# SIERRA WIRELESS

*HEART OF THE WIRELESS MACHINE®*

## AirCard 880E Test Report

For

## FCC and IC Certifications

FCC ID: N7NAC880E
IC: 2417C-AC880E

Prepared by

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July 10, 2007

## Table of Contents

**SIERRA WIRELESS, INC.**

## 1   Introduction and Purpose

This document provides the AIRCARD 880E wireless modem test data for the FCC and Industry Canada certifications.  The tests included in this report are limited to all conducted tests required.  The 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 | 5 |
| 2.1049 | Occupied Bandwidth | Complies | 8 |
| 2.1051, 22.901(d) 22.917, 24.238(a) | Out of Band Emissions at Antenna Terminals | Complies | 19 |
| FCC part 22H/24E | Block Edge Requirements | Complies | 56 |
| 2.1053 | Field Strength of Spurious Radiation | Complies | See CCS Report |
| 2.1055 | Frequency Stability versus Temperature | Complies | 63 |
| 2.1055 | Frequency Stability versus Voltage | Complies | 66 |

The tests described in this report were performed by Mr. Philip Wright at:

Sierra Wireless, Inc.
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Canada

## 3   Description of Equipment Under Test

The Sierra Wireless Inc. model AIRCARD 880E is a multi-band wireless modem operating on the GSM/GPRS/EDGE/UMTS network. In Canada and the US, only cellular and PCS bands are used for GSM/GPRS/EDGE/UMTS operation, so this test report only contains data for these two bands (850MHz and 1900MHz).

## 4   RF Power Output
FCC 2.1046

### *4.1   Test Procedure*

The transmitter output was connected to a Rohde & Schwarz CMU200 Test Set and configured to operate at maximum power in a call. The power was measured using the spectrum analyzer at three equally spaced operating frequencies for each band. The RBW was set to 300 KHz for the GSM and EDGE measurements, and 5MHz for the WCDMA measurements. The spectrum analyzer was set to measure the RF output power with the cable and coupler losses accounted for.

**Test Setup**

### 4.2    Test Equipment

### Instrument List

| EQUIPMENT | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE |
|---|---|---|---|---|
| Control Computer | TC | Generic PC | 100488 | N/A |
| Wireless Test Set | Rohde & Schwarz | CMU200 | 836766/030 | N/A |
| Spectrum Analyzer | Agilent | PSA E4440A | US41421268 | Mar. 1, 2007 |
| DC Power Supply | HP | 6632A | 3530A | N/A |
| Interface Board | Shop built | Minnow | N/A | N/A |
| Directional Coupler | Mini-Circuits | ZA3PD-2 | N/A | N/A |

### 4.3    Test Results GSM/EDGE

| Frequency (MHz) | Channel | Power (dBm) | |
|---|---|---|---|
| | | GMSK Mode | 8-PSK Mode |
| 824.2 | 128 | 31.8 | 27.0 |
| 836.6 | 190 | 31.8 | 27.0 |
| 848.8 | 251 | 31.9 | 27.1 |
| 1850.2 | 512 | 28.7 | 25.9 |
| 1880.0 | 661 | 28.7 | 25.9 |
| 1909.8 | 810 | 28.8 | 25.9 |

### 4.4    Test Results UMTS

| Frequency (MHz) | Channel | RMS Power (dBm) | |
|---|---|---|---|
| | | WCDMA Mode | HSDPA Mode |
| 826.4 | 4132 | 22.5 | 22.6 |
| 836.4 | 4182 | 22.6 | 22.5 |
| 846.6 | 4233 | 22.7 | 22.6 |
| 1852.4 | 9262 | 22.4 | 22.7 |
| 1880.0 | 9400 | 22.4 | 22.6 |
| 1907.6 | 9538 | 22.4 | 22.6 |
| Frequency (MHz) | Channel | Peak Power (dBm) | |
| | | WCDMA Mode | HSDPA Mode |
| 826.4 | 4132 | 25.9 | 25.8 |
| 836.4 | 4182 | 25.8 | 26.1 |
| 846.6 | 4233 | 25.8 | 26.1 |
| 1852.4 | 9262 | 25.9 | 25.7 |
| 1880.0 | 9400 | 25.9 | 25.9 |
| 1907.6 | 9538 | 25.9 | 25.9 |

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### 4.5   Test Settings for UMTS Mode on the CMU200

UE Power Control Settings
Maximum allowable UE-Power = 24.0 dBm
UL Target Power = 24.0 dBm

Node B Settings
Primary Scrambling Code = 9
Output Channel Power = -51.7 dBm
OCNS  = Off
Total Output Power (Ior+Ioc) = -51.7 dBm

RMC Settings
Reference Channel Type: 12.2 kbps Downlink/Uplink DL DTCH Transport Format: 12.2
kbps DL Resources in Use: 100 % UL CRC (Sym. Loop Mode 2): Off Test Mode: Loop
Mode 2 Channel Data Source DTCH: PRBS9

Voice Settings
Voice Source: Echo
Loopback Type: Off

Adaptive Multirate Settings
Active Code Set: Selection A
Codec Mode: 12.2 kbps

Signaling RAB Settings
SRB Cell DCH: 3.4 kbps

BS Down Link Physical Channels Settings
Ior     = -51.7 dBm
P-CPICH  = -3.3 dB
P-SCH    = -8.3 dB
S-SCH    = -8.3 dB
P-CCPCH  = -5.3 dB
S-CCPCH  = -5.3 dB
S-CCPCH Channel Code = 2
PICH     = -8.3 dB
PICH Channel Code = 3
AICH     = -8.3 dB
AICH Channel Code = 6
DPDCH    = -10.3 dB
DPDCH Channel Code = 96
Power Offset (DPCCH/DPDCH) = 0.0 dB
DL DPCH Timing Offset  = 0

Secondary Scrambling Code  = 0
Secondary Scrambling Code (HSDPA) = 0
HSDPA Channels = Off

TPC Settings
Algorithm = 2
TPC Step Size = 1dB
TPC Pattern Setup = Set 1 (All 1, after linked to get maximum power)

***HSDPA Mode Settings:***

Network Settings
Packet Switched Domain = ON

HSDPA Test Mode Settings
Radiobearer Setup = RMC 12.2 kbps + HSPDA
RMC Test Loop = Loop Mode 1 RLC TM

HSDPA HS-DSCH Settings
Data Pattern = PRBS9
Force NACK = Off
CQI Feedback Cycle = 4 ms
UE Category = 12
Channel Configuration Type = Fixed Reference Channel

Fixed Reference Channel Settings
H-Set Selection = H-Set 5 QPSK
RV Coding Sequence = {0,2,5,6}

The EUT is calibrated to the same power level for both UMTS and HSDPA modes, and in both modes the EUT uses the same modulation for transmitting, so only one mode was tested.  In this report, all WCDMA test data were collected in the UMTS mode.

## 5   Occupied Bandwidth

FCC 2.1049

### 5.1   Test Procedure

The transmitter output was connected to a calibrated coaxial cable and coupler, 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 3 frequencies in each band.  The –26dB bandwidth was also measured and recorded.

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### Test Setup
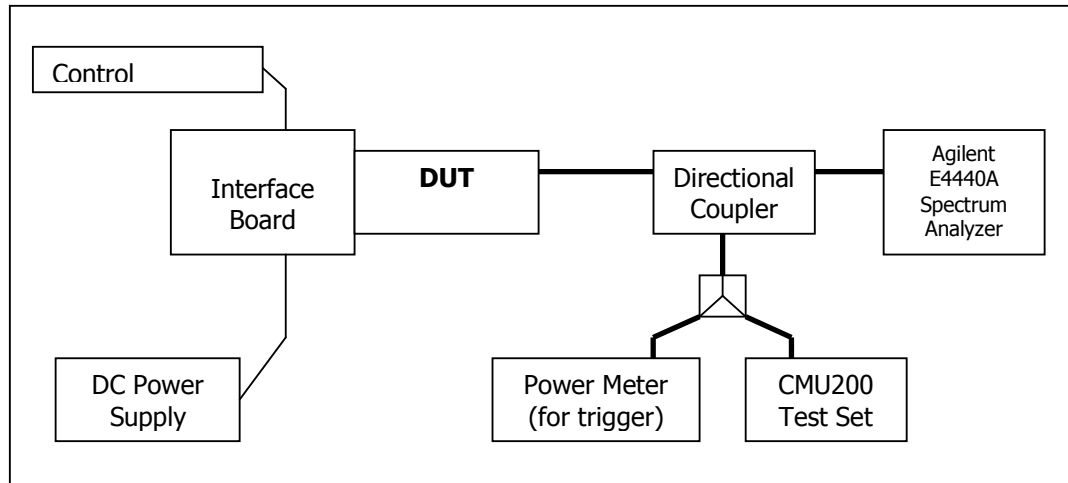


### *5.2 Test Results*

The performance of the GSM 850 MHz cellular band is shown in plots 5.3.1 to 5.3.6.
Performance of the GSM 1900 MHz PCS band is shown in plots 5.3.7 to 5.3.12.
Performance of the UMTS 850 cellular band is shown in plots 5.3.13 to 5.3.15
Performance of the UMTS 1900 PCS band is shown in plots 5.3.16 to 5.3.18

| Frequency (MHz) | Channel | 99% Occupied Bandwidth (kHz) | | -26dBc Occupied Bandwidth (kHz) | |
|---|---|---|---|---|---|
| | | GMSK Mode | 8-PSK Mode | GMSK Mode | 8-PSK Mode |
| 824.2 | 128 | 244.31 | 245.57 | 311.19 | 310.68 |
| 836.6 | 190 | 244.92 | 242.74 | 314.82 | 304.7 |
| 848.8 | 251 | 242.56 | 247.27 | 314 | 301.02 |
| 1850.2 | 512 | 244.12 | 246.45 | 323.57 | 308.68 |
| 1880.0 | 661 | 241.84 | 241.23 | 313.9 | 305.2 |
| 1909.8 | 810 | 241.62 | 245.83 | 315.7 | 304.17 |

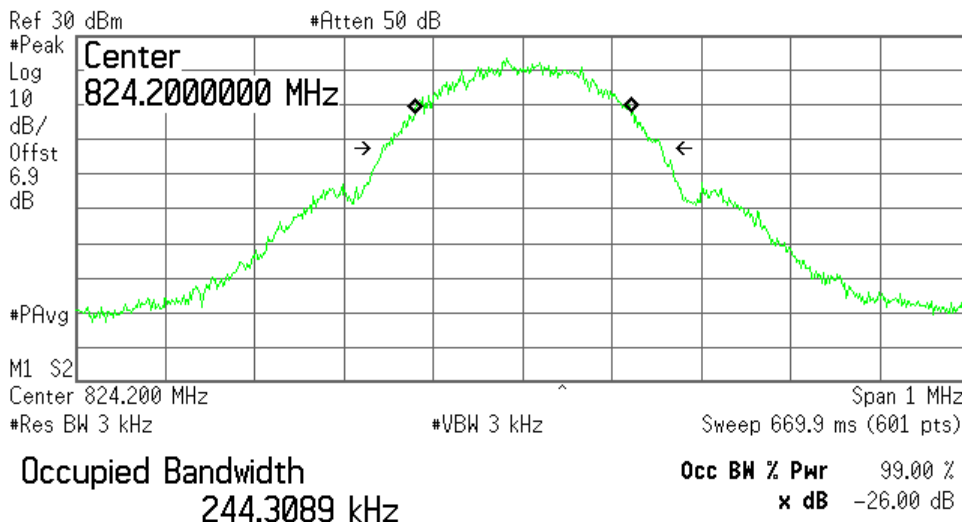| Frequency (MHz) | Channel | 99% Occupied Bandwidth (MHz) | -26dBc Occupied Bandwidth (MHz) |
|---|---|---|---|
| 826.4 | 4132 | 4.1642 | 4.626 |
| 836.4 | 4182 | 4.1680 | 4.621 |
| 846.6 | 4233 | 4.1697 | 4.629 |
| 1852.4 | 9262 | 4.1590 | 4.618 |
| 1880.0 | 9400 | 4.1762 | 4.626 |
| 1907.6 | 9538 | 4.1720 | 4.630 |

### *5.3    Test Plots*

**5.3.1) GMSK Occupied Bandwidth**, Low channel 128, 824.2 MHz, 99% bandwidth



```
Agilent 14:23:36  20 Mar 2007                                    L

Ref 30 dBm              #Atten 50 dB
#Peak
Log       Center
10        824.2000000 MHz
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 824.200 MHz                                    Span 1 MHz
#Res BW 3 kHz              #VBW 3 kHz       Sweep 669.9 ms (601 pts)

Occupied Bandwidth                    Occ BW % Pwr    99.00 %
        244.3089 kHz                        x dB    -26.00 dB


Transmit Freq Error    323.825 Hz
Occupied Bandwidth     311.192 kHz
```
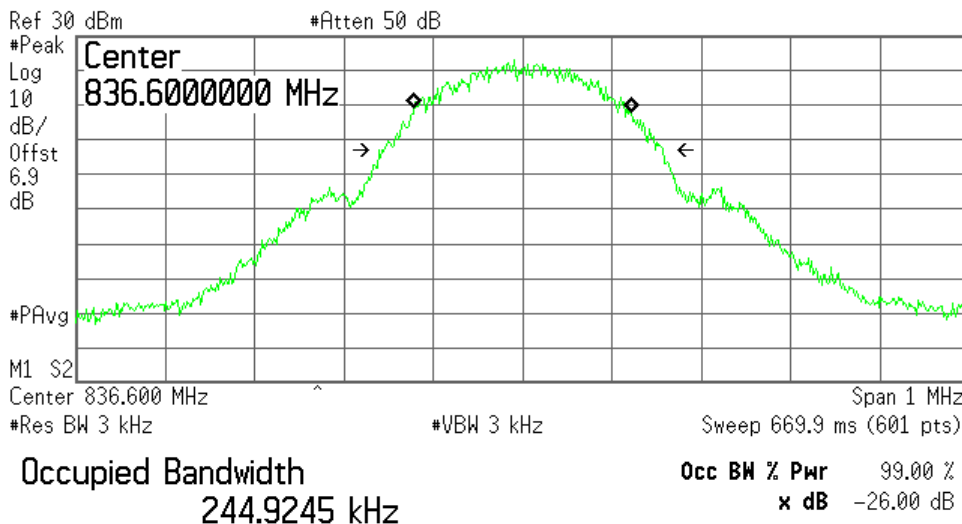
**5.3.2) GMSK Occupied Bandwidth**, Mid channel 190, 836.6 MHz, 99% bandwidth



```
Agilent 14:24:49  20 Mar 2007                                    L

Ref 30 dBm              #Atten 50 dB
#Peak
Log       Center
10        836.6000000 MHz
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 836.600 MHz                                    Span 1 MHz
#Res BW 3 kHz              #VBW 3 kHz       Sweep 669.9 ms (601 pts)

Occupied Bandwidth                    Occ BW % Pwr    99.00 %
        244.9245 kHz                        x dB    -26.00 dB


Transmit Freq Error    142.188 Hz
Occupied Bandwidth     314.828 kHz
```
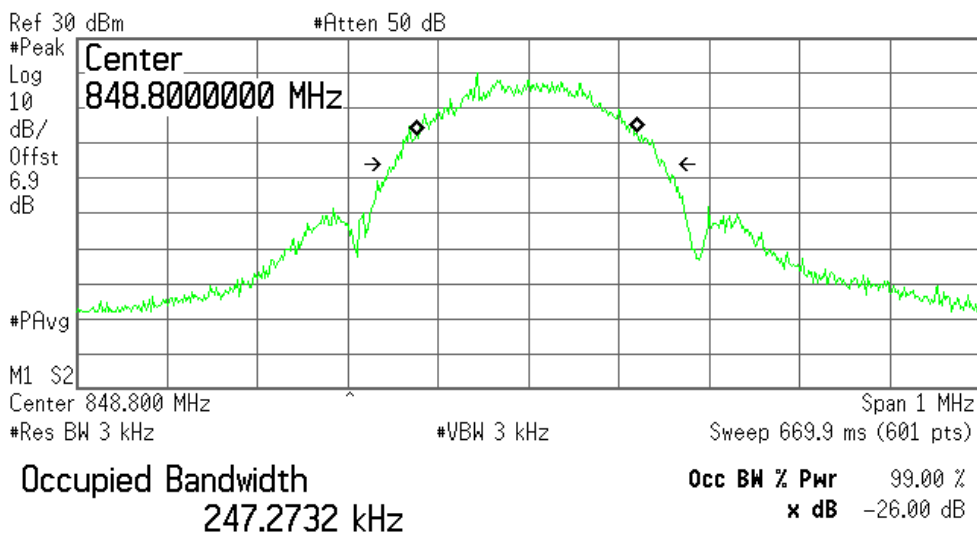
**5.3.3) GMSK Occupied Bandwidth**, High channel 251, 848.8 MHz, 99% bandwidth



```
⁂ Agilent 14:25:54  20 Mar 2007                              R

Ref 30 dBm              #Atten 50 dB
#Peak
Log
10
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 848.800 MHz                                  Span 1 MHz
#Res BW 3 kHz              #VBW 3 kHz        Sweep 669.9 ms (601 pts)
```
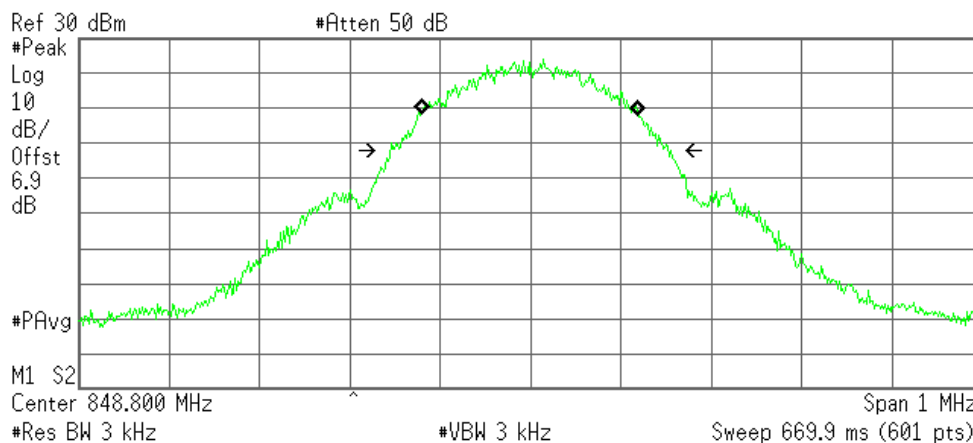
Occupied Bandwidth                    Occ BW % Pwr    99.00 %
        242.5539 kHz                          x dB   −26.00 dB


Transmit Freq Error    −468.721 Hz
Occupied Bandwidth      313.993 kHz

**5.3.4) 8-PSK Occupied Bandwidth**, Low channel 128, 824.2 MHz, 99% bandwidth



```
⁂ Agilent 13:56:45  20 Mar 2007                              L

Ref 30 dBm              #Atten 50 dB
#Peak   RBW
Log     3.0 kHz
10
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 824.200 MHz                                  Span 1 MHz
#Res BW 3 kHz              #VBW 3 kHz        Sweep 669.9 ms (601 pts)
```
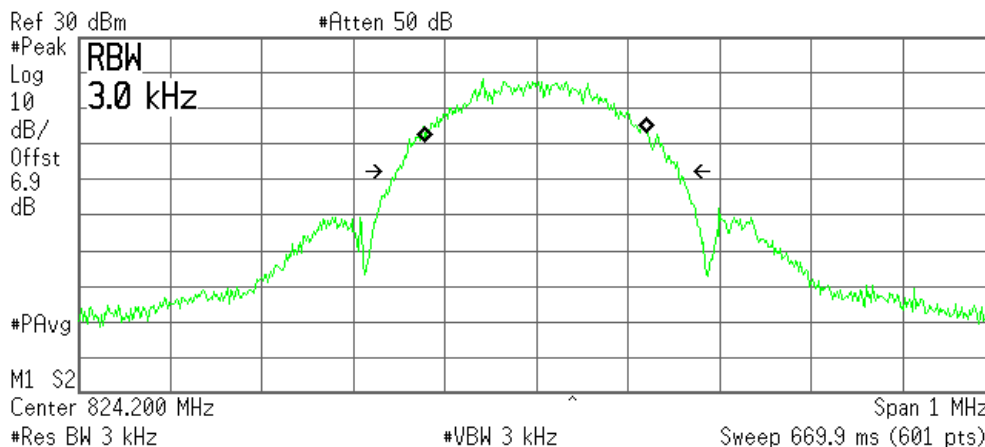
Occupied Bandwidth                    Occ BW % Pwr    99.00 %
        245.5652 kHz                          x dB   −26.00 dB


Transmit Freq Error    −1.024 kHz
Occupied Bandwidth      310.679 kHz

**5.3.5) 8-PSK Occupied Bandwidth**, Mid channel 190, 836.6 MHz, 99% bandwidth

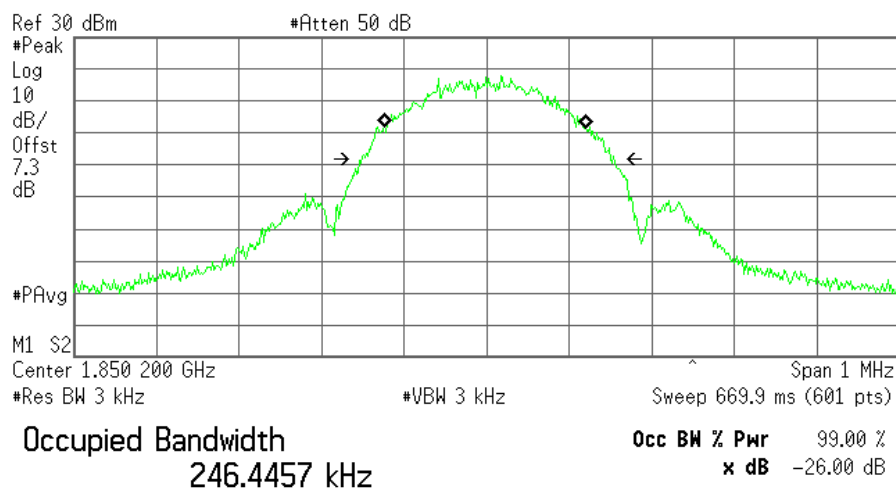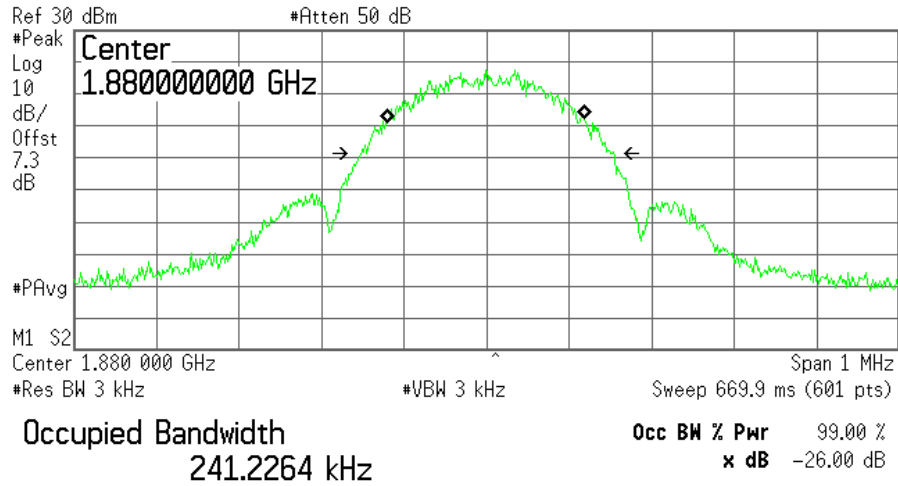Agilent 14:17:15 20 Mar 2007                          L

```
Ref 30 dBm                    #Atten 50 dB
#Peak
Log     Center
10      836.6000000 MHz
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 836.600 MHz                              Span 1 MHz
#Res BW 3 kHz           #VBW 3 kHz      Sweep 669.9 ms (601 pts)
```

Occupied Bandwidth              Occ BW % Pwr    99.00 %
        242.7415 kHz                x dB    -26.00 dB
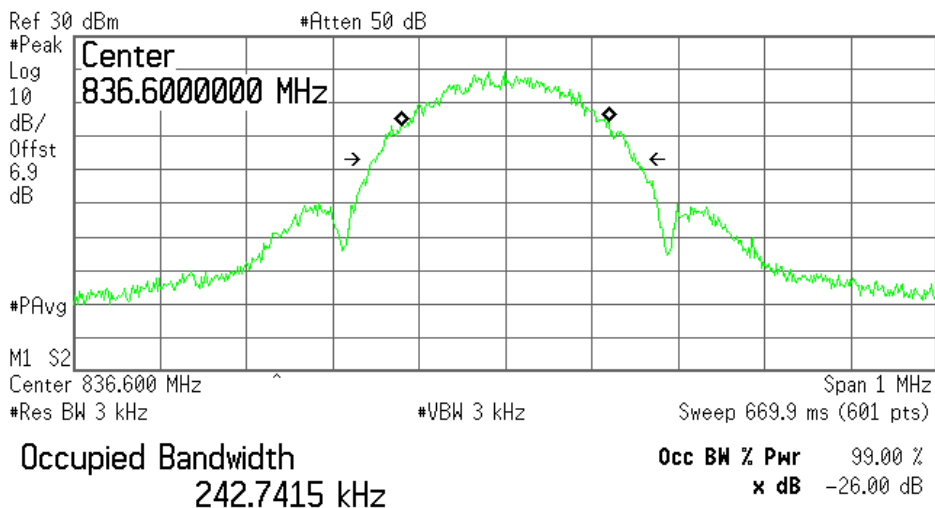

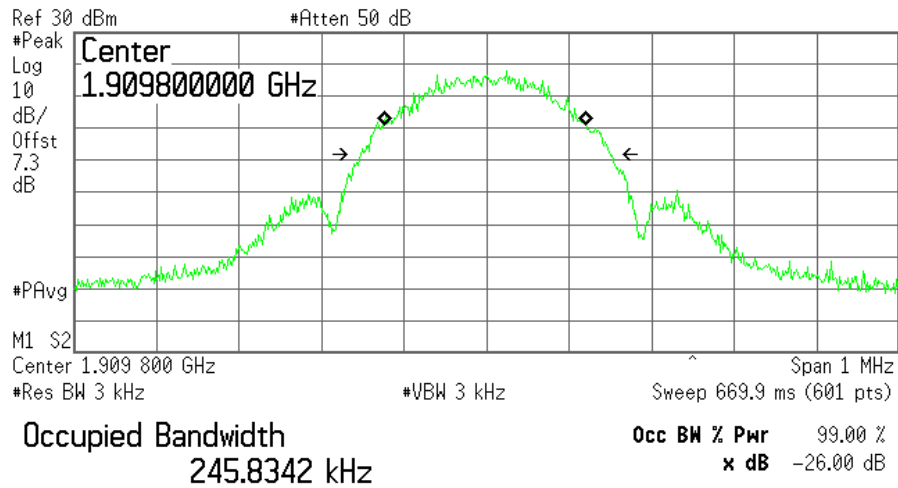Transmit Freq Error     -743.875 Hz
Occupied Bandwidth      304.696 kHz


**5.3.6) 8-PSK Occupied Bandwidth**, High channel 251, 848.8 MHz, 99% bandwidth

Agilent 14:19:32 20 Mar 2007                          L

```
Ref 30 dBm                    #Atten 50 dB
#Peak
Log     Center
10      848.8000000 MHz
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 848.800 MHz                              Span 1 MHz
#Res BW 3 kHz           #VBW 3 kHz      Sweep 669.9 ms (601 pts)
```

Occupied Bandwidth              Occ BW % Pwr    99.00 %
        247.2732 kHz                x dB    -26.00 dB


Transmit Freq Error     -1.935 kHz
x dB Bandwidth          301.019 kHz

**5.3.7) GMSK Occupied Bandwidth**, PCS Low channel 512, 1850.2 MHz, 99% bandwidth

```
       Agilent 14:32:11  20 Mar 2007                        L

Ref 30 dBm                    #Atten 50 dB
#Peak
Log   ┌Center
10    │1.850200000 GHz
dB/
Offst
7.3
dB

#PAvg

M1  S2
Center 1.850 200 GHz                                  Span 1 MHz
#Res BW 3 kHz            #VBW 3 kHz       Sweep 669.9 ms (601 pts)

Occupied Bandwidth                    Occ BW % Pwr     99.00 %
          244.1151 kHz                        x dB    -26.00 dB


Transmit Freq Error    -1.221 kHz
x dB Bandwidth          323.568 kHz
```
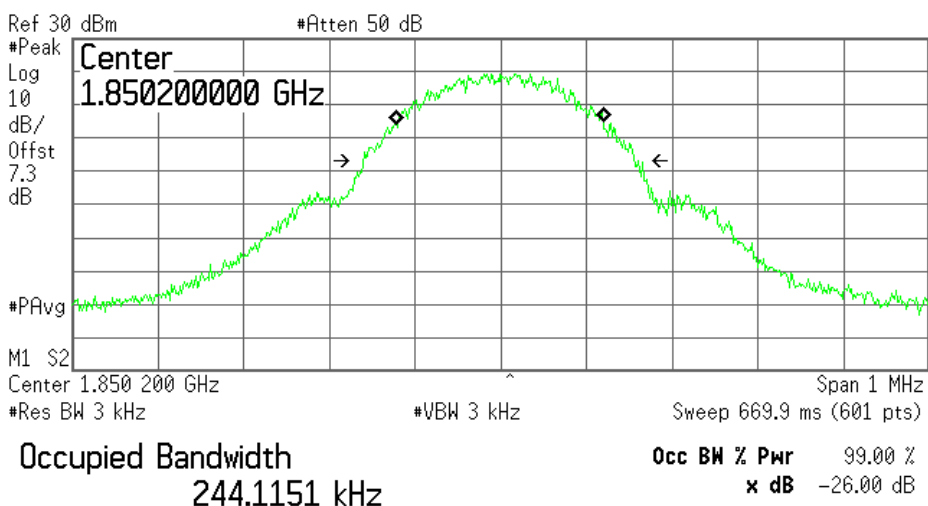
**5.3.8) GMSK Occupied Bandwidth**, PCS Middle channel 661, 1880.0 MHz, 99% bandwidth

```
       Agilent 14:34:53  20 Mar 2007                        L

Ref 30 dBm                    #Atten 50 dB
#Peak
Log
10
dB/
Offst
7.3
dB

#PAvg

M1  S2
Center 1.880 000 GHz                                  Span 1 MHz
#Res BW 3 kHz            #VBW 3 kHz       Sweep 669.9 ms (601 pts)

Occupied Bandwidth                    Occ BW % Pwr     99.00 %
          241.8387 kHz                        x dB    -26.00 dB


Transmit Freq Error    -1.178 kHz
x dB Bandwidth          313.900 kHz
```
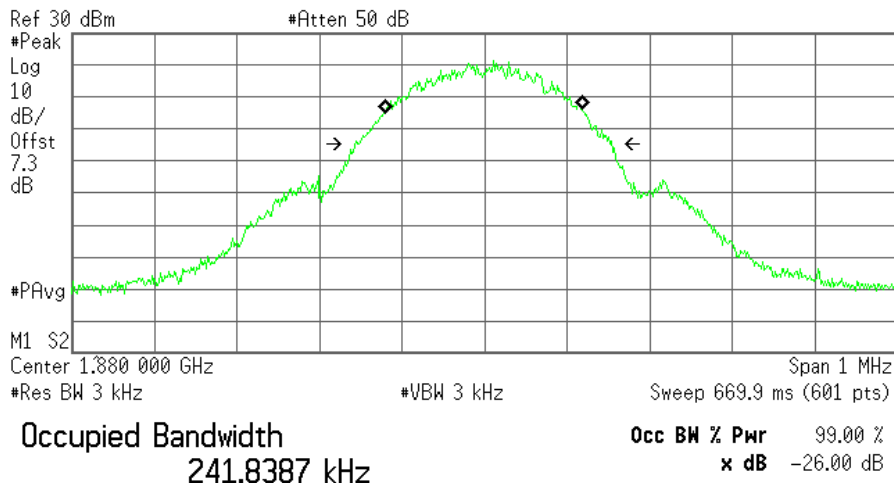
**5.3.9) GMSK Occupied Bandwidth**, PCS High channel 810, 1909.8 MHz, 99% bandwidth



**5.3.10) 8-PSK Occupied Bandwidth**, PCS Low channel 512, 1850.2 MHz, 99% bandwidth

**5.3.11) 8-PSK Occupied Bandwidth**, PCS Middle channel 661, 1880.0 MHz, 99% bandwidth



**5.3.12) 8-PSK Occupied Bandwidth**, PCS High channel 810, 1909.8 MHz, 99% bandwidth

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**5.3.13) WCDMA Occupied Bandwidth**, Cellular Low channel 4132, 826.4 MHz, 99% bandwidth



**5.3.14) WCDMA Occupied Bandwidth**, Cellular Middle channel 4182, 836.4 MHz, 99% bandwidth
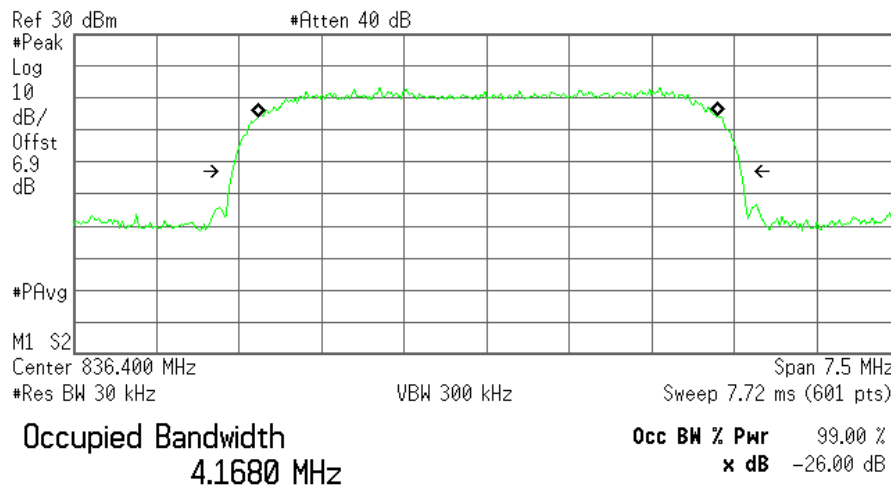
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### 5.3.15) WCDMA Occupied Bandwidth, Cellular High channel 4233, 846.6 MHz, 99% bandwidth



```
☀ Agilent 15:41:22  20 Mar 2007                              L

Ref 30 dBm              #Atten 40 dB
#Peak
Log
10
dB/
Offst
6.9
dB

#PAvg

M1 S2
Center 846.600 MHz                              Span 7.5 MHz
#Res BW 30 kHz          VBW 300 kHz      Sweep 7.72 ms (601 pts)

Occupied Bandwidth              Occ BW % Pwr    99.00 %
      4.1697 MHz                     x dB    -26.00 dB


Transmit Freq Error    -11.378 kHz
x dB Bandwidth          4.629 MHz
```
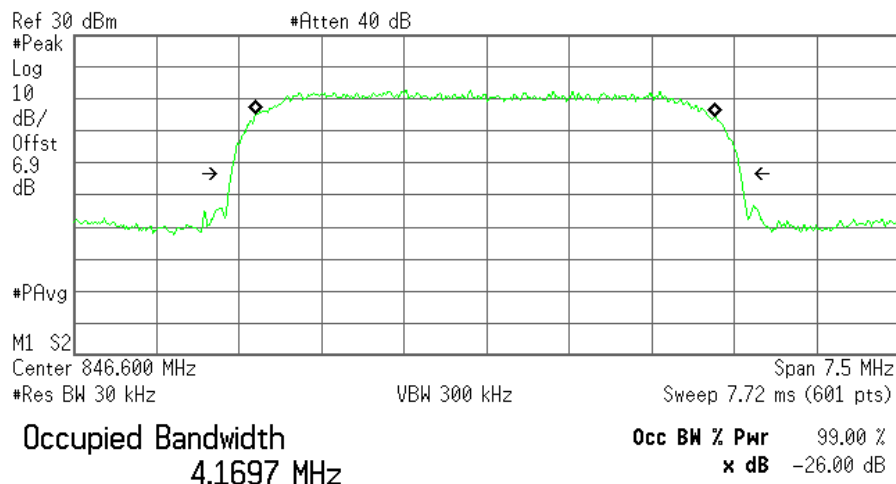
### 5.3.16) WCDMA Occupied Bandwidth, PCS Low channel 9262, 1852.4 MHz, 99% bandwidth



```
☀ Agilent 15:49:22  20 Mar 2007                              L

Ref 30 dBm              #Atten 40 dB
#Peak
Log
10
dB/
Offst
7.3
dB

#PAvg

M1 S2
Center 1.852 400 GHz                            Span 7.5 MHz
#Res BW 30 kHz          VBW 300 kHz      Sweep 7.72 ms (601 pts)

Occupied Bandwidth              Occ BW % Pwr    99.00 %
      4.1590 MHz                     x dB    -26.00 dB


Transmit Freq Error     6.567 kHz
x dB Bandwidth          4.618 MHz
```
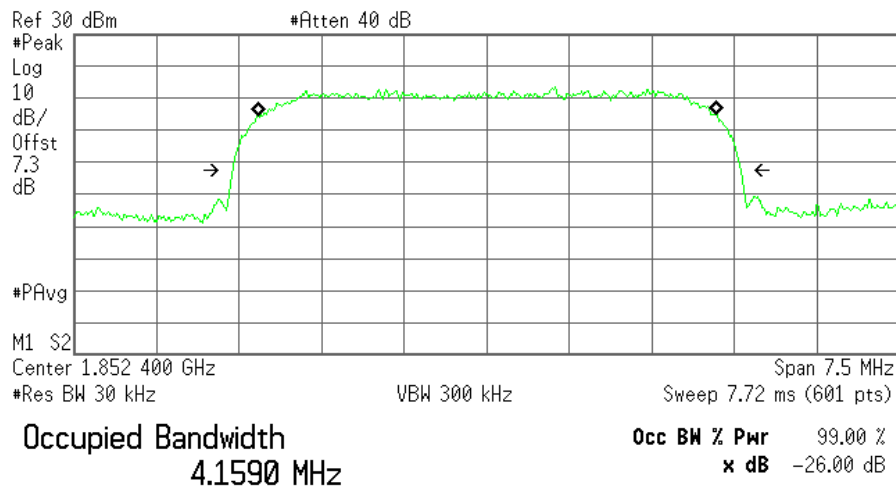
**5.3.17) WCDMA Occupied Bandwidth**, PCS Middle channel 9400, 1880 MHz, 99% bandwidth



```
※ Agilent 15:50:41  20 Mar 2007                              L

Ref 30 dBm                    #Atten 40 dB
#Peak
Log
10
dB/
Offst
7.3
dB

#PAvg

M1 S2
Center 1.880 000 GHz                                Span 7.5 MHz
#Res BW 30 kHz              VBW 300 kHz        Sweep 7.72 ms (601 pts)

Occupied Bandwidth                    Occ BW % Pwr    99.00 %
        4.1762 MHz                         x dB    -26.00 dB


Transmit Freq Error    -199.600 Hz
x dB Bandwidth          4.626 MHz
```
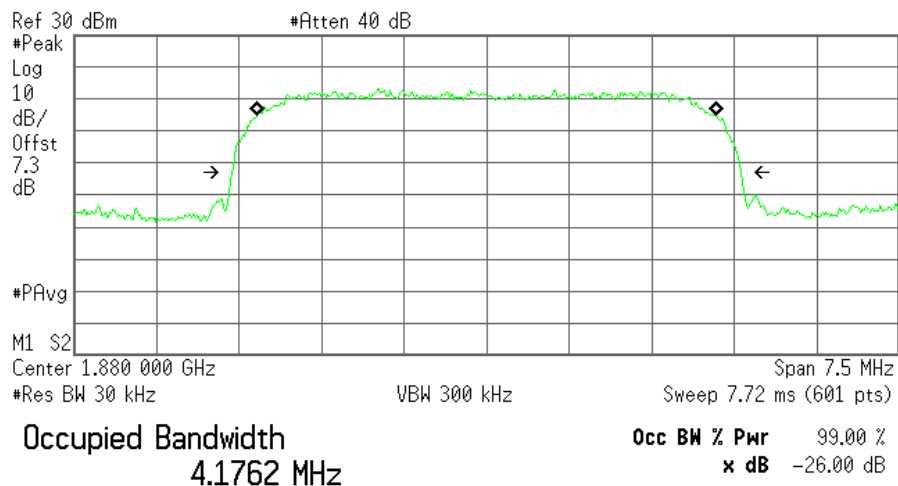
**5.3.18) WCDMA Occupied Bandwidth**, PCS High channel 9538, 1907.6 MHz, 99% bandwidth



```
※ Agilent 15:51:59  20 Mar 2007                              L

Ref 30 dBm                    #Atten 40 dB
#Peak
Log
10
dB/
Offst
7.3
dB

#PAvg

M1 S2
Start 1.903 850 GHz                            Stop 1.911 350 GHz
#Res BW 30 kHz              VBW 300 kHz        Sweep 7.72 ms (601 pts)

Occupied Bandwidth                    Occ BW % Pwr    99.00 %
        4.1720 MHz                         x dB    -26.00 dB


Transmit Freq Error    -15.214 kHz
x dB Bandwidth          4.630 MHz
```
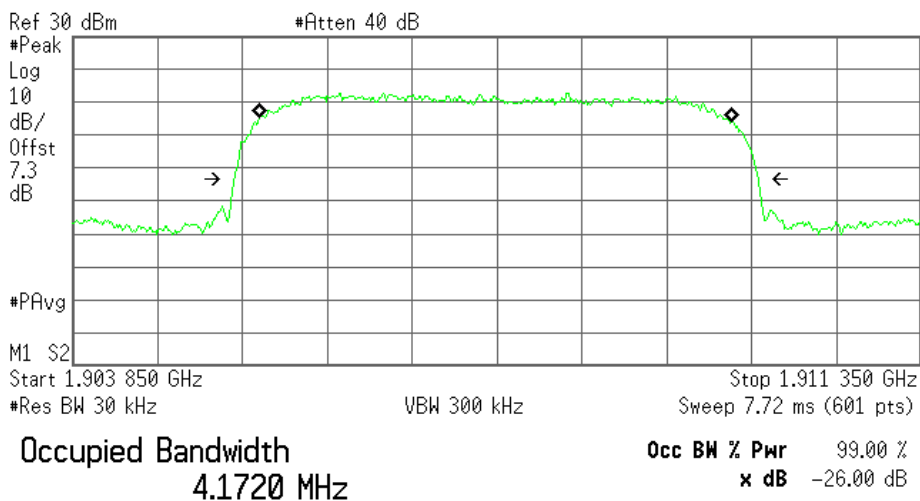
# 6 Out of Band Emissions at Antenna Terminals
FCC 22.901(d), 22.917, 24.238(a)

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.

## 6.1 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. The measurement cable path loss at 20GHz (including an attenuator) was 10dB (7dB at lower frequencies). The larger path loss of 10dB was used for all measurements to be conservative. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

**Test Setup**



## 6.2 Test Equipment

| EQUIPMENT | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE |
|---|---|---|---|---|
| Control Computer | TC | Generic PC | 100488 | N/A |
| Wireless Test Set | Rohde & Schwarz | CMU200 | 836766/030 | N/A |
| Spectrum Analyzer | Agilent | PSA E4440A | US41421268 | Mar. 1, 2007 |
| DC Power Supply | HP | 6632A | 3530A | N/A |
| Interface Board | Shop built | Minnow | N/A | N/A |
| Directional Coupler | Mini-Circuits | ZA3PD-2 | N/A | N/A |

### *6.3    Test Results*

Refer to the following plots.

- **Cellular Band**

| Plot Number | Description |
|---|---|
| 6.4.1 – 6.4.3 | GMSK Mode, Low channel, 824.20 MHz |
| 6.4.4 – 6.4.6 | GMSK Mode, Middle Channel, 836.6 MHz |
| 6.4.7 – 6.4.9 | GMSK Mode, High Channel, 848.8 MHz |
| 6.4.10 – 6.4.12 | 8-PSK Mode, Low channel, 824.20 MHz |
| 6.4.13 – 6.4.15 | 8-PSK Mode, Middle Channel, 836.6 MHz |
| 6.4.16 – 6.4.18 | 8-PSK Mode, High Channel, 848.8 MHz |

- **PCS Band**

| Plot Number | Description |
|---|---|
| 6.4.19 – 6.4.21 | GMSK Mode, Low Channel, 1850.2 MHz |
| 6.4.22 – 6.4.24 | GMSK Mode, Middle Channel, 1880.0 MHz |
| 6.4.25 – 6.4.27 | GMSK Mode, High Channel, 1909.8 MHz |
| 6.4.28 – 6.4.30 | 8-PSK, Mode, Low Channel, 1850.2 MHz |
| 6.4.31 – 6.4.33 | 8-PSK Mode, Middle Channel, 1880.0 MHz |
| 6.4.34 – 6.4.36 | 8-PSK Mode, High Channel, 1909.8 MHz |

- **UMTS Cellular Band**

| Plot Number | Description |
|---|---|
| 6.4.37 – 6.4.39 | WCDMA Mode, Low Channel, 826.4 MHz |
| 6.4.40 – 6.4.42 | WCDMA Mode, Middle Channel, 836.4 MHz |
| 6.4.43 – 6.4.45 | WCDMA Mode, High Channel, 846.6 MHz |

- **UMTS PCS Band**

| Plot Number | Description |
|---|---|
| 6.4.46 – 6.4.48 | WCDMA Mode, Low Channel, 1852.4 MHz |
| 6.4.49 – 6.4.51 | WCDMA Mode, Middle Channel, 1880.0 MHz |
| 6.4.52 – 6.4.54 | WCDMA Mode, High Channel, 1907.6 MHz |

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

## 6.4 Test Plots

### Plot 6.4.1) Out of Band Emissions at Antenna Terminals
GMSK, Low channel 128, 824.200 MHz, 1 MHz to 1 GHz
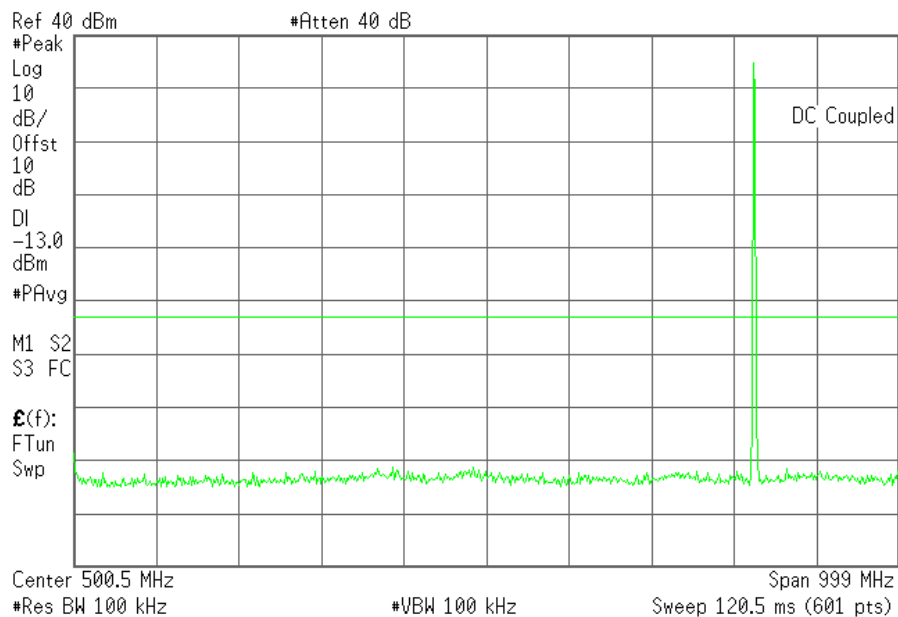


### Plot 6.4.2) Out of Band Emissions at Antenna Terminals
GMSK, Low channel, 824.200 MHz, TX signal +/- 20 MHz
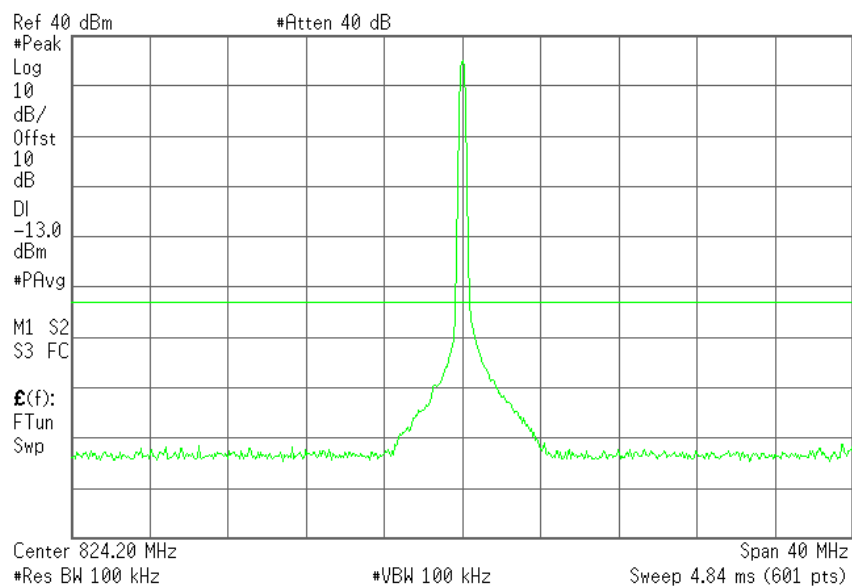


**The strong emission shown in each case is the carrier signal.**

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**Plot 6.4.3) Out of Band Emissions at Antenna Terminals**
GMSK, Low channel 128, 824.200 MHz, 1 GHz to 20 GHz
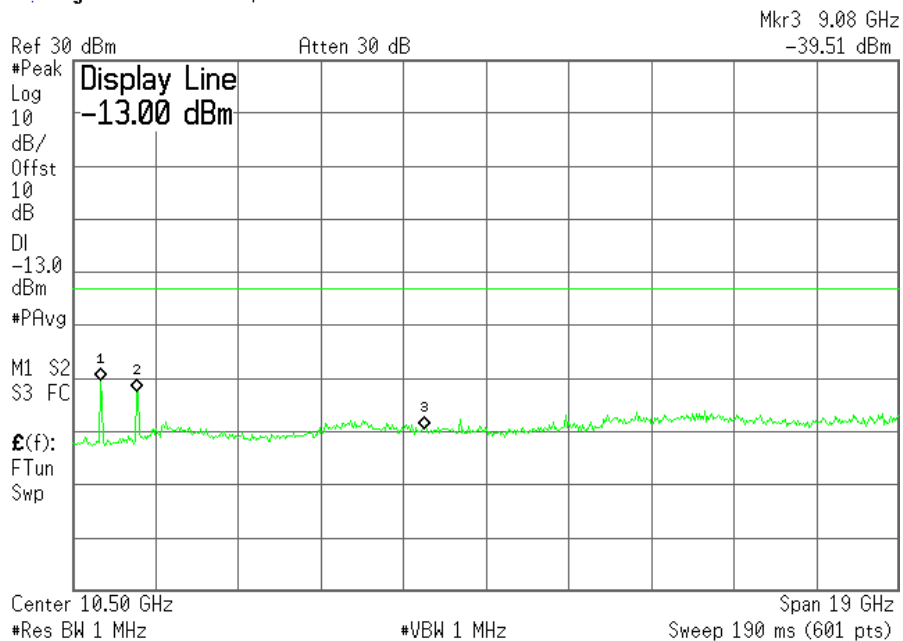


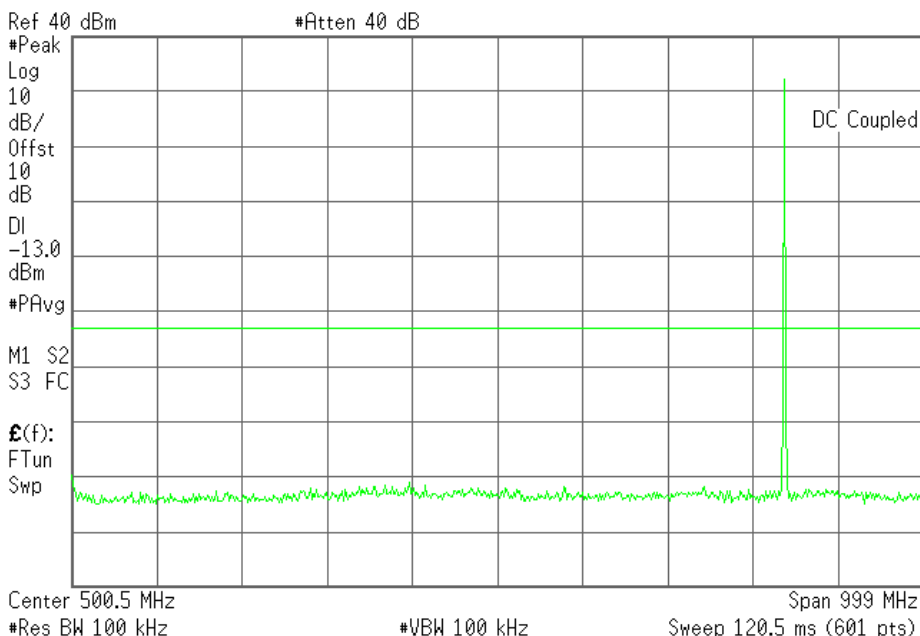| Cellular Harmonics for Ch. 128 (824.2 MHz) | Level (dBm) |
|---|---|
| Second | -31 dBm |
| Third | -33 dBm |
| All others | < -30dBm up to 20GHz |

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### Plot 6.4.4) Out of Band Emissions at Antenna Terminals
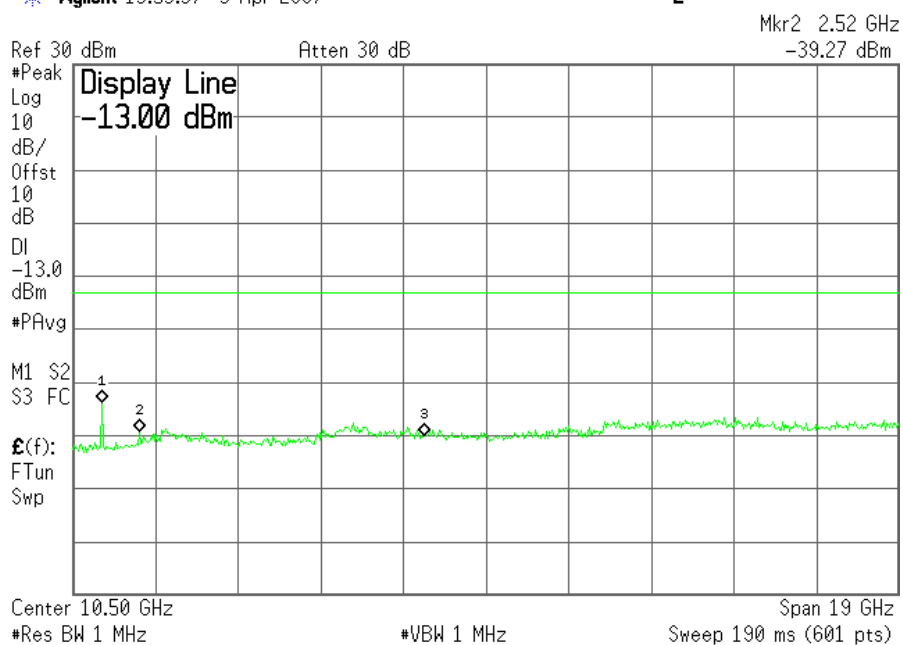GMSK, Mid Channel 190, 836.6 MHz, 1 MHz to 1 GHz



### Plot 6.4.5) Out of Band Emissions at Antenna Terminals
GMSK, Mid Channel 190, 836.6 MHz, TX signal +/- 20 MHz
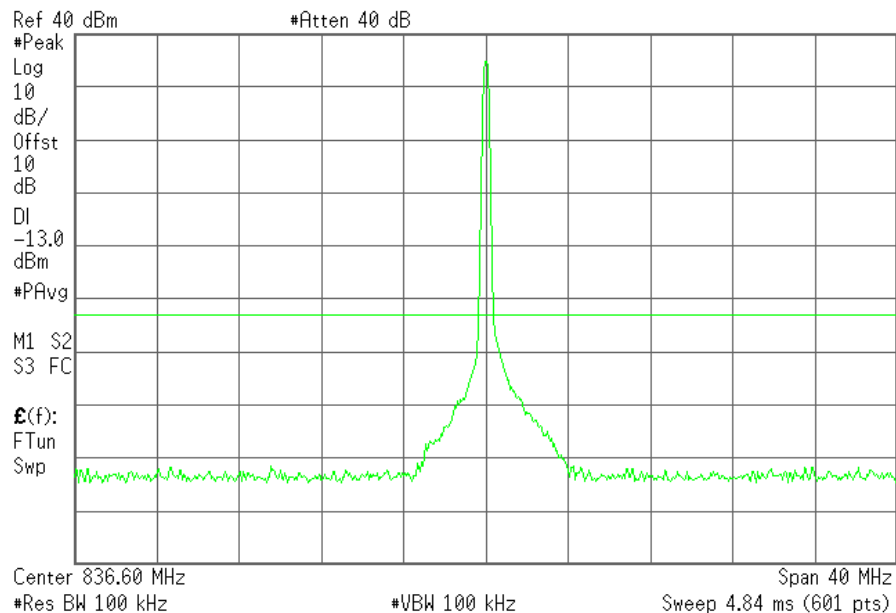


**The strong emission shown in each case is the carrier signal.**

**Plot 6.4.6) Out of Band Emissions at Antenna Terminals**
GMSK, Mid Channel 190, 836.6 MHz, 1 GHz to 20 GHz
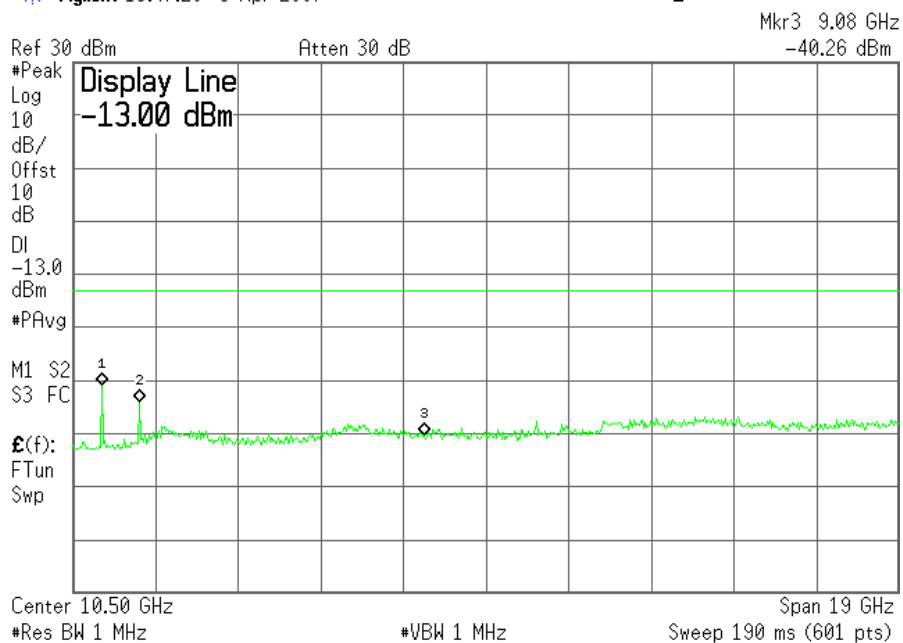


| Cellular Harmonics for Ch. 190 (836.6 MHz) | Level (dBm) |
|---|---|
| Second | -31 dBm |
| Third | -34 dBm |
| All others | < -30dBm up to 20GHz |

### Plot 6.4.7) Out of Band Emissions at Antenna Terminals
GMSK, High Channel 251, 848.8 MHz, 1 MHz to 1 GHz
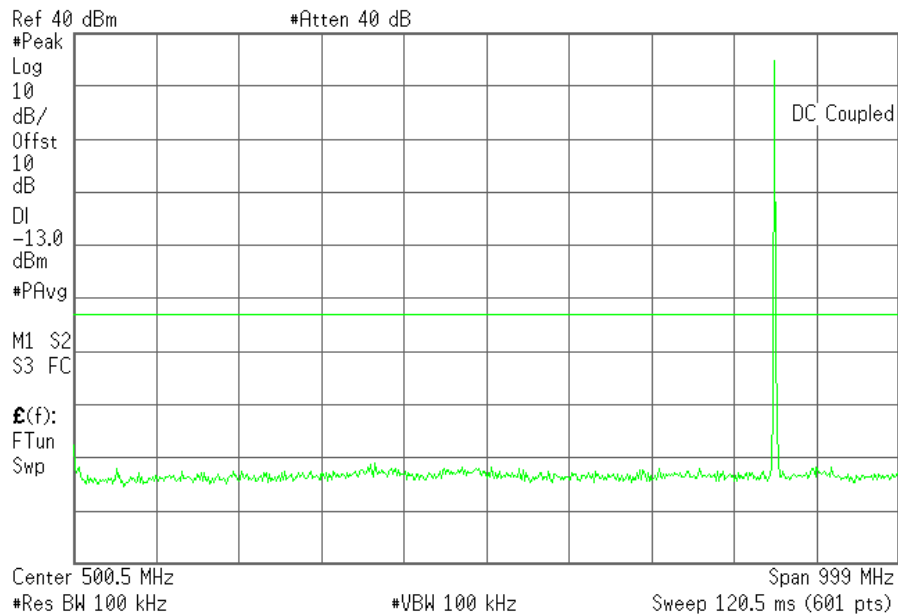


### Plot 6.4.8) Out of Band Emissions at Antenna Terminals
GMSK, High Channel 251, 848.8 MHz, TX signal +/- 20 MHz



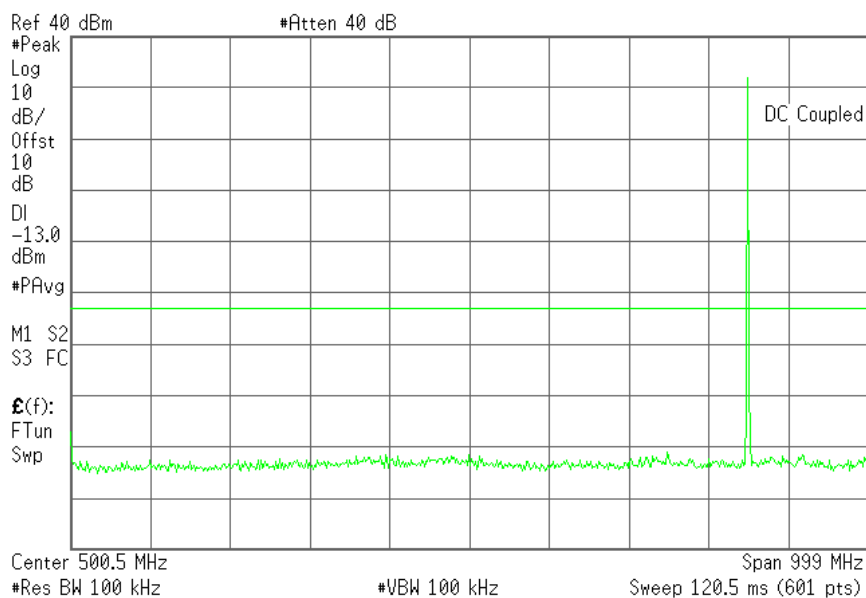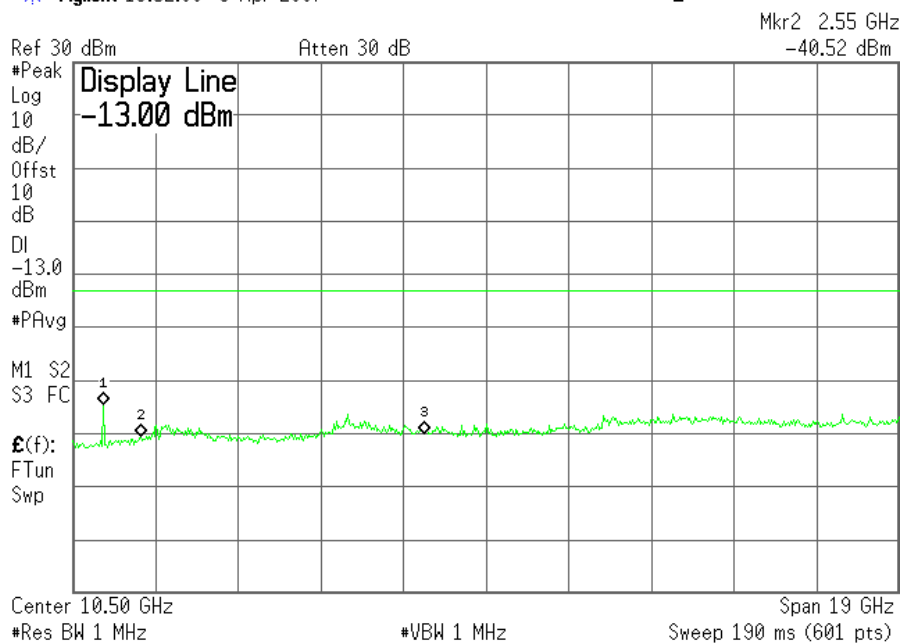**The strong emission shown in each case is the carrier signal.**

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**Plot 6.4.9) Out of Band Emissions at Antenna Terminals**
GMSK, High Channel 251, 848.8 MHz, 1 GHz to 20 GHz
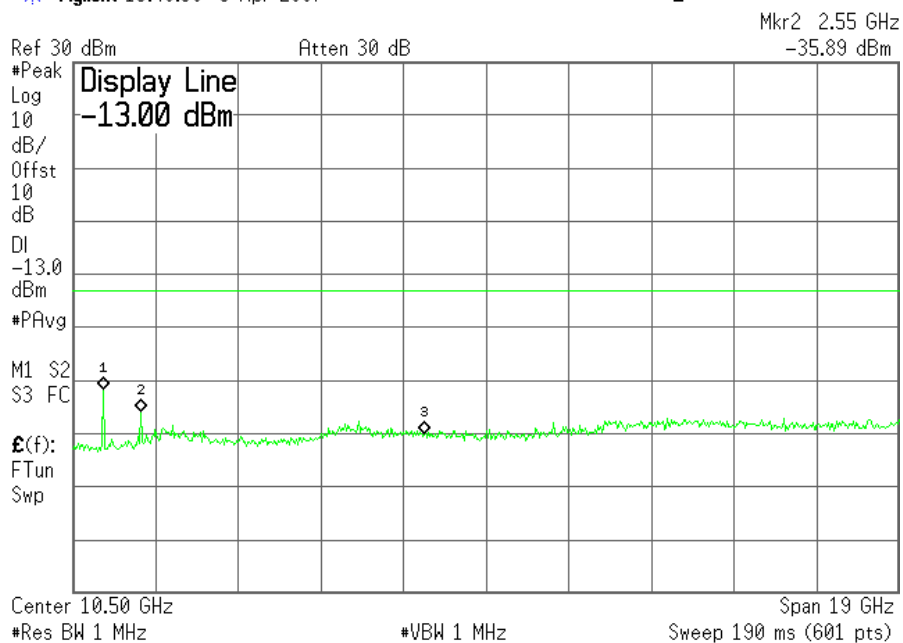


| Cellular Harmonics for Ch. 251 (848.8 MHz) | Level (dBm) |
|---|---|
| Second | -32 dBm |
| Third | -35 dBm |
| All others | < -30dBm up to 20GHz |

**Plot 6.4.10) Out of Band Emissions at Antenna Terminals**
8-PSK, Low channel, 824.200 MHz, 1 MHz to 1 GHz
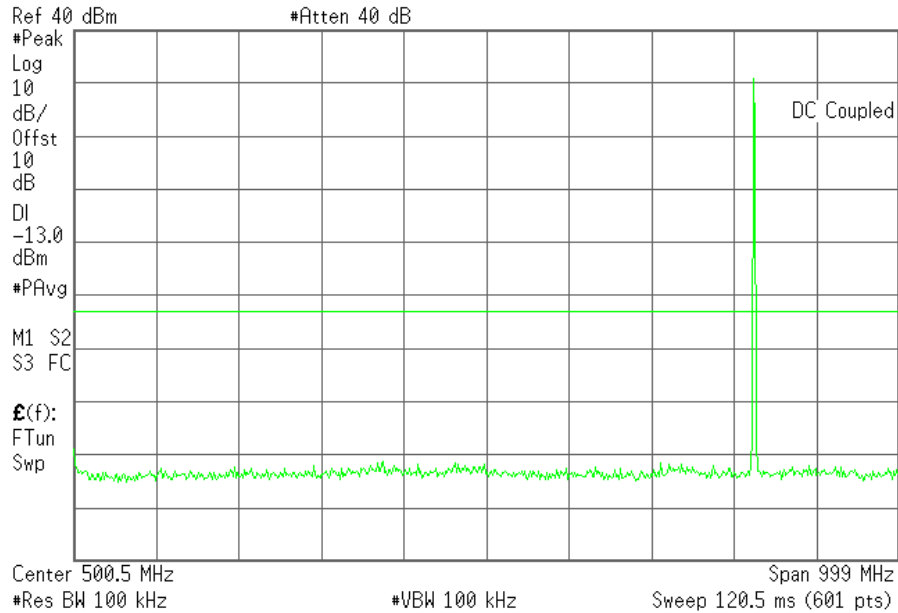


**Plot 6.4.11) Out of Band Emissions at Antenna Terminals**
8-PSK, Low channel 128, 824.200 MHz, TX signal +/- 20 MHz



**The strong emission shown in each case is the carrier signal.**

**Plot 6.4.12) Out of Band Emissions at Antenna Terminals**
8-PSK, Low channel 128, 824.200 MHz, 1 GHz to 20 GHz



| Cellular Harmonics for Ch. 128 (824.2 MHz) | Level (dBm) |
|---|---|
| Second | -34dBm |
| Third | -38dBm |
| All others | < -30dBm up to 20GHz |

### Plot 6.4.13) Out of Band Emissions at Antenna Terminals
8-PSK, Mid Channel 190, 836.6 MHz, 1 MHz to 1 GHz



### Plot 6.4.14) Out of Band Emissions at Antenna Terminals
8-PSK, Mid Channel 190, 836.6 MHz, TX signal +/- 20 MHz



**The strong emission shown in each case is the carrier signal.**

**Plot 6.4.15) Out of Band Emissions at Antenna Terminals**
8-PSK, Mid Channel 190, 836.6 MHz, 1 GHz to 20 GHz



| Cellular Harmonics for Ch. 190 (836.6 MHz) | Level (dBm) |
|---|---|
| Second | -34dBm |
| Third | -38dBm |
| All others | < -30dBm up to 20GHz |

**Plot 6.4.16) Out of Band Emissions at Antenna Terminals**
8-PSK, High Channel 251, 848.8 MHz, 1 MHz to 1 GHz



**Plot 6.4.17) Out of Band Emissions at Antenna Terminals**
8-PSK, High Channel, 848.8 MHz, TX signal +/- 20 MHz



**The strong emission shown in each case is the carrier signal.**

**Plot 6.4.18) Out of Band Emissions at Antenna Terminals**
8-PSK, High Channel 251, 848.8 MHz, 1 GHz to 20 GHz



| Cellular Harmonics for Ch. 251 (848.8 MHz) | Level (dBm) |
|---|---|
| Second | -34dBm |
| Third | -39dBm |
| All others | < -30dBm up to 20GHz |

## Plot 6.4.19) Out of Band Emissions at Antenna Terminals
GMSK, Low channel 512, 1850.2 MHz, 1 MHz to 1 GHz



## Plot 6.4.20) Out of Band Emissions at Antenna Terminals
GMSK, Low channel 512, 1850.2 MHz, TX signal +/- 20 MHz

**Plot 6.4.21) Out of Band Emissions at Antenna Terminals**
GMSK, Low channel 512, 1850.2 MHz, 1 GHz to 20 GHz



**The strong emission shown is the carrier signal.**
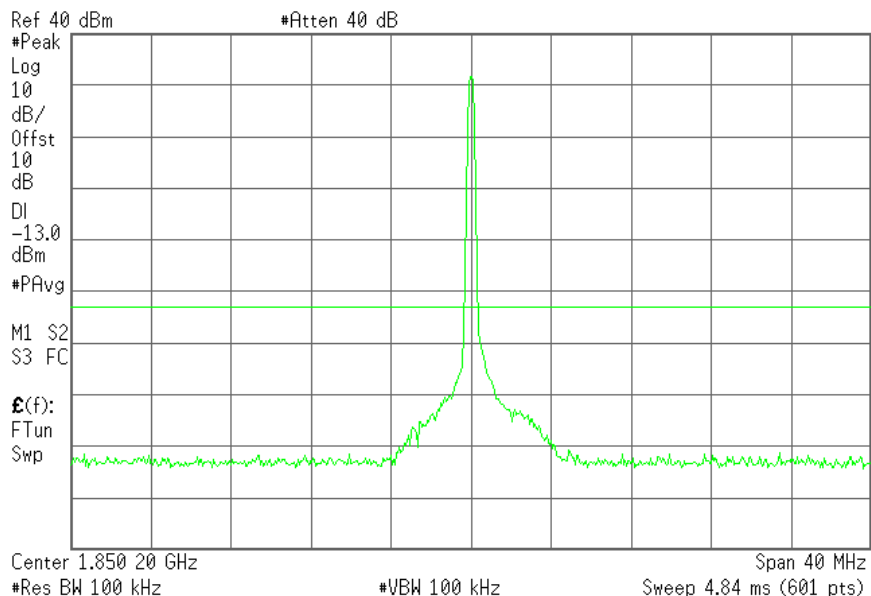
### Plot 6.4.22) Out of Band Emissions at Antenna Terminals
GMSK, Middle channel 661, 1880.0 MHz, 1 MHz to 1 GHz



### Plot 6.4.23) Out of Band Emissions at Antenna Terminals
GMSK, Middle channel 661, 1880.0 MHz, TX signal +/- 20 MHz

**Plot 6.4.24) Out of Band Emissions at Antenna Terminals**
GMSK, Middle channel 661, 1880.0 MHz, 1 GHz to 20 GHz

Agilent 13:58:33  3 Apr 2007                                                L

Ref 30 dBm                          Atten 30 dB

#Peak
Log
10
dB/
Offst
10
dB

DI
−13.0
dBm

#PAvg

M1  S2
S3  FC

£(f):
FTun
Swp

Display Line
−13.00 dBm

Center 10.50 GHz                                              Span 19 GHz
#Res BW 1 MHz                     #VBW 1 MHz         Sweep 190 ms (601 pts)
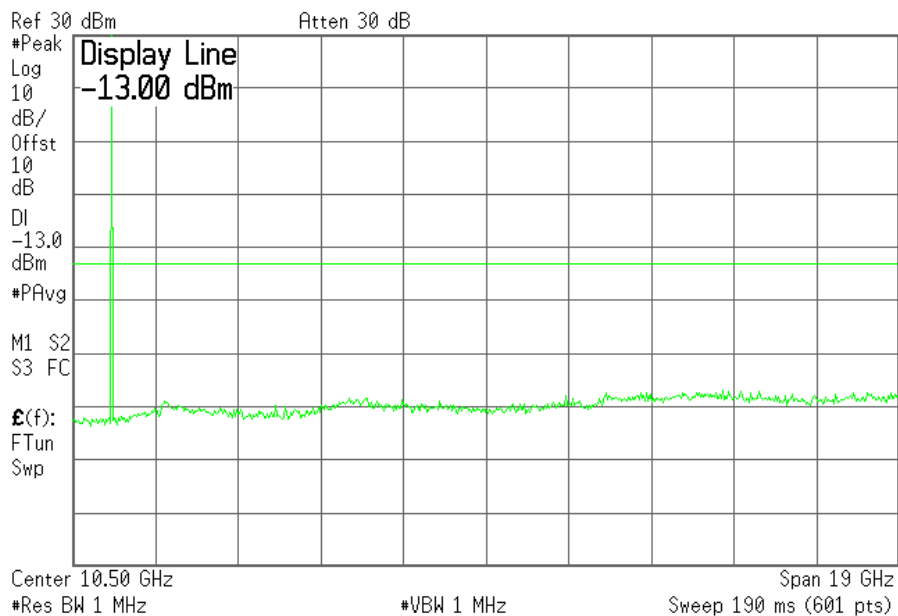
**The strong emission shown is the carrier signal.**

**Plot 6.4.25) Out of Band Emissions at Antenna Terminals**
GMSK, High channel 810, 1909.8 MHz, 1 MHz to 1 GHz
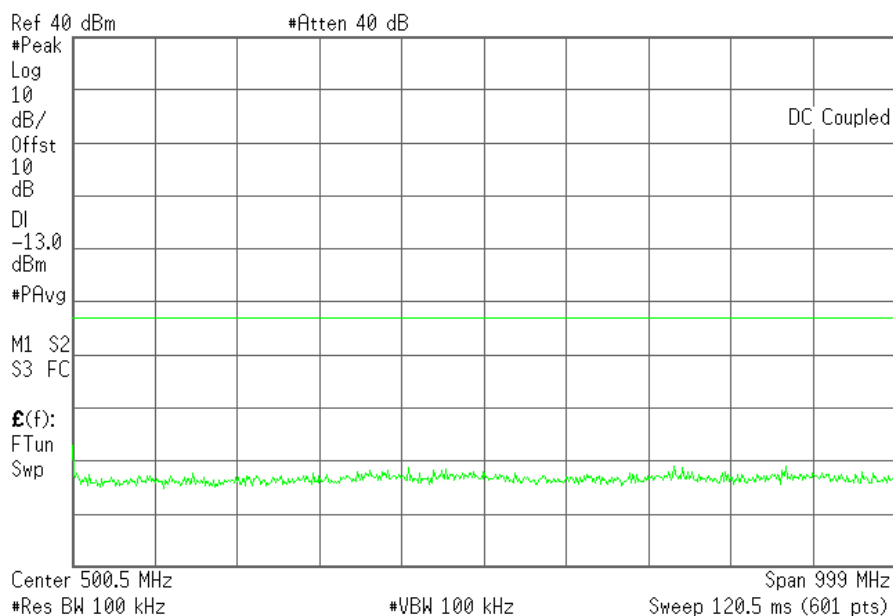


**Plot 6.4.26) Out of Band Emissions at Antenna Terminals**
GMSK, High channel 810, 1909.8 MHz, TX signal +/- 20 MHz
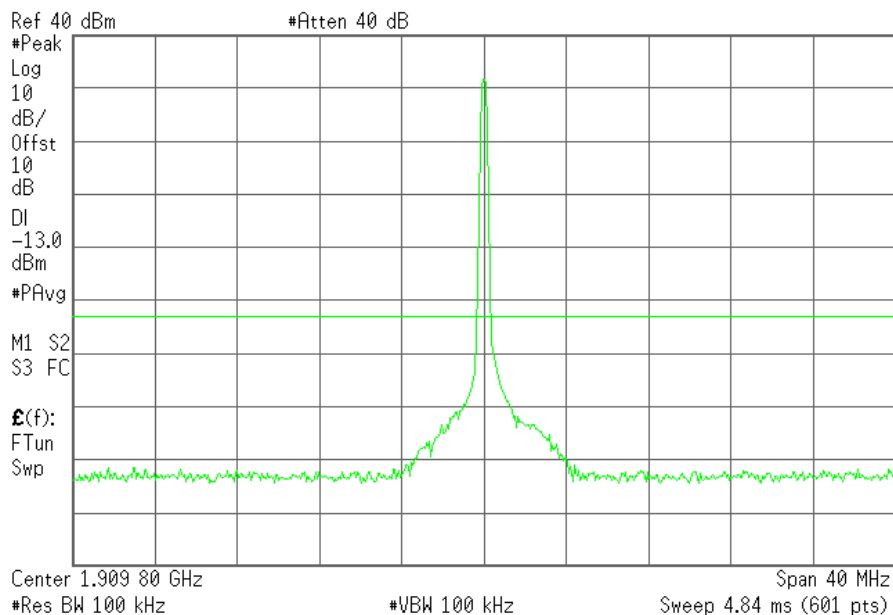
**Plot 6.4.27) Out of Band Emissions at Antenna Terminals**
GMSK, High channel 810, 1909.8 MHz, 1 GHz to 20 GHz

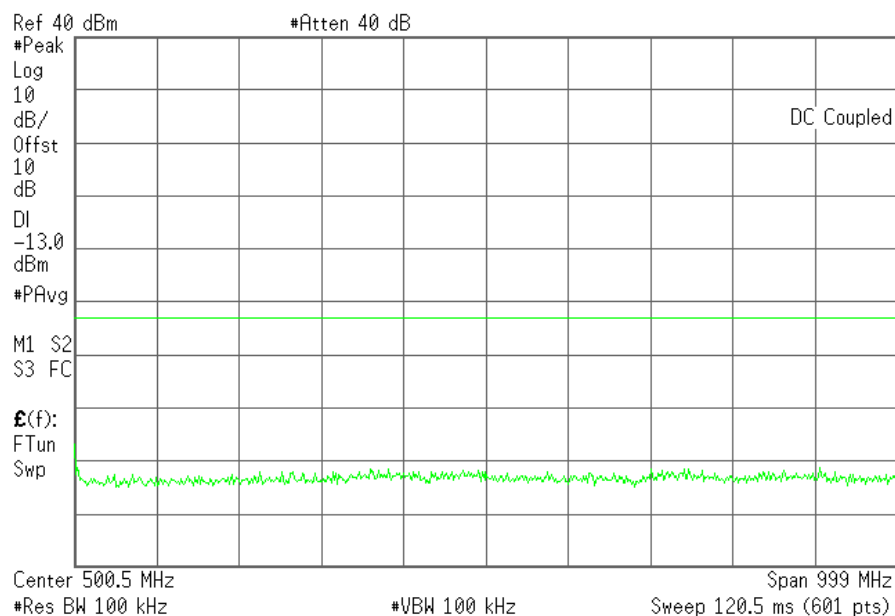Agilent 13:59:21  3 Apr 2007                                      L

Ref 30 dBm                          Atten 30 dB

#Peak
Log
10
dB/
Offst
10
dB

DI
-13.0
dBm

#PAvg

M1 S2
S3 FC

£(f):
FTun
Swp

Display Line -13.00 dBm

Center 10.50 GHz                                      Span 19 GHz
#Res BW 1 MHz            #VBW 1 MHz        Sweep 190 ms (601 pts)

**The strong emission shown is the carrier signal.**

### Plot 6.4.28) Out of Band Emissions at Antenna Terminals
8-PSK, Low channel 512, 1850.2 MHz, 1 MHz to 1 GHz



### Plot 6.4.29) Out of Band Emissions at Antenna Terminals
8-PSK, Low channel 512, 1850.2 MHz, TX signal +/- 20 MHz
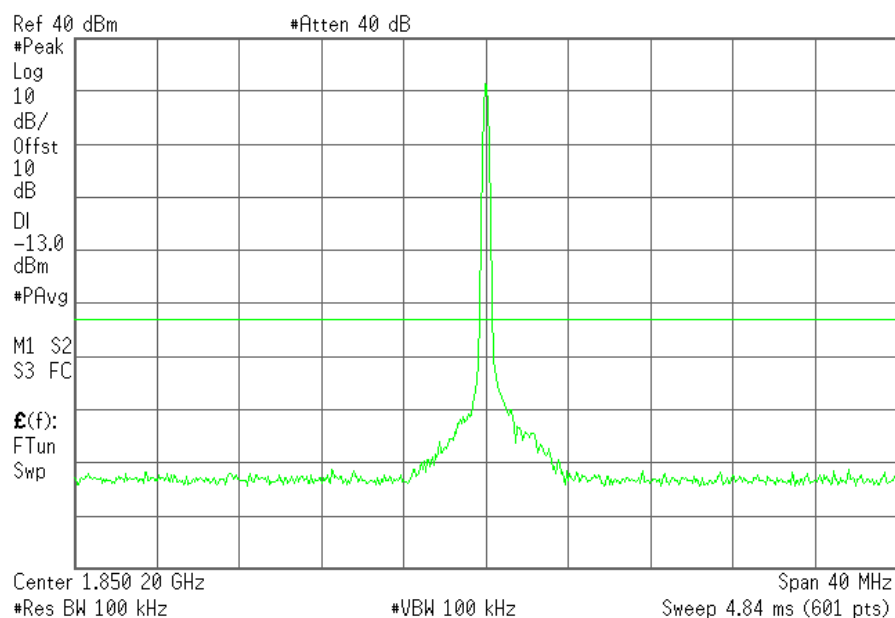
**Plot 6.4.30) Out of Band Emissions at Antenna Terminals**

8-PSK, Low channel 512, 1850.2 MHz, 1 GHz to 20 GHz
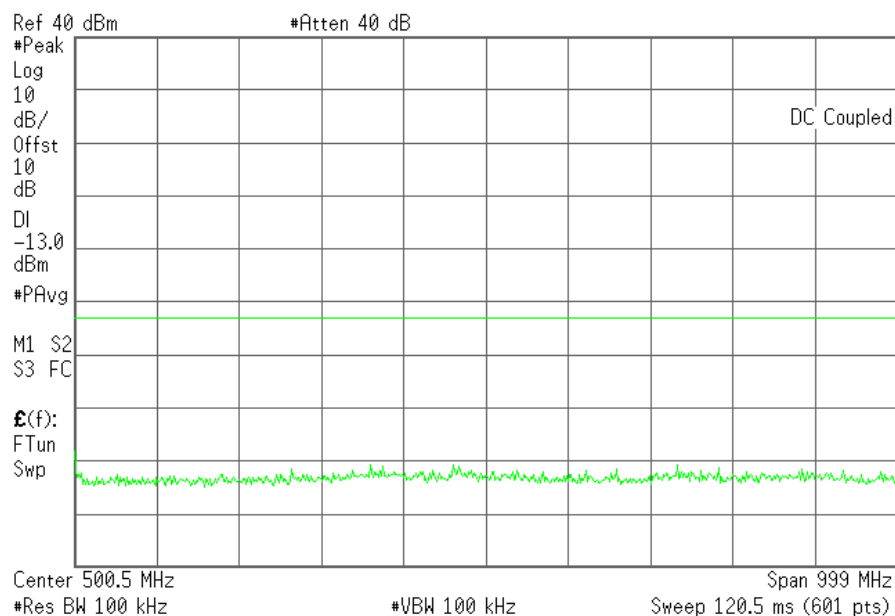


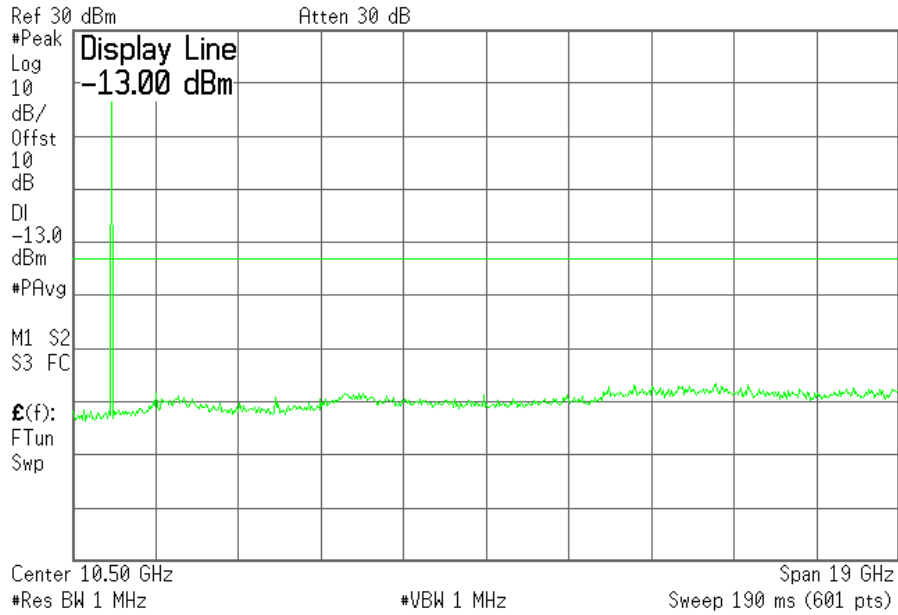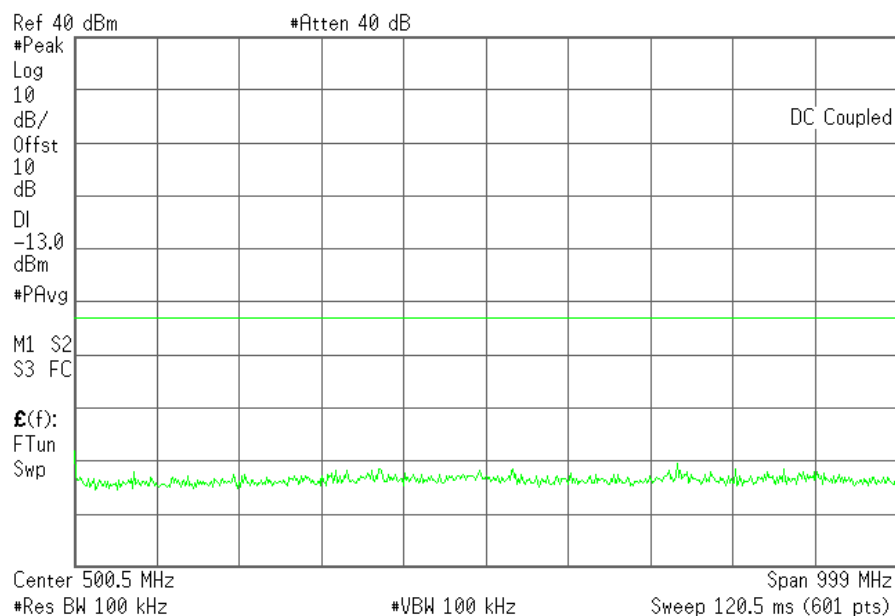**The strong emission shown is the carrier signal.**

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### Plot 6.4.31) Out of Band Emissions at Antenna Terminals
8-PSK, Middle channel 661, 1880.0 MHz, 1 MHz to 1 GHz



### Plot 6.4.32) Out of Band Emissions at Antenna Terminals
8-PSK, Middle channel 661, 1880.0 MHz, TX signal +/- 20 MHz



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**Plot 6.4.33) Out of Band Emissions at Antenna Terminals**
8-PSK, Middle channel 661, 1880.0 MHz, 1 GHz to 20 GHz



**The strong emission shown is the carrier signal.**

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### Plot 6.4.34) Out of Band Emissions at Antenna Terminals
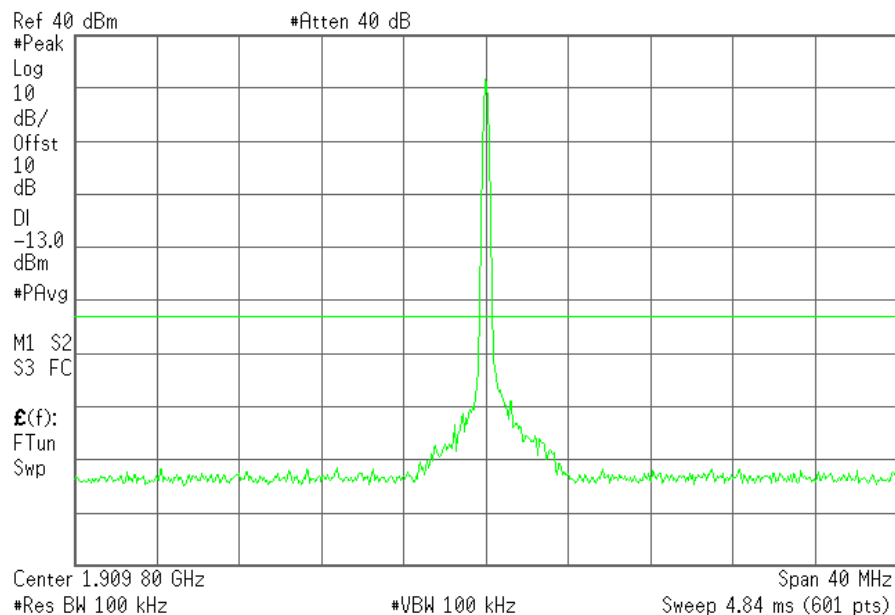8-PSK, High channel 810, 1909.8 MHz, 1 MHz to 1 GHz



### Plot 6.4.35) Out of Band Emissions at Antenna Terminals
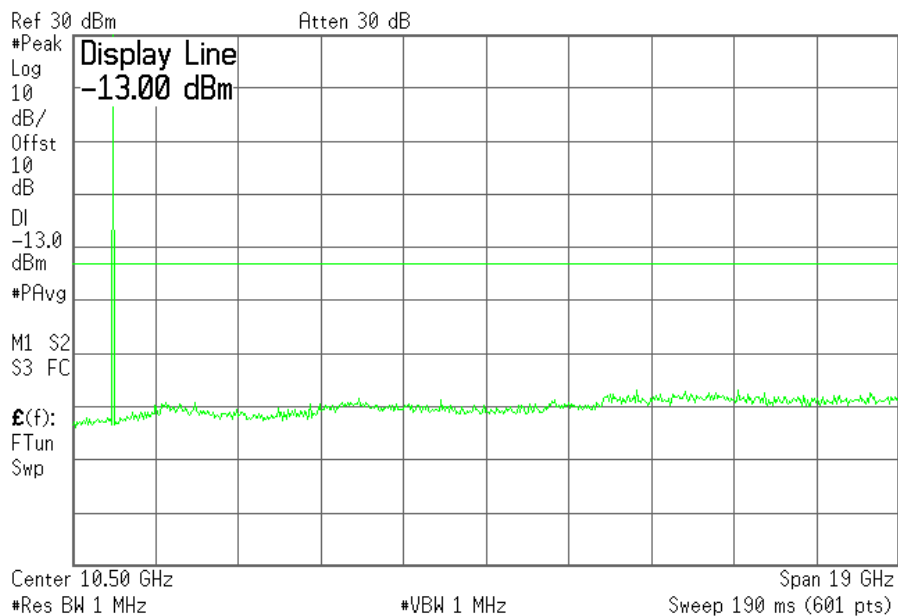8-PSK, High channel 810, 1909.8 MHz, TX signal +/- 20 MHz

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**Plot 6.4.36) Out of Band Emissions at Antenna Terminals**
8-PSK, High channel 810, 1909.8 MHz, 1 GHz to 20 GHz



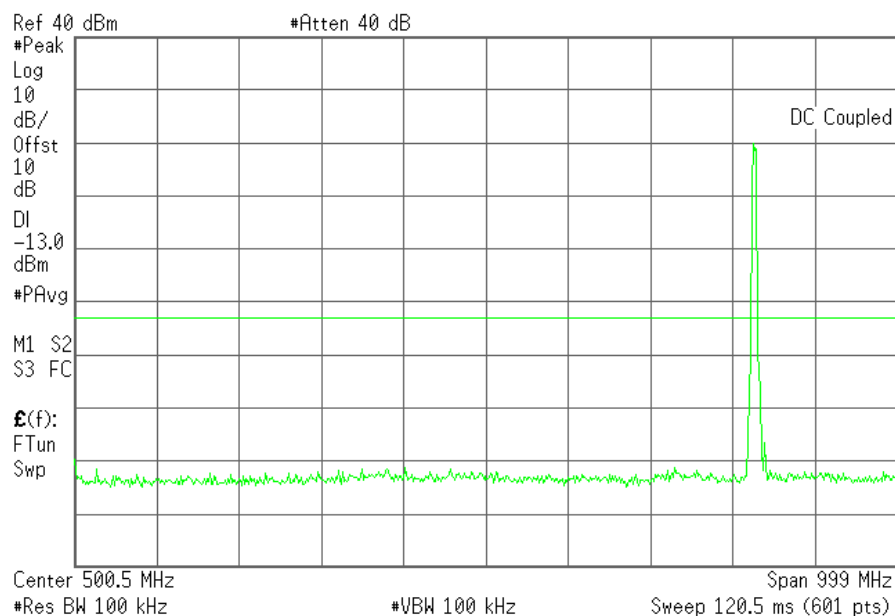**The strong emission shown is the carrier signal.**

### Plot 6.4.37) Out of Band Emissions at Antenna Terminals
WCDMA, Low channel 4132, 826.4 MHz, 1 MHz to 1 GHz



### Plot 6.4.38) Out of Band Emissions at Antenna Terminals
WCDMA, Low channel 4132, 826.4 MHz, TX signal +/- 20 MHz



**The strong emission shown in each case is the carrier signal.**

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### Plot 6.4.39) Out of Band Emissions at Antenna Terminals
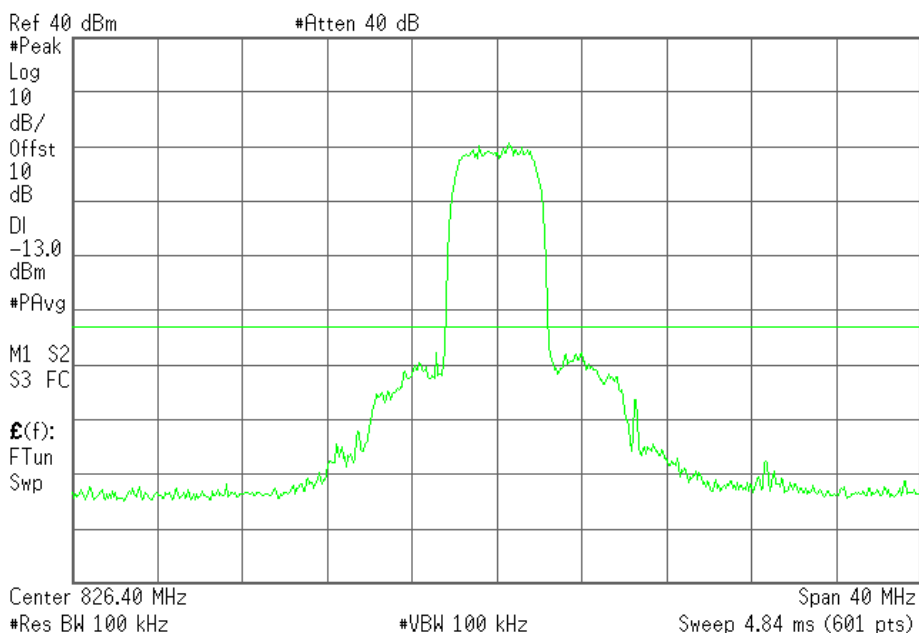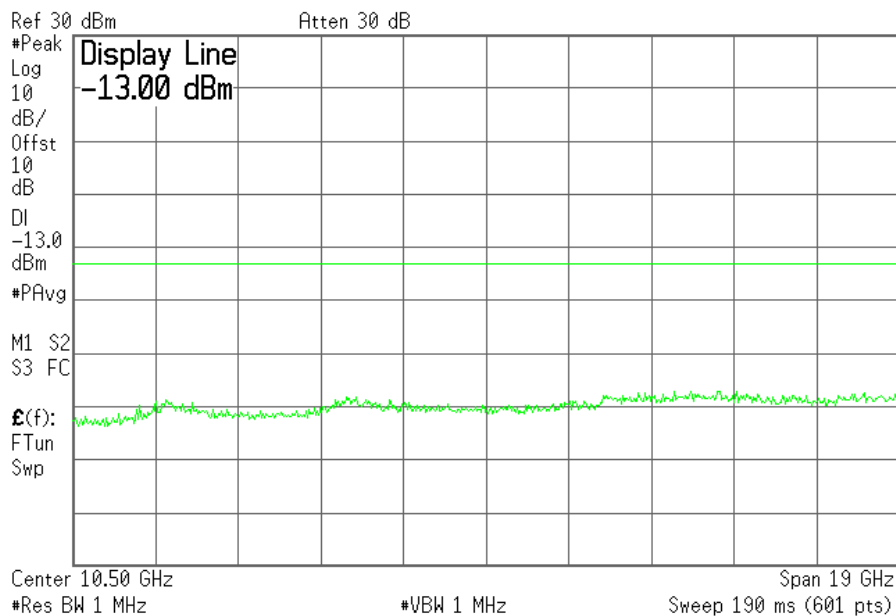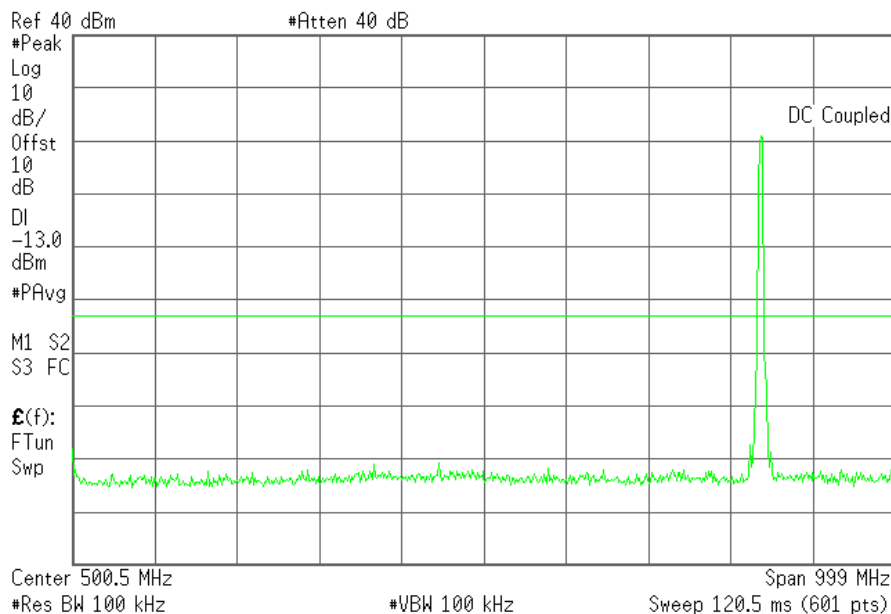WCDMA, Low channel 4132, 826.4 MHz, 1 GHz to 20 GHz



| Cellular Harmonics for Ch. 128 (824.2 MHz) | Level (dBm) |
| --- | --- |
| Second | -- |
| Third | -- |
| All others | < -30dBm up to 20GHz |

**Plot 6.4.40) Out of Band Emissions at Antenna Terminals**
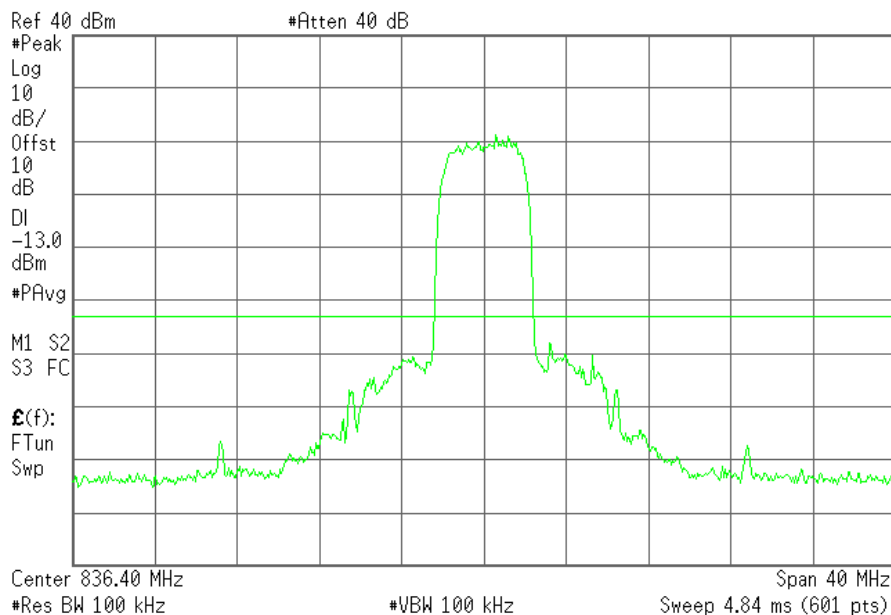WCDMA, Middle channel 4182, 836.4 MHz, 1 MHz to 1 GHz

Agilent 09:50:43 21 Mar 2007                    R

Ref 40 dBm                    #Atten 40 dB
#Peak
Log
10
dB/
Offst                                                    DC Coupled
10
dB
DI
−13.0
dBm
#PAvg

M1 S2
S3 FC

£(f):
FTun
Swp

Center 500.5 MHz                              Span 999 MHz
#Res BW 100 kHz          #VBW 100 kHz     Sweep 120.5 ms (601 pts)

**Plot 6.4.41) Out of Band Emissions at Antenna Terminals**
WCDMA, Middle channel 4182, 836.4 MHz, TX signal +/- 20 MHz

Agilent 10:28:07 21 Mar 2007                    L

Ref 40 dBm                    #Atten 40 dB
#Peak
Log
10
dB/
Offst
10
dB
DI
−13.0
dBm
#PAvg

M1 S2
S3 FC

£(f):
FTun
Swp

Center 836.40 MHz                             Span 40 MHz
#Res BW 100 kHz          #VBW 100 kHz     Sweep 4.84 ms (601 pts)

**The strong emission shown in each case is the carrier signal.**
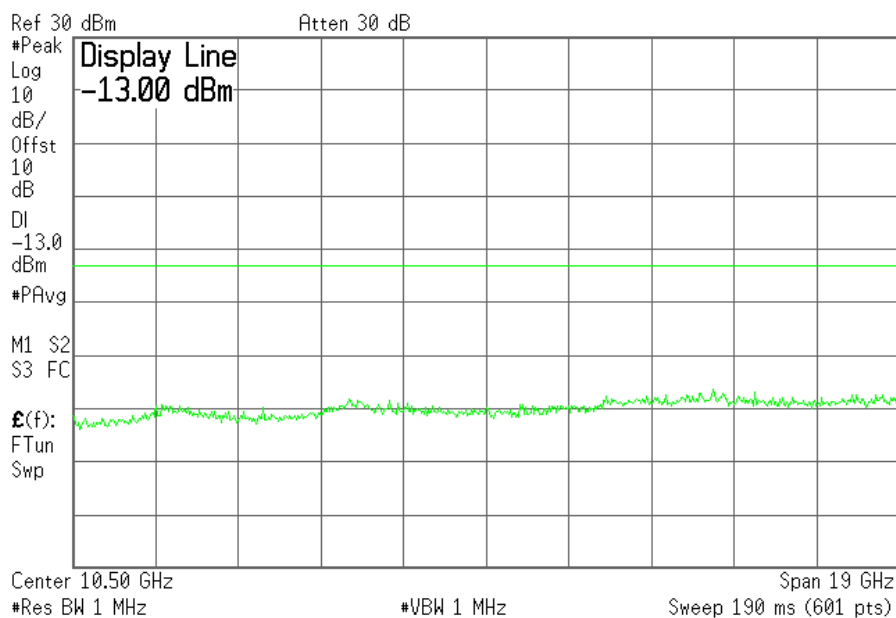
### Plot 6.4.42) Out of Band Emissions at Antenna Terminals
WCDMA, Middle channel 4182, 836.4 MHz, 1 GHz to 20 GHz



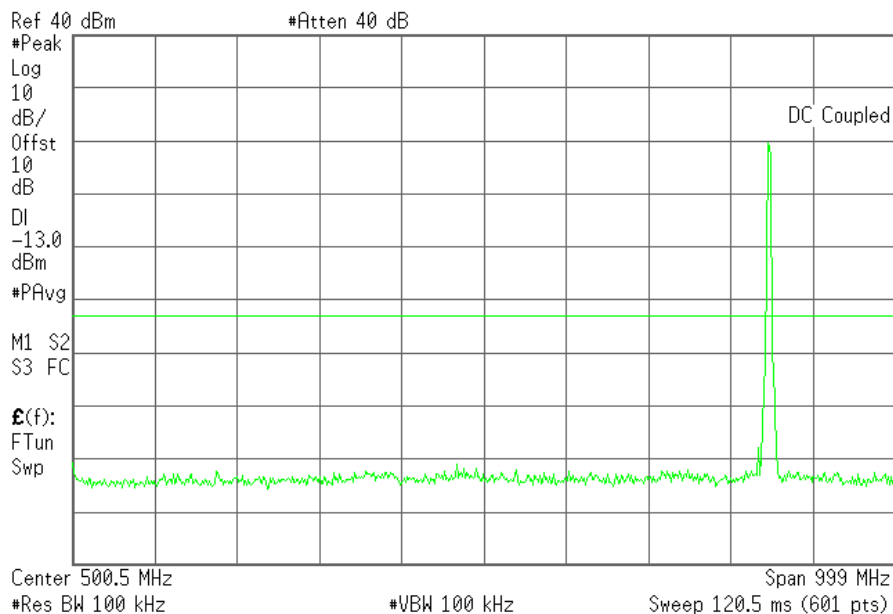| Cellular Harmonics for Ch. 190 (836.6 MHz) | Level (dBm) |
|---|---|
| Second | -- |
| Third | -- |
| All others | < -30dBm up to 20GHz |

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### Plot 6.4.43) Out of Band Emissions at Antenna Terminals
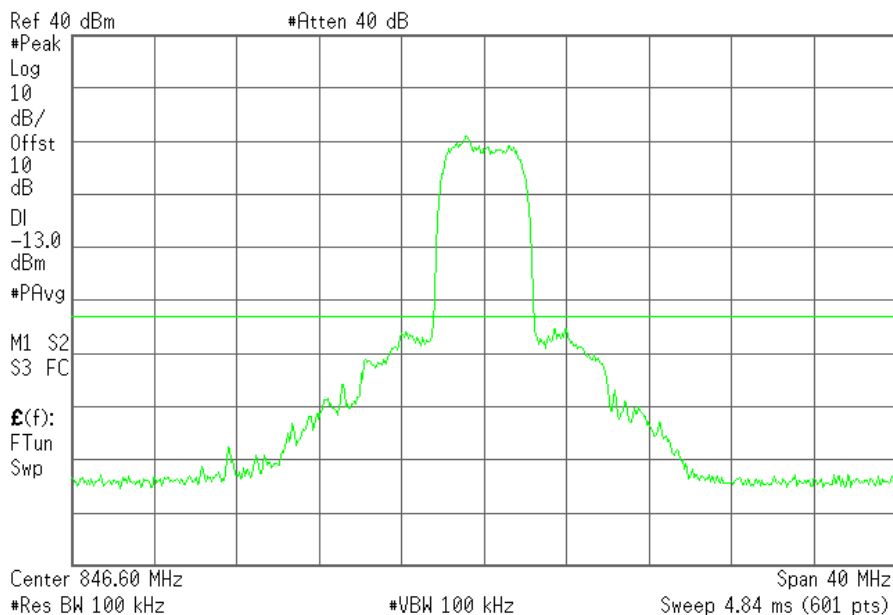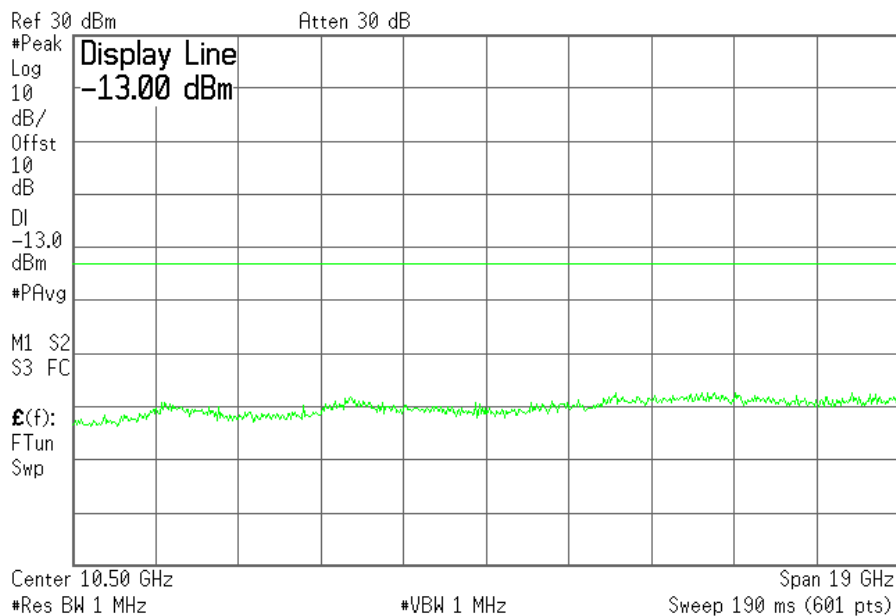WCDMA, High Channel 4233, 846.6 MHz, 1 MHz to 1 GHz

### Plot 6.4.44) Out of Band Emissions at Antenna Terminals
WCDMA, High Channel 4233, 846.6 MHz, TX signal +/- 20 MHz

**The strong emission shown in each case is the carrier signal.**

**Plot 6.4.45) Out of Band Emissions at Antenna Terminals**
WCDMA, High Channel 4233, 846.6 MHz, 1 GHz to 20 GHz



| Cellular Harmonics for Ch. 251 (848.8 MHz) | Level (dBm) |
|---|---|
| Second | -- |
| Third | -- |
| All others | < -30dBm up to 20GHz |

**Plot 6.4.46) Out of Band Emissions at Antenna Terminals**
WCDMA, Low channel 9262, 1852.4 MHz, 1 MHz to 1 GHz



**Plot 6.4.47) Out of Band Emissions at Antenna Terminals**
WCDMA, Low channel 9262, 1852.4 MHz, TX signal +/- 20 MHz

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**Plot 6.4.48) Out of Band Emissions at Antenna Terminals**
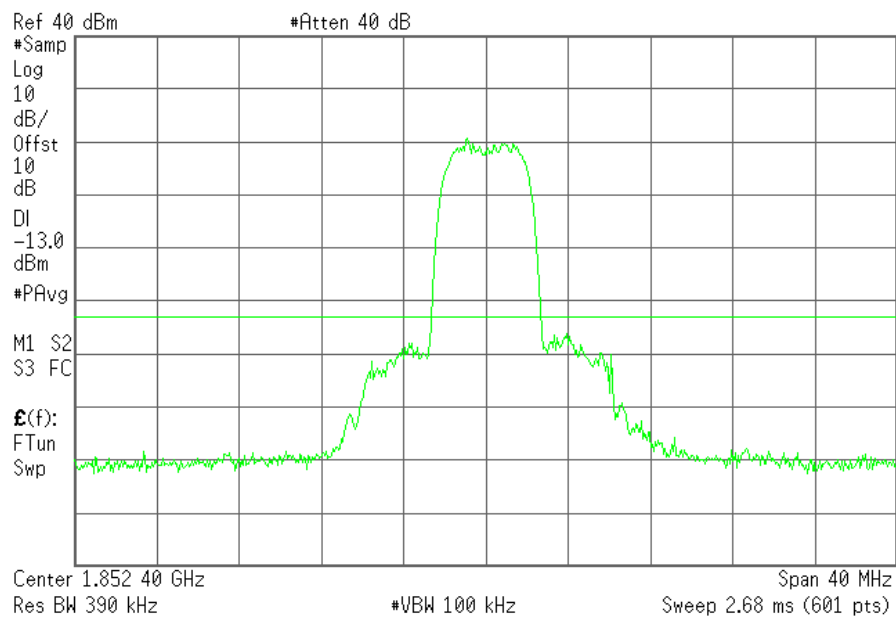WCDMA, Low channel 9262, 1852.4 MHz, 1 GHz to 20 GHz
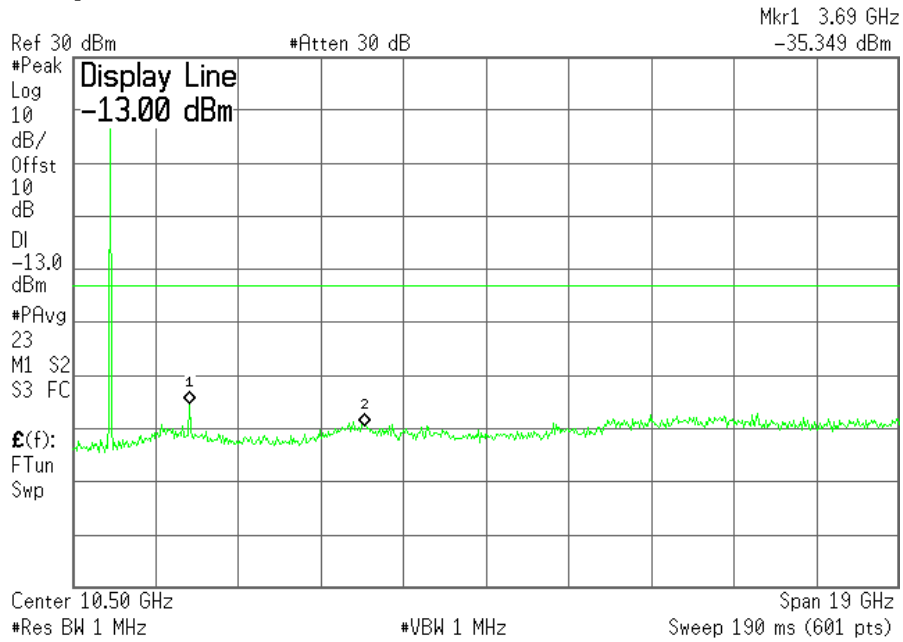


**The strong emission shown is the carrier signal.**

## Plot 6.4.49) Out of Band Emissions at Antenna Terminals
### WCDMA, Middle channel 9400, 1880 MHz, 1 MHz to 1 GHz



## Plot 6.4.50) Out of Band Emissions at Antenna Terminals
### WCDMA, Middle channel 9400, 1880 MHz, TX signal +/- 20 MHz

**Plot 6.4.51) Out of Band Emissions at Antenna Terminals**
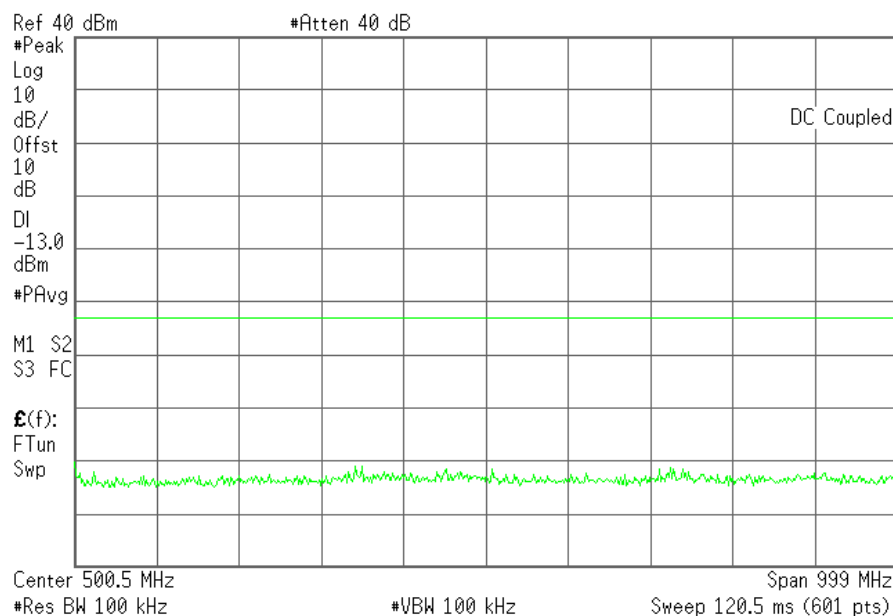WCDMA, Middle channel 9400, 1880 MHz, 1 GHz to 20 GHz
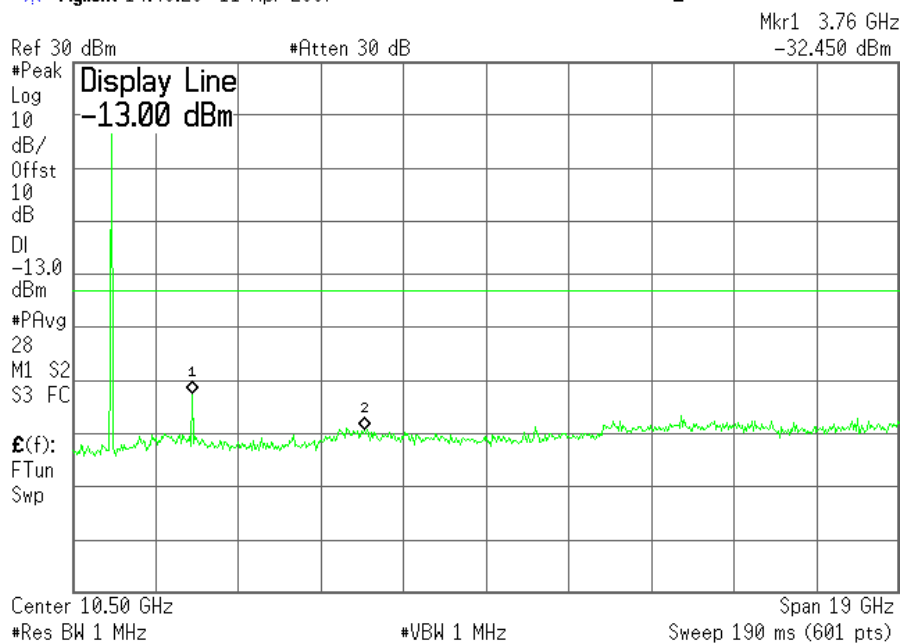


**The strong emission shown is the carrier signal.**

### Plot 6.4.52) Out of Band Emissions at Antenna Terminals
WCDMA, High channel 9538, 1907.6 MHz, 1 MHz to 1 GHz
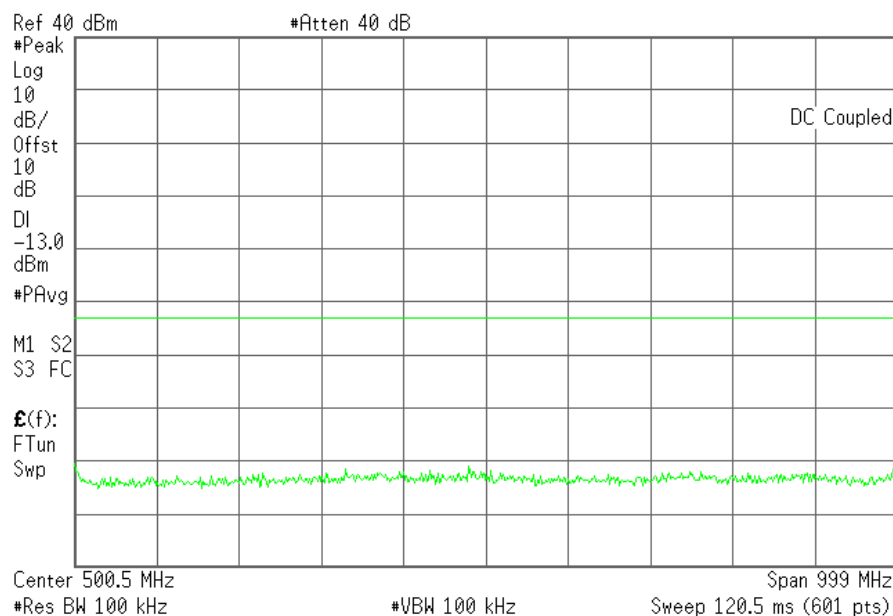


### Plot 6.4.53) Out of Band Emissions at Antenna Terminals
WCDMA, High channel 9538, 1907.6 MHz, TX signal +/- 20 MHz

**Plot 6.4.54) Out of Band Emissions at Antenna Terminals**
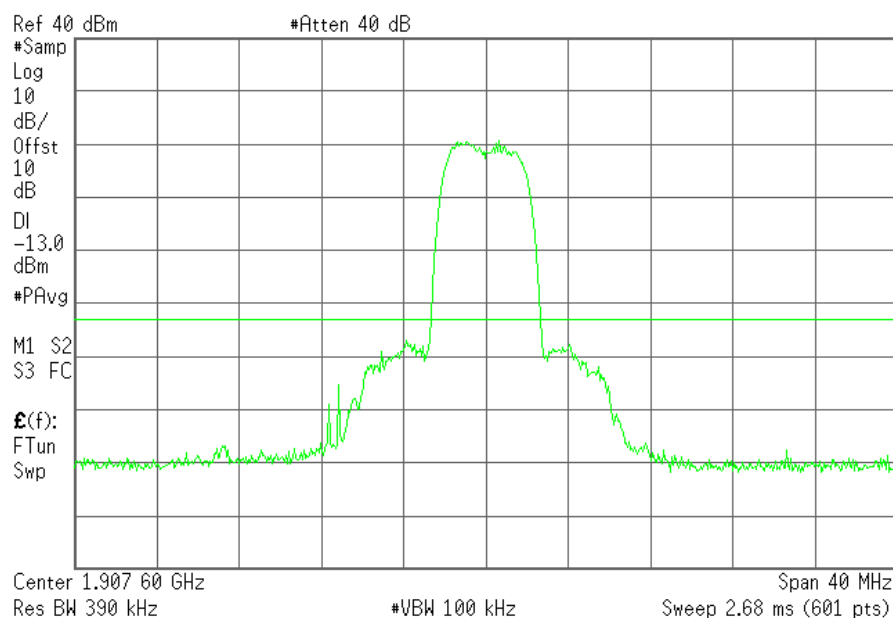WCDMA, High channel 9538, 1907.6 MHz, 1 GHz to 20 GHz
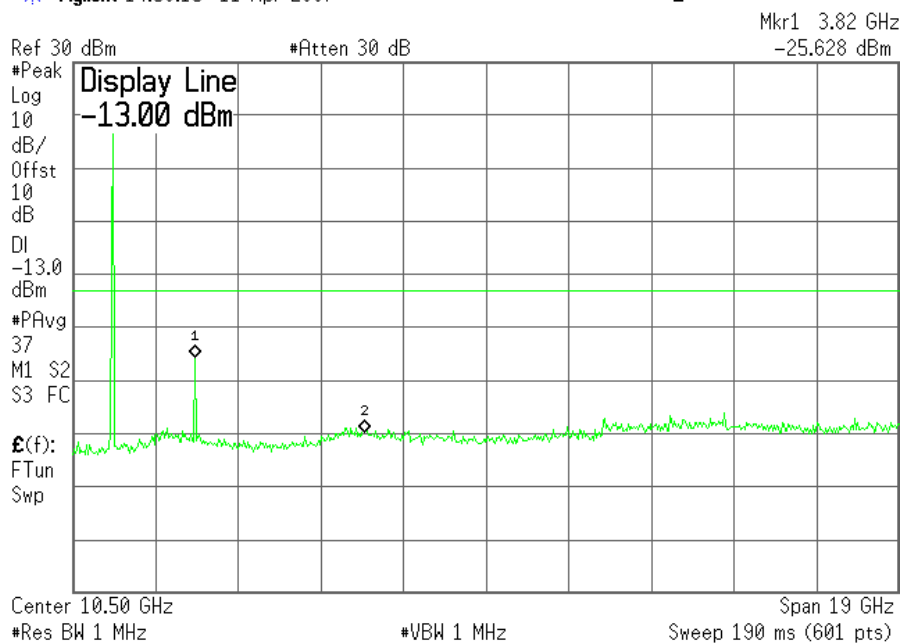


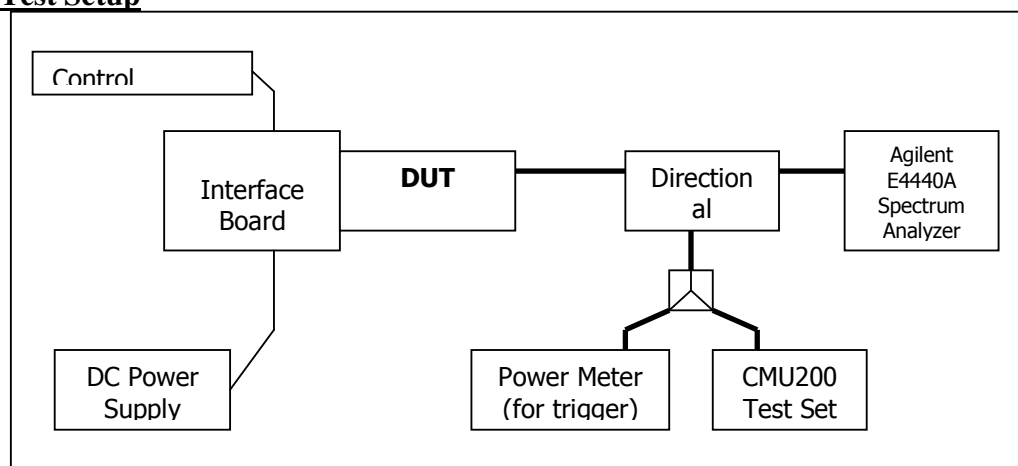**The strong emission shown is the carrier signal.**

## 7 Block Edge Compliance

FCC Part 22H/24E

### 7.1 Test Procedure

The transmitter output was connected to a Rohde & Schwarz CMU200 Test Set and configured to operate at maximum power. The block edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

**Test Setup**



### 7.2 Test Equipment

**Instrument List**

| EQUIPMENT | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE |
|---|---|---|---|---|
| Control Computer | TC | Generic PC | 100488 | N/A |
| Wireless Test Set | Rohde & Schwarz | CMU200 | 836766/030 | N/A |
| Spectrum Analyzer | Agilent | PSA E4440A | US41421268 | Mar. 1, 2007 |
| DC Power Supply | HP | 6632A | 3530A | N/A |
| Interface Board | Shop built | Minnow | N/A | N/A |
| Directional Coupler | Mini-Circuits | ZA3PD-2 | N/A | N/A |

### 7.3 Test Results

| Block Test | Frequency Boundaries (MHz) | Channels Tested | Corresponding Plots | Result |
|---|---|---|---|---|
| 1 | GMSK: Below 824 MHz, above 849 MHz | 128, 251 | 7.4.1, 7.4.2 | Complies |
| 2 | 8PSK: Below 824 MHz, above 849 MHz | 128, 251 | 7.4.3, 7.4.4 | Complies |
| 3 | GMSK: Below 1850MHz, above 1910MHz | 512, 810 | 7.4.5, 7.4.6 | Complies |
| 4 | 8PSK: Below 1850MHz, above 1910MHz | 512, 810 | 7.4.7, 7.4.8 | Complies |
| Block Test | Frequency Boundaries (MHz) | Channels Tested | Corresponding Plots | Result |
| 1 | WCDMA: Below 824MHz, above 849MHz | 4132, 4233 | 7.4.9, 7.4.10 | Complies |
| 2 | WCDMA: Below 1850MHz, above 1910MHz | 9262, 9538 | 7.4.11, 7.4.12 | Complies |

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### *7.4    Test Plots*

#### Plot 7.4.1) GSMK; Cellular low channel 128, below 824 MHz
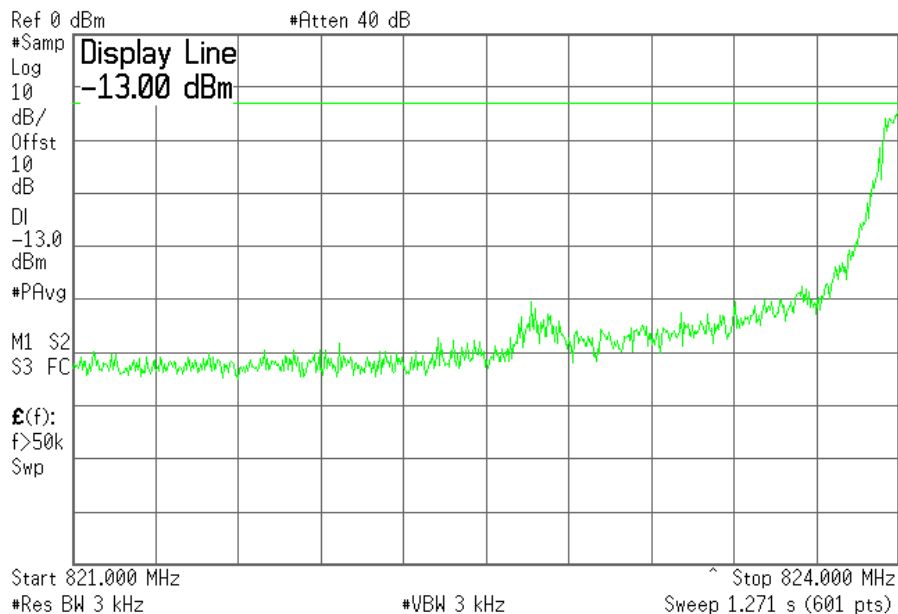


#### Plot 7.4.2) GMSK; Cellular high channel 251, above 849 MHz
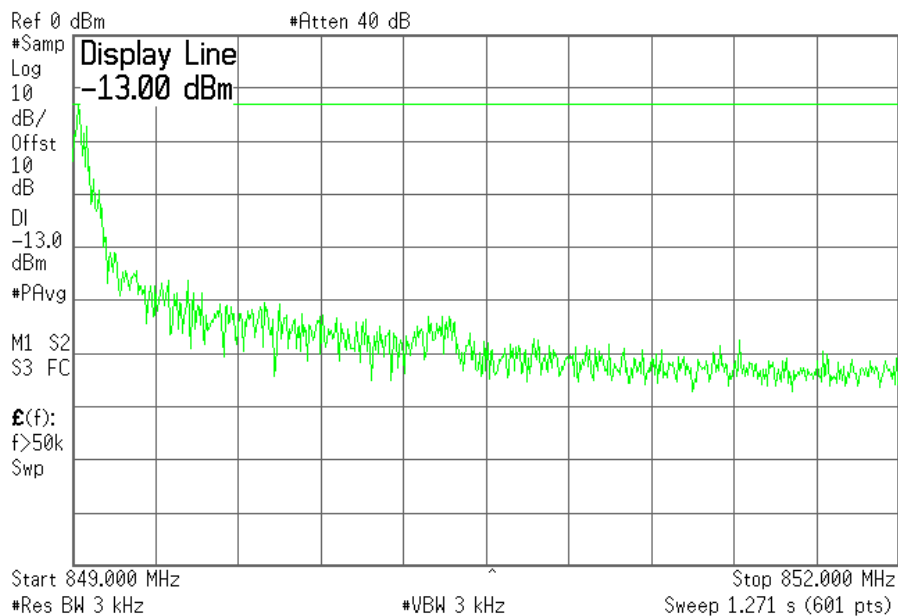
### Plot 7.4.3) 8-PSK; Cellular low channel 128, below 824 MHz
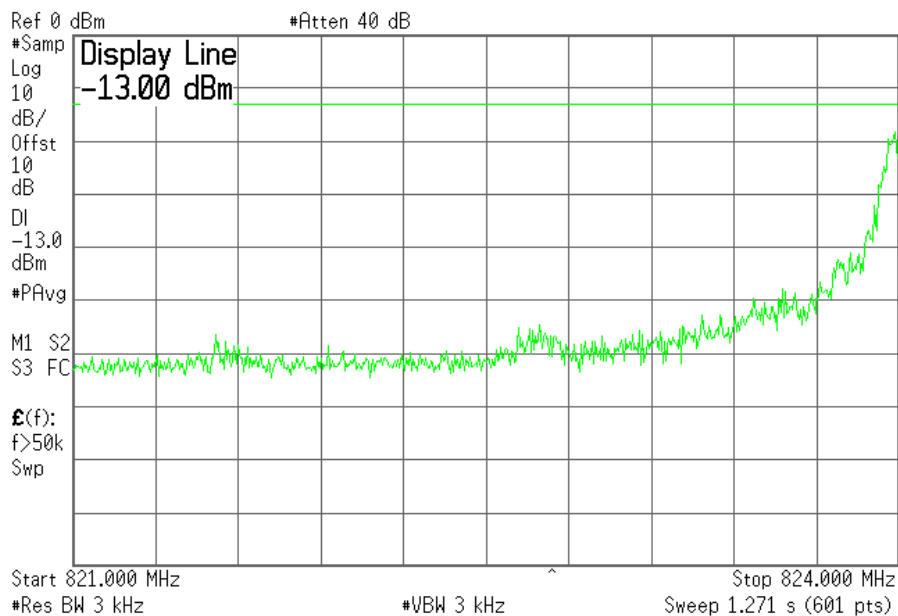


### Plot 7.4.4) 8-PSK; Cellular high channel 251, above 849 MHz
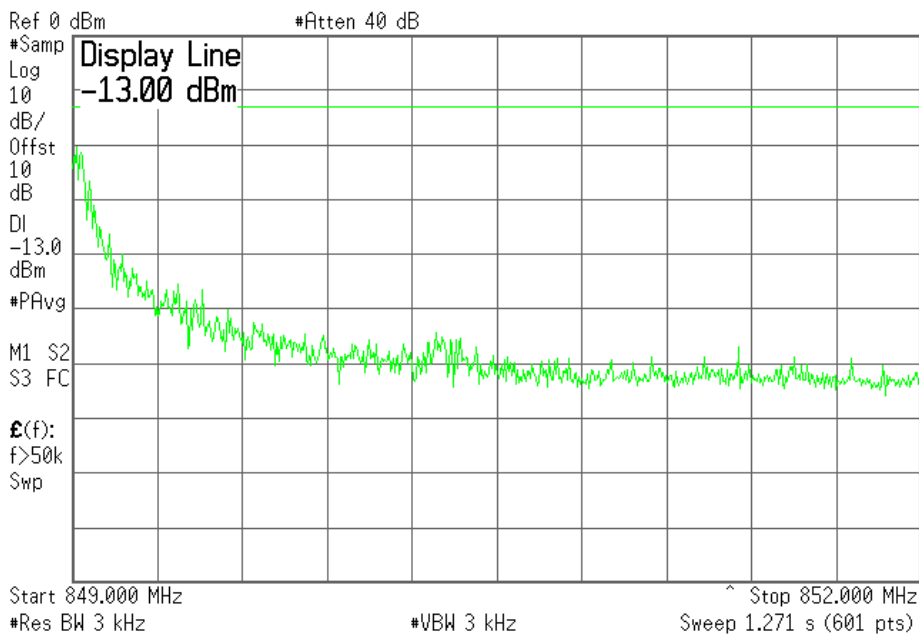
### Plot 7.4.5) GMSK; PCS low channel 512, below 1850 MHz
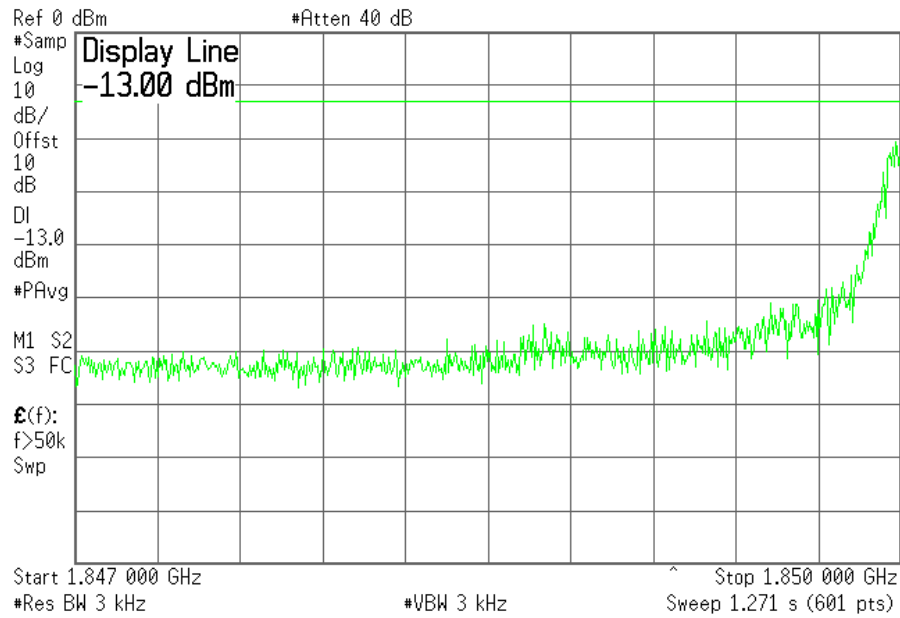


### Plot 7.4.6) GMSK; PCS high channel 810, above 1910 MHz
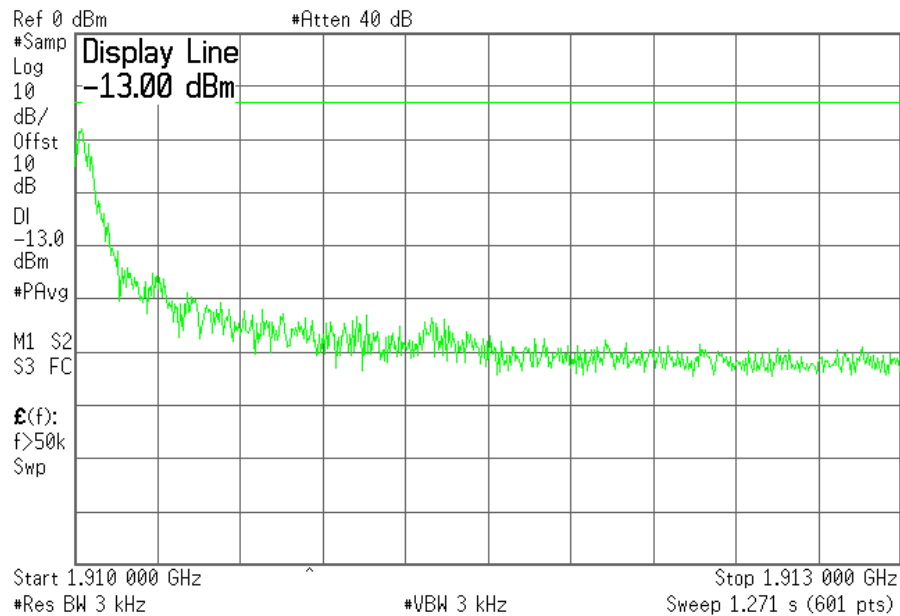
### Plot 7.4.7) 8-PSK; PCS low channel, below 1850 MHz
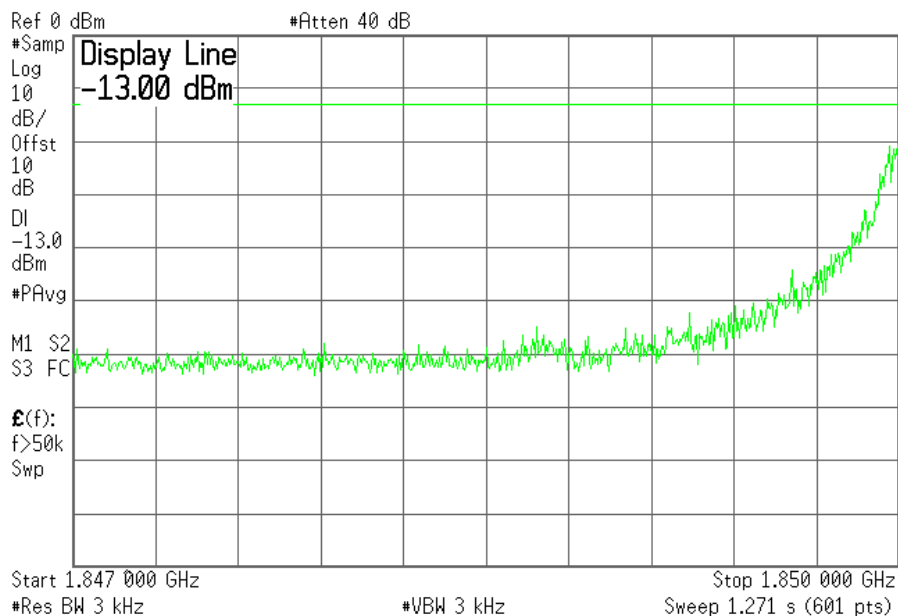


### Plot 7.4.8) 8-PSK; PCS high channel 810, above 1910 MHz
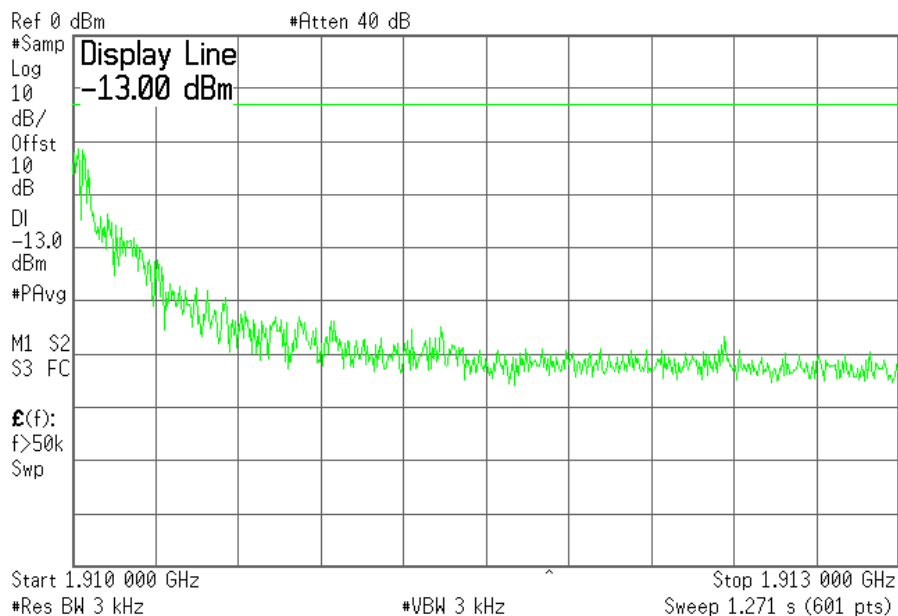
### Plot 7.4.9) WCDMA; Cellular low channel, below 824 MHz
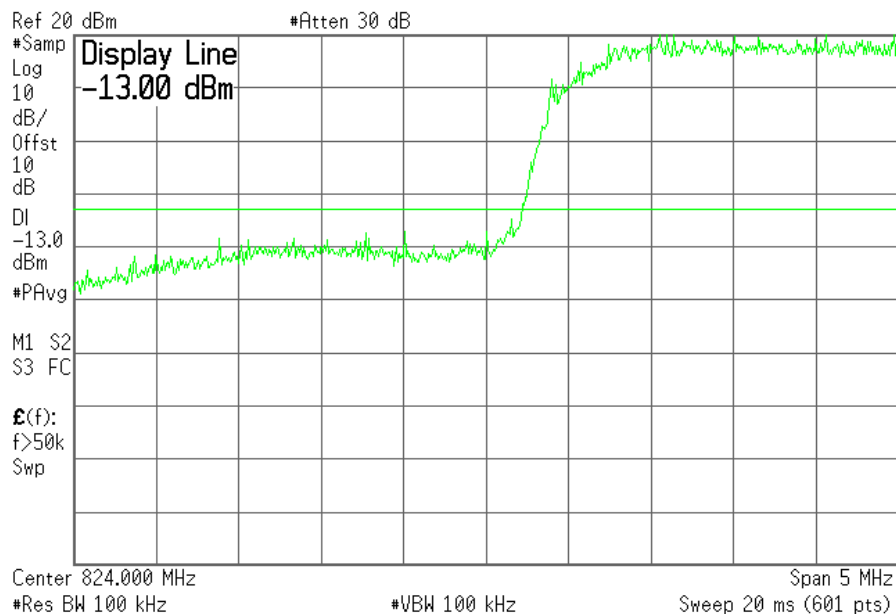


### Plot 7.4.10) WCDMA; Cellular high channel, above 849 MHz
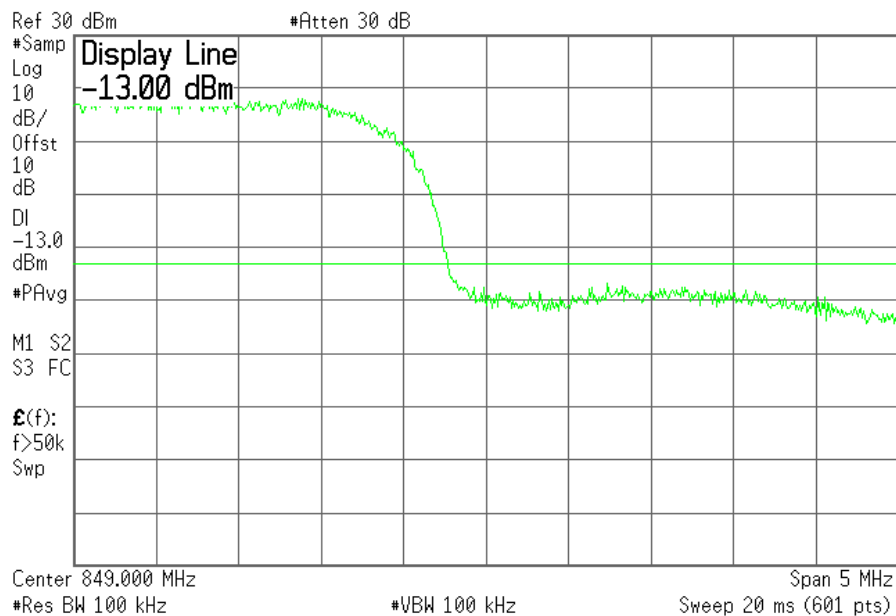
### Plot 7.4.11) WCDMA; PCS low channel, below 1850 MHz
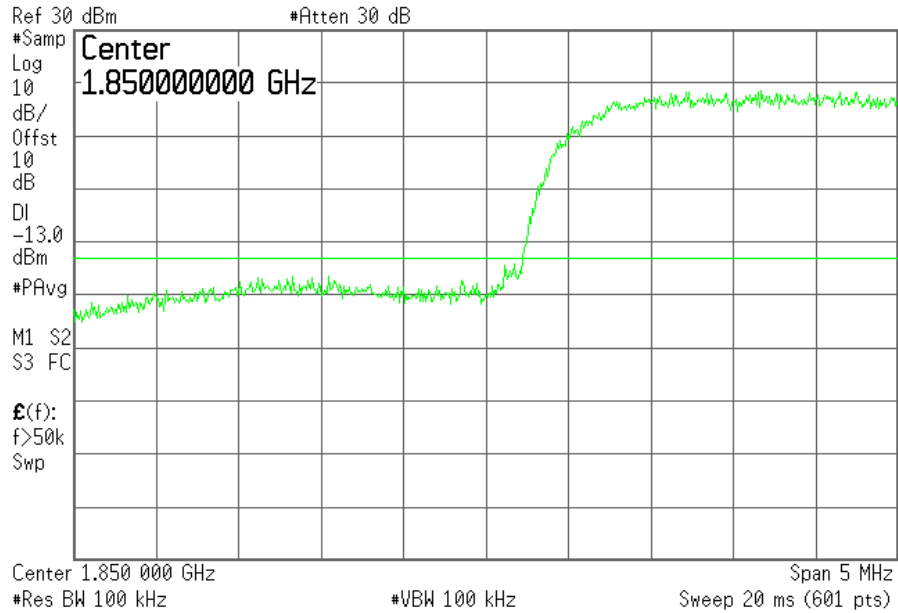


### Plot 7.4.12) WCDMA; PCS high channel, above 1910 MHz
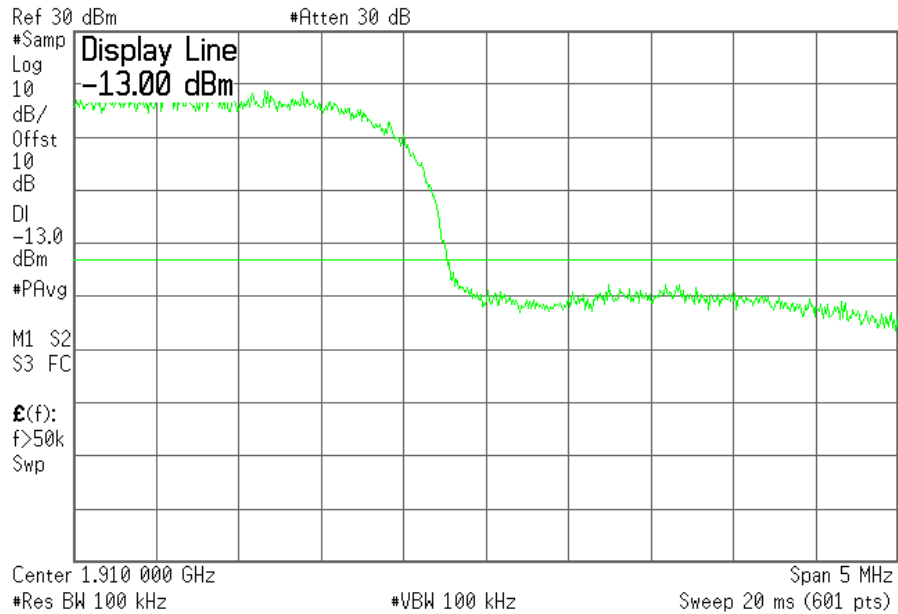
## 8 Frequency Stability Versus Temperature
FCC 2.1055

### 8.1 Summary of Results

The AIRCARD 880E Frequency Stability versus temperature meets the requirement of being within ±0.1ppm of the received base station frequency.

### 8.2 Test Procedure

The AIRCARD 880E was placed inside the temperature chamber. The transmitting frequency error is measured at 25 degrees C, and then the temperature is set to +60 degrees C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is decreased by 10 degrees, allowed to stabilize and soak, then the measurement is repeated. This is repeated until -20 degrees C is completed. The process is then repeated back up to +60 degrees C. Frequency metering included internal averaging of the CMU200 to stabilize the reading. Reference power supply voltage for these tests is 3.3 volts.

**Test Setup**



### 8.3 Test Equipment

| EQUIPMENT | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE |
|---|---|---|---|---|
| Control Computer | TC | Generic PC | 100488 | N/A |
| Wireless Test Set | Rohde & Schwarz | CMU200 | 836766/030 | N/A |
| Spectrum Analyzer | Agilent | PSA E4440A | US41421268 | Mar. 1, 2007 |
| DC Power Supply | HP | 6632A | 3530A | N/A |
| Interface Board | Shop built | Minnow | N/A | N/A |
| Directional Coupler | Mini-Circuits | ZA3PD-2 | N/A | N/A |

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### 8.4    Test Results

Low to High Temperature Frequency Error

| Temp.(C) | Cellular Mode: 824MHz to 848MHz | | | | PCS Mode: 1850MHz to 1909MHz | | | |
|---|---|---|---|---|---|---|---|---|
| | GMSK Mode | | 8-PSK Mode | | GMSK Mode | | 8-PSK Mode | |
| | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) |
| -20 | -24 | 0.0287 | -23 | 0.0275 | -33 | 0.0176 | -41 | 0.0218 |
| -10 | -23 | 0.0275 | -25 | 0.0299 | -39 | 0.0207 | -47 | 0.0250 |
| 0 | -27 | 0.0323 | -30 | 0.0359 | -36 | 0.0191 | -48 | 0.0255 |
| 10 | -24 | 0.0287 | -32 | 0.0383 | -29 | 0.0154 | -49 | 0.0261 |
| 20 | -22 | 0.0263 | -29 | 0.0347 | -35 | 0.0186 | -42 | 0.0223 |
| 30 | -26 | 0.0311 | -31 | 0.0371 | -33 | 0.0176 | -46 | 0.0245 |
| 40 | 24 | 0.0287 | 26 | 0.0311 | -36 | 0.0191 | -44 | 0.0234 |
| 50 | -27 | 0.0323 | -29 | 0.0347 | -38 | 0.0202 | -45 | 0.0239 |
| 60 | 23 | 0.0275 | 25 | 0.0299 | -42 | 0.0223 | -43 | 0.0229 |

| Temp.(C) | UMTS Mode: 826MHz to 846MHz | | UMTS Mode: 1850MHz to 1909MHz | |
|---|---|---|---|---|
| | Offset (Hz) | Offset (Hz) | Offset (Hz) | Offset (ppm) |
| -20 | -4 | 0.0048 | 8 | 0.0043 |
| -10 | 8 | 0.0096 | -7 | 0.0037 |
| 0 | 7 | 0.0084 | -5 | 0.0027 |
| 10 | 5 | 0.0060 | 6 | 0.0032 |
| 20 | 7 | 0.0084 | -5 | 0.0027 |
| 30 | -4 | 0.0048 | -6 | 0.0032 |
| 40 | 7 | 0.0084 | 6 | 0.0032 |
| 50 | 6 | 0.0072 | -5 | 0.0027 |
| 60 | 9 | 0.0108 | 4 | 0.0021 |

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High to Low Temperature Frequency Error

| Temp.(C) | Cellular Mode: 824MHz to 848MHz | | | | PCS Mode: 1850MHz to 1909MHz | | | |
|---|---|---|---|---|---|---|---|---|
| | GMSK Mode | | 8-PSK Mode | | GMSK Mode | | 8-PSK Mode | |
| | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) |
| 60 | -19 | 0.0227 | -27 | 0.0323 | -36 | 0.0191 | -42 | 0.0223 |
| 50 | -21 | 0.0251 | -26 | 0.0311 | -35 | 0.0186 | -48 | 0.0255 |
| 40 | 24 | 0.0287 | 23 | 0.0275 | -34 | 0.0181 | -46 | 0.0245 |
| 30 | -25 | 0.0299 | -28 | 0.0335 | -28 | 0.0149 | -41 | 0.0218 |
| 20 | -21 | 0.0251 | -26 | 0.0311 | -32 | 0.0170 | -39 | 0.0207 |
| 10 | -25 | 0.0299 | -27 | 0.0323 | -35 | 0.0186 | -55 | 0.0293 |
| 0 | -21 | 0.0251 | -25 | 0.0299 | -36 | 0.0191 | -56 | 0.0298 |
| -10 | 22 | 0.0263 | 25 | 0.0299 | -35 | 0.0186 | -43 | 0.0229 |
| -20 | -24 | 0.0287 | -23 | 0.0275 | -33 | 0.0176 | -41 | 0.0218 |

| Temp.(C) | UMTS Mode: 826MHz to 846MHz | | UMTS Mode: 1850MHz to 1909MHz | |
|---|---|---|---|---|
| | Offset (Hz) | Offset (Hz) | Offset (ppm) | Offset (ppm) |
| 60 | 8 | 0.0096 | -6 | 0.0032 |
| 50 | 7 | 0.0084 | -5 | 0.0027 |
| 40 | 7 | 0.0084 | 6 | 0.0032 |
| 30 | 6 | 0.0072 | -6 | 0.0032 |
| 20 | -6 | 0.0072 | -4 | 0.0021 |
| 10 | 5 | 0.0060 | -6 | 0.0032 |
| 0 | 5 | 0.0060 | -7 | 0.0037 |
| -10 | -7 | 0.0084 | 3 | 0.0016 |
| -20 | 8 | 0.0096 | -4 | 0.0021 |

## 9 Frequency Stability Versus Voltage
FCC 2.1055

### 9.1 Summary of Results

The unit meets the limit of less than 0.1ppm of frequency offset from center for 85% and 115% of the supply voltage for 3.3 volts.

### 9.2 Test Procedure

The AIRCARD 880E was connected to a DC Power Supply and a UMTS test set (CMU 200) 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 peak frequency error is recorded (worst case).

The test voltages are 2.8 volts to 3.8 volts.

**Test Setup**



### 9.3 Test Equipment

| EQUIPMENT | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE |
|-----------|-------------|-----------|-----------|-----------|
| Control Computer | TC | Generic PC | 100488 | N/A |
| Wireless Test Set | Rohde & Schwarz | CMU200 | 836766/030 | N/A |
| Spectrum Analyzer | Agilent | PSA E4440A | US41421268 | Mar. 1, 2007 |
| DC Power Supply | HP | 6632A | 3530A | N/A |
| Interface Board | Shop built | Minnow | N/A | N/A |
| Directional Coupler | Mini-Circuits | ZA3PD-2 | N/A | N/A |

**SIERRA WIRELESS, INC.**

### 9.4 Test Results

<u>GSM 85% to 115% of 5.0 Volts Frequency Error</u>

| Supply (V) | Cellular Mode: 824MHz to 848MHz | | | | PCS Mode: 1850MHz to 1909MHz | | | |
|---|---|---|---|---|---|---|---|---|
| | GMSK Mode | | 8-PSK Mode | | GMSK Mode | | 8-PSK Mode | |
| | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) |
| 4.2 | -27 | 0.0323 | -26 | 0.0311 | -29 | 0.0154 | -46 | 0.0245 |
| 4.3 | -26 | 0.0311 | -28 | 0.0335 | -31 | 0.0165 | -47 | 0.0250 |
| 4.4 | -26 | 0.0311 | -25 | 0.0299 | -32 | 0.0170 | -46 | 0.0245 |
| 4.5 | -25 | 0.0299 | -23 | 0.0275 | -35 | 0.0186 | -44 | 0.0234 |
| 4.6 | -25 | 0.0299 | -27 | 0.0323 | -32 | 0.0170 | -48 | 0.0255 |
| 4.7 | -21 | 0.0251 | -25 | 0.0299 | -30 | 0.0160 | -41 | 0.0218 |
| 4.8 | -22 | 0.0263 | -27 | 0.0323 | -31 | 0.0165 | -44 | 0.0234 |
| 4.9 | -21 | 0.0251 | -24 | 0.0287 | -35 | 0.0186 | -42 | 0.0223 |
| 5.0 | -20 | 0.0239 | -23 | 0.0275 | -30 | 0.0160 | -40 | 0.0213 |
| 5.1 | -20 | 0.0239 | -28 | 0.0335 | -32 | 0.0170 | -46 | 0.0245 |
| 5.2 | -22 | 0.0263 | -29 | 0.0347 | -34 | 0.0181 | -53 | 0.0282 |
| 5.3 | -24 | 0.0287 | -23 | 0.0275 | -31 | 0.0165 | -45 | 0.0239 |
| 5.4 | -21 | 0.0251 | -29 | 0.0347 | -31 | 0.0165 | -46 | 0.0245 |
| 5.5 | -23 | 0.0275 | -26 | 0.0311 | -32 | 0.0170 | -53 | 0.0282 |
| 5.6 | -22 | 0.0263 | -28 | 0.0335 | -29 | 0.0154 | -55 | 0.0293 |
| 5.7 | -25 | 0.0299 | -27 | 0.0323 | -33 | 0.0176 | -51 | 0.0271 |
| 5.8 | -26 | 0.0311 | -29 | 0.0347 | -30 | 0.0160 | -49 | 0.0261 |

| Supply (V) | UMTS Mode | | | |
|---|---|---|---|---|
| | 850MHz | | 1900MHz | |
| | Offset (Hz) | Offset (ppm) | Offset (Hz) | Offset (ppm) |
| 4.2 | 5 | 0.0060 | 4 | 0.0021 |
| 4.3 | 5 | 0.0060 | 6 | 0.0032 |
| 4.4 | 6 | 0.0072 | 3 | 0.0016 |
| 4.5 | 5 | 0.0060 | 2 | 0.0011 |
| 4.6 | 4 | 0.0048 | 1 | 0.0005 |
| 4.7 | 5 | 0.0060 | 4 | 0.0021 |
| 4.8 | 4 | 0.0048 | 3 | 0.0016 |
| 4.9 | 3 | 0.0036 | -1 | 0.0005 |
| 5.0 | 4 | 0.0048 | -4 | 0.0021 |
| 5.1 | 6 | 0.0072 | -3 | 0.0016 |
| 5.2 | 4 | 0.0048 | 2 | 0.0011 |
| 5.3 | 3 | 0.0036 | 3 | 0.0016 |
| 5.4 | 3 | 0.0036 | 3 | 0.0016 |
| 5.5 | 4 | 0.0048 | -1 | 0.0005 |
| 5.6 | 4 | 0.0048 | 2 | 0.0011 |
| 5.7 | 2 | 0.0024 | -1 | 0.0005 |