

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

**FCC ID: N7NSB555**

**Prepared by  
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RICHMOND, BC V6V 3A4  
CANADA**

**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

| FCC RULE                                     | DESCRIPTION OF TEST                                                                          | RESULT   | PAGE              |
|----------------------------------------------|----------------------------------------------------------------------------------------------|----------|-------------------|
| 2.1046                                       | RF Power Output                                                                              | Complies | 6                 |
| 2.1049                                       | Occupied Bandwidth                                                                           | Complies | 15                |
| 2.1051, 22.901(d)<br>22.917(f),<br>24.238(a) | Out of Band Emissions at Antenna<br>Terminals<br>Mobile Emissions In Base Frequency<br>Range | Complies | 18                |
| 2.1053                                       | Field Strength of Spurious Radiation                                                         | Complies | See CCS<br>Report |
| 2.1055                                       | Frequency Stability vs Temperature                                                           | Complies | 44                |
| 2.1055                                       | Frequency Stability vs Voltage                                                               | Complies | 45                |

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.

|                                                      |                                                                                                                  |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>EUT Type</b>                                      | Cellular and PCS CDMA Embedded Modem                                                                             |
| <b>Whether quantity(&gt;1) production is planned</b> | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                              |
| <b>Standards</b>                                     | CDMA2000                                                                                                         |
| <b>Types of Emission</b>                             | 1M25F9W                                                                                                          |
| <b>RF Output Power</b>                               | 824-849 MHz:      23.5 dBm max<br>1850-1910 MHz:    23.5 dBm max<br>In both bands, power is variable to –50 dBm. |
| <b>Frequency Range</b>                               | 824-849 MHz, 1850-1910 MHz                                                                                       |

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### 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 |
|        |             |           |                 |

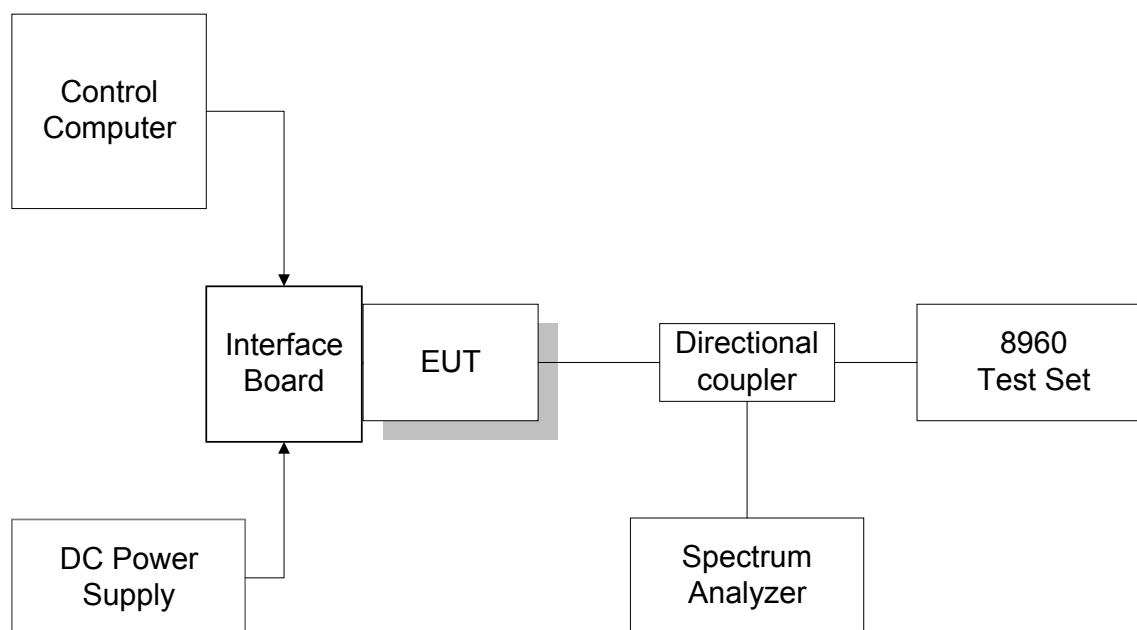
## 5 RF Power Output

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        |

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### 5.3 Test Results

| Frequency<br>(MHz) | Power<br>(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.

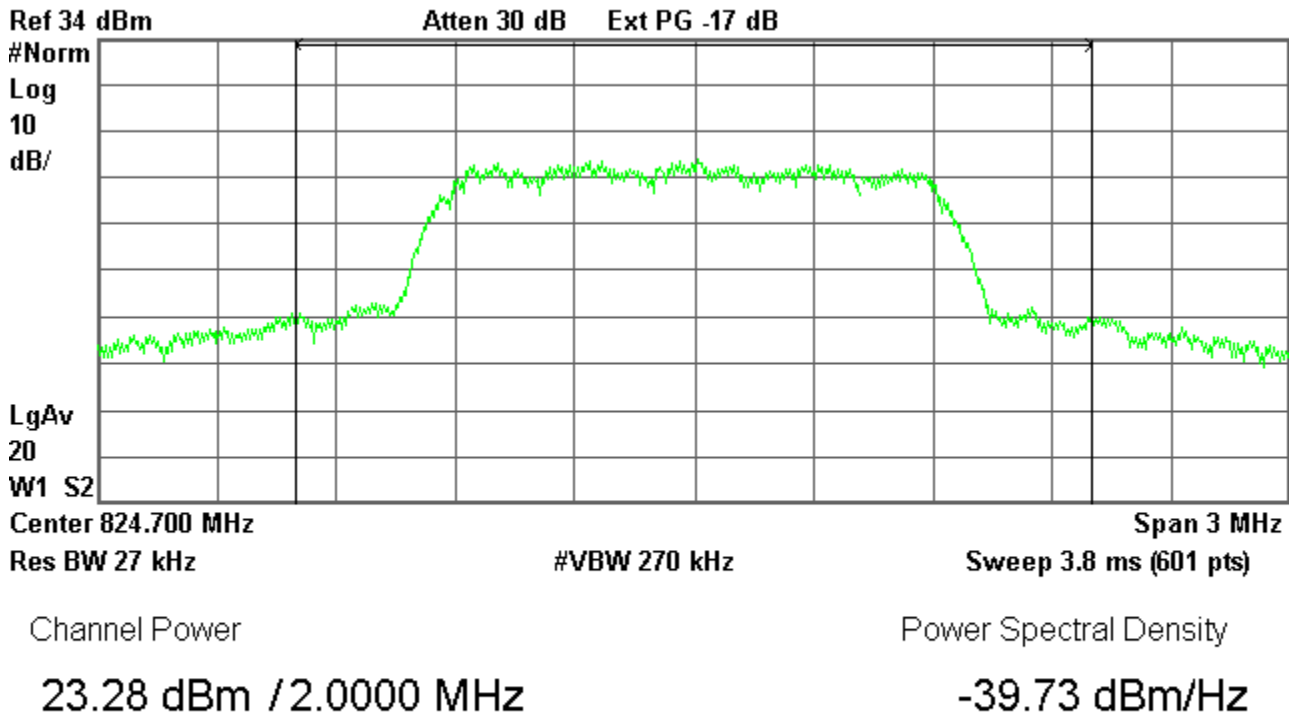
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|                              |         |           |              |
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## Plot 1.1 Cellular Band (Low Channel)

\* Agilent 16:28:31 Sep 24, 2002

L



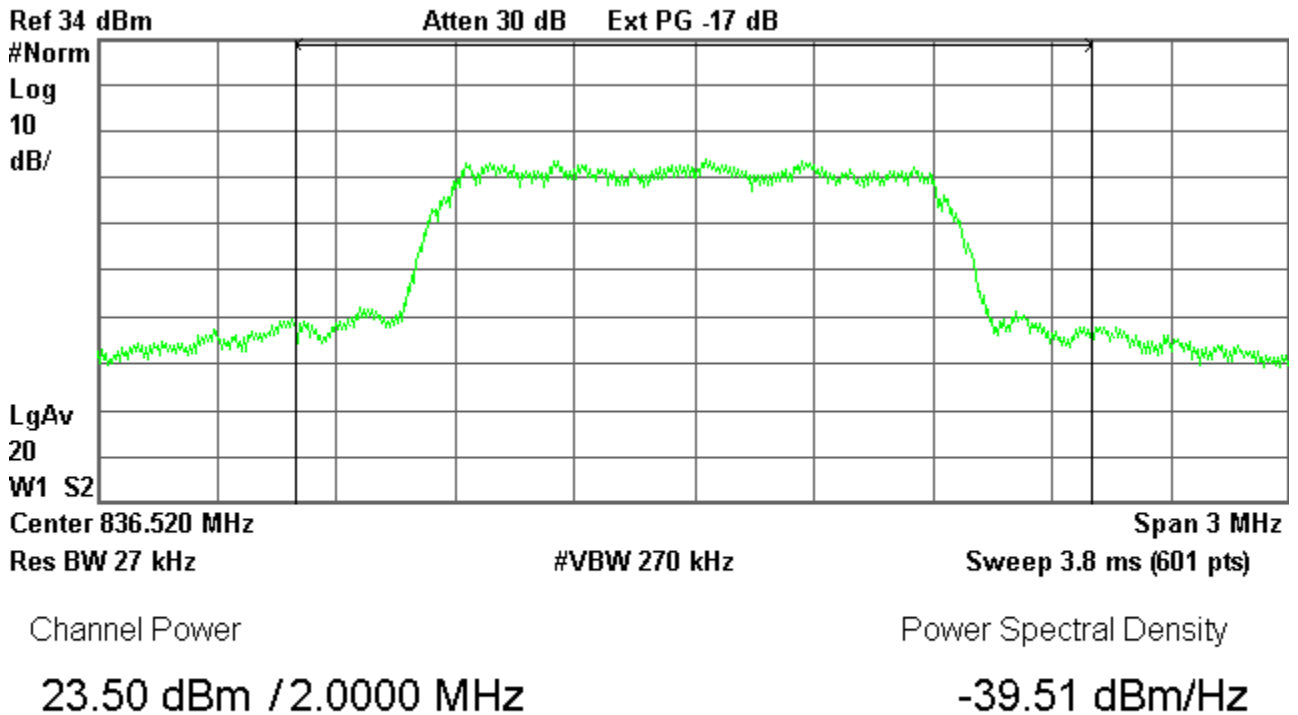
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|------------------------------|---------|-----------|--------------|
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## Plot 1.2 Cellular Band (Middle Channel)

\* Agilent 16:29:03 Sep 24, 2002

L



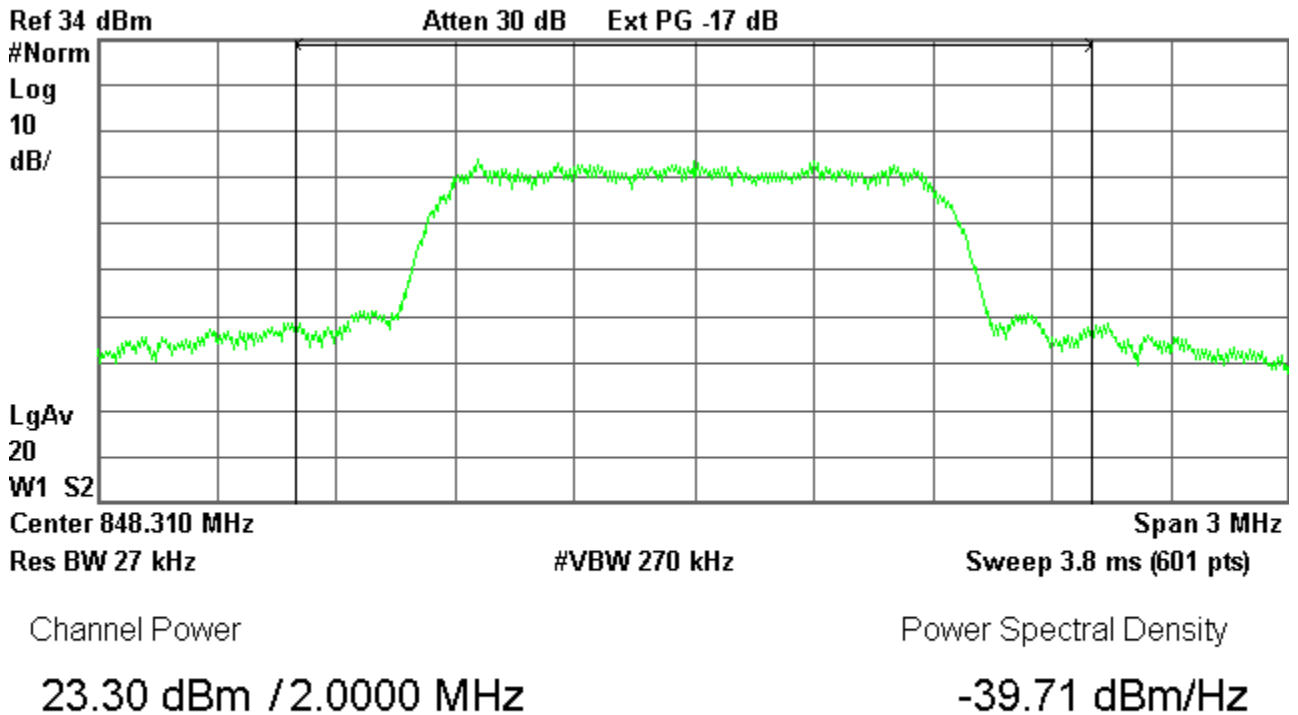
# SIERRA WIRELESS, INC.

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|------------------------------|---------|-----------|---------------|
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## Plot 1.3 Cellular Band (High Channel)

\* Agilent 16:29:46 Sep 24, 2002

L



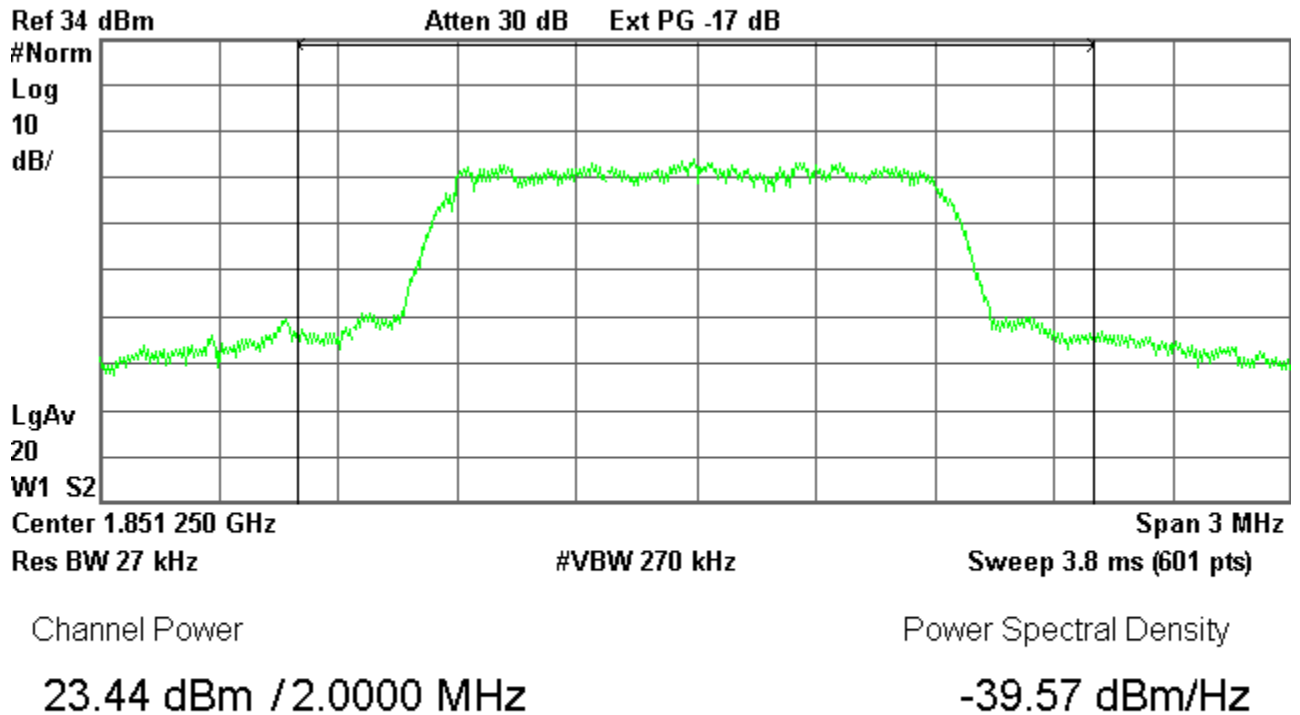
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## Plot 1.4 PCS Band (Low Channel)

✱ Agilent 16:25:49 Sep 24, 2002

L



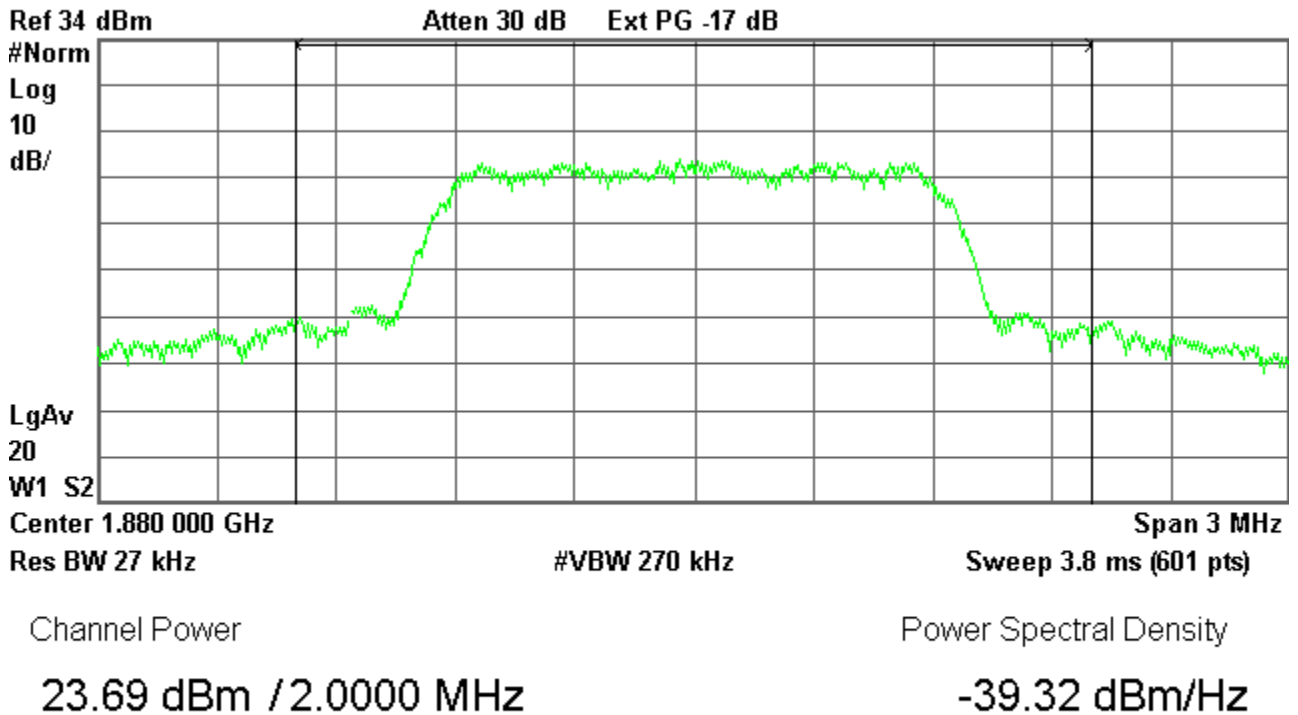
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|------------------------------|---------|-----------|---------------|
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## Plot 1.4 PCS Band (Middle Channel)

\* Agilent 16:24:39 Sep 24, 2002

L



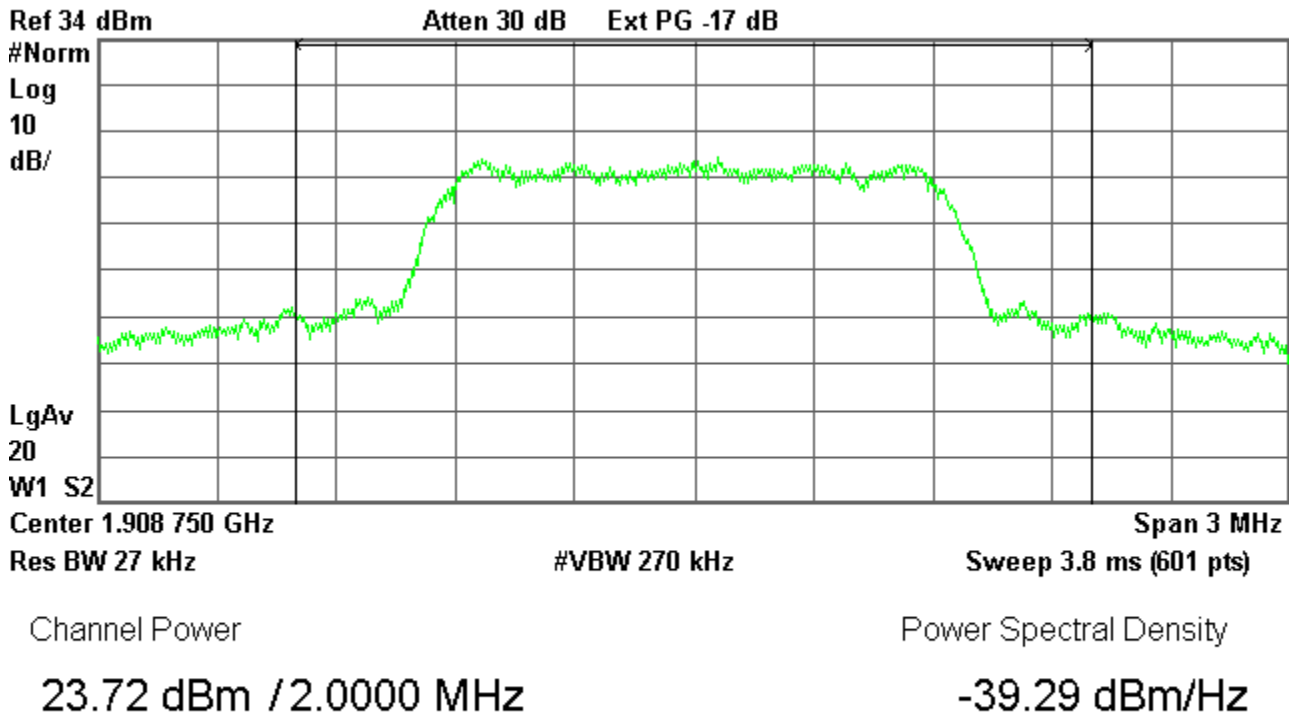
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## Plot 1.4 PCS Band (High Channel)

\* Agilent 16:26:50 Sep 24, 2002

L



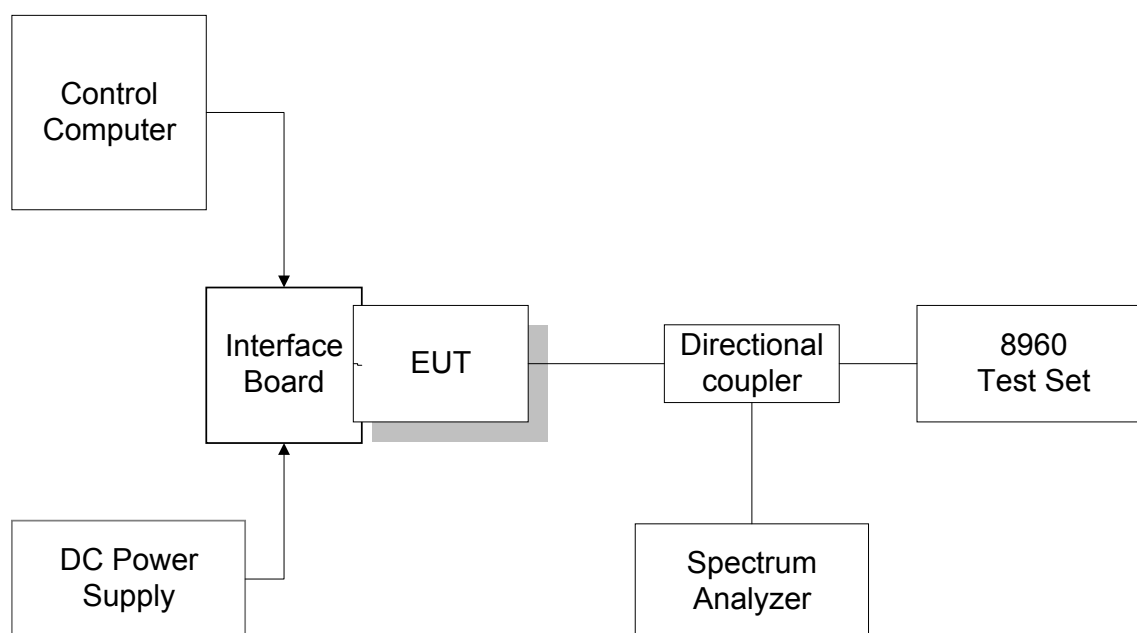
## 6 Occupied Bandwidth

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.

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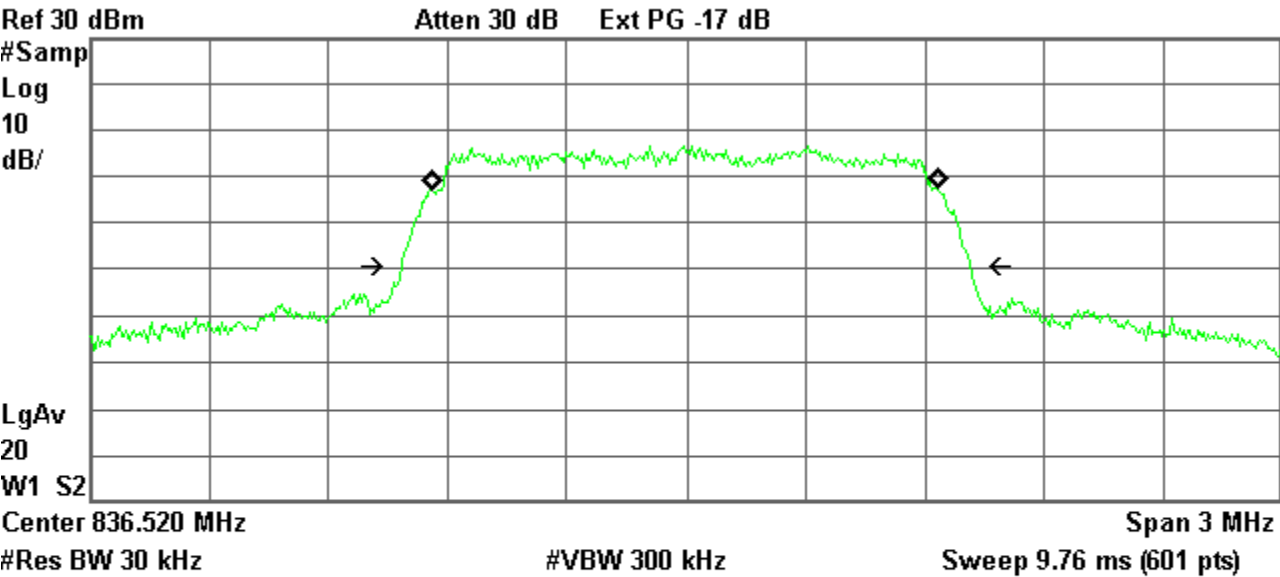
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Plot 2.1 Cellular Band (Middle Channel)

Agilent 12:53:44 Sep 24, 2002

L



Occupied Bandwidth  
1.2726 MHz

Occ BW % Pwr      99.00 %  
x dB      -26.00 dB

Transmit Freq Error      -1.760 kHz  
x dB Bandwidth      1.432 MHz\*

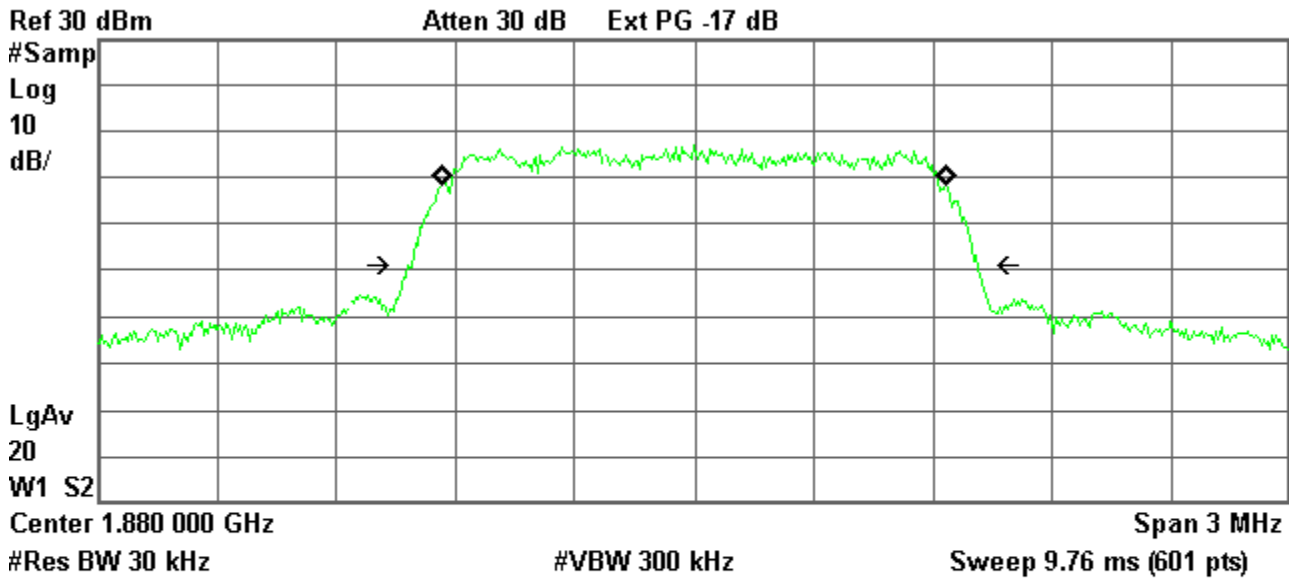
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## Plot 2.2 PCS Band (Middle Channel)

\* Agilent 12:54:22 Sep 24, 2002

L



Occupied Bandwidth  
1.2716 MHz

Occ BW % Pwr      99.00 %  
x dB      -26.00 dB

Transmit Freq Error      -106.709 Hz  
x dB Bandwidth      1.434 MHz\*

## 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.

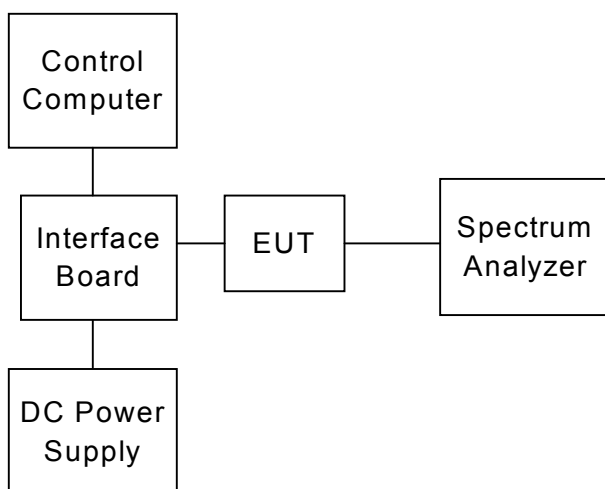
### Mobile Emissions in Base Frequency Range:

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 10<sup>th</sup> 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            |

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### 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.

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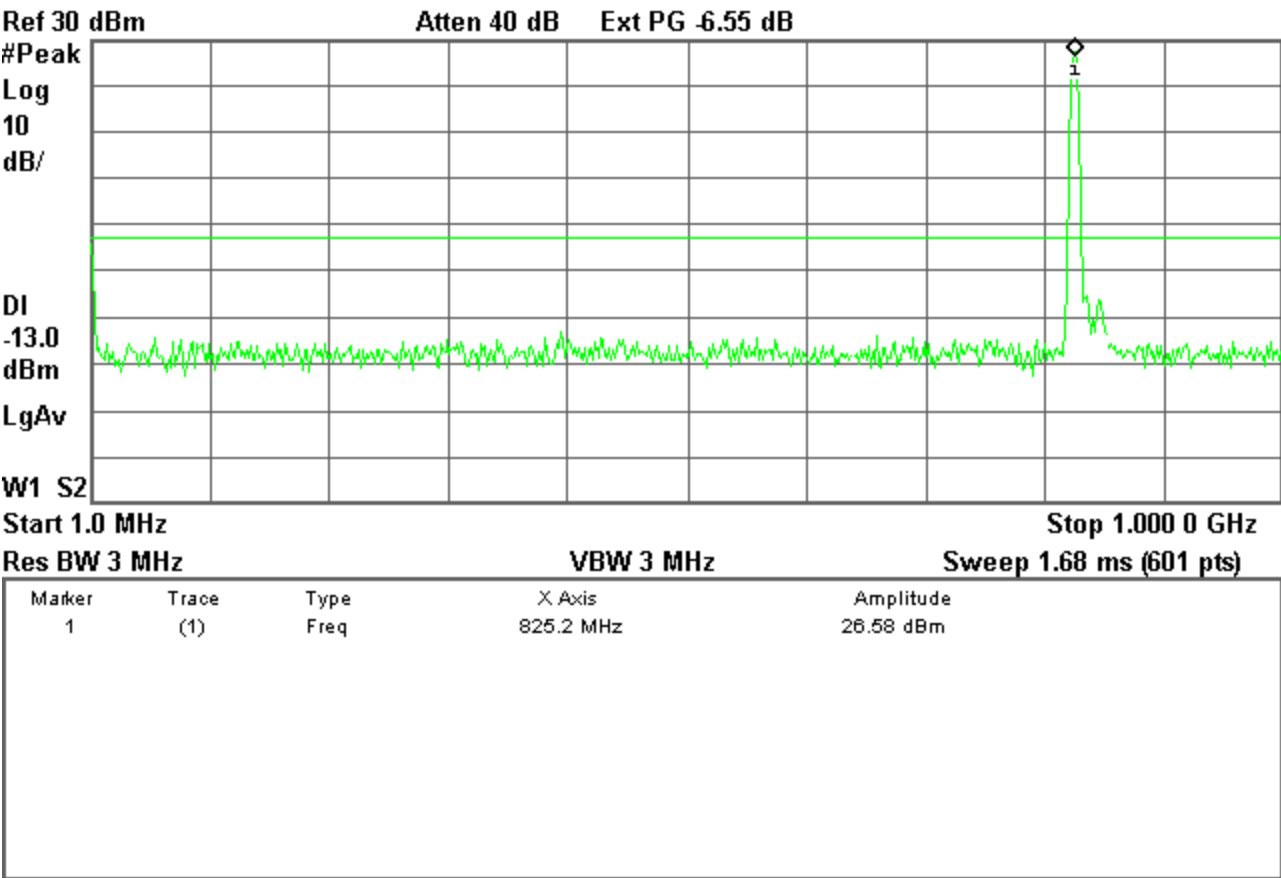
|                              |         |           |               |
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Plot 3.1a Out of Band Emissions at Antenna Terminals

Low channel, 824.700 MHz,  
1 Mhz to 1 GHz

✱ Agilent 17:34:57 Sep 18, 2002

L



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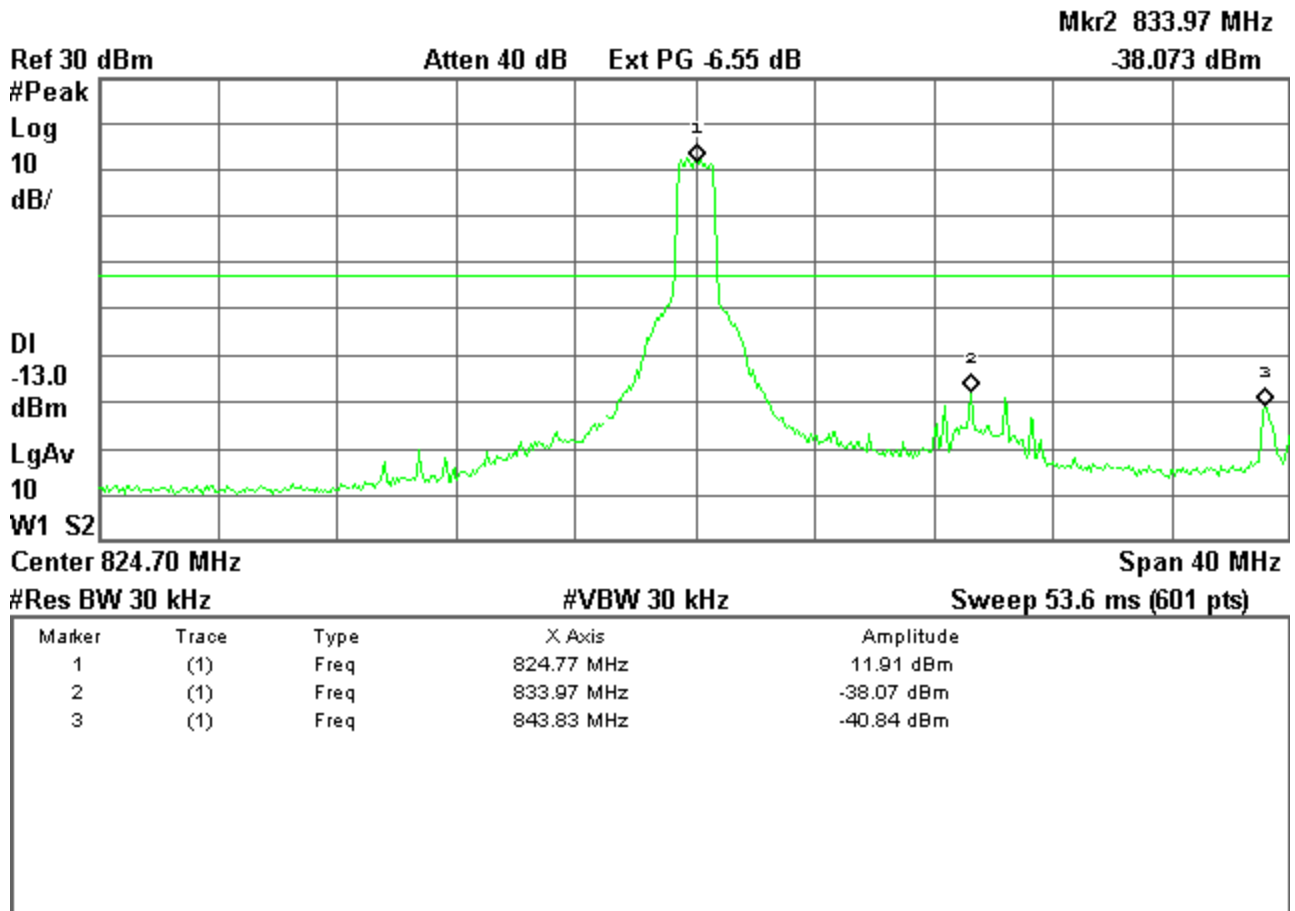
## Plot 3.1b Out of Band Emissions at Antenna Terminals

Low channel, 824.700 MHz

TX signal +/- 20 MHz

Agilent 17:38:19 Sep 18, 2002

L



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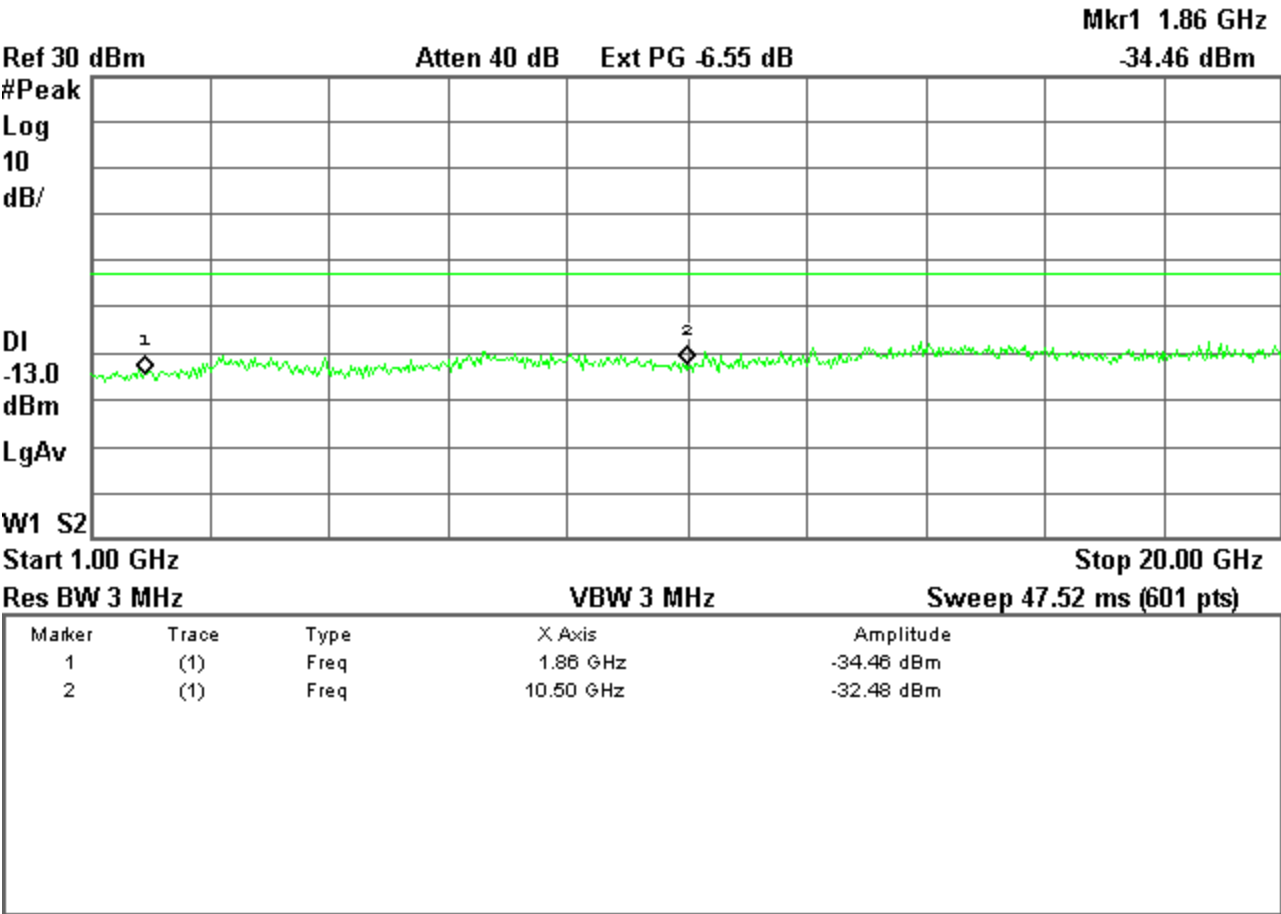
|                              |         |           |               |
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Plot 3.1c Out of Band Emissions at Antenna Terminals

Low channel, 824.700 MHz  
1 GHz to 20 GHz

Agilent 17:49:33 Sep 18, 2002

L



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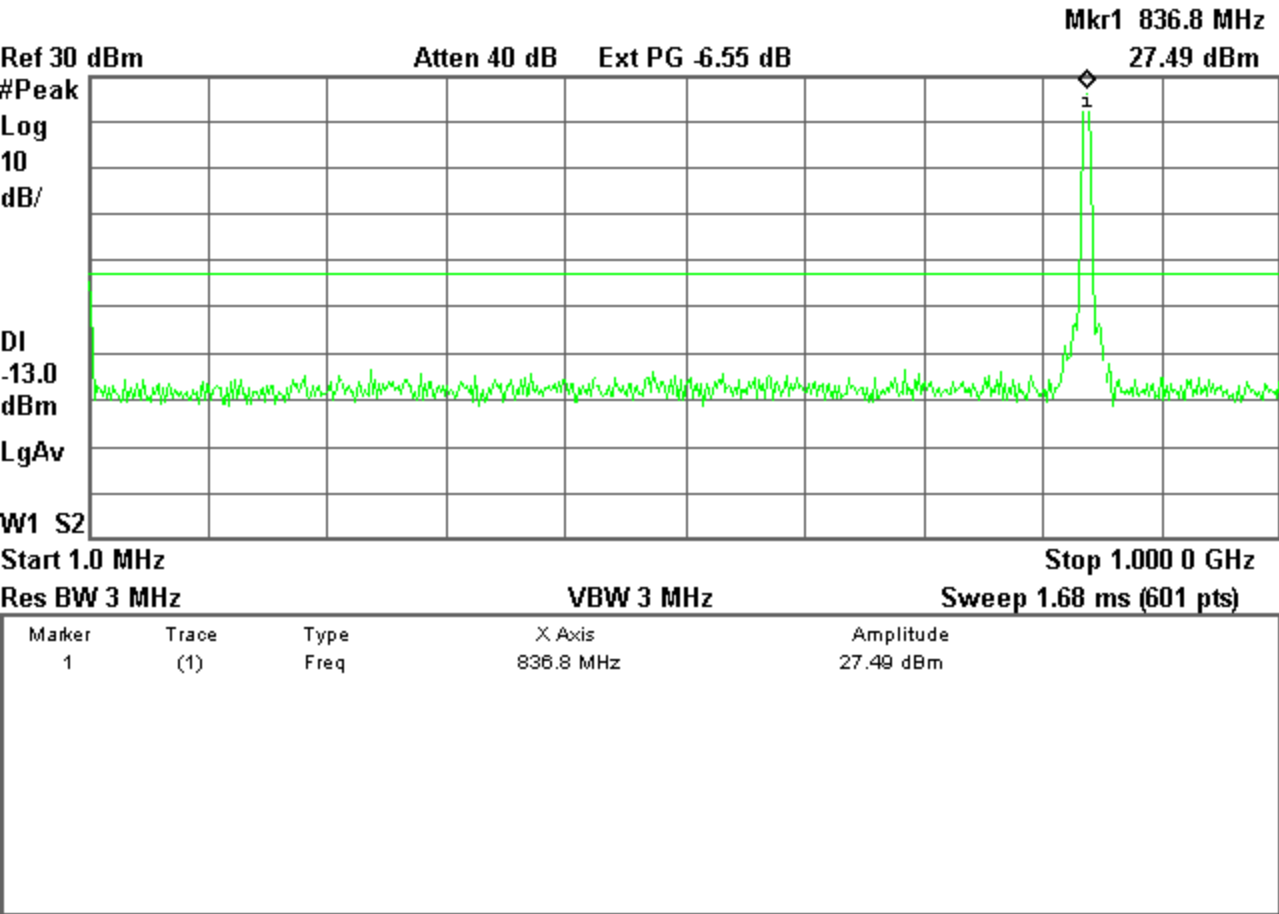
|                              |         |           |               |
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Plot 3.2a Out of Band Emissions at Antenna Terminals

Mid Channel, 836.52 MHz  
1 MHz to 1 GHz

Agilent 17:35:26 Sep 18, 2002

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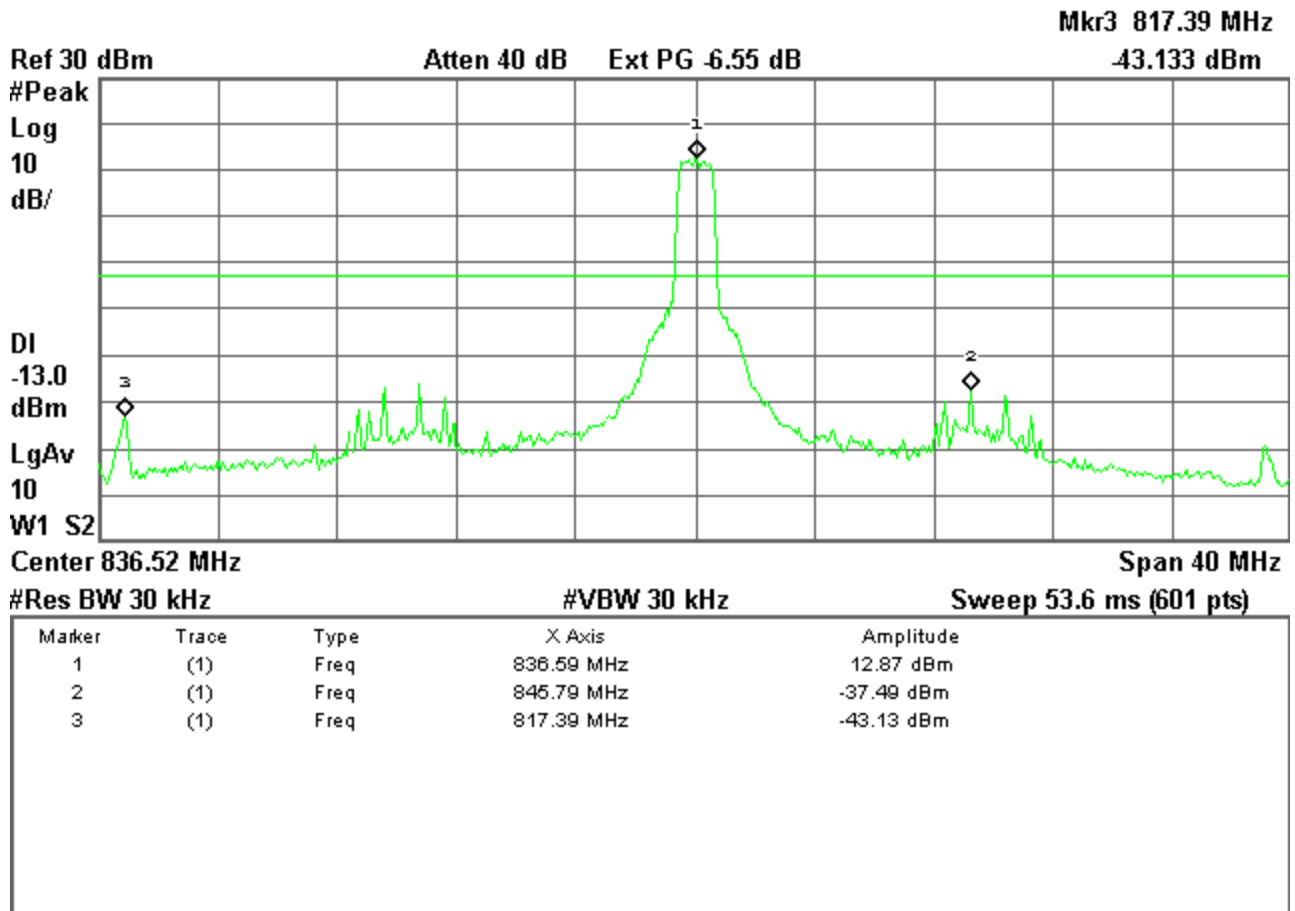
## Plot 3.2b Out of Band Emissions at Antenna Terminals

Mid Channel, 836.52 MHz

TX signal +/- 20 MHz

Agilent 17:39:31 Sep 18, 2002

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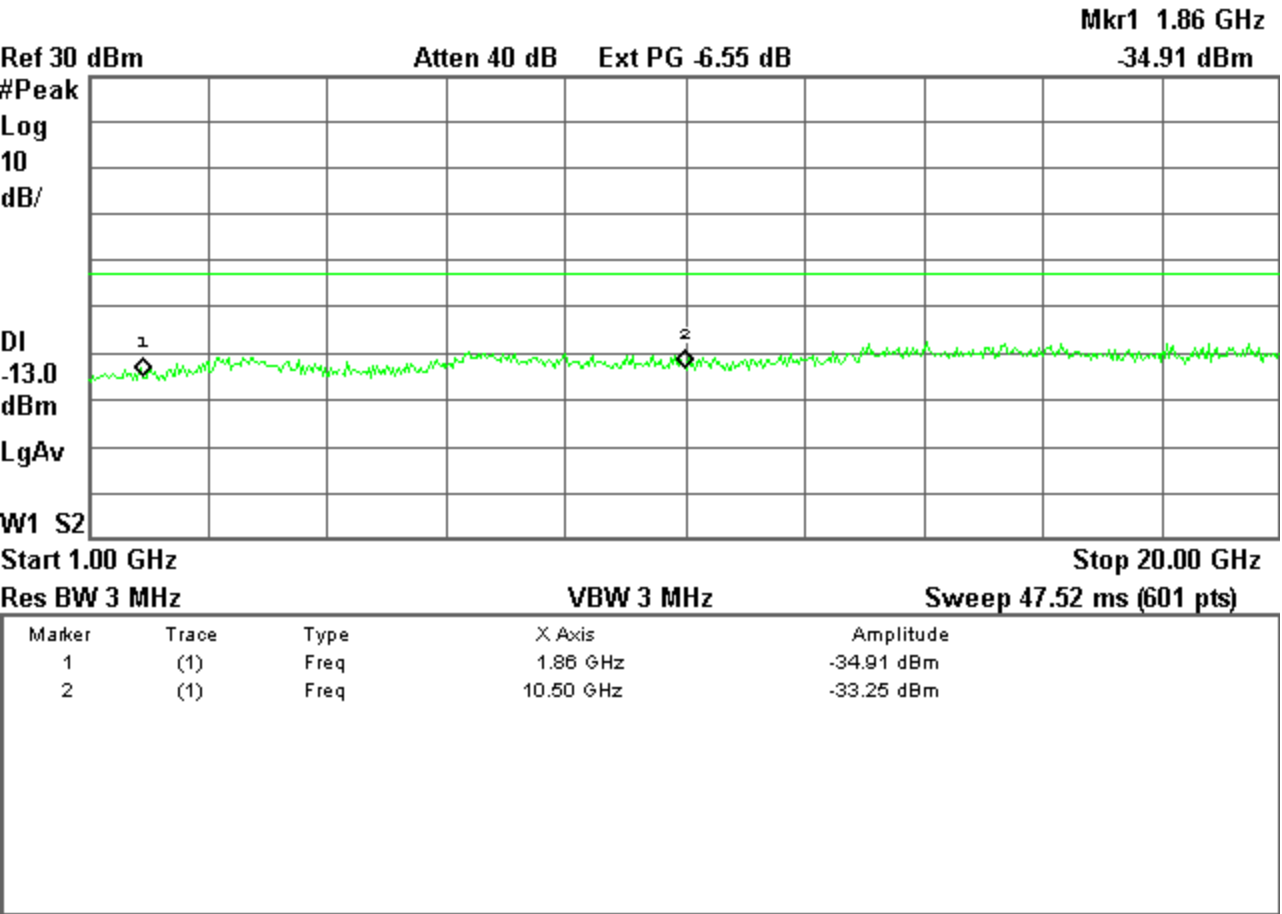
Plot 3.2c Out of Band Emissions at Antenna Terminals

Mid Channel, 836.52 MHz

1 GHz to 20 GHz

Agilent 17:49:22 Sep 18, 2002

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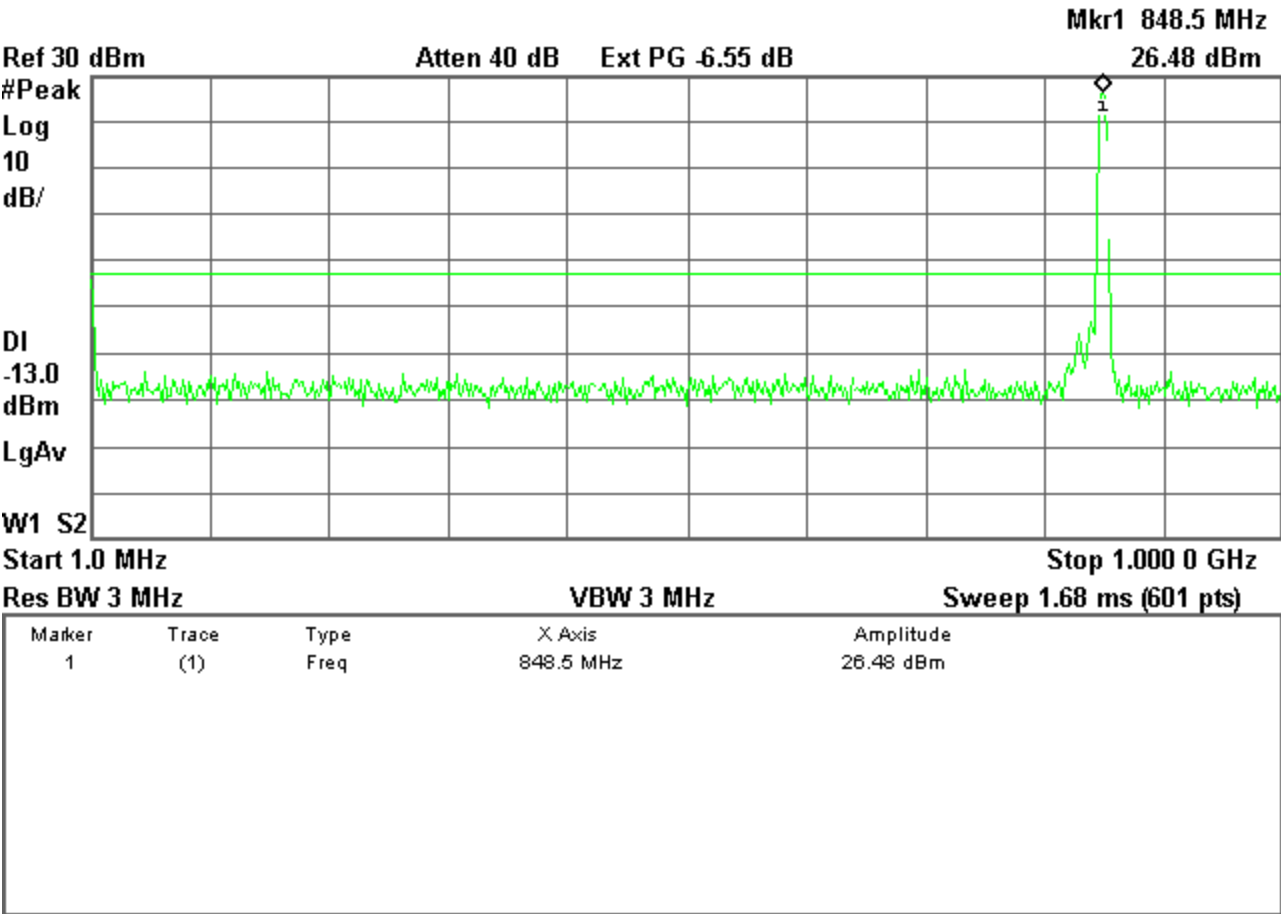
|                              |         |           |               |
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Plot 3.3a Out of Band Emissions at Antenna Terminals

High Channel, 848.31 MHz  
1 Mhz to 1 GHz

✱ Agilent 17:35:54 Sep 18, 2002

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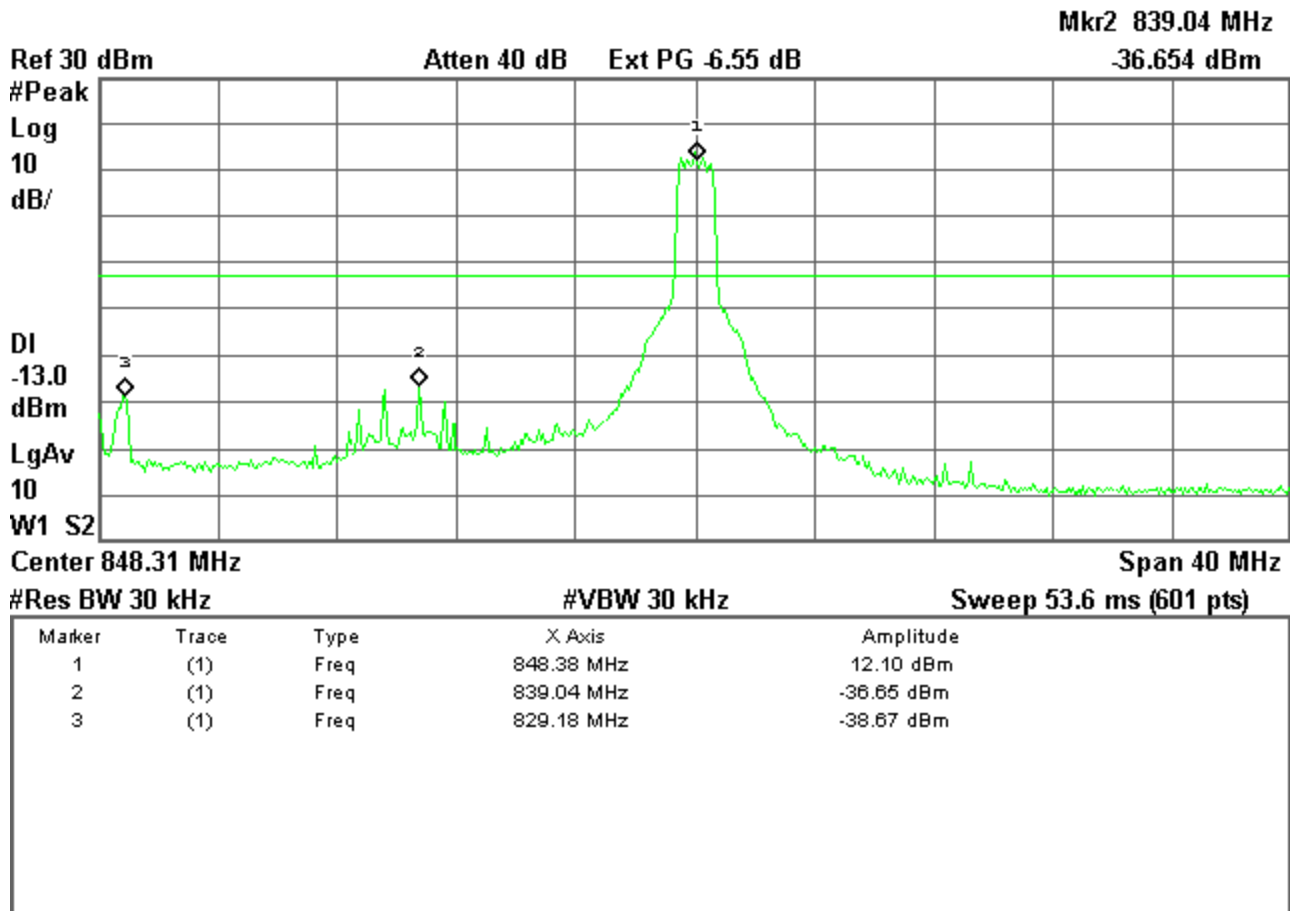
## Plot 3.3b Out of Band Emissions at Antenna Terminals

High Channel, 848.31 MHz

TX signal +/- 20 MHz

Agilent 17:40:22 Sep 18, 2002

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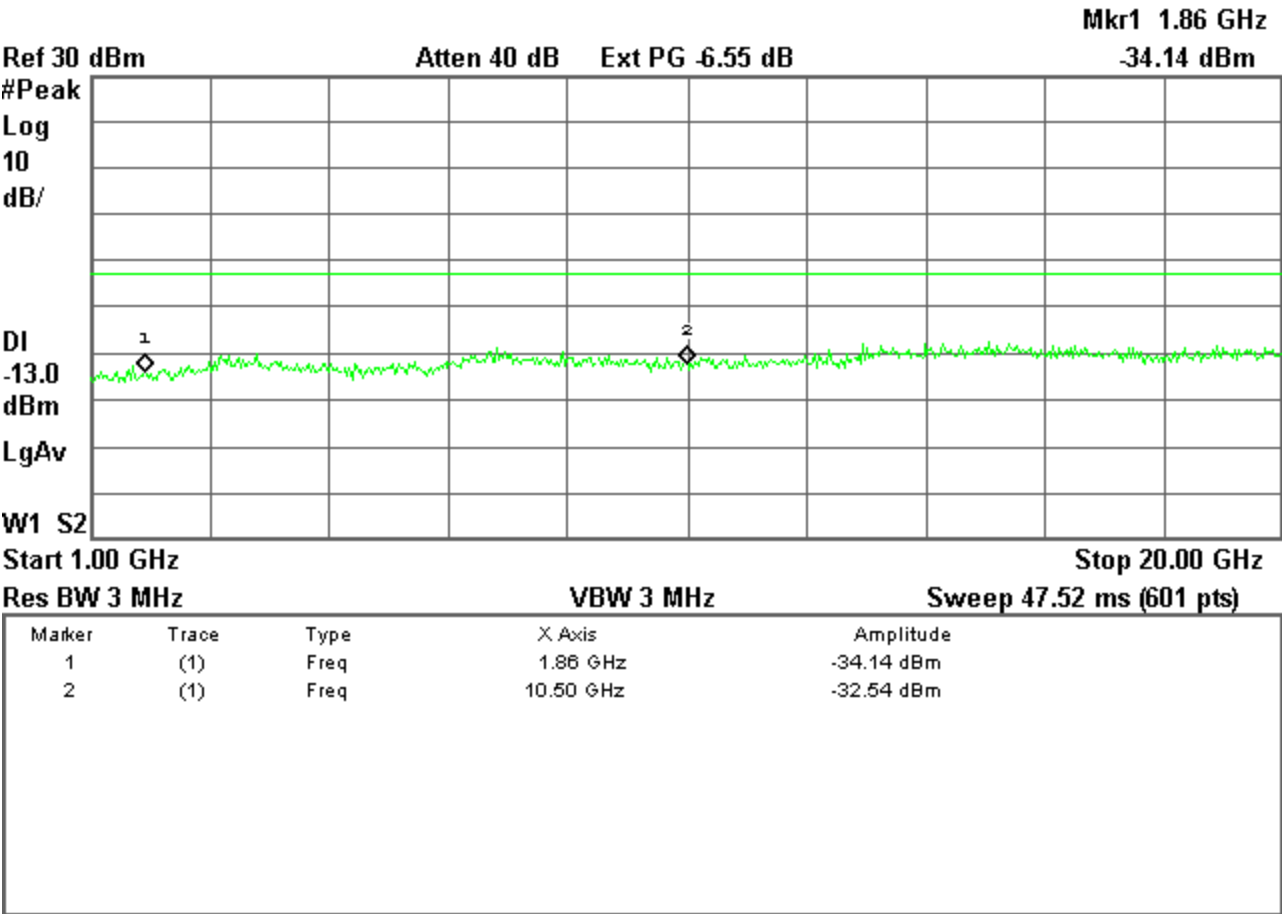
Plot 3.3c Out of Band Emissions at Antenna Terminals

High Channel, 848.31 MHz

1 GHz to 20 GHz

Agilent 17:49:09 Sep 18, 2002

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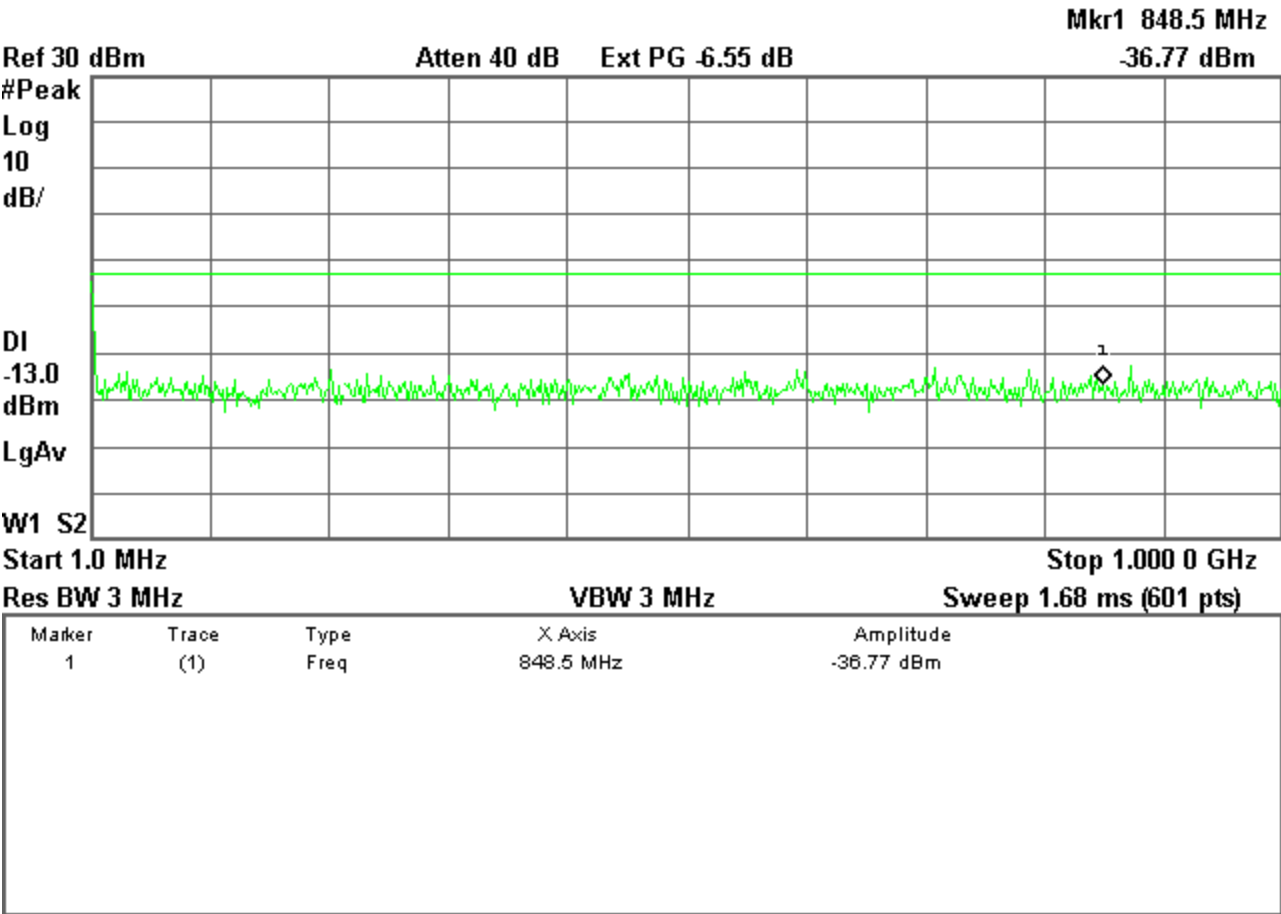
|                              |         |           |               |
|------------------------------|---------|-----------|---------------|
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Plot 3.4a Out of Band Emissions at Antenna Terminals

Low channel, 1851.25 MHz  
1 Mhz to 1 GHz

Agilent 17:36:19 Sep 18, 2002

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## Plot 3.4b Out of Band Emissions at Antenna Terminals

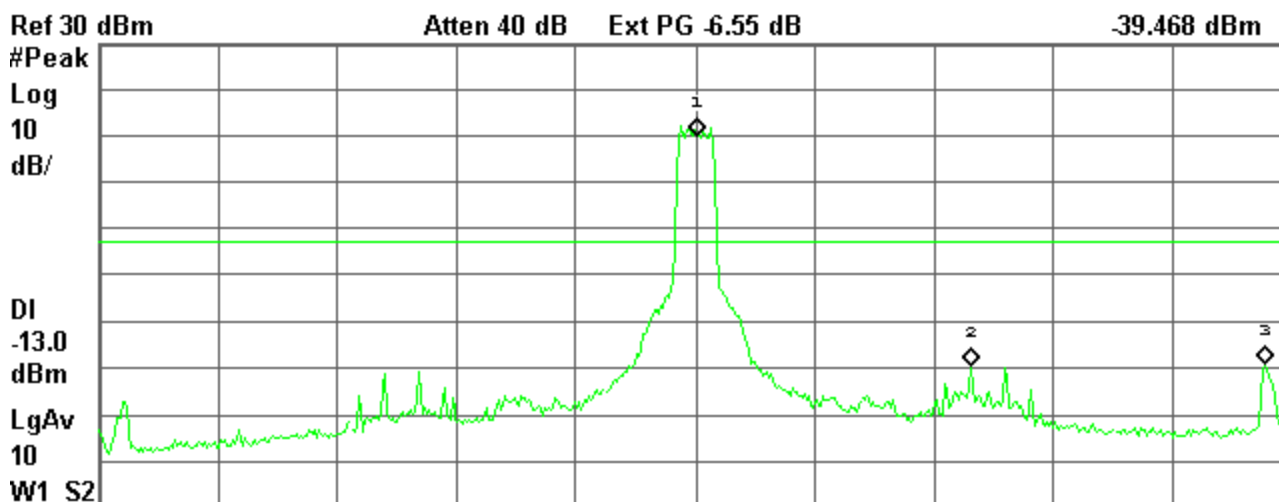
Low channel, 1851.25 MHz

TX signal +/- 20 MHz

Agilent 17:45:41 Sep 18, 2002

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Mkr3 1.870 38 GHz



Center 1.851 25 GHz

Span 40 MHz

#Res BW 30 kHz

#VBW 30 kHz

Sweep 53.6 ms (601 pts)

| Marker | Trace | Type | X Axis       | Amplitude  |
|--------|-------|------|--------------|------------|
| 1      | (1)   | Freq | 1.851 32 GHz | 10.30 dBm  |
| 2      | (1)   | Freq | 1.860 52 GHz | -39.72 dBm |
| 3      | (1)   | Freq | 1.870 38 GHz | -39.47 dBm |

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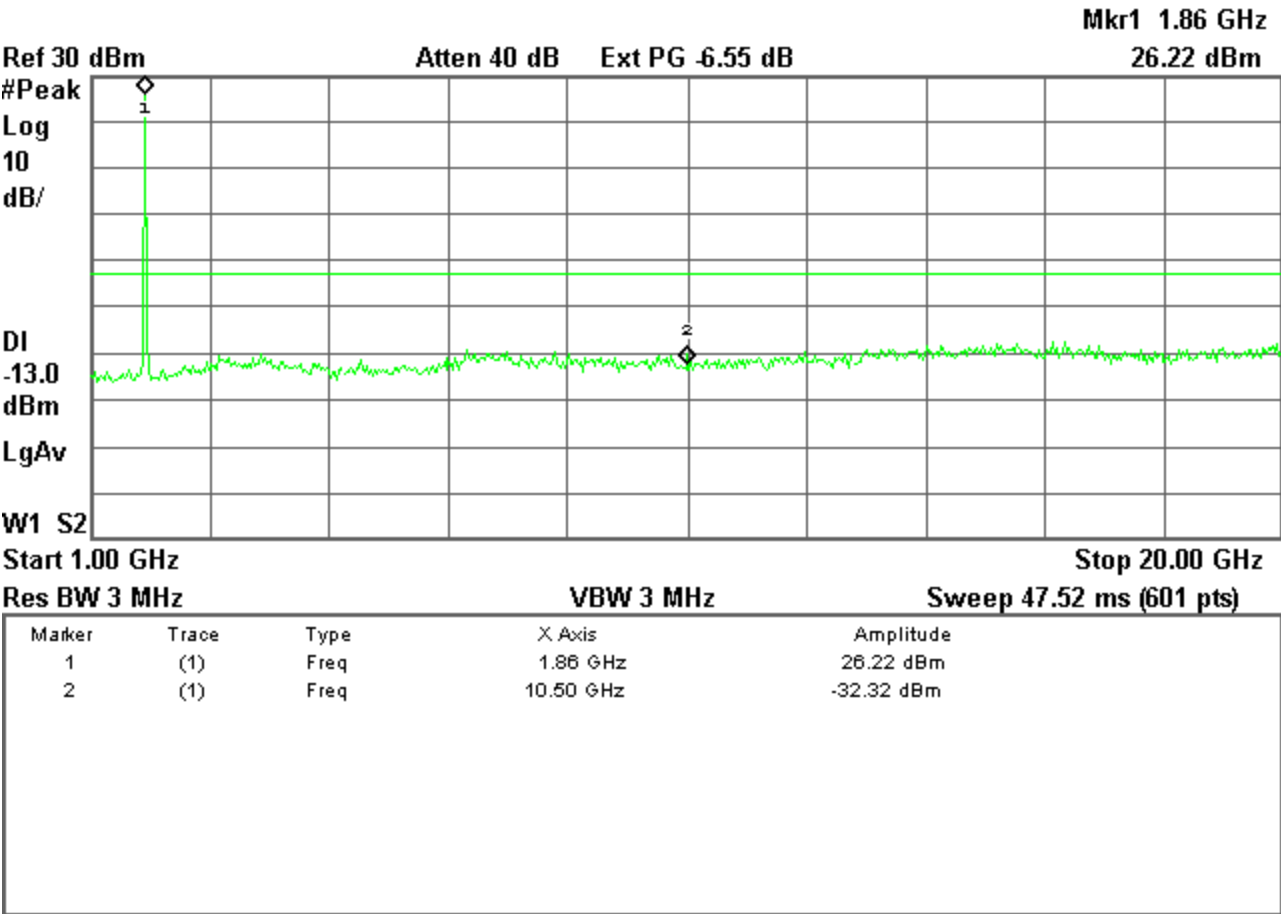
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Plot 3.4c Out of Band Emissions at Antenna Terminals

Low channel, 1851.25 MHz  
1 GHz to 20 GHz

Agilent 17:48:46 Sep 18, 2002

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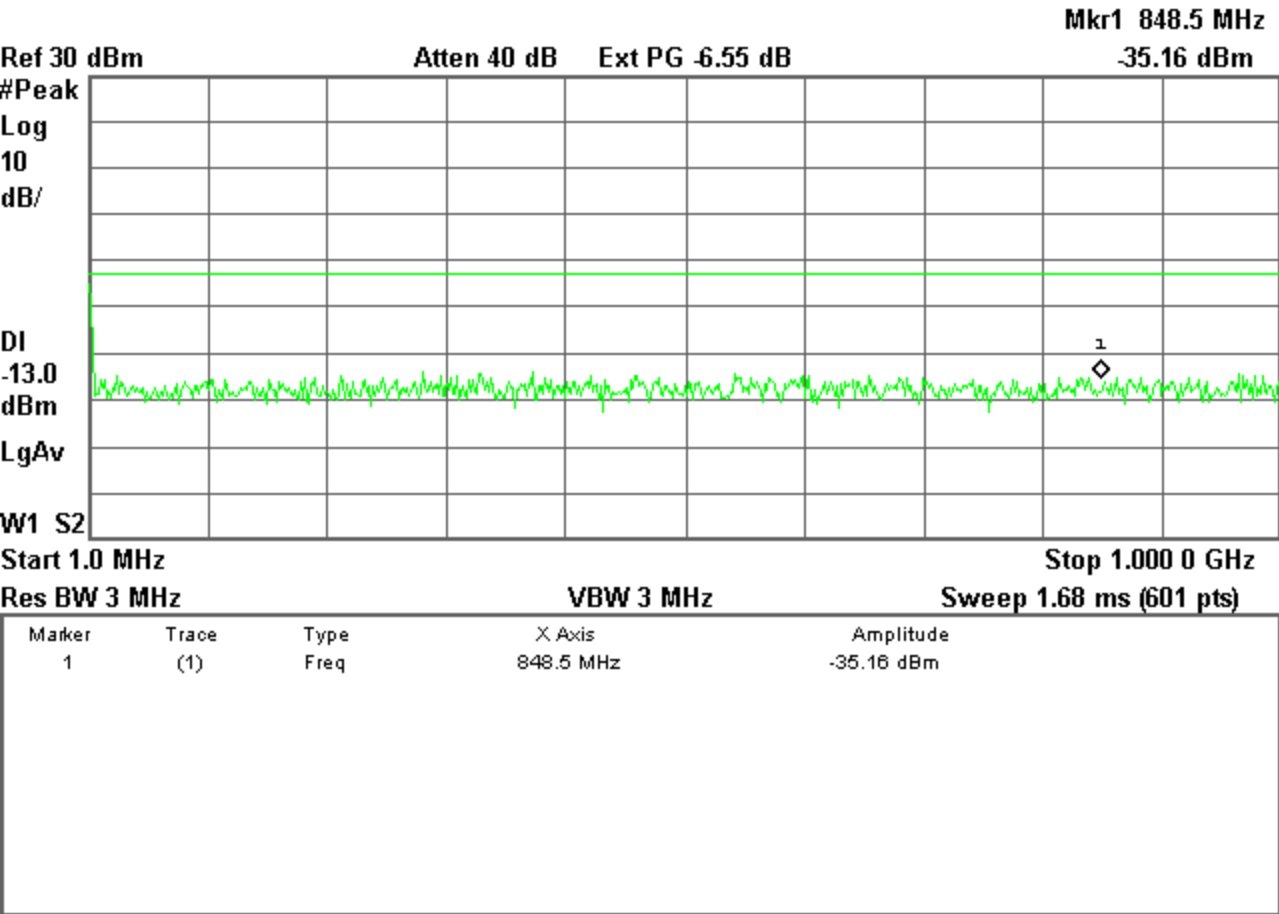
Plot 3.5a Out of Band Emissions at Antenna Terminals

Mid Channel, 1880 MHz

1 Mhz to 1 GHz

✱ Agilent 17:36:50 Sep 18, 2002

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|                              |         |           |               |
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## Plot 3.5b Out of Band Emissions at Antenna Terminals

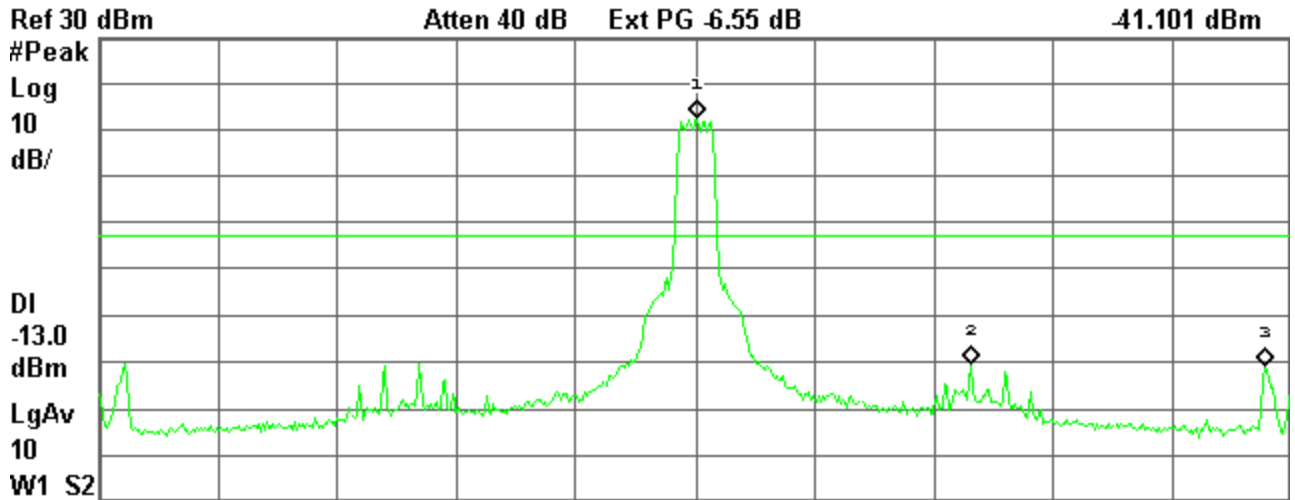
Mid Channel, 1880 MHz

TX signal +/- 20 MHz

Agilent 17:46:24 Sep 18, 2002

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Mkr3 1.899 13 GHz



Center 1.880 00 GHz      Span 40 MHz

#Res BW 30 kHz      #VBW 30 kHz      Sweep 53.6 ms (601 pts)

| Marker | Trace | Type | X Axis       | Amplitude  |
|--------|-------|------|--------------|------------|
| 1      | (1)   | Freq | 1.880 07 GHz | 12.79 dBm  |
| 2      | (1)   | Freq | 1.889 27 GHz | -40.42 dBm |
| 3      | (1)   | Freq | 1.899 13 GHz | -41.10 dBm |

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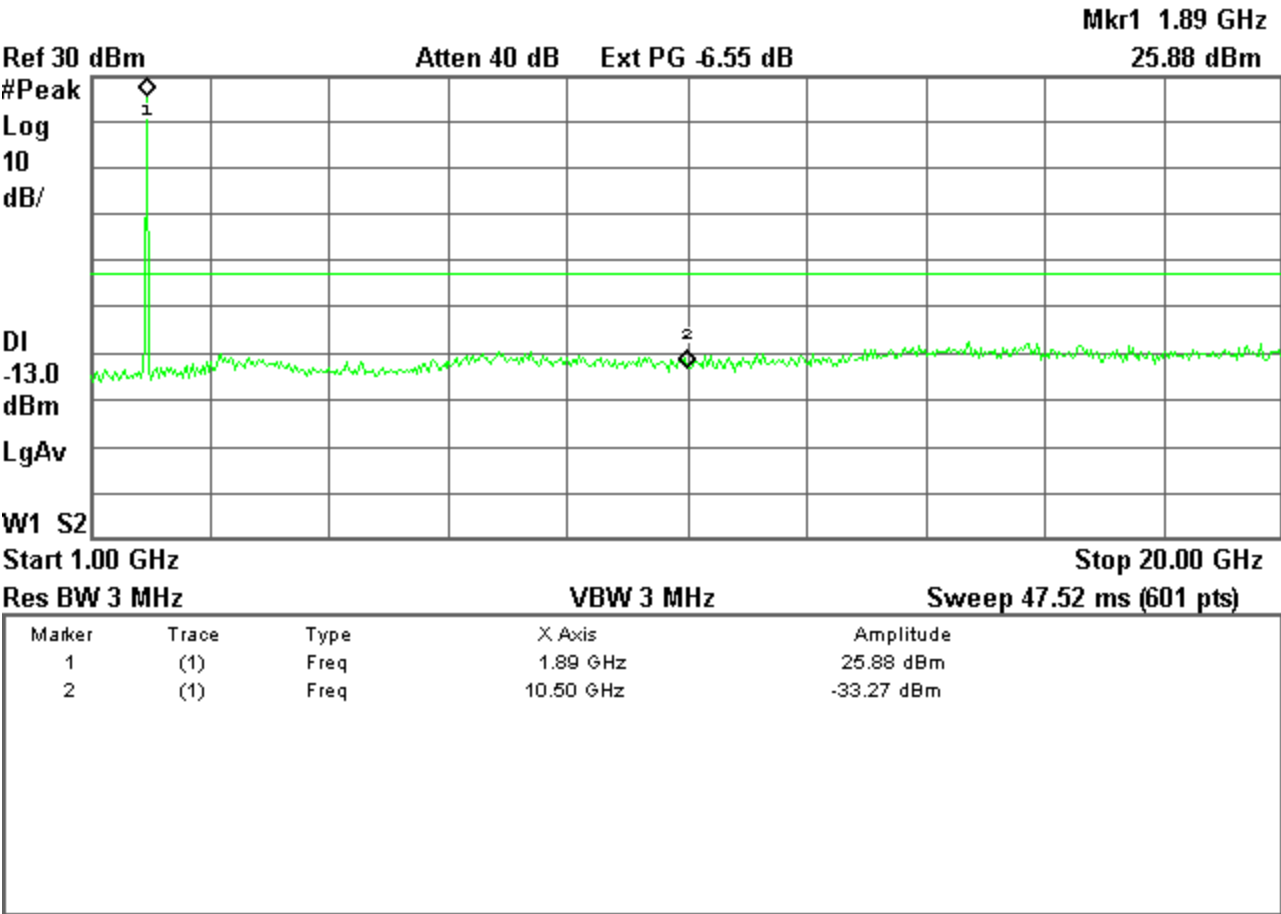
Plot 3.5c Out of Band Emissions at Antenna Terminals

Mid Channel, 1880 MHz

1 GHz to 20 GHz

Agilent 17:48:21 Sep 18, 2002

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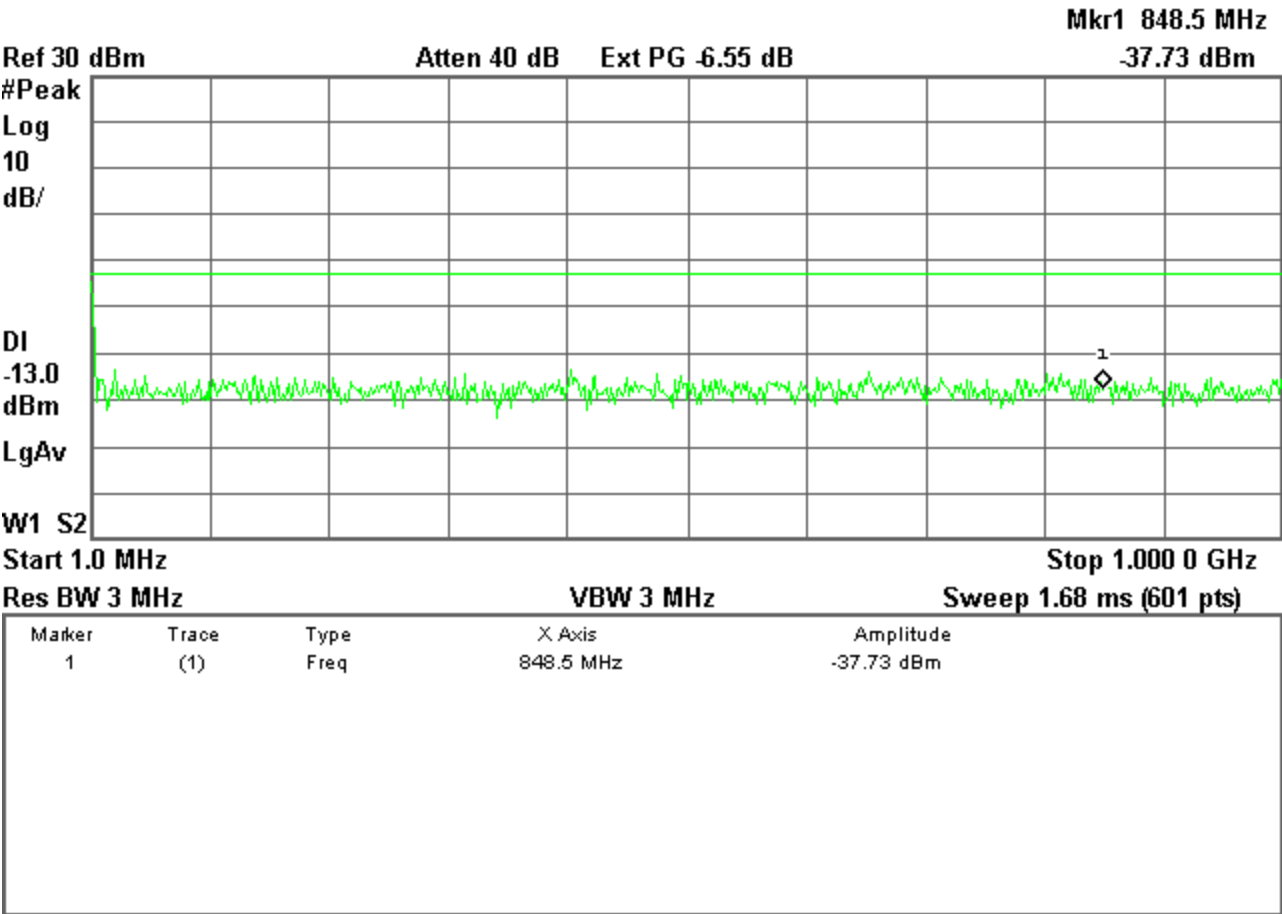
|                              |         |           |               |
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Plot 3.6a Out of Band Emissions at Antenna Terminals

High Channel, 1908.75 MHz  
1 Mhz to 1 GHz

✱ Agilent 17:37:06 Sep 18, 2002

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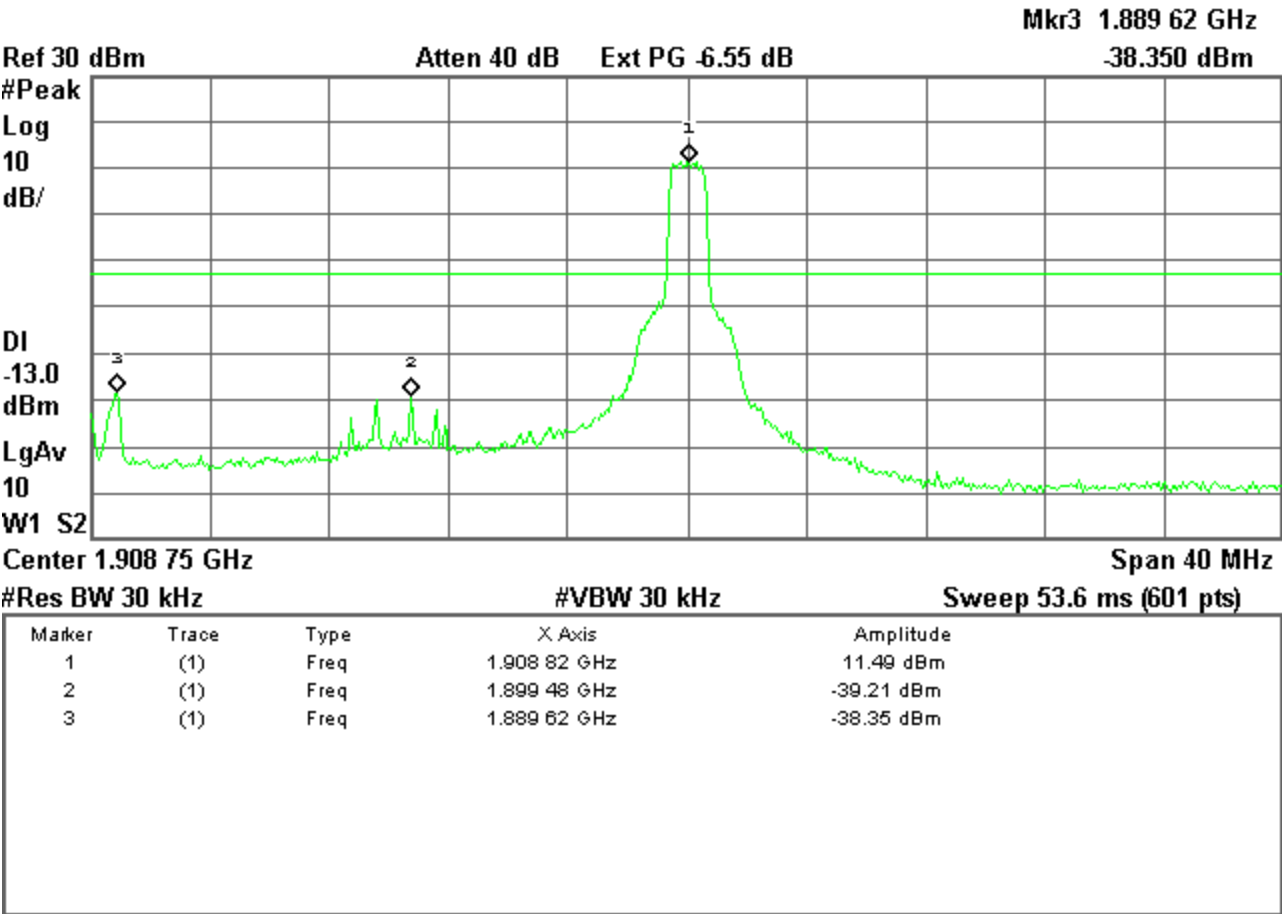
Plot 3.6b Out of Band Emissions at Antenna Terminals

High Channel, 1908.75 MHz

TX signal +/- 20 MHz

✱ Agilent 17:47:09 Sep 18, 2002

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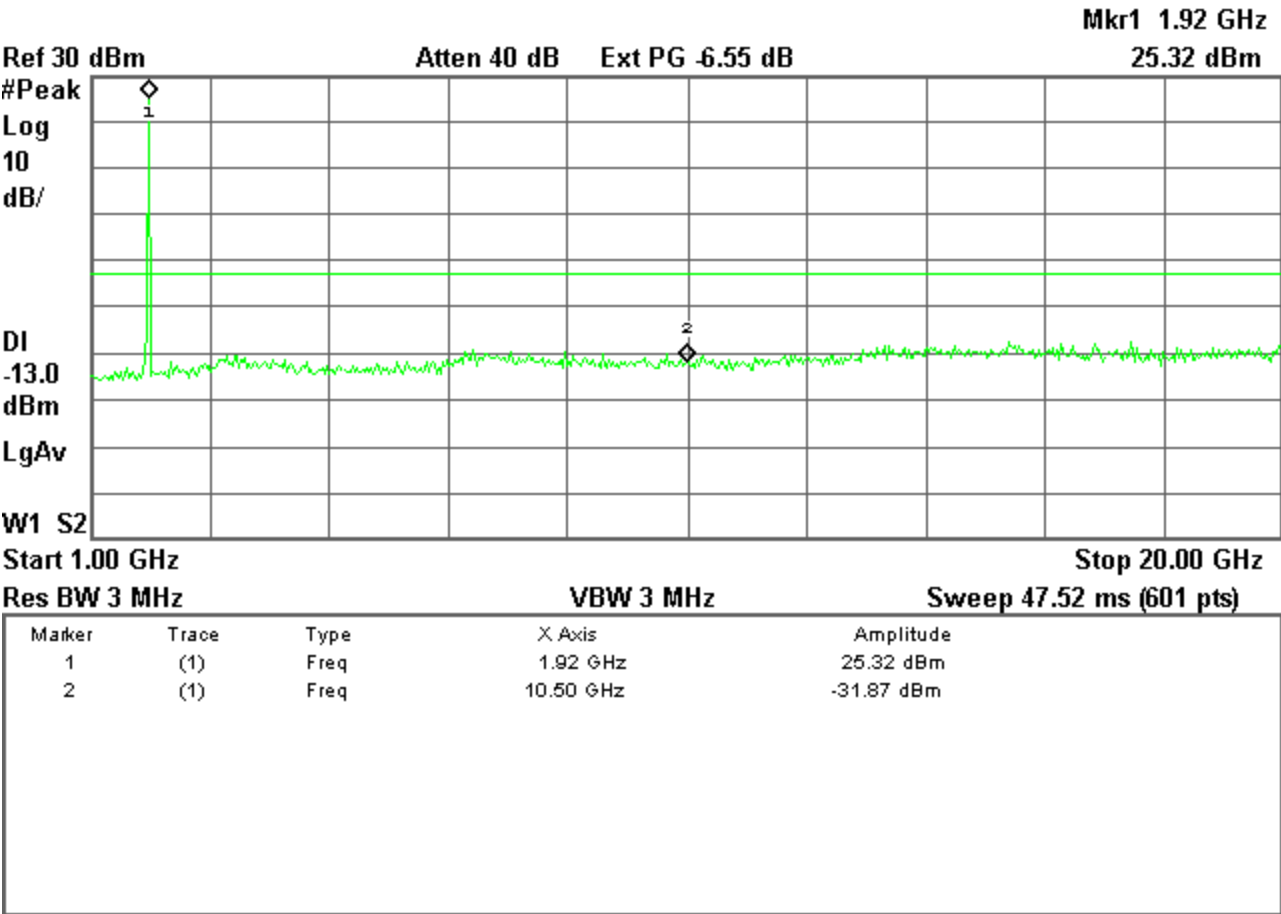
|                              |         |           |               |
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Plot 3.6c Out of Band Emissions at Antenna Terminals

High Channel, 1908.75 MHz  
1 GHz to 20 GHz

Agilent 17:47:59 Sep 18, 2002

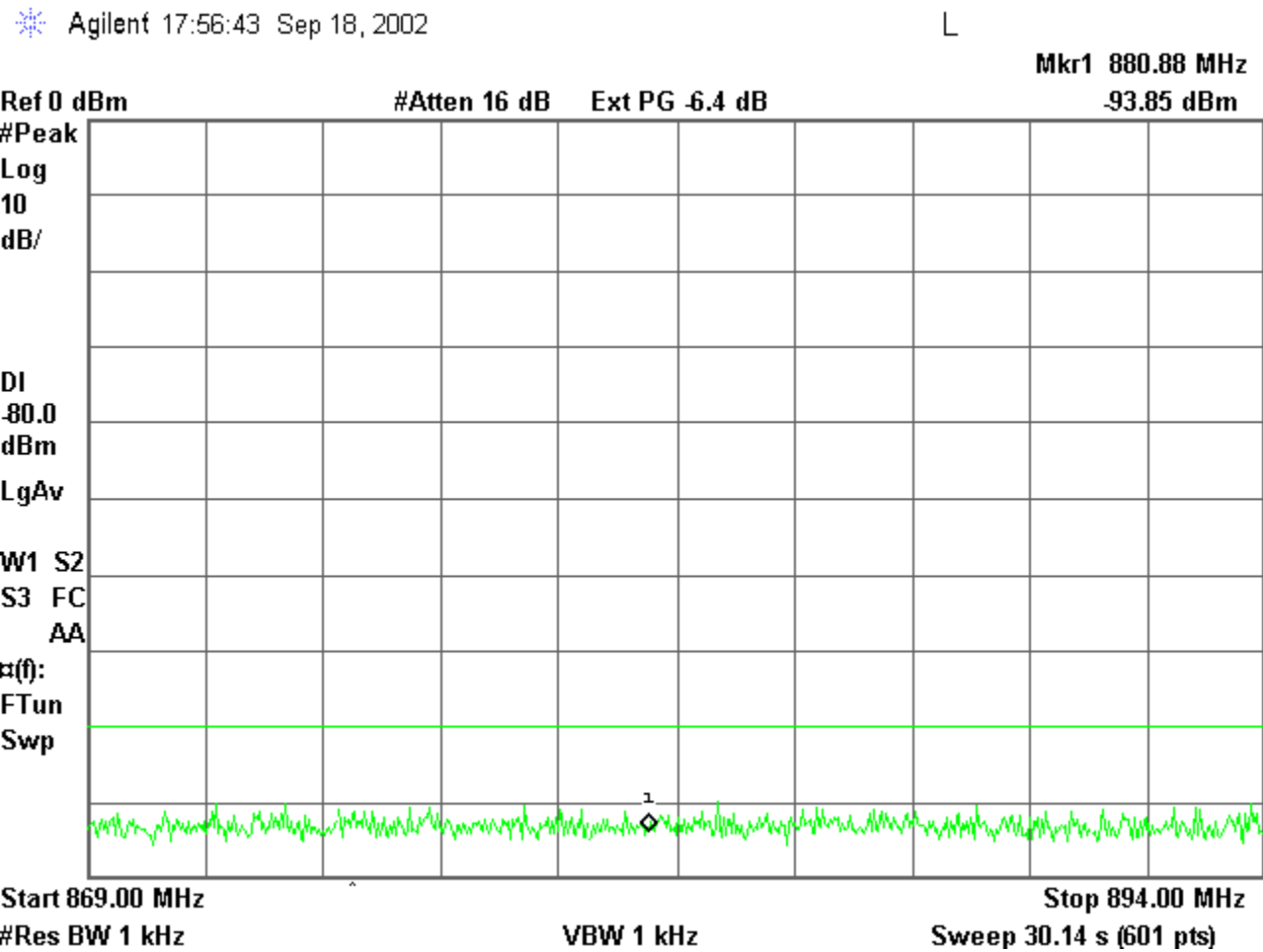
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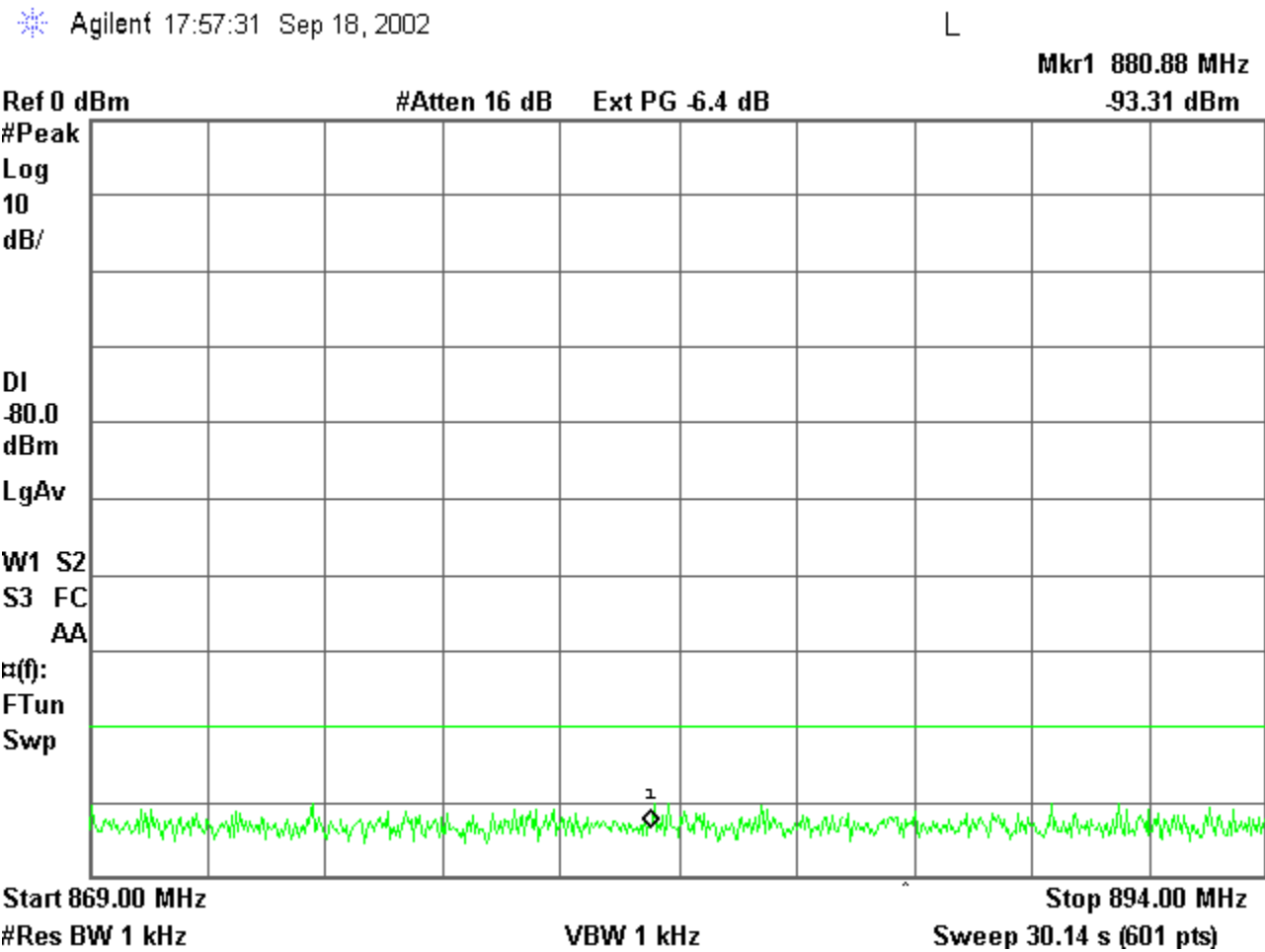
Plot 3.7a Low Channel, 824.70 MHz



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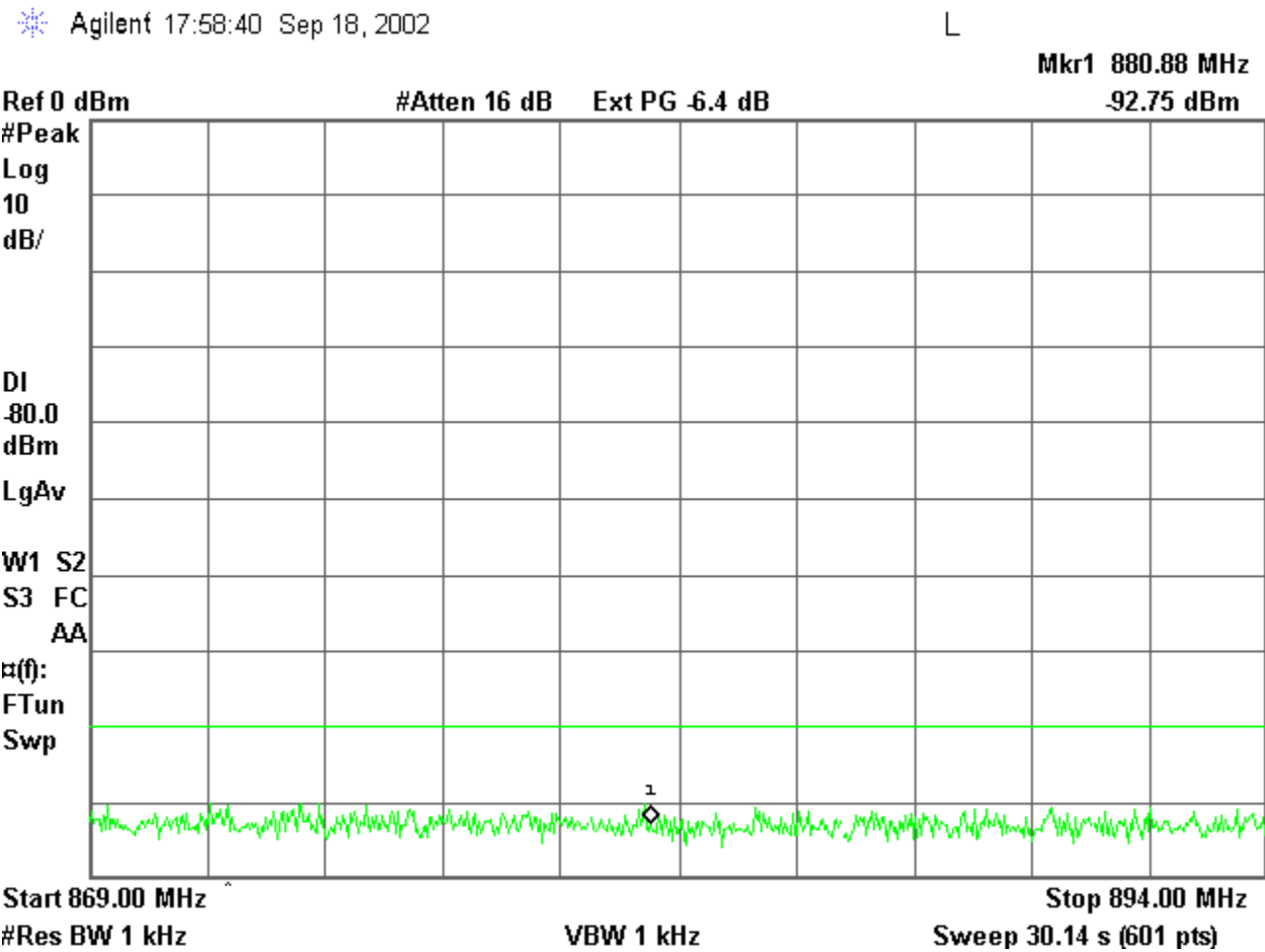
Plot 3.7a Middle Channel, 836.52 MHz



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Plot 3.7c High Channel, 848.31 MHz



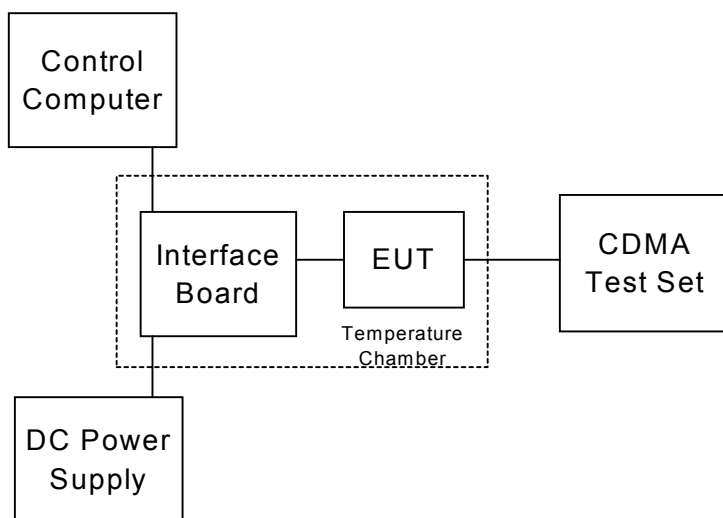
## 8 Frequency Stability vs Temperature

### 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            |

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### 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:

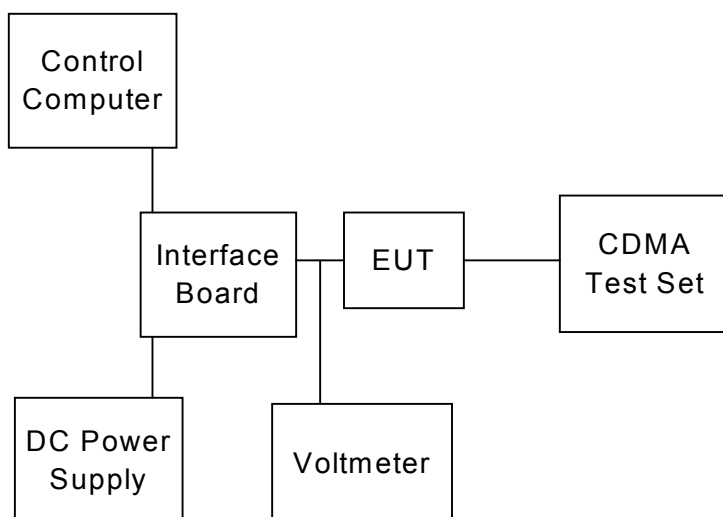
3.15 V, rated voltage

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**



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### 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.