



Compliance Testing, LLC

Previously Flom Test Lab

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Test Report

Prepared for: Wilson Electronics, Inc.

Model: 460004

Description: Quint Band In-Building Signal Booster

FCC ID: PWO460004

To

FCC Part 20

Date of Issue: September 30, 2014

On the behalf of the applicant:

Wilson Electronics, Inc.
3301 E Deseret Drive
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To the attention of:

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Greg Corbin
Project Test Engineer

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All results contained herein relate only to the sample tested



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	August 8, 2013	Greg Corbin	Original Document
2.0	September 4, 2013	Greg Corbin	Manufacturer modified the EUT noise power. New Noise Power test data was inserted on pages 81 – 83 and associated graphs on pages 84 – 88. Revised references to specifications in the Test Summary Table on page 6
3.0	September 19, 2013	Greg Corbin	Corrected downlink detection time limit on page 129 and the downlink restart time test results units on page 130 , added formulas for calculating limits where required.
4.0	September 25, 2013	Greg Corbin	On Rev 3.0, the downlink detection time limit on page 129 did not get updated. Updated downlink detection time limit on page 129. Added a statement clarifying the modulation types and protocols shown in the tables on page 5.
5.0	October 29, 2013	Amanda Reed	Incorporated customer requested changes
6.0	December 19, 2013	Greg Corbin	Added MSCL to the variable gain tables on page 97. Added OOB rule sections to the Test Summary table on page 6. Added Spurious Emissions Test data on page 56 and 57
7.0	January 9, 2014	Greg Corbin	Updated Conducted Emissions rule sections in the test summary table on page 6 and 57 to match the eCFR rule sections dated January 7, 2014.
8.0	January 24, 2014	Amanda Reed	Corrected Rule Sections per FCC guidance
9.0	September 29, 2014	Greg Corbin	Corrected RSSI input levels in 829 – 849 Table on page 97, original data was a typo.



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ILAC / A2LA

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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 Draft KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516.

Standard Test Conditions and Engineering Practices

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

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

Environmental Conditions		
Temp (°C)	Humidity (%)	Pressure (mbar)
25.5 – 31.4	34.7 – 61.9	959.2 – 971.7

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

EUT Description

Model: 460004

Description: Quint Band In-Building Signal Booster

Firmware: A460004A

Software: 460004A

Additional Information:

The EUT is a bi-directional amplifier for the boosting of cellular phone signals and data communication devices. The frequency bands listed in the table below are the bands used by the EUT.

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

Frequency Band (MHz)					
Uplink	698 - 716	777 - 787	824 - 849	1850 - 1915	1710 - 1755
Downlink	728 - 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: SMU 200A - S/N:101369
E4407B - S/N:MY41444836

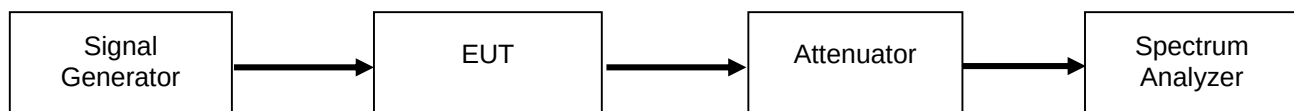
Engineer: Greg Corbin

Test Date: 7/15/2013

Test Procedure

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

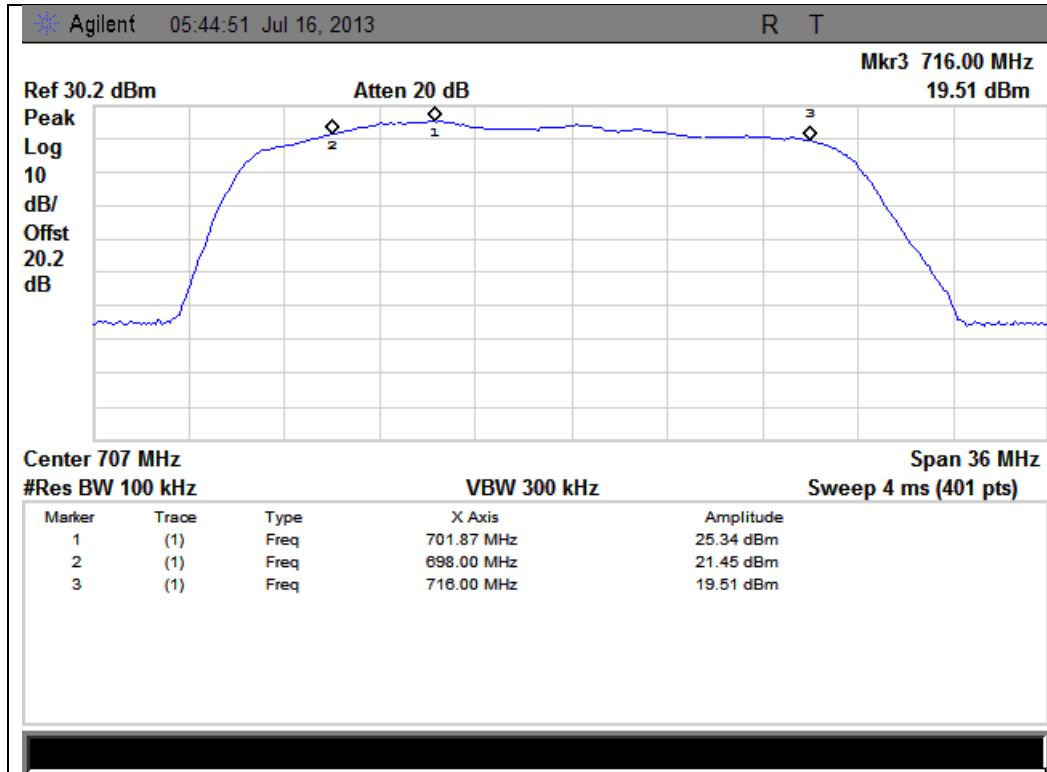
Test Setup



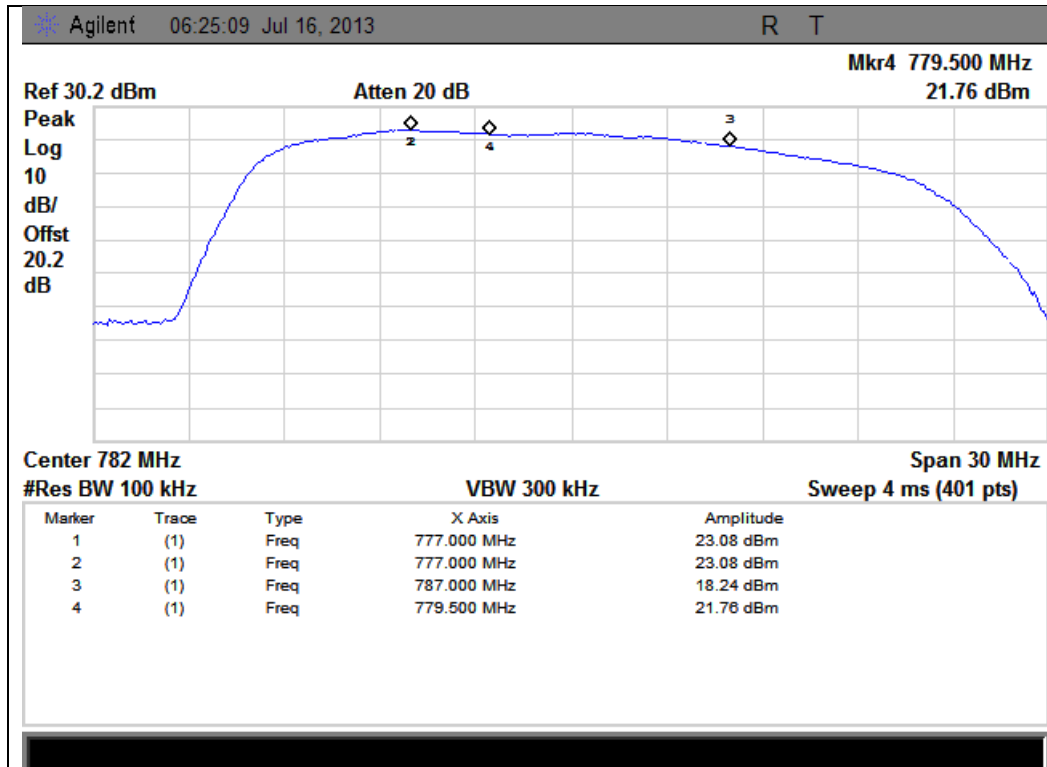


Uplink Test Results

698 - 716 MHz Band

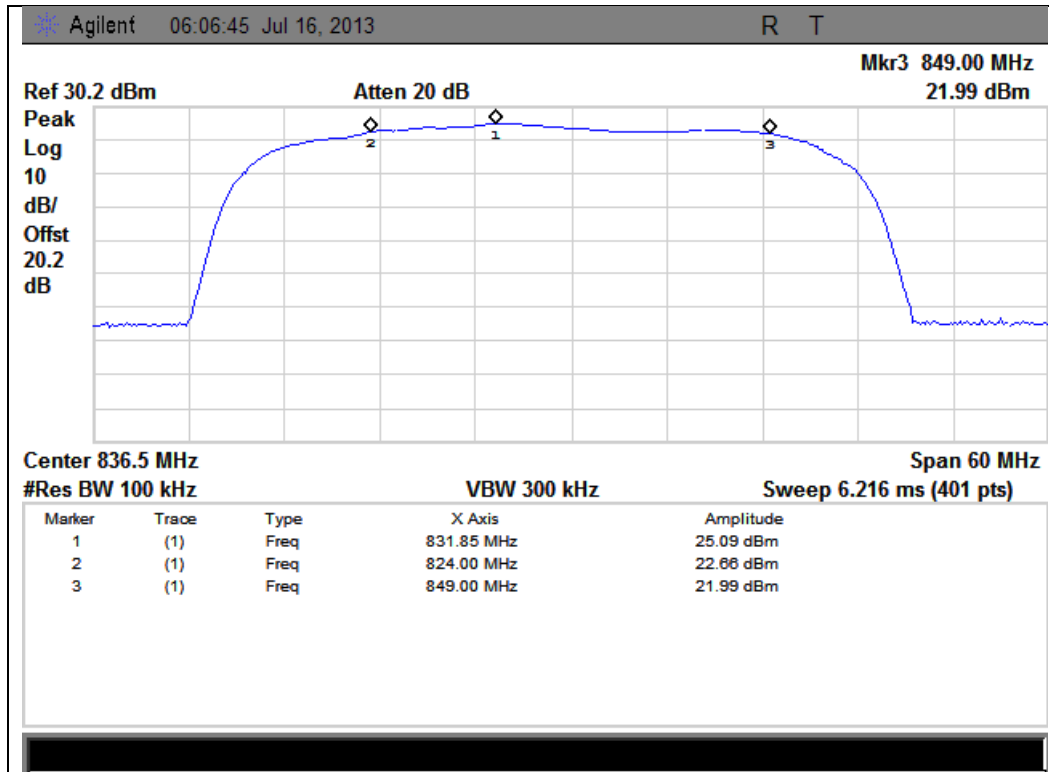


777 - 787 MHz Band

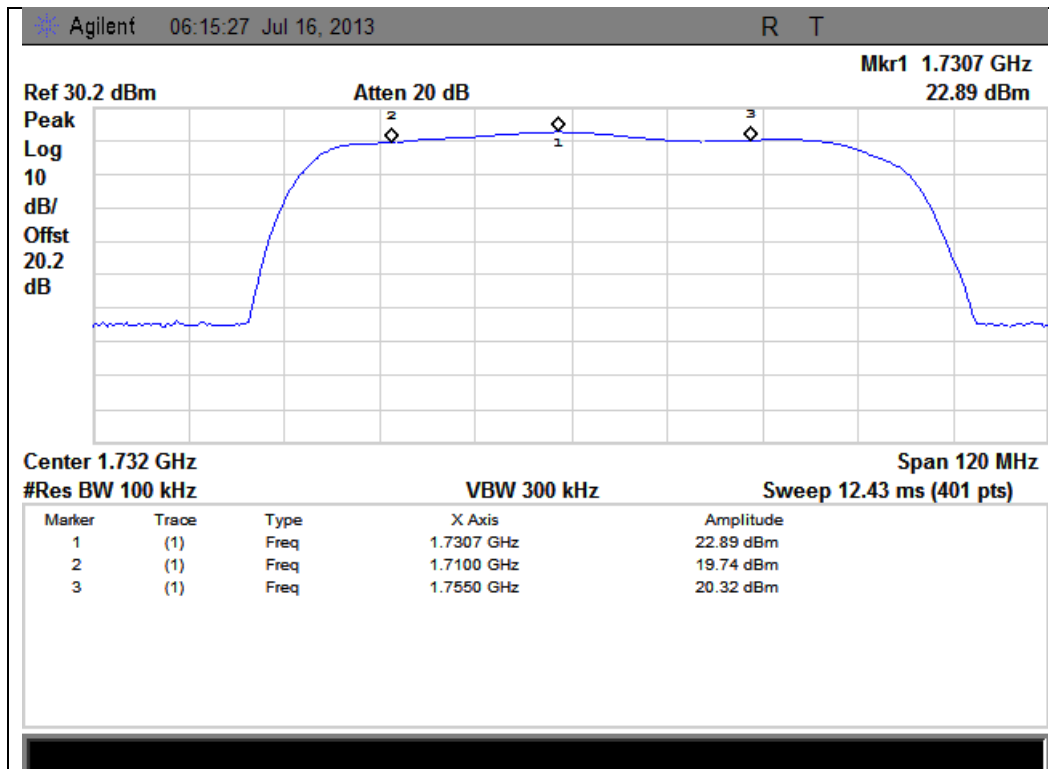




824 - 849 MHz Band

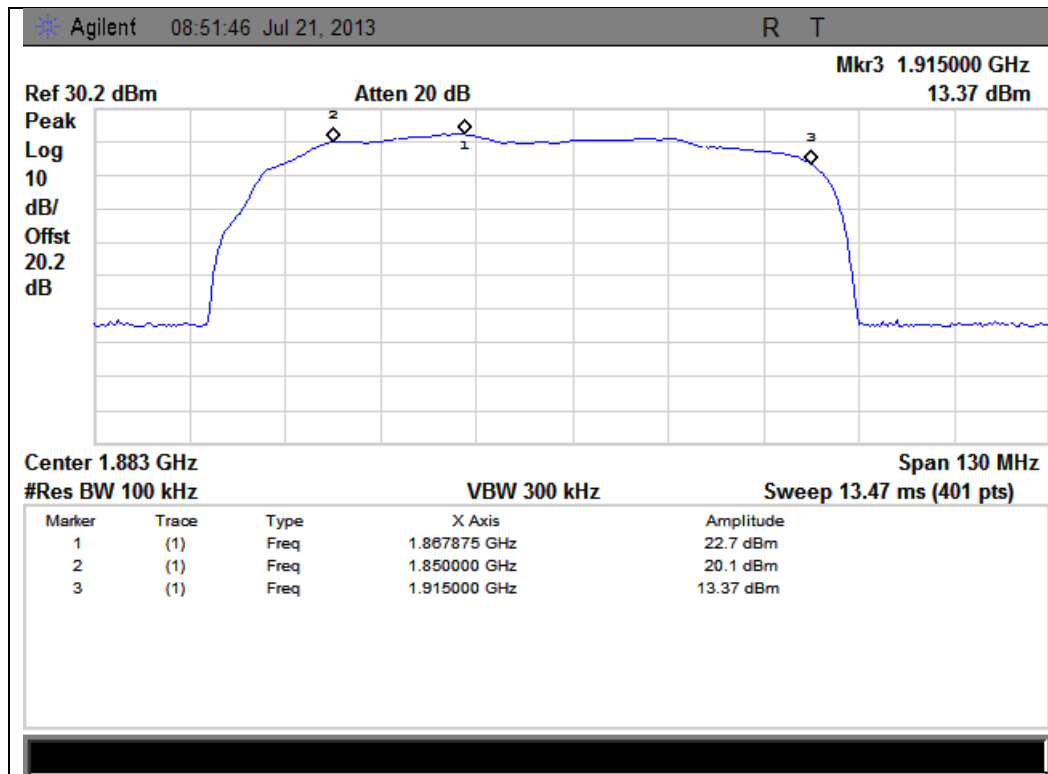


1710 - 1755 MHz Band



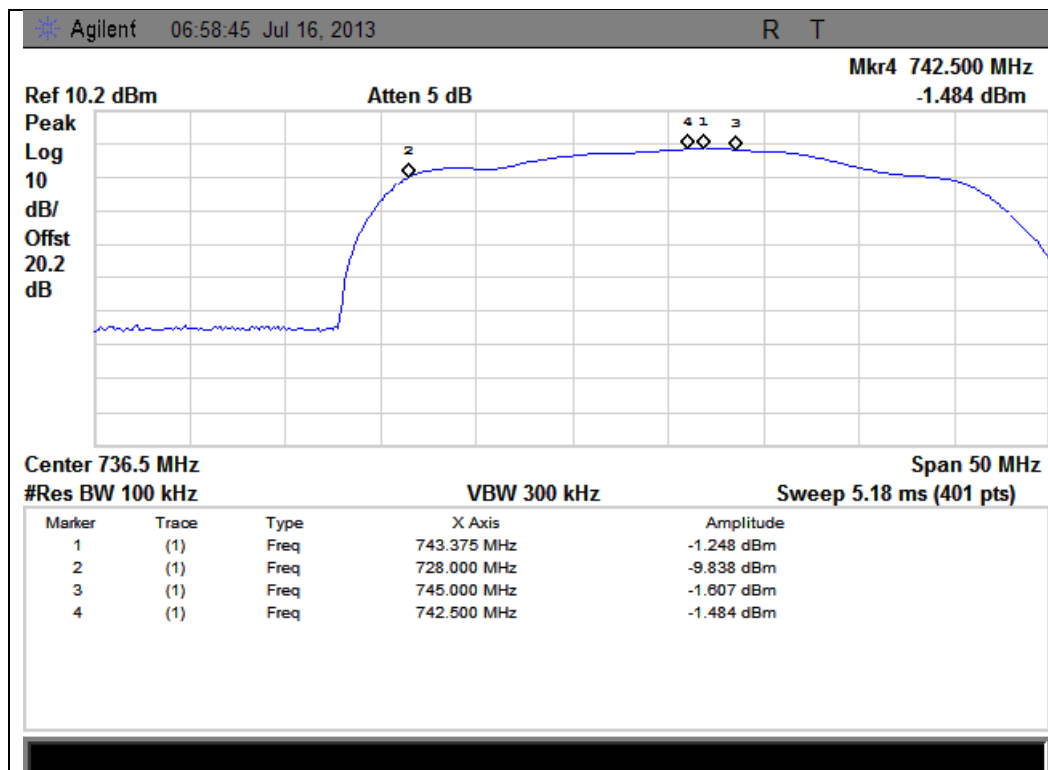


1850 - 1915 MHz Band



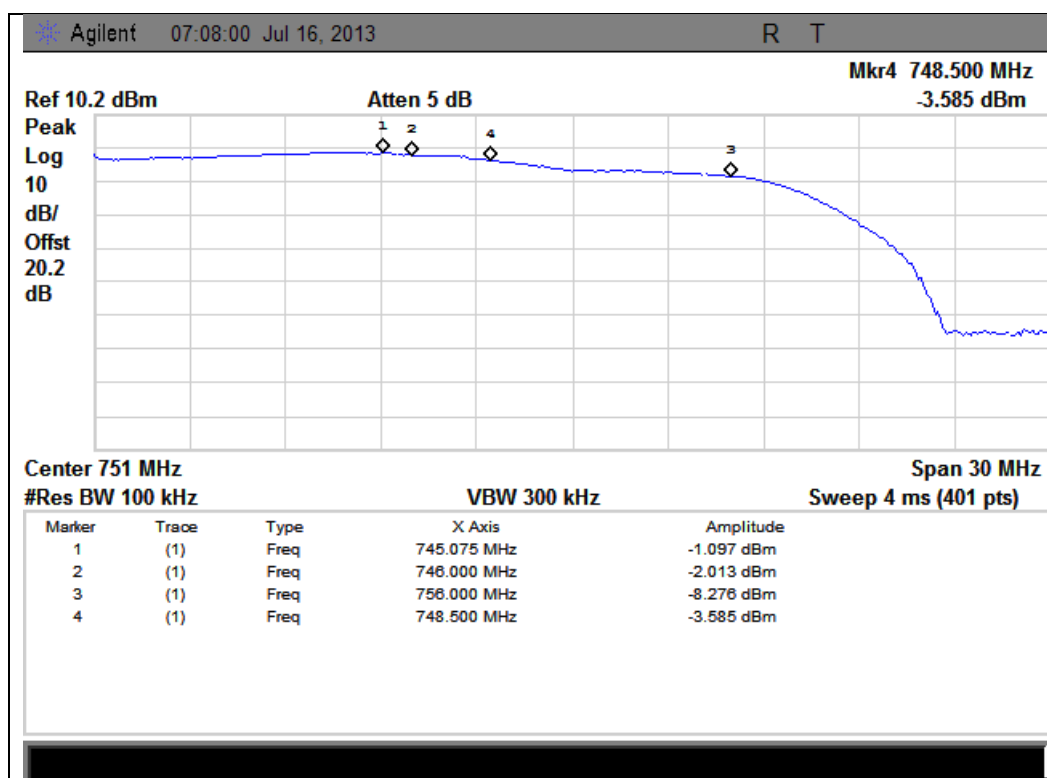
Downlink Test Results

728 - 746 MHz Band

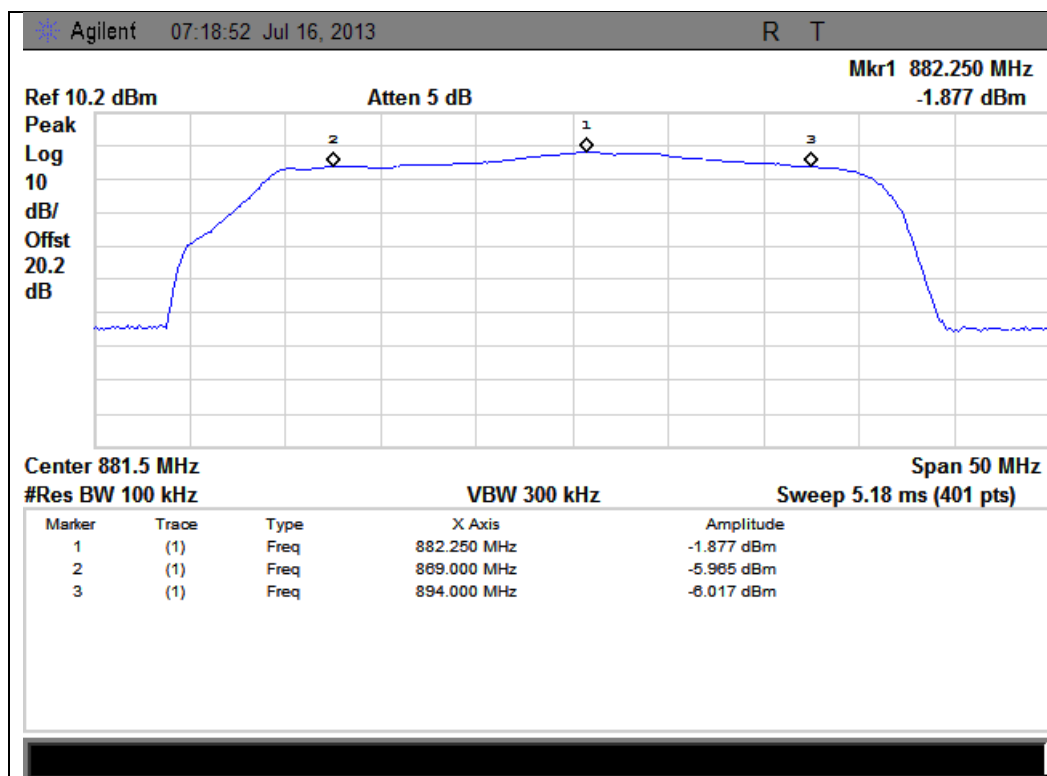




746 - 756 MHz Band

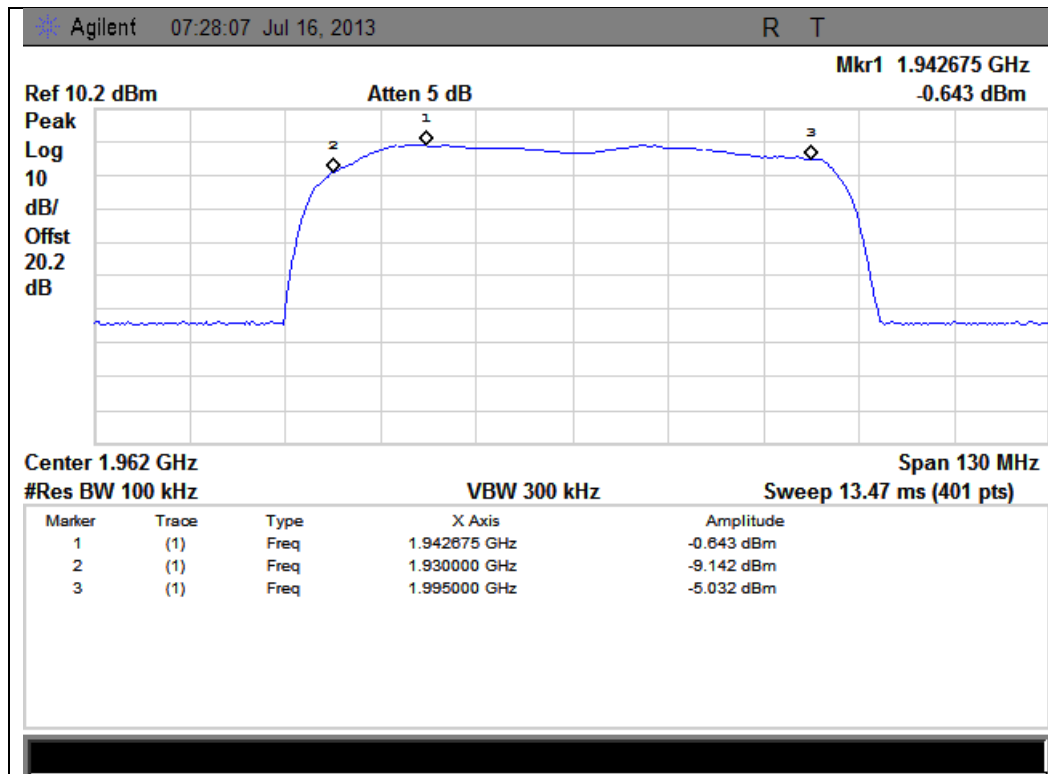


869 - 894 MHz Band

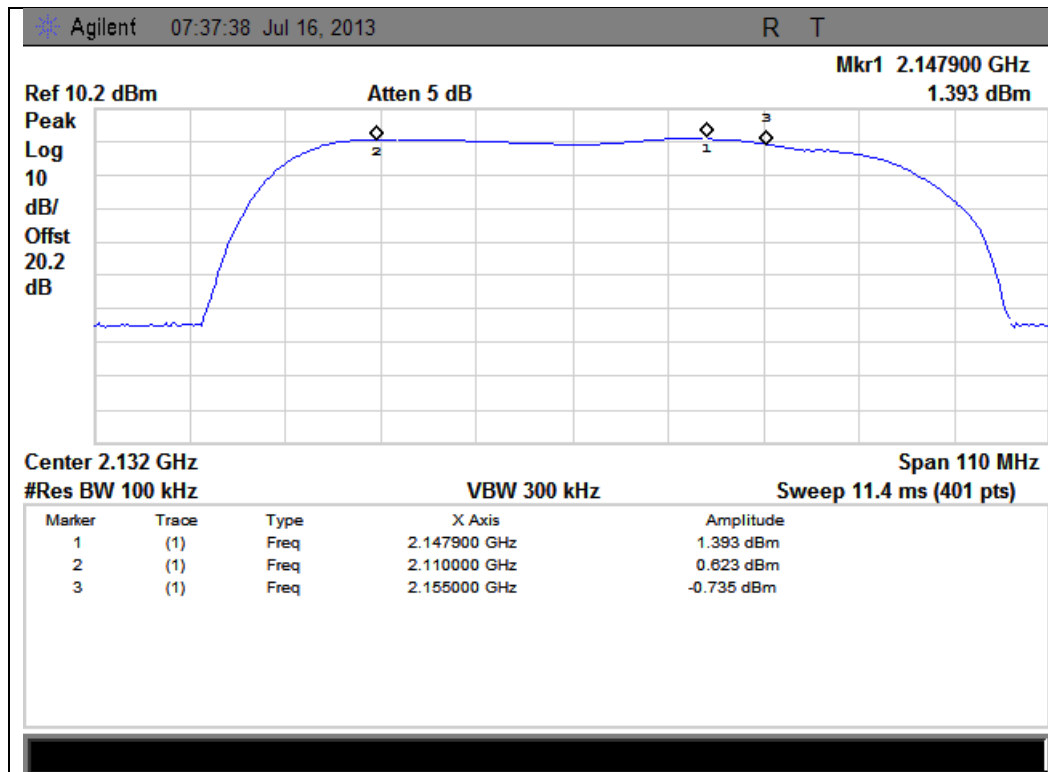




1930 - 1995 MHz Band



2110 - 2155 MHz Band





Maximum Power and Gain

Name of Test: Maximum Power and Gain
Test Equipment Utilized: SMU 200A - S/N:101369
E4407B - S/N:MY41444836

Engineer: Greg Corbin

Test Date: 7/16/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator with the losses being input into the spectrum analyzer as a combination of reference level offset and correction factor as necessary to ensure accurate readings were obtained. The spectrum analyzer and signal generator were tuned to the highest frequency in the band as determined by the Authorized Frequency Band test. The RF input level was increased to a point just prior to the AGC being in control of the power with both a 540 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 with the maximum gain was computed from these values. The uplink and downlink gain under each condition was verified to be within 9 dB of each other.

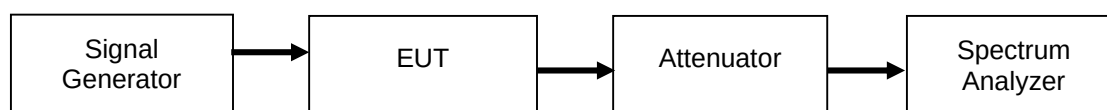
The following formulas are used for calculating the limits.

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
698 - 716 MHz Pulsed CW	-38.3	23.2	17	30	Pass
698 - 716 MHz AWGN	-38.3	21.7	17	30	Pass
777 - 787 MHz Pulsed CW	-35.7	23.8	17	30	Pass
777 - 787 MHz AWGN	-35.7	21.0	17	30	Pass
824 - 849 MHz Pulsed CW	-39.8	25.2	17	30	Pass
824 - 849 MHz AWGN	-39.8	21.8	17	30	Pass
1710 - 1755 MHz Pulsed CW	-44.4	22.5	17	30	Pass
1710 - 1755 MHz AWGN	-44.4	20.2	17	30	Pass
1850 - 1915 MHz Pulsed CW	-47.8	22.1	17	30	Pass
1850 - 1915 MHz AWGN	-47.8	20.0	17	30	Pass



Downlink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Upper Limit (dBm)	Result
728 - 746 MHz Pulsed CW	-63.3	-1.2	17	Pass
728 - 746 MHz AWGN	-63.3	-0.4	17	Pass
746 - 756 MHz Pulsed CW	-63.9	-3.6	17	Pass
746 - 756 MHz AWGN	-63.9	-2.1	17	Pass
869 - 894 MHz Pulsed CW	-64.6	-2.4	17	Pass
869 - 894 MHz AWGN	-64.6	-2.0	17	Pass
1930 - 1995 MHz Pulsed CW	-67.6	-1.4	17	Pass
1930 - 1995 MHz AWGN	-67.6	-1.9	17	Pass
2110 - 2155 MHz Pulsed CW	-66.9	0.9	17	Pass
2110 - 2155 MHz AWGN	-66.9	-0.2	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	701.87	742.5	61.5	63.5	62.1	63.5	0.6	9	-8.4
AWGN	701.87	742.5	60.0	63.5	62.9	63.5	2.9	9	-6.1
Pulsed CW	779.5	748.5	59.5	64.4	60.3	64.4	0.8	9	-8.2
AWGN	779.5	748.5	56.7	64.4	61.8	64.4	5.1	9	-3.9
Pulsed CW	831.85	882.25	65.0	64.9	62.2	64.9	2.8	9	-6.2
AWGN	831.85	882.25	61.6	64.9	62.6	64.9	1	9	-8
Pulsed CW	1730.7	2147.9	66.9	71	67.8	71	0.9	9	-8.1
AWGN	1730.7	2147.9	64.6	71	66.7	71	2.1	9	-6.9
Pulsed CW	1867.875	1942.685	69.9	72	66.2	72	3.7	9	-5.3
AWGN	1867.875	1942.685	67.8	72	65.7	72	2.1	9	-6.9



Intermodulation

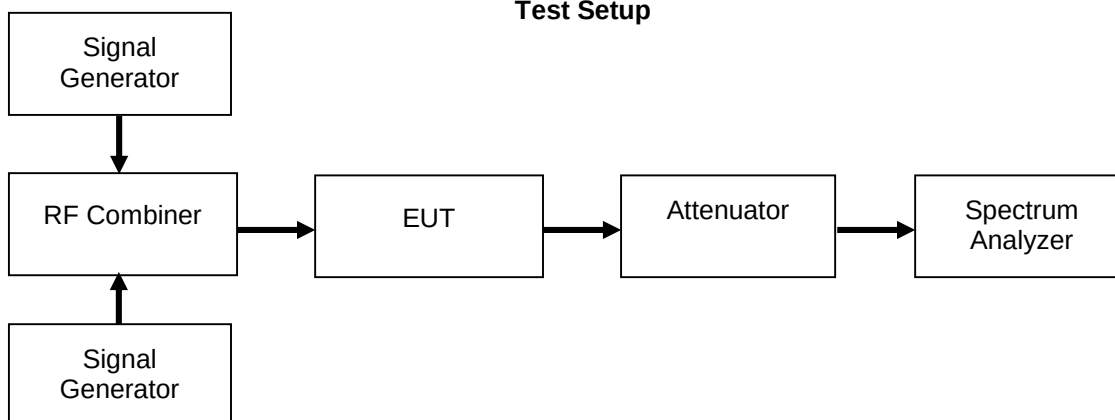
Name of Test: Intermodulation
Test Equipment Utilized: SMU 200A - S/N:101369
E4407B - S/N:MY41444836

Engineer: Greg Corbin
Test Date: 7/19/2013

Test Procedure

The EUT was connected to a spectrum analyzer through an attenuator. Two signal generators were utilized to produce two CW signals 600 kHz apart and centered in the operational band. Attenuator and cable insertion loss correction factors were input to either the signal generator or the spectrum analyzer as required to ensure accurate measurements were recorded. The input power was set at the maximum allowable power and the 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
698 - 716 MHz	-23.5	-19	Pass
777 - 787 MHz	-20.4	-19	Pass
824 - 849 MHz	-20.9	-19	Pass
1710 - 1755 MHz	-22.2	-19	Pass
1850 - 1915 MHz	-21.6	-19	Pass

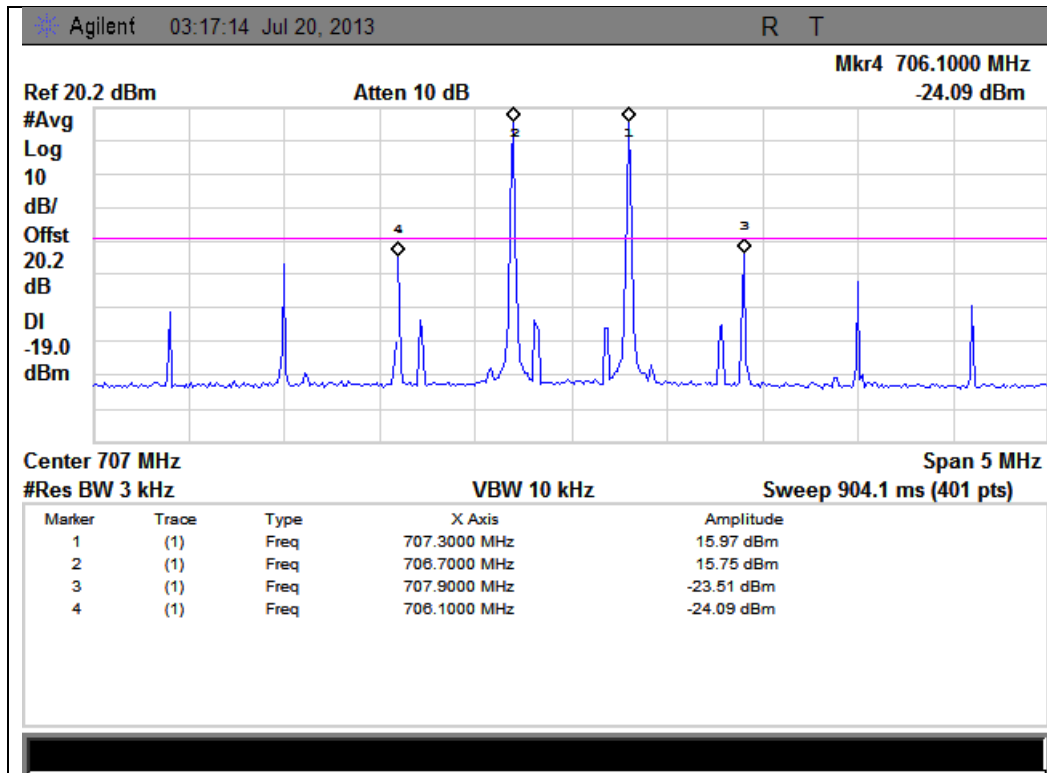
Downlink Test Results

Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
728 - 746 MHz	-62.8	-19	Pass
746 - 756 MHz	-63.4	-19	Pass
869 - 894 MHz	-63.9	-19	Pass
1930 - 1995 MHz	-63	-19	Pass
2110 - 2155 MHz	-61.9	-19	Pass

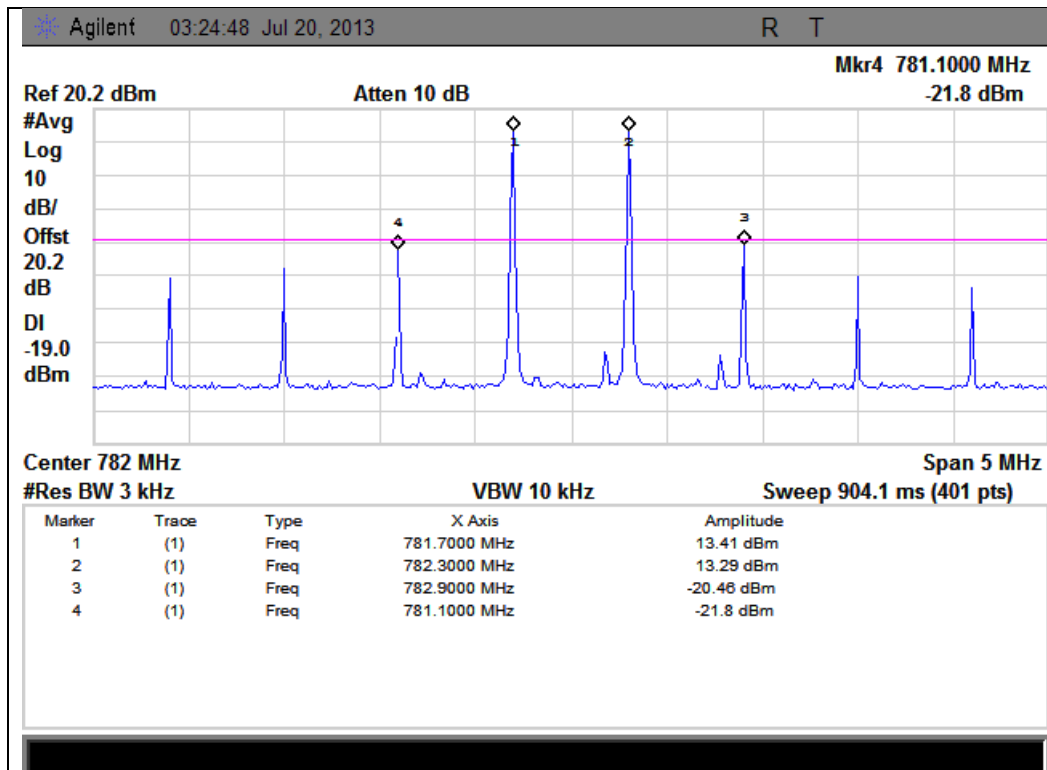


Uplink Test Results

698 - 716 MHz Band

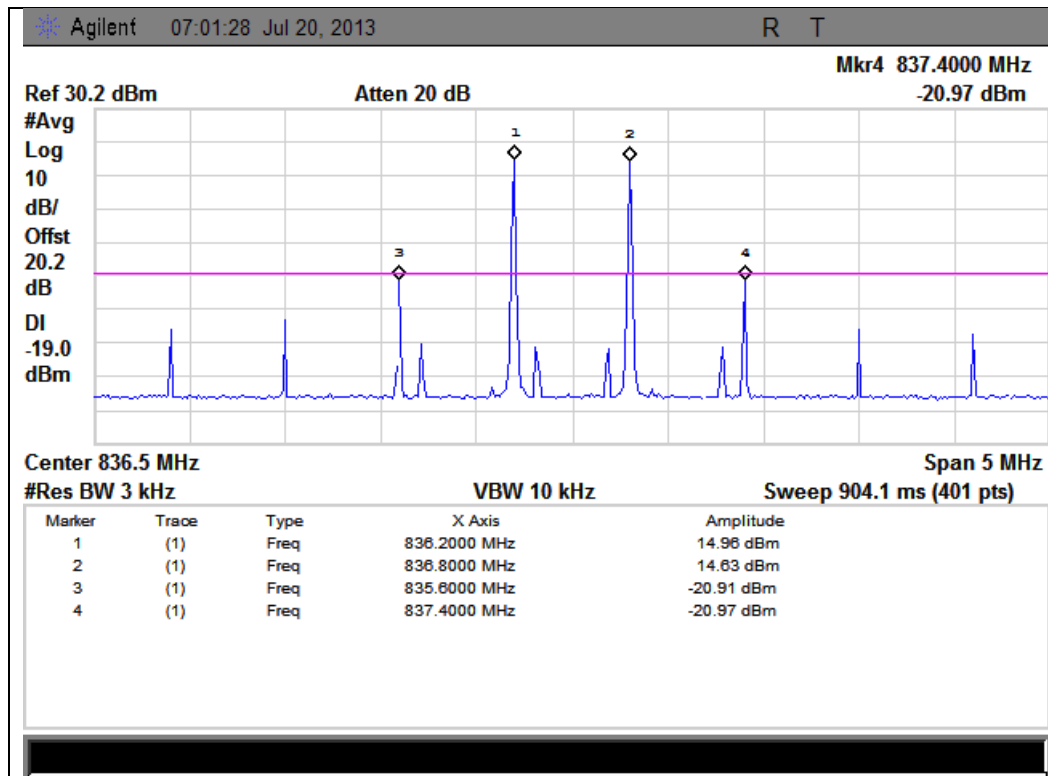


777 - 787 MHz Band

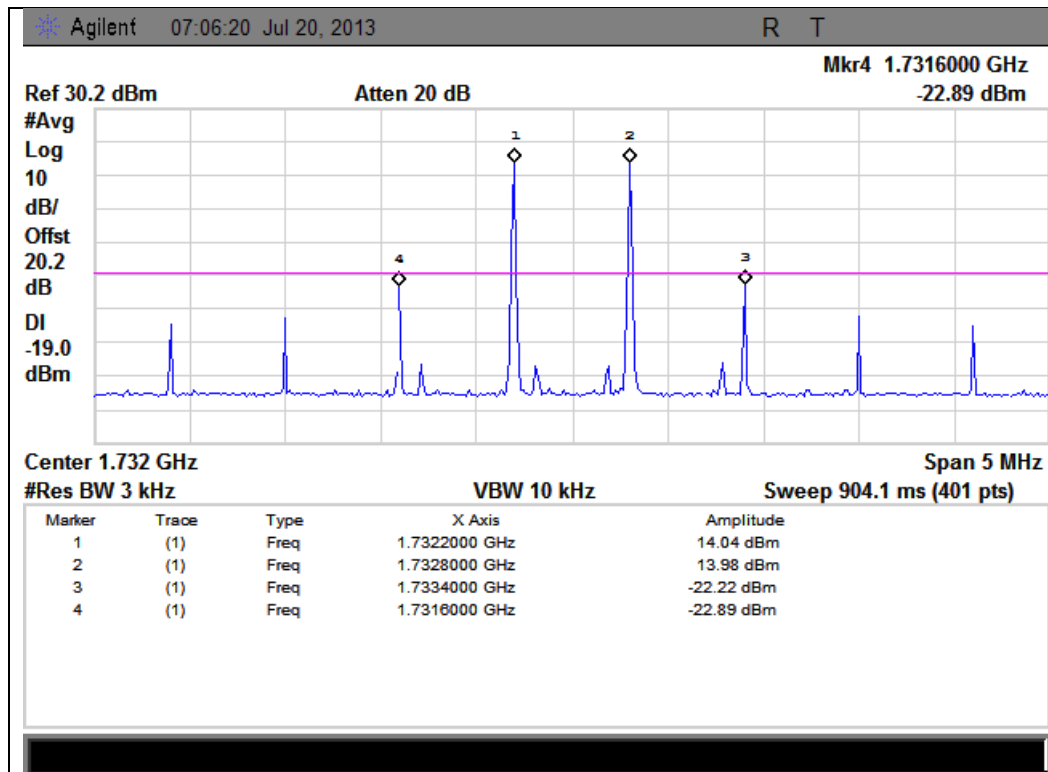




824 - 849 MHz Band

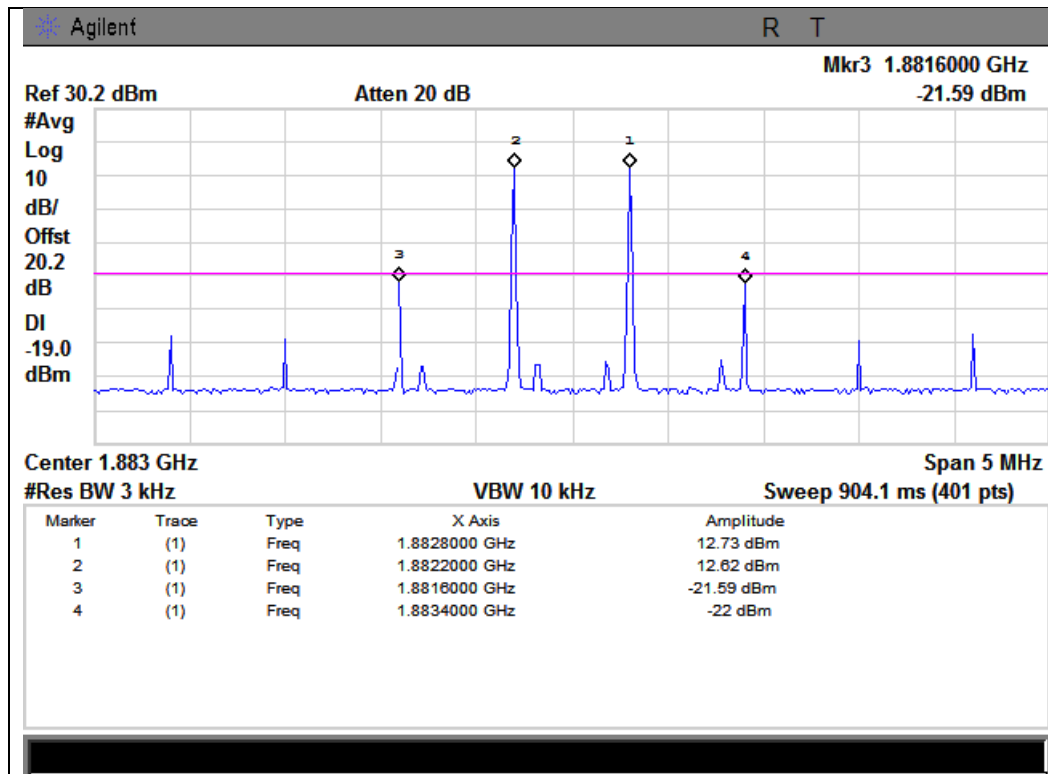


1710 - 1755 MHz Band



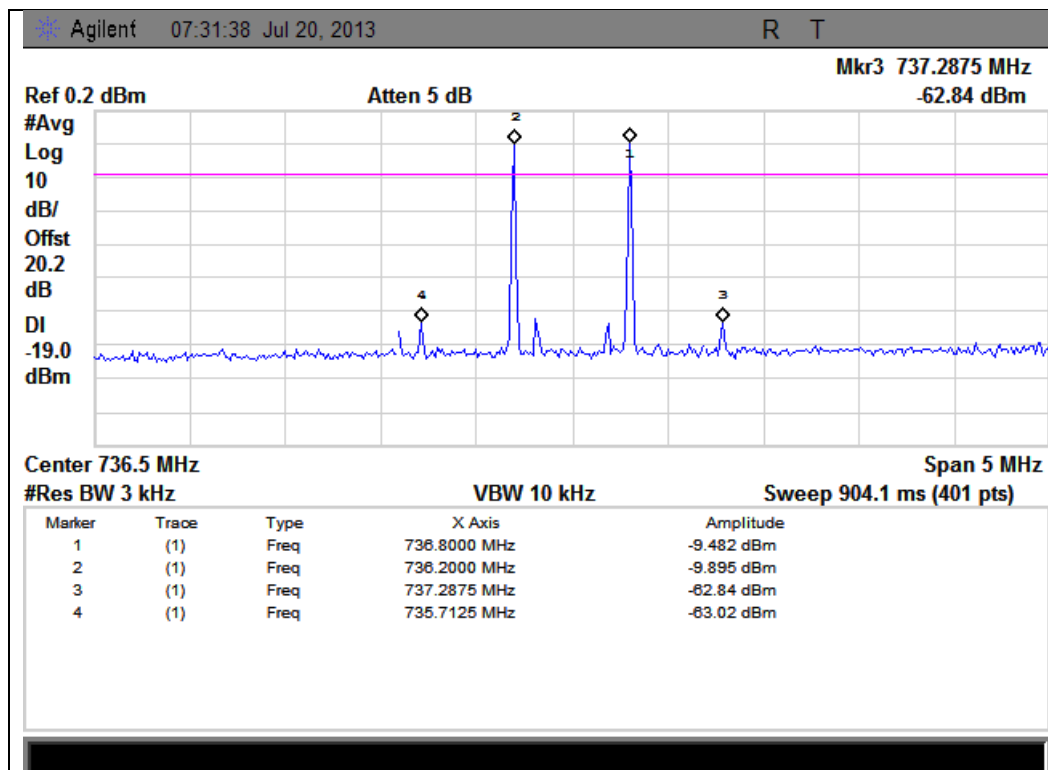


1850 - 1915 MHz Band



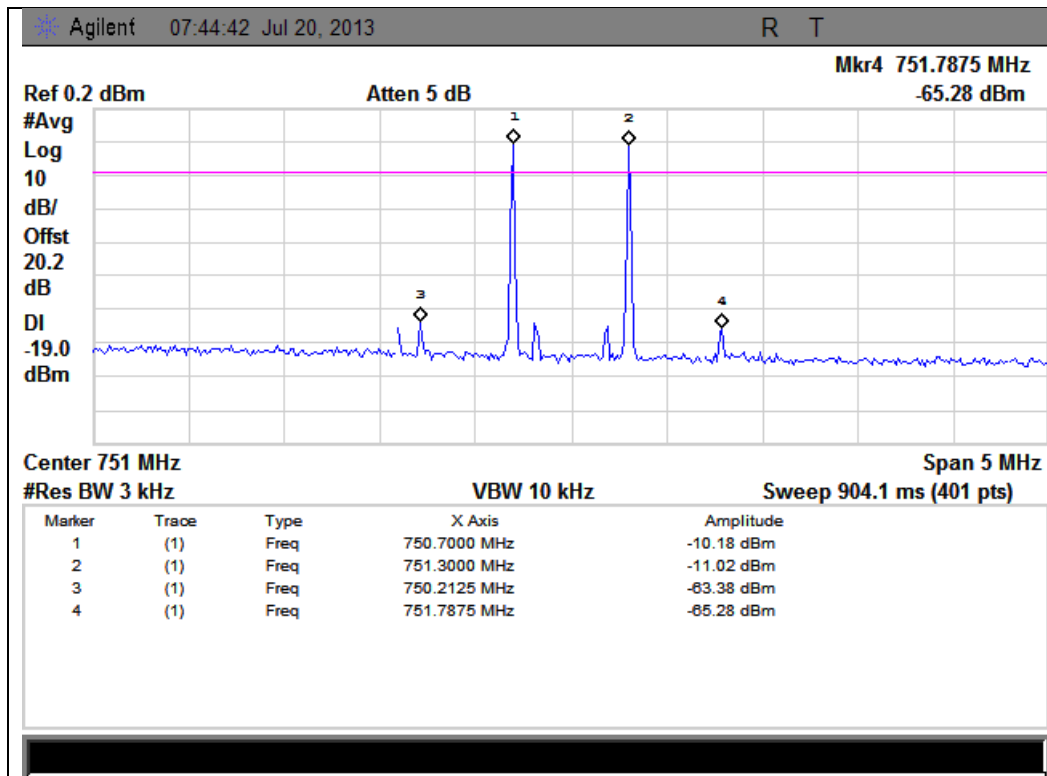
Downlink Test Results

728 - 746 MHz Band

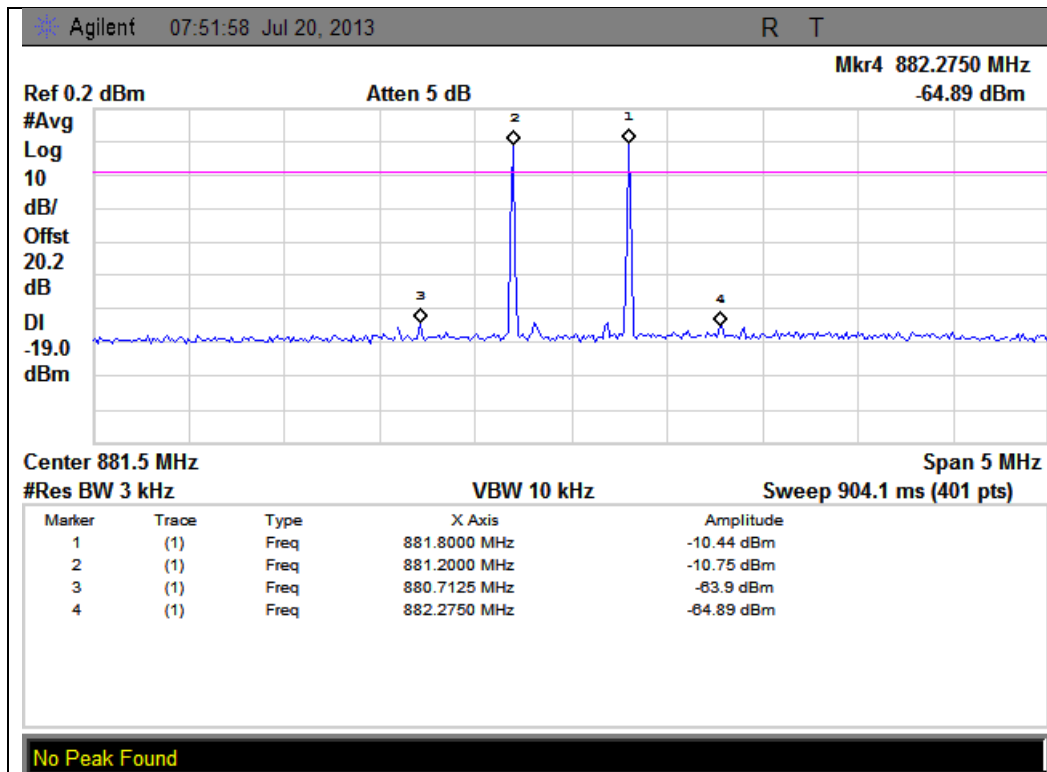




746 - 756 MHz Band

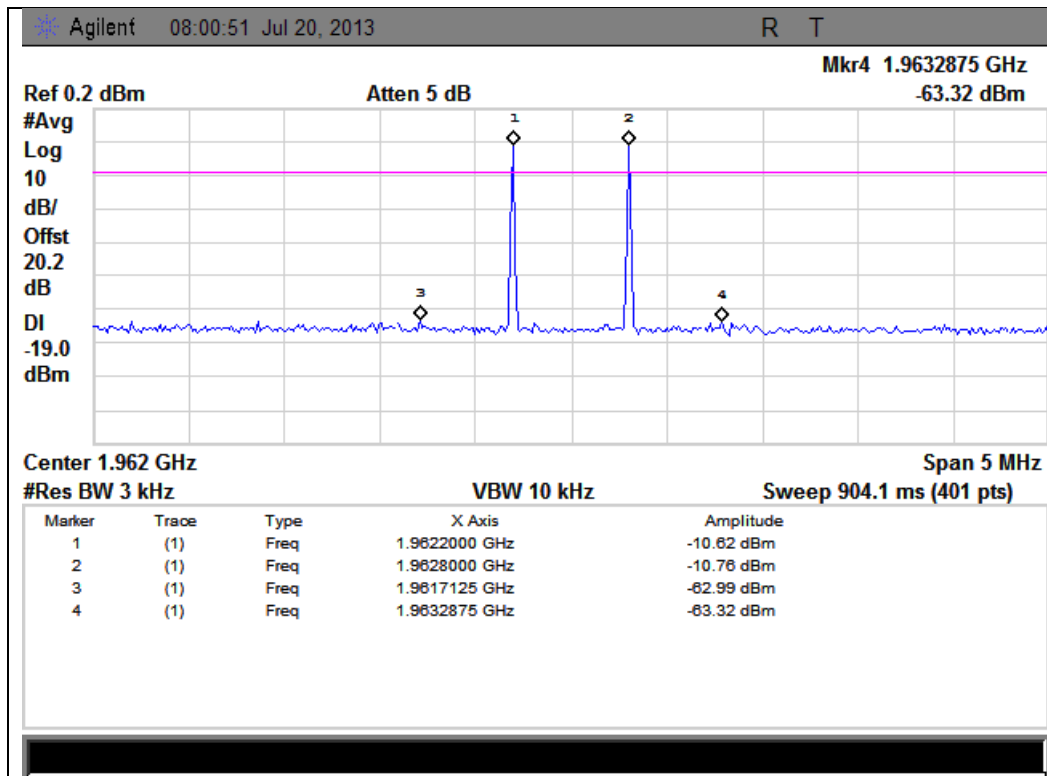


869 - 894 MHz Band

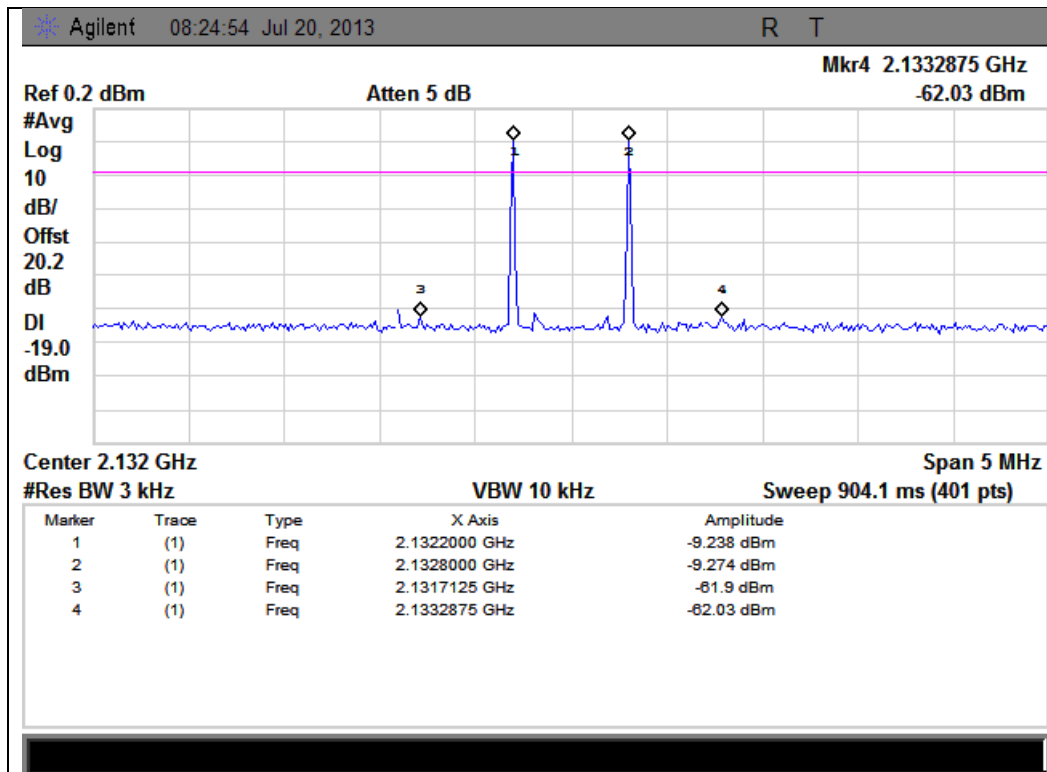




1930 - 1995 MHz Band



2110 - 2155 MHz Band





Out-of-Band Emissions

Name of Test:

Out-of-Band Emissions

Engineer: Greg Corbin

Test Equipment Utilized:

SMU 200A - S/N:101369
E4407B - S/N:MY41444836

Test Date: 7/22/2013

Test Procedure

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

The following 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
698 - 716	Lower	-20.3	-19	Pass
698 - 716	Upper	-19.8	-19	Pass
777 - 787	Lower	-57.4	-19	Pass
777 - 787	Upper	-20.5	-19	Pass
824 - 849	Lower	-29.9	-19	Pass
824 - 849	Upper	-28.4	-19	Pass
1710 - 1755	Lower	-29.8	-19	Pass
1710 - 1755	Upper	-30.2	-19	Pass
1850 - 1915	Lower	-31.9	-19	Pass
1850 - 1915	Upper	-34.8	-19	Pass

CDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-42.9	-19	Pass
698 - 716	Upper	-43.6	-19	Pass
777 - 787	Lower	-42.2	-19	Pass
777 - 787	Upper	-40.6	-19	Pass
824 - 849	Lower	-35.4	-19	Pass
824 - 849	Upper	-31.2	-19	Pass
1710 - 1755	Lower	-33.1	-19	Pass
1710 - 1755	Upper	-38.6	-19	Pass
1850 - 1915	Lower	-37.7	-19	Pass
1850 - 1915	Upper	-39.9	-19	Pass



WCDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-41.1	-19	Pass
698 - 716	Upper	-42.8	-19	Pass
777 - 787	Lower	-45.9	-19	Pass
777 - 787	Upper	-41.8	-19	Pass
824 - 849	Lower	-35.1	-19	Pass
824 - 849	Upper	-31.5	-19	Pass
1710 - 1755	Lower	-33.4	-19	Pass
1710 - 1755	Upper	-35.4	-19	Pass
1850 - 1915	Lower	-35.1	-19	Pass
1850 - 1915	Upper	-37	-19	Pass

GSM Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-46.5	-19	Pass
728 - 746	Upper	-61.7	-19	Pass
746 - 756	Lower	-42.7	-19	Pass
746 - 756	Upper	-65.9	-19	Pass
869 - 894	Lower	-55.6	-19	Pass
869 - 894	Upper	-56.1	-19	Pass
1930 - 1995	Lower	-56.3	-19	Pass
1930 - 1995	Upper	-55.3	-19	Pass
2110 - 2155	Lower	-51.1	-19	Pass
2110 - 2155	Upper	-53.2	-19	Pass



CDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 – 746	Lower	-68.1	-19	Pass
728 - 746	Upper	-61.2	-19	Pass
746 - 756	Lower	-67.1	-19	Pass
746 - 756	Upper	-67.1	-19	Pass
869 - 894	Lower	-62.7	-19	Pass
869 - 894	Upper	-62.8	-19	Pass
1930 - 1995	Lower	-65.5	-19	Pass
1930 - 1995	Upper	-61.2	-19	Pass
2110 - 2155	Lower	-58.3	-19	Pass
2110 - 2155	Upper	-58.8	-19	Pass

WCDMA Downlink Test Results

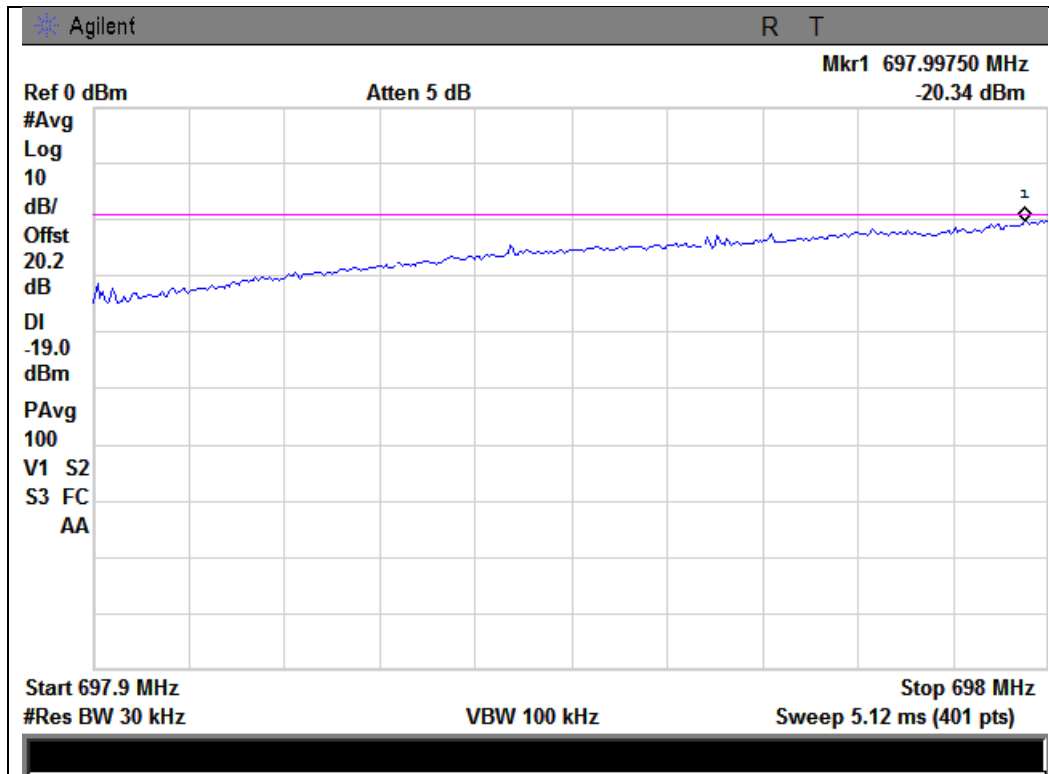
Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-67.5	-19	Pass
728 - 746	Upper	-61.7	-19	Pass
746 - 756	Lower	-61.5	-19	Pass
746 - 756	Upper	-67.4	-19	Pass
869 - 894	Lower	-57.7	-19	Pass
869 - 894	Upper	-57.4	-19	Pass
1930 - 1995	Lower	-60.3	-19	Pass
1930 - 1995	Upper	-56.8	-19	Pass
2110 - 2155	Lower	-53.2	-19	Pass
2110 - 2155	Upper	-53	-19	Pass



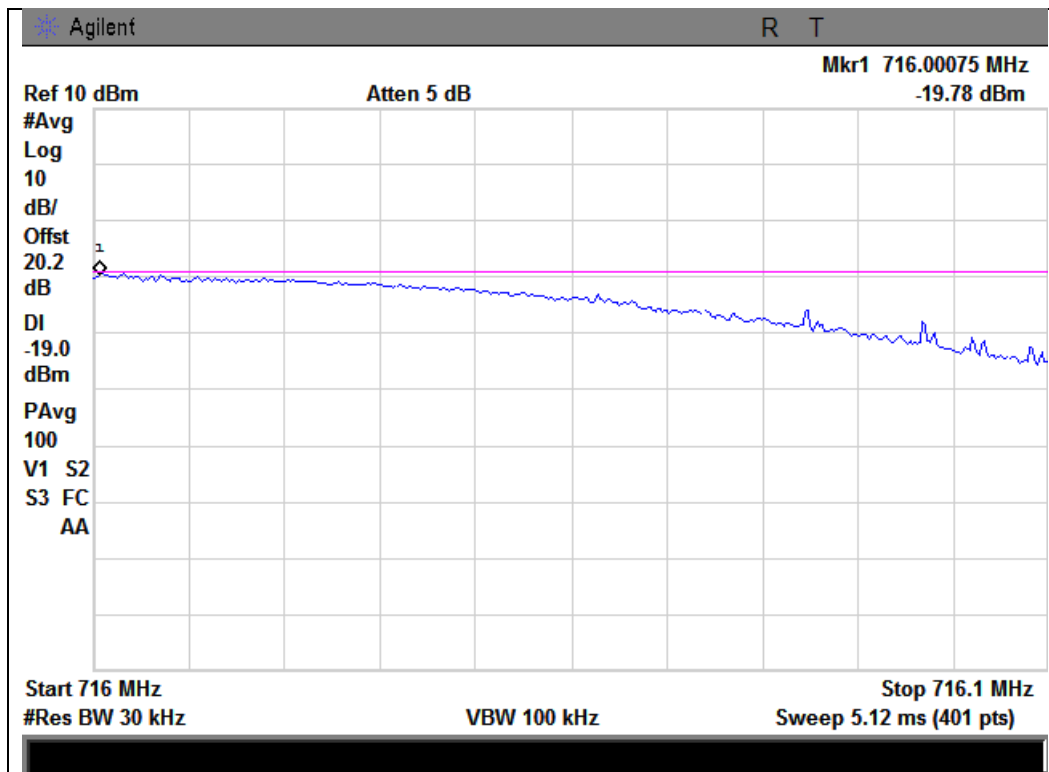
GSM Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge



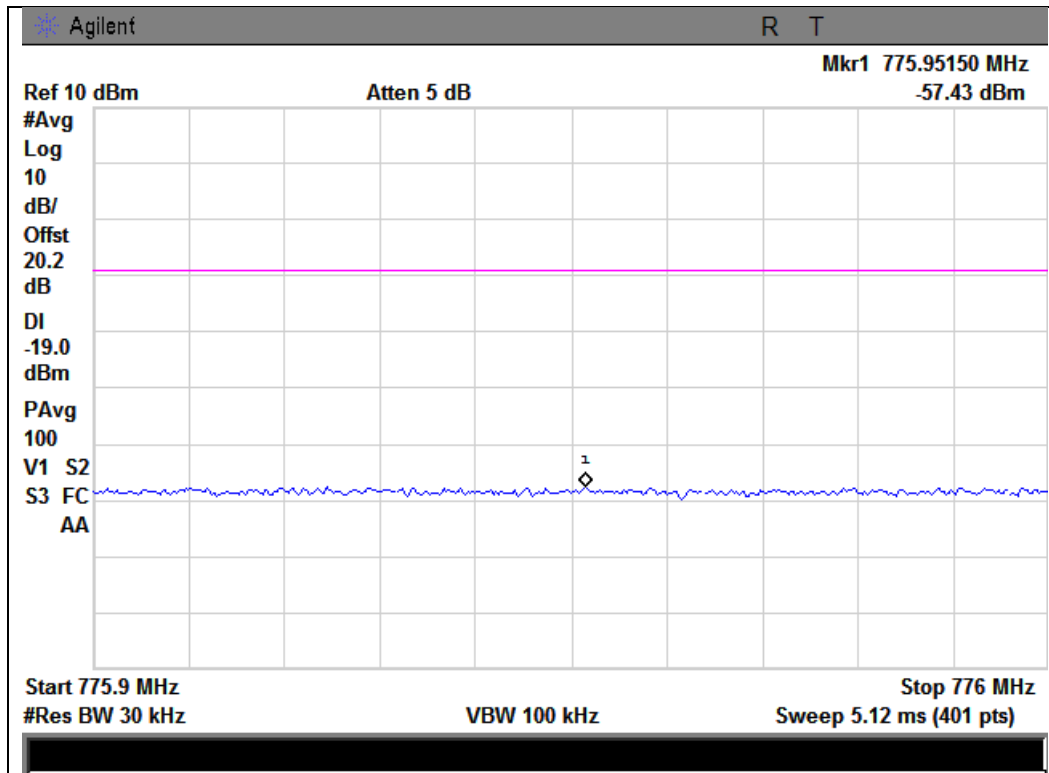
Upper Band Edge



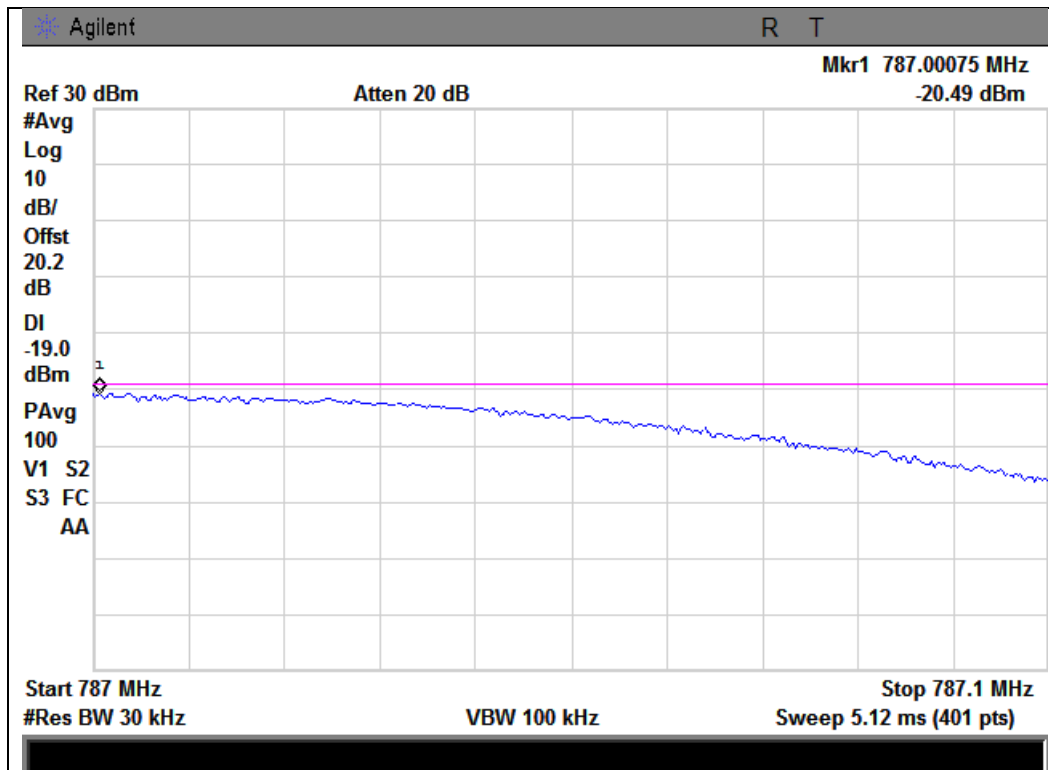


777 - 787 MHz Band

Lower Band Edge



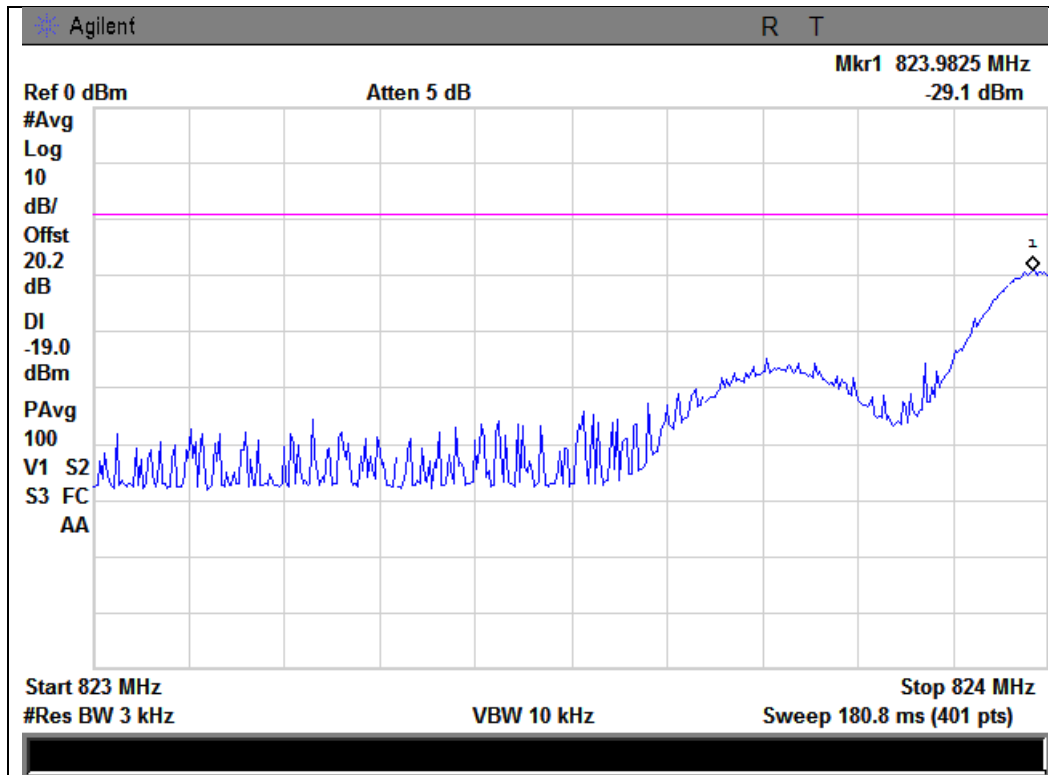
Upper Band Edge



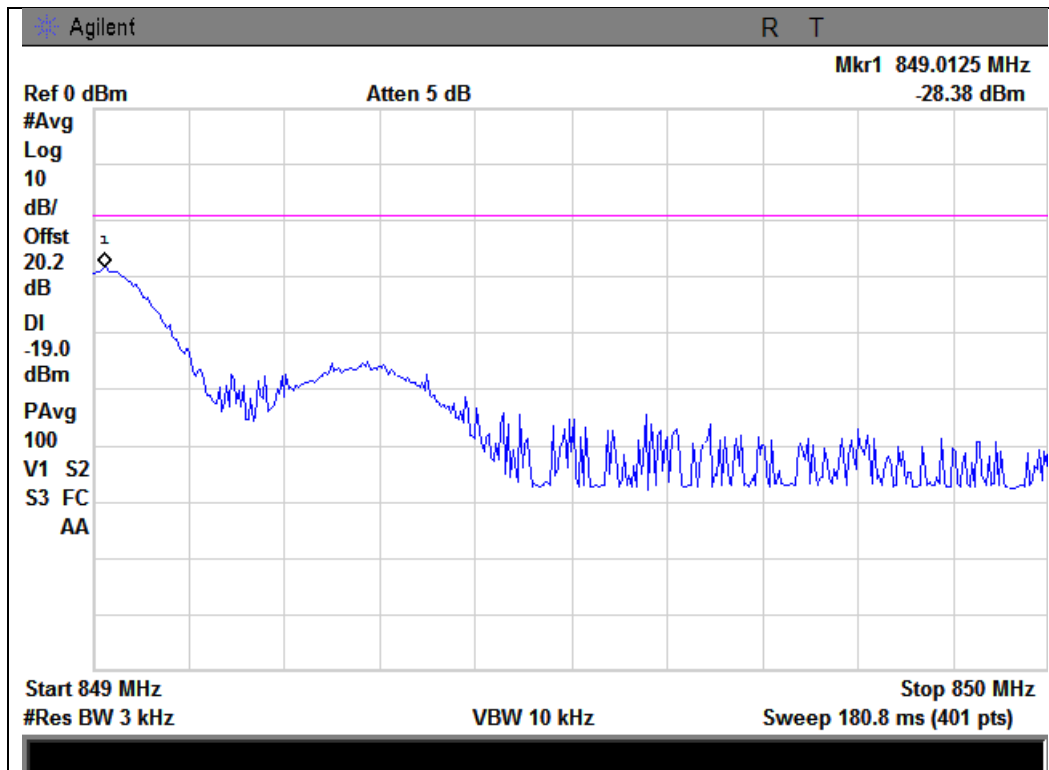


824 - 849 MHz Band

Lower Band Edge



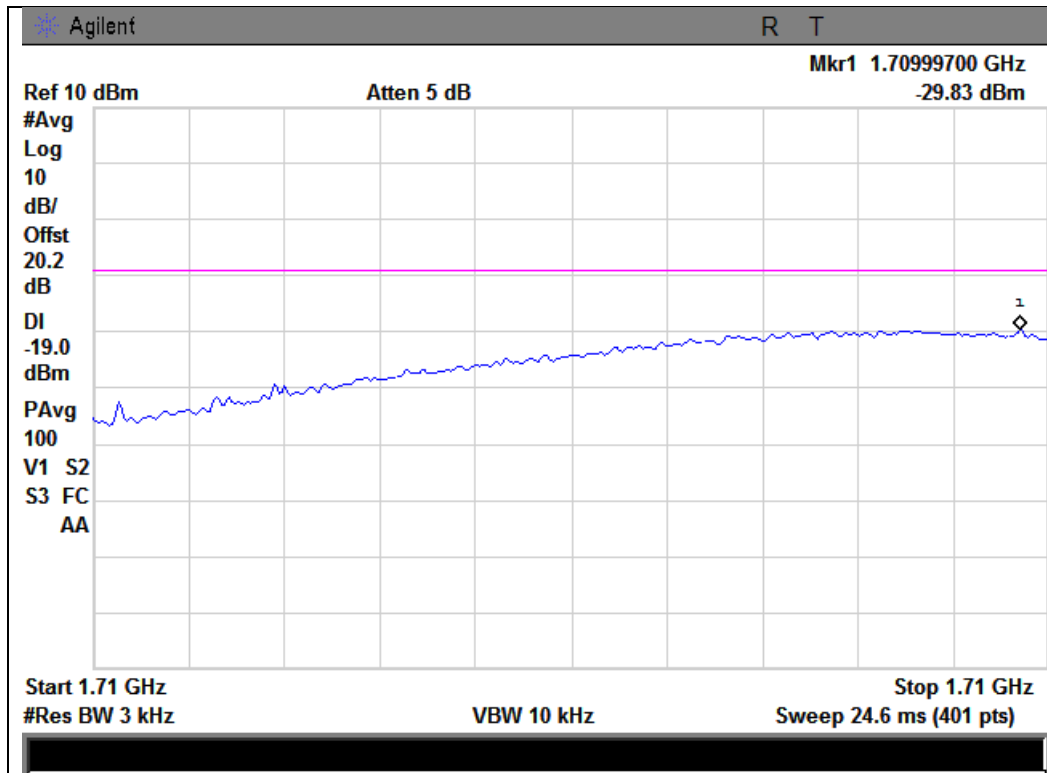
Upper Band Edge



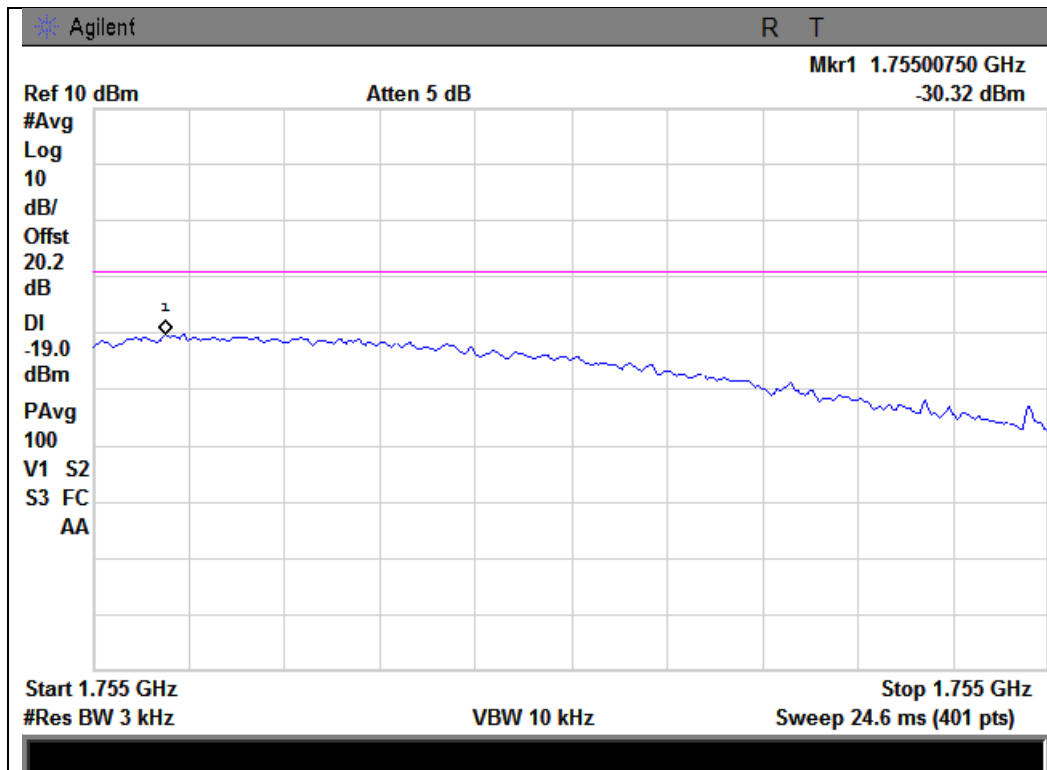


1710 - 1755 MHz Band

Lower Band Edge



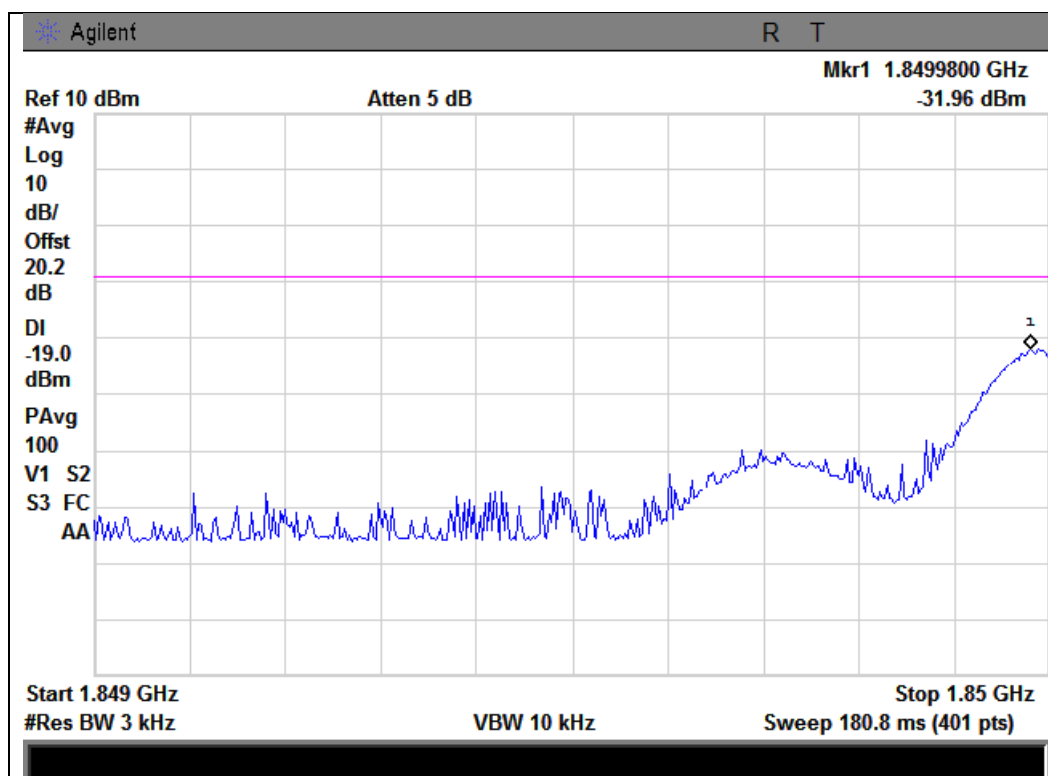
Upper Band Edge



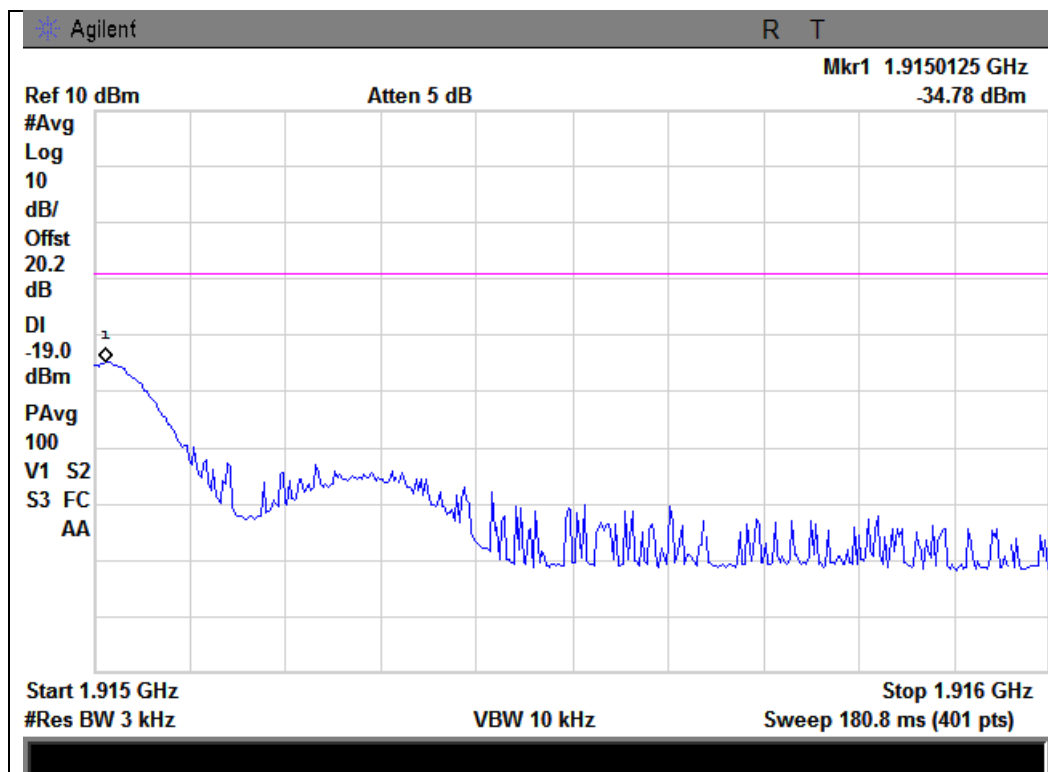


1850 - 1915 MHz Band

Lower Band Edge



Upper Band Edge

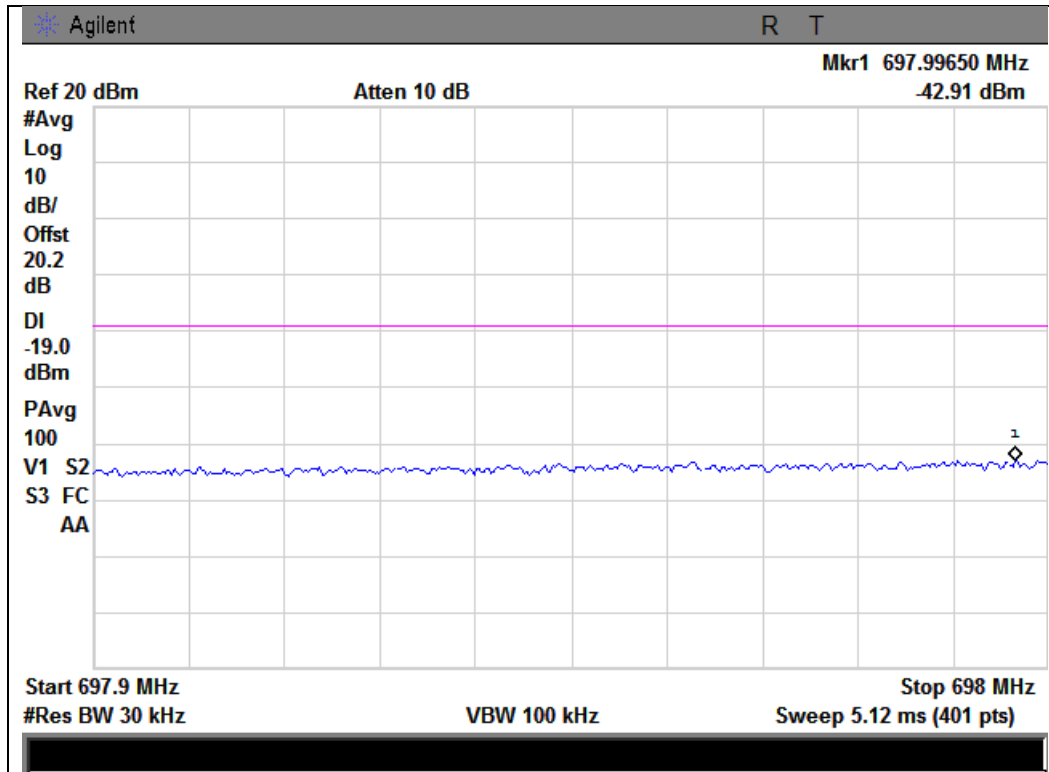




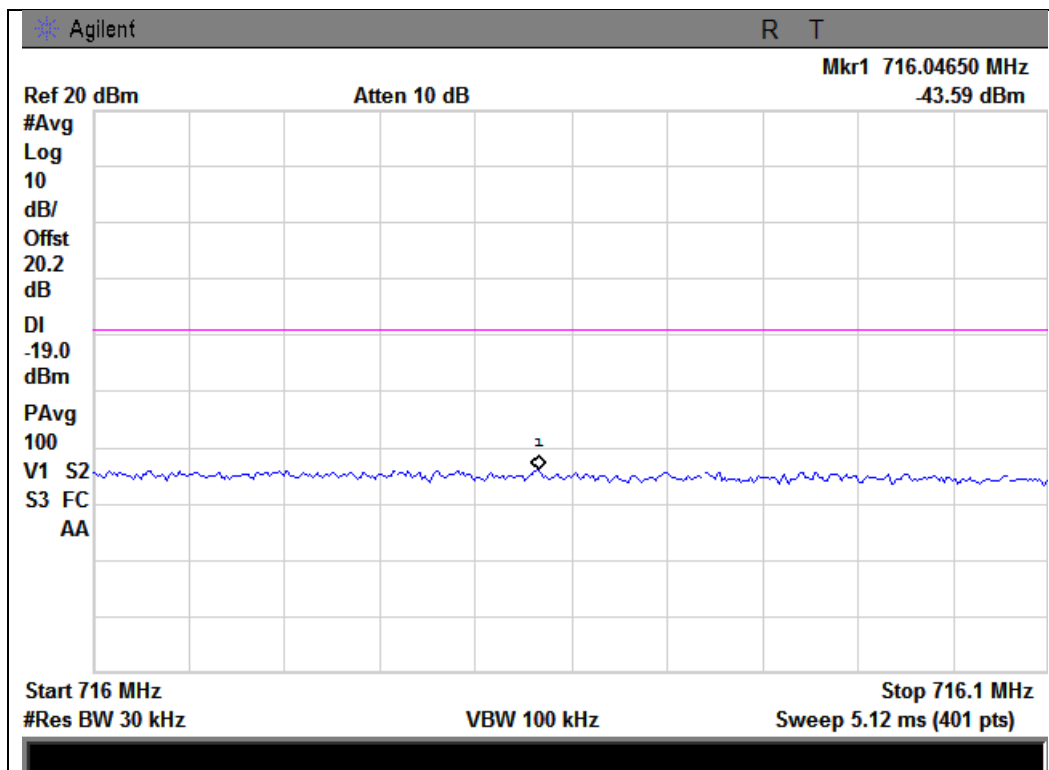
CDMA Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge



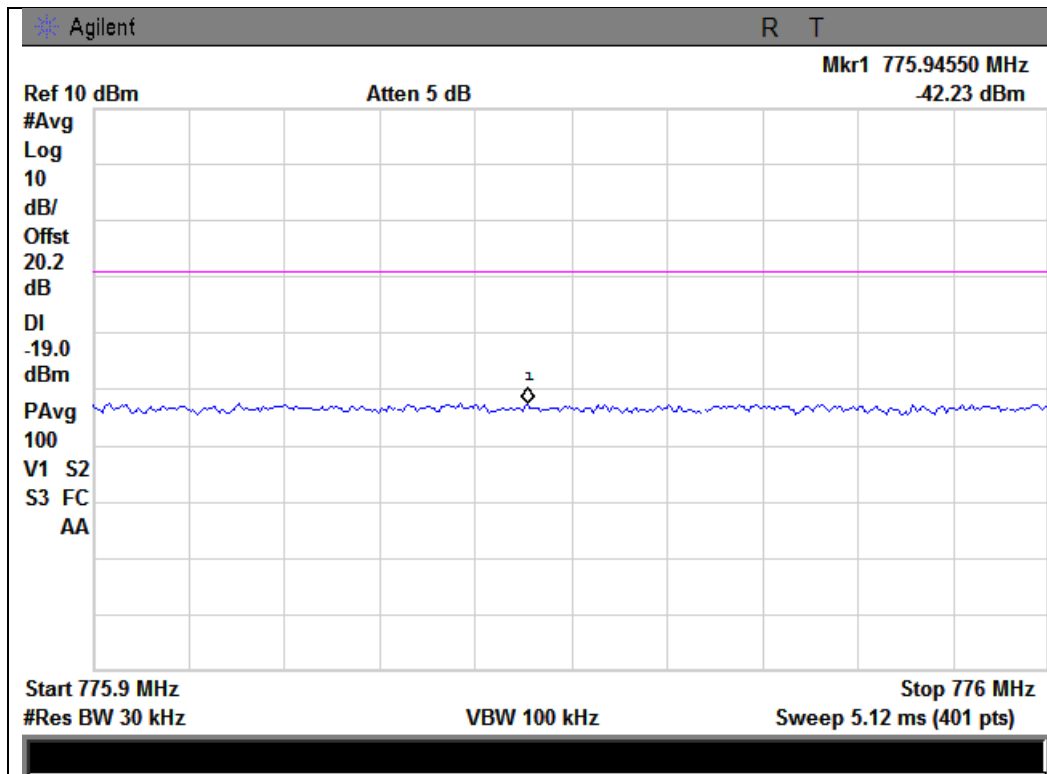
Upper Band Edge



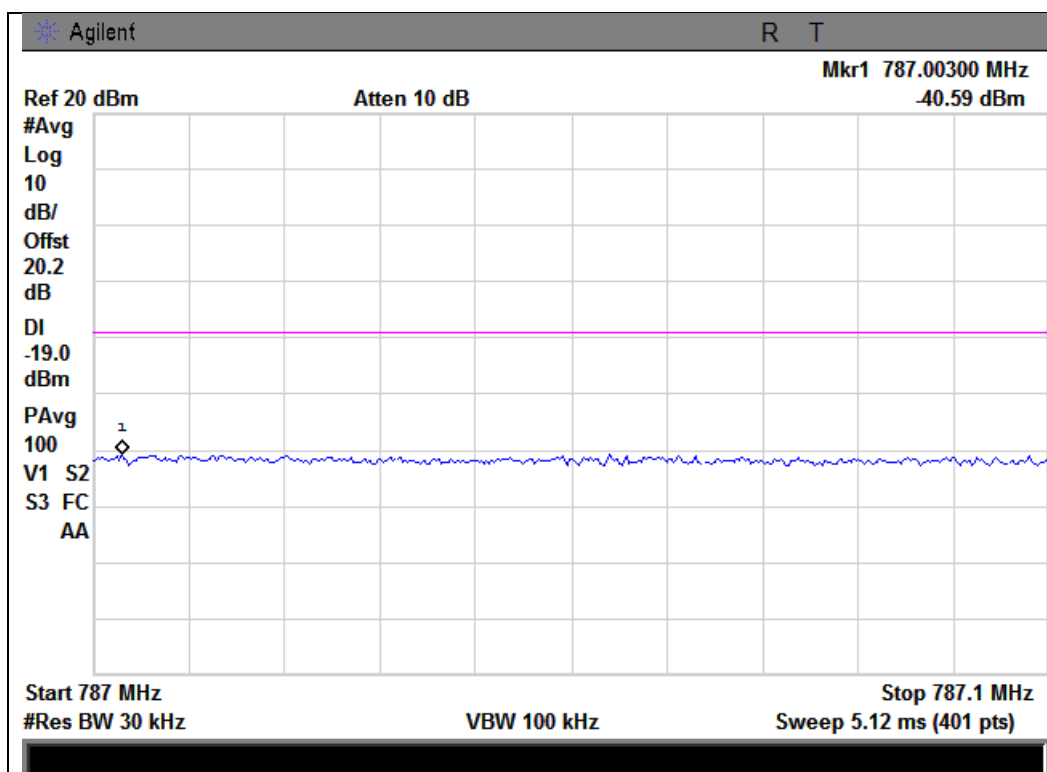


777 - 787 MHz Band

Lower Band Edge



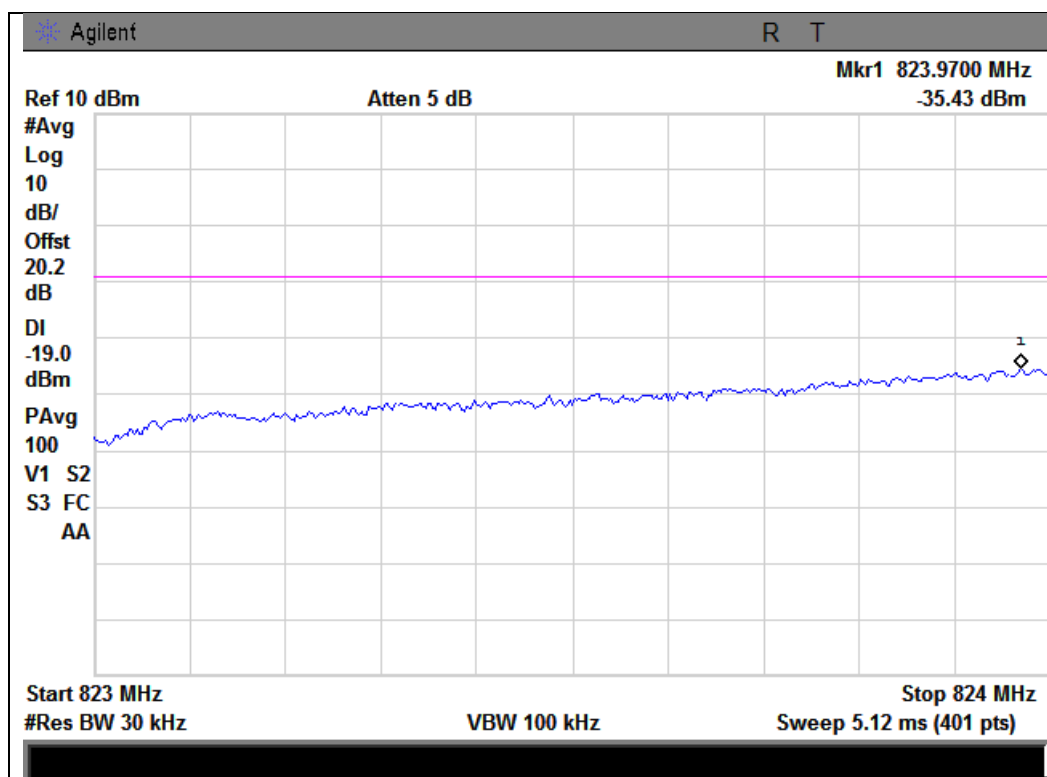
Upper Band Edge



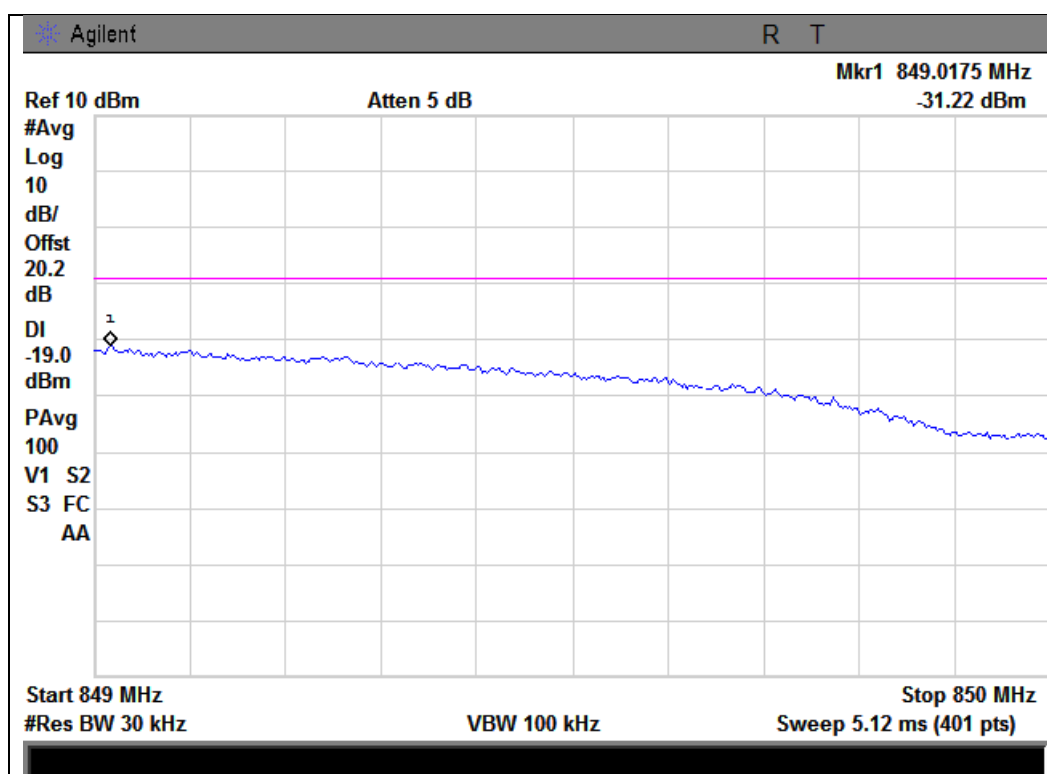


824 - 849 MHz Band

Lower Band Edge



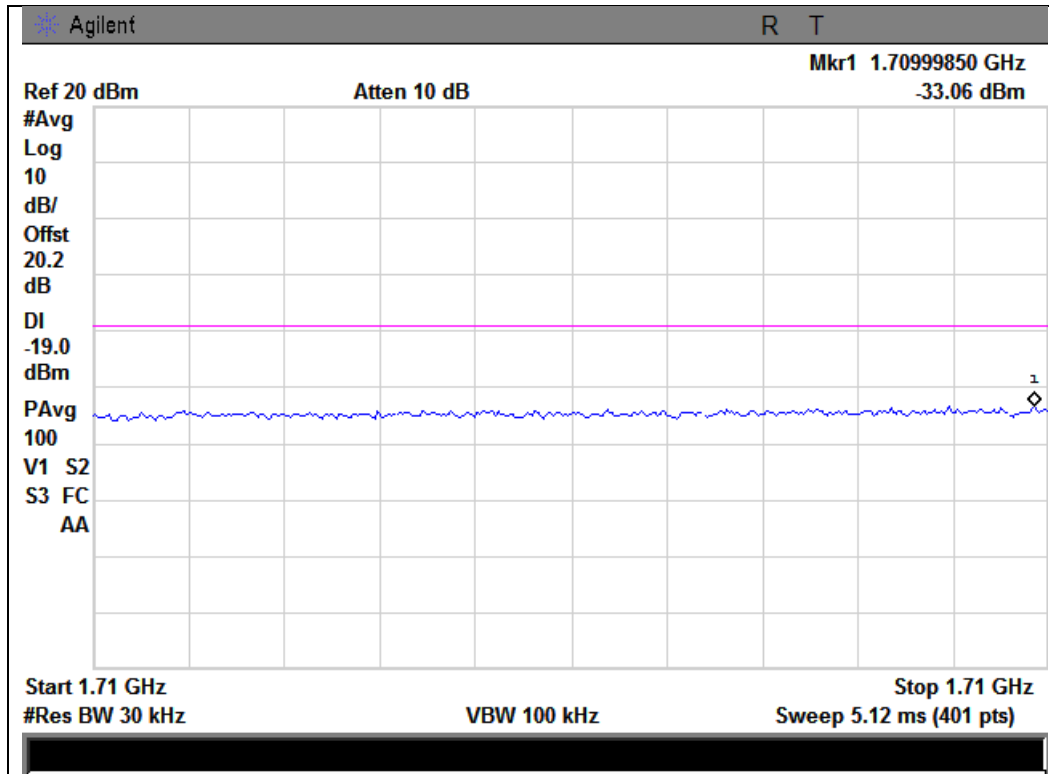
Upper Band Edge



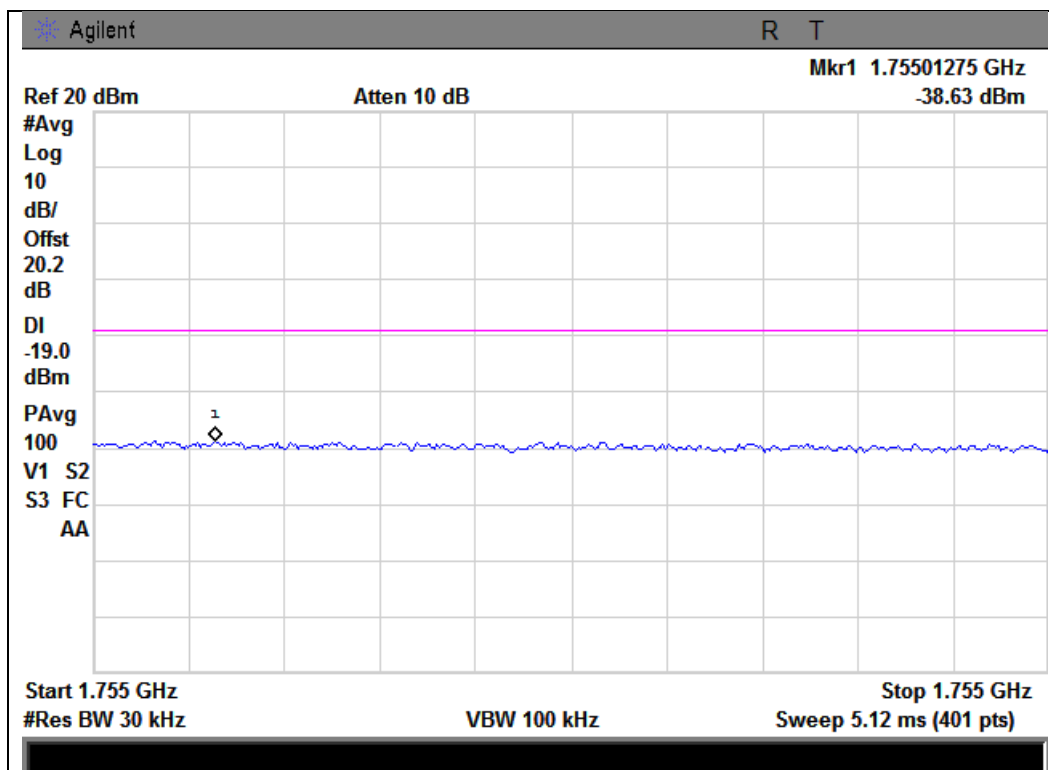


1710 - 1755 MHz Band

Lower Band Edge



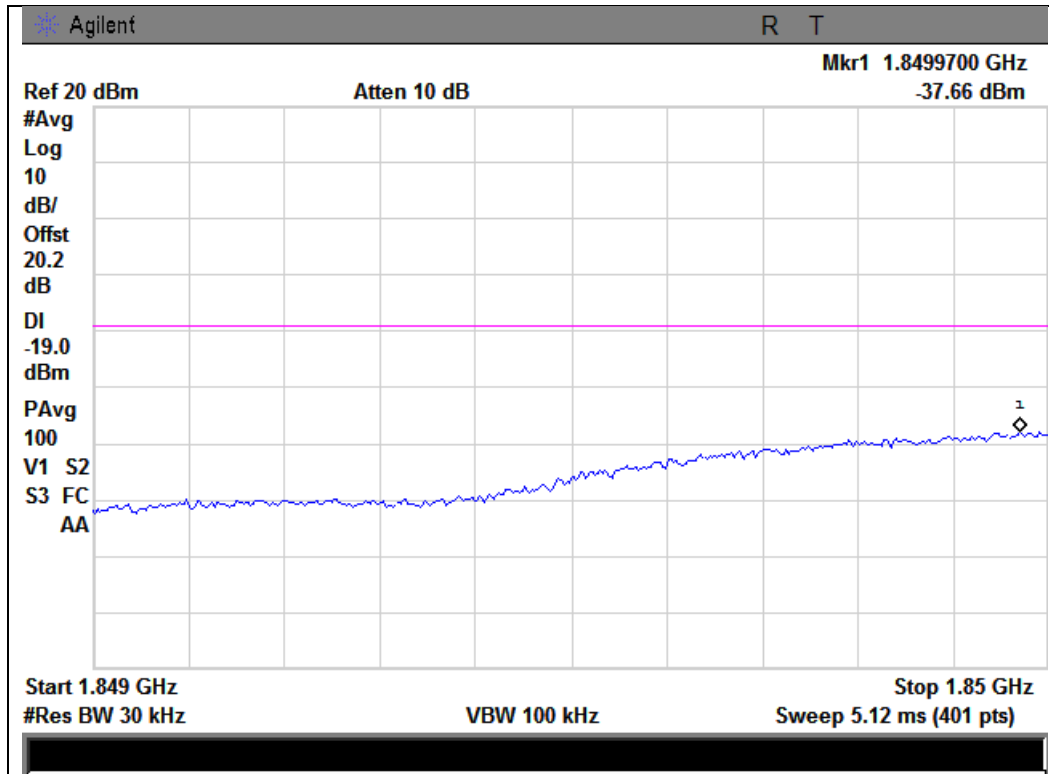
Upper Band Edge



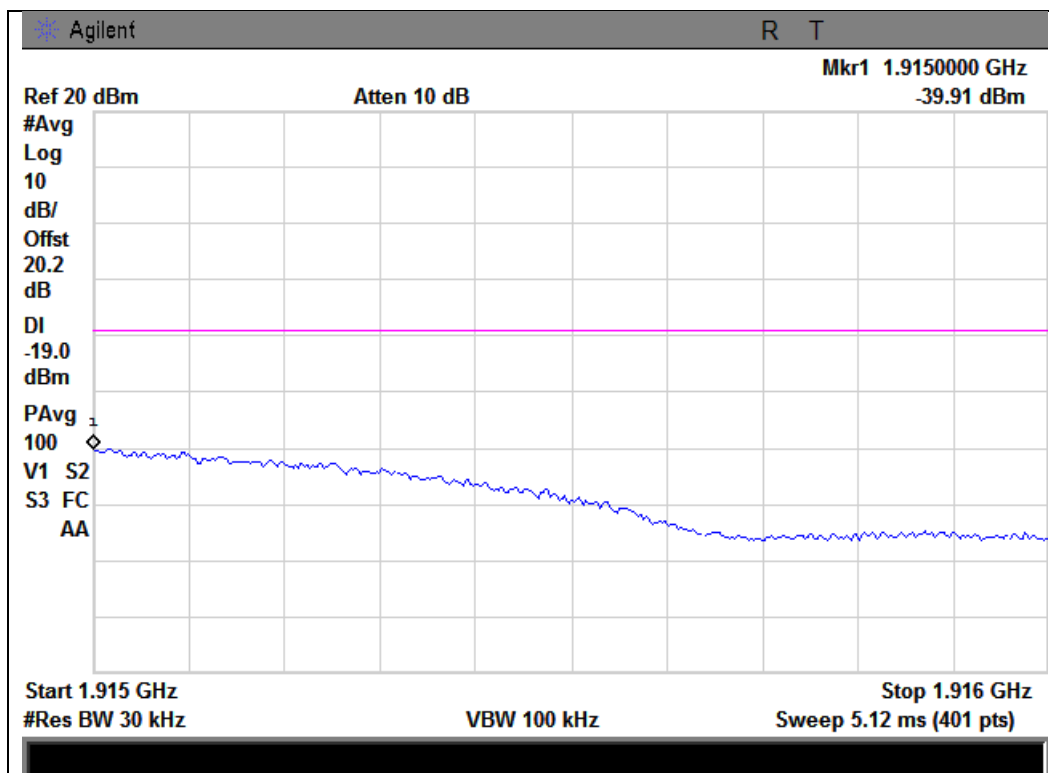


1850 - 1915 MHz Band

Lower Band Edge



Upper Band Edge

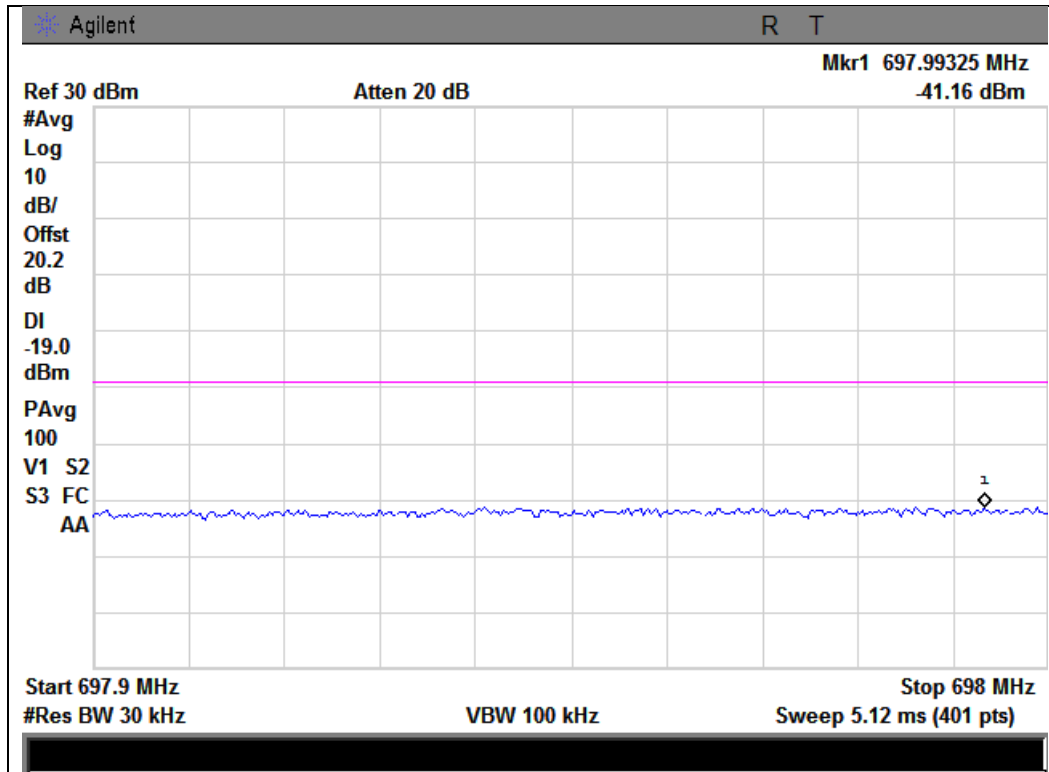




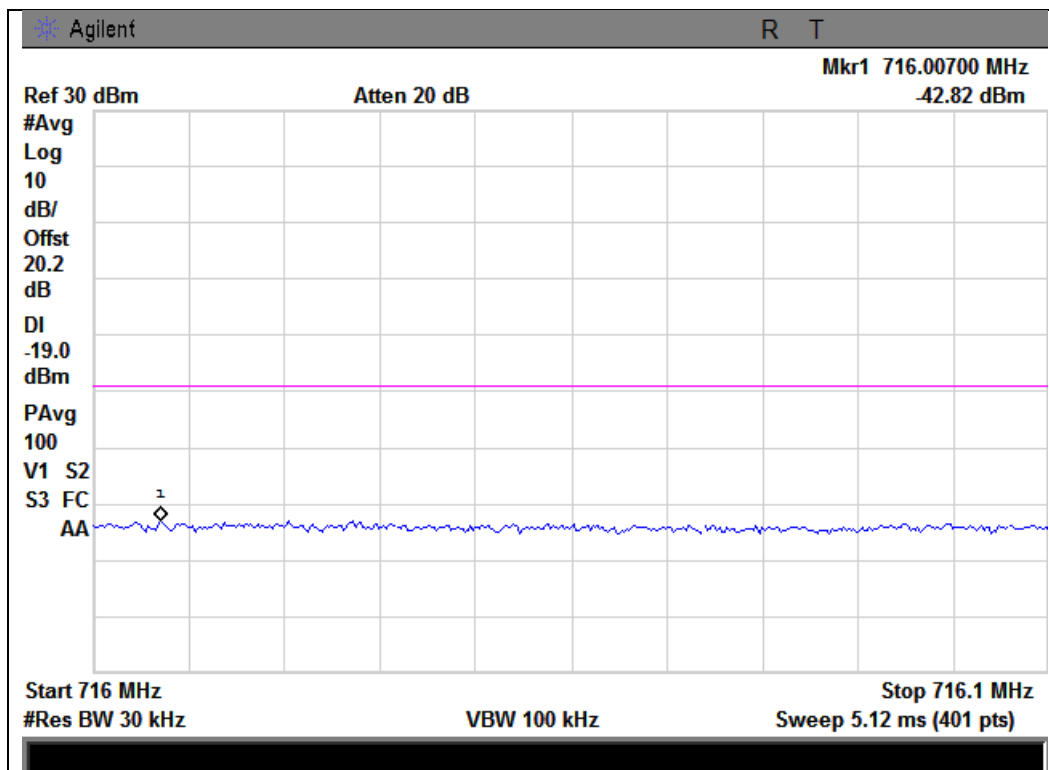
WCDMA Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge



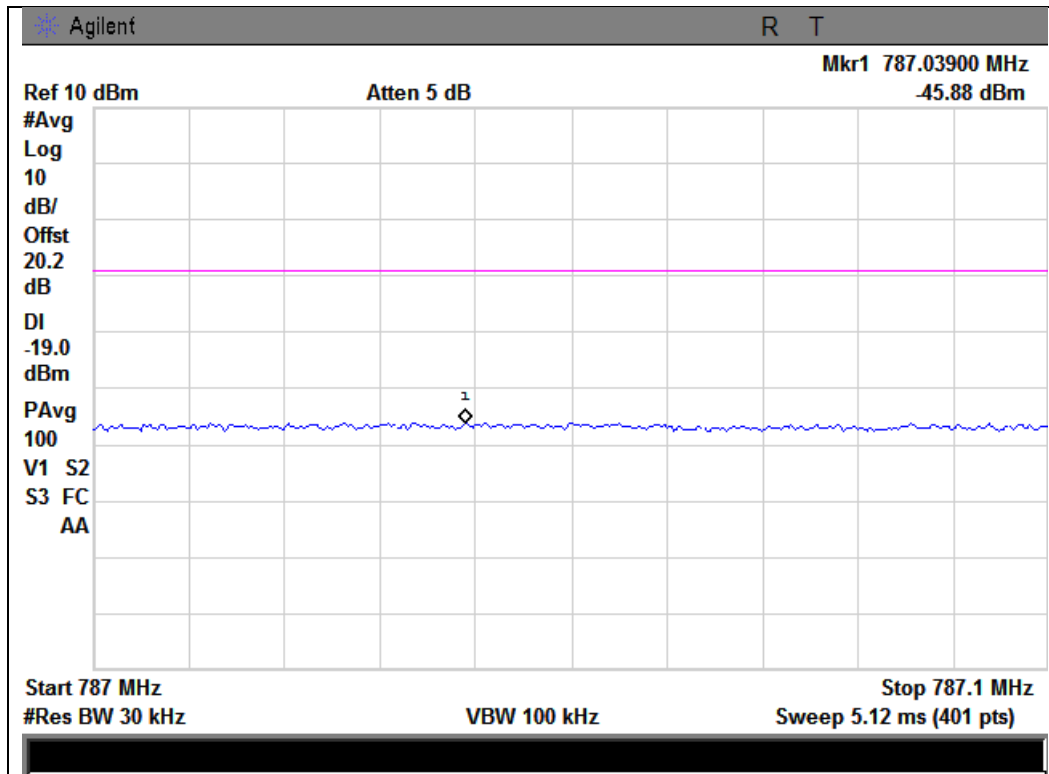
Upper Band Edge



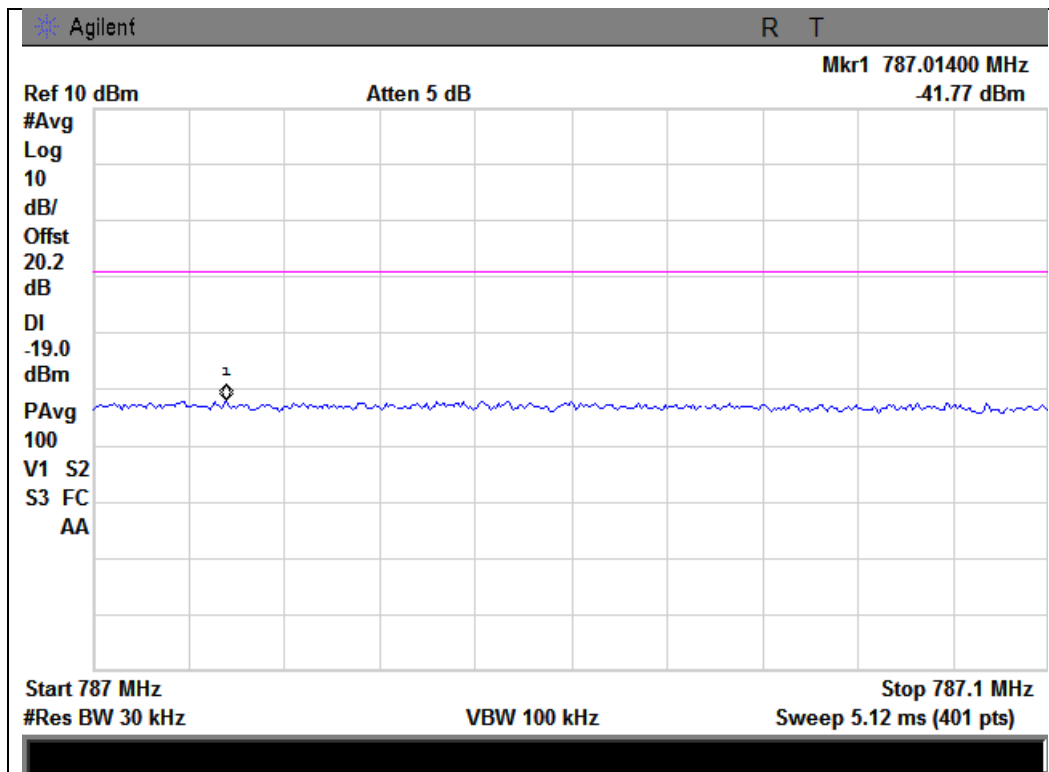


777 - 787 MHz Band

Lower Band Edge



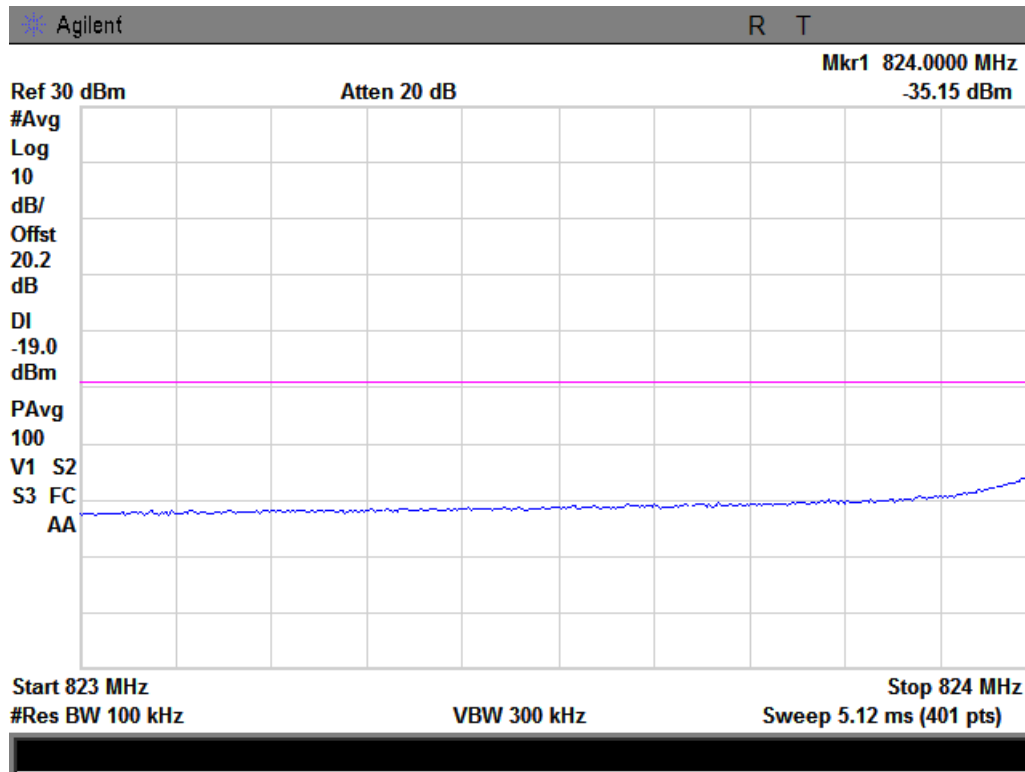
Upper Band Edge



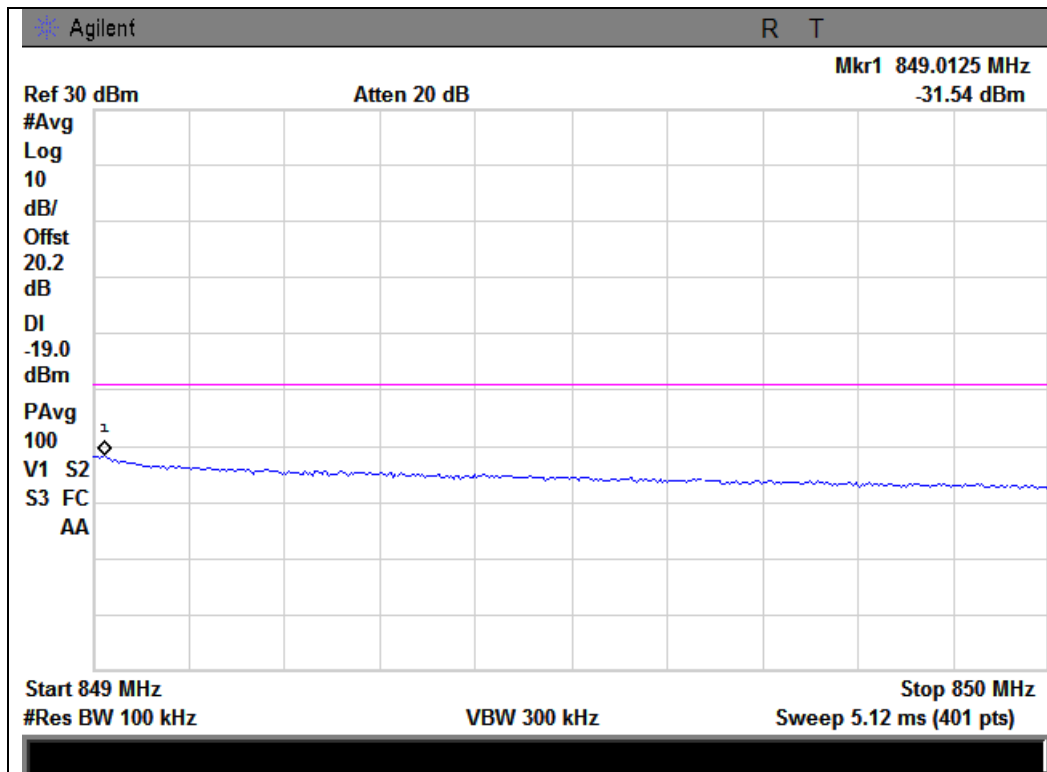


824 - 849 MHz Band

Lower Band Edge



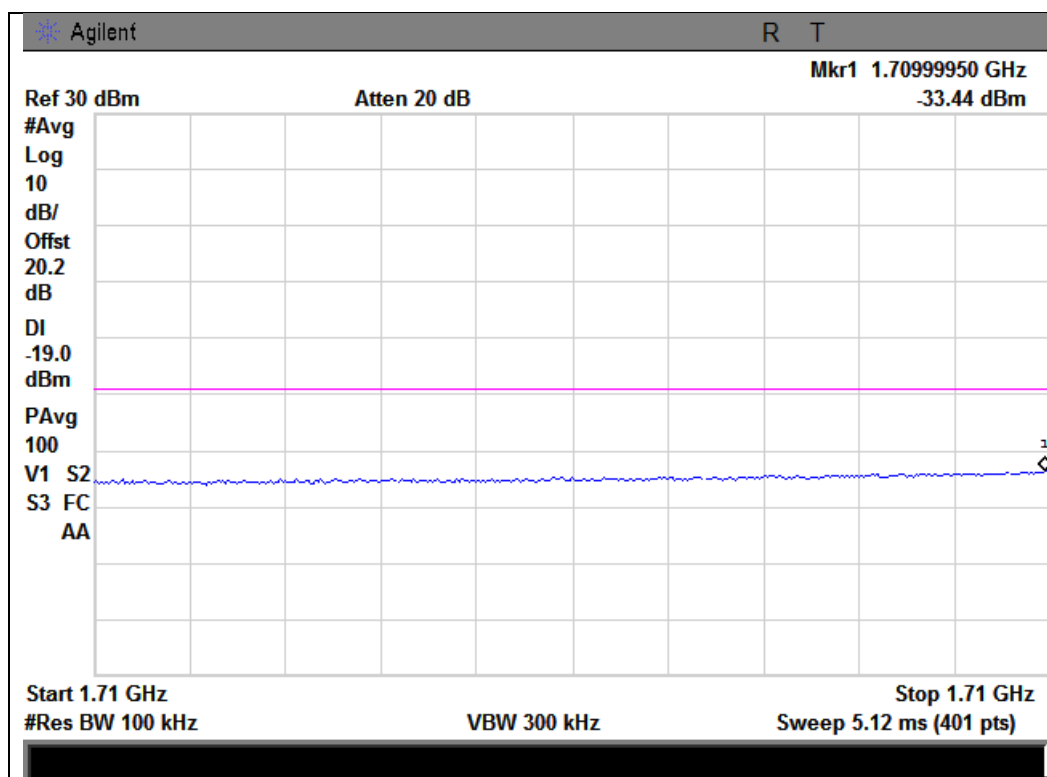
Upper Band Edge



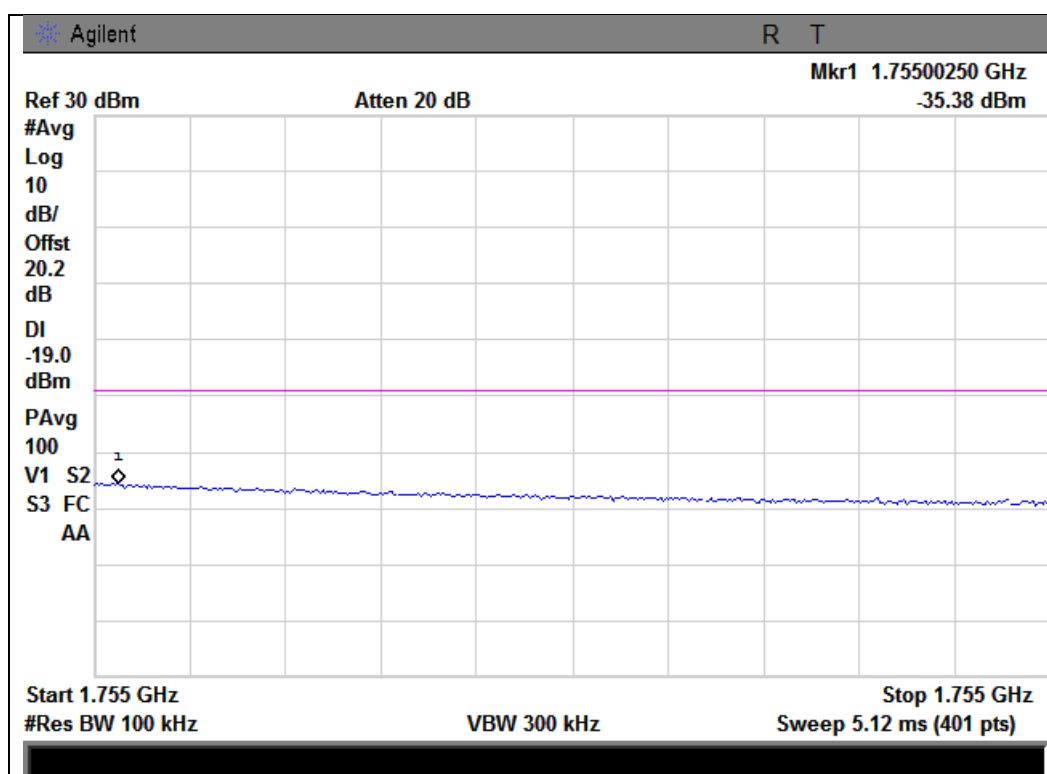


1710 - 1755 MHz Band

Lower Band Edge



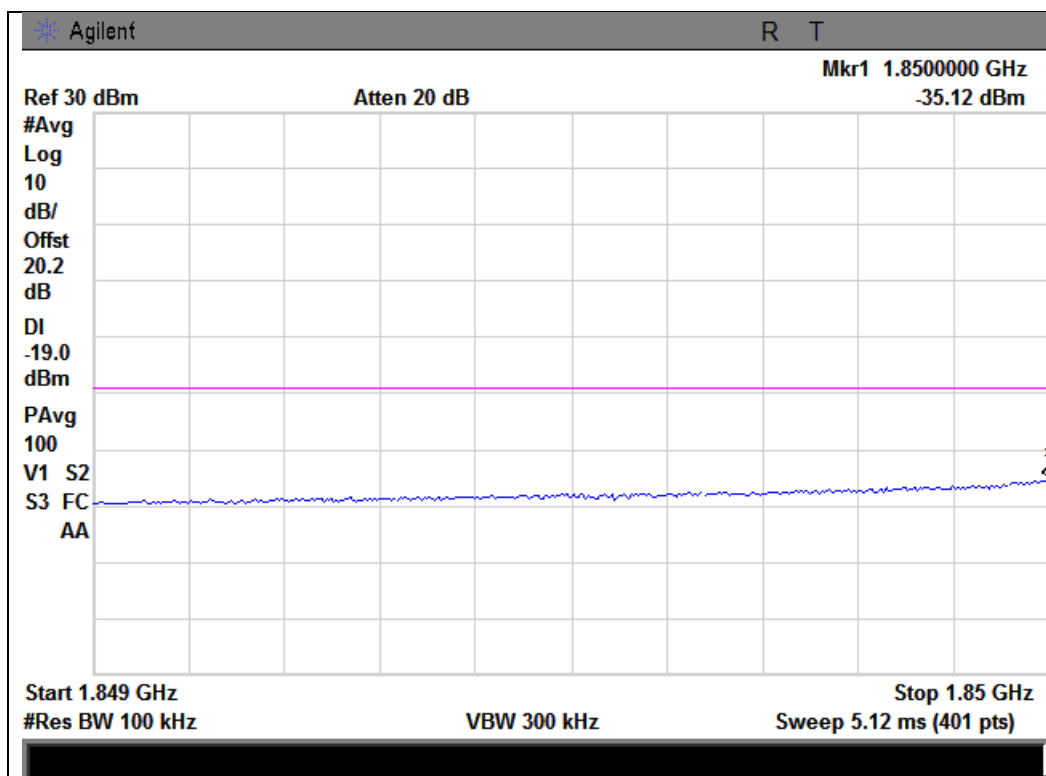
Upper Band Edge



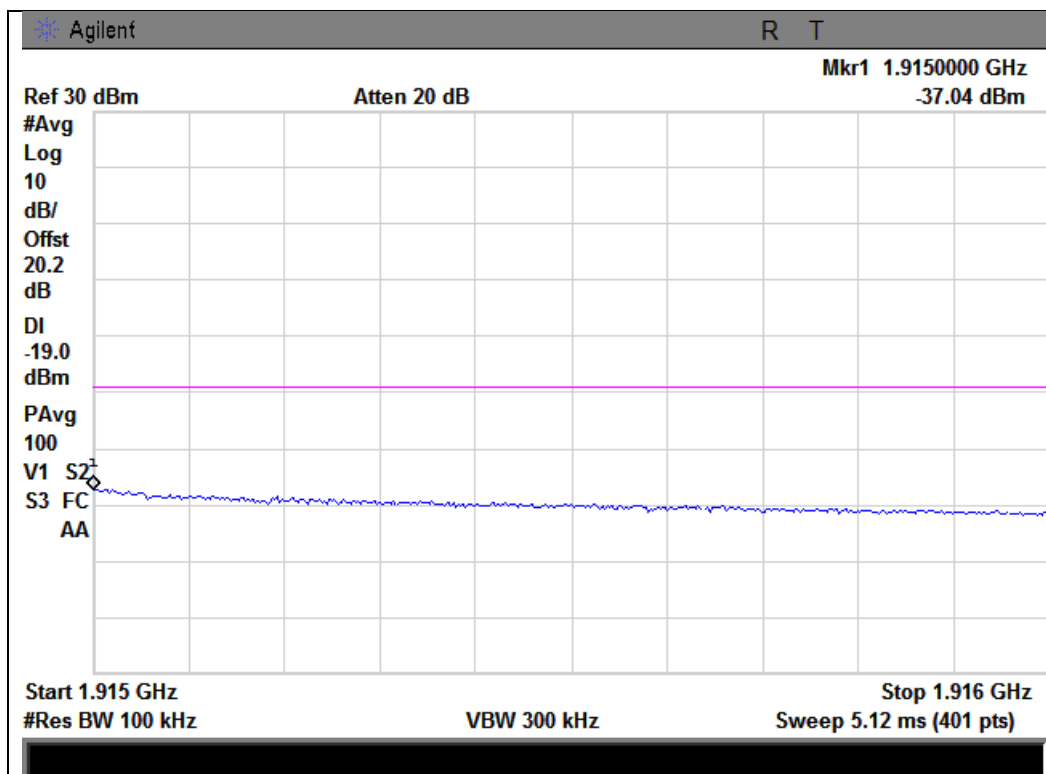


1850 - 1915 MHz Band

Lower Band Edge



Upper Band Edge

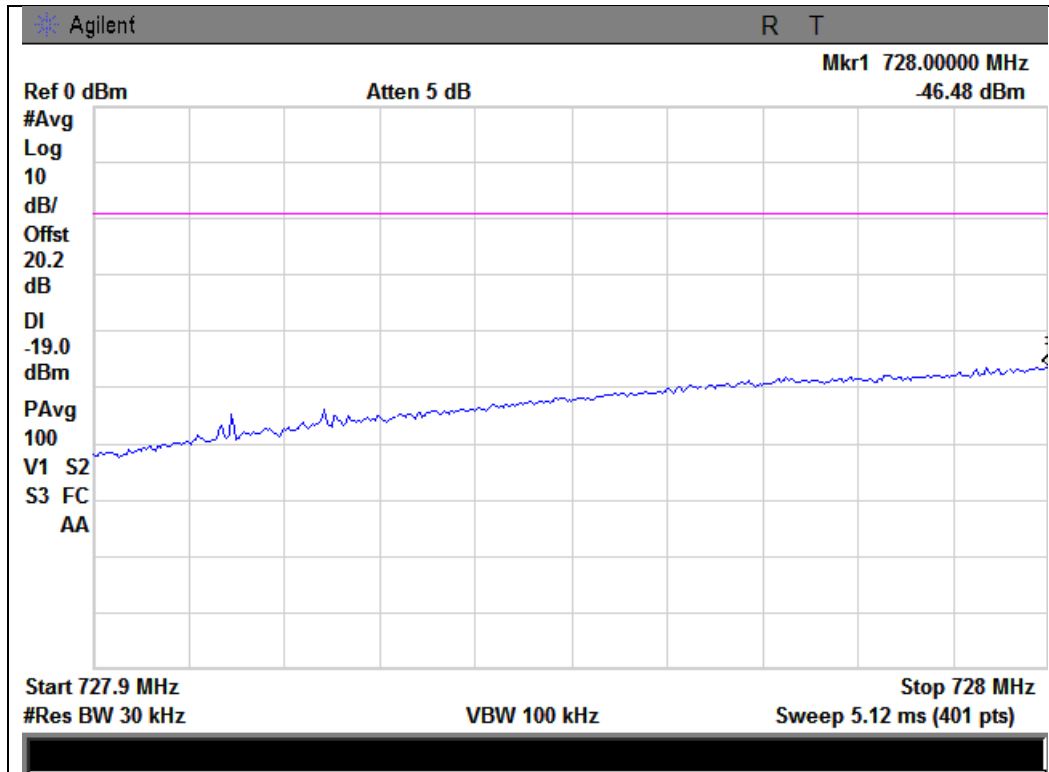




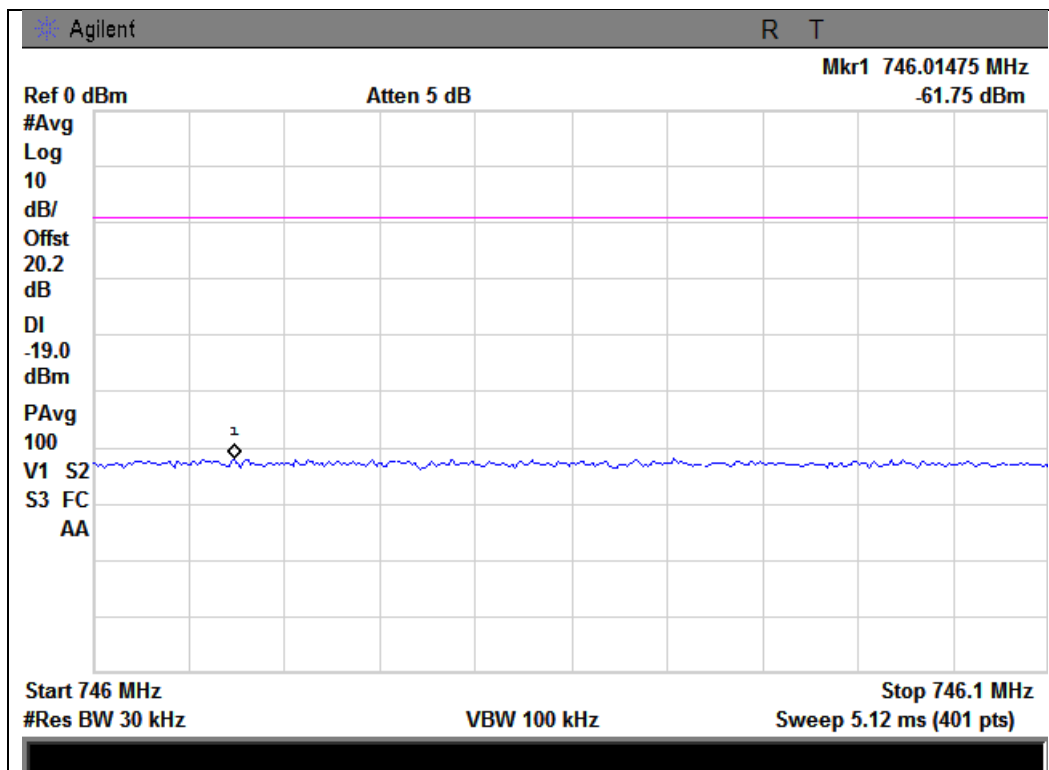
GSM Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge



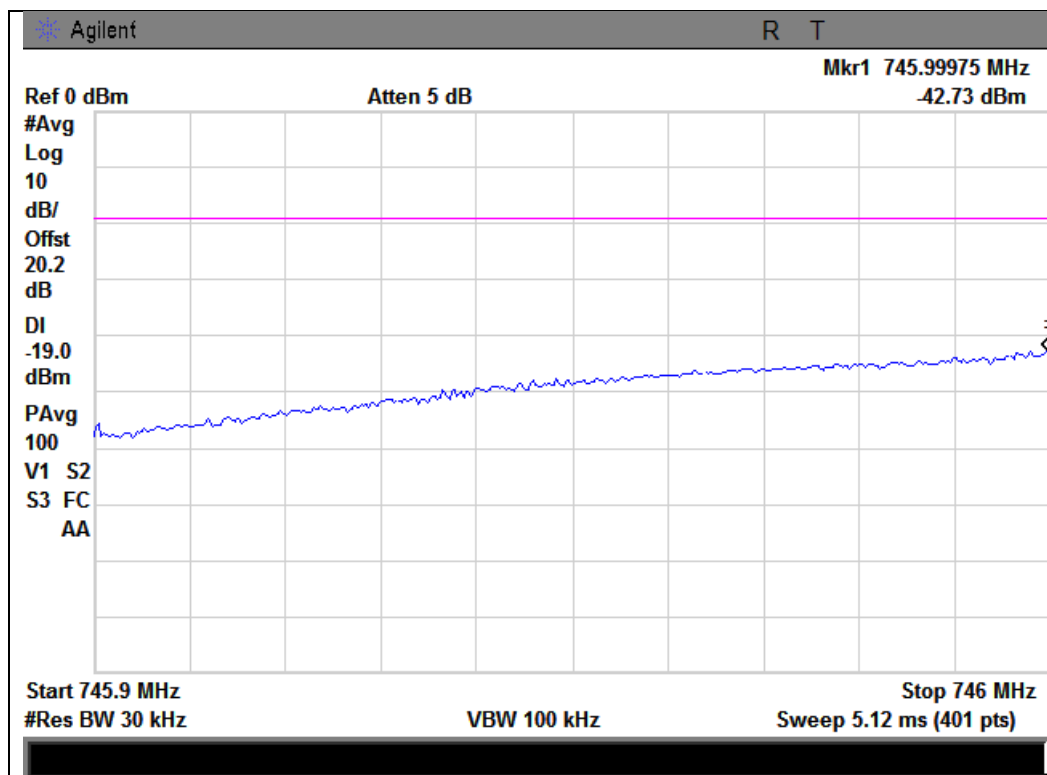
Upper Band Edge



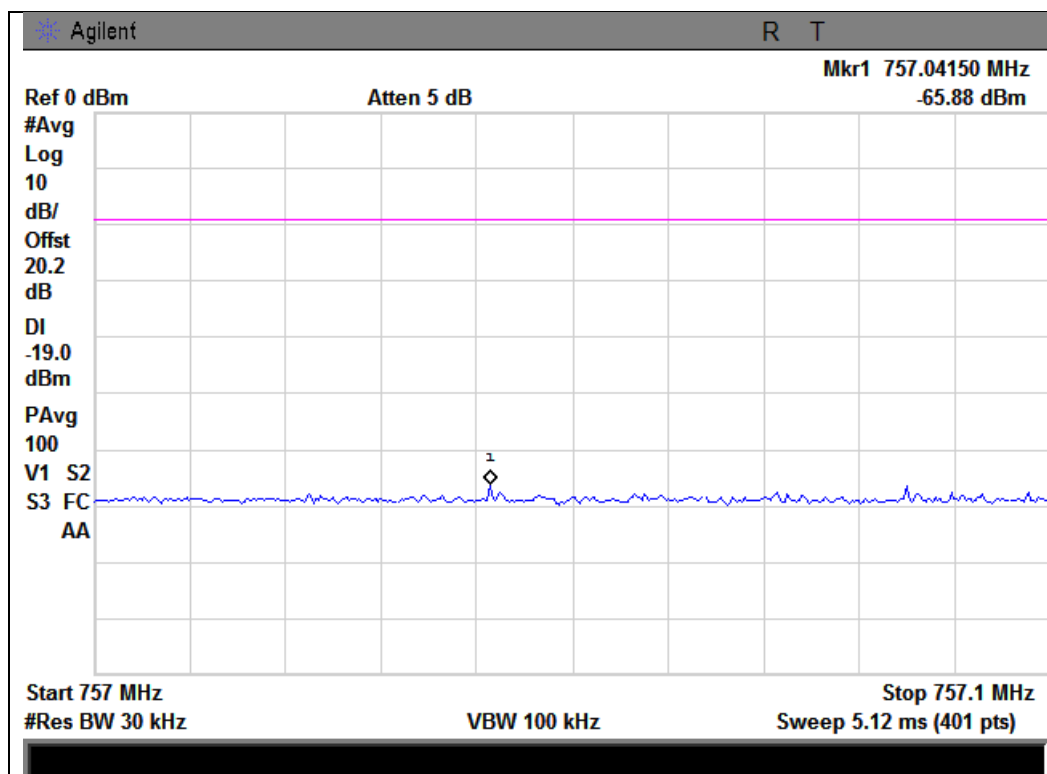


746 - 756 MHz Band

Lower Band Edge



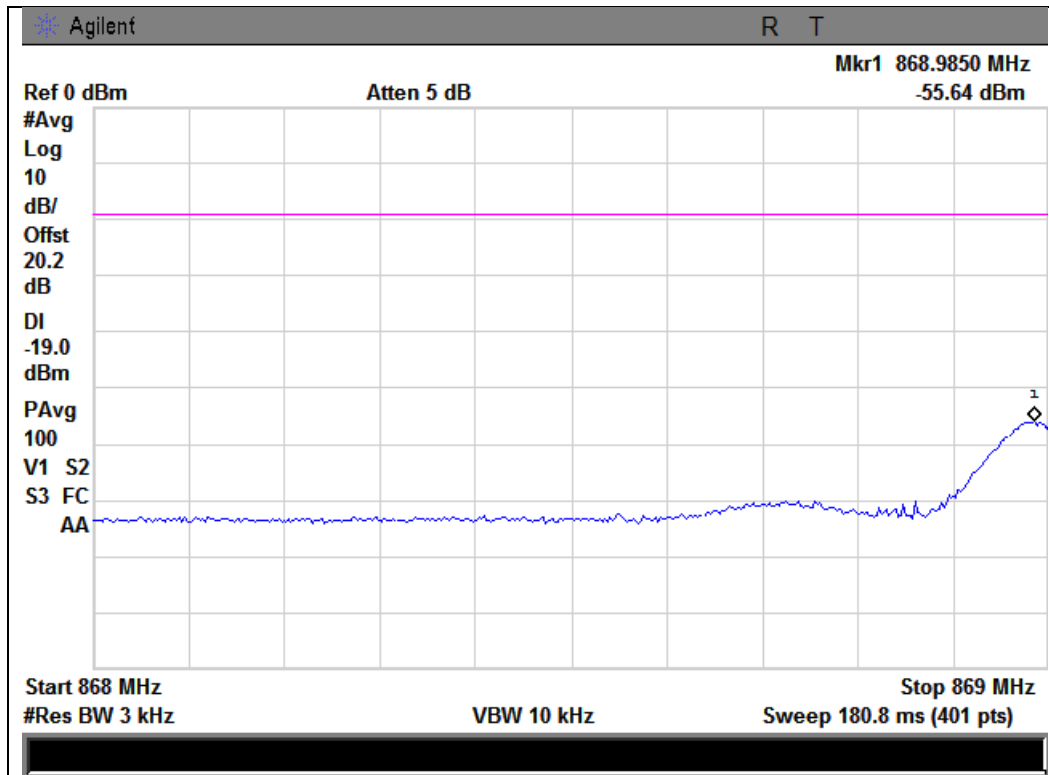
Upper Band Edge



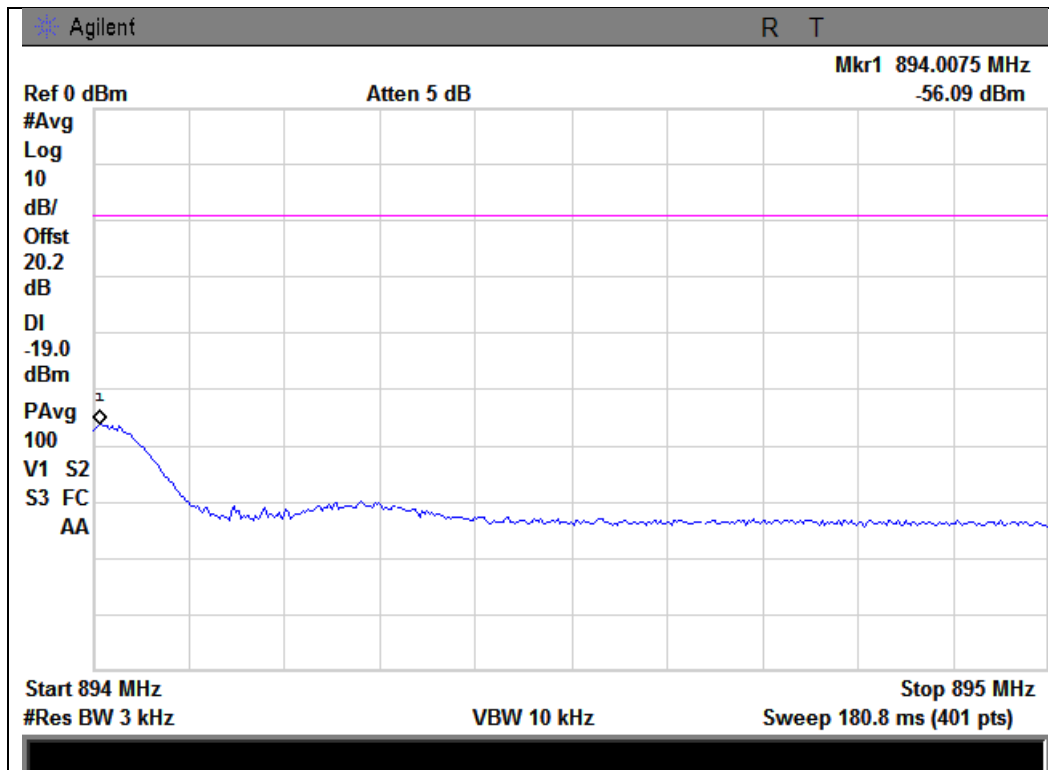


869 - 894 MHz Band

Lower Band Edge



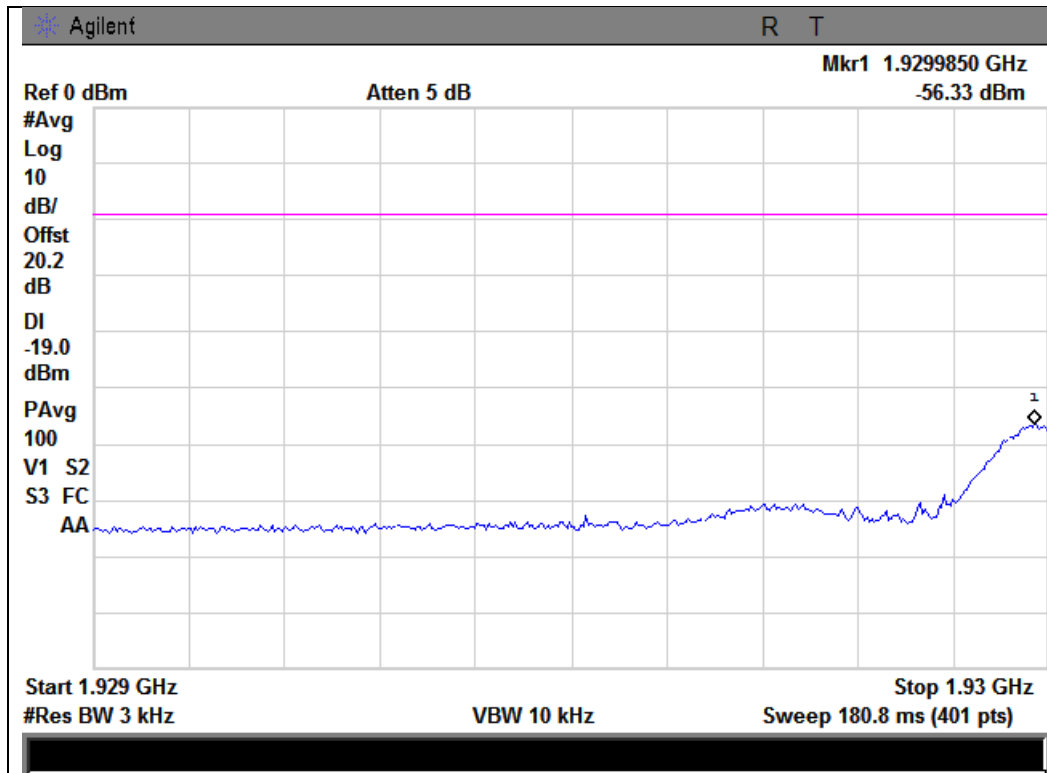
Upper Band Edge



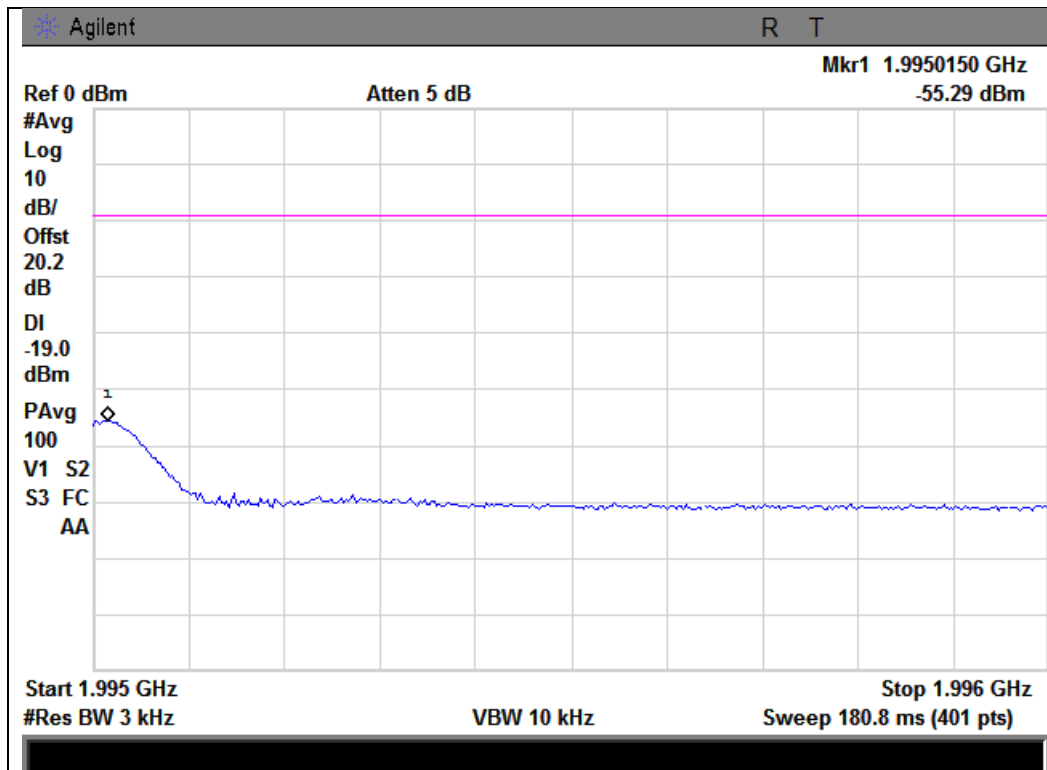


1930 - 1995 MHz Band

Lower Band Edge



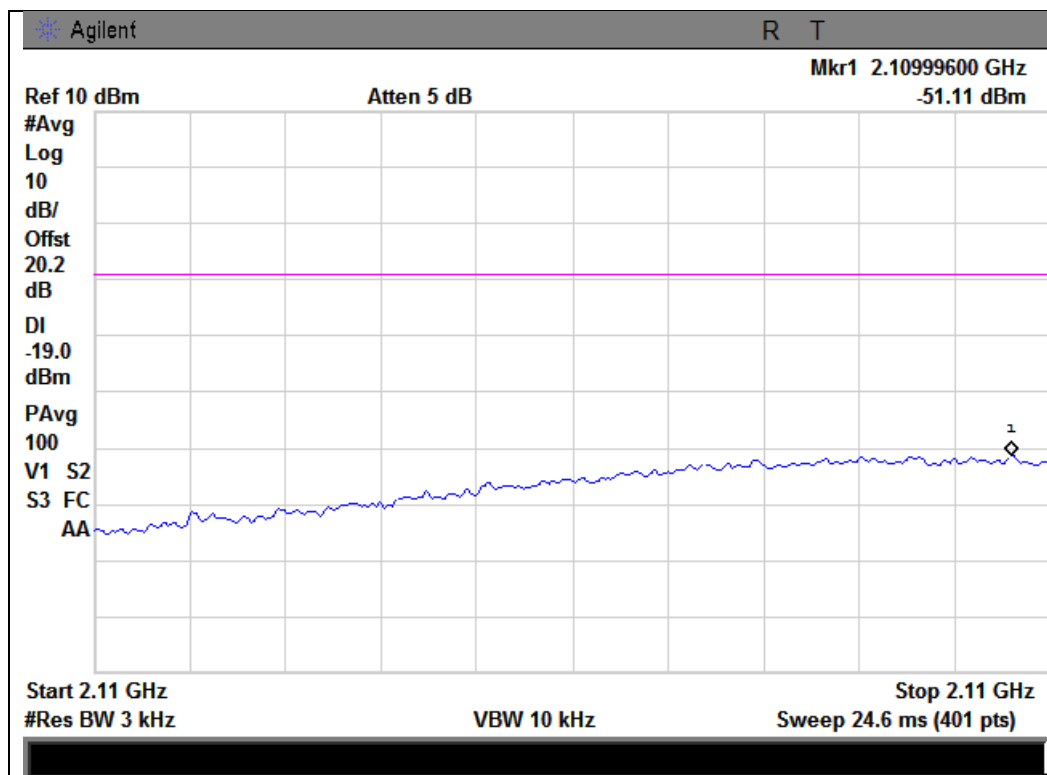
Upper Band Edge



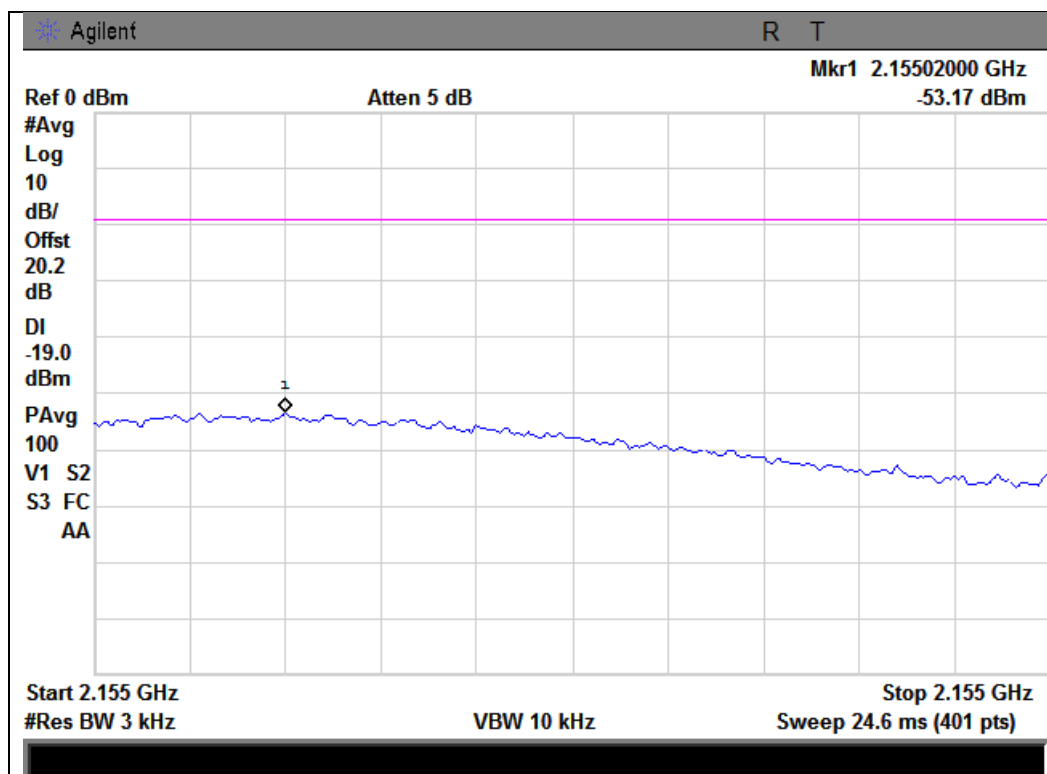


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge

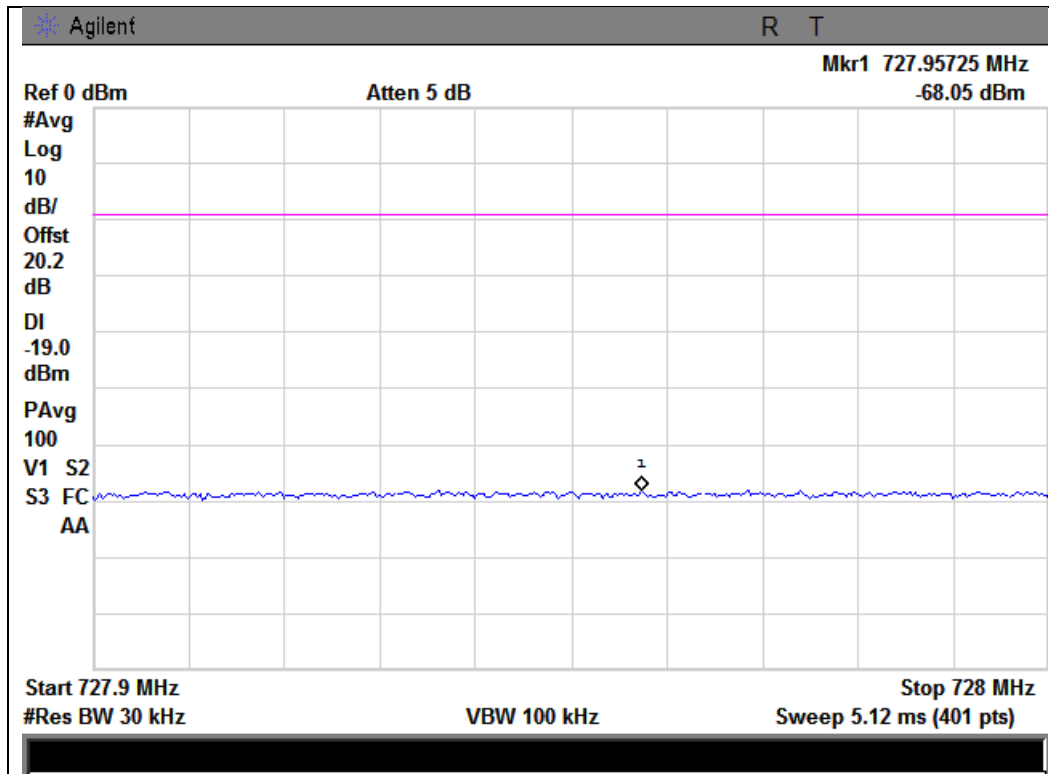




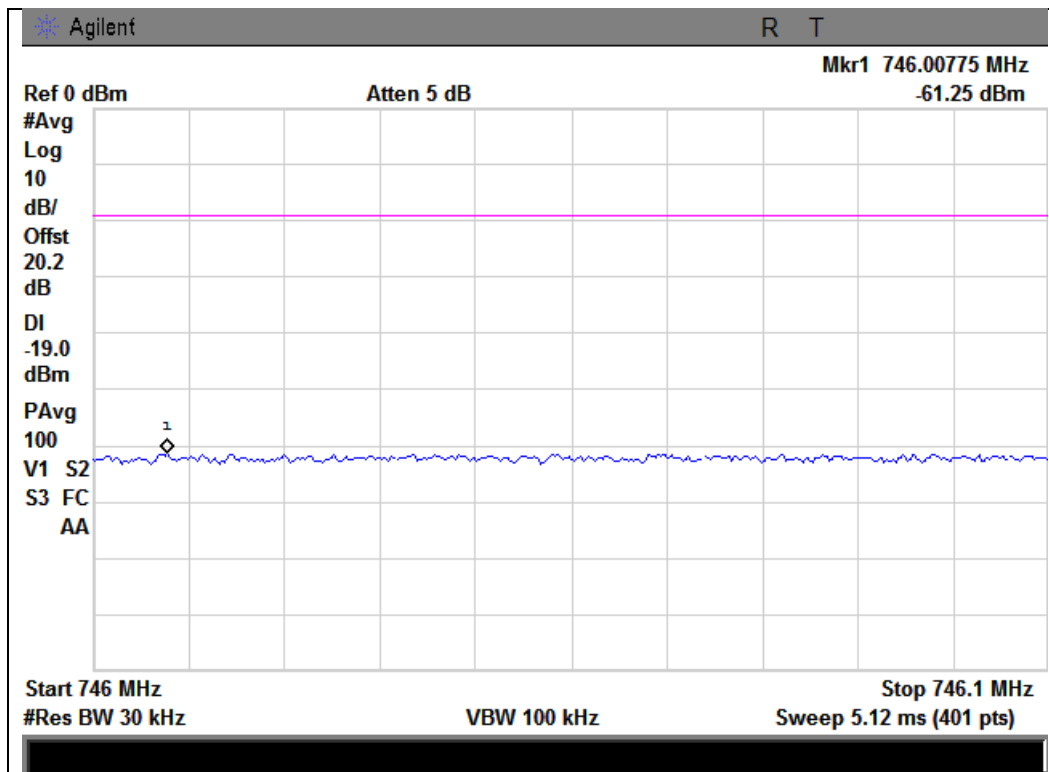
CDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge



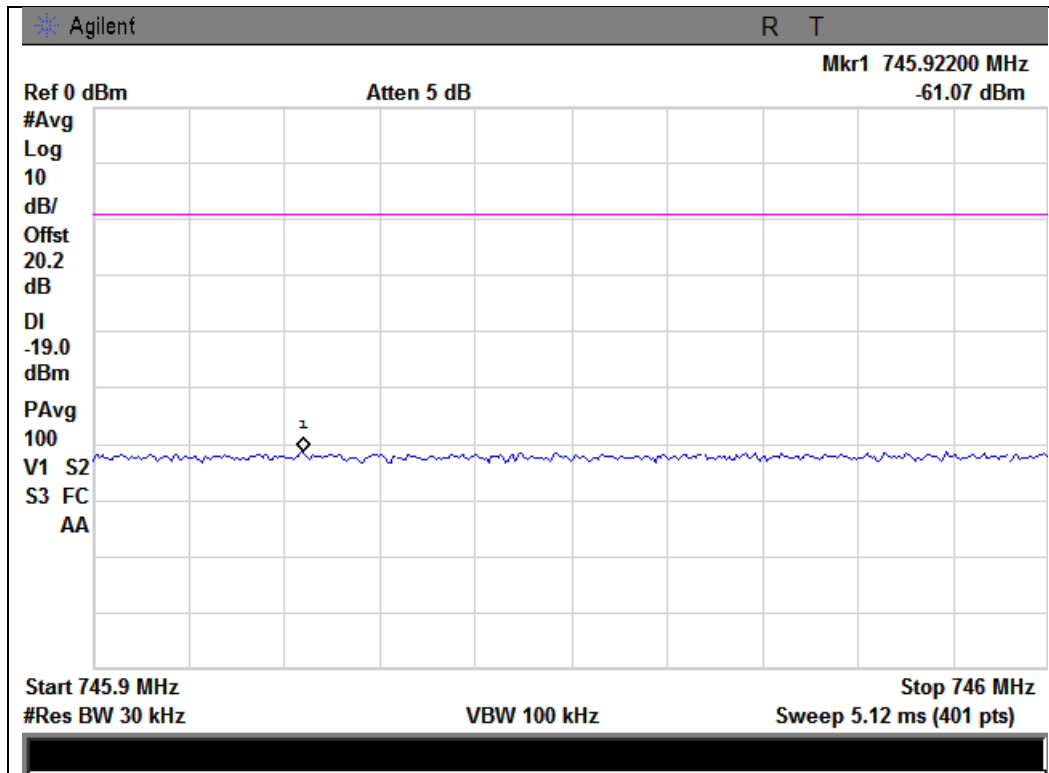
Upper Band Edge



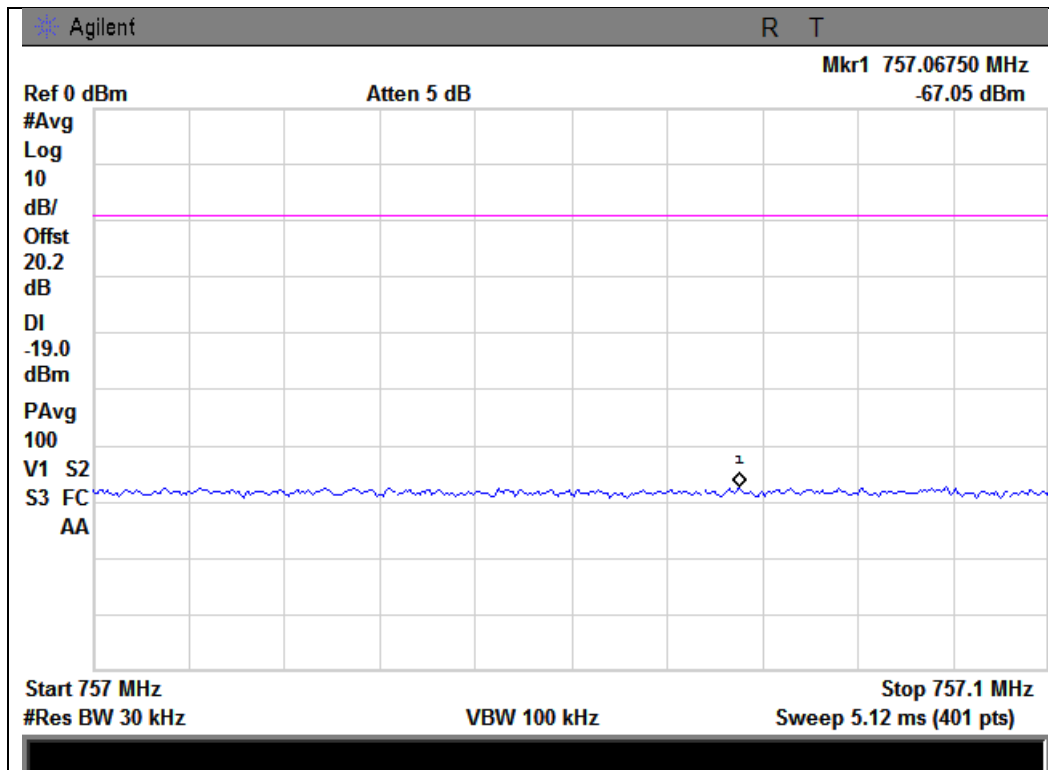


746 - 756 MHz Band

Lower Band Edge



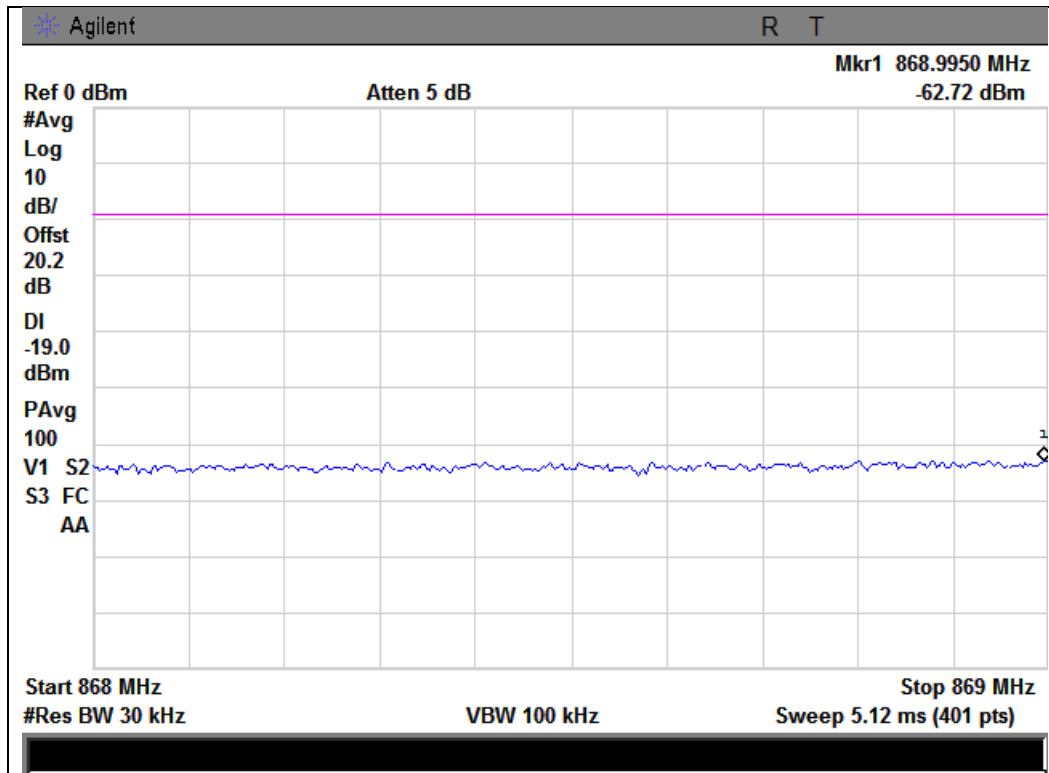
Upper Band Edge



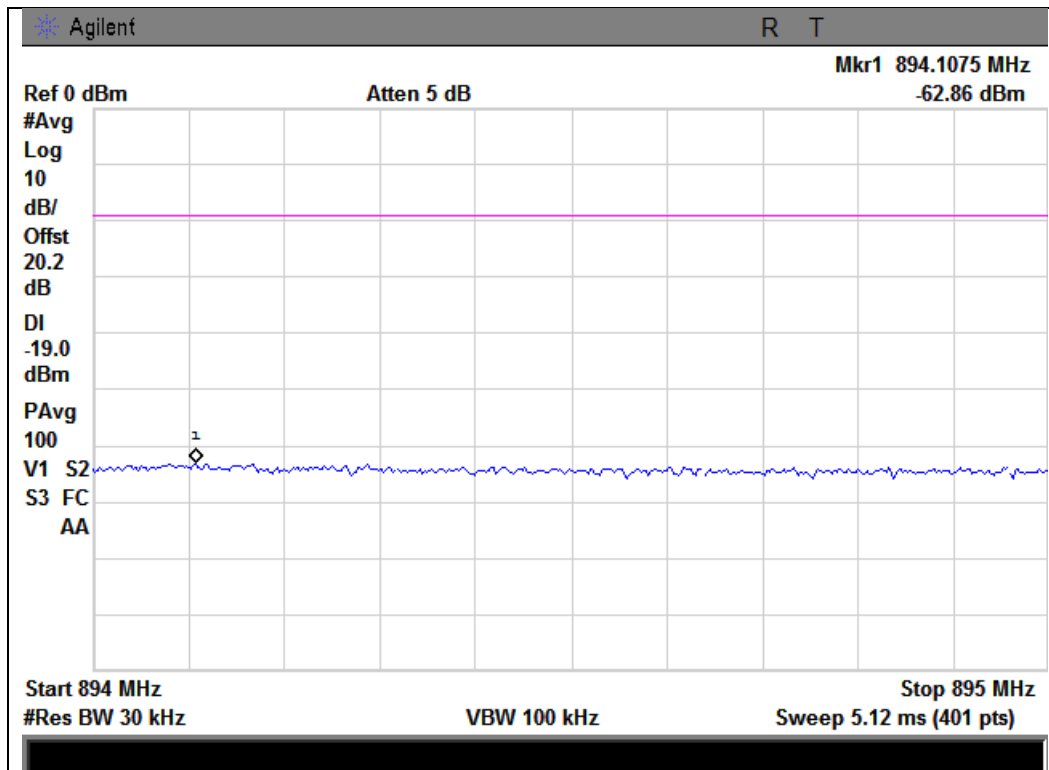


869 - 894 MHz Band

Lower Band Edge



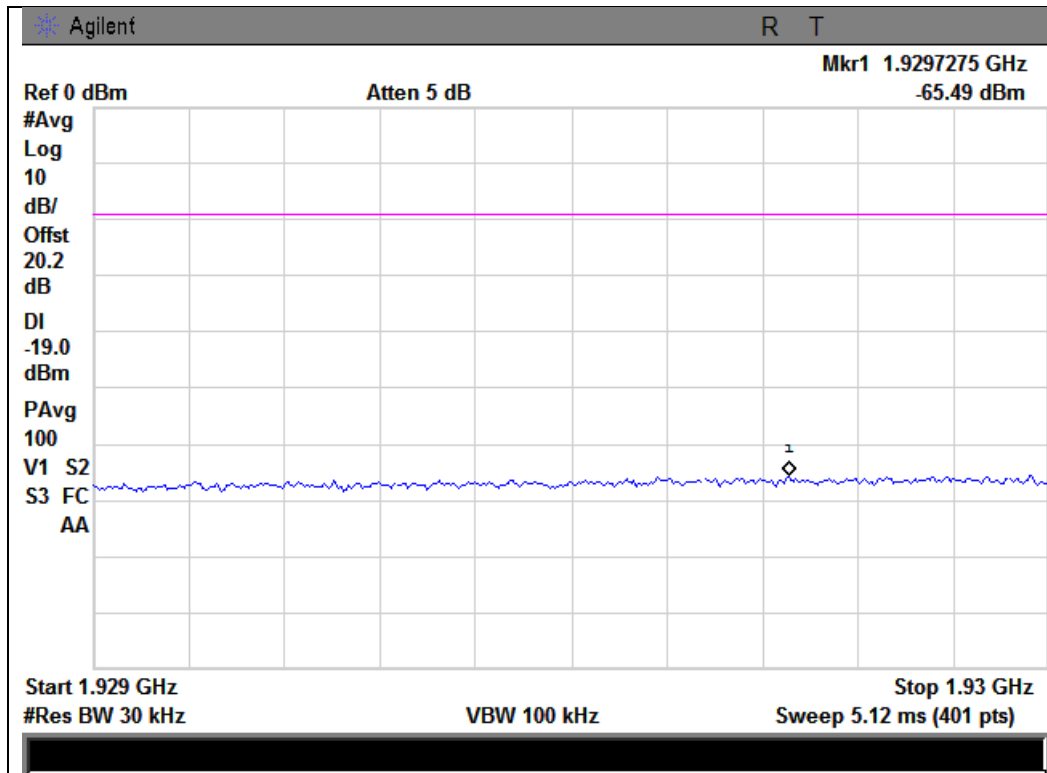
Upper Band Edge



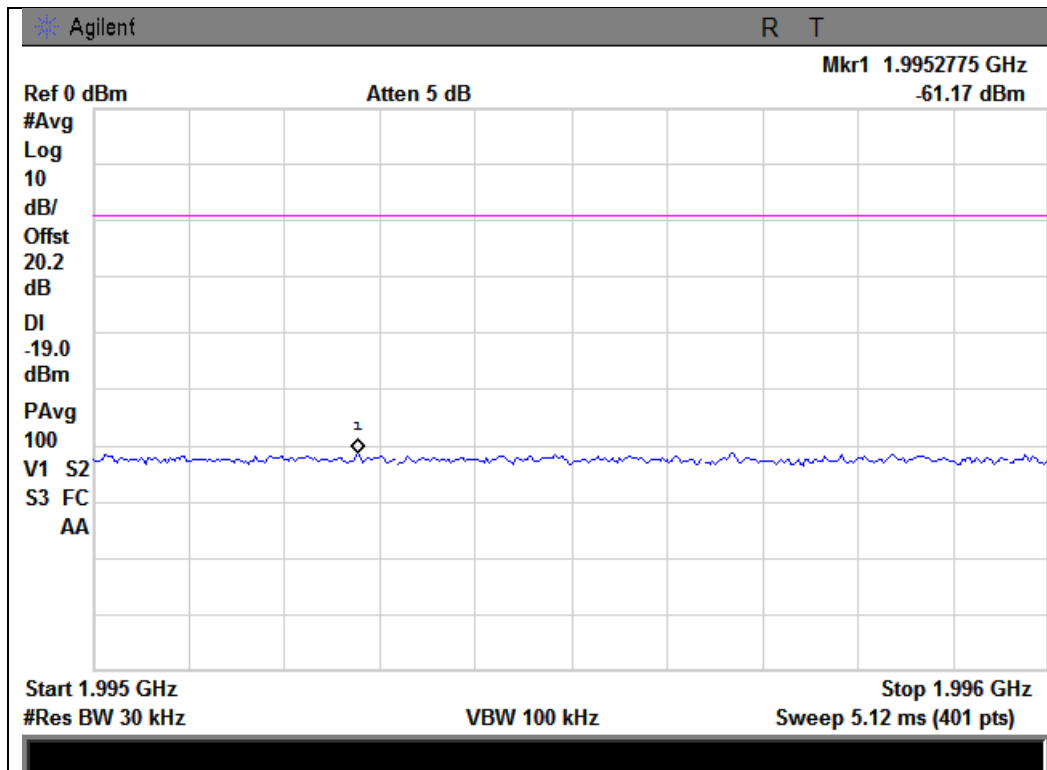


1930 - 1995 MHz Band

Lower Band Edge



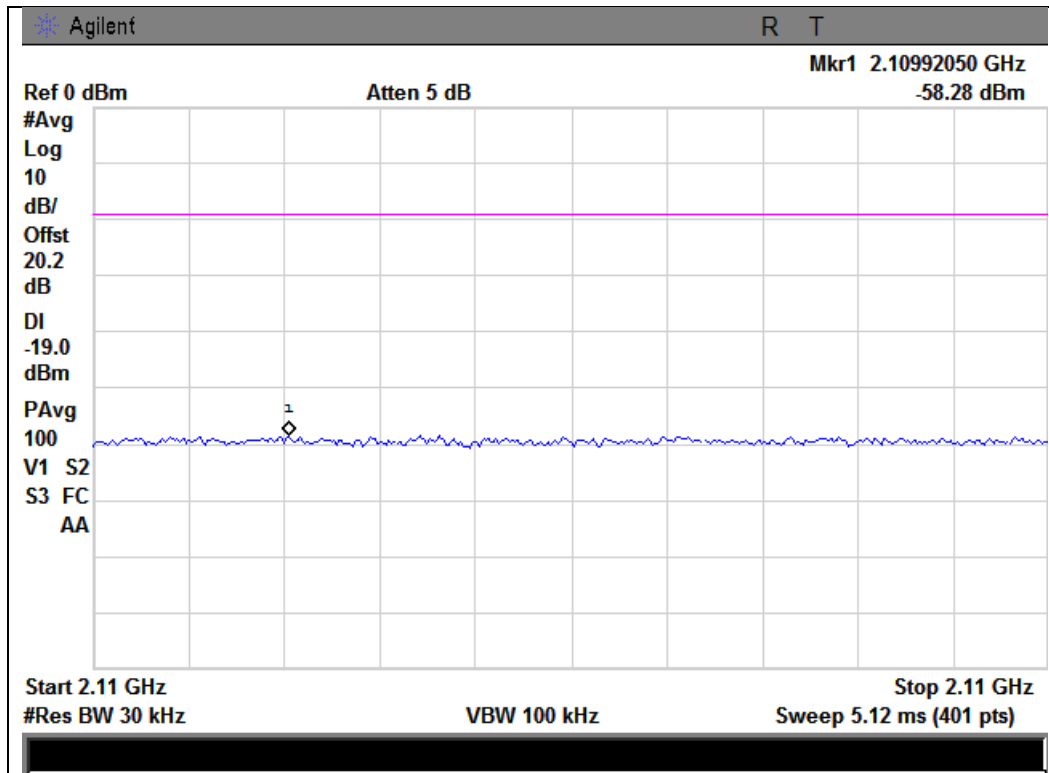
Upper Band Edge



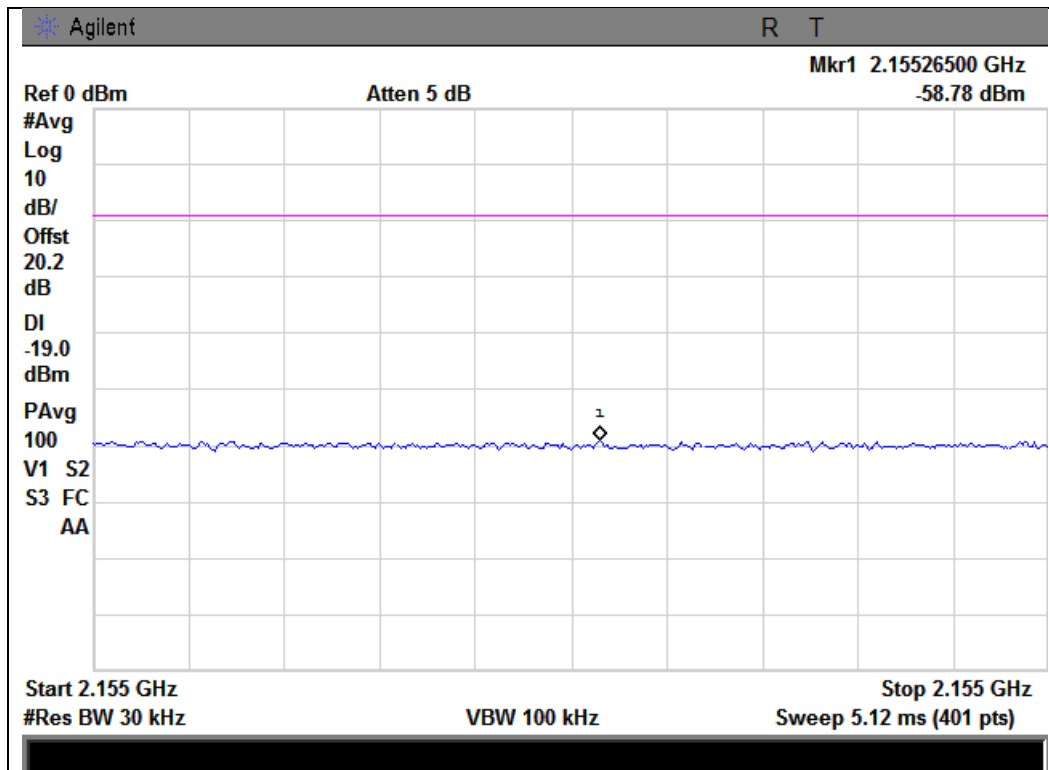


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge

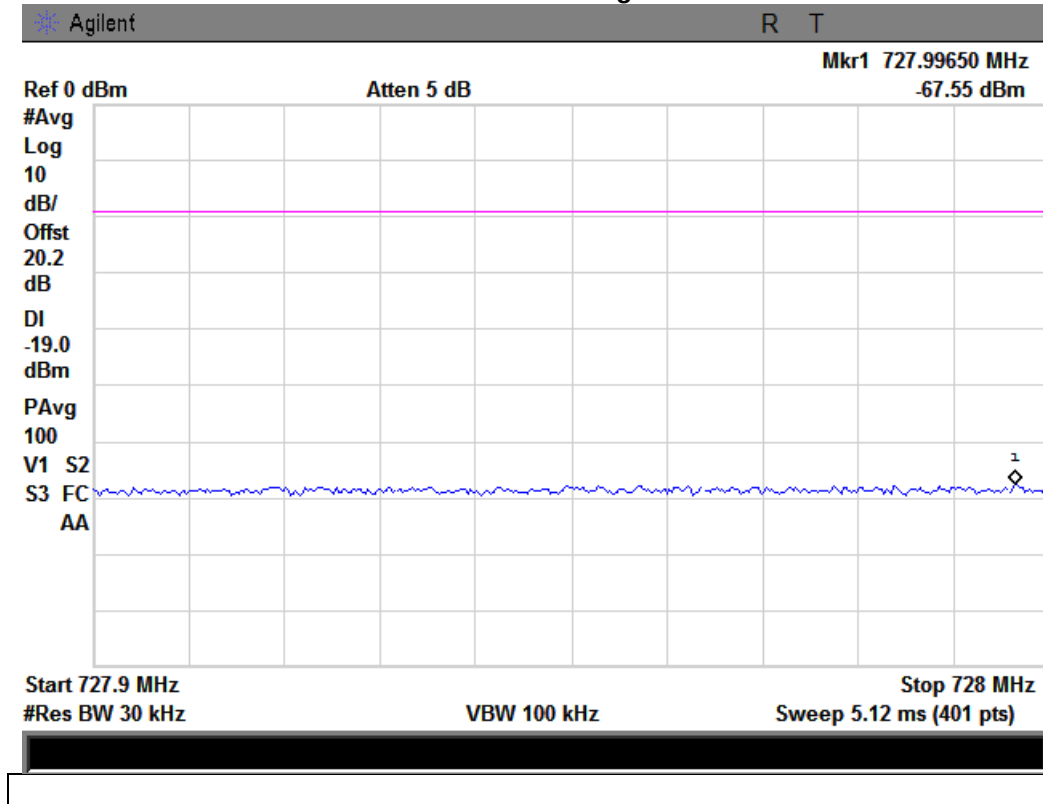




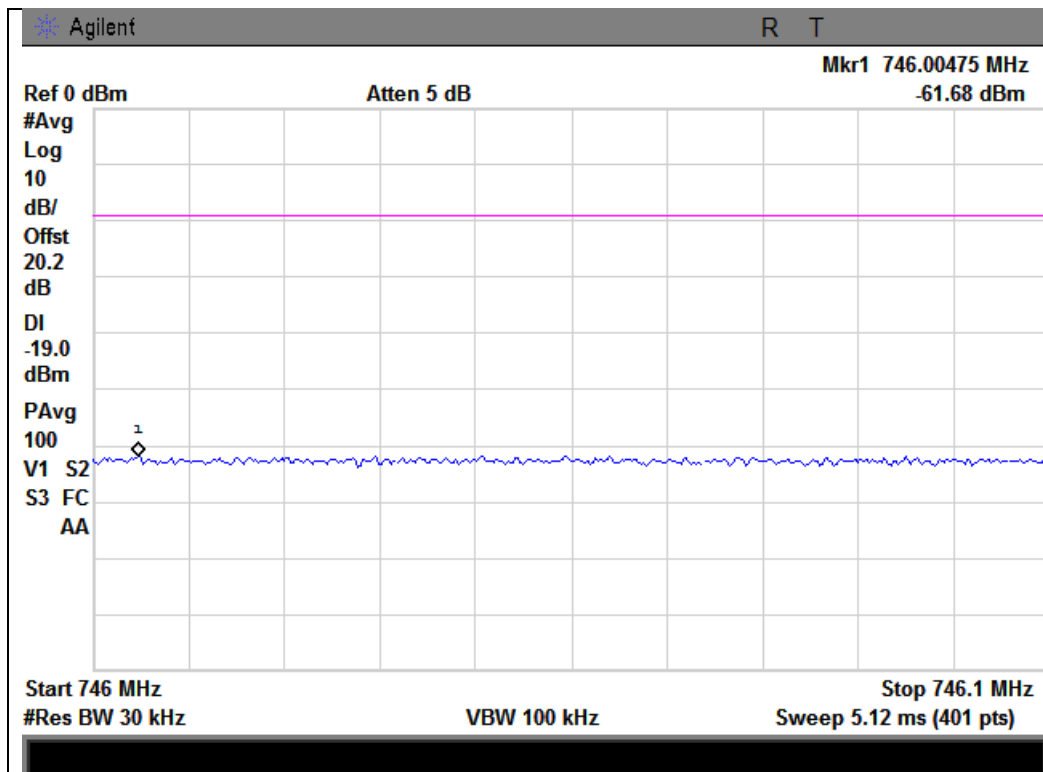
WCDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge



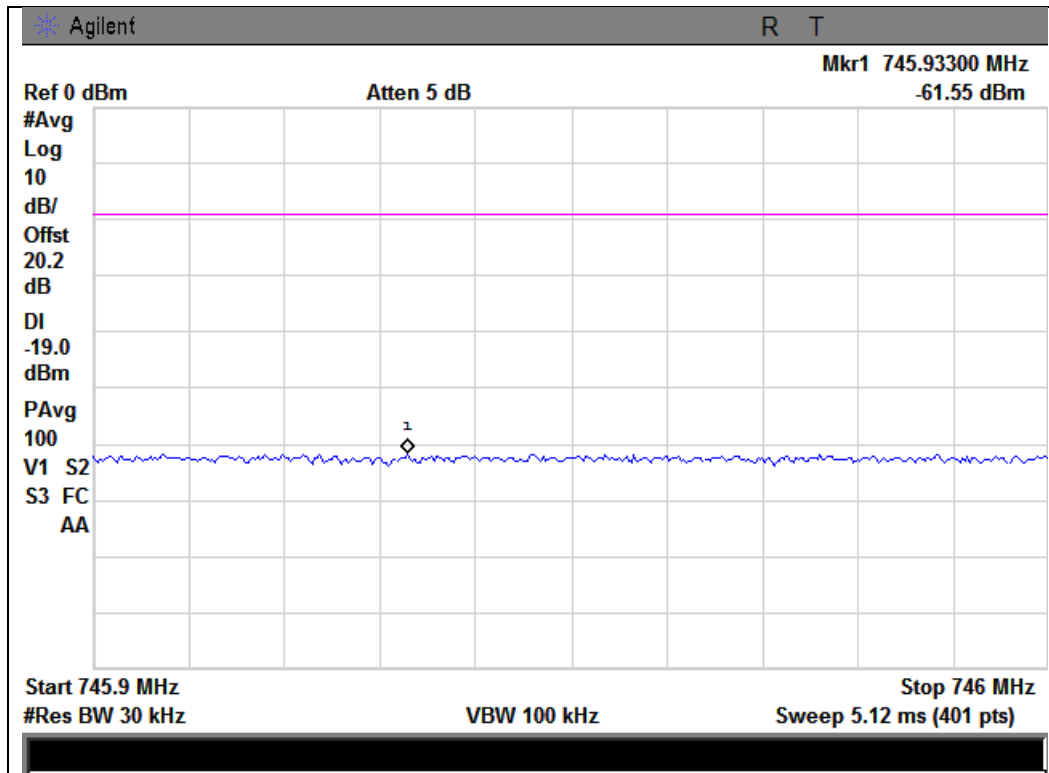
Upper Band Edge



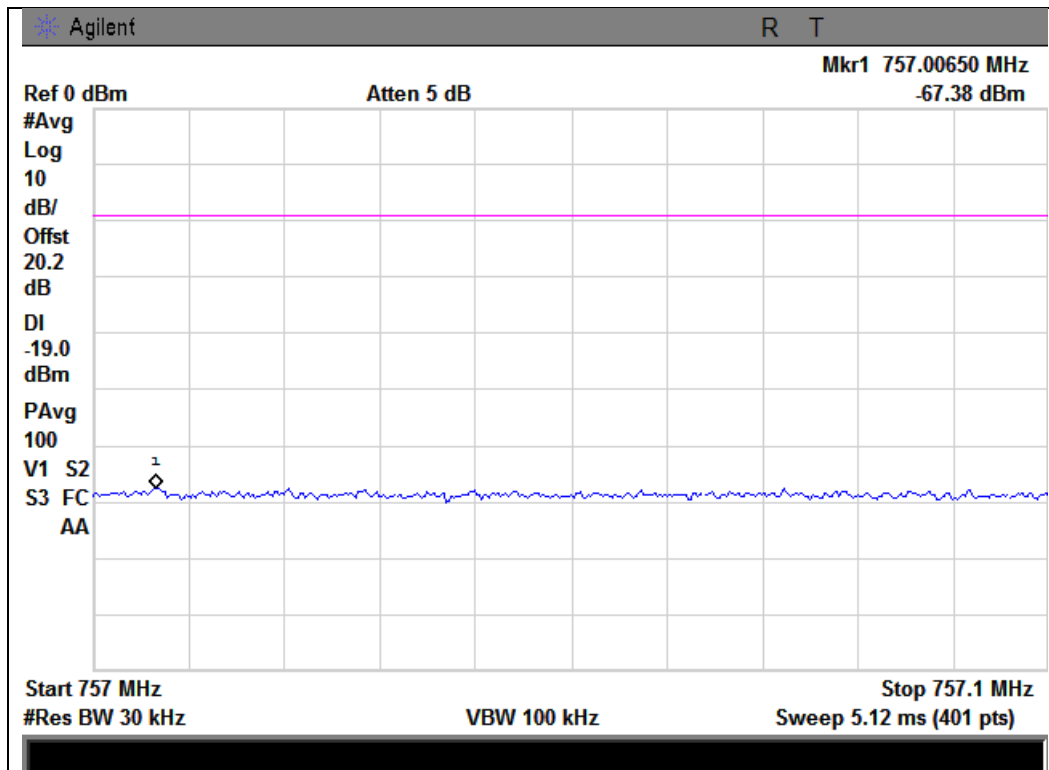


746 - 756 MHz Band

Lower Band Edge



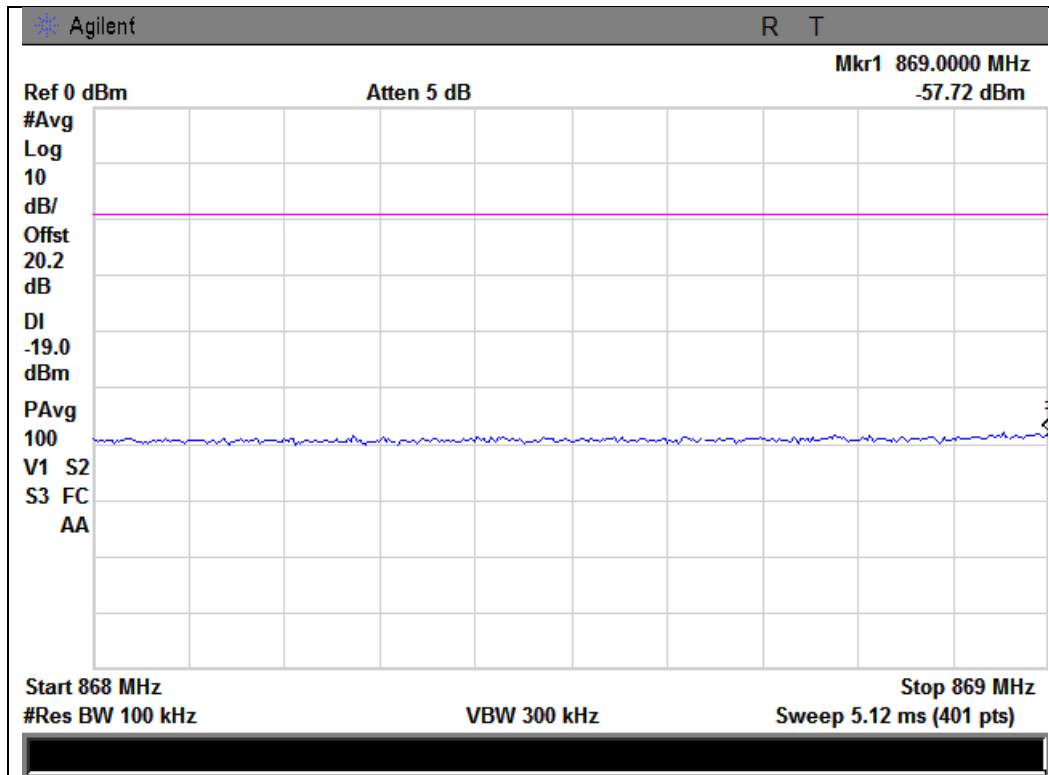
Upper Band Edge



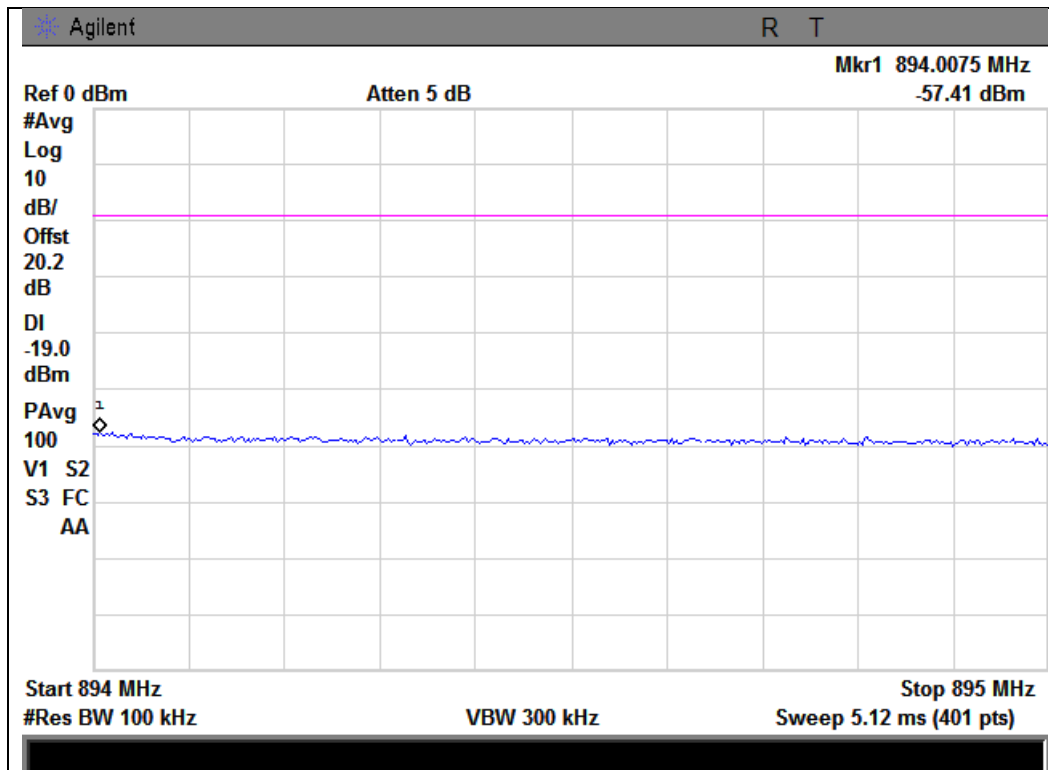


869 - 894 MHz Band

Lower Band Edge



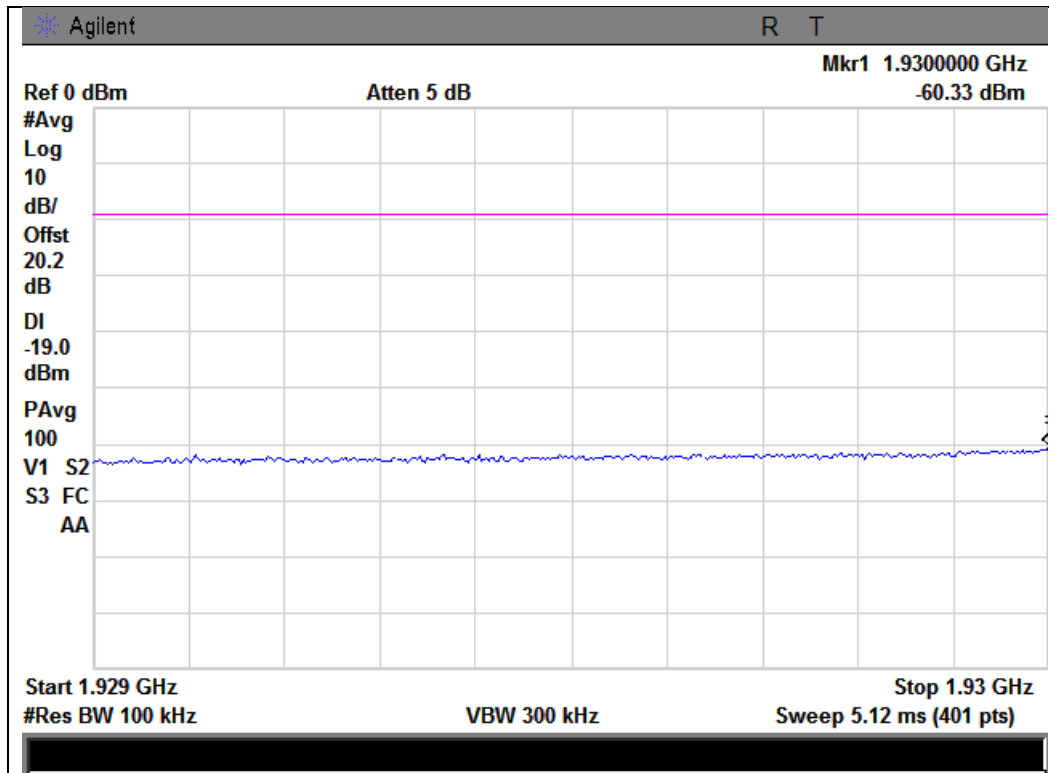
Upper Band Edge



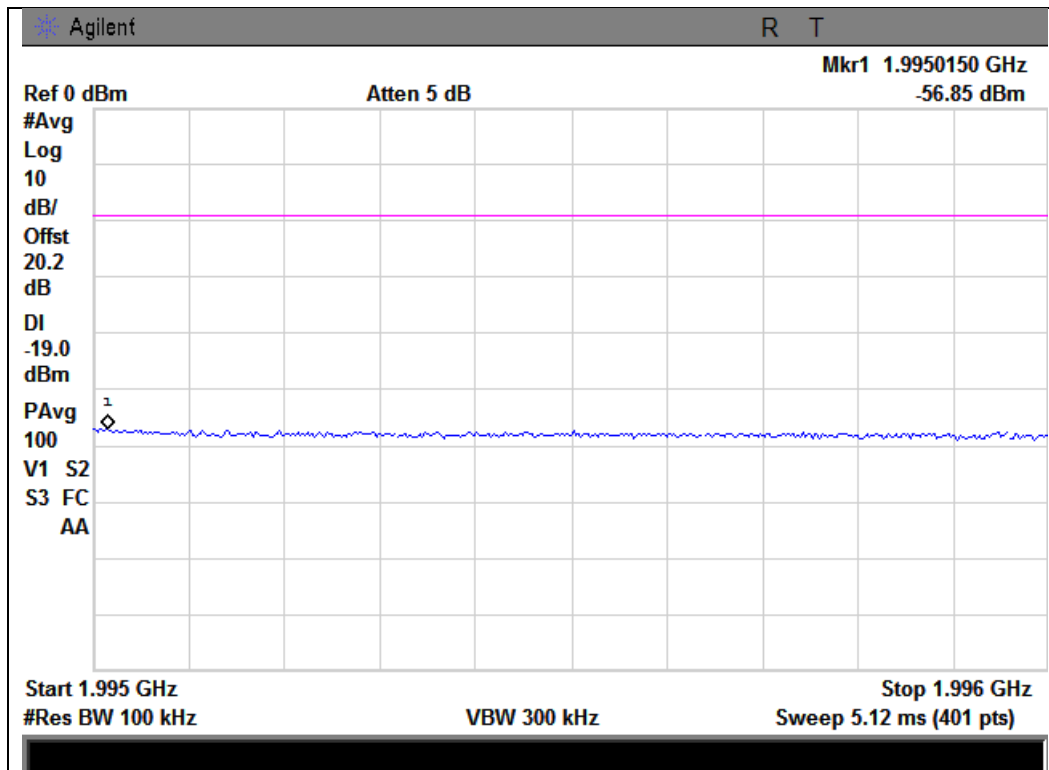


1930 - 1995 MHz Band

Lower Band Edge



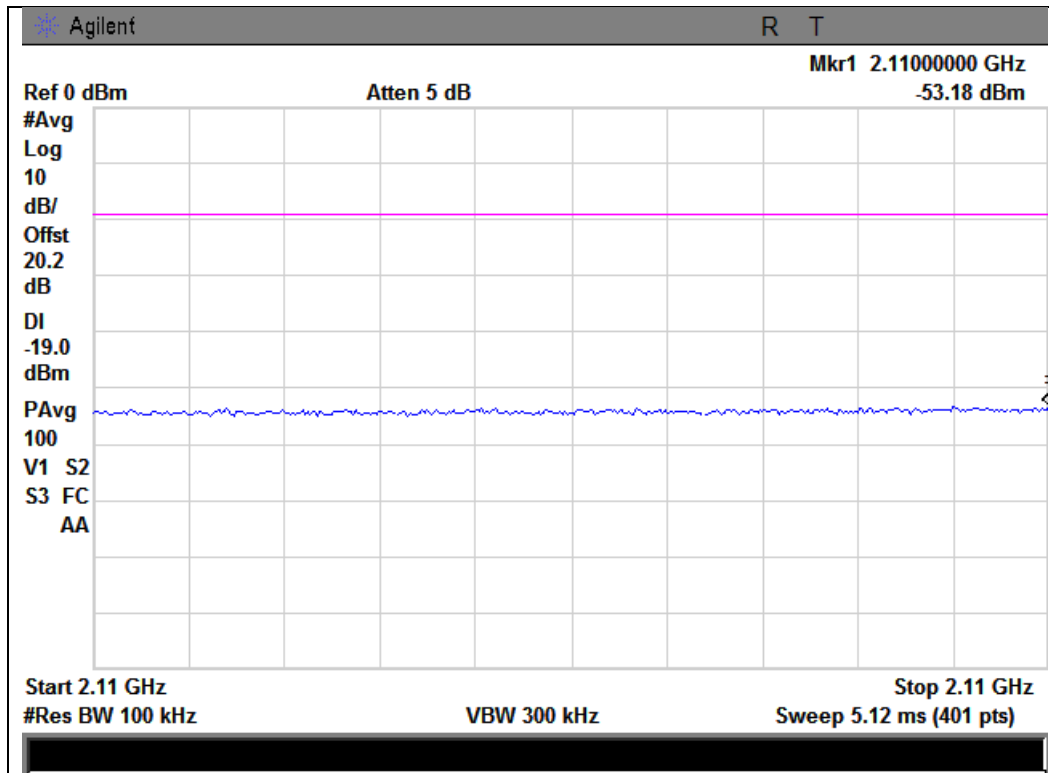
Upper Band Edge



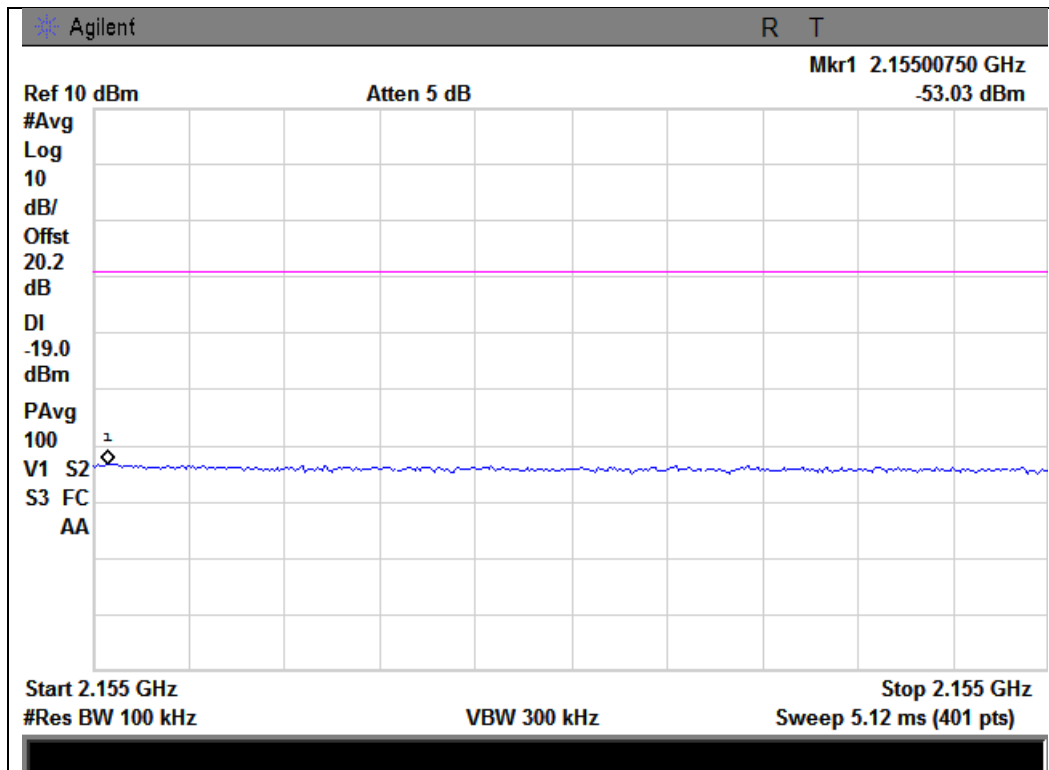


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge





Conducted Spurious Emissions

Name of Test: Conducted Spurious Emissions
Test Equipment Utilized: SMU 200A - S/N:101369
E4407B - S/N:MY41444836

Engineer: Greg Corbin

Test Date: 7/22/2013

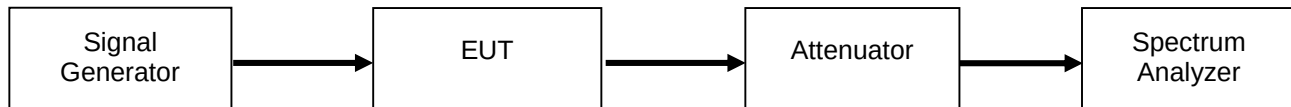
Test Procedure

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

The following formulas are used for calculating the limits.

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

Test Setup



Uplink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	697.81	-31.6	-13	Pass
777 - 787	775.71	-41.7	-13	Pass
824 - 849	1.8918	-36.5	-13	Pass
1710 - 1755	1.8678	-34.7	-13	Pass
1850 - 1915	3.7647	-33.4	-13	Pass

Downlink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	1.9772	-37.9	-13	Pass
746 - 756	1.9757	-37.5	-13	Pass
869 - 894	1.978	-37.2	-13	Pass
1930 - 1995	2.1309	-39	-13	Pass
2110 - 2155	1.979	-35.8	-13	Pass



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

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 $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;

To show compliance with 27.53 (c)(3) rule section, the limit would be -46 dBm in a 6.25 kHz bandwidth, based on the maximum output power of +23.8 dBm (page 13 of the test report) and using the formula $76 + 10 \log (P)$ dB.

The graphs on page 70 of the test report for the 746 – 758 MHz band and page 58 for the 776 – 788 MHz band show the noise floor to be < -50 dBm in a 1 MHz bandwidth.

The original data was recorded in a 1 MHz RBW, since the limit is referenced to a 6.25 kHz BW the measured value has the following bandwidth correction factor added to it.

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

BW correction Factor = $10\log 6.25 / 1000 = 22.0$ dB

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

777 – 787 MHz Uplink Band

Spurious Frequency Range (MHz)	Measured Value (dB)	Bandwidth Correction Factor (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	-56	-22.0	-76	-46	-30
793 – 805	-56	-22.0	-76	-46	-30

746 - 756 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Value (dB)	Bandwidth Correction Factor (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	-56	-22.0	-76	-46	-30
793 – 805	-56	-22.0	-76	-46	-30



27.53(e)

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

To show compliance with 27.53(e) rule section, the Limit is -70dBW/MHz equivalent EIRP for wideband signals which is -40 dBm/MHz.

The final value for the spurious emissions in the 1559 – 1610 MHz band is calculated using the data provided from the test report and antenna kitting document. ,

Data:

- Conducted measurement = Measured value (-57 dBm in a 1 MHz BW) from the Conducted Spurious Emissions graphs in the test report on page 58,
- The final gain/loss (+4.2 dB) from the antenna kitting document) for the 777 – 787 band.
- The original data was recorded in a 1 MHz RBW, since the limit for narrowband emissions is referenced to (< 700Hz BW) , the measured value has the following bandwidth correction factor added to it.
BW correction Factor = $10\log B1/B2$
BW correction Factor = $10\log 700 / 1,000,000 = 31.5 \text{ dB}$

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.

777 – 787 MHz Uplink Band

Spurious Frequency Range (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Gain/Loss from Antenna Kitting Information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Narrowband)	-57	-31.5	4.2	-84.3	-50	-34.3
1559 – 1610 (Wideband)	-57	0	4.2	-52.8	-40	-12.8

746 - 756 MHz Downlink Band

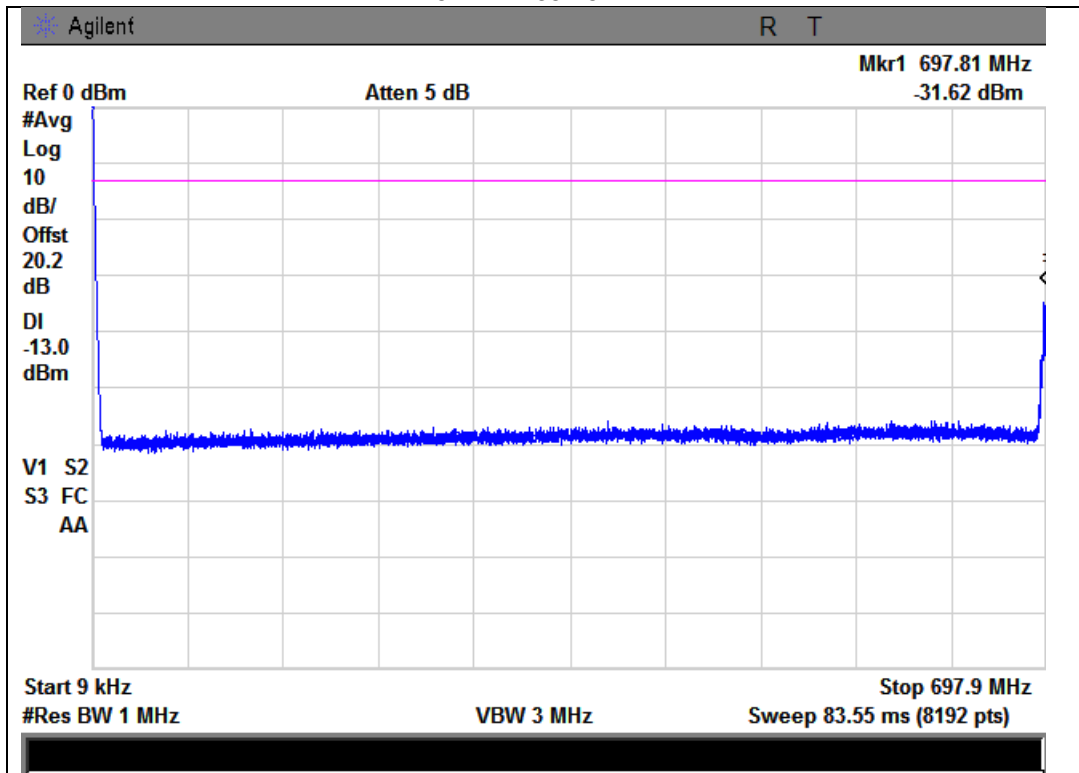
Spurious Frequency Range (MHz)	Measured Value (dBm)	Bandwidth Correction Factor (dB)	Gain/Loss from Antenna Kitting information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Narrowband)	-57	-31.5	2.1	-86.4	-50	-36.4
1559 – 1610 (Wideband)	-57	0	2.1	-54.9	-40	-14.9



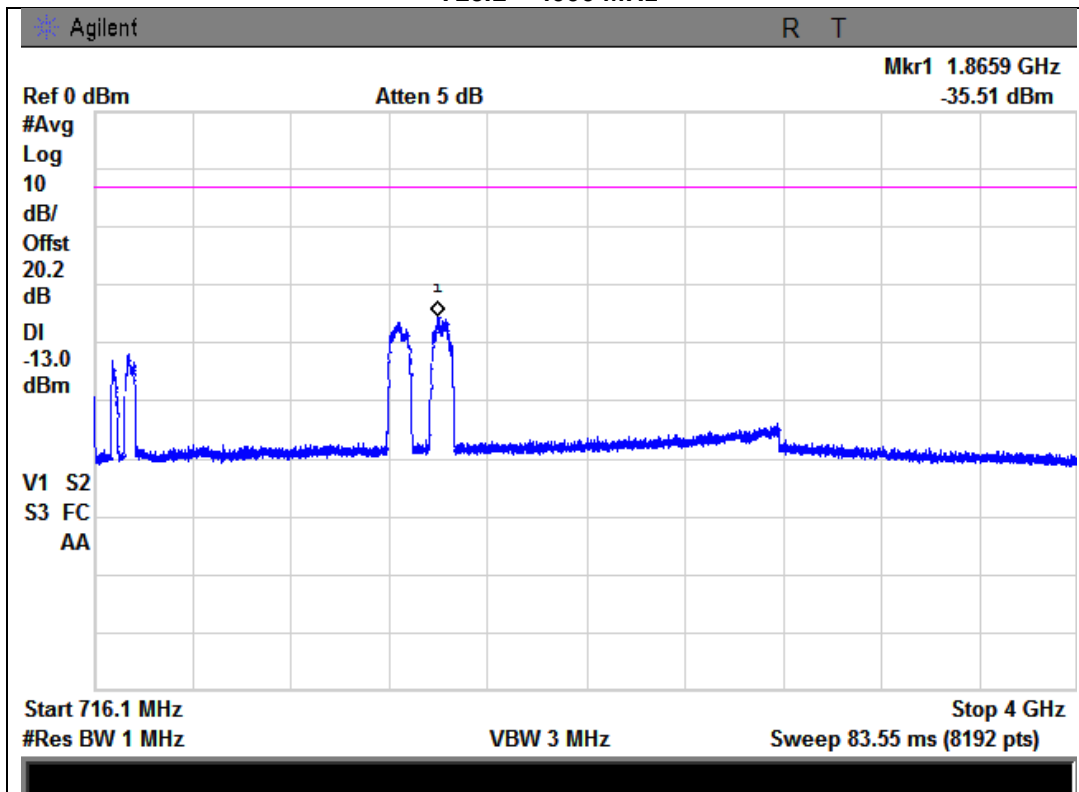
Uplink Test Plots

698 - 716 MHz Band

9 kHz – 697.9 MHz

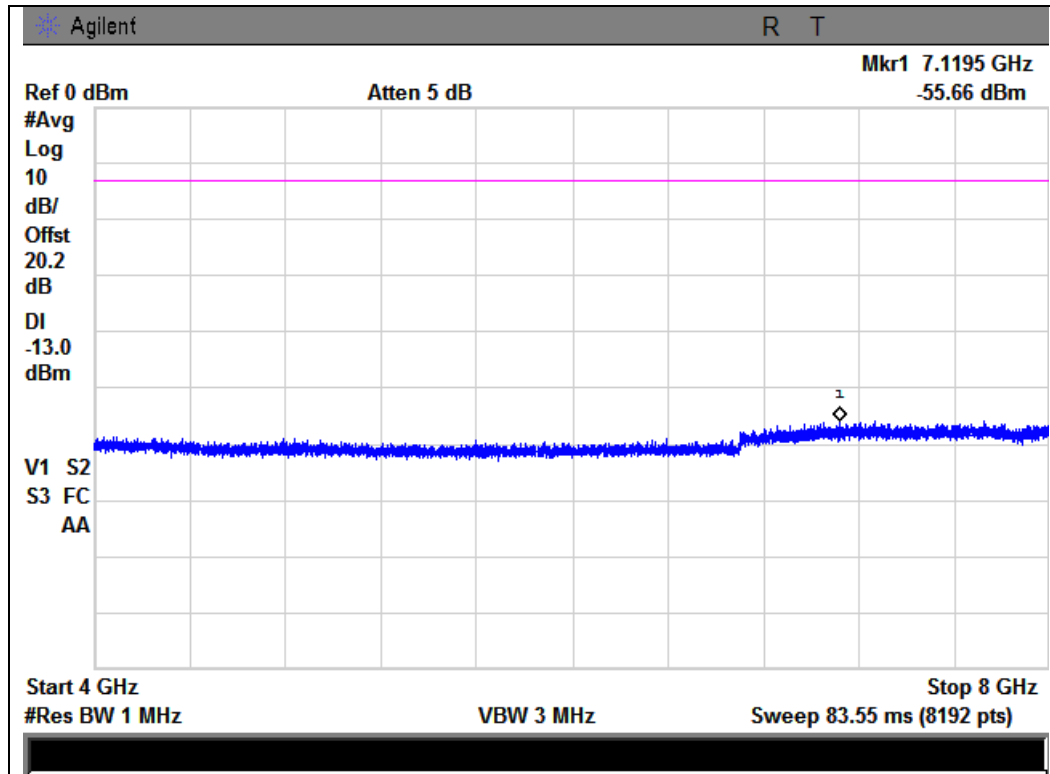


716.1 – 4000 MHz





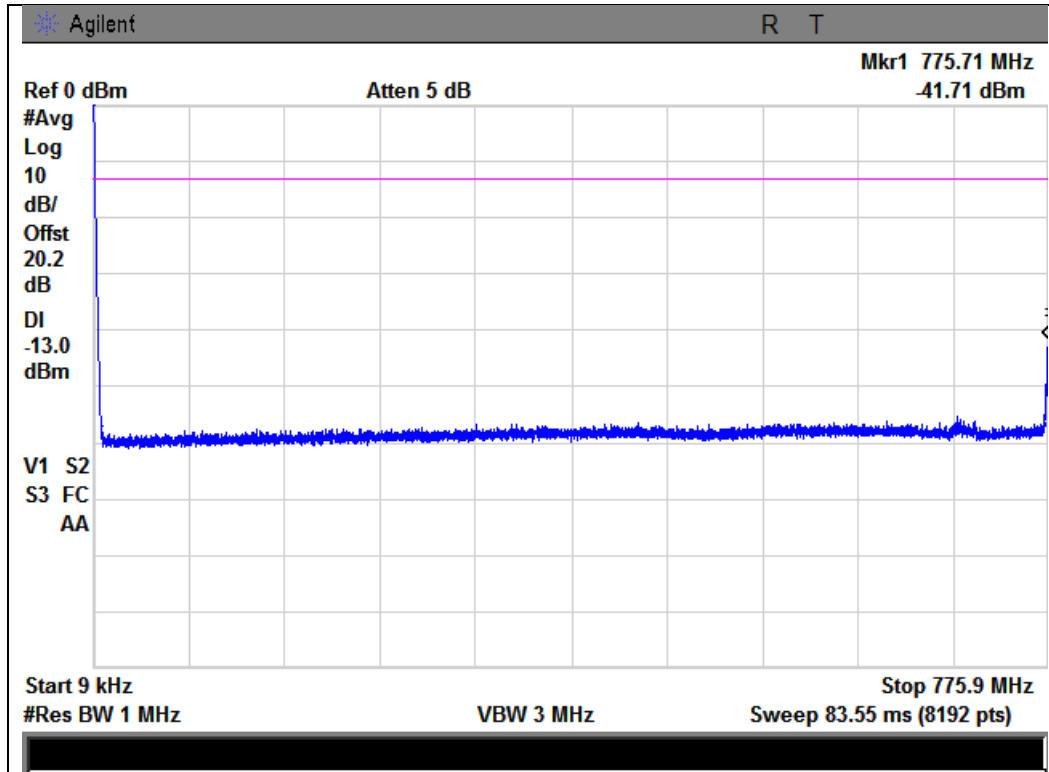
4000 – 8000 MHz



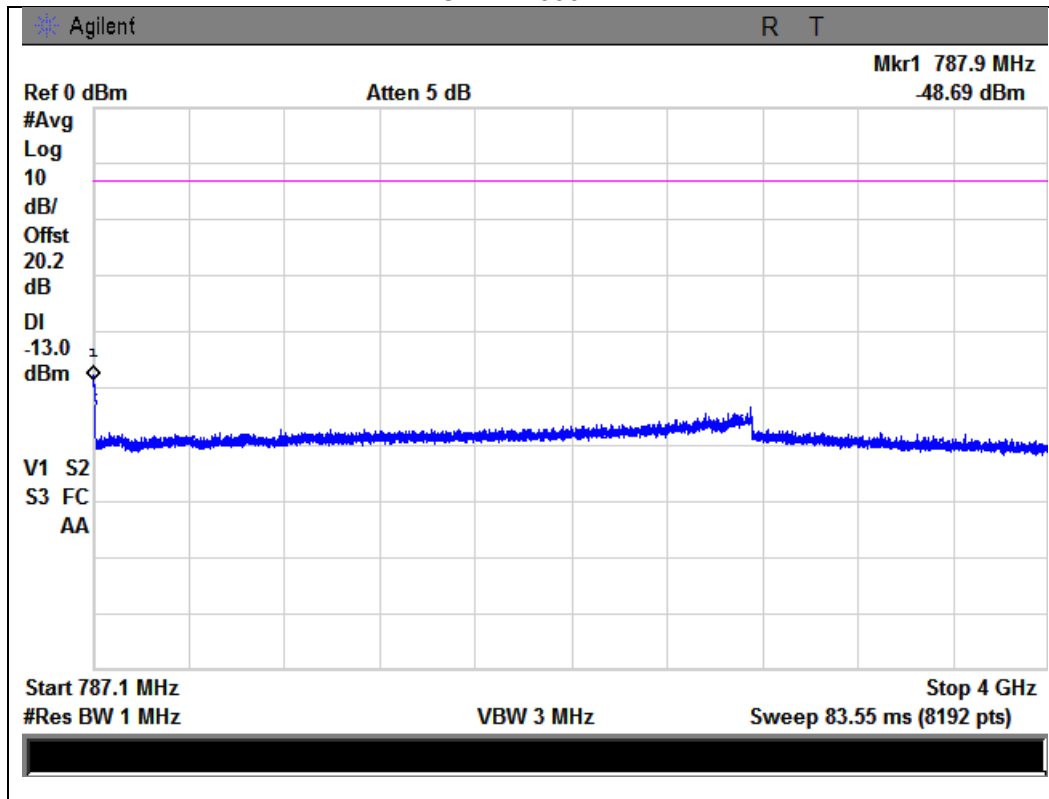


777 - 787 MHz Band

9 kHz – 775.9 MHz

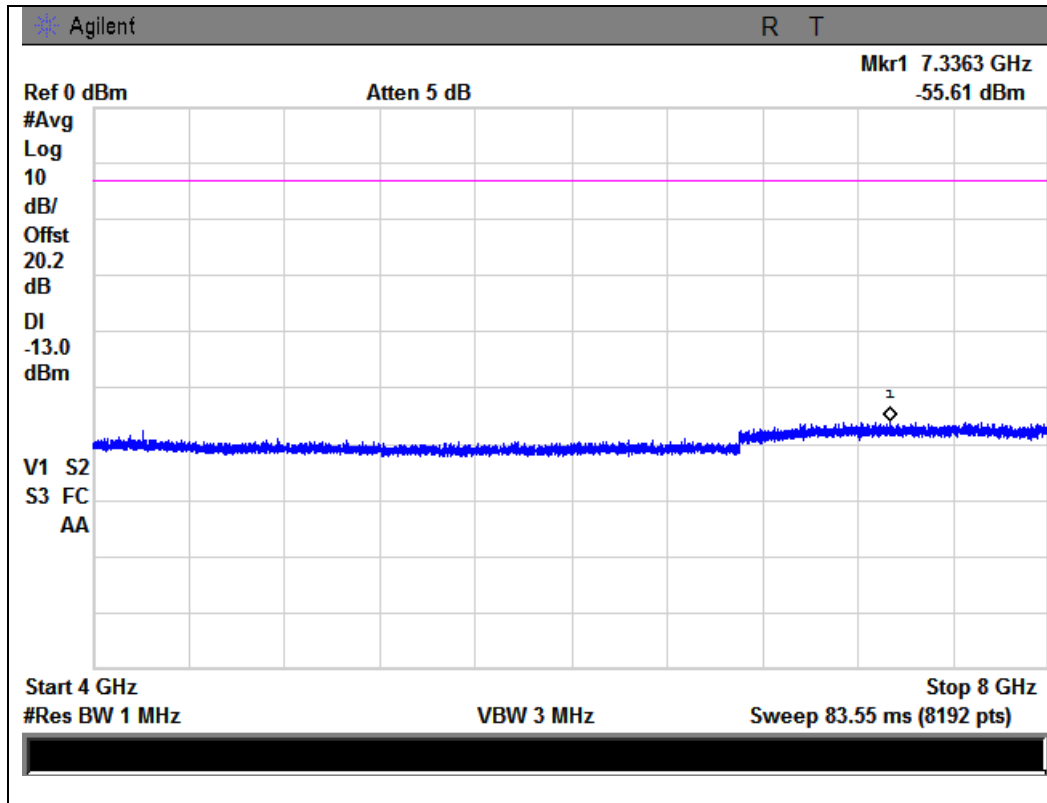


787.1 – 4000 MHz





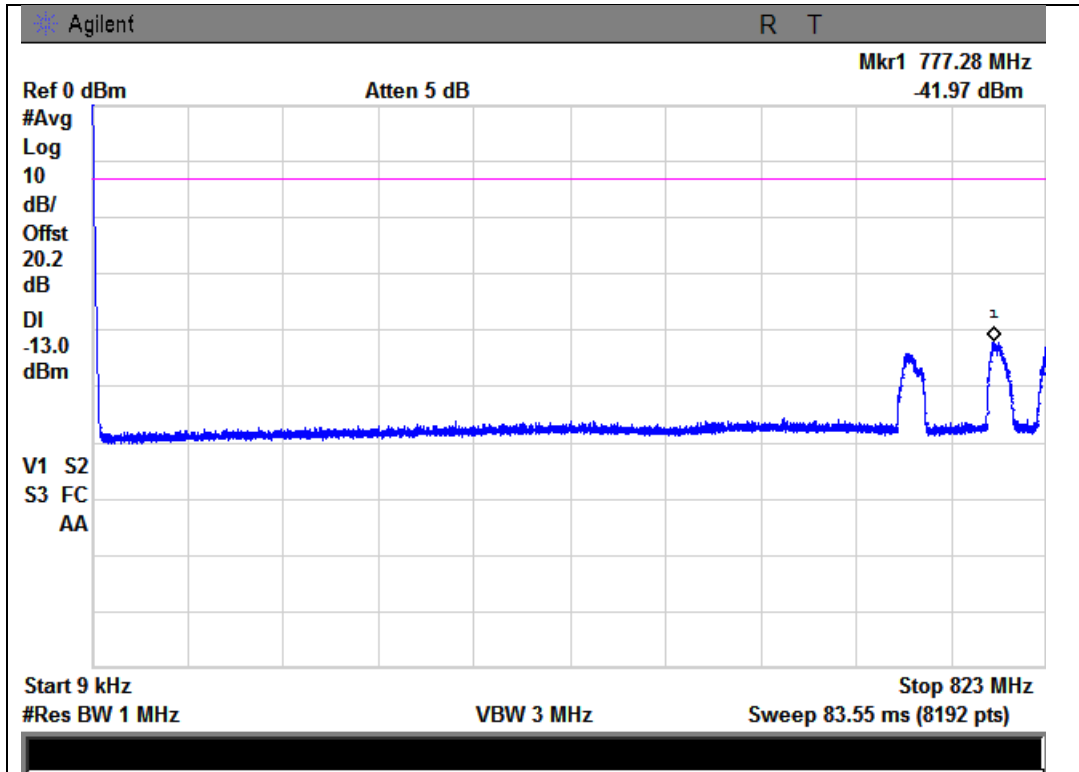
4000 – 8000 MHz



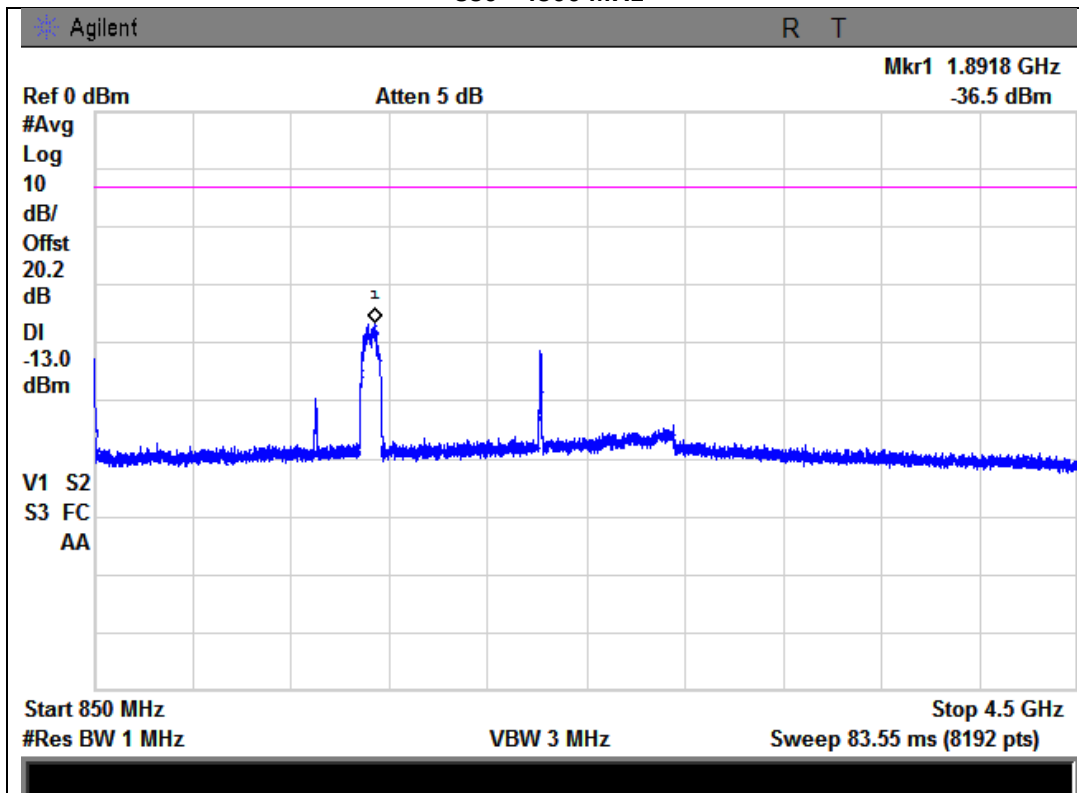


824 - 849 MHz Band

9 kHz – 823 MHz

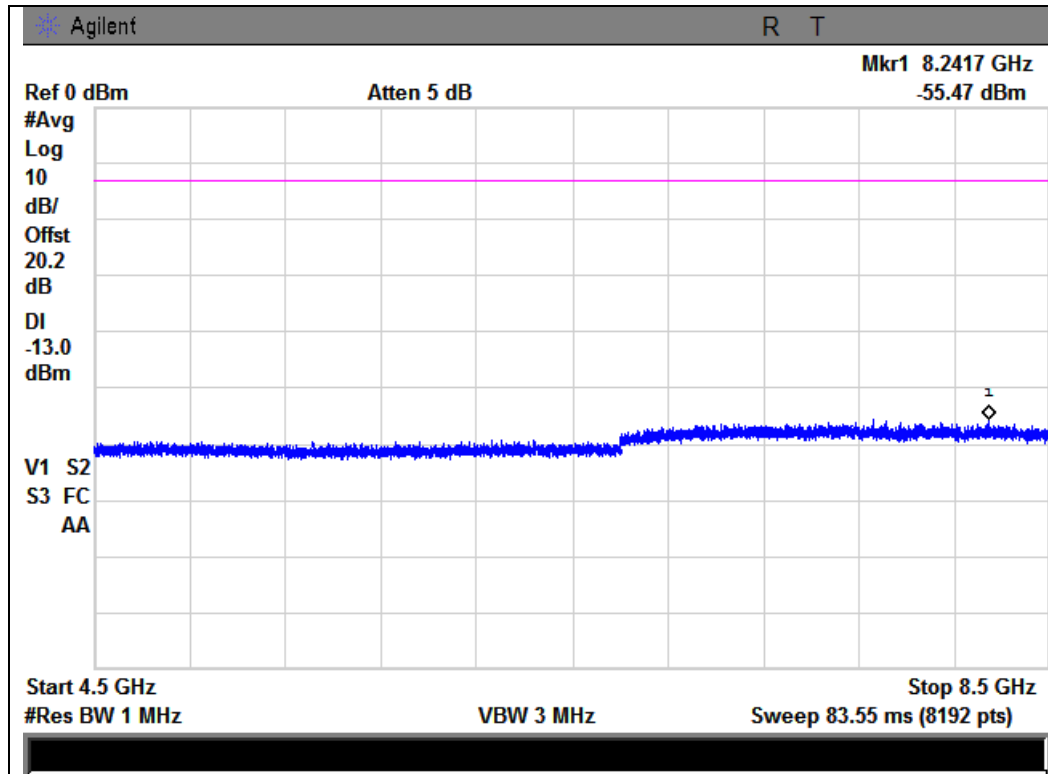


850 - 4500 MHz





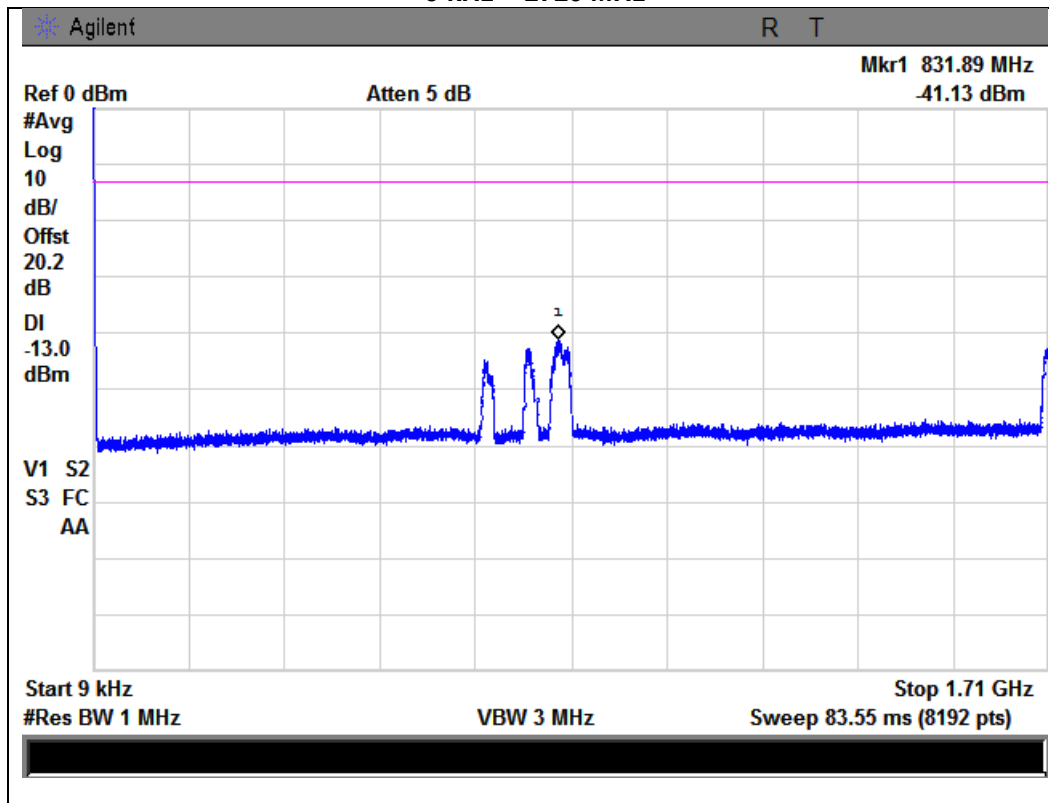
4500 – 8500 MHz



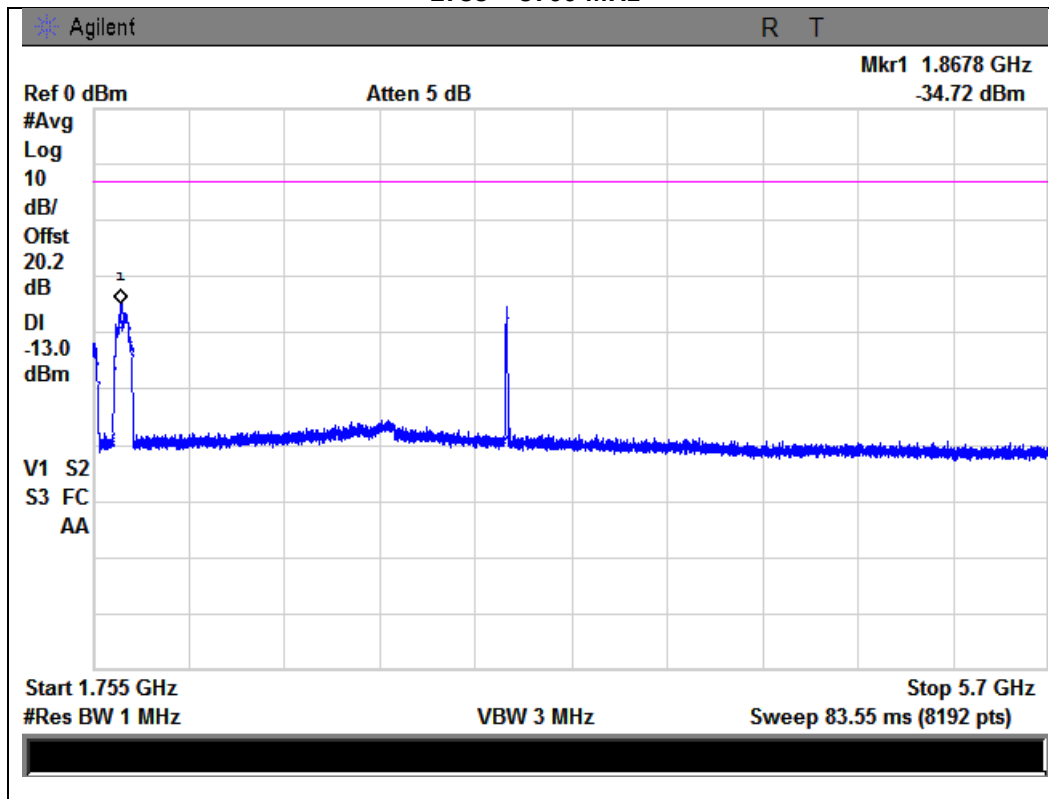


1710 - 1755 MHz Band

9 kHz – 1710 MHz

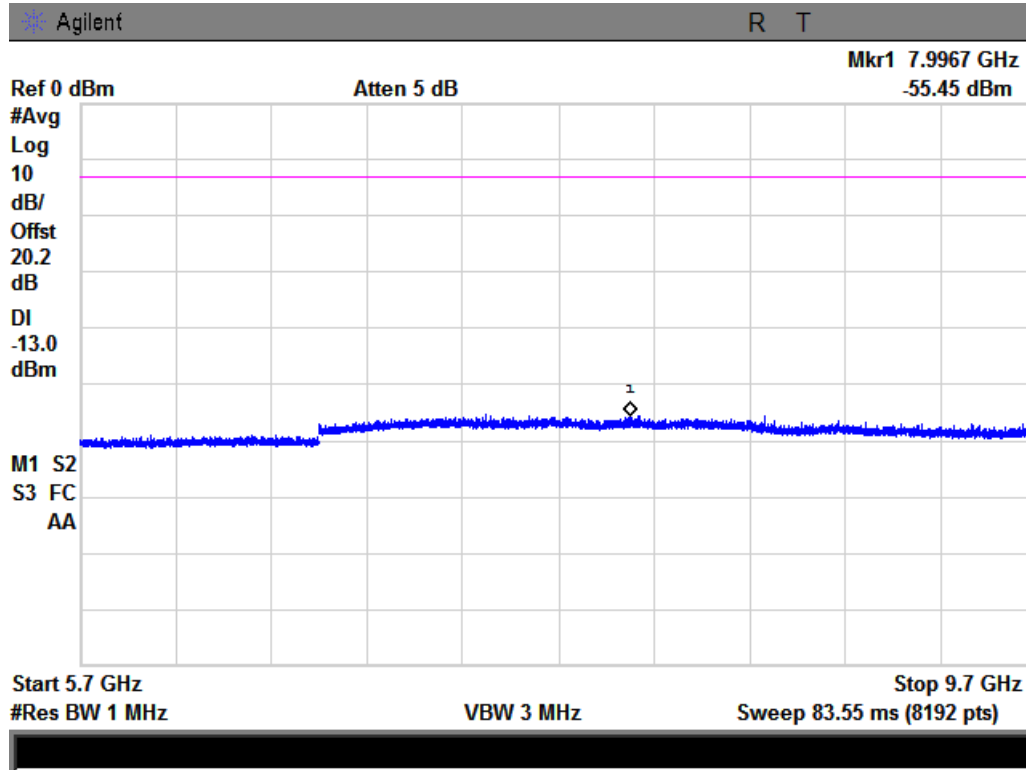


1755 – 5700 MHz

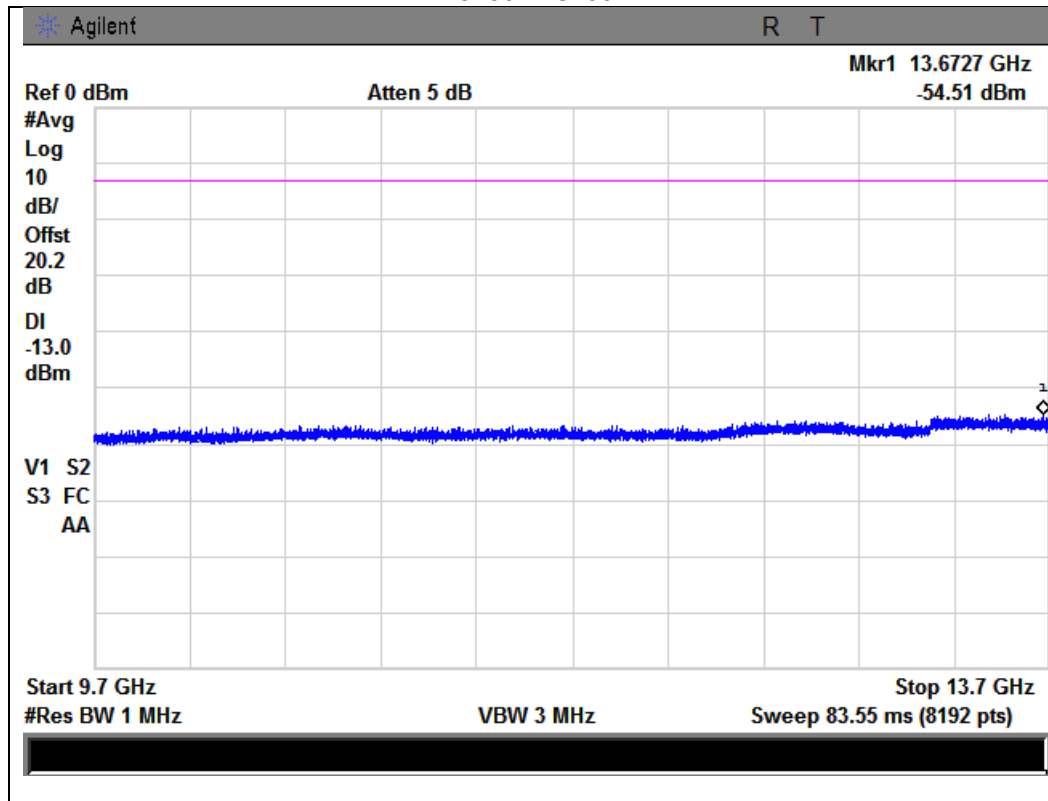




5700 - 9700 MHz

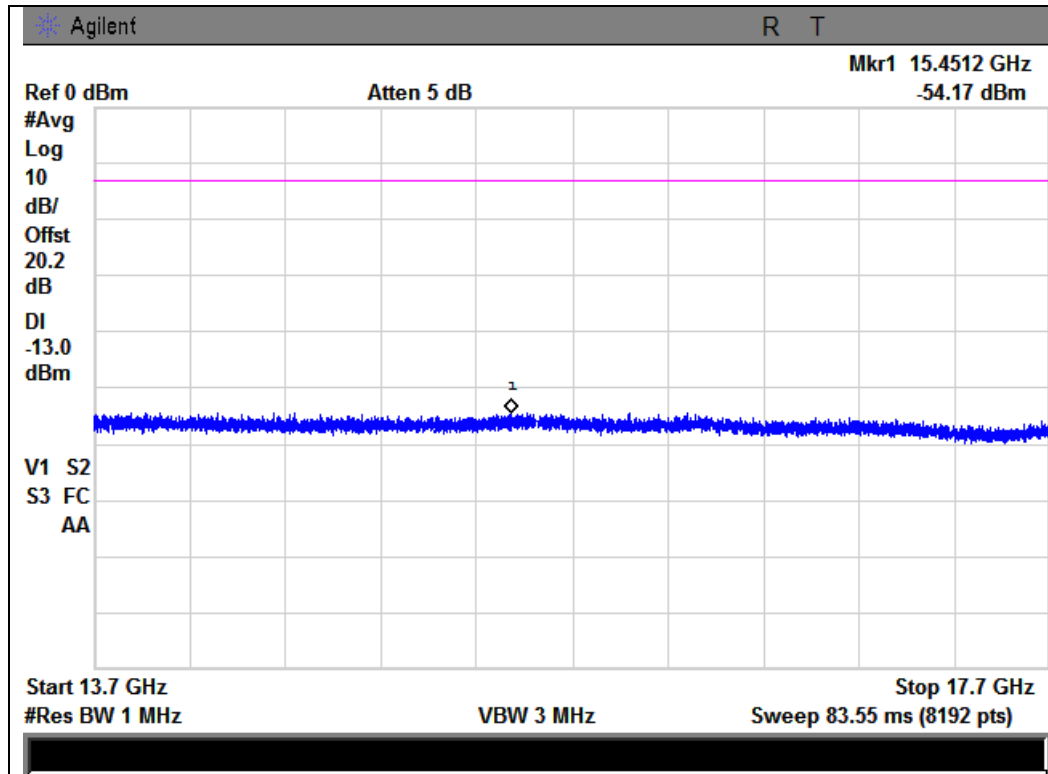


9700 - 13700





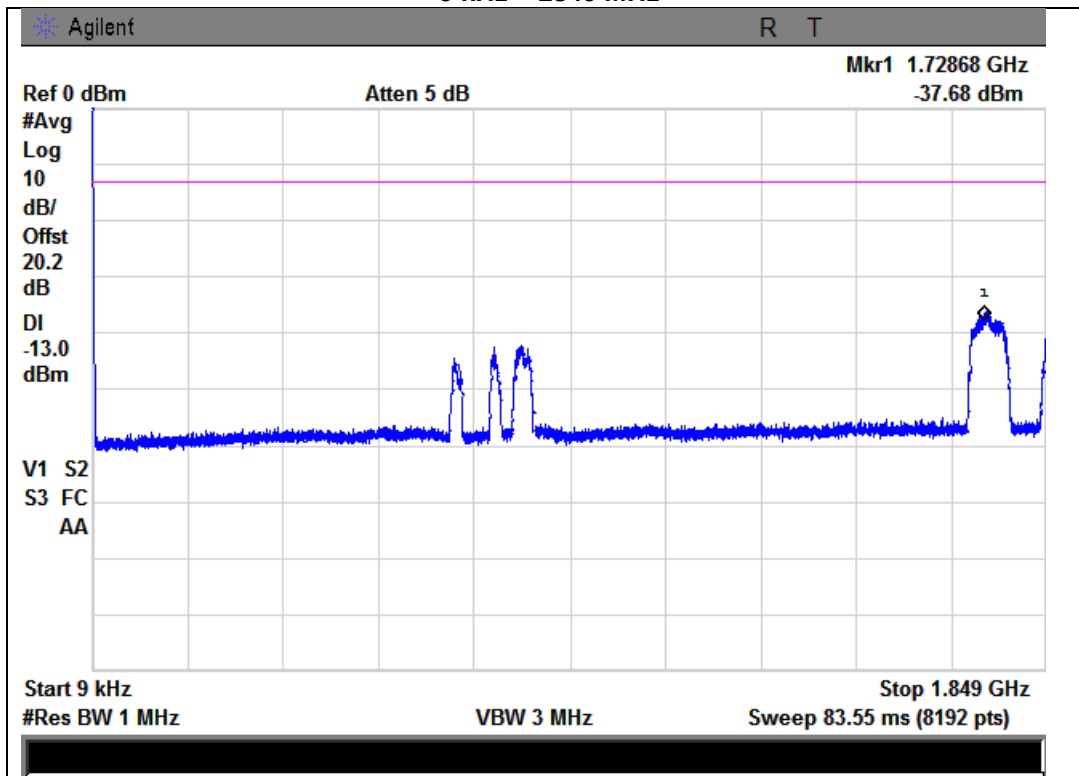
13700 – 17700



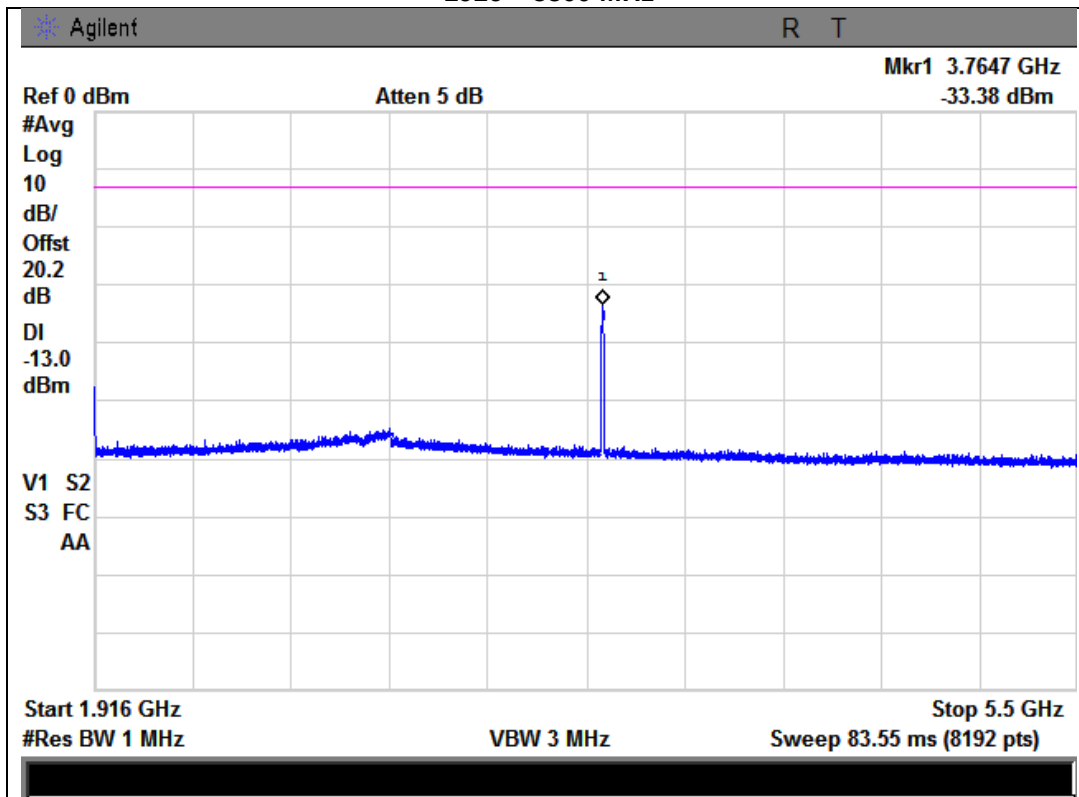


1850 - 1915 MHz Band

9 kHz – 1849 MHz

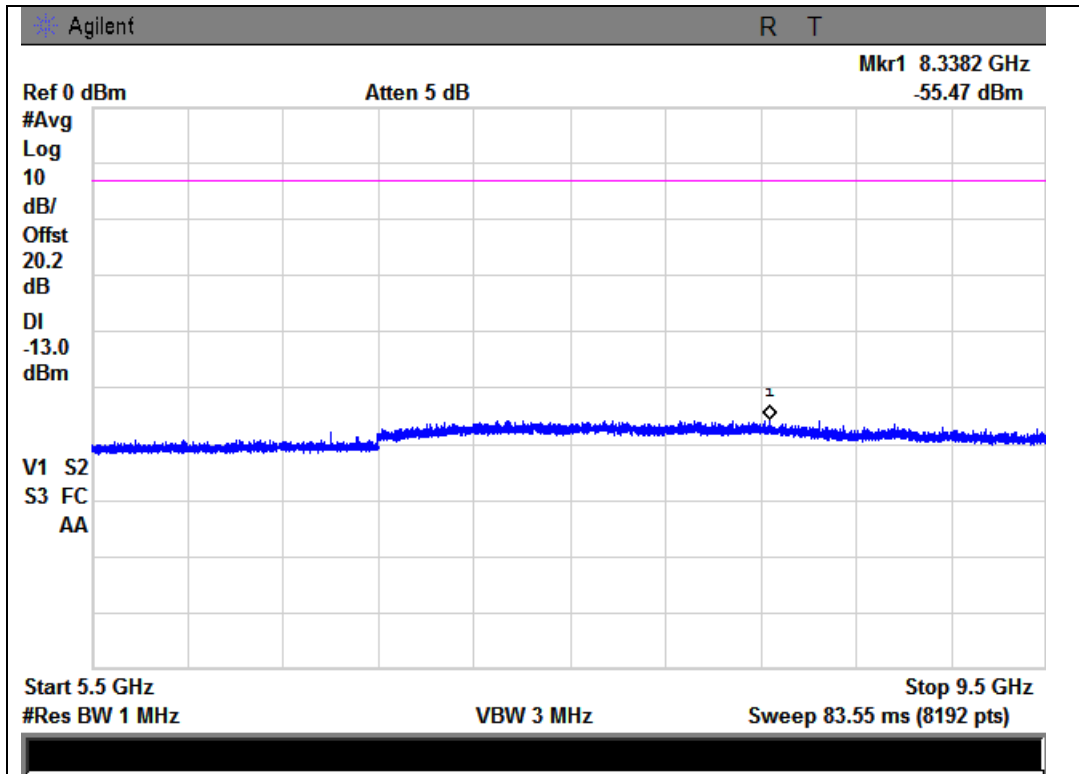


1916 – 5500 MHz

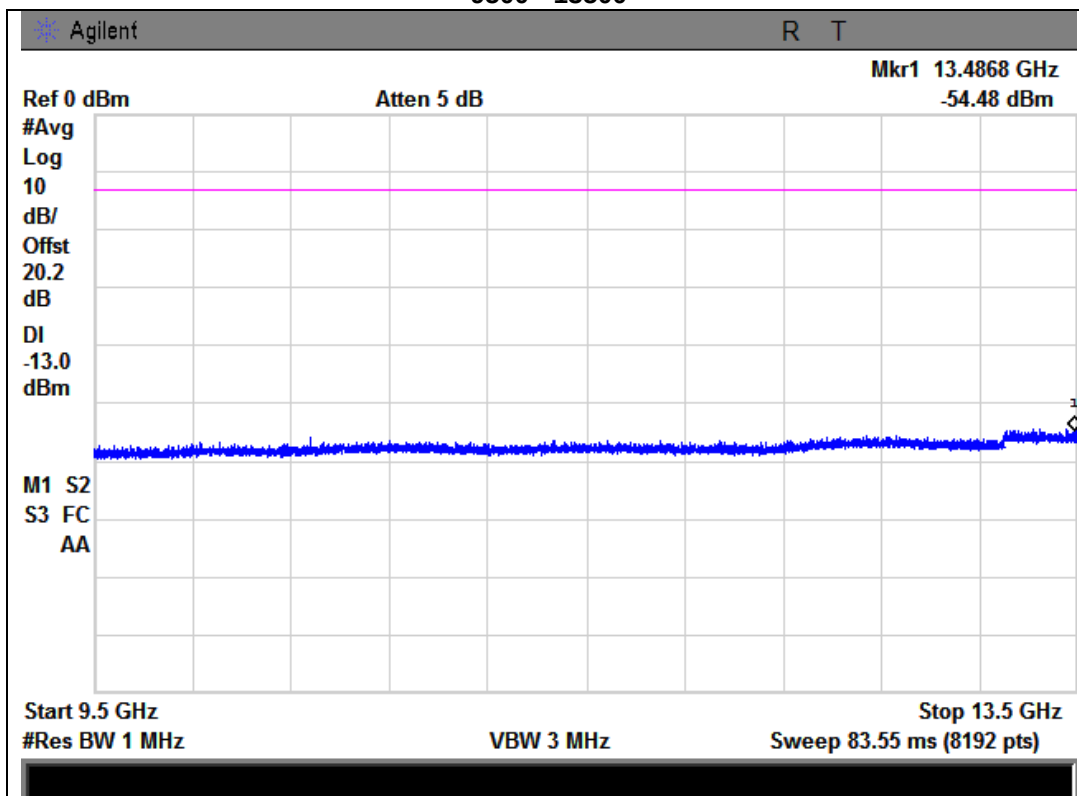




5500 – 9500 MHz

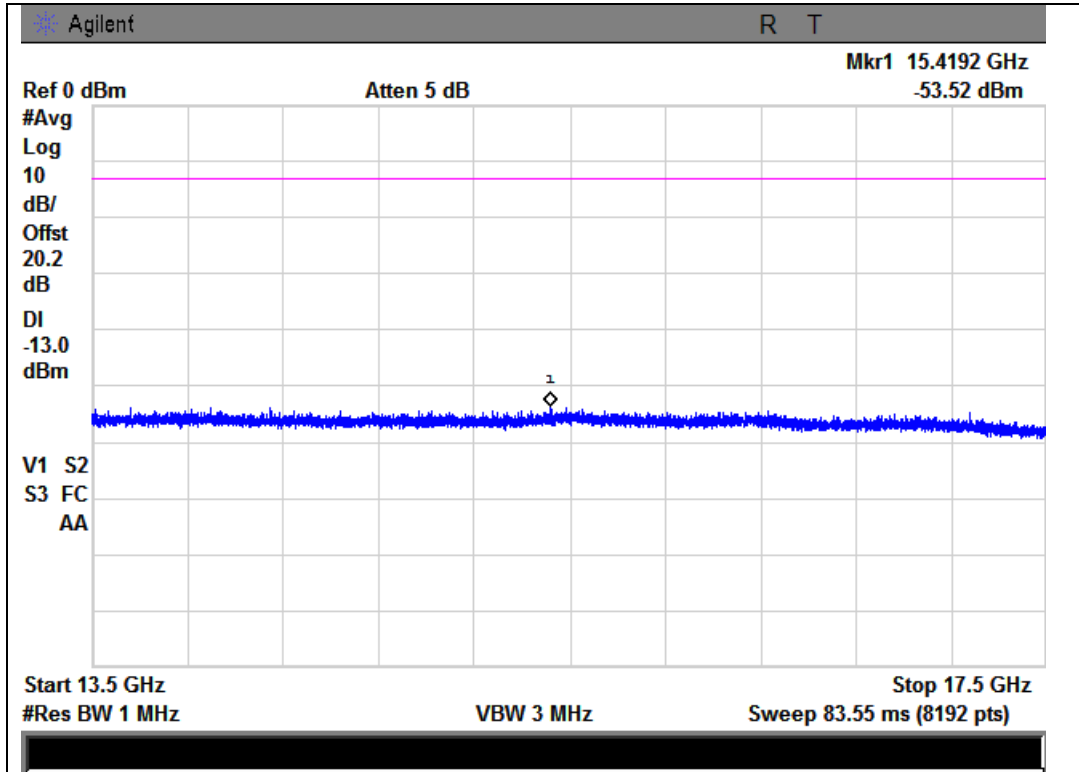


9500 - 13500

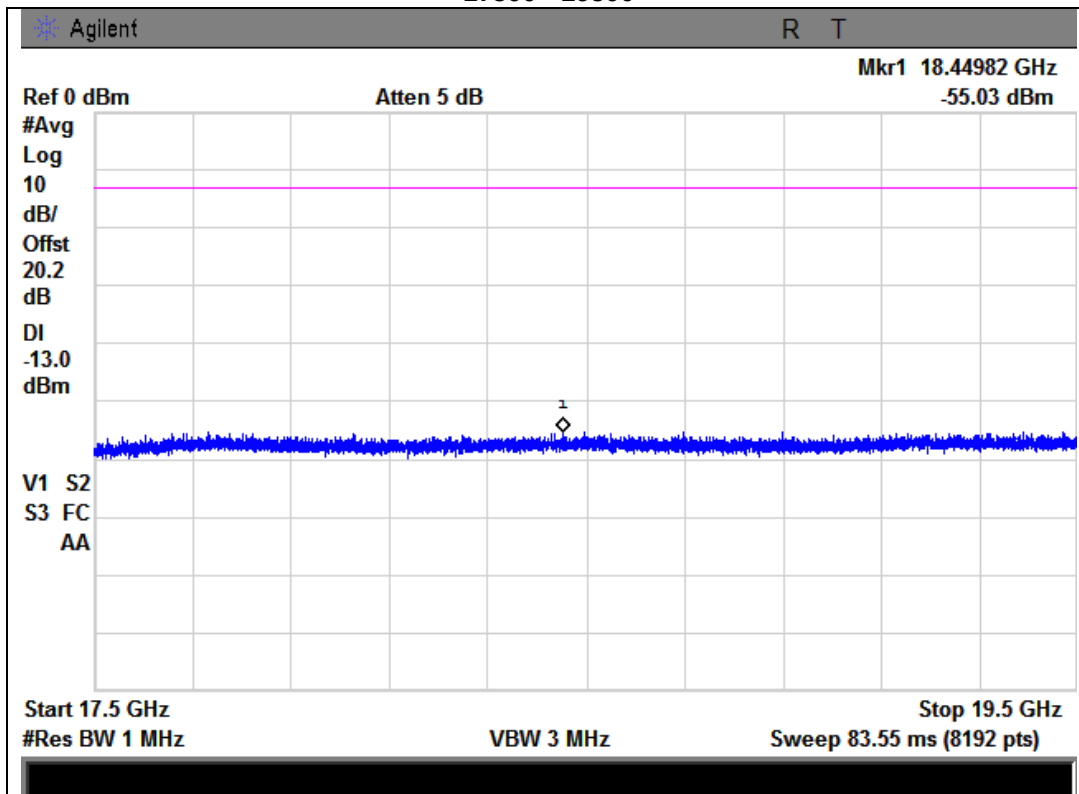




13500 - 17500



17500 - 19500

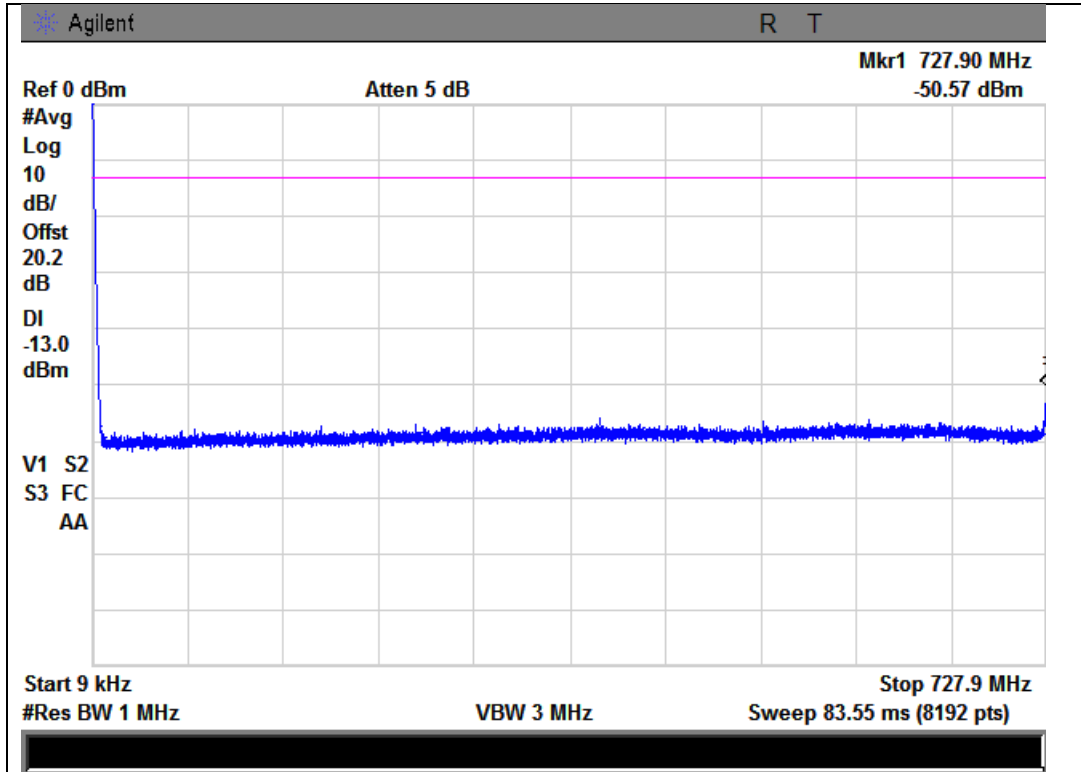




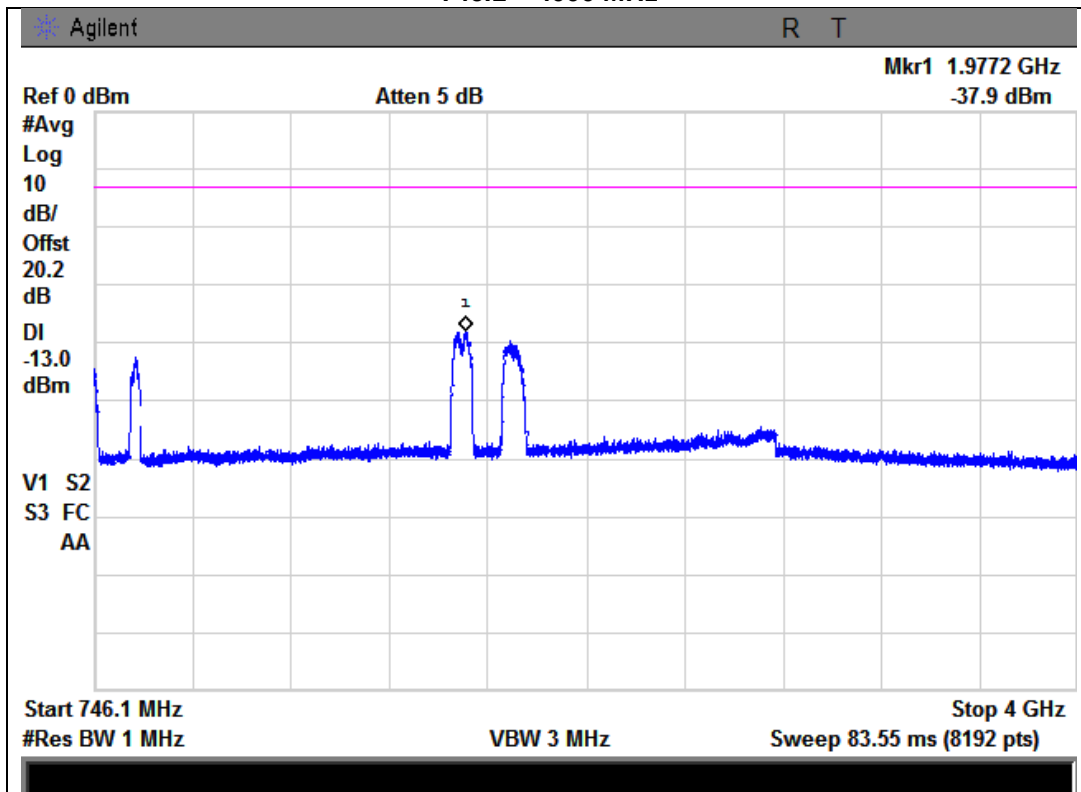
Downlink Test Plots

728 - 746 MHz Band

9 kHz – 727.9 MHz

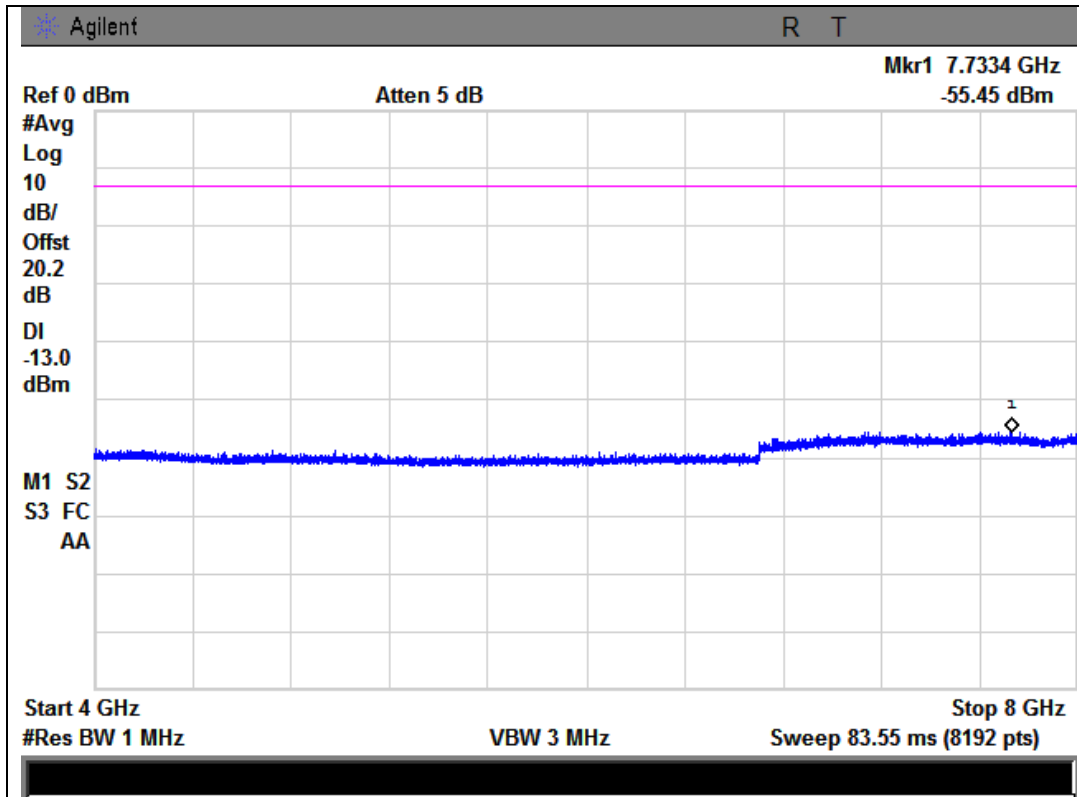


746.1 – 4000 MHz





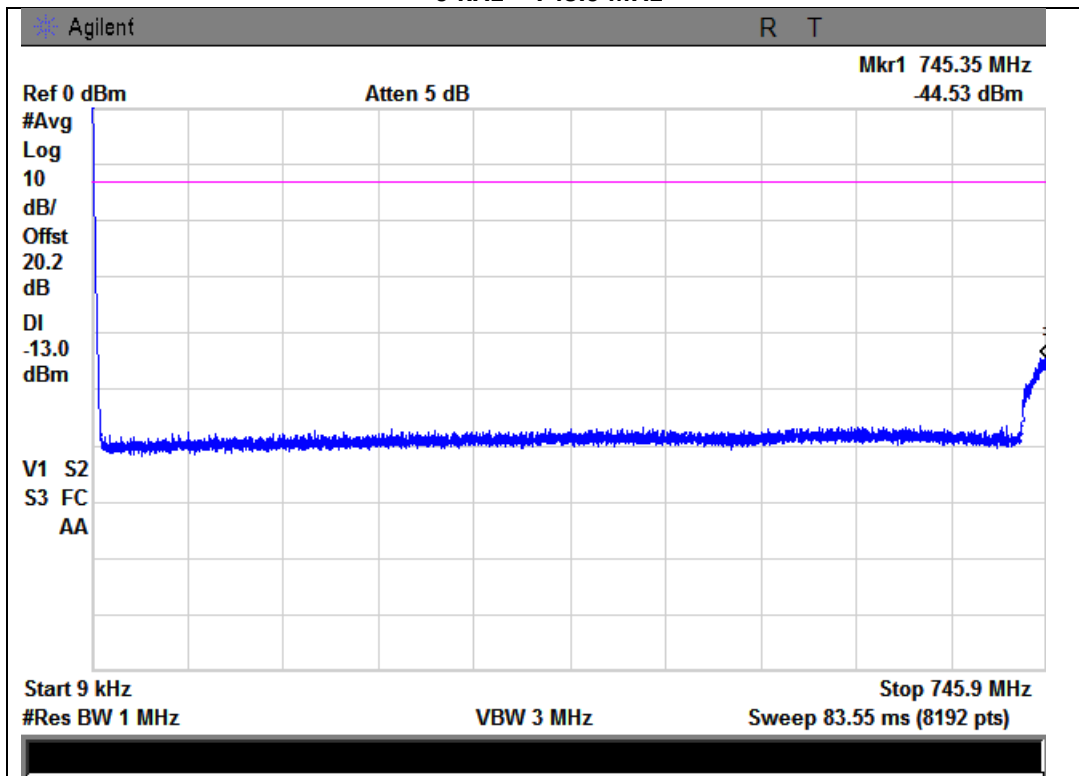
4000 – 8000 MHz



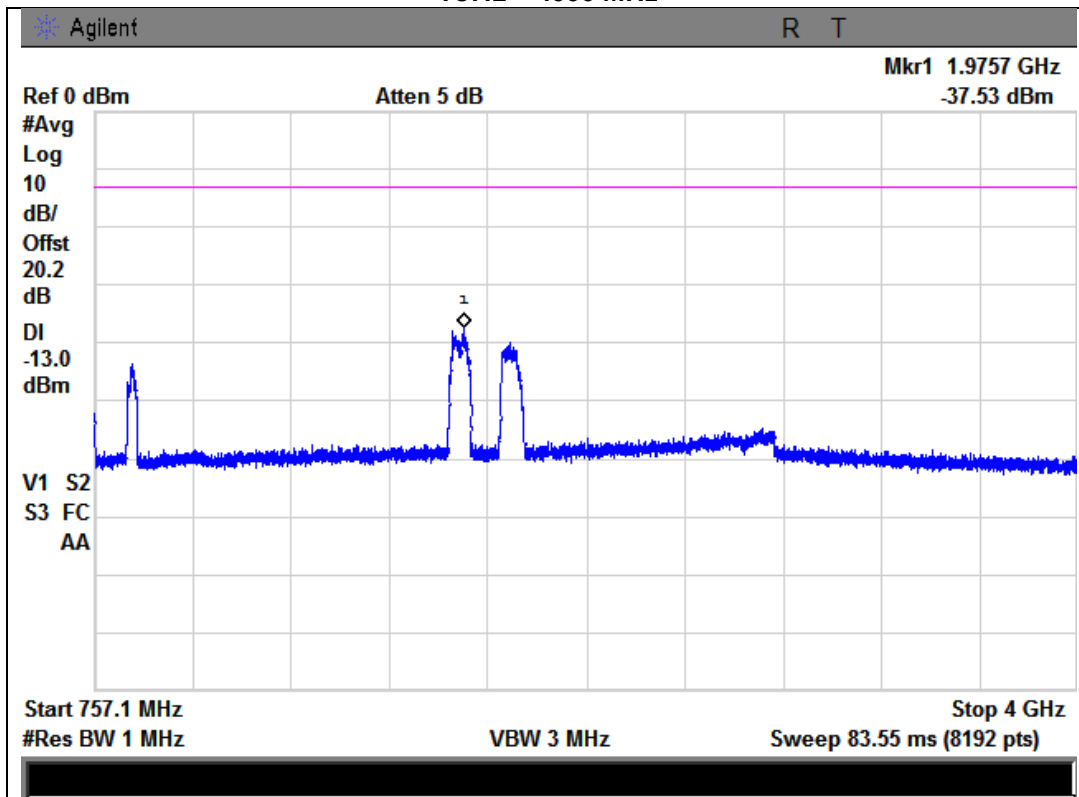


746 - 756 MHz Band

9 kHz – 745.9 MHz

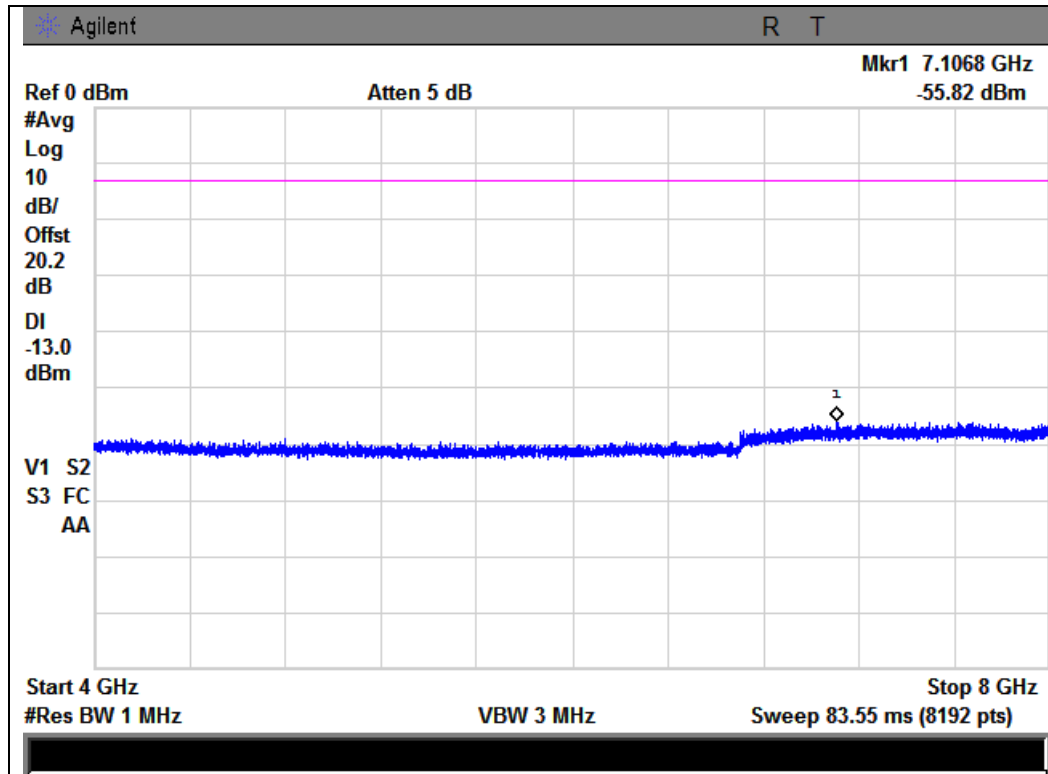


757.1 – 4000 MHz





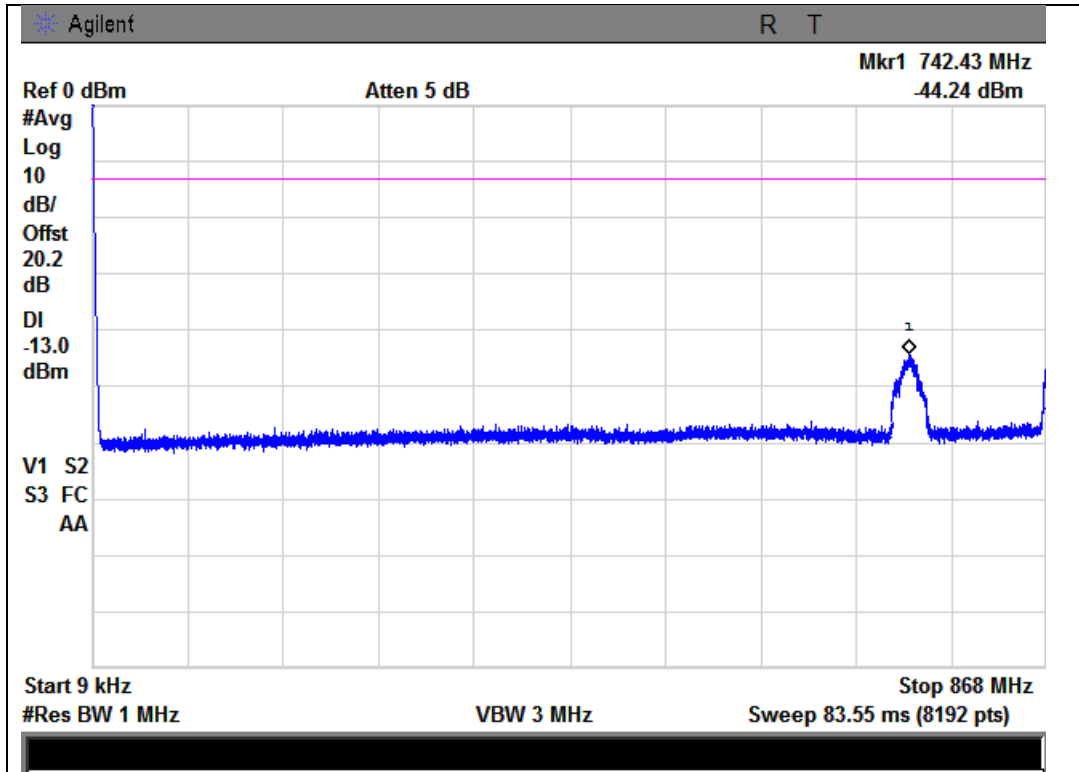
4000 – 8000 MHz



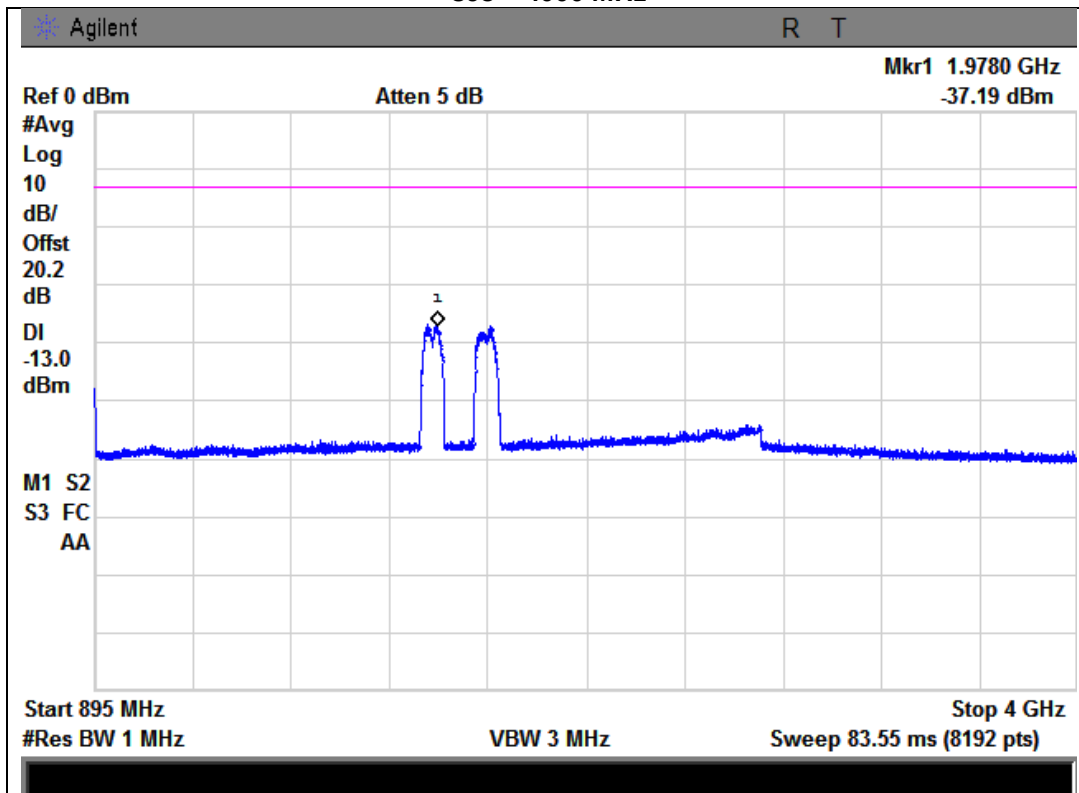


869 - 894 MHz Band

9 kHz – 868 MHz

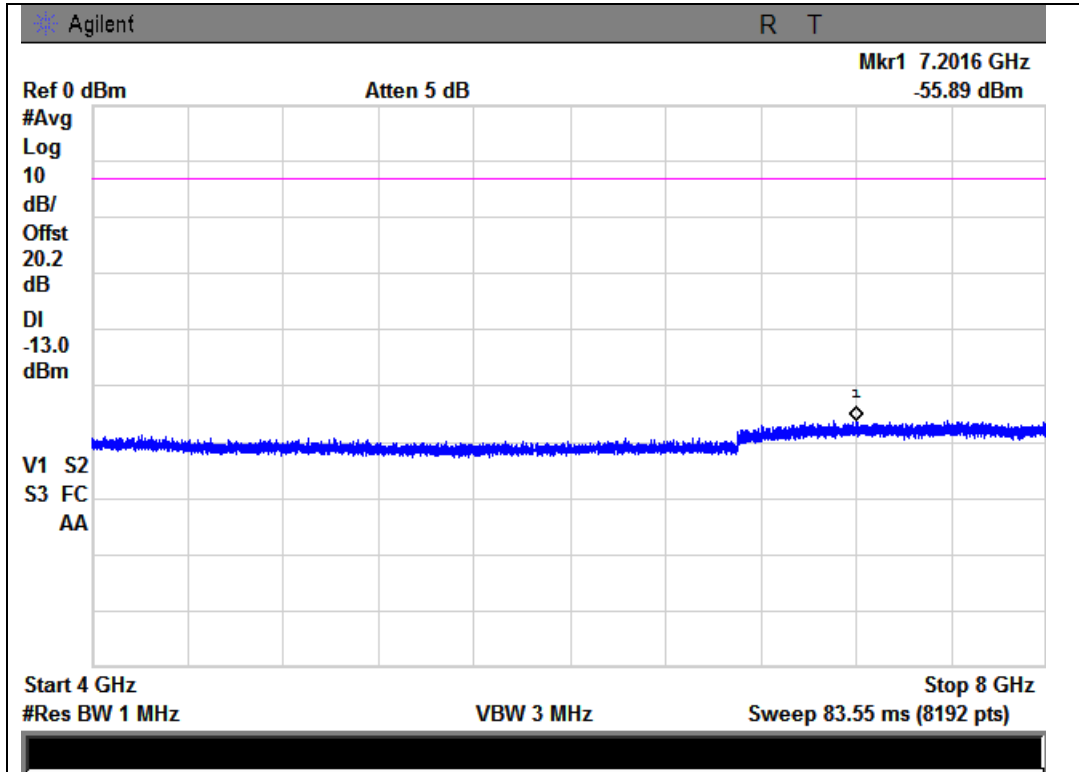


895 – 4000 MHz

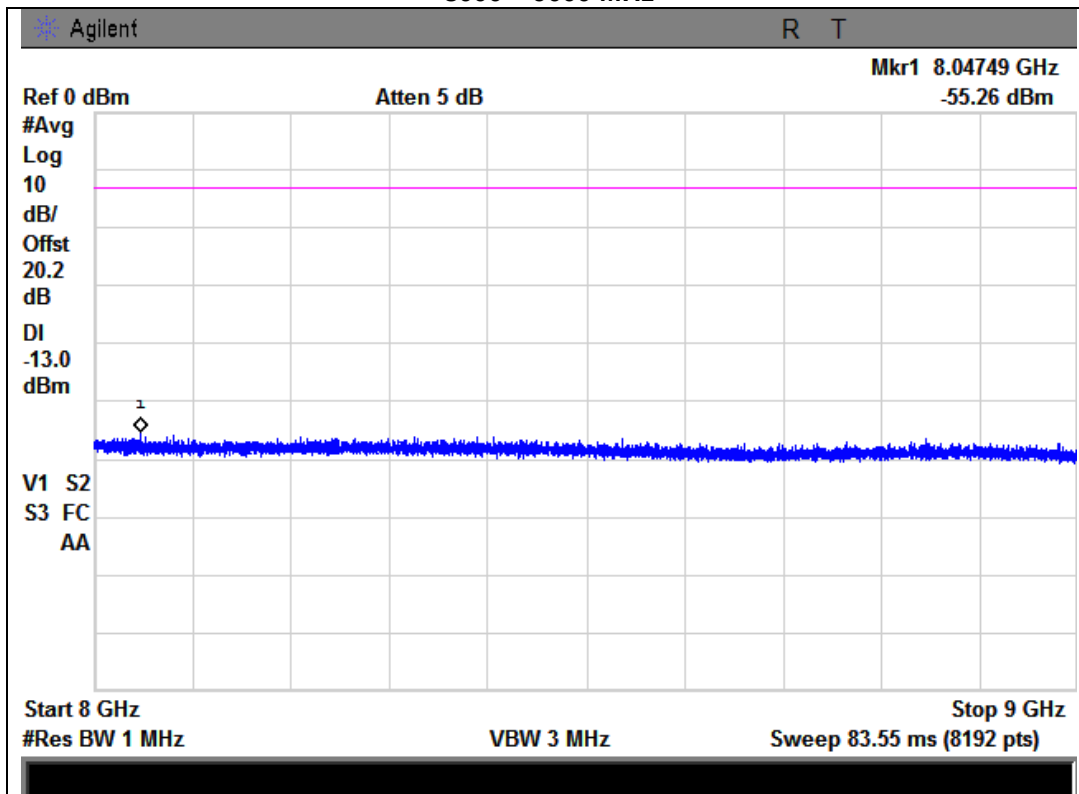




4000 – 8000 MHz



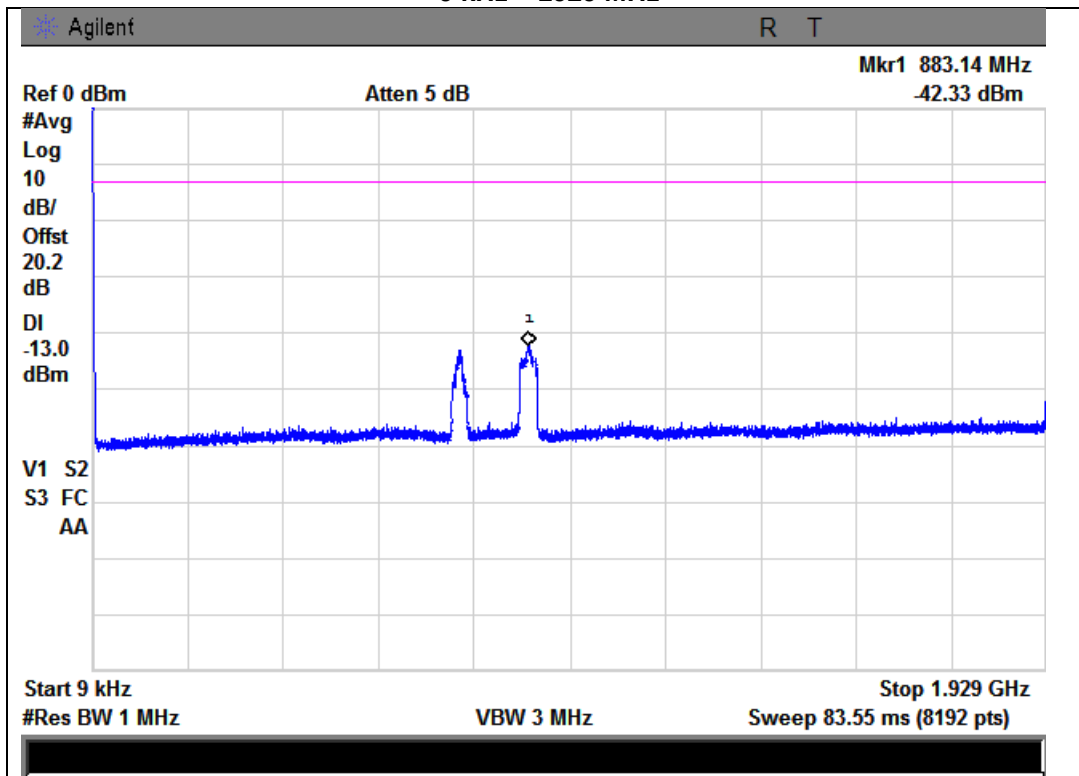
8000 – 9000 MHz



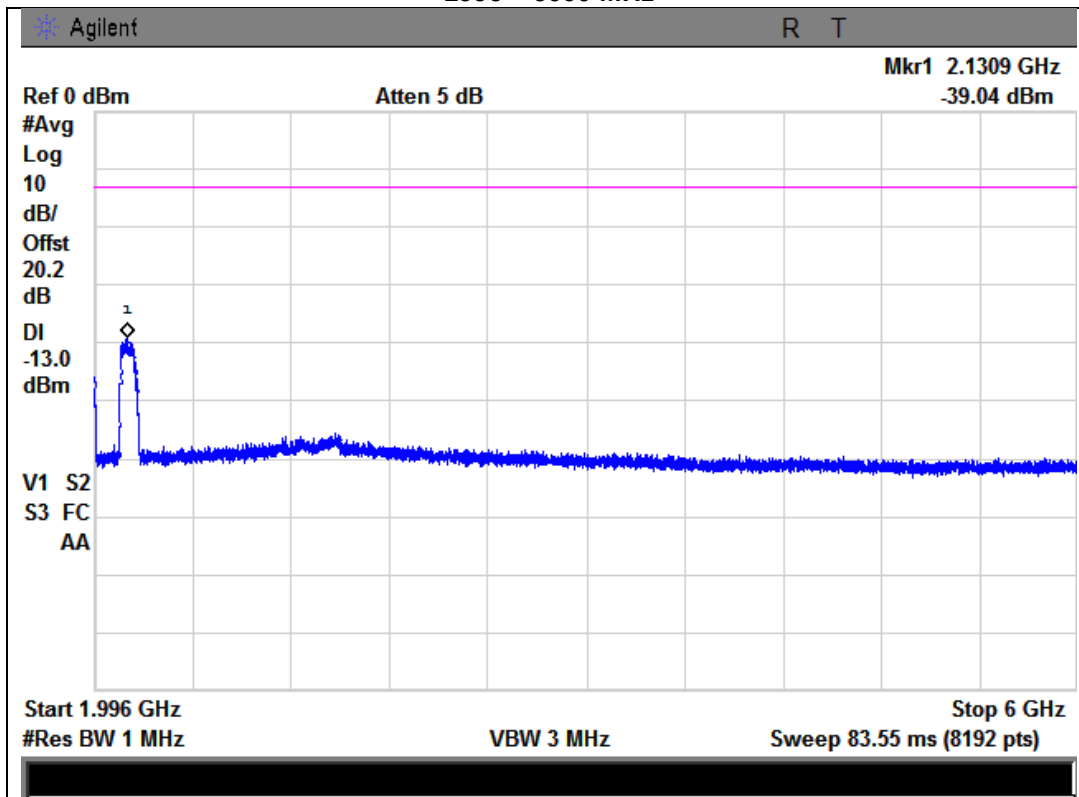


1930 - 1995 MHz Band

9 kHz – 1929 MHz

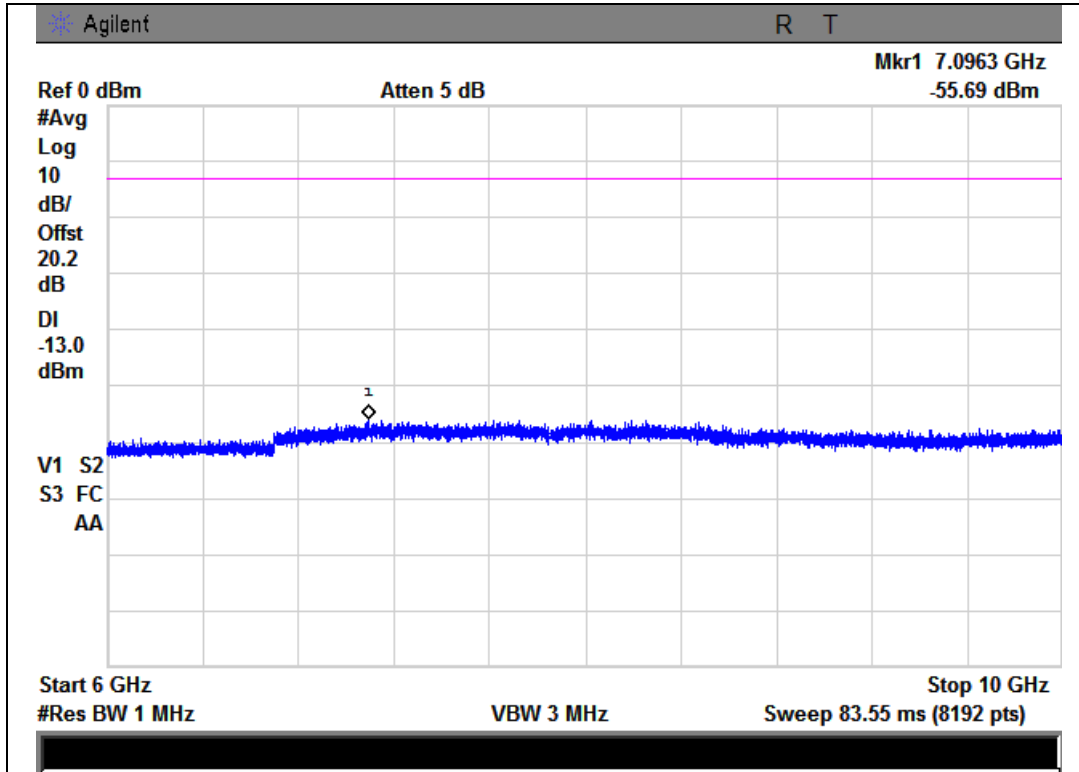


1996 – 6000 MHz

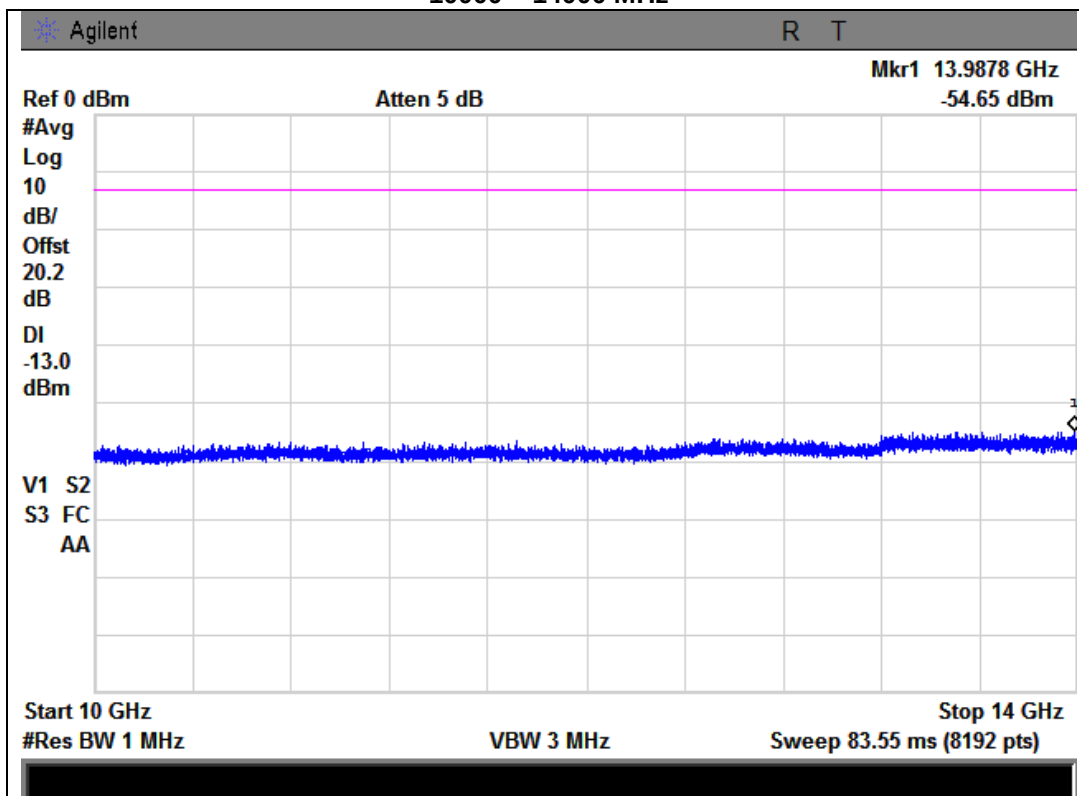




6000 – 10000 MHz

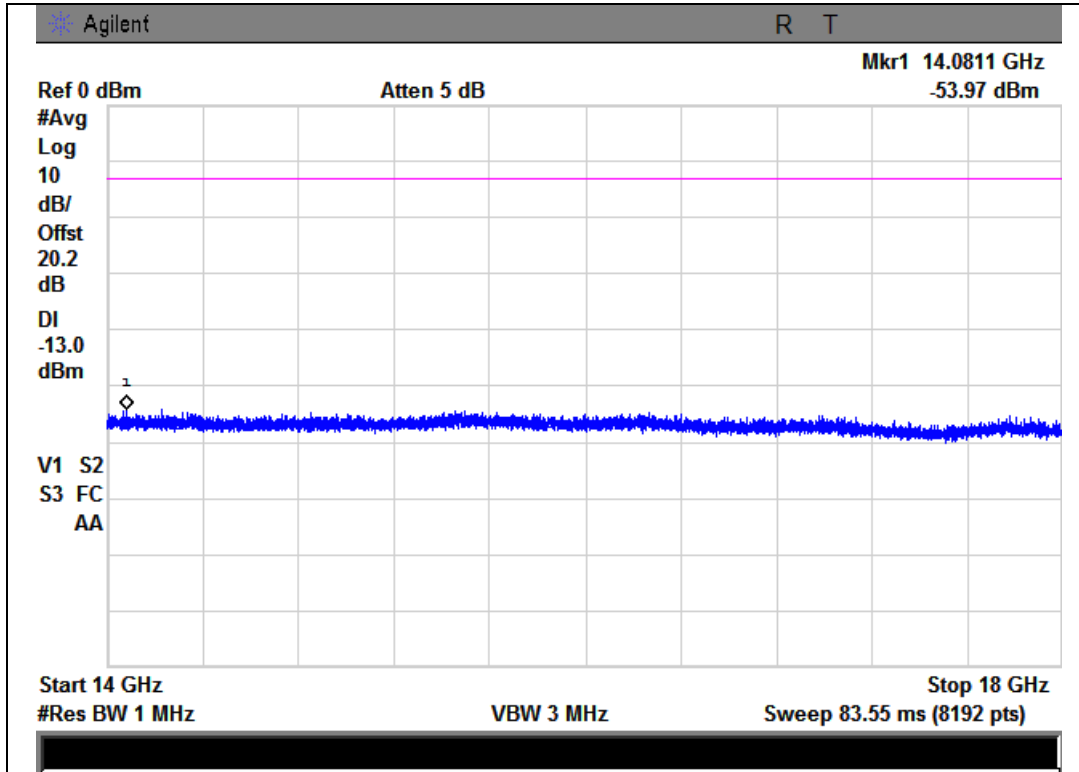


10000 – 14000 MHz

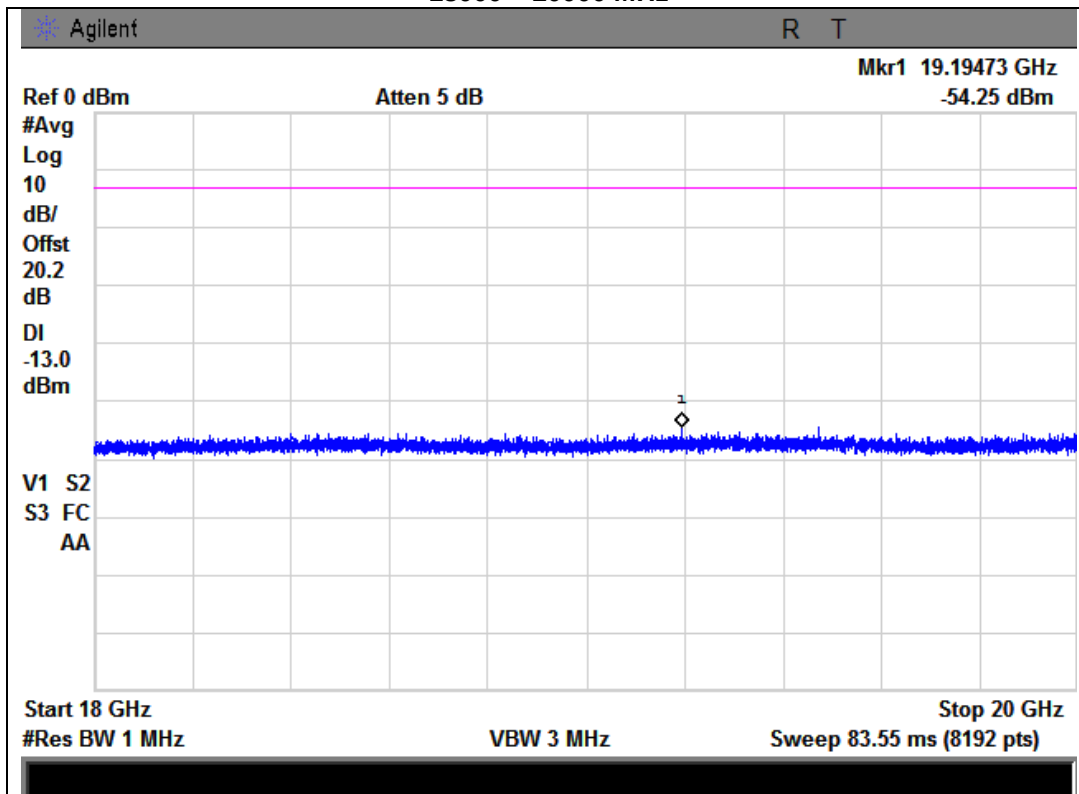




14000 – 18000 MHz



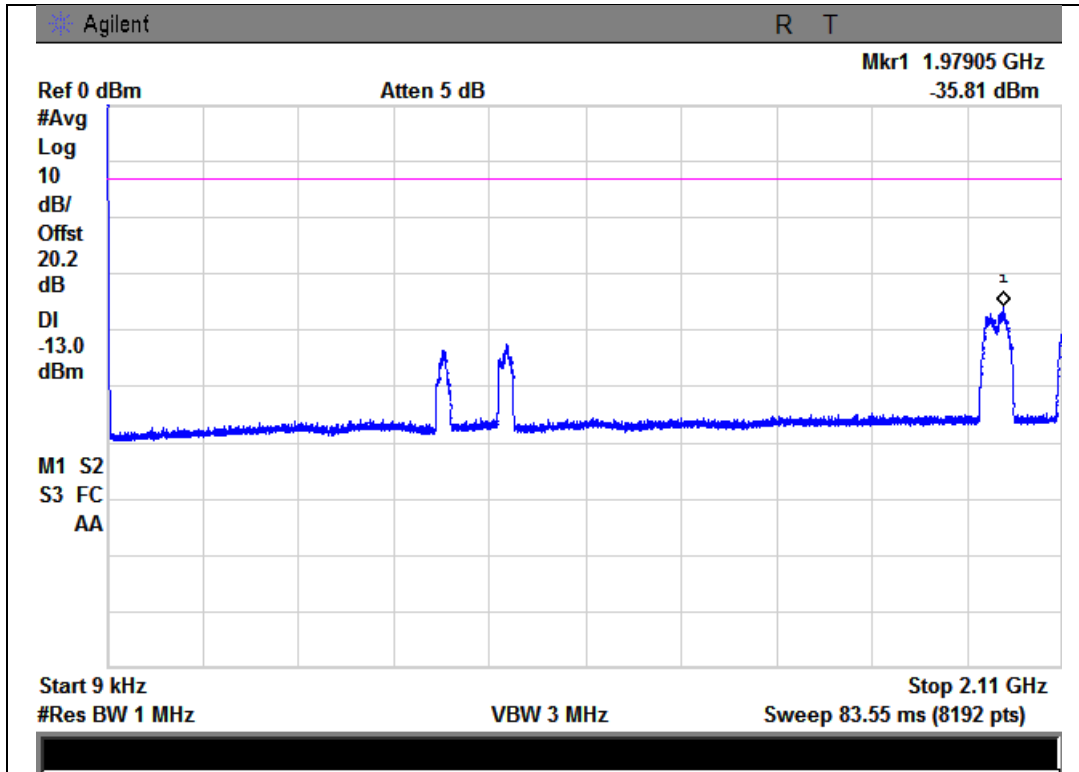
18000 – 20000 MHz



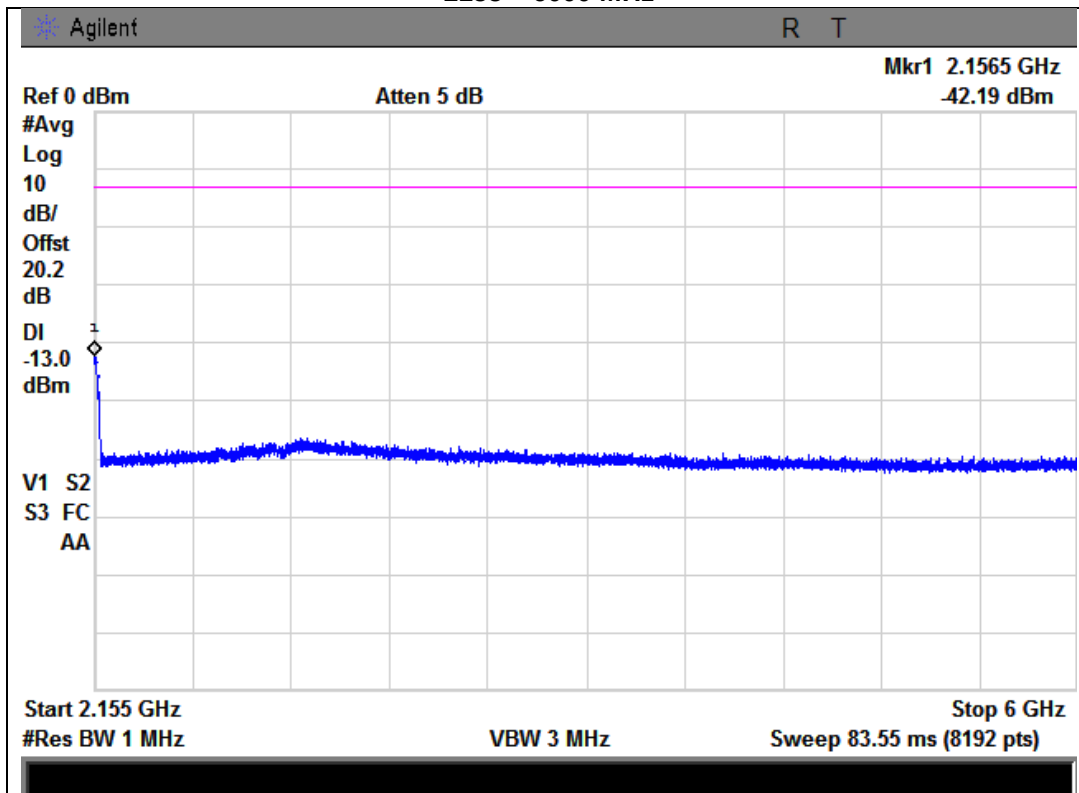


2110 - 2155 MHz Band

9 kHz – 2110 MHz

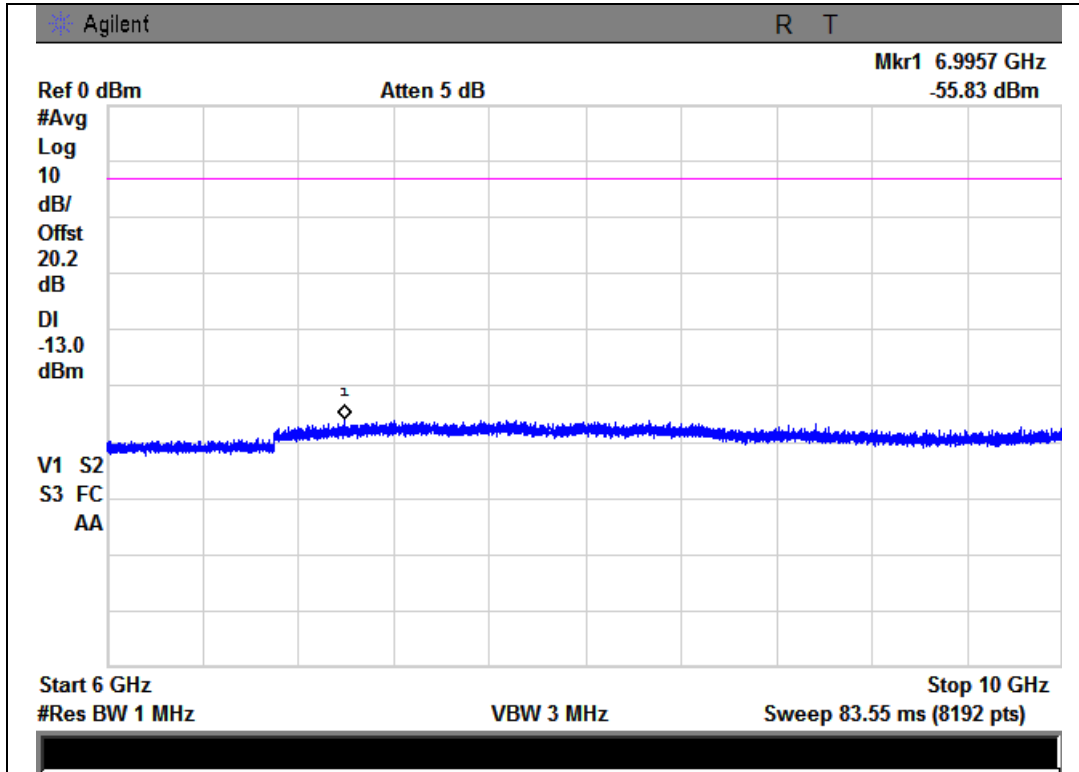


2155 – 6000 MHz

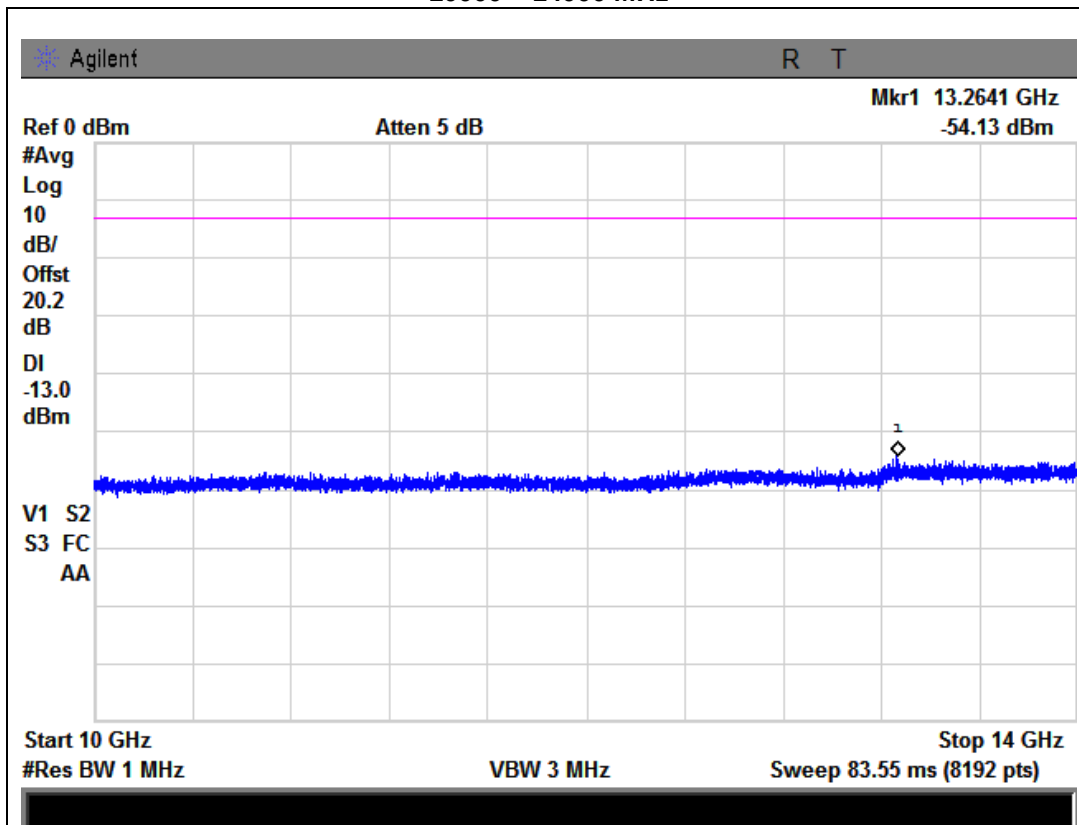




6000 – 10000 MHz

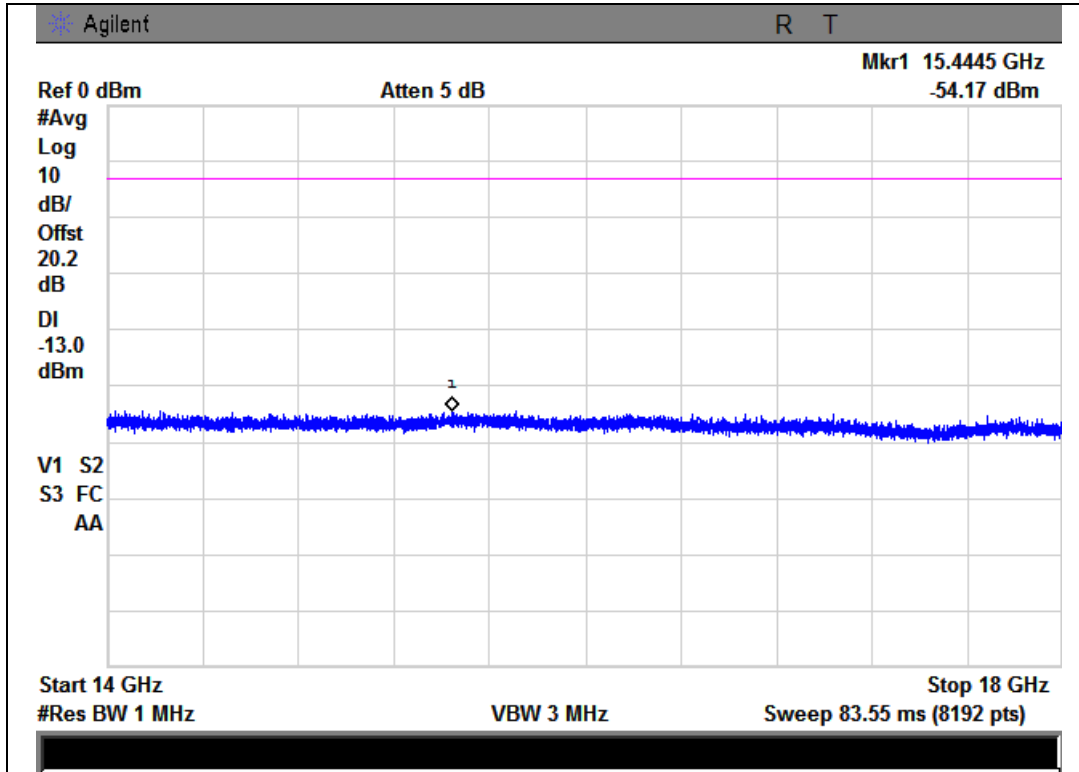


10000 – 14000 MHz

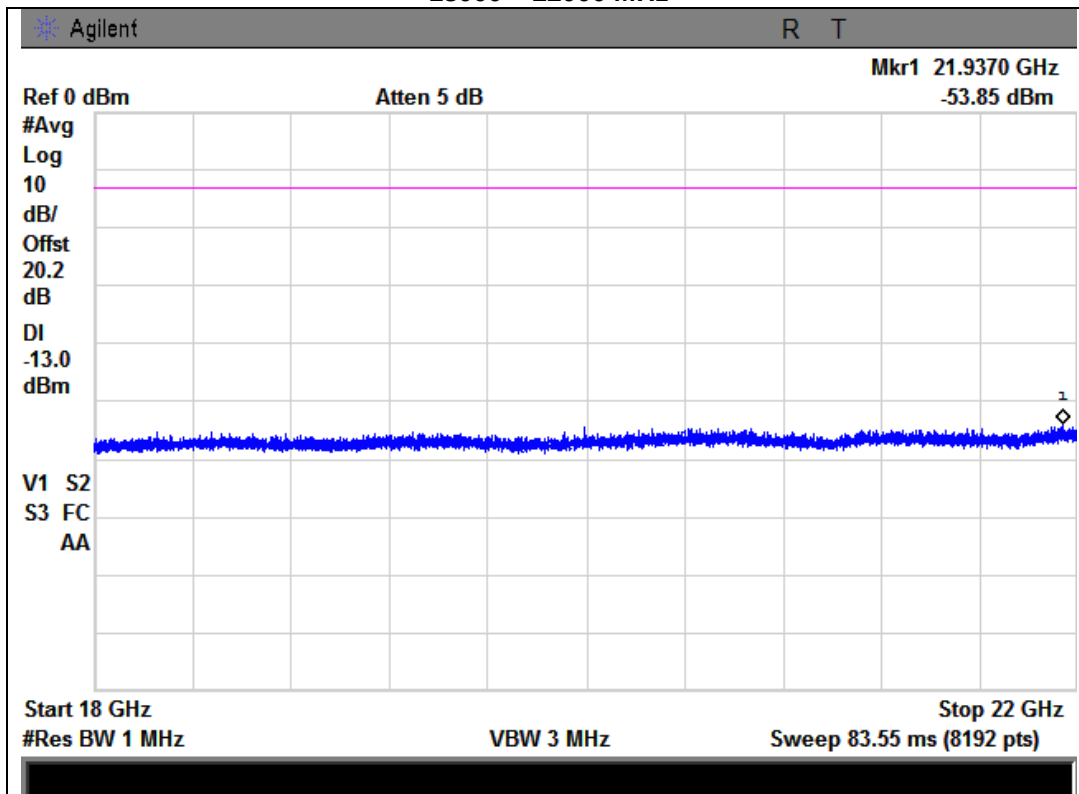




14000 – 18000 MHz



18000 – 22000 MHz





Noise Limits

Name of Test: Noise Limits
Test Equipment Utilized: i00413, SMU 200A - S/N:101369
E4407B - S/N:MY41444836

Engineer: Greg Corbin

Test Date: 7/29/2013

Test Procedure

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

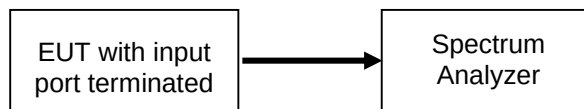
The following formulas are used for calculating the limits. Note – Downlink noise is calculated with the CF of the associated uplink band.

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

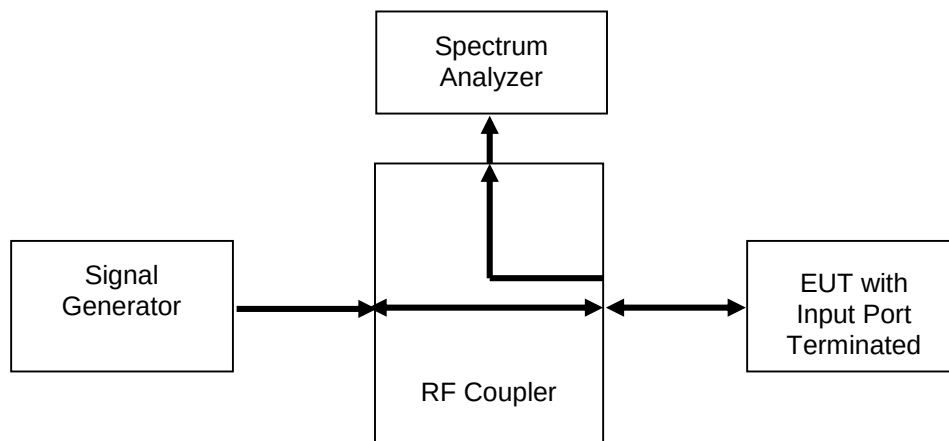
Variable Noise = $-103 \text{ dBm/MHz-RSSI}$

Test Setup

Maximum Noise Power



Variable Uplink Noise Power and Timing



Variable Downlink Noise Power and Timing





Maximum Uplink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
698 - 716	-49.5	-45.5	-4.0	Pass
777 - 787	-48.1	-44.6	-3.5	Pass
824 - 849	-47.7	-44.1	-3.6	Pass
1710 - 1755	-41	-37.7	-3.3	Pass
1850 - 1915	-39.8	-37.0	-2.8	Pass

Maximum Downlink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
728 - 746	-48.9	-45.5	-3.4	Pass
746 - 756	-49.2	-44.6	-4.6	Pass
869 - 894	-47.6	-44.1	-3.5	Pass
1930 - 1995	-41.3	-37.0	-4.3	Pass
2110 - 2155	-41.5	-37.7	-3.8	Pass

Uplink Noise Timing Test Results

Frequency Band (MHz)	Measured Timing (Seconds)	Limit (Seconds)	Result
698 - 716	0.48	3.0	Pass
777 - 787	0.38	3.0	Pass
824 - 849	0.30	3.0	Pass
1710 - 1755	0.40	3.0	Pass
1850 - 1915	0.45	3.0	Pass



Variable Uplink Noise Limit Test Results

698 - 716 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-73.0	-45.5	-49.8	-4.3
-72.0	-45.5	-49.8	-4.3
-71.0	-45.5	-49.8	-4.3
-70.0	-45.5	-49.8	-4.3
-53.0	-50.0	-55.5	-5.5
-46.0	-57.0	-62.2	-5.2

777 - 787 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-43.0	-60.0	-62.8	-2.8
-42.0	-61.0	-63.7	-2.7
-41.0	-62.0	-64.4	-2.4
-40.0	-63.0	-65.4	-2.4
-39.0	-64.0	-66.2	-2.2
-38.0	-65.0	-67.1	-2.1

824 - 849 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-66.0	-44.0	-47.8	-3.8
-65.0	-44.0	-47.9	-3.9
-64.0	-44.0	-47.8	-3.8
-63.0	-44.0	-47.9	-3.9
-62.0	-44.0	-48.5	-4.5
-61.0	-44.0	-49.5	-5.5

1710 - 1755 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-54.0	-49.0	-51.4	-2.4
-48.0	-55.0	-57.4	-2.4
-47.0	-56.0	-58.3	-2.3
-46.0	-57.0	-59.3	-2.3
-45.0	-58.0	-60.4	-2.4
-44.0	-59.0	-61.3	-2.3

1850 - 1915 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-47.0	-56.0	-58.3	-2.3
-46.0	-57.0	-59.5	-2.5
-45.0	-58.0	-60.3	-2.3
-44.0	-59.0	-61.4	-2.4
-43.0	-60.0	-62.5	-2.5
-42.0	-61.0	-63.2	-2.2



Variable Downlink Noise Limit Test Results

728 - 746 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-66.0	-45.5	-47.7	-2.2
-65.0	-45.5	-47.6	-2.1
-64.0	-45.5	-47.7	-2.2
-63.0	-45.5	-47.7	-2.2
-62.0	-45.5	-48.1	-2.6
-61.0	-45.5	-49.4	-3.9

746 - 756 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-83.0	-44.6	-48.5	-3.9
-82.0	-44.6	-48.5	-3.9
-81.0	-44.6	-48.5	-3.9
-63.0	-44.6	-48.5	-3.9
-44.0	-59.0	-63.4	-4.4
-40.0	-63.0	-67.1	-4.1

869 - 894 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-81.0	-44.0	-47.2	-3.2
-69.0	-44.0	-47.2	-3.2
-68.0	-44.0	-47.3	-3.3
-67.0	-44.0	-47.3	-3.3
-66.0	-44.0	-48.0	-4.0
-65.0	-44.0	-48.9	-4.9

1930 - 1995 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-82.0	-37.0	-40.5	-3.5
-81.0	-37.0	-40.5	-3.5
-70.0	-37.0	-40.4	-3.4
-69.0	-37.0	-40.4	-3.4
-68.0	-37.0	-40.9	-3.9
-44.0	-59.0	-63.4	-4.4

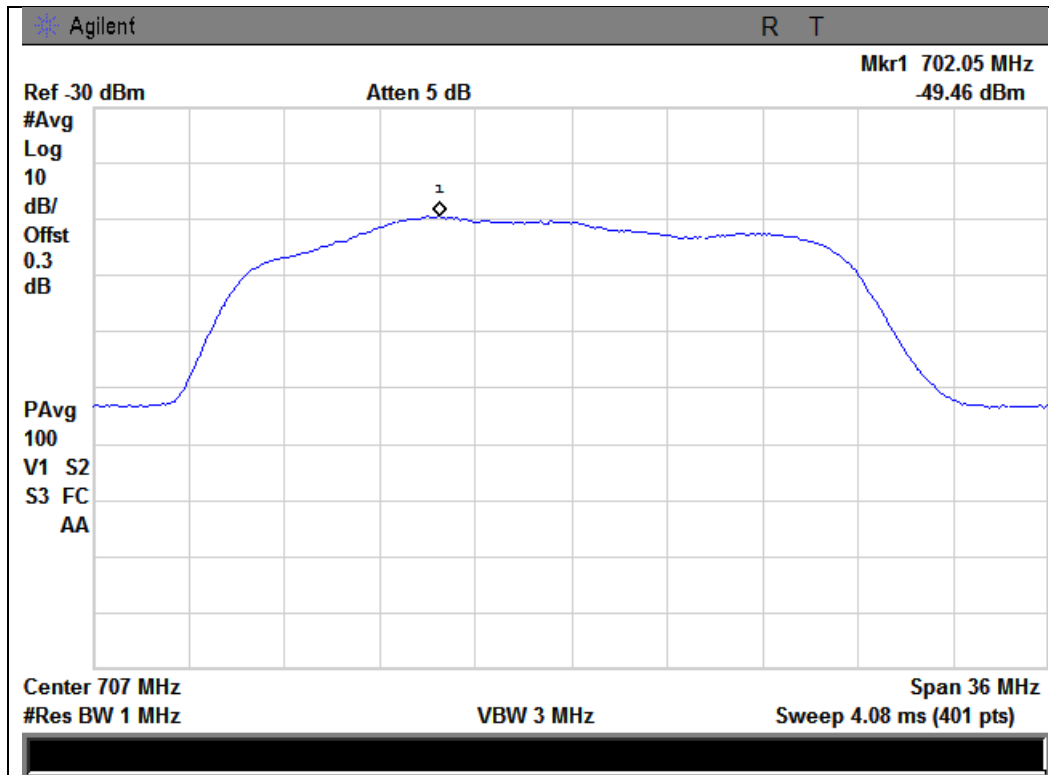
2110 - 2155 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-75.0	-37.7	-40.6	-2.9
-74.0	-37.7	-40.3	-2.6
-73.0	-37.7	-40.5	-2.8
-72.0	-37.7	-40.6	-2.9
-70.0	-37.7	-42.5	-4.8
-69.0	-37.7	-43.3	-5.6

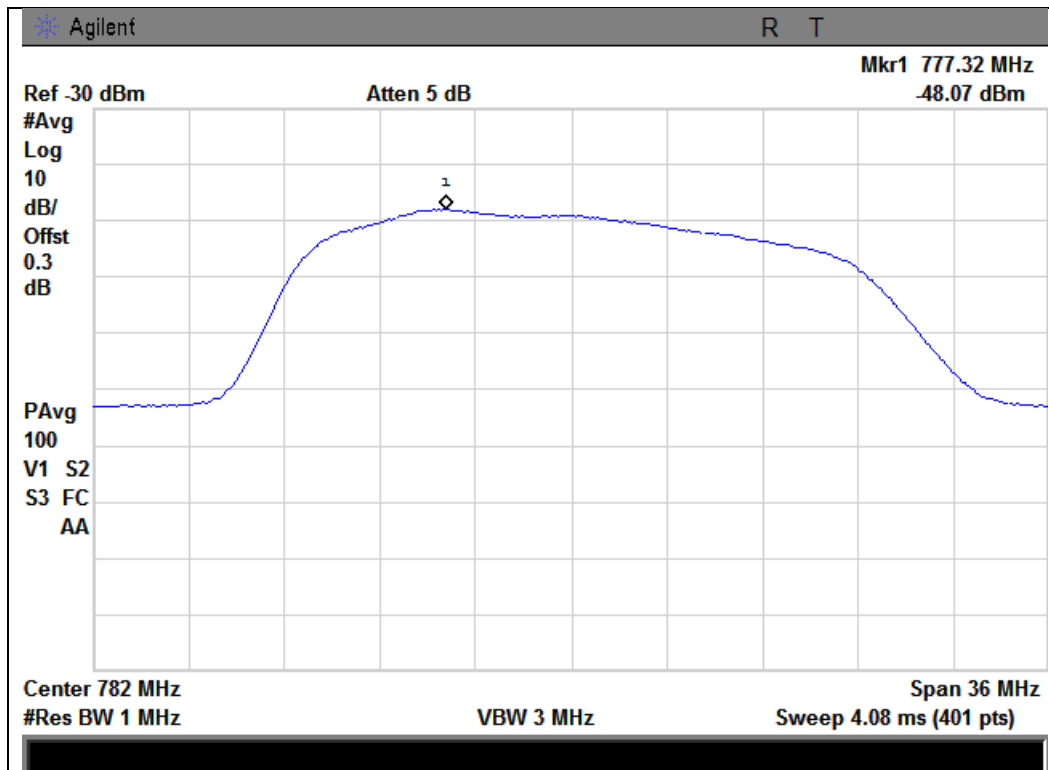


Maximum Uplink Noise Test Plots

698 - 716 MHz Band

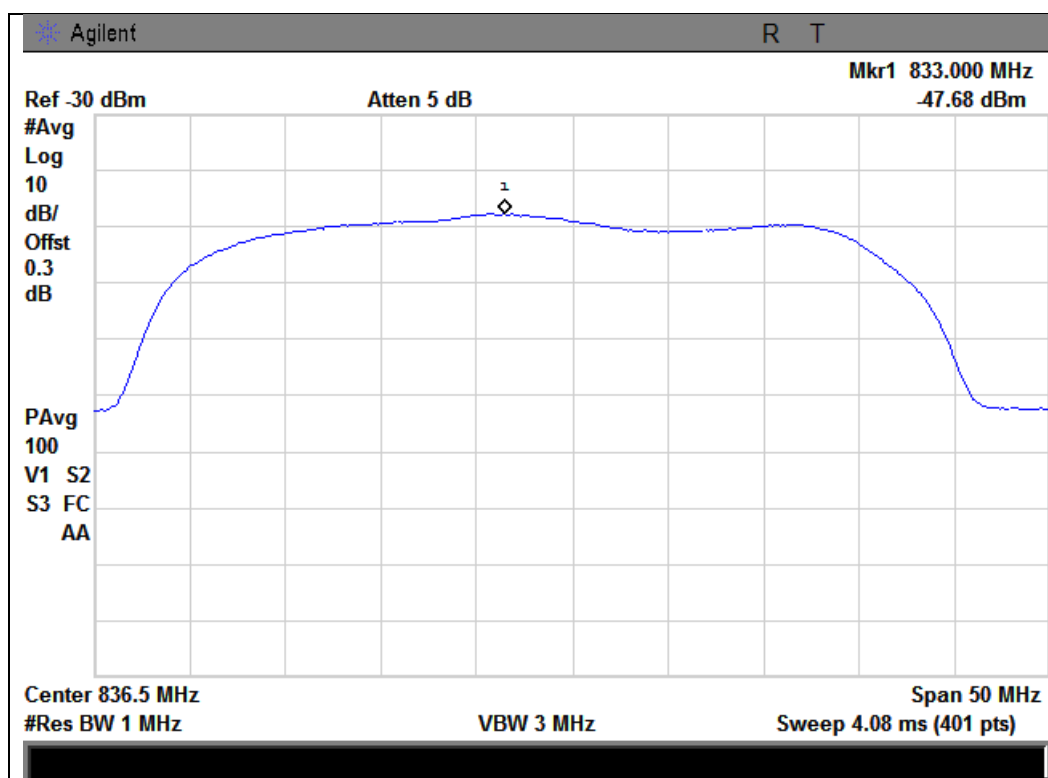


777 - 787 MHz Band

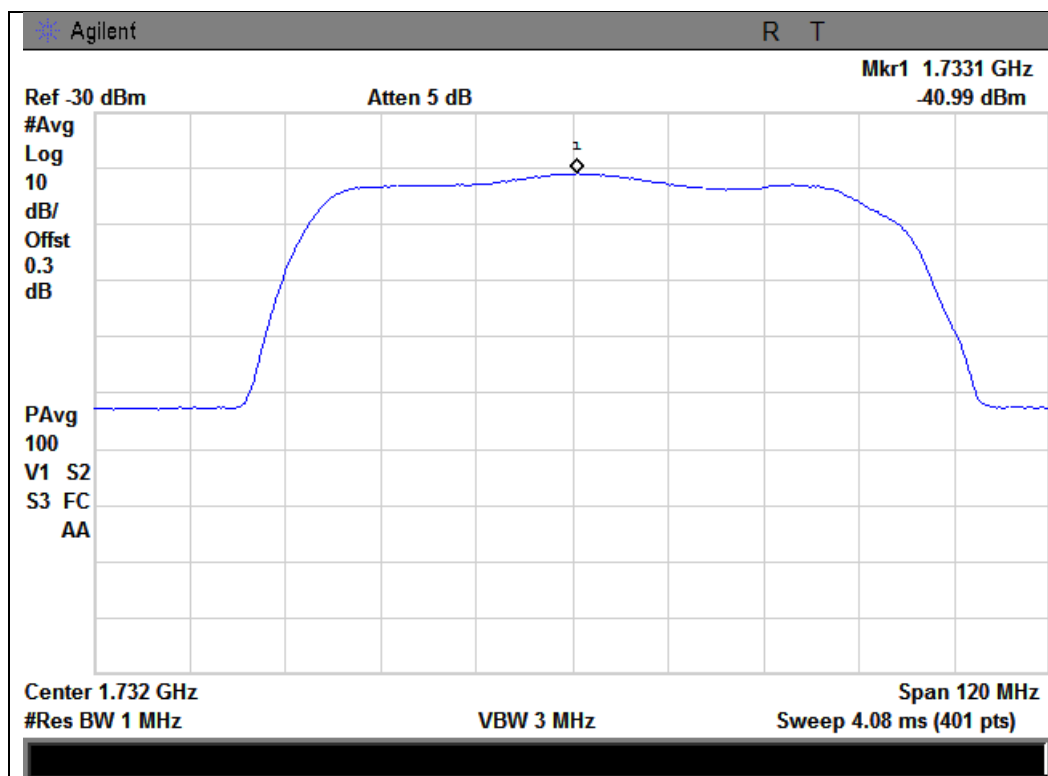




824 - 849 MHz Band

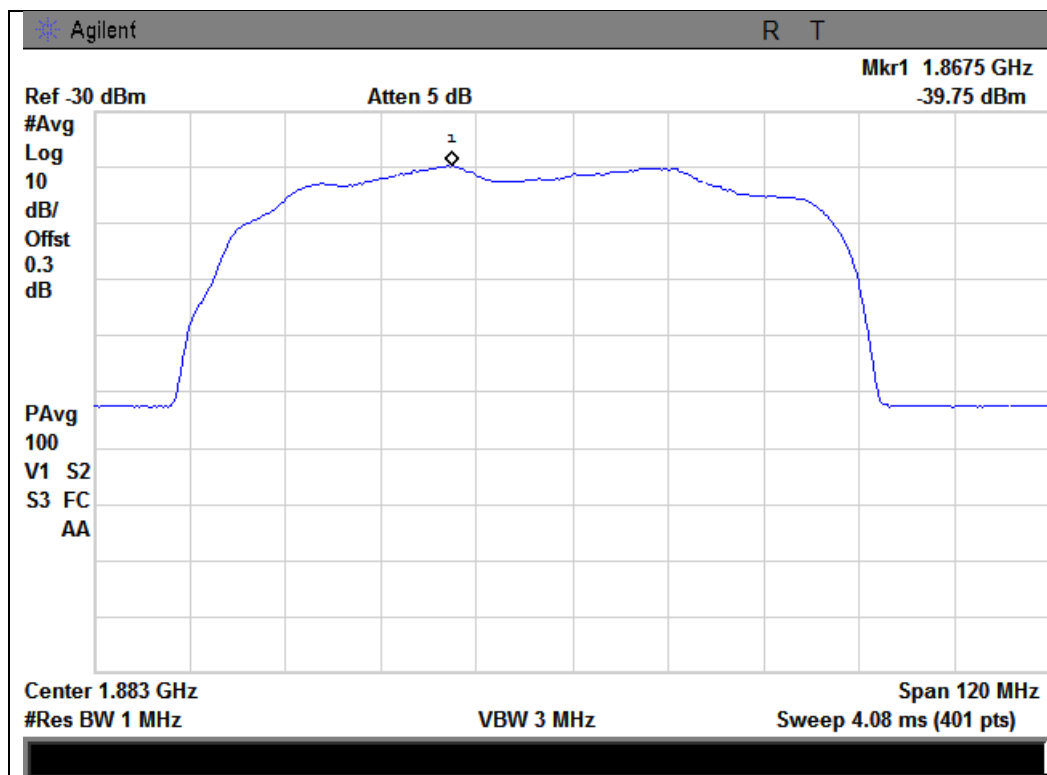


1710 - 1755 MHz Band



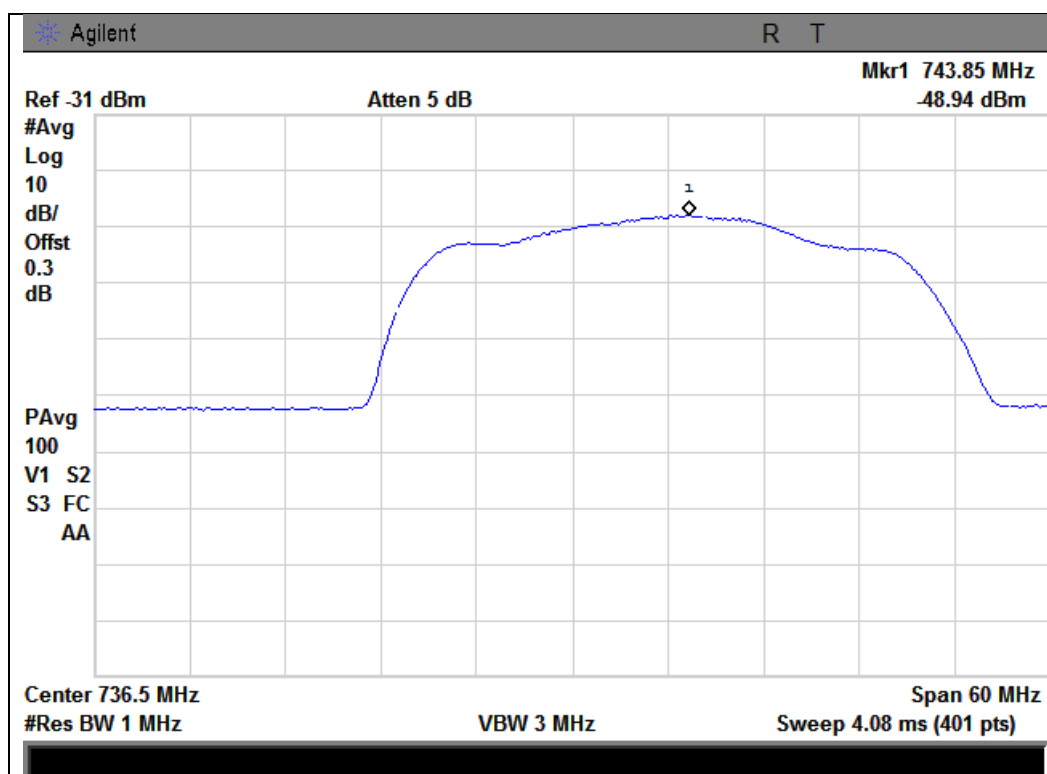


1850 - 1915 MHz Band



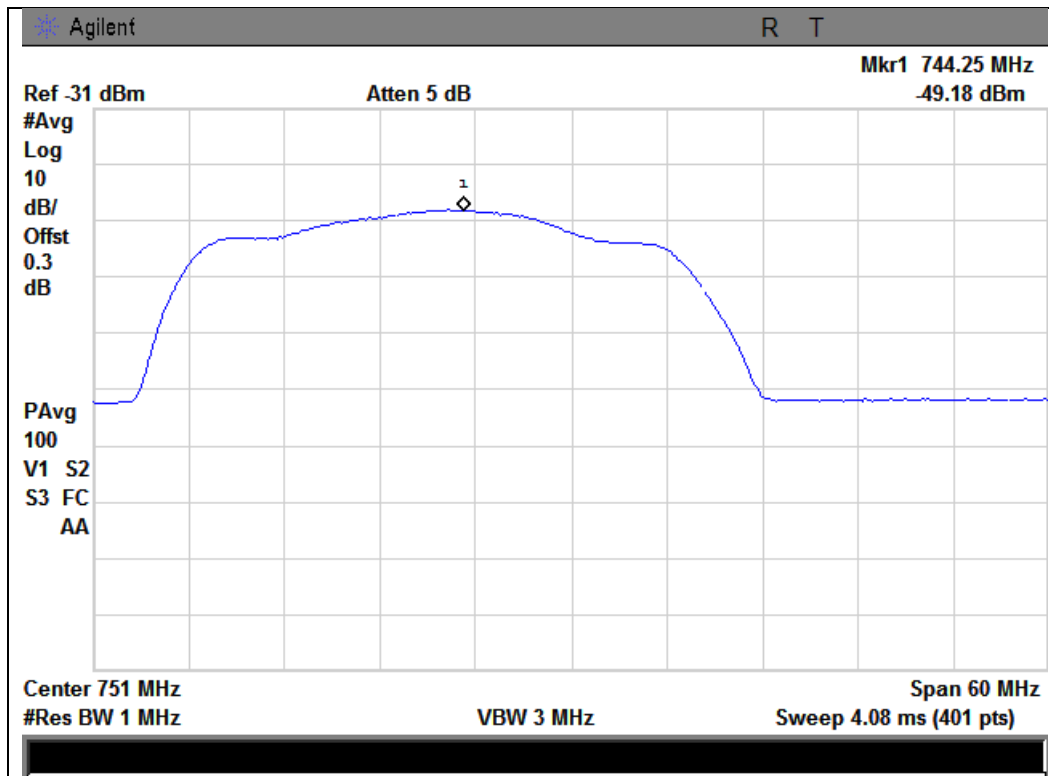
Maximum Downlink Noise Test Plots

728 - 746 MHz Band

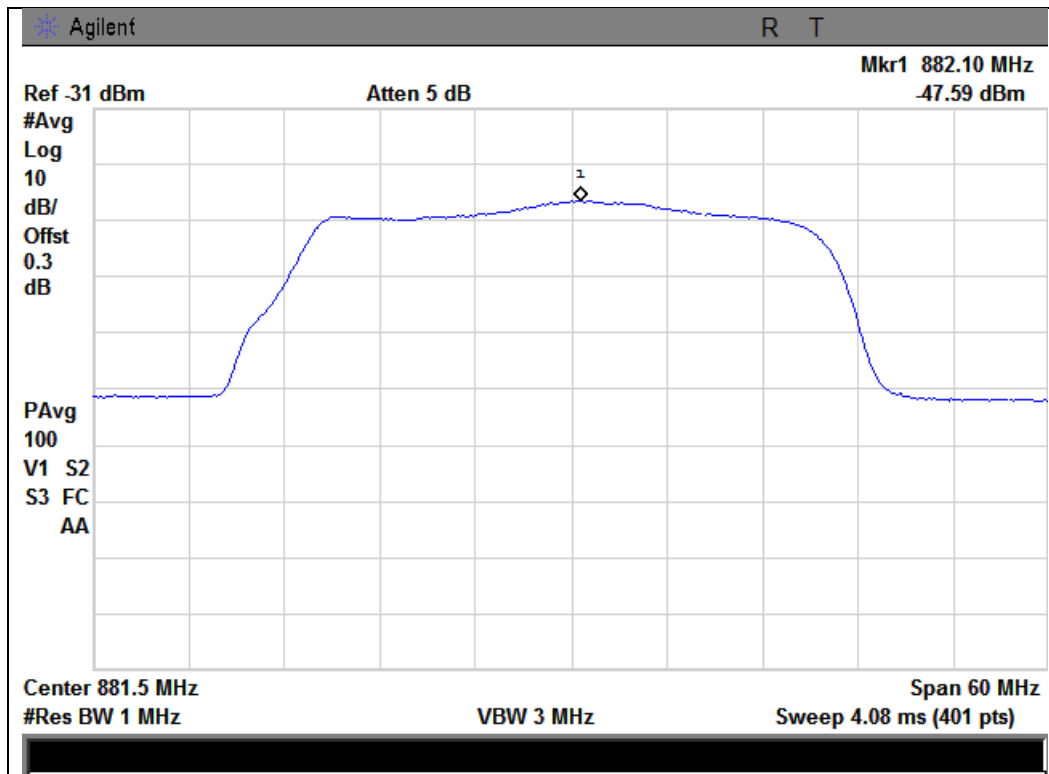




746 - 756 MHz Band

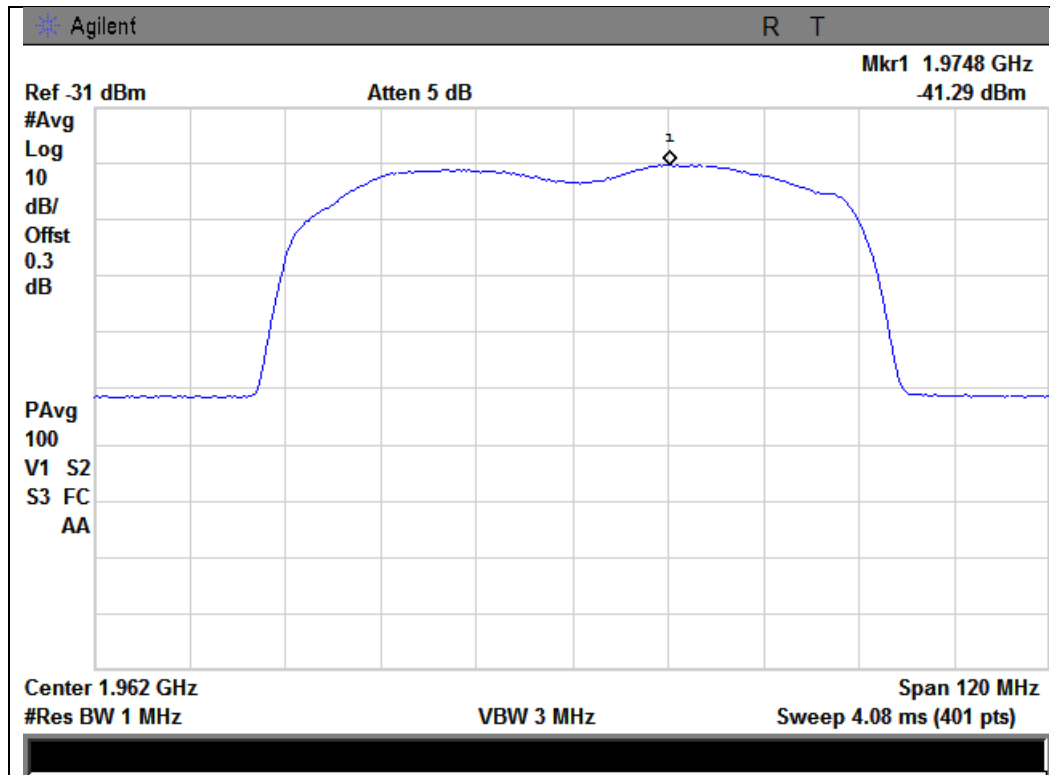


869 - 894 MHz Band

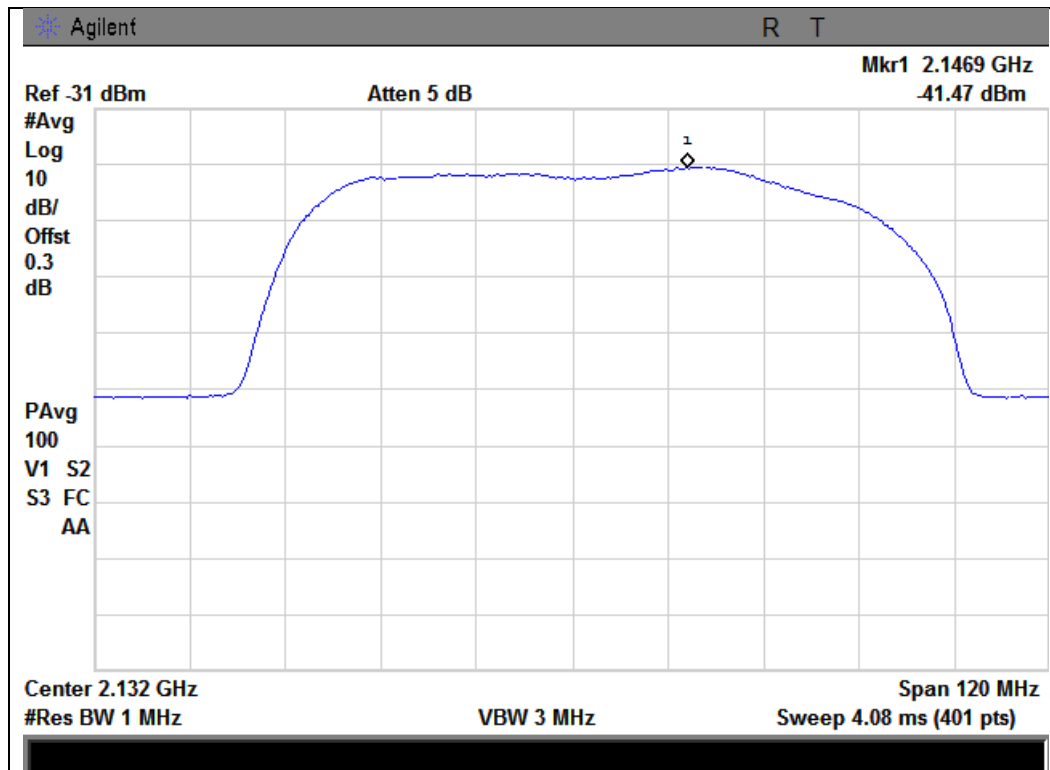




1930 - 1995 MHz Band



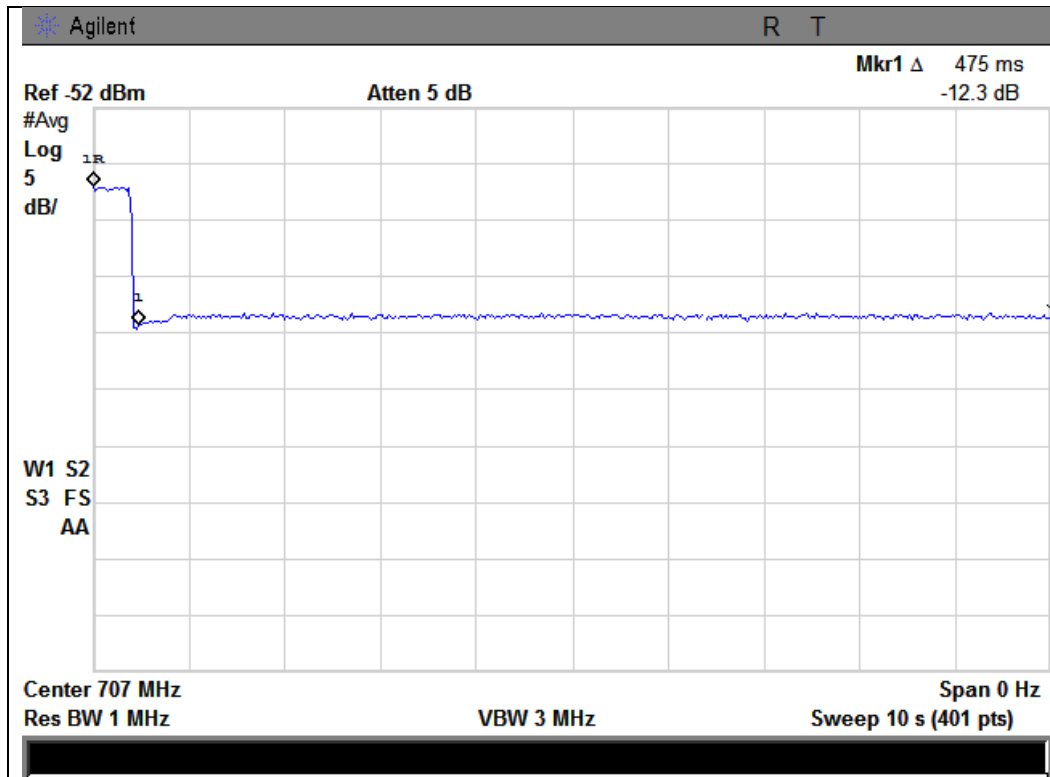
2110 - 2155 MHz Band



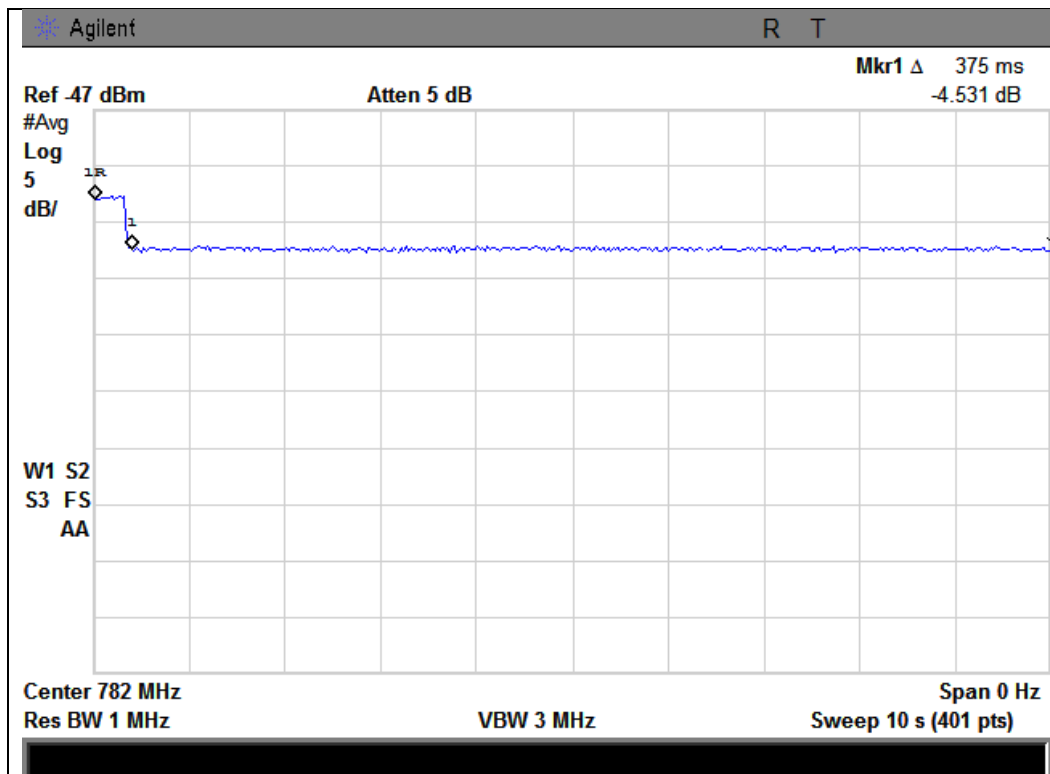


Uplink Noise Timing Test Plots

698 - 716 MHz Band

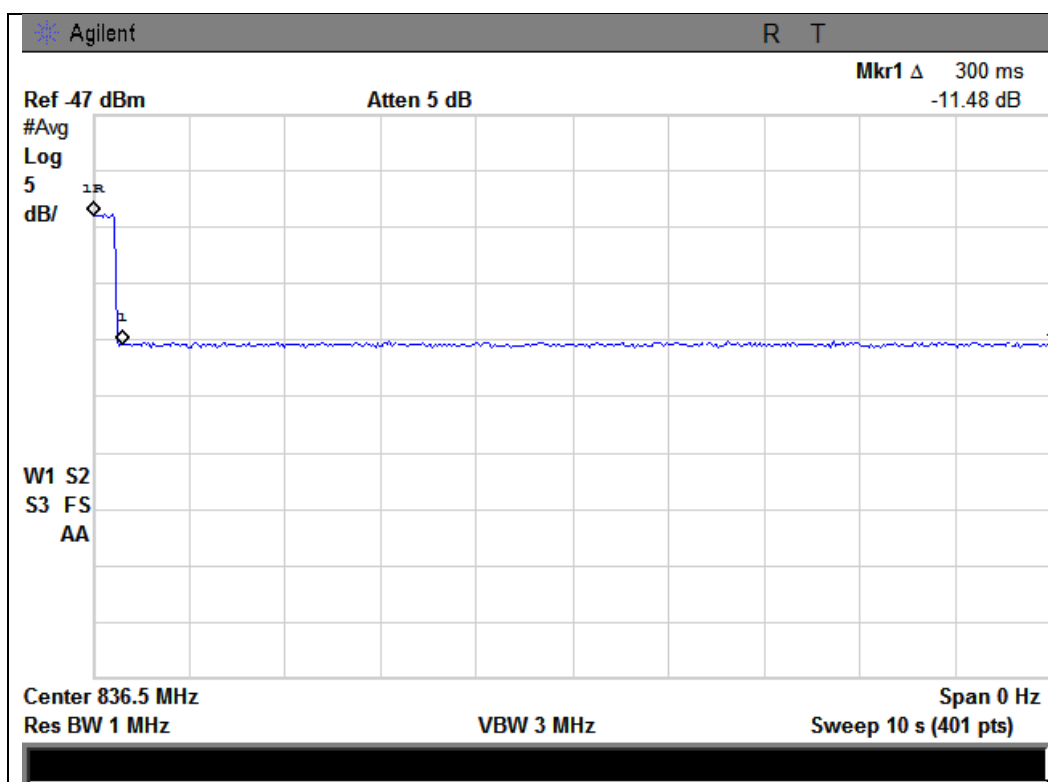


777 - 787 MHz Band

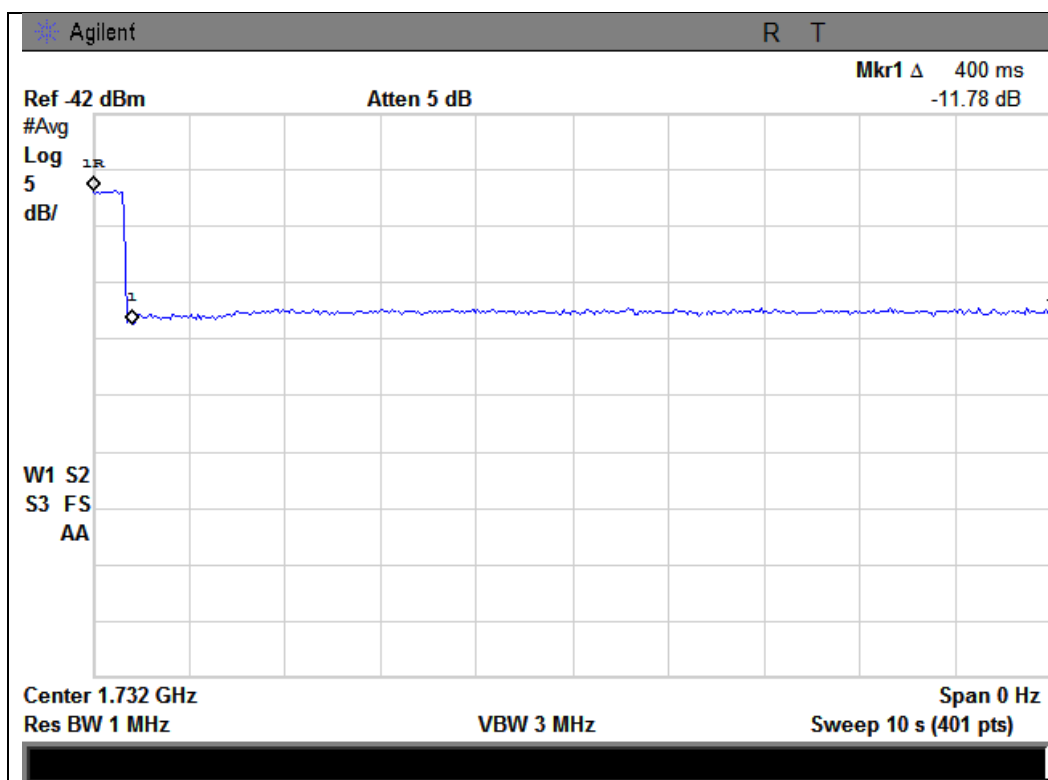




824 - 849 MHz Band

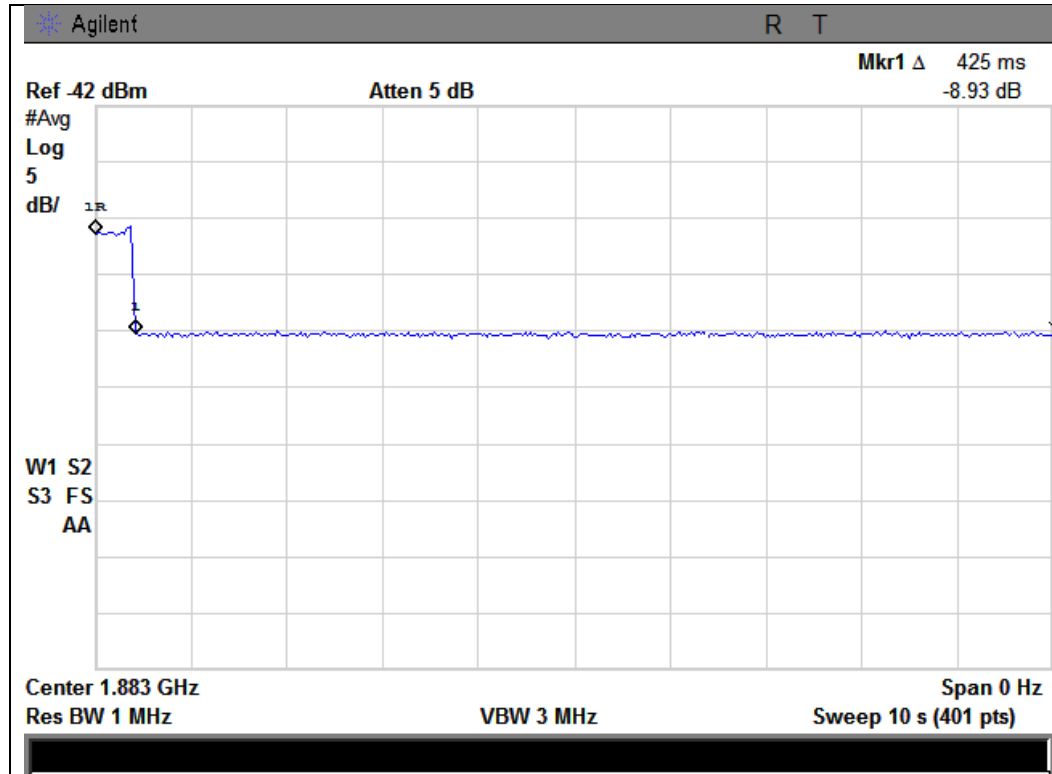


1710 - 1755 MHz Band





1850 - 1915 MHz Band





Uplink Inactivity

Name of Test: Uplink Inactivity

Engineer: Greg Corbin

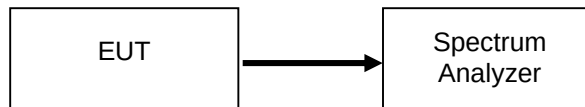
Test Equipment Utilized: E4407B - S/N:MY41444836

Test Date: 7/23/2013

Test Procedure

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

Test Setup



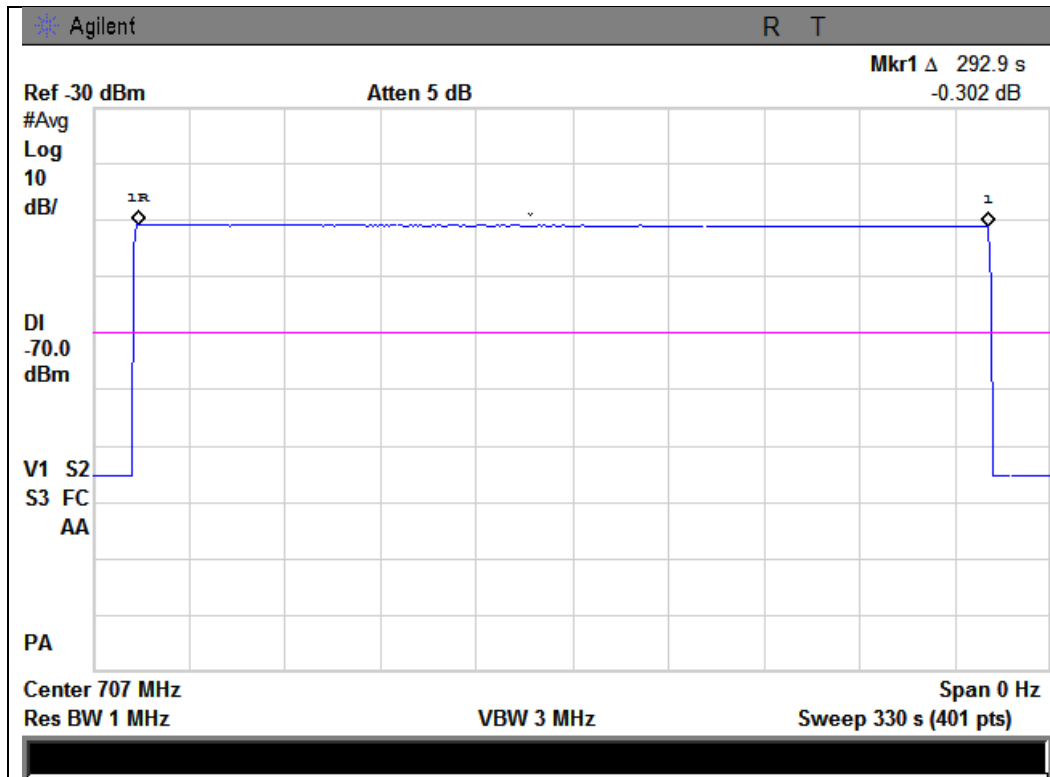
Uplink Test Results

Frequency Band (MHz)	Measured Time (Seconds)	Limit (Seconds)	Result
698 - 716	292.9	300	Pass
777 - 787	293.7	300	Pass
824 - 849	292.9	300	Pass
1710 - 1755	292.9	300	Pass
1850 - 1915	292.9	300	Pass

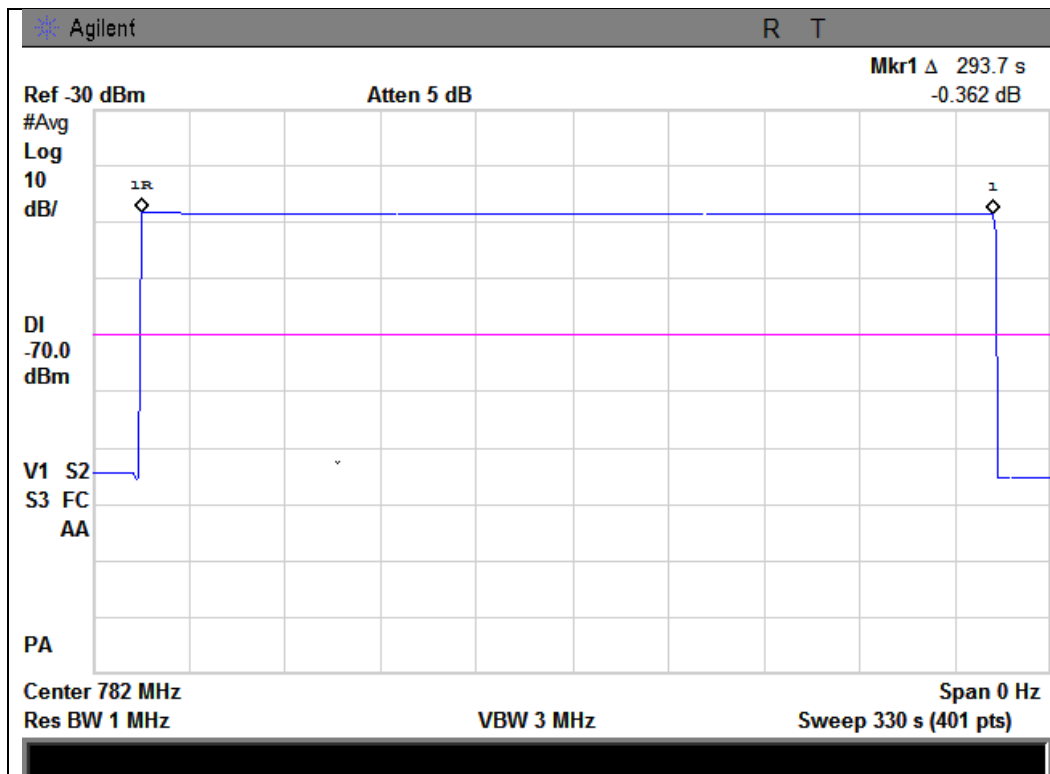


Uplink Inactivity Test Results

698 - 716 MHz

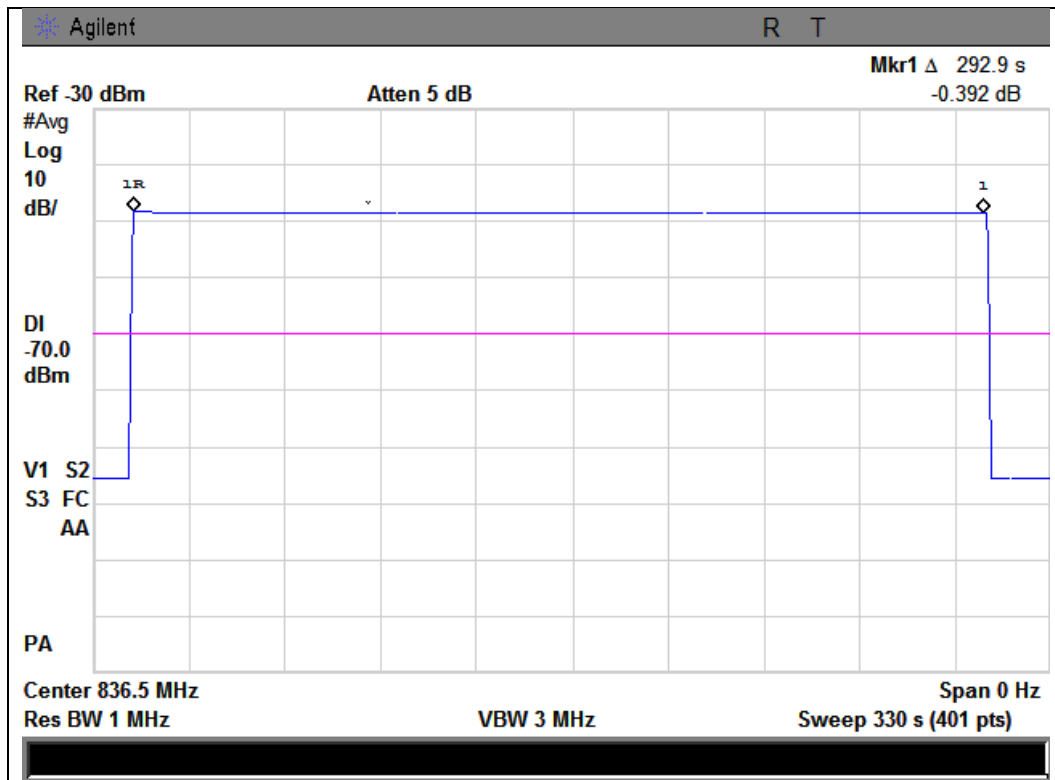


777 - 787 MHz

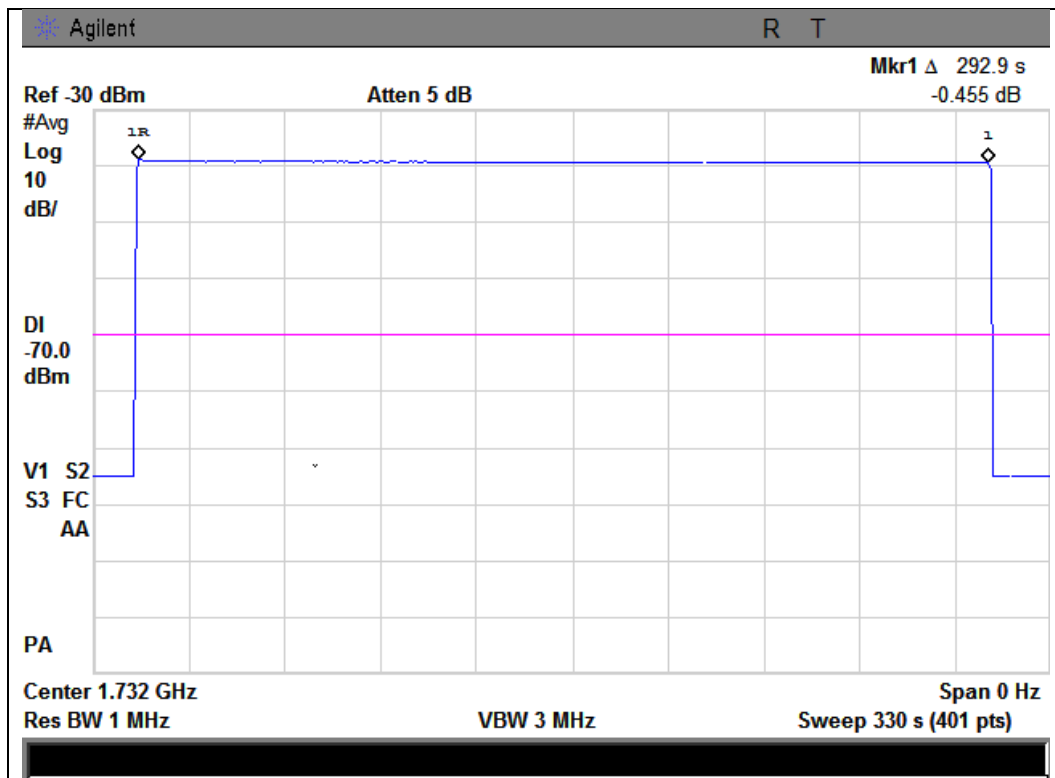




824 - 849 MHz

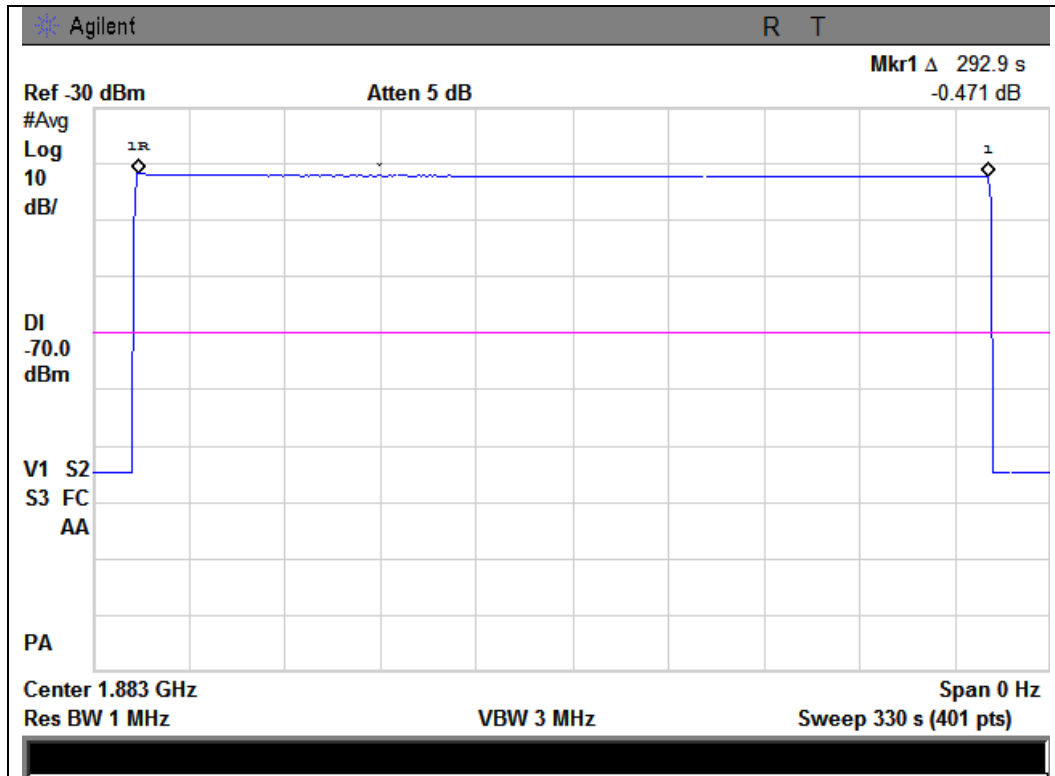


1710 - 1755 MHz





1850 - 1915 MHz





Variable Gain

Name of Test: Variable Gain
Test Equipment Utilized: i00413, SMU 200A - S/N:101369
E4407B - S/N:MY41444836

Engineer: Greg Corbin

Test Date: 8/2/2013

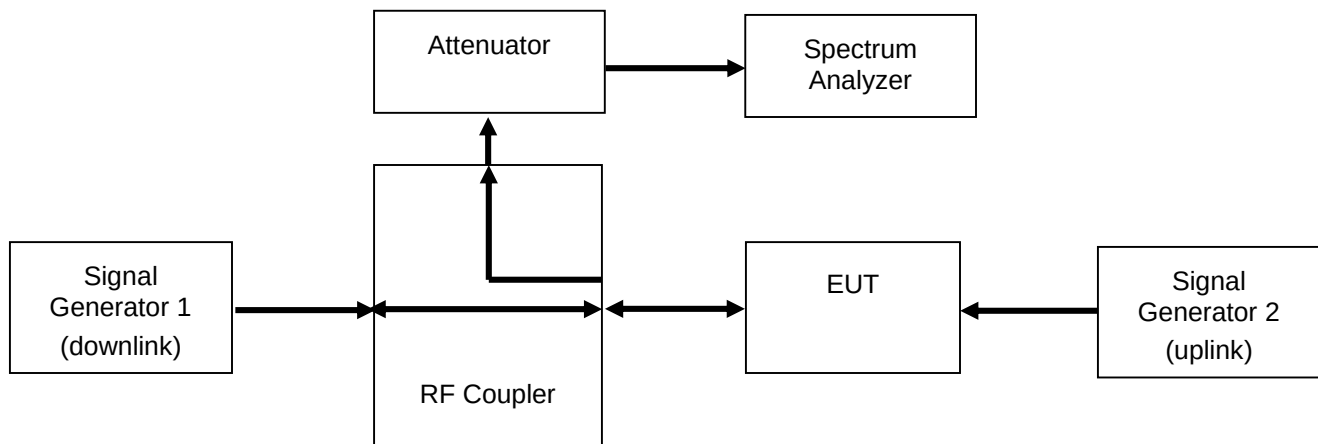
Test Procedure

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

Test Setup





Uplink Test Results

698 - 716 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-60.0	34.9	60.9	-43.3	16.8	60.1	-0.8
-59.0	34.9	59.9	-43.3	15.6	58.9	-1.0
-43.0	34.9	43.9	-43.3	-0.4	42.9	-1.0
-42.0	34.9	42.9	-43.3	-1.5	41.8	-1.1
-41.0	34.9	41.9	-43.3	-2.5	40.8	-1.1
-40.0	34.9	40.9	-43.3	-3.5	39.8	-1.1

777 - 787 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-37	35.8	38.8	-40.7	-2.1	38.6	-0.2
-53	35.8	54.8	-40.7	13.8	54.5	-0.3
-51	35.8	52.8	-40.7	11.8	52.5	-0.3
-48.0	35.8	49.8	-40.7	8.8	49.5	-0.3
-47.0	35.8	48.8	-40.7	7.8	48.5	-0.3
-46.0	35.8	47.8	-40.7	6.8	47.5	-0.3

824 - 849 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-74.0	36.2	65.0	-44.8	19.2	64.0	-1.0
-73.0	36.2	65.0	-44.8	19.2	64.0	-1.0
-72.0	36.2	65.0	-44.8	19.2	64.0	-1.0
-71.0	36.2	65.0	-44.8	19.2	64.0	-1.0
-61.0	36.2	63.2	-44.8	16.9	61.7	-1.5
-60.0	36.2	62.2	-44.8	15.9	60.7	-1.5

1710 - 1755 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-53	40.5	59.5	-49.4	6.3	55.7	-3.8
-51	40.5	57.5	-49.4	4.3	53.7	-3.8
-66	40.5	71.0	-49.4	17.7	67.1	-3.9
-54	40.5	60.5	-49.4	7.2	56.6	-3.9
-52	40.5	58.5	-49.4	5.2	54.6	-3.9
-43	40.5	49.5	-49.4	-3.8	45.6	-3.9

1850 - 1915 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-71	41.2	72.0	-52.8	16.2	69.0	-3.0
-70	41.2	72.0	-52.8	16.2	69.0	-3.0
-67	41.2	72.0	-52.8	16.1	68.9	-3.1
-66	41.2	72.0	-52.8	16.1	68.9	-3.1
-49	41.2	56.2	-52.8	-0.5	52.3	-3.9
-43	41.2	50.2	-52.8	-6.5	46.3	-3.9



Occupied Bandwidth

Name of Test: Occupied Bandwidth
Test Equipment Utilized: SMU 200A - S/N:101369
E4407B - S/N:MY41444836

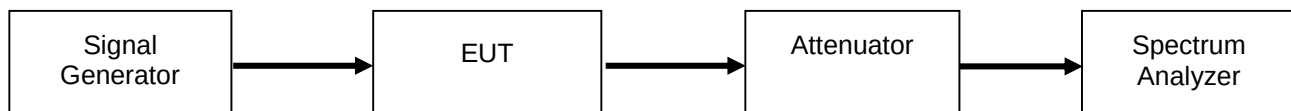
Engineer: Greg Corbin

Test Date: 7/22/2013

Test Procedure

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

Test Setup

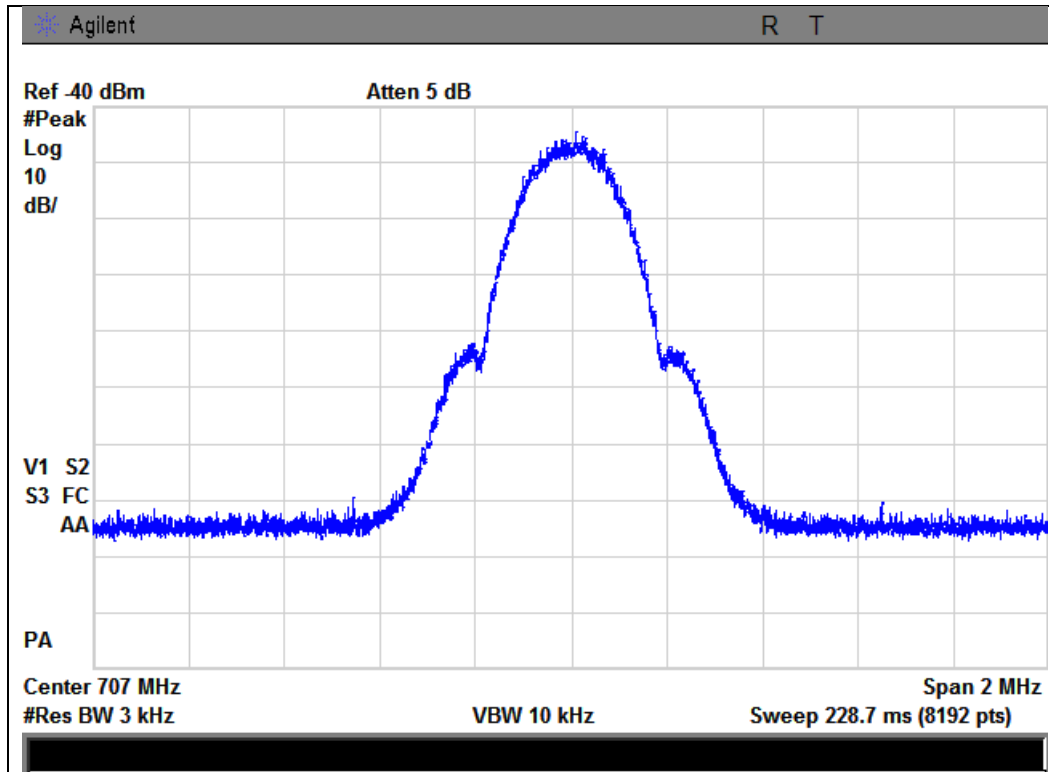




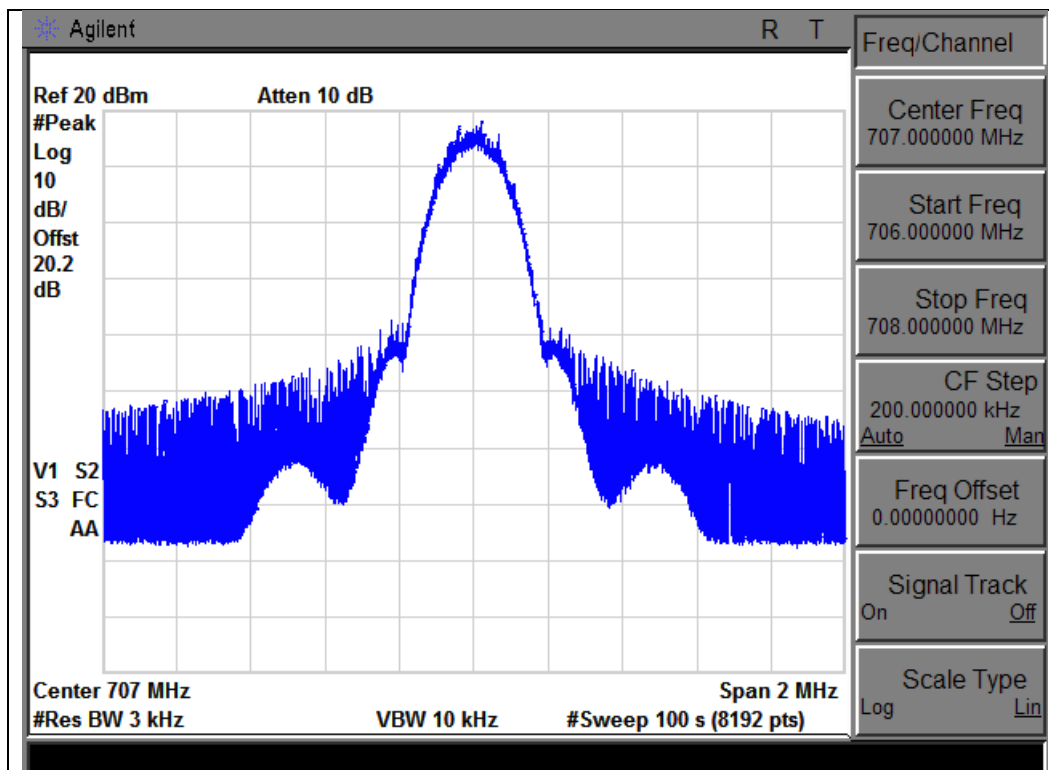
GSM Uplink Test Plots

698 - 716 MHz Band

Input



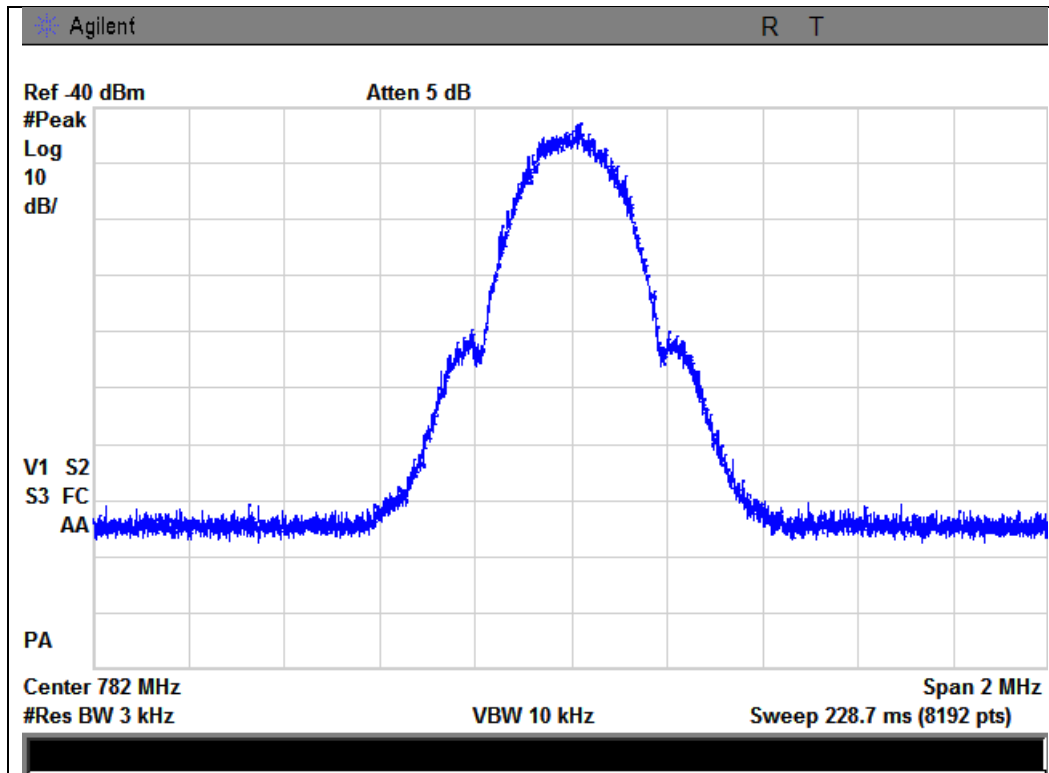
Output



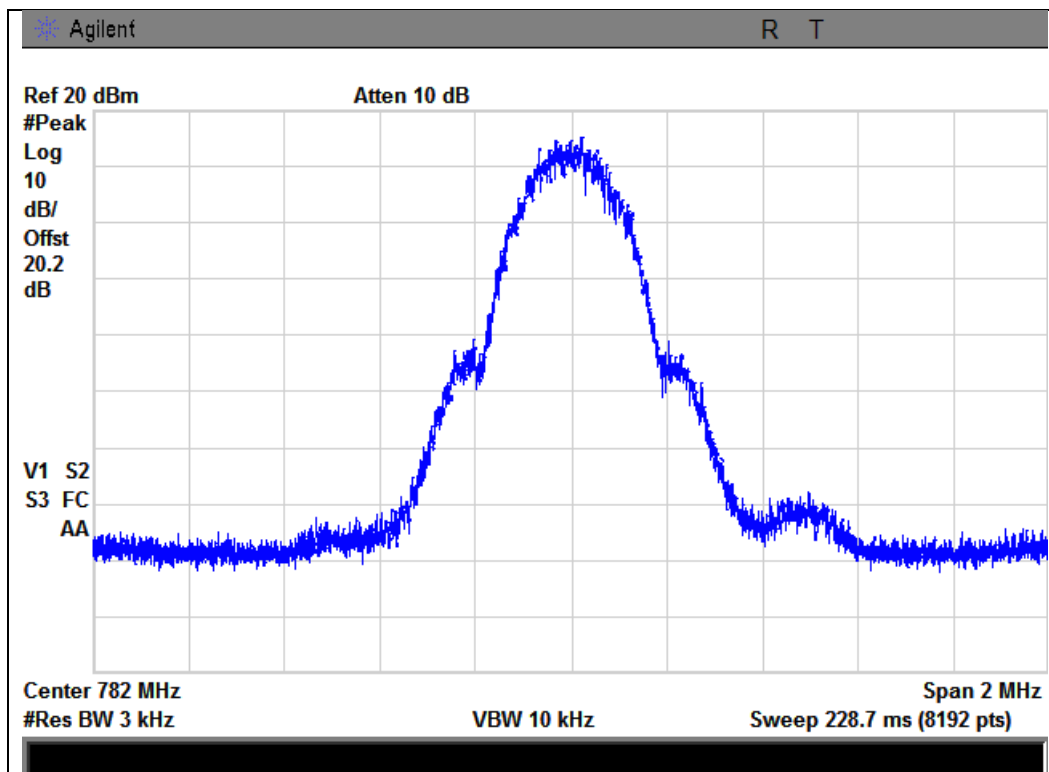


777 - 787 MHz Band

Input



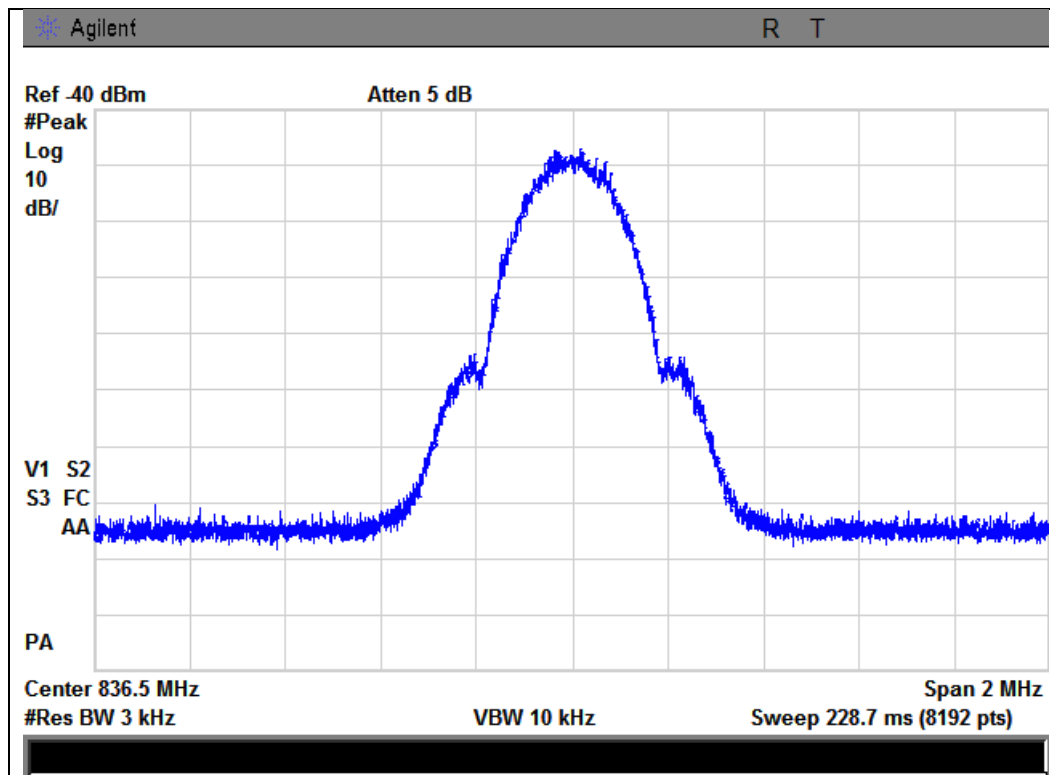
Output



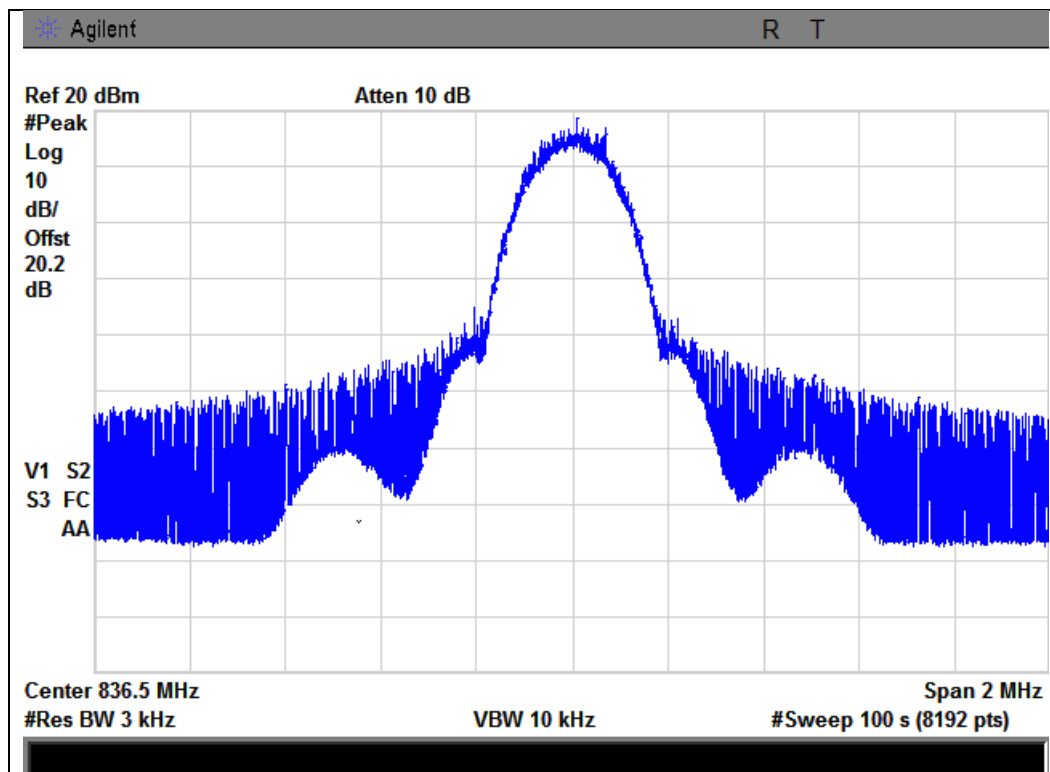


824 - 849 MHz Band

Input



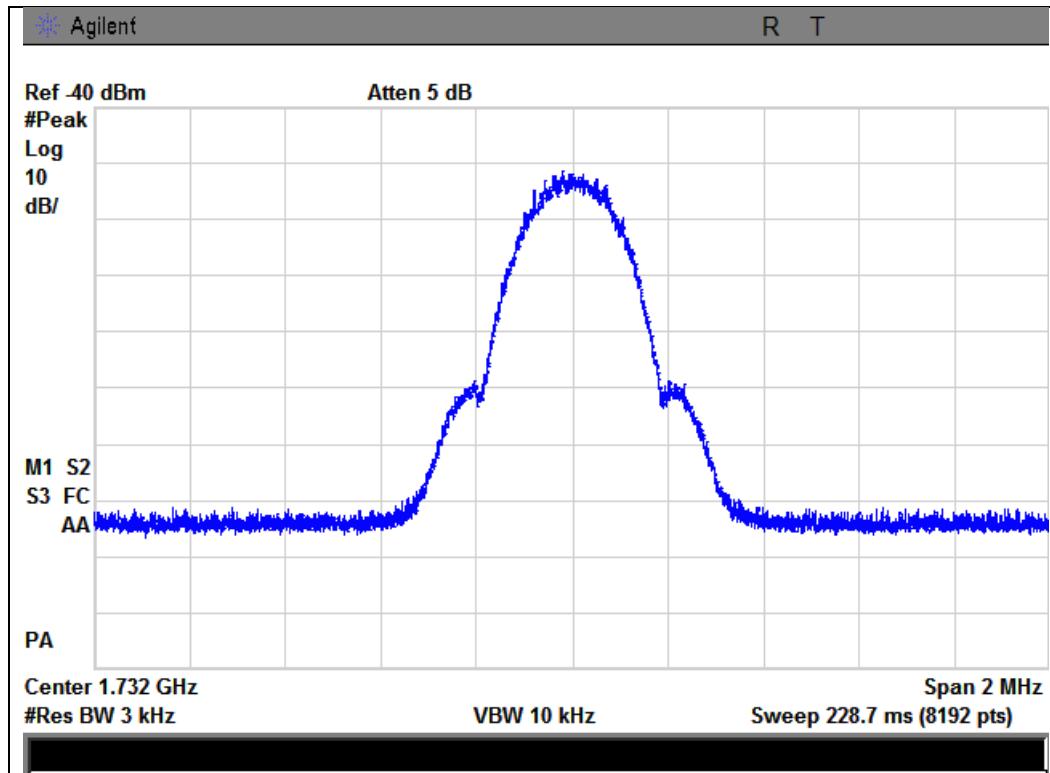
Output



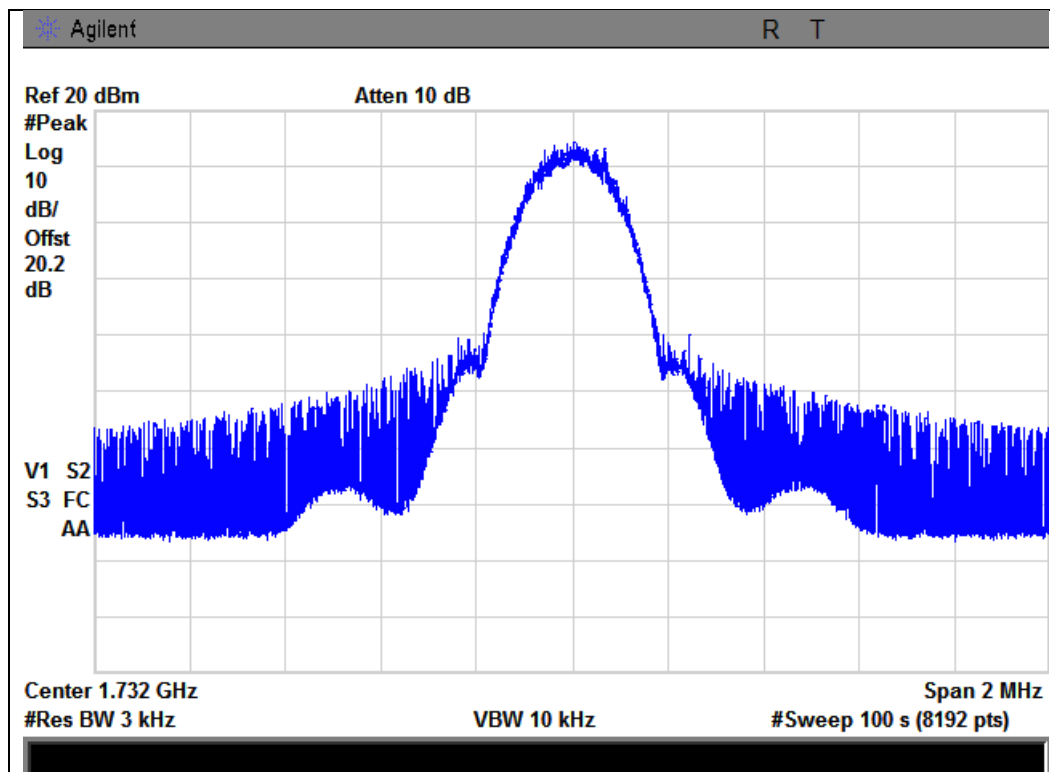


1710 - 1755 MHz Band

Input



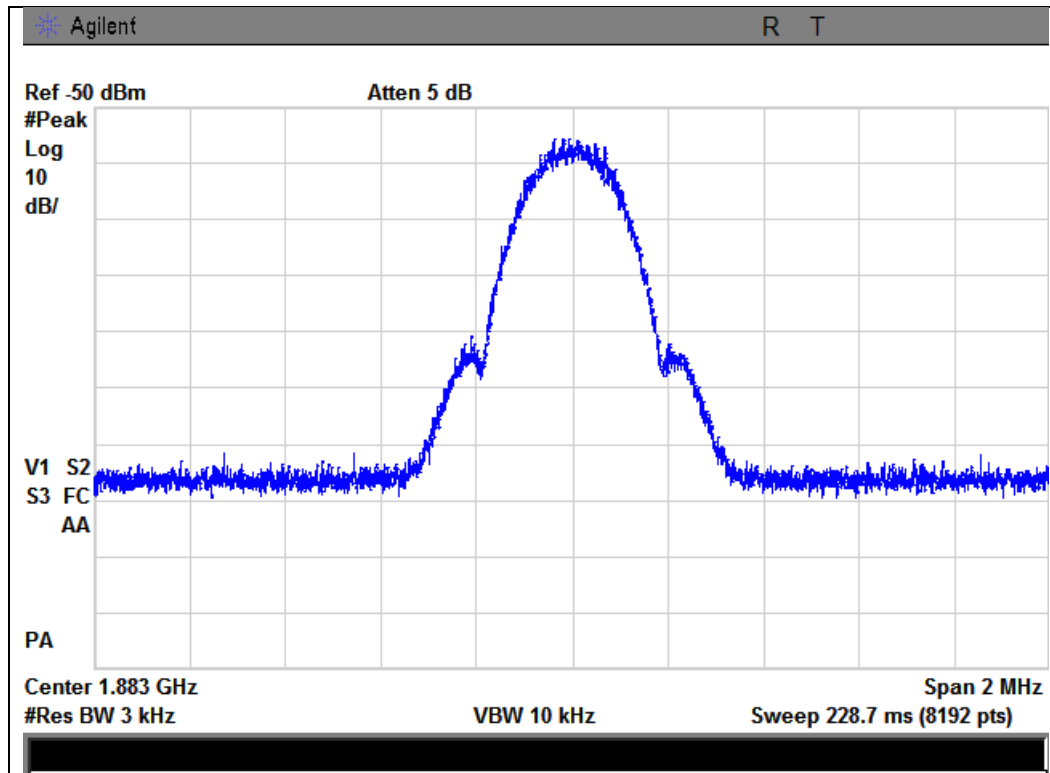
Output



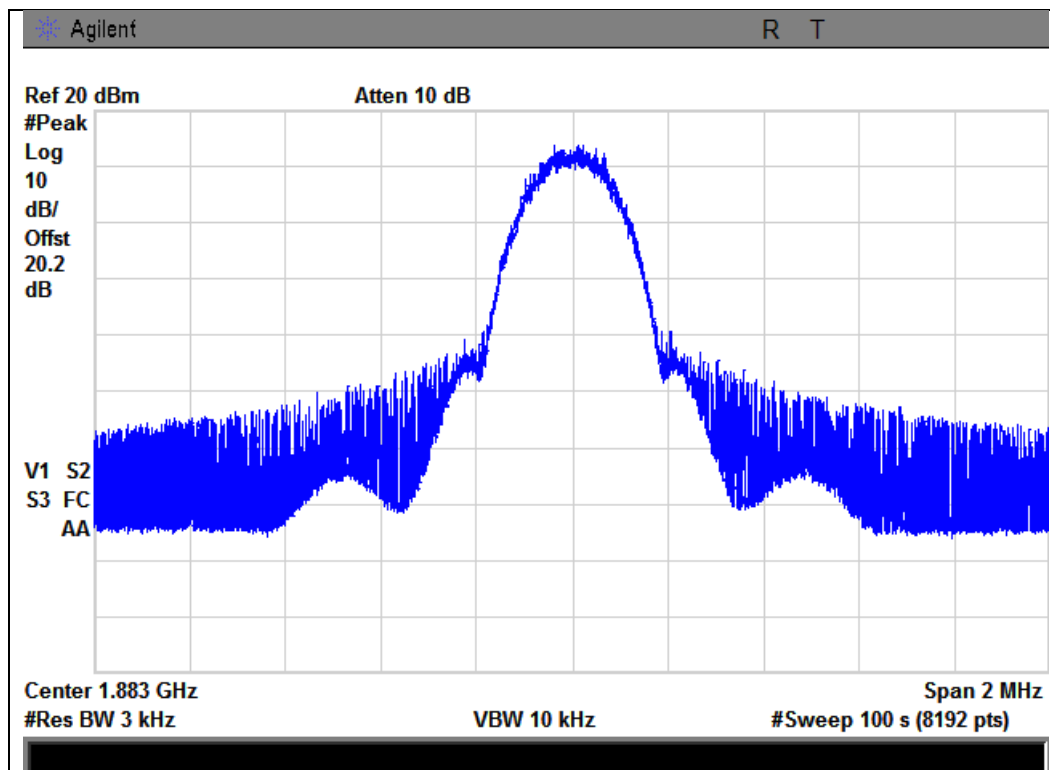


1850 - 1915 MHz Band

Input



Output

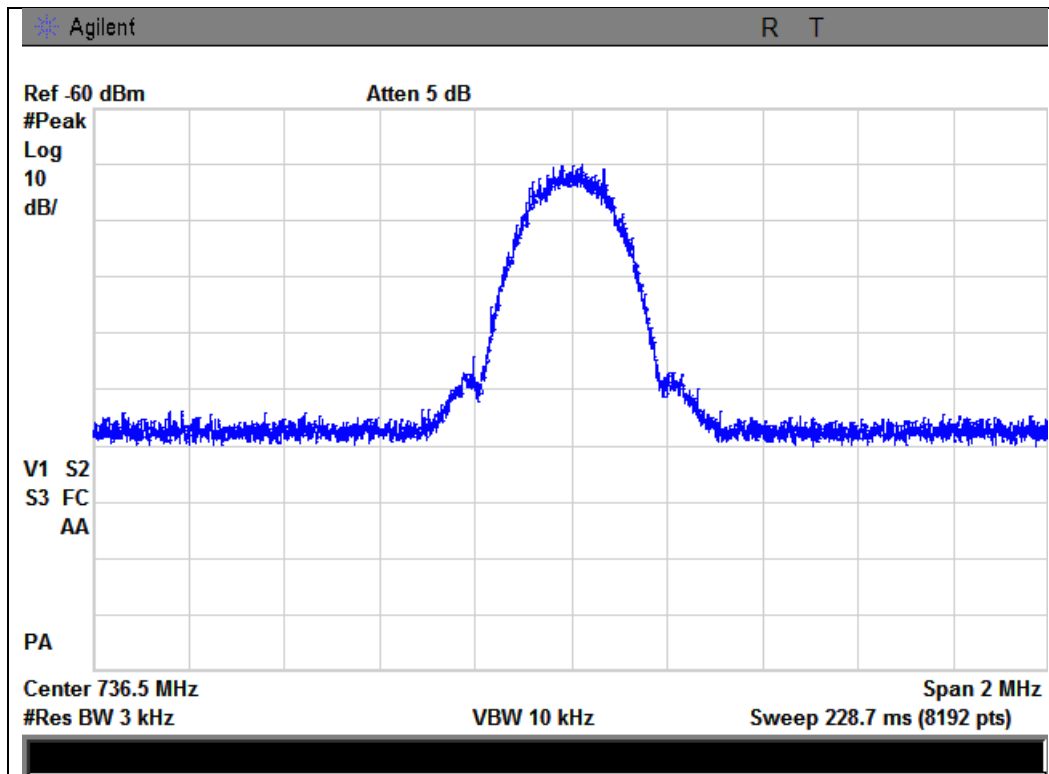




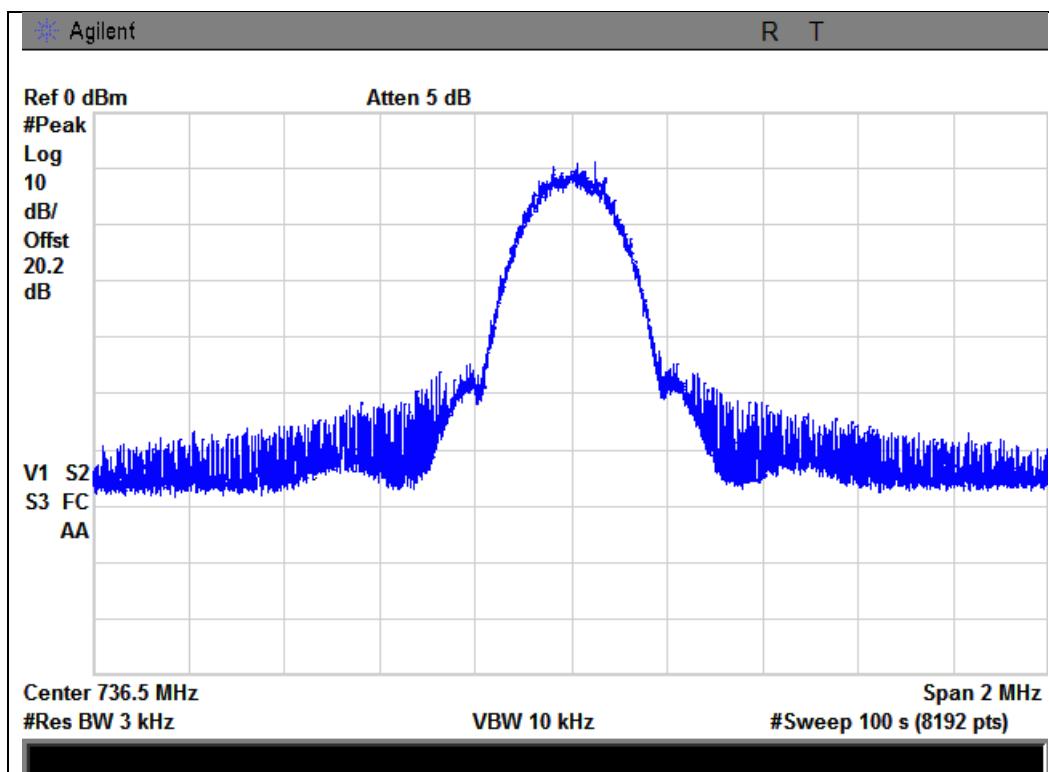
GSM Downlink Test Plots

728 - 746 MHz Band

Input



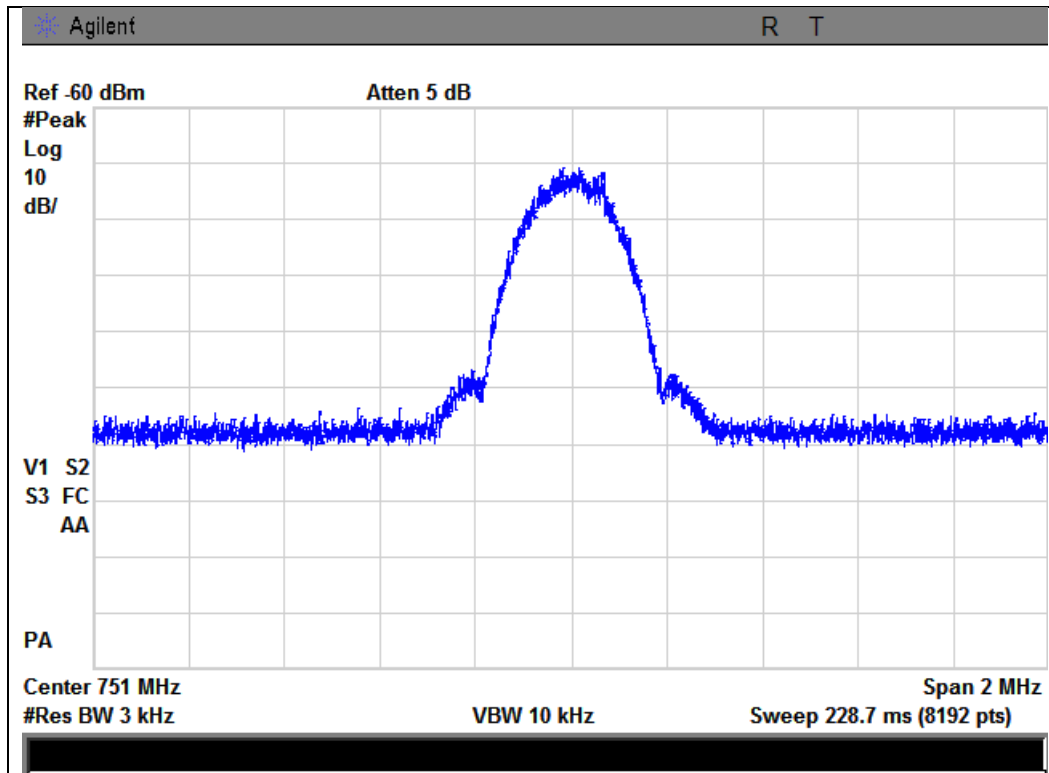
Output



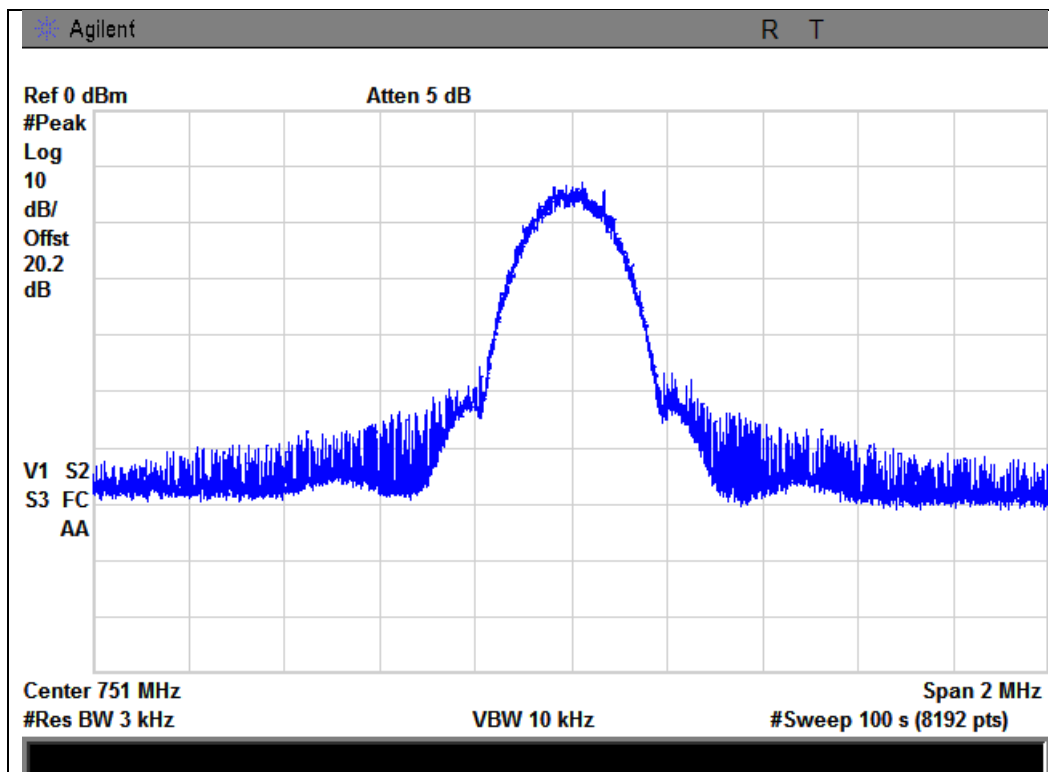


746 - 756 MHz Band

Input



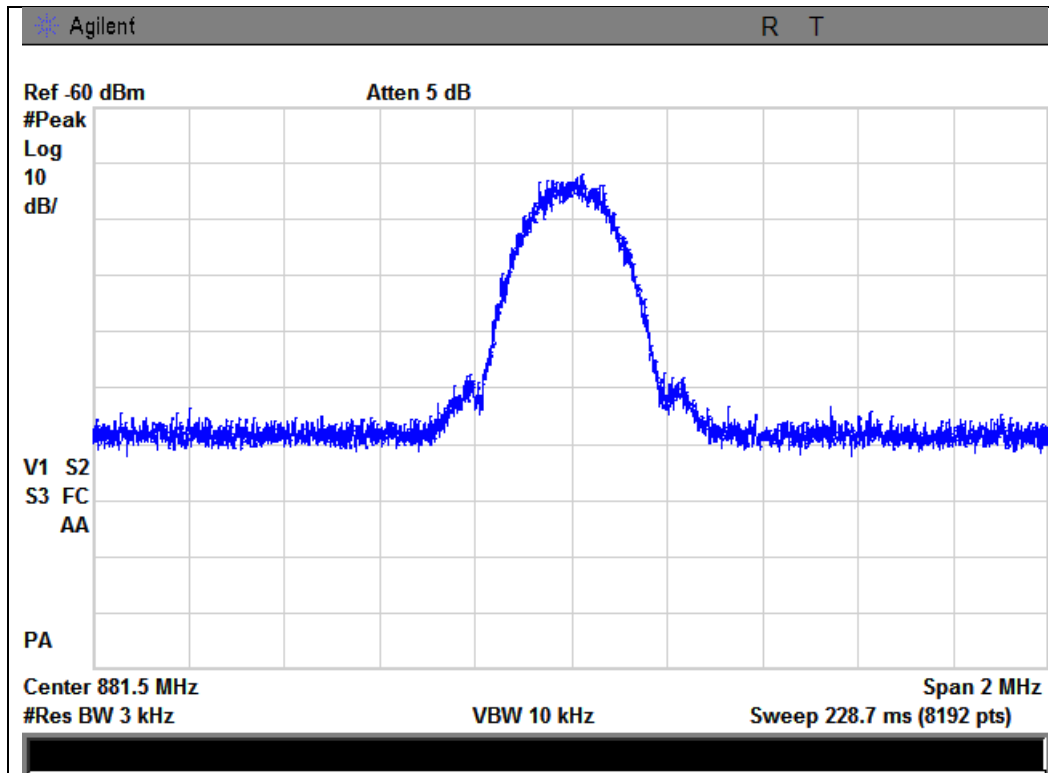
Output



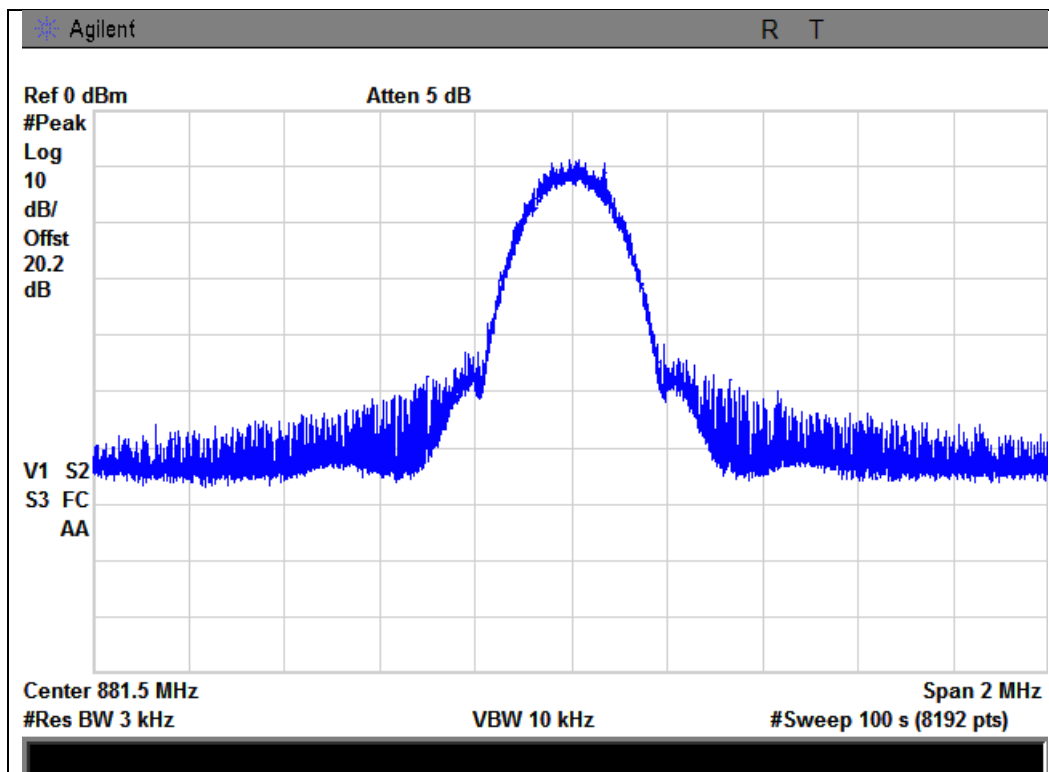


869 - 894 MHz Band

Input



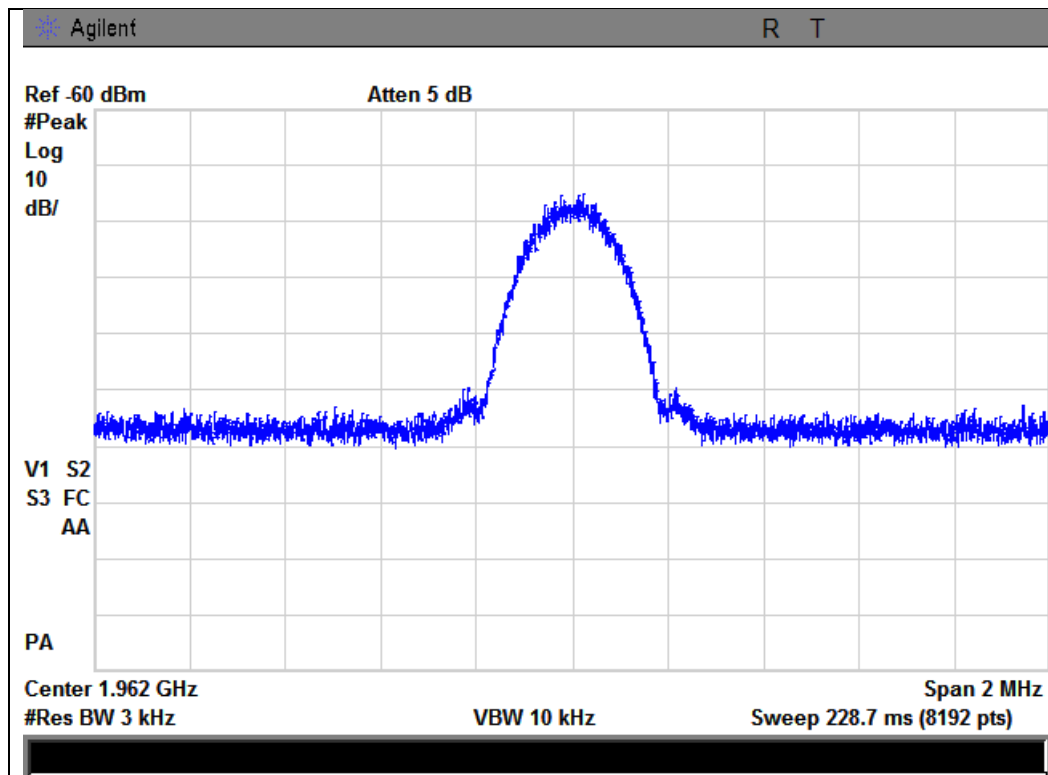
Output



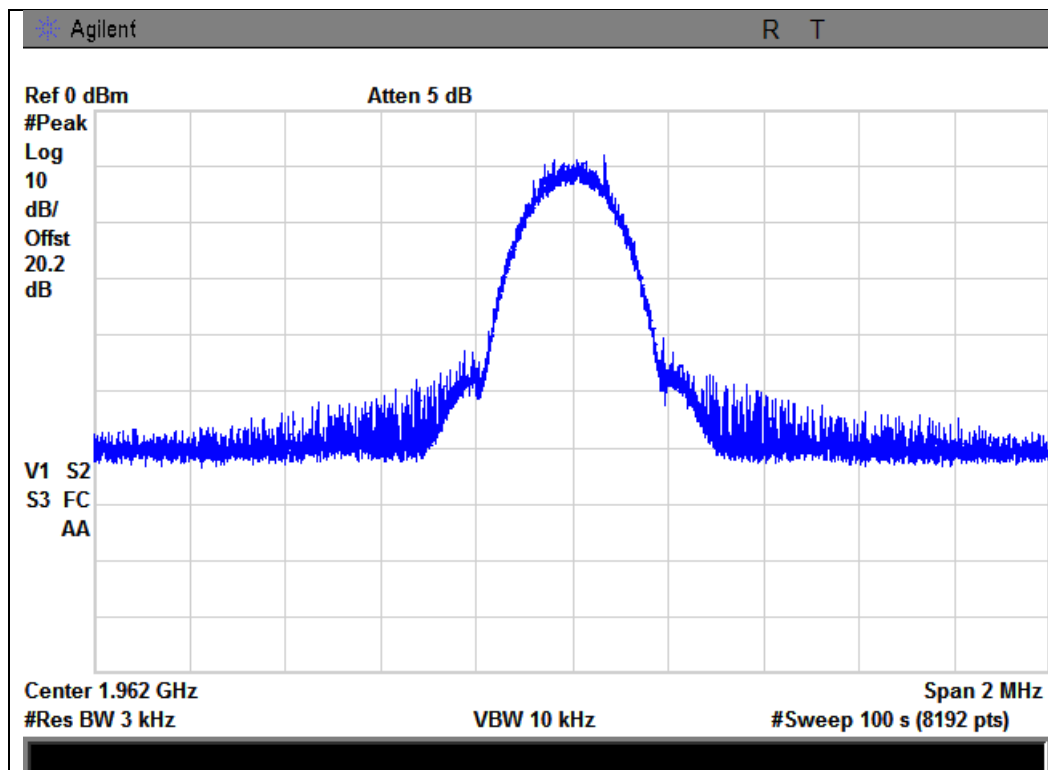


1930 - 1995 MHz Band

Input



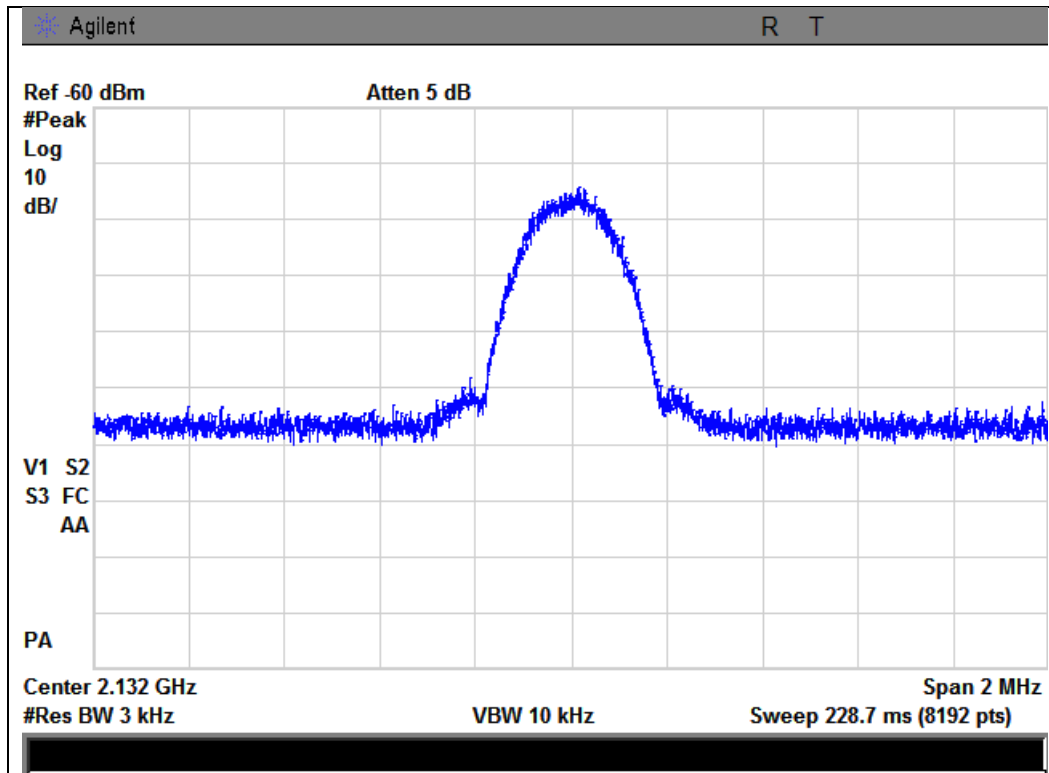
Output



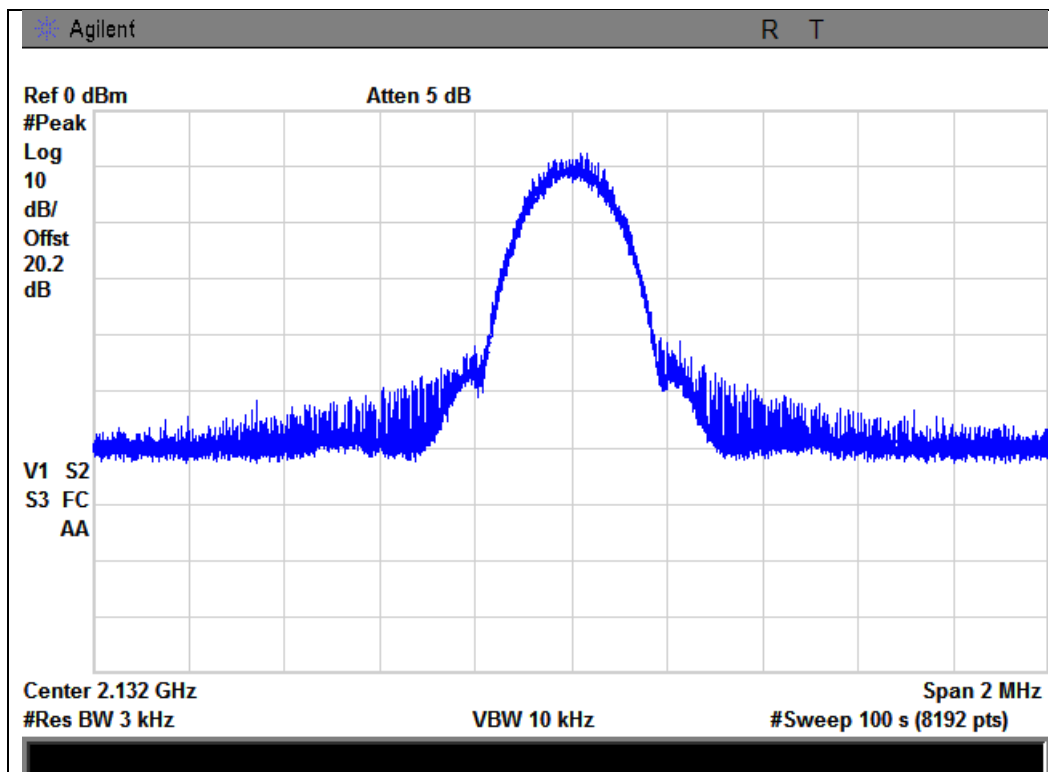


2110 - 2155 MHz Band

Input



Output

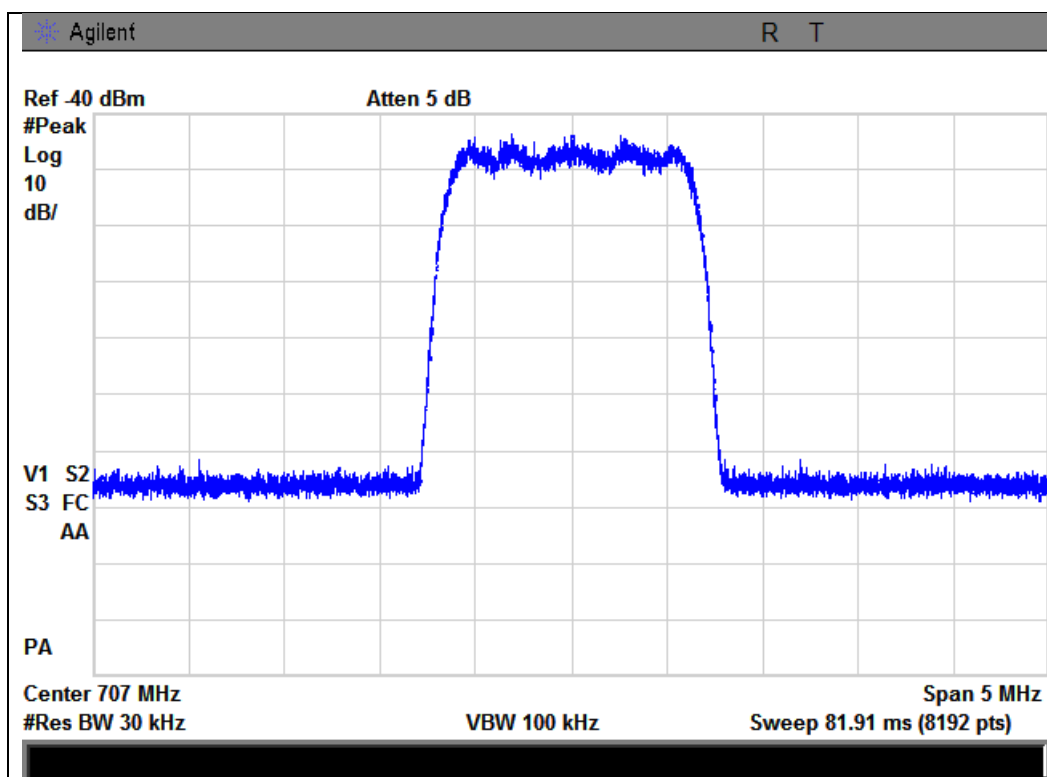




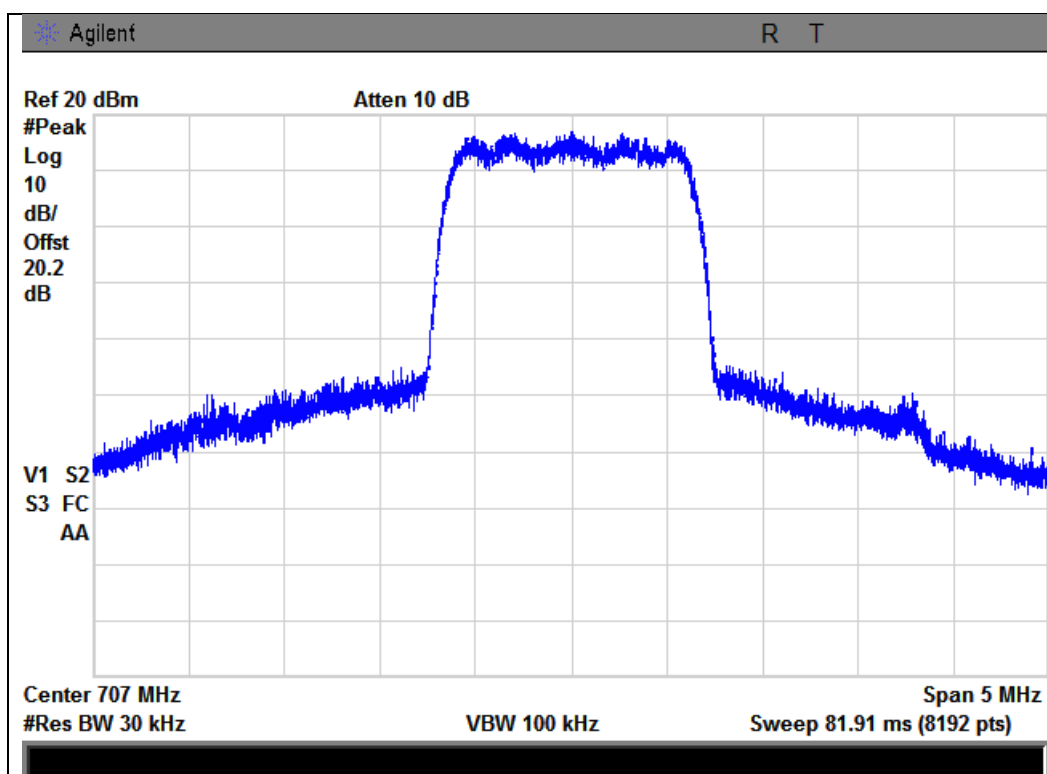
CDMA Uplink Test Plots

698 - 716 MHz Band

Input



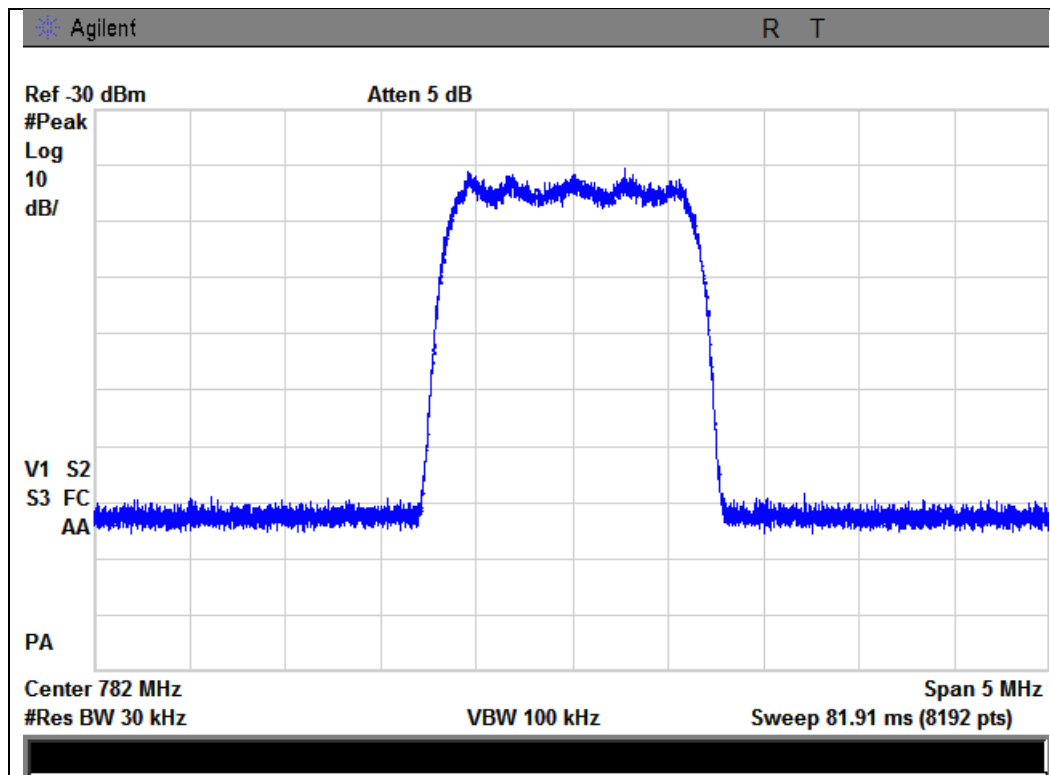
Output



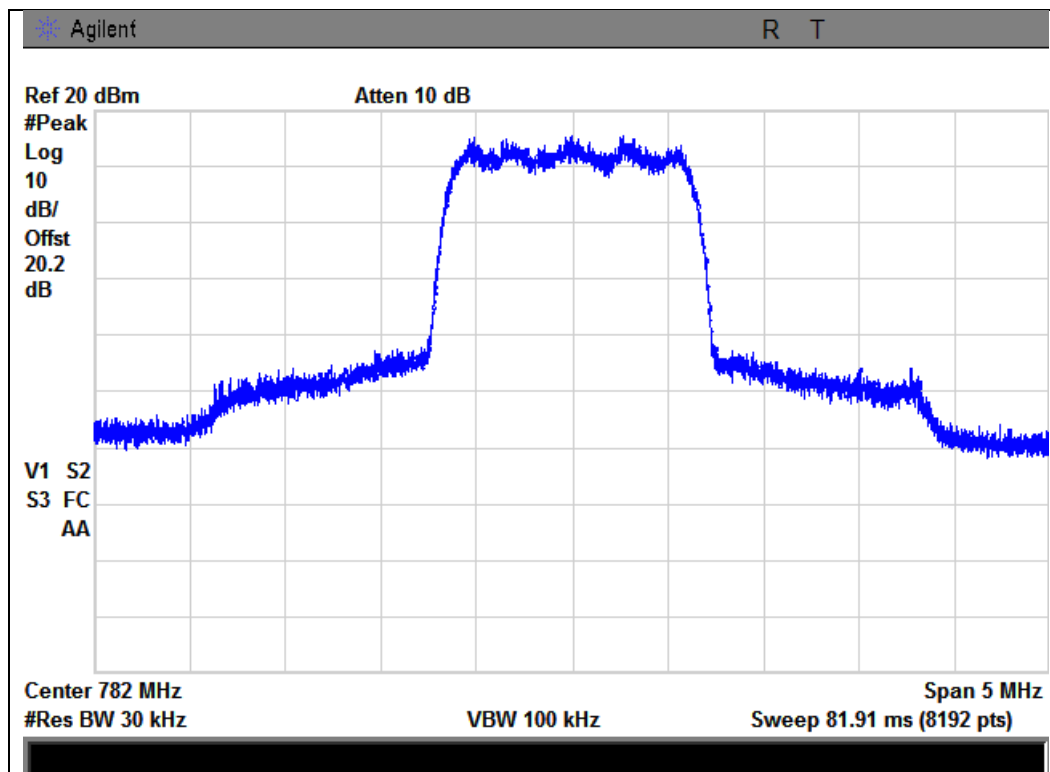


777 - 787 MHz Band

Input



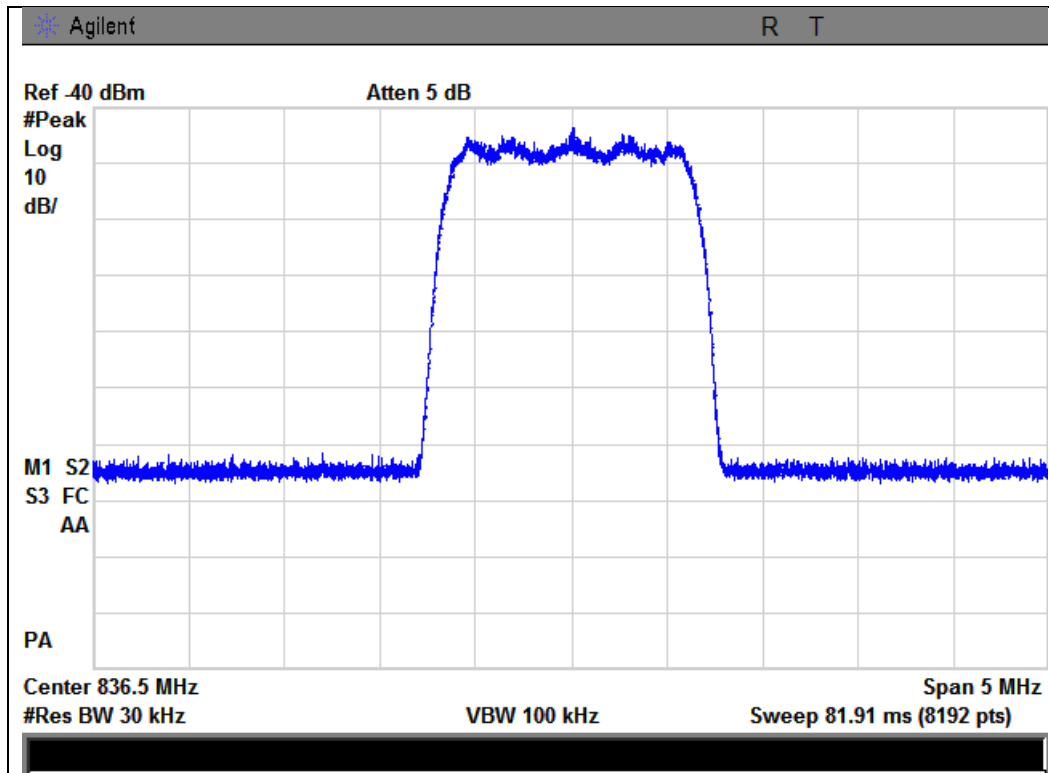
Output



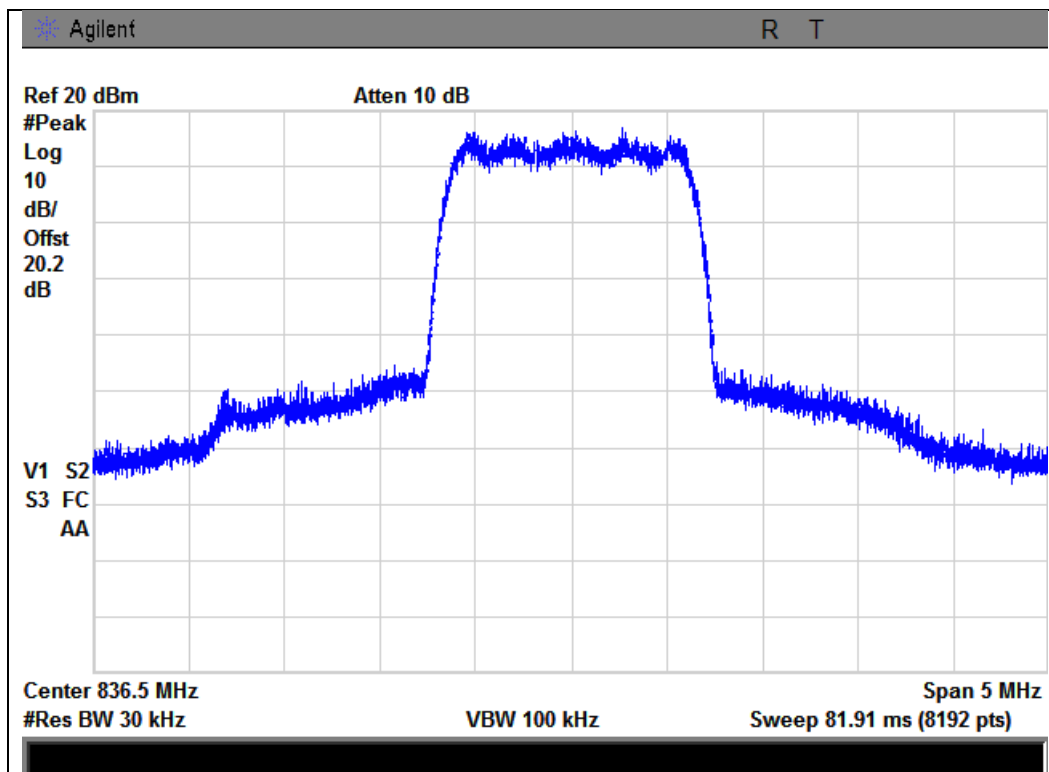


824 - 849 MHz Band

Input



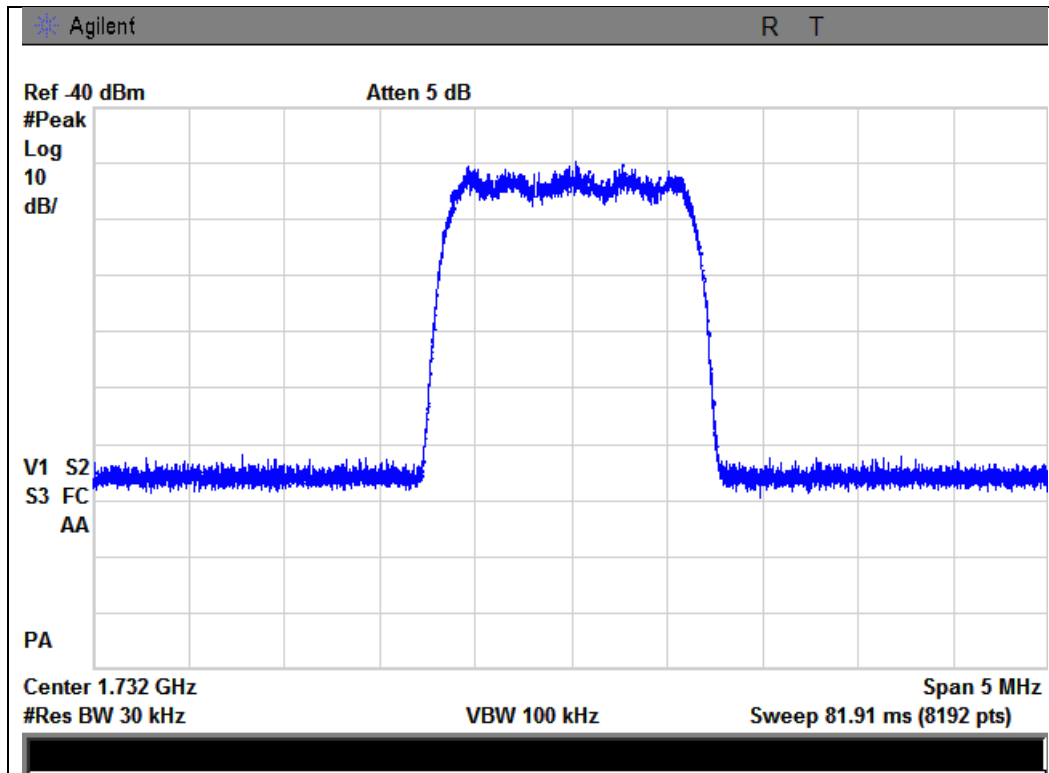
Output



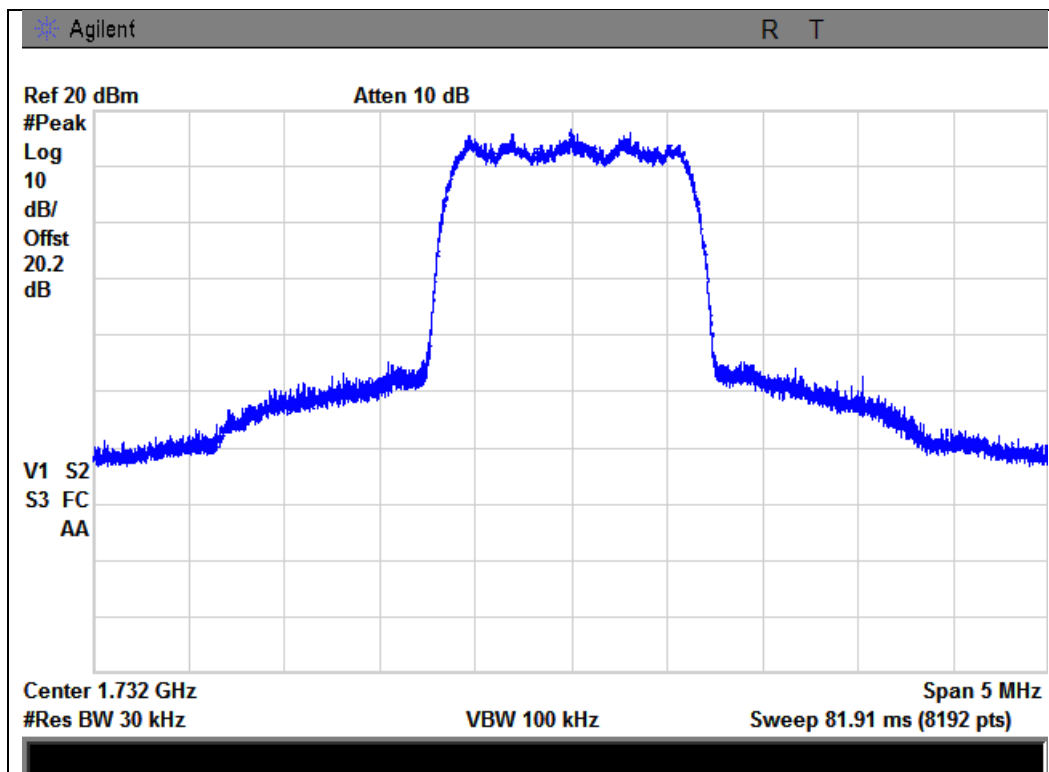


1710 - 1755 MHz Band

Input



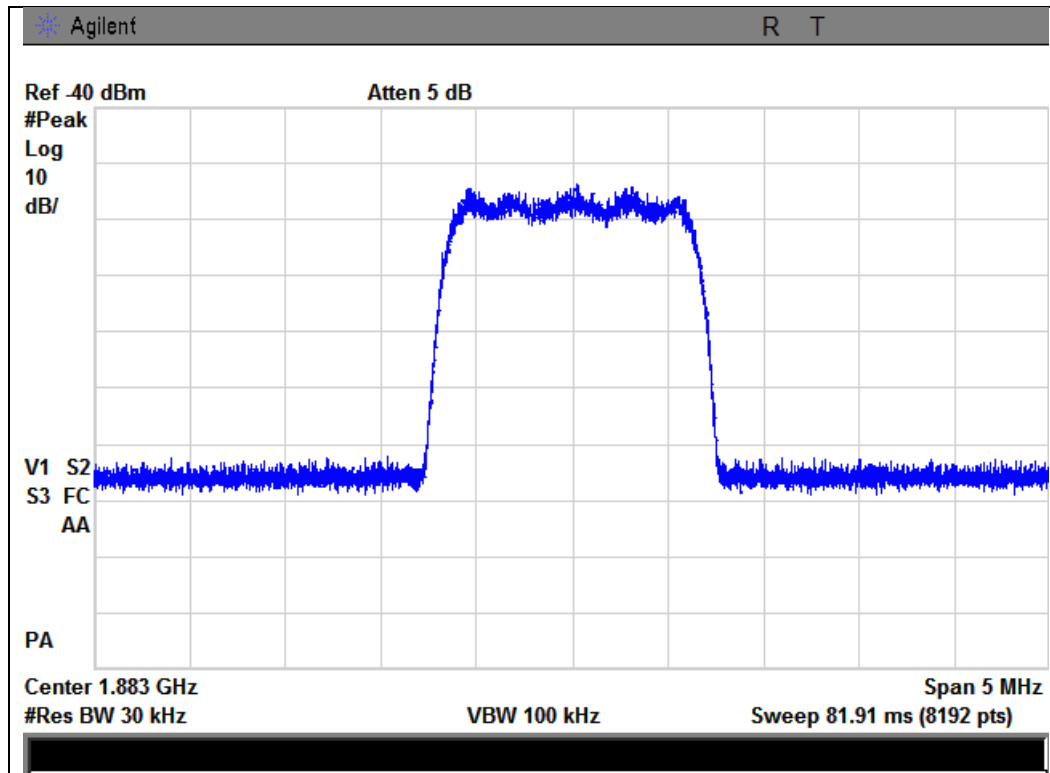
Output



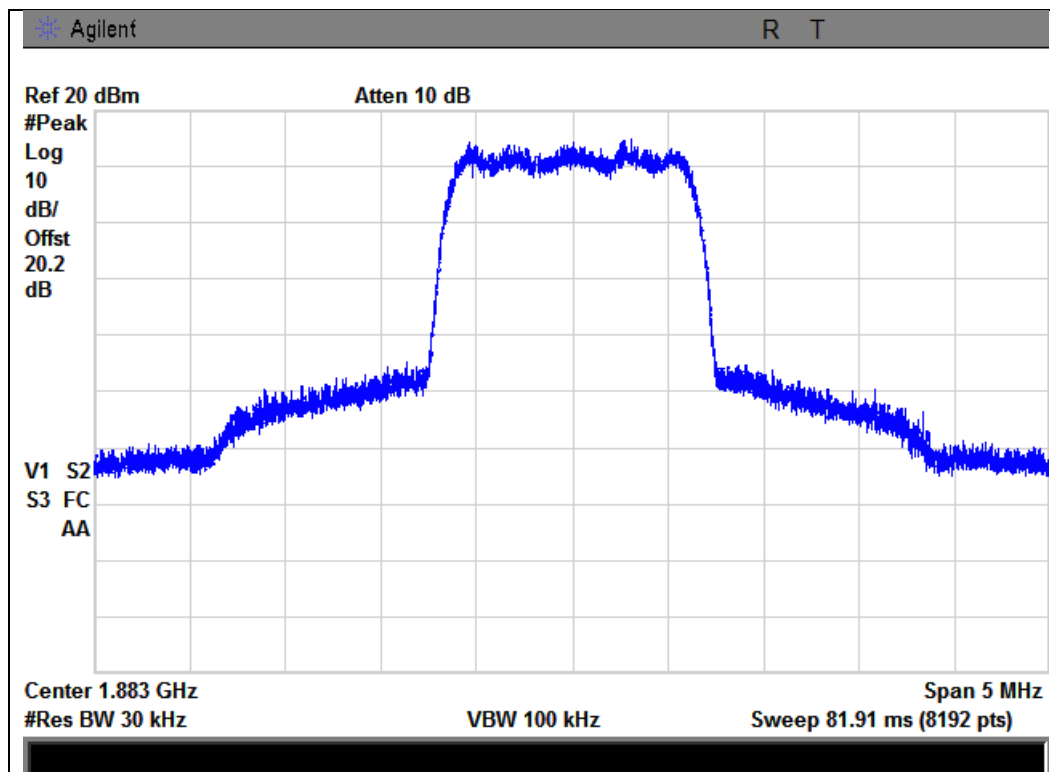


1850 - 1915 MHz Band

Input



Output

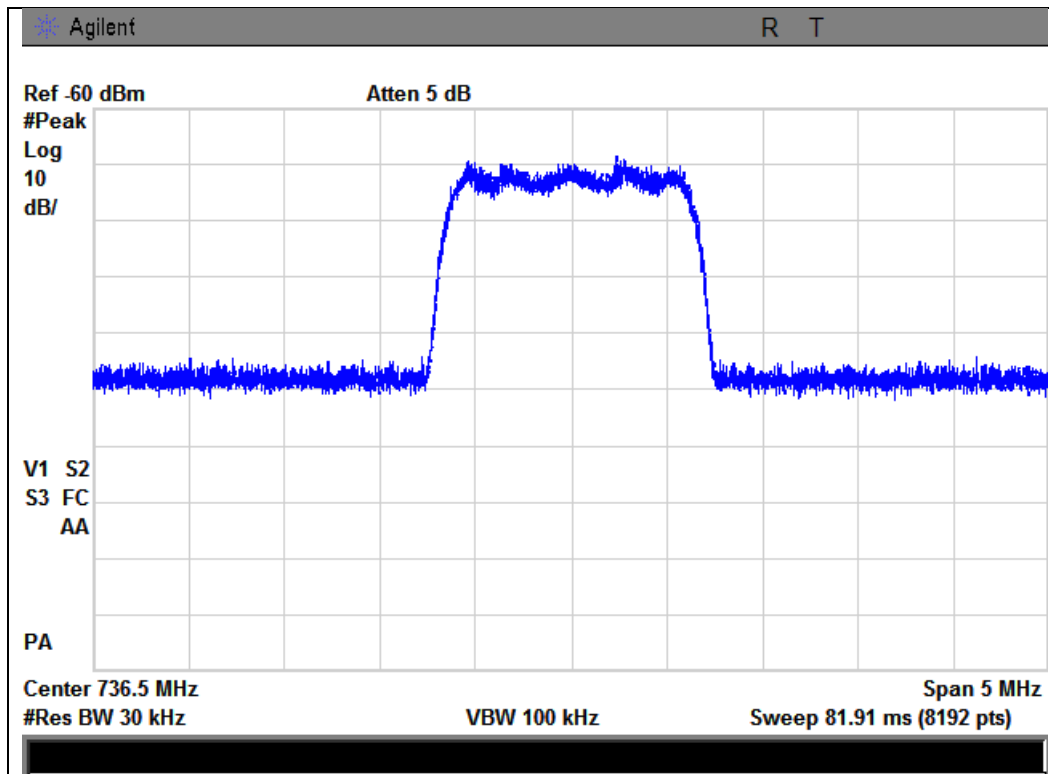




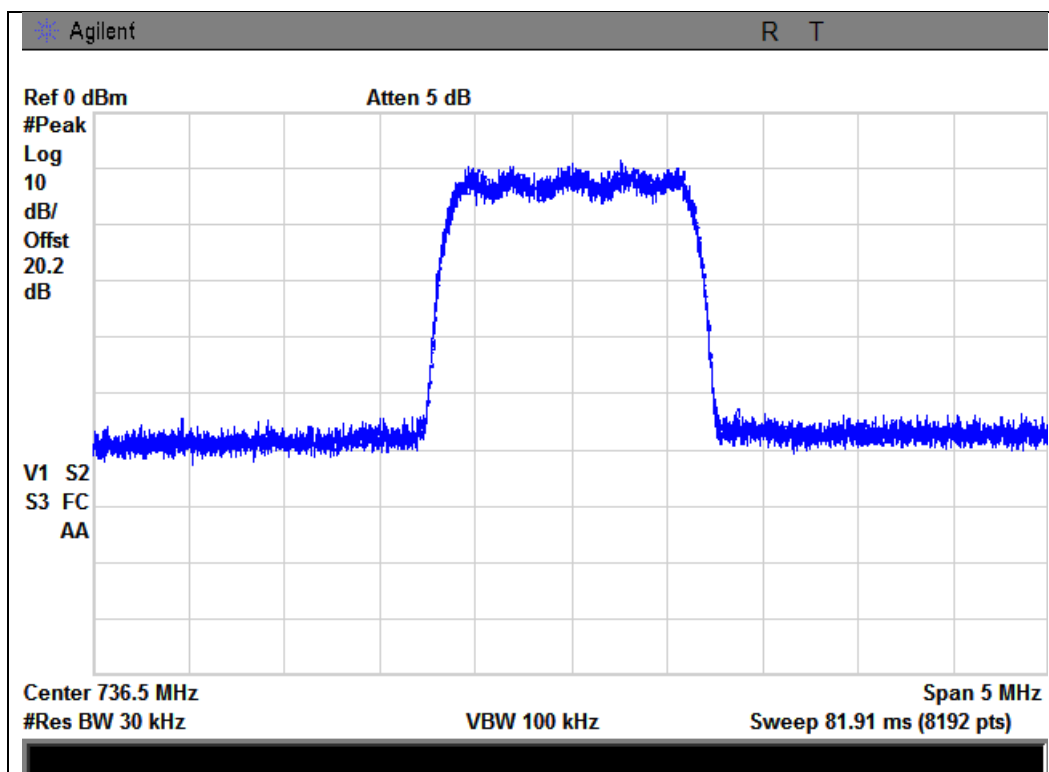
CDMA Downlink Test Plots

728 - 746 MHz Band

Input



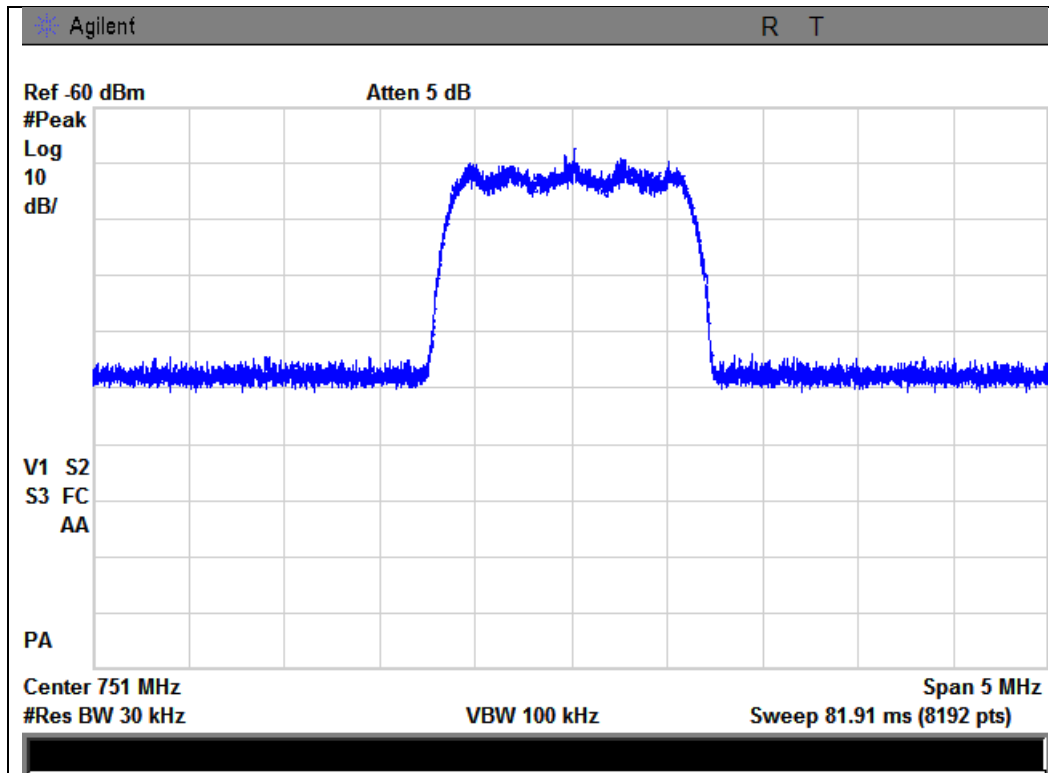
Output



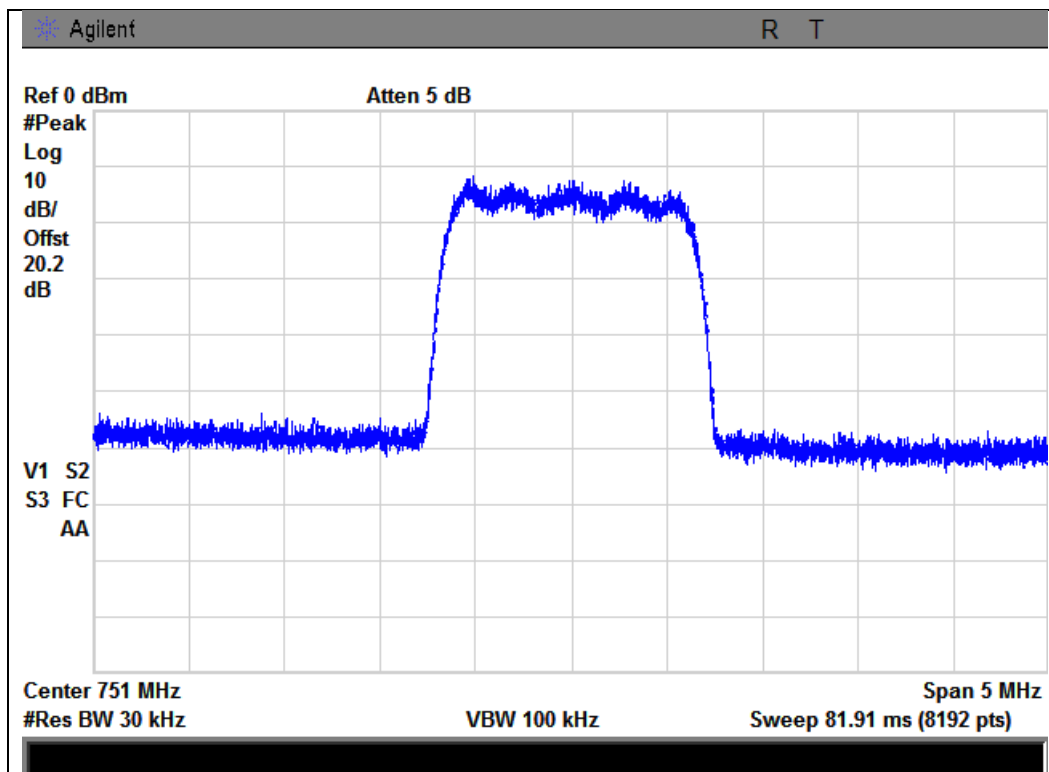


746 - 756 MHz Band

Input



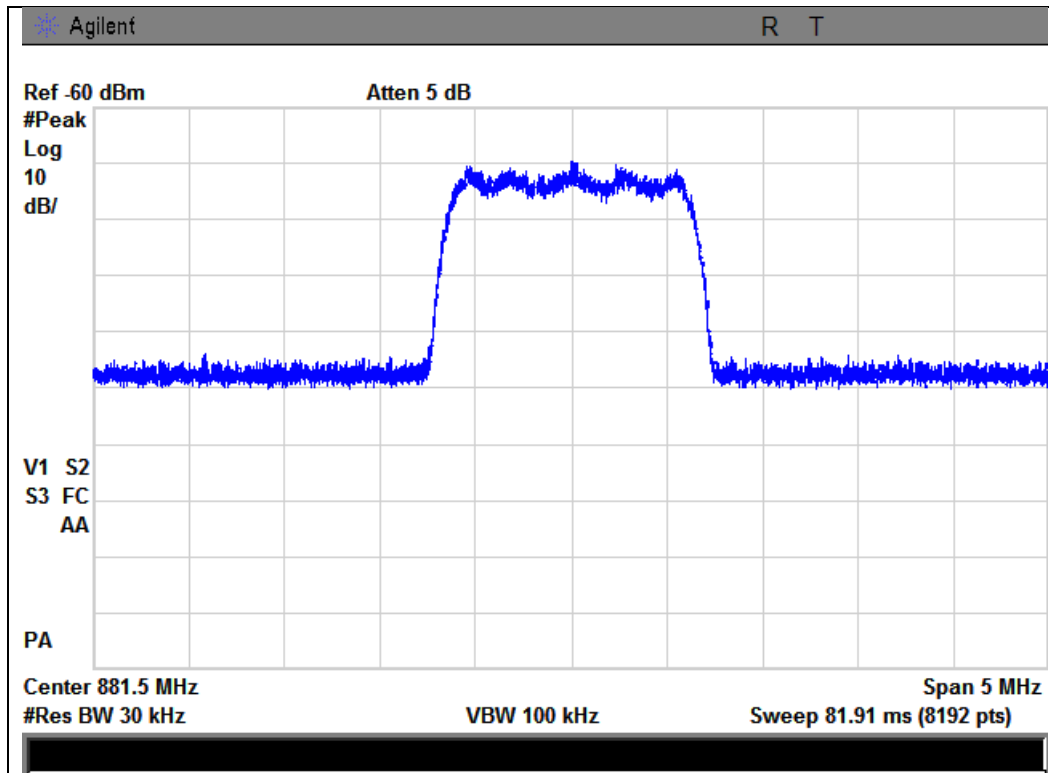
Output



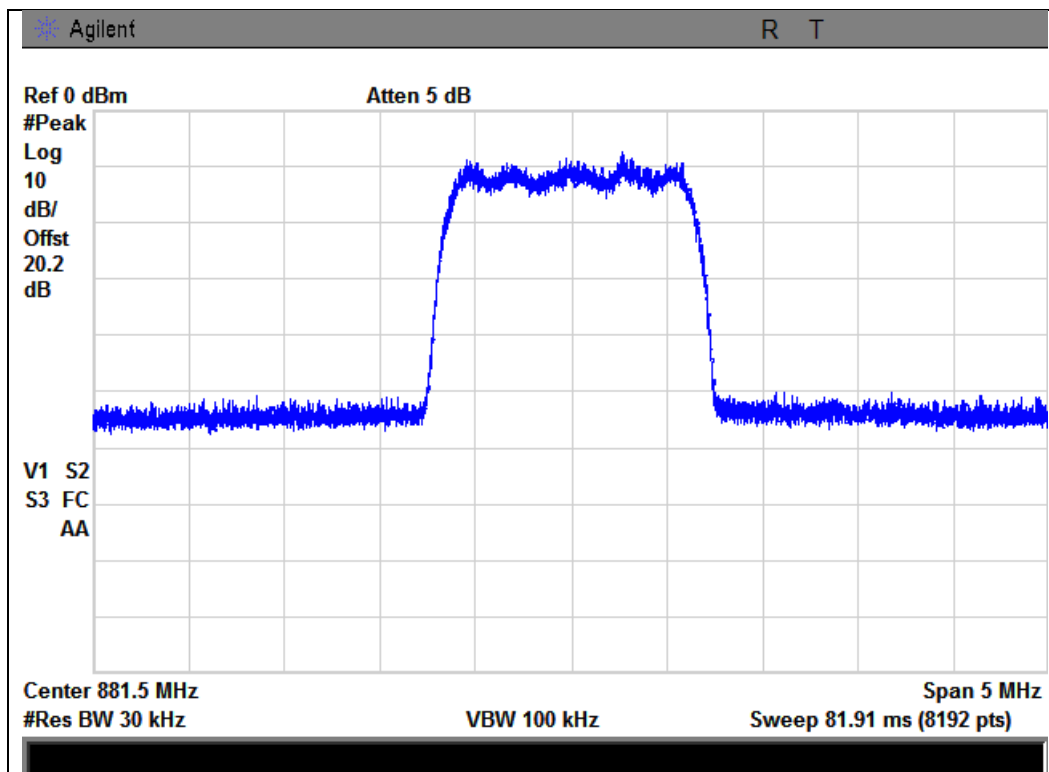


869 - 894 MHz Band

Input



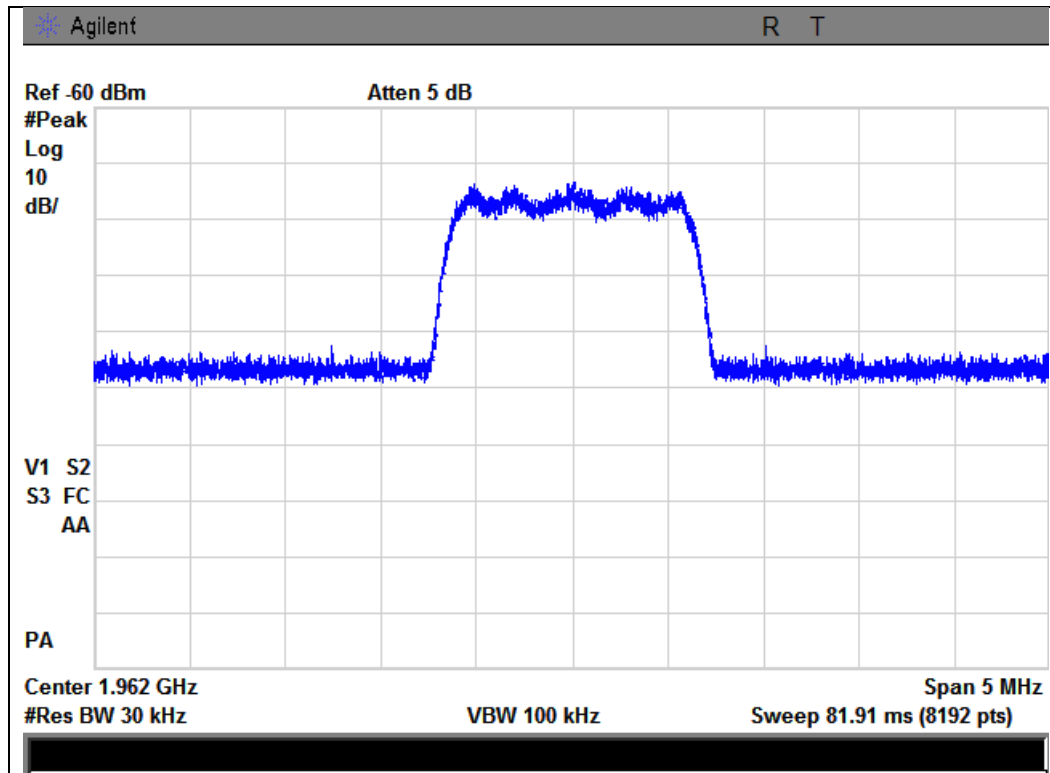
Output



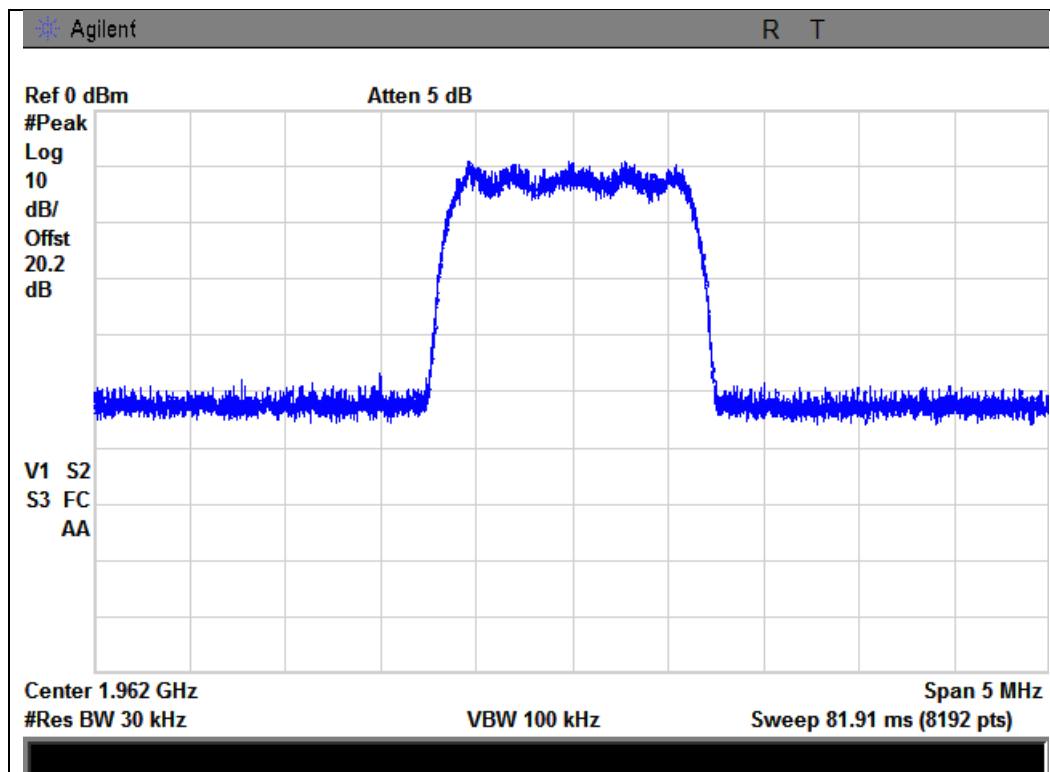


1930 - 1995 MHz Band

Input



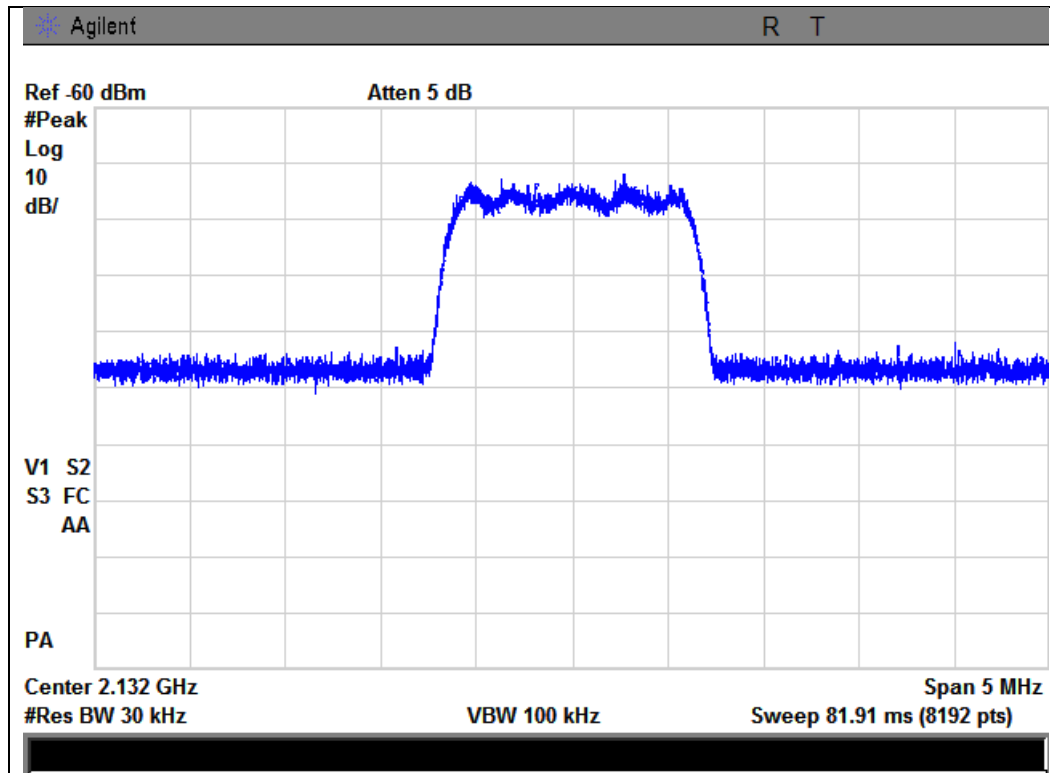
Output



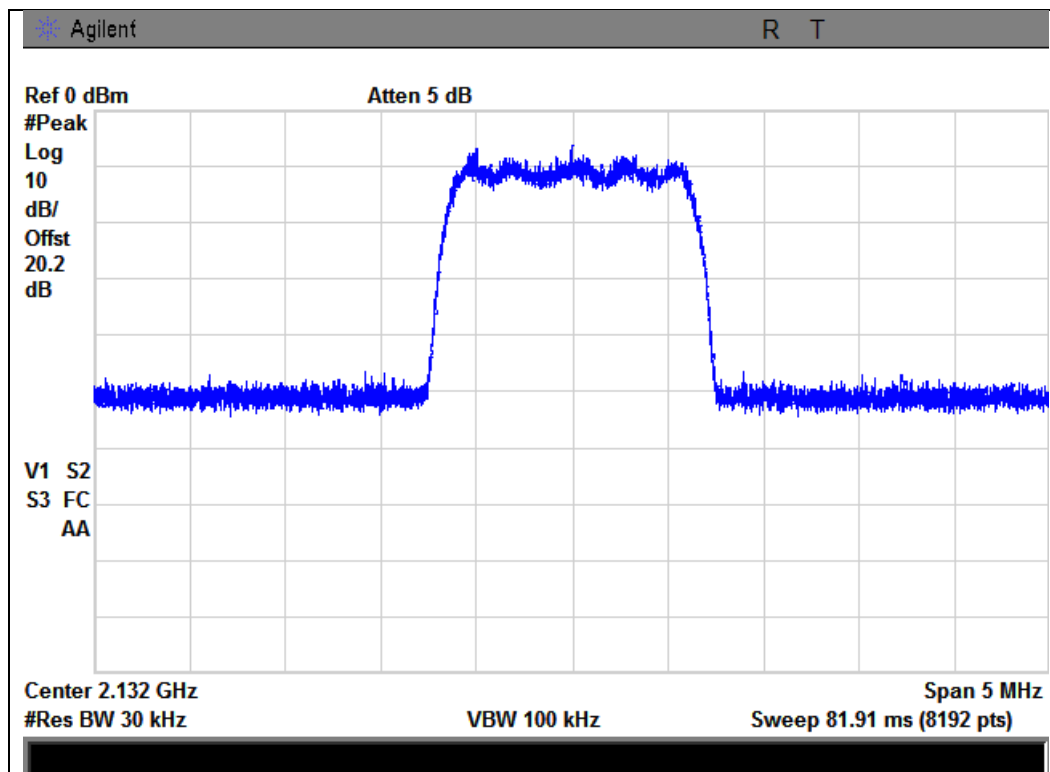


2110 - 2155 MHz Band

Input



Output

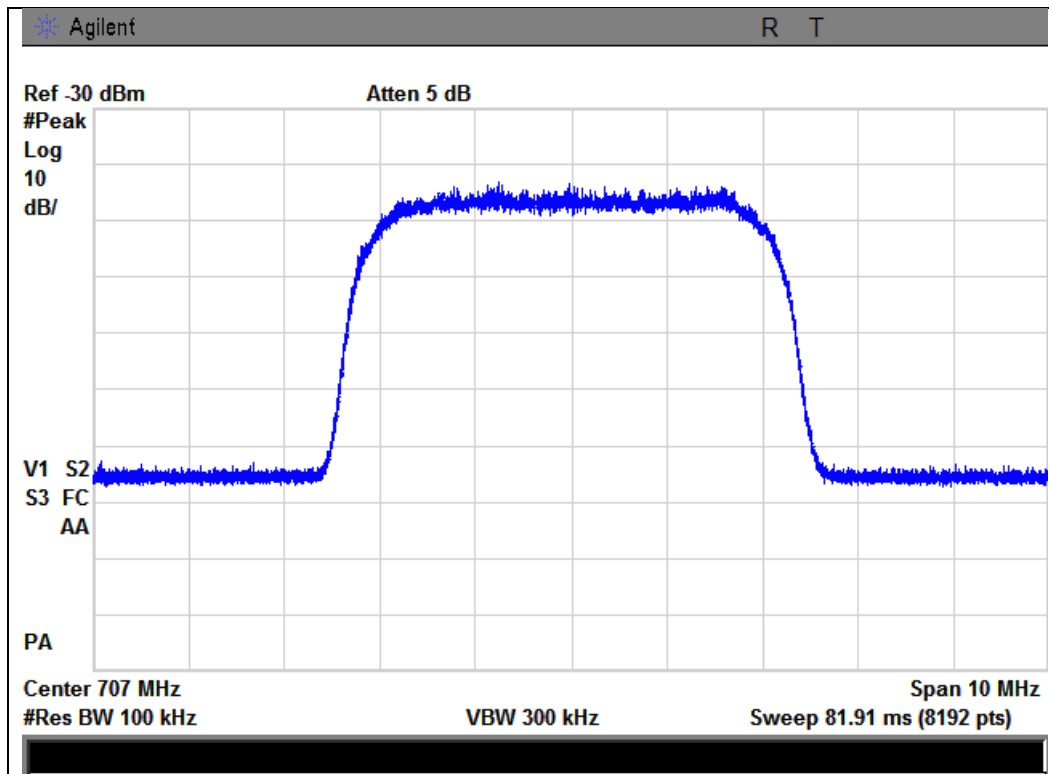




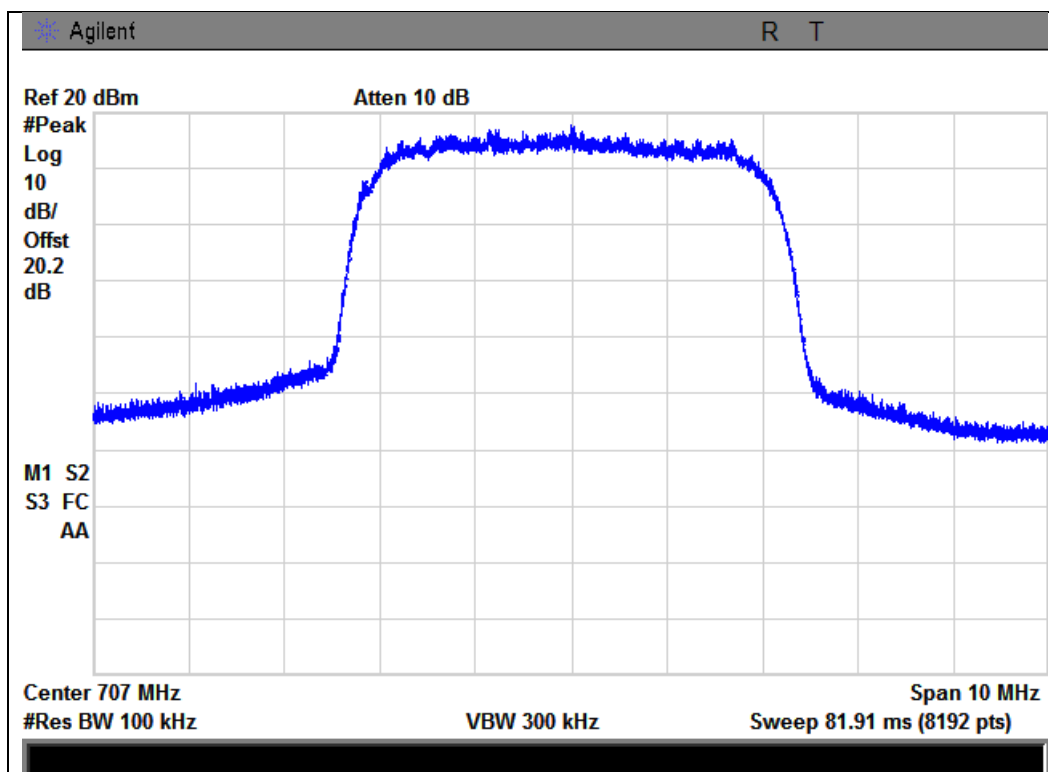
WCDMA Uplink Test Plots

698 - 716 MHz Band

Input



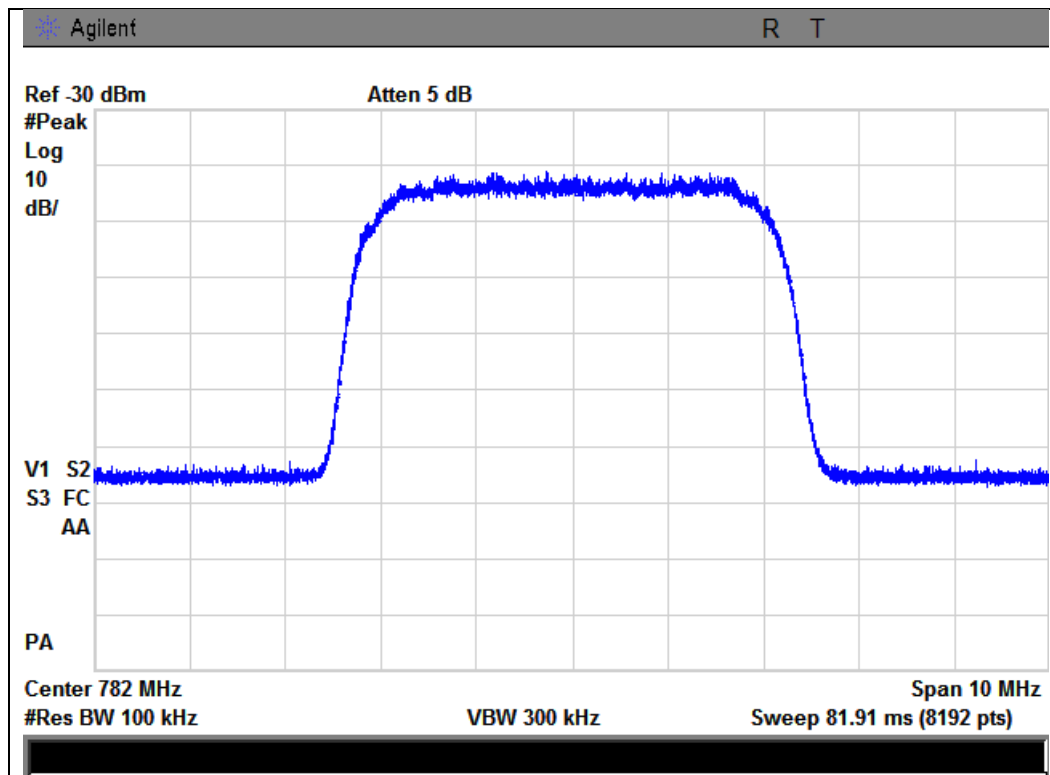
Output



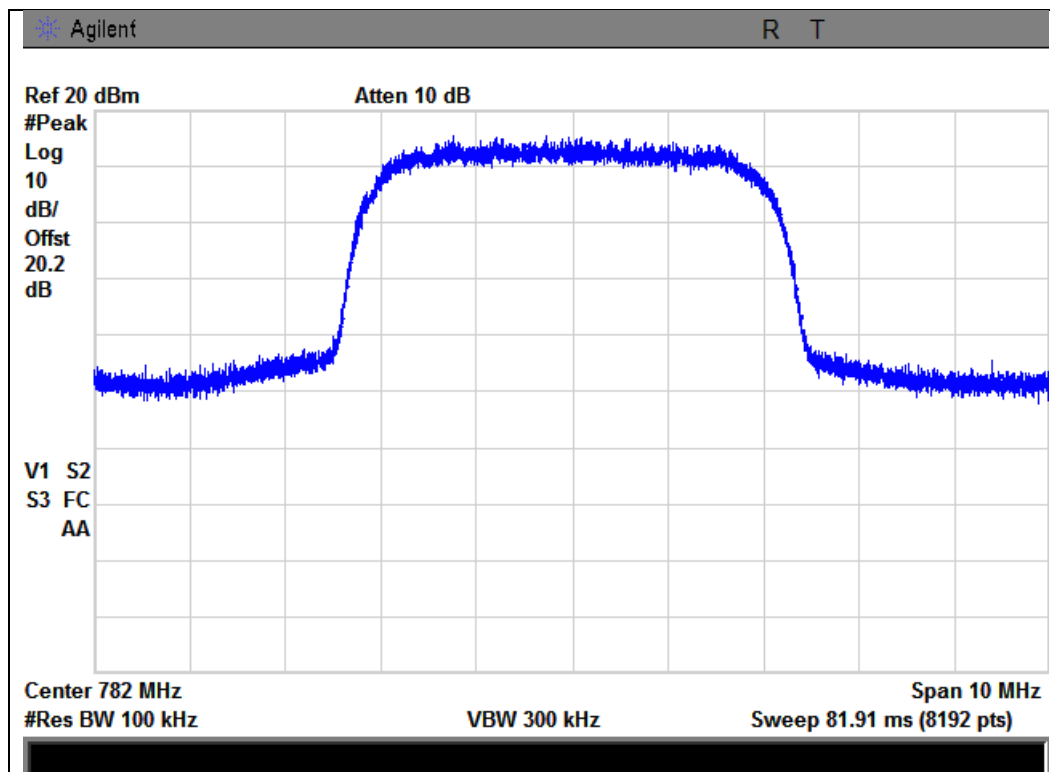


777 - 787 MHz Band

Input



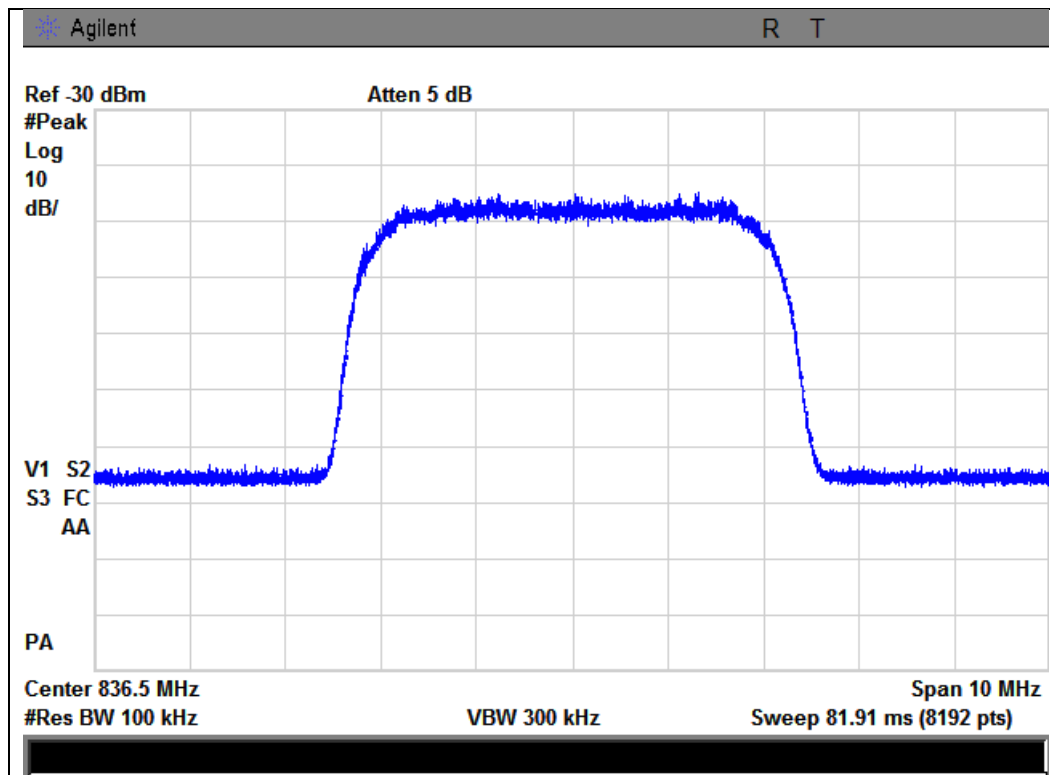
Output



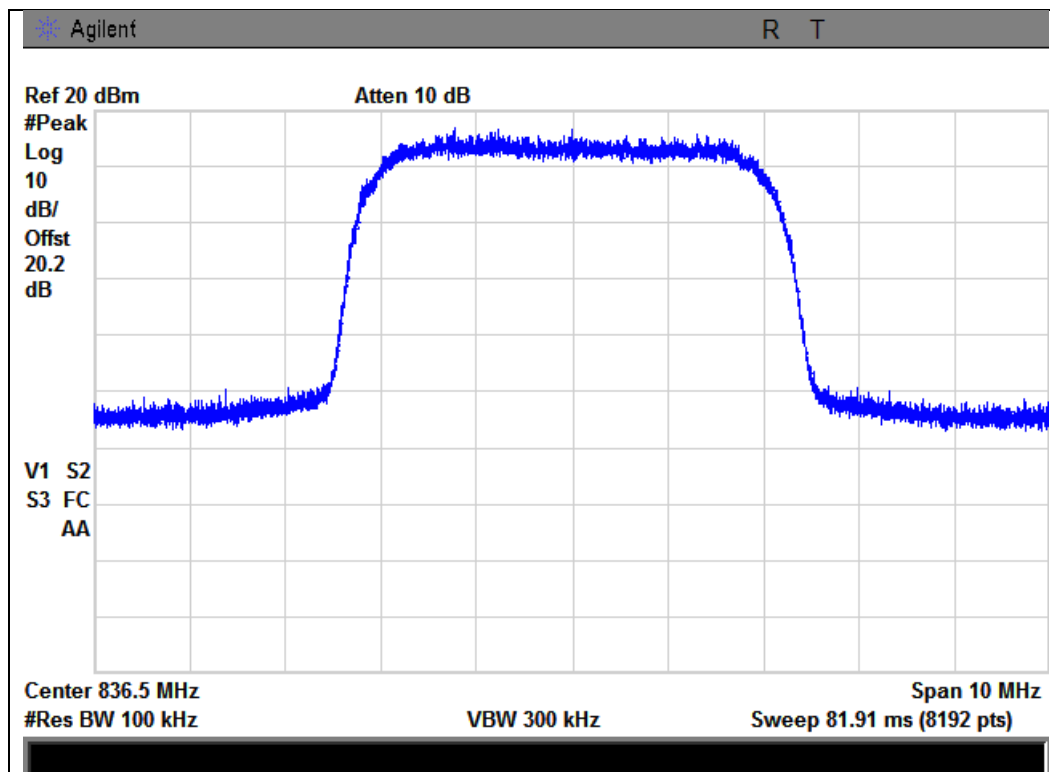


824 - 849 MHz Band

Input



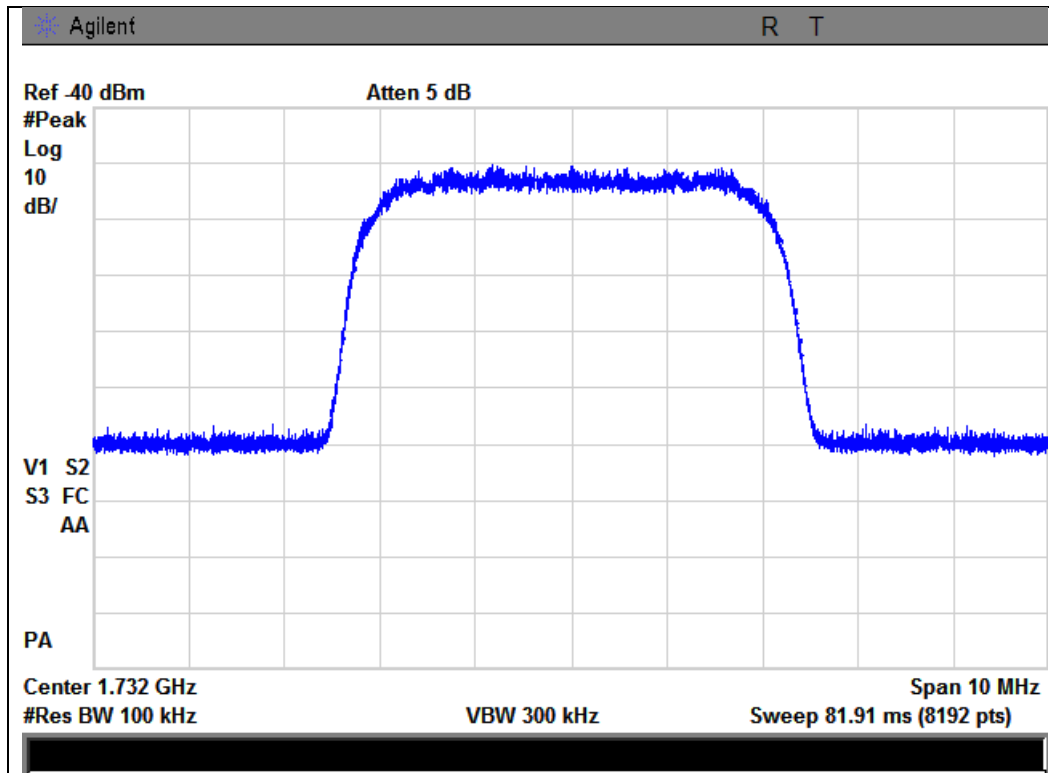
Output



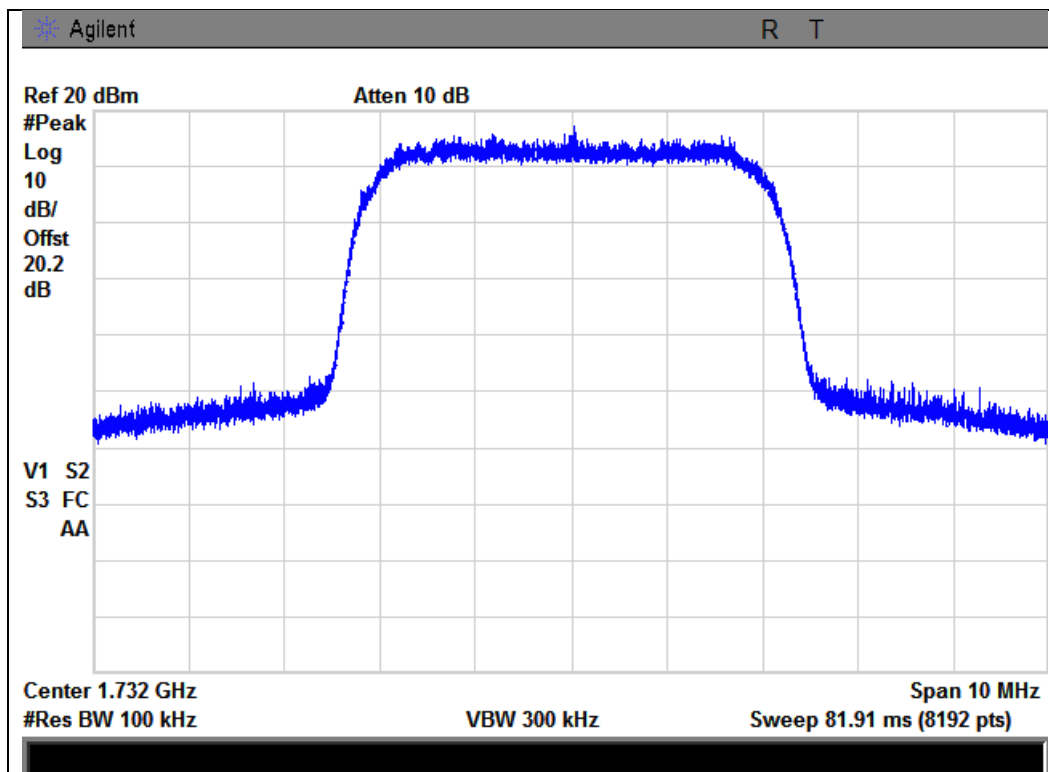


1710 - 1755 MHz Band

Input



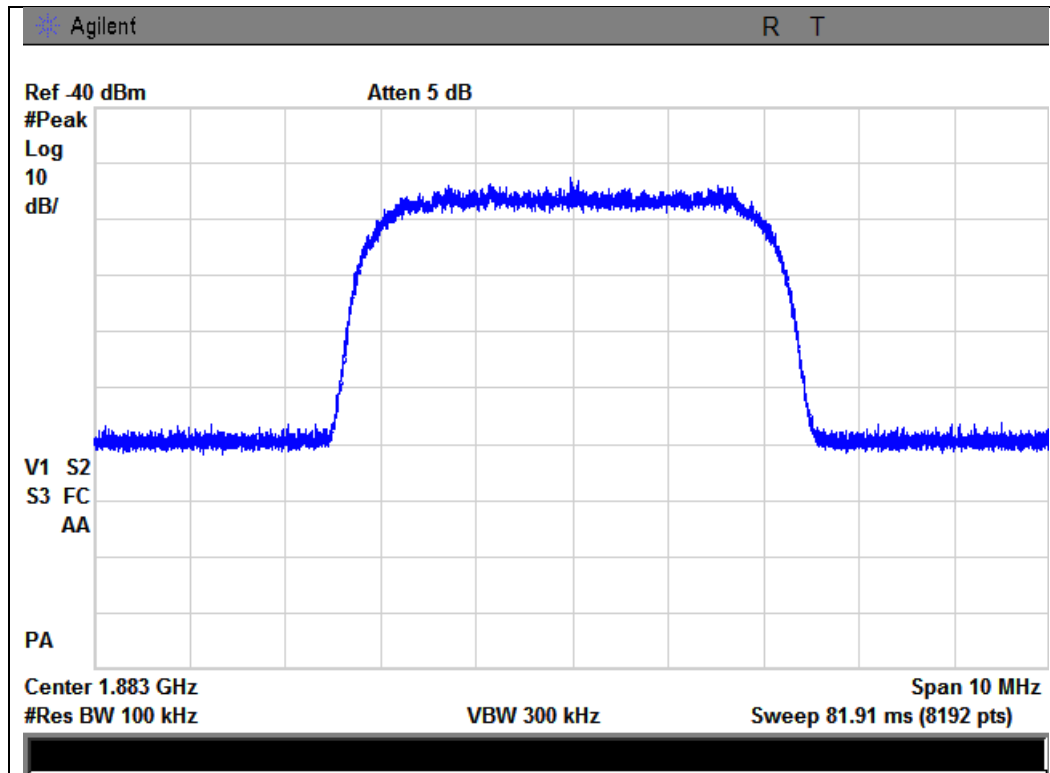
Output



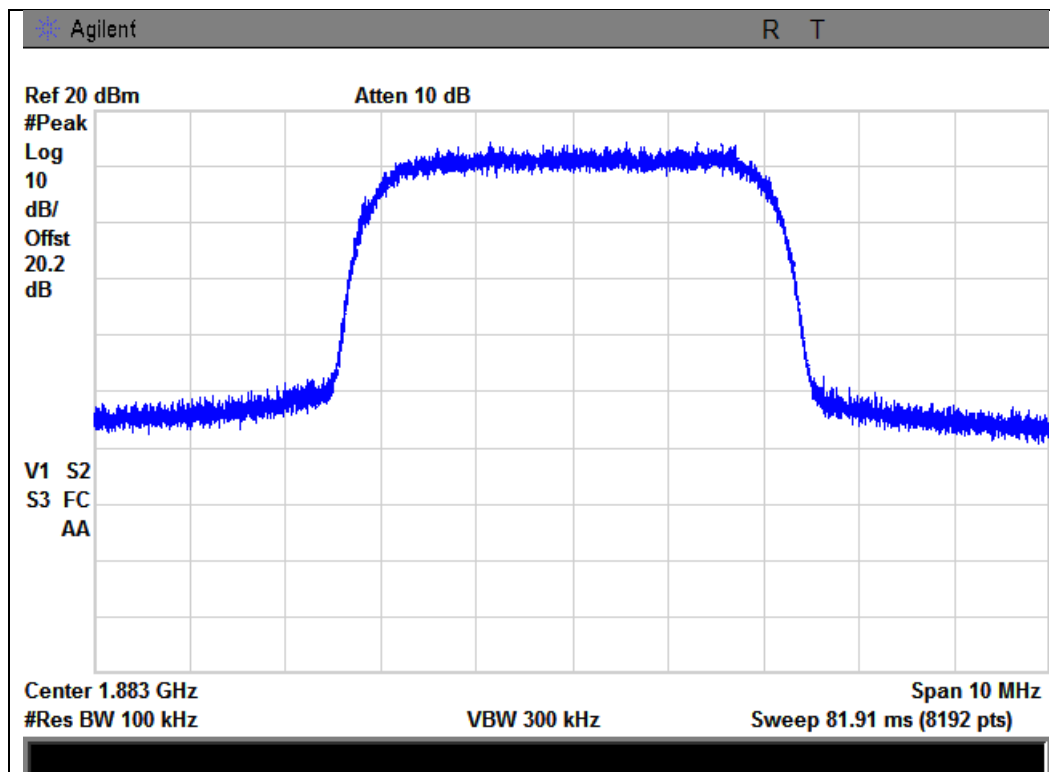


1850 - 1915 MHz Band

Input



Output

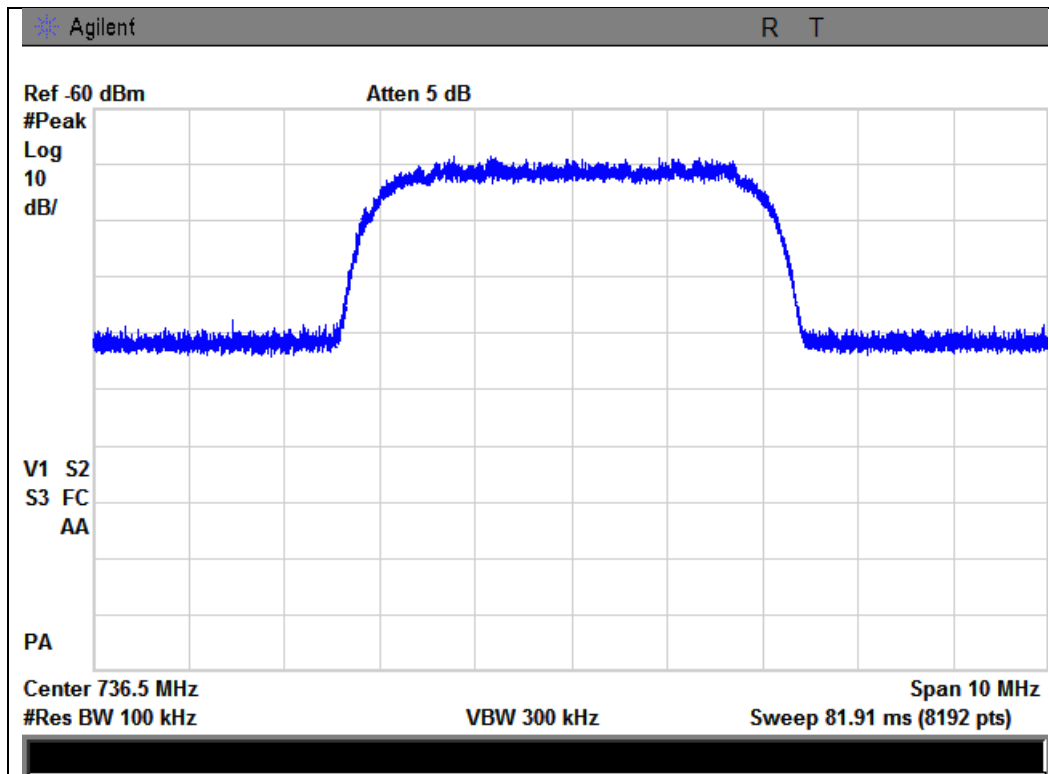




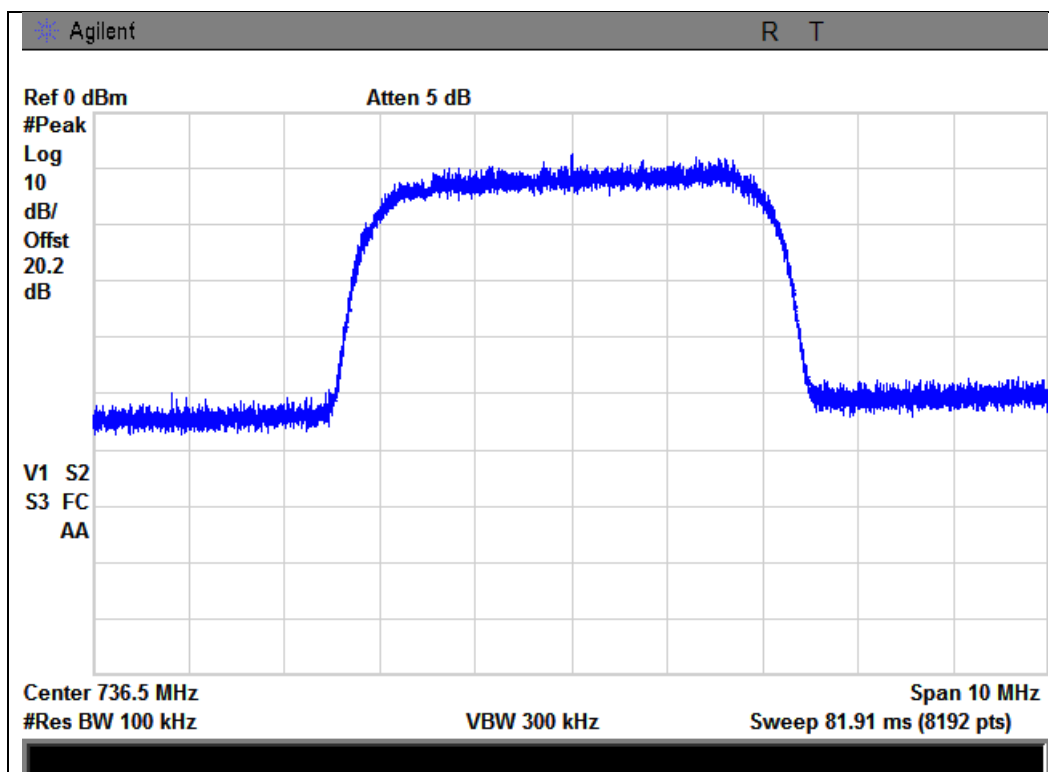
WCDMA Downlink Test Plots

728 - 746 MHz Band

Input



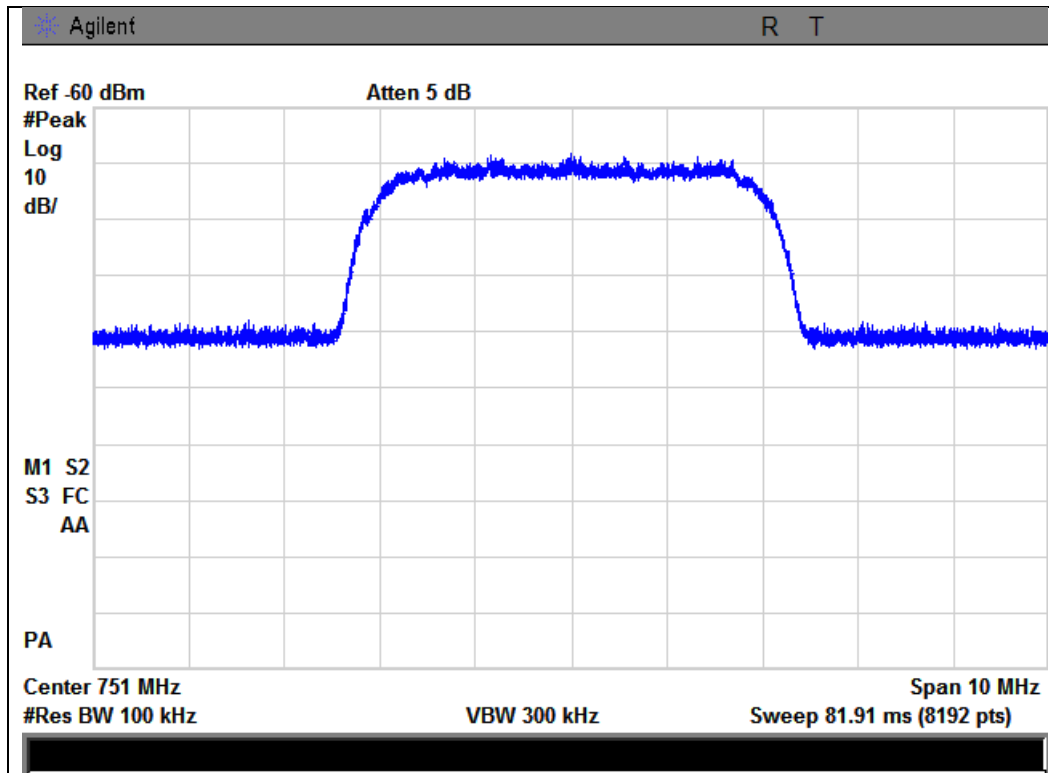
Output



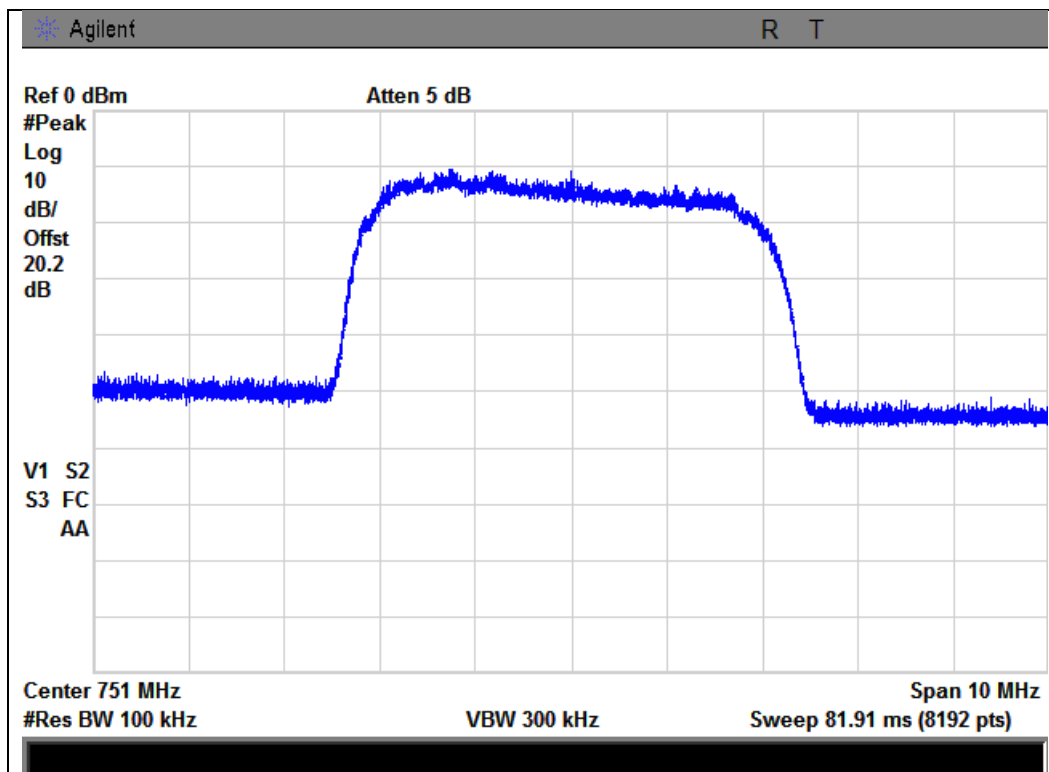


746 - 756 MHz Band

Input



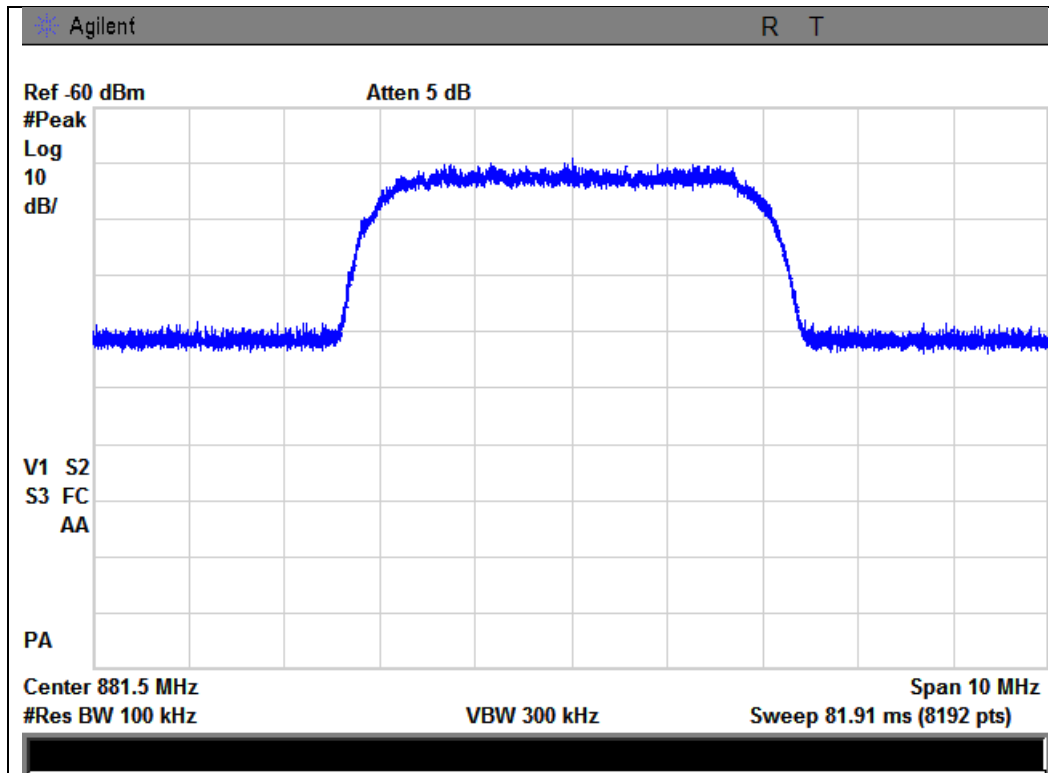
Output



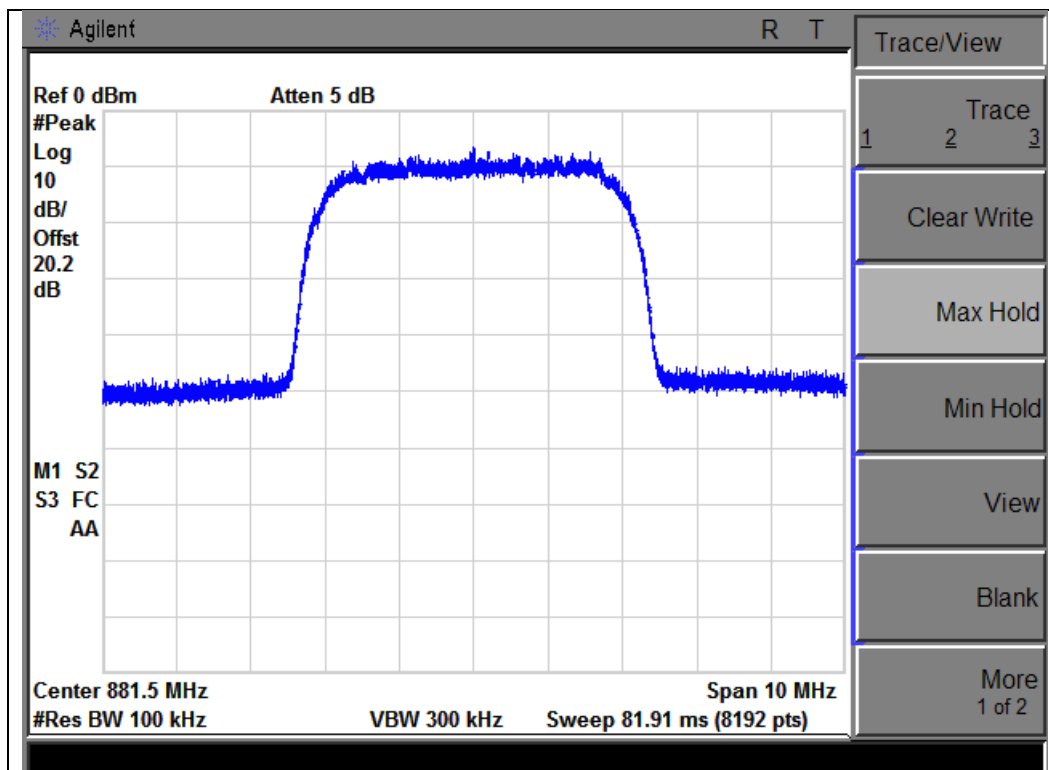


869 - 894 MHz Band

Input



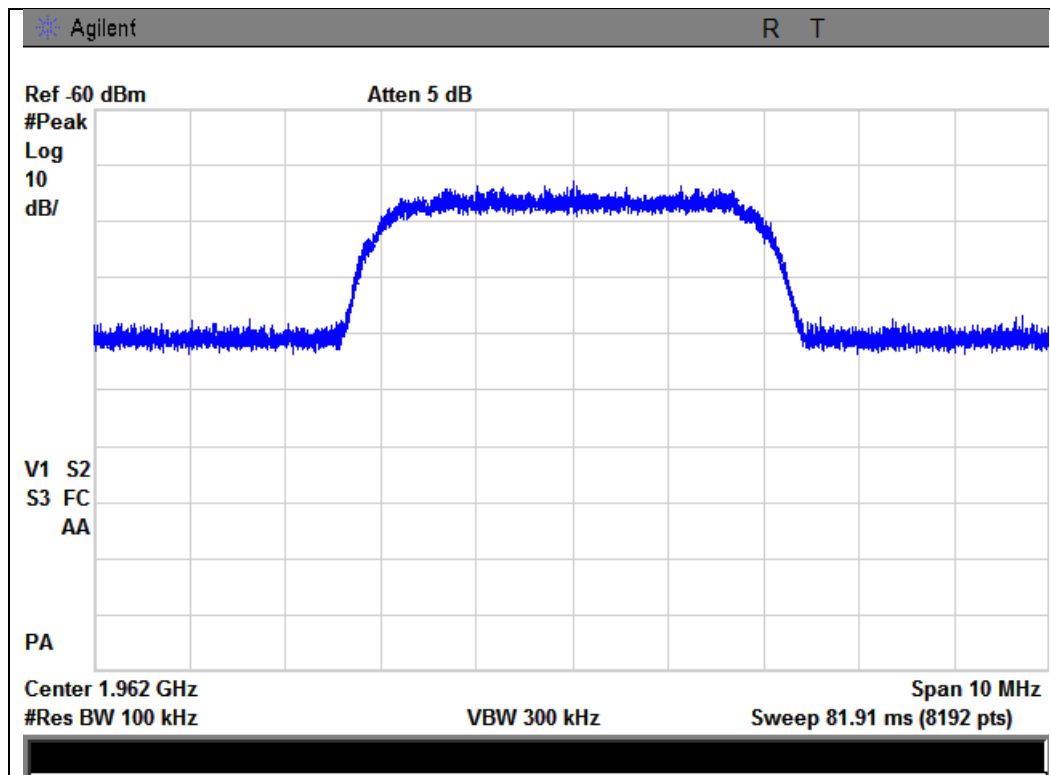
Output



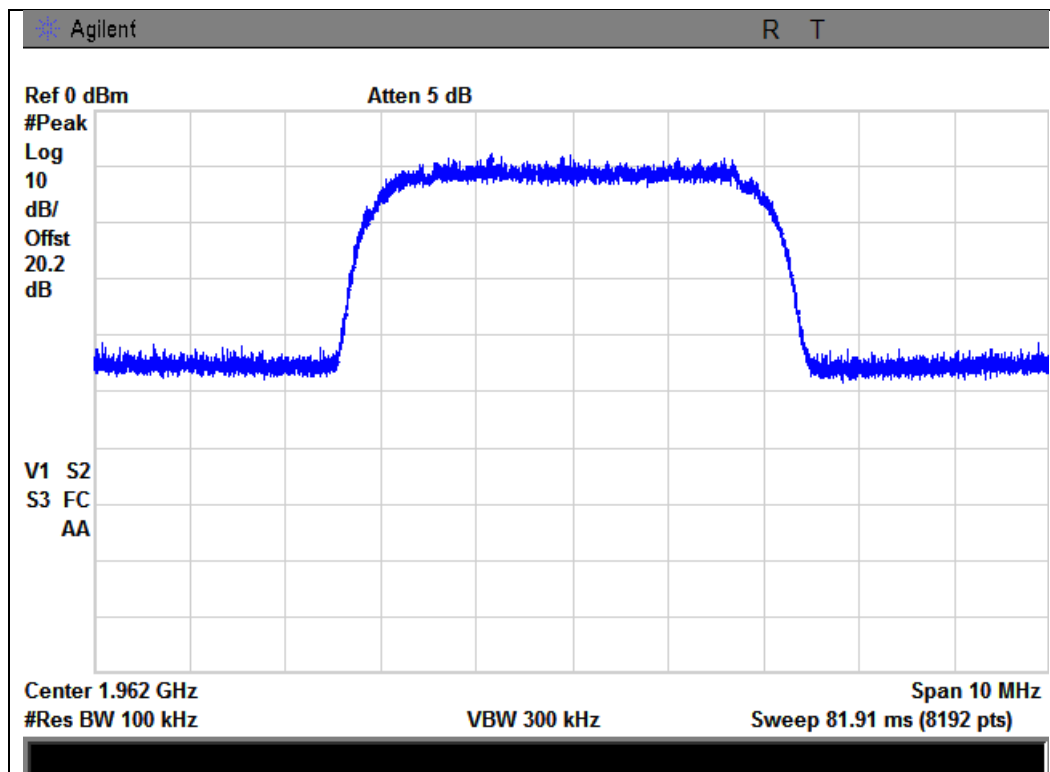


1930 - 1995 MHz Band

Input



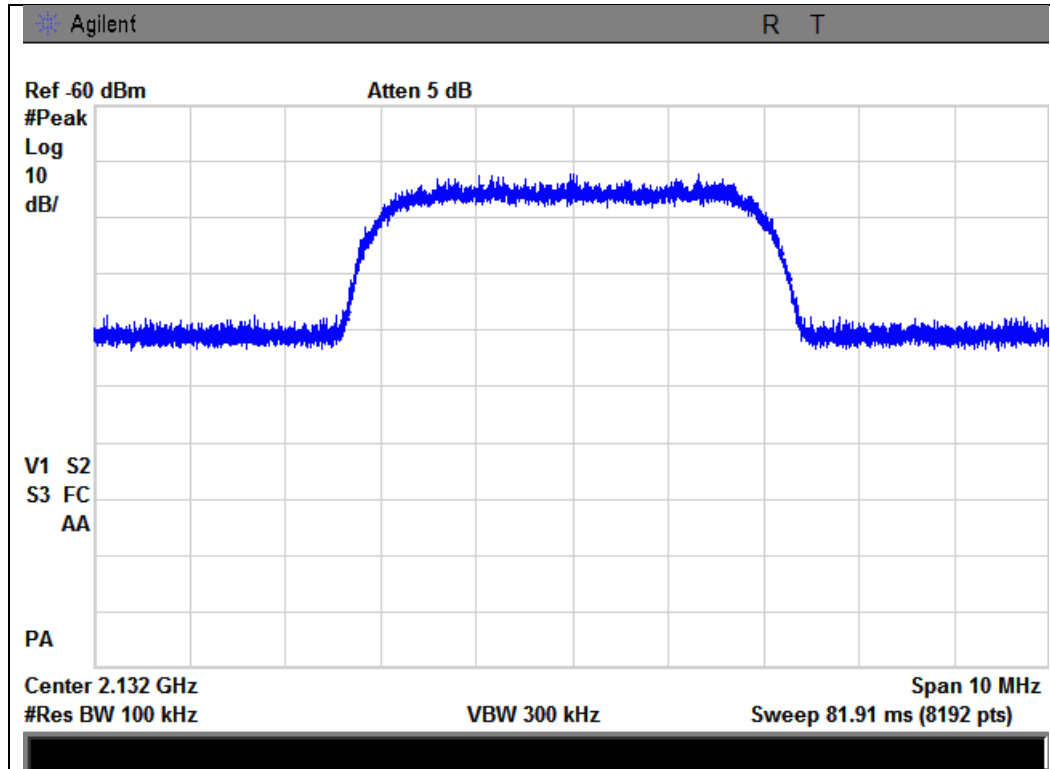
Output



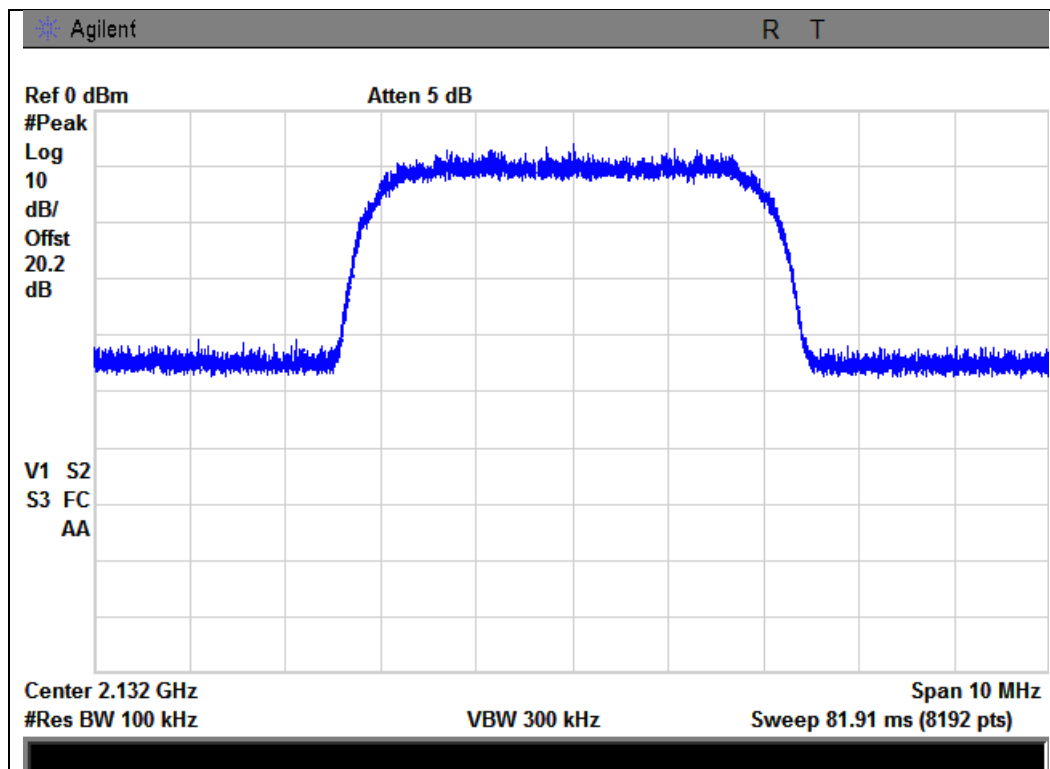


2110 - 2155 MHz Band

Input



Output





Oscillation Detection

Name of Test: Oscillation Detection
Test Equipment Utilized: i00413,
E4407B - S/N:MY41444836

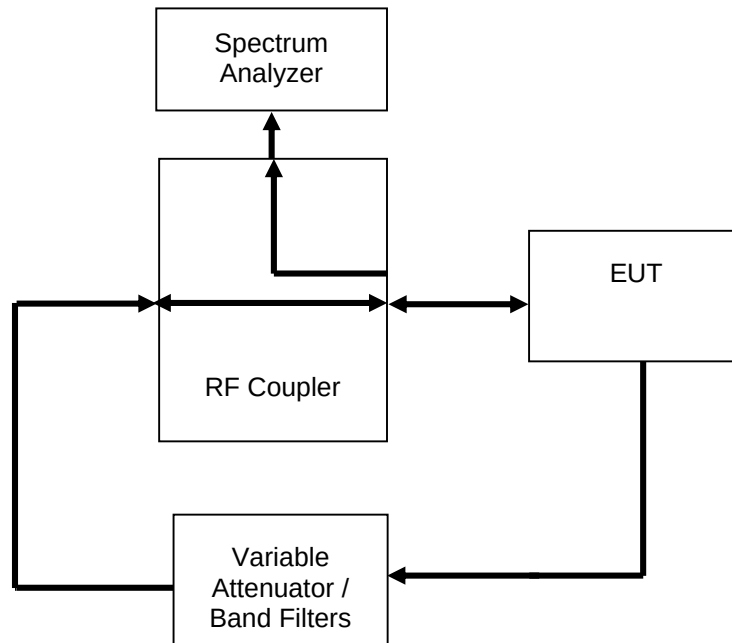
Engineer: Greg Corbin

Test Date: 8/14/2013

Test Procedure

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

Test Setup



Uplink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
698 - 716	66.1	300	Pass
777 - 787	57.5	300	Pass
824 - 849	70.1	300	Pass
1710 - 1755	37.5	300	Pass
1850 - 1915	95	300	Pass

Downlink Detection Time Test Results

Frequency Band (MHz)	Measured Time (mS)	Limit (mS)	Result
728 - 746	40	1000	Pass
746 - 756	52.5	1000	Pass
869 - 894	57.5	1000	Pass
1930 - 1995	75	1000	Pass
2110 - 2155	45	1000	Pass



Uplink Restart Time Test Results

Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result
698 - 716	70.7	≥60	Pass
777 - 787	70.7	≥60	Pass
824 - 849	70.2	≥60	Pass
1710 - 1755	71	≥60	Pass
1850 - 1915	71	≥60	Pass

Downlink Restart Time Test Results

Frequency Band (MHz)	Measured Time (S)	Limit (S)	Result
728 - 746	70	≥60	Pass
746 - 756	70.2	≥60	Pass
869 - 894	70.5	≥60	Pass
1930 - 1995	70	≥60	Pass
2110 - 2155	70.2	≥60	Pass

Uplink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
698 - 716	4	≤5	Pass
777 - 787	4	≤5	Pass
824 - 849	4	≤5	Pass
1710 - 1755	4	≤5	Pass
1850 - 1915	4	≤5	Pass

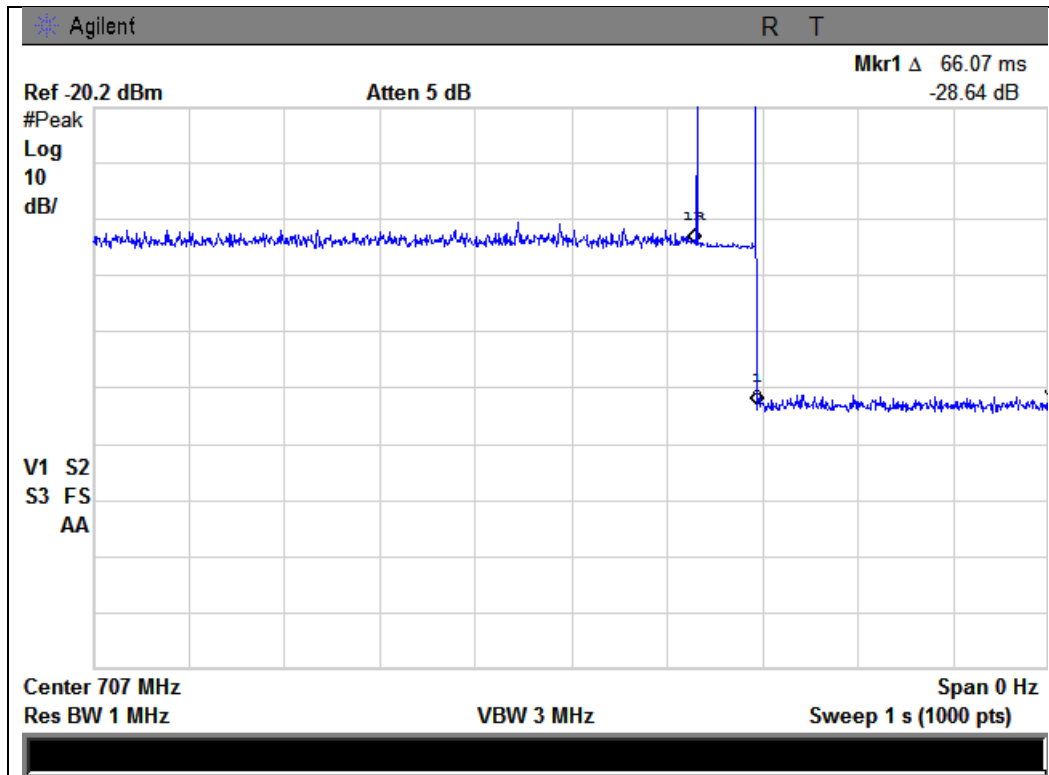
Downlink Restart Count Test Results

Frequency Band (MHz)	Restarts	Limit	Result
728 - 746	4	≤5	Pass
746 - 756	4	≤5	Pass
869 - 894	4	≤5	Pass
1930 - 1995	4	≤5	Pass
2110 - 2155	4	≤5	Pass

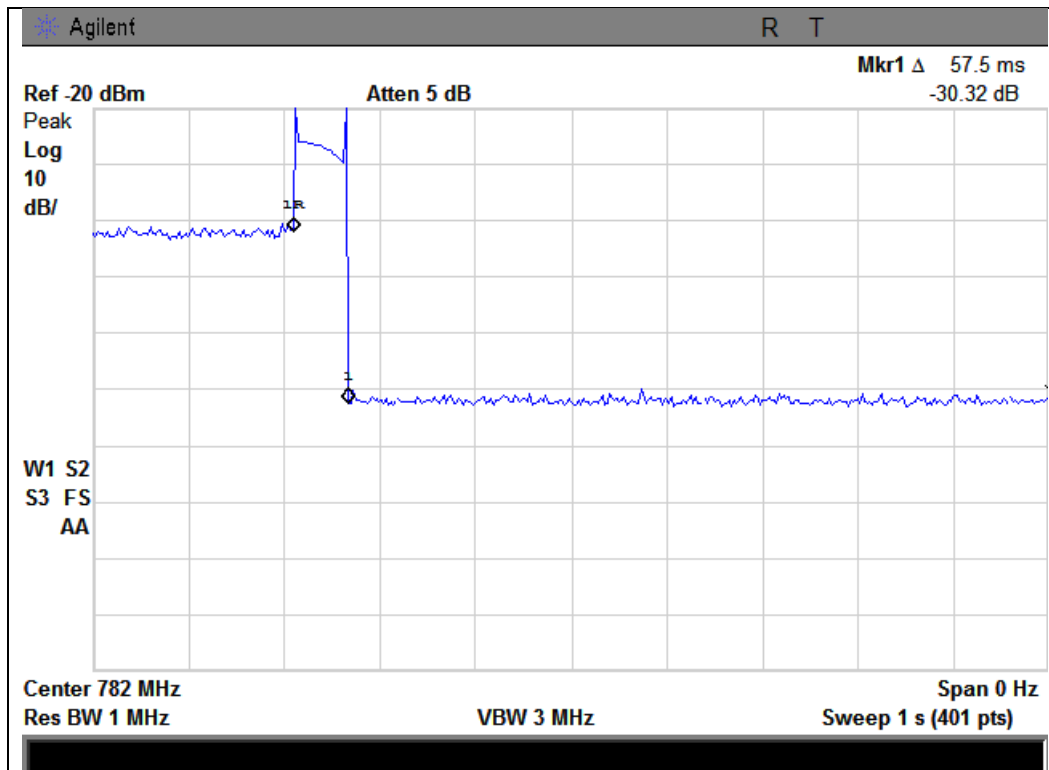


Uplink Detection Time Test Results

698 - 716 MHz Band

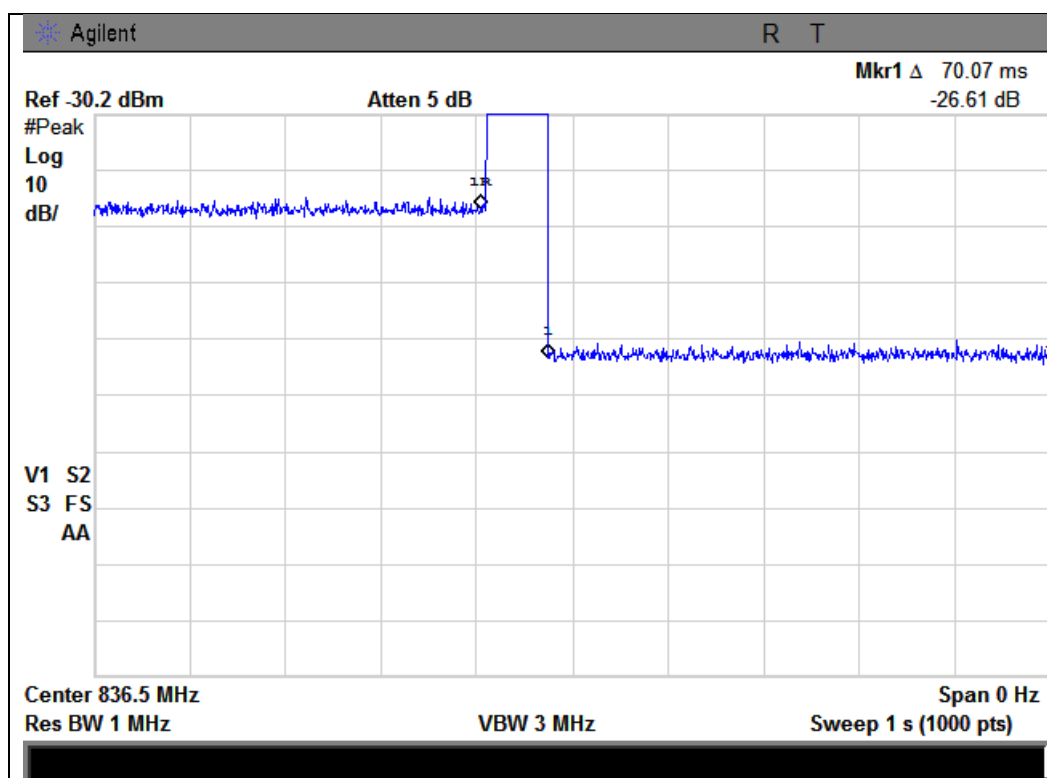


777 - 787 MHz Band

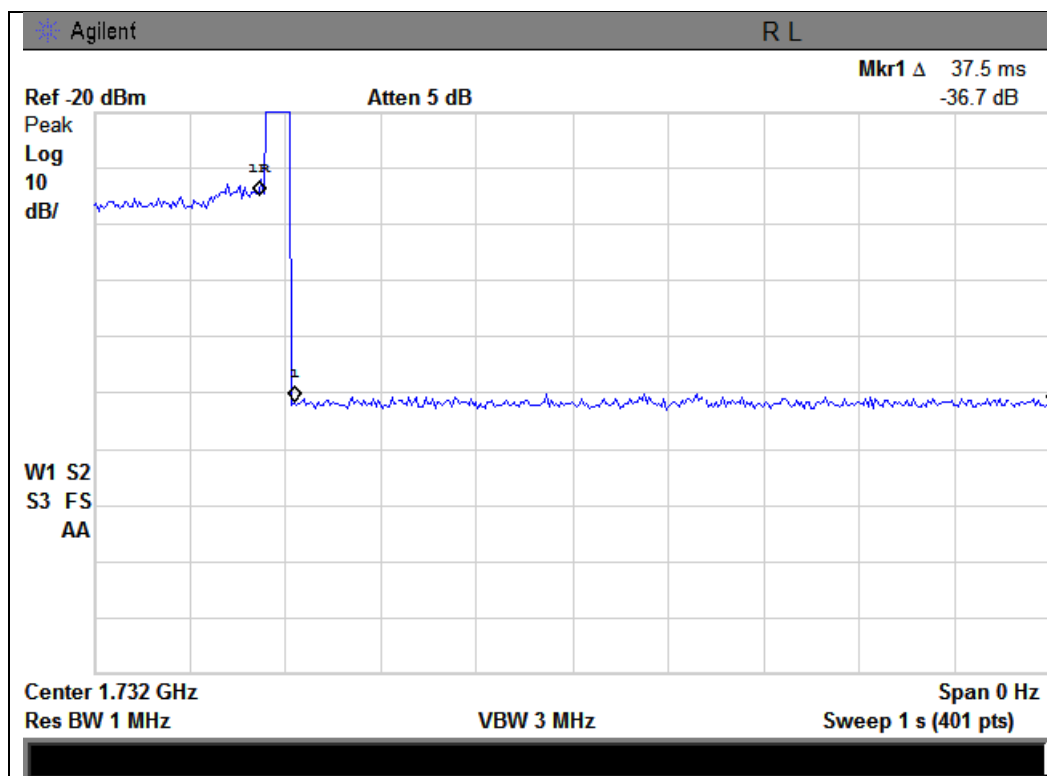




824 - 849 MHz Band

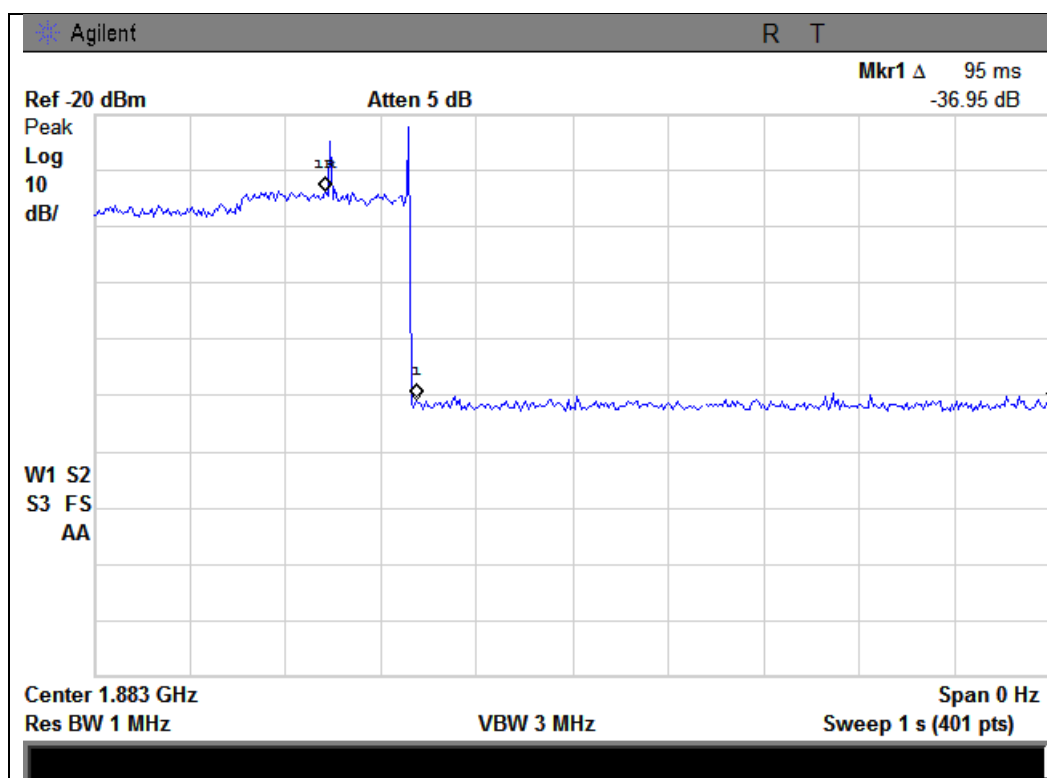


1710 - 1755 MHz Band



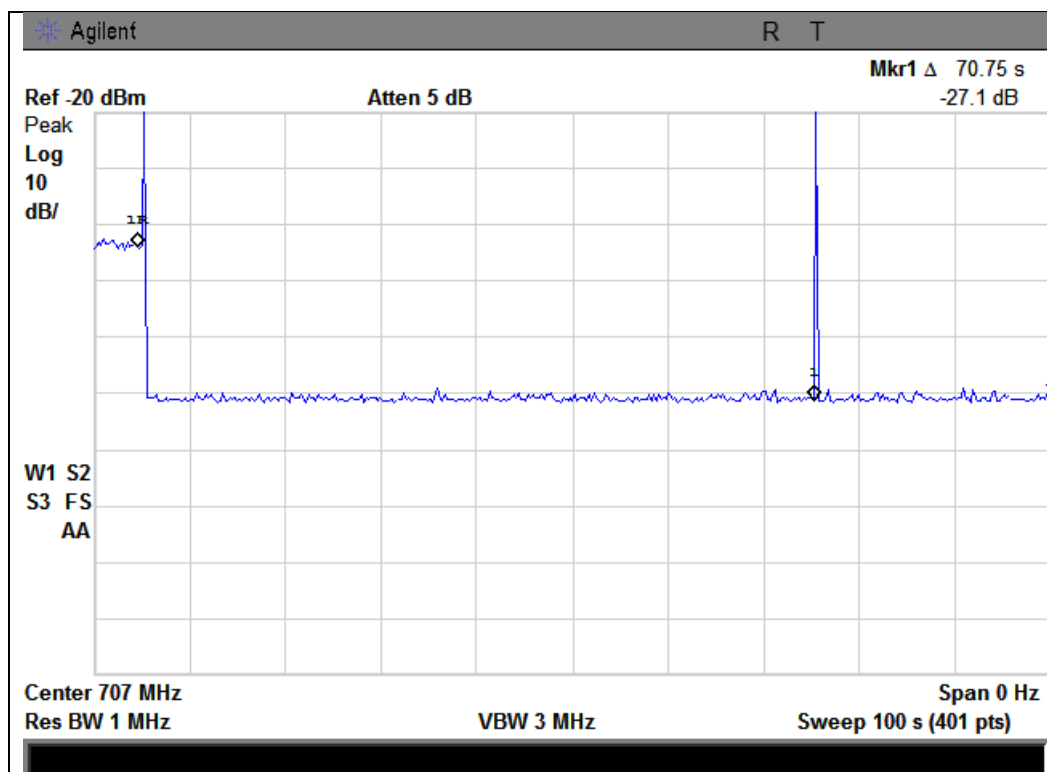


1850 - 1915 MHz Band



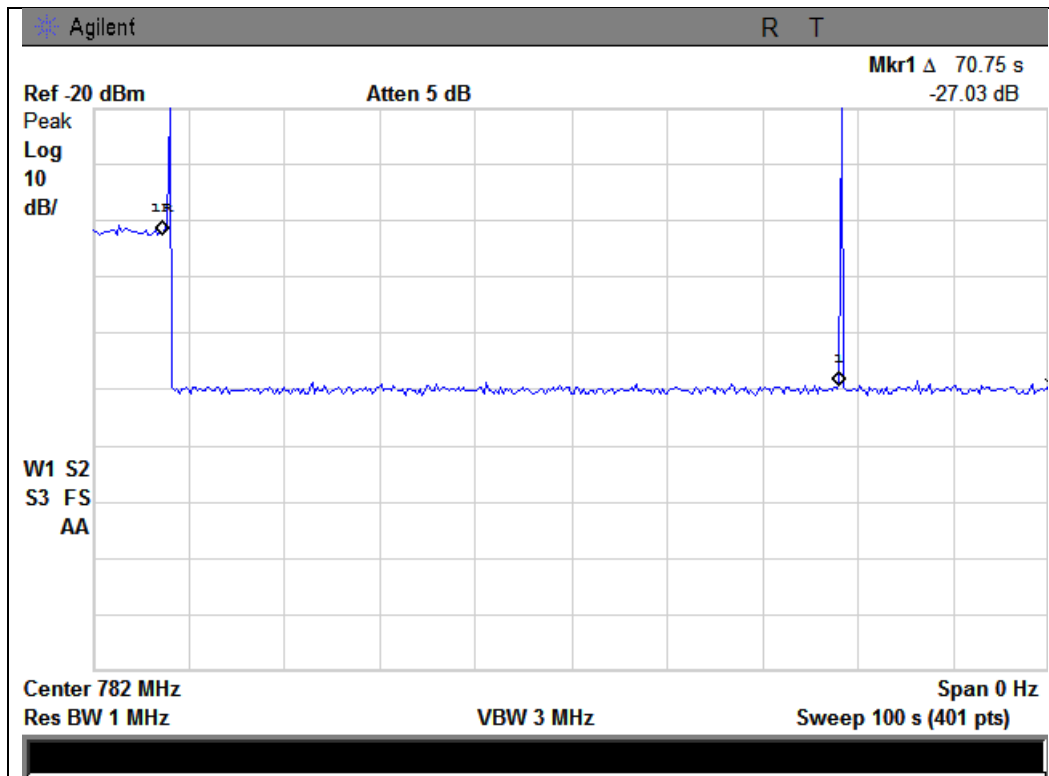
Uplink Restart Time Test Results

698 - 716 MHz Band

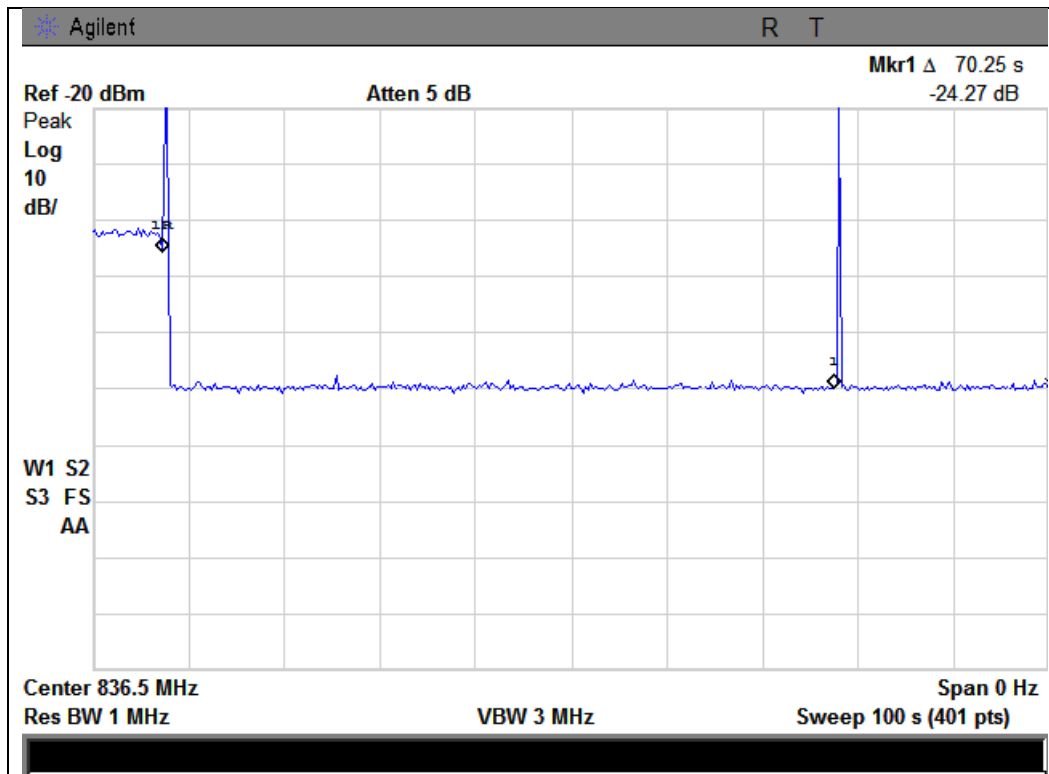




777 - 787 MHz Band

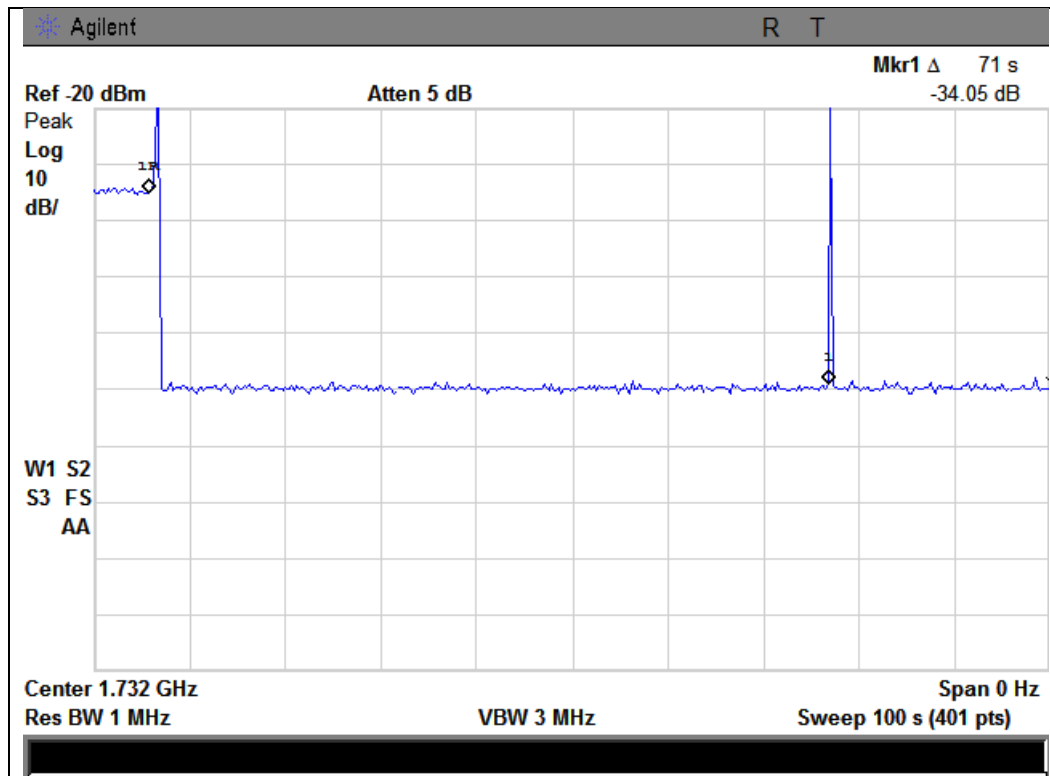


824 - 849 MHz Band

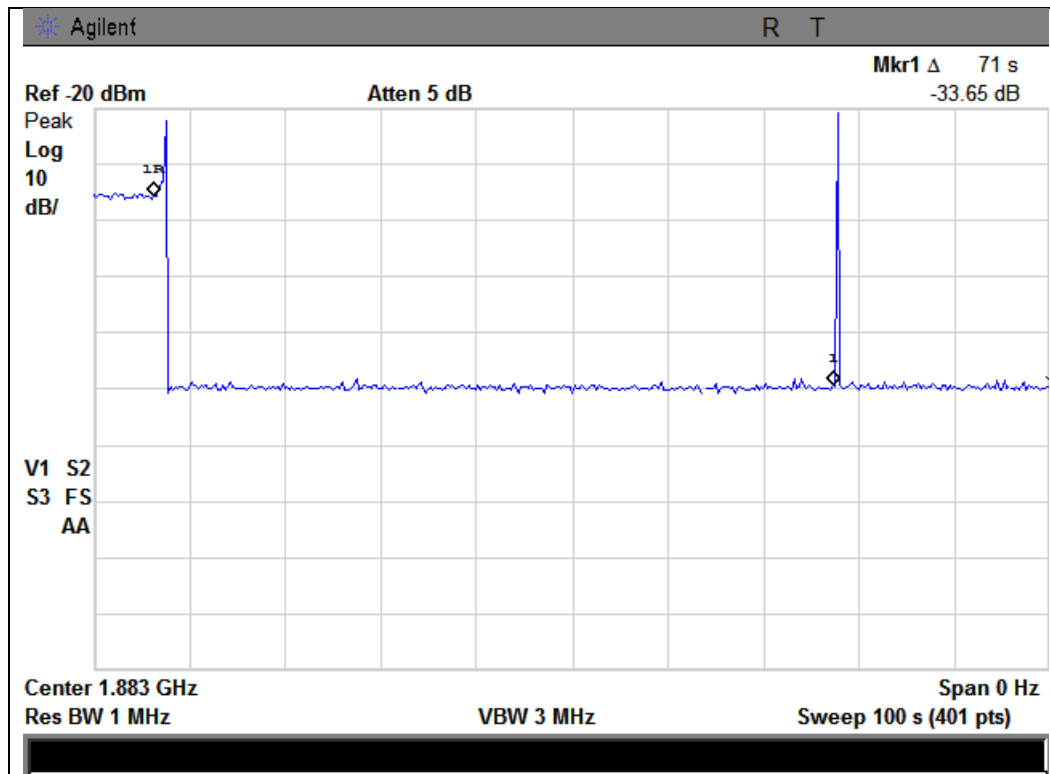




1710 - 1755 MHz Band



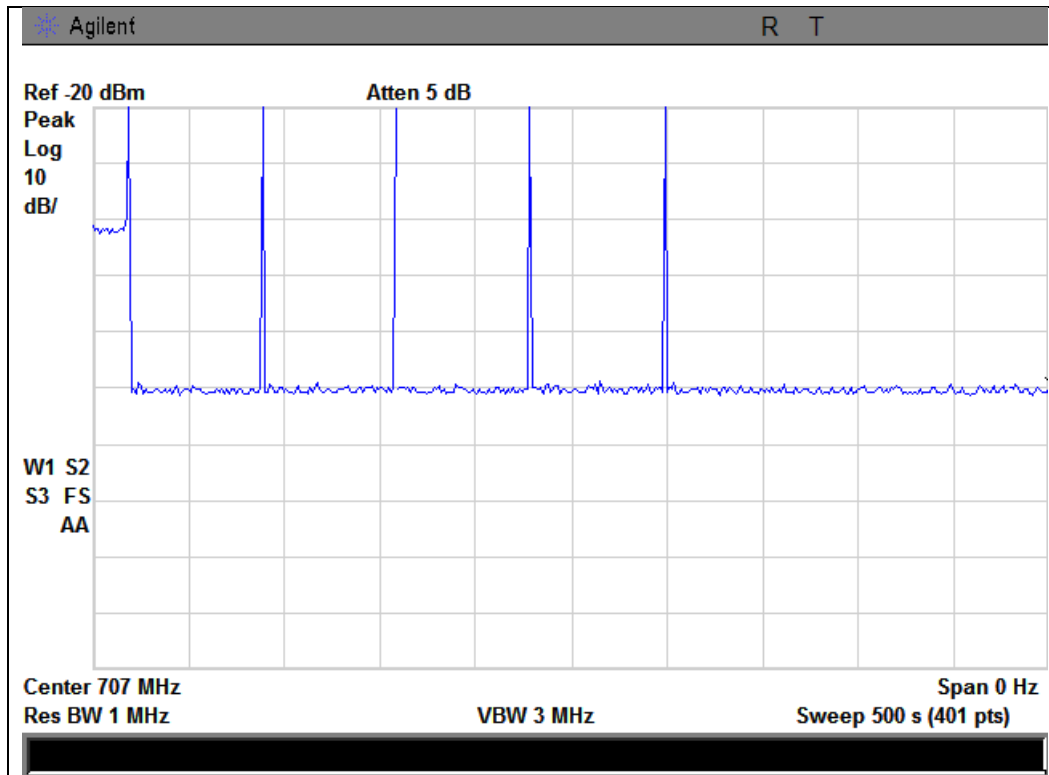
1850 - 1915 MHz Band



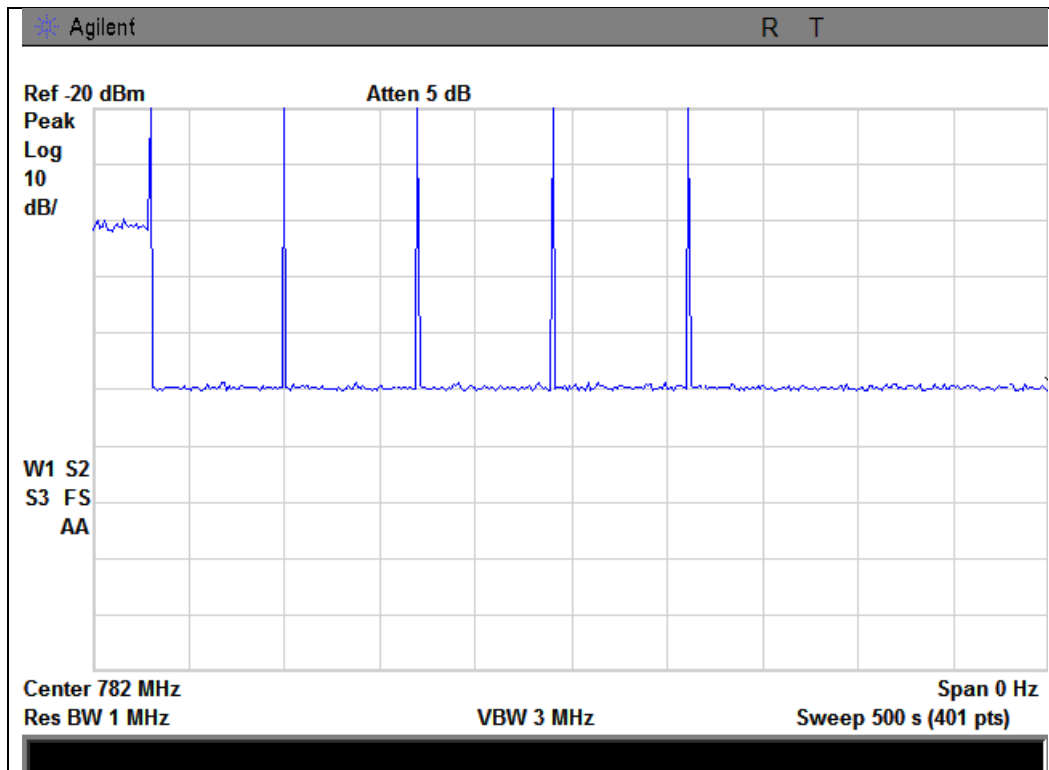


Uplink Restart Count Test Results

698 - 716 MHz Band

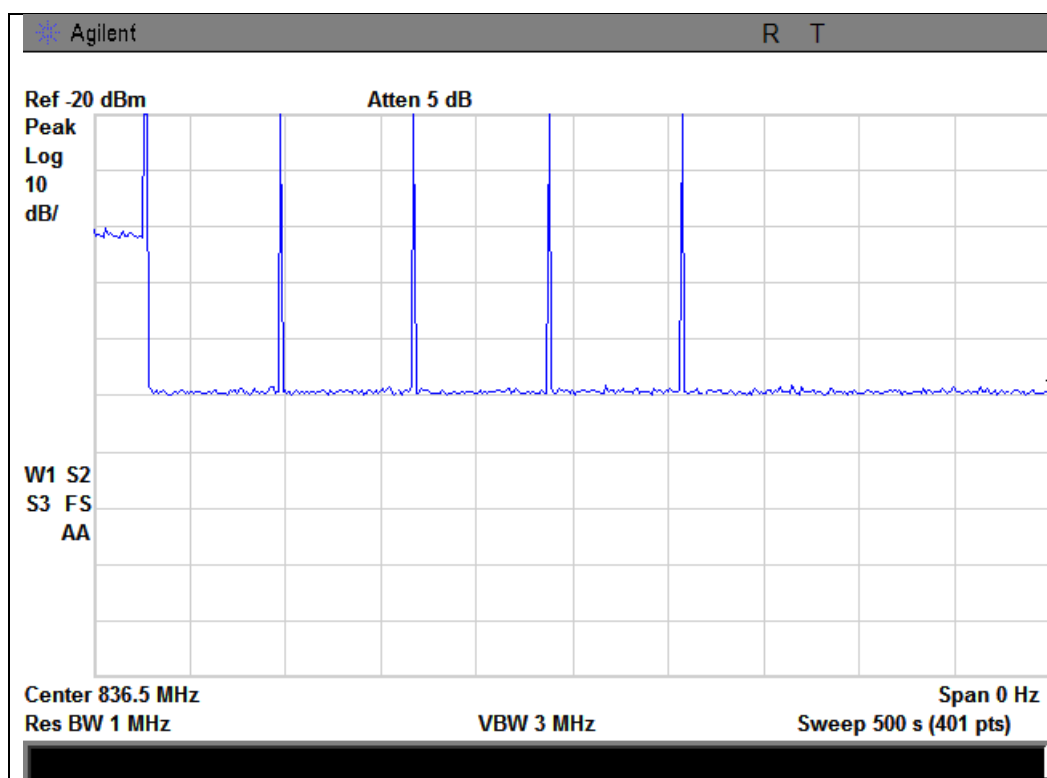


777 - 787 MHz Band

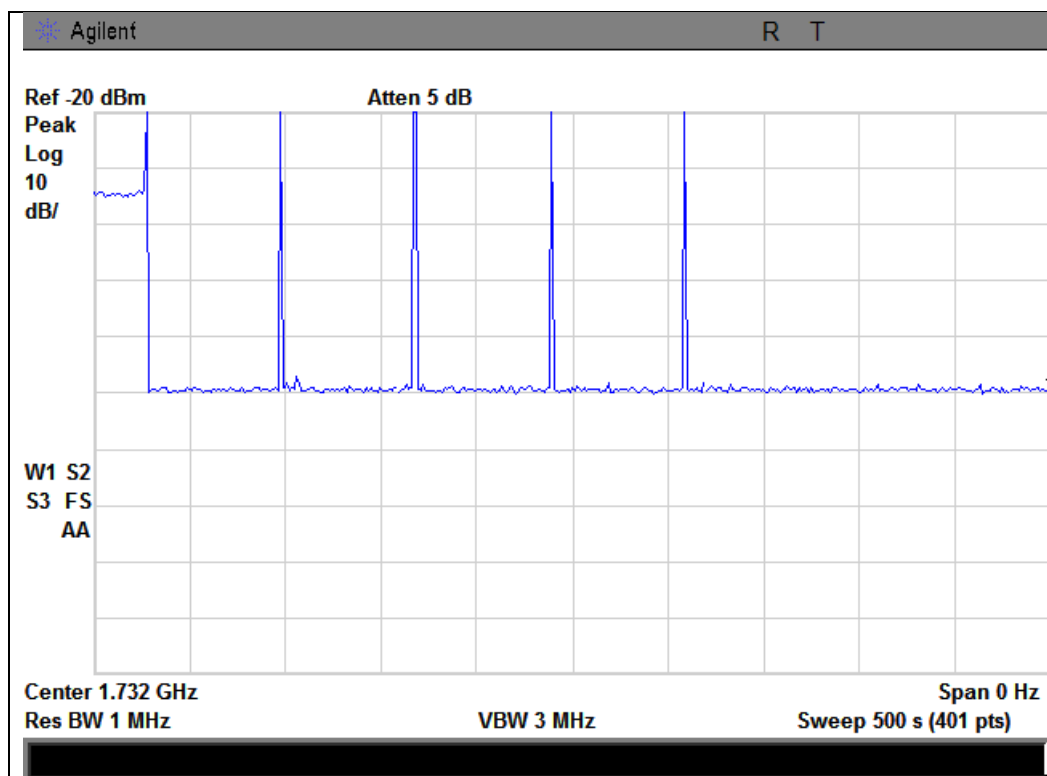




824 - 849 MHz Band

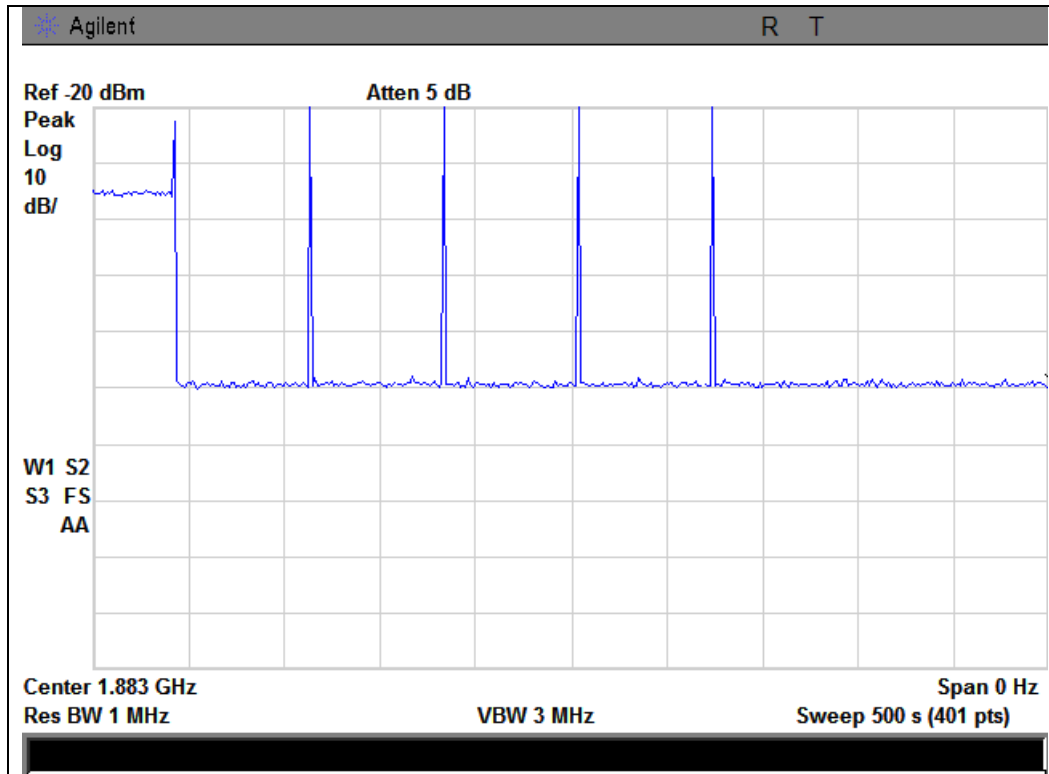


1710 - 1755 MHz Band

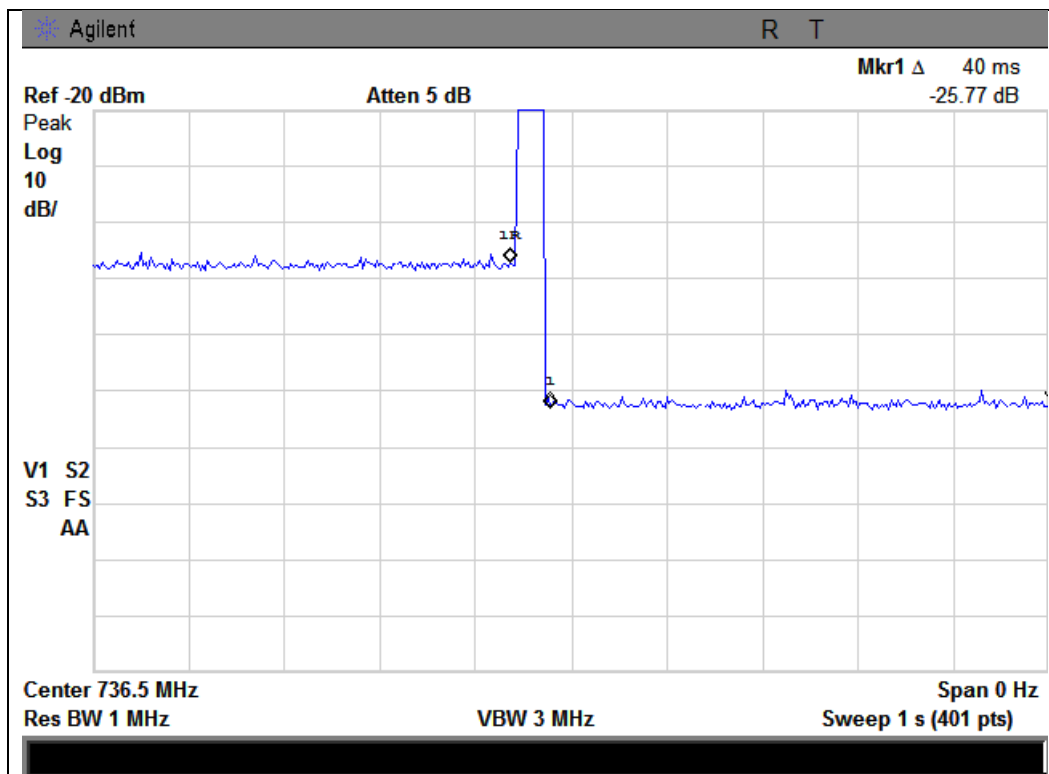




1850 - 1915 MHz Band

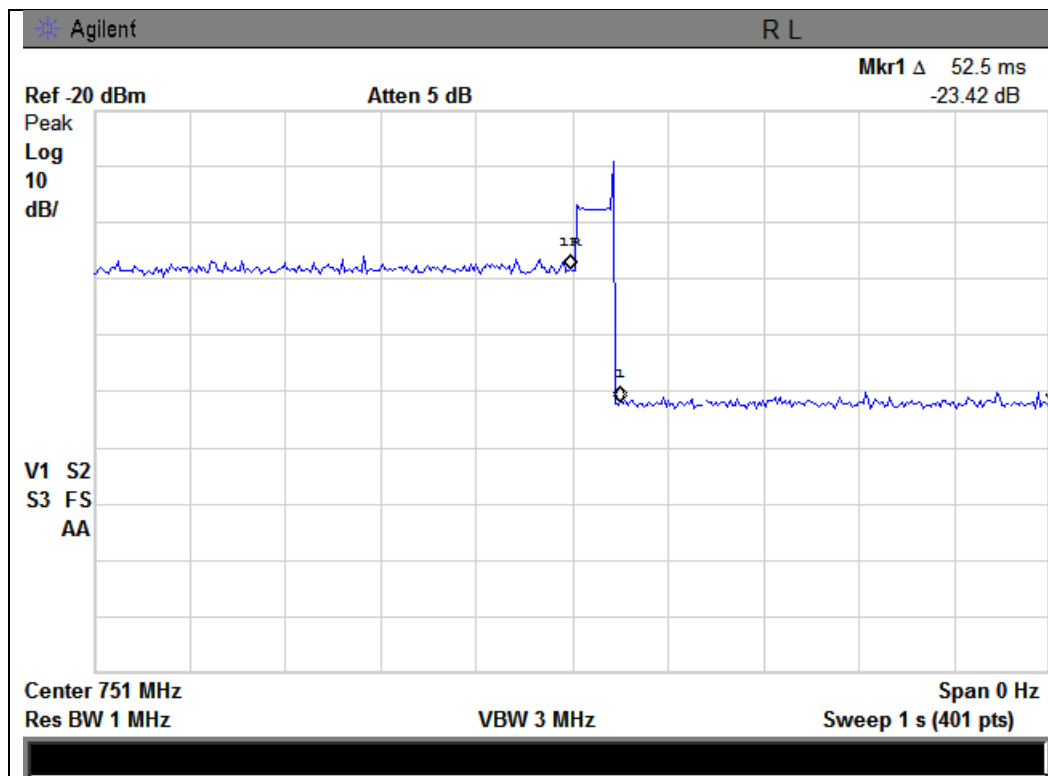


Downlink Detection Time Test Results 728 - 746 MHz Band

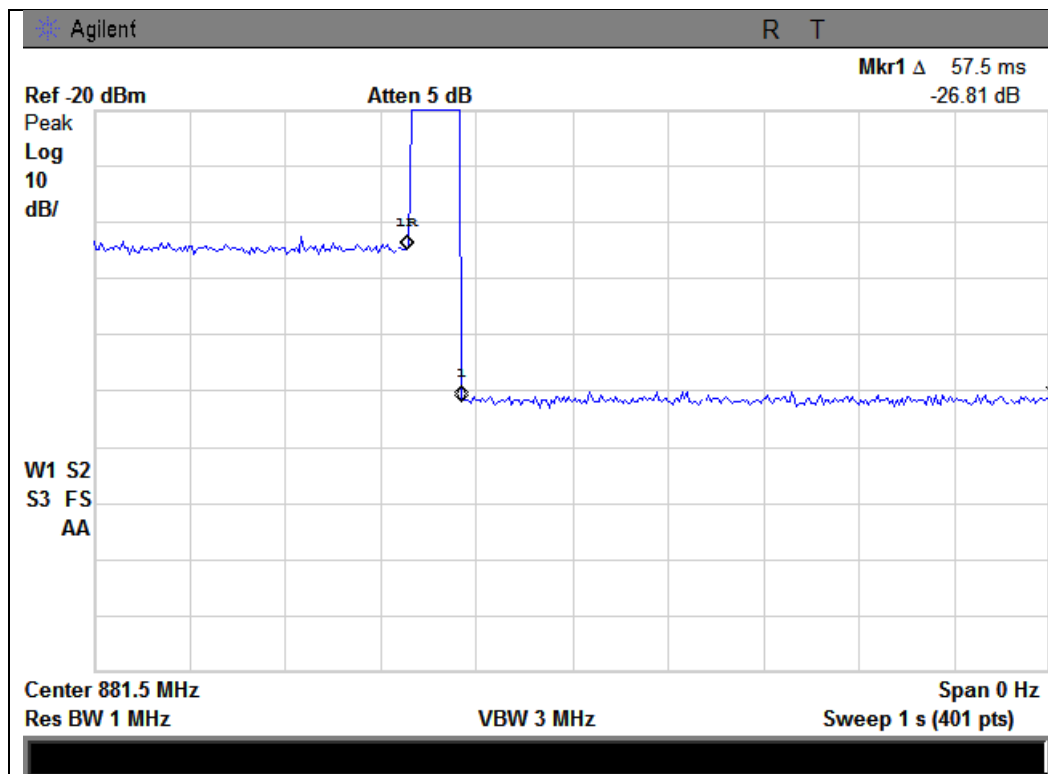




746 - 756 MHz Band

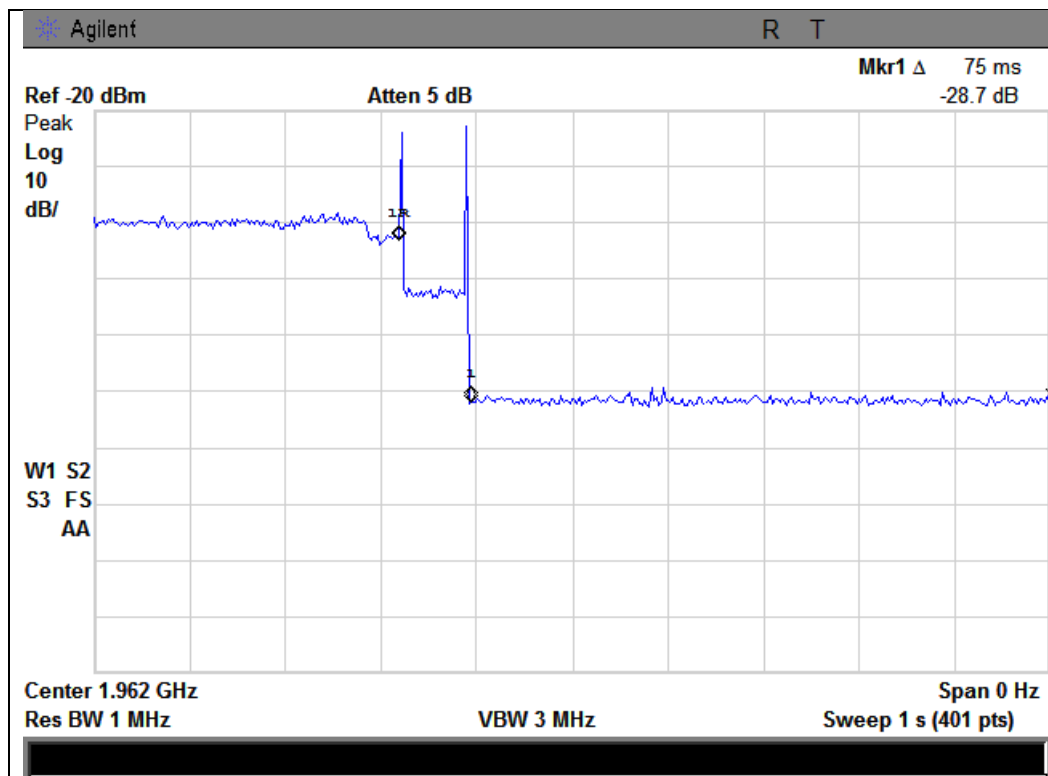


869 - 894 MHz Band

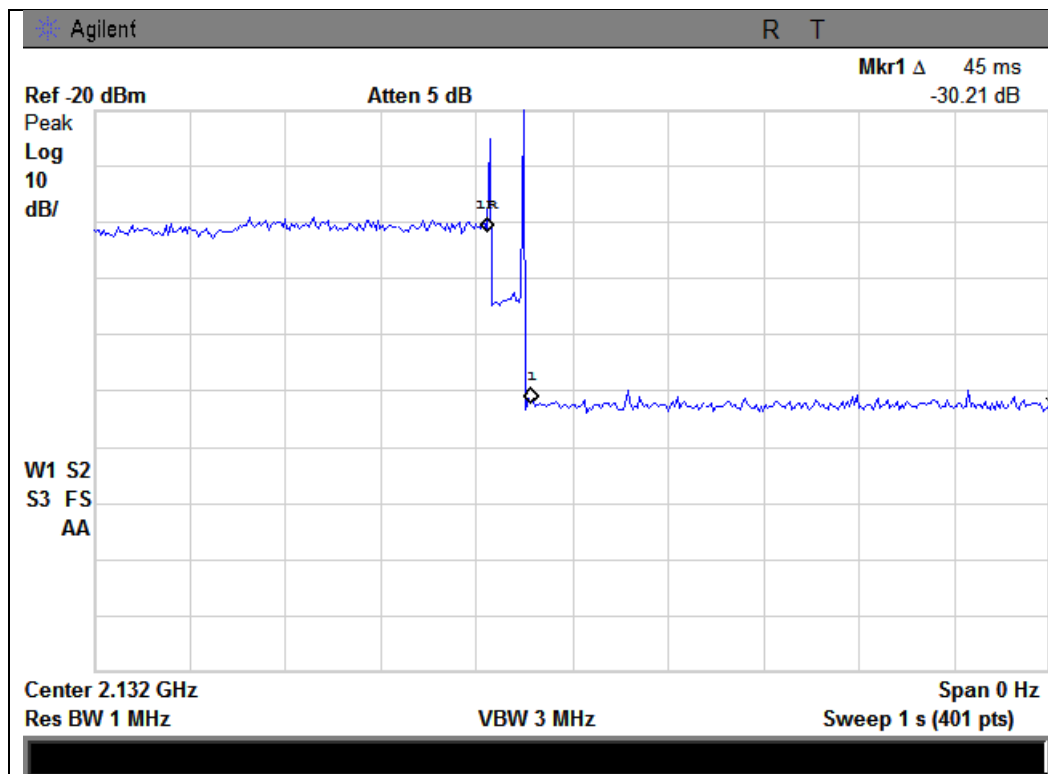




1930 - 1995 MHz Band



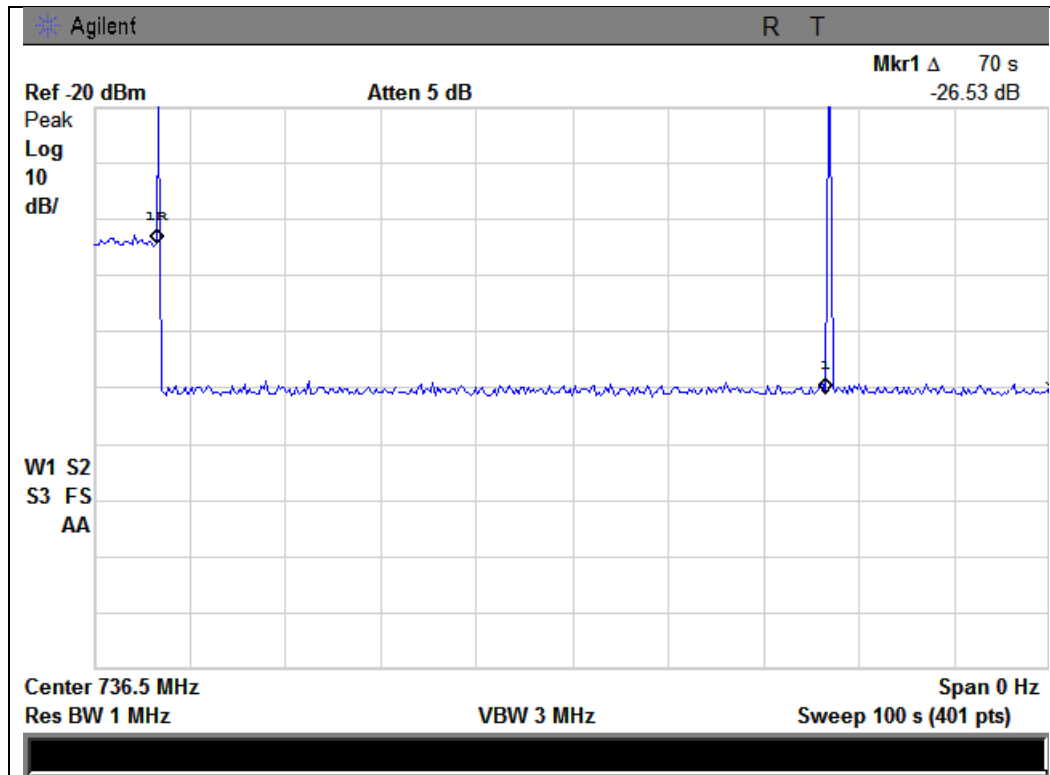
2110 - 2155 MHz Band



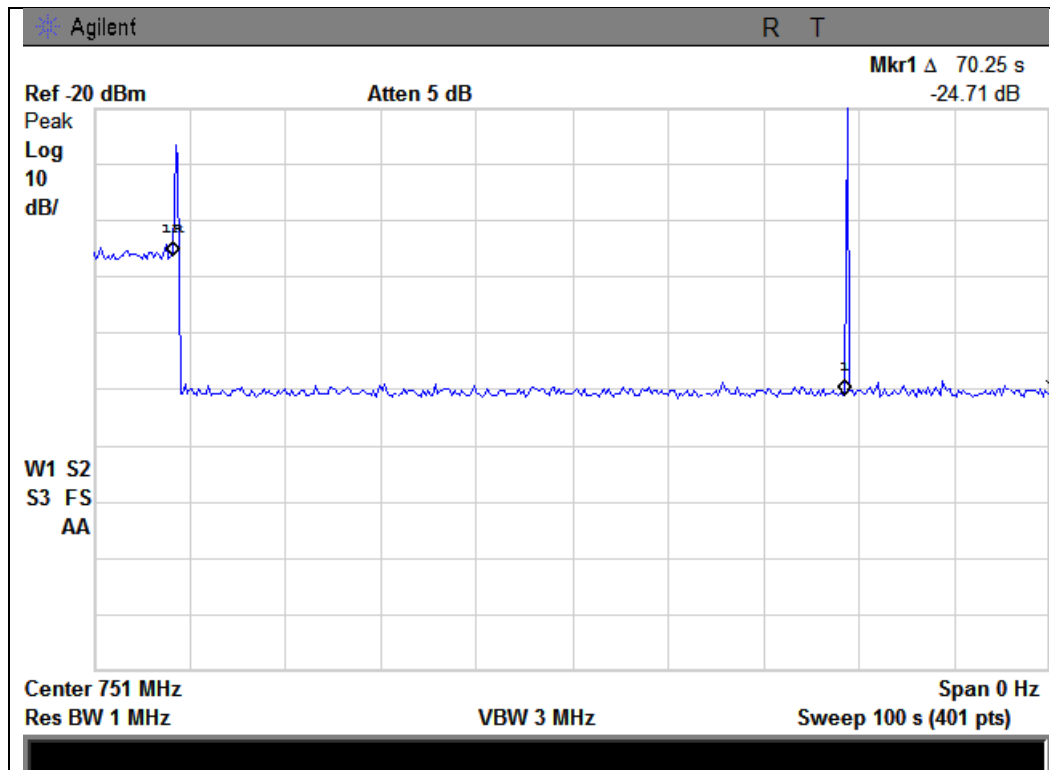


Downlink Restart Time Test Results

728 - 746 MHz Band

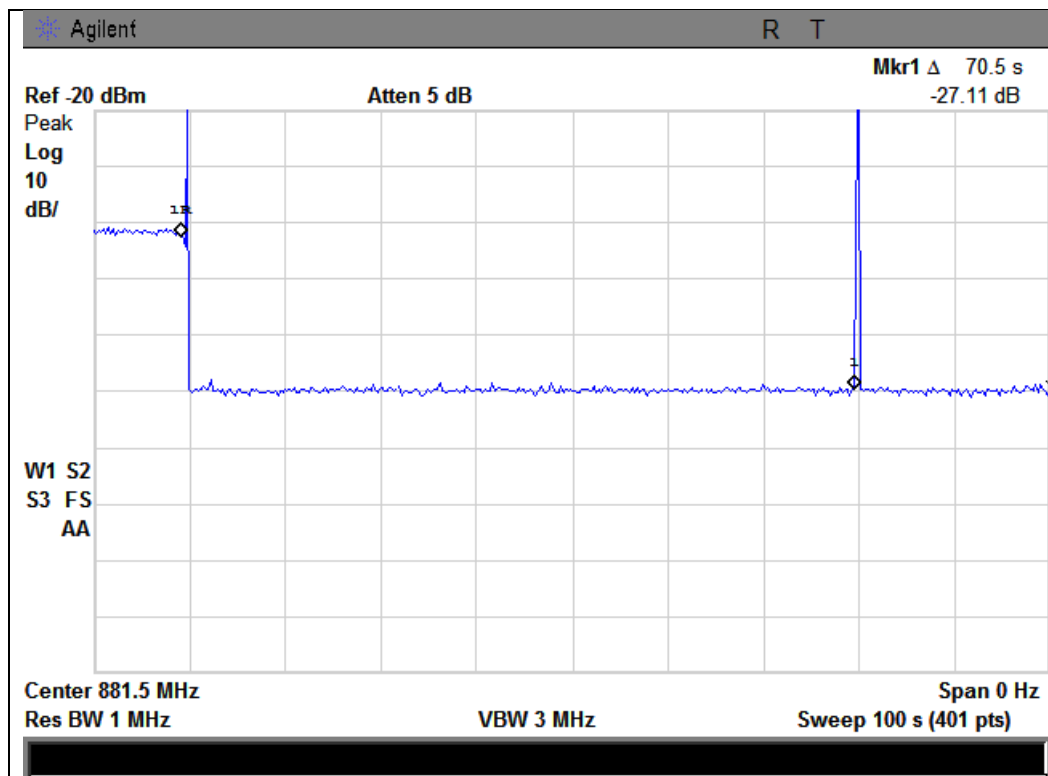


746 - 756 MHz Band

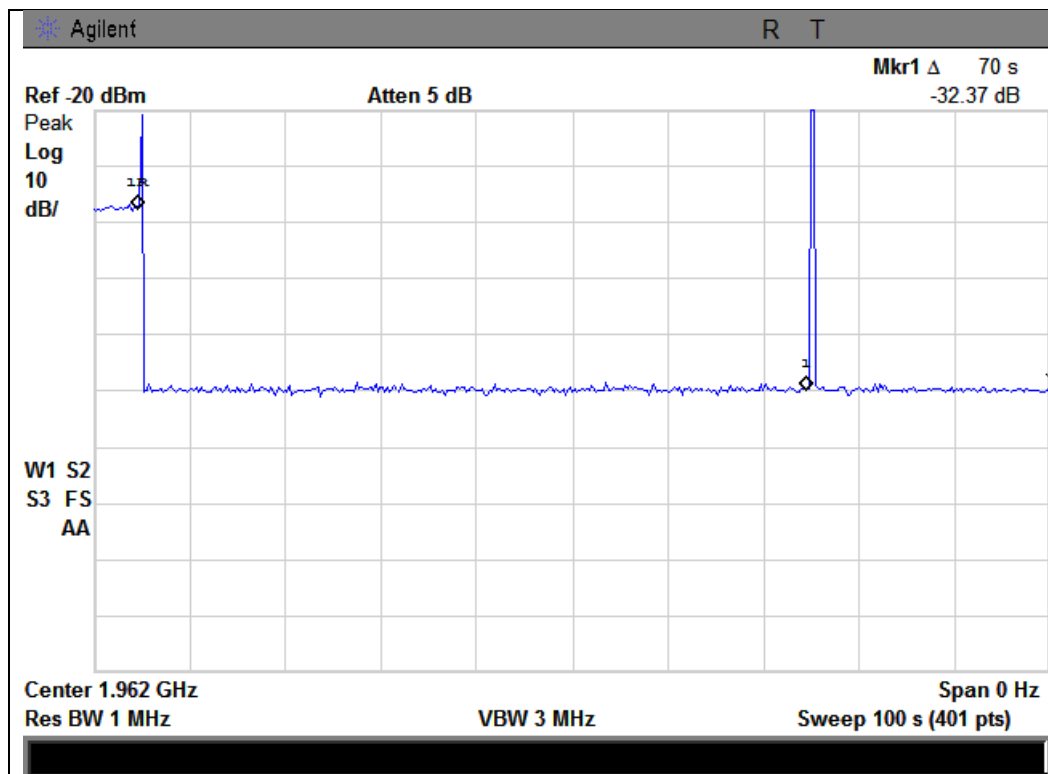




869 - 894 MHz Band

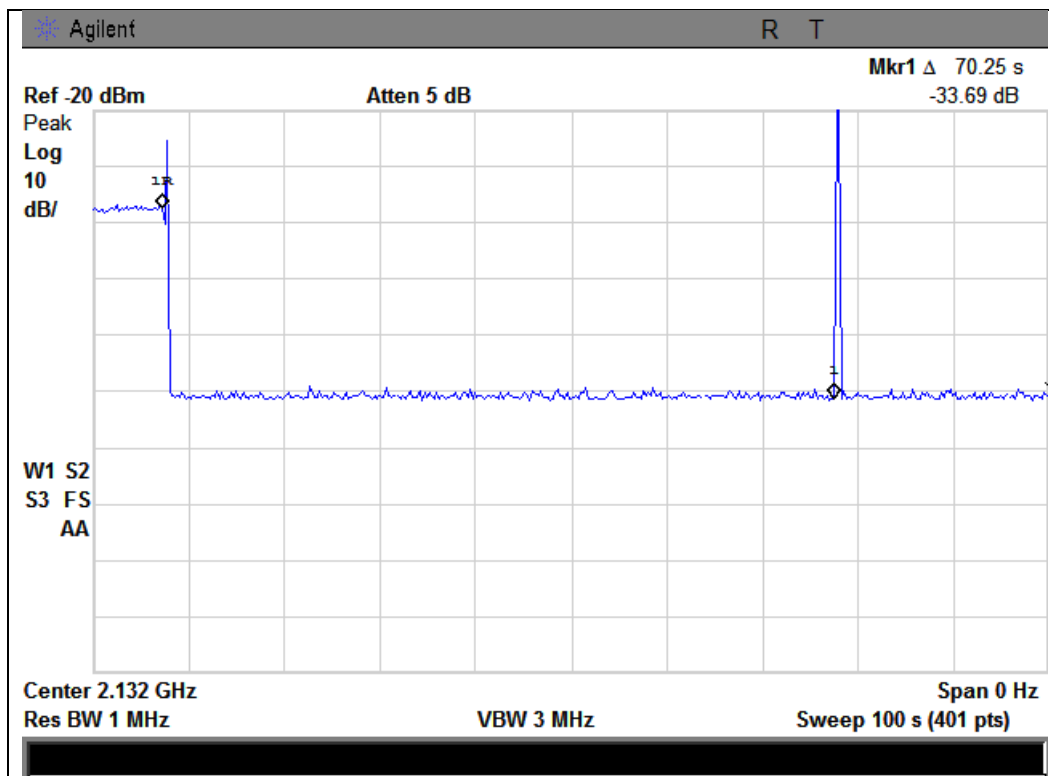


1930 - 1995 MHz Band



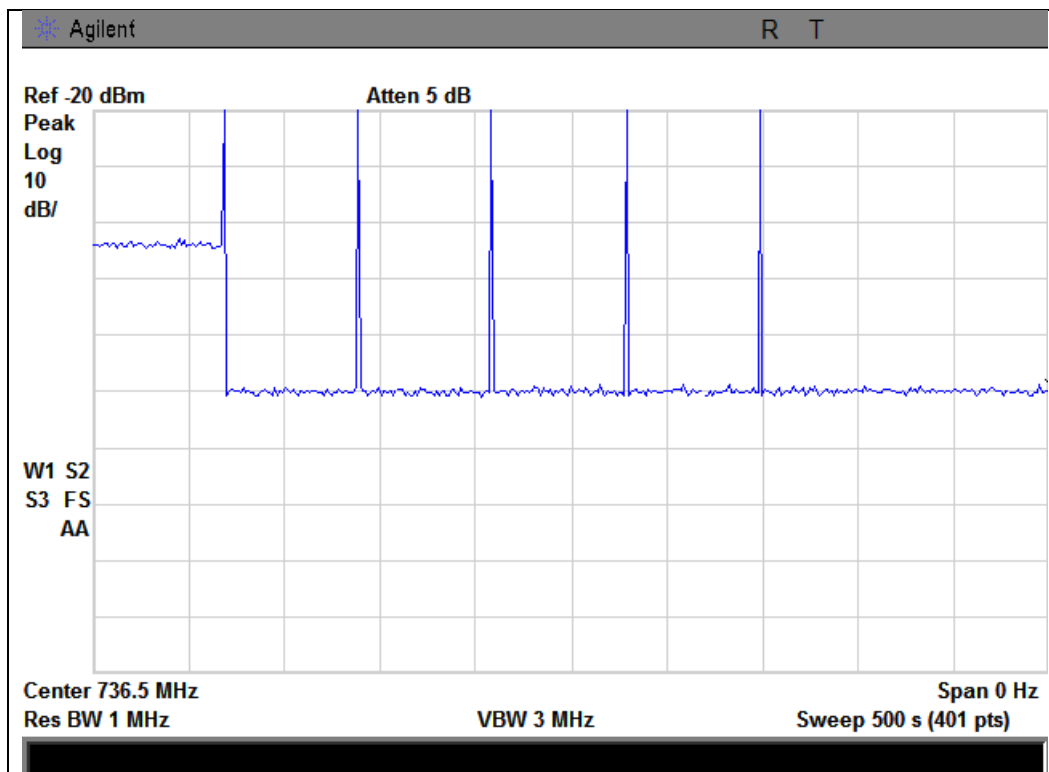


2110 - 2155 MHz Band



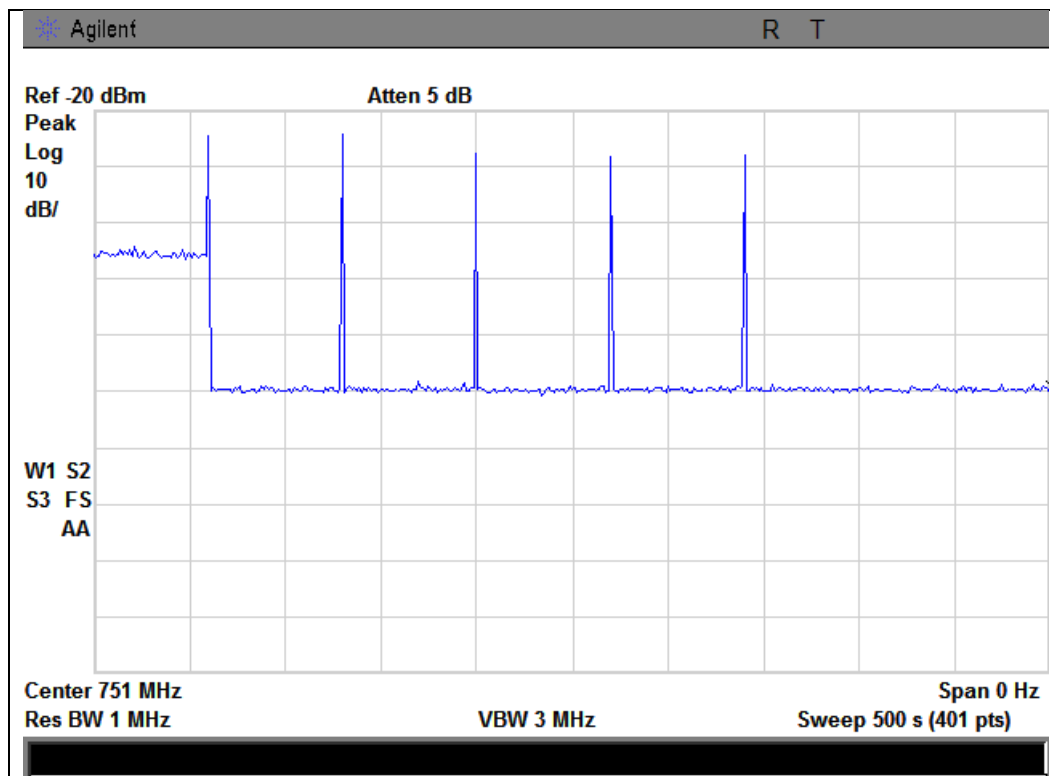
Downlink Restart Count Test Results

728 - 746 MHz Band

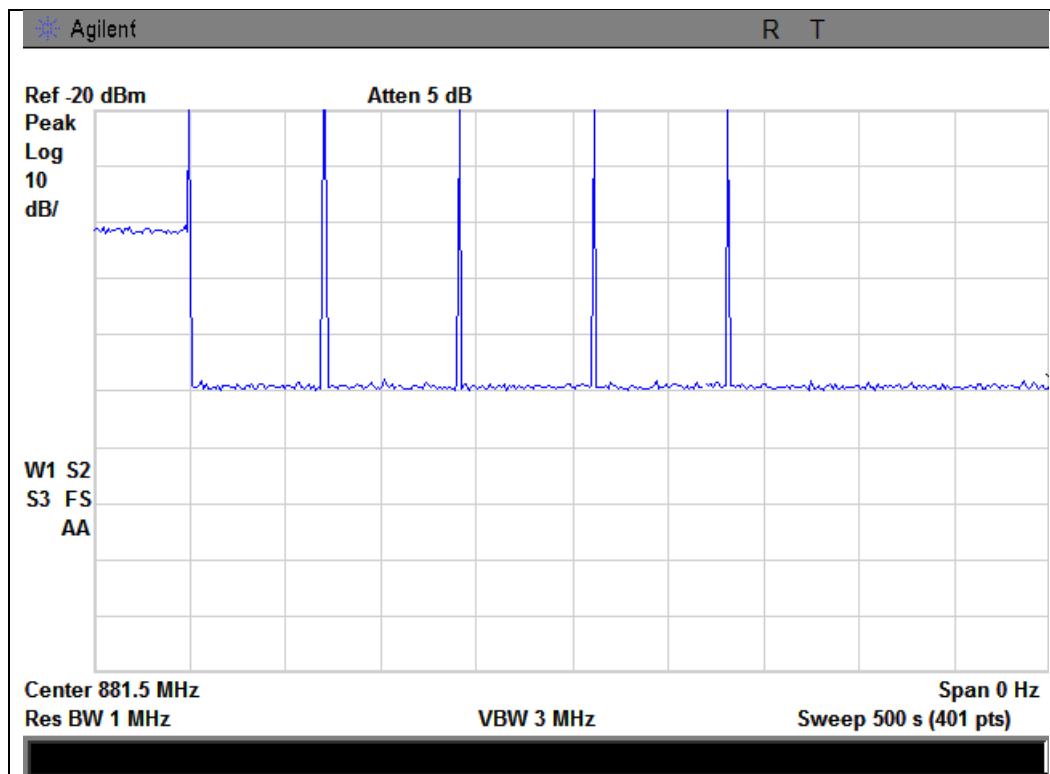




746 - 756 MHz Band

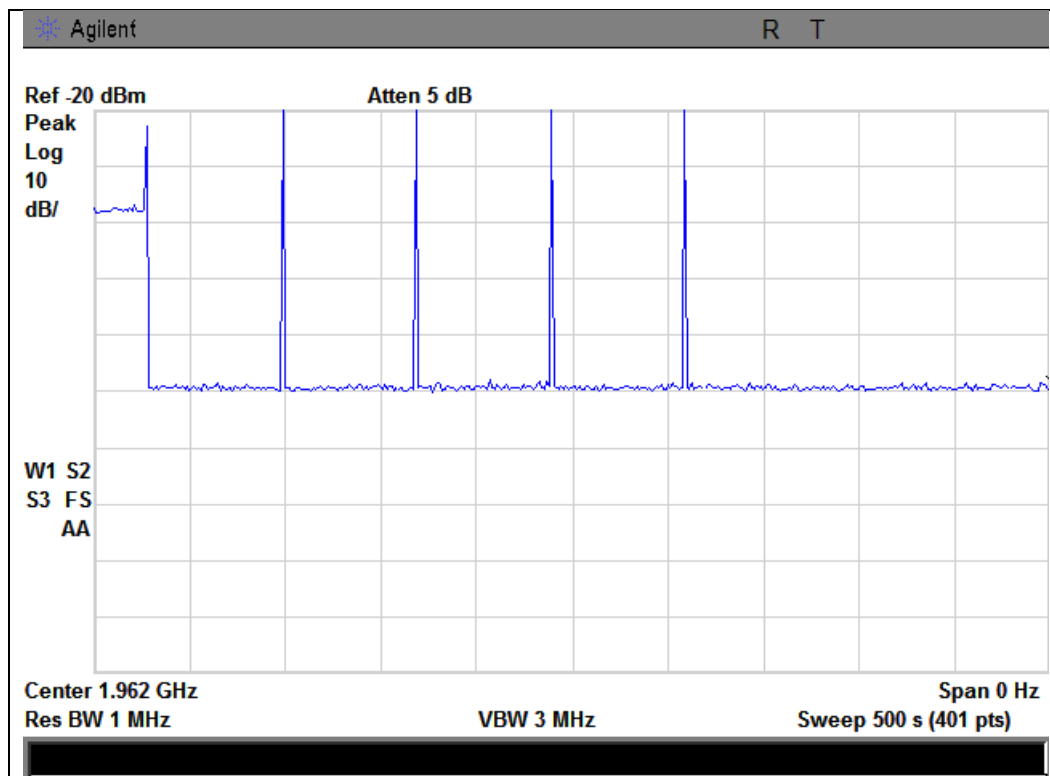


869 - 894 MHz Band

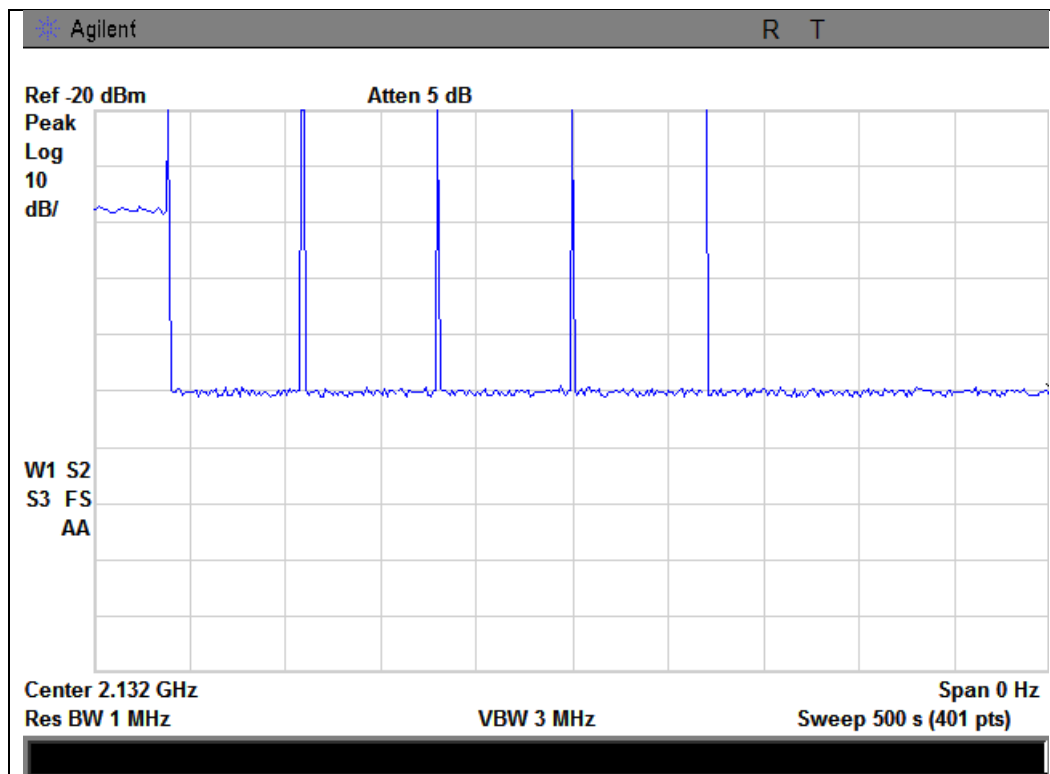




1930 - 1995 MHz Band



2110 - 2155 MHz Band





Radiated Spurious

Name of Test:

Radiated Spurious

Engineer: Greg Corbin

Test Equipment Utilized:

i00103, i00334, i00348, i00379

Test Date: 8/15/2013

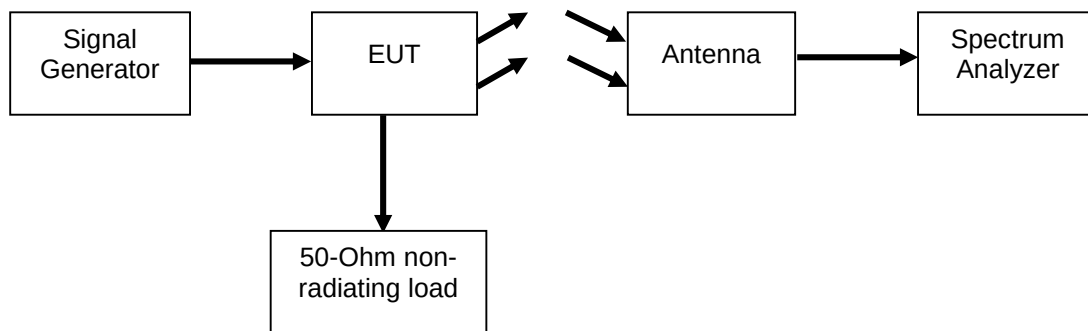
Test Procedure

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

The following formulas are used for calculating the limits.

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

Test Setup





Uplink Test Results

698 - 716 MHz Band_707 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1414	-42.5	-13	Pass
2121	-39.6	-13	Pass
2828	-36	-13	Pass

777 - 787 MHz Band_782 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1563	-44.2	-13	Pass
2344.5	-40.4	-13	Pass
3126	-36.3	-13	Pass

824 - 849 MHz Band_836.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1672	-44.6	-13	Pass
2508	-37.6	-13	Pass
3344	-33.1	-13	Pass

1710 - 1755 MHz Band_1732.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3484	-32.5	-13	Pass
5226	-32.2	-13	Pass
6968	-25.0	-13	Pass

1850 - 1915 MHz Band 1882.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3760	-33.1	-13	Pass
5640	-30.5	-13	Pass
7520	-23.3	-13	Pass



Downlink Test Results

728 - 746 MHz Band_736.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1474	-44.0	-13	Pass
2211	-41	-13	Pass
2948	-36.0	-13	Pass

746 - 756 MHz Band_751 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1503	-44.2	-13	Pass
2254.5	-38.4	-13	Pass
3006	-35.0	-13	Pass

869 - 894 MHz Band_881.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1763	-42.2	-13	Pass
2644.5	-37.4	-13	Pass
3526	-33.8	-13	Pass

1930 - 1995 MHz Band_1962.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3920	-34.4	-13	Pass
5880	-30.8	-13	Pass
7840	-22.6	-13	Pass

2110 - 2155 MHz Band_2132.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
4265	-33.5	-13	Pass
6397.5	-29.6	-13	Pass
8530	-21.3	-13	Pass

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



Test Equipment Utilized

Description	Manufacturer	Model Number	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	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
Non-radiating load	Termaline	8201	i00334	Verified on: 8/15/13	
Vector Signal Generator	Agilent	E4438C	i00348	1/4/13	1/4/14
EMI Analyzer	Agilent	E7405A	i00379	11/21/12	11/21/13
Tunable Band Pass Filter	Wilson Electronics	Variable attenuator / Bandpass Filter Switch Assembly	i00411	Verified on: 8/14/13	
RF Directional Coupler	Meca	CS06-1.500V	i00413	Verified on: 7/29/2013	
Signal Generator	Rohde & Schwarz	SMU200A	S/N:101369	6/24/13	6/24/16
Spectrum Analyzer	Agilent	E4407B	S/N: MY41444836	6/21/13	6/21/14

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

END OF TEST REPORT