



## **Compliance Testing, LLC**

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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# **Test Report**

**Prepared for: Cellphone-Mate Inc.**

**Model: CM M2M**

**Description: Dual-Band Cellphone Signal Booster**

**FCC ID: RSNM2M**

**To**

**FCC Part 20**

**Date of Issue: December 2, 2013**

**On the behalf of the applicant:**

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

**To the attention of:**

**Hongtao Zhan, CEO  
Ph: (510) 770-0469  
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**Prepared By  
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Project No: p1370003**

**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      | December 2, 2013 | Greg Corbin | Original Document                                                                                                        |
| 2.0      | January 28, 2014 | Greg Corbin | Corrected rule sections in the test summary table for conducted spurious, Noise Limits, and Uplink Inactivity on page 7. |
|          |                  |             |                                                                                                                          |



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## ILAC / A2LA

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

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

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

Testing Certificate Number: **2152.01**



FCC OATS Reg, #933597

IC Reg. #2044A-1

**Non-accredited tests contained in this report:**

**N/A**



## Test and Measurement Data

Subpart  
2.1033(c)(14):

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Part 2, Subpart J and the following individual Parts: 20.21 in conjunction with latest version of 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 – 29.4              | 38.2 – 63.9  | 958.1 – 970.7   |

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

## EUT Description

**Model:** CM M2M

**Description:** Dual-Band Cell-Phone Signal Booster

**Firmware:** N/A

**Software:** Version 1.1

## Additional Information:

The EUT is a **Direct Connect** bi-directional amplifier for the boosting of cellular phone signals and data communication devices.

The following frequency bands are used by the EUT:

|                        |                                  |             |
|------------------------|----------------------------------|-------------|
| <b>Uplink</b>          | 824 - 849                        | 1850 - 1910 |
| <b>Downlink</b>        | 869 - 894                        | 1930 - 1990 |
| <b>Modulation Type</b> | GSM, CDMA, EDGE, HSPA, EVDO, LTE |             |

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

The modulation types and emission designators listed in the tables represent the modulations that the cell phone providers use for each frequency band. 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.

## EUT Operation during Tests

The EUT was in a normal operating condition.

The EUT is powered by an 120 vac to +12 vdc wall adapter.



**Accessories:**

| Qty | Description         | Mfg      | Model           | S/N |
|-----|---------------------|----------|-----------------|-----|
| 1   | I.T.E. Power Supply | Surecall | G101U-120100-B1 | N/A |



## 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)<br>20.21(e)(8)(i)(C)<br>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<br>22.917(a)<br>24.238(a)                            | Conducted Spurious Emissions | Pass            |                                                                                                                                                                                                                                                      |
| 20.21(e)(8)(i)(A)                                           | Noise Limits                 | Pass            |                                                                                                                                                                                                                                                      |
| 20.21(e)(8)(i)(I)                                           | Uplink Inactivity            | N/A             | The uplink and downlink noise power is less than -70 dBm/MHz and the uplink gain is less than 23 dB, therefor the signal booster meets the requirements for section 20.21H (Transmit Power Off Mode) and the Uplink Inactivity test is not required. |
| 21(e)(8)(i)(C)                                              | Variable Gain                | Pass            |                                                                                                                                                                                                                                                      |
| 2.1049                                                      | Occupied Bandwidth           | Pass            |                                                                                                                                                                                                                                                      |
| 20.21(e)(8)(ii)(A)                                          | Oscillation Detection        | Pass            |                                                                                                                                                                                                                                                      |
| 2.1053                                                      | Radiated Spurious            | Pass            |                                                                                                                                                                                                                                                      |
| 20.21(e)(8)(i)(B)                                           | Spectrum Block Filtering     | N/A             | This only applies to devices utilizing spectrum block filtering                                                                                                                                                                                      |



## Authorized Frequency Band

**Name of Test:**

Authorized Frequency Band

**Engineer:** Greg Corbin

**Test Equipment Utilized:**

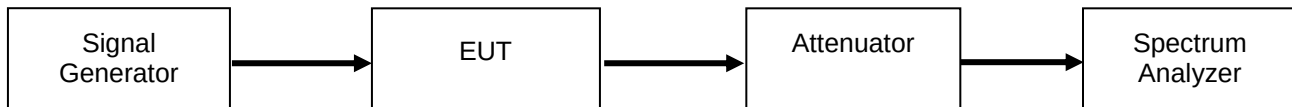
i00424, SMU 200A - S/N:101369

**Test Date:** 11/19/2013

## Test Procedure

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

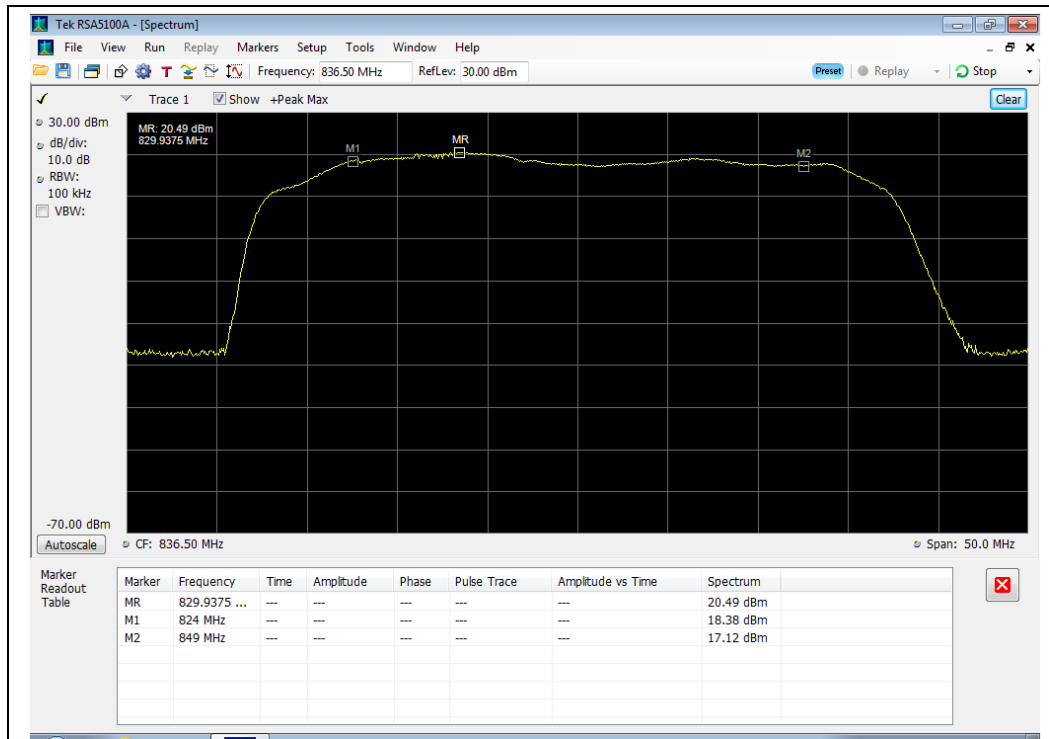
## Test Setup



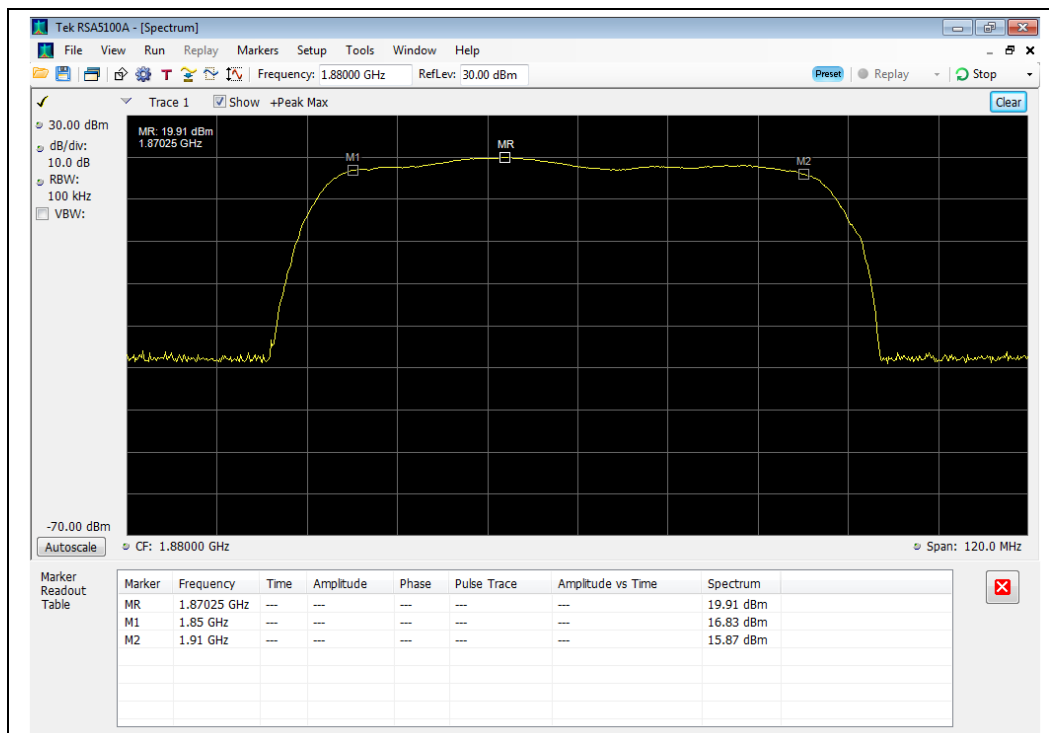


## Uplink Test Results

### 824 - 849 MHz Band



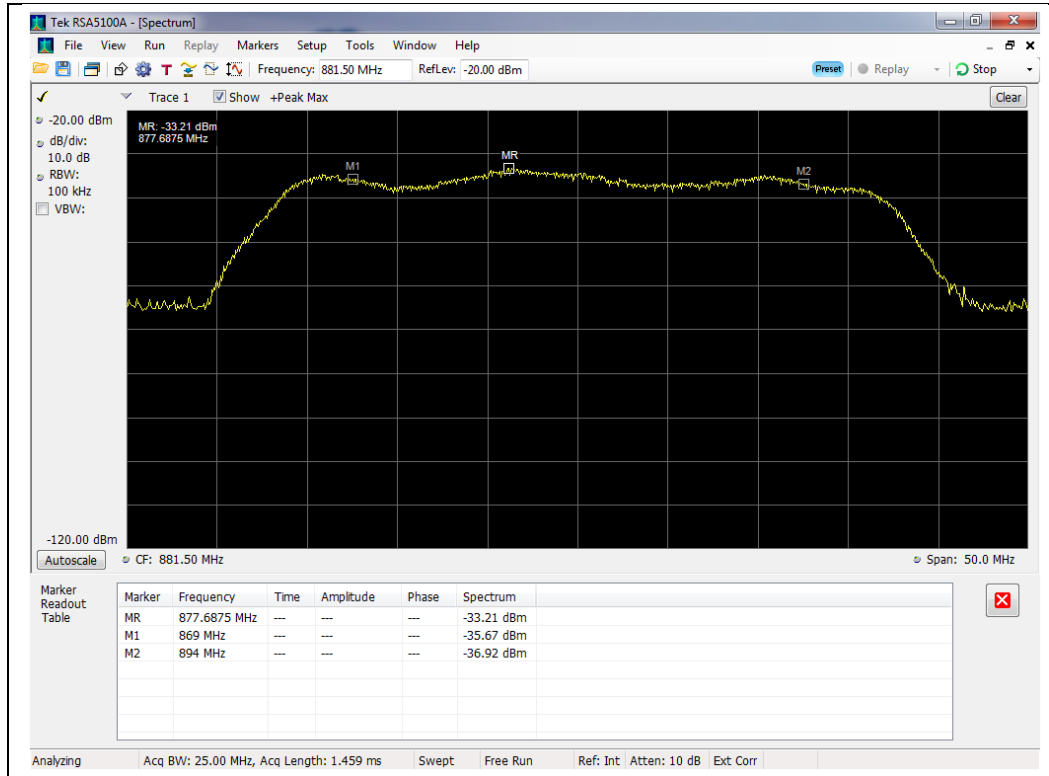
### 1850 - 1910 MHz Band



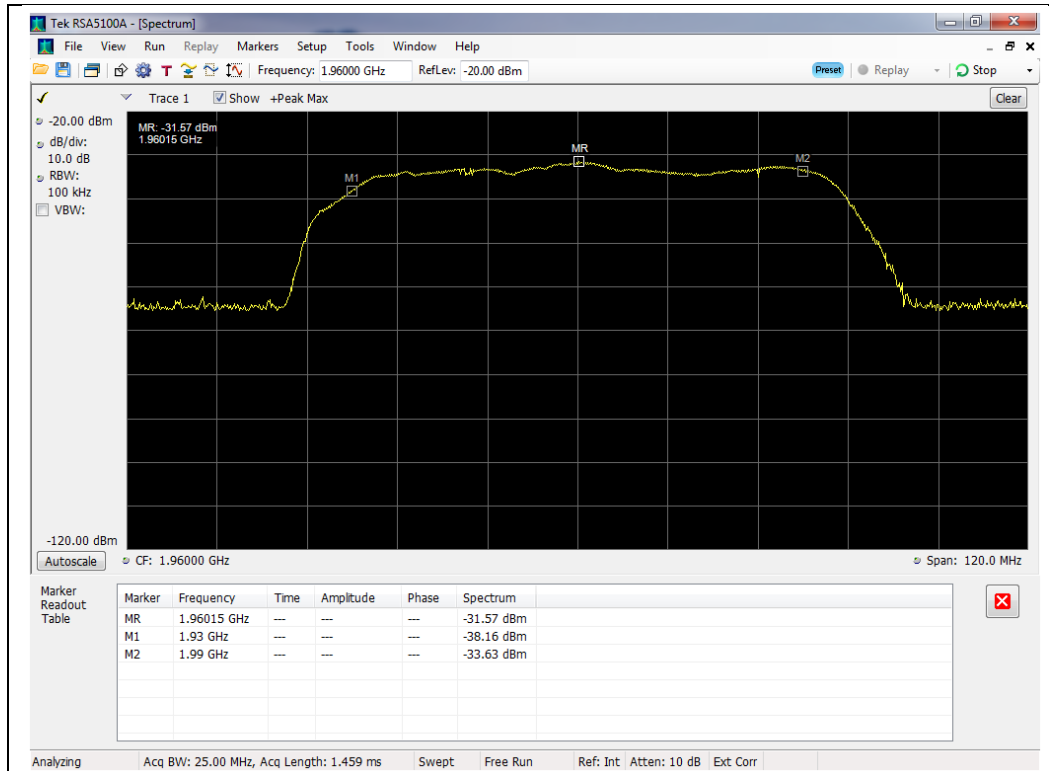


## Downlink Test Results

### 869 - 894 MHz Band



### 1930 - 1990 MHz Band





## Maximum Power and Gain

**Name of Test:** Maximum Power and Gain  
**Test Equipment Utilized:** i00424, SMU 200A - S/N:101369

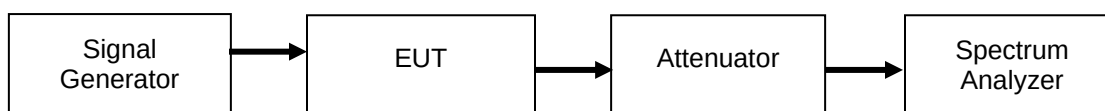
**Engineer:** Greg Corbin  
**Test Date:** 11/19/2013

### Test Procedure

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

The EUT is a Direct Connect device and the Uplink and Downlink gain limit is fixed at 15 dB maximum.

### Test Setup



### Uplink Power Test Results

| Frequency Band (MHz)       | Input Level (dBm) | Output Power (dBm) | Lower Limit (dBm) | Upper Limit (dBm) | Result |
|----------------------------|-------------------|--------------------|-------------------|-------------------|--------|
| 824 - 849 MHz Pulsed GSM   | 16.3              | 27.7               | 17                | 30                | Pass   |
| 824 - 849 MHz AWGN         | 5.8               | 18.3               | 17                | 30                | Pass   |
| 1850 - 1910 MHz Pulsed GSM | 16.9              | 28.5               | 17                | 30                | Pass   |
| 1850 - 1910 MHz AWGN       | 6.3               | 18.4               | 17                | 30                | Pass   |

### Downlink Power Test Results

| Frequency Band (MHz)       | Input Level (dBm) | Output Power (dBm) | Upper Limit (dBm) | Result |
|----------------------------|-------------------|--------------------|-------------------|--------|
| 869 - 894 MHz Pulsed GSM   | -49.7             | -36.4              | 17                | Pass   |
| 869 - 894 MHz AWGN         | -49.7             | -38.0              | 17                | Pass   |
| 1930 - 1990 MHz Pulsed GSM | -47.3             | -34.3              | 17                | Pass   |
| 1930 - 1990 MHz AWGN       | -47.8             | -36.2              | 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 GSM | 829.9375               | 877.6875                 | 11.4             | 15                | 13.3               | 15                  | 1.9        | 9          | -7.1        |
| AWGN       | 829.9375               | 877.6875                 | 12.5             | 15                | 11.7               | 15                  | 0.8        | 9          | -8.2        |
| Pulsed GSM | 1870.25                | 1960.15                  | 11.6             | 15                | 13.0               | 15                  | 1.4        | 9          | -7.6        |
| AWGN       | 1870.25                | 1960.15                  | 12.1             | 15                | 11.6               | 15                  | 0.5        | 9          | -8.5        |



## Intermodulation

**Name of Test:** Intermodulation  
**Test Equipment Utilized:** i00424, SMU 200A - S/N:101369  
E4407B - S/N:MY41444836

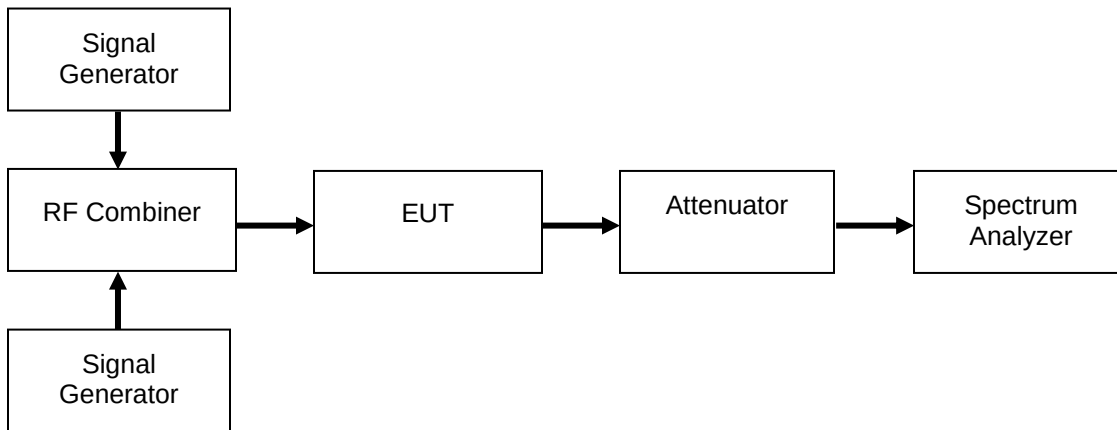
**Engineer:** Greg Corbin

**Test Date:** 10/22/2013

### Test Procedure

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

### Test Setup



### Uplink Test Results

| Frequency Band (MHz) | Intermodulation Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------------------------|-------------|--------|
| 824 - 849 MHz        | -32.3                       | -19         | Pass   |
| 1850 - 1910 MHz      | -25.3                       | -19         | Pass   |

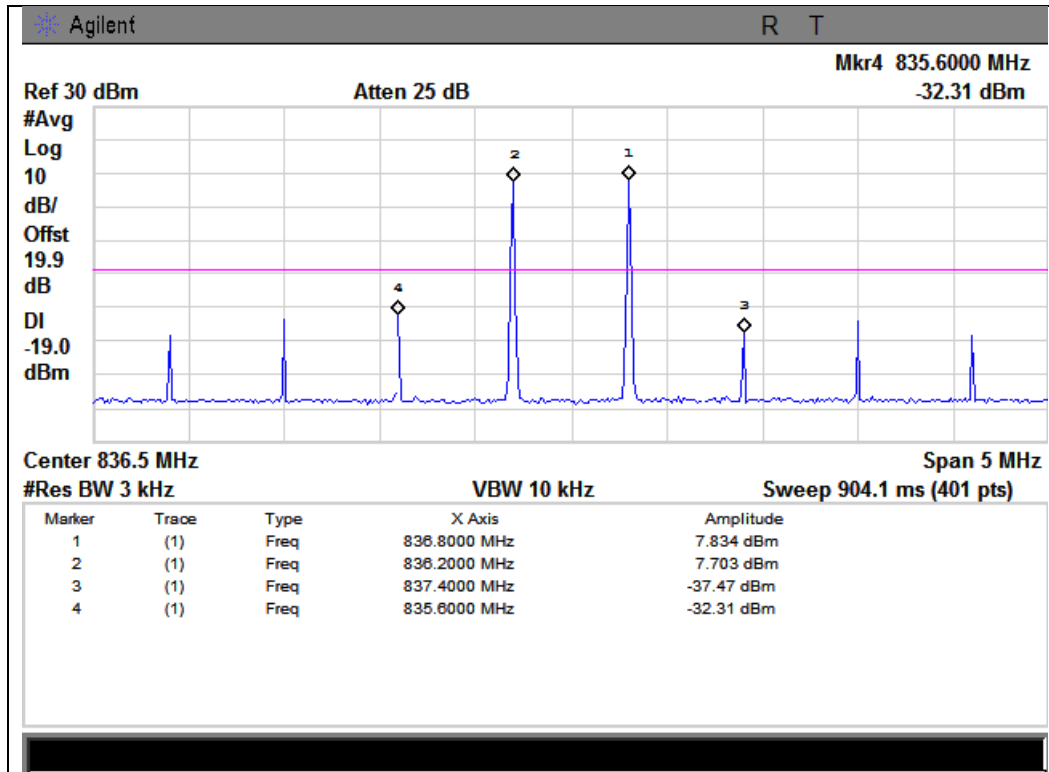
### Downlink Test Results

| Frequency Band (MHz) | Intermodulation Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------------------------|-------------|--------|
| 869 - 894 MHz        | -83.9                       | -19         | Pass   |
| 1930 - 1990 MHz      | -81.3                       | -19         | Pass   |

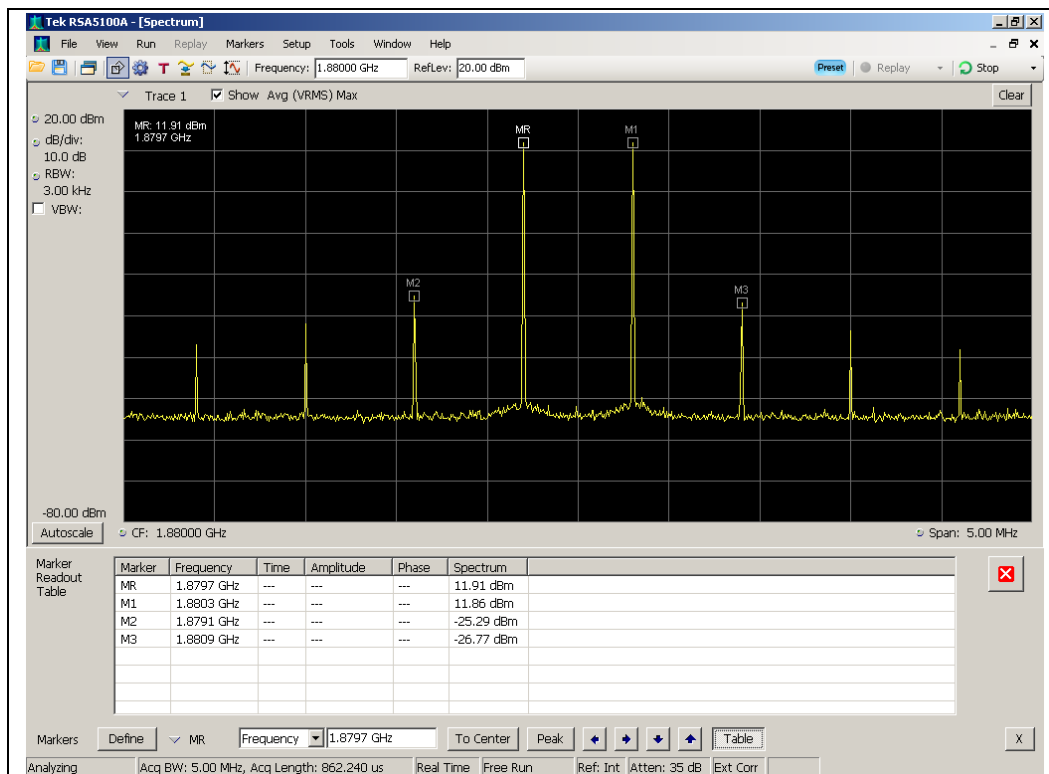


## Uplink Test Results

### 824 - 849 MHz Band



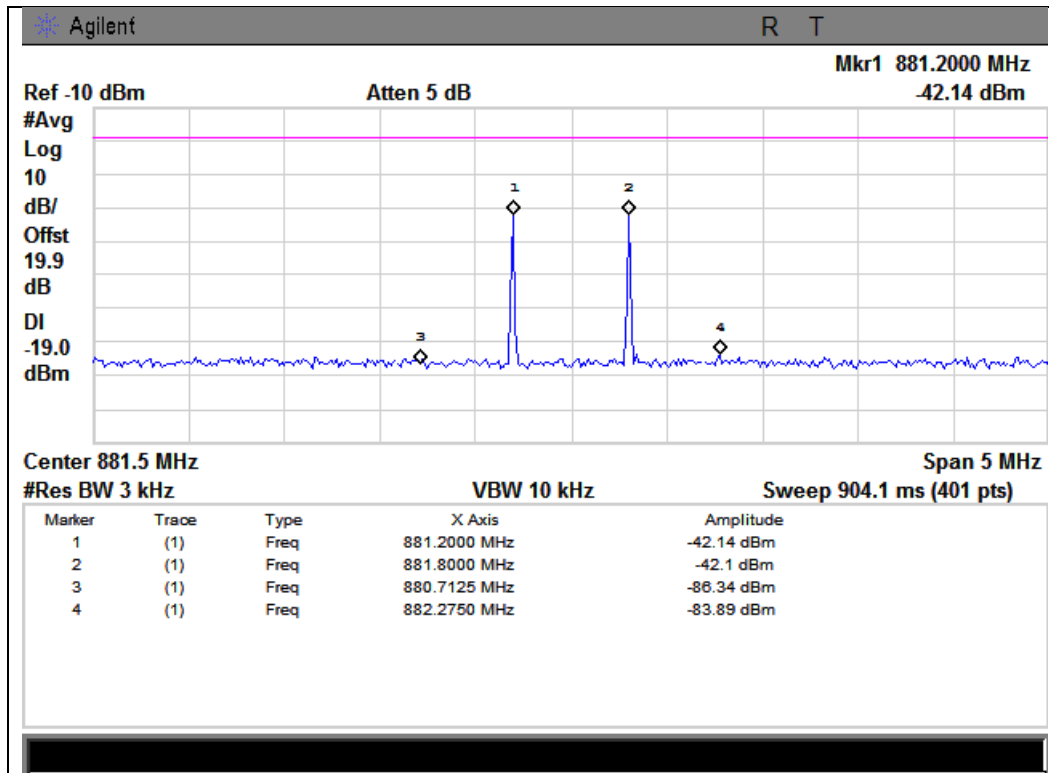
### 1850 - 1910 MHz Band



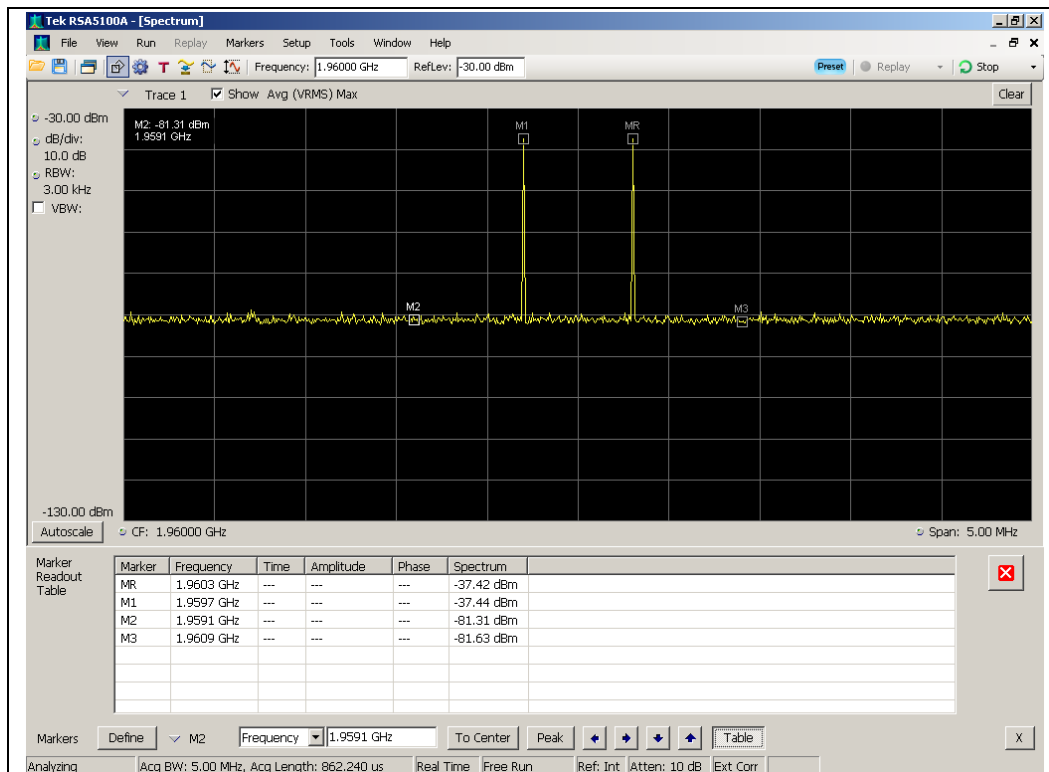


## Downlink Test Results

### 869 - 894 MHz Band



### 1930 - 1990 MHz Band





## Out-of-Band Emissions

**Name of Test:**

Out-of-Band Emissions

**Engineer:** Greg Corbin

**Test Equipment Utilized:**

i00424, SMU 200A - S/N:101369

**Test Date:** 11/21/2013

### Test Procedure

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

The following formula is used for calculating the limits.

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

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 |
|----------------------|-----------|----------------------|-------------|--------|
| 824 - 849            | Lower     | -32.9                | -19         | Pass   |
| 824 - 849            | Upper     | -34.5                | -19         | Pass   |
| 1850 - 1910          | Lower     | -33.4                | -19         | Pass   |
| 1850 - 1910          | Upper     | -72                  | -19         | Pass   |

### CDMA Uplink Test Results

| Frequency Band (MHz) | Band Edge | Measured Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------|----------------------|-------------|--------|
| 824 - 849            | Lower     | -35.2                | -19         | Pass   |
| 824 - 849            | Upper     | -36.8                | -19         | Pass   |
| 1850 - 1910          | Lower     | -42.7                | -19         | Pass   |
| 1850 - 1910          | Upper     | -62.2                | -19         | Pass   |

### WCDMA Uplink Test Results

| Frequency Band (MHz) | Band Edge | Measured Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------|----------------------|-------------|--------|
| 824 - 849            | Lower     | -34.2                | -19         | Pass   |
| 824 - 849            | Upper     | -38.4                | -19         | Pass   |
| 1850 - 1910          | Lower     | -39.4                | -19         | Pass   |
| 1850 - 1910          | Upper     | -53.9                | -19         | Pass   |



### GSM Downlink Test Results

| Frequency Band (MHz) | Band Edge | Measured Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------|----------------------|-------------|--------|
| 869 - 894            | Lower     | -87.8                | -19         | Pass   |
| 869 - 894            | Upper     | -88                  | -19         | Pass   |
| 1930 - 1990          | Lower     | -88.1                | -19         | Pass   |
| 1930 - 1990          | Upper     | -88.2                | -19         | Pass   |

### CDMA Downlink Test Results

| Frequency Band (MHz) | Band Edge | Measured Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------|----------------------|-------------|--------|
| 869 - 894            | Lower     | -78.3                | -19         | Pass   |
| 869 - 894            | Upper     | -78.1                | -19         | Pass   |
| 1930 - 1990          | Lower     | -78.7                | -19         | Pass   |
| 1930 - 1990          | Upper     | -78.8                | -19         | Pass   |

### WCDMA Downlink Test Results

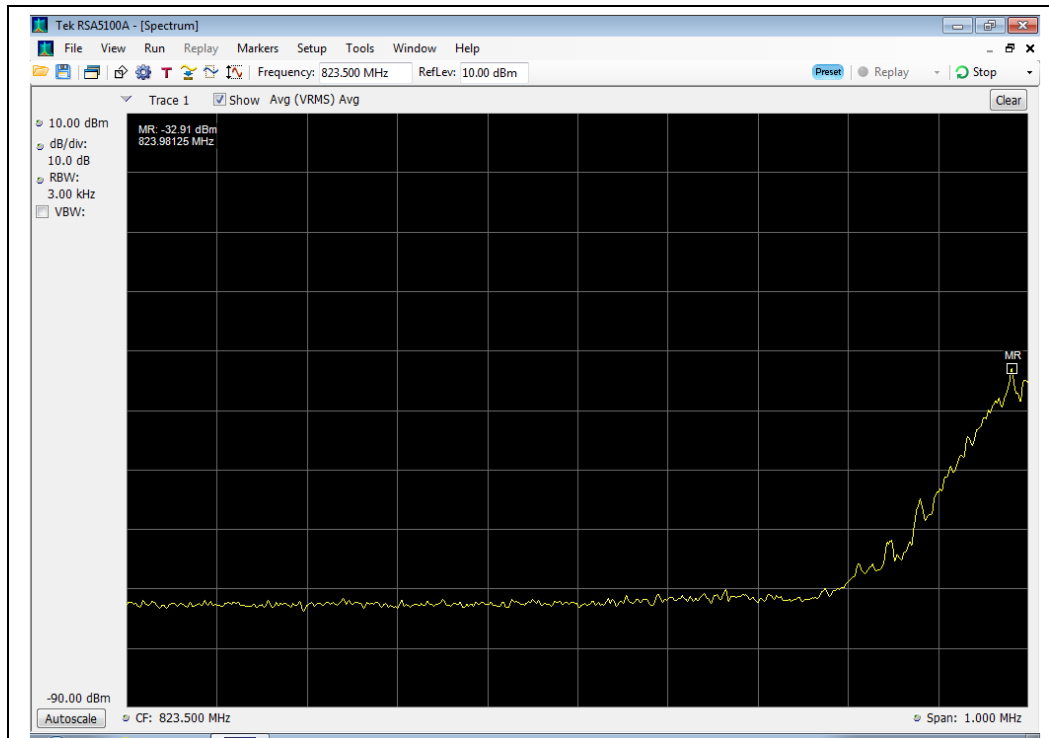
| Frequency Band (MHz) | Band Edge | Measured Level (dBm) | Limit (dBm) | Result |
|----------------------|-----------|----------------------|-------------|--------|
| 869 - 894            | Lower     | -72.8                | -19         | Pass   |
| 869 - 894            | Upper     | -73.4                | -19         | Pass   |
| 1930 - 1990          | Lower     | -73.6                | -19         | Pass   |
| 1930 - 1990          | Upper     | -72.9                | -19         | Pass   |



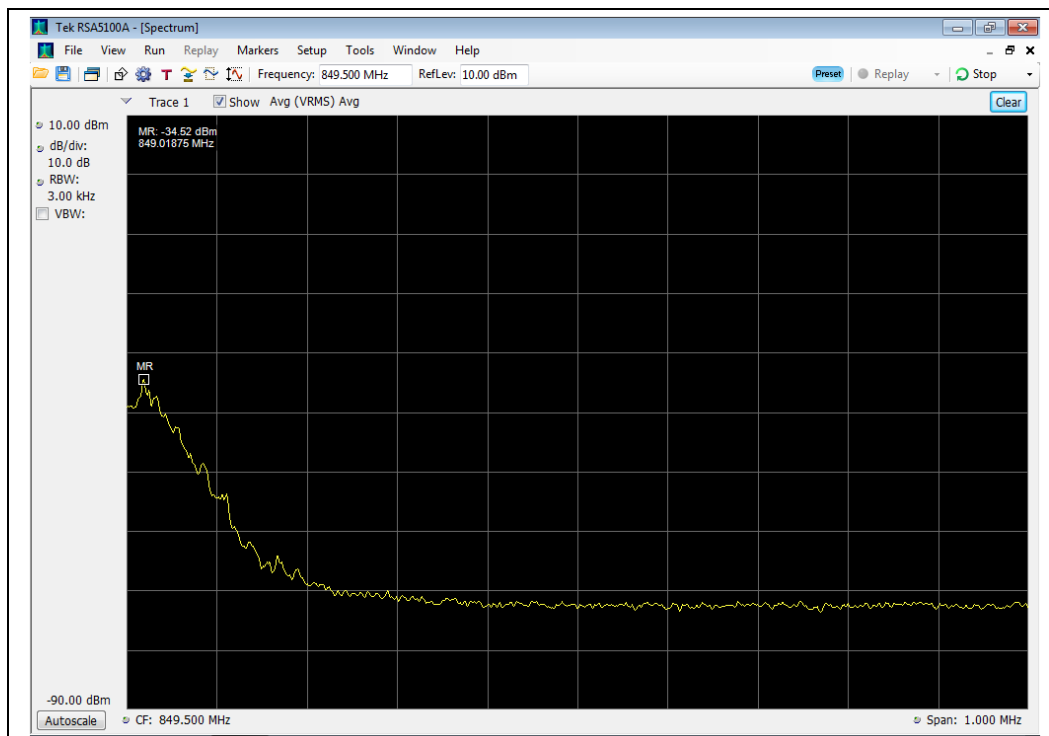
## GSM Uplink Test Plots

824 - 849 MHz Band

Lower Band Edge



Upper Band Edge

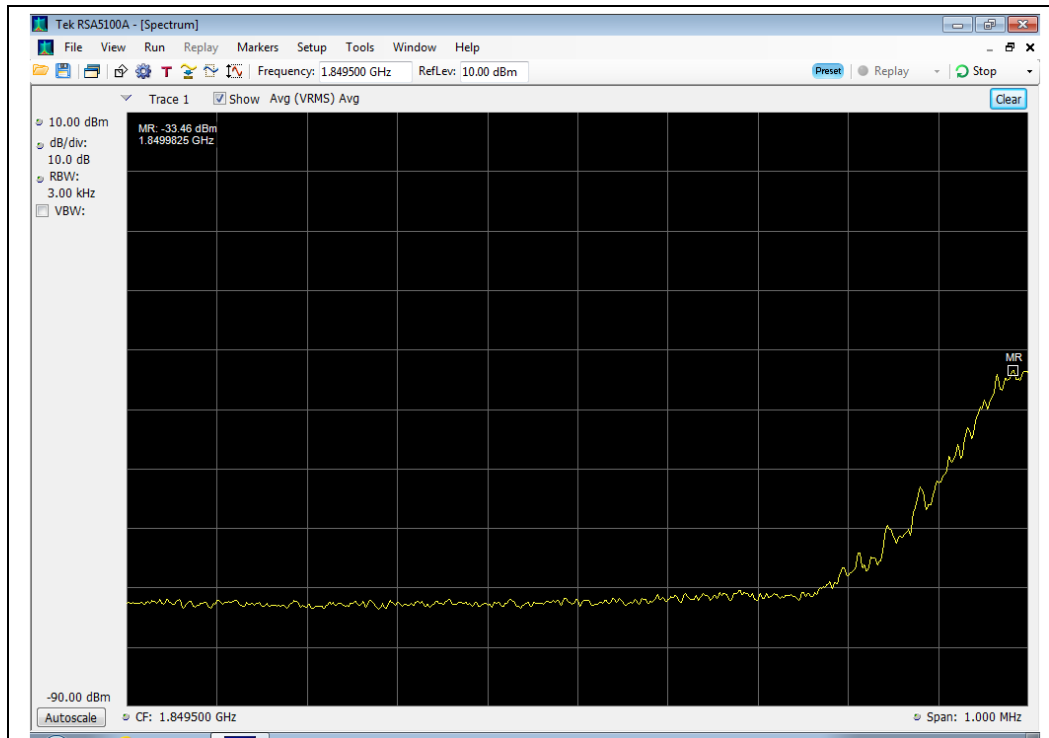




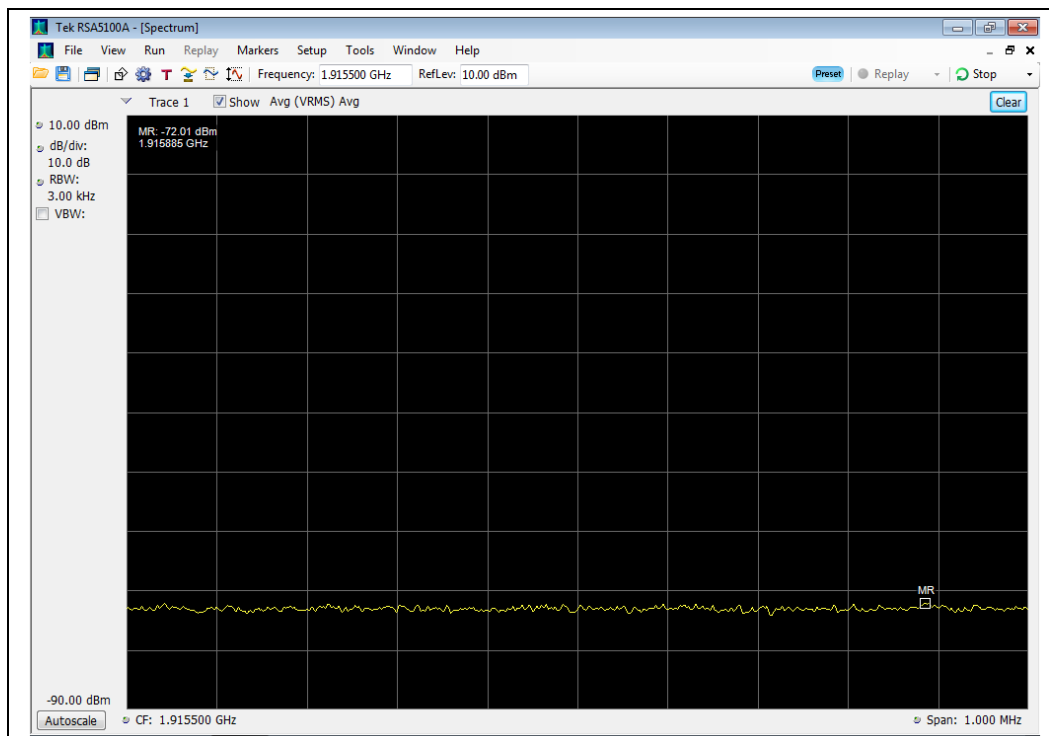
## GSM Uplink Test Plots

1850 - 1910 MHz Band

Lower Band Edge



Upper Band Edge

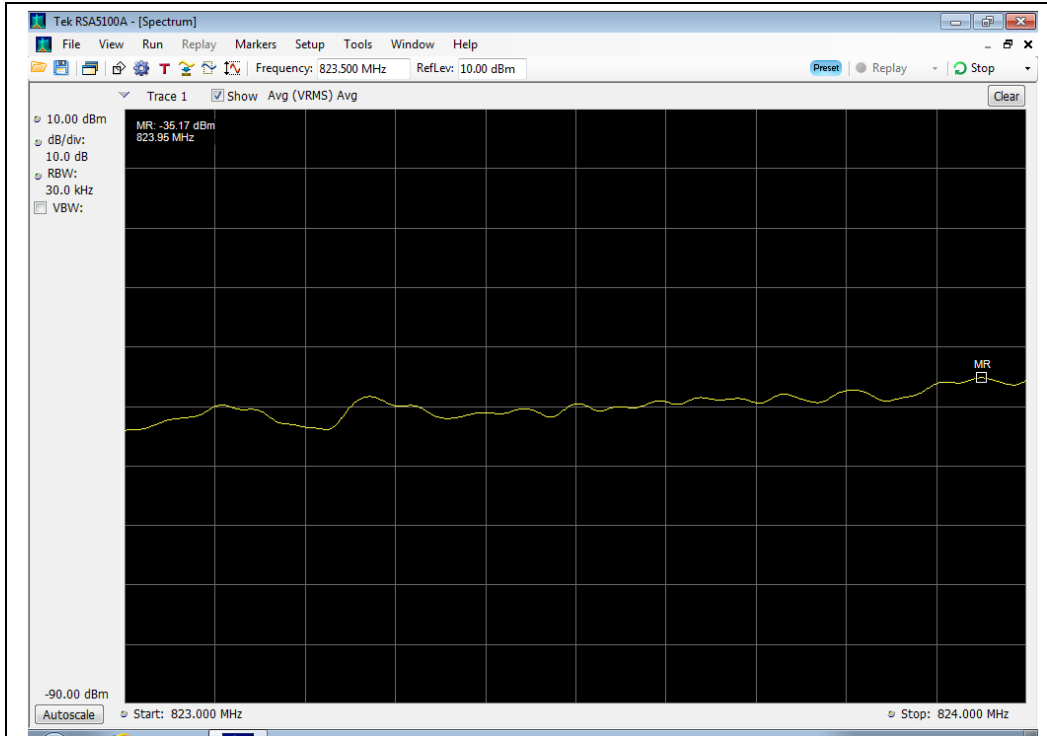




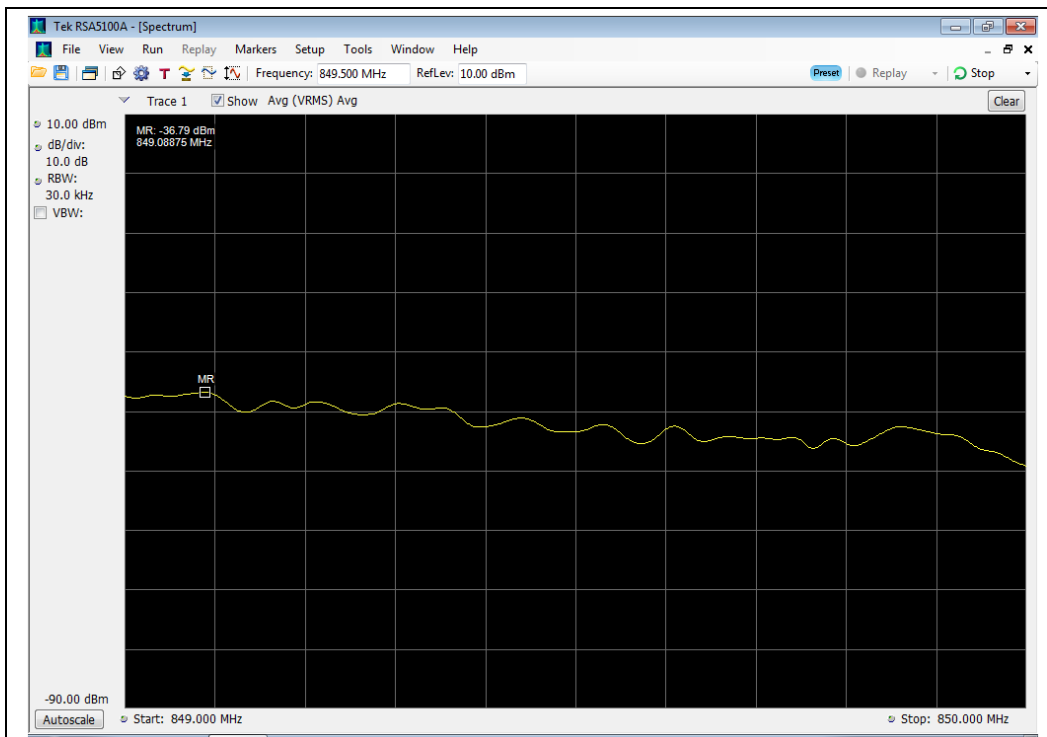
## CDMA Uplink Test Plots

824 - 849 MHz Band

Lower Band Edge



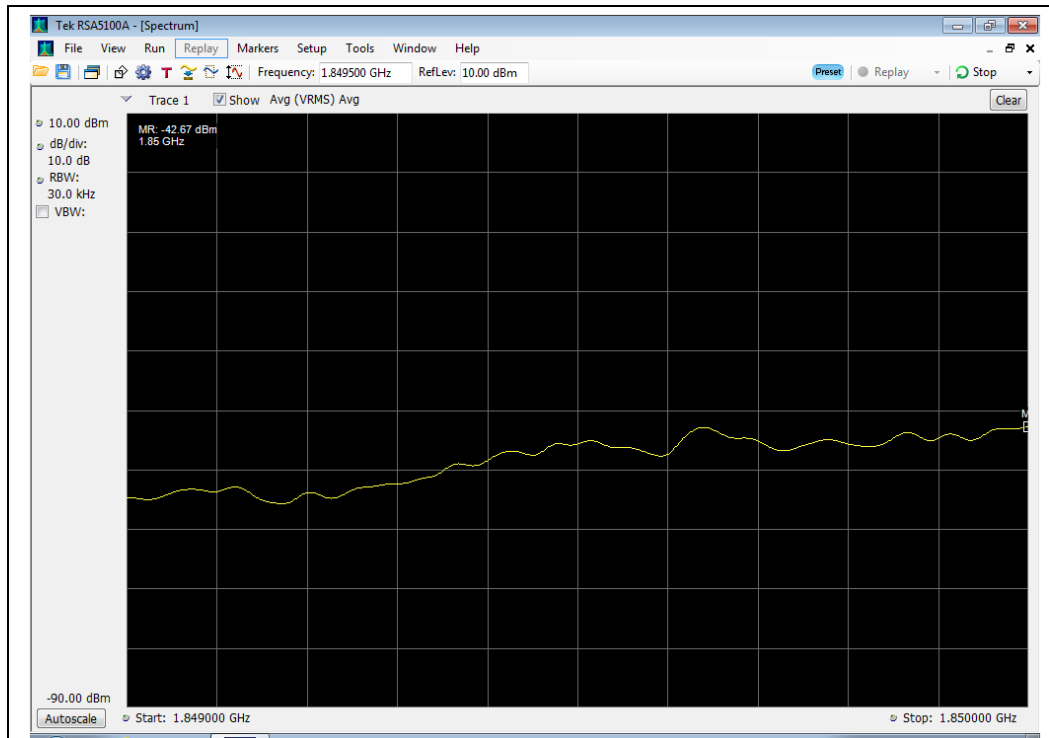
Upper Band Edge



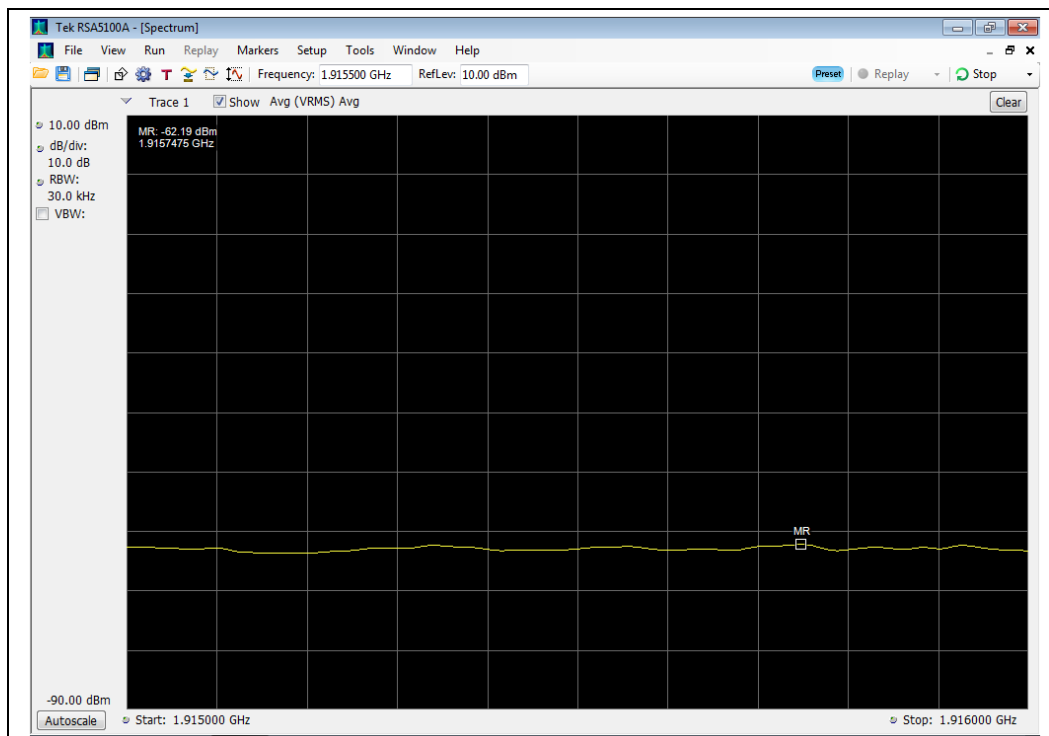


## 1850 - 1910 MHz Band

### Lower Band Edge



### Upper Band Edge

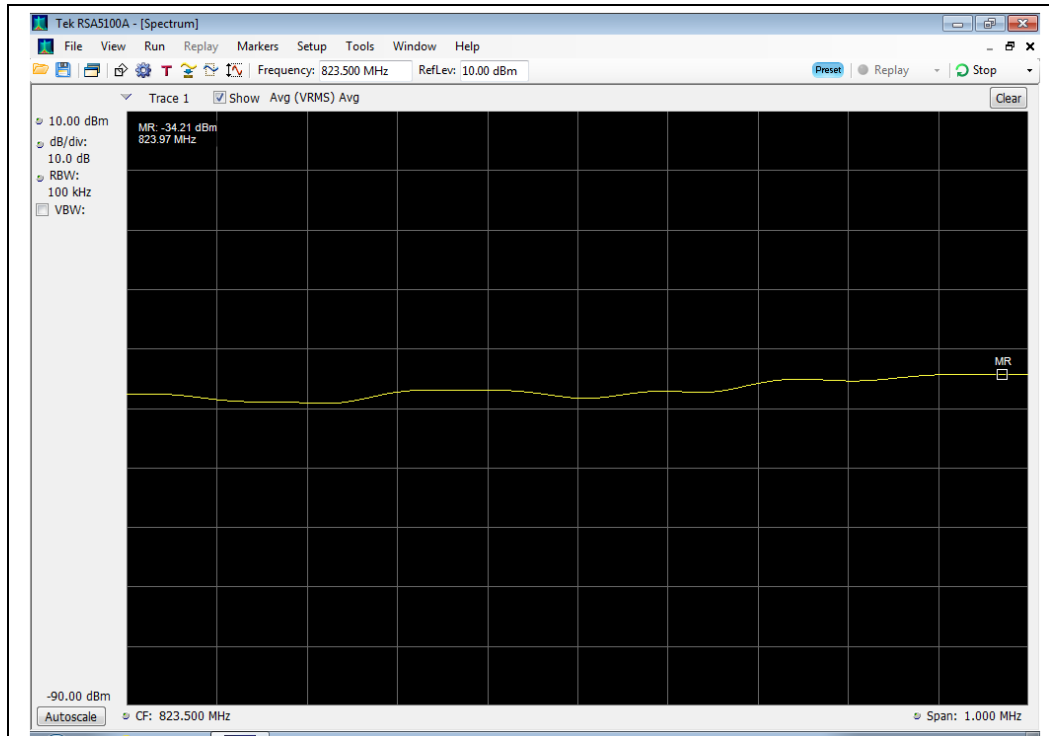




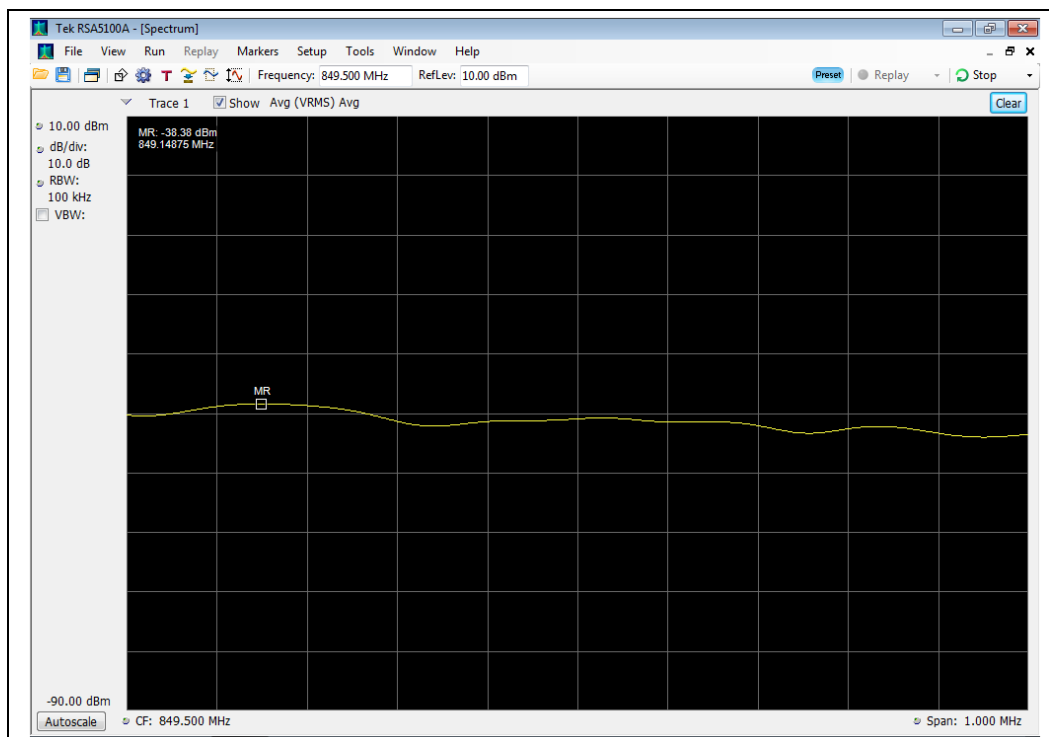
## WCDMA Uplink Test Plots

824 - 849 MHz Band

Lower Band Edge



Upper Band Edge

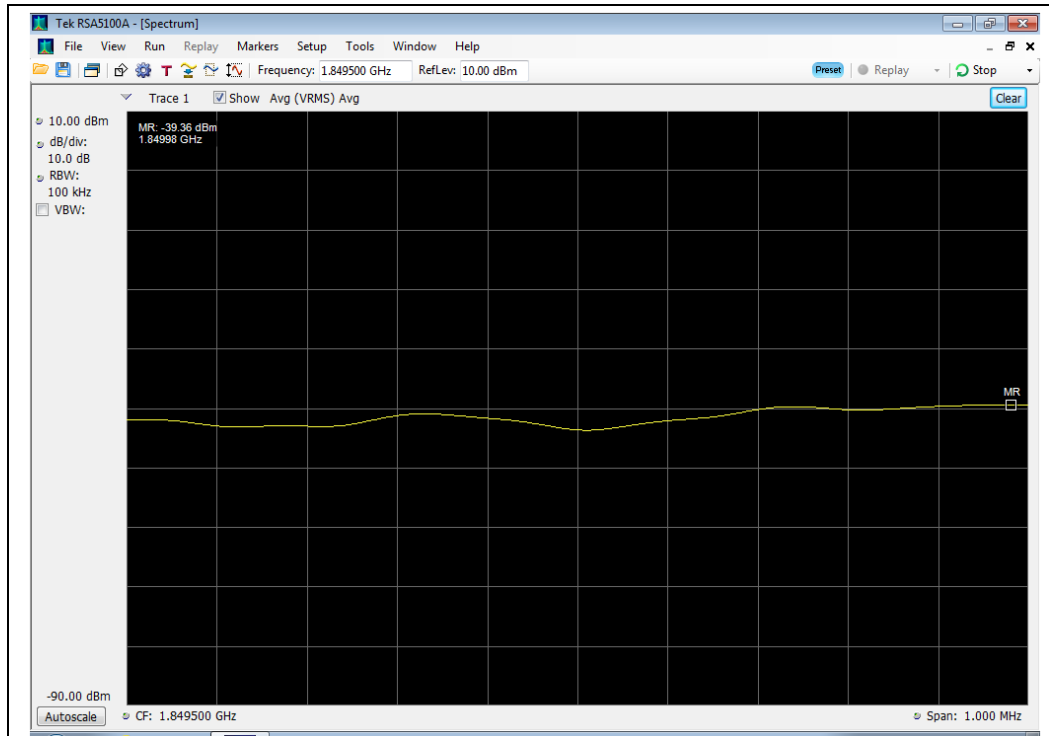




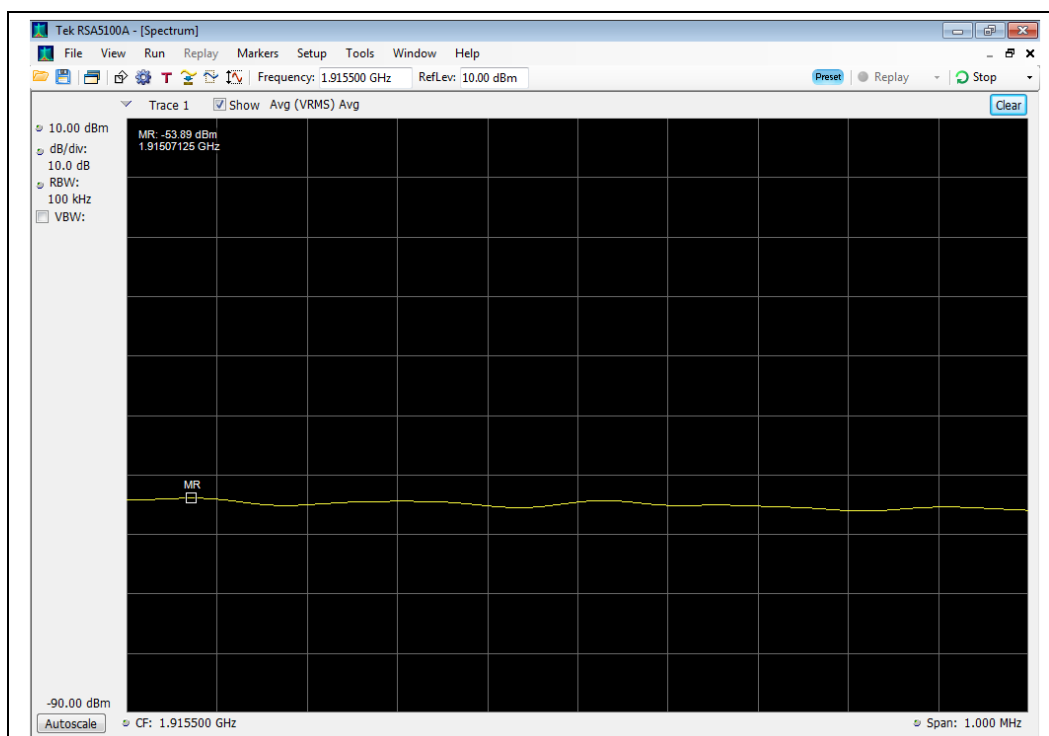
## WCDMA Uplink Test Plots

1850 - 1910 MHz Band

Lower Band Edge



Upper Band Edge

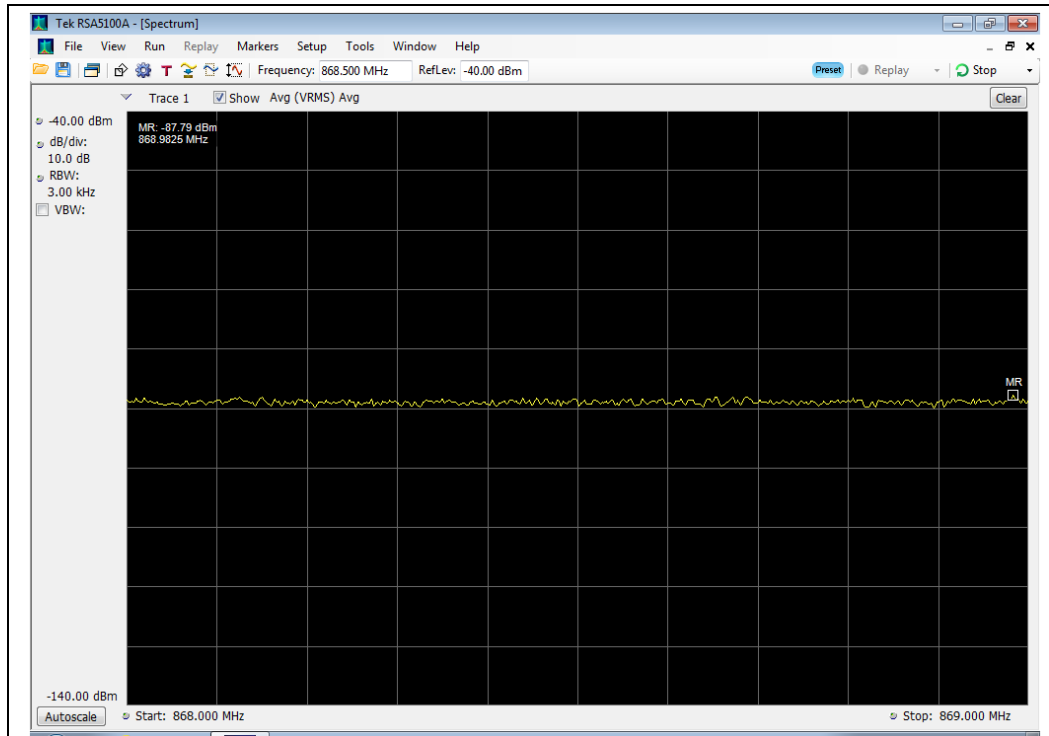




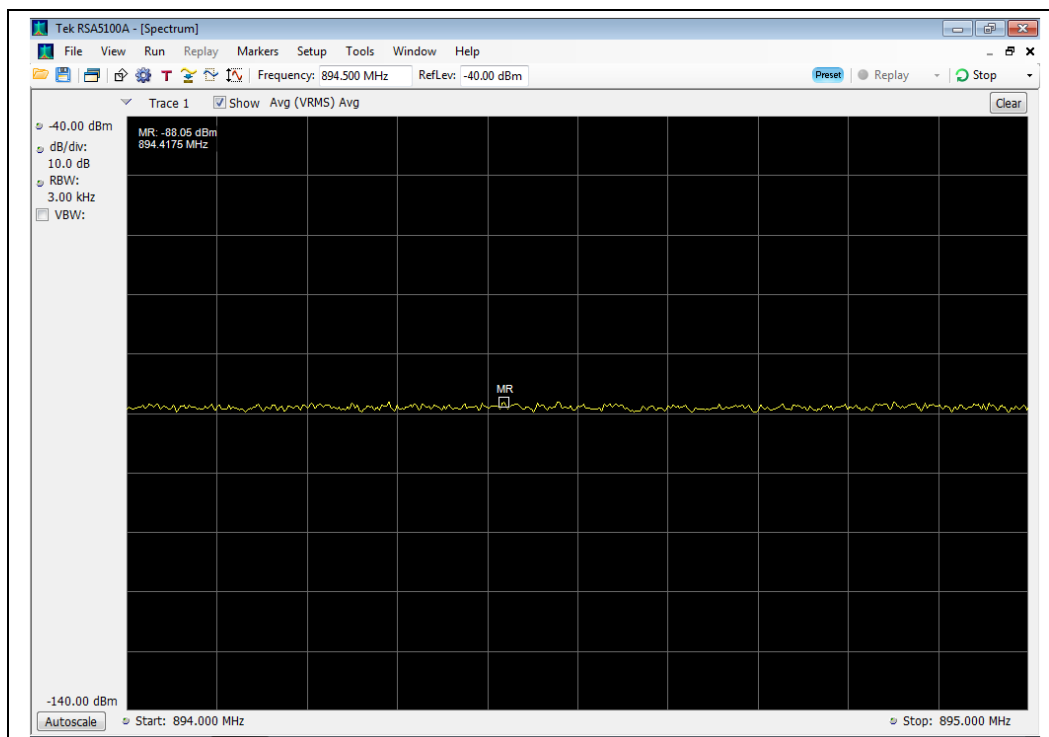
## GSM Downlink Test Plots

869 - 894 MHz Band

Lower Band Edge



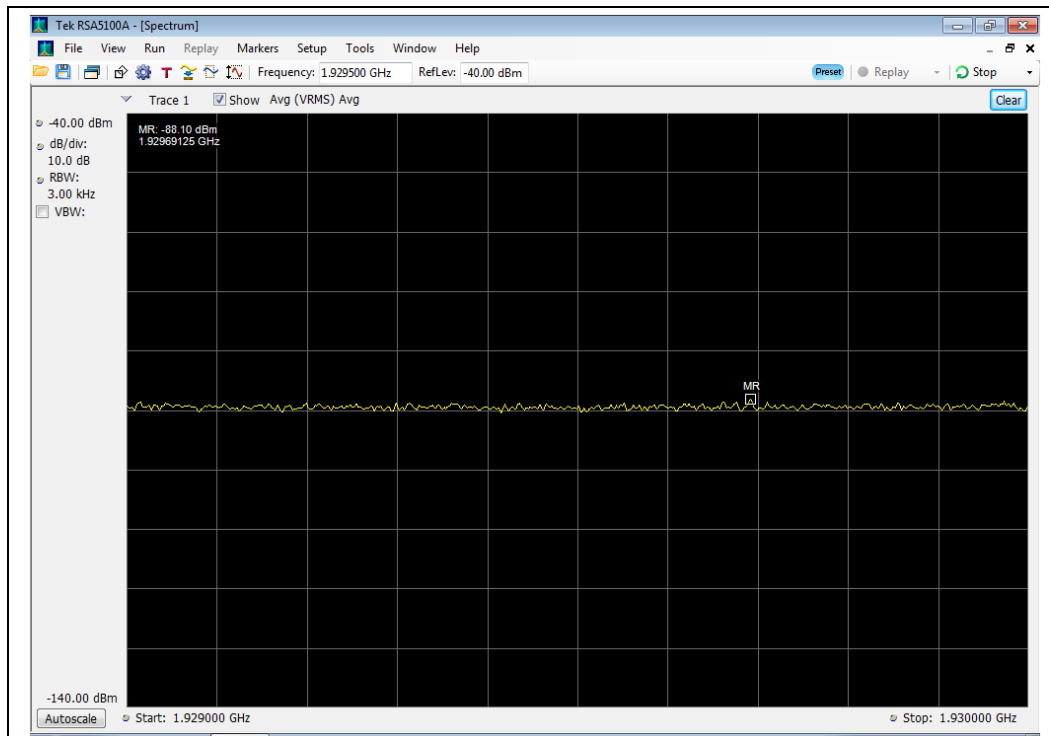
Upper Band Edge



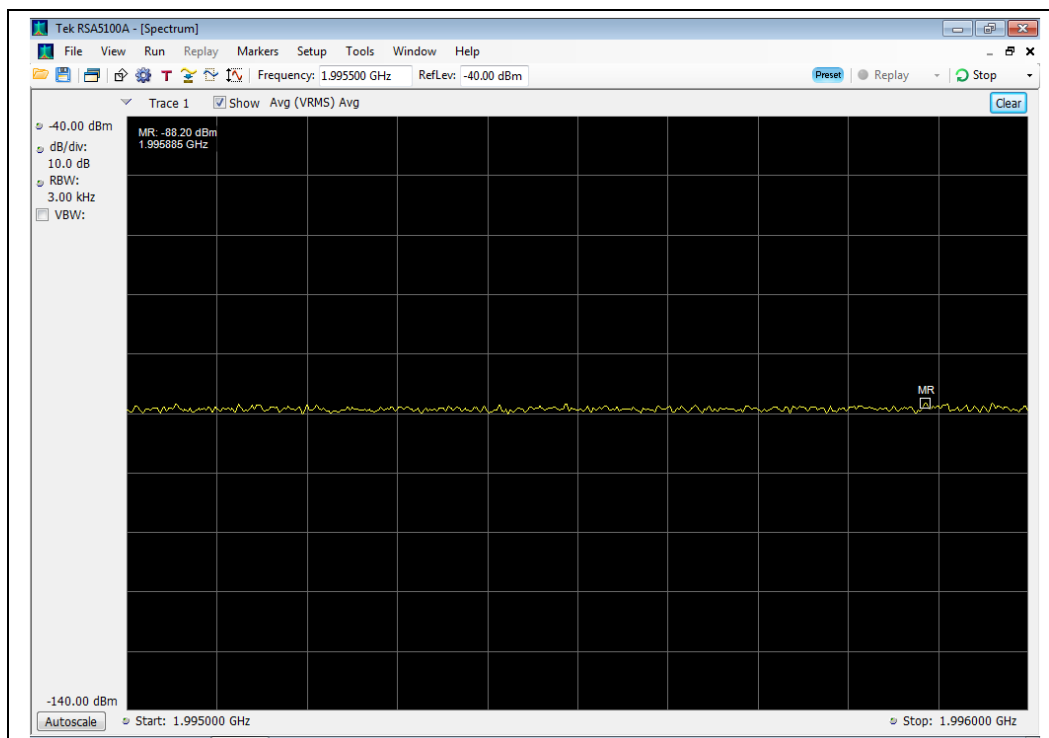


## 1930 - 1990 MHz Band

### Lower Band Edge



### Upper Band Edge

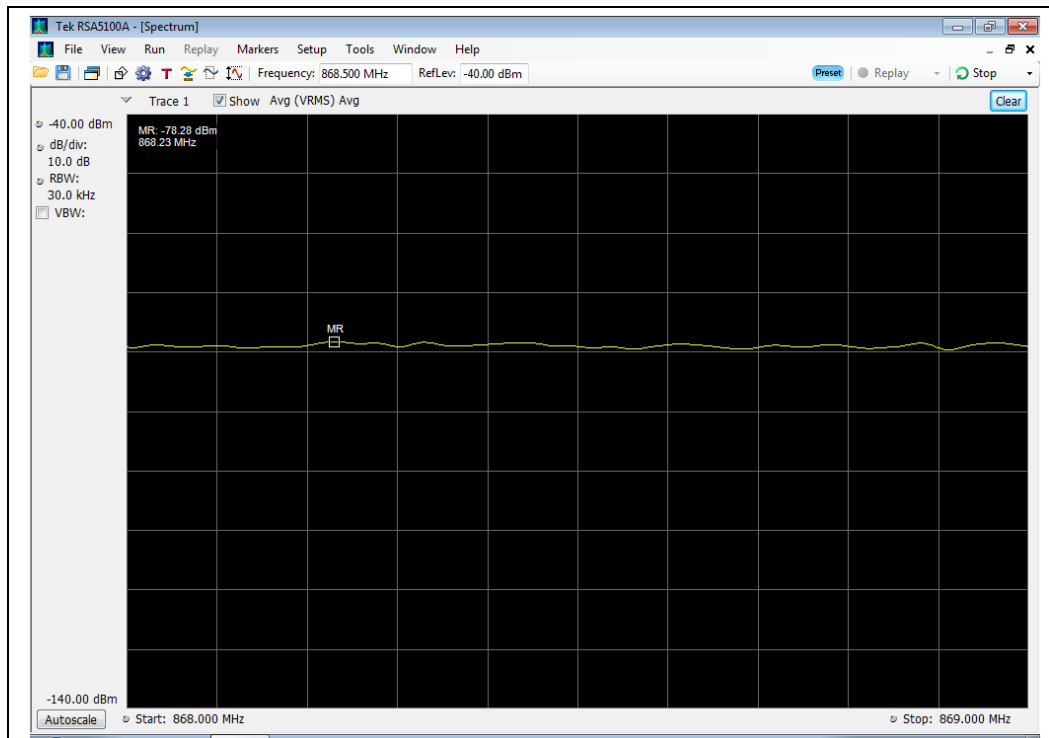




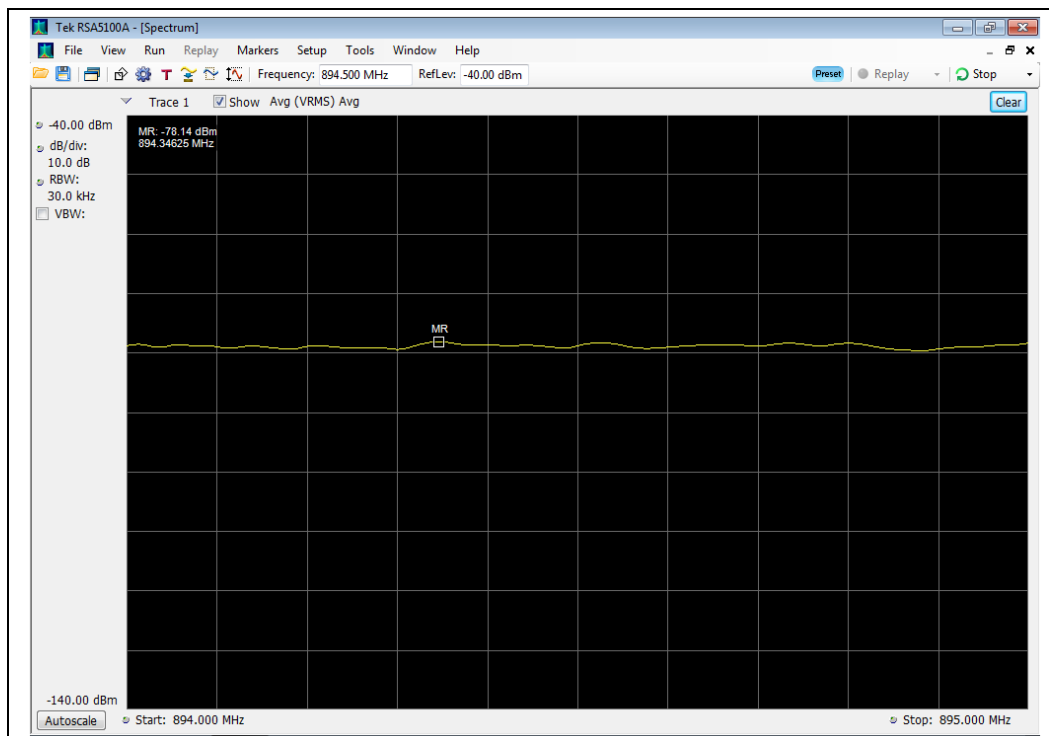
## CDMA Downlink Test Plots

869 - 894 MHz Band

Lower Band Edge



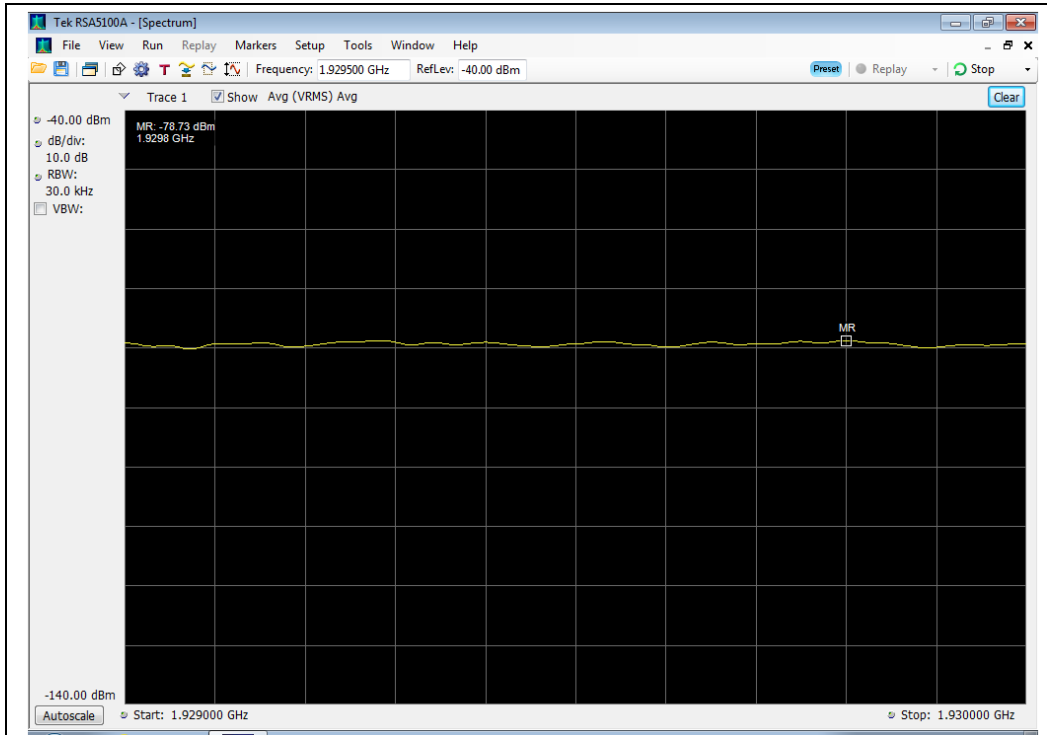
Upper Band Edge



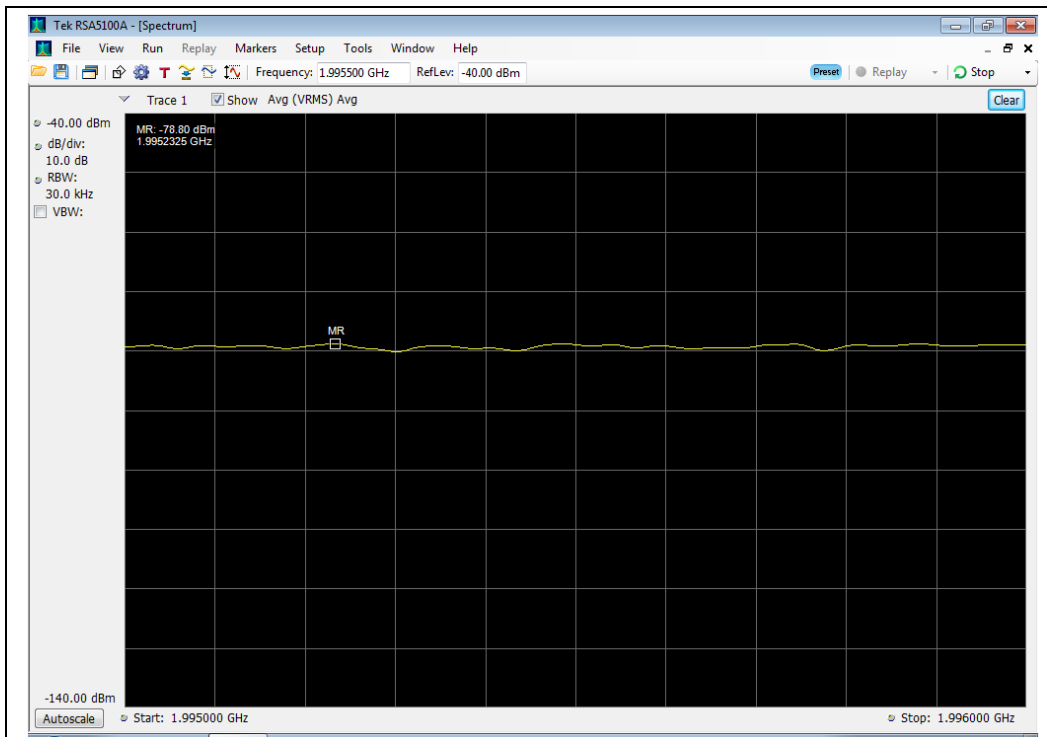


## CDMA Downlink Test Plots 1930 - 1990 MHz Band

### Lower Band Edge



### Upper Band Edge

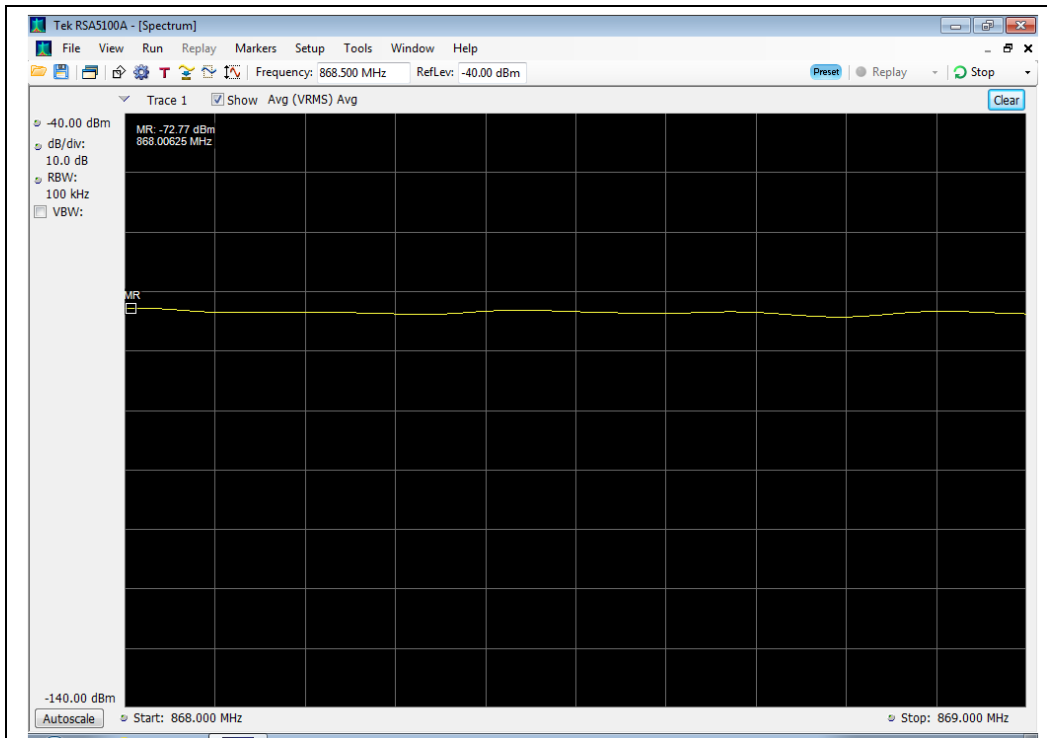




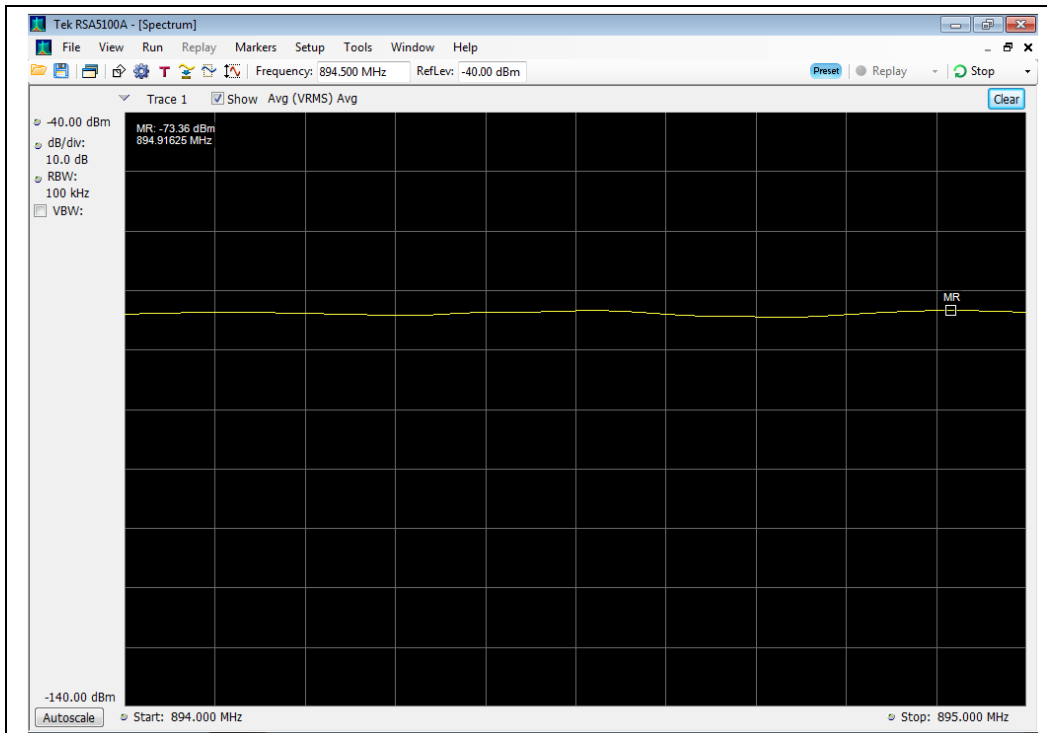
## WCDMA Downlink Test Plots

869 - 894 MHz Band

Lower Band Edge



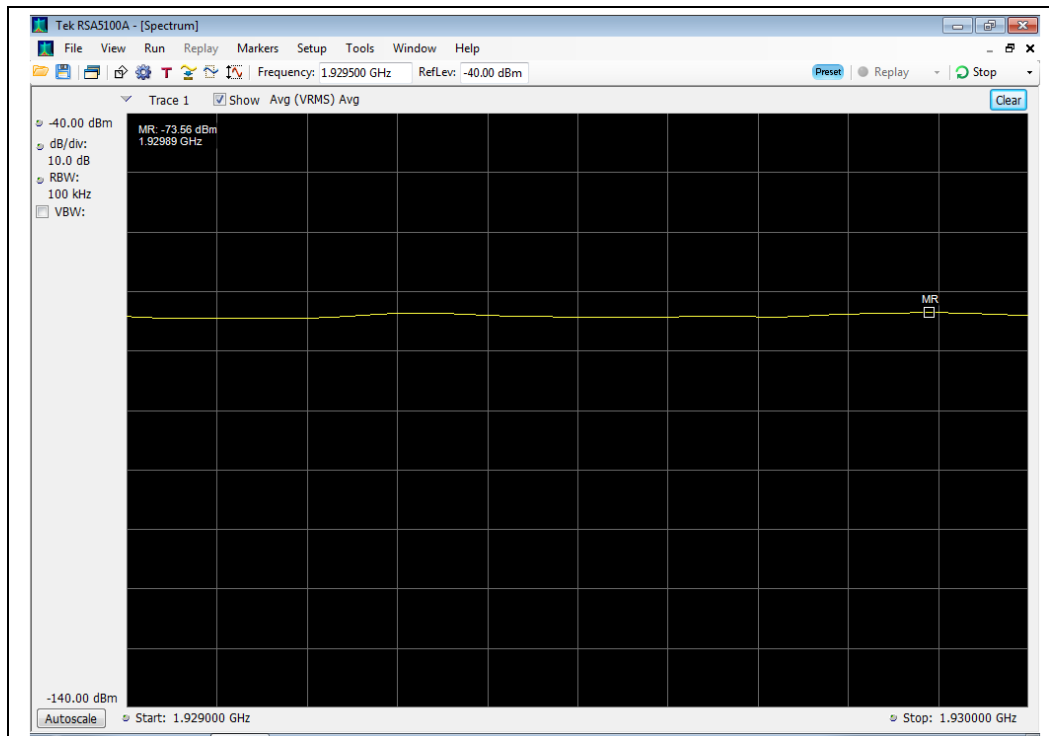
Upper Band Edge



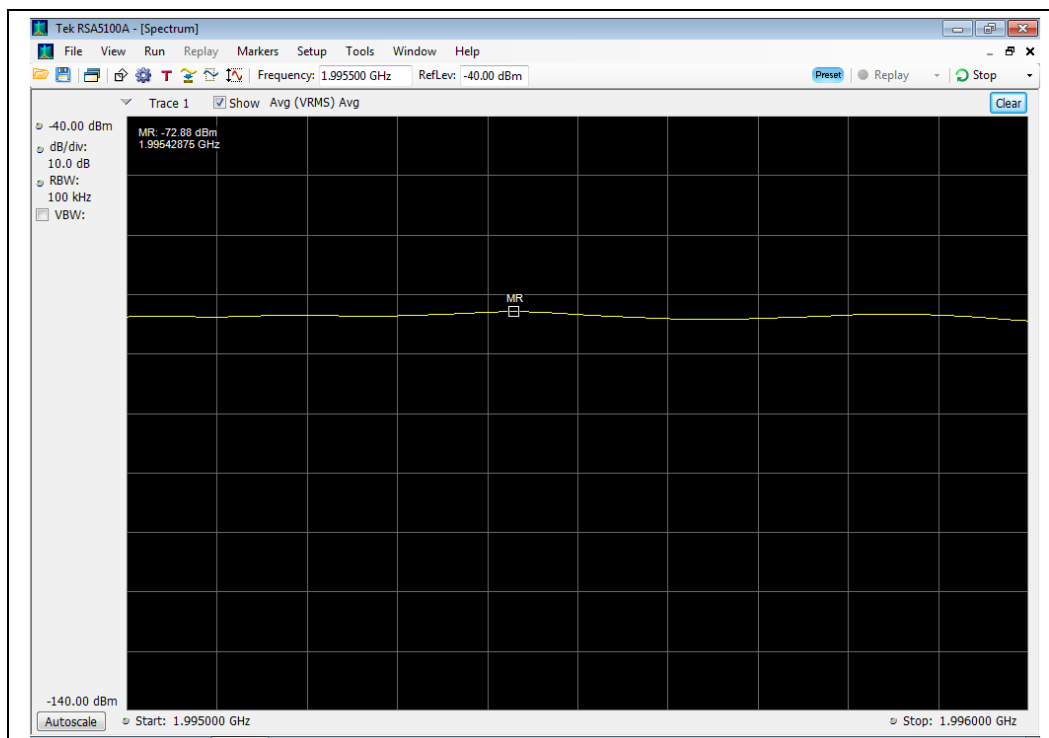


## 1930 - 1990 MHz Band

### Lower Band Edge



### Upper Band Edge





## Conducted Spurious Emissions

**Name of Test:** Conducted Spurious Emissions  
**Test Equipment Utilized:** i00424, SMU 200A - S/N:101369

**Engineer:** Greg Corbin  
**Test Date:** 11/21/2013

### 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 9 kHz 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.

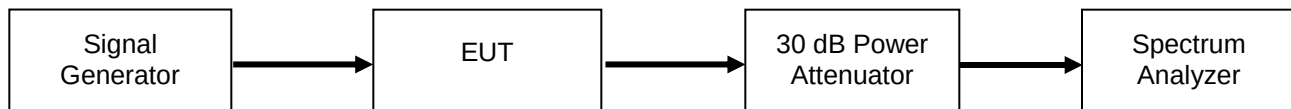
The following formulas are used for calculating the limits.

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

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 |
|----------------------|--------------------------|----------------------|-------------|--------|
| 824 - 849            | 823                      | -38.8                | -13         | Pass   |
| 1850 - 1910          | 17002                    | -30.3                | -13         | Pass   |

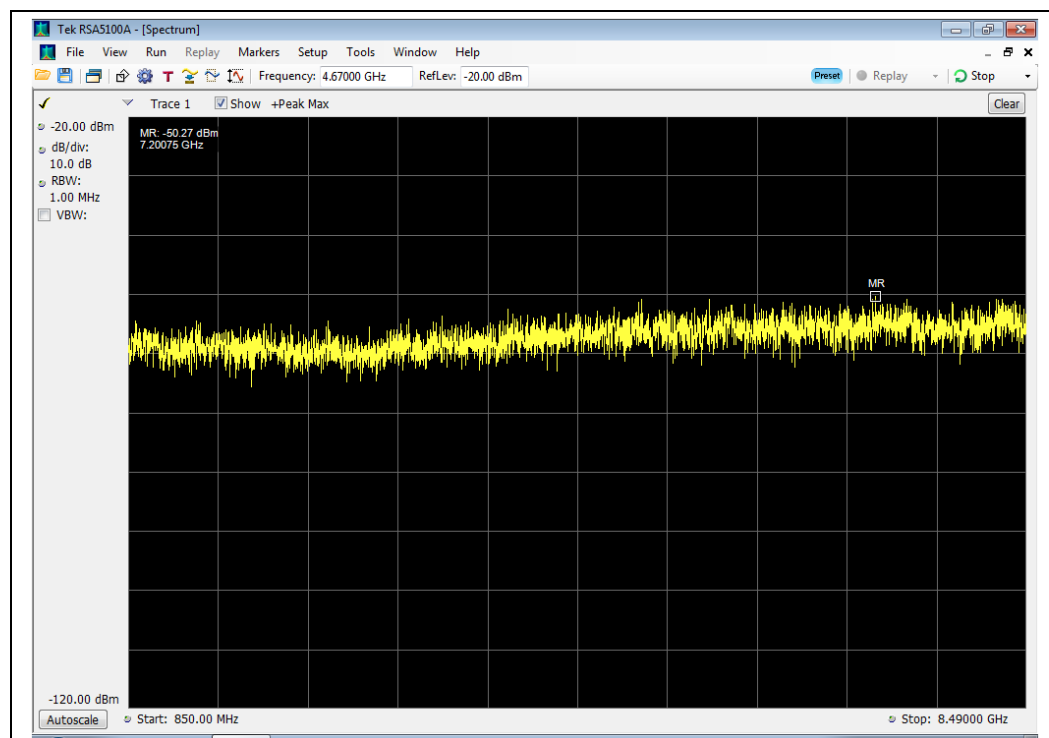
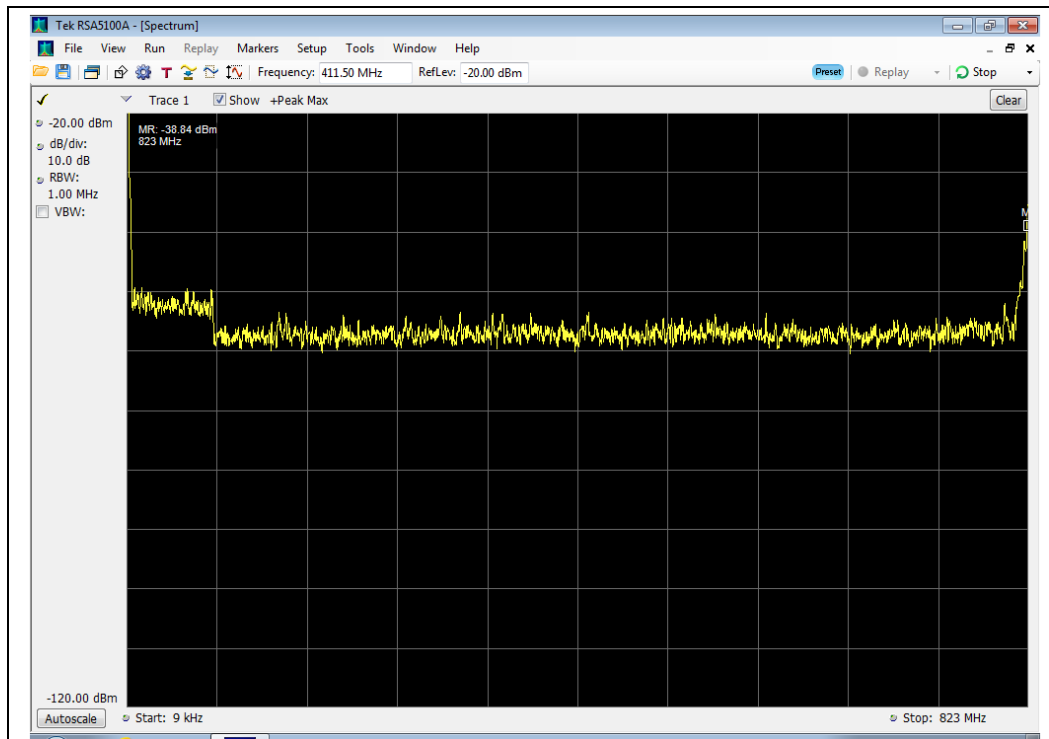
### Downlink Test Results

| Frequency Band (MHz) | Measured Frequency (MHz) | Measured Level (dBm) | Limit (dBm) | Result |
|----------------------|--------------------------|----------------------|-------------|--------|
| 869 - 894            | 39.936                   | -34                  | -13         | Pass   |
| 1930 - 1990          | 19890.3                  | -30.5                | -13         | Pass   |



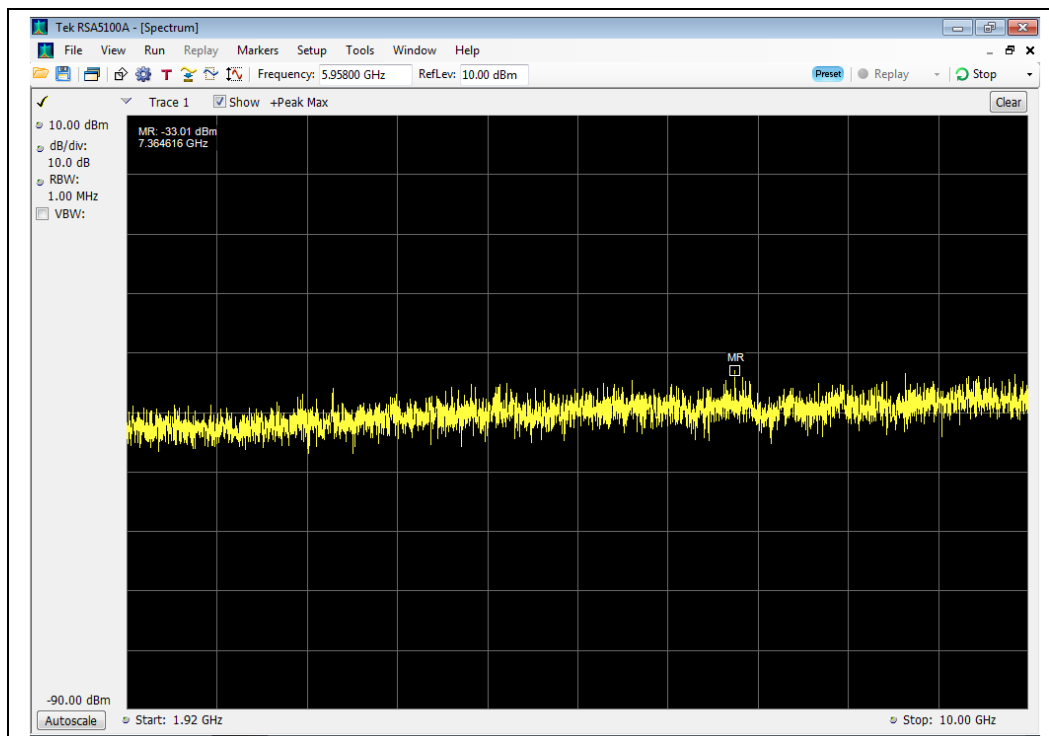
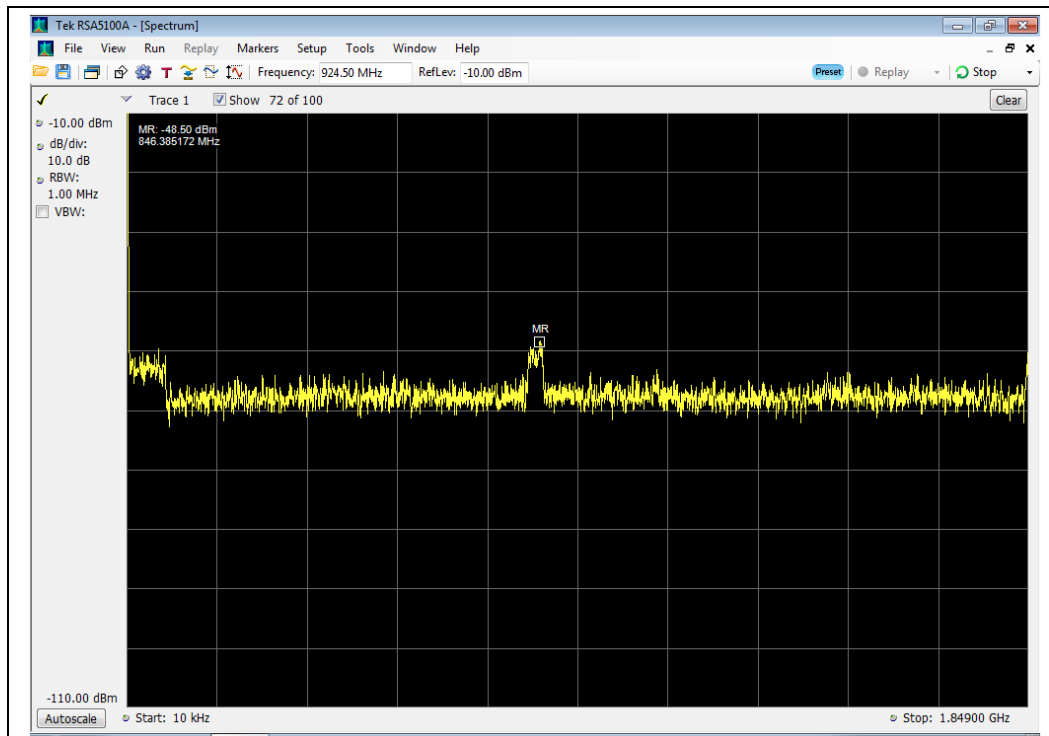
## Uplink Test Plots

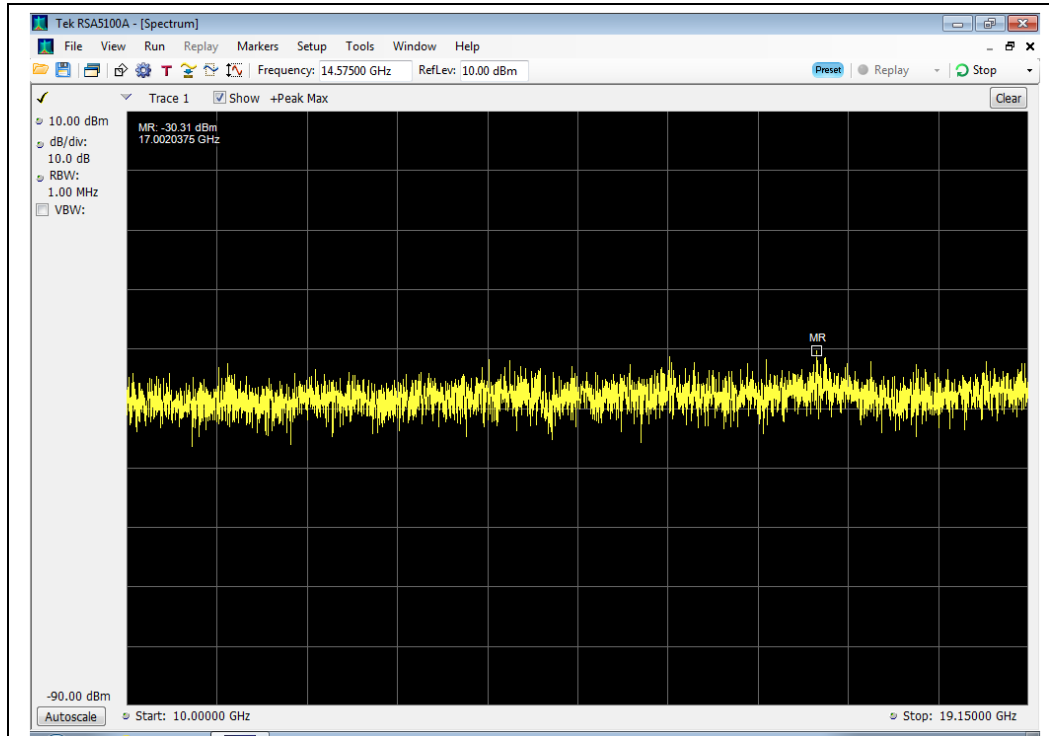
### 824 - 849 MHz Band





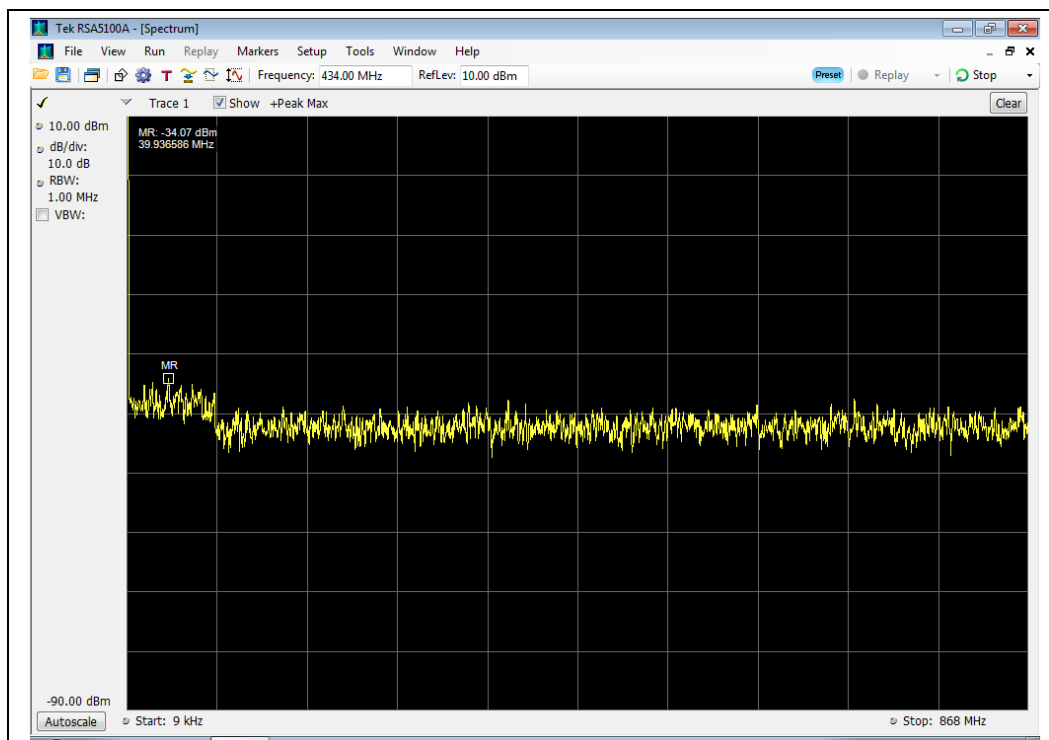
## 1850 - 1910 MHz Band

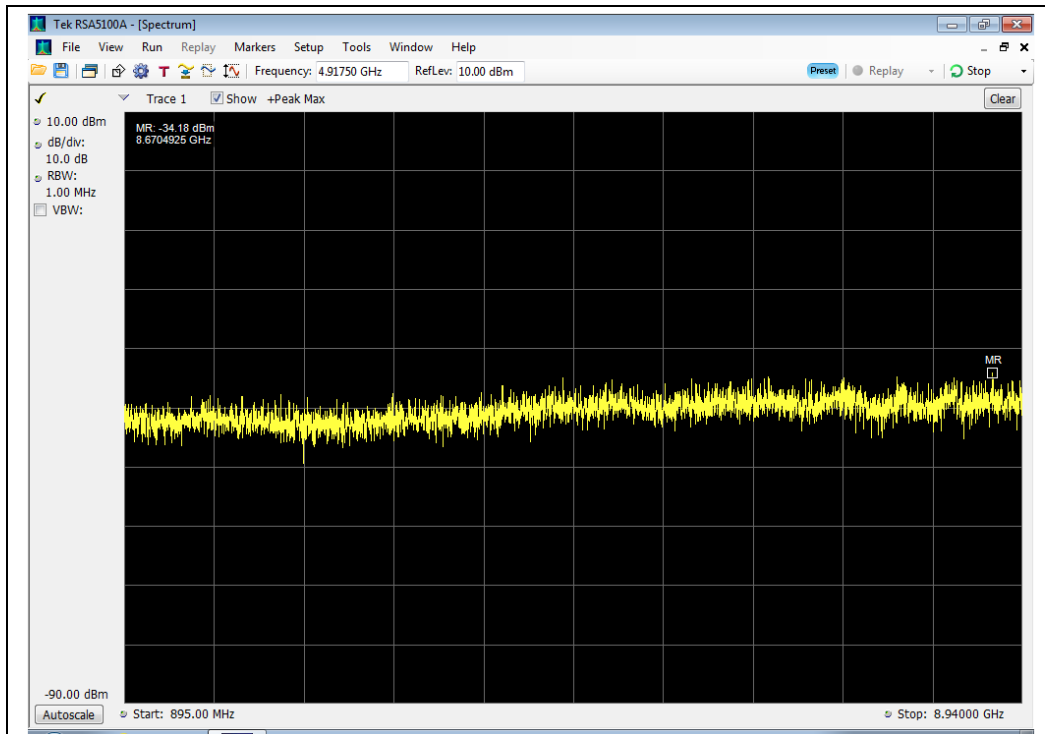




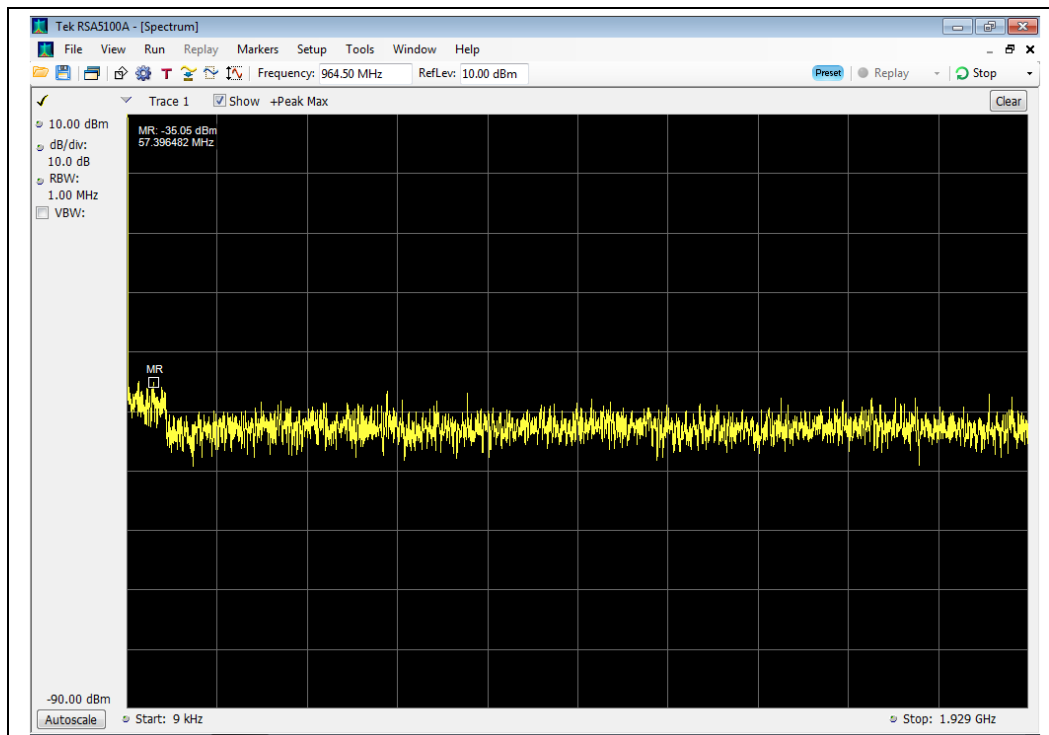
**Downlink Test Plots**

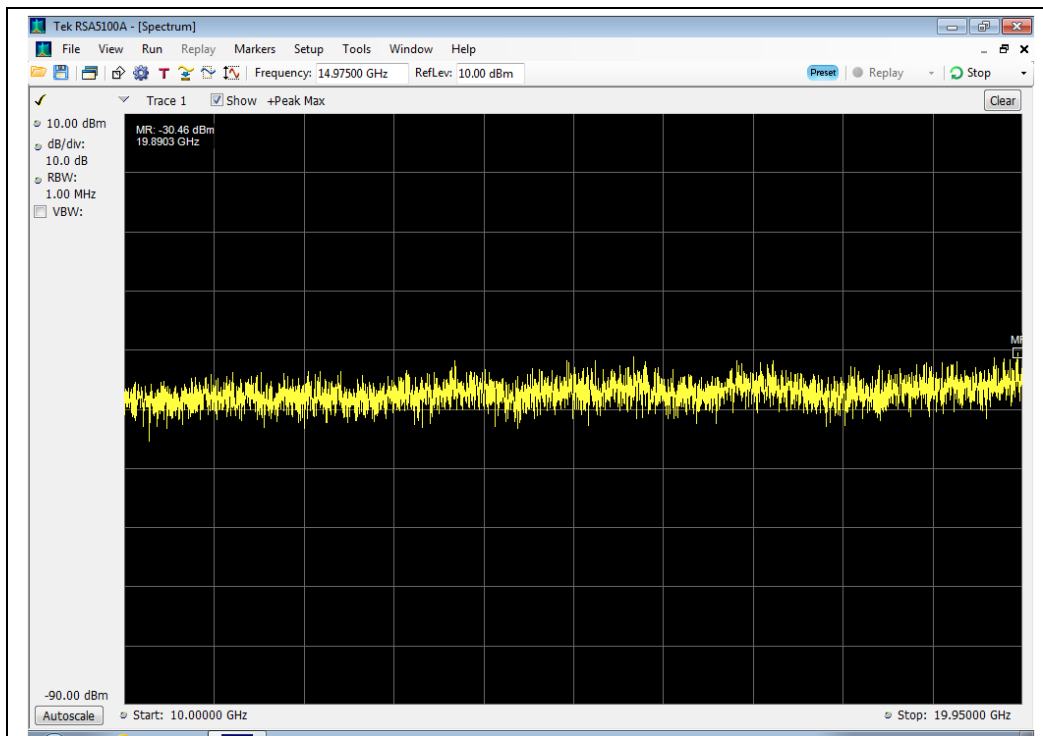
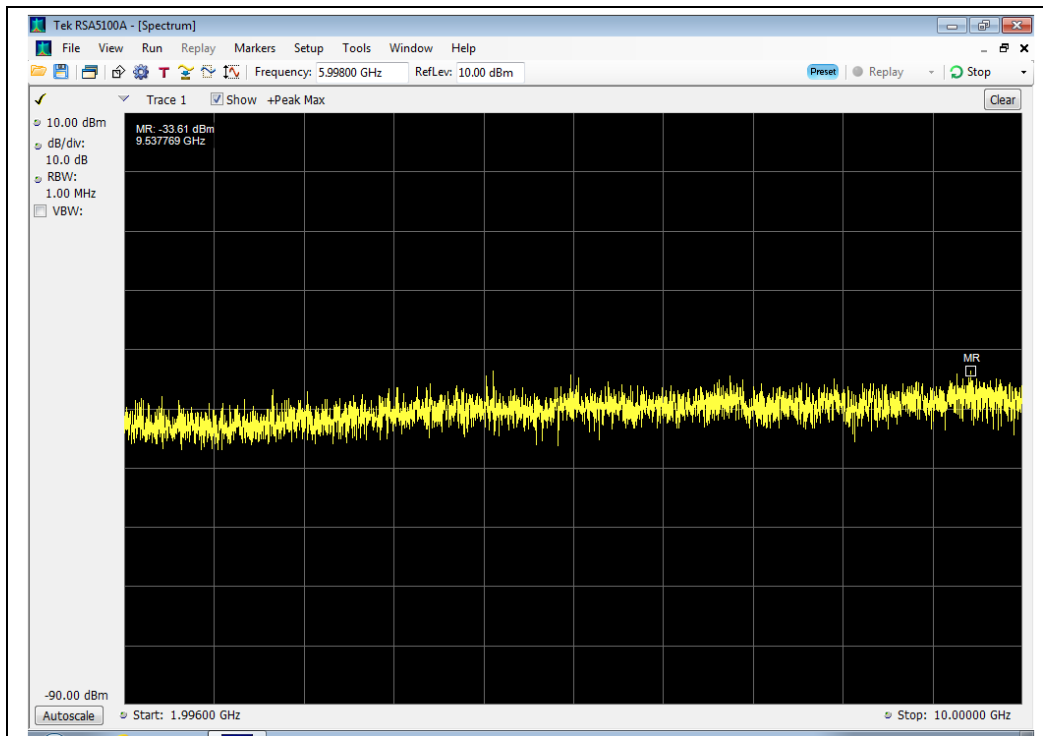
**869 - 894 MHz Band**





### 1930 - 1990 MHz Band







## Noise Limits

**Name of Test:**

Noise Limits

**Engineer:** Greg Corbin

**Test Equipment Utilized:**

i00424, SMU 200A - S/N:101369  
E4407B - S/N:MY41444836

**Test Date:** 11/20/2013

## 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.

For the Uplink Noise Timing plots, the first marker (MR) is the reference marker where the Downlink signal level was increased and marker (M1) is the time it took the booster to react to the increase in the Downlink signal level per KDB 935210 D03 Wideband Consumer Signal Booster Measurement Guidance DR04-41516c.

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

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

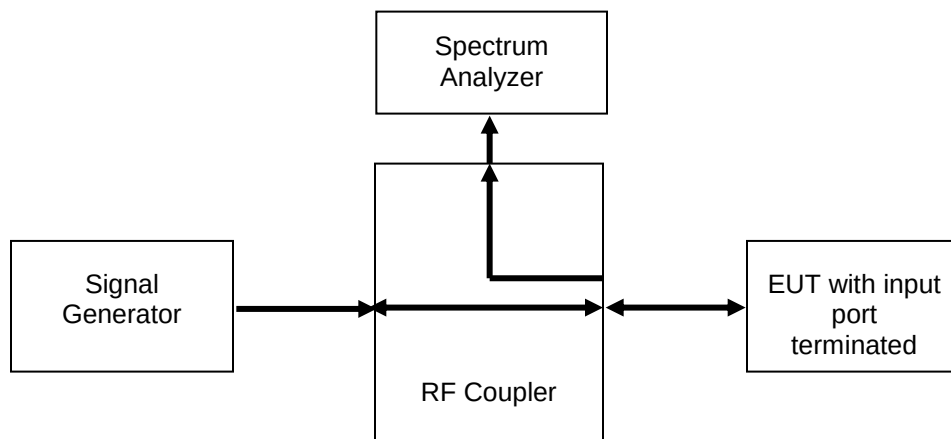
Variable Noise =  $-103 \text{ dBm/MHz-RSSI}$

## Test Setup

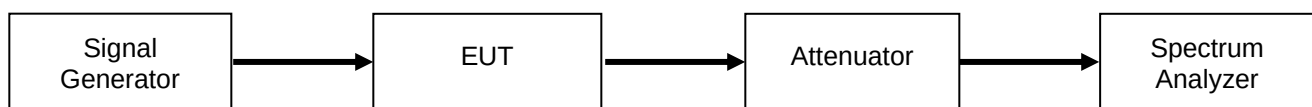
### Maximum Noise Power



### Variable Uplink Noise Power and Timing



### Variable Downlink Noise Power and Timing







### Maximum Uplink Noise Test Results

| Frequency Band (MHz) | Measured Noise (dBm) | Limit (dBm) | Margin (dB) | Result |
|----------------------|----------------------|-------------|-------------|--------|
| 824 - 849            | -80.7                | -44.1       | -36.6       | Pass   |
| 1850 - 1910          | -82.2                | -37.0       | -45.2       | Pass   |

### Maximum Downlink Noise Test Results

| Frequency Band (MHz) | Measured Noise (dBm) | Limit (dBm) | Margin (dB) | Result |
|----------------------|----------------------|-------------|-------------|--------|
| 869 - 894            | -87.8                | -44.1       | -43.7       | Pass   |
| 1930 - 1990          | -89.1                | -37.0       | -52.1       | Pass   |

### Uplink Noise Timing Test Results

| Frequency Band (MHz) | Measured Timing (Seconds) | Limit (Seconds) | Result |
|----------------------|---------------------------|-----------------|--------|
| 824 - 849            | 0.3125                    | 3.0             | Pass   |
| 1850 - 1910          | 0.3625                    | 3.0             | Pass   |



### Variable Uplink Noise Limit Test Results

#### 824 - 849 MHz

| RSSI (dBm) | Noise Limit (dBm) | Measured Noise (dBm) | Margin (dB) |
|------------|-------------------|----------------------|-------------|
| -43.0      | -60.0             | -81                  | -21.0       |
| -44.0      | -59.0             | -80.8                | -21.8       |
| -45.0      | -58.0             | -81.2                | -23.2       |
| -46.0      | -57.0             | -80.9                | -23.9       |
| -47.0      | -56.0             | -81.3                | -25.3       |
| -48.0      | -55.0             | -80.4                | -25.4       |

#### 1850 - 1910 MHz

| RSSI (dBm) | Noise Limit (dBm) | Measured Noise (dBm) | Margin (dB) |
|------------|-------------------|----------------------|-------------|
| -41.0      | -62.0             | -80.3                | -18.3       |
| -40.0      | -63.0             | -81.9                | -18.9       |
| -42.0      | -61.0             | -81.2                | -20.2       |
| -43.0      | -60.0             | -81.2                | -21.2       |
| -44.0      | -59.0             | -81.9                | -22.9       |
| -45.0      | -58.0             | -81.5                | -23.5       |

### Variable Downlink Noise Limit Test Results

#### 869 - 894 MHz

| RSSI (dBm) | Noise Limit (dBm) | Measured Noise (dBm) | Margin (dB) |
|------------|-------------------|----------------------|-------------|
| -52.0      | -51.0             | -82.4                | -31.4       |
| -53.0      | -50.0             | -82.3                | -32.3       |
| -54.0      | -49.0             | -81.6                | -32.6       |
| -55.0      | -48.0             | -81.5                | -33.5       |
| -56.0      | -47.0             | -82.4                | -35.4       |
| -57.0      | -46.0             | -82.1                | -36.1       |

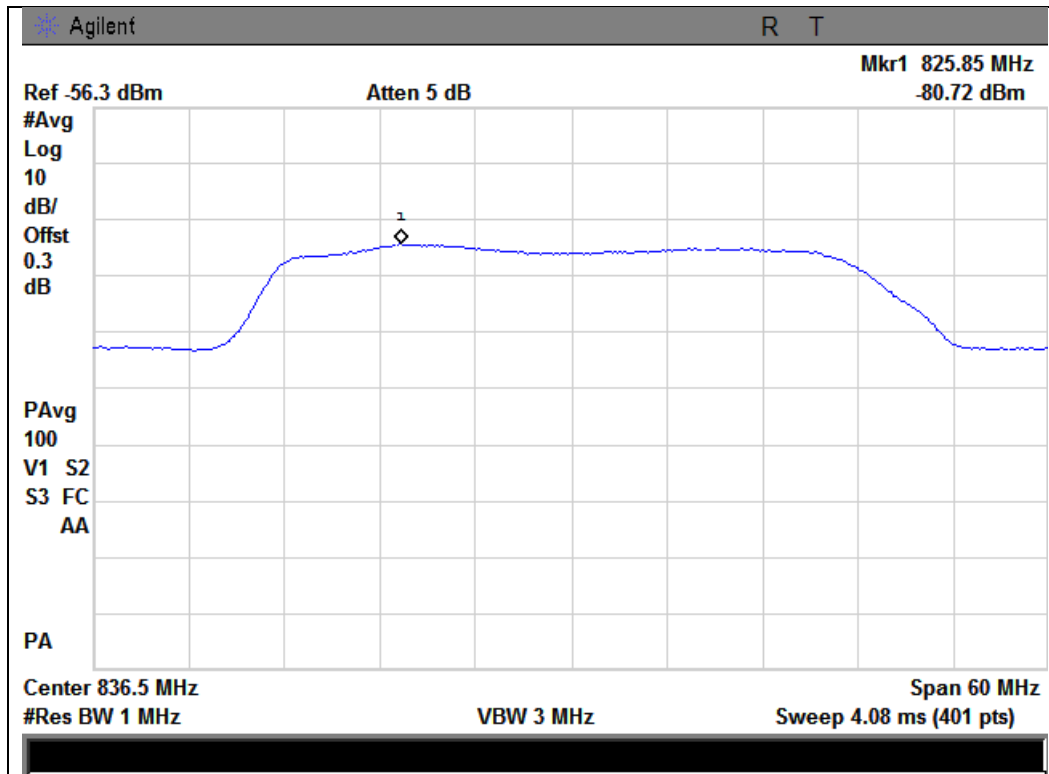
#### 1930 - 1990 MHz

| RSSI (dBm) | Noise Limit (dBm) | Measured Noise (dBm) | Margin (dB) |
|------------|-------------------|----------------------|-------------|
| -34.0      | -69.0             | -83.3                | -14.3       |
| -35.0      | -68.0             | -83.3                | -15.3       |
| -36.0      | -67.0             | -83.3                | -16.3       |
| -37.0      | -66.0             | -83.3                | -17.3       |
| -38.0      | -65.0             | -83.3                | -18.3       |
| -39.0      | -64.0             | -83.3                | -19.3       |

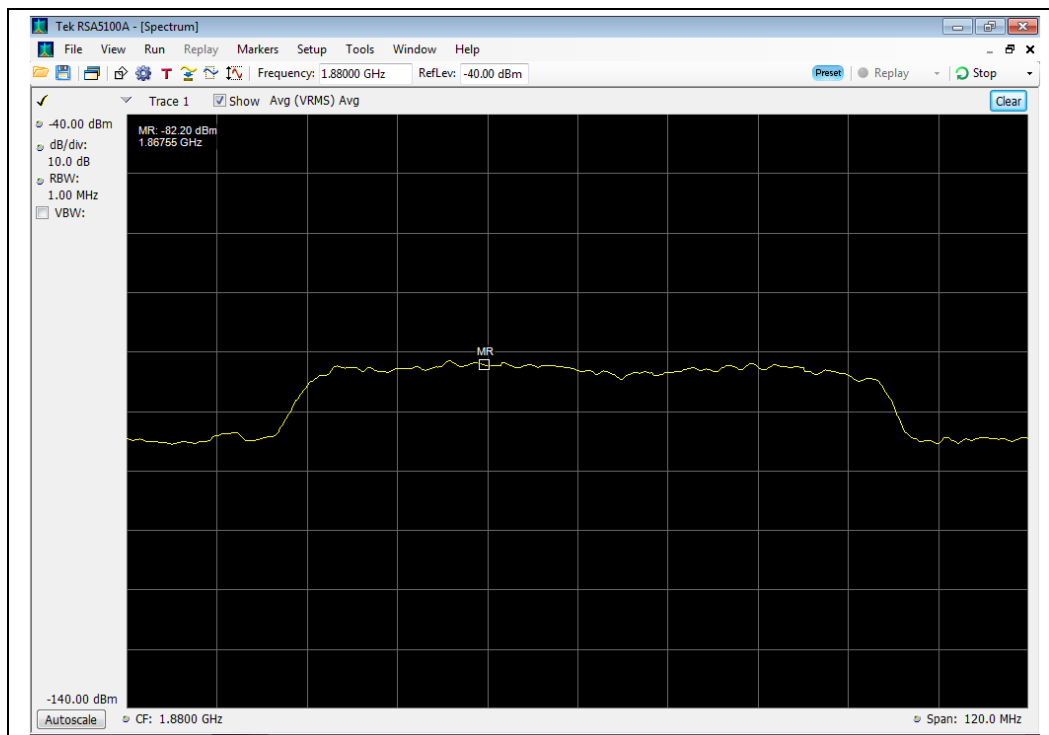


## Maximum Uplink Noise Test Plots

### 824 - 849 MHz Band



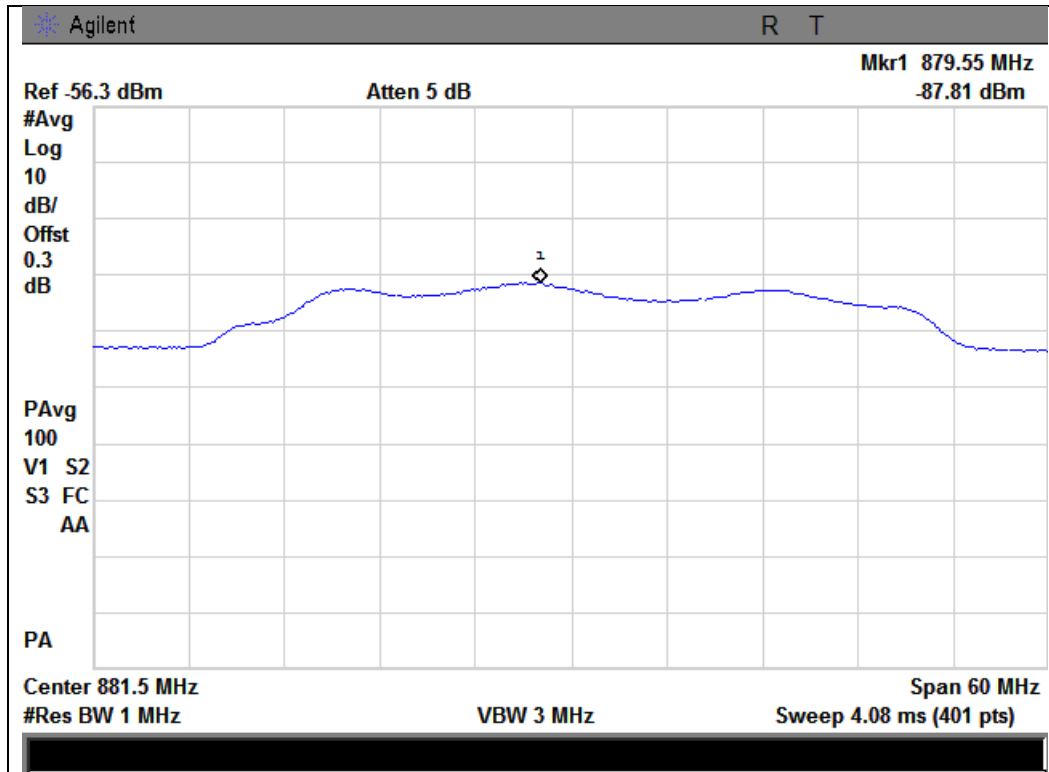
### 1850 - 1910 MHz Band



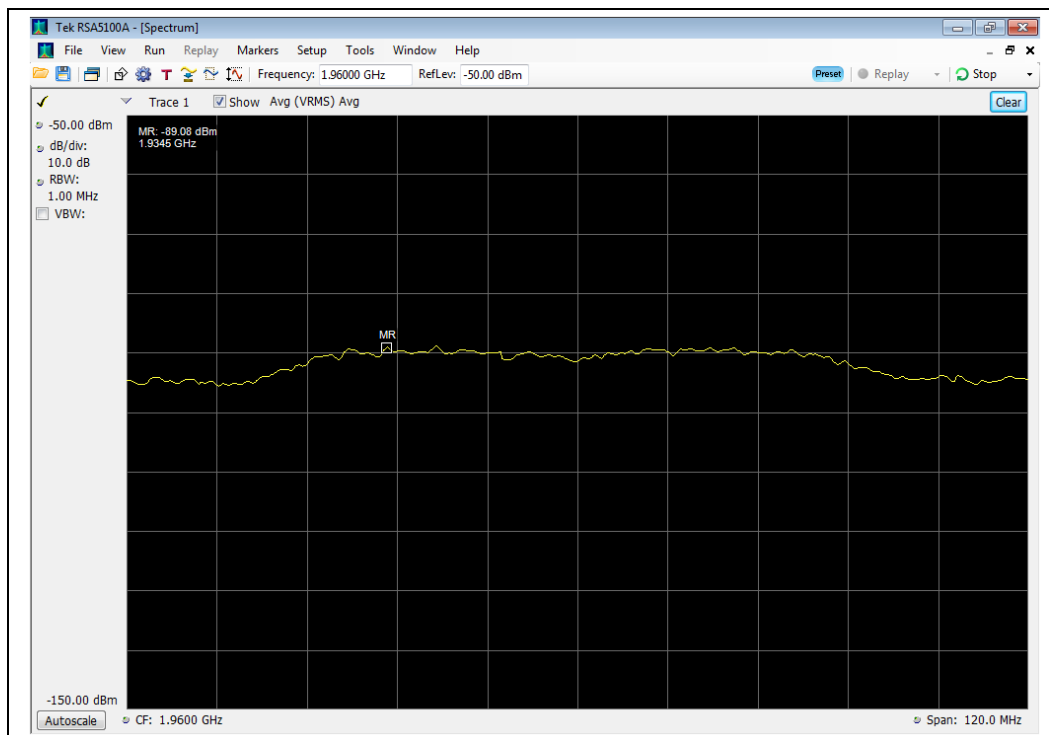


## Maximum Downlink Noise Test Plots

### 869 - 894 MHz Band



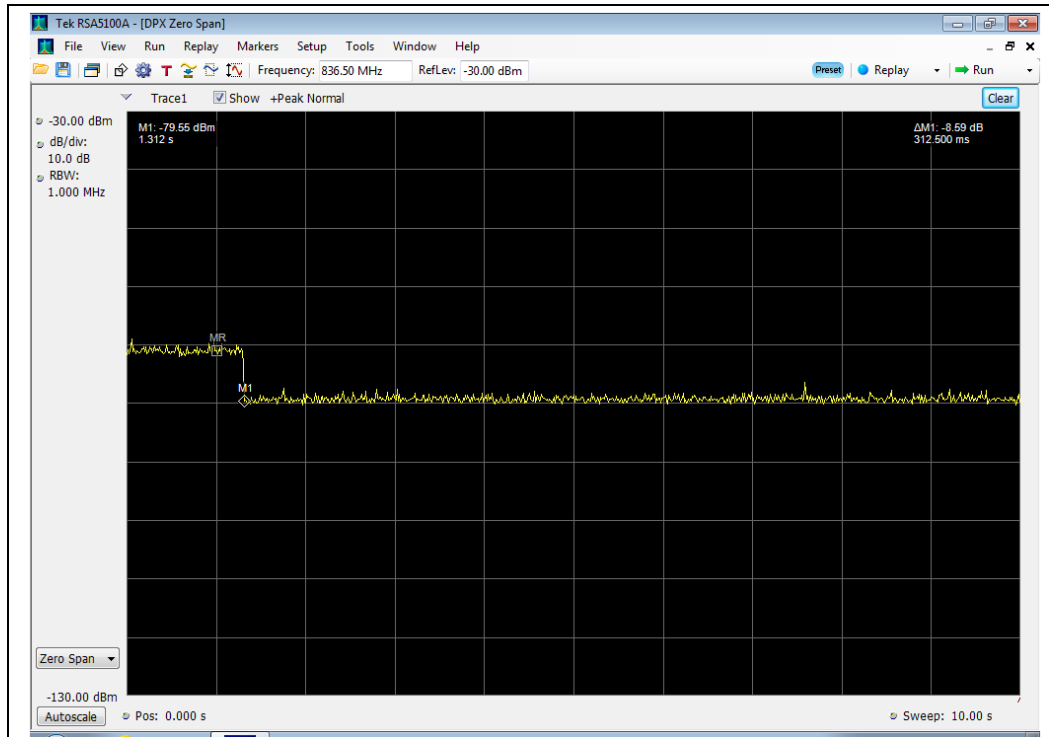
### 1930 - 1990 MHz Band



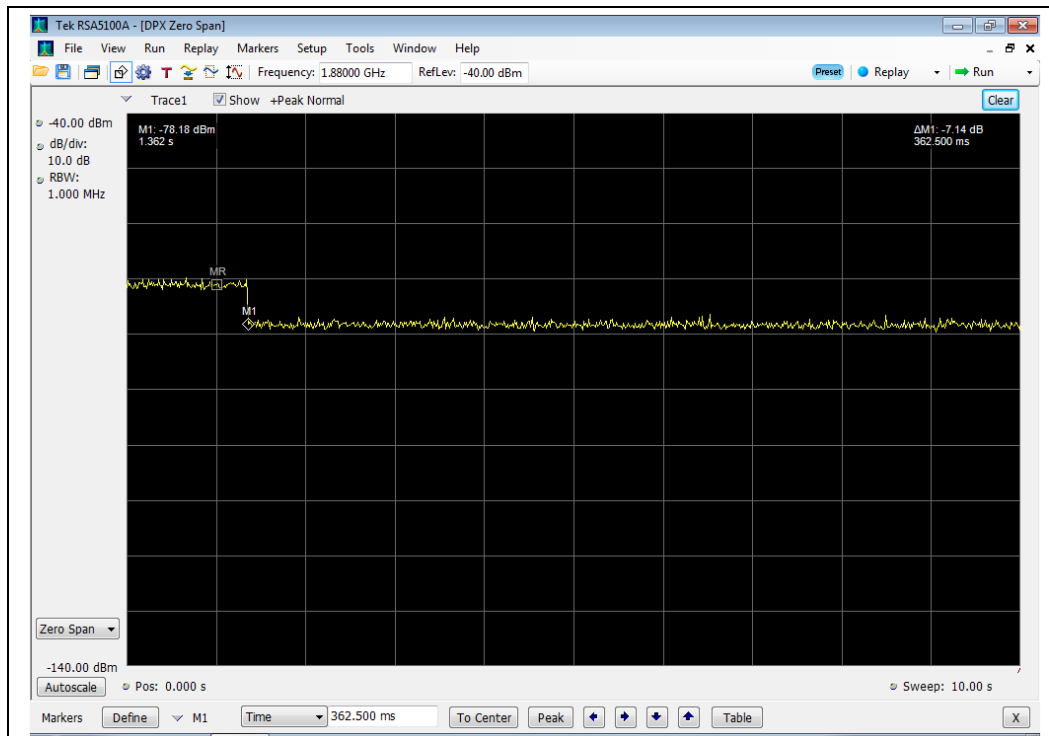


## Uplink Noise Timing Test Plots

### 824 - 849 MHz Band



### 1850 - 1910 MHz Band





## **Uplink Inactivity**

**Name of Test:** Uplink Inactivity

**Test Equipment Utilized:** N/A

**Engineer:** Greg Corbin

**Test Date:** 12/2/2013

The uplink and downlink noise power is less than -70 dBm/MHz and the uplink gain is less than 23 dB, therefore the signal booster meets the requirements for section 20.21H (Transmit Power Off Mode) and the Uplink Inactivity test is not required

**This test is not required.**



## Variable Gain

**Name of Test:** Variable Gain  
**Test Equipment Utilized:** i00424, SMU 200A - S/N:101369

**Engineer:** Greg Corbin  
**Test Date:** 11/20/2013

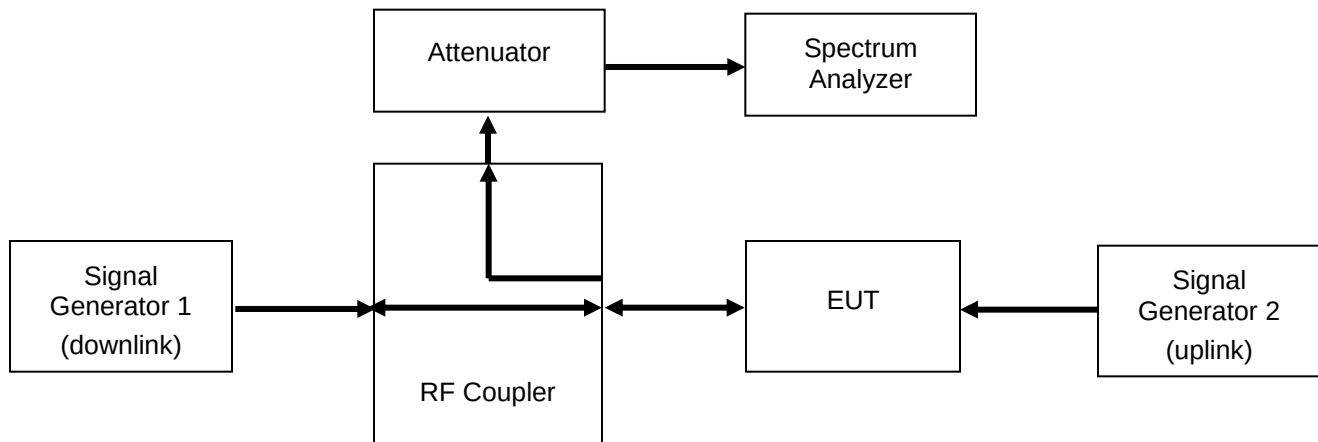
### Test Procedure

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

#### 824 - 849 MHz

| RSSI (dBm) | MSCL (dB) | Gain Limit (dBm) | P(in) (dBm) | P(out) (dBm) | Gain (dB) | Margin (dB) |
|------------|-----------|------------------|-------------|--------------|-----------|-------------|
| -56.0      | 0.0       | 15.0             | 0.8         | 10.3         | 9.5       | -5.5        |
| -55.0      | 0.0       | 15.0             | 0.8         | 10.3         | 9.5       | -5.5        |
| -54.0      | 0.0       | 15.0             | 0.8         | 10.3         | 9.5       | -5.5        |
| -53.0      | 0.0       | 15.0             | 0.8         | 10.3         | 9.5       | -5.5        |
| -52.0      | 0.0       | 15.0             | 0.8         | 9.3          | 8.5       | -6.5        |
| -51.0      | 0.0       | 15.0             | 0.8         | 8.3          | 7.5       | -7.5        |

#### 1850 – 1910 MHz

| RSSI (dBm) | MSCL (dB) | Gain Limit (dBm) | P(in) (dBm) | P(out) (dBm) | Gain (dB) | Margin (dB) |
|------------|-----------|------------------|-------------|--------------|-----------|-------------|
| -52.0      | 0.0       | 15.0             | 1.3         | 12.0         | 10.7      | -4.3        |
| -51.0      | 0.0       | 15.0             | 1.3         | 12.0         | 10.7      | -4.3        |
| -50.0      | 0.0       | 15.0             | 1.3         | 12.0         | 10.7      | -4.3        |
| -49.0      | 0.0       | 15.0             | 1.3         | 11.8         | 10.5      | -4.5        |
| -48.0      | 0.0       | 15.0             | 1.3         | 10.8         | 9.5       | -5.5        |
| -47.0      | 0.0       | 15.0             | 1.3         | 10.0         | 8.7       | -6.3        |

### Uplink Gain Timing Test Results

| Frequency Band (MHz) | Measured Timing (Seconds) | Limit (Seconds) | Result |
|----------------------|---------------------------|-----------------|--------|
| 824 - 849            | 0.2125                    | 3.0             | Pass   |
| 1850 - 1910          | 0.3125                    | 3.0             | Pass   |



## Occupied Bandwidth

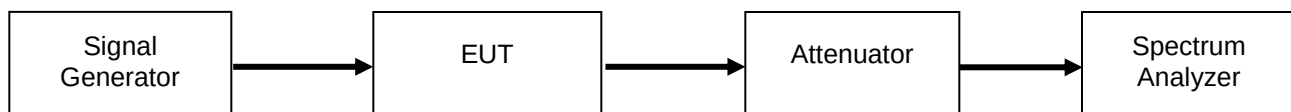
**Name of Test:** Occupied Bandwidth  
**Test Equipment Utilized:** i00424, SMU 200A - S/N:101369

**Engineer:** Greg Corbin  
**Test Date:** 11/21/2013

## Test Procedure

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

## Test Setup

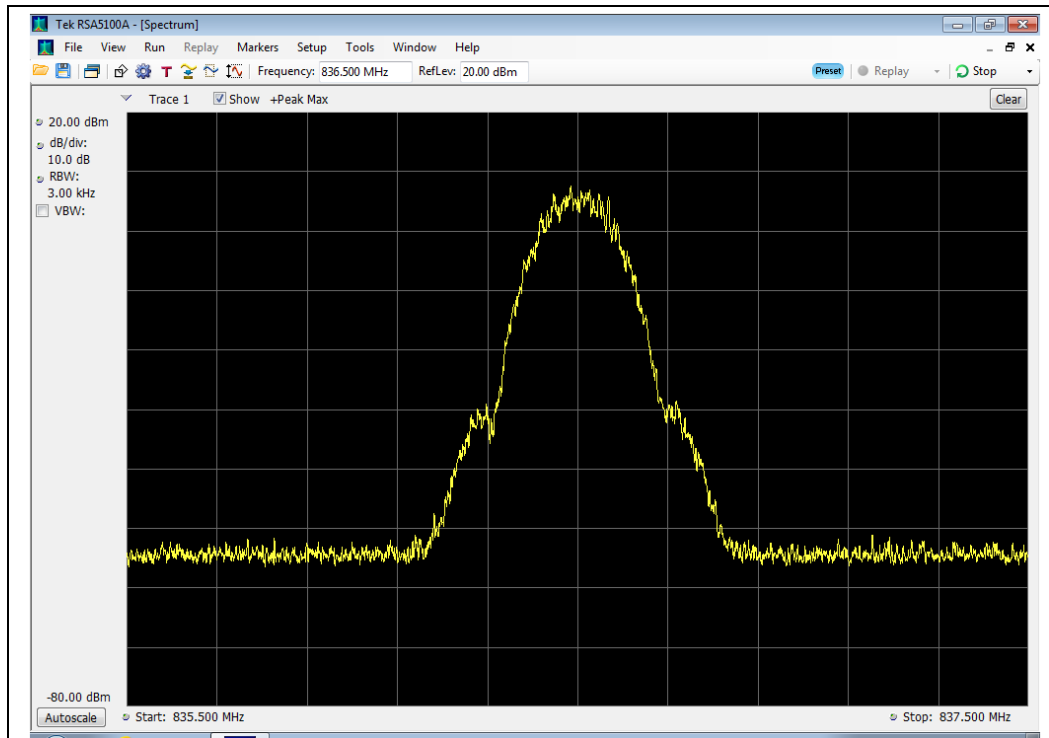




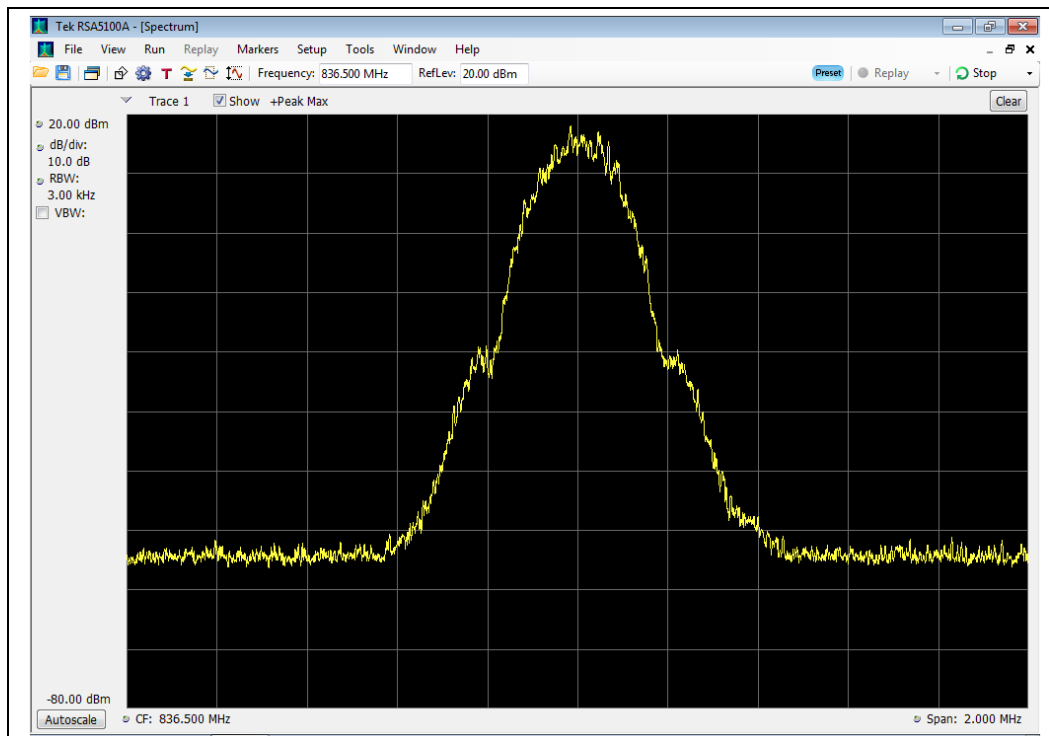
## GSM Uplink Test Plots

824 - 849 MHz Band

Input



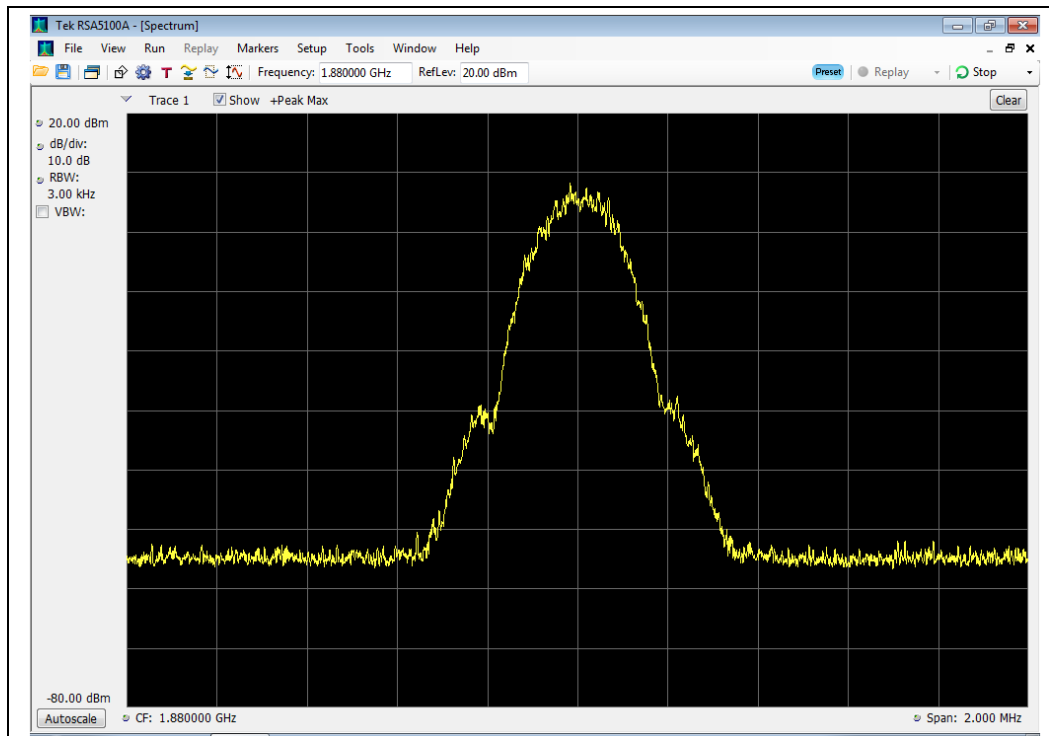
Output



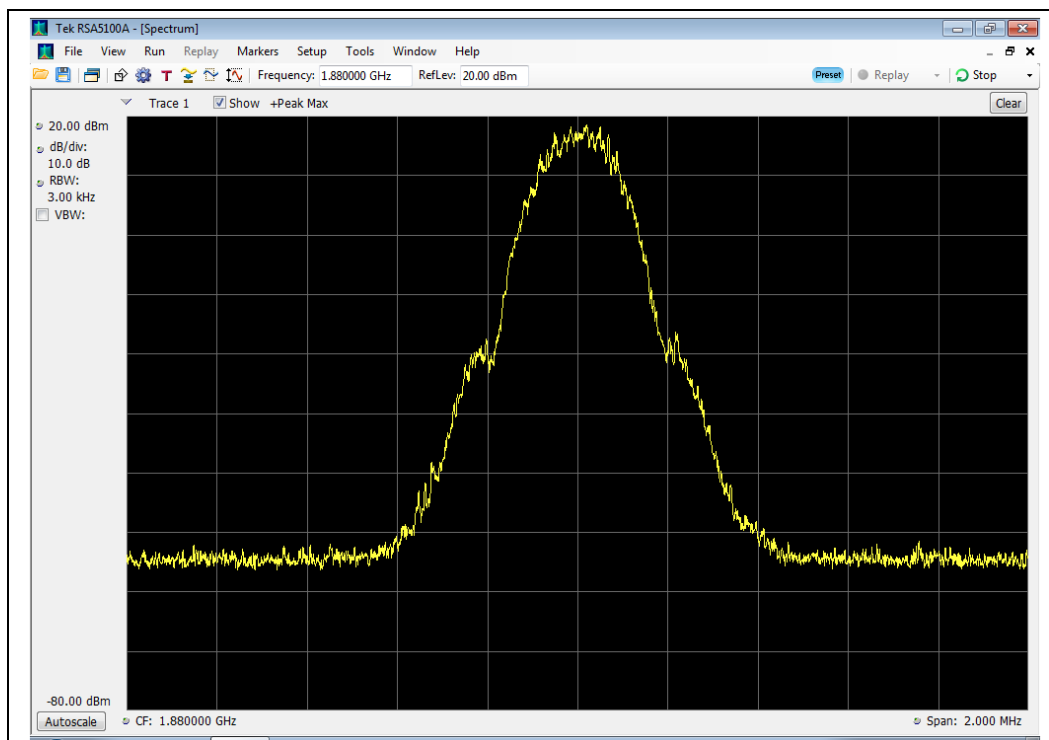


## 1850 - 1910 MHz Band

### Input



### Output

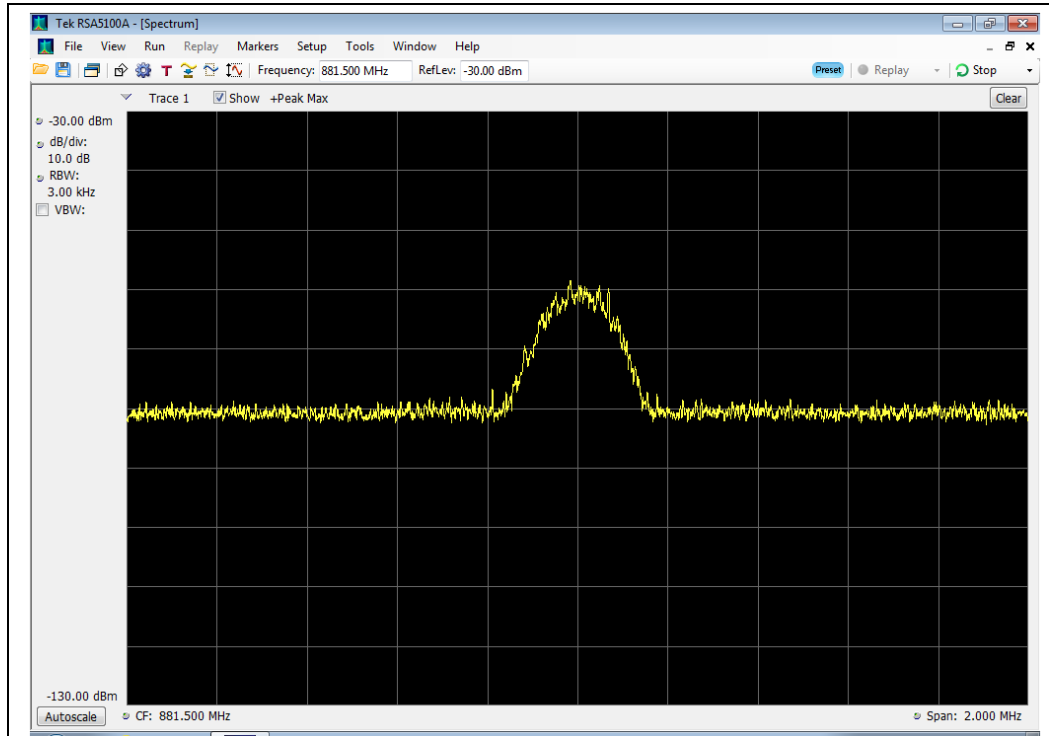




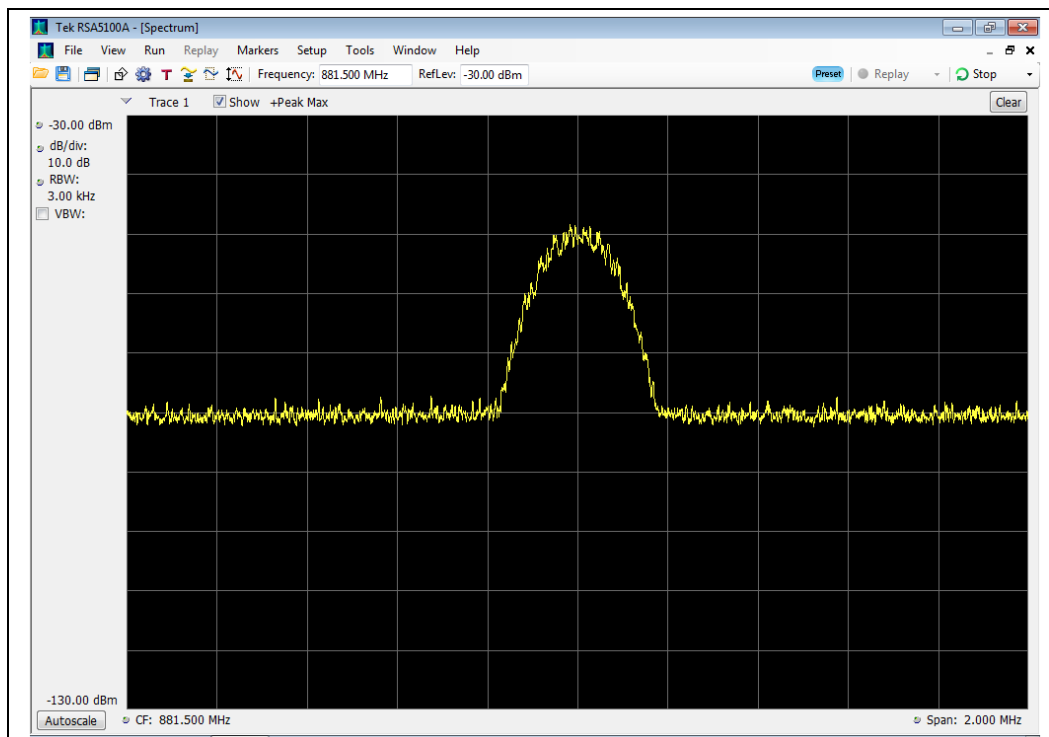
## GSM Downlink Test Plots

869 - 894 MHz Band

Input



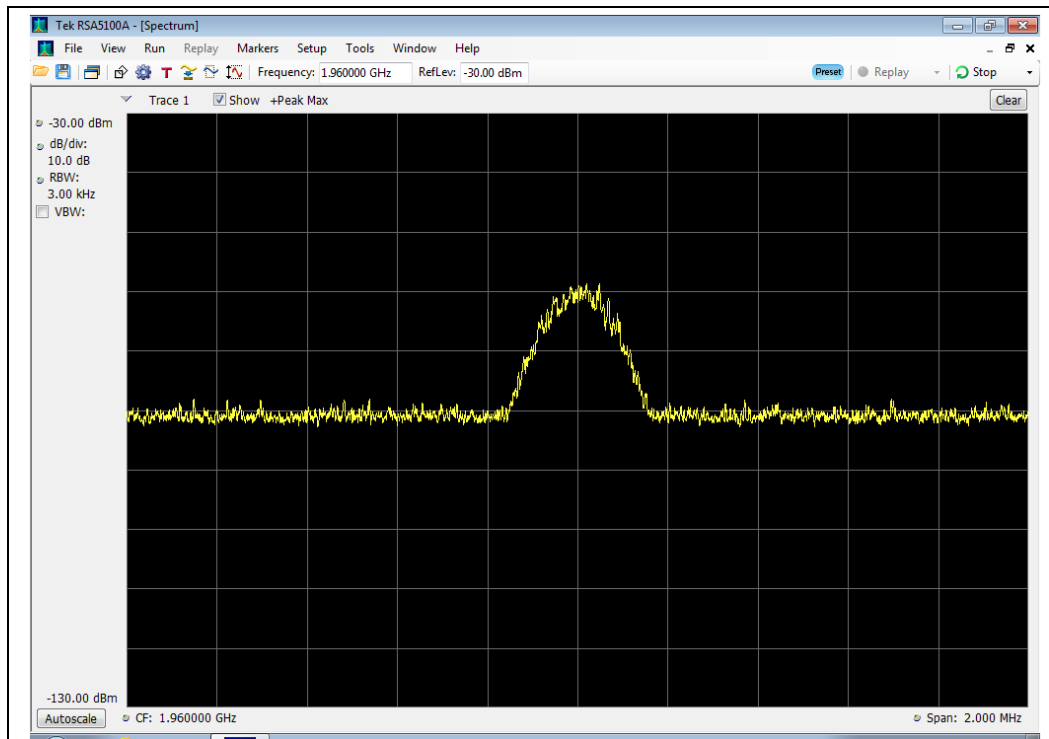
Output



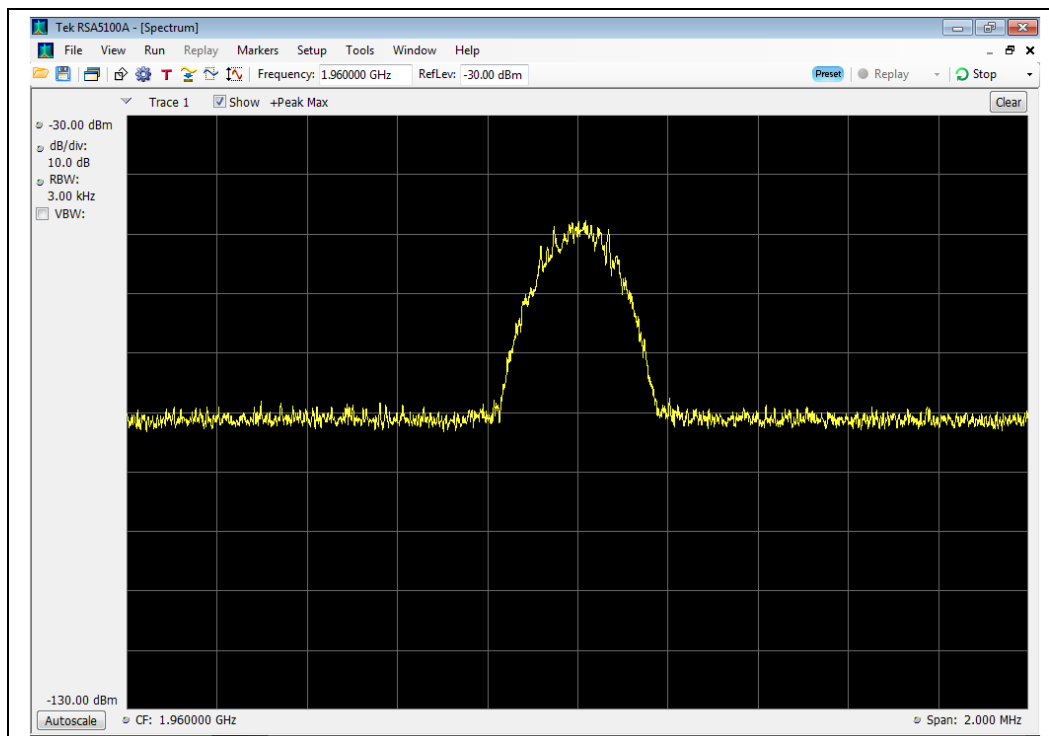


## 1930 - 1990 MHz Band

### Input



### Output

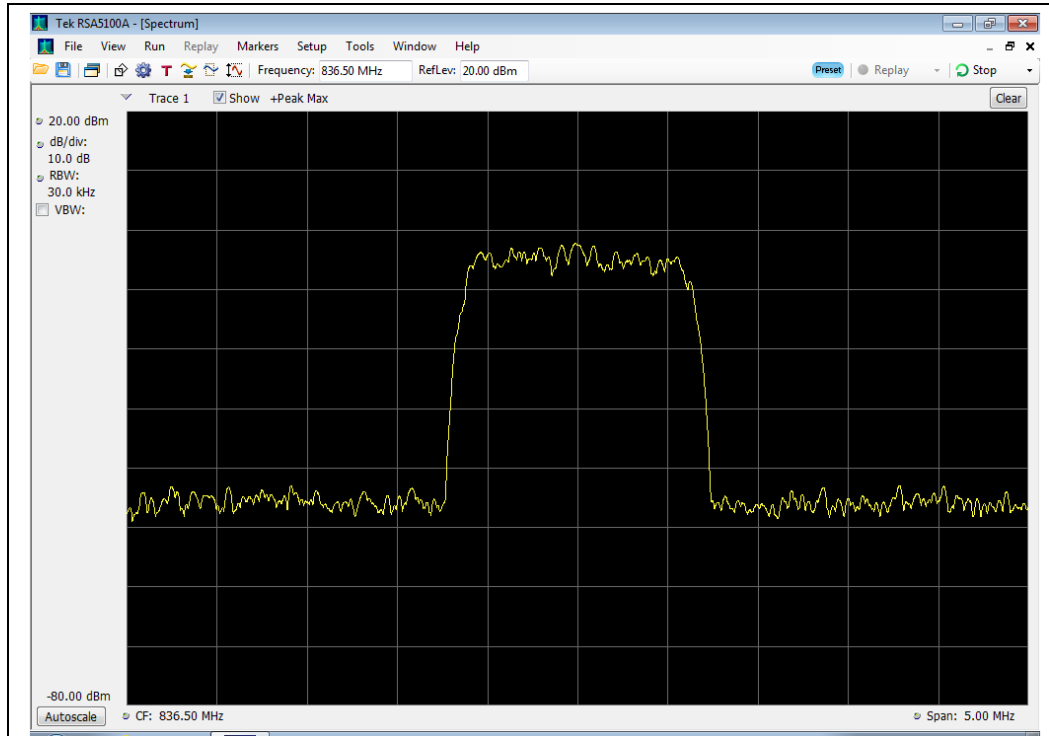




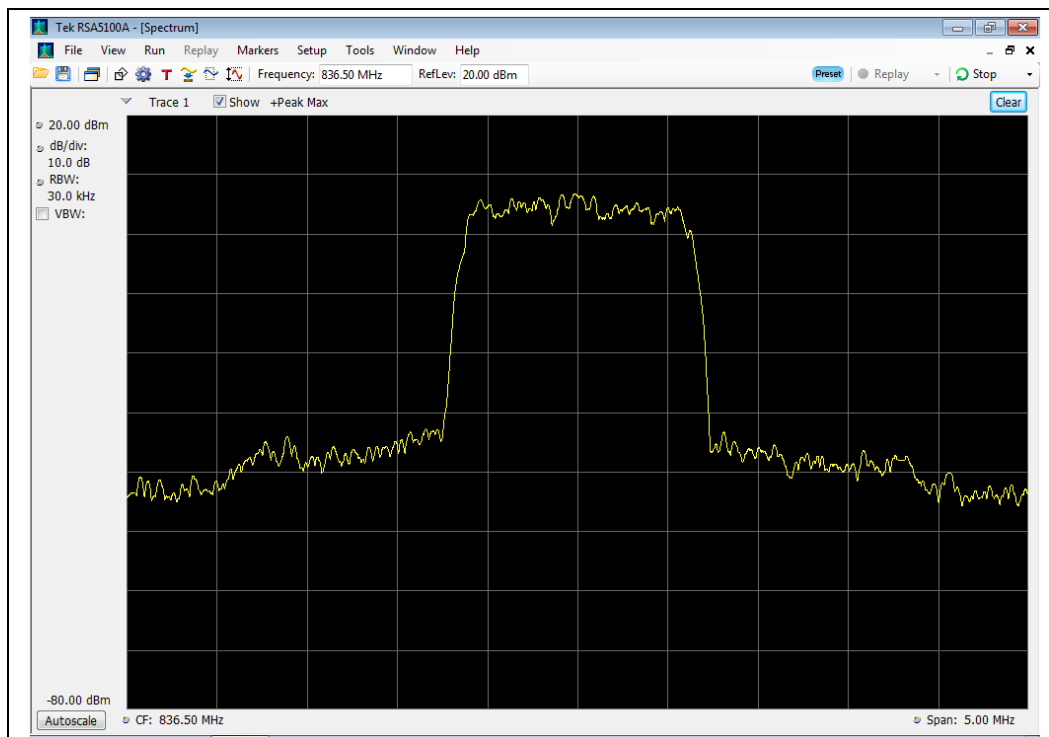
## CDMA Uplink Test Plots

824 - 849 MHz Band

Input



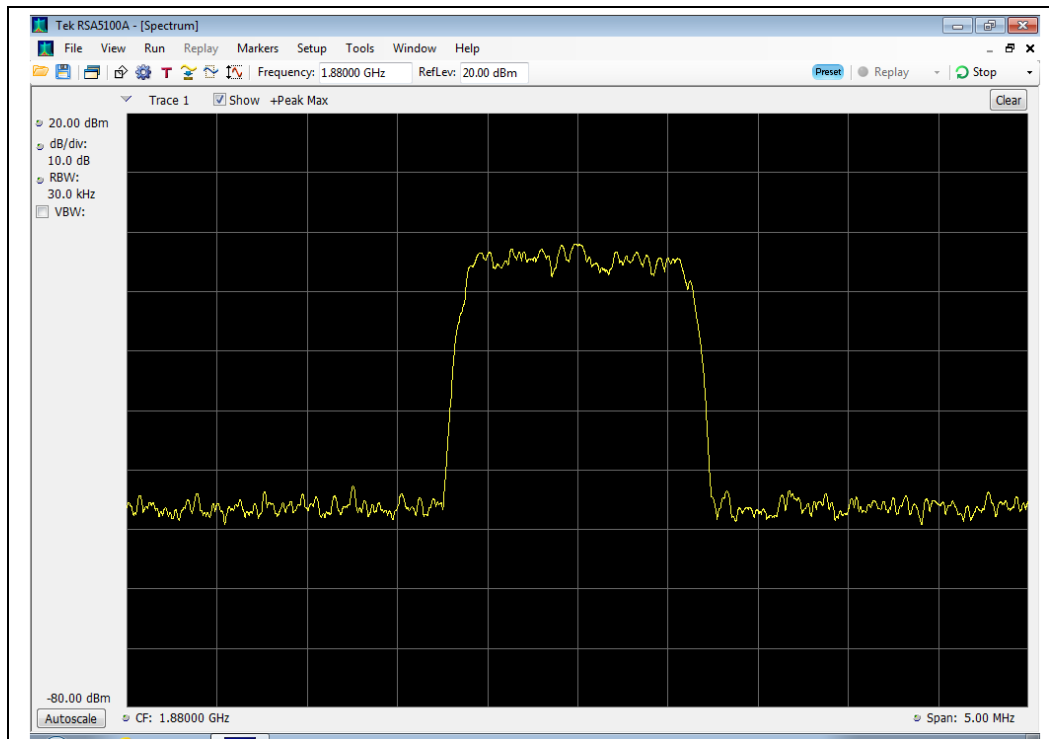
Output



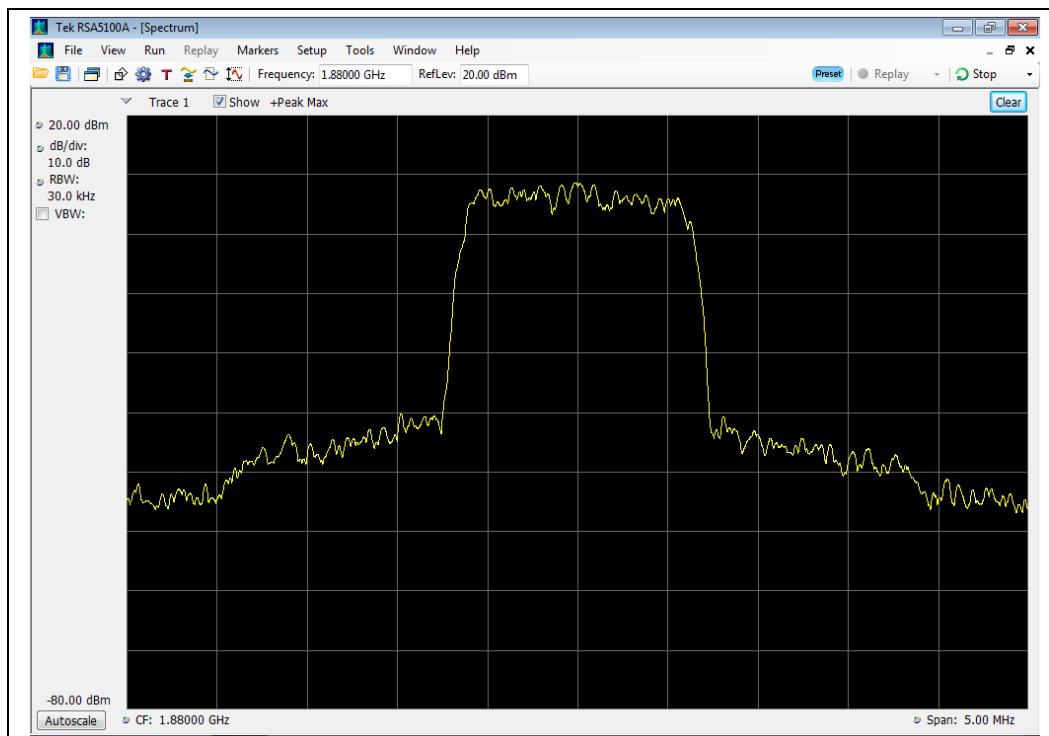


## 1850 - 1910 MHz Band

### Input



### Output

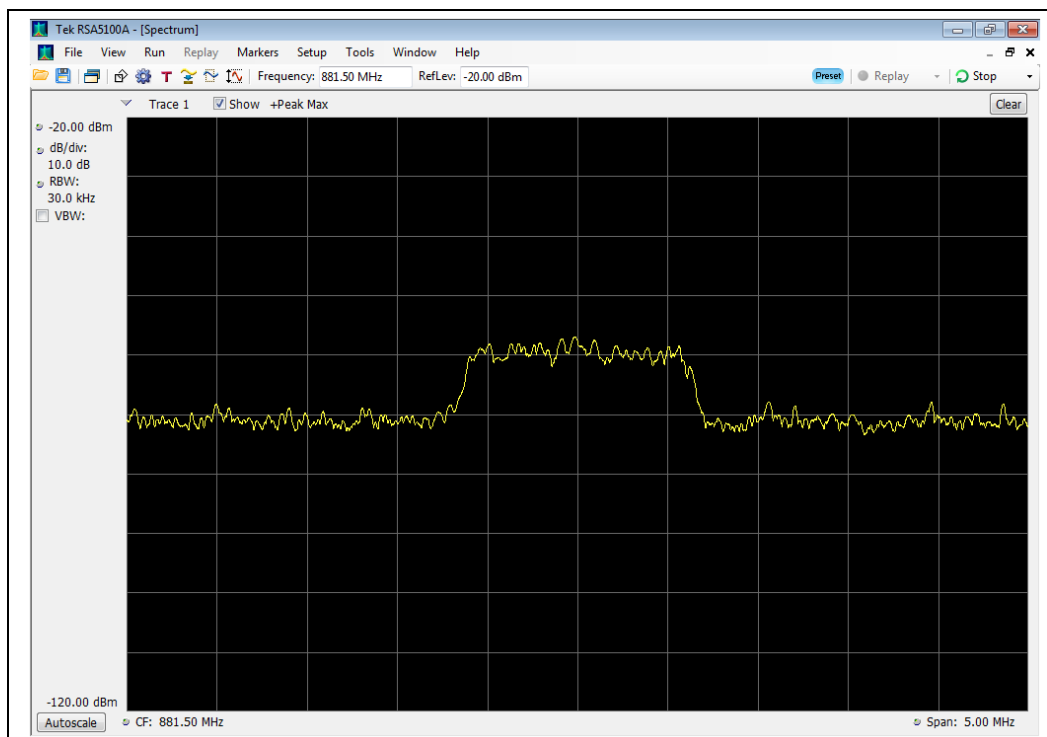




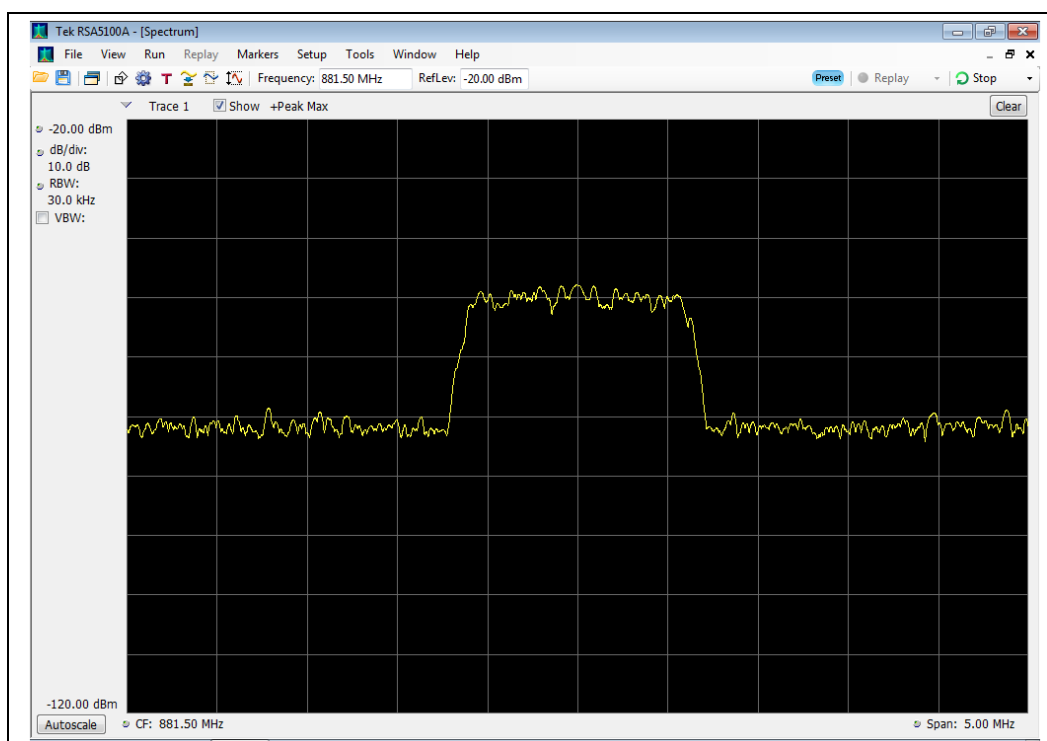
## CDMA Downlink Test Plots

869 - 894 MHz Band

Input



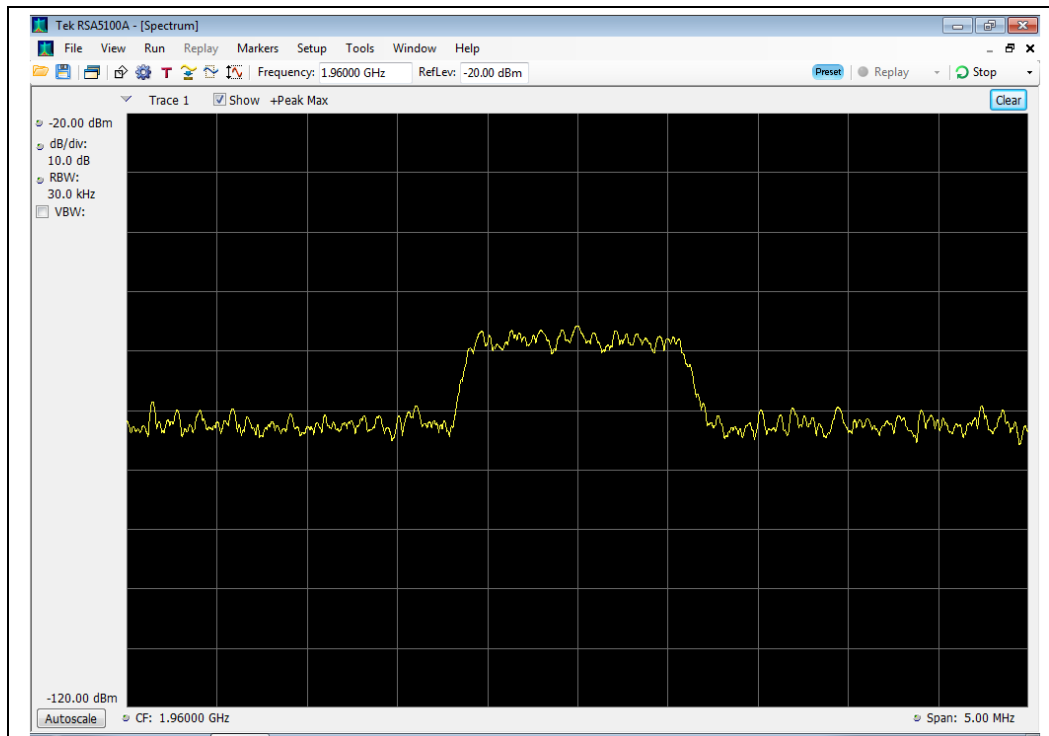
Output



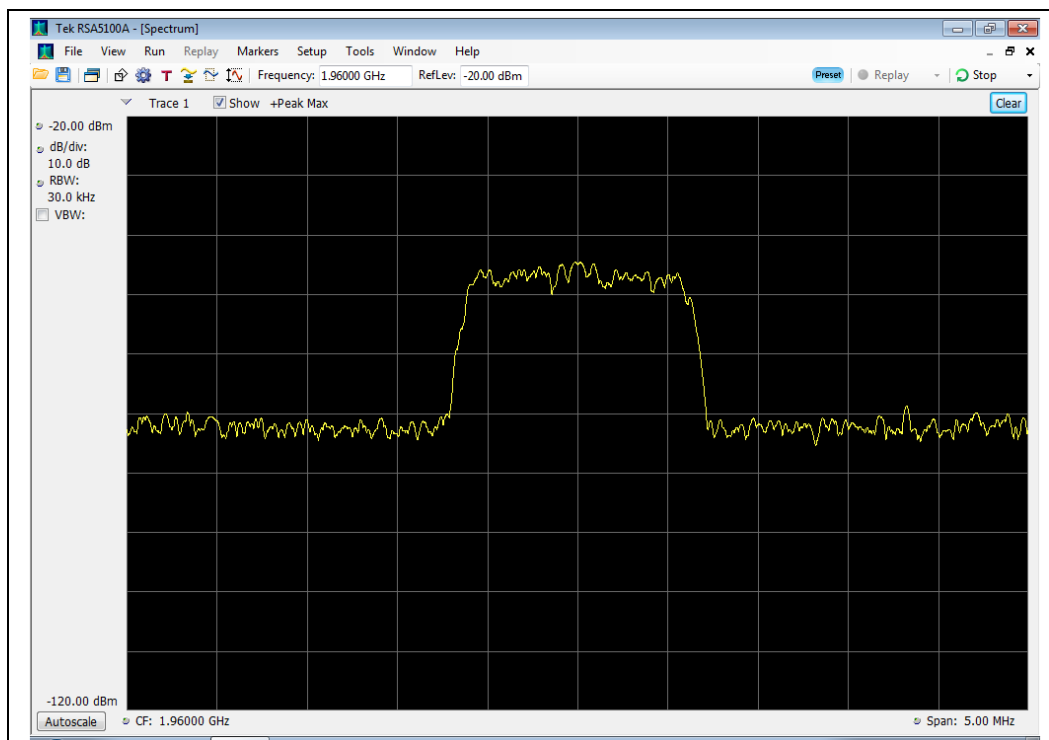


## 1930 - 1990 MHz Band

### Input



### Output

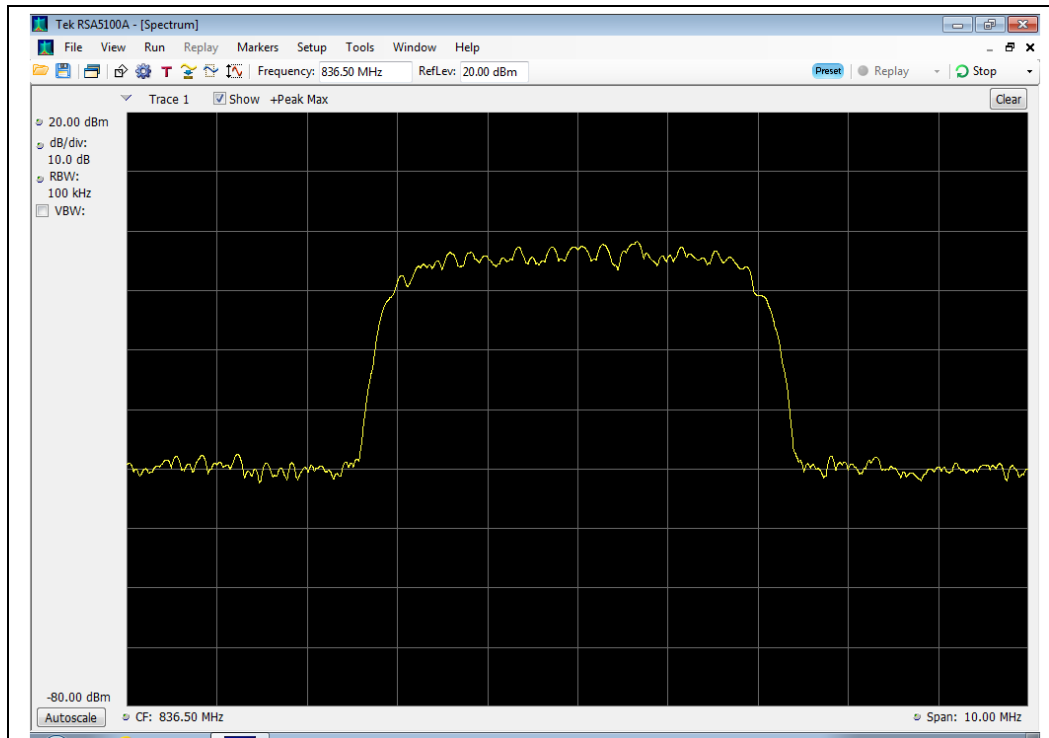




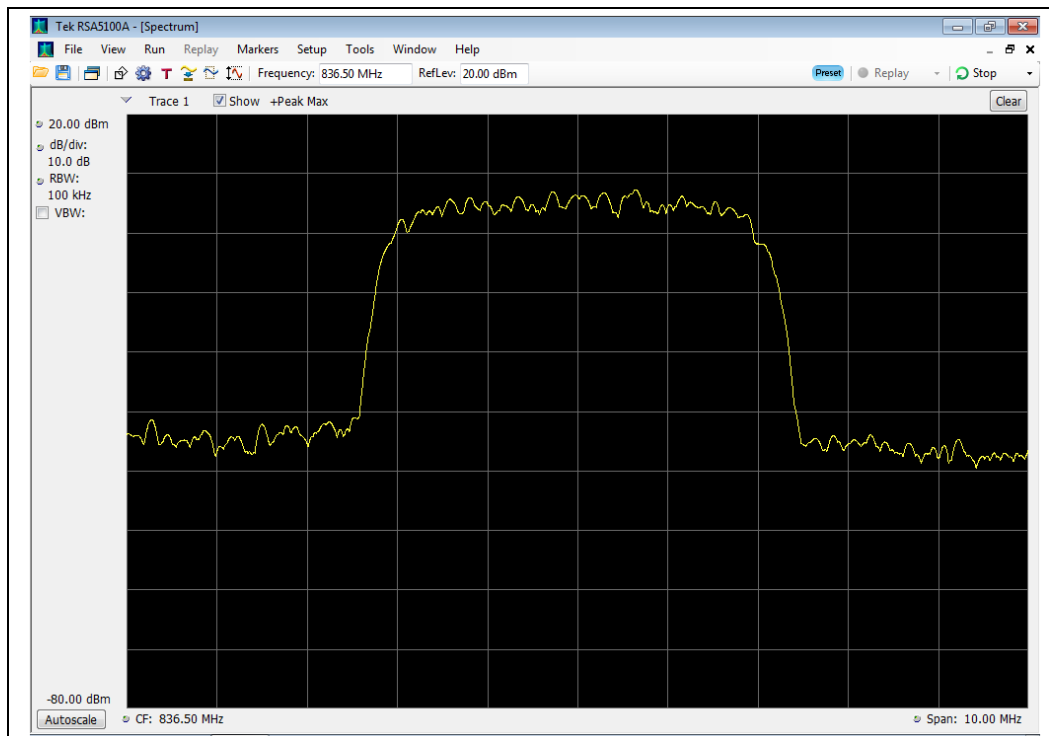
## WCDMA Uplink Test Plots

824 - 849 MHz Band

Input



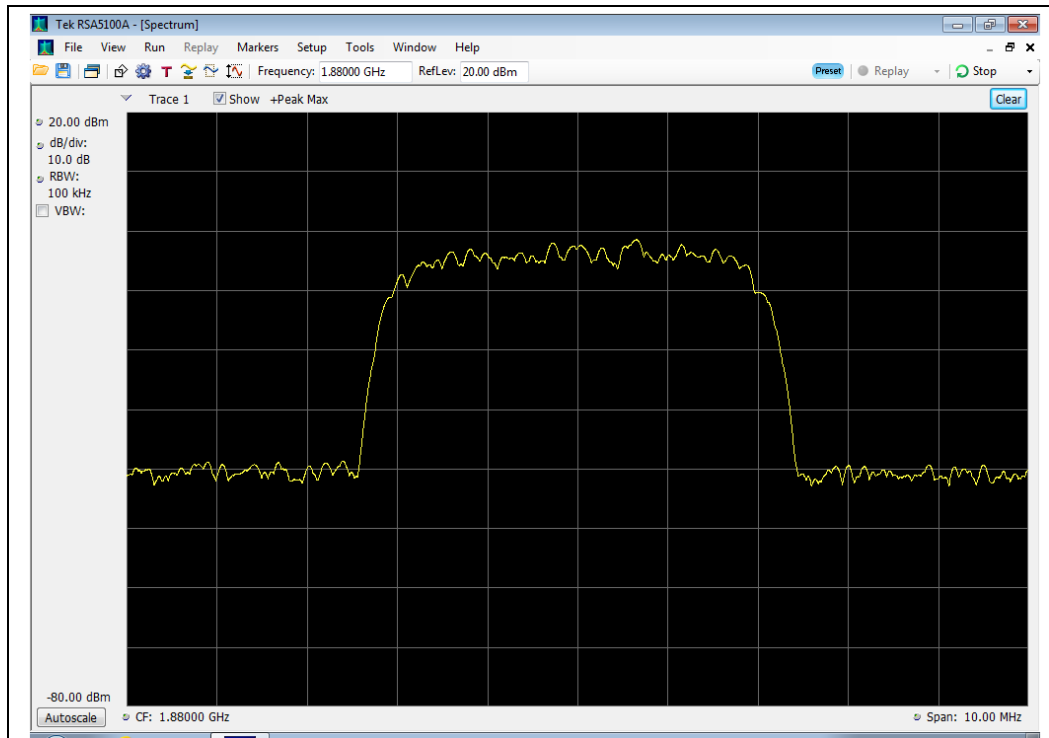
Output



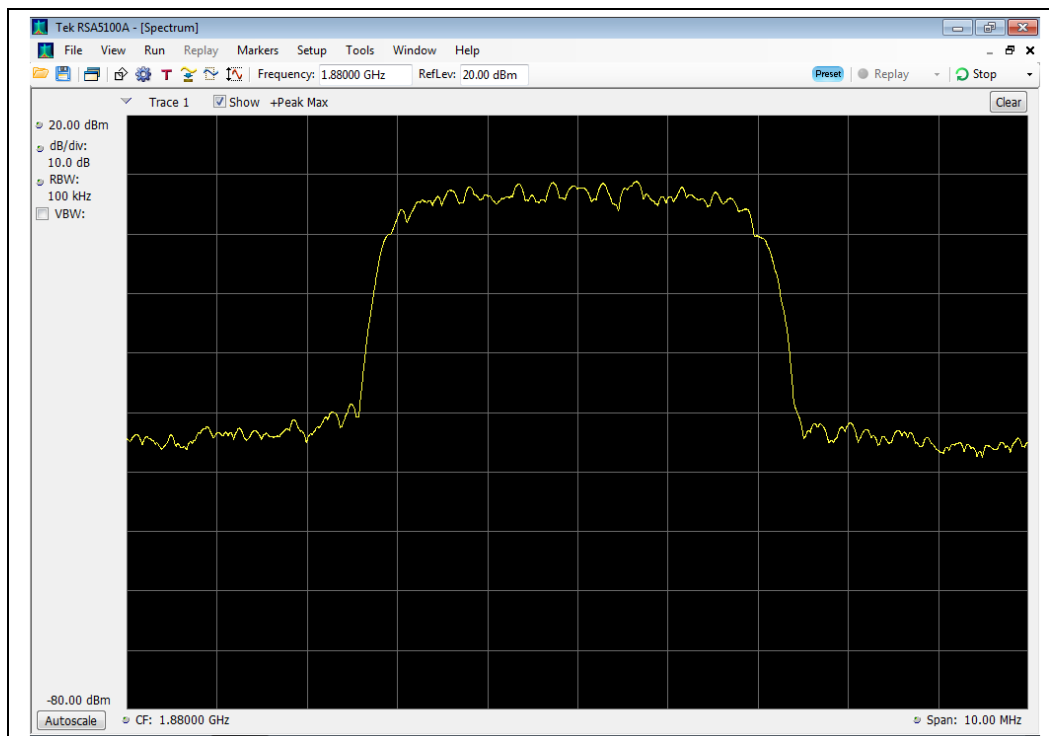


## 1850 - 1910 MHz Band

### Input



### Output

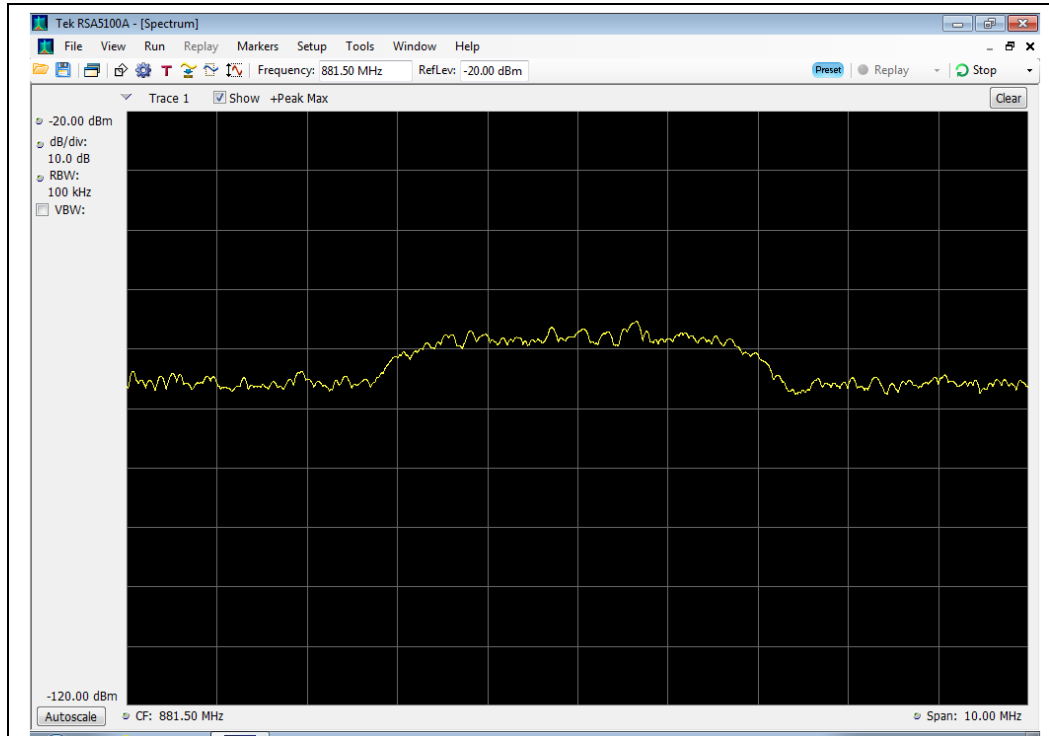




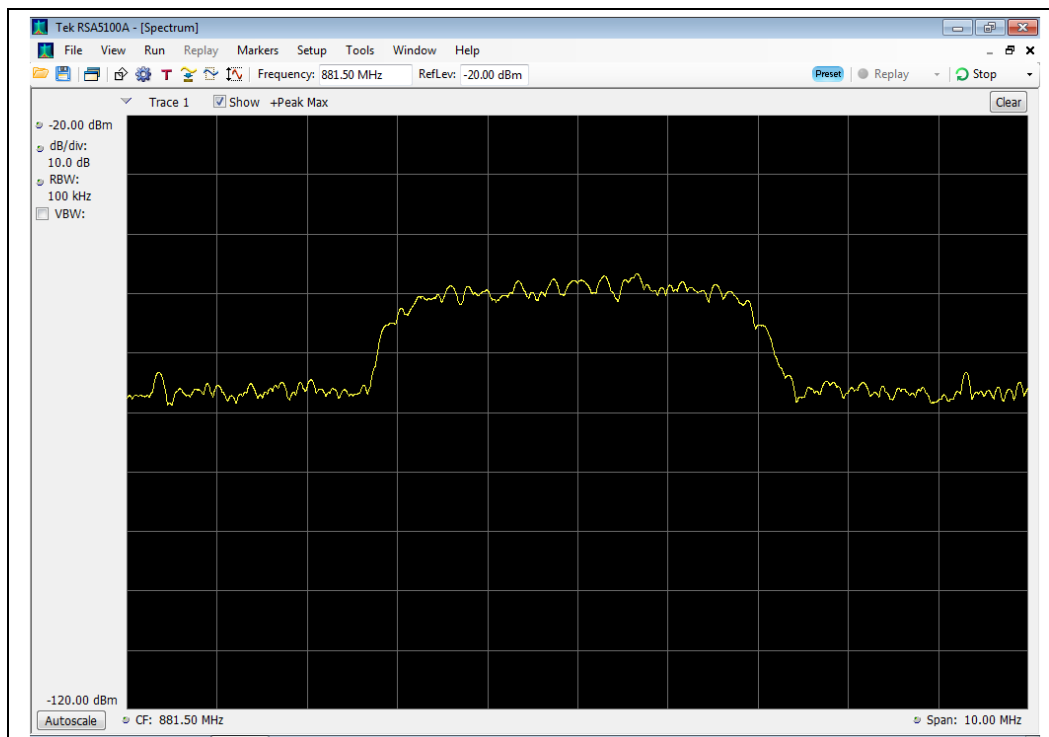
## WCDMA Downlink Test Plots

869 - 894 MHz Band

Input



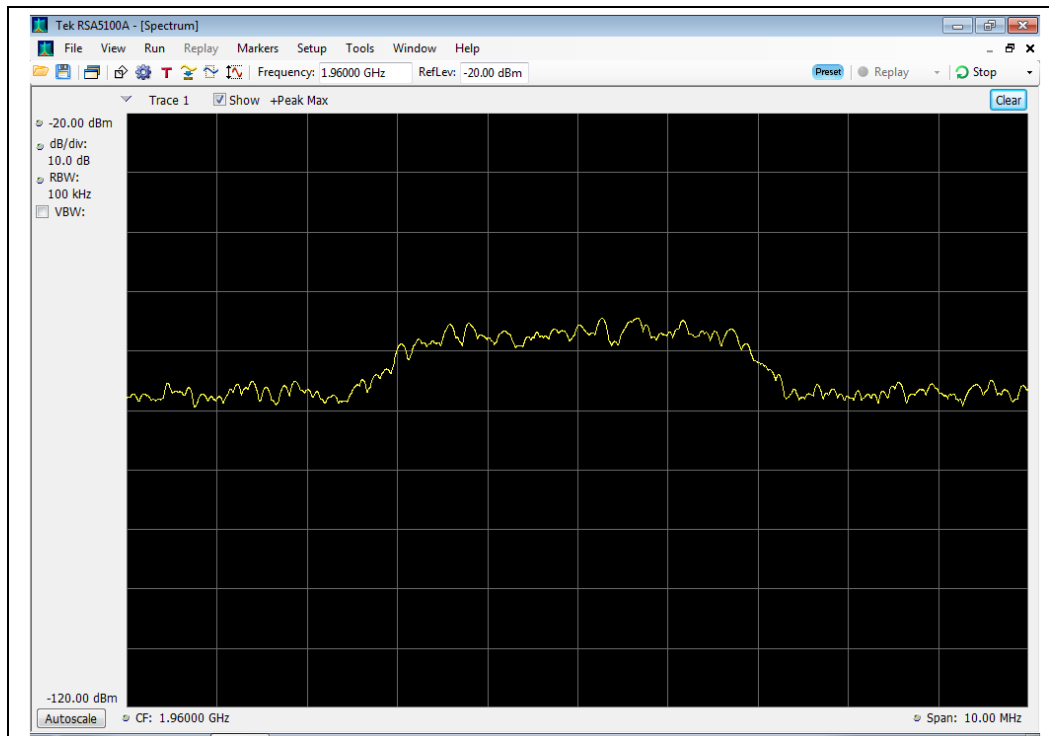
Output



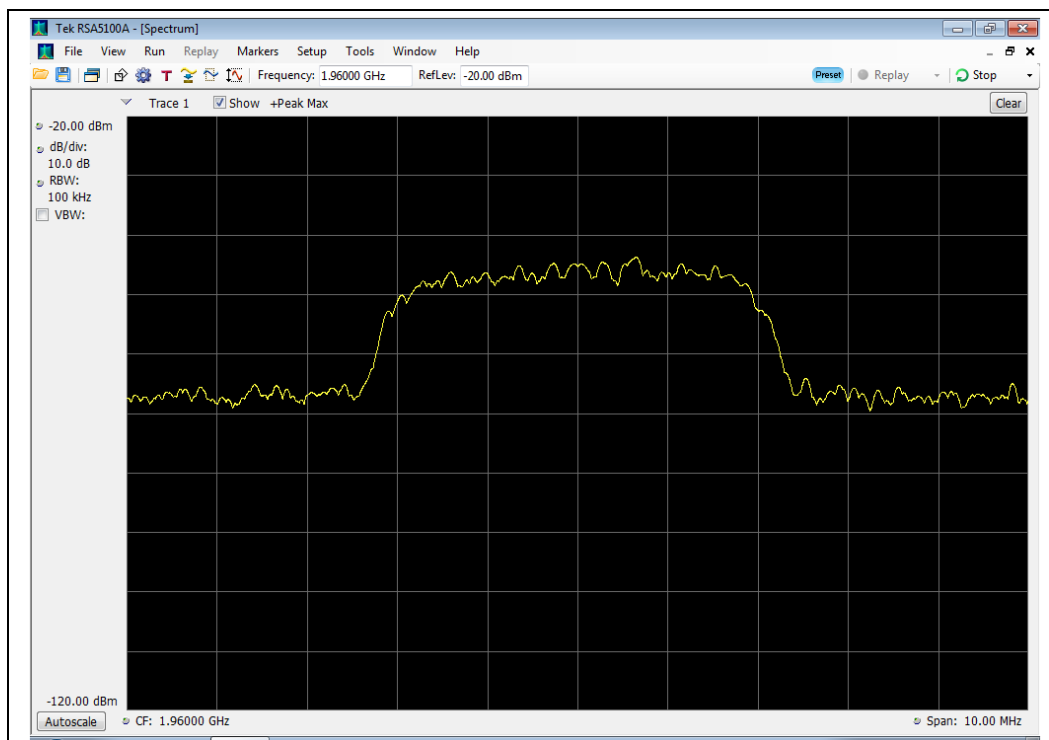


## 1930 - 1990 MHz Band

### Input



### Output





## Oscillation Detection

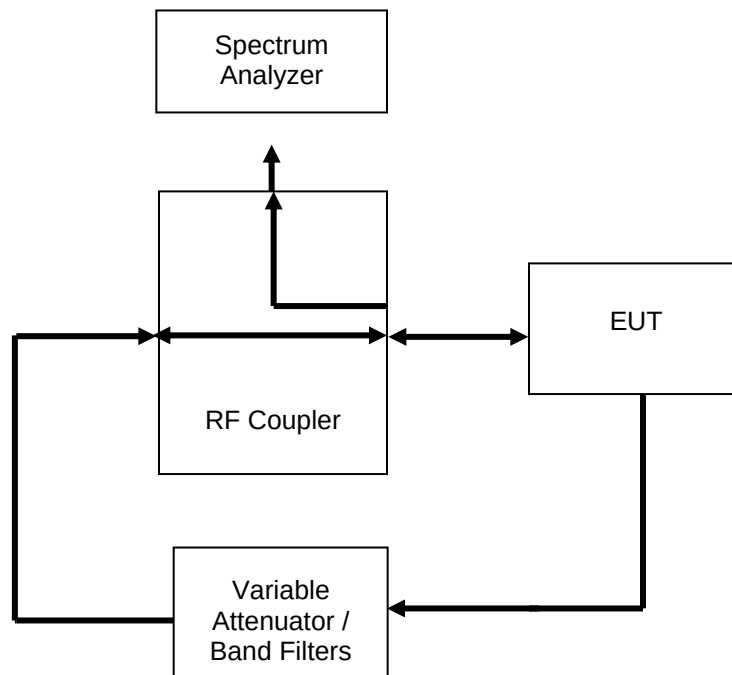
**Name of Test:** Oscillation Detection  
**Test Equipment Utilized:** i00424

**Engineer:** Greg Corbin  
**Test Date:** 10/21/2013

### Test Procedure

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

### Test Setup





**Uplink Detection Time Test Results**

| Frequency Band (MHz) | Measured Time (mS) | Limit (mS) | Result |
|----------------------|--------------------|------------|--------|
| 824 - 849            | 141.25             | 300        | Pass   |
| 1850 - 1910          | 105                | 300        | Pass   |

**Downlink Detection Time Test Results**

| Frequency Band (MHz) | Measured Time (mS) | Limit (S) | Result |
|----------------------|--------------------|-----------|--------|
| 869 - 894            | 161.25             | 1         | Pass   |
| 1930 - 1990          | 108.75             | 1         | Pass   |

**Uplink Restart Time Test Results**

| Frequency Band (MHz) | Measured Time (S) | Limit (S) | Result |
|----------------------|-------------------|-----------|--------|
| 824 - 849            | 69.125            | ≥60       | Pass   |
| 1850 - 1910          | 68.375            | ≥60       | Pass   |

**Downlink Restart Time Test Results**

| Frequency Band (MHz) | Measured Time (mS) | Limit (mS) | Result |
|----------------------|--------------------|------------|--------|
| 869 - 894            | 68.5               | ≥60        | Pass   |
| 1930 - 1990          | 68.25              | ≥60        | Pass   |

**Uplink Restart Count Test Results**

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

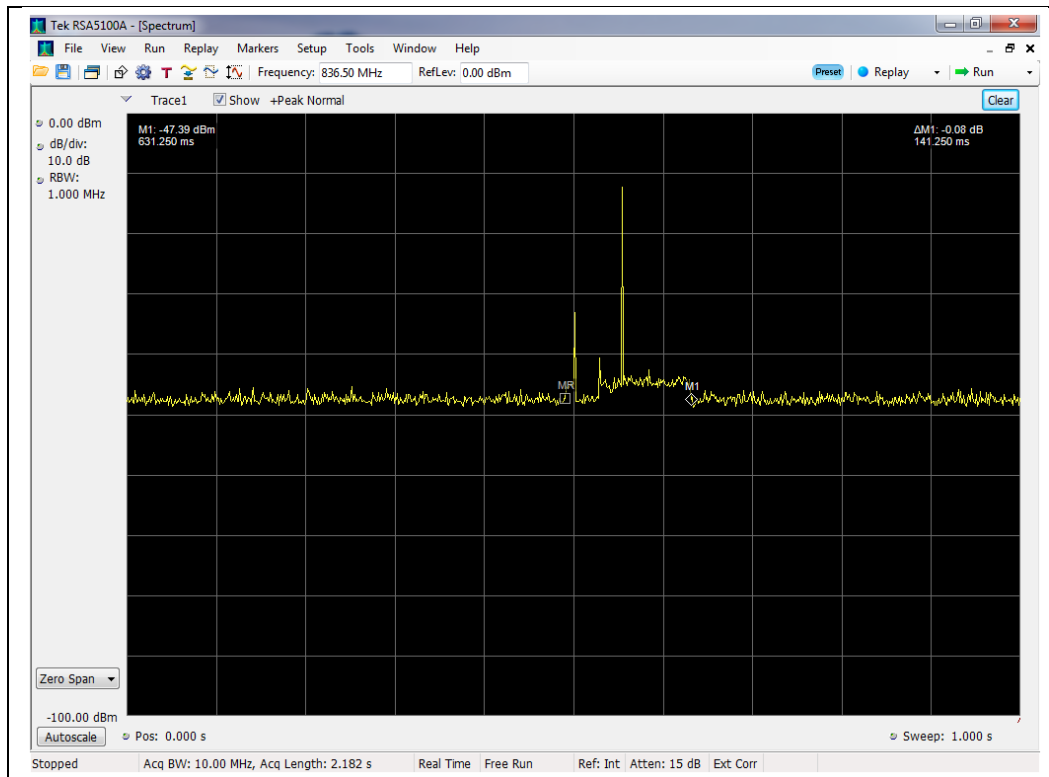
**Downlink Restart Count Test Results**

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

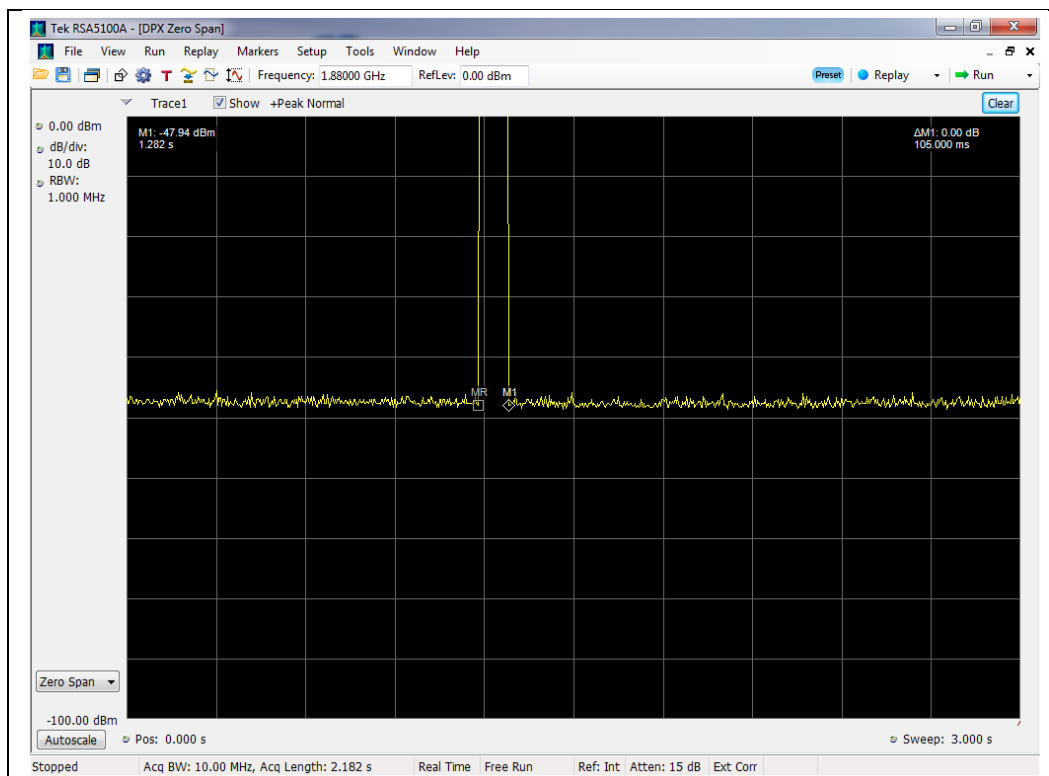


## Uplink Detection Time Test Results

### 824 - 849 MHz Band



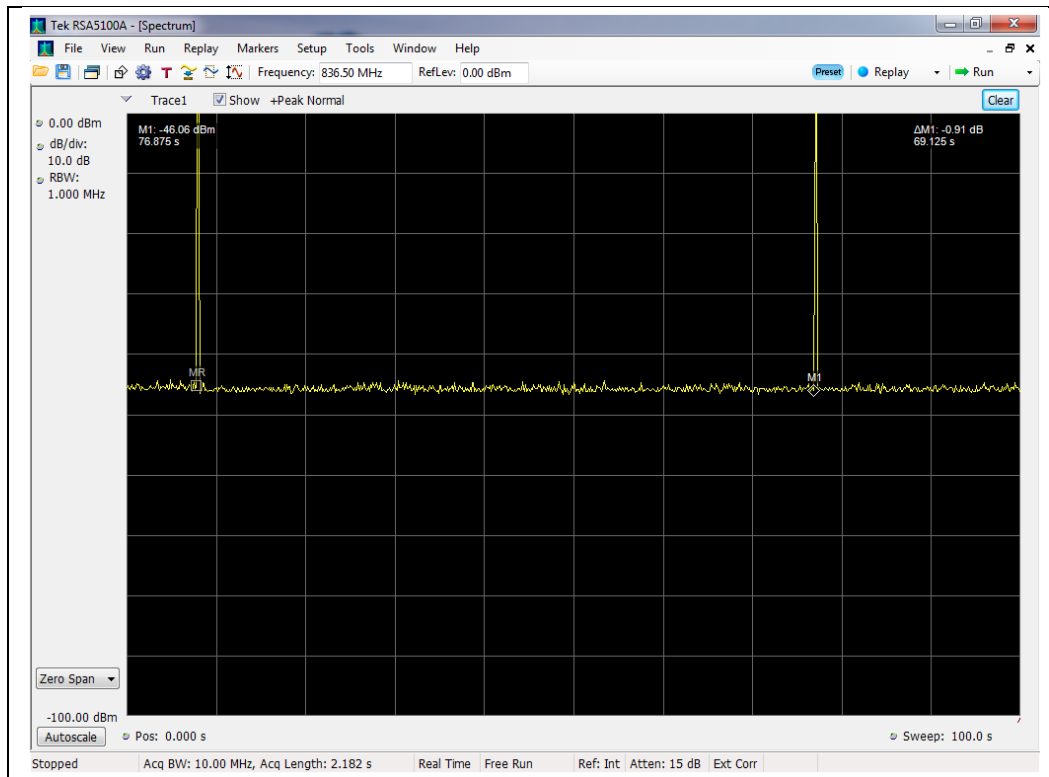
### 1850 - 1910 MHz Band



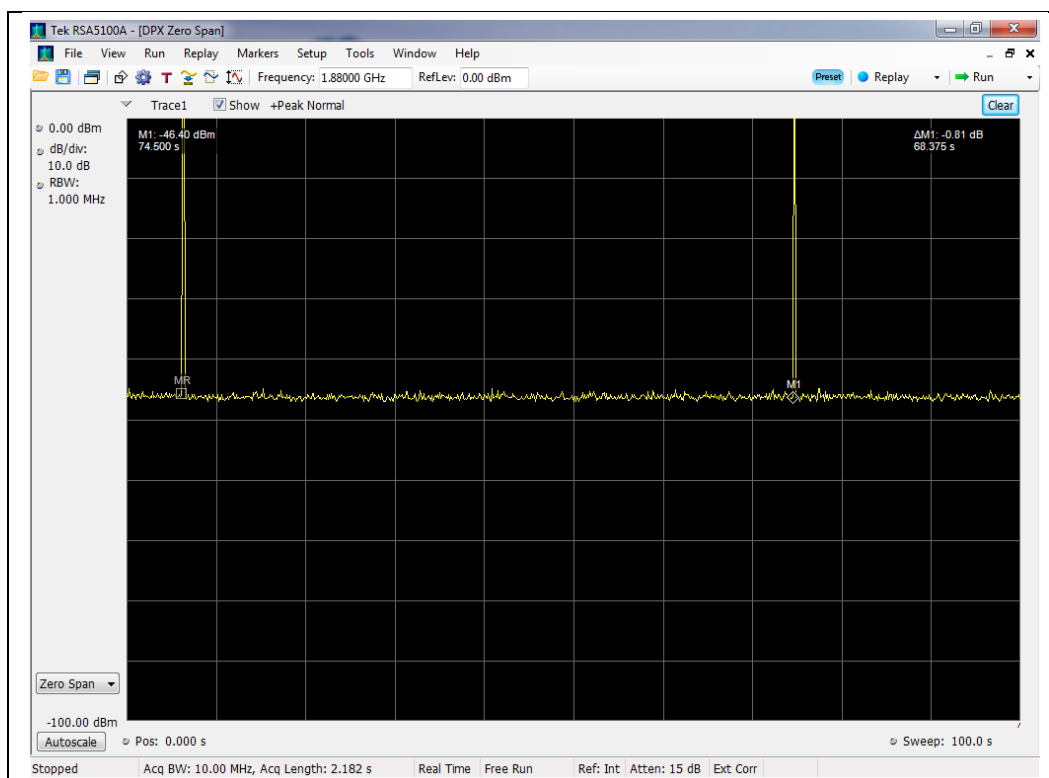


## Uplink Restart Time Test Results

### 824 - 849 MHz Band



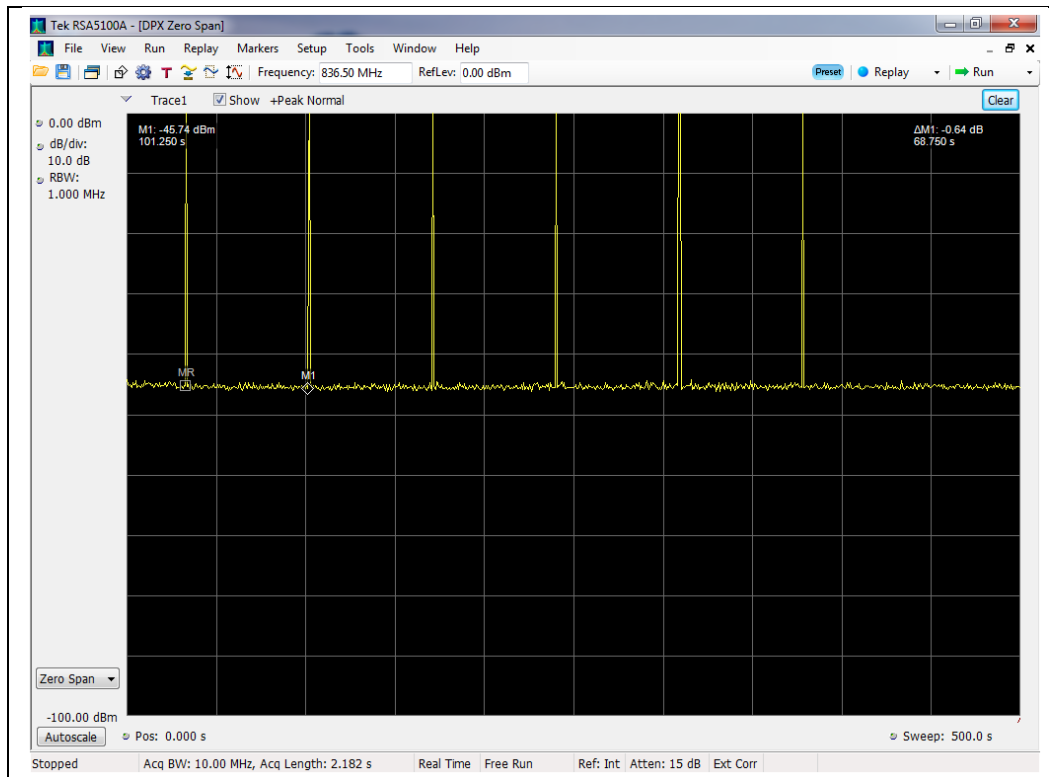
### 1850 - 1910 MHz Band



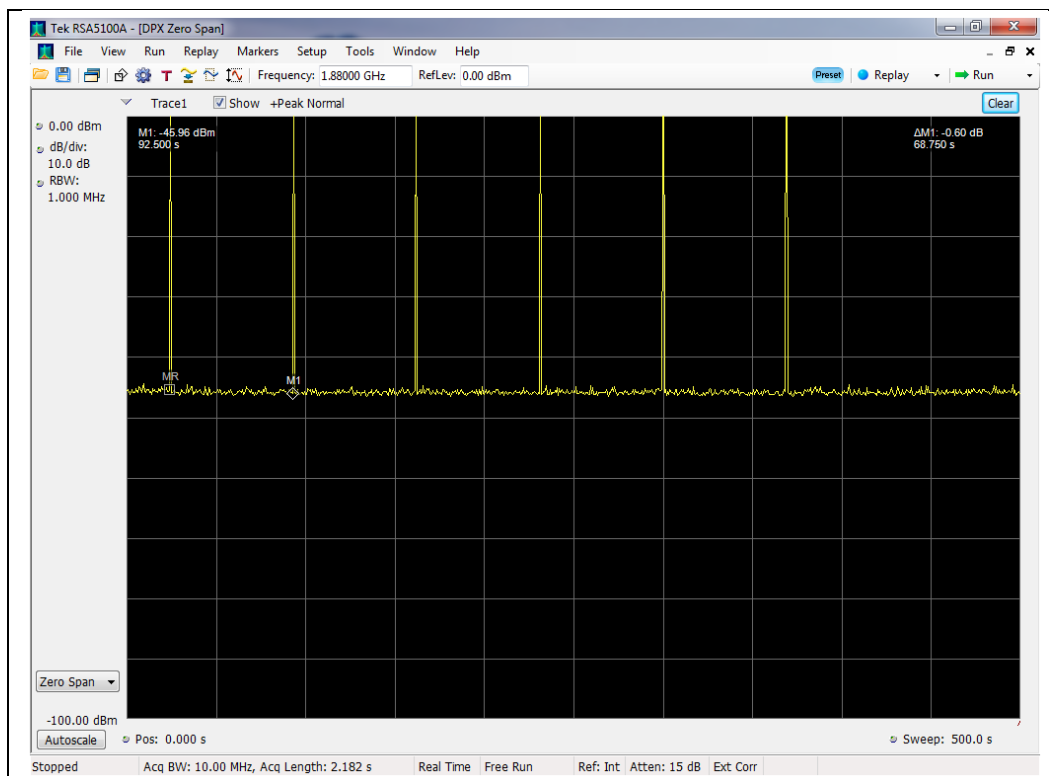


## Uplink Restart Count Test Results

### 824 - 849 MHz Band



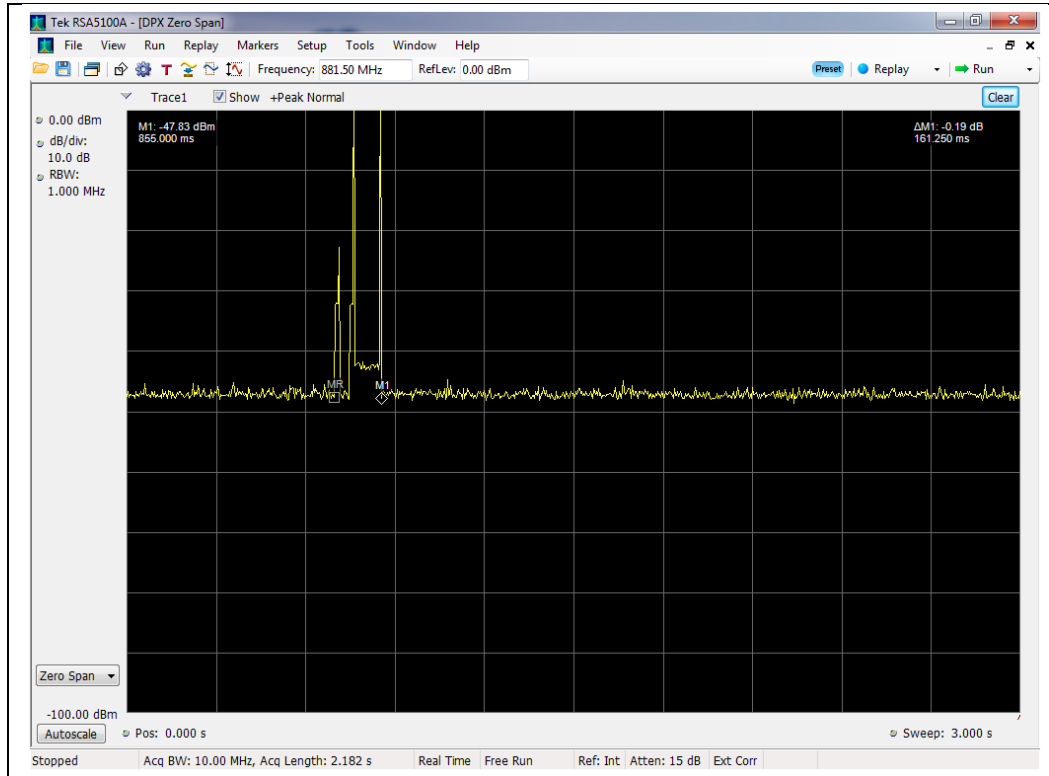
### 1850 - 1910 MHz Band



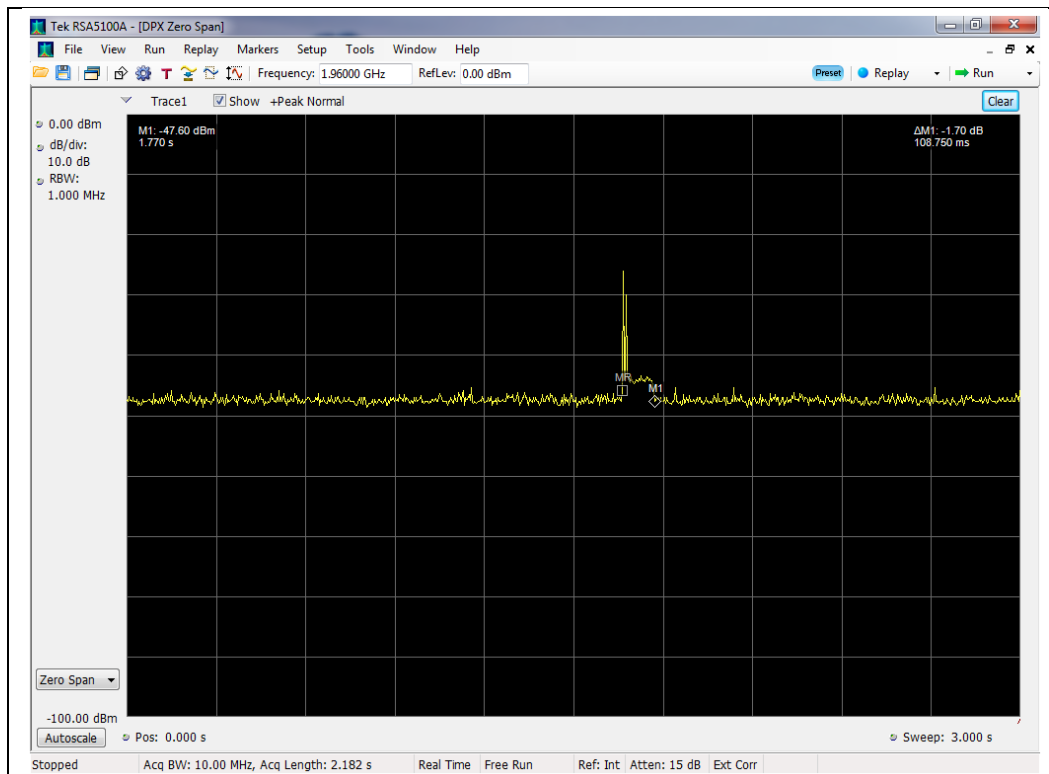


## Downlink Detection Time Test Results

### 869 - 894 MHz Band



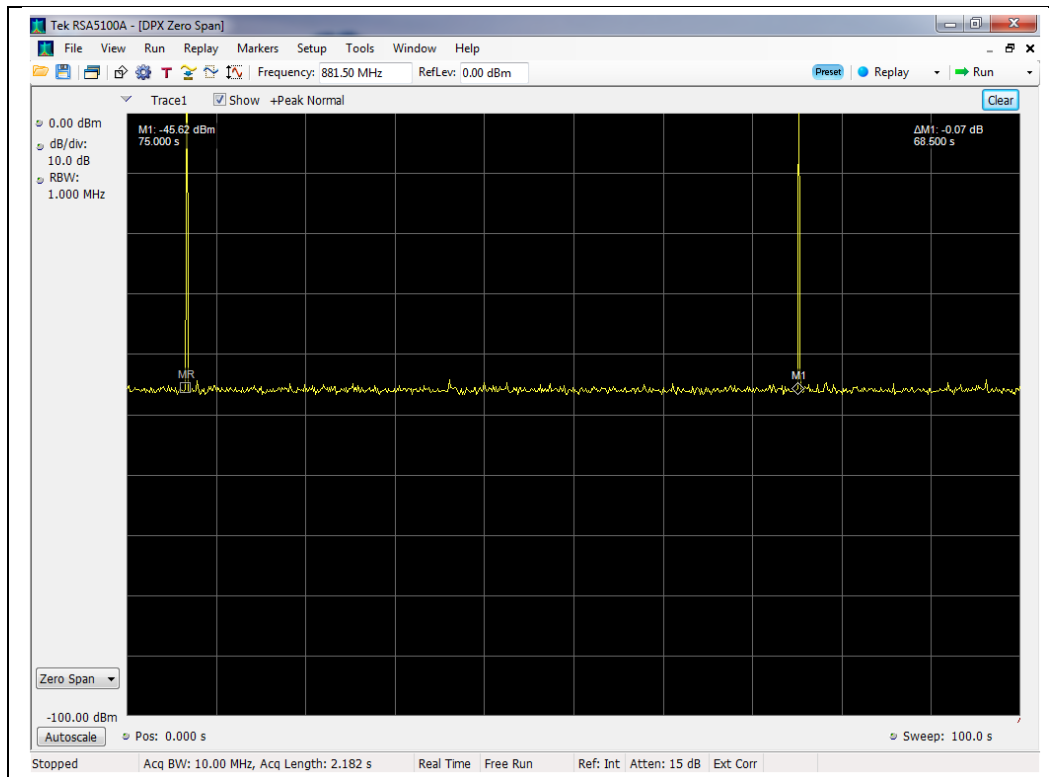
### 1930 - 1990 MHz Band



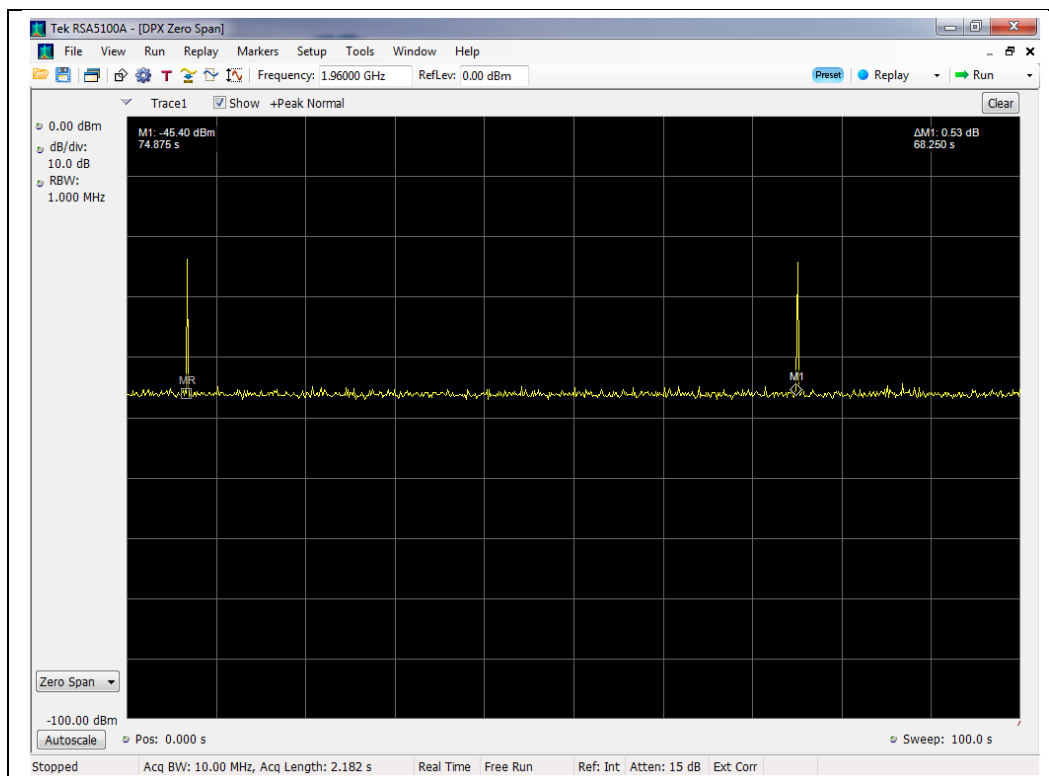


## Downlink Restart Time Test Results

### 869 - 894 MHz Band



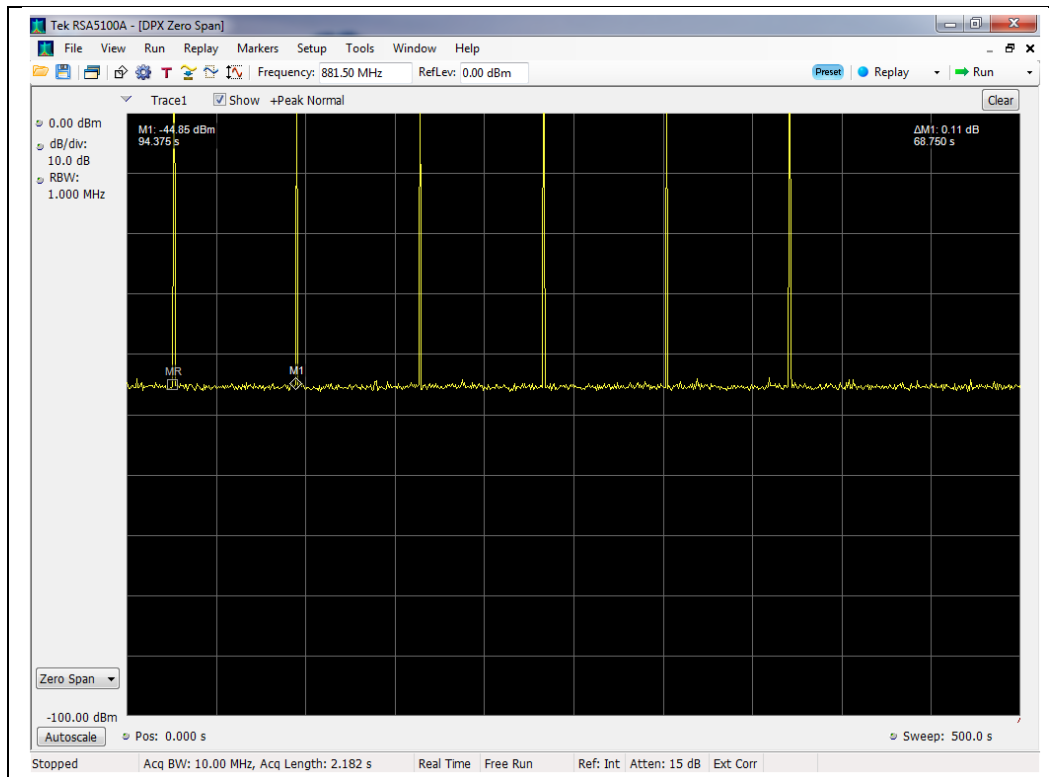
### 1930 - 1990 MHz Band



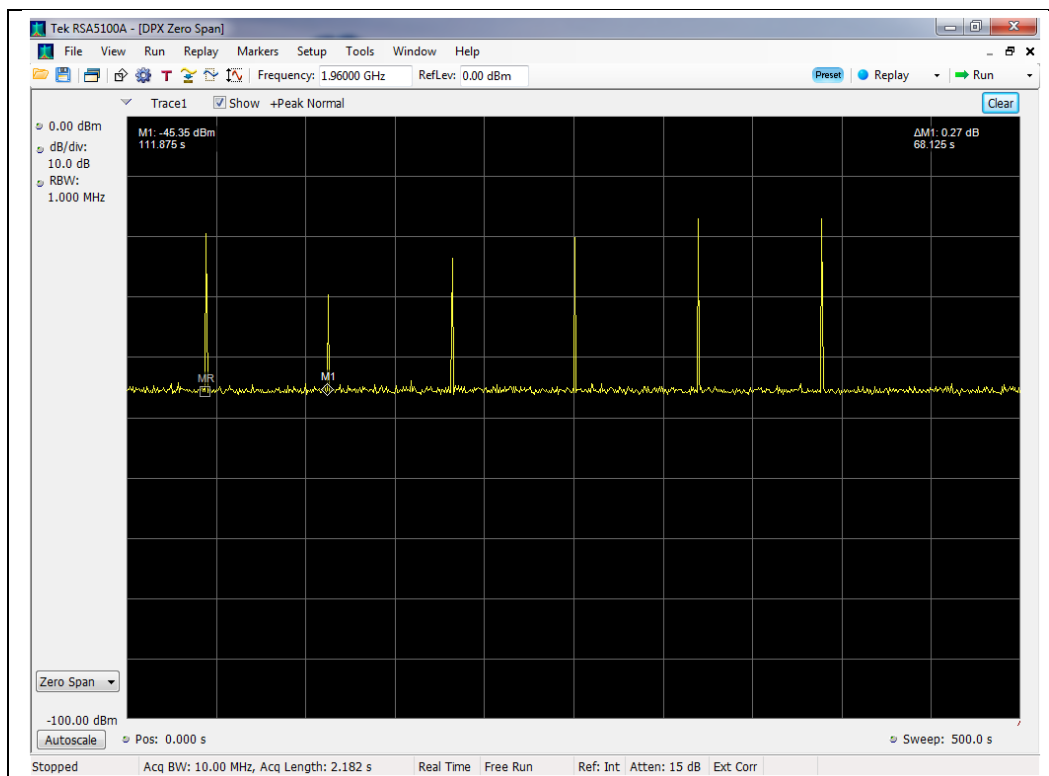


## Downlink Restart Count Test Results

### 869 - 894 MHz Band



### 1930 - 1990 MHz Band





## Radiated Spurious

**Name of Test:** Radiated Spurious  
**Test Equipment Utilized:** i00103, i00348  
E4407B - S/N:MY41444836

**Engineer:** Greg Corbin

**Test Date:** 10/15/2013

### 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.

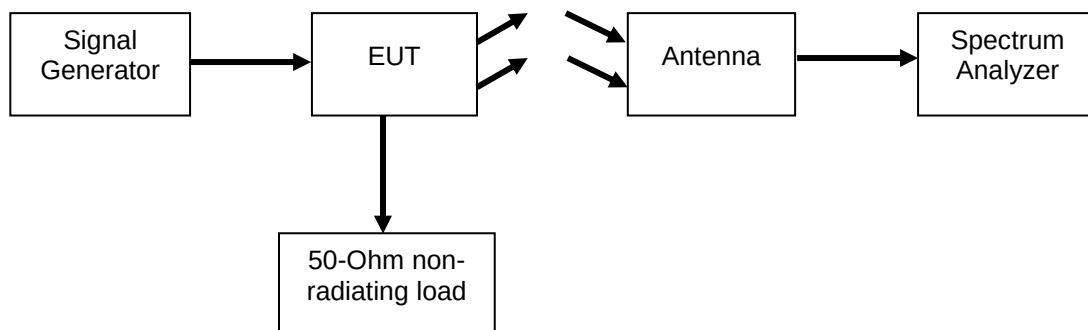
The following formulas are used for calculating the limits.

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

P1=power in dBm,

P2 = power in Watts

### Test Setup





## Uplink Test Results

### 824 - 849 MHz Band 836 MHz Tuned Frequency

| Measured Frequency (MHz) | Measured Level (dBm) | Limit (dBm) | Result |
|--------------------------|----------------------|-------------|--------|
| 1672                     | -45.3                | -13         | Pass   |
| 2508                     | -39.5                | -13         | Pass   |
| 3344                     | -35.8                | -13         | Pass   |

### 1850 - 1910 MHz Band 1880 MHz Tuned Frequency

| Measured Frequency (MHz) | Measured Level (dBm) | Limit (dBm) | Result |
|--------------------------|----------------------|-------------|--------|
| 3760                     | -36.3                | -13         | Pass   |
| 5640                     | -32.6                | -13         | Pass   |
| 7520                     | -25.0                | -13         | Pass   |

## Downlink Test Results

### 869 - 894 MHz Band 881.5 MHz Tuned Frequency

| Measured Frequency (MHz) | Measured Level (dBm) | Limit (dBm) | Result |
|--------------------------|----------------------|-------------|--------|
| 1763                     | -44.5                | -13         | Pass   |
| 2644.5                   | -39.5                | -13         | Pass   |
| 3526                     | -36.0                | -13         | Pass   |

### 1930 - 1990 MHz Band 1960 MHz Tuned Frequency

| Measured Frequency (MHz) | Measured Level (dBm) | Limit (dBm) | Result |
|--------------------------|----------------------|-------------|--------|
| 3920                     | -36.0                | -13         | Pass   |
| 5880                     | -34.4                | -13         | Pass   |
| 7840                     | -25                  | -13         | Pass   |

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



## Test Equipment Utilized

| Description              | Manufacturer       | Model #                                               | CT Asset #         | Last Cal Date           | Cal Due Date |
|--------------------------|--------------------|-------------------------------------------------------|--------------------|-------------------------|--------------|
| Horn Antenna             | EMCO               | 3115                                                  | i00103             | 12/11/2012              | 12/11/2014   |
| 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             | N/A                     |              |
| Vector Signal Generator  | Agilent            | E4438C                                                | i00348             | 1/4/13                  | 1/4/14       |
| Tunable Band Pass Filter | Wilson Electronics | Variable attenuator / Bandpass Filter Switch Assembly | i00411             | Verified on: 10/21/2013 |              |
| RF Directional Coupler   | Meca               | CS06-1.500V                                           | i00413             | Verified on: 10/21/2013 |              |
| Signal Generator         | Rohde & Schwarz    | SMU200A                                               | S/N:101369         | 6/24/13                 | 6/24/16      |
| Spectrum Analyzer        | Agilent            | E4407B                                                | S/N:<br>MY41444836 | 6/21/13                 | 6/21/14      |
| Spectrum Analyzer        | Textronix          | RSA5126A                                              | i00424             | 9/22/13                 | 9/22/14      |

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