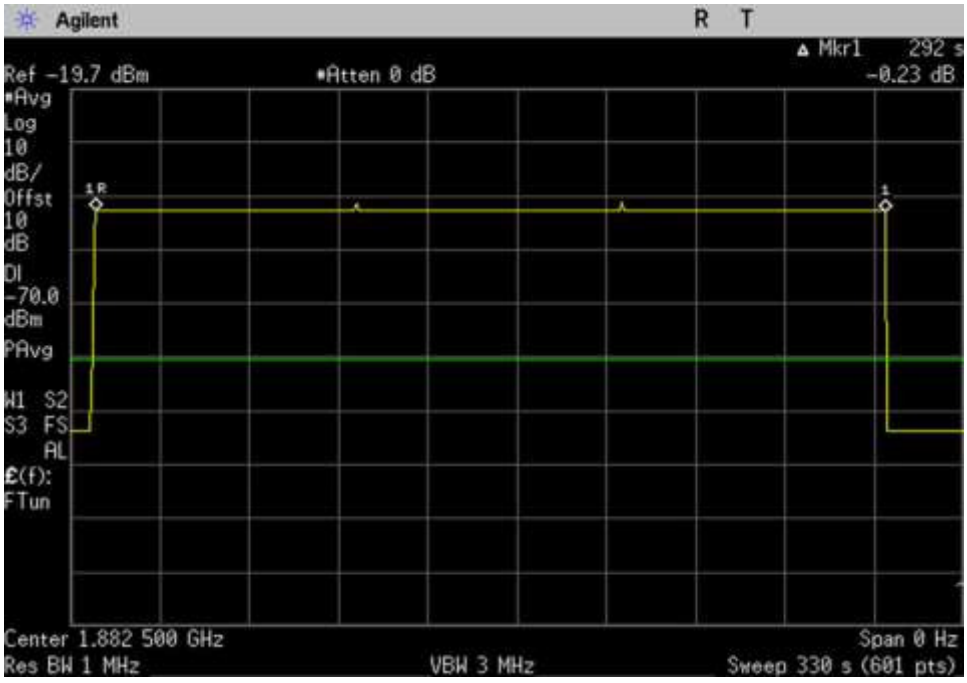
Pass: As demonstrated, when the booster is not serving an active device connection after 5 minutes the uplink noise power does not exceed -70dBm/MHz.

Uplink Inactivity		
Frequency	**Measured**	**Limit**
MHz	**Min**	**Min**
UL1850-1915	4.9	5
UL824-849	4.9	5

Plots



UL_824-849MHz



UL_1850-1915MHz

7.9 Booster Gain Limit

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Place • Brea, CA 92821•		
Customer:	**Huaptec**		
Specification:	**7.9 Variable Booster gain(Max Gain / Variable Uplink Gain Timing)**		
Work Order #:	**100670**	Date:	01/03/2018
Test Type:	**Conducted Emissions**	Time:	15:00:00
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Manufacturer provided MSCL calculation based on

6.3 Panel Antenna with30' 400 N male & a 50 Ohm 3-Way Splitter Kit numbers:103-30400-50

Antenna Gain (dBi)	6.5	9.4
Splitter/Coax Loss (dB)	6.7	7.3
Final Gain Less Splitter/Coax Loss (dB)	-0.2	2.1
Antenna Gain with Coax Loss Margin (dB)	-1.66	-0.39
Final Output Power (dBm EIRP)	15.60	16.70

136.1 Dome Antenna with 30' 300 N male Kit numbers:3-30300-50

Antenna Gain (dBi)	3	3
Splitter/Coax Loss (dB)	1.8	2.8
Final Gain Less Splitter/Coax Loss (dB)	1.2	0.2
Antenna Gain with Coax Loss Margin (dB)	-0.26	-2.29
Final Output Power (dBm EIRP)	17.00	14.80

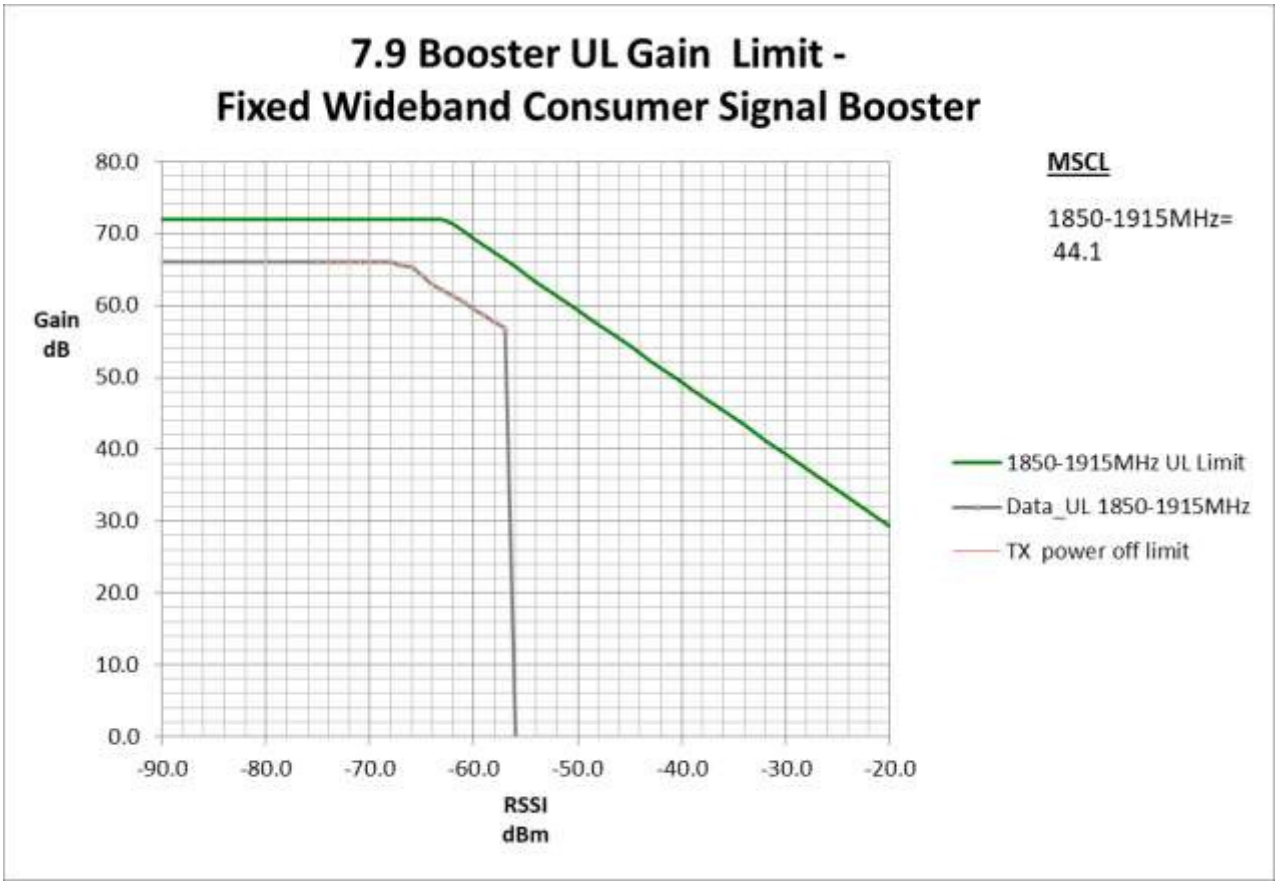
Test Equipment:

Asset #	Description	Model	Calibration Date	Cal Due Date
02869	Spectrum Analyzer	E4440A	8/1/2017	8/1/2018
02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
03430	Attenuator	75A-10-12	12/19/2017	12/19/2019
P06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
C00082	Directional Coupler	722-10-1.500V	9/18/2017	9/18/2019
P07037	RF Signal Generator	E4432B	10/6/2016	10/6/2018

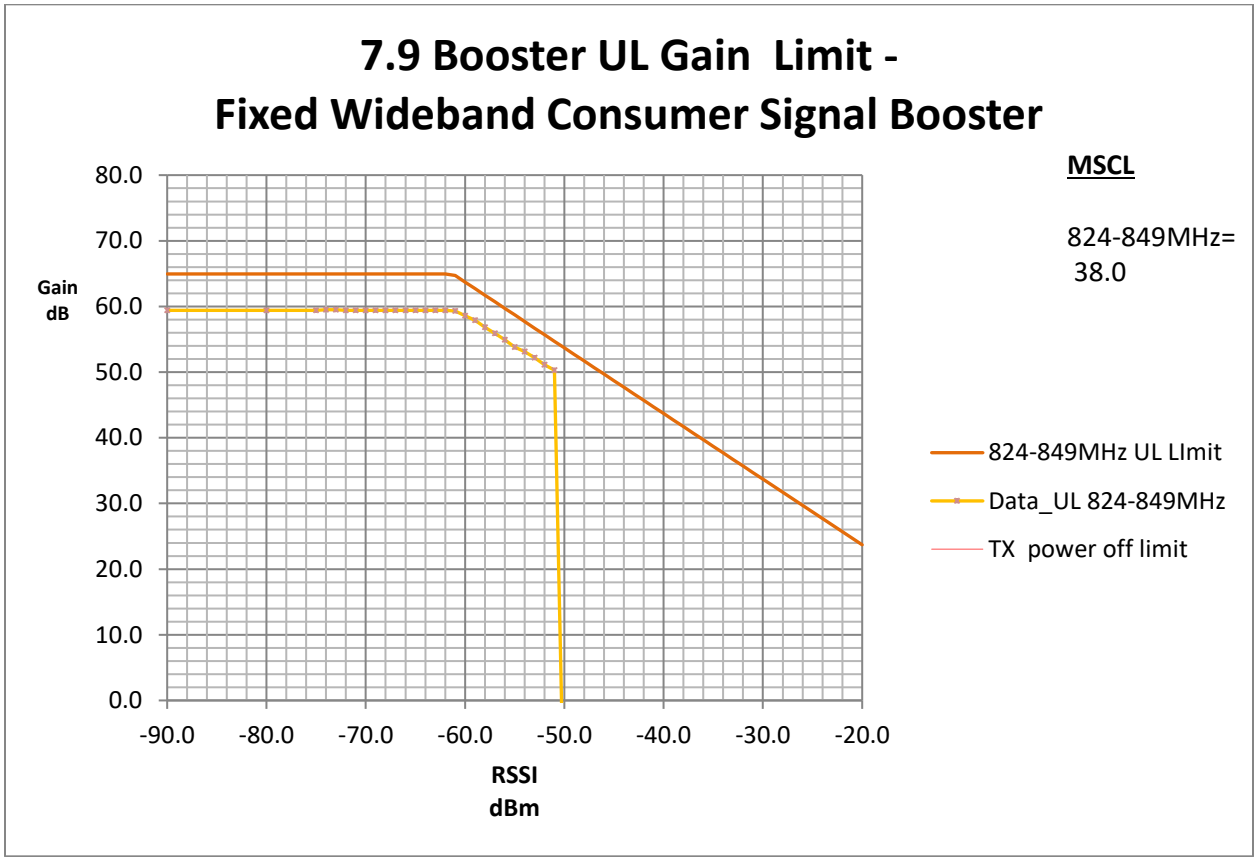
Summary of Results

PASS: As demonstrated, computed gains are within the gain limit. All maximum variable uplink gain timings are within 3 second limit.

7.9.1 Variable Gain



1850.0 - 1915.0 MHz							
				Limit			Margin
RSSI (dBm)	Input dBm	Measured Output (dBm)	Measured Gain (dB)	RSSI Dependent	Freq Dependent	TX off	
-90.0	-50.5	15.6	66.1	-	72.0	-	-5.9
-57.0	-50.5	6.3	56.8	67.1	-	-	-10.3
-58.0	-50.5	7.2	57.7	68.1	-	-	-10.4
-59.0	-50.5	8.1	58.6	69.1	-	-	-10.5
-60.0	-50.5	9.0	59.5	70.1	-	-	-10.6
-61.0	-50.5	9.9	60.4	71.1	-	-	-10.7



824.0 - 849.0 MHz							
				Limit			Margin
RSSI (dBm)	Input dBm	Measured Output (dBm)	Measured Gain (dB)	RSSI Dependent	Frequency Dependent	TX off	
-74.0	-46.8	12.7	59.5	-	64.9	-	-5.4
-61.0	-46.8	12.5	59.3	64.9	-	-	-5.6
-60.0	-46.8	11.8	58.6	64.0	-	-	-5.4
-59.0	-46.8	11.1	57.9	63.0	-	-	-5.1
-58.0	-46.8	10.0	56.8	62.0	-	-	-5.2
-57.0	-46.8	9.1	55.9	61.0	-	-	-5.1

7.9.1 Maximum Gain

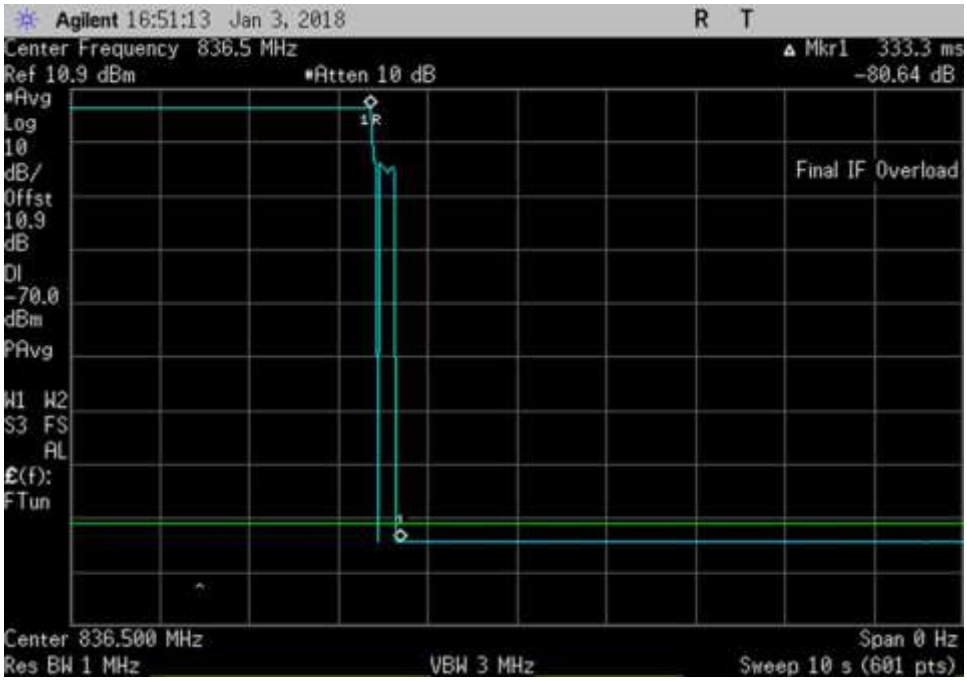
For this subsection, see summary of results of 7.9
7.9.1 Maximum gain

7.9.2 Variable uplink Gain Timing

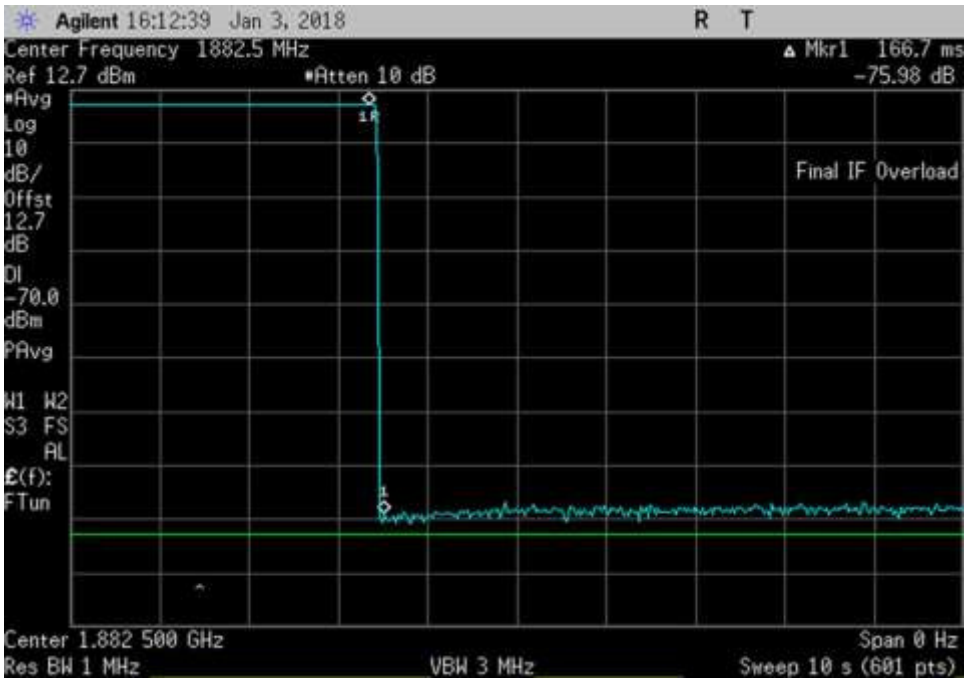
7.9.2 Variable uplink gain timing

Uplink Gain Timing		
Frequency	Measured	Limit
(MHz)	(Sec)	(Sec)
UL 1850-1915	0.17	3
UL 824-849	0.33	3

Plots



UL_ 836.5MHz



UL_ 1882.5MHz

7.10 Occupied Band Width

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Place • Brea, CA 92821•		
Customer:	**Huaptec**		
Specification:	**7.10 Occupied Band Width**		
Work Order #:	**100670**	Date:	01/03/2018
Test Type:	**Conducted Emissions**	Time:	14:54:00
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Equipment:

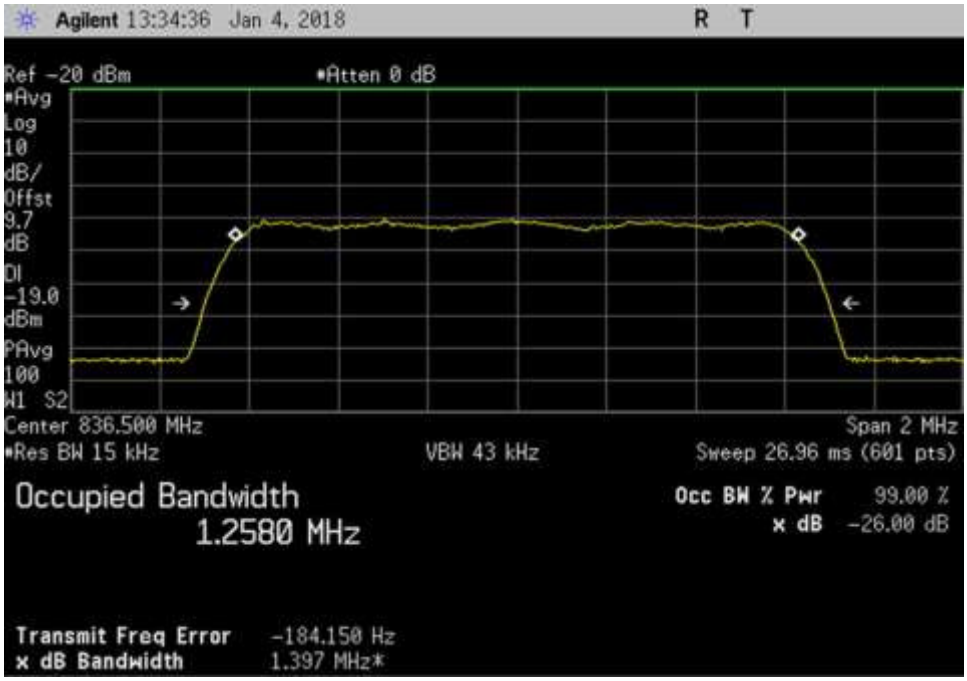
Asset #	Description	Model	Calibration Date	Cal Due Date
02869	Spectrum Analyzer	E4440A	8/1/2017	8/1/2018
02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
03430	Attenuator	75A-10-12	12/19/2017	12/19/2019
P06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
03420	Signal Generator	E4438C	6/9/2017	6/9/2019
P07037	RF Signal Generator	E4432B	10/6/2016	10/6/2018

Summary of Results

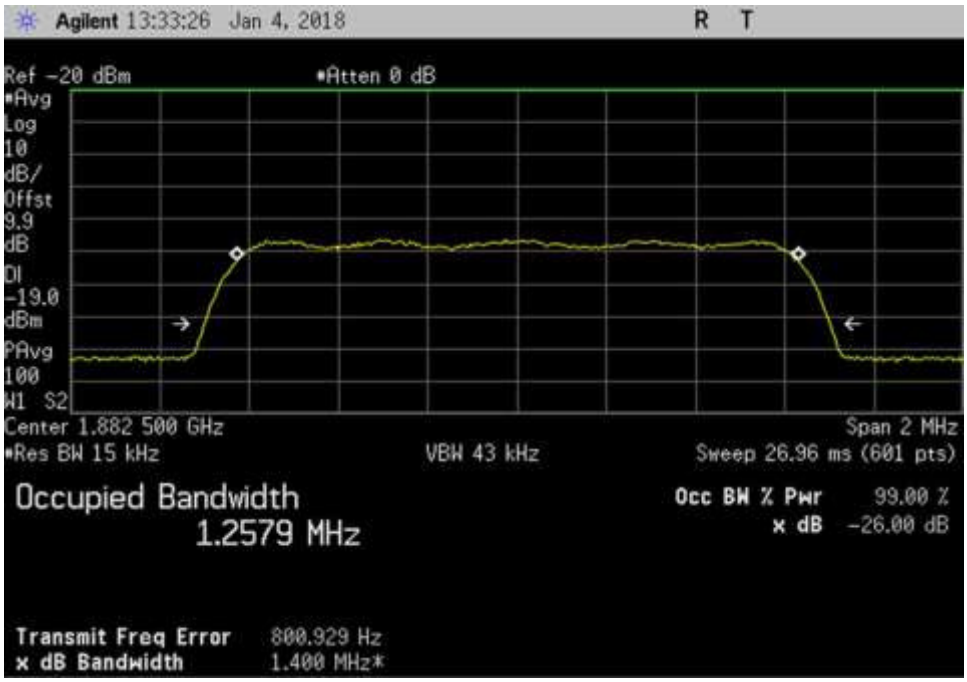
Pass: As summarized in plots below, the uniformity of the output signal relative to the input signal are practically identical. Therefore, the comparison is within limits.

Plots

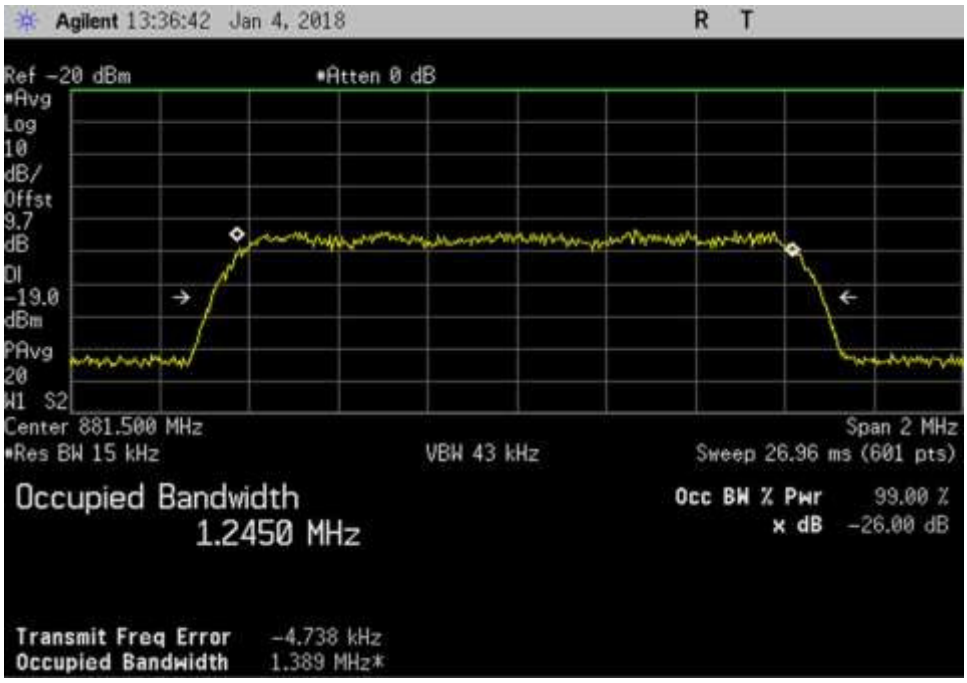
CDMA Input



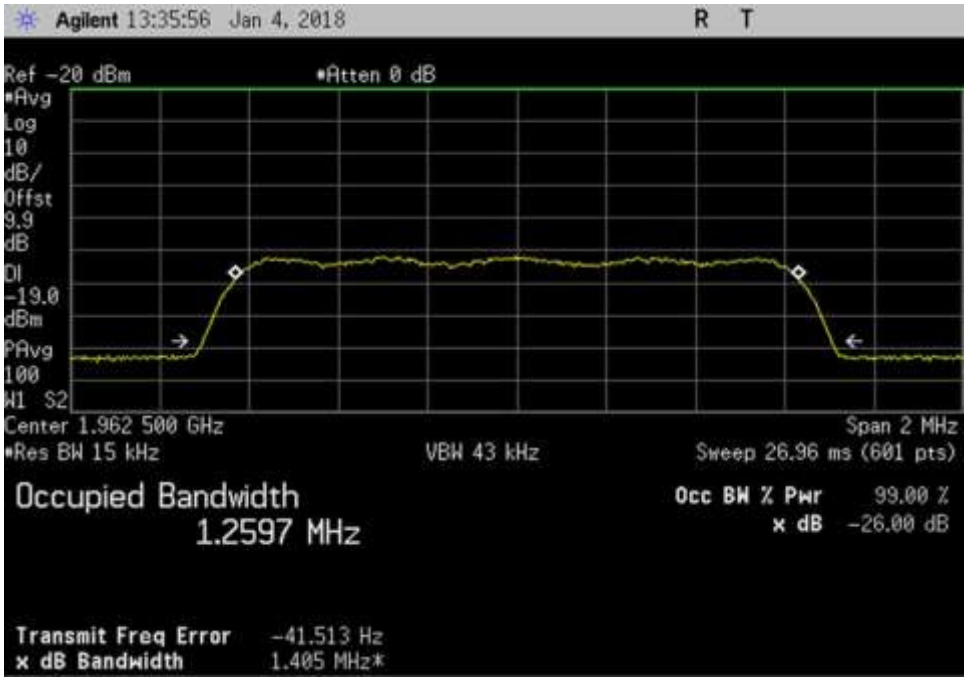
UL_ 836.5MHz_CDMA



UL_ 1882.5MHz_CDMA

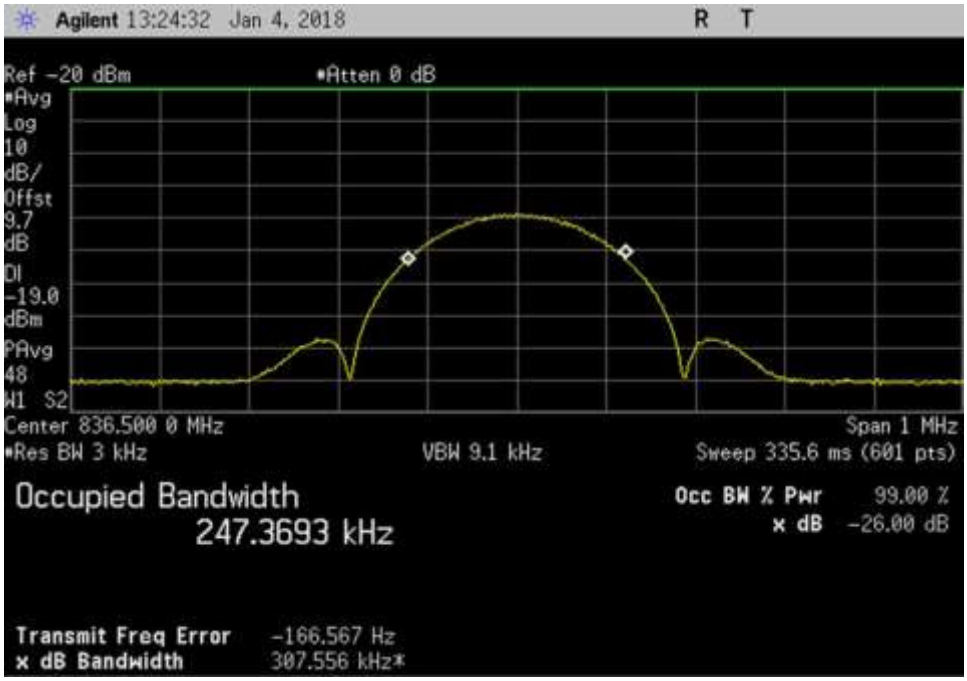


DL_ 881.5MHz_CDMA

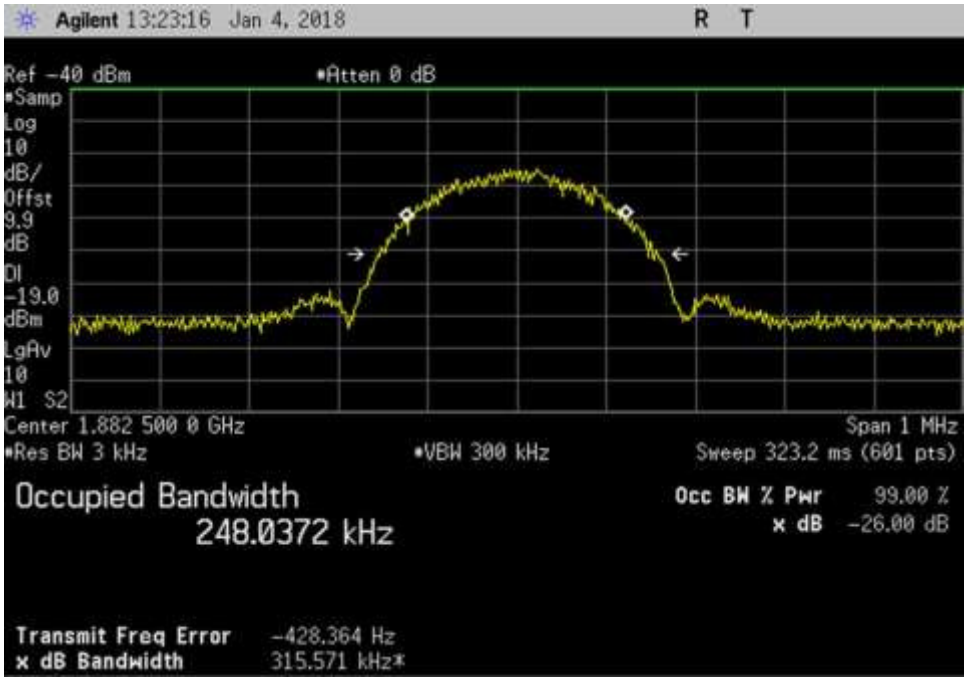


DL_ 1962.5MHz_CDMA

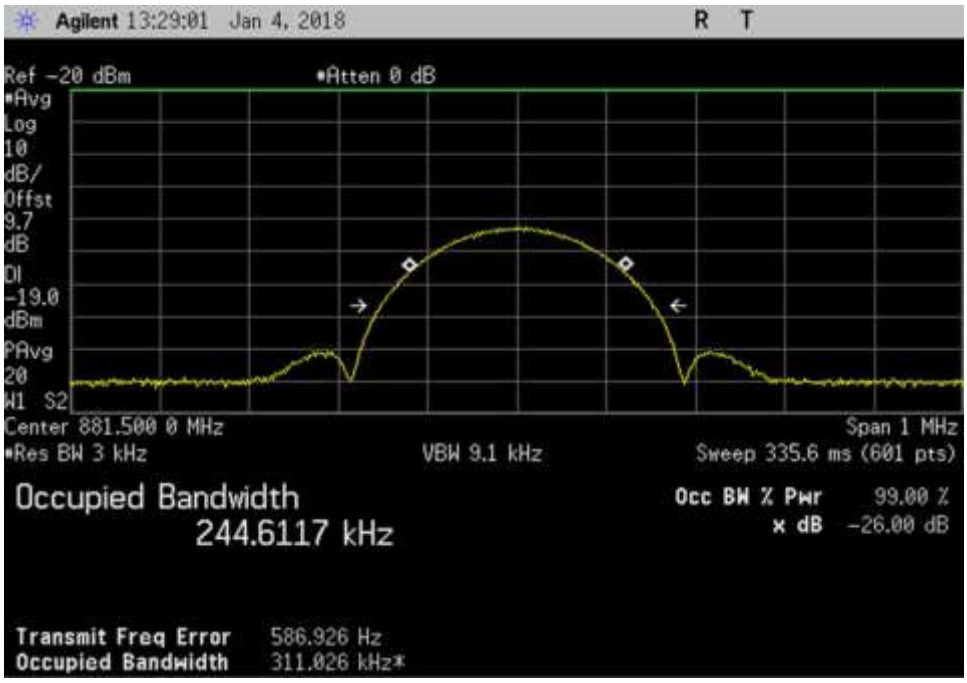
EDGE Input



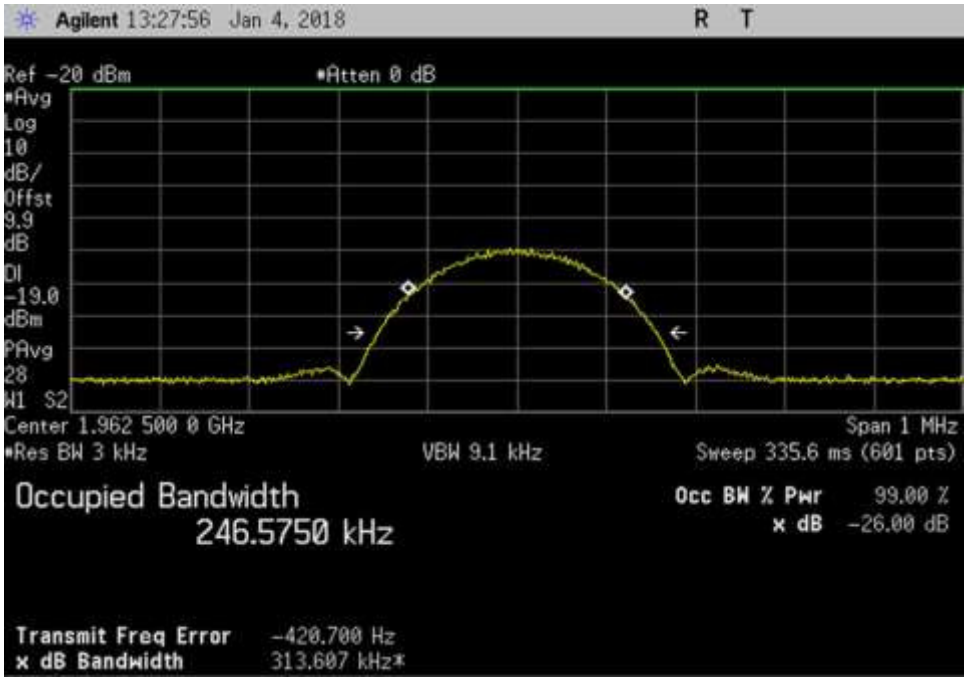
UL_ 836.5MHz_EDGE



UL_ 1882.5MHz_EDGE

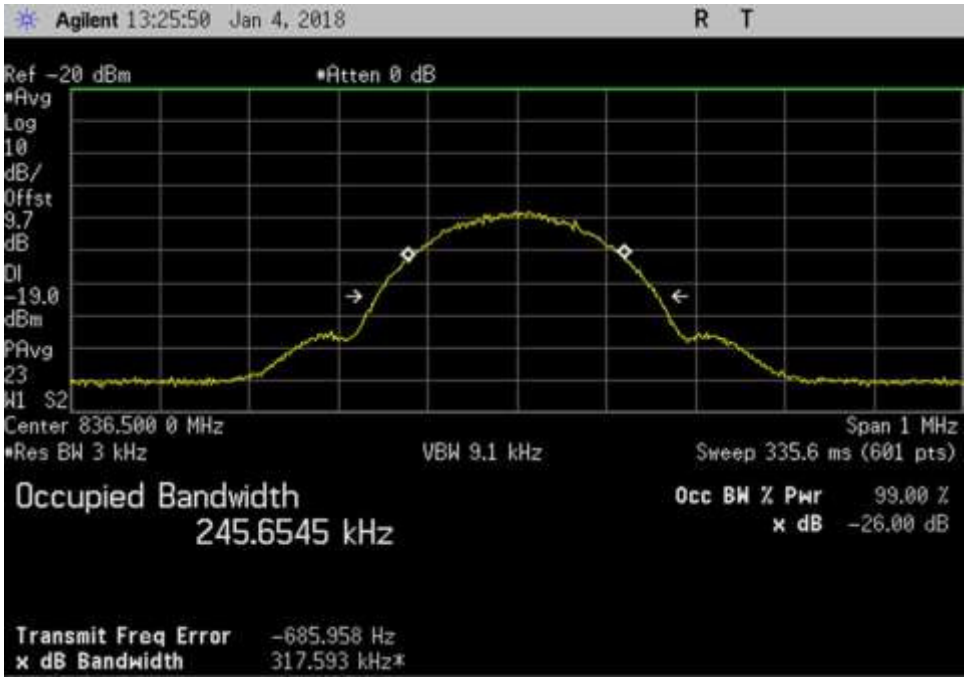


DL_ 881.5MHz_EDGE



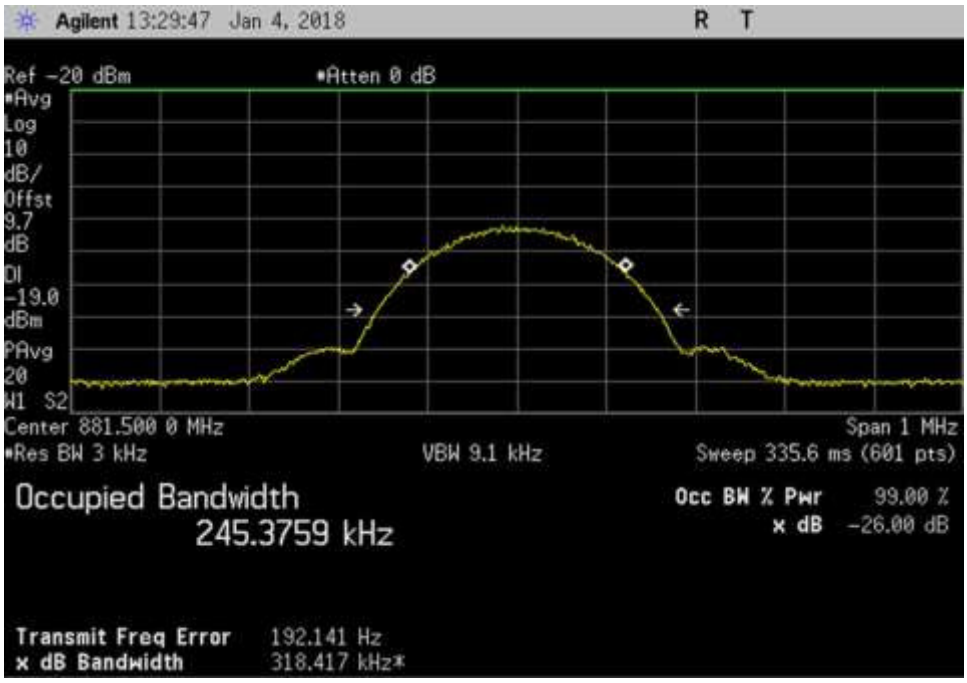
DL_ 1962.5MHz_EDGE

GSM Input

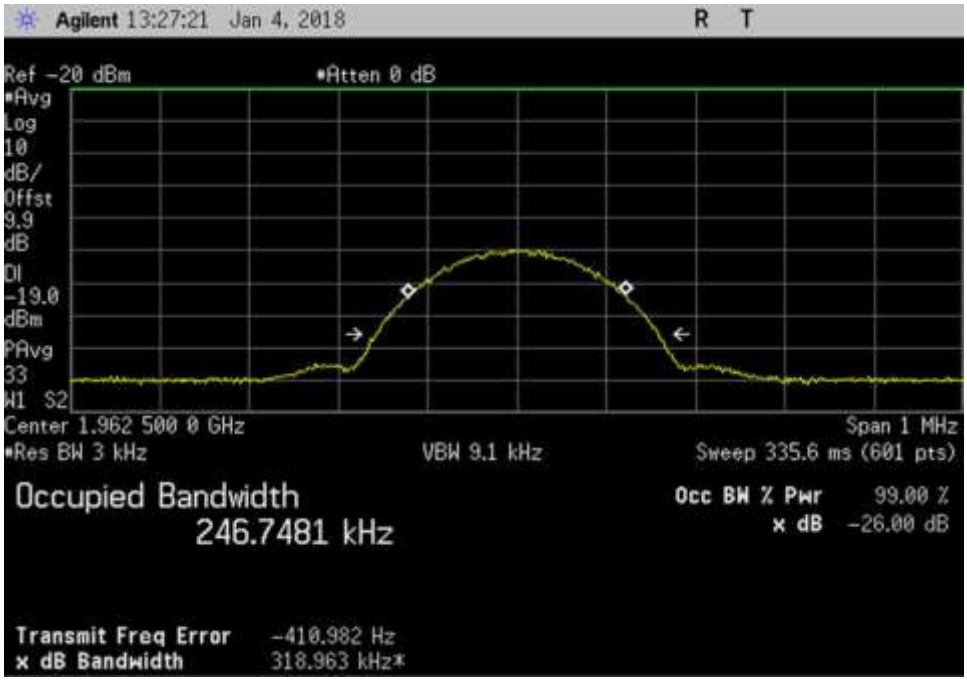


UL_ 836.5MHz_GSM

UL_ 1882.5MHz_GSM

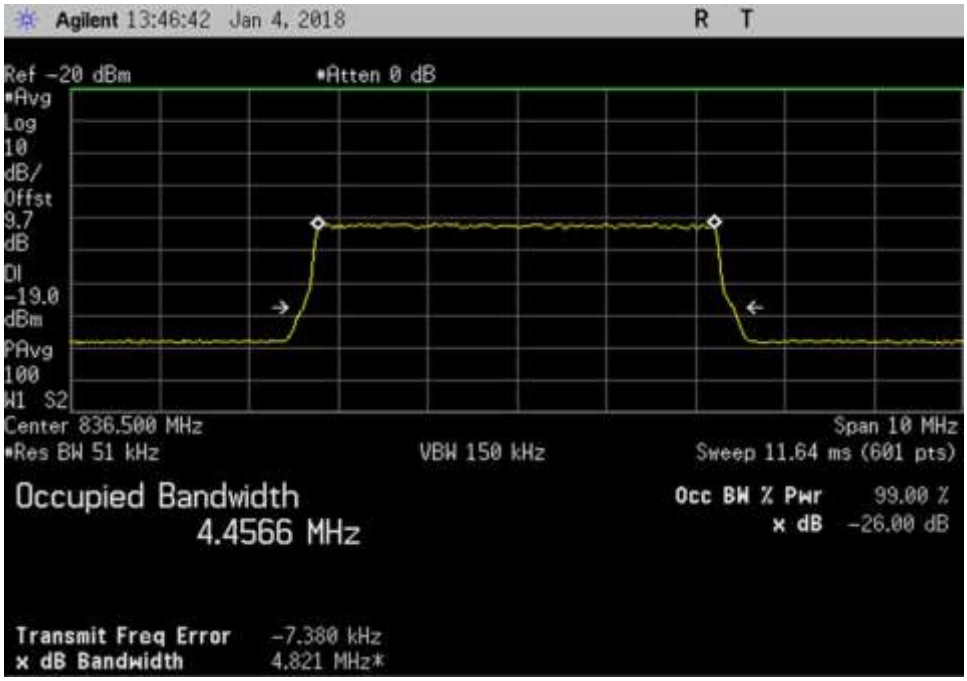


DL_ 881.5MHz_GSM

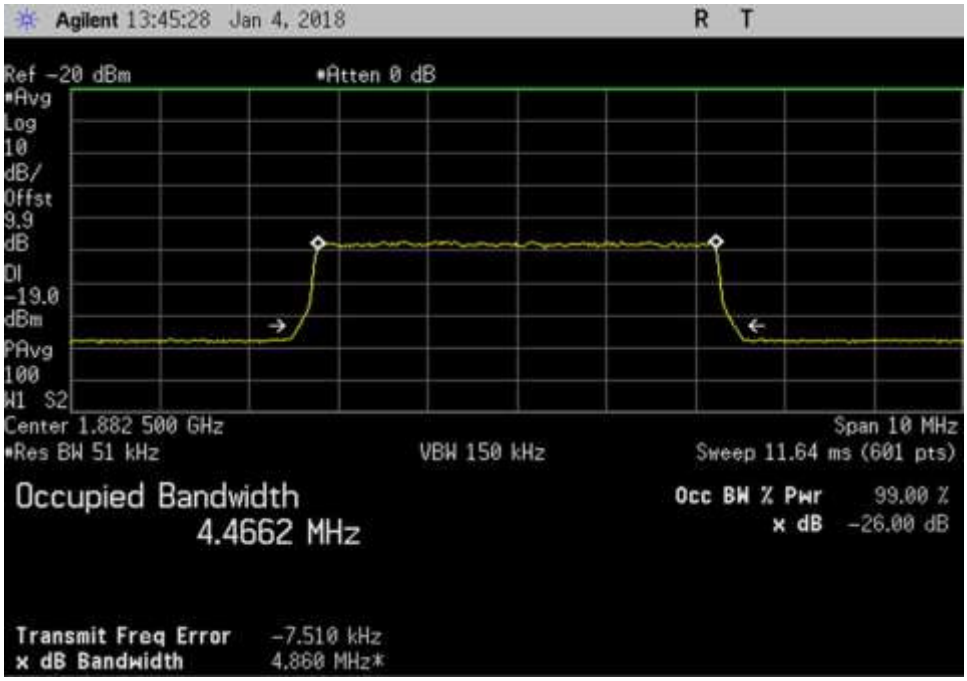


DL_ 1962.5MHz_GSM

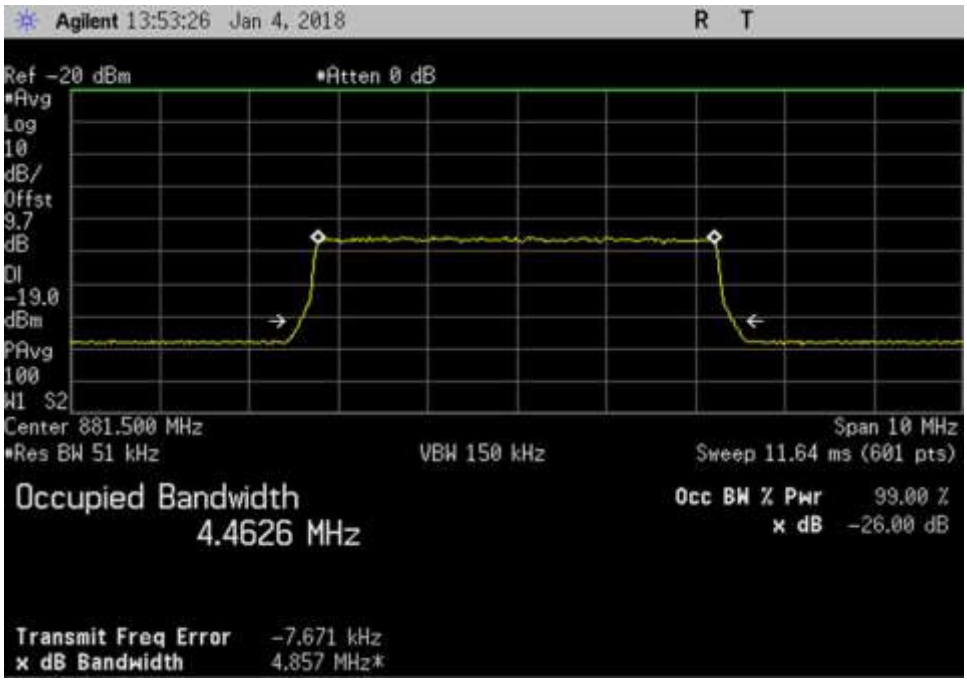
LTE Input



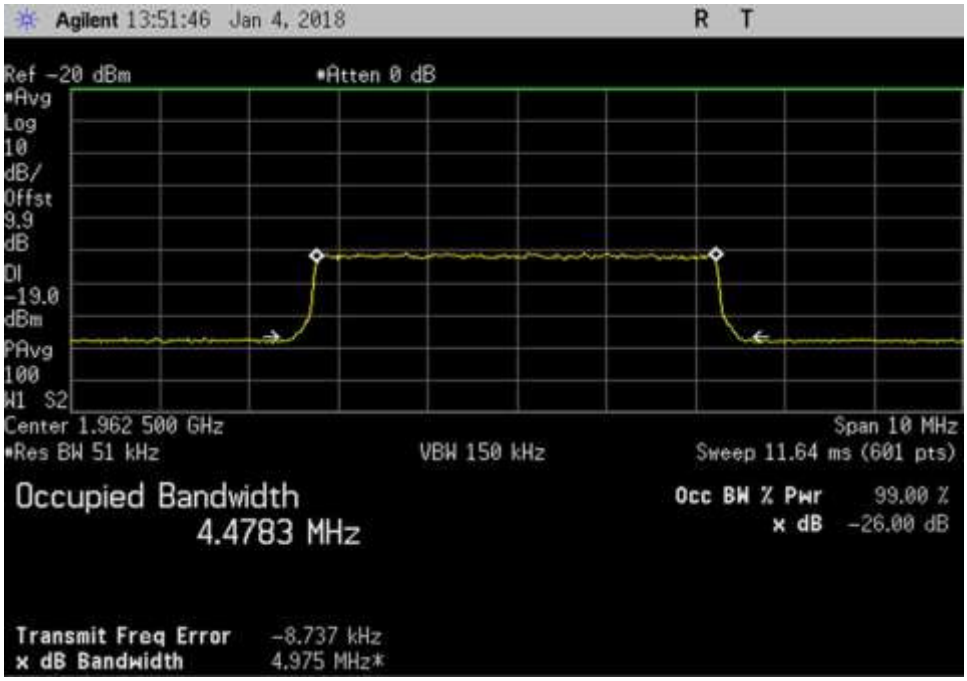
UL_ 836.5MHz_LTE



UL_ 1882.5MHz_LTE

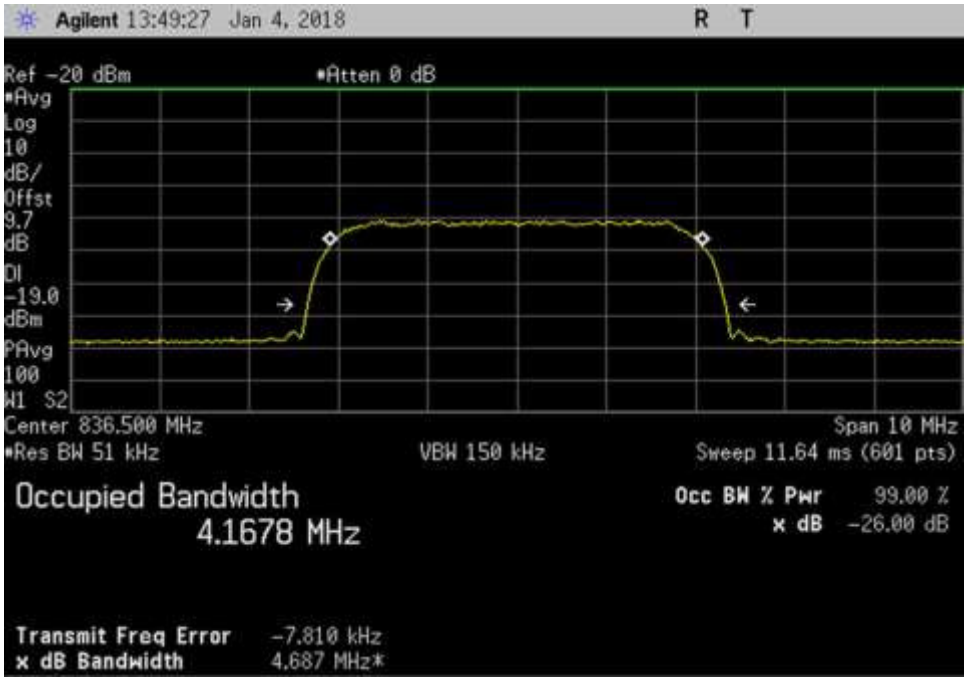


DL_ 881.5MHz_LTE

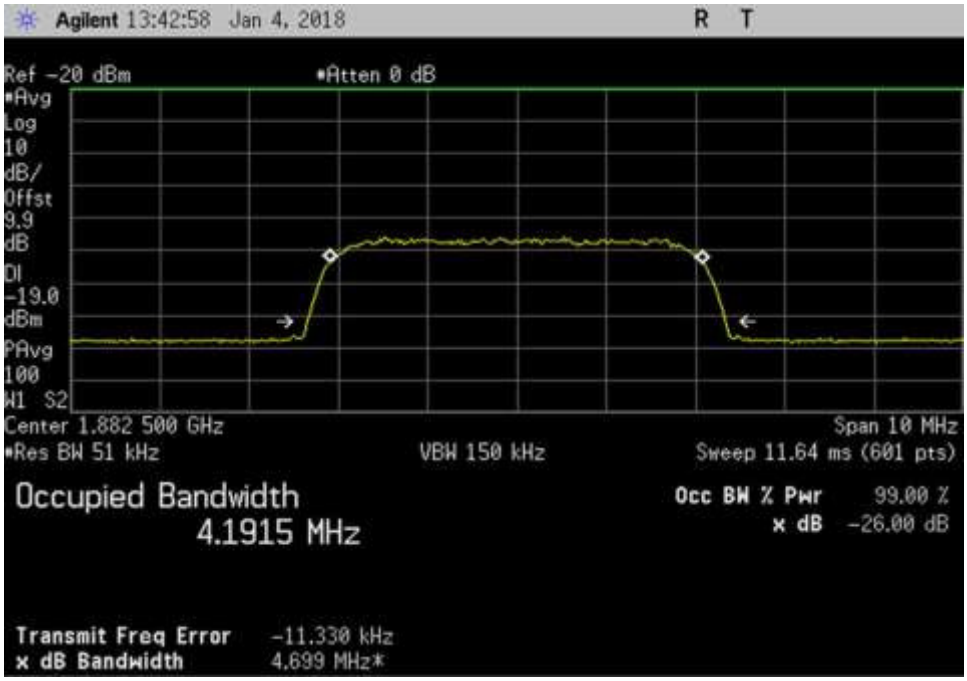


DL_ 1962.5MHz_LTE

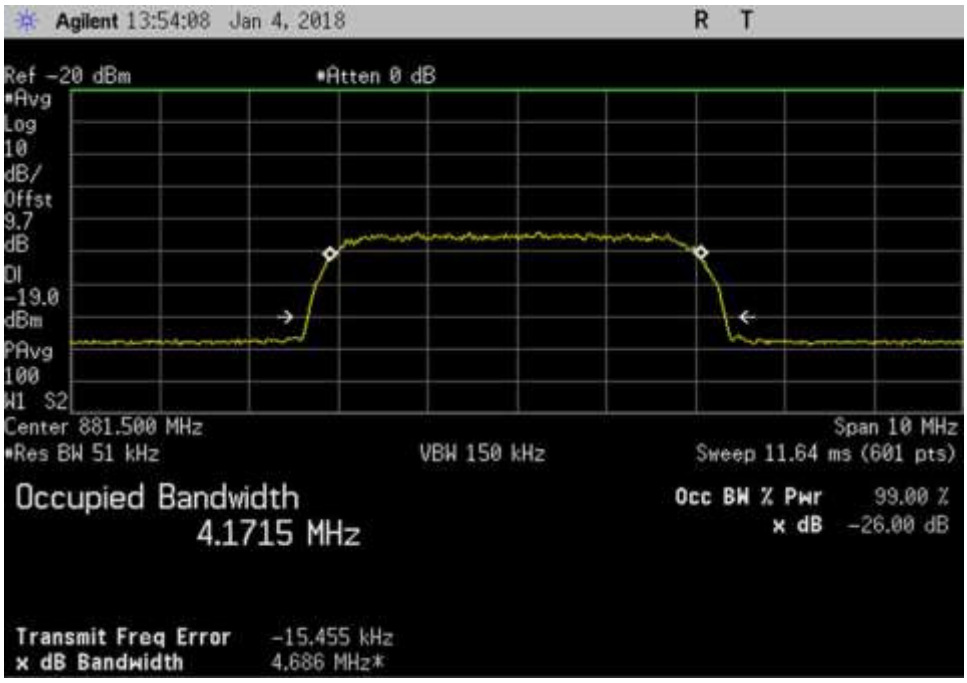
WCDMA Input



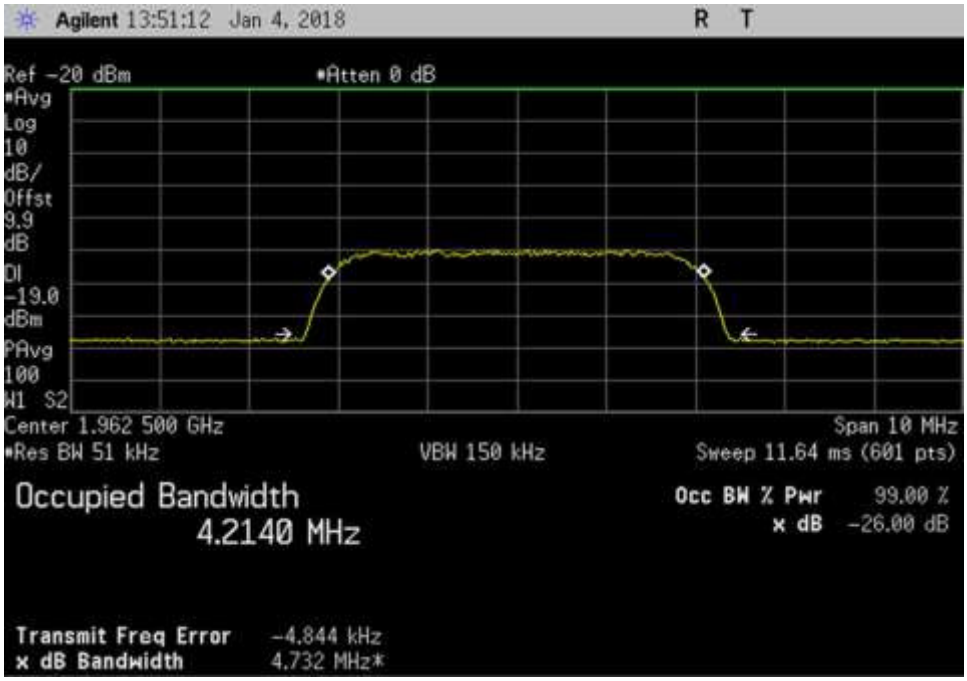
UL_ 836.5MHz_WCDMA



UL_ 1882.5MHz_WCDMA

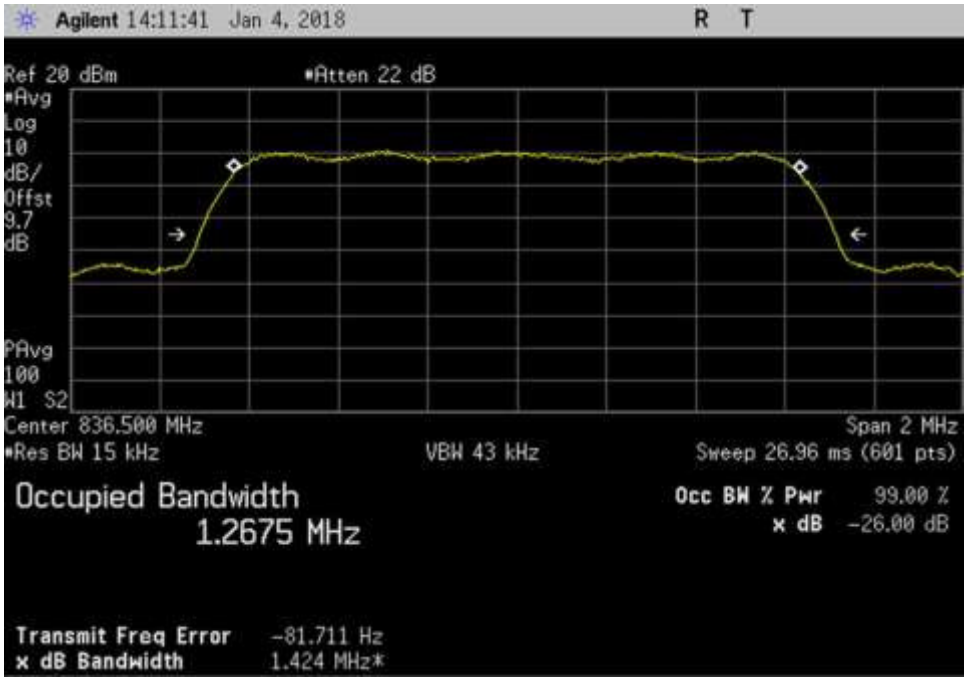


DL_ 881.5MHz_WCDMA

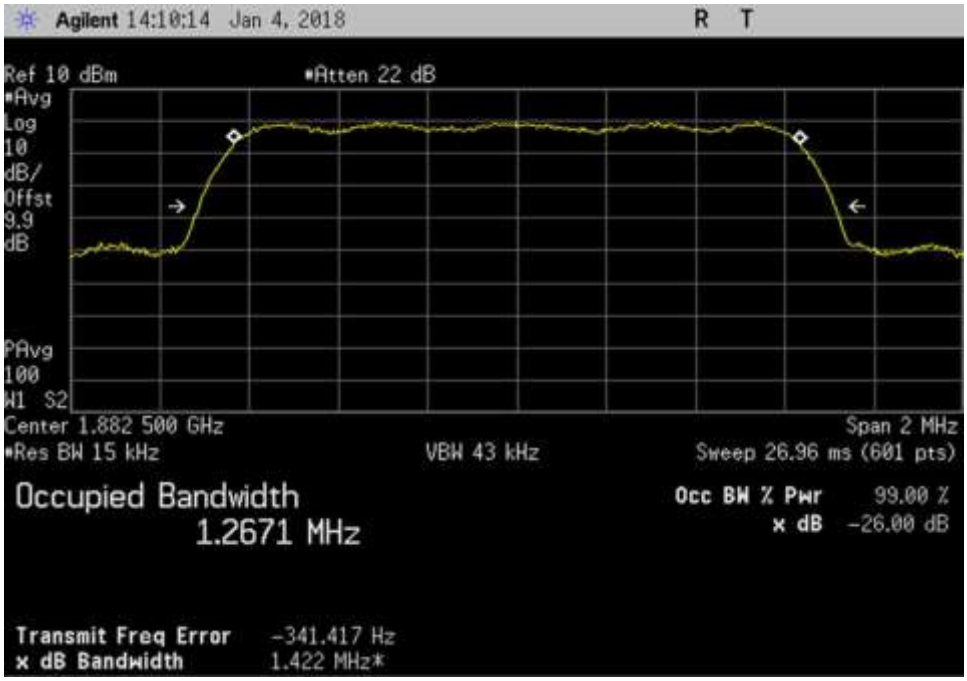


DL_ 1962.5MHz_WCDMA

CDMA Output

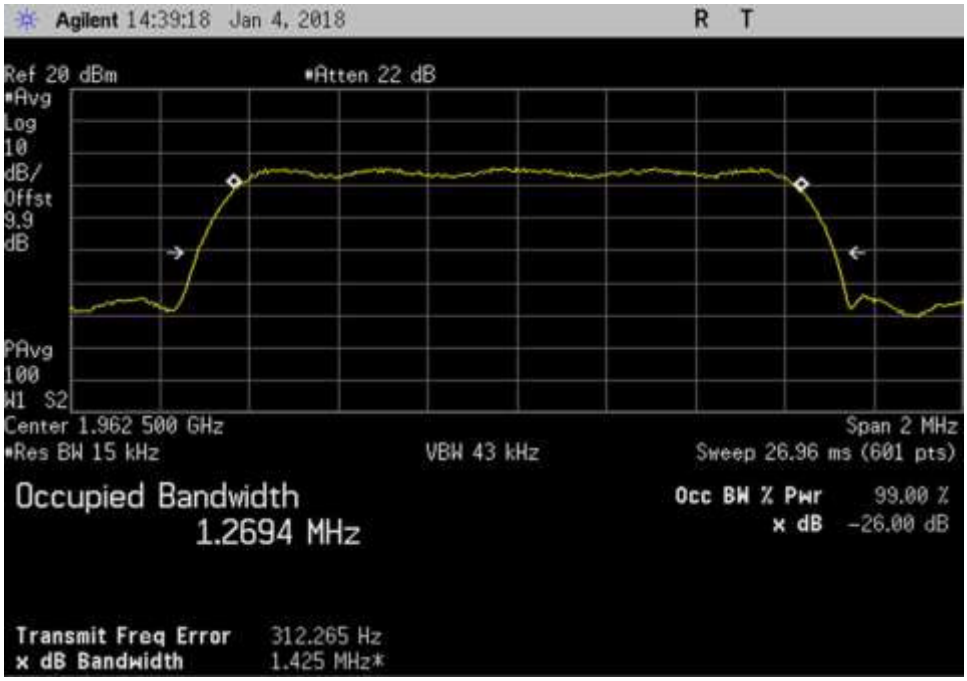


UL_ 836.5MHz_CDMA



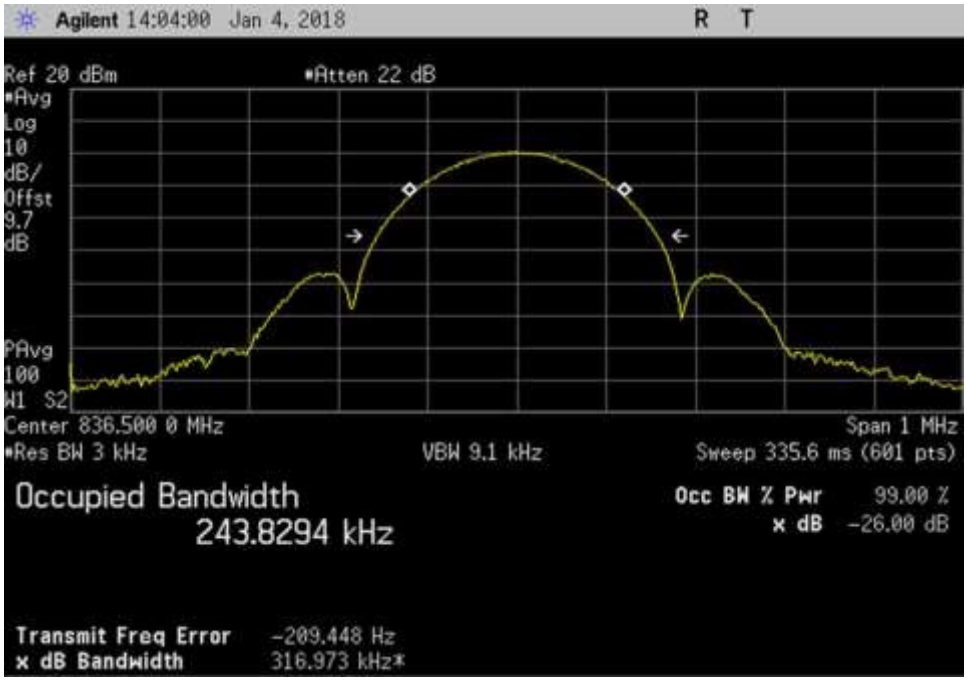
UL_ 1882.5MHz_CDMA

881.5MHz_CDMA

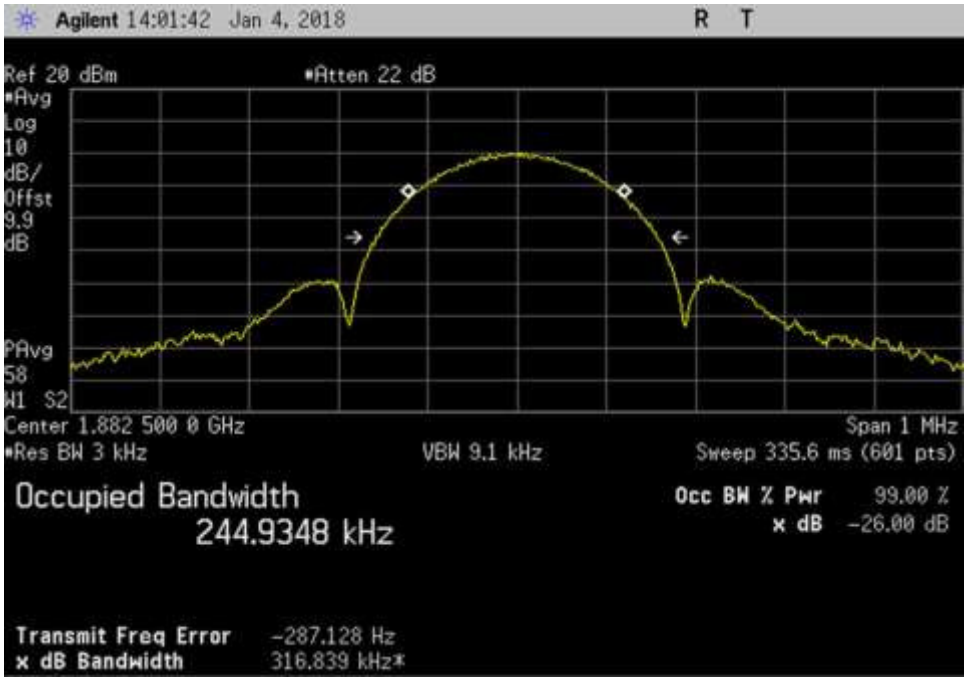


DL_ 1962.5MHz_CDMA

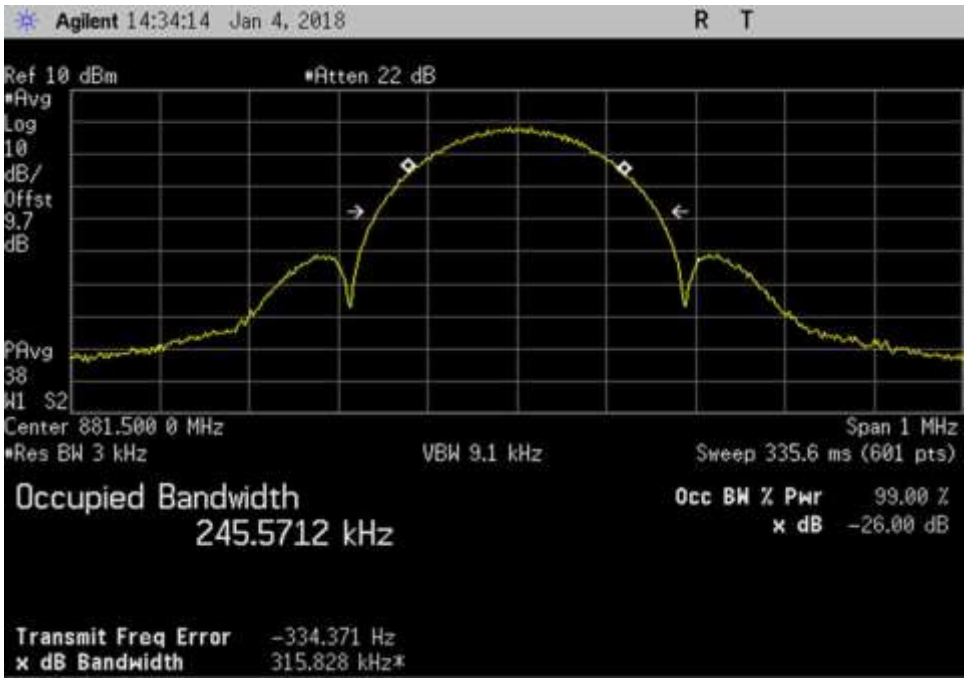
EDGE Output



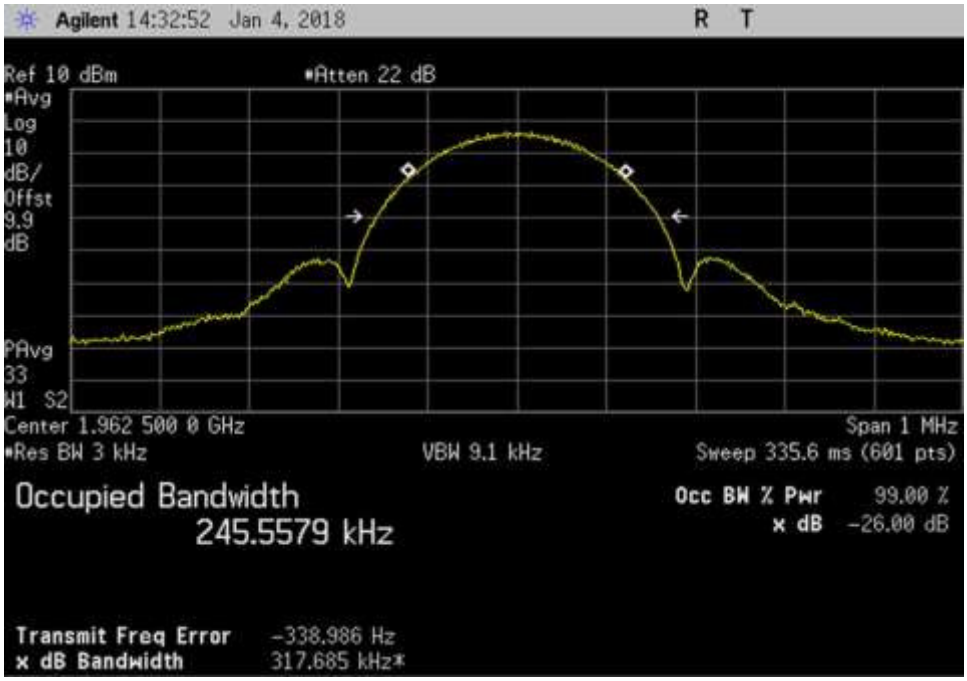
UL_ 836.5MHz_EDGE



UL_ 1882.5MHz_EDGE

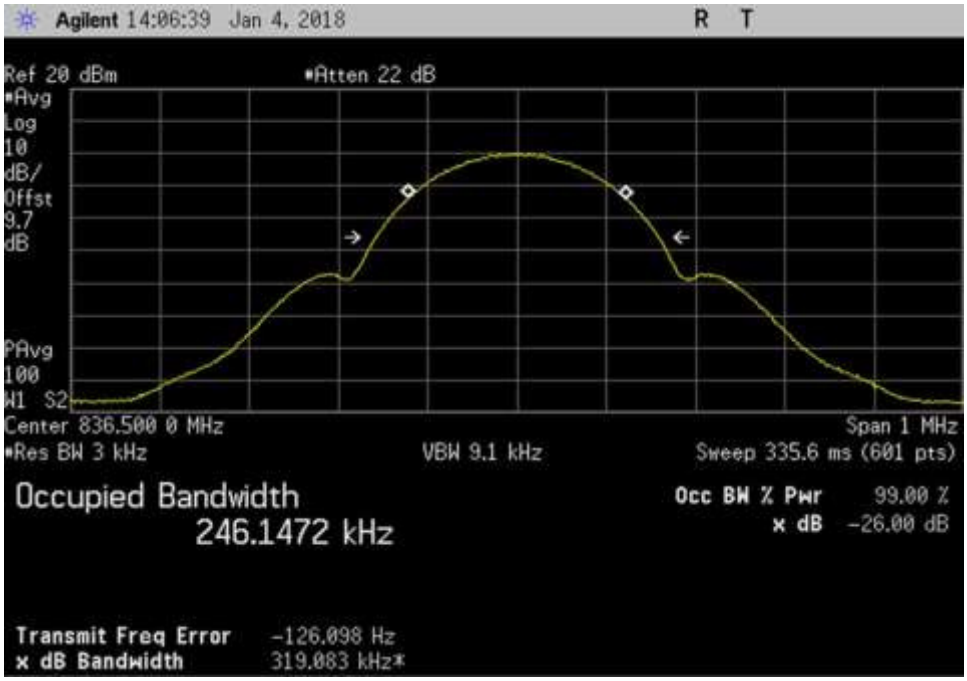


DL_ 881.5MHz_EDGE

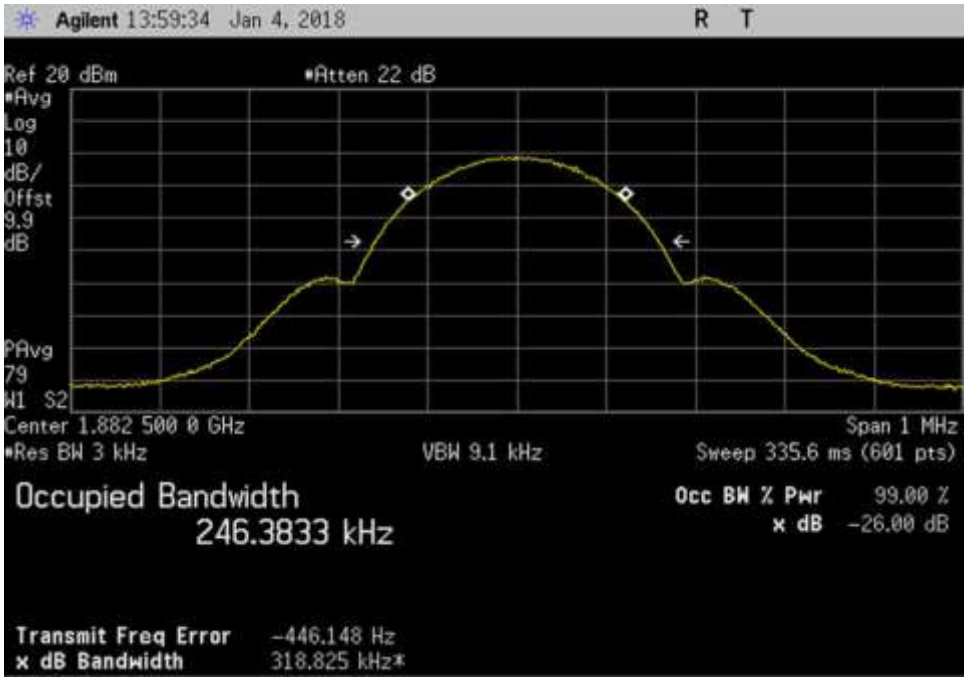


DL_ 1962.5MHz_EDGE

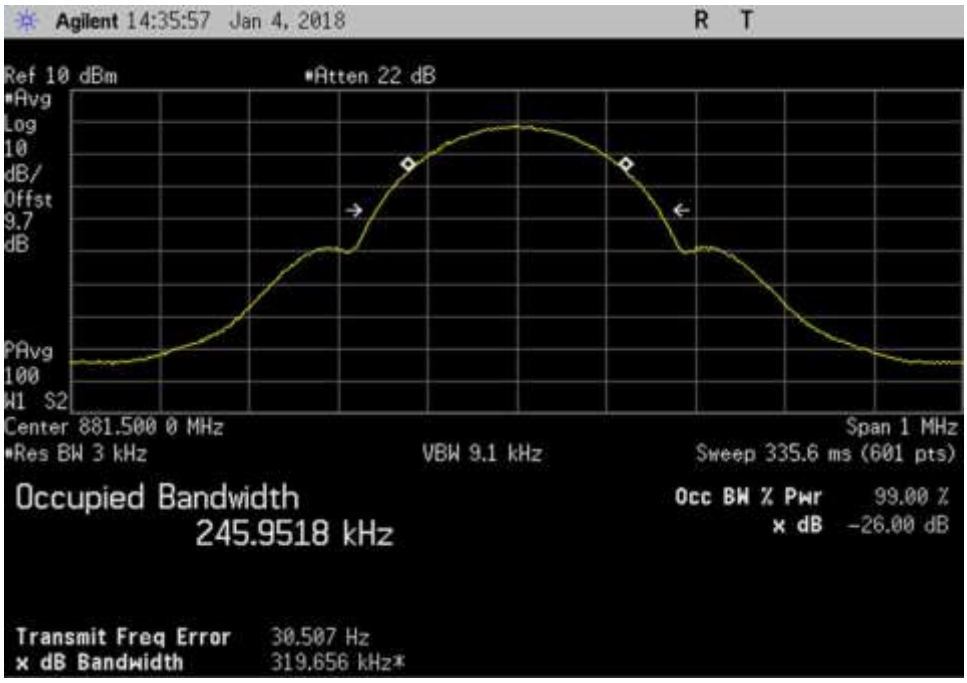
GSM Output



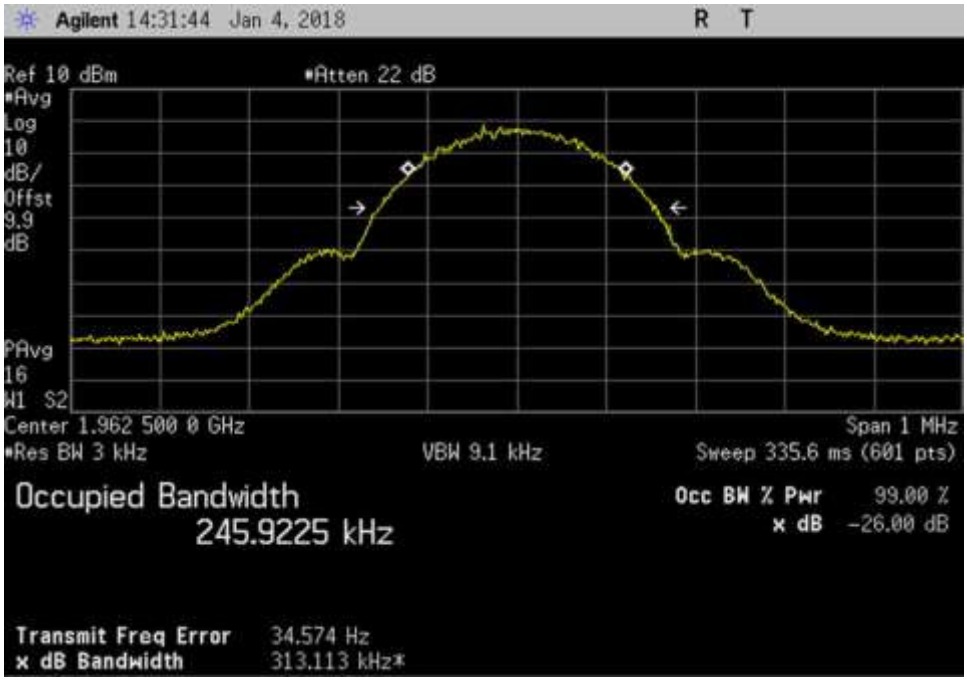
UL_ 836.5MHz_GSM



UL_ 1882.5MHz_GSM

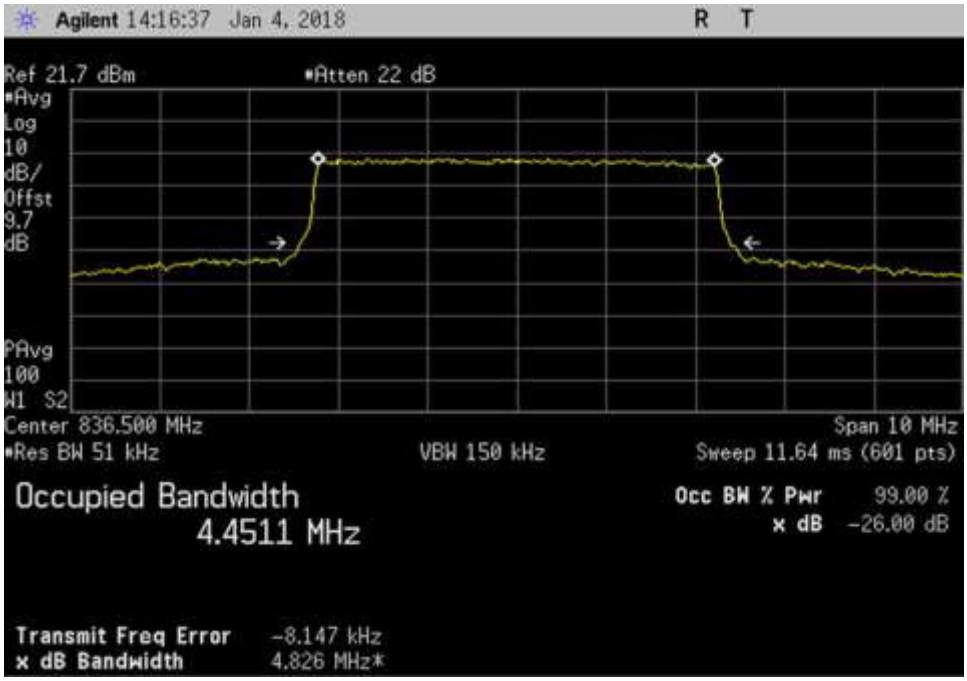


DL_ 881.5MHz_GSM

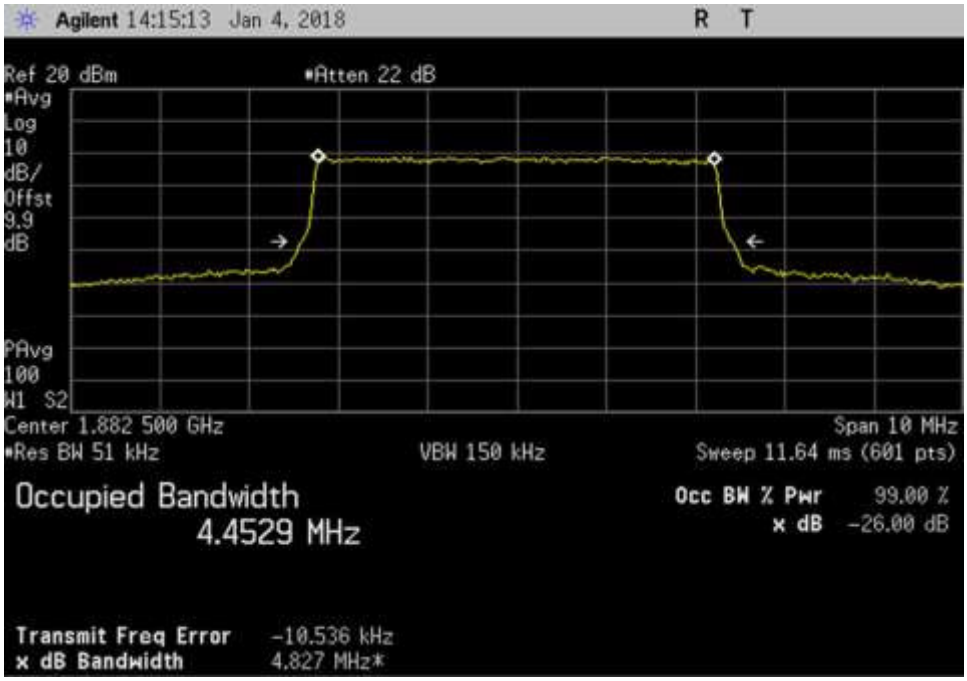


DL_ 1962.5MHz_GSM

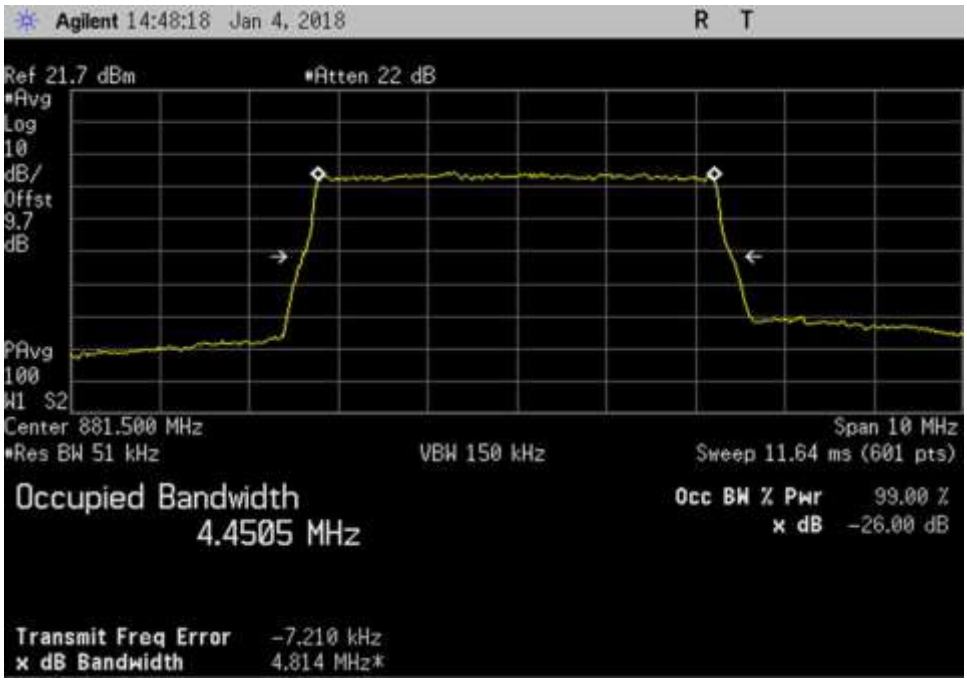
LTE Output



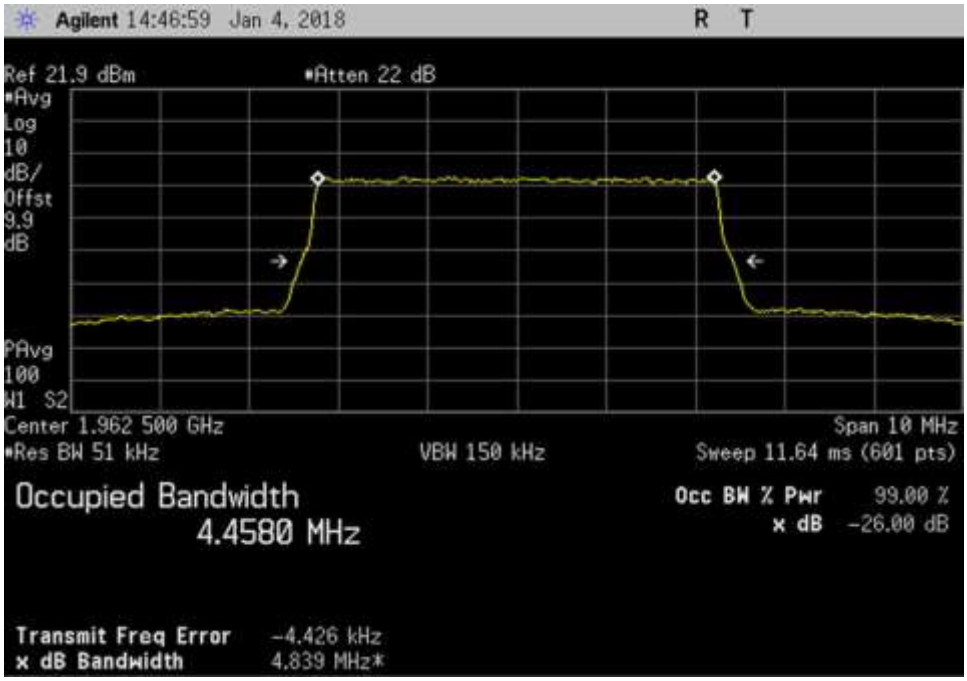
UL_ 836.5MHz_LTE



UL_ 1882.5MHz_LTE

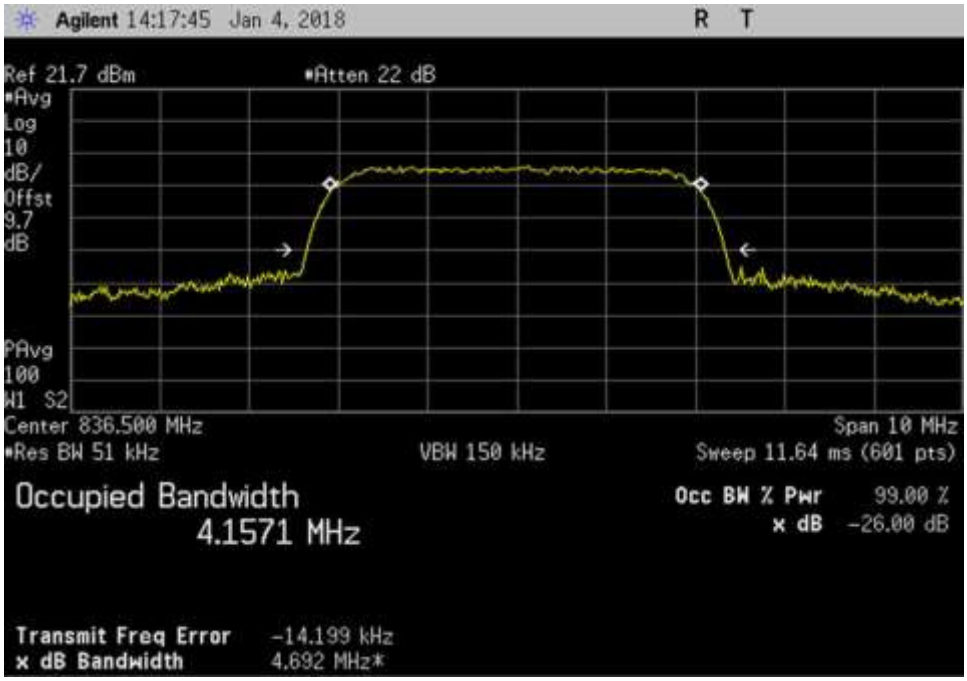


DL_ 881.5MHz_LTE

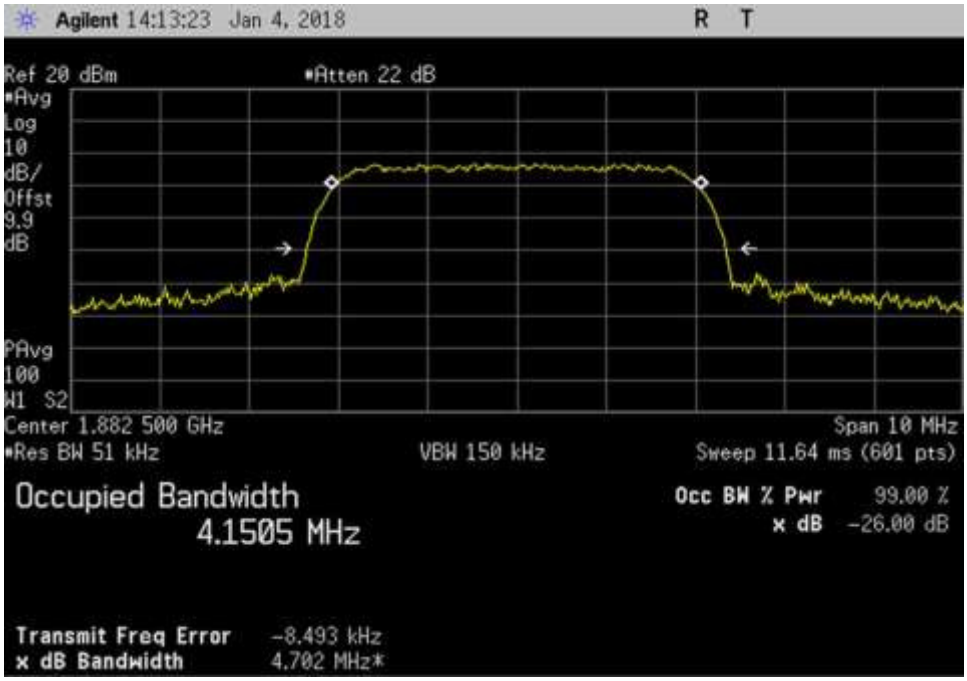


DL_ 1962.5MHz_LTE

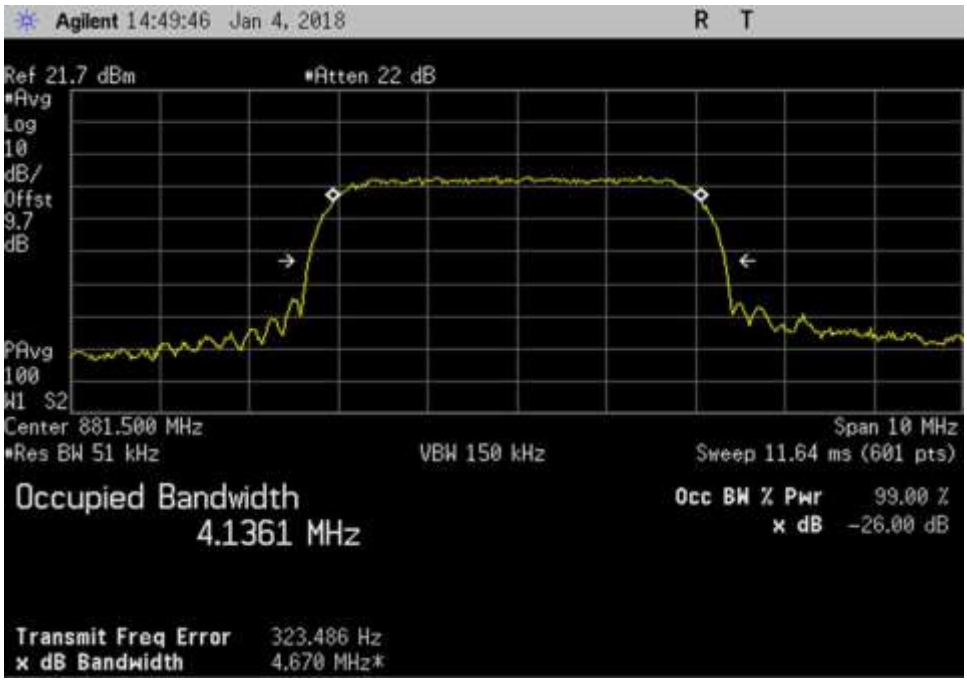
WCDMA Output



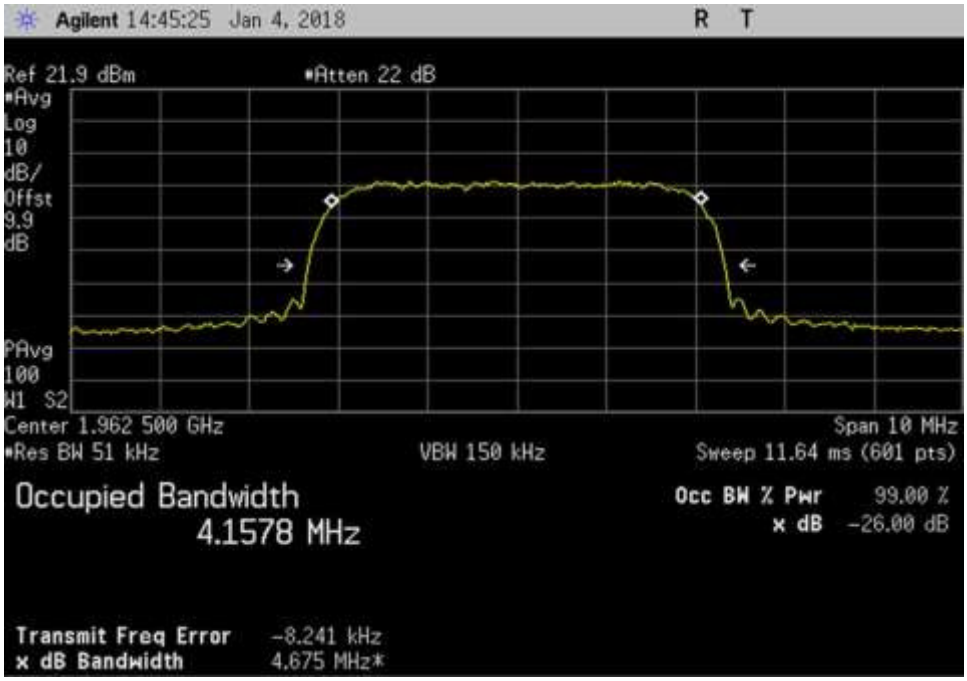
UL_ 836.5MHz_WCDMA



UL_ 1882.5MHz_WCDMA



DL_ 881.5MHz_WCDMA



DL_ 1962.5MHz_WCDMA

7.11 Oscillation Detection

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Place • Brea, CA 92821•		
Customer:	**Huaptec**		
Specification:	**7.11 Anti-Oscillation (Oscillation Restarts / Oscillation mitigation or shutdown)**		
Work Order #:	**100670**	Date:	01/05/2018
Test Type:	**Conducted Emissions**	Time:	08:42:00
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		110V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Note:
- +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	Model	Calibration Date	Cal Due Date
02869	Spectrum Analyzer	E4440A	8/1/2017	8/1/2018
02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
03430	Attenuator	75A-10-12	12/19/2017	12/19/2019
C00082	Directional Coupler	722-10-1.500V	9/18/2017	9/18/2019
P06662	Cable	PHASEFLEX EJR01N01024.0	4/5/2016	4/5/2018
P06660	Cable	PHASEFLEX FJR01N01036.0	4/5/2016	4/5/2018
P07086	Power Divider/Combiner	42000	1/24/2017	1/24/2019
C00121	Step Attenuator, 10 dB	8496B	11/27/2017	11/27/2019
C00122	Step Attenuator	8494B	11/27/2017	11/27/2019
P06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
03412	Band Pass Filter	PE8705	8/16/2017	8/16/2019
03413	Band Pass Filter	PE8706	8/16/2017	8/16/2019
03414	Band Pass Filter	PE8707	8/16/2017	8/16/2019
03415	Band Pass Filter	PE8708	8/16/2017	8/16/2019
P07037	RF Signal Generator	E4432B	10/6/2016	10/6/2018

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**		**Measured**	**Limit**	**Measured**	**Limit**
			Peak Level				
MHz	Sec	Sec	dBm	Sec	At least sec		
UL1850-1915	0.22	0.3	21.7	62	60	3	5
UL824-894	0.24	0.3	22.8	62	60	3	5
DL1930-1995	0.16	1	22.8	62	60	3	5
DL869-894	0.16	1	23.8	62	60	3	5

The booster continues to mitigate at least 1 minute before restarting. The plots demonstrate after 3 restarts (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

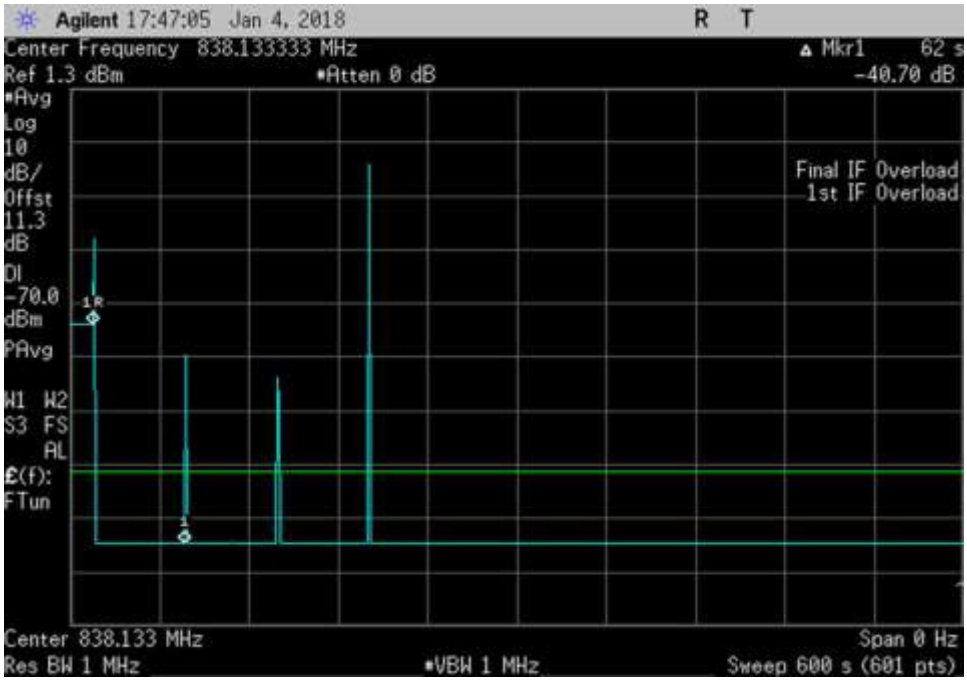
	UL1850-1915	**UL 824-894**	
Max Gain	Pk-Pk	Pk-Pk	Limit
Isolation	Difference	Difference	
dB	dB	dB	dB
+5dB	15.0*	11.2	12
+4dB	19.0*	13.0*	12
+3dB	19.8*	15.0*	12
+2dB	25.0*	19.0*	12
+1dB	60.0*	26.0*	12
0dB	15.0*	**	12
-1dB	**	**	12
-2dB	**	**	12
-3dB	**	**	12
-4dB	**	**	12
-5dB	**	**	12

	DL 1930-1995	DL 869-894	
Max Gain	**Pk-Pk**	**Pk-Pk**	**Limit**
Isolation	**Difference**	**Difference**	
dB	**dB**	**dB**	**dB**
+5dB	12.6*	11.6	12
+4dB	14.0*	14.0*	12
+3dB	17.0*	16.0*	12
+2dB	23.0*	18.0*	12
+1dB	41.0*	25.0*	12
0dB	**	65.0*	12
-1dB	**	**	12
-2dB	**	**	12
-3dB	**	**	12
-4dB	**	**	12
-5dB	**	**	12

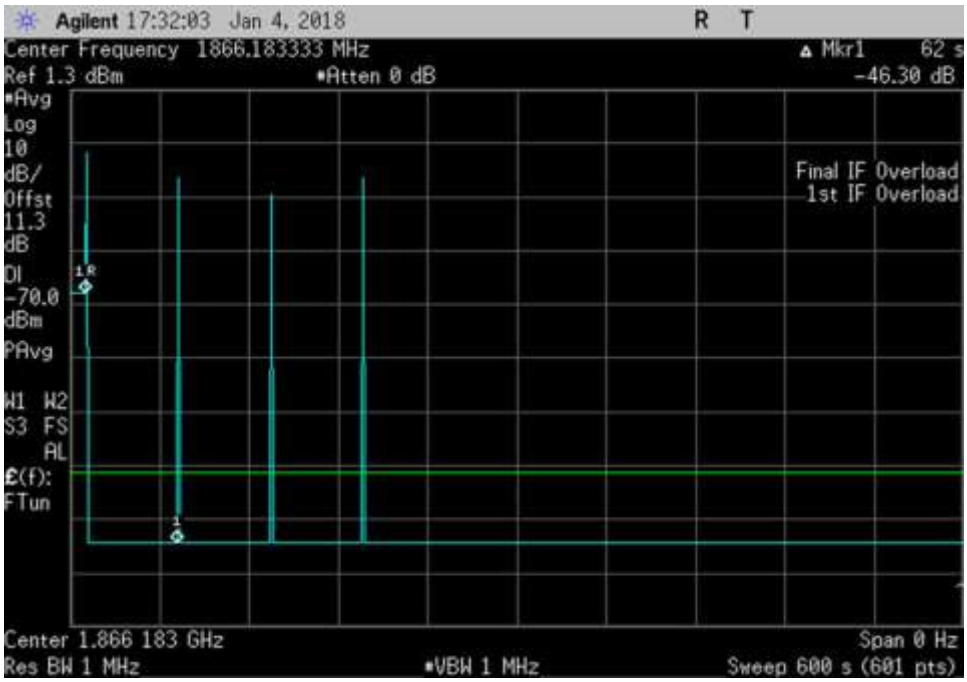
Note:
* The measured difference exceeds the limit for a period of less than 300 second before device mitigates and shuts down. The maximum recorded time prior to shutdown was 182 seconds for the Uplink bands and 96 seconds for the Downlink bands.
** The device shuts down immediately.

7.11.2 Oscillation Restart Tests

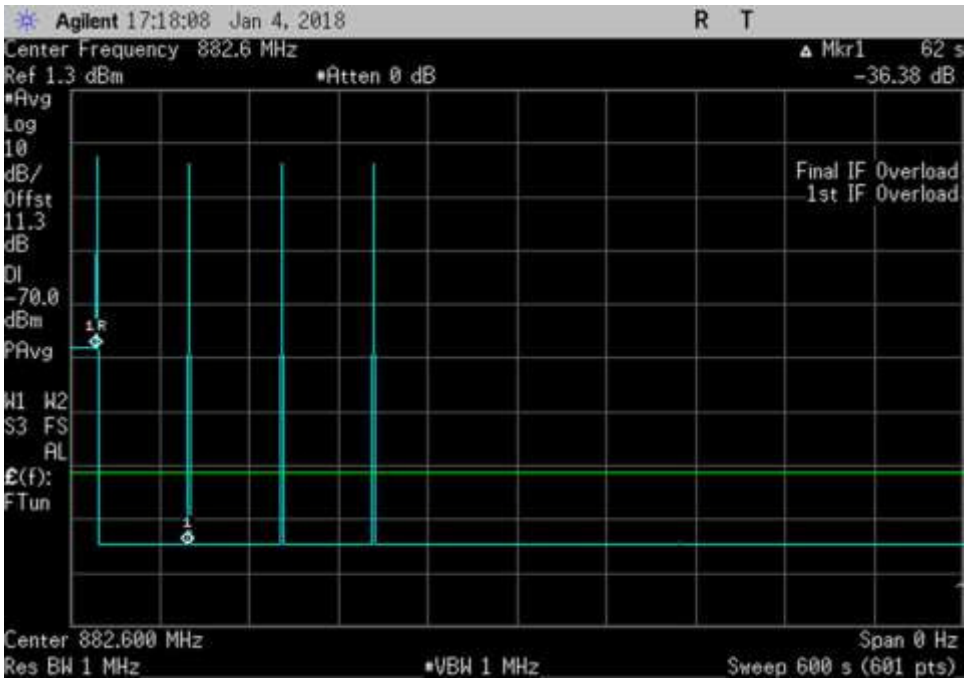
Plots



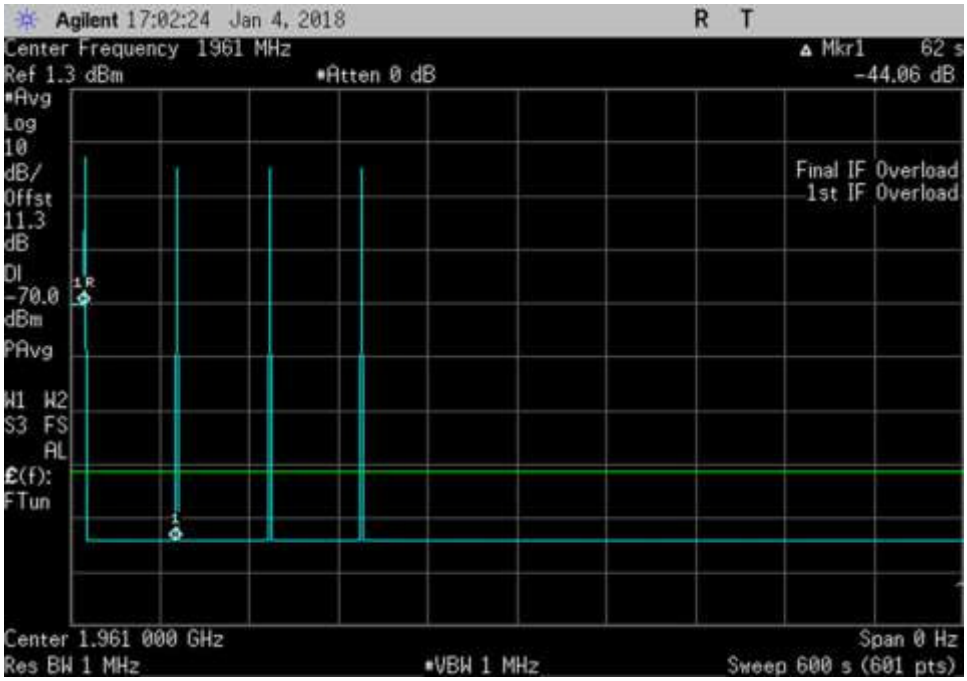
UL_ 838.133333MHz_600sec



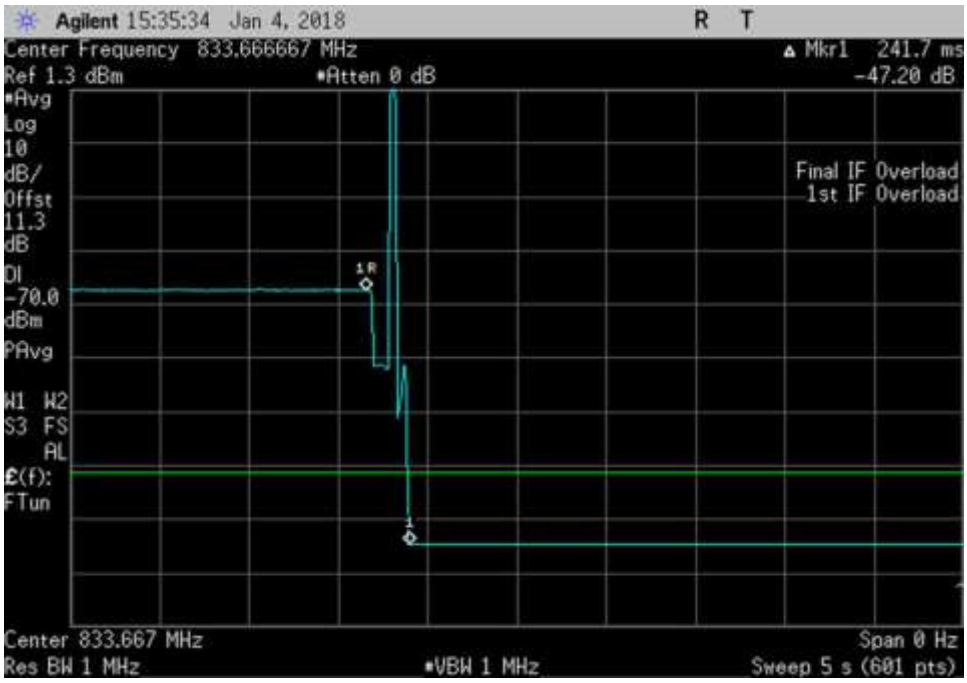
UL_ 1866.183333MHz_600sec



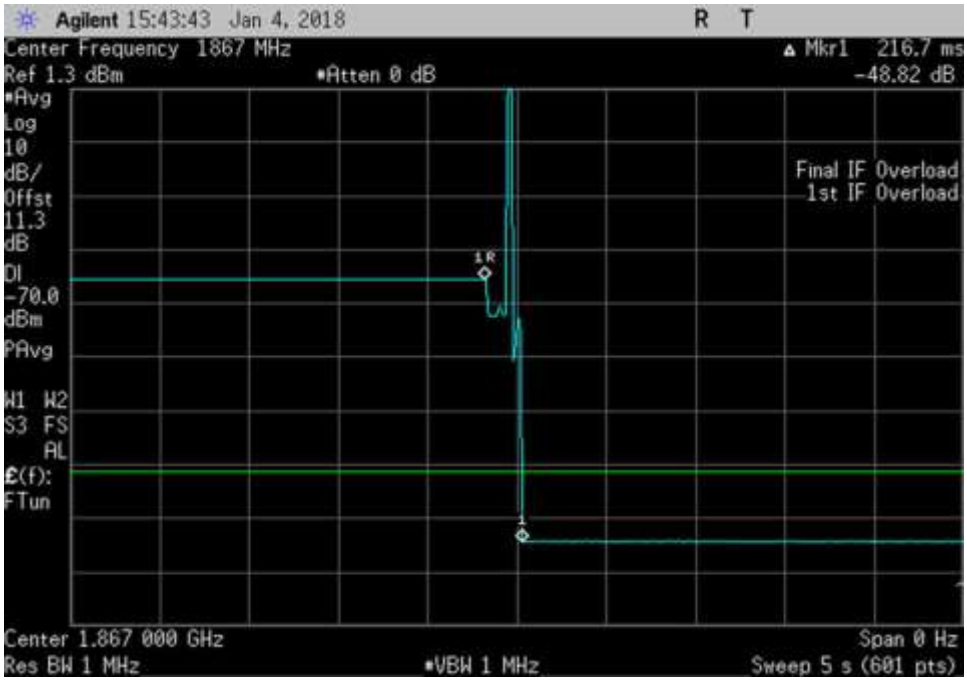
DL_ 882.6MHz_600sec_rev b



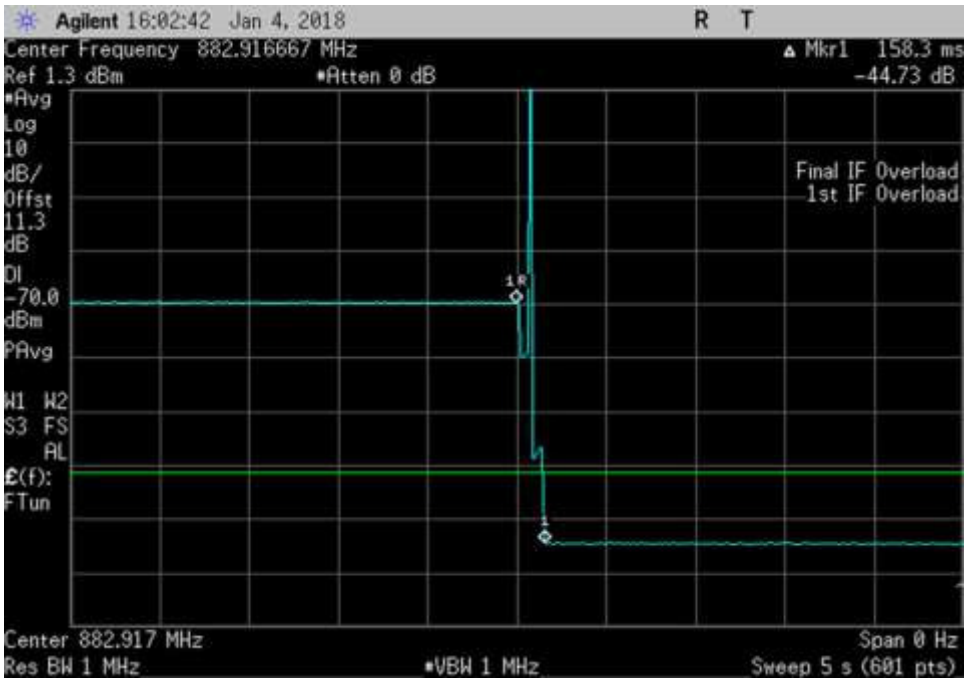
DL_ 1961MHz_600sec



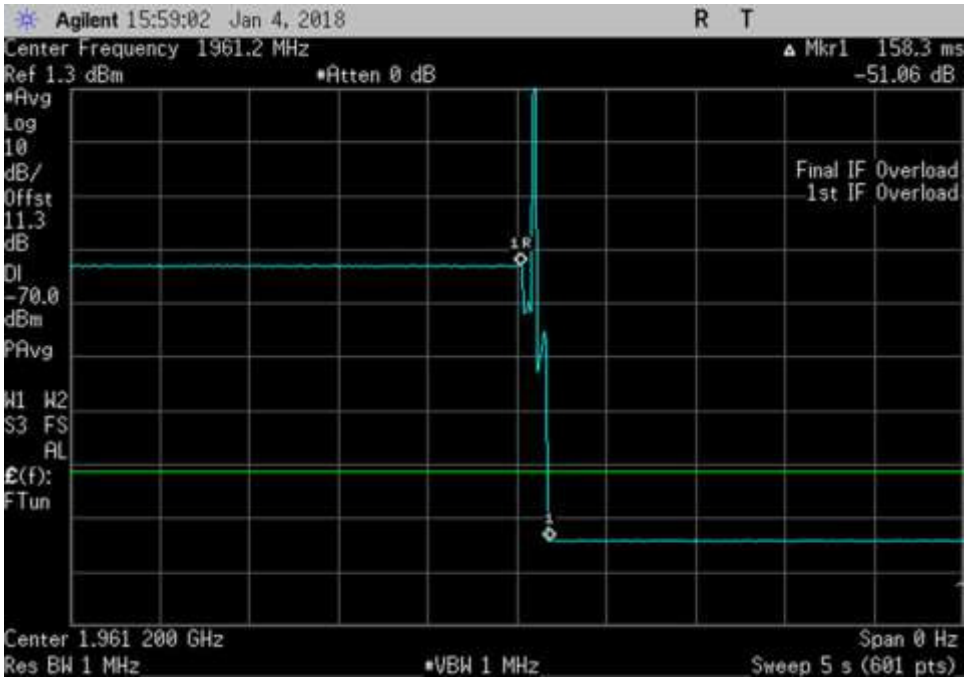
UL_ 833.6MHz_Mitigation time



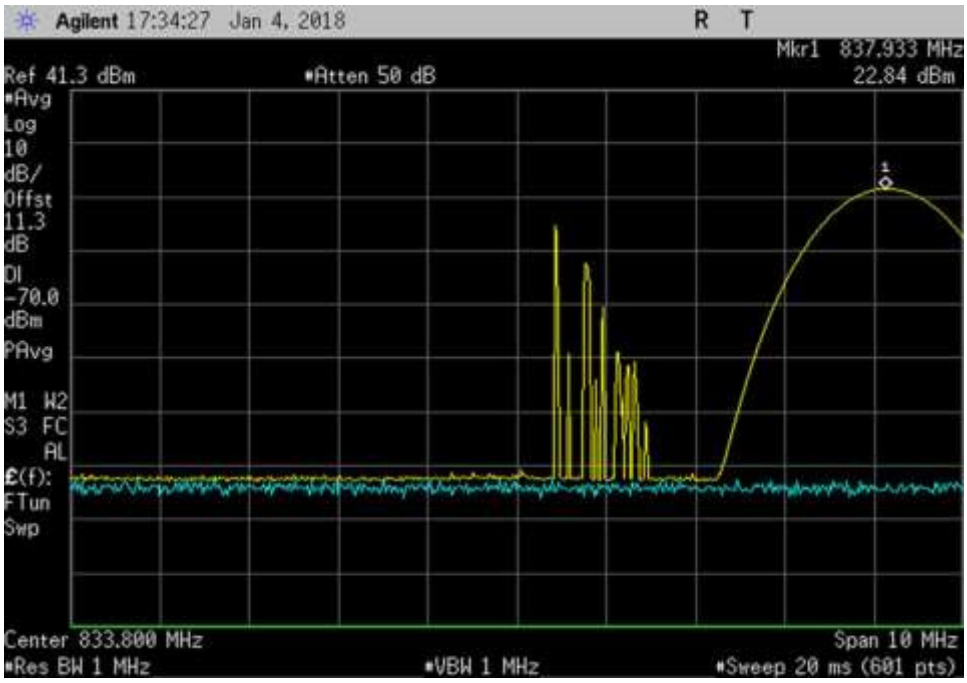
UL_ 1867MHz_Mitigation time



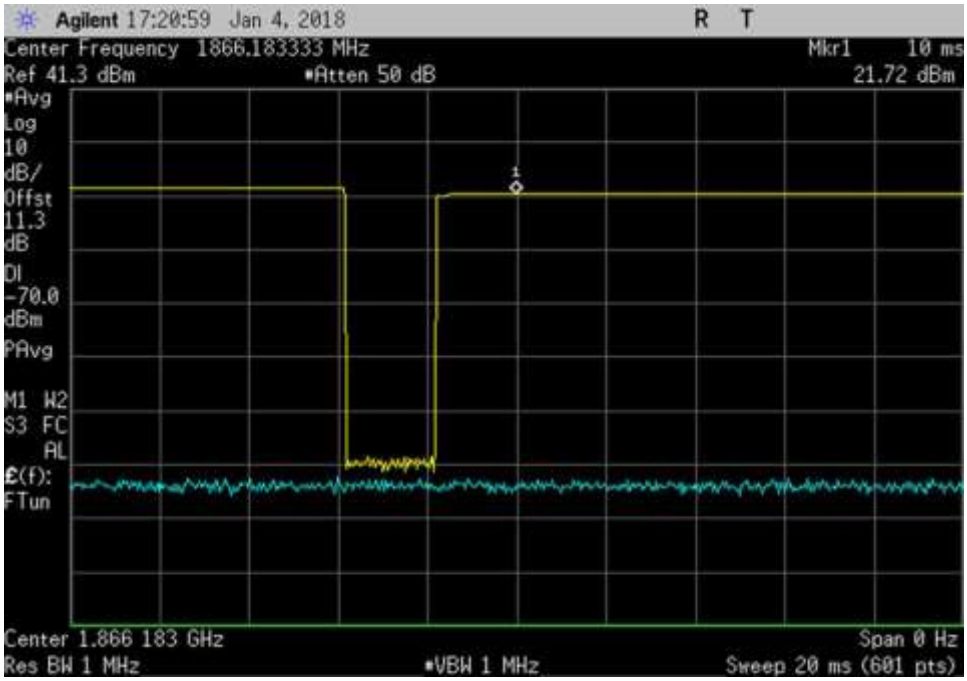
DL_ 882.916667MHz_Mitigation time



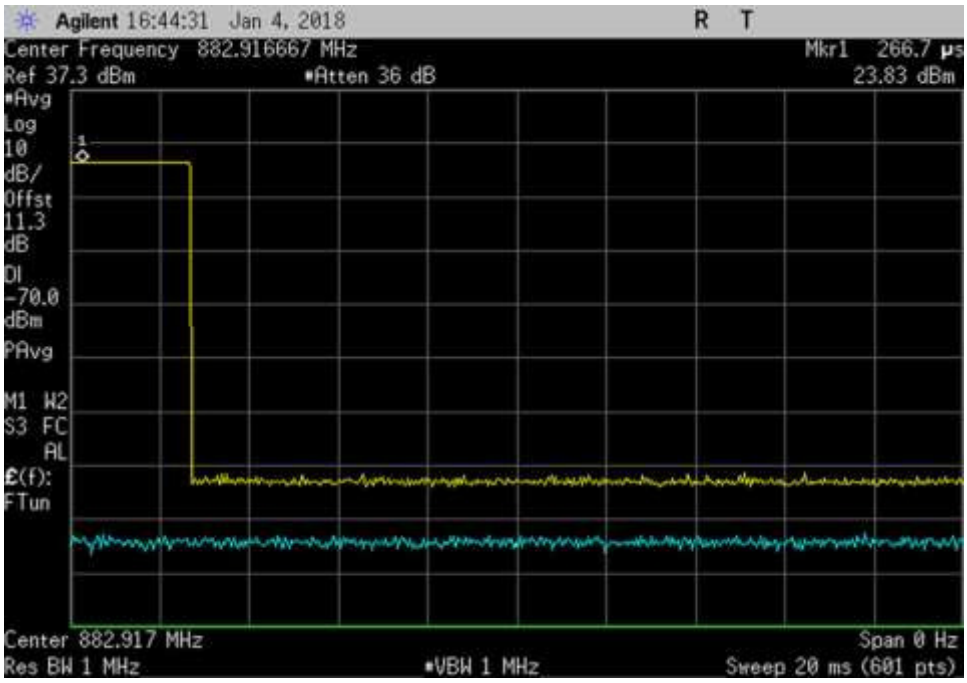
DL_ 1961.2MHz_Mitigation time



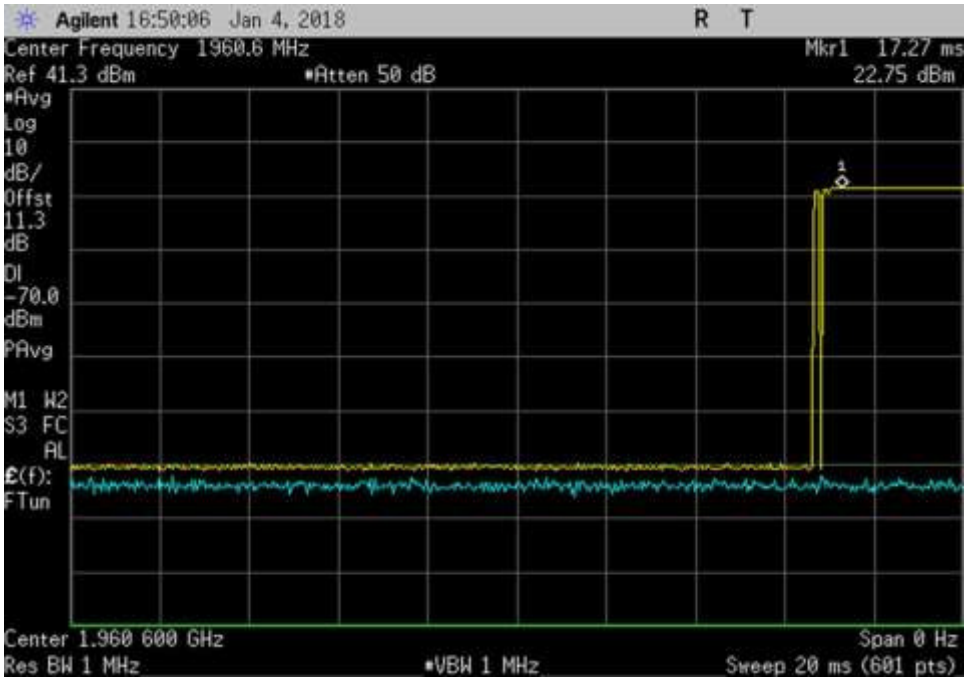
UL_ 833.8MHz_Peak



UL_ 1866.183333MHz_Peak



DL_ 882.916667MHz_Peak



DL_ 1960.6MHz_Peak

7.12 Radiated Spurious Emissions

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92821 • 714 993 6112		
Customer:	**Huaptec**		
Specification:	**7.12 Radiated Emission**		
Work Order #:	**100670**	Date:	1/5/2018
Test Type:	**Radiated Scan**	Time:	13:58:58
Tested By:	E. Wong	Sequence#:	1
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:

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

No emission found within 20 dB of the limit line.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
	AN01995	Biconilog Antenna	CBL6111C	5/10/2016	5/10/2018
	ANP05275	Attenuator	1W	5/5/2016	5/5/2018
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
	AN00309	Preamp	8447D	3/14/2016	3/14/2018
	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
	AN01413	Horn Antenna	84125-80008	10/7/2016	10/7/2018
	AN02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
	AN00786	Preamp	83017A	5/9/2016	5/9/2018
	AN00849	Horn Antenna	3115	3/4/2016	3/4/2018
	ANP06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
	ANP06661	Cable	LDF1-50	5/6/2016	5/6/2018
	AN00314	Loop Antenna	6502	5/20/2016	5/20/2018

Summary of Results

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

Frequency Range of measurement 9kHz –> 22GHz

LIMIT LINE FOR SPURIOUS RADIATED EMISSION

REQUIRED ATTENUATION = 43+10 LOG P (DB)

For radiated spurious emission measured at 3 meter test distance.
Required attenuation = 43+10 Log $P_{t\ at\ 3\ meter}$ dB
Limit line (dBuV) = E_{dBuv} - Attenuation

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

Power Density (Isotropic)

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

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

Field Intensity E (V/m)

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

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

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

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

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 Log P_t = 20 Log E (V/m) + 20 Log 3 – 10 Log 30

10 Log P_t = 20 Log E (V/m) + 9.54 – 14.77

10 Log P_t = 20 Log E (V/m) - 5.23

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

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

10 Log P_t = 20 Log E (uV/m) –125.23

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

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

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

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

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

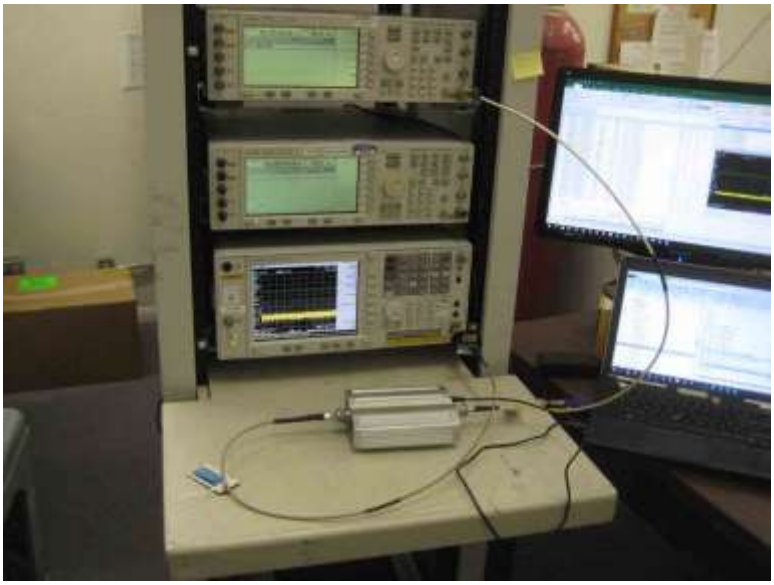
= E_{dBuv} - 20 Log E (uV/m) + 82.23

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

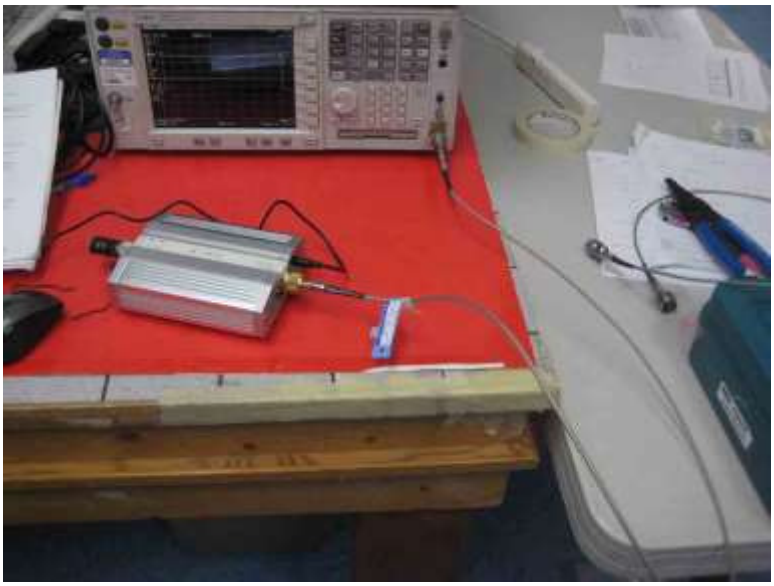
Radiated Emission limit 3 meter = 82.23 dBuV at any power level measured in dBuV

EXHIBIT A: TEST SETUP PHOTOS

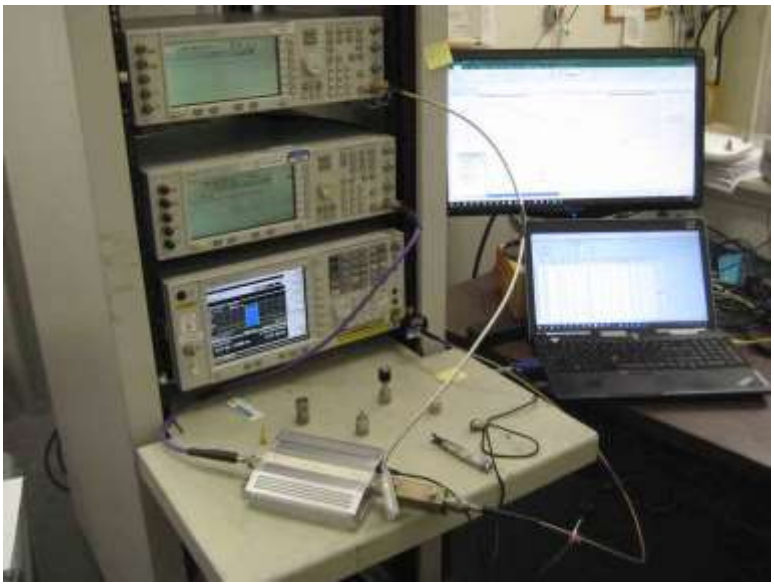
Section 7.1, 7.2, 7.3 and 7.4 Test Setup



Section 7.5, 7.6 and 7.10

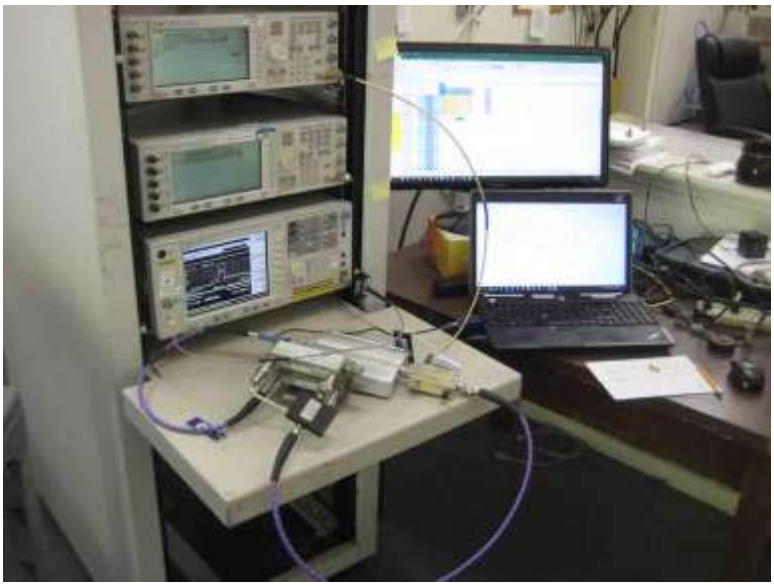


Section 7.7 and 7.8



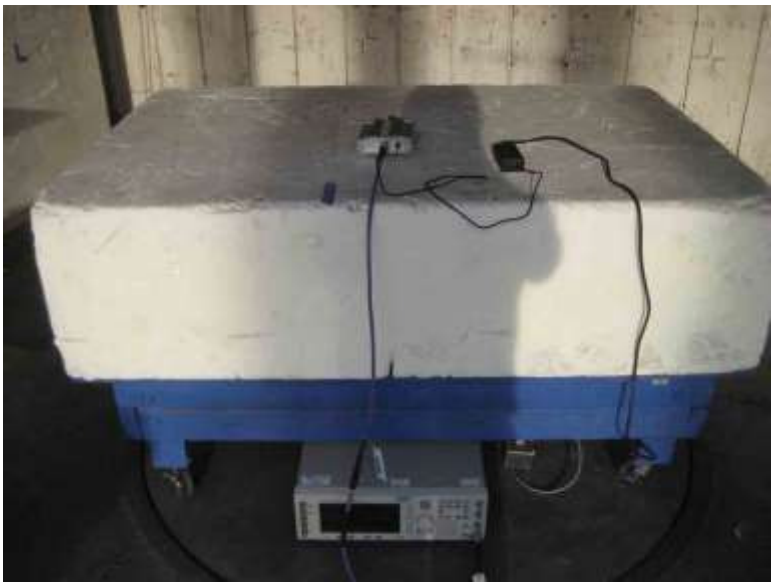
Section 7.9

Section 7.11.2



Section 7.11.3

Section 7.12



Section 7.12

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.