



Compliance Testing, LLC

Previously Flom Test Lab

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Test Report

Prepared for: Wireless Extenders

Model: ZB545

Description: Cellular Dual Band Booster

FCC ID: SO4ZB570-PCS-CEL

To

FCC Part 20

Date of Issue: October 11, 2013

On the behalf of the applicant:

**Wireless Extenders
One Meca Way
Norcross, GA 30093**

To the attention of:

**Scott Terry, VP of Engineering
Ph: (770) 239-5475
Email: sterry@zboost.com**

**Prepared By
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Project No: p1390008**

**John Erhard
Project Test Engineer**

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All results contained herein relate only to the sample tested



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	October 11, 2013	John Erhard	Original Document
2.0	January 8, 2014	John Erhard	Edit per TCB review requirements
3.0	January 27, 2014	Mike Graffeo	Updated Conducted Emissions rule sections in the test summary table on page 6 to match the new eCFR rule sections dated January 7, 2014.



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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009)

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.

Testing Certificate Number: **2152.01**



FCC OATS Reg, #933597

IC Reg. #2044A-1

Non-accredited tests contained in this report:

N/A



Test and Measurement Data

Subpart

2.1033(c)(14):

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Part 2, Subpart J and the following individual Parts: 20.21 in conjunction with KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516.

Standard Test Conditions and Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI/C63.4-2009, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions		
Temp (°C)	Humidity (%)	Pressure (mbar)
22.3 – 28.9	48.7 – 56.8	960.2 – 971.4

Measurement results, unless otherwise noted, are worst-case measurements.

EUT Description

Model: ZB545, Plus Many Derivative Models

Description: Cellular Dual Band Booster

Firmware: N/A

Software: N/A

Additional Information:

The EUT is a bi-directional amplifier for the boosting of cellular phone signals and data communication devices. The following frequency bands and emission types are utilized.

Frequency Band (MHz)		
Uplink	824 - 849	1850 - 1910
Downlink	869 - 894	1930 - 1990
Modulation Type	GSM, CDMA, EDGE, HSPA, EVDO, LTE	

Emission Designators					
CDMA	HSPA	LTE	EVDO	EDGE	GSM
F9W	F9W	G7D	F9W	G7W	GXW

The modulation types and emission designators listed in the tables represent the modulations that the cell phone providers use for each frequency band. GSM, CDMA, and WCDMA represent all the modulation types (phase and amplitude or a combination thereof) utilized within the industry. EDGE, HSPA, LTE etc. are all protocols or multiplexing techniques using the base modulations.

EUT Operation during Tests

The EUT was in a normal operating condition.



Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
20.21(e)(3)	Authorized Frequency Band	Pass	
20.21(e)(8)(i)(B) 20.21(e)(8)(i)(C) 20.21(e)(8)(i)(D)	Maximum Power and Gain	Pass	
20.21(e)(8)(i)(F)	Intermodulation	Pass	
20.21(e)(8)(i)(E)	Out-of-Band Emissions	Pass	
2.1051 22.917(a) 24.238((a)	Conducted Spurious Emissions	Pass	
20.21(e)(8)(i)(A)	Noise Limits	Pass	
20.21(e)(8)(i)(I)	Uplink Inactivity	Pass	
21(e)(8)(i)(C)	Variable Gain	Pass	
2.1049	Occupied Bandwidth	Pass	
20.21(e)(8)(ii)(A)	Oscillation Detection	Pass	
2.1053	Radiated Spurious	Pass	
20.21(e)(8)(i)(B)	Spectrum Block Filtering	N/A	This only applies to devices utilizing spectrum block filtering



Authorized Frequency Band

Name of Test:

Authorized Frequency Band

Engineer: John Erhard

Test Equipment Utilized:

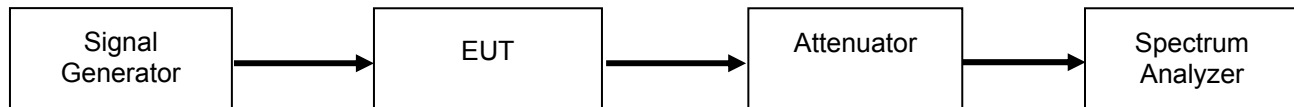
i00331, i00405

Test Date: 10/2/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. A signal generator was utilized to produce a CW input signal tuned to the center channel of the operational band. The RF input level was increased to a point just prior to the AGC being in control of the power. The Signal generator was set to sweep across 2X the operational band of the EUT while the spectrum analyzer was set to MAX HOLD. Two markers were placed at the edges of the operational band and a third marker was placed at the highest point within the band no closer than 2.5 MHz from the band edge.

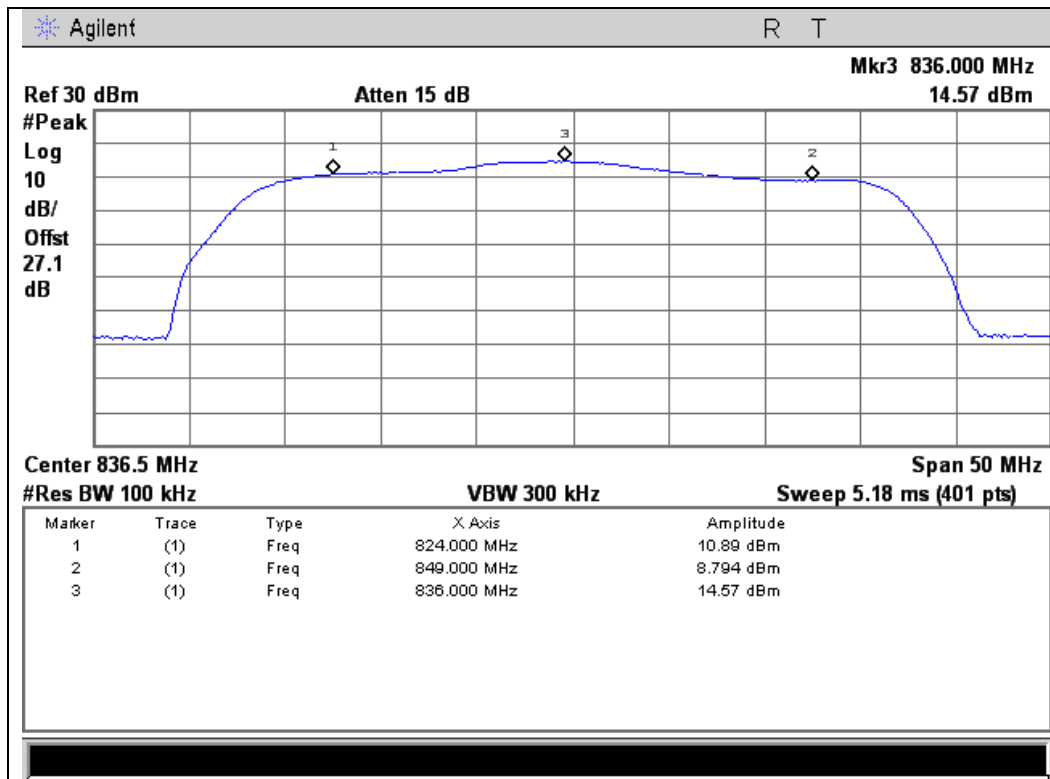
Test Setup



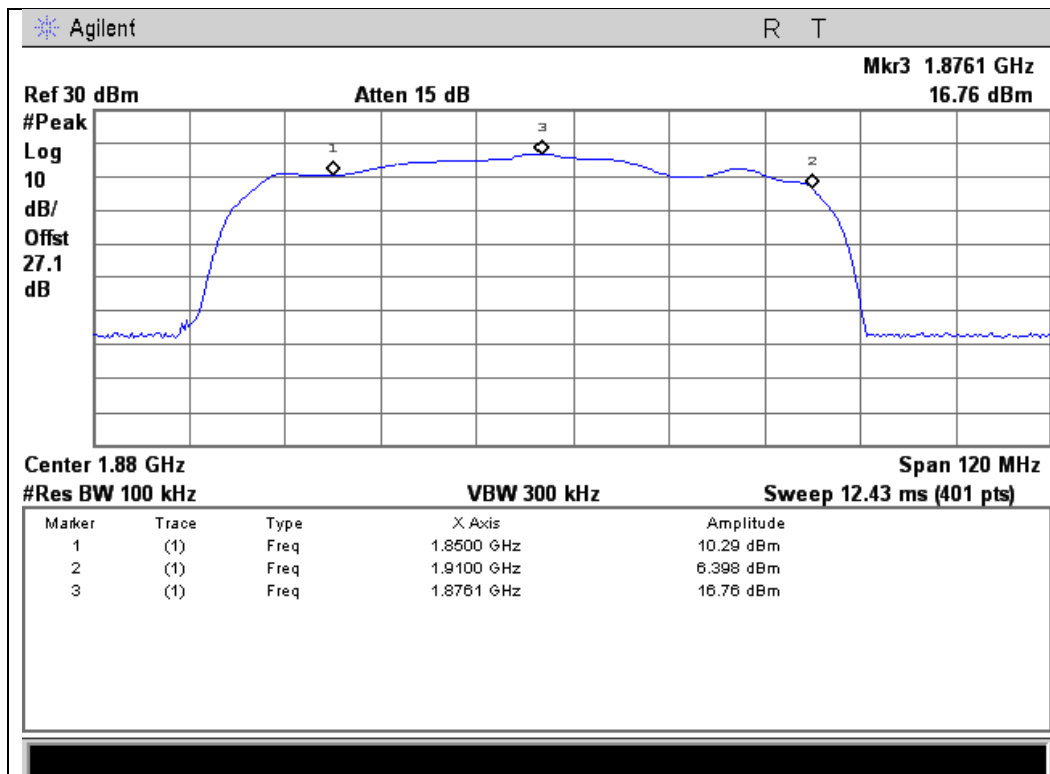


Uplink Test Results

824 - 849 MHz Band



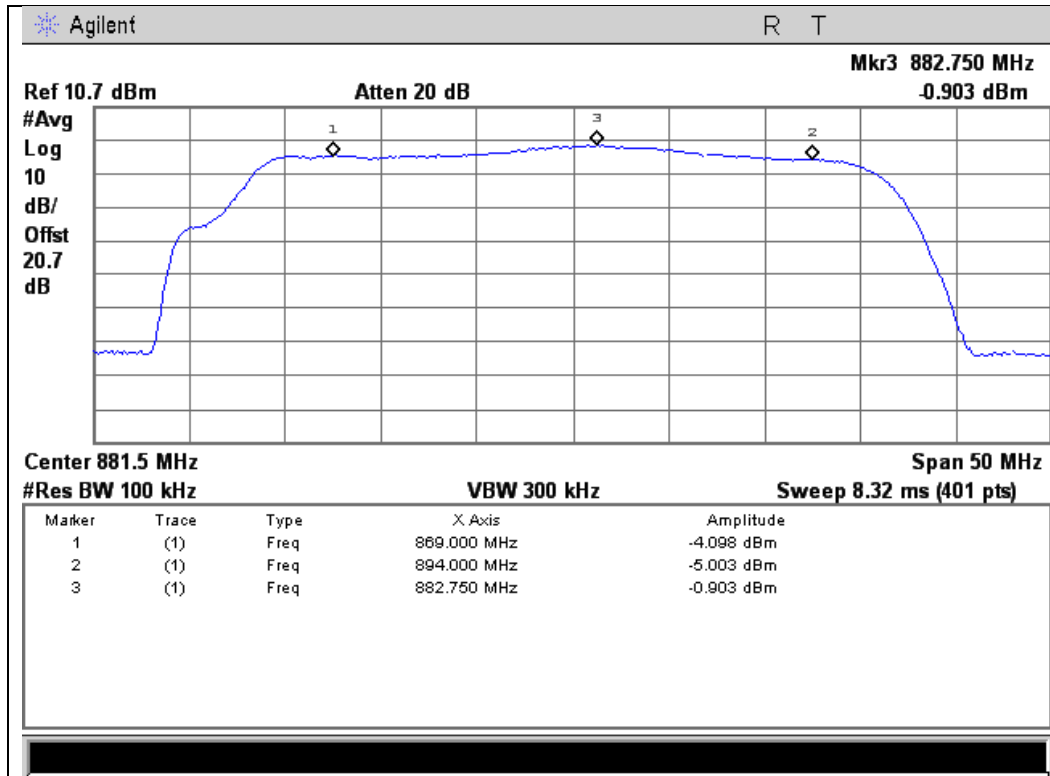
1850 - 1910 MHz Band



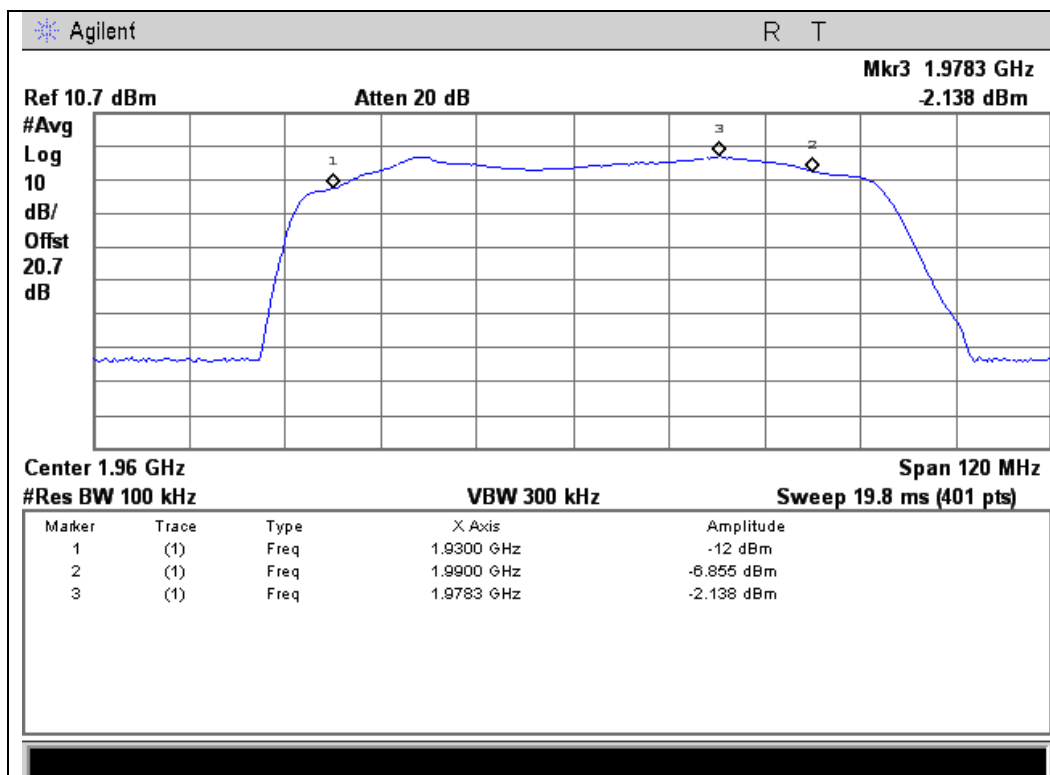


Downlink Test Results

869 - 894 MHz Band



1930 - 1990 MHz Band





Maximum Power and Gain

Name of Test: Maximum Power and Gain
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/3/2013

Test Procedure

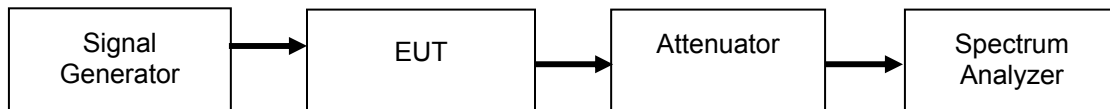
The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. The spectrum analyzer and signal generator were tuned to the highest frequency in the band as determined by the Authorized Frequency Band test. The RF input level was increased to a point just prior to the AGC being in control of the power with both a pulsed single time slot GSM and 4.1 MHz AWGN modulation. The maximum power was measured and verified to meet the minimum and maximum levels allowed with the maximum gain was computed from these values. The uplink and downlink gain under each condition was verified to be within 9 dB of each other.

The following formula is used for calculating the gain limits.

$$\text{Gain Limit (dB)} = 6.5 \text{ dB} + 20\text{Log}(F_{\text{MHz}})$$

F_{MHz} is the uplink mid-band frequency with the downlink gain being equivalent to the paired Uplink band.

Test Setup



Uplink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Lower Limit (dBm)	Upper Limit (dBm)	Result
824 - 849 MHz Pulsed GSM	-39.7	21.2	17	30	Pass
824 - 849 MHz AWGN	-41.5	18.9	17	30	Pass
1850 - 1910 MHz Pulsed GSM	-48.4	19.0	17	30	Pass
1850 - 1910 MHz AWGN	-48.5	17.8	17	30	Pass

Downlink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Upper Limit (dBm)	Result
869 - 894 MHz Pulsed GSM	-59.3	0.4	17	Pass
869 - 894 MHz AWGN	-53.7	2.9	17	Pass
1930 - 1990 MHz Pulsed GSM	-65.8	1.9	17	Pass
1930 - 1990 MHz AWGN	-57.8	2.9	17	Pass



Uplink and Downlink Gain Test Results

Modulation	Uplink Frequency (MHz)	Downlink Frequency (MHz)	Uplink Gain (dB)	Uplink Limit (dB)	Downlink Gain (dB)	Downlink Limit (dB)	Delta (dB)	Limit (dB)	Margin (dB)
Pulsed GSM	836	882.75	60.9	64.9	59.7	64.9	1.2	9	-7.8
AWGN	836	882.75	60.4	64.9	56.6	64.9	3.8	9	-5.2
Pulsed GSM	1876.1	1978.3	67.4	72	67.7	71	0.32	9	-8.68
AWGN	1876.1	1978.3	66.3	72	60.7	71	5.6	9	-3.4



Intermodulation

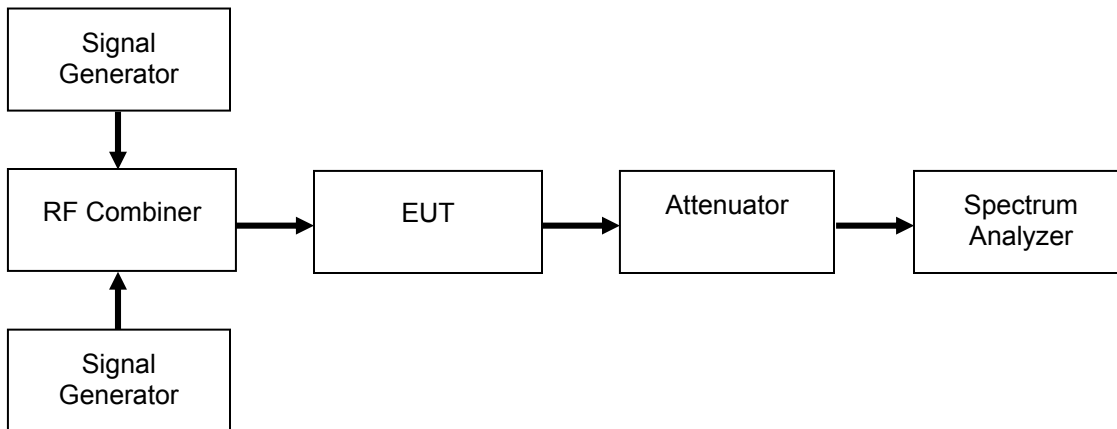
Name of Test: Intermodulation
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/3/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator. Two signal generators were utilized to produce two CW signals 600 kHz apart and centered in the operational band. Attenuator and cable insertion loss correction factors were input to either the signal generator or the spectrum analyzer as required to ensure accurate measurements were recorded. The input power was set at the maximum allowable power and the RMS intermodulation products were measured to ensure they were less than -19 dBm in a 3 kHz RBW. The uplink and downlink intermodulation products were plotted with the levels being listed in the summary tables.

Test Setup



Uplink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
824 - 849 MHz	-24.39	-19	Pass
1850 - 1910 MHz	-26.93	-19	Pass

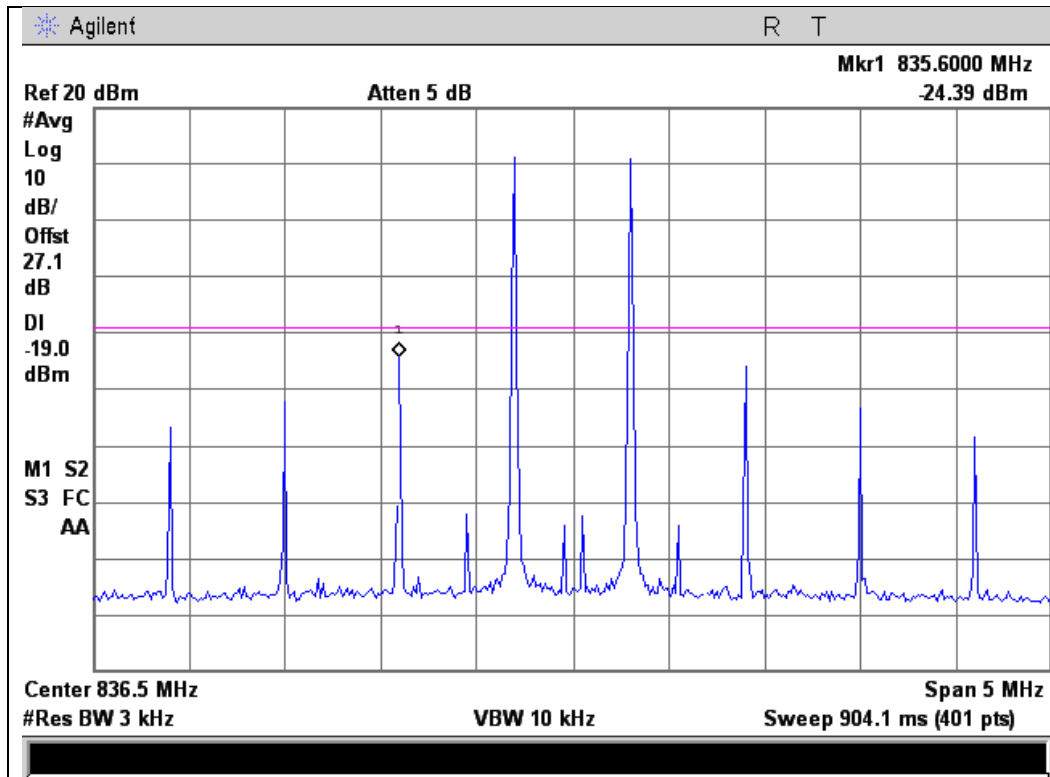
Downlink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
869 - 894 MHz	-45.46	-19	Pass
1930 - 1990 MHz	-39.33	-19	Pass

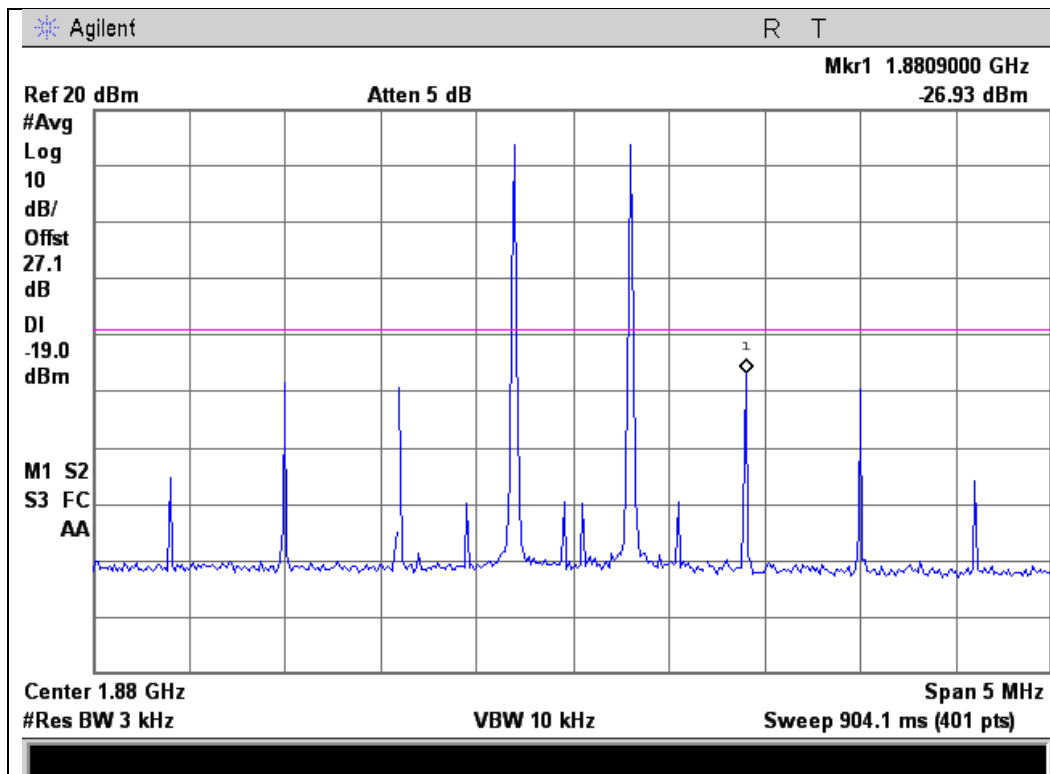


Uplink Test Results

824 - 849 MHz Band



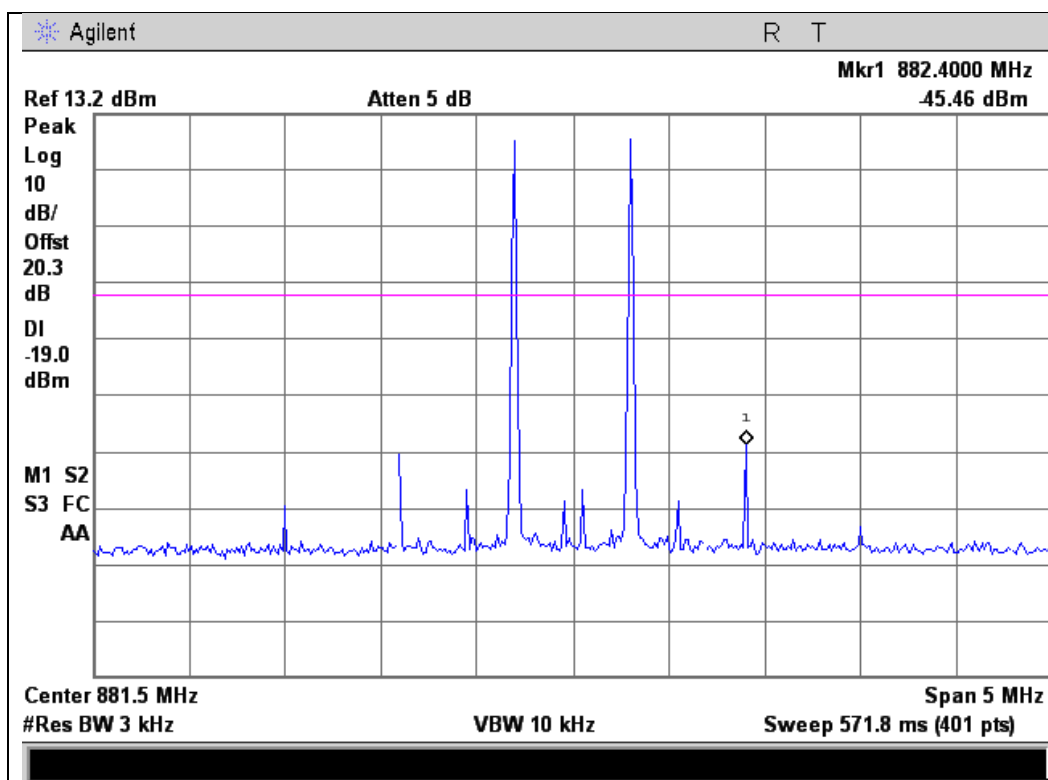
1850 - 1910 MHz Band



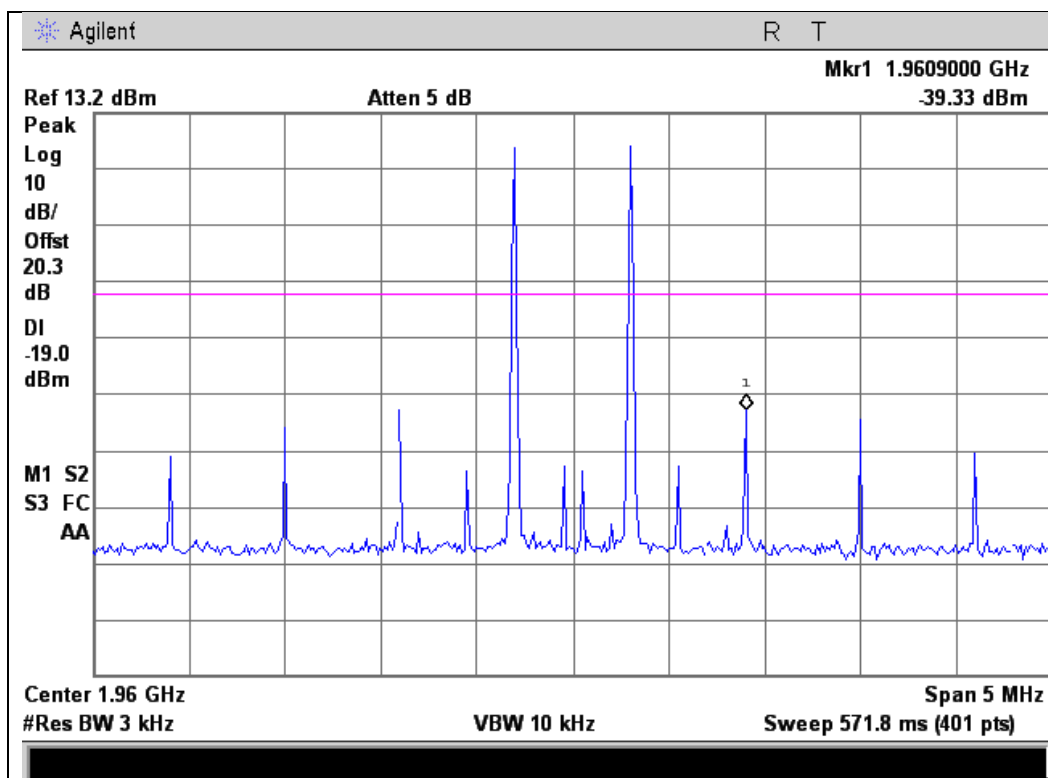


Downlink Test Results

869 - 894 MHz Band



1930 - 1990 MHz Band





Out-of-Band Emissions

Name of Test:

Out-of-Band Emissions

Engineer: John Erhard

Test Equipment Utilized:

i00331, i00405

Test Date: 10/4/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. A signal generator was utilized to produce the following signals; GSM, CDMA, and WCDMA tuned to the lowest allowable upper and lower channel within the EUT operational band for each respective modulation type. The RF input level was increased to a point just prior to the AGC being in control of the power. For each modulation type the Out of Band Emissions was measured ensuring the meet the requirements.

The following formula is used for calculating the limits.

$$\text{Limit} = -6 + (43 + 10\log P)$$

Test Setup





GSM Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
824 - 849	Lower	-38.50	-19	Pass
824 - 849	Upper	-39.97	-19	Pass
1850 - 1910	Lower	-34.18	-19	Pass
1850 - 1910	Upper	-40.23	-19	Pass

CDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
824 - 849	Lower	-51.47	-19	Pass
824 - 849	Upper	-38.62	-19	Pass
1850 - 1910	Lower	-44.58	-19	Pass
1850 - 1910	Upper	-46.04	-19	Pass

WCDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
824 - 849	Lower	-36.9	-19	Pass
824 - 849	Upper	-38.4	-19	Pass
1850 - 1910	Lower	-41.08	-19	Pass
1850 - 1910	Upper	-40.86	-19	Pass



GSM Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
869 - 894	Lower	-44.61	-19	Pass
869 - 894	Upper	-44.43	-19	Pass
1930 - 1990	Lower	-47.60	-19	Pass
1930 - 1990	Upper	-45.55	-19	Pass

CDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
869 - 894	Lower	-61.59	-19	Pass
869 - 894	Upper	-61.73	-19	Pass
1930 - 1990	Lower	-56.98	-19	Pass
1930 - 1990	Upper	-56.84	-19	Pass

WCDMA Downlink Test Results

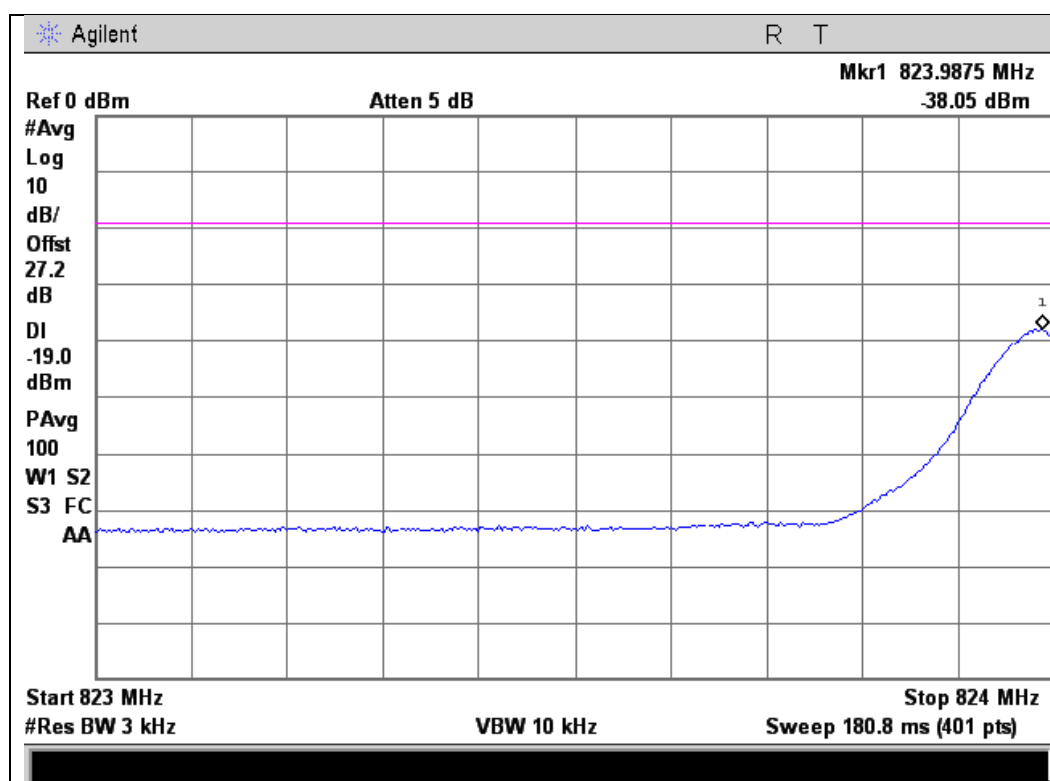
Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
869 - 894	Lower	-50.06	-19	Pass
869 - 894	Upper	-48.68	-19	Pass
1930 - 1990	Lower	-51.74	-19	Pass
1930 - 1990	Upper	-49.8	-19	Pass



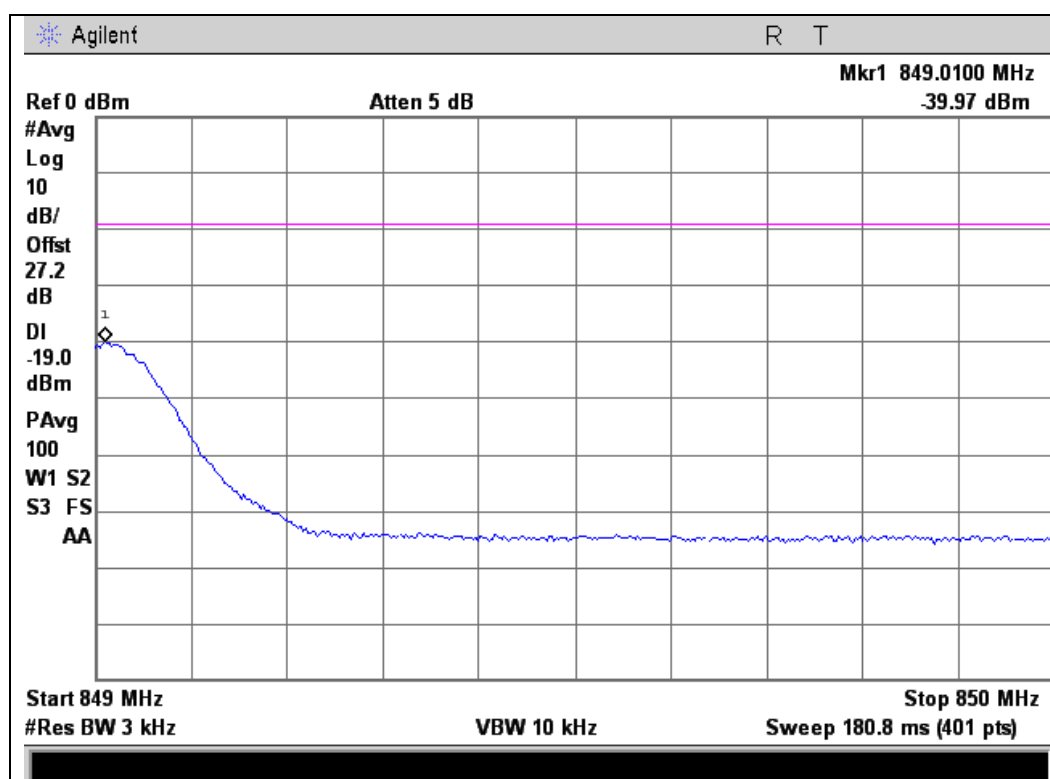
GSM Uplink Test Plots

824 - 849 MHz Band

Lower Band Edge



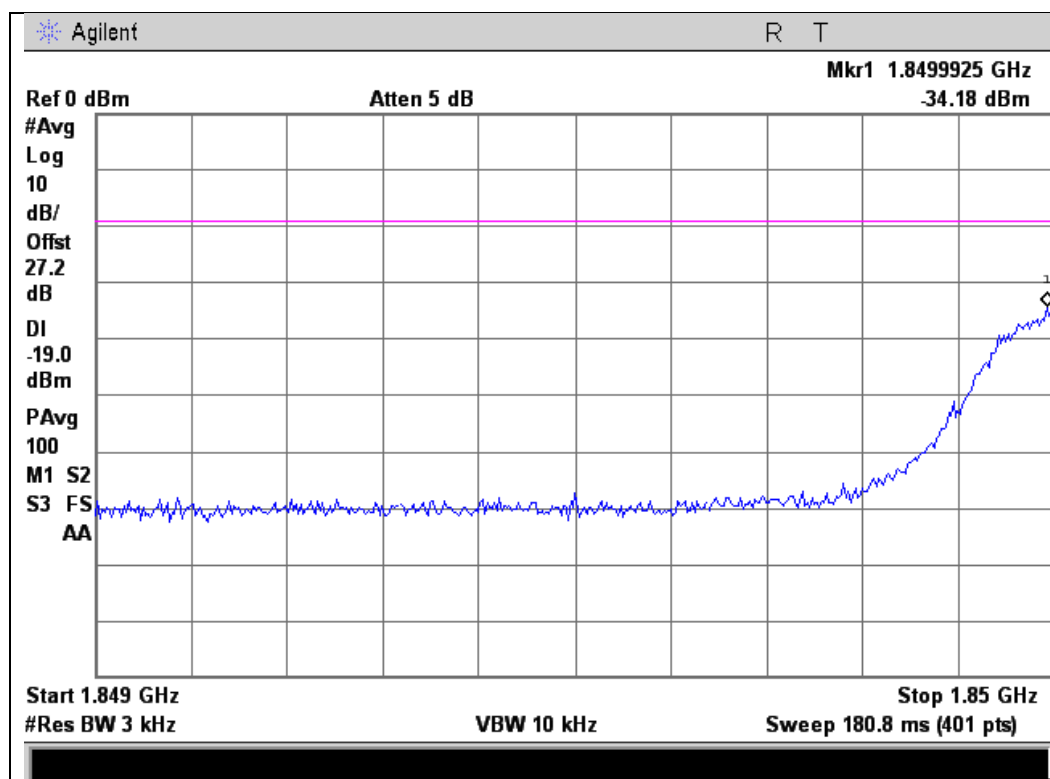
Upper Band Edge



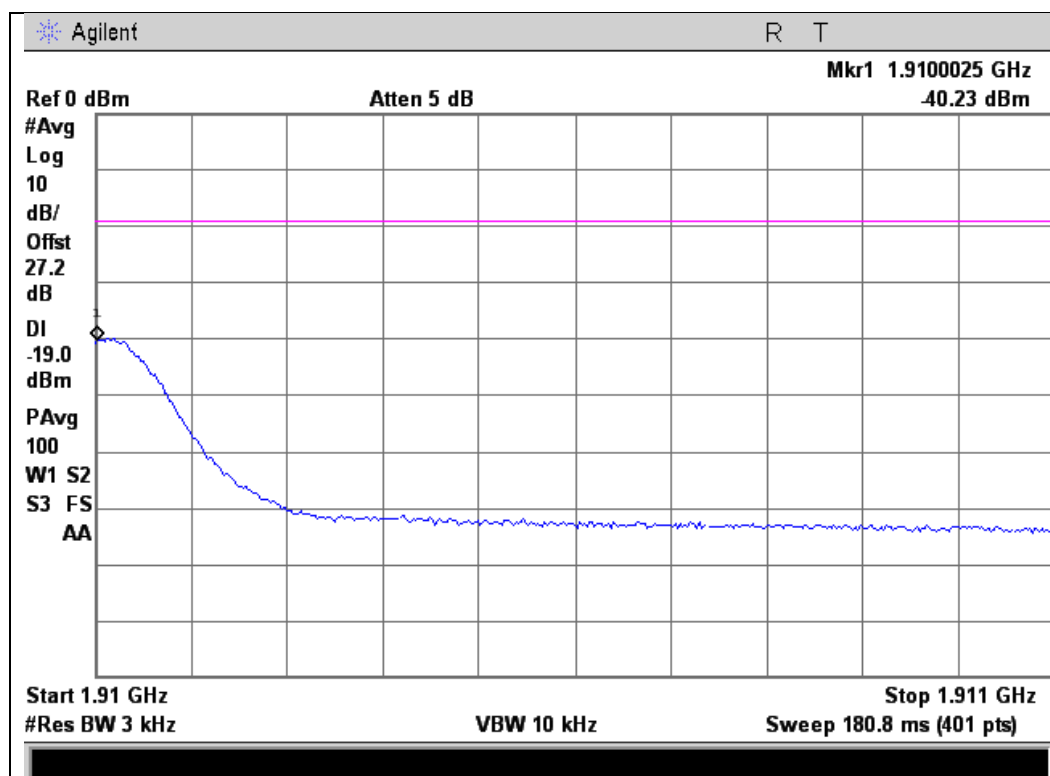


1850 - 1910 MHz Band

Lower Band Edge



Upper Band Edge

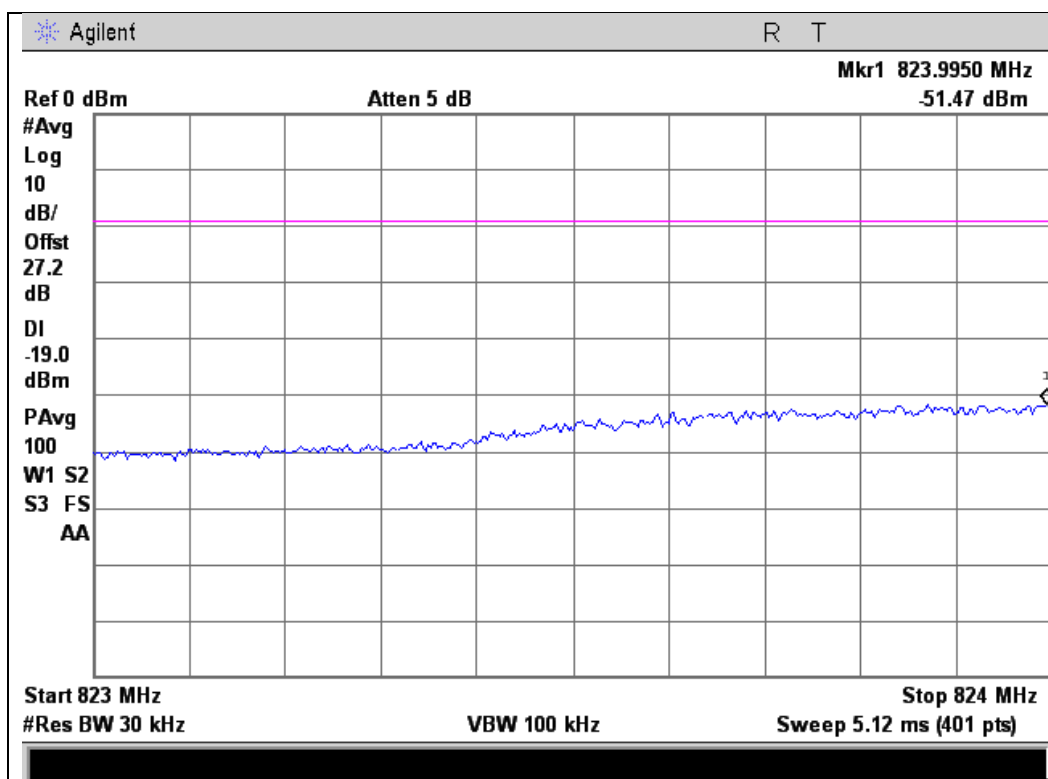




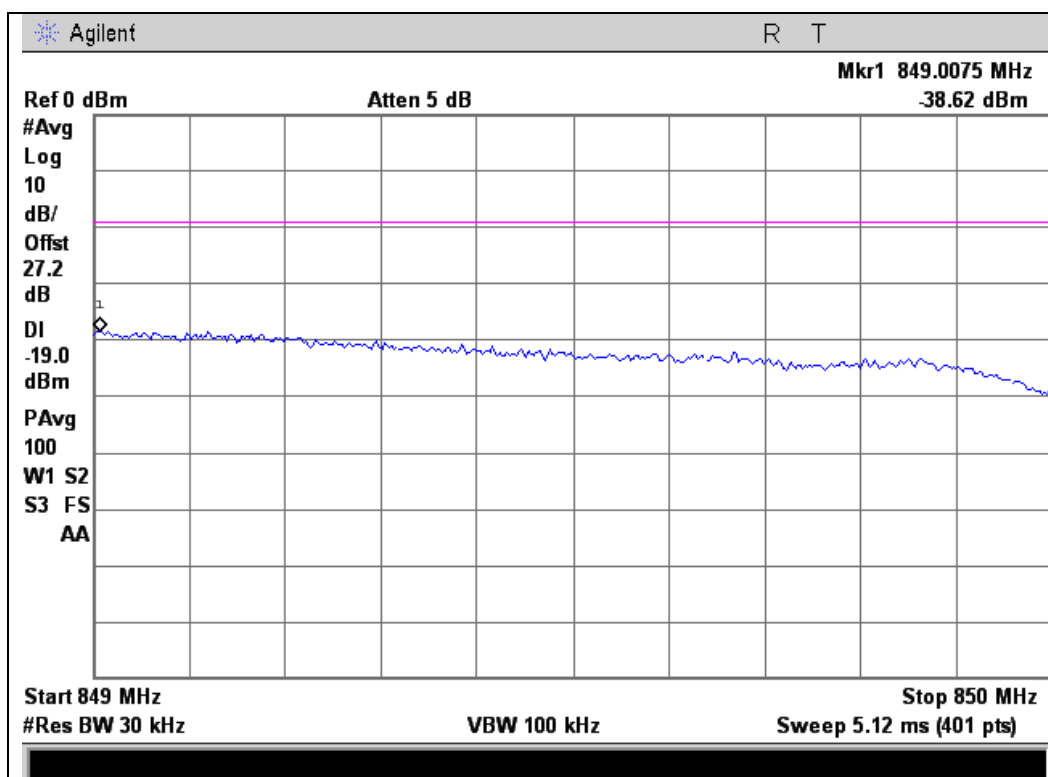
CDMA Uplink Test Plots

824 - 849 MHz Band

Lower Band Edge



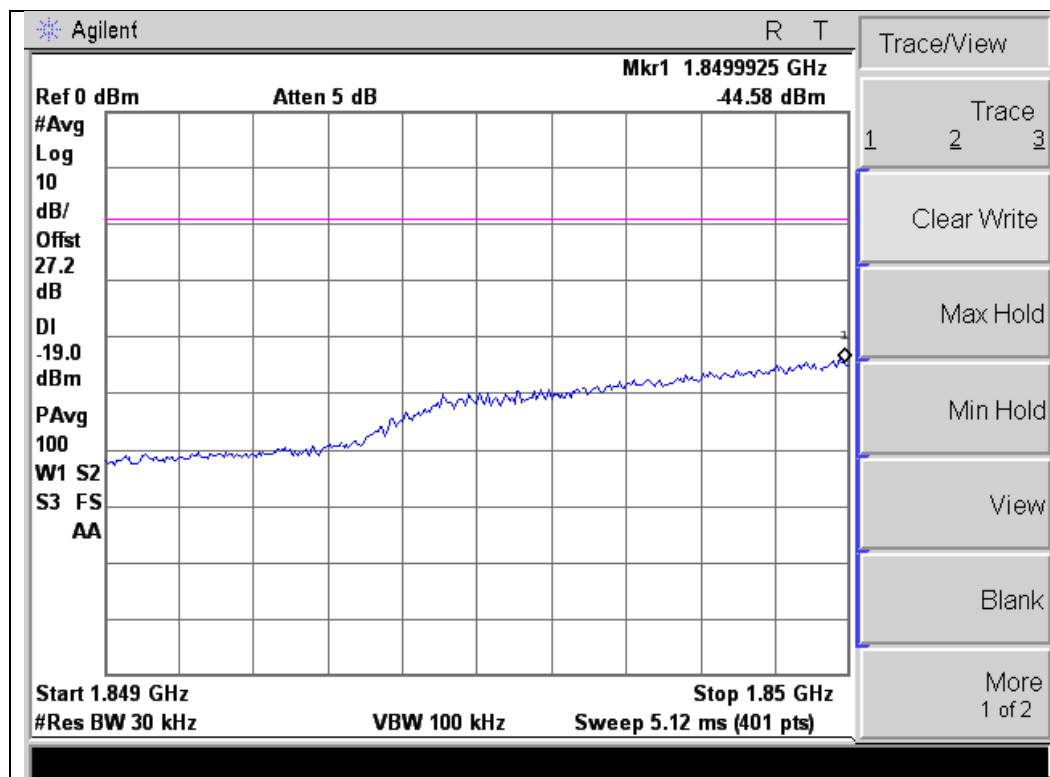
Upper Band Edge



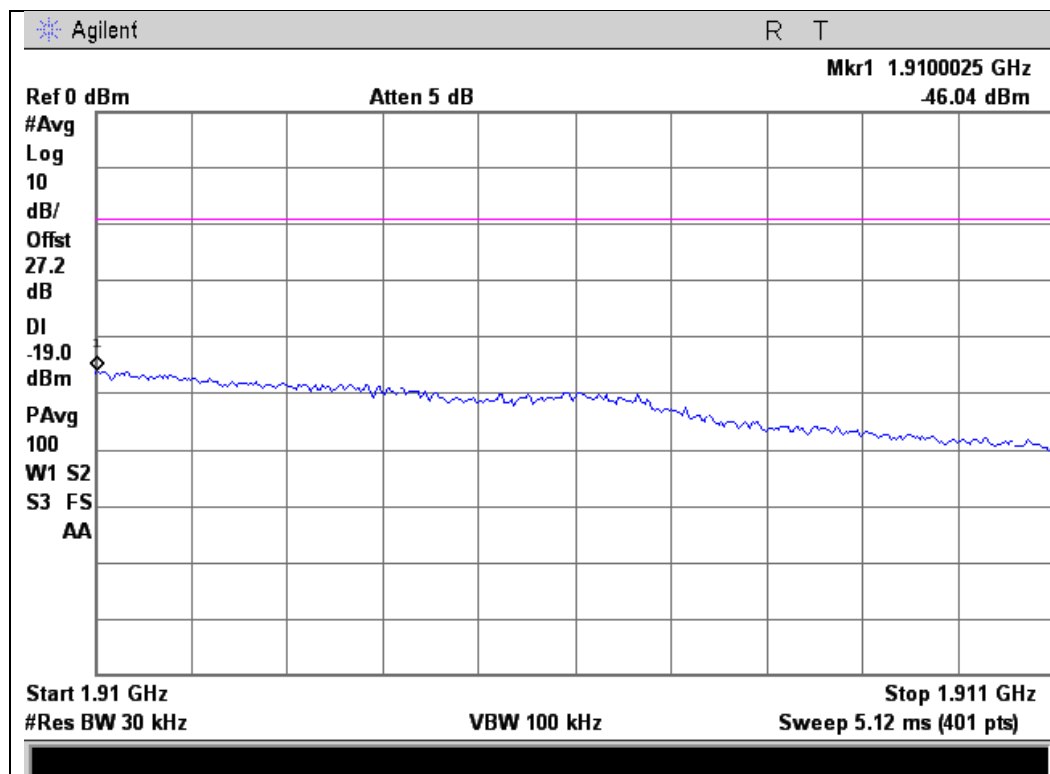


1850 - 1910 MHz Band

Lower Band Edge



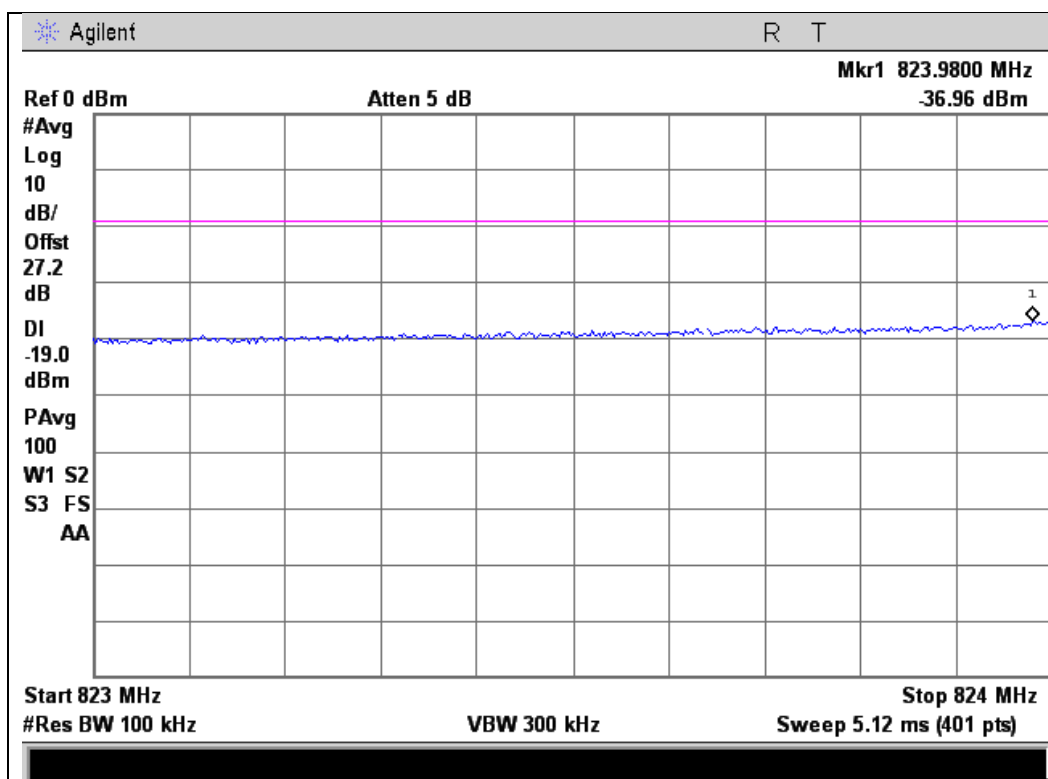
Upper Band Edge



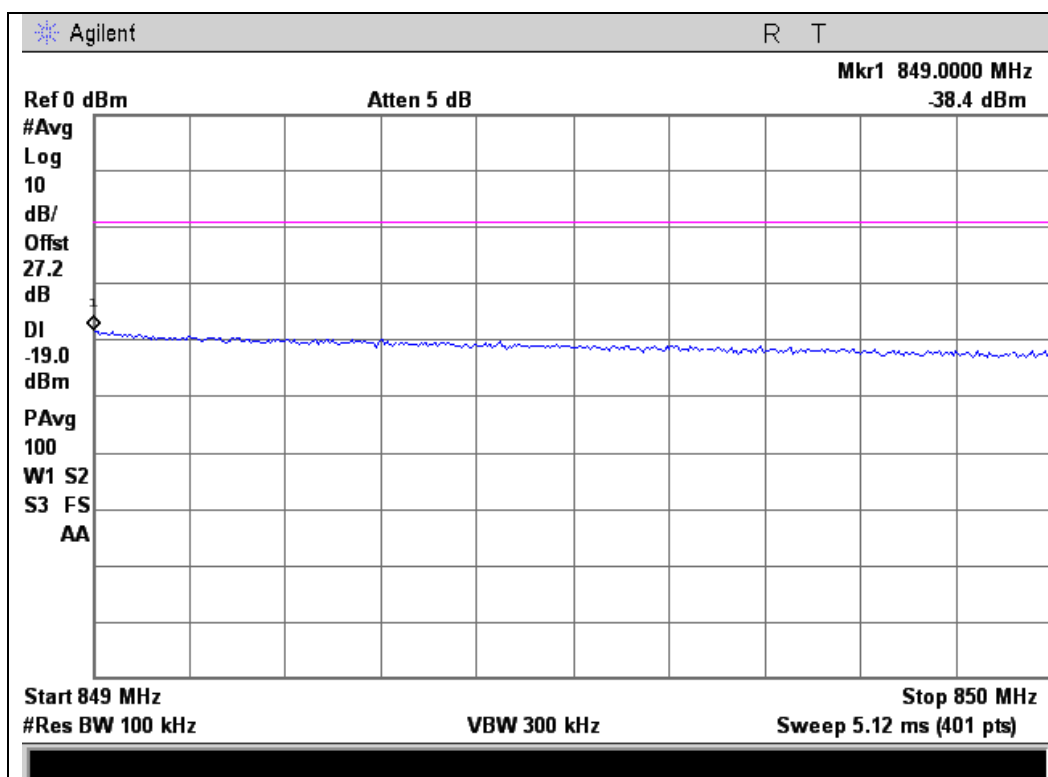


WCDMA Uplink Test Plots 824 - 849 MHz Band

Lower Band Edge



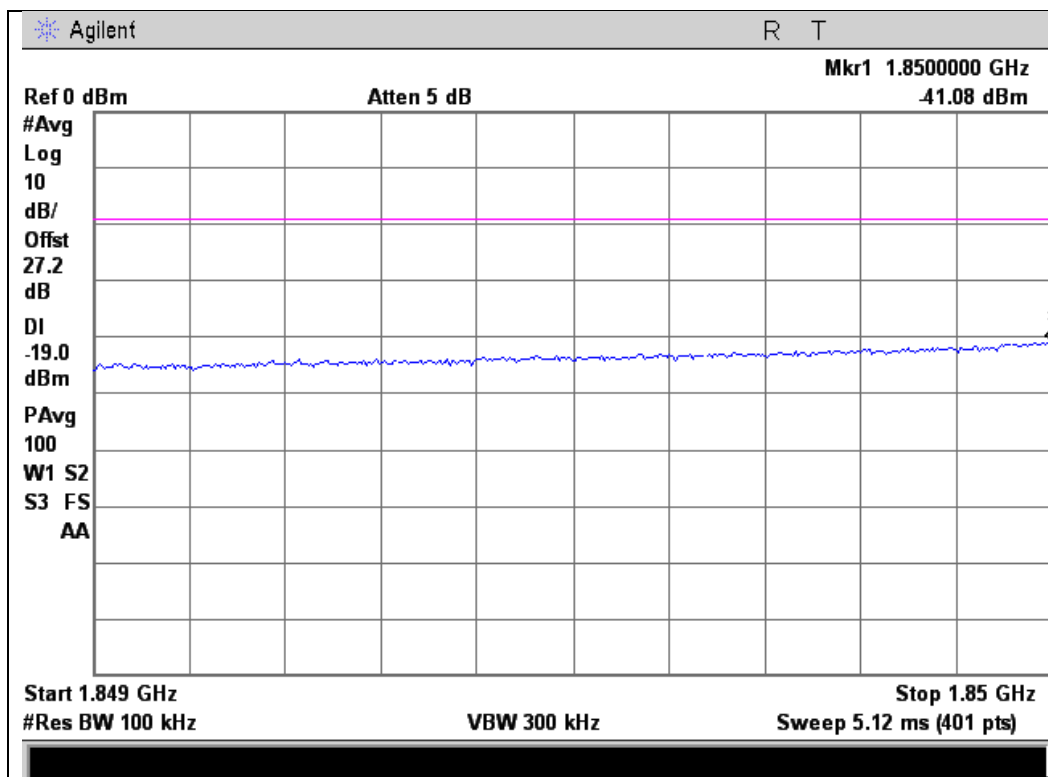
Upper Band Edge



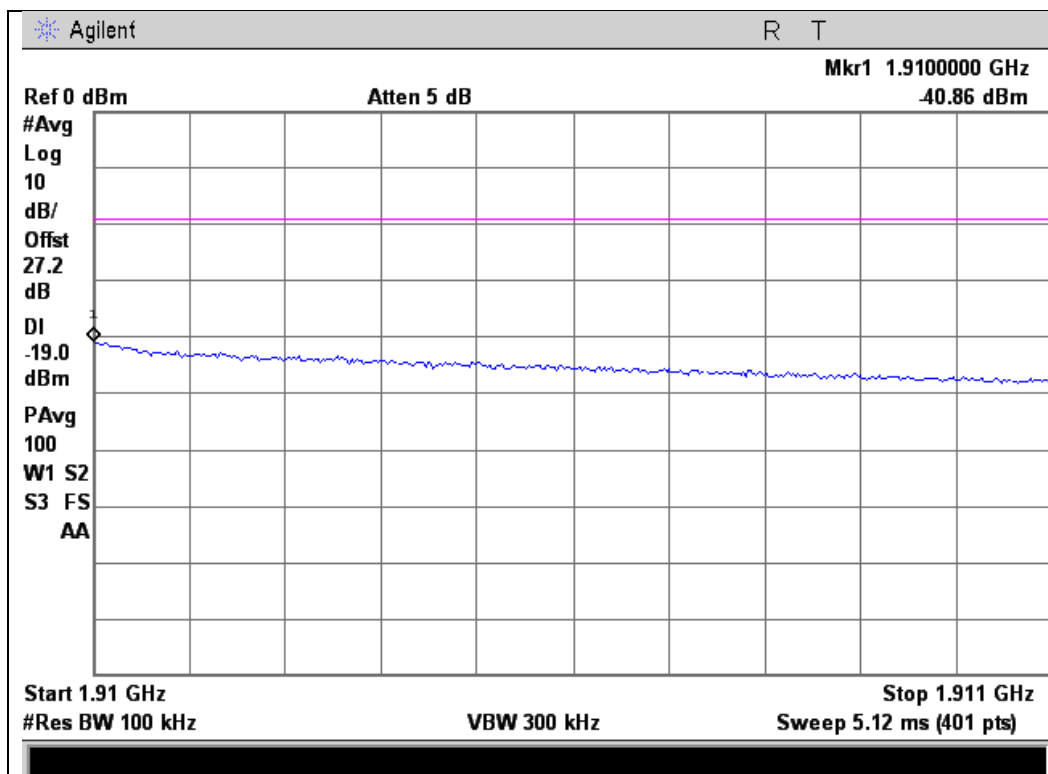


1850 - 1910 MHz Band

Lower Band Edge



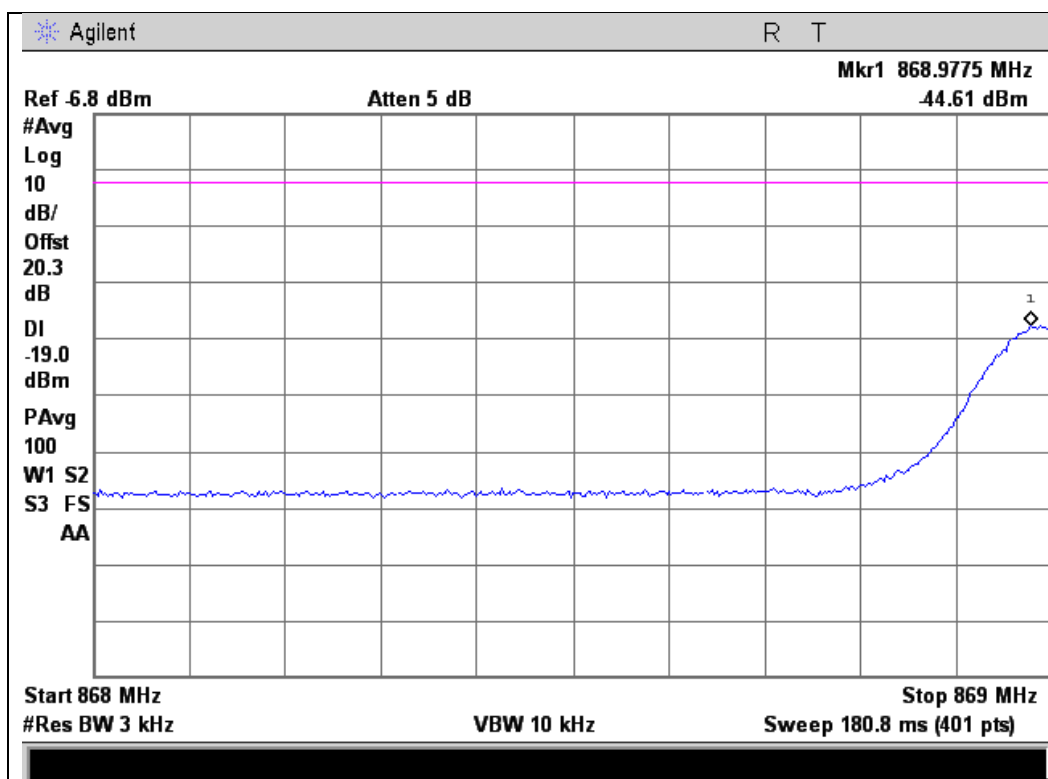
Upper Band Edge



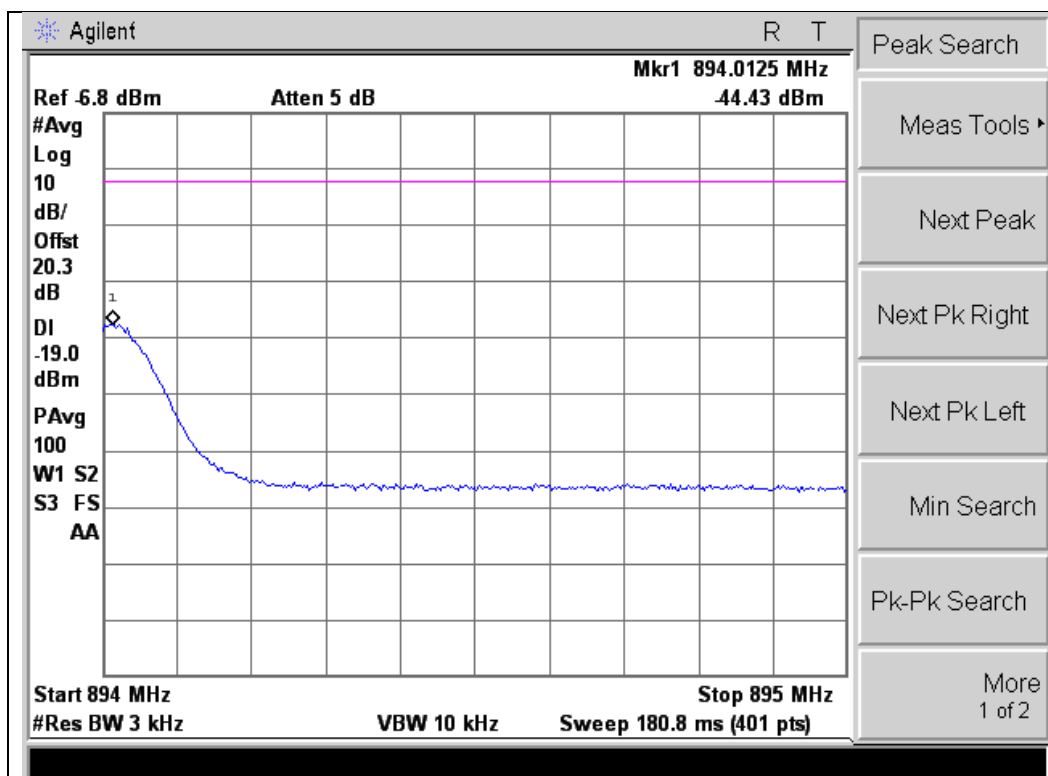


GSM Downlink Test Plots 869 - 894 MHz Band

Lower Band Edge



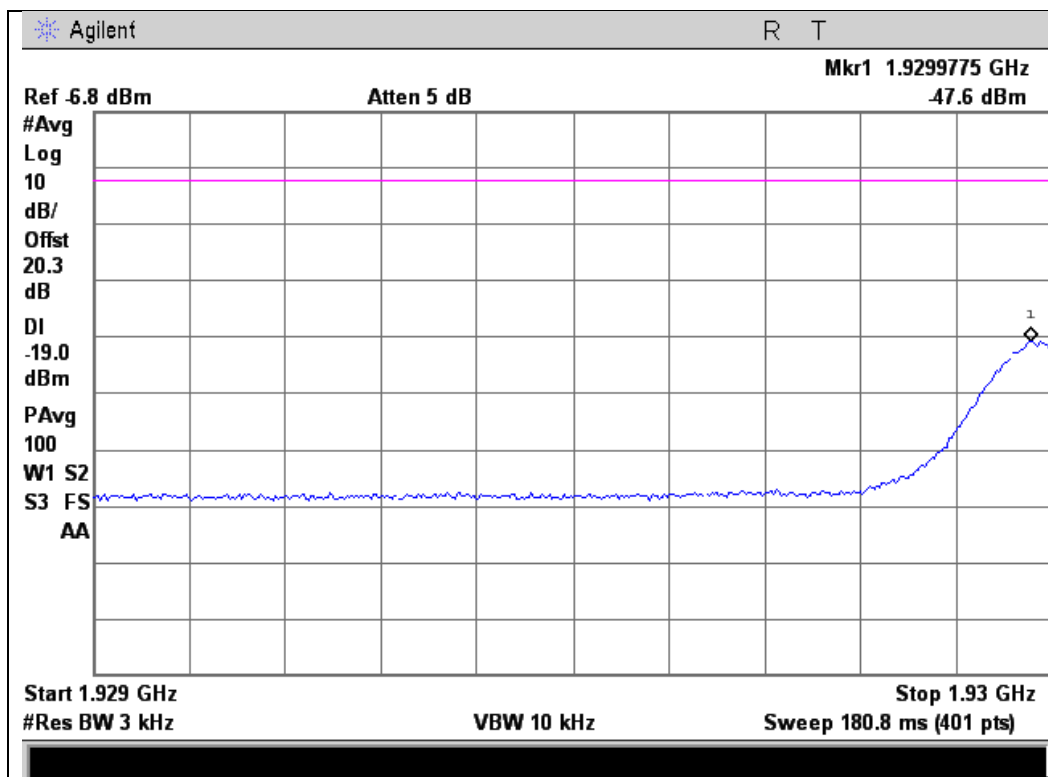
Upper Band Edge



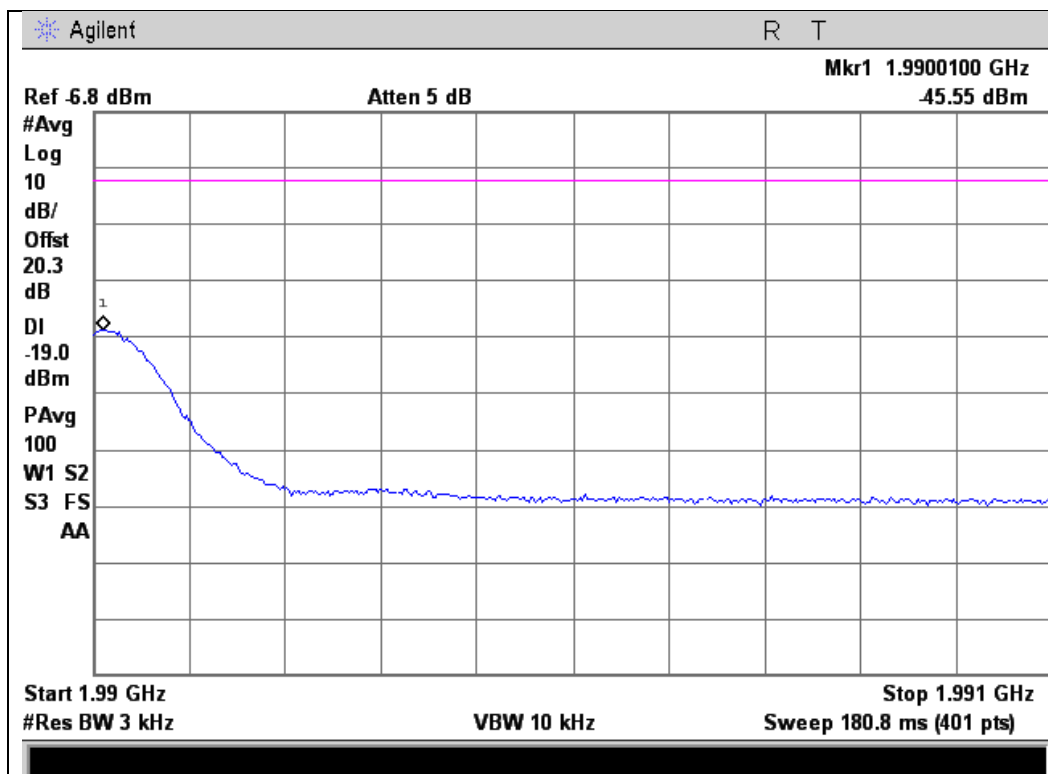


1930 - 1990 MHz Band

Lower Band Edge



Upper Band Edge

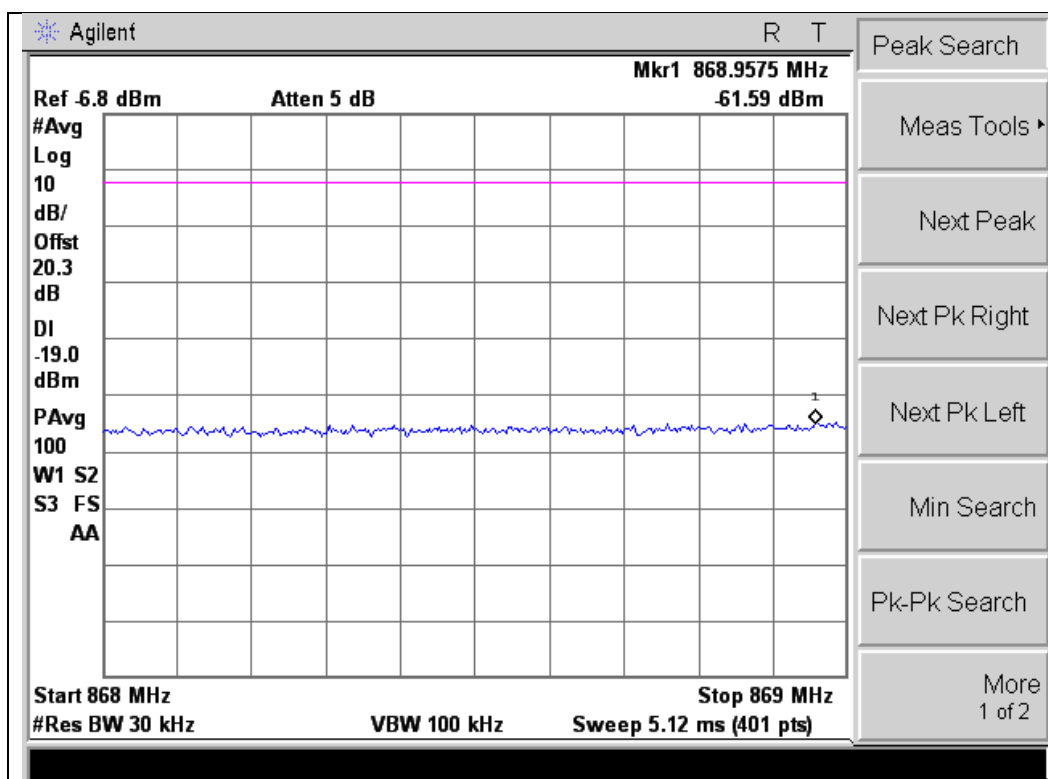




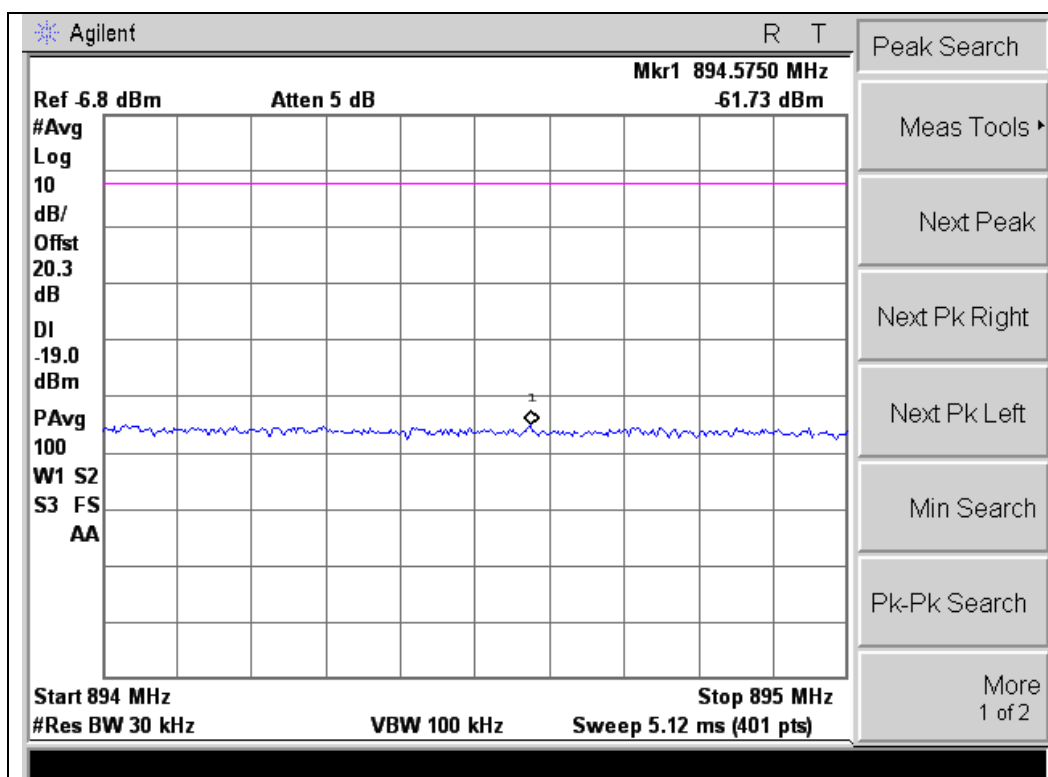
CDMA Downlink Test Plots

869 - 894 MHz Band

Lower Band Edge



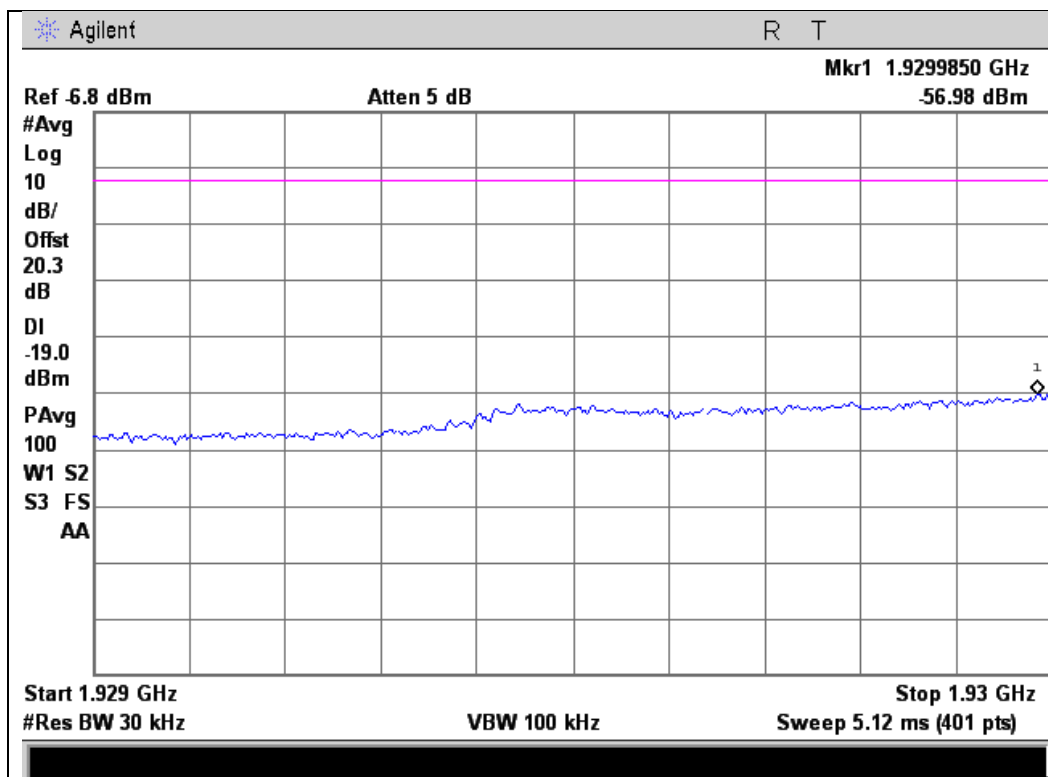
Upper Band Edge



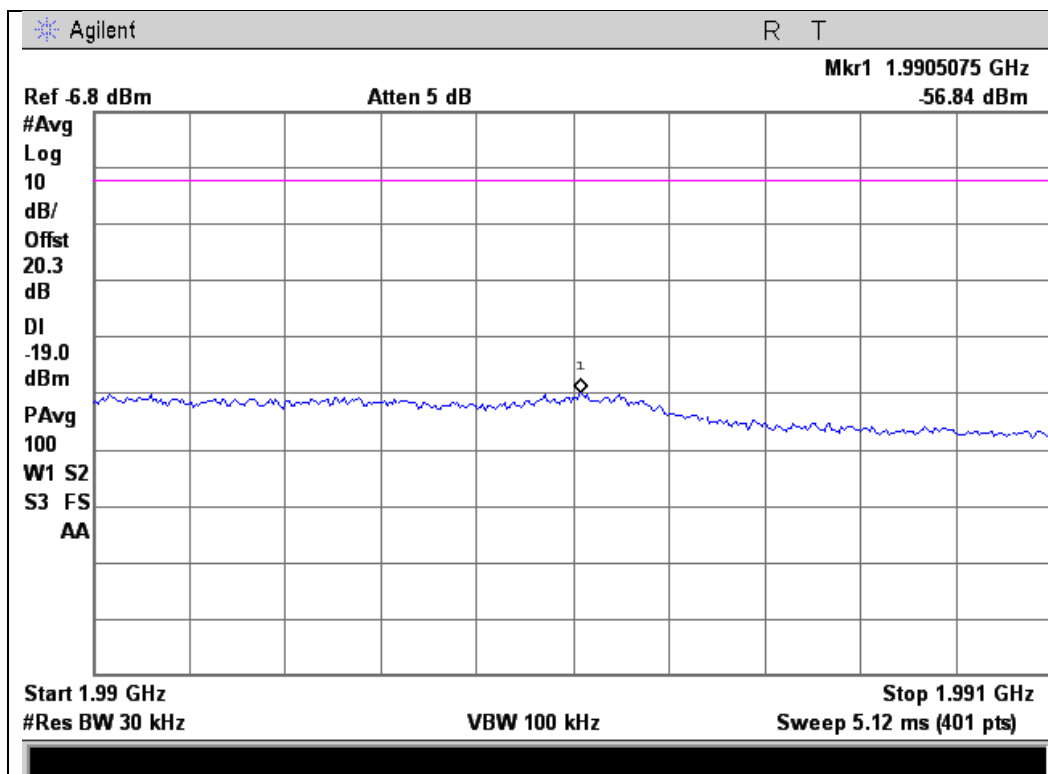


1930 - 1990 MHz Band

Lower Band Edge



Upper Band Edge

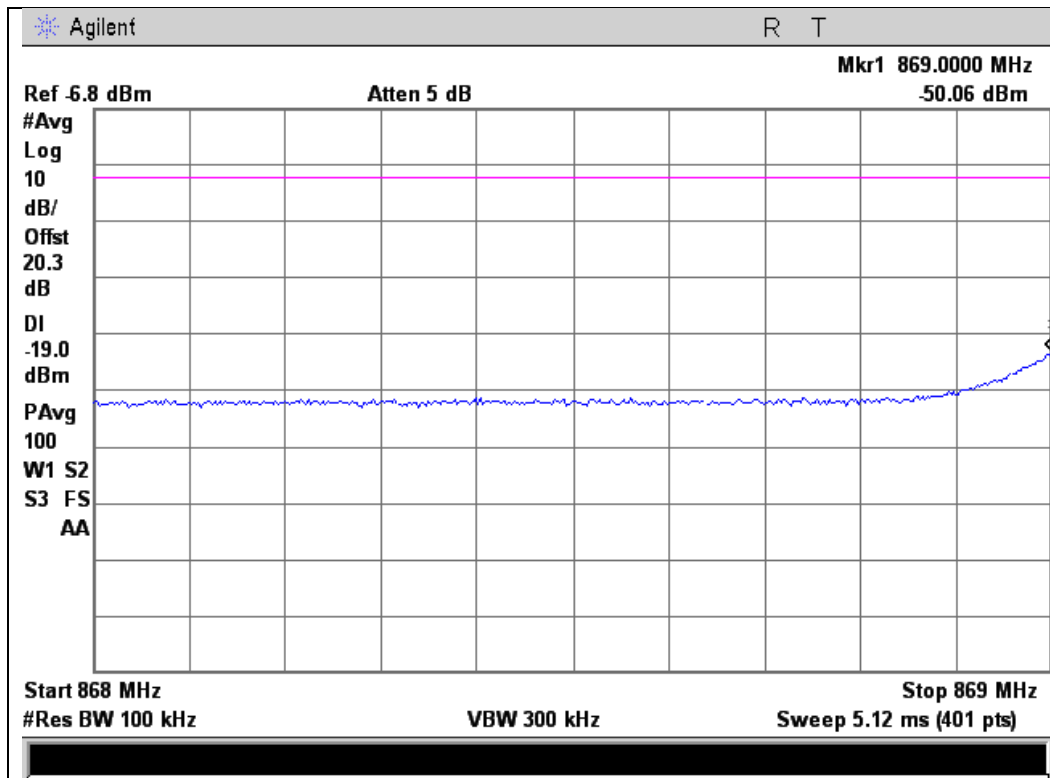




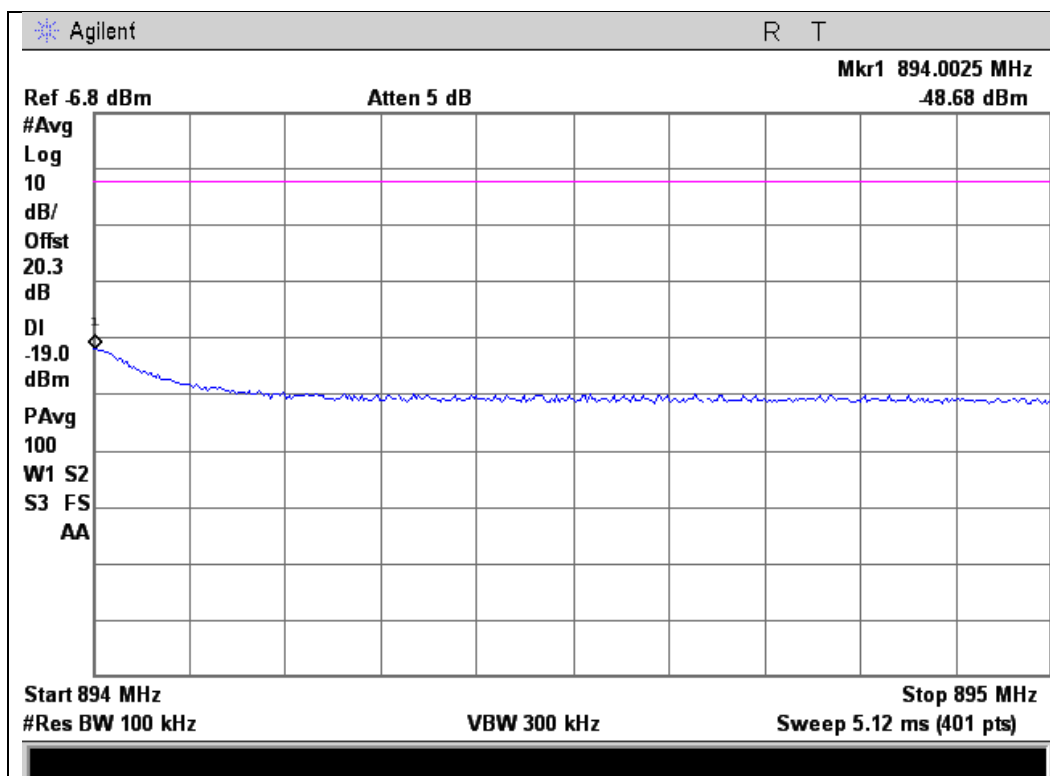
WCDMA Downlink Test Plots

869 - 894 MHz Band

Lower Band Edge



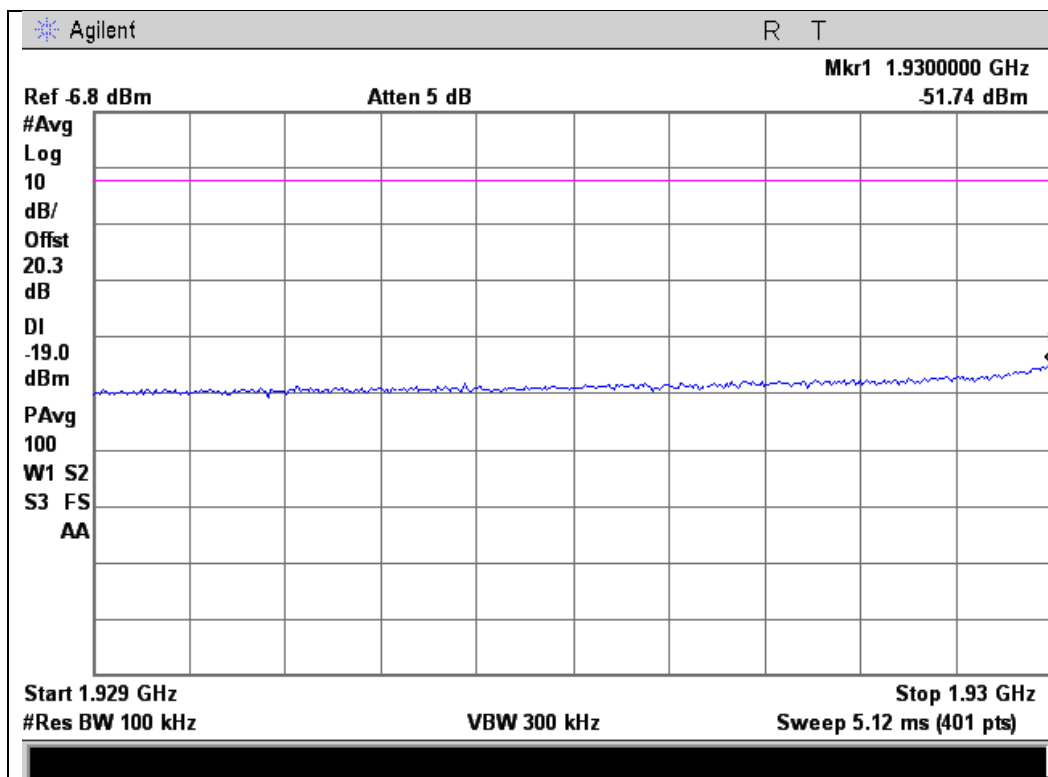
Upper Band Edge



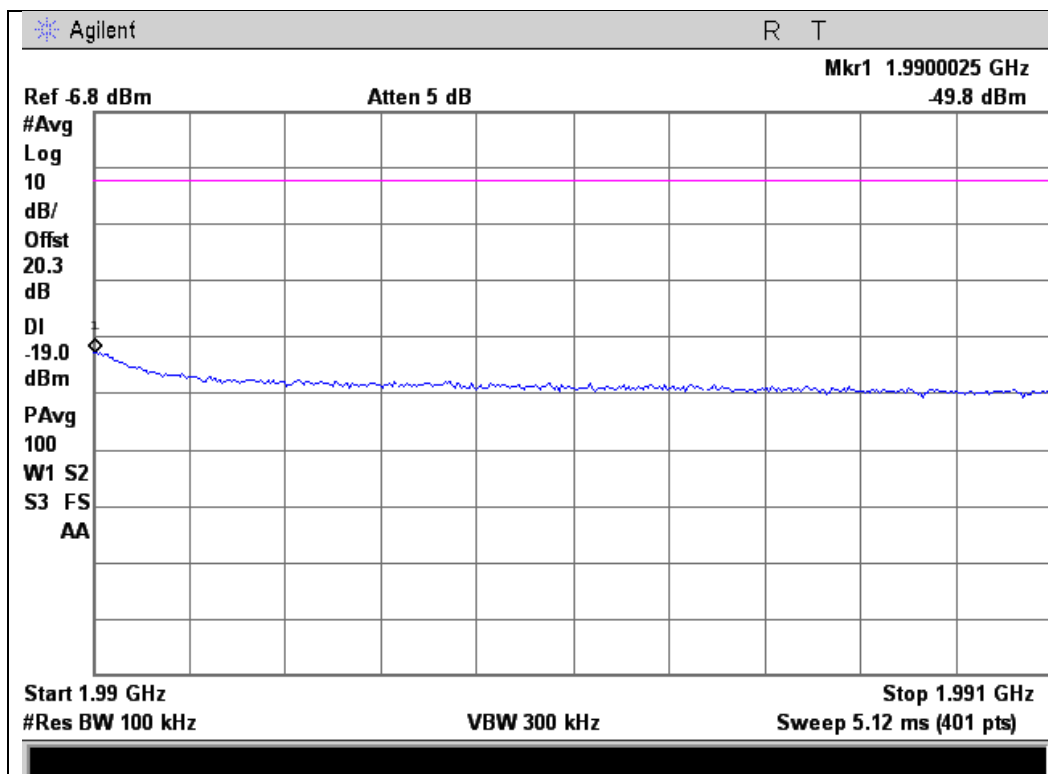


1930 - 1990 MHz Band

Lower Band Edge



Upper Band Edge





Conducted Spurious Emissions

Name of Test: Conducted Spurious Emissions
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/3/2013

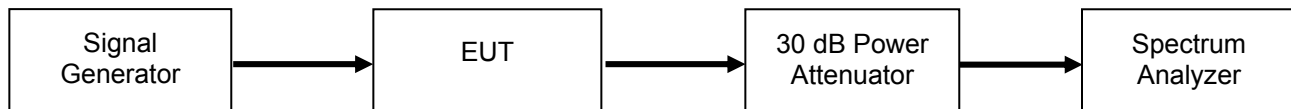
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. A signal generator was utilized to produce a 4.1 MHz AWGN signal operating at the maximum allowable power. The conducted spurious emissions from 30 MHz to 10 times the highest tunable frequency for each operational band was measured excluding the band defined by the Out of band emissions test. The emissions were plotted and the highest level was recorded in the summary table.

The following formulas are used for calculating the limits.

Conducted Spurious Emissions Limit = $43 + 10\log(P)$ dB

Test Setup



Uplink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
824 - 849	1875.1	-37.77	-13	Pass
1850 - 1910	835.9	-41.39	-13	Pass

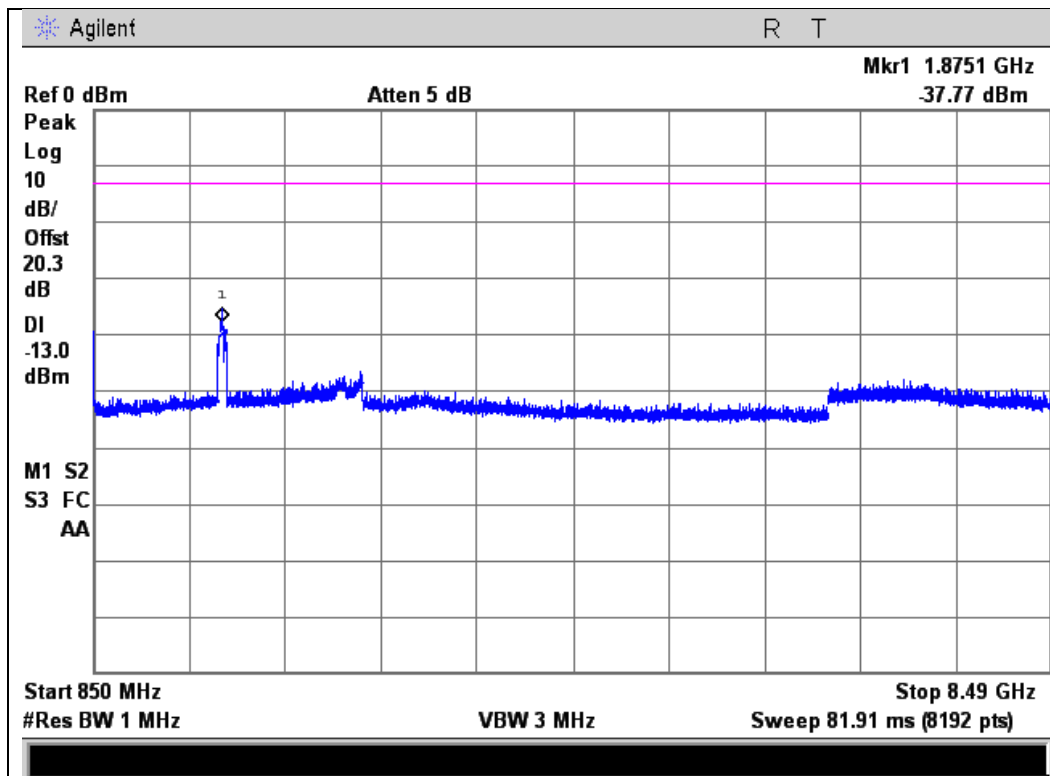
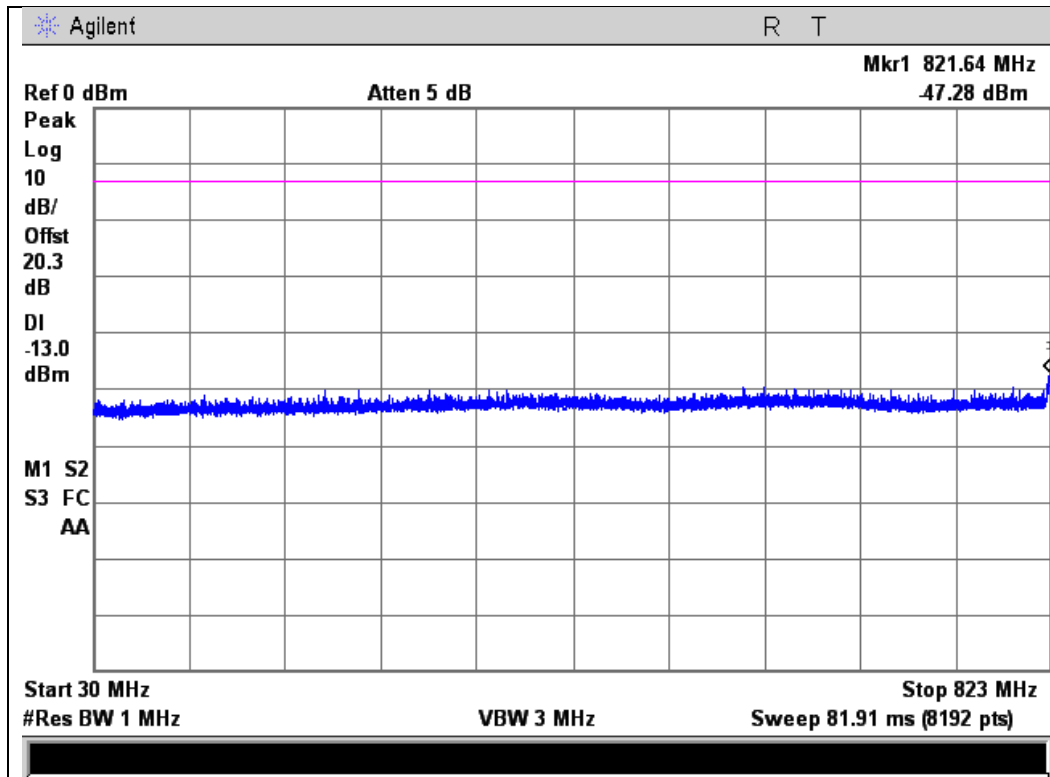
Downlink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
869 - 894	1942	-30.75	-13	Pass
1930 - 1990	879.46	-36.84	-13	Pass



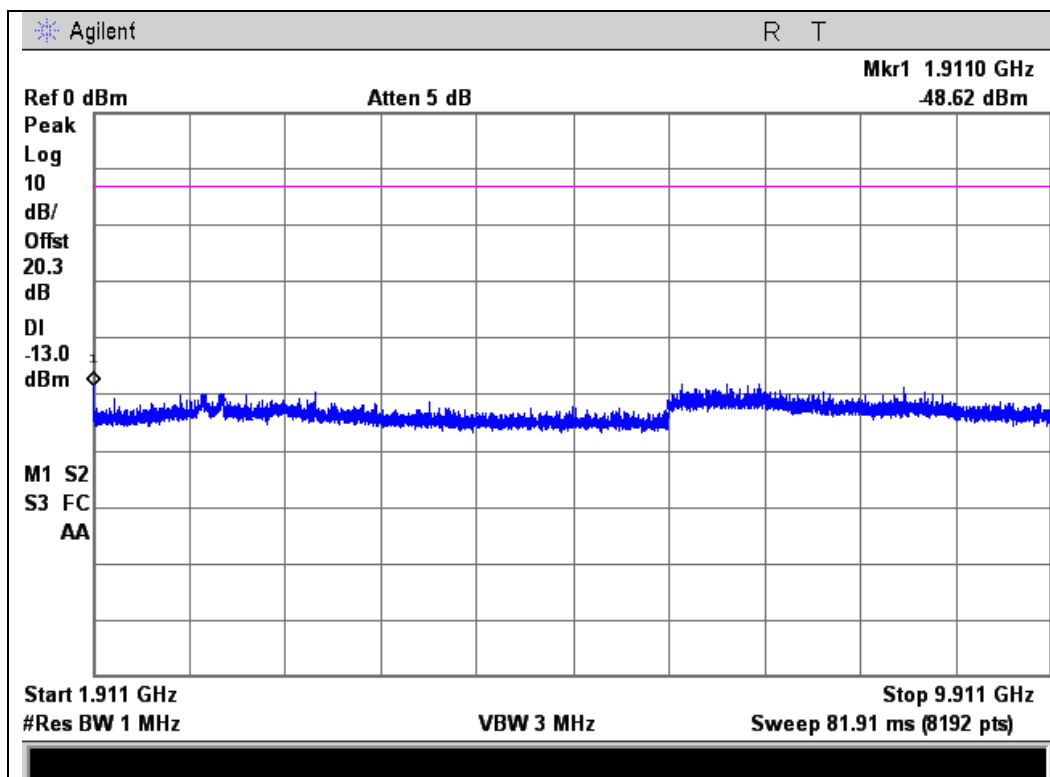
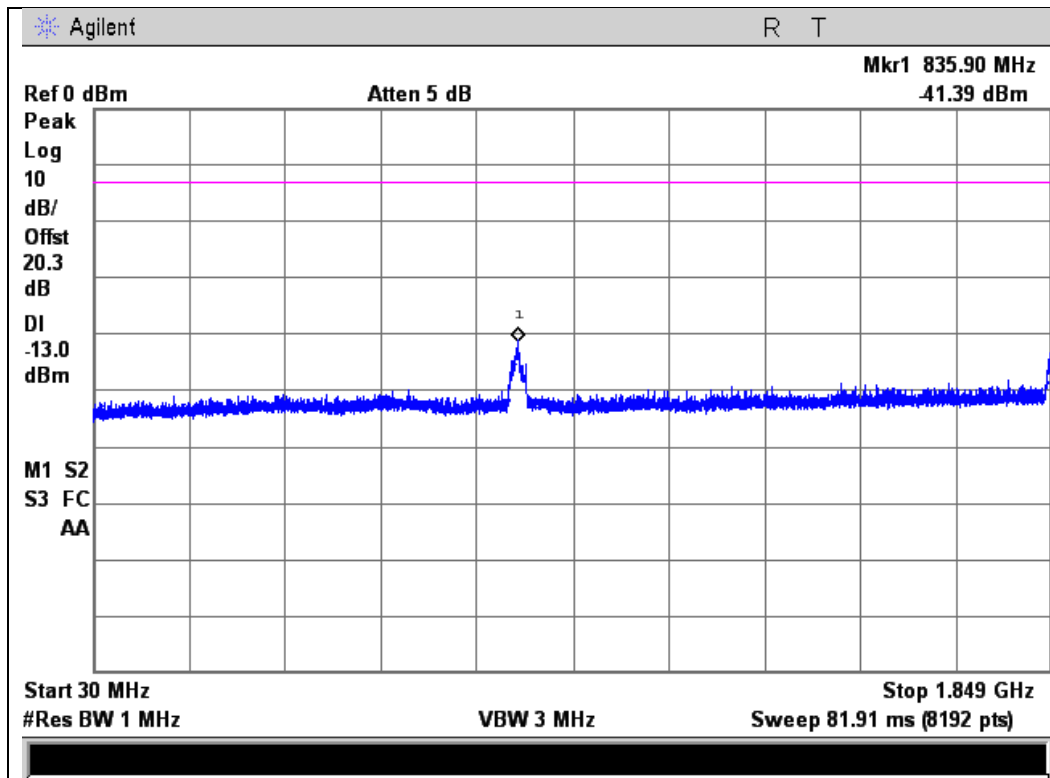
Uplink Test Plots

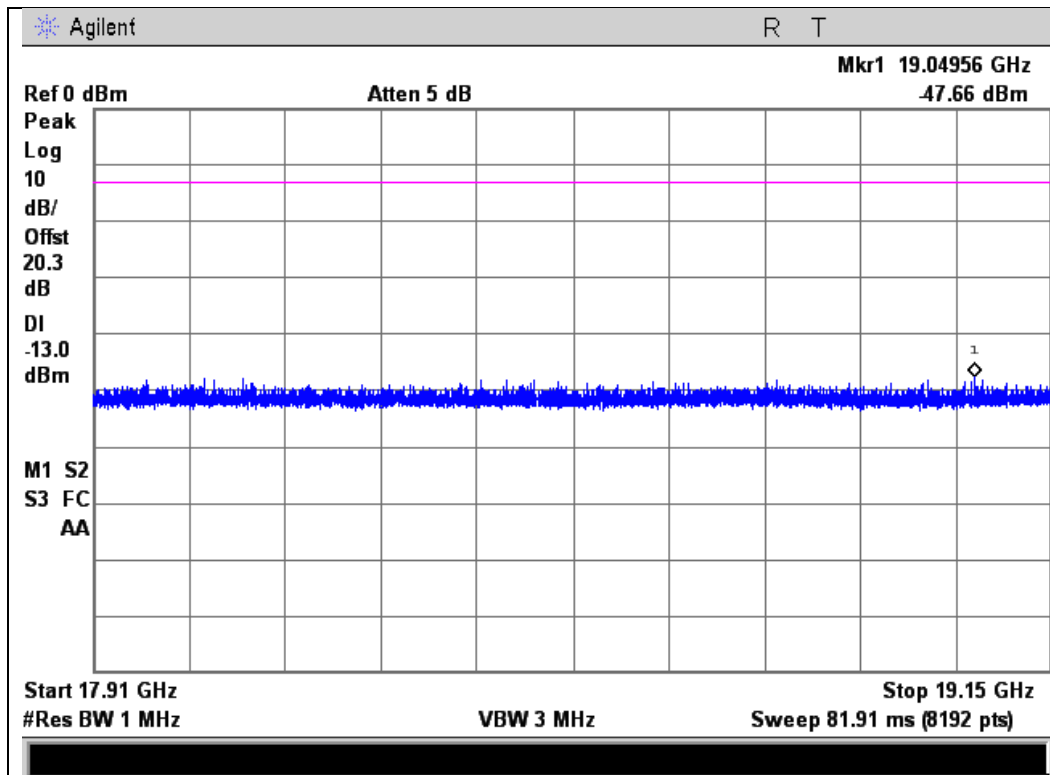
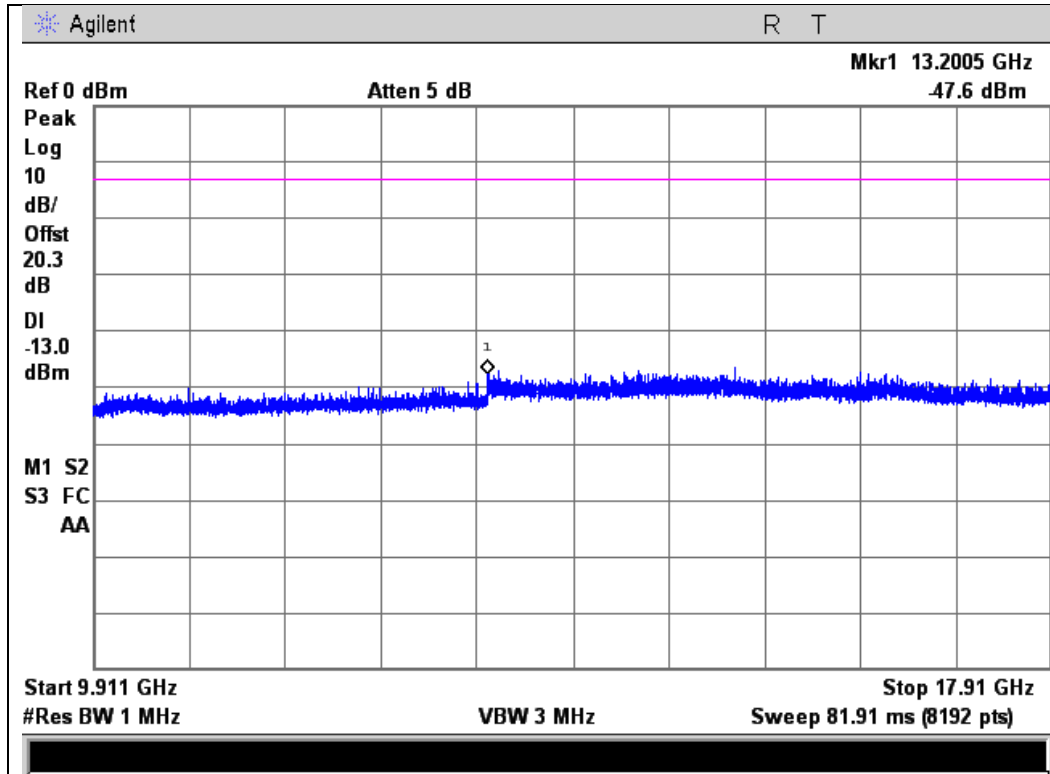
824 - 849 MHz Band





1850 - 1910 MHz Band

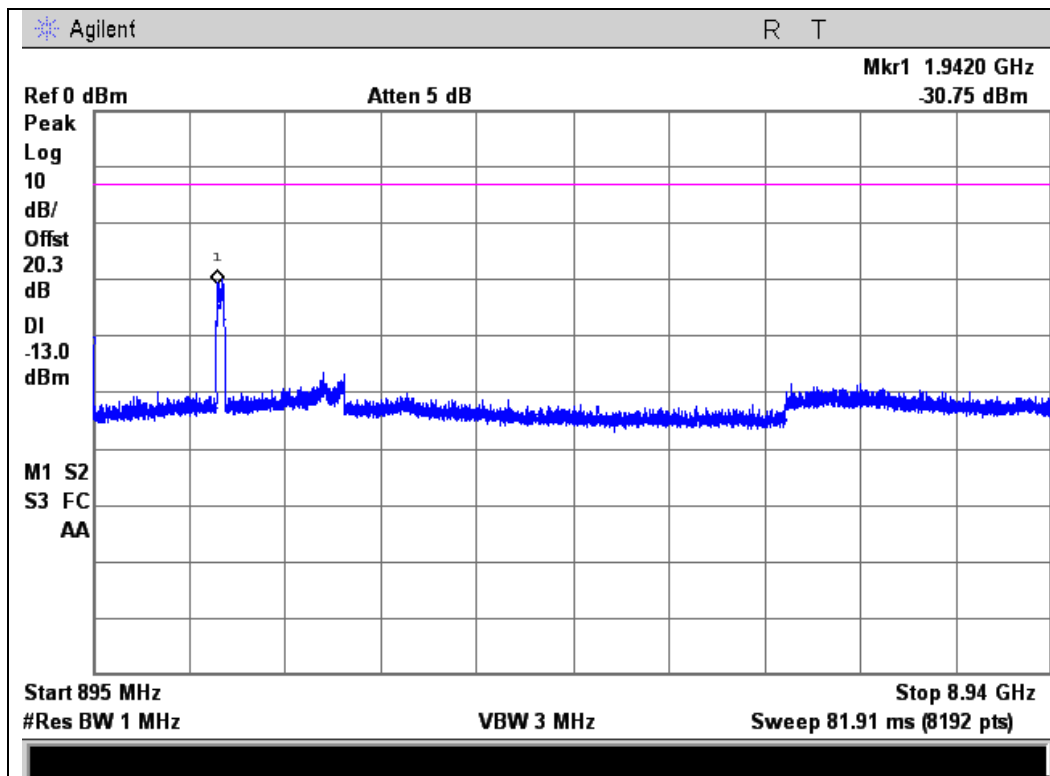
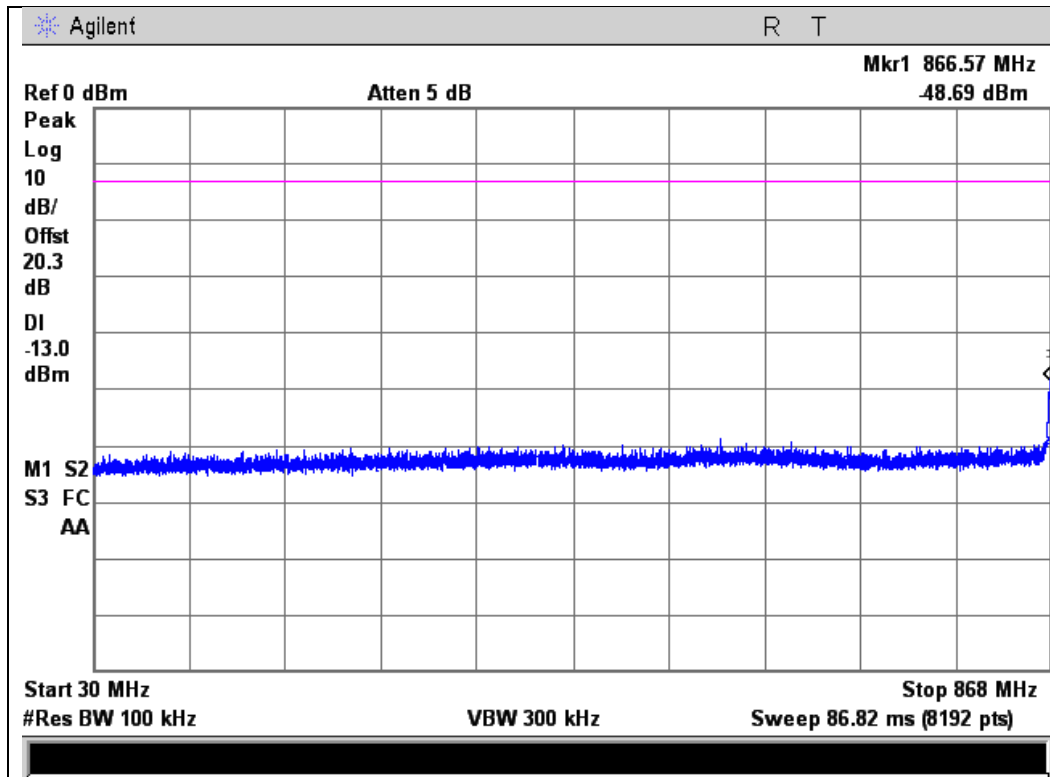






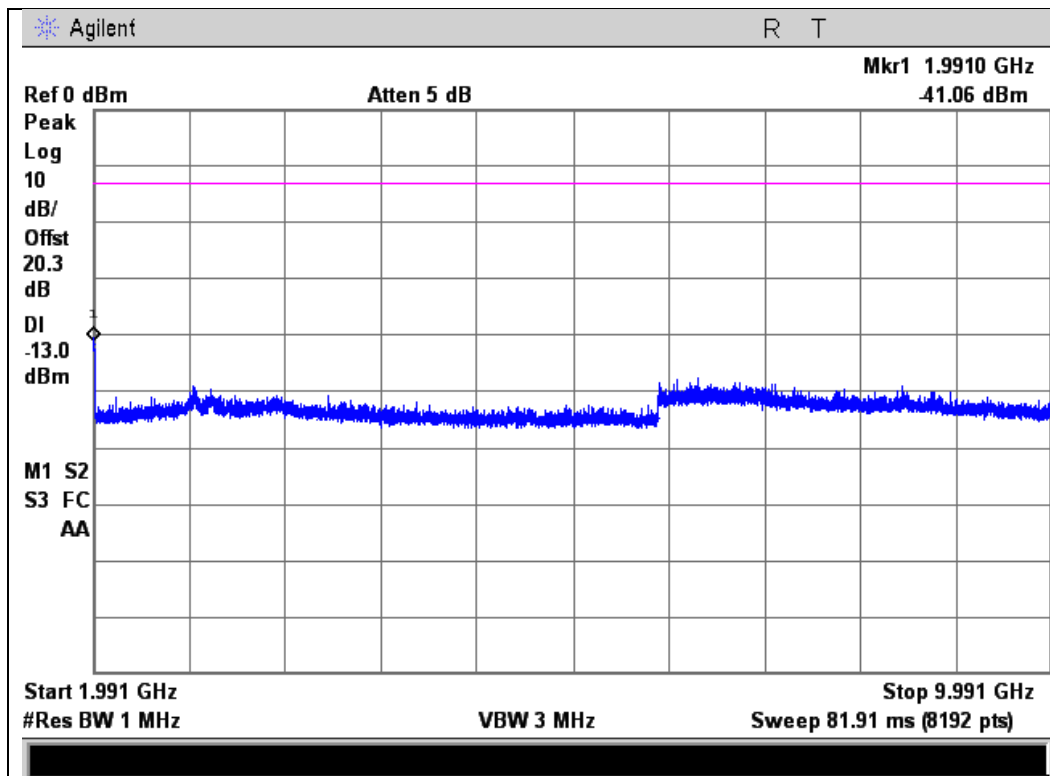
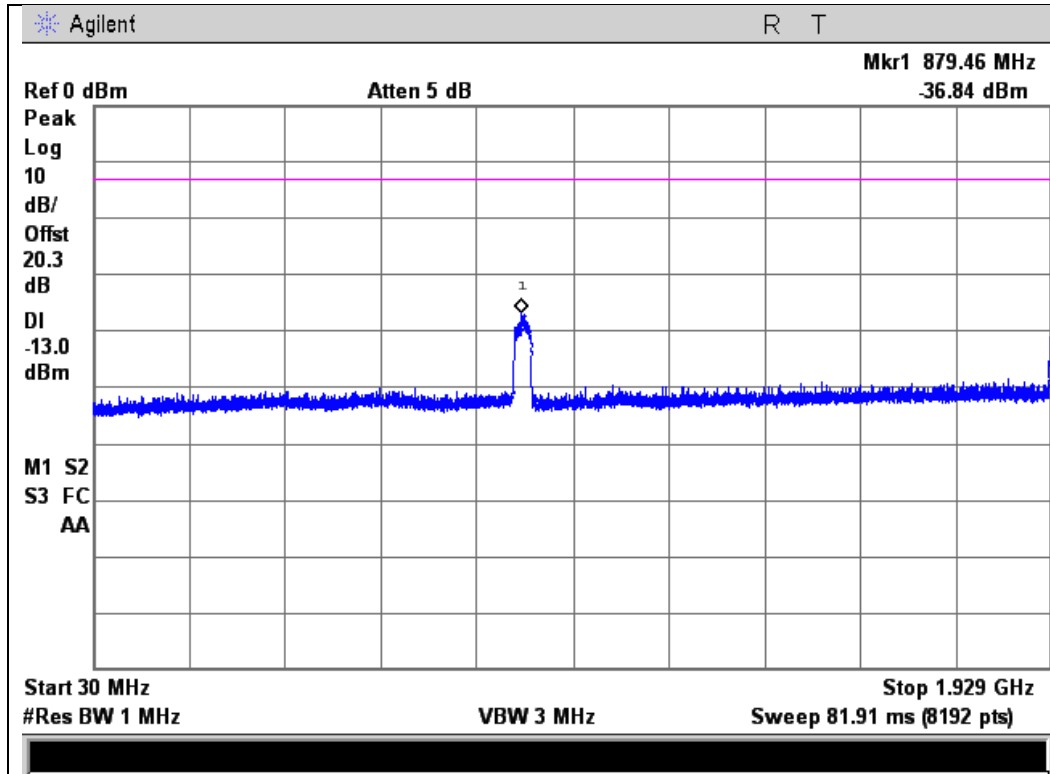
Downlink Test Plots

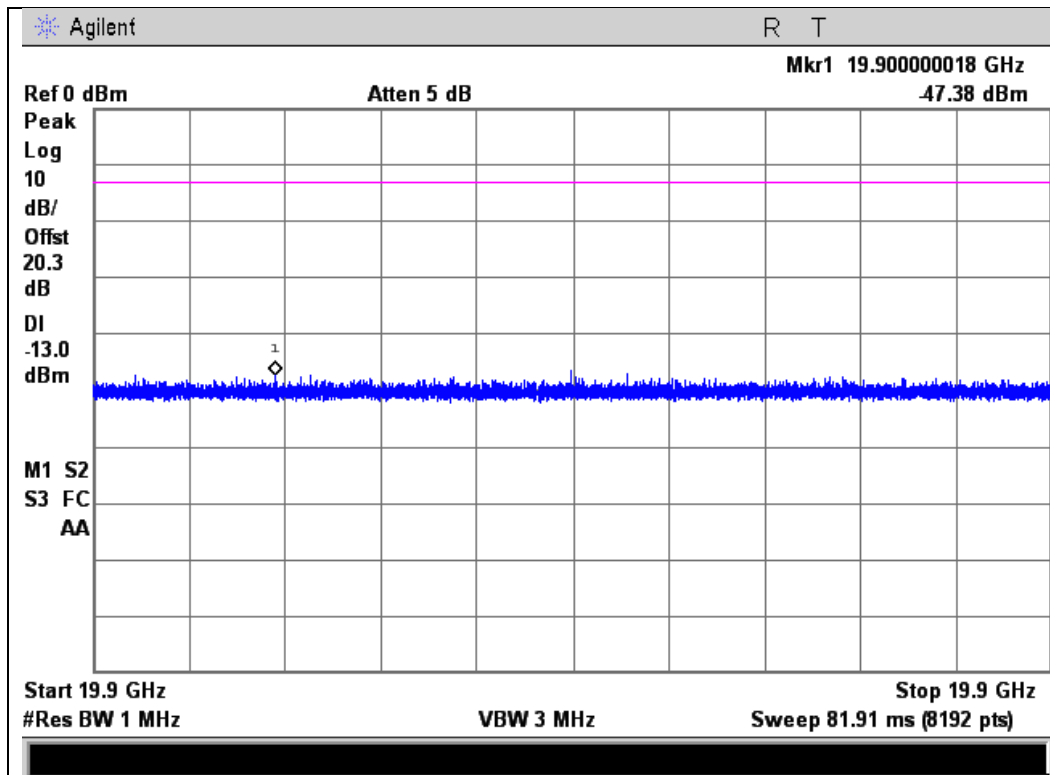
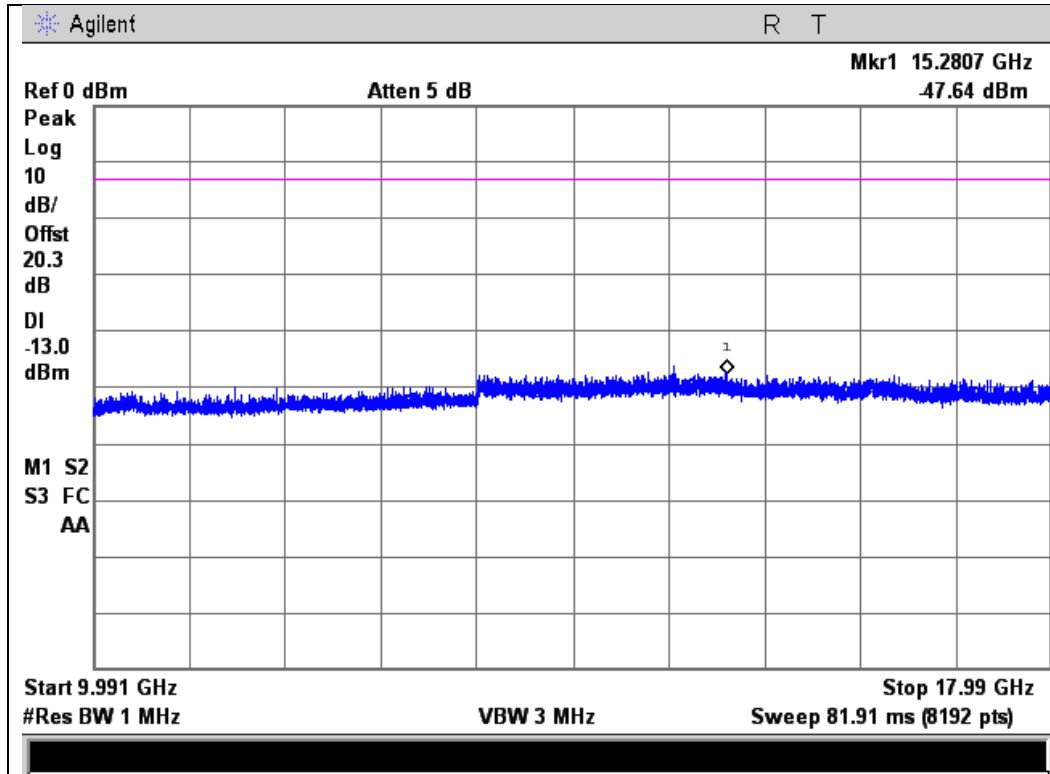
869 - 894 MHz Band





1930 - 1990 MHz Band







Noise Limits

Name of Test: Noise Limits
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/4/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. A series of three tests are performed to measure the maximum uplink and downlink noise and the variable noise for the uplink and downlink in the presence of a downlink signal. The detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516c were followed.

The following formulas are used for calculating the limits. Note – Downlink noise is calculated with the CF of the associated uplink band.

Noise Power = $-102.5 + \text{LOG}_{10}(\text{Band Center Frequency}) * 20$

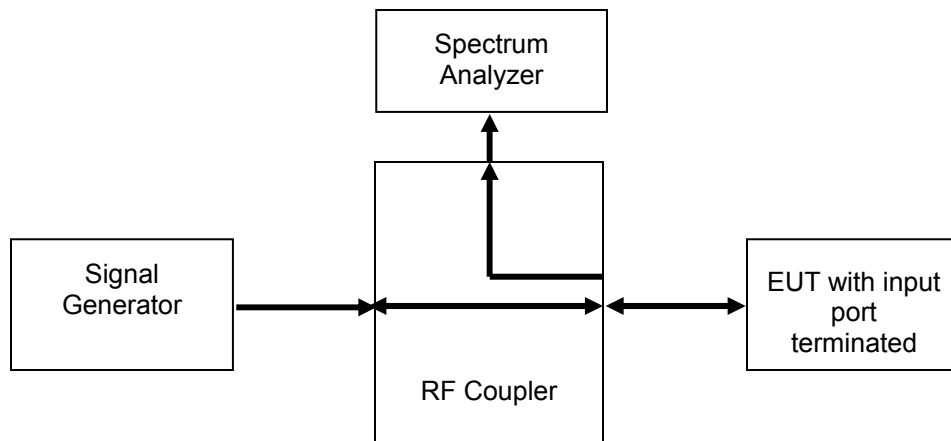
Variable Noise = $-103 \text{ dBm/MHz-RSSI}$

Test Setup

Maximum Noise Power



Variable Uplink Noise Power and Timing



Variable Downlink Noise Power and Timing





Maximum Uplink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
824 - 849	-45.5	-44.1	-1.4	Pass
1850 - 1910	-40.62	-37.0	-3.6	Pass

Maximum Downlink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
869 - 894	-44.88	-44.1	-0.8	Pass
1930 - 1990	-38.54	-37.0	-1.5	Pass

Uplink Noise Timing Test Results

Frequency Band (MHz)	Measured Timing (Seconds)	Limit (Seconds)	Result
824 - 849	22.50 mS	3.0	Pass
1850 - 1910	22.50 mS	3.0	Pass



Variable Uplink Noise Limit Test Results

824 - 849 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-80.0	-44.0	-46.4	-2.4
-70.0	-44.0	-46.3	-2.3
-50.0	-53.0	-55.8	-2.8
-49.0	-54.0	-56.7	-2.7
-48.0	-55.0	-56.9	-1.9
-47.0	-56.0	-57.2	-1.2

1850 - 1910 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-64.0	-39.0	-40.1	-1.1
-63.0	-40.0	-40.4	-0.4
-62.0	-41.0	-41.3	-0.3
-61.0	-42.0	-43.1	-1.1
-56.0	-47.0	-47.9	-0.9
-55.0	-48.0	-48.7	-0.7

Variable Downlink Noise Limit Test Results

869 - 894 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-90.0	-44.0	-45.8	-1.8
-80.0	-44.0	-45.7	-1.7
-70.0	-44.0	-45.8	-1.8
-49.0	-54.0	-56.6	-2.6
-48.0	-55.0	-56.7	-1.7
-47.0	-56.0	-57.2	-1.2

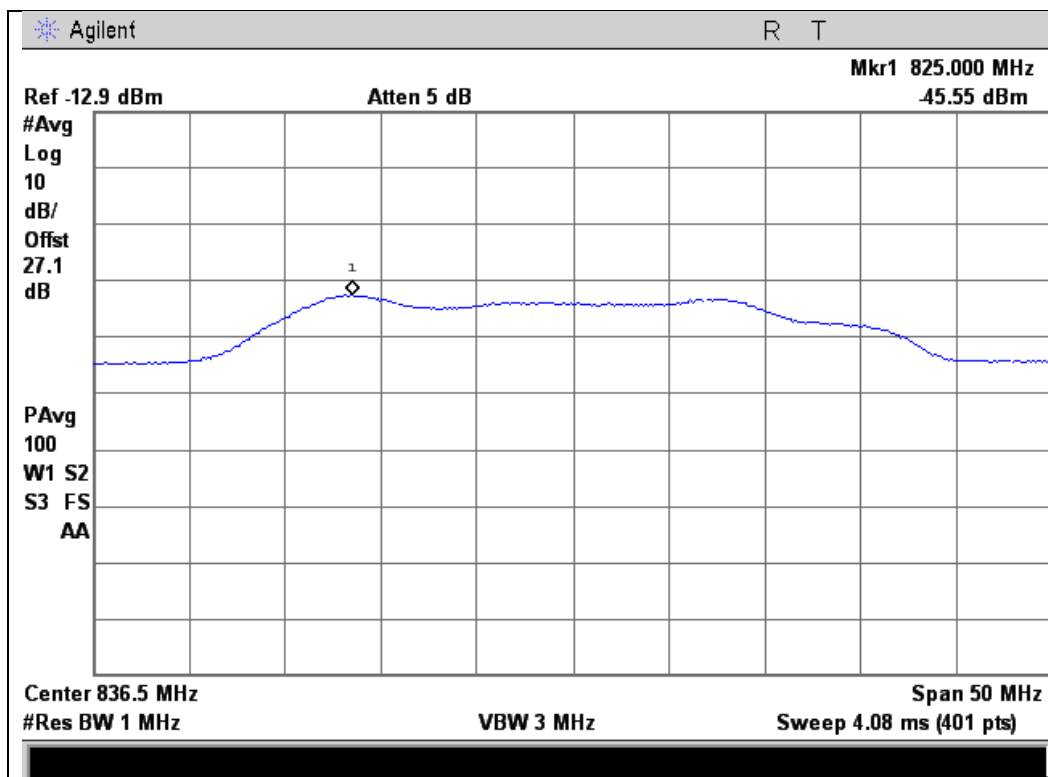
1930 - 1990 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-50.0	-53.0	-53.4	-0.4
-51.0	-52.0	-52.6	-0.6
-52.0	-51.0	-51.6	-0.6
-53.0	-50.0	-50.9	-0.9
-54.0	-49.0	-49.9	-0.9
-58.0	-45.0	-45.9	-0.9

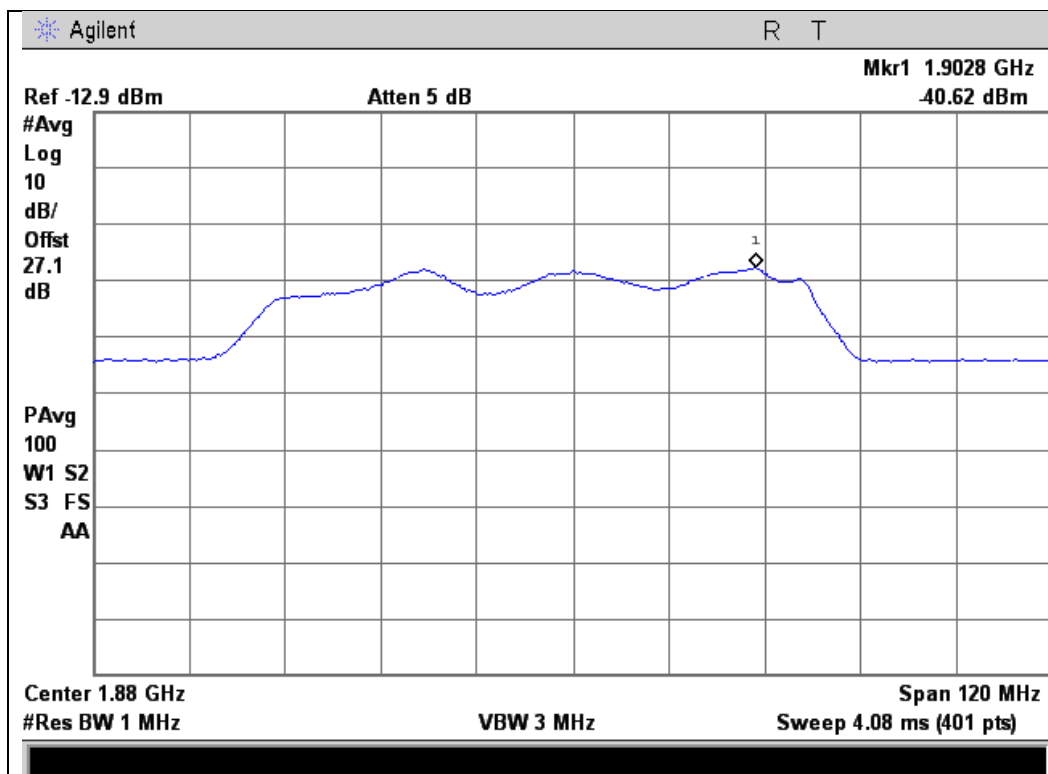


Maximum Uplink Noise Test Plots

824 - 849 MHz Band



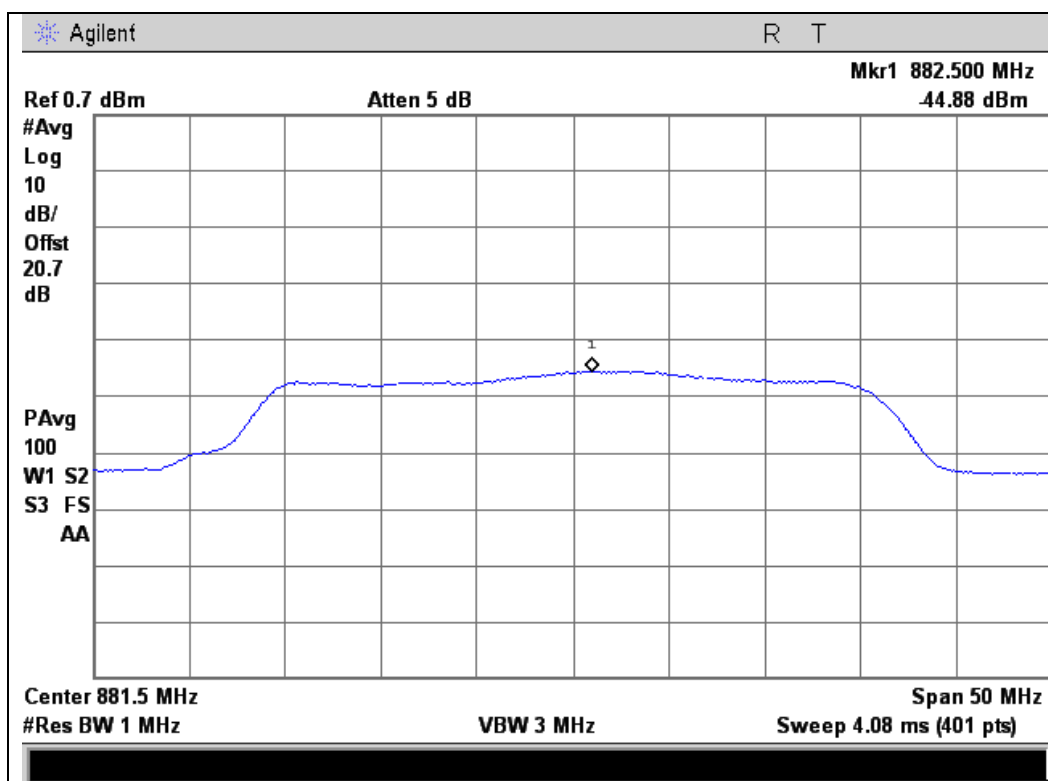
1850 - 1910 MHz Band



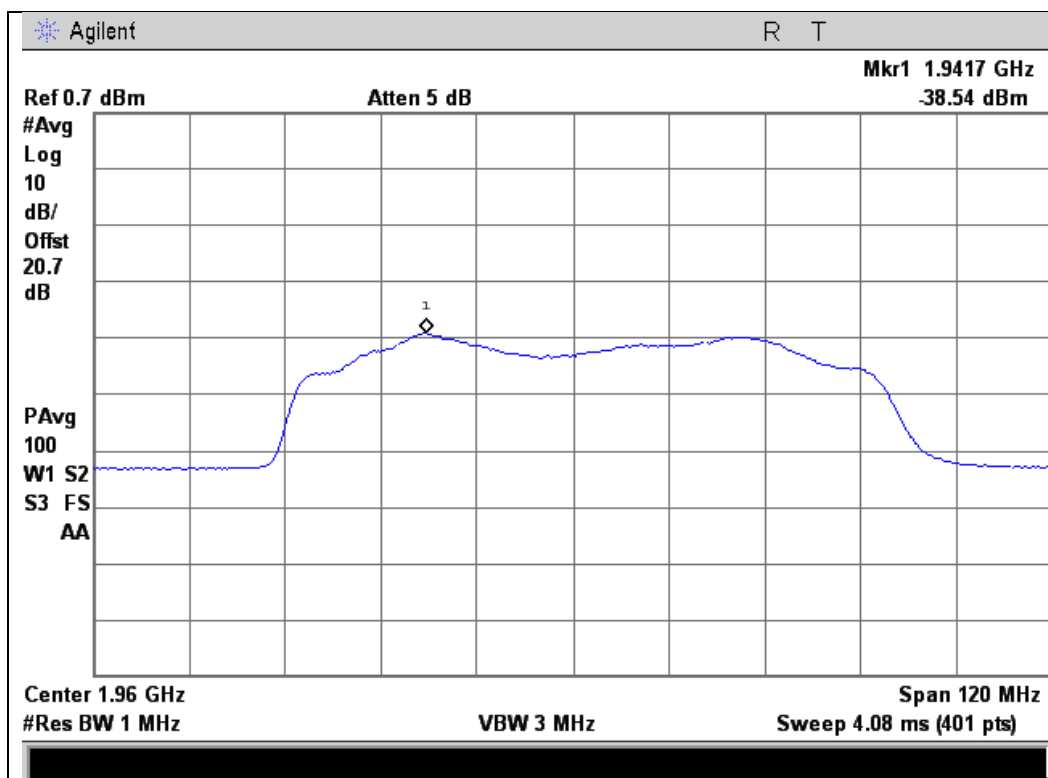


Maximum Downlink Noise Test Plots

869 - 894 MHz Band



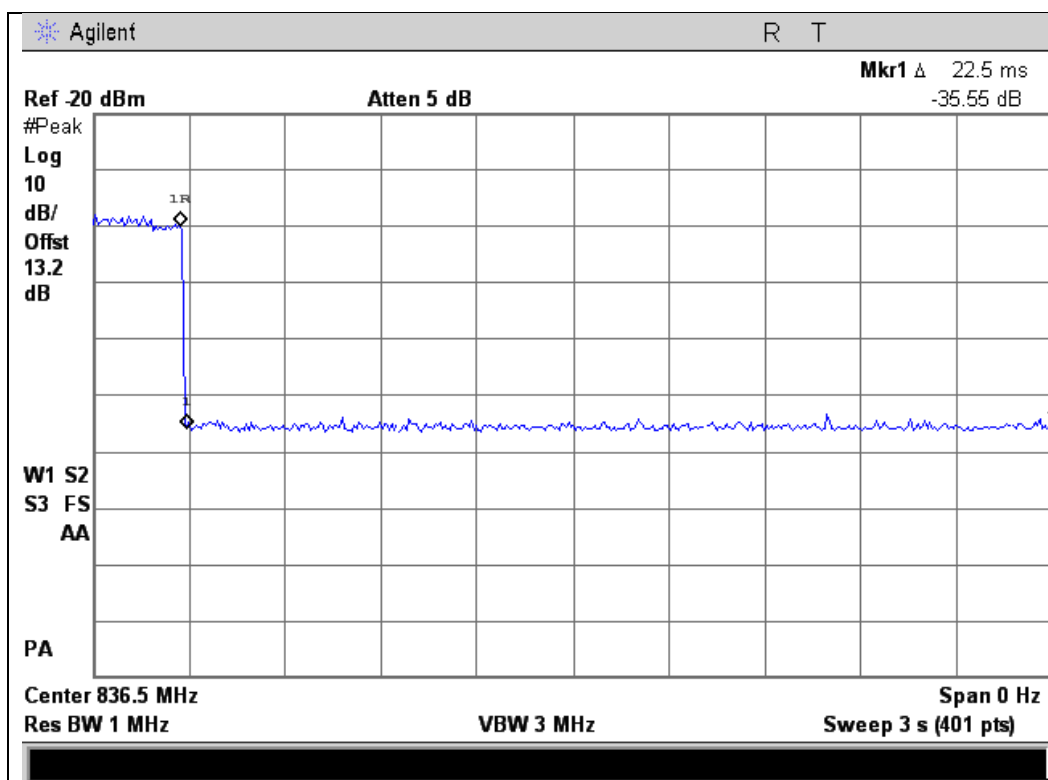
1930 - 1990 MHz Band



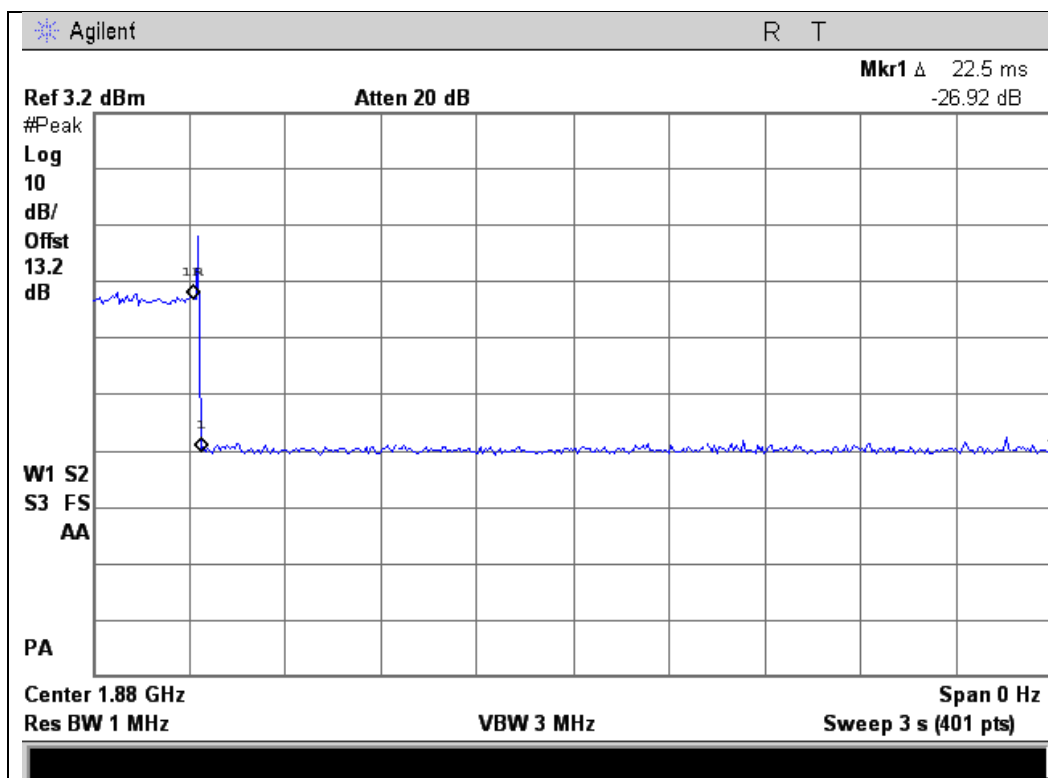


Uplink Noise Timing Test Plots

824 - 849 MHz Band



1850 - 1910 MHz Band





Uplink Inactivity

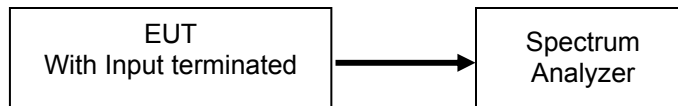
Name of Test: Uplink Inactivity
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/2/2013

Test Procedure

The EUT was connected directly to a spectrum analyzer set to operate in the center of the EUT operational uplink and downlink bands. The span was set to 0 Hz with a sweep time of 330 seconds and MAX HOLD operation. The EUT was powered on and the time for the uplink to return to an inactive state was measured using the DELTA MARKER method was utilized to ensure it was less than 300 seconds. The noise level after the return to an inactive state was less than 70 dBm/MHz.

Test Setup



Uplink Test Results

Frequency Band (MHz)	Measured Time (Seconds)	Limit (Seconds)	Result
824 - 849	67.2	300	Pass
1850 - 1910	65.5	300	Pass

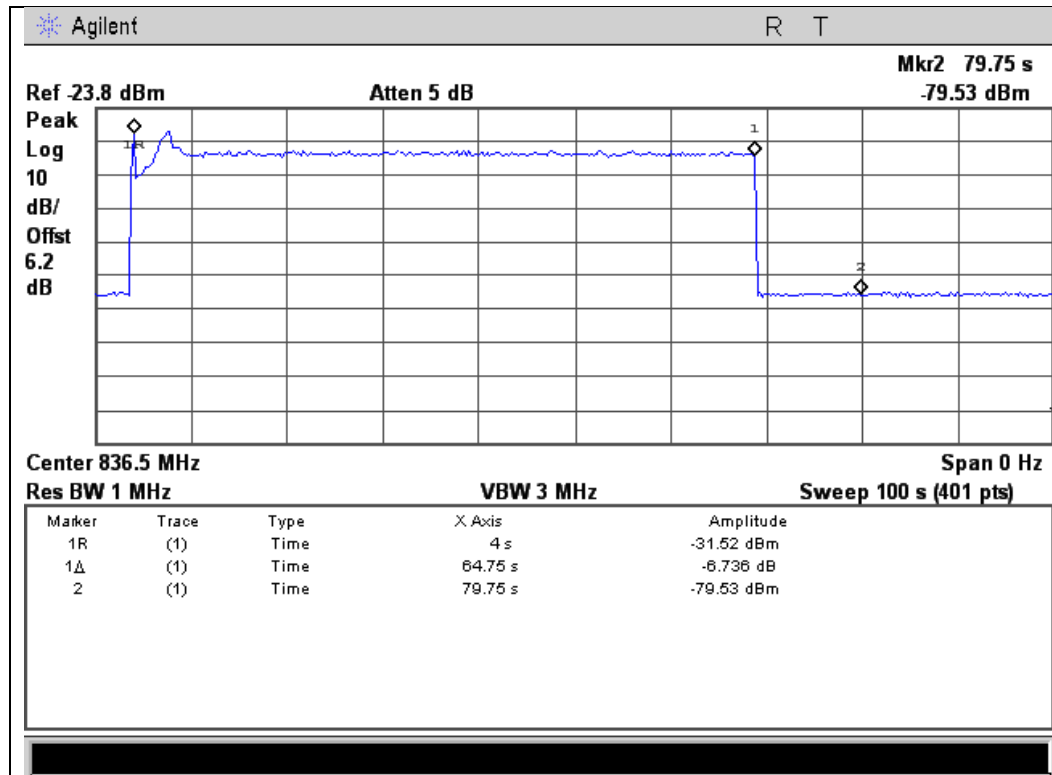
Uplink Transmit Power Off Results

Frequency Band (MHz)	Measured Time (dBm/MHz)	Limit (dBm/MHz)	Result
824 - 849	-79.53	-70	Pass
1850 - 1910	-80.82	-70	Pass

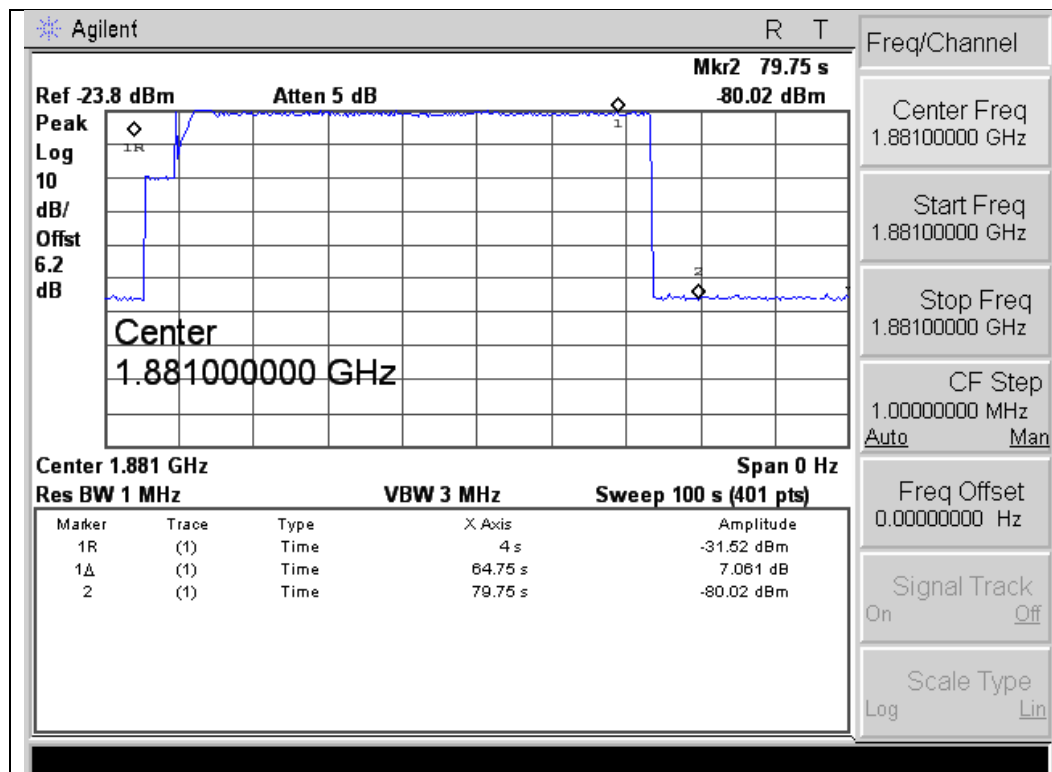


Uplink Inactivity Test Results

824 - 849 MHz



1850 - 1910 MHz





Variable Gain

Name of Test: Variable Gain
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/4/2013

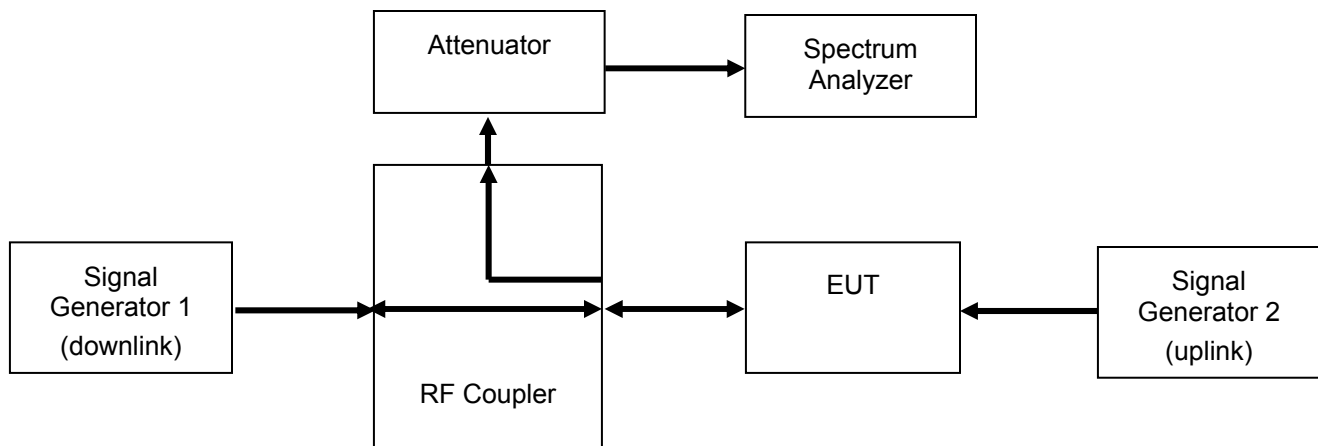
Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. The uplink gain in the presence of a downlink signal was measured for each operational uplink band using the detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516.

The following formula is used for calculating the limits.

$$\text{Variable Gain} = -34 \text{ dB} - \text{RSSI} + \text{MSCL}$$

Test Setup





Uplink Test Results

824 - 849 MHz

RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-59.0	61	-47.1	13.2	60.3	-0.7
-58.0	60	-47.1	12.3	59.4	-0.6
-56.0	58	-47.1	10.3	57.4	-0.6
-55.0	57	-47.1	9.6	56.7	-0.3
-54.0	56	-47.1	8.6	55.7	-0.3
-53.0	55	-47.1	7.5	54.6	-0.4

1850 - 1910 MHz

RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-62.0	67	-54	11.1	65.1	-1.9
-61.0	66	-54	10.3	64.3	-1.7
-59.0	64	-54	8.4	62.4	-1.6
-58.0	63	-54	7.5	61.5	-1.5
-56.0	61	-54	5.5	59.5	-1.5
-54.0	59	-54	3.2	57.2	-1.8



Occupied Bandwidth

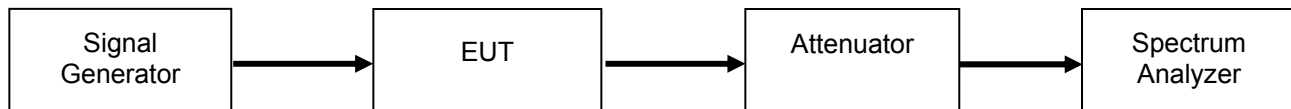
Name of Test: Occupied Bandwidth
Test Equipment Utilized: i00331, i00405

Engineer: John Erhard
Test Date: 10/3/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. A signal generator was utilized to produce the following signals; GSM, CDMA, and WCDMA tuned to the center channel of each the EUT operational uplink and downlink band with the RF level set a point just prior to the AGC being in control of the power. For each modulation type the input and output signal was measured and plotted to ensure that the signals were similar.

Test Setup

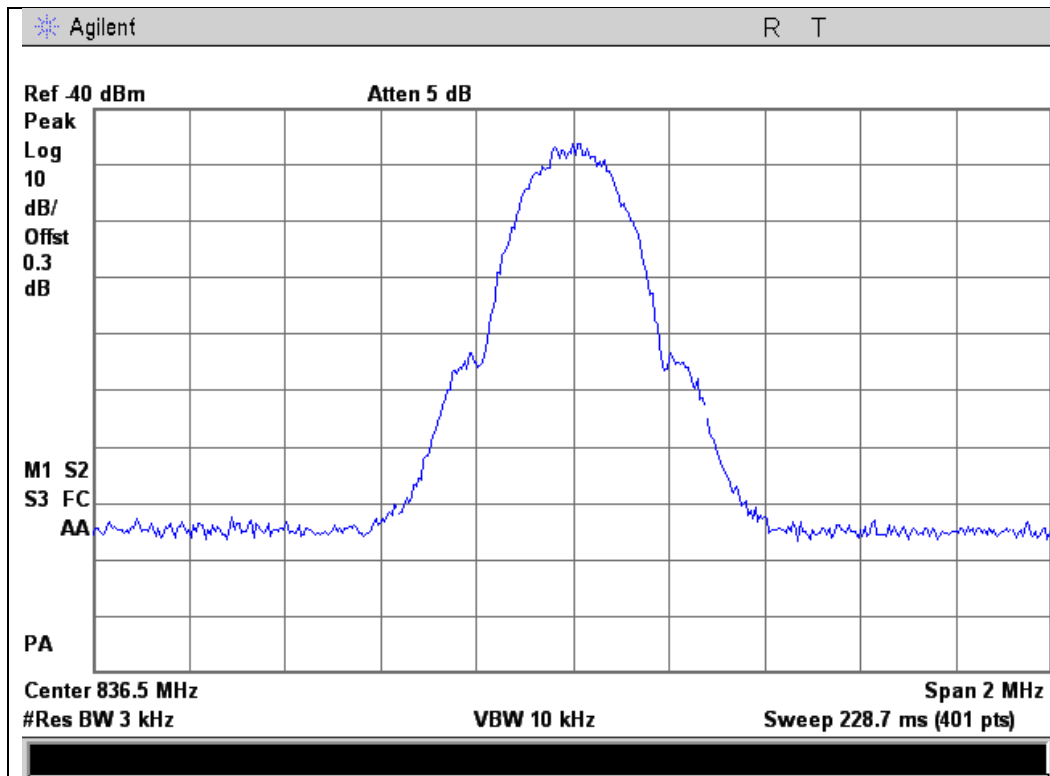




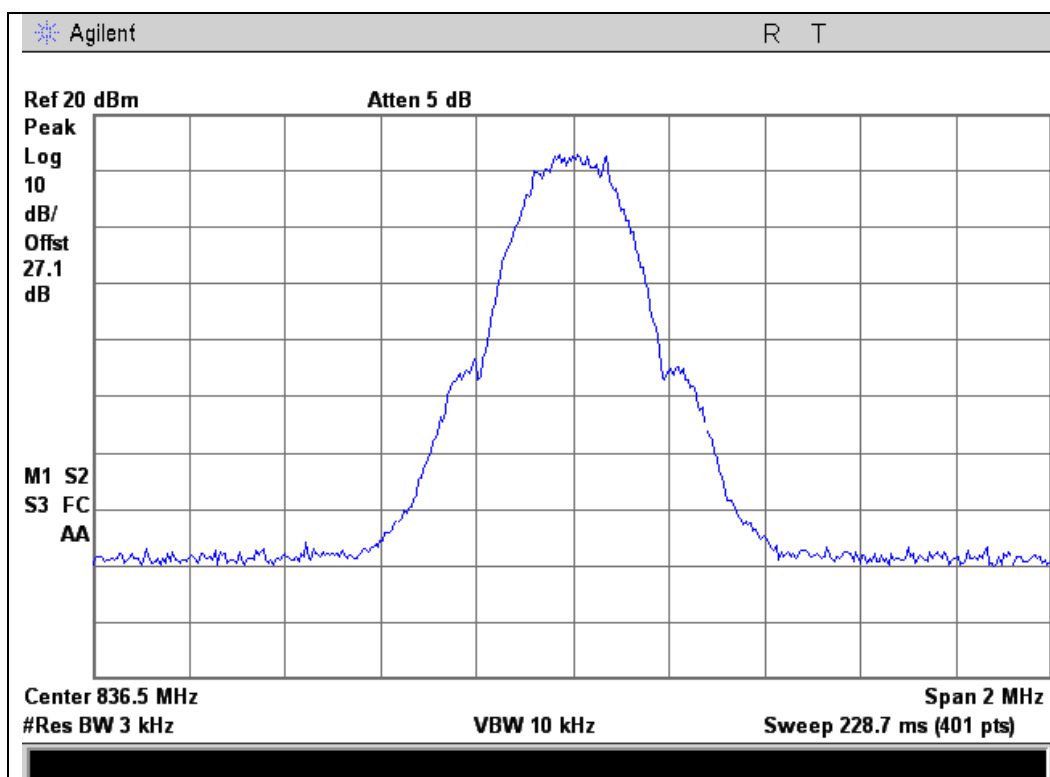
GSM Uplink Test Plots

824 - 849 MHz Band

Input



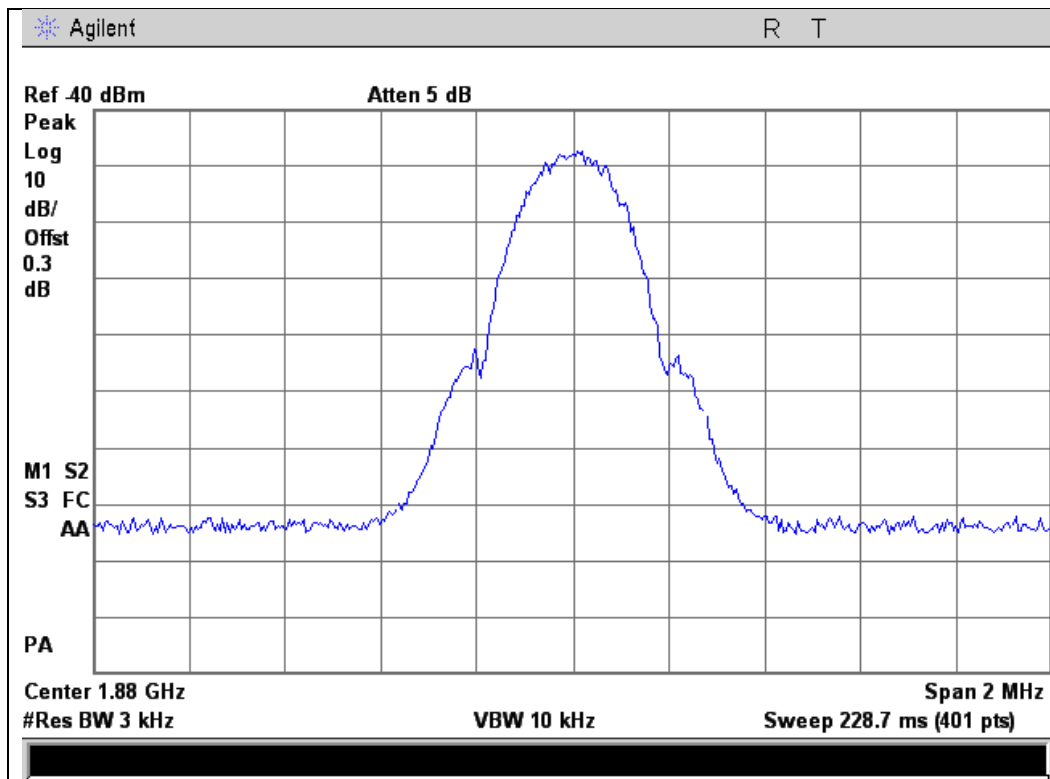
Output



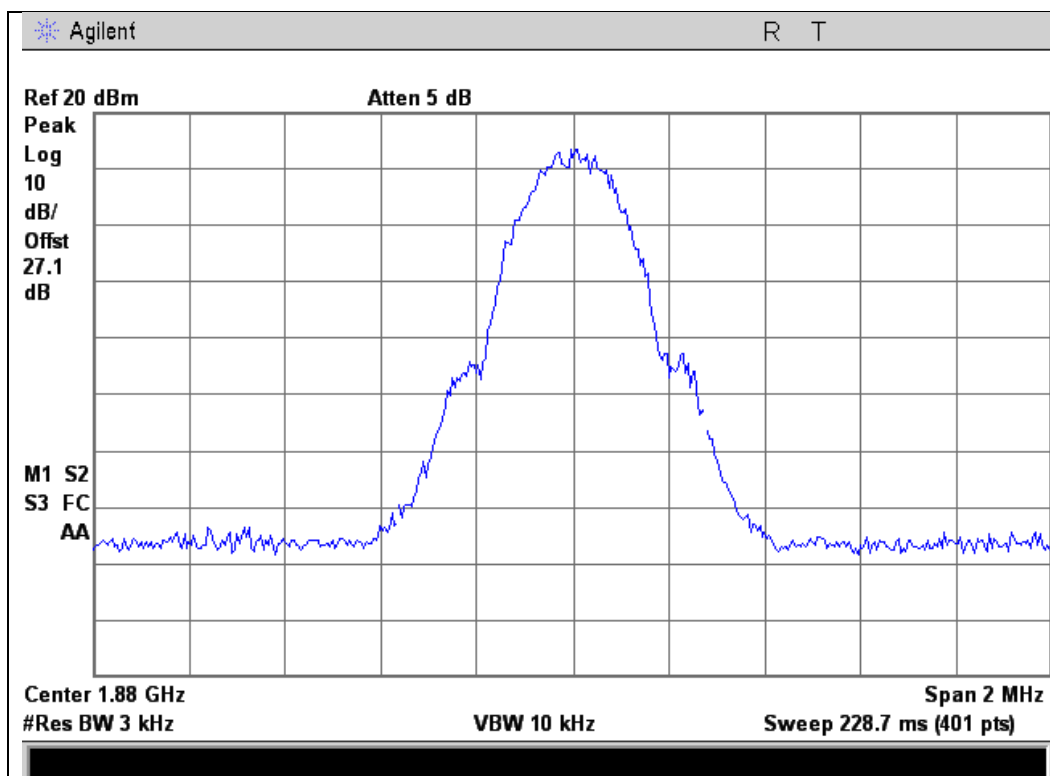


1850 - 1910 MHz Band

Input



Output

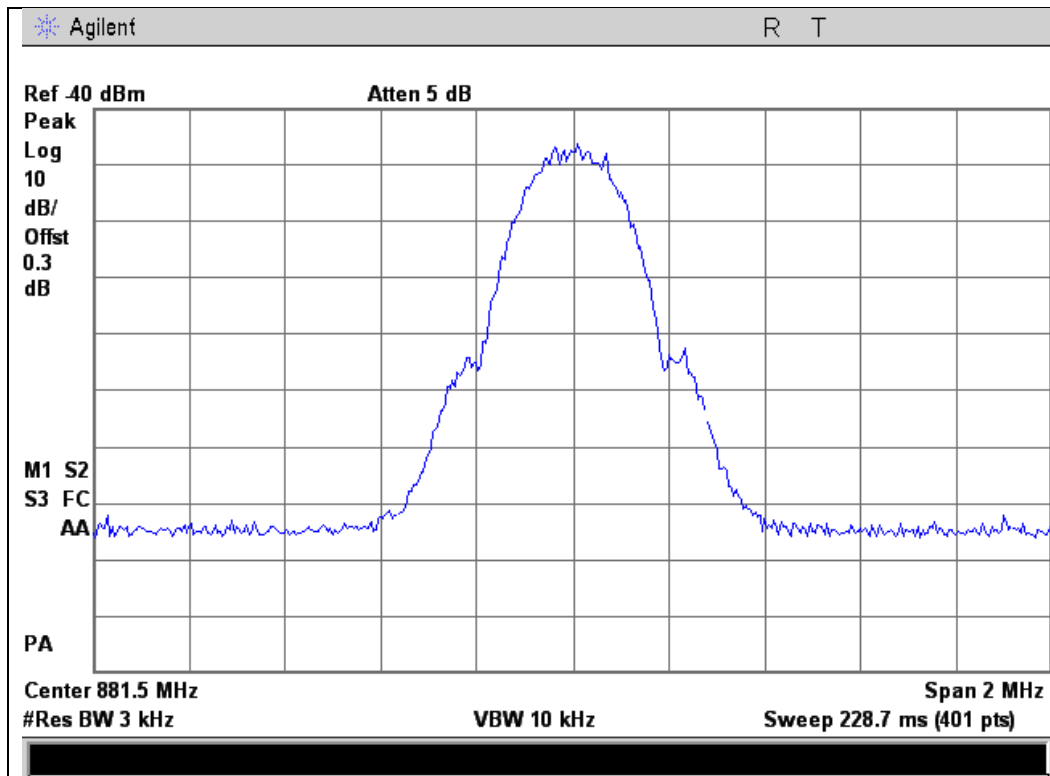




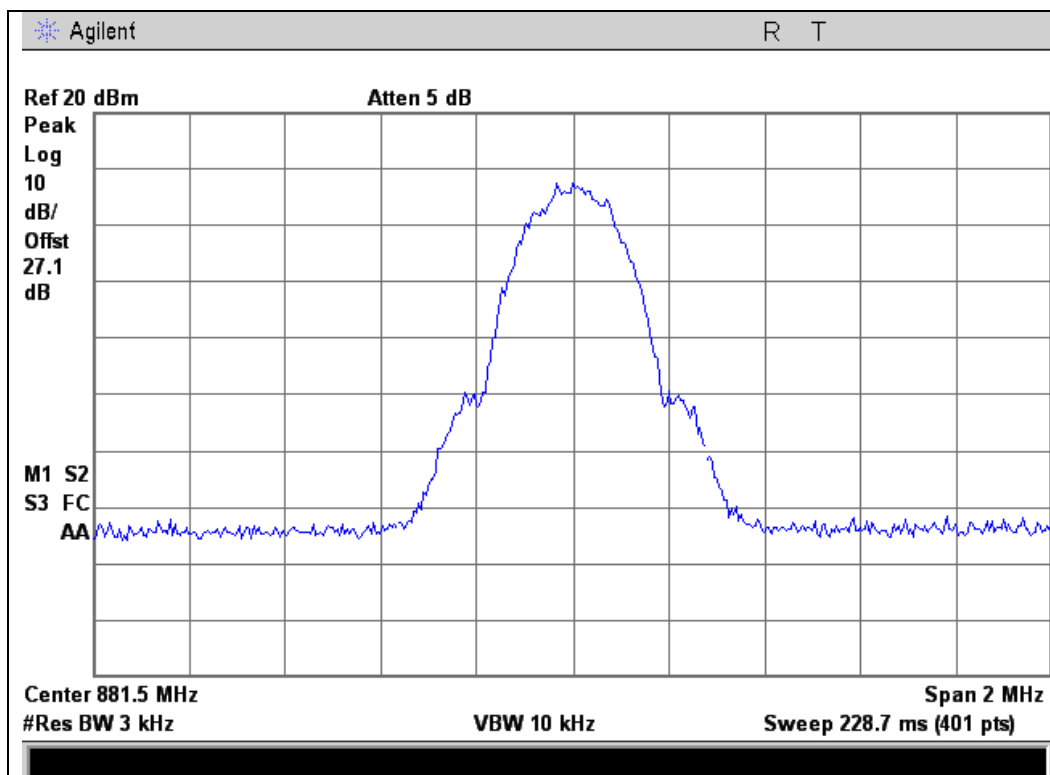
GSM Downlink Test Plots

869 - 894 MHz Band

Input



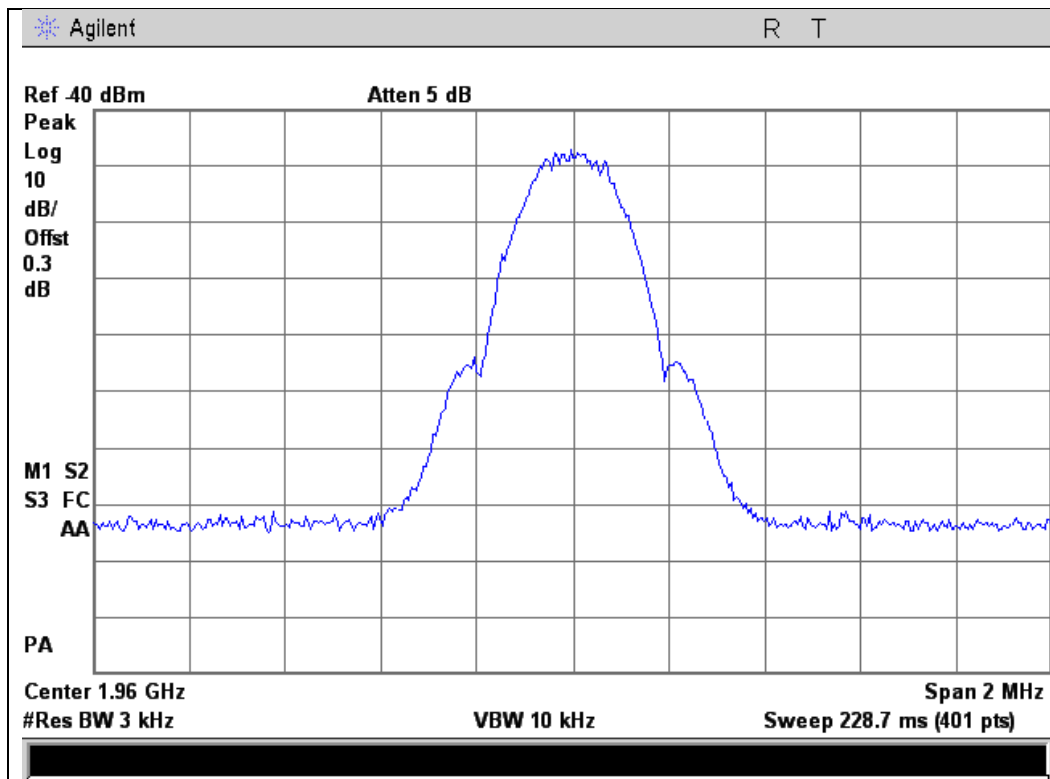
Output



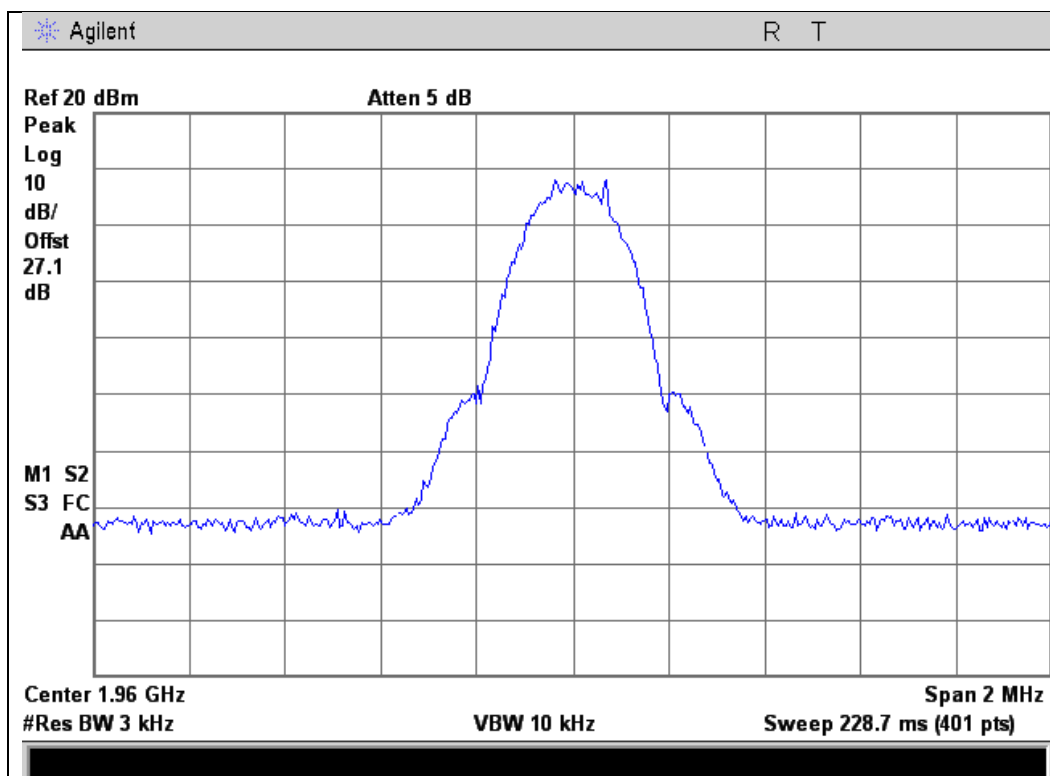


1930 - 1990 MHz Band

Input



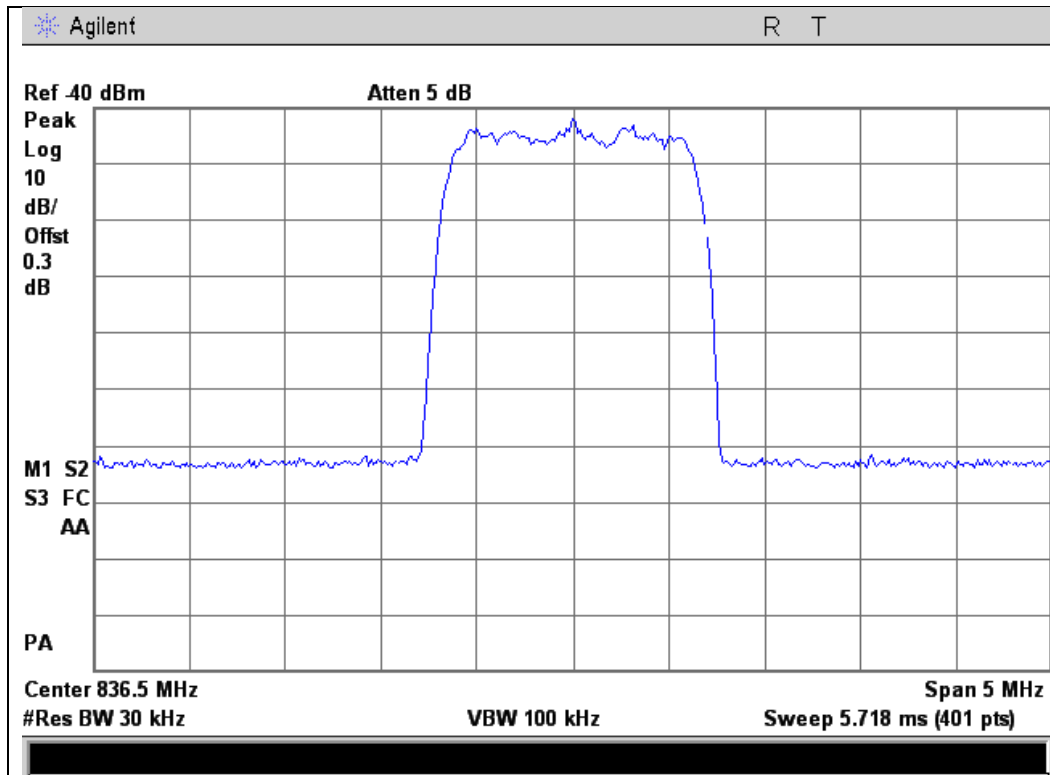
Output





CDMA Uplink Test Plots
Output
824 - 849 MHz Band

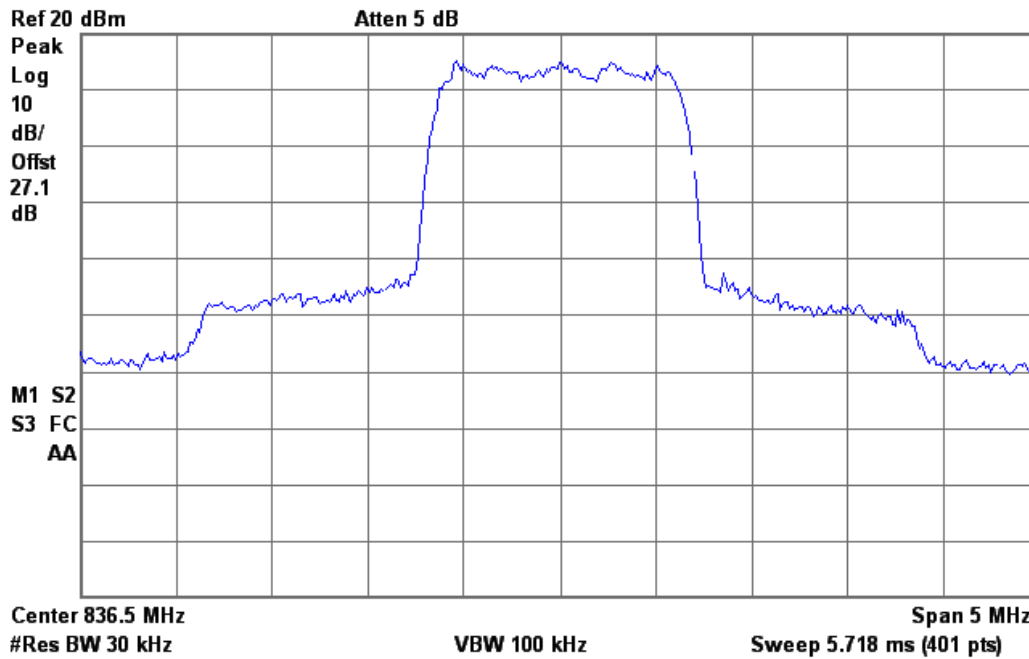
Input





Agilent

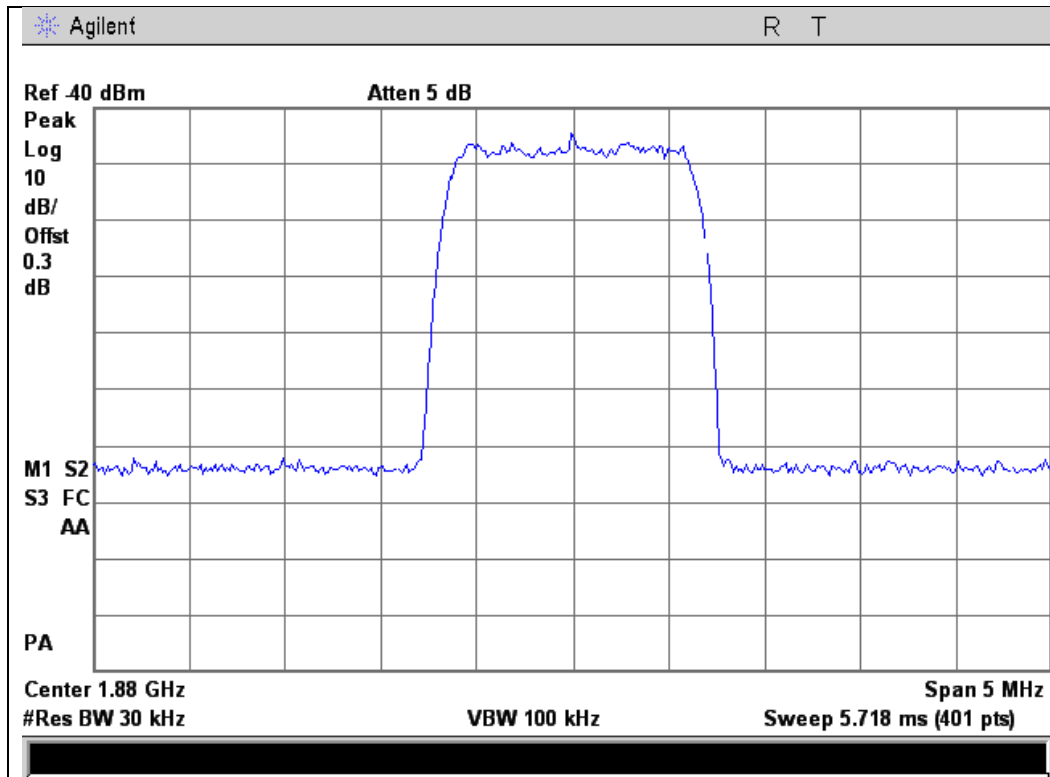
R T



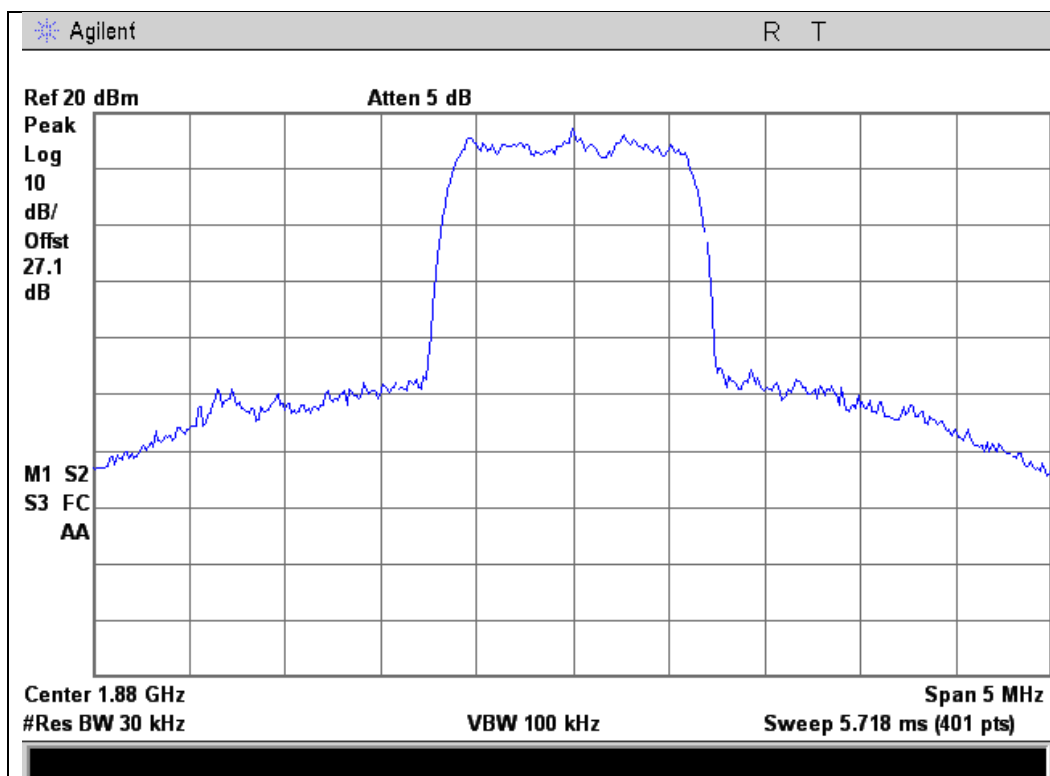


1850 - 1910 MHz Band

Input



Output

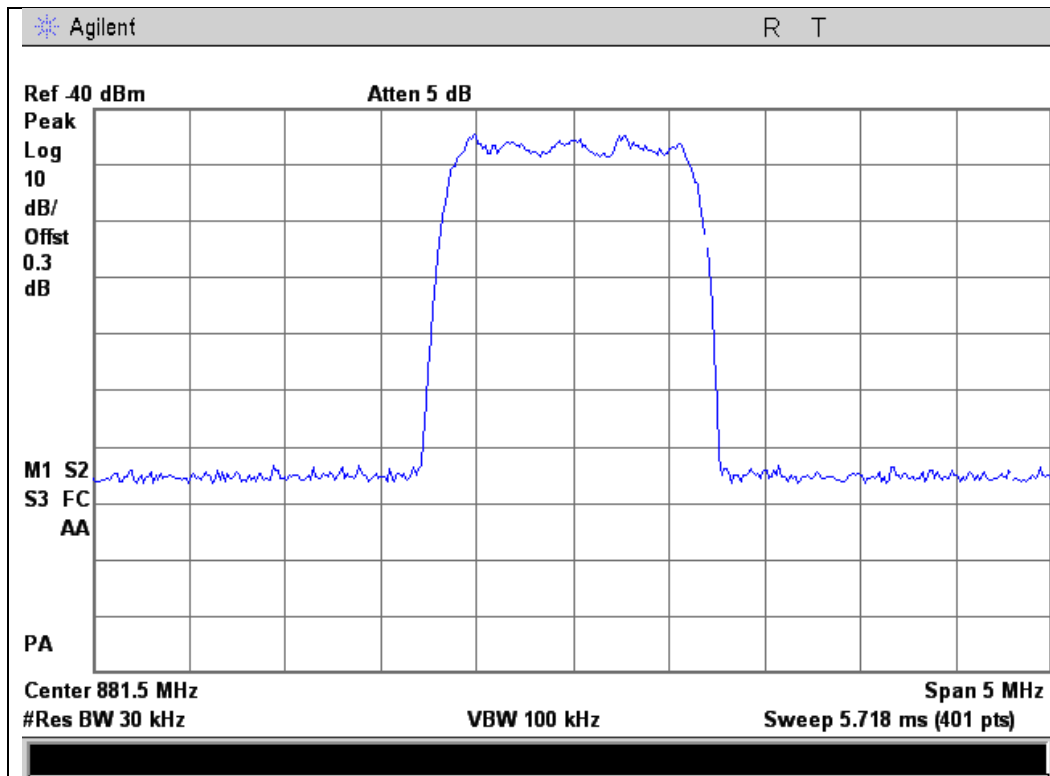




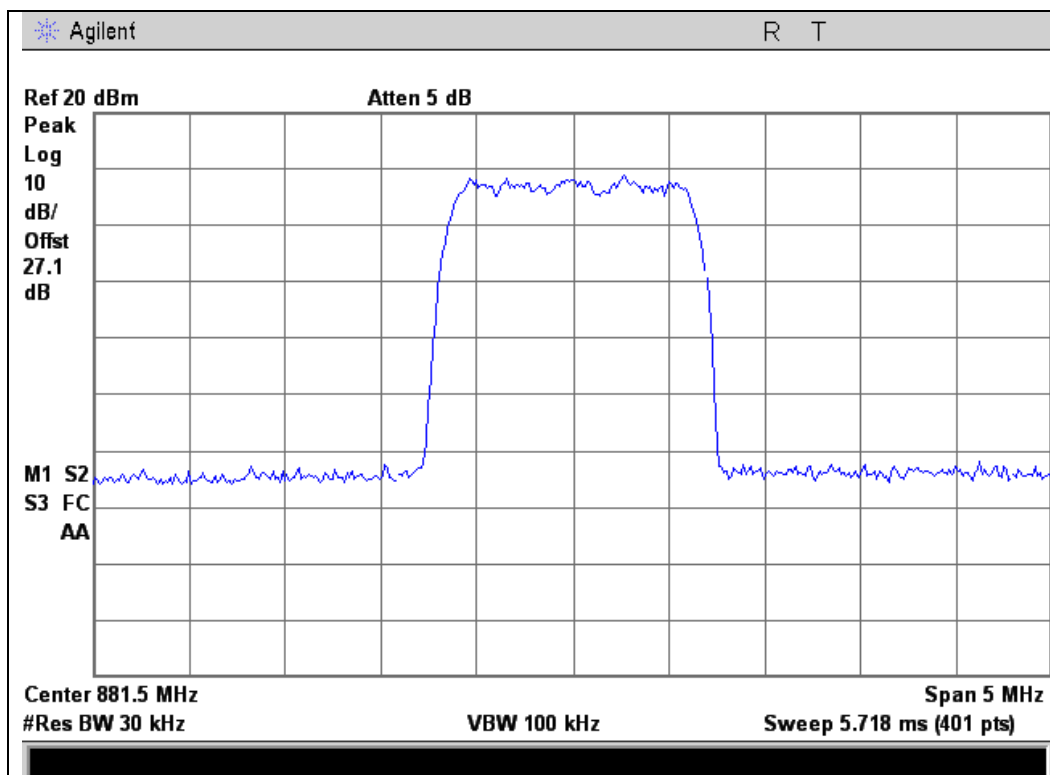
CDMA Downlink Test Plots

869 - 894 MHz Band

Input



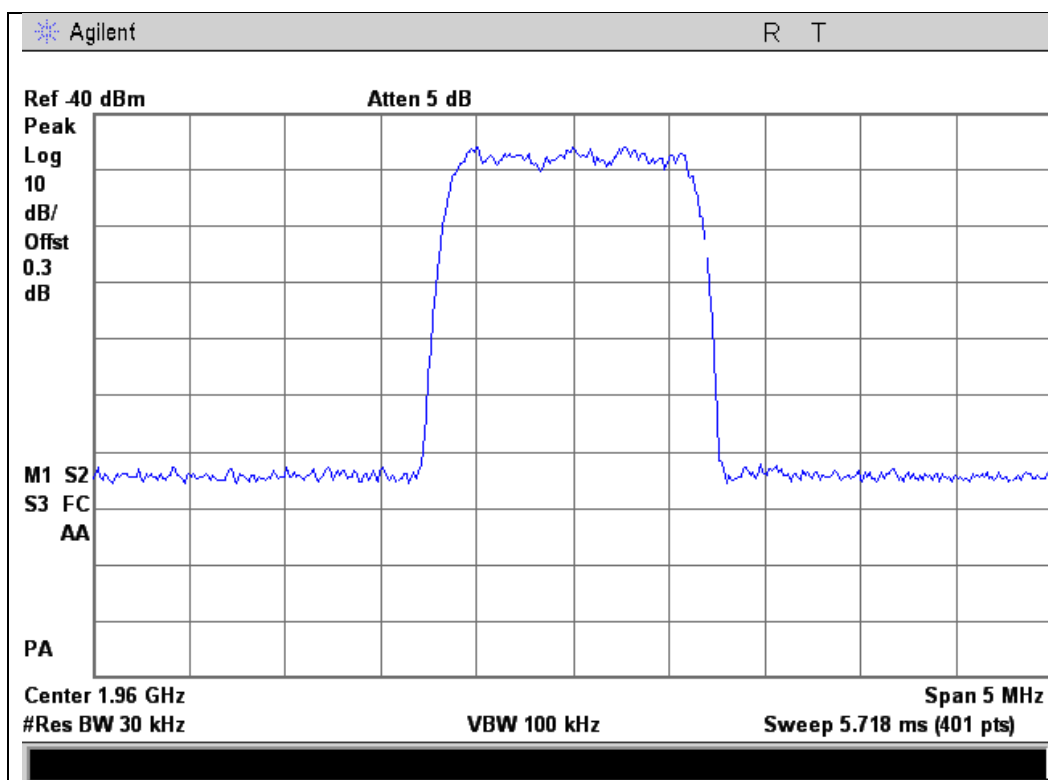
Output



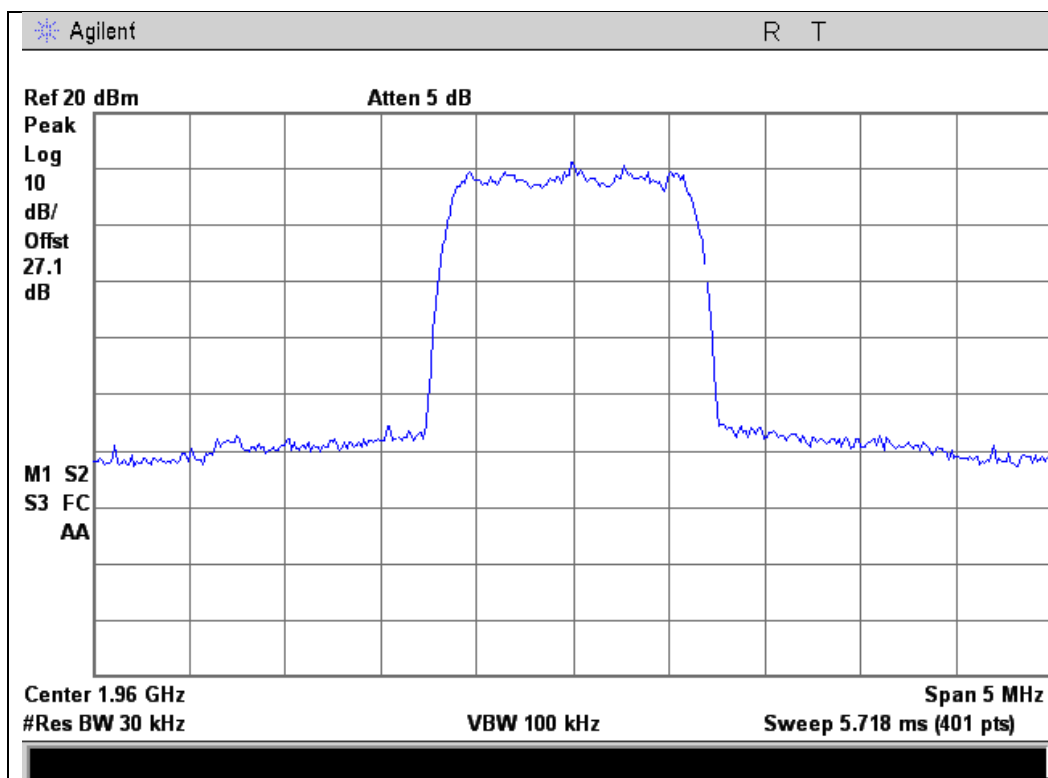


1930 - 1990 MHz Band

Input



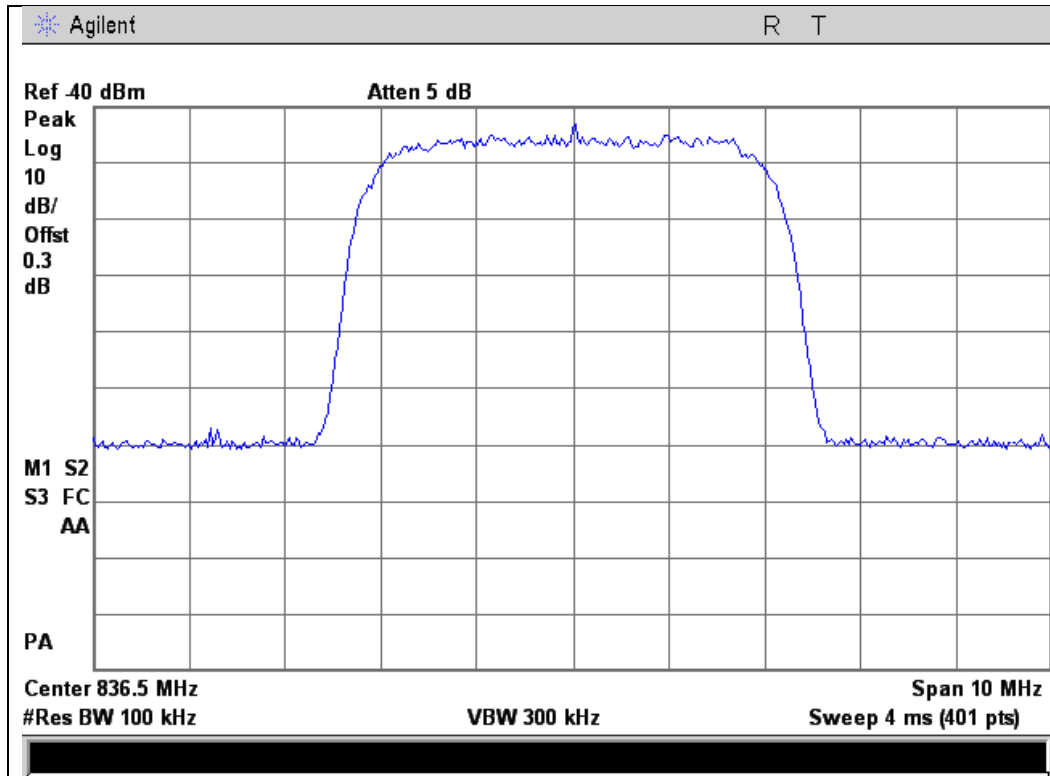
Output





WCDMA Uplink Test Plots
Output
824 - 849 MHz Band

Input





Agilent

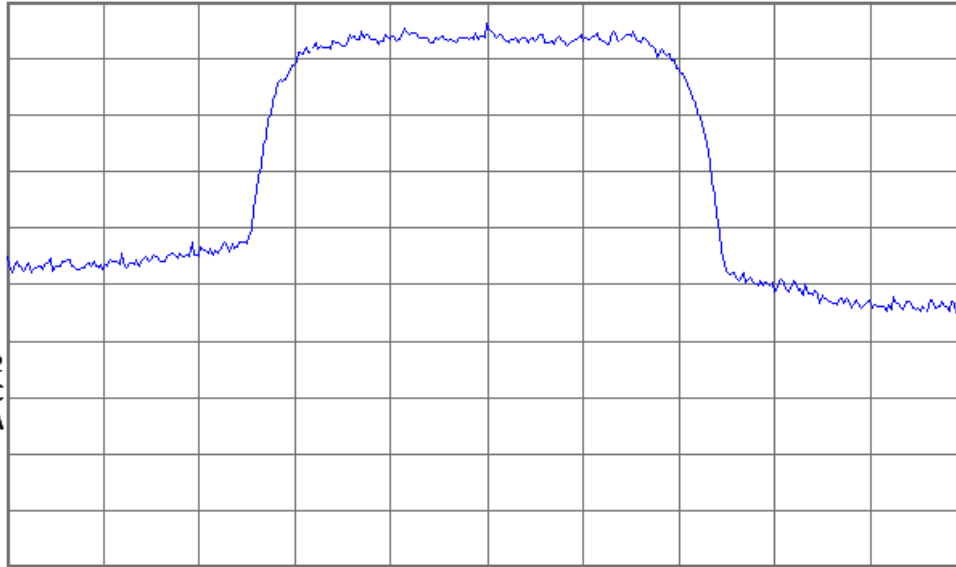
R T

Ref 20 dBm

Atten 5 dB

Peak
Log
10
dB/
Offset
27.1
dB

M1 S2
S3 FC
AA



Center 836.5 MHz

#Res BW 100 kHz

VBW 300 kHz

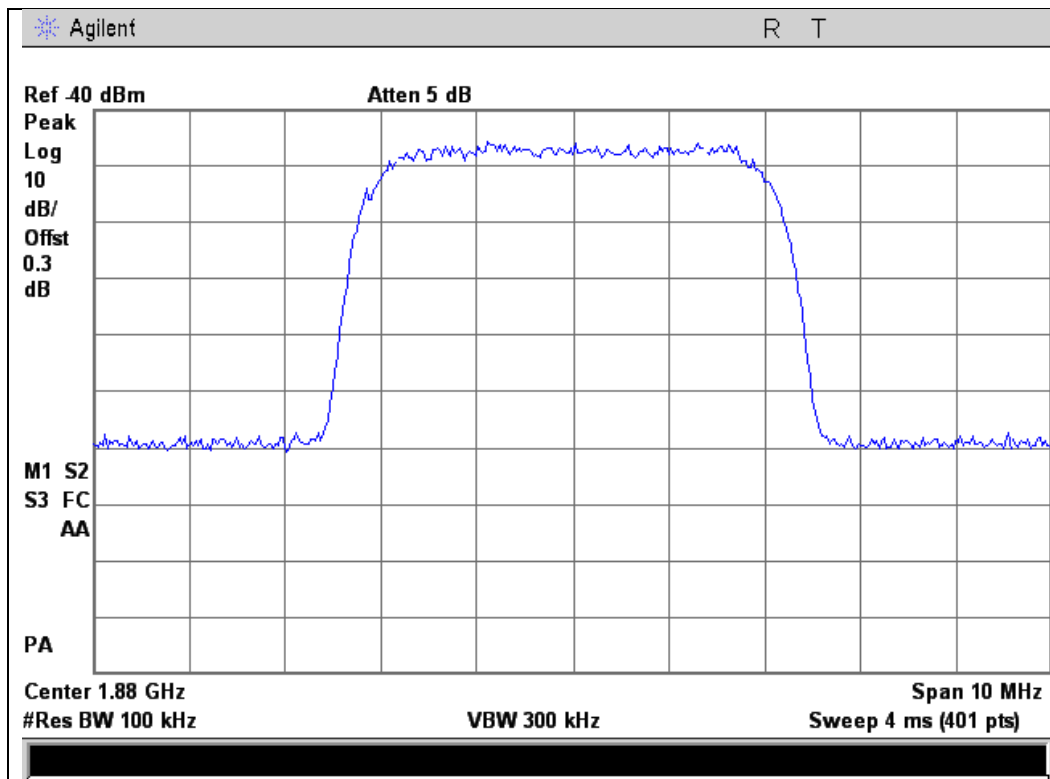
Span 10 MHz

Sweep 4 ms (401 pts)

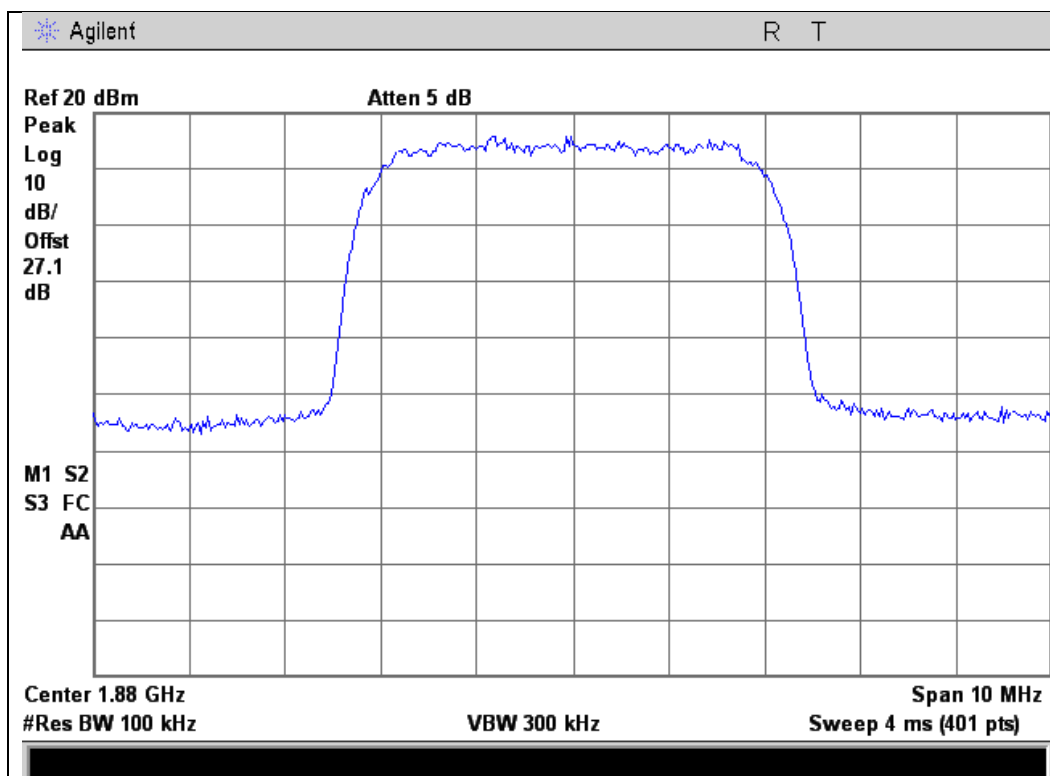


1850 - 1910 MHz Band

Input



Output

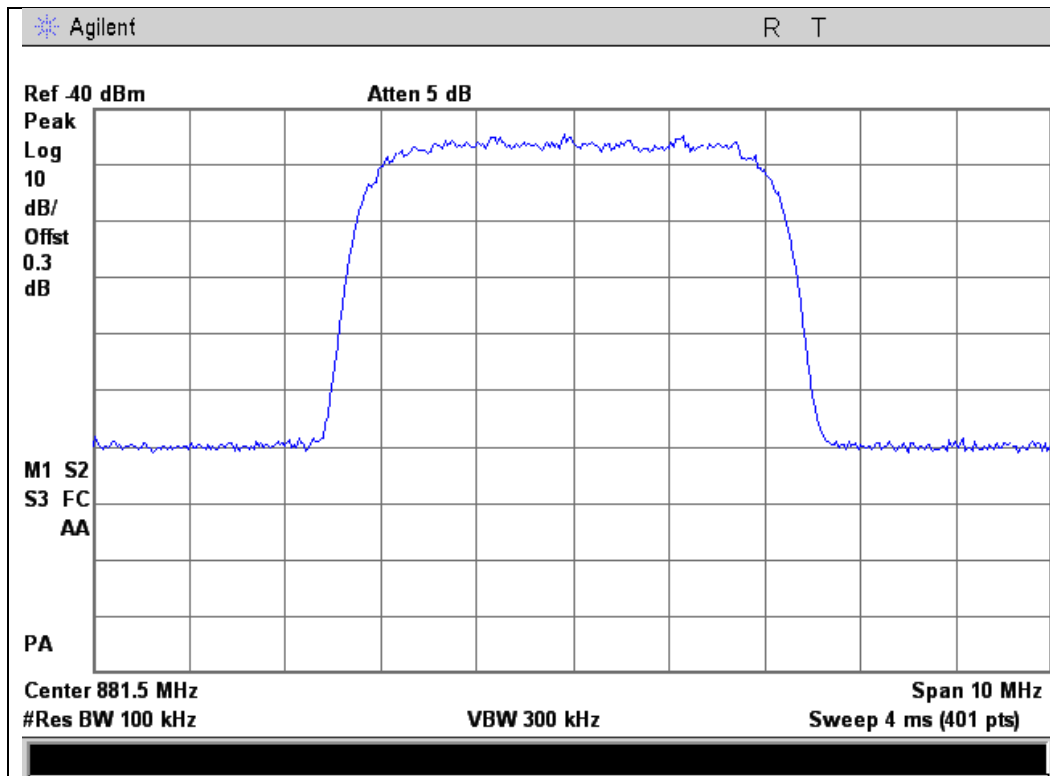




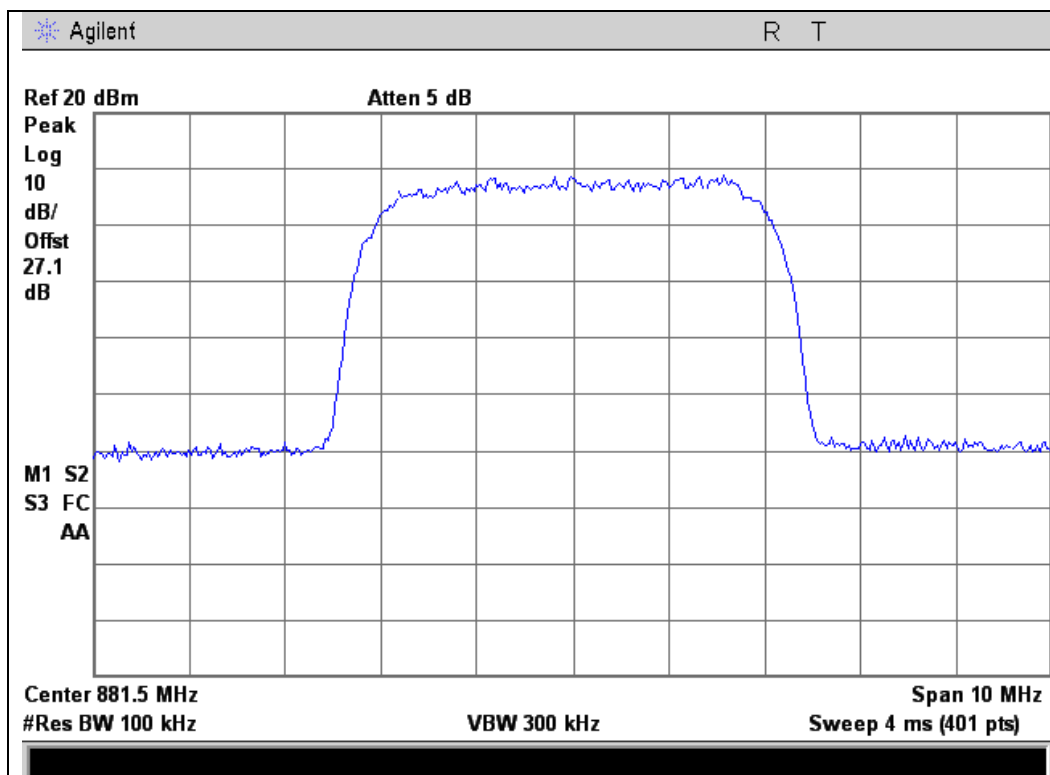
WCDMA Downlink Test Plots

869 - 894 MHz Band

Input



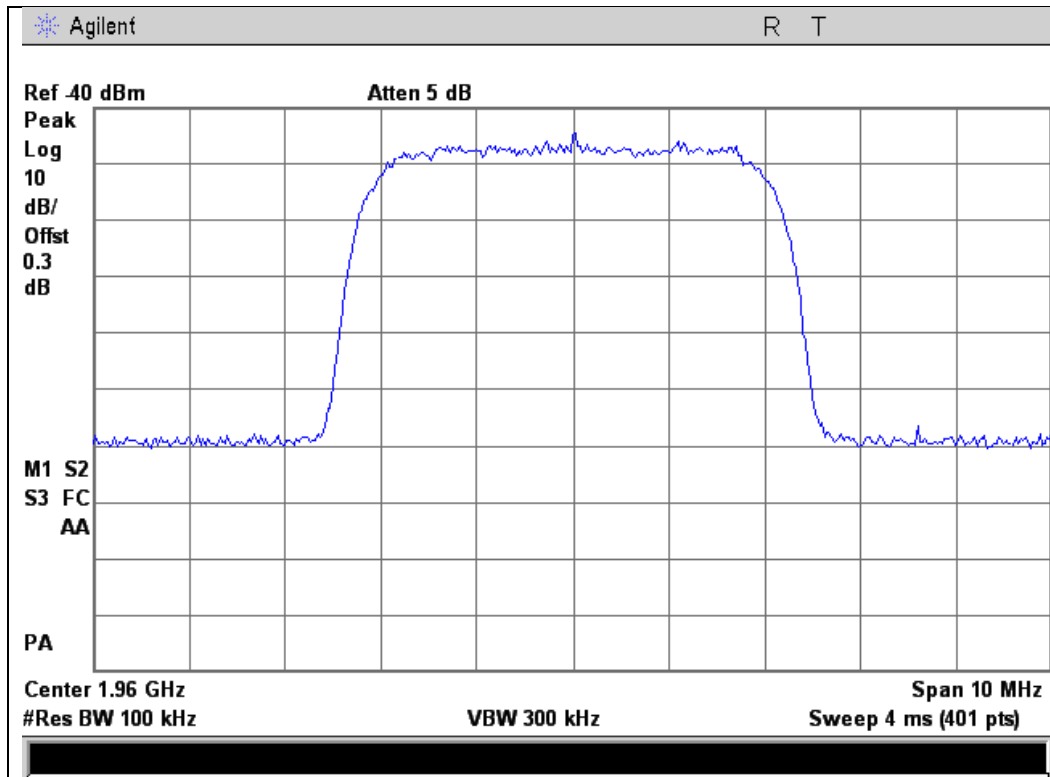
Output



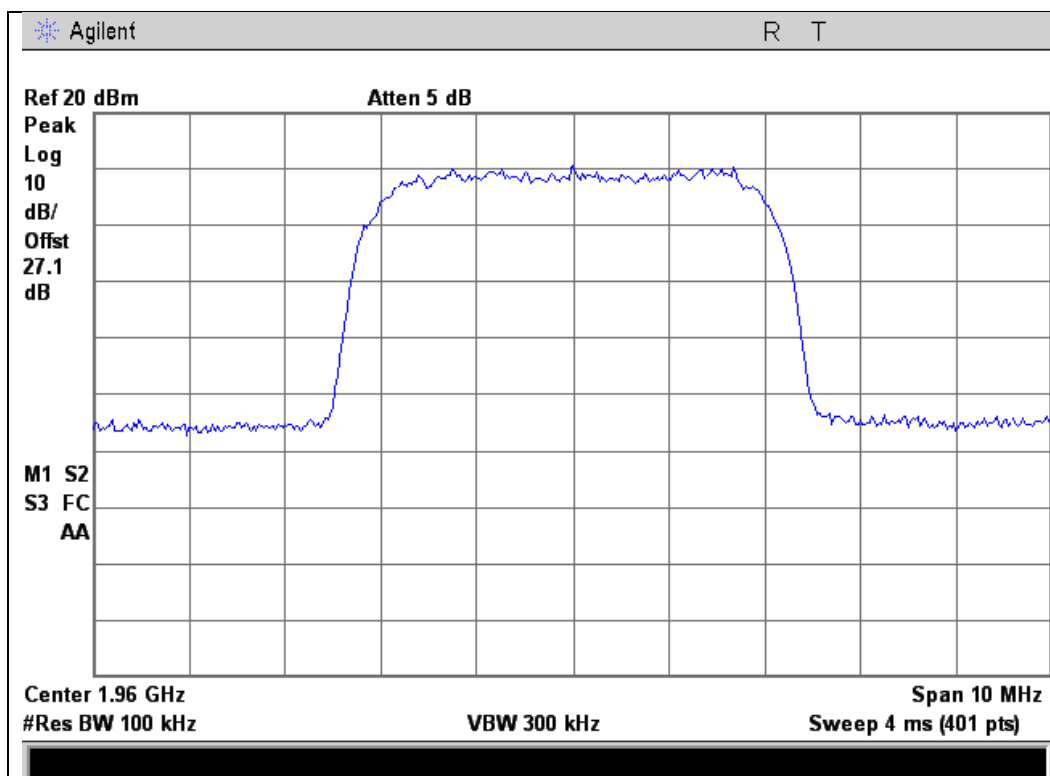


1930 - 1990 MHz Band

Input



Output





Oscillation Detection

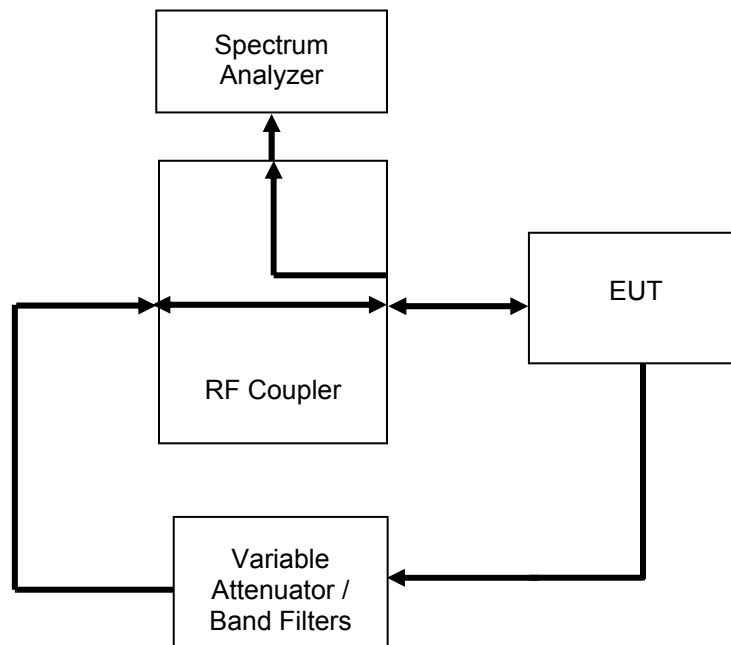
Name of Test: Oscillation Detection
Test Equipment Utilized: i00331, i00411, i00412

Engineer: John Erhard
Test Date: 10/2/2013

Test Procedure

The EUT was connected to a spectrum analyzer set for 0 Hz operation. The EUT uplink and downlink were fed back upon each other through a selectable band pass filter and variable attenuator. The EUT uplink and downlink were tested to ensure that the presence of oscillation was detected and that the EUT output turned off within 300 mS for the Uplink and 1 second for the Downlink and remained off for 1 minute. A EUT with test software was utilized to ensure that the EUT only had a maximum of 5 attempts at restart from oscillation before permanently shutting off.

Test Setup





Uplink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
824 - 849	84.5	300	Pass
1850 - 1910	30.25	300	Pass

Downlink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (S)	Result
869 - 894	82.5	1	Pass
1930 - 1990	72.3	1	Pass

Uplink Restart Time Test Results

Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result
824 - 849	65	≥60	Pass
1850 - 1910	65	≥60	Pass

Downlink Restart Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
869 - 894	64.5	≥60	Pass
1930 - 1990	65	≥60	Pass

Uplink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
824 - 849	5	≤5	Pass
1850 - 1910	5	≤5	Pass

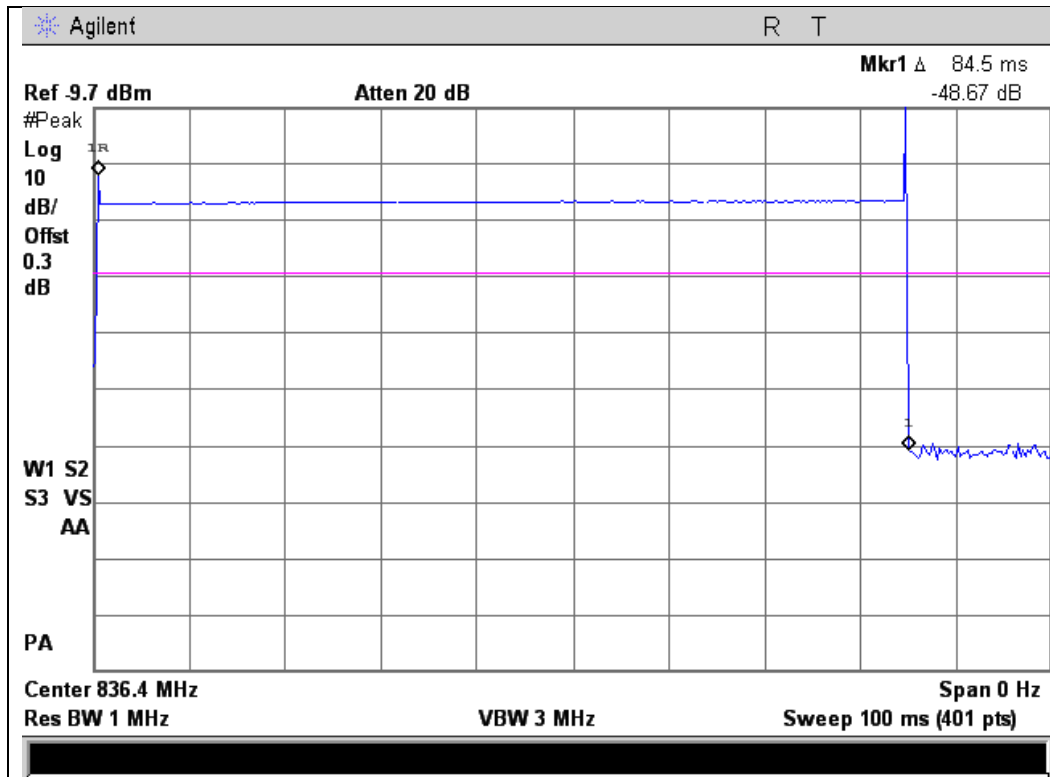
Downlink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
869 - 894	5	≤5	Pass
1930 - 1990	5	≤5	Pass

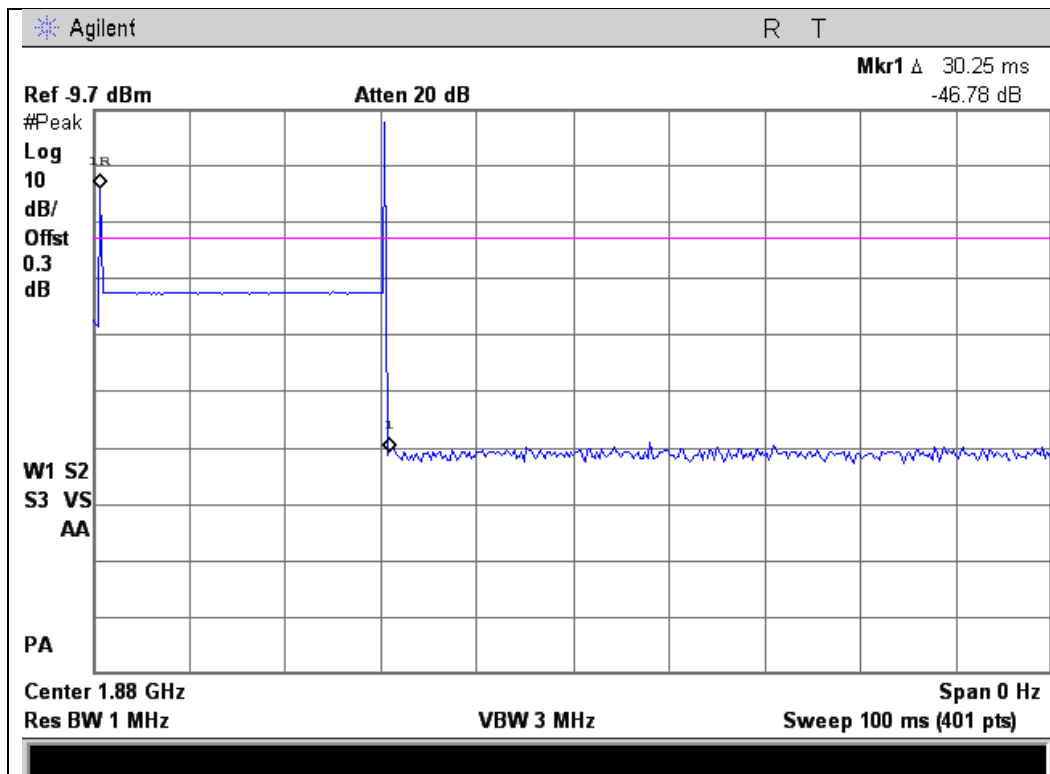


Uplink Detection Time Test Results

824 - 849 MHz Band



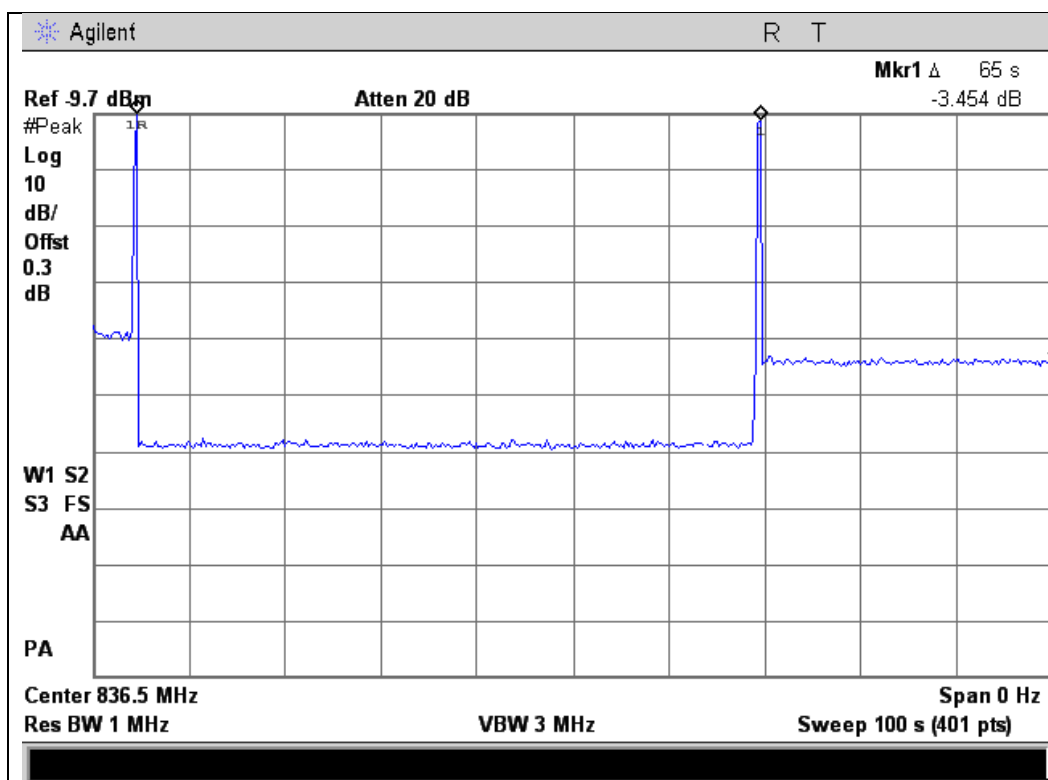
1850 - 1910 MHz Band



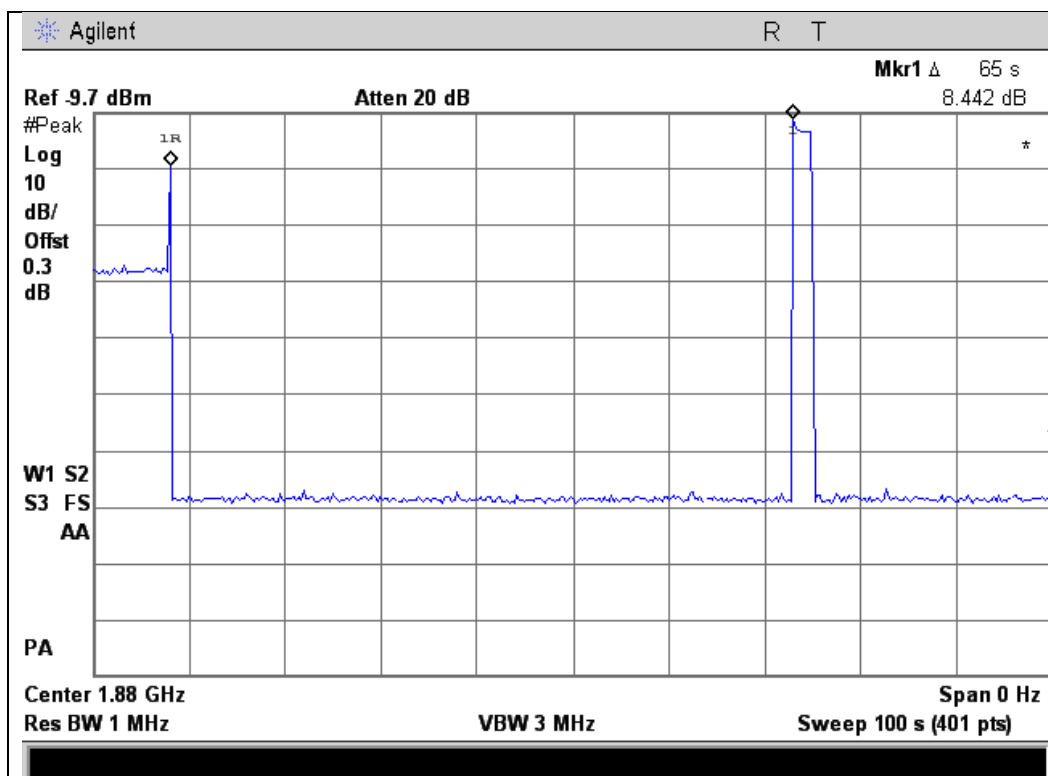


Uplink Restart Time Test Results

824 - 849 MHz Band



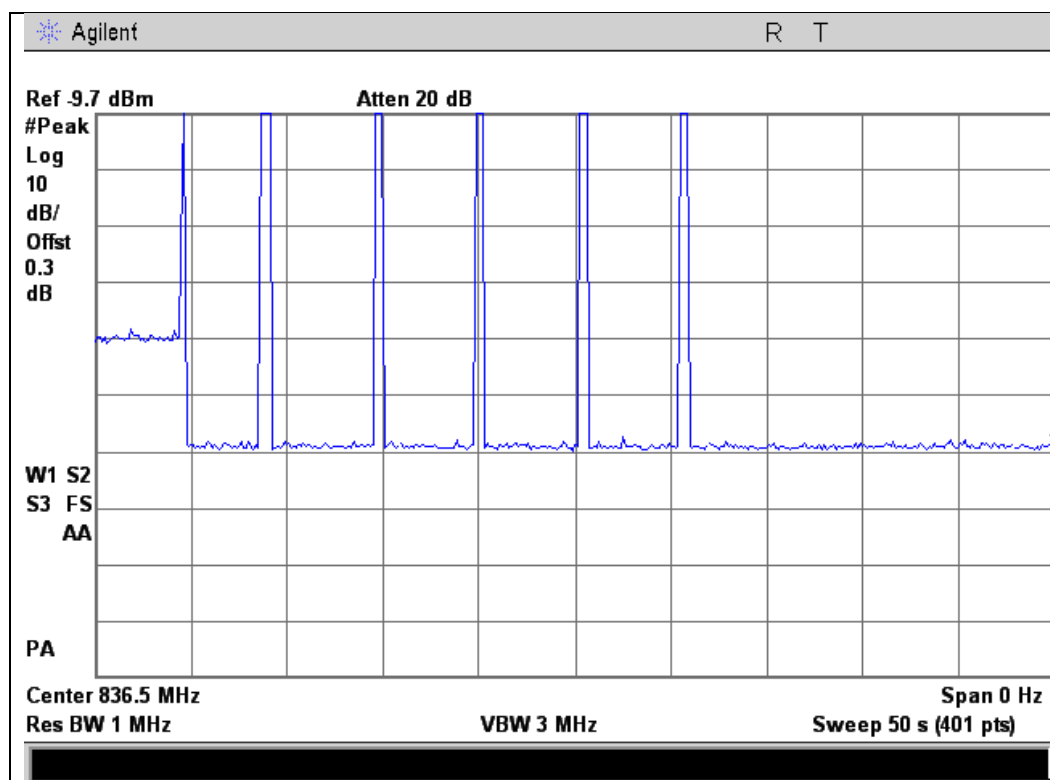
1850 - 1910 MHz Band



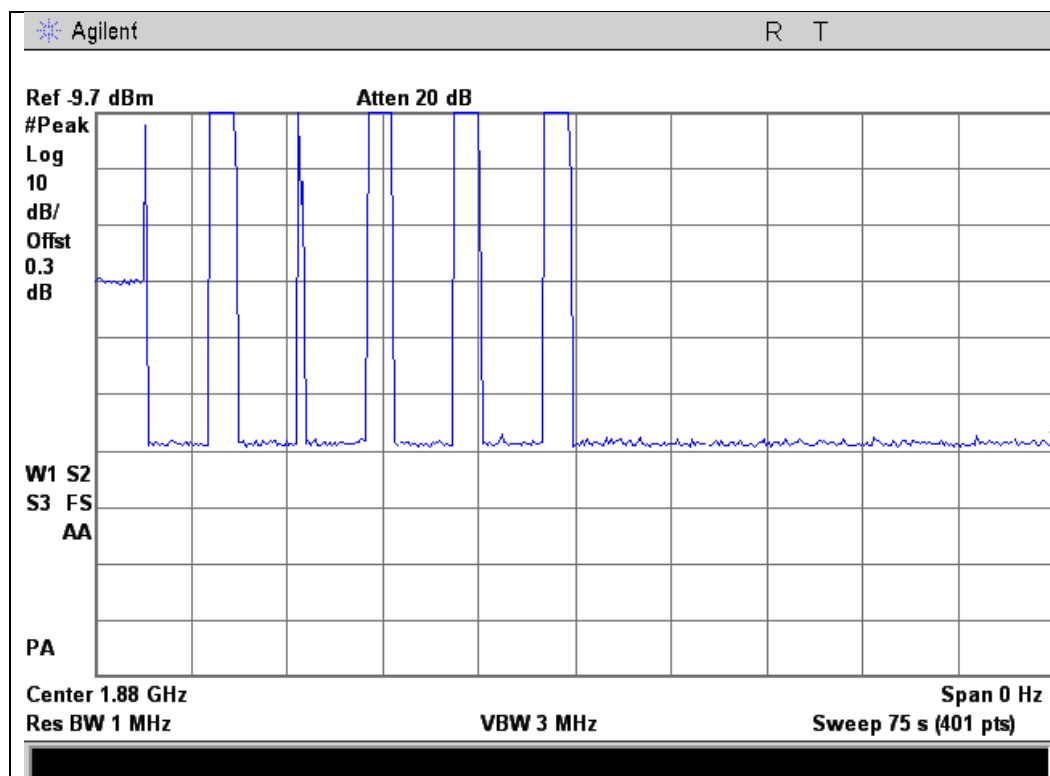


Uplink Restart Count Test Results

824 - 849 MHz Band



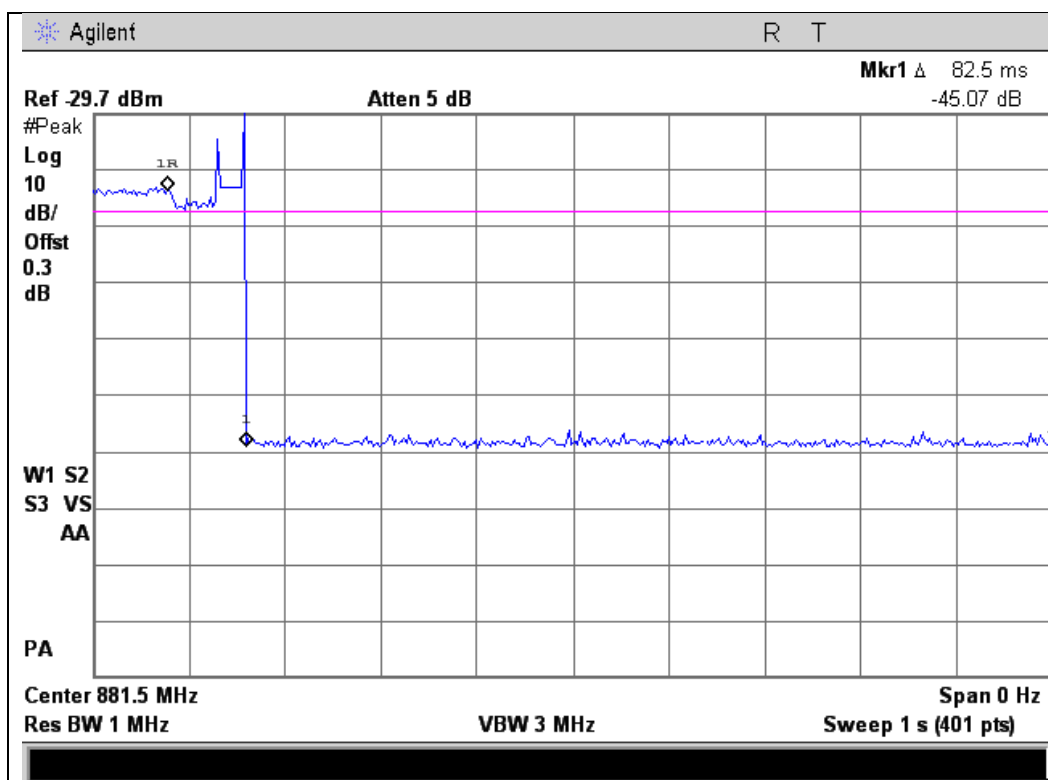
1850 - 1910 MHz Band



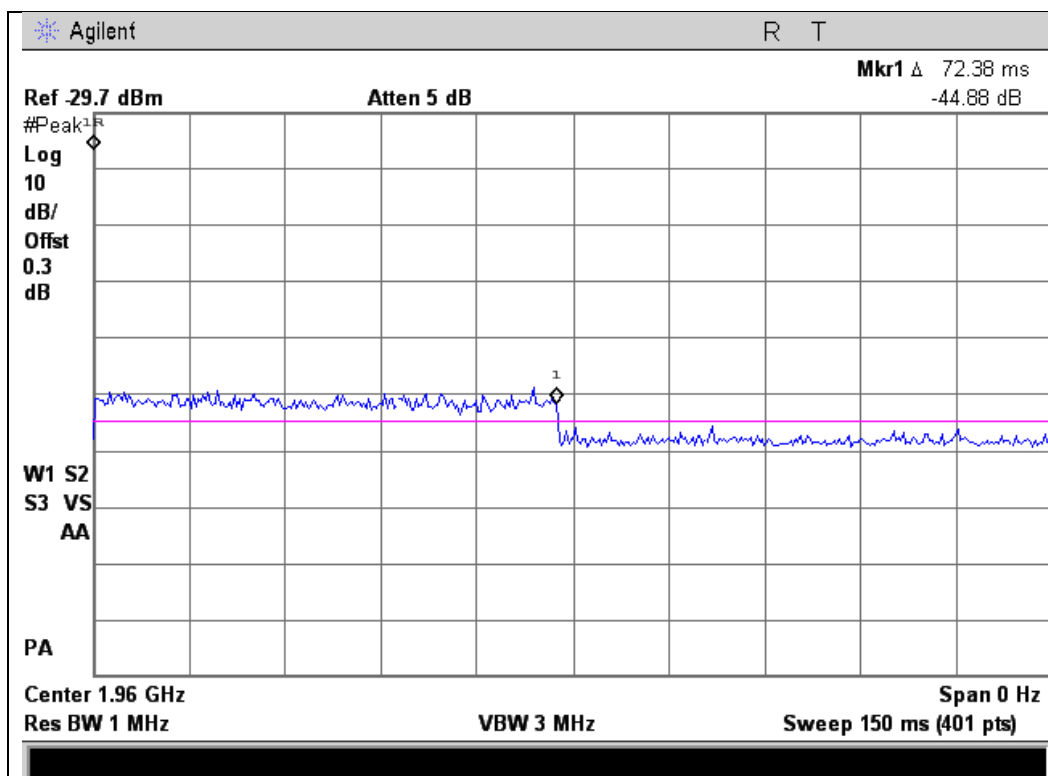


Downlink Detection Time Test Results

869 - 894 MHz Band



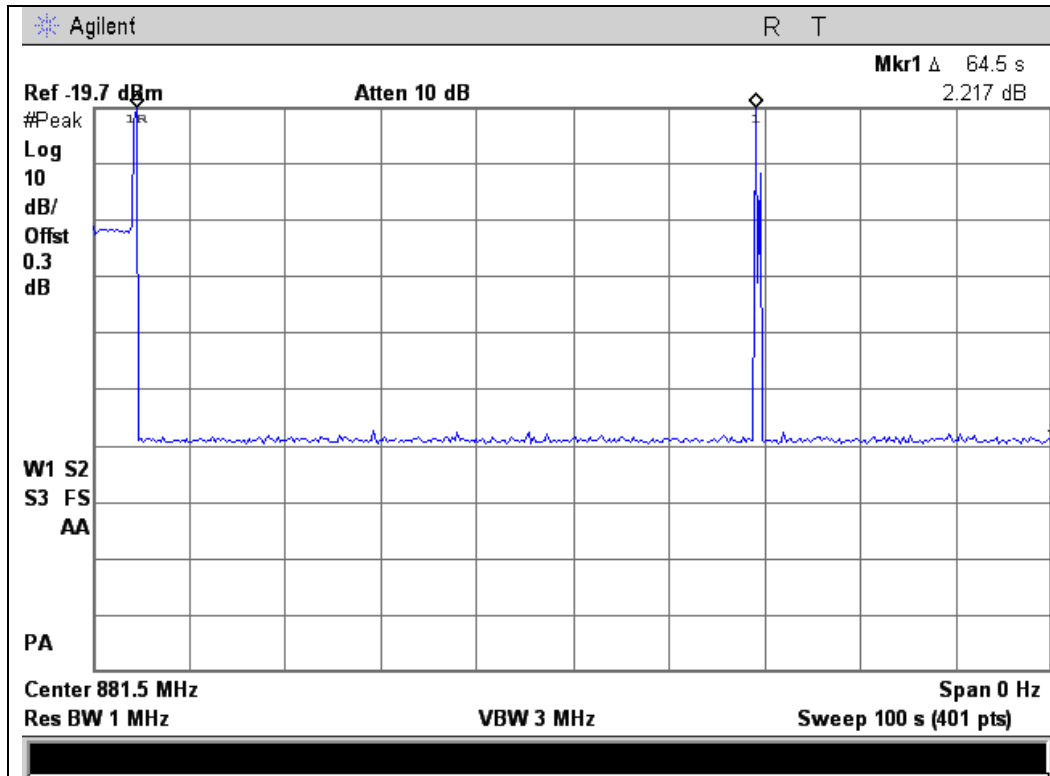
1930 - 1990 MHz Band



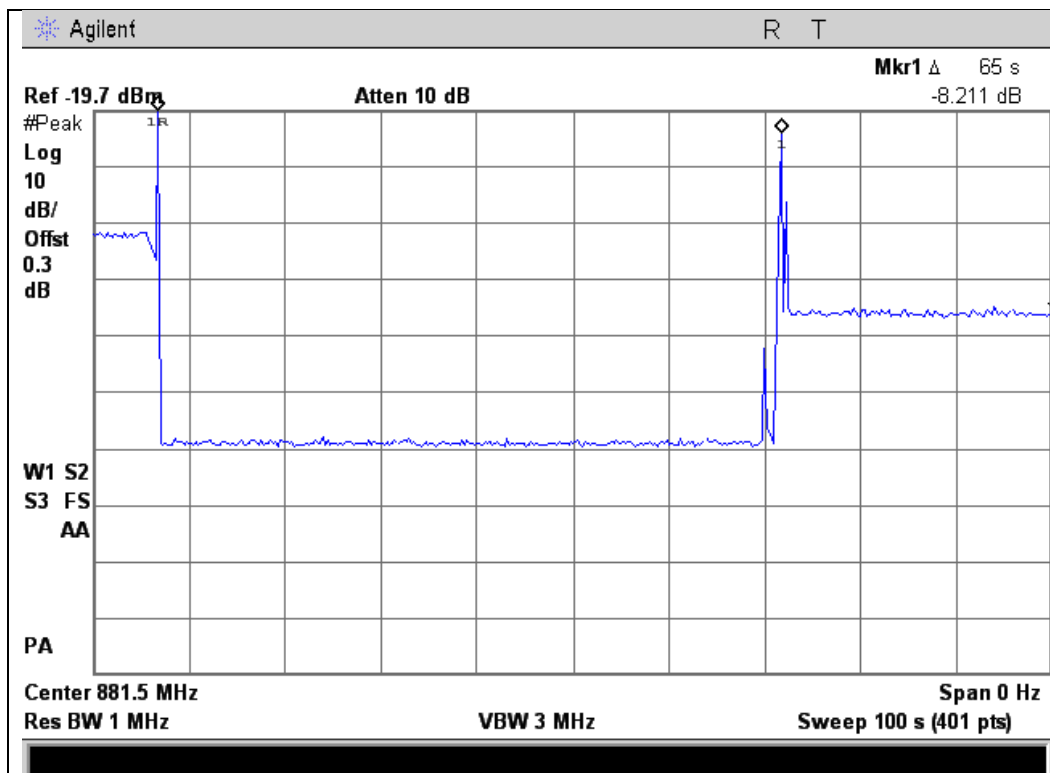


Downlink Restart Time Test Results

869 - 894 MHz Band



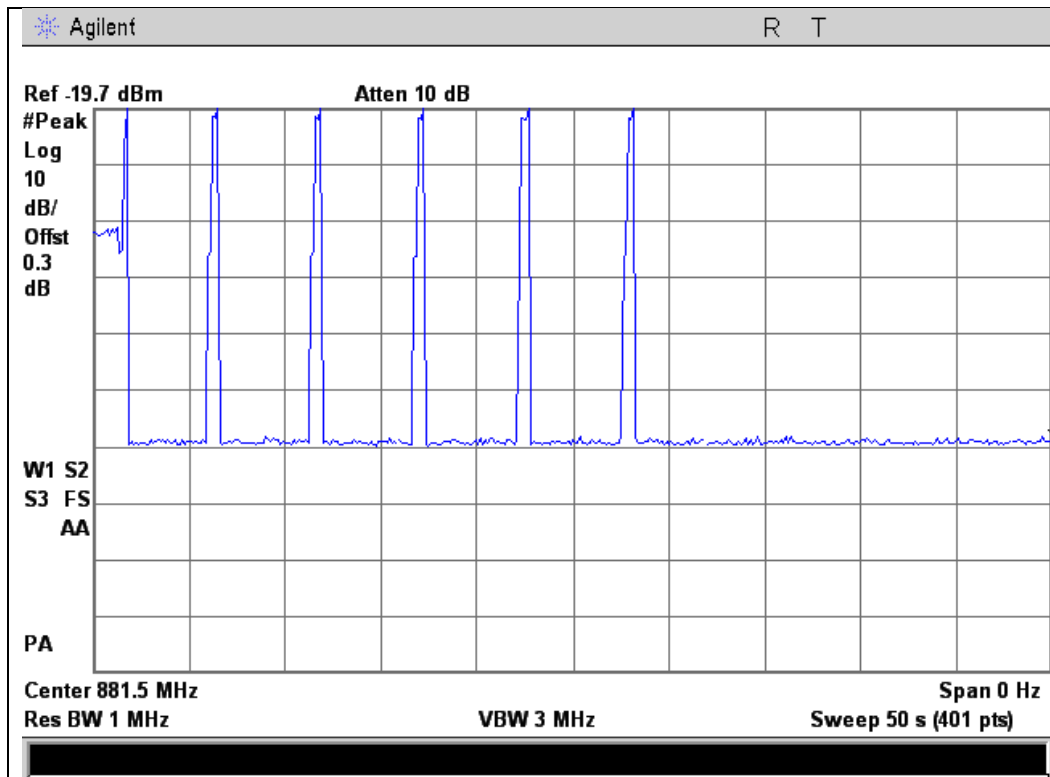
1930 - 1990 MHz Band



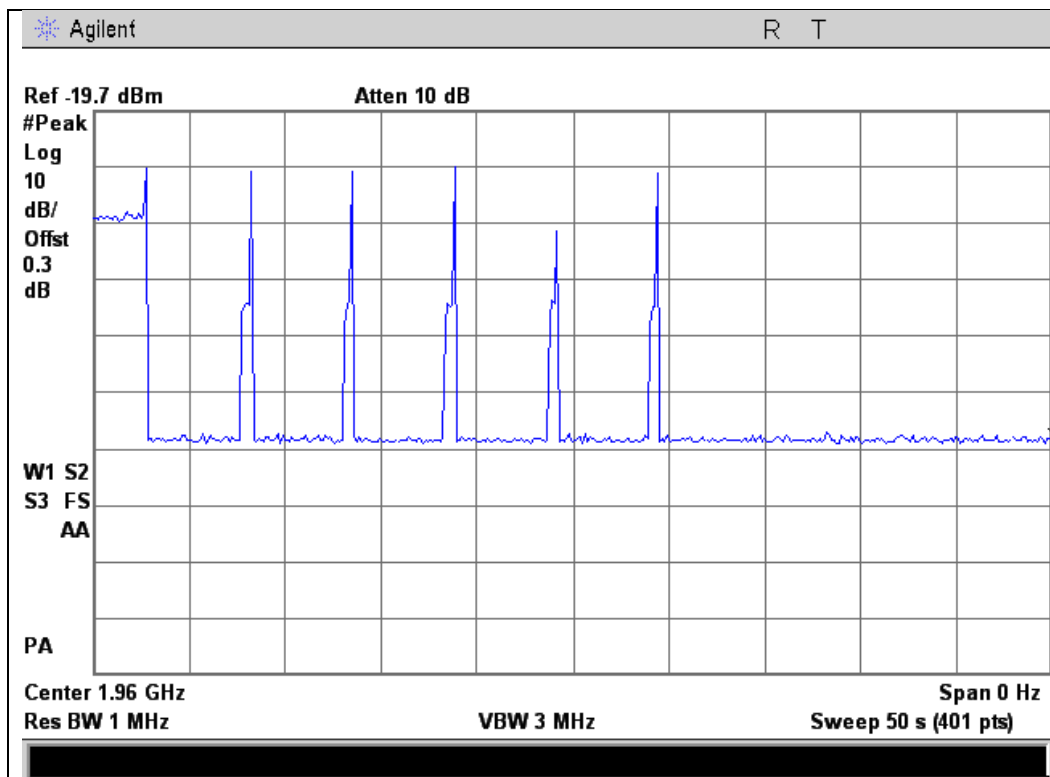


Downlink Restart Count Test Results

869 - 894 MHz Band



1930 - 1990 MHz Band





Radiated Spurious

Name of Test: Radiated Spurious
Test Equipment Utilized: i00271, i00379

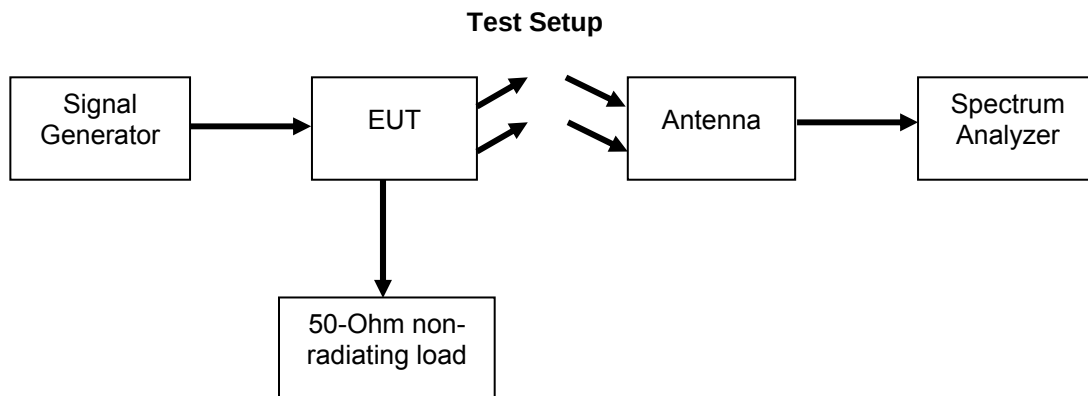
Engineer: John Erhard
Test Date: 10/8/2013

Test Procedure

The EUT was tested in an Open Area Test Site (OATS) set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antennas in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the signal levels were maximized. All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm. A signal generator was used to provide a CW signal centered in each operational uplink and downlink band. The EUT output was terminated into a 50 Ohm non-radiating load.

The following formulas are used for calculating the limits.

Radiated Spurious Emissions Limit = $43 + 10\log(P)$ dB





Uplink Test Results

824 - 849 MHz Band 836 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1672	-61.39	-13	Pass
2508	-60.02	-13	Pass
3344	-44.84	-13	Pass

1850 - 1910 MHz Band 1880 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3760	-44.24	-13	Pass
5640	-43.25	-13	Pass
7520	-32.48	-13	Pass

Downlink Test Results

869 - 894 MHz Band 881.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1763	-69.32	-13	Pass
2644.5	-59.51	-13	Pass
3526	-48.17	-13	Pass

1930 - 1990 MHz Band 1960 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3920	-46.74	-13	Pass
5880	-45.52	-13	Pass
7840	-31.63	-13	Pass

No other emissions were detected. All emissions were lower than -13 dBm.
All emissions were system noise floor.



Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	12/4/12	12/4/13
Voltmeter	Fluke	87III	i00319	7/3/12	7/3/13 **
Spectrum Analyzer	Agilent	E4407B	i00331	4/23/13	4/23/14
Non-radiating load	Termaline	8201	i00334	Verified on:8/2/13	
Power Supply	HP	6654A	i00350	Verified on:7/1/13	
Vector Signal Generator	Agilent	E4438C	i00348	1/4/13	1/4/14
EMI Analyzer	Agilent	E7405A	i00379	11/21/12	11/21/13
Signal Generator	Rohde & Schwarz	SMU200A	i00405	10/26/12	10/26/13
Tunable Band Pass Filter	Wilson Electronics	Variable attenuator / Bandpass Filter Switch Assembly	i00411	Verified on: 8/1/2013	
RF Directional Coupler	Meca	CS06-1.500V	i00412	Verified on: 8/1/2013	

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT