FCC Part 22 and 24
800/1900 MHz CDMA DUAL BAND MODULE
Model: SB555-S

FCC ID: N7NSB555

Prepared by
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Test Date(s): September 2002

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1 Introduction and Purpose

This document provides the FCC test data for the SB555-S module. The tests included in this report are limited to all conducted tests required. Other radiated tests were performed at an external test facility.

2 Test Summary

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The tests described in this report were performed by Mr. Sean Hoare, under the supervision of Mr Ron Vanderhelm, P.Eng. at

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3 Product Description

The Sierra Wireless Inc. model SB555-S is a dual band CDMA embedded modem.

EUT Type	Cellular and PCS CDMA Embedded Modem
Whether quantity(>1) production is planned	[X] Yes [ ]No
Standards	CDMA2000
Types of Emission	1M25F9W
RF Output Power	824-849 MHz: 23.5 dBm max 1850-1910 MHz: 23.5 dBm max In both bands, power is variable to –50 dBm.
Frequency Range	824-849 MHz, 1850-1910 MHz

4 Test Configuration

Tests were performed on the radio module alone. For frequency stability versus temperature, testing the module requires a wider range of temperature at the higher extreme to account for the insulating and warming affects of the end-user device. We test up to 70 degrees C for the module alone rather than just 50 deg C for the module in the end user device. For the effect of variation of DC power supply on frequency stability, the DC supply to the module was varied to the extremes of its specified voltage range, 3.15 to 4.2 volts.

Item #	Description	Model No.	Serial No.
1	Module EUT	SB555-S	E0207135003503C

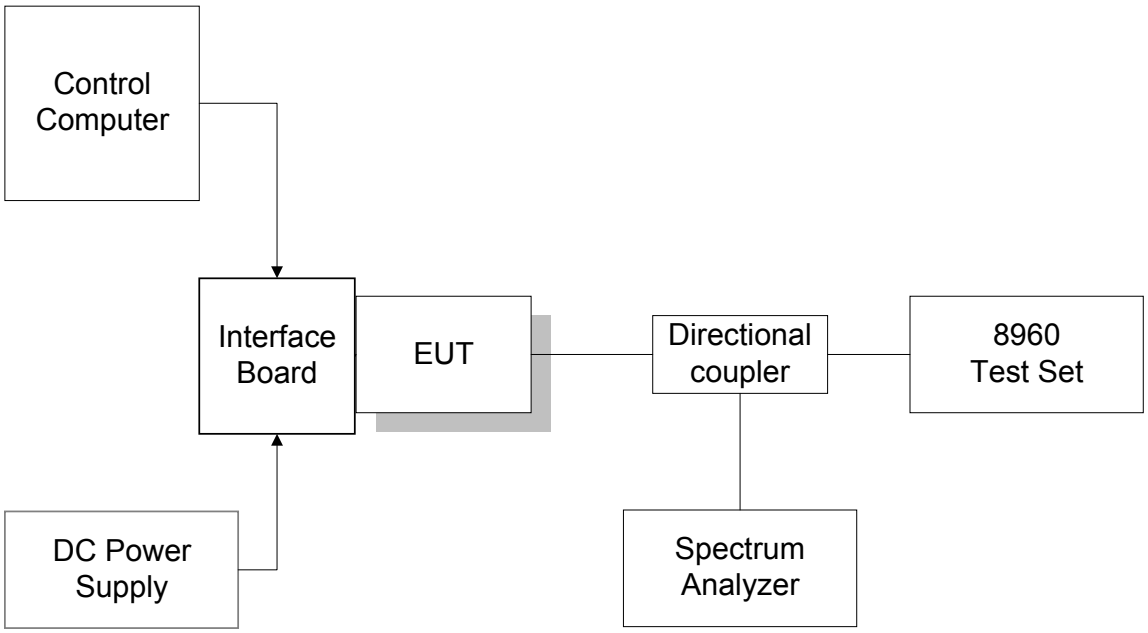
5 RF Power Output

FCC 2.1046

5.1 Test Procedure

The transmitter output was connected to an Agilent 8960 CDMA Test Set and configured to operate at maximum power. The power was measured at three equally spaced operating frequencies in each band and was confirmed by the plots taken on the Spectrum Analyzer.

Test Setup



5.2 Test Equipment

Instrument List

EQUIPMENT	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE
Control Computer	TC	Generic PC	100844	N/A
Wireless Test Set	Agilent	8960	US41070182	09/05/2001
Spectrum Analyzer	Agilent	PSA E4440A	US41421268	2002-01-25
DC Power Supply	HP	HP6632A	3326A-03423	N/A
Interface Board	Shop built	Nest	N/a	N/A
Directional Coupler	Pasternack	PE2209-10	N/A	N/A

5.3 Test Results

Frequency (MHz)	Power (dBm)
824.70	23.28
836.52	23.50
848.31	23.30
1851.25	23.44
1880.0	23.69
1908.75	23.72

- **Cellular Band (CDMA Mode)**

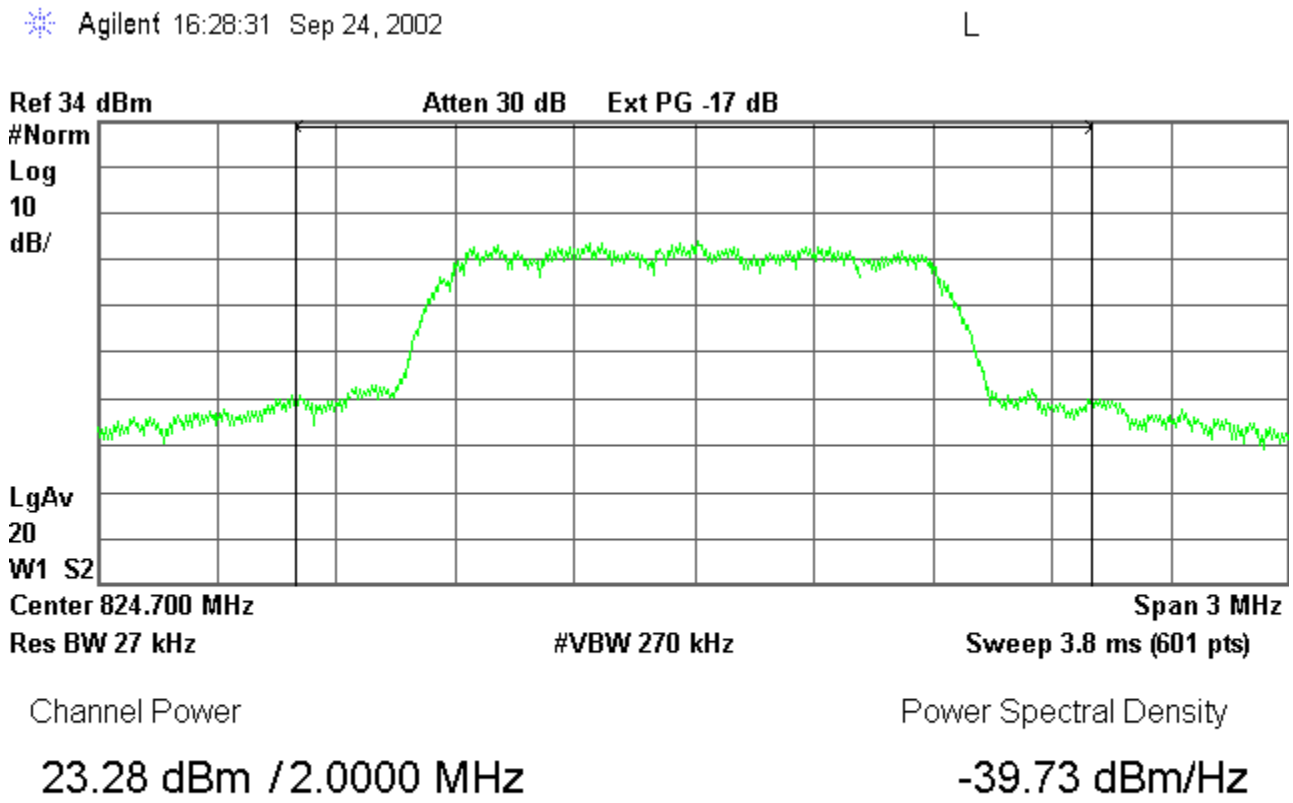
Plot Number	Description
1.1	Low Channel (Ch 1013)
1.2	Middle Channel (Ch 384)
1.3	High Channel (Ch 777)

- **PCS Band (CDMA Mode)**

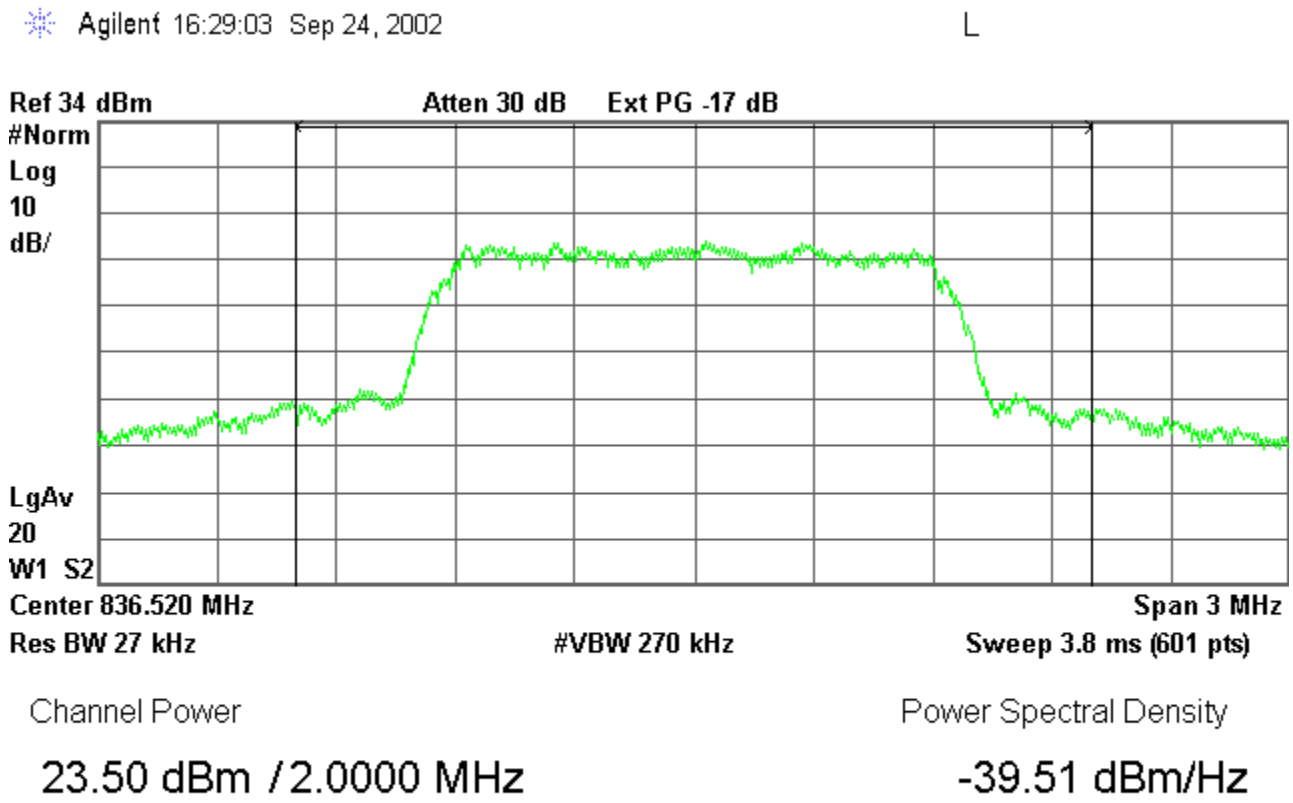
Plot Number	Description
1.4	Low Channel (Ch 25)
1.5	Middle Channel (Ch 600)
1.6	High Channel (Ch 1175)

The Modem was calibrated to a maximum power of 23.5 dBm.

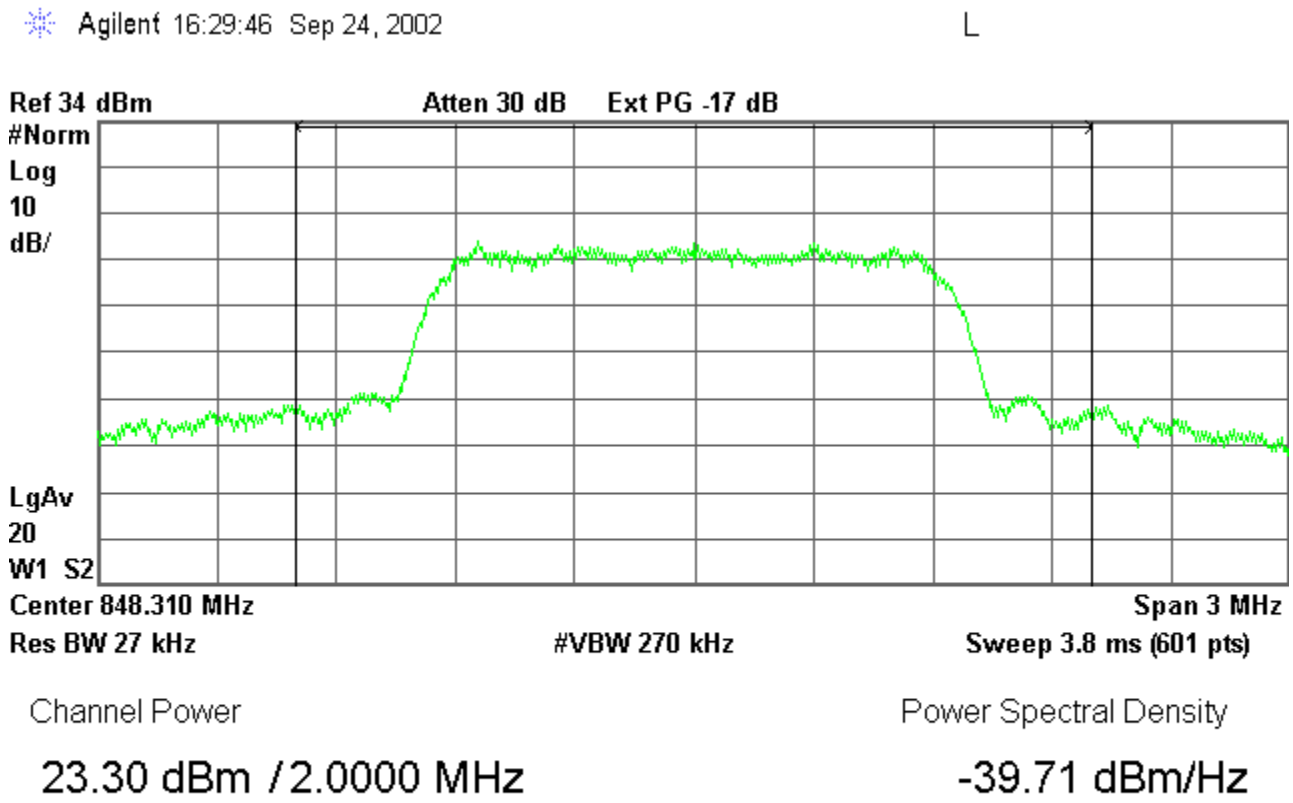
Plot 1.1 Cellular Band (Low Channel)



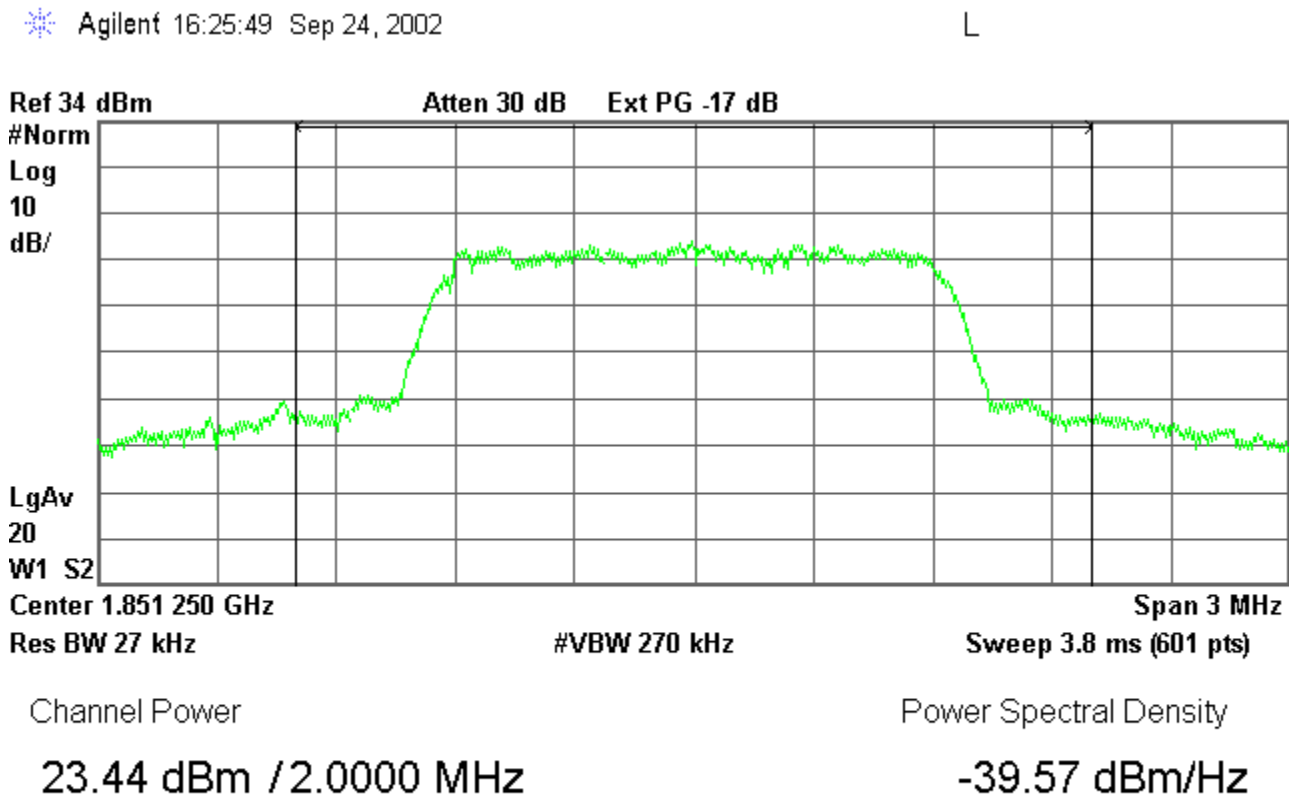
Plot 1.2 Cellular Band (Middle Channel)



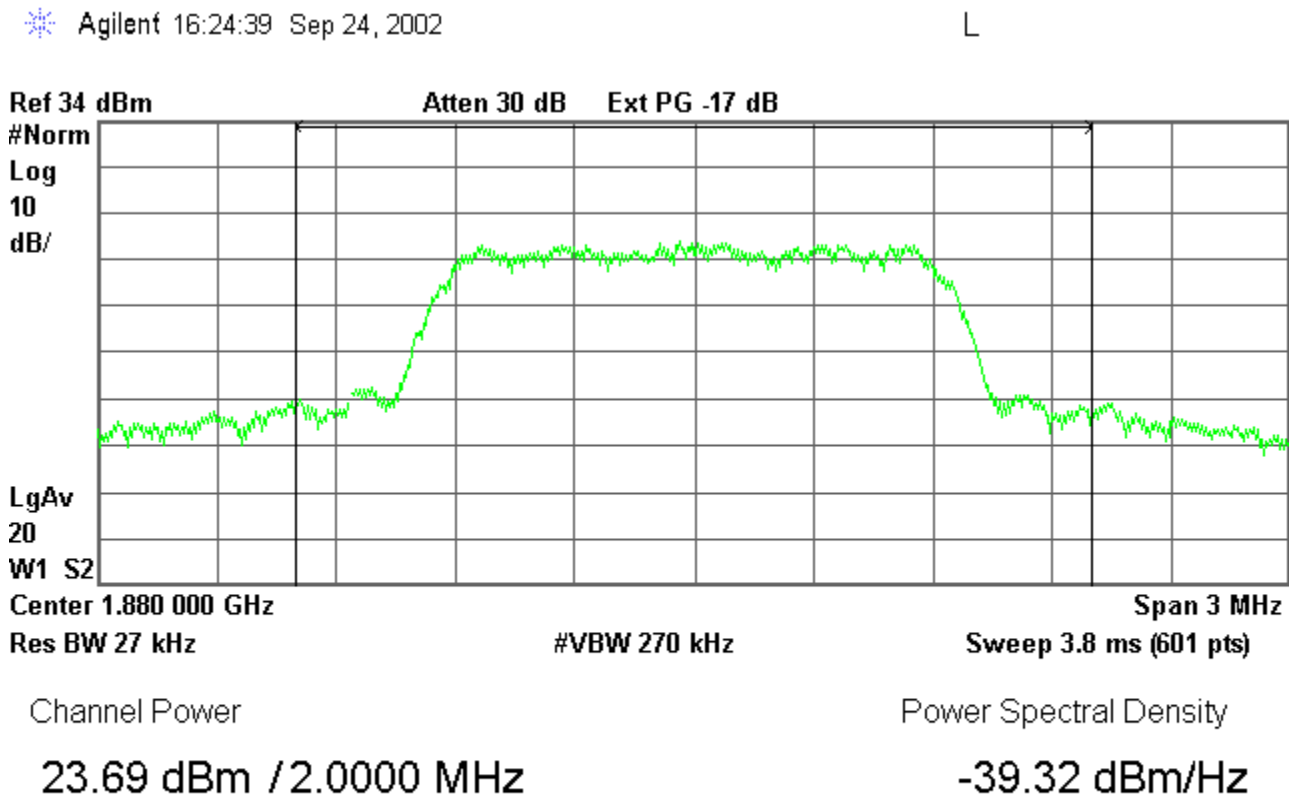
Plot 1.3 Cellular Band (High Channel)



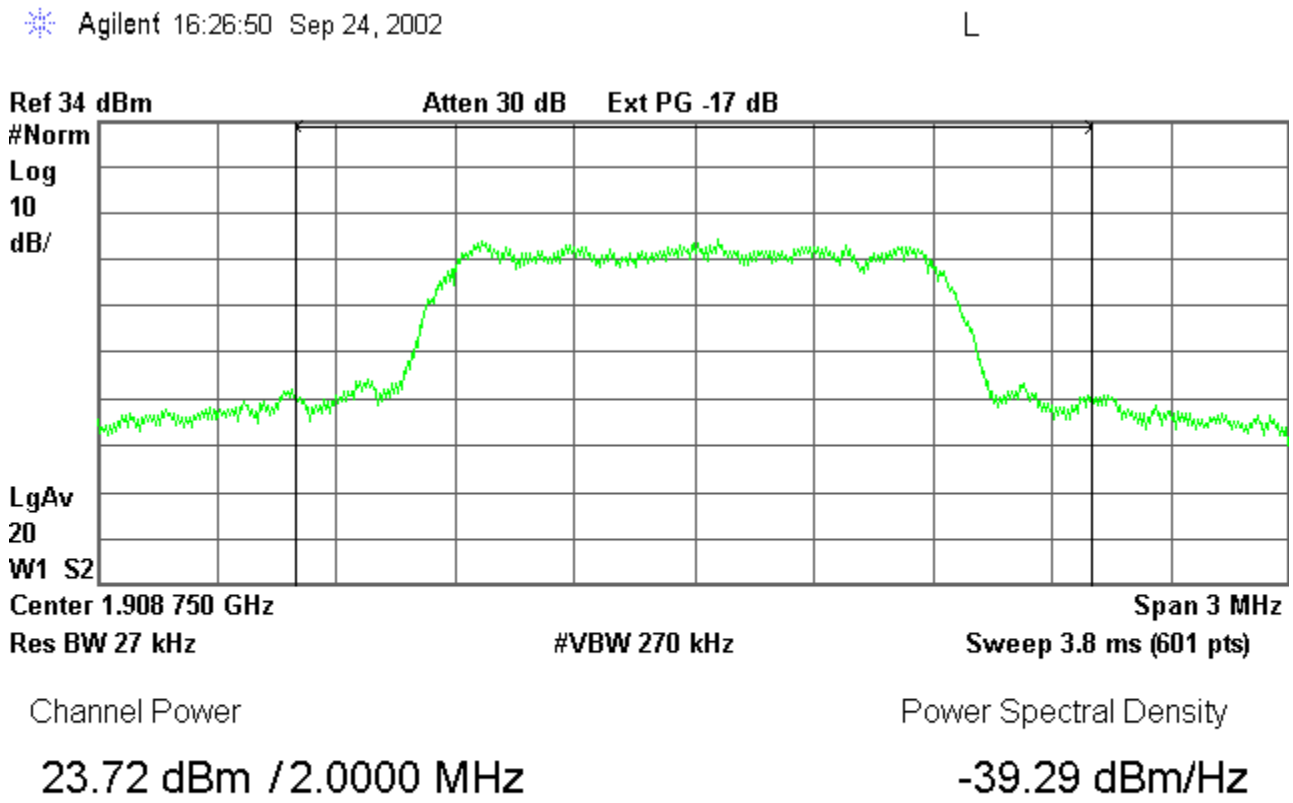
Plot 1.4 PCS Band (Low Channel)



Plot 1.4 PCS Band (Middle Channel)



Plot 1.4 PCS Band (High Channel)



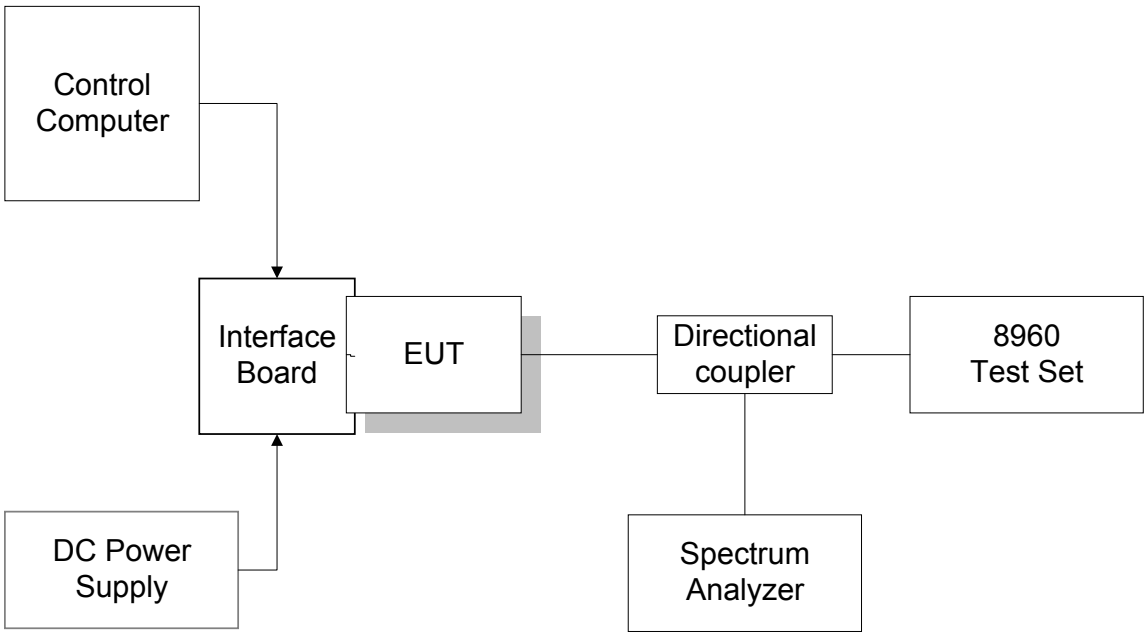
6 Occupied Bandwidth

FCC 2.1049

6.1 Test Procedure

The transmitter output was connected to a calibrated coaxial cable, the other end of which was connected to a spectrum analyzer. The occupied Bandwidth (defined as the 99% Power Bandwidth) was measured with the Spectrum Analyzer at the center frequency of each band.

Test Setup



6.2 Test Equipment

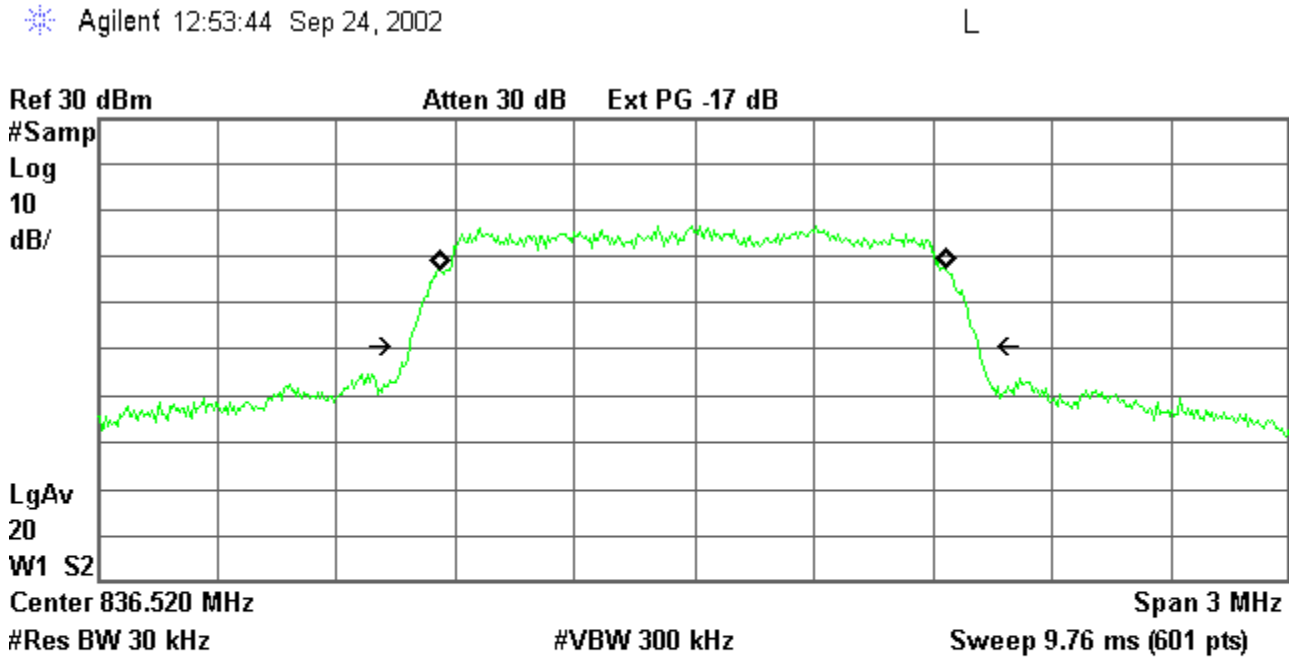
EQUIPMENT	MANUFACTURER	MODEL NO.	SERIAL NO.	Last CAL.DATE
Spectrum Analyzer	Agilent	PSA E4440A	US41421268	2002-01-25
Interface Board	Shop built	Nest	N/a	N/a
Control Computer	TC	Generic PC	100844	N/a
DC Power Supply	HP	HP6632A	3326A-03423	N/a

6.3 Test Results

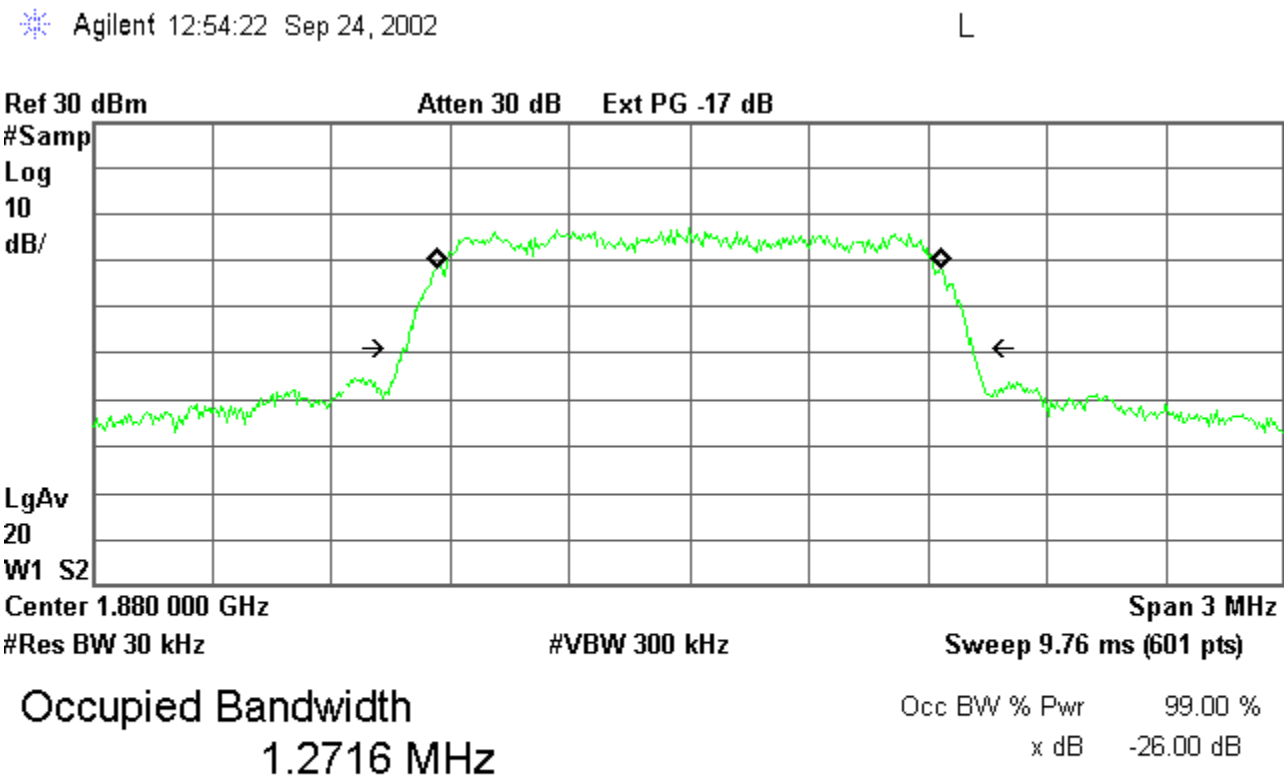
The performance of 800 MHz cellular band is shown in plots 2.1.
Performance of 1900 MHz PCS band is shown in plots 2.3.

The test results shows that the bandwidth in all cases is approximately 1.270 MHz.

Plot 2.1 Cellular Band (Middle Channel)



Plot 2.2 PCS Band (Middle Channel)



7 Out of Band Emissions at Antenna Terminals

FCC 22.901(d), 22.917(f), 24.238(a)

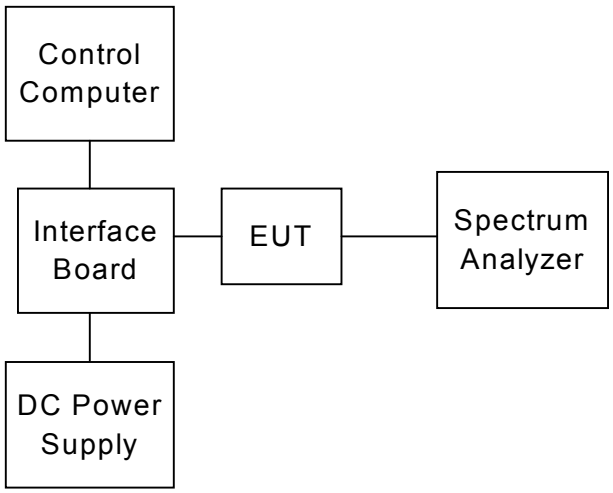
Out of Band Emissions:
The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB, in this case, -13dBm.

Mobile Emissions in Base Frequency Range:
The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not exceed –80 dBm at the transmit antenna connector.

7.1 Test Procedure

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. The EUT was scanned for spurious emissions from 1MHz to 20GHz with sufficient bandwidth and video resolution. Data plots are included.

Test Setup



7.2 Test Equipment

EQUIPMENT	MANUFACTURER	MODEL NO.	SERIAL NO.	Last CAL. DATE
Spectrum Analyzer	Agilent	PSA E4440A	US41421268	2002-01-25
Interface Board	Shop built	Nest	N/a	N/a
Control Computer	TC	Generic PC	100844	N/a
DC Power Supply	HP	HP6632A	3326A-03423	N/a
Directional Coupler	Pasternack	PE2209-10	N/A	N/A

7.3 Test Results

Refer to the following plots.

- **Cellular Band**

Plot Number	Description
3.1a – 3.1c	Low channel, 824.70 MHz
3.2a – 3.2c	Middle Channel, 836.52 MHz
3.3a – 3.3c	High Channel, 848.31 MHz

- **PCS Band**

Plot Number	Description
3.4a – 3.4c	Low Channel, 1851.25 MHz
3.5a – 3.5c	Middle Channel, 1880 MHz
3.6a – 3.6c	High Channel, 1908.75 MHz

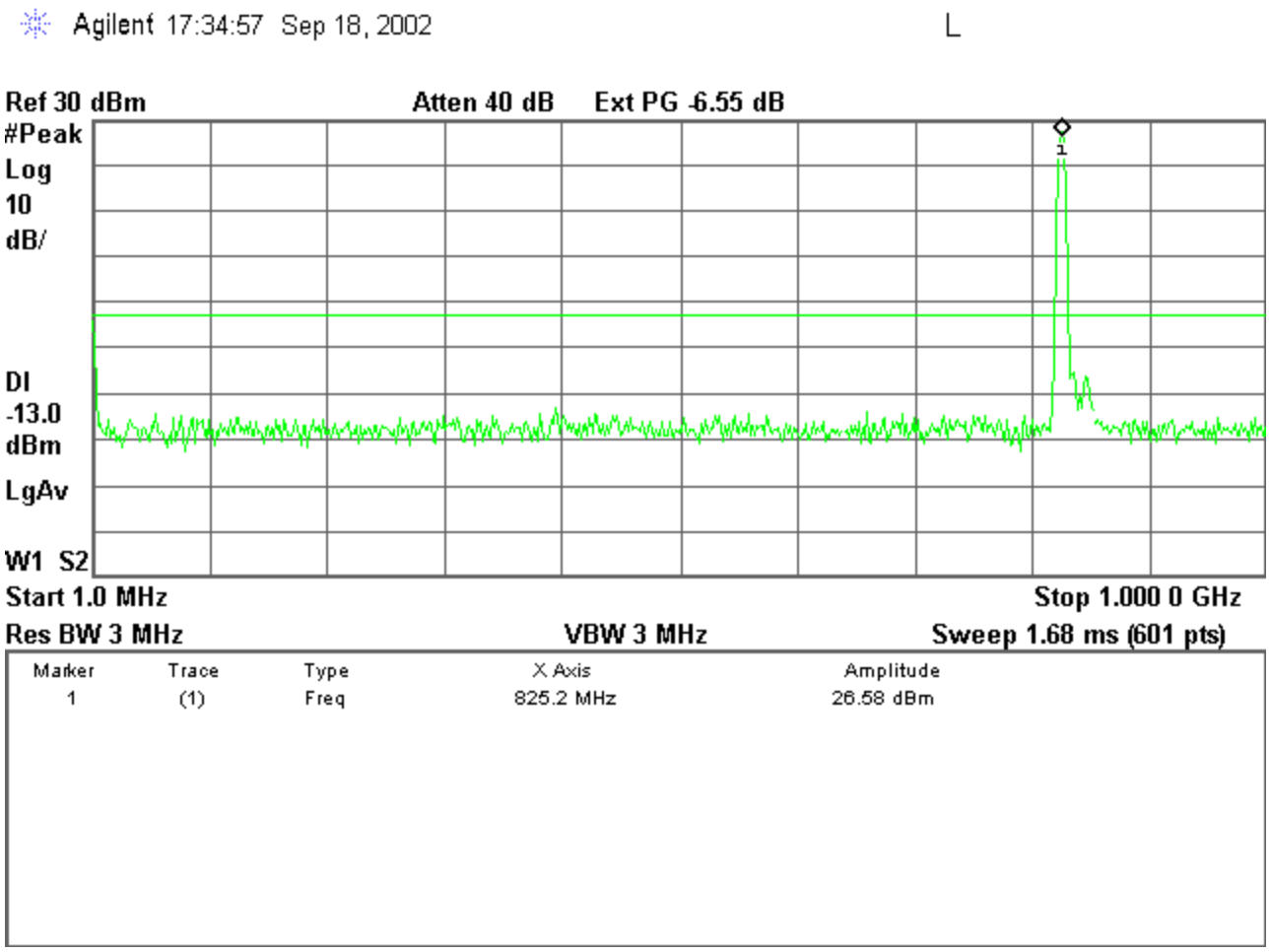
- **Emissions in Base Station Frequency Range, Cellular band**

Plot Number	Description
3.7a	Low Channel, 824.70 MHz,
3.8a	Middle Channel, 836.52 MHz
3.9a	High Channel, 848.31 MHz

These plots show that the radiated emission limits requirements are met.

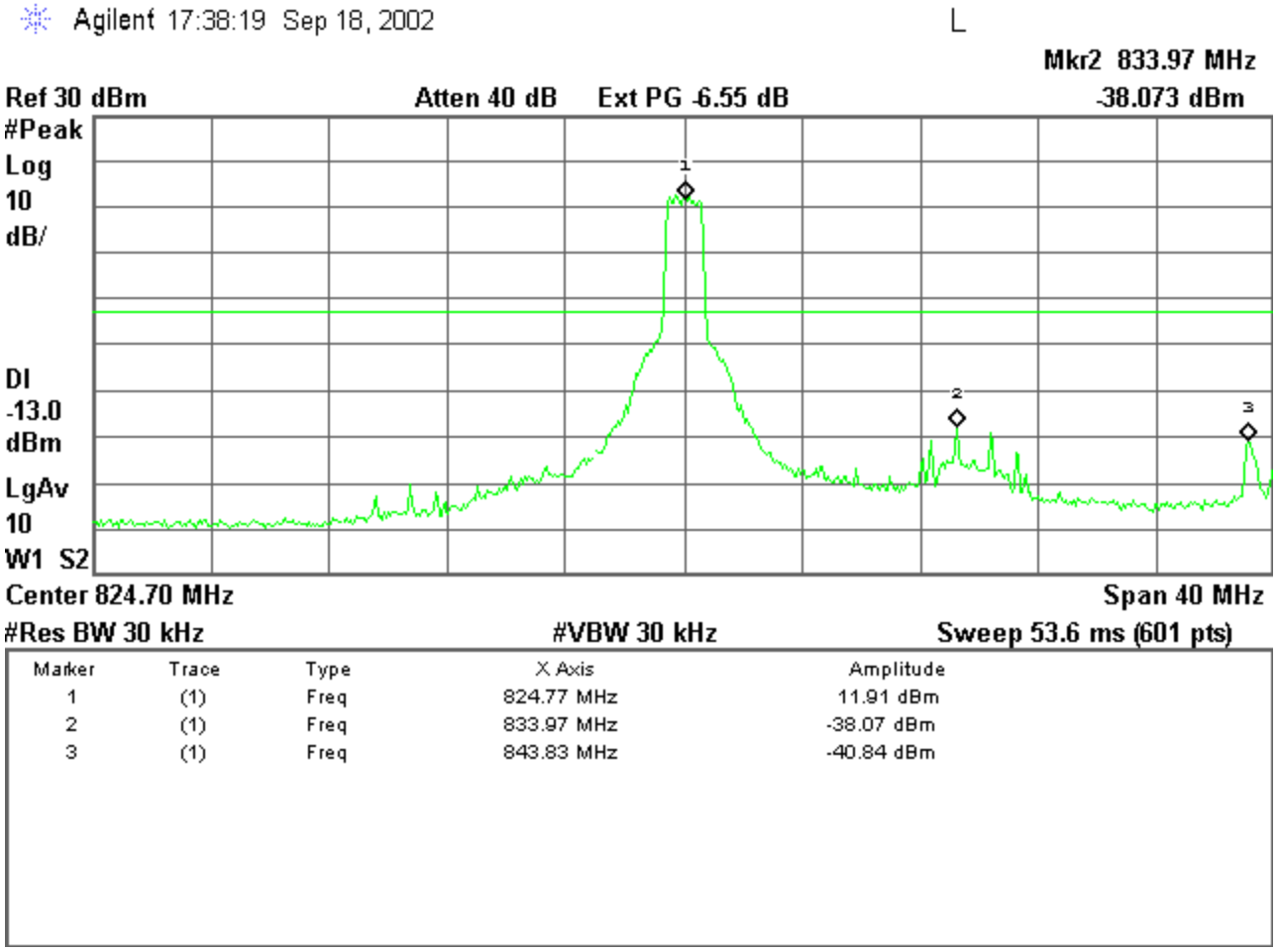
Plot 3.1a Out of Band Emissions at Antenna Terminals

Low channel, 824.700 MHz,
1 Mhz to 1 GHz



Plot 3.1b Out of Band Emissions at Antenna Terminals

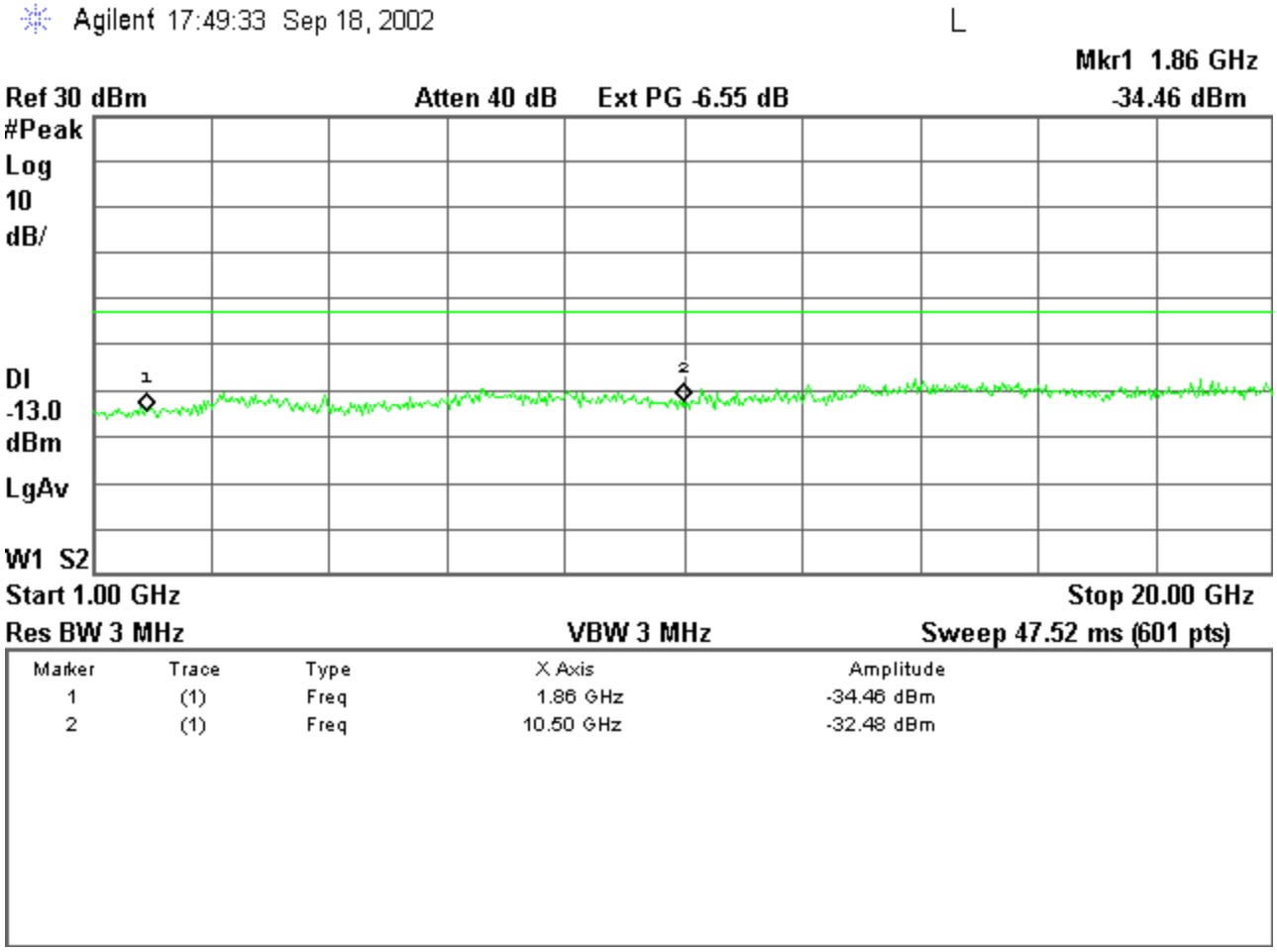
Low channel, 824.700 MHz
TX signal +/- 20 MHz



Plot 3.1c Out of Band Emissions at Antenna Terminals

Low channel, 824.700 MHz

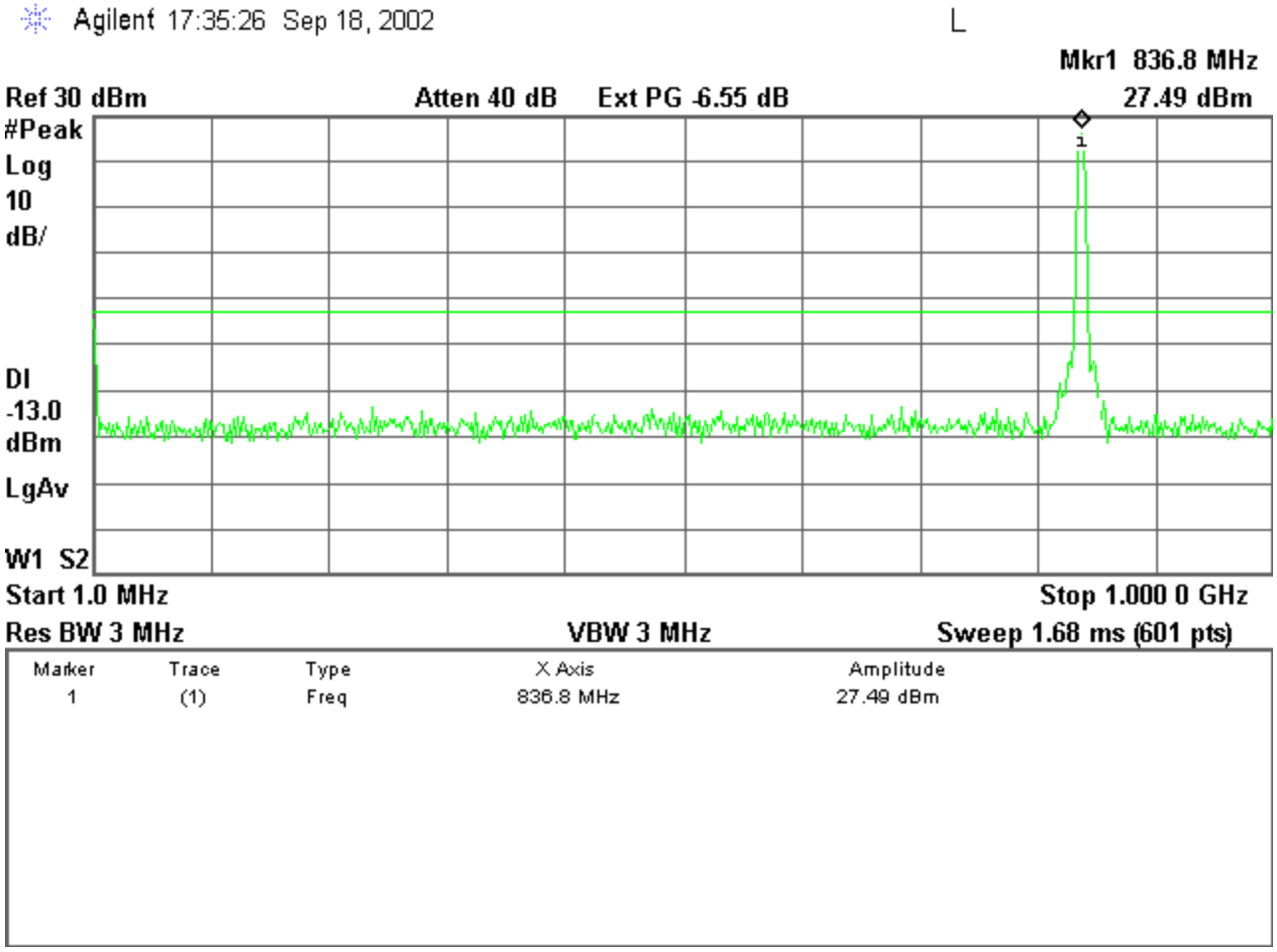
1 GHz to 20 GHz



Plot 3.2a Out of Band Emissions at Antenna Terminals

Mid Channel, 836.52 MHz

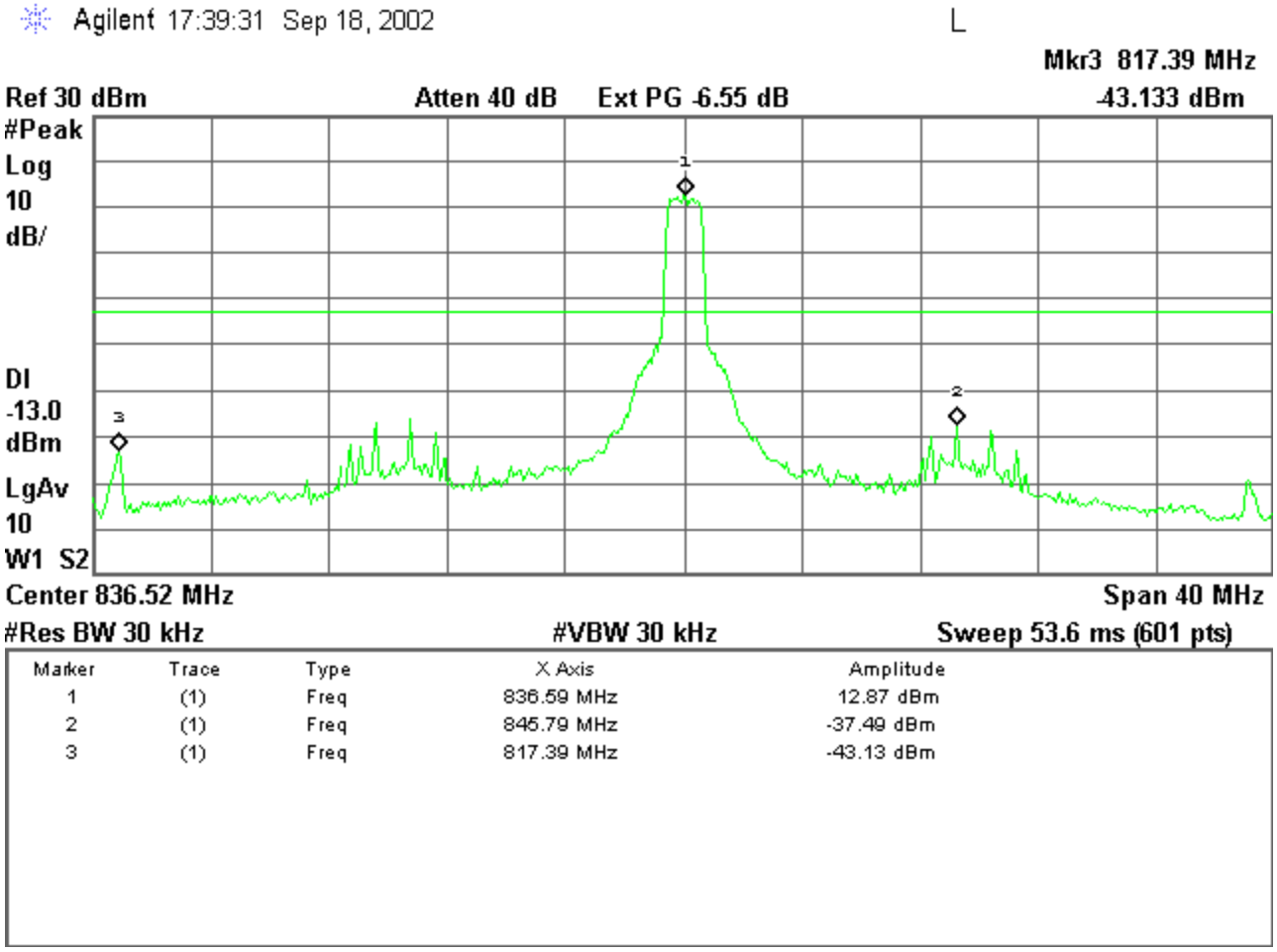
1 MHz to 1 GHz



Plot 3.2b Out of Band Emissions at Antenna Terminals

Mid Channel, 836.52 MHz

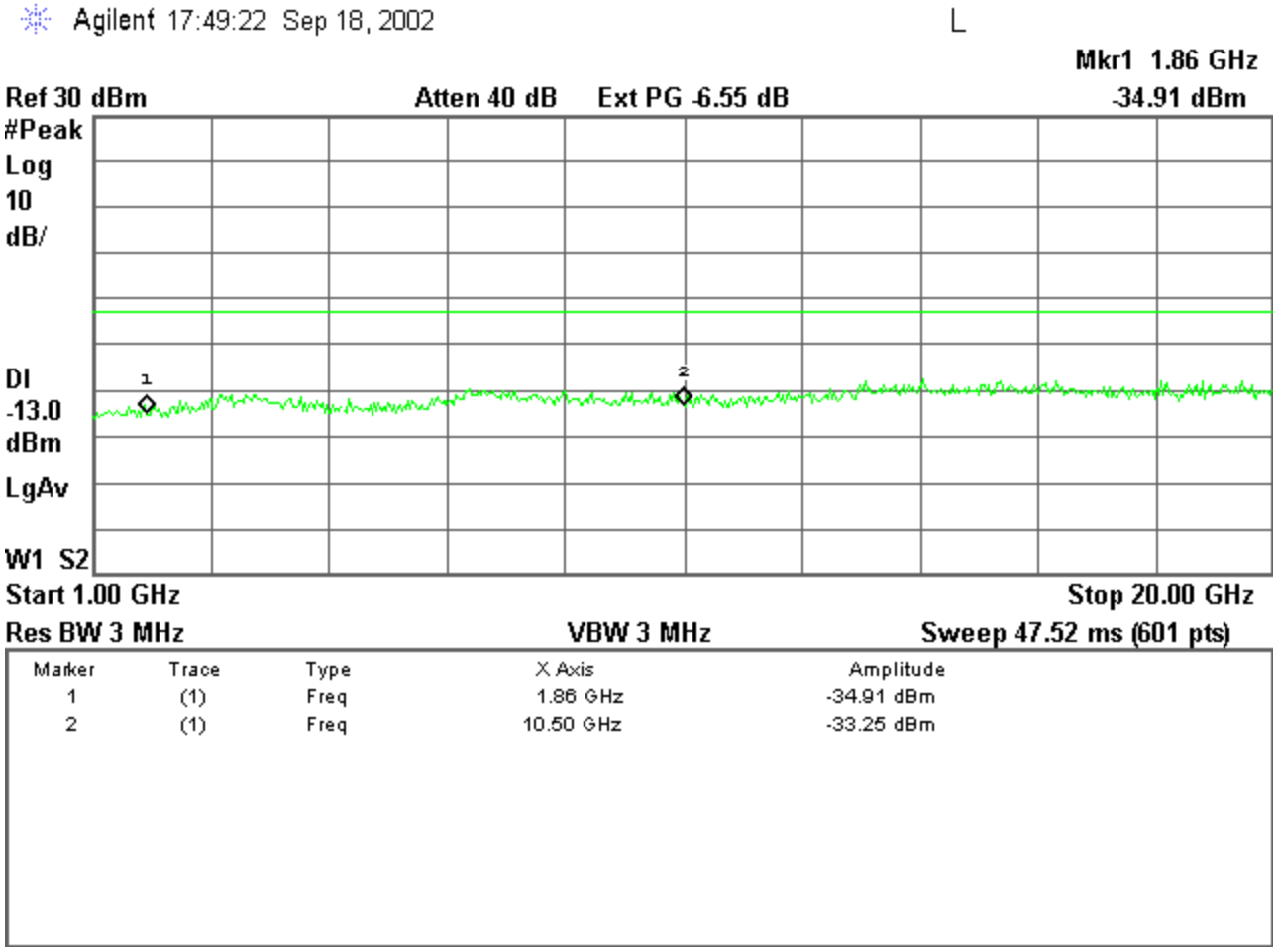
TX signal +/- 20 MHz



Plot 3.2c Out of Band Emissions at Antenna Terminals

Mid Channel, 836.52 MHz

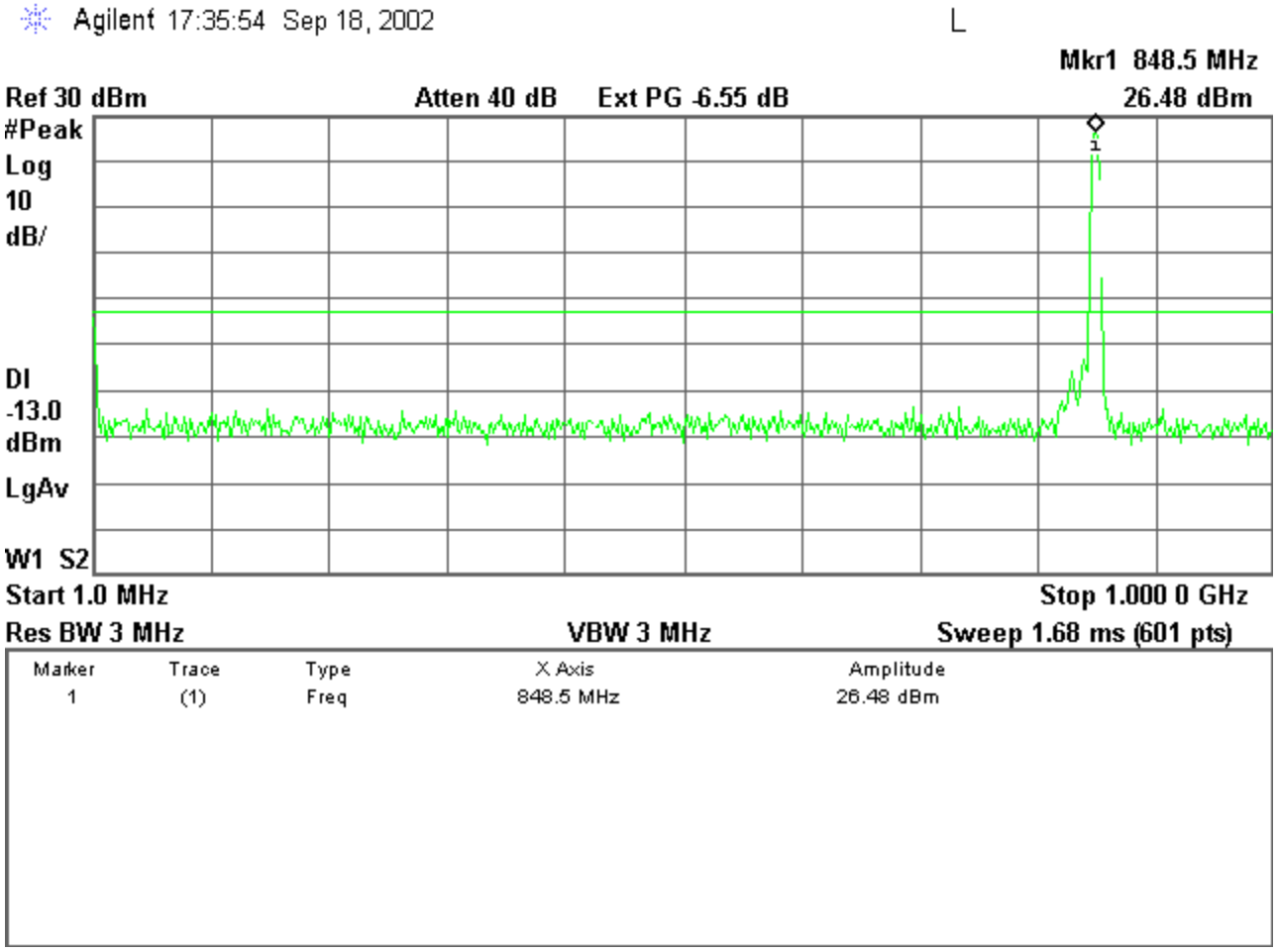
1 GHz to 20 GHz



Plot 3.3a Out of Band Emissions at Antenna Terminals

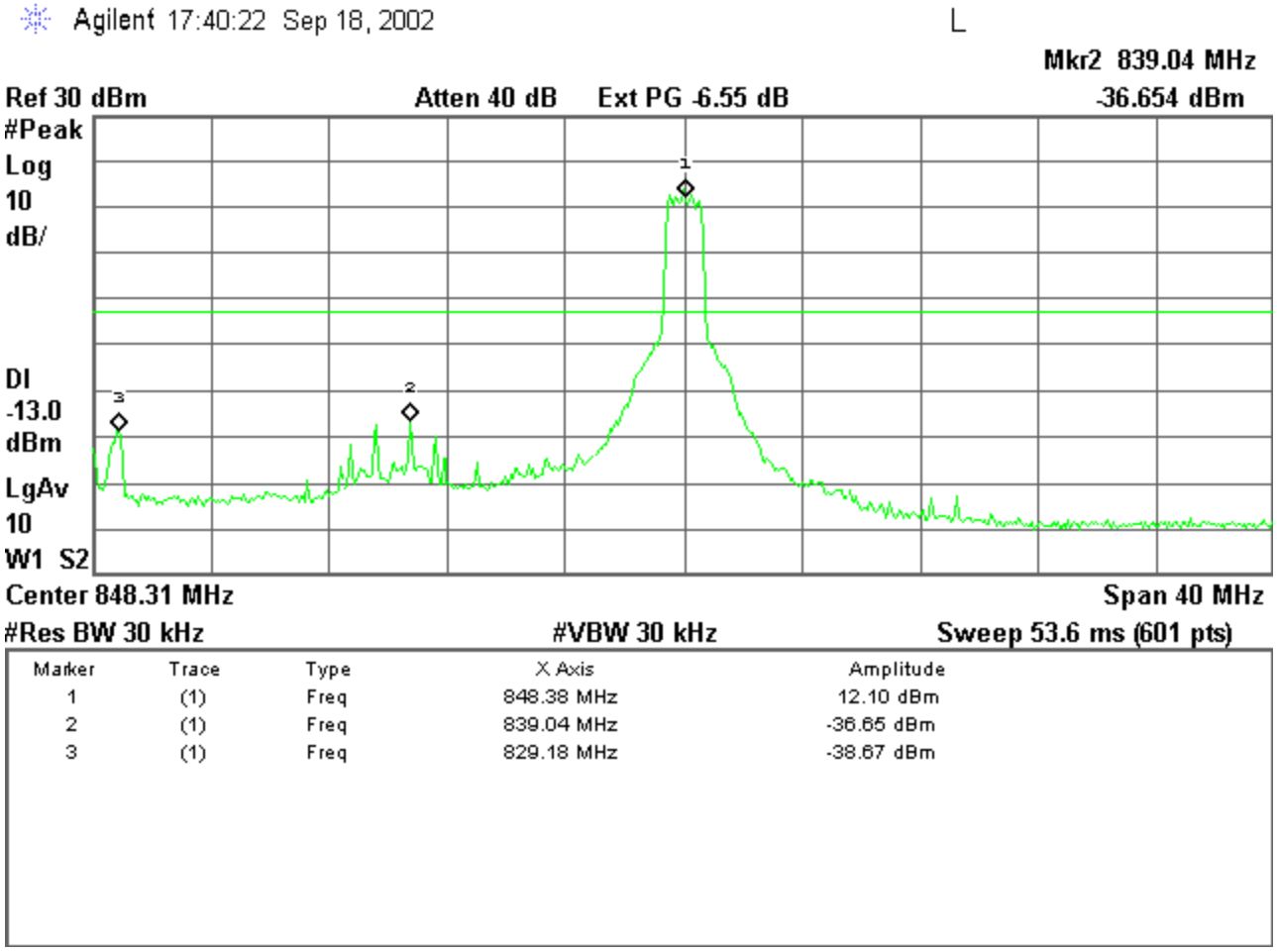
High Channel, 848.31 MHz

1 Mhz to 1 GHz



Plot 3.3b Out of Band Emissions at Antenna Terminals

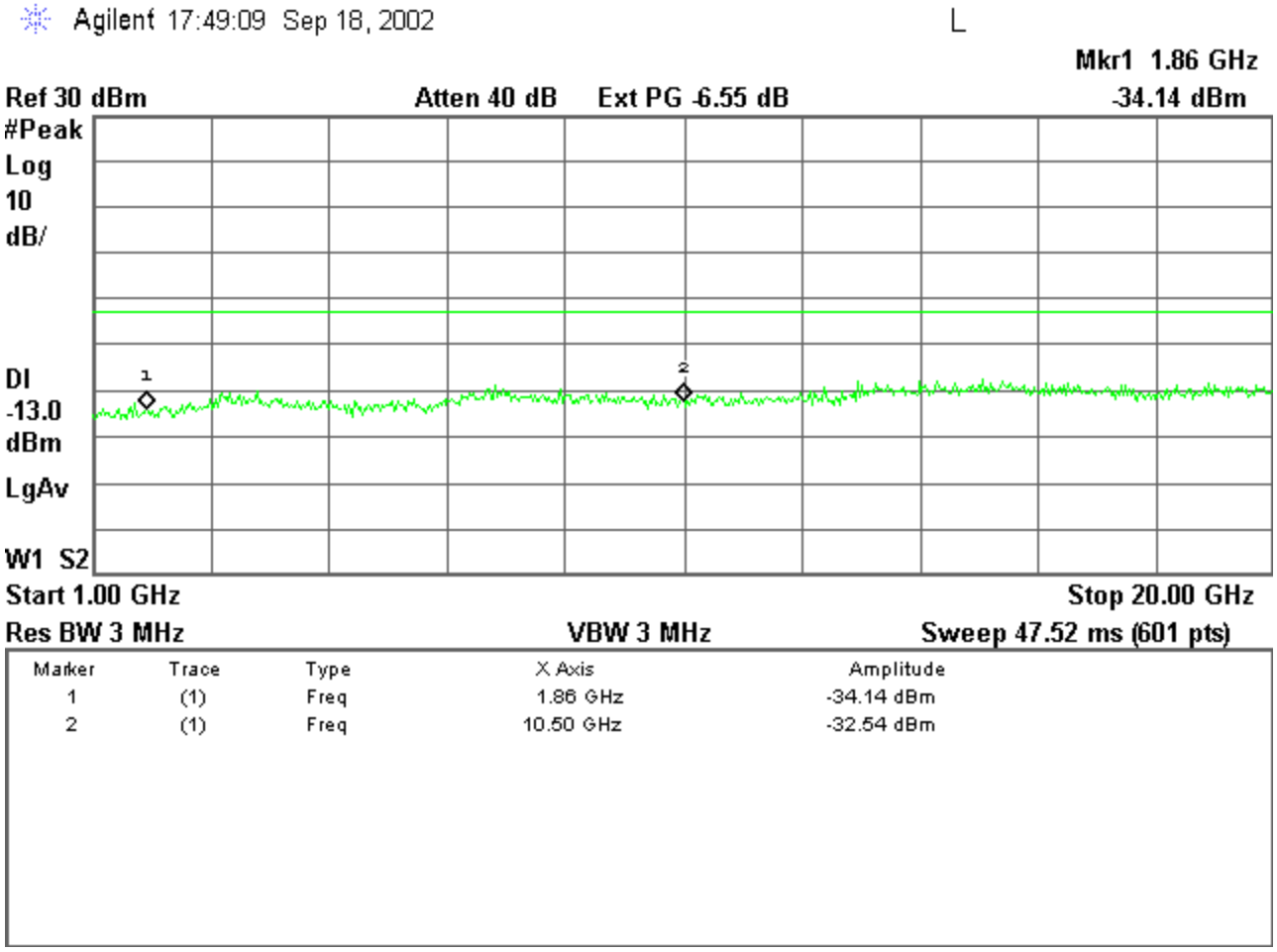
High Channel, 848.31 MHz
TX signal +/- 20 MHz



Plot 3.3c Out of Band Emissions at Antenna Terminals

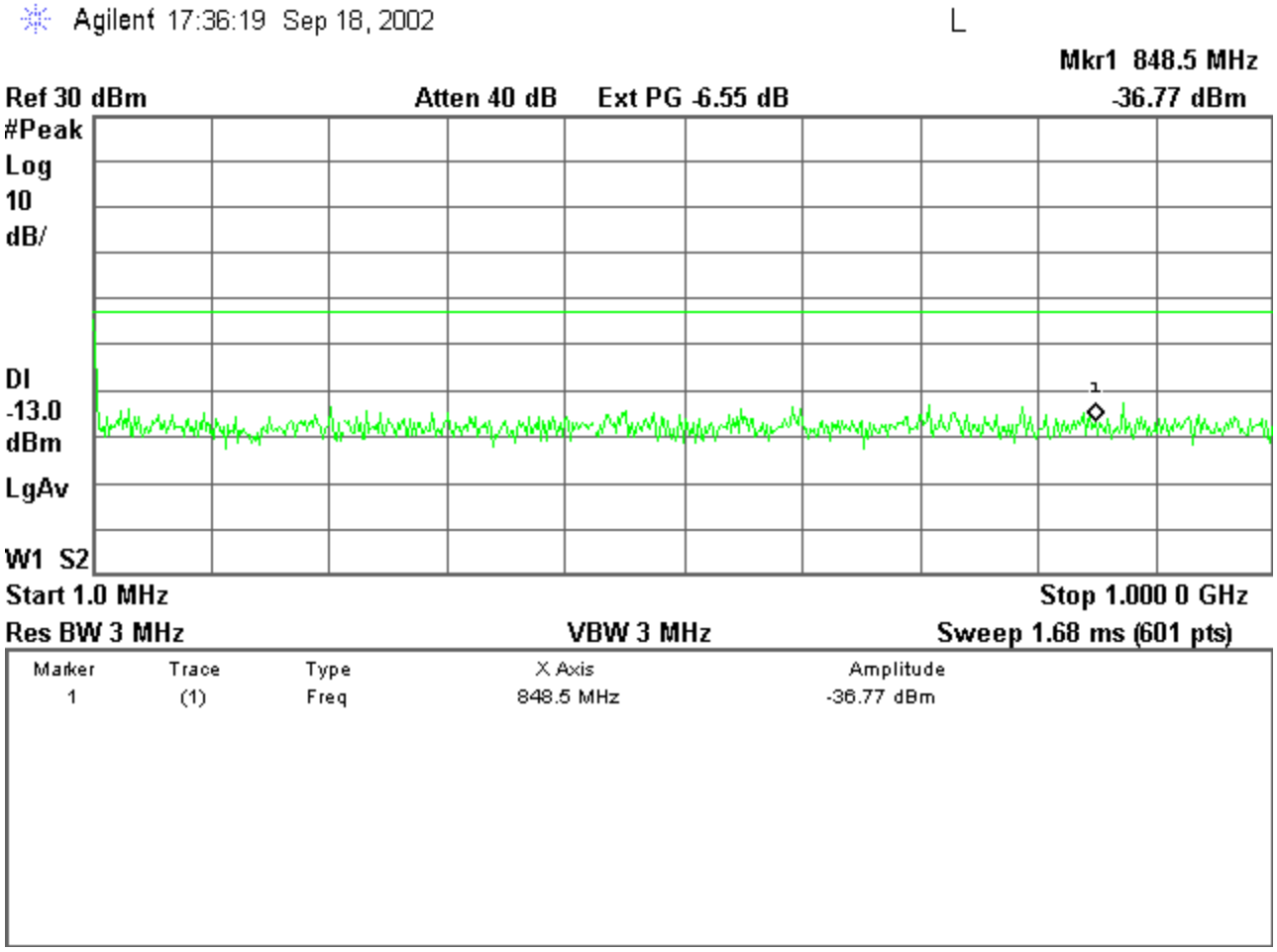
High Channel, 848.31 MHz

1 Ghz to 20 GHz



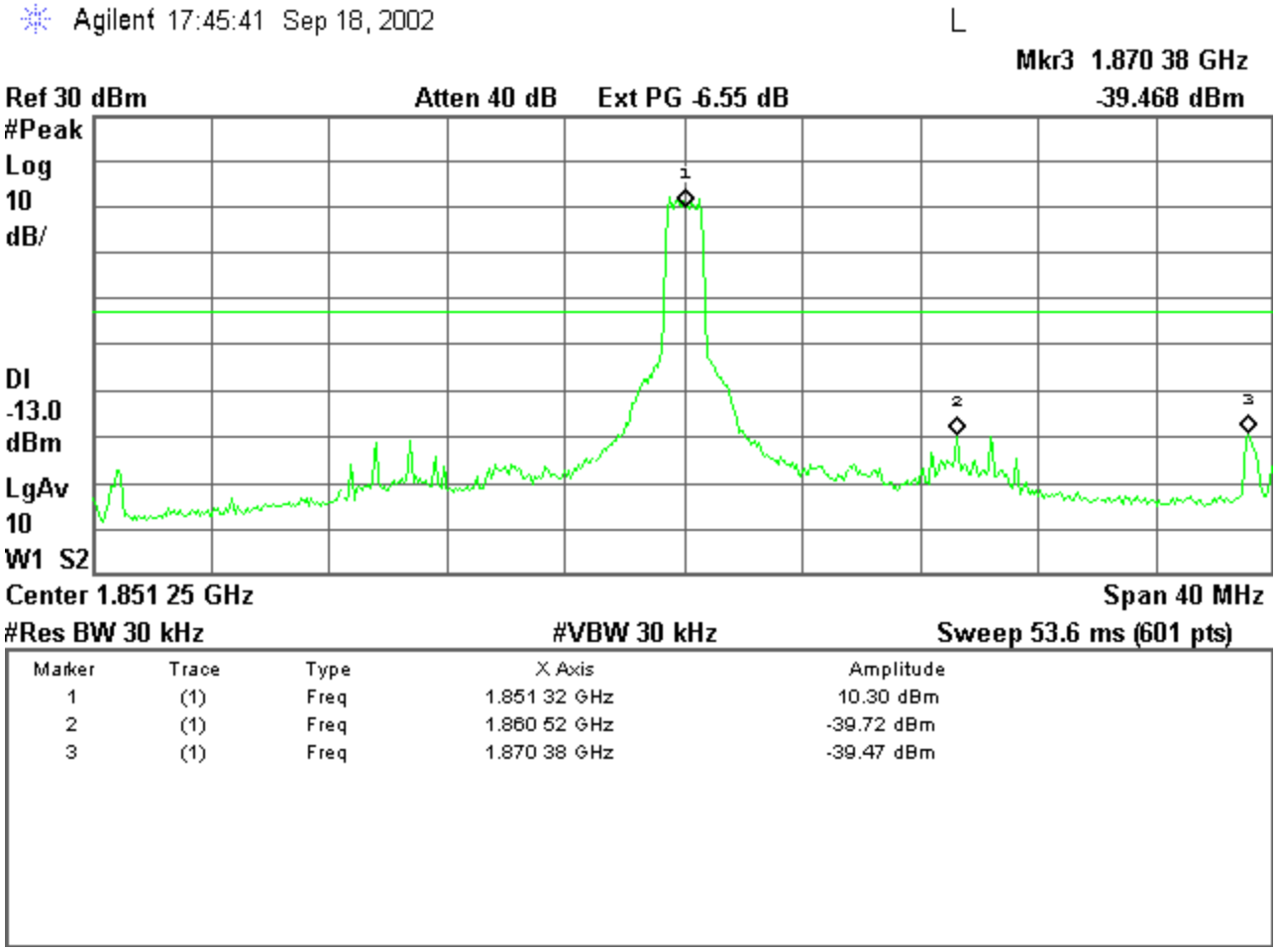
Plot 3.4a Out of Band Emissions at Antenna Terminals

Low channel, 1851.25 MHz
1 Mhz to 1 GHz



Plot 3.4b Out of Band Emissions at Antenna Terminals

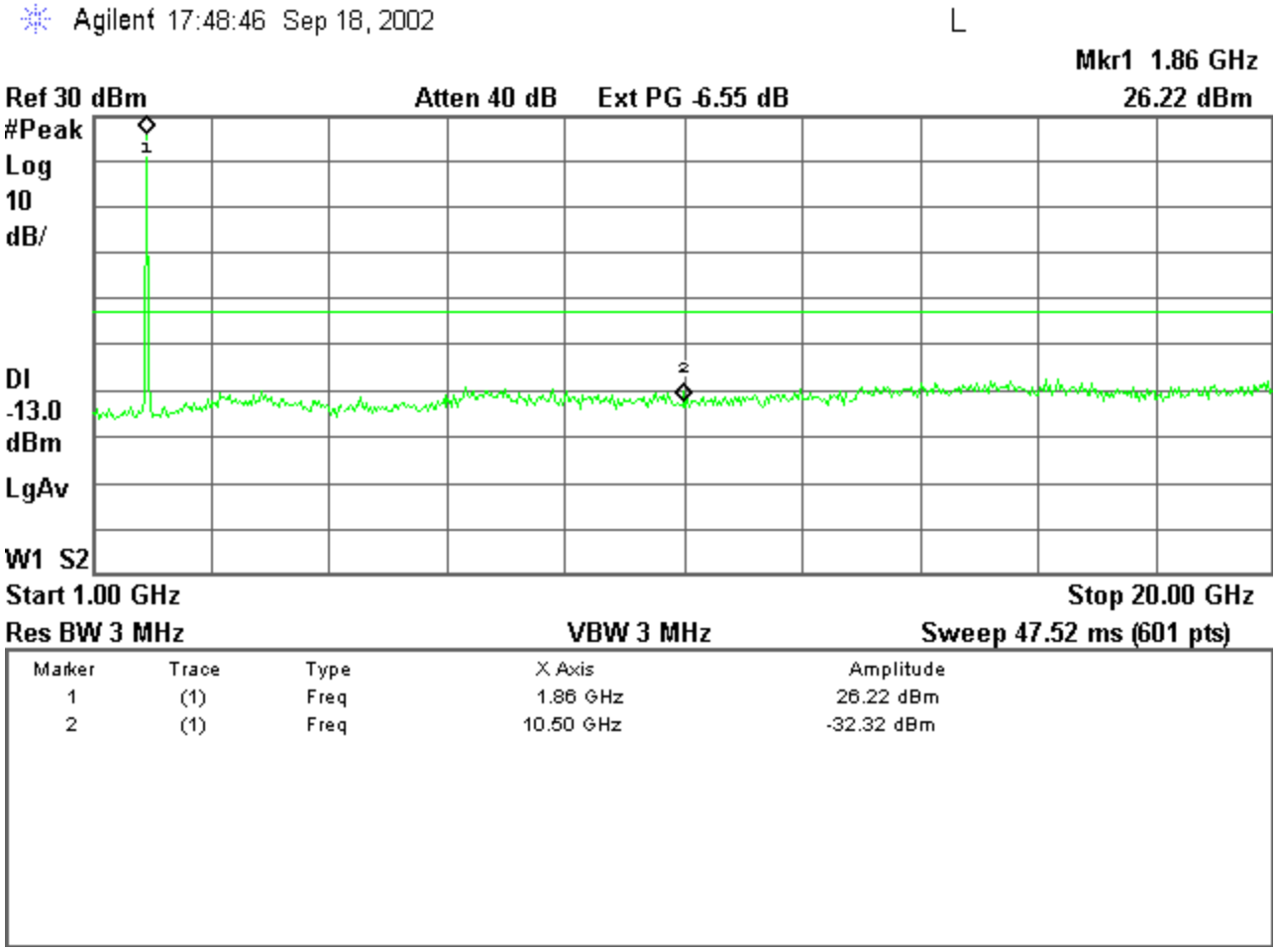
Low channel, 1851.25 MHz
TX signal +/- 20 MHz



Plot 3.4c Out of Band Emissions at Antenna Terminals

Low channel, 1851.25 MHz

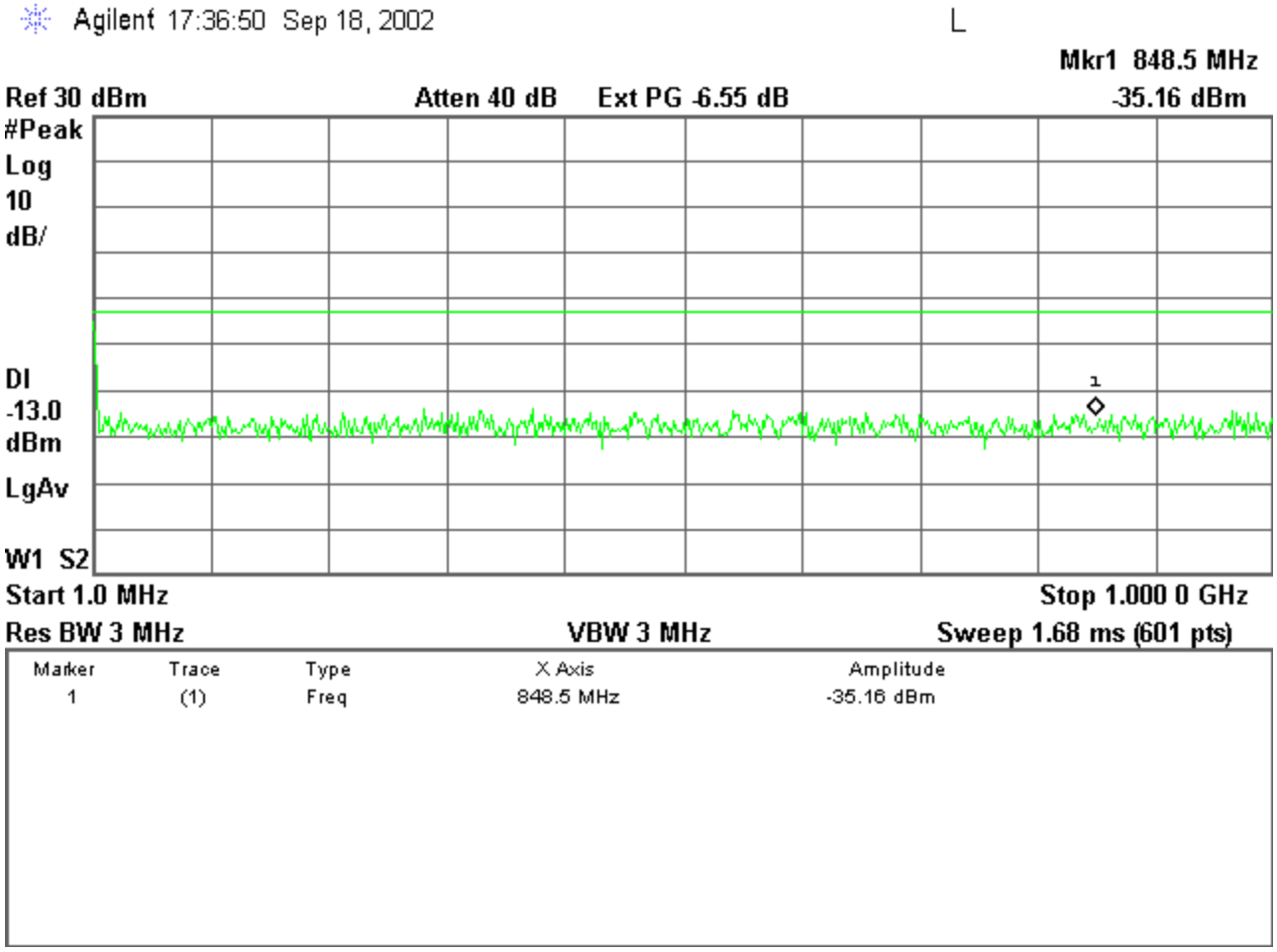
1 GHz to 20 GHz



Plot 3.5a Out of Band Emissions at Antenna Terminals

Mid Channel, 1880 MHz

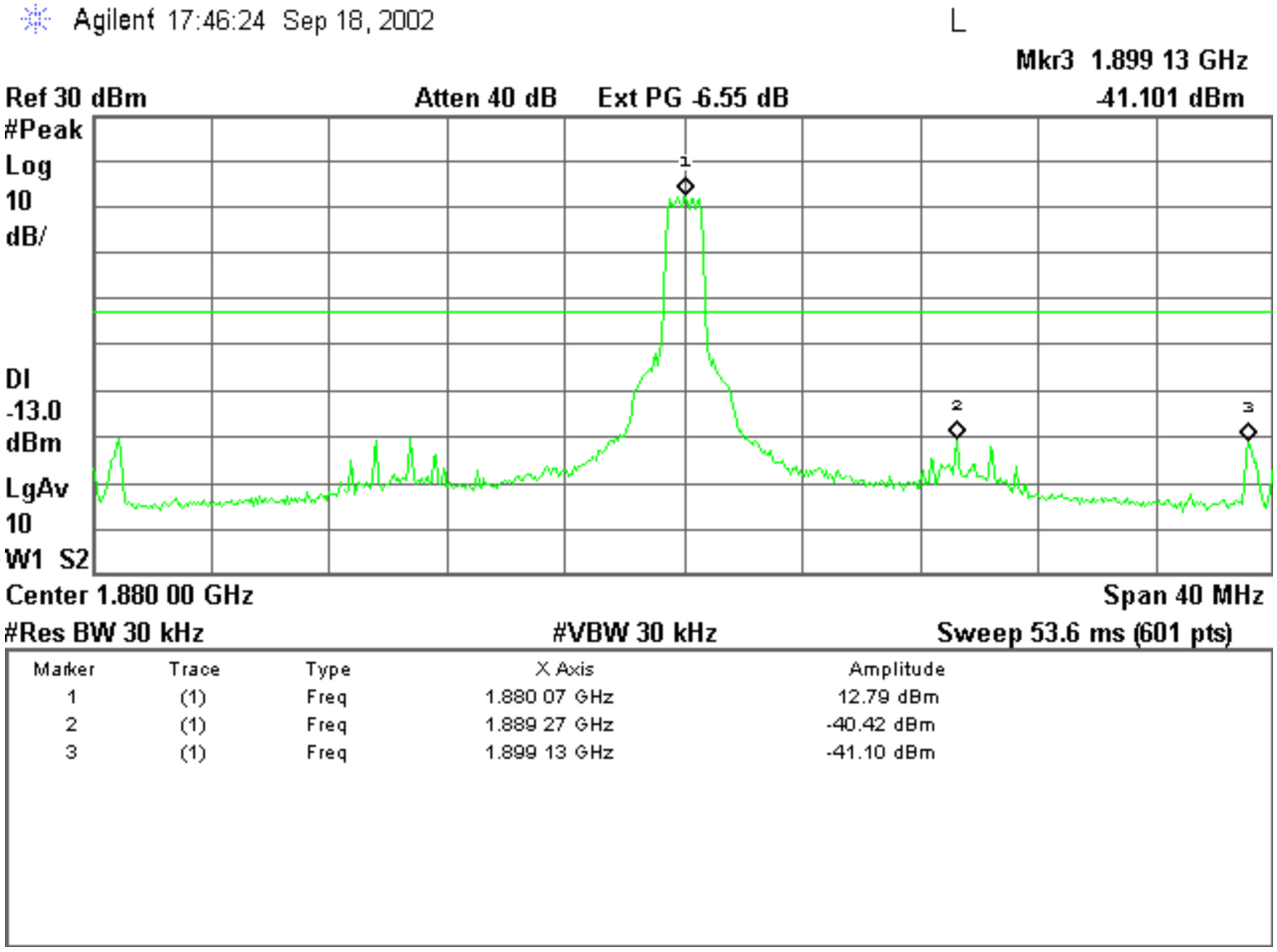
1 Mhz to 1 GHz



Plot 3.5b Out of Band Emissions at Antenna Terminals

Mid Channel, 1880 MHz

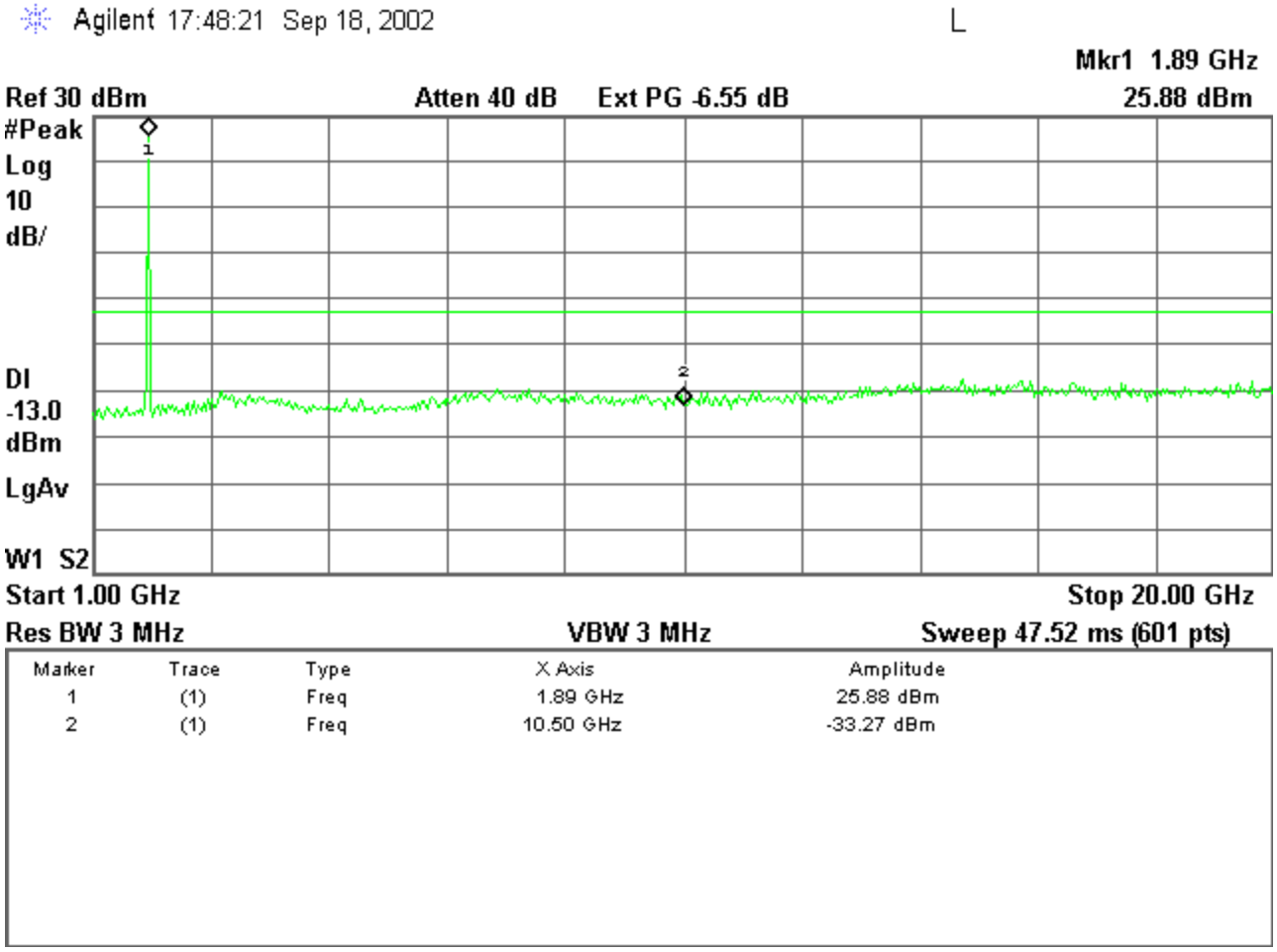
TX signal +/- 20 MHz



Plot 3.5c Out of Band Emissions at Antenna Terminals

Mid Channel, 1880 MHz

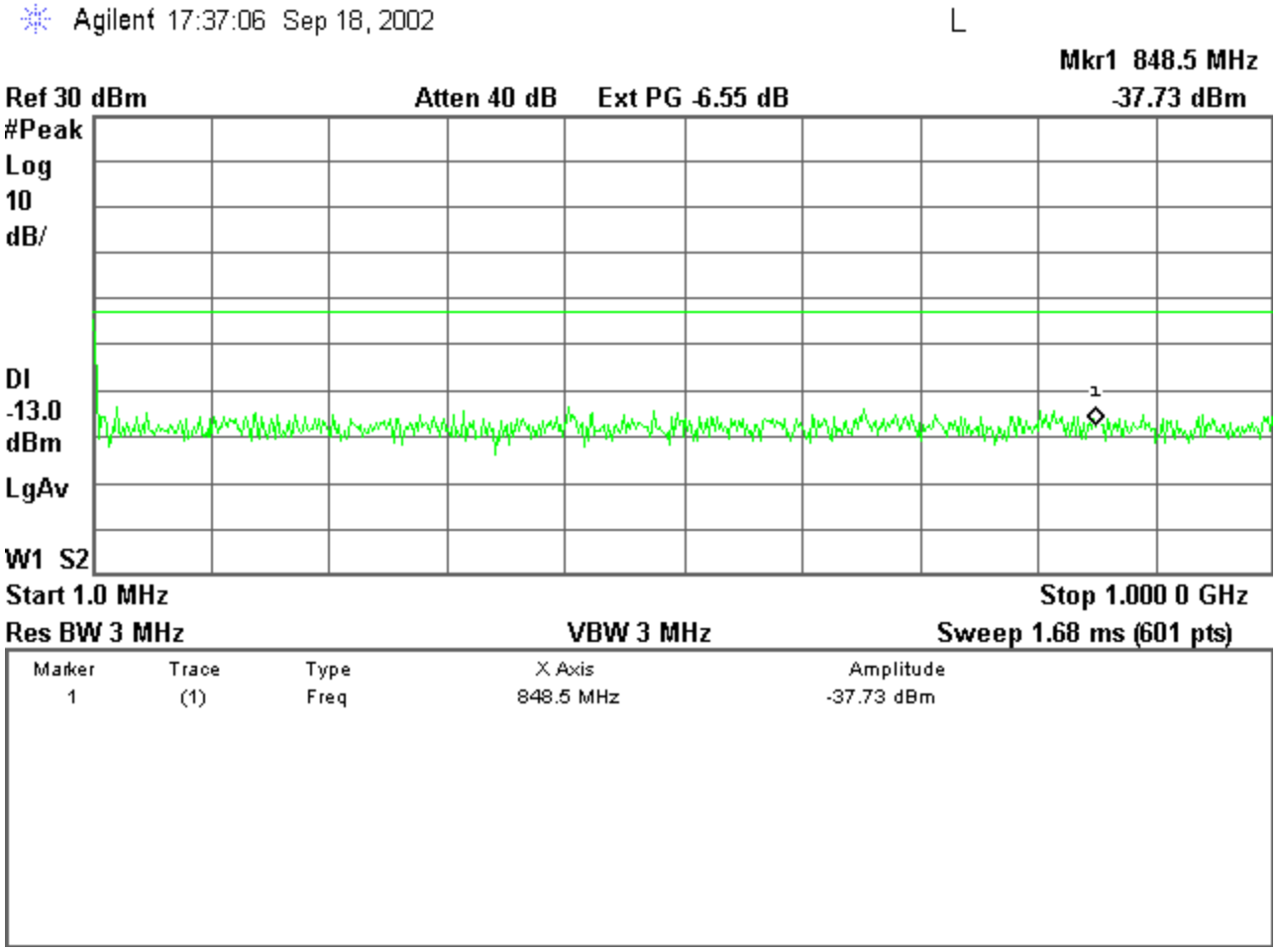
1 GHz to 20 GHz



Plot 3.6a Out of Band Emissions at Antenna Terminals

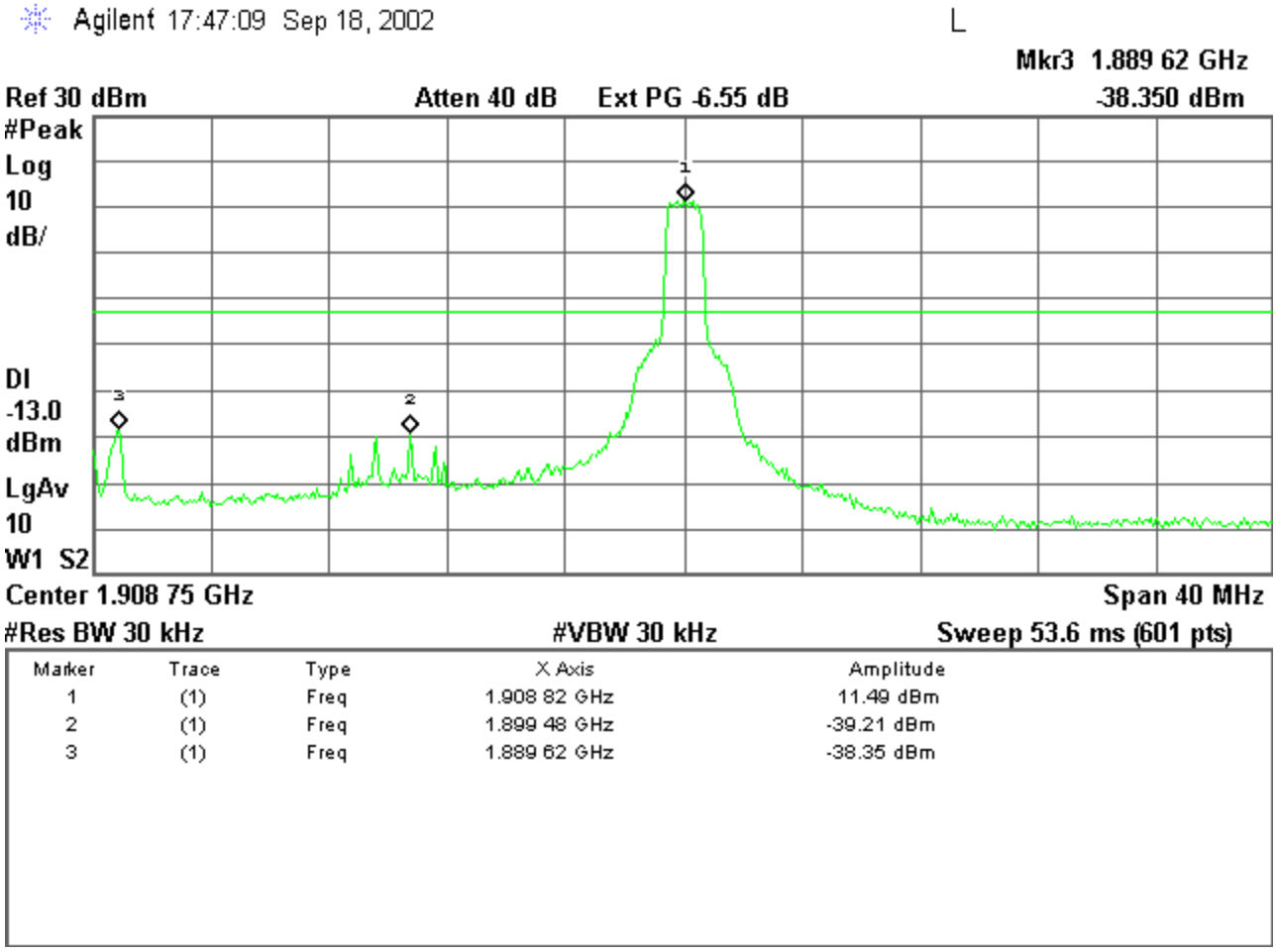
High Channel, 1908.75 MHz

1 Mhz to 1 GHz



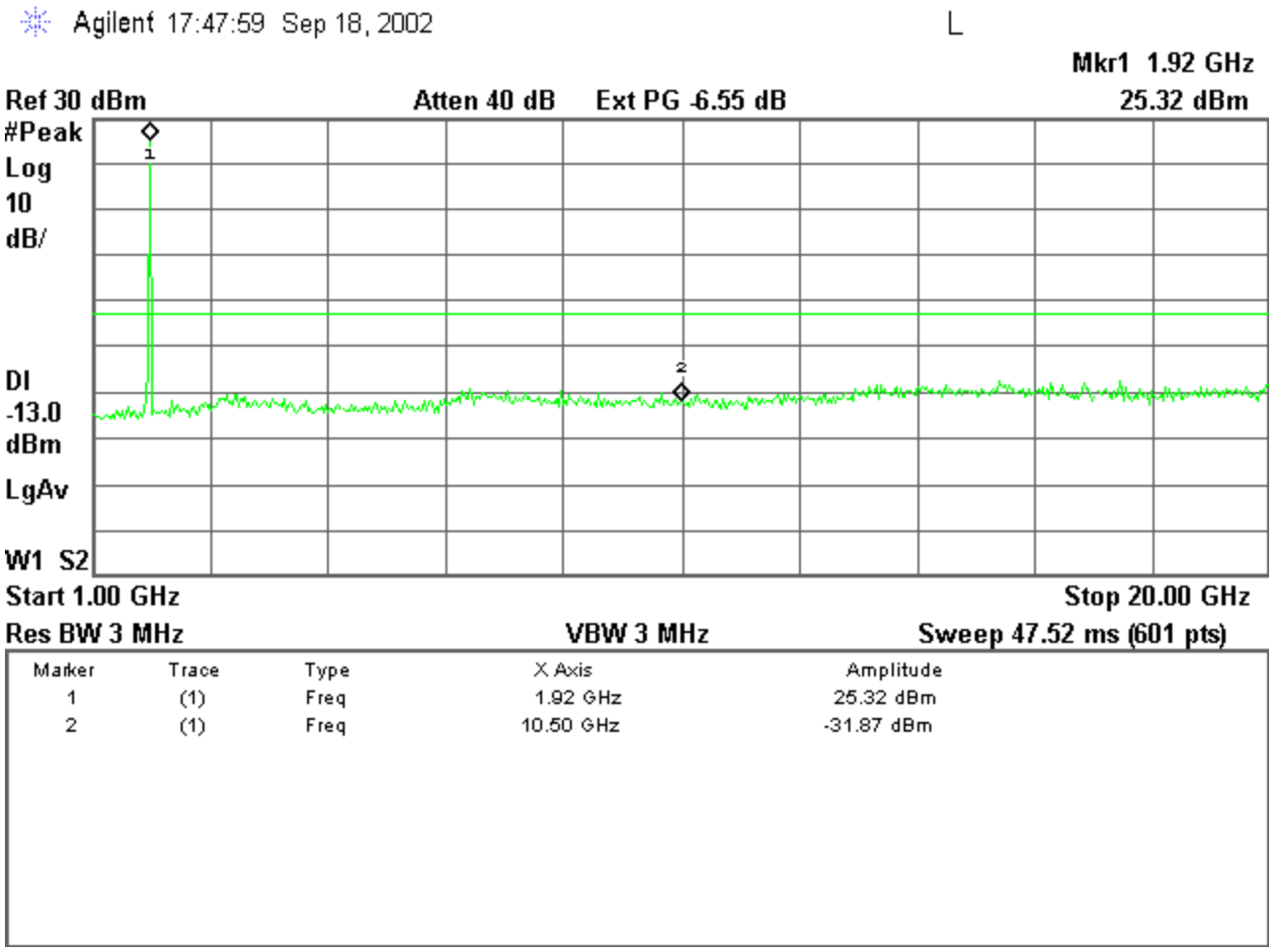
Plot 3.6b Out of Band Emissions at Antenna Terminals

High Channel, 1908.75 MHz
TX signal +/- 20 MHz

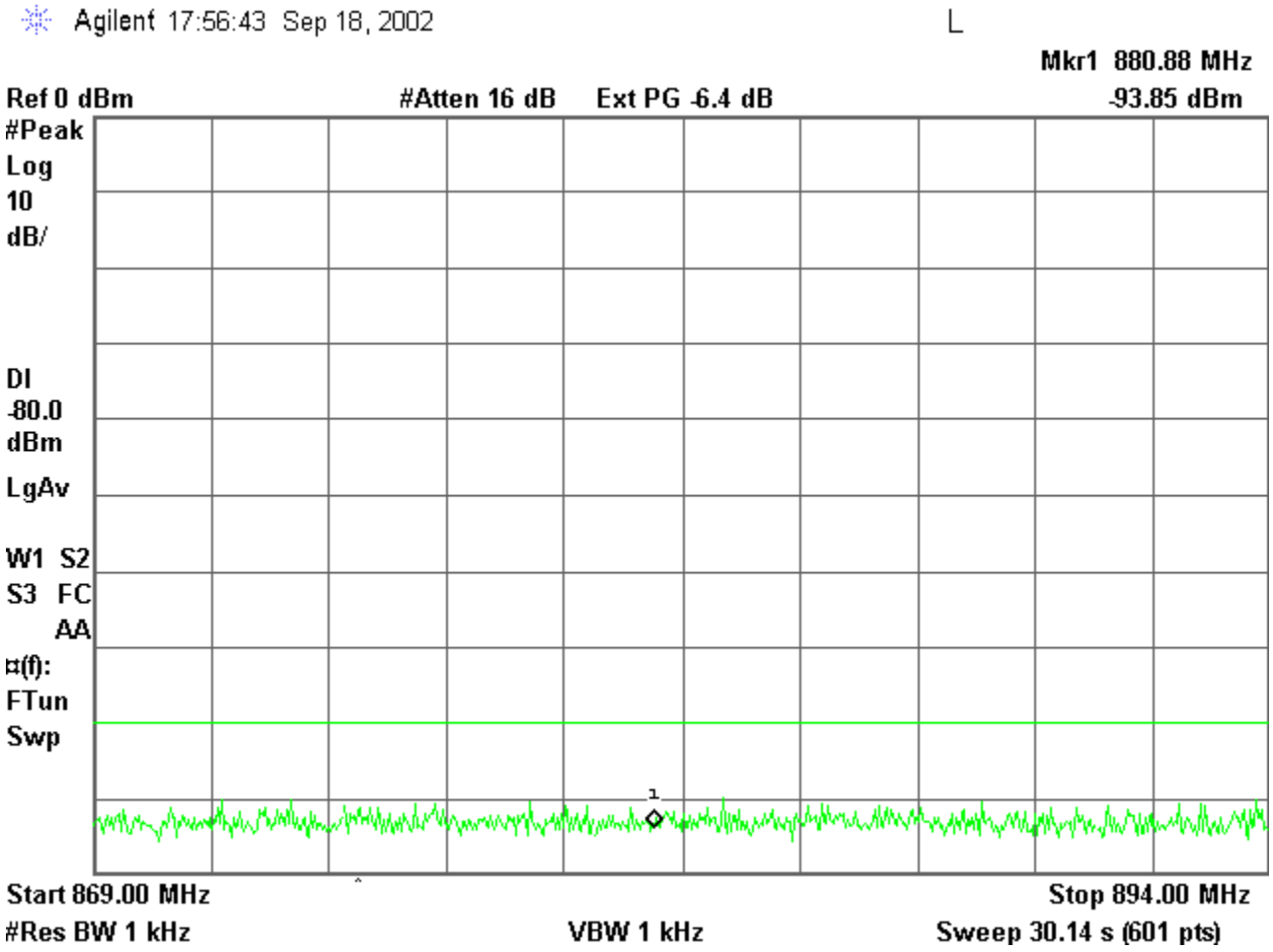


Plot 3.6c Out of Band Emissions at Antenna Terminals

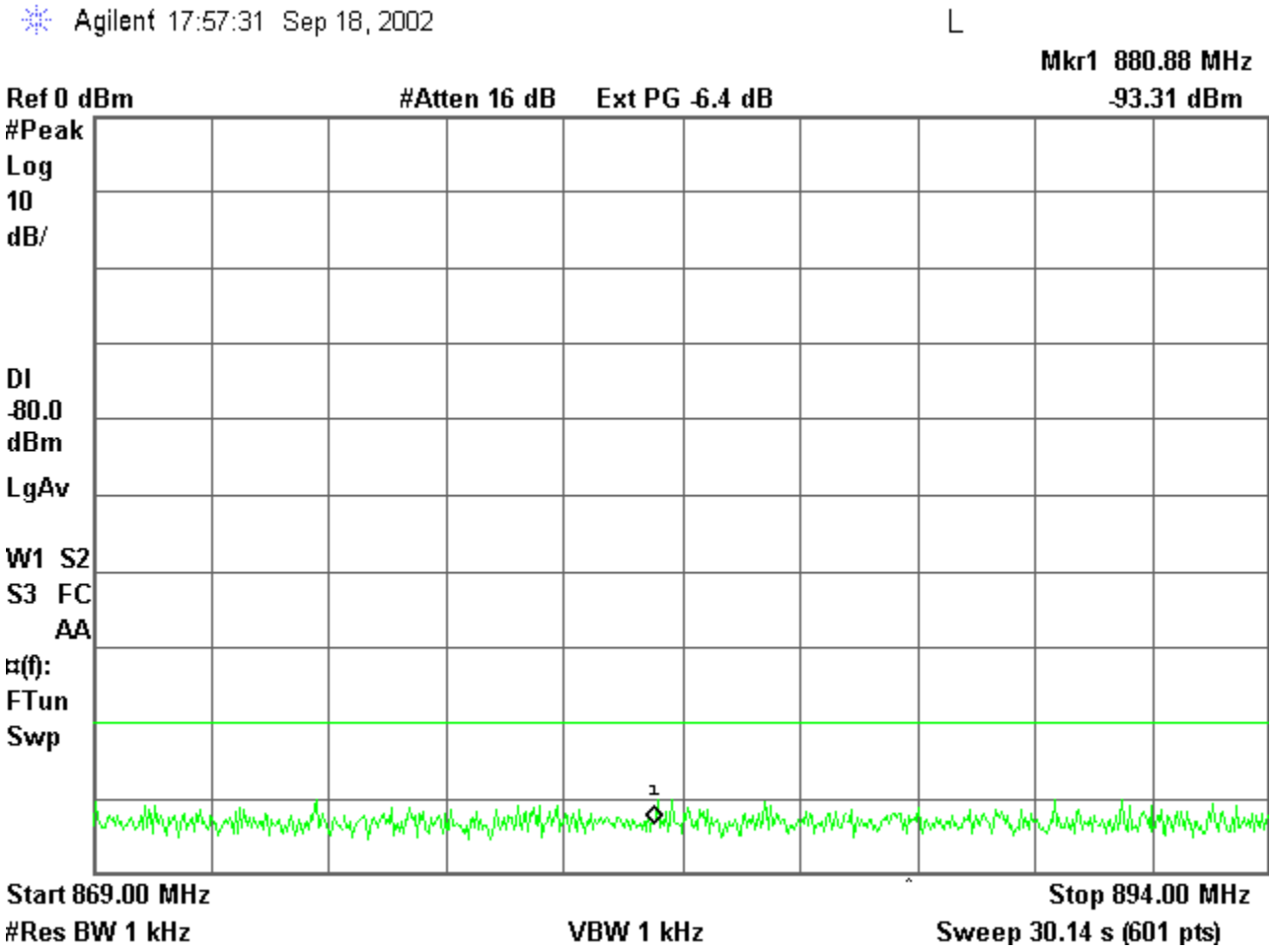
High Channel, 1908.75 MHz
1 GHz to 20 GHz



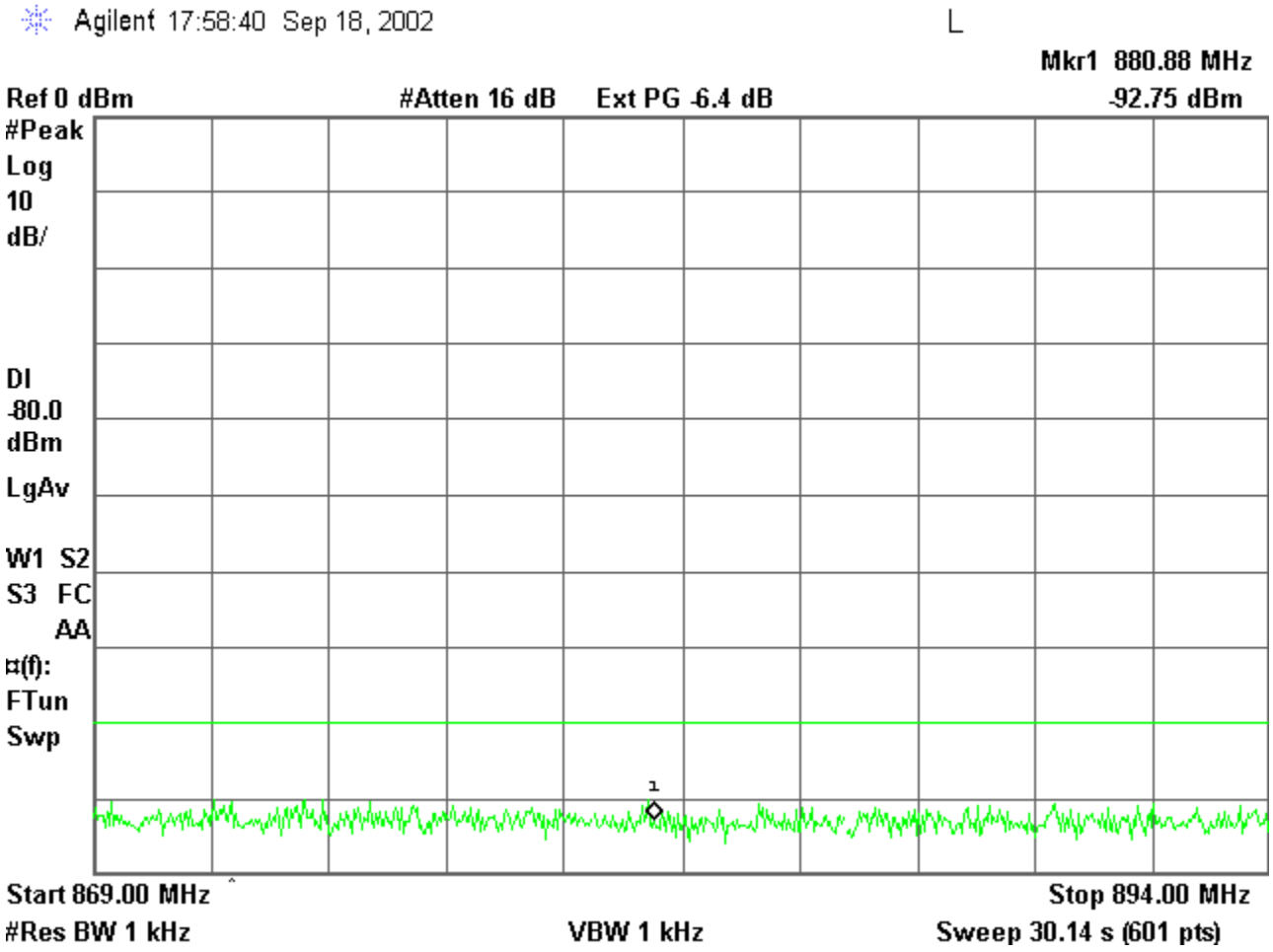
Plot 3.7a Low Channel, 824.70 MHz



Plot 3.7a Middle Channel, 836.52 MHz



Plot 3.7c High Channel, 848.31 MHz



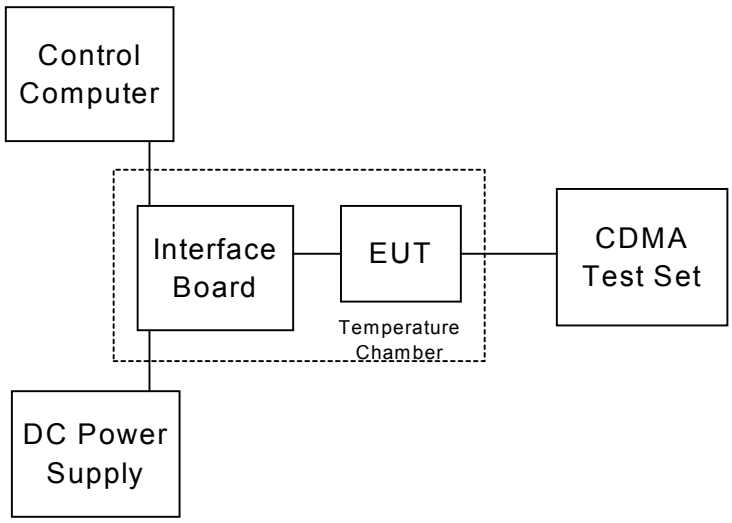
8 Frequency Stability vs Temperature

FCC 2.1055

8.1 Test Procedure

The SB555-S was placed inside the temperature chamber. The transmitting frequency error is measured at 25 deg C, then the temperature is set to –30 deg C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, then the measurement is repeated. This is repeated until 80 deg C is completed. Frequency metering included averaging of 50 samples per reading to stabilize the reading. Reference power supply voltage for these tests is 3.30 volts.

Test Setup



8.2 Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NO.	Last CAL. DATE
Wireless Test Set	Agilent	8960	US41070182	09/05/2001
DC Power Supply	Hewlett Packard	E3631A	MY40003202	1/11/00
Temperature Chamber	Sigma Systems	M30M	7550	N/a
Control Computer	ACT	Canadien	N/A	N/a
Interface Board	Shop built	Nest	N/a	N/a

8.3 Test Results

PCS band

	1880.00 MHz	
Temperature (degC)	Frequency error (Hz)	Worst case Frequency error (ppm)
25	1.83	.001
-30	1.21	-.001
-20	2.21	0
-10	2.22	.001
0	1.29	-.002
10	-0.32	-.002
20	-0.55	-.001
30	2.22	0
40	1.17	.001
50	1.65	.001
60	2.74	.001
70	1.18	.001
80	-1.89	.002

9 Frequency Stability vs Voltage

FCC 2.1055

9.1 Test Procedure

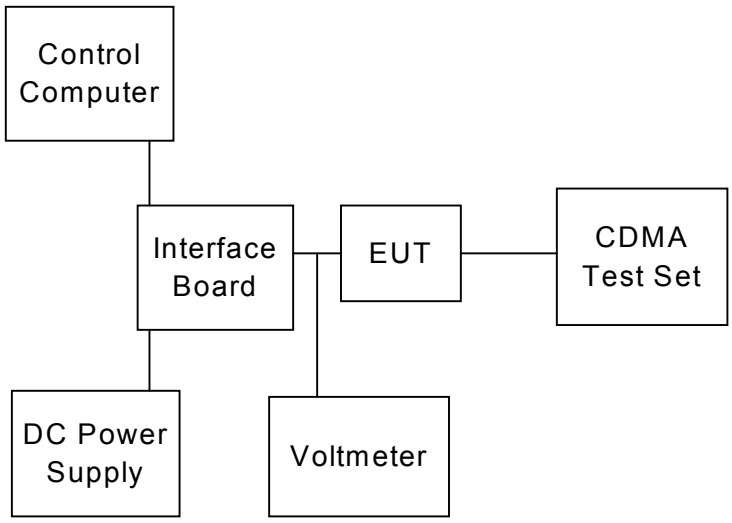
The SB555-S was connected to a DC Power Supply and a CDMA test set with frequency error measurement capability. The power supply output is adjusted to the test voltage as measured at the input terminals to the module while transmitting. A voltmeter was used to confirm the terminal voltage.

The test voltages are:

3.15 V, rated voltage
3.2 V, minimum specified operating voltage
4.2 V, maximum specified operating voltage.

The output frequency error was recorded for each voltage setting at one center channel for each band of operation. Frequency metering included averaging of 50 samples per reading to stabilize the reading.

Test Setup



9.2 Test Equipment

EQUIPMENT	MANUFACTURER	MODEL	SERIAL NO.	Last Cal. DATE
CDMA Test Set	Agilent	8960	US41070182	09/05/2001
DC Power Supply	Hewlett Packard	HP6632A	3326A-03423	N/A
Control Computer	TC	Generic PC	100844	N/a
Interface Board	Shop built	Nest	N/a	N/a
Voltmeter	Fluke	75III	78270326	21/12/01

9.3 Test Results

Cellular Band

Expected Transmitting Frequency : **837.00 MHz**

Vcc (Volts)	**Measured Frequency Error (Hz)**	**Measured Frequency Error (ppm) see note 1 below**
3.3	2.77	.001 (+/-.006)
3.2	3.29	-.002 (+/-.006)
4.2	0.77	-.001 (+/-.006)

PCS Band

Expected Transmitting Frequency: **1880 MHz**

Vcc (Volts)	**Measured Frequency Error (Hz)**	**Measured Frequency Error (ppm) see note 1 below**
3.3	2.00	0 (+/-.006)
3.2	1.02	.001 (+/-.006)
4.2	1.14	.001 (+/-.006)

Note 1 There is considerable short-term variation of the frequency as measured on an 8960 test set. Without averaging, an actual error of 0 Hz can appear to vary from –50 to +50 Hz from one sample to the next due to the effect of the CDMA modulation. Averaging helps steady this variation down to +/- 5 Hz or less, and that is what was used for our tests. Observation of the readings by the test engineer are that the variation is symmetrical around 0 Hz.

This data shows that frequency stability versus voltage meets the requirements.