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toll-free: (866) 311-3268
fax: (480) 926-3598
<http://www.ComplianceTesting.com>
info@ComplianceTesting.com

Test Report

Prepared for: Wilson Electronics, Inc

Model: 460003

Description: Quint Band In-Building Wireless Signal Booster

FCC ID: PWO460003

To

FCC Part 20

Date of Issue: October 2, 2013

On the behalf of the applicant:

Wilson Electronics, Inc.
3301 E Deseret Drive
St. George, UT 84790

To the attention of:

Pat Cook, Sr. Electrical Engineer
Ph: (435)673-5021
Email: pcook@infowest.com

Prepared By
Compliance Testing, LLC
3356 N San Marcos Pl, Suite 107
Chandler, AZ 85225-7176
(866) 311-3268 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1350022

Mike Graffeo
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	October 2, 2013	Mike Graffeo	Original Document
2.0	January 13, 2014	Mike Graffeo	Added additional spurious emissions data on pages 56, 57 and plots on pages 72-75 for compliance to rule part 27.53c and 27.53f.
3.0	January 27, 2014	Mike Graffeo	Updated Conducted Emissions rule sections in the test summary table on page 6 and 57 to match the new eCFR rule sections dated January 7, 2014.
4.0	February 6, 2014	Amanda Reed	Updated FCC Rule part on page 57 to 27.53(f)



Table of Contents

<u>Description</u>	<u>Page</u>
Standard Test Conditions and Engineering Practices	5
Test Result Summary	6
Authorized Frequency Band	7
Maximum Power and Gain	13
Intermodulation	15
Out-of-Band Emissions	21
Conducted Spurious Emissions	55
Noise Limits	72
Uplink Inactivity	90
Variable Gain	94
Occupied Bandwidth	100
Oscillation Detection	131
Radiated Spurious	149
Test Equipment Utilized	152



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 latest version of KDB 935210.

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)
24.9 – 31.0	33.5 – 63.0	985.5 - 943.0

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

EUT Description

Model: 460003

Description: Quint Band In-Building Wireless Signal Booster

Firmware: A460003A

Software: 460003A

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	704 - 716	777 - 787	824 - 849	1850 - 1915	1710 – 1755
Downlink	734 - 746	746 - 756	869 - 894	1930 - 1995	2110 - 2155
Modulation Type	LTE		GSM, CDMA, EDGE, HSPA, EVDO, LTE		CDMA, HSPA, LTE, EDGE, EVDO

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

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) 27.53(c) 27.53(e) 27.53(f) 27.53(g)	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

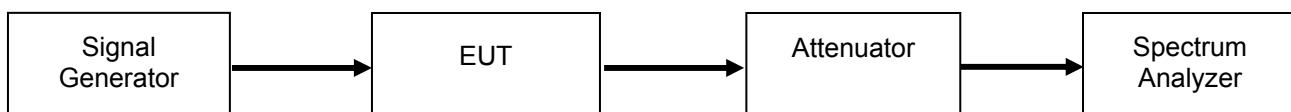
Name of Test: Authorized Frequency Band
Test Equipment Utilized: i00331 and i00405

Engineer: Mike Graffeo
Test Date: 9/11/13

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.

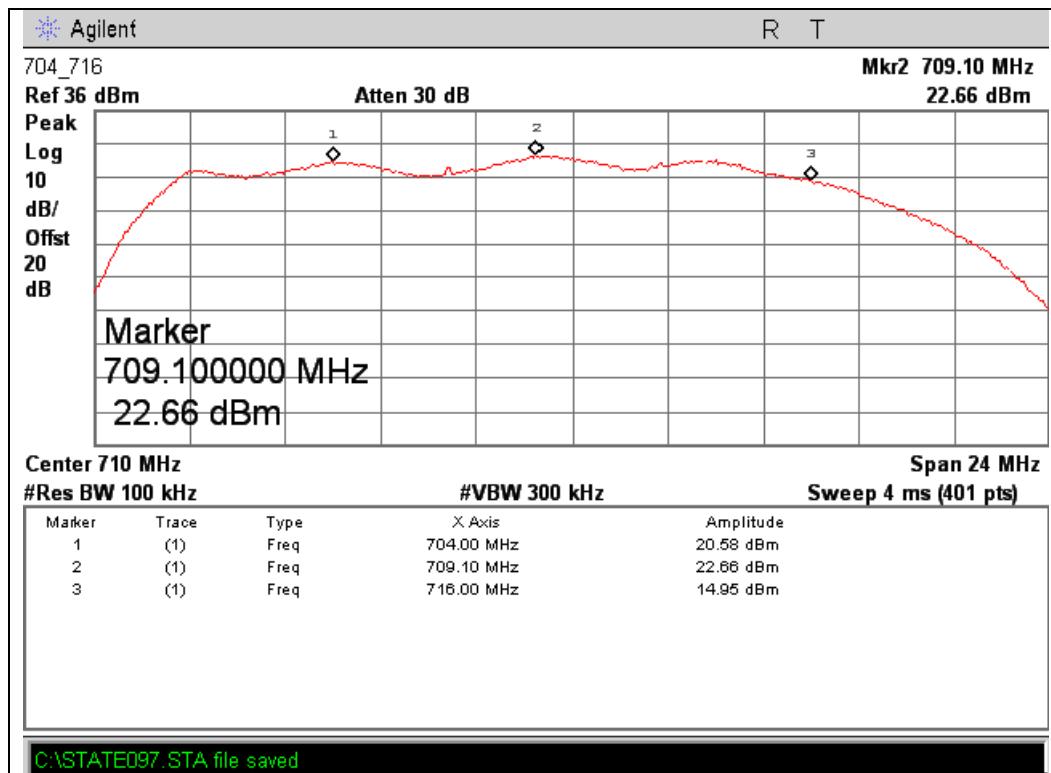
Test Setup



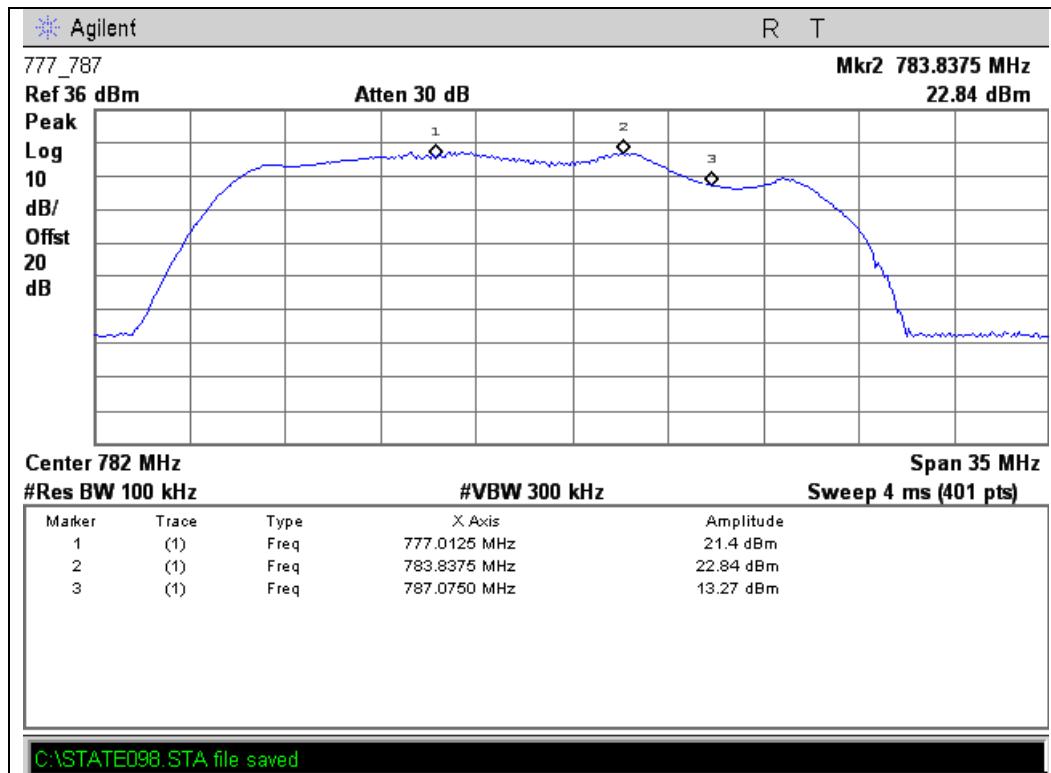


Uplink Test Results

704 - 716 MHz Band

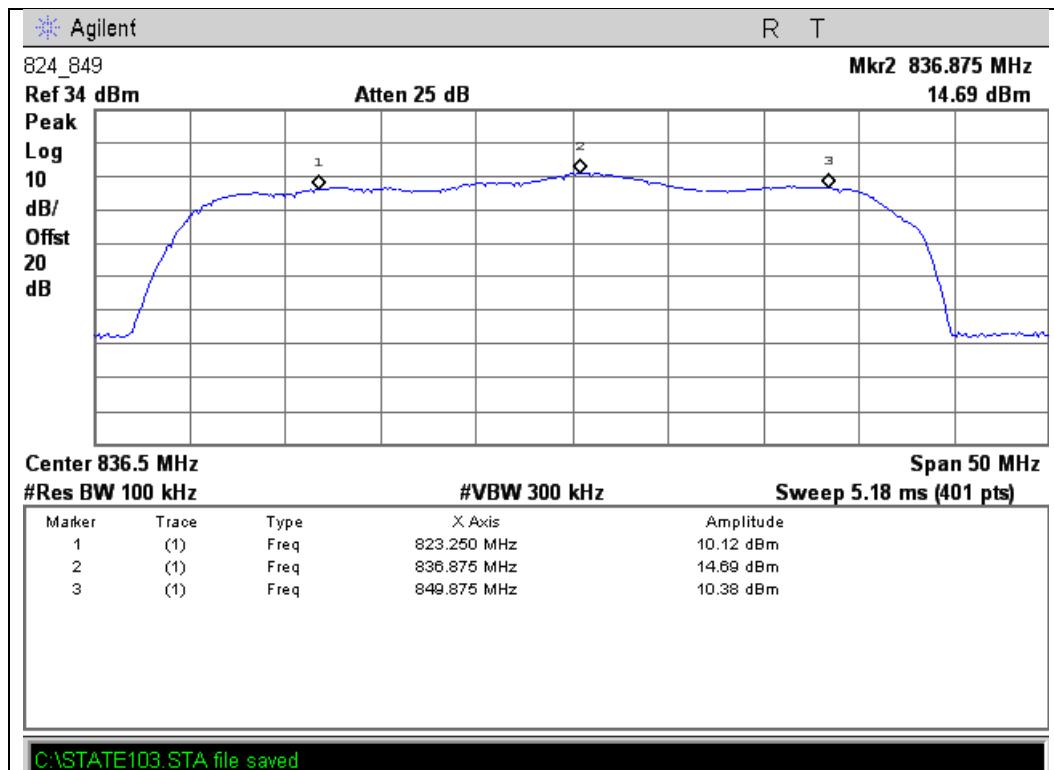


777 - 787 MHz Band

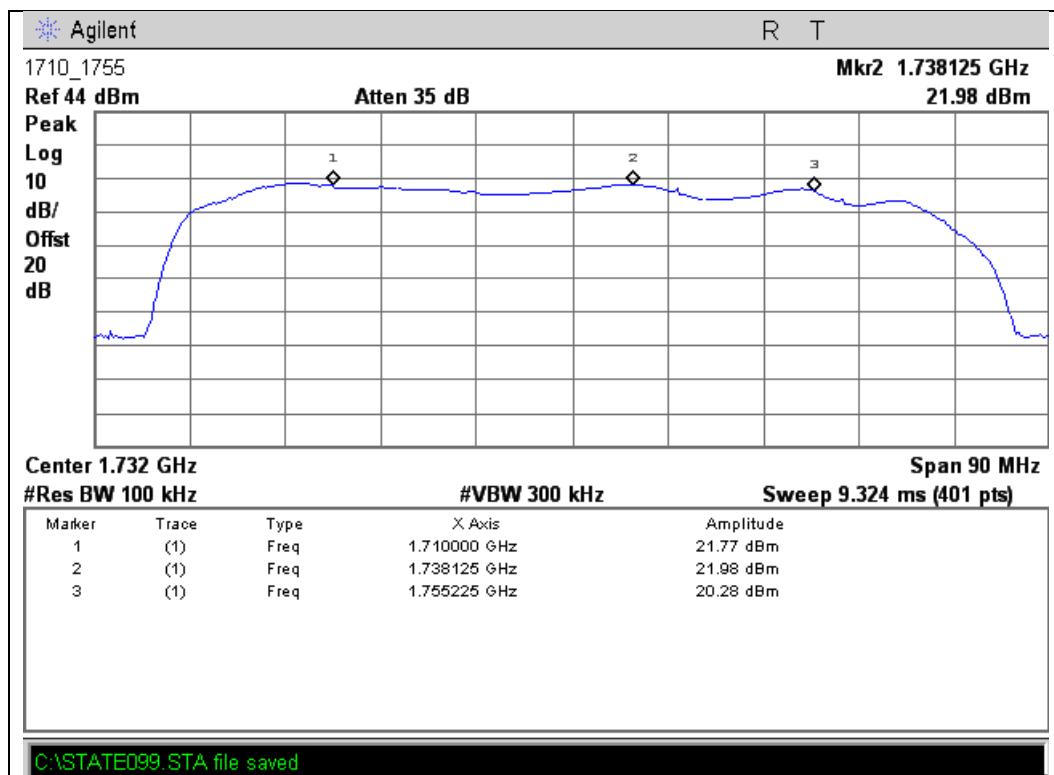




824 - 849 MHz Band

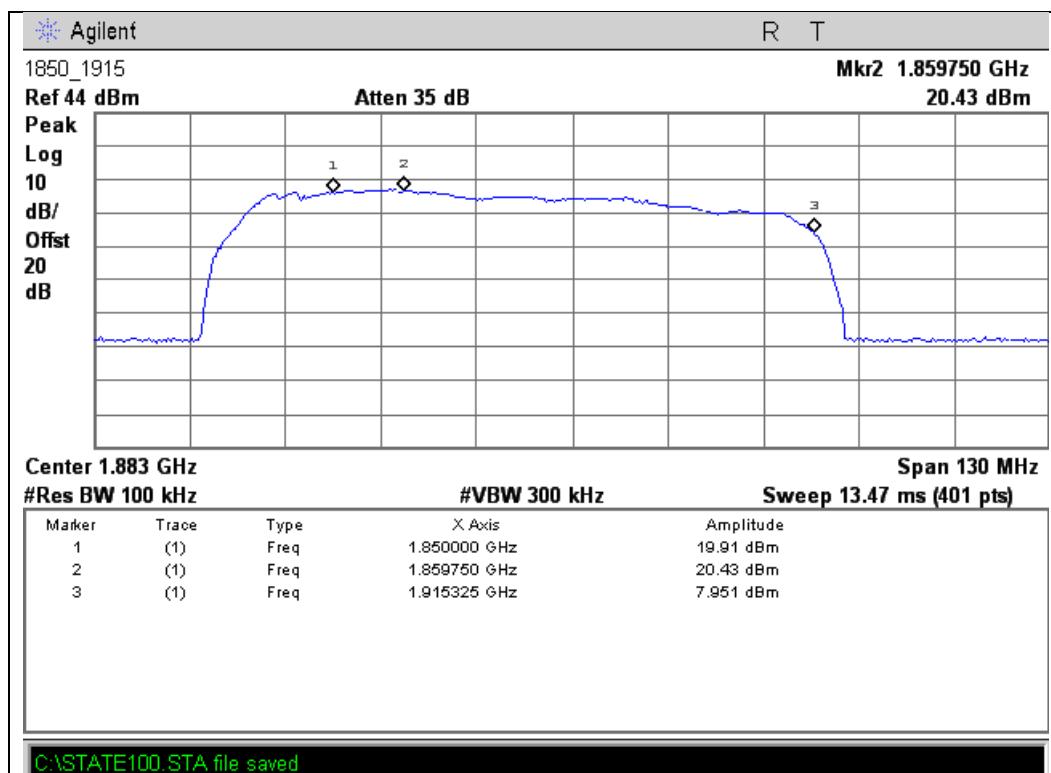


1710 - 1755 MHz Band



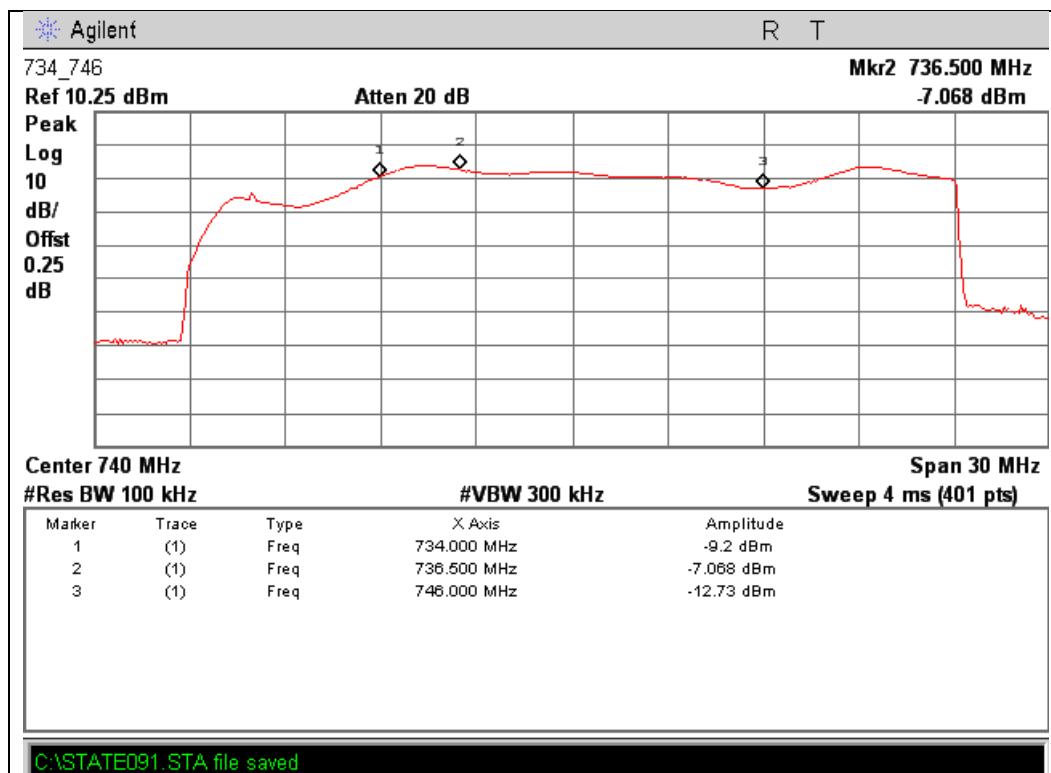


1850 - 1915 MHz Band

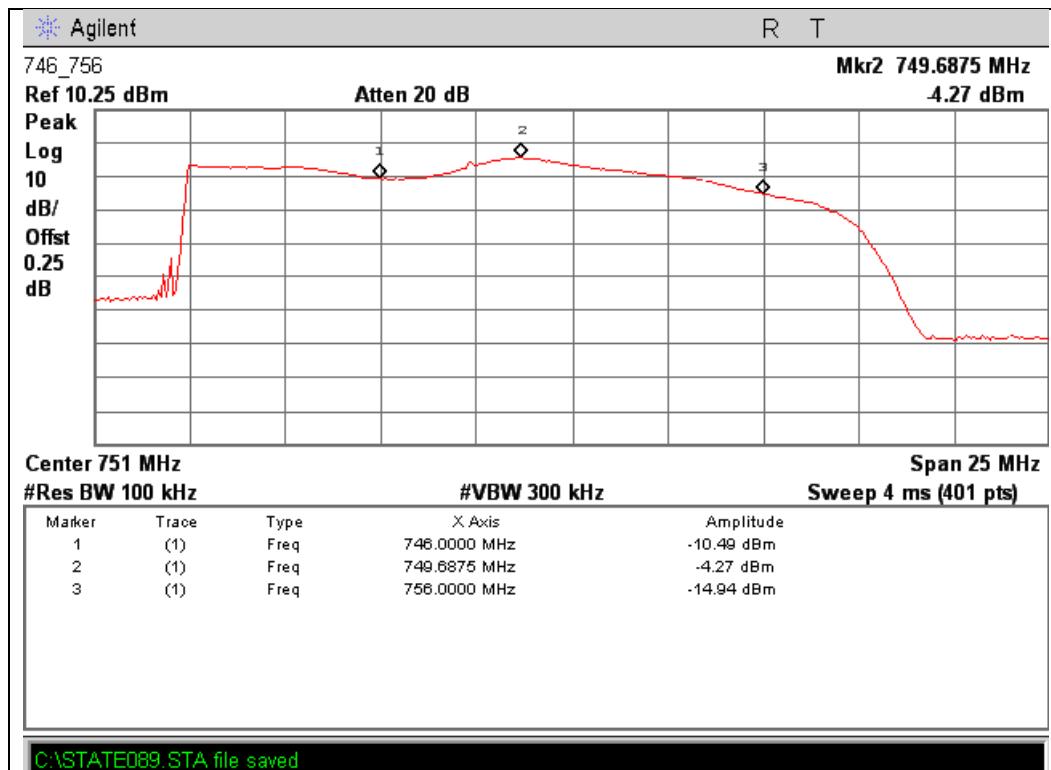


Downlink Test Results

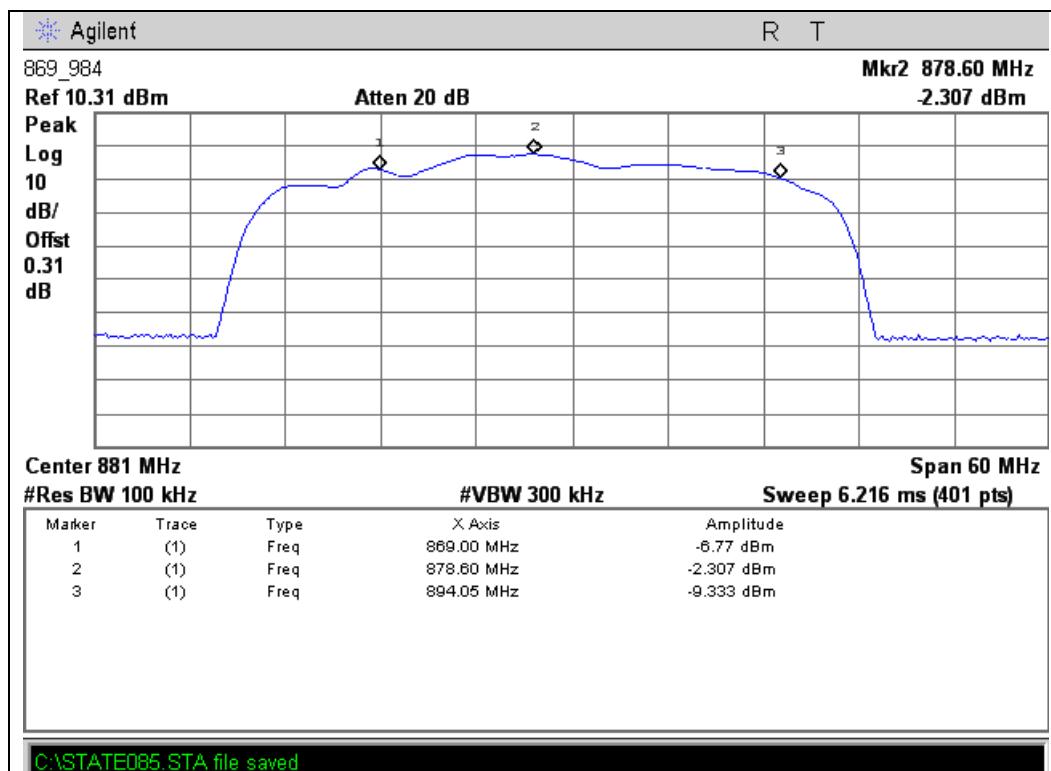
734 - 746 MHz Band



746 - 756 MHz Band

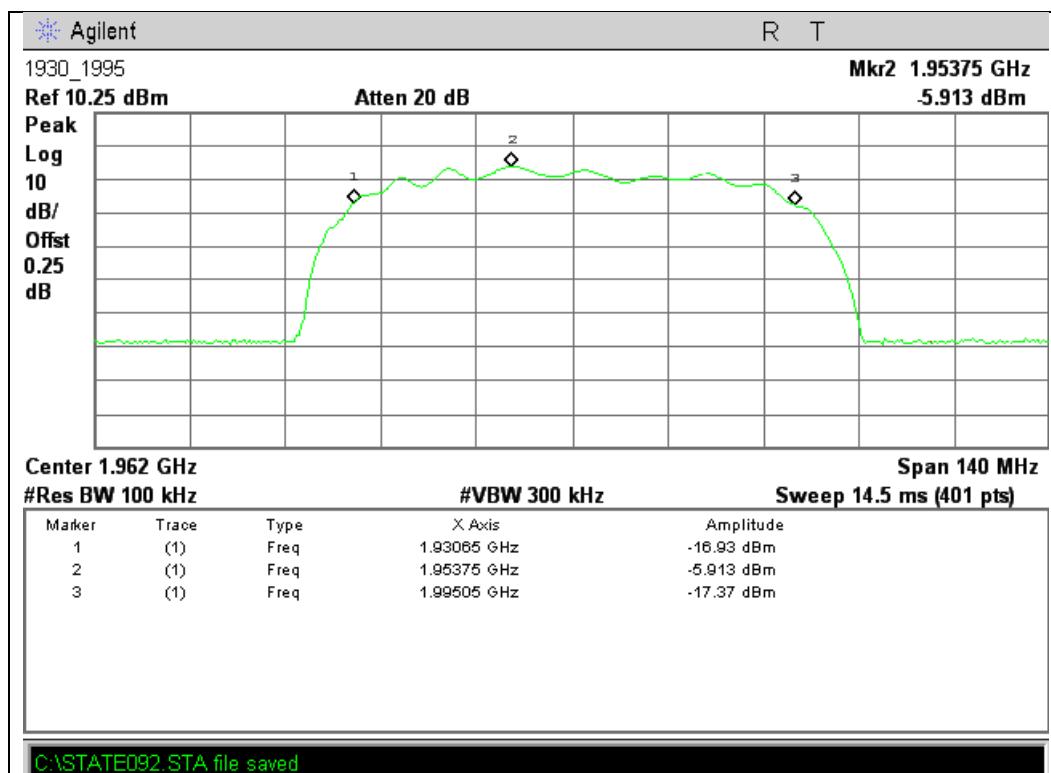


869 - 894 MHz Band

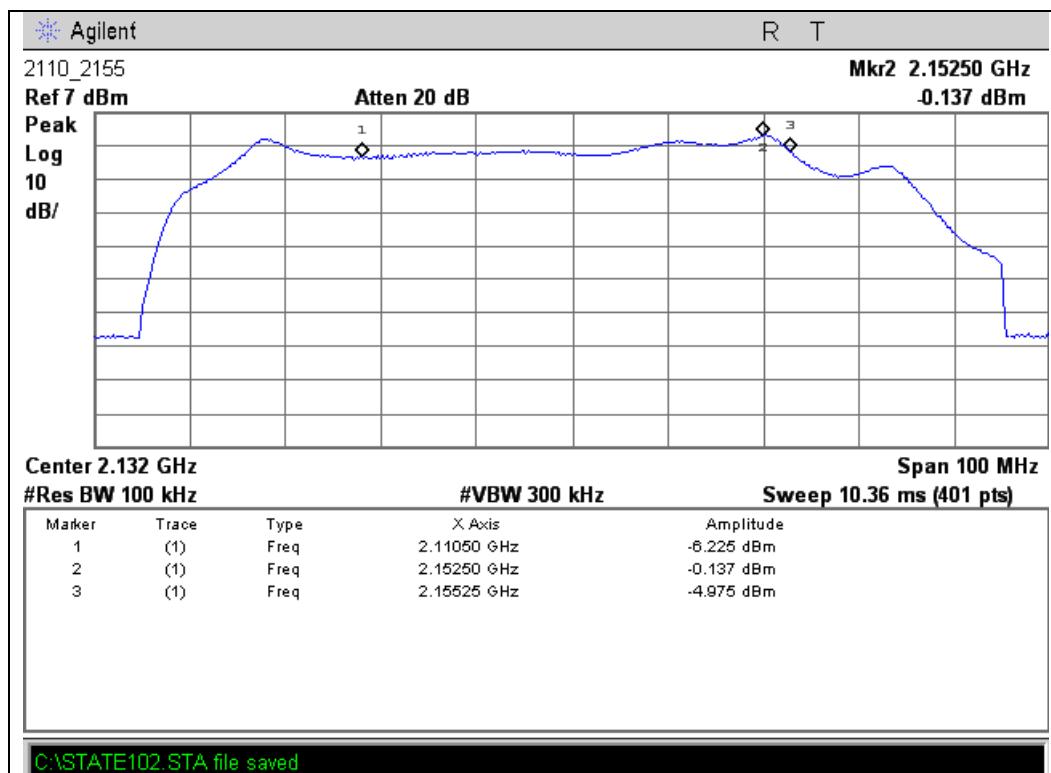




1930 - 1995 MHz Band



2110 - 2155 MHz Band





Maximum Power and Gain

Name of Test: Maximum Power and Gain
Test Equipment Utilized: i00331, i00405, i00412

Engineer: Mike Graffeo
Test Date: 9/12/13

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 frequency with the highest power level 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 570 μ S 12.5% duty-cycle pulsed CW and 4.1 MHz AWGN modulation. The maximum power was measured and verified to meet the minimum and maximum levels allowed and 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.

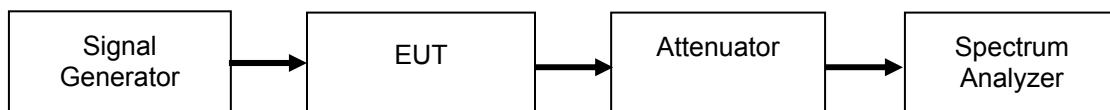
The following formulas are used for calculating the limits.

Note – The Downlink gain is calculated based on the paired Uplink center frequency.

Maximum Gain Limit (dB) = 6.5 dB + 20Log(Frequency)

Note - Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Test Setup



Uplink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Lower Limit (dBm)	Upper Limit (dBm)	Result
704 - 716 MHz Pulsed CW	-38.4	22.5	17	30	Pass
704 - 716 MHz AWGN	-40.0	18.2	17	30	Pass
777 - 787 MHz Pulsed CW	-37.3	24.2	17	30	Pass
777 - 787 MHz AWGN	-39.6	18.8	17	30	Pass
824 - 849 MHz Pulsed CW	-39.5	24.4	17	30	Pass
824 - 849 MHz AWGN	-37.6	20.5	17	30	Pass
1710 - 1755 MHz Pulsed CW	-36.0	24.1	17	30	Pass
1710 - 1755 MHz AWGN	-44.0	22.2	17	30	Pass
1850 - 1915 MHz Pulsed CW	-38.8	22.6	17	30	Pass
1850 - 1915 MHz AWGN	-40.0	21.0	17	30	Pass



Downlink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Upper Limit (dBm)	Result
734 - 746 MHz Pulsed CW	-58.6	4.7	17	Pass
734 - 746 MHz AWGN	-67.0	-4.2	17	Pass
746 - 756 MHz Pulsed CW	-58.6	4.5	17	Pass
746 - 756 MHz AWGN	-65.0	-2.0	17	Pass
869 - 894 MHz Pulsed CW	-57.5	6.9	17	Pass
869 - 894 MHz AWGN	-63.0	-3.0	17	Pass
1930 - 1995 MHz Pulsed CW	-56.7	10.4	17	Pass
1930 - 1995 MHz AWGN	-66.7	2.0	17	Pass
2110 - 2155 MHz Pulsed CW	-58.4	2.4	17	Pass
2110 - 2155 MHz AWGN	-68.0	-0.6	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 CW	709.22	736.5	60.9	63.5	63.3	63.5	2.42	9	-6.58
AWGN	709.22	736.5	58.2	63.5	62.8	63.5	4.6	9	-4.4
Pulsed CW	783.84	749.69	61.5	64	63.1	64	1.61	9	-7.39
AWGN	783.84	749.69	58.4	64	63.0	64	4.6	9	-4.4
Pulsed CW	836.87	878.75	63.9	65	64.4	65	0.49	9	-8.51
AWGN	836.87	878.75	58.1	65	60.0	65	1.94	9	-7.06
Pulsed CW	1738.12	2151.5	60.1	71	60.8	72	0.7	9	-8.3
AWGN	1738.12	2151.5	66.2	71	67.4	72	1.24	9	-7.76
Pulsed CW	1859.76	1953.75	61.4	72	67.1	71	5.71	9	-3.29
AWGN	1859.76	1953.75	61.0	72	68.7	71	7.7	9	-1.3



Intermodulation

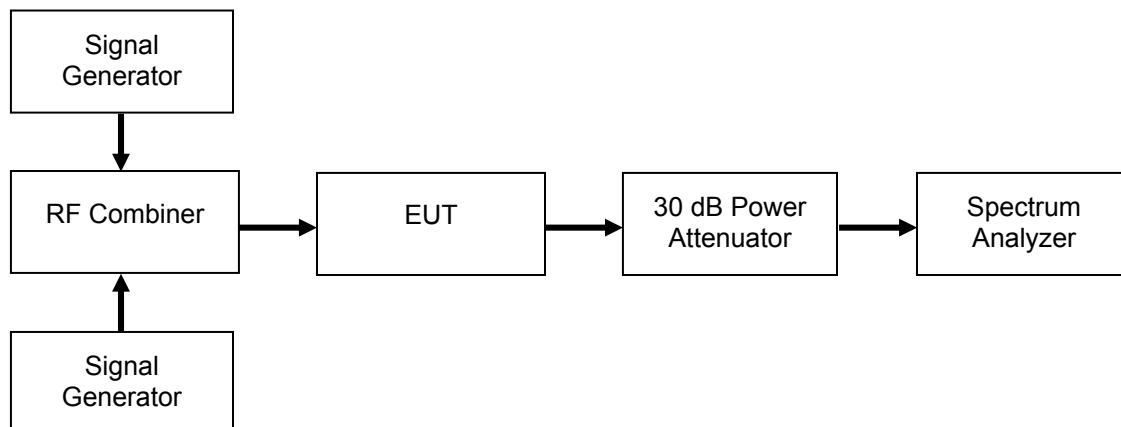
Name of Test: Intermodulation
Test Equipment Utilized: i00331, i00405, i00412

Engineer: Mike Graffeo
Test Date: 9/12/13

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 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
704 - 716 MHz	-27.91	-19	Pass
777 - 787 MHz	-28.45	-19	Pass
824 - 849 MHz	-25.95	-19	Pass
1710 - 1755 MHz	-23.19	-19	Pass
1850 - 1915 MHz	-31.88	-19	Pass

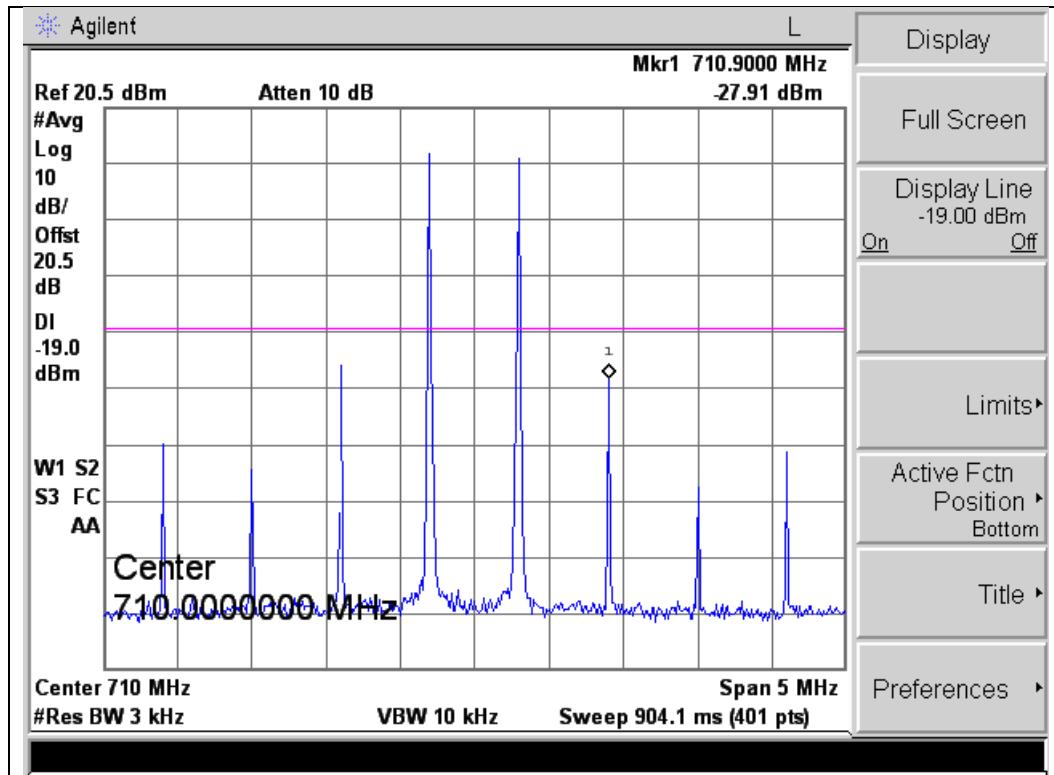
Downlink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
734 - 746 MHz	-34.28	-19	Pass
746 - 756 MHz	-49.33	-19	Pass
869 - 894 MHz	-42.98	-19	Pass
1930 - 1995 MHz	-38.01	-19	Pass
2110 - 2155 MHz	-26.18	-19	Pass

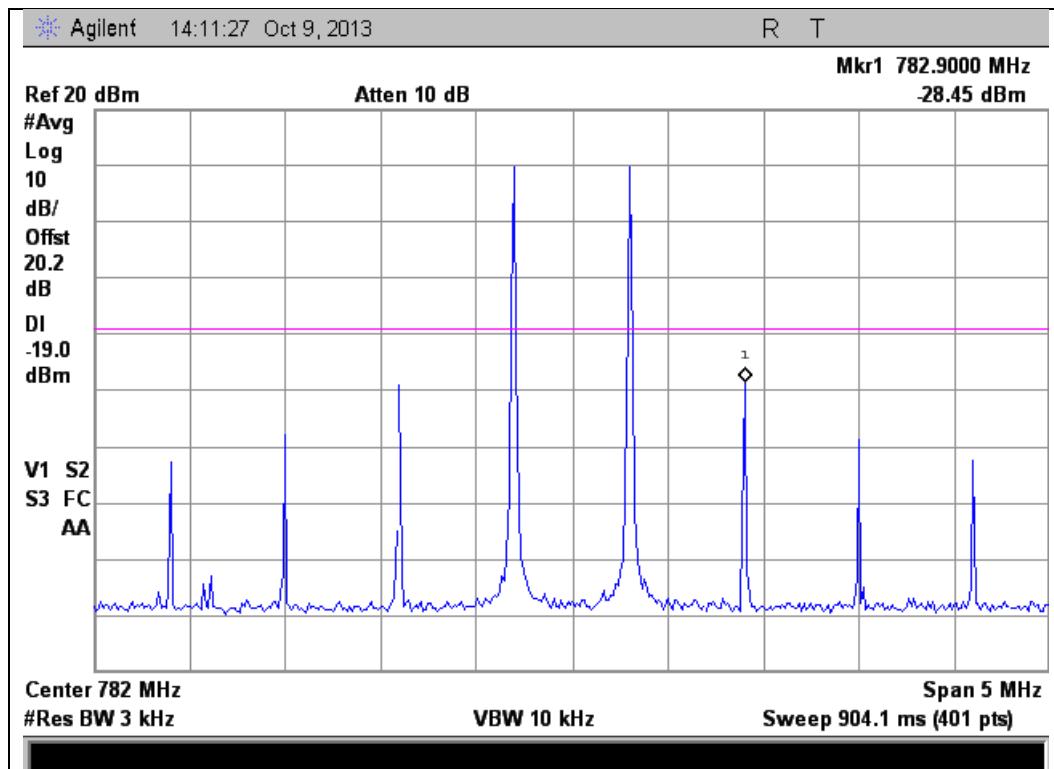


Uplink Test Results

704 - 716 MHz Band

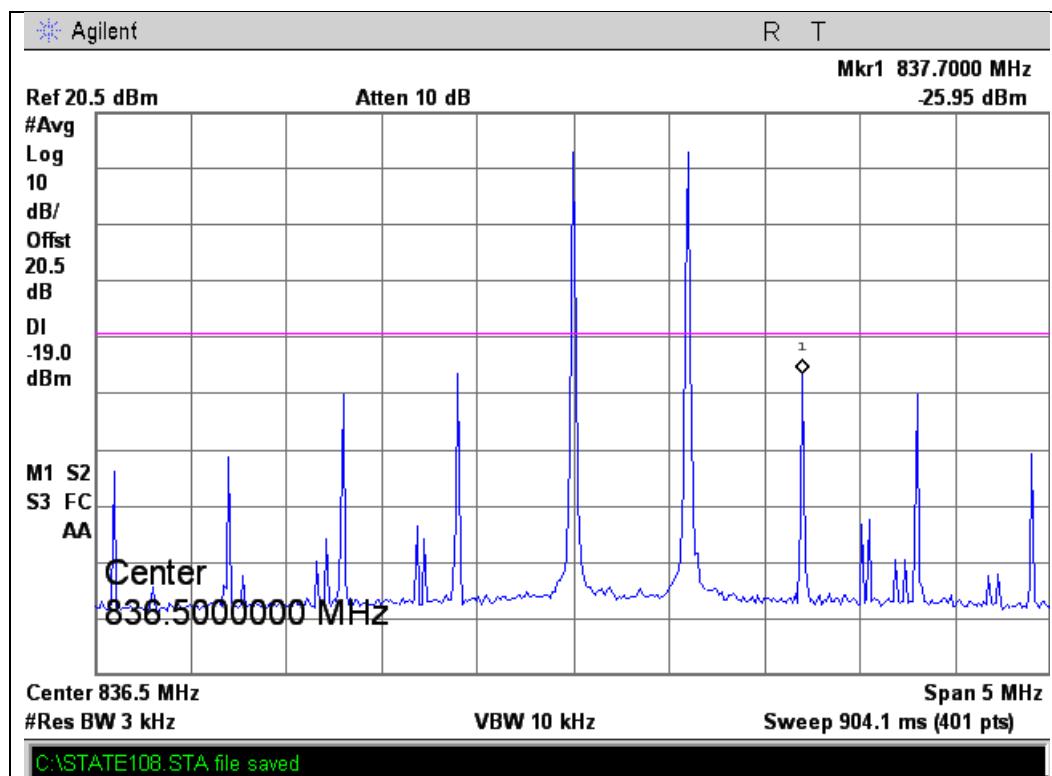


777 - 787 MHz Band

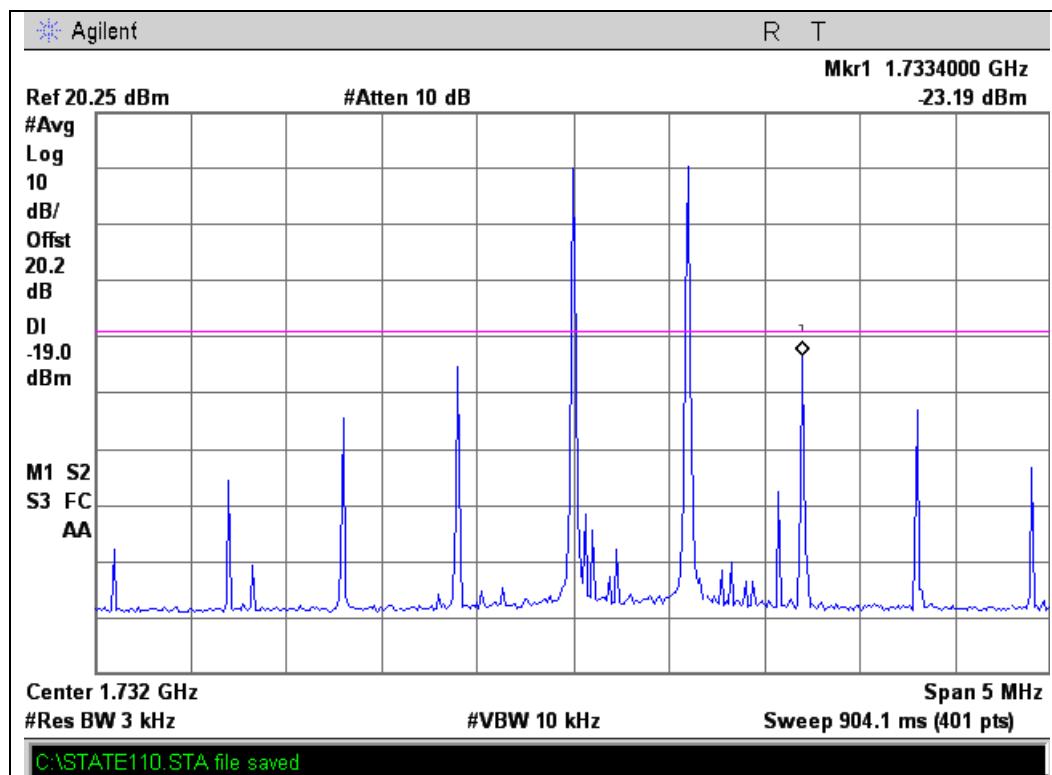




824 - 849 MHz Band

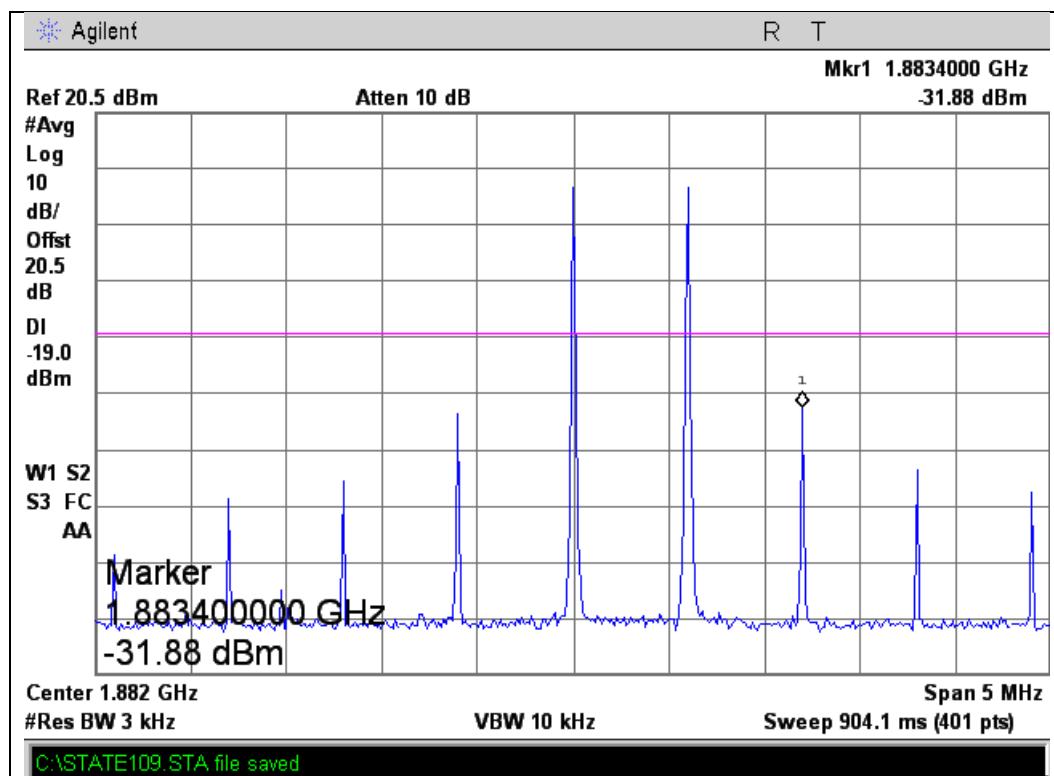


1710 - 1755 MHz Band



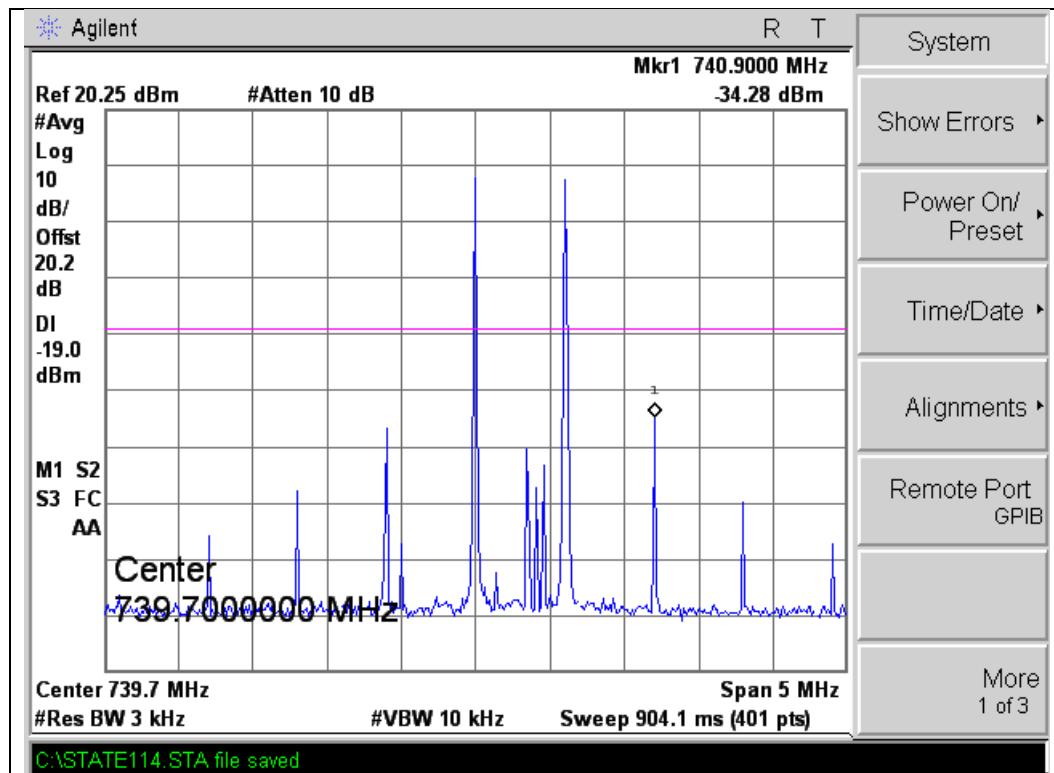


1850 - 1915 MHz Band



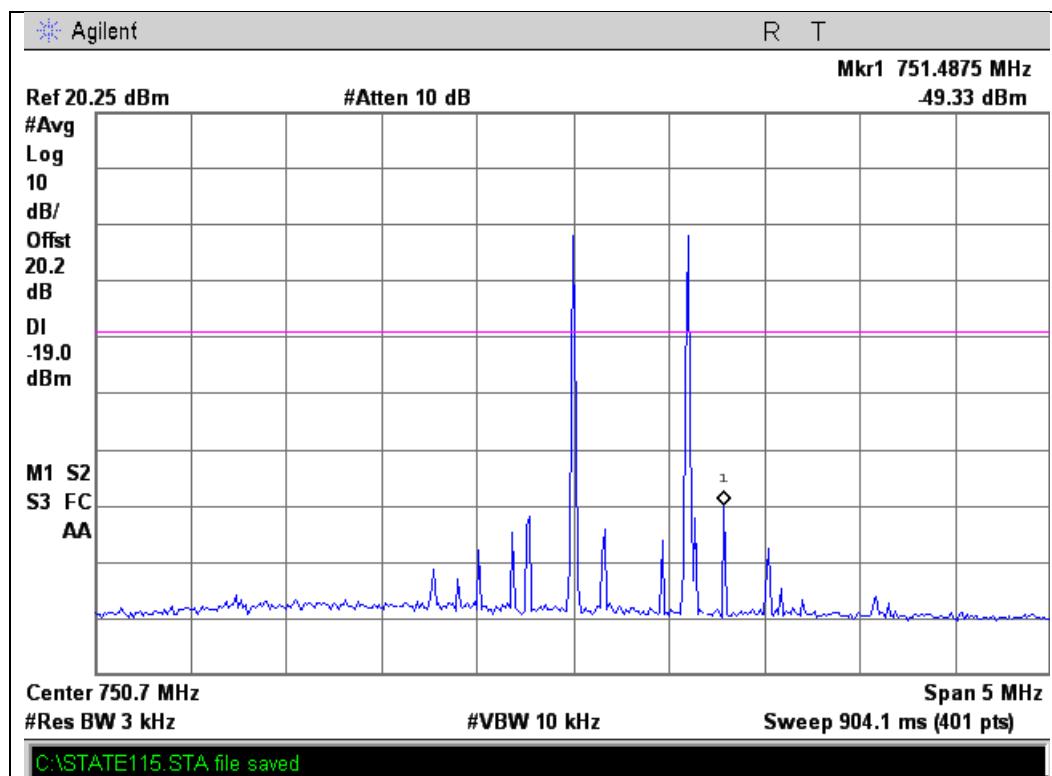
Downlink Test Results

734 - 746 MHz Band

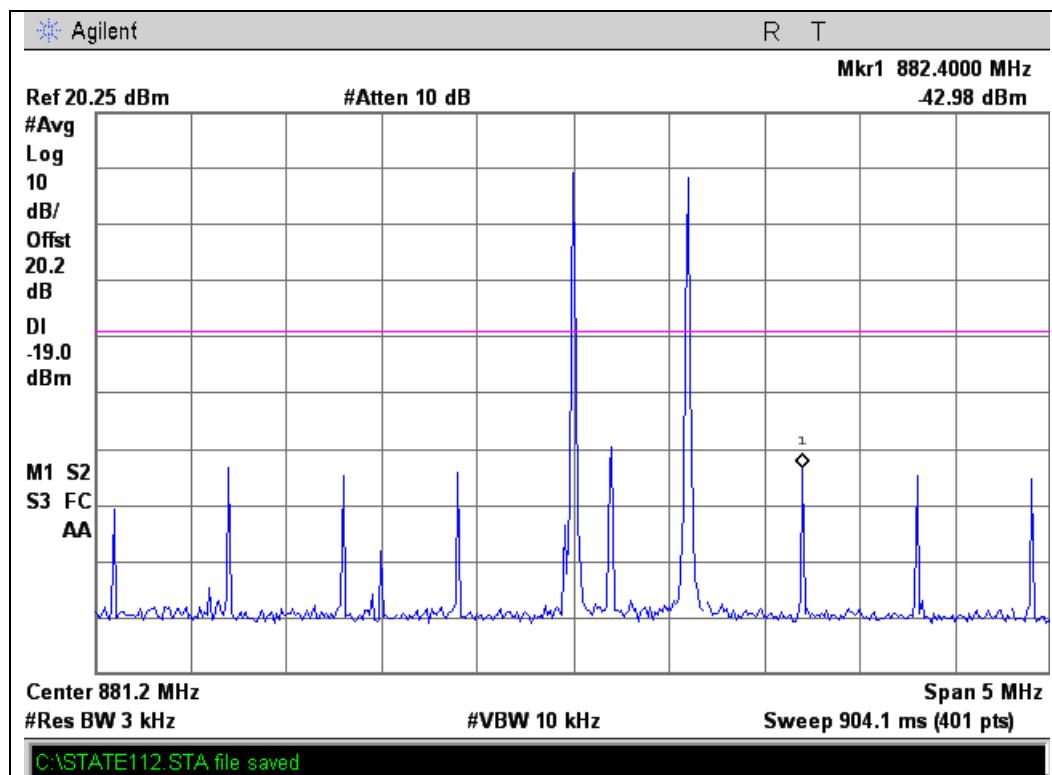




746 - 756 MHz Band

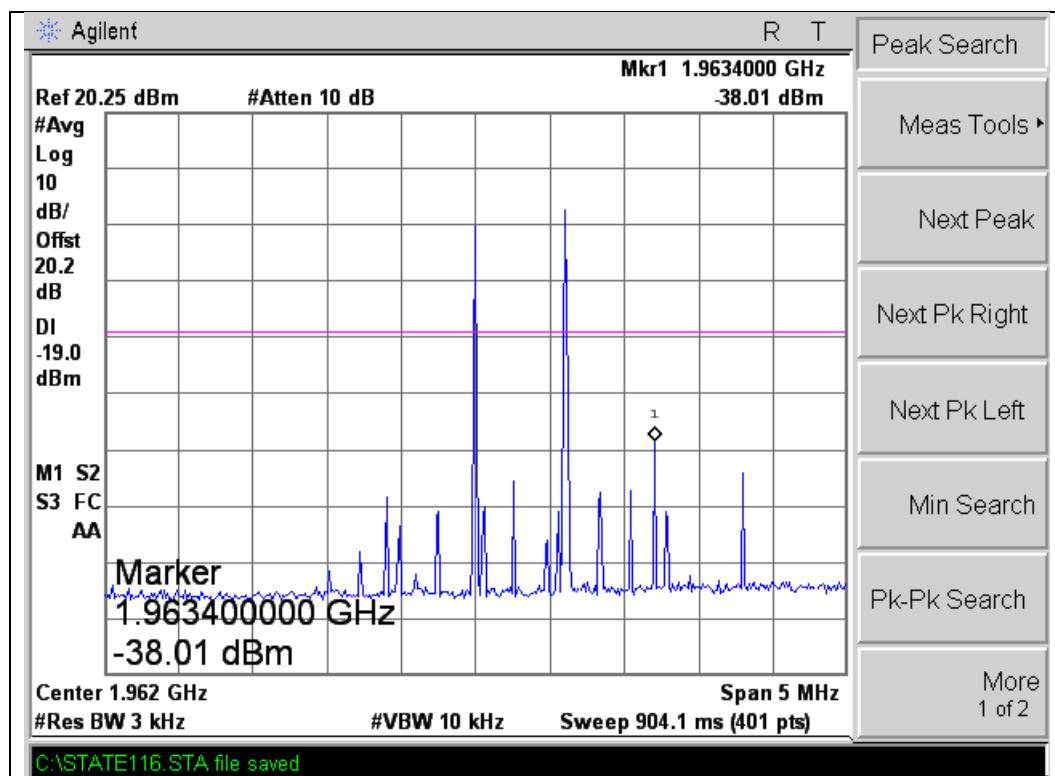


869 - 894 MHz Band

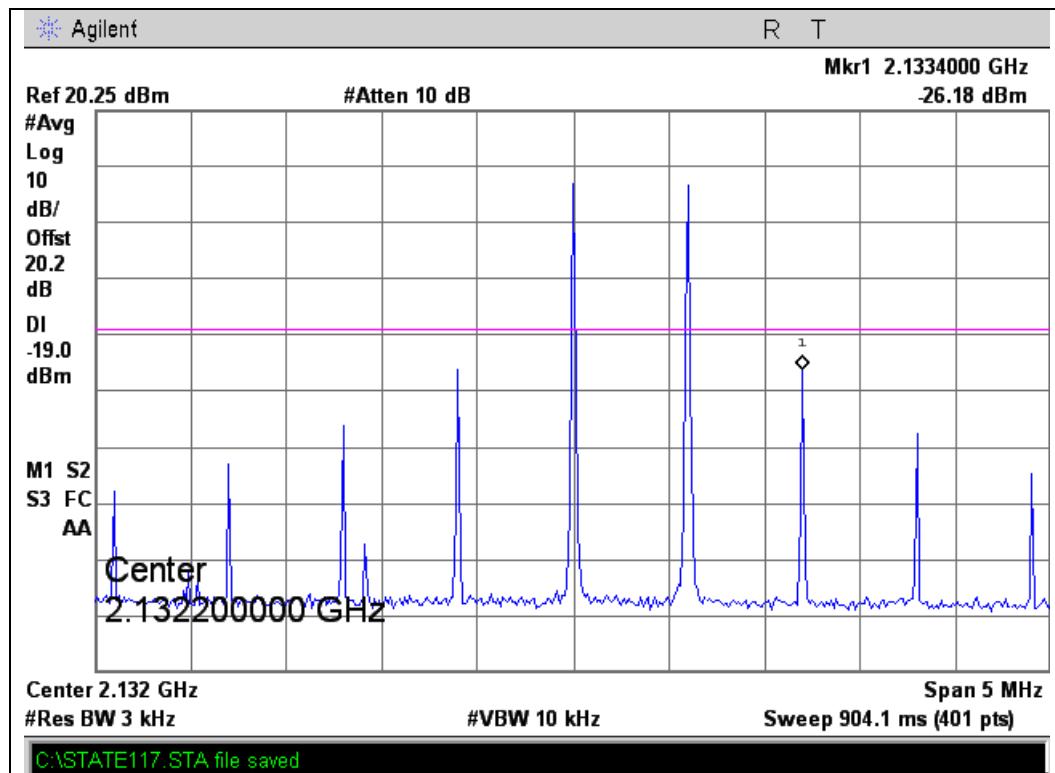




1930 - 1995 MHz Band



2110 - 2155 MHz Band





Out-of-Band Emissions

Name of Test: Out-of-Band Emissions
Test Equipment Utilized: i00331 and i00405

Engineer: Mike Graffeo
Test Date: 9/13/13

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 they met the requirements.

The following formulas are used for calculating the limits.

Out-of-Band Emissions Limit = $6 + (43 + 10\log P)$

Test Setup





GSM Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
704 - 716	Lower	-63.18	-19	Pass
704 - 716	Upper	-26.63	-19	Pass
777 - 787	Lower	-57.91	-19	Pass
777 - 787	Upper	-28.84	-19	Pass
824 - 849	Lower	-70.73	-19	Pass
824 - 849	Upper	-69.77	-19	Pass
1710 - 1755	Lower	-32.84	-19	Pass
1710 - 1755	Upper	-33.20	-19	Pass
1850 - 1915	Lower	-36.16	-19	Pass
1850 - 1915	Upper	-43.43	-19	Pass

CDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
704 - 716	Lower	-63.71	-19	Pass
704 - 716	Upper	-47.22	-19	Pass
777 - 787	Lower	-47.49	-19	Pass
777 - 787	Upper	-47.63	-19	Pass
824 - 849	Lower	-39.33	-19	Pass
824 - 849	Upper	-40.84	-19	Pass
1710 - 1755	Lower	-39.25	-19	Pass
1710 - 1755	Upper	-34.50	-19	Pass
1850 - 1915	Lower	-46.01	-19	Pass
1850 - 1915	Upper	-59.23	-19	Pass



WCDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
704 - 716	Lower	-63.42	-19	Pass
704 - 716	Upper	-51.09	-19	Pass
777 - 787	Lower	-44.94	-19	Pass
777 - 787	Upper	-47.03	-19	Pass
824 - 849	Lower	-40.63	-19	Pass
824 - 849	Upper	-48.82	-19	Pass
1710 - 1755	Lower	-34.23	-19	Pass
1710 - 1755	Upper	-34.69	-19	Pass
1850 - 1915	Lower	-30.41	-19	Pass
1850 - 1915	Upper	-40.88	-19	Pass

GSM Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
734 - 746	Lower	-65.31	-19	Pass
734 - 746	Upper	-55.66	-19	Pass
746 - 756	Lower	-52.31	-19	Pass
746 - 756	Upper	-65.73	-19	Pass
869 - 894	Lower	-57.28	-19	Pass
869 - 894	Upper	-58.85	-19	Pass
1930 - 1995	Lower	-67.84	-19	Pass
1930 - 1995	Upper	-74.73	-19	Pass
2110 - 2155	Lower	-74.26	-19	Pass
2110 - 2155	Upper	-74.61	-19	Pass



CDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
734 - 746	Lower	-63.22	-19	Pass
734 - 746	Upper	-63.45	-19	Pass
746 - 756	Lower	-63.41	-19	Pass
746 - 756	Upper	-64.78	-19	Pass
869 - 894	Lower	-42.29	-19	Pass
869 - 894	Upper	-64.52	-19	Pass
1930 - 1995	Lower	-64.14	-19	Pass
1930 - 1995	Upper	-54.19	-19	Pass
2110 - 2155	Lower	-64.16	-19	Pass
2110 - 2155	Upper	-63.32	-19	Pass

WCDMA Downlink Test Results

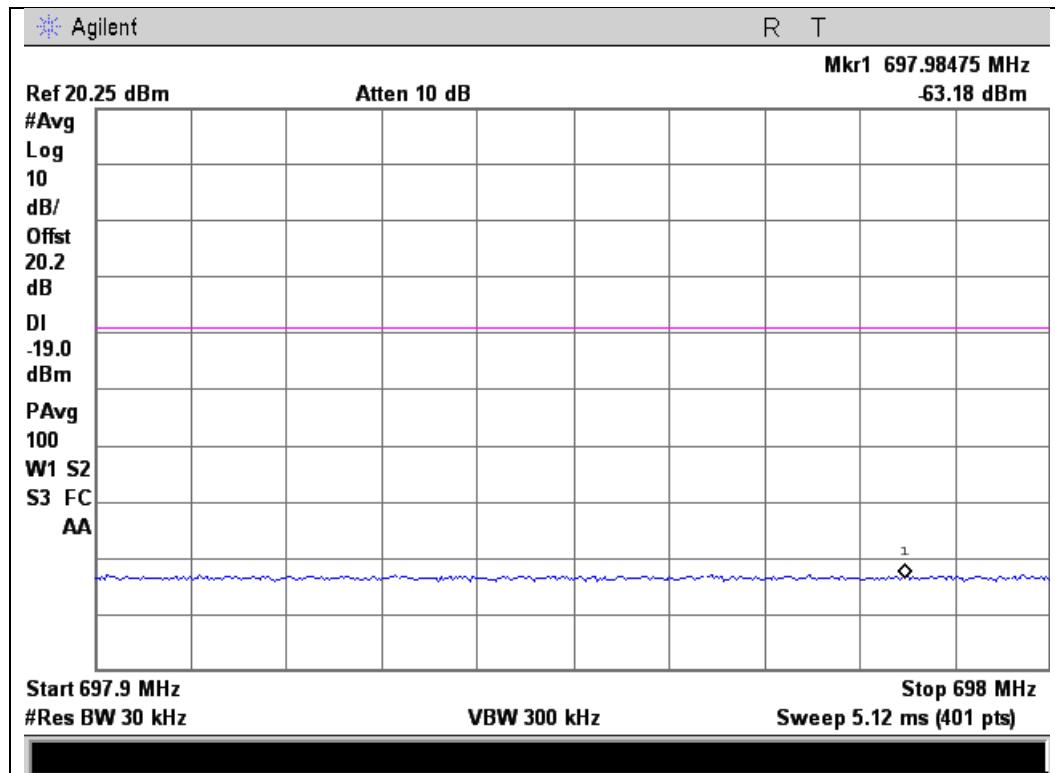
Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
734 - 746	Lower	-63.89	-19	Pass
734 - 746	Upper	-63.88	-19	Pass
746 - 756	Lower	-64.08	-19	Pass
746 - 756	Upper	-64.80	-19	Pass
869 - 894	Lower	-57.70	-19	Pass
869 - 894	Upper	-57.55	-19	Pass
1930 - 1995	Lower	-56.79	-19	Pass
1930 - 1995	Upper	-57.28	-19	Pass
2110 - 2155	Lower	-56.74	-19	Pass
2110 - 2155	Upper	-57.91	-19	Pass



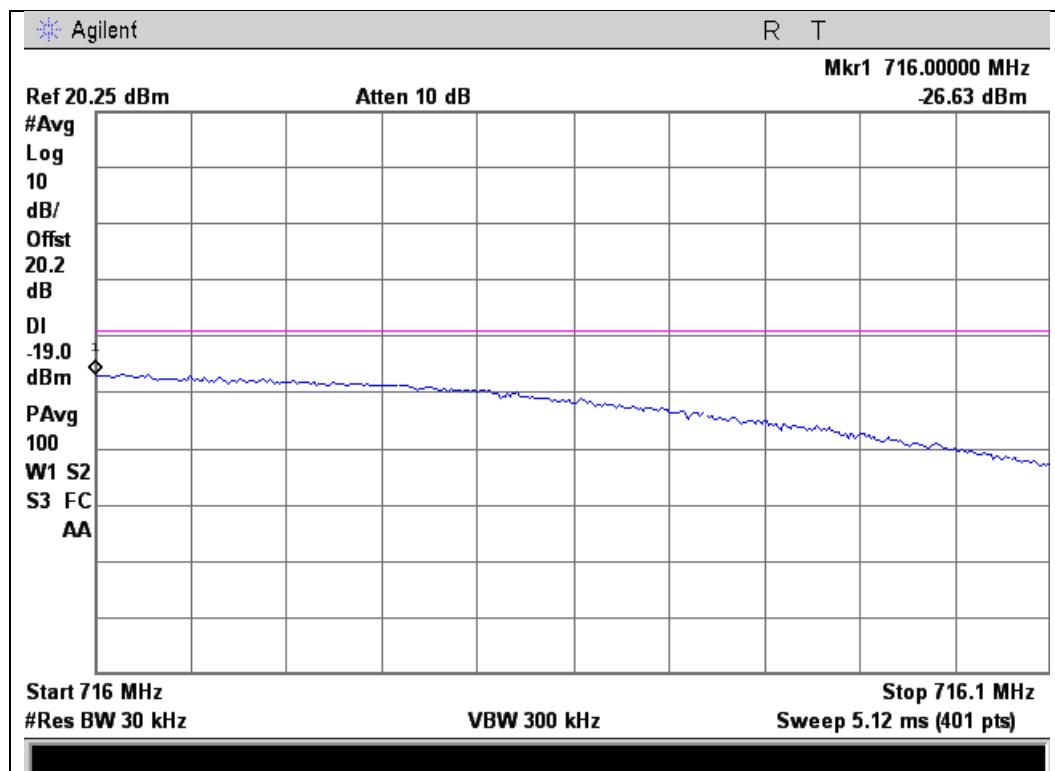
GSM Uplink Test Plots

704 - 716 MHz Band

Lower Band Edge



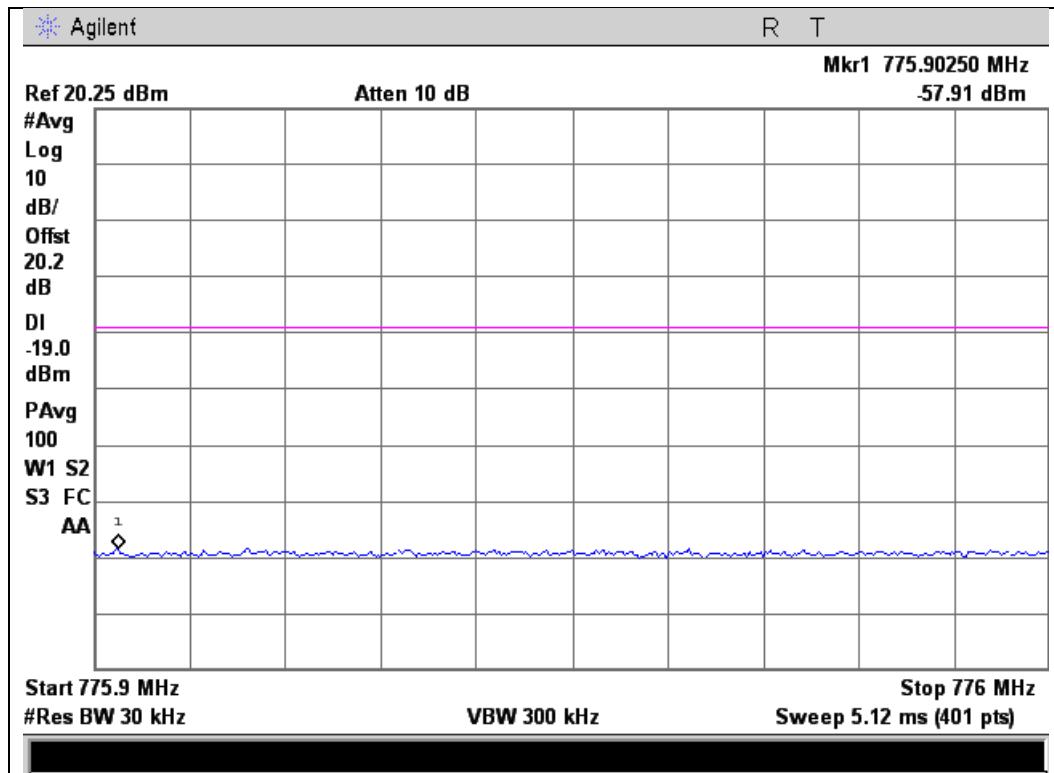
Upper Band Edge



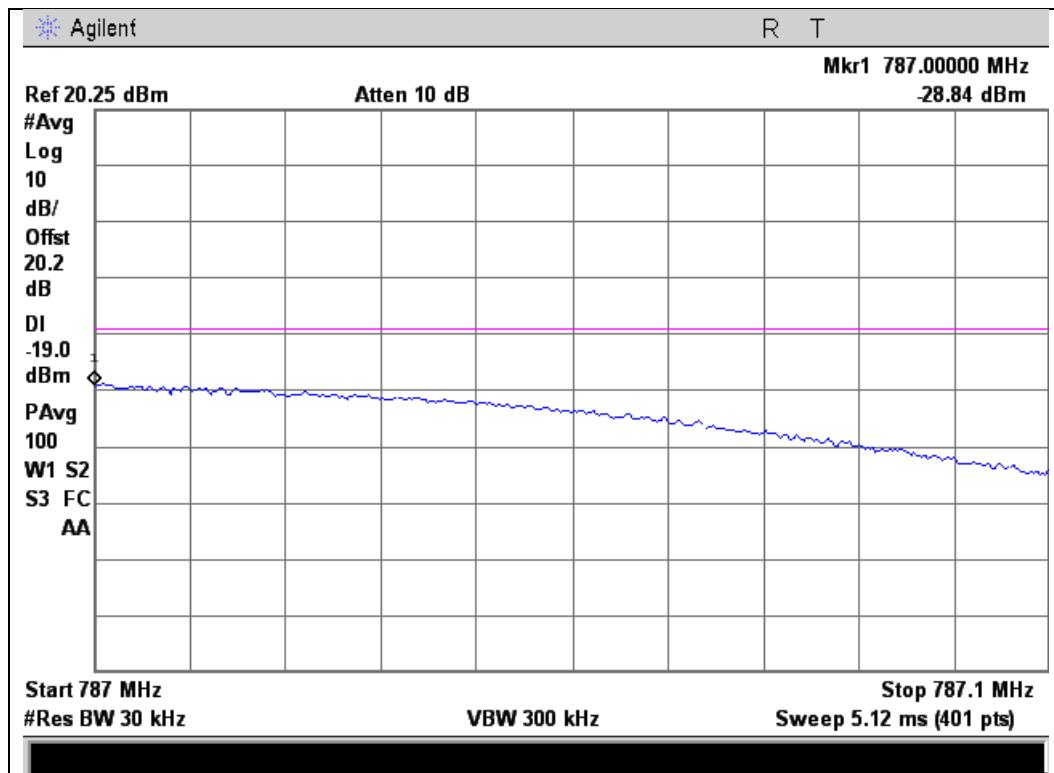


777 - 787 MHz Band

Lower Band Edge



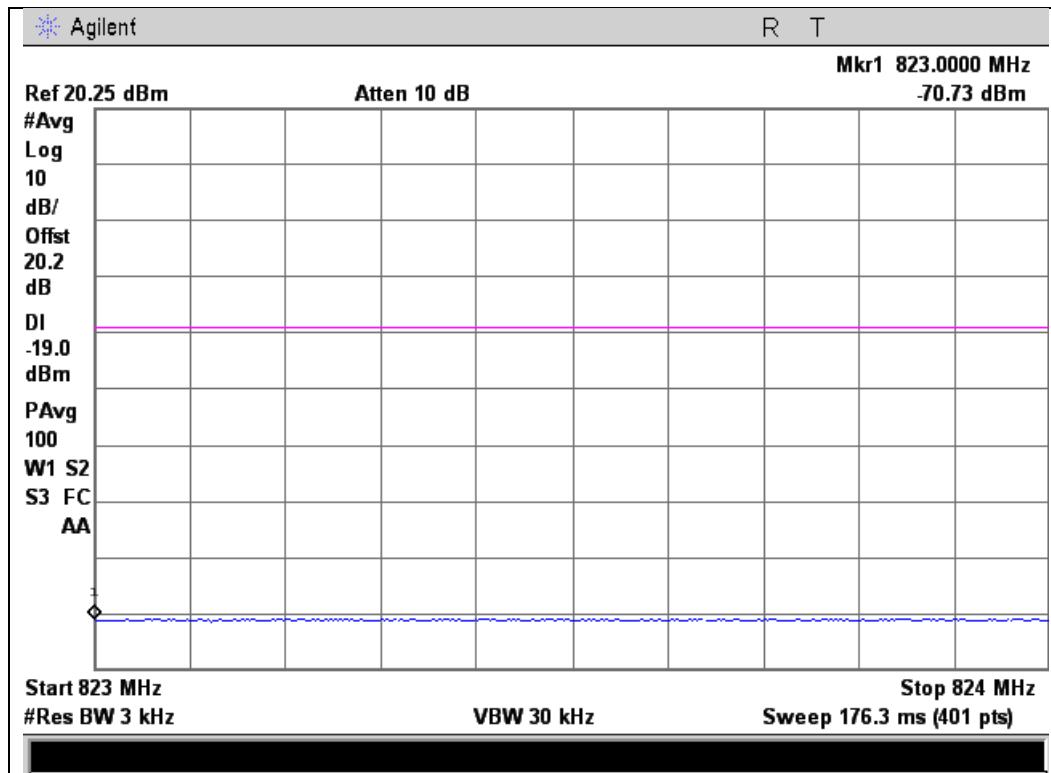
Upper Band Edge



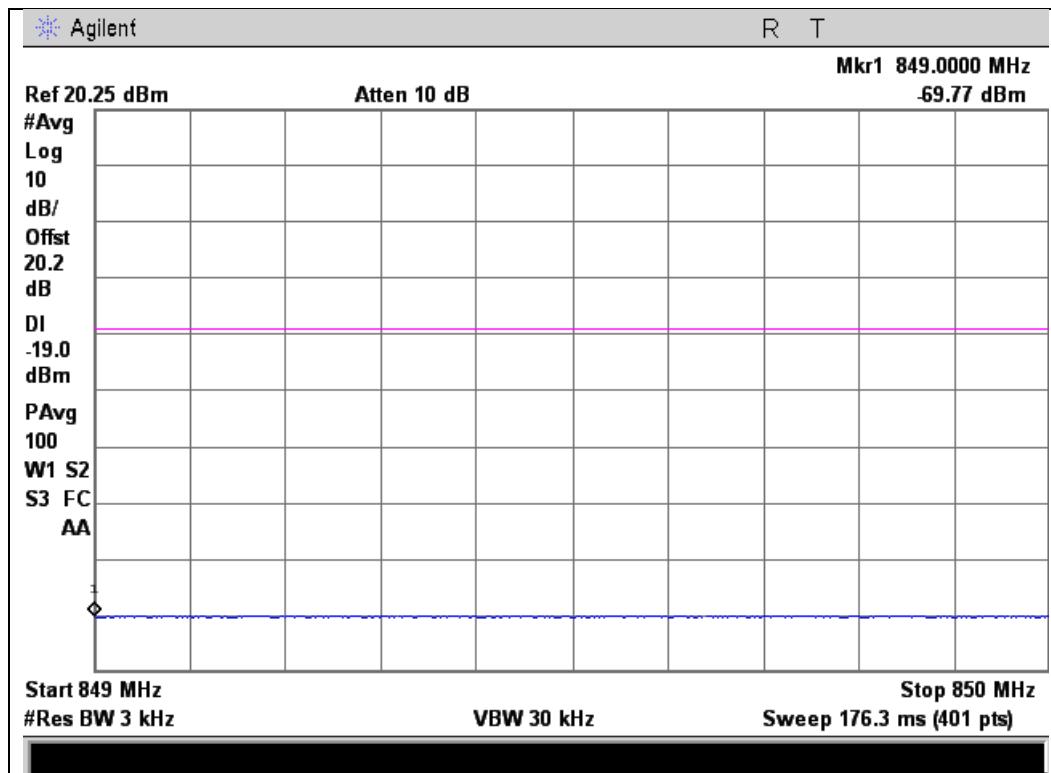


824 - 849 MHz Band

Lower Band Edge



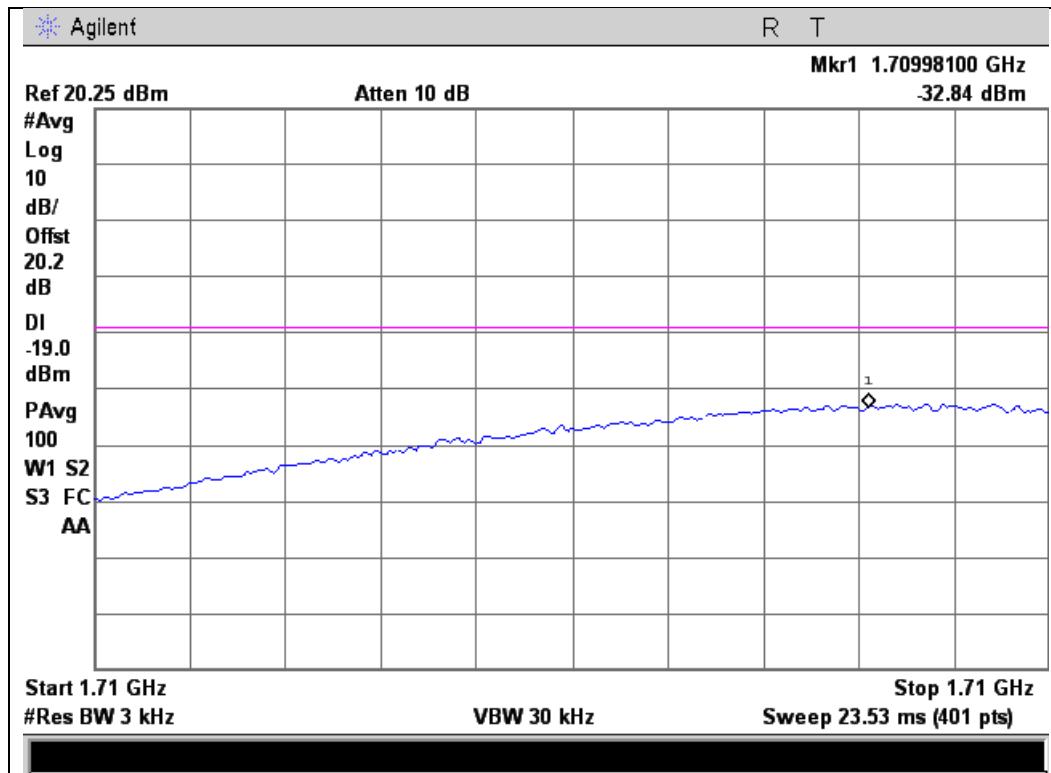
Upper Band Edge



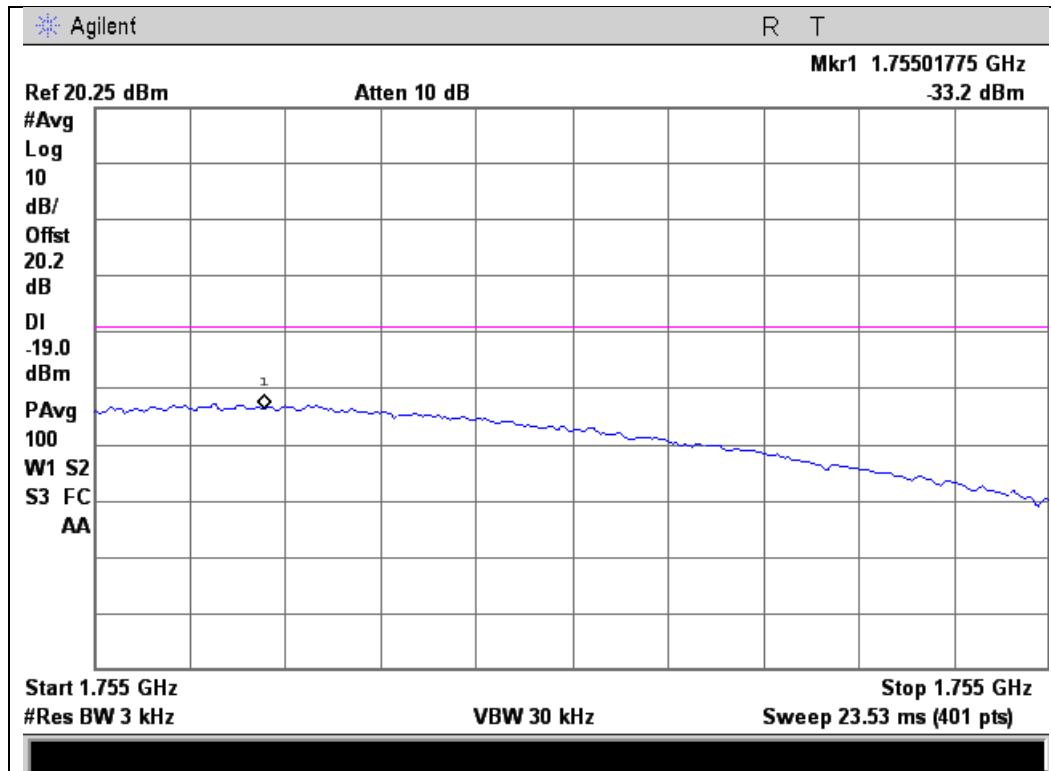


1710 - 1755 MHz Band

Lower Band Edge



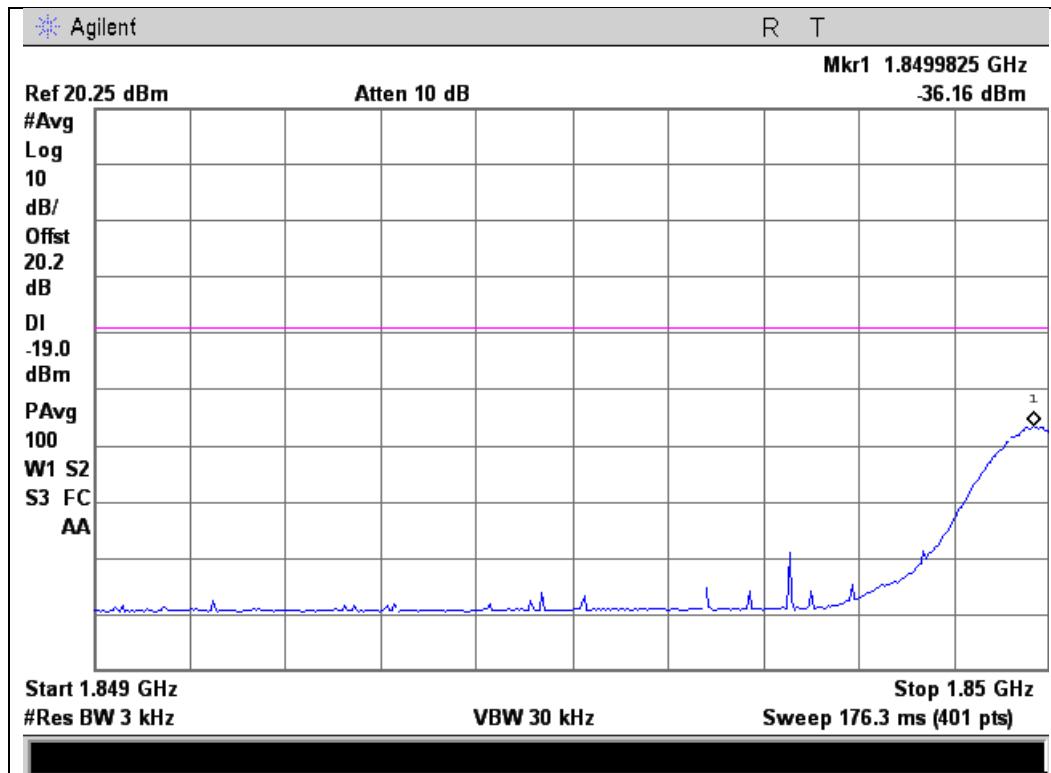
Upper Band Edge



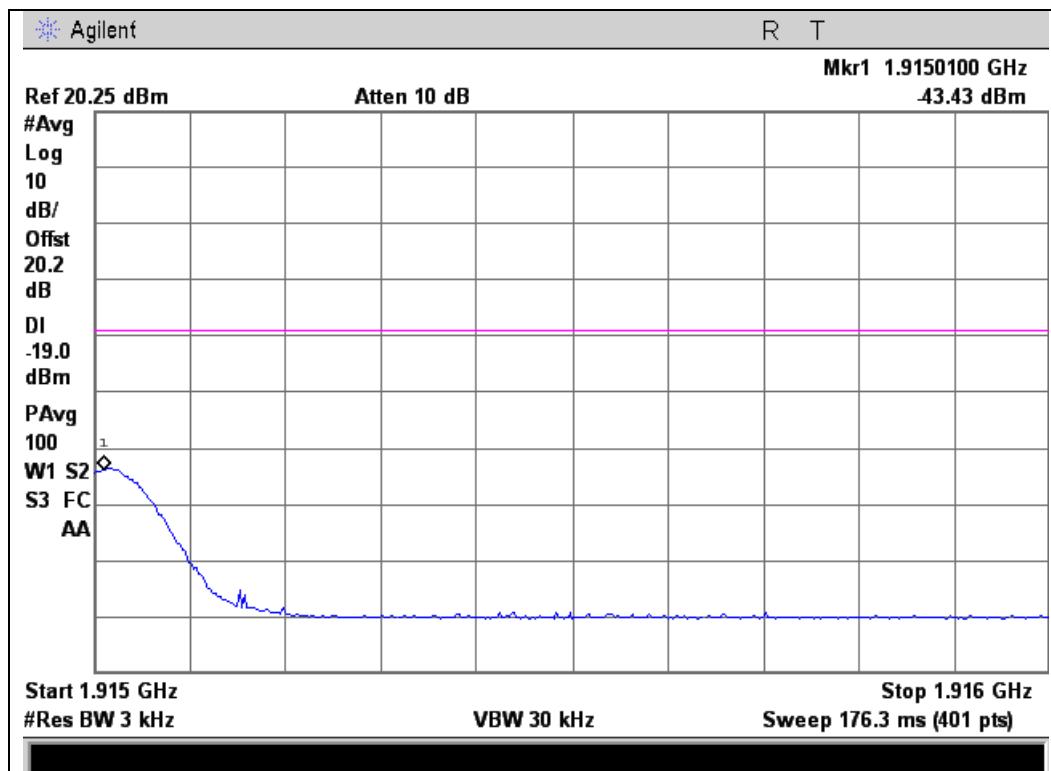


1850 - 1915 MHz Band

Lower Band Edge



Upper Band Edge

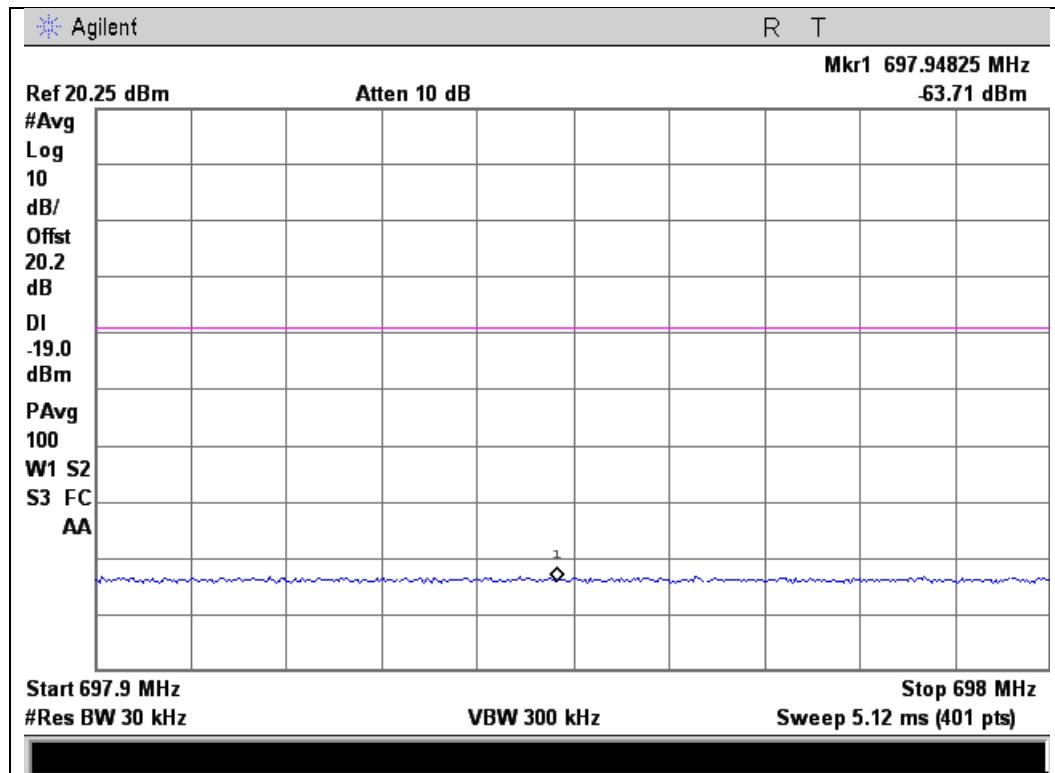




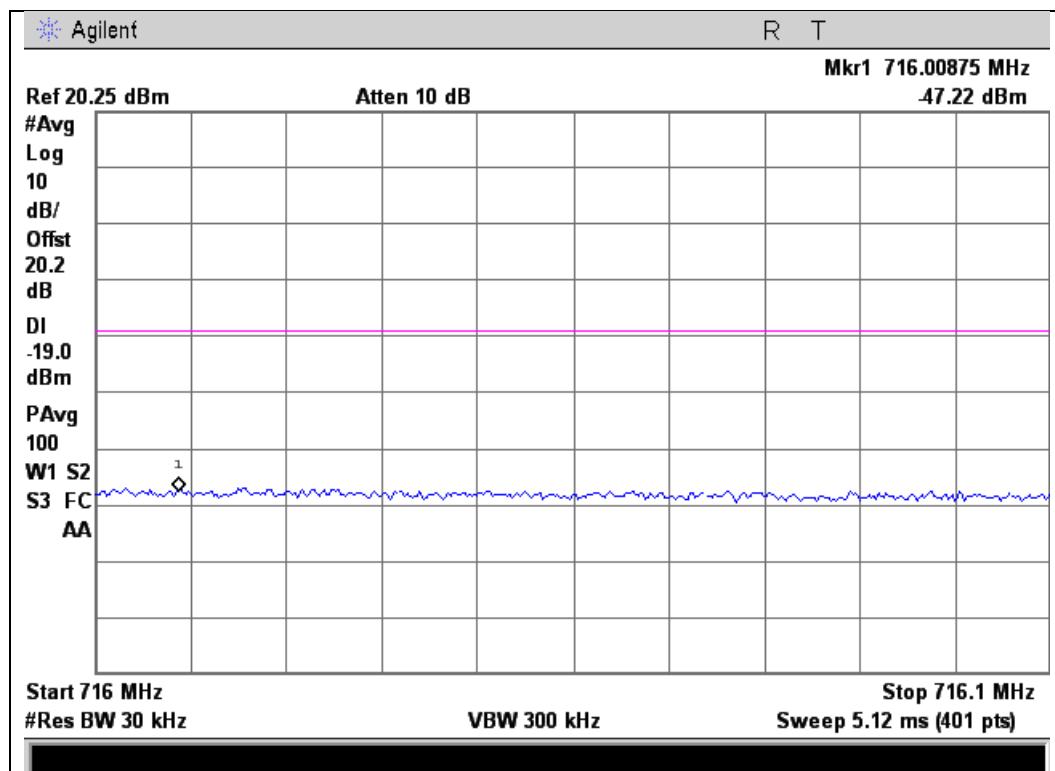
CDMA Uplink Test Plots

704 - 716 MHz Band

Lower Band Edge



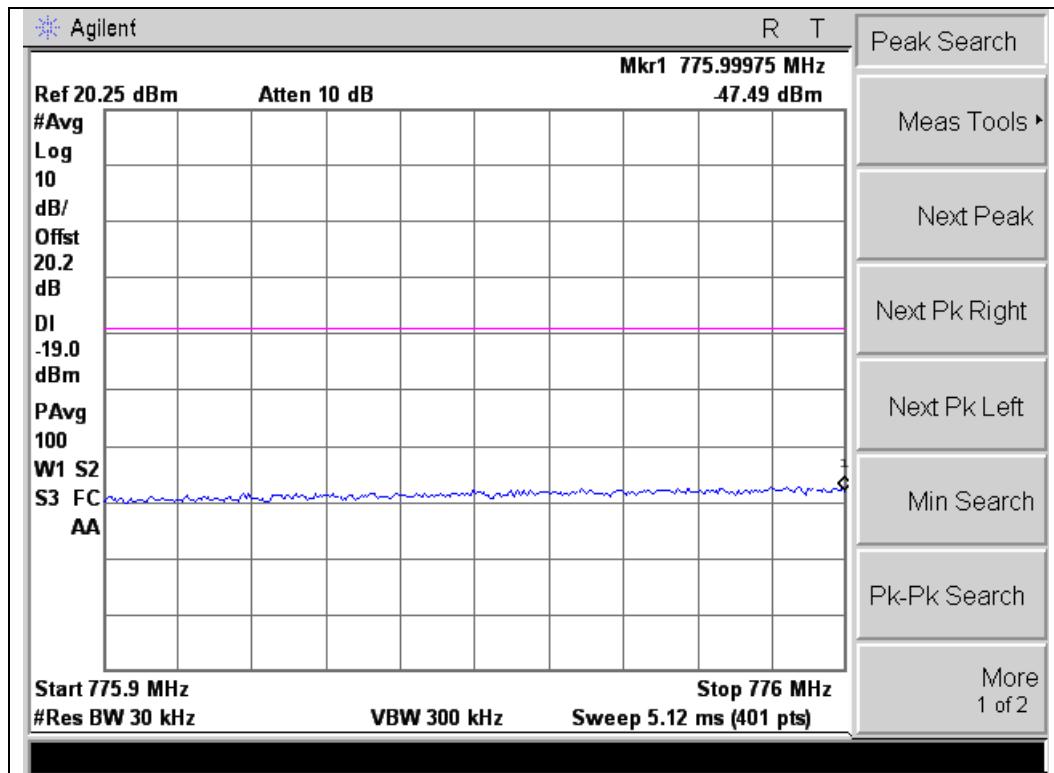
Upper Band Edge



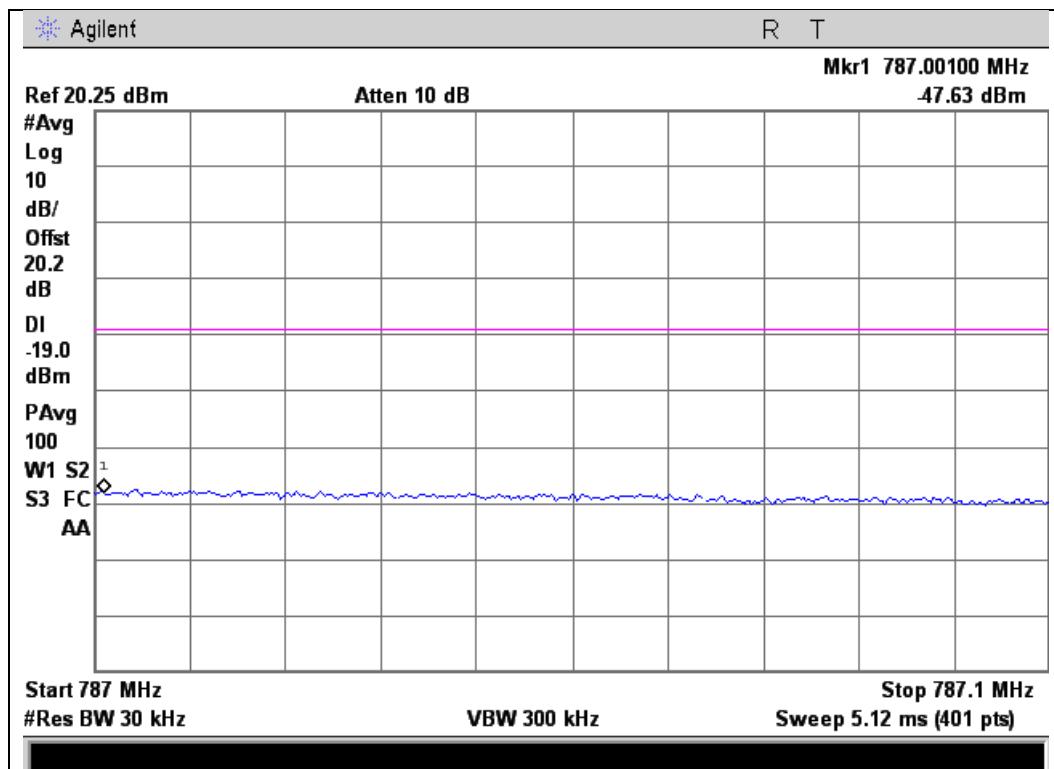


777 - 787 MHz Band

Lower Band Edge



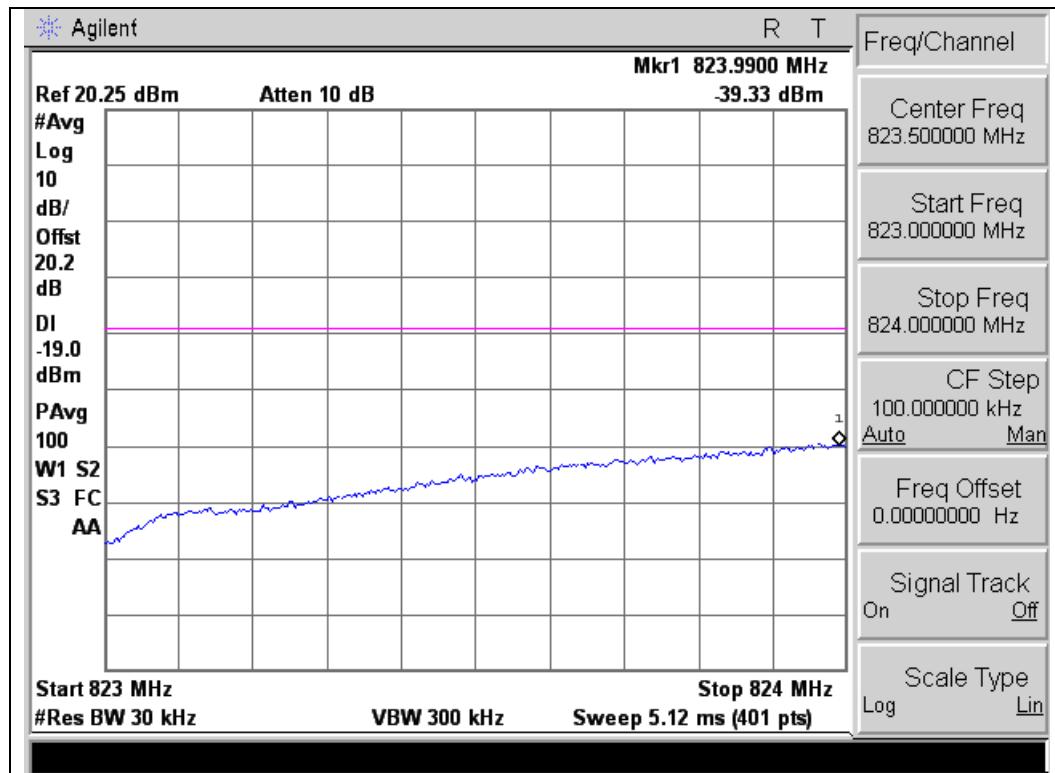
Upper Band Edge



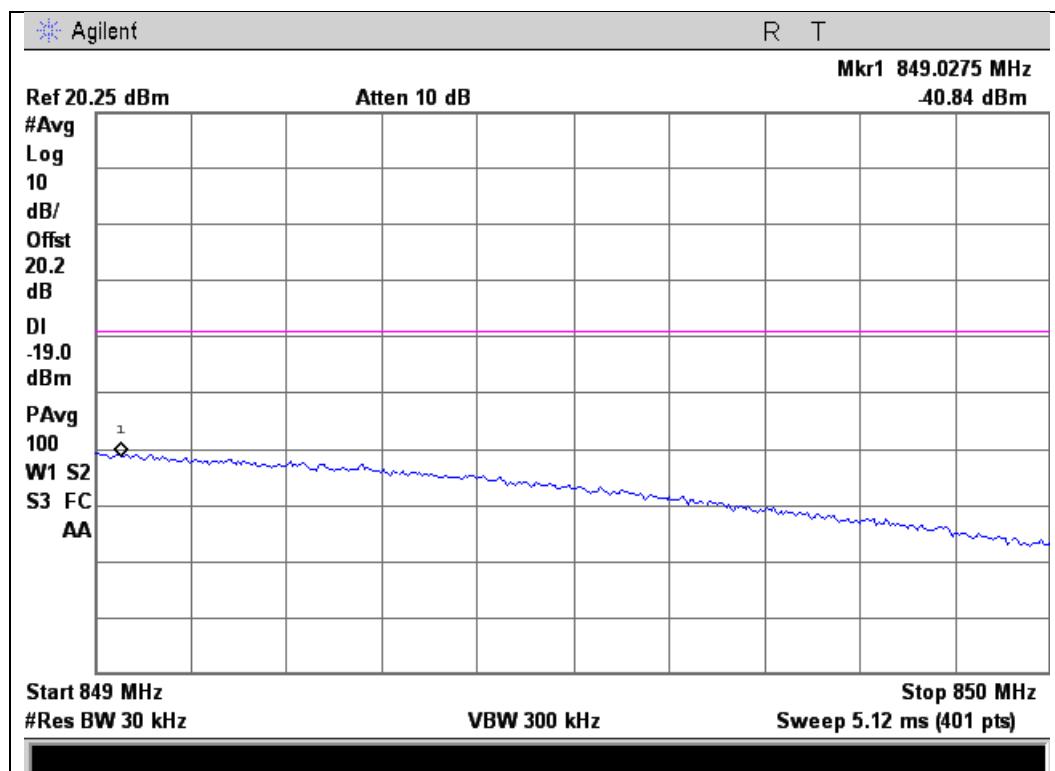


824 - 849 MHz Band

Lower Band Edge



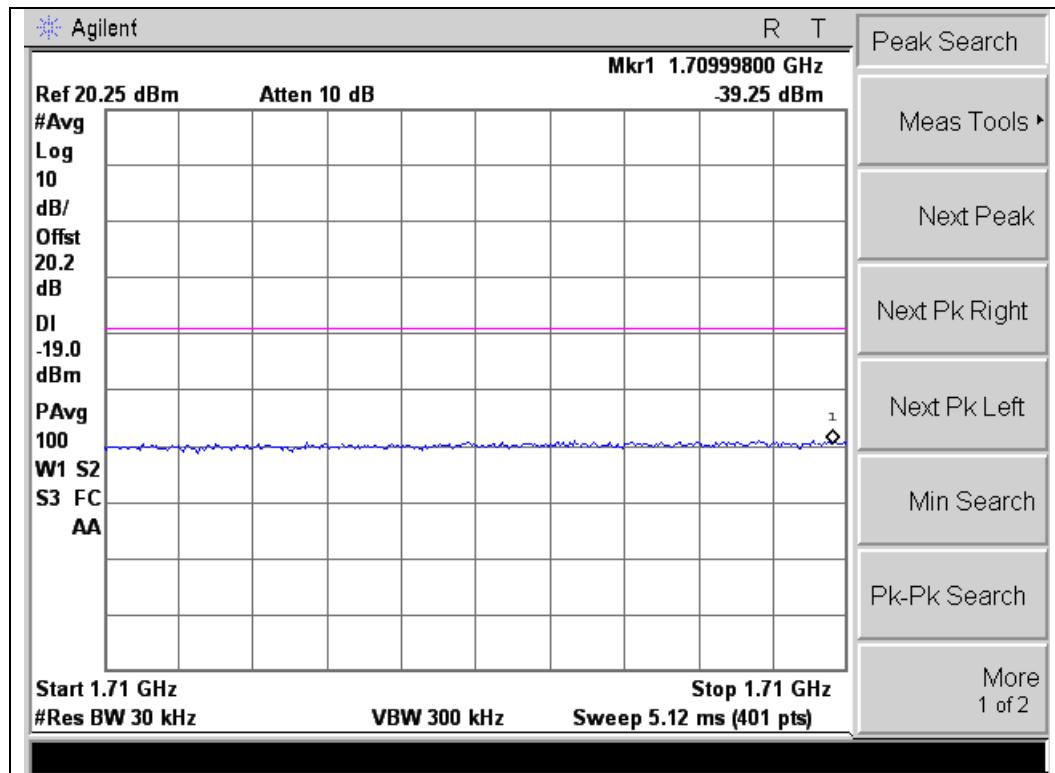
Upper Band Edge



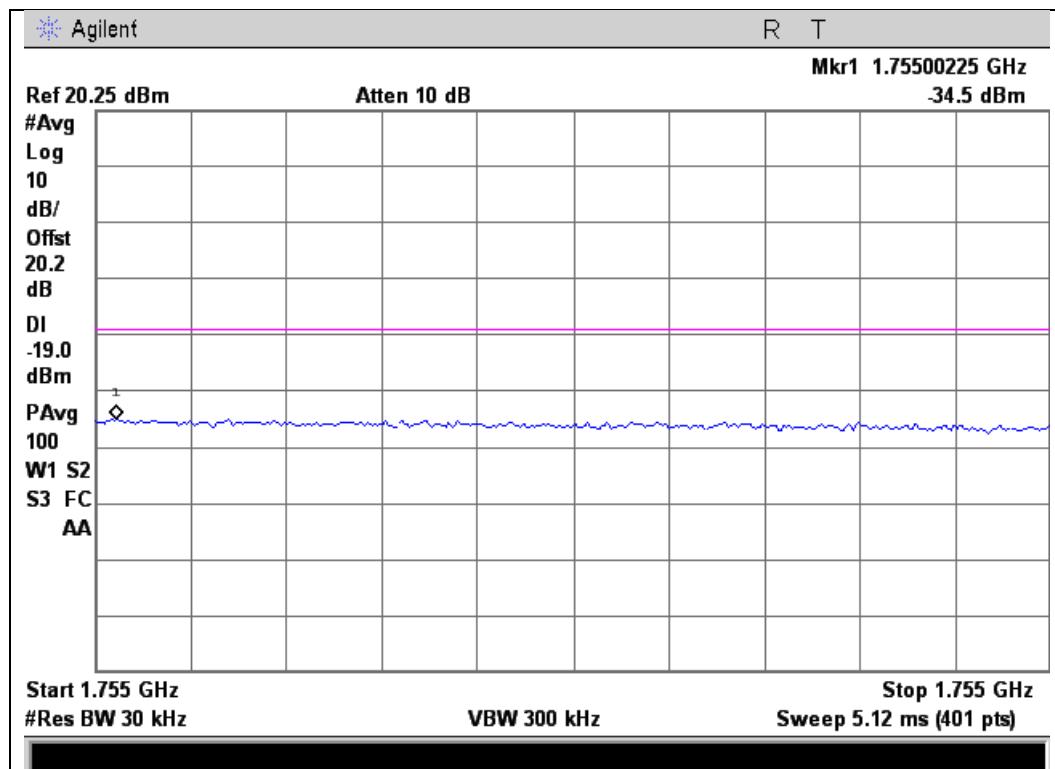


1710 - 1755 MHz Band

Lower Band Edge



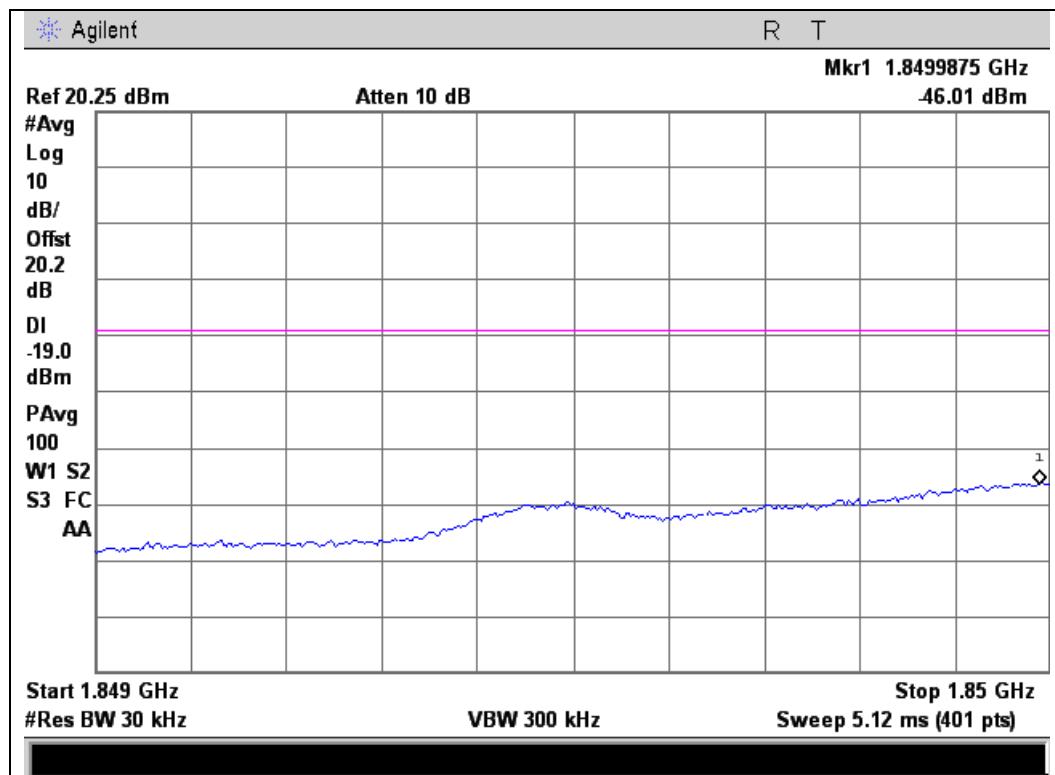
Upper Band Edge



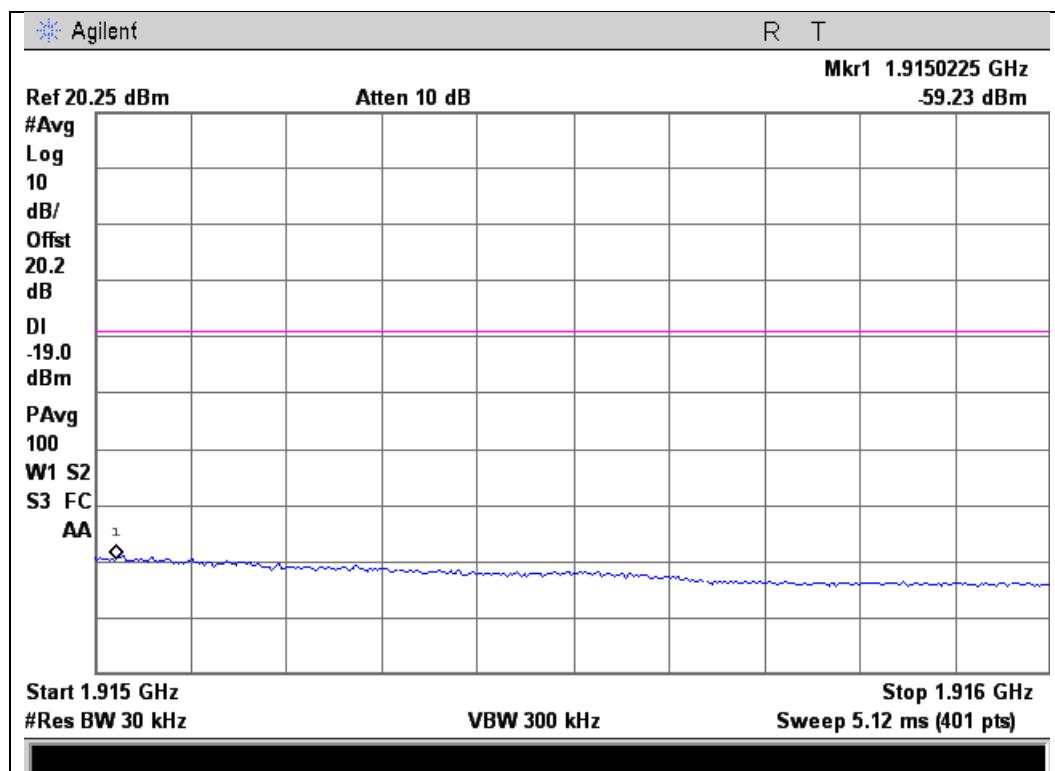


1850 - 1915 MHz Band

Lower Band Edge

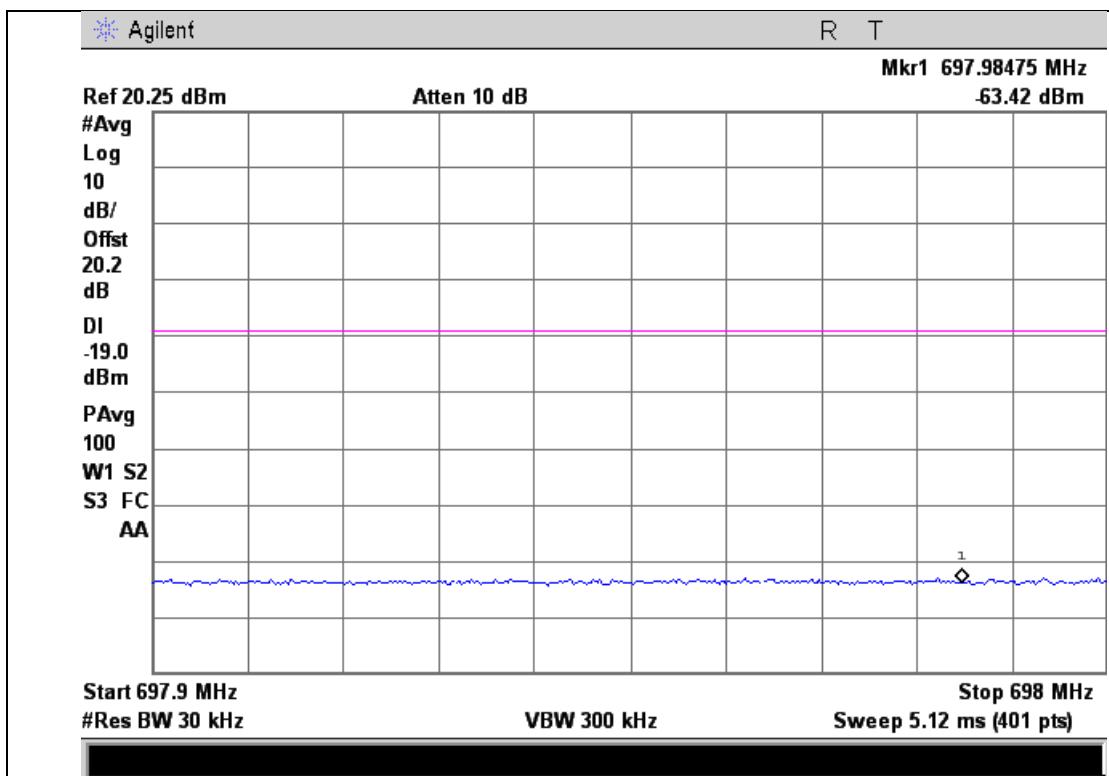


Upper Band Edge

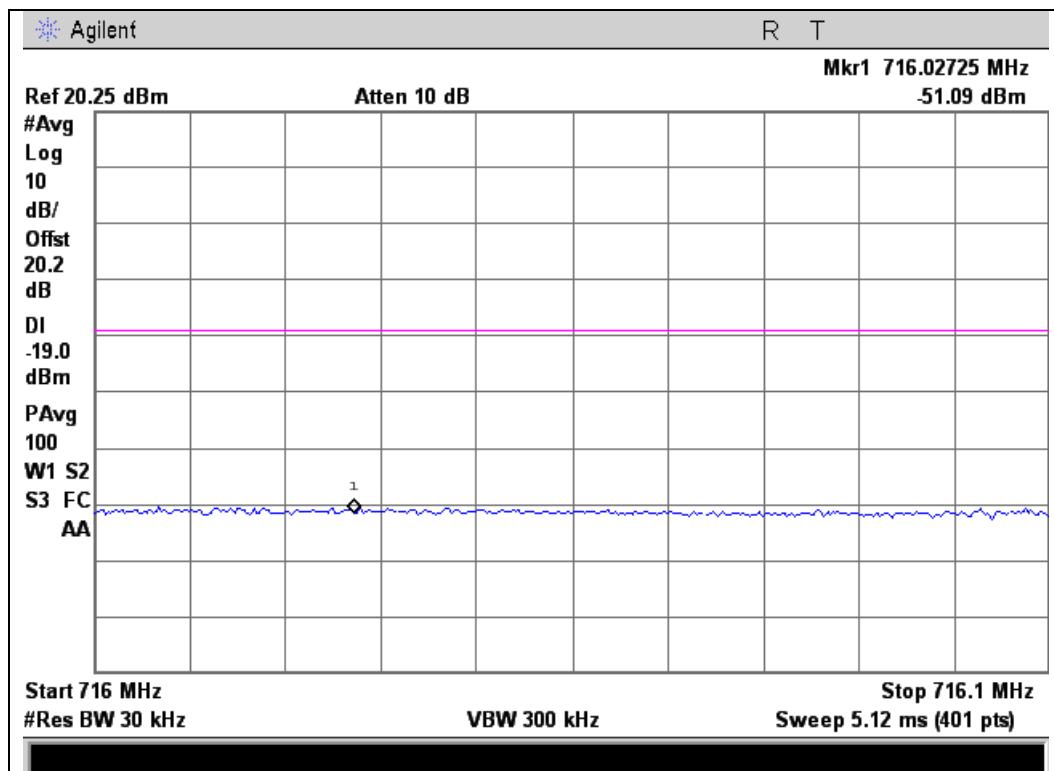




WCDMA Uplink Test Plots
704 - 716 MHz Band
Lower Band Edge



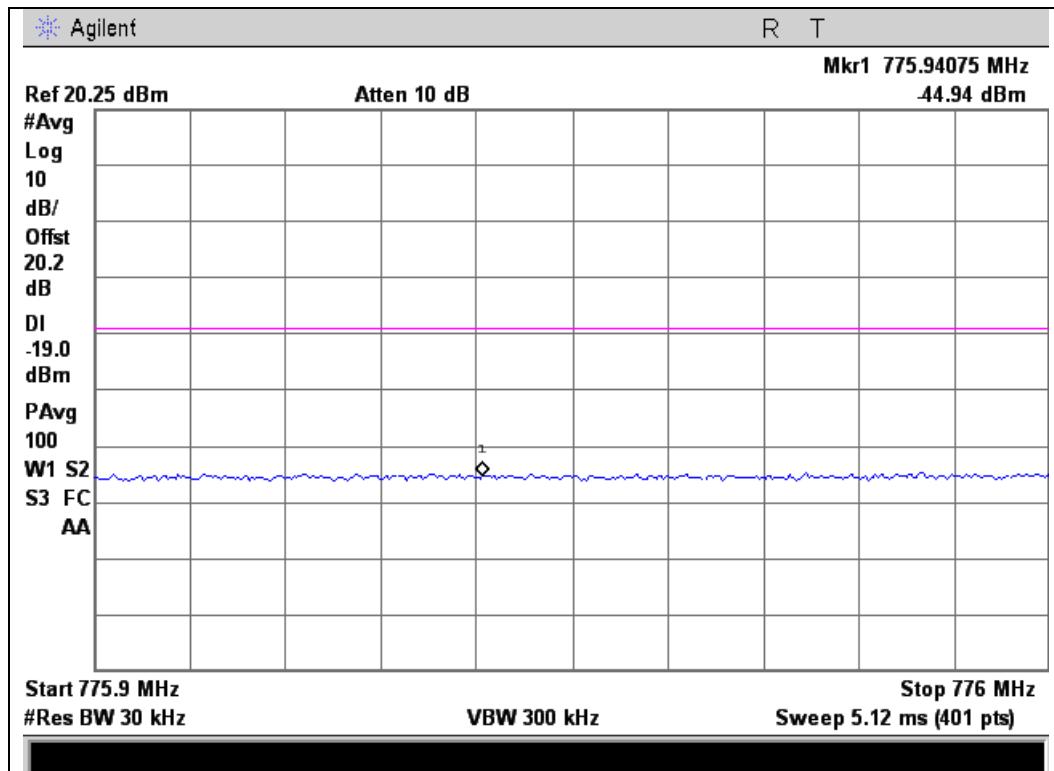
Upper Band Edge



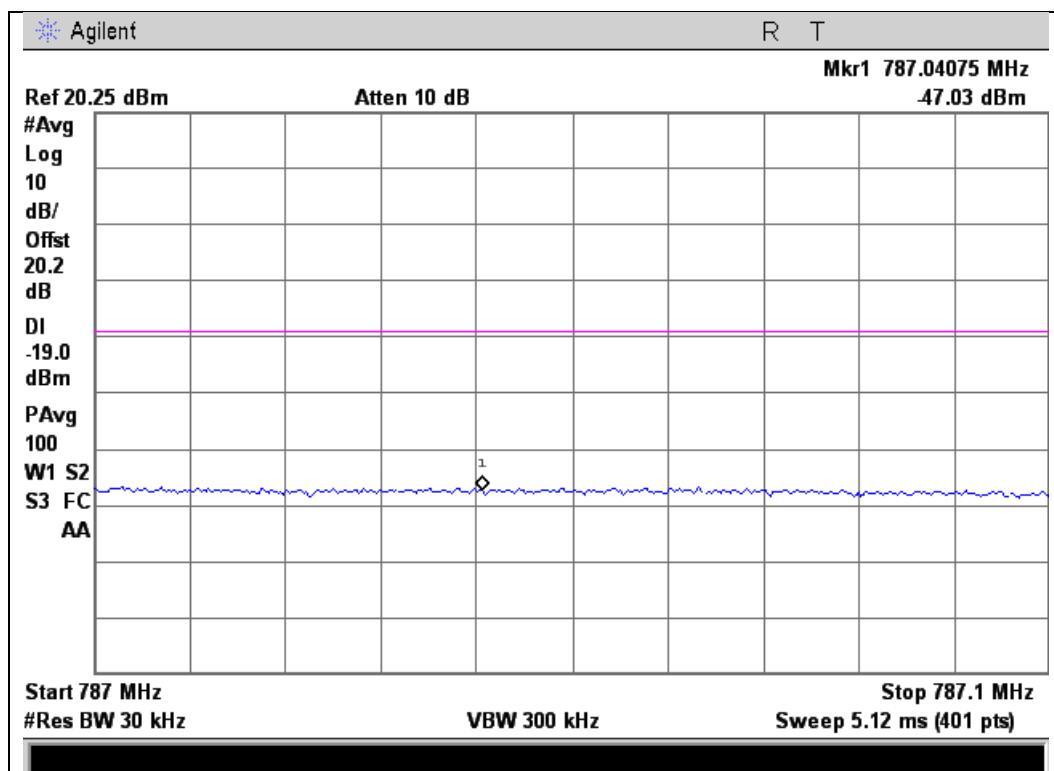


777 - 787 MHz Band

Lower Band Edge



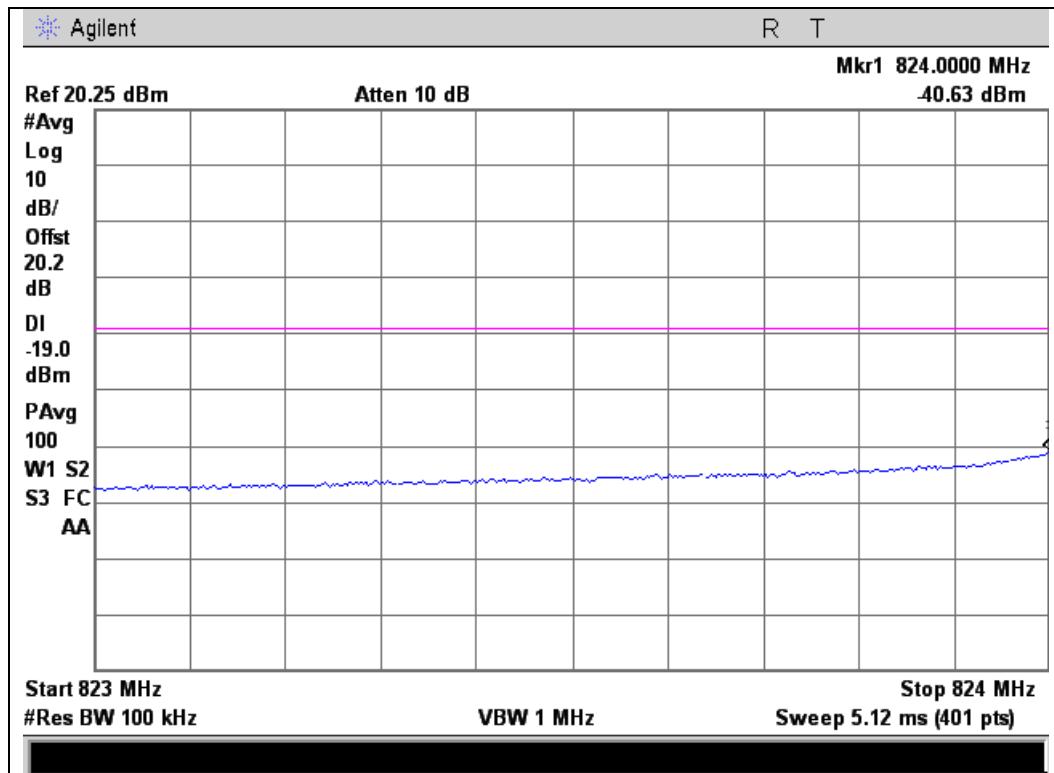
Upper Band Edge



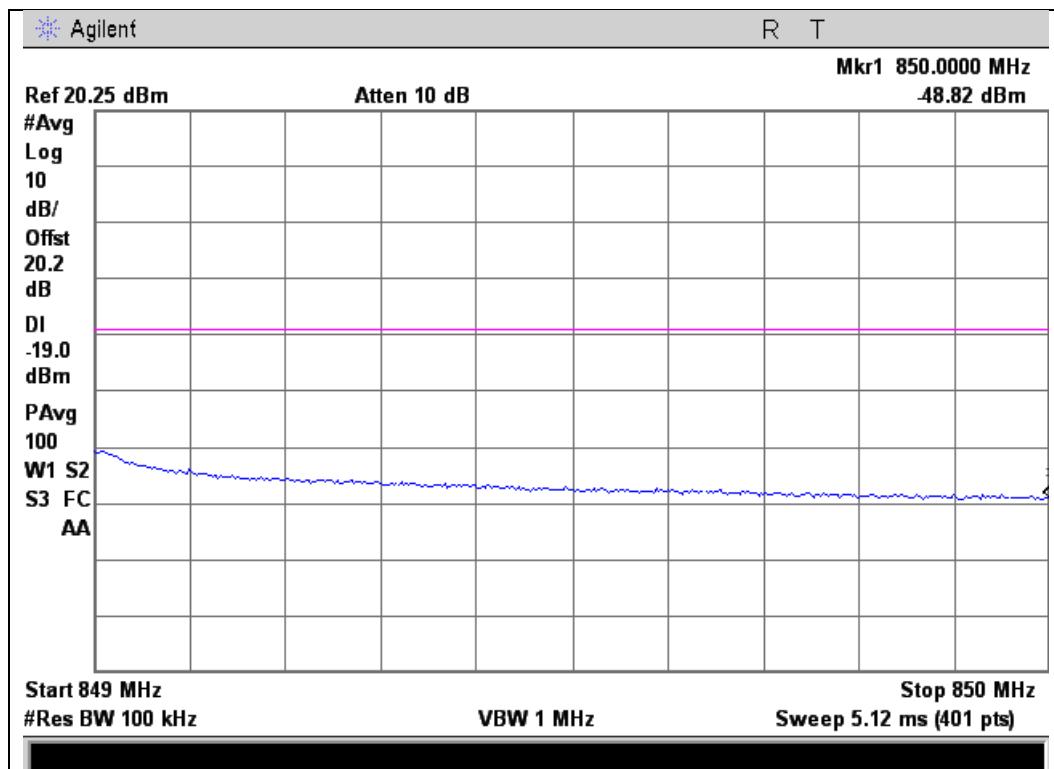


824 - 849 MHz Band

Lower Band Edge



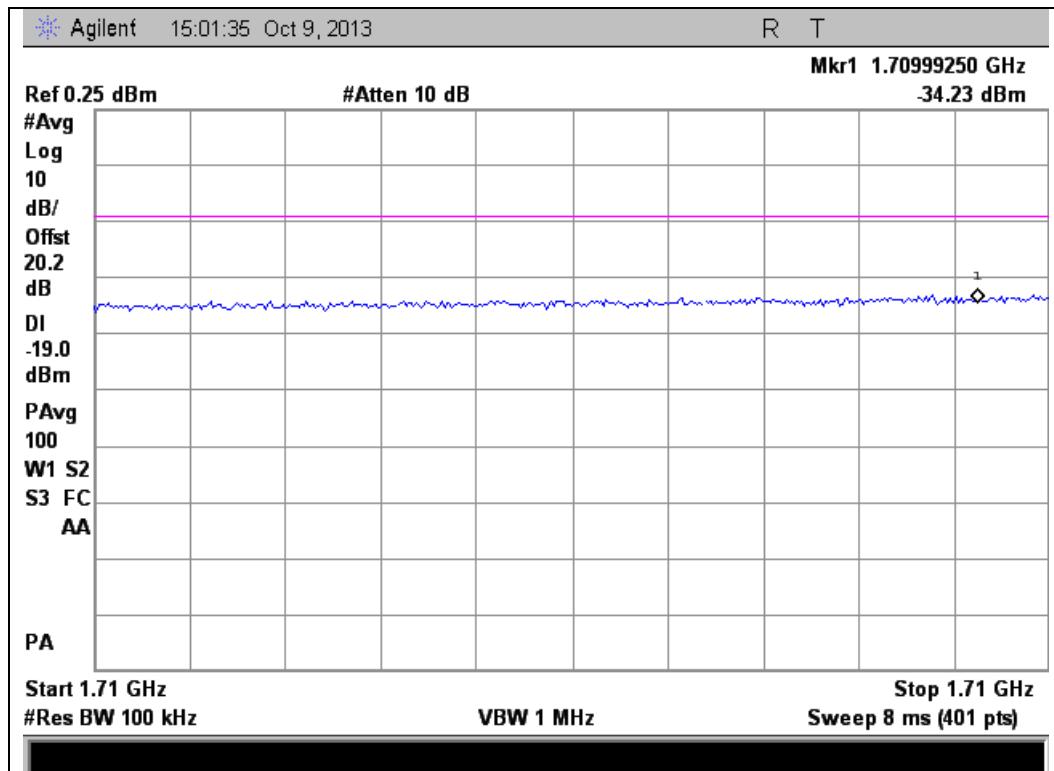
Upper Band Edge



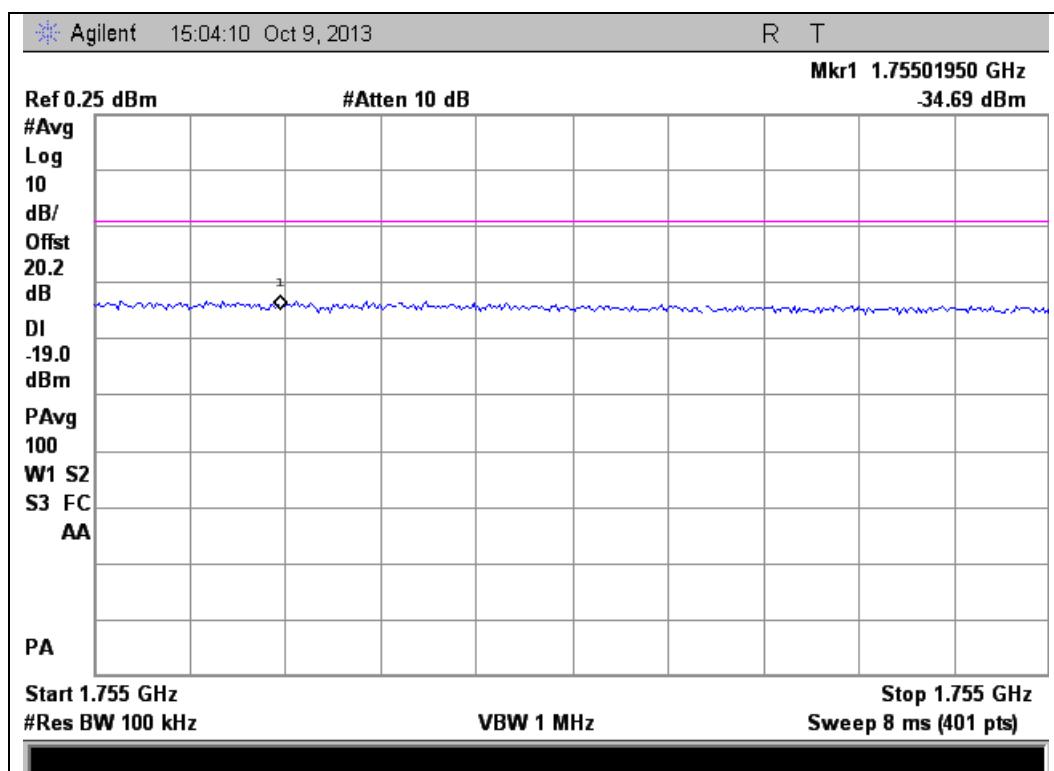


1710 - 1755 MHz Band

Lower Band Edge



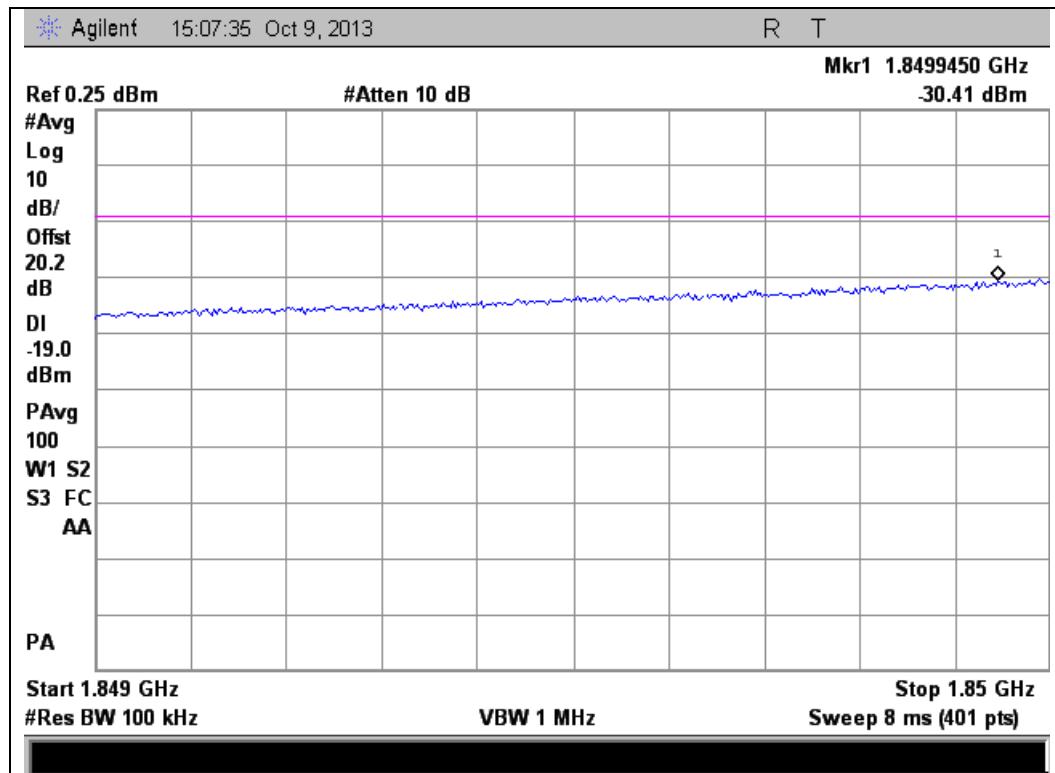
Upper Band Edge



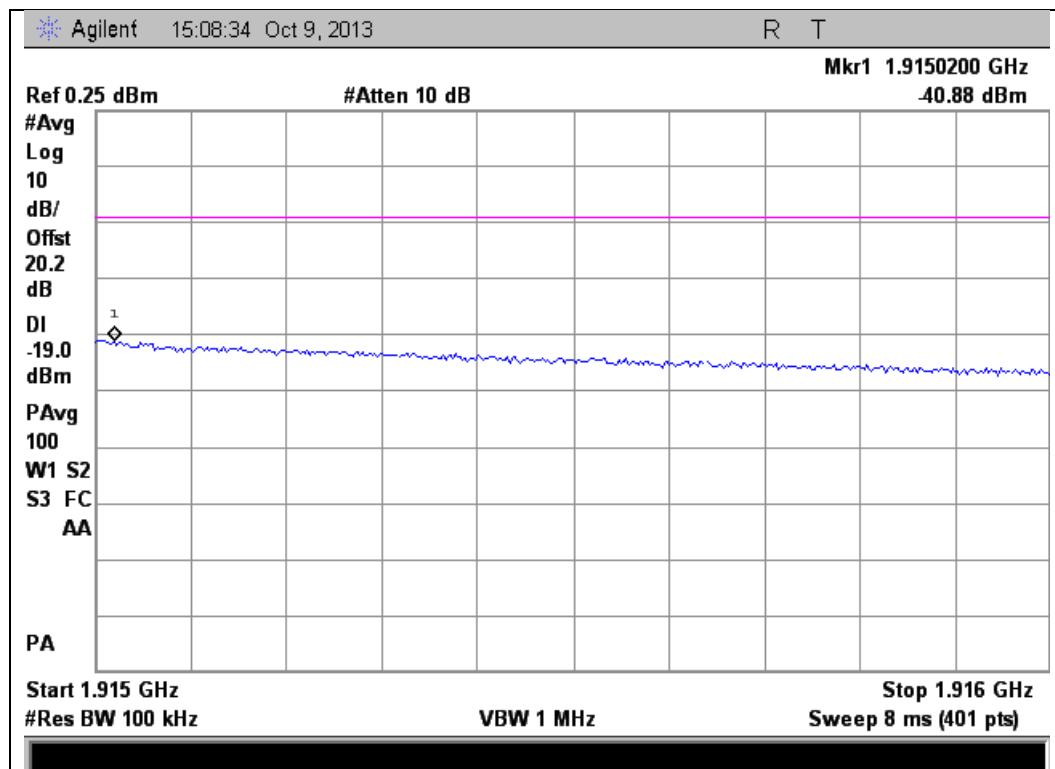


1850 - 1915 MHz Band

Lower Band Edge

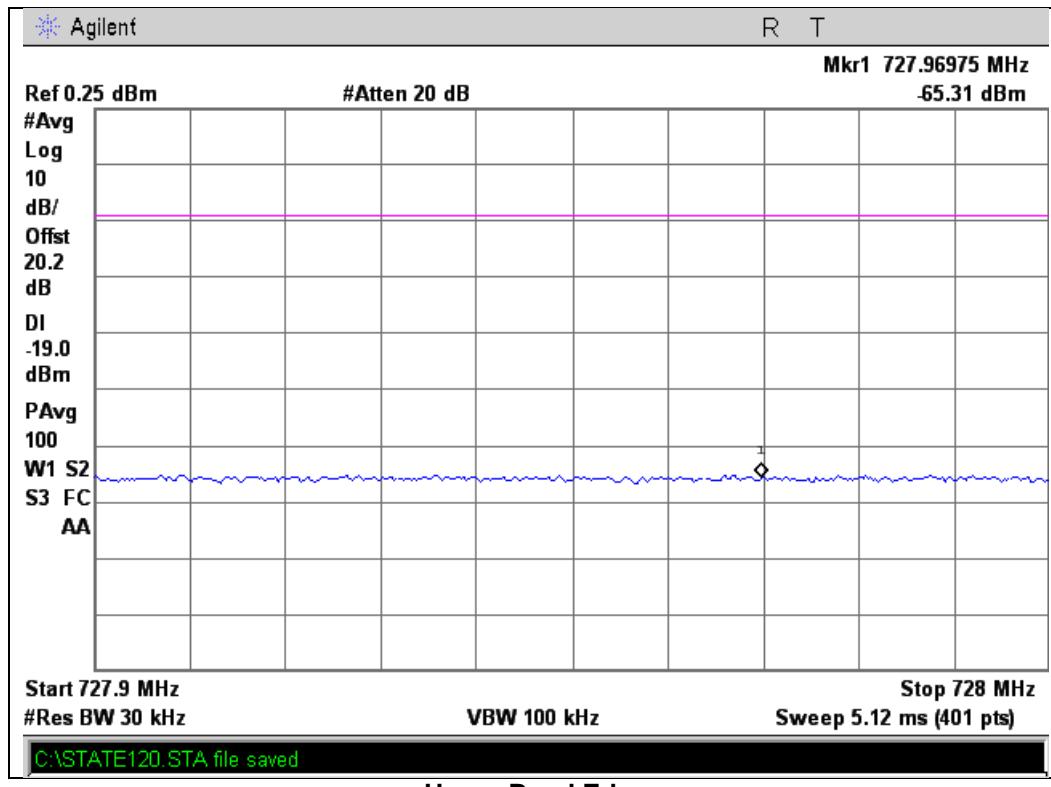


Upper Band Edge

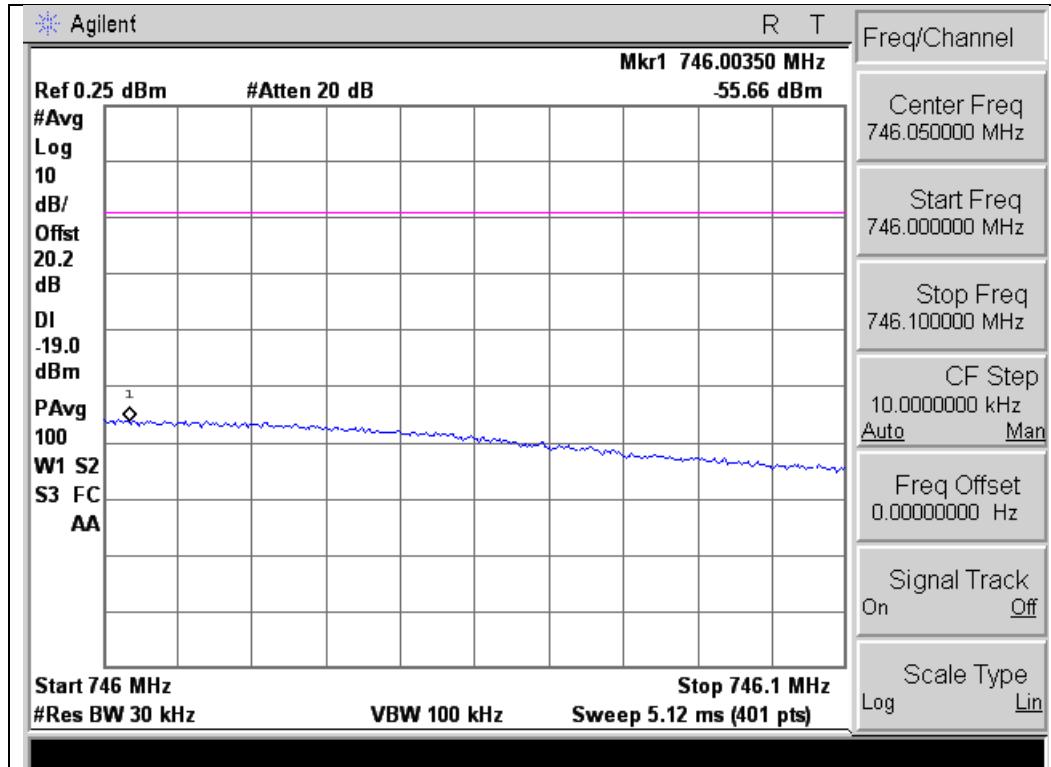




GSM Downlink Test Plots
734 - 746 MHz Band
Lower Band Edge



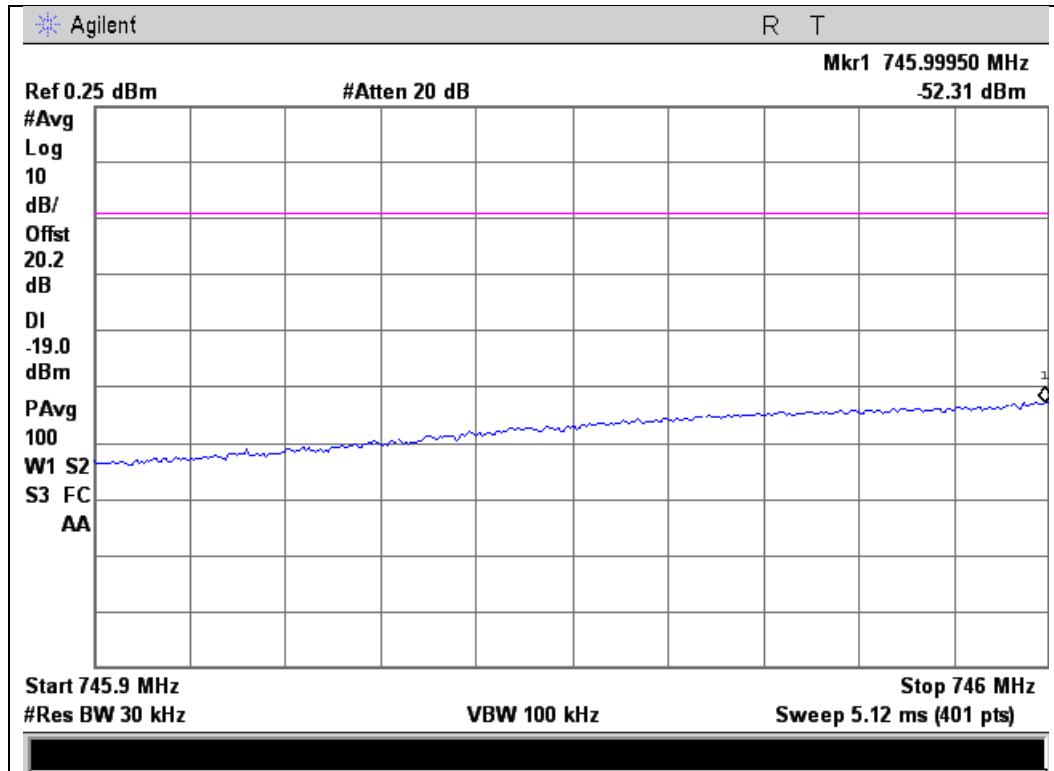
Upper Band Edge



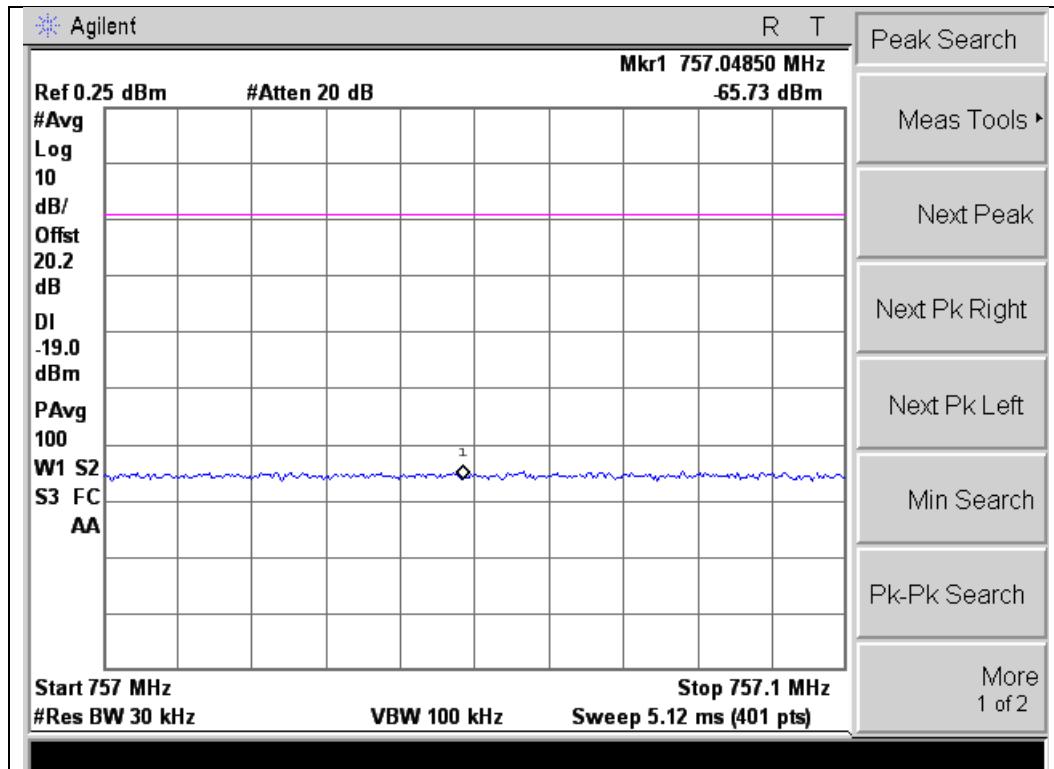


746 - 756 MHz Band

Lower Band Edge



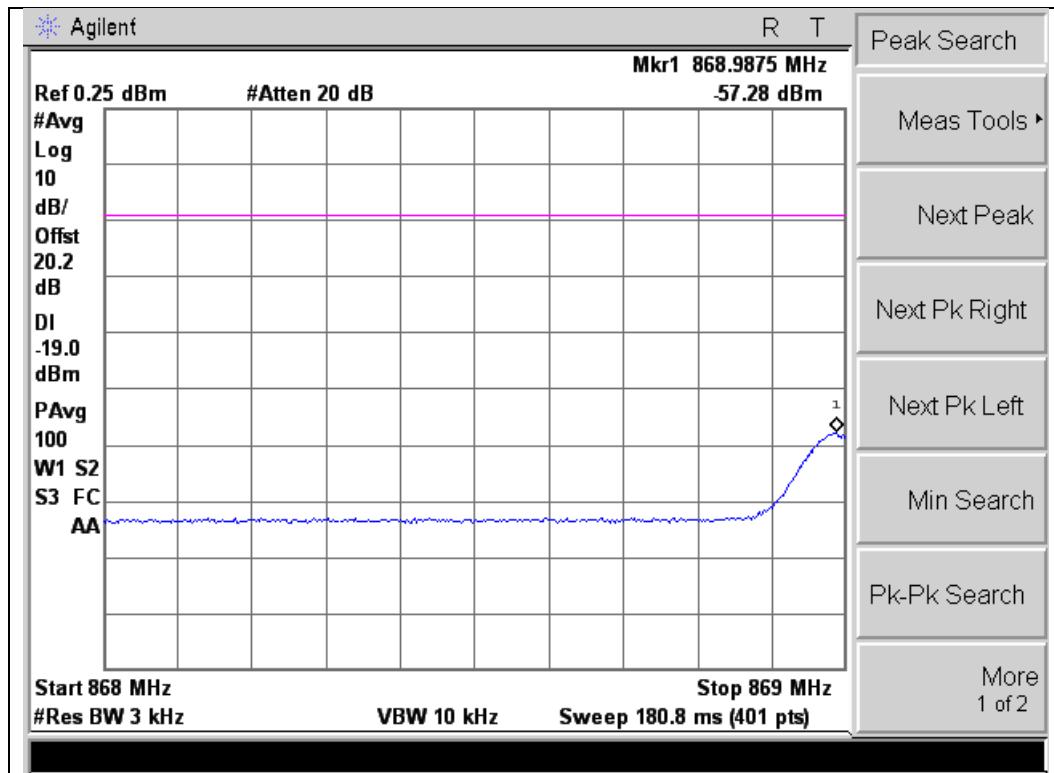
Upper Band Edge



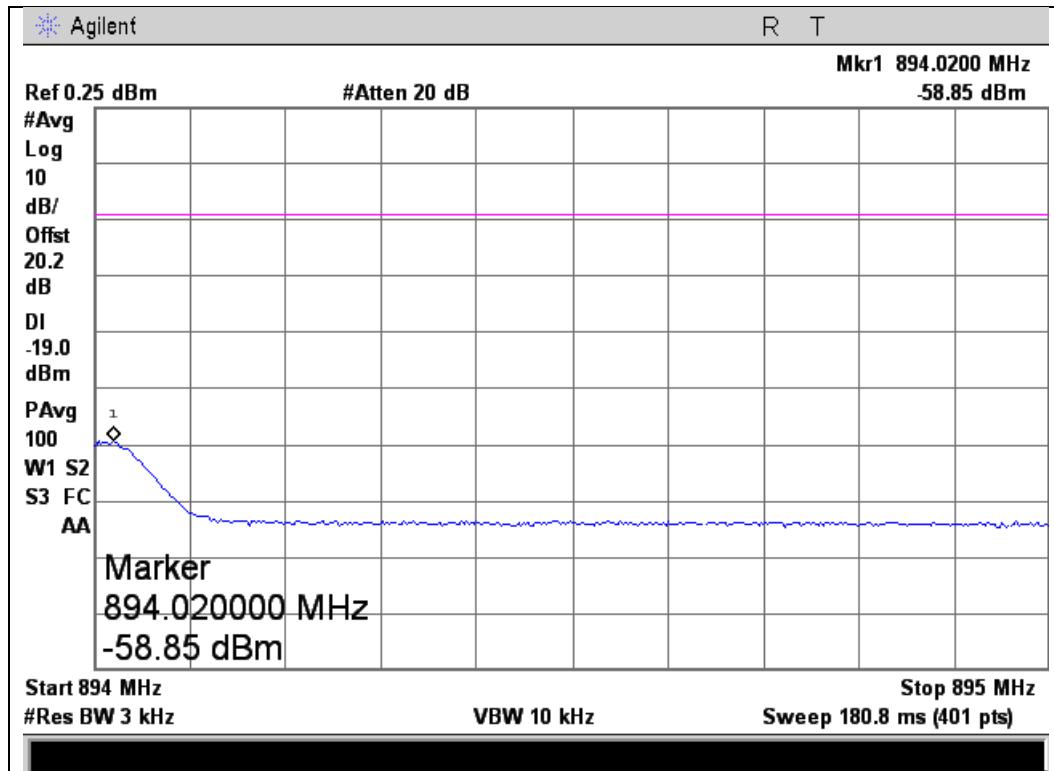


869 - 894 MHz Band

Lower Band Edge



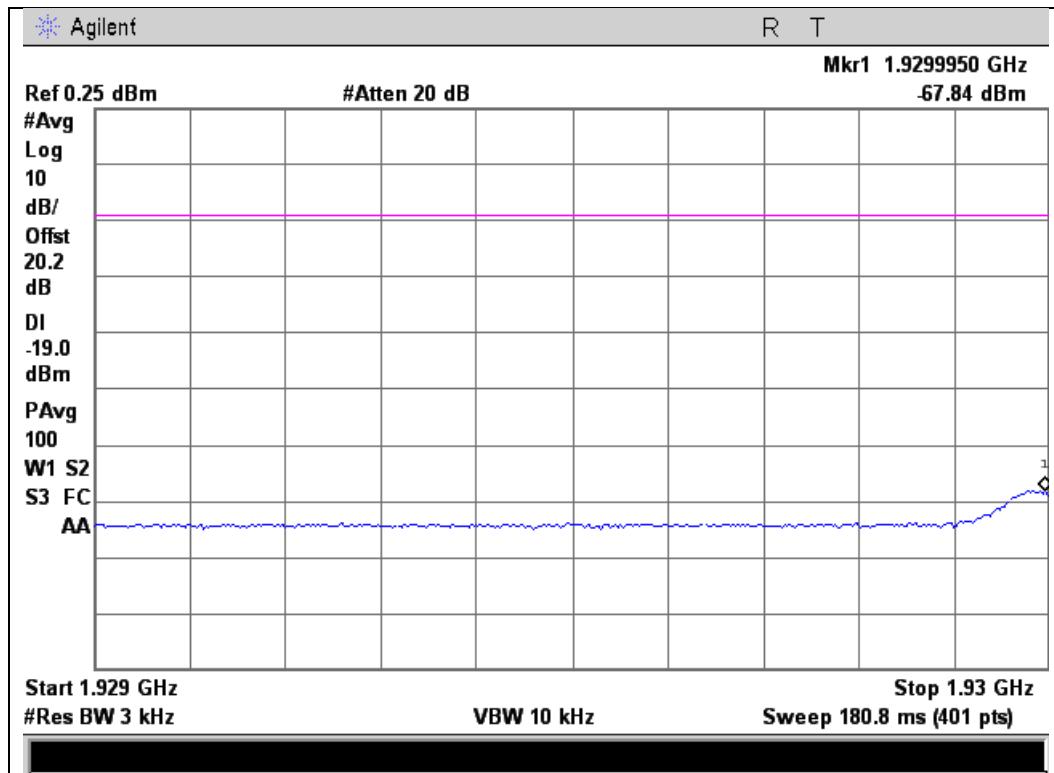
Upper Band Edge



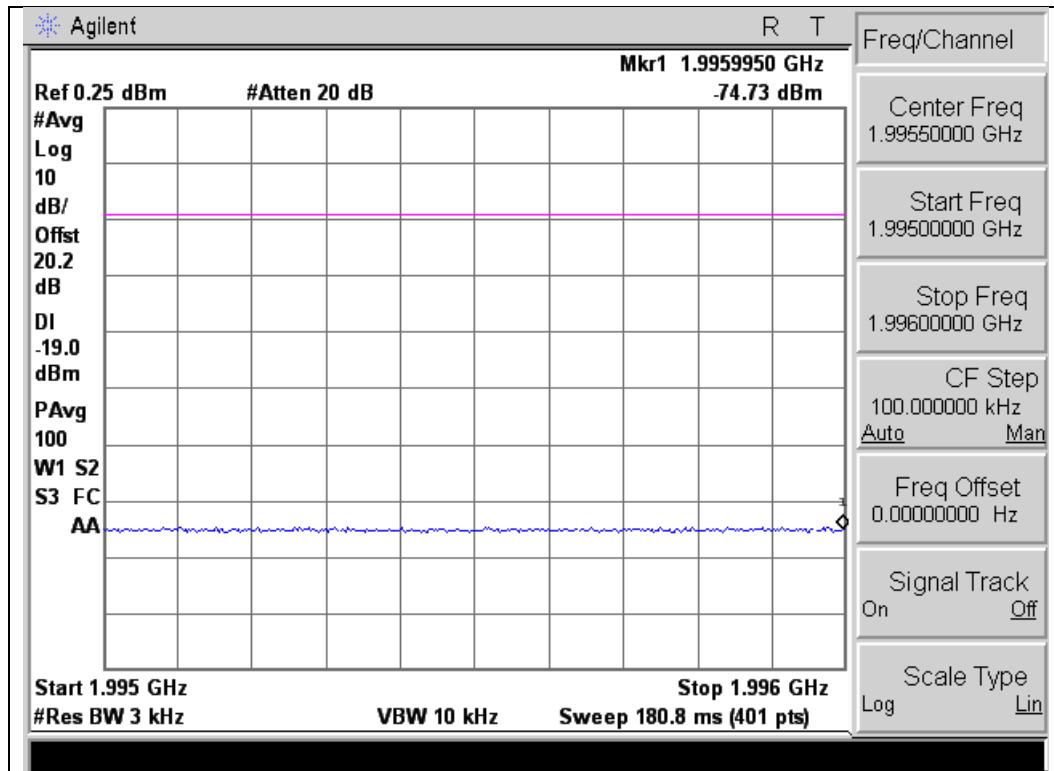


1930 - 1995 MHz Band

Lower Band Edge



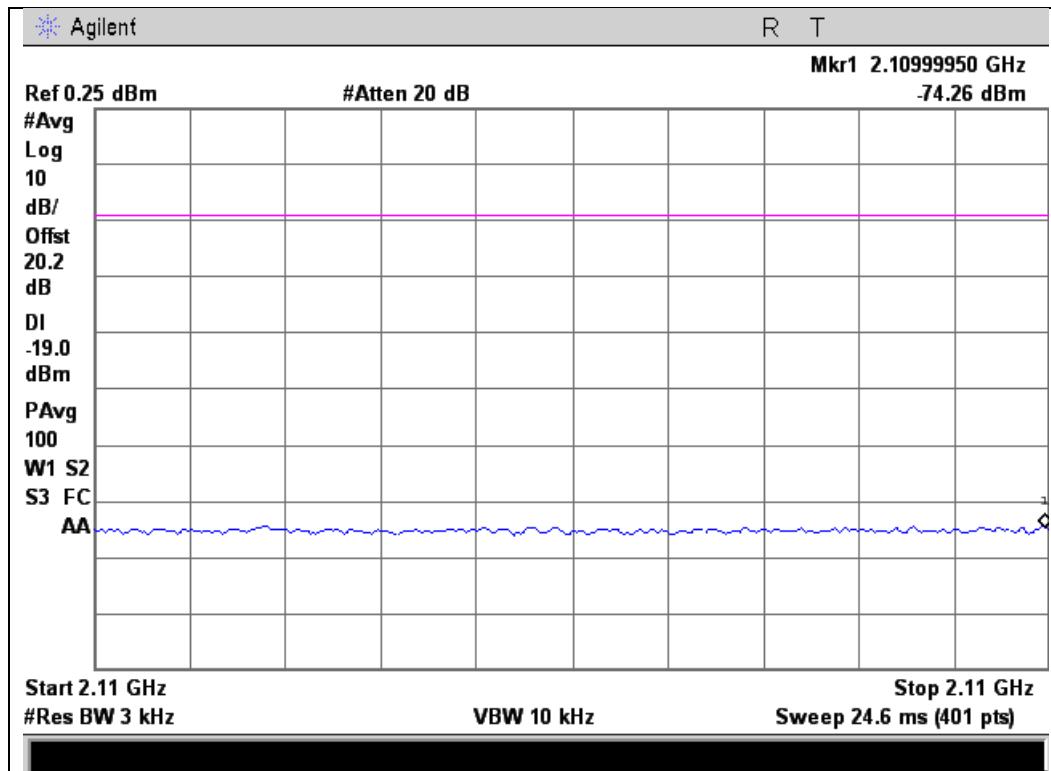
Upper Band Edge



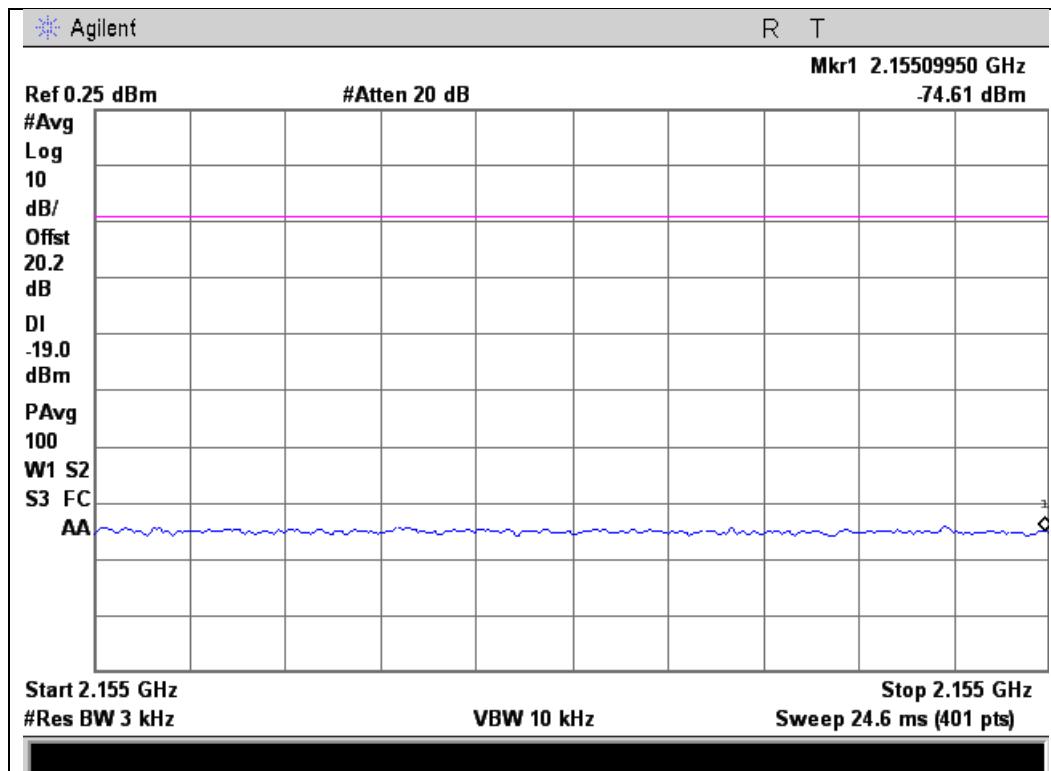


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge

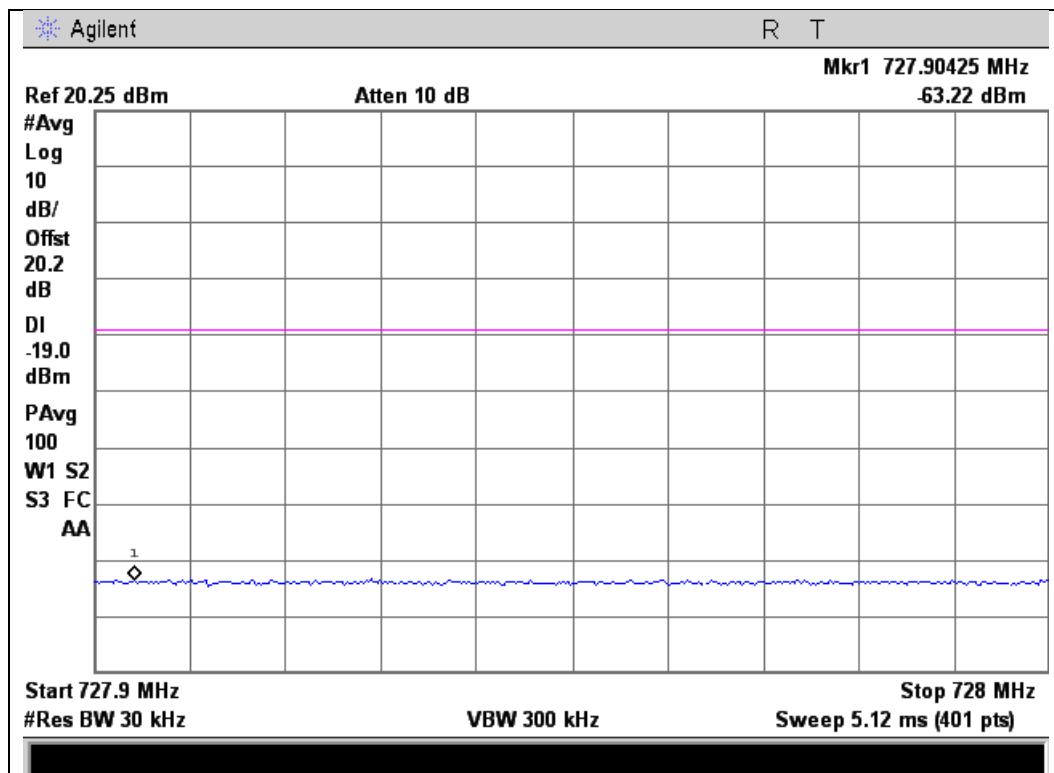




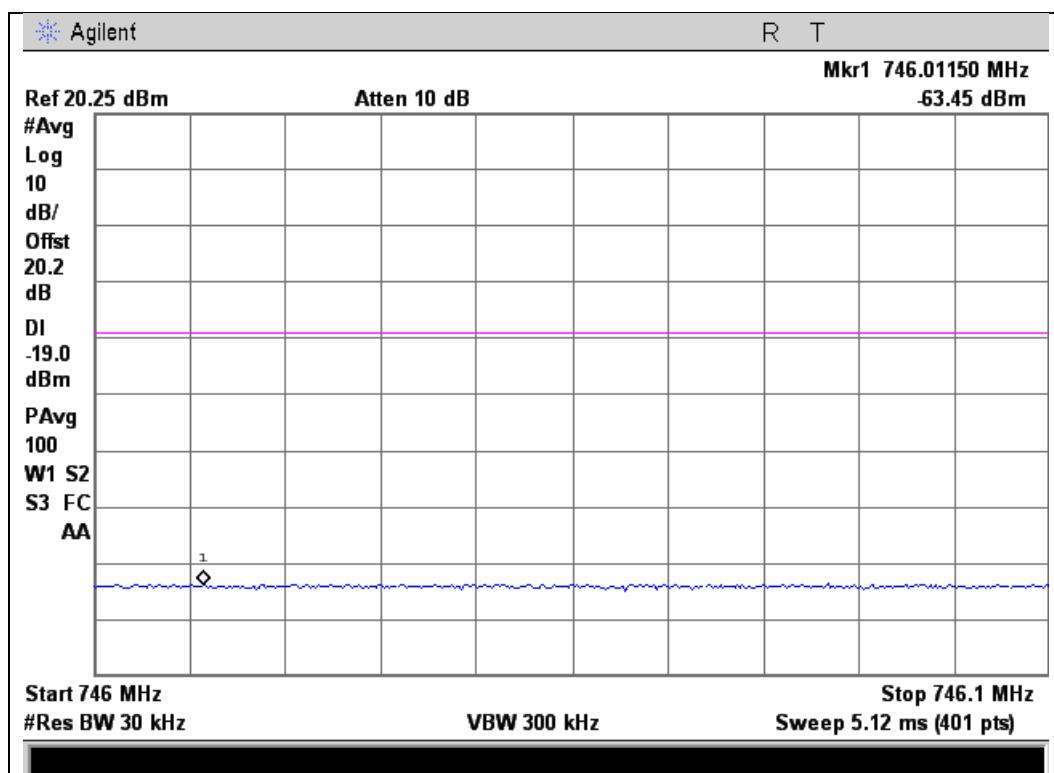
CDMA Downlink Test Plots

734 - 746 MHz Band

Lower Band Edge



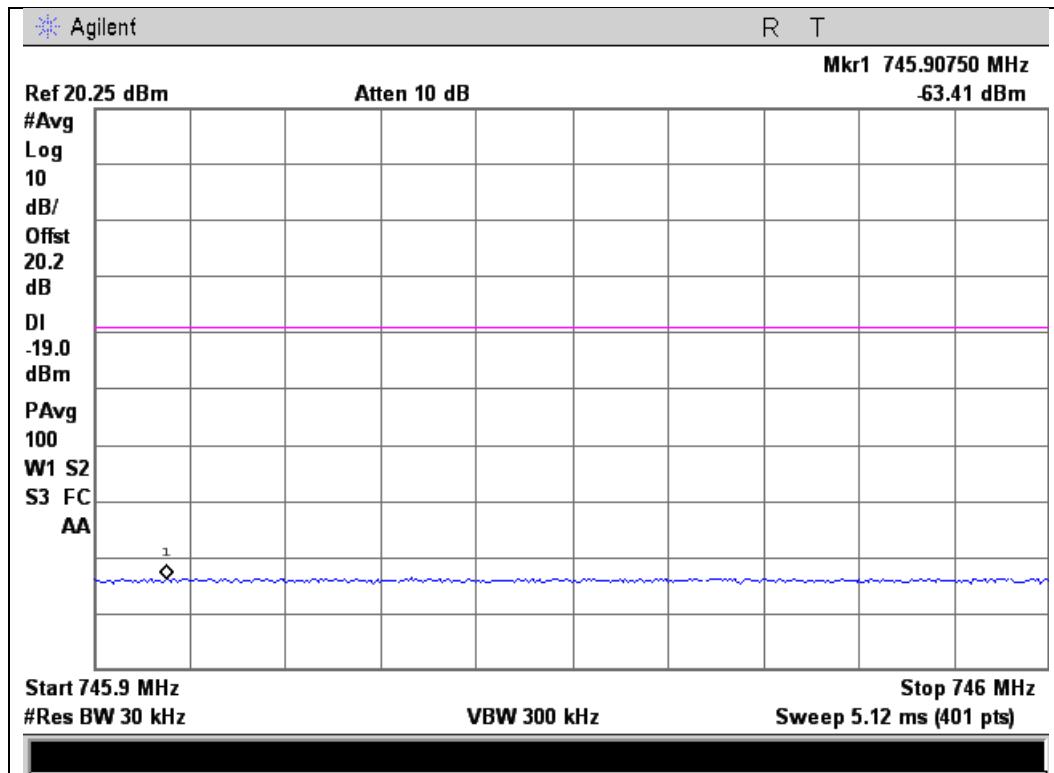
Upper Band Edge



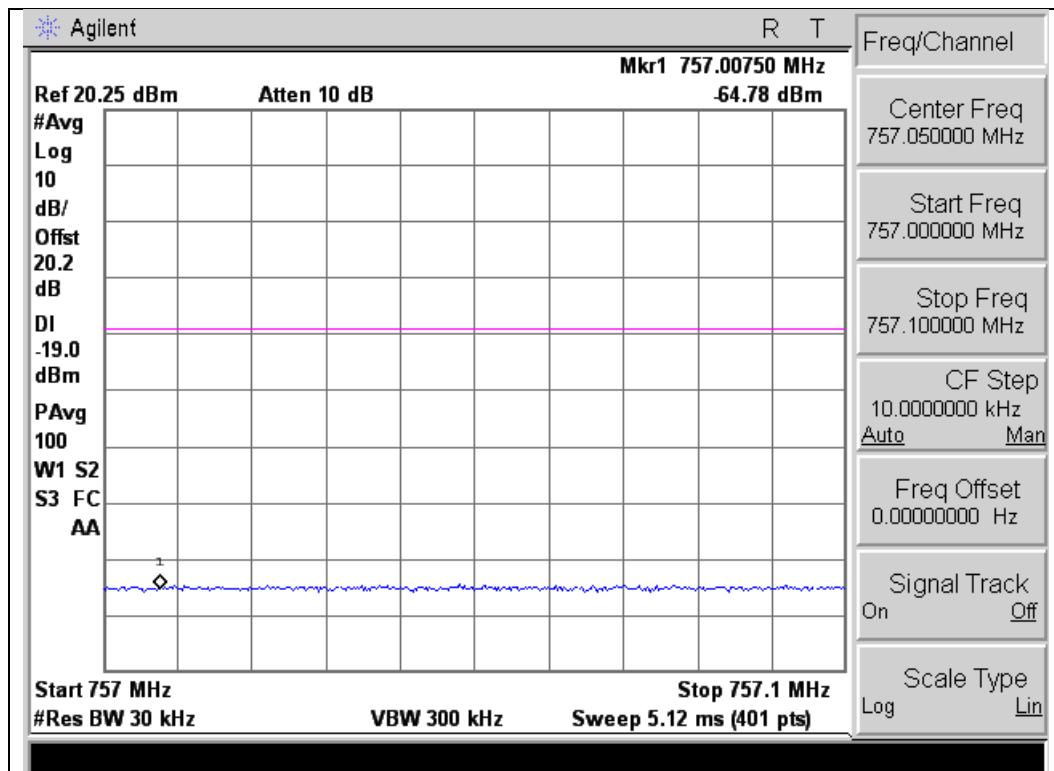


746 - 756 MHz Band

Lower Band Edge



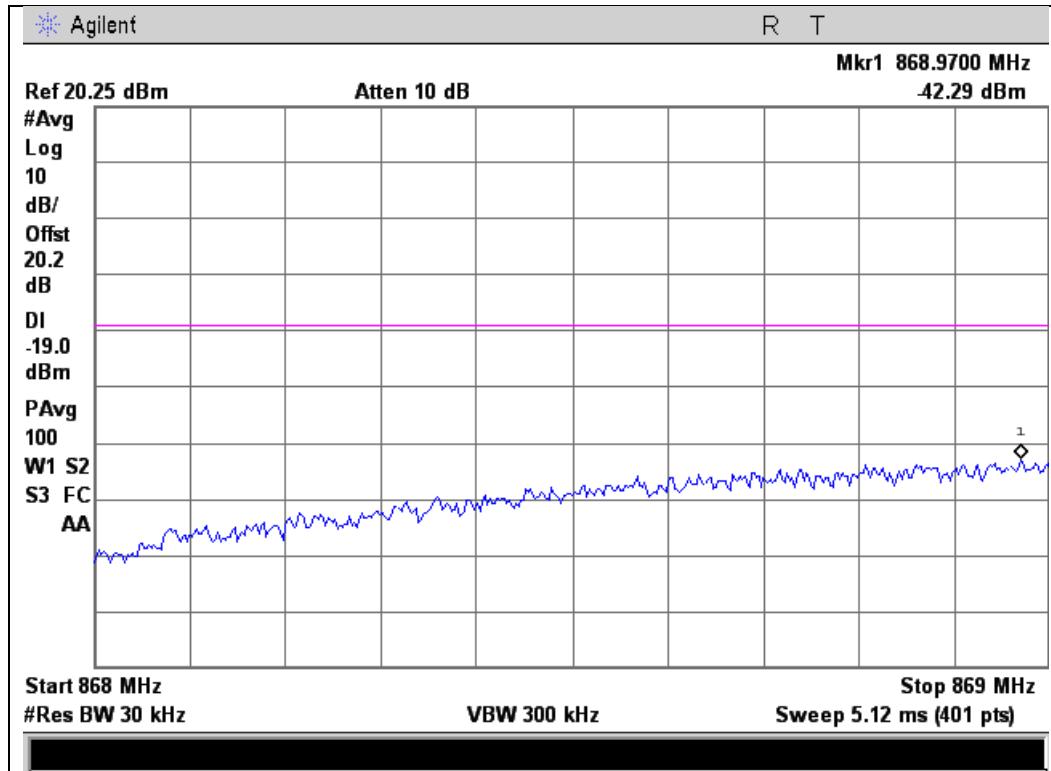
Upper Band Edge



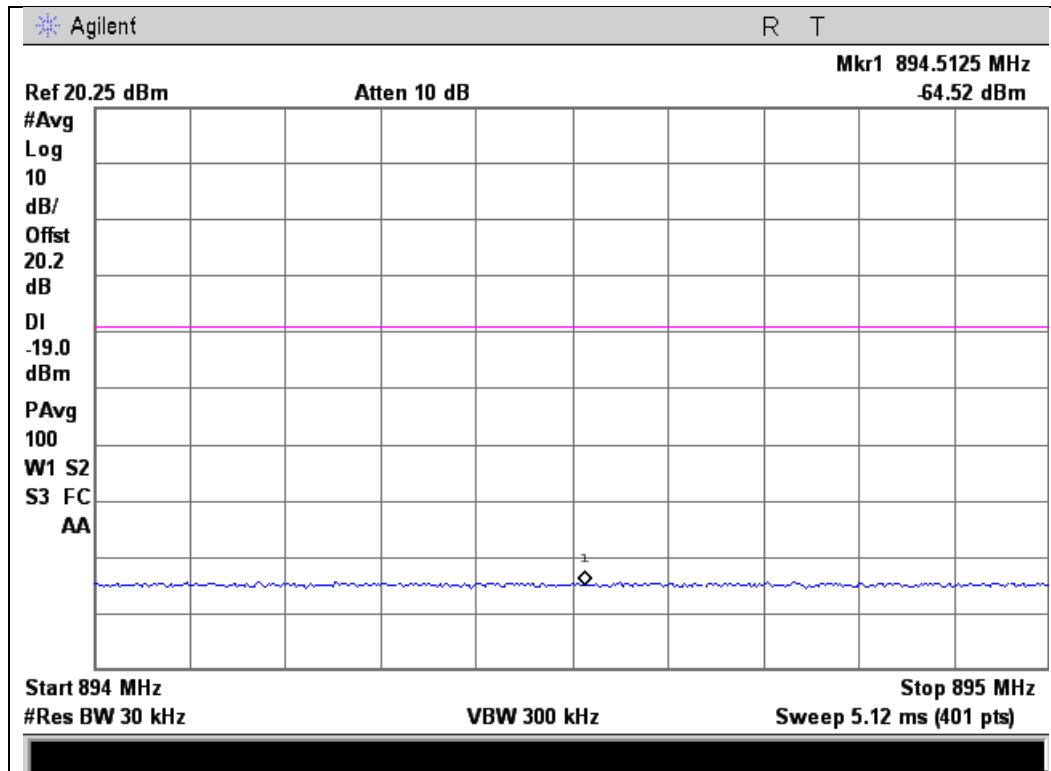


869 - 894 MHz Band

Lower Band Edge



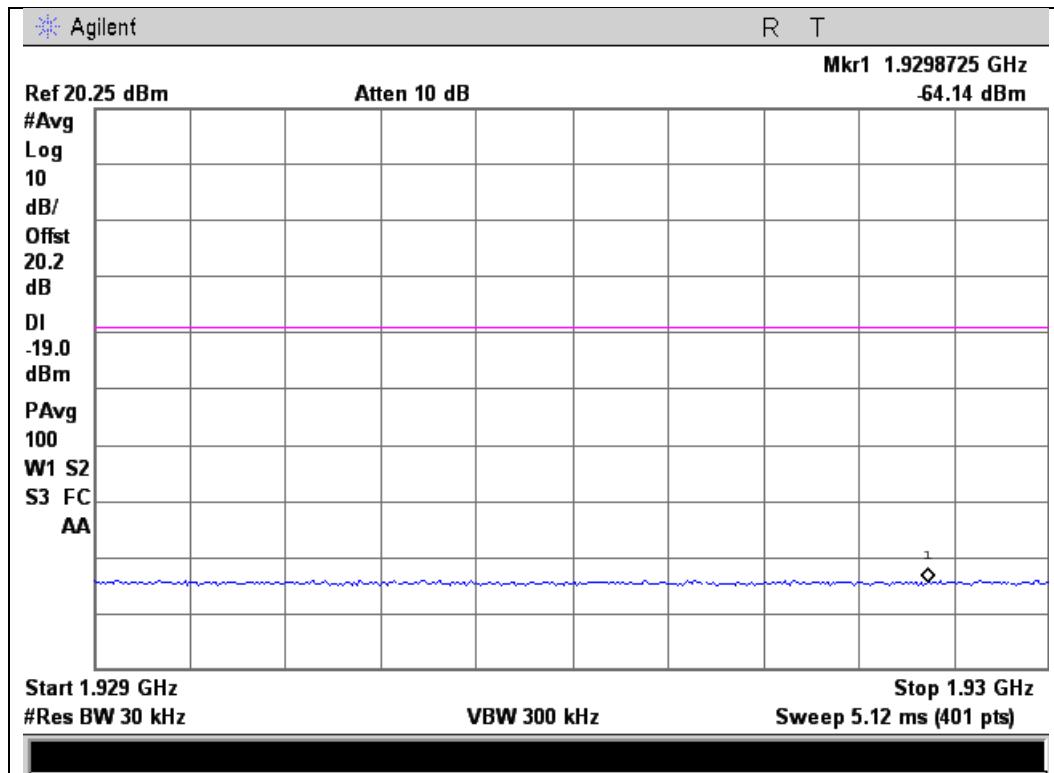
Upper Band Edge



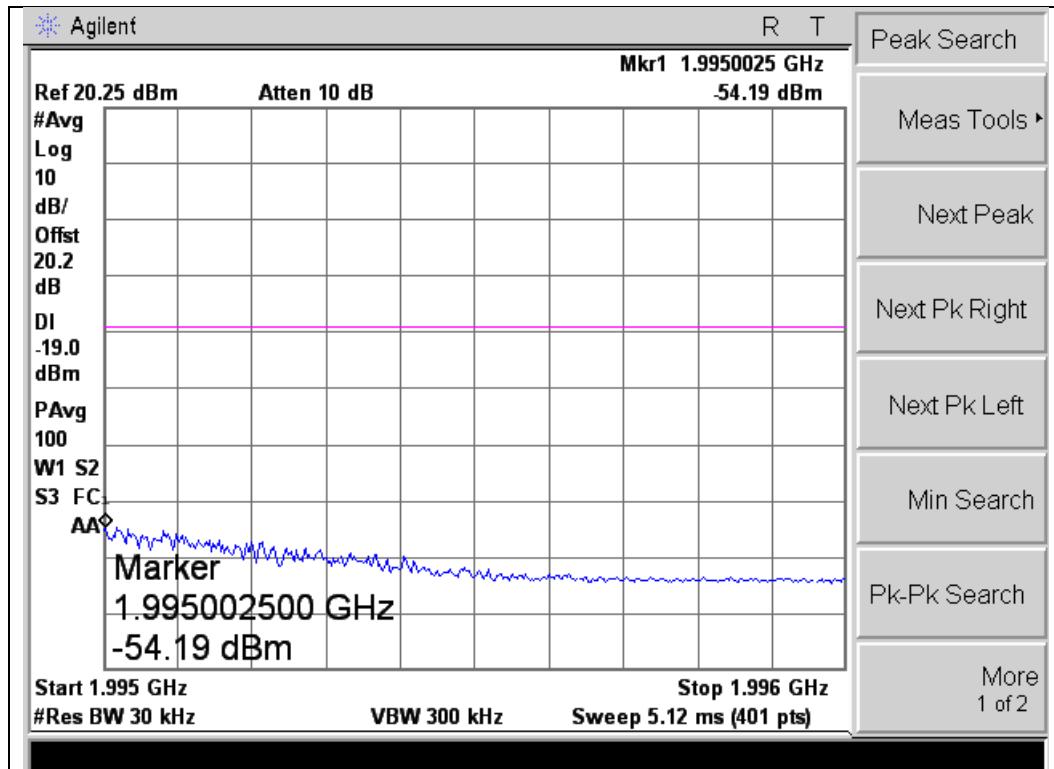


1930 - 1995 MHz Band

Lower Band Edge



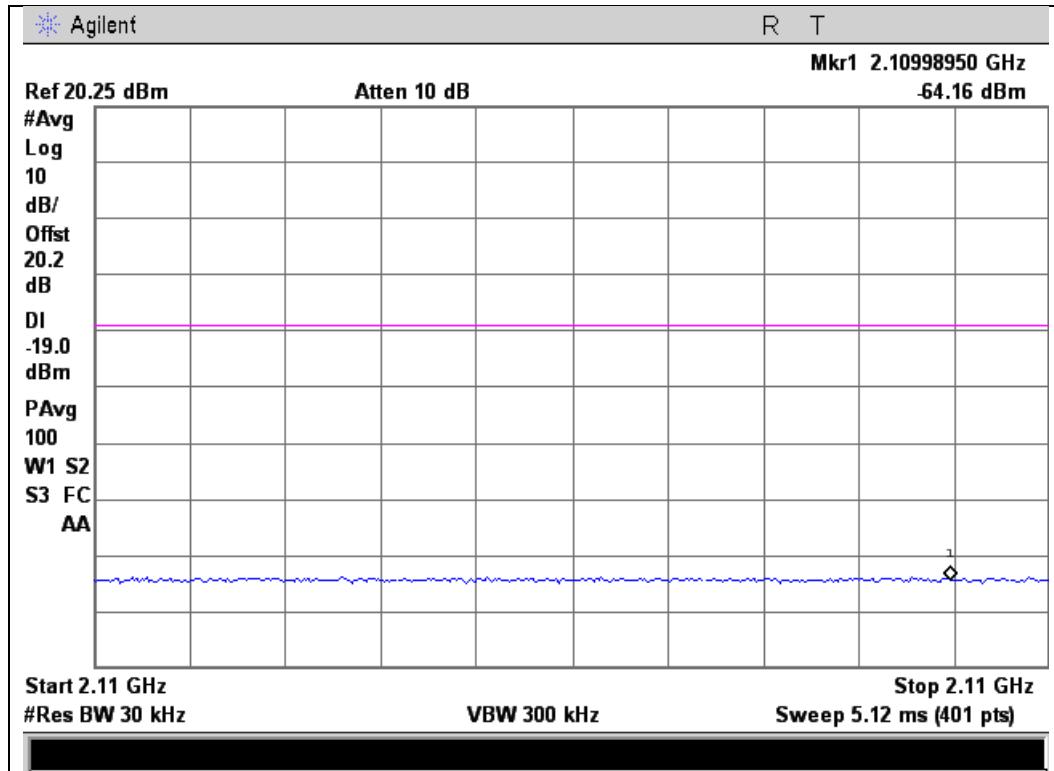
Upper Band Edge



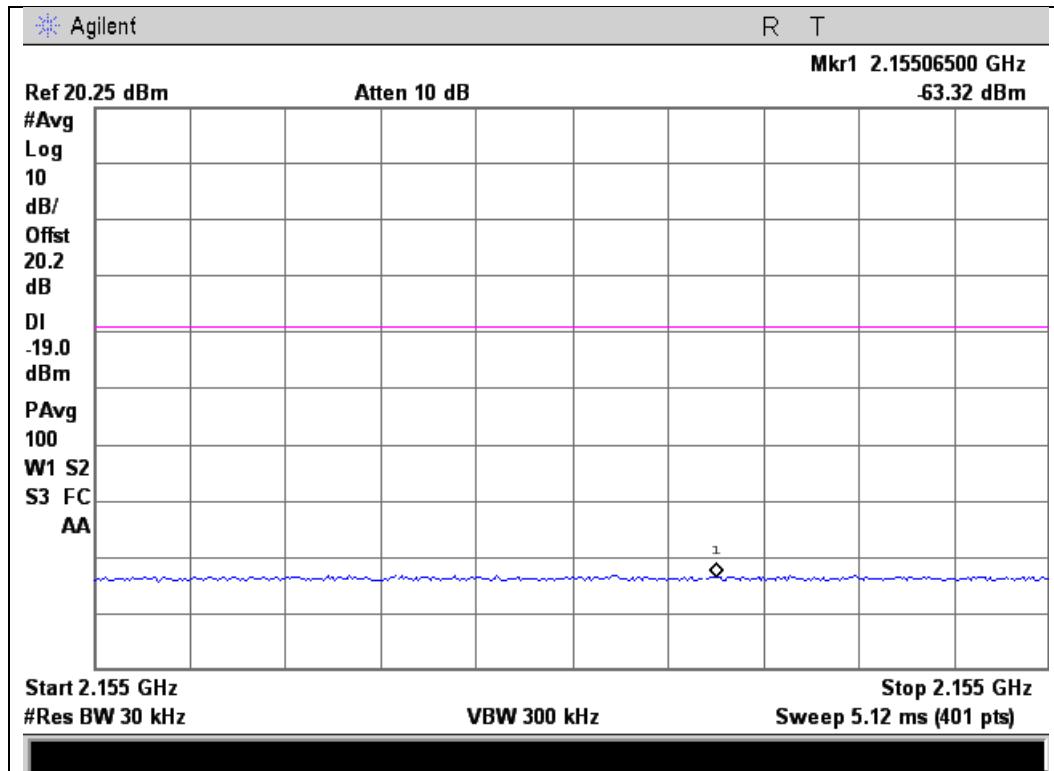


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge

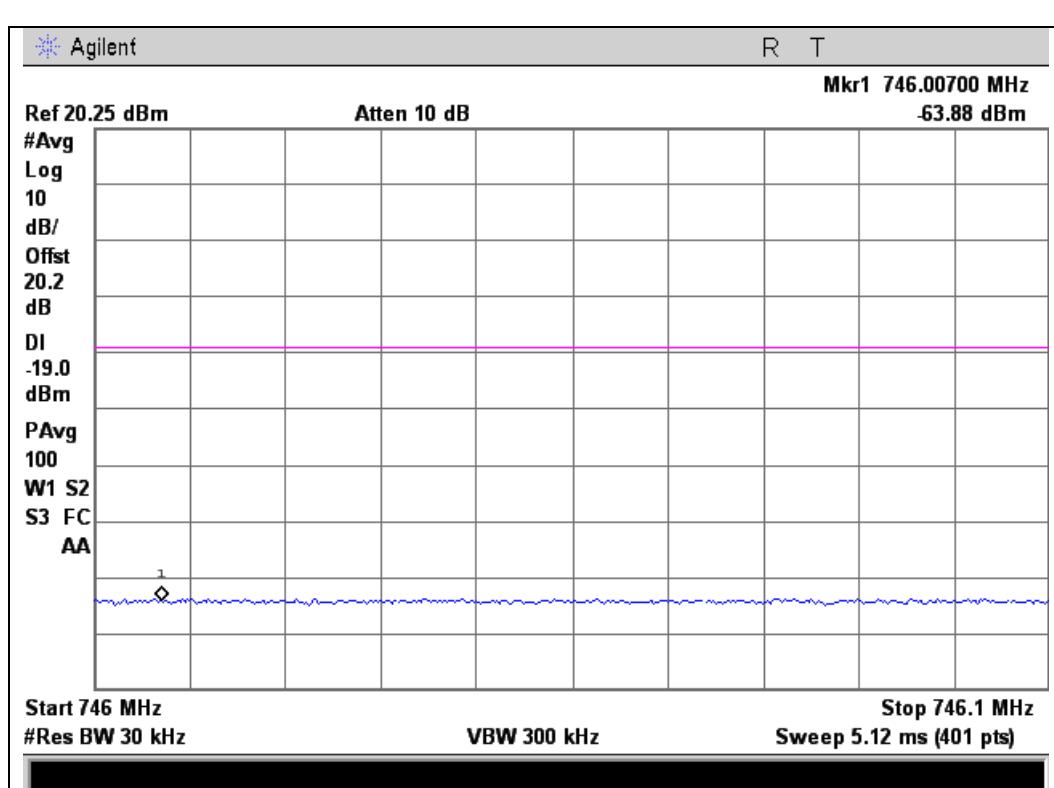
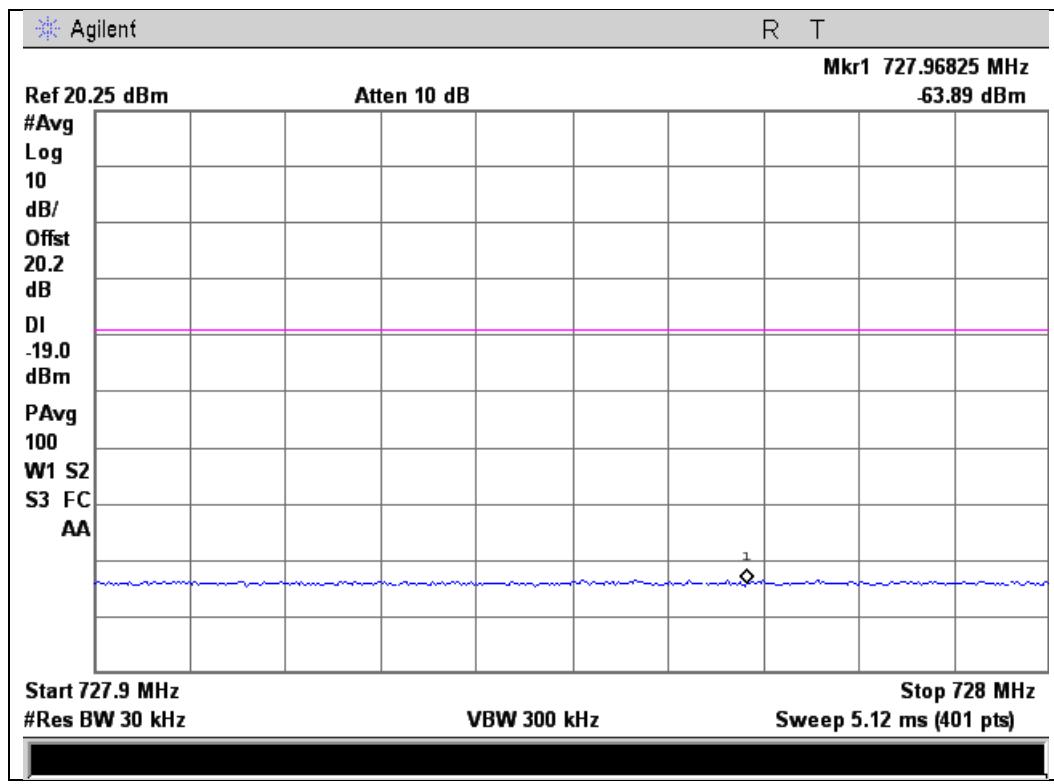




WCDMA Downlink Test Plots

734 - 746 MHz Band

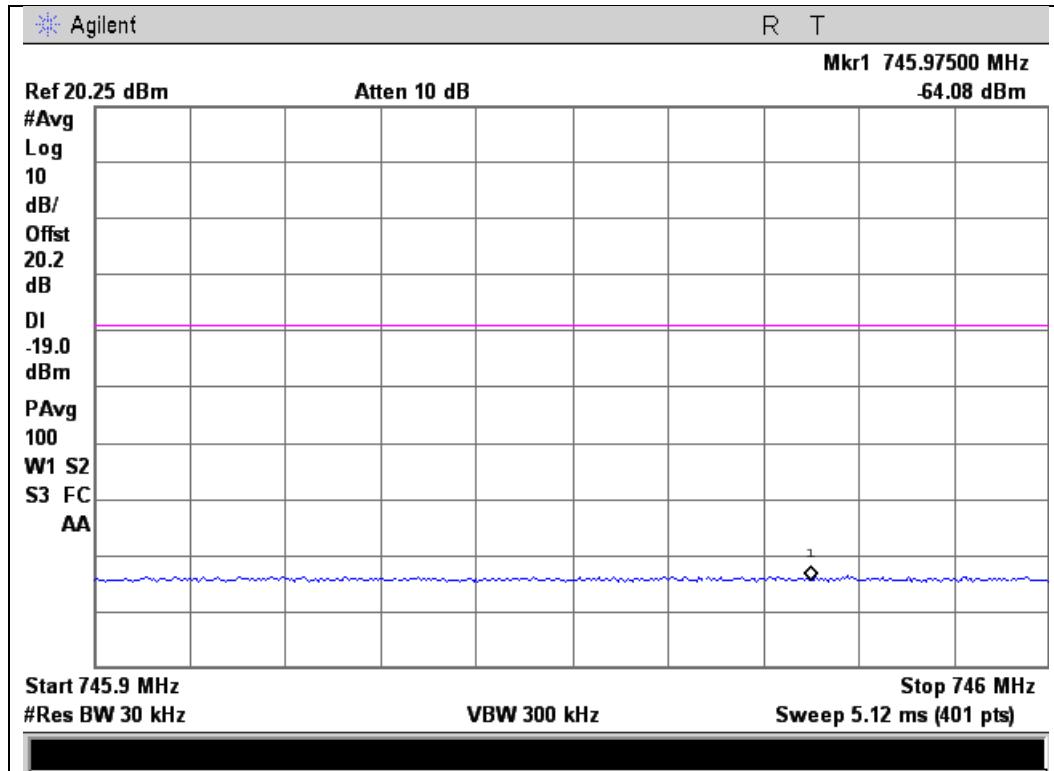
Lower Band Edge



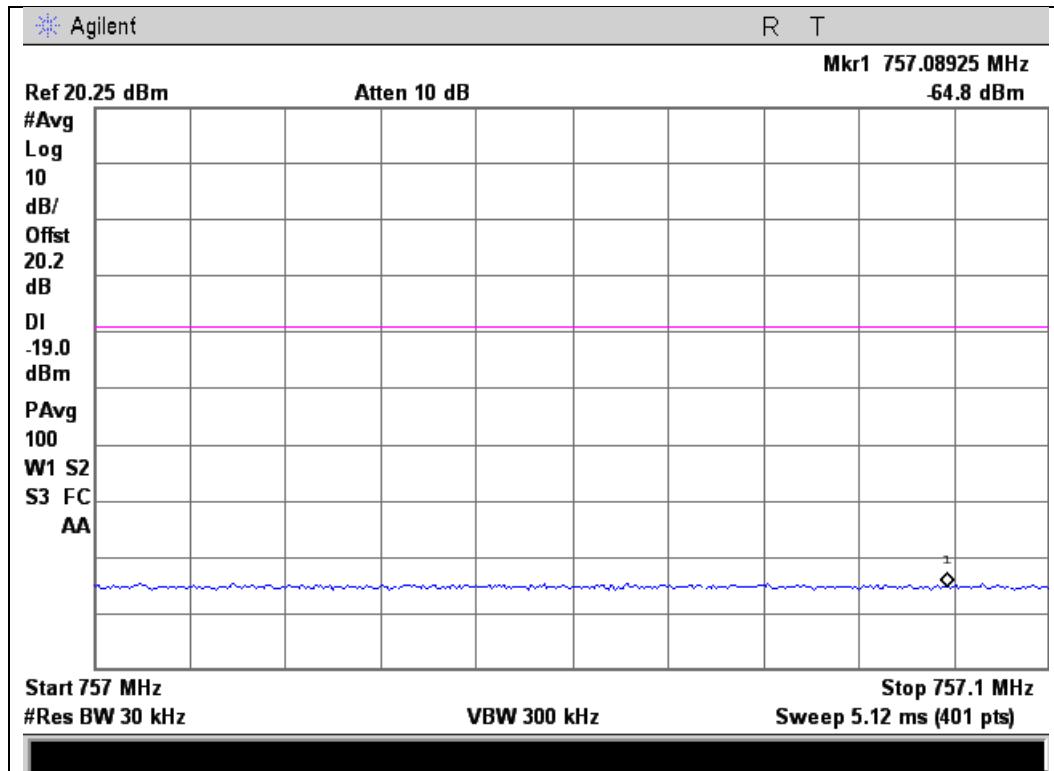


746 - 756 MHz Band

Lower Band Edge



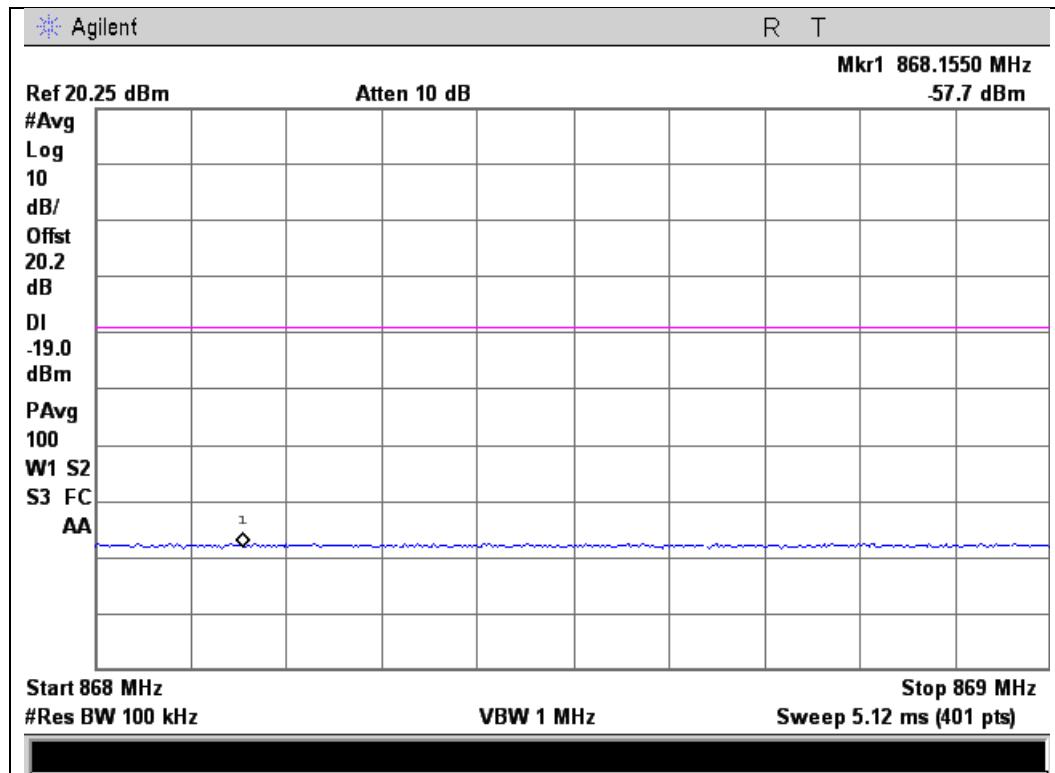
Upper Band Edge



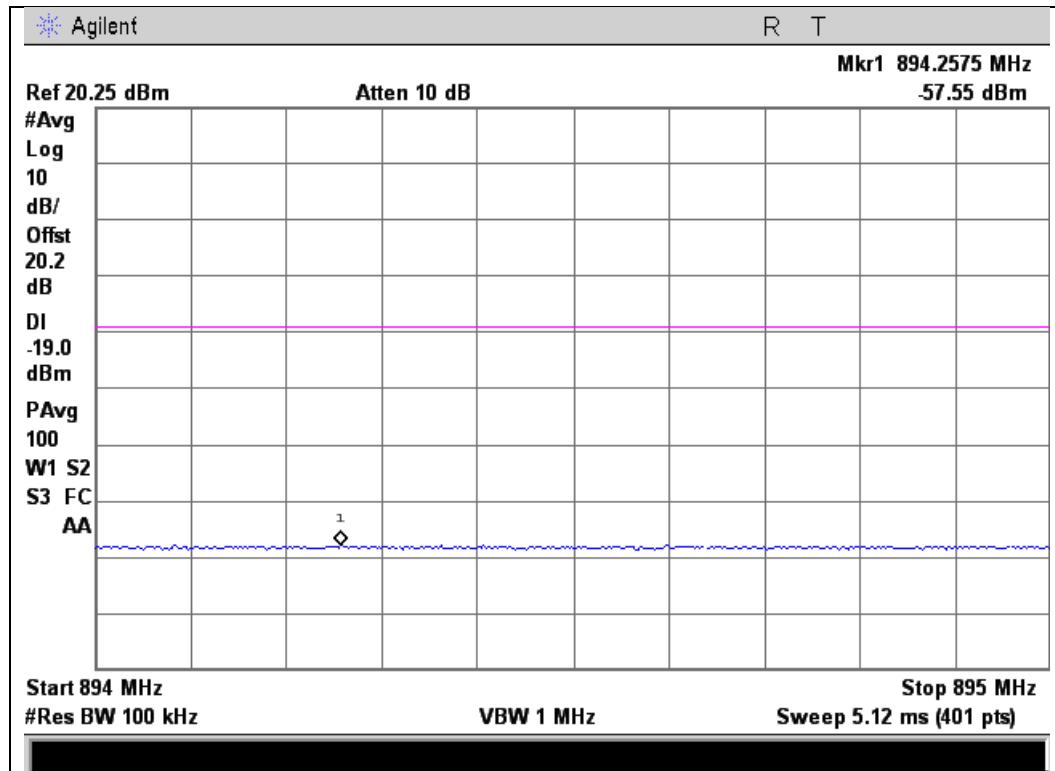


869 - 894 MHz Band

Lower Band Edge



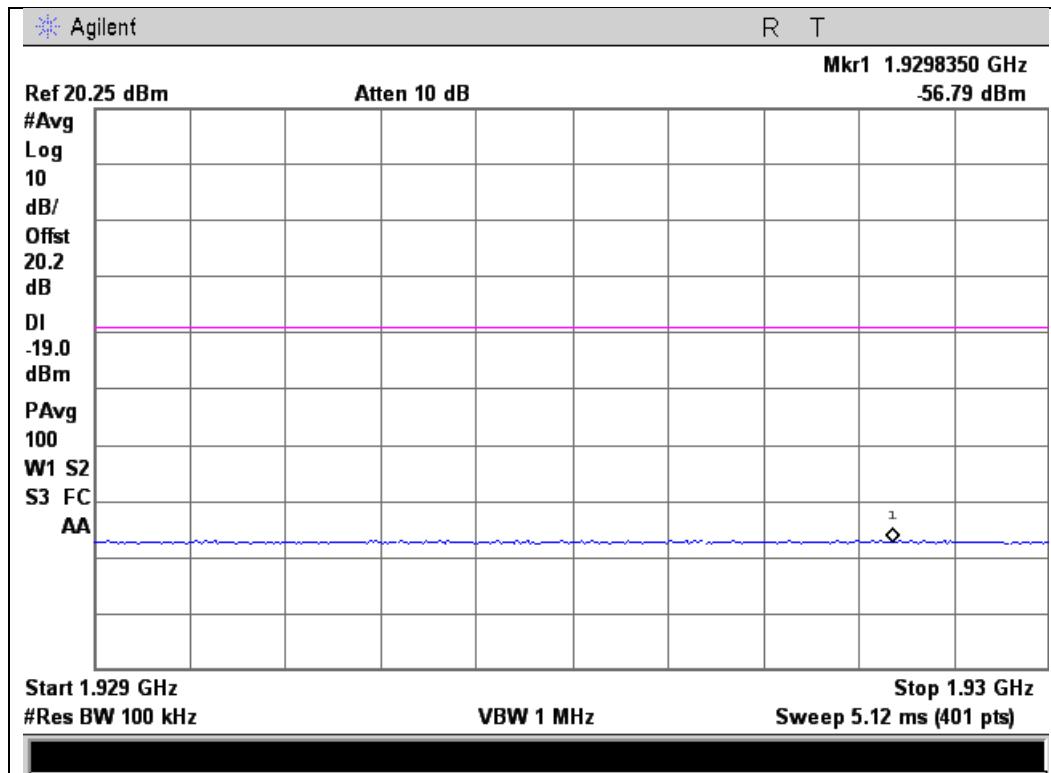
Upper Band Edge



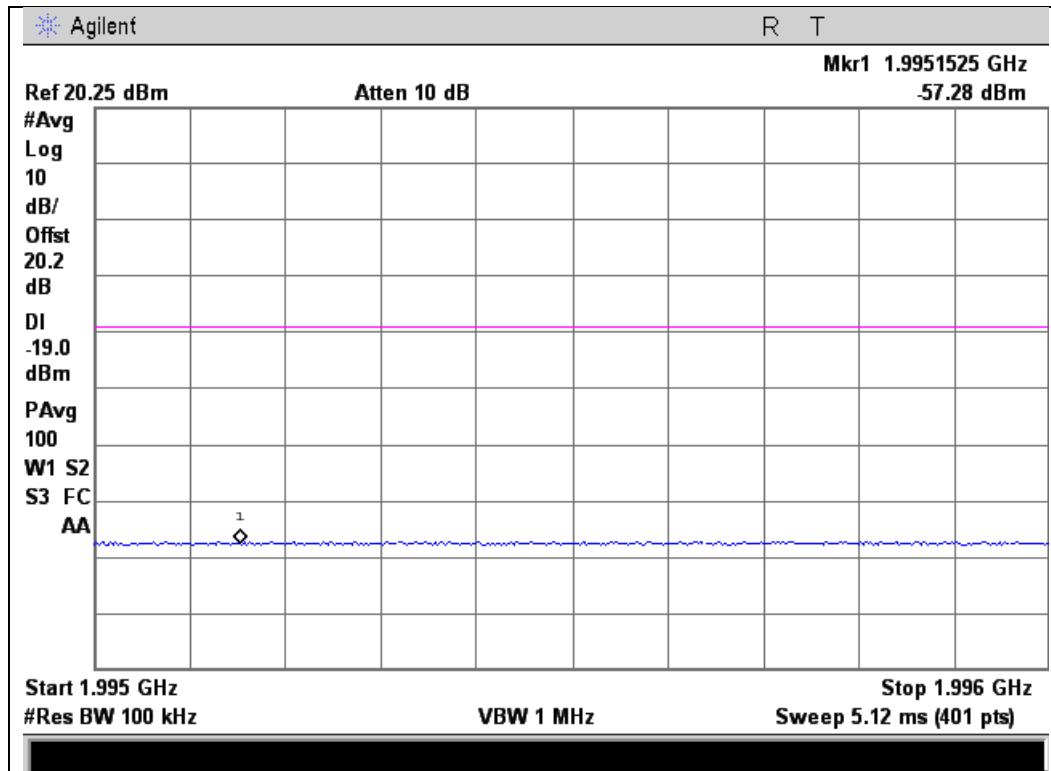


1930 - 1995 MHz Band

Lower Band Edge



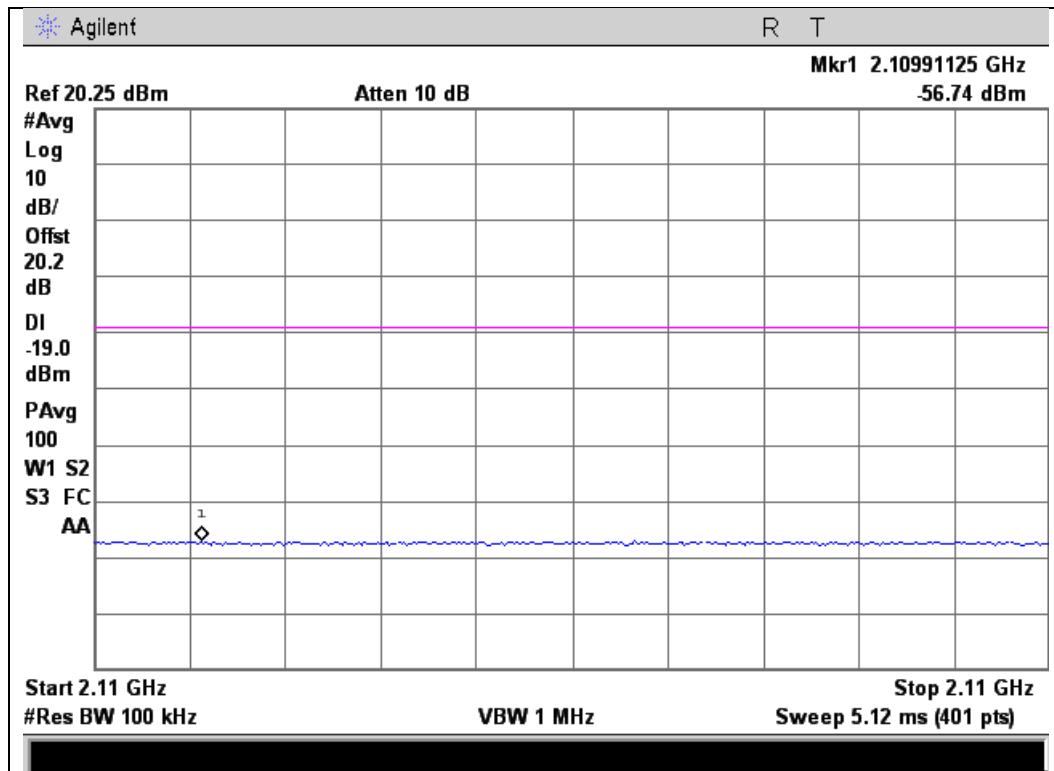
Upper Band Edge



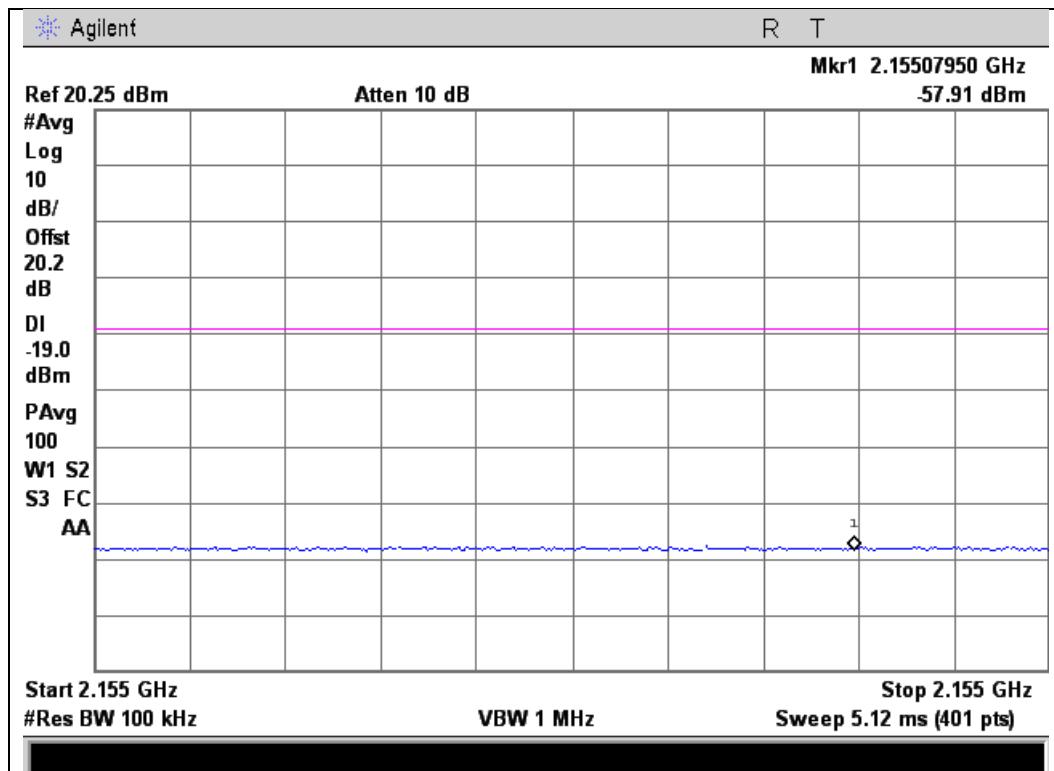


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge





Conducted Spurious Emissions

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

Engineer: Mike Graffeo
Test Date: 9/16/13, 1/9/14

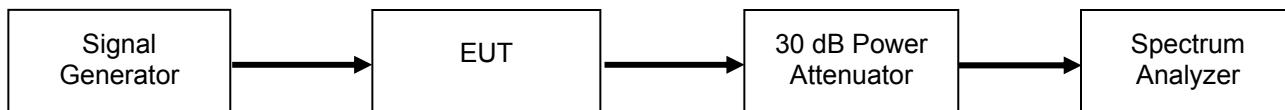
Test Procedure

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 = $43 + 10\log(P)\text{dB}$

Test Setup



Uplink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
704 - 716	1738	-45.03	-13	Pass
777 - 787	1741	-45.64	-13	Pass
824 - 849	779	-52.47	-13	Pass
1710 - 1755	1862	-37.89	-13	Pass
1850 - 1915	1739	-34.92	-13	Pass

Downlink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
734 - 746	2154	-47.98	-13	Pass
746 - 756	2152	-54.82	-13	Pass
869 - 894	2154	-42.67	-13	Pass
1930 - 1995	2152	-34.49	-13	Pass
2110 - 2155	1954	-33.75	-13	Pass



For the 746 – 758 downlink and 776 – 788 Uplink bands of operation, the following additional spurious emissions requirements apply.

FCC 27.53(c)

For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(3) *On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log (P) \text{ dB}$ in a 6.25 kHz band segment, for base and fixed stations;*

The test is performed using a 10 kHz RBW. Since the limit is referenced to a 6.25 kHz BW, the following correction factor is applied to the measured data.

BW correction Factor = $10 \log B1/B2$

BW correction Factor = $10 \log 6.25 / 10 = -2.04 \text{ dB}$

Final Value (dBm) = conducted measurement + BW correction factor

776-787 MHz Uplink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dB)	Bandwidth Correction Factor (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	774.80	-57.28	-2.04	-59.32	-46	-13.32
793 – 805	793.16	-75.99	-2.04	-78.03	-46	-32.03

746 – 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dB)	Bandwidth Correction Factor (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	771.30	-83.62	-2.04	-85.66	-46	-39.66
793 – 805	794.14	-84.13	-2.04	-86.17	-46	-40.17



FCC 27.53(f)

For operations in the 746-763 MHz, 775-793 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.

Since the limit is referenced to EIRP, the final data is computed using the Conducted Spurious Emission data and adding the BW correction factor and the final gain/loss data from the antenna kitting information supplied by the manufacturer.

For the Narrowband measurement, the test is performed using a 10 kHz RBW. Since the limit is referenced to a 700 Hz BW, the following correction factor is applied to the measured data.

BW correction Factor = $10\log B1/B2$

BW correction Factor = $10\log 700 / 10000 = -11.55 \text{ dB}$

Final Value (dBm) = conducted measurement +BW correction factor + final gain/loss from Antenna Kitting document

The Limit for discreet (narrowband) emissions is -80dBW (-50 dBm) in 700 MHz BW.

The Limit for (wideband Emissions) is -70 dBW (-40 dBm) in a 1 MHz BW

776-787 MHz Uplink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Gain/Loss from Antenna Kitting Information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1564.04	-54.01	0.00	2.41	-51.60	-40	-11.60
1559 – 1610 (Narrowband)	1564.37	-73.12	-11.55	2.41	-82.26	-50	-32.26

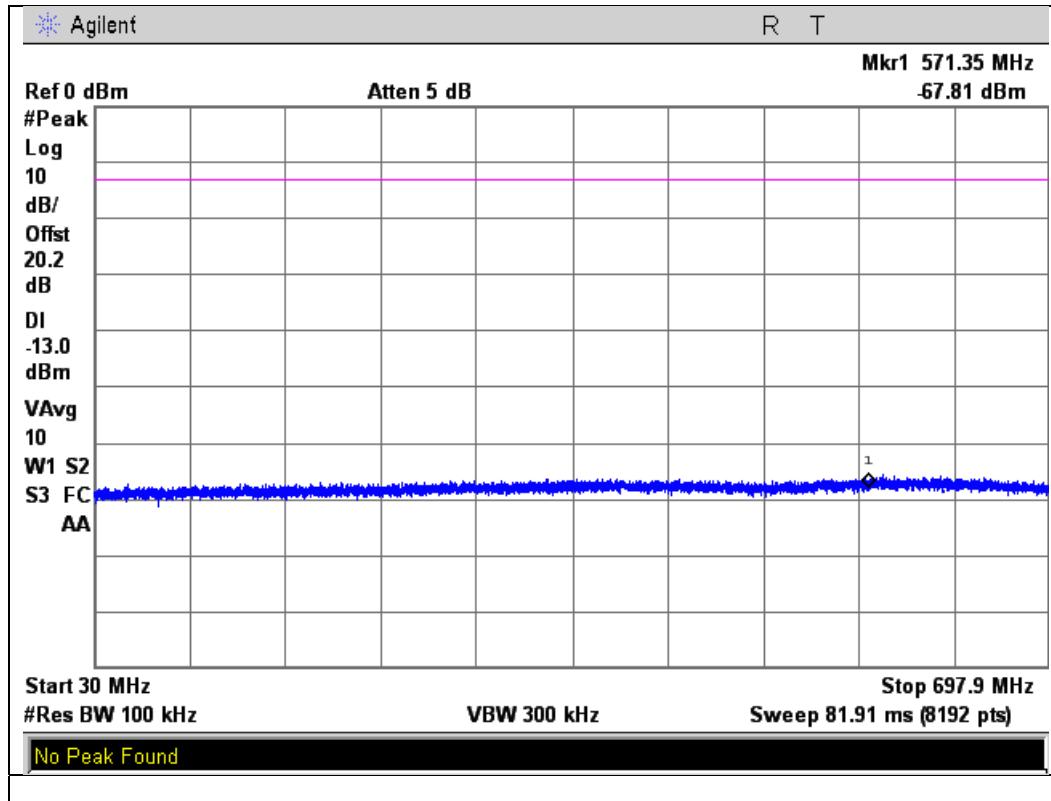
746 – 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Gain/Loss from Antenna Kitting information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1565.21	-62.81	0	1.21	-61.60	-40	-21.60
1559 – 1610 (Narrowband)	1596.66	-82.68	-11.55	1.21	-93.02	-50	-43.02

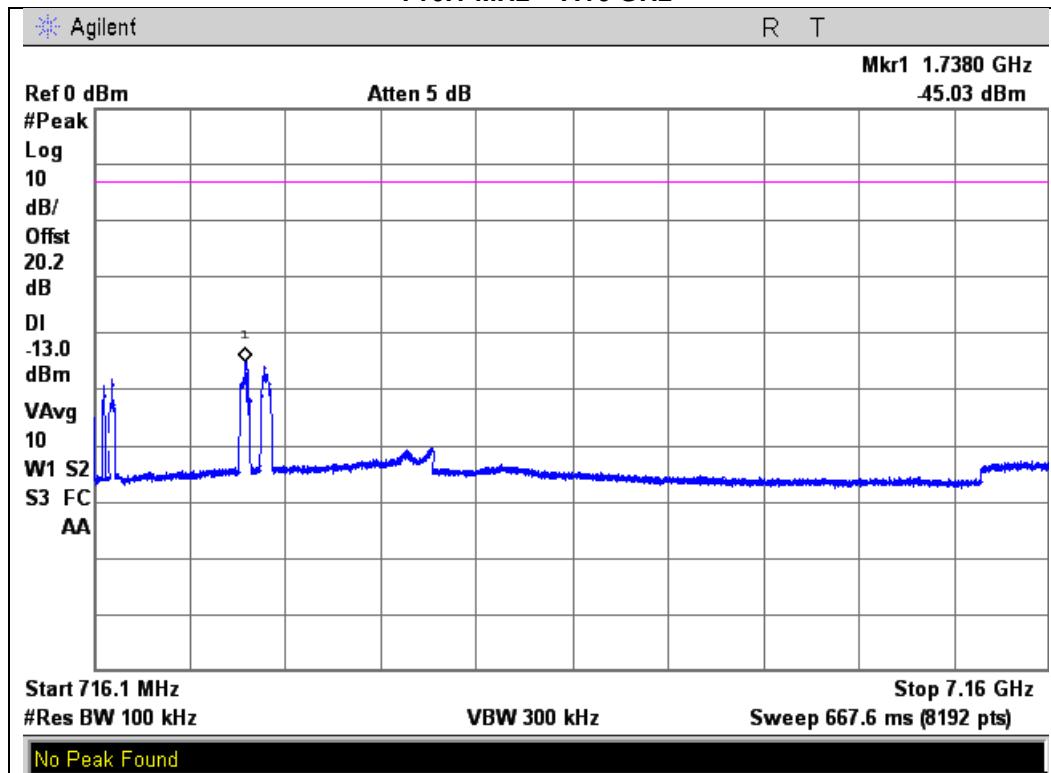


Uplink Test Plots

704 - 716 MHz Band
30MHz – 697.9 MHz

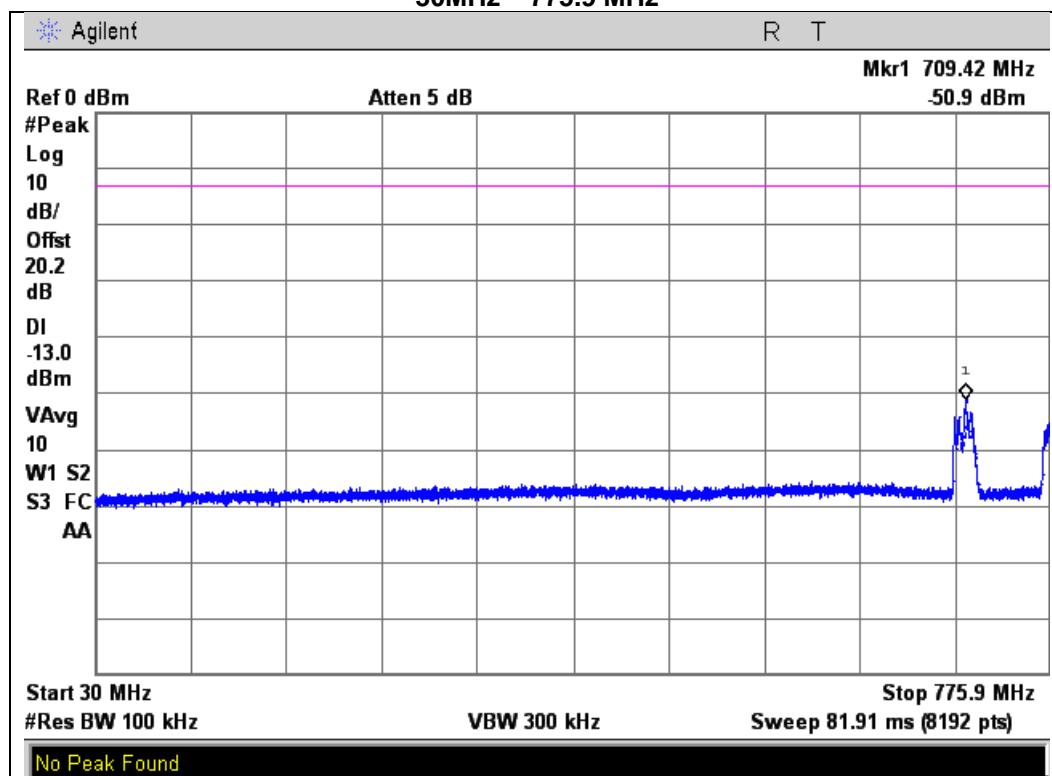


704 - 716 MHz Band
716.1 MHz – 7.16 GHz

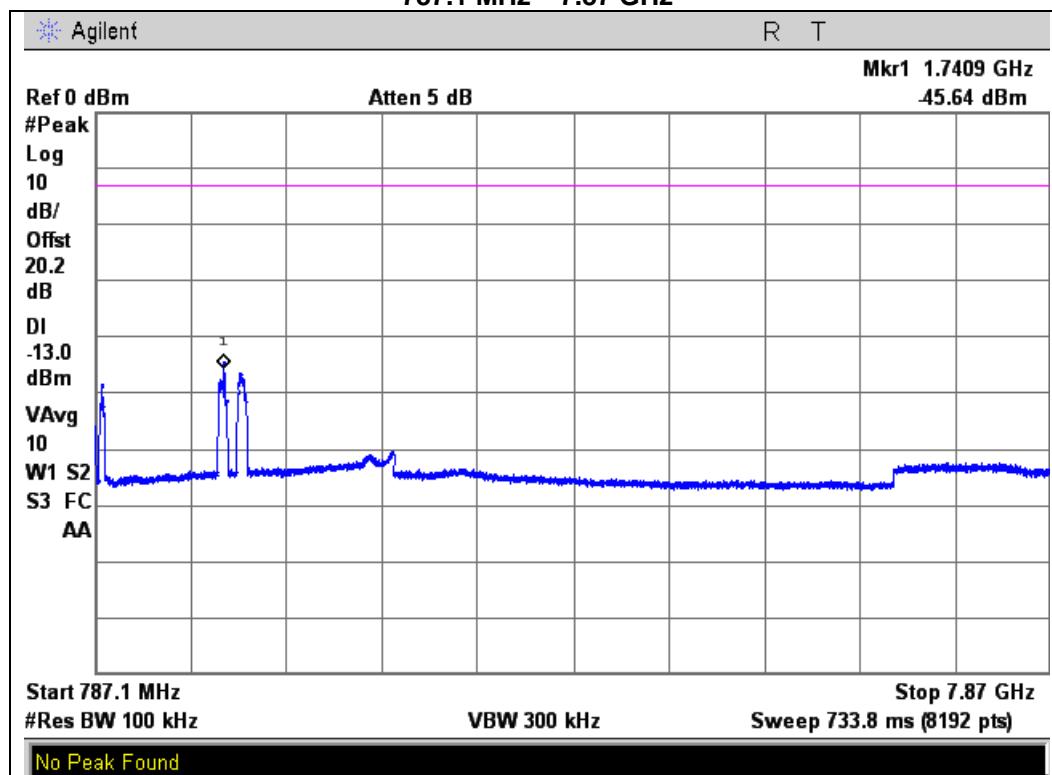




777 - 787 MHz Band
30MHz – 775.9 MHz

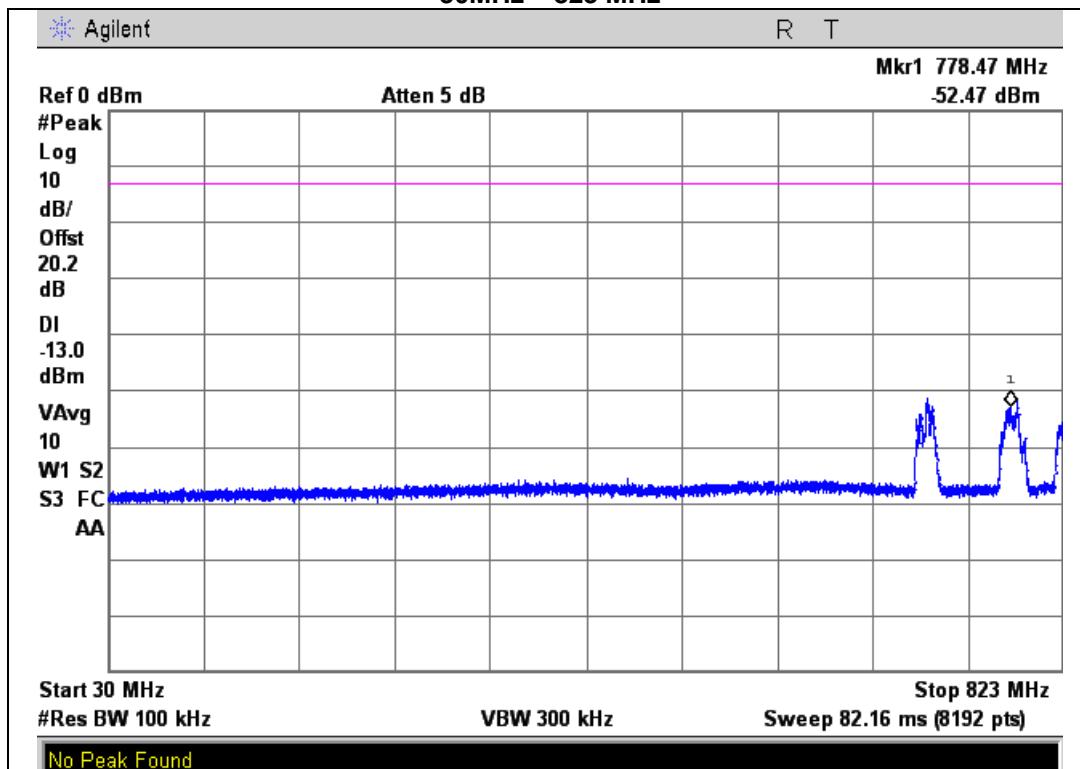


777 - 787 MHz Band
787.1 MHz – 7.87 GHz

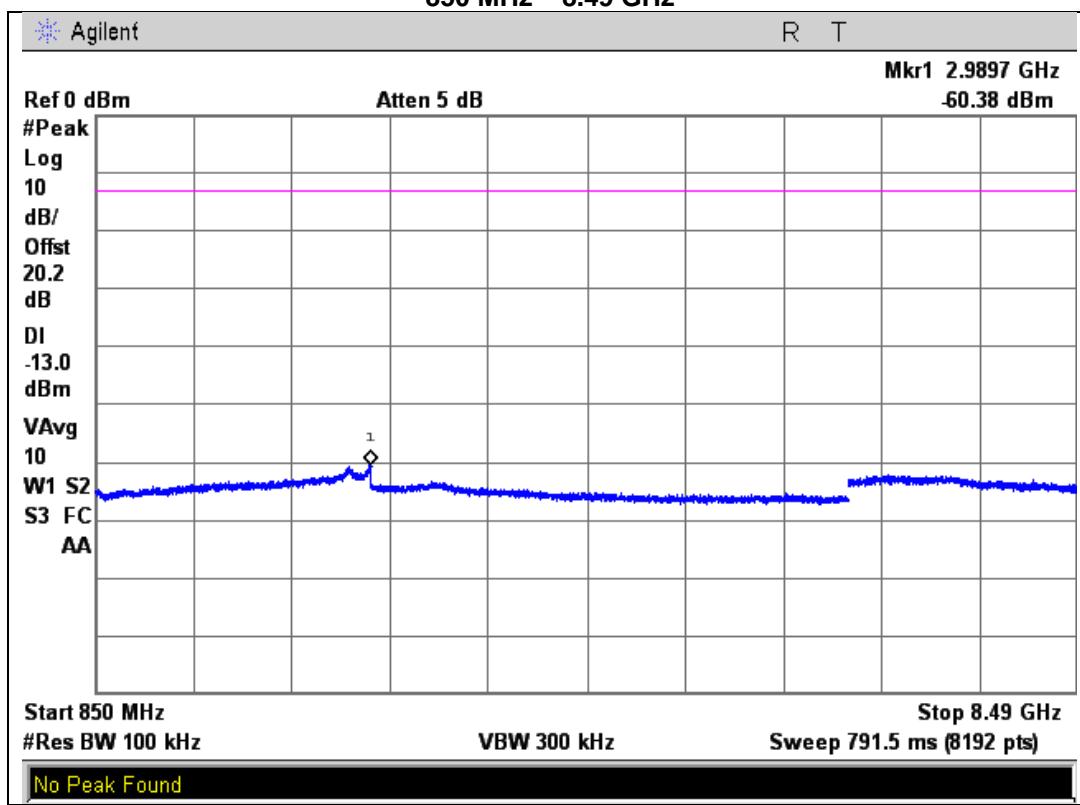




824 - 849 MHz Band
30MHz – 823 MHz

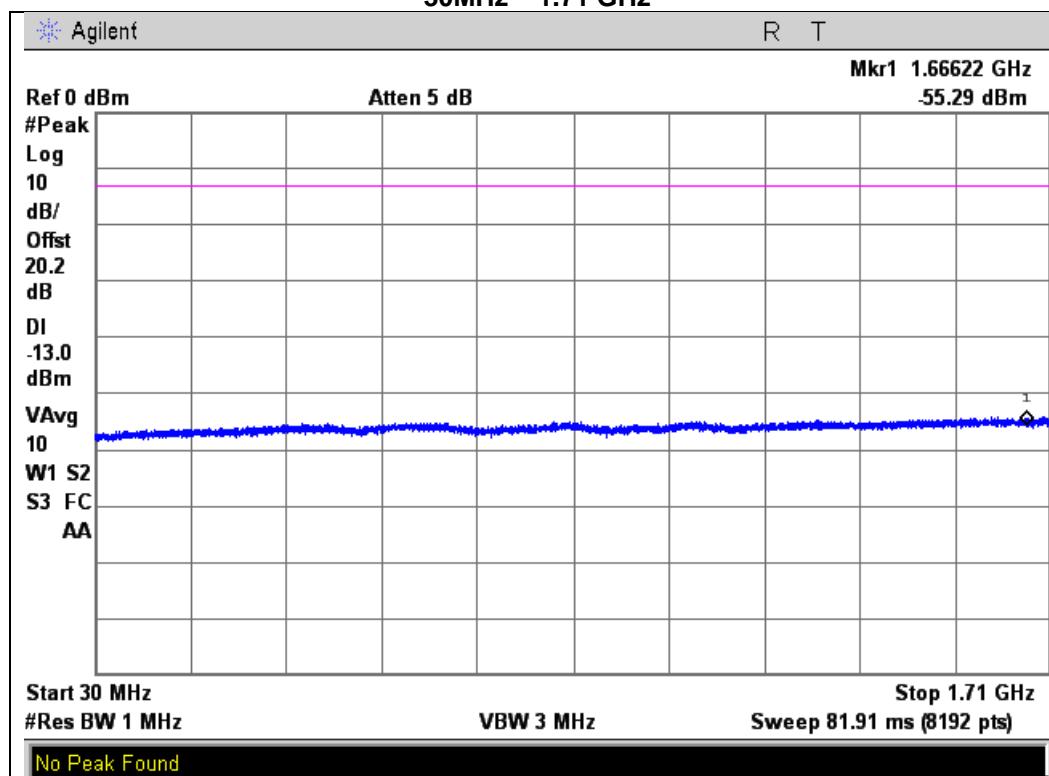


824 - 849 MHz Band
850 MHz – 8.49 GHz

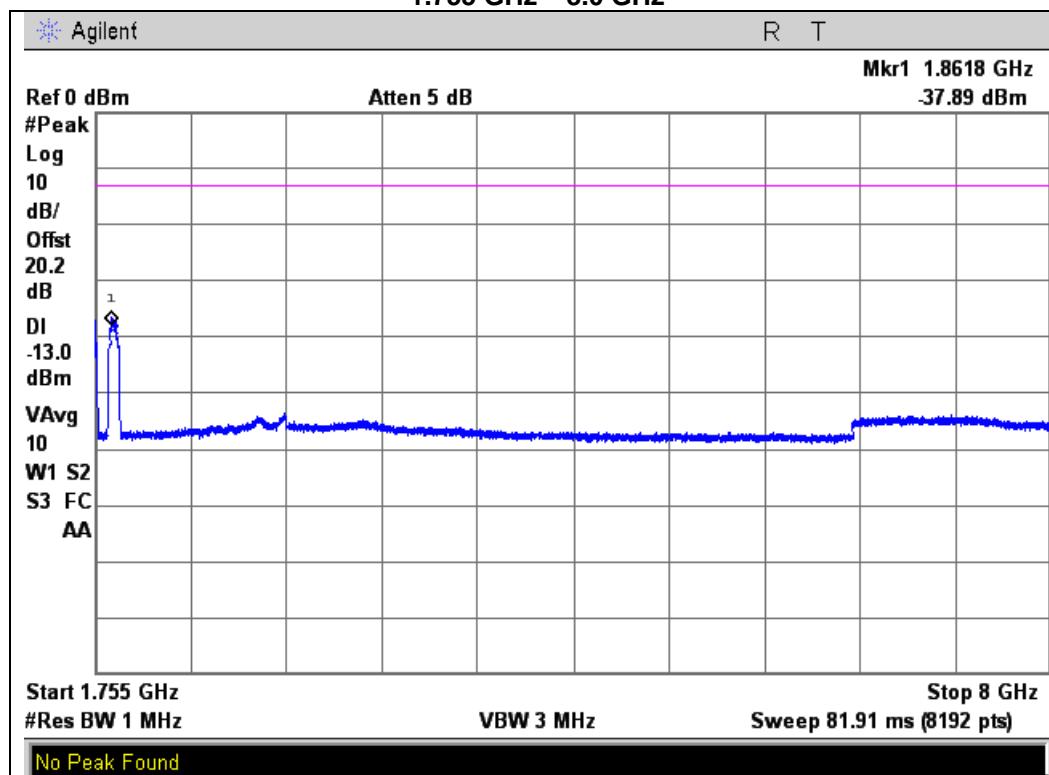




1710 - 1755 MHz Band
30MHz – 1.71 GHz

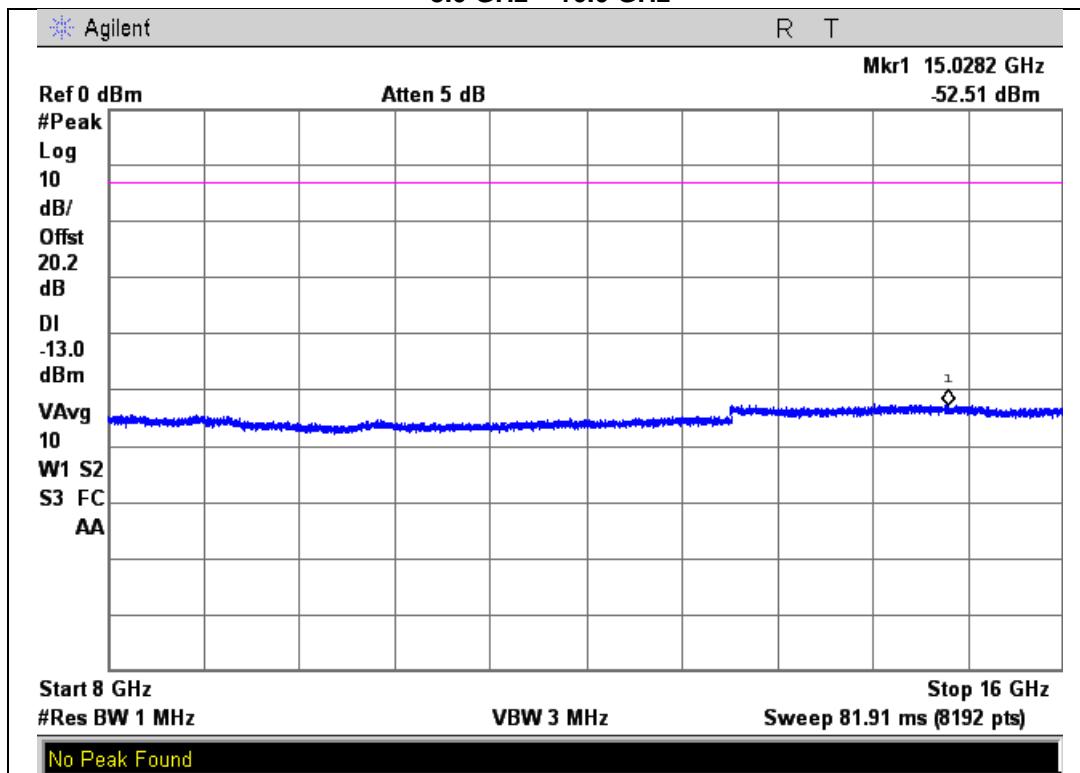


1710 - 1755 MHz Band
1.755 GHz – 8.0 GHz

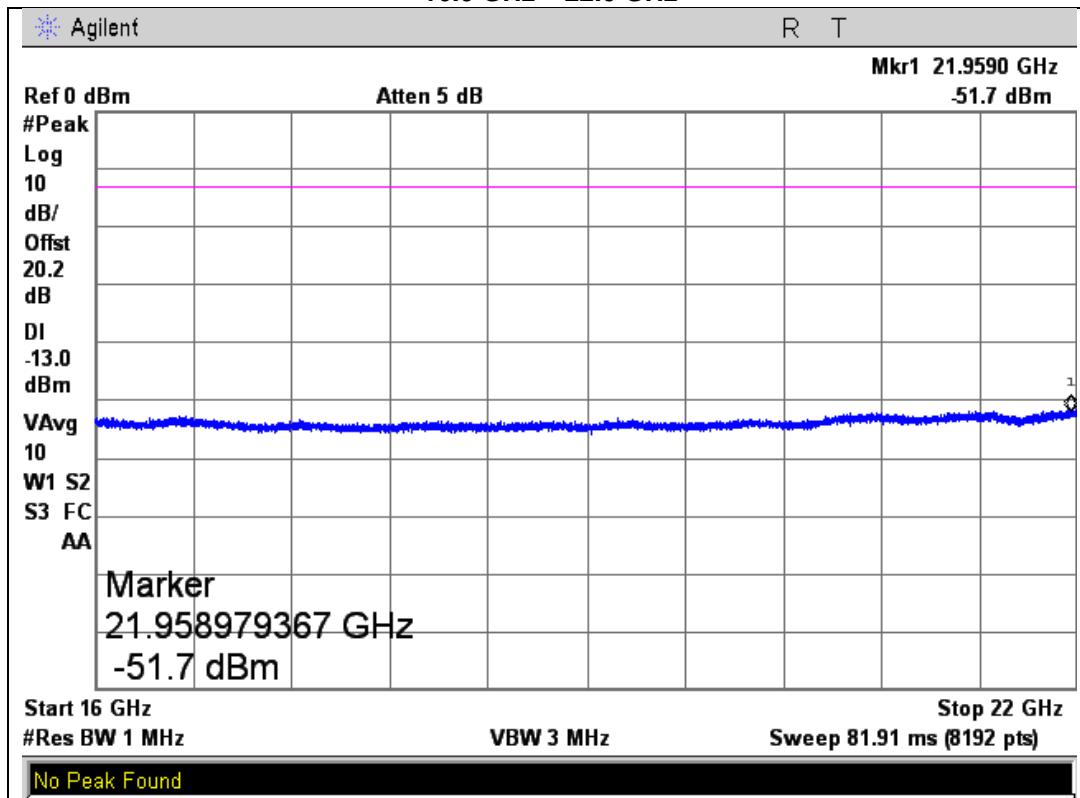




1710 - 1755 MHz Band
8.0 GHz – 16.0 GHz

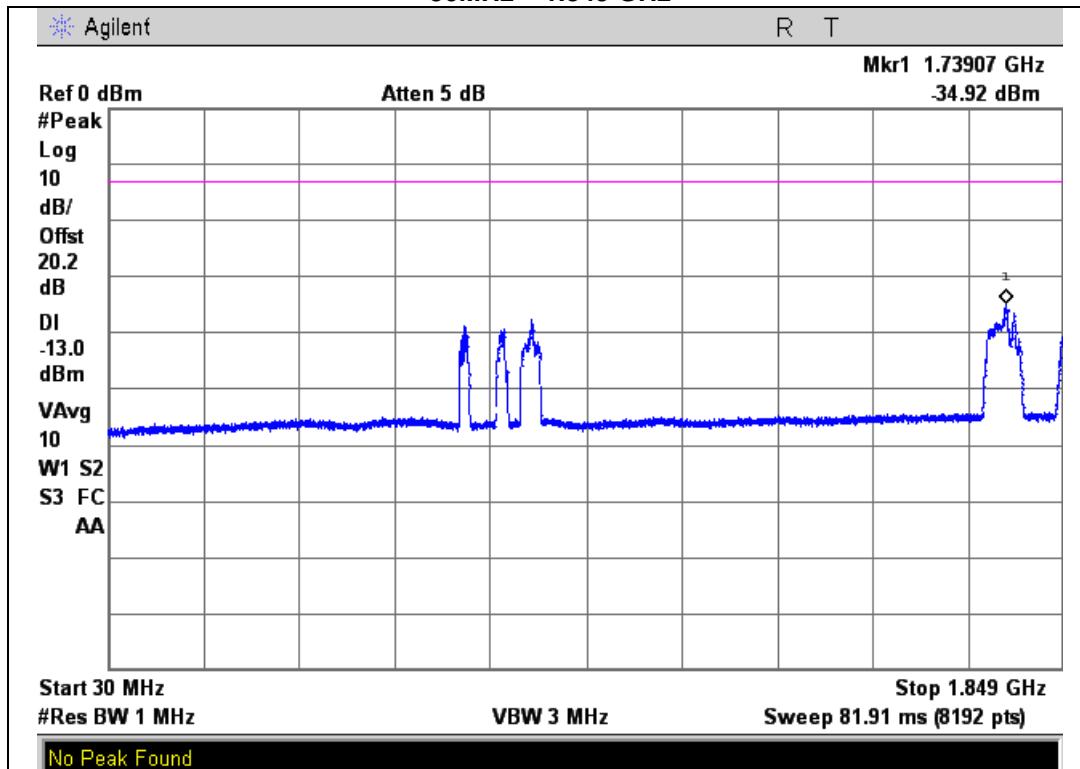


1710 - 1755 MHz Band
16.0 GHz – 22.0 GHz

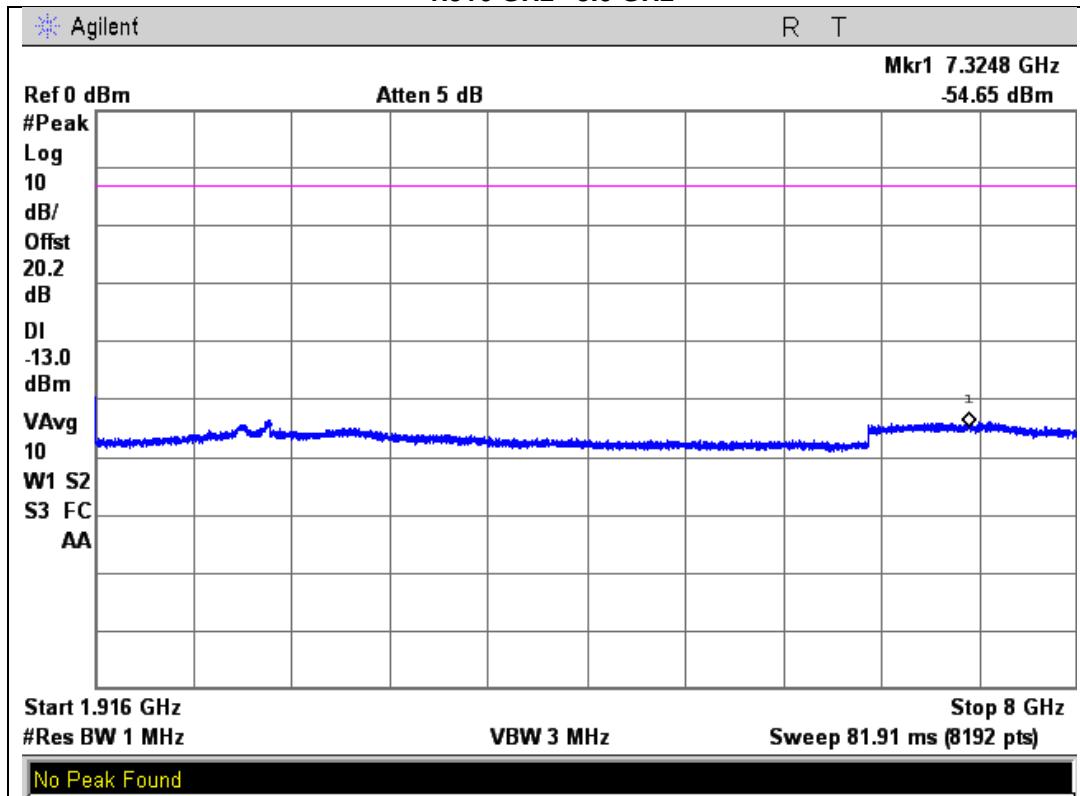




1850 – 1915 MHz Band
30MHz – 1.849 GHz

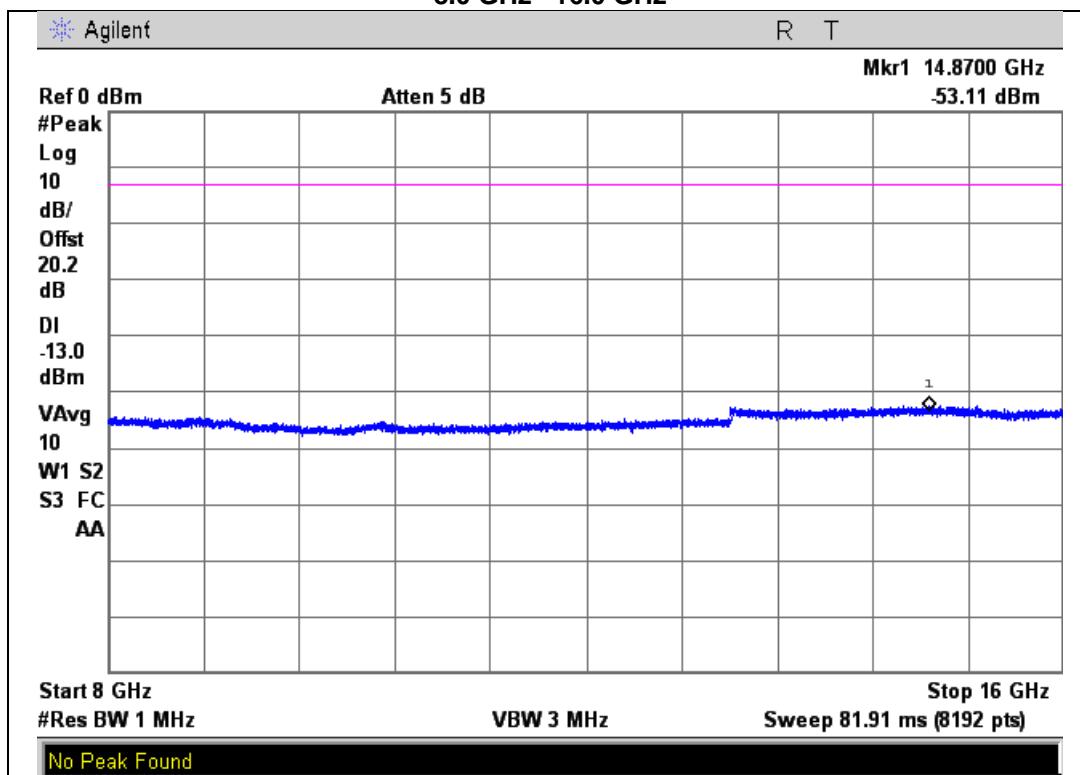


1850 – 1915 MHz Band
1.916 GHz – 8.0 GHz

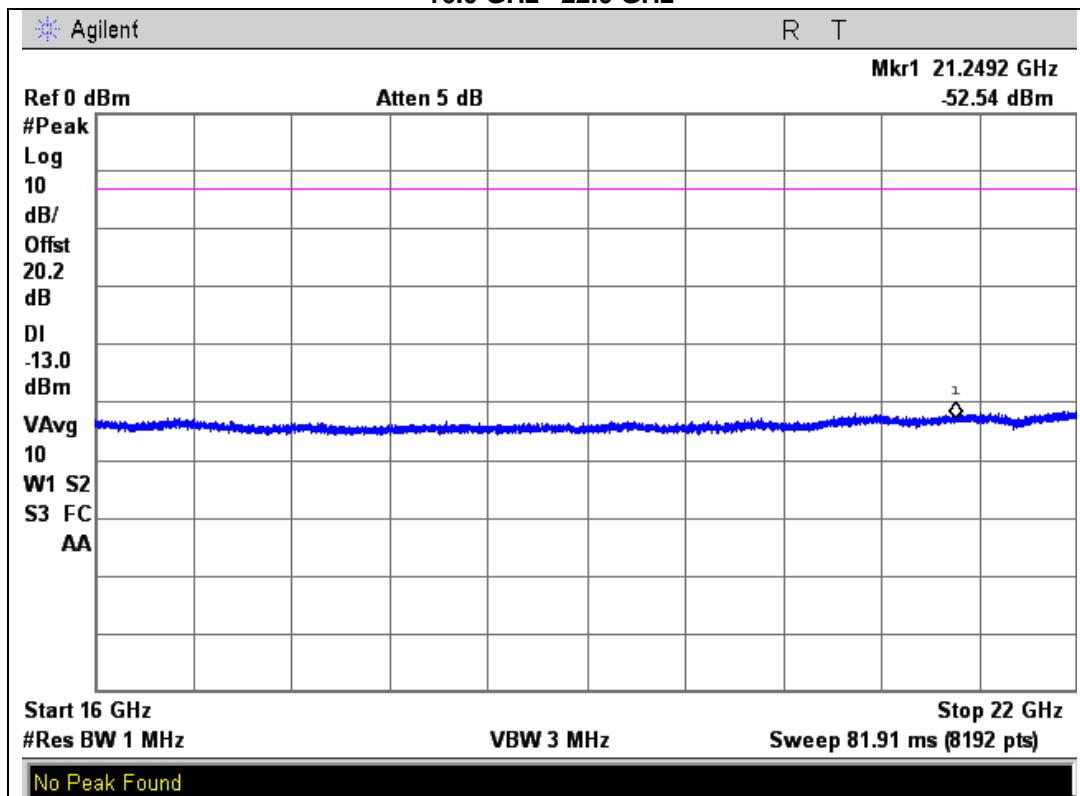




1850 – 1915 MHz Band
8.0 GHz – 16.0 GHz



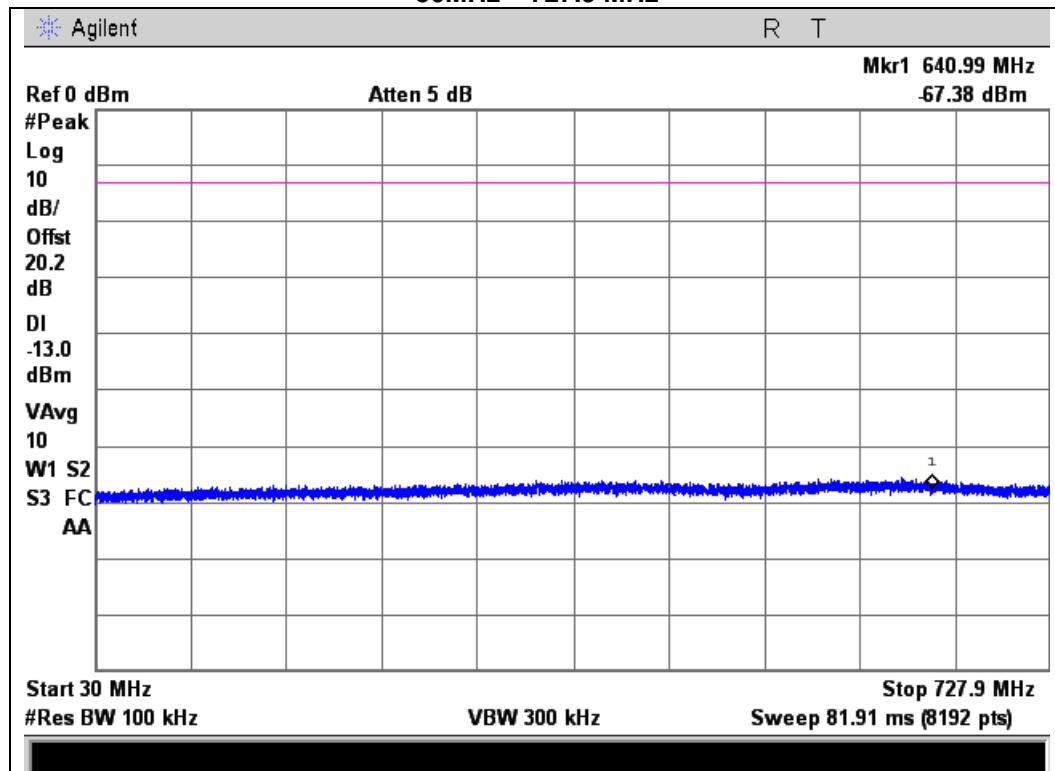
1850 – 1915 MHz Band
16.0 GHz – 22.0 GHz



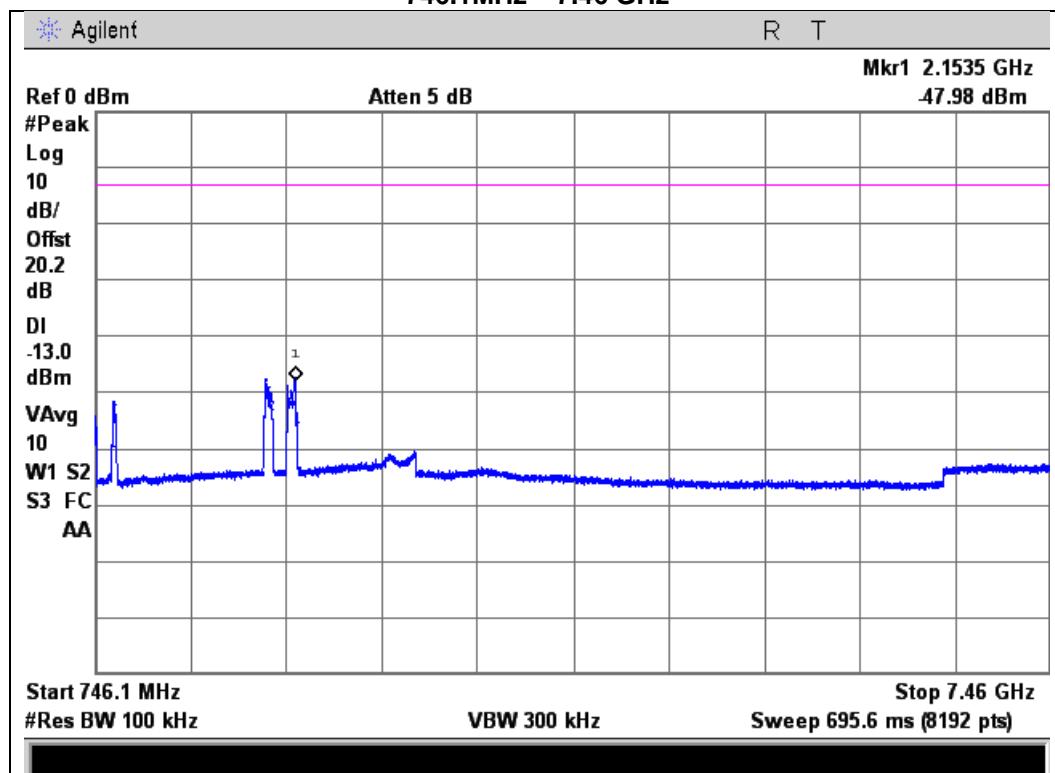


Downlink Test Plots

734 - 746 MHz Band
30MHz – 727.9 MHz

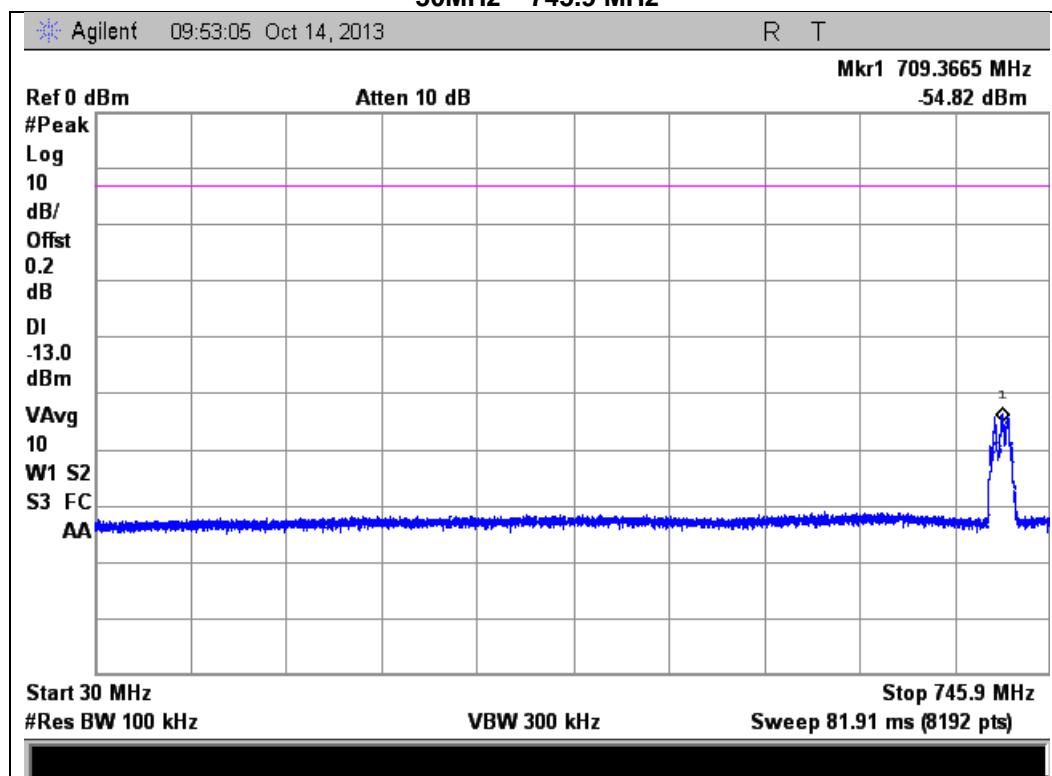


734 - 746 MHz Band
746.1MHz – 7.46 GHz

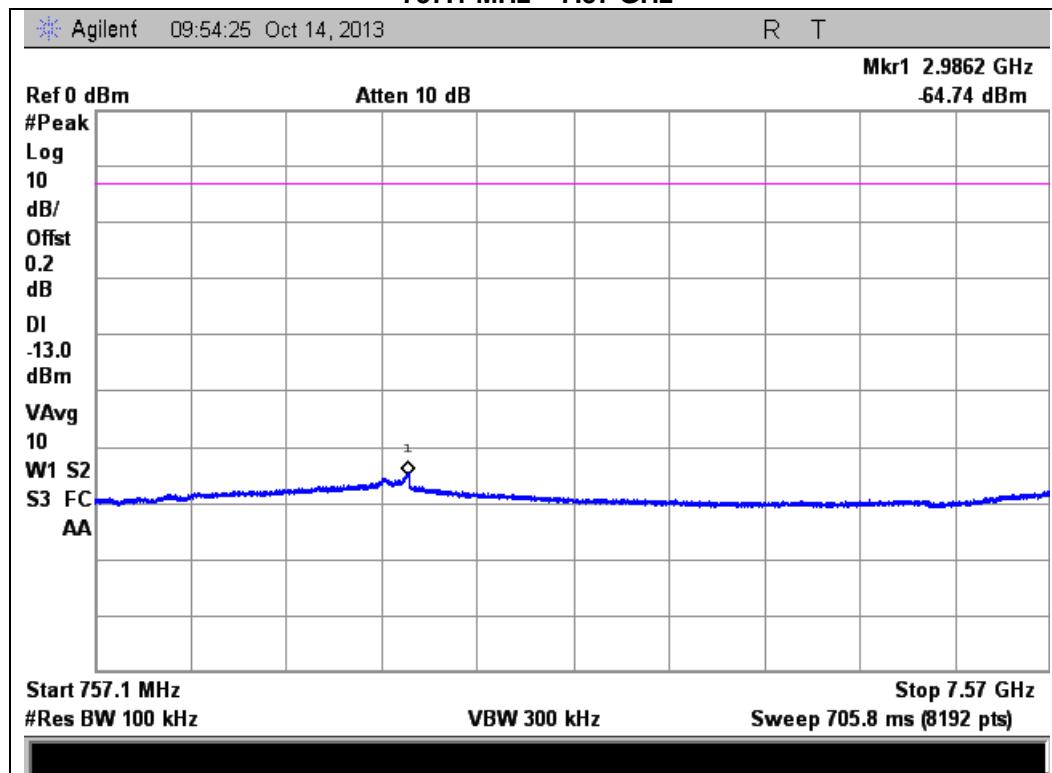




746 - 756 MHz Band
30MHz – 745.9 MHz

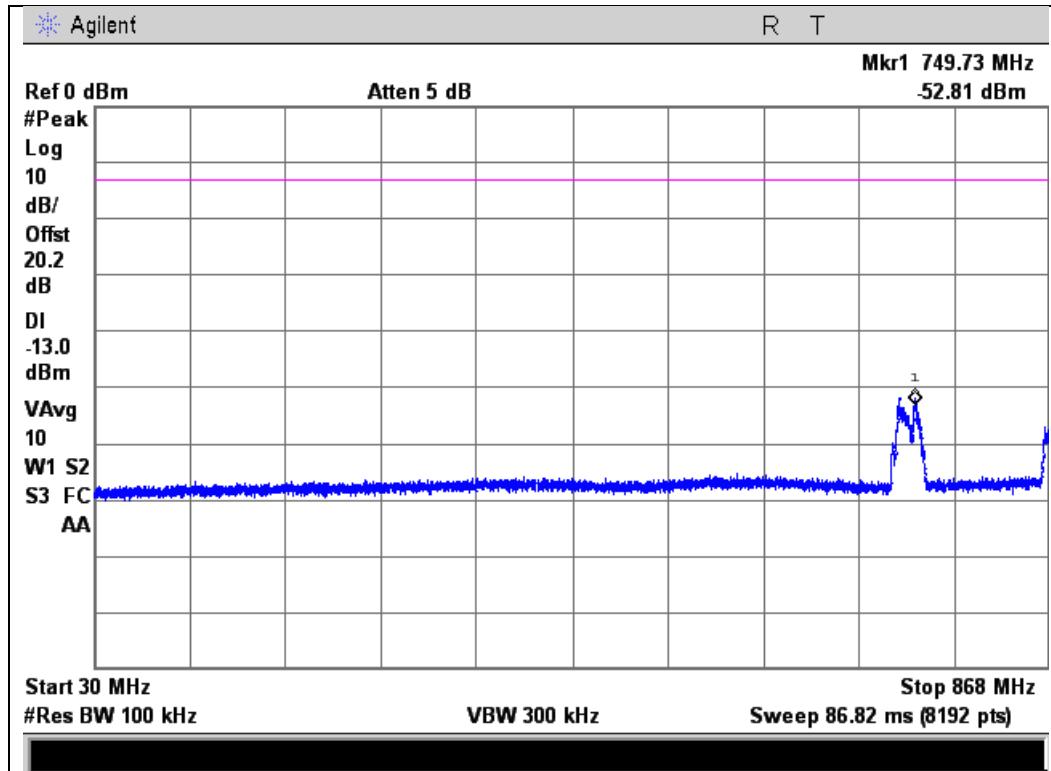


746 - 756 MHz Band
757.1 MHz – 7.57 GHz

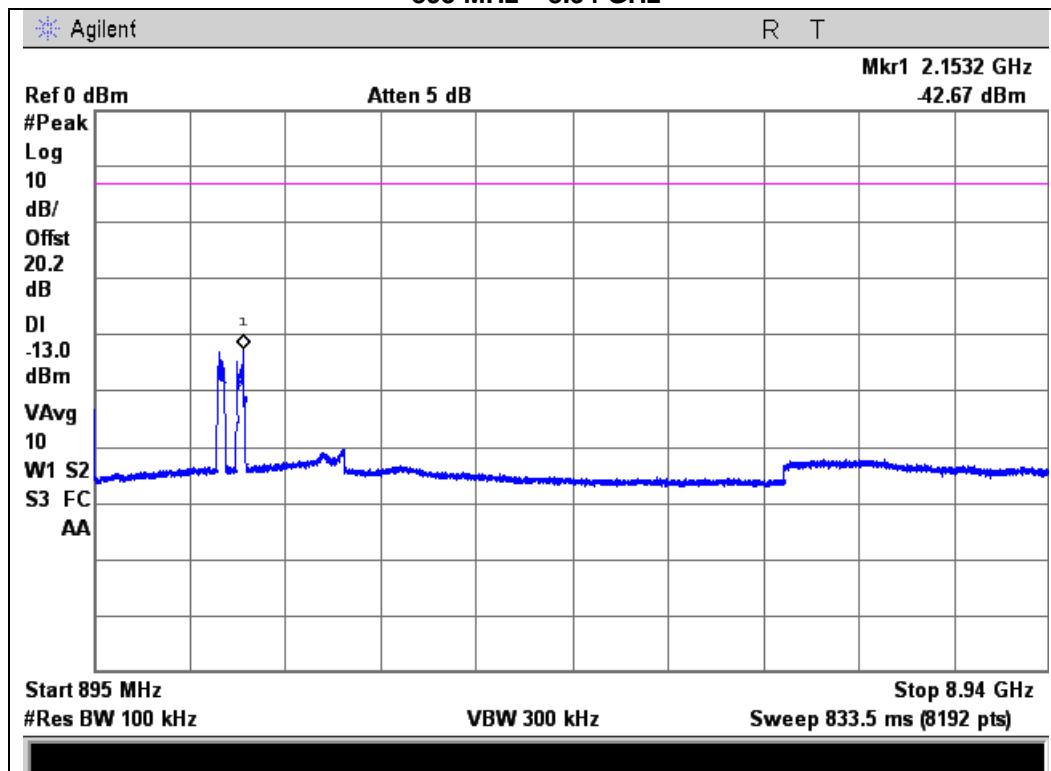




869 - 894 MHz Band
30MHz – 868 MHz

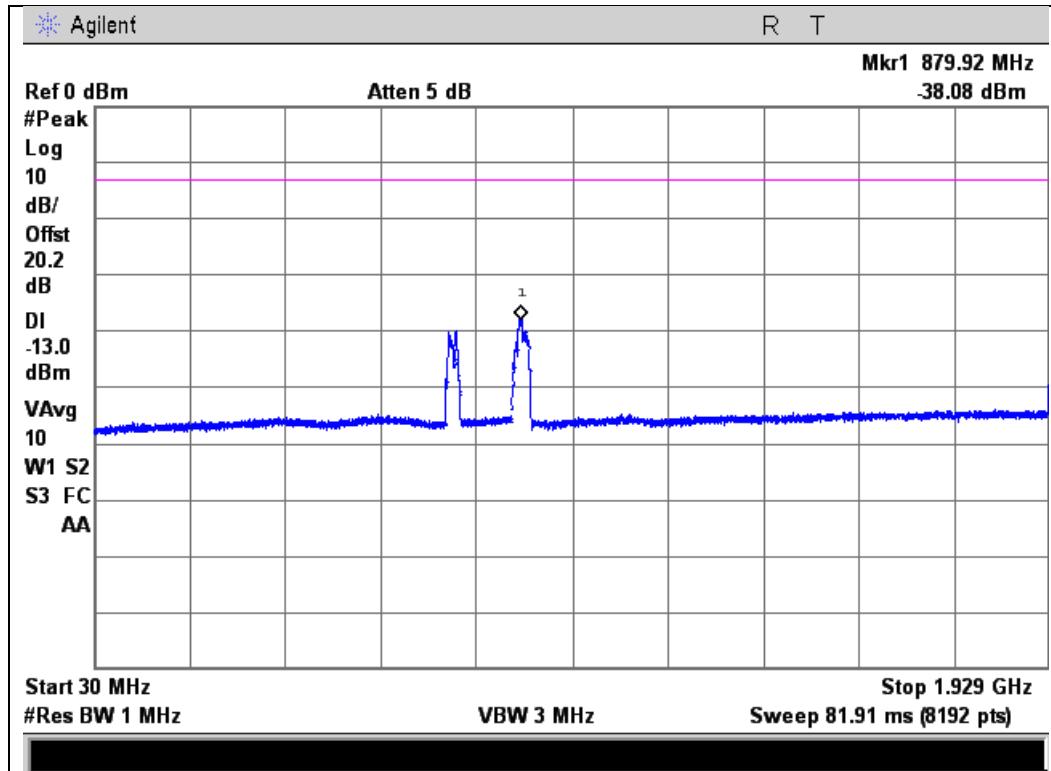


869 - 894 MHz Band
895 MHz – 8.94 GHz

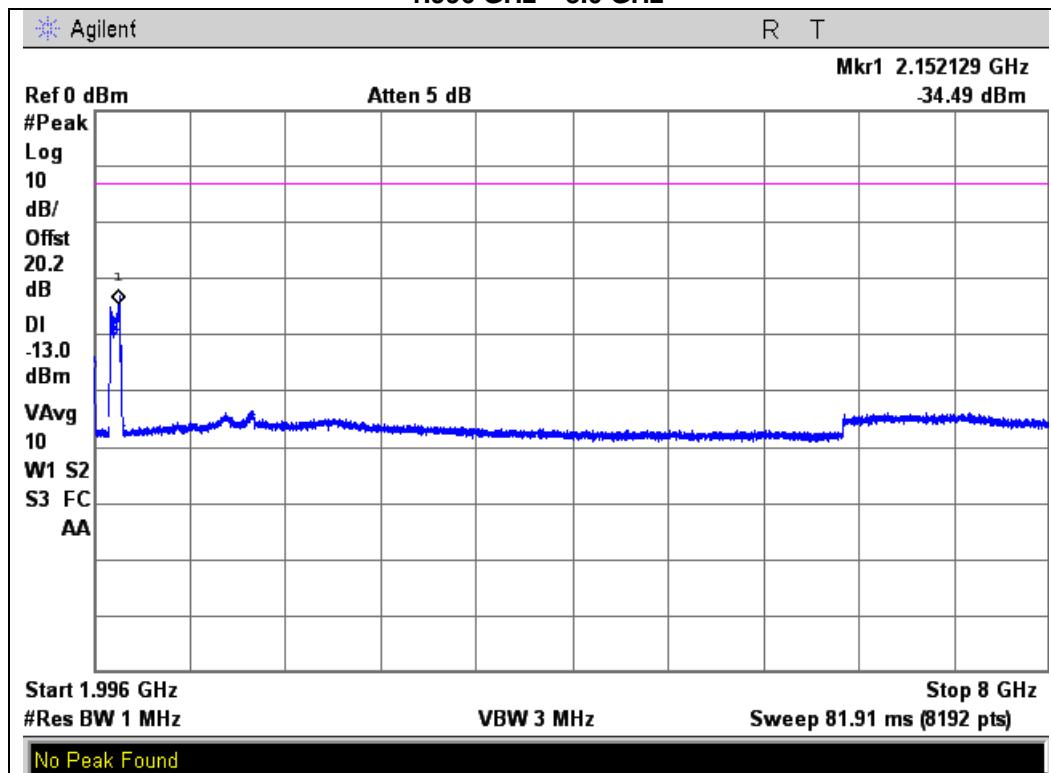




1930 - 1995 MHz Band
30MHz – 1.929 GHz

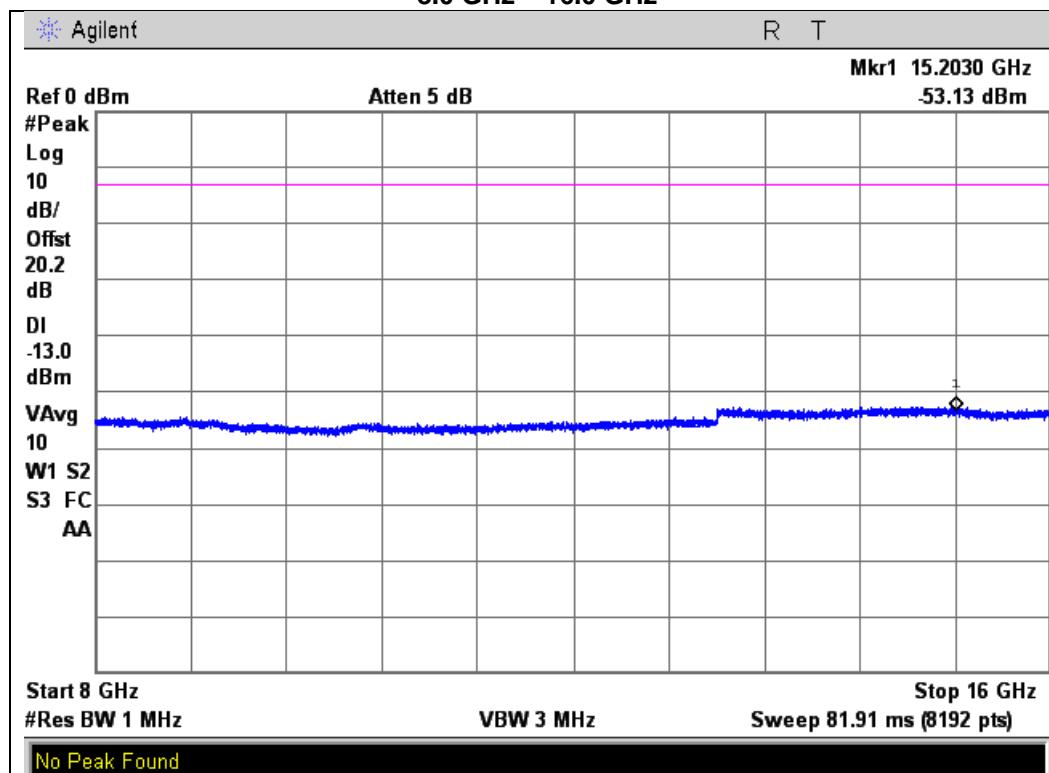


1930 - 1995 MHz Band
1.996 GHz – 8.0 GHz

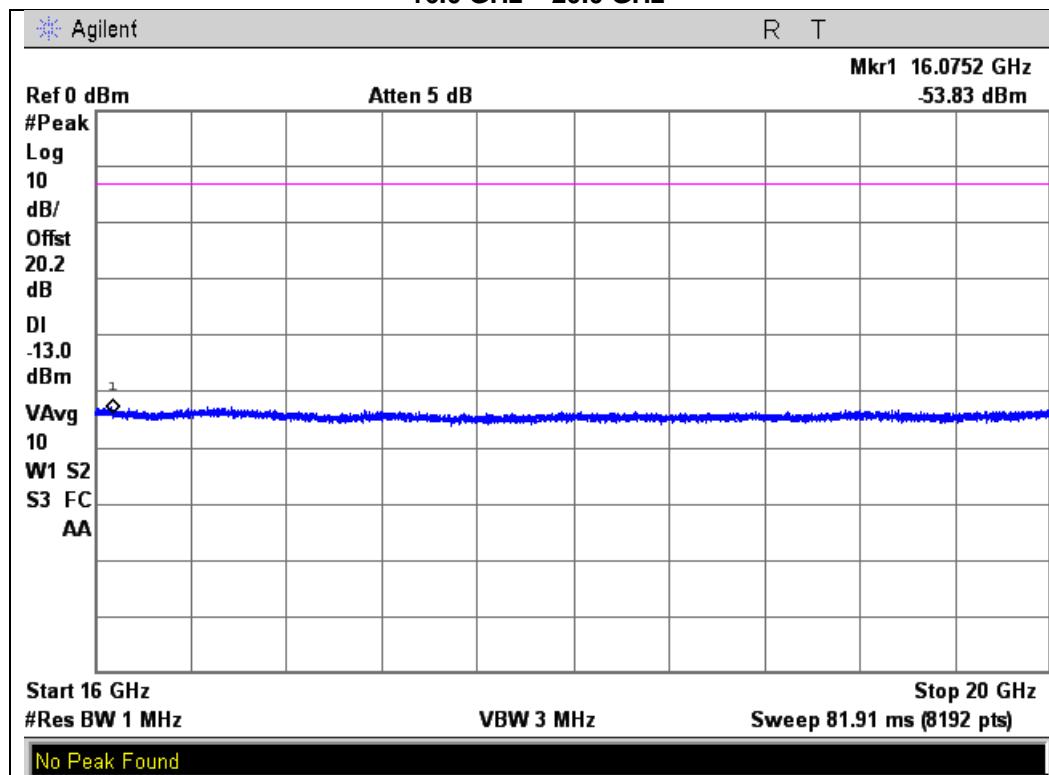




1930 - 1995 MHz Band
8.0 GHz – 16.0 GHz

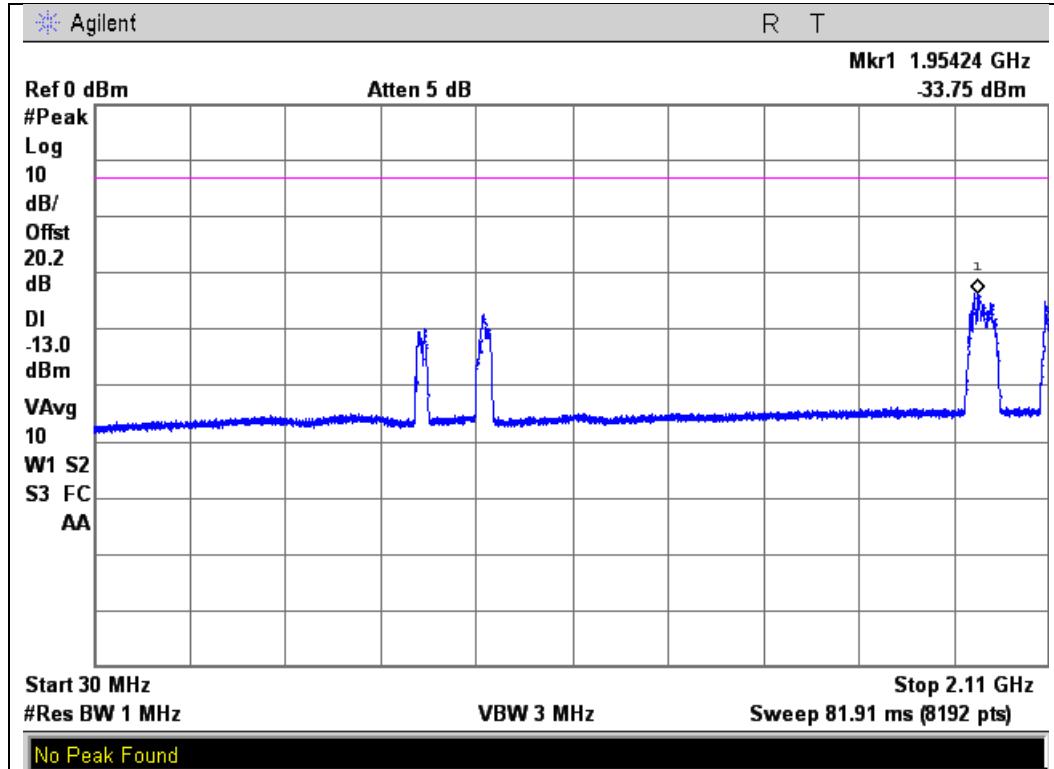


1930 - 1995 MHz Band
16.0 GHz – 20.0 GHz

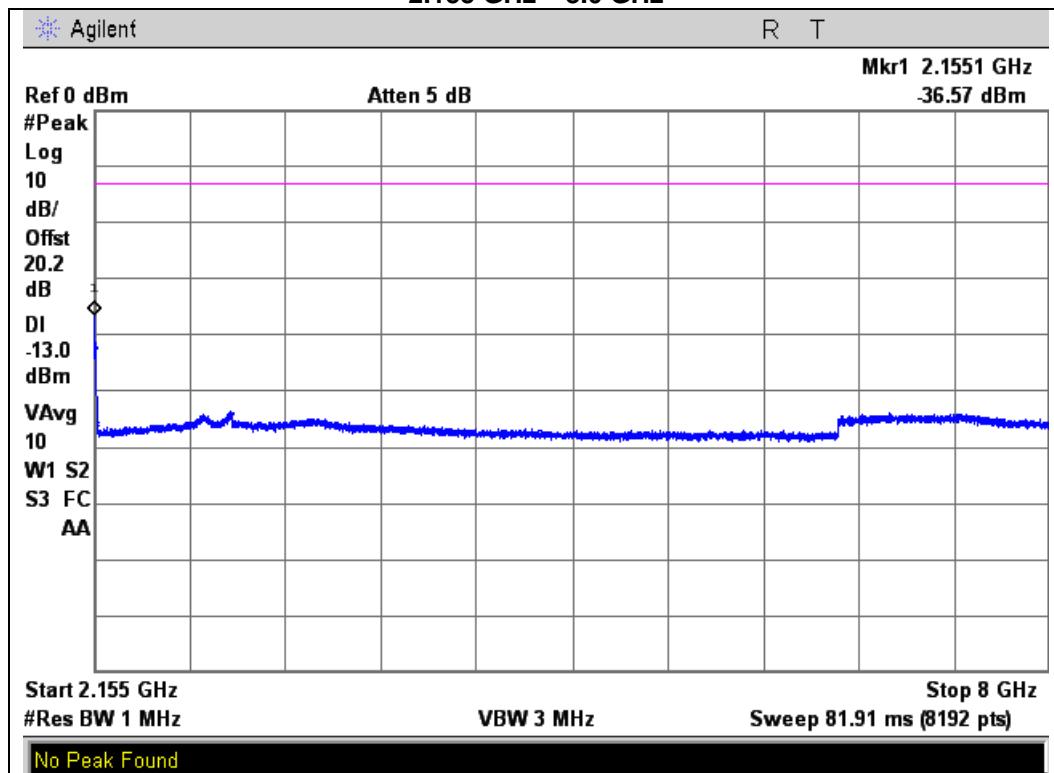




2110 - 2155 MHz Band
30MHz – 2.11 GHz

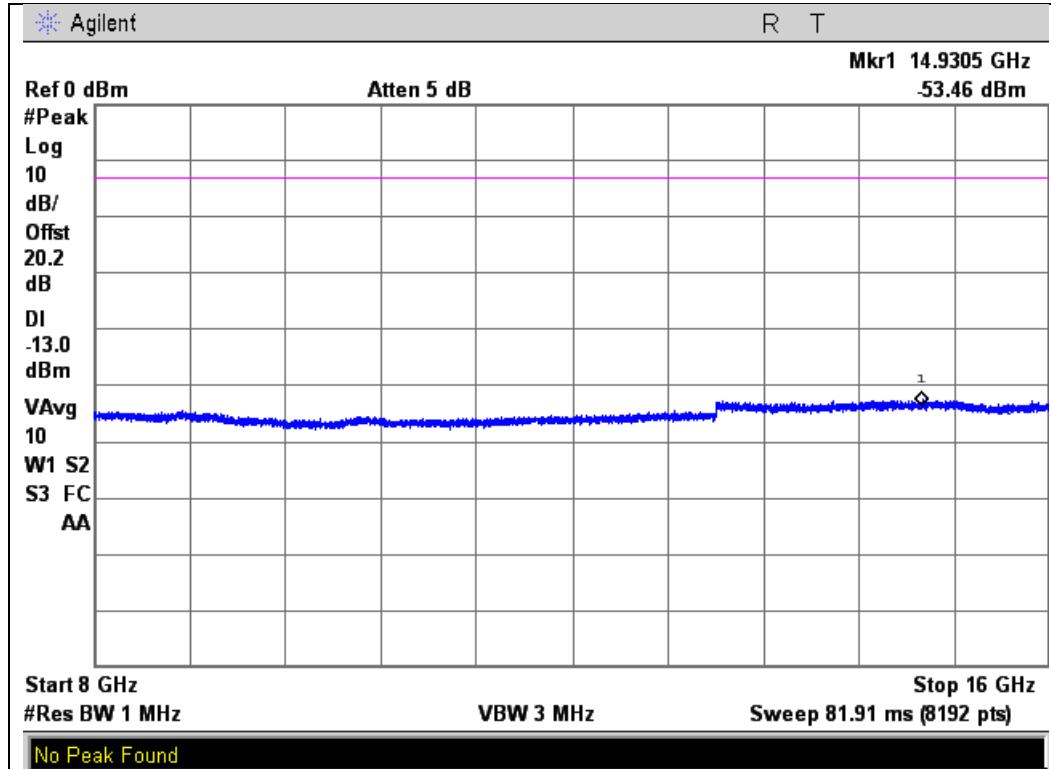


2110 - 2155 MHz Band
2.155 GHz – 8.0 GHz

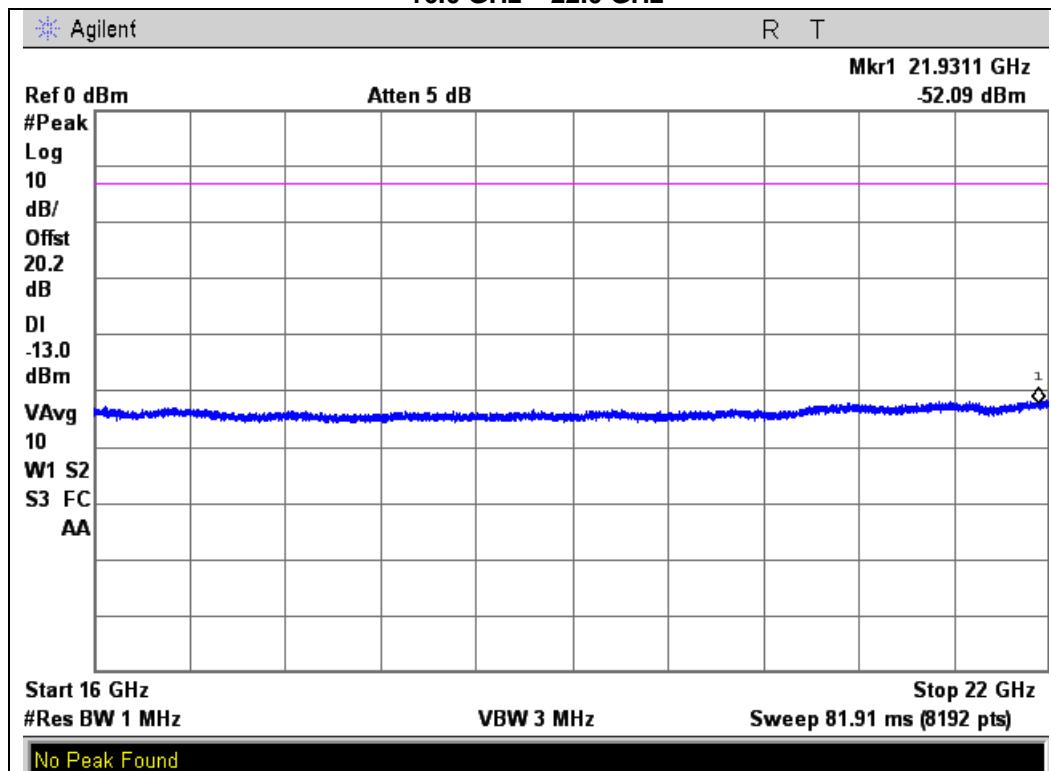




2110 - 2155 MHz Band
8.0 GHz – 16.0 GHz



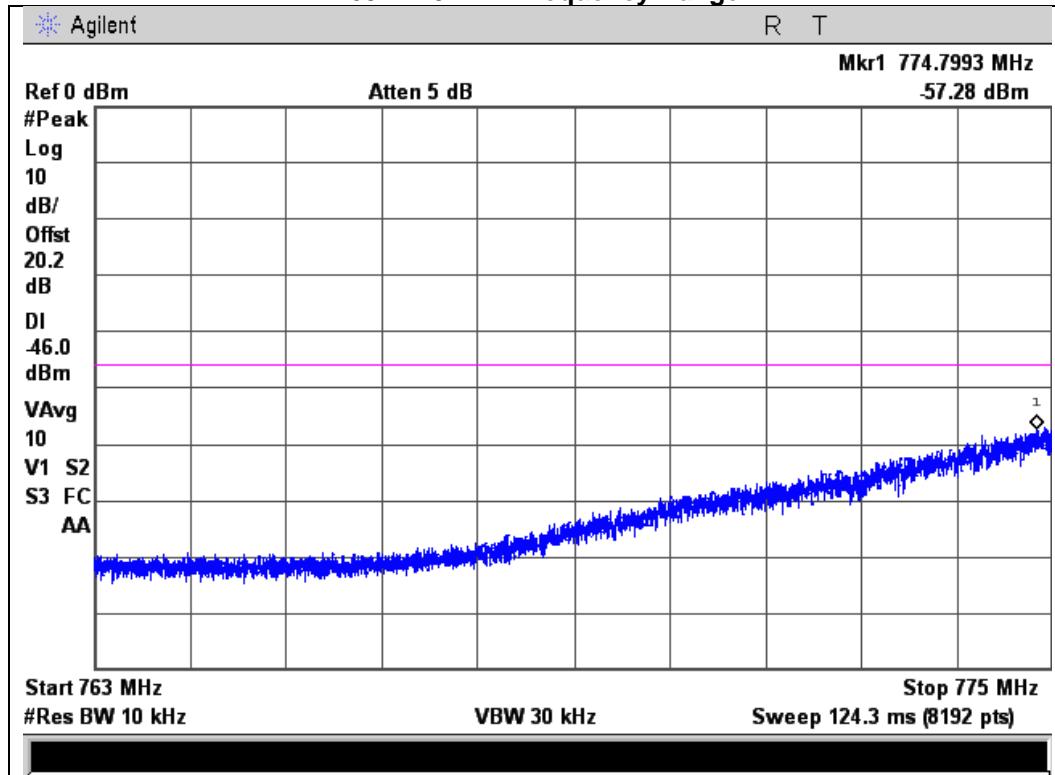
2110 - 2155 MHz Band
16.0 GHz – 22.0 GHz



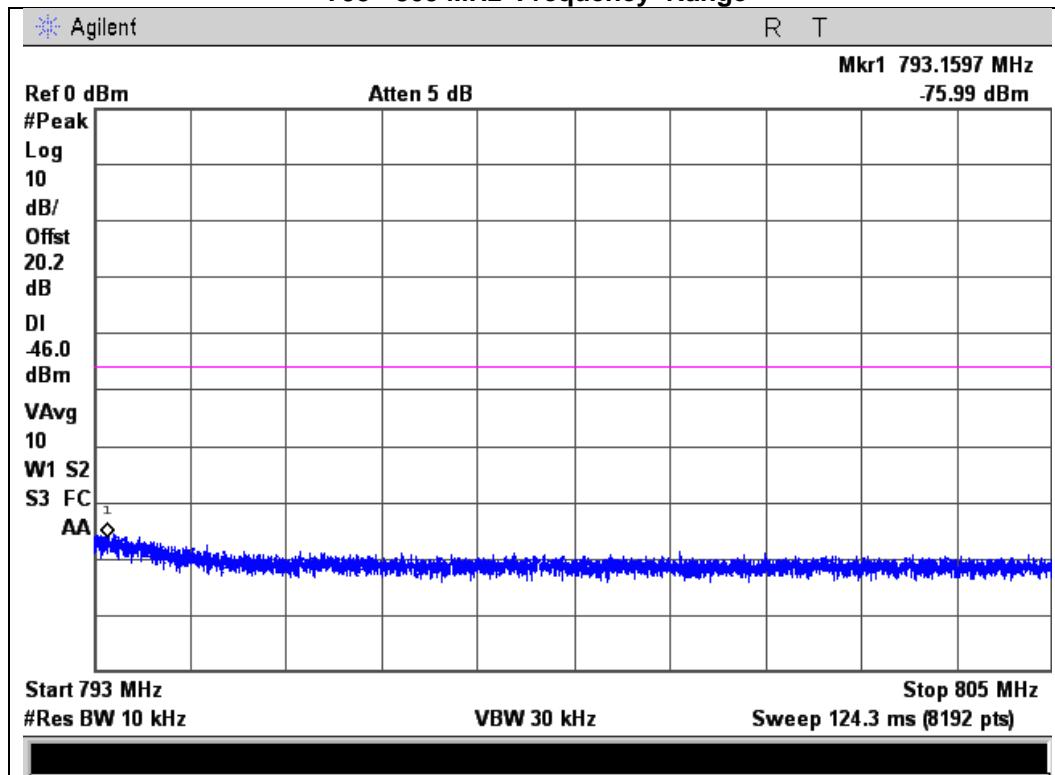


776 – 787 MHz Uplink Test Plots for the

763 - 775 MHz Frequency Range



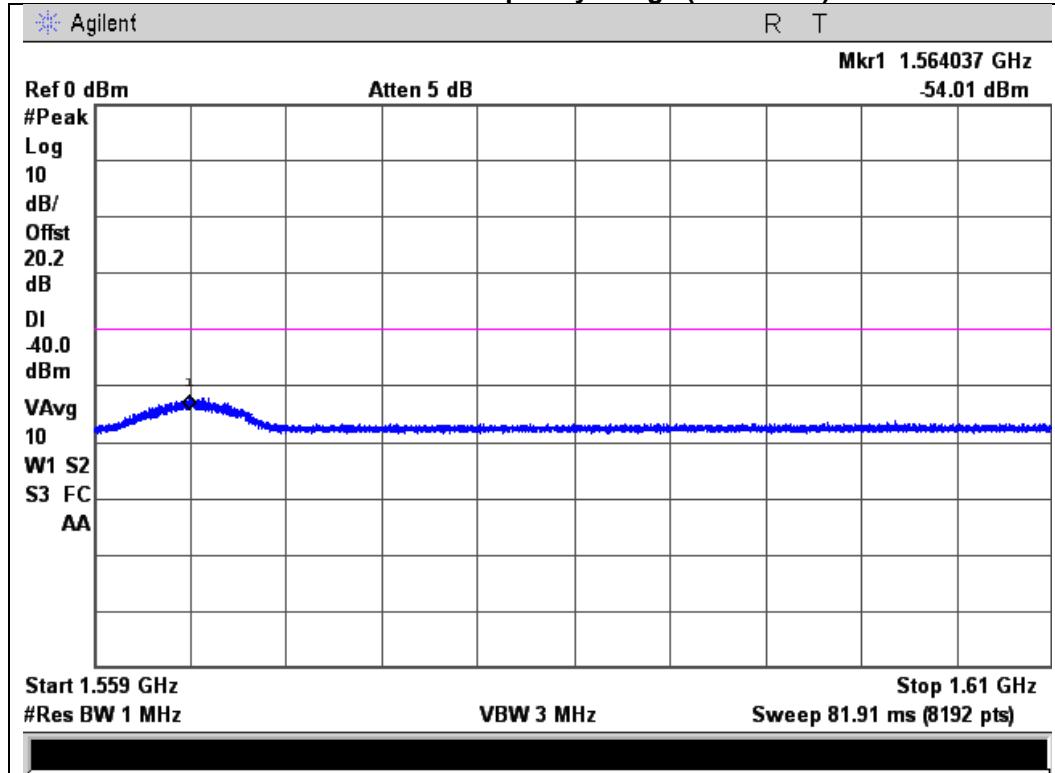
793 - 805 MHz Frequency Range



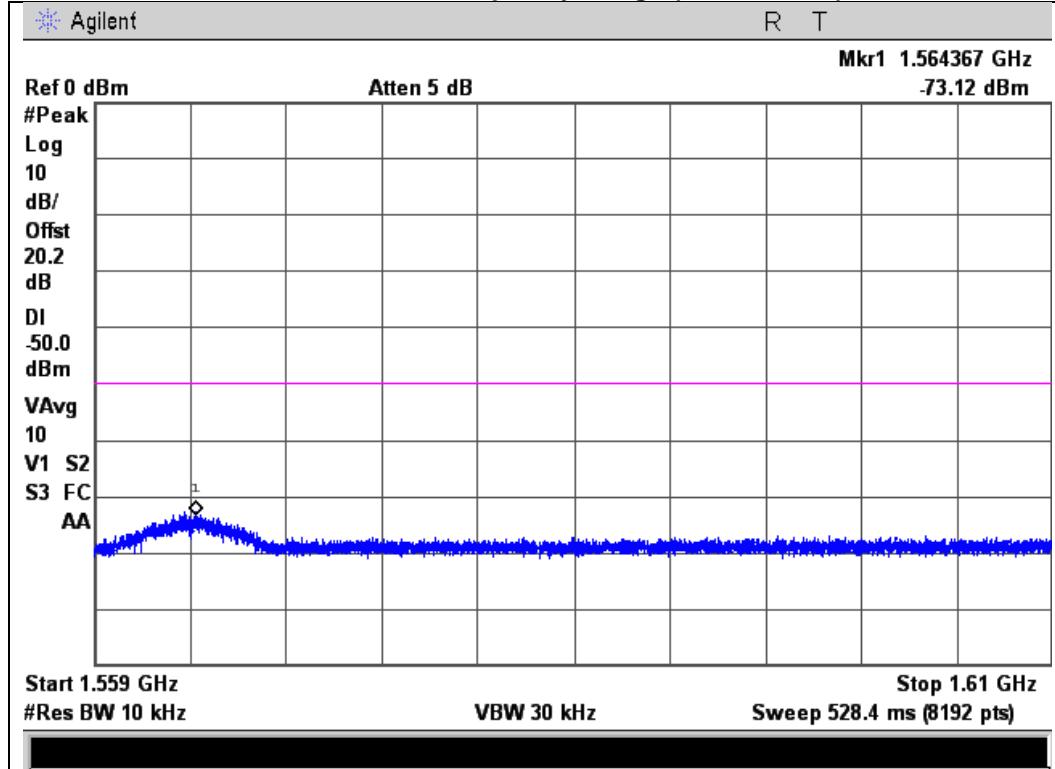


776 – 787 MHz Uplink Test Plots for the

1559 - 1610 MHz Frequency Range (Wideband)



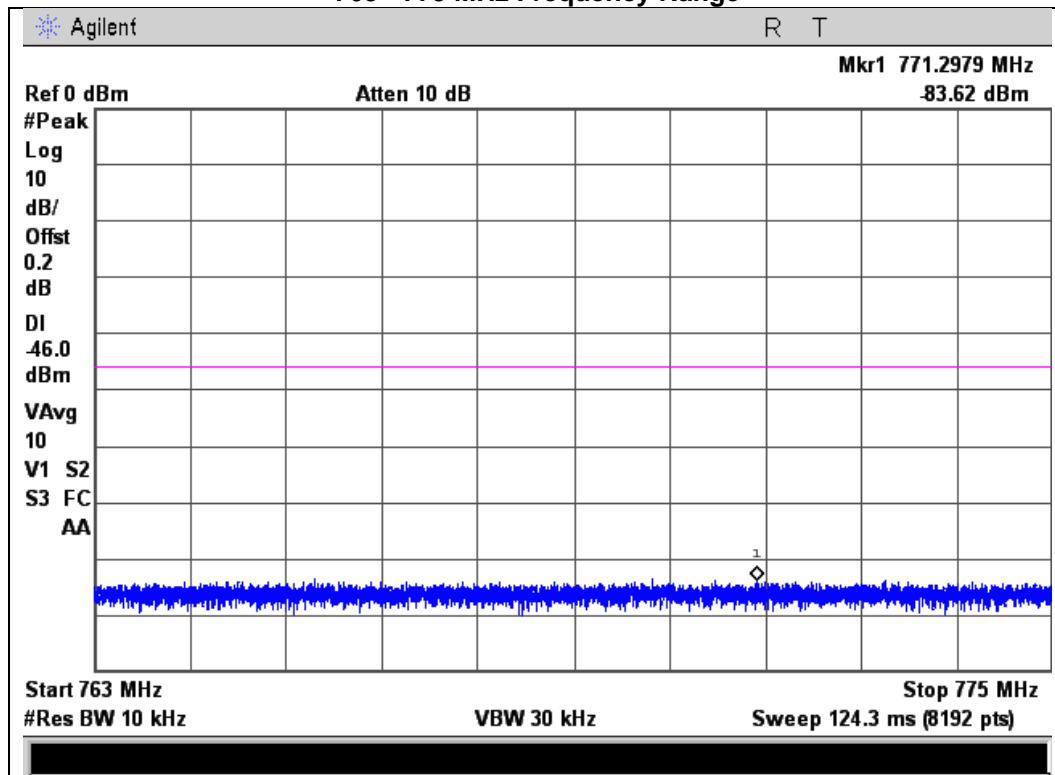
1559 - 1610 MHz Frequency Range (Narrowband)



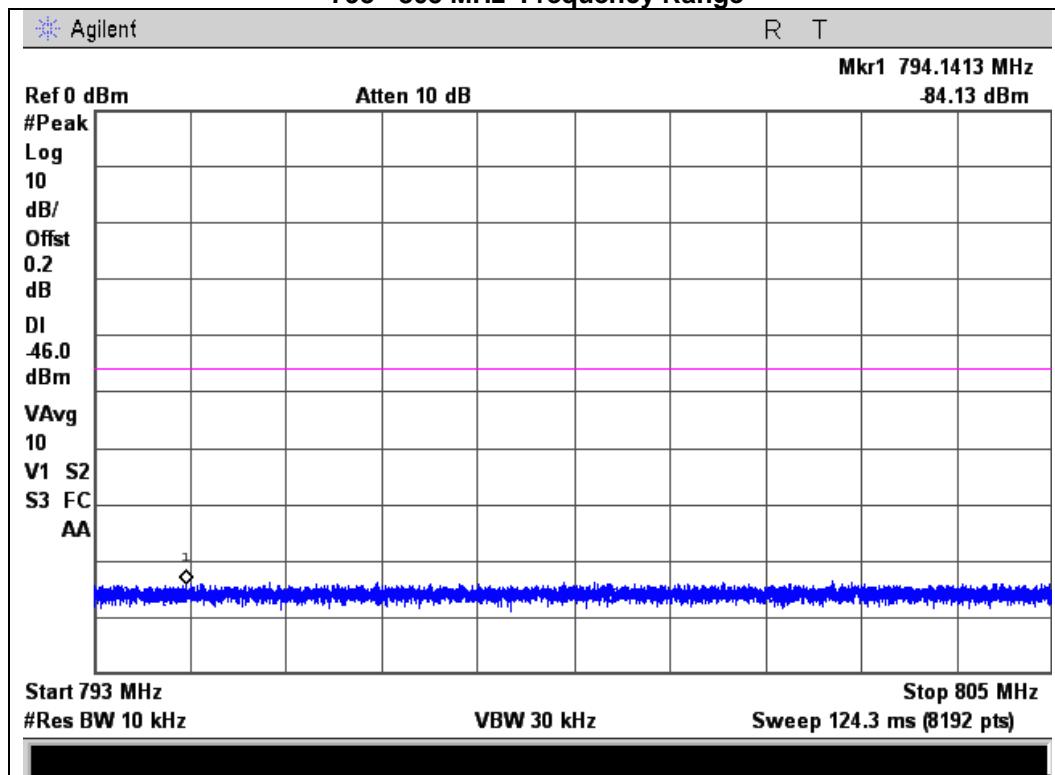


746 – 757 MHz Downlink Test Plots for the

763 - 775 MHz Frequency Range



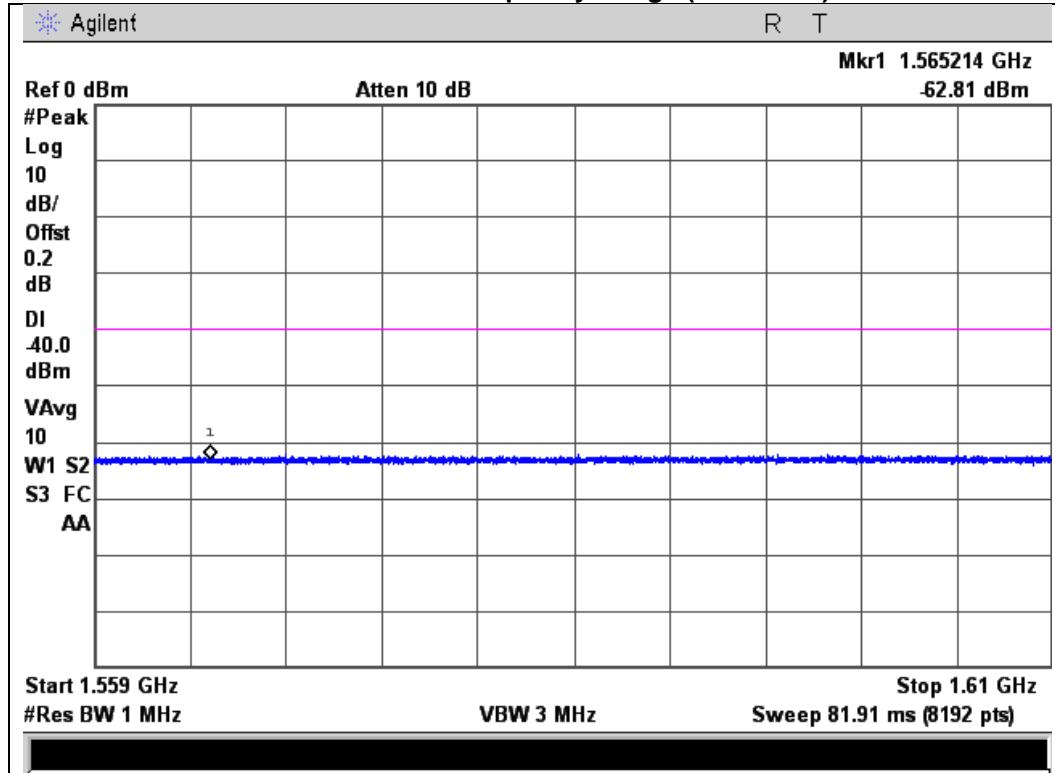
793 - 805 MHz Frequency Range



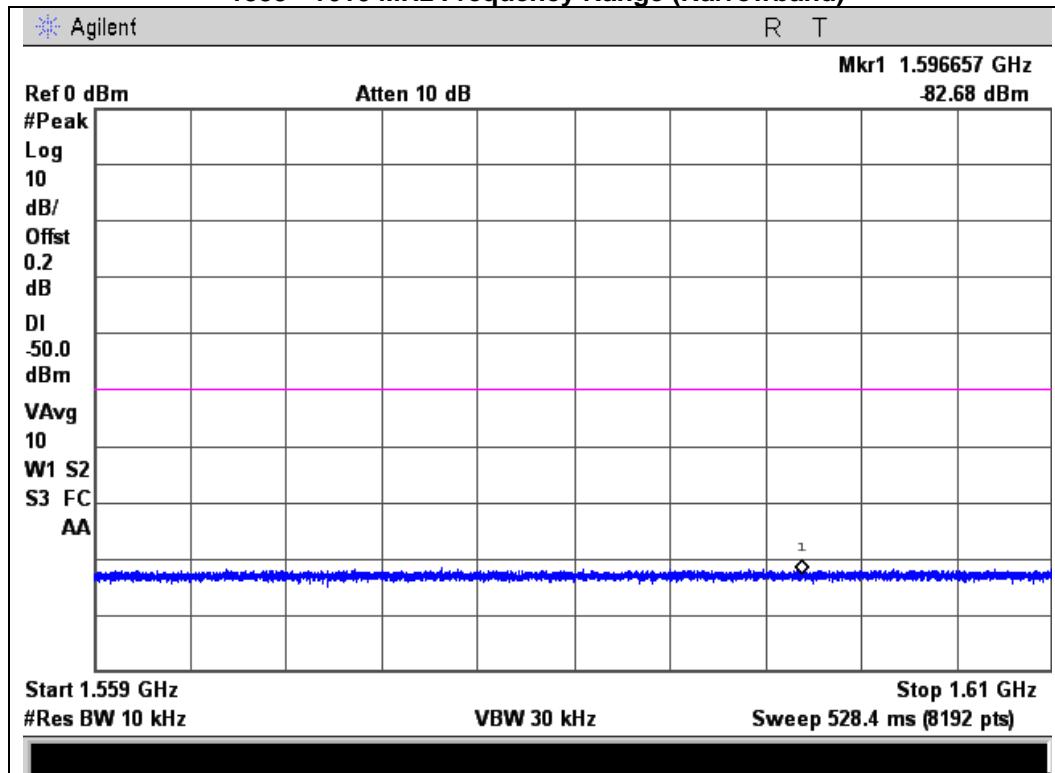


746 – 757 MHz Downlink Test Plots for the

1559 - 1610 MHz Frequency Range (Wideband)



1559 - 1610 MHz Frequency Range (Narrowband)





Noise Limits

Name of Test: Noise Limits
Test Equipment Utilized: i00331, i00405, i00412

Engineer: Mike Graffeo
Test Date: 9/27/13

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.

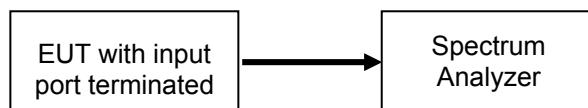
The following formulas are used for calculating the limits. Note – Downlink noise is calculated with the CF of the associated uplink band.

Noise Power =-102.5+LOG10(Band Center Frequency)*20

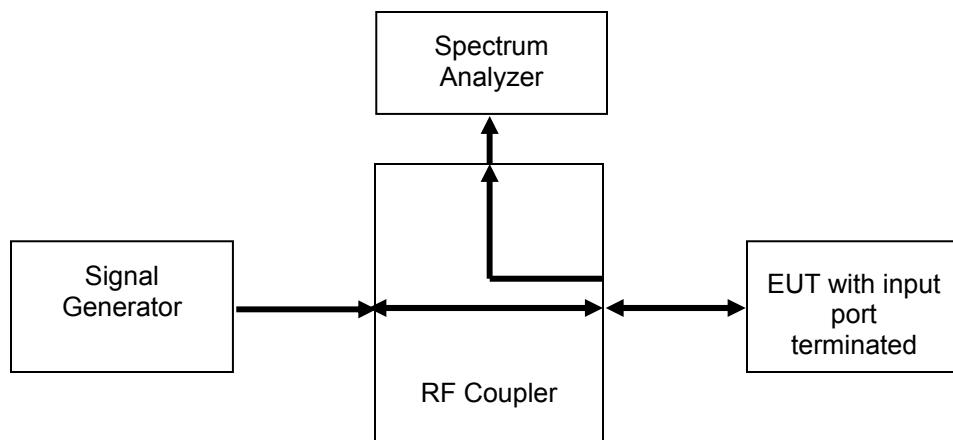
Variable Noise =-103 dBm/MHz-RSSI

Test Setup

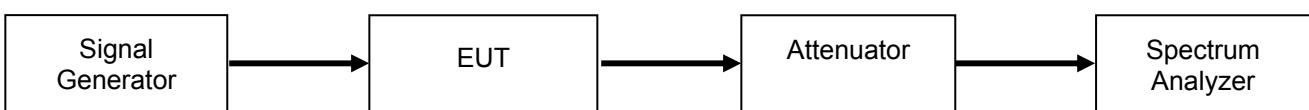
Maximum Noise Limit



Variable Uplink Noise Power and Timing



Variable Downlink Noise Power





Maximum Uplink Noise Limit Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
704 - 716	-45.86	-45.5	-0.4	Pass
777 - 787	-46.22	-44.6	-1.6	Pass
824 - 849	-45.73	-44.1	-1.7	Pass
1710 - 1755	-42.23	-37.7	-4.5	Pass
1850 - 1915	-41.97	-37.0	-5.0	Pass

Maximum Downlink Noise Limit Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
734 - 746	-46.17	-45.5	-0.7	Pass
746 - 756	-50.92	-44.6	-6.3	Pass
869 - 894	-48.59	-44.1	-4.5	Pass
1930 - 1995	-39.75	-37.0	-2.7	Pass
2110 - 2155	-40.49	-37.7	-2.8	Pass

Uplink Noise Timing Test Results

Frequency Band (MHz)	Measured Timing (Seconds)	Limit (Seconds)	Result
704 - 716	1.10	3.0	Pass
777 - 787	0.81	3.0	Pass
824 - 849	1.82	3.0	Pass
1710 - 1755	1.94	3.0	Pass
1850 - 1915	2.02	3.0	Pass



Variable Uplink Noise Power Test Results
704 - 716 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-47.0	-56.0	-60.3	-4.3
-40.0	-63.0	-67.2	-4.2
-34.0	-69.0	-73.1	-4.1
-39.0	-64.0	-67.9	-3.9
-59.0	-45.5	-49.0	-3.5
-60.0	-45.5	-46.3	-0.8

777 - 787 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-53.0	-50.0	-66.1	-16.1
-44.0	-59.0	-72.6	-13.6
-35.0	-68.0	-79.3	-11.3
-34.0	-69.0	-79.3	-10.3
-33.0	-70.0	-79.3	-9.3
-60.0	-44.6	-52.3	-7.7

824 - 849 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-56.0	-47.0	-59.2	-12.2
-49.0	-54.0	-66.1	-12.1
-35.0	-68.0	-79.9	-11.9
-34.0	-69.0	-79.9	-10.9
-20.0	-70.0	-79.9	-9.9
-60.0	-44.0	-51.7	-7.7



1710 - 1755 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-58.0	-45.0	-54.3	-9.3
-51.0	-52.0	-61.3	-9.3
-34.0	-69.0	-78.3	-9.3
-47.0	-56.0	-65.2	-9.2
-59.0	-44.0	-47.3	-3.3
-60.0	-43.0	-46.1	-3.1

1850 - 1915 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-61.0	-42.0	-56.3	-14.3
-49.0	-54.0	-68.3	-14.3
-39.0	-64.0	-78.3	-14.3
-48.0	-55.0	-69.2	-14.2
-50.0	-53.0	-66.8	-13.8
-66.0	-37.0	-40.8	-3.8



Variable Downlink Noise Power Test Results
734 - 746 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-58.0	-45.5	-48.2	-2.7
-59.0	-45.5	-48.1	-2.6
-55.0	-48.0	-50.1	-2.1
-56.0	-47.0	-49.0	-2.0
-57.0	-46.0	-47.9	-1.9
-60.0	-45.5	-47.1	-1.6

746 - 756 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-59.0	-44.6	-53.7	-9.1
-58.0	-45.0	-53.8	-8.8
-53.0	-50.0	-58.3	-8.3
-45.0	-58.0	-66.2	-8.2
-46.0	-57.0	-65.1	-8.1
-70.0	-44.6	-46.3	-1.7

869 - 894 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-39.0	-64.0	-64.7	-0.7
-80.0	-44.0	-44.6	-0.6
-70.0	-44.0	-44.6	-0.6
-51.0	-52.0	-52.6	-0.6
-90.0	-44.0	-44.3	-0.3
-45.0	-58.0	-58.1	-0.1



1930 - 1995 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-48.0	-55.0	-69.7	-14.7
-45.0	-58.0	-72.6	-14.6
-43.0	-60.0	-74.3	-14.3
-39.0	-64.0	-78.3	-14.3
-46.0	-57.0	-71.0	-14.0
-60.0	-43.0	-47.3	-4.3

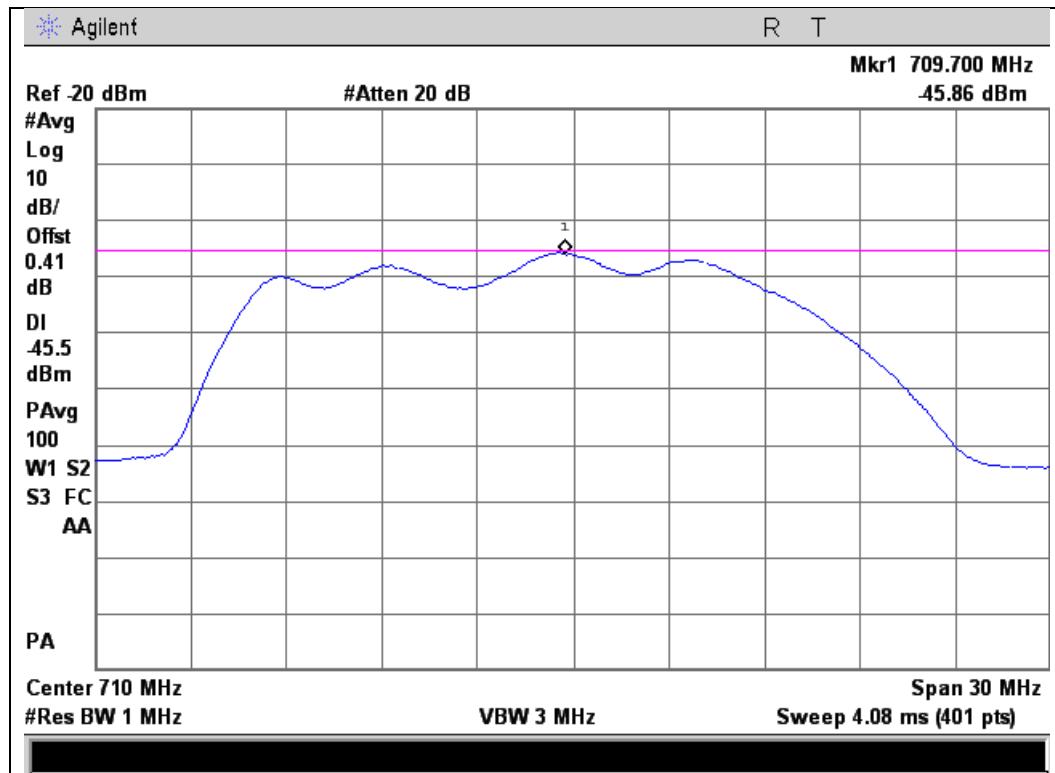
2110 - 2155 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-58.0	-45.0	-53.6	-8.6
-56.0	-47.0	-55.6	-8.6
-57.0	-46.0	-54.1	-8.1
-53.0	-50.0	-57.3	-7.3
-52.0	-51.0	-58.3	-7.3
-51.0	-52.0	-59.3	-7.3

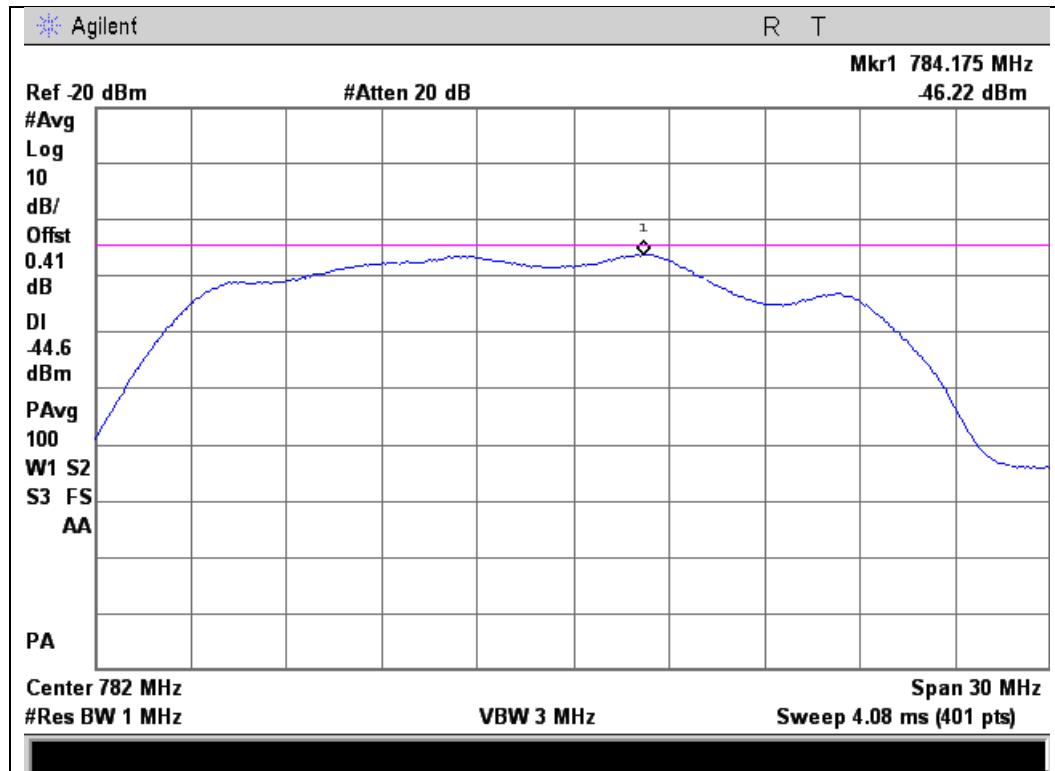


Maximum Uplink Noise Test Plots

704 - 716 MHz Band

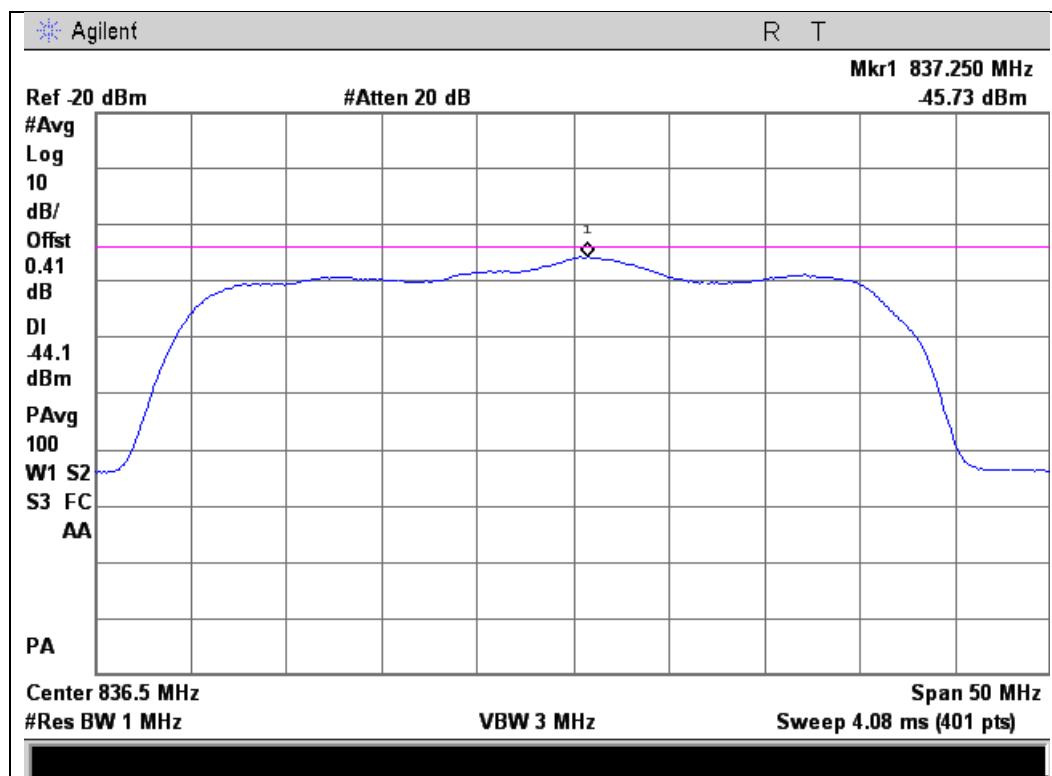


777 - 787 MHz Band

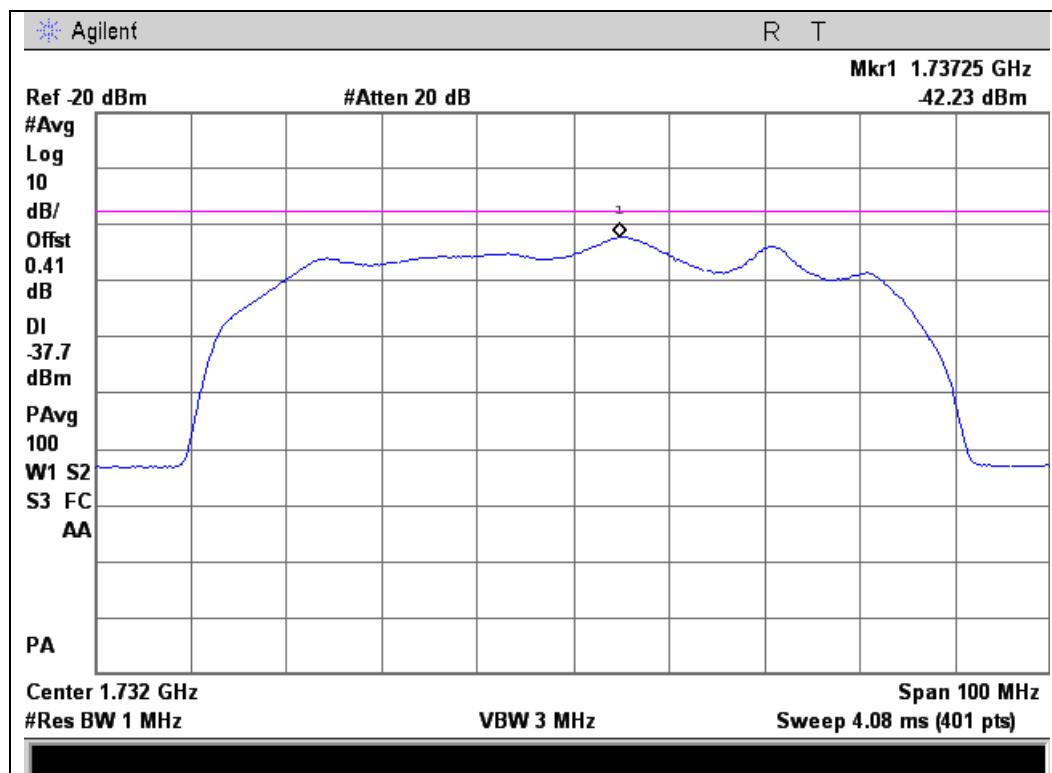




824 - 849 MHz Band

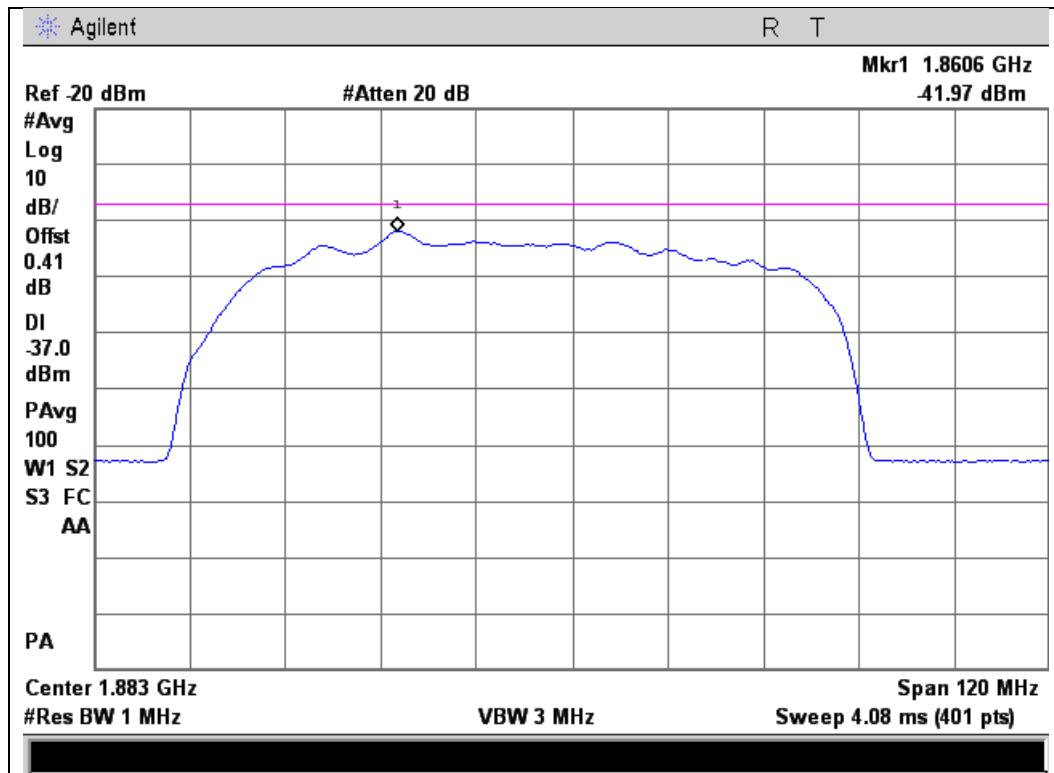


1710 - 1755 MHz Band



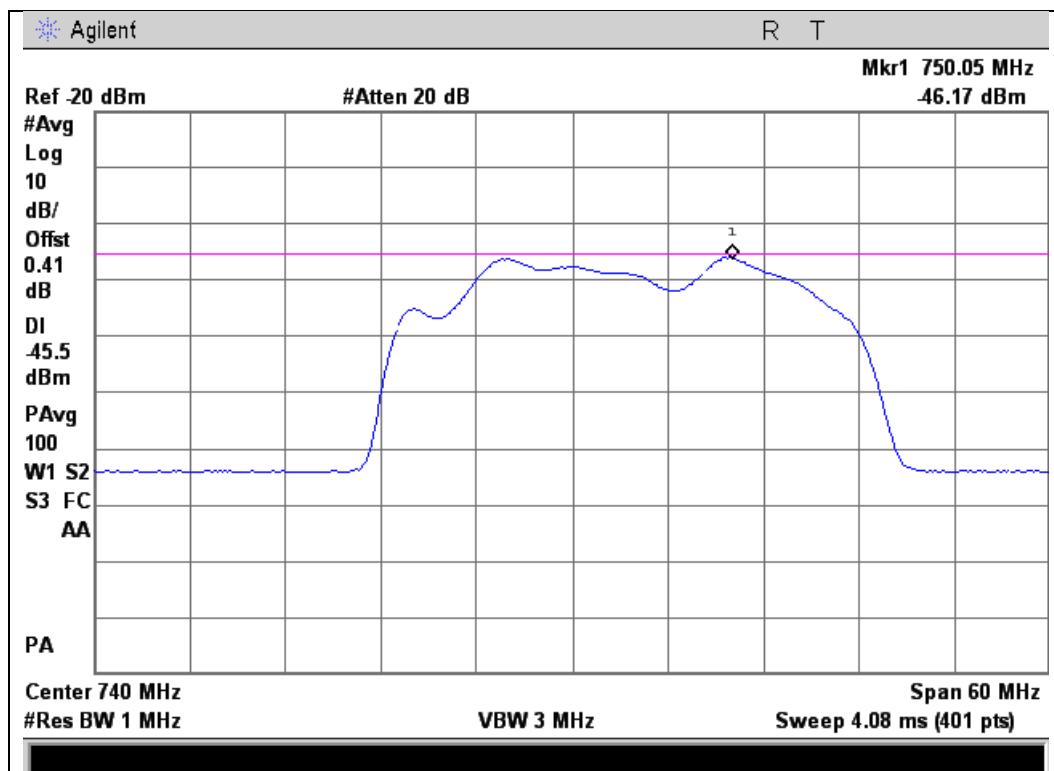


1850 - 1915 MHz Band



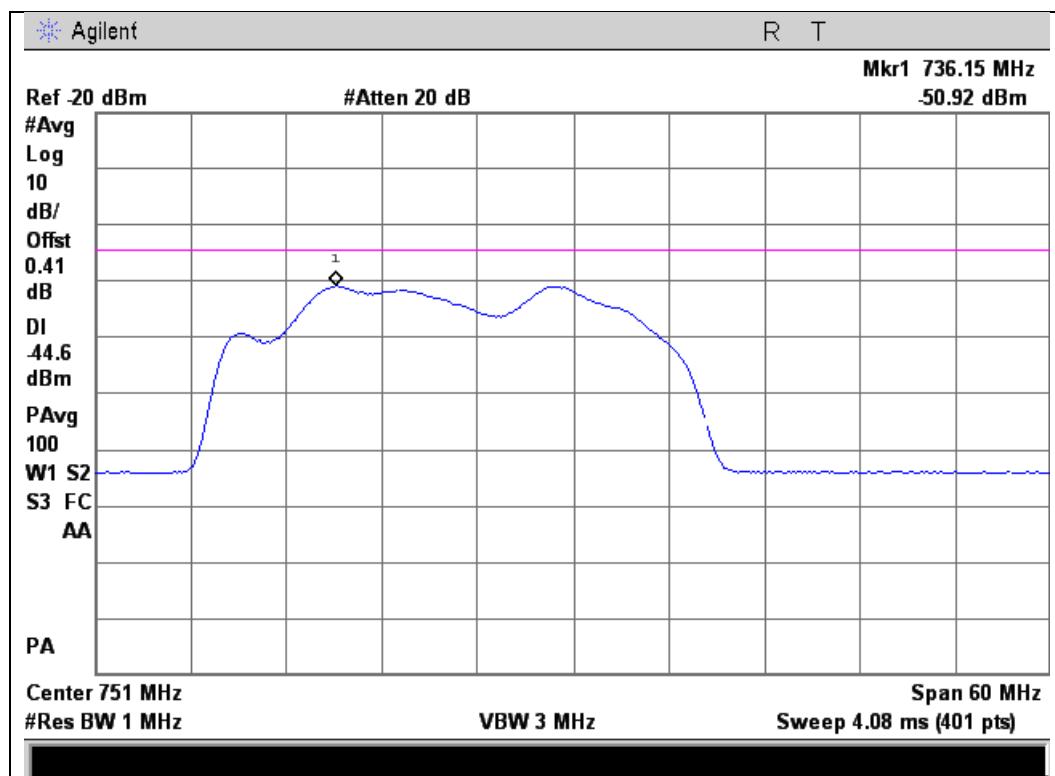
Maximum Downlink Noise Test Plots

734 - 746 MHz Band

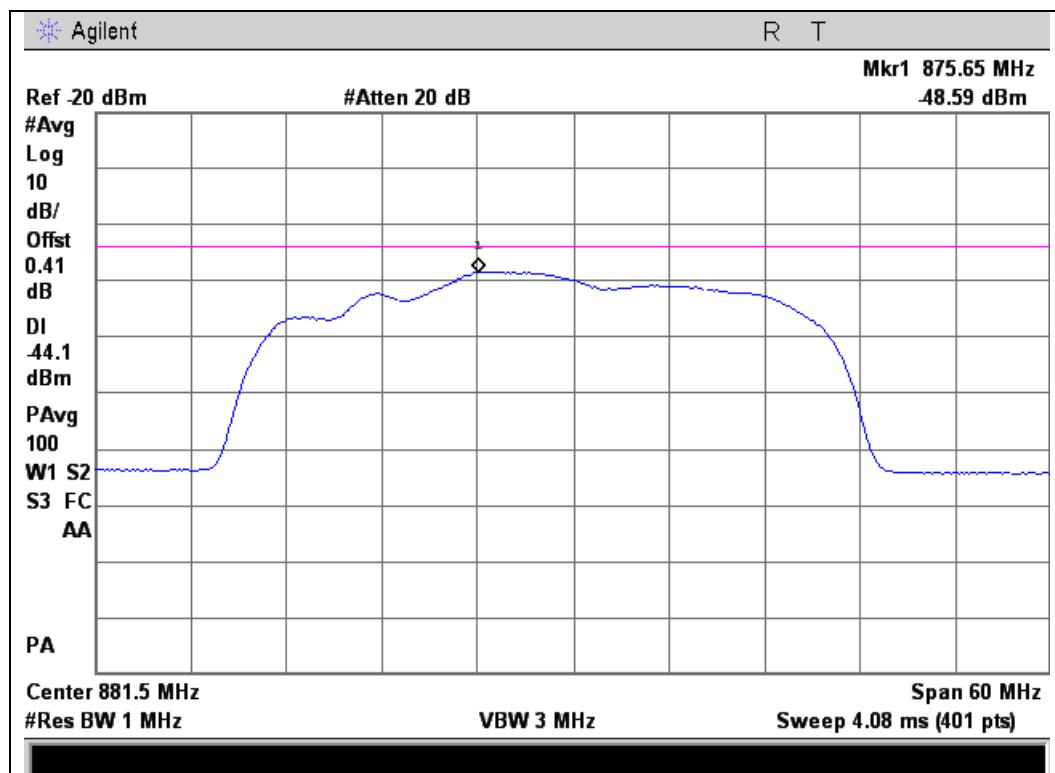




746 - 756 MHz Band

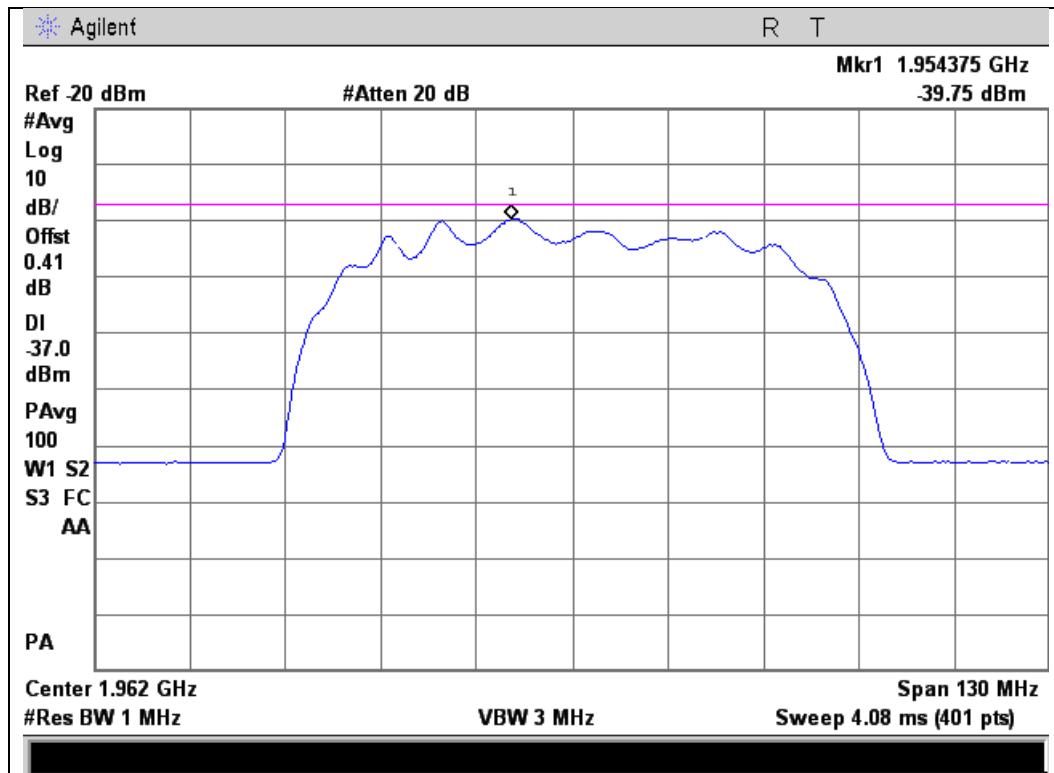


869 - 894 MHz Band

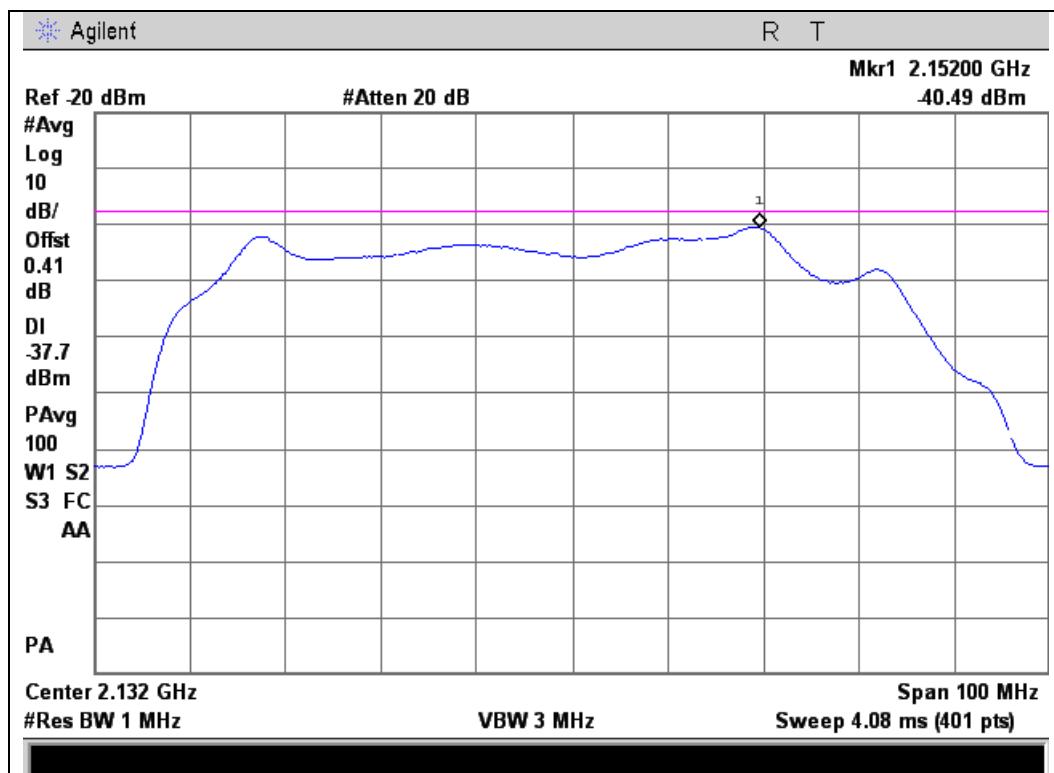




1930 - 1995 MHz Band



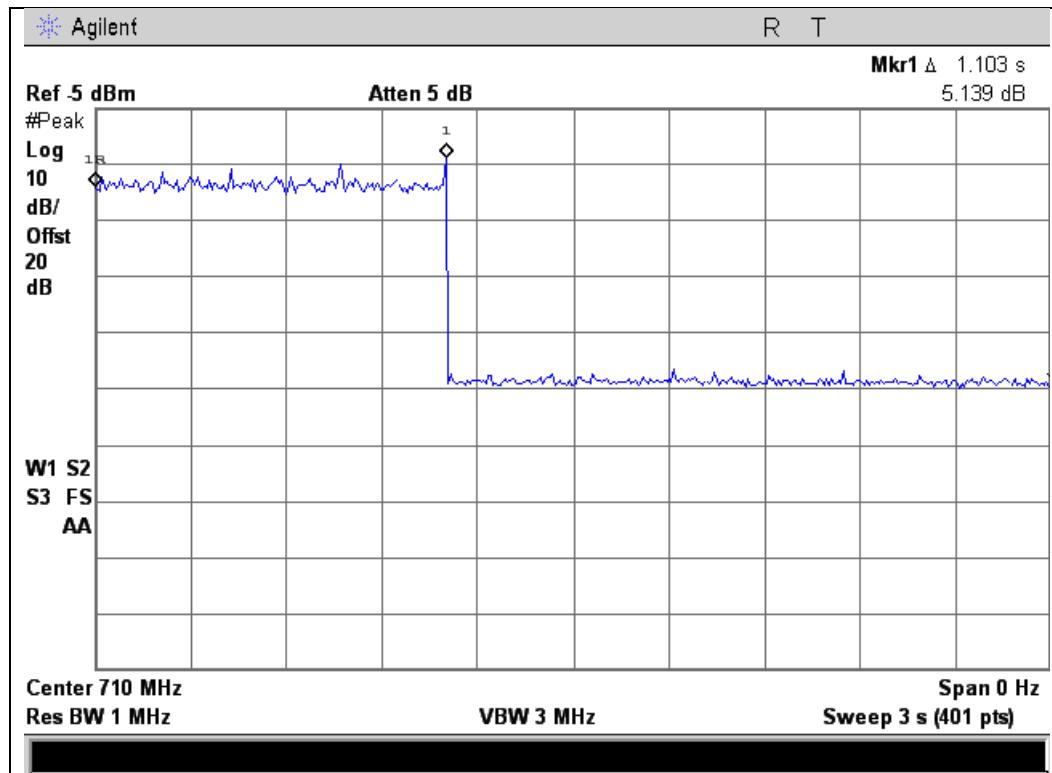
2110 - 2155 MHz Band



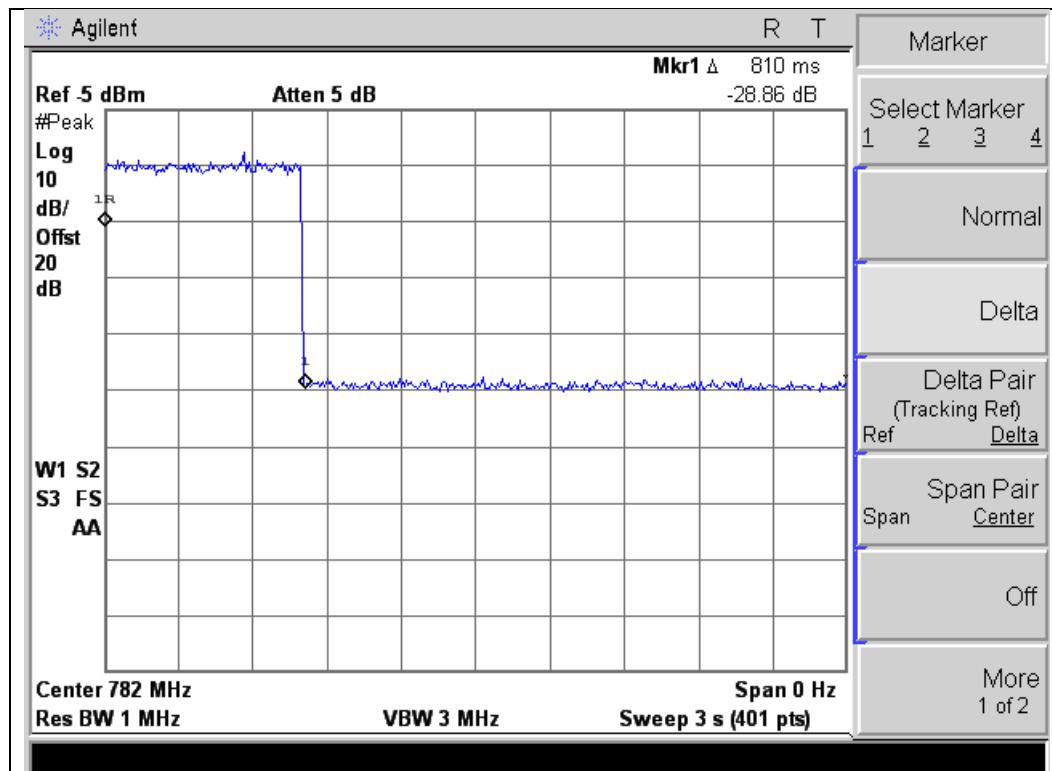


Uplink Noise Timing Test Plots

704 - 716 MHz Band

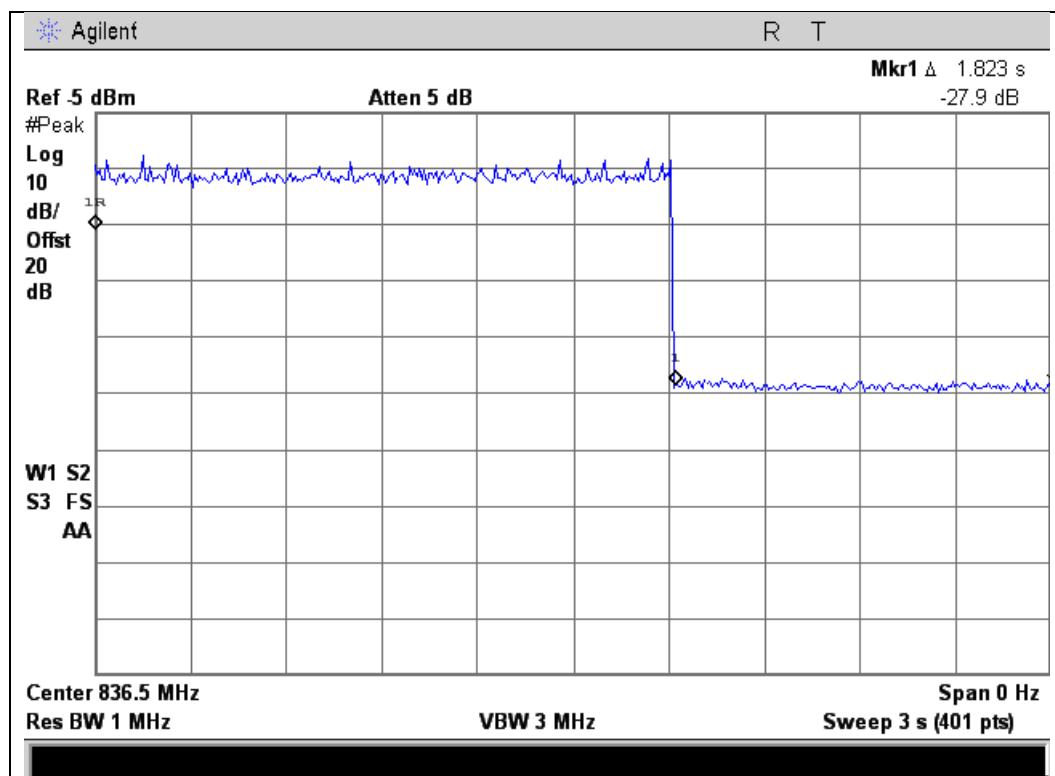


777 - 787 MHz Band

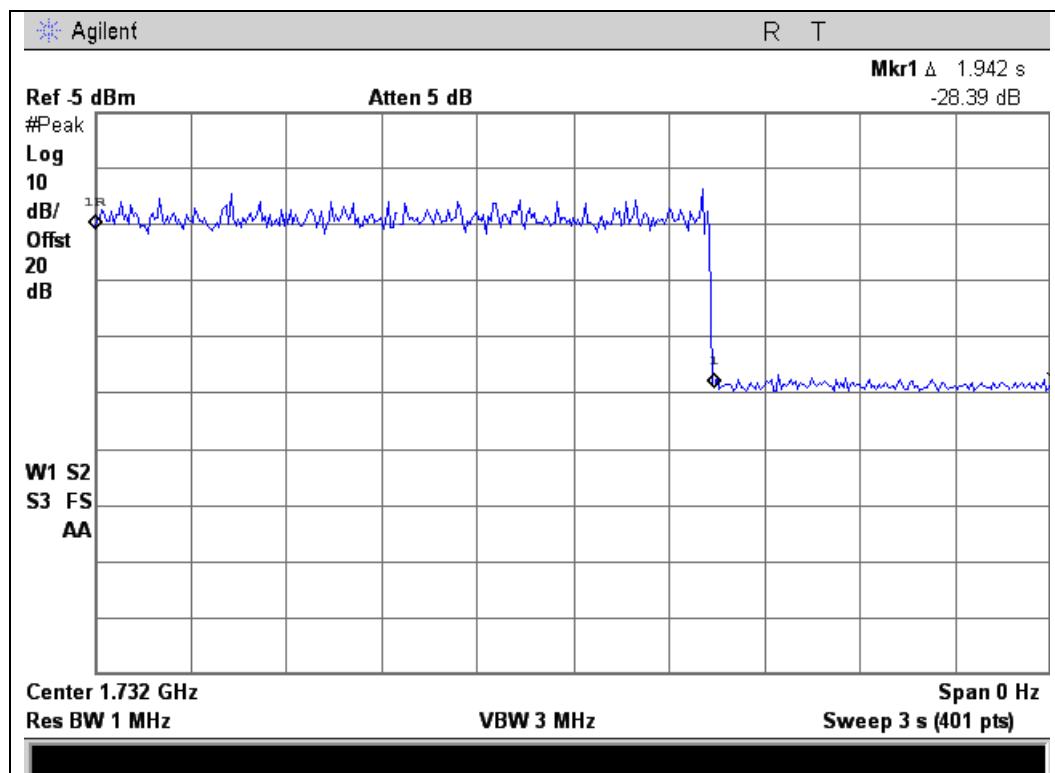




824 - 849 MHz Band

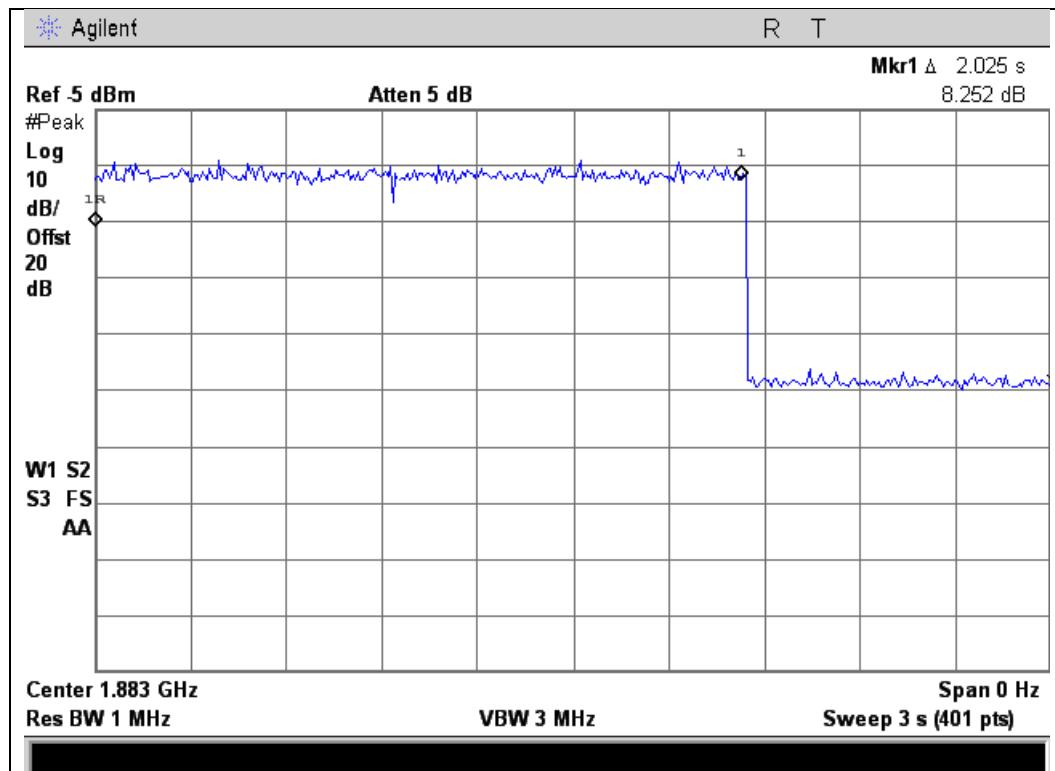


1710 - 1755 MHz Band





1850 - 1915 MHz Band





Uplink Inactivity

Name of Test: Uplink Inactivity
Test Equipment Utilized: i00331

Engineer: Mike Graffeo
Test Date: 9/17/13

Test Procedure

The EUT was connected directly to a spectrum analyzer set to operate in the center of the EUT operational uplink band. 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



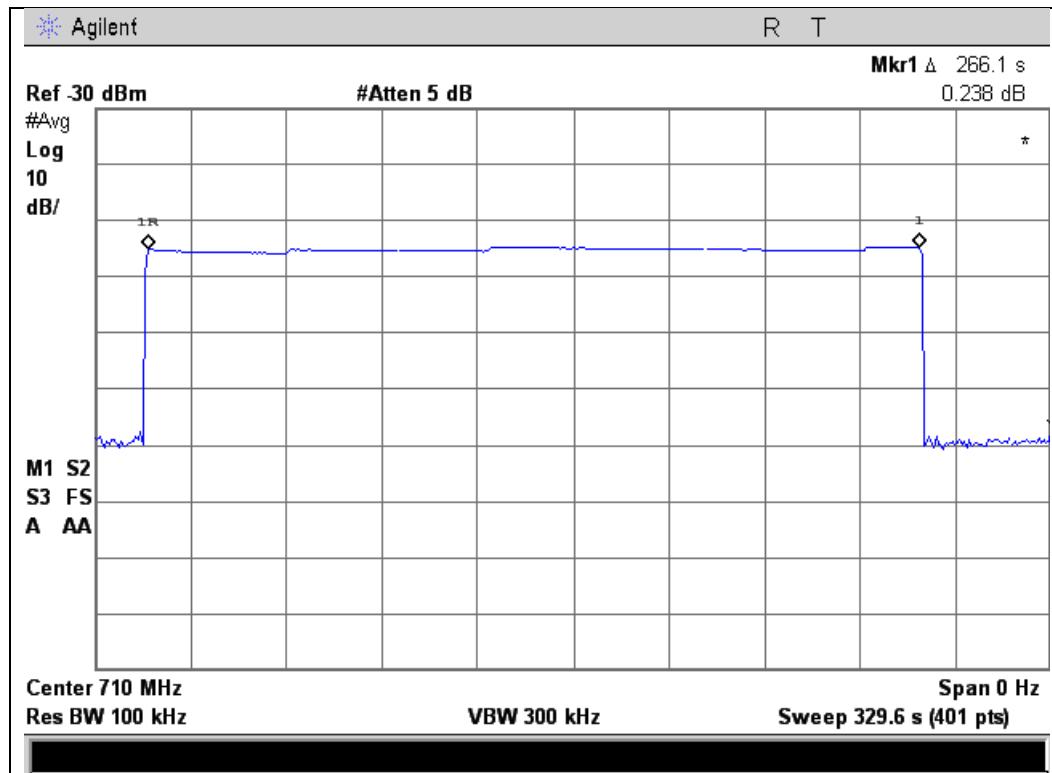
Uplink Test Results

Frequency Band (MHz)	Measured Time (Seconds)	Limit (Seconds)	Result
704 - 716	266.1	300	Pass
777 - 787	266.5	300	Pass
824 - 849	266.5	300	Pass
1710 - 1755	267.3	300	Pass
1850 - 1915	266.5	300	Pass

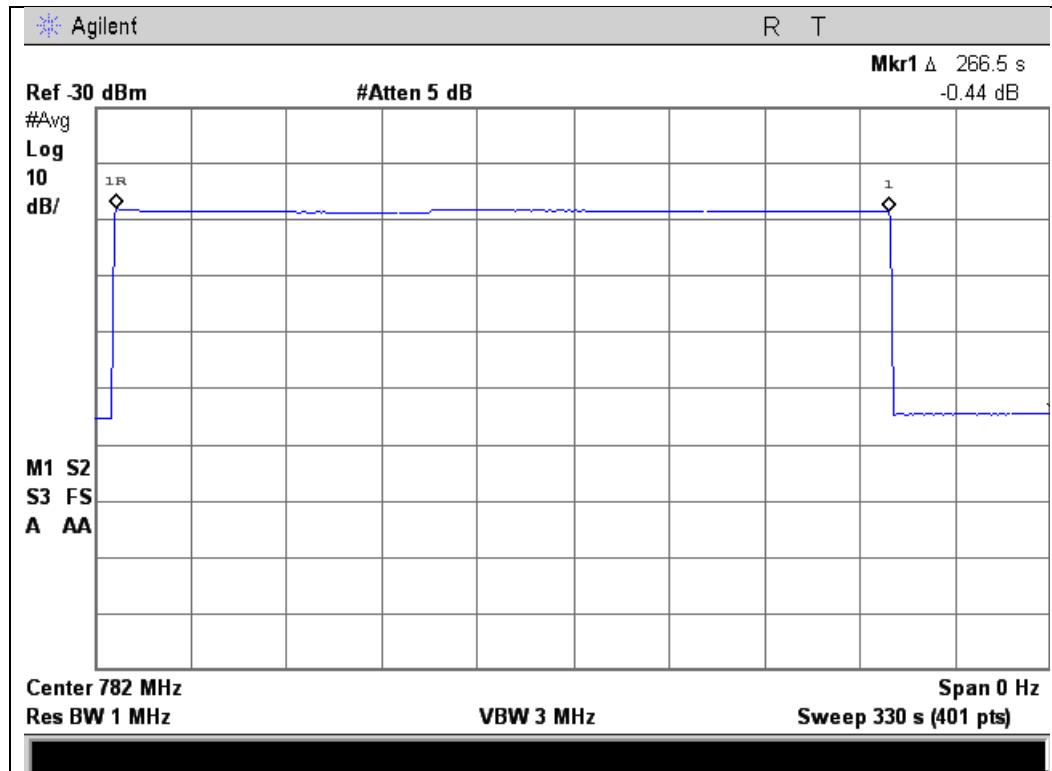


Uplink Inactivity Test Results

704 - 716 MHz

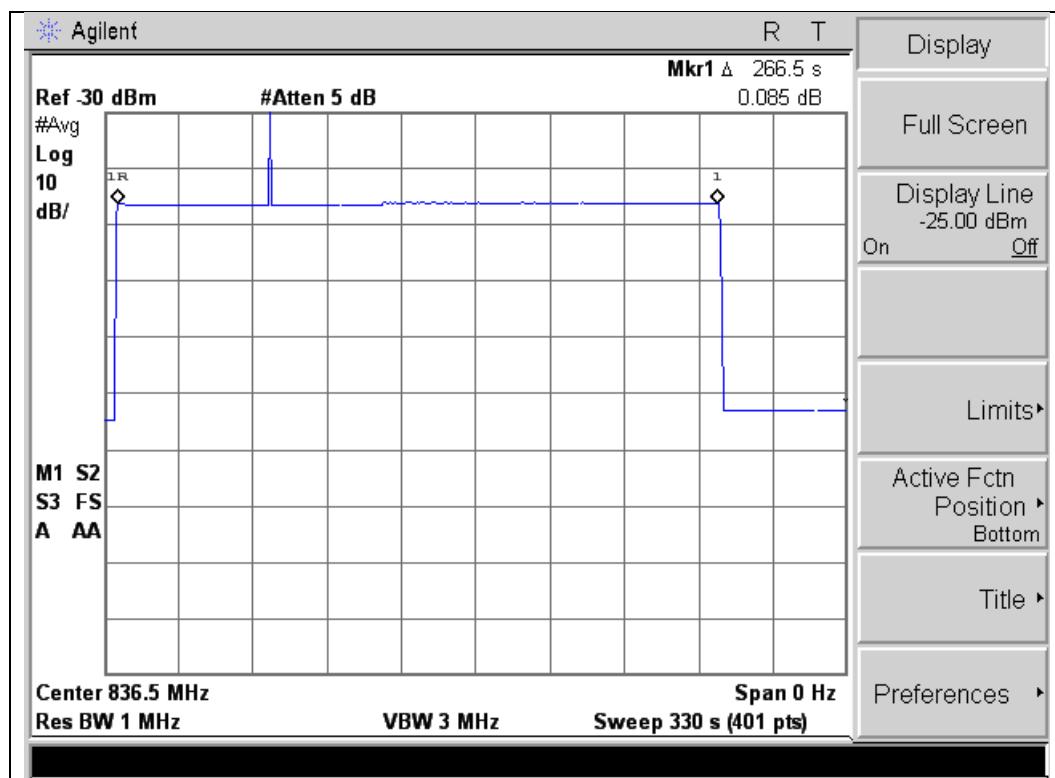


777 - 787 MHz

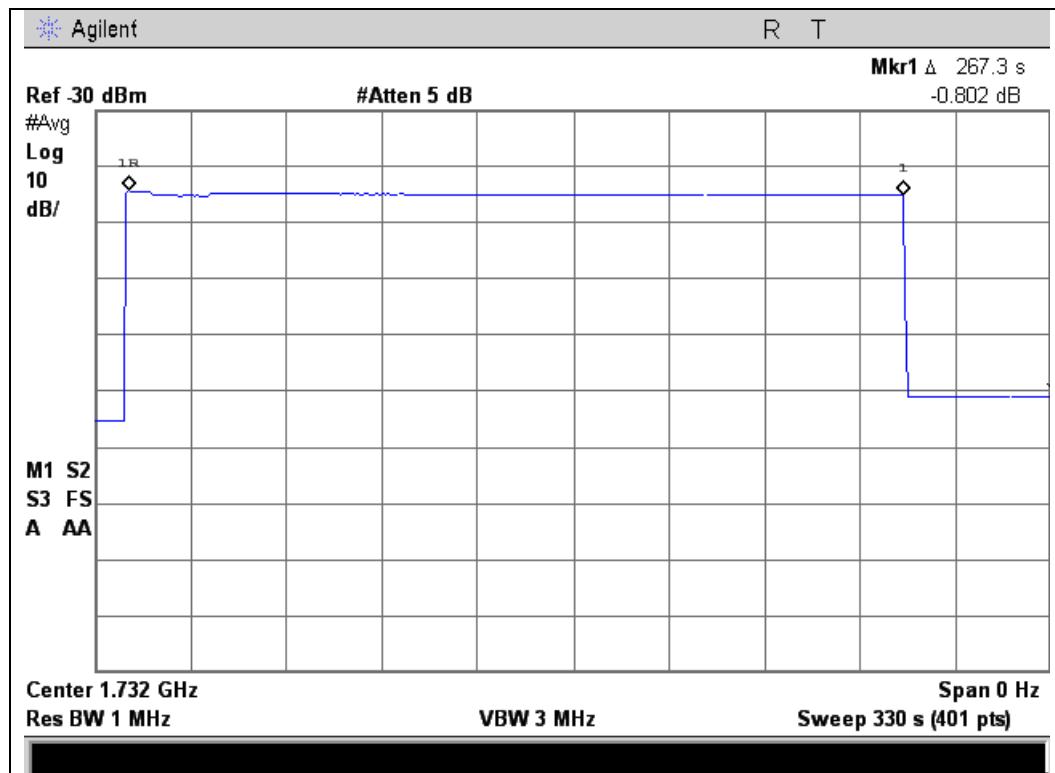




824 - 849 MHz

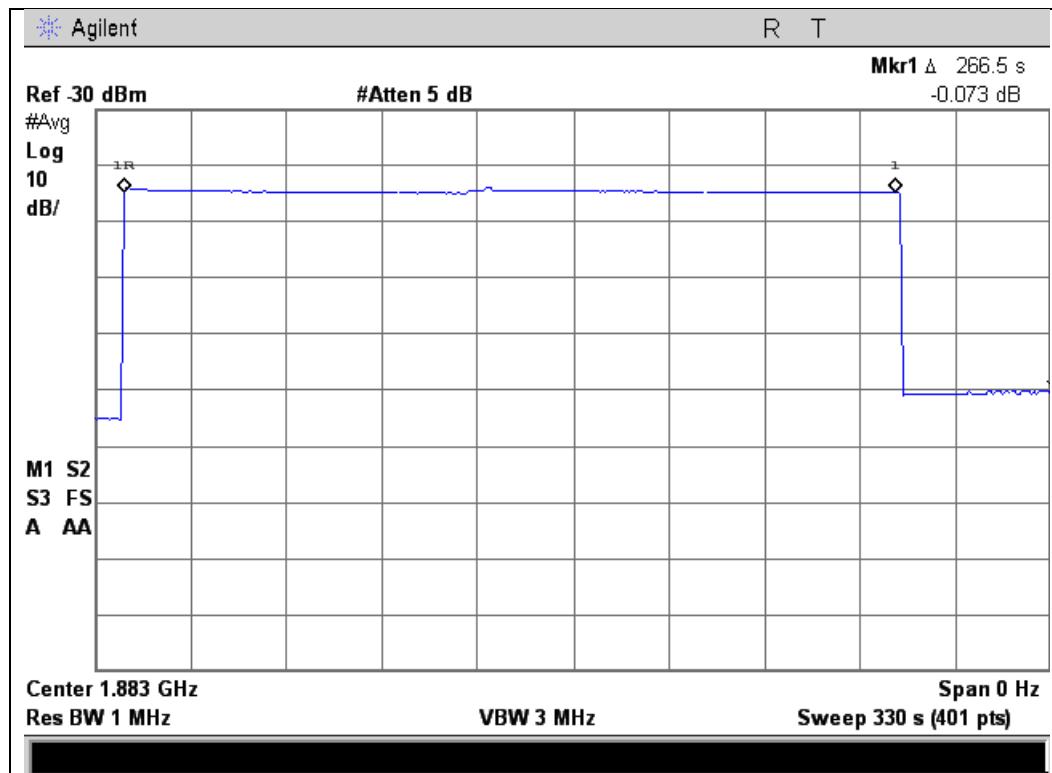


1710 - 1755 MHz





1850 - 1915 MHz





Variable Gain

Name of Test:

Variable Gain

Engineer: Mike Graffeo

Test Equipment Utilized: i00331, i00405, i00412

Test Date: 9/27/13

Test Procedure

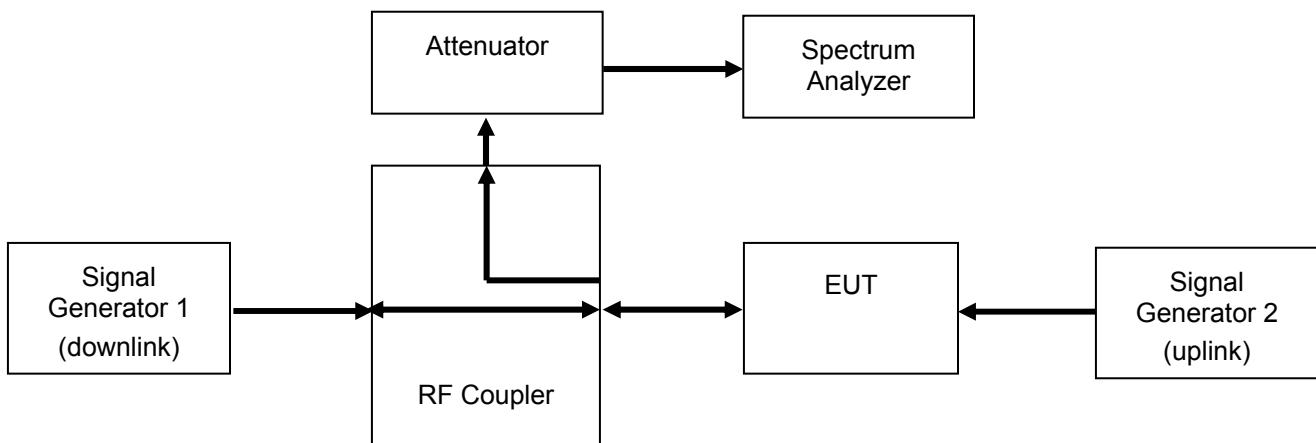
The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. The uplink gain in the presence of a downlink signal was measured 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.

Variable Gain = -34 dB - RSSI +MSCL

Gain timing was verified by decreasing to a specific level and verifying the EUT responded within 1sec.

Test Setup





Uplink Test Results
704 - 716 MHz

RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-45.0	45.9	-43.4	-2.4	41.0	-4.9
-44.0	44.9	-43.4	-3.3	40.1	-4.8
-43.0	43.9	-43.4	-4.4	39.0	-4.9
-42.0	42.9	-43.4	-2.0	41.4	-1.5
-41.0	41.9	-43.4	-2.0	41.4	-0.5
-38.0	38.9	-43.4	-5.0	38.4	-0.5

777 - 787 MHz

RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-61	62.8	-42.3	10.3	52.6	-10.2
-54.0	55.8	-42.3	5.1	47.4	-8.4
-55.0	56.8	-42.3	6.2	48.5	-8.3
-57.0	58.8	-42.3	8.8	51.1	-7.7
-66.0	64.0	-42.3	17.2	59.5	-4.5
-70.0	64.0	-42.3	17.5	59.8	-4.2

824 - 849 MHz

RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-54.0	56.3	-44.5	9.6	54.1	-2.2
-41.0	43.3	-44.5	-2.8	41.7	-1.6
-65.0	65.0	-44.5	19.9	64.4	-0.6
-64.0	65.0	-44.5	19.9	64.4	-0.6
-67.0	65.0	-44.5	20.1	64.6	-0.4
-66.0	65.0	-44.5	20.1	64.6	-0.4



1710 - 1755 MHz

RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-49.0	55.5	-41.0	5.2	46.2	-9.3
-50.0	56.5	-41.0	7.1	48.1	-8.4
-48.0	54.5	-41.0	5.2	46.2	-8.3
-56.0	62.5	-41.0	13.3	54.3	-8.2
-55.0	61.5	-41.0	12.3	53.3	-8.2
-47.0	53.5	-41.0	4.3	45.3	-8.2

1850 - 1915 MHz

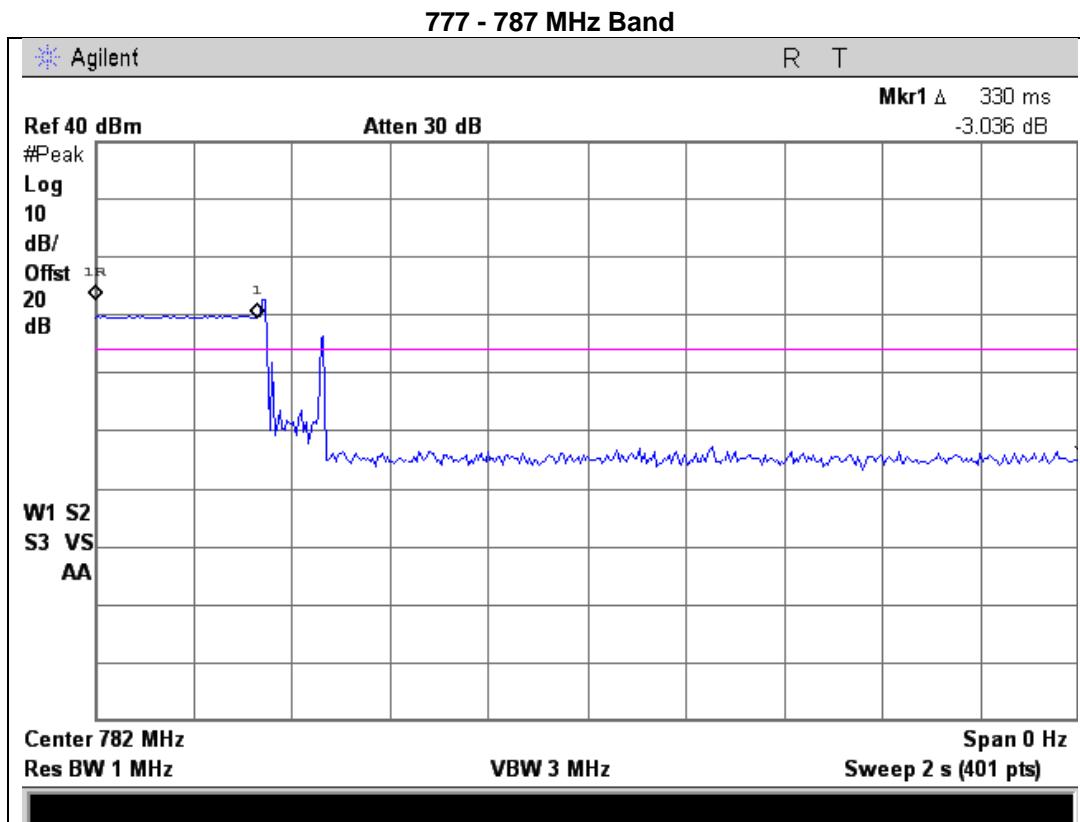
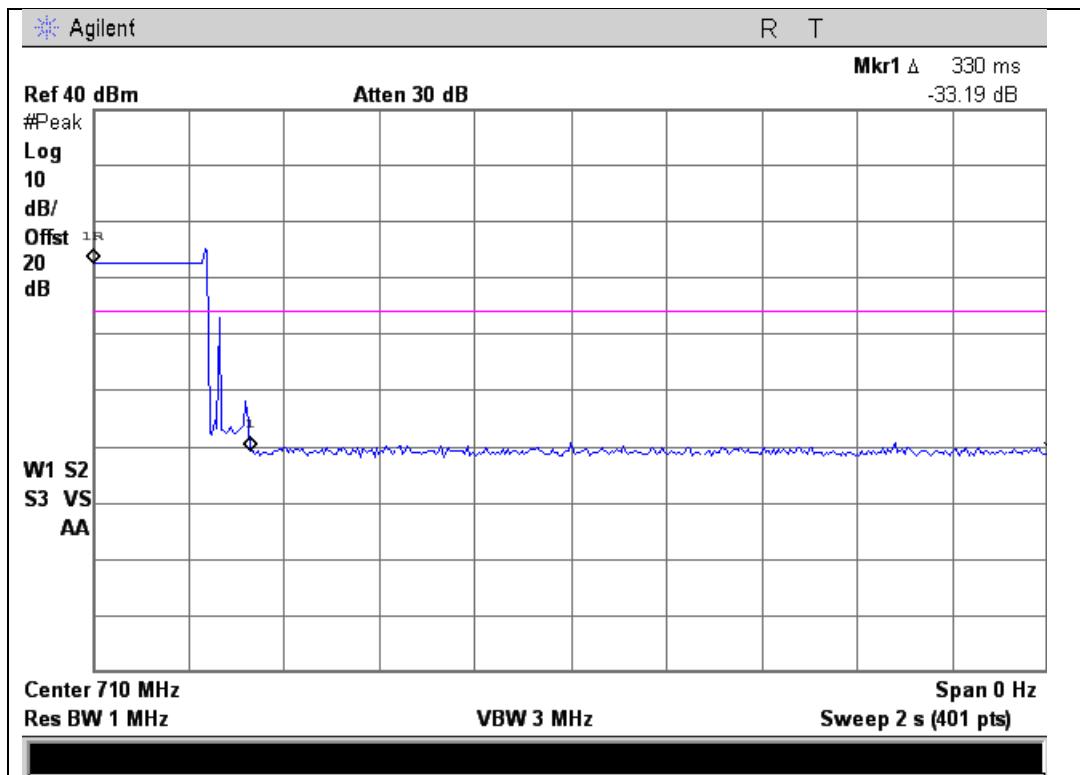
RSSI (dBm)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-54.0	61.2	-43.8	5.3	49.1	-12.1
-51.0	58.2	-43.8	2.4	46.2	-12.0
-50.0	57.2	-43.8	0.4	44.2	-13.0
-49.0	56.2	-43.8	0.6	44.4	-11.8
-48.0	55.2	-43.8	-0.5	43.3	-11.9
-47.0	54.2	-43.8	-1.4	42.4	-11.8

Variable Uplink Gain Timing Test Results

Frequency Band (MHz)	Measured Timing (Seconds)	Limit (Seconds)	Result
704 - 716	0.330	1.0	Pass
777 - 787	0.330	1.0	Pass
824 - 849	0.595	1.0	Pass
1710 - 1755	0.760	1.0	Pass
1850 - 1915	0.795	1.0	Pass

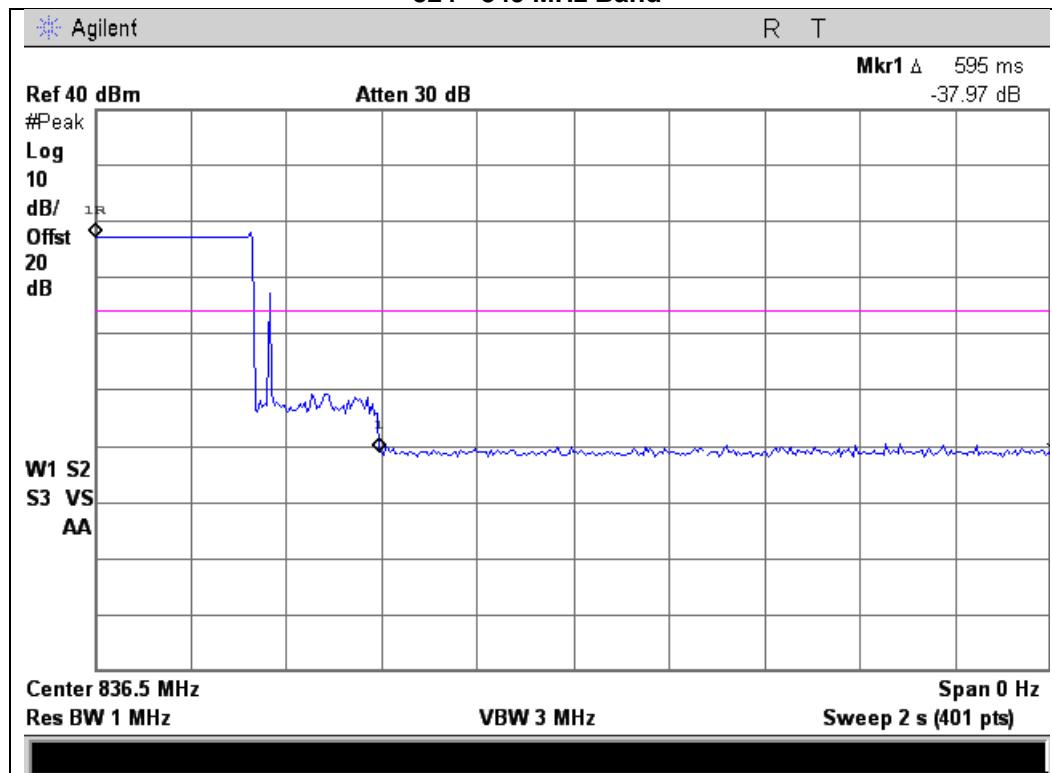


Variable Uplink Gain Timing
704 - 716 MHz Band





824 - 849 MHz Band

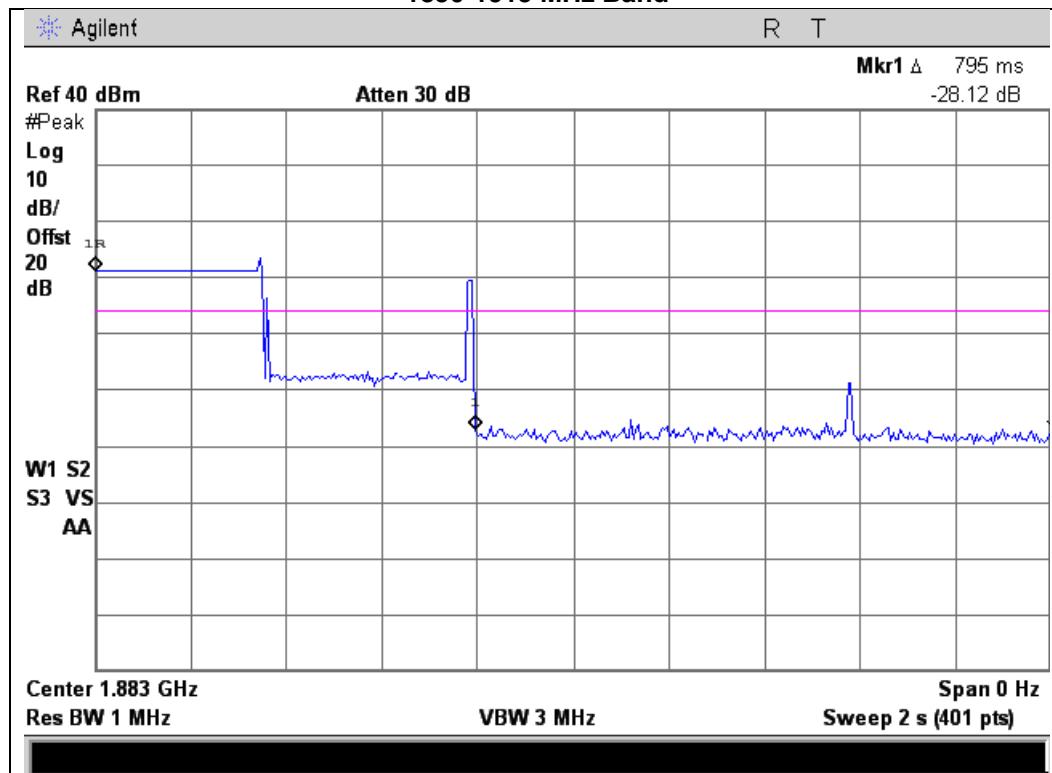


1710-1755 MHz Band





1850-1915 MHz Band





Occupied Bandwidth

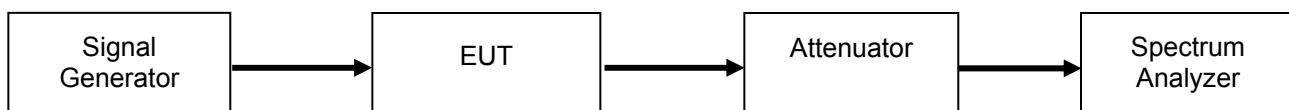
Name of Test: Occupied Bandwidth
Test Equipment Utilized: i00331 and i00405

Engineer: Mike Graffeo
Test Date: 9/16/13

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

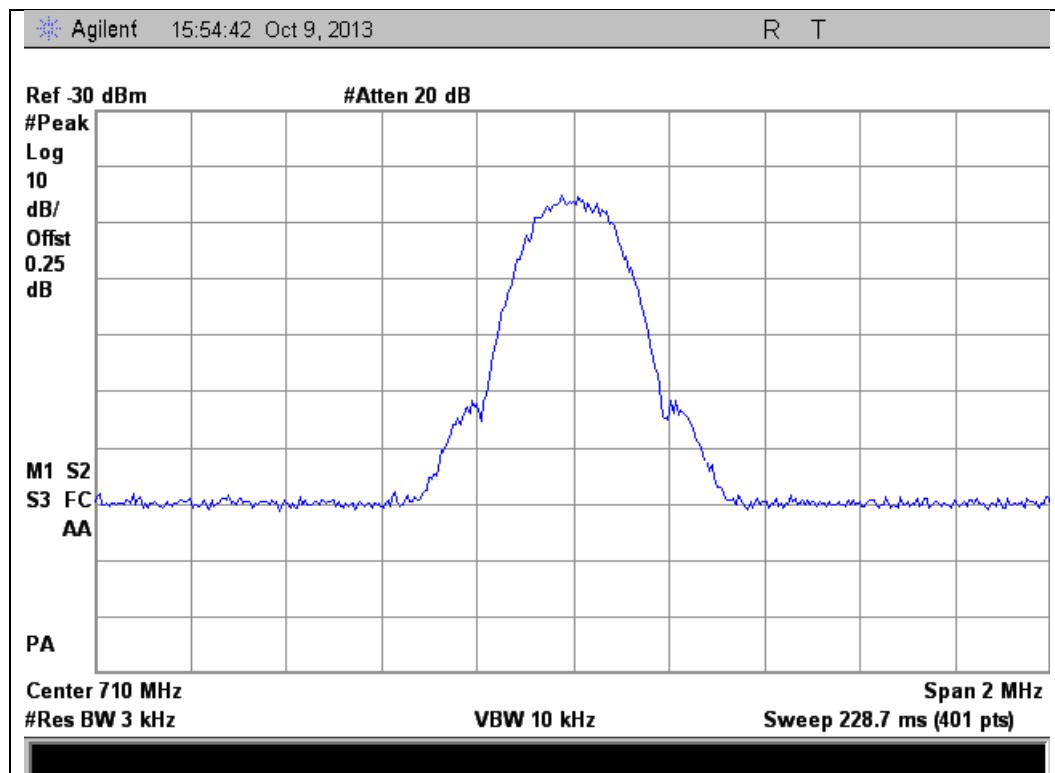




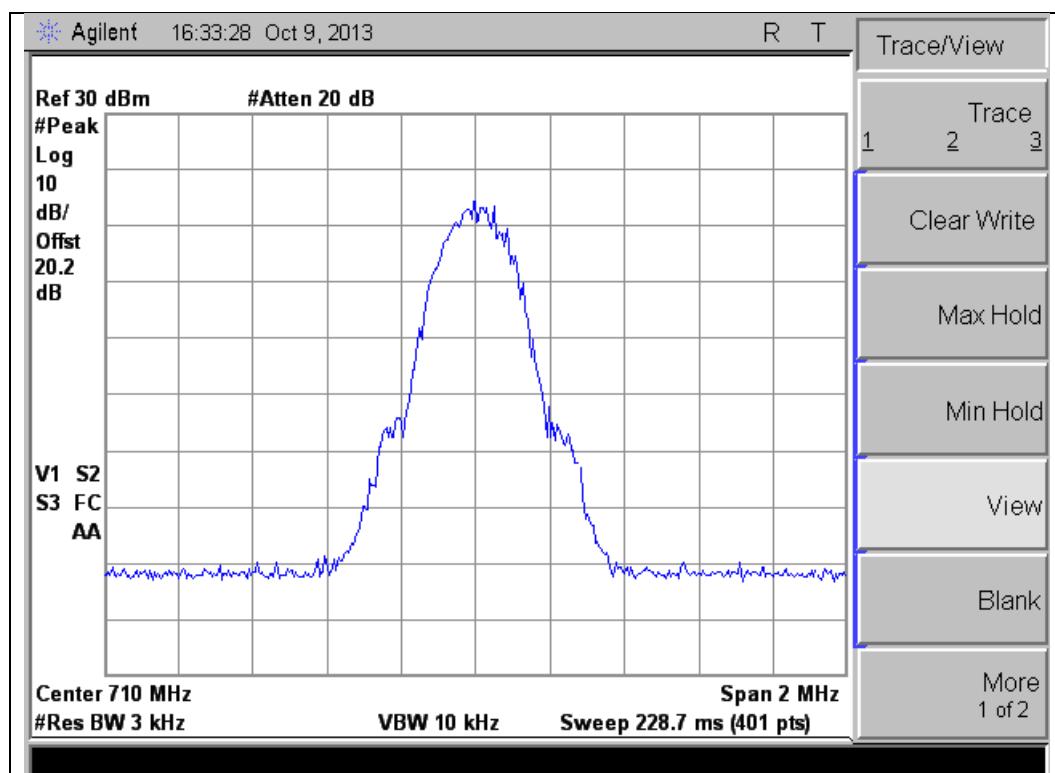
GSM Uplink Test Plots

704 - 716 MHz Band

Input



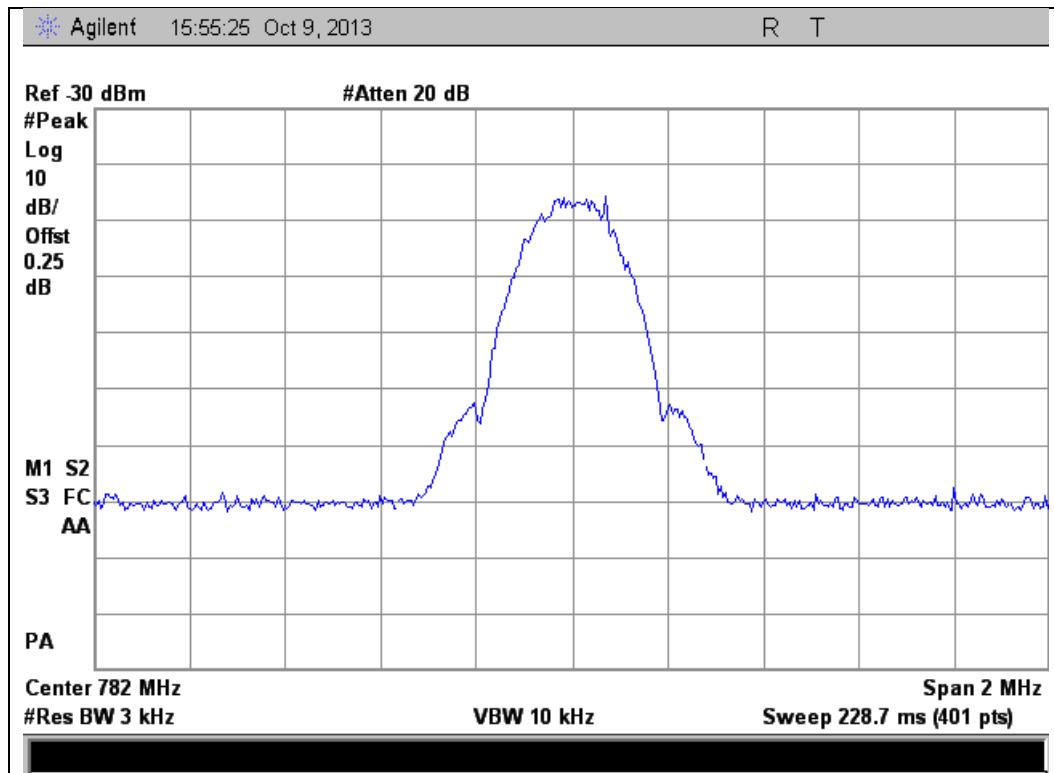
Output



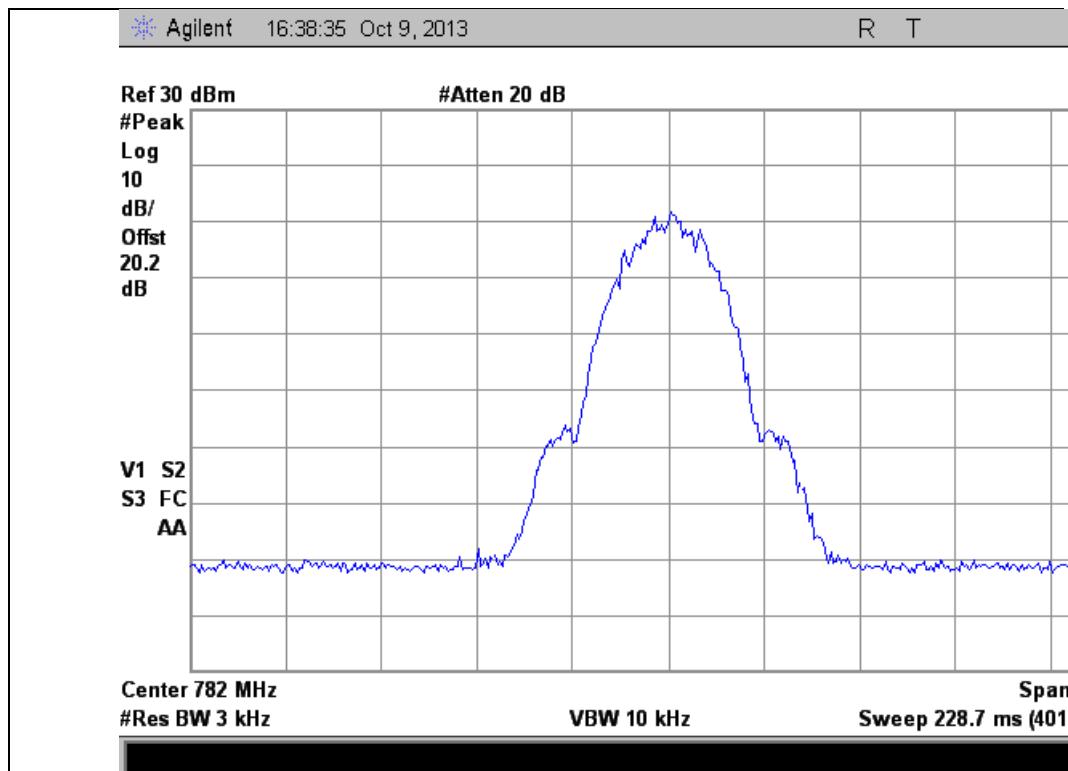


777 - 787 MHz Band

Input



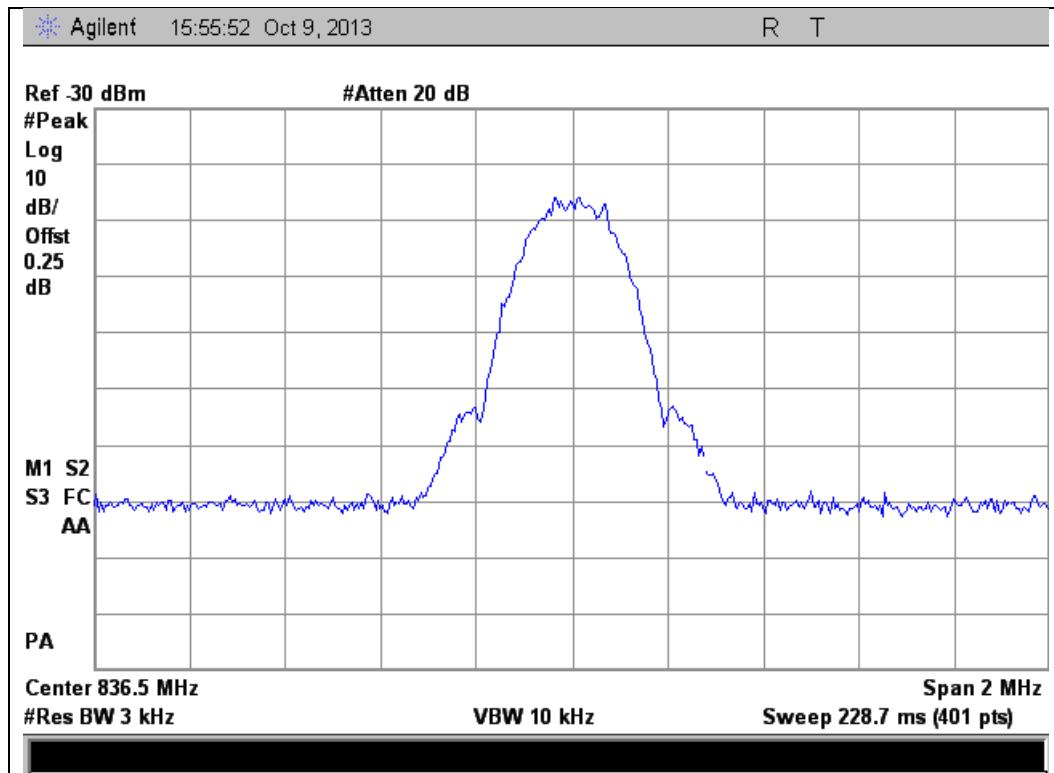
Output



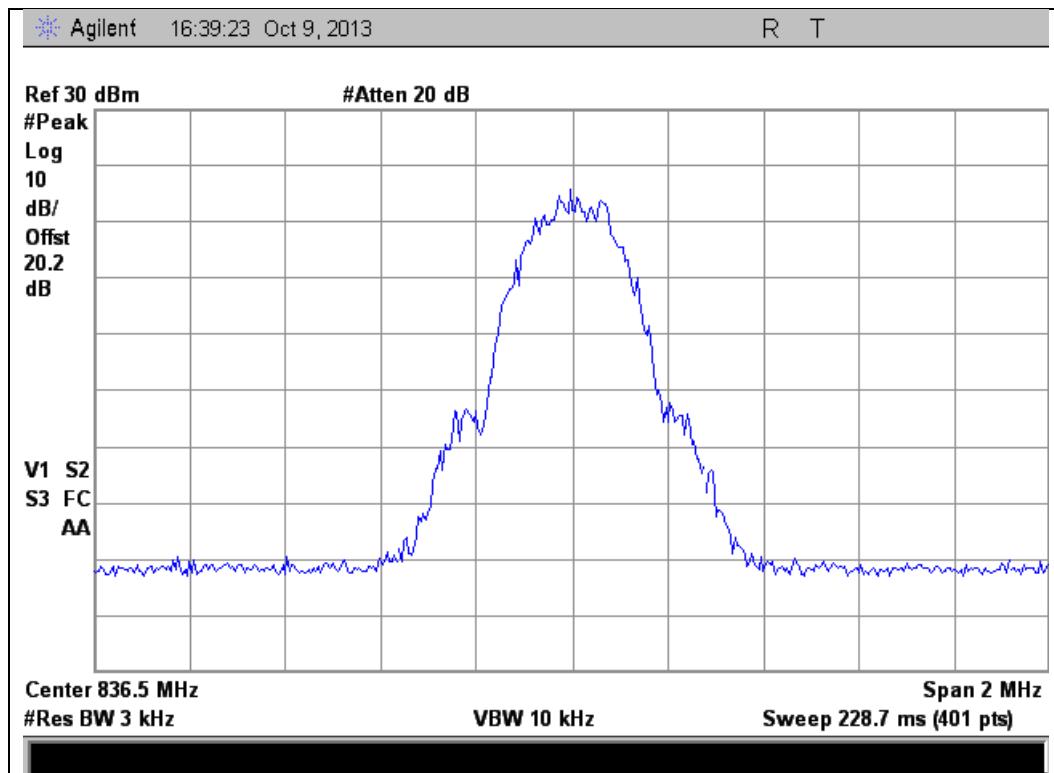


824 - 849 MHz Band

Input



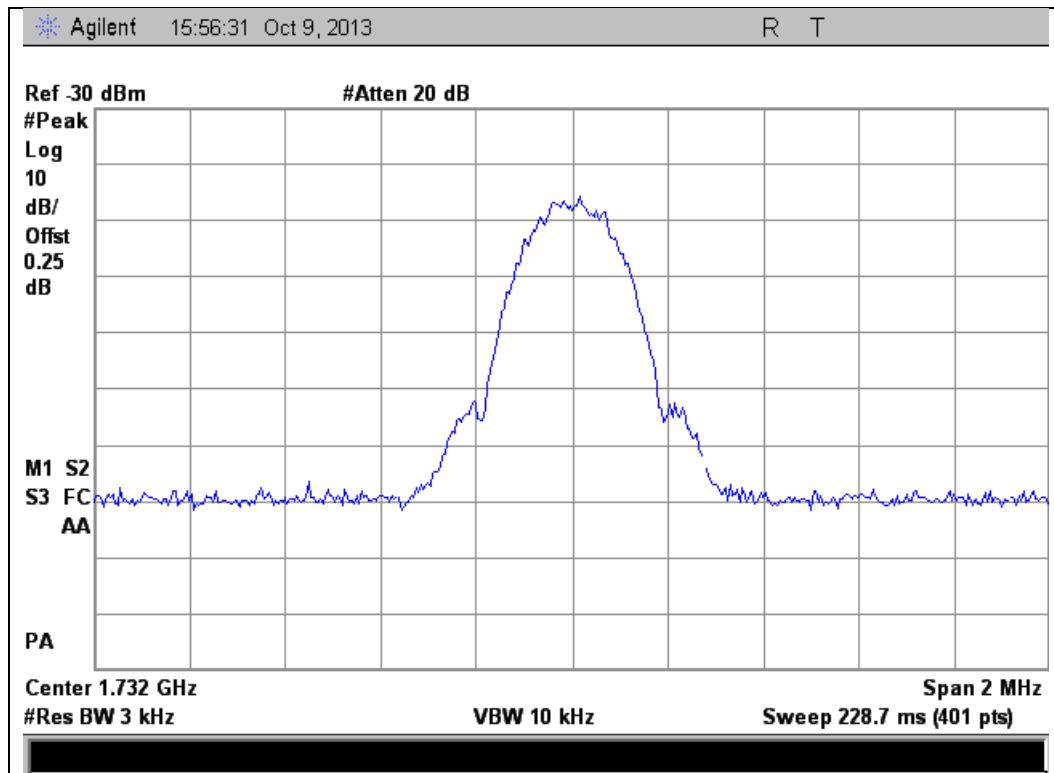
Output



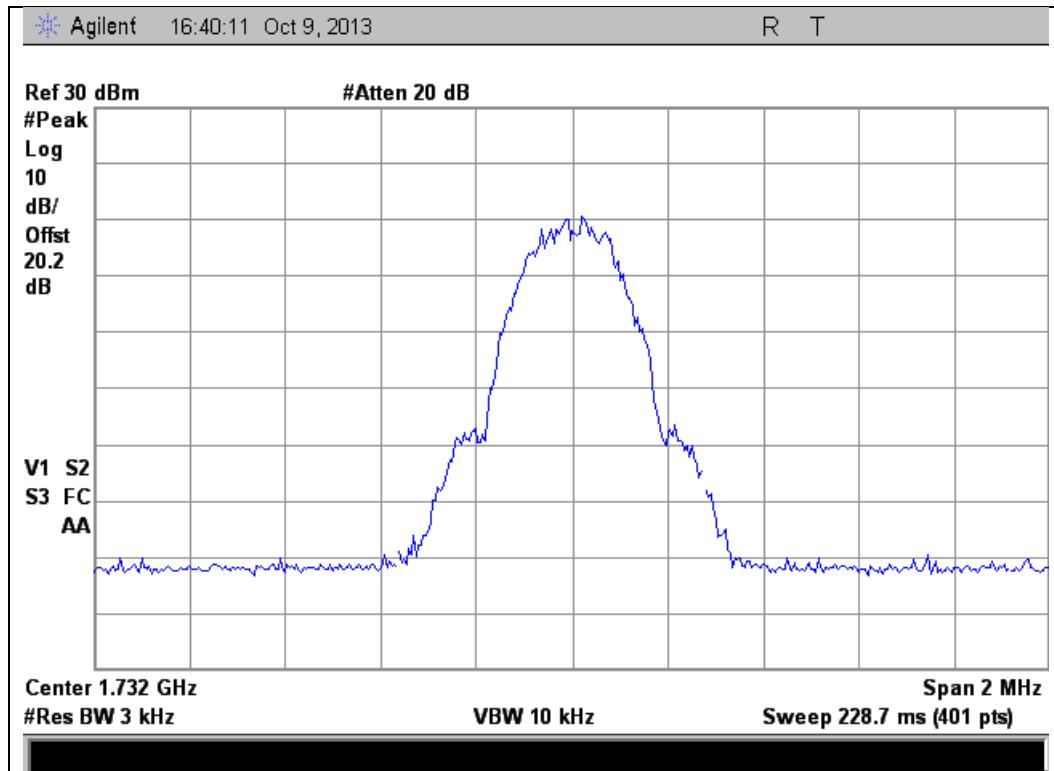


1710 - 1755 MHz Band

Input



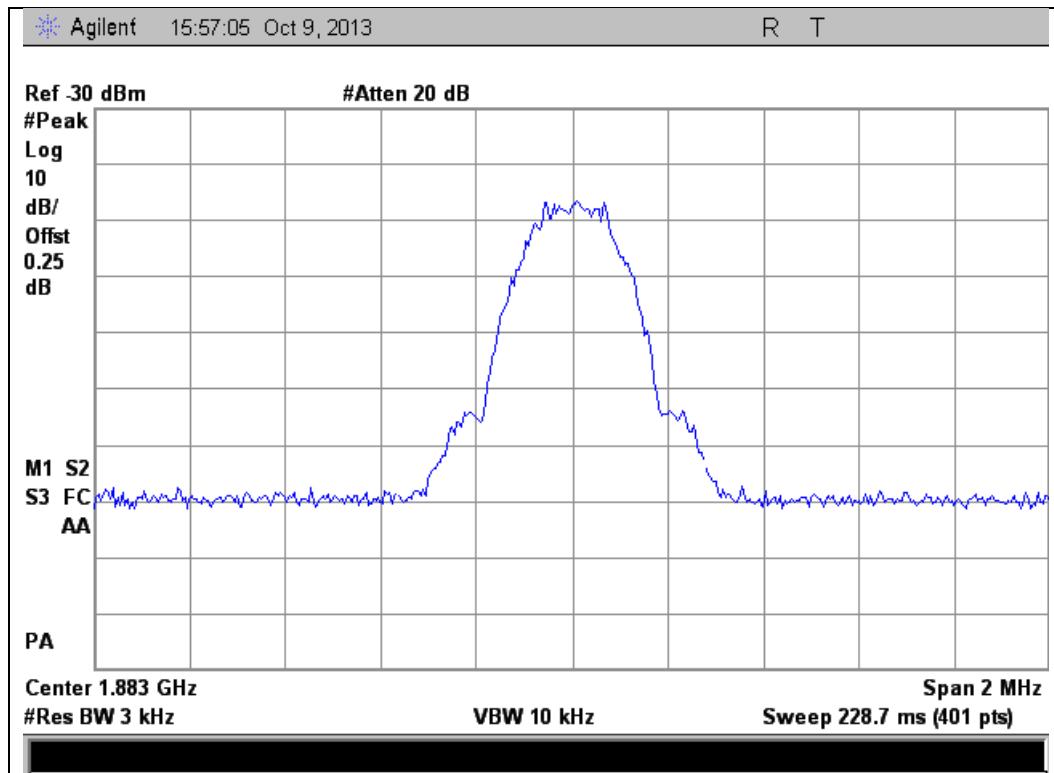
Output



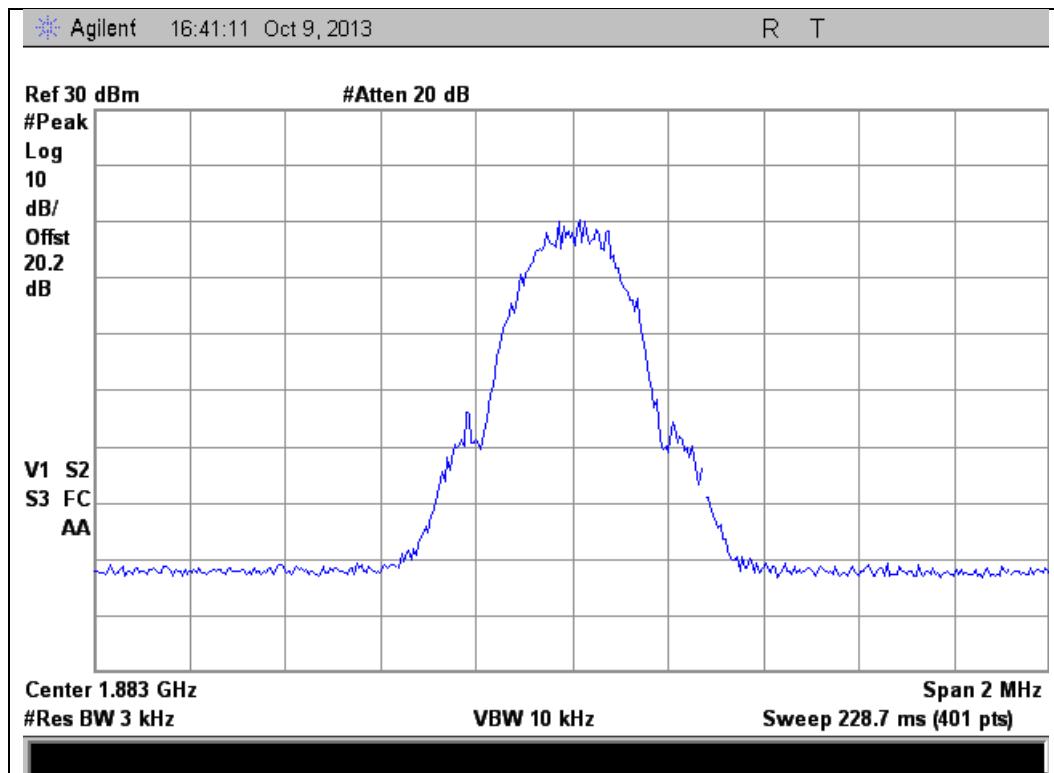


1850 - 1915 MHz Band

Input



Output

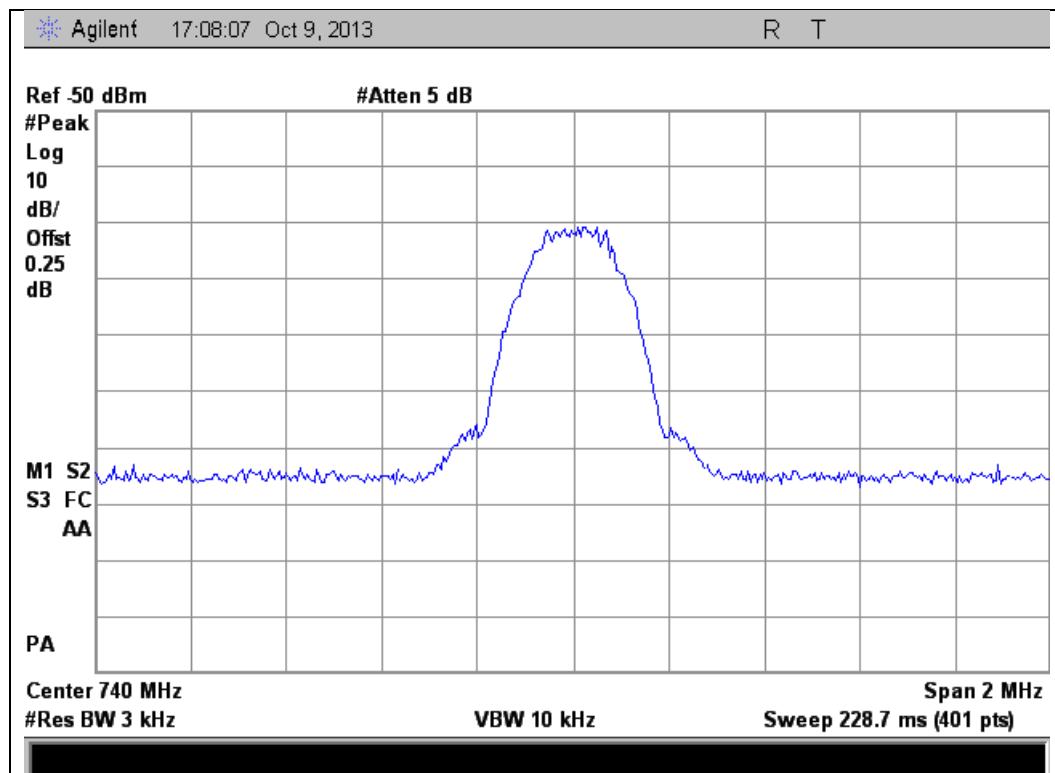




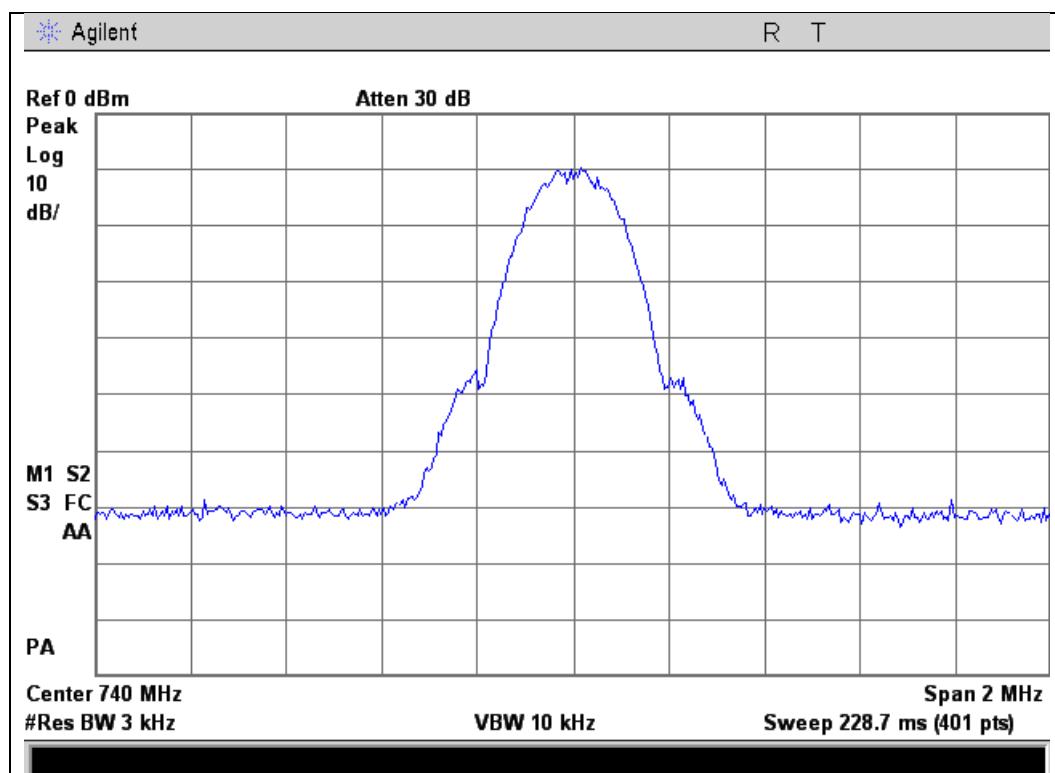
GSM Downlink Test Plots

734 - 746 MHz Band

Input



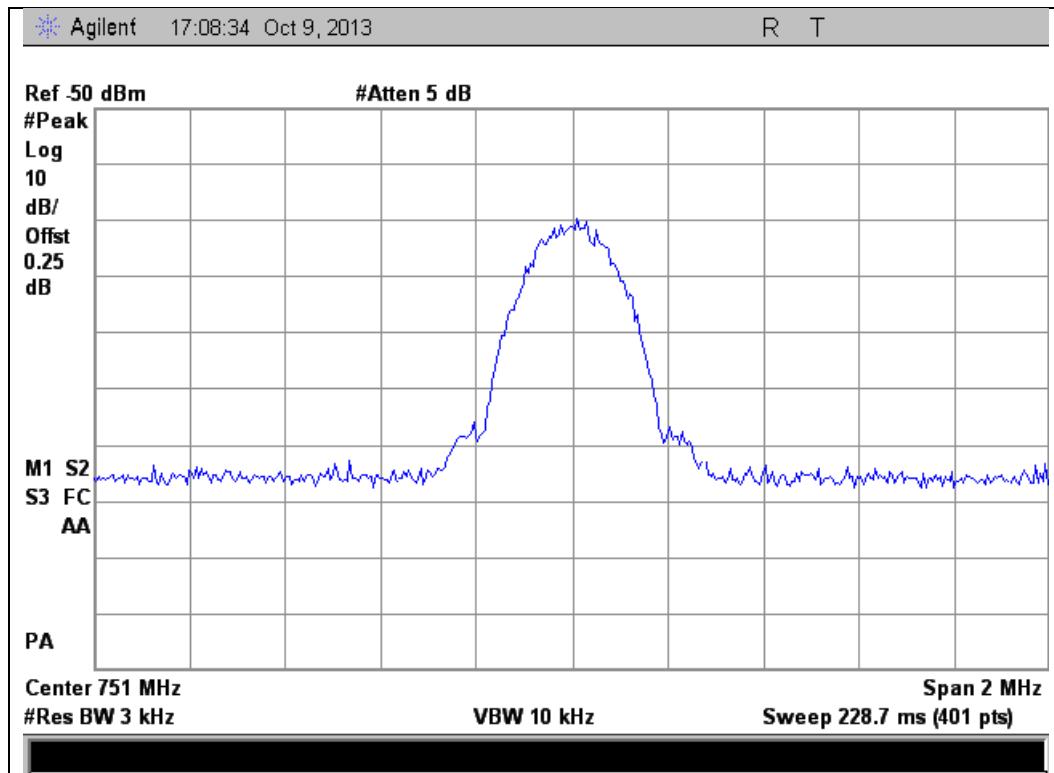
Output



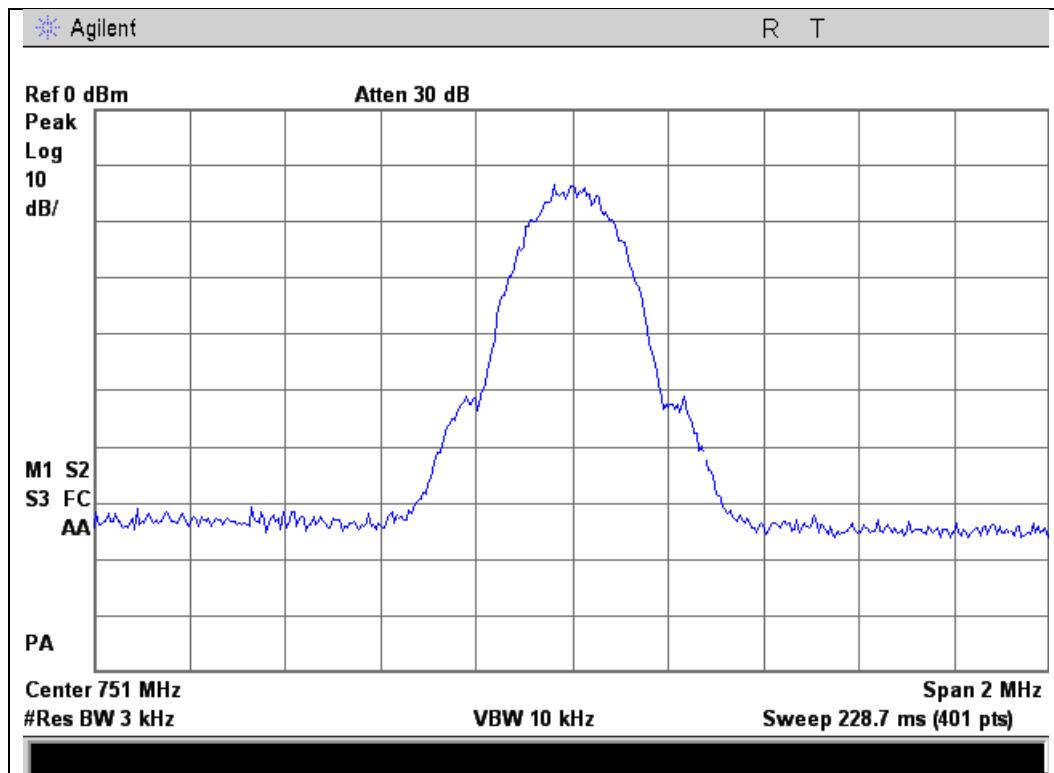


746 - 756 MHz Band

Input



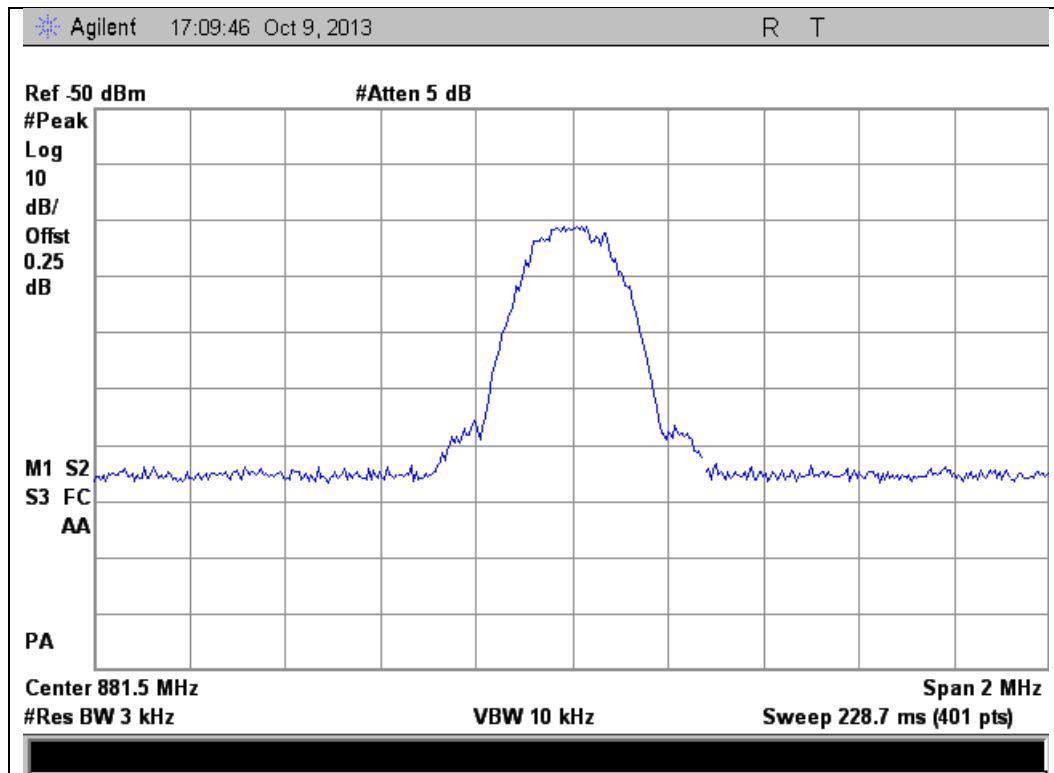
Output



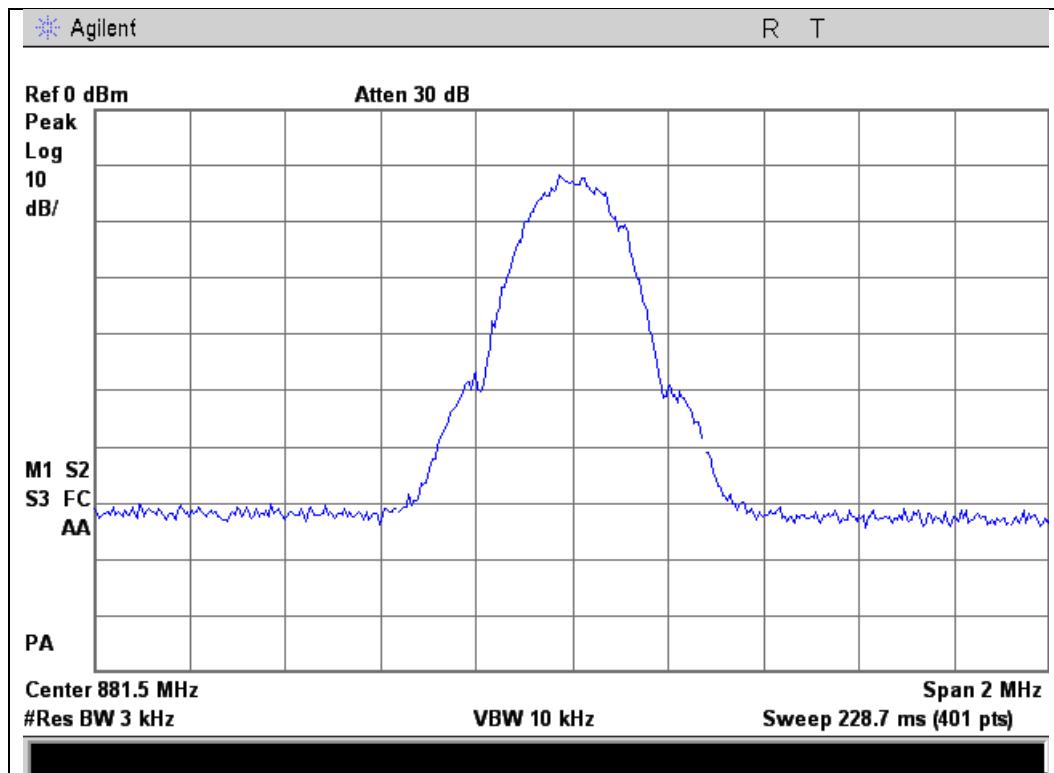


869 - 894 MHz Band

Input



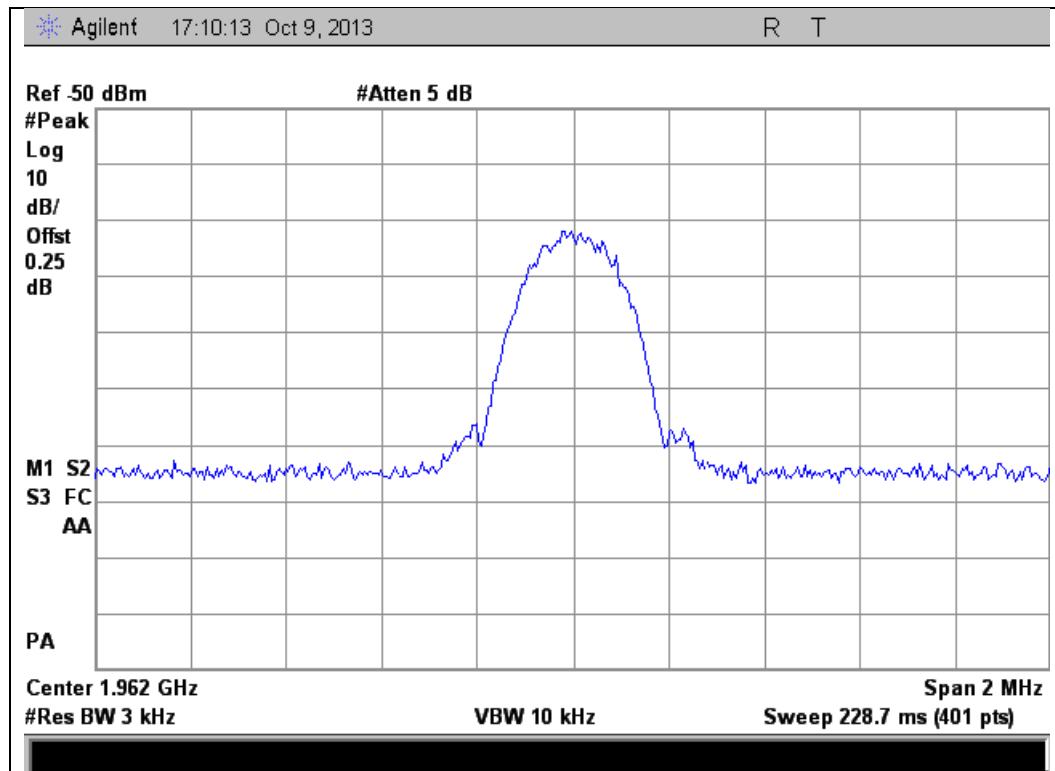
Output



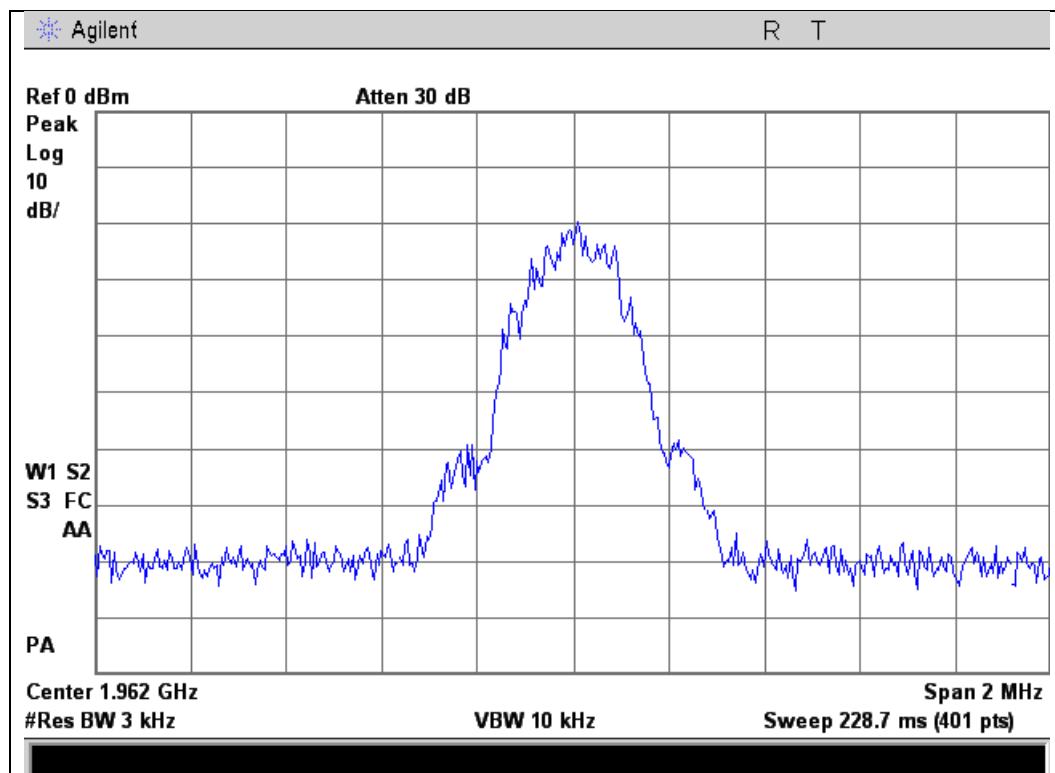


1930 - 1995 MHz Band

Input



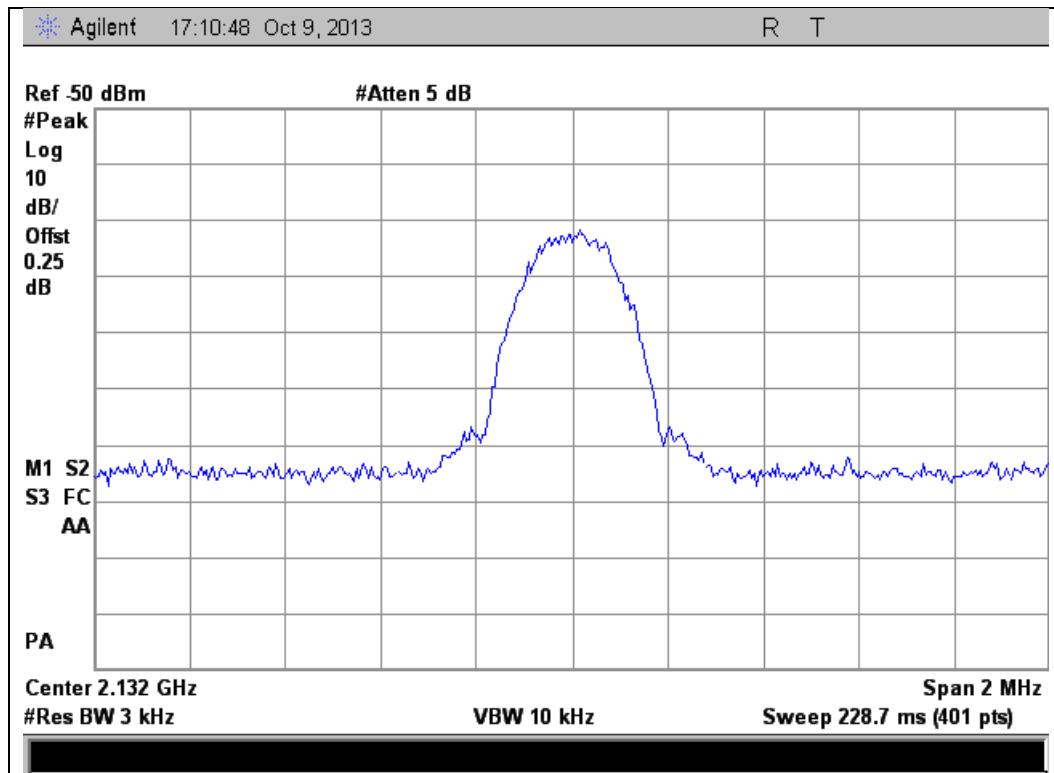
Output



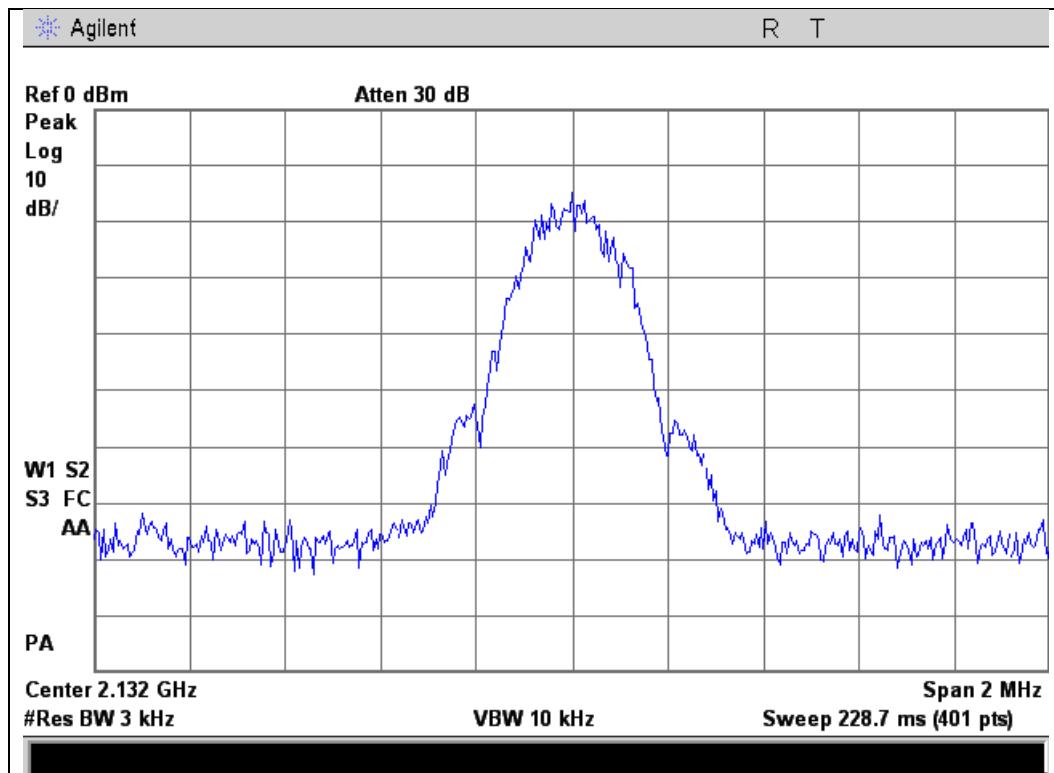


2110 - 2155 MHz Band

Input



Output

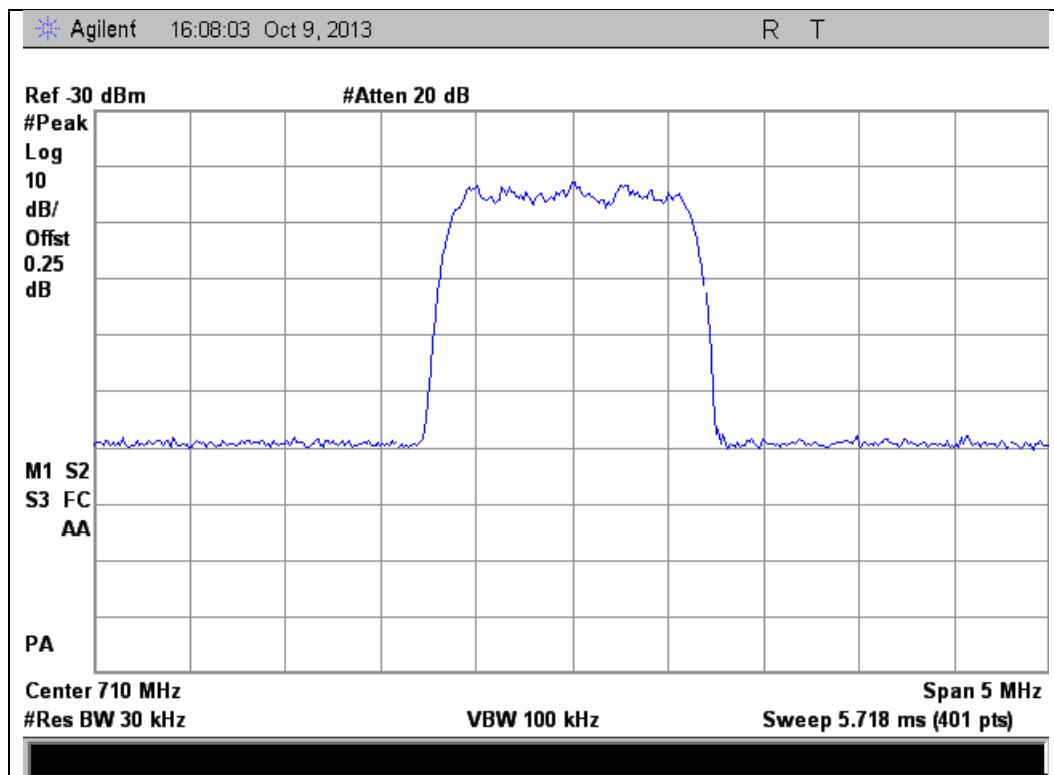




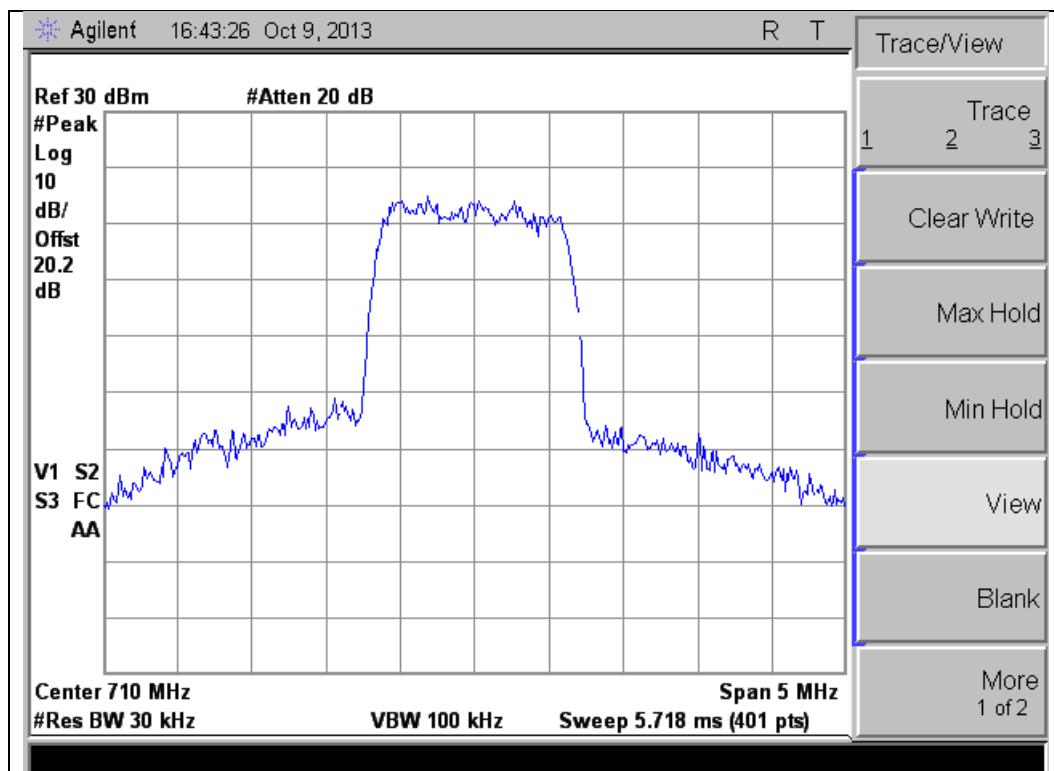
CDMA Uplink Test Plots

704 - 716 MHz Band

Input



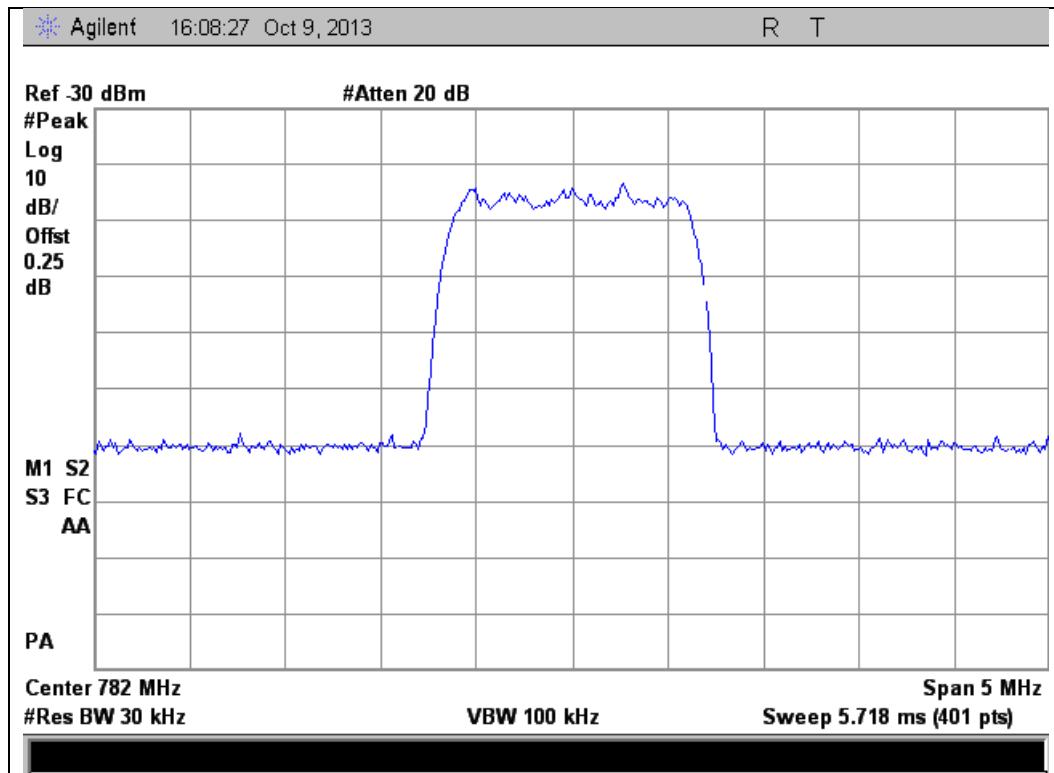
Output



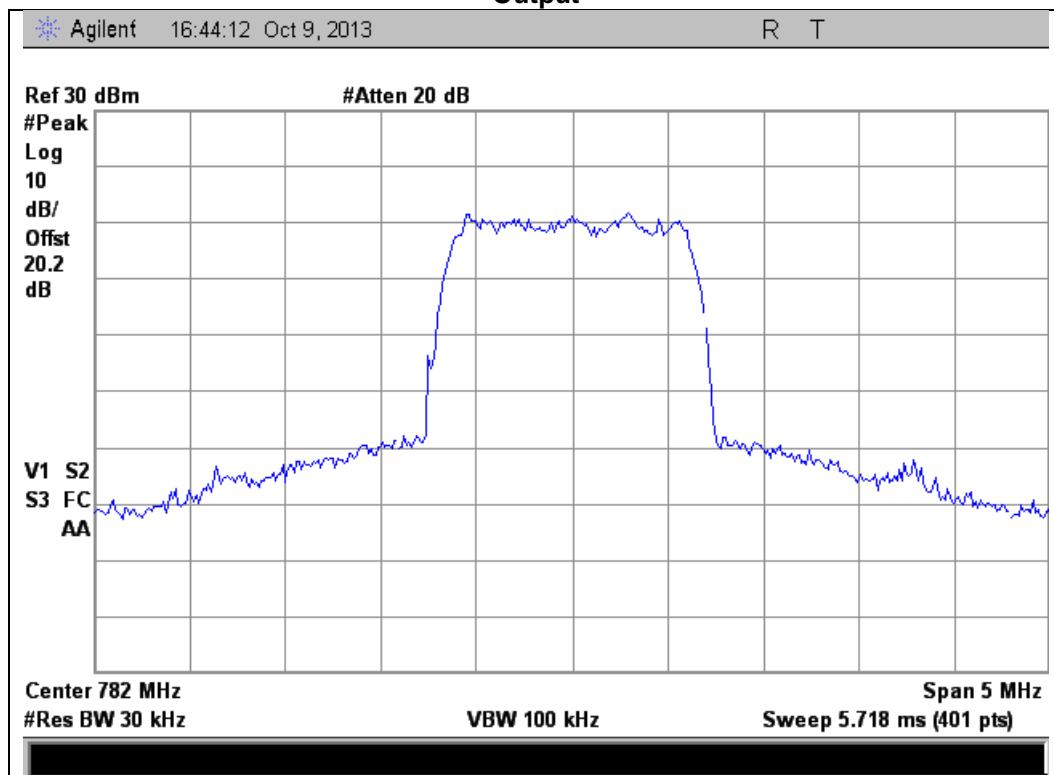


777 - 787 MHz Band

Input



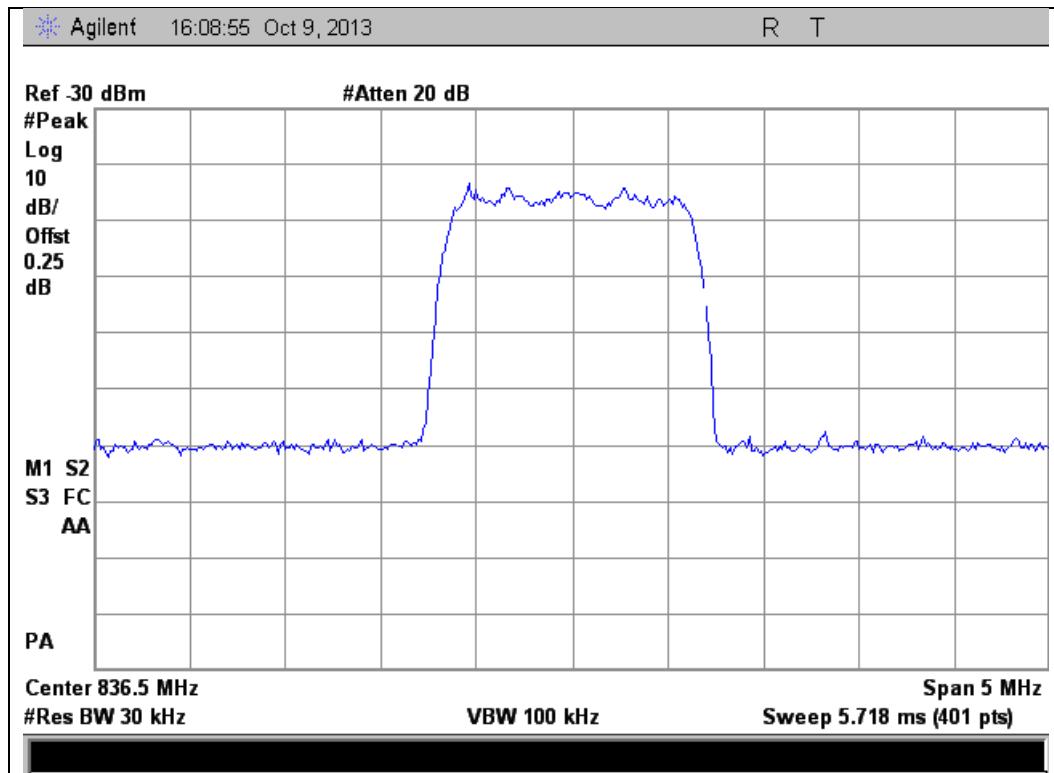
Output



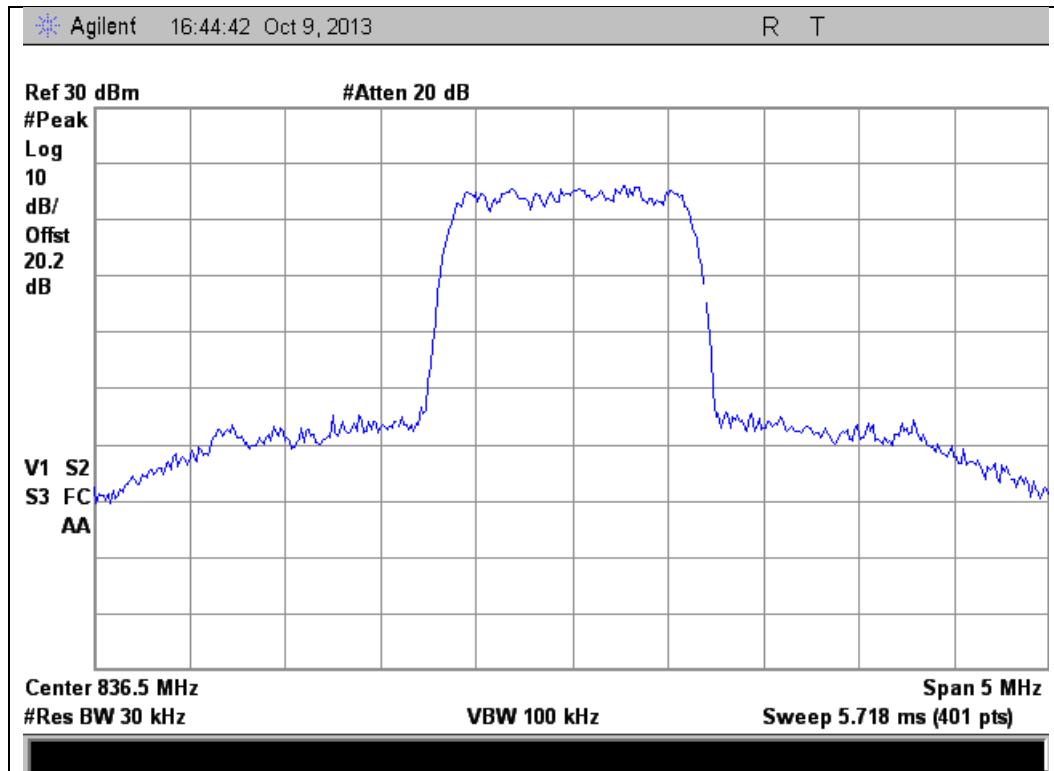


824 - 849 MHz Band

Input



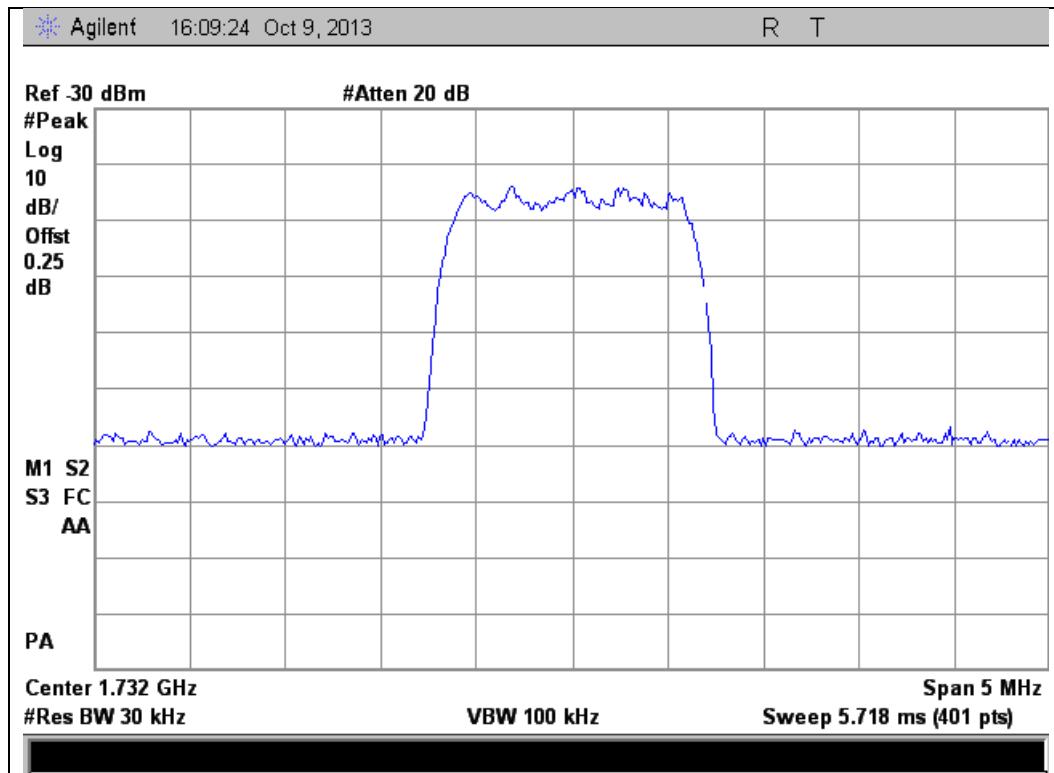
Output



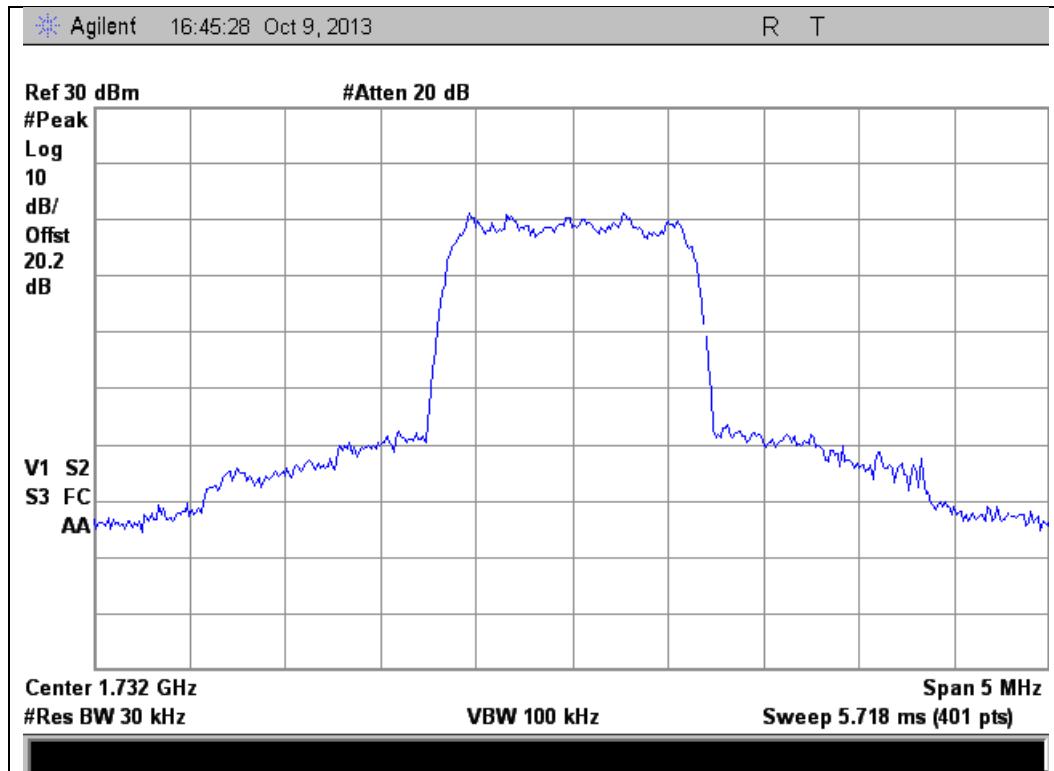


1710 - 1755 MHz Band

Input



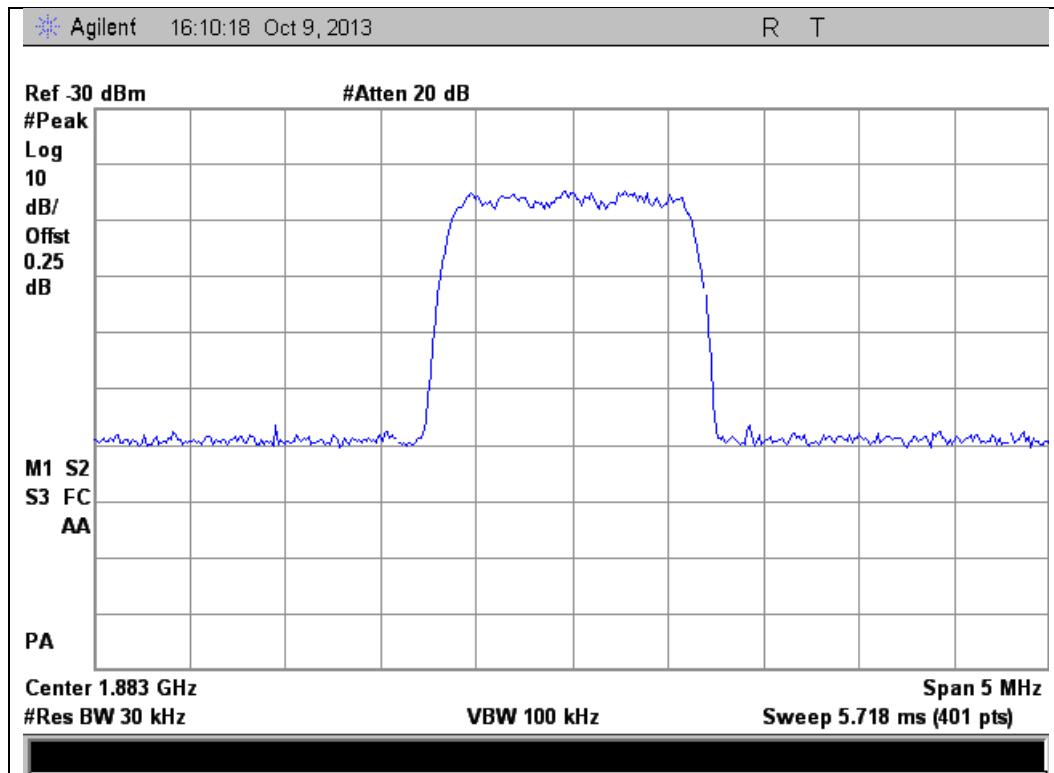
Output



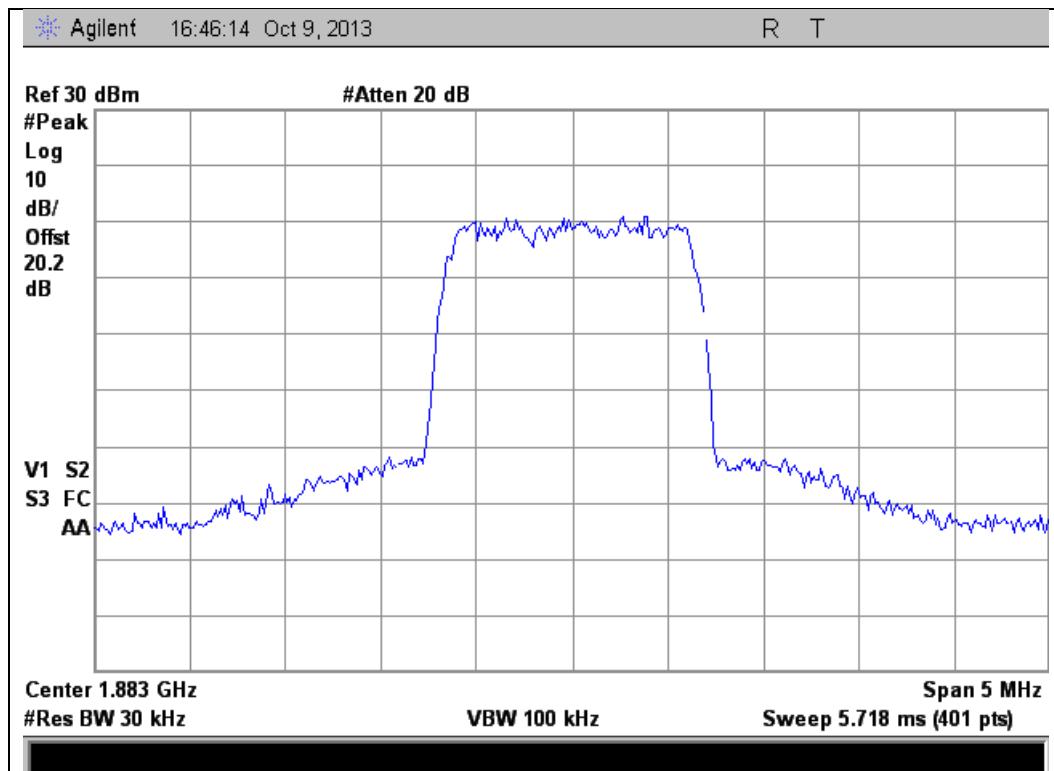


1850 - 1915 MHz Band

Input



Output

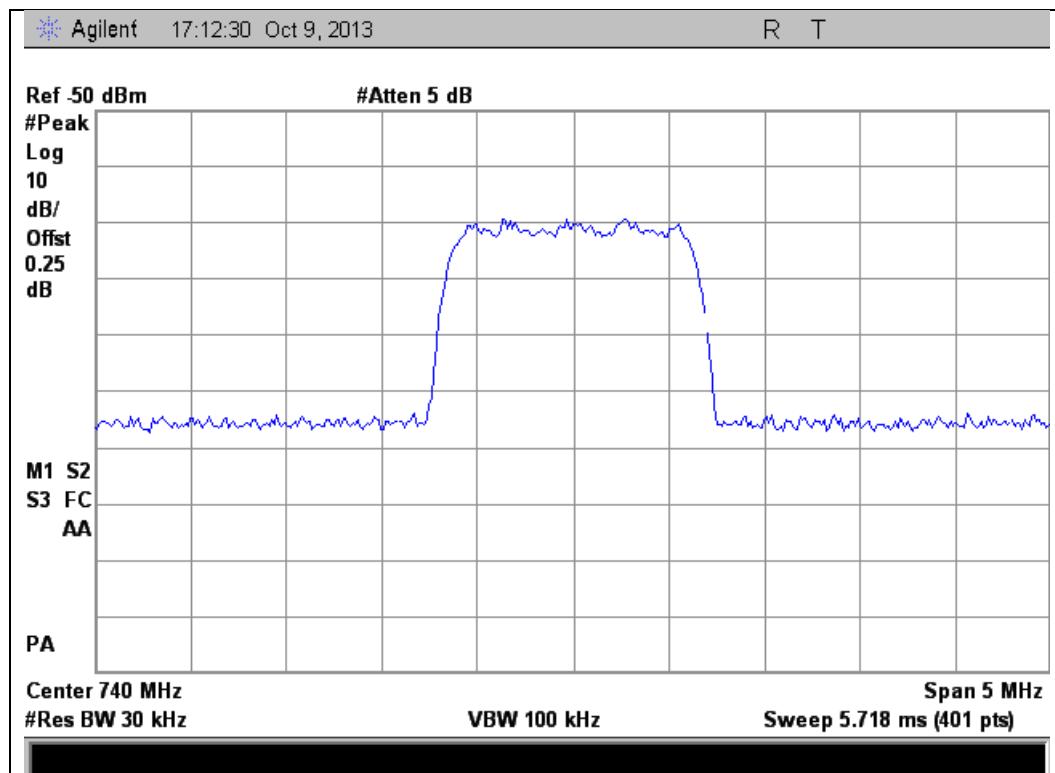




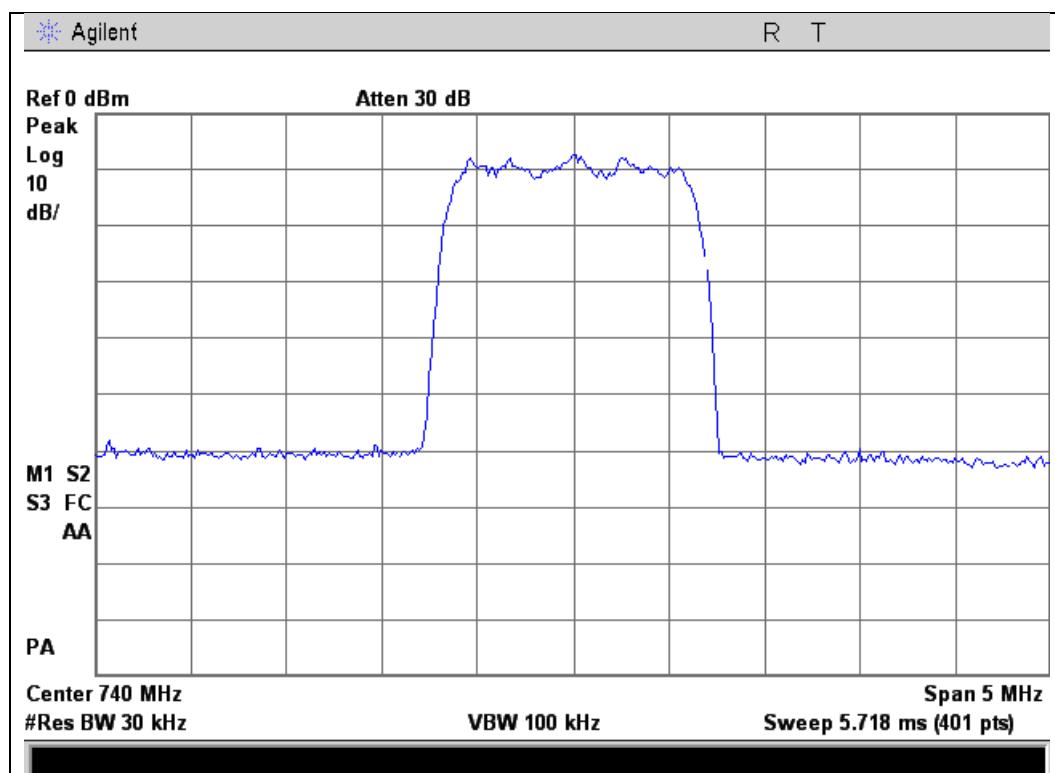
CDMA Downlink Test Plots

734 - 746 MHz Band

Input



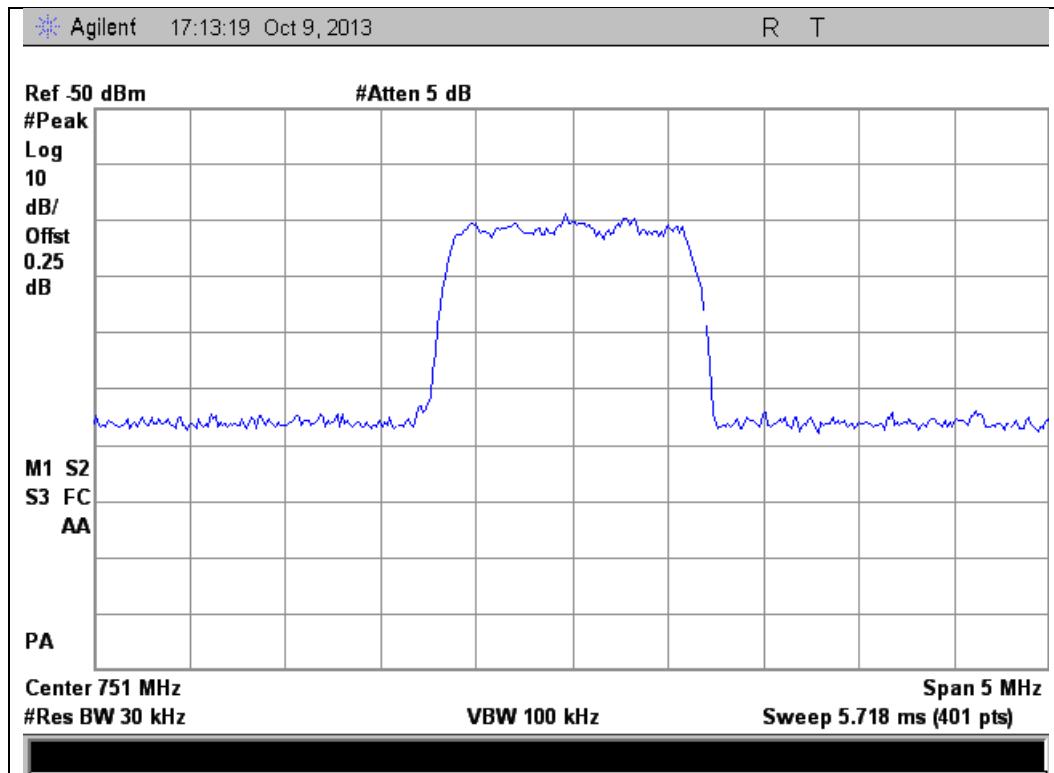
Output



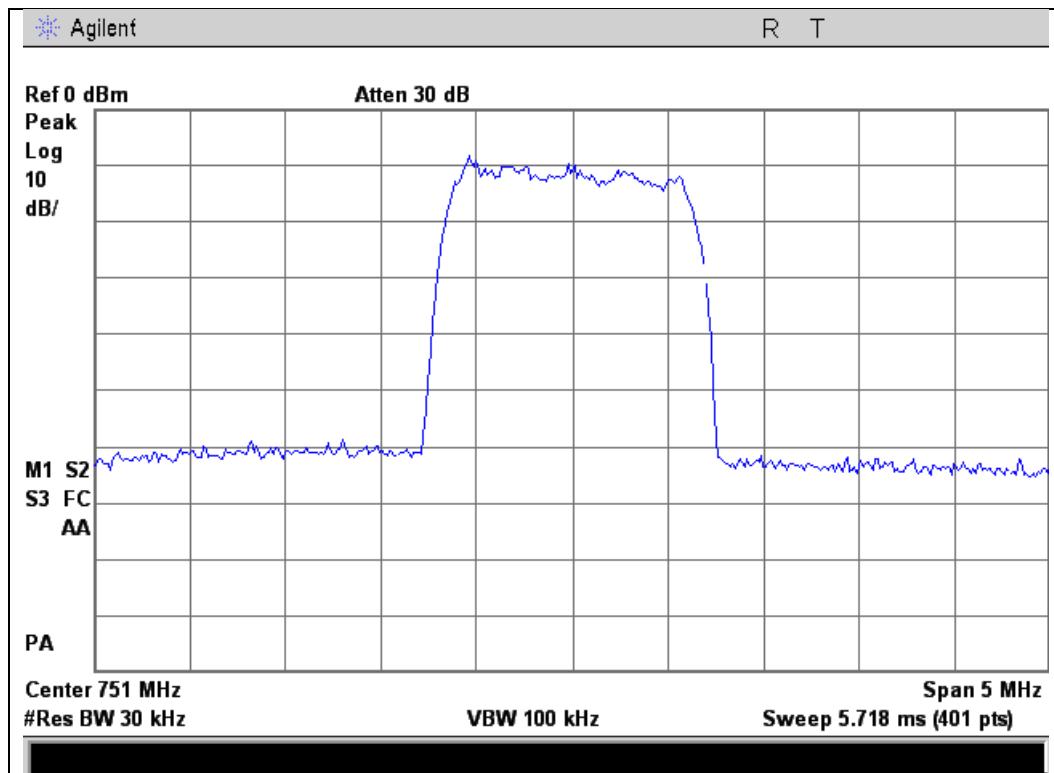


746 - 756 MHz Band

Input



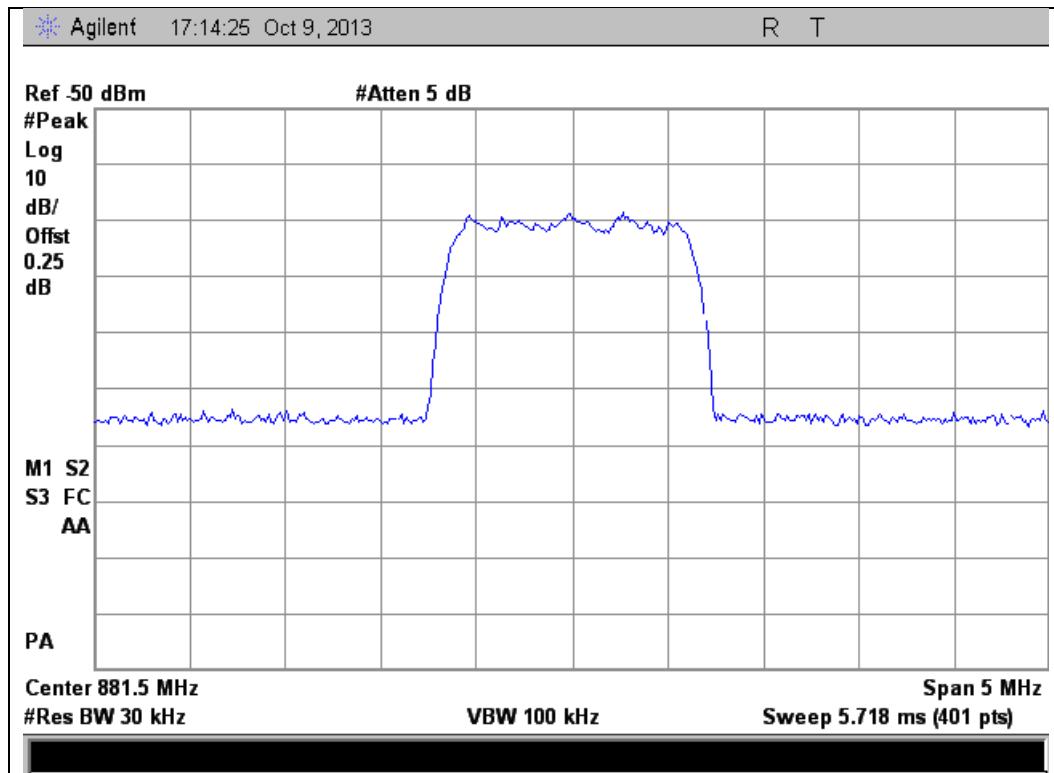
Output



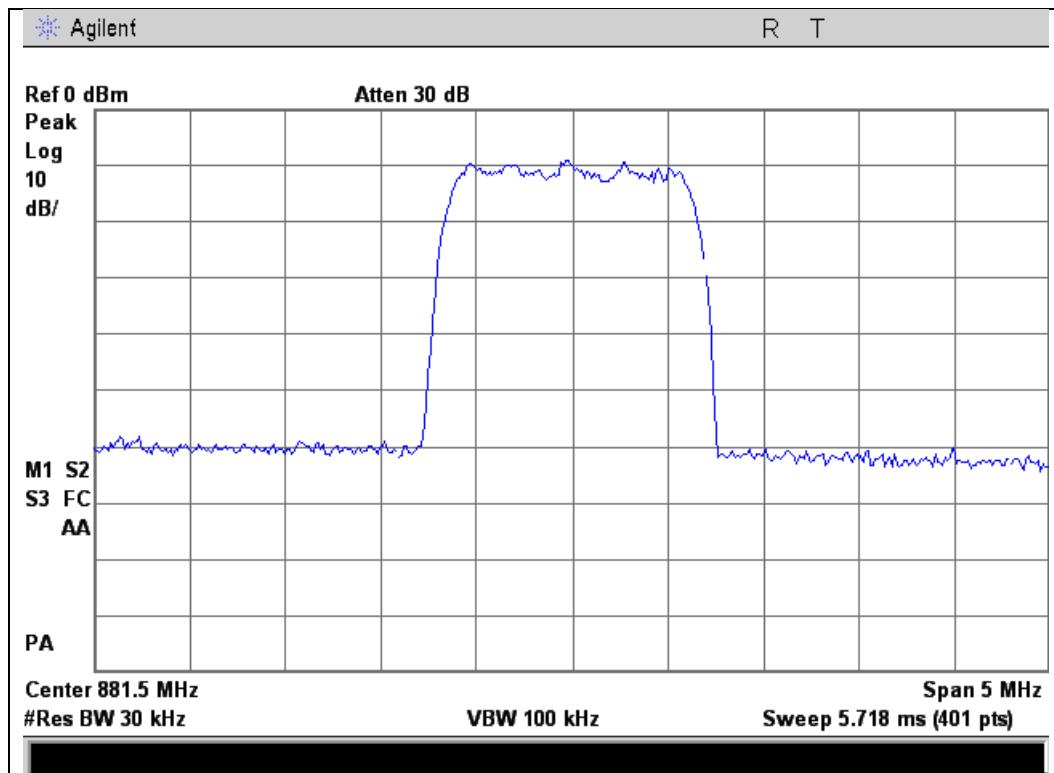


869 - 894 MHz Band

Input



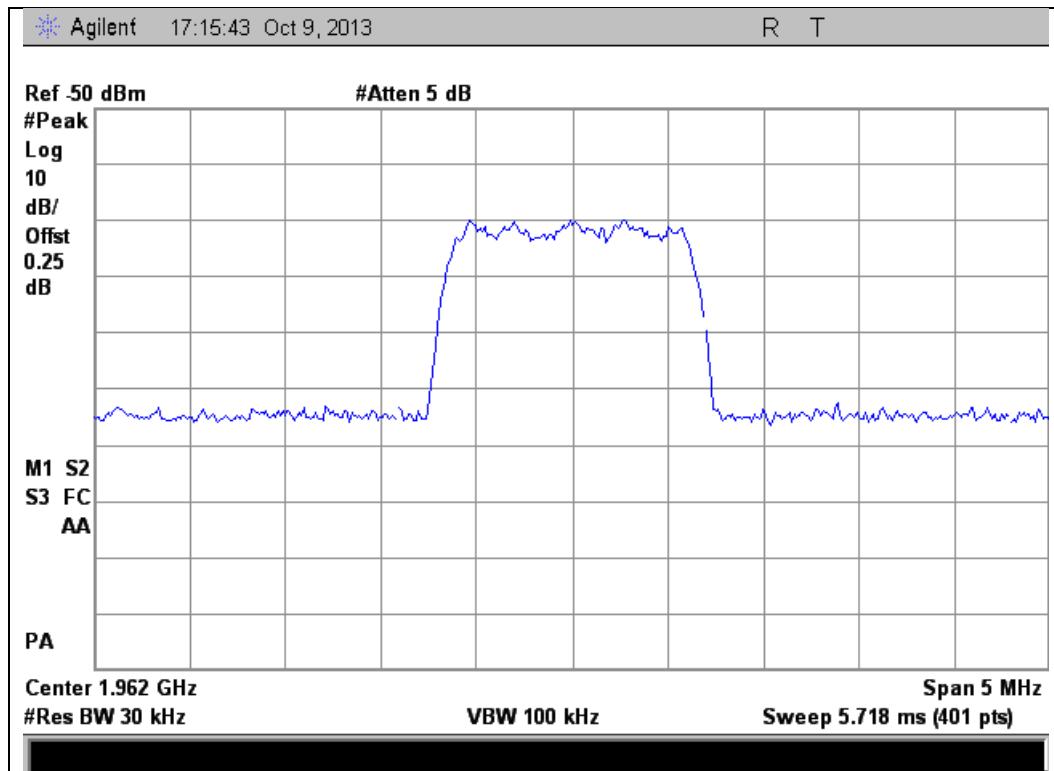
Output



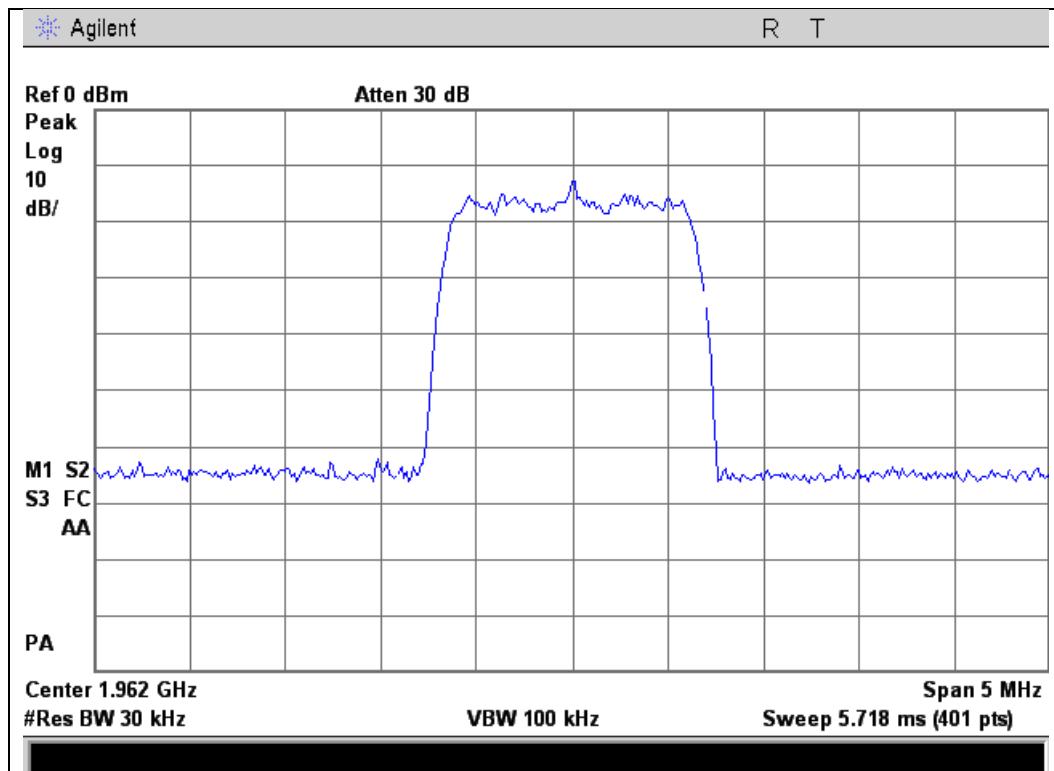


1930 - 1995 MHz Band

Input



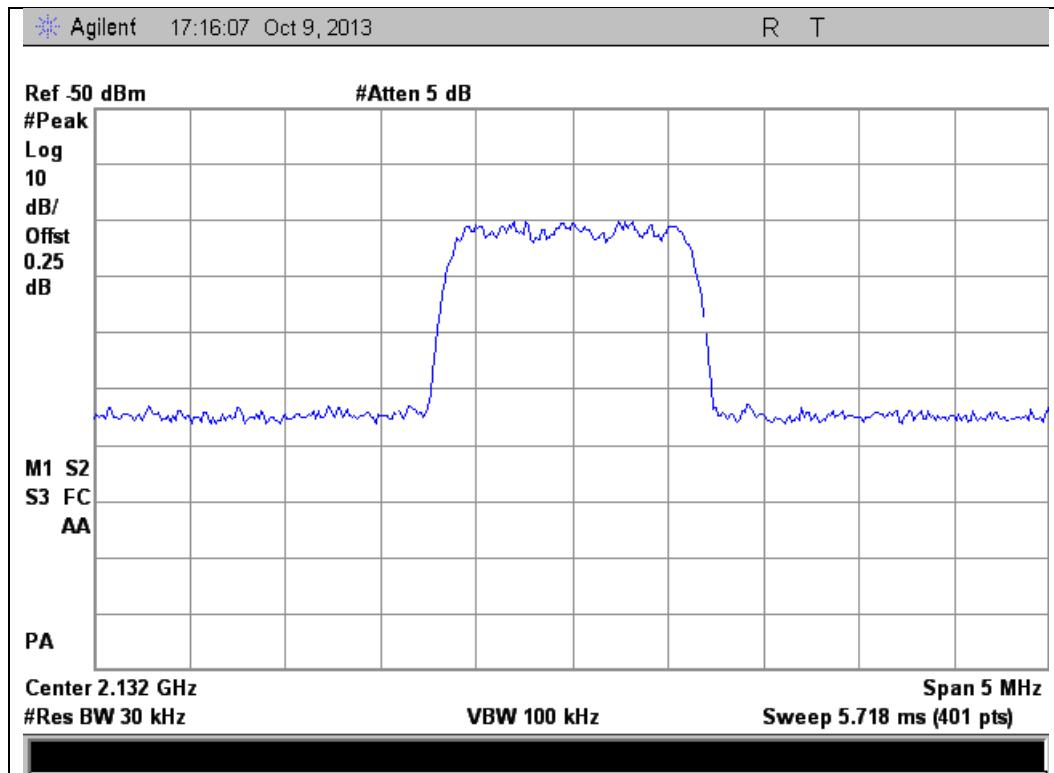
Output



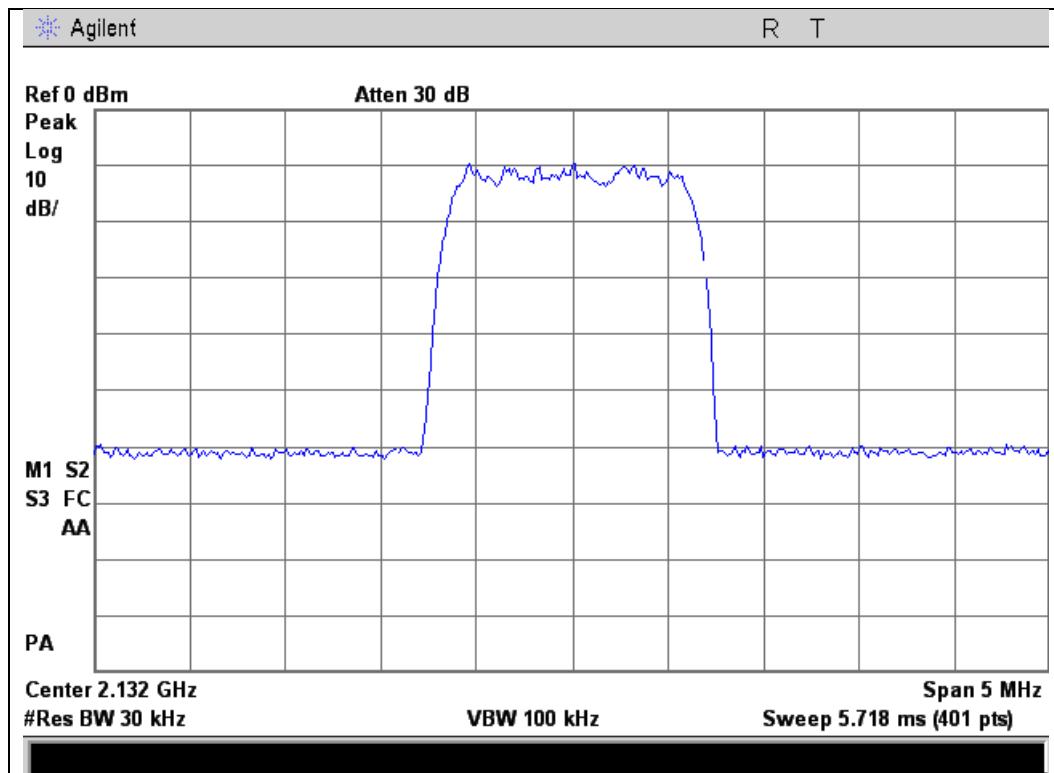


2110 - 2155 MHz Band

Input



Output

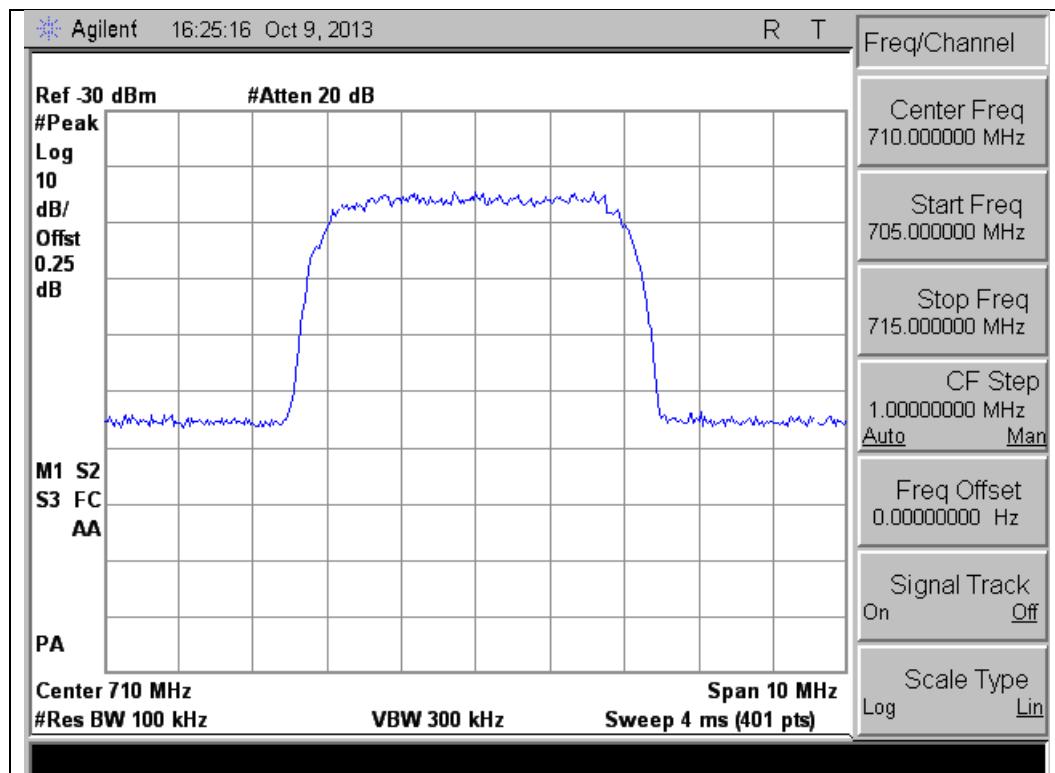




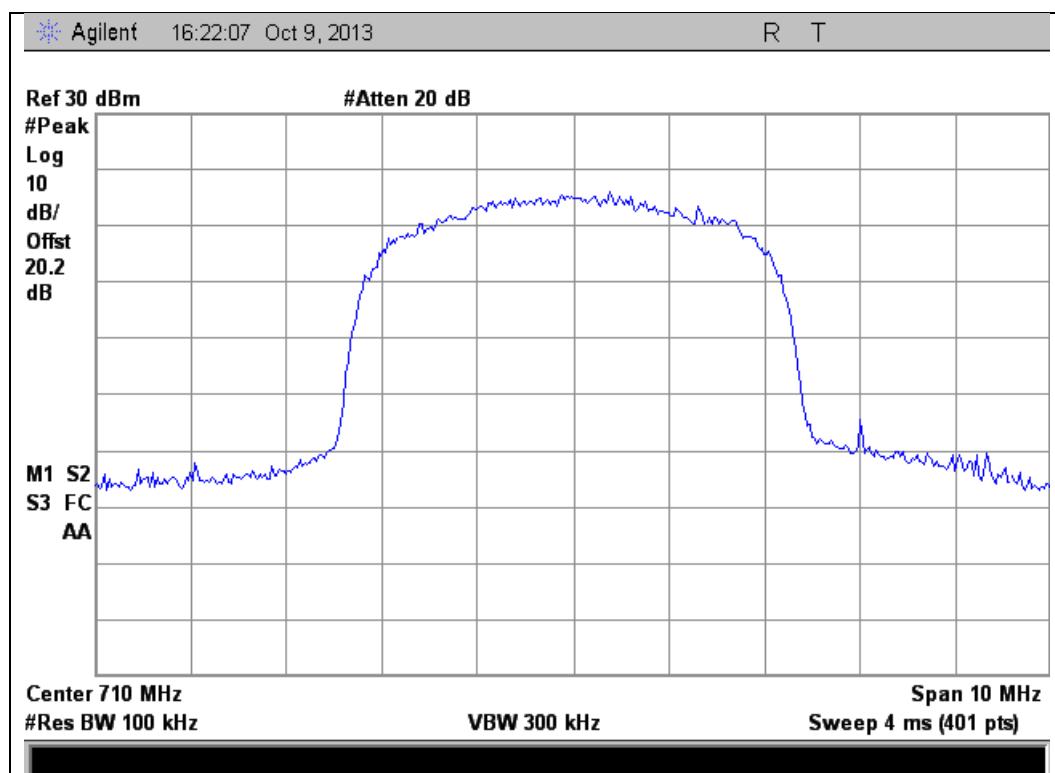
WCDMA Uplink Test Plots

704 - 716 MHz Band

Input



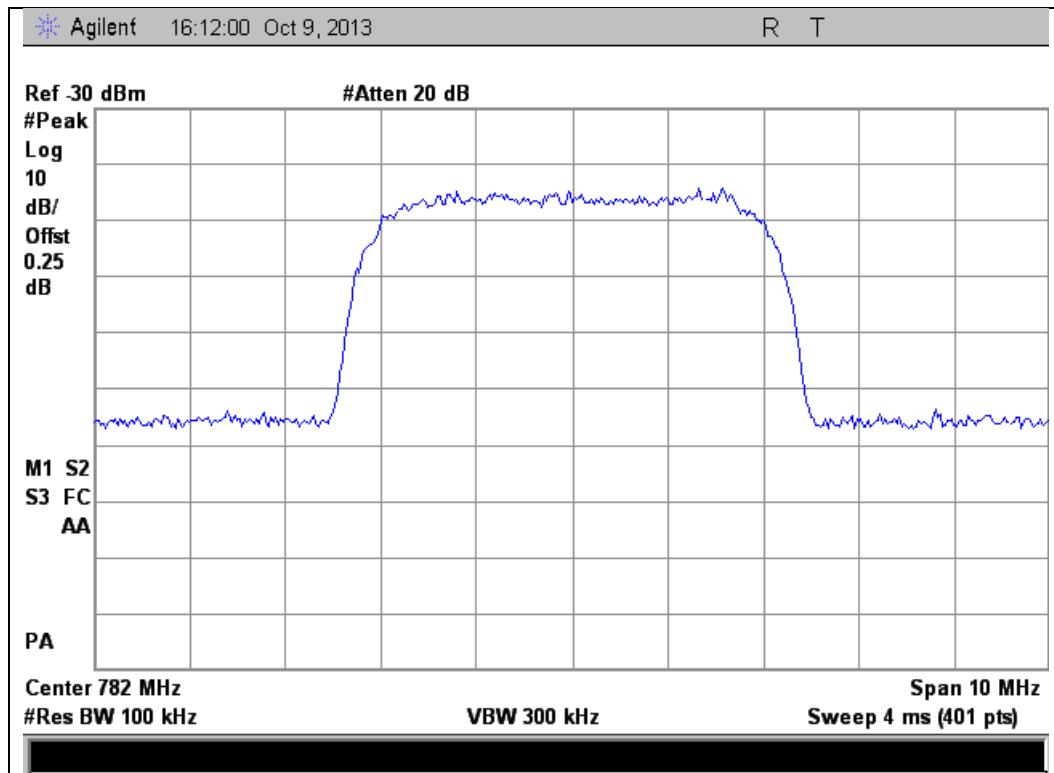
Output



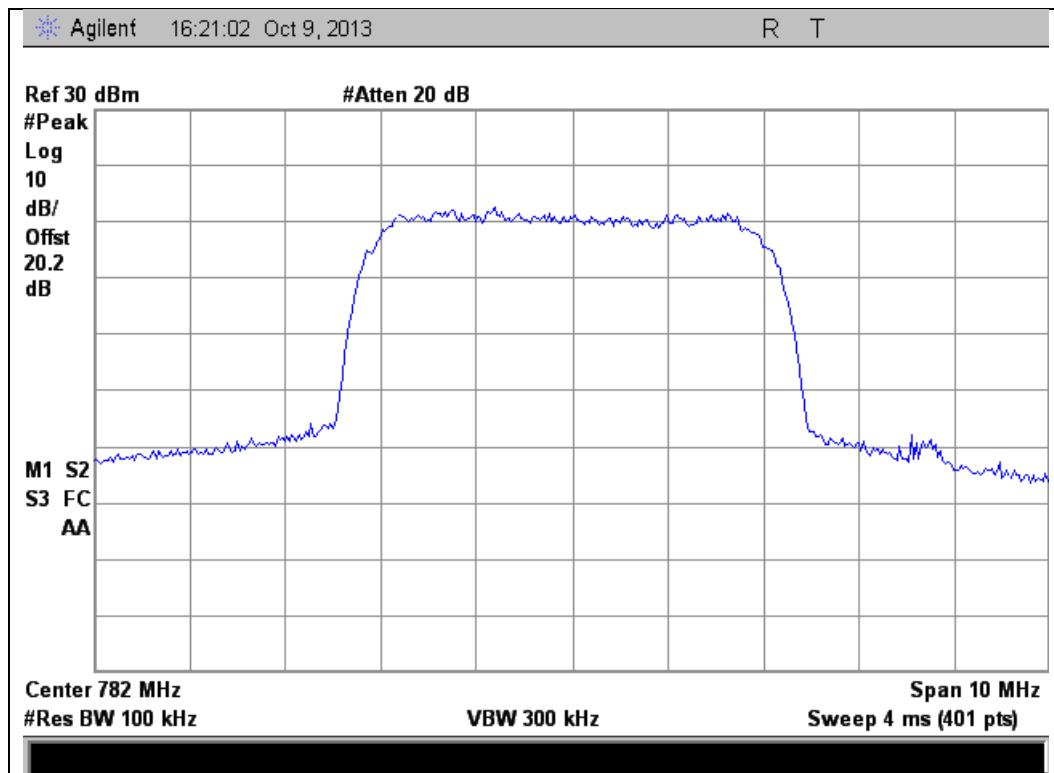


777 - 787 MHz Band

Input



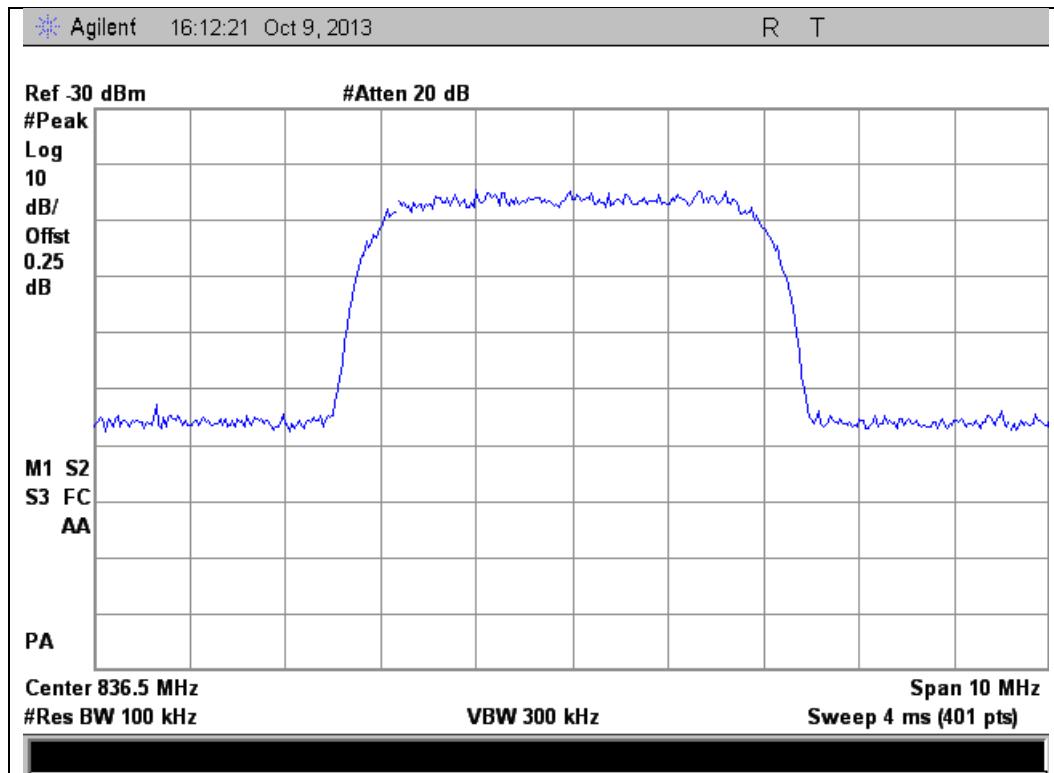
Output



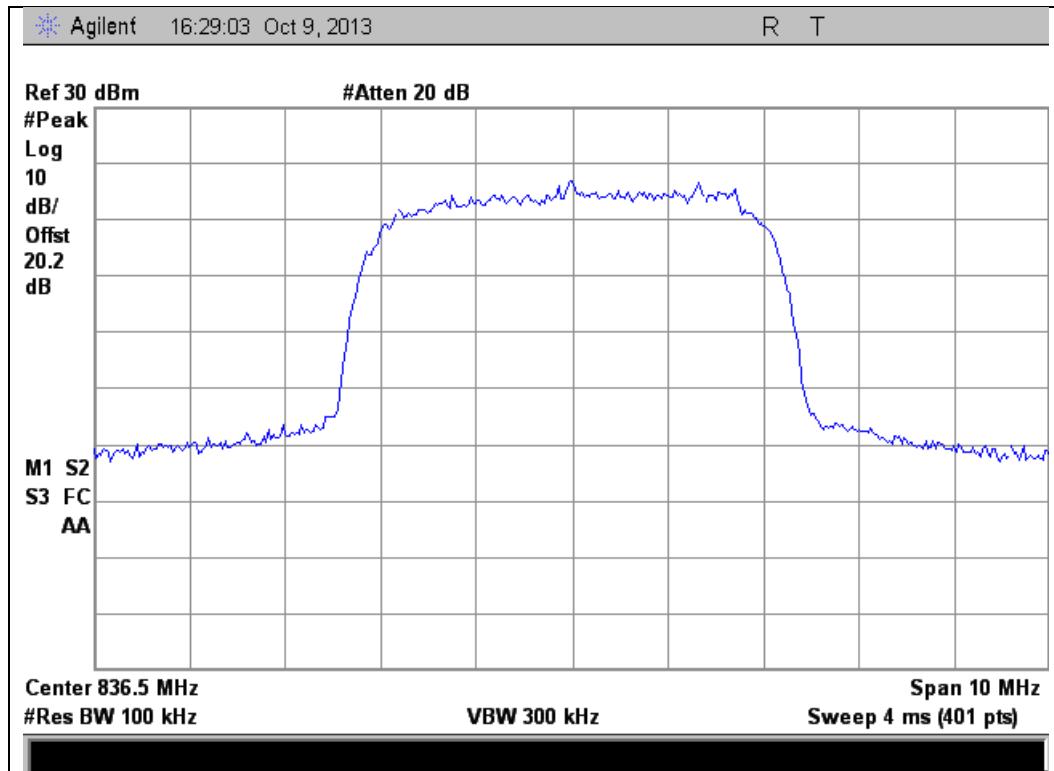


824 - 849 MHz Band

Input



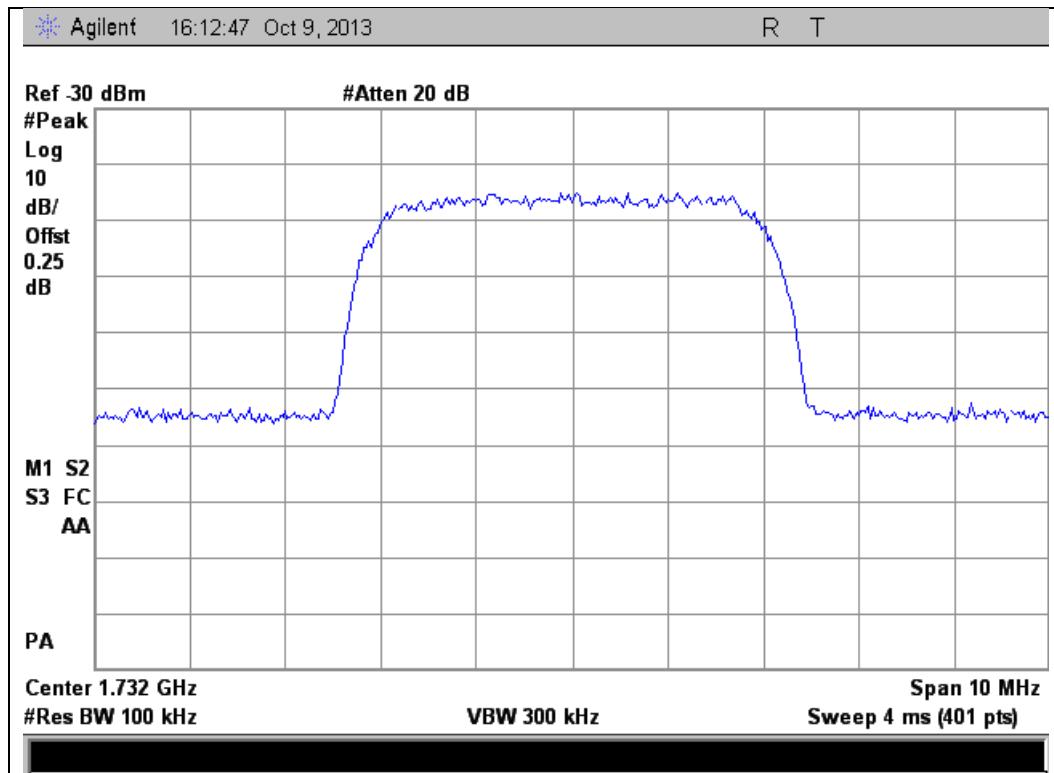
Output



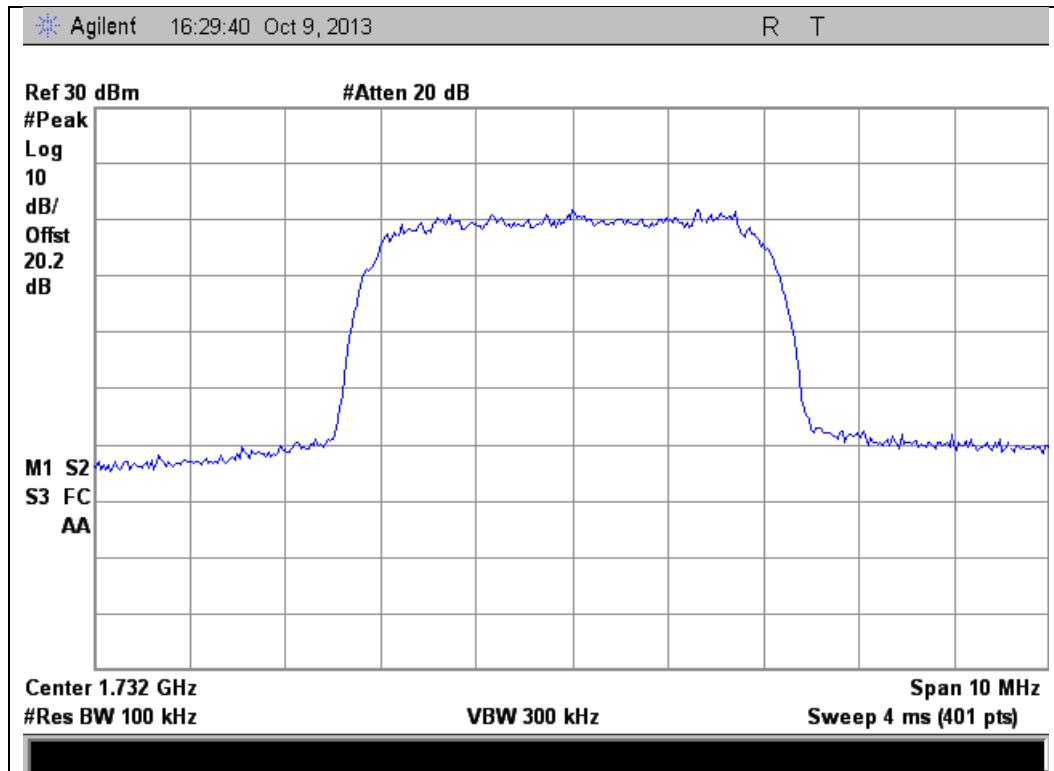


1710 - 1755 MHz Band

Input



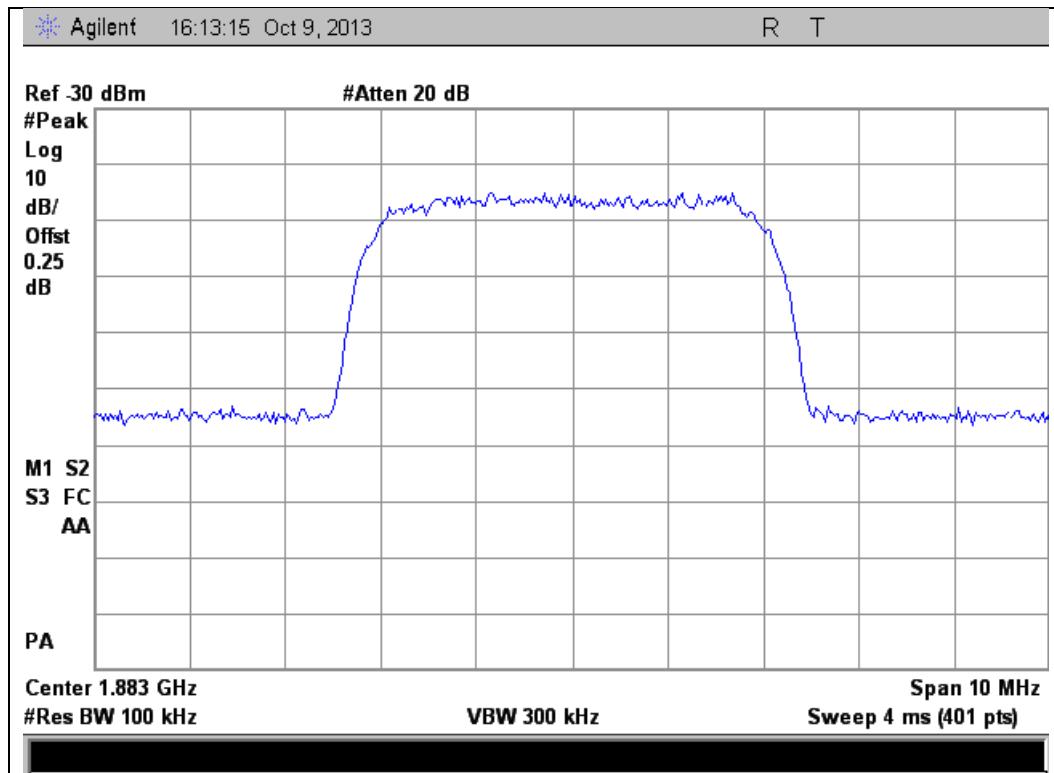
Output



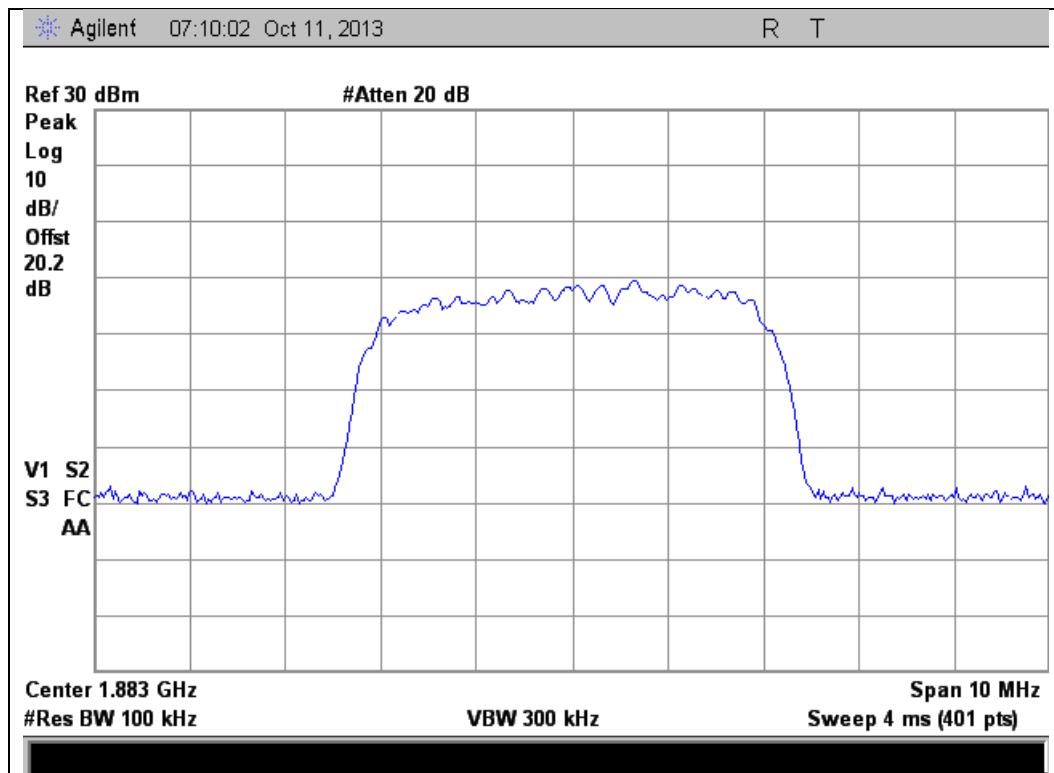


1850 - 1915 MHz Band

Input



Output

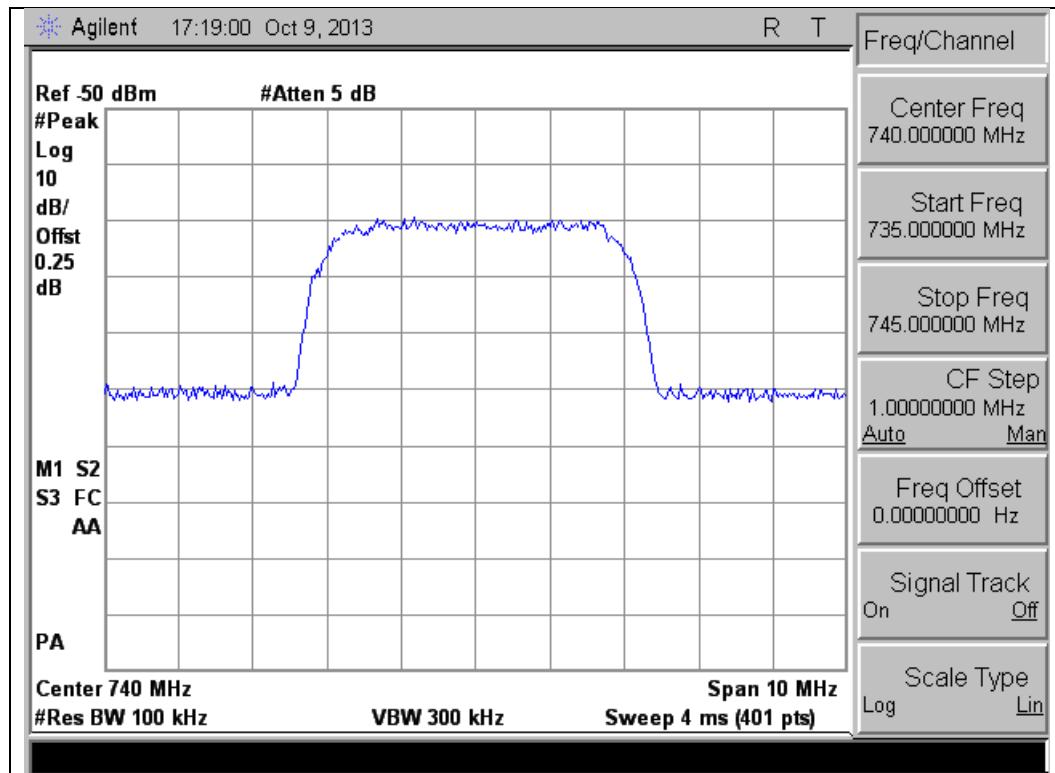




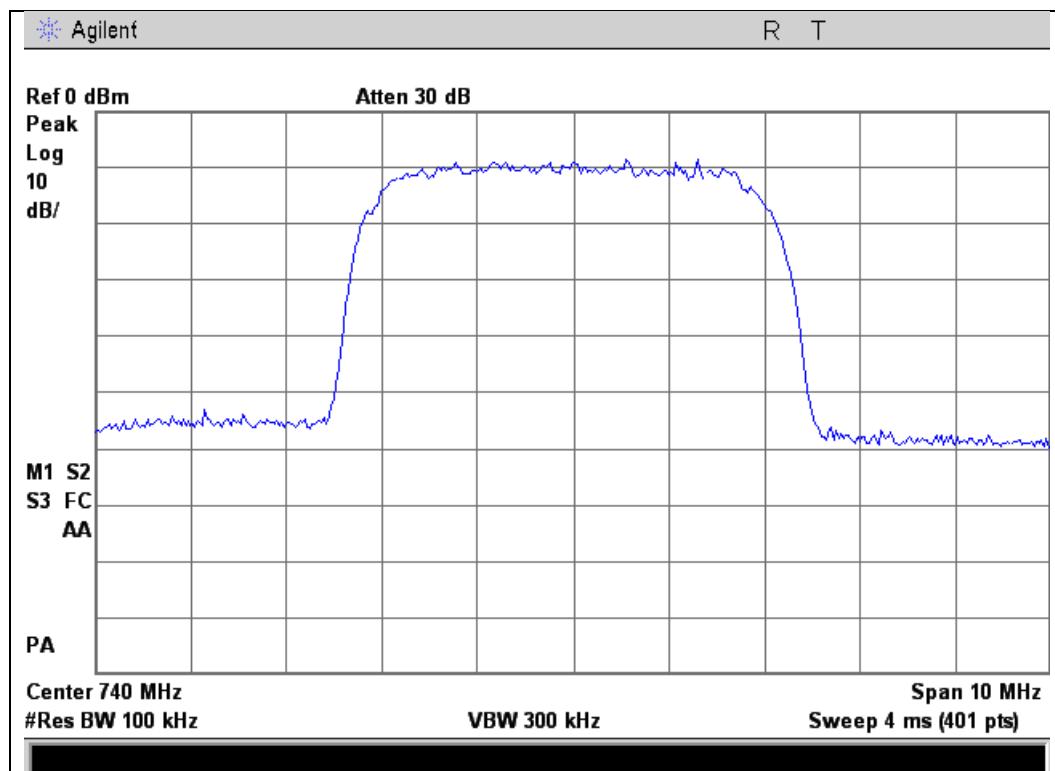
WCDMA Downlink Test Plots

734 - 746 MHz Band

Input



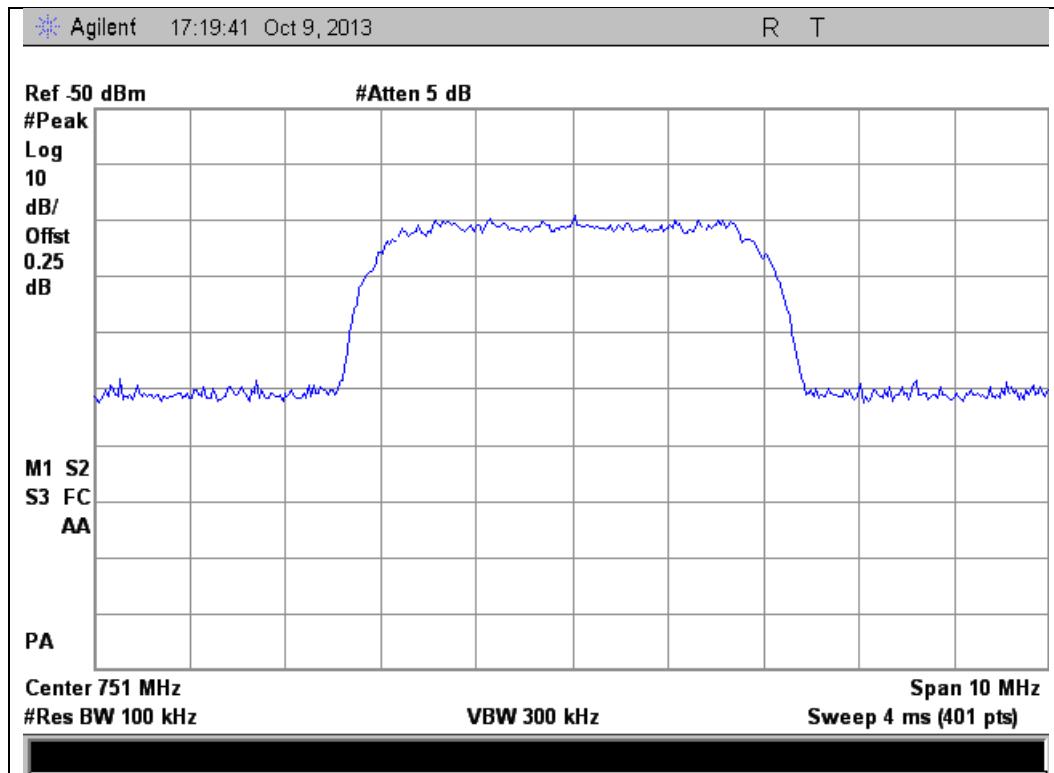
Output



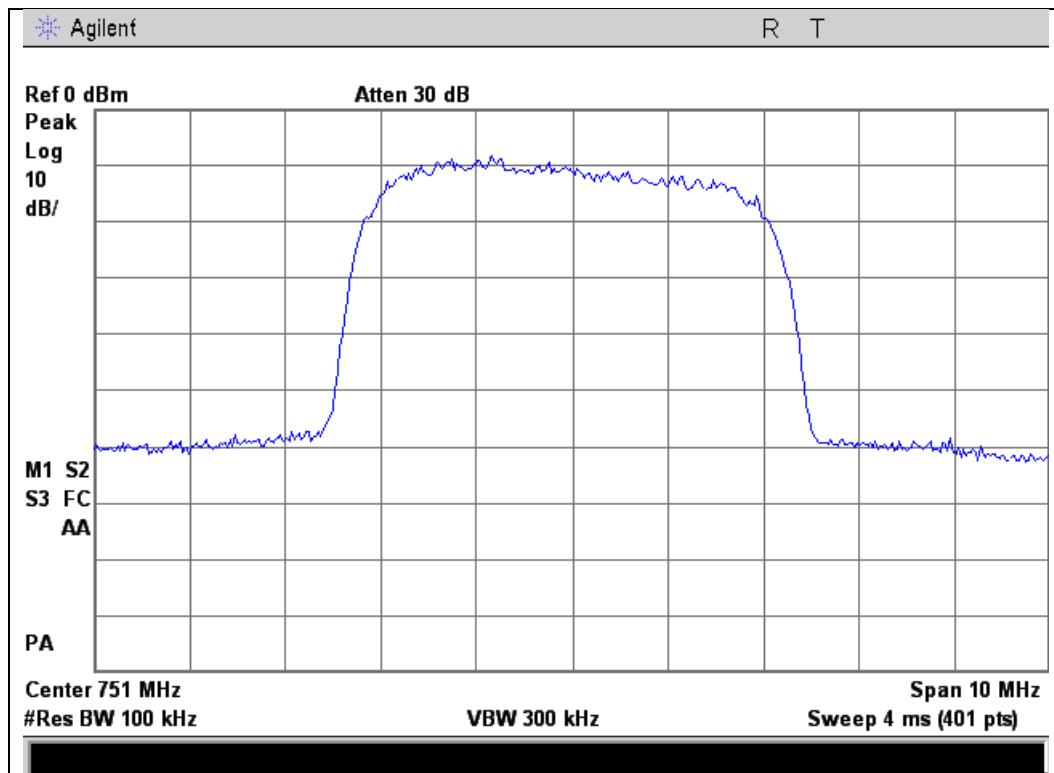


746 - 756 MHz Band

Input



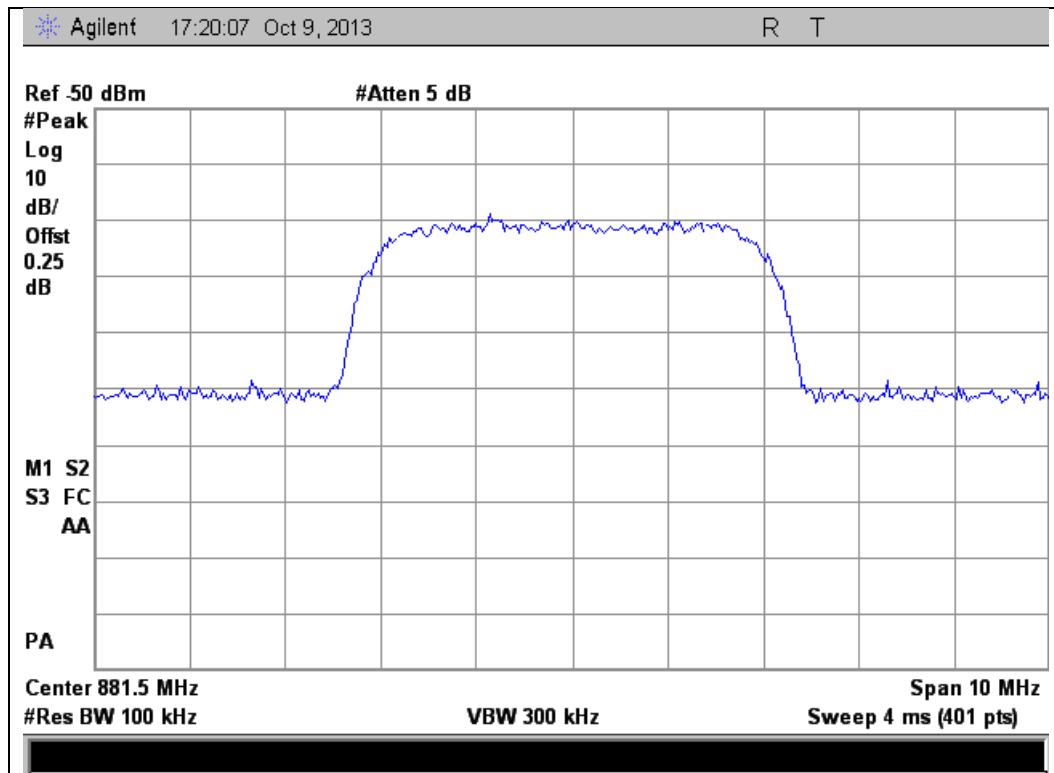
Output



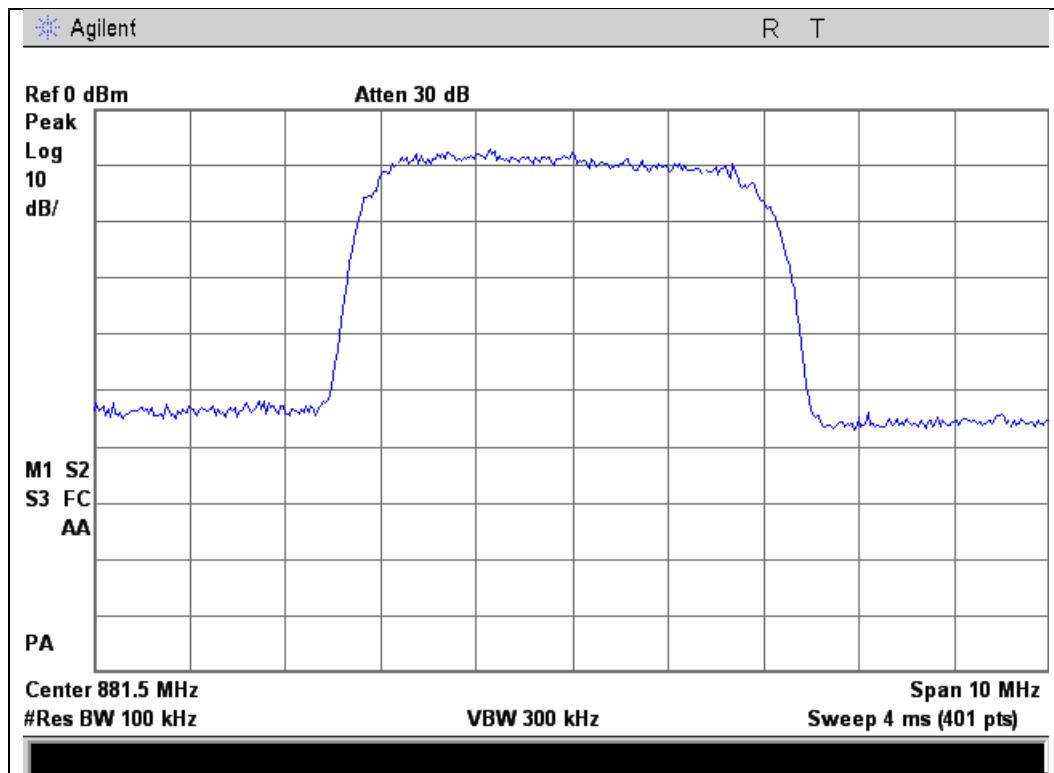


869 - 894 MHz Band

Input



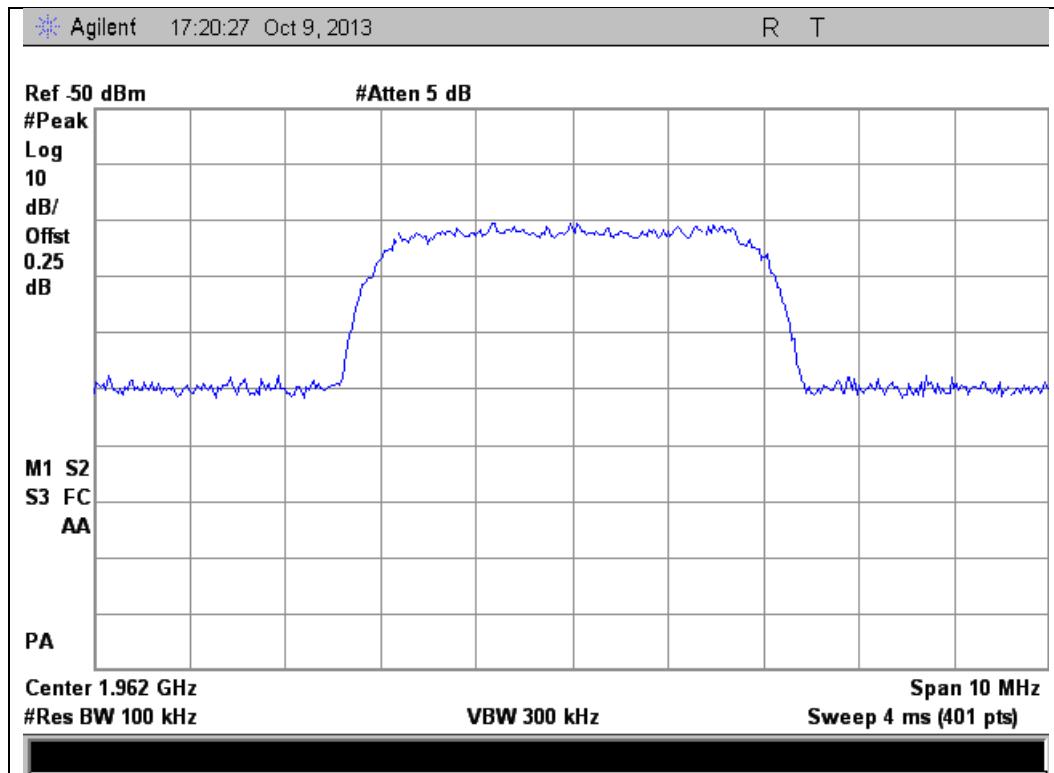
Output



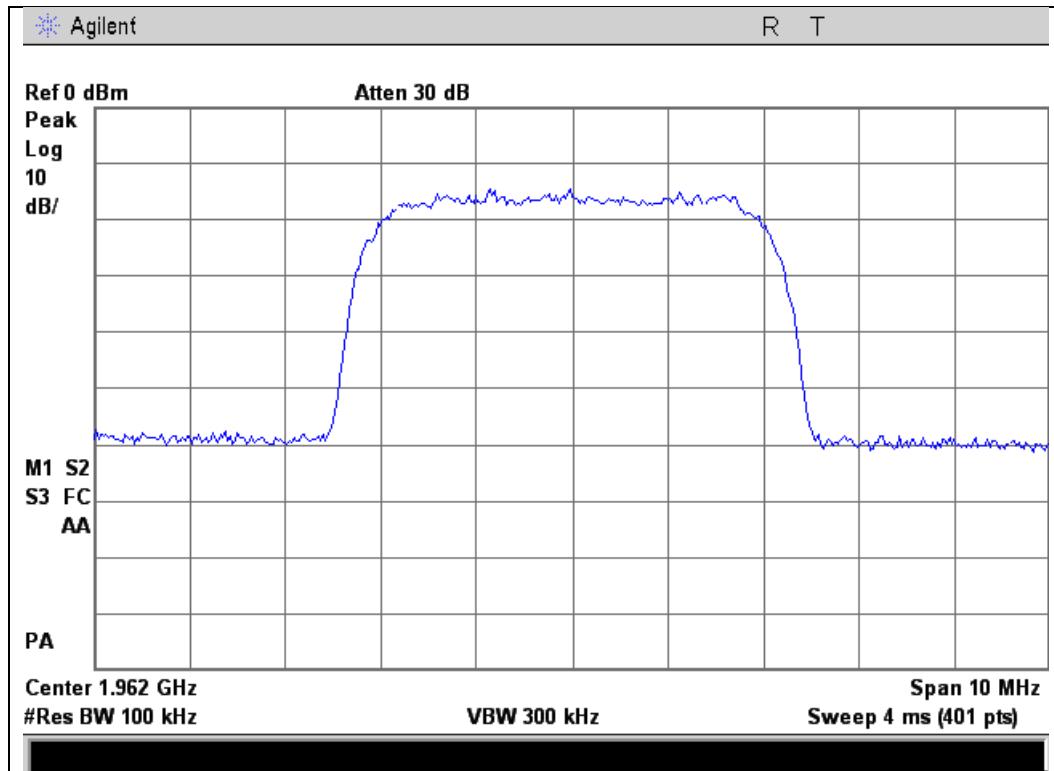


1930 - 1995 MHz Band

Input



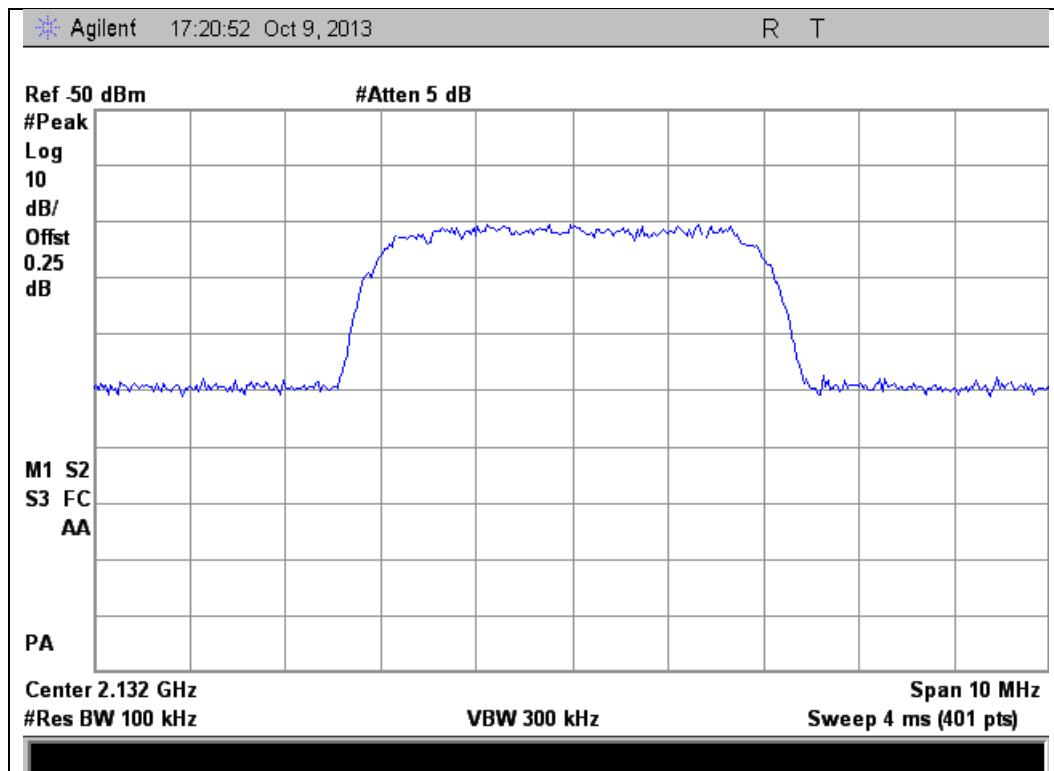
Output



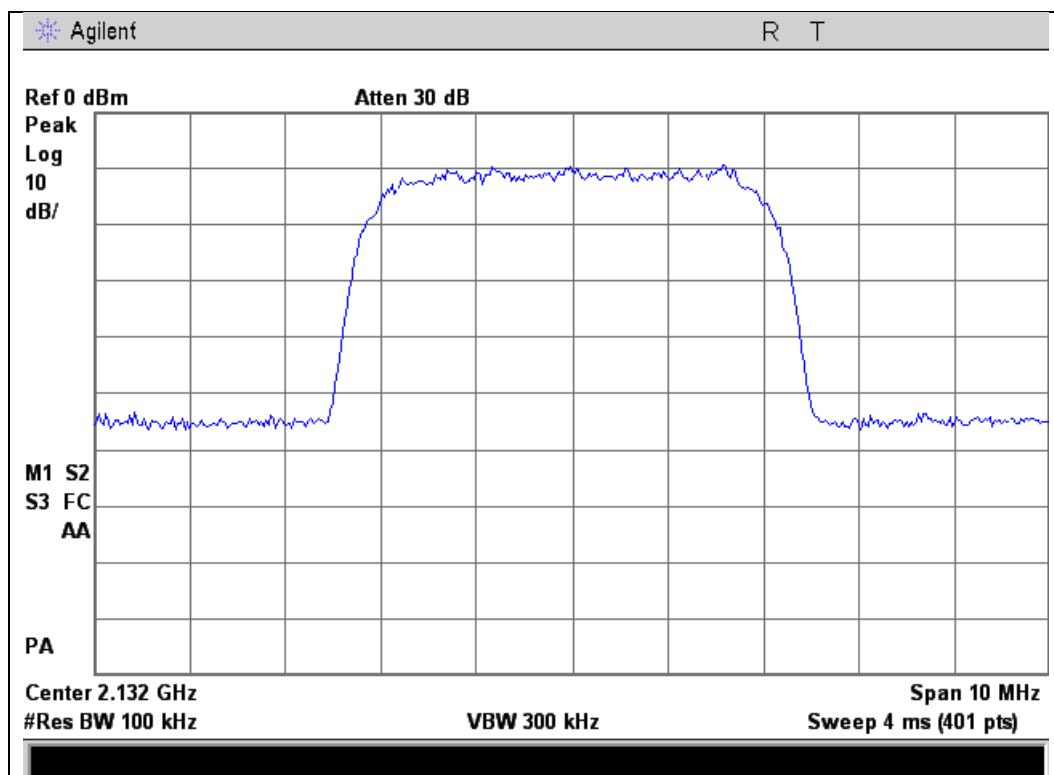


2110 - 2155 MHz Band

Input



Output





Oscillation Detection

Name of Test:

Oscillation Detection

Engineer: Mike Graffeo

Test Equipment Utilized:

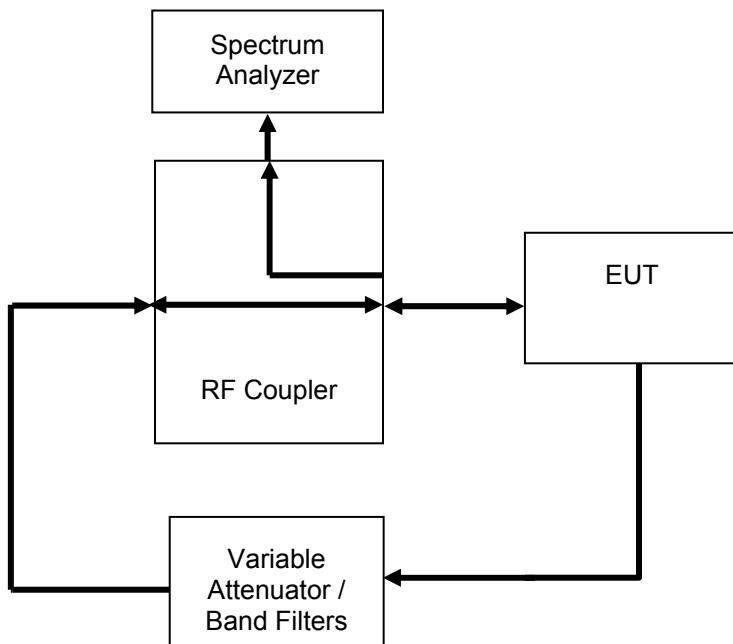
i00331, i00405, i00412

Test Date: 9/26/13

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
704 - 716	144.4	300	Pass
777 - 787	126.2	300	Pass
824 - 849	145.2	300	Pass
1710 - 1755	142.7	300	Pass
1850 - 1915	160.9	300	Pass

Downlink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (S)	Result
734 - 746	21.5	1	Pass
746 - 756	22.5	1	Pass
869 - 894	144.5	1	Pass
1930 - 1995	143.5	1	Pass
2110 - 2155	143.0	1	Pass

Uplink Restart Time Test Results

Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result
704 - 716	65.8	≥60	Pass
777 - 787	65.4	≥60	Pass
824 - 849	65.8	≥60	Pass
1710 - 1755	65.8	≥60	Pass
1850 - 1915	66.4	≥60	Pass



Downlink Restart Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
734 - 746	65.6	≥60	Pass
746 - 756	65.6	≥60	Pass
869 - 894	65.8	≥60	Pass
1930 - 1995	65.8	≥60	Pass
2110 - 2155	65.6	≥60	Pass

Uplink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
704 - 716	2	≤5	Pass
777 - 787	2	≤5	Pass
824 - 849	1	≤5	Pass
1710 - 1755	1	≤5	Pass
1850 - 1915	1	≤5	Pass

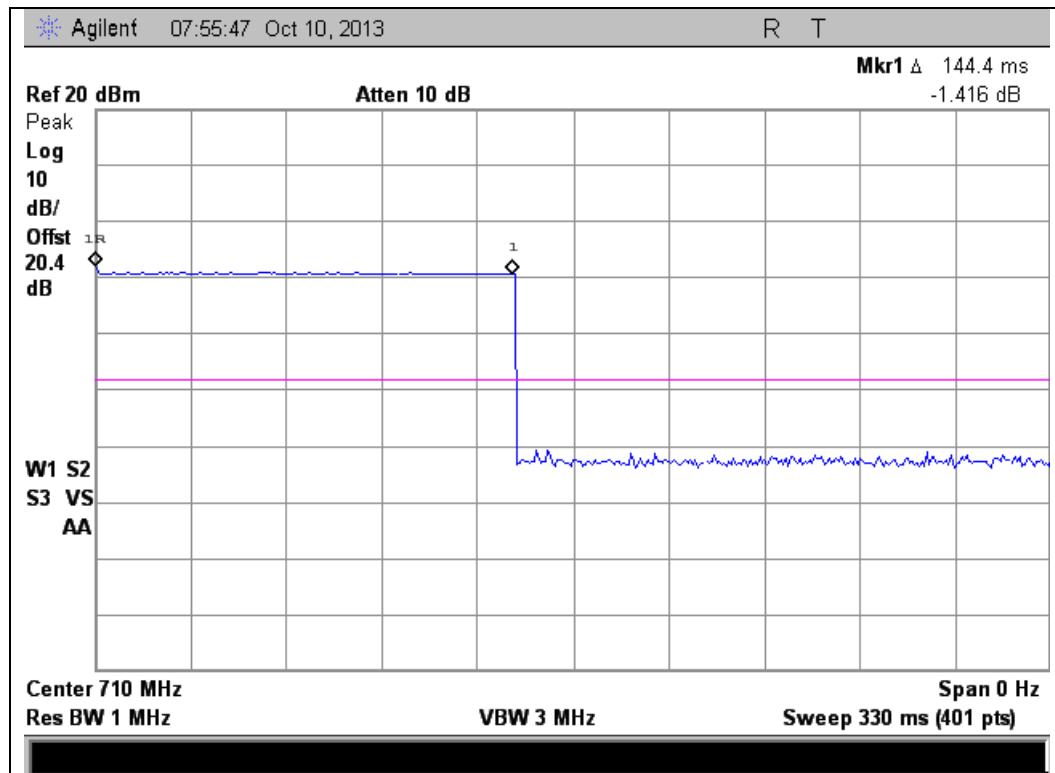
Downlink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
734 - 746	3	≤5	Pass
746 - 756	2	≤5	Pass
869 - 894	1	≤5	Pass
1930 - 1995	5	≤5	Pass
2110 - 2155	5	≤5	Pass

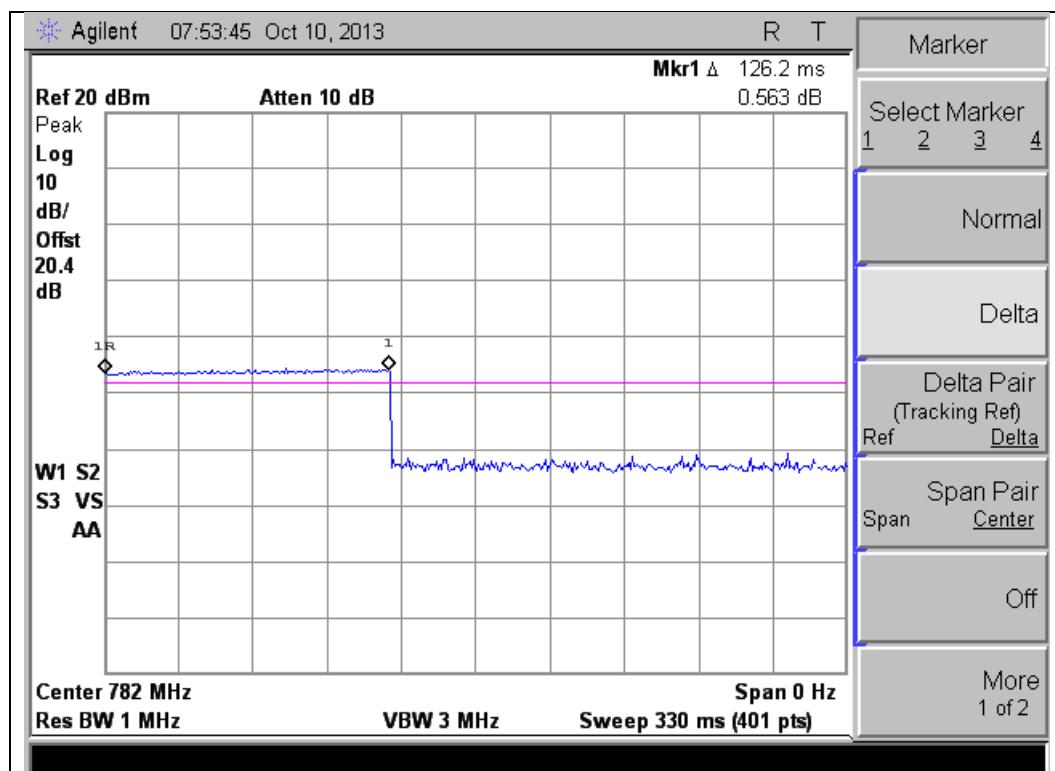


Uplink Detection Time Test Results

704 - 716 MHz Band

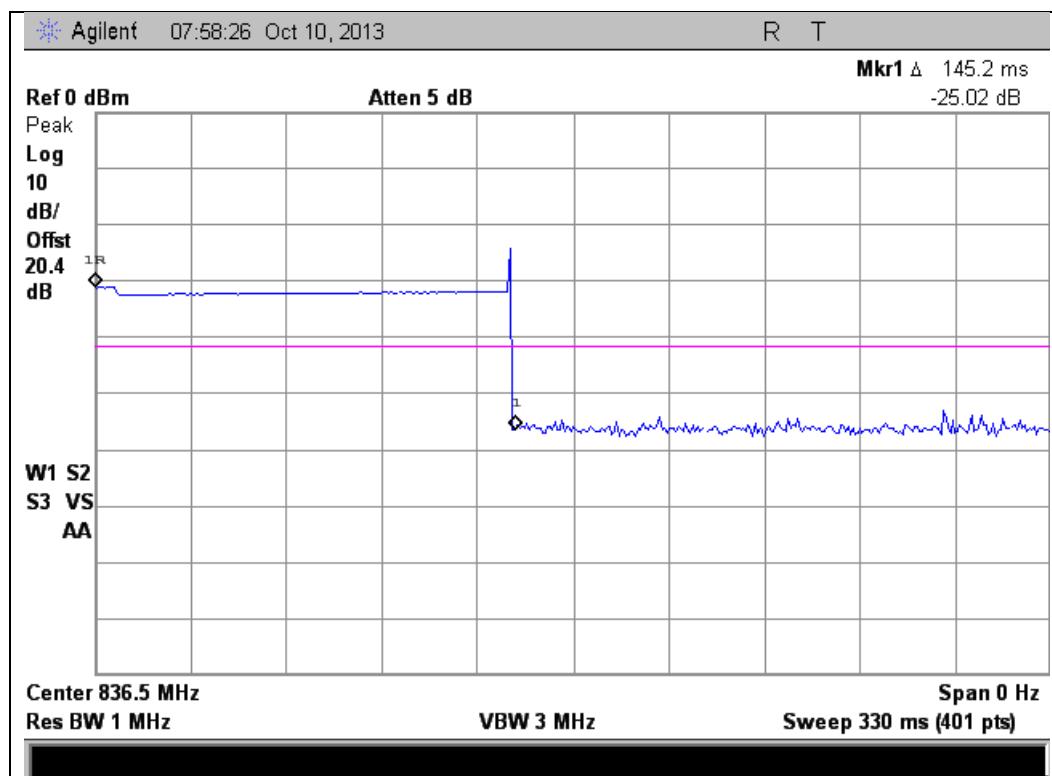


777 - 787 MHz Band

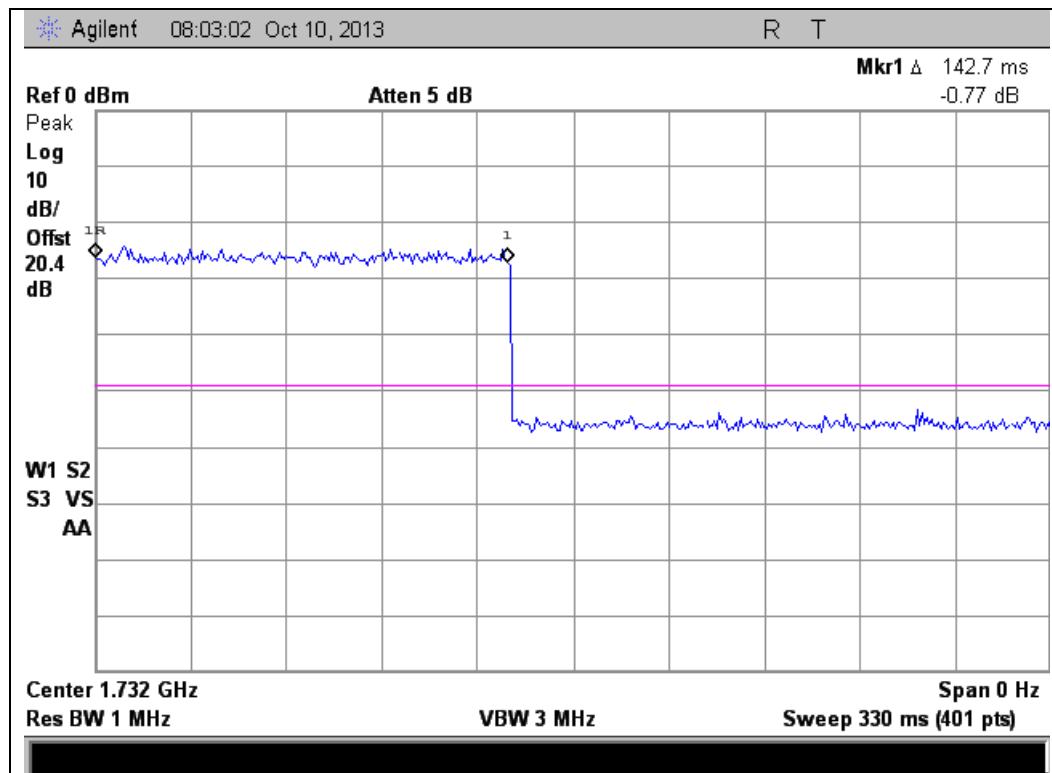




824 - 849 MHz Band

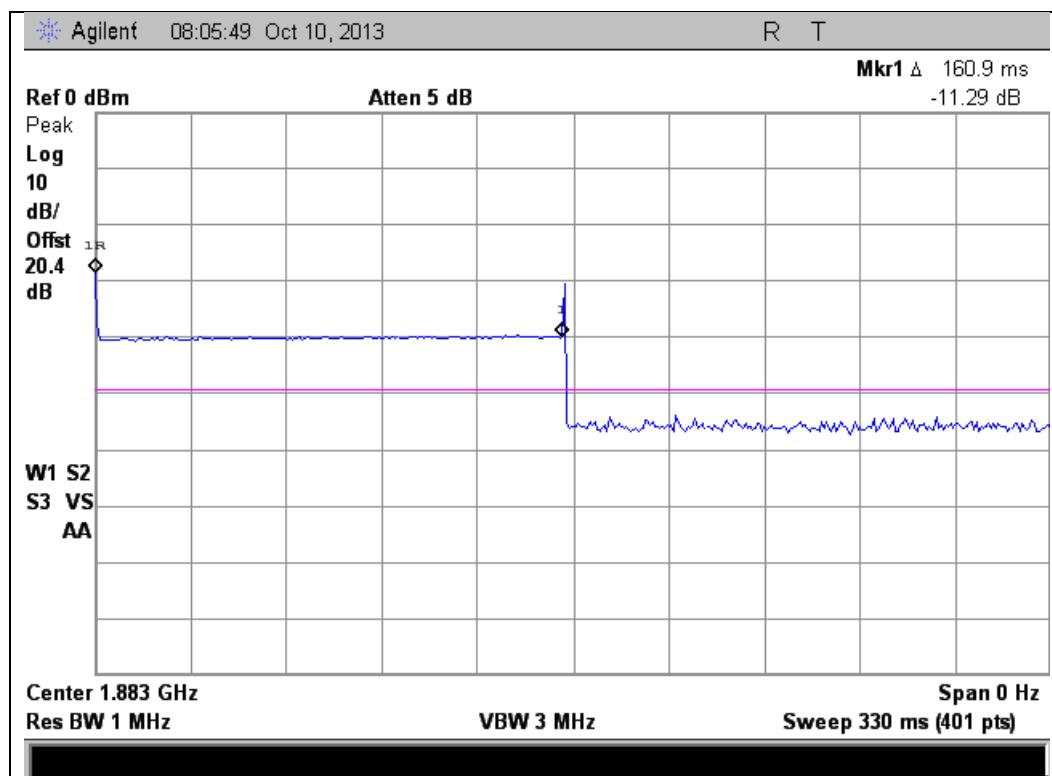


1710 - 1755 MHz Band



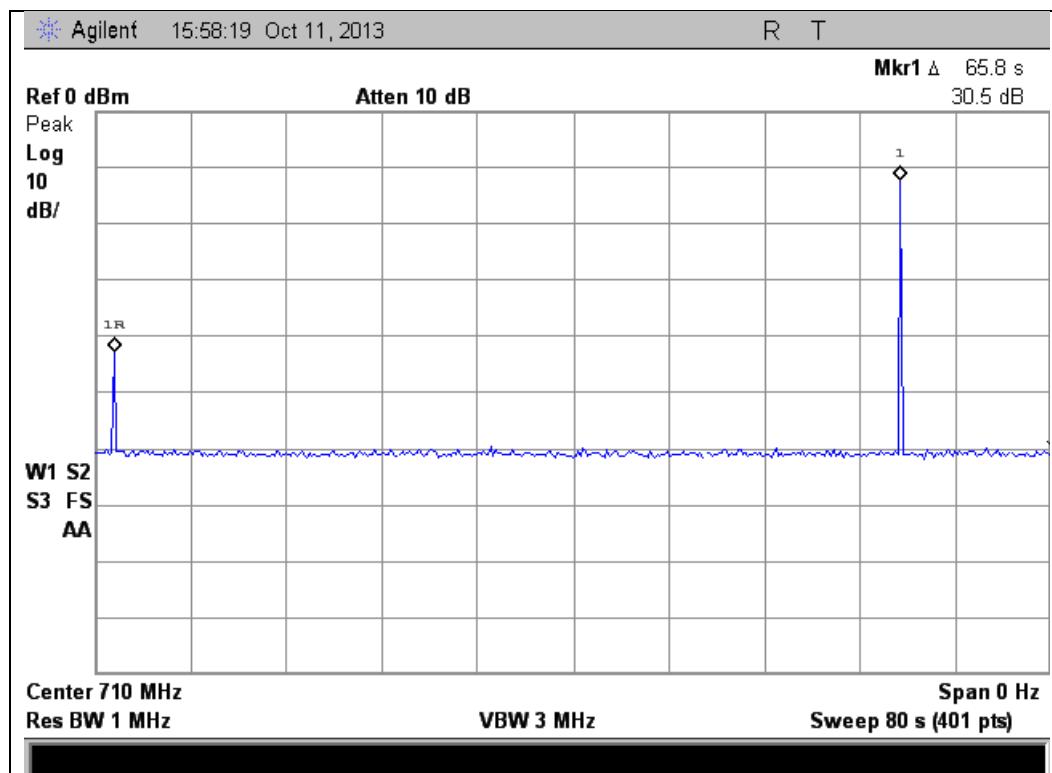


1850 - 1915 MHz Band



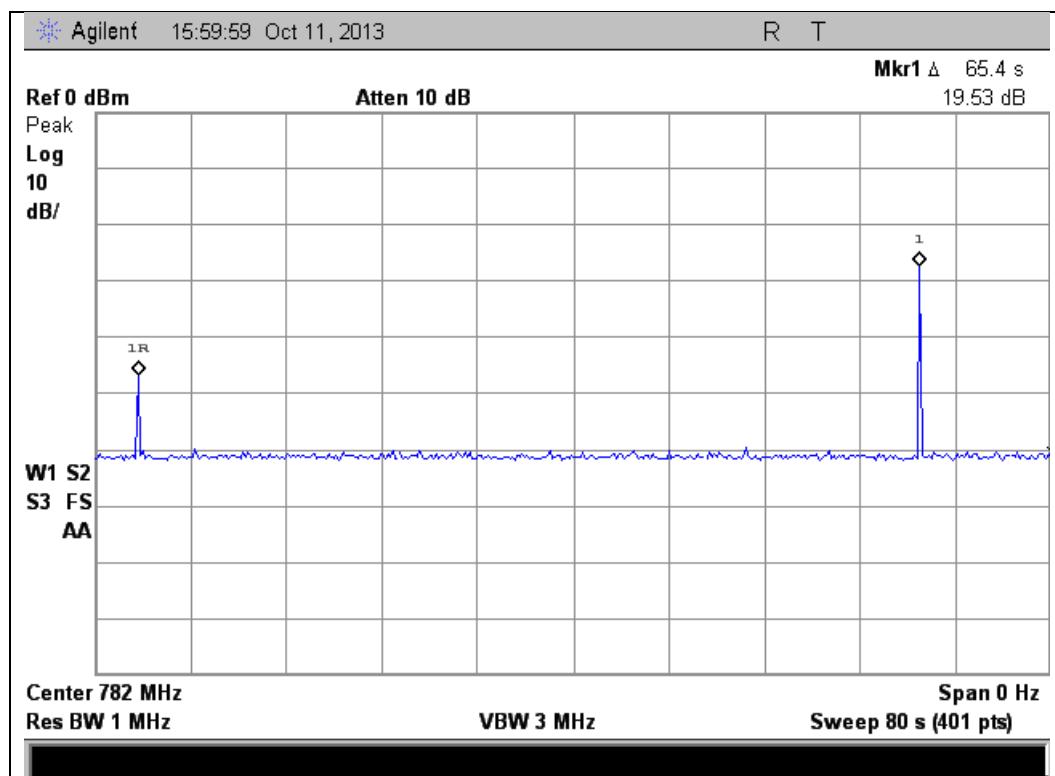
Uplink Restart Time Test Results

704 - 716 MHz Band

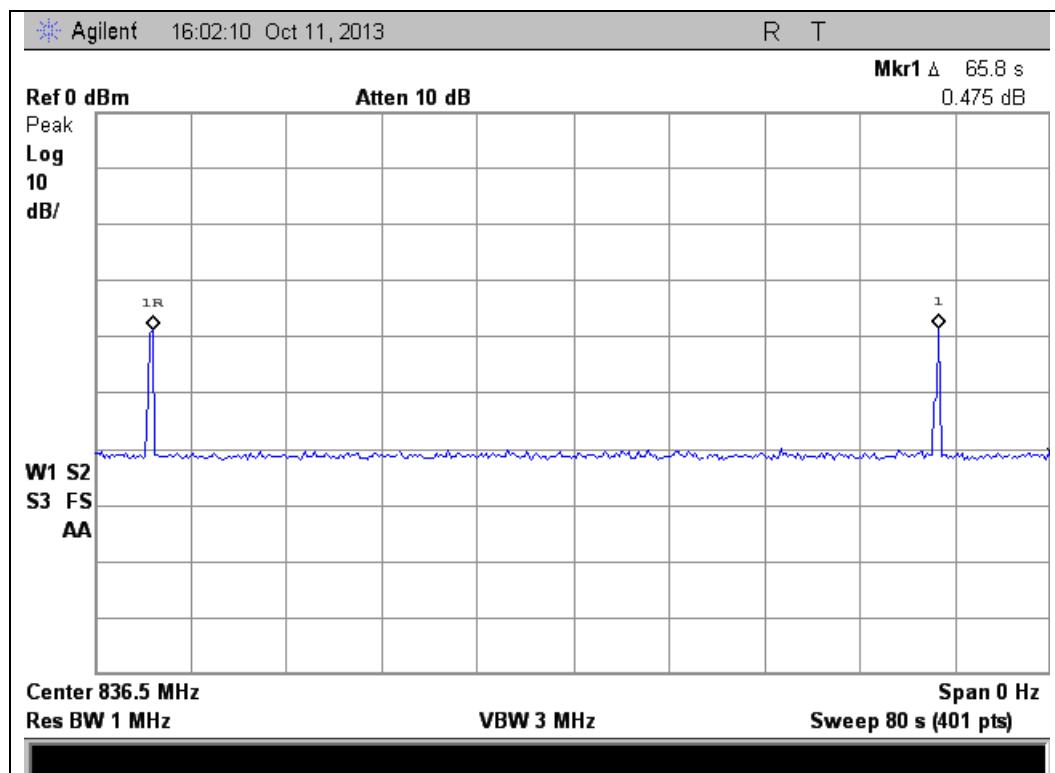




777 - 787 MHz Band

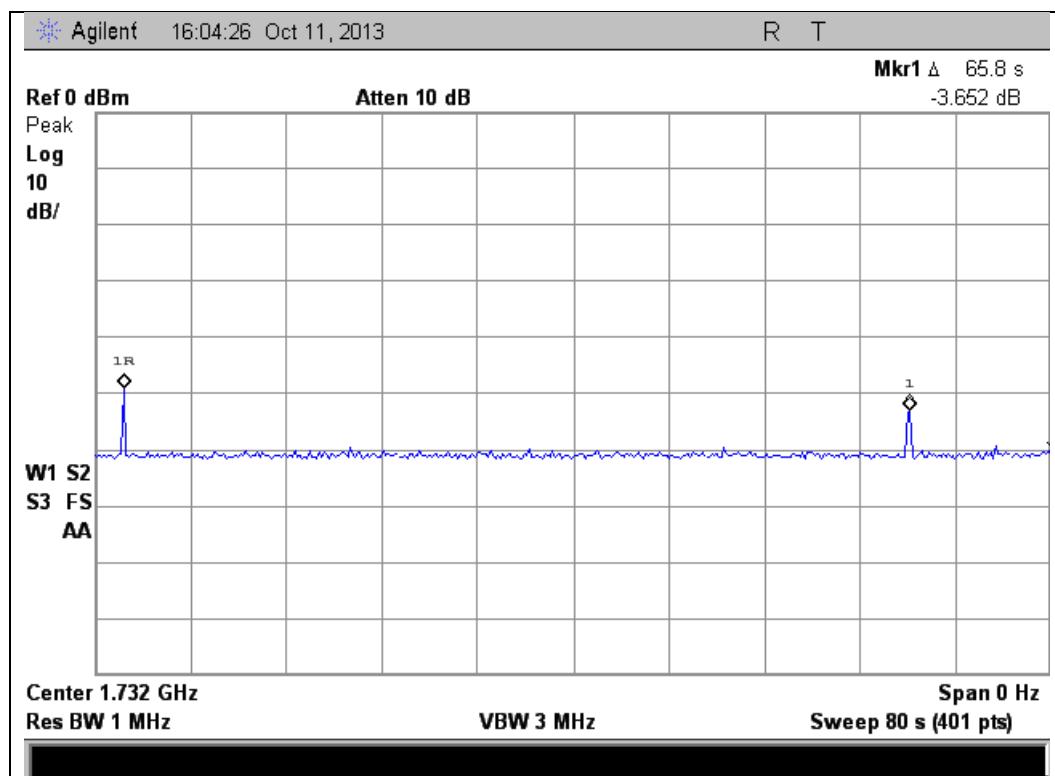


824 - 849 MHz Band

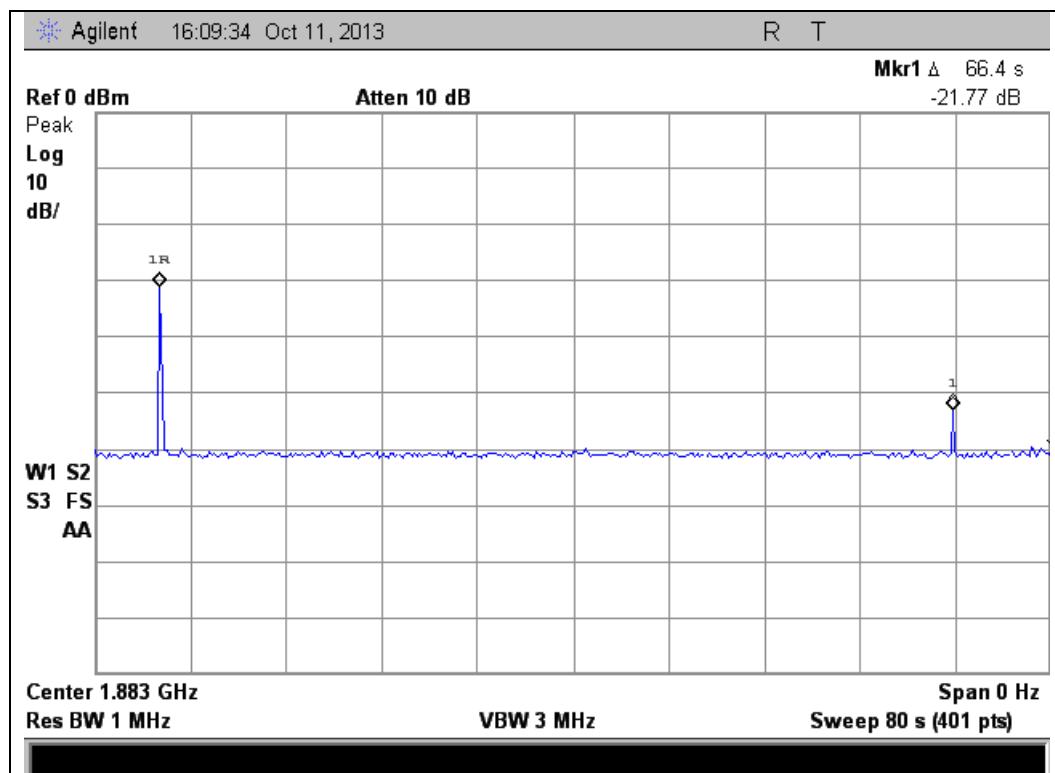




1710 - 1755 MHz Band



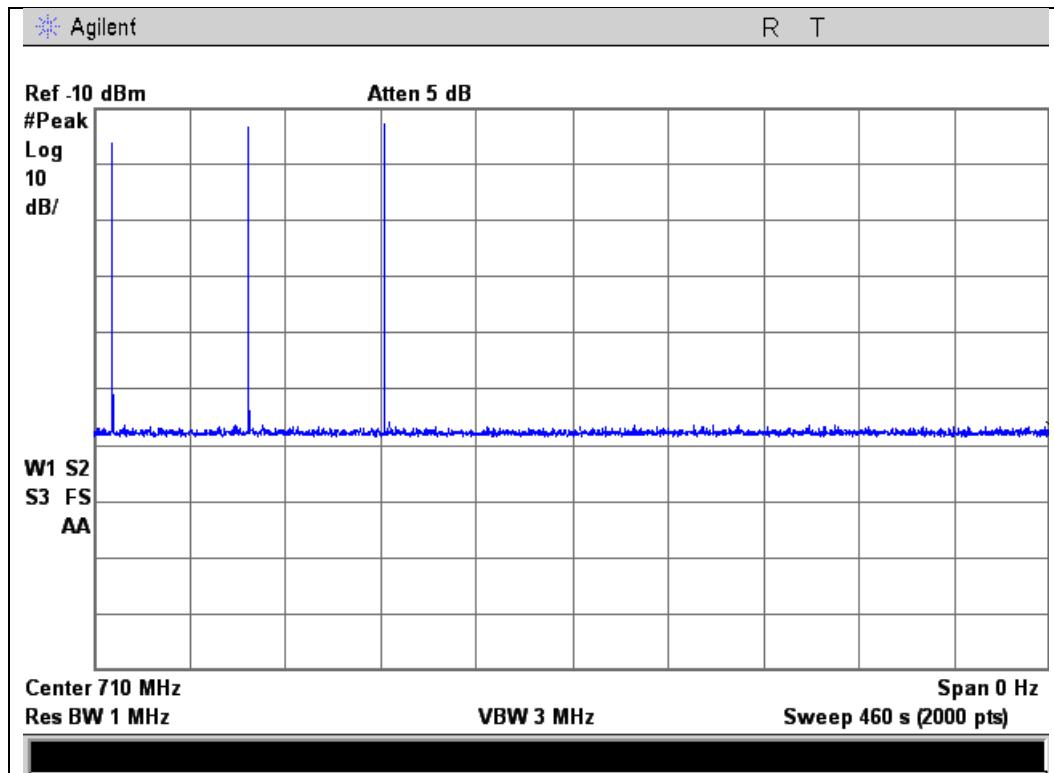
1850 - 1915 MHz Band



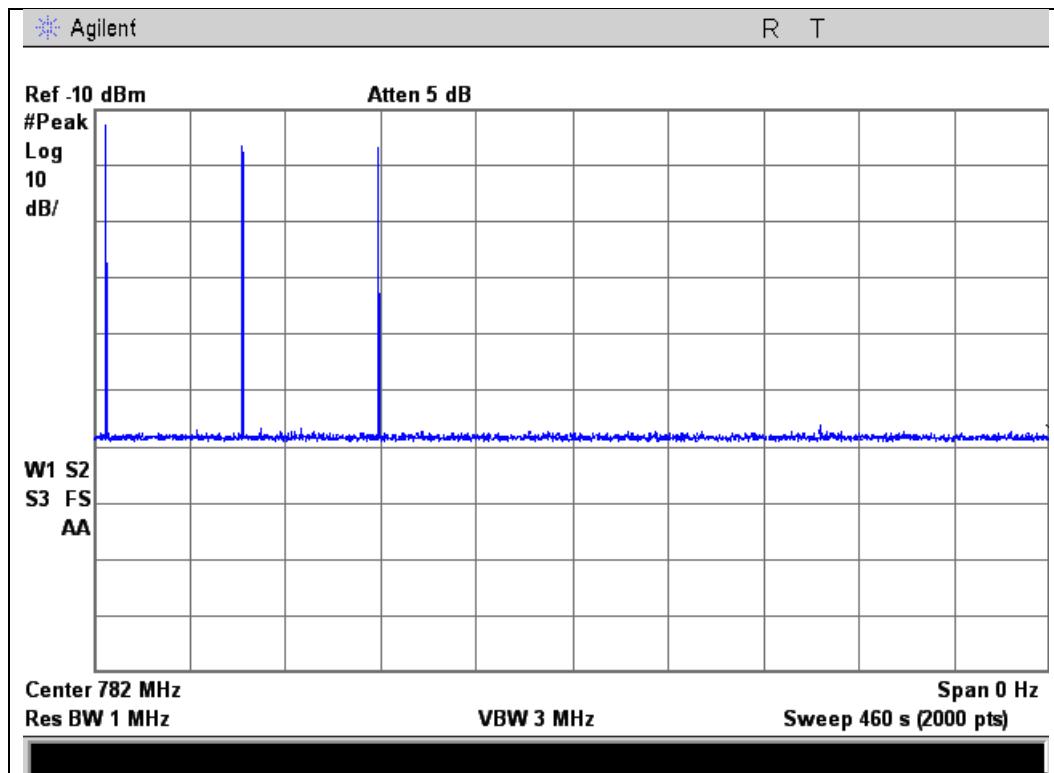


Uplink Restart Count Test Results

704 - 716 MHz Band

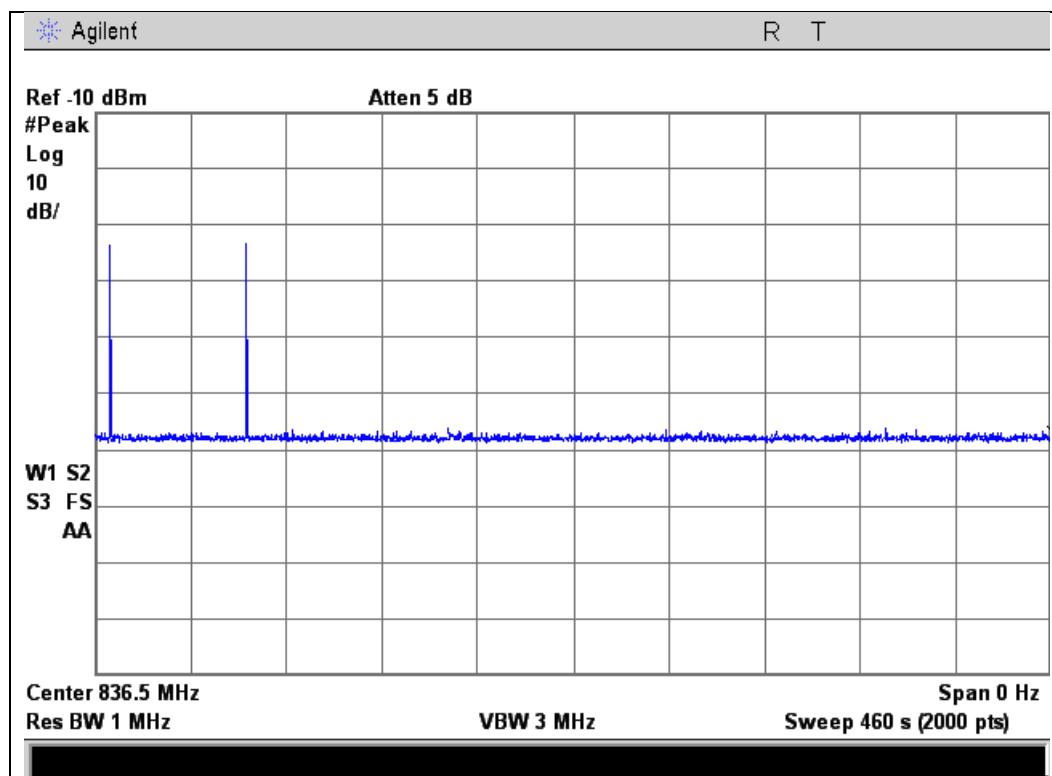


777 - 787 MHz Band

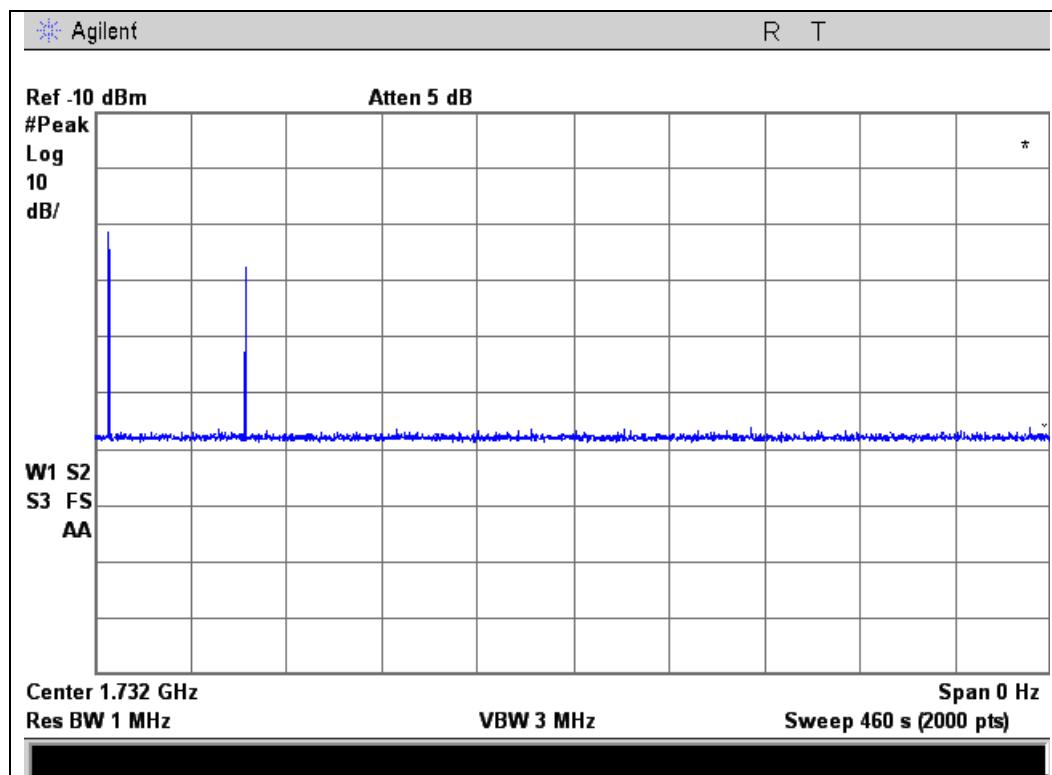




824 - 849 MHz Band

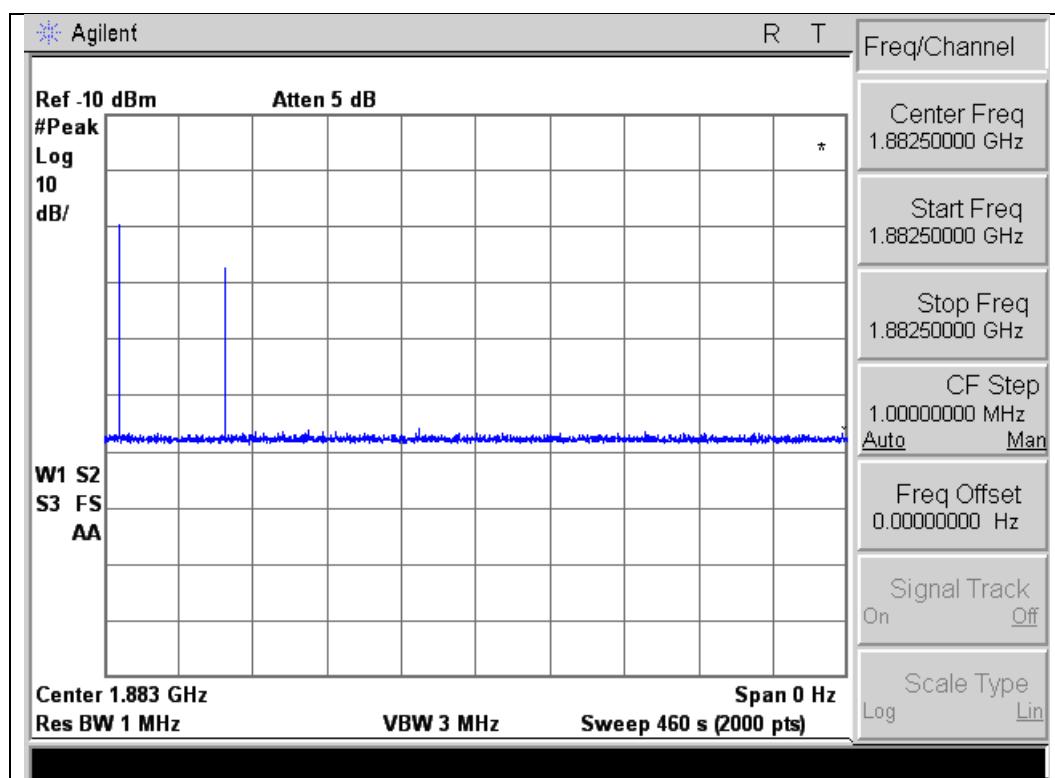


1710 - 1755 MHz Band



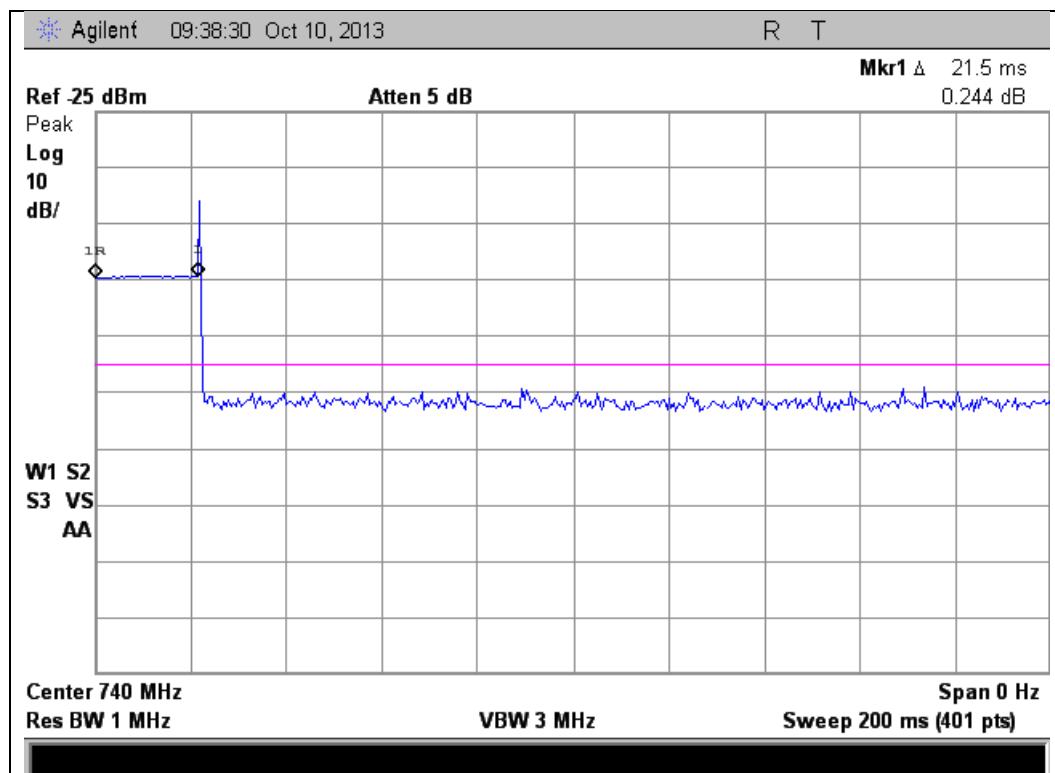


1850 - 1915 MHz Band



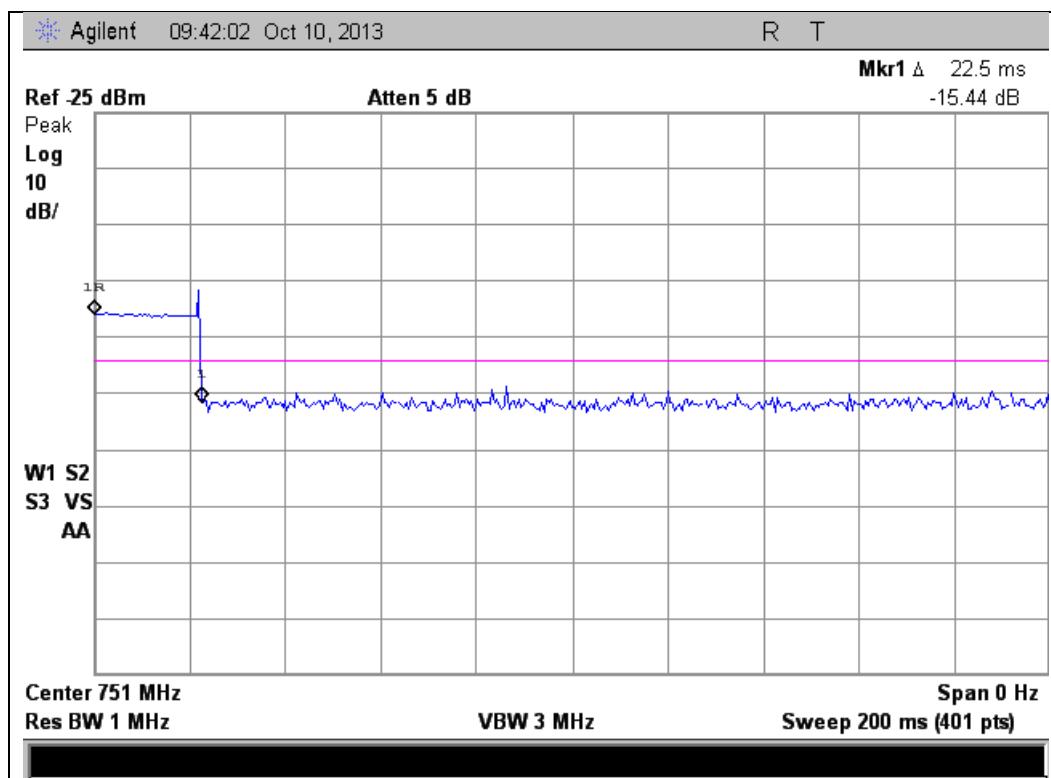
Downlink Detection Time Test Results

734 - 746 MHz Band

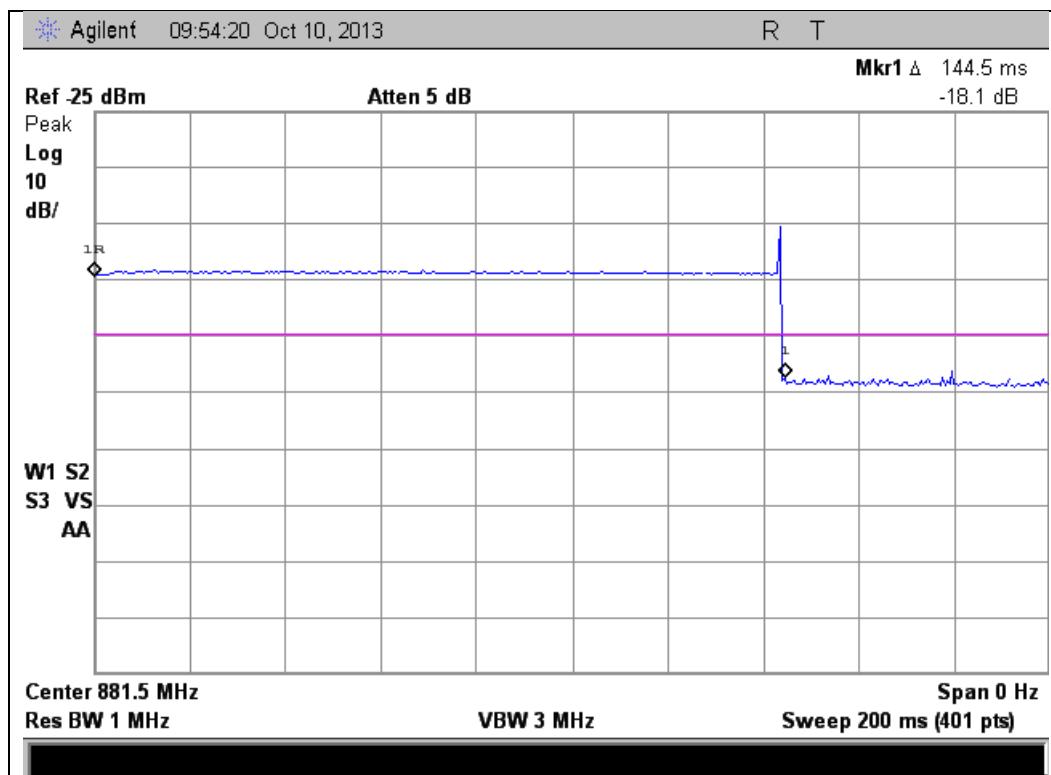




746 - 756 MHz Band

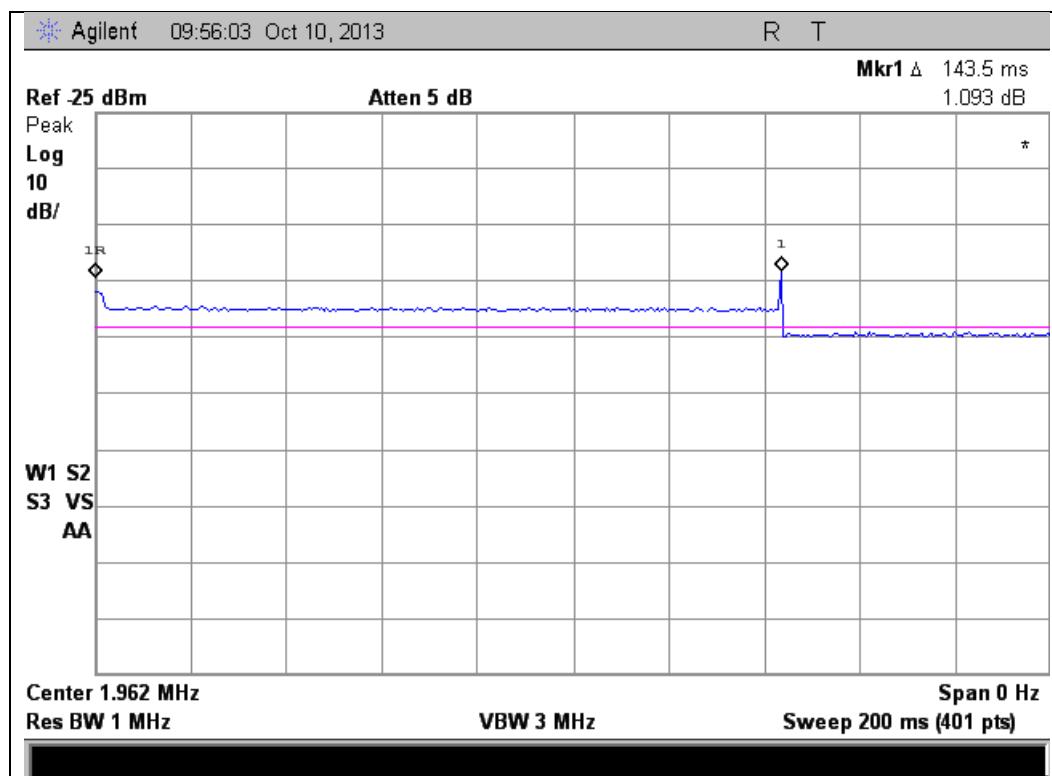


869 - 894 MHz Band

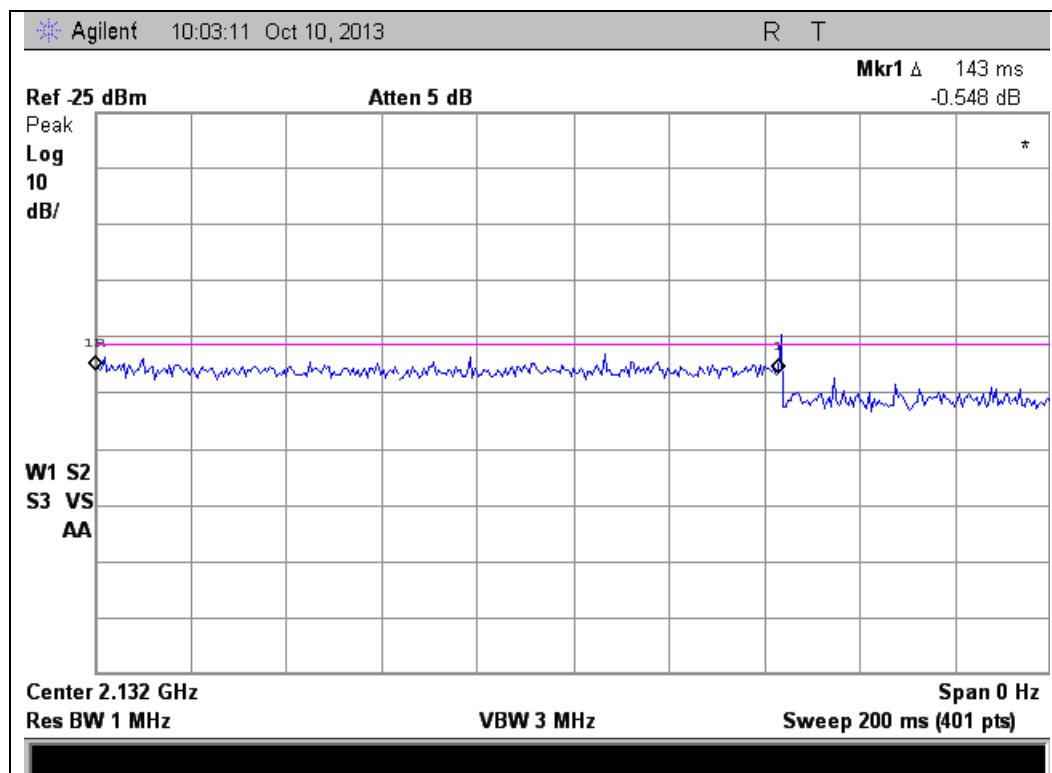




1930 - 1995 MHz Band



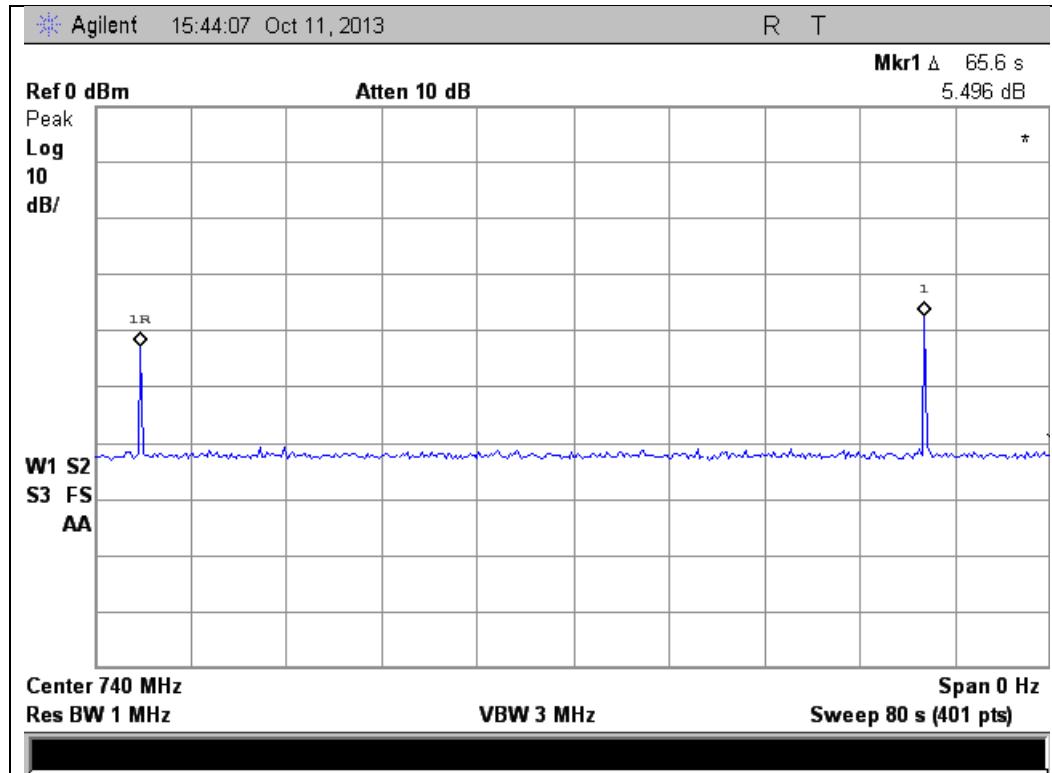
2110 - 2155 MHz Band



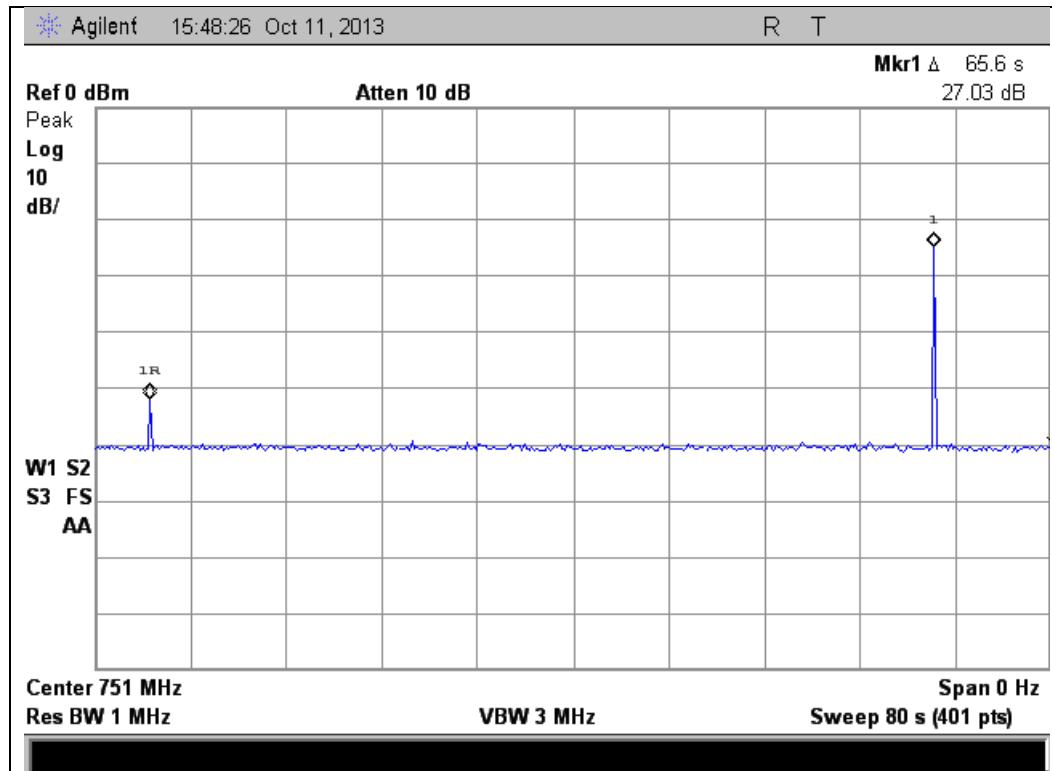


Downlink Restart Time Test Results

734 - 746 MHz Band

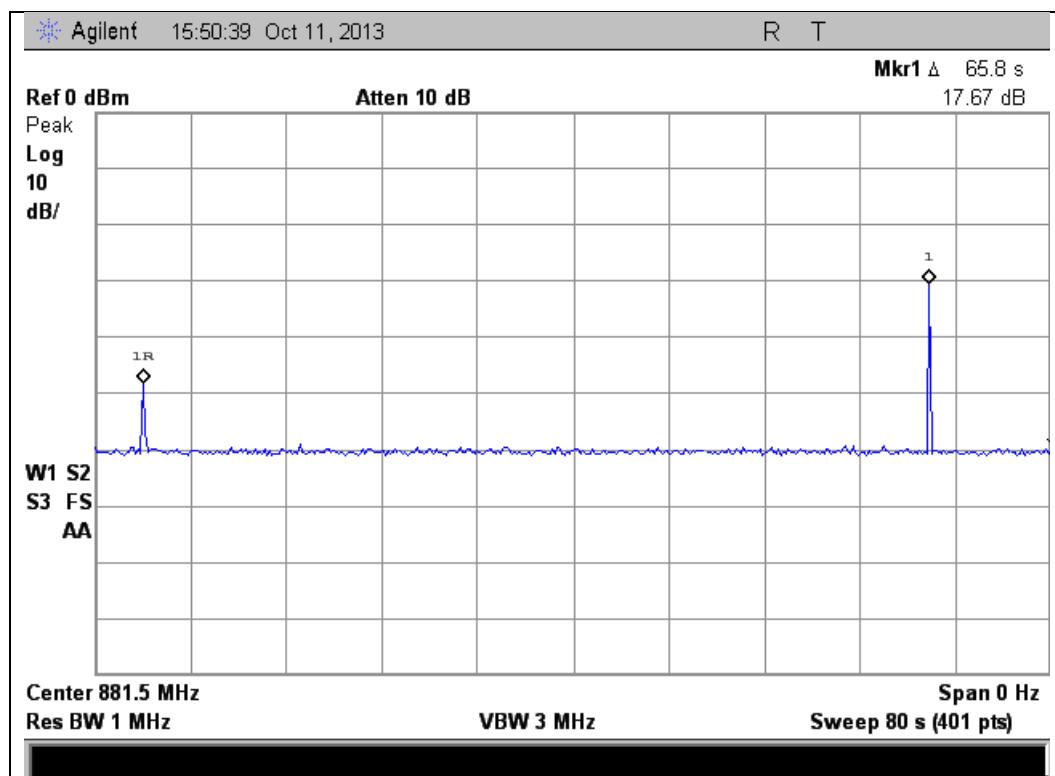


746 - 756 MHz Band

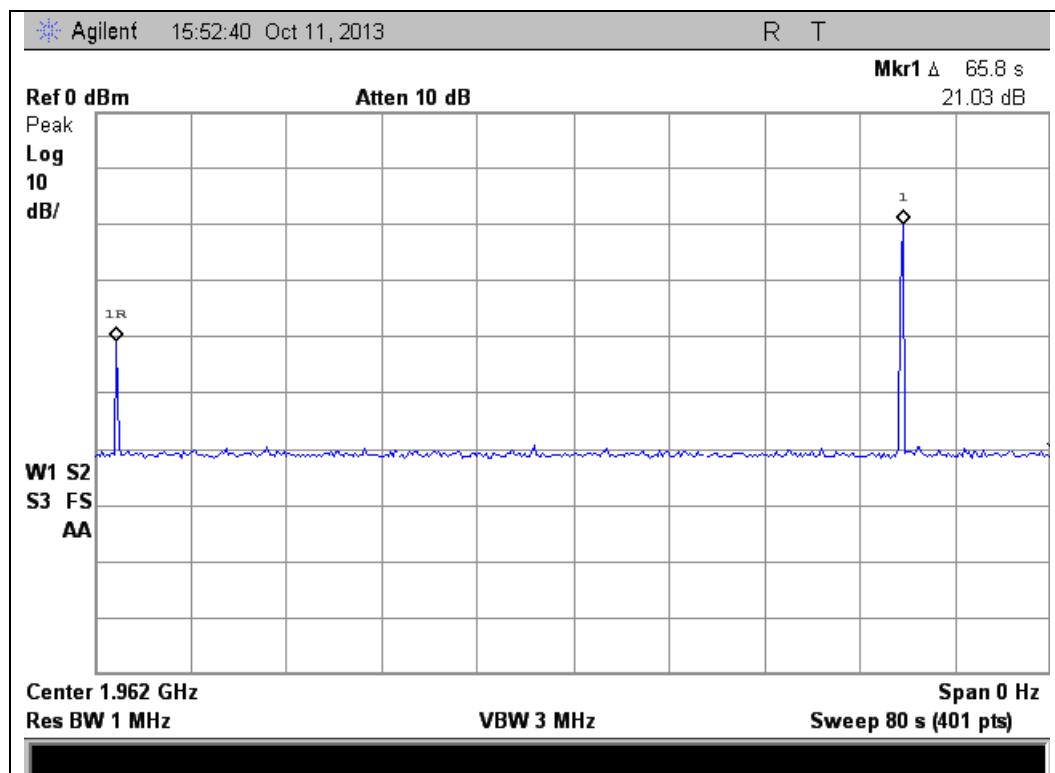




869 - 894 MHz Band

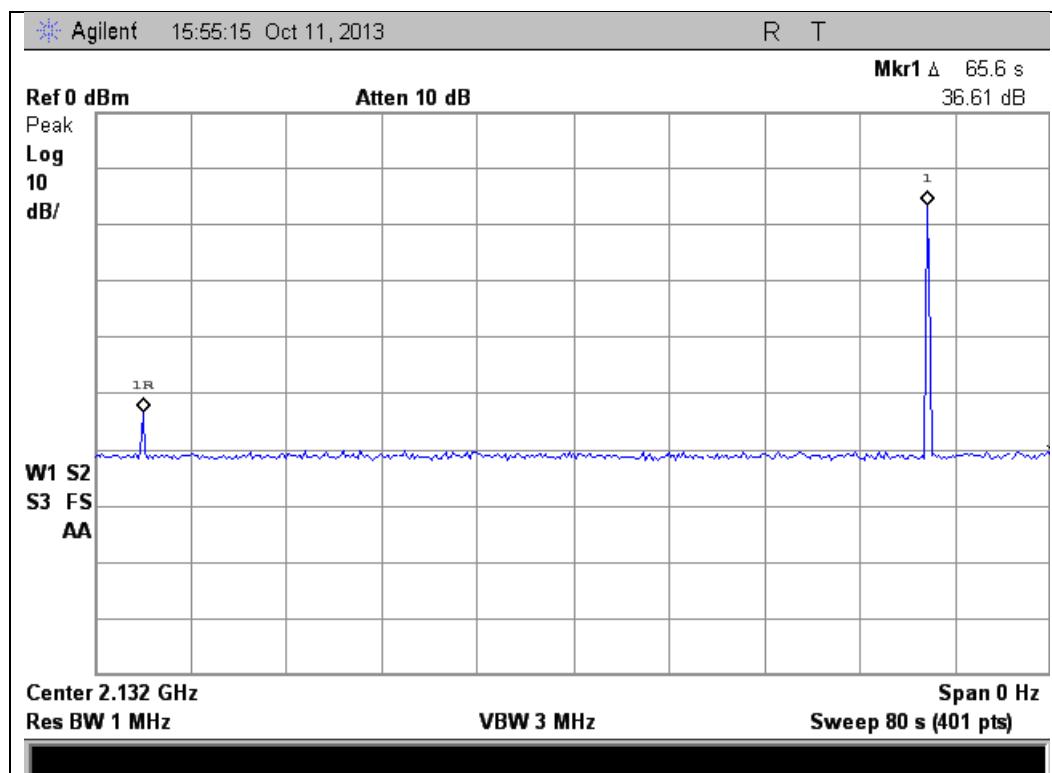


1930 - 1995 MHz Band



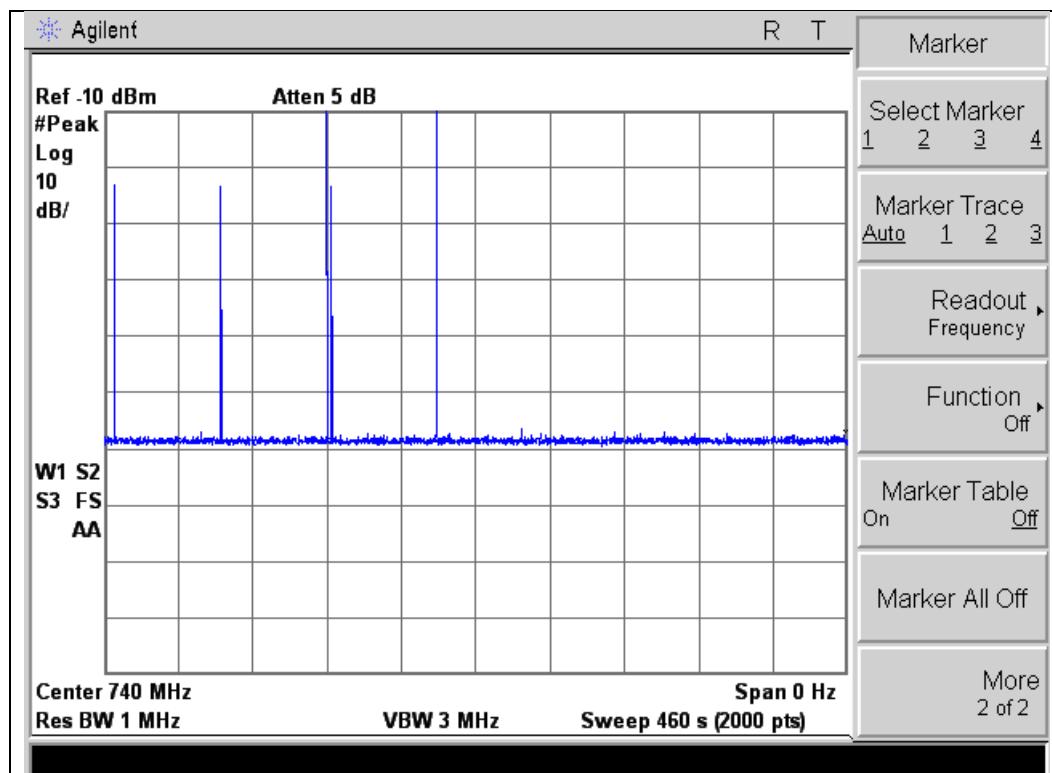


2110 - 2155 MHz Band



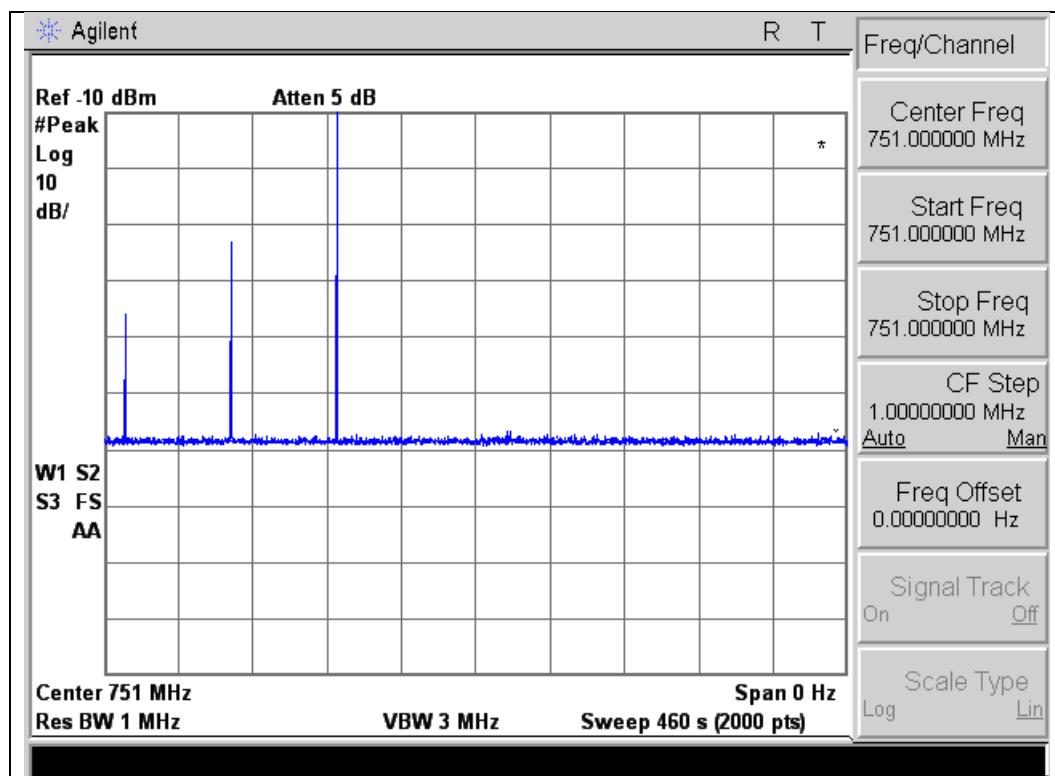
Downlink Restart Count Test Results

734 - 746 MHz Band

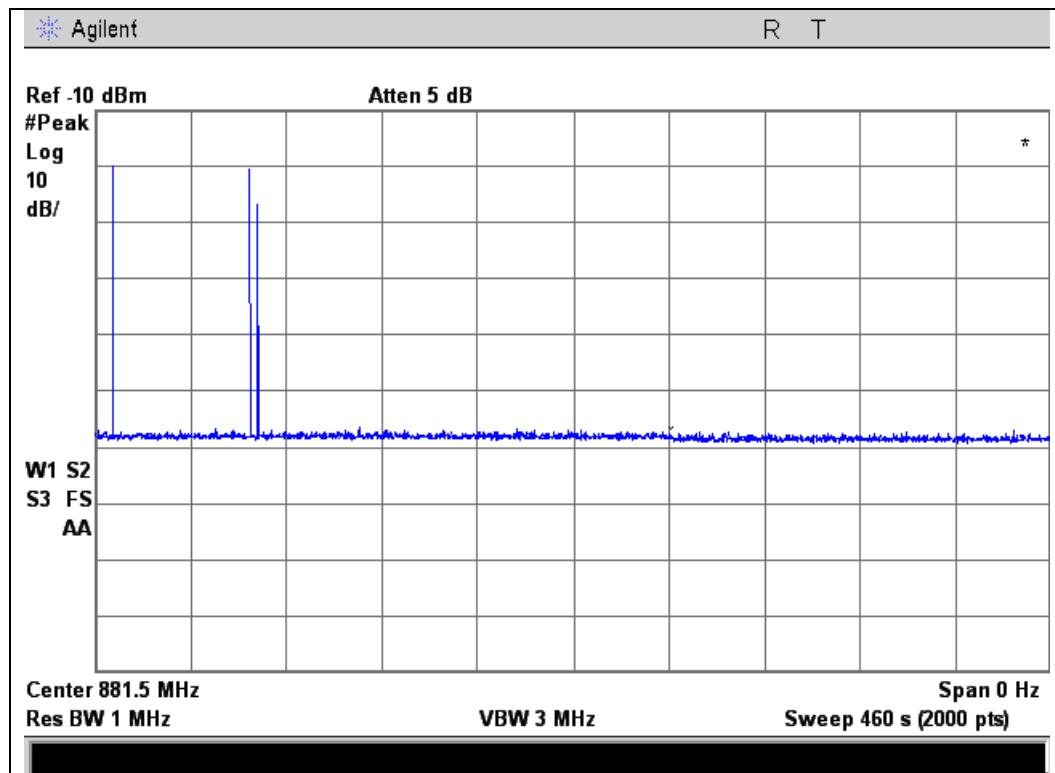




746 - 756 MHz Band

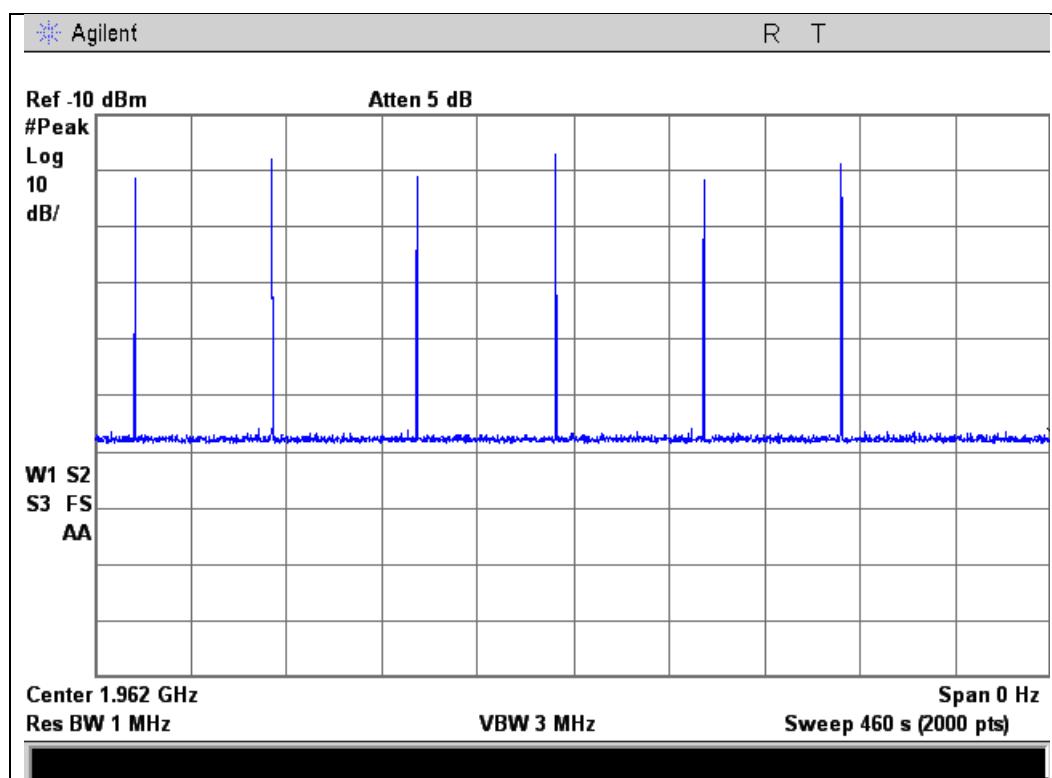


869 - 894 MHz Band

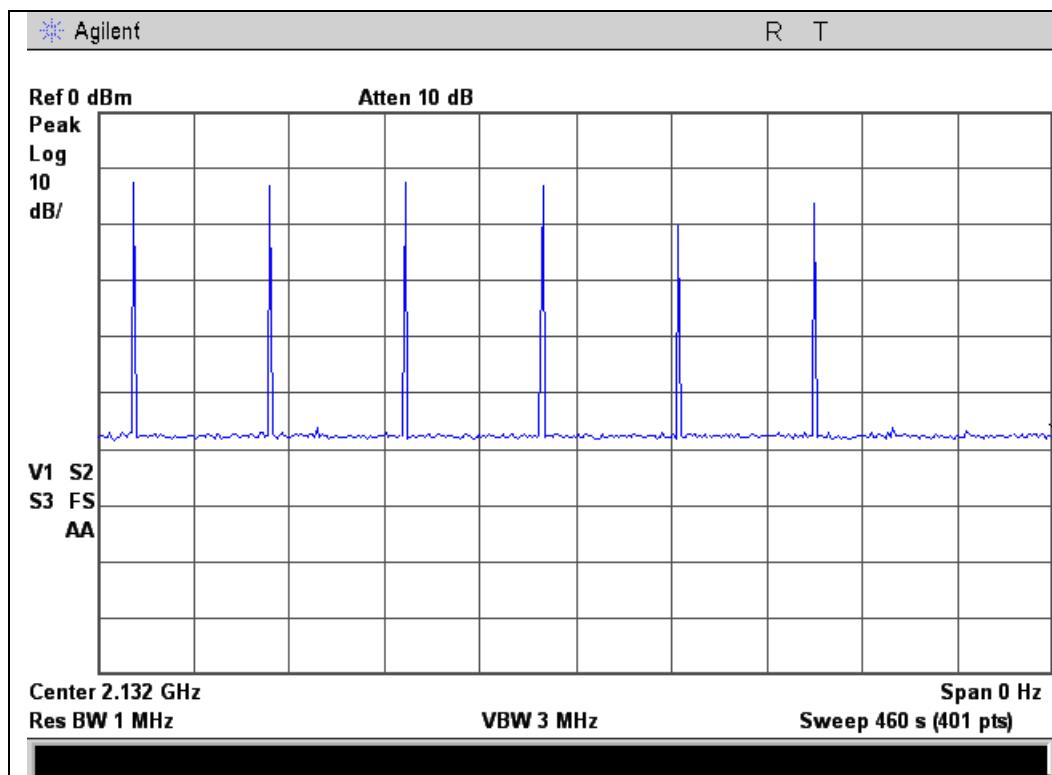




1930 - 1995 MHz Band



2110 - 2155 MHz Band





Radiated Spurious

Name of Test:

Radiated Spurious

Engineer: Mike Graffeo

Test Equipment Utilized:

i00405, i00334, i00271, i00331

Test Date: 10/1/13

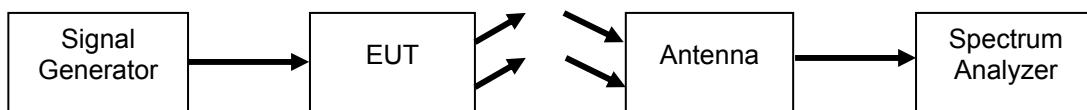
Test Procedure

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 = $43 + 10\log(P)\text{dB}$

Test Setup





Uplink Test Results

704 - 716 MHz Band 710 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1420	-74.96	-13	Pass
2130	-60.99	-13	Pass
2840	-65.46	-13	Pass

777 - 787 MHz Band 782 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1564	-71.72	-13	Pass
2346	-67.27	-13	Pass
3128	-49.35	-13	Pass

824 - 849 MHz Band 836.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1673	-66.28	-13	Pass
2509.5	-67.99	-13	Pass
3346	-52.66	-13	Pass

1710 - 1755 MHz Band 1732.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3465	-50.54	-13	Pass
5197.5	-50.23	-13	Pass
6930	-44.20	-13	Pass

1850 - 1915 MHz Band 1882.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3765	-47.96	-13	Pass
5647.5	-46.48	-13	Pass
7530	-37.93	-13	Pass



Downlink Test Results

734 - 746 MHz Band 740 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1480	-71.56	-13	Pass
2220	-66.40	-13	Pass
2960	-61.78	-13	Pass

746 - 756 MHz Band 751 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1502	-71.81	-13	Pass
2253	-68.27	-13	Pass
3004	-49.22	-13	Pass

869 - 894 MHz Band 881.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1763	-69.88	-13	Pass
2644.5	-62.89	-13	Pass
3526	-51.90	-13	Pass

1930 - 1995 MHz Band 1962.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3925	-49.87	-13	Pass
5887.5	-46.62	-13	Pass
7850	-39.52	-13	Pass

2110 - 2155 MHz Band 2132.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
4265	-48.63	-13	Pass
6397.5	-46.10	-13	Pass
8530	-38.28	-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 #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	EMCO	3115	i00103	12/11/12	12/11/14
* Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	12/4/12	12/4/13
Voltmeter	Fluke	75III	i00320	2/1/13	2/1/14
Spectrum Analyzer	Agilent	E4407B	i00331	4/23/13	4/23/14
Non-radiating load	Termaline	8201	i00334	Verified on: 8/2/13	
Power Supply (for EUT)	HP	6654A	i00350	Verified on: 9/15/13	
Vector Signal Generator	Agilent	E4438C	i00348	1/4/13	1/4/14
Spectrum Analyzer	Agilent	E4407B	i00331	4/23/13	4/23/14
Signal Generator	Rohde & Schwarz	SMU200A	i00405	10/26/12	10/26/13
** Signal Generator	Rohde & Schwarz	SMU200A	i00405	12/11/13	12/11/14
RF Directional Coupler	Meca	CS06-1.500V	i00412	Verified on: 8/1/13	

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.

* Note a 60 day calibration extension was issued for the equipment by the Lab Manager

** This equipment was calibrated in Dec 2013 prior to the addition testing performed in January 2014

END OF TEST REPORT