



Compliance Testing, LLC

Previously Flom Test Lab

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Test Report

Prepared for: Wilson Electronics, Inc.

Model: 460032

Description: Quint Band Signal Booster

FCC ID: PWO460032

To

FCC Part 20

Date of Issue: January 30, 2017

On the behalf of the applicant: Wilson Electronics, Inc.
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Attention of: Patrick Cook, Sr Research & Development Engineer
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Project No: p16b0008

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	January 5, 2017	Greg Corbin	Original Document
2.0	January 30, 2017	Greg Corbin	Revised Output Power and gain for 1930 - 1995 MHz Downlink pg 14

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the 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 Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

Test and Measurement Data

Sub-part

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 specified 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: 460032

Description: Quint Band Signal Booster

Serial Number: 464020C101370197

The EUT is a Fixed Install, bi-directional amplifier for the boosting of cellular phone signals and data communication devices.

This test report has been updated as part of a Class 2 Permissive change.

The C2PC was to remove an external RF switch located at the uplink sma output connector and incorporate the switch into the PCB layout. The switch is used to select either an internal patch antenna or an external antenna. Test data was used from the original filing except for Authorized Frequency Band, Output Power, Gain, Noise Power, Conducted and Radiated Spurious Emissions.

Additional antenna kitting options are also included in the filing.

The following frequency bands and emission types are utilized.

Frequency Band (MHz)					
Uplink	698 - 716	776 - 787	824 - 849	1850 - 1915	1710 – 1755
Downlink	728 - 746	746 - 757	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

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

EUT Operation during Tests

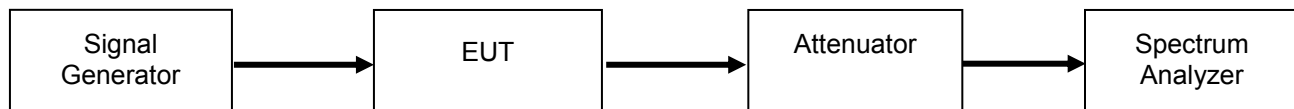
The EUT was in a normal operating condition.

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
20.21(e)(3)	Authorized Frequency Band	Pass	New Data
20.21(e)(8)(i)(B) 20.21(e)(8)(i)(C) 20.21(e)(8)(i)(D)	Maximum Power and Gain	Pass	New Data
20.21(e)(8)(i)(F)	Intermodulation	Pass	Data from original filing
20.21(e)(8)(i)(E)	Out-of-Band Emissions	Pass	Data from original filing
2.1051 22.917(a) 24.238((a) 27.53(c) 27.53(e) 27.53(f) 27.53(g)	Conducted Spurious Emissions	Pass	New Data
20.21(e)(8)(i)(A)	Noise Limits	Pass	New Data for Noise Power
20.21(e)(8)(i)(I)	Uplink Inactivity	Pass	Data from original filing
20.21(e)(8)(i)(C)(1) 20.21(e)(8)(i)(H) Choose: 20.21(e)(8)(i)(C)(2)(i) (Fixed)	Variable Gain	Pass	Data from original filing
2.1049	Occupied Bandwidth	Pass	Data from original filing
20.21(e)(8)(ii)(A)	Anti-Oscillation	Pass	Data from original filing
2.1053	Radiated Spurious	Pass	New Data
20.21(e)(8)(i)(B)	Spectrum Block Filtering	N/A	This only applies to devices utilizing spectrum block filtering

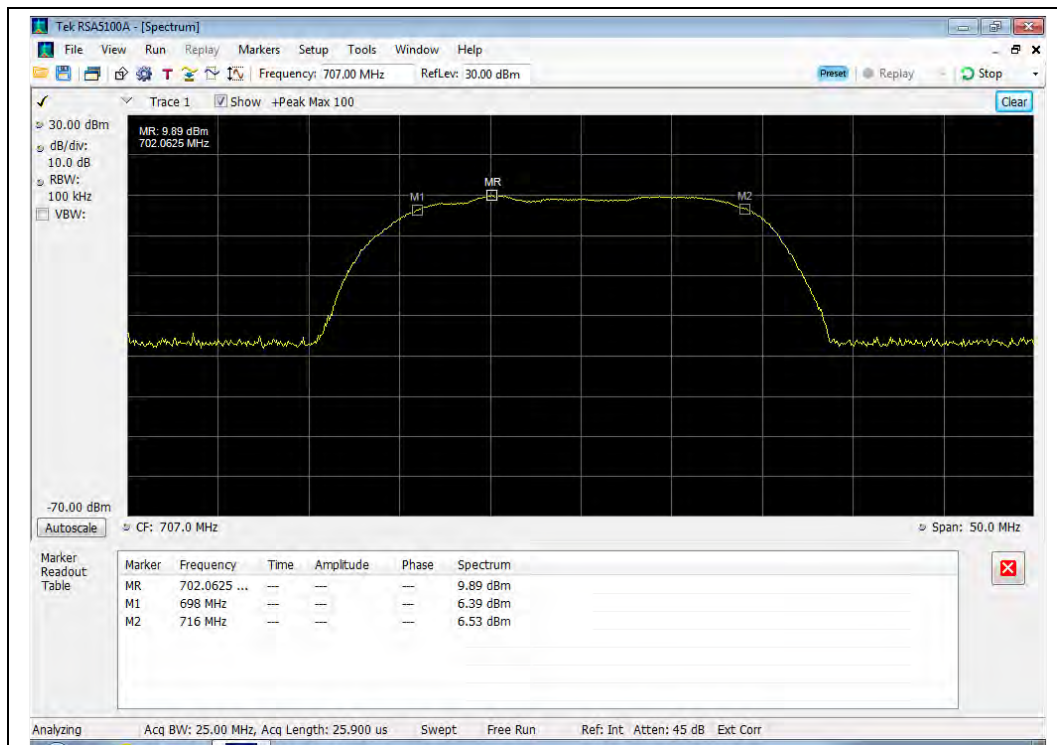
Authorized Frequency Band**Engineer:** Greg Corbin**Test Date:** 1/3/2017**Test Procedure**

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 needed to ensure accurate readings. 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.

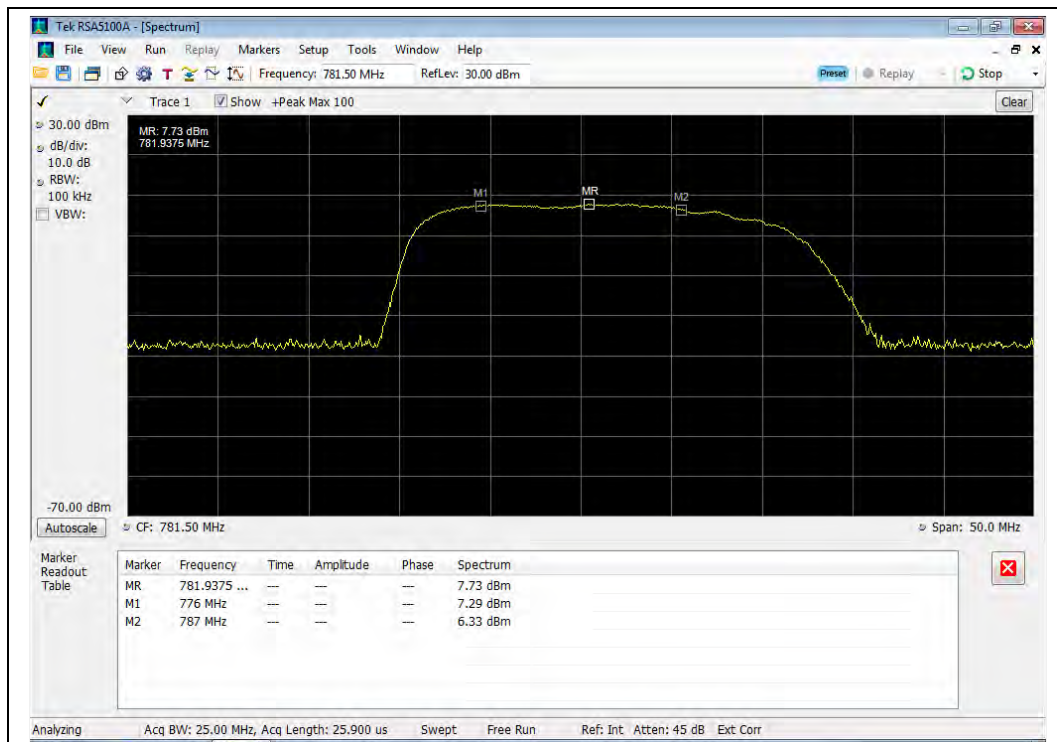
Test Setup

Uplink Test Results

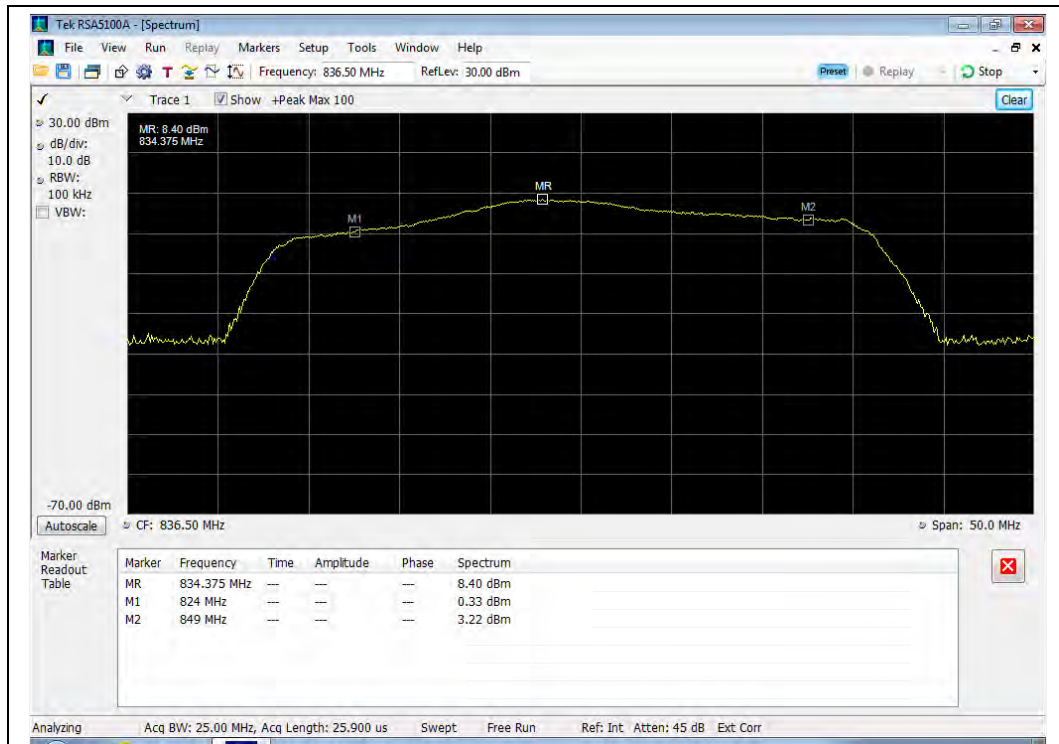
698 - 716 MHz Band



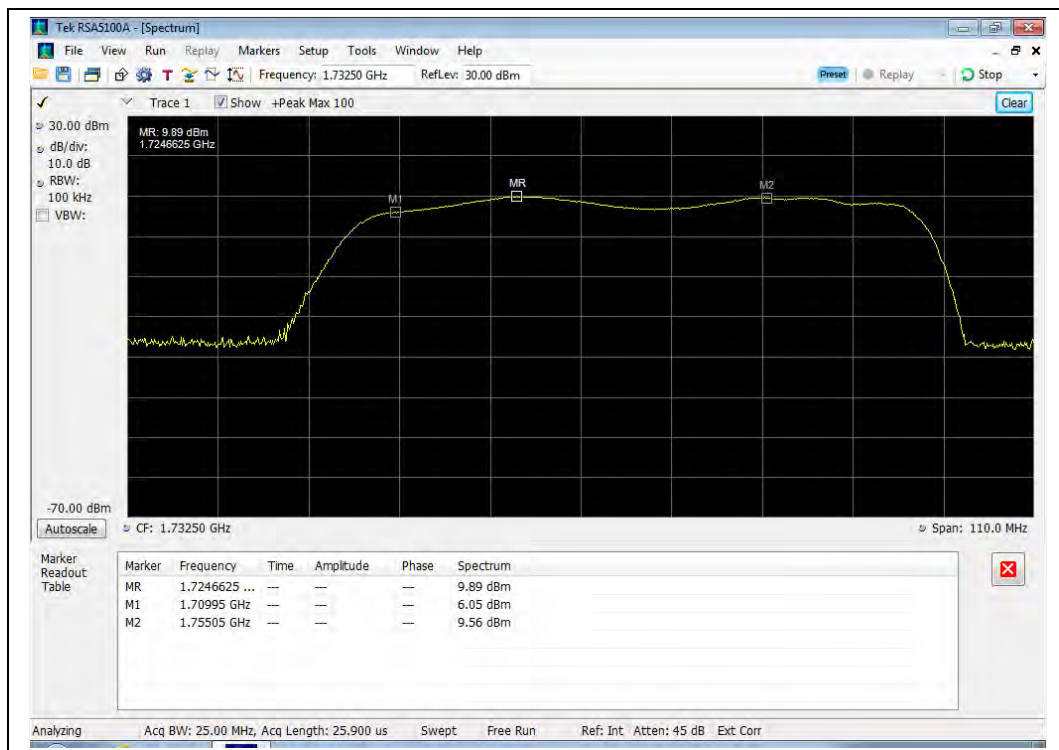
776 - 787 MHz Band



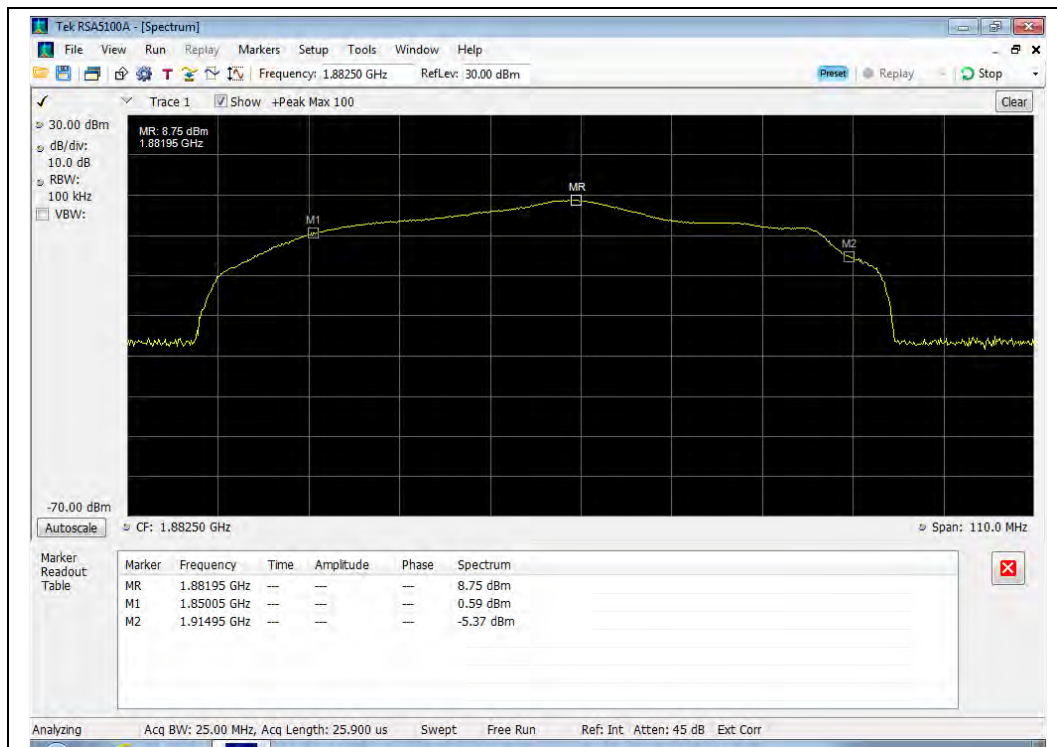
824 - 849 MHz Band



1710 - 1755 MHz Band

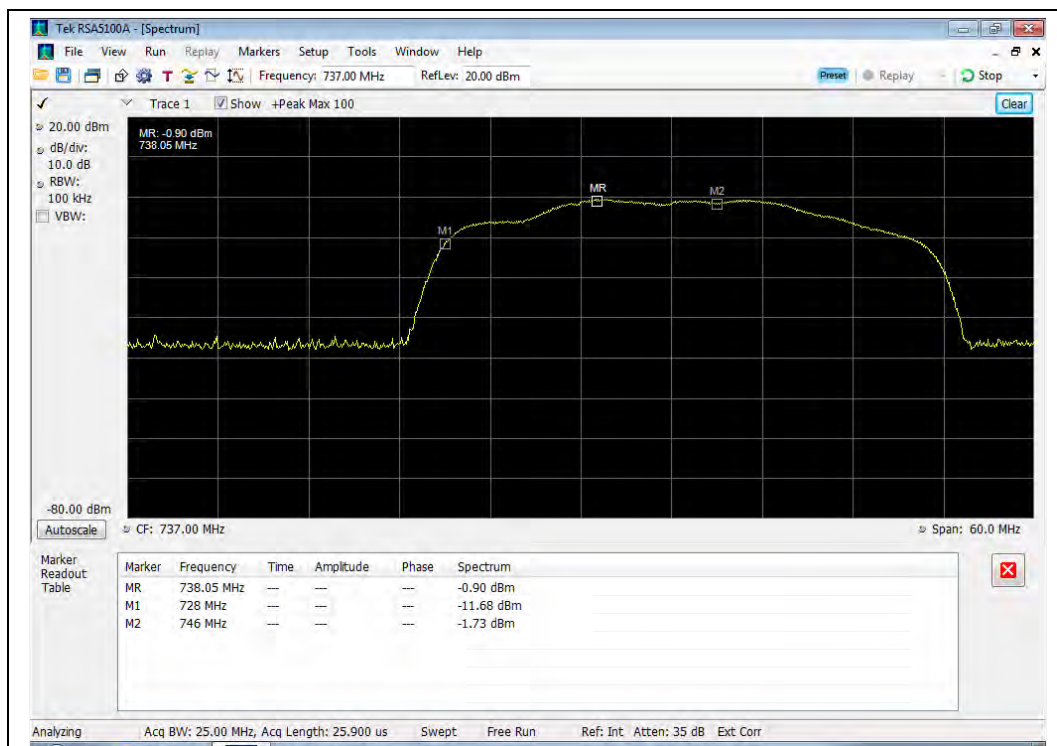


1850 - 1915 MHz Band

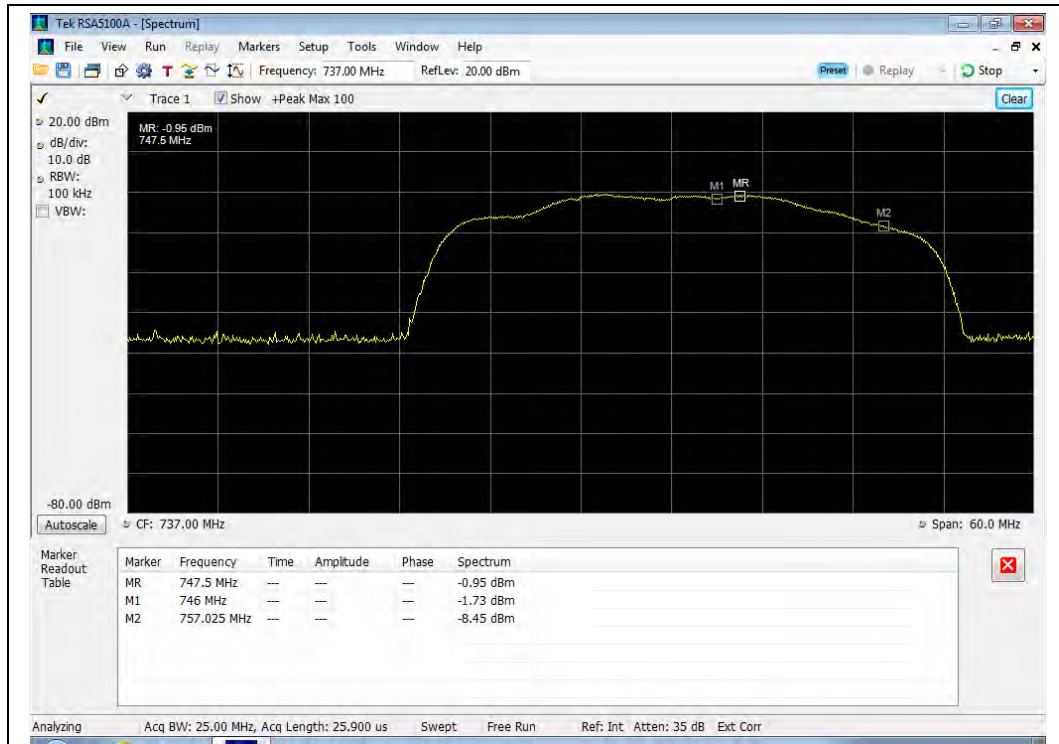


Downlink Test Results

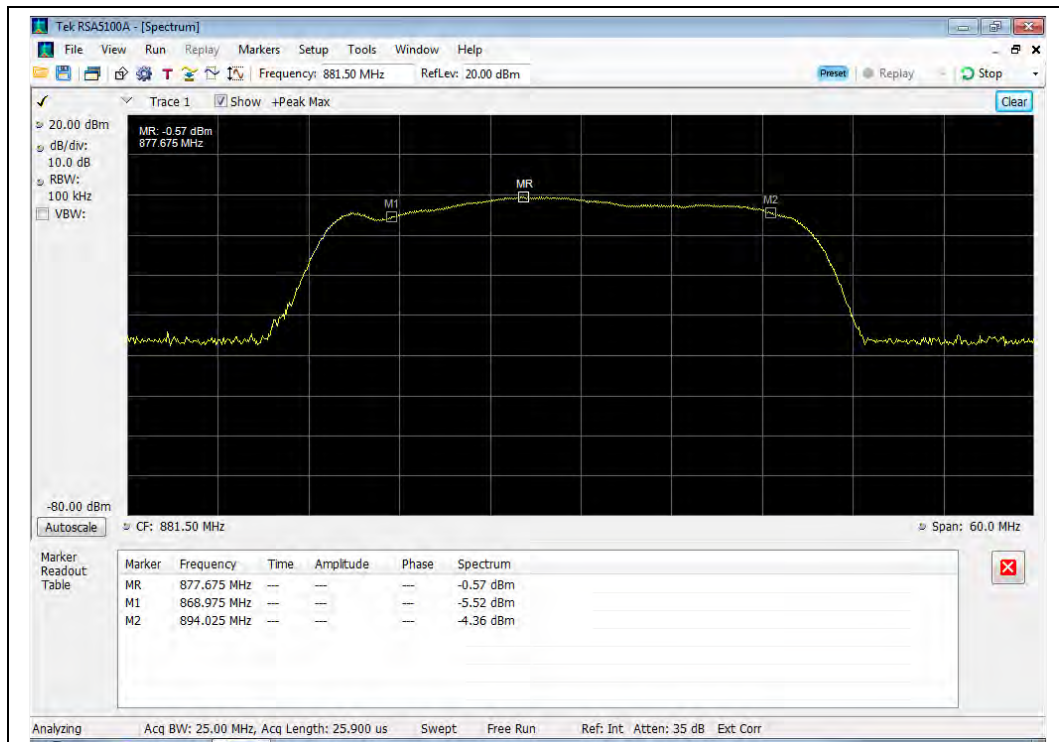
728 - 746 MHz Band



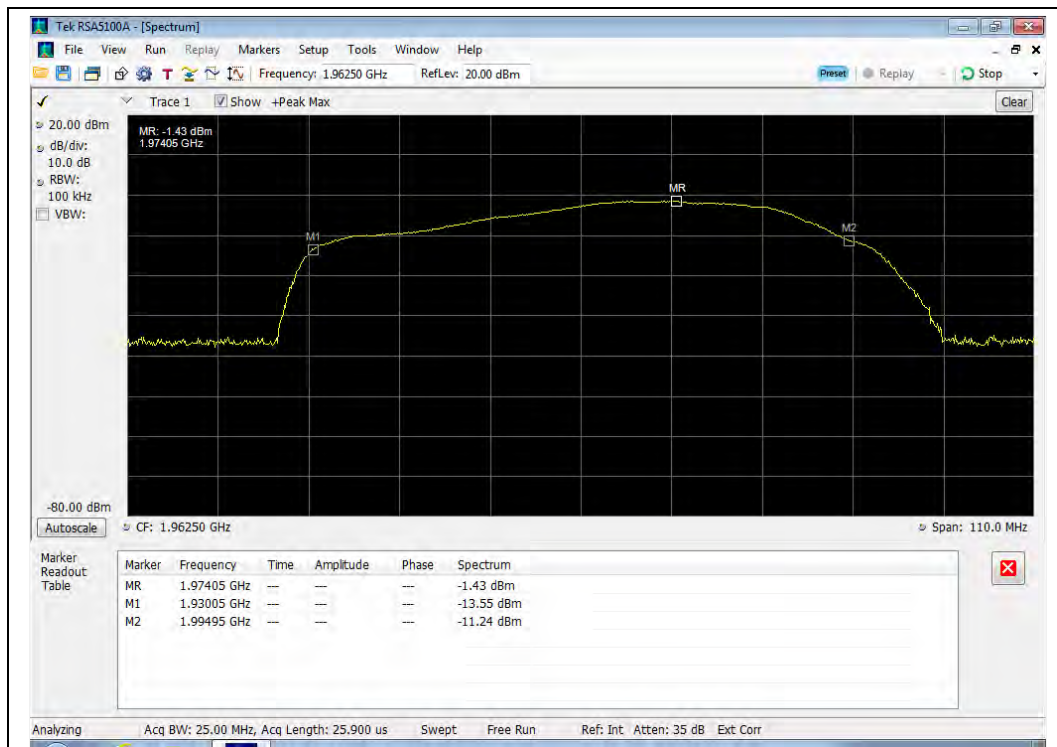
746 - 757 MHz Band



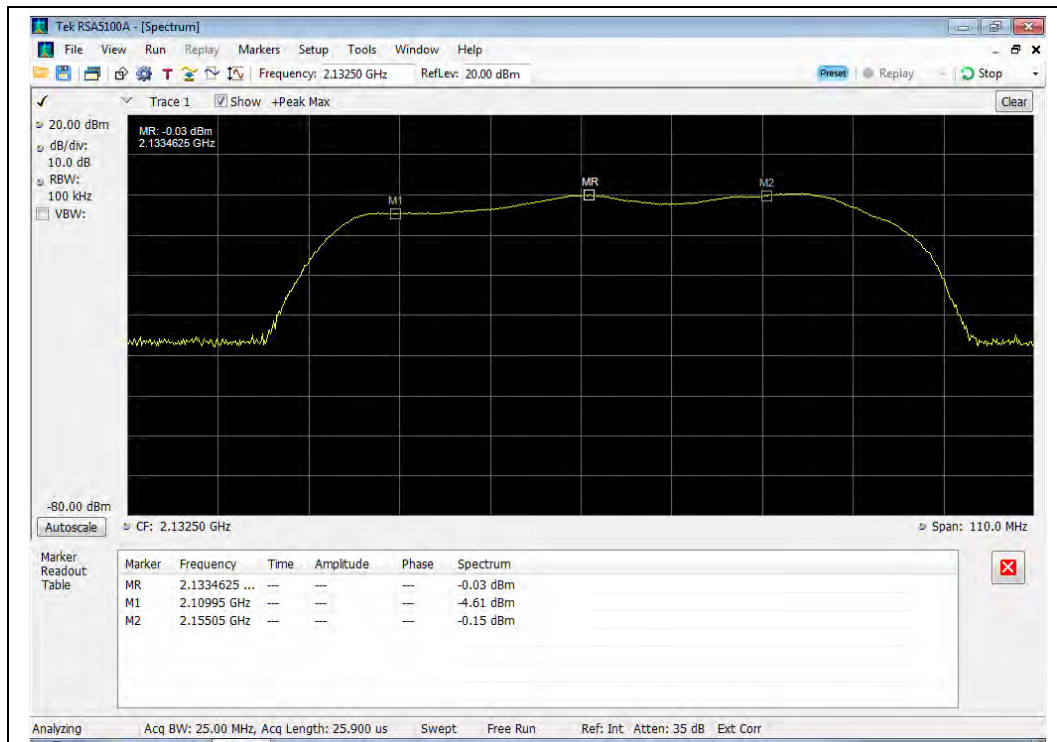
869 - 894 MHz Band



1930 - 1995 MHz Band



2110 - 2155 MHz Band



Maximum Power and Gain

Engineer: Greg Corbin

Test Date: 1/3/2017

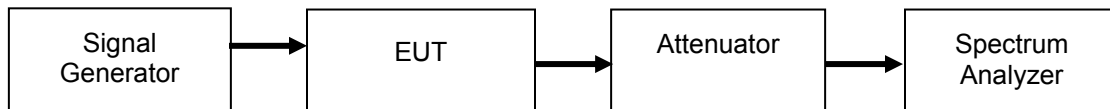
Test Procedure

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 needed to ensure accurate readings. 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 for both pulsed single time slot GSM modulation 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 being computed from these values. The uplink and downlink gain under each condition were verified to be within 9 dB of each other.

Gain limit: $6.5\text{dB} + 20 \cdot \text{LOG}_{10}(\text{midband of UL freq})$

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

Test Setup



Uplink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Lower Limit (dBm)	Upper Limit (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
698 - 716 MHz Pulsed GSM	-36.9	23.5	17	30	5.03	28.53	Pass
698 - 716 MHz AWGN	-38.5	20.3	17	30	5.03	25.33	Pass
776 - 787 MHz Pulsed GSM	-32.1	24.2	17	30	5.10	29.3	Pass
776 - 787 MHz AWGN	-35.6	19.6	17	30	5.10	24.7	Pass
824 - 849 MHz Pulsed GSM	-37.4	23.3	17	30	5.35	28.65	Pass
824 - 849 MHz AWGN	-35.1	23.2	17	30	5.35	28.55	Pass
1710 - 1755 MHz Pulsed GSM	-41.4	24.3	17	30	5.25	29.55	Pass
1710 - 1755 MHz AWGN	-41.0	22.8	17	30	5.25	28.05	Pass
1850 - 1915 MHz Pulsed GSM	-45.8	23.6	17	30	4.92	28.52	Pass
1850 - 1915 MHz AWGN	-47.0	20.6	17	30	4.92	25.52	Pass

Downlink Power Test Results

Frequency Band (MHz)	Input Level (dBm)	Output Power (dBm)	Upper Limit (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Result
728 - 746 MHz Pulsed GSM	-47.7	11.1	17	4.16	15.26	Pass
728 - 746 MHz AWGN	-46.7	11.7	17	4.16	15.86	Pass
746 - 757 MHz Pulsed GSM	-47.2	11.2	17	4.16	15.36	Pass
746 - 757 MHz AWGN	-46.0	11.9	17	4.16	16.06	Pass
869 - 894 MHz Pulsed GSM	-48.8	10.4	17	3.73	14.13	Pass
869 - 894 MHz AWGN	-47.4	12.1	17	3.73	15.83	Pass
1930 - 1995 MHz Pulsed GSM	-59.4	9.4	17	6.60	16	Pass
1930 - 1995 MHz AWGN	-58.8	9.5	17	6.60	16.1	Pass
2110 - 2155 MHz Pulsed GSM	-57.2	10.3	17	3.49	13.79	Pass
2110 - 2155 MHz AWGN	-55.0	12.0	17	3.49	15.49	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	702.06	738.05	60.4	63.5	58.8	63.5	1.6	9	-7.4
AWGN	702.06	738.05	58.8	63.5	58.4	63.5	0.4	9	-8.6
Pulsed CW	781.9375	747.5	56.3	64.4	58.4	64.4	2.1	9	-6.9
AWGN	781.9375	747.5	55.2	64.4	57.9	64.4	2.7	9	-6.3
Pulsed CW	834.375	877.675	60.7	64.9	59.2	64.9	1.5	9	-7.5
AWGN	834.375	877.675	58.3	64.9	59.5	64.9	1.2	9	-7.8
Pulsed CW	1724.6625	2133.4625	65.7	71	67.5	71	1.8	9	-7.2
AWGN	1724.6625	2133.4625	63.8	71	67.0	71	3.2	9	-5.8
Pulsed CW	1881.95	1974.05	69.4	72	68.8	72	0.6	9	-8.4
AWGN	1881.95	1974.05	67.6	72	68.3	72	0.7	9	-8.3

Intermodulation

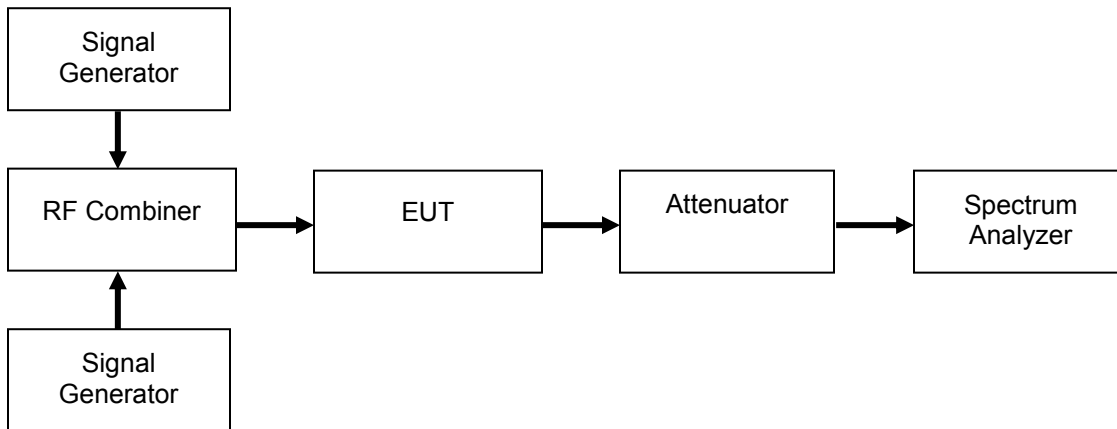
Engineer: Mike Graffeo

Test Date: 9/23/14

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 that accurate measurements were recorded. The input power was set at the maximum allowable power and the RMS intermodulation products were measured to ensure they were less than -19 dBm in a 3 kHz RBW. The uplink and downlink intermodulation products were plotted, with the levels being listed in the summary tables.

Test Setup



Uplink Test Results

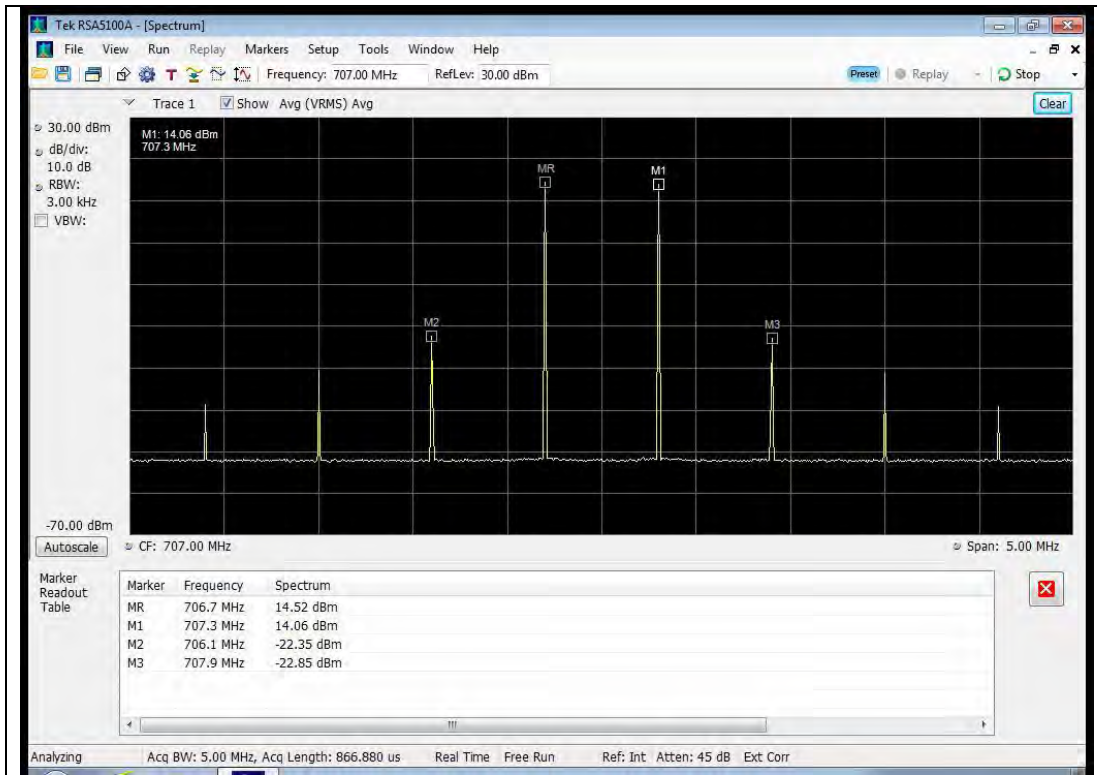
Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
698 - 716 MHz	-22.35	-19	Pass
776 - 787 MHz	-21.29	-19	Pass
824 - 849 MHz	-19.42	-19	Pass
1710 - 1755 MHz	-22.13	-19	Pass
1850 - 1915 MHz	-20.09	-19	Pass

Downlink Test Results

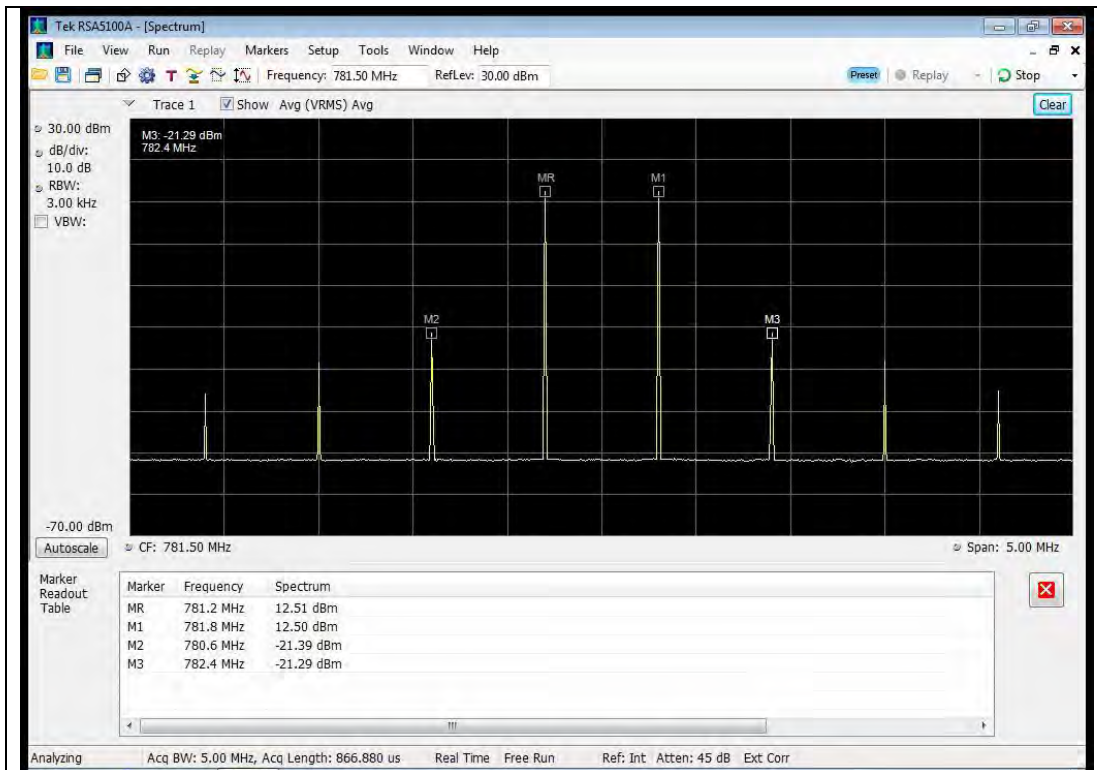
Frequency Band (MHz)	Intermodulation Level (dBm)	Limit (dBm)	Result
728 - 746 MHz	-37.73	-19	Pass
746 - 757 MHz	-36.55	-19	Pass
869 - 894 MHz	-33.63	-19	Pass
1930 - 1995 MHz	-36.44	-19	Pass
2110 - 2155 MHz	-34.64	-19	Pass

Uplink Test Results

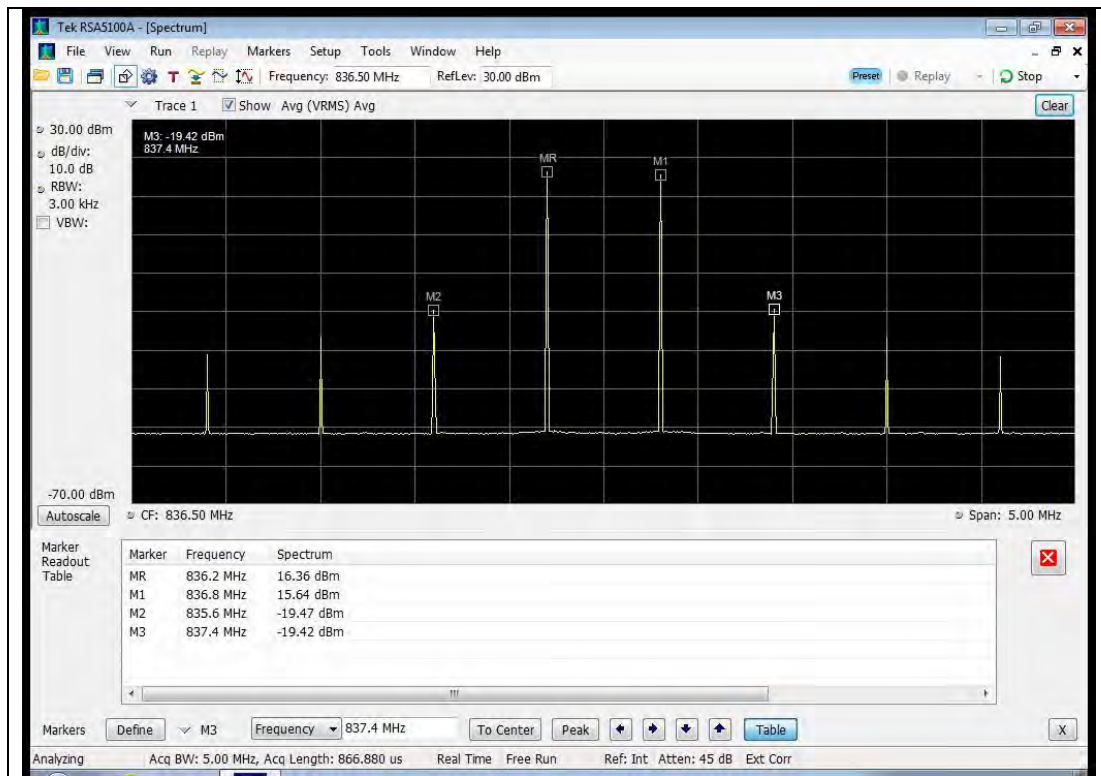
698 - 716 MHz Band



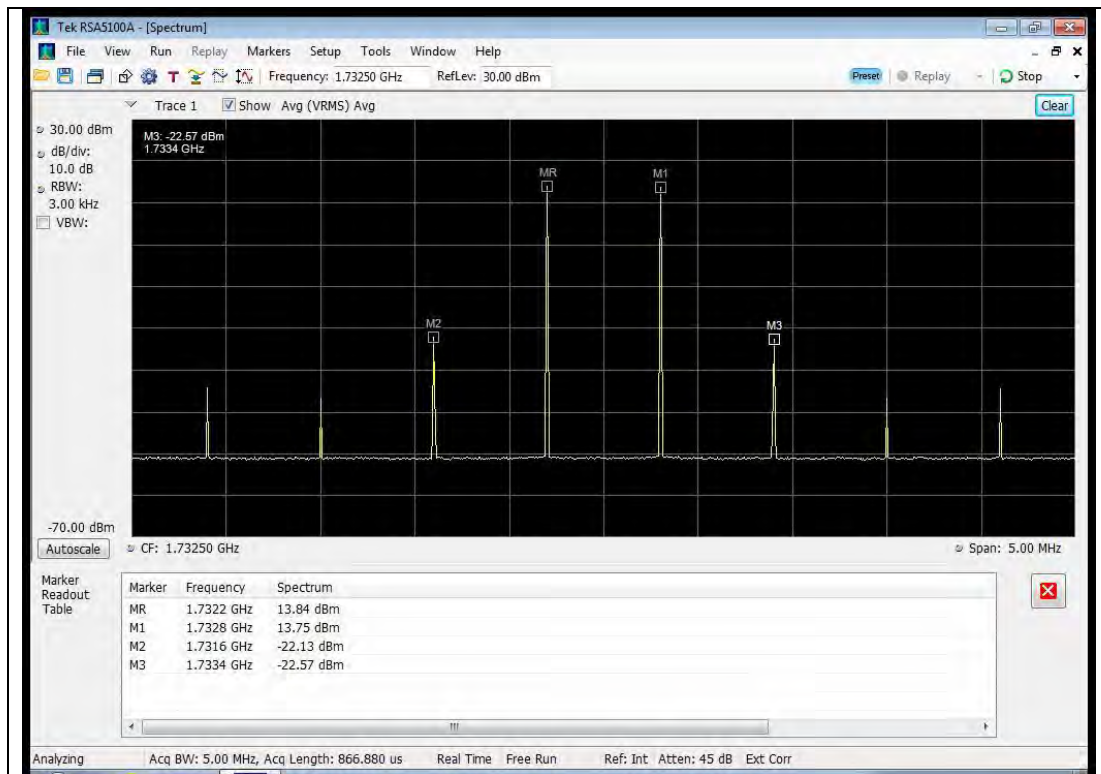
776 - 787 MHz Band



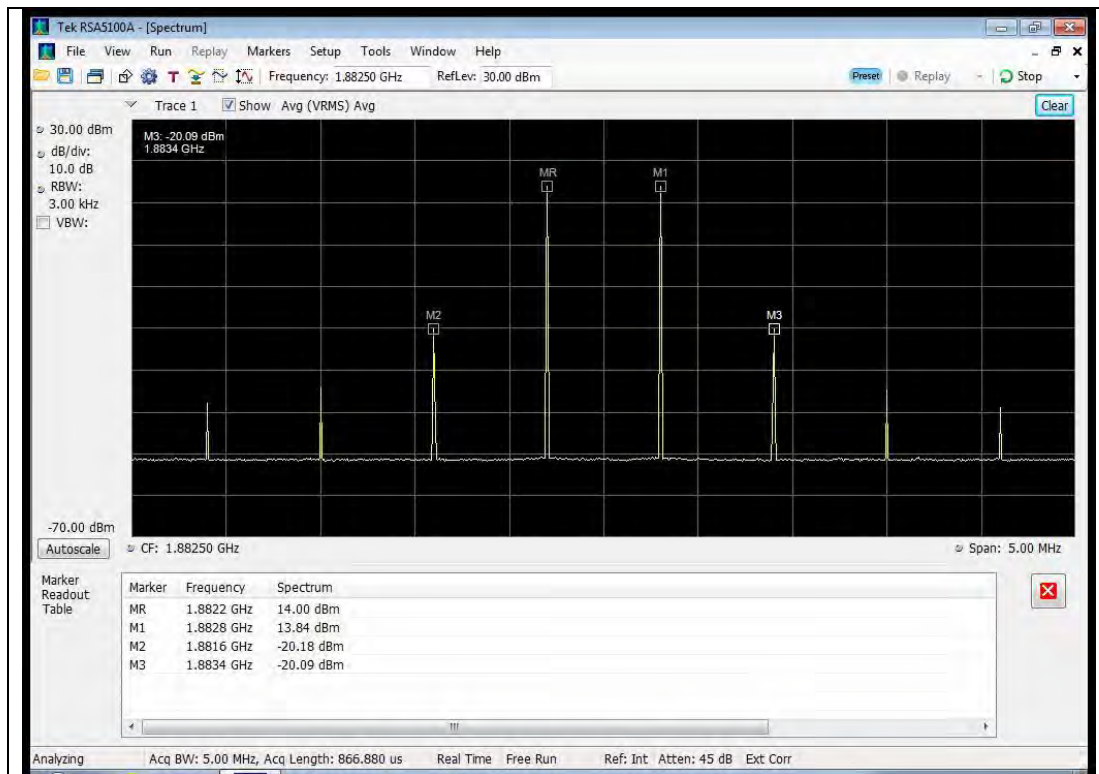
824 - 849 MHz Band



1710 - 1755 MHz Band

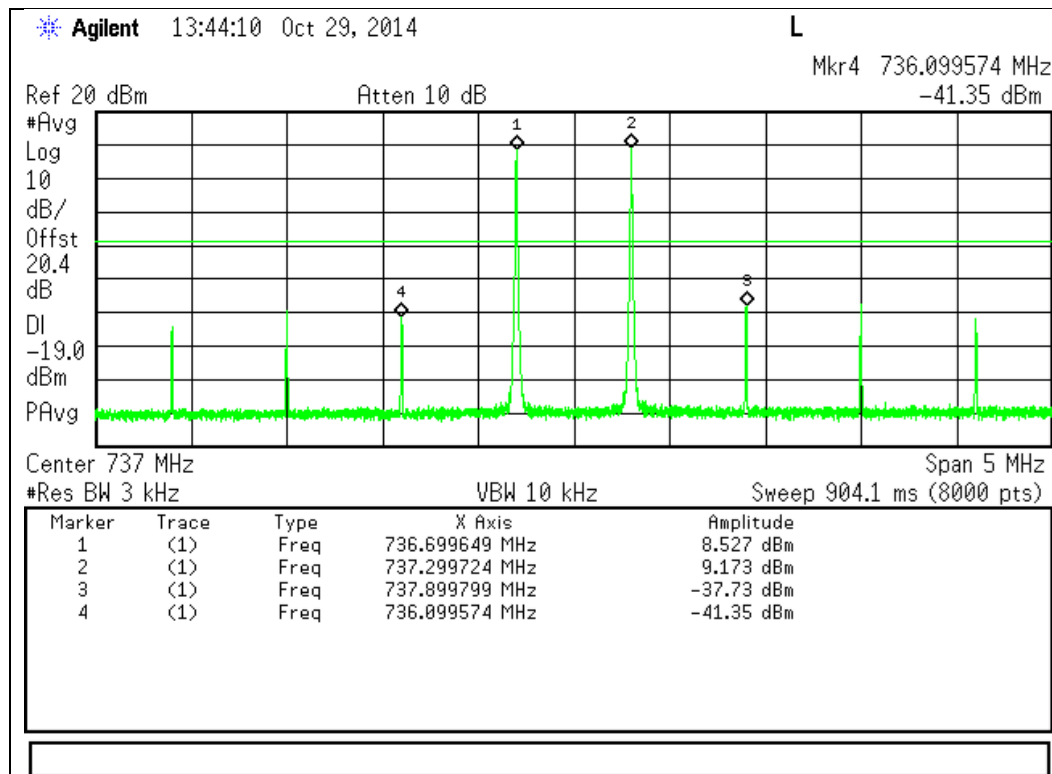


1850 - 1915 MHz Band



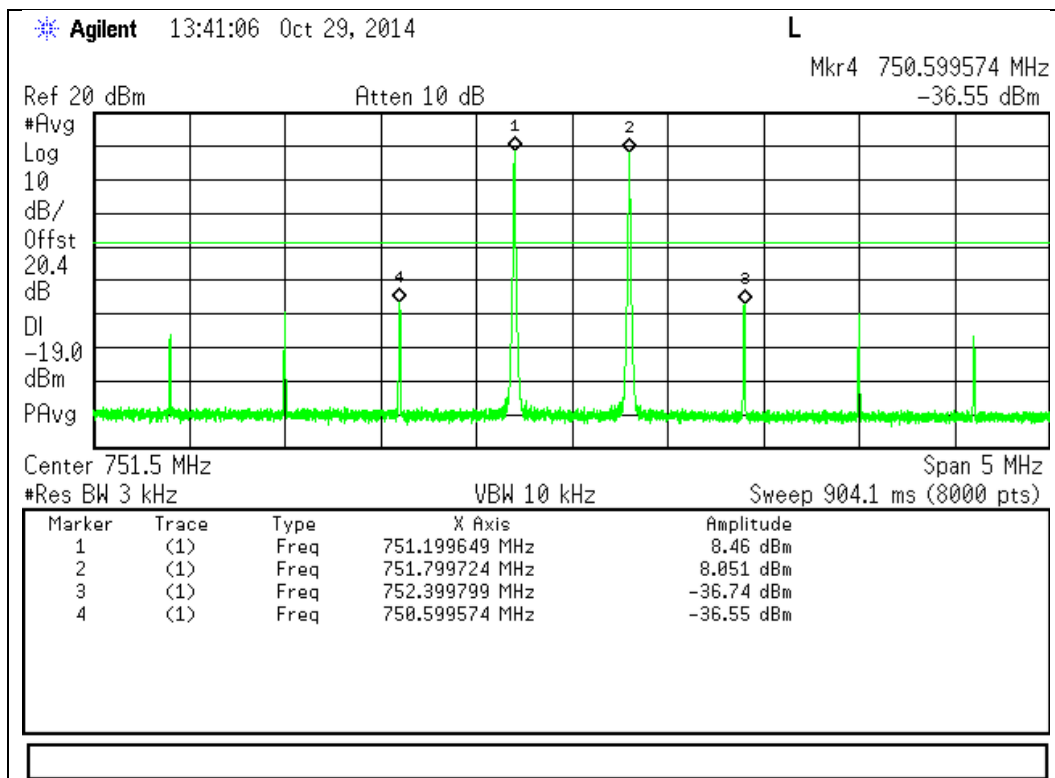
Downlink Test Results

728 - 746 MHz Band

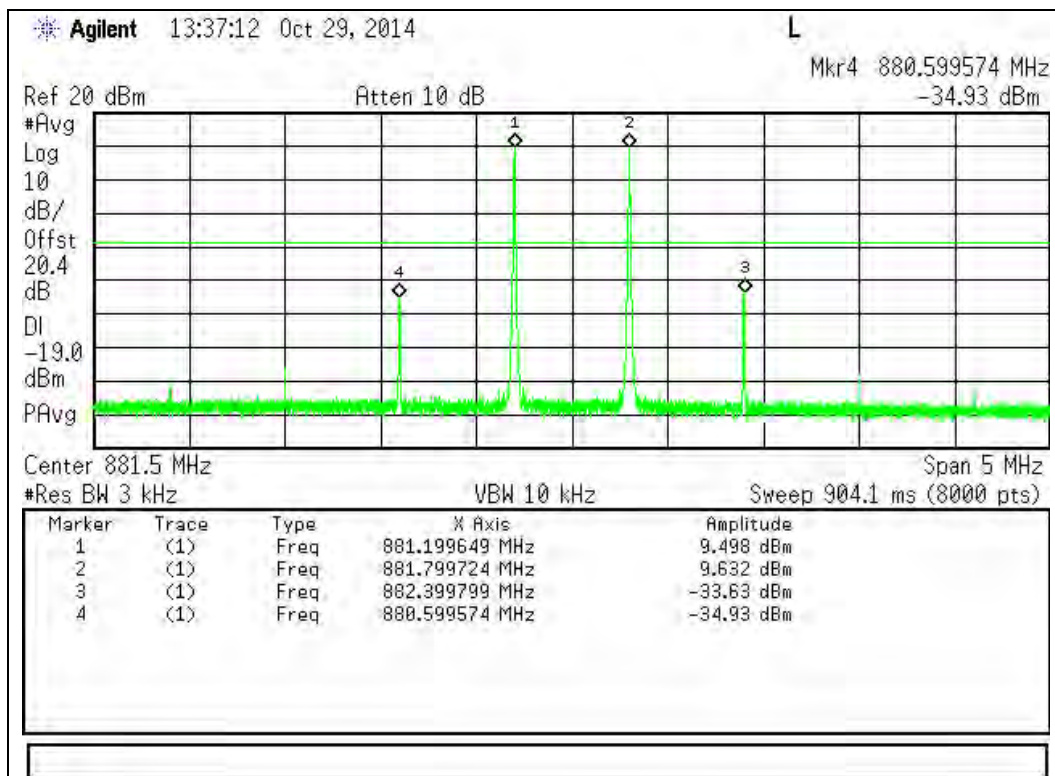




746 - 757 MHz Band

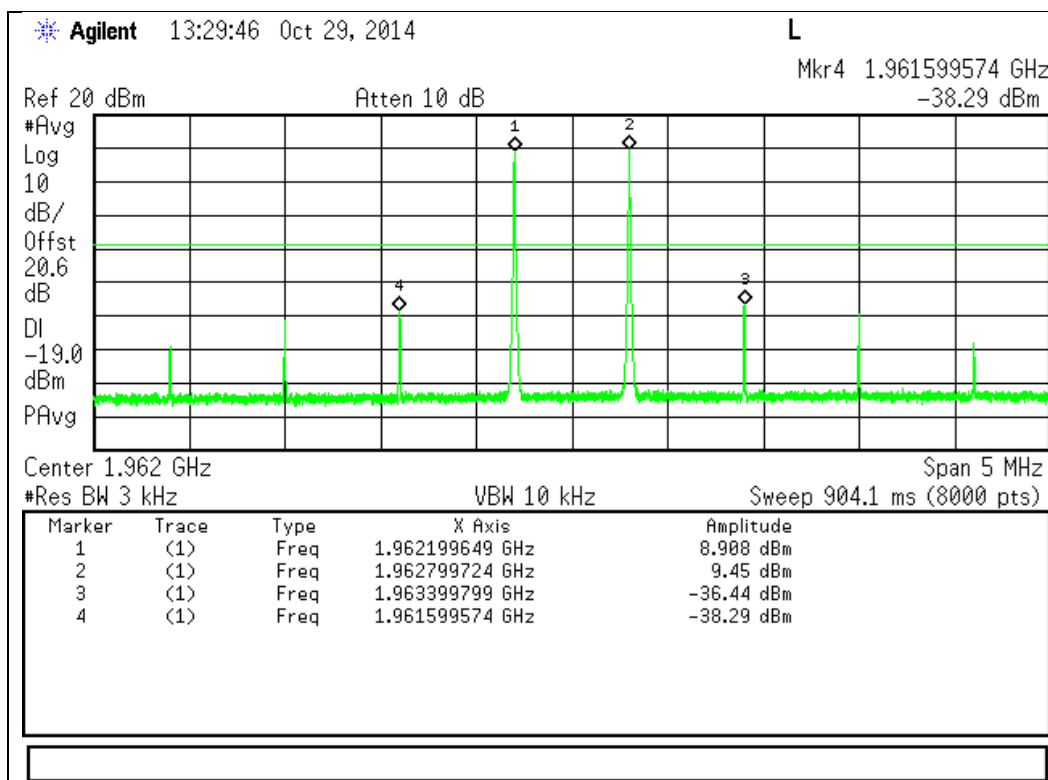


869 - 894 MHz Band

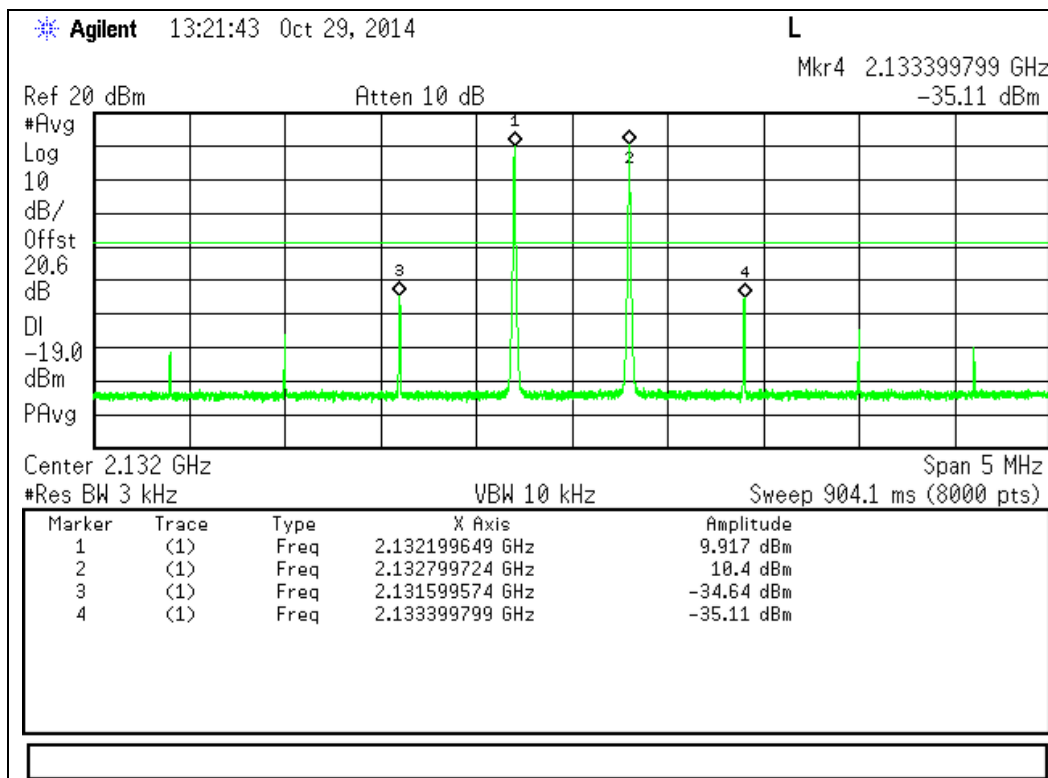




1930 - 1995 MHz Band



2110 - 2155 MHz Band



Out-of-Band Emissions

Engineer: Mike Graffeo

Test Date: 9/30/14

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 in order to ensure accurate readings. A signal generator was utilized to produce the following signals: GSM, CDMA, and WCDMA. The signal generator was 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 were measured to ensure they met the limits

The following formula was used for calculating the limits:

$$\text{Limit} = P1 - 6 - (43 + 10\log(P2)) = -19\text{dBm}$$

P1 = power in dBm

P2 = power in Watts

Test Setup



GSM Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-27.71	-19	Pass
698 - 716	Upper	-29.04	-19	Pass
776 - 787	Lower	-28.40	-19	Pass
776 - 787	Upper	-29.12	-19	Pass
824 - 849	Lower	-37.24	-19	Pass
824 - 849	Upper	-34.92	-19	Pass
1710 - 1755	Lower	-37.68	-19	Pass
1710 - 1755	Upper	-38.29	-19	Pass
1850 - 1915	Lower	-40.09	-19	Pass
1850 - 1915	Upper	-48.63	-19	Pass

CDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-43.68	-19	Pass
698 - 716	Upper	-42.35	-19	Pass
776 - 787	Lower	-40.54	-19	Pass
776 - 787	Upper	-39.45	-19	Pass
824 - 849	Lower	-33.60	-19	Pass
824 - 849	Upper	-34.29	-19	Pass
1710 - 1755	Lower	-40.62	-19	Pass
1710 - 1755	Upper	-41.26	-19	Pass
1850 - 1915	Lower	-40.87	-19	Pass
1850 - 1915	Upper	-42.16	-19	Pass

WCDMA Uplink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	Lower	-56.14	-19	Pass
698 - 716	Upper	-54.89	-19	Pass
776 - 787	Lower	-40.16	-19	Pass
776 - 787	Upper	-40.85	-19	Pass
824 - 849	Lower	-33.67	-19	Pass
824 - 849	Upper	-36.44	-19	Pass
1710 - 1755	Lower	-37.40	-19	Pass
1710 - 1755	Upper	-38.96	-19	Pass
1850 - 1915	Lower	-45.01	-19	Pass
1850 - 1915	Upper	-49.58	-19	Pass

GSM Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-39.73	-19	Pass
728 - 746	Upper	-32.47	-19	Pass
746 - 757	Lower	-31.83	-19	Pass
746 - 757	Upper	-40.54	-19	Pass
869 - 894	Lower	-50.02	-19	Pass
869 - 894	Upper	-47.37	-19	Pass
1930 - 1995	Lower	-55.37	-19	Pass
1930 - 1995	Upper	-52.86	-19	Pass
2110 - 2155	Lower	-48.30	-19	Pass
2110 - 2155	Upper	-45.81	-19	Pass

CDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-59.52	-19	Pass
728 - 746	Upper	-53.38	-19	Pass
746 - 757	Lower	-54.27	-19	Pass
746 - 757	Upper	-63.89	-19	Pass
869 - 894	Lower	-61.51	-19	Pass
869 - 894	Upper	-61.38	-19	Pass
1930 - 1995	Lower	-64.40	-19	Pass
1930 - 1995	Upper	-61.48	-19	Pass
2110 - 2155	Lower	-59.78	-19	Pass
2110 - 2155	Upper	-54.59	-19	Pass

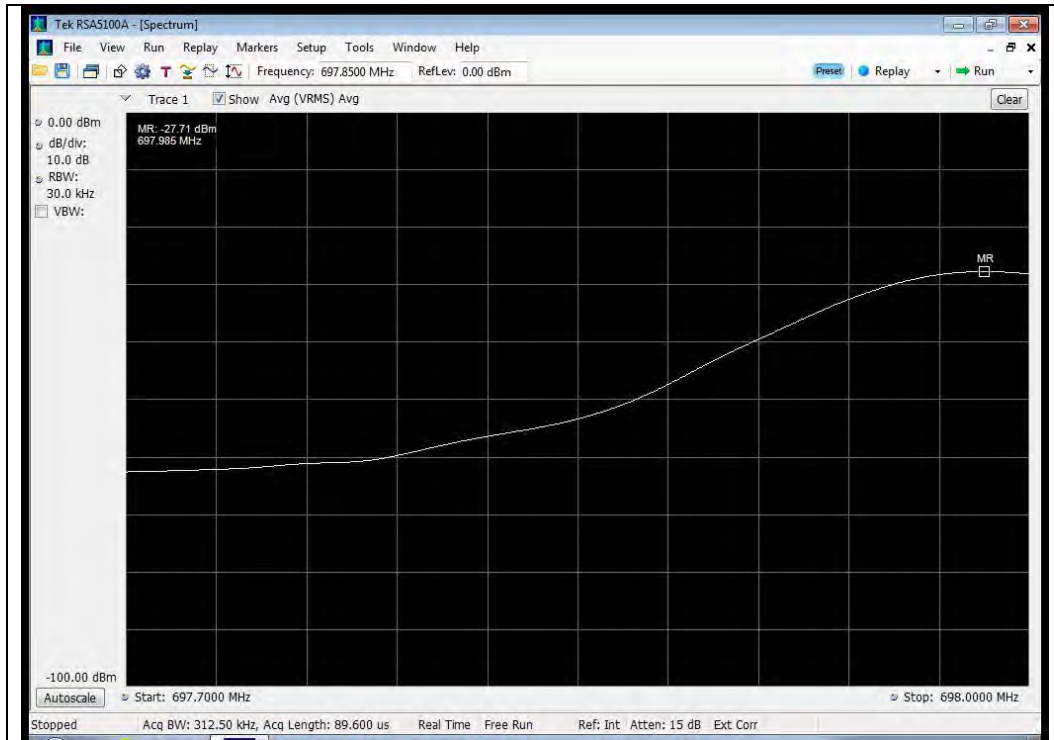
WCDMA Downlink Test Results

Frequency Band (MHz)	Band Edge	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	Lower	-60.27	-19	Pass
728 - 746	Upper	-56.35	-19	Pass
746 - 757	Lower	-54.24	-19	Pass
746 - 757	Upper	-63.14	-19	Pass
869 - 894	Lower	-53.80	-19	Pass
869 - 894	Upper	-51.63	-19	Pass
1930 - 1995	Lower	-57.56	-19	Pass
1930 - 1995	Upper	-54.32	-19	Pass
2110 - 2155	Lower	-51.76	-19	Pass
2110 - 2155	Upper	-47.39	-19	Pass

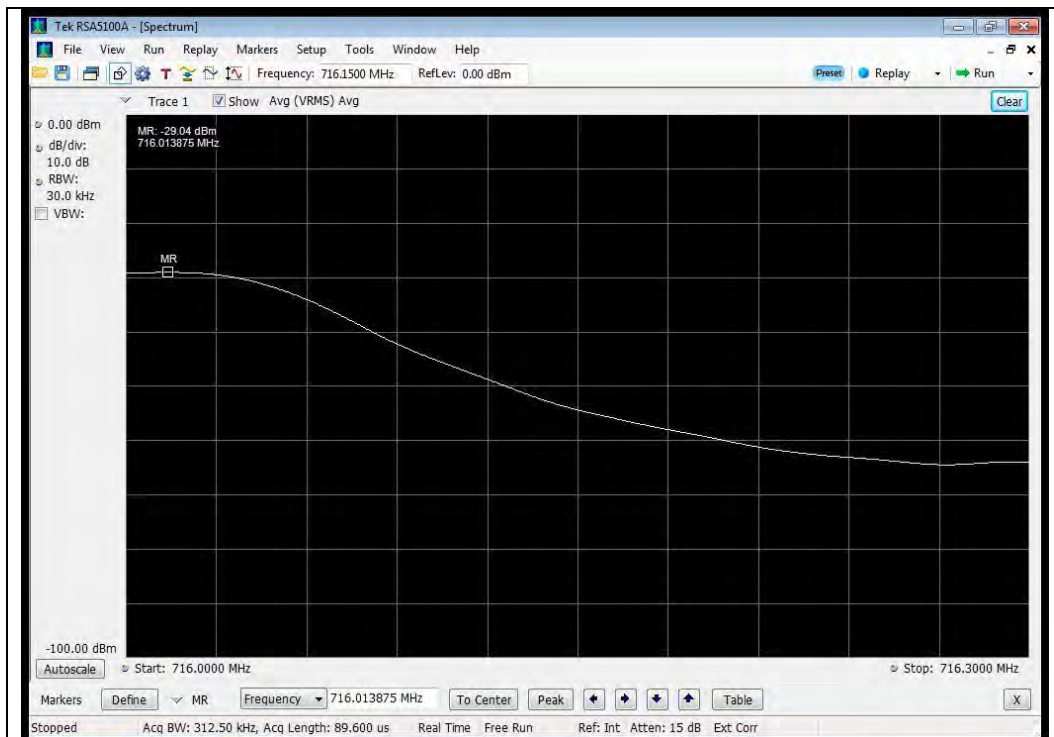
GSM Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge

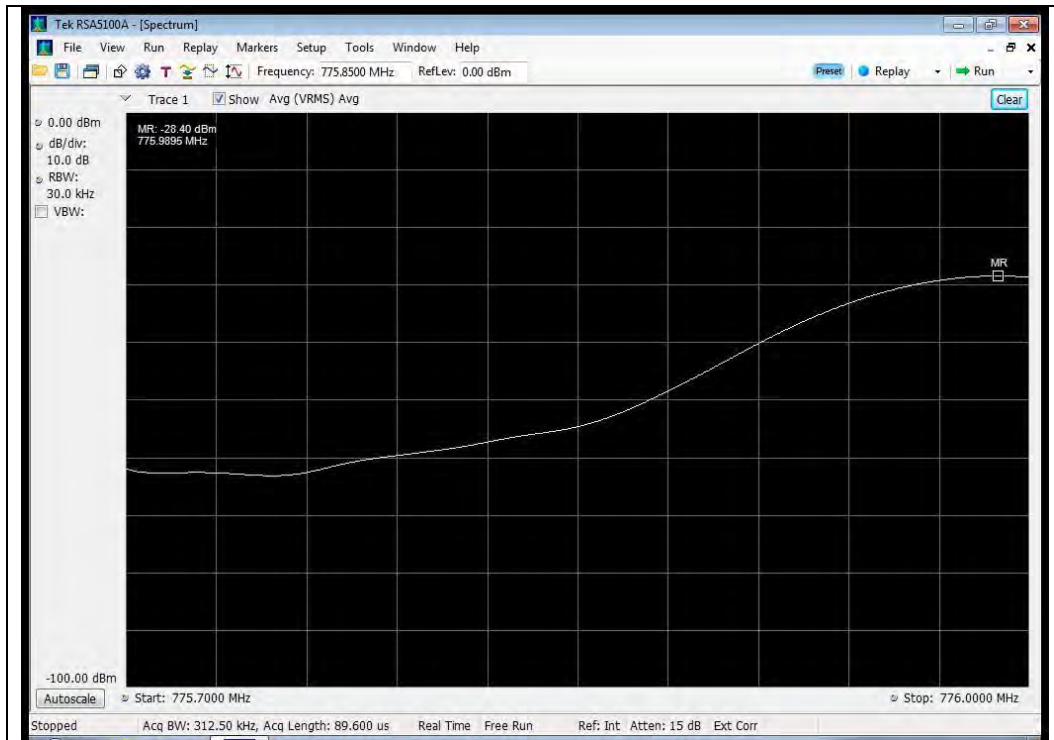


Upper Band Edge

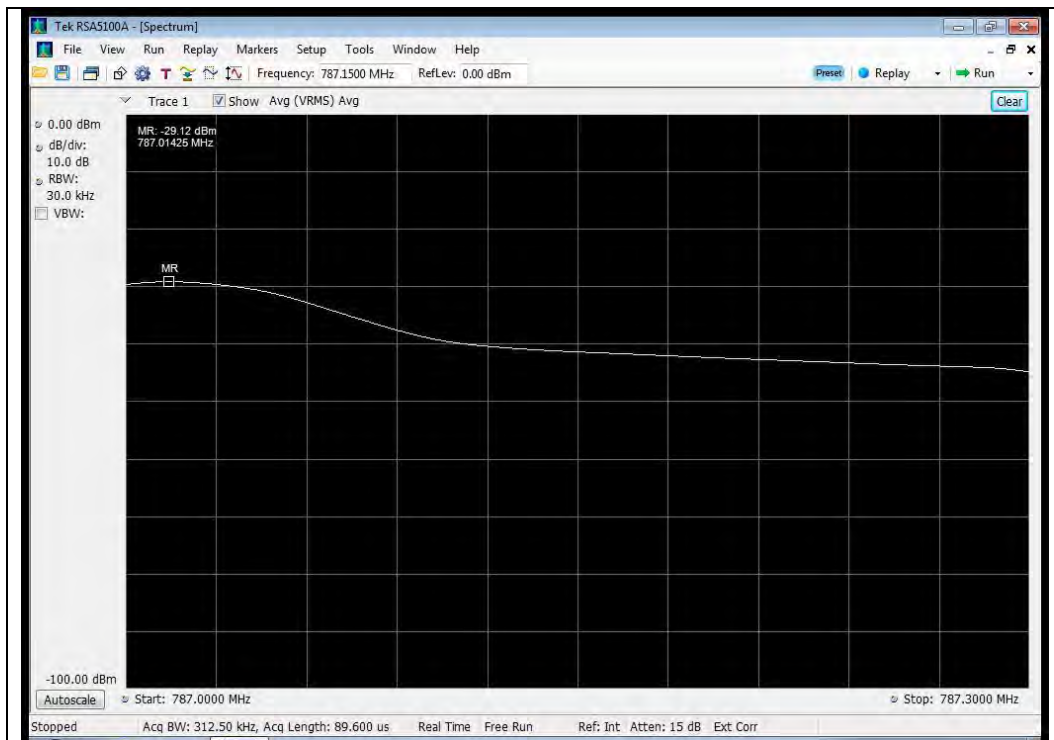


776 - 787 MHz Band

Lower Band Edge

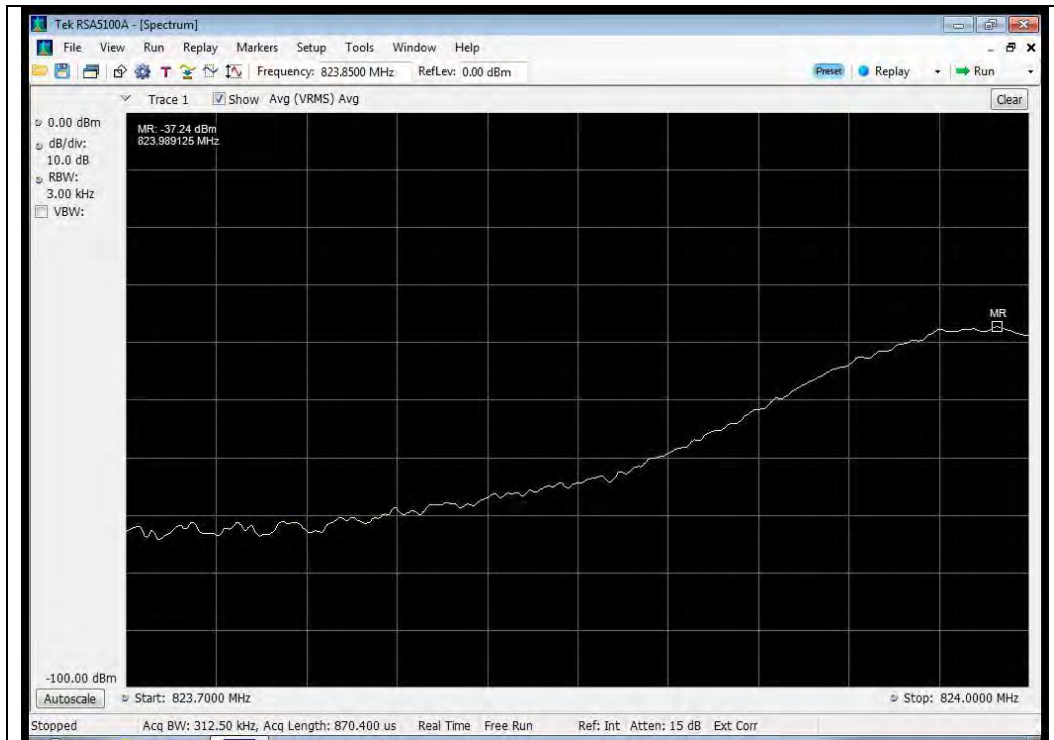


Upper Band Edge

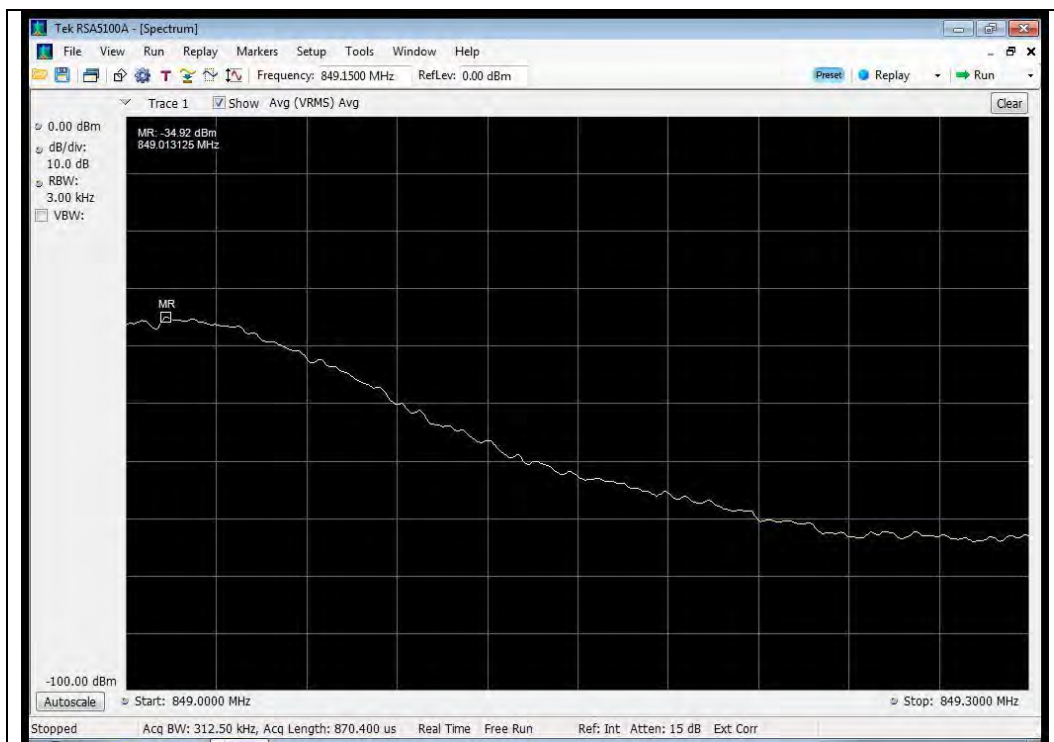


824 - 849 MHz Band

Lower Band Edge

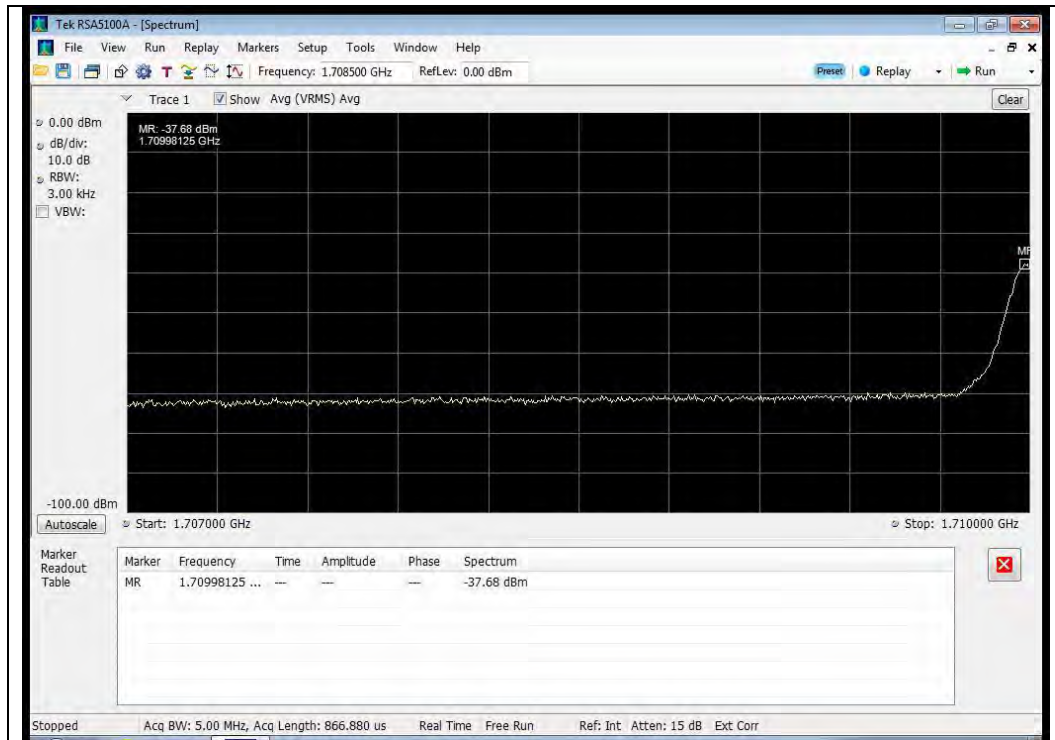


Upper Band Edge

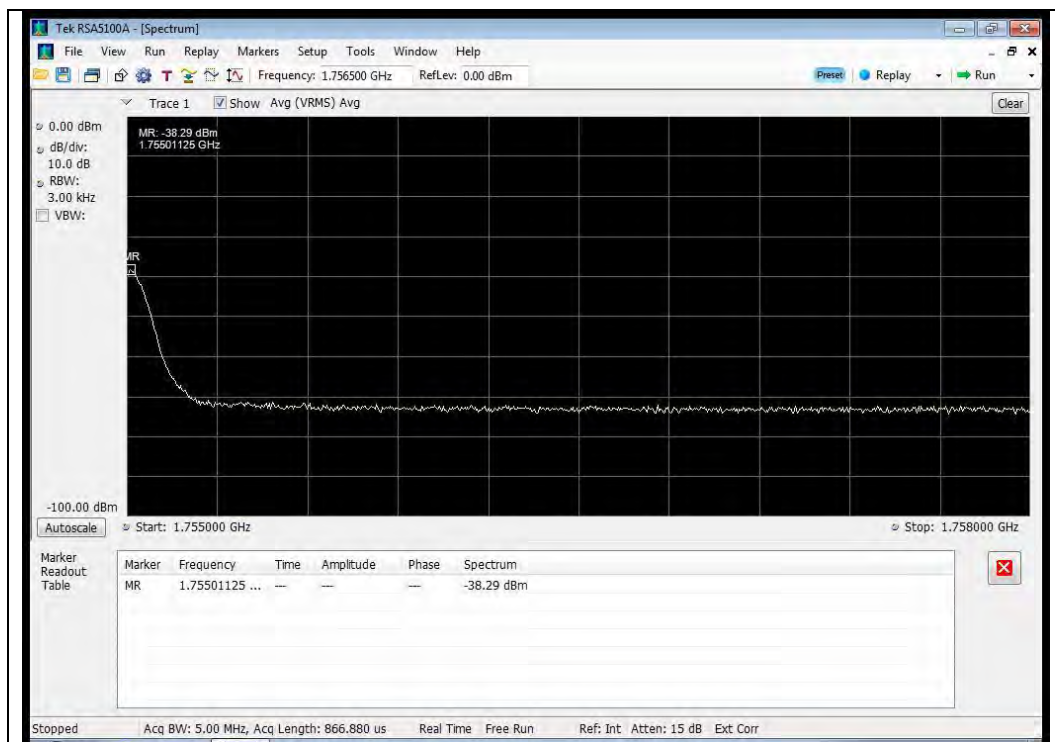


1710 - 1755 MHz Band

Lower Band Edge

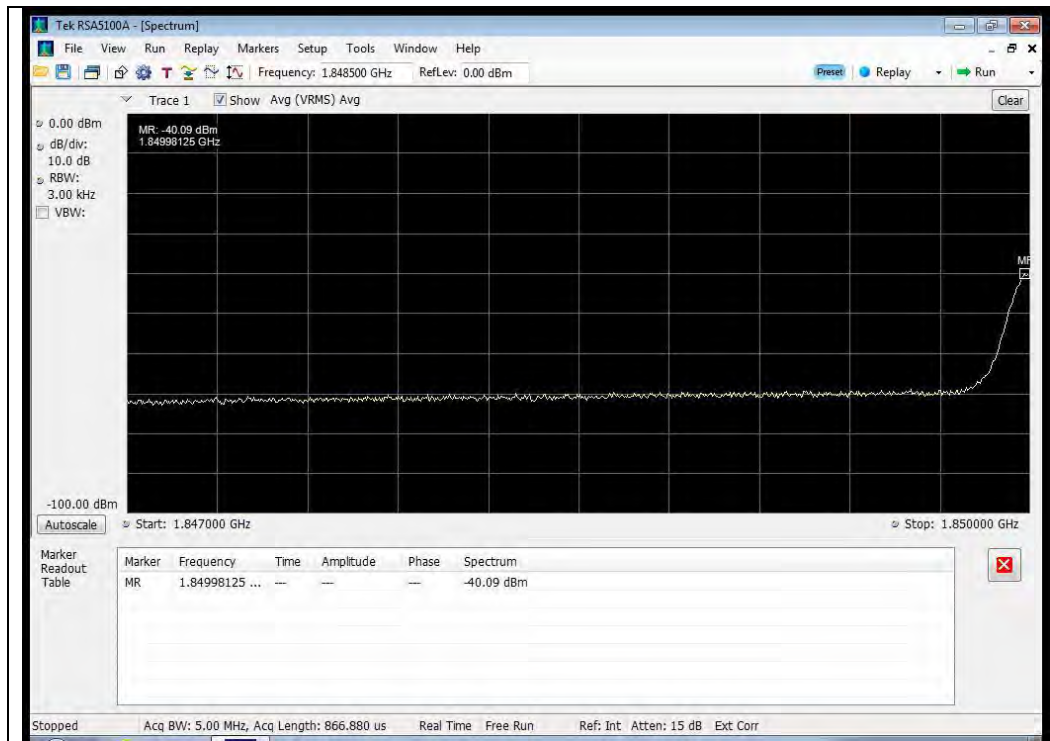


Upper Band Edge

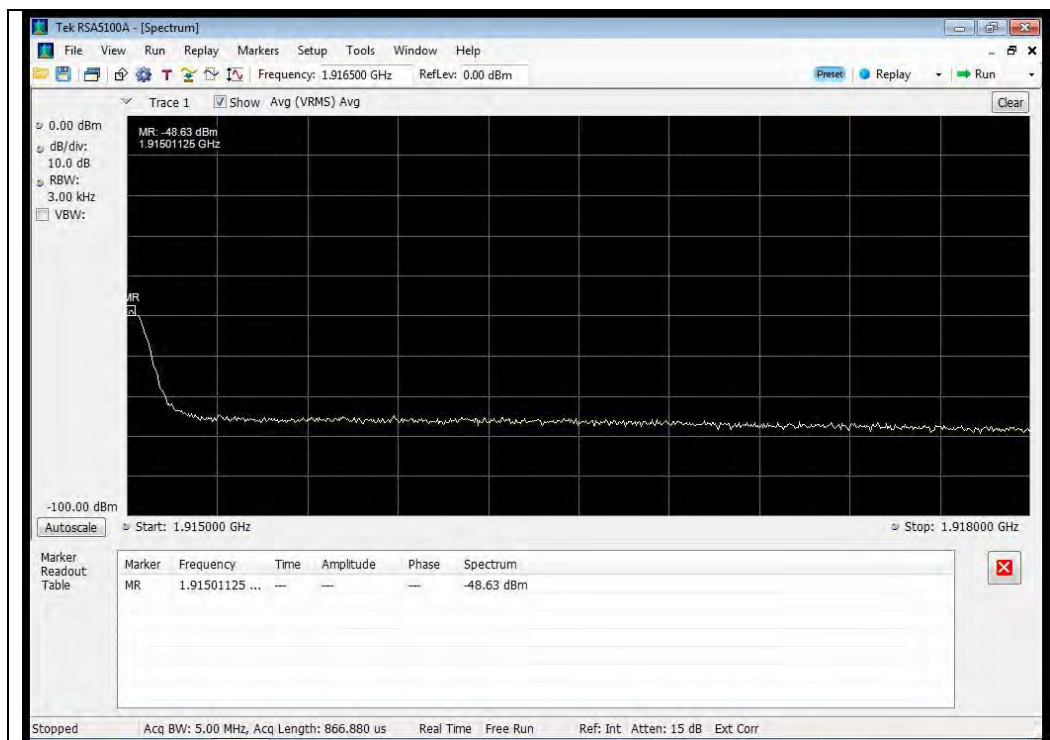


1850 - 1915 MHz Band

Lower Band Edge



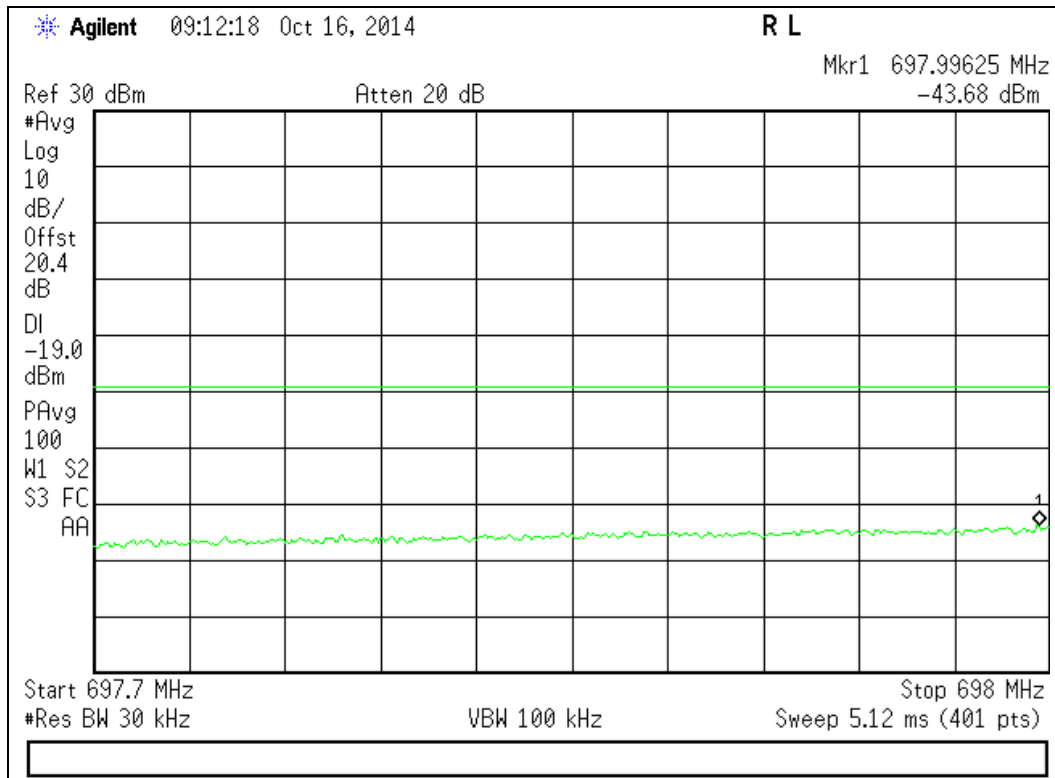
Upper Band Edge



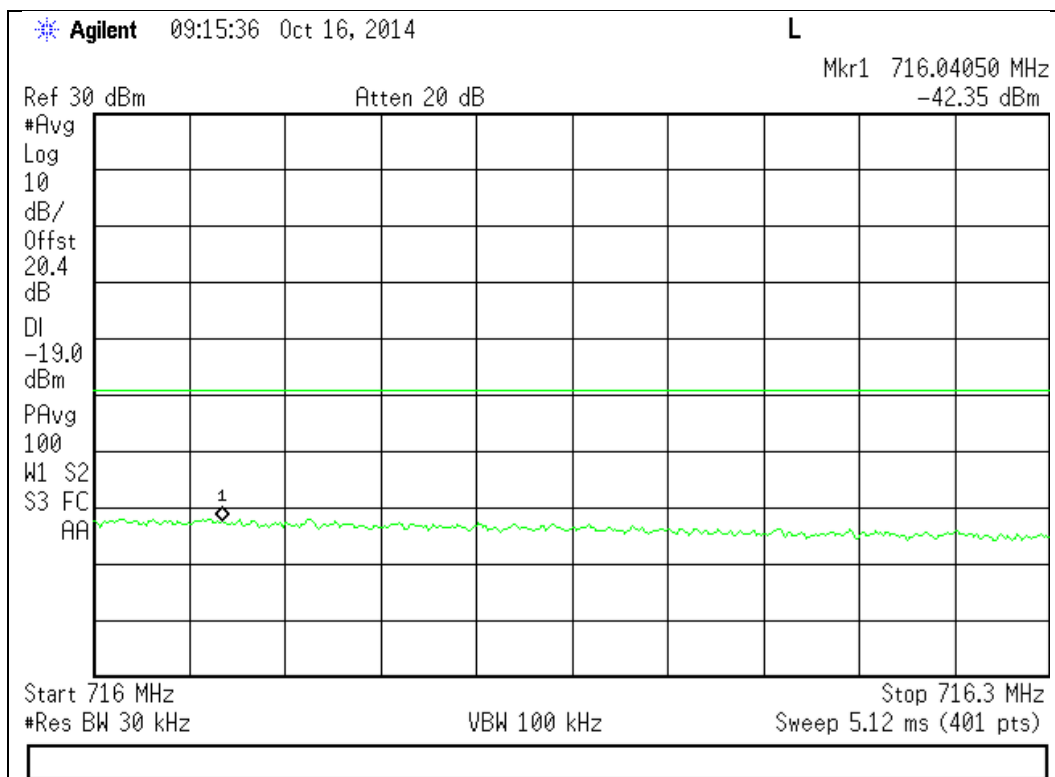
CDMA Uplink Test Plots

698 - 716 MHz Band

Lower Band Edge



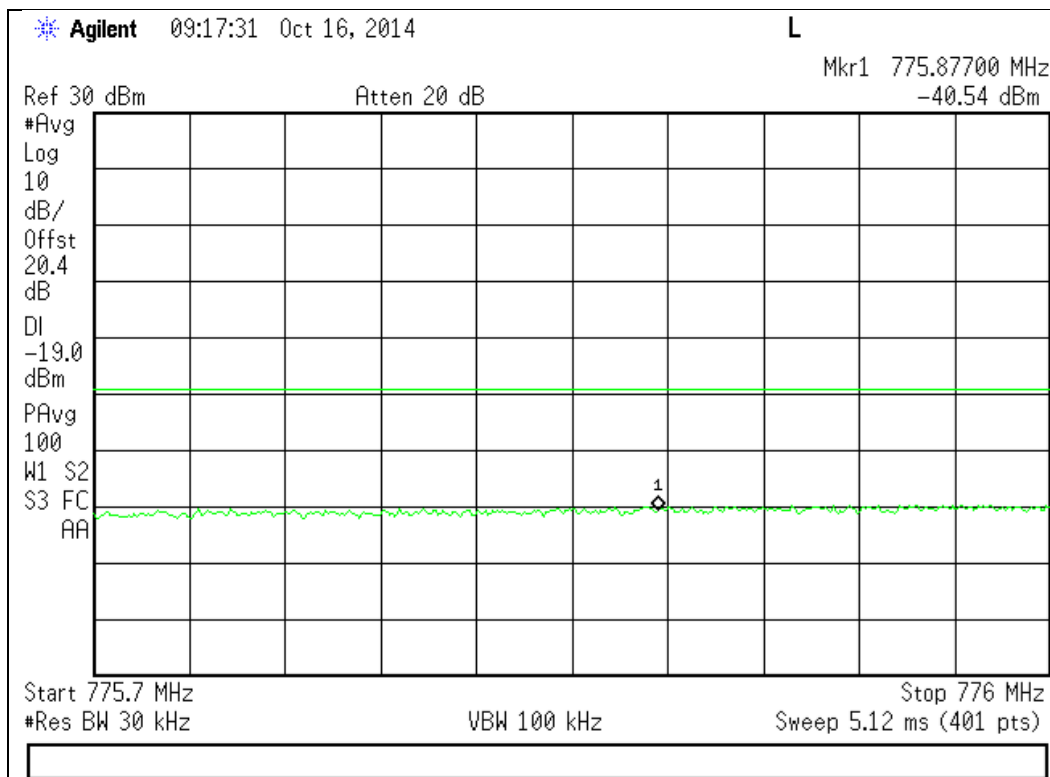
Upper Band Edge



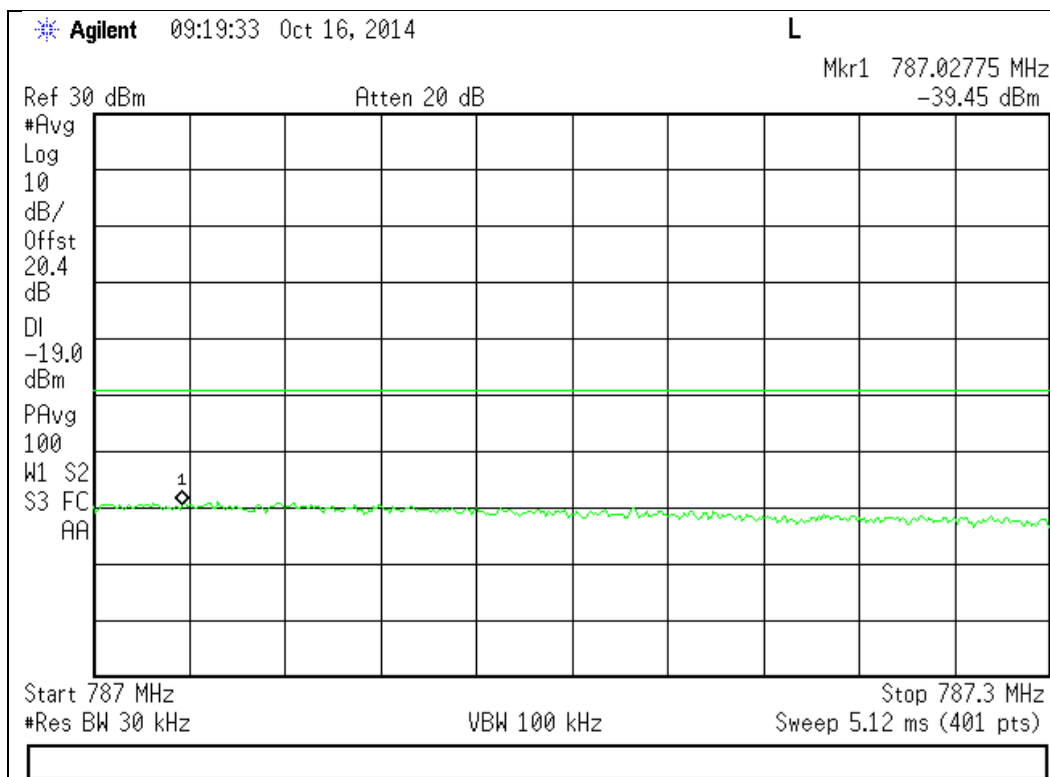


776 - 787 MHz Band

Lower Band Edge

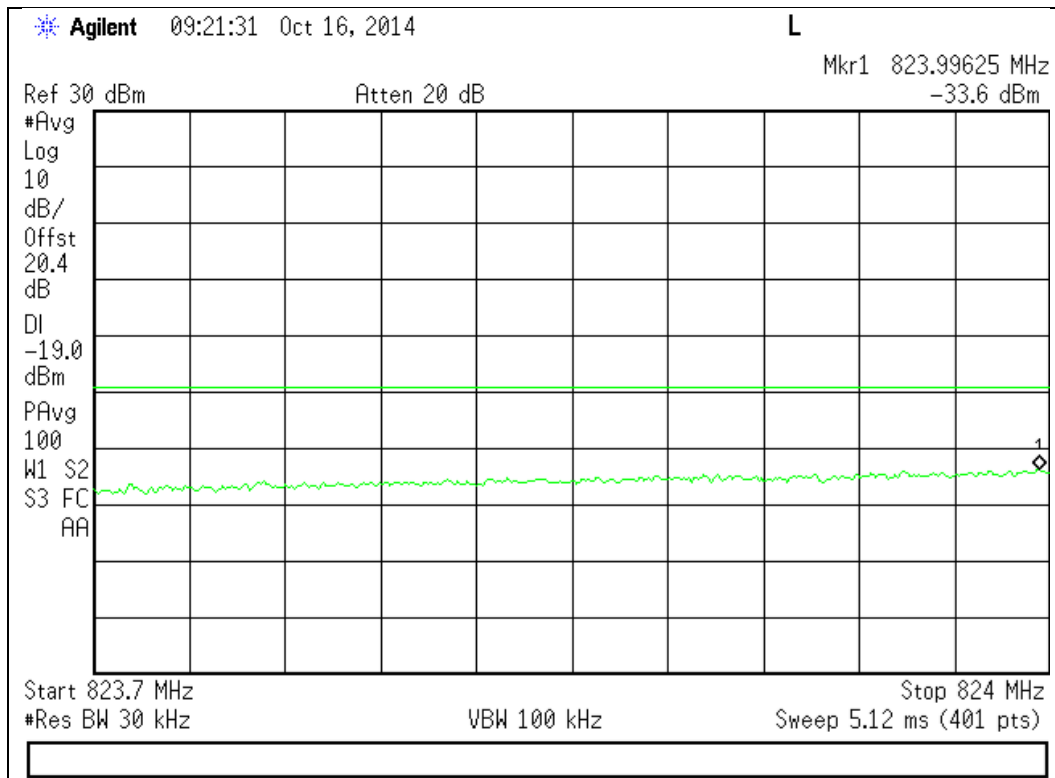


Upper Band Edge

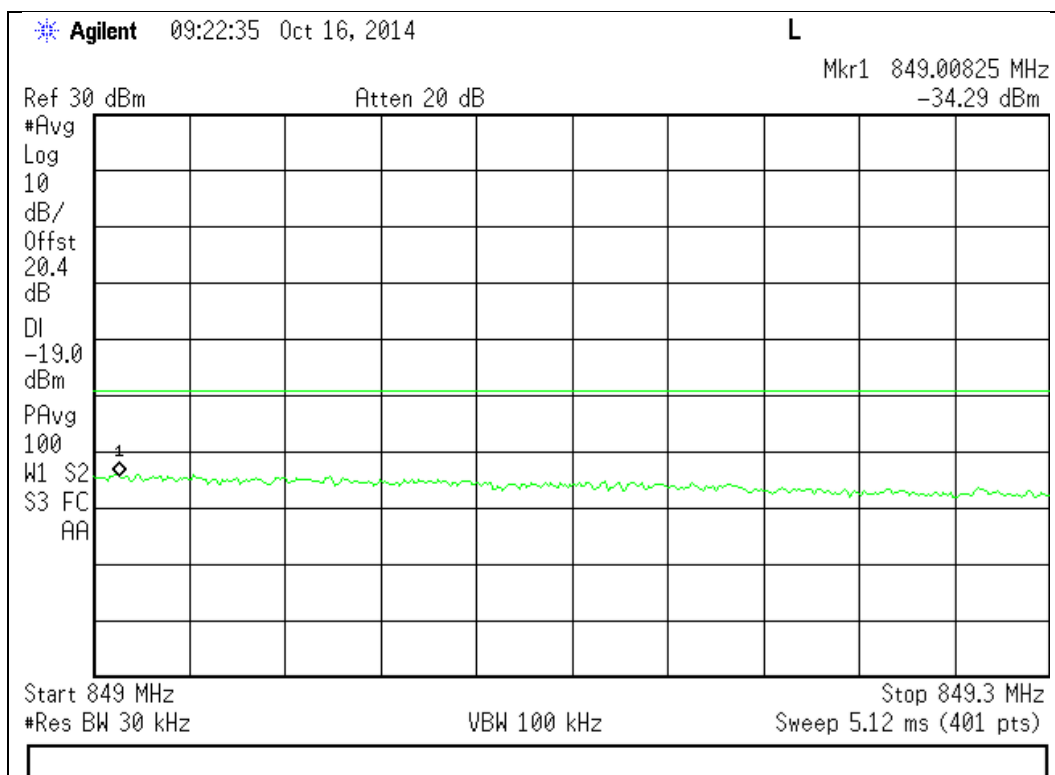


824 - 849 MHz Band

Lower Band Edge

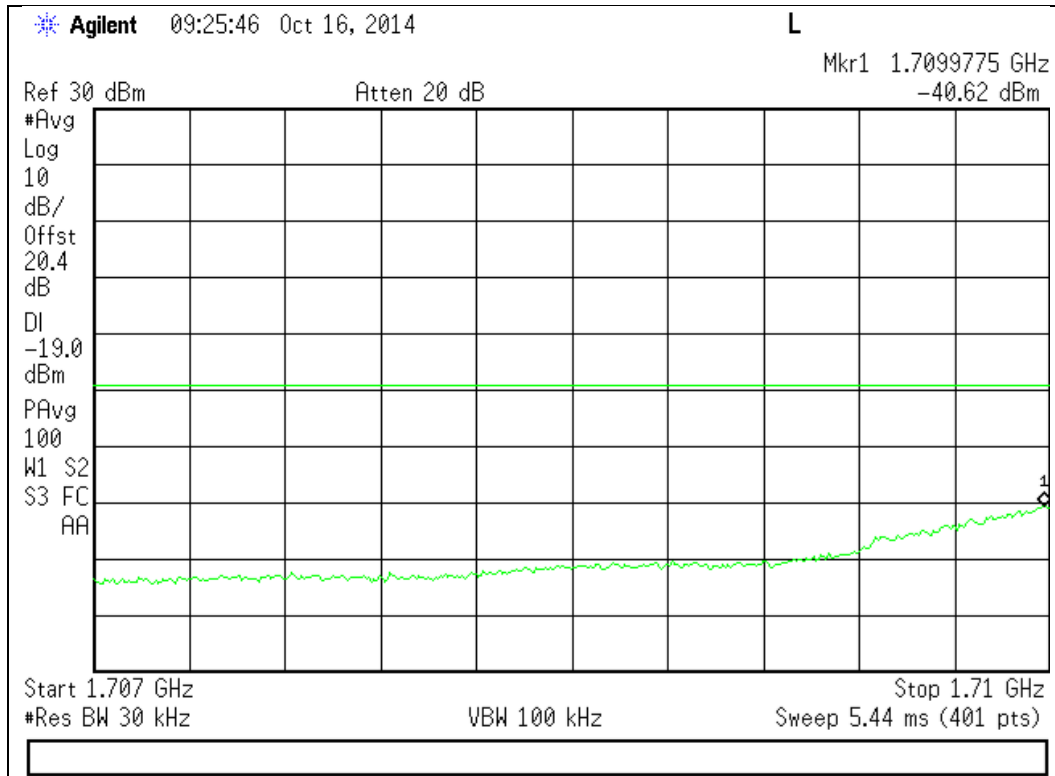


Upper Band Edge

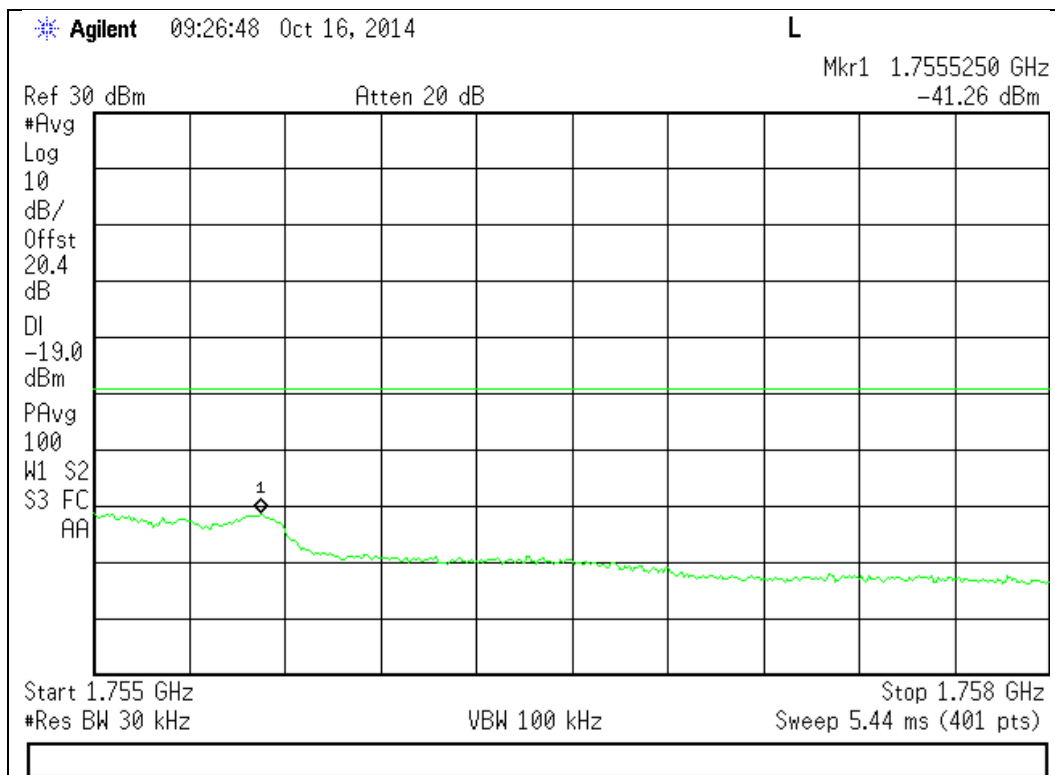


1710 - 1755 MHz Band

Lower Band Edge

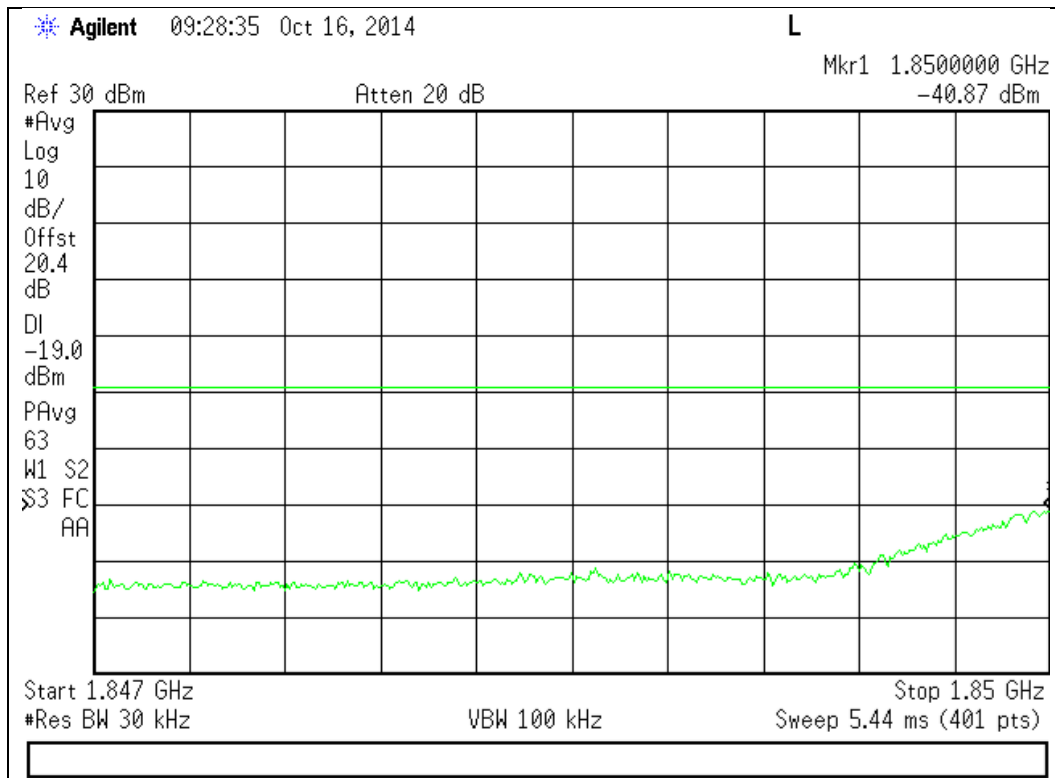


Upper Band Edge

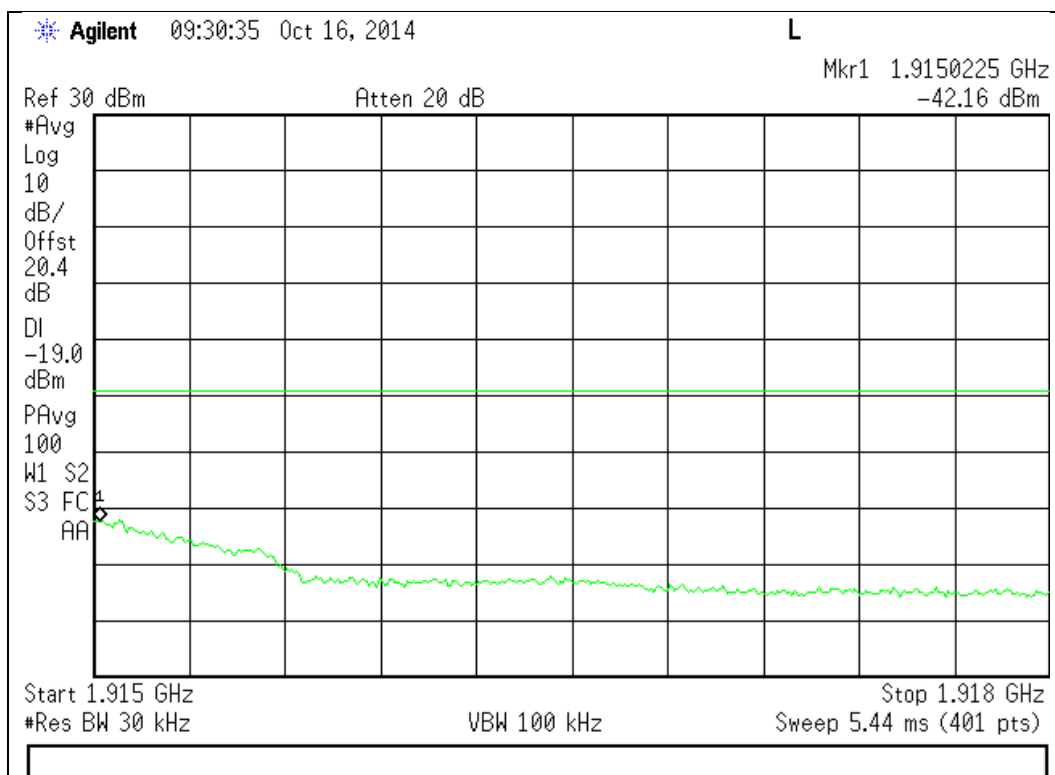


1850 - 1915 MHz Band

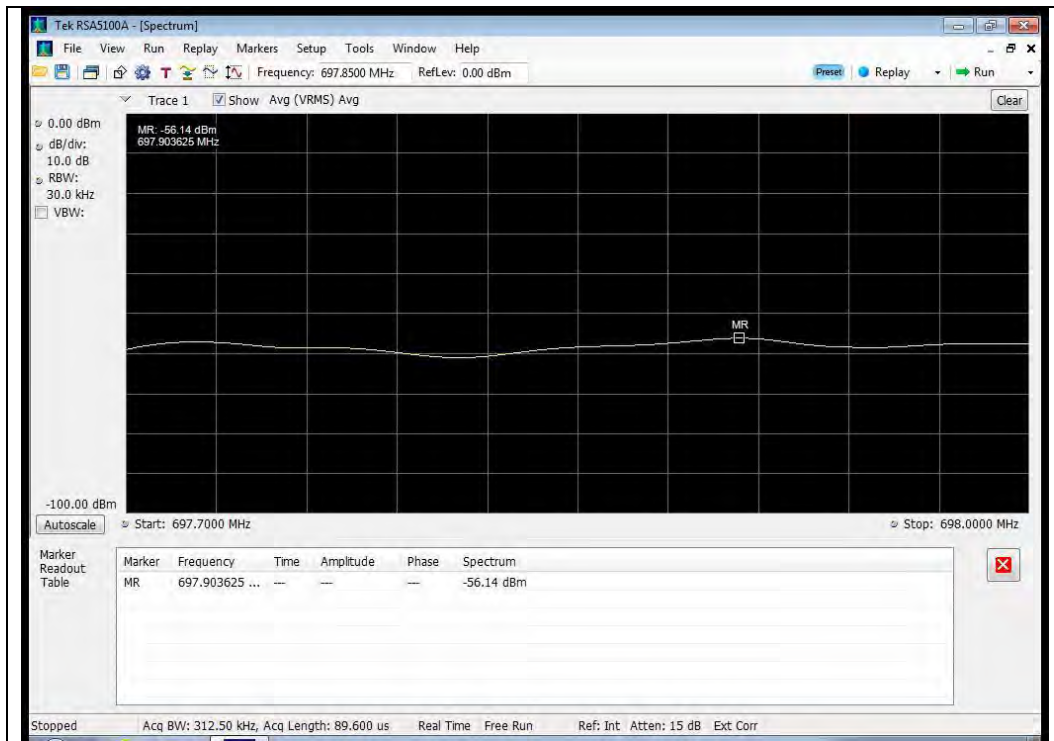
Lower Band Edge



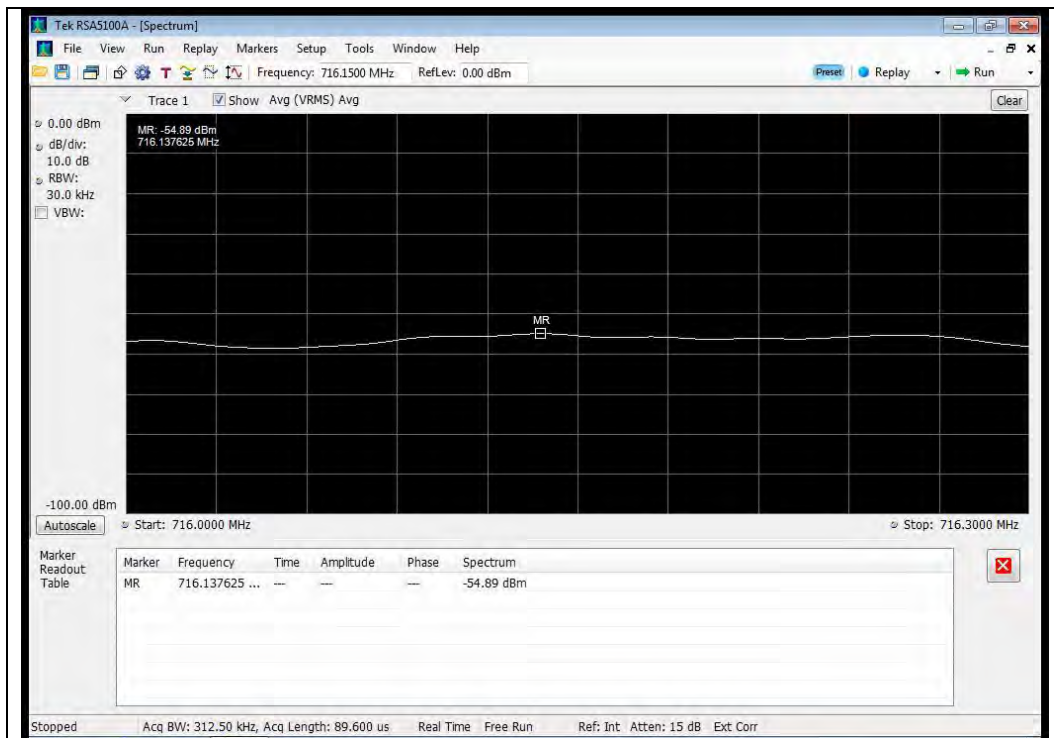
Upper Band Edge



WCDMA Uplink Test Plots 698 - 716 MHz Band Lower Band Edge

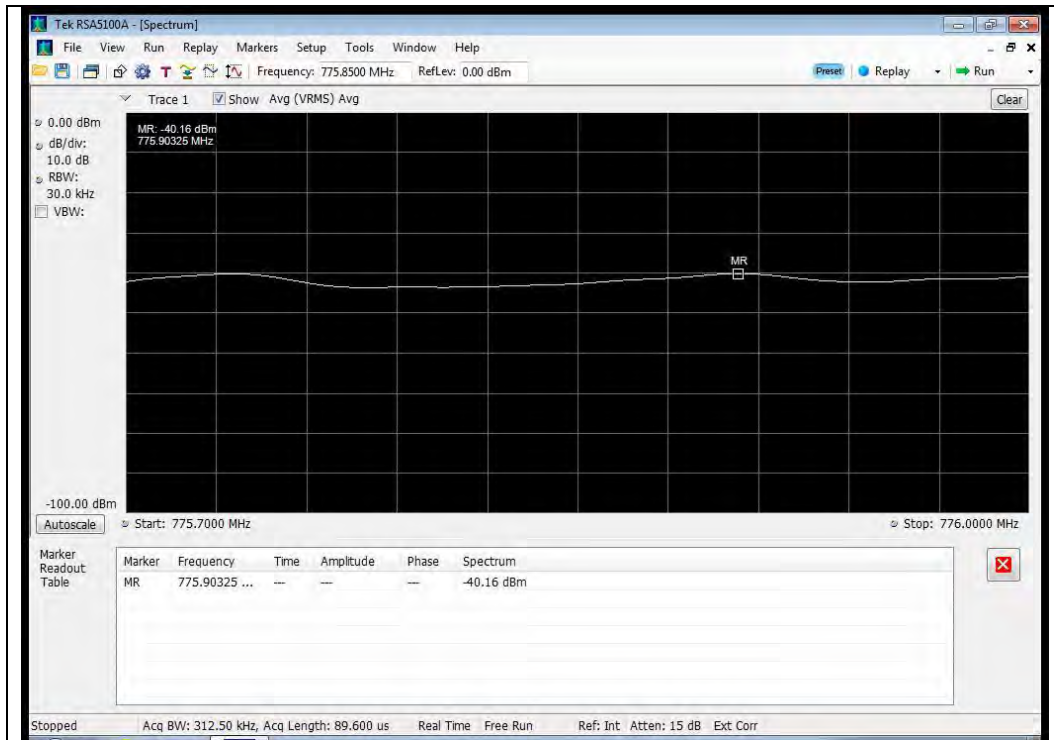


Upper Band Edge

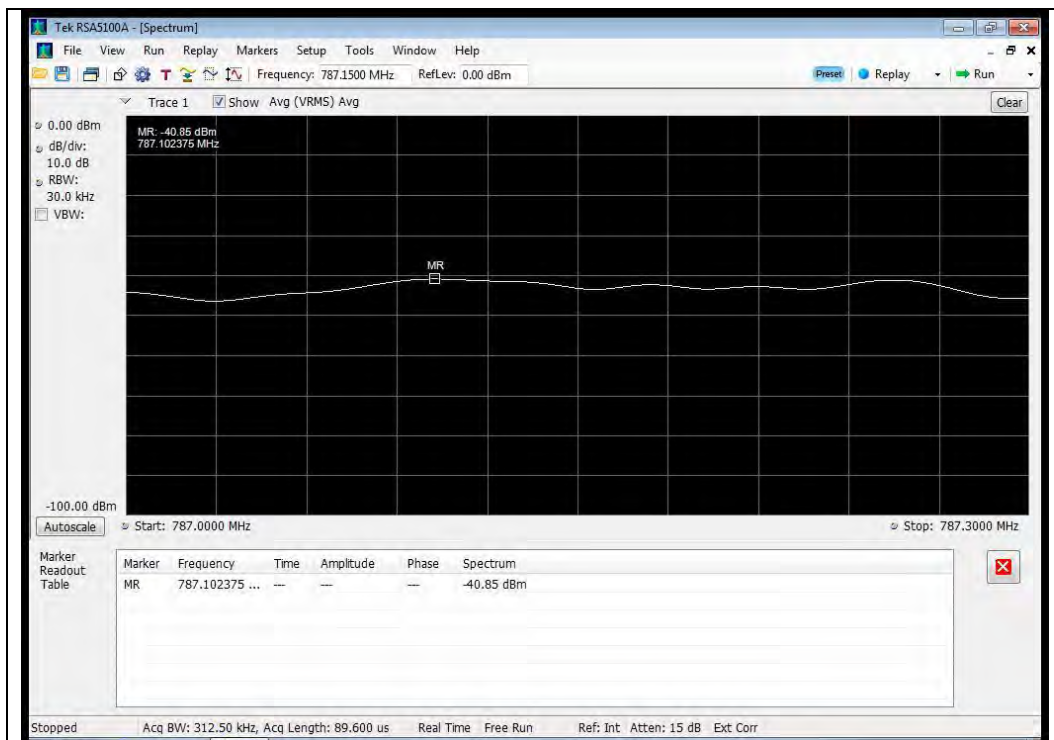


776 - 787 MHz Band

Lower Band Edge

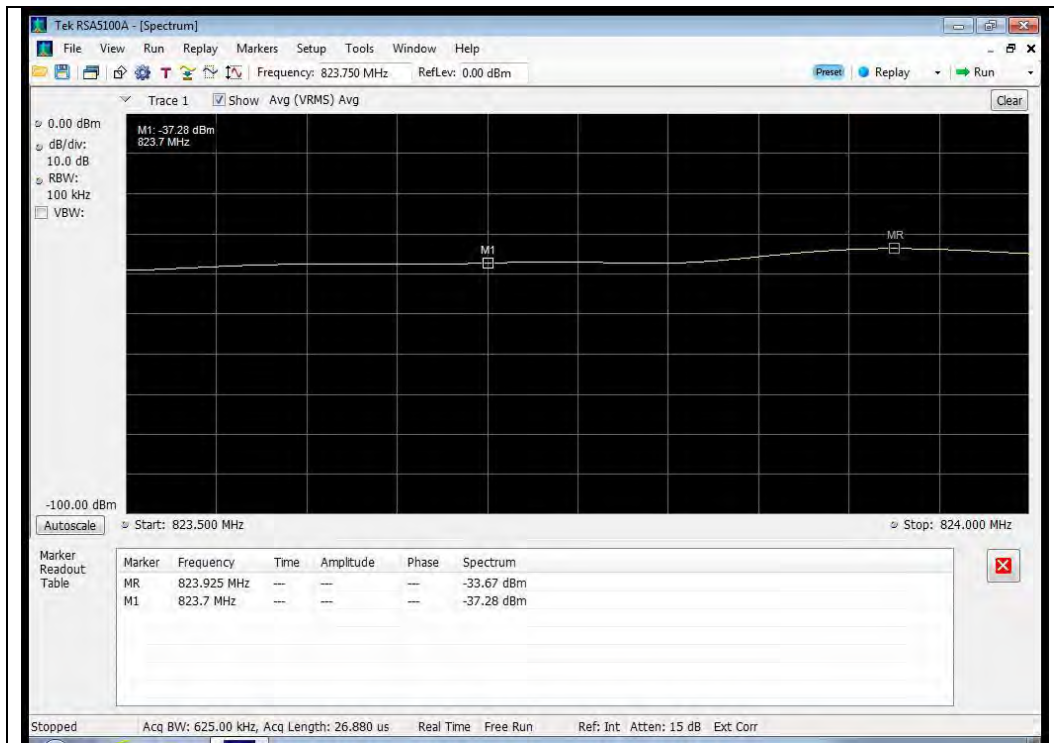


Upper Band Edge

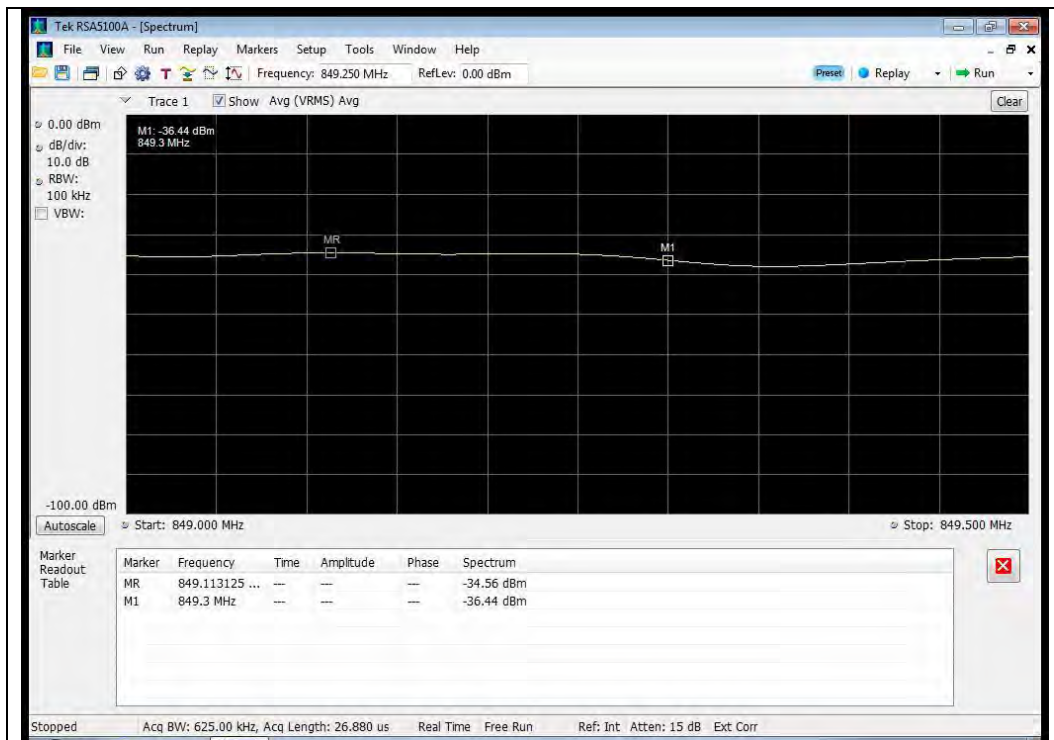


824 - 849 MHz Band

Lower Band Edge

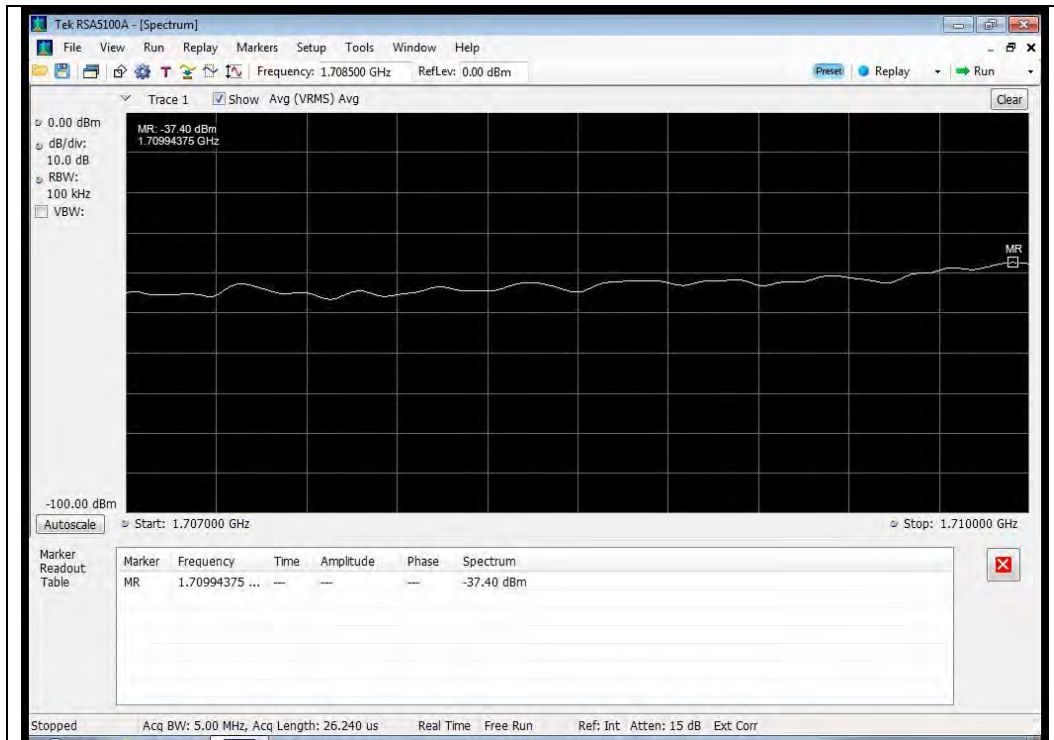


Upper Band Edge

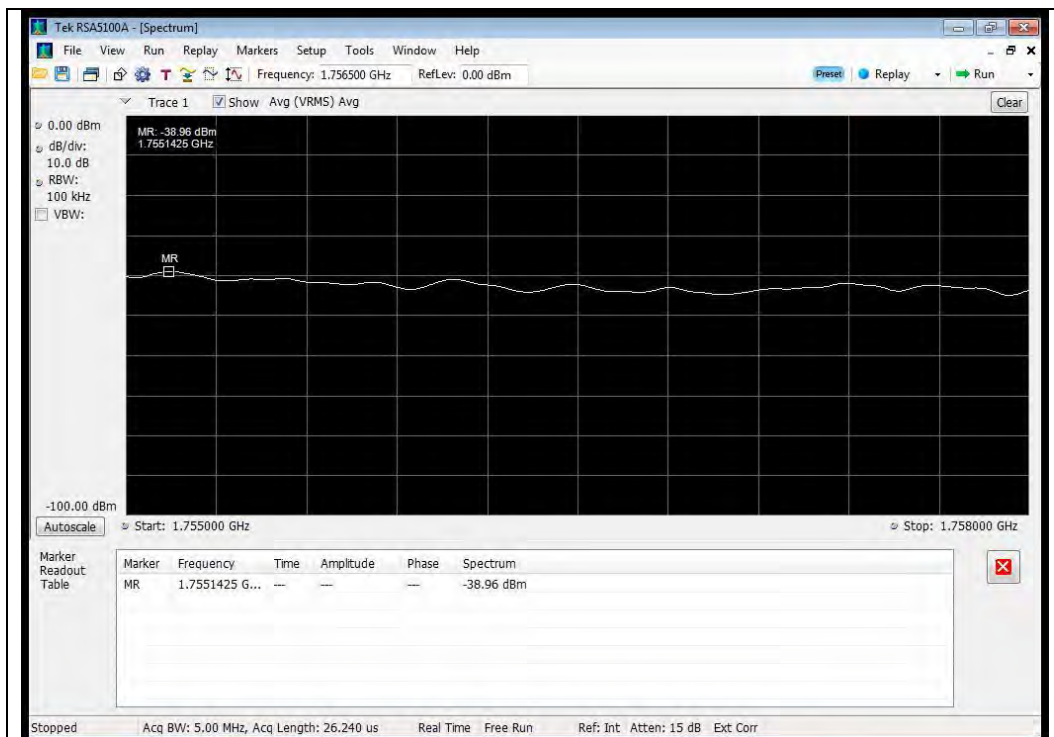


1710 - 1755 MHz Band

Lower Band Edge

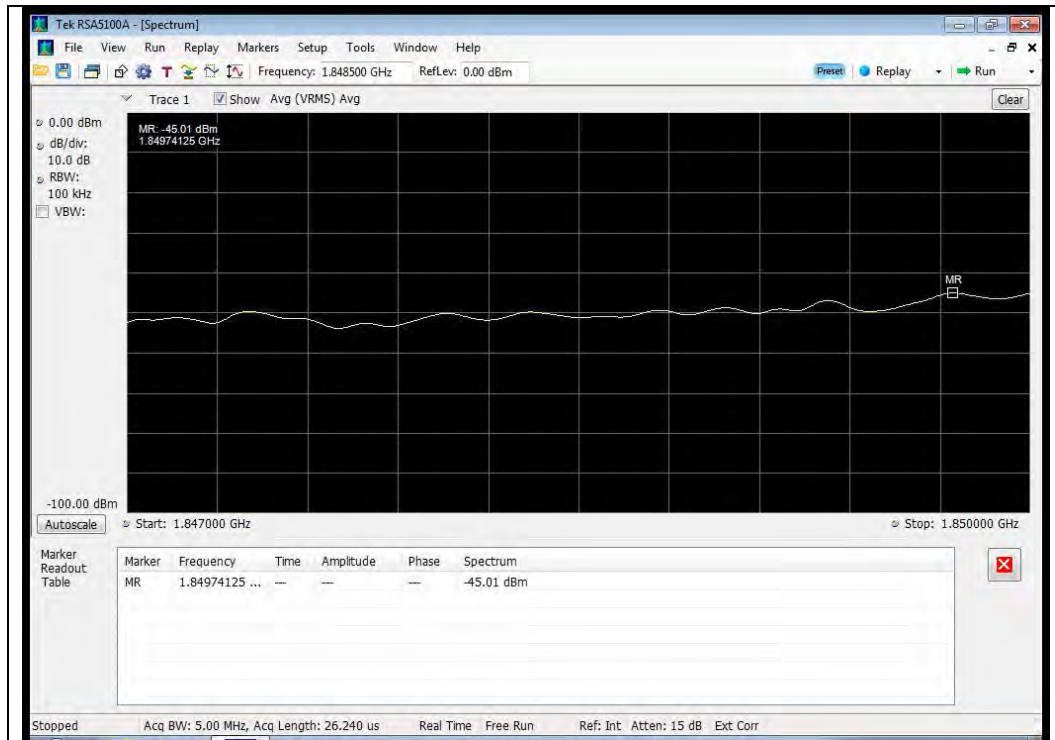


Upper Band Edge

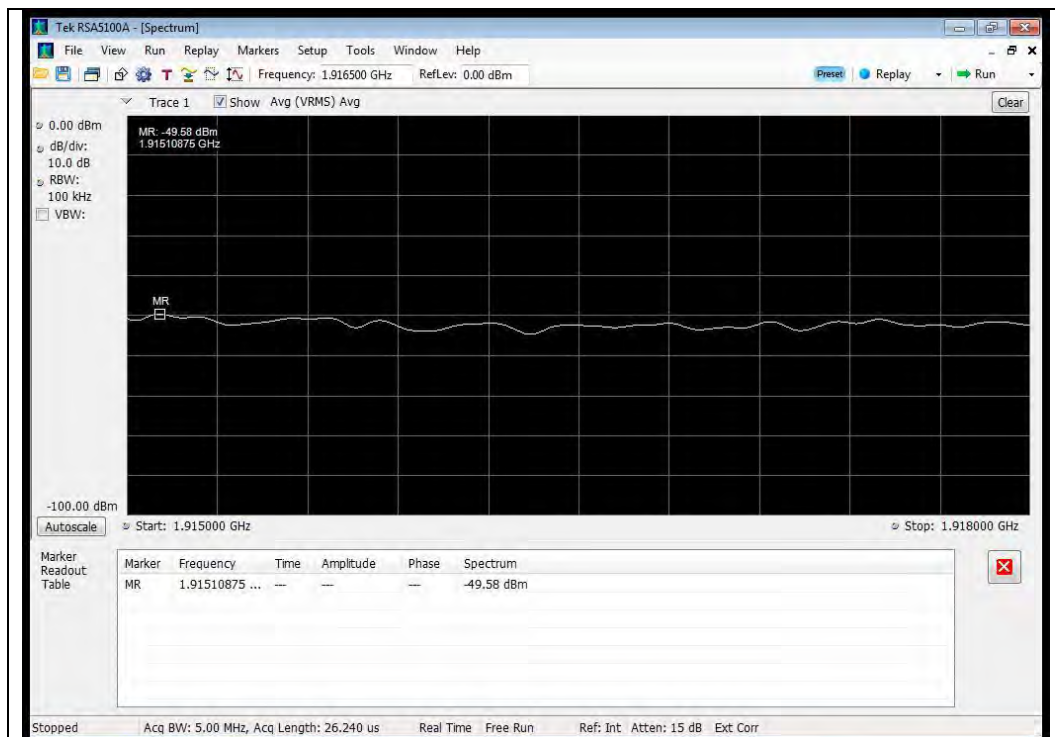


1850 - 1915 MHz Band

Lower Band Edge

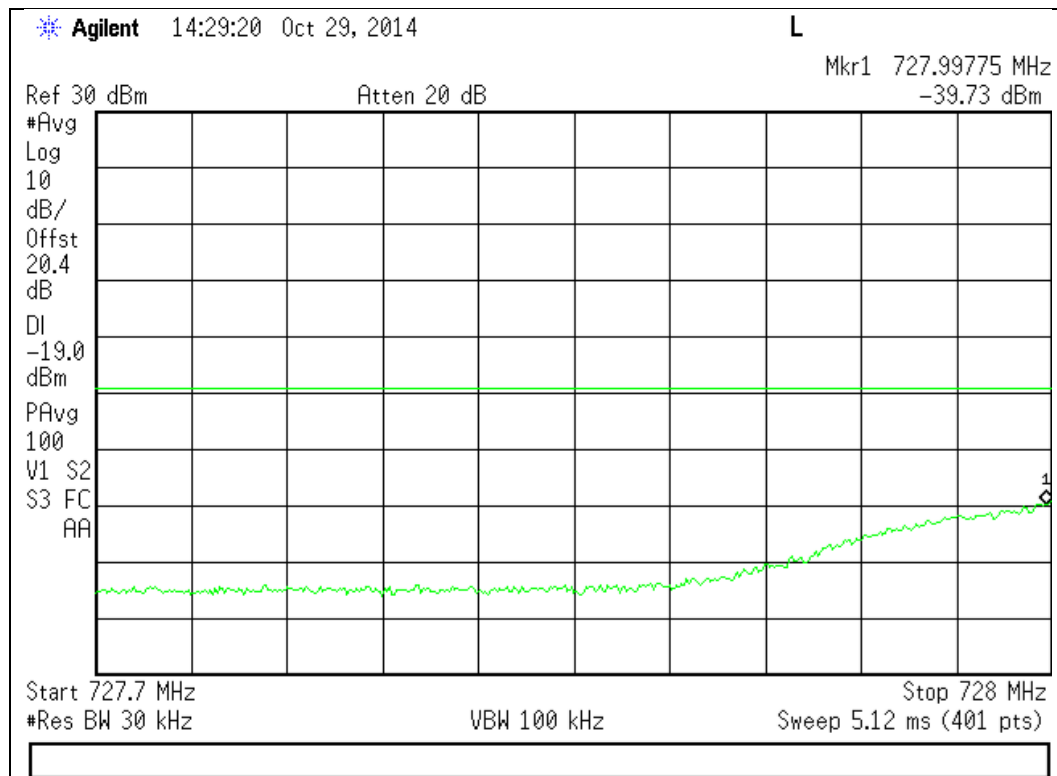


Upper Band Edge

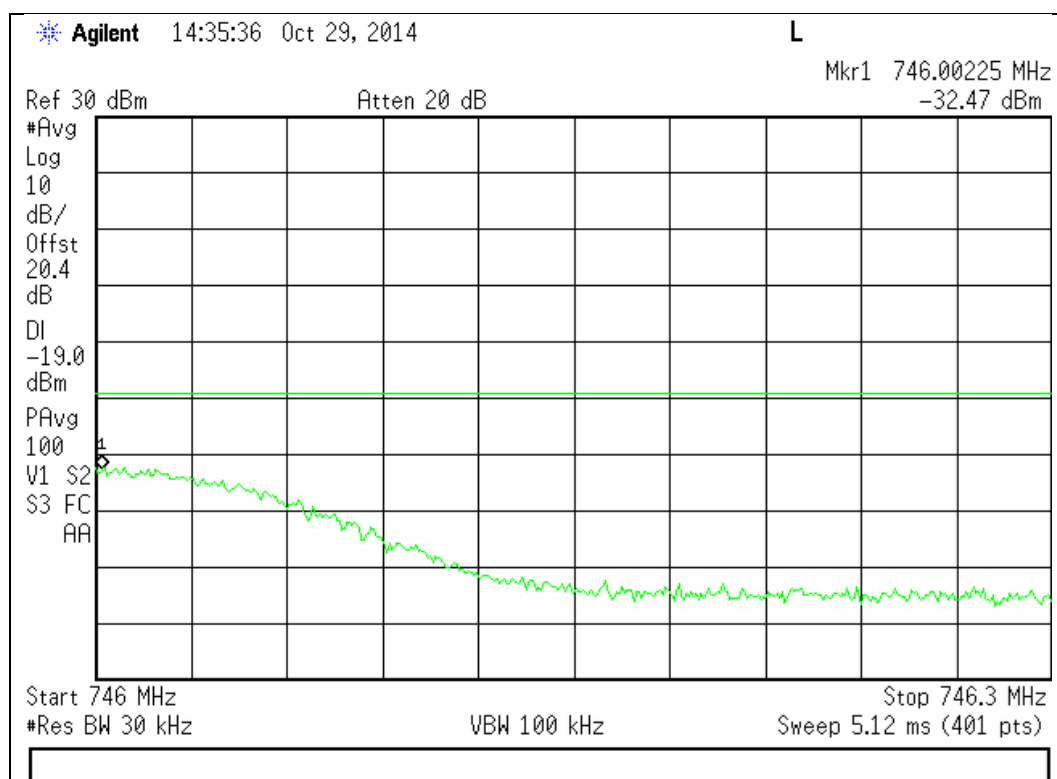




GSM Downlink Test Plots
728 - 746 MHz Band
Lower Band Edge



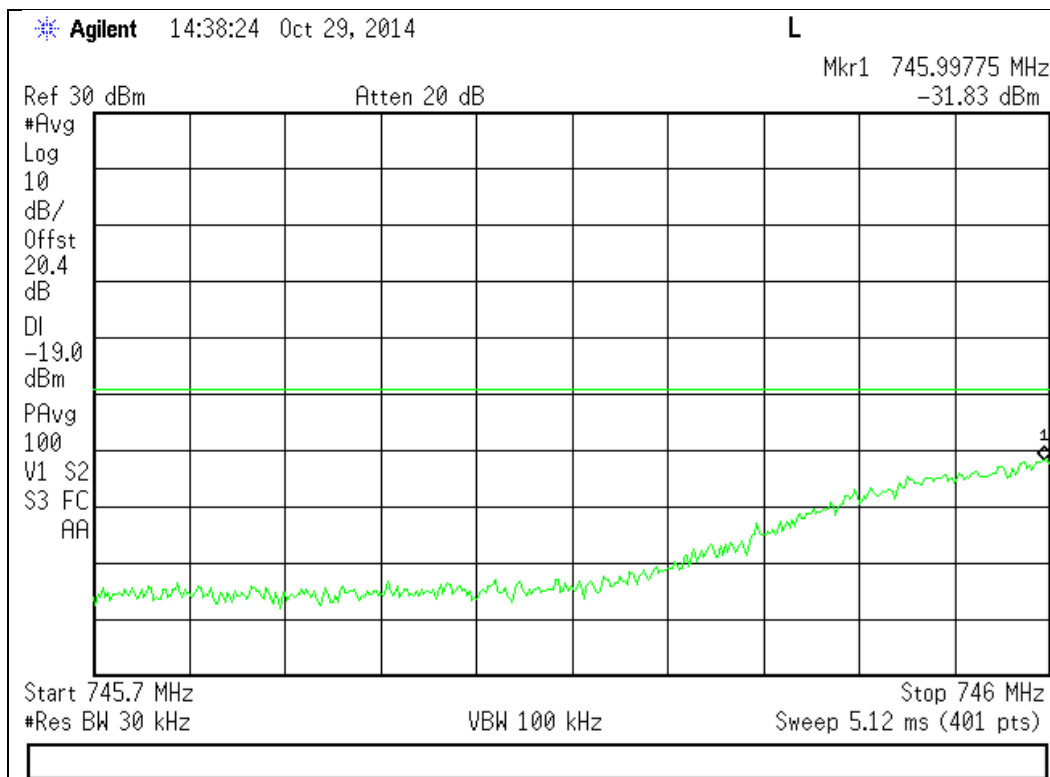
Upper Band Edge



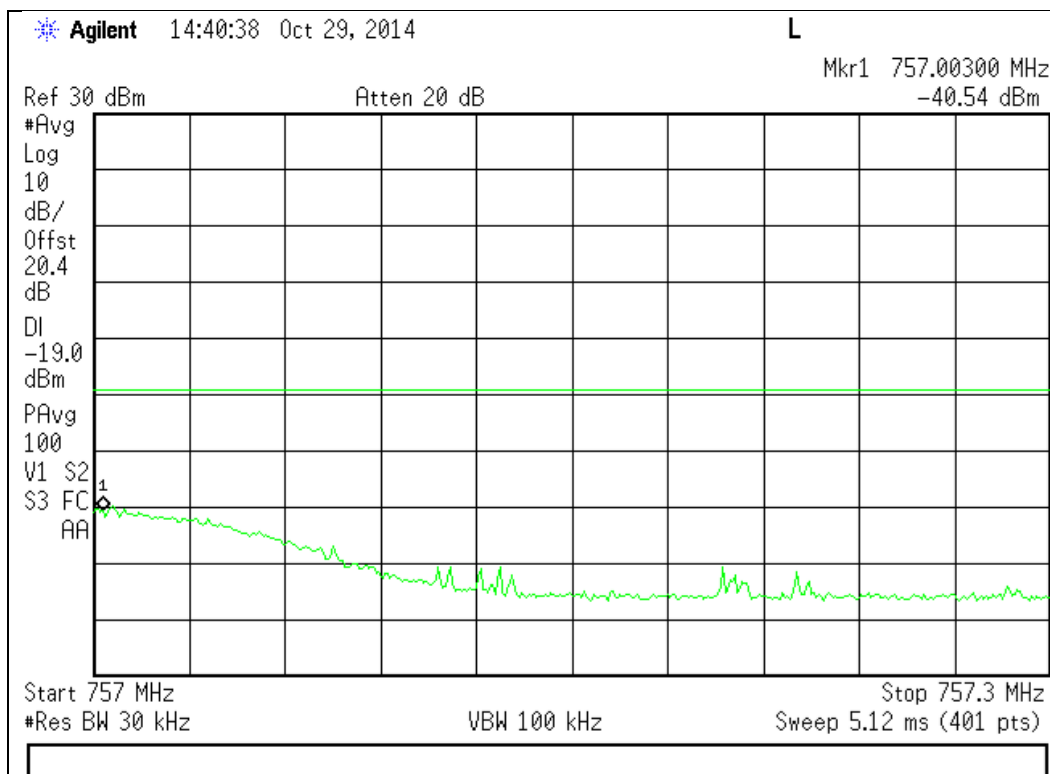


746 - 757 MHz Band

Lower Band Edge



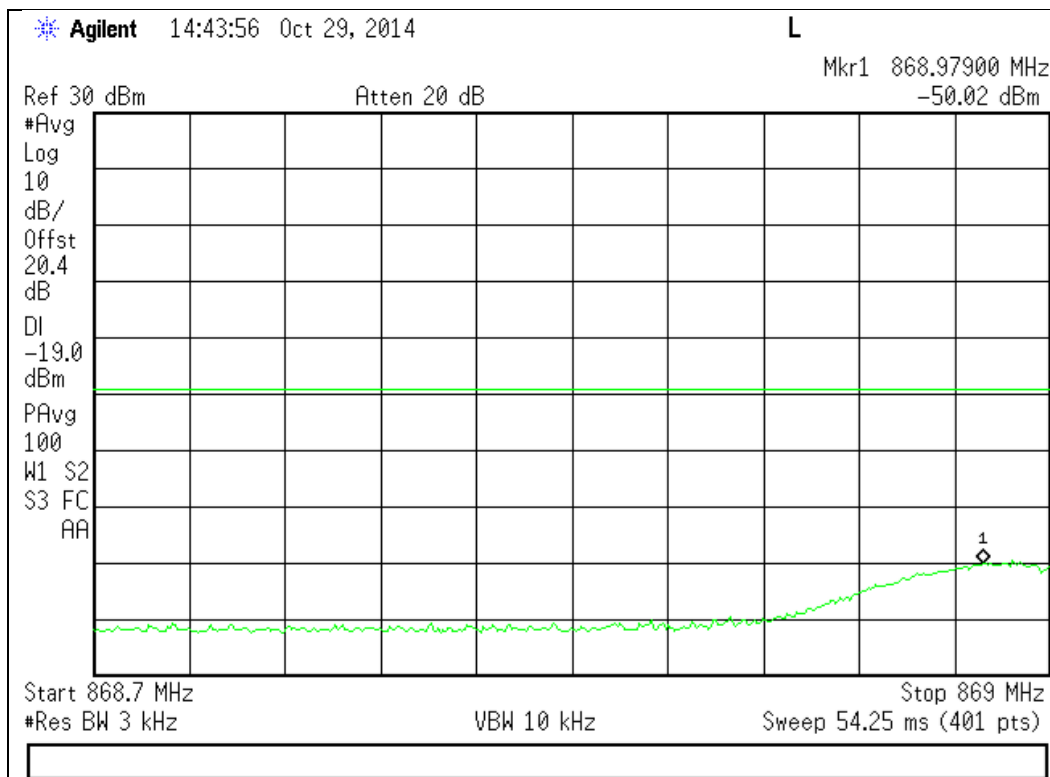
Upper Band Edge



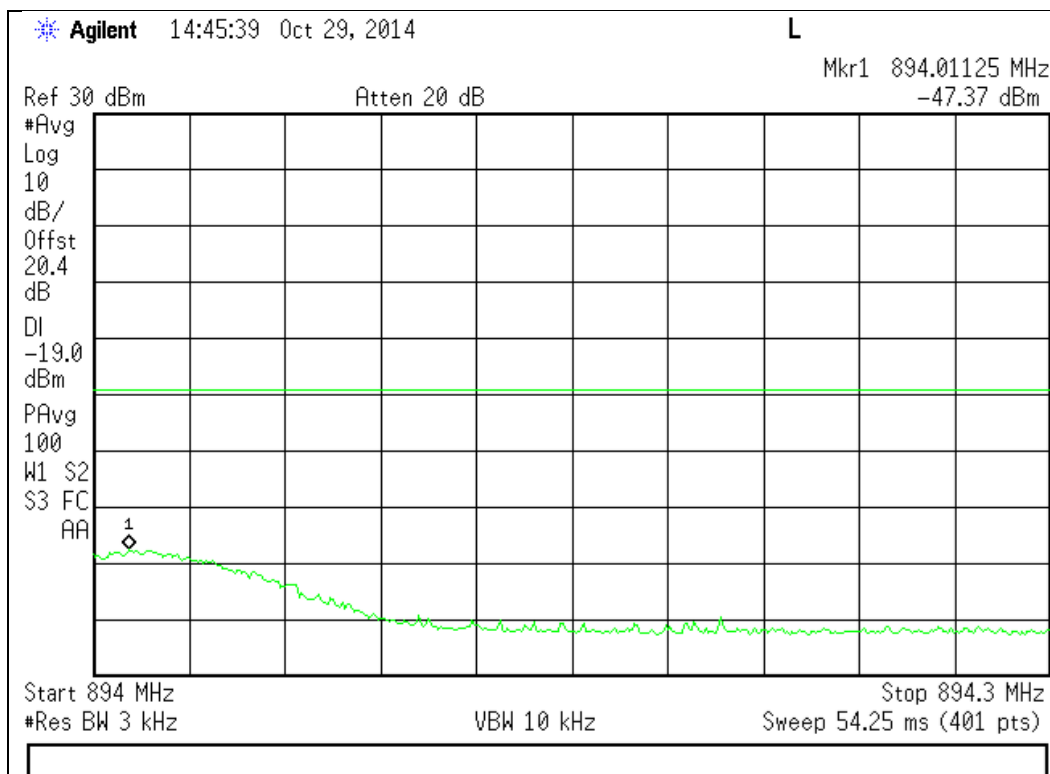


869 - 894 MHz Band

Lower Band Edge



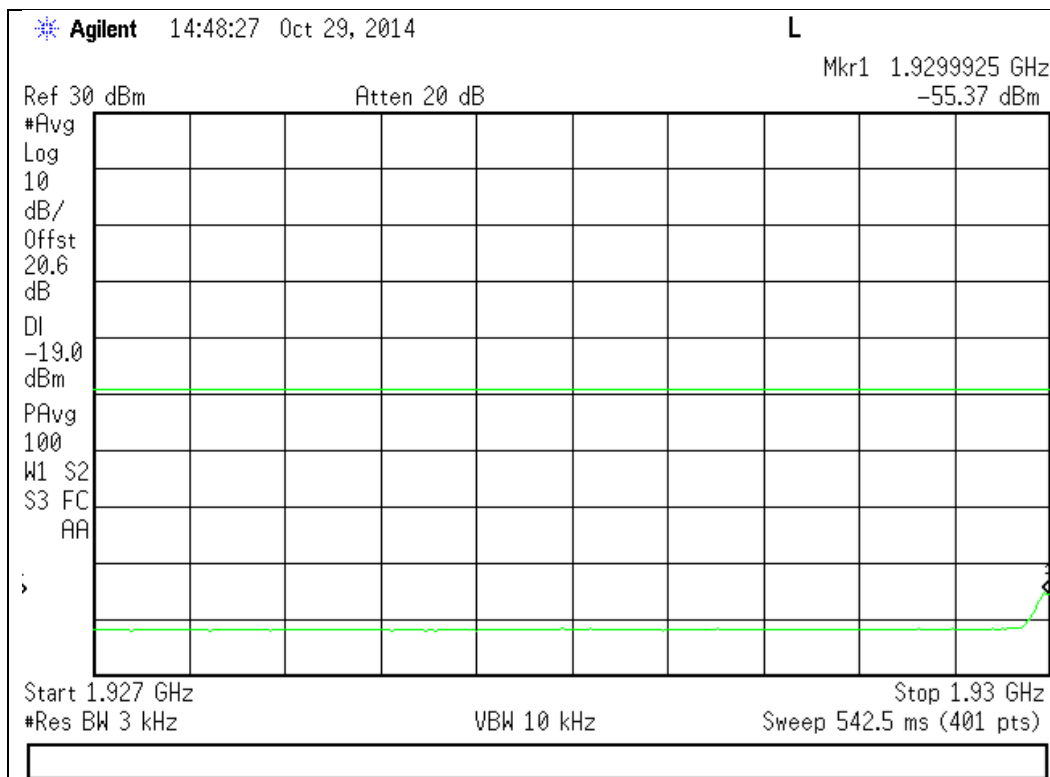
Upper Band Edge



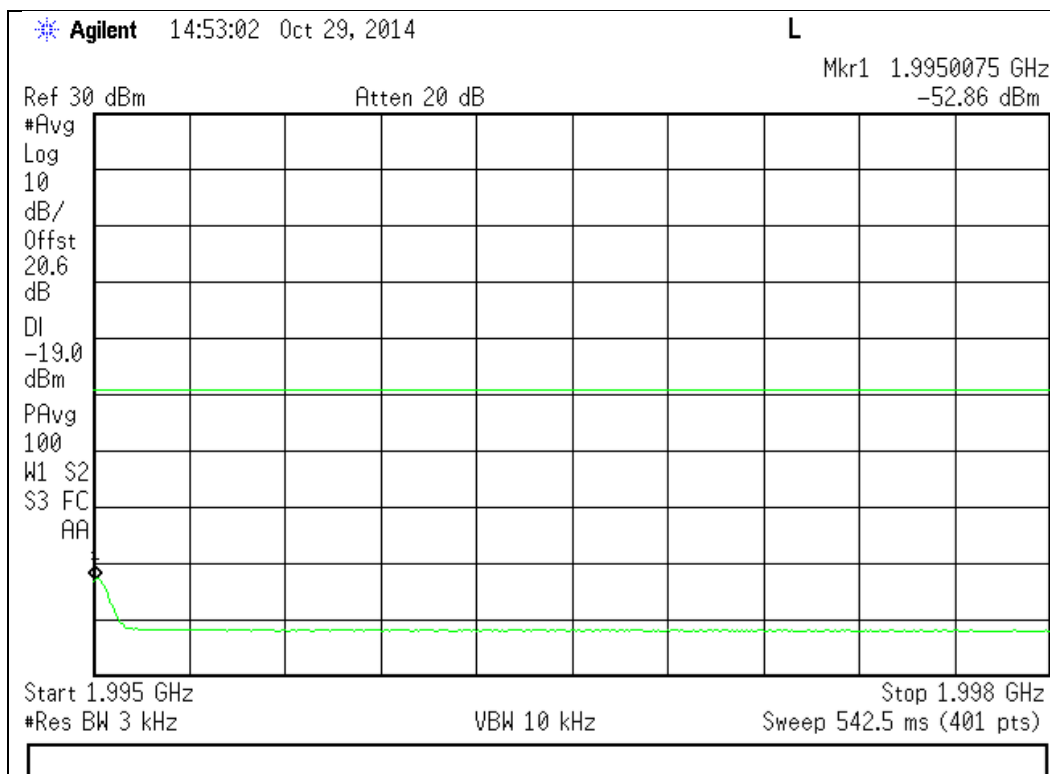


1930 - 1995 MHz Band

Lower Band Edge



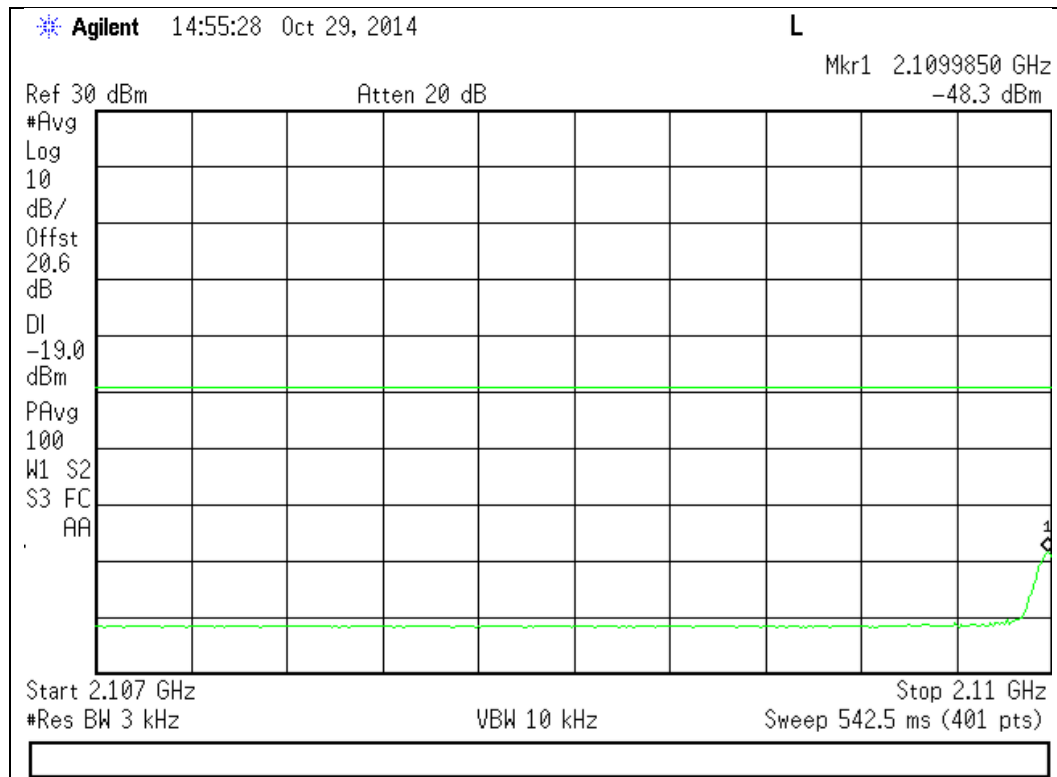
Upper Band Edge



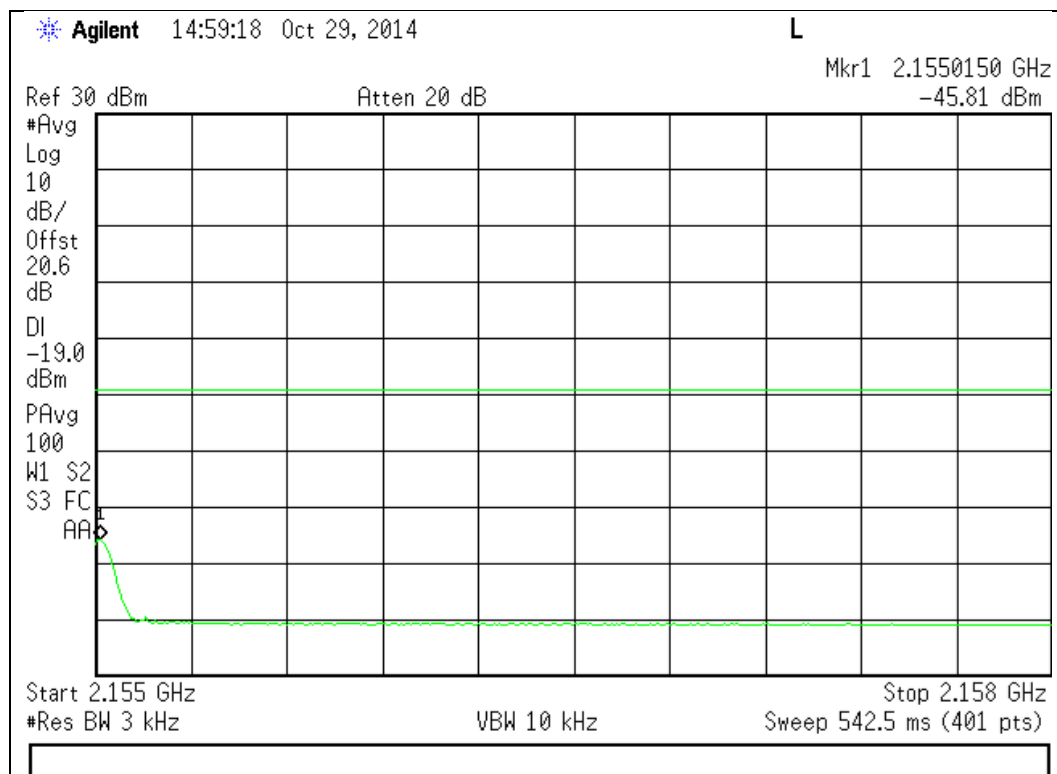


2110 - 2155 MHz Band

Lower Band Edge



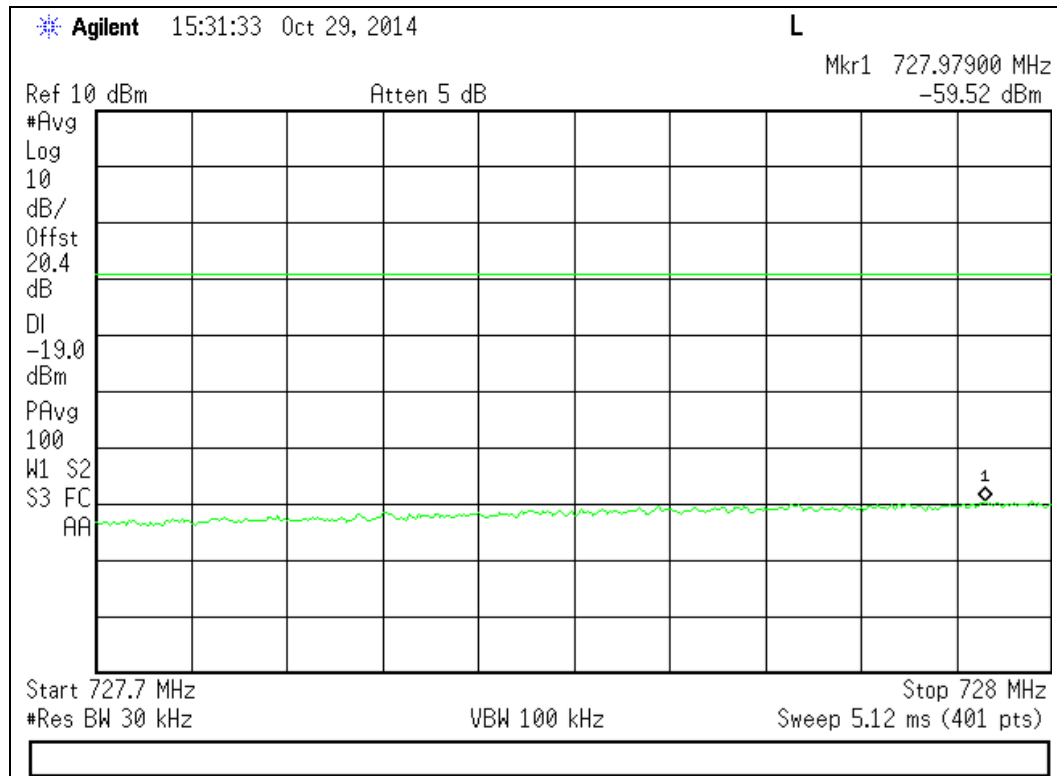
Upper Band Edge



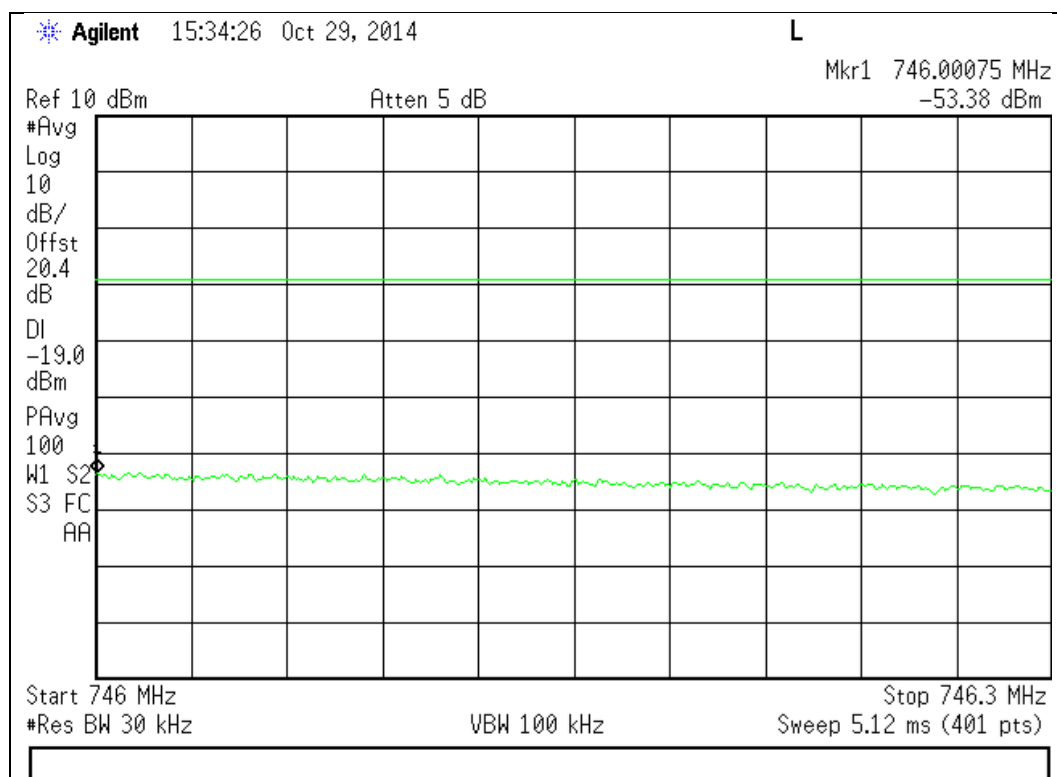
CDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge



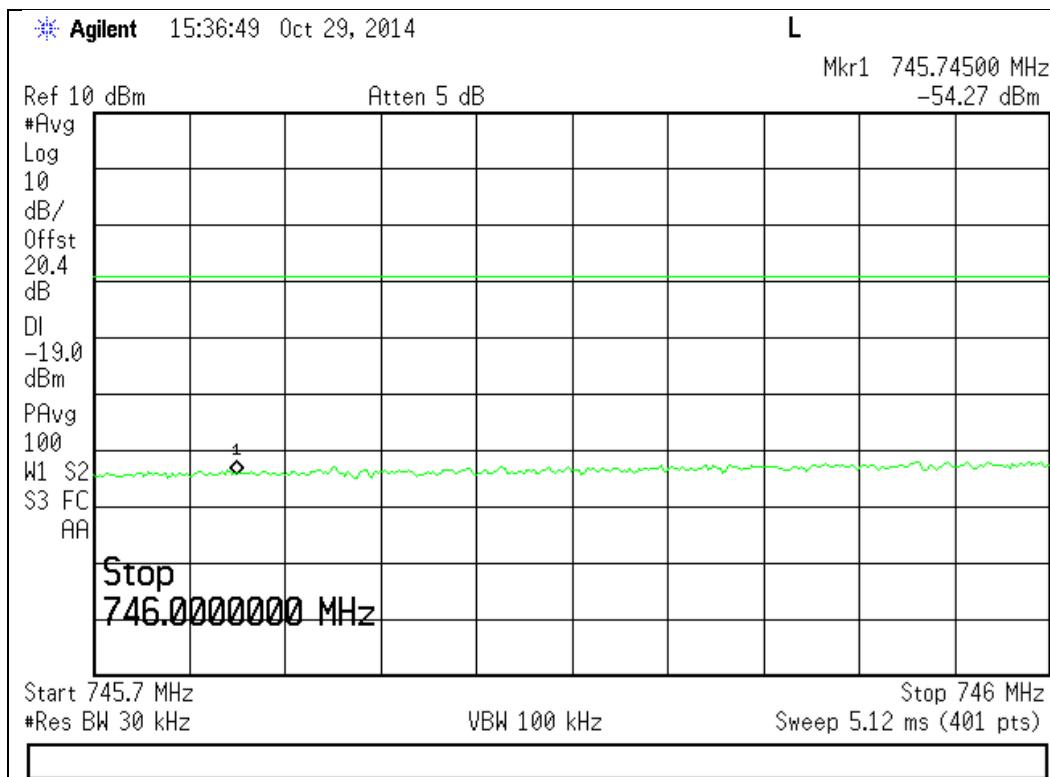
Upper Band Edge



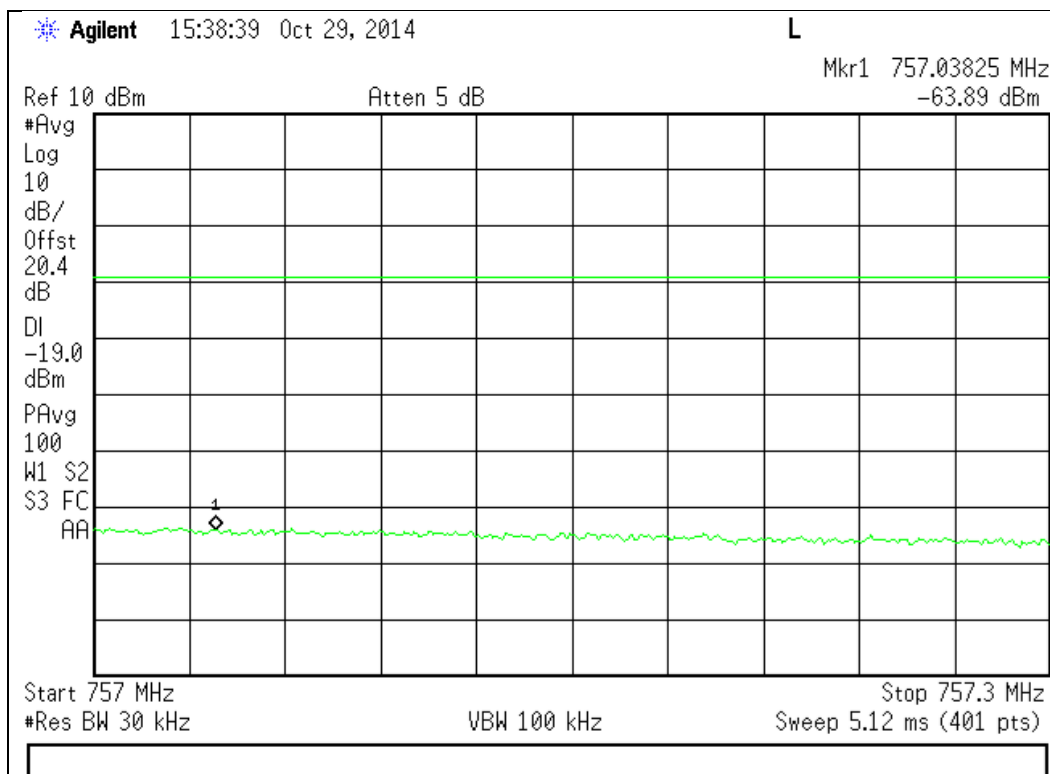


746 - 757 MHz Band

Lower Band Edge



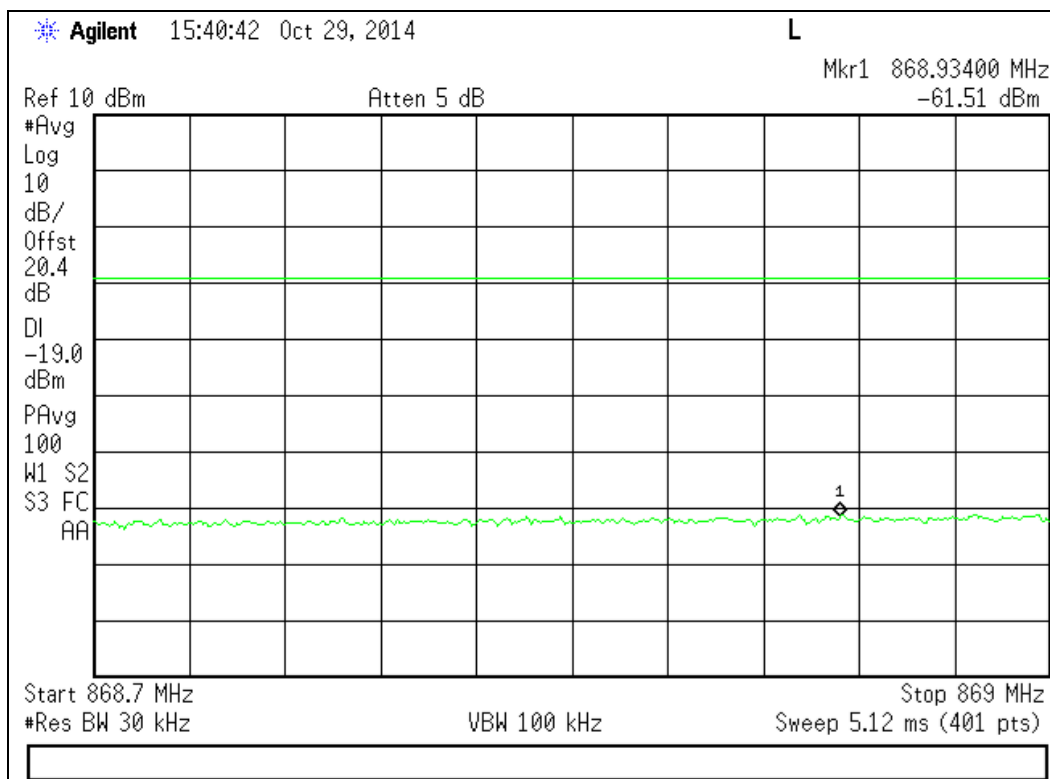
Upper Band Edge



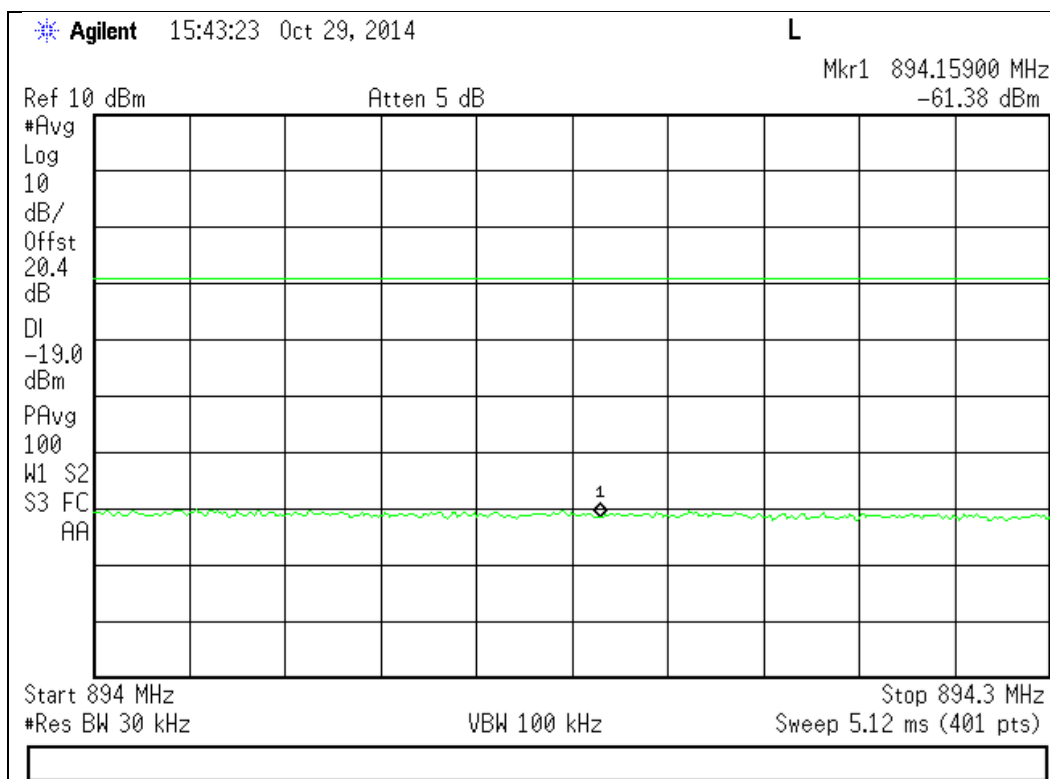


869 - 894 MHz Band

Lower Band Edge



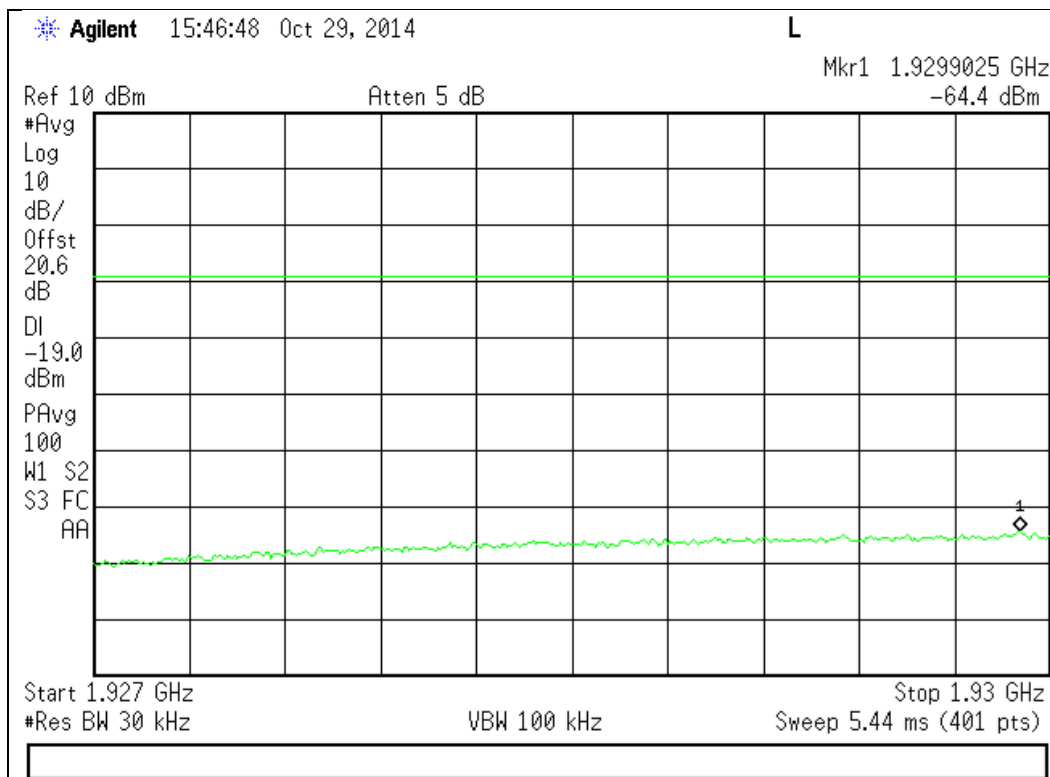
Upper Band Edge



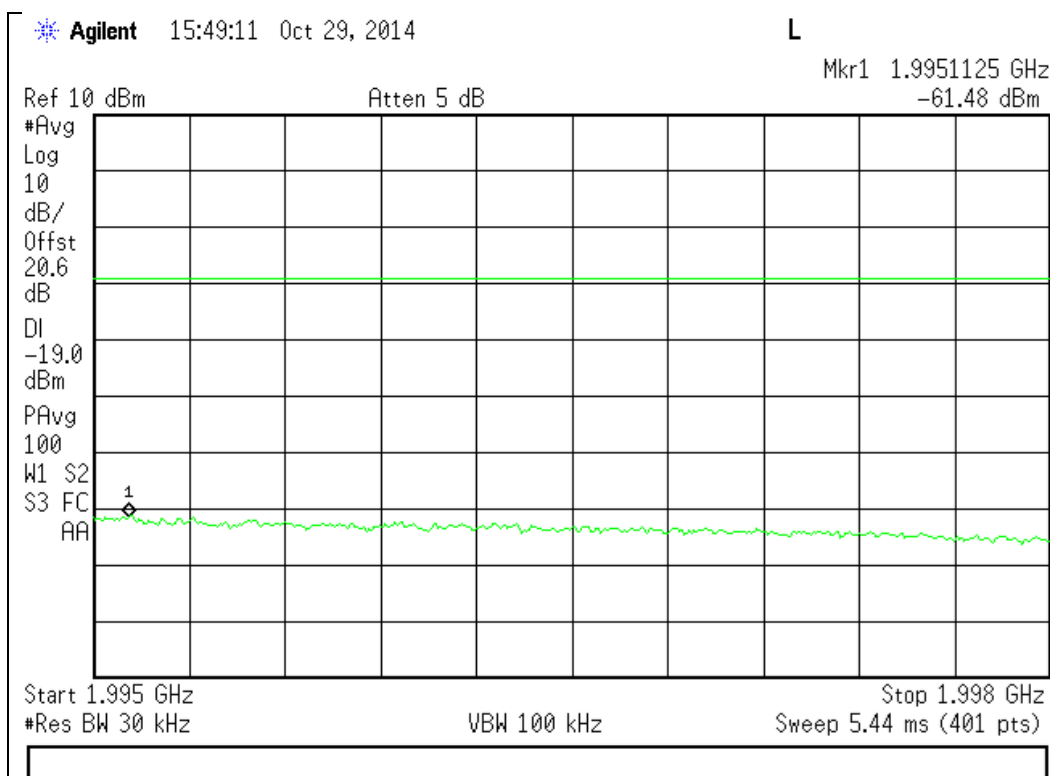


1930 - 1995 MHz Band

Lower Band Edge



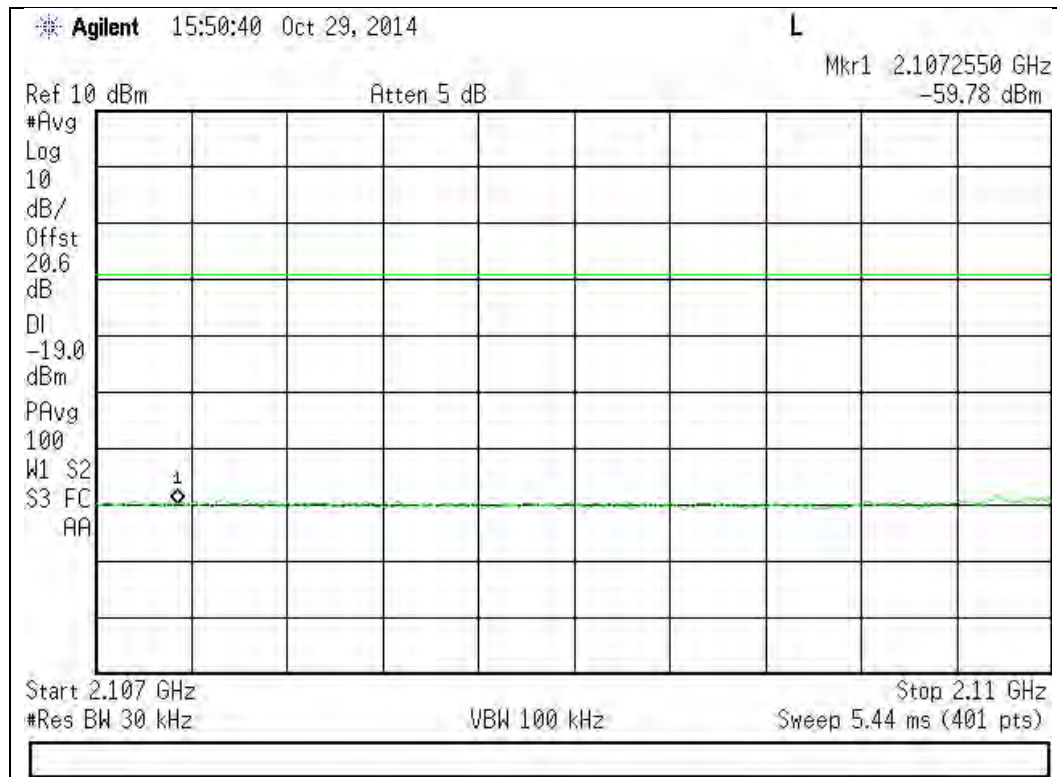
Upper Band Edge



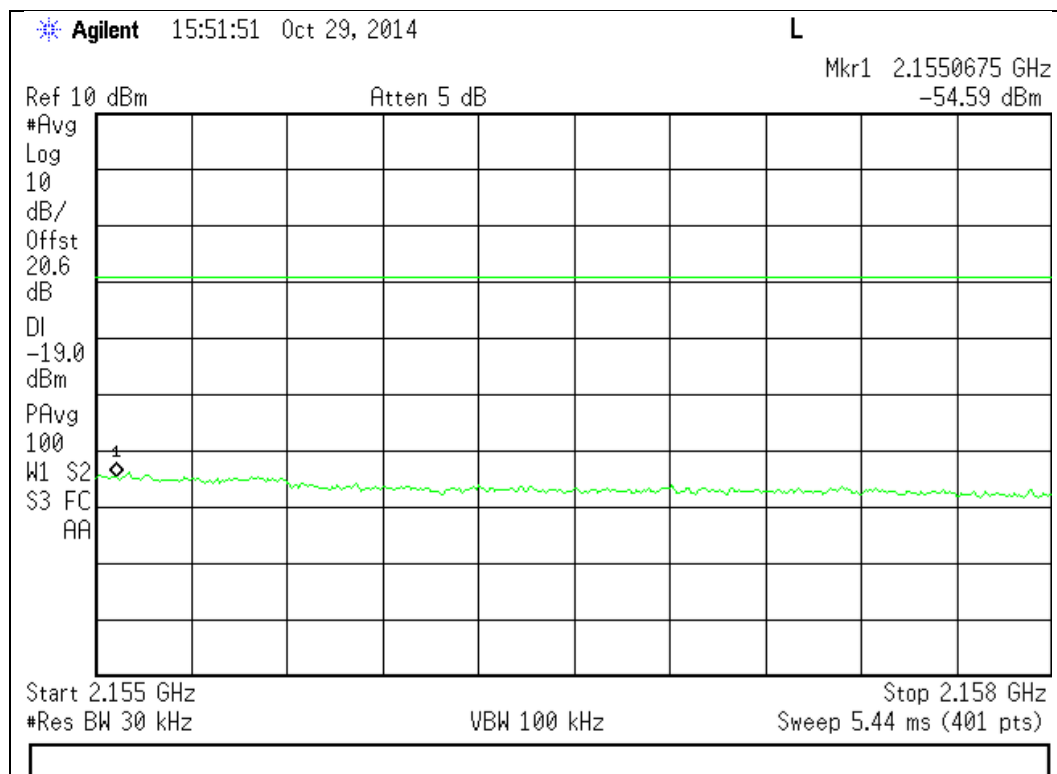


2110 - 2155 MHz Band

Lower Band Edge



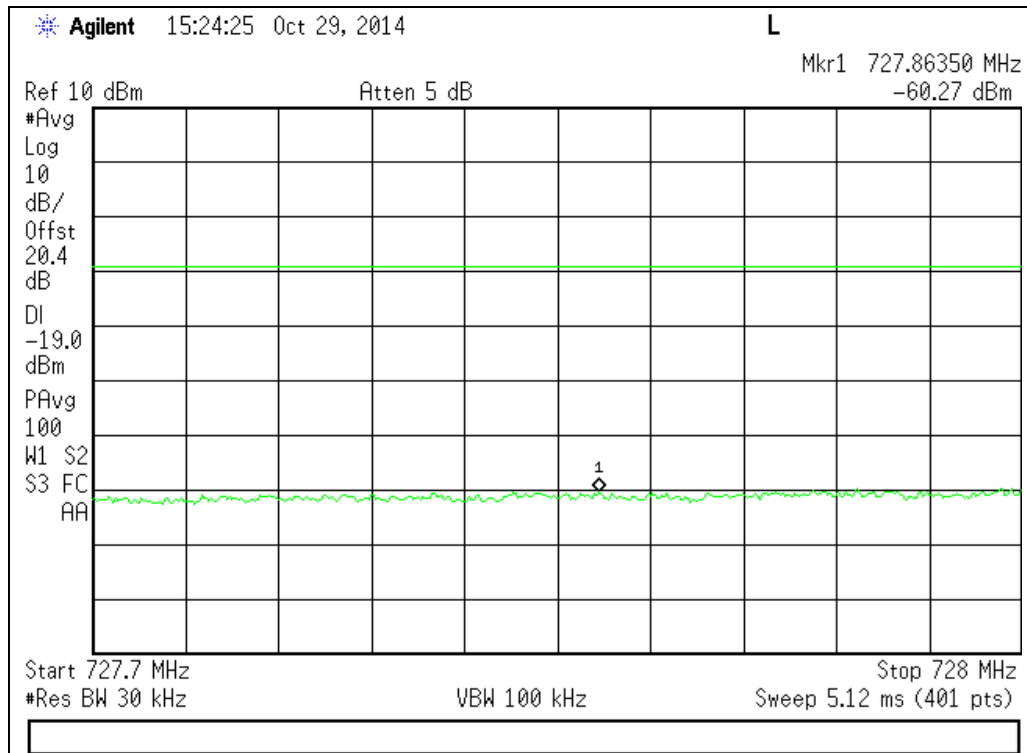
Upper Band Edge



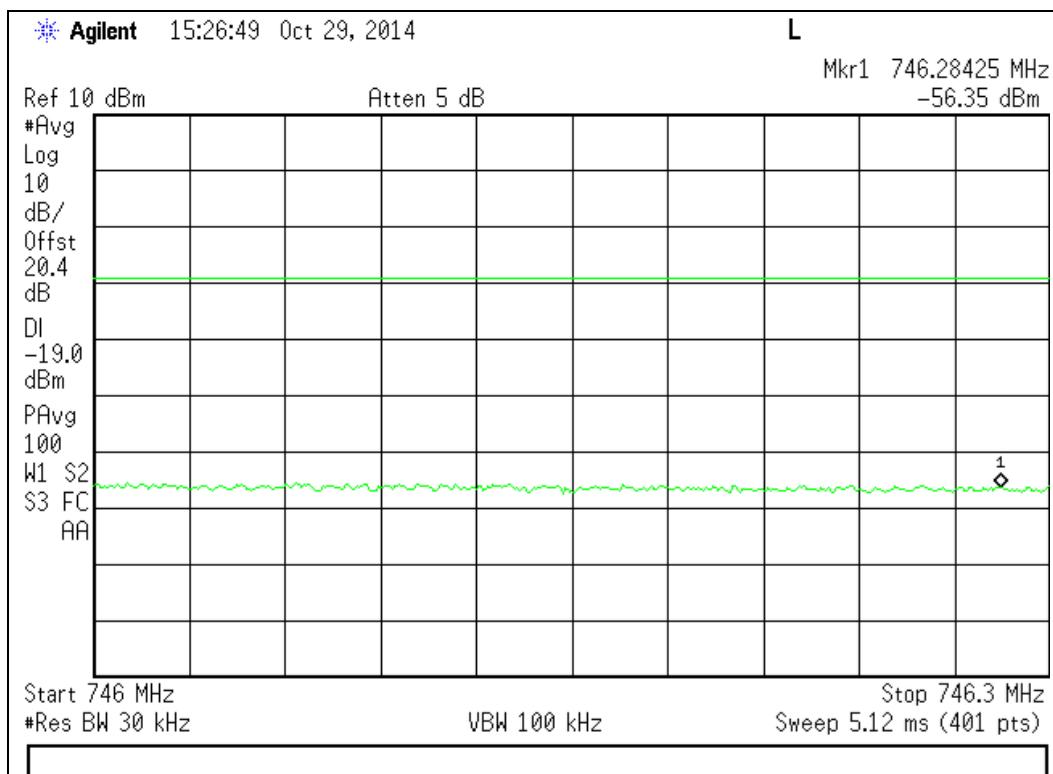
WCDMA Downlink Test Plots

728 - 746 MHz Band

Lower Band Edge



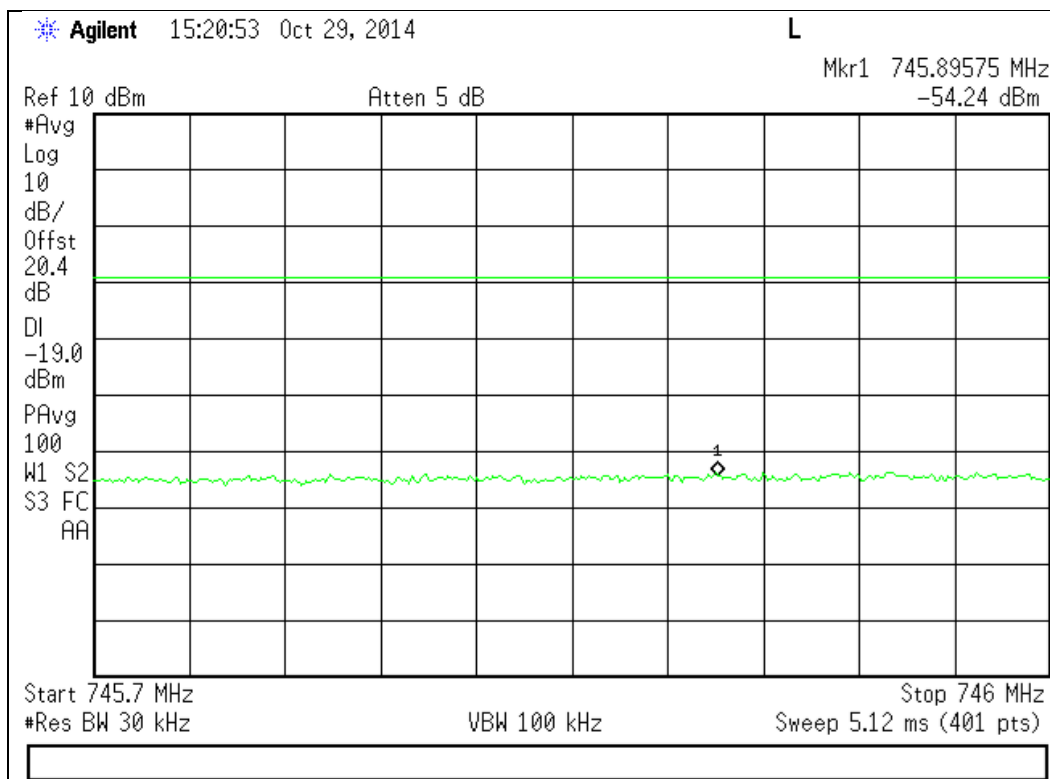
Upper Band Edge



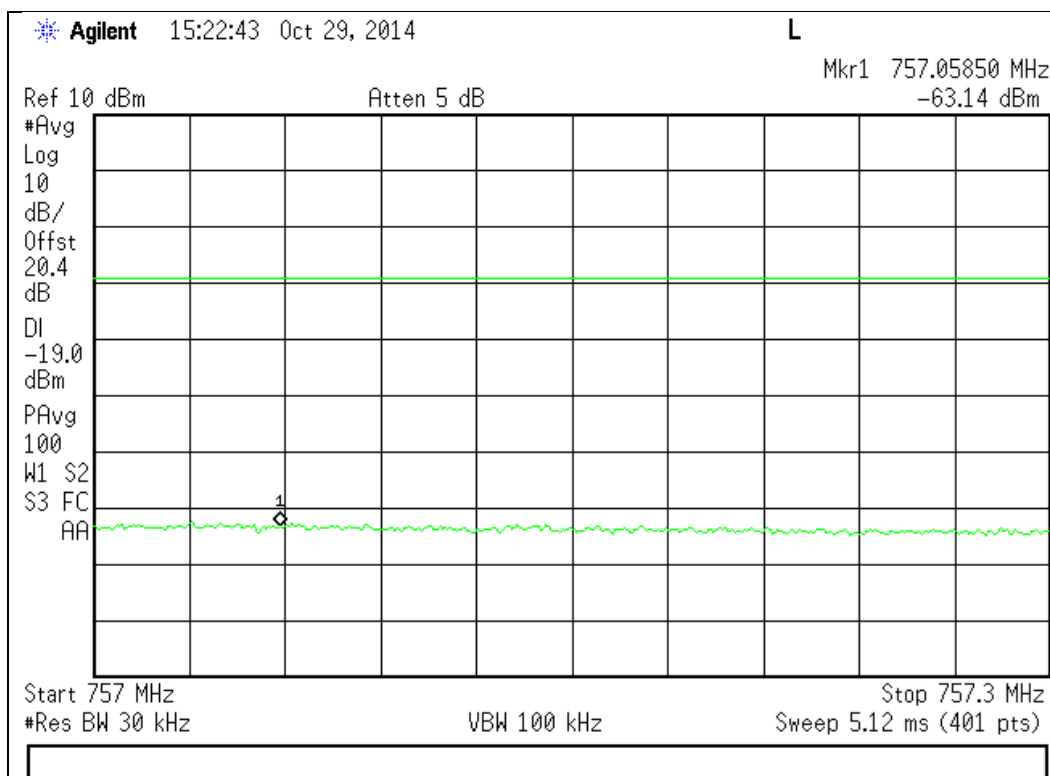


746 - 757 MHz Band

Lower Band Edge



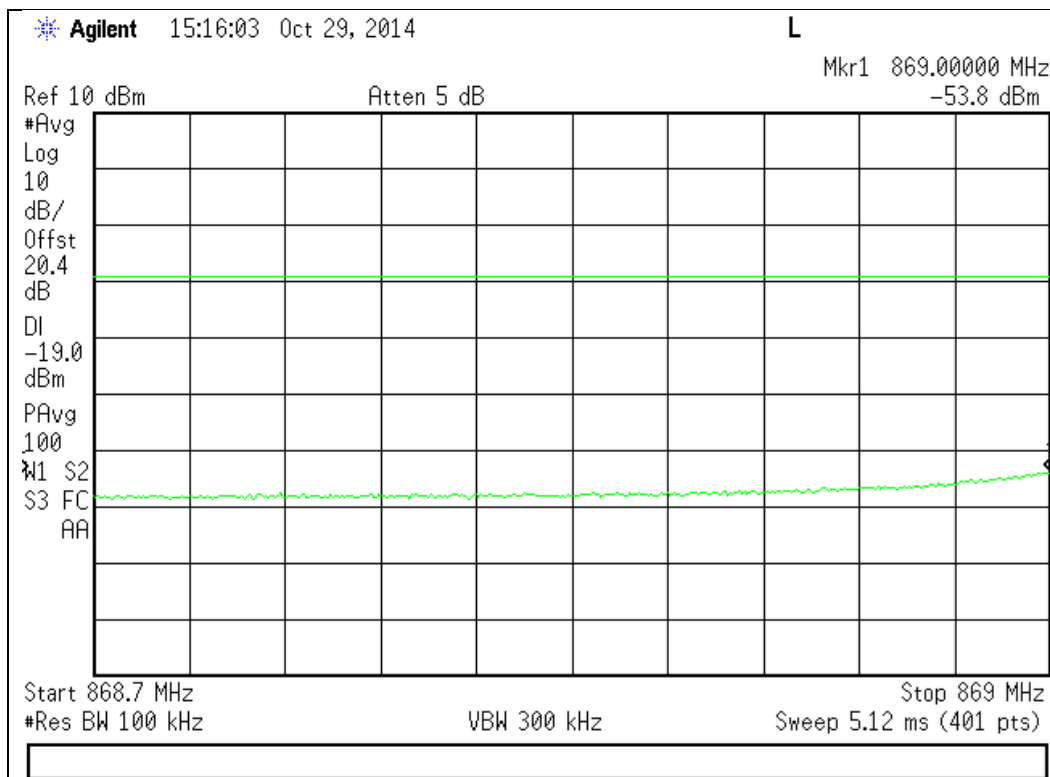
Upper Band Edge



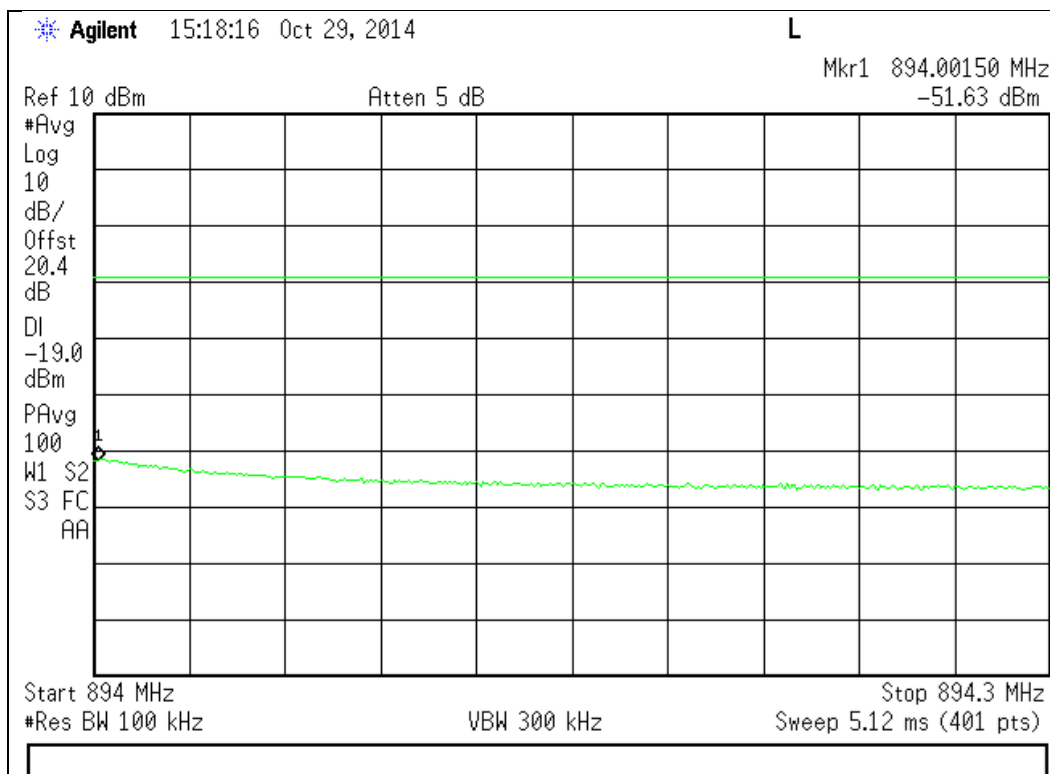


869 - 894 MHz Band

Lower Band Edge

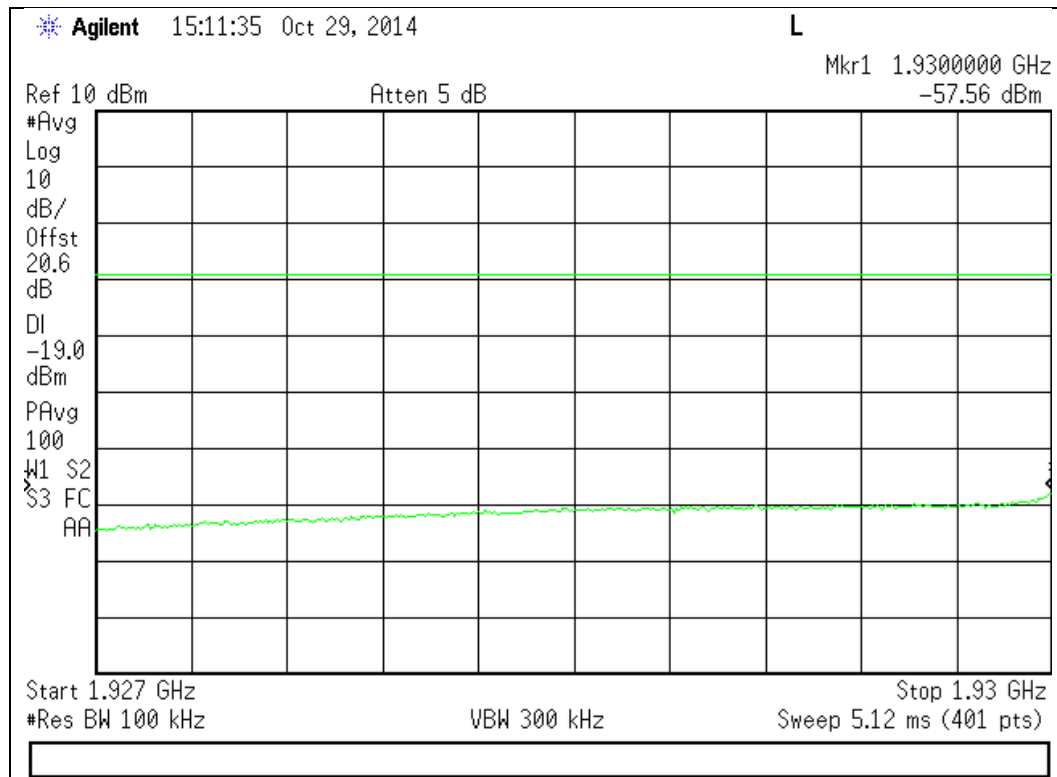


Upper Band Edge

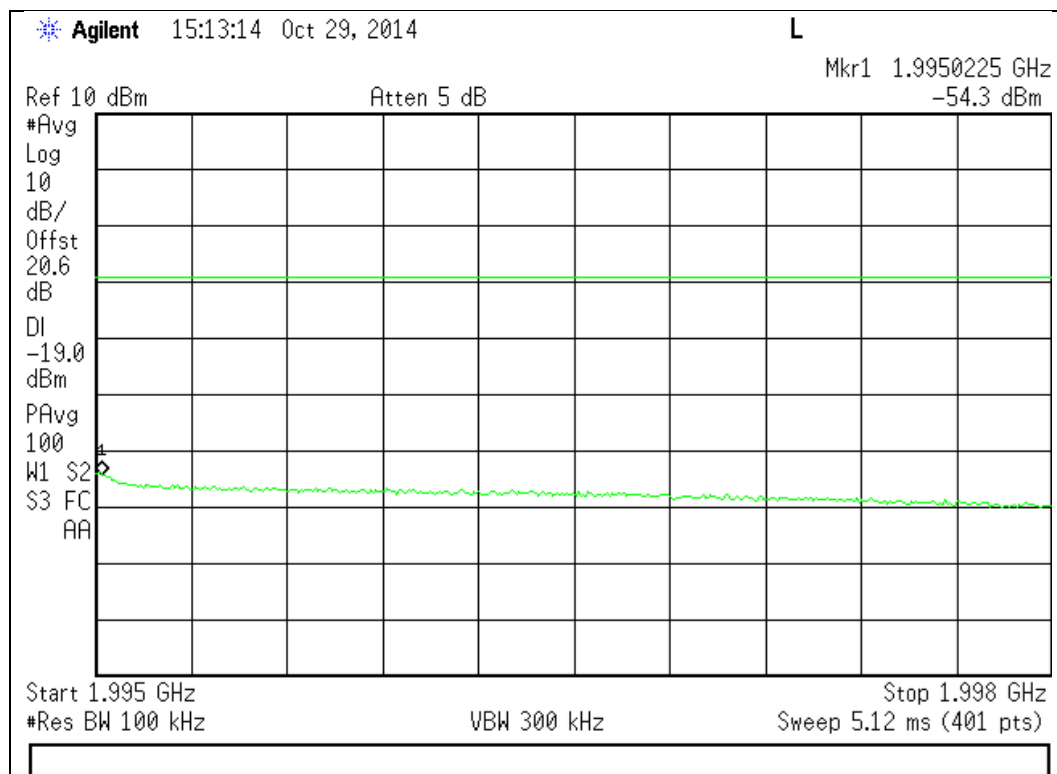


1930 - 1995 MHz Band

Lower Band Edge



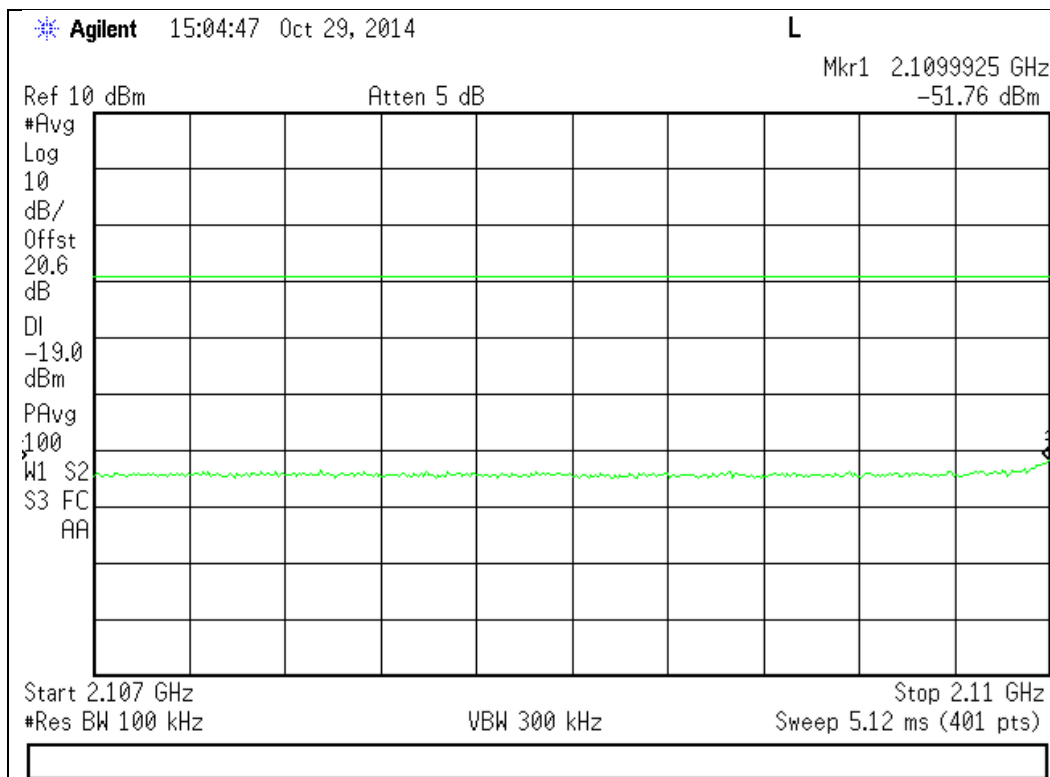
Upper Band Edge



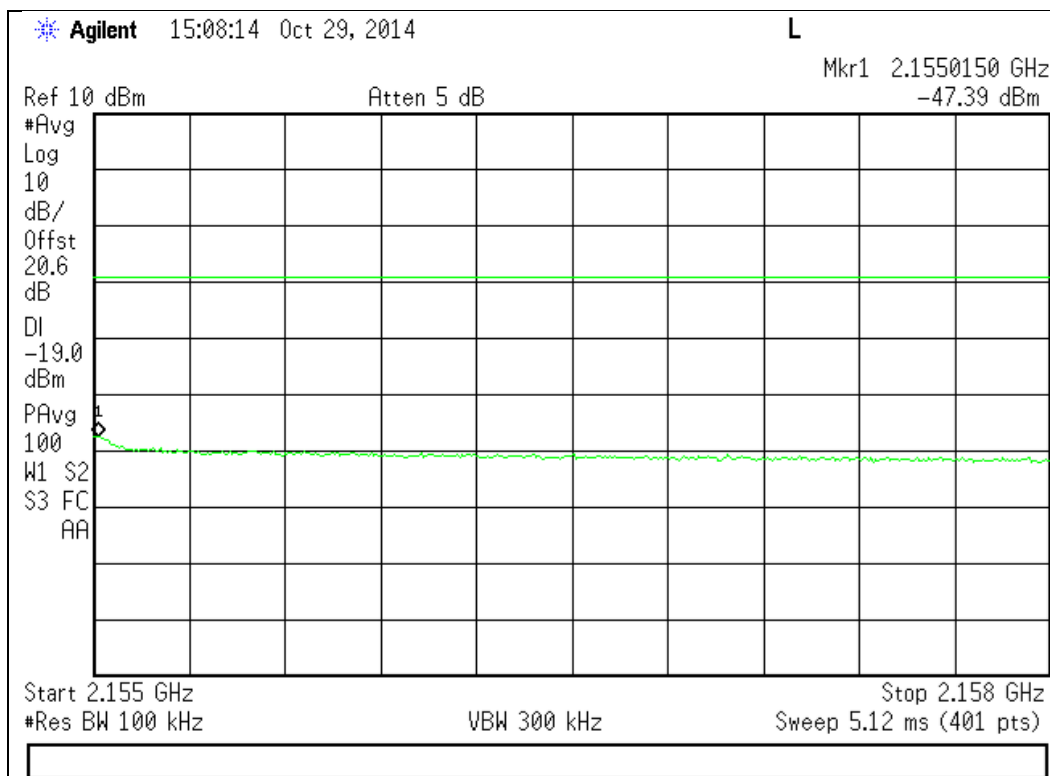


2110 - 2155 MHz Band

Lower Band Edge



Upper Band Edge



Conducted Spurious Emissions

Engineer: Greg Corbin

Test Date: 1/3/2017

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 needed to ensure accurate readings. A signal generator was utilized to produce a 4.1 MHz AWGN signal operating at the maximum allowable power. The conducted spurious emissions from 9 kHz to 10 times the highest tunable frequency for each operational band were 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.

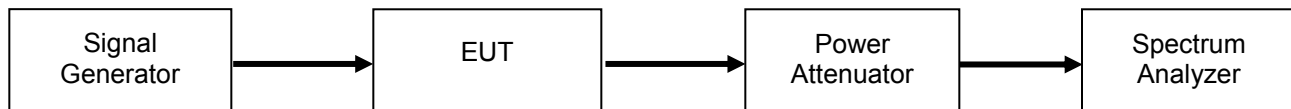
The following formulas are used for calculating the limits.

Conducted Spurious Emissions Limit = $P1 - (43 + 10\log(P2)) = -13 \text{ dBm}$

P1 = power in dBm

P2 = power in Watts

Test Setup



Uplink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
698 - 716	1884	-33.8	-13	Pass
776 - 787	1879.8	-33.9	-13	Pass
824 - 849	6350.8	-31.4	-13	Pass
1710 - 1755	1882.2	-30.2	-13	Pass
1850 - 1915	19726	-26	-13	Pass

Downlink Test Results

Frequency Band (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
728 - 746	2156	-30.2	-13	Pass
746 - 757	1969.2	-30.5	-13	Pass
869 - 894	8624.9	-30.3	-13	Pass
1930 - 1995	19912.5	-25.2	-13	Pass
2110 - 2155	20.987	-24.3	-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 793-805MHz, by a factor of not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations;

776 – 787 MHz Uplink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	RBW (kHz)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	774.955	-49.6	6.25	-49.60	-46	-3.60
793 – 805	793.12	-63.2	6.25	-63.20	-46	-17.20

746 - 757 MHz Downlink Band

Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	RBW (kHz)	Final Value (dBm)	Limit (dBm)	Margin (dB)
763 – 775	771.97	-72.8	6.25	-72.80	-46	-26.80
793 – 805	795.7	-72.7	6.25	-72.70	-46	-26.70

FCC 27.53(f)

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

Since the limit is referenced to EIRP, the final data is computed using the Conducted Spurious Emission data and adding the BW correction factor plus 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

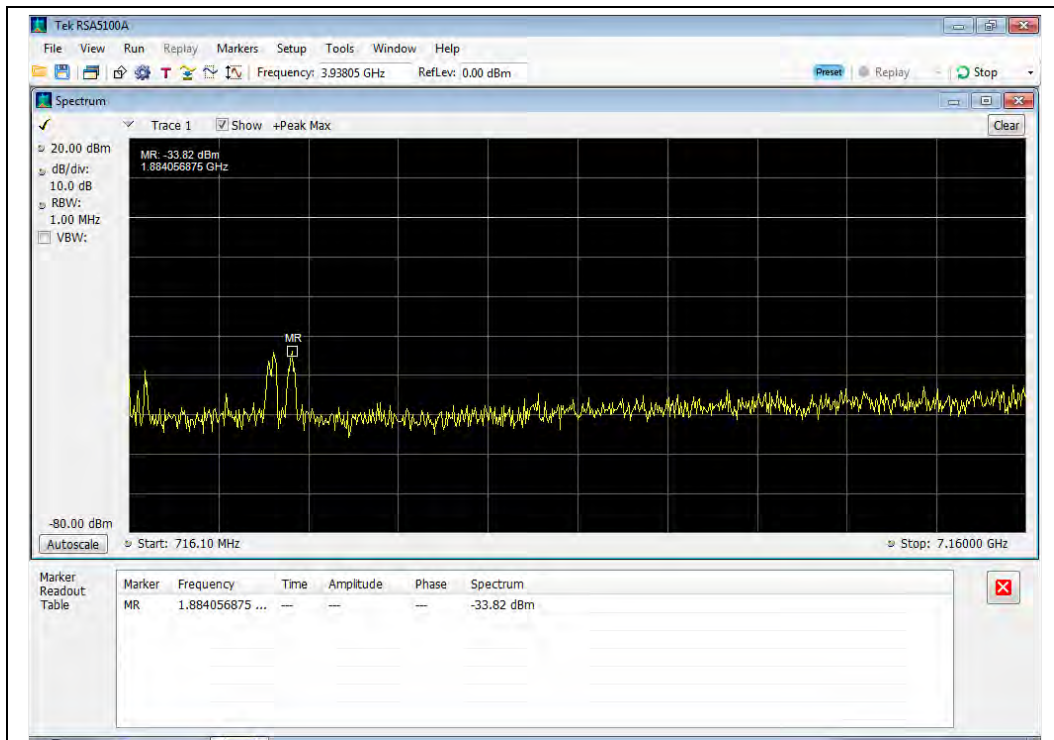
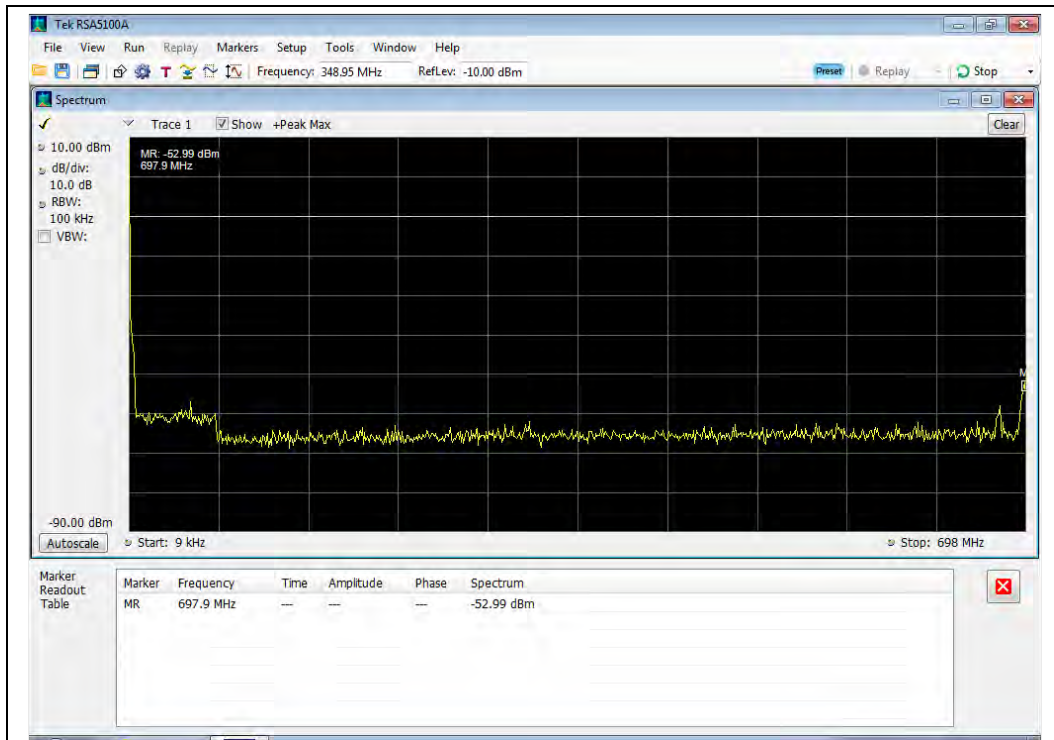
Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	RBW	Gain/Loss from Antenna Kitting Information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1602.41	-53.9	1 MHz	5.10	-48.80	-40	-8.80
1559 – 1610 (Narrowband)	1602.54	-91.0	700 Hz	5.10	-85.90	-50	-35.90

746 - 757 MHz Downlink Band

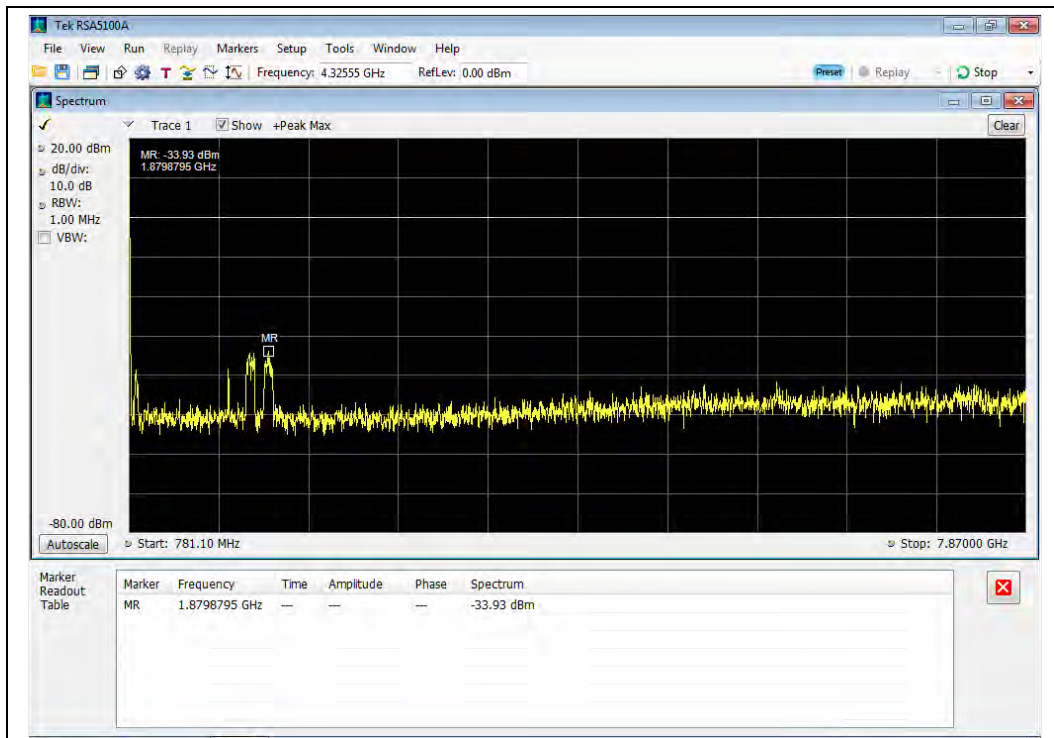
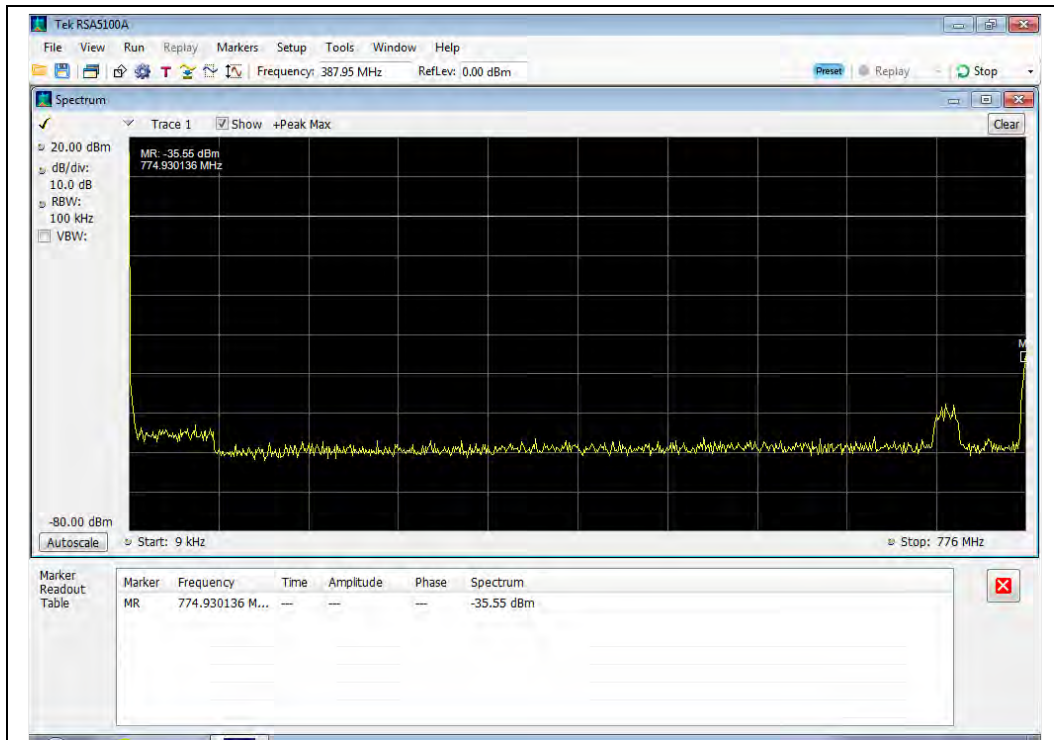
Spurious Frequency Range (MHz)	Measured Frequency (MHz)	Measured Value (dBm)	RBW	Gain/Loss from Antenna Kitting Information (dB)	Final Value (dBm)	Limit (dBm)	Margin (dB)
1559 – 1610 (Wideband)	1607.38	-58.9	1 MHz	4.16	-54.74	-40	-14.74
1559 – 1610 (Narrowband)	1578.95	-92.1	700 Hz	4.16	-87.94	-50	-37.94

Uplink Test Plots

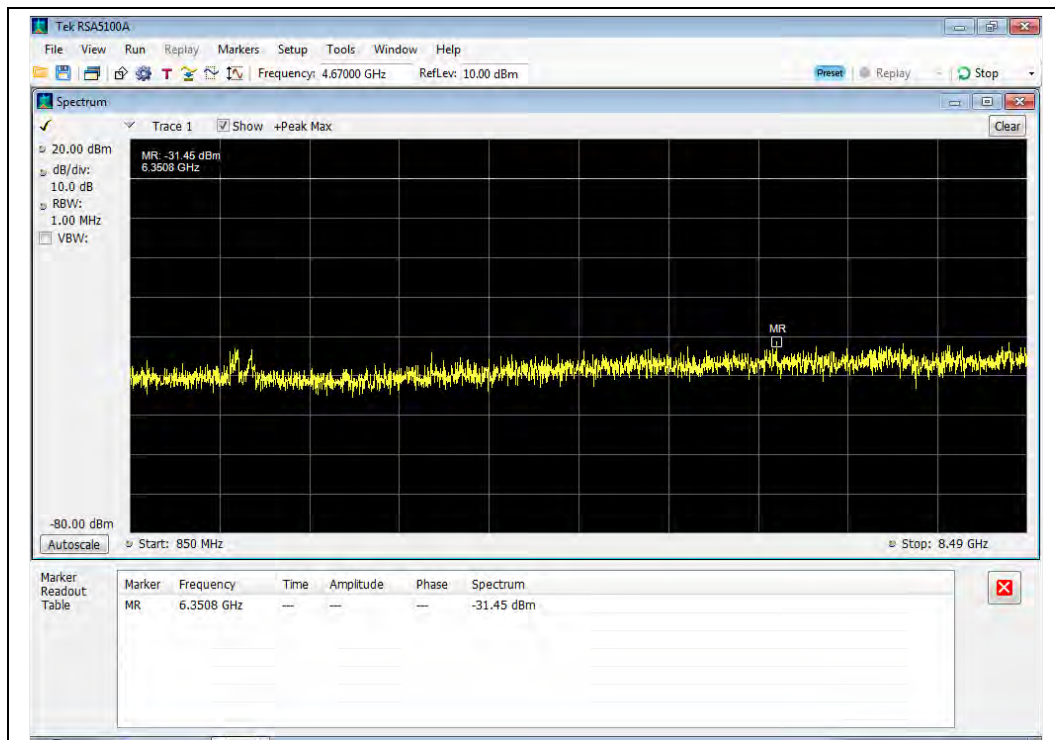
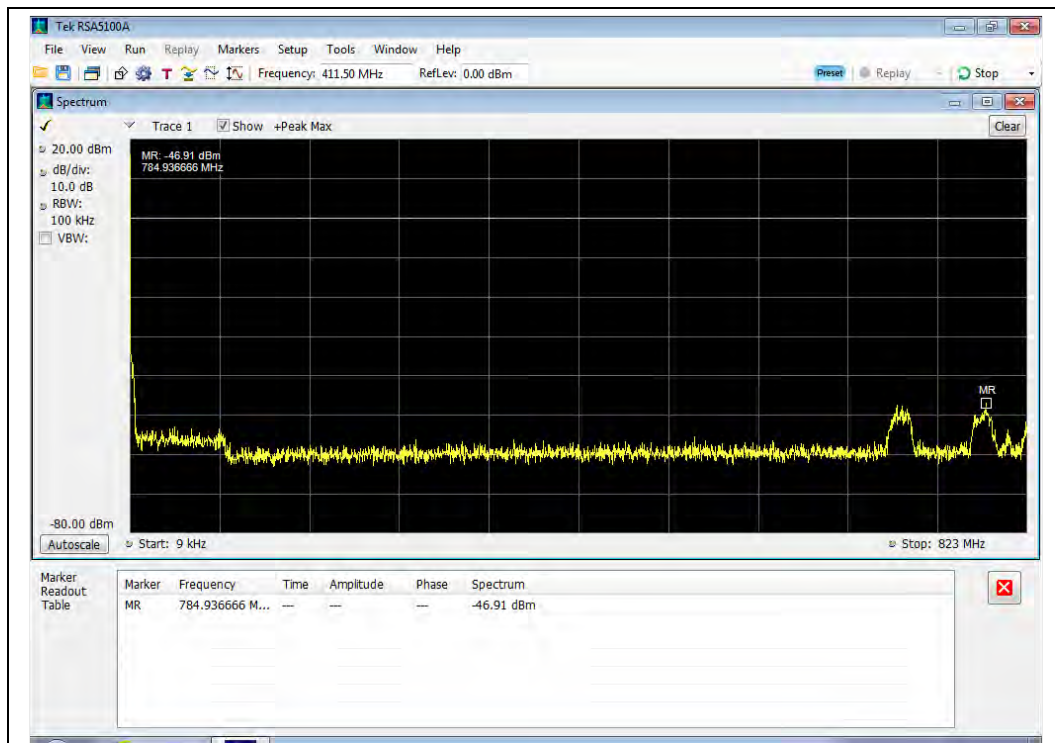
698 - 716 MHz Band



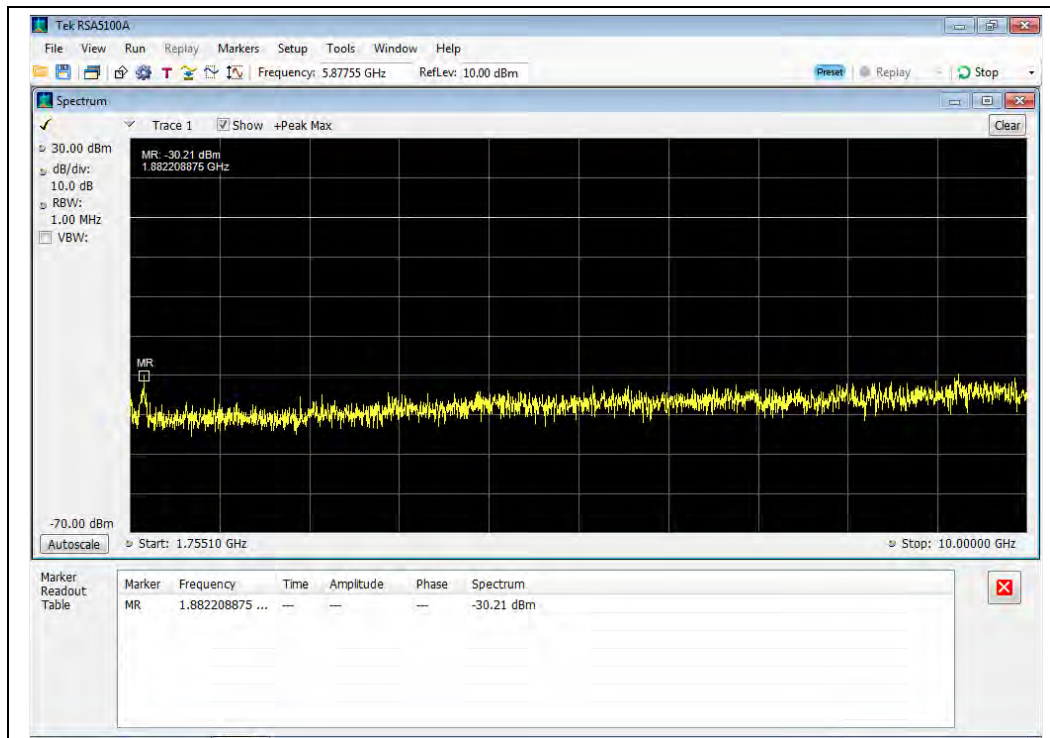
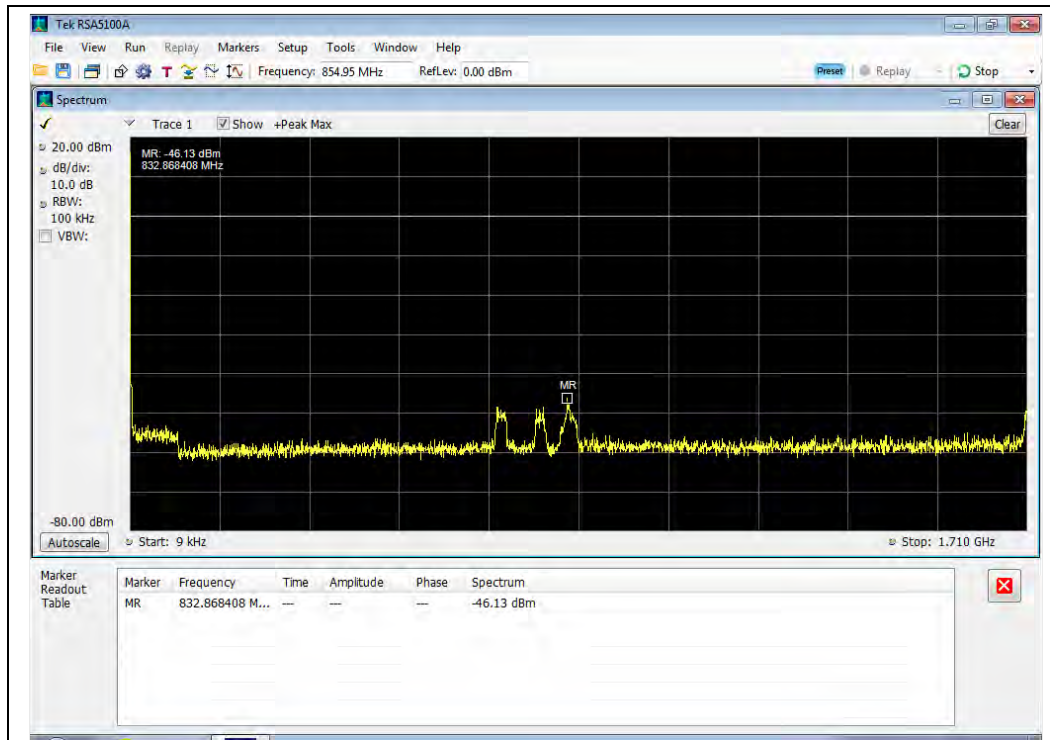
776 - 787 MHz Band



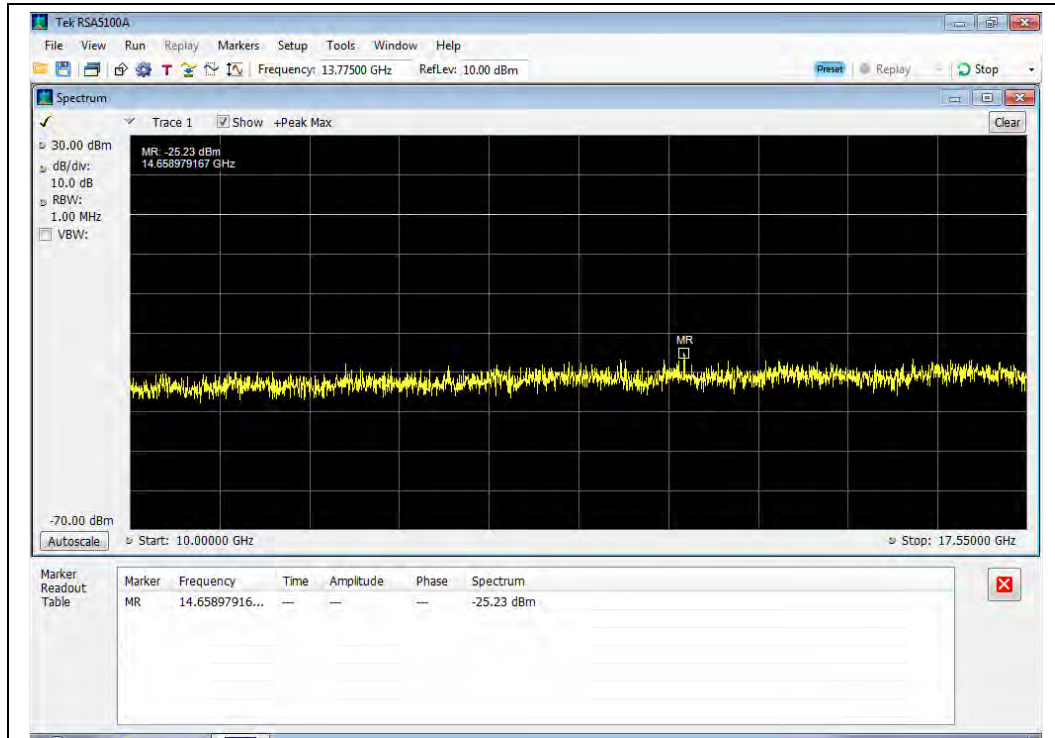
824 - 849 MHz Band



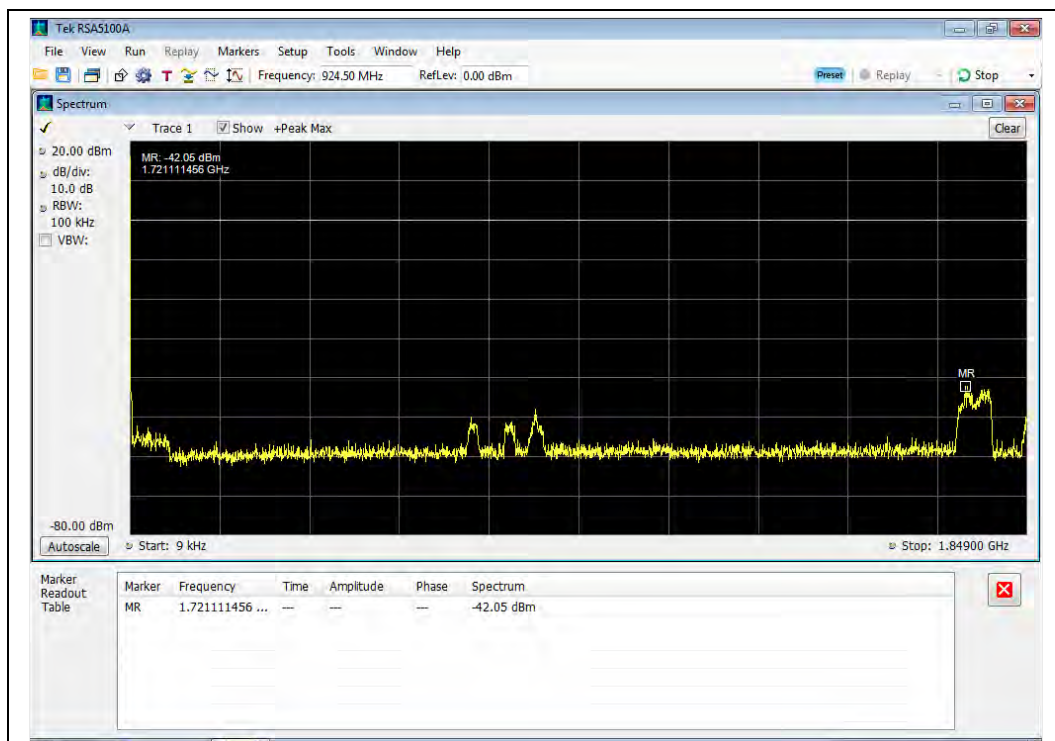
1710 - 1755 MHz Band



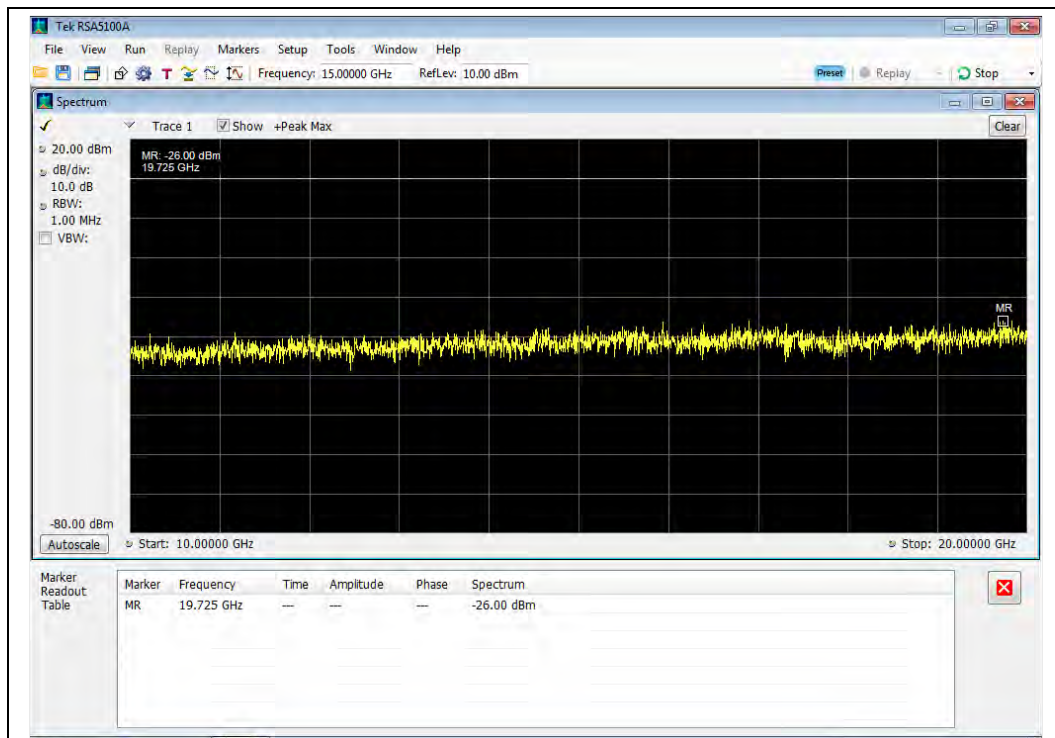
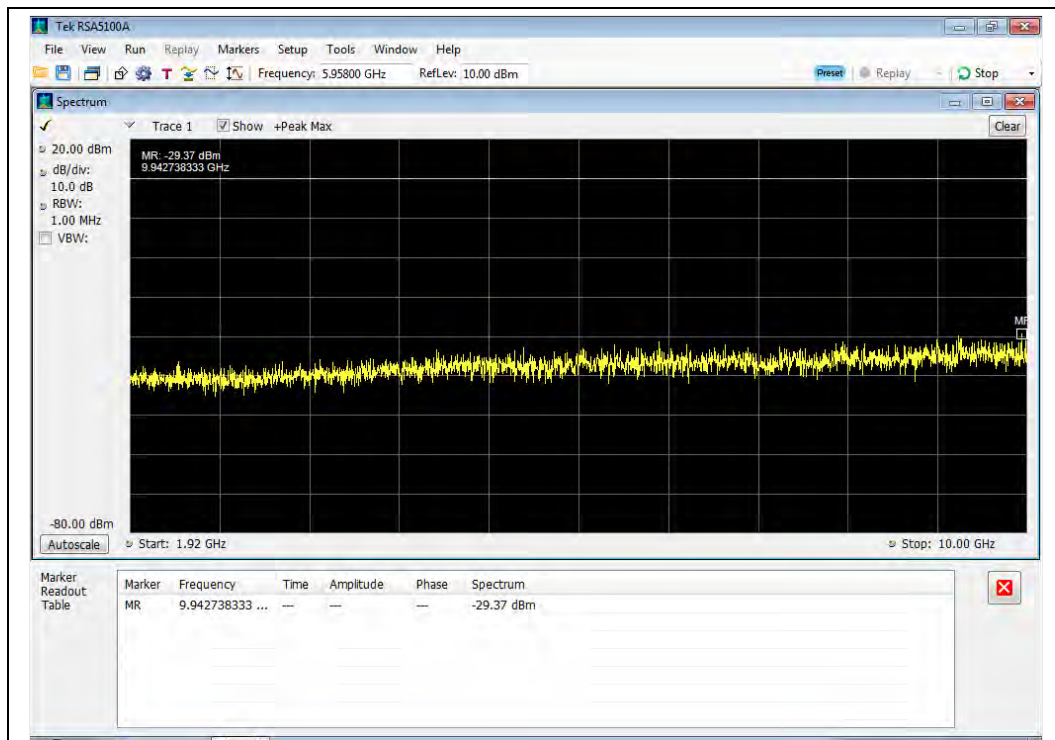
1710 - 1755 MHz Band (cont)



1850 - 1915 MHz Band

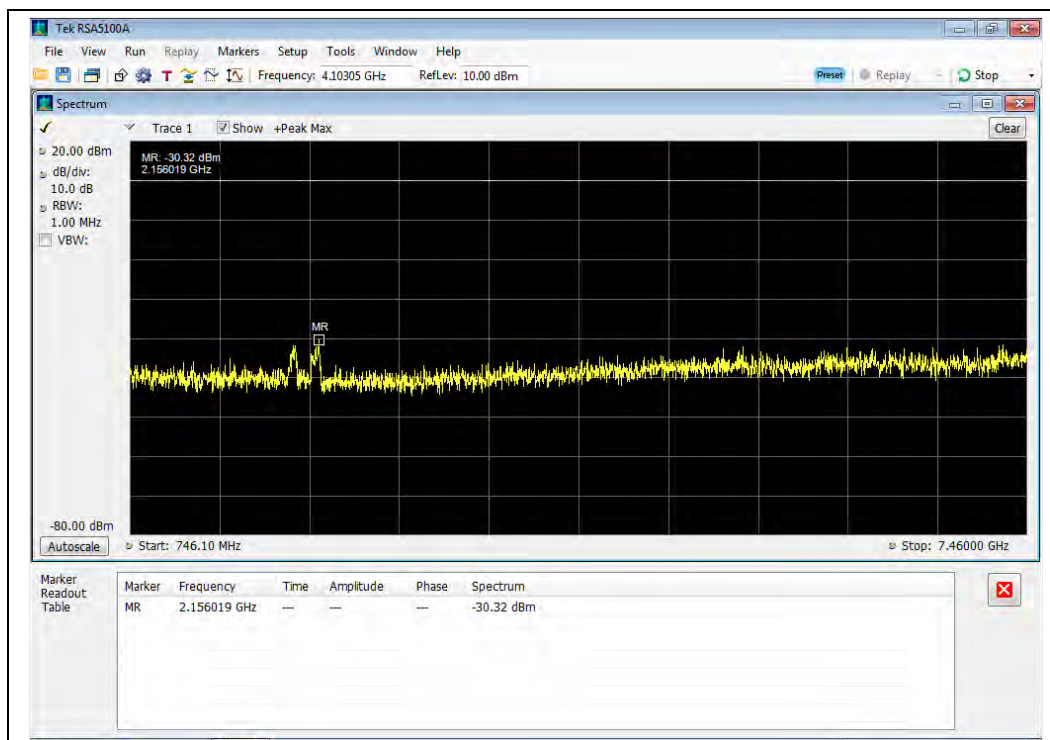
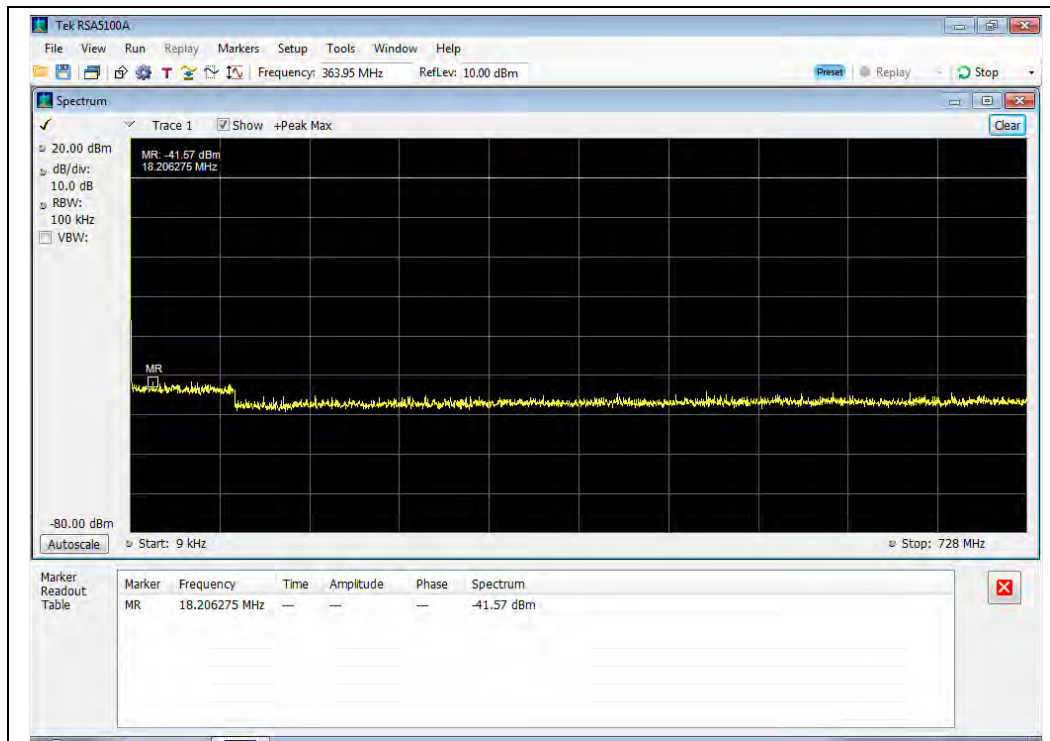


1850 - 1915 MHz Band (cont)

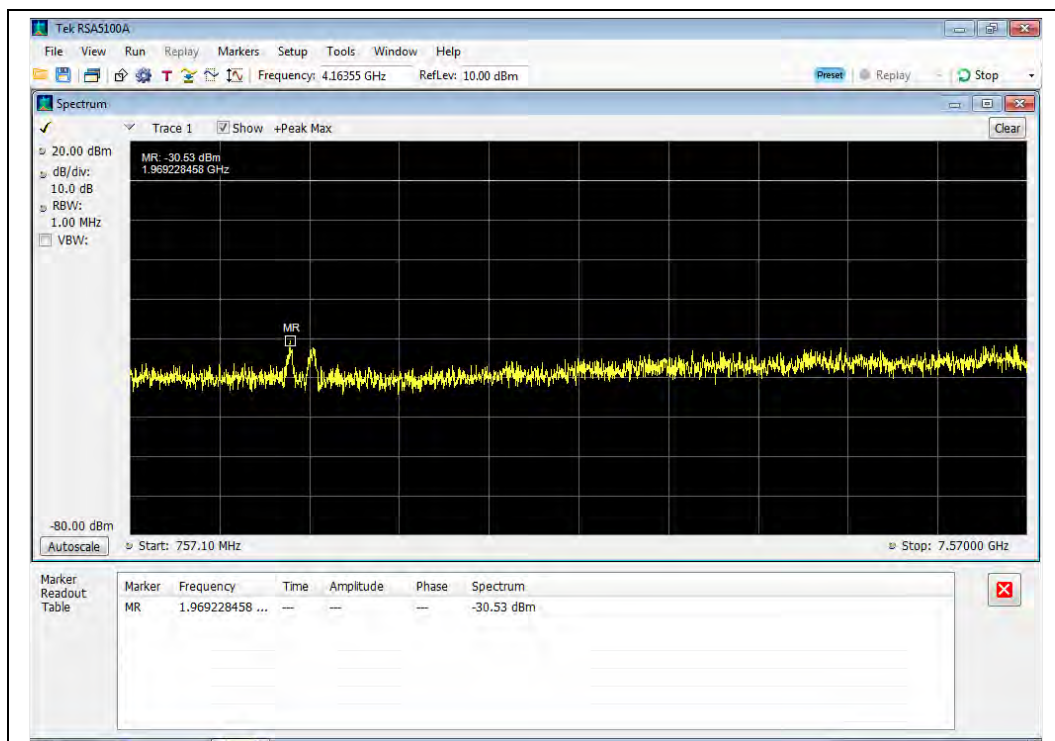
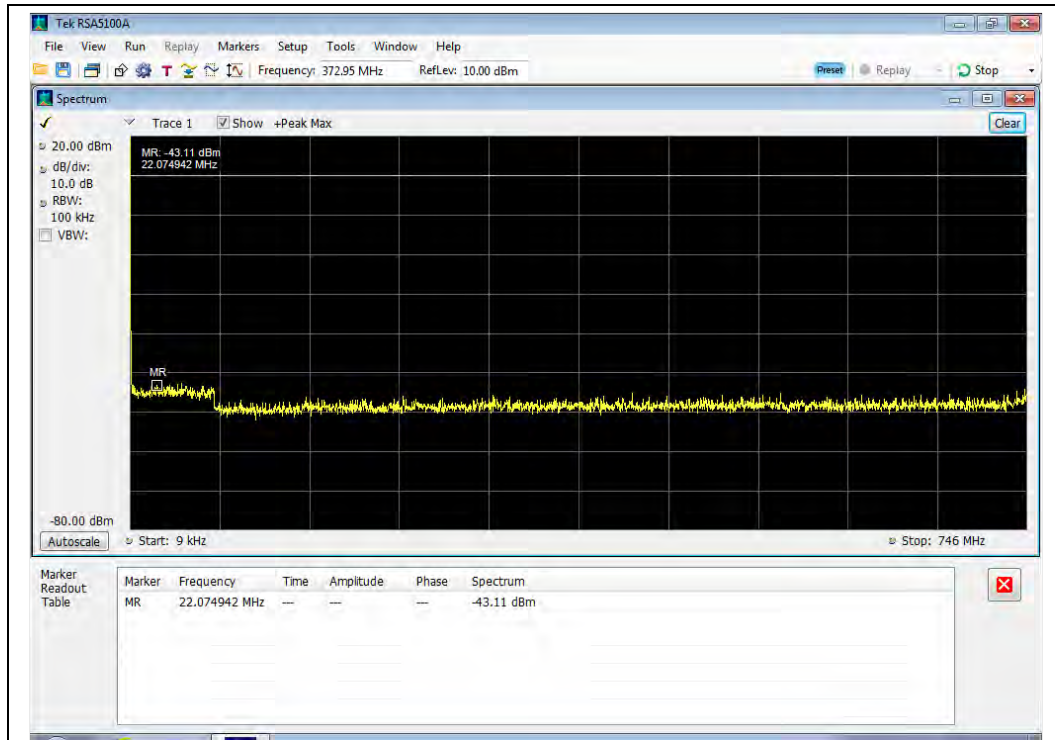


Downlink Test Plots

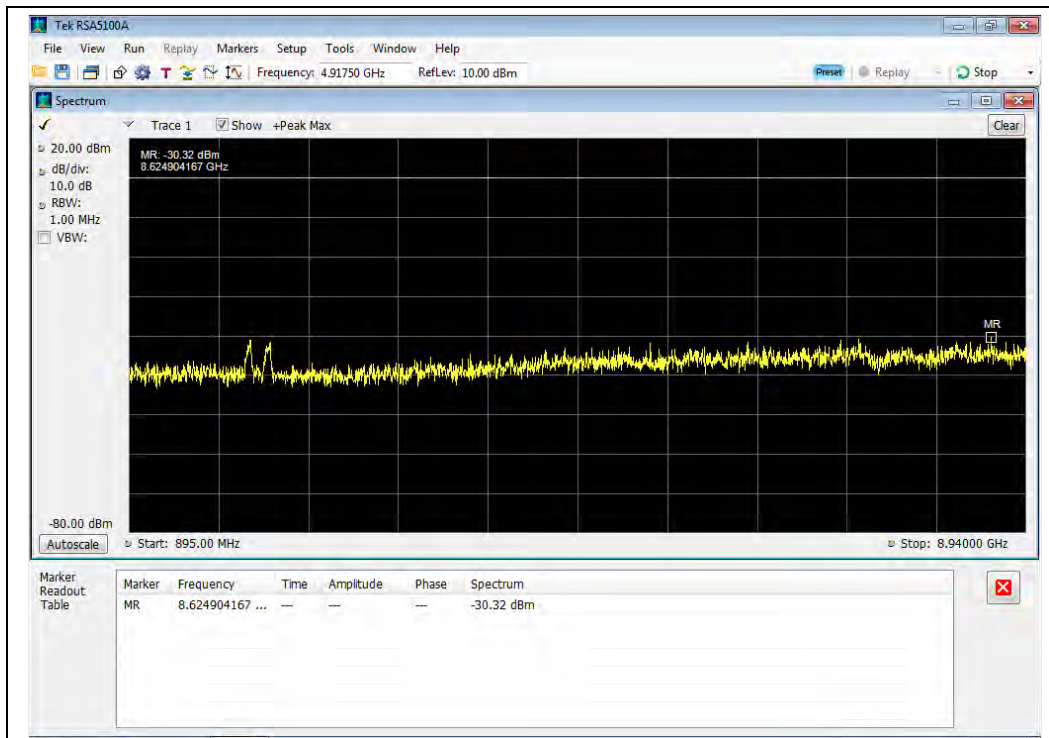
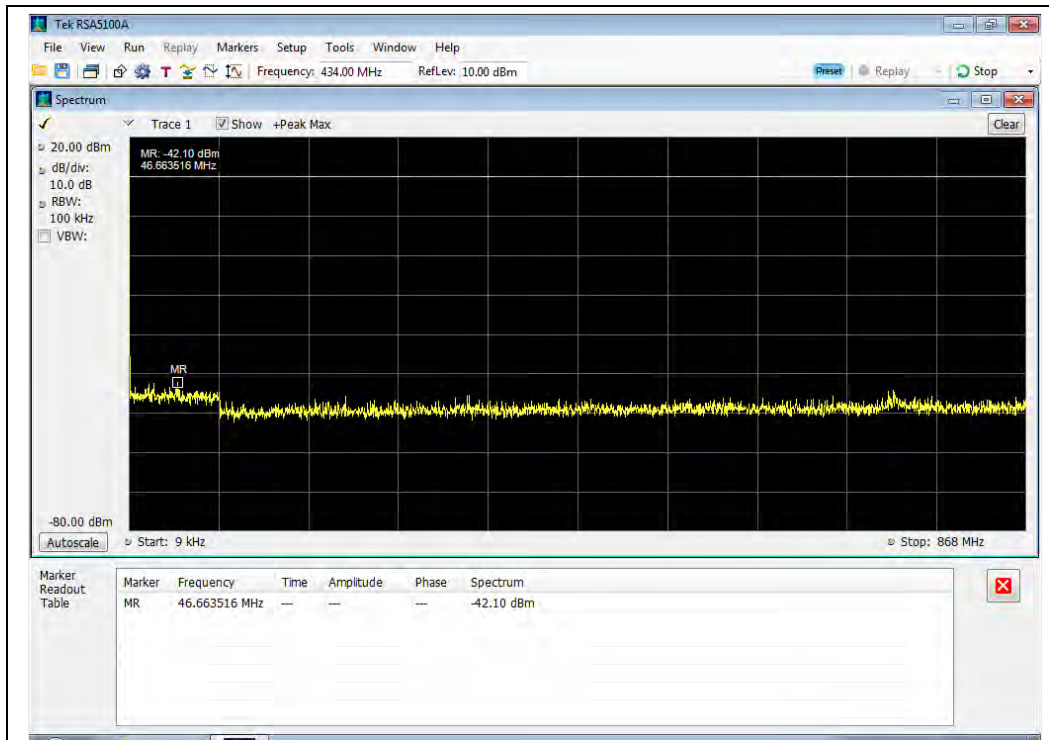
728 - 746 MHz Band



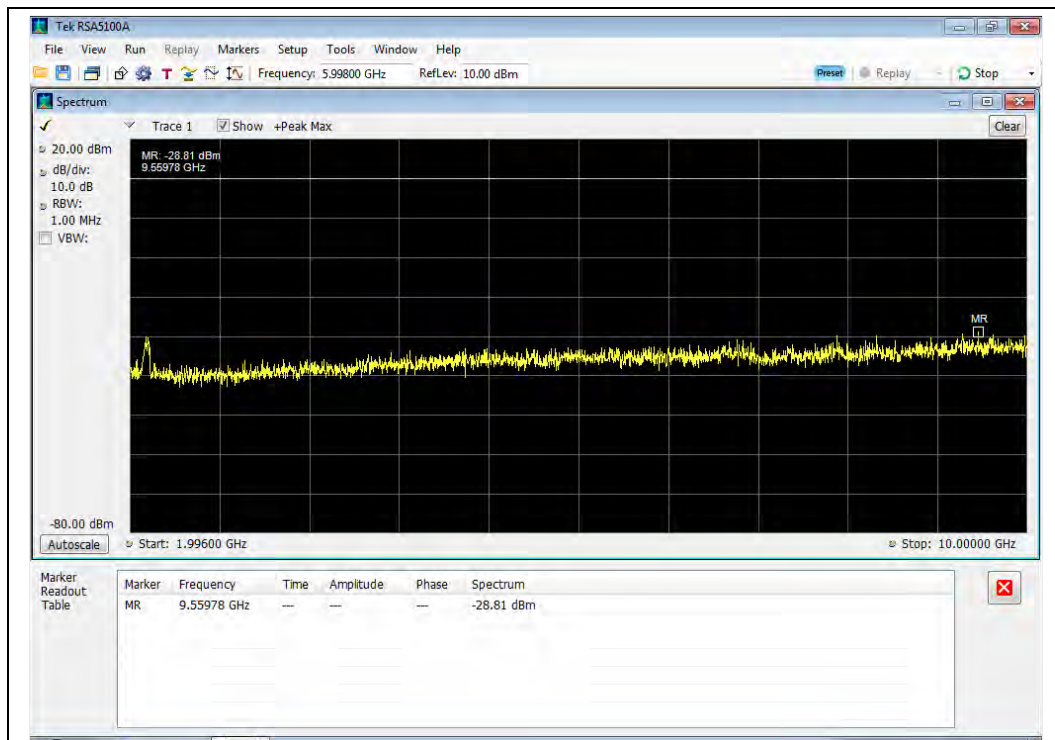
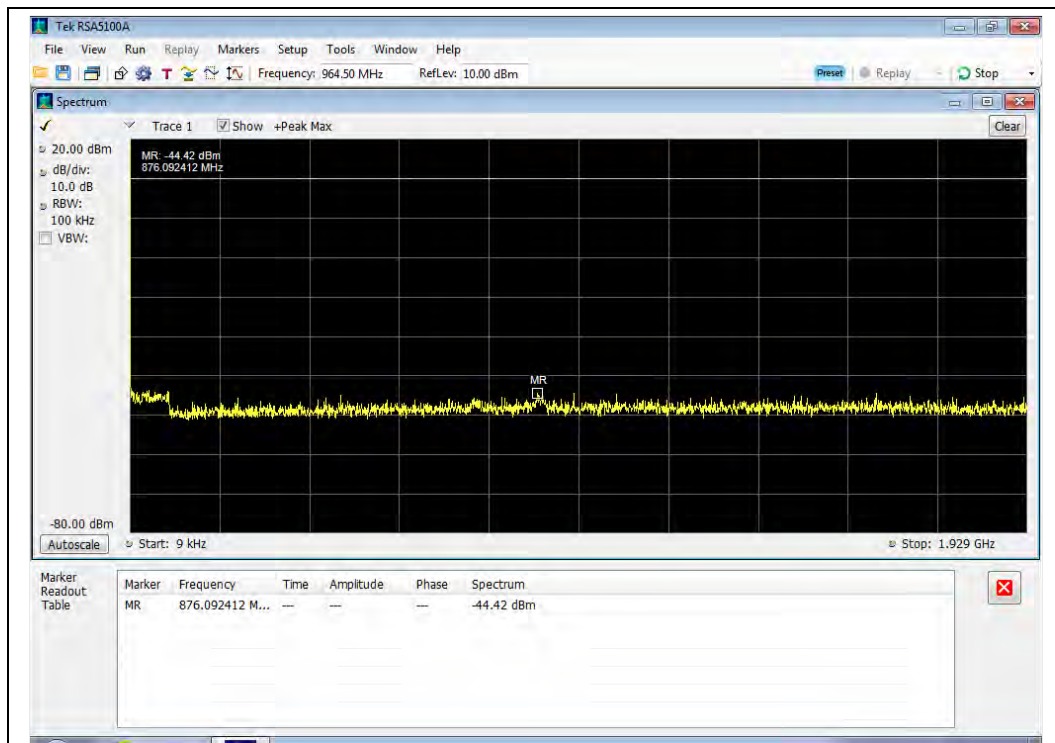
746 - 757 MHz Band



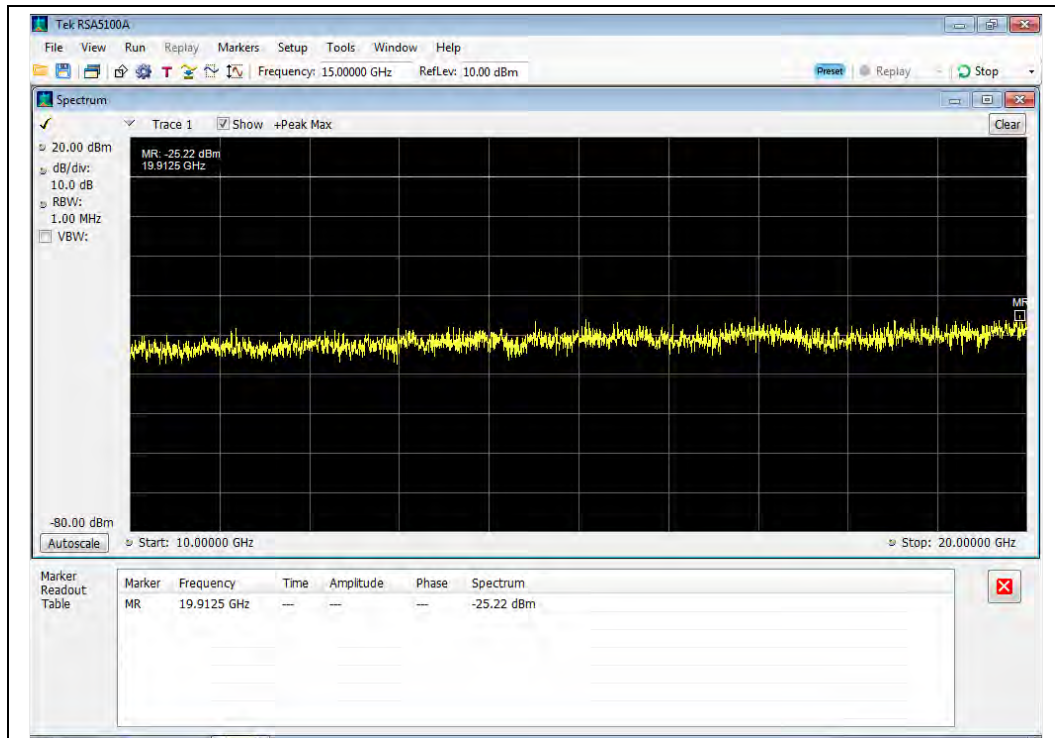
869 - 894 MHz Band



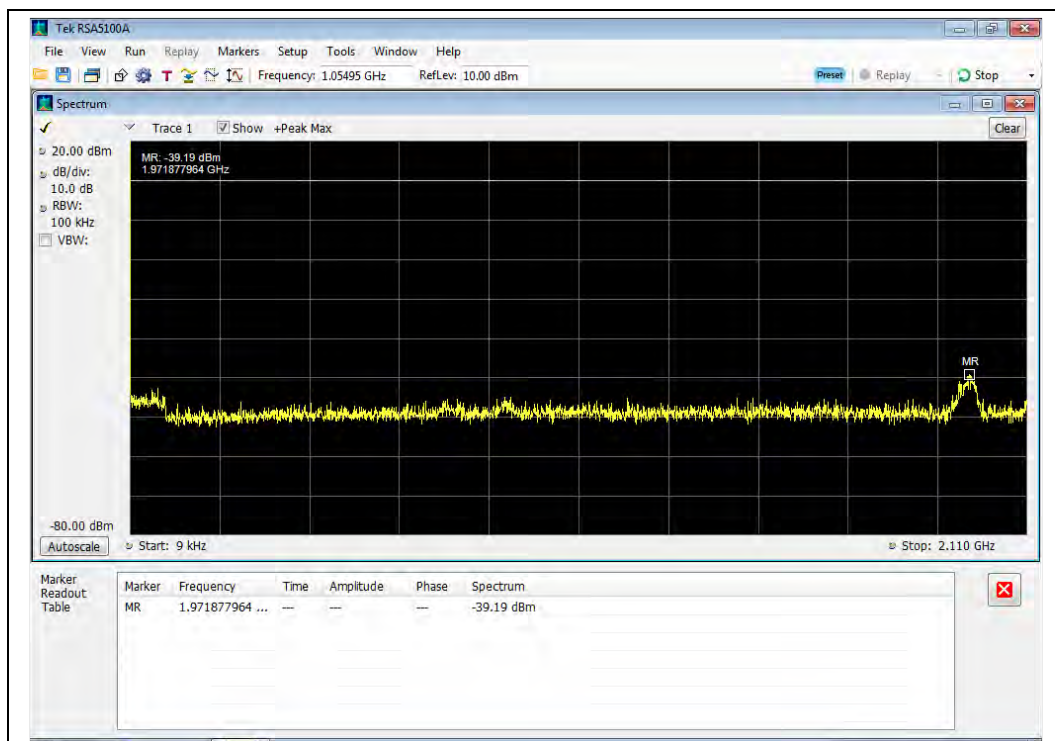
1930 - 1995 MHz Band



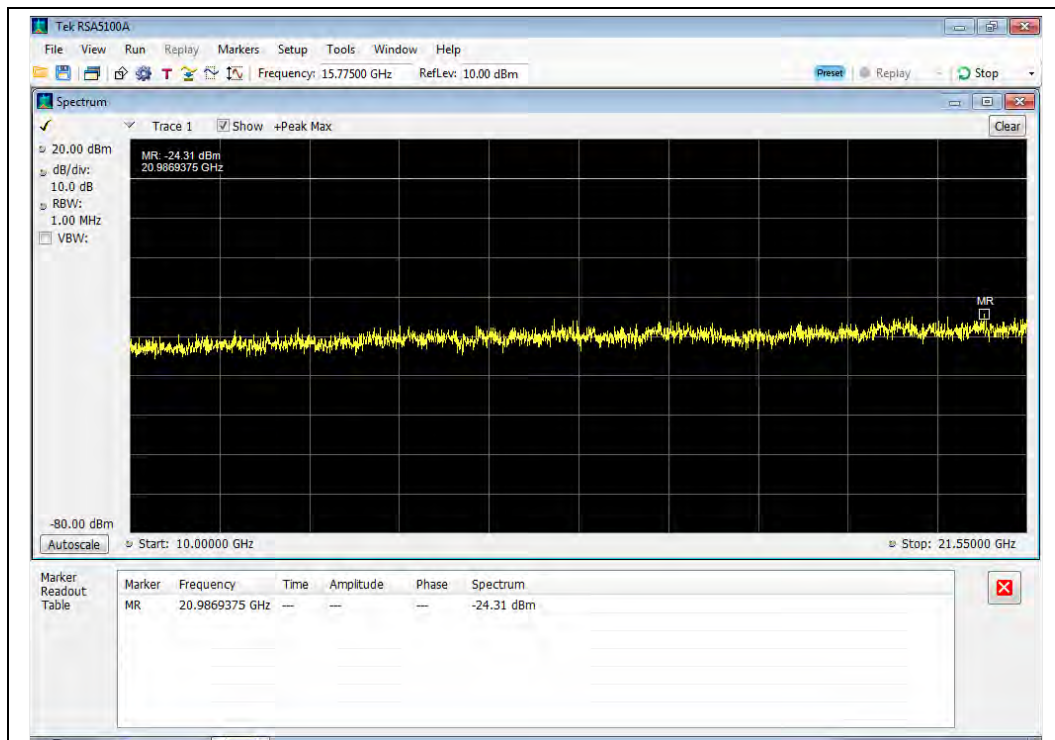
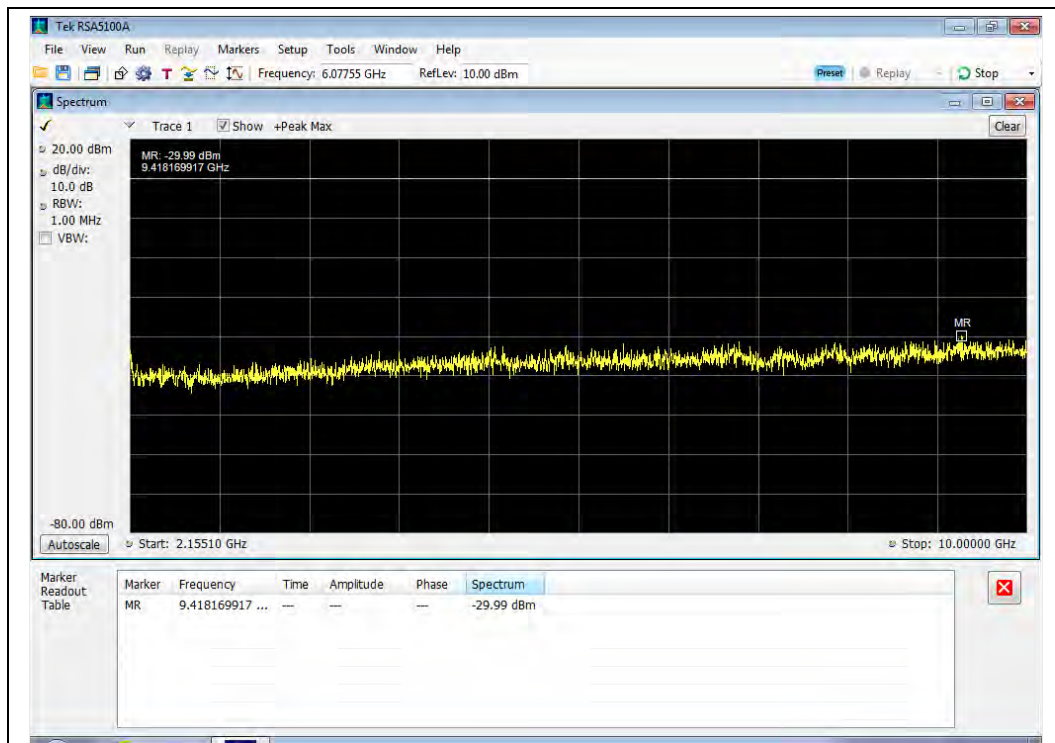
1930 - 1995 MHz Band (cont)



2110 - 2155 MHz Band

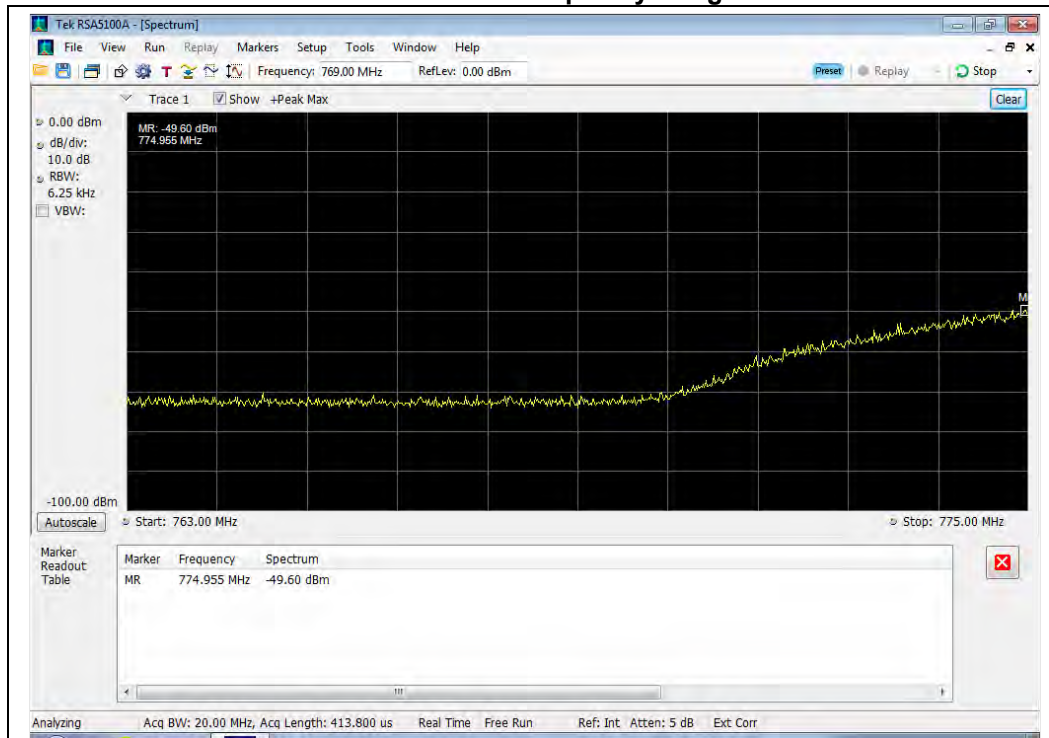


2110 - 2155 MHz Band (cont)

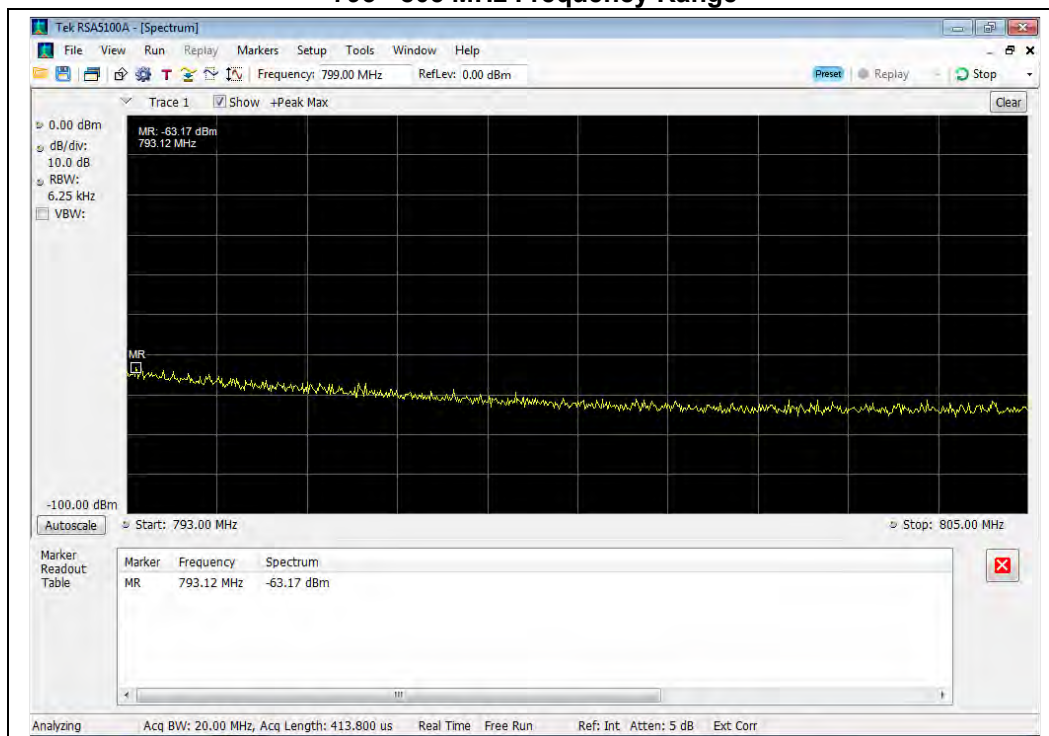


776 – 787 MHz Uplink Test Plots for the

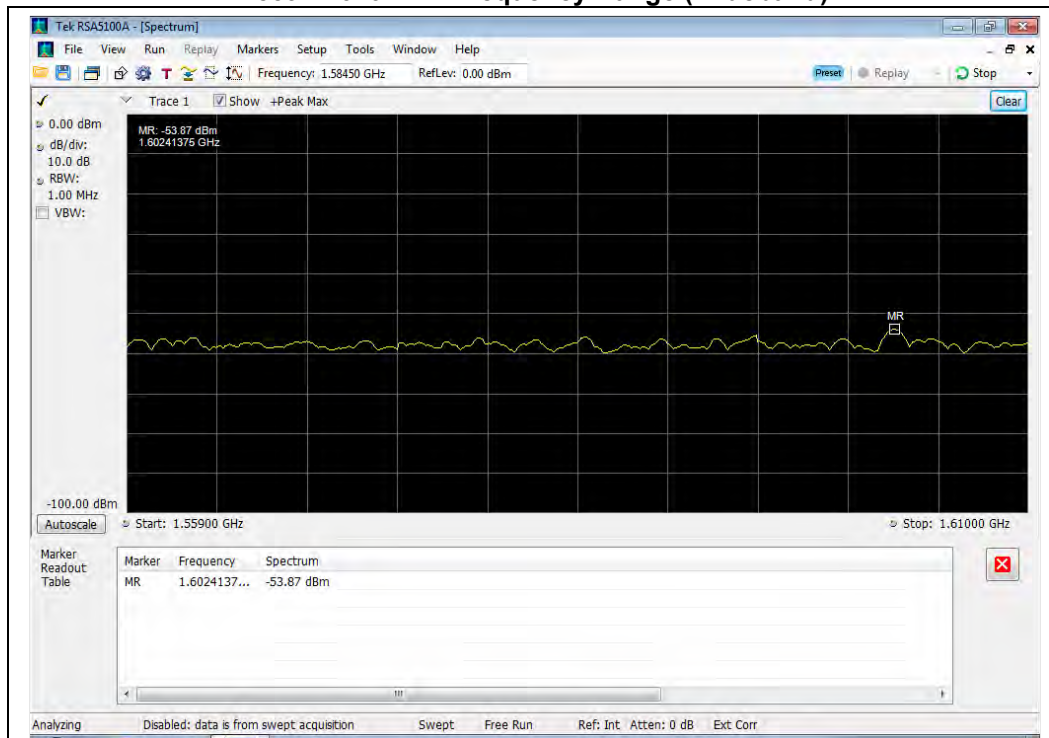
763 - 775 MHz Frequency Range



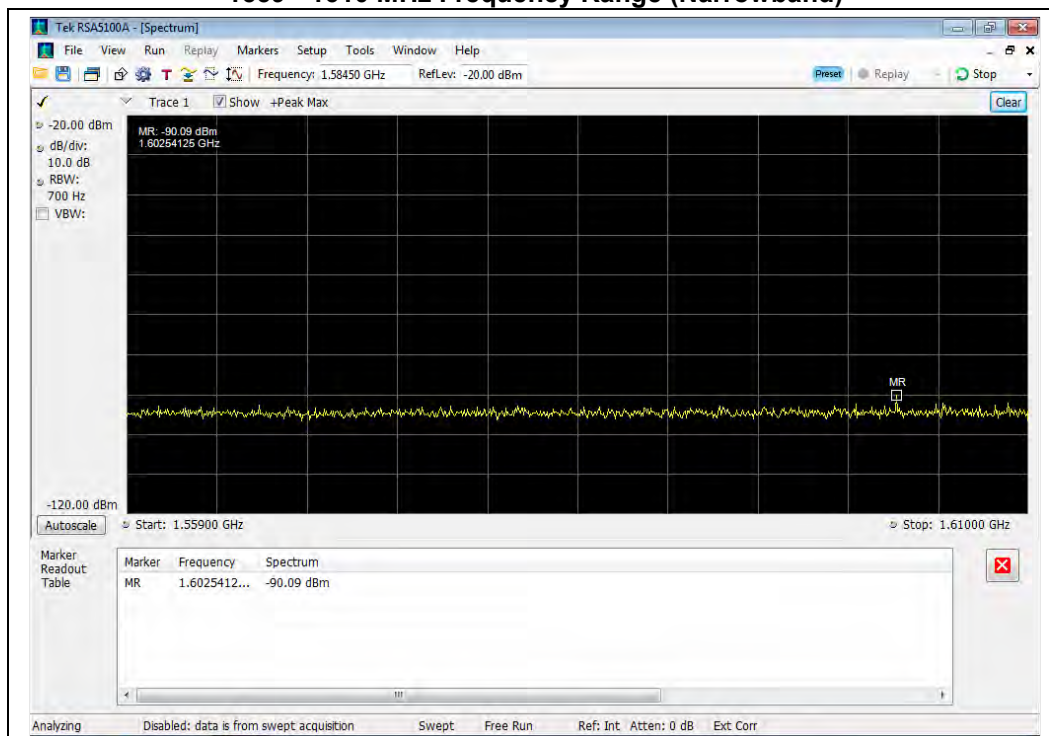
793 - 805 MHz Frequency Range



776 – 787 MHz Uplink Test Plots for the 1559 - 1610 MHz Frequency Range (Wideband)

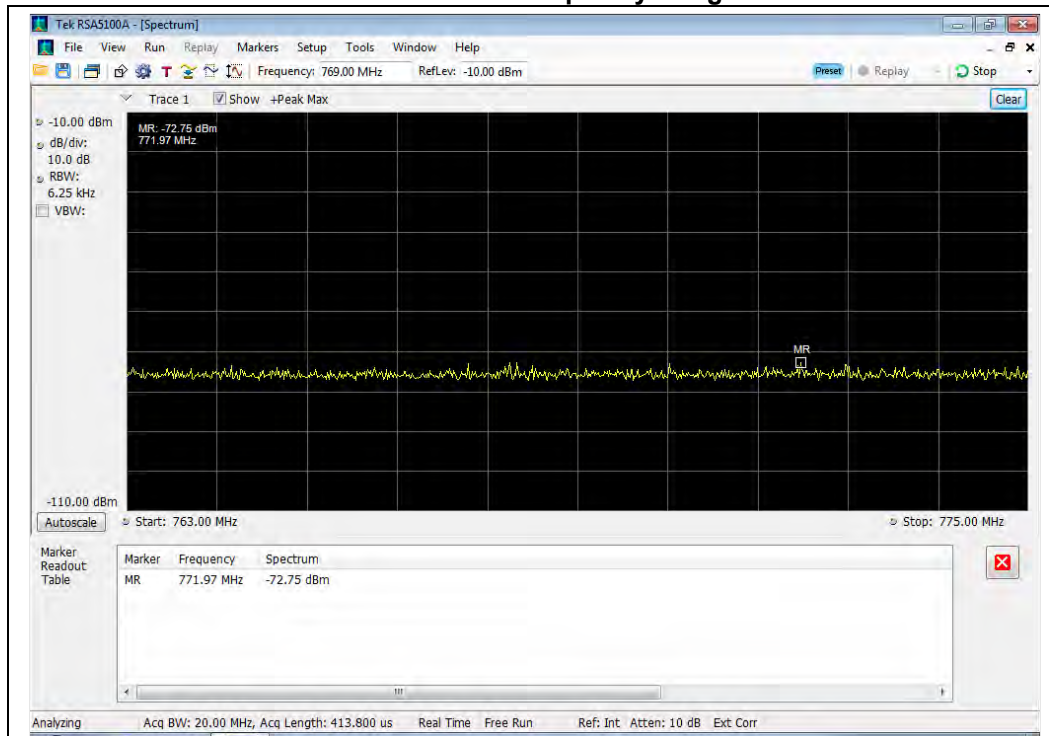


1559 - 1610 MHz Frequency Range (Narrowband)

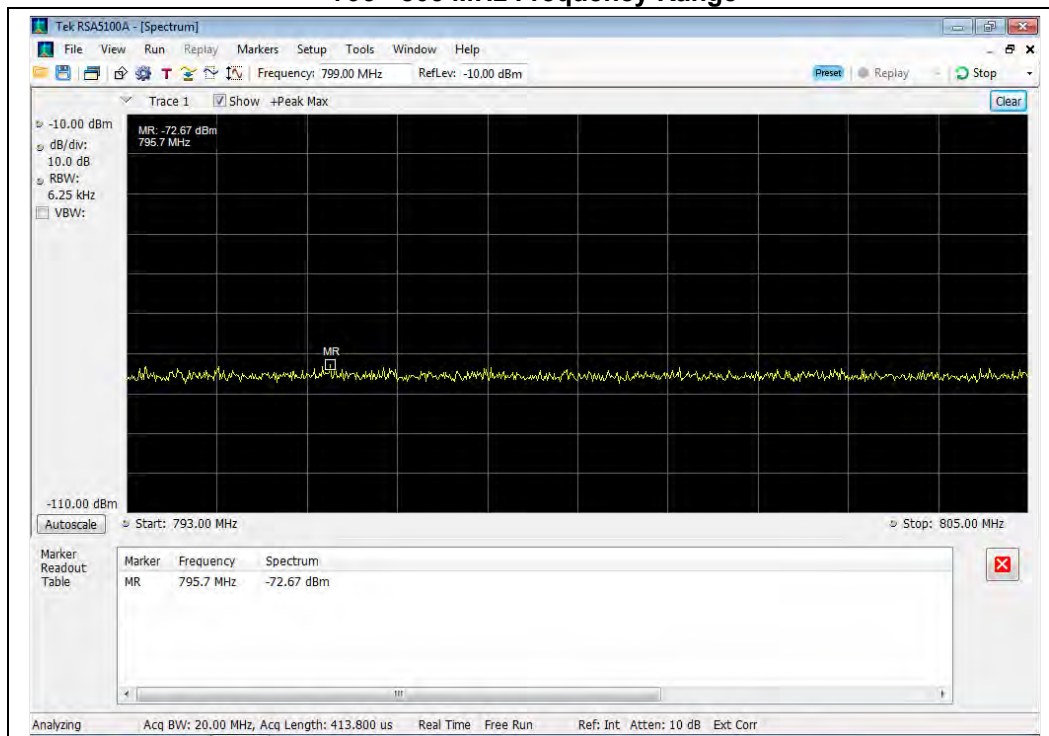


746 – 757 MHz Downlink Test Plots for the

763 - 775 MHz Frequency Range

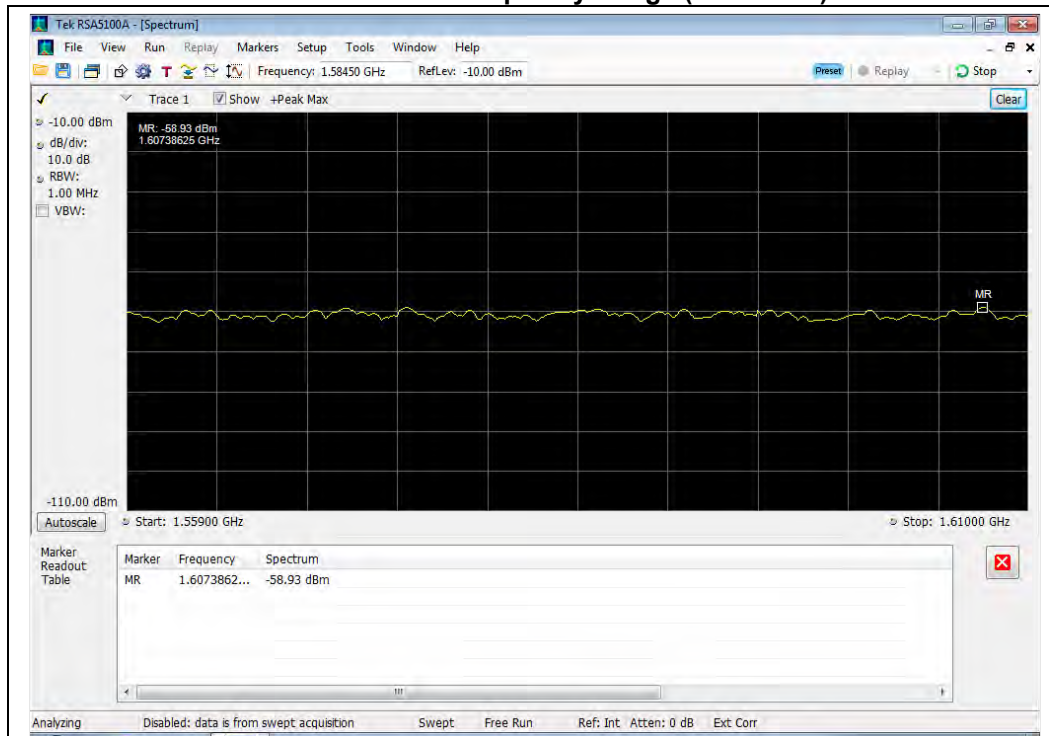


793 - 805 MHz Frequency Range

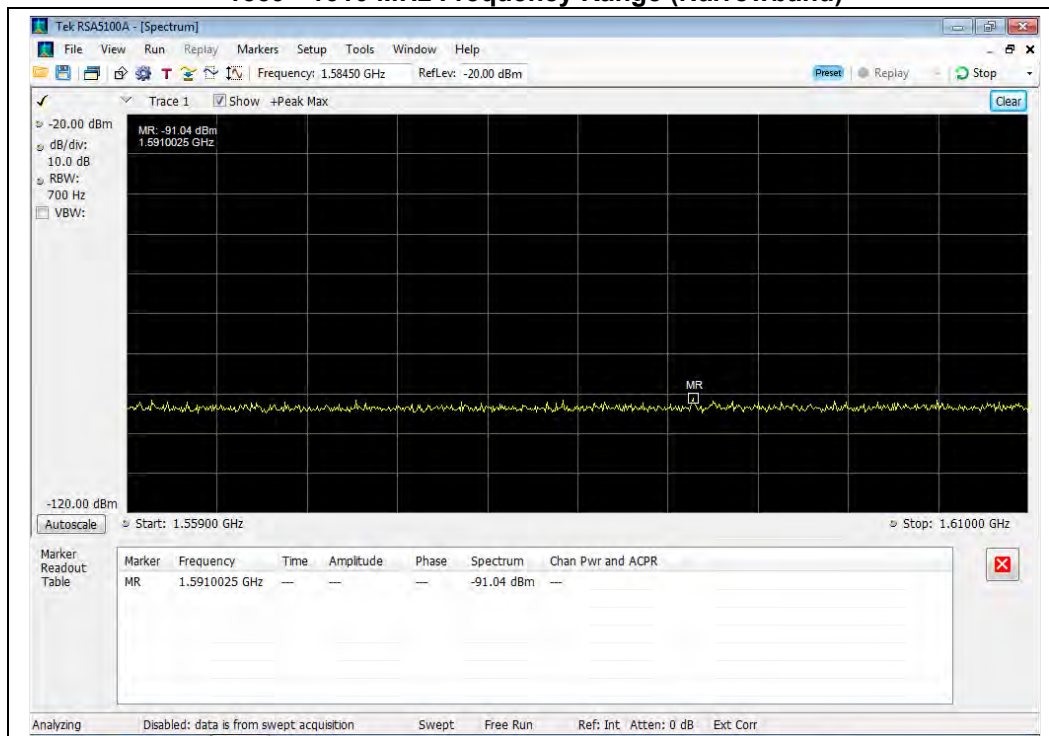


746 – 757 MHz Downlink Test Plots for the

1559 - 1610 MHz Frequency Range (Wideband)



1559 - 1610 MHz Frequency Range (Narrowband)



Noise Limits

Engineer: Greg Corbin

Test Date: 1/3/2017

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 that accurate readings were obtained. A series of tests were performed: the maximum uplink and downlink noise, the variable noise for the uplink and in the presence of a downlink signal, and the variable uplink noise timing. The detailed procedures from KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516c were followed.

Noise Limit = $-102.5 + 20 * \text{Log}_{10}(\text{midband of UL})$

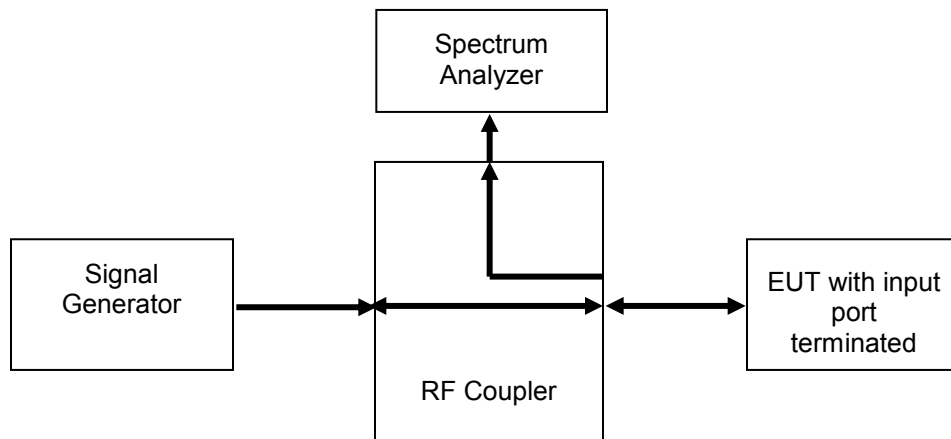
Variable Noise = $-103 \text{ dBm/MHz-RSSI}$

Test Setup

Maximum Noise Power



Variable Uplink Noise Power and Timing



Maximum Uplink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
698 - 716	-46.9	-45.5	-1.4	Pass
776 - 787	-48.7	-44.6	-4.1	Pass
824 - 849	-47.1	-44.1	-3.0	Pass
1710 - 1755	-41	-37.7	-3.3	Pass
1850 - 1915	-39	-37.0	-2.0	Pass

Maximum Downlink Noise Test Results

Frequency Band (MHz)	Measured Noise (dBm)	Limit (dBm)	Margin (dB)	Result
728 - 746	-49.2	-45.5	-3.7	Pass
746 - 757	-49.4	-44.6	-4.8	Pass
869 - 894	-47.3	-44.1	-3.2	Pass
1930 - 1995	-37.5	-37.0	-0.5	Pass
2110 - 2155	-38.5	-37.7	-0.8	Pass

Uplink Noise Timing Test Results

Frequency Band (MHz)	Measured Timing (mS)	Limit (mS)	Result
698 - 716	525.00	3000	Pass
776 - 787	543.80	3000	Pass
824 - 849	600.00	3000	Pass
1710 - 1755	675.00	3000	Pass
1850 - 1915	393.70	3000	Pass



Variable Uplink Noise Limit Test Results

698 - 716 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-43.0	-60.0	-65.3	-5.3
-42.0	-61.0	-65.6	-4.6
-64.0	-45.5	-47.7	-2.2
-62.0	-45.5	-47.6	-2.1
-65.0	-45.5	-47.5	-2.0
-66.0	-45.5	-47.5	-2.0

776 - 787 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-44.0	-59.0	-60.6	-1.6
-43.0	-60.0	-61.1	-1.1
-70.0	-44.6	-45.7	-1.1
-69.0	-44.6	-45.7	-1.1
-68.0	-44.6	-45.7	-1.1
-67.0	-44.6	-45.7	-1.1

824 - 849 MHz

RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-44.0	-59.0	-62.6	-3.6
-43.0	-60.0	-63.0	-3.0
-70.0	-44.0	-45.1	-1.1
-69.0	-44.0	-45.1	-1.1
-68.0	-44.0	-45.1	-1.1
-67.0	-44.0	-45.1	-1.1

1710 - 1755 MHz

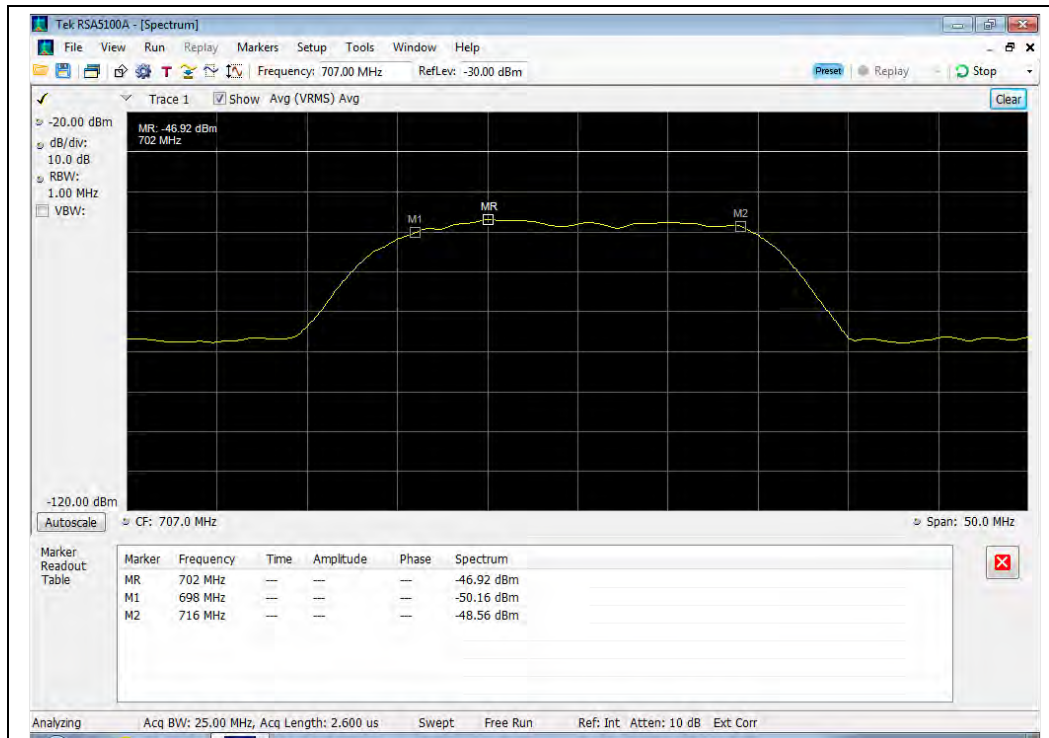
RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-80.0	-37.7	-39.8	-2.1
-79.0	-37.7	-39.8	-2.1
-78.0	-37.7	-39.8	-2.1
-77.0	-37.7	-39.8	-2.1
-54.0	-49.0	-50.6	-1.6
-56.0	-47.0	-48.6	-1.6

1850 - 1915 MHz

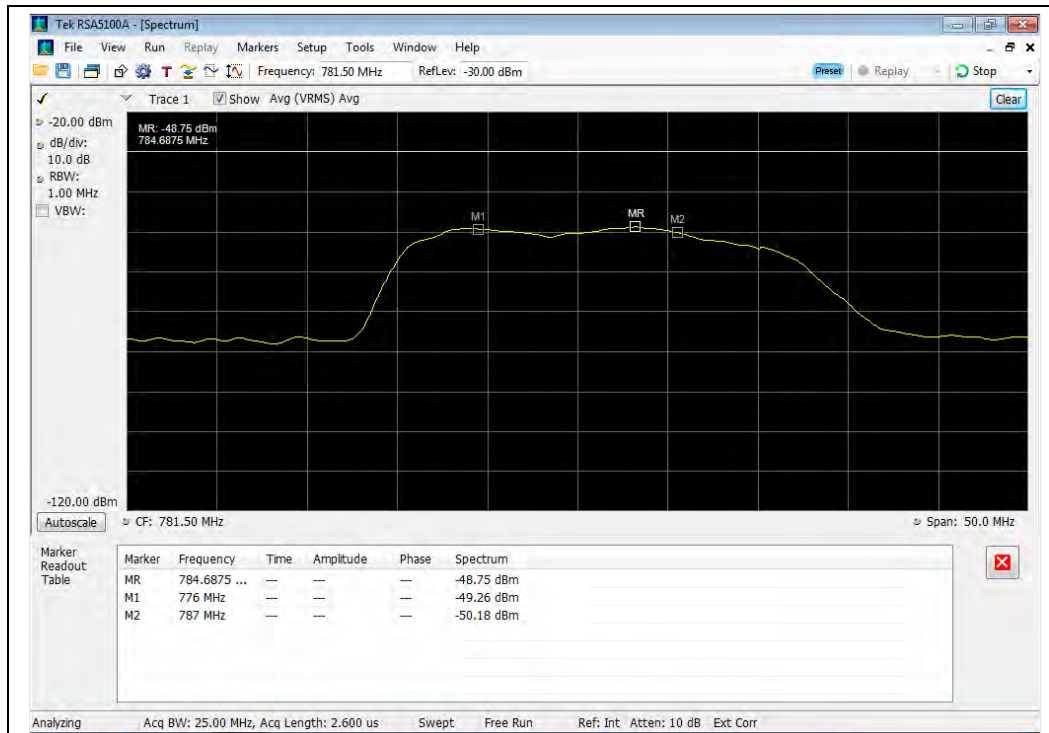
RSSI (dBm)	Noise Limit (dBm)	Measured Noise (dBm)	Margin (dB)
-46.0	-57.0	-58.9	-1.9
-45.0	-58.0	-59.3	-1.3
-80.0	-37.0	-38.2	-1.2
-79.0	-37.0	-38.2	-1.2
-78.0	-37.0	-38.2	-1.2
-77.0	-37.0	-38.2	-1.2

Maximum Uplink Noise Test Plots

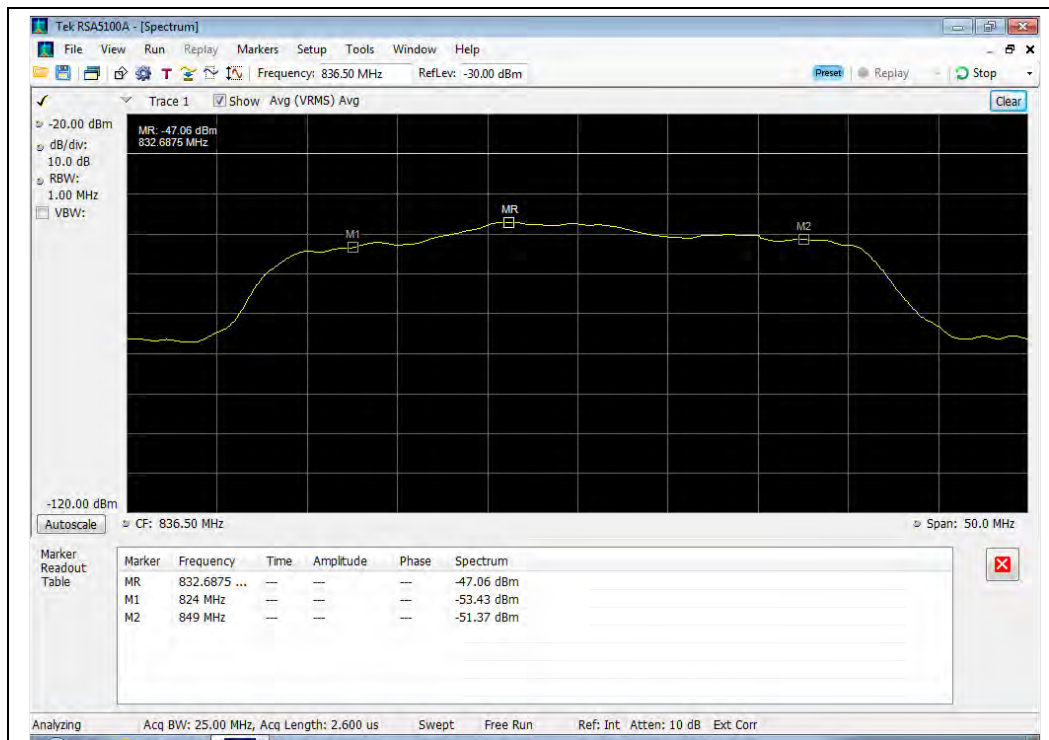
698 - 716 MHz Band



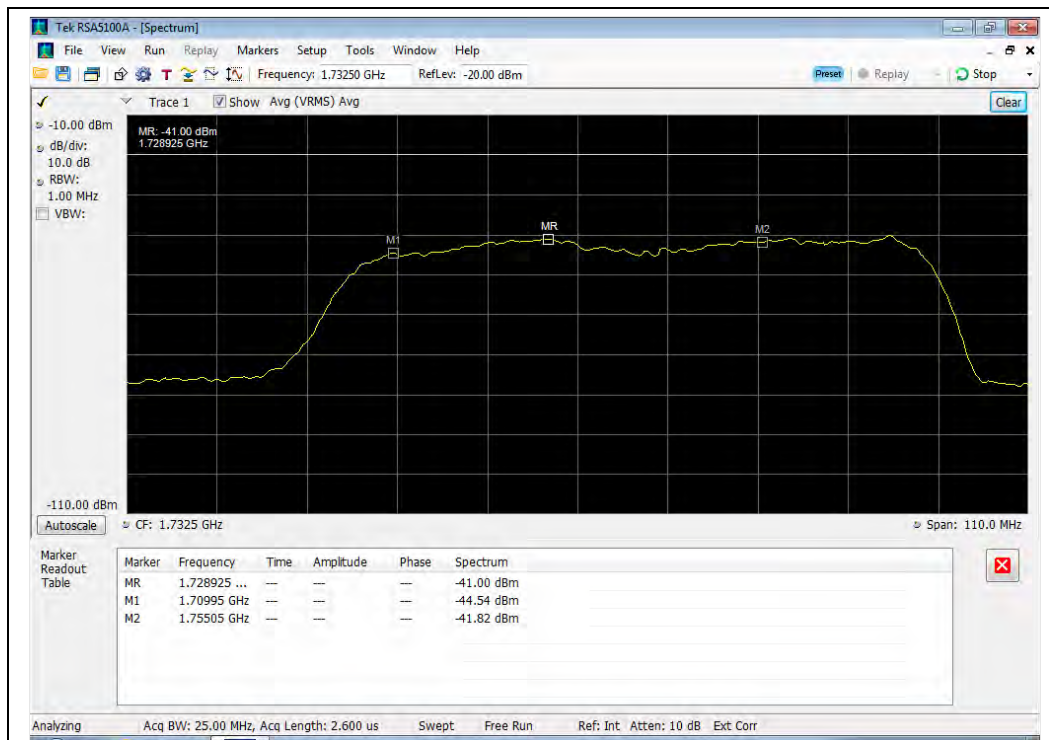
776 - 787 MHz Band



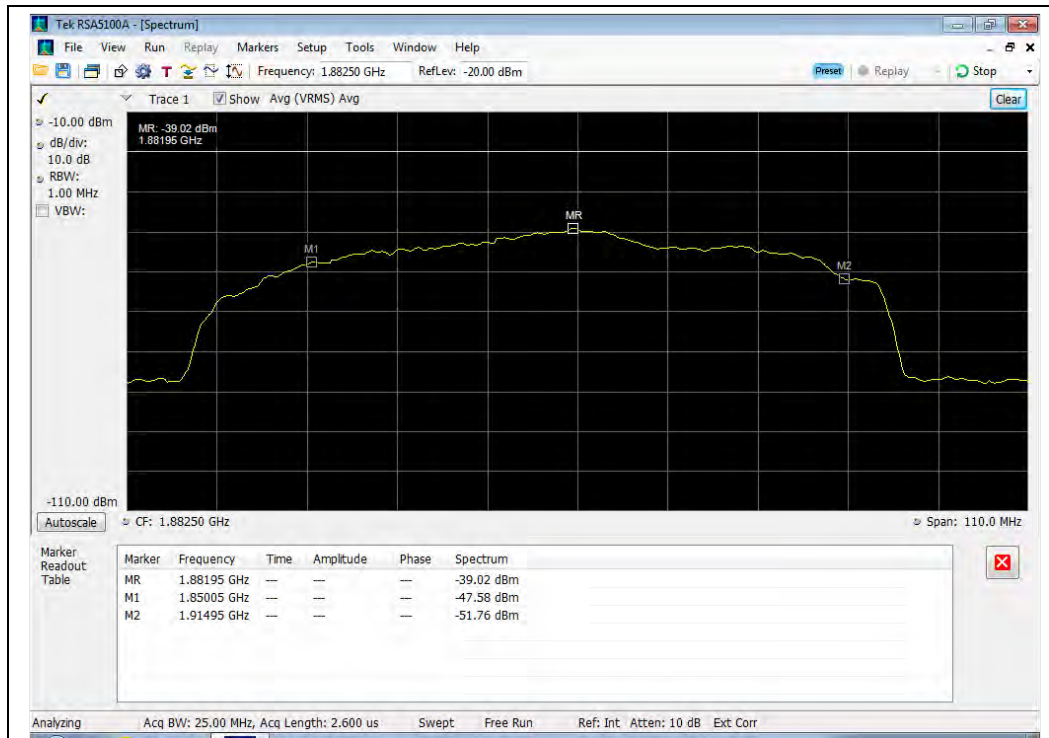
824 - 849 MHz Band



1710 - 1755 MHz Band

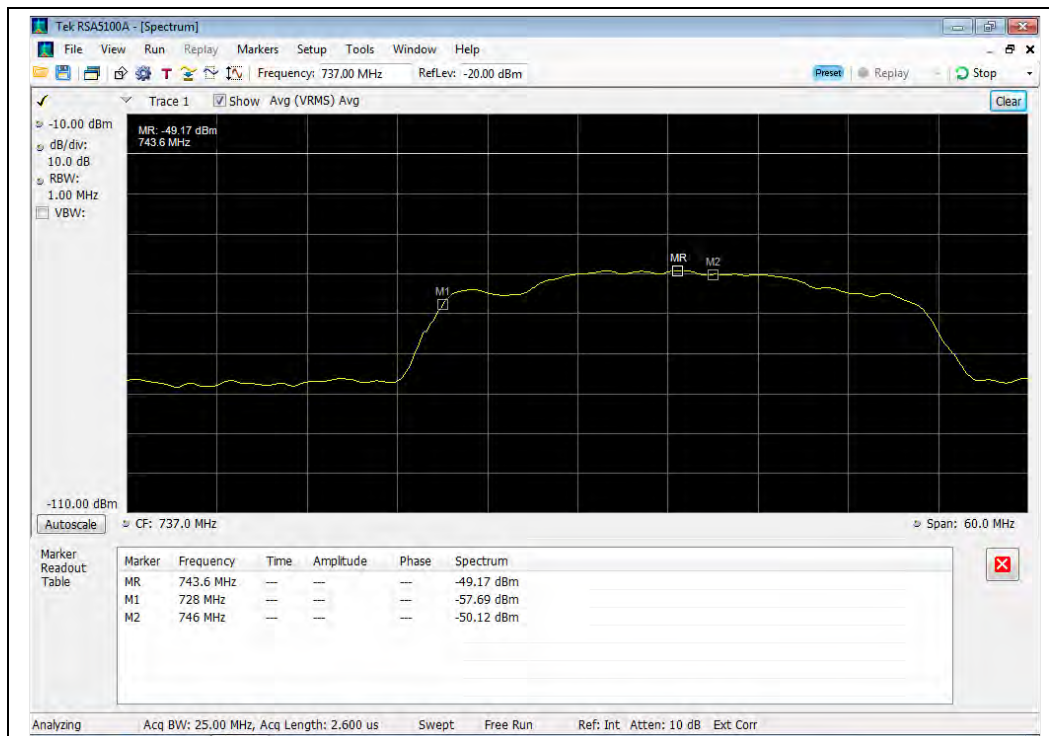


1850 - 1915 MHz Band

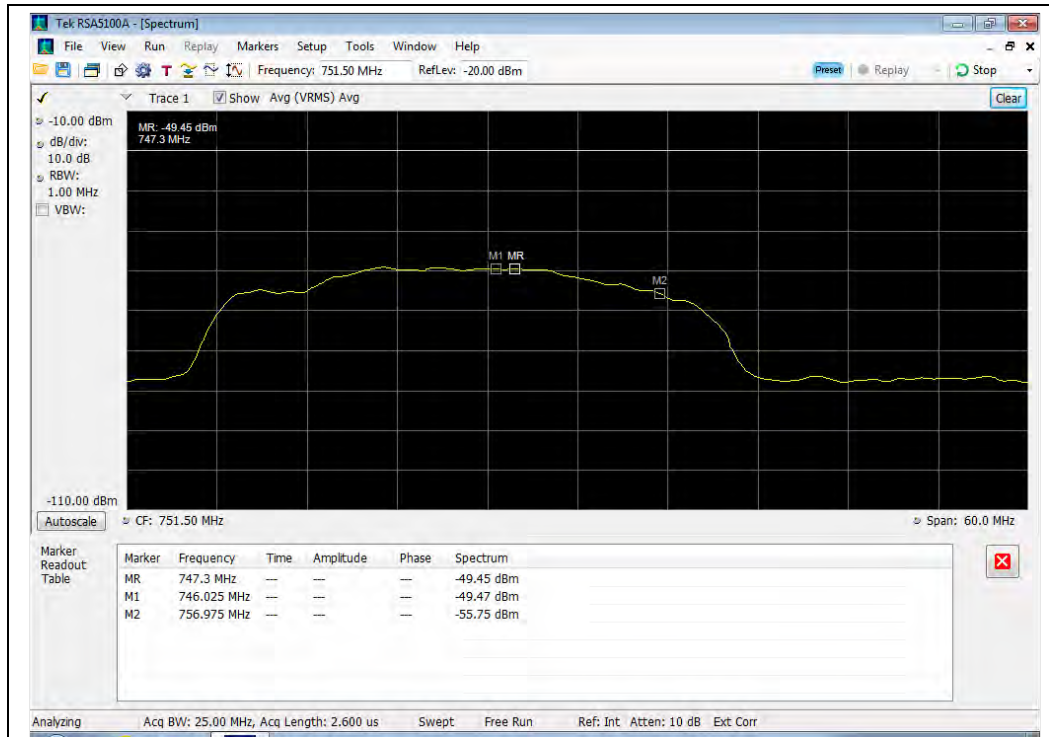


Maximum Downlink Noise Test Plots

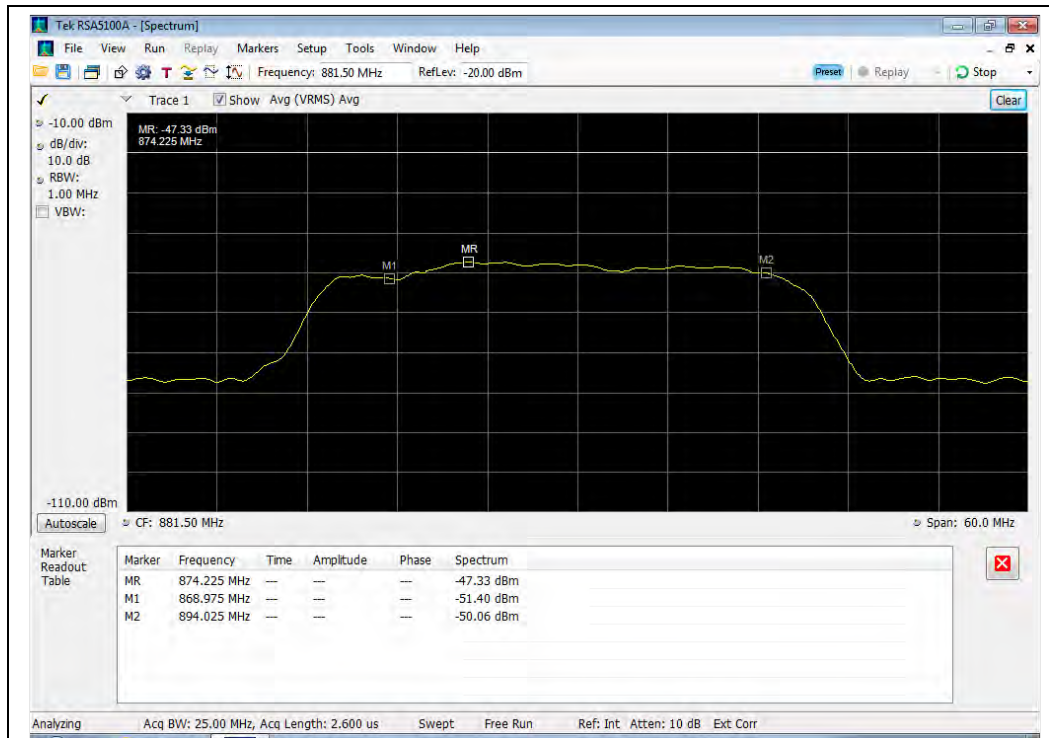
728 - 746 MHz Band



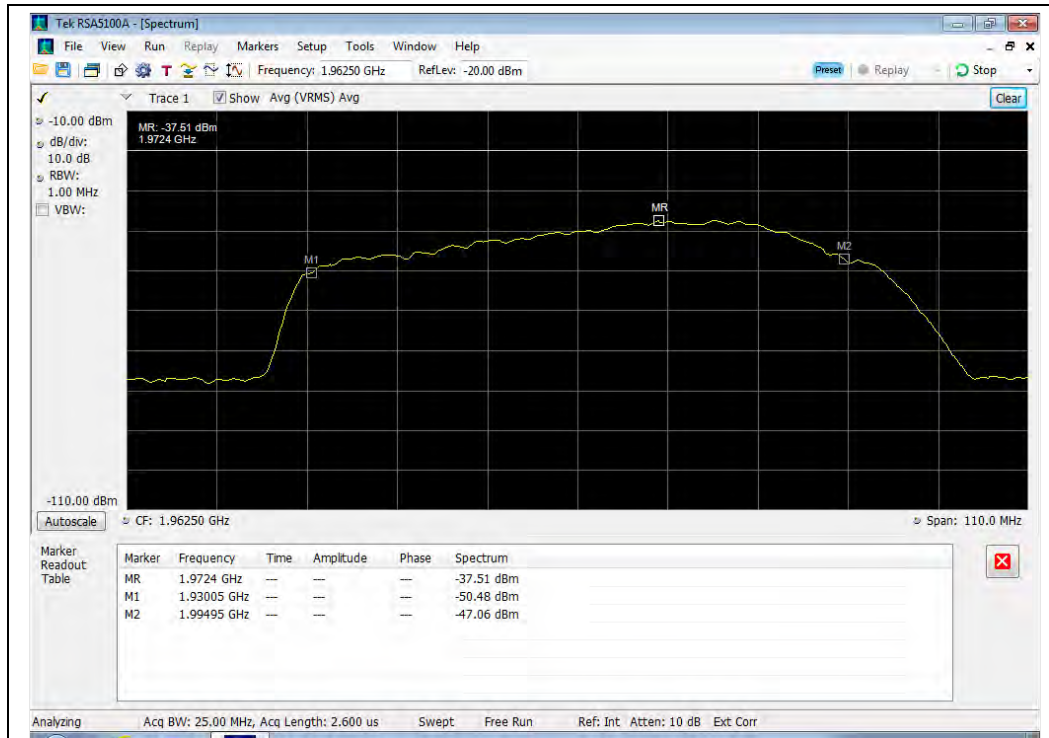
746 - 757 MHz Band



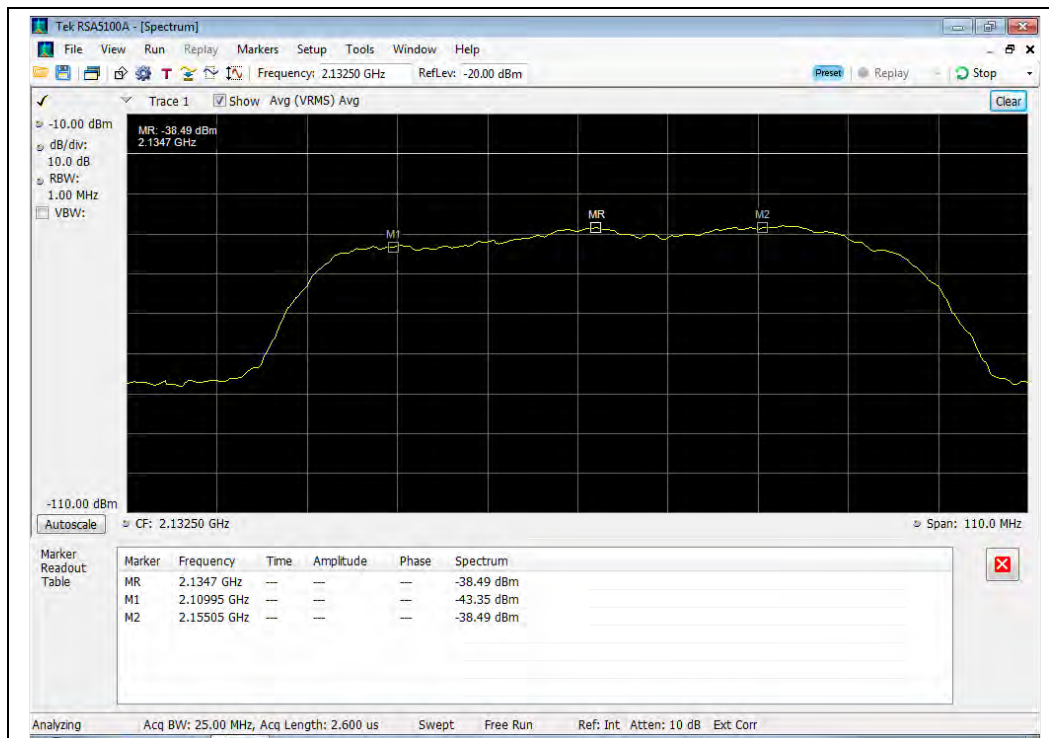
869 - 894 MHz Band



1930 - 1995 MHz Band



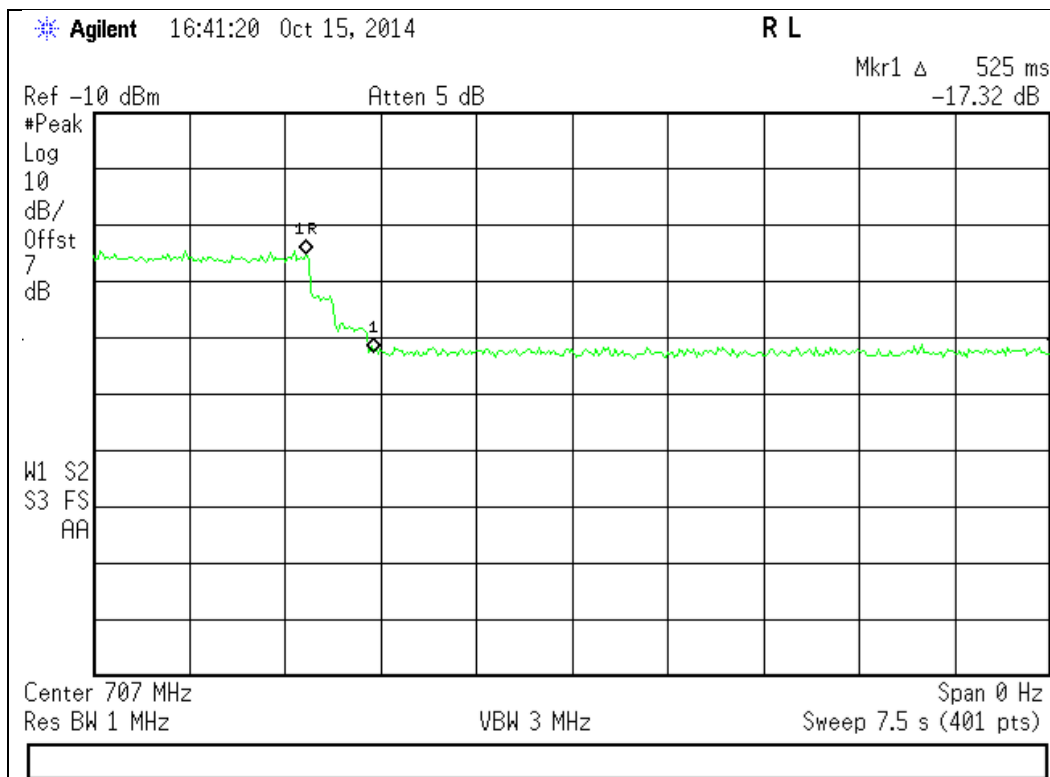
2110 - 2155 MHz Band



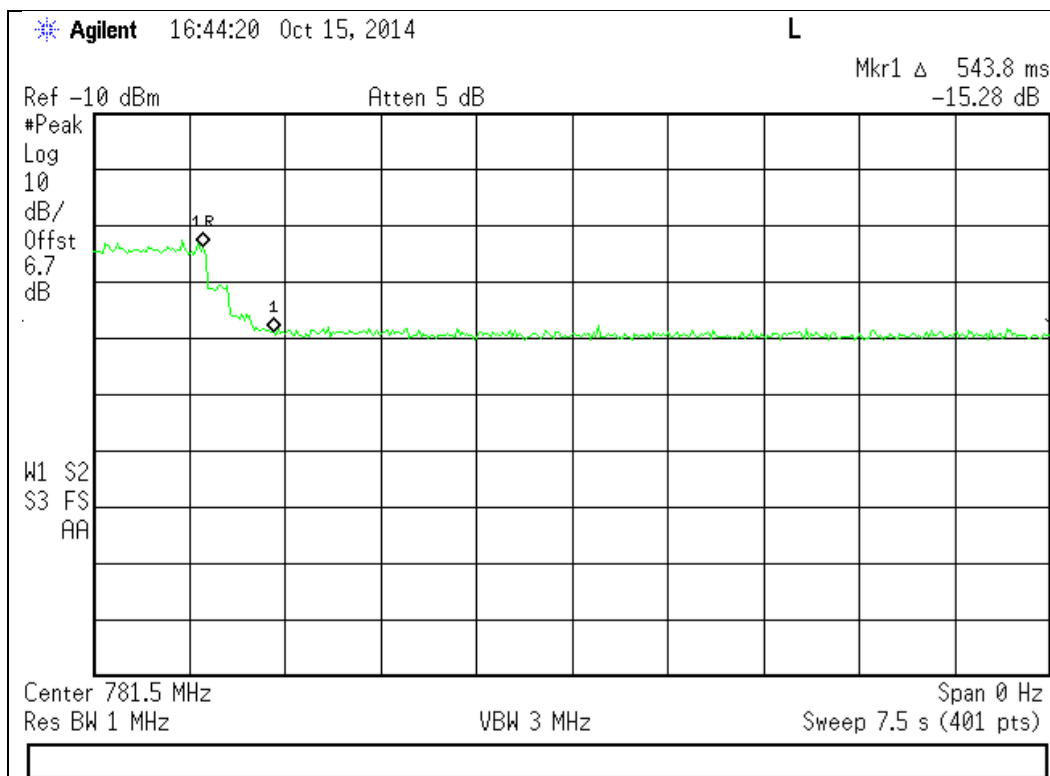


Uplink Noise Timing Test Plots

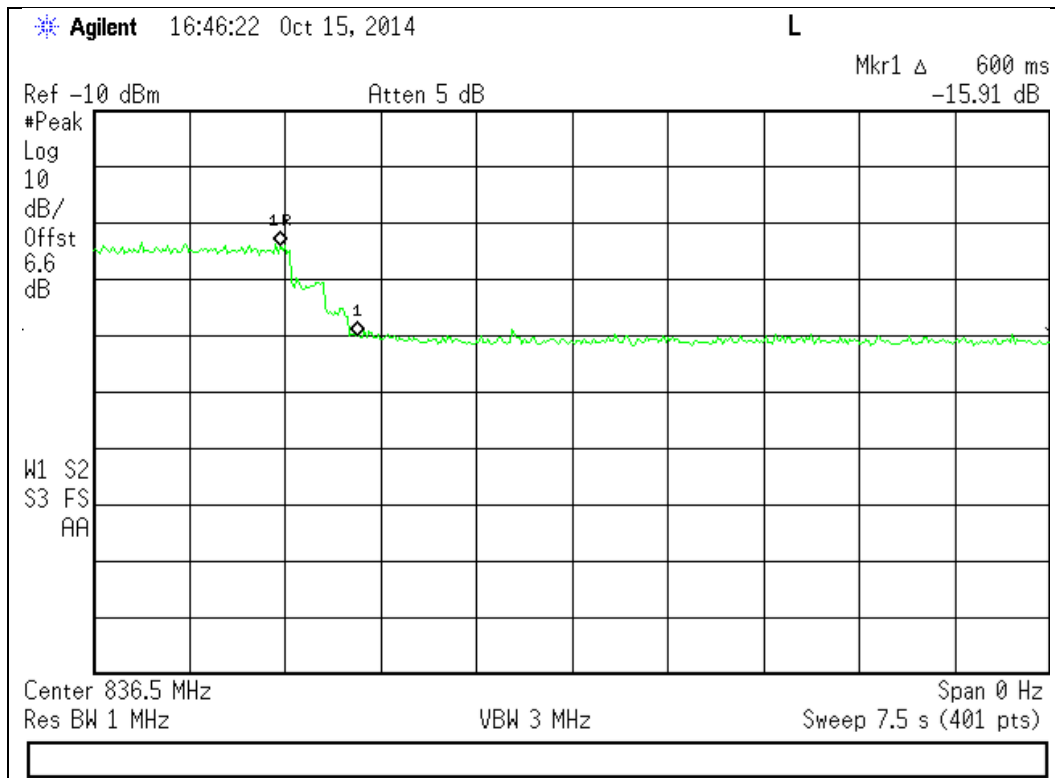
698 - 716 MHz Band



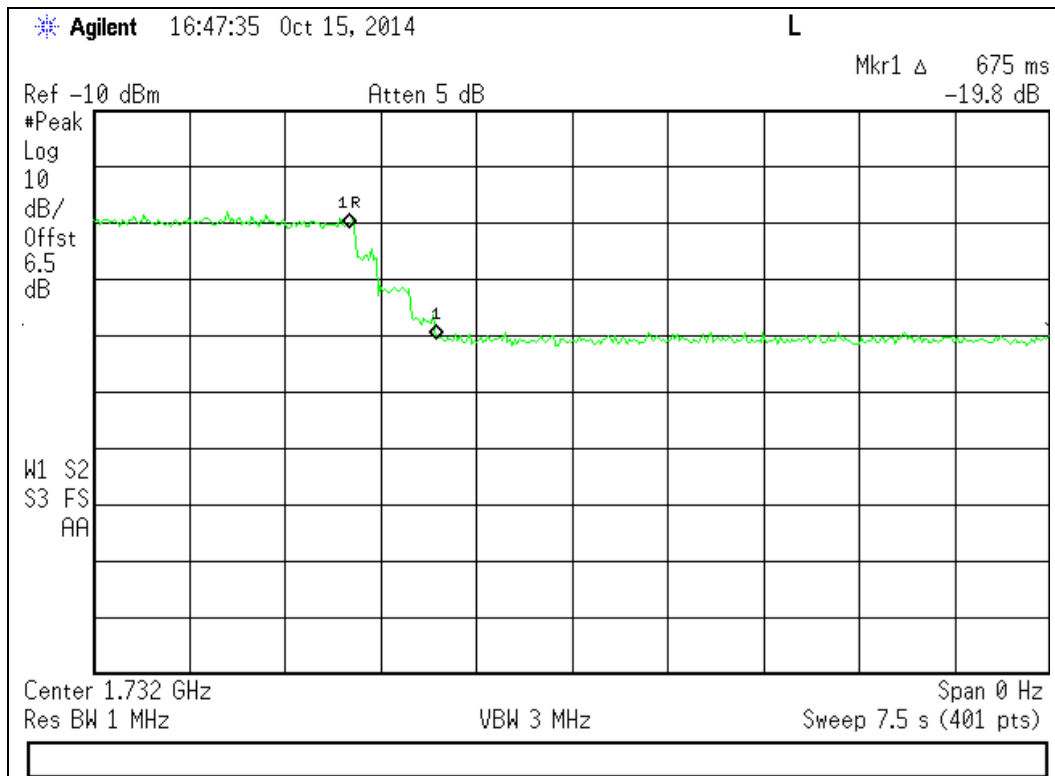
776 - 787 MHz Band



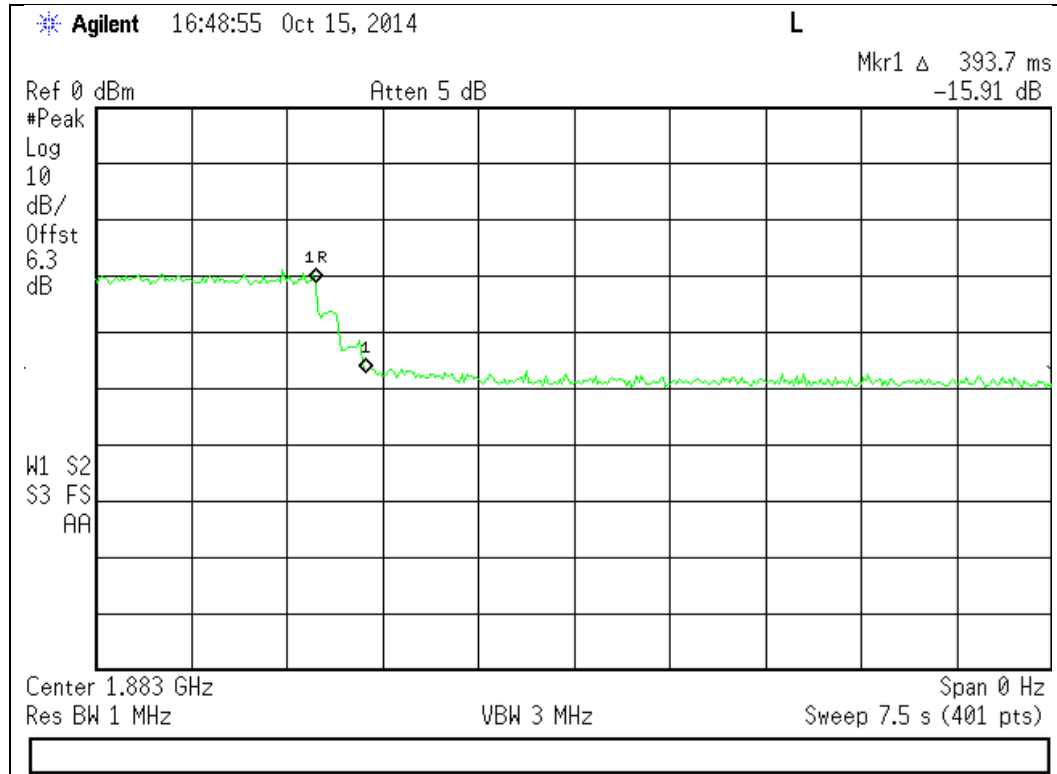
824 - 849 MHz Band



1710 - 1755 MHz Band



1850 - 1915 MHz Band



Uplink Inactivity

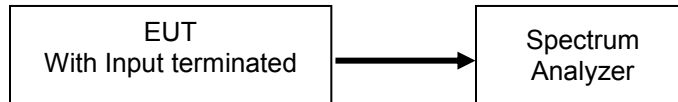
Engineer: Mike Graffeo

Test Date: 10/3/14

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 to ensure that it was less than 300 seconds. The noise level after the return to an inactive state was less than -70 dBm/MHz

Test Setup

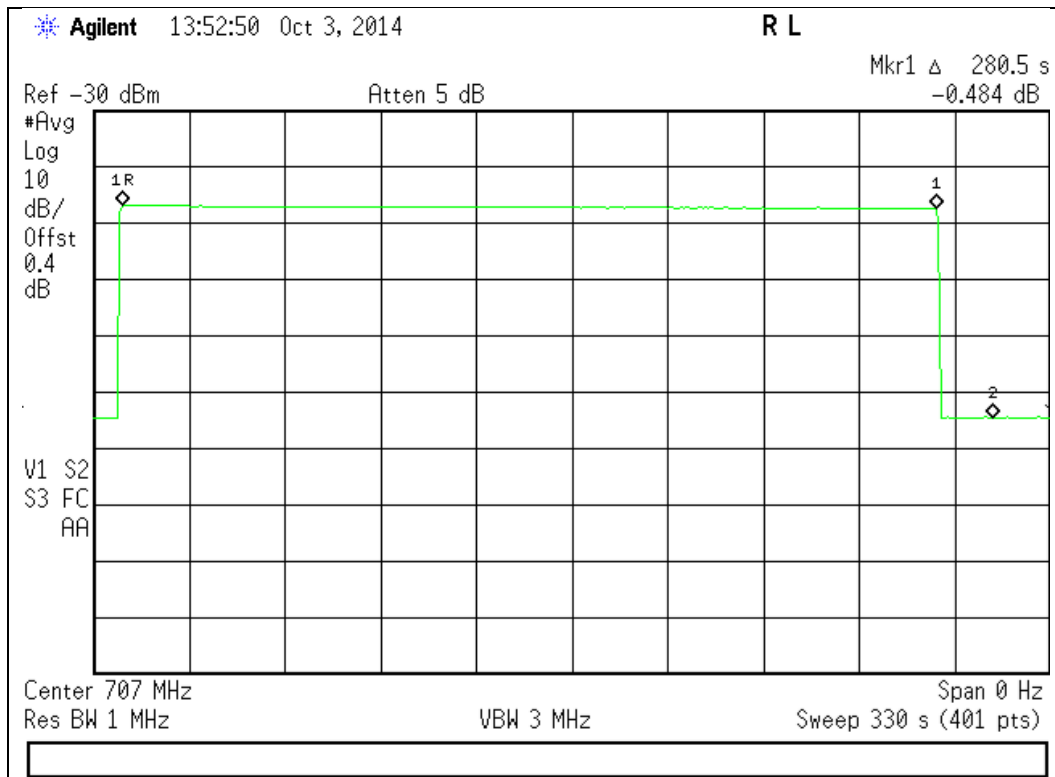


Uplink Test Results

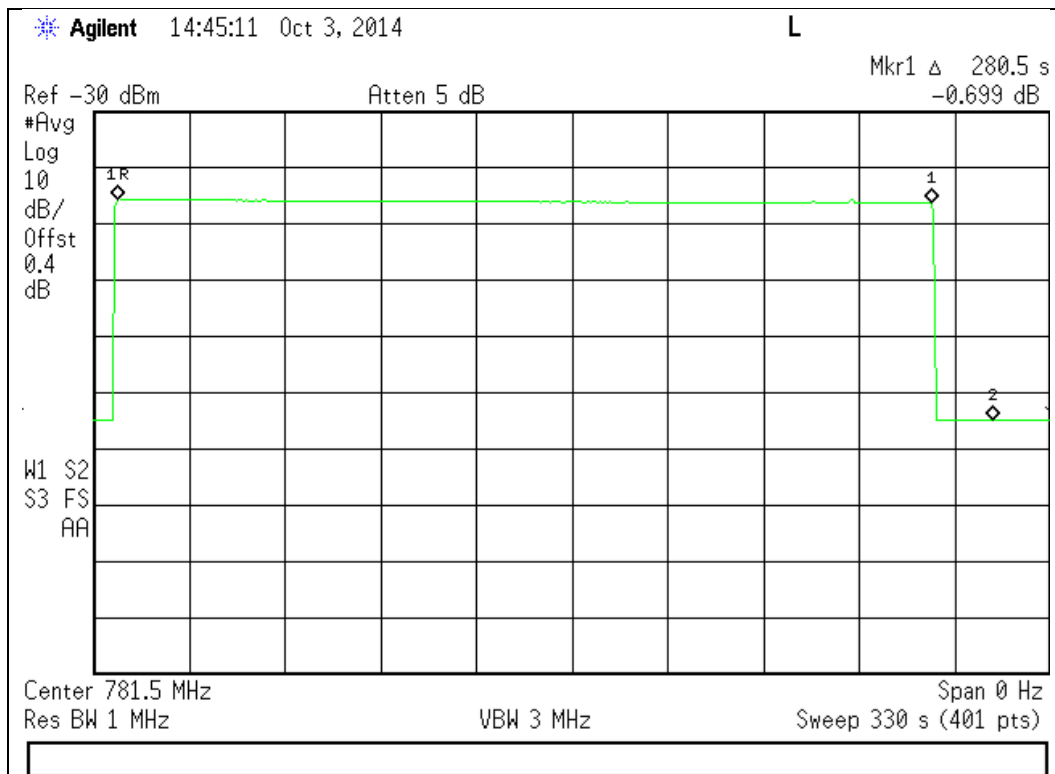
Frequency Band (MHz)	Measured Time (Seconds)	Limit (Seconds)	Result
698 - 716	280.5	300	Pass
776 - 787	280.5	300	Pass
824 - 849	281.3	300	Pass
1710 - 1755	279.7	300	Pass
1850 - 1915	281.3	300	Pass

Uplink Inactivity Test Results

698 - 716 MHz

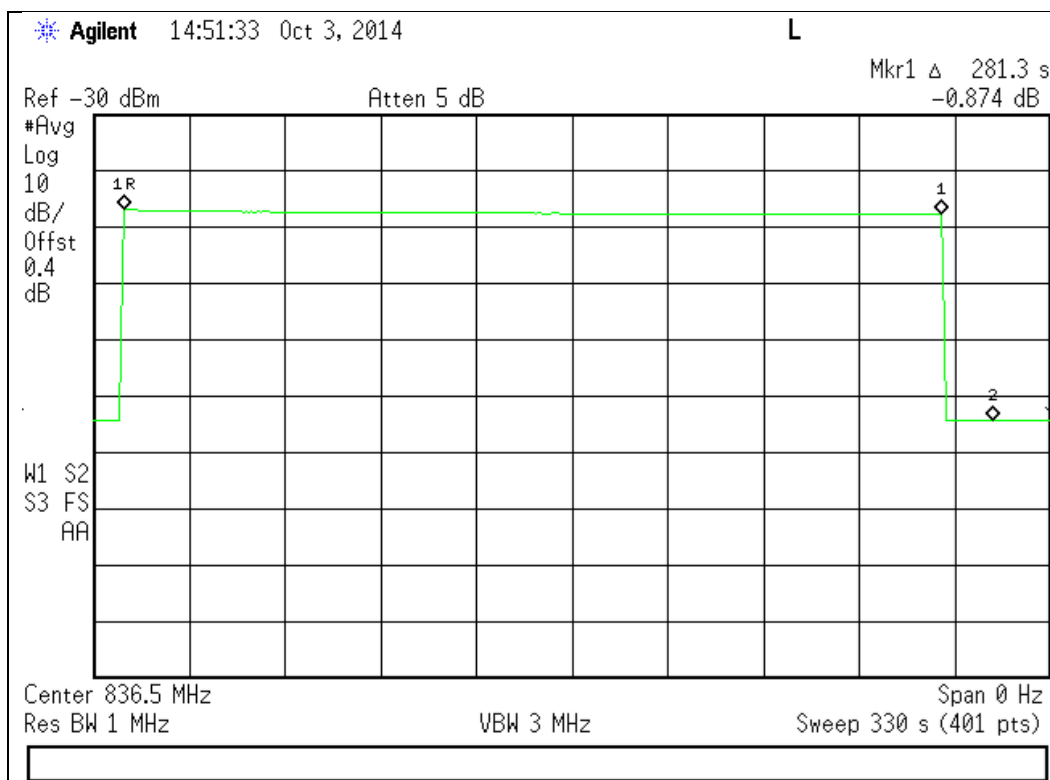


776 - 787 MHz

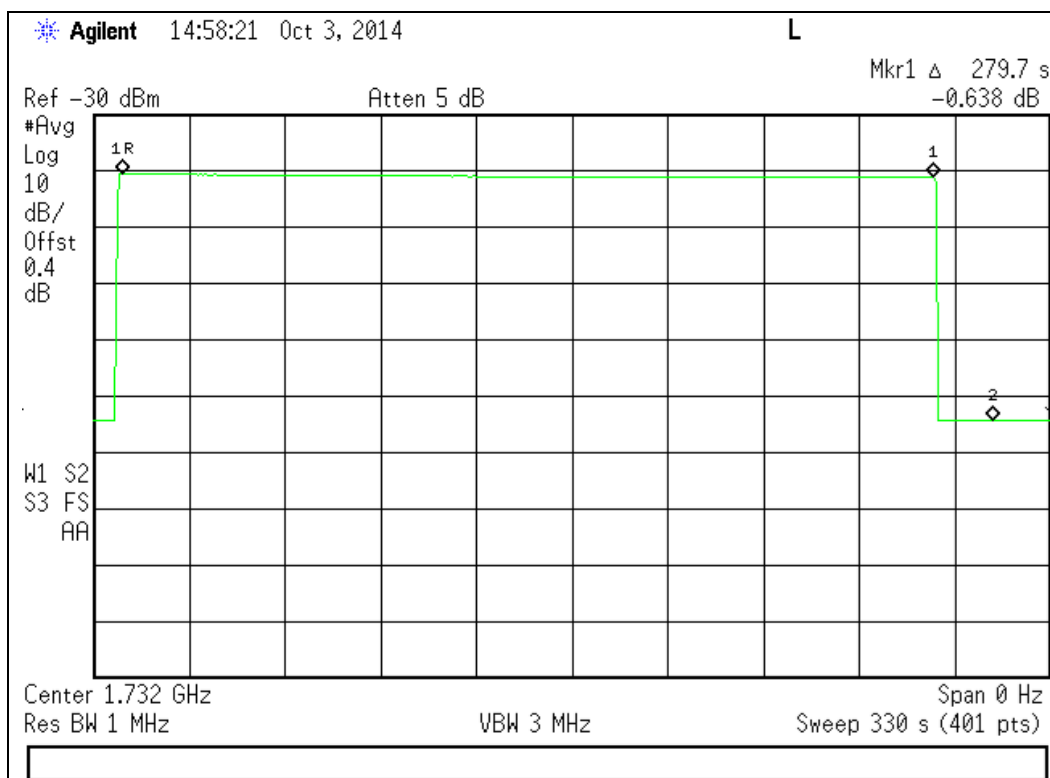




824 - 849 MHz

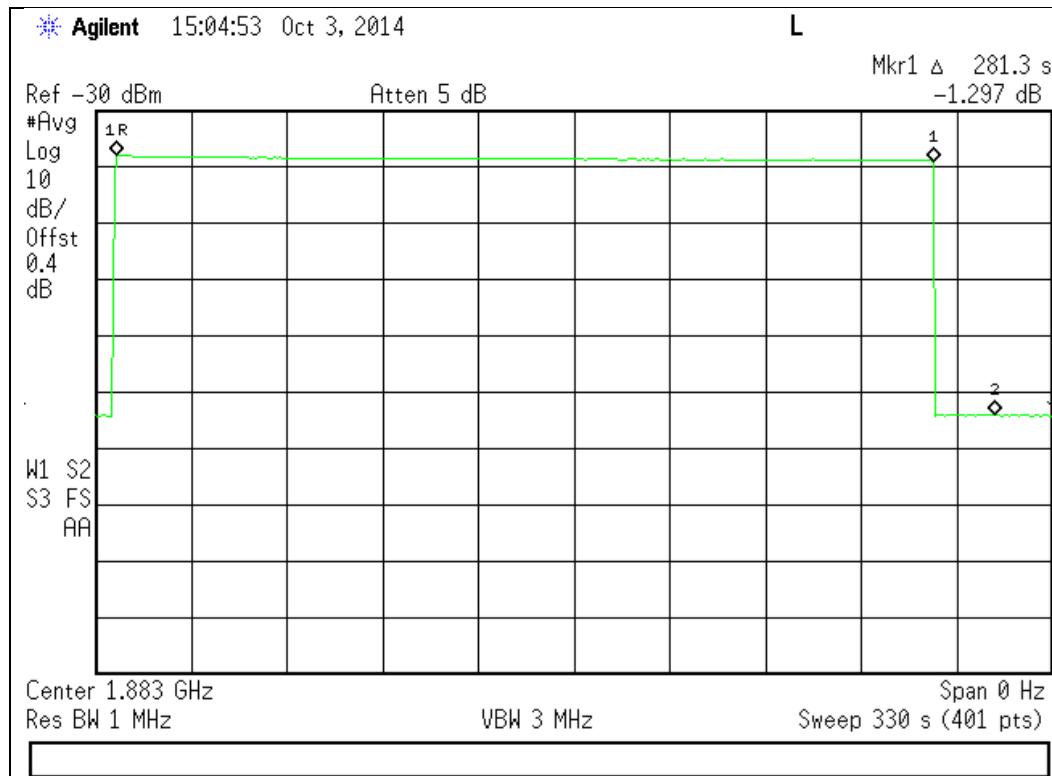


1710 - 1755 MHz





1850 - 1915 MHz



Variable Gain

Engineer: Mike Graffeo

Test Date: 9/25/14

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 in order 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.

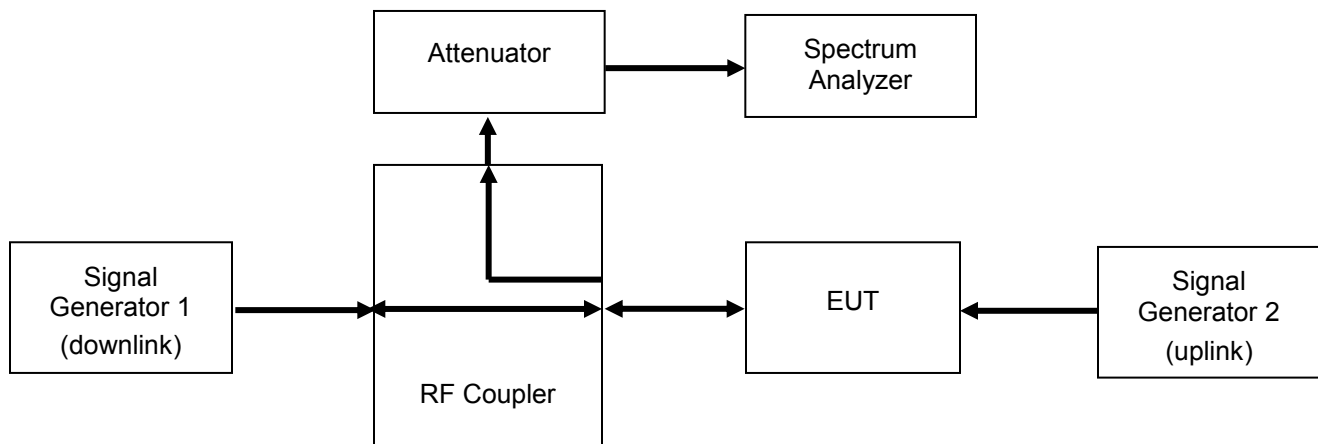
The following formula is used for calculating the limits:

Variable Gain = -34 dB - RSSI + MSCL

Fixed booster maximum gain = 6.5 dB + 20 * Log10(midband of UL)

(Fixed booster maximum gain is same for Downlink as for Uplink.)

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)
-69.0	35.6	63.5	-46.4	17.0	63.4	-0.1
-68.0	35.6	63.5	-46.4	17.0	63.4	-0.1
-67.0	35.6	63.5	-46.4	17.0	63.4	-0.1
-66.0	35.6	63.5	-46.4	17.0	63.4	-0.1
-50	35.6	51.6	-46.4	3.4	49.8	-1.8
-49	35.6	50.6	-46.4	2.4	48.8	-1.8

776 - 787 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-51.0	36.4	53.4	-44.8	8.1	52.9	-0.5
-50.0	36.4	52.4	-44.8	7.1	51.9	-0.5
-69.0	36.4	64.0	-44.8	17.0	61.8	-2.2
-68.0	36.4	64.0	-44.8	17.0	61.8	-2.2
-67.0	36.4	64.0	-44.8	17.0	61.8	-2.2
-66.0	36.4	64.0	-44.8	17.0	61.8	-2.2

824 - 849 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-73.0	37.0	65.0	-42.6	20.0	62.6	-2.4
-72.0	37.0	65.0	-42.6	20.0	62.6	-2.4
-71.0	37.0	65.0	-42.6	20.0	62.6	-2.4
-70.0	37.0	65.0	-42.6	20.0	62.6	-2.4
-52	37.0	55.0	-42.6	8.2	50.8	-4.2
-51	37.0	54.0	-42.6	7.2	49.8	-4.2

1710 - 1755 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-46	40.4	52.4	-44.6	-1.5	43.1	-9.3
-73.0	40.4	71.0	-44.6	17.0	61.6	-9.4
-72.0	40.4	71.0	-44.6	17.0	61.6	-9.4
-71.0	40.4	71.0	-44.6	17.0	61.6	-9.4
-70.0	40.4	71.0	-44.6	17.0	61.6	-9.4
-47	40.4	53.4	-44.6	-0.7	43.9	-9.5

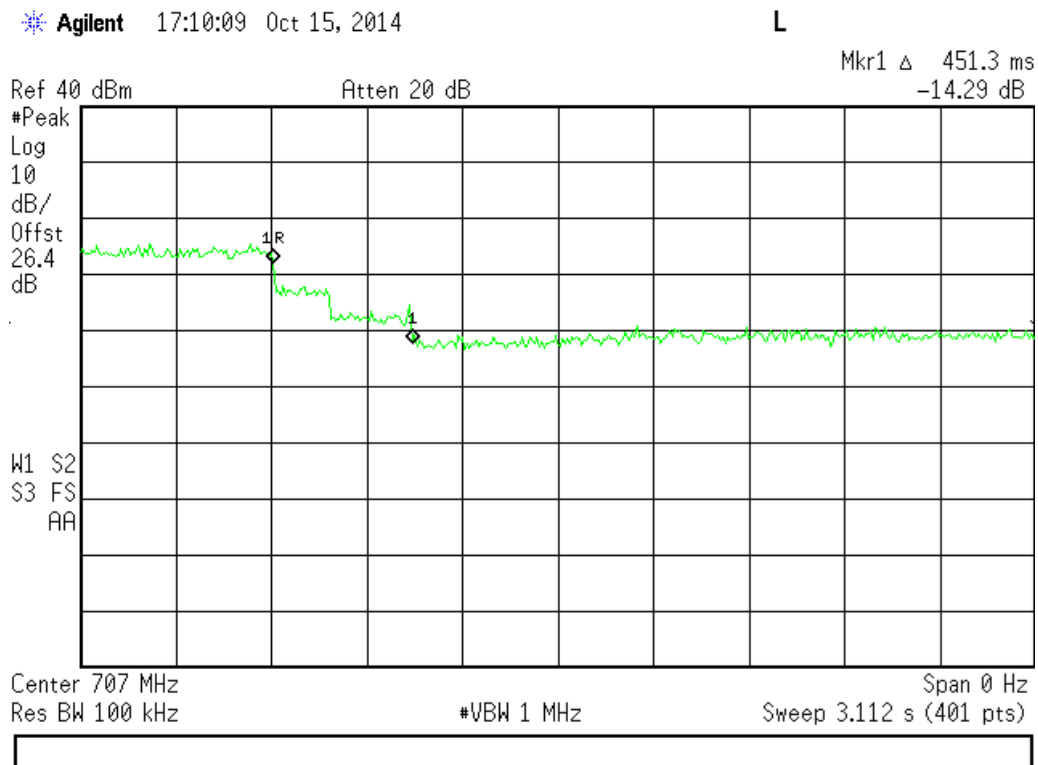
1850 - 1915 MHz

RSSI (dBm)	MSCL (dB)	Gain Limit (dBm)	P(in) (dBm)	P(out) (dBm)	Gain (dB)	Margin (dB)
-78.0	38.7	72.0	-50.0	17.0	67.0	-5.0
-77.0	38.7	72.0	-50.0	17.0	67.0	-5.0
-76.0	38.7	72.0	-50.0	17.0	67.0	-5.0
-75.0	38.7	72.0	-50.0	17.0	67.0	-5.0
-65	38.7	69.7	-50.0	13.2	63.2	-6.5
-64	38.7	68.7	-50.0	12.1	62.1	-6.6

Uplink Gain Timing Test Results

Frequency Band (MHz)	Measured Timing (milliseconds)	Limit (milliseconds)	Result
698 - 716	451.30	3000	Pass
776 - 787	381.30	3000	Pass
824 - 849	643.20	3000	Pass
1710 - 1755	395.30	3000	Pass
1850 - 1915	635.50	3000	Pass

Uplink Gain Timing Test Plot 698 – 716 MHz

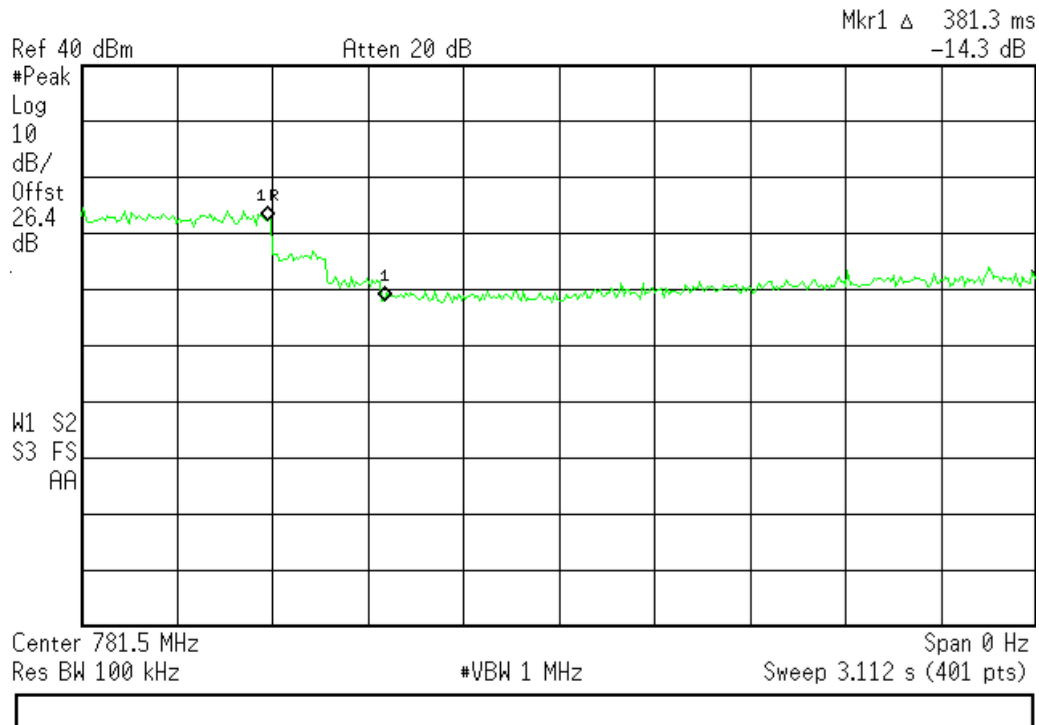




Uplink Gain Timing Test Plot 776 - 787 MHz

Agilent 17:20:17 Oct 15, 2014

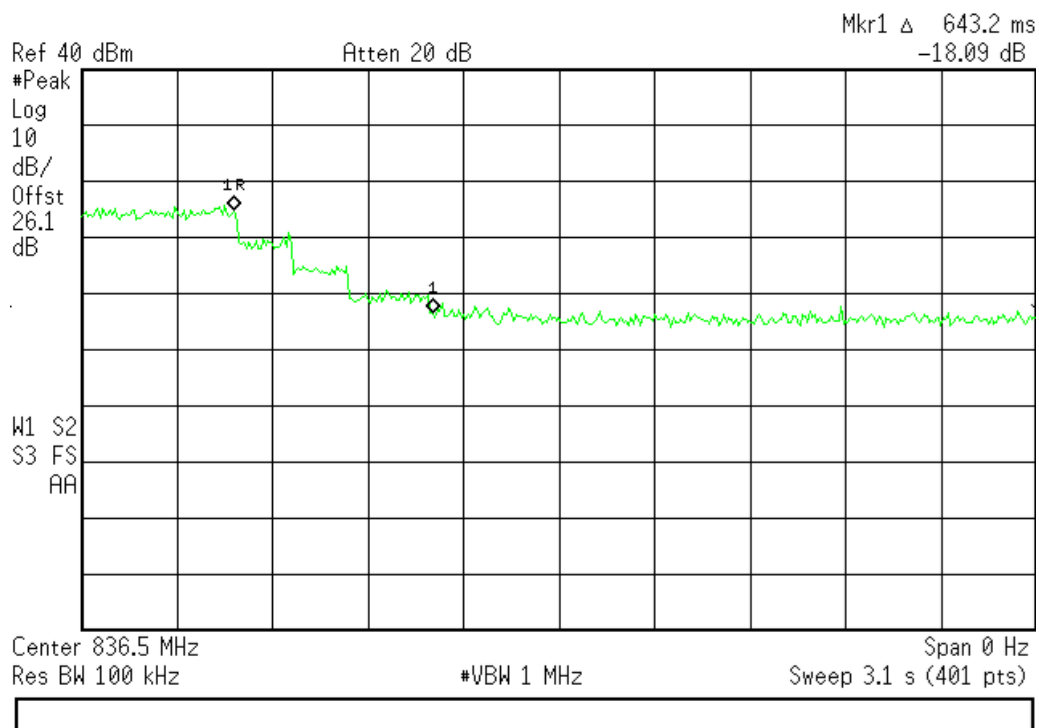
L



Uplink Gain Timing Test Plot 824 - 849 MHz

Agilent 17:27:12 Oct 15, 2014

L



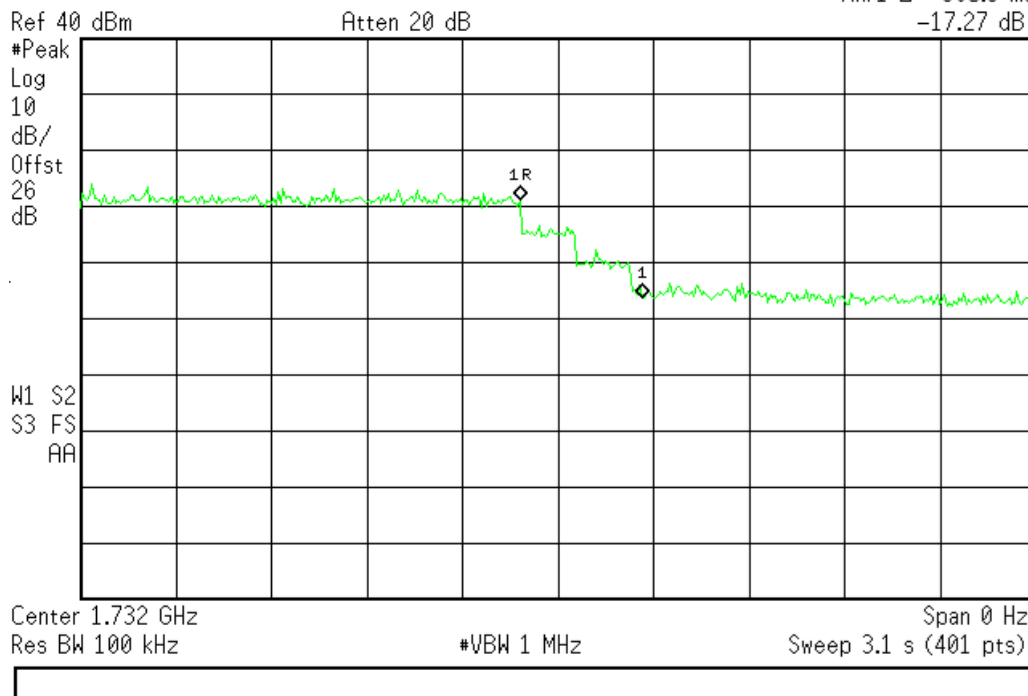


Uplink Gain Timing Test Plot 1710 – 1755 MHz

Agilent 17:37:06 Oct 15, 2014

L

Mkr1 Δ 395.3 ms
-17.27 dB

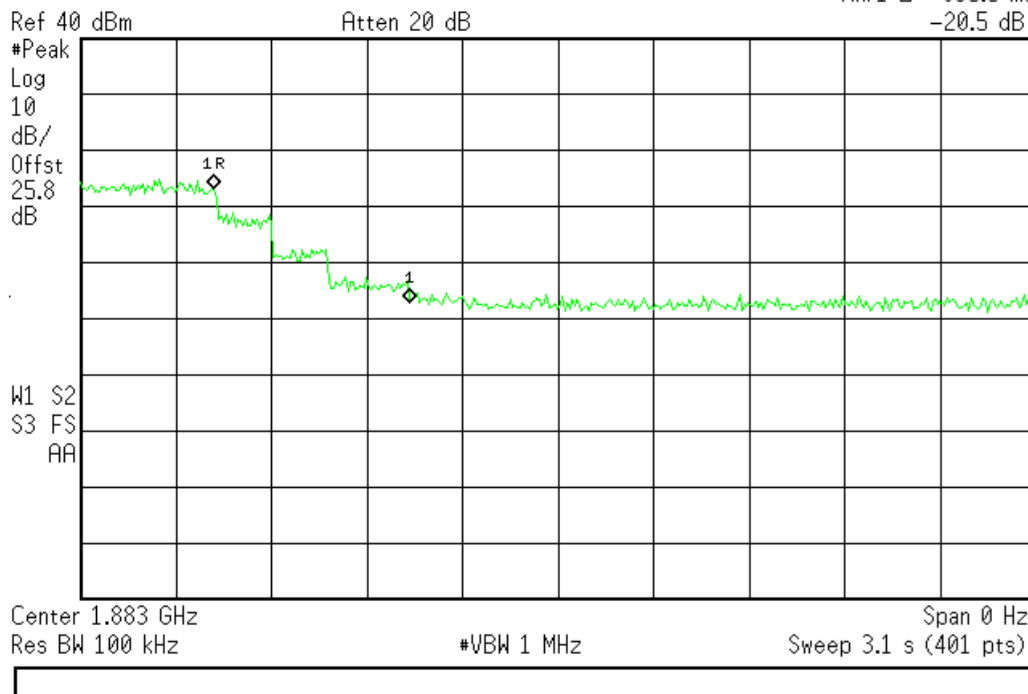


Uplink Gain Timing Test Plot 1850 - 1915 MHz

Agilent 17:50:35 Oct 15, 2014

L

Mkr1 Δ 635.5 ms
-20.5 dB



Occupied Bandwidth

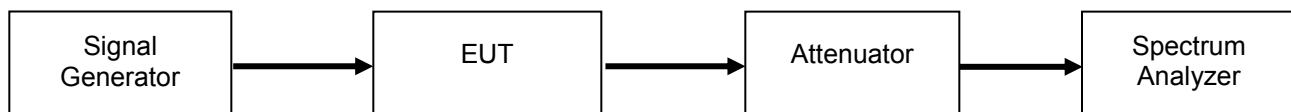
Engineer: Mike Graffeo

Test Date: 9/29/14

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 required to ensure that accurate readings were obtained. A signal generator was utilized to produce the following signals: GSM, CDMA, and WCDMA. The signal generator was tuned to the center channel of each of the EUT operational uplink and downlink bands with the RF level set at 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.

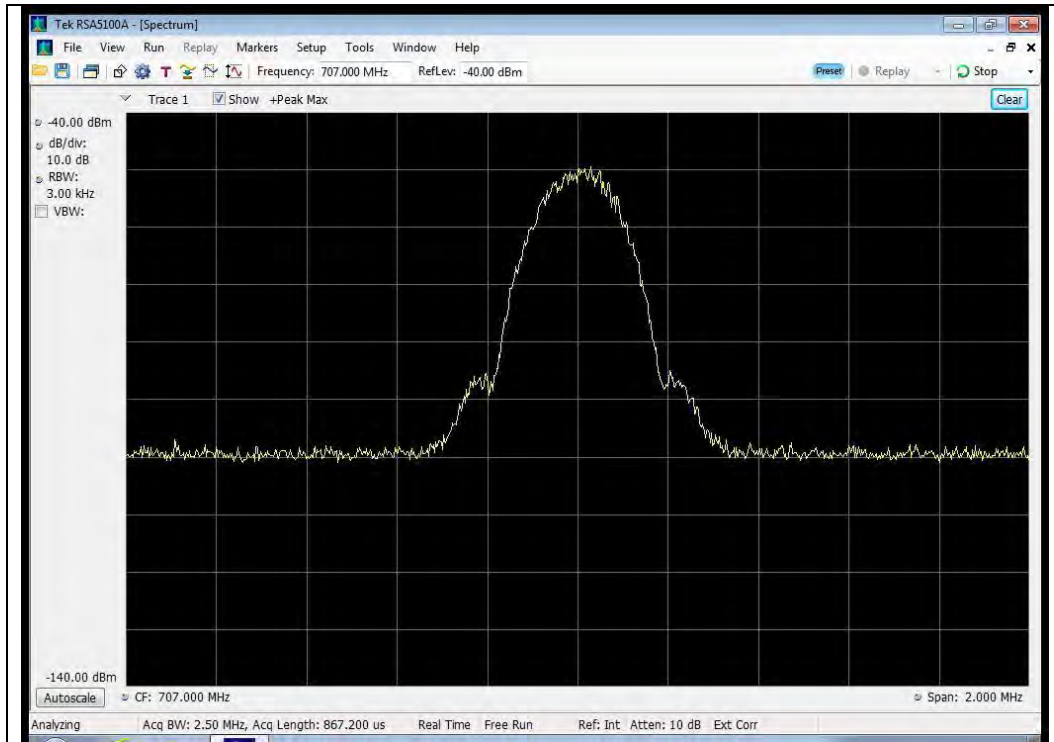
Test Setup



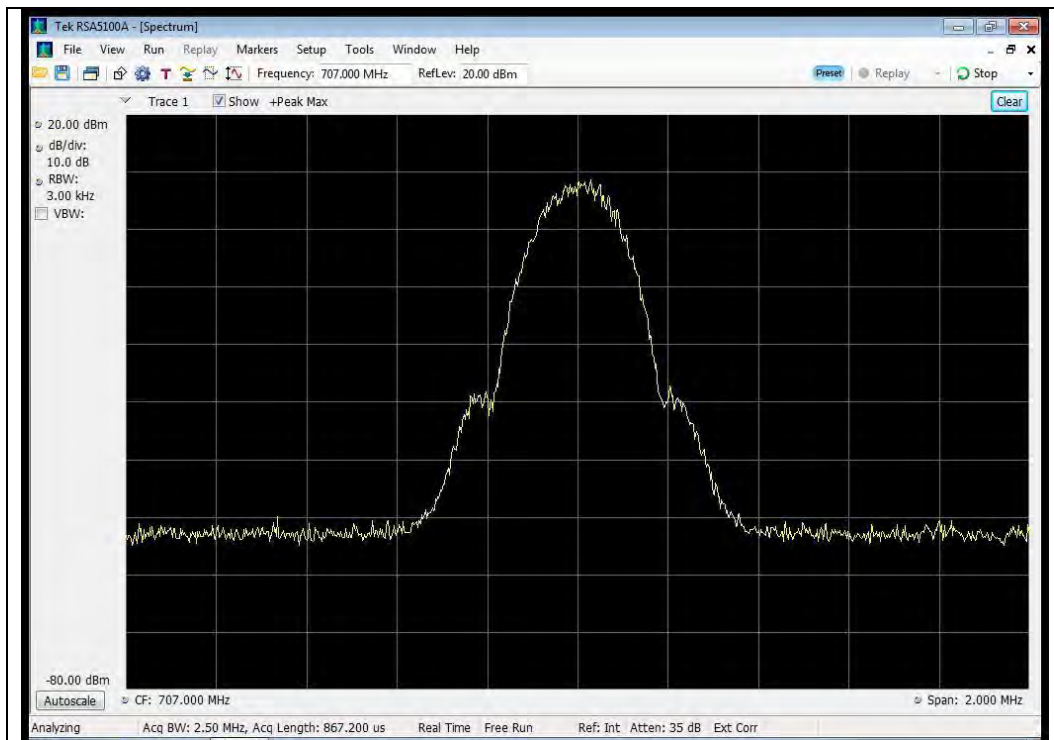
GSM Uplink Test Plots

698 - 716 MHz Band

Input

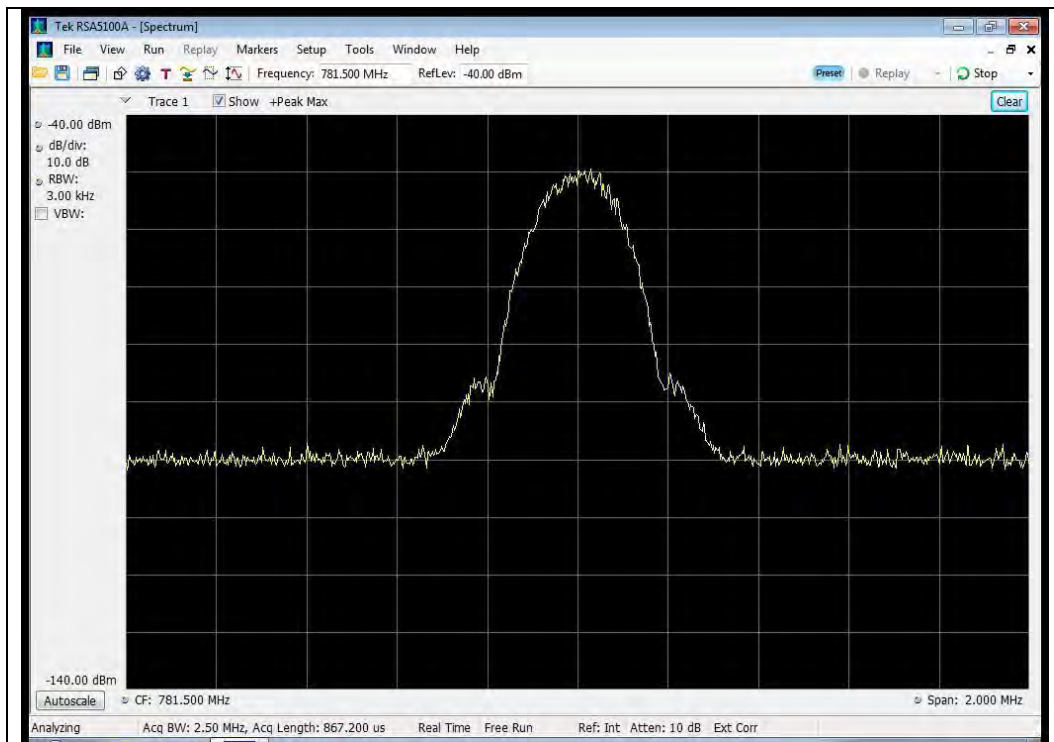


Output

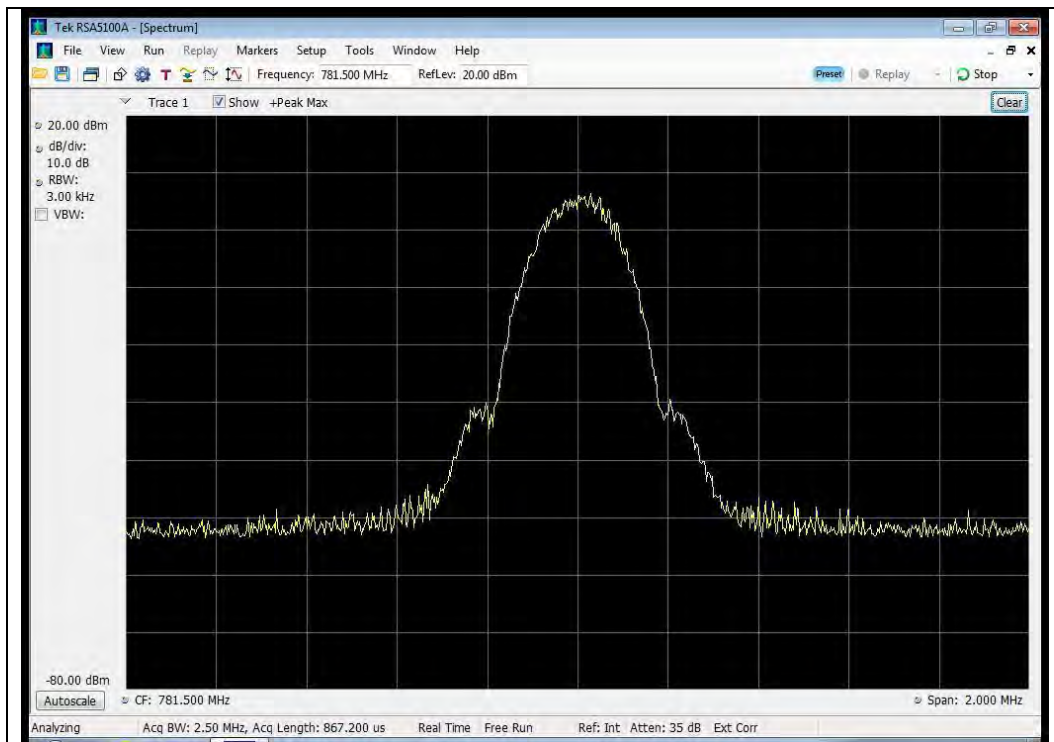


776 - 787 MHz Band

Input

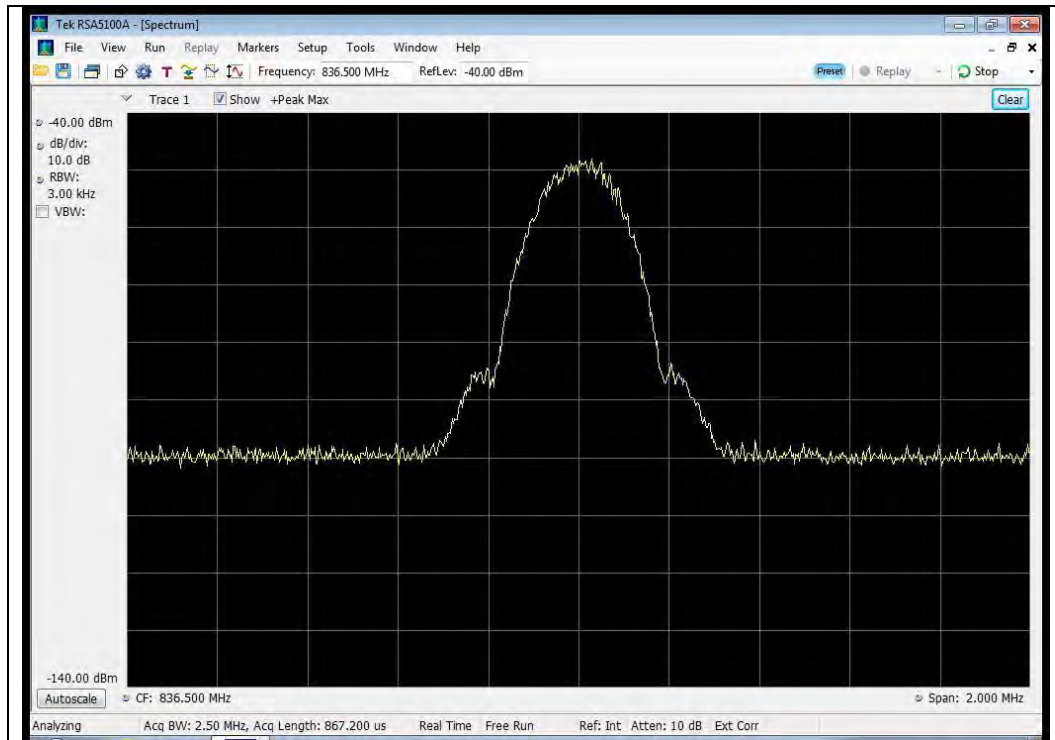


Output

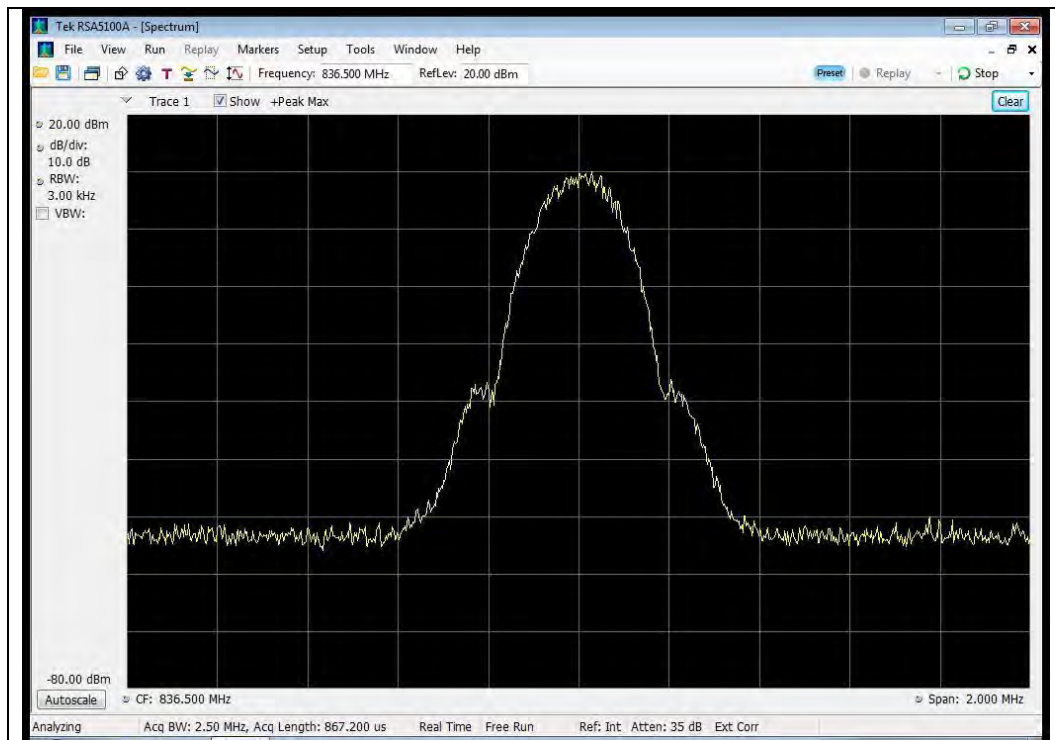


824 - 849 MHz Band

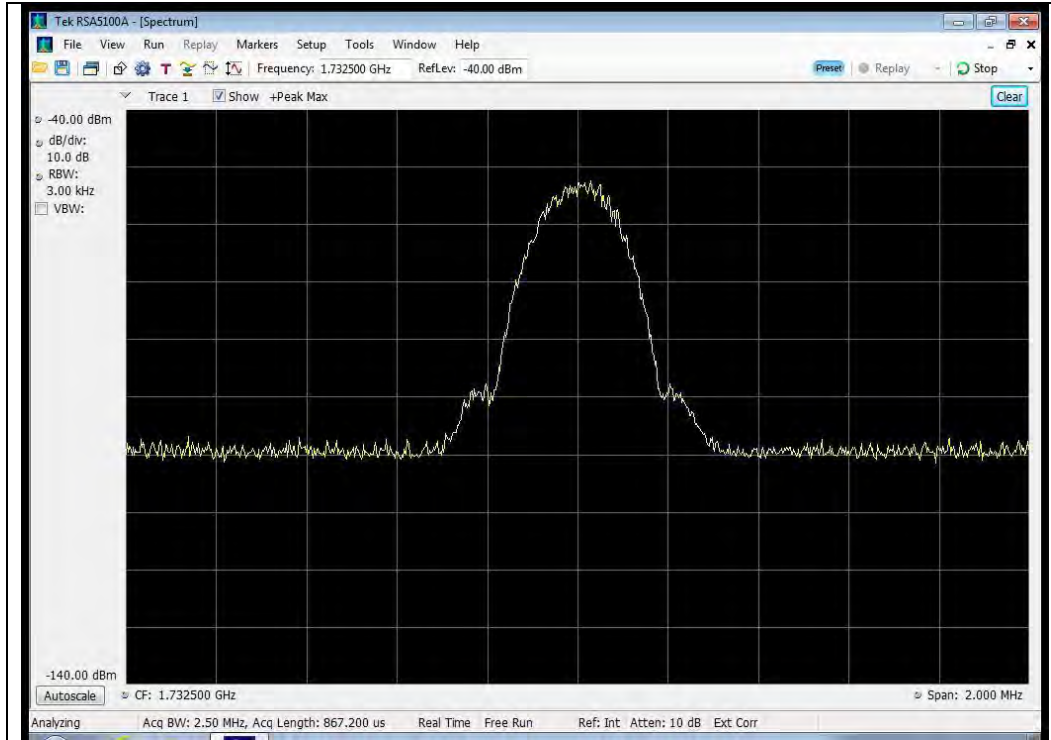
Input



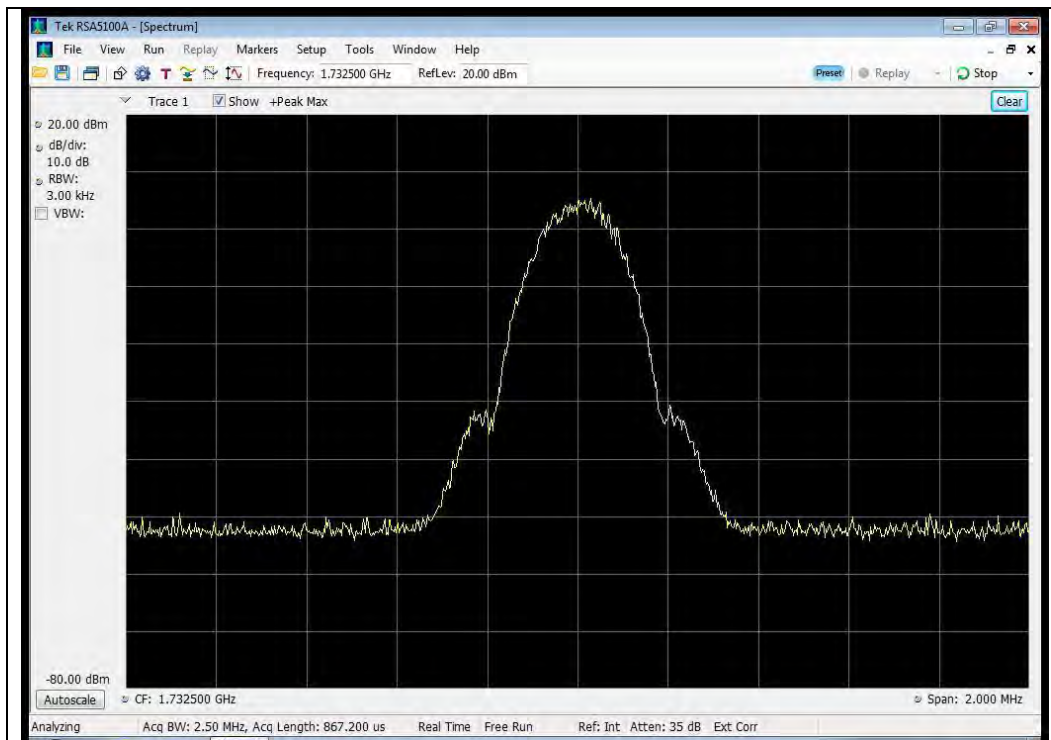
Output



Input

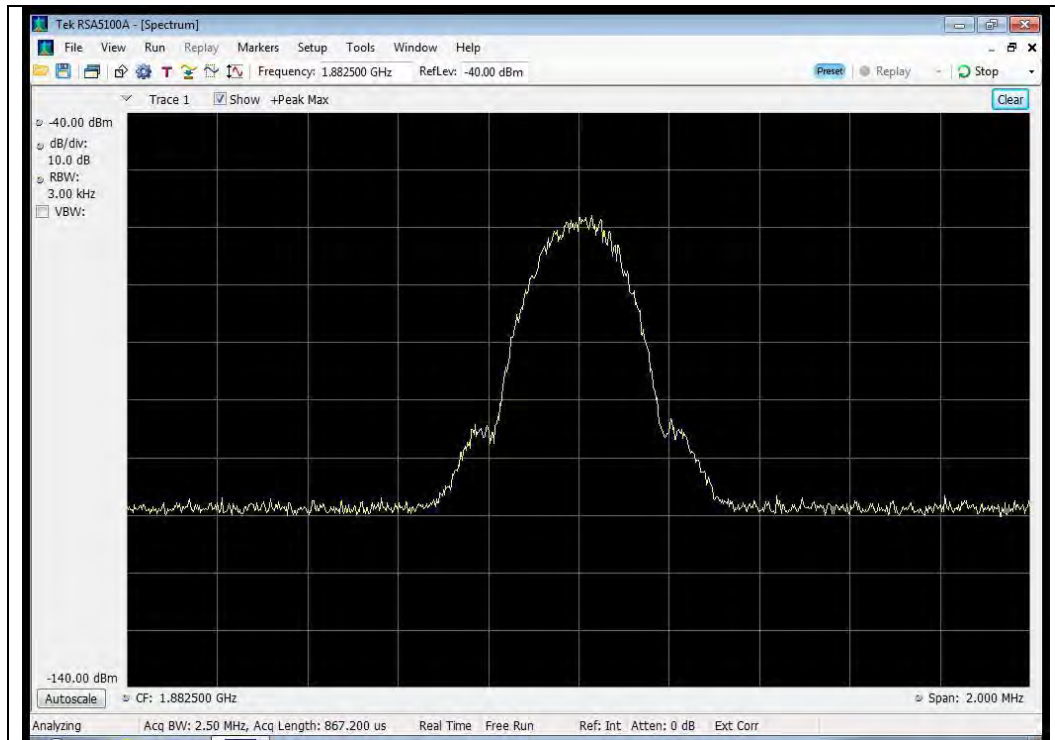


Output

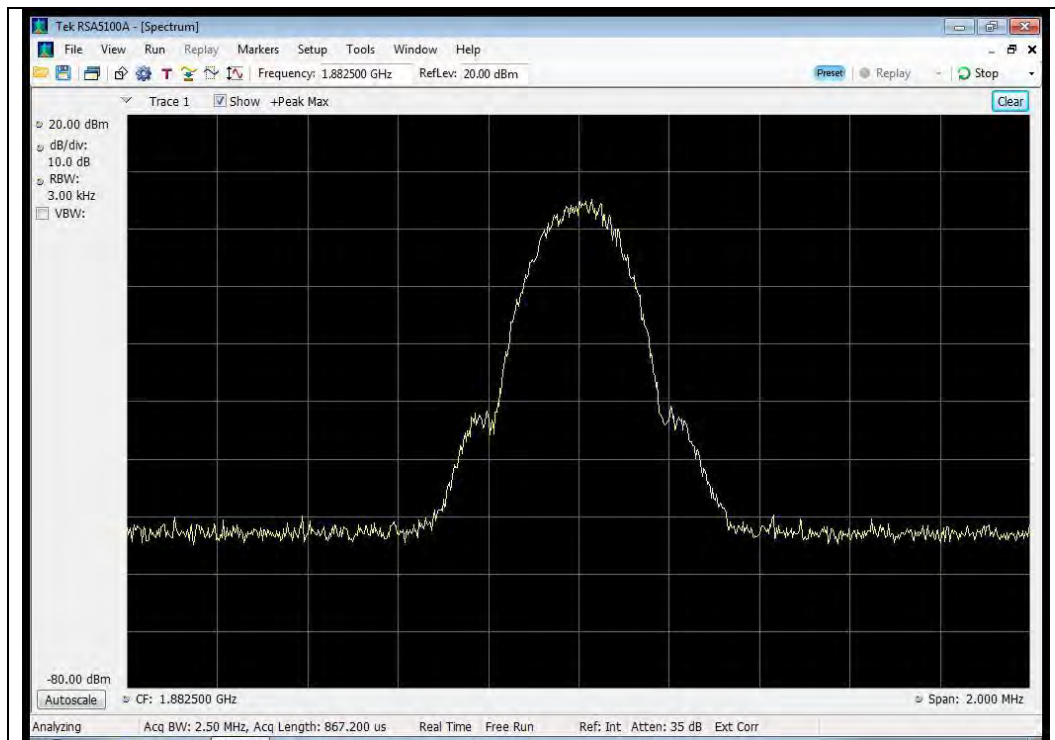


1850 - 1915 MHz Band

Input



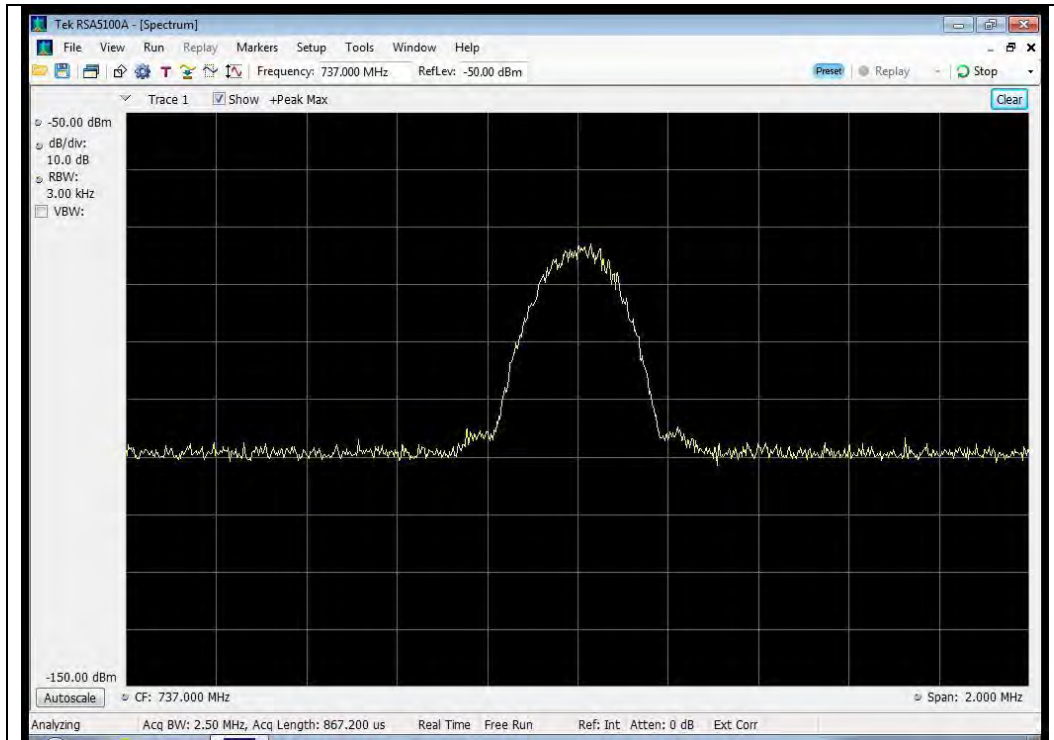
Output



GSM Downlink Test Plots

728 - 746 MHz Band

Input



Output

