Cellphone-Mate, Inc.

TEST REPORT FOR

Consumer Booster
Model: Fusion4Home

Tested To The Following Standard:

FCC Part 2 / 27

Report No.: 97835-15

Date of issue: December 21, 2015

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:

Cellphone-Mate, Inc.
48346 Milmont Drive
Fremont, CA 94538

REPRESENTATIVE: Dennis Findley
Customer Reference Number: CKC20151106

REPORT PREPARED BY:

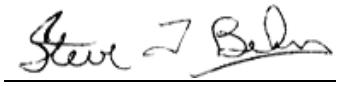
Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 97835

DATE OF EQUIPMENT RECEIPT: December 14, 2015
DATE(S) OF TESTING: December 14-17, 2015

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.
1120 Fulton Place
Fremont, CA 94539

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.02.00
EMITest Immunity	5.02.00

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Fremont	US0082	SL2-IN-E-1148R	3082B-1	958979	A-0149

SUMMARY OF RESULTS

Standard / Specification: FCC Part 2/27

KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance v03, June 5, 2015		FCC Part Section Correlation		Mods	Results
Guidance Sec #	**Guidance Description**	**FCC Sec #**	**FCC Rule Description**		
7.1 a) - k)	Authorized Frequency Band Verification Test	20.21(e)(3)	Frequency Bands	NA	NA[1]
7.2.2 a) - k)	Maximum Power Measurement Procedure	2.1046/20.21(e)(8)(i)(D)	Power Limit	NA	NA[1]
7.3 a) - d)	Maximum Booster Gain Computation	20.21(e)(8)(i)(B)	Bidirectional Capabilities	NA	NA[1]
7.4 a) - n)	Intermodulation Product	20.21(e)(8)(i)(F)	Intermodulation Limit	NA	NA[1]
7.5 a) - n)	Out of Band Emissions	20.21(e)(8)(i)(E)	Out of Band Emission	NA	NA[1]
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	NA[1]
7.8 a) - l)	Uplink inactivity	20.21(e)(8)(i)(I)	Uplink Inactivity	NA	NA[1]

NA = Not Applicable

NA[1] = A different standard applies; see applicable test report.

Standard / Specification: FCC Part 2/27 - continued

KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance v03, June 5, 2015		FCC Part Section Correlation		Mods	Results
Guidance Sec #	**Guidance Description**	**FCC Sec #**	**FCC Rule Description**		
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	NA[1]
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	NA[1]
7.12a) - f)	Radiated Spurious Emission	2.1053/ 22/24/27	Spurious Emission	NA	Pass
7.13 a) - c)	Spectrum Block Filter[2]	NA[1]	NA[1]	NA	NA[1]

NA = Not Applicable

NA[1] = A different standard applies; see applicable test report.

Modifications During Testing

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

Summary of Conditions
No modifications were made during testing.

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
On the Outside (Donor) antenna port, which is a 75 ohm impedance port, an impedance matching pad is used. Readings are compensated by adding the additional loss on the Spectrum Analyzer. On the Inside (Server) antenna port, which is a 50 ohm impedance port, readings are taken using injection signals compensated. The level of these signals is corrected by adding the additional loss due to the usage of the impedance matching pad to create equivalent power/RSSI at the Donor antenna port.

EQUIPMENT UNDER TEST (EUT)

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
Consumer Booster	Cellphone-Mate, Inc.	Fusion4Home	01
AC/DC Power Adapter	SureCall	GFP181U-0628B-1	1409-0000765

Support Equipment:

Device	Manufacturer	Model #	S/N
Signal Generator	Agilent	E4433B	US40052164
Signal Generator	Agilent	E4438C	MY42082260

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Consumer Booster	Cellphone-Mate, Inc.	Fusion4Home	01
AC/DC Power Adapter	SureCall	GFP181U-0628B-1	1409-0000765

Support Equipment:

Device	Manufacturer	Model #	S/N
Signal Generator	Agilent	E4433B	US40052164
Signal Generator	Agilent	E4438C	MY42082260
Signal Generator	Marconi	2022D	1191941005
Signal Generator	Marconi	2026	112247/015

FCC PART(S) 2 / 27

2.1049 Occupied Bandwidth

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**		
Work Order #:	**97835**	Date:	12/14/2015
Test Type:	**Conducted Emissions**	Time:	10:04:44
Tested By:	Daniel Bertran	Sequence#:	1
Software:	EMITest 5.02.00		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

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.

Part 27
UL: 1710-1755MHz, 698-716MHz, 776-787MHz
DL: 2110-2155MHz, 728-746MHz, 746-757MHz

Test environment conditions: Temperature: 20°C, Relative Humidity: 40%, Pressure: 102kPa

Test procedure:
The test was performed in accordance with section 7.10 of the FCC document: 935210 D03 Wideband Consumer Signal Booster Measurement Guidance v03 Dated June 5, 2015
Firmware: V2.0

Test Equipment:

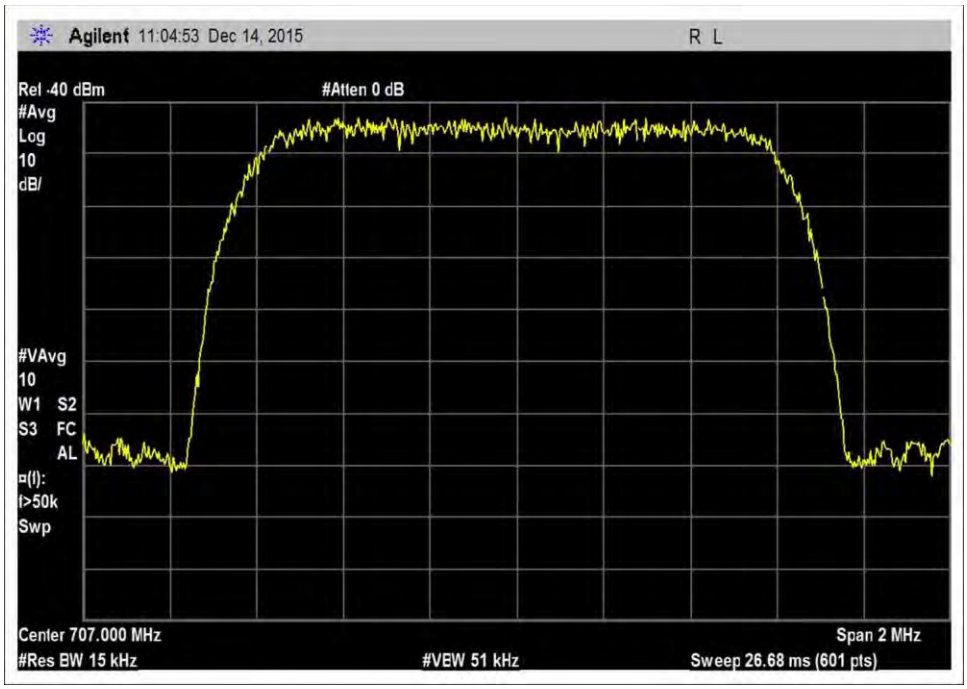
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP06709	Cable	32026-29094K-29094K-72TC	9/18/2014	9/18/2016
	ANP06710	Cable	32026-29094K-29094K-72TC	9/18/2014	9/18/2016
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017
	ANP06467	Attenuator	PE7014-10	5/13/2015	5/13/2017
	ANP06239	Attenuator	54A-10	7/9/2014	7/9/2016

Summary of Results

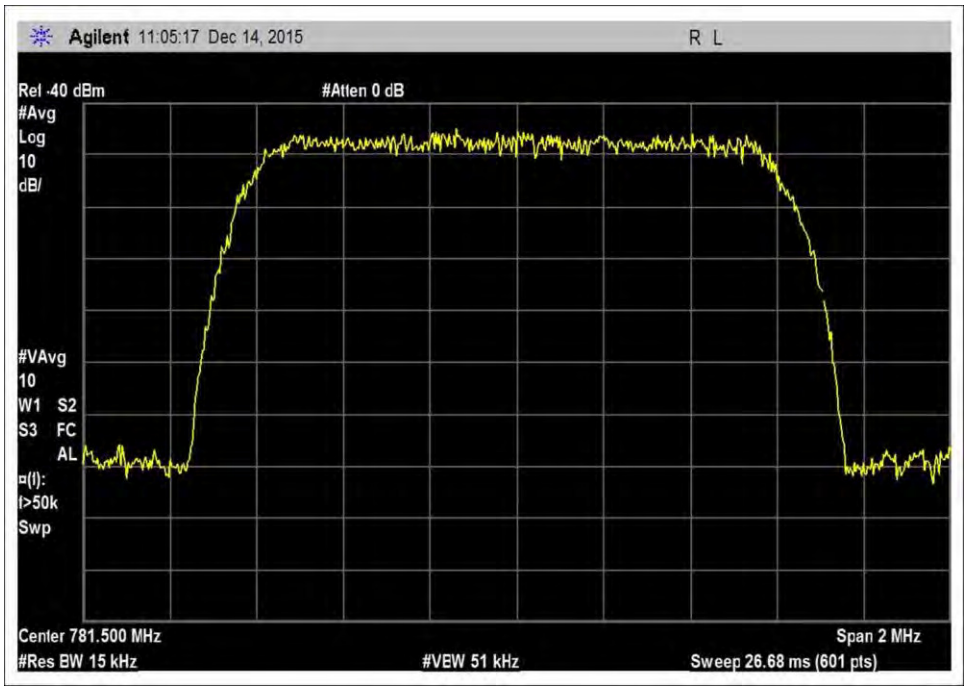
Pass: As summarized in plots below, the uniformity of the output signal relative to the input signal are practically identical. Therefore, the comparison is within limits.

Plots

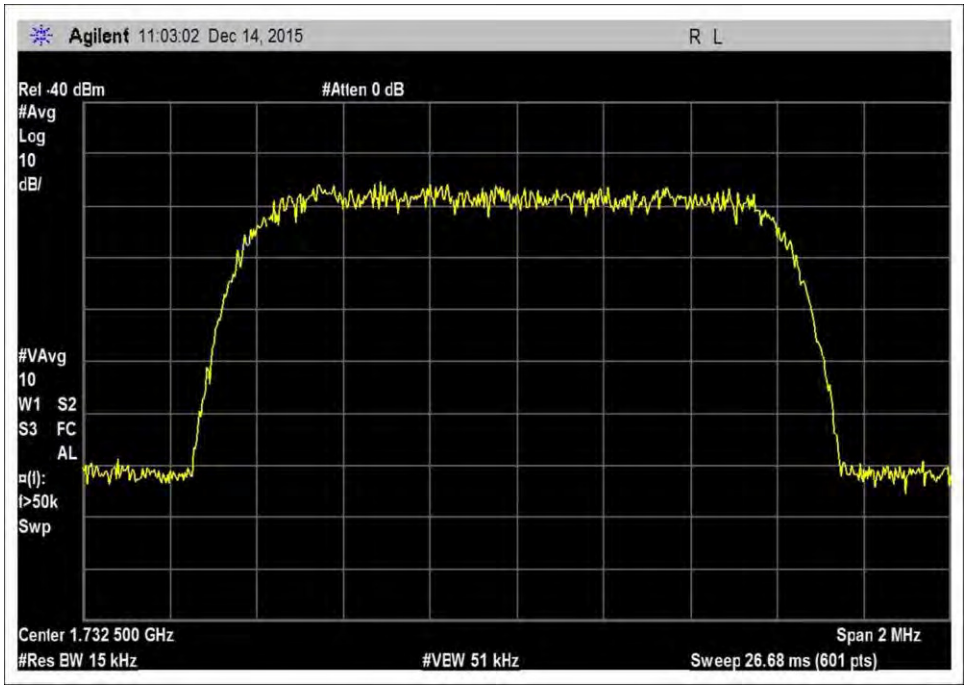
Input – CDMA



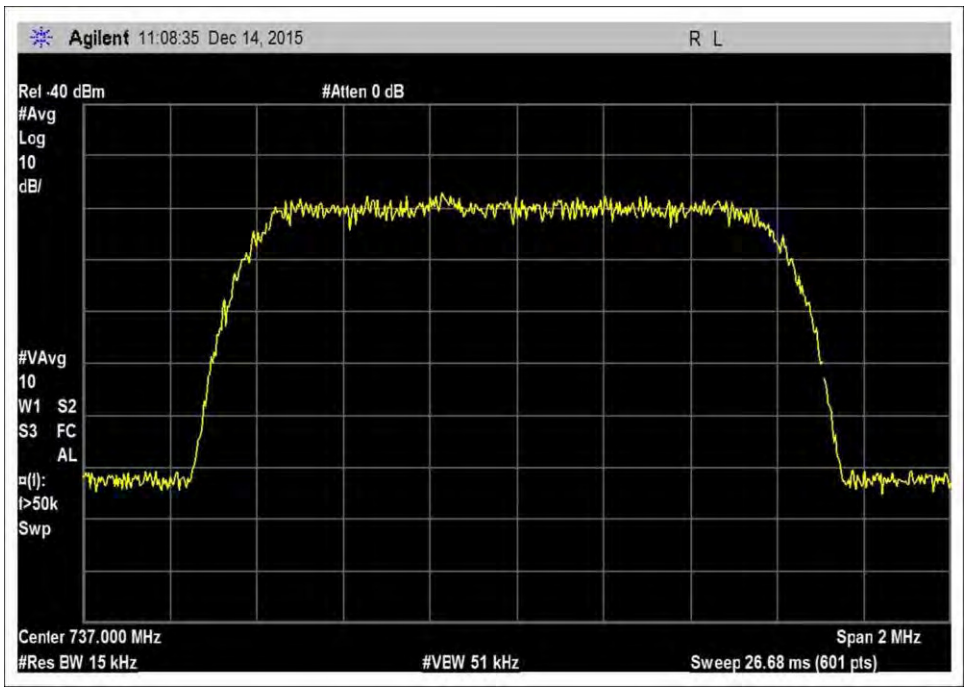
7.10_OBW_UL_698-716MHz_CDMA



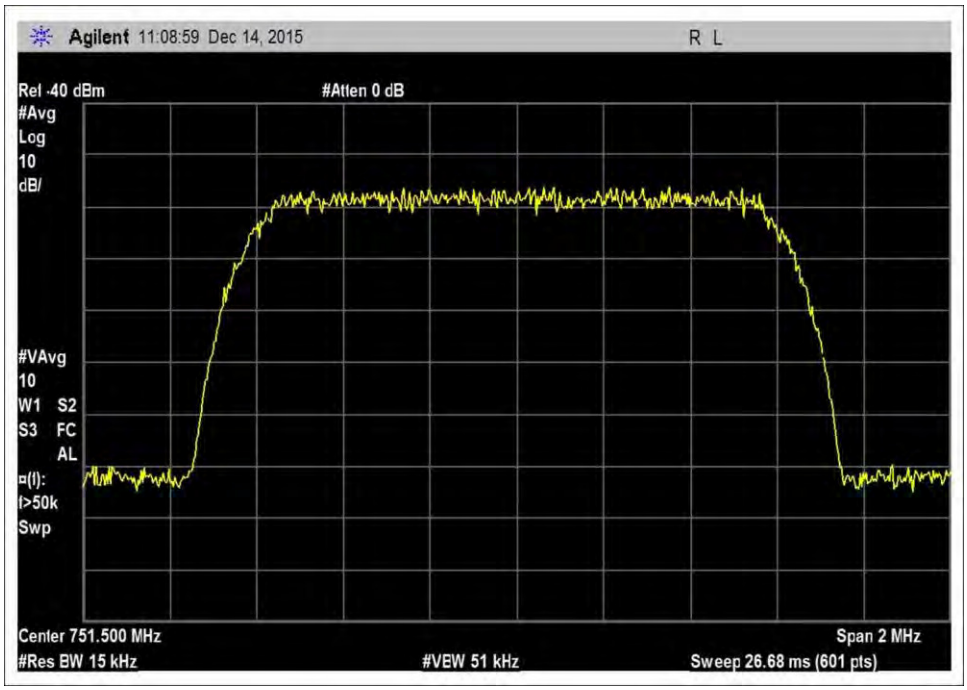
7.10_OBW_UL_776-787MHz_CDMA



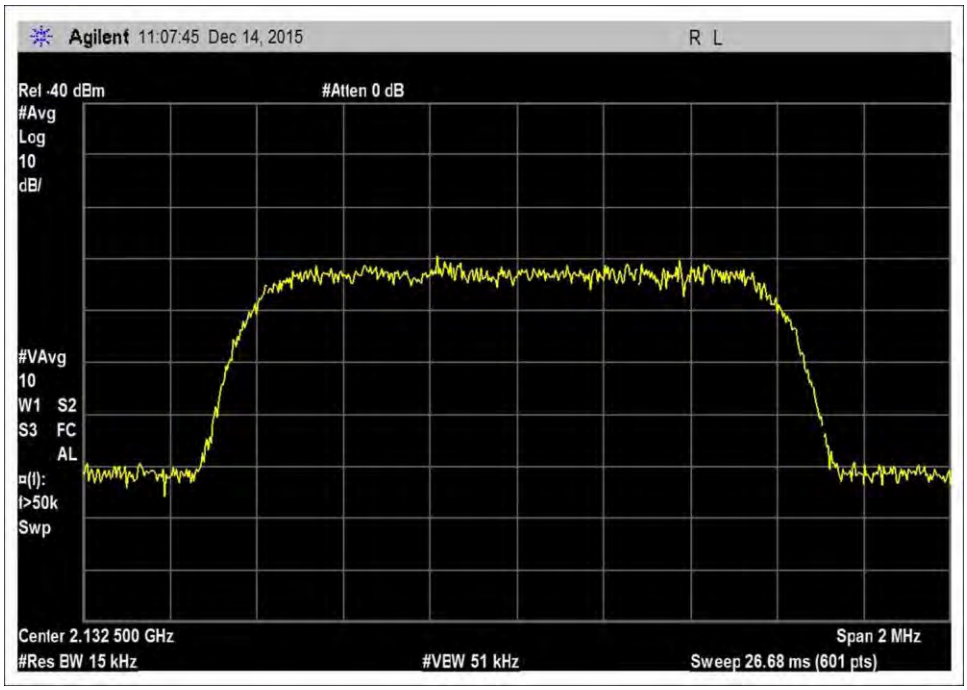
7.10_OBW_UL_1710-1755MHz_CDMA



7.10_OBW_DL_728-746MHz_CDMA

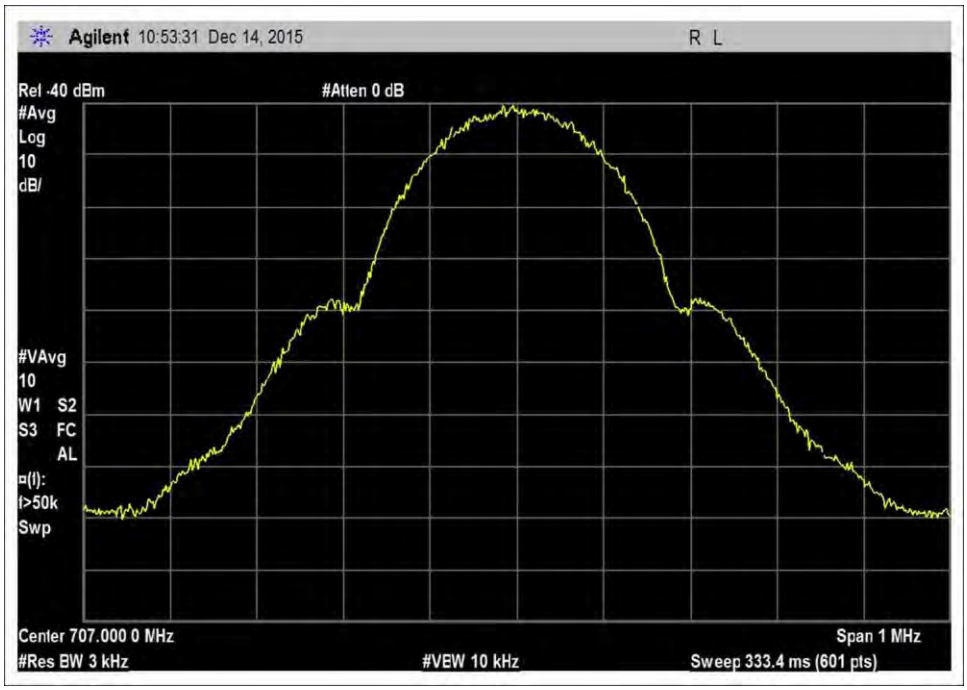


7.10_OBW_DL_746-757MHz_CDMA

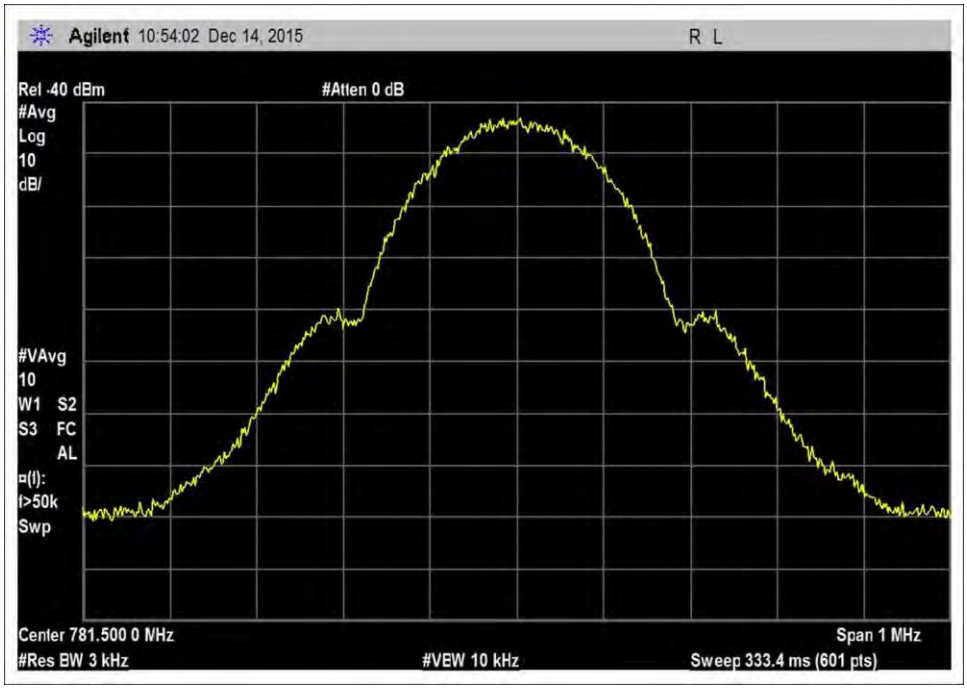


7.10_OBW_DL_2110-2155MHz_CDMA

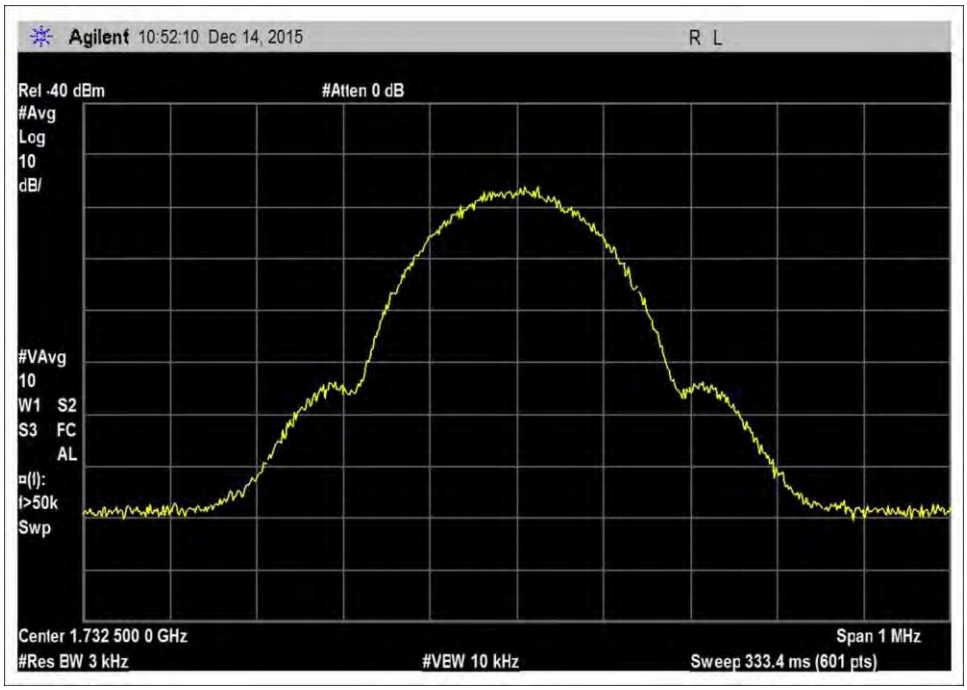
Input - GSM



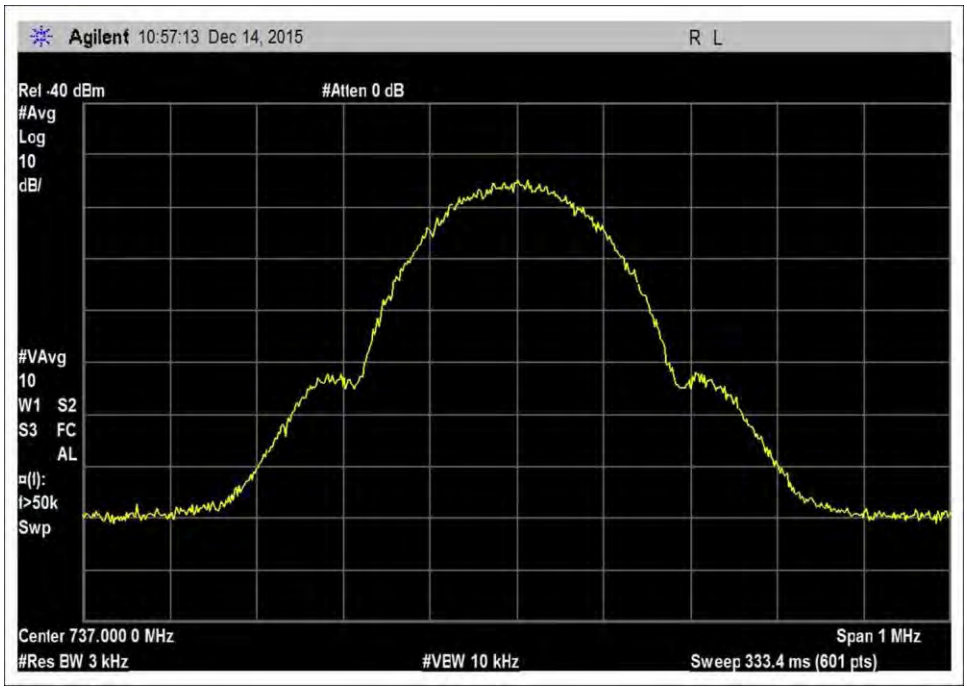
7.10_OBW_UL_698-716MHz_GSM



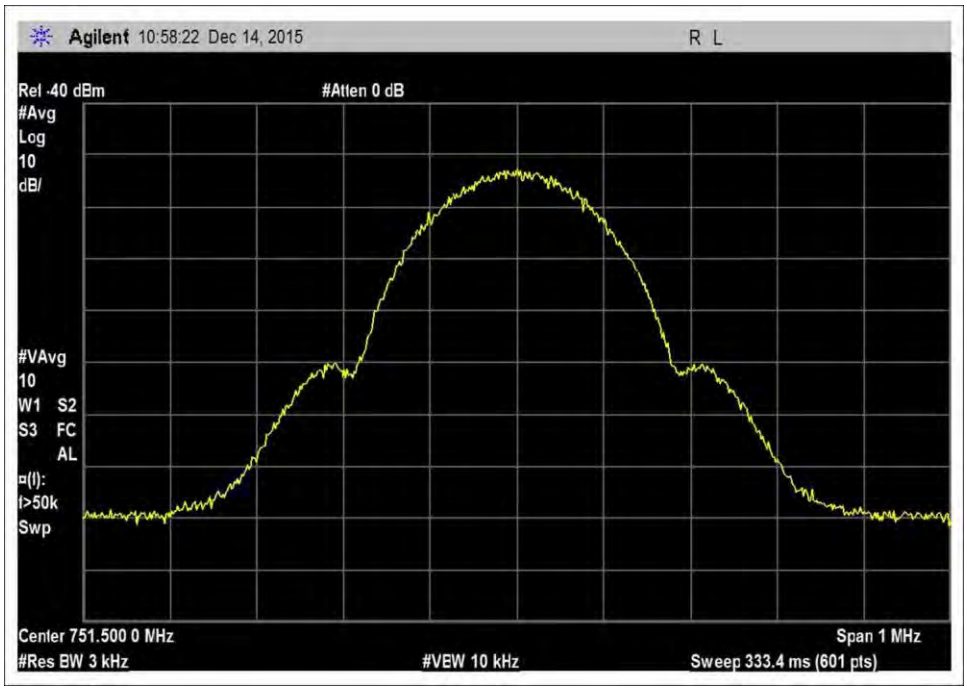
7.10_OBW_UL_776-787MHz_GSM



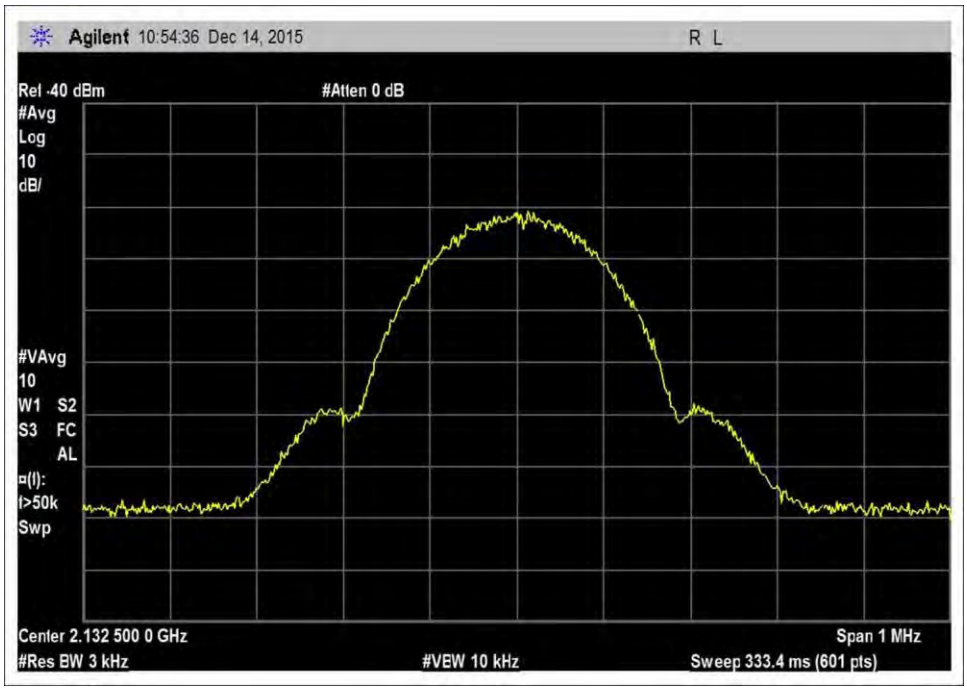
7.10_OBW_UL_1710-1755MHz_GSM



7.10_OBW_DL_728-746MHz_GSM

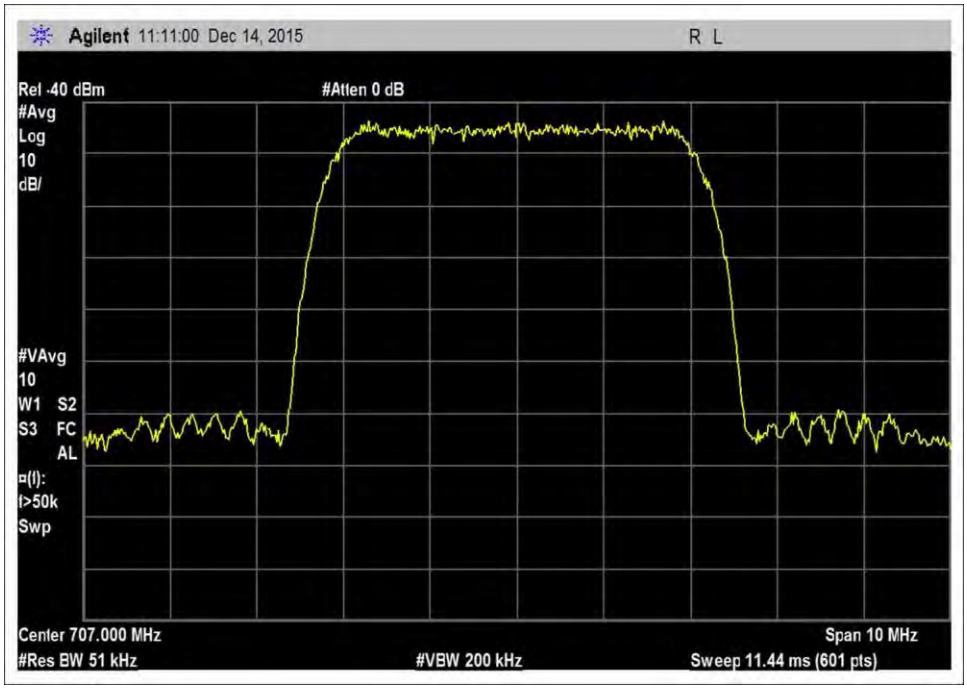


7.10_OBW_DL_746-757MHz_GSM

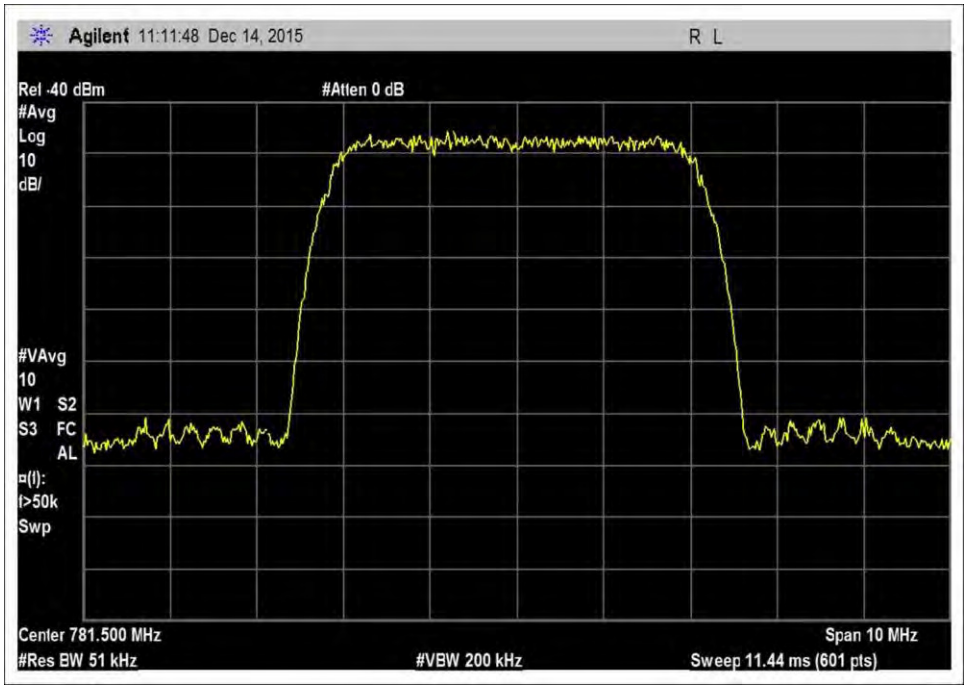


7.10_OBW_DL_2110-2155MHz_GSM

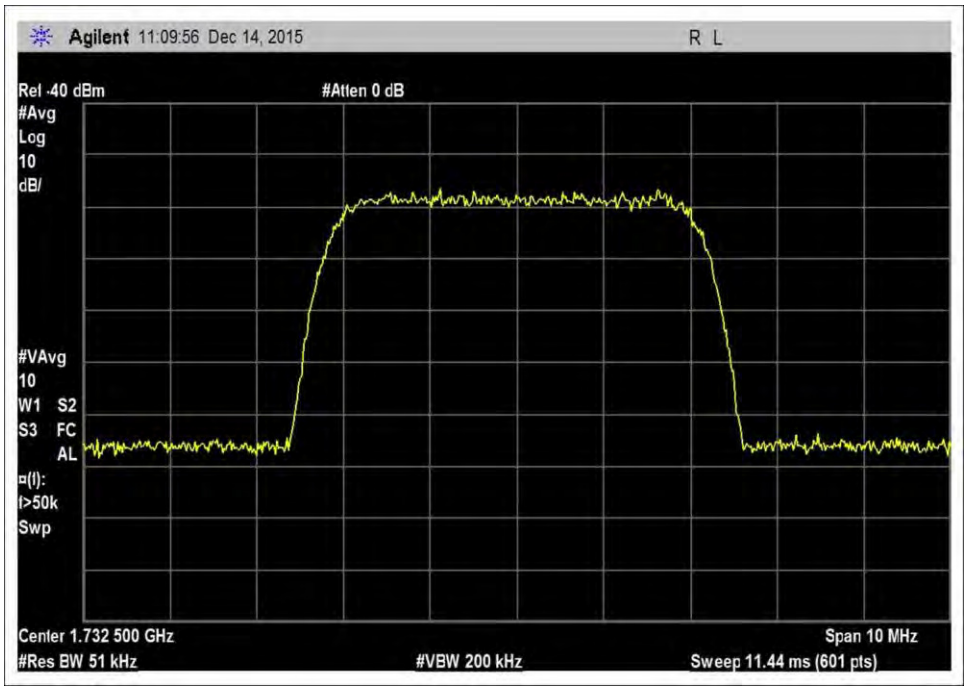
Input – WCDMA



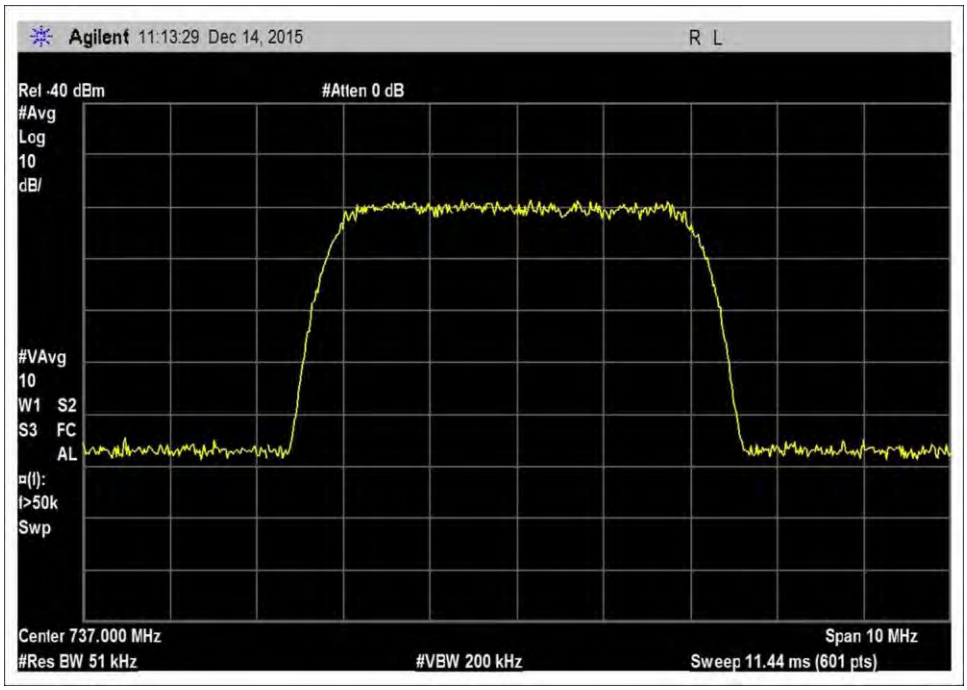
7.10_OBW_UL_698-716MHz_WCDMA



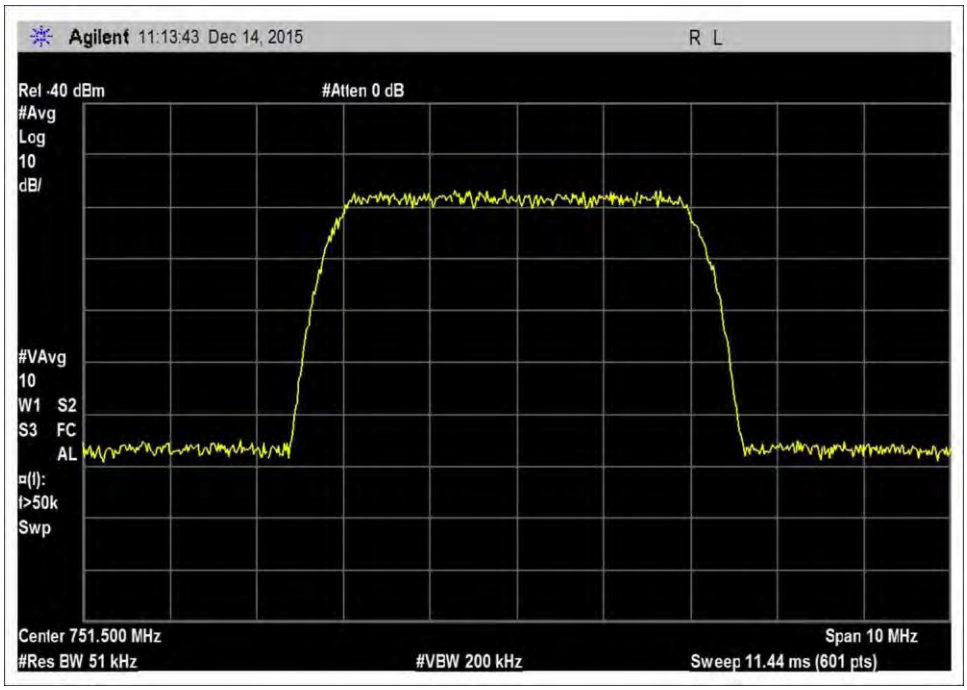
7.10_OBW_UL_776-787MHz_WCDMA



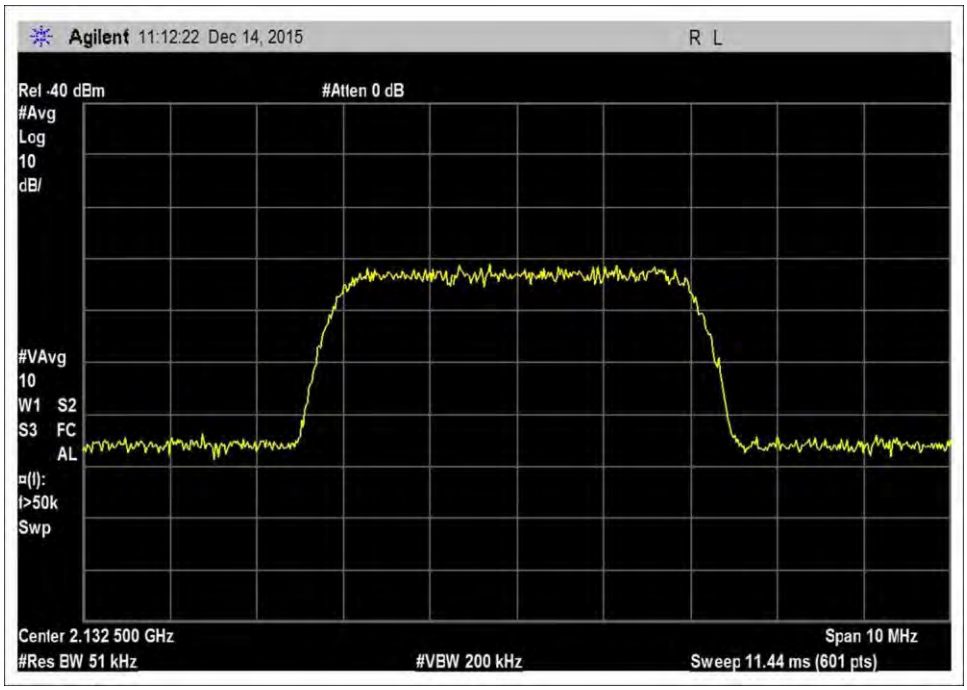
7.10_OBW_UL_1710-1755MHz_WCDMA



7.10_OBW_DL_728-746MHz_WCDMA

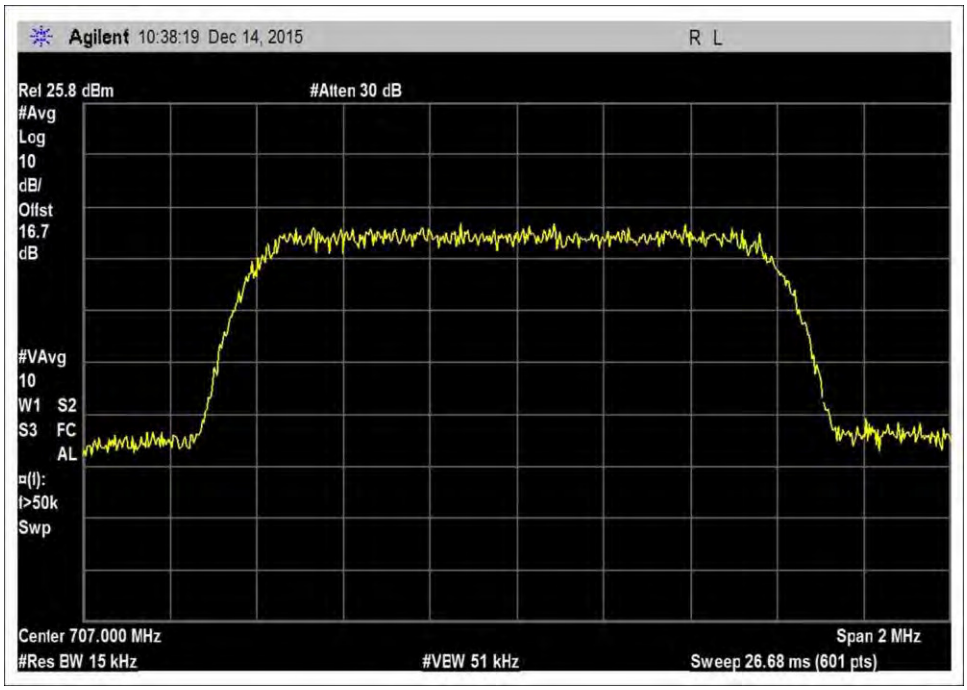


7.10_OBW_DL_746-757MHz_WCDMA

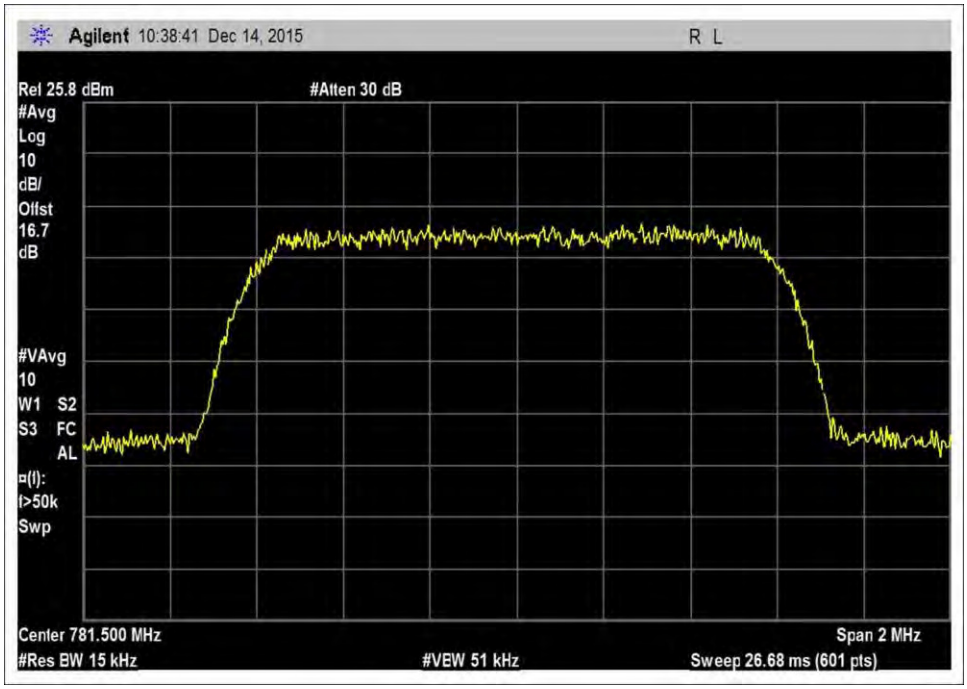


7.10_OBW_DL_2110-2155MHz_WCDMA

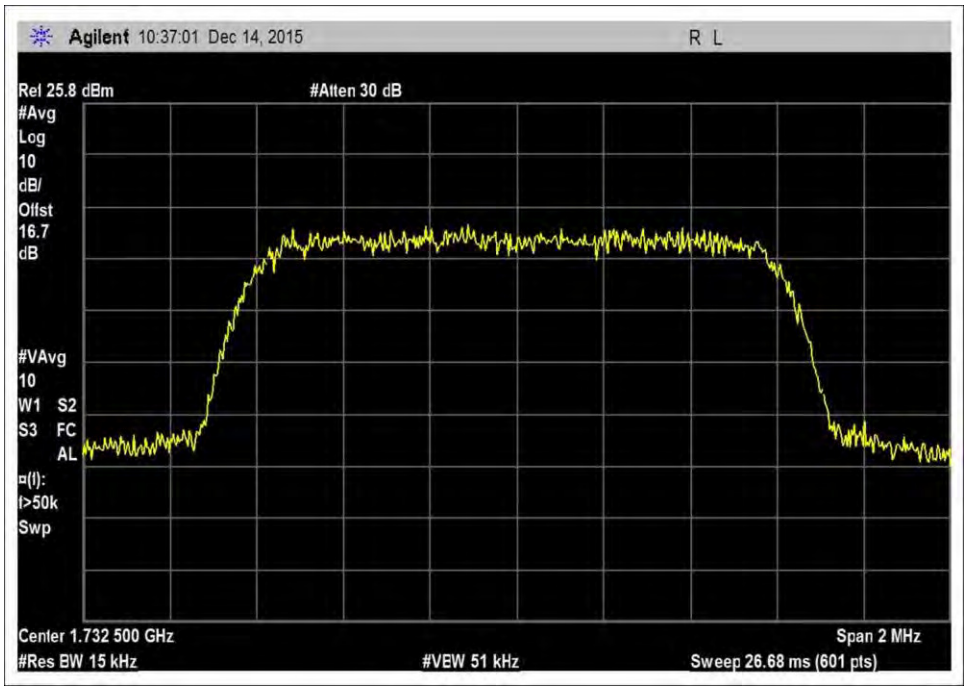
Output–CDMA



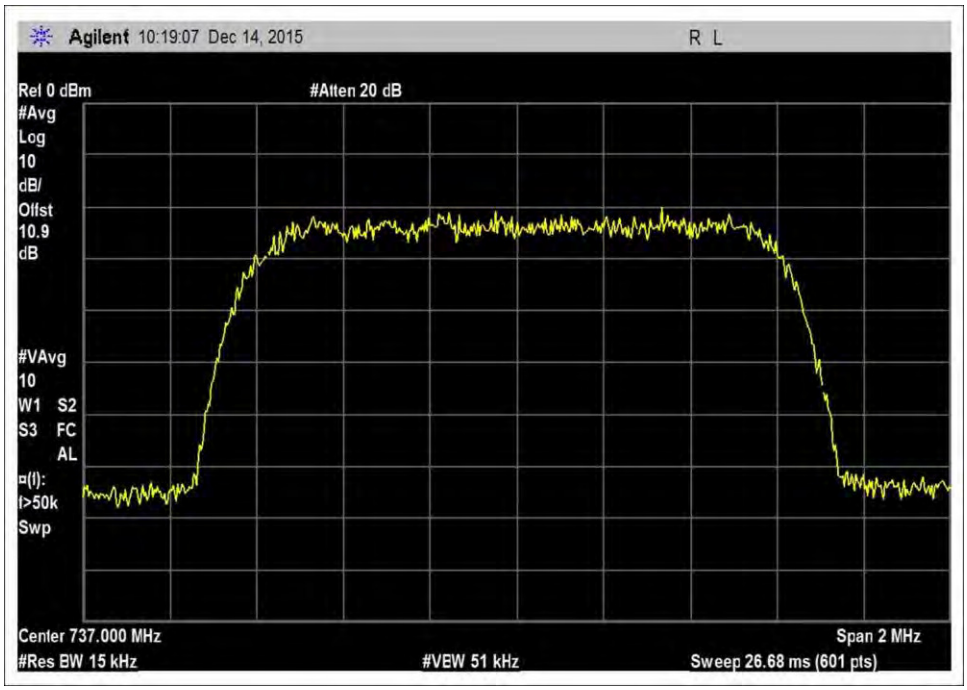
7.10_OBW_UL_698-716MHz_CDMA



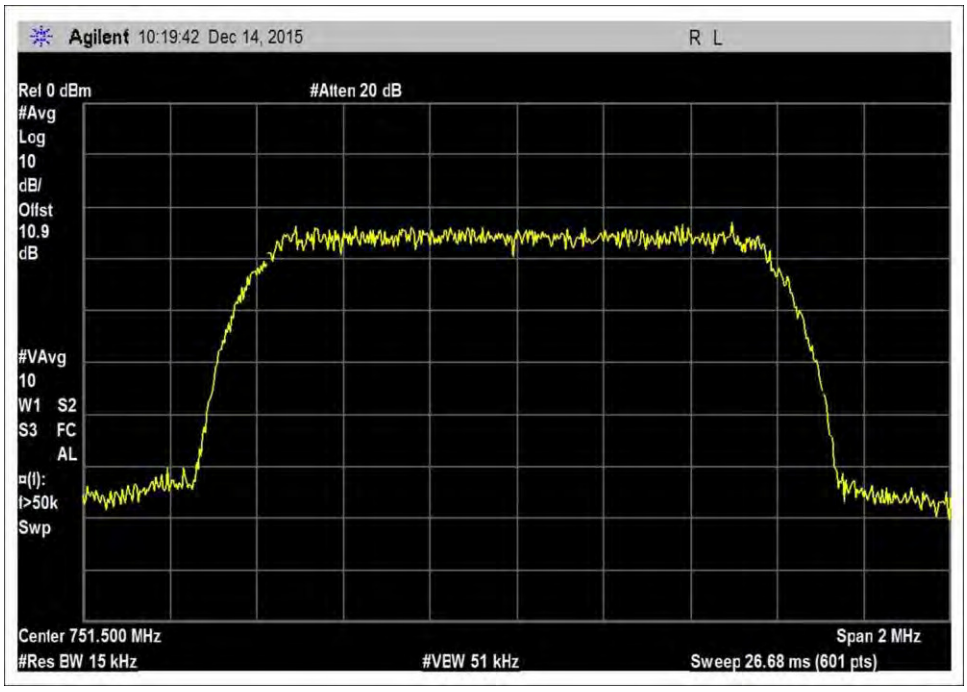
7.10_OBW_UL_776-787MHz_CDMA



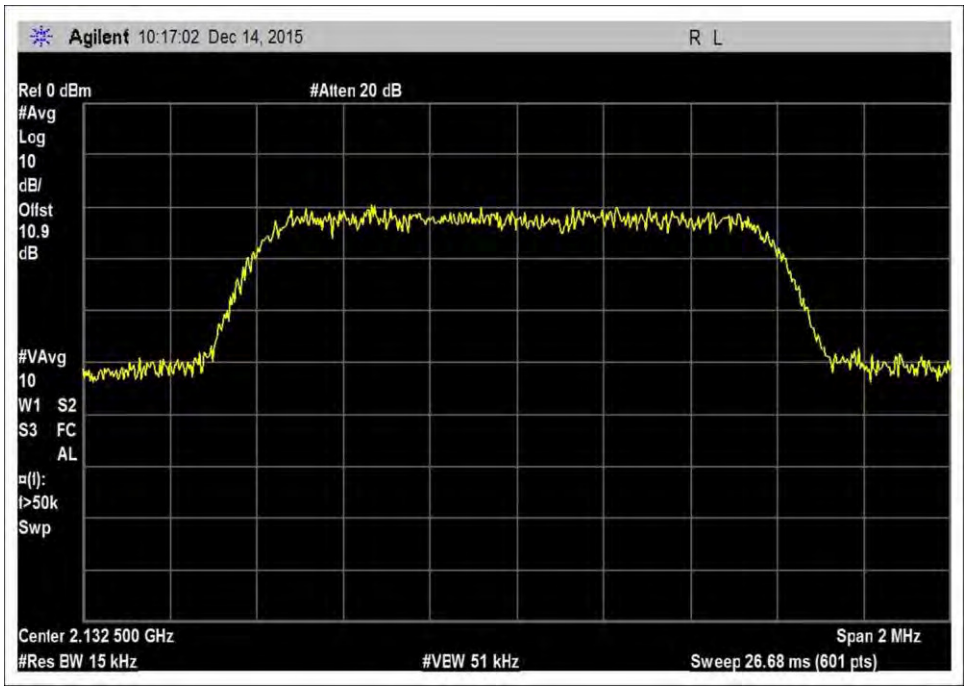
7.10_OBW_UL_1710-1755MHz_CDMA



7.10_OBW_DL_728-746MHz_CDMA

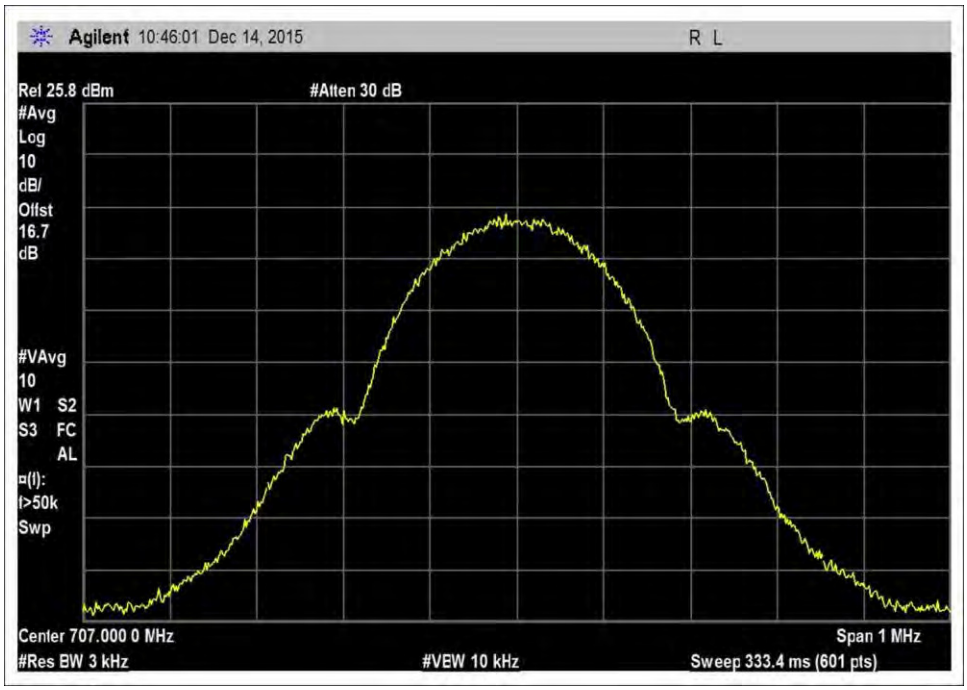


7.10_OBW_DL_746-757MHz_CDMA

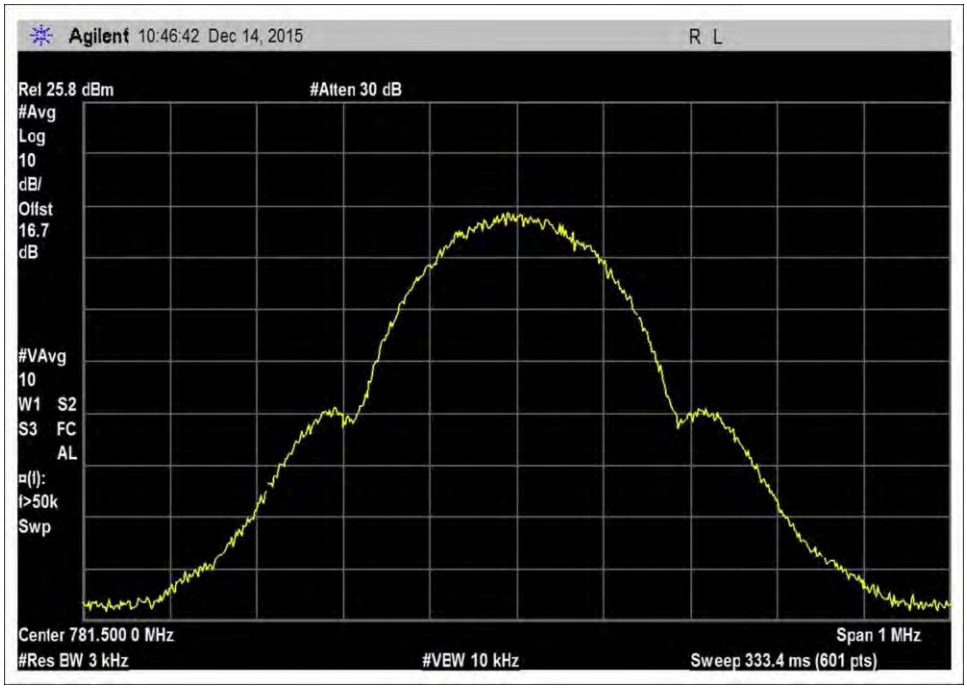


7.10_OBW_DL_2110-2155MHz_CDMA

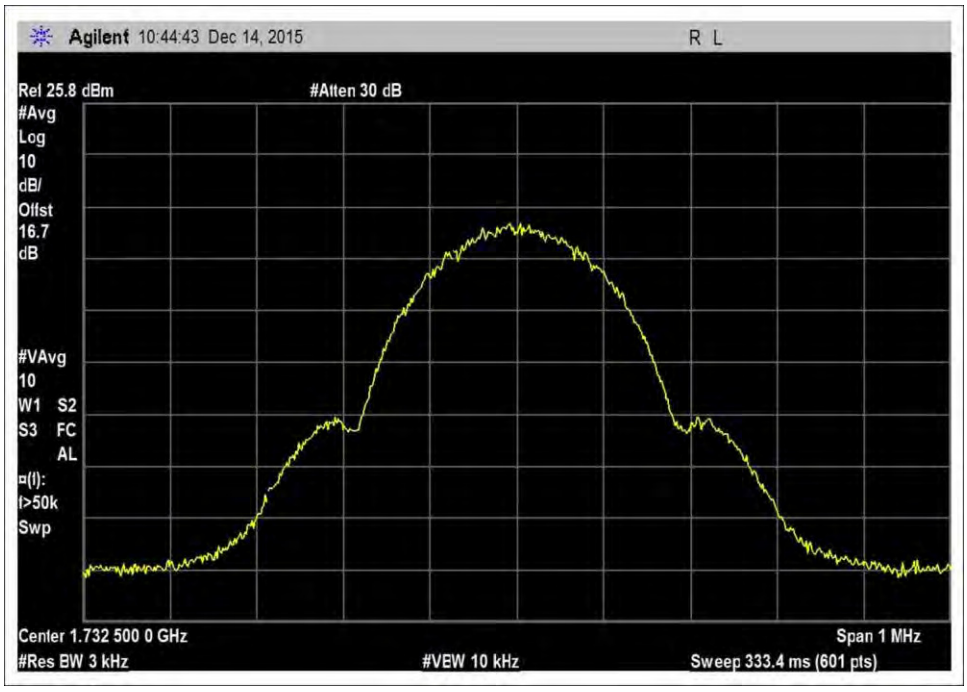
Output– GSM



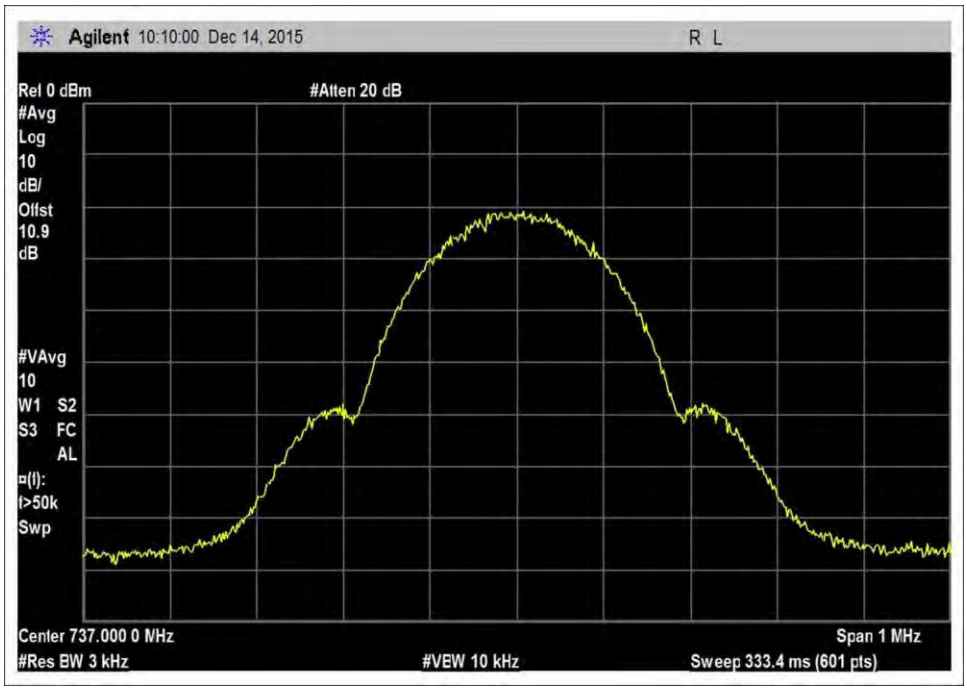
7.10_OBW_UL_698-716MHz_GSM



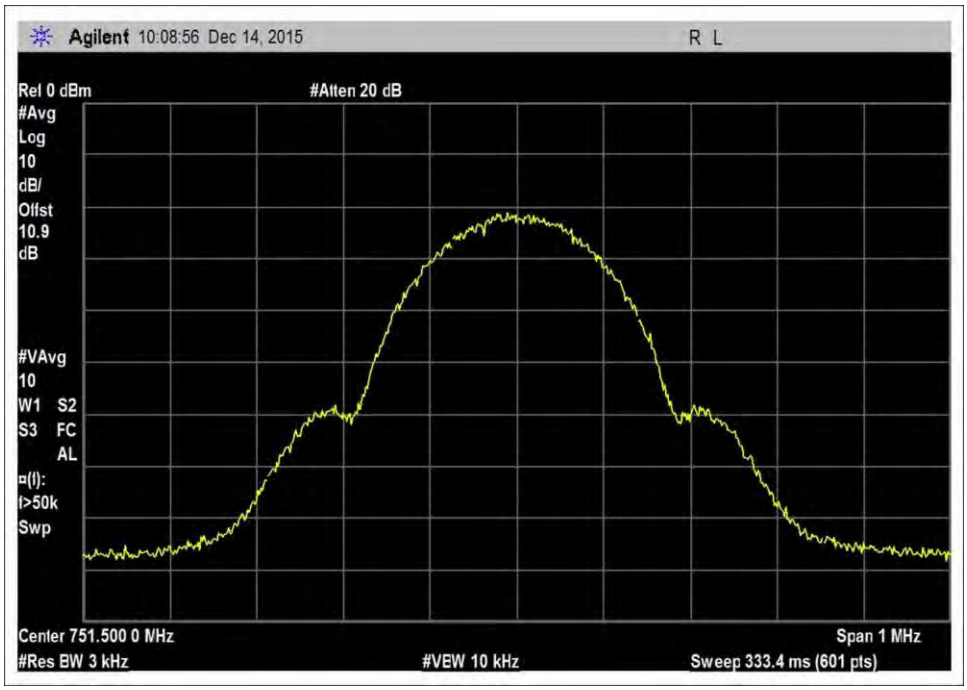
7.10_OBW_UL_776-787MHz_GSM



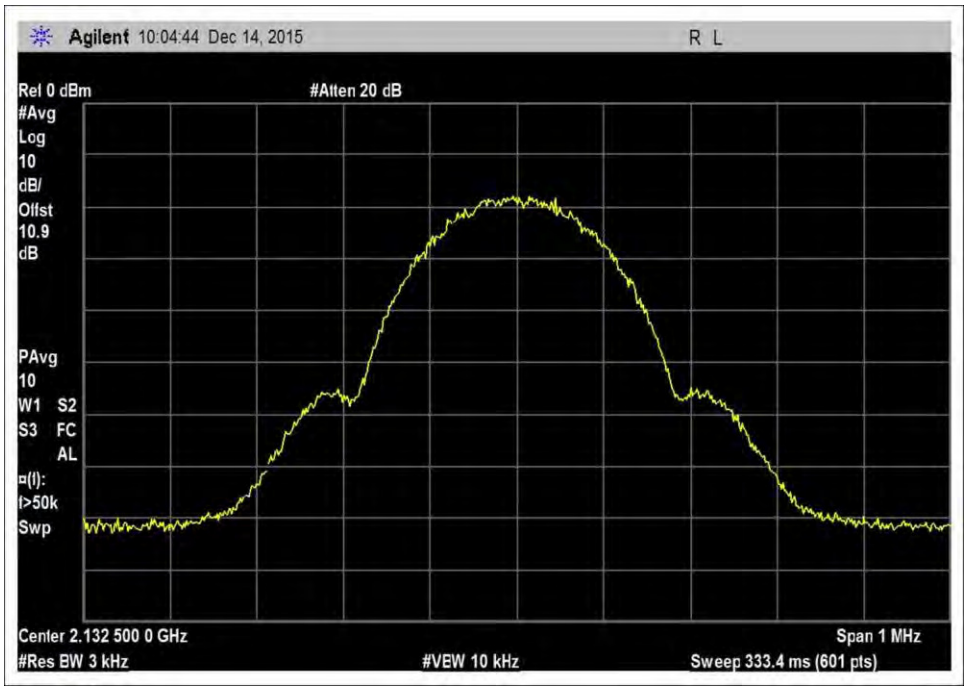
7.10_OBW_UL_1710-1755MHz_GSM



7.10_OBW_DL_728-746MHz_GSM

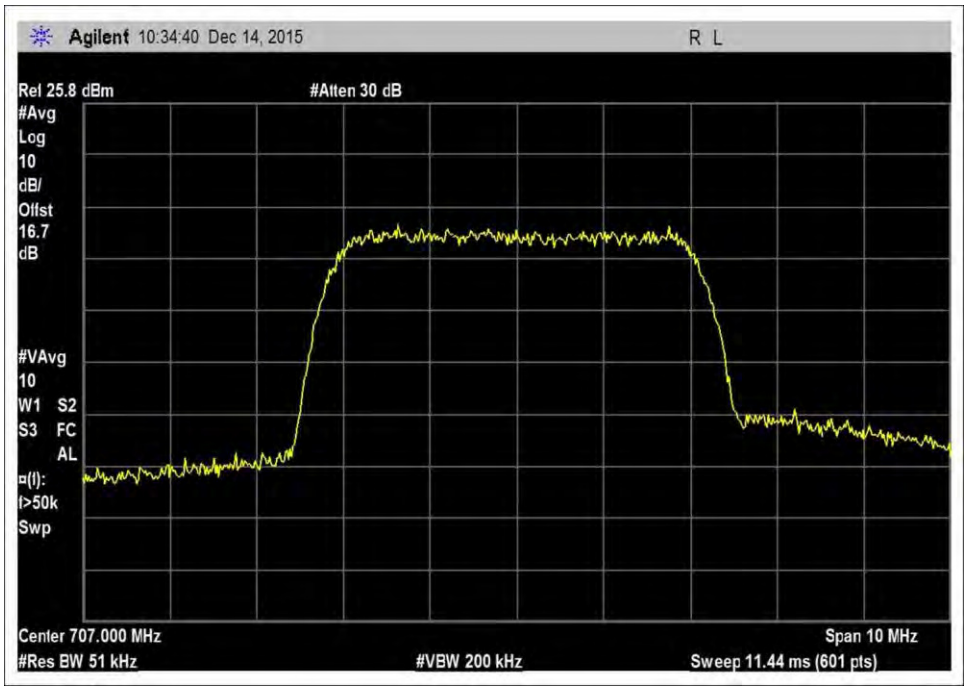


7.10_OBW_DL_746-757MHz_GSM

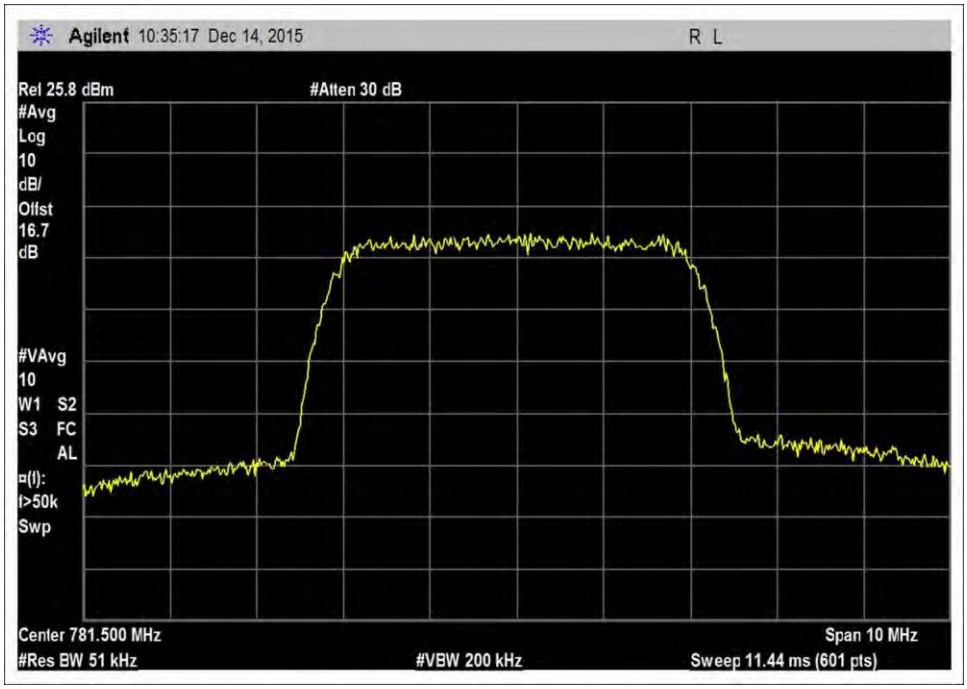


7.10_OBW_DL_2110-2155MHz_GSM

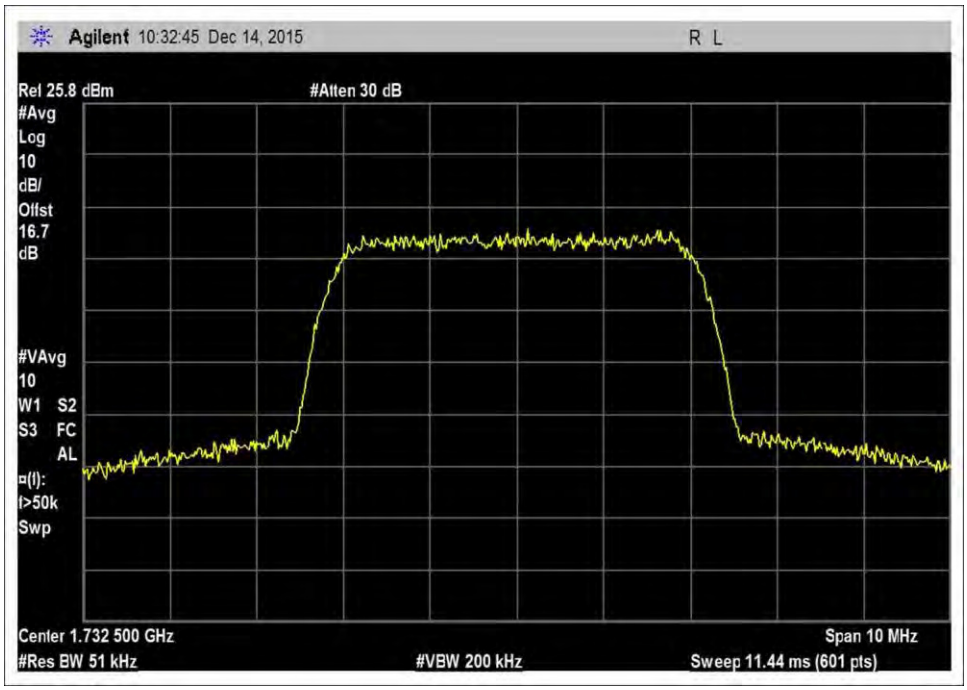
Output– WCDMA



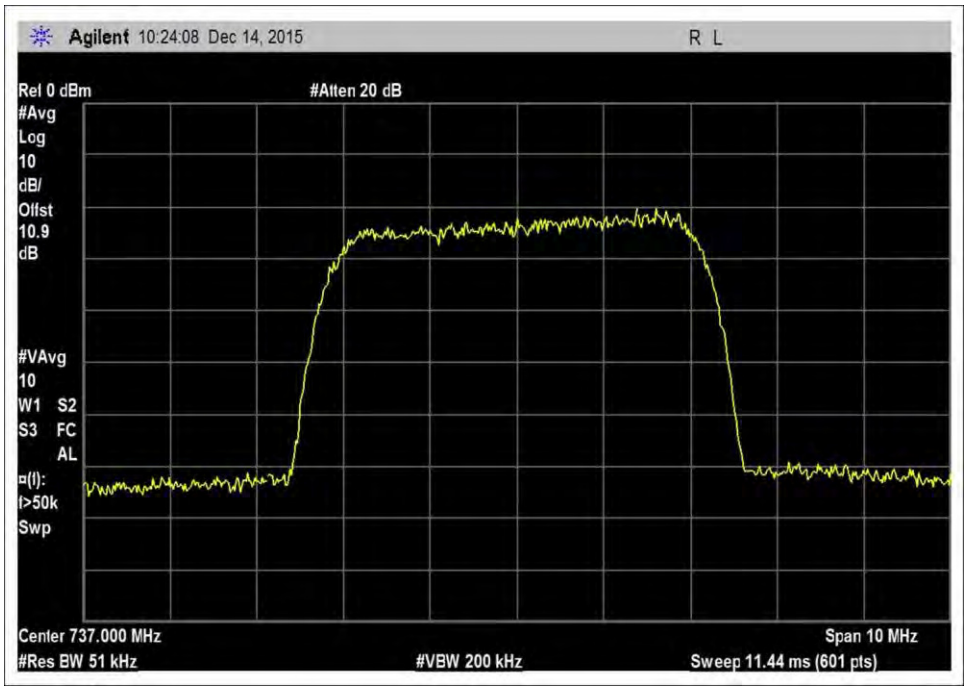
7.10_OBW_UL_698-716MHz_WCDMA



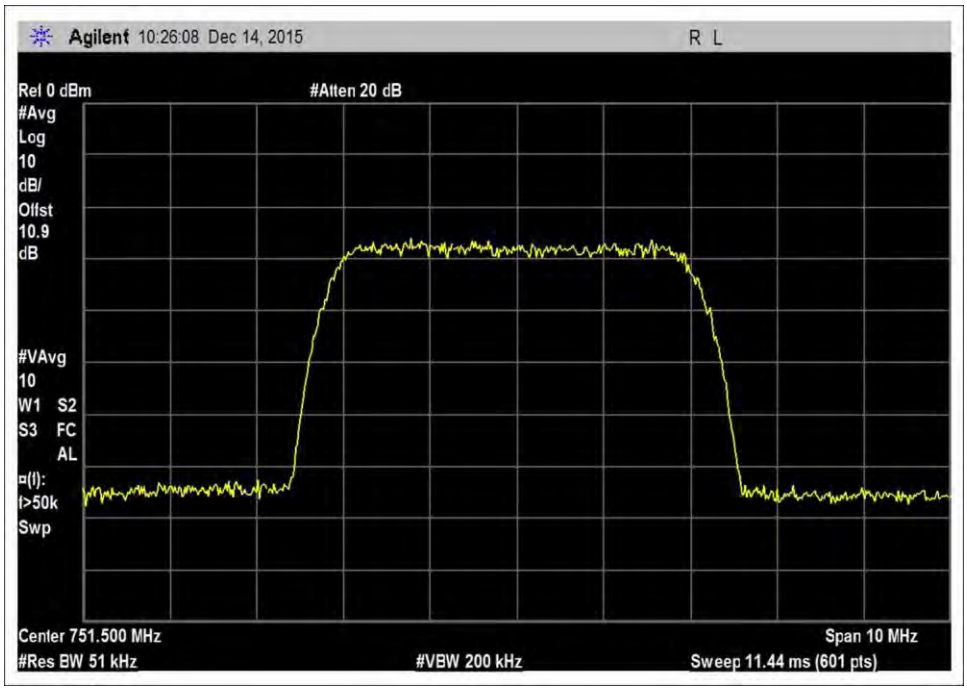
7.10_OBW_UL_776-787MHz_WCDMA



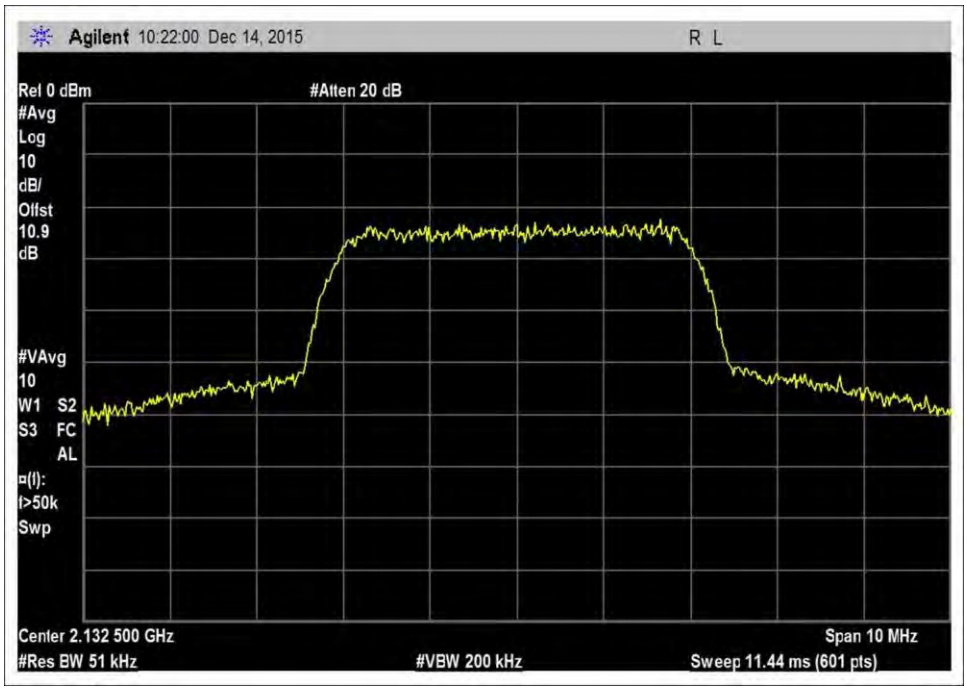
7.10_OBW_UL_1710-1755MHz_WCDMA



7.10_OBW_DL_728-746MHz_WCDMA

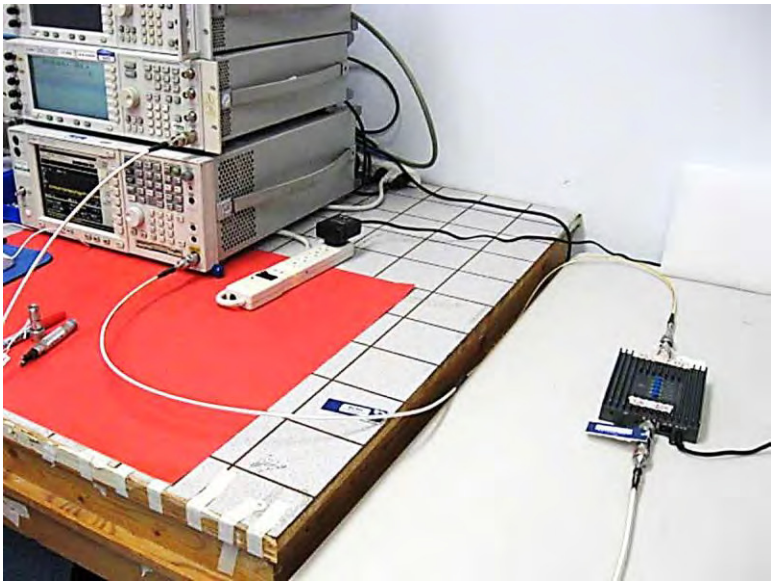


7.10_OBW_DL_746-757MHz_WCDMA



7.10_OBW_DL_2110-2155MHz_WCDMA

Test Setup Photo



2.1051 Spurious Emissions at Antenna Terminals

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	Cellphone-Mate, Inc.		
Specification:	**7.6 Conducted Spurious Emissions / 47 CFR §2.1051 Spurious Emissions at Antenna Terminals**		
Work Order #:	**97835**	Date:	12/14/2015
Test Type:	**Conducted Emissions**	Time:	08:16:35
Tested By:	Daniel Bertran	Sequence#:	1
Software:	EMITest 5.02.00		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

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.

Part 27
UL: 1710-1755MHz, 698-716MHz, 776-787MHz
DL: 2110-2155MHz, 728-746MHz, 746-757MHz
Frequency range of measurement = 9 kHz- 22 GHz.
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
*Note: As specified on 7.6 Conducted spurious emissions test procedure of 935210 D03 Signal Booster Measurements v03, 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.

Test environment conditions: Temperature: 20°C, Relative Humidity: 40%, Pressure: 102kPa

Test procedure:
The test was performed in accordance with section 7.6 of the FCC document: 935210 D03 Wideband Consumer Signal Booster Measurement Guidance v03 Dated June 5, 2015
Firmware: V2.0
Note: 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. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP06709	Cable	32026-29094K-29094K-72TC	9/18/2014	9/18/2016
	ANP06710	Cable	32026-29094K-29094K-72TC	9/18/2014	9/18/2016
	AN02660	Spectrum Analyzer	E4446A	7/9/2015	7/9/2017
	ANP06467	Attenuator	PE7014-10	5/13/2015	5/13/2017
	ANP06239	Attenuator	54A-10	7/9/2014	7/9/2016

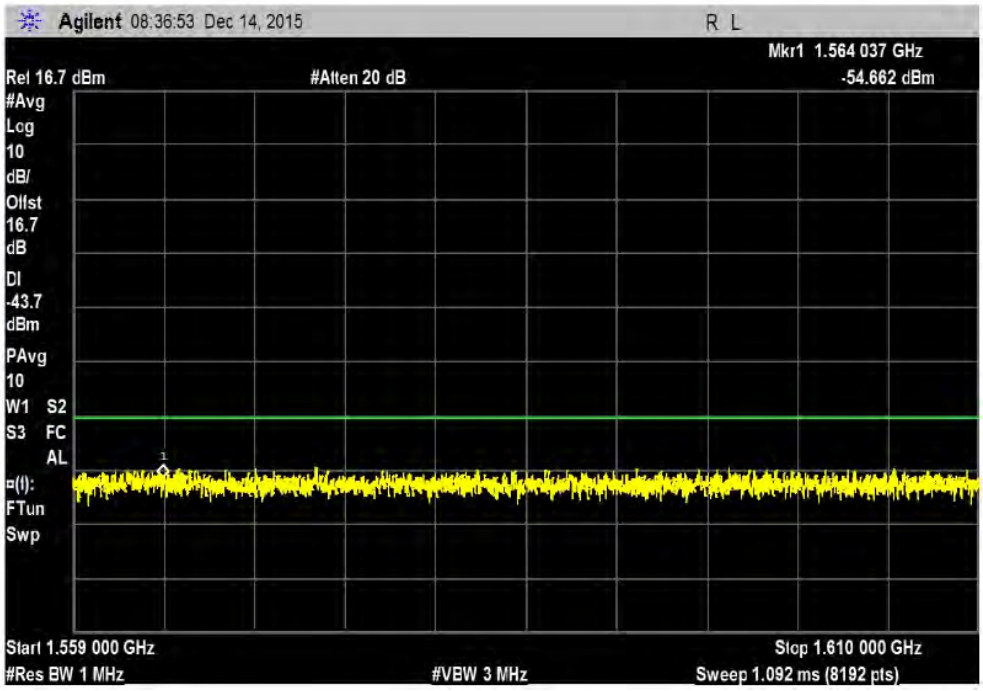
Summary of Results

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

9 KHz-30 MHz

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

Per section 27.53 (f), the 1559-1610 band was also investigated and found emission within limits using applied correction (see calculation below).



Calculation:

UL776-787MHz=>	Antenna Gain (7dB) / Cable Loss (3.32dB)
Limit line EIRP on this band 1559-1610MHz =>	−70 dBW/MHz =>-40dBm
Limit line EIRP corrected =>	-40dBm-7dBi+3.32dB=> -43.68dBm

LIMIT LINE FOR SPURIOUS CONDUCTED EMISSION

REQUIRED ATTENUATION = 43+10 LOG P DB

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

$$V_{dBuV} = 20 \text{ Log } \frac{V}{1 \text{ x } 10^{-6}}$$

$$= 20\left(\text{Log } V - \text{Log } 1 \text{ x } 10^{-6}\right)$$

$$= 20 \text{ Log } V - 20 \text{ Log} 1 \text{ x } 10^{-6}$$

$$= 20 \text{ Log } V - 20\left(-6\right)$$

$$= 20 \text{ Log } V + 120$$

$$\text{Attenuation} = 43 + 10 \text{ Log } P$$

$$= 43 + 10 \text{ Log } \frac{V^2}{R}$$

$$= 43 + 10\left(\text{Log } V^2 \text{ - Log } R\right)$$

$$= 43 + 10\left(2 \text{ Log } V \text{ - Log } R\right)$$

$$= 43 + 20 \text{ Log } V \text{ - } 10 \text{ Log } R$$

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

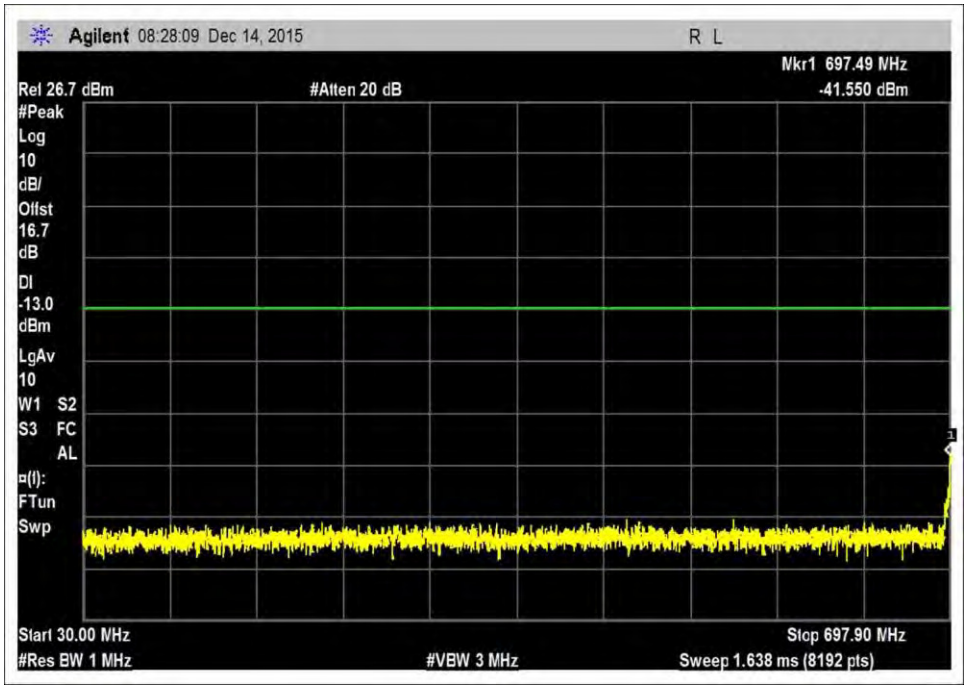
= 20 Log V + 120 – 43 – 20 Log V + 10Log R

= 120 – 43 + 10 Log 50 Note : R = 50 Ω

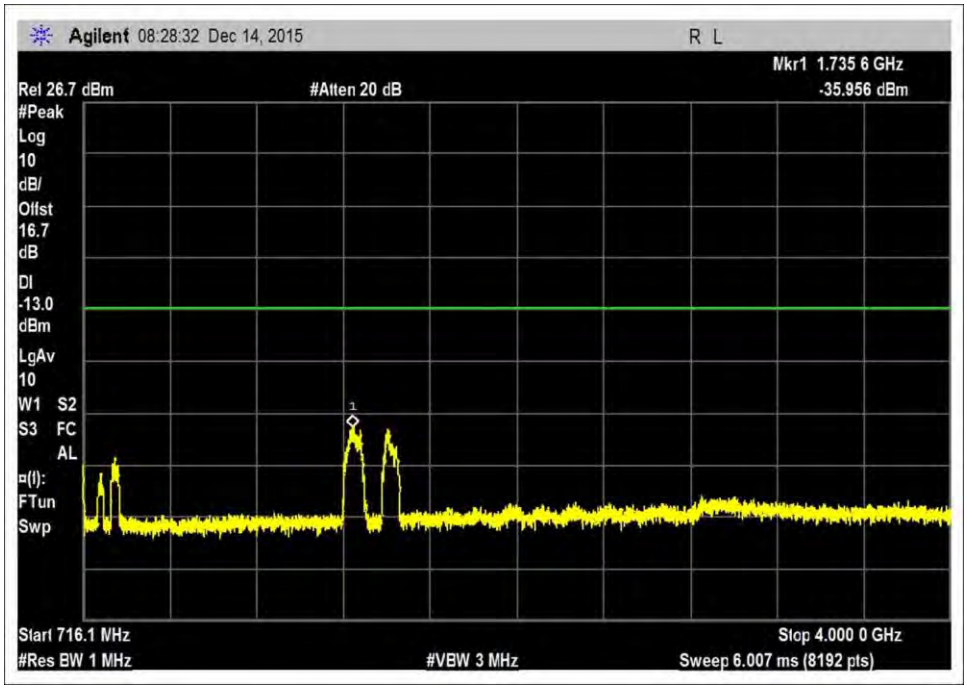
= 120 –43 + 16.897

= 94 dBuV at any power level

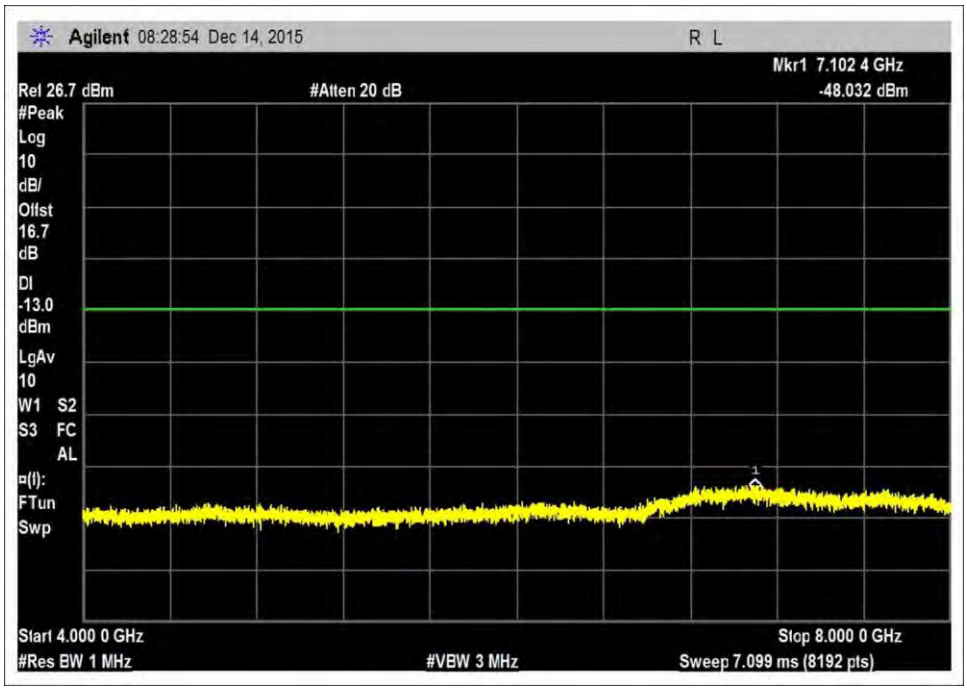
Plots



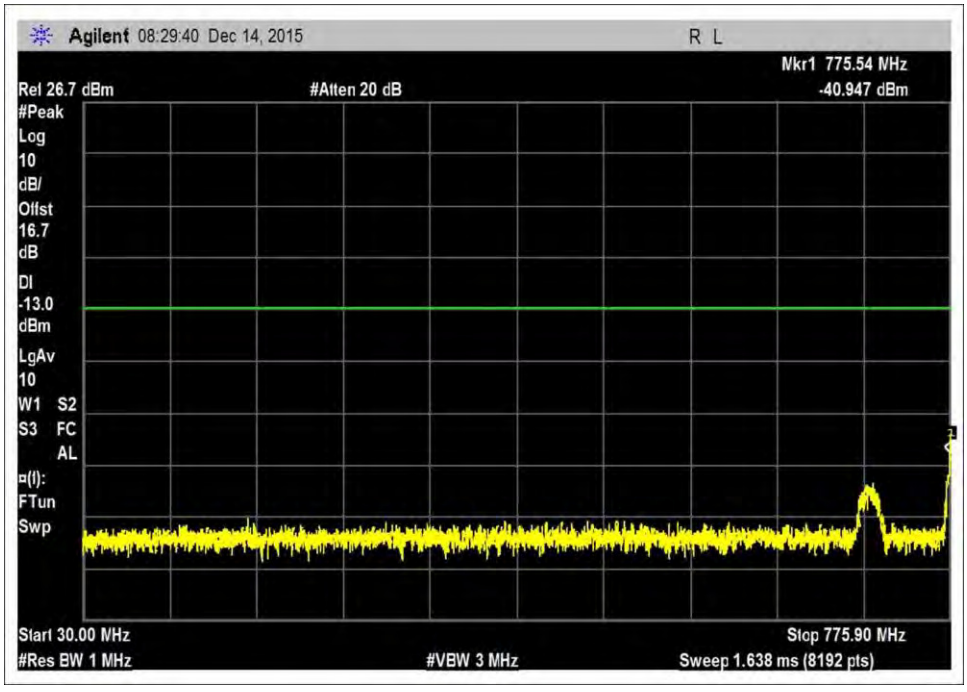
UL_698-716L



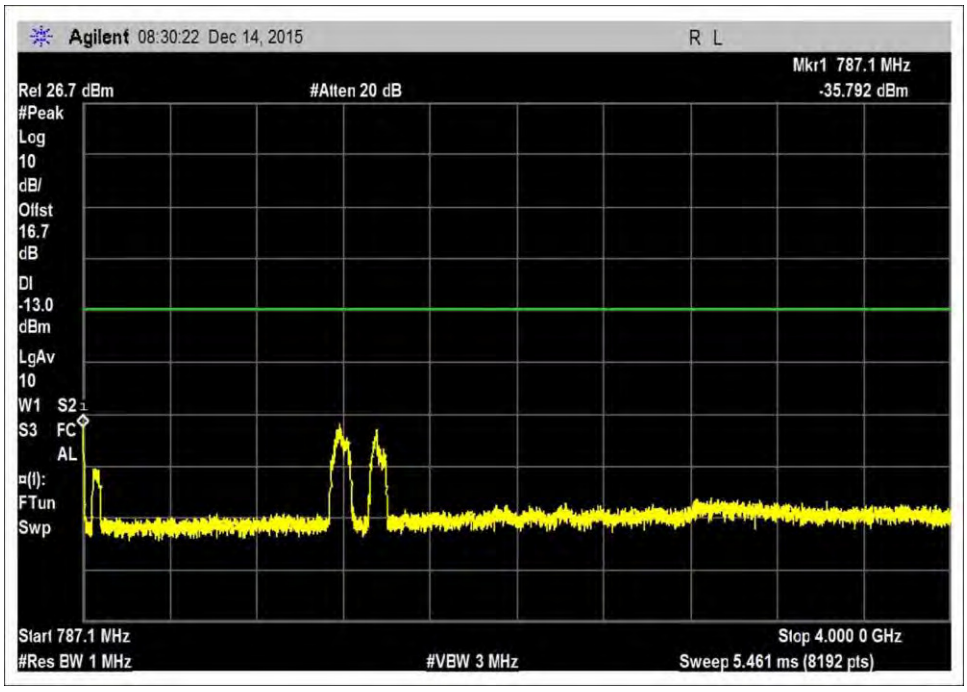
UL_698-716R1



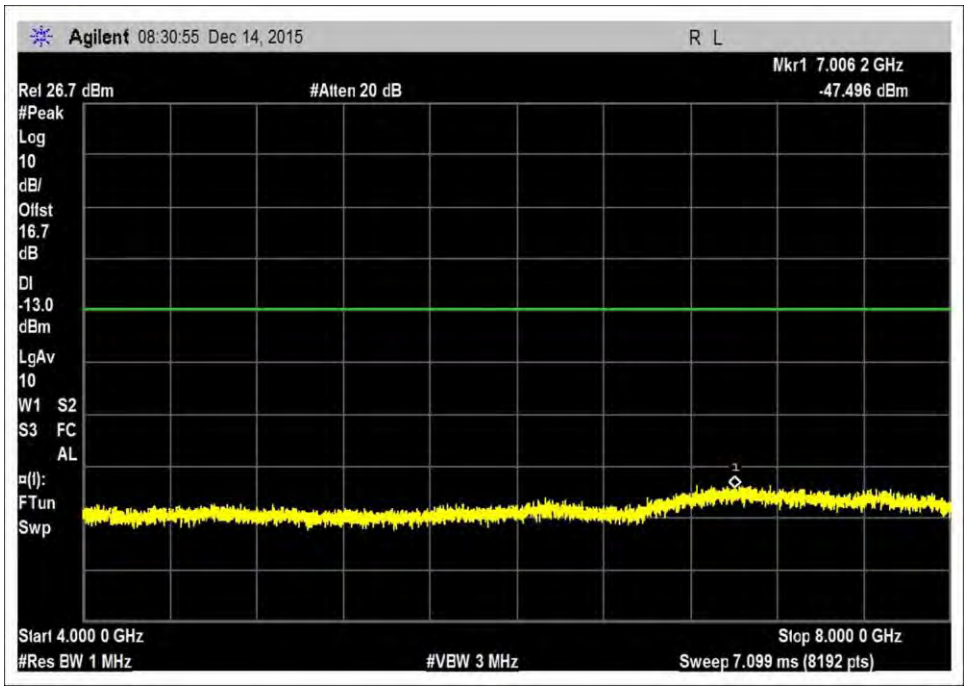
UL_698-716R2



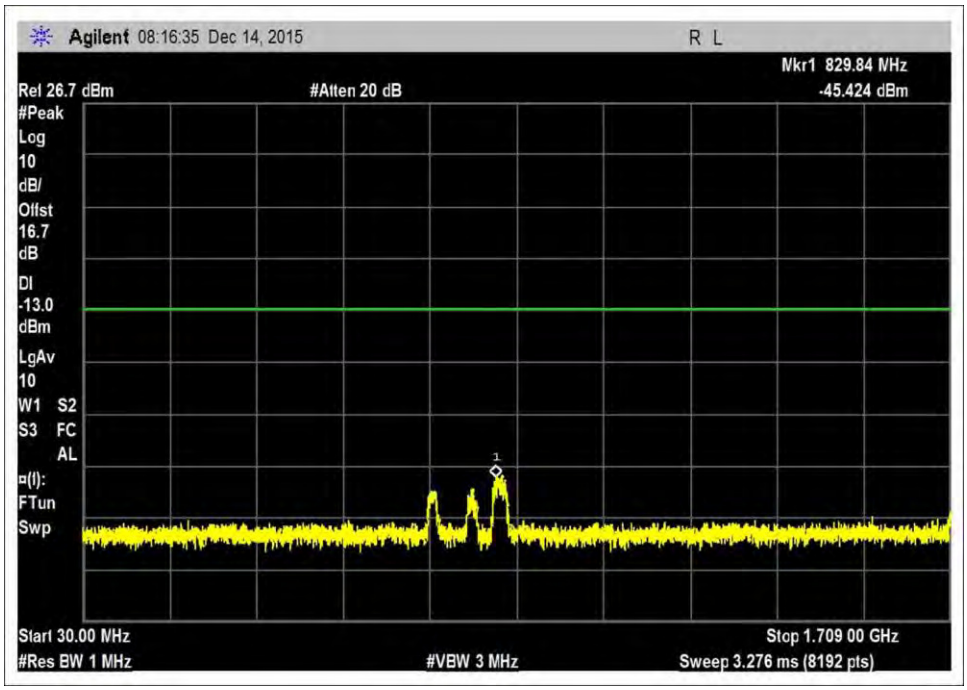
UL_776-787L



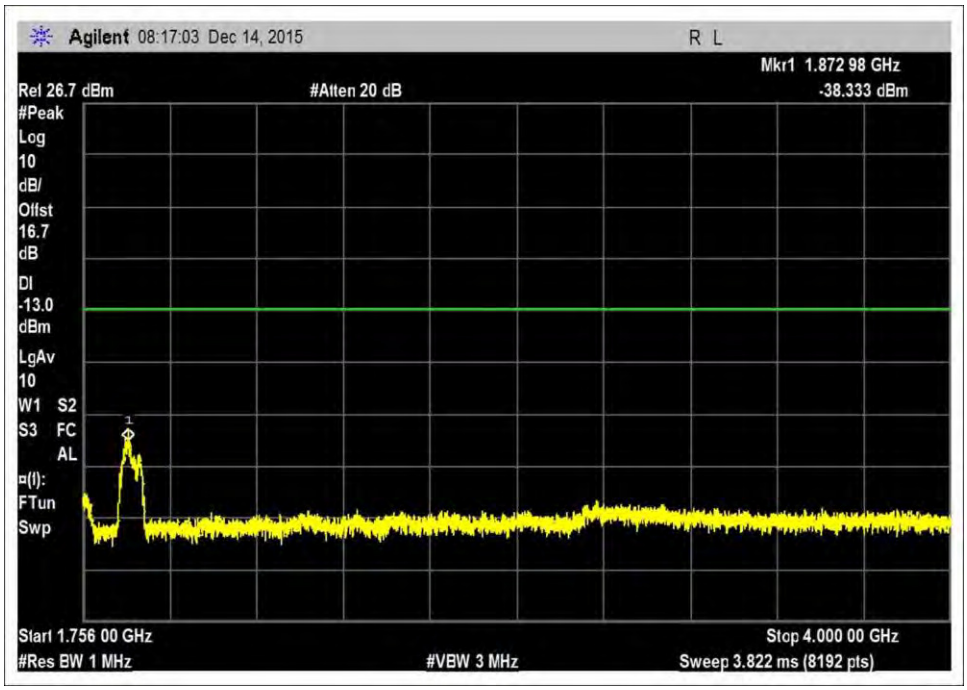
UL_776-787R1



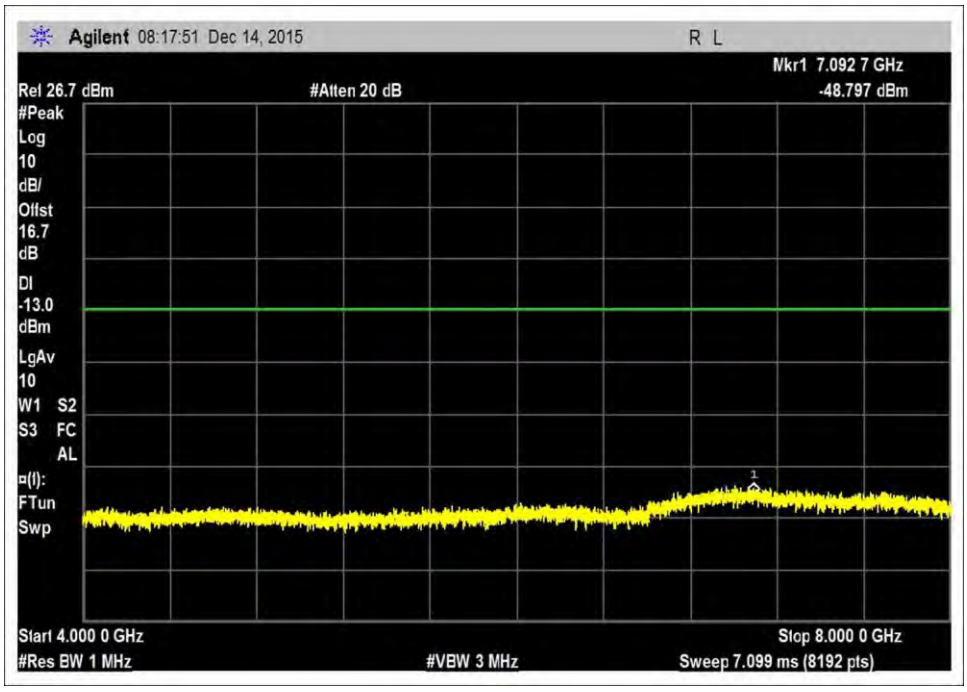
UL_776-787R2



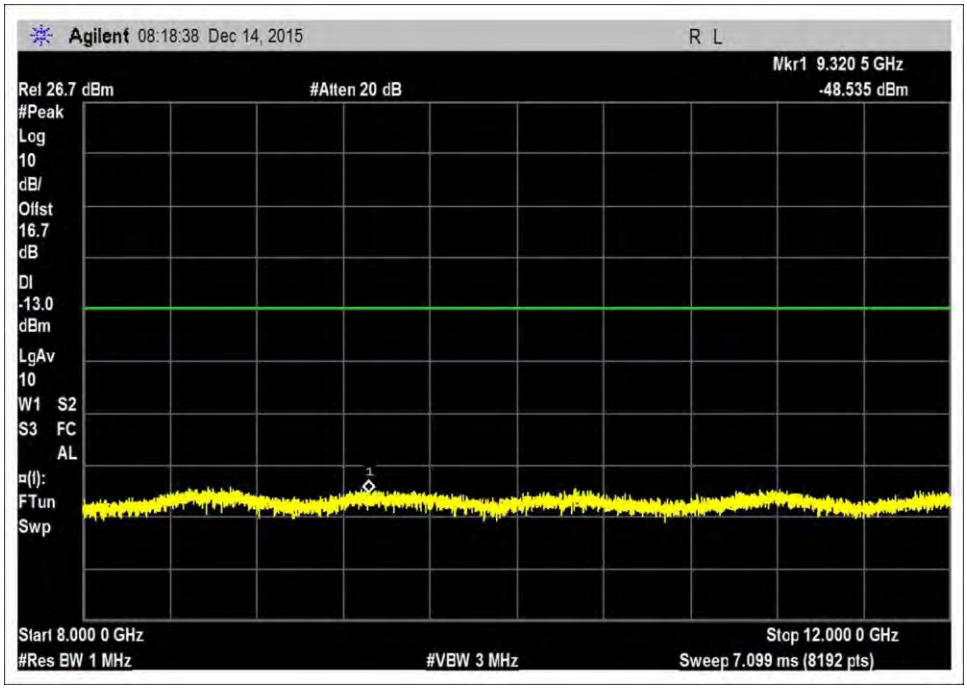
UL_1710-1755L



UL_1710-1755R1



UL_1710-1755R2



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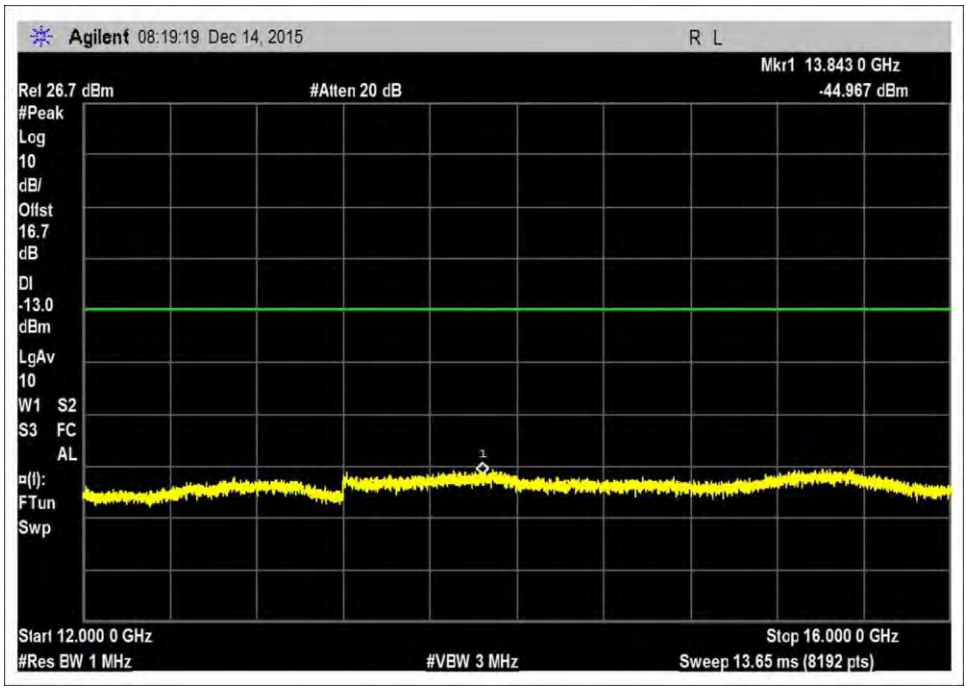
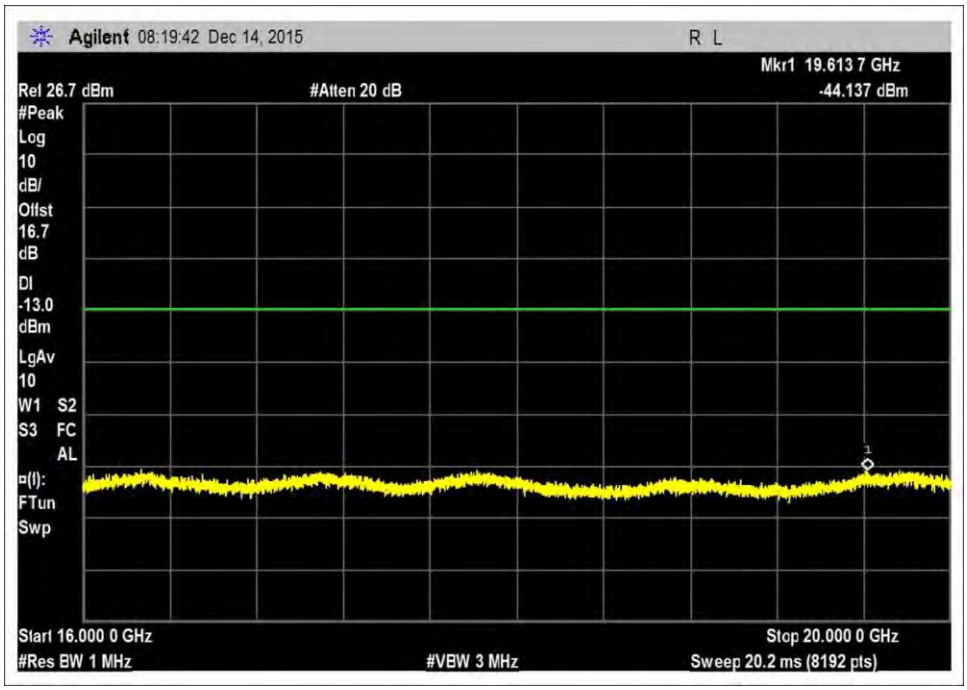
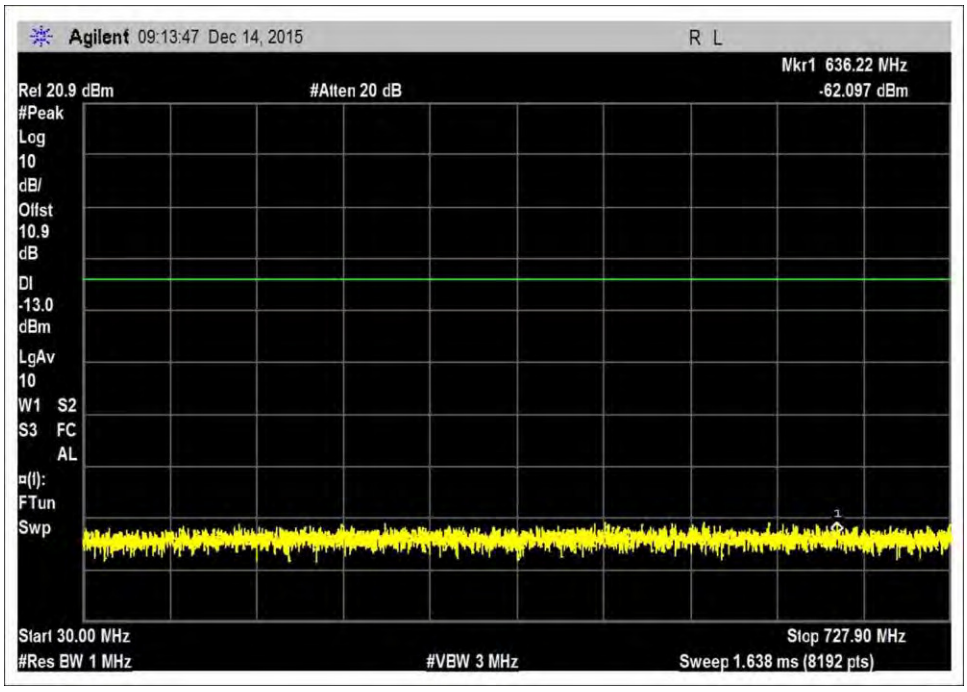


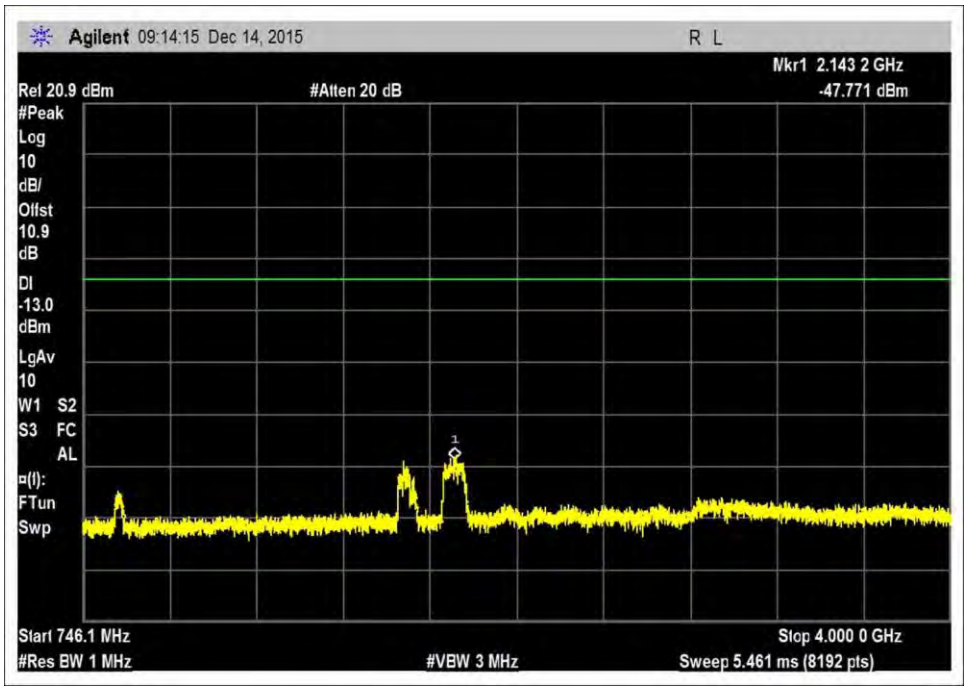
UL_1710-1755R4



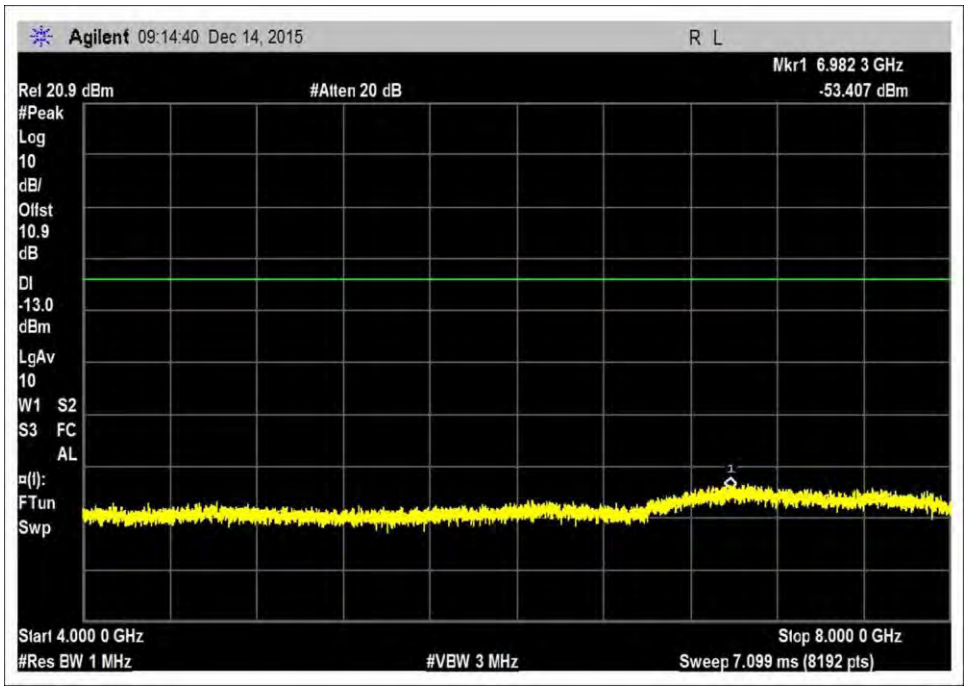
UL_1710-1755R5



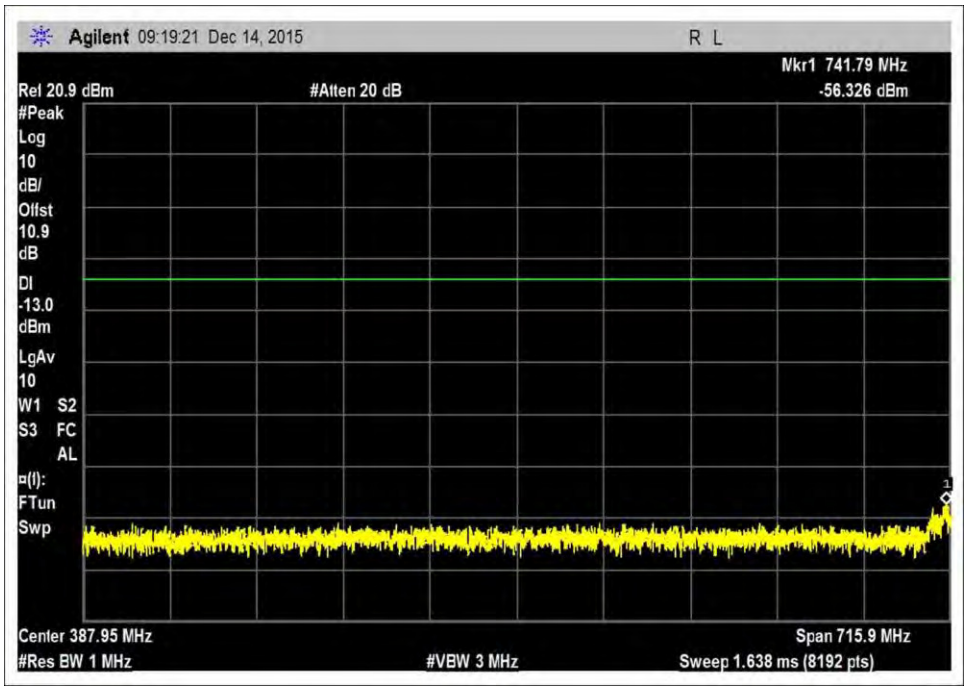
DL_728-746L



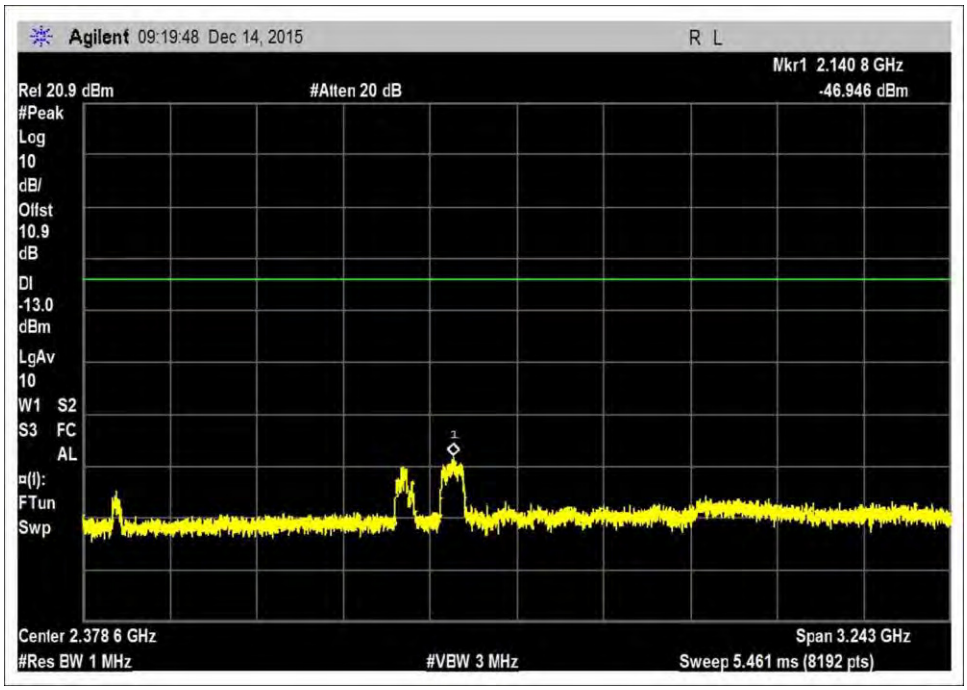
DL_728-746R1



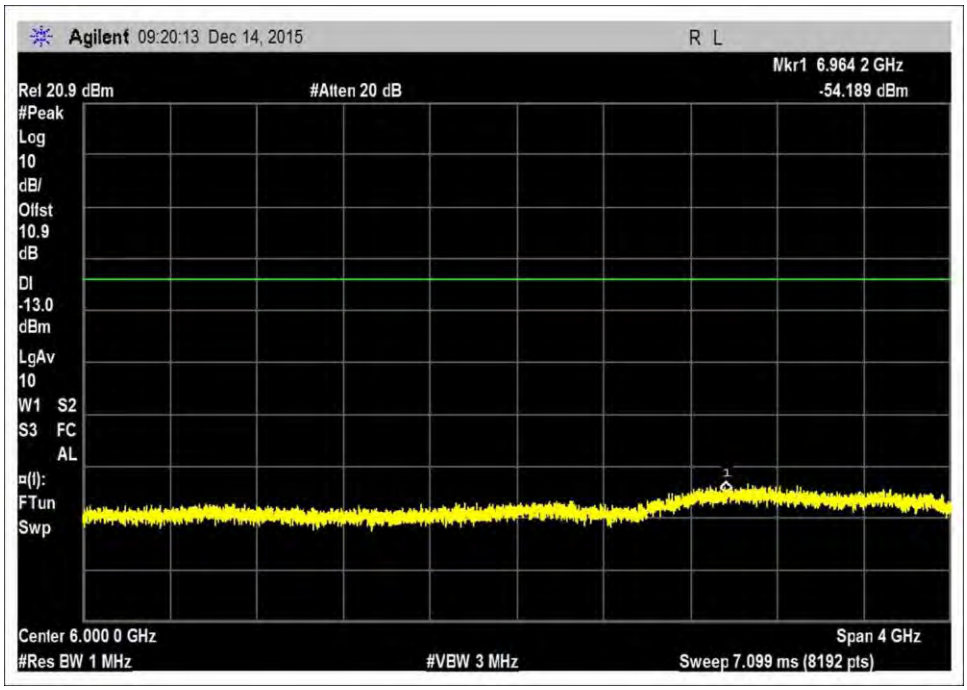
DL_728-746R2



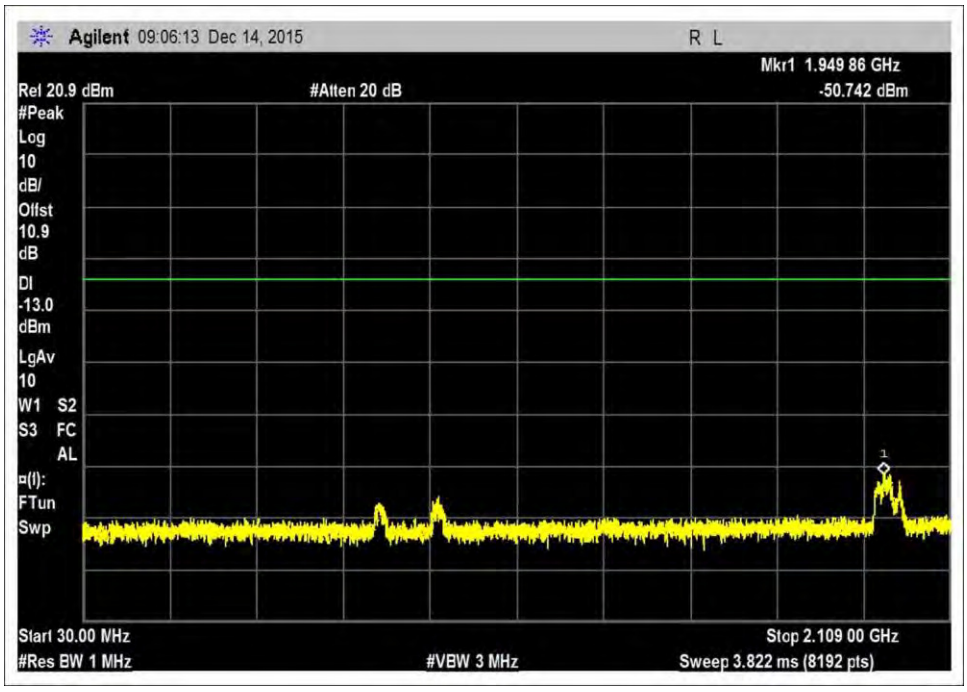
DL_746-757L



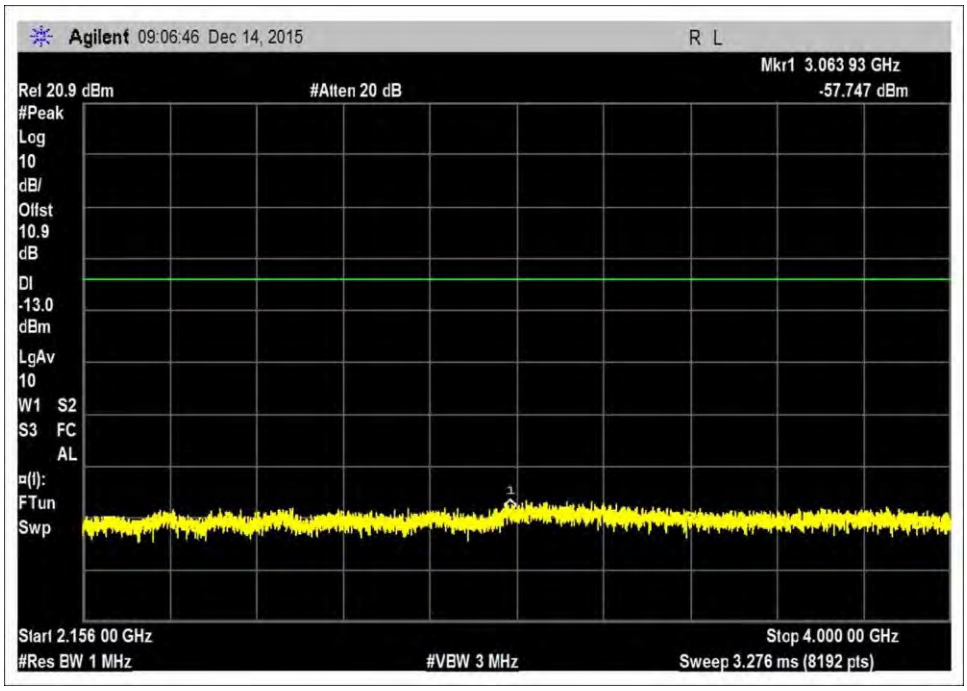
DL_746-757R1



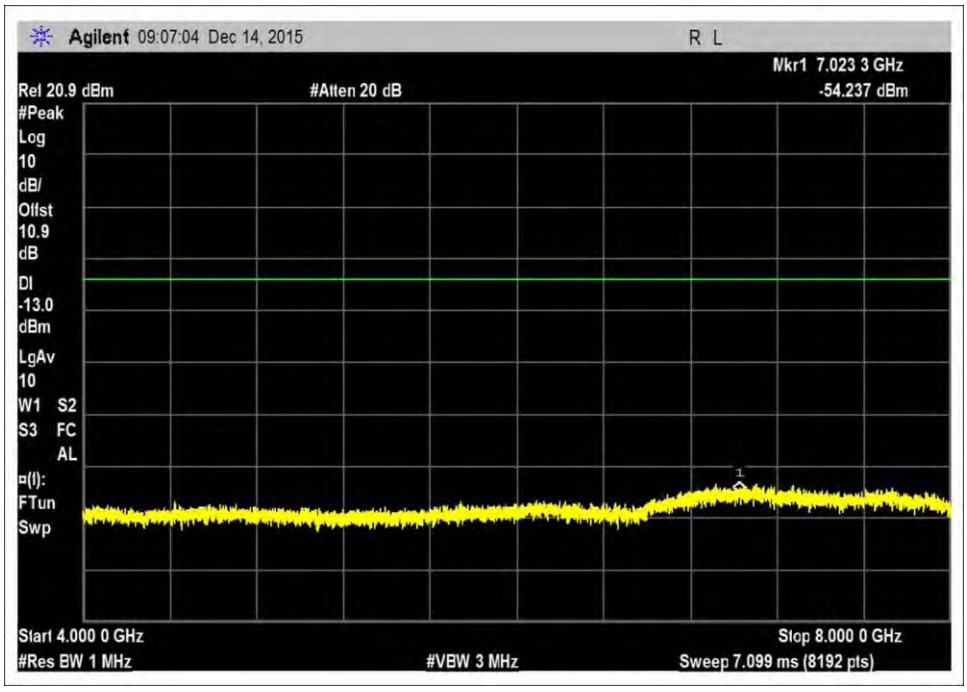
DL_746-757R2



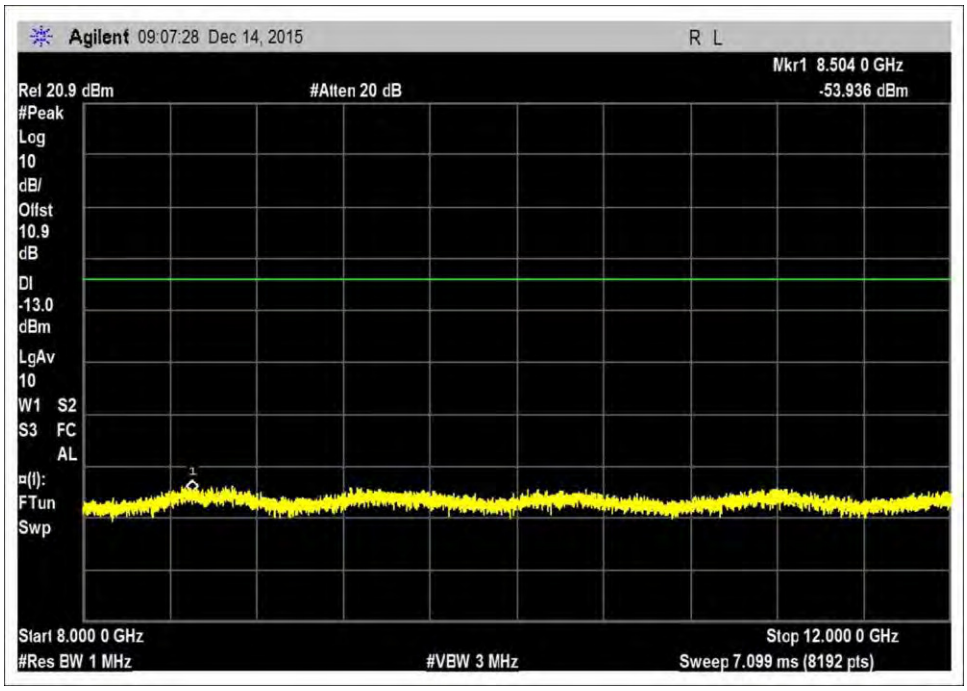
DL_2110-2155L



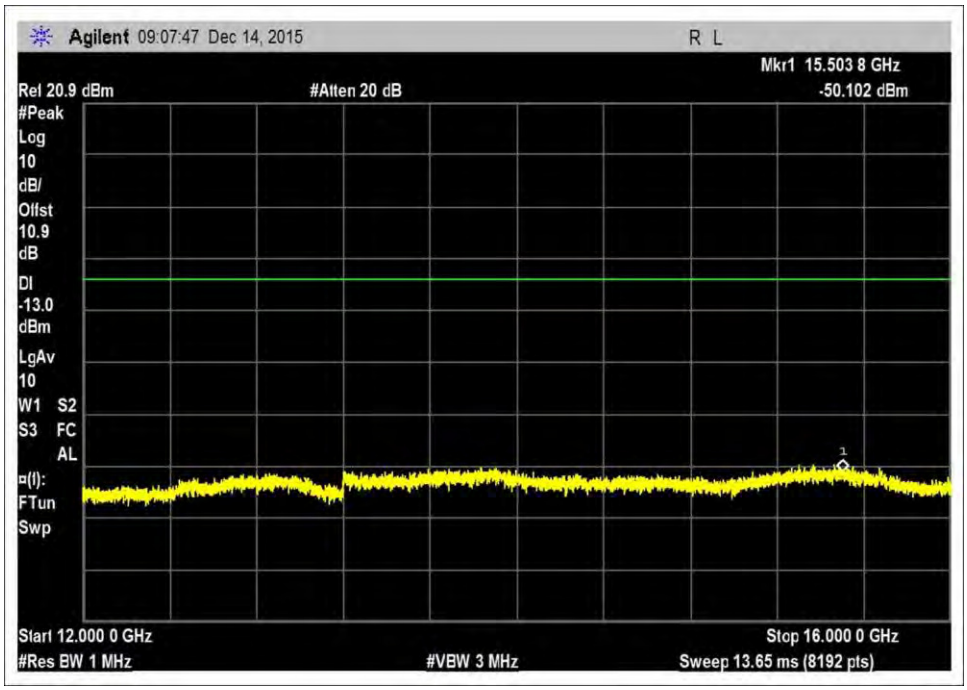
DL_2110-2155R1



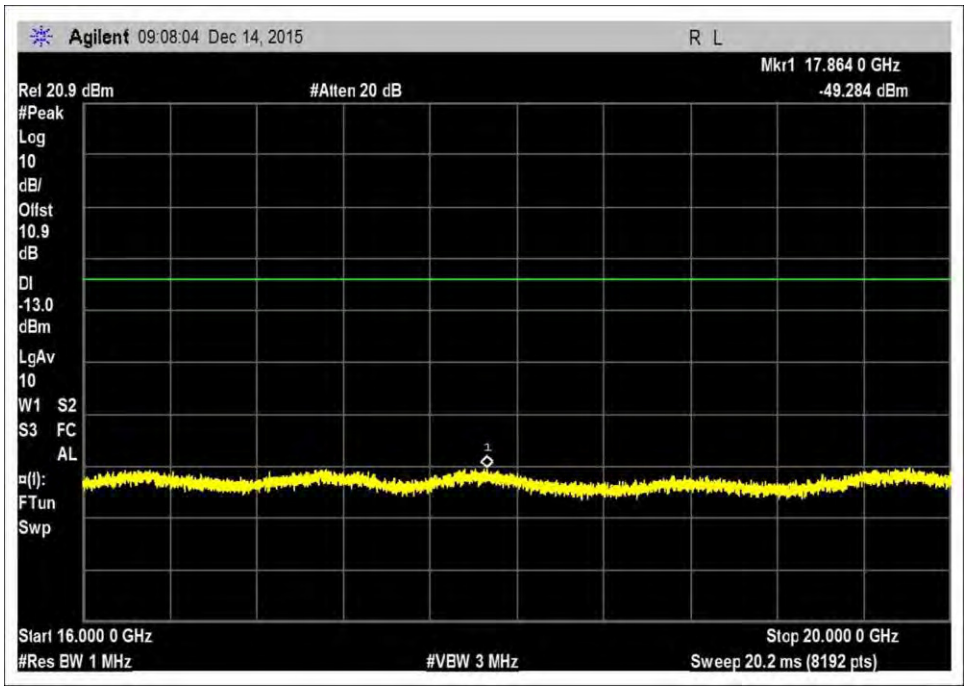
DL_2110-2155R2



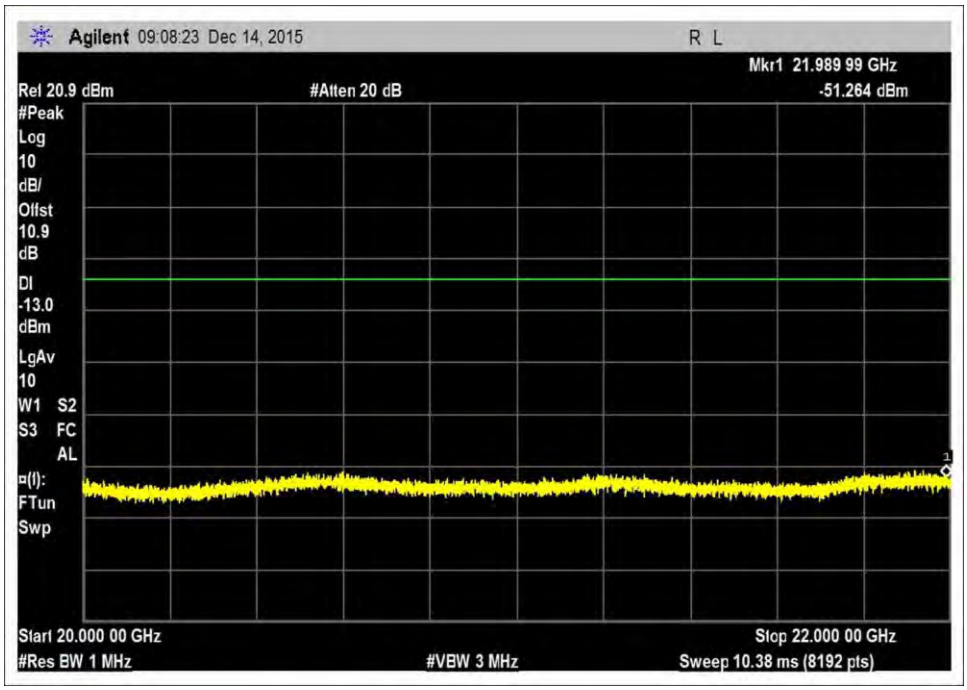
DL_2110-2155R3



DL_2110-2155R4

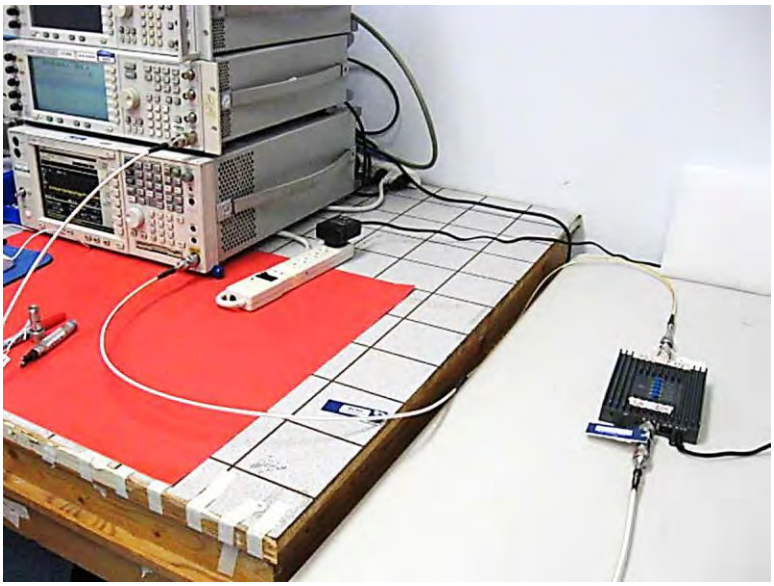


DL_2110-2155R5



DL_2110-2155R6

Test Setup Photo



2.1053 Field Strength of Spurious Radiation

Test Conditions / Setup

Test Location:	CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170		
Customer:	Cellphone-Mate, Inc.		
Specification:	**47 CFR §27.53(c), (f), (g) and (h) Spurious Emissions**		
Work Order #:	**97835**	Date:	12/17/2015
Test Type:	**Radiated Emissions**	Time:	9:40:24 AM
Tested By:	Daniel Bertran	Sequence#:	1
Software:	EMITest 5.02.00		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The equipment under test (EUT) is a Fixed CMRS Wideband Consumer Booster.
During testing, the (EUT) is placed on the Styrofoam table top.
Four signal generators are used to inject 5 signals simultaneously to the input port of EUT using a signal combiner.
Each signal generator is set to produce a CW signal with the frequency set to the center of each operational band under test and the power level is set at Pin as determined from 7.2 section of the test procedure indicated further below.
Evaluation of DL path was performed with signals fed into the Outside antenna port while Inside antenna port was terminated with 50 Ohm Pasternack load (MN: PE6187 / SN: 1443).
Evaluation of UL path was performed with signal fed into the Inside antenna port while Outside antenna port was terminated using an impedance matching pad with the same above 50 Ohm load.
Part 27
UL: 1710-1755MHz, 698-716MHz, 776-787MHz
DL: 2110-2155MHz, 728-746MHz, 746-757MHz
TX Freq = > Center frequency of above listed bands.
Modulation=> CW
Frequency range of measurement = 9 kHz- 22GHz.
9 kHz - 150 kHz - RBW=200 Hz VBW=200Hz
150 kHz - 30 MHz - RBW=9 kHz VBW=9kHz
30 MHz - 1000MHz - RBW=120 kHz VBW=120 kHz
1000 MHz-22000MHz - RBW=1 MHz VBW=1 MHz
Test environment conditions: Temperature: 19°C, Relative Humidity: 35%, Pressure: 102.3kPa
Test procedure:
The test was performed in accordance with section 7.12 of the FCC document: 935210 D03 Wideband Consumer Signal Booster Measurement Guidance v03 Dated June 5, 2015
Firmware: V2.0
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:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02157	Horn Antenna-ANSI C63.5 Calibration	3115	12/2/2014	12/2/2016
	AN03143	Cable	32022-29094K-144TC	3/18/2015	3/18/2017
	AN03114	Preamp	AMF-7D-00101800-30-10P	4/22/2015	4/22/2017
	ANP06126	Cable	32022-29094K-29094K-168TC	3/18/2015	3/18/2017
	AN03302	Cable	32026-29094K-29094K-72TC	3/24/2014	3/24/2016
	AN03471	RF Characteristics Analyzer	E4440A	12/19/2013	12/19/2015
	ANP00880	Cable	RG214U	6/13/2014	6/13/2016
	ANP06691	Cable	PE3062-180	8/8/2014	8/8/2016
	ANP01187	Cable	CNT-195	12/30/2014	12/30/2016
	AN00567	Preamp	8447D	1/2/2015	1/2/2017
	AN00852	Biconilog Antenna	CBL 6111C	11/24/2014	11/24/2016
	ANP00929	Cable	various	1/23/2014	1/23/2016
	AN00432	Loop Antenna	6502	5/8/2015	5/8/2017
	AN02694	Active Horn Antenna	AMFW-5F-18002650-20-10P	5/7/2015	5/7/2017
	ANP05389	Attenuator	766-10	2/27/2014	2/27/2016
	ANC00087	Combiner	44000	01/09/2014	01/9/2016
	ANP06709	Cable	32026-29094K-29094K-72TC	9/18/2014	9/18/2016
	ANP06710	Cable	32026-29094K-29094K-72TC	9/18/2014	9/18/2016
	ANP06711	Cable	32022-29094K-29094K-132TC	11/21/2014	11/21/2016
	ANP01183	Cable	CNT-195	9/1/2015	9/1/2017
	ANP01184	Cable	CNT-195	12/30/2014	12/30/2016

Summary of Results

Pass: **No data provided since all emissions were found more than 20dB below the limit.**

LIMIT LINE FOR SPURIOUS RADIATED EMISSION

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

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

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

Power Density (Isotropic)

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

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

Field Intensity E (V/m)

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

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

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

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

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

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

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

10 Log P_t = 20 Log E (uV/m) - 120 - 5.23
10 Log P_t = 20 Log E (uV/m) –125.23
Limit line (dBuV) at 3 meter = E_{dBuv} – Attenuation

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

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

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

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

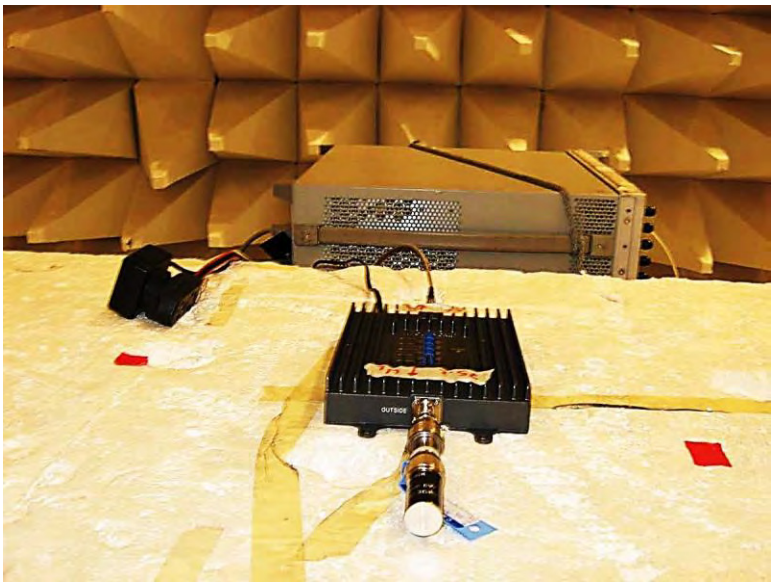
= E_{dBuv} - 20 Log E (uV/m) + 82.23

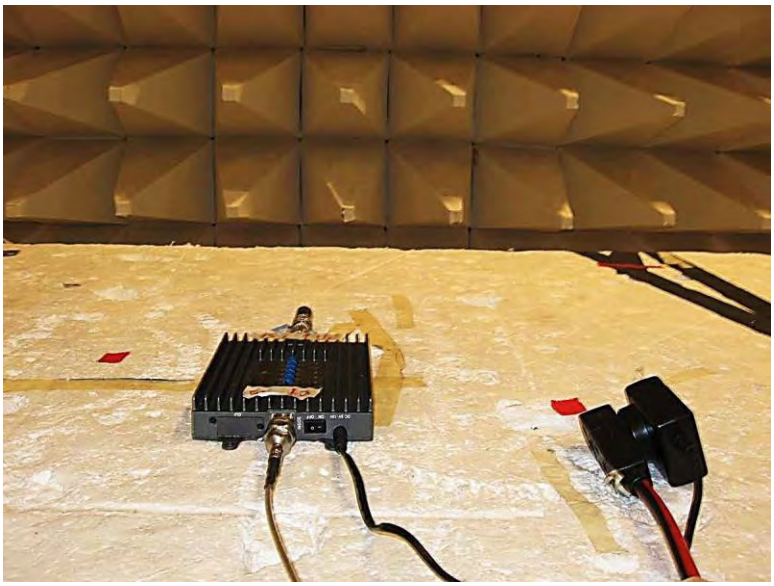
Since 20 Log E (uV/m) = E in dBuV/m

= ~~E_{dBuv}~~ - ~~E_{dBuv}~~ + 82.23

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

Test Setup Photos





SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2.

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 the limit value subtracting the corrected measured value; a negative margin represents a measurement exceeding the limit while a positive 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 carrot ("^") 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.