



Test Report

Prepared for: G-Way Microwave

Model: BDA-CELLAB/PCSF-2/2W-80-OCA1

Description: RigBooster PRO, Dual Band Outdoor BDA

FCC ID: Q8KCELLPCS2W80N

To

FCC Part 20

Date of Issue: March 13, 2015

On the behalf of the applicant:

G-Way Microwave
38 Leuning Street
South Hackensack, NJ 07606

Attention of:

Gregory Tsvika Blekher, Project Engineer
Ph: (201) 343-3140
E-Mail: t_blekher@gwaymicrowave.com

Prepared By
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1510014

Mike Graffeo
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	February 20, 2015	Mike Graffeo	Original Document
2.0	March 4, 2015	Greg Corbin	Corrected typo's and copy/paste errors throughout report while performing internal review of the project.
3.0	March 11, 2015	Greg Corbin	Corrected plot on page 69 and 100.



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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 Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A



The Applicant has been cautioned as to the following:

15.21: Information to the User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.



Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations Part 90.219, KDB 935210 D03 Booster, and FCC Part 2, Part 20.21, Part 22, Part 24, and C63-26D13 where appropriate.

Standard Test Conditions and Engineering Practices

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

In accordance with ANSI/TIA 603C, 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)
23.0 – 29.4	23.3 – 38.1	960.8 – 968.5

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

EUT Description

Model: BDA-CELLAB/PCSF-2/2W-80-OCA1

Description: RigBooster PRO, Dual Band Outdoor BDA

Firmware: N/A

Software: N/A

Additional Information: N/A



The signal booster uses the following frequency bands.

The emission designators listed are representative emission designators used by transmitters whose signal is amplified by this booster.

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

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

EUT Operation during Tests

The output power was set to the maximum level available for all the tests, when applicable.

AGC Threshold

Several tests reference the AGC Threshold level.

The AGC Threshold was measured as follows:

- Connect a signal generator to the input of the EUT.
- Connect a spectrum analyzer to the output of the EUT using appropriate attenuation.
- While monitoring the output of the EUT, increase the input level until the output stops increasing or drops a few 10ths of a dB.
- This is the AGC threshold level of the EUT.
- When the procedure calls out to set the RF Input to just below the AGC Threshold, The AGC Threshold is measured using the procedure listed above, and then the RF Input is backed off 0.2 dB below this threshold level.



Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
KDB 935210-D03	Authorized Frequency Band	Pass	
2.1046 KDB 935210-D02	Output Power (Conducted)	Pass	
2.1051 KDB 935210-D02	Spurious Emissions (Transmitter Conducted)	Pass	
2.1053 KDB 935210-D02	Radiated Spurious Emissions	Pass	
2.1049 KDB 935210-D02	Occupied Bandwidth	Pass	
KDB 935210-D03	Intermodulation	Pass	



Authorized Frequency Band

Name of Test: Authorized Frequency Band
Test Equipment Utilized: i00457, i00331

Engineer: Mike Graffeo
Test Date: 2/16/15

Test Procedure

The EUT was connected to a spectrum analyzer through a power attenuator. A signal generator was utilized to produce a swept CW signal with the RF input level set to 3 dB below the AGC Threshold level. The Uplink and Downlink filter response and the -20 dB bandwidth were measured. The marker table function of the spectrum analyzer was used to show the peak amplitude in the passband and the -20 dB bandwidth of the pass band filter.

RBW = 100 KHz
Video BW = 3x RBW

Test Setup



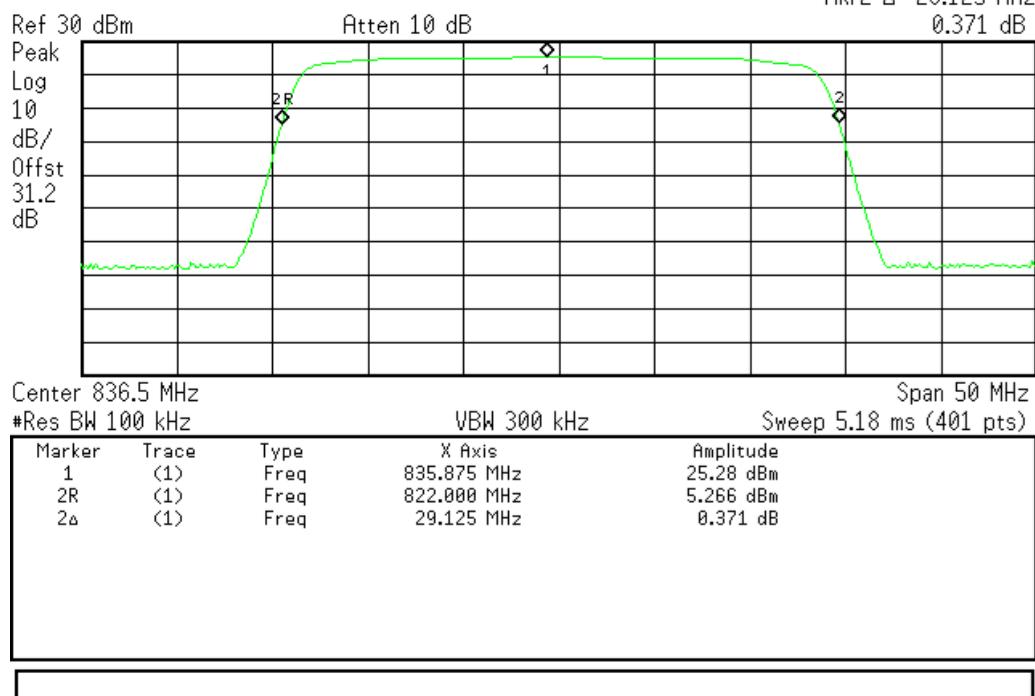


Authorized Frequency Band Test Results

824-849 MHz Band

* Agilent 11:50:09 Feb 16, 2015

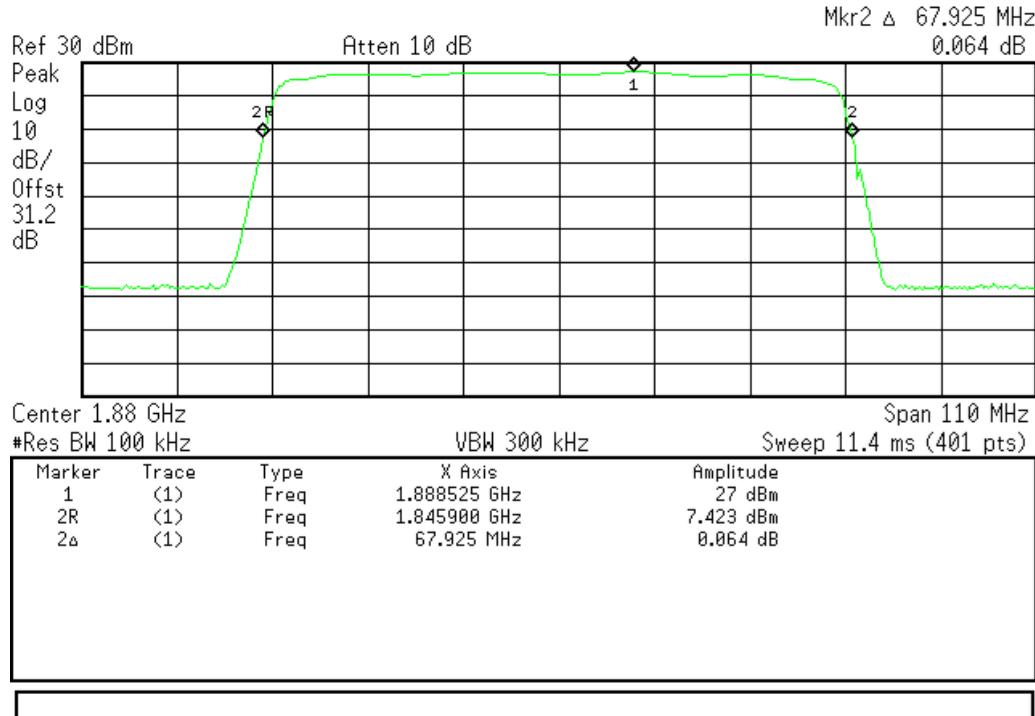
L



1850-1910 MHz Band

* Agilent 11:45:01 Feb 16, 2015

L

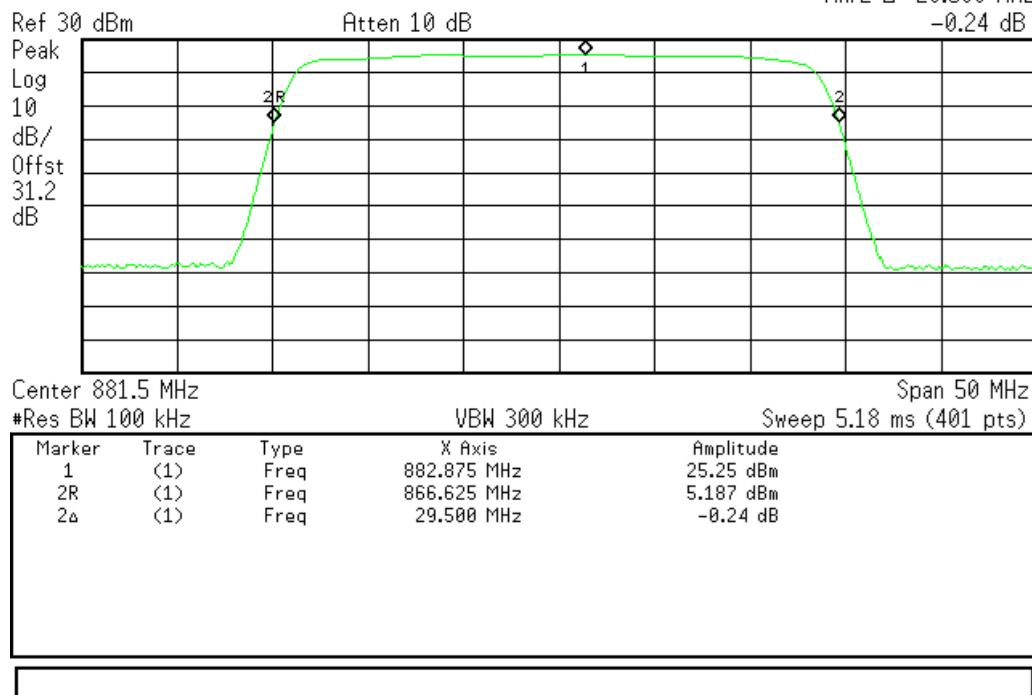


Downlink

869-894 MHz Band

* Agilent 11:36:55 Feb 16, 2015

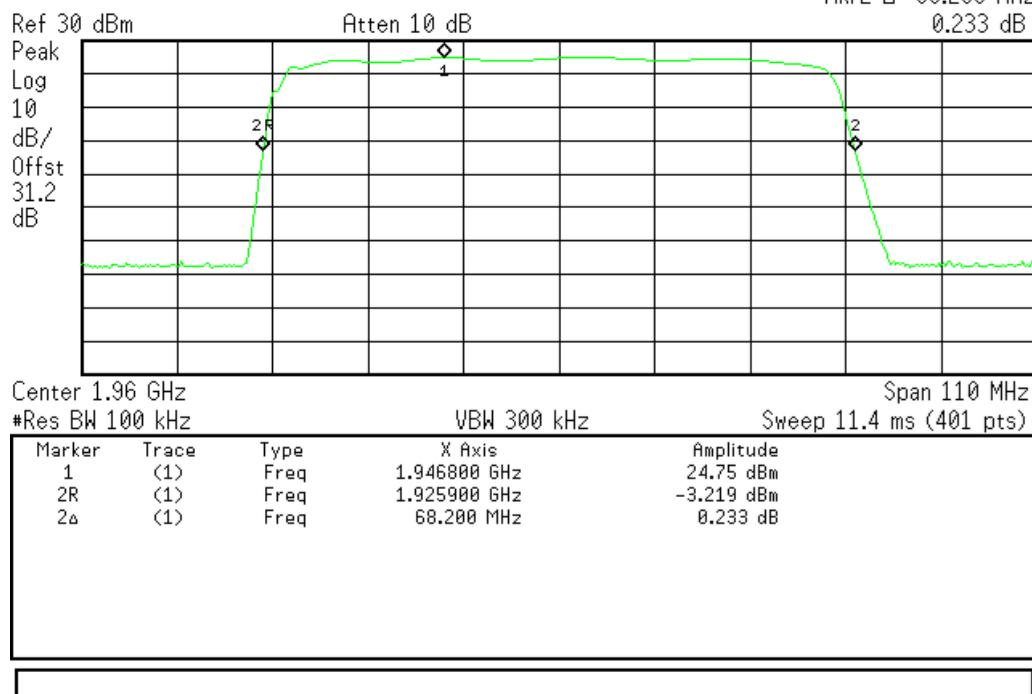
L

Mkr2 Δ 29.500 MHz
-0.24 dB

1930-1990 MHz Band

* Agilent 11:41:09 Feb 16, 2015

L

Mkr2 Δ 68.200 MHz
0.233 dB



Conducted Output Power and Amplifier Gain

Name of Test: Conducted Output Power and Amplifier Gain
Test Equipment Utilized: i00457, i00331

Engineer: Mike Graffeo
Test Date: 2/16/15

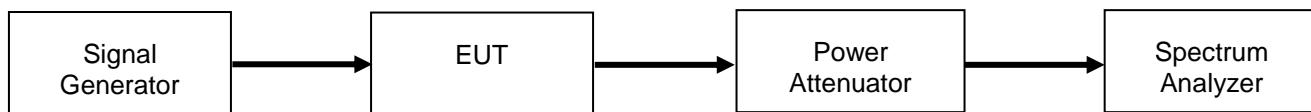
Test Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a reference level offset to ensure accurate readings were obtained. Both narrow band (GSM 250 KHz) and wide bands (CDMA 4.1MHz) and (WCDMA 4.1MHz) signals were utilized. The RF input signal level was set to 0.2 dB below the AGC Threshold.

The Input and Output power levels were recorded and the gain was calculated using the following formula:

$$\text{Gain (dB)} = \text{Output Power (dBm)} - \text{Input Power (dBm)}$$

Test Setup





Uplink Output Power and Gain

824-849 MHz Band GSM

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 824.20	-53.9	26.34	80.2
Tuned to 836.50	-54.7	27.05	81.8
Tuned to 848.80	-53.1	26.49	79.6

1850-1910 MHz Band GSM

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 1850.20	-52.1	25.87	78.0
Tuned to 1880.00	-55.1	26.84	81.9
Tuned to 1909.80	-53.1	26.67	79.8

Uplink Output Power and Gain 824-849 MHz Band CDMA

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 825.25	-53.1	26.12	79.2
Tuned to 836.50	-56.0	26.35	82.4
Tuned to 847.75	-53.2	26.07	79.3

1850-1910 MHz Band CDMA

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 1851.25	-54.3	24.94	79.2
Tuned to 1880.00	-56.2	25.81	82.0
Tuned to 198.75	-53.6	25.61	79.2



**Uplink Output Power and Gain
824-849 MHz Band
WCDMA**

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 826.50	-54.9	26.34	81.2
Tuned to 836.50	-56.3	26.55	82.9
Tuned to 846.50	-54.6	26.42	81.0

**1850-1910 MHz Band
WCDMA**

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 1852.50	-53.6	25.50	79.1
Tuned to 1880.00	-54.5	26.10	80.6
Tuned to 1907.50	-53.7	25.99	79.7

Downlink Output Power and Gain

**869-894 MHz Band
GSM**

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 869.20	-53.1	26.46	79.6
Tuned to 881.50	-53.8	26.91	80.7
Tuned to 893.80	-53.6	26.29	79.9

**1930-1990 MHz Band
GSM**

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 1930.20	-52.7	25.94	78.6
Tuned to 1960.00	-54.6	26.67	81.3
Tuned to 1989.80	-53.5	26.06	79.6



Downlink Output Power and Gain

869-894 MHz Band CDMA

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 870.25	-53.2	26.27	79.5
Tuned to 881.50	-54.2	26.50	80.7
Tuned to 892.75	-53.4	26.20	79.6

Downlink Output Power and Gain

1930-1990 MHz Band CDMA

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 1931.25	-53.0	25.02	78.0
Tuned to 1960.00	-55.2	25.75	81.0
Tuned to 1988.75	-53.6	25.20	78.8

Downlink Output Power and Gain

869-894 MHz Band WCDMA

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 871.50	-52.4	26.46	78.9
Tuned to 881.50	-54.9	26.64	81.5
Tuned to 891.50	-53.6	26.41	80.0

1930-1990 MHz Band WCDMA

Tuned Frequency (MHz)	Input Power (dBm)	Output Power (dBm)	Gain (dB)
Tuned to 1932.50	-53.2	25.52	78.7
Tuned to 1960.00	-54.2	26.06	80.3
Tuned to 1987.50	-54.3	25.67	80.0



EIRP Uplink Power Calculations

Frequency Band (MHz)	Test Frequency MHz	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
824 - 849	836.50	27.05	9.5	36.55
1850 – 1910	1880.00	26.84	11	37.84

EIRP Downlink Power Calculations

Frequency Band (MHz)	Test Frequency MHz	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
869 – 894	881.50	26.91	9.5	36.41
1930 - 1990	1960.00	26.67	11	37.67



Conducted Spurious Emissions

Name of Test:

Conducted Spurious Emissions

Test Equipment Utilized:

i00457, i00331

Engineer: Mike Graffeo

Test Date: 2/19/15

Test Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a combination of reference level offset and correction factor as needed to ensure accurate readings were obtained.

The RF input signal level was set to 0.2 dB below the AGC Threshold.

The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.

The VBW was set to 3 times the RBW.

The frequency range from 30 MHz to the 10th harmonic of the passband frequency was observed and plotted.

The following formula was used for calculating the limits.

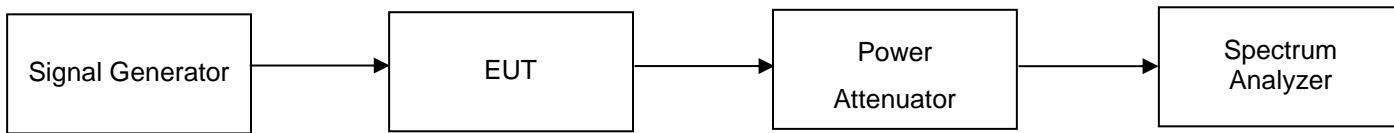
Conducted Spurious Emissions Limit = $P1 - (43 + 10\log(P2)) = -13 \text{ dBm}$

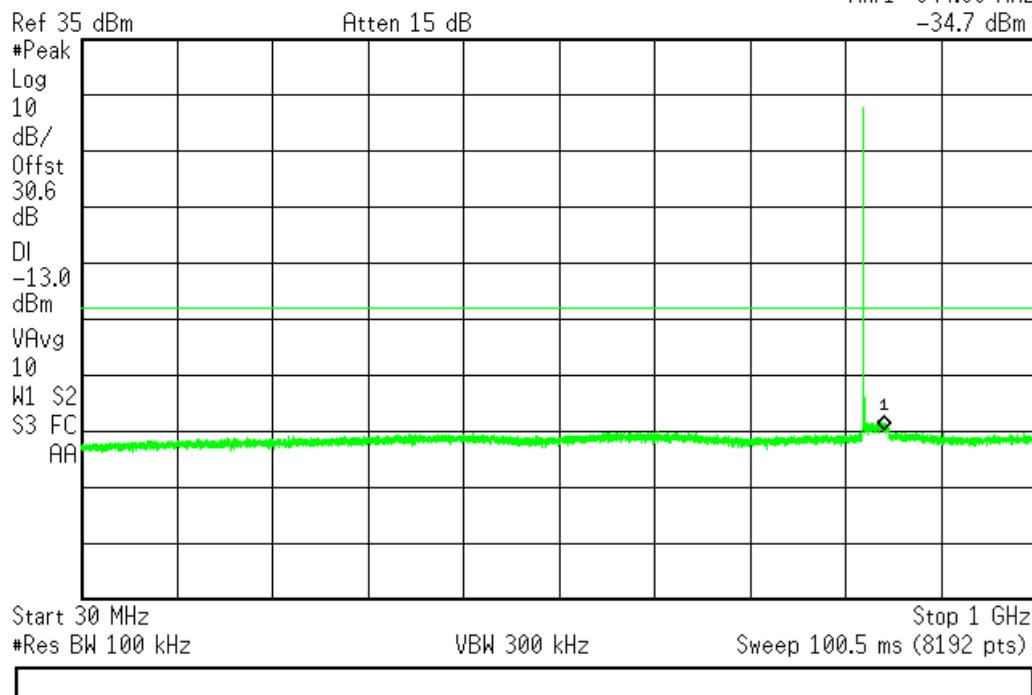
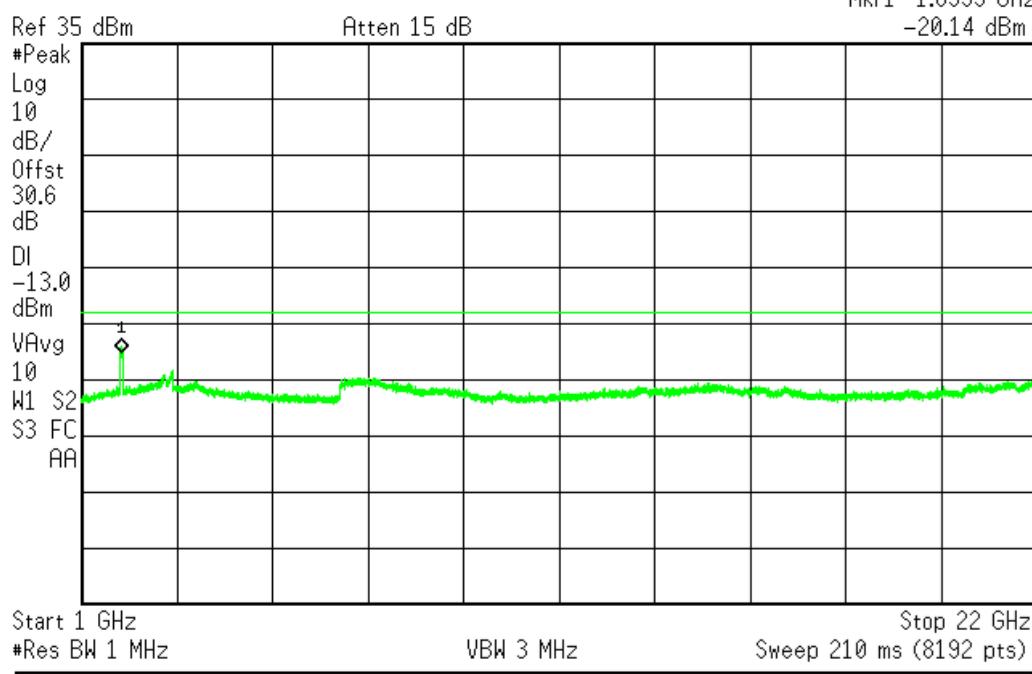
P1 = power in dBm

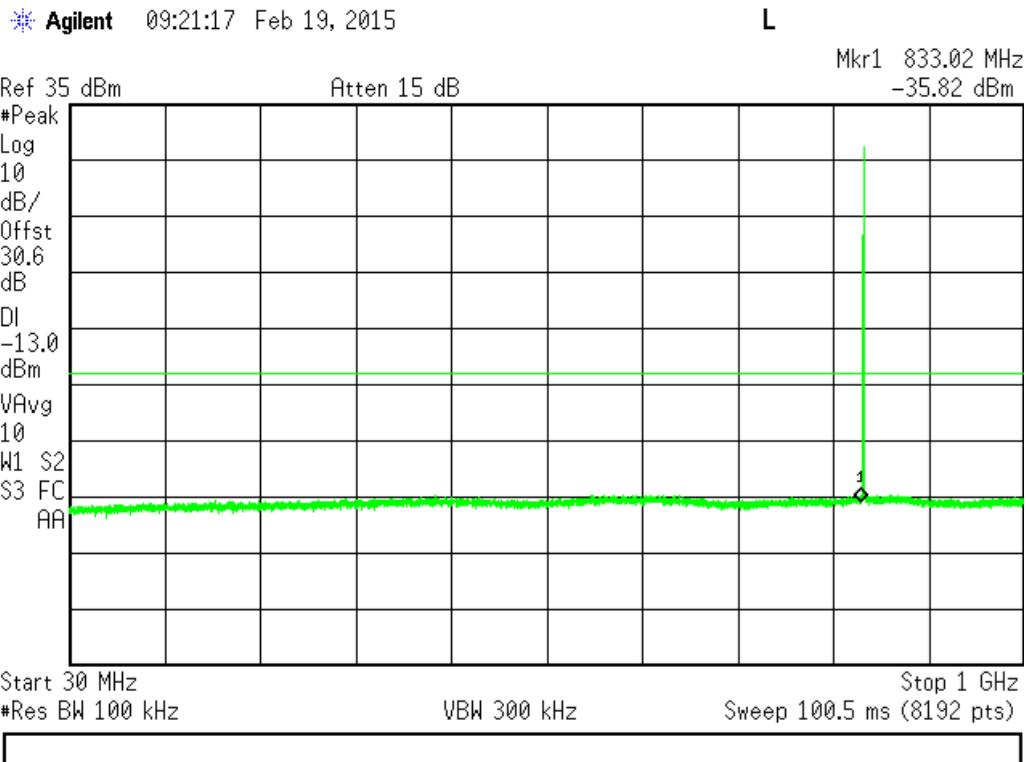
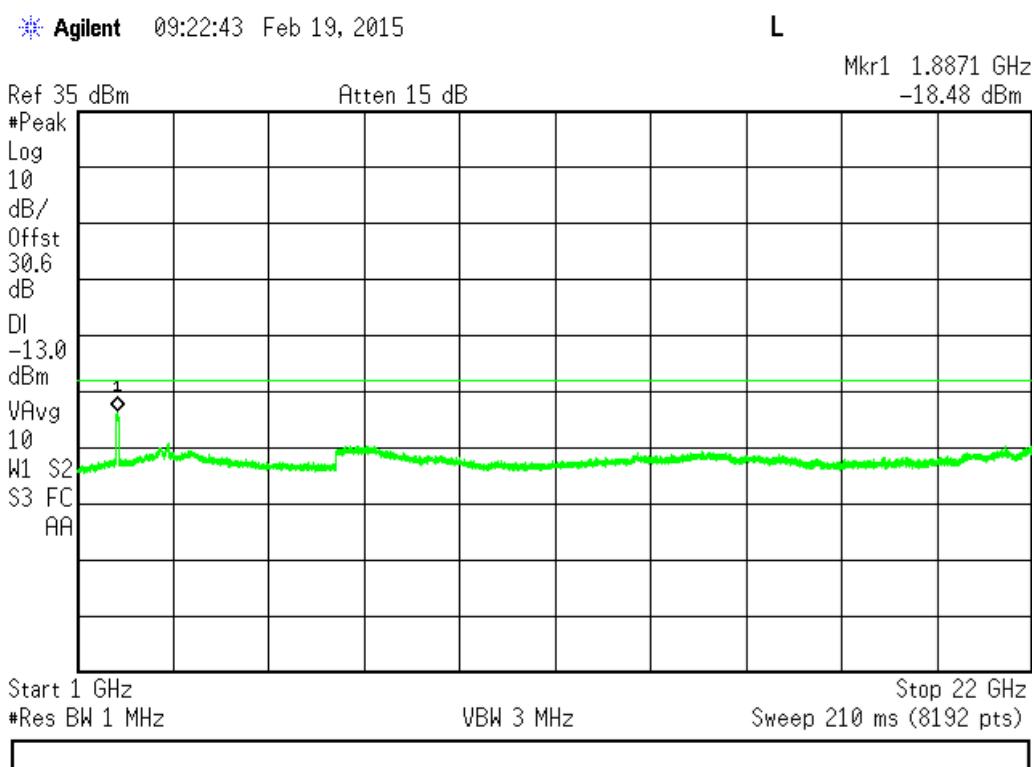
P2 = power in Watts

Tests were performed at low, mid and high frequencies and with both narrow band (GSM 250 KHz) and wide band (WCDMA 4.1MHz) signals

Test Setup



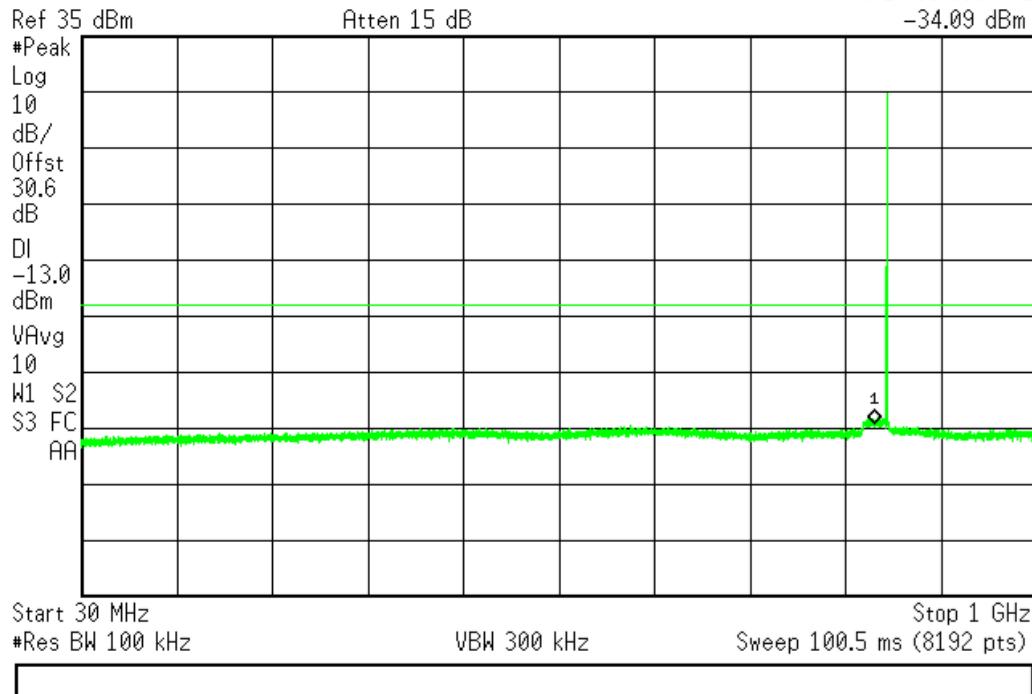
**Uplink GSM Signal
824-849 MHz Band (Low Frequency)***** Agilent** 09:27:18 Feb 19, 2015**L**Mkr1 844.98 MHz
-34.7 dBm**824-849 MHz Band (Low Frequency) (Cont)***** Agilent** 09:34:28 Feb 19, 2015**L**Mkr1 1.8999 GHz
-20.14 dBm

824-849 MHz Band (Mid Frequency)**824-849 MHz Band (Mid Frequency) (Cont)**

824-849 MHz Band (High Frequency)

* Agilent 09:29:50 Feb 19, 2015

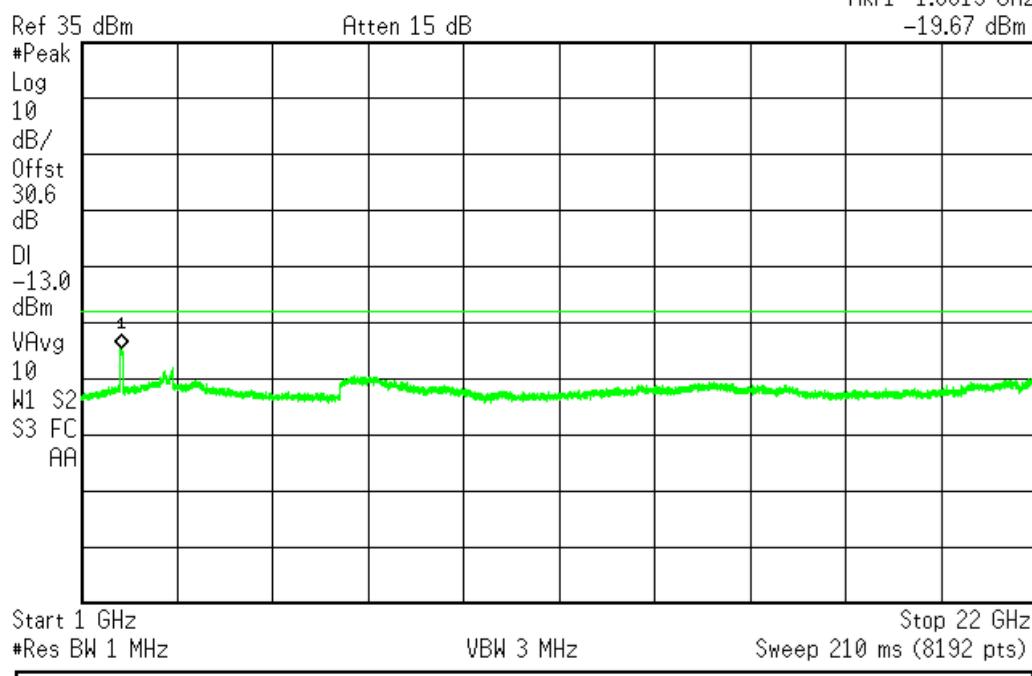
L

Mkr1 834.80 MHz
-34.09 dBm

824-849 MHz Band (High Frequency) (Cont)

* Agilent 09:30:43 Feb 19, 2015

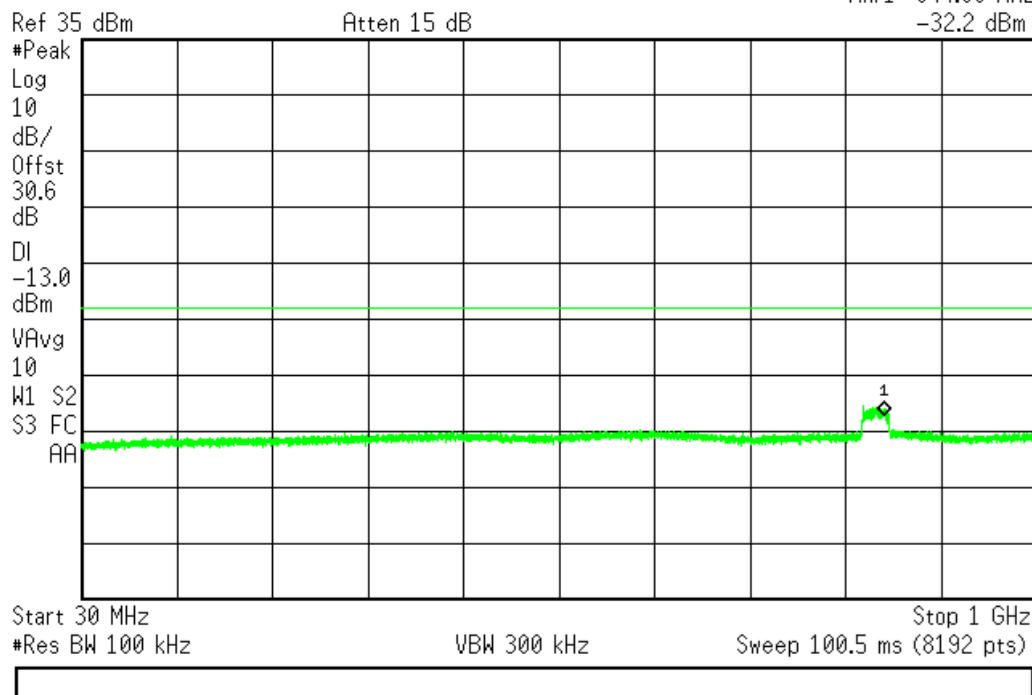
L

Mkr1 1.8819 GHz
-19.67 dBm

**Uplink GSM Signal
1850-1910 MHz Band (Low Frequency)**

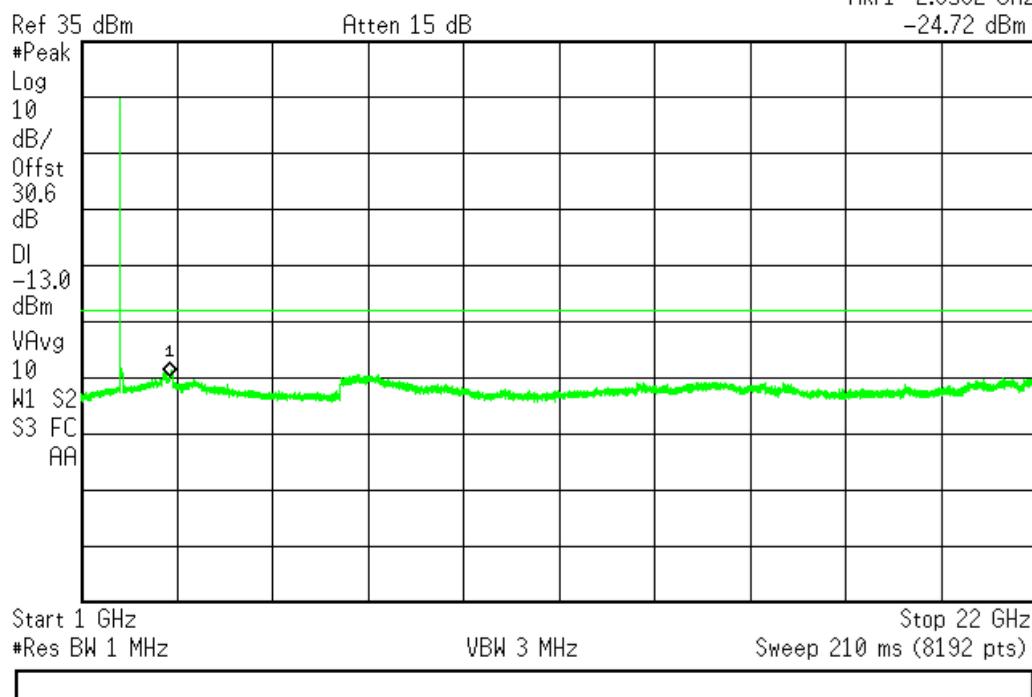
* Agilent 09:28:17 Feb 19, 2015

L

Mkr1 844.98 MHz
-32.2 dBm**1850-1910 MHz Band (Low Frequency) (Cont)**

* Agilent 09:35:26 Feb 19, 2015

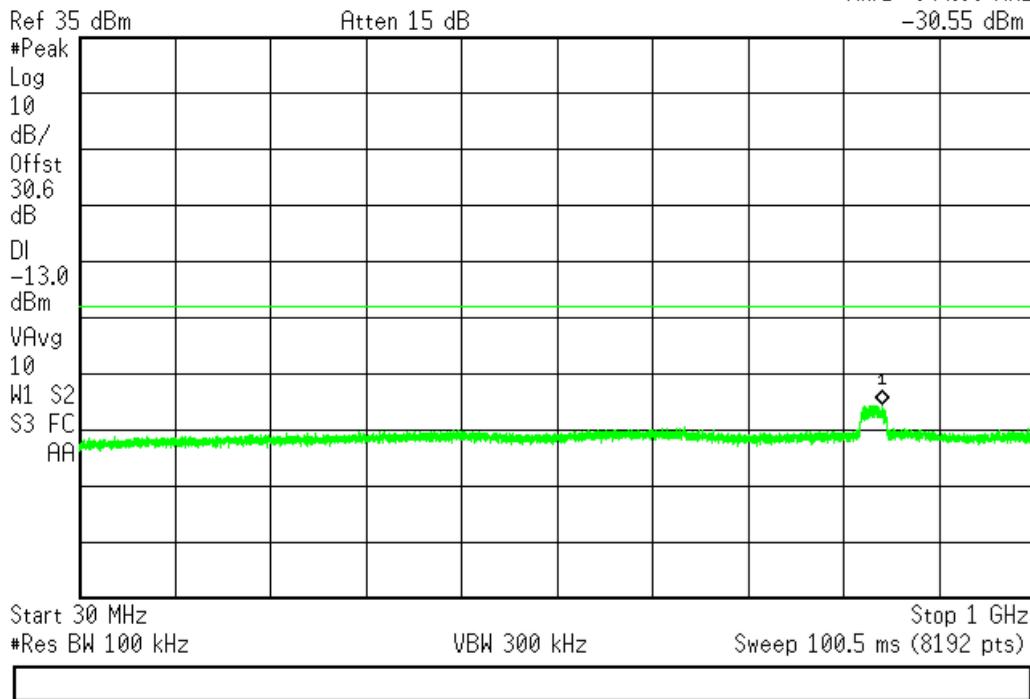
L

Mkr1 2.9562 GHz
-24.72 dBm

1850-1910 MHz Band (Mid Frequency)

* Agilent 09:24:59 Feb 19, 2015

L

Mkr1 844.98 MHz
-30.55 dBm

1850-1910 MHz Band (Mid Frequency) (Cont)

* Agilent 09:24:14 Feb 19, 2015

L

Mkr1 1.8871 GHz
-24.21 dBm

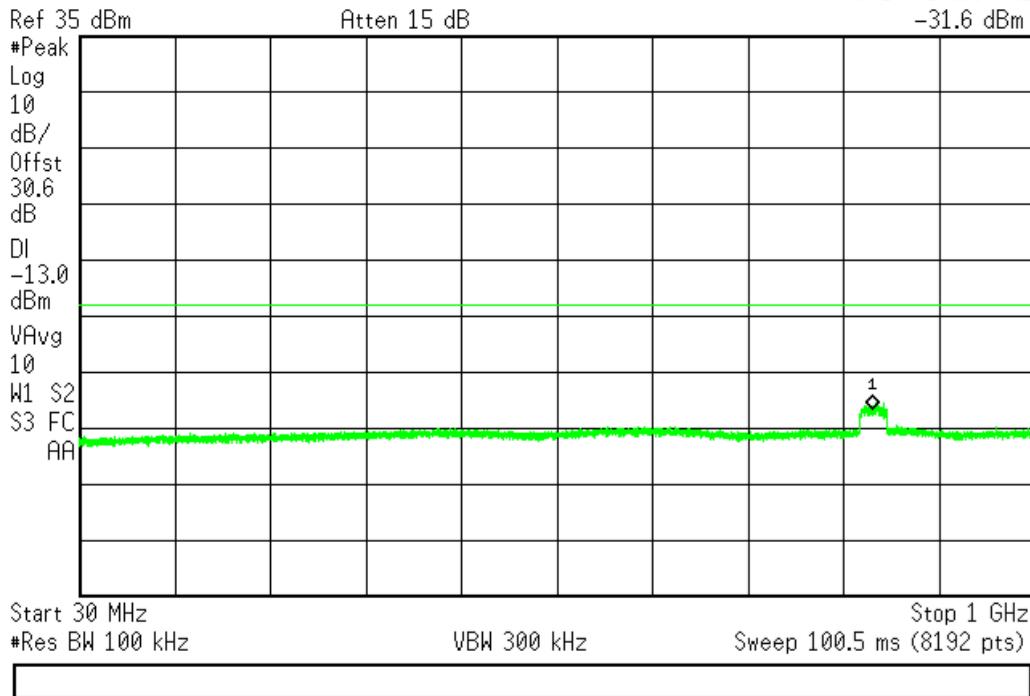


1850-1910MHz Band (High Frequency)

* Agilent 09:29:01 Feb 19, 2015

L

Mkr1 834.80 MHz
-31.6 dBm



1850-1910 MHz Band (High Frequency) (Cont)

* Agilent 09:31:50 Feb 19, 2015

L

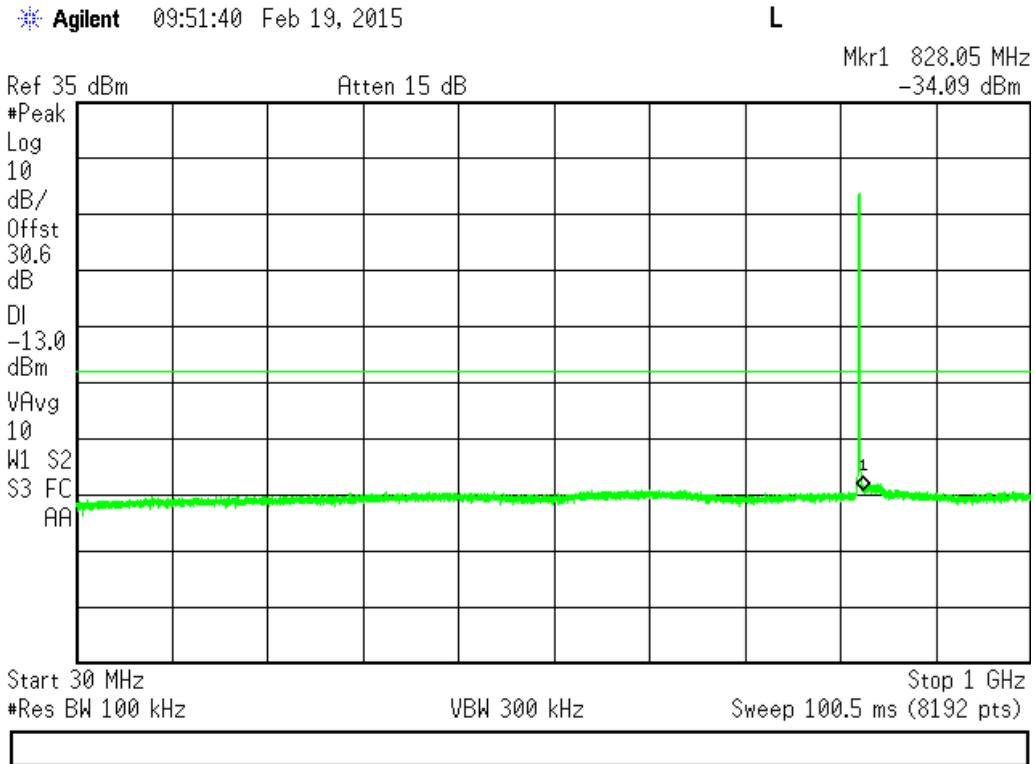
Mkr1 2.9921 GHz
-23.6 dBm



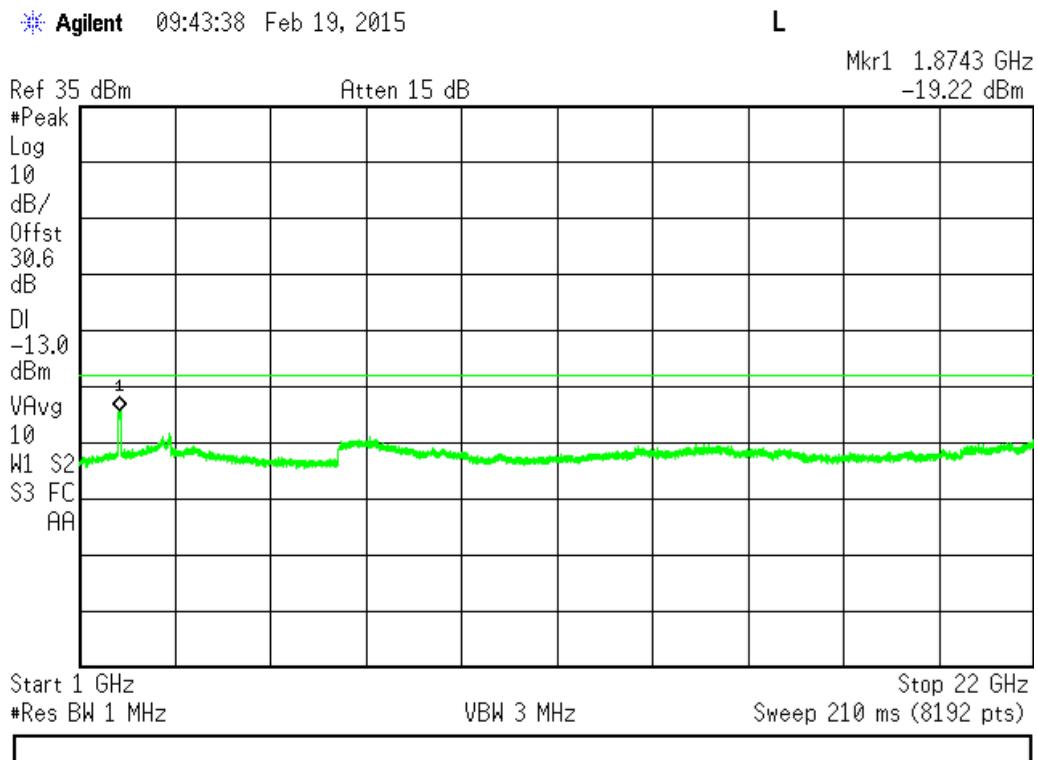


Uplink CDMA Signal

824-849 MHz Band (Low Frequency)



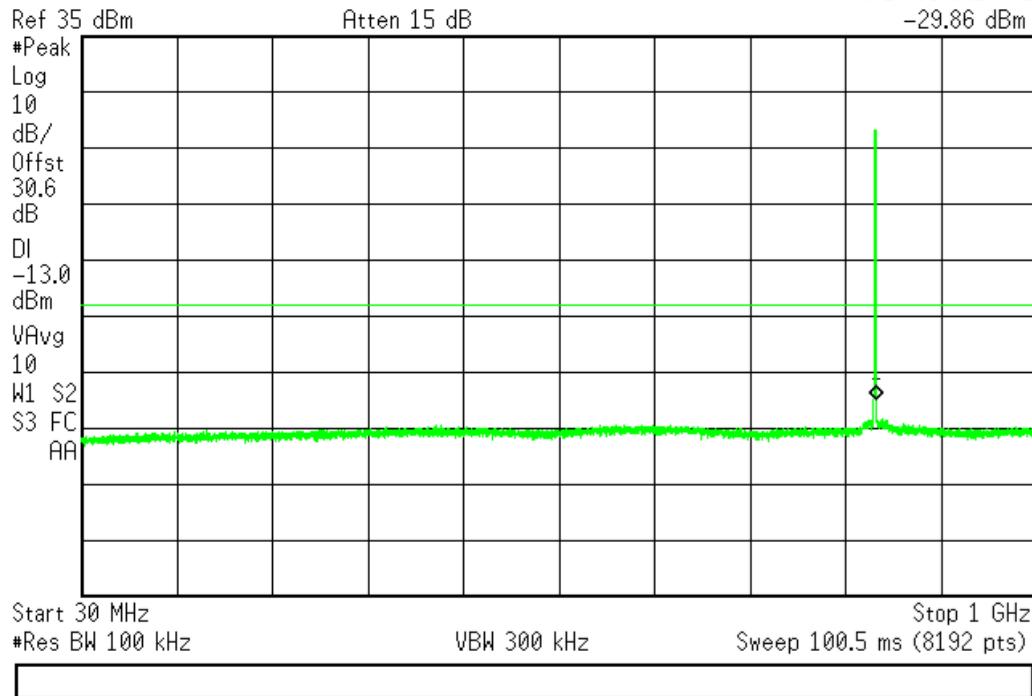
824-849 MHz Band (Low Frequency) (Cont)



824-849 MHz Band (Mid Frequency)

* Agilent 09:48:28 Feb 19, 2015

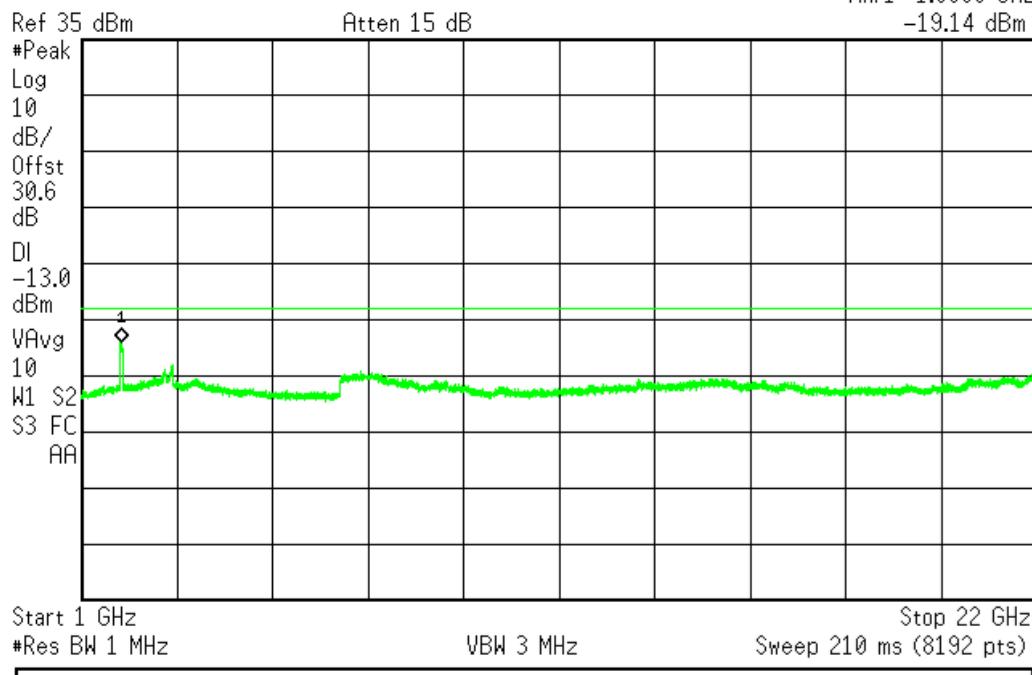
L

Mkr1 837.41 MHz
-29.86 dBm

824-849 MHz Band (Mid Frequency) (Cont)

* Agilent 09:41:18 Feb 19, 2015

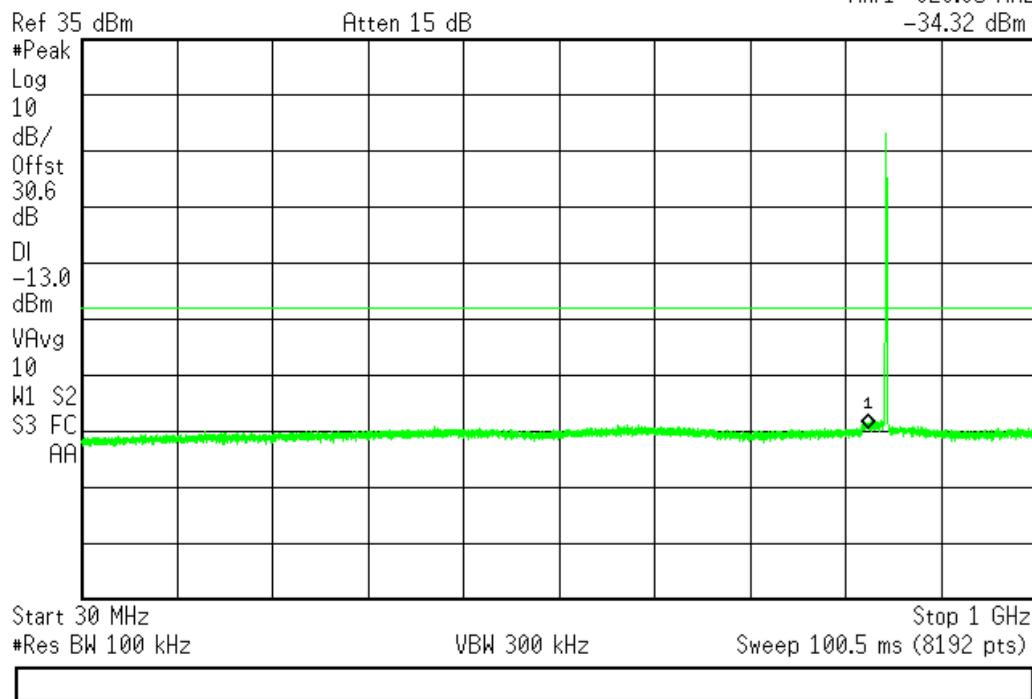
L

Mkr1 1.8999 GHz
-19.14 dBm

824-849 MHz Band (High Frequency)

* Agilent 09:52:13 Feb 19, 2015

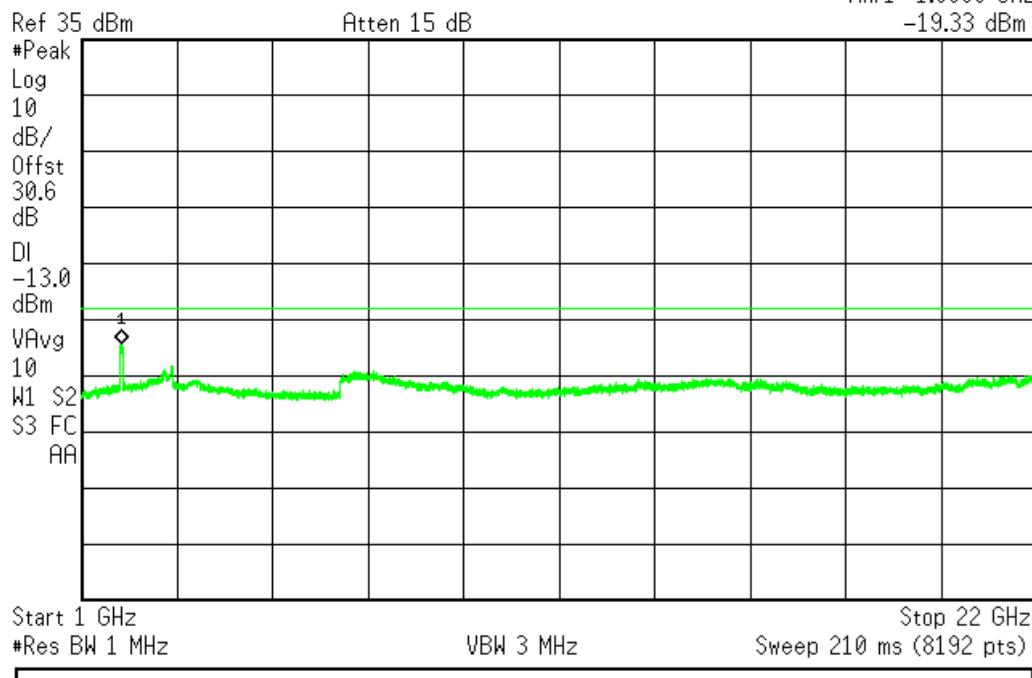
L

Mkr1 828.05 MHz
-34.32 dBm

824-849 MHz Band (High Frequency) (Cont)

* Agilent 09:47:30 Feb 19, 2015

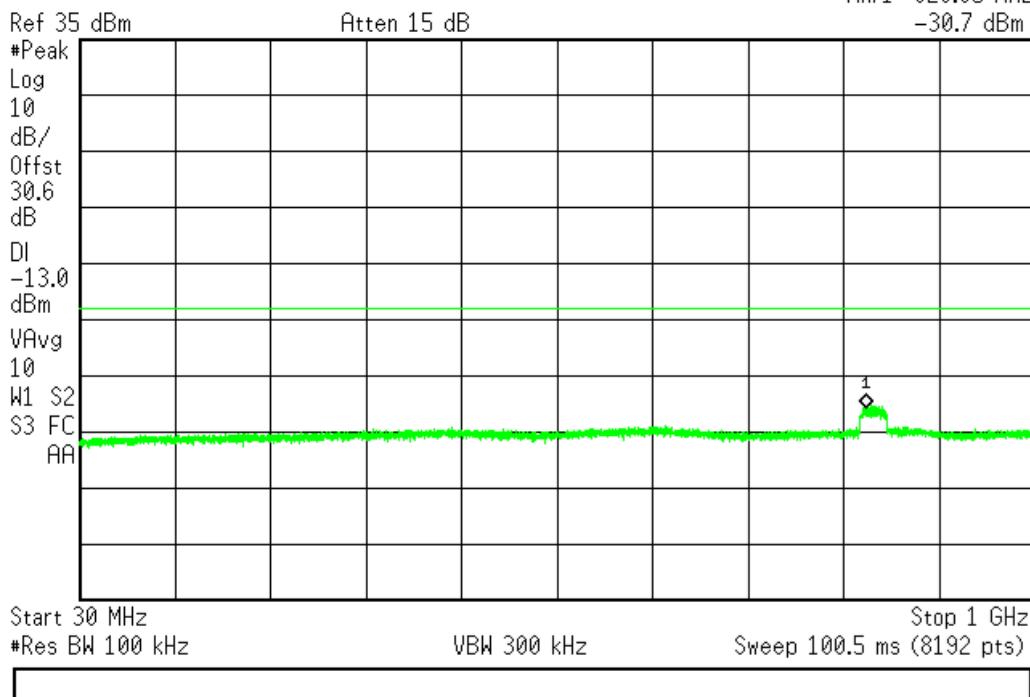
L

Mkr1 1.8896 GHz
-19.33 dBm

Uplink CDMA Signal
1850-19150 MHz Band (Low Frequency)

* Agilent 09:50:58 Feb 19, 2015

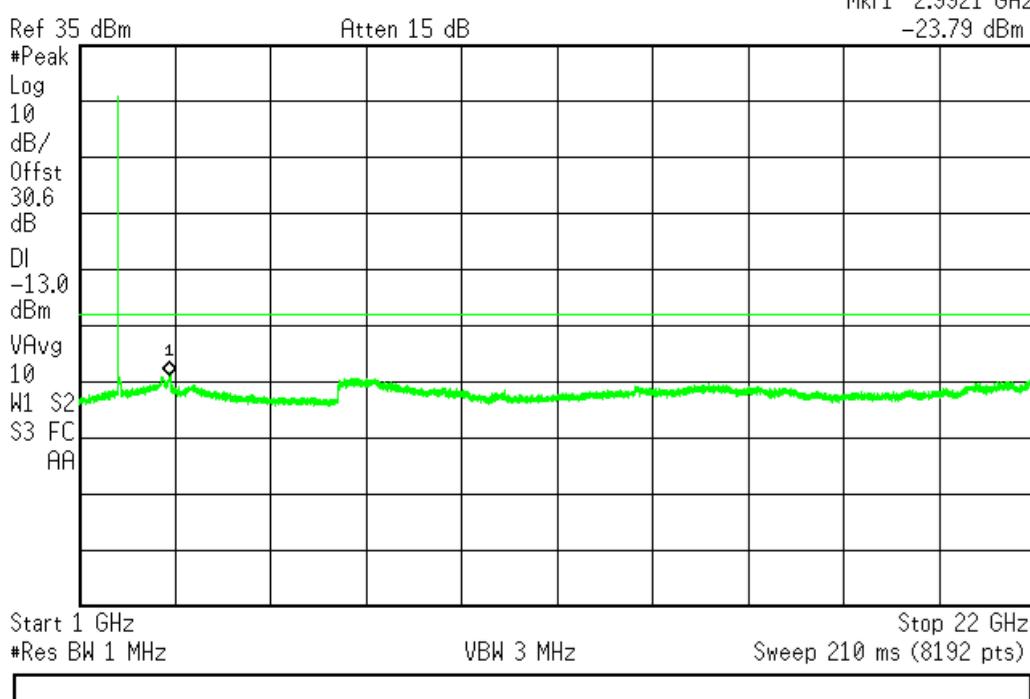
L

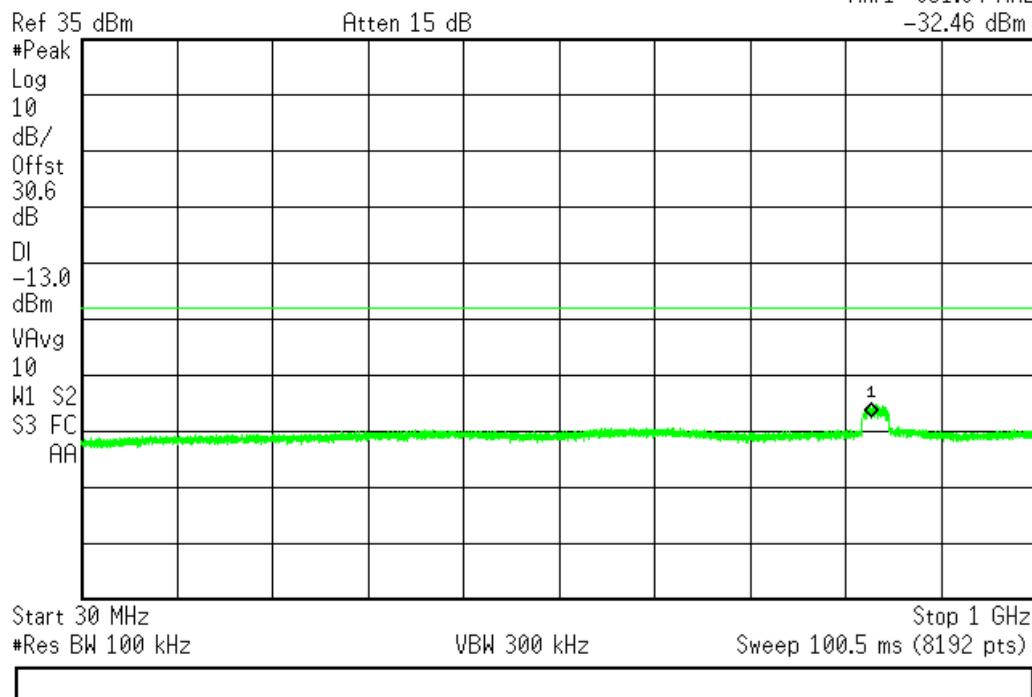
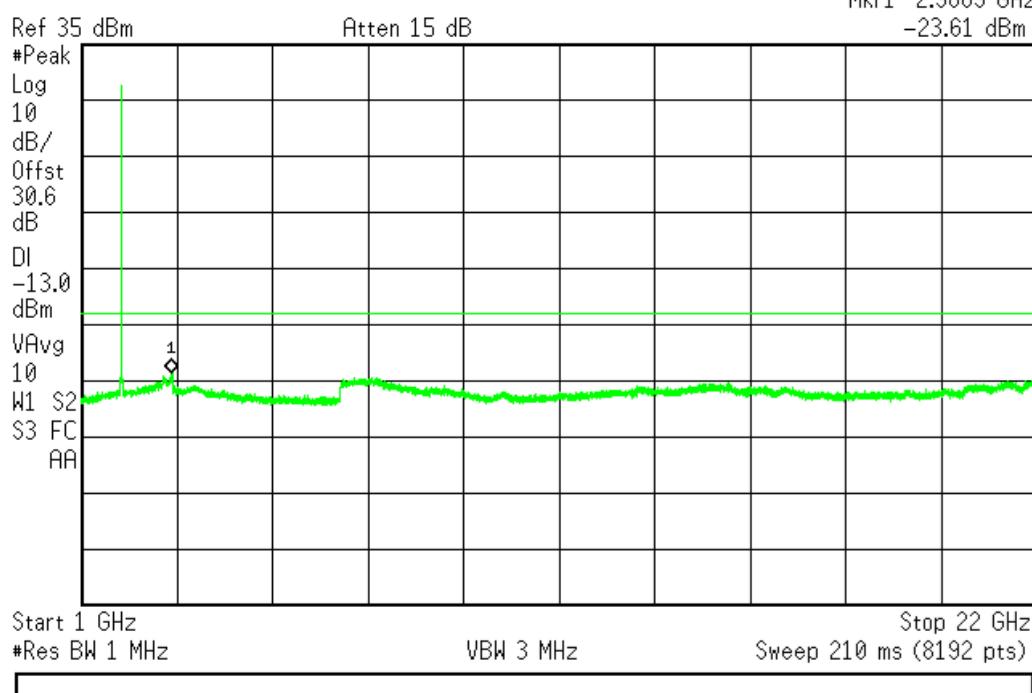
Mkr1 828.05 MHz
-30.7 dBm

1850-1910 MHz Band (Low Frequency) (Cont)

* Agilent 09:45:48 Feb 19, 2015

L

Mkr1 2.9921 GHz
-23.79 dBm

1850-1910 MHz Band (Mid Frequency)*** Agilent** 09:49:24 Feb 19, 2015**L**Mkr1 831.84 MHz
-32.46 dBm**1850-1910 MHz Band (Mid Frequency) (Cont)***** Agilent** 09:42:41 Feb 19, 2015**L**Mkr1 2.9869 GHz
-23.61 dBm

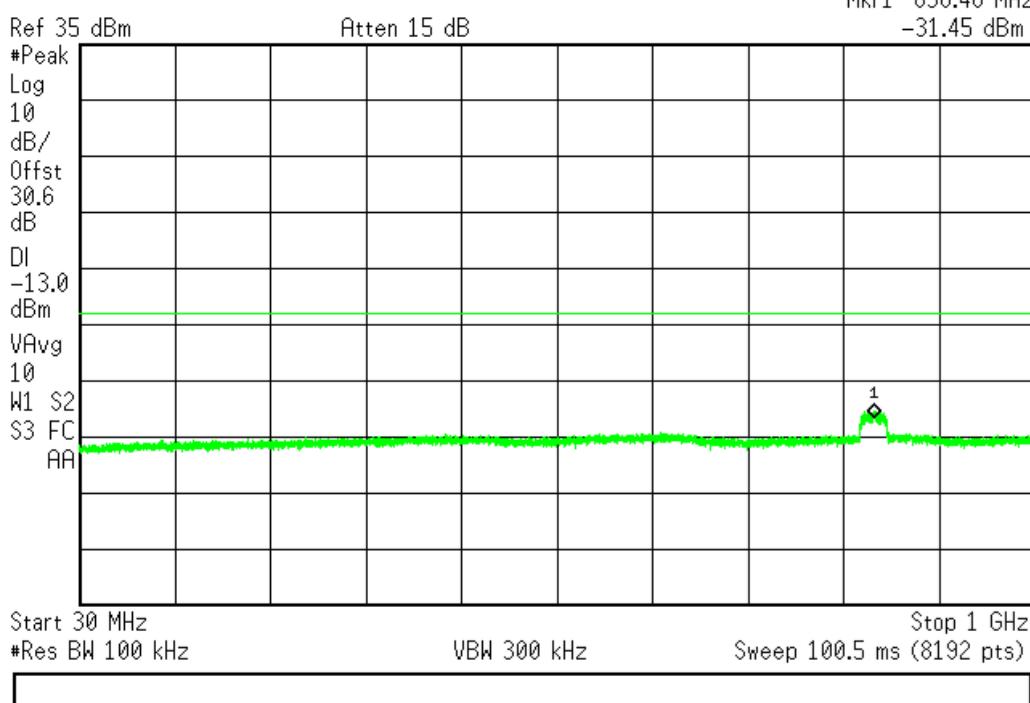


1850-1910 MHz Band (High Frequency)

* Agilent 09:50:07 Feb 19, 2015

L

Mkr1 836.46 MHz
-31.45 dBm

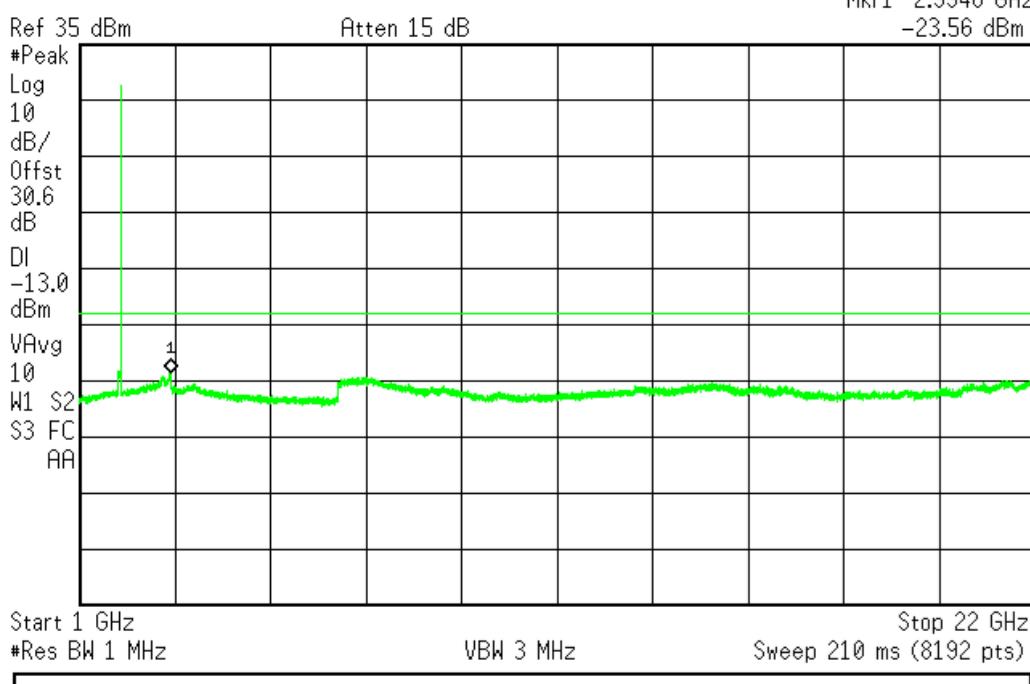


1850-1910 MHz Band (High Frequency) (Cont)

* Agilent 09:46:40 Feb 19, 2015

L

Mkr1 2.9946 GHz
-23.56 dBm



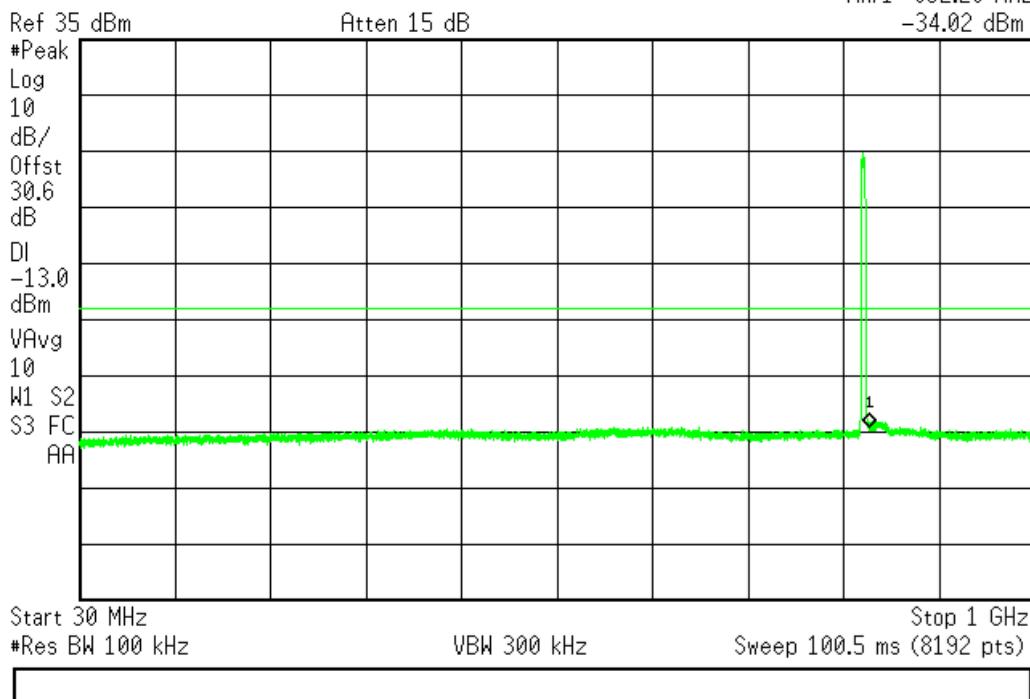


**Uplink WCDMA Signal
824-849 MHz Band (Low Frequency)**

* Agilent 09:54:38 Feb 19, 2015

L

Mkr1 832.20 MHz
-34.02 dBm

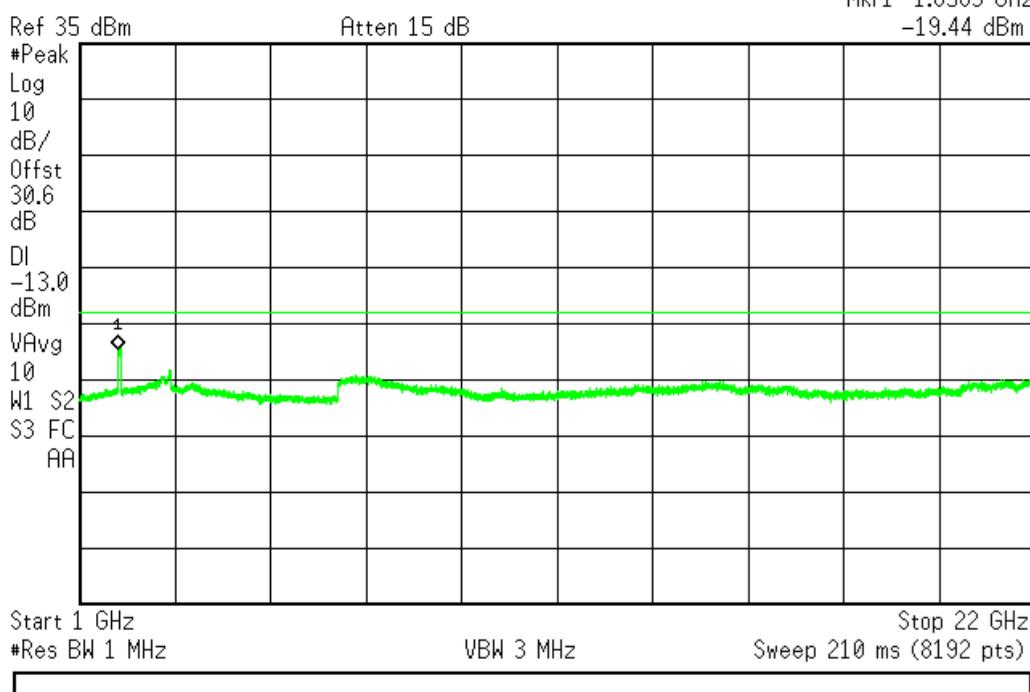


824-849 MHz Band (Low Frequency) (Cont)

* Agilent 10:01:25 Feb 19, 2015

L

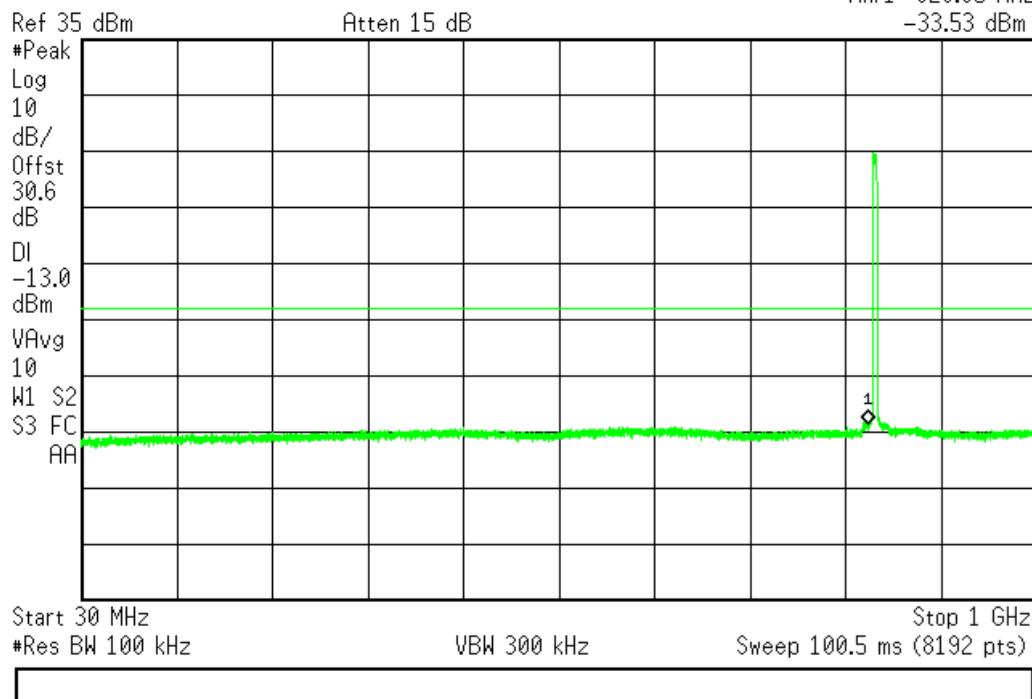
Mkr1 1.8563 GHz
-19.44 dBm



824-849 MHz Band (Mid Frequency)

* Agilent 09:53:08 Feb 19, 2015

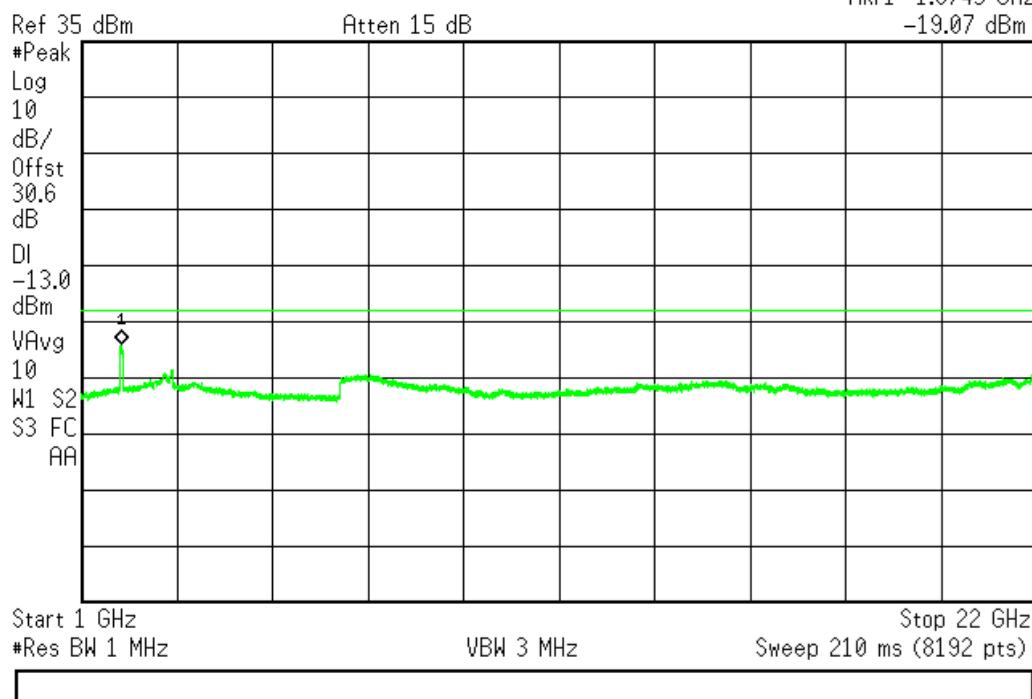
L

Mkr1 828.05 MHz
-33.53 dBm

824-849 MHz Band (Mid Frequency) (Cont)

* Agilent 10:00:43 Feb 19, 2015

L

Mkr1 1.8743 GHz
-19.07 dBm

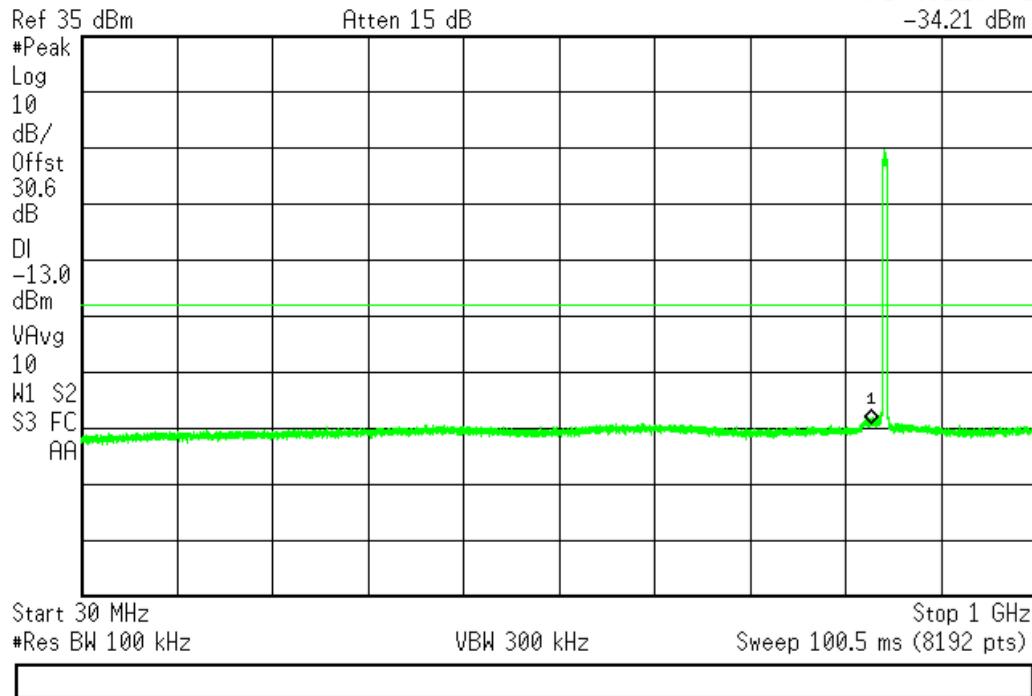


824-849 MHz Band (High Frequency)

* Agilent 09:55:08 Feb 19, 2015

L

Mkr1 832.20 MHz
-34.21 dBm

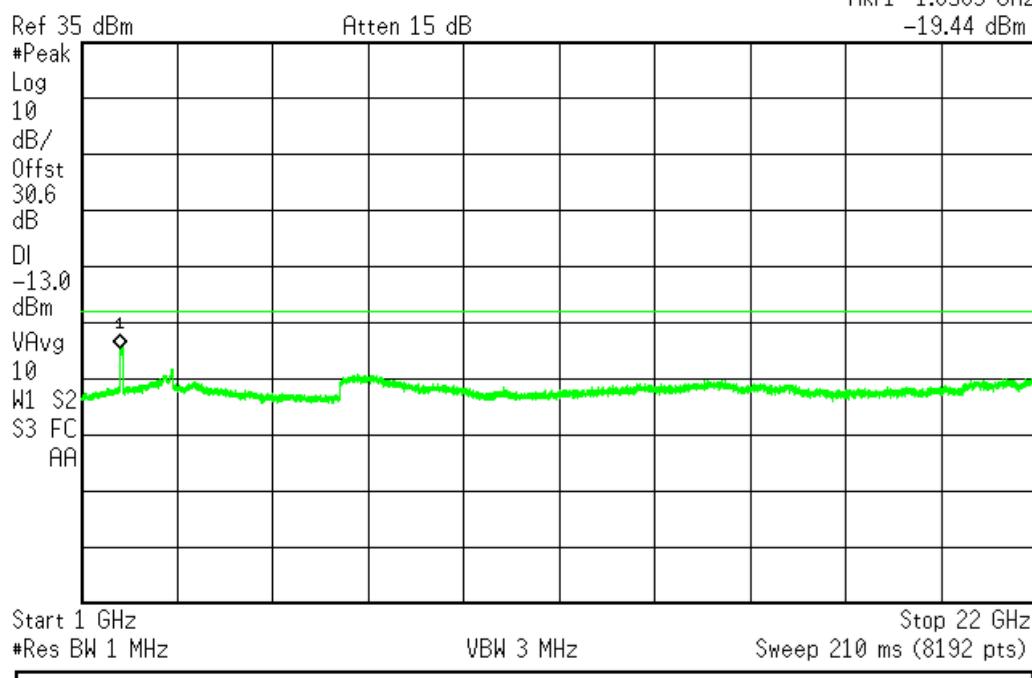


824-849 MHz Band (High Frequency) (Cont)

* Agilent 10:01:25 Feb 19, 2015

L

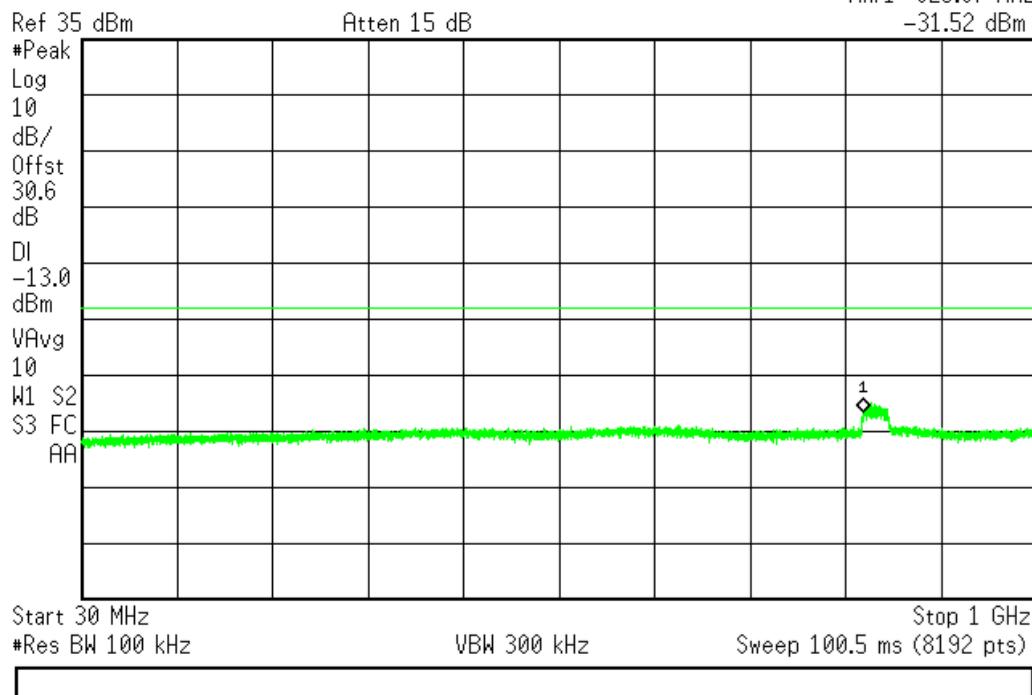
Mkr1 1.8563 GHz
-19.44 dBm



Uplink WCDMA Signal
1850-1910 MHz Band (Low Frequency)

* Agilent 09:56:15 Feb 19, 2015

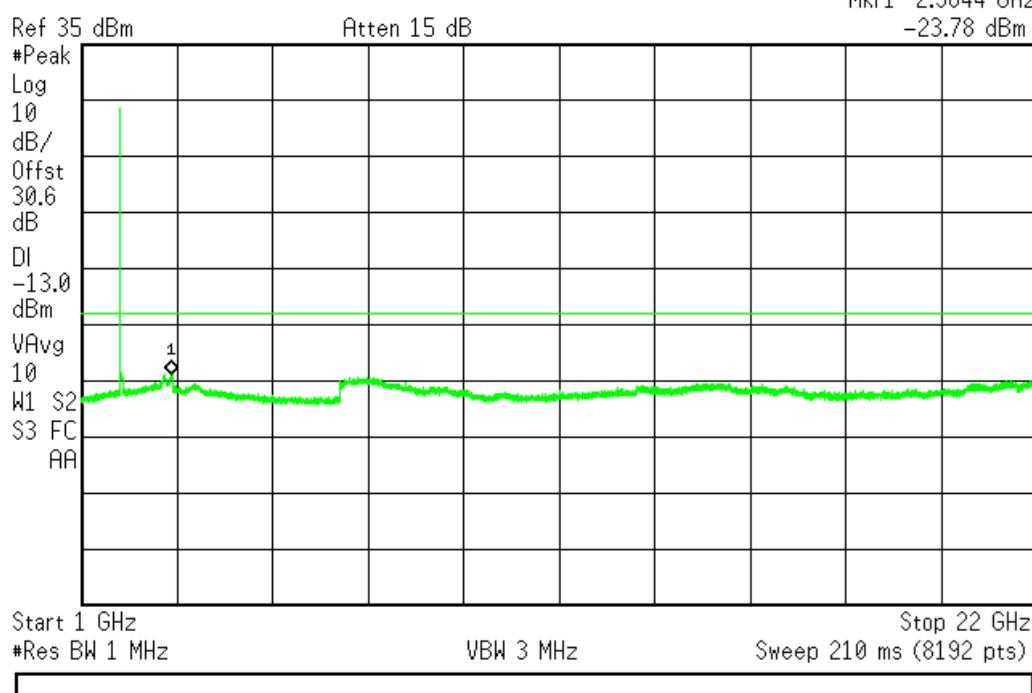
L

Mkr1 823.67 MHz
-31.52 dBm

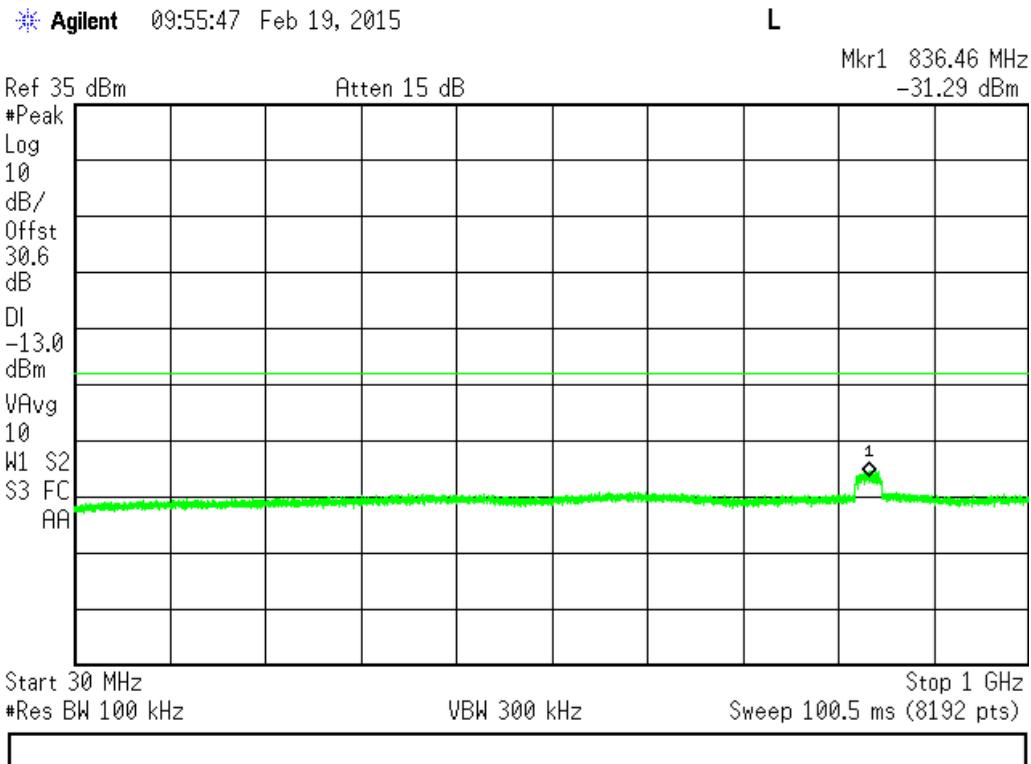
1850-1910 MHz Band (Low Frequency) (Cont)

* Agilent 10:00:04 Feb 19, 2015

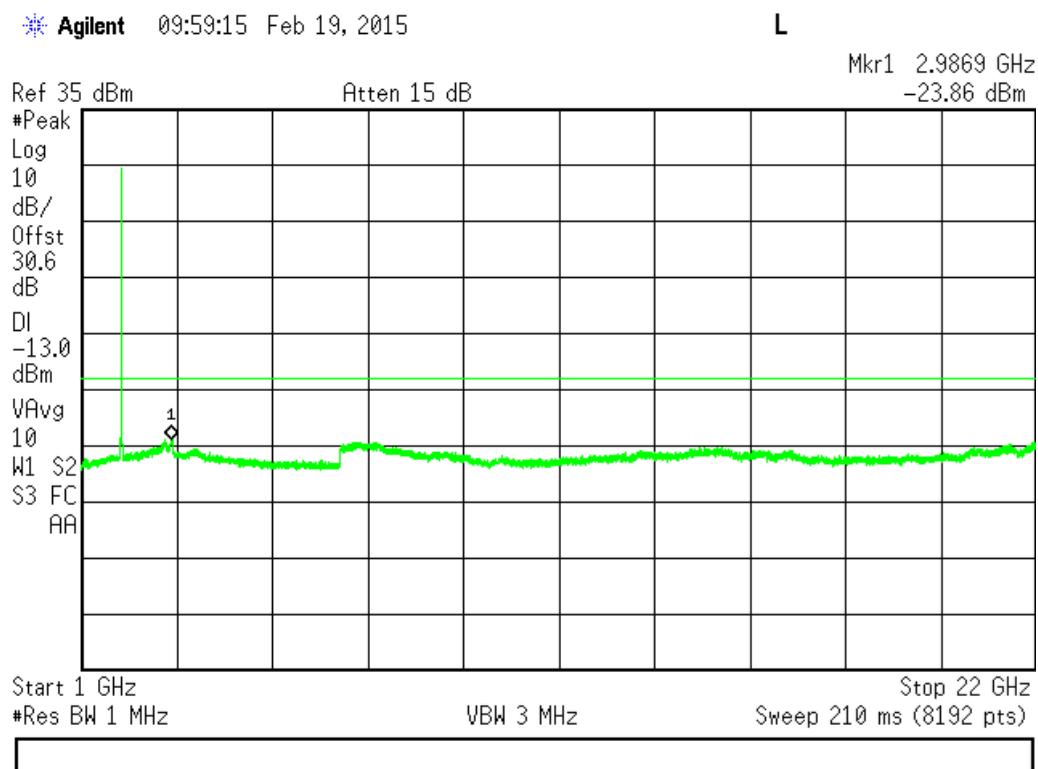
L

Mkr1 2.9844 GHz
-23.78 dBm

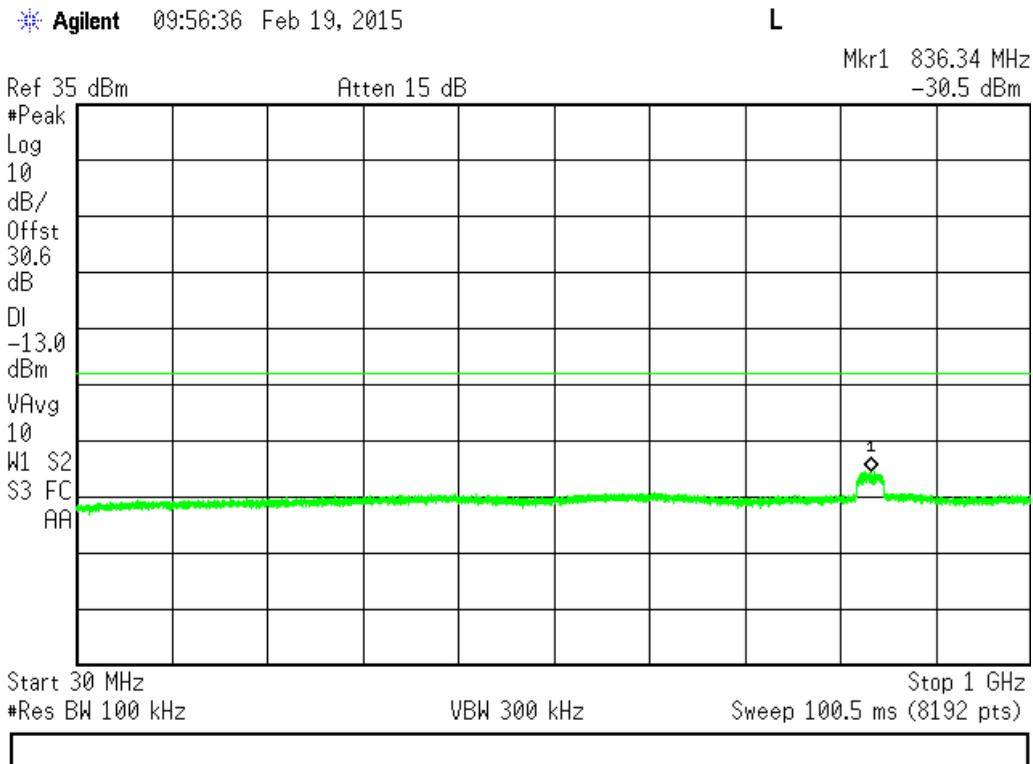
1850-1910 MHz Band (Mid Frequency)



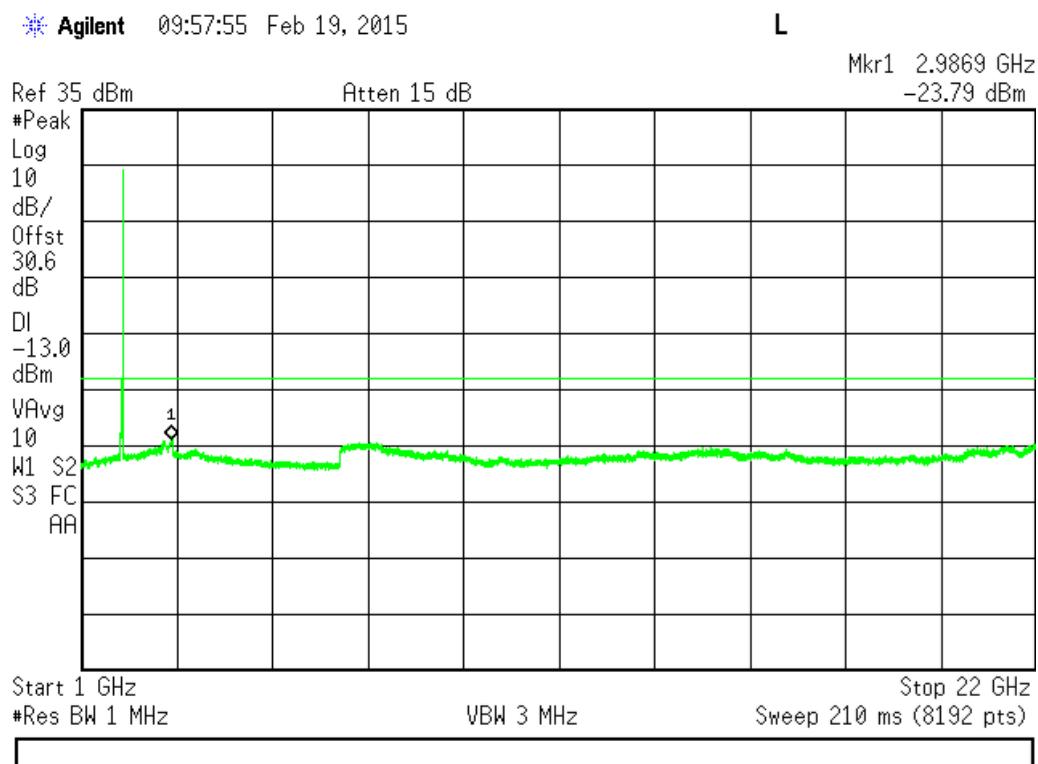
1850-1910 MHz Band (Mid Frequency) (Cont)



1850-1910 MHz Band (High Frequency)



1850-1910 MHz Band (High Frequency) (Cont)

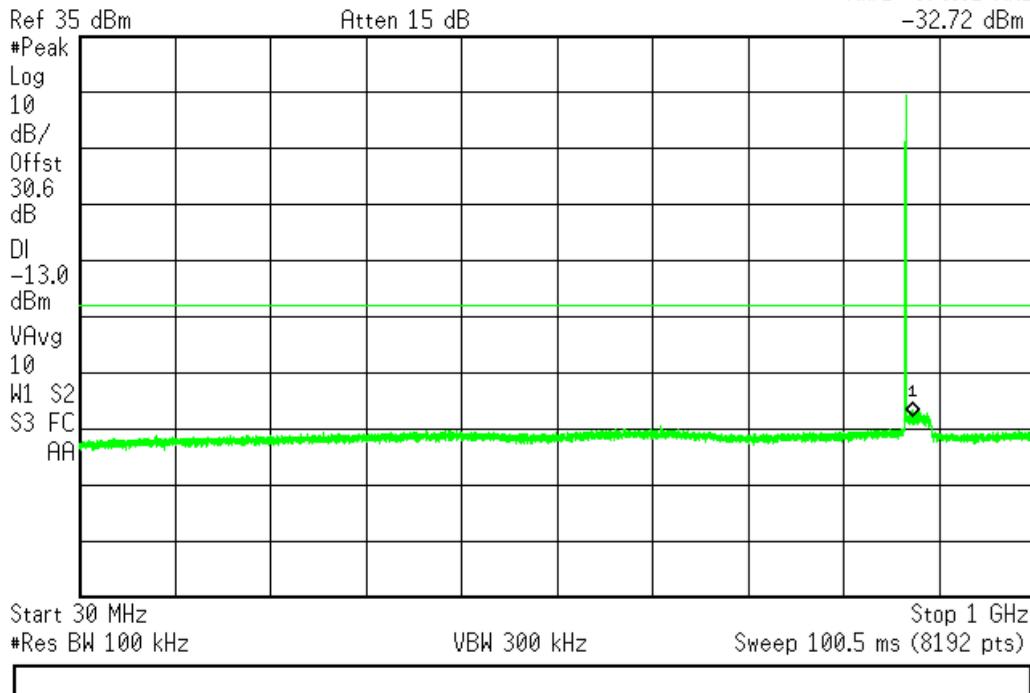


**Downlink GSM Signal
869-894 MHz Band (Low Frequency)**

* Agilent 10:24:10 Feb 19, 2015

L

Mkr1 876.01 MHz
-32.72 dBm

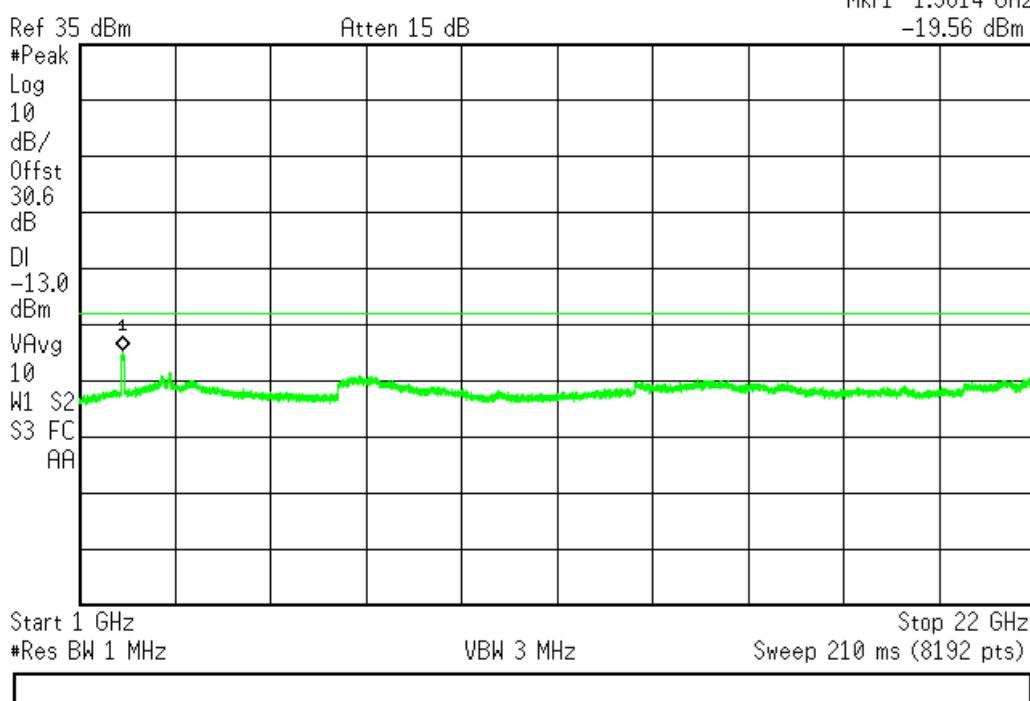


869-894 MHz Band (Low Frequency) (Cont)

* Agilent 10:18:40 Feb 19, 2015

L

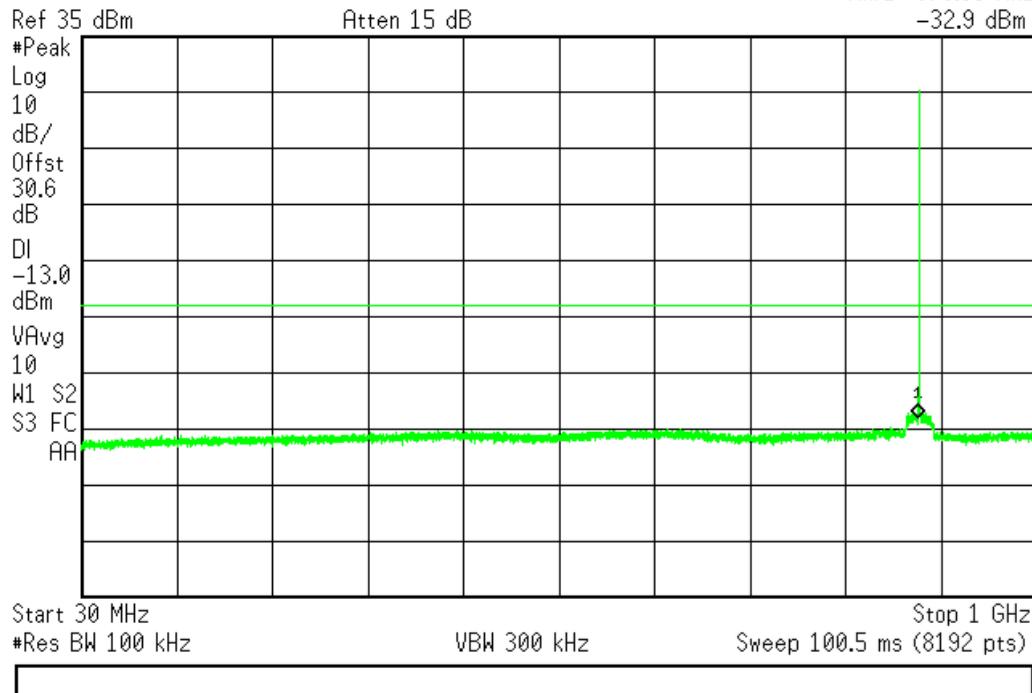
Mkr1 1.9614 GHz
-19.56 dBm



869-894 MHz Band (Mid Frequency)

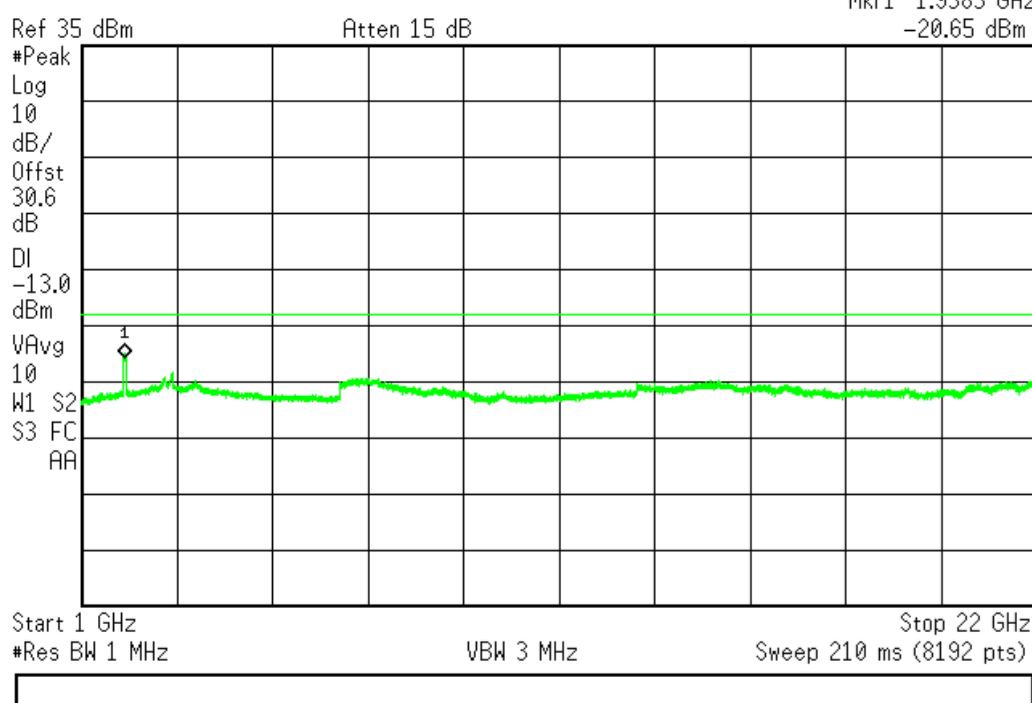
* Agilent 10:23:26 Feb 19, 2015

L

Mkr1 879.33 MHz
-32.9 dBm**869-894 MHz Band (Mid Frequency) (Cont)**

* Agilent 10:15:13 Feb 19, 2015

L

Mkr1 1.9383 GHz
-20.65 dBm

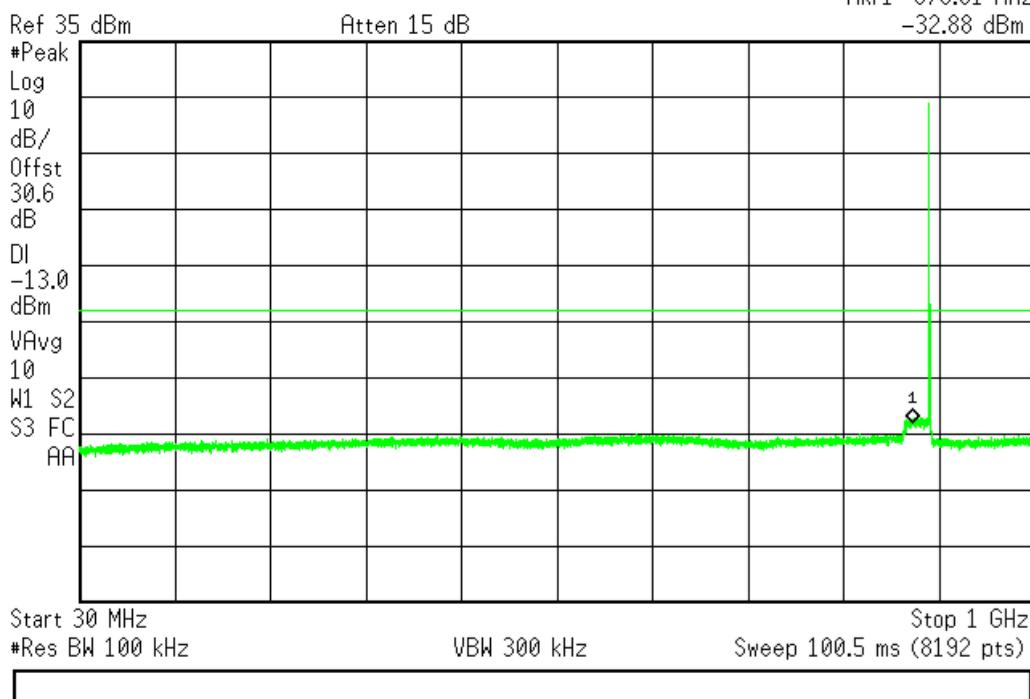


869-894 MHz Band (High Frequency)

* Agilent 10:25:03 Feb 19, 2015

L

Mkr1 876.01 MHz
-32.88 dBm

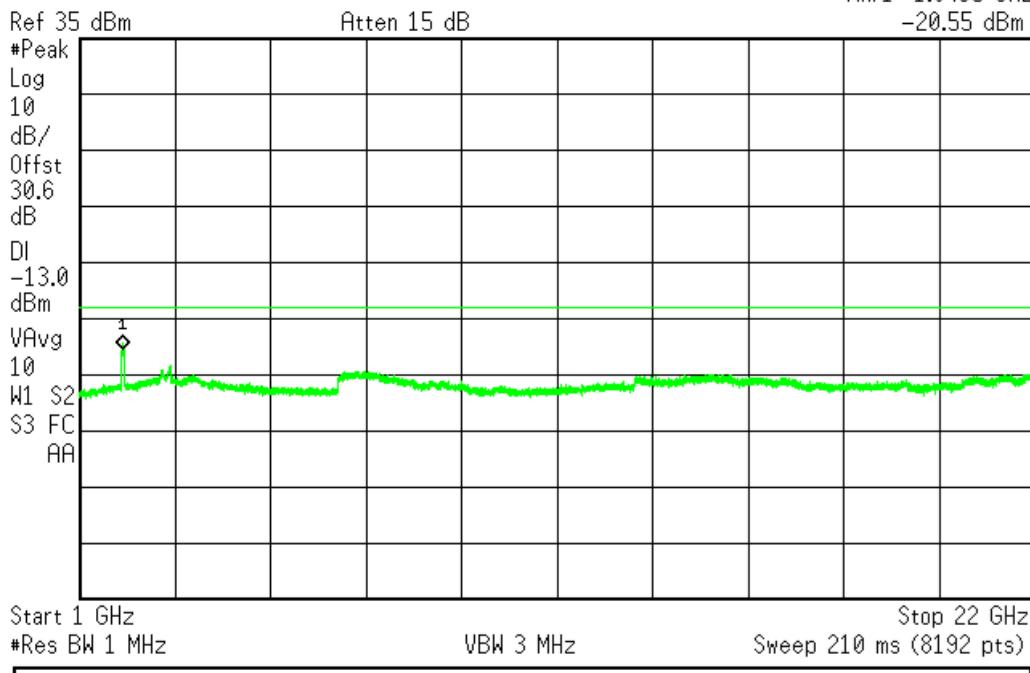


869-894 MHz Band (High Frequency) (Cont)

* Agilent 10:19:28 Feb 19, 2015

L

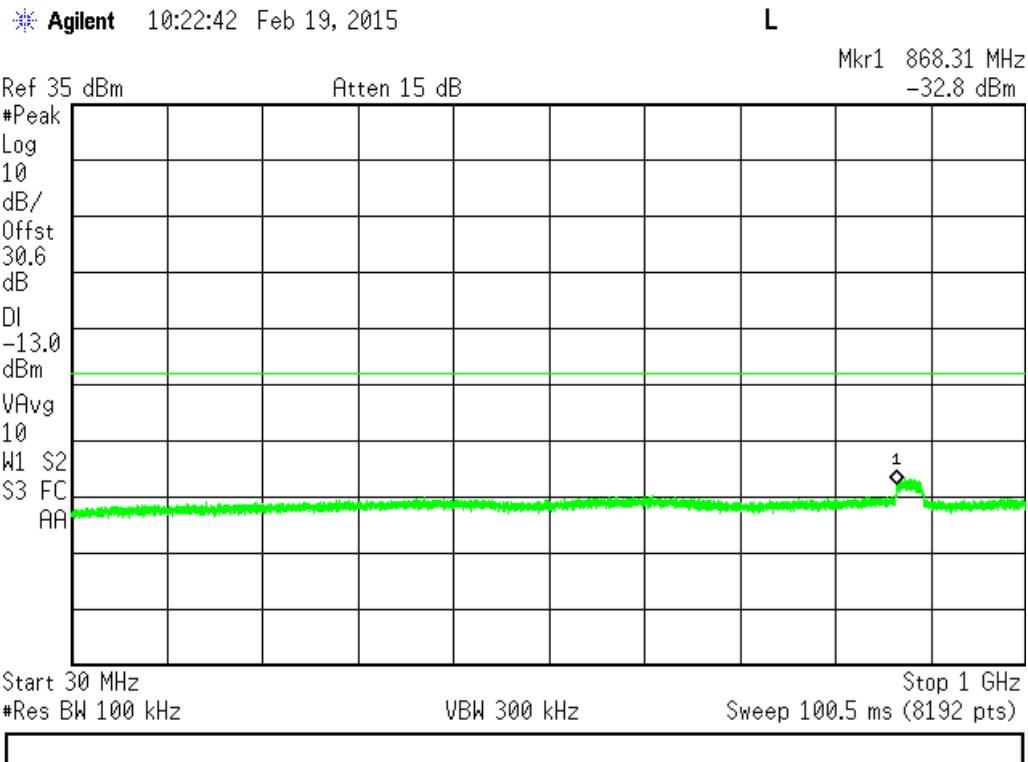
Mkr1 1.9435 GHz
-20.55 dBm



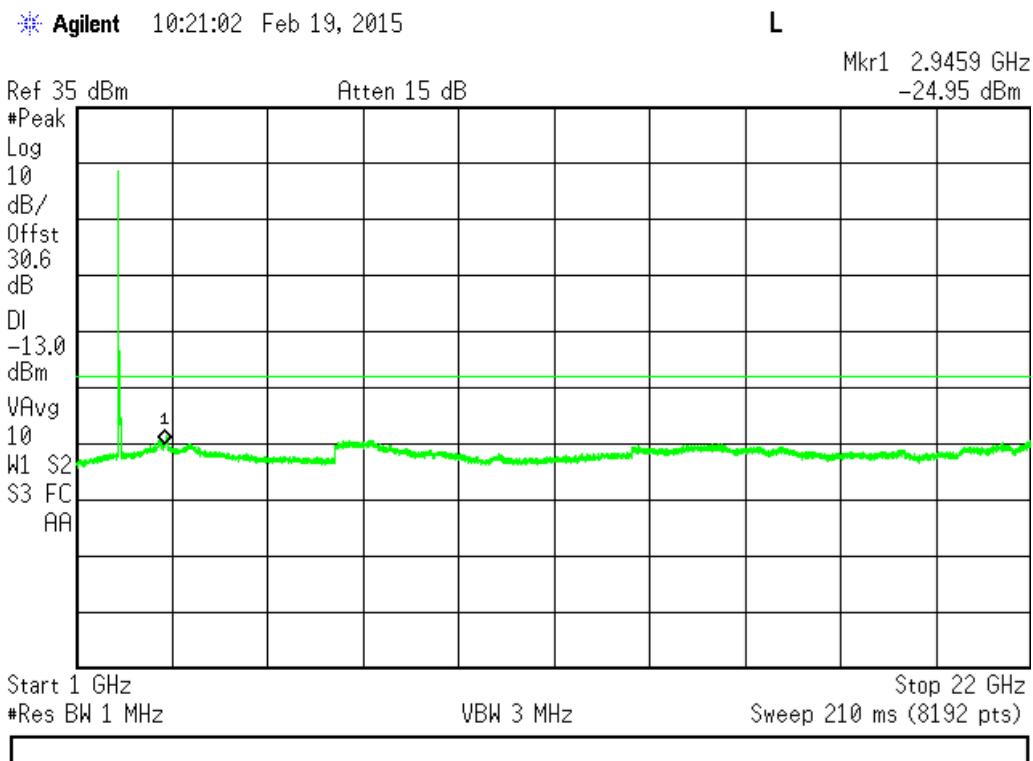


Downlink GSM Signal

1930 - 1990 MHz Band (Low Frequency)



1930 - 1990 MHz Band (Low Frequency) (Cont)



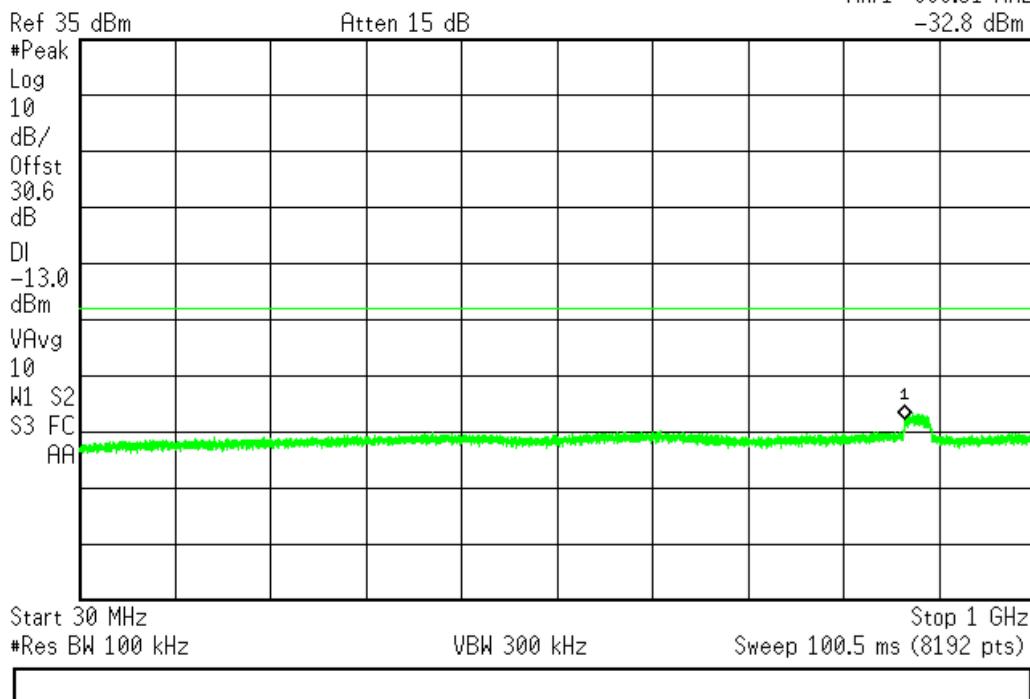


1930 - 1990 MHz Band (Mid Frequency)

* Agilent 10:22:42 Feb 19, 2015

L

Mkr1 868.31 MHz
-32.8 dBm

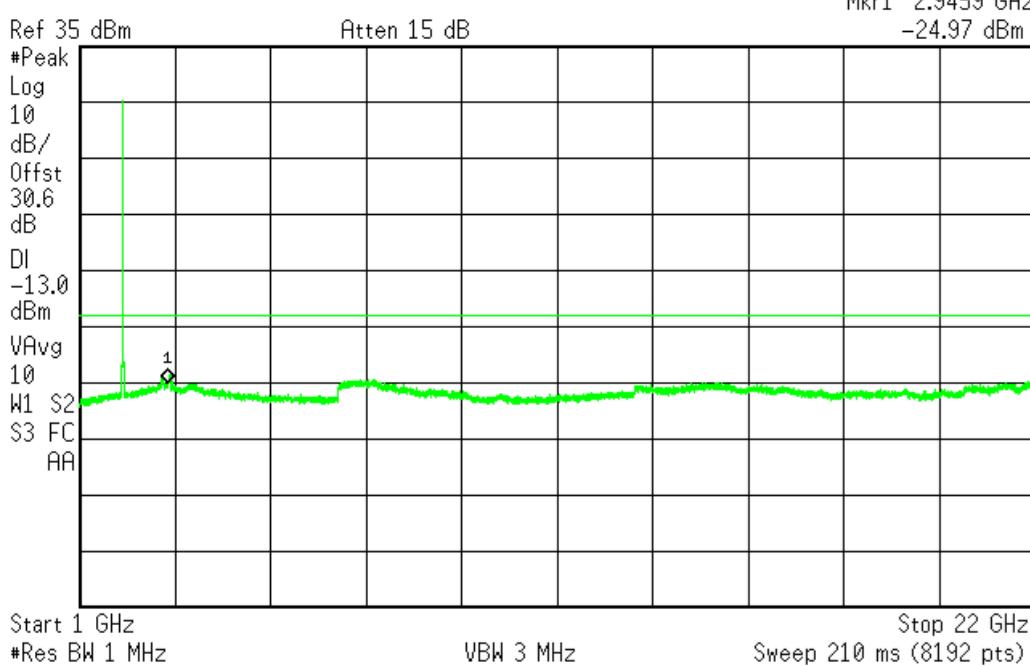


1930 - 1990 MHz Band (Mid Frequency) (Cont)

* Agilent 10:20:32 Feb 19, 2015

L

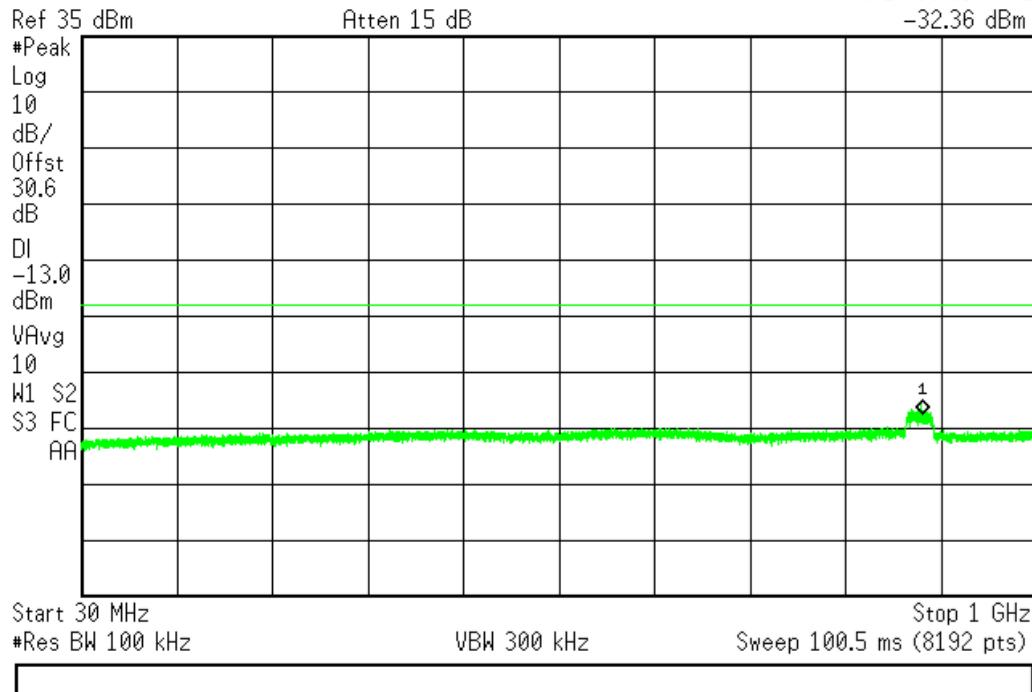
Mkr1 2.9459 GHz
-24.97 dBm



1930 - 1990 MHz Band (High Frequency)

* Agilent 10:22:03 Feb 19, 2015

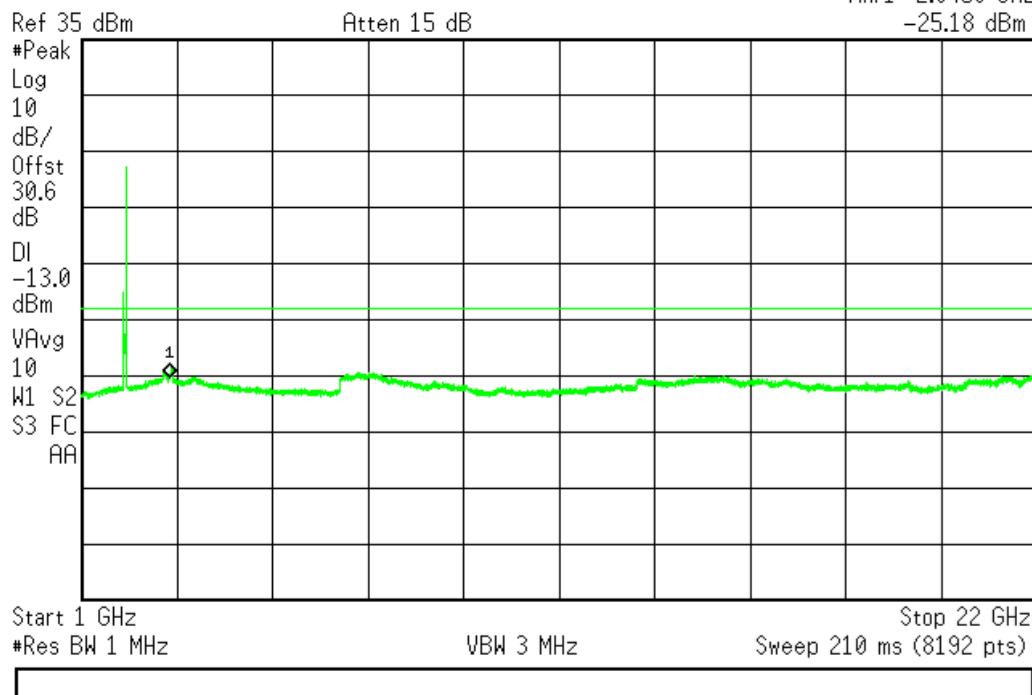
L

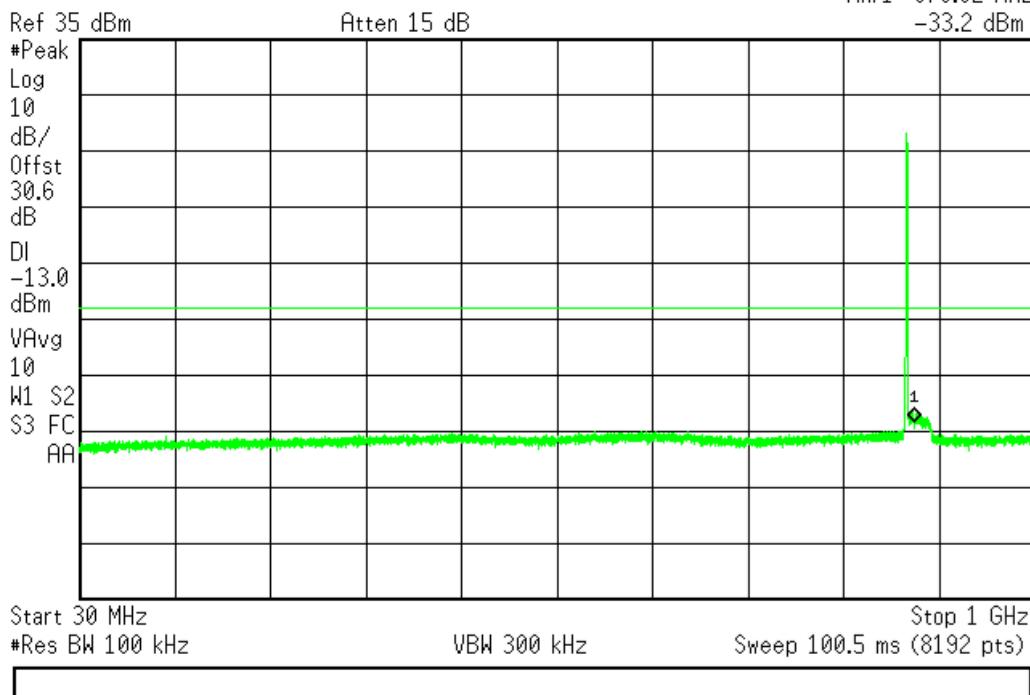
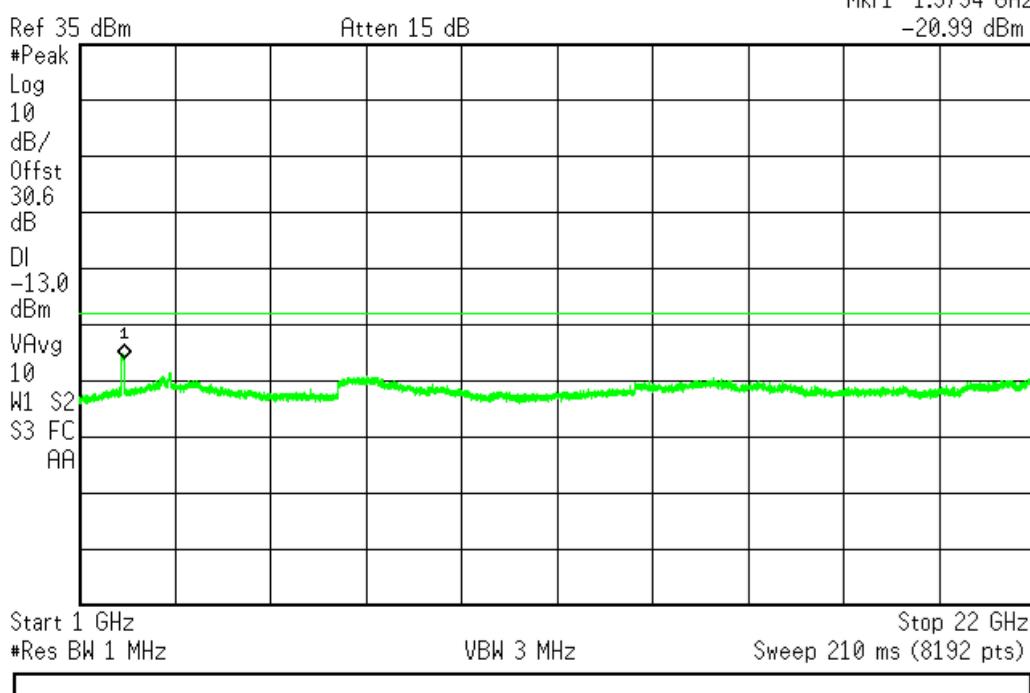
Mkr1 884.54 MHz
-32.36 dBm

1930 - 1990 MHz Band (High Frequency) (Cont)

* Agilent 10:21:22 Feb 19, 2015

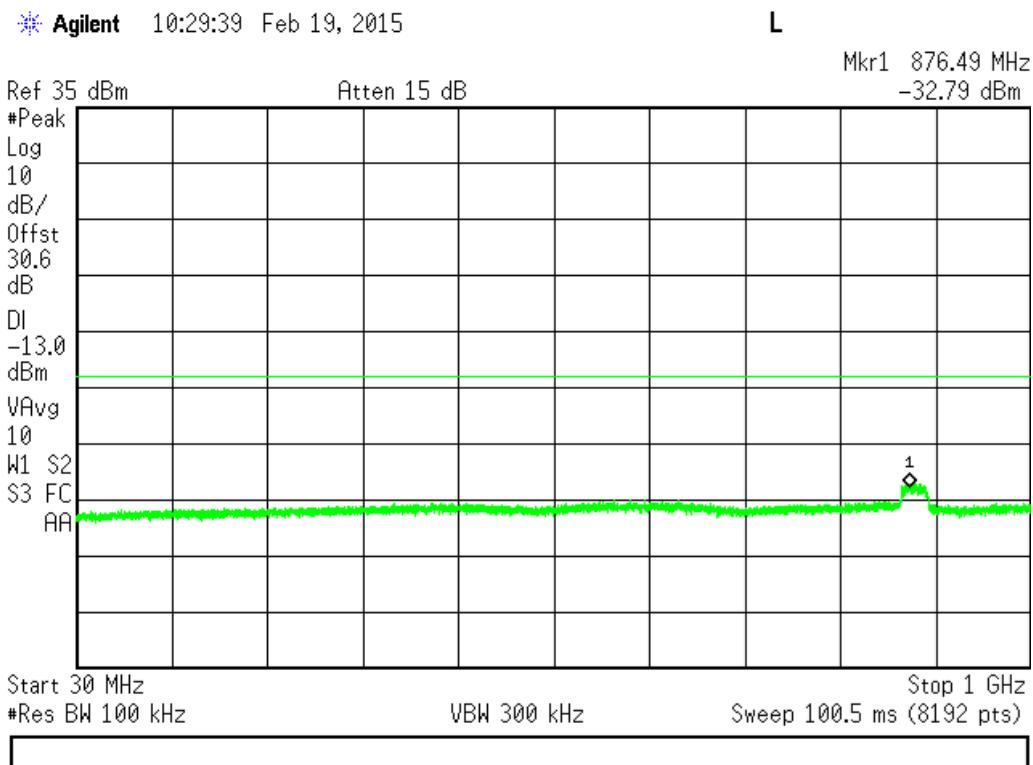
L

Mkr1 2.9459 GHz
-25.18 dBm

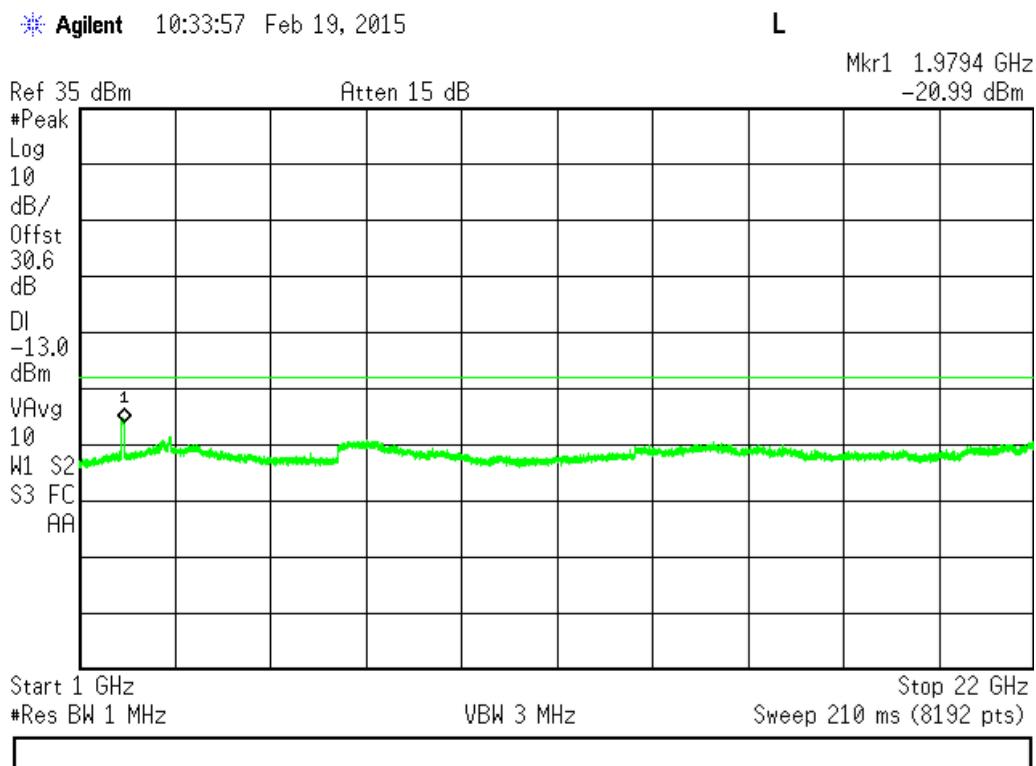
**Downlink CDMA Signal
869-894 MHz Band (Low Frequency)***** Agilent** 10:30:42 Feb 19, 2015**L**Mkr1 878.02 MHz
-33.2 dBm**869-894 MHz Band (Low Frequency) (Cont)***** Agilent** 10:33:57 Feb 19, 2015**L**Mkr1 1.9794 GHz
-20.99 dBm



869-894 MHz Band (Mid Frequency)

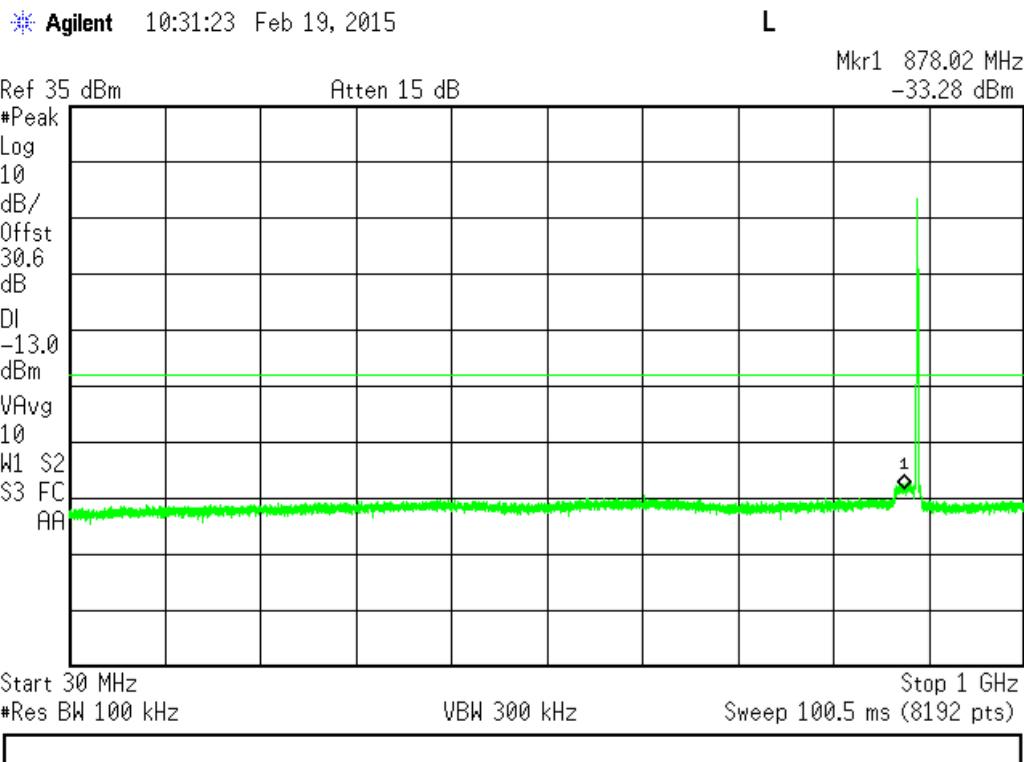


869-894 MHz Band (Mid Frequency) (Cont)

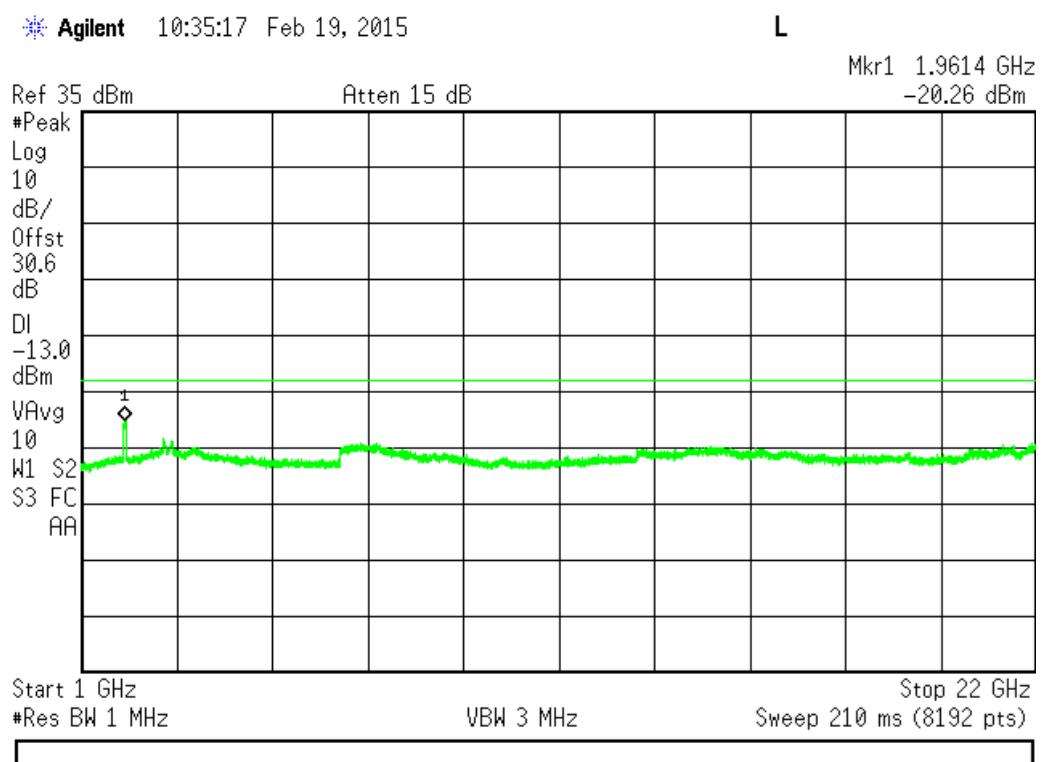




869-894 MHz Band (High Frequency)



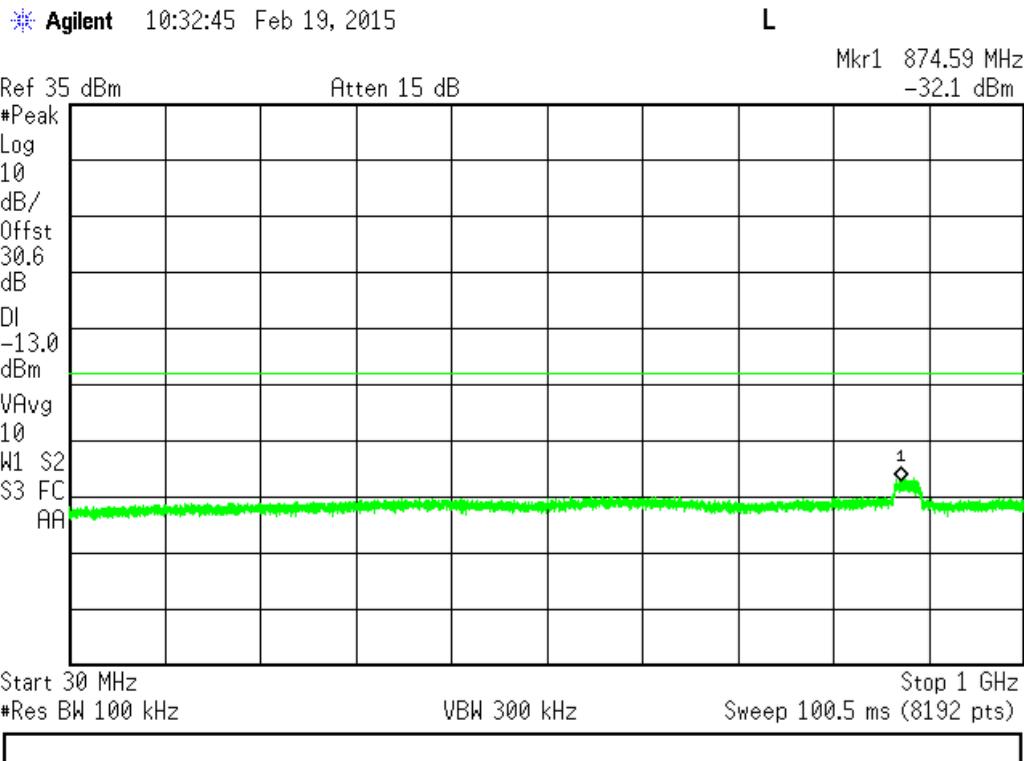
869-894 MHz Band (High Frequency) (Cont)



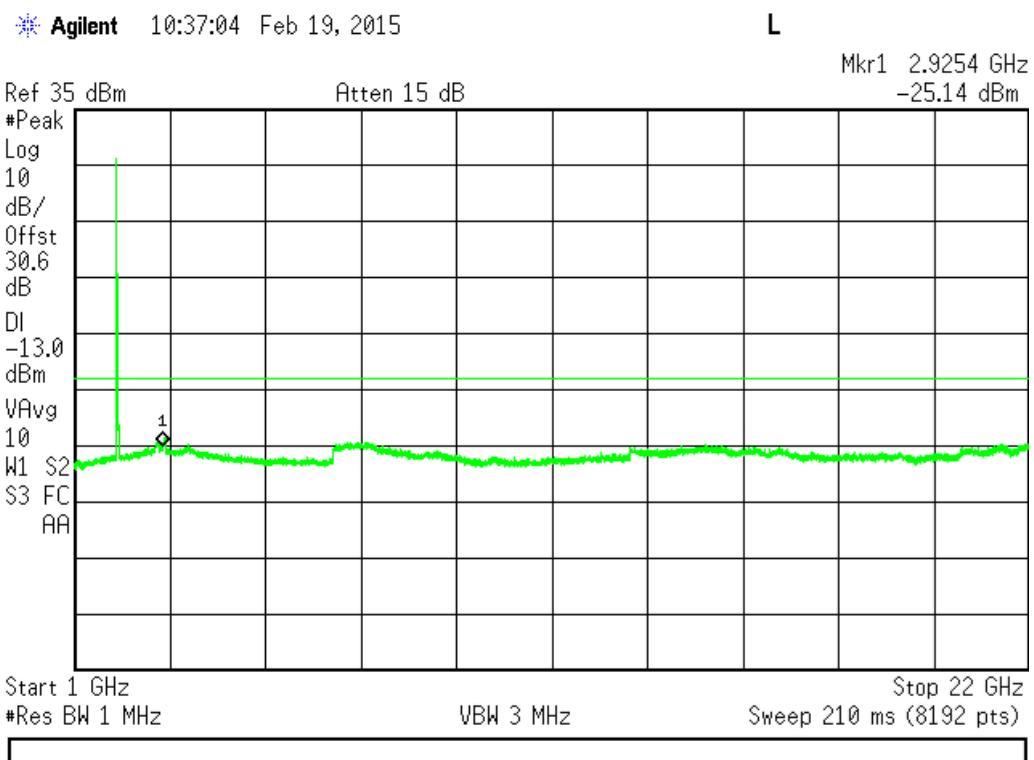


Downlink CDMA Signal

1930 - 1990 MHz Band (Low Frequency)



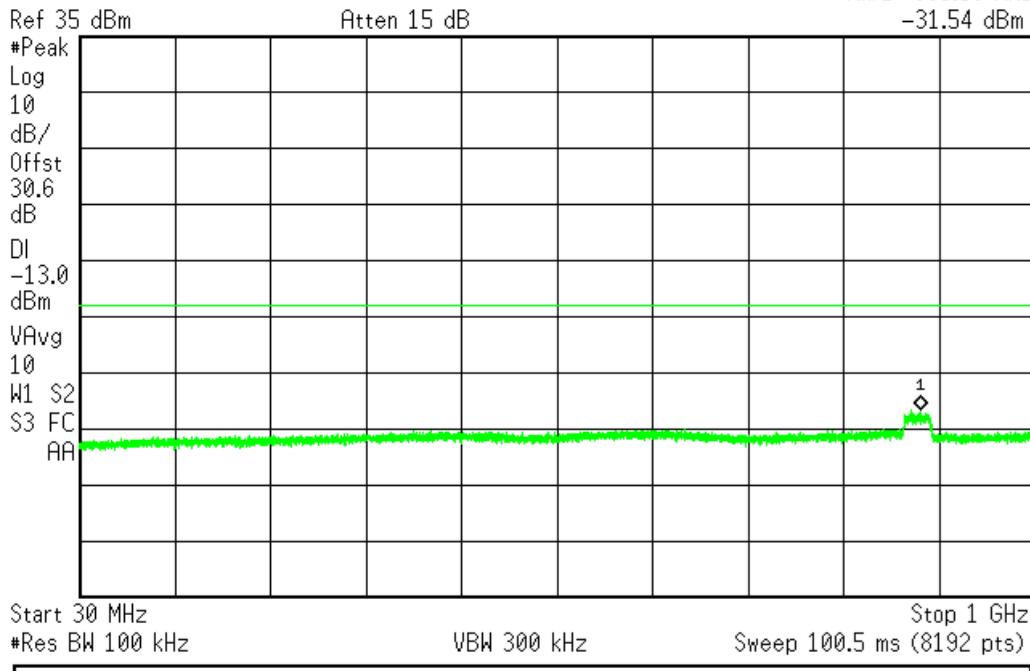
1930 - 1990 MHz Band (Low Frequency) (Cont)



1930 - 1990 MHz Band (Mid Frequency)

* Agilent 10:32:03 Feb 19, 2015

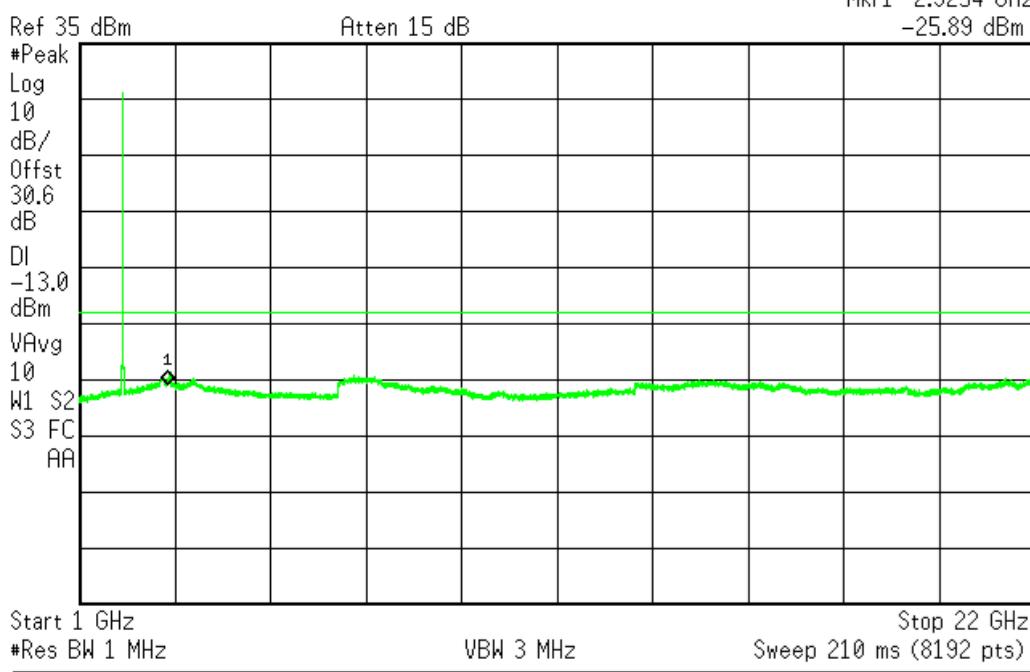
L

Mkr1 883.59 MHz
-31.54 dBm

1930 - 1990 MHz Band (Mid Frequency) (Cont)

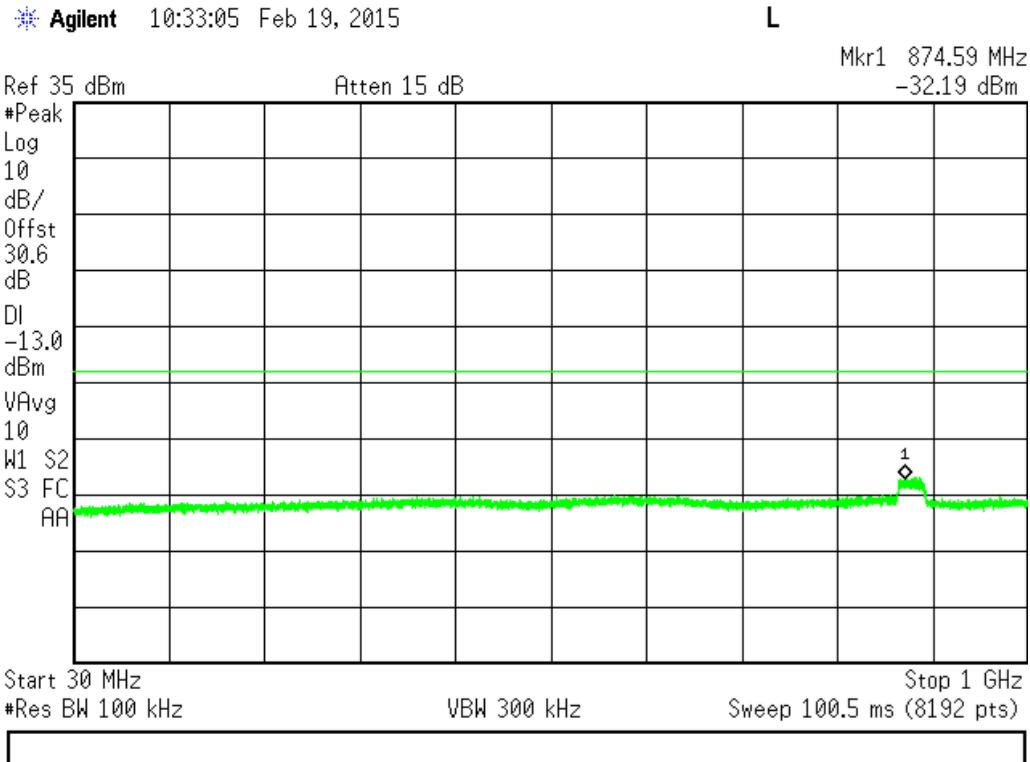
* Agilent 10:36:38 Feb 19, 2015

L

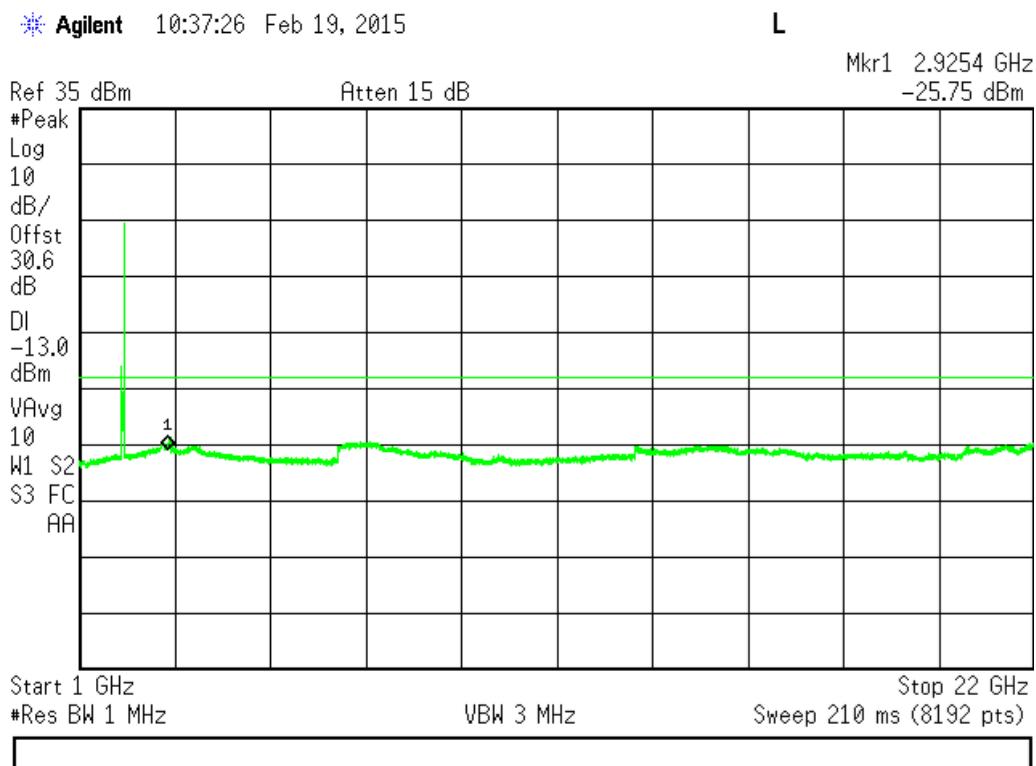
Mkr1 2.9254 GHz
-25.89 dBm



1930 - 1990 MHz Band (High Frequency)



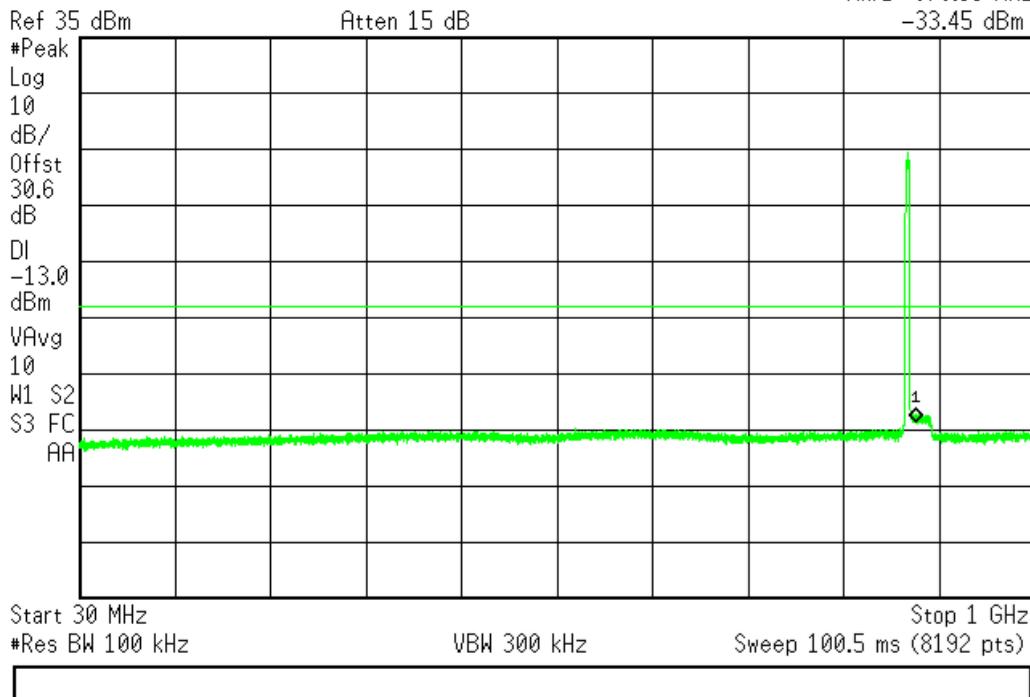
1930 - 1990 MHz Band (High Frequency) (Cont)



Downlink WCDMA Signal
869-894 MHz Band (Low Frequency)

* Agilent 10:46:47 Feb 19, 2015

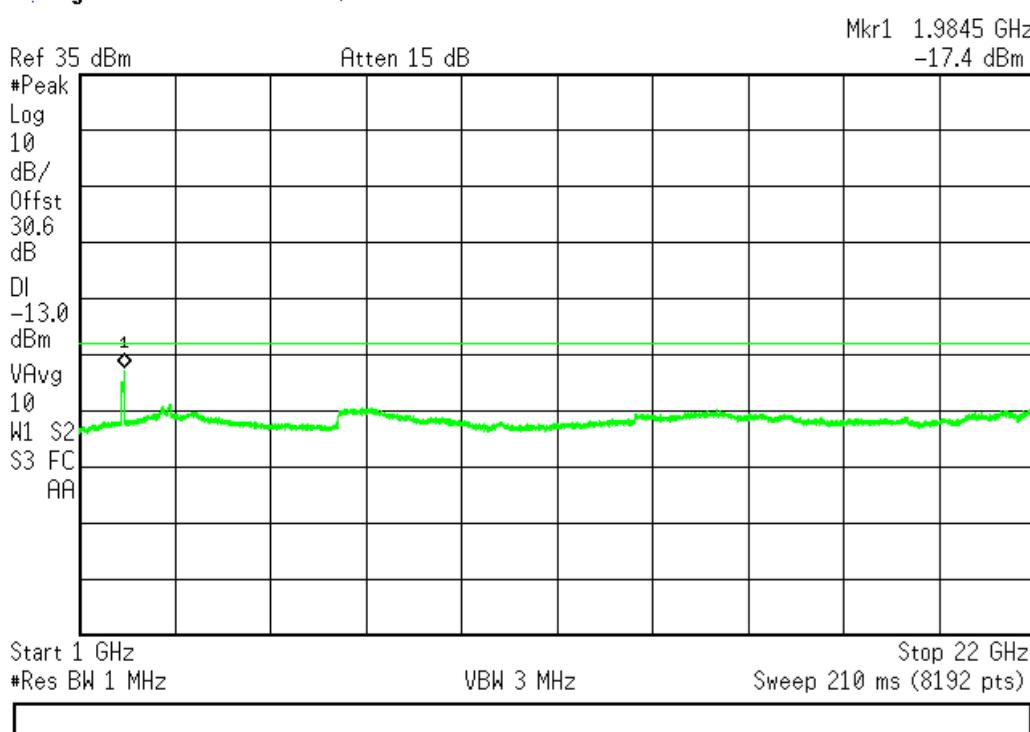
L

Mkr1 879.33 MHz
-33.45 dBm

869-894 MHz Band (Low Frequency) (Cont)

* Agilent 10:56:49 Feb 19, 2015

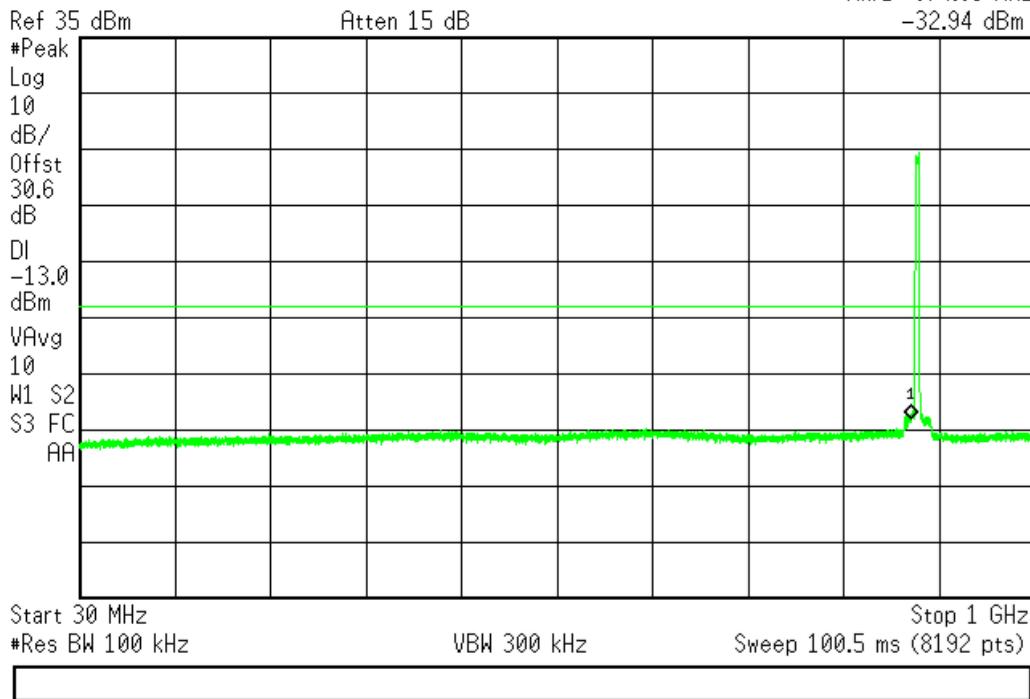
L

Mkr1 1.9845 GHz
-17.4 dBm

869-894 MHz Band (Mid Frequency)

* Agilent 10:45:54 Feb 19, 2015

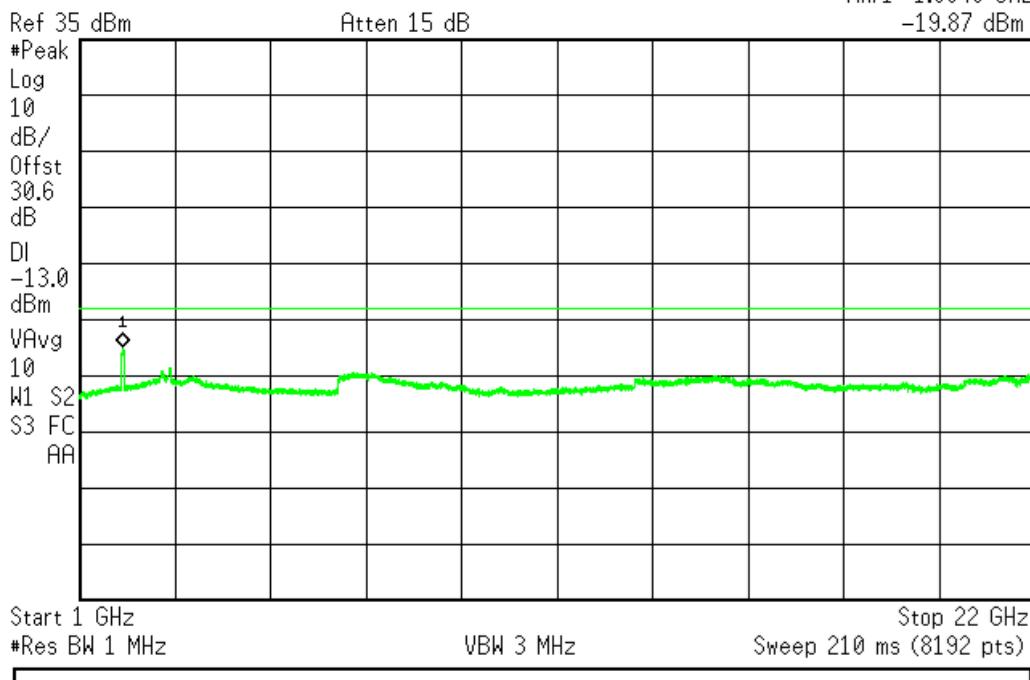
L

Mkr1 874.83 MHz
-32.94 dBm

869-894 MHz Band (Mid Frequency) (Cont)

* Agilent 10:57:37 Feb 19, 2015

L

Mkr1 1.9640 GHz
-19.87 dBm

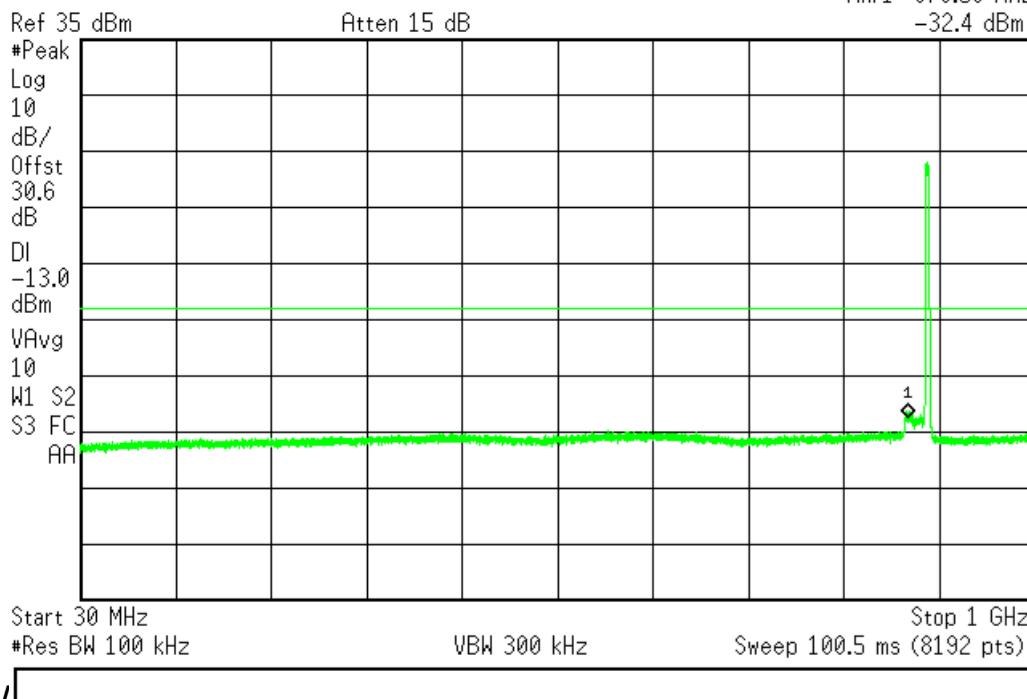


869-894 MHz Band (High Frequency)

* Agilent 10:47:22 Feb 19, 2015

L

Mkr1 870.56 MHz
-32.4 dBm

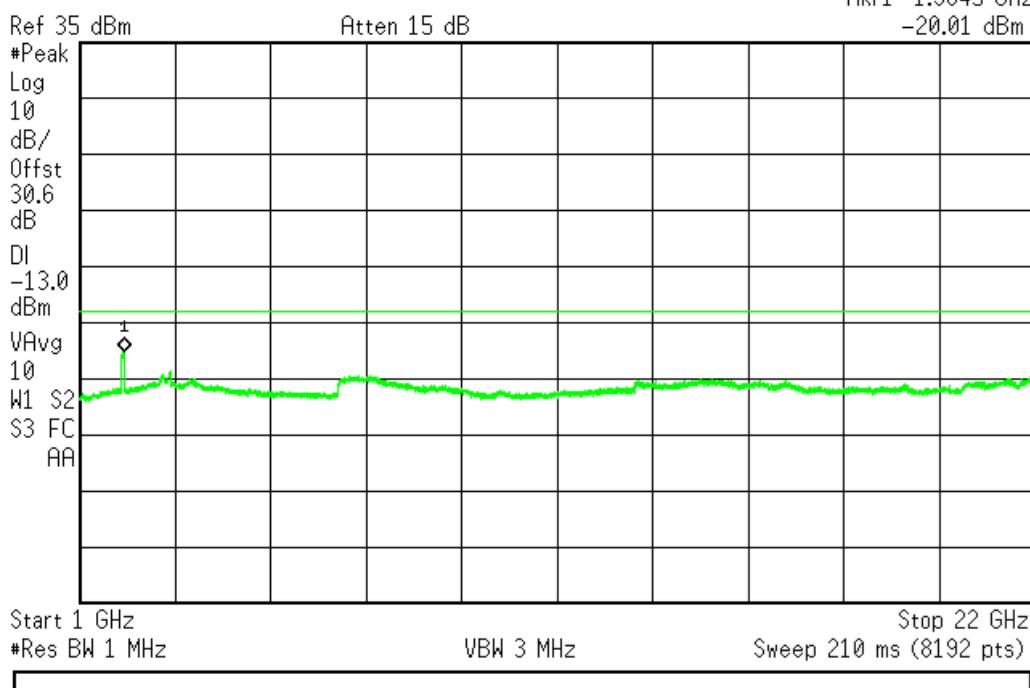


869-894 MHz Band (High Frequency) (Cont)

* Agilent 10:57:11 Feb 19, 2015

L

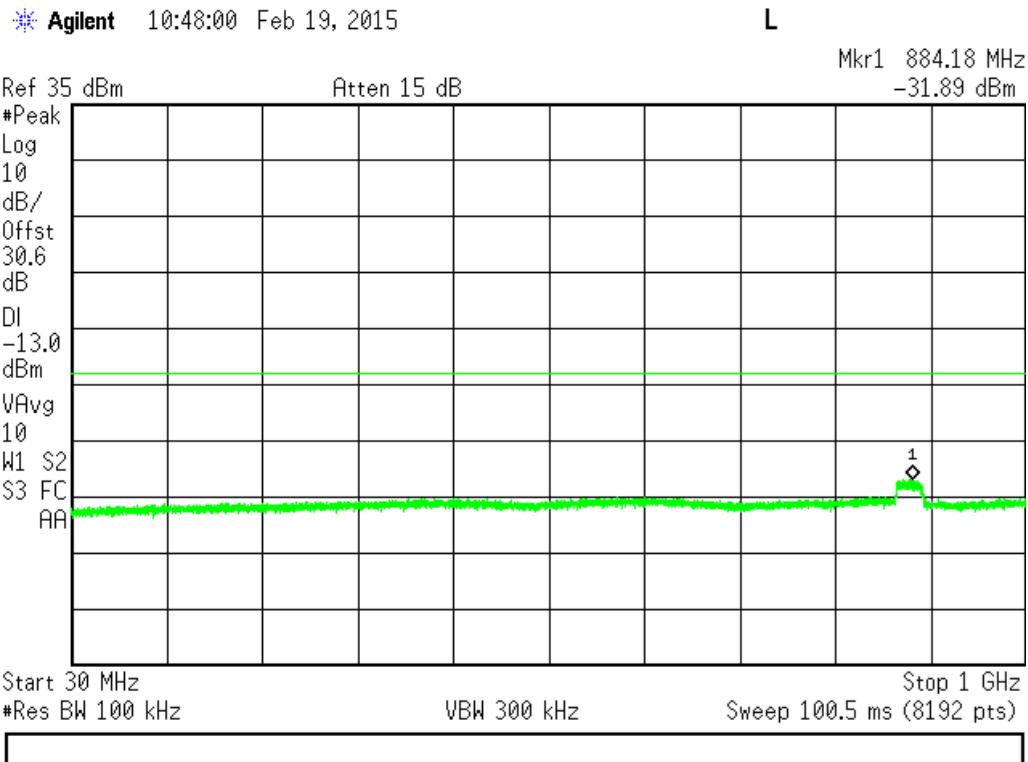
Mkr1 1.9845 GHz
-20.01 dBm



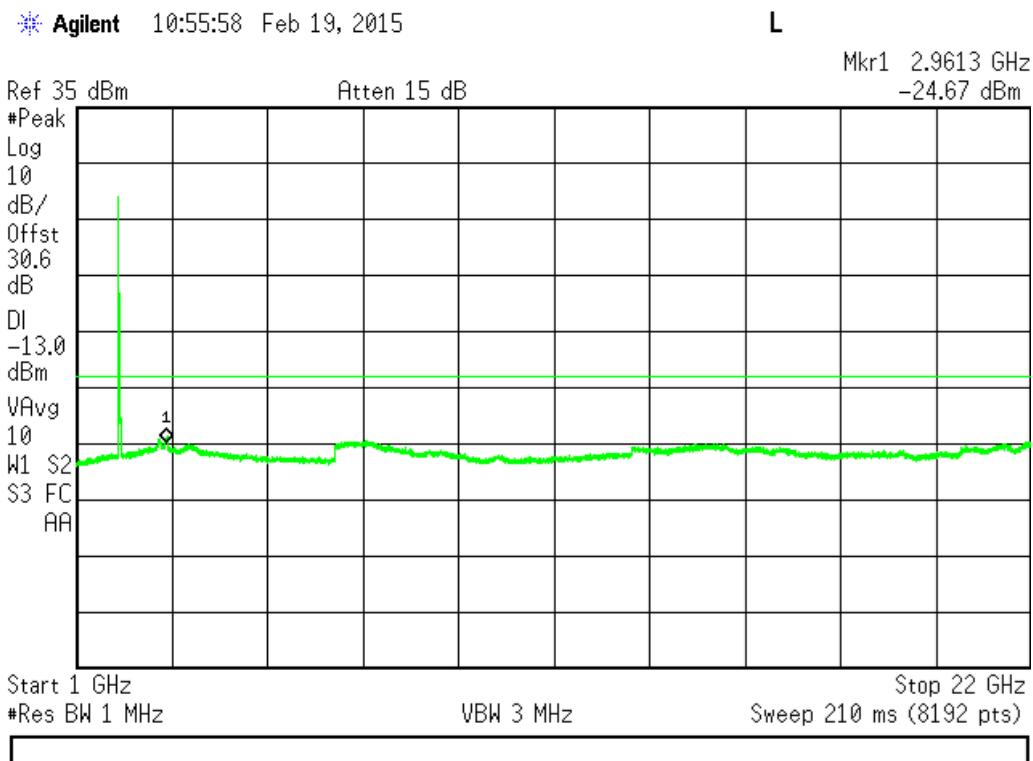


Downlink WCDMA Signal

1930 - 1990 MHz Band (Low Frequency)

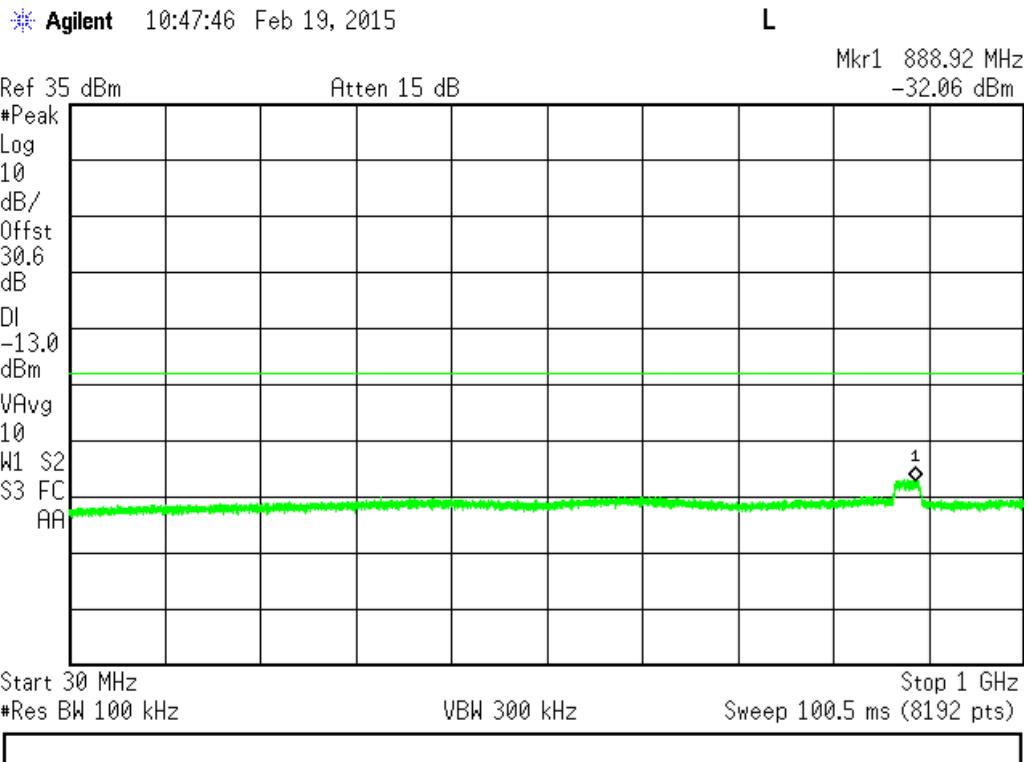


1930 - 1990 MHz Band (Low Frequency) (Cont)

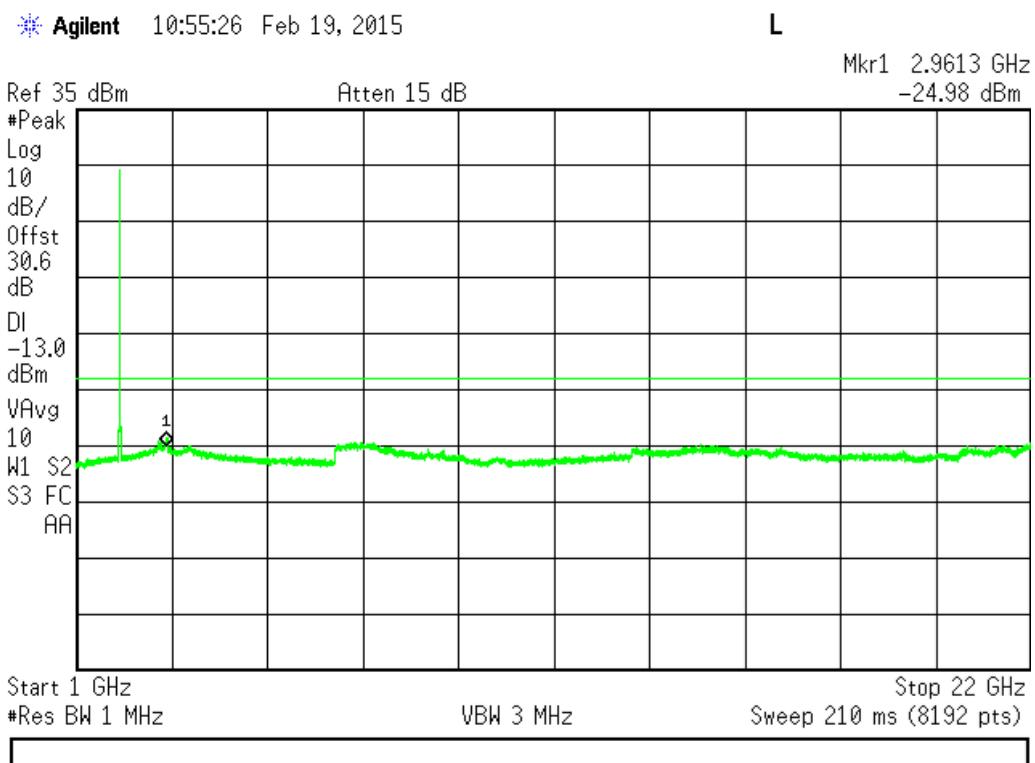




1930 - 1990 MHz Band (Mid Frequency)

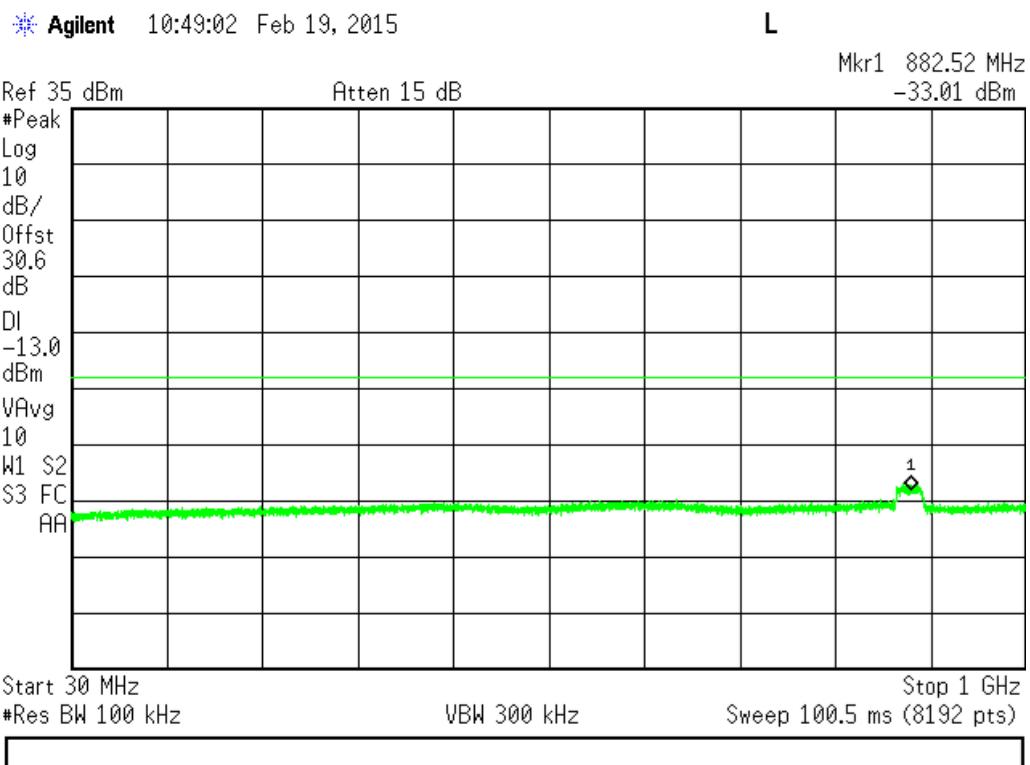


1930 - 1990 MHz Band (Mid Frequency) (Cont)

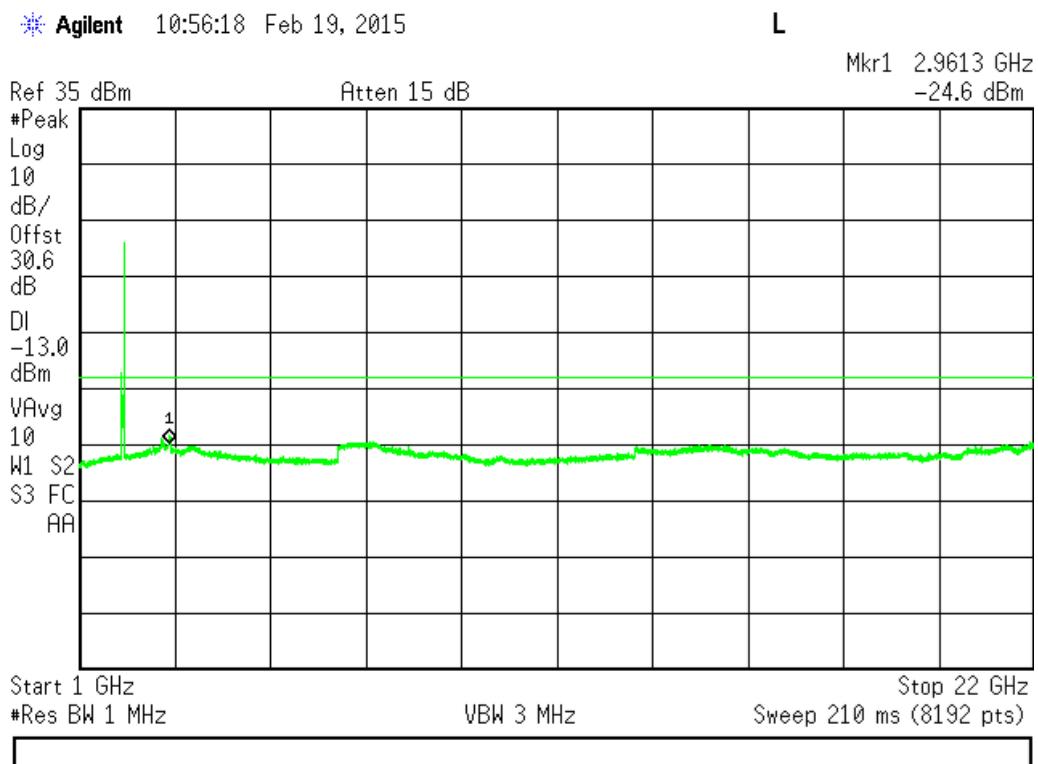




1930 - 1990 MHz Band (High Frequency)



1930 - 1990 MHz Band (High Frequency) (Cont)





Radiated Spurious Emissions

Name of Test:

Radiated Spurious Emissions

Engineer: Mike Graffeo

Test Equipment Utilized:

i00103, i00349, i00428, I00457, i00331

Test Date: 2/16/15

Test Procedure

The EUT was tested in a semi-anechoic chamber with the turntable 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 antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that 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. The EUT output was terminated into a 50 Ohm non-radiating load.

The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz. The VBW was set to 3 times the RBW.

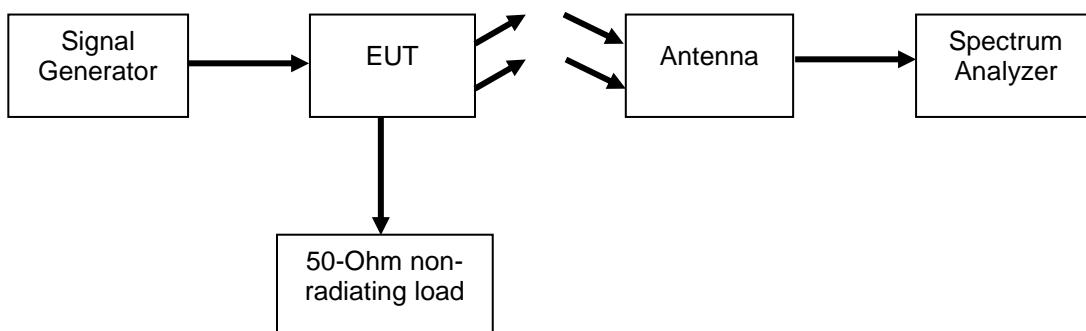
The following formula was used for calculating the limits:

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

P1 = power in dBm

P2 = power in Watts

Test Setup





UPLINK BAND

824 - 849 MHz Band 836.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1673	-54.04	-13	Pass
2509.5	-51.97	-13	Pass
3346	-44.99	-13	Pass

1850 - 1910 MHz Band 1880 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3765	-47.56	-13	Pass
5647.5	-41.62	-13	Pass
7530	-35.06	-13	Pass

DLINK BAND

869 - 894 MHz Band 881.5 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
1763	-52.77	-13	Pass
2644.5	-49.60	-13	Pass
3526	-45.50	-13	Pass

1930 - 1990 MHz Band 1960 MHz Tuned Frequency

Measured Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3920	-46.49	-13	Pass
5880	-44.20	-13	Pass
7840	-34.13	-13	Pass

No other emissions were detected. All emissions were 20 below the limit of -13 dBm.



Occupied Bandwidth

Name of Test:

Test Equipment Utilized

Occupied Bandwidth

i00457, i00331

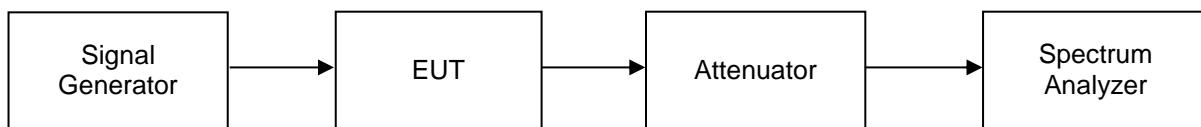
Engineer: Mike Graffeo

Test Date: 2/19/15

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

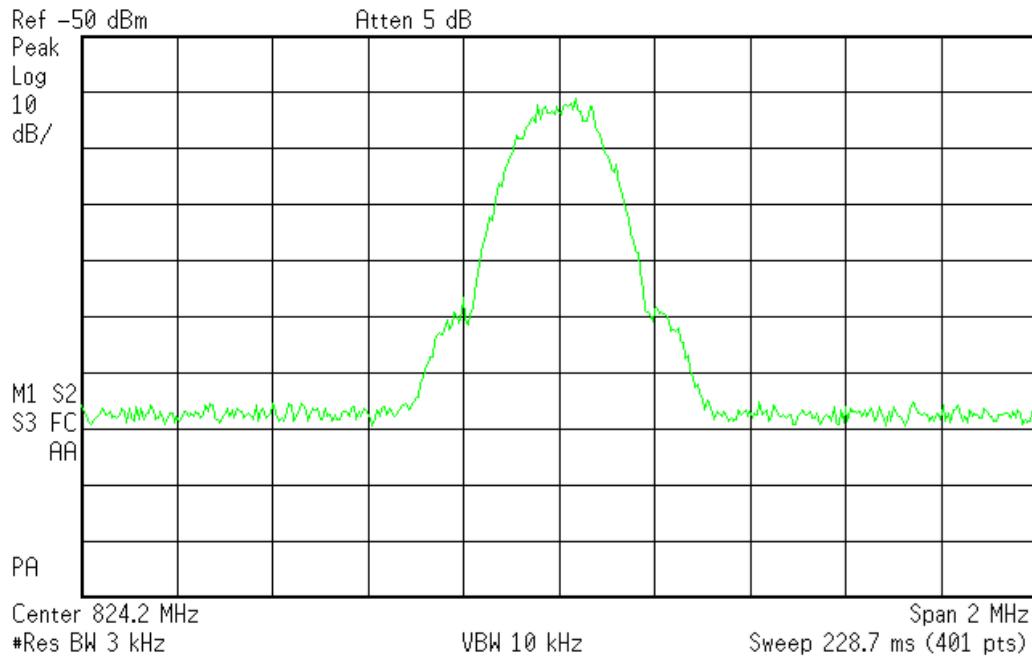




**Uplink (GSM Signal Low band)
824-849 MHz Band
Input**

* Agilent 14:33:12 Feb 19, 2015

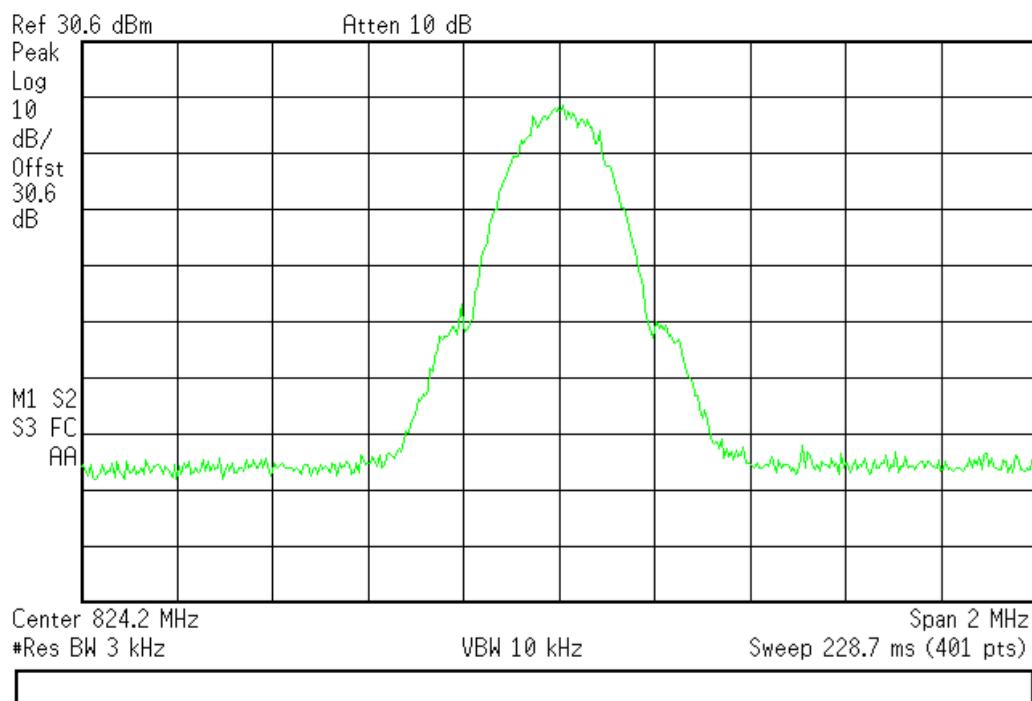
L



Output

* Agilent 15:09:41 Feb 19, 2015

L

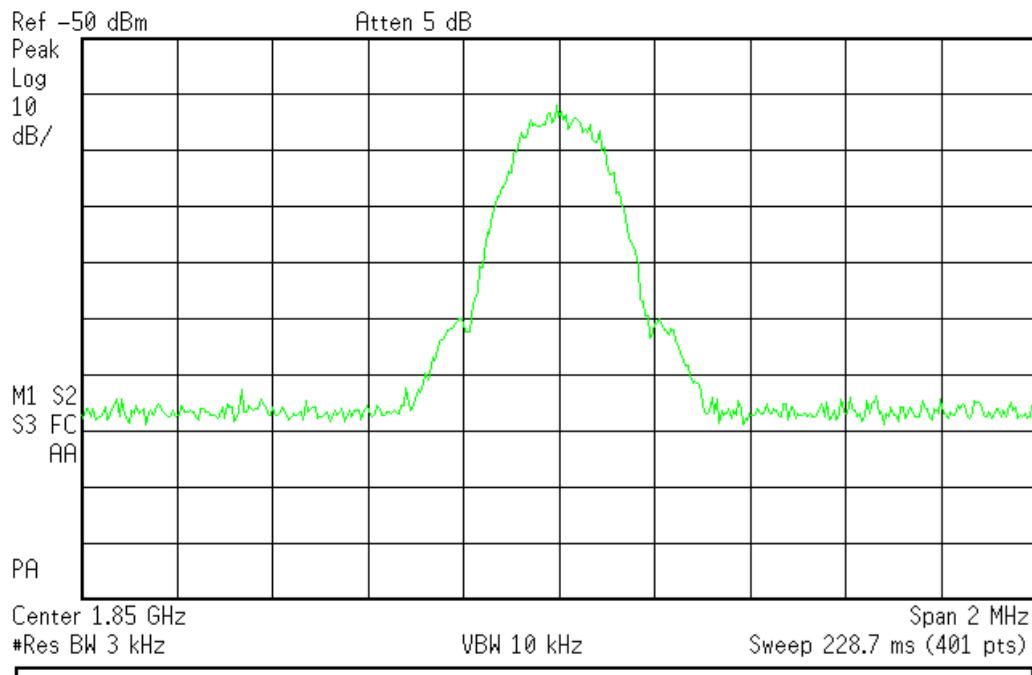




**Uplink (GSM Signal Low band)
1850-1910 MHz Band
Input**

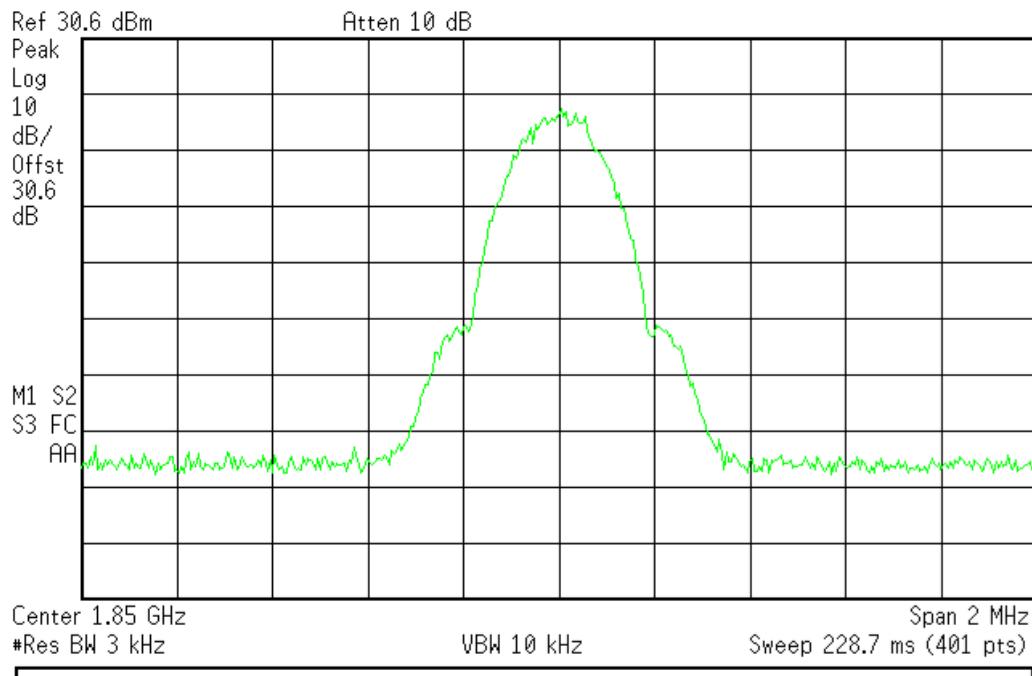
* Agilent 14:35:09 Feb 19, 2015

L



* Agilent 15:12:07 Feb 19, 2015

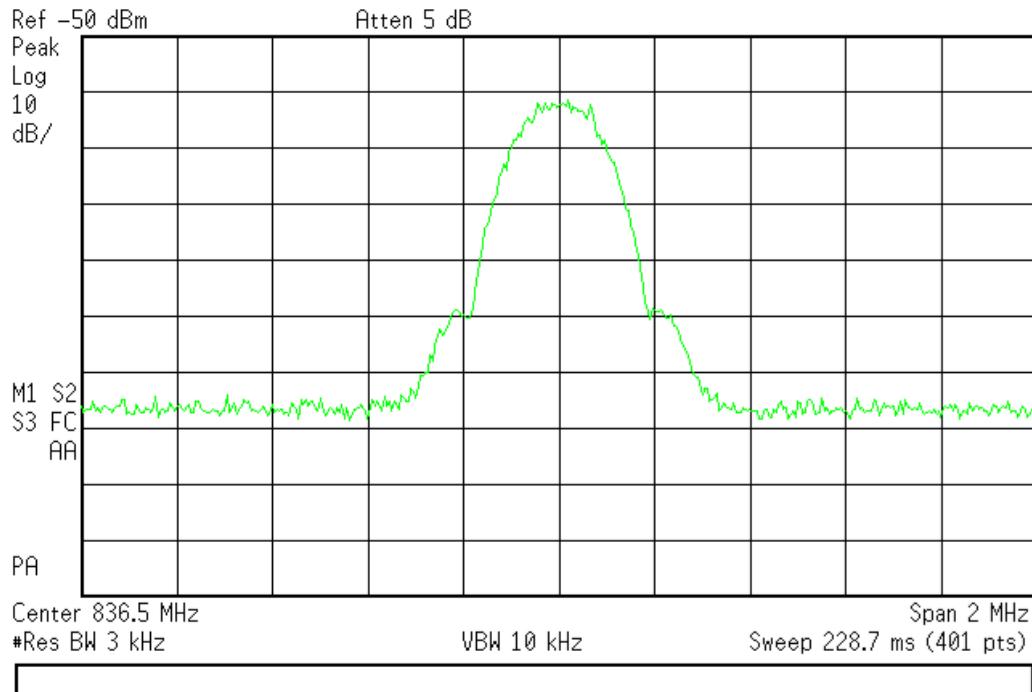
L



**Uplink (GSM Signal Mid band)
824-849 MHz Band
Input**

* Agilent 14:31:12 Feb 19, 2015

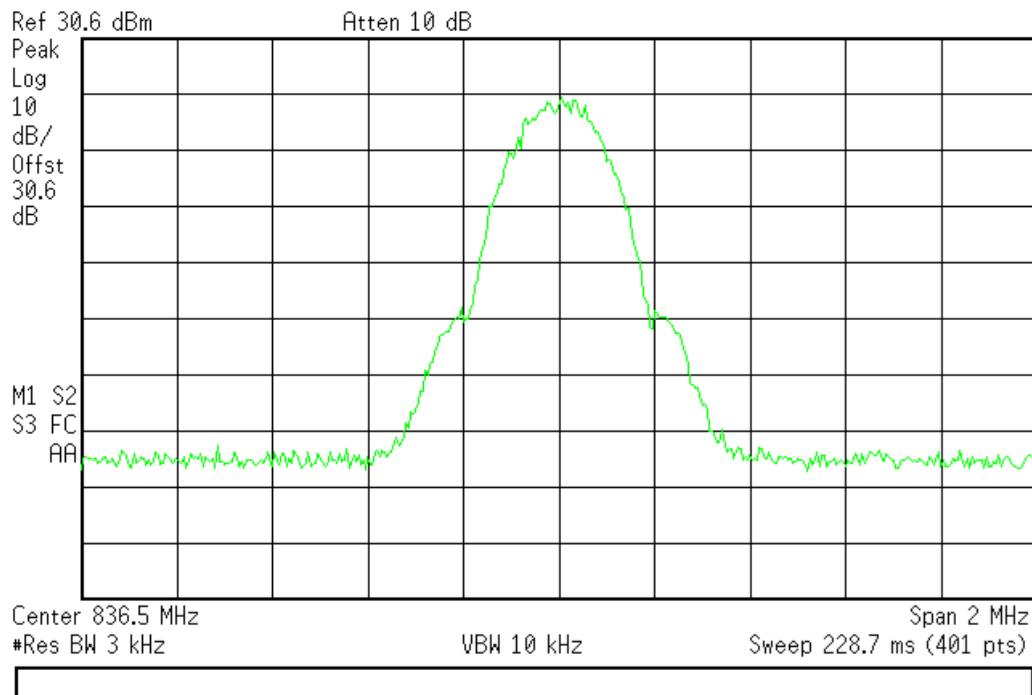
L



Output

* Agilent 15:07:32 Feb 19, 2015

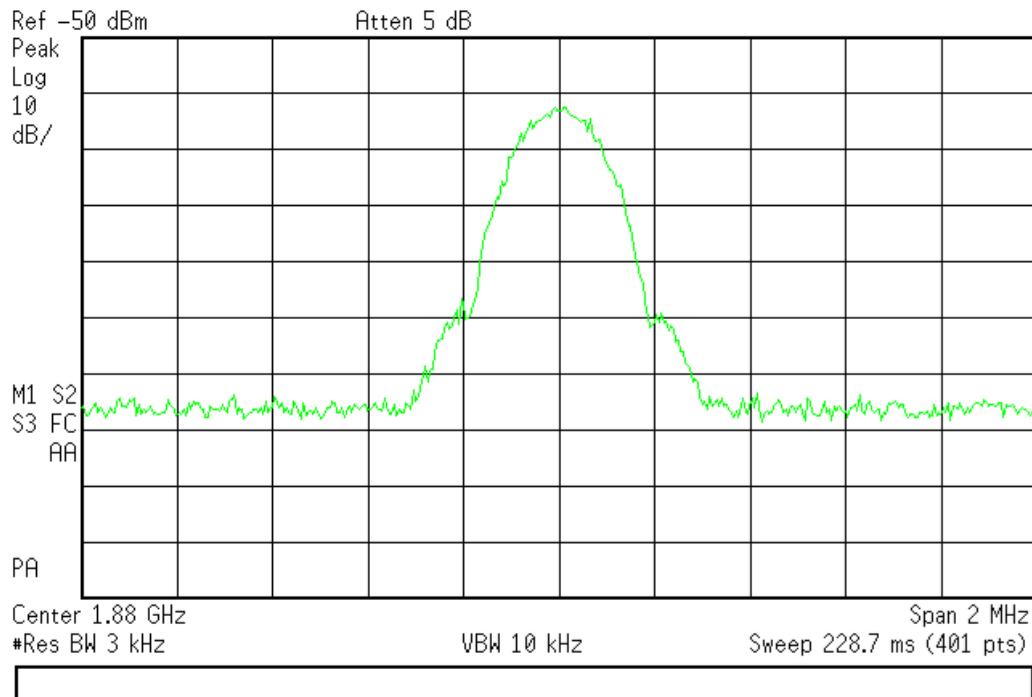
L



**Uplink (GSM Signal Mid band)
1850-1910 MHz Band
Input**

* Agilent 14:34:22 Feb 19, 2015

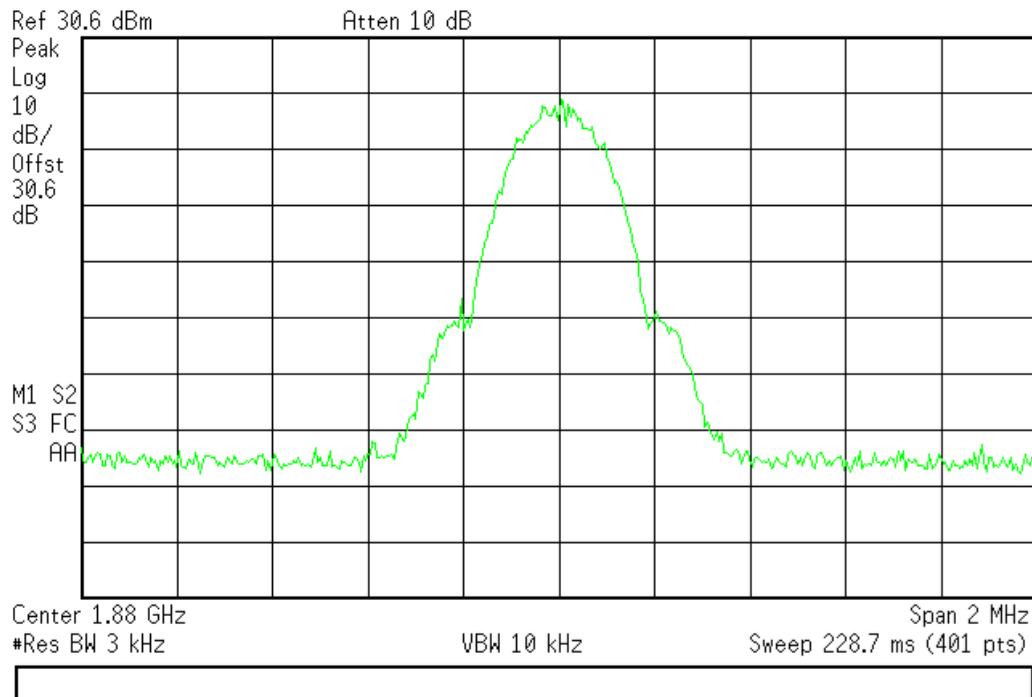
L



Output

* Agilent 15:11:27 Feb 19, 2015

L



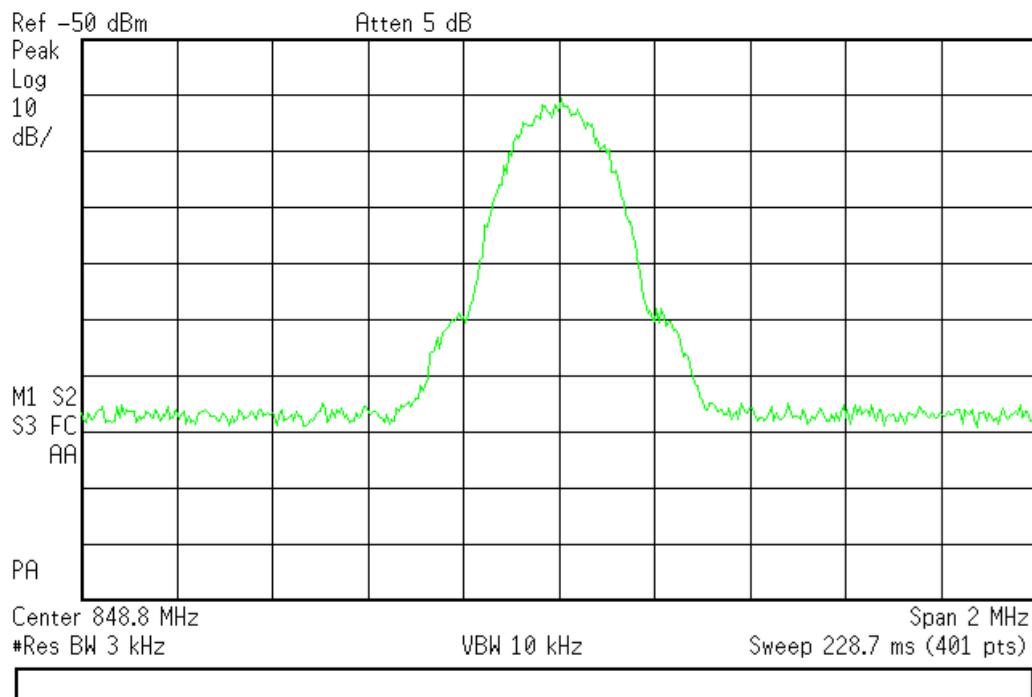


Uplink (GSM Signal High band)

824-849 MHz Band Input

* Agilent 14:33:52 Feb 19, 2015

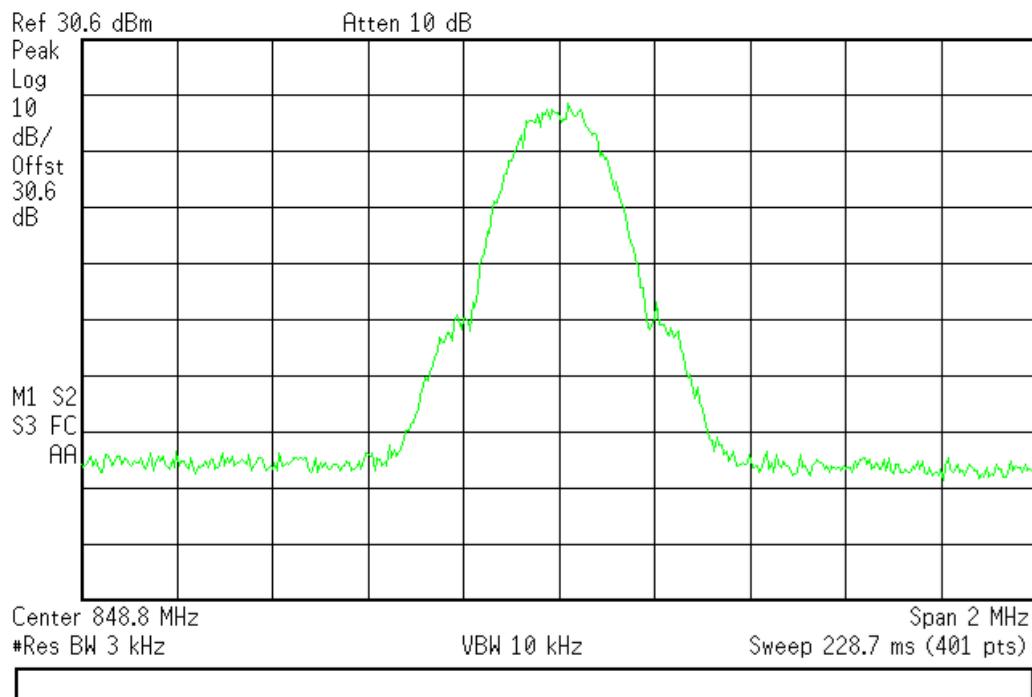
L



Output

* Agilent 15:10:41 Feb 19, 2015

L



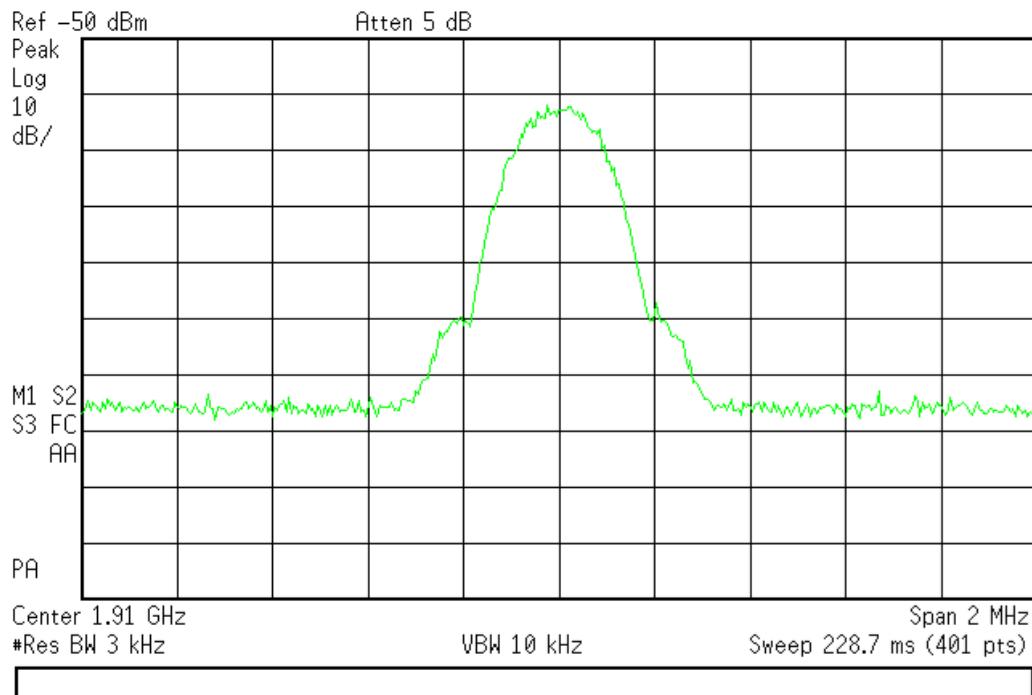


Uplink (GSM Signal High band)

1850-1910 MHz Band Input

* Agilent 14:36:08 Feb 19, 2015

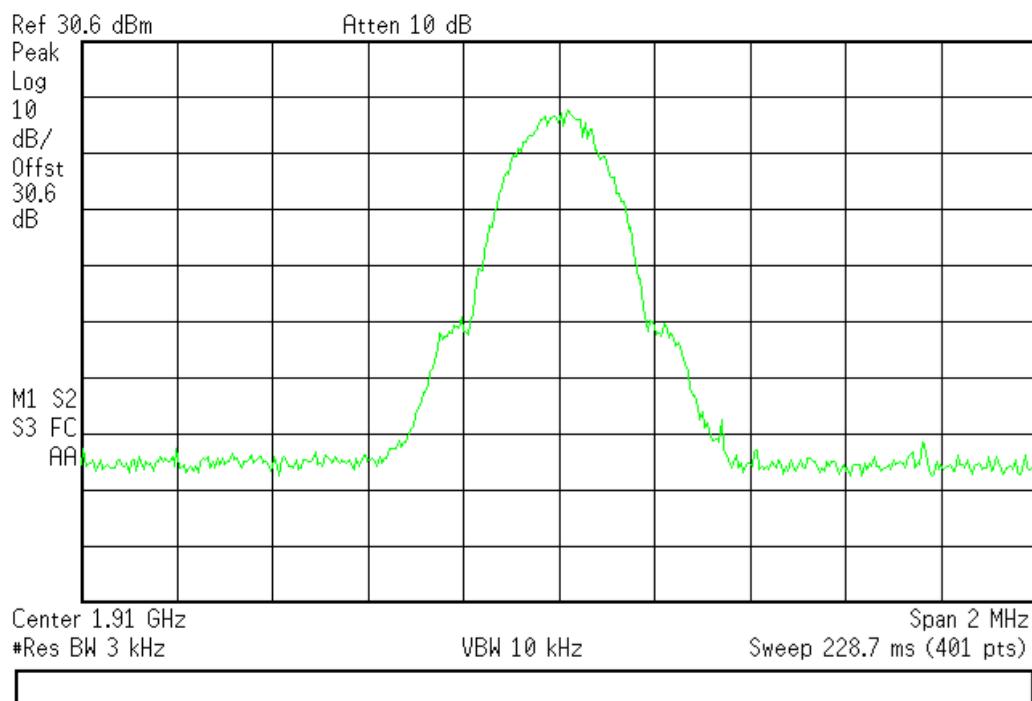
L



Output

* Agilent 15:13:01 Feb 19, 2015

L



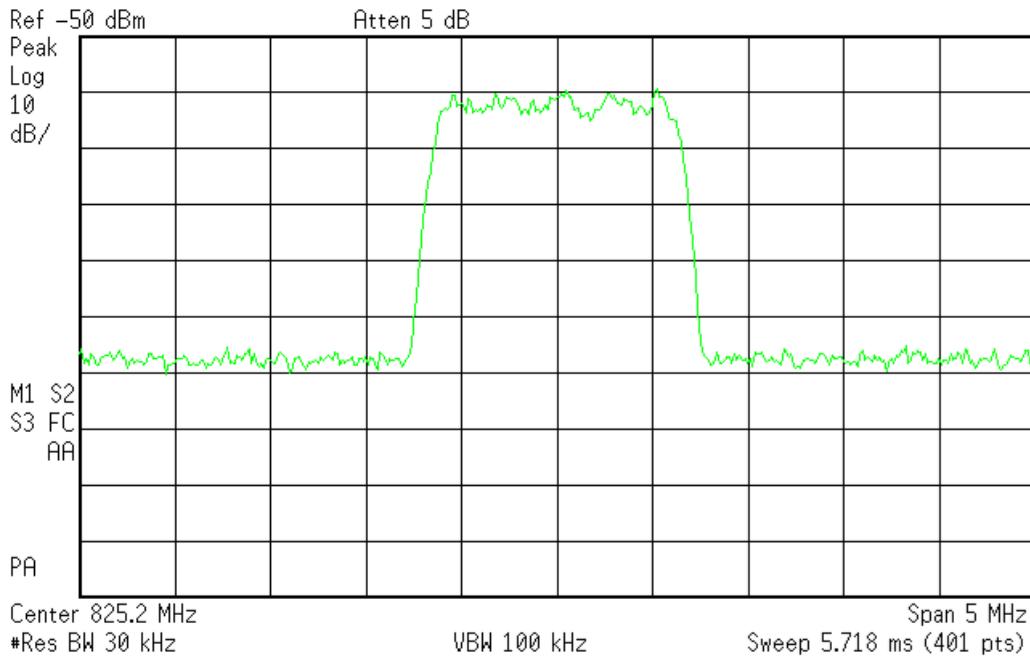


Uplink (CDMA Signal Low band)

824-849 MHz Band
Input

* Agilent 14:43:26 Feb 19, 2015

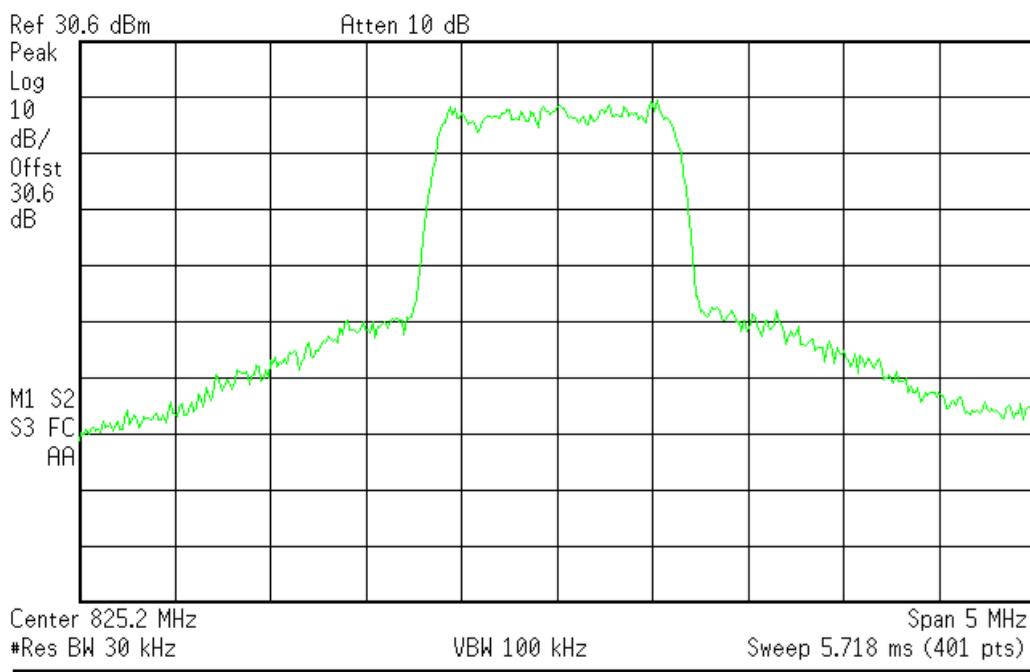
L



Output

* Agilent 15:15:51 Feb 19, 2015

L



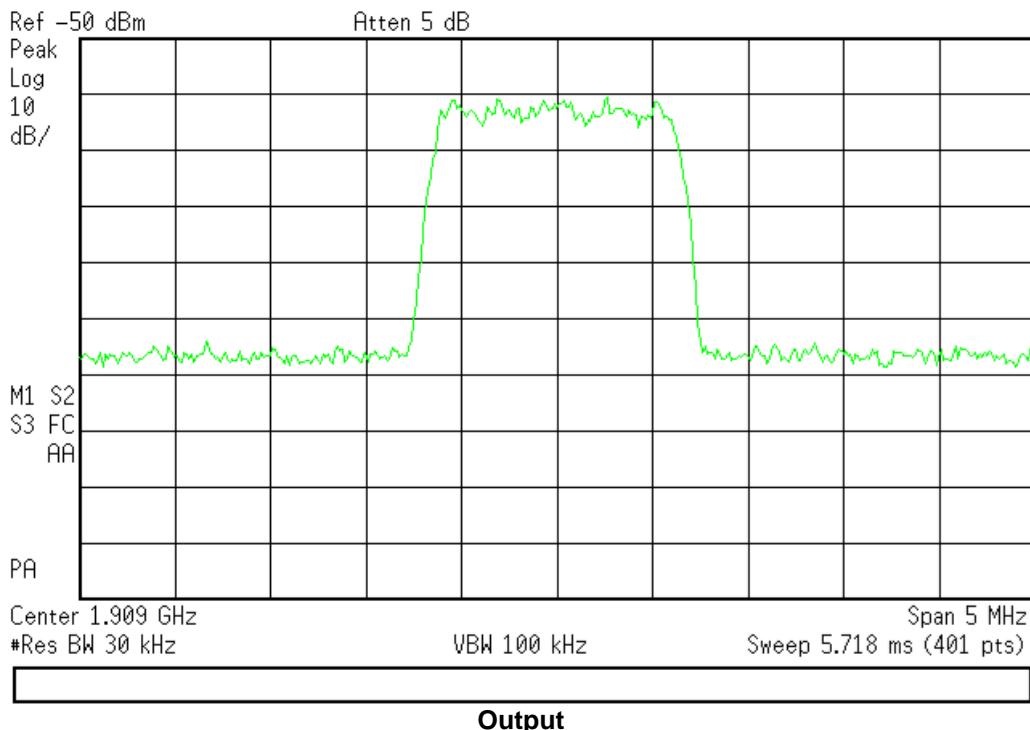


Uplink (CDMA Signal low band)

1850-1910 MHz Band Input

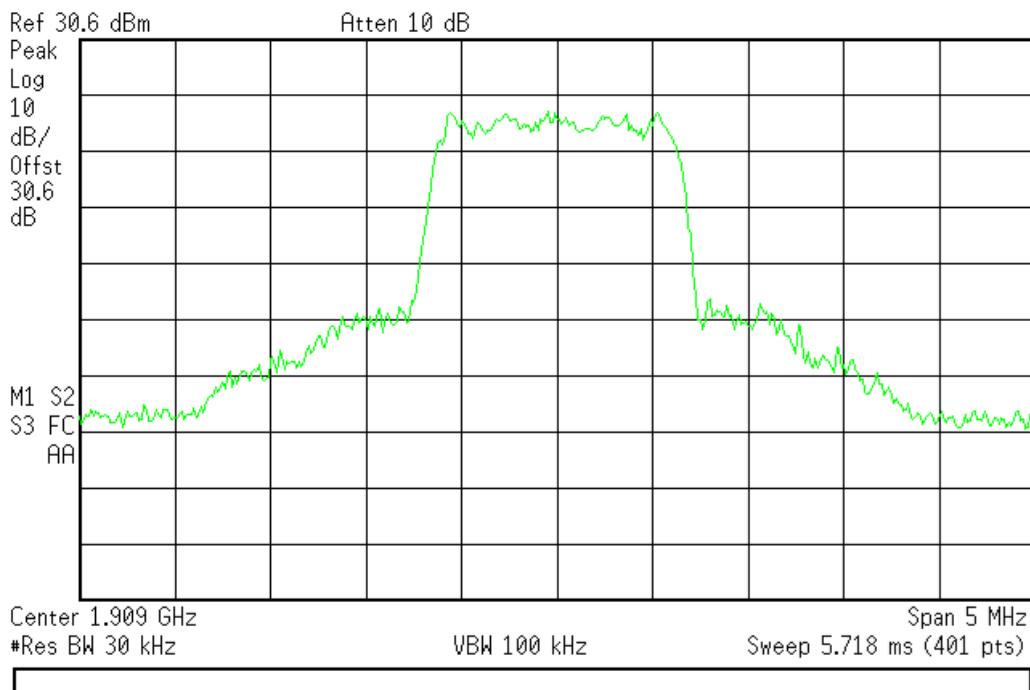
* Agilent 14:46:03 Feb 19, 2015

L



* Agilent 15:18:31 Feb 19, 2015

L



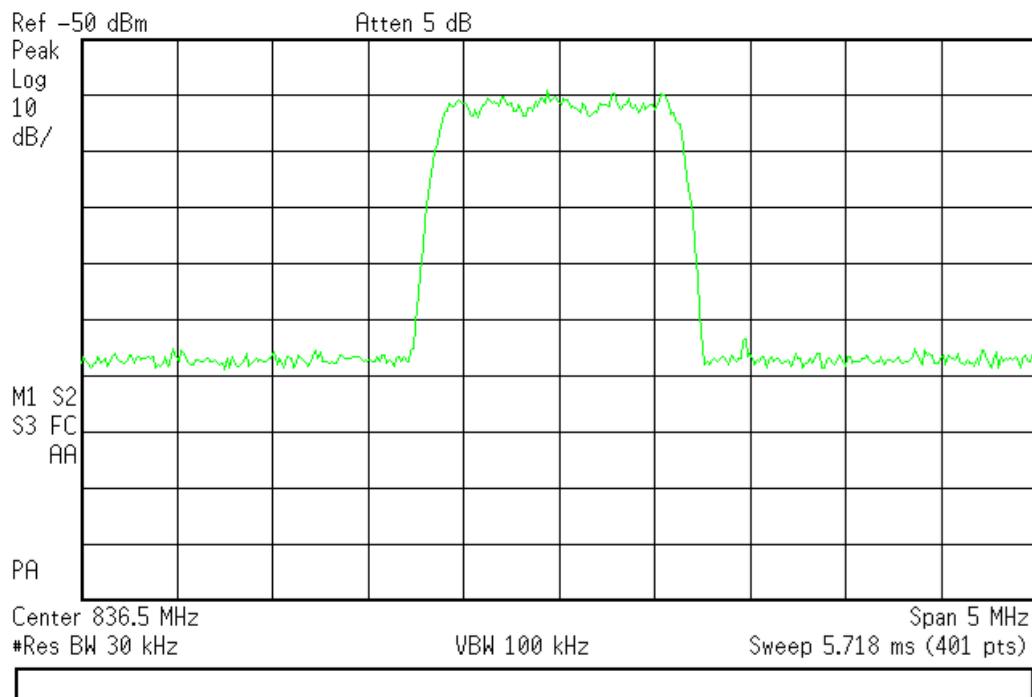


Uplink (CDMA Signal mid band)

824-849 MHz Band
Input

* Agilent 14:42:15 Feb 19, 2015

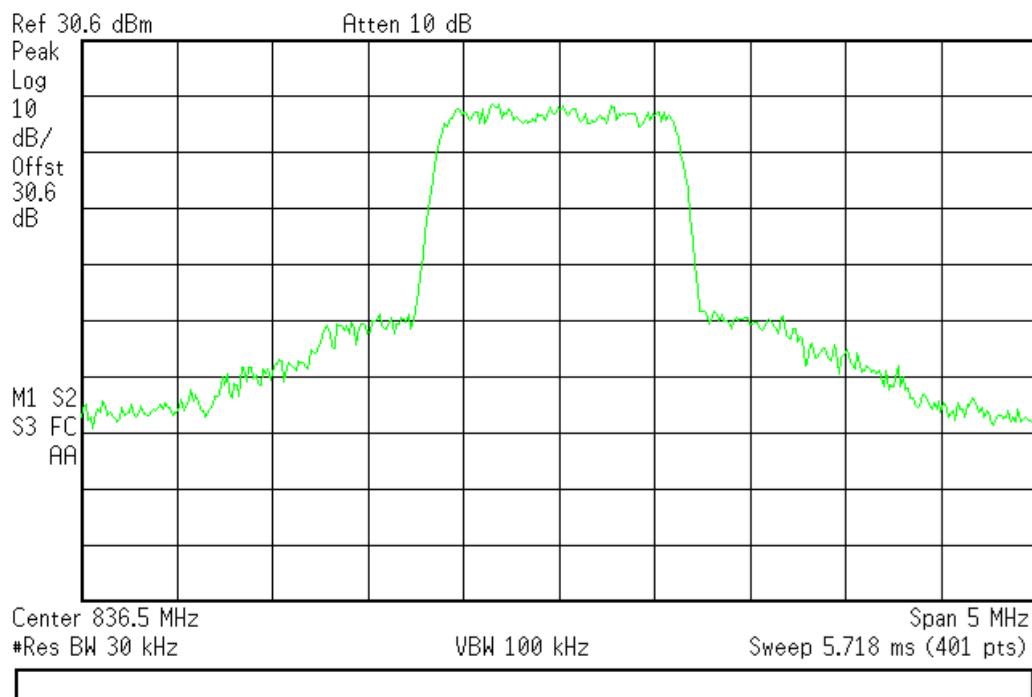
L



Output

* Agilent 15:14:13 Feb 19, 2015

L

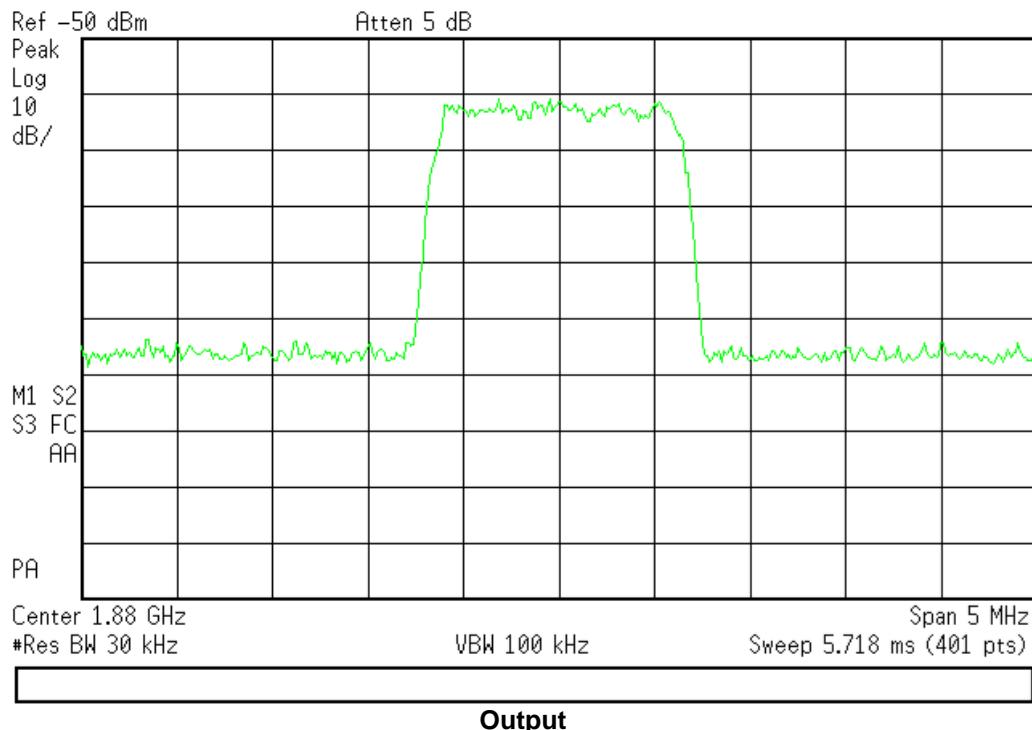


Uplink (CDMA Signal mid band)

1850-1910 MHz Band
Input

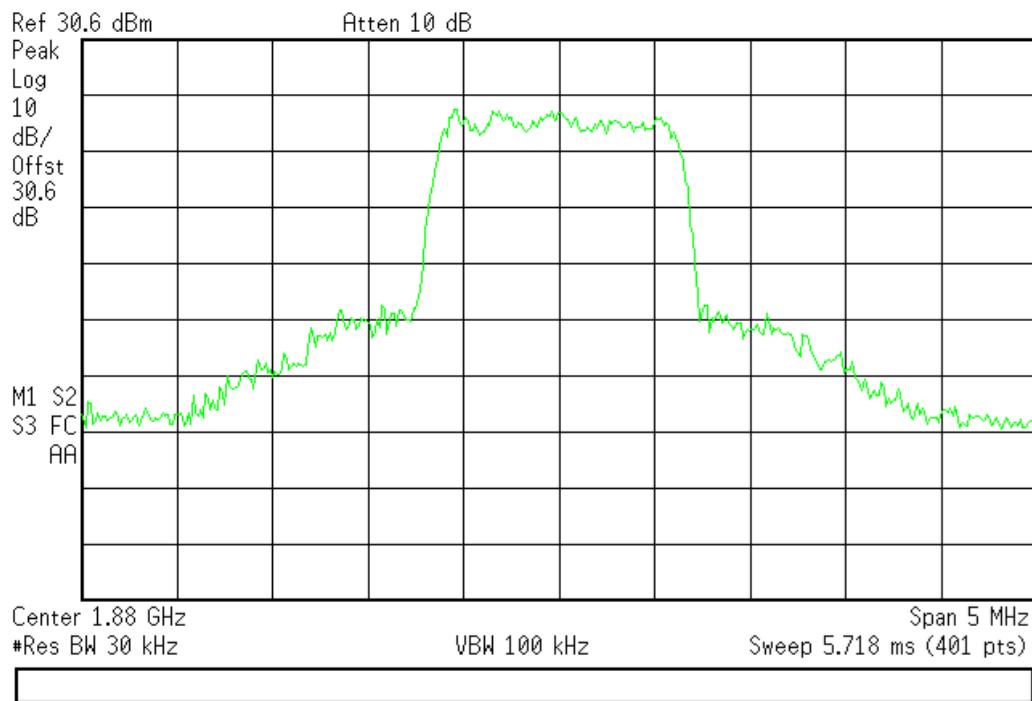
* Agilent 14:44:38 Feb 19, 2015

L



* Agilent 15:17:09 Feb 19, 2015

L



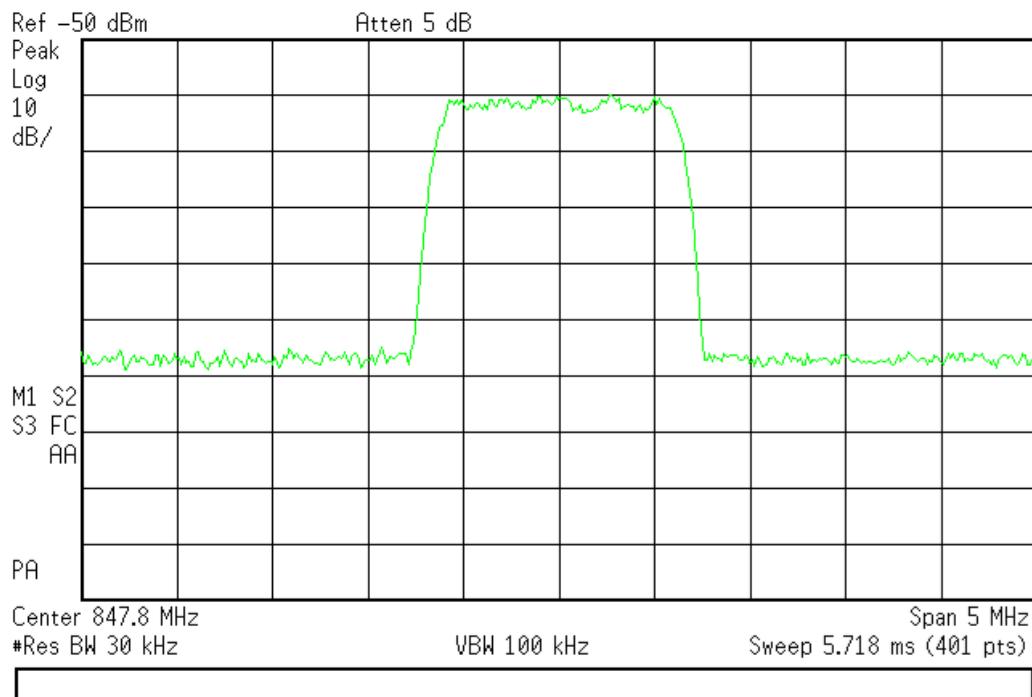


Uplink (CDMA Signal high band)

824-849 MHz Band
Input

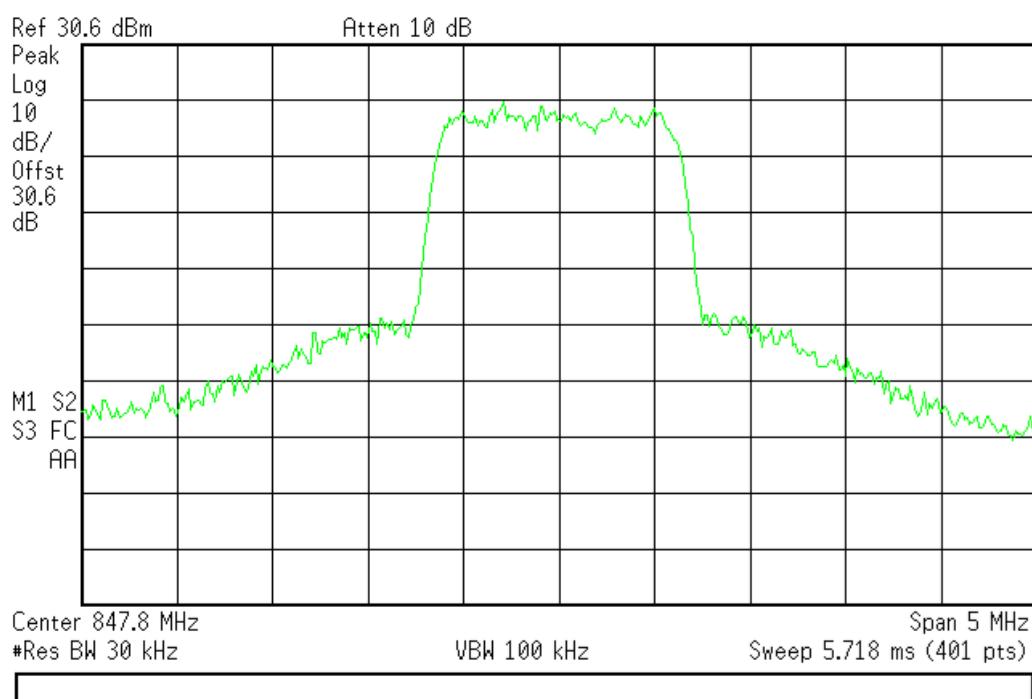
* Agilent 14:44:08 Feb 19, 2015

L



* Agilent 15:16:35 Feb 19, 2015

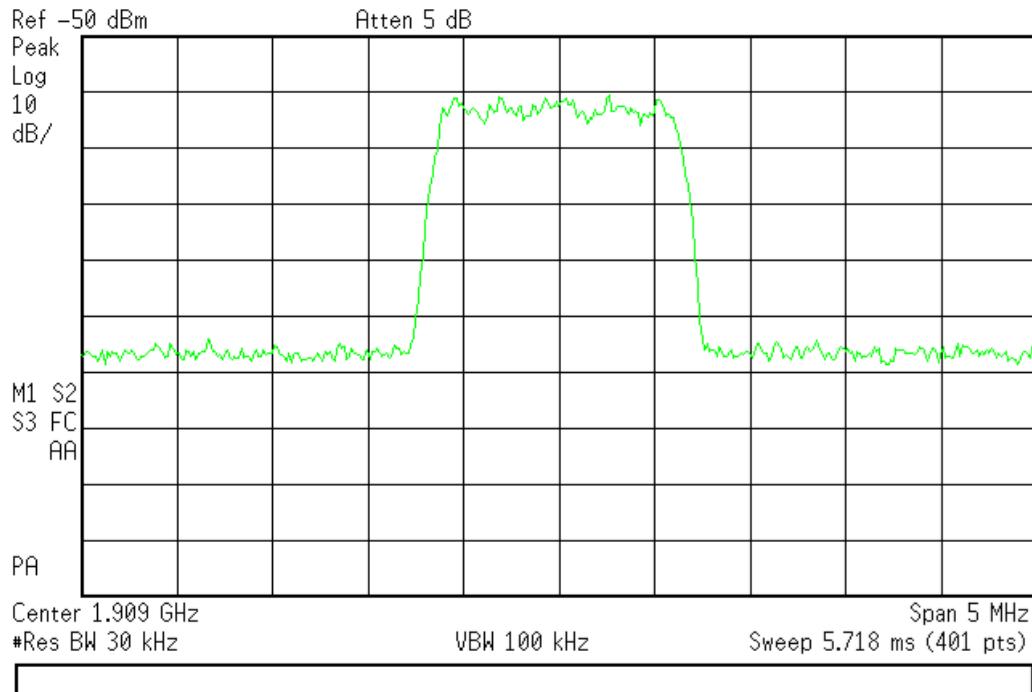
L



**Uplink (CDMA Signal high band)
1850-1910 MHz Band
Input**

* Agilent 14:46:03 Feb 19, 2015

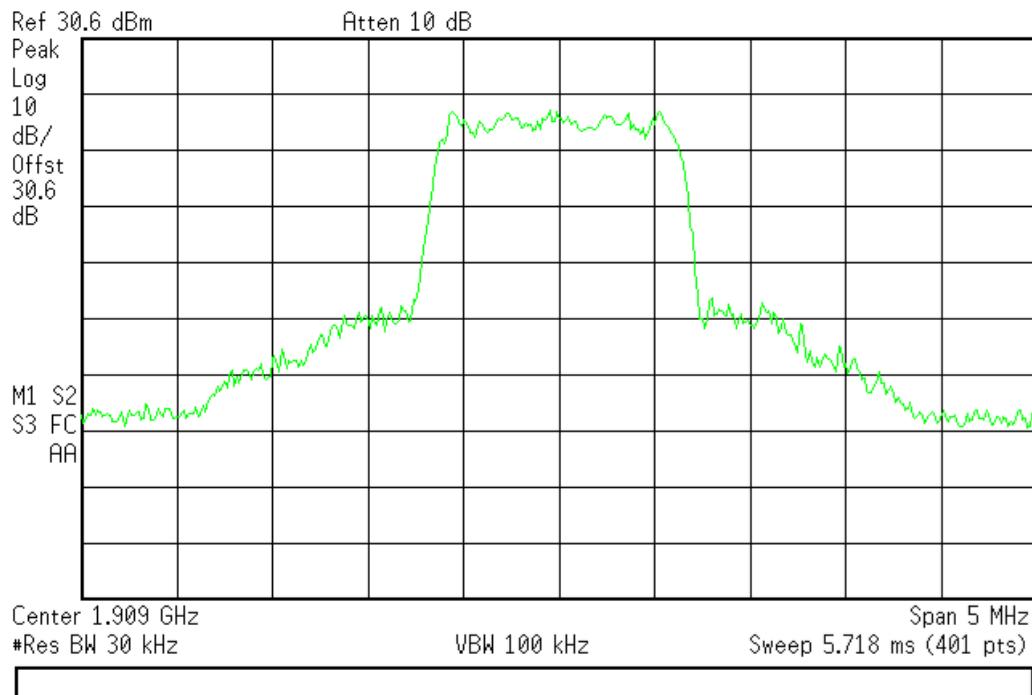
L



Output

* Agilent 15:18:31 Feb 19, 2015

L



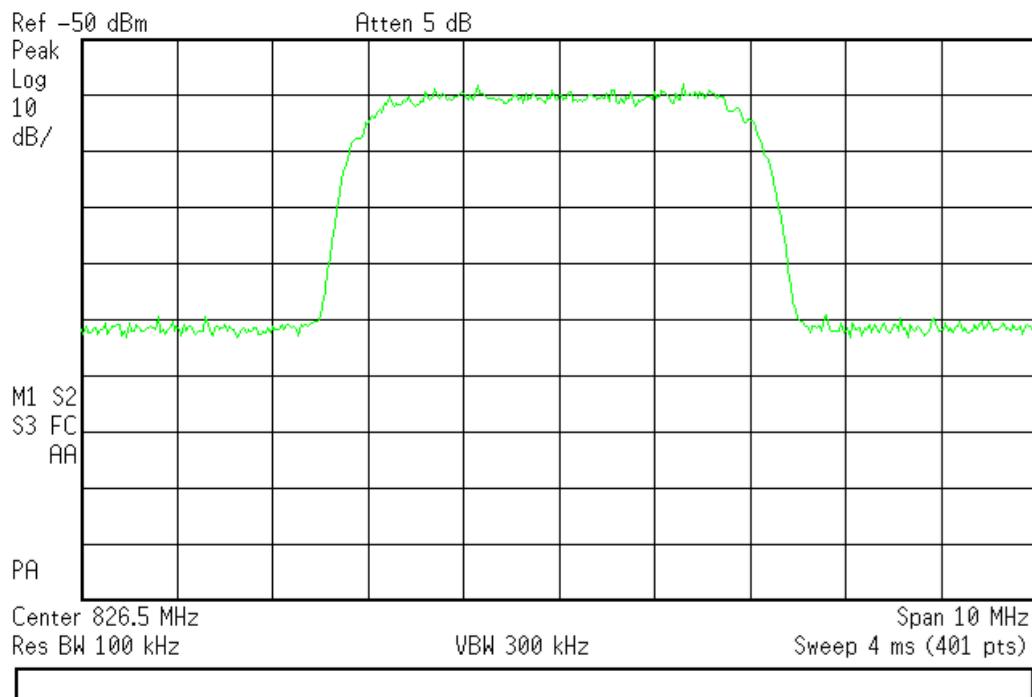


Uplink (WCDMA Signal Low band)

824-849 MHz Band Input

* Agilent 14:12:46 Mar 12, 2015

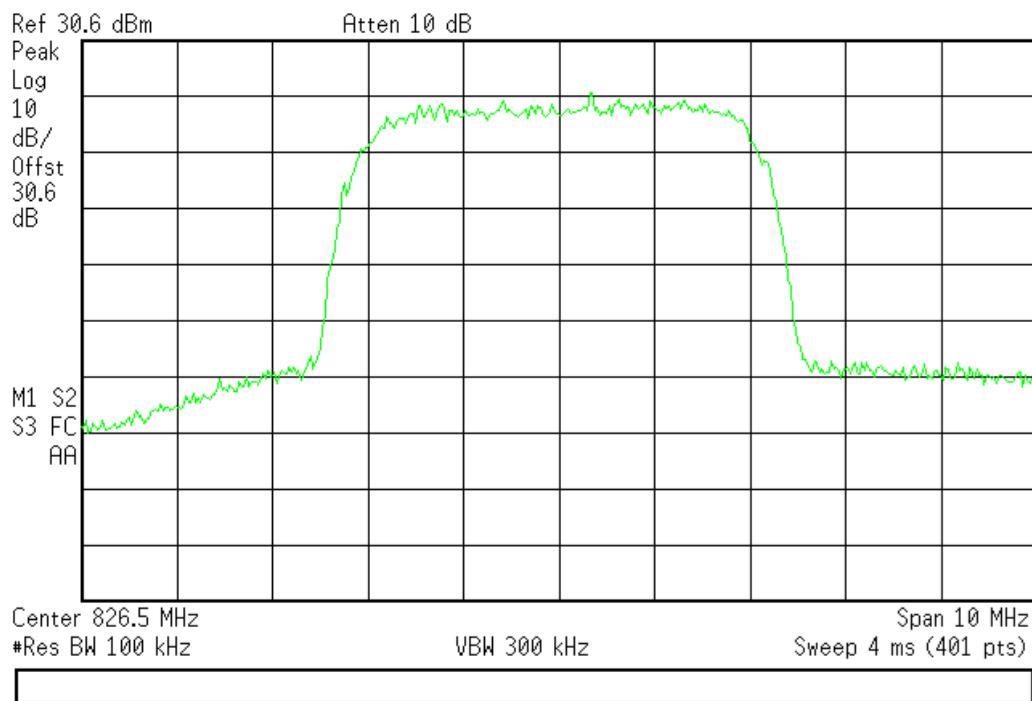
L

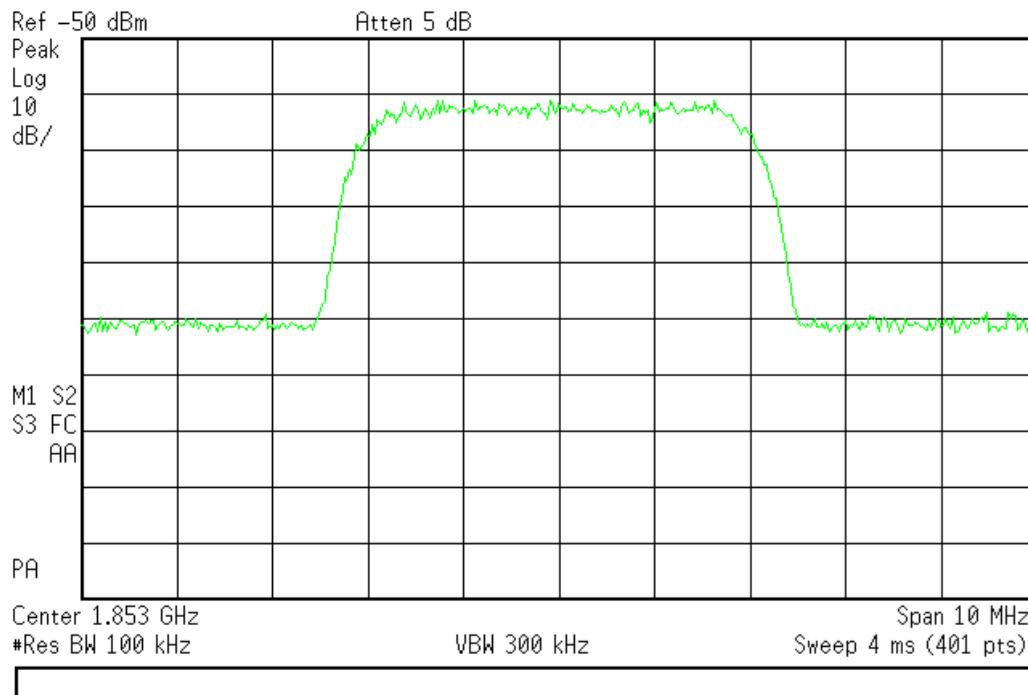
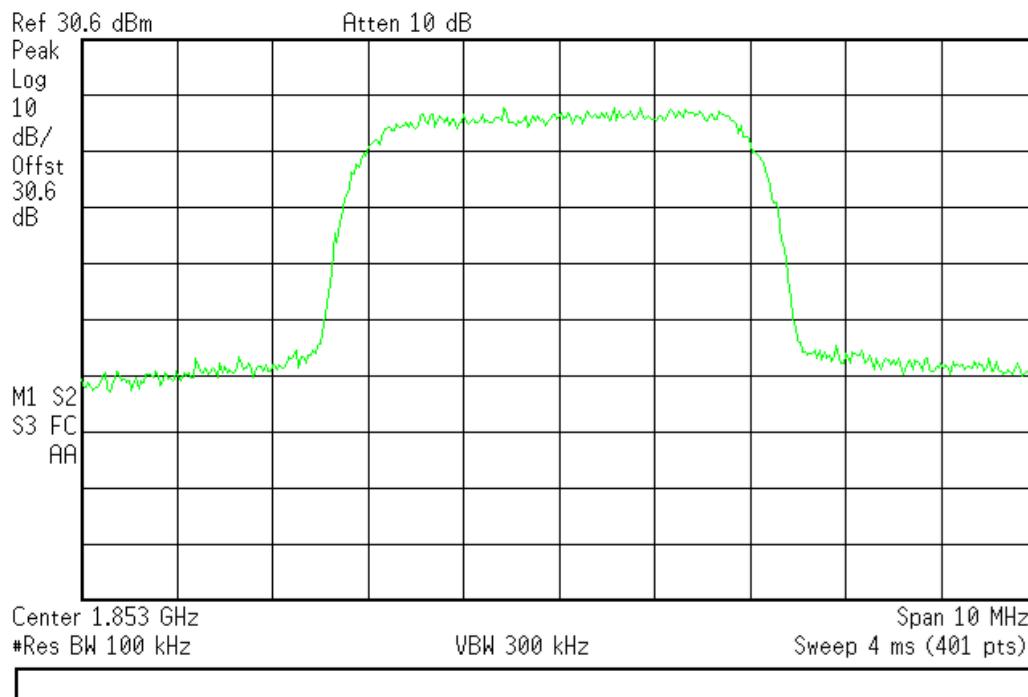


Output

* Agilent 15:20:59 Feb 19, 2015

L



Uplink (WCDMA Signal Low band)**1850-1910 MHz Band
Input***** Agilent 14:54:07 Feb 19, 2015****L****Output***** Agilent 15:22:28 Feb 19, 2015****L**

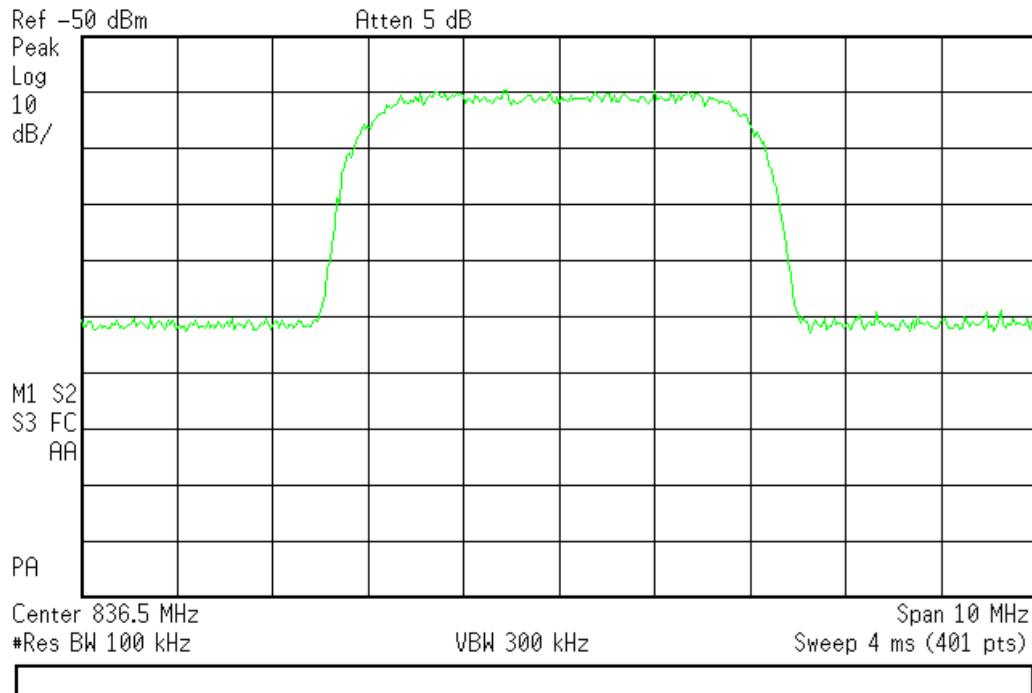


Uplink (WCDMA Signal Mid band)

**824-849 MHz Band
Input**

* Agilent 14:51:08 Feb 19, 2015

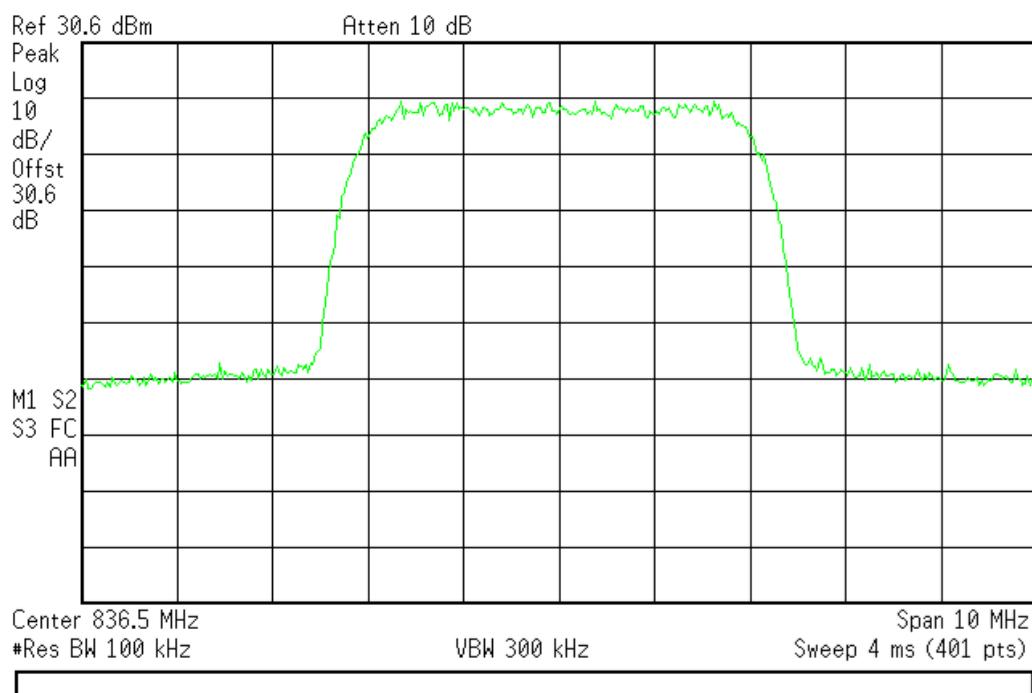
L



Output

* Agilent 15:20:06 Feb 19, 2015

L



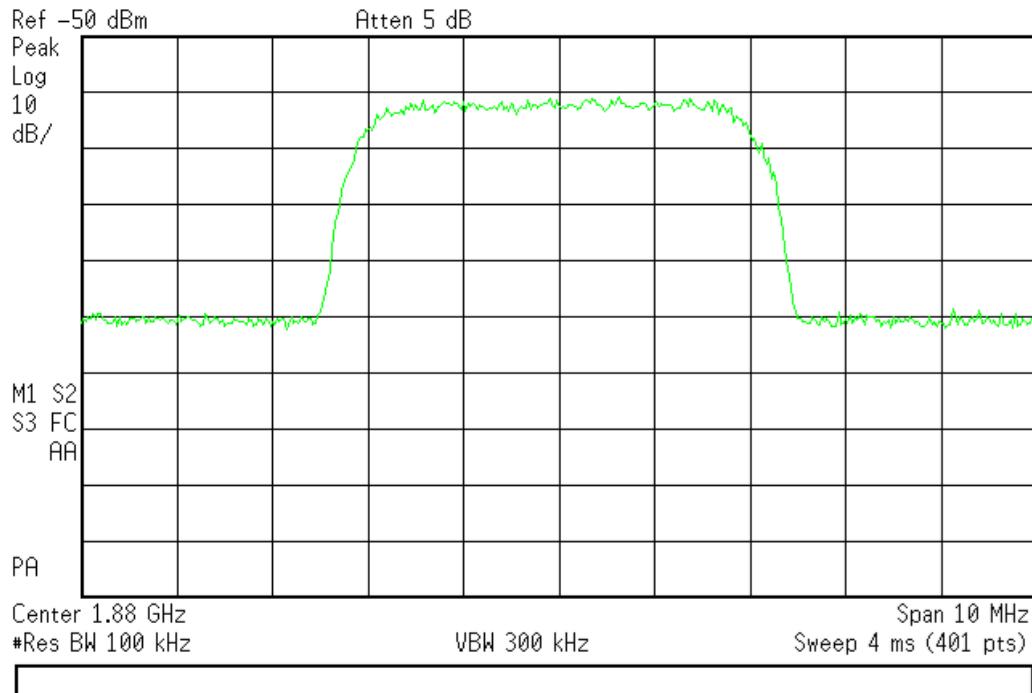


Uplink (WCDMA Signal Mid band)

1850-1910 MHz Band
Input

* Agilent 14:53:07 Feb 19, 2015

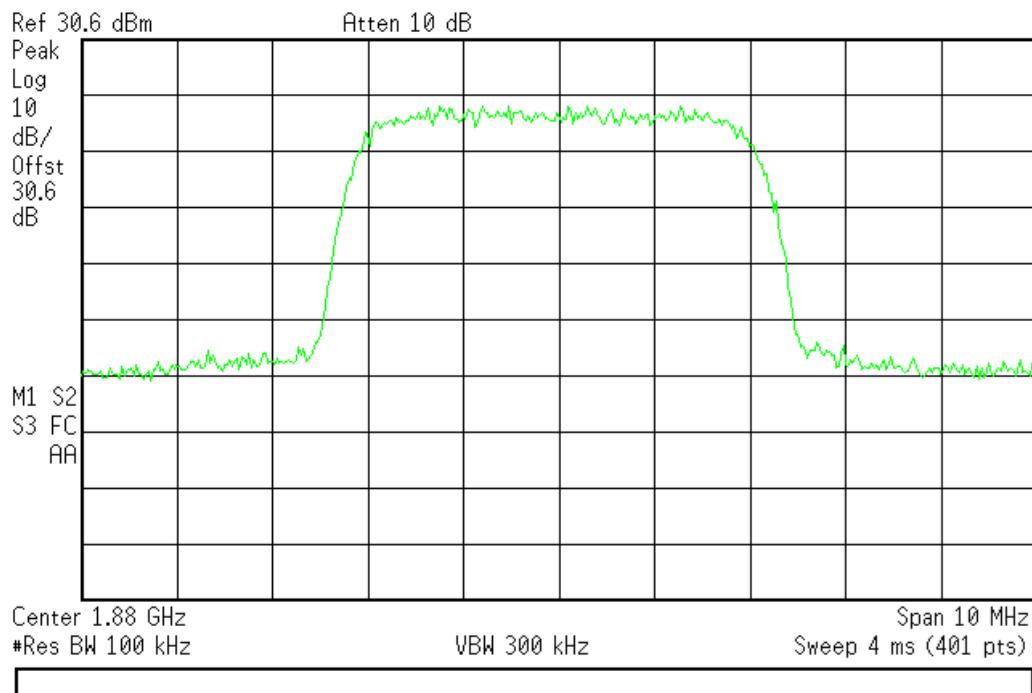
L



Output

* Agilent 15:21:56 Feb 19, 2015

L



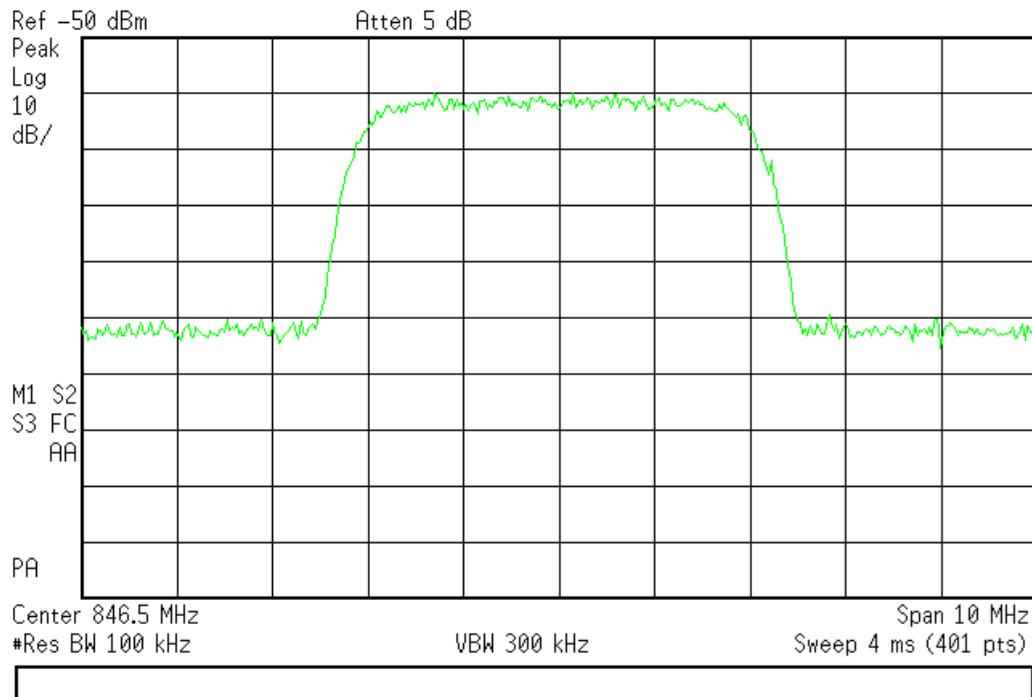


Uplink (WCDMA Signal High band)

824-849 MHz Band
Input

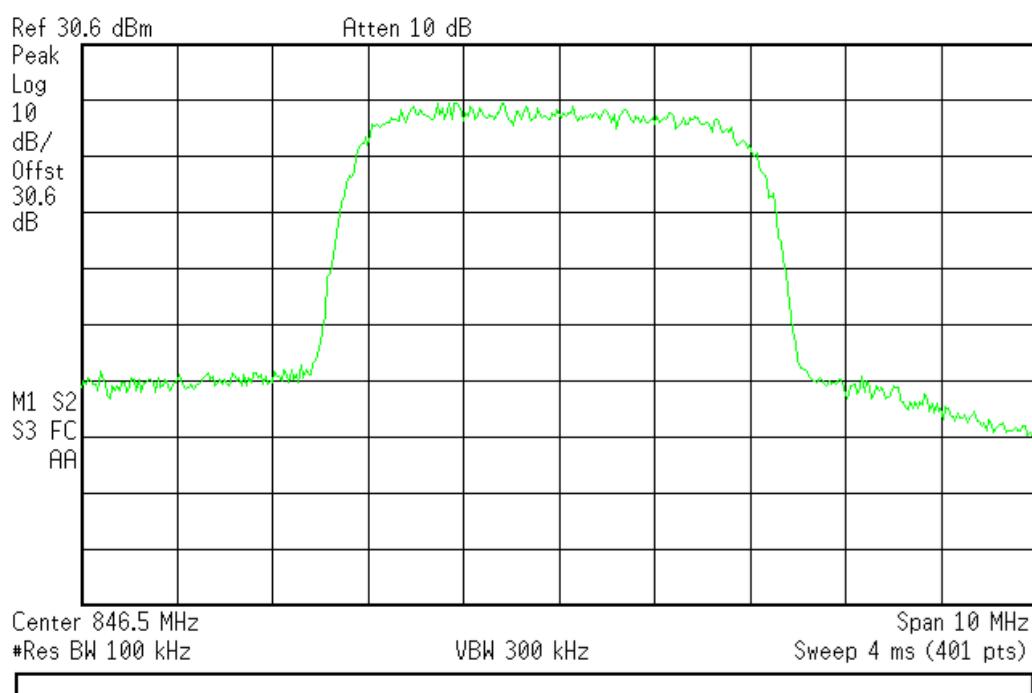
* Agilent 14:52:30 Feb 19, 2015

L



* Agilent 15:21:29 Feb 19, 2015

L



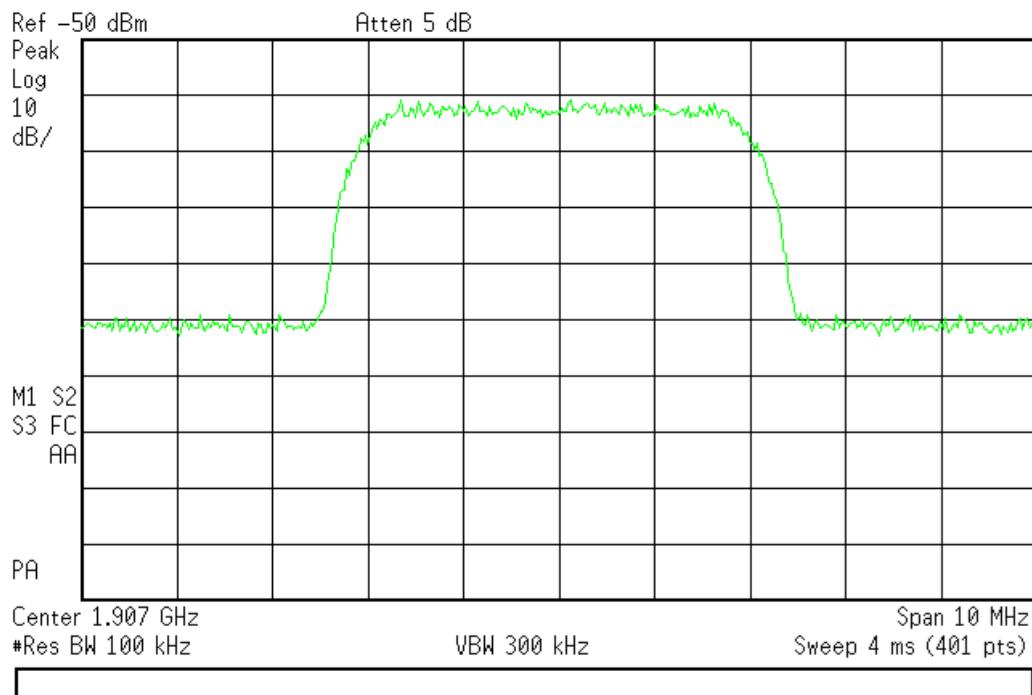


Uplink (WCDMA Signal High band)

1850-1910 MHz Band
Input

* Agilent 14:54:47 Feb 19, 2015

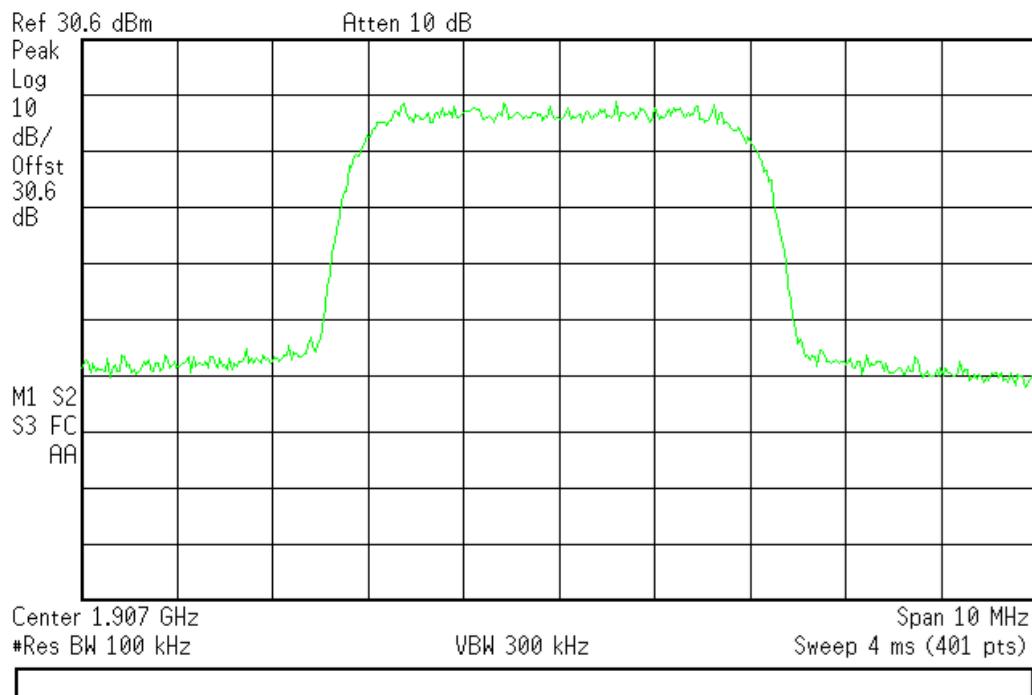
L



Output

* Agilent 15:23:12 Feb 19, 2015

L



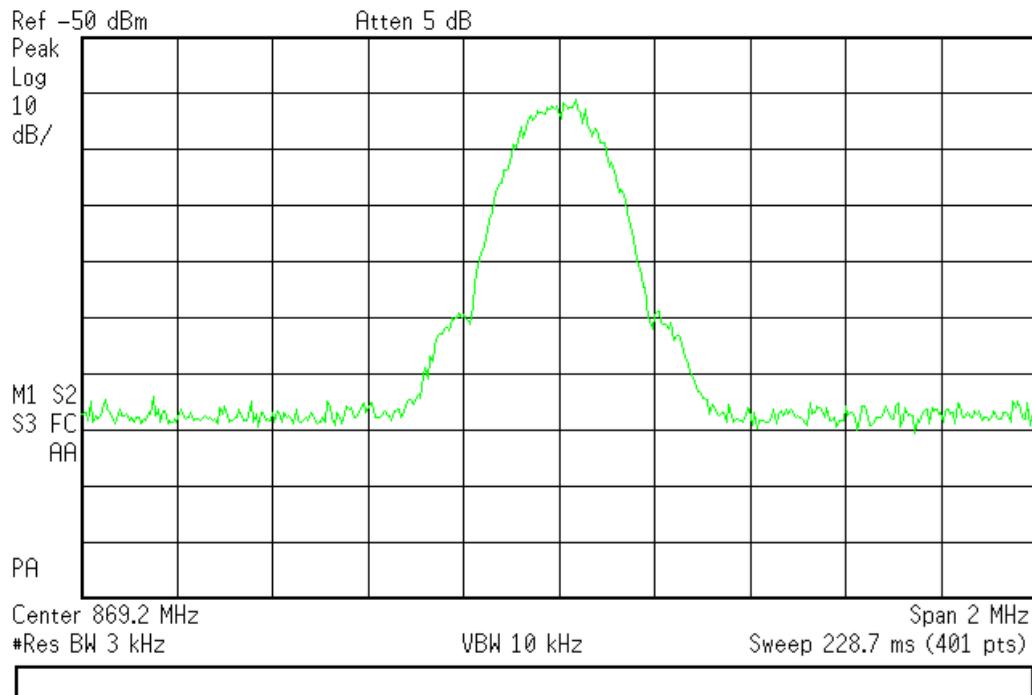


Downlink (GSM Signal low band)

869-894 MHz Band Input

* Agilent 14:38:11 Feb 19, 2015

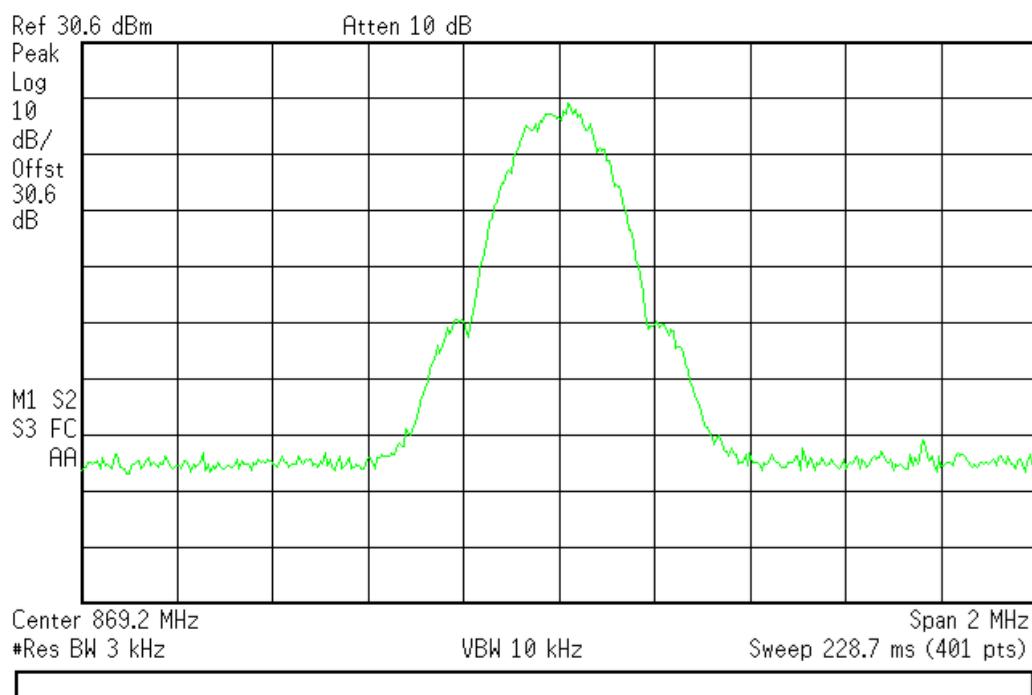
L



Output

* Agilent 15:31:31 Feb 19, 2015

L

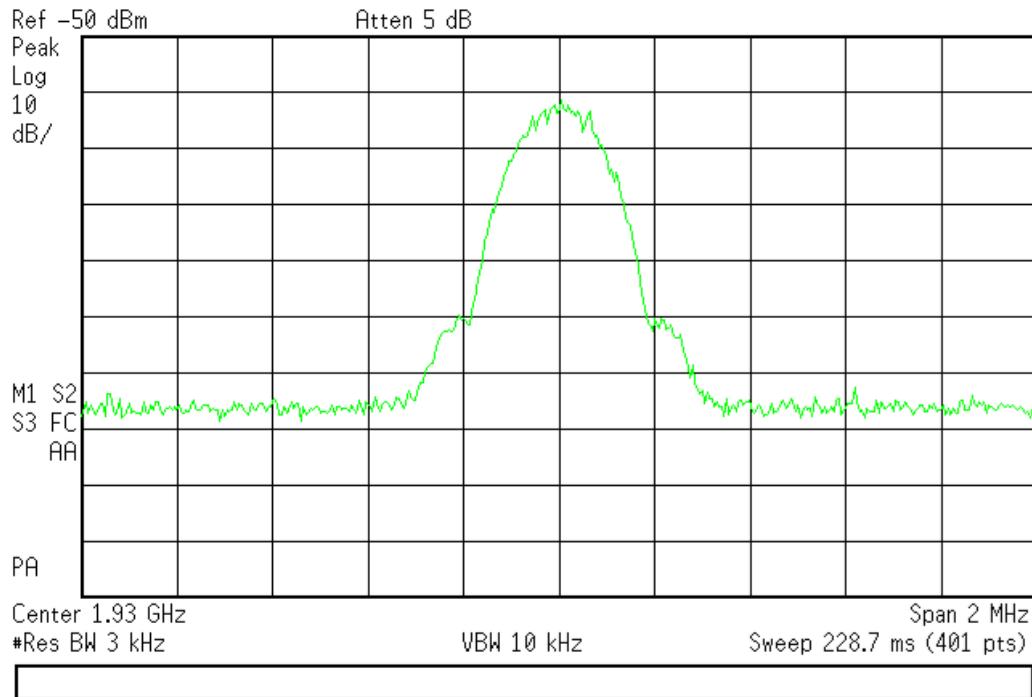


Downlink (GSM Signal low band)

1930-1990 MHz Band
Input

Agilent 14:39:59 Feb 19, 2015

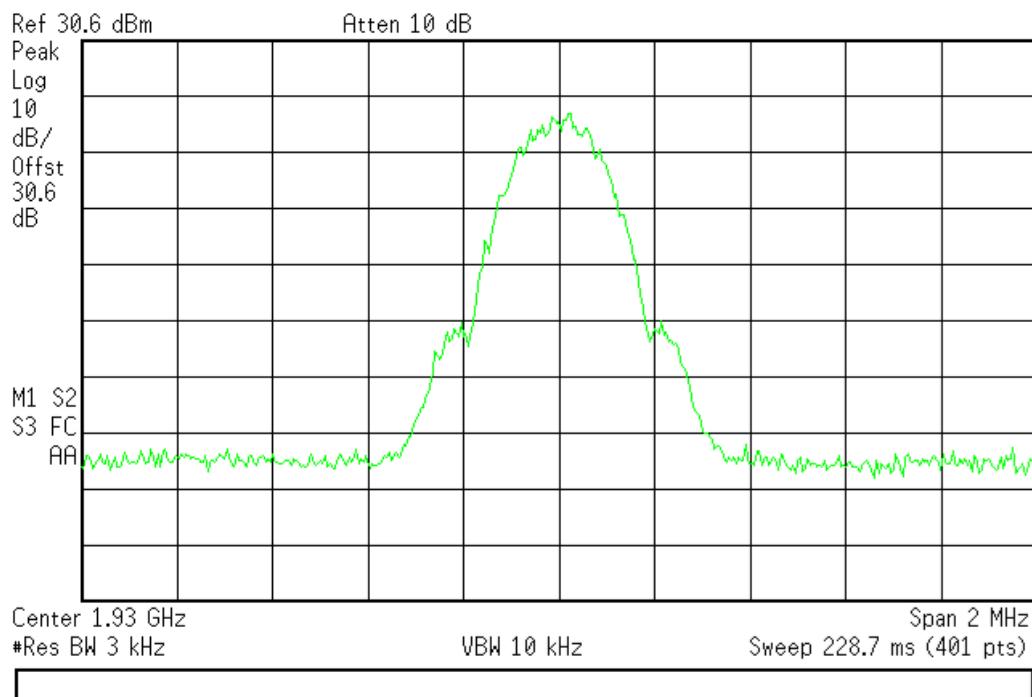
L



Output

Agilent 15:33:31 Feb 19, 2015

L



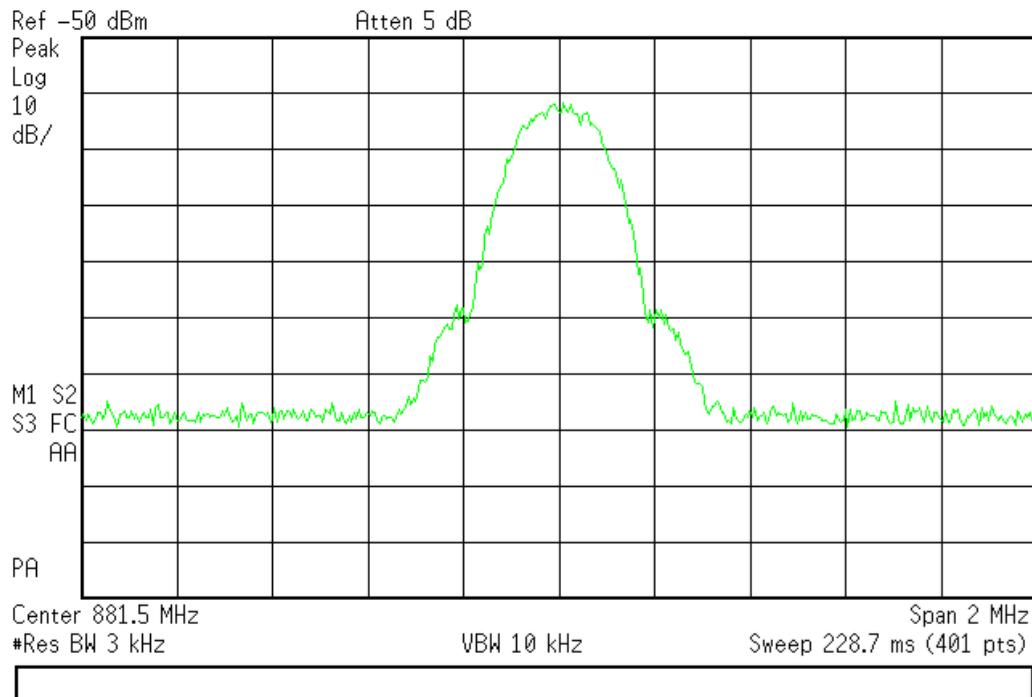


Downlink (GSM Signal mid band)

869-894 MHz Band
Input

* Agilent 14:37:11 Feb 19, 2015

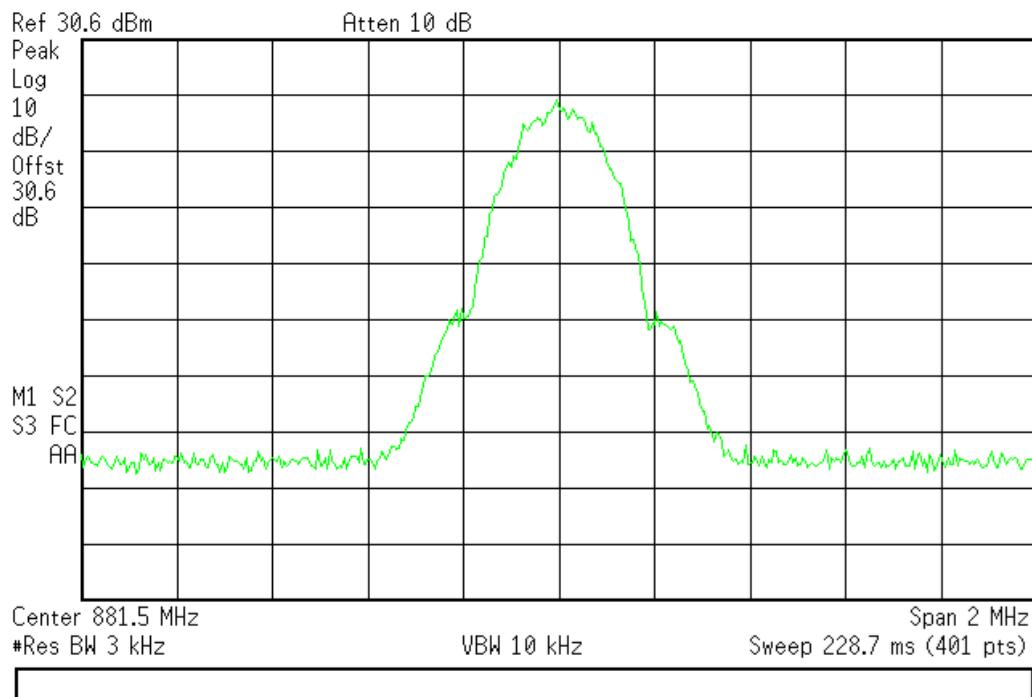
L



Output

* Agilent 15:29:51 Feb 19, 2015

L

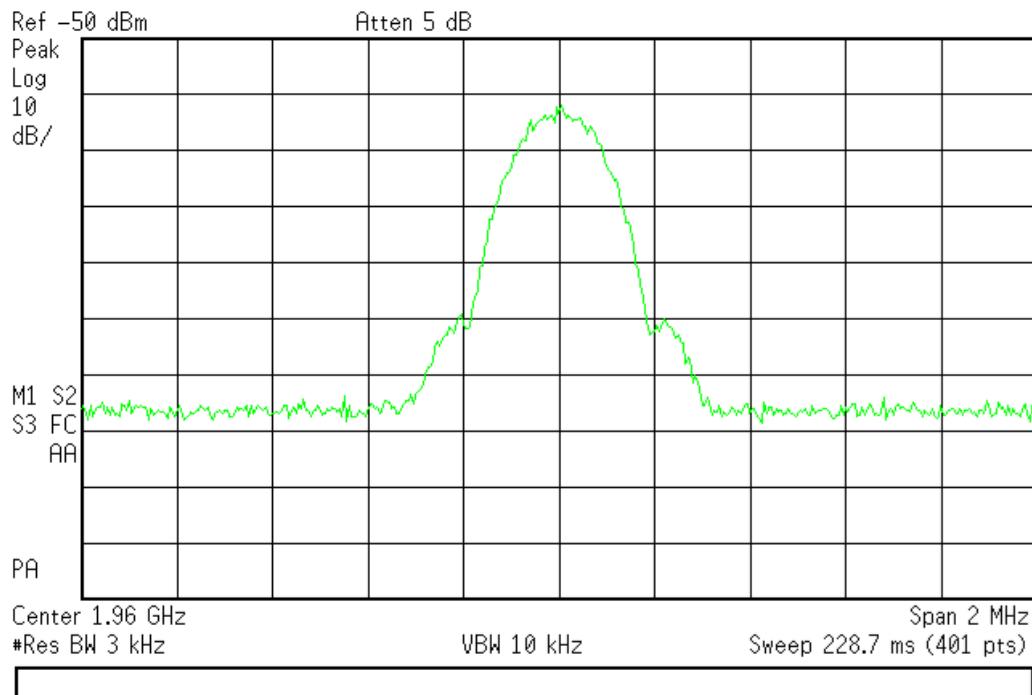


Downlink (GSM Signal mid band)

1930-1990 MHz Band
Input

* Agilent 14:39:19 Feb 19, 2015

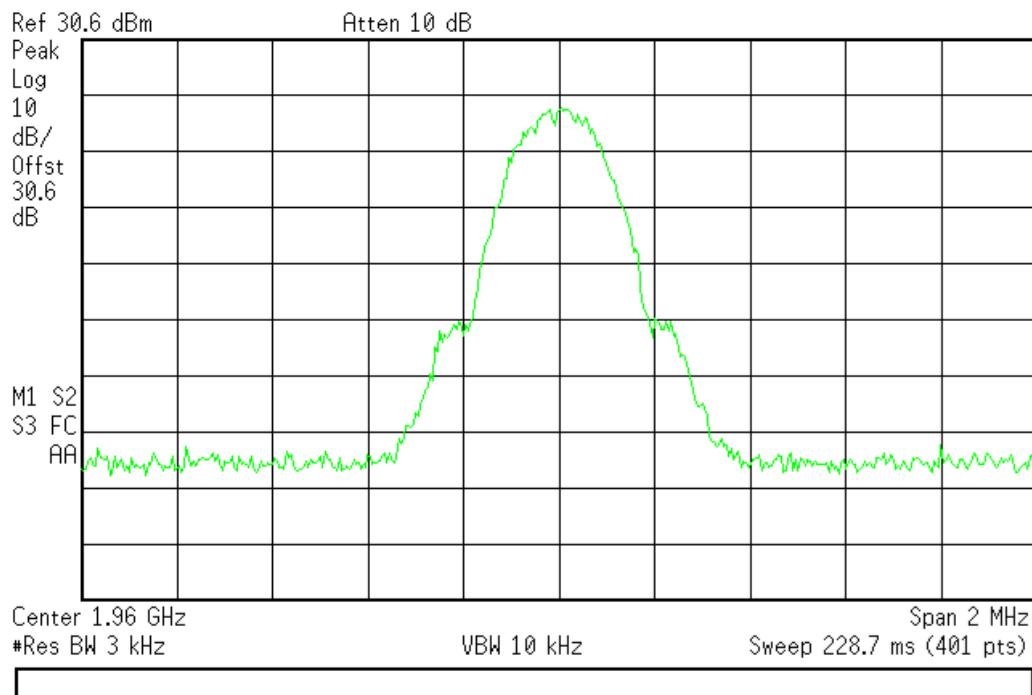
L



Output

* Agilent 15:32:43 Feb 19, 2015

L

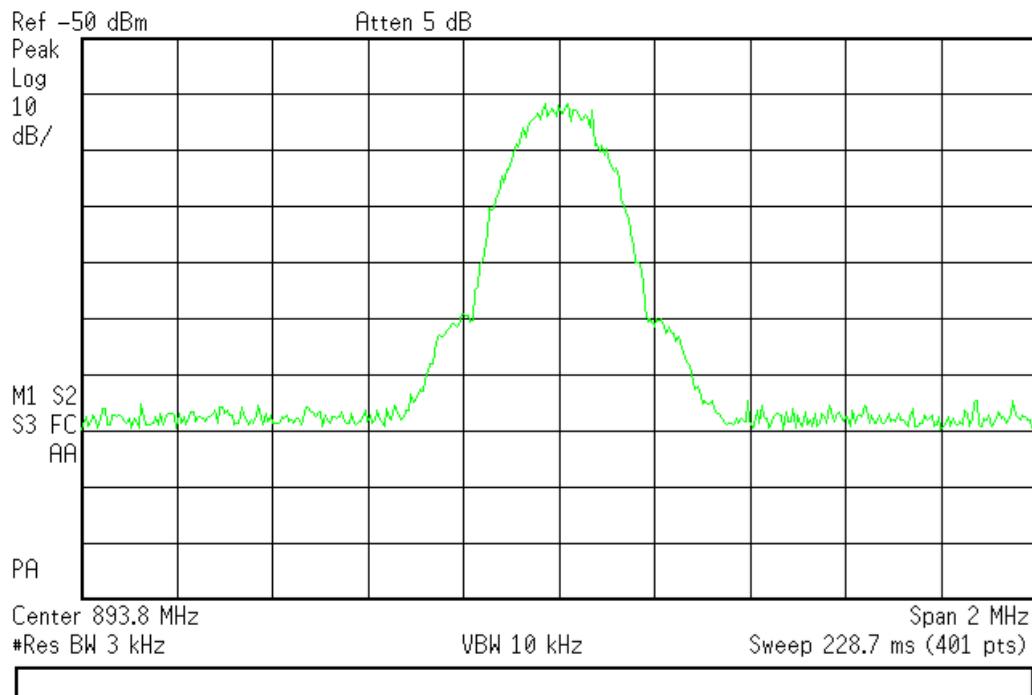


Downlink (GSM Signal high band)

869-894 MHz Band
Input

* Agilent 14:38:48 Feb 19, 2015

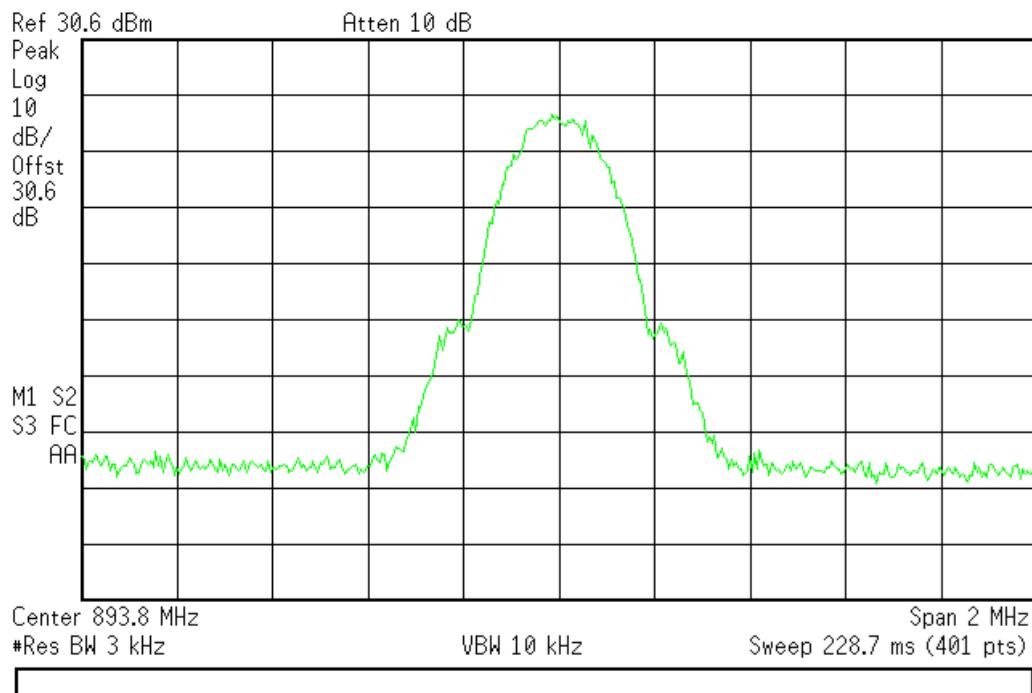
L



Output

* Agilent 15:32:10 Feb 19, 2015

L

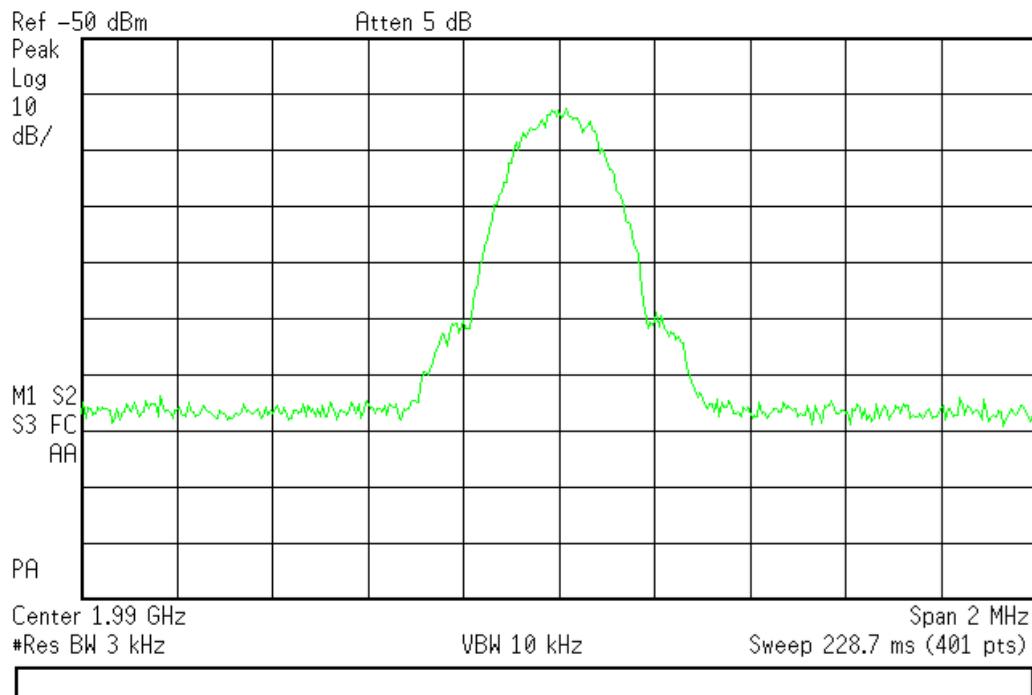


Downlink (GSM Signal high band)

1930-1990 MHz Band
Input

⌘ Agilent 14:40:36 Feb 19, 2015

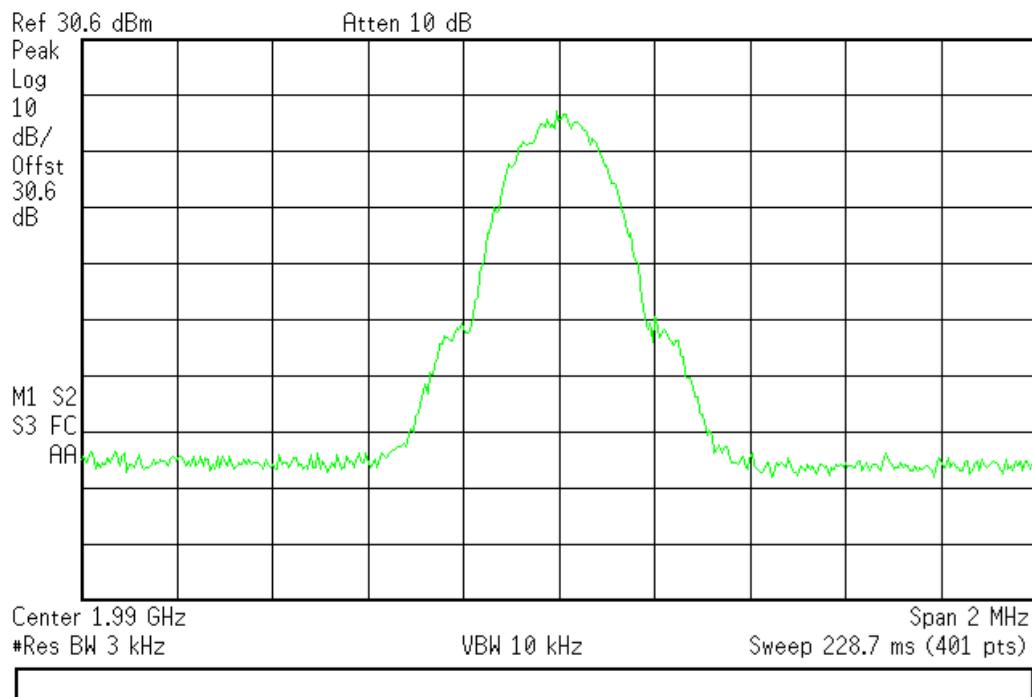
L



Output

⌘ Agilent 15:34:12 Feb 19, 2015

L

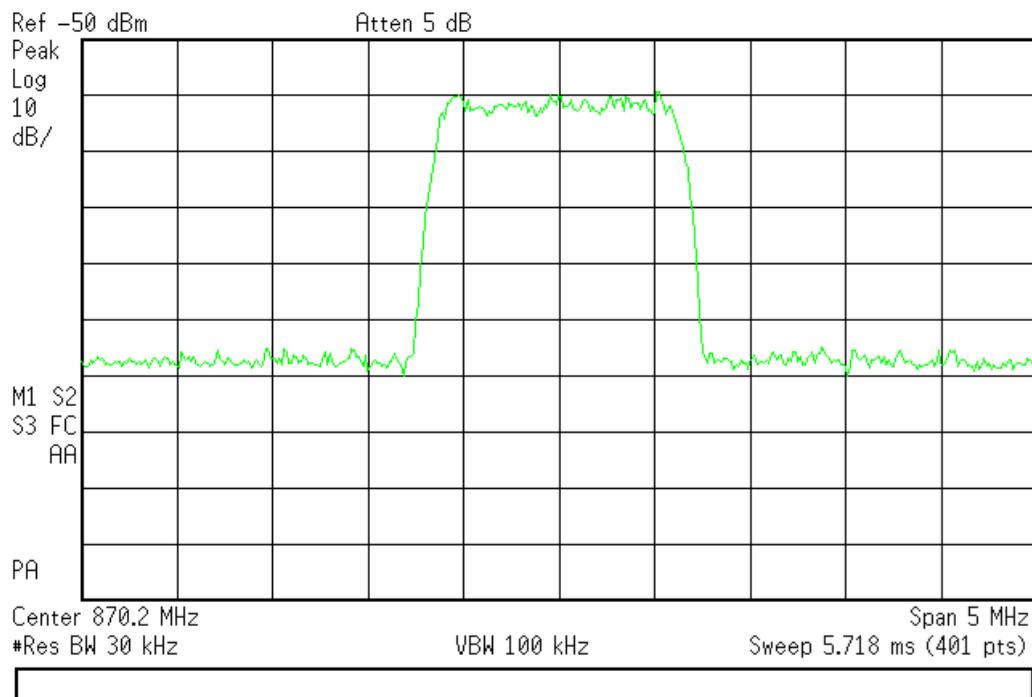


Downlink (CDMA Signal low band)

869-894 MHz Band
Input

* Agilent 14:47:28 Feb 19, 2015

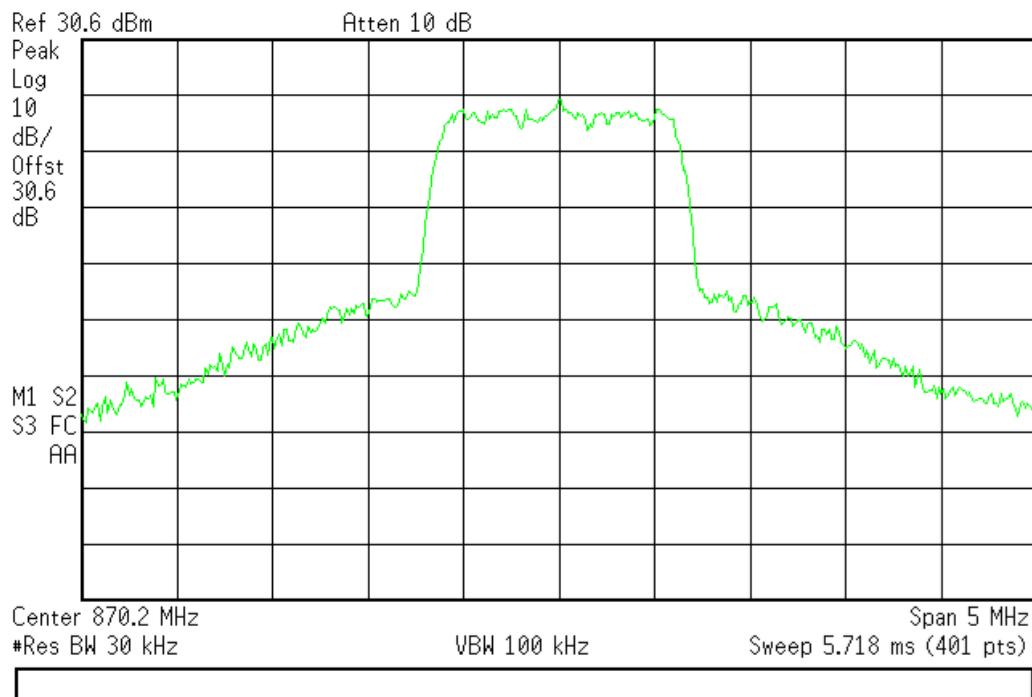
L



Output

* Agilent 15:37:35 Feb 19, 2015

L

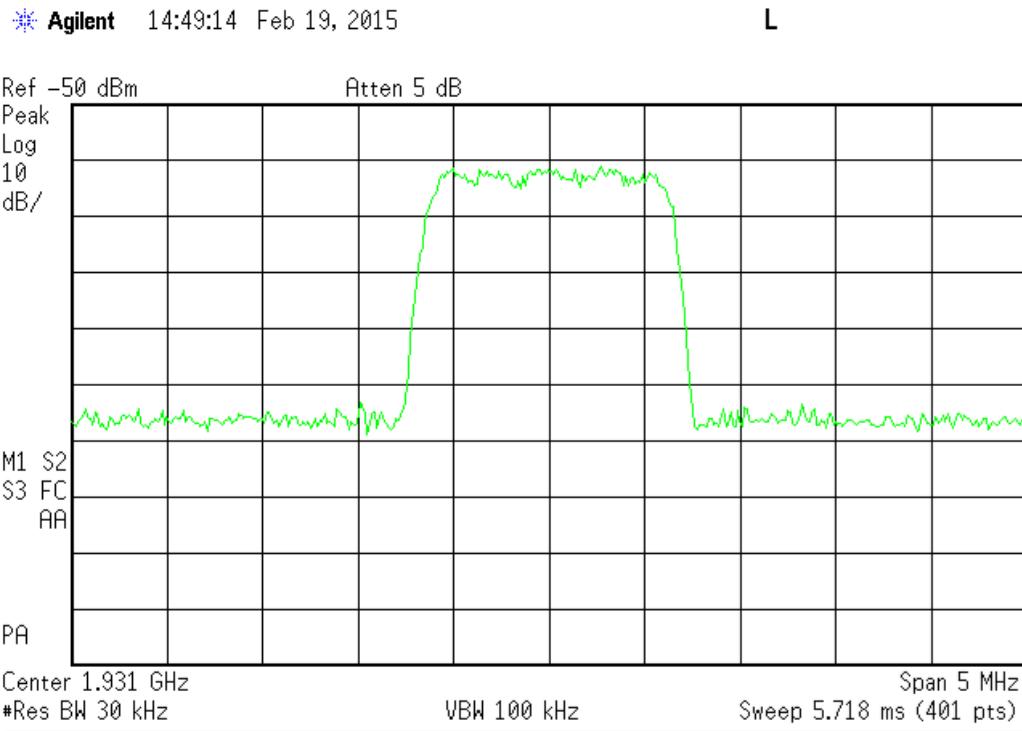




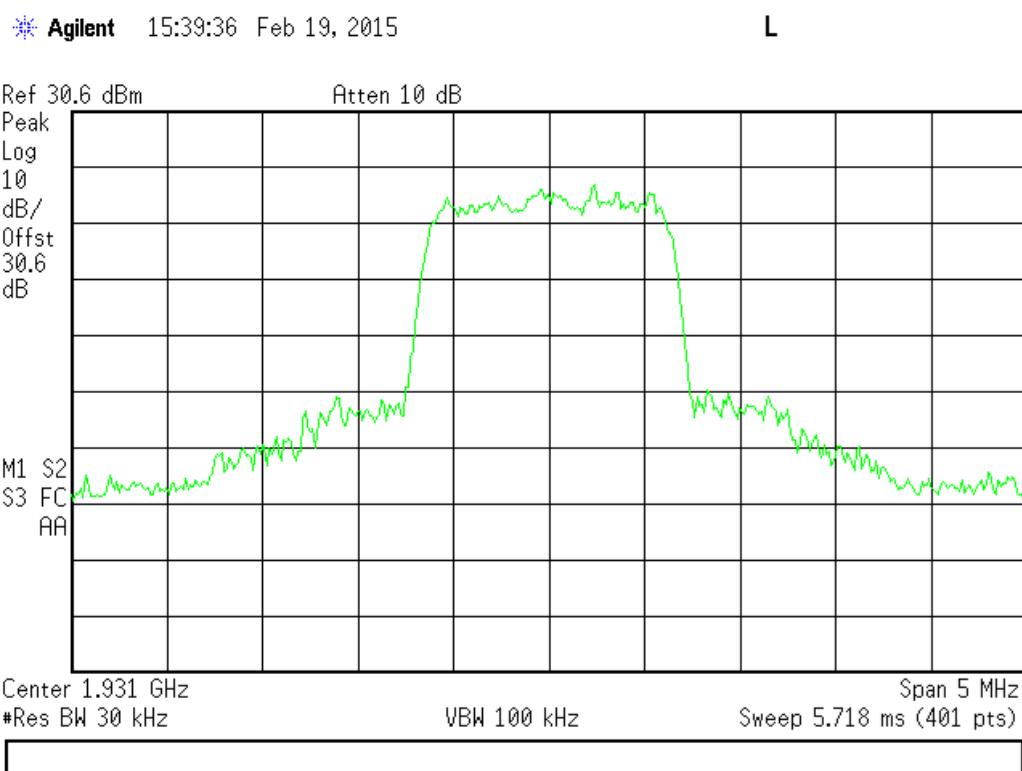
Downlink (CDMA Signal low band)

1930-1990 MHz Band

Input



Output

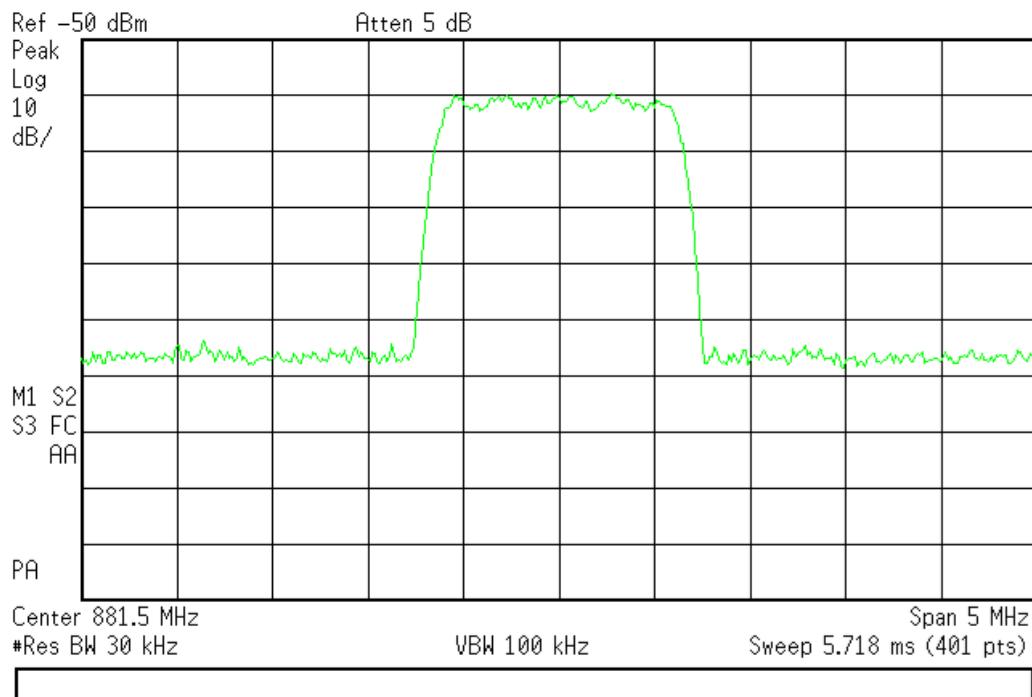


Downlink (CDMA Signal mid band)

869-894 MHz Band
Input

* Agilent 14:46:44 Feb 19, 2015

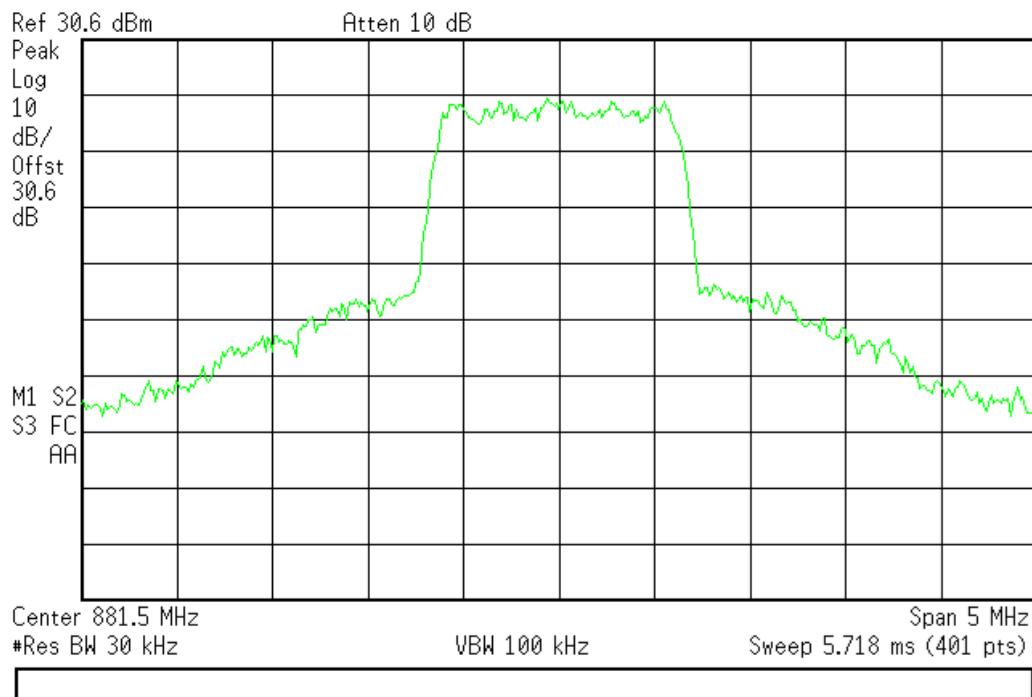
L



Output

* Agilent 15:36:37 Feb 19, 2015

L

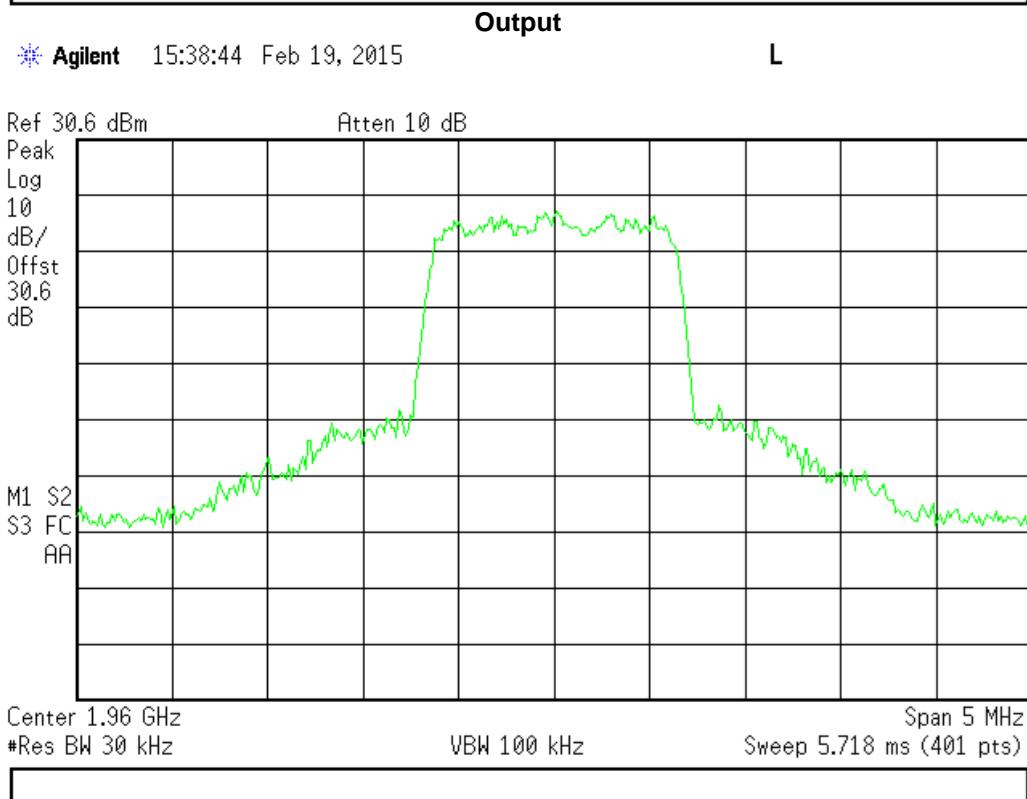
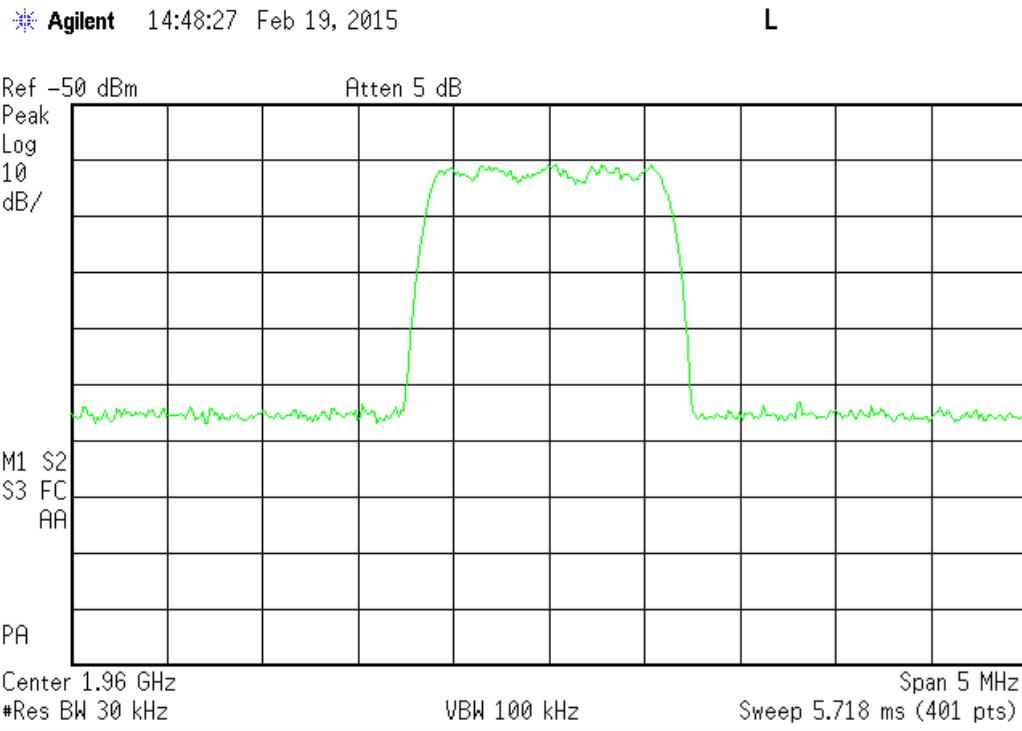




Downlink (CDMA Signal mid band)

1930-1990 MHz Band

Input



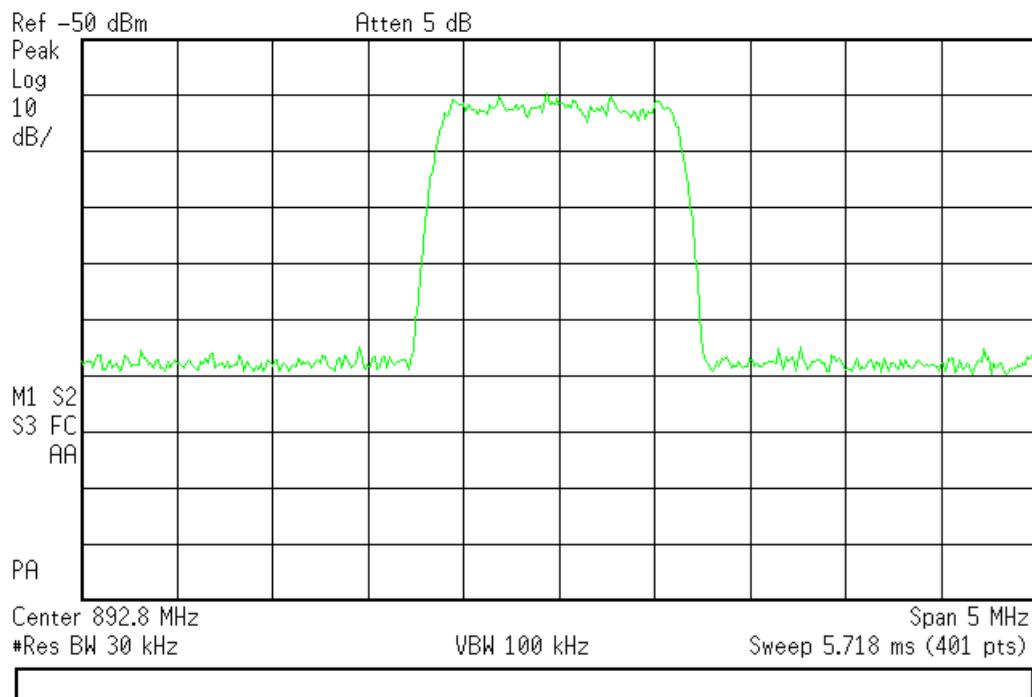


Downlink (CDMA Signal high band)

869-894 MHz Band
Input

* Agilent 14:48:00 Feb 19, 2015

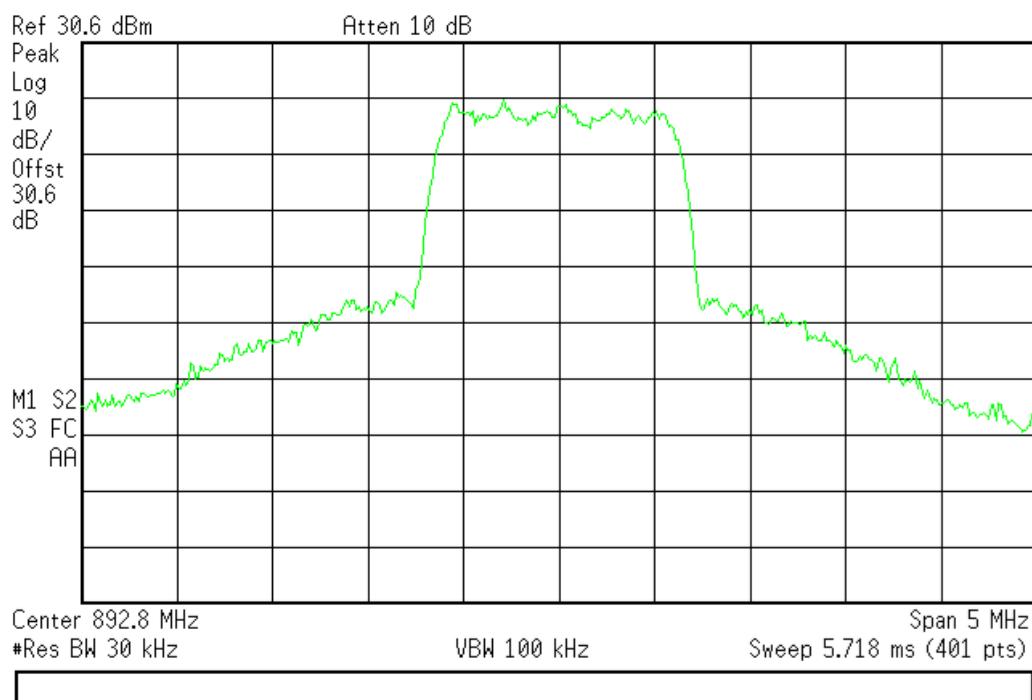
L



Output

* Agilent 15:38:13 Feb 19, 2015

L





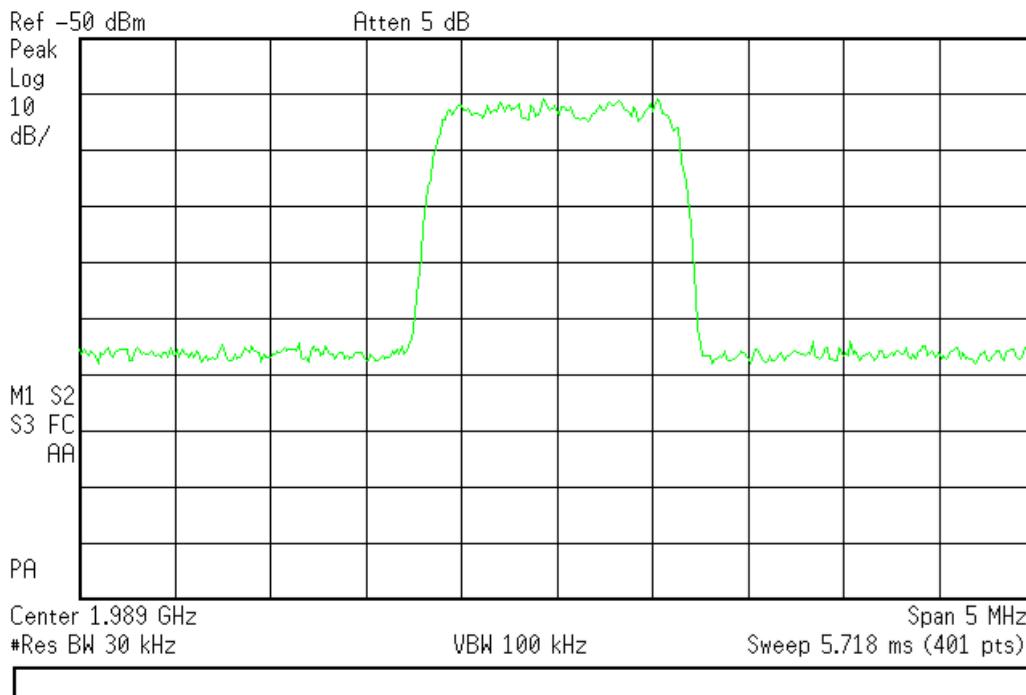
Downlink (CDMA Signal high band)

1930-1990 MHz Band

Input

* Agilent 14:49:47 Feb 19, 2015

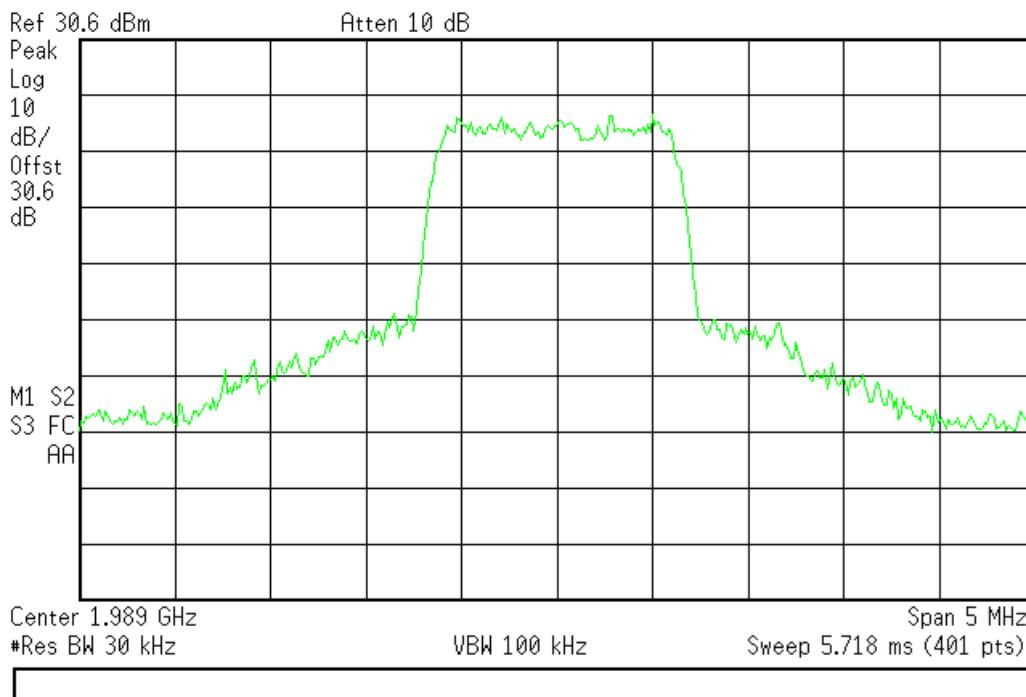
L



Output

* Agilent 15:40:16 Feb 19, 2015

L

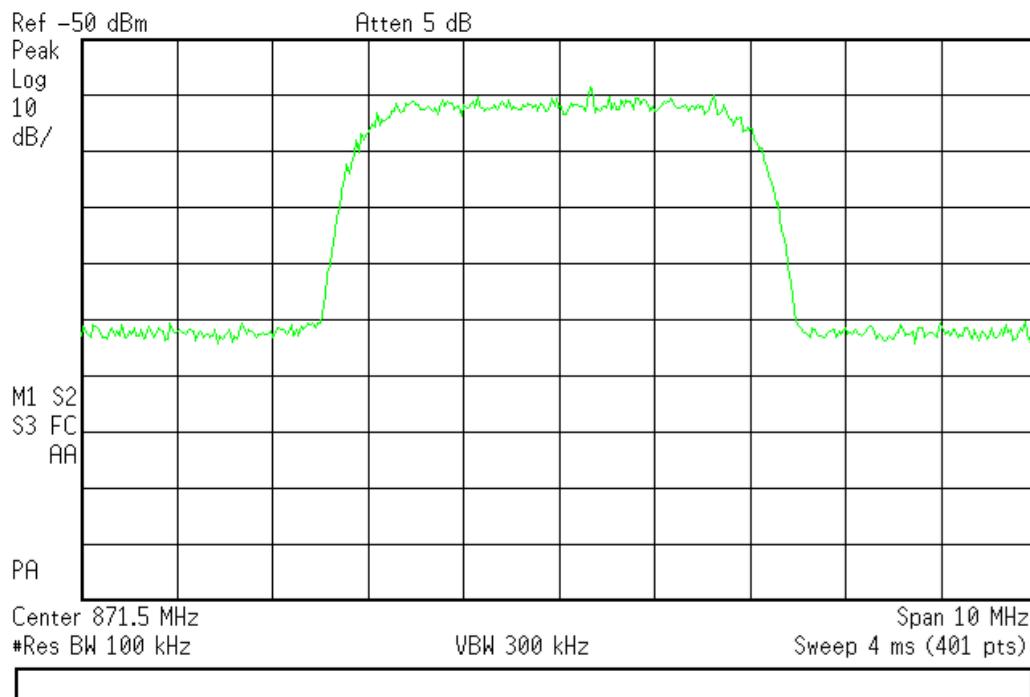


Downlink (WCDMA Signal low band)

869-894 MHz Band
Input

* Agilent 14:55:53 Feb 19, 2015

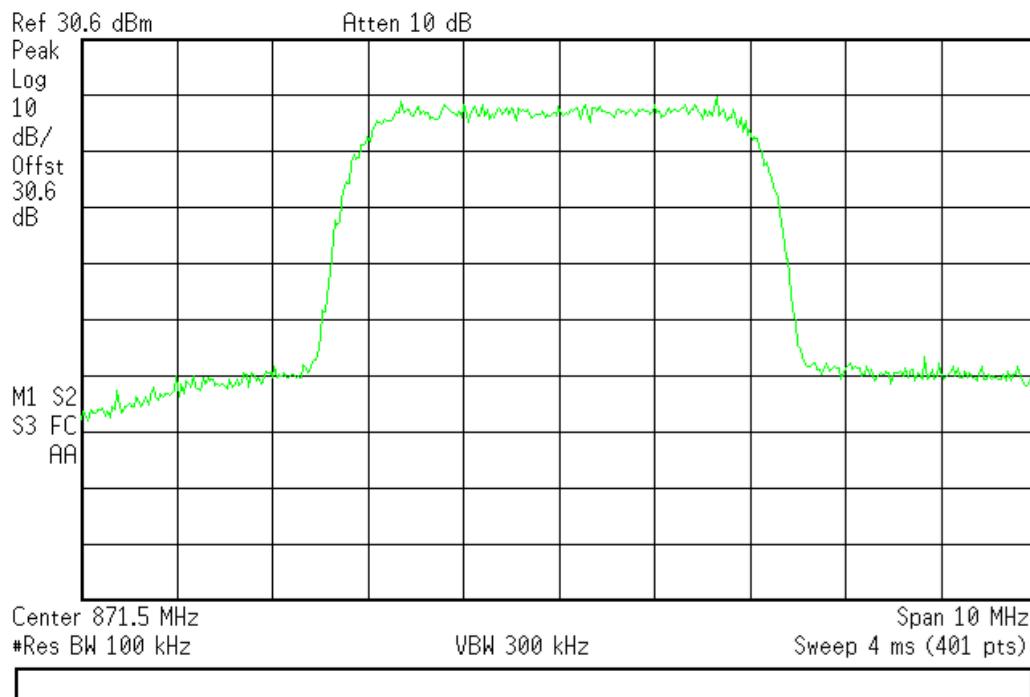
L



Output

* Agilent 15:42:40 Feb 19, 2015

L

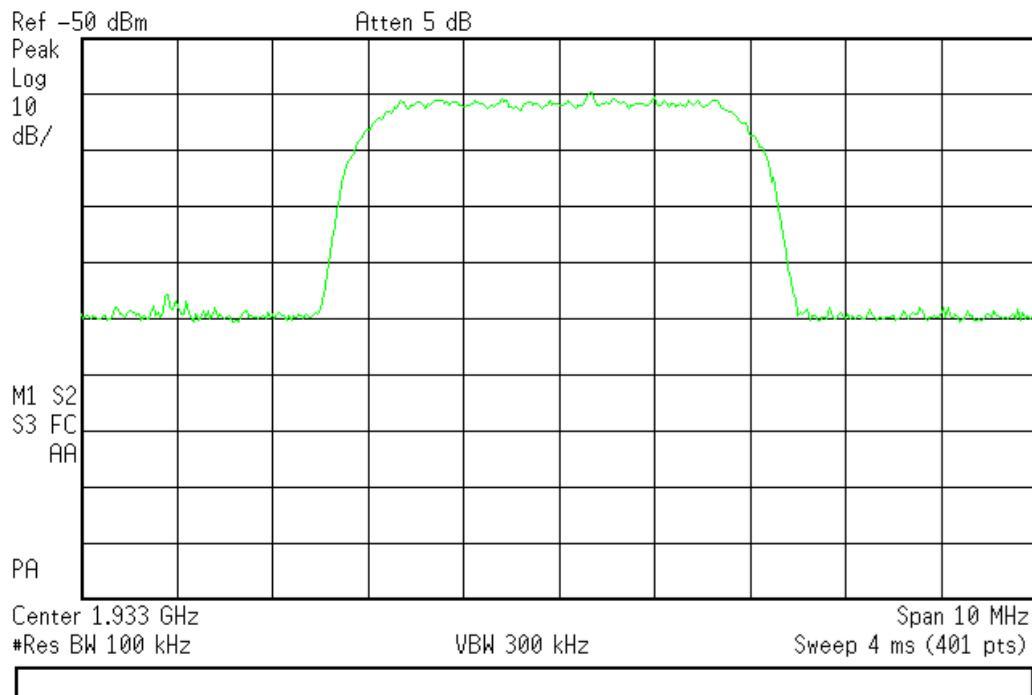


Downlink (WCDMA Signal low band)

1930-1990 MHz Band
Input

⌘ Agilent 14:58:18 Feb 19, 2015

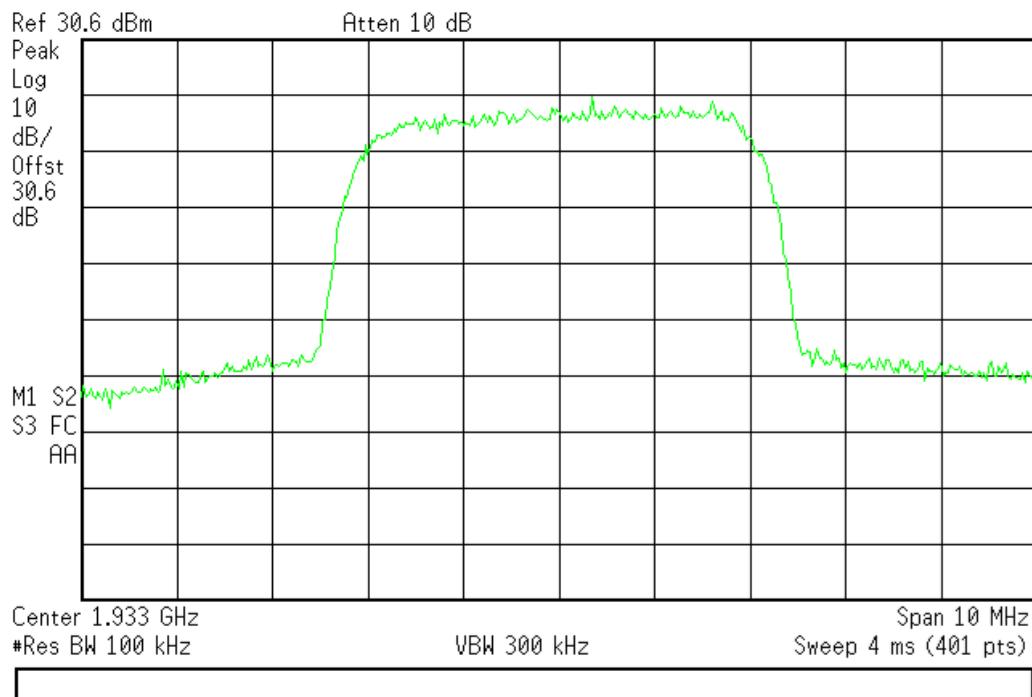
L



Output

⌘ Agilent 15:44:09 Feb 19, 2015

L



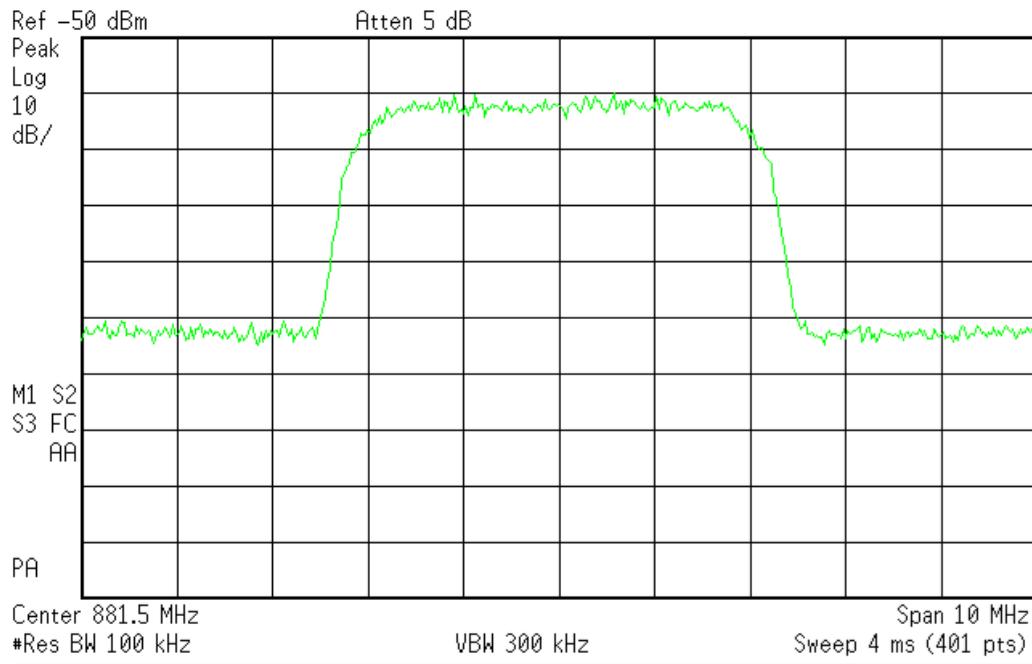


Downlink (WCDMA Signal mid band)

869-894 MHz Band
Input

* Agilent 14:55:16 Feb 19, 2015

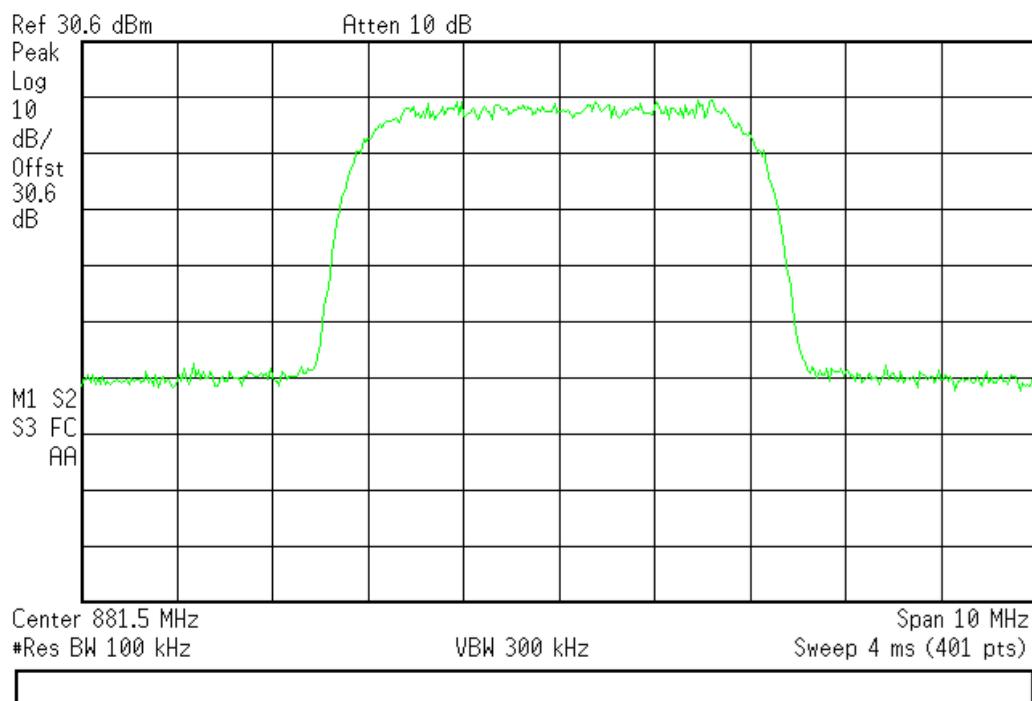
L



Output

* Agilent 15:41:39 Feb 19, 2015

L

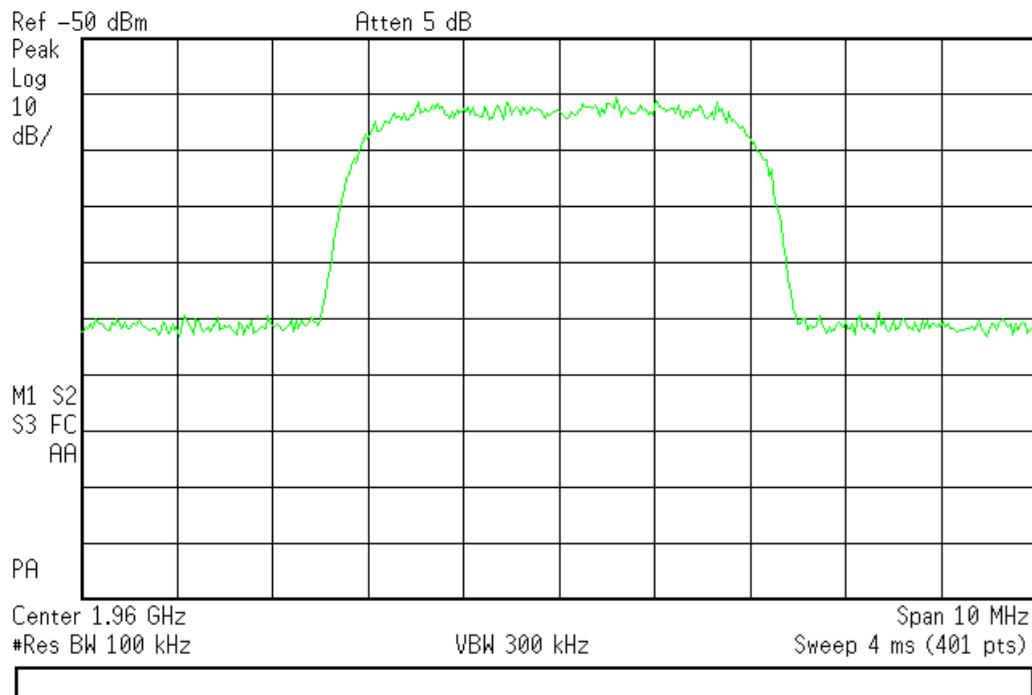


Downlink (WCDMA Signal mid band)

1930-1990 MHz Band
Input

⌘ Agilent 14:56:50 Feb 19, 2015

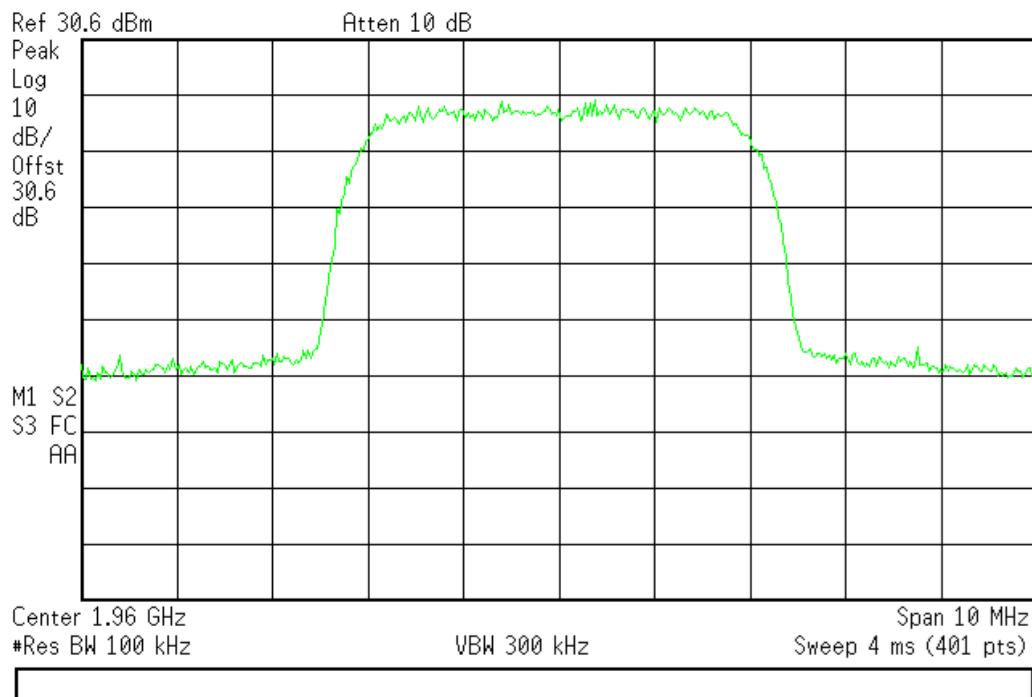
L



Output

⌘ Agilent 15:43:31 Feb 19, 2015

L



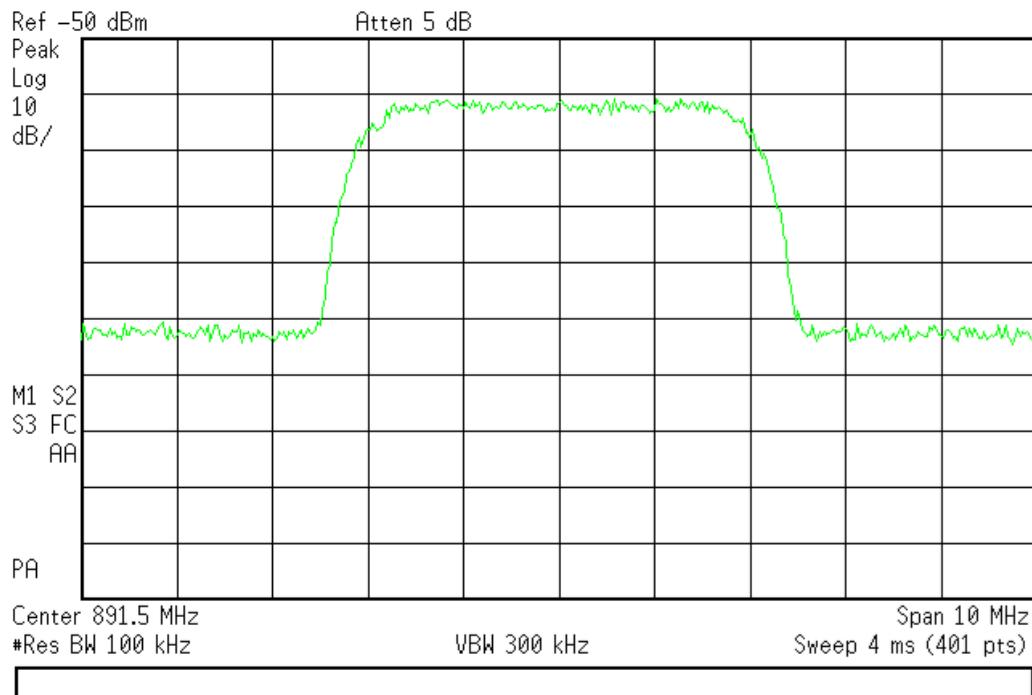


Downlink (WCDMA Signal high band)

869-894 MHz Band
Input

* Agilent 14:56:25 Feb 19, 2015

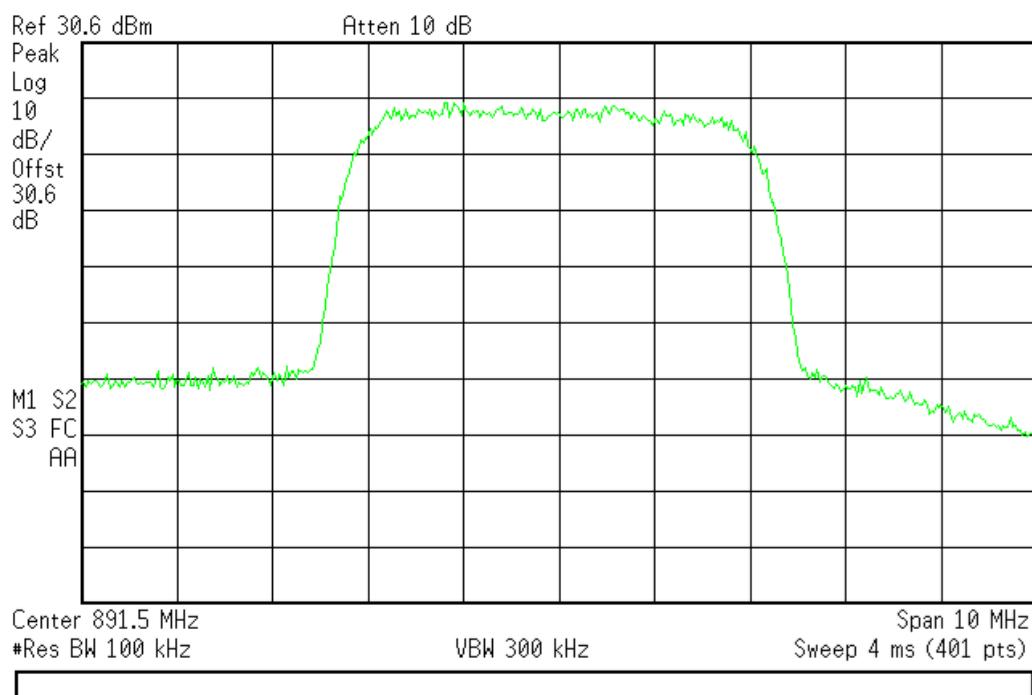
L



Output

* Agilent 15:43:10 Feb 19, 2015

L

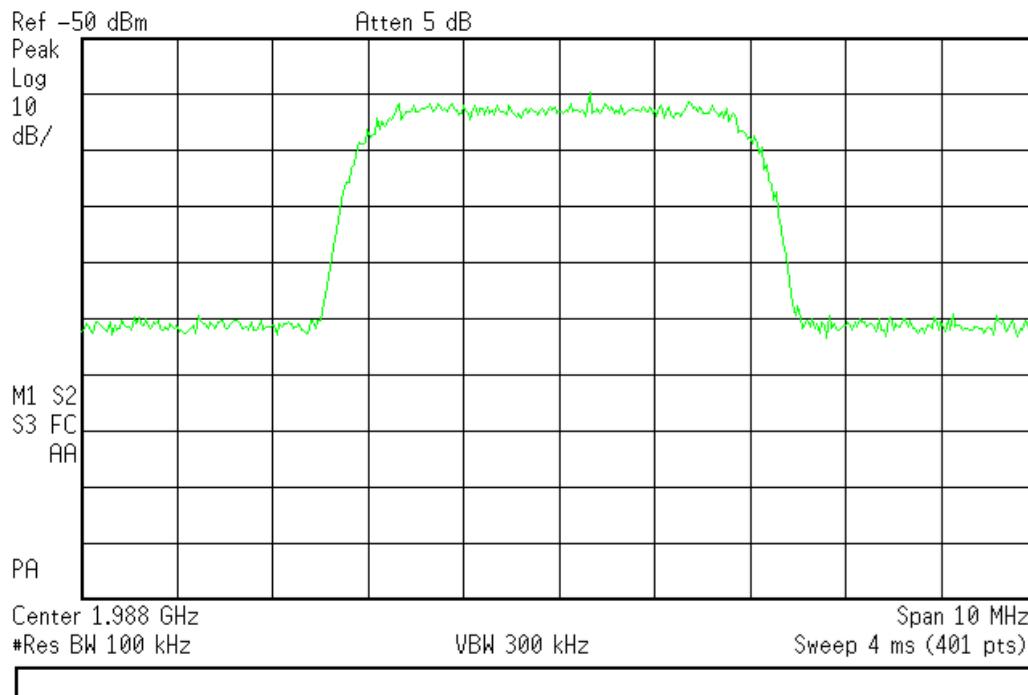


Downlink (WCDMA Signal high band)

1930-1990 MHz Band
Input

⌘ Agilent 14:59:01 Feb 19, 2015

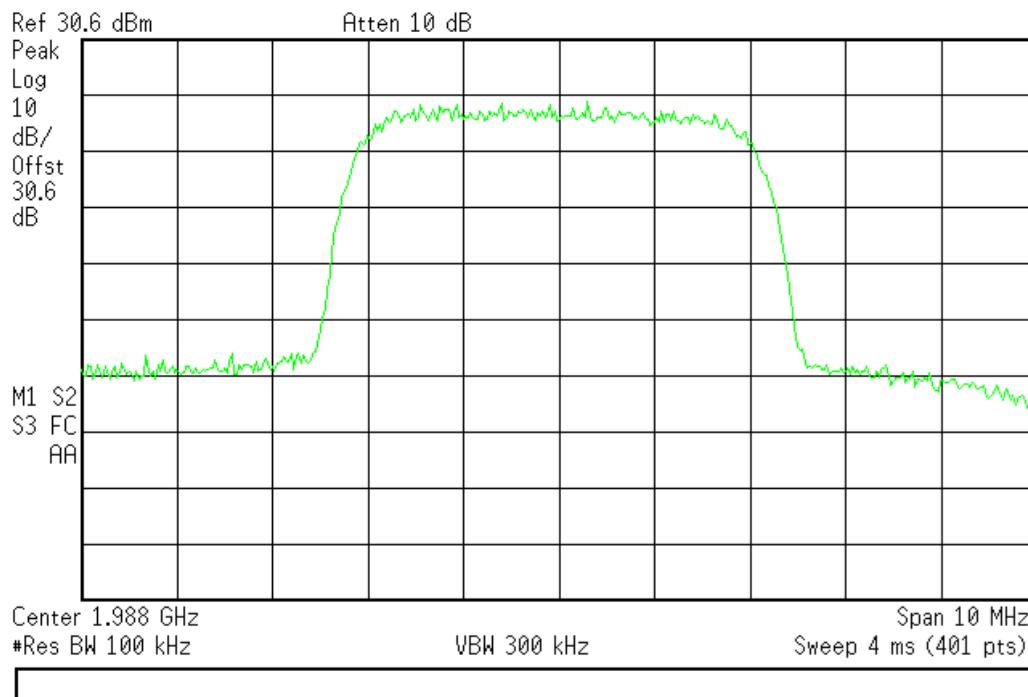
L



Output

⌘ Agilent 15:44:49 Feb 19, 2015

L





Intermodulation

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

Engineer: Mike Graffeo
Test Date: 2/17/15

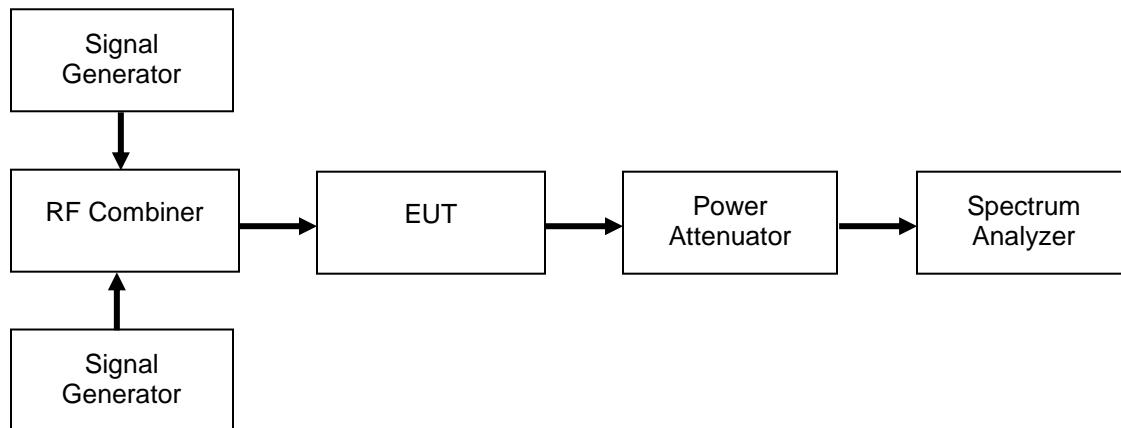
Test Procedure

The EUT was connected to a spectrum analyzer through a power attenuator. Two signal generators were utilized to produce a two tone signal set so the intermodulation products fell within the operational band. Frequency at the maximum power from out of band rejection was utilized.

The RF input signal level was set to 0.2 dB below the AGC Threshold.

All losses for the combiner, attenuator and cables were accounted for.

Test Setup



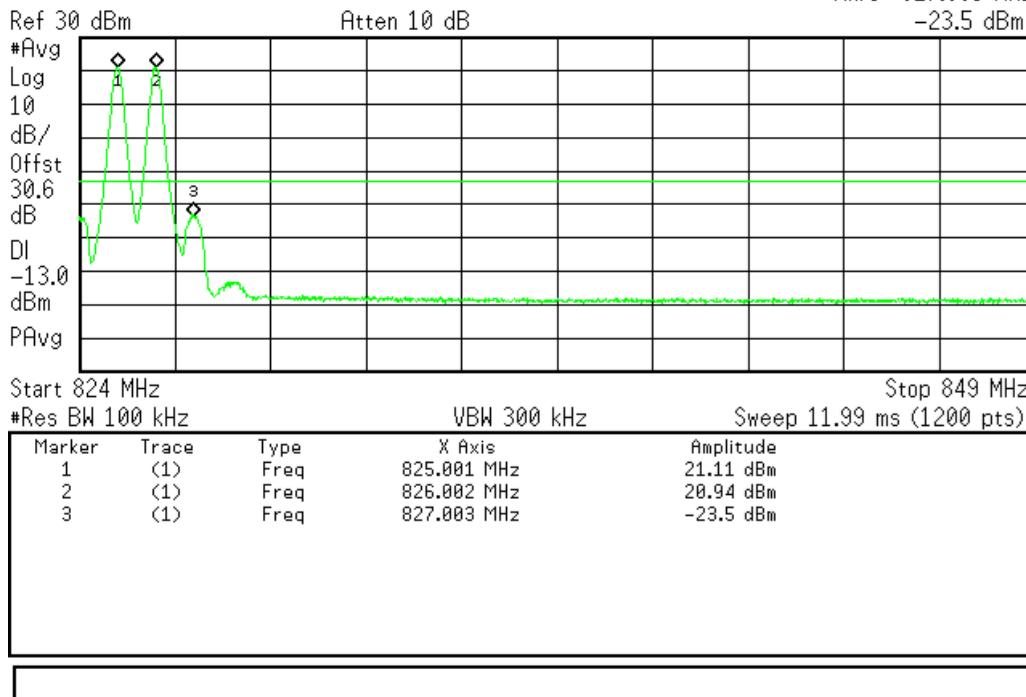


Intermodulation Uplink Test Results (Two GSM Signals)
824-849 MHz Band (Low Band)

* Agilent 06:42:56 Feb 17, 2015

L

Mkr3 827.003 MHz
-23.5 dBm

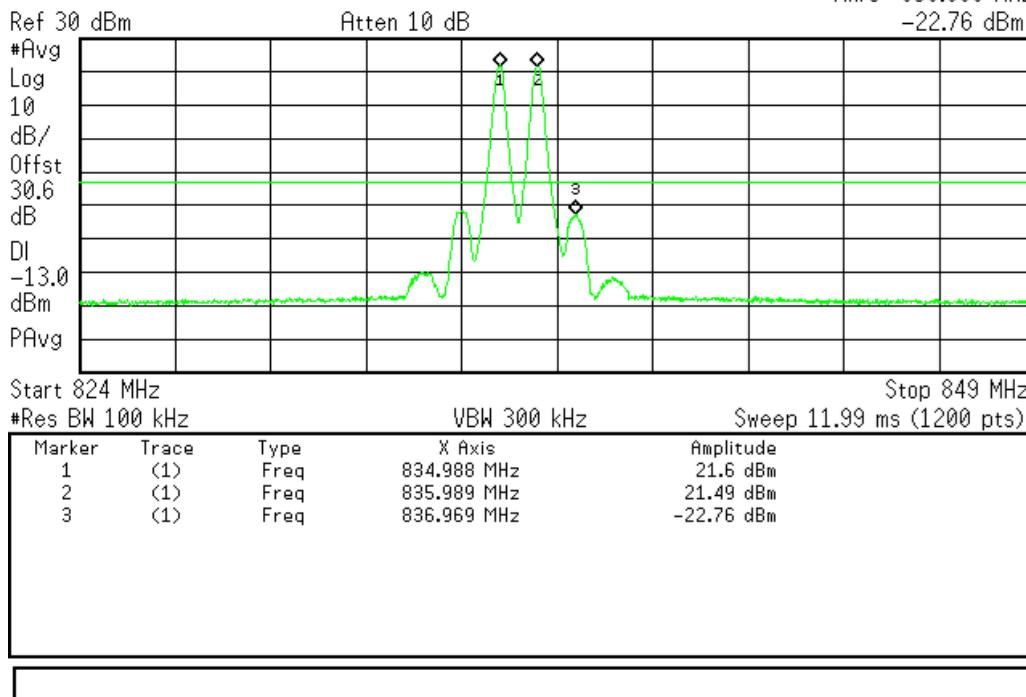


Intermodulation Uplink Test Results (Two GSM Signals)
824-849 MHz Band (Mid Band)

* Agilent 06:41:25 Feb 17, 2015

R L

Mkr3 836.969 MHz
-22.76 dBm



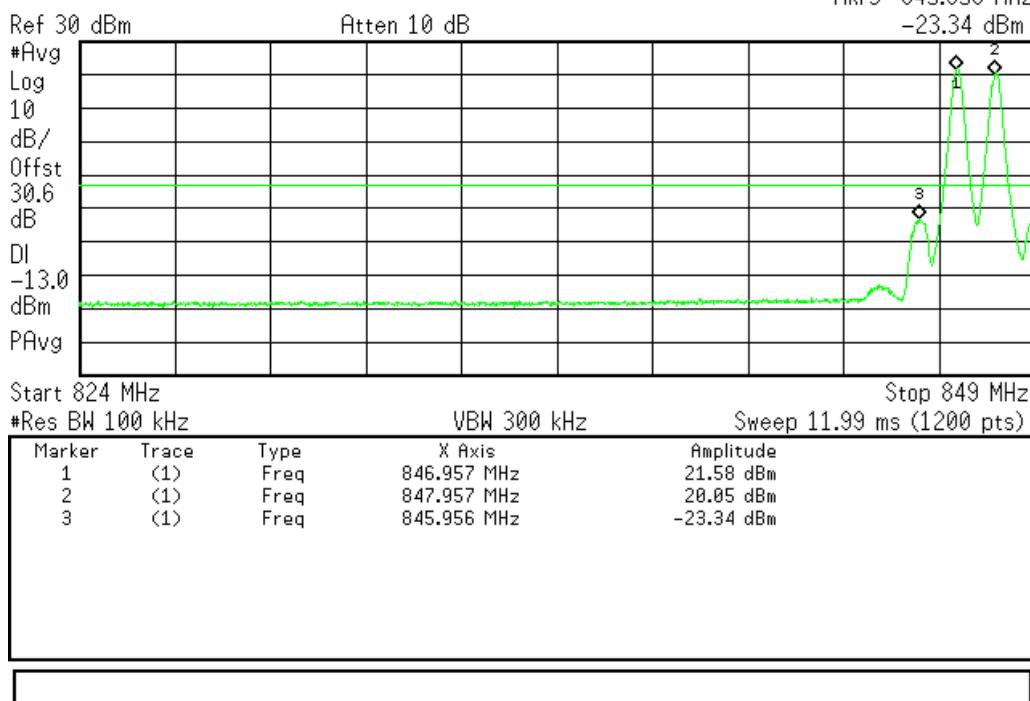


Intermodulation Uplink Test Results (Two GSM Signals)
824-849 MHz Band (High Band)

* Agilent 06:43:53 Feb 17, 2015

L

Mkr3 845.956 MHz
-23.34 dBm

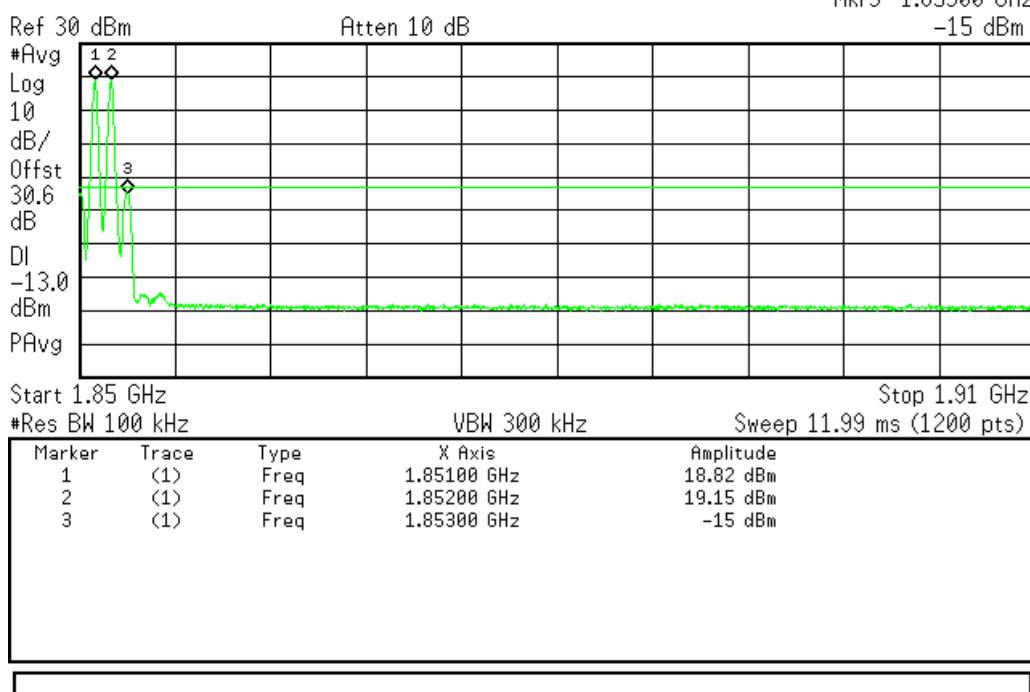


Intermodulation Uplink Test Results (Two GSM Signals)
1850-1910 MHz Band (Low Band)

* Agilent 06:47:05 Feb 17, 2015

L

Mkr3 1.85300 GHz
-15 dBm



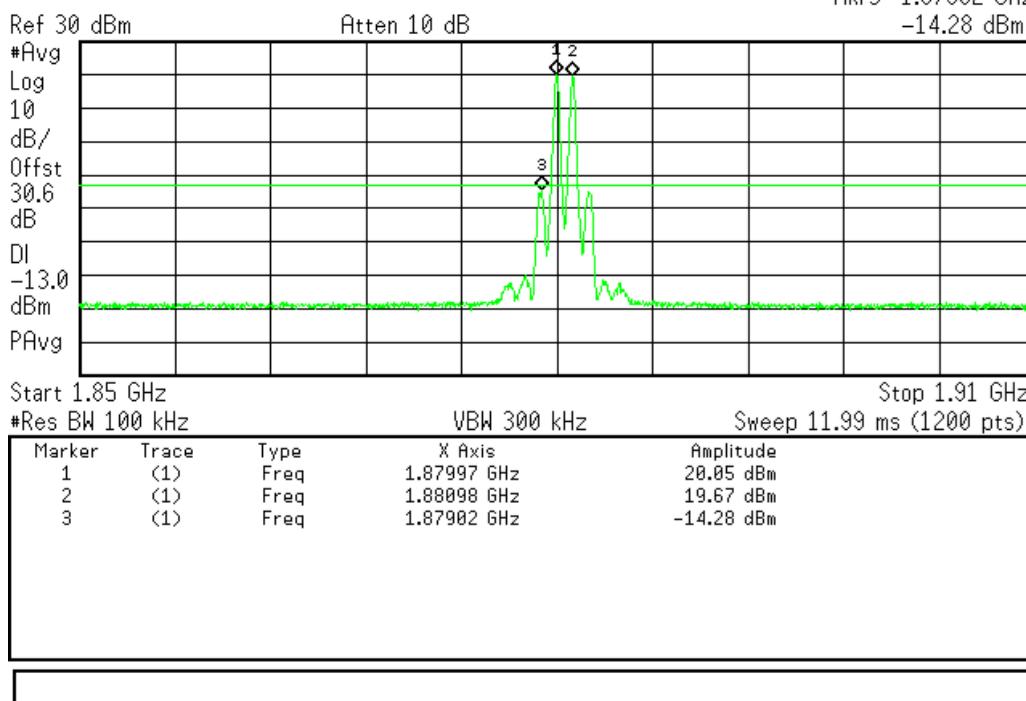


Intermodulation Uplink Test Results (Two GSM Signals)
1850-1910 MHz Band (Mid Band)

* Agilent 06:46:13 Feb 17, 2015

L

Mkr3 1.87902 GHz
-14.28 dBm

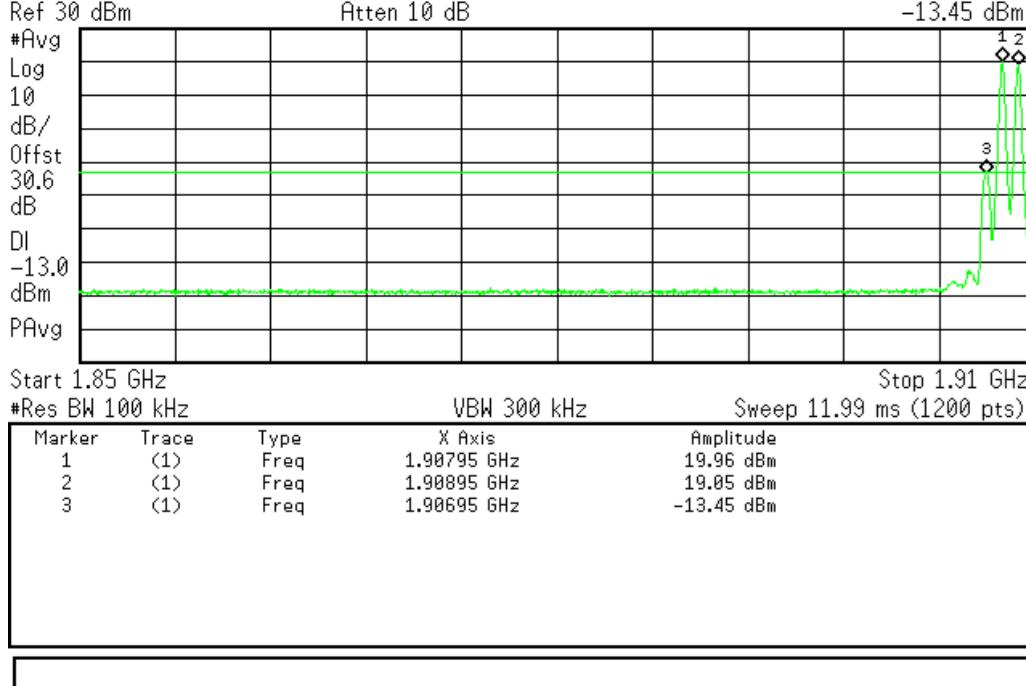


Intermodulation Uplink Test Results (Two GSM Signals)
1850-1910 MHz Band (High Band)

* Agilent 06:47:51 Feb 17, 2015

L

Mkr3 1.90695 GHz
-13.45 dBm



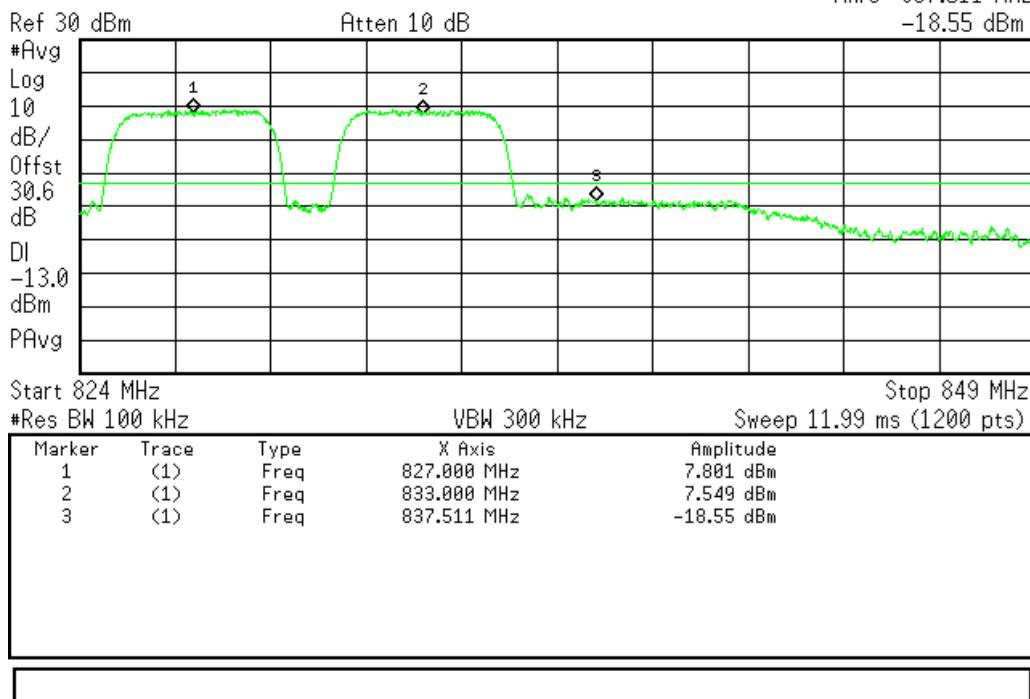


Intermodulation Uplink Test Results (Two WCDMA Signals)
824-849 MHz Band (Low Band)

* Agilent 07:03:35 Feb 17, 2015

L

Mkr3 837.511 MHz
-18.55 dBm

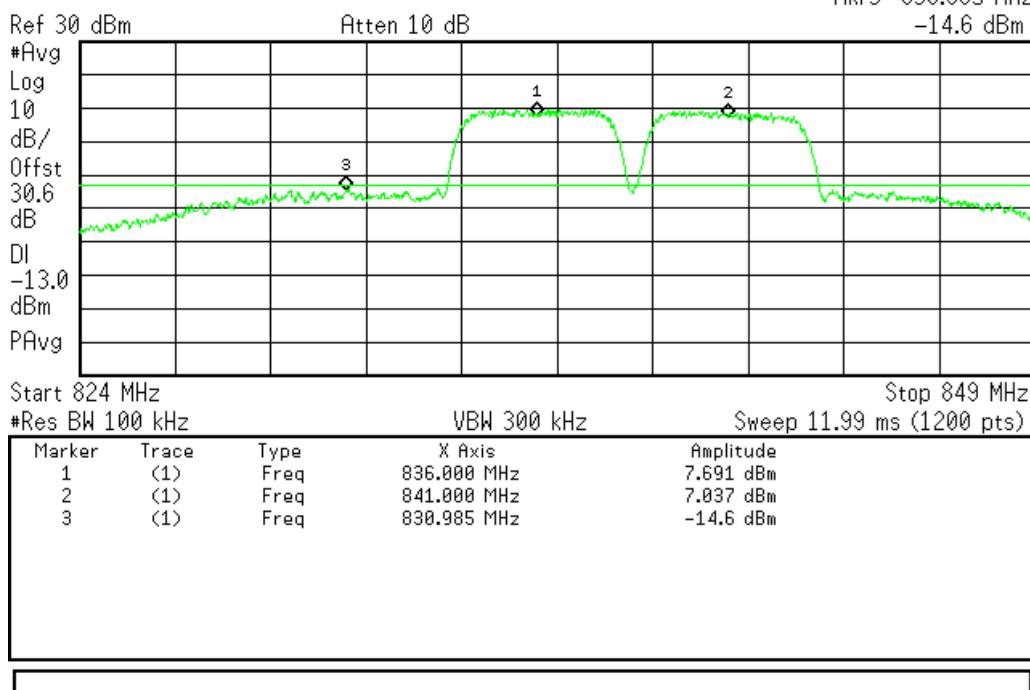


Intermodulation Uplink Test Results (Two WCDMA Signals)
824-849 MHz Band (Mid Band)

* Agilent 07:05:01 Feb 17, 2015

L

Mkr3 830.985 MHz
-14.6 dBm



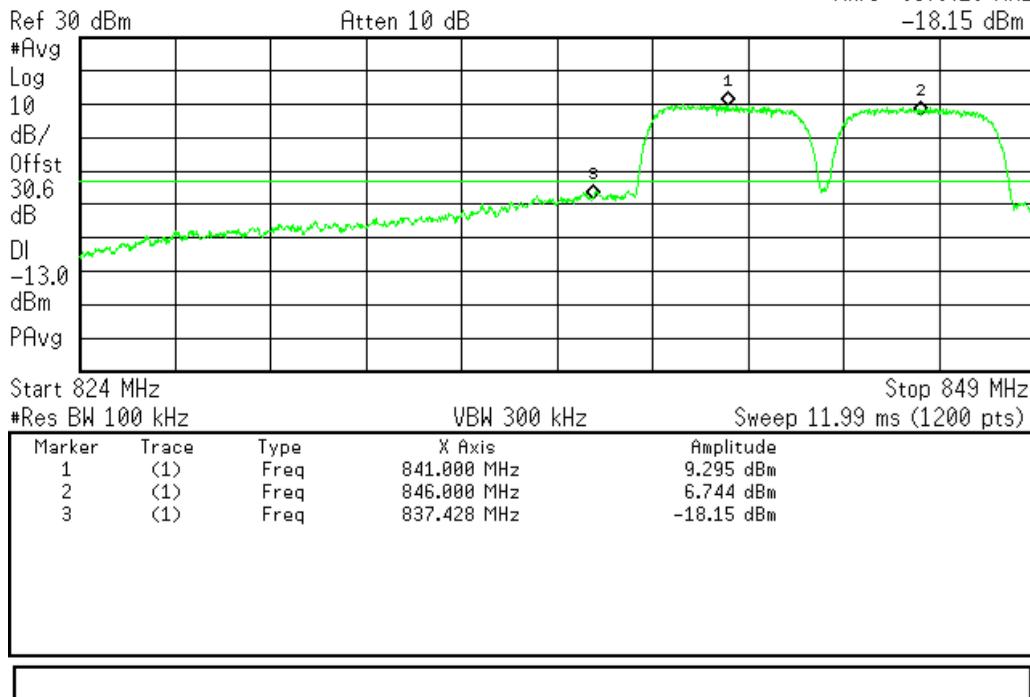


**Intermodulation Uplink Test Results (Two WCDMA Signals)
824-849 MHz Band (High Band)**

* Agilent 07:06:11 Feb 17, 2015

L

Mkr3 837.428 MHz
-18.15 dBm

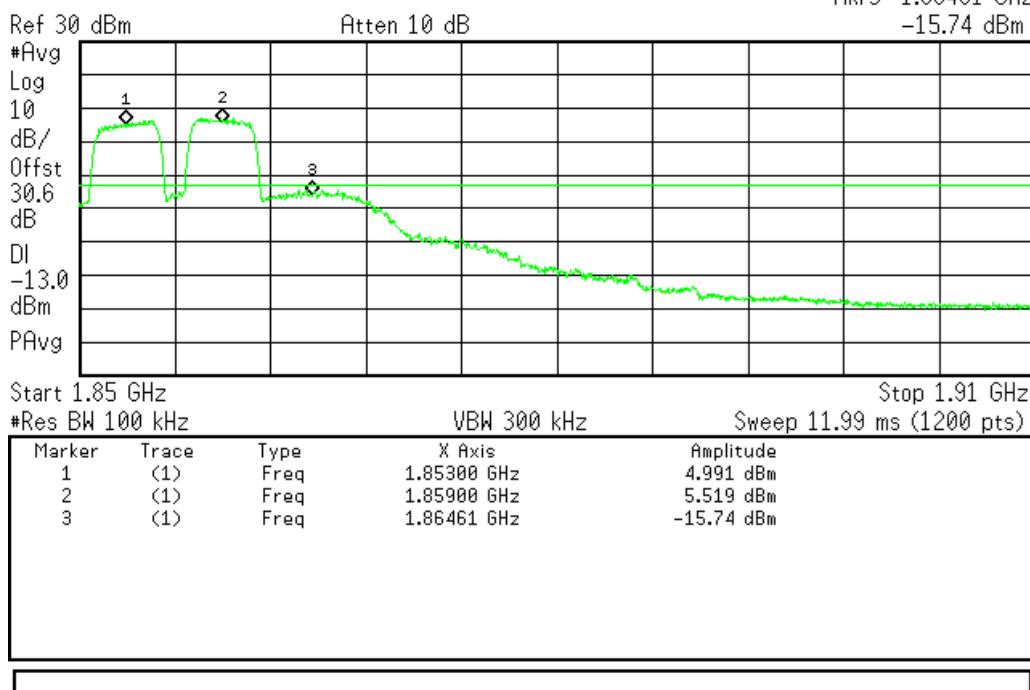


**Intermodulation Uplink Test Results (Two WCDMA Signals)
1850-1910 MHz Band (Low Band)**

* Agilent 06:55:46 Feb 17, 2015

L

Mkr3 1.86461 GHz
-15.74 dBm



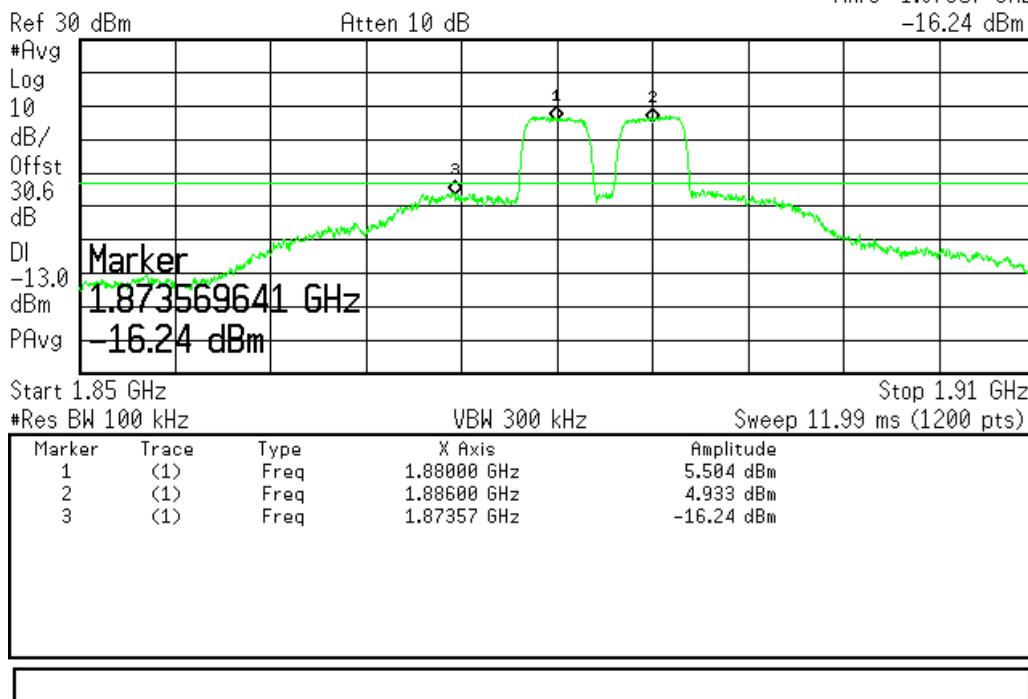


Intermodulation Uplink Test Results (Two WCDMA Signals)
1850-1910 MHz Band (Mid Band)

* Agilent 06:54:38 Feb 17, 2015

L

Mkr3 1.87357 GHz
-16.24 dBm

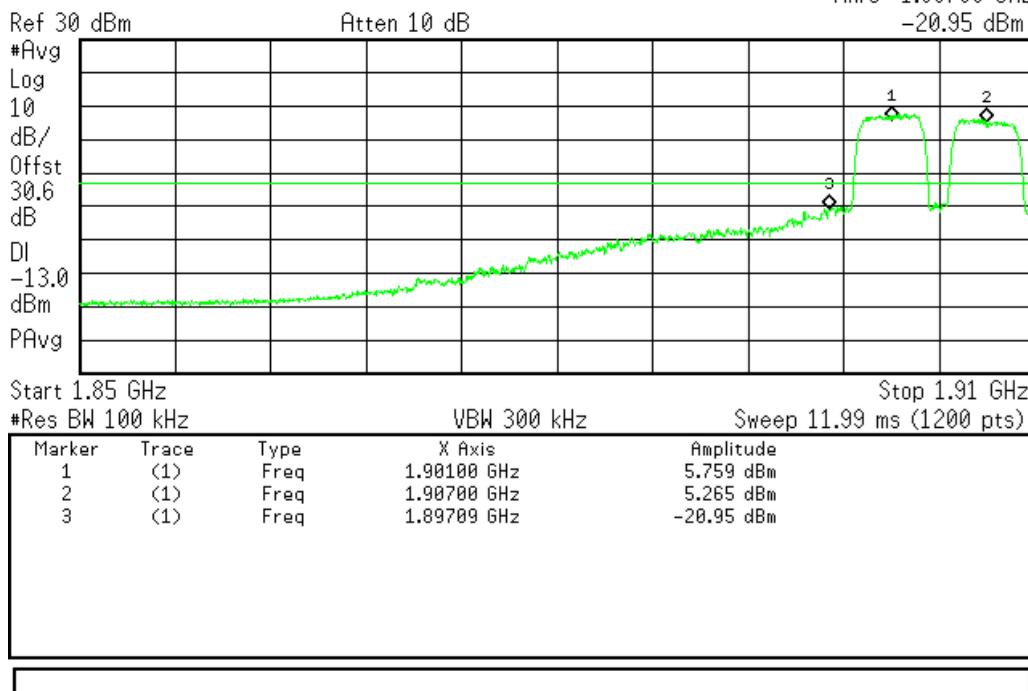


Intermodulation Uplink Test Results (Two WCDMA Signals)
1850-1910 MHz Band (High Band)

* Agilent 06:52:01 Feb 17, 2015

L

Mkr3 1.89709 GHz
-20.95 dBm



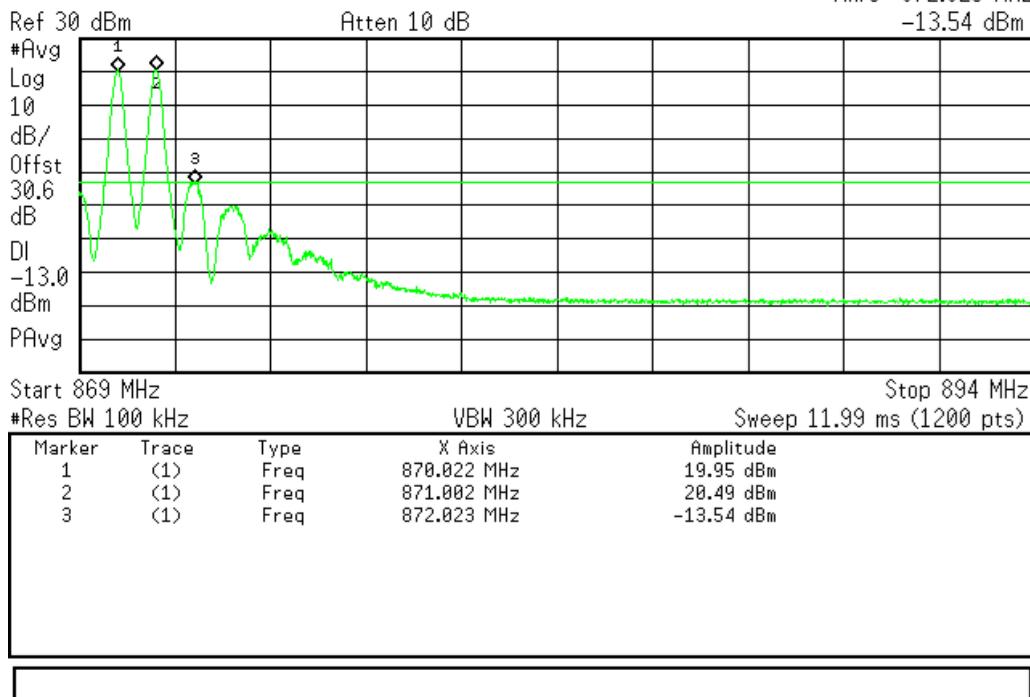


**Intermodulation Downlink Test Results (Two GSM Signals)
869-894 MHz Band (Low Band)**

* Agilent 07:24:18 Feb 17, 2015

L

Mkr3 872.023 MHz
-13.54 dBm

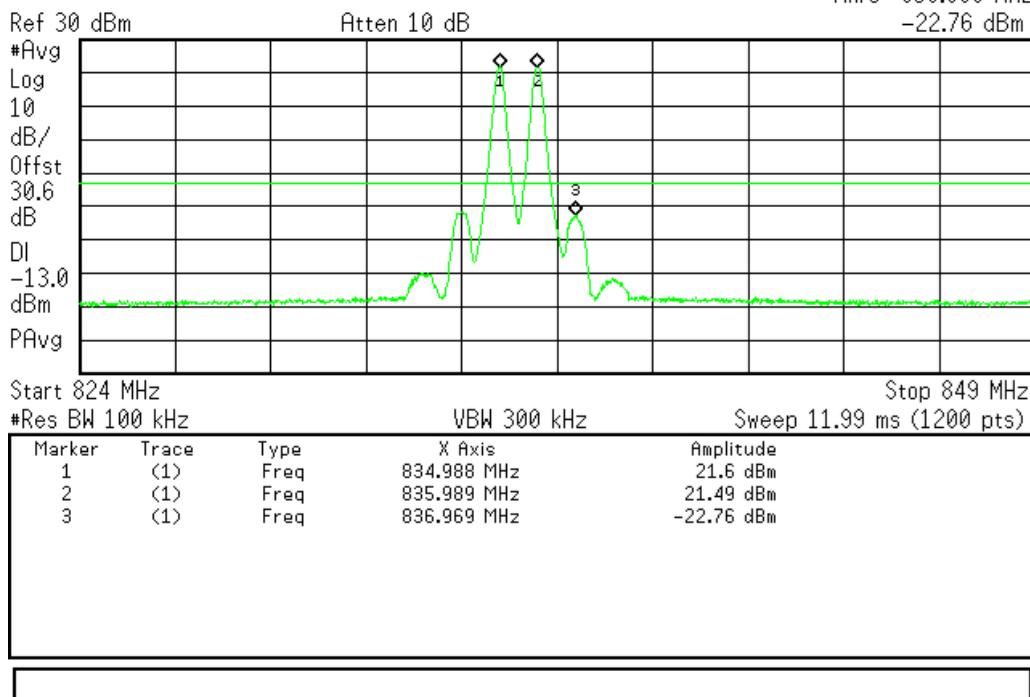


**Intermodulation Downlink Test Results (Two GSM Signals)
869-894 MHz Band (Mid Band)**

* Agilent 06:41:25 Feb 17, 2015

R L

Mkr3 836.969 MHz
-22.76 dBm



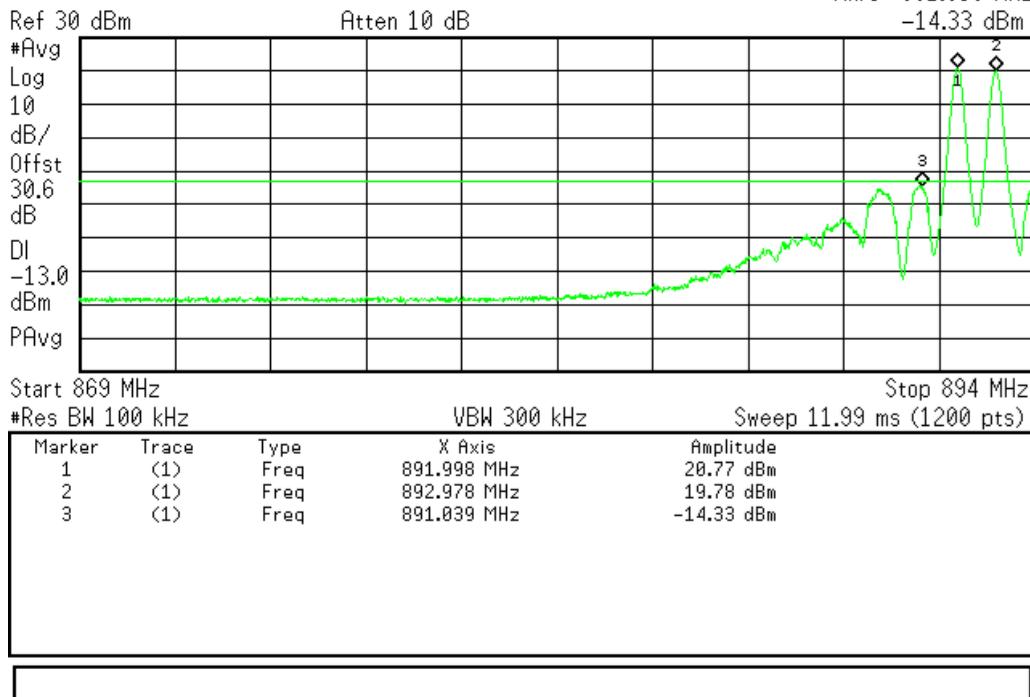


**Intermodulation Downlink Test Results (Two GSM Signals)
869-894 MHz Band (High Band)**

* Agilent 07:21:53 Feb 17, 2015

L

Mkr3 891.039 MHz
-14.33 dBm

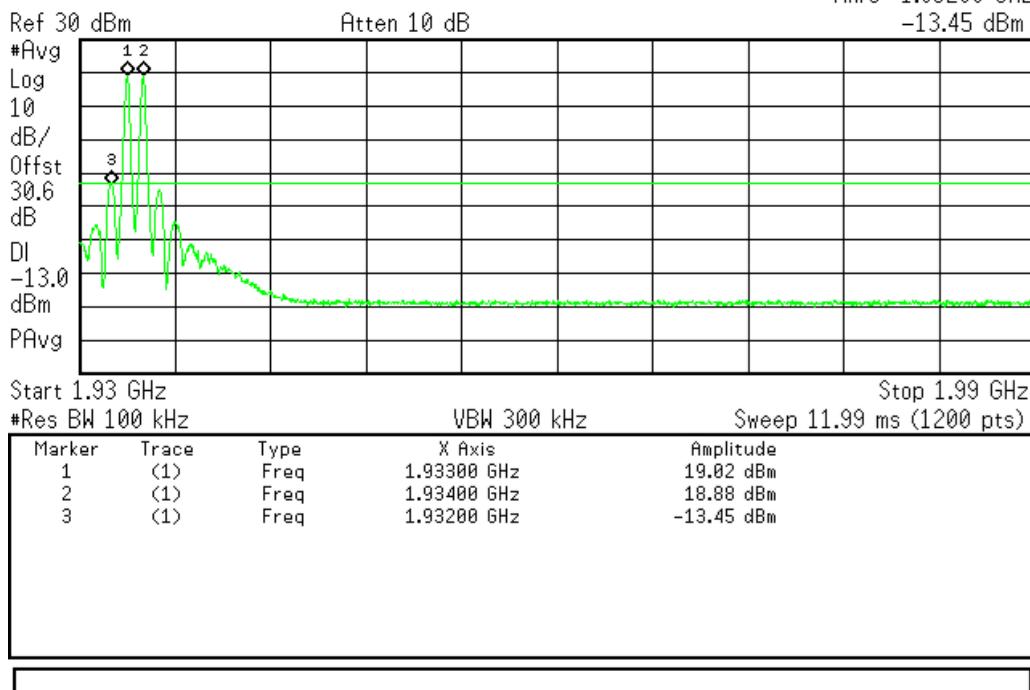


**Intermodulation Downlink Test Results (Two GSM Signals)
1930-1990 MHz Band (Low Band)**

* Agilent 07:36:44 Feb 17, 2015

L

Mkr3 1.93200 GHz
-13.45 dBm



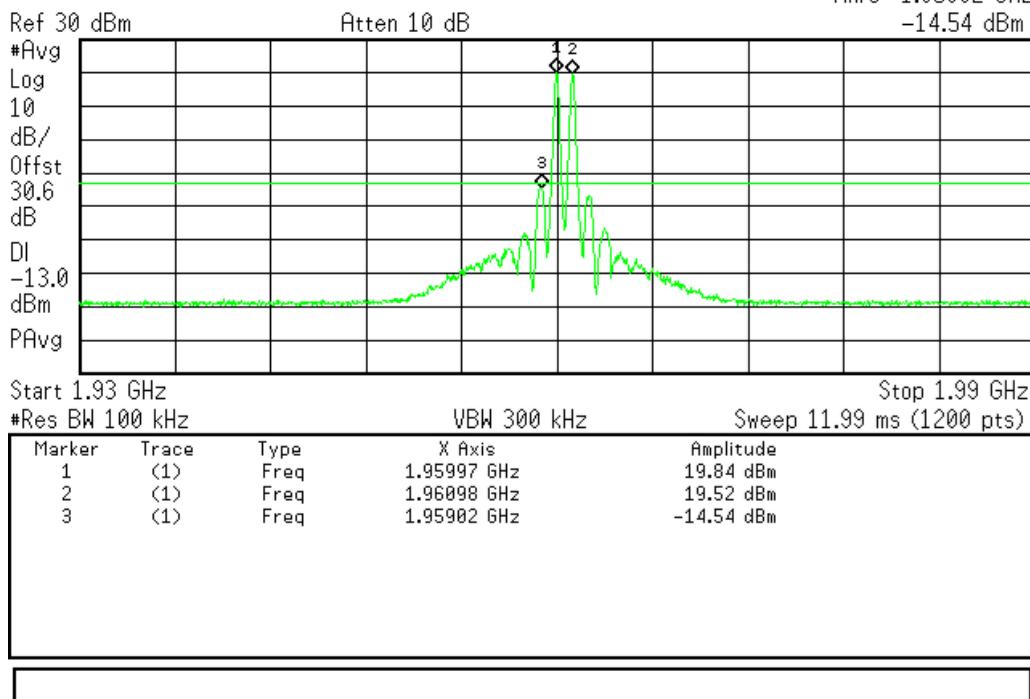


**Intermodulation Downlink Test Results (Two GSM Signals)
1930-1990 MHz Band (Mid Band)**

* Agilent 07:35:54 Feb 17, 2015

L

Mkr3 1.95902 GHz
-14.54 dBm

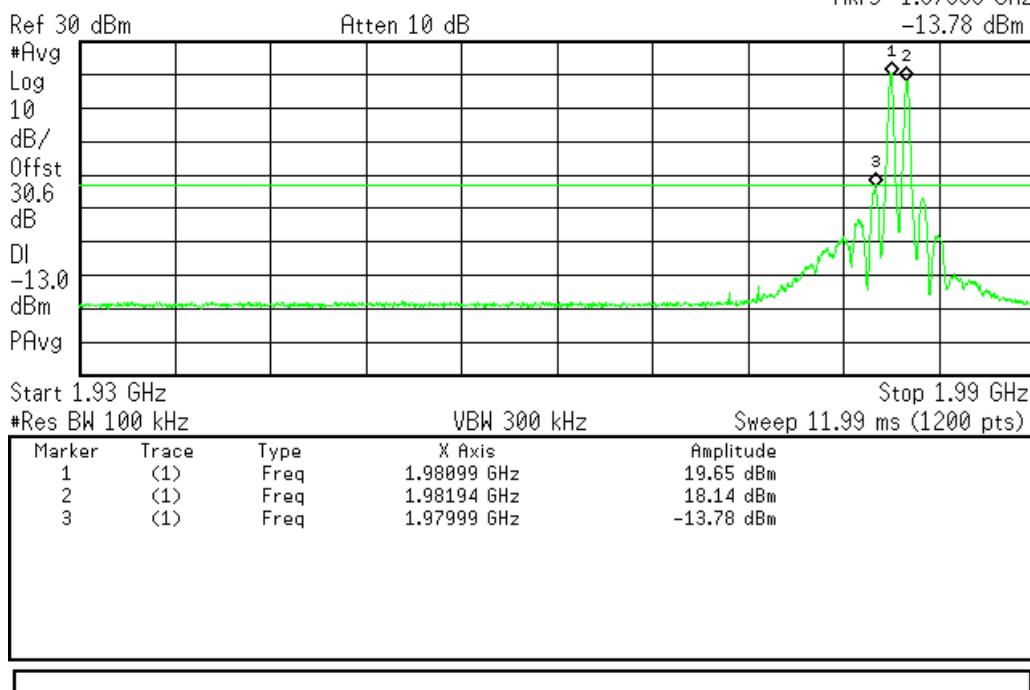


**Intermodulation Downlink Test Results (Two GSM Signals)
1930-1990 MHz Band (High Band)**

* Agilent 07:33:59 Feb 17, 2015

L

Mkr3 1.97999 GHz
-13.78 dBm



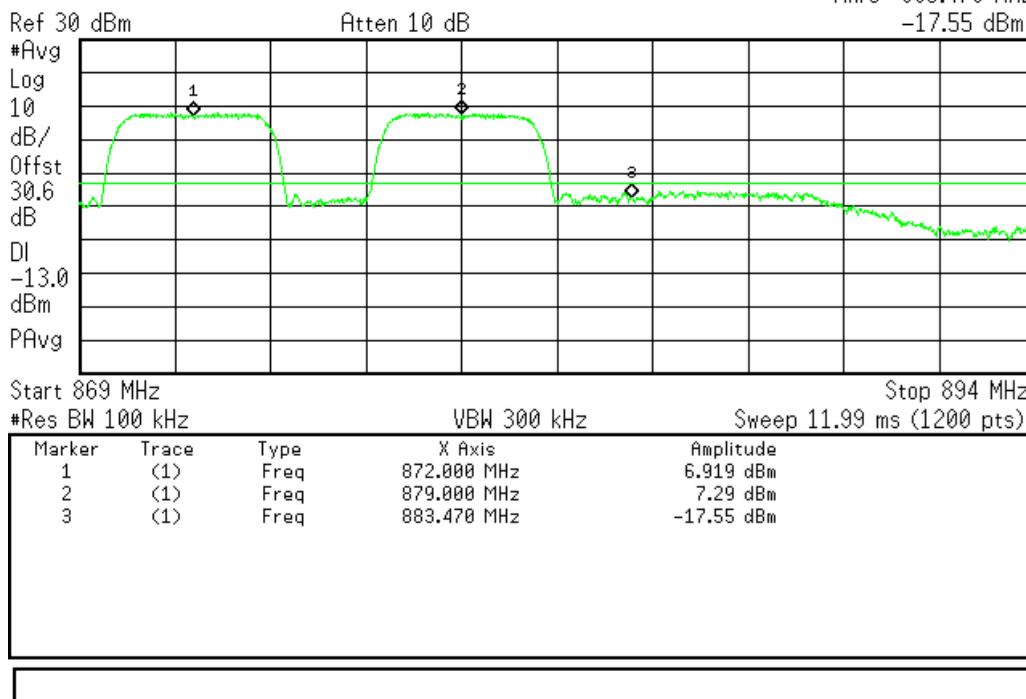


Intermodulation Downlink Test Results (Two WCDMA Signals)
869-894 MHz Band (Low Band)

* Agilent 07:20:22 Feb 17, 2015

L

Mkr3 883.470 MHz
-17.55 dBm

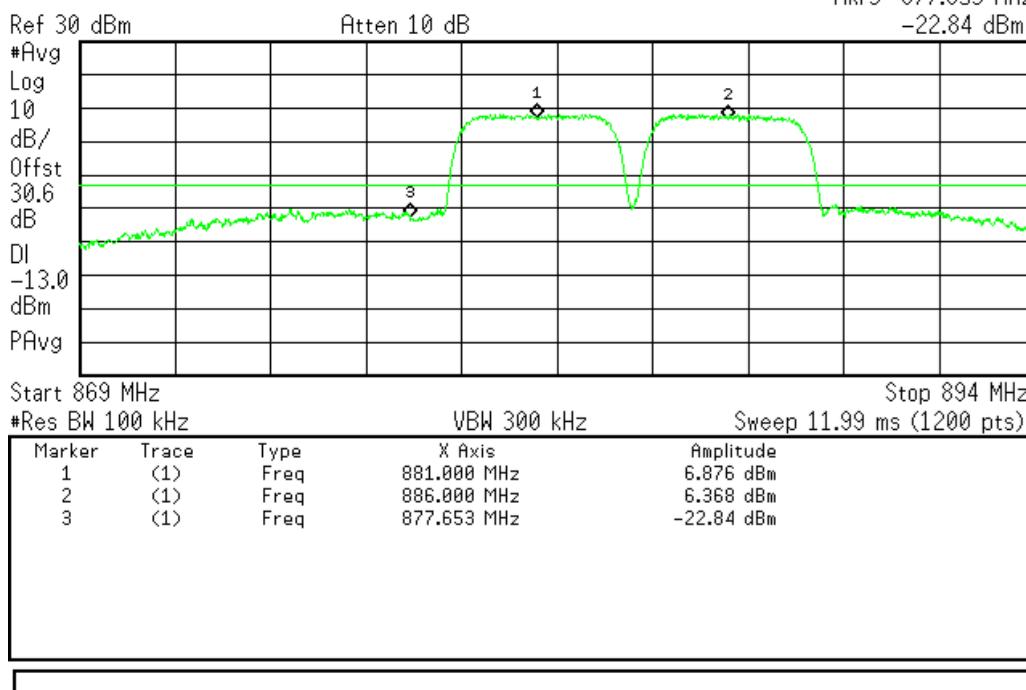


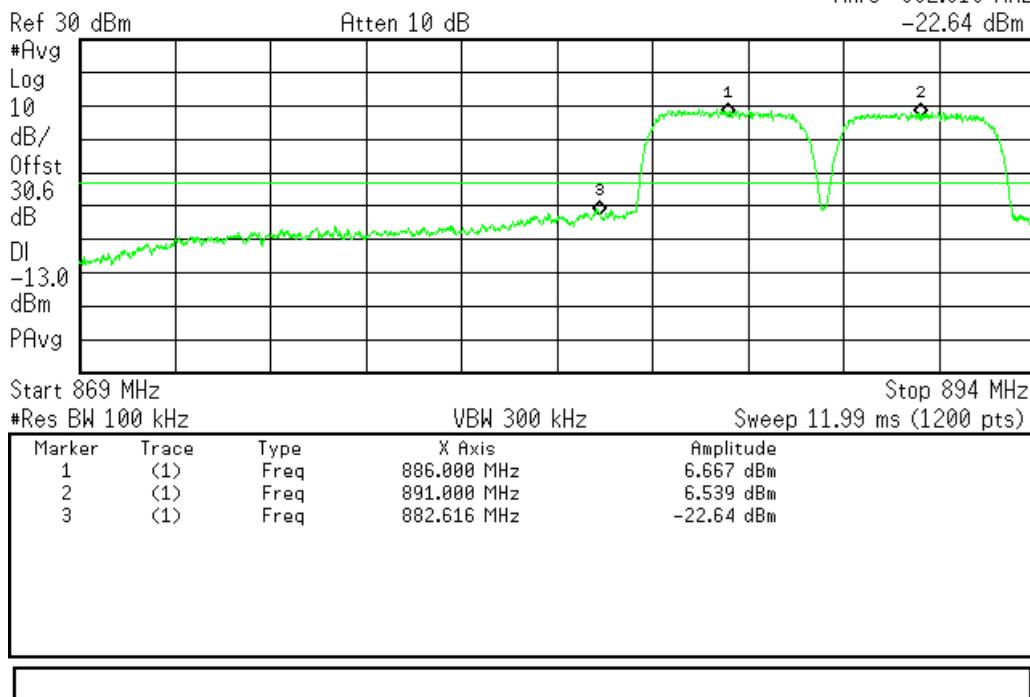
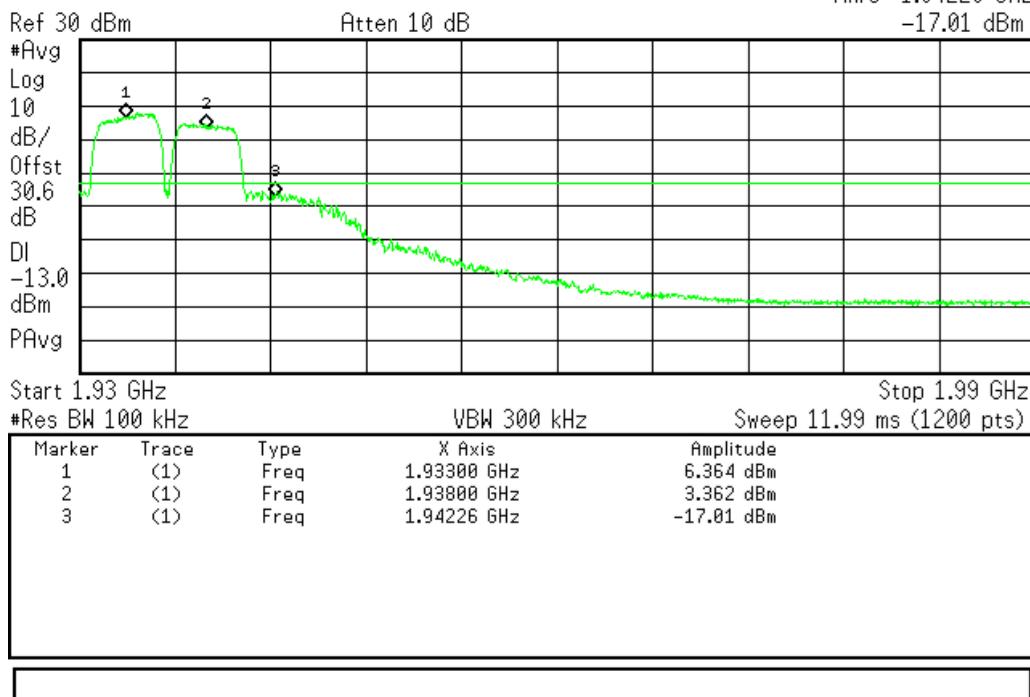
Intermodulation Downlink Test Results (Two WCDMA Signals)
869-894 MHz Band (Mid Band)

* Agilent 07:19:04 Feb 17, 2015

L

Mkr3 877.653 MHz
-22.84 dBm



**Intermodulation Downlink Test Results (Two WCDMA Signals)
869-894 MHz Band (High Band)***** Agilent** 07:17:57 Feb 17, 2015**L**Mkr3 882.616 MHz
-22.64 dBm**Intermodulation Up Downlink link Test Results (Two WCDMA Signals)
1930-1990 MHz Band (Low Band)***** Agilent** 07:32:14 Feb 17, 2015**L**Mkr3 1.94226 GHz
-17.01 dBm

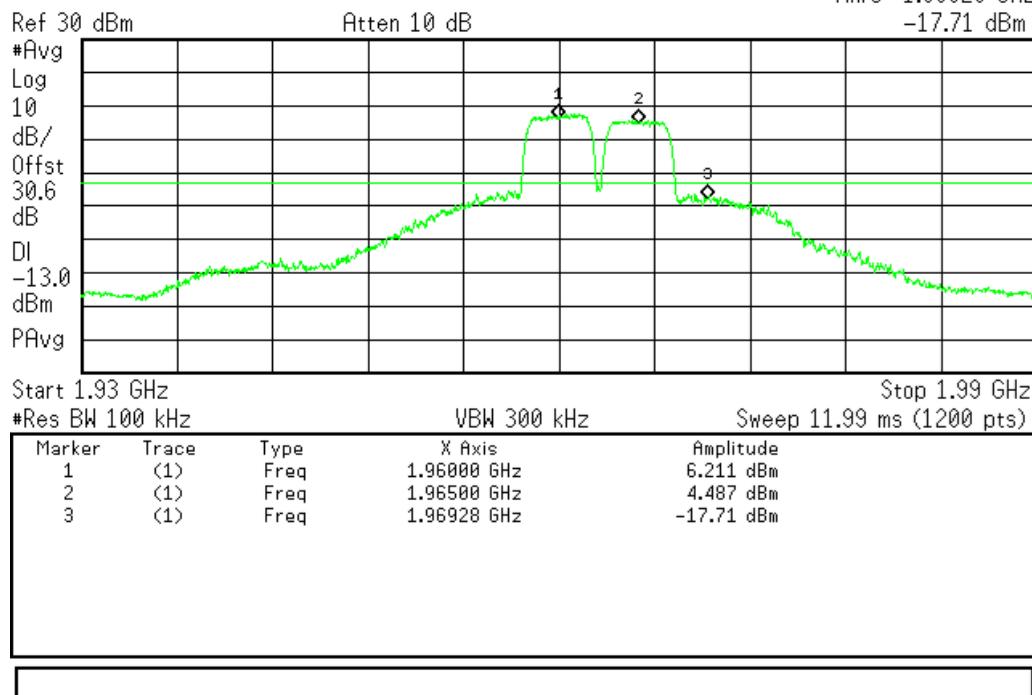


**Intermodulation Downlink Test Results (Two WCDMA Signals)
1930-1990 MHz Band (Mid Band)**

* Agilent 07:28:36 Feb 17, 2015

L

Mkr3 1.96928 GHz
-17.71 dBm

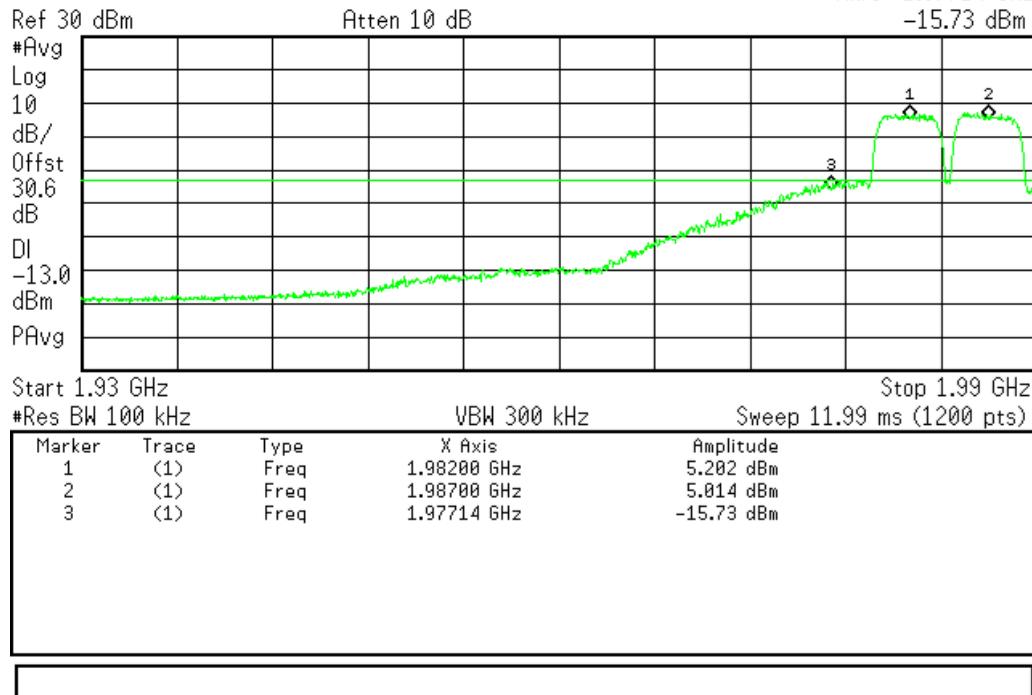


**Intermodulation Downlink Test Results (Two WCDMA Signals)
1930-1990 MHz Band (High Band)**

* Agilent 07:26:58 Feb 17, 2015

L

Mkr3 1.97714 GHz
-15.73 dBm





Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	5/8/14	5/8/16
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	3/24/14	3/24/15
Voltmeter	Fluke	75III	i00320	3/24/14	3/24/15
Spectrum Analyzer	Agilent	E4407B	i00331	6/13/2014	6/13/2016
Non-radiating load	Termaline	8201	i00334	Verified on: 1/10/15	
Signal Generator	Keysight (Agilent)	E4438C	i00457	9/26/2014	9/26/2016
Signal Generator	Rohde & Schwarz	SMU200A	i00405	12/11/14	12/11/15
RF Directional Coupler	Meca	CS06-1.500V	i00412	Verified on: 1/10/15	

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