# Certification Test Report
# FCC Part 22, Subpart H/ Industry Canada RSS 132
# FCC Part 24, Subpart E/ Industry Canada RSS 133

## Novatel Wireless Inc.
## MC545

## FCC ID # NBZNRM-MC545
## IC ID # 3229A-MC545

## Project Code C-0091342

**(Report C-0091342-RA-2-1)**
**Revision: 1**

**October 26, 2010**

| | |
|---|---|
| **Prepared for**: | Novatel Wireless Inc |
| **Author:** | Deniz Demirci<br>Senior Wireless / EMC Technologist |
| **Approved by:** | Nick Kobrosly<br>Director of Canadian operations |

| | |
|---|---|
| **Test Facility:** | **National Technical Systems, Canada**<br>Product Integrity Laboratory<br>5151-47th Street, N.E.<br>Calgary Alberta T3J 3R2 |
| **Applicant:** | **FCC:** Novatel Wireless Inc.<br>9645 Scranton Rd, Suite 205<br>San Diego, CA 92121<br><br>**IC:** Novatel Wireless Technologies Ltd<br>6715 – 8th St N.E. Suite 200<br>Calgary, Alta. T2E-7H7 |
| **Customer Representative:** | Todd Gallagher<br>Ph: (403) 618-8483<br>Fax: (403) 295-4801<br>E Mail: tgallagher@nvtl.com |

## Test Summary

| Appendix | Test / Requirement Description | Deviations* from: | | | Status | Applicable Rule Parts | | |
|---|---|---|---|---|---|---|---|---|
| | | Base Standard | Test Basis | NTS Procedure | | Mode | FCC | IC |
| A | Occupied BW | No | No | No | PASS | Cell | 2.1049/ 22.917 | RSS 132 4.5 |
| | | | | | | PCS | 2.1049/ 24.238 | RSS 133 6.5 |
| B | Radiated Peak Power Output | No | No | No | PASS | Cell | 2.1046/ 22.913 | RSS 132 4.4 |
| | | | | | | PCS | 2.1046/ 24.232 | RSS 133 6.4 |
| C | TX Frequency Stability | No | No | No | PASS | Cell | 2.1055/ 22.335 | RSS 132 4.3 |
| | | | | | | PCS | 2.1055/ 24.235 | RSS 133 6.3 |
| D | Peak-to-average Ratio | No | No | No | PASS | PCS | 24.232 (d) | RSS 133 6.4 |
| E | Transmitter Conducted Output Power | No | No | No | N/A | Cell PCS | 2.1046 | RSS Gen 4.8 |
| F | TX Conducted Spurious Emissions | No | No | No | PASS | Cell | 2.1051/ 22.917 | RSS 132 4.5 |
| | | | | | | PCS | 2.1051/ 24.238 | RSS 133 6.5 |
| G | TX / RX Radiated Spurious Emissions 30 MHz – 20 GHz | No | No | No | PASS | Cell | 2.1053/ 22.917 | RSS 132 4.3 RSS Gen |
| | | | | | | PCS | 2.1053/ 24.238 | RSS 133 6.3 RSS Gen |

Note: RSS 132 Issue 2, RSS 133 Issue 5

Prepared By:

Digitally signed by Deniz Demirci
Date: 2010.11.01 15:53:09 -06'00'

Deniz Demirci
Senior Wireless / EMC Technologist

Reviewed By:

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Date: 2010.11.01 15:55:14 -06'00'

Glen Moore
Wireless / EMC Manager

Approved By:

Alex Mathews
2010.11.01 15:56:35 -06'00'

Alex Mathews
Quality Management Representative

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## Register of revisions

| Revision | Date | Description of Revisions |
|---|---|---|
| 1 | October 26, 2010 | Released for customer review |

# 1.0 INTRODUCTION

## 1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the MC545 Wireless Modem from Novatel Wireless Inc to the following specifications:

FCC Part 22, Subpart H Public Mobile Services
FCC Part 24, Subpart E Personal Communications Services
RSS 132 – Issue 2 - Cellular Telephones Operating in the Bands 824-849 MHz and 869-894 MHz
RSS-133, Issue 5 - 2 GHz Personal Communications Services
RSS Gen Issue 2 – General Requirements (Receiver Spurious Emissions)

# 2.0 EUT DESCRIPTION

## 2.1 CONFIGURATION

| EUT | Name | Model | Revision / Description | Serial Number |
|---|---|---|---|---|
| | Ovation MC545 | MC545 | HW E5 | N/A |
| **Classification** | Mobile | | | |
| **TX Operating Frequency** | GSM 850 824.2 - 848.8 MHz<br>PCS 1900 1850.2 - 1909.8 MHz<br>WCDMA Band II: 1852.4 - 1907.6 MHz | | | |
| **RX Operating Frequency Range** | GSM 850 869 - 894 MHz<br>PCS 1900 1930 - 1990 MHz<br>WCDMA Band II: 1930 - 1990 MHz | | | |
| **Maximum Output Power** | Cell band 0.750 Watts ERP in GSM GPRS Mode<br>PCS band 1.219 Watts EIRP in GSM GPRS Mode<br>PCS band 0.340 Watts EIRP in WDCMA Mode | | | |
| **Antenna Type** | See separate exhibit | | | |
| **Functional description** | The MC545 is a wireless modem with WCDMA W2100, W1900 and W900 band wireless networks as well as GSM/EDGE for Quad band (850/900/1800/1900) It has GPRS / EDGE, WCDMA Release 99, HSDPA Release 5, HSUPA Release 6, HSPA+ Release 7(Downlink), DC-HSPA+ Release 8 (Downlink) capabilities | | | |
| **Voltage** | +5 VDC USB powered | | | |
| **Tune up procedure** | See separate exhibit | | | |
| **Emission Designators** | GSM/GPRS 850 244K5GXW<br>GSM/GPRS 1900 244K5GXW<br>EDGE 850 244K5G7W<br>EDGE 1900 244K5G7W<br>WCDMA 1900 4M15F9W | | | |
| **Frequency Tolerance** | 2.5 ppm in all modes | | | |

### 2.2 MODE OF OPERATION DURING TESTS

The EUT was tested in all configurations to determine worst case results. See test appendices for specific EUT operating modes and conditions

## 3.0 SUPPORT EQUIPMENT

### 3.1 CONFIGURATION

The following equipment was used as the host system for the EUT

| Peripheral / Device Description | Manufacturer | Model | Description | Serial Number |
|---|---|---|---|---|
| **Laptop** | ACER | Aspire One 533 | Novatel Wireless Regulatory Test Host | N/A |
| **AC/DC Adapter** | DELTA Electronics Inc. | ADP-40$^{TH}$ A | Novatel Wireless Regulatory Test Host AC/DC Adapter | N/A |

The following equipment was used to configure the EUT. There was no measurement taken with this call box. Agilent 8960 (CG-R-1254) was used for the call box related measurements

| Peripheral / Device Description | Manufacturer | Model | Description | Serial Number |
|---|---|---|---|---|
| **Radio Communication Analyzer** | Anritsu | MT8820A | Novatel Wireless Call Box | 6100244546 |

# APPENDICES

# APPENDIX A: OCCUPIED BANDWIDTH

## A.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standards** | **FCC Part 2.1049** |
| | **Industry Canada**<br>Cell Mode: IC RSS 132, Issue 2<br>PCS Mode: IC RSS 133, Issue 5 |
| **Test Basis** | FCC PART 22.917, FCC PART 24.238<br>RSS GEN Issue 2, 4.6.1 |
| **Test Method** | FCC PART 22.917, FCC PART 24.238<br>RSS GEN Issue 2, 4.6.1 |

## A.2. Specifications

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission

## A.3. Test Method

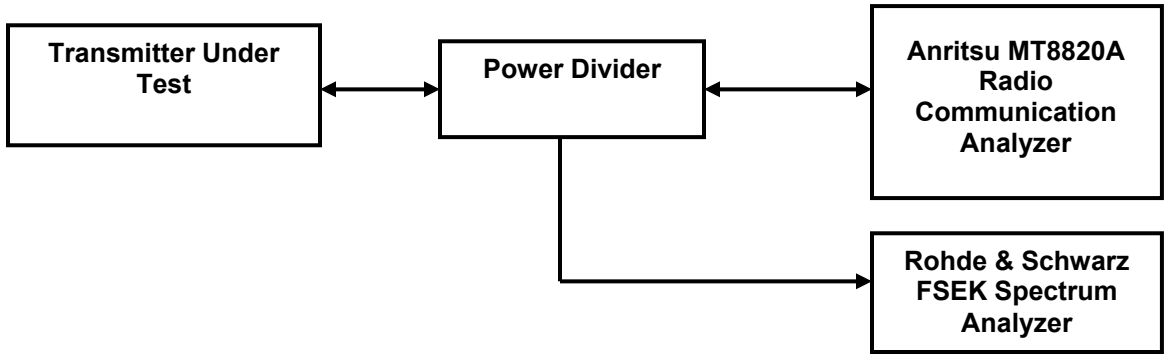
### A.3.1 FCC PART 22.917 and FCC PART 24.238

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### A.3.2 IC:

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms.
The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded.
The process is repeated for the highest frequency data points. This frequency is recorded.
The span between the two recorded frequencies is the occupied bandwidth.

## A.4. Test Setup diagram



### A.5. Operating Mode During Test

The EUT was tested while in a continuous transmit mode operating at maximum rated RF output for all bands and operating modes.

### A.6. Test Results

The EUT is in compliance with the limits as specified above. The worst case bandwidths are provided below:

#### A.6.1 Industry Canada 99% Bandwidth Summary of Results

**Cell Mode**

| Modulation type | Channel | Frequency (MHz) | Occupied Bandwidth |
|---|---|---|---|
| GSM/GPRS | 190 | 836.6 | 244.5 kHz |
| EDGE | 190 | 836.6 | 244.5 kHz |

**PCS Mode**

| Modulation type | Channel | Frequency (MHz) | Occupied Bandwidth |
|---|---|---|---|
| GSM/GPRS | 661 | 1880 | 244.5 kHz |
| EDGE | 661 | 1880 | 244.5 kHz |
| WCDMA | 9400 | 1880 | 4.15 MHz |

#### A.6.2 FCC Part 2, 22 and 24, 26 dB Bandwidth Summary of Results

**Cell Mode**

| Modulation type | Channel | Frequency (MHz) | Occupied Bandwidth |
|---|---|---|---|
| GSM/GPRS | 190 | 836.6 | 291.6 kHz |
| EDGE | 190 | 836.6 | 273.5 kHz |

**PCS Mode**

| Modulation type | Channel | Frequency (MHz) | Occupied Bandwidth |
|---|---|---|---|
| GSM/GPRS | 661 | 1880 | 289.6 kHz |
| EDGE | 661 | 1880 | 276.6 kHz |
| WCDMA | 9400 | 1880 | 4.51 MHz |

**Note:** Marker 1 (Trace 2) measurements in FCC 26 dB Bandwidth plots show measured integrated output power with RBW set to 10 MHz and VBW set to 10 MHz (RBW >> EBW). These measurements were used as 0 dB reference point. D1 lines were set 26 dB below this reference point

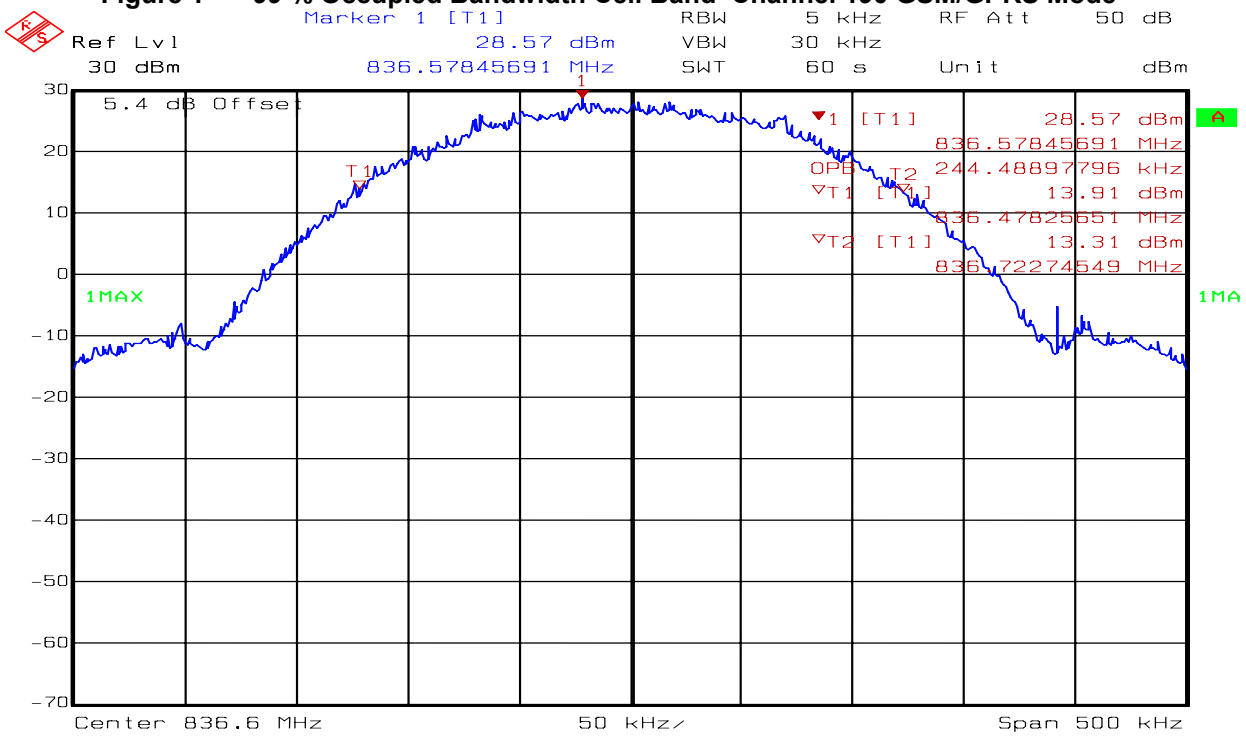
### A.7. Tested By

Name: Deniz Demirci
Function: Senior Wireless/EMC Technologist

### A.8. Test date

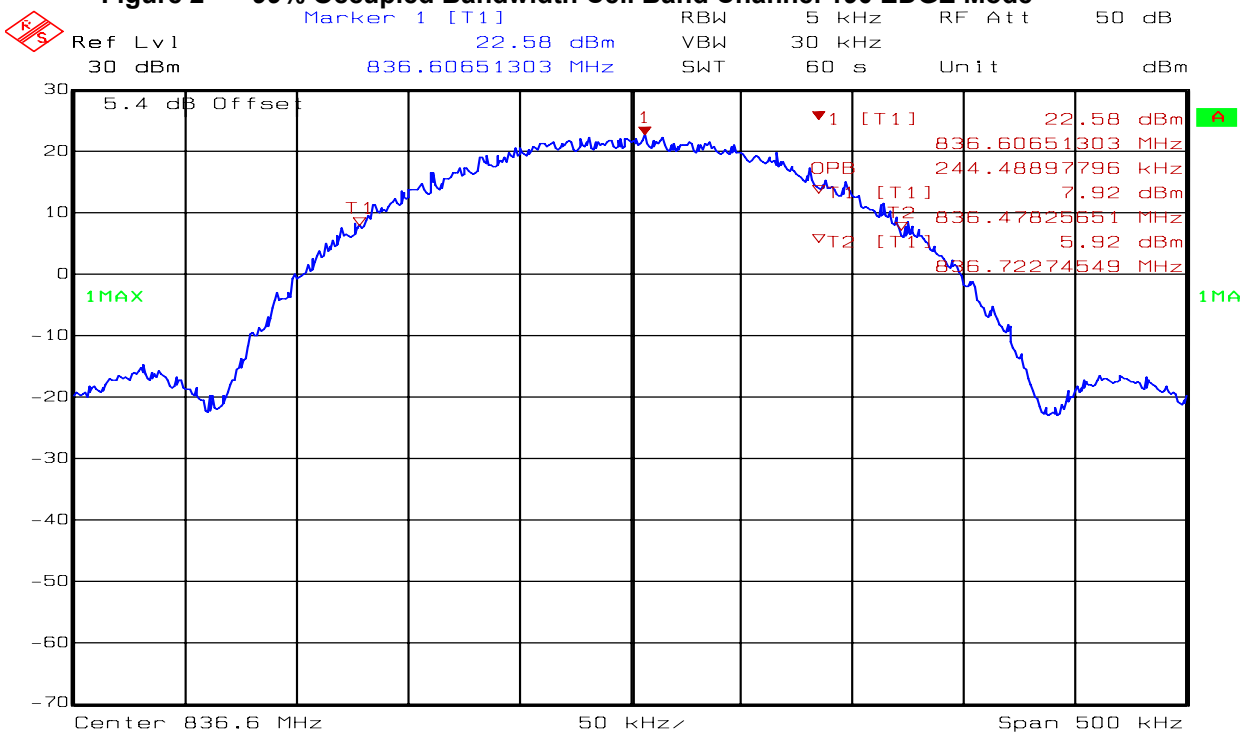
September 27, 2010

**Figure 1 99 % Occupied Bandwidth Cell Band Channel 190 GSM/GPRS Mode**




```
Title:      C-0091342 Novatel Wireless Finetooth
Comment A:  CELL GPRS CS-4 Ch190, Max power
Date:       27.SEP.2010   8:30:36
```

**Figure 2 99% Occupied Bandwidth Cell Band Channel 190 EDGE Mode**

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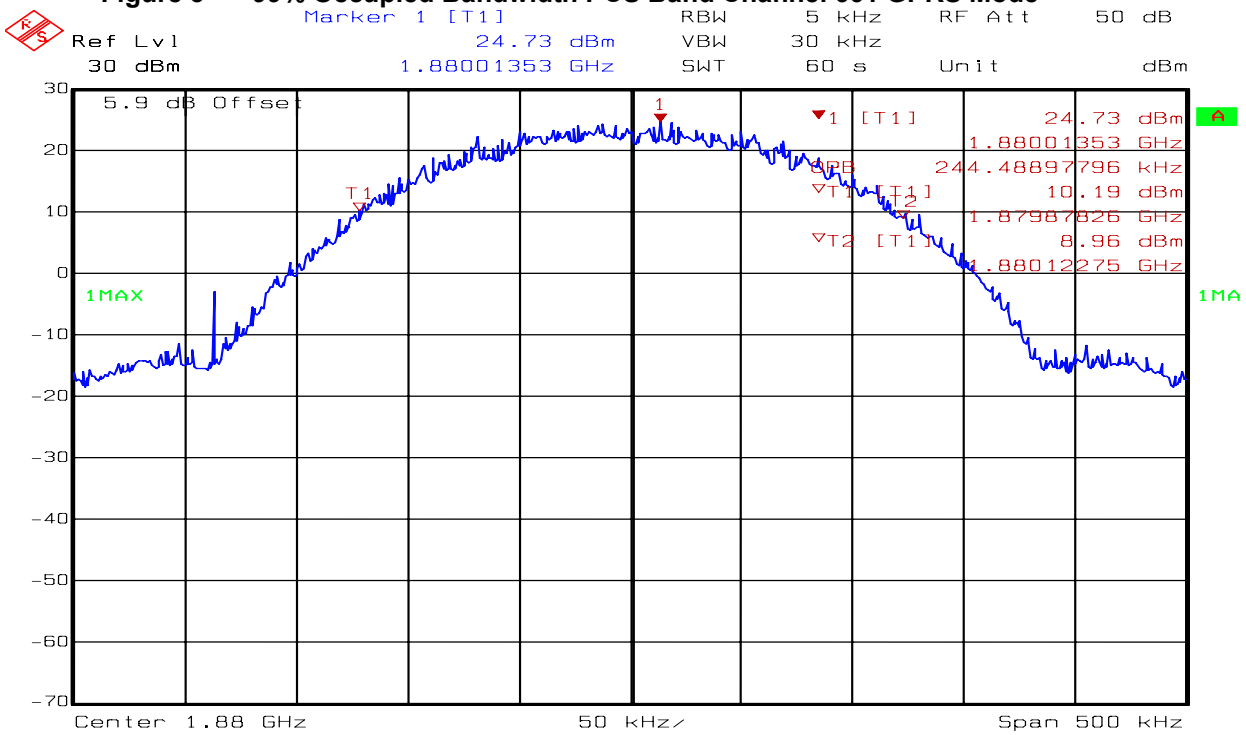
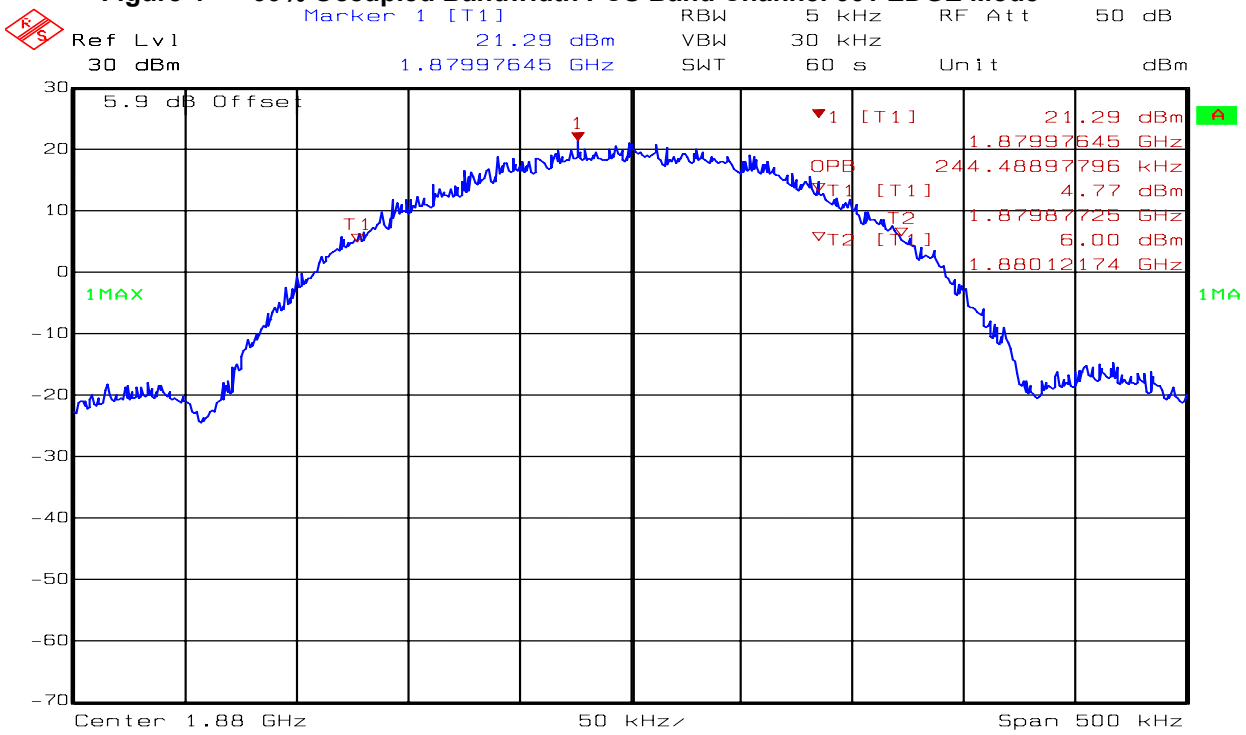
Title:      C-0091342 Novatel Wireless Finetooth
Comment A:  CELL EDGE 8PSK Ch190, Max power
Date:       27.SEP.2010   8:38:07
```

**Figure 3 99% Occupied Bandwidth PCS Band Channel 661 GPRS Mode**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4 Ch661, Max power
Date: 27.SEP.2010 8:51:25

**Figure 4 99% Occupied Bandwidth PCS Band Channel 661 EDGE Mode**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK, Ch661, Max power
Date: 27.SEP.2010 8:58:02

**Figure 5 99 % Occupied Bandwidth PCS Band Channel 9400 WCDMA Mode**

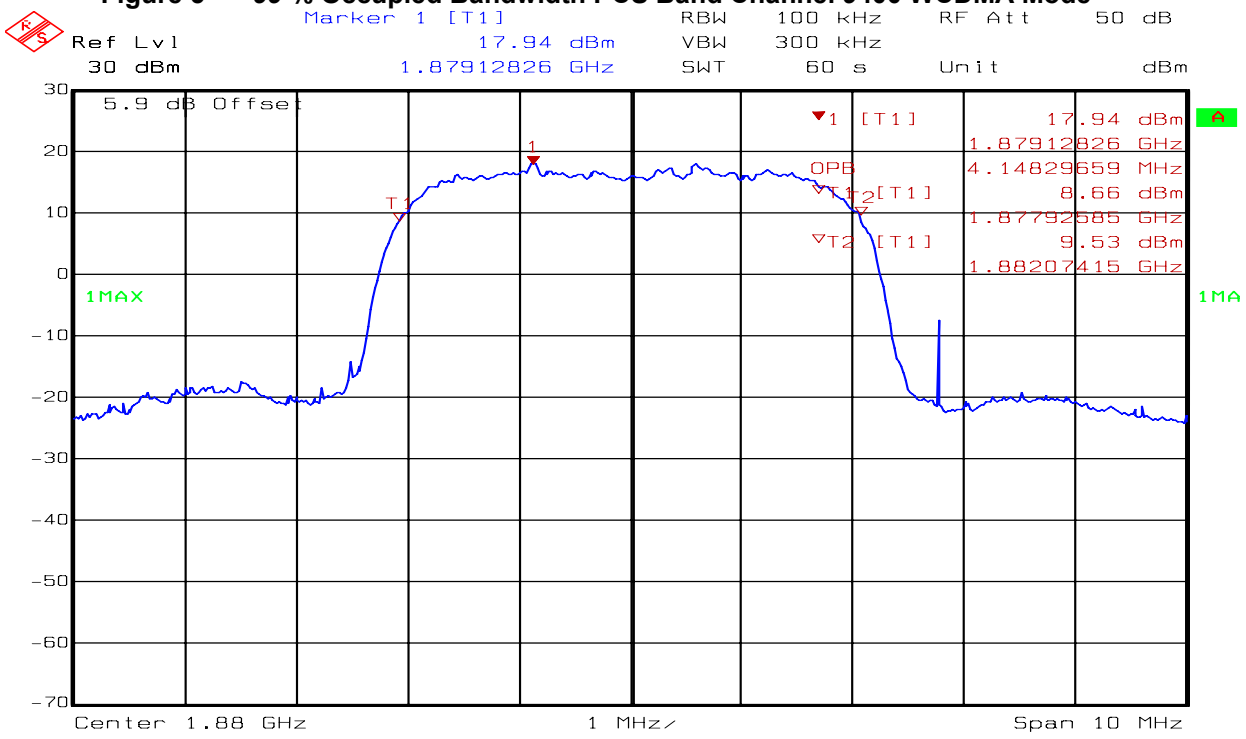



**Figure 6 26 dB Bandwidth Cell Band Channel 190 GPRS Mode**

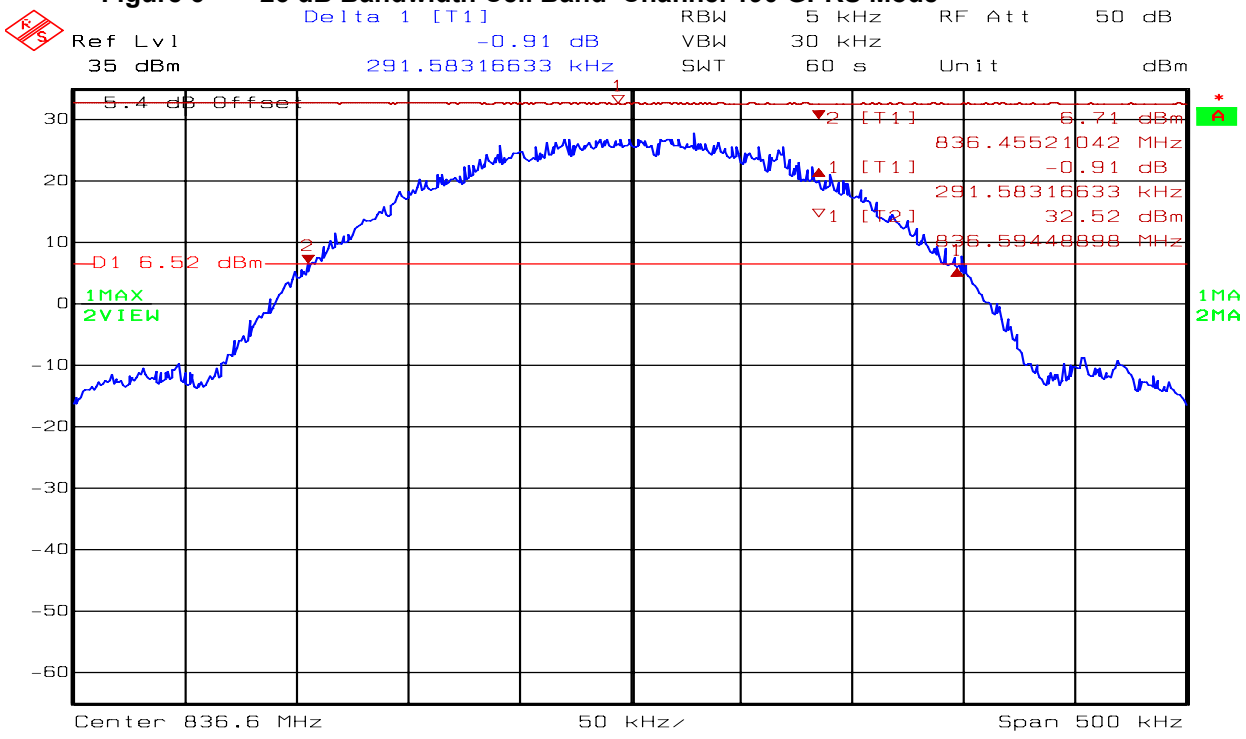
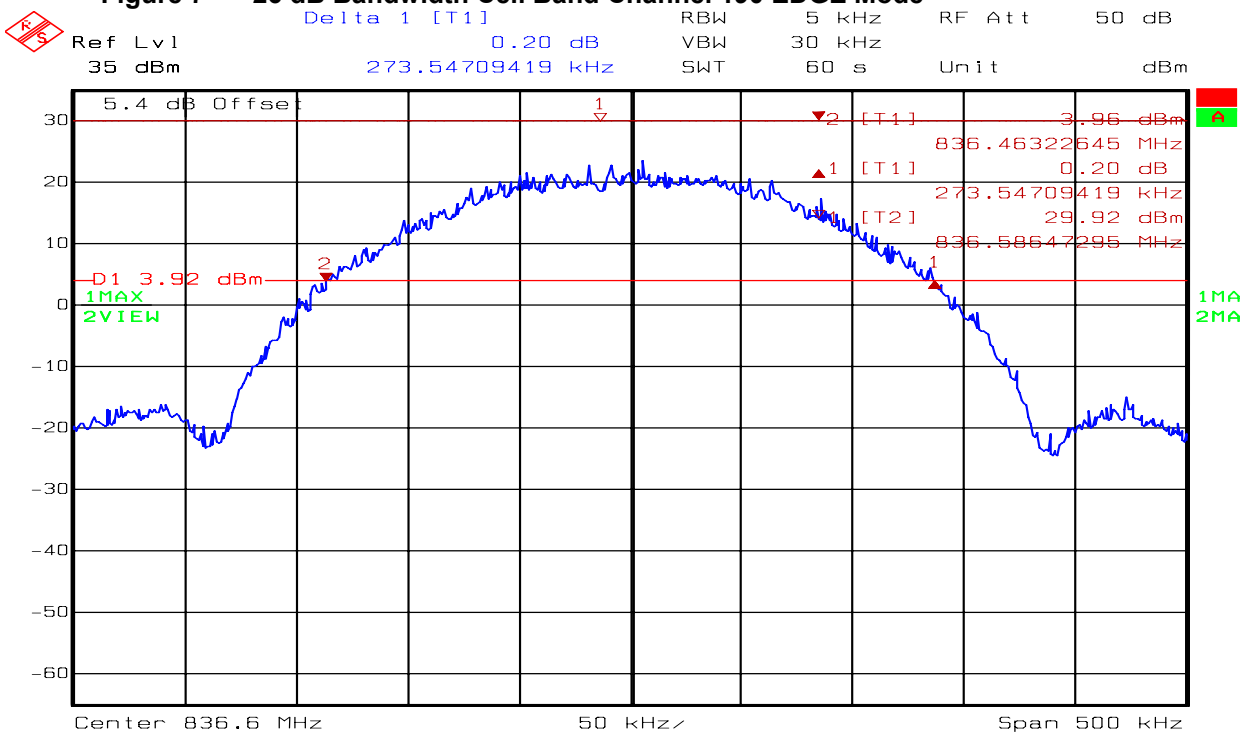
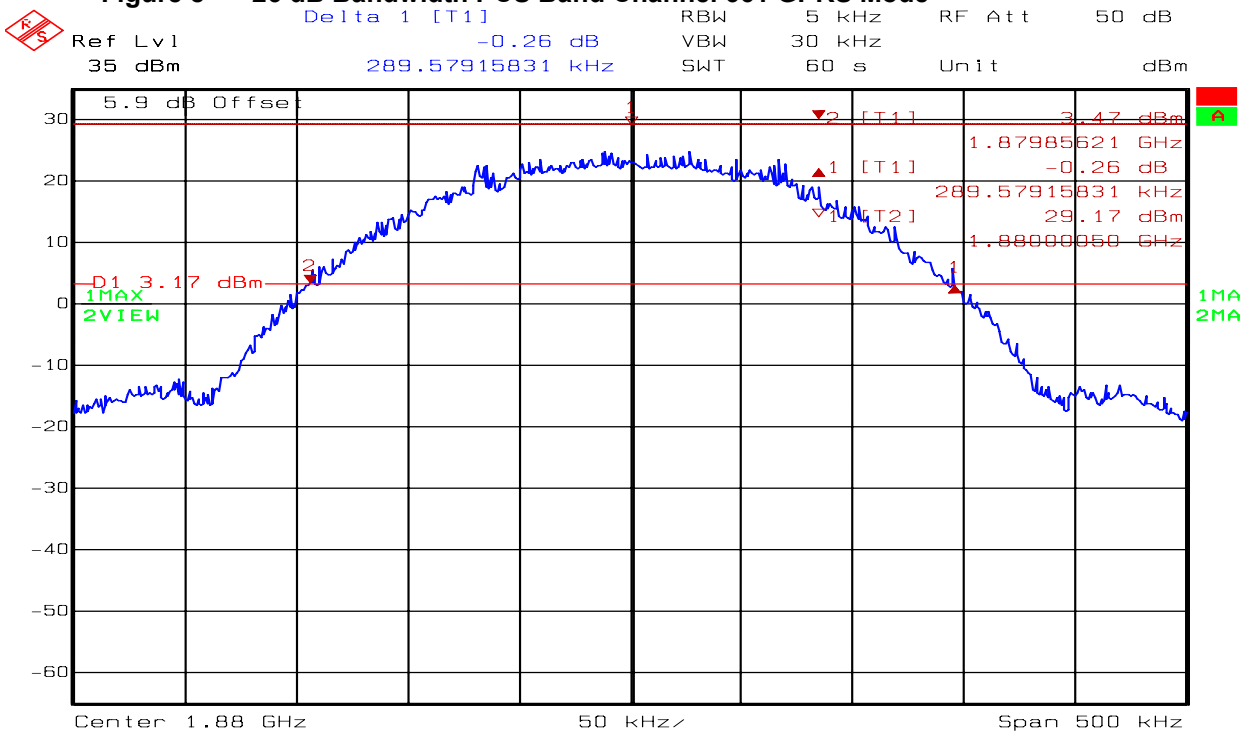


**Figure 7 26 dB Bandwidth Cell Band Channel 190 EDGE Mode**



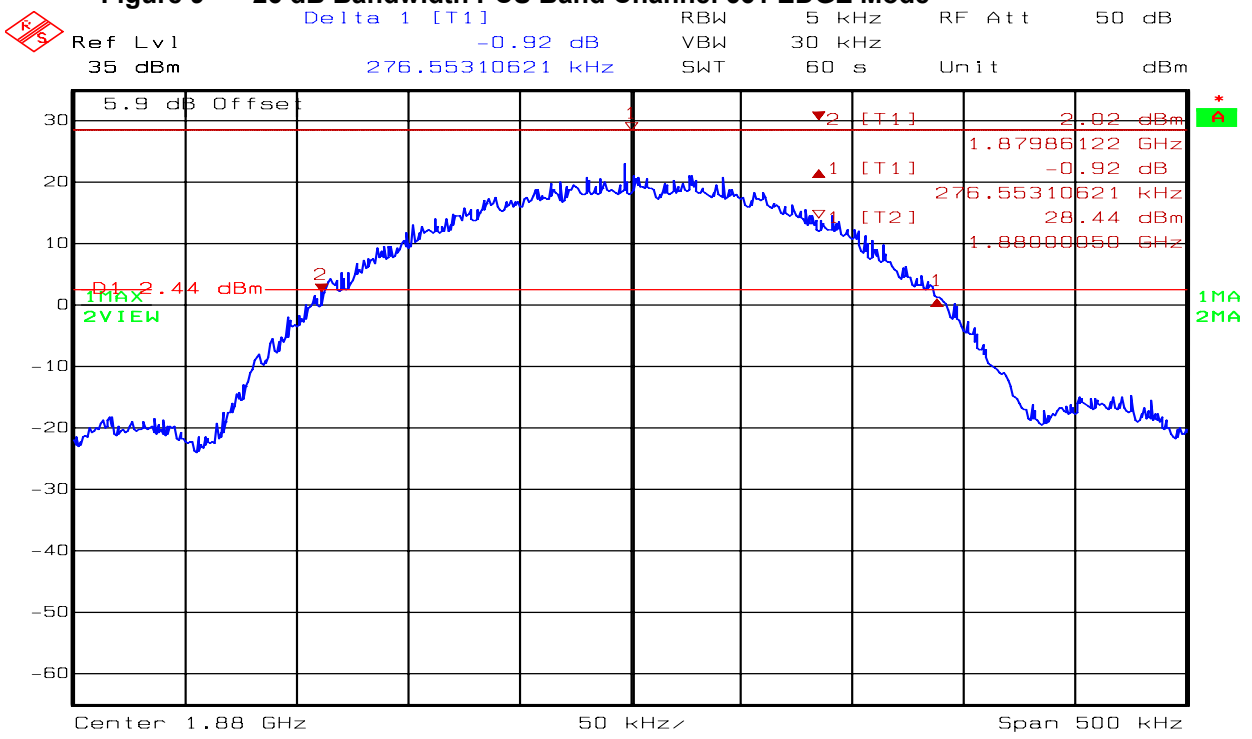

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM EDGE 8PSK Ch190, Max power
Date: 27.SEP.2010 10:15:46

**Figure 8 26 dB Bandwidth PCS Band Channel 661 GPRS Mode**



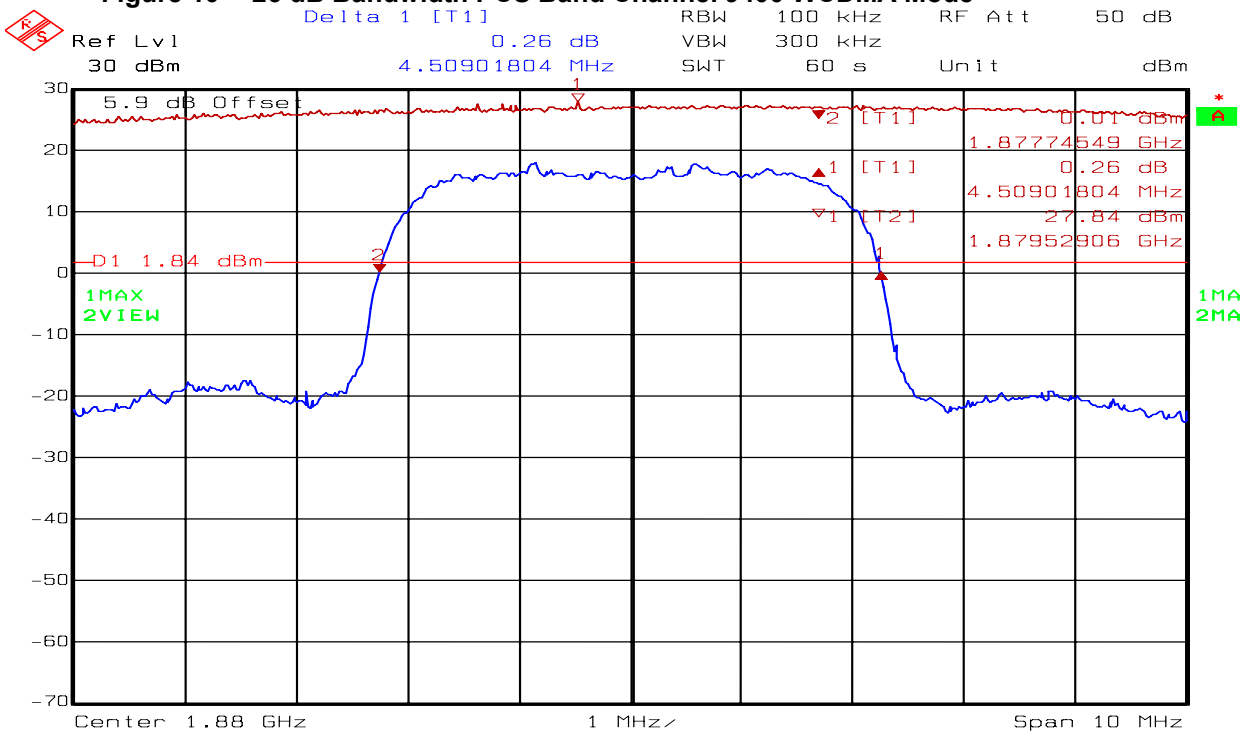

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4 Ch661, Max power
Date: 27.SEP.2010 9:56:44

**Figure 9 26 dB Bandwidth PCS Band Channel 661 EDGE Mode**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK Ch661, Max power
Date: 27.SEP.2010 10:04:35

**Figure 10 26 dB Bandwidth PCS Band Channel 9400 WCDMA Mode**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: WCDMA Ch9400, Max power
Date: 27.SEP.2010 9:35:53

# APPENDIX B: RADIATED PEAK POWER OUTPUT

## B.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standards** | **FCC 2.1046**<br>Cell Mode: FCC Part 22.913<br>PCS Mode: FCC Part 24.232 |
| | **Industry Canada**<br>Cell Mode: IC RSS 132, Issue 2<br>PCS Mode: IC RSS 133, Issue 5 |
| **Test Basis** | FCC 2.1046 |
| **Test Method** | ANSI/TIA/EIA-603-C-2004 |

## B.2. Specifications

### B.2.1 Cell Mode

**22.913 Effective radiated power limits.**

(2) Extend coverage on a secondary basis into cellular unserved areas, as those areas are defined in §22.949, the ERP of base transmitters and cellular repeaters of such systems must not exceed 1000 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

### B.2.2 PCS Mode

**24.232 Power and antenna height limits.**

(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

## B.3. Test Method

ANSI/TIA/EIA-603-C-2004 using signal substitution. The carrier signal is maximized for worst case power level and the maximum field strength is recorded. The EUT is replaced with a ½ wave dipole tuned to the frequency of interest driven by a signal source. The signal generator level is adjusted until the field strength level is equal to the field strength measured from the EUT. The signal generator level is recorded and corrected for cable losses and antenna gain to arrive at the final ERP/EIRP value. For all radiated measurements the peak power was reported using the following instrument settings:

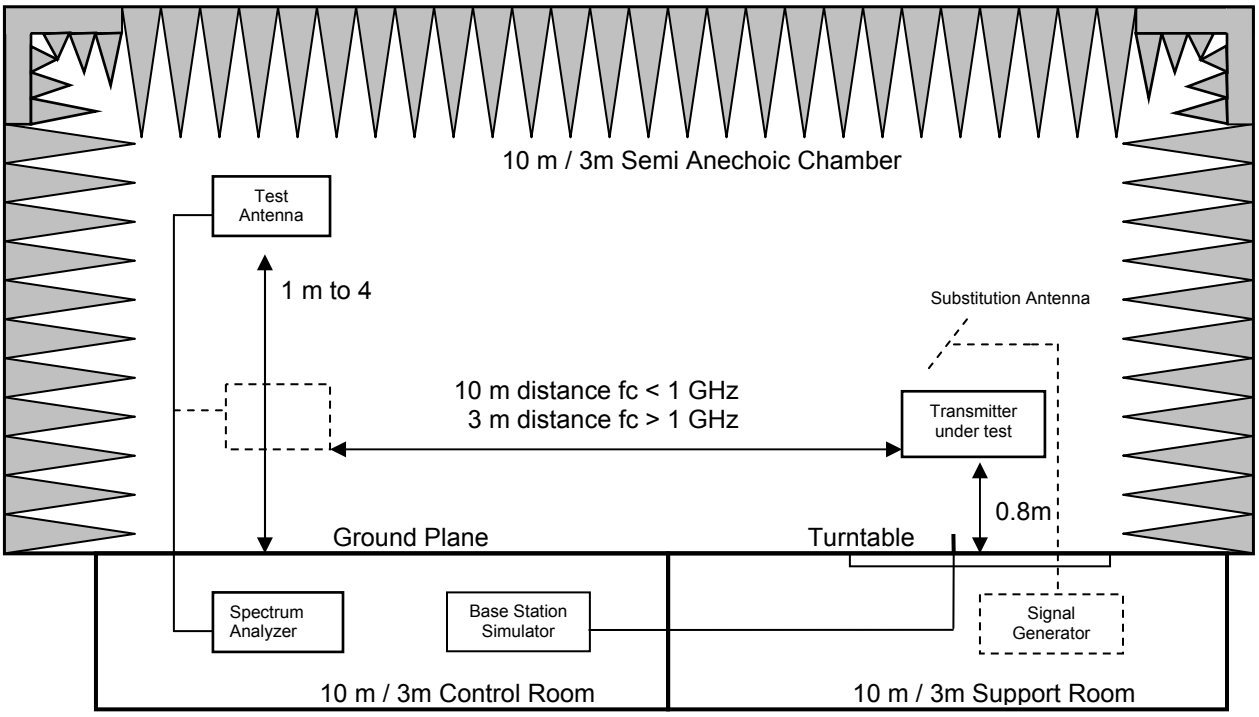
**GSM/GPRS/EDGE Measurements:**

RBW: 1 MHz
VBW: 1 MHz
Detector: Peak

**WCDMA Measurements:**

RBW: 5 MHz
VBW: 5 MHz
Detector: Peak

## B.4. Test Setup Diagram




## B.5. Operating Modes During Test

The EUT was tested to determine worst case operating modes to produce maximum peak power for the different modulation types. The following modes and associated configurations produced the highest power levels

CELL 850 GPRS – 1up 1down, Ms Tx level burst 5 to 0
CELL 850 EDGE – 1up 1down, Ms Tx level burst 8 to 0
PCS GPRS - 1up 1down, Ms Tx level burst 0
PCS EDGE - 1up 1down, Ms Tx level burst 2 to 0
PCS WCDMA – All up bits, 12.2 kbps RMC
Please see EUT description, mode of operation section for details.

## B.6. Test Results

Compliant

### B.6.1 FCC Part 22, Radiated Power Measurement Test Data Summary

Compliant - The maximum ERP is 28.75 dBm (0.750 Watts) on channel 128 in GPRS Mode
Results are indicated for each channel in the table below

| GSM850 Channel # | | Frequency (MHz) | Measured Field strength @ 10m (dBµV/m) | Substitution Signal generator level (dBm) | Antenna gain (dBd) | Cable loss (dB) | Measured ERP (dBm) |
|---|---|---|---|---|---|---|---|
| GPRS | 128 | 824.2 | 120.31 | 30.30 | -0.1 | 1.45 | 28.75 |
| | 190 | 836.6 | 120.23 | 30.20 | -0.1 | 1.45 | 28.65 |
| | 251 | 848.8 | 120.15 | 30.10 | -0.1 | 1.45 | 28.55 |
| EDGE | 128 | 824.2 | 117.37 | 27.30 | -0.1 | 1.45 | 25.75 |
| | 190 | 836.6 | 116.98 | 27.00 | -0.1 | 1.45 | 25.45 |
| | 251 | 848.8 | 116.94 | 26.90 | -0.1 | 1.45 | 25.35 |

### B.6.2 FCC Part 24, Radiated Power Measurement Test Data Summary

Compliant – The maximum EIRP is 29.56 dBm (1.219 Watts) on channel 661 in GPRS Mode
Results for each channel are indicated in the table below

| PCS Channel # | | Frequency (MHz) | Measured Field strength @ 3m (dBµV/m) | Substitution Signal generator level (dBm) | Antenna gain (dBi) | Cable lass (dB) | Measured EIRP (dBm) |
|---|---|---|---|---|---|---|---|
| GPRS | 512 | 1850.2 | 126.39 | 23.50 | 8.67 | 1.31 | 30.86 |
| | 661 | 1880.0 | 126.07 | 23.20 | 8.78 | 1.32 | 30.66 |
| | 810 | 1909.8 | 125.88 | 23.40 | 8.15 | 1.33 | 30.22 |
| EDGE | 512 | 1850.2 | 125.62 | 22.80 | 8.67 | 1.31 | 30.16 |
| | 661 | 1880.0 | 125.55 | 22.70 | 8.78 | 1.32 | 30.16 |
| | 810 | 1909.8 | 125.19 | 22.70 | 8.15 | 1.33 | 29.52 |
| WCDMA | 9262 | 1852.4 | 120.75 | 17.90 | 8.67 | 1.31 | 25.26 |
| | 9400 | 1880.0 | 120.47 | 17.60 | 8.78 | 1.32 | 25.06 |
| | 9538 | 1907.6 | 120.91 | 18.50 | 8.14 | 1.33 | 25.31 |

## B.7. Tested By

Name: Deniz Demirci
Function: Senior Wireless/EMC Technologist

## B.8. Test dates

**Started:** September 15, 2010 **Completed:** October 19, 2010

# APPENDIX C: FREQUENCY STABILITY

## C.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | Cell Mode: FCC 22.355, RSS 132 Issue 2 (4.3)<br>PCS Mode: FCC 24.235, RSS 133 Issue 5 (6.3) |
| **Test Basis** | FCC Part 2.1055 |
| **Test Method** | FCC Part 2.1055 |

## C.2. Specifications

2.1055 Measurements required: Frequency stability;
(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

### C.2.1 Cell Mode

22.355 Frequency Tolerance;
Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in the Table

**Frequency Tolerance for Transmitters in the Public Mobile Services**

| Frequency range (MHz) | Base, fixed (ppm) | Mobile >3 watts (ppm) | Mobile ≤3 watts (ppm) |
|---|---|---|---|
| 25 to 50 | 20.0 | 20.0 | 50.0 |
| 50 to 450 | 5.0 | 5.0 | 50.0 |
| 450 to 512 | 2.5 | 5.0 | 5.0 |
| 821 to 896 | 1.5 | 2.5 | 2.5 |
| 928 to 929 | 5.0 | n/a | n/a |
| 929 to 960 | 1.5 | n/a | n/a |
| 2110 to 2220 | 10.0 | n/a | n/a |

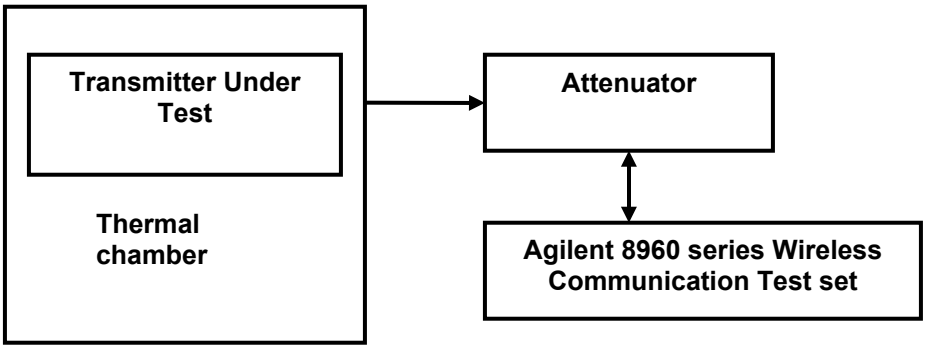
### C.2.2 PCS Mode

24.235 Frequency stability;
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

## C.3. Test Method

The EUT was placed in the thermal chamber and tested at 20° Celsius and increased in 10 degree increments to 50° Celsius and then down to -30° Celsius.
After a sufficient time of temperature stabilization with the EUT was attached to the callbox, the transmitter was set to transmit at full rated RF power output.
Maximum frequency drift was recorded over a 10 minute period using the appropriate technique in the case of digital modulations. Minimum 600 measurements were taken and the worst case drift for each modes were presented.

### C.4. Test Setup diagram




### C.5. Operating Mode During Test

For all modulation modes and bands the EUT was configured to transmit at maximum RF Power output.

### C.6. Test Results

Compliant.
The maximum measured frequency drift in cell band WCDMA mode (Part 22 Subpart H – 2.5ppm limit) was 205 Hz.
The maximum measured drift in PCS band WCDMA mode was 226 Hz (Part 24 subpart E), sufficient to stay within the frequency block.

| Temperature ( °C) | Voltage (V dc) | GSM 850 GPRS 836.6 MHz | | PCS GPRS 1880 MHz | | WCDMA Band II 1880 MHz | |
|---|---|---|---|---|---|---|---|
| | | Error (Hz) | Error (ppm) | Error (Hz) | Error (ppm) | Error (Hz) | Error (ppm) |
| 21 | 4.75 | -36 | 0.04 | -28 | 0.01 | 188 | 0.10 |
| 21 | 5.25 | -45 | 0.05 | -32 | 0.02 | 226 | 0.12 |
| 21 | 5.00 | 24 | 0.03 | 32 | 0.02 | 6 | 0.00 |
| -30 | 5.00 | 157 | 0.19 | -130 | 0.07 | 120 | 0.06 |
| -20 | 5.00 | -79 | 0.09 | 138 | 0.07 | -39 | 0.02 |
| -10 | 5.00 | -170 | 0.20 | 158 | 0.08 | 34 | 0.02 |
| 0 | 5.00 | 72 | 0.09 | 67 | 0.04 | -35 | 0.02 |
| 10 | 5.00 | -42 | 0.05 | 44 | 0.02 | 38 | 0.02 |
| 30 | 5.00 | 62 | 0.07 | 13 | 0.01 | 14 | 0.01 |
| 40 | 5.00 | 22 | 0.03 | 15 | 0.01 | -30 | 0.02 |
| 50 | 5.00 | -78 | 0.09 | -94 | 0.05 | 18 | 0.01 |

### C.7. Tested By

Name: Deniz Demirci
Function: Senior Wireless/EMC Technologist

### C.8. Test date

Started: October 04, 2010 Completed: October 06, 2010

# APPENDIX D: PEAK-TO-AVERAGE RATIO

## D.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC Part 24.232, RSS 133 Issue 5 (6.4) |
| **Test Basis** | FCC Part 24.232 |
| **Test Method** | ANSI/TIA/EIA-603-C-2004 |

## D.2. Specifications

FCC Part 24.232

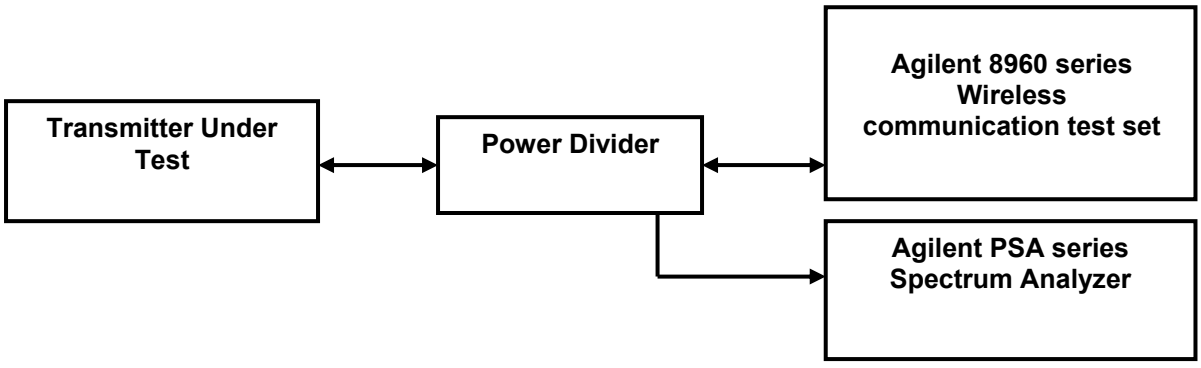
(d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, *etc.* so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

RSS 133 Issue 5

(6.4) When the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

## D.3. Test Setup Diagram



### D.4. Operating Modes During Test

The EUT was tested to determine worst case operating modes to produce maximum peak power for the different modulation types. The following modes and associated configurations produced the highest power levels

PCS GPRS - 1up 1down, Ms Tx level burst 0
PCS EDGE - 1up 1down, Ms Tx level burst 2
PCS WCDMA – All up bits, 12.2 kbps RMC

### D.5. Test Method

The EUT was connected to a call box and a spectrum analyzer via a calibrated power divider and cable assembly. Testing was done with the EUT operating in all modes at highest power level available.

For GPRS and EDGE modulations: The average and peak traces are used on the spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT

For WCDMA modulation: The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT

All reported emissions are corrected for cable and attenuator losses

### D.6. Test Results

Compliant, Peak-to-average ratio for all modes do not exceed 13 dB
For GPRS modulation = 0.11 dB
For EDGE modulation = 0.18 dB
For WCDMA modulation = 3.53 dB

### D.7. Tested By

Name: Deniz Demirci
Function: Senior Wireless/EMC Technologist

### D.8. Test date

October 25, 2010

**Figure 11 PCS GPRS Ch661**

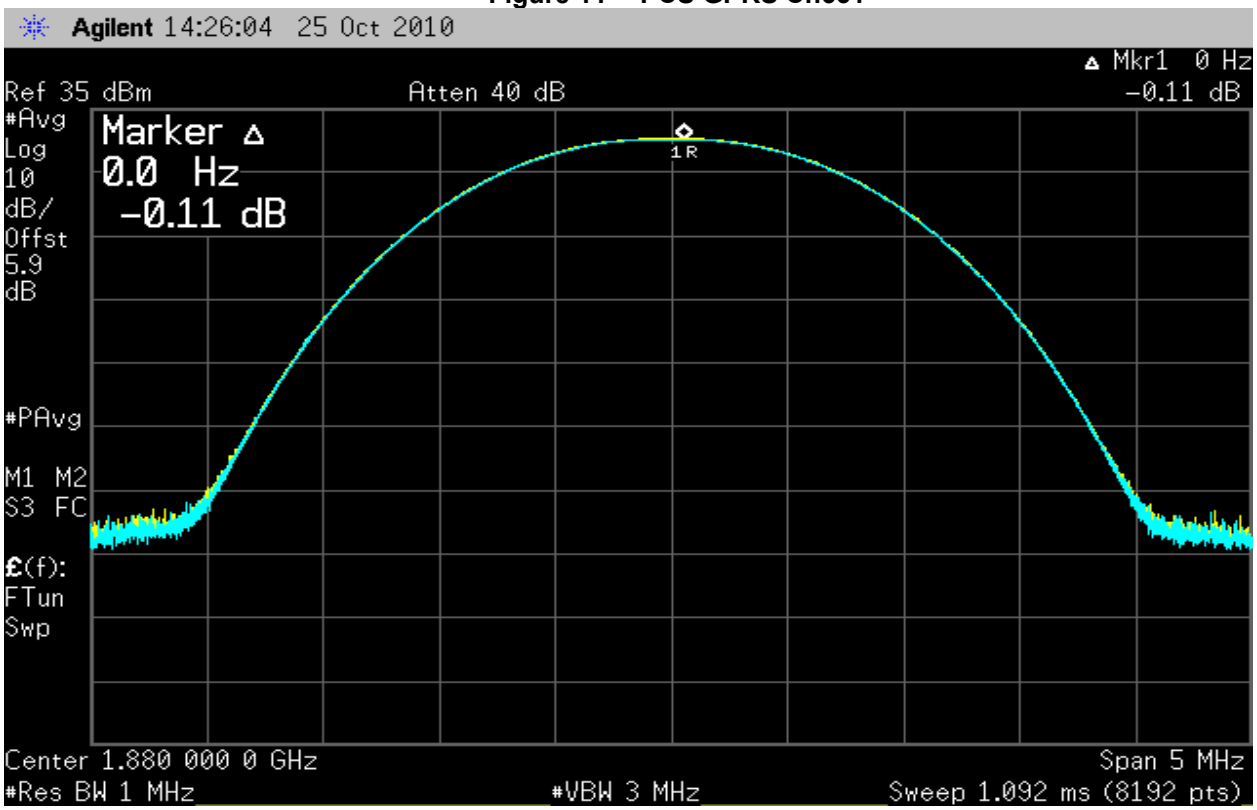



**Figure 12 PCS EDGE Ch661**

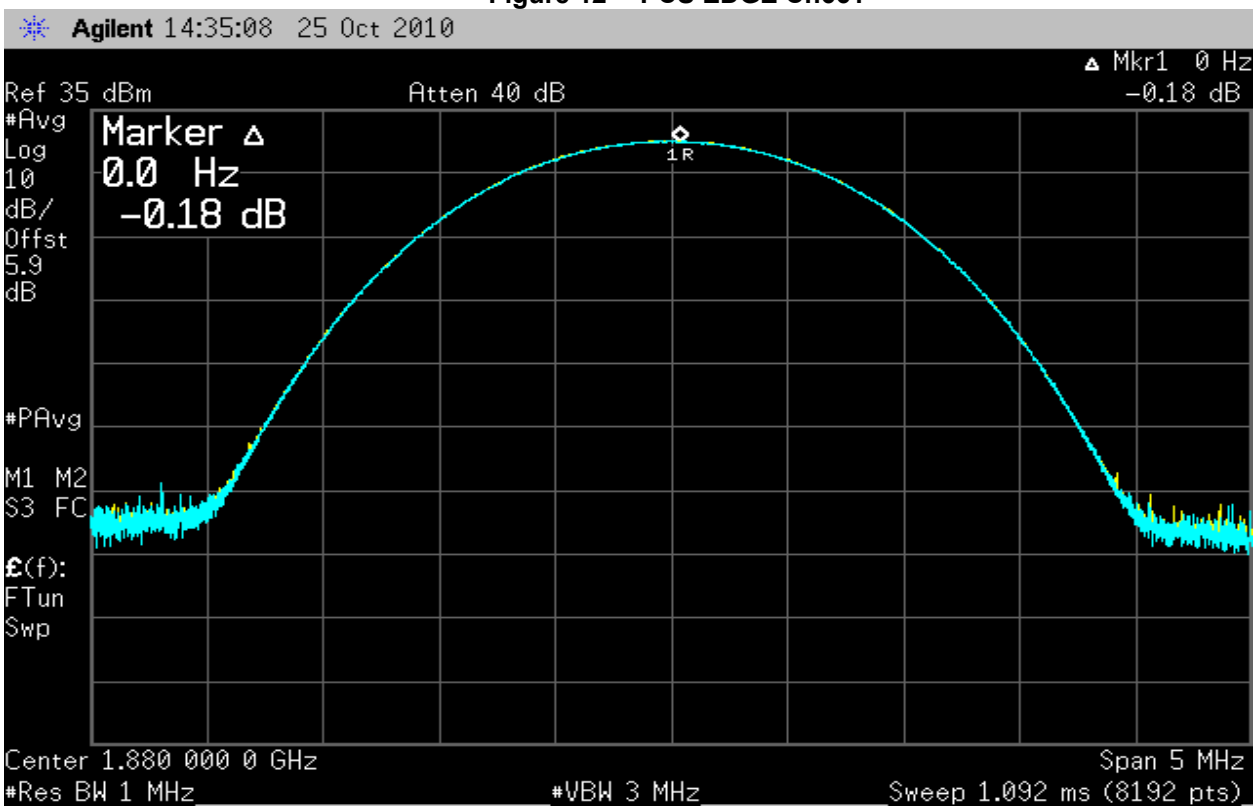
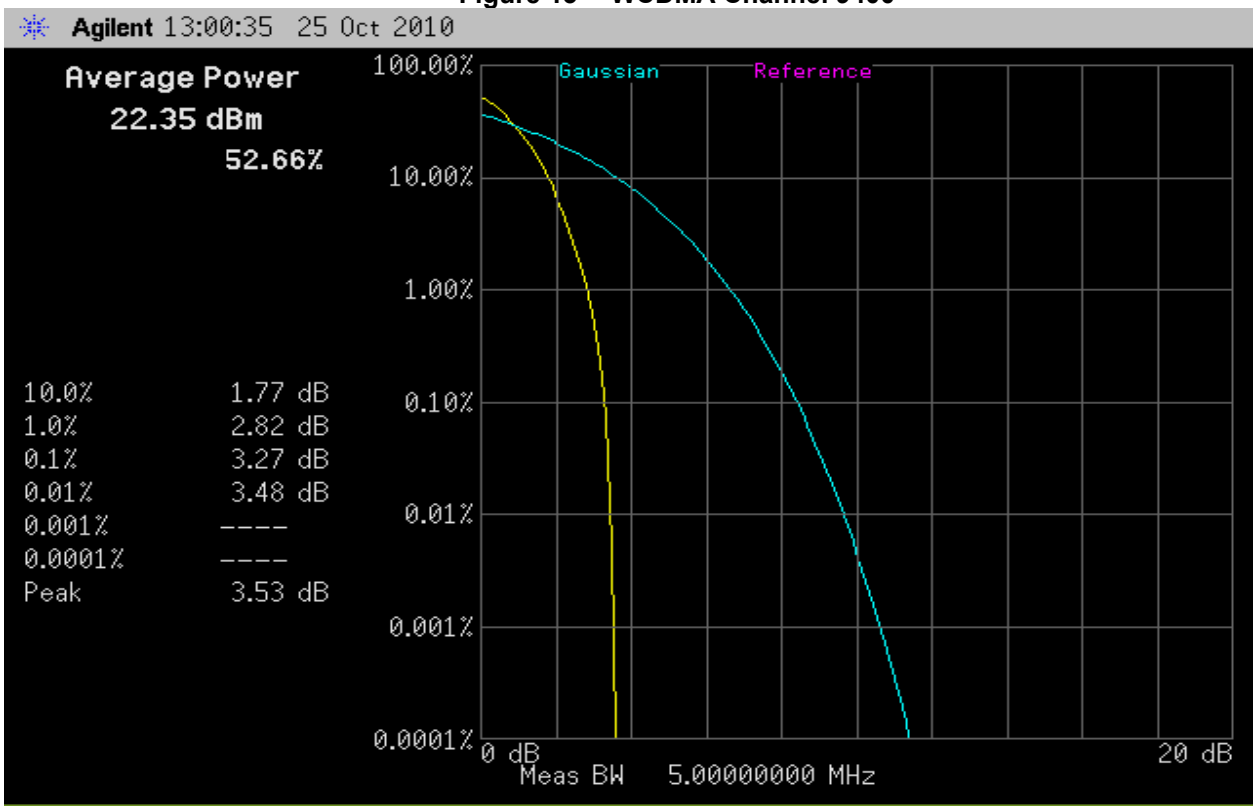


**Figure 13 WCDMA Channel 9400**



# APPENDIX E: TRANSMITTER CONDUCTED OUTPUT POWER

## E.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC Part 2.1046 |
| **Test Basis** | FCC Part 2.1046 |
| **Test Method** | FCC Part 2.1046 |

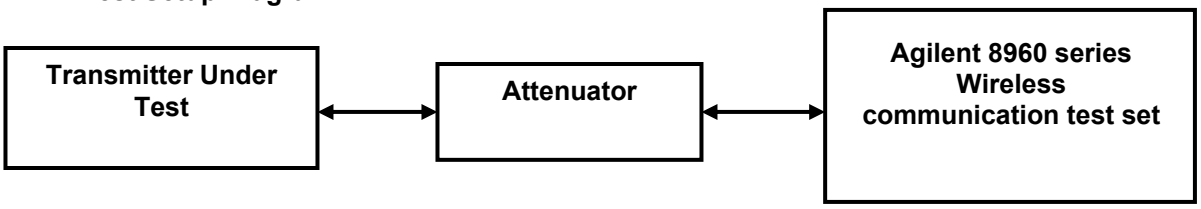
## E.2. Specifications

FCC Part 2.1046
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.
(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter
(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations..

## E.3. Test Method

The EUT was connected to a call box and via a calibrated attenuator and cable assembly. Testing was done with the EUT operating in all modes at highest power level available and on low, mid and high channels with the worst case configurations being reported.
All reported emissions are corrected for cable and attenuator losses.

## E.4. Test Setup Diagram




## E.5. Operating Modes During Test

The EUT was tested to determine worst case operating modes to produce maximum peak power for the different modulation types. The following modes and associated configurations produced the highest power levels
CELL 850 GPRS – 1up 1down, Ms Tx level burst 5 to 0
CELL 850 EDGE – 1up 1down, Ms Tx level burst 8 to 0
PCS GPRS - 1up 1down, Ms Tx level burst 0
PCS EDGE - 1up 1down, Ms Tx level burst 2 to 0
PCS WCDMA – All up bits, 12.2 kbps RMC

## E.6. Test Results

| Cell Channel # | | Frequency (MHz) | Measured conducted power (dBm) |
|---|---|---|---|
| GPRS | 128 | 824.2 | 32.29 |
| | 190 | 836.6 | 32.63 |
| | 251 | 848.8 | 32.65 |
| EDGE | 128 | 824.2 | 27.94 |
| | 190 | 836.6 | 28.34 |
| | 251 | 848.8 | 28.48 |

| PCS Channel # | | Frequency (MHz) | Measured conducted power (dBm) |
|---|---|---|---|
| GPRS | 512 | 1850.2 | 29.40 |
| | 661 | 1880.0 | 29.60 |
| | 810 | 1909.8 | 29.70 |
| EDGE | 512 | 1850.2 | 26.70 |
| | 661 | 1880.0 | 26.81 |
| | 810 | 1909.8 | 26.90 |
| WCDMA | 9262 | 1852.4 | 22.22 |
| | 9400 | 1880.0 | 22.34 |
| | 9538 | 1907.6 | 21.87 |

## E.7. Tested By

Name: Deniz Demirci
Function: Senior Wireless/EMC Technologist

## E.8. Test date

October 22, 2010

# APPENDIX F: TX CONDUCTED SPURIOUS EMISSIONS

## F.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | Cell Mode: FCC Part 22.917<br>PCS Mode: FCC Part 24.238 |
| **Test Basis** | FCC 2.1051 |
| **Test Method** | FCC 2.1051 |

## F.2. Specifications

**Cell Mode:**

a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( *i.e.* 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

**PCS Mode:**

**24.238 Emission limitations for Broadband PCS equipment.**

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

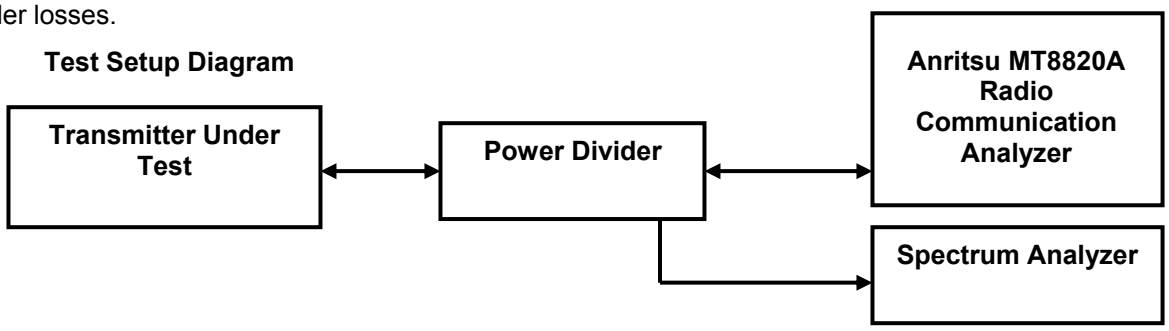
(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( *i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power

## F.3. Test Method

The EUT was connected to a spectrum analyzer via a calibrated cable assembly. Testing was done with the EUT operating in all modes at highest power level available and on low, mid and high channels with the worst case configurations being reported. All reported emissions are corrected for cable and power divider losses.

## F.4. Test Setup Diagram



### F.5. Test Results

Compliant,
See following pages for plots of band edge for all modes and spurious data to the 10th harmonic and summary tables below

#### D.5.1 Cell Band

| Channel | Mode | Note | Emission Frequency (MHz) | Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| 128 | GPRS | Lower band edge | 823.98 | -13.71 | -13 | 0.71 |
| 251 | GPRS | Upper band edge | 849.02 | -13.49 | -13 | 0.49 |
| 128 | EDGE | Lower band edge | 823.98 | -17.36 | -13 | 4.36 |
| 251 | EDGE | Upper band edge | 849.00 | -19.71 | -13 | 6.71 |

**Note:** The above are the worst case measurements, no other reportable emissions were detected in any of the modes. Therefore for spurious emissions noise floor readings are reported along with plots of the EUT operating at highest power mode

#### D.5.2 PCS Band

| Channel | Mode | Note | Emission Frequency (MHz) | Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| 512 | GPRS | Lower band edge | 1849.99 | -15.72 | -13 | 2.72 |
| 810 | GPRS | Upper band edge | 1910.02 | -14.68 | -13 | 1.68 |
| 512 | EDGE | Lower band edge | 1849.99 | -21.96 | -13 | 8.96 |
| 810 | EDGE | Upper band edge | 1910.01 | -17.12 | -13 | 4.12 |
| 9262 | WCDMA | Lower band edge | 1850.00 | -22.29 | -13 | 9.29 |
| 9538 | WCDMA | Upper band edge | 1910.00 | -21.12 | -13 | 8.12 |

**Note:** The above are the worst case measurements, no other reportable emissions were detected in any of the modes. Therefore for spurious emissions noise floor readings are reported along with plots of the EUT operating at highest power mode

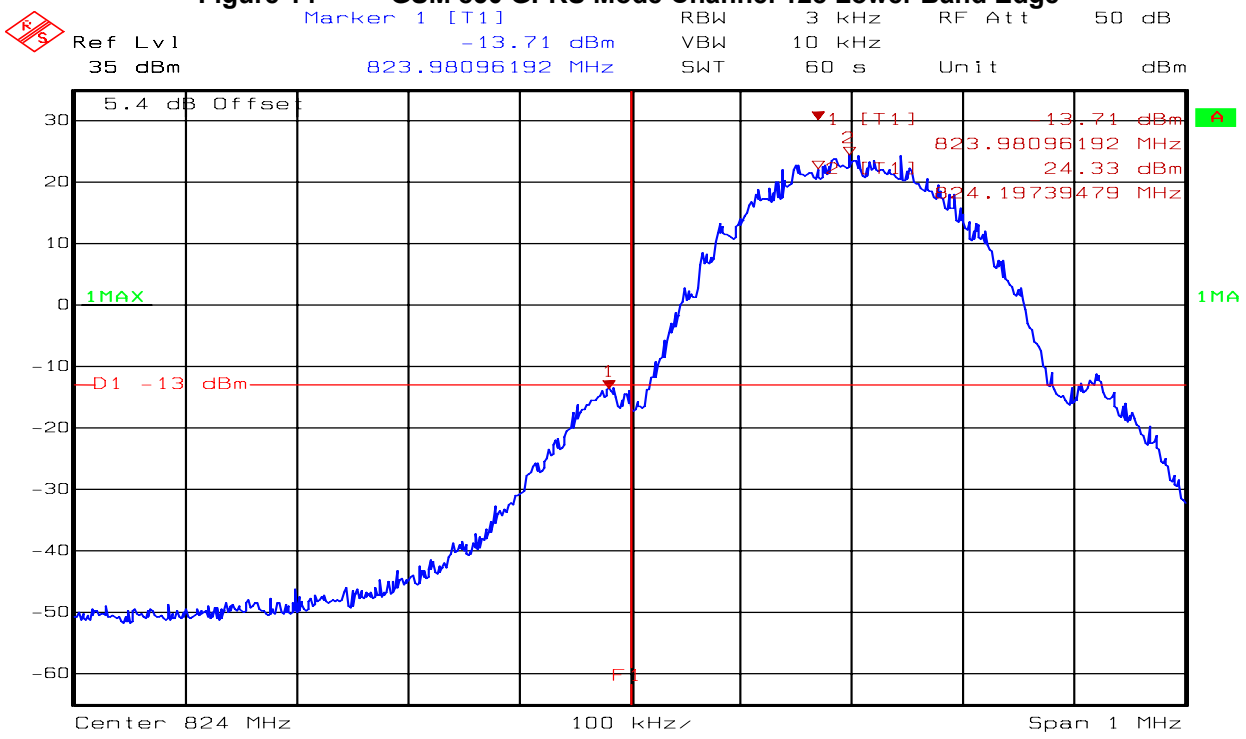
### F.6. Tested By

Name: Deniz Demirci
Function: Senior Wireless/EMC Technologist

### F.7. Test dates

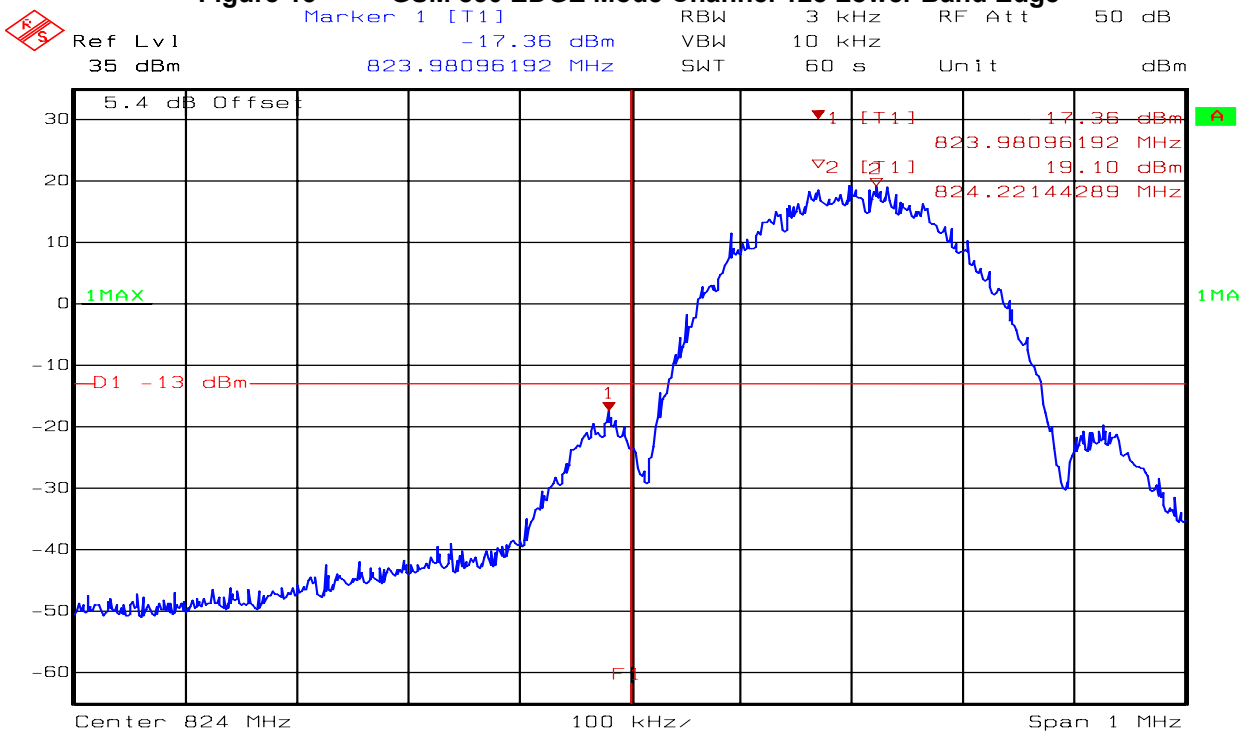
Started: September 27, 2010 Completed: September 28, 2010

**Figure 14 GSM 850 GPRS Mode Channel 128 Lower Band Edge**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM GPRS CS-4 Ch128, Max power
Date: 27.SEP.2010 11:16:56

**Figure 15 GSM 850 EDGE Mode Channel 128 Lower Band Edge**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM EDGE 8PSK Ch128, Max power
Date: 27.SEP.2010 11:24:35

**Figure 16 GSM 850 GPRS Mode Channel 128 Conducted Spurious**

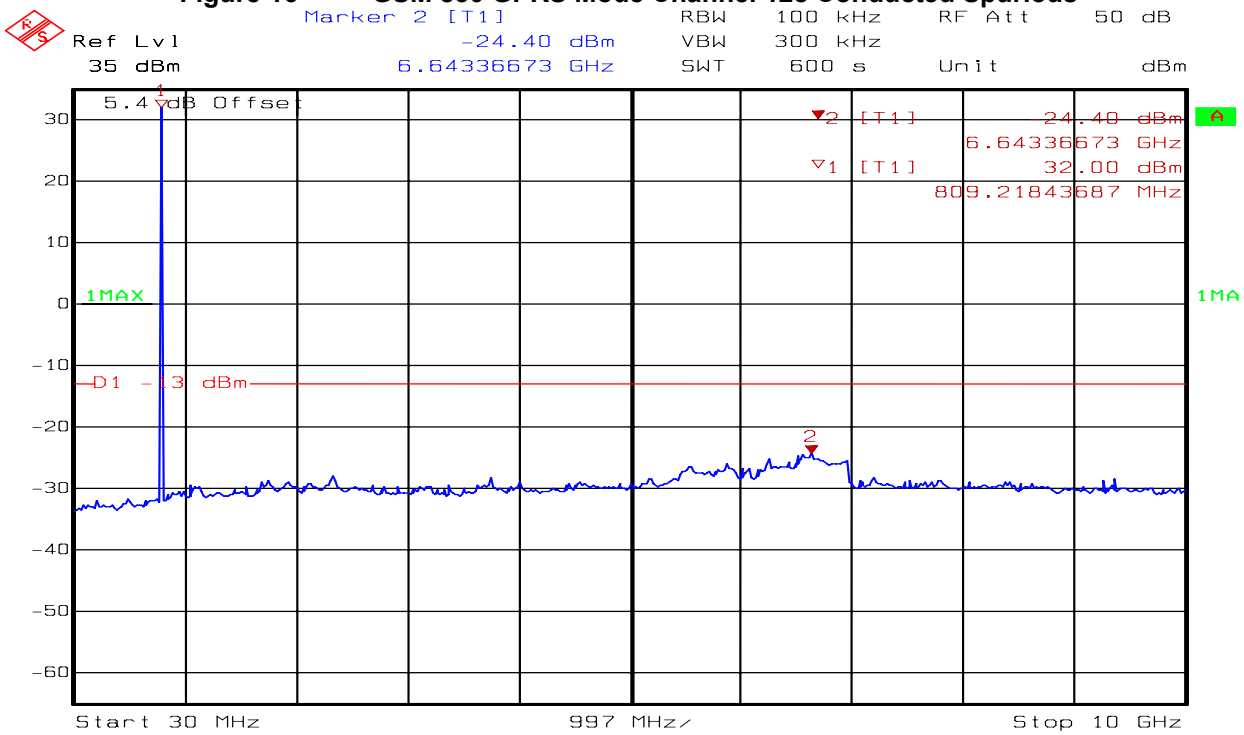



**Figure 17 GSM 850 EDGE Mode Channel 128 Conducted Spurious**

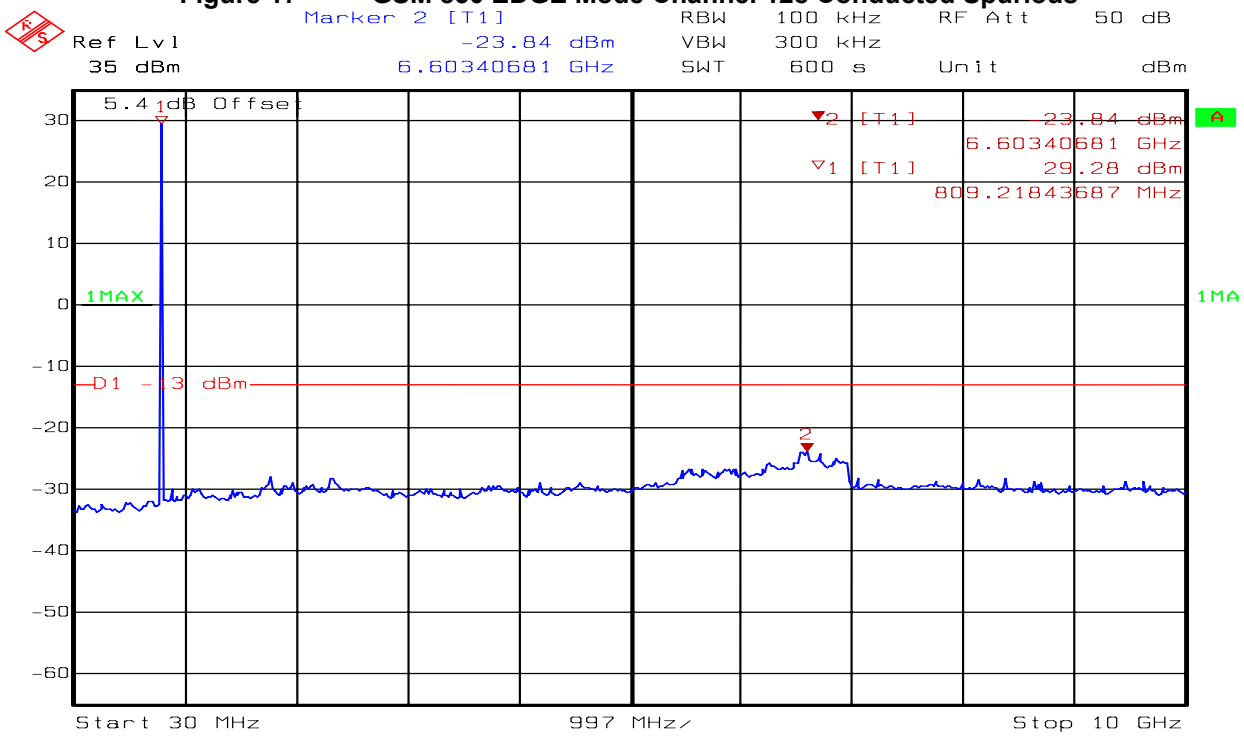
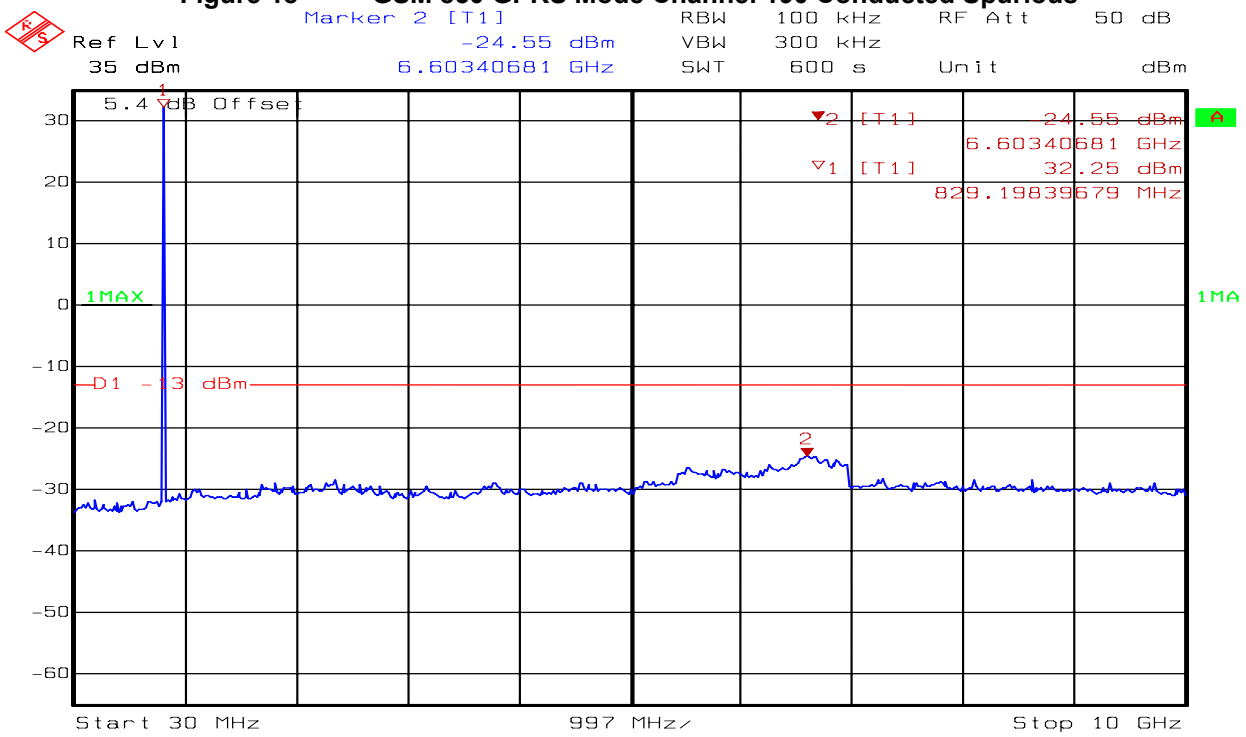
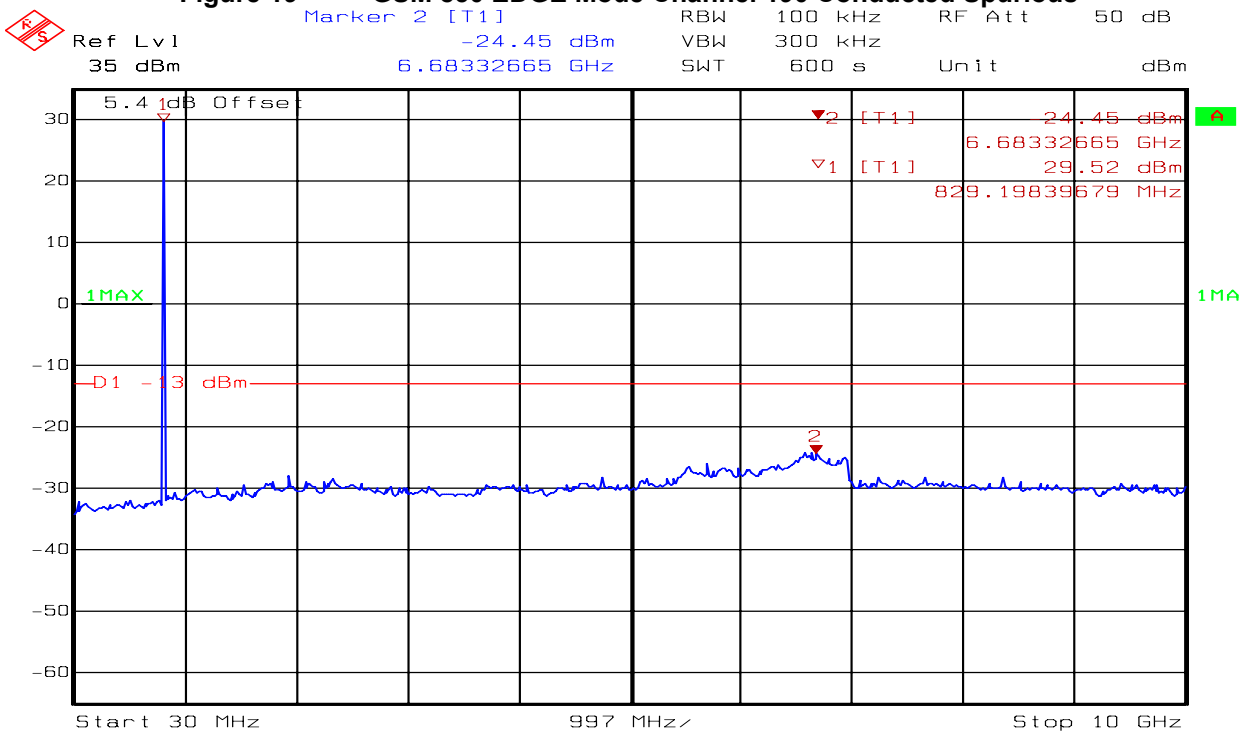


**Figure 18 GSM 850 GPRS Mode Channel 190 Conducted Spurious**



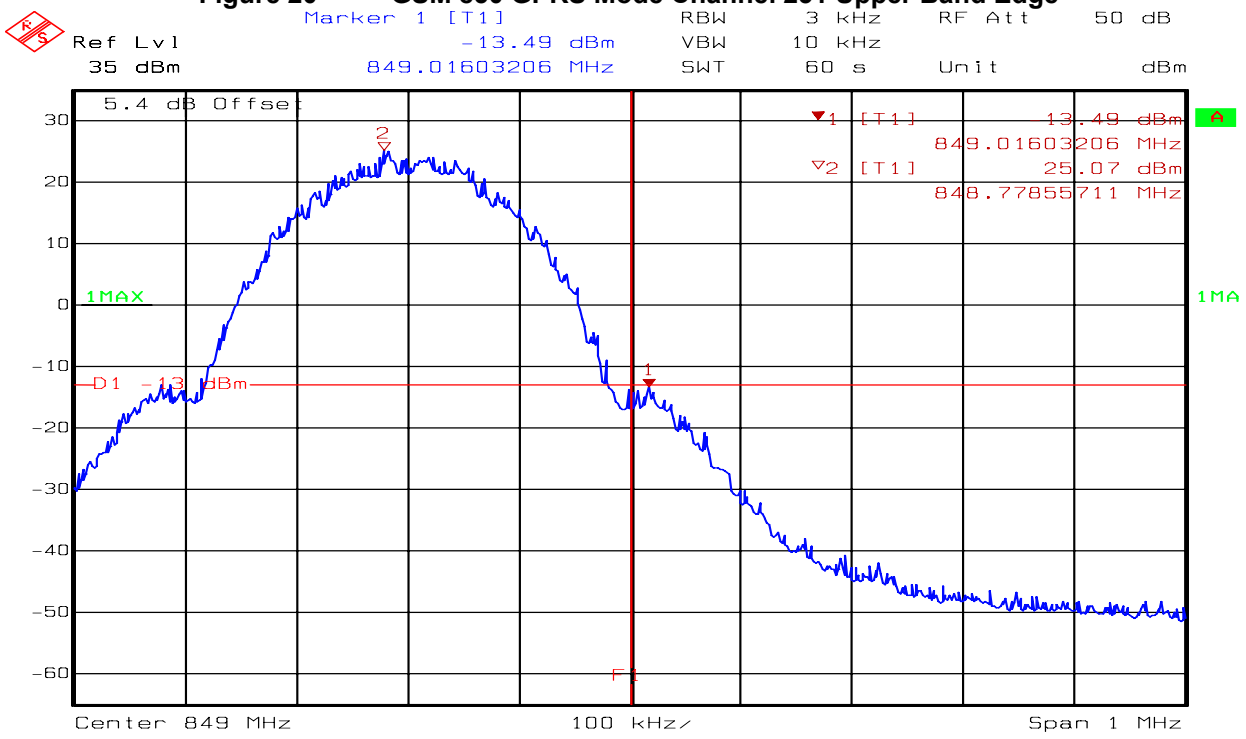

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM GPRS CS-4 Ch190, Max power
Date: 27.SEP.2010 12:04:03

**Figure 19 GSM 850 EDGE Mode Channel 190 Conducted Spurious**



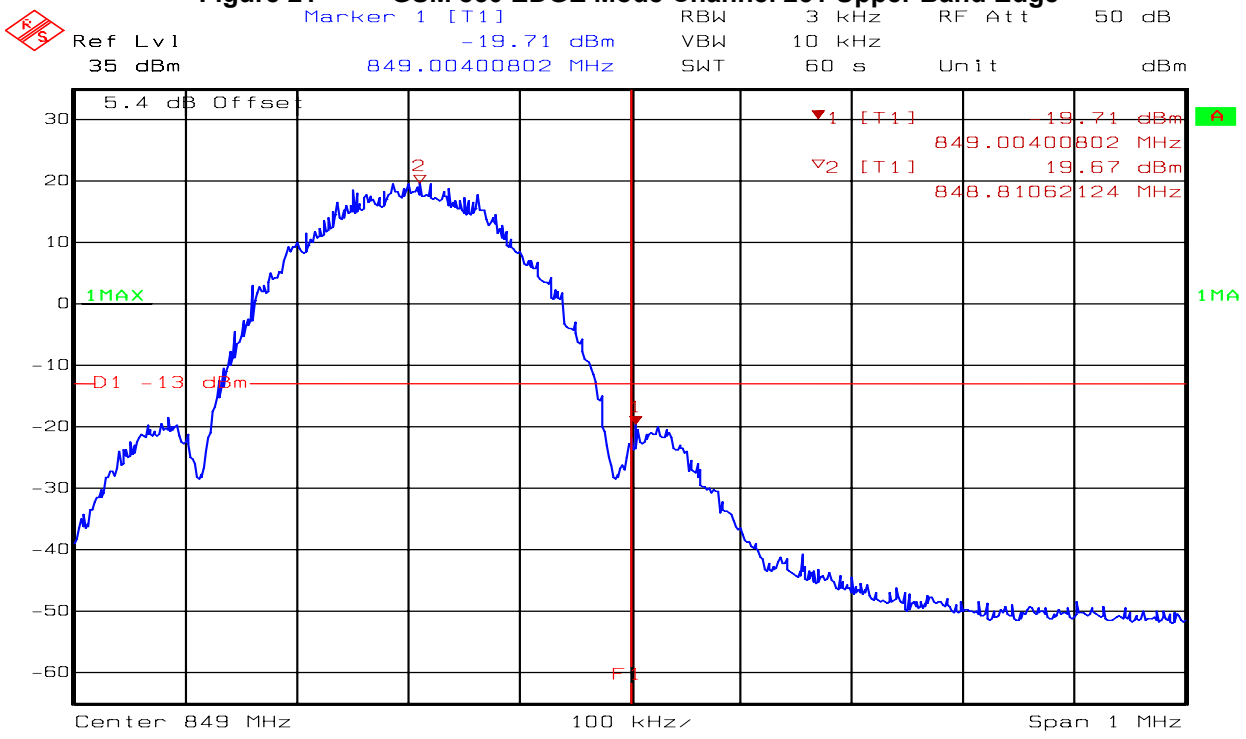

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM EDGE 8PSK Ch190, Max power
Date: 27.SEP.2010 11:49:54

**Figure 20 GSM 850 GPRS Mode Channel 251 Upper Band Edge**



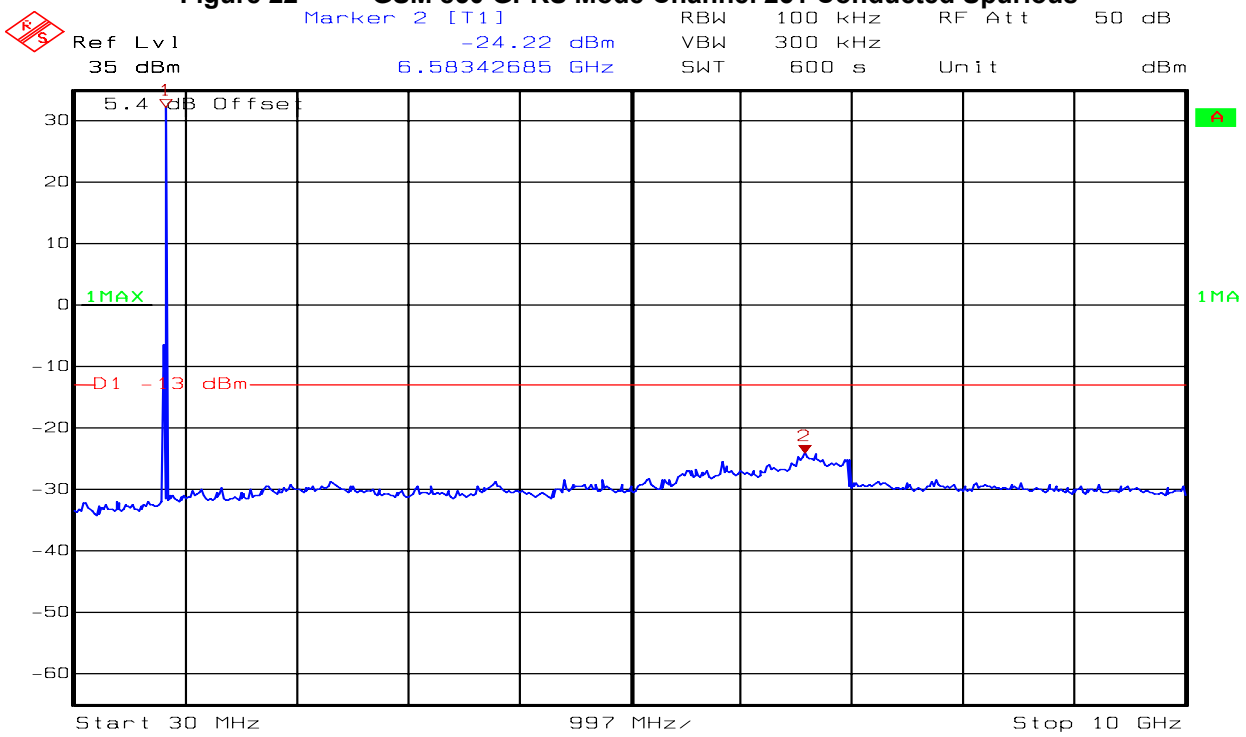

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM GPRS CS-4 Ch251, Max power
Date: 27.SEP.2010 12:28:16

**Figure 21 GSM 850 EDGE Mode Channel 251 Upper Band Edge**



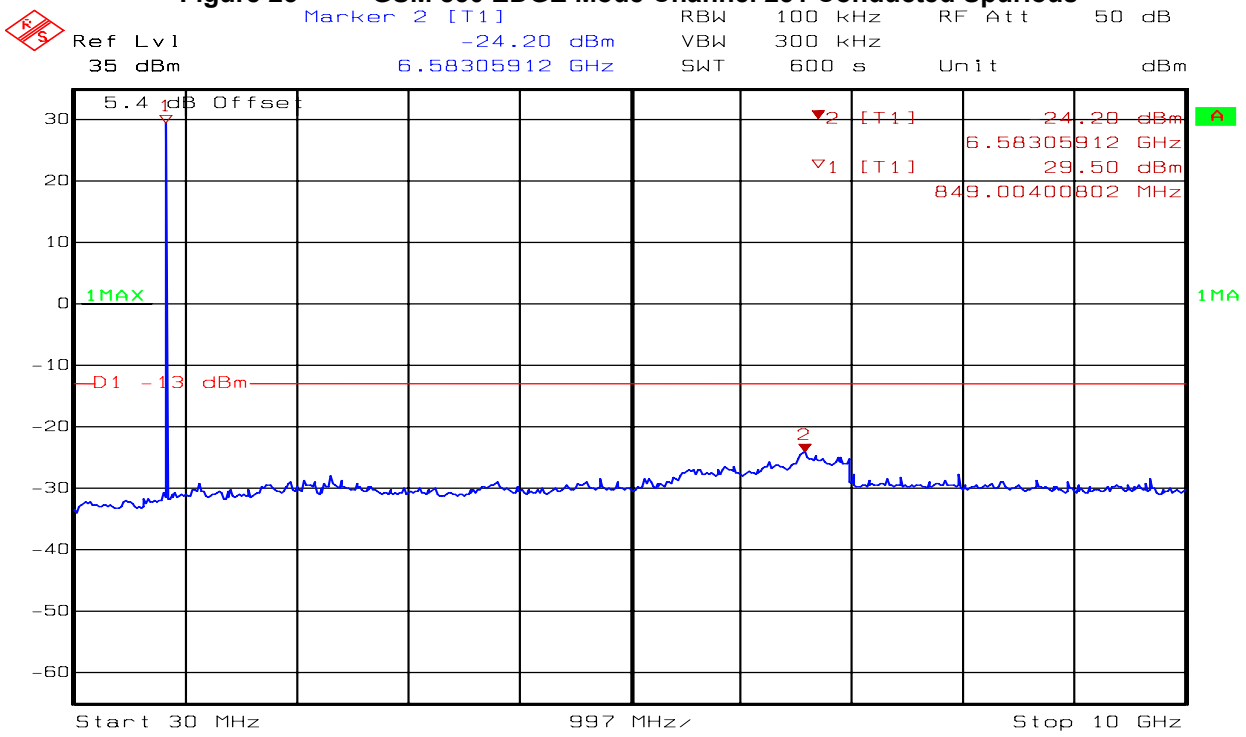

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM EDGE 8PSK Ch251, Max power
Date: 27.SEP.2010 12:33:17

**Figure 22 GSM 850 GPRS Mode Channel 251 Conducted Spurious**



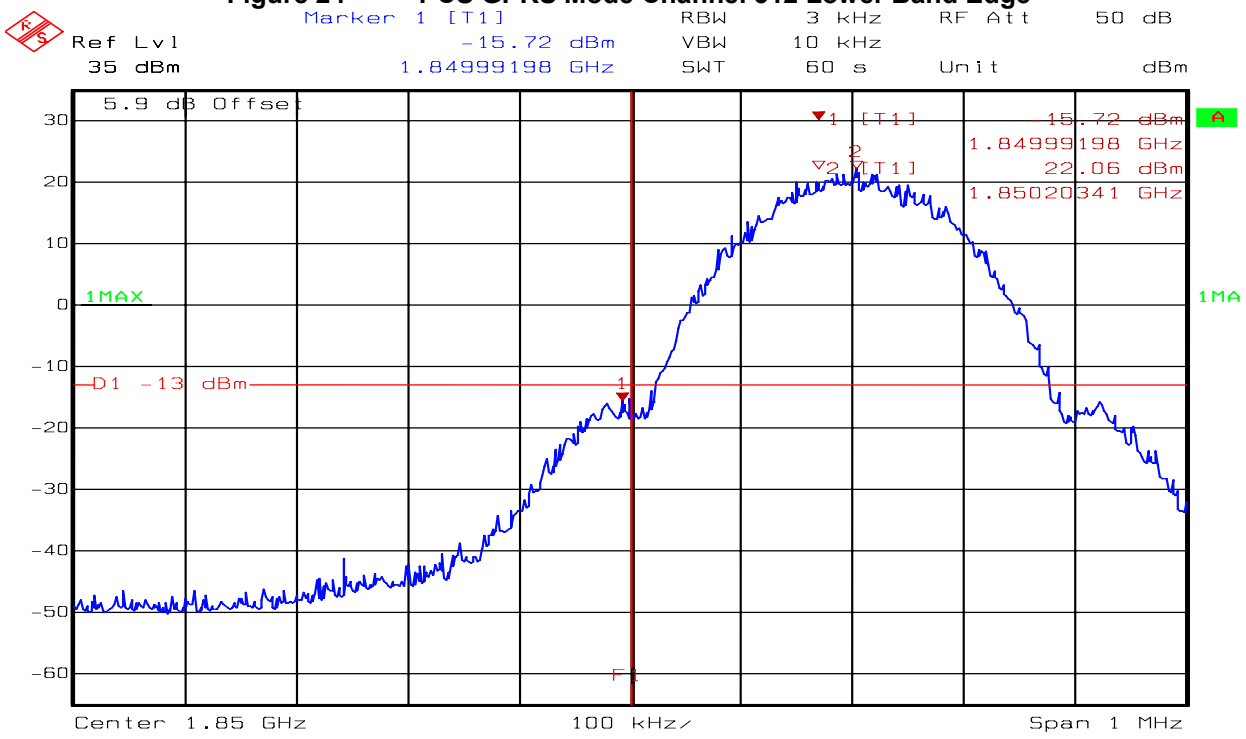

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM GPRS CS-4 Ch251, Max power
Date: 27.SEP.2010 12:15:38

**Figure 23 GSM 850 EDGE Mode Channel 251 Conducted Spurious**



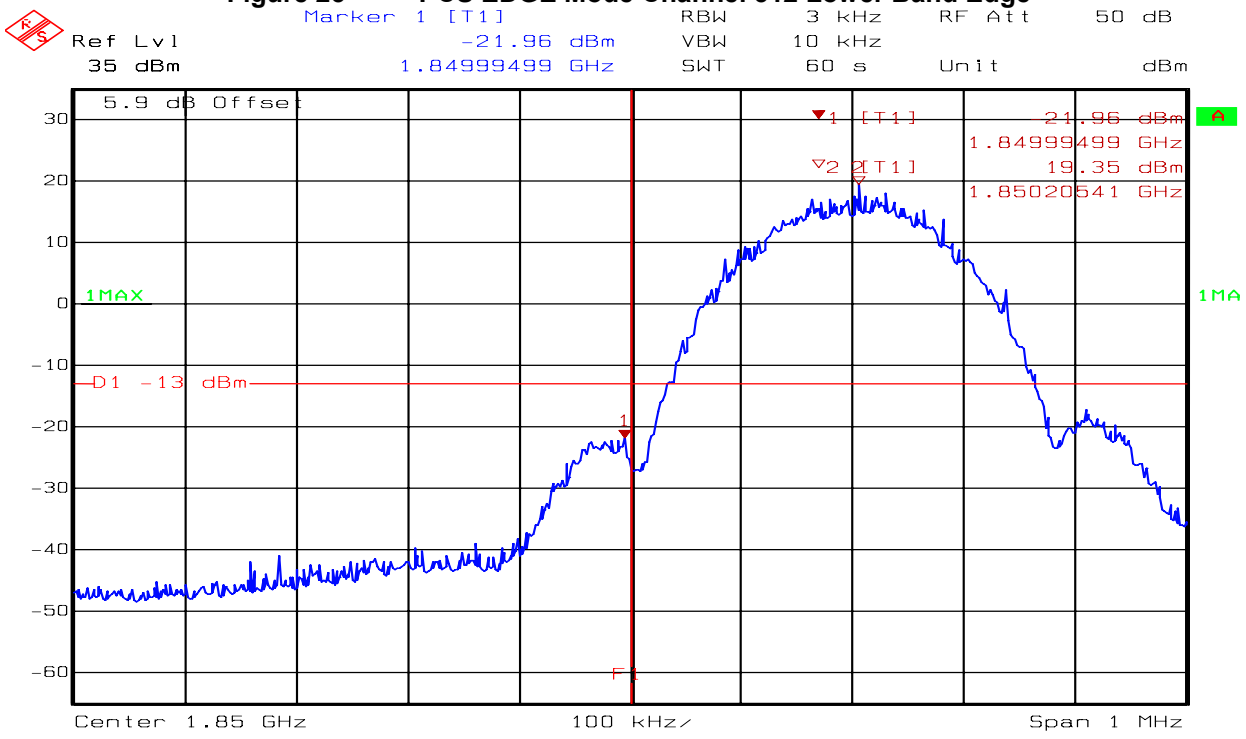

Title: C-0091342 Novatel Wireless Finetooth
Comment A: GSM EDGE 8PSK Ch251, Max power
Date: 27.SEP.2010 12:51:25

**Figure 24 PCS GPRS Mode Channel 512 Lower Band Edge**



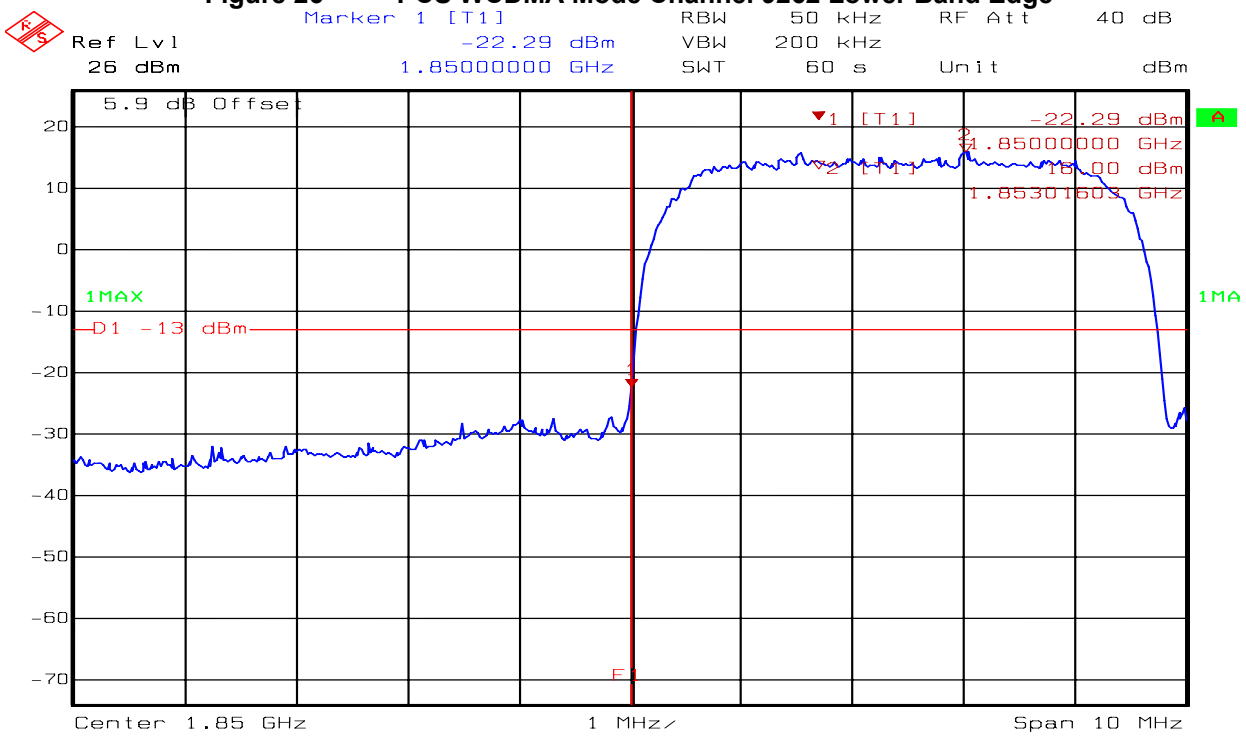

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4, Ch512, Max power
Date: 27.SEP.2010 14:59:07

**Figure 25 PCS EDGE Mode Channel 512 Lower Band Edge**



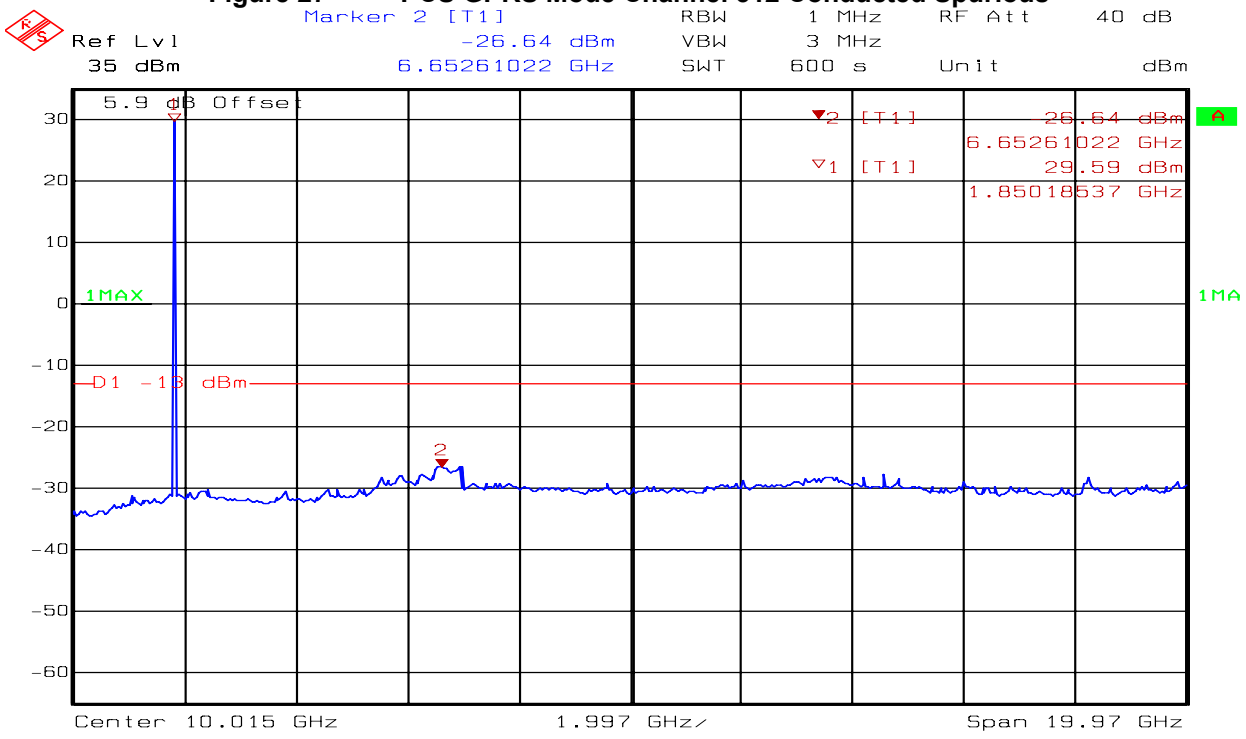

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK, Ch512, Max power
Date: 27.SEP.2010 15:04:27

**Figure 26 PCS WCDMA Mode Channel 9262 Lower Band Edge**



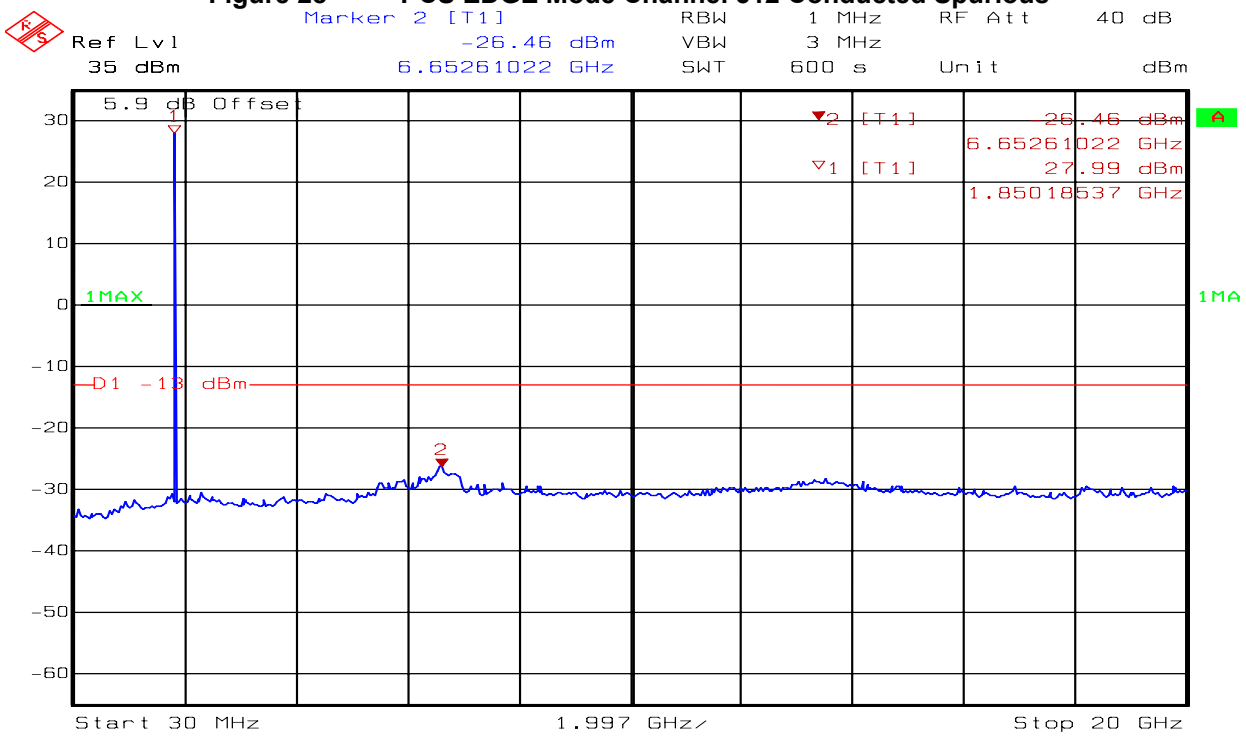

Title: C-0091342 Novatel Wireless Finetooth
Comment A: WCDMA Ch9262, Max power
Date: 27.SEP.2010 14:38:12

**Figure 27 PCS GPRS Mode Channel 512 Conducted Spurious**



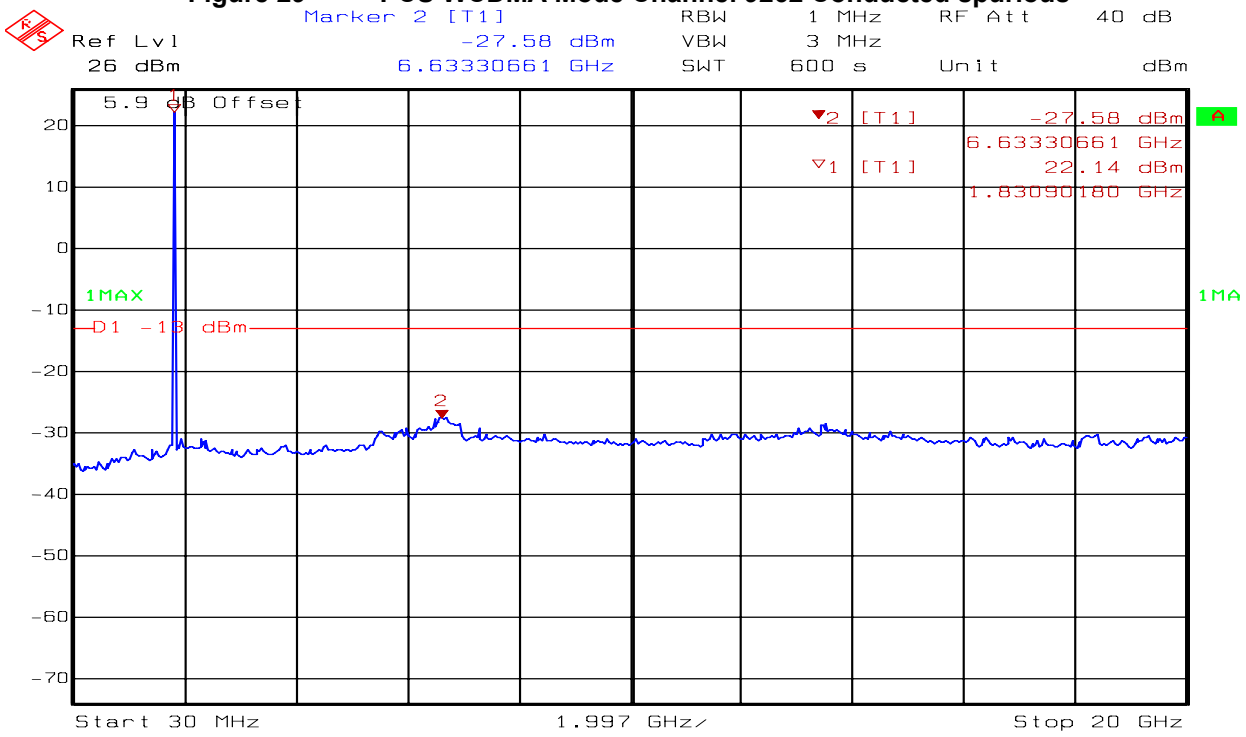

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4, Ch512, Max power
Date: 28.SEP.2010 7:48:45

**Figure 28 PCS EDGE Mode Channel 512 Conducted Spurious**



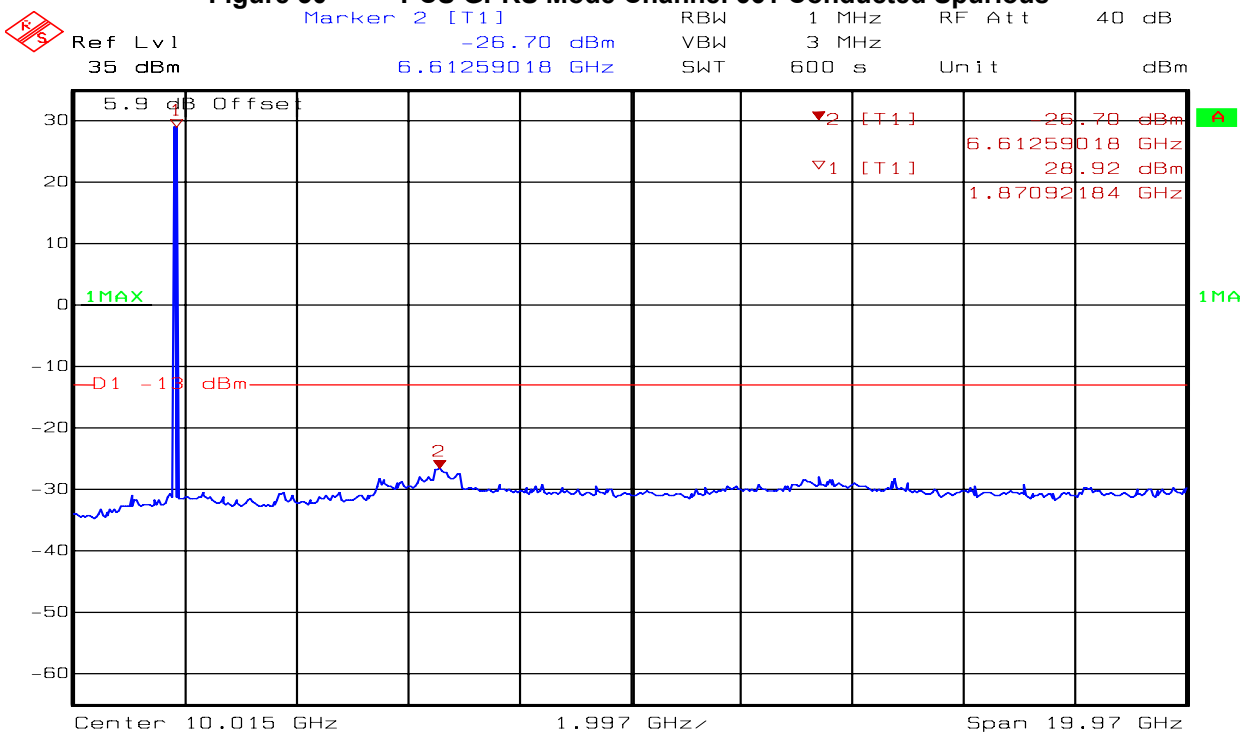

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK, Ch512, Max power
Date: 27.SEP.2010 15:18:06

**Figure 29 PCS WCDMA Mode Channel 9262 Conducted spurious**



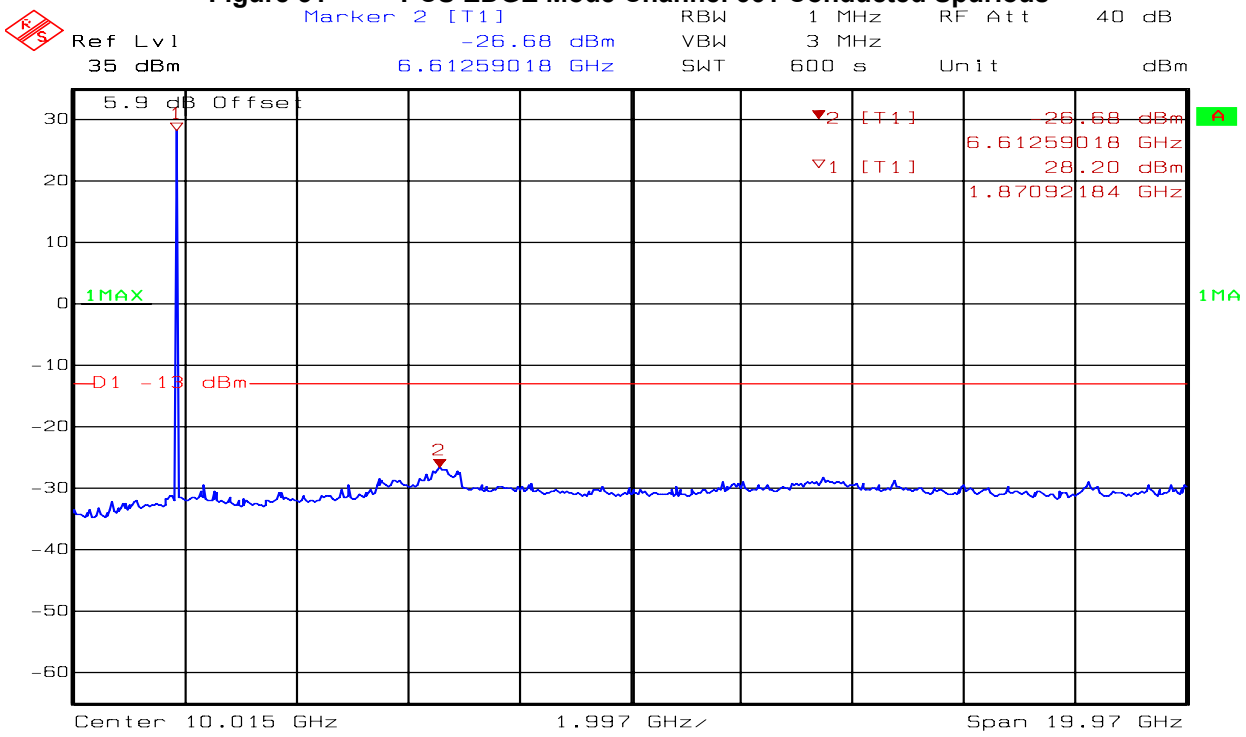

Title: C-0091342 Novatel Wireless Finetooth
Comment A: WCDMA Ch9262, Max power
Date: 27.SEP.2010 14:04:31

**Figure 30 PCS GPRS Mode Channel 661 Conducted Spurious**



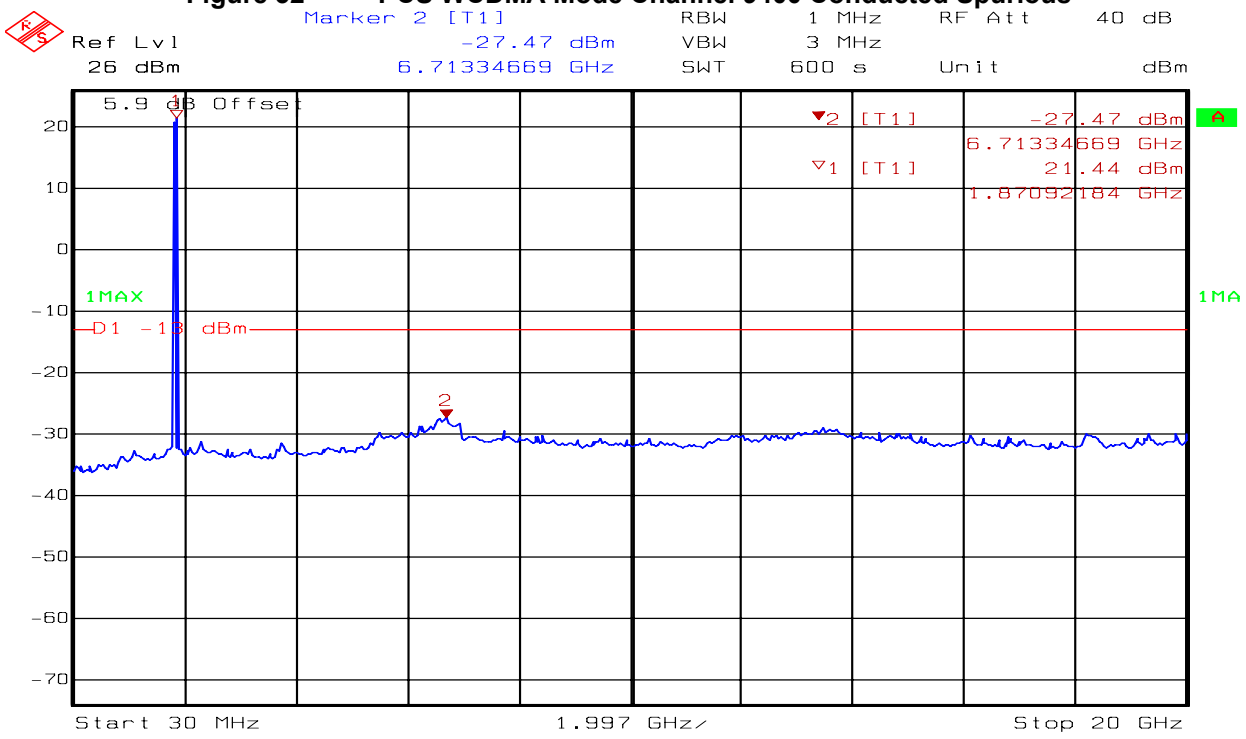

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4, Ch661, Max power
Date: 28.SEP.2010 8:02:42

**Figure 31 PCS EDGE Mode Channel 661 Conducted Spurious**



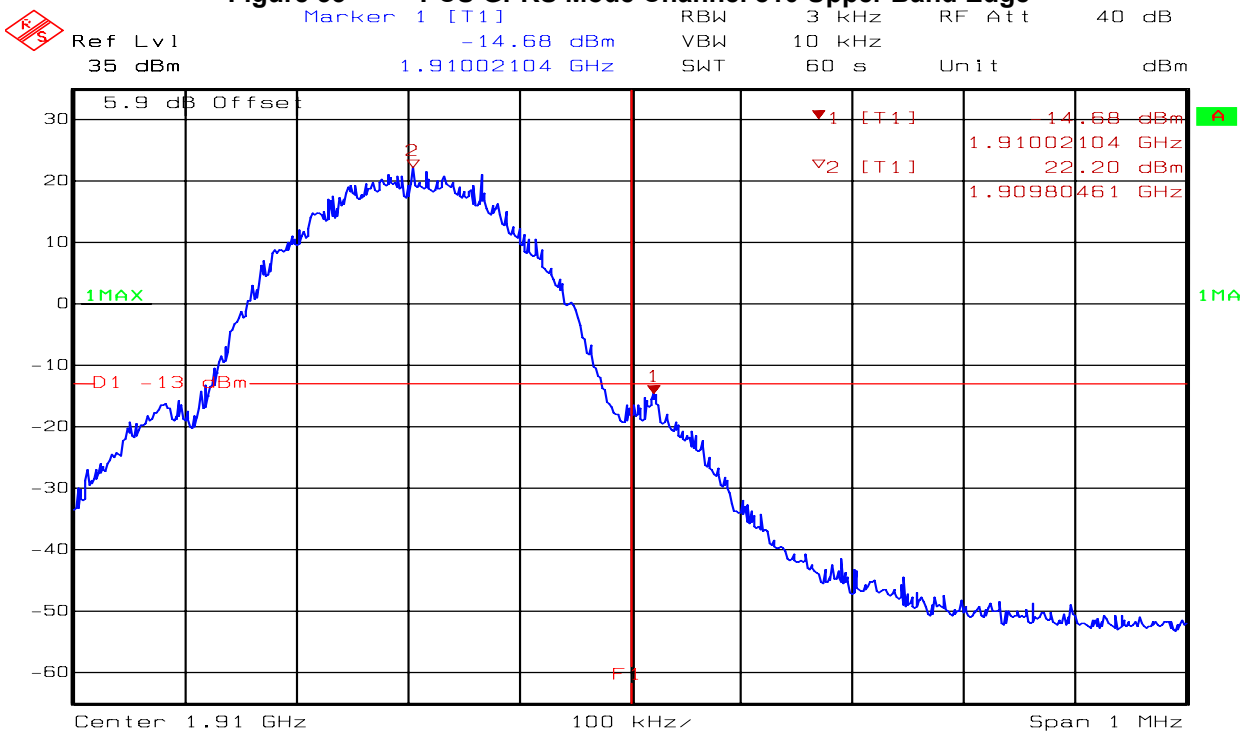

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK, Ch661, Max power
Date: 28.SEP.2010 8:14:37

**Figure 32 PCS WCDMA Mode Channel 9400 Conducted Spurious**



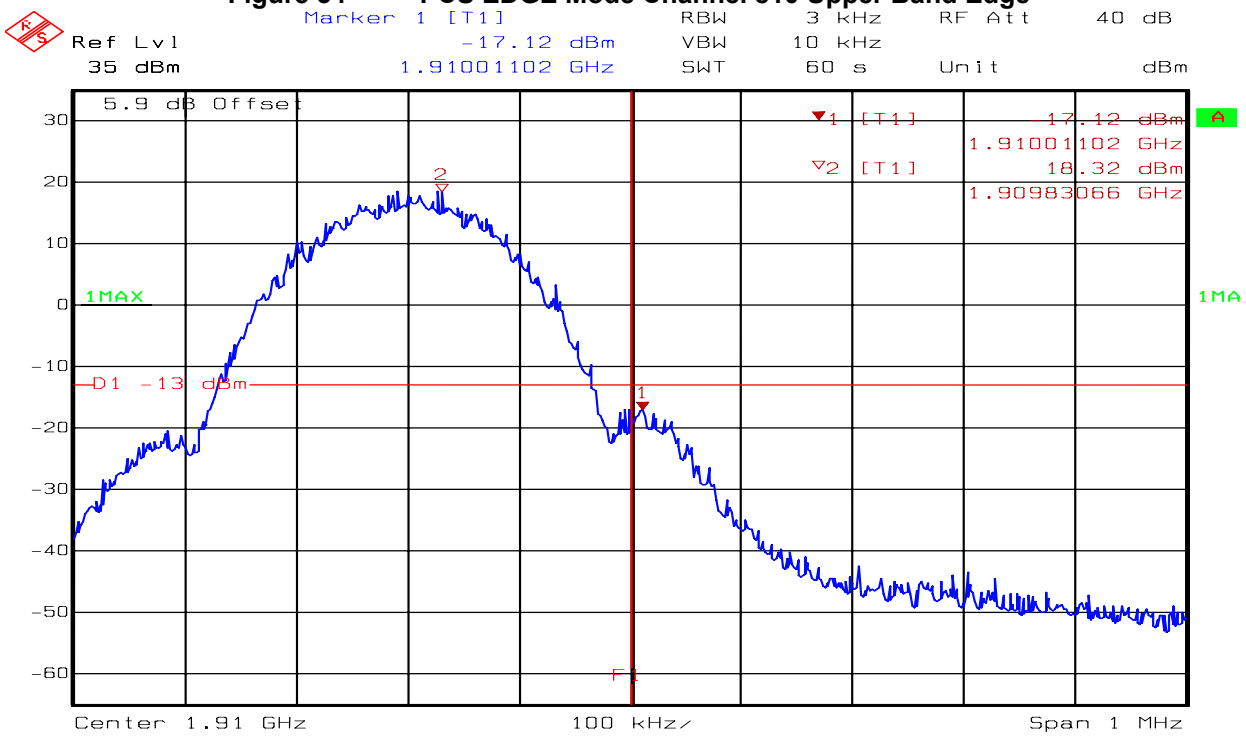

Title: C-0091342 Novatel Wireless Finetooth
Comment A: WCDMA Ch9400, Max power
Date: 27.SEP.2010 14:18:48

**Figure 33 PCS GPRS Mode Channel 810 Upper Band Edge**



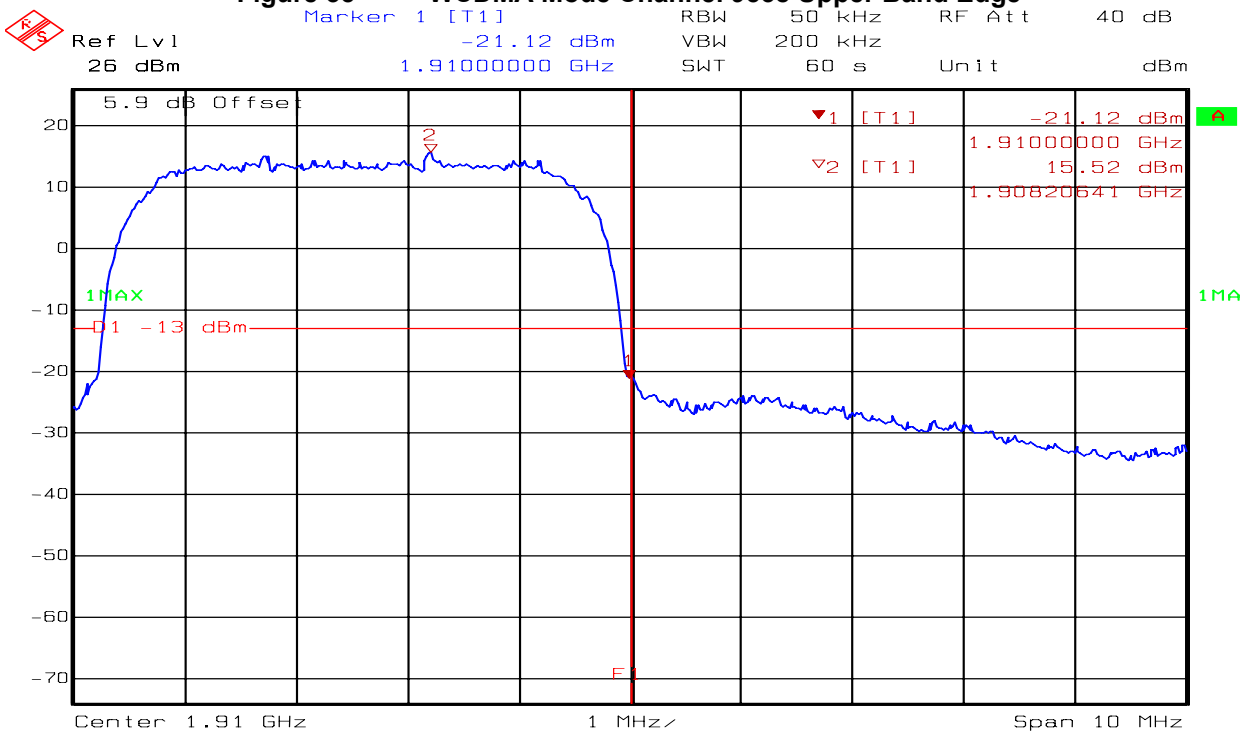

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4, Ch810, Max power
Date: 28.SEP.2010 8:49:59

**Figure 34 PCS EDGE Mode Channel 810 Upper Band Edge**



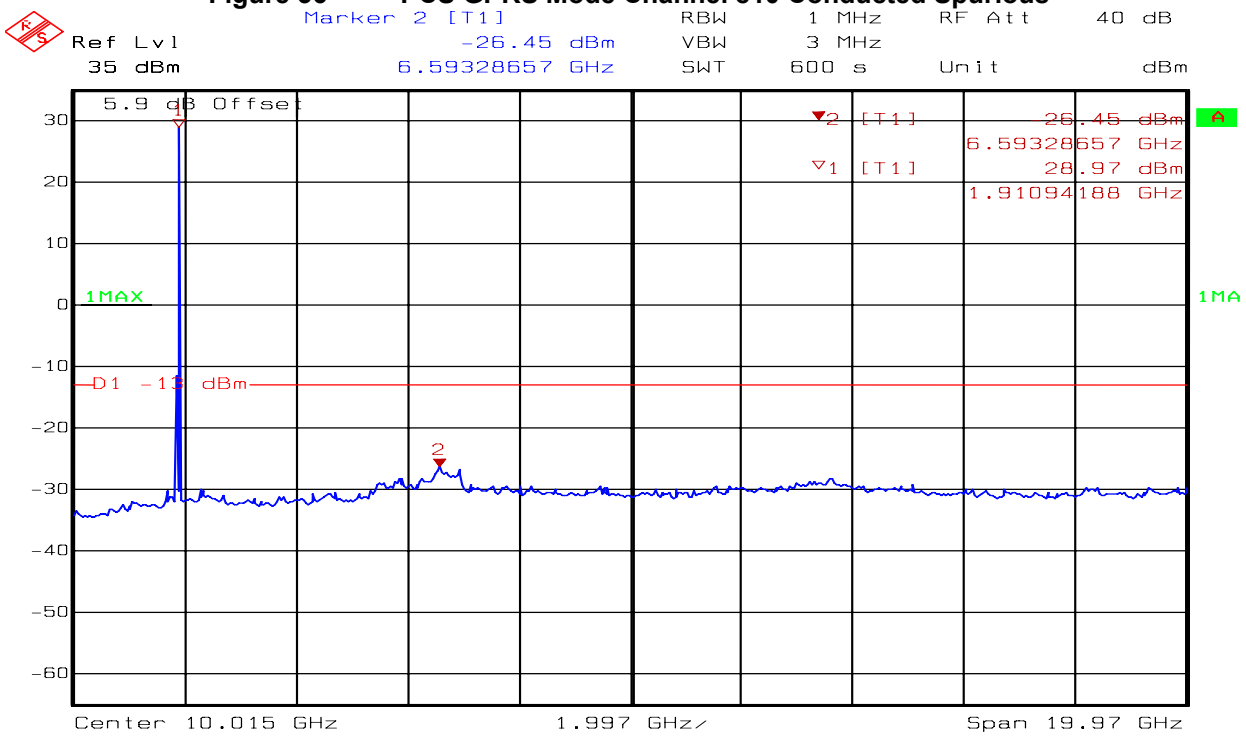

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK, Ch810, Max power
Date: 28.SEP.2010 8:56:14

**Figure 35 WCDMA Mode Channel 9538 Upper Band Edge**



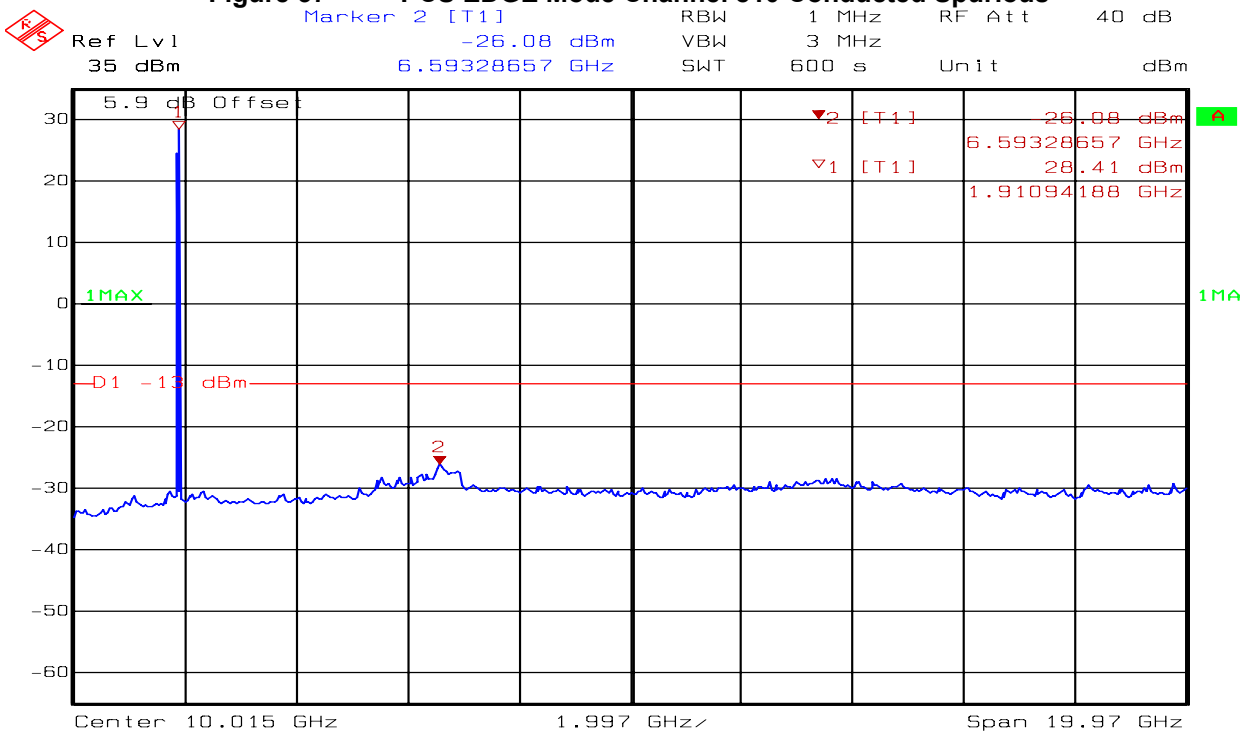

Title: C-0091342 Novatel Wireless Finetooth
Comment A: WCDMA Ch9538, Max power
Date: 27.SEP.2010 14:34:50

**Figure 36 PCS GPRS Mode Channel 810 Conducted Spurious**



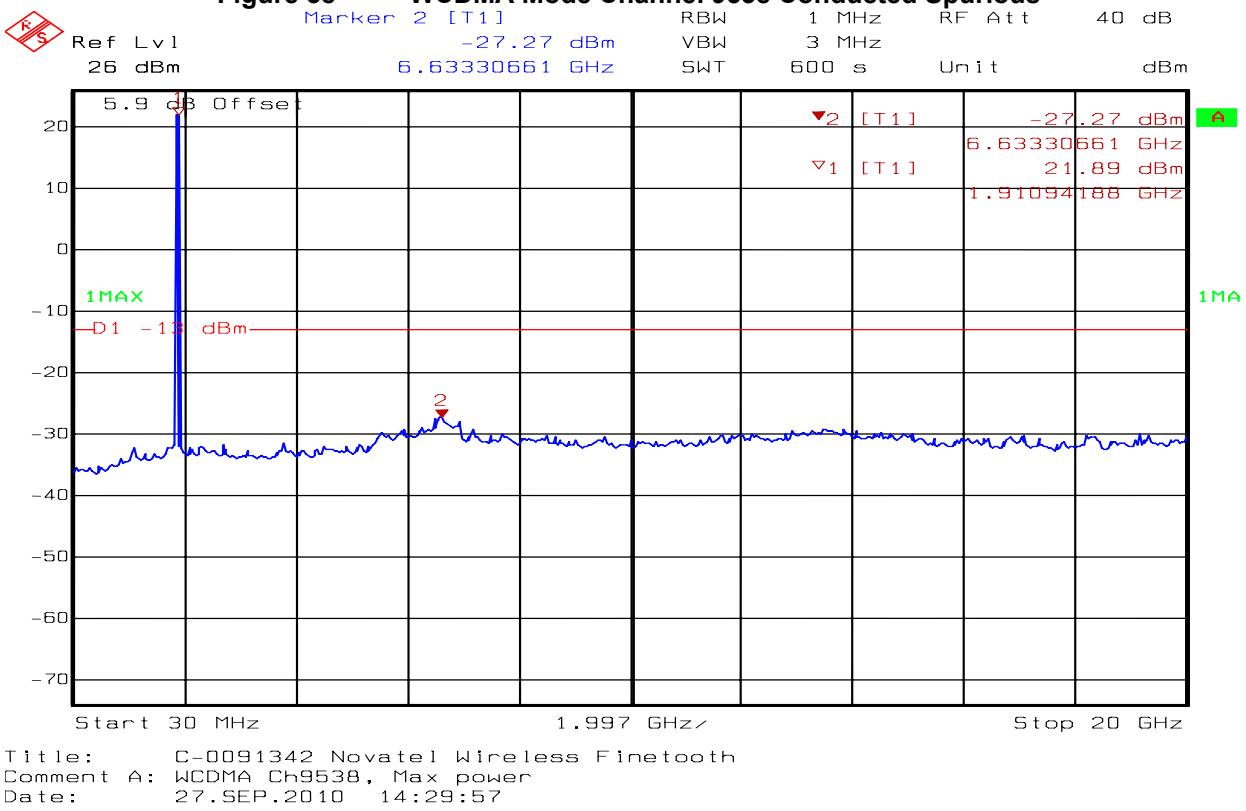

Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS GPRS CS-4, Ch810, Max power
Date: 28.SEP.2010 8:43:22

**Figure 37 PCS EDGE Mode Channel 810 Conducted Spurious**




Title: C-0091342 Novatel Wireless Finetooth
Comment A: PCS EDGE 8PSK, Ch810, Max power
Date: 28.SEP.2010 8:29:38

**Figure 38 WCDMA Mode Channel 9538 Conducted Spurious**



# APPENDIX G: TX / RX RADIATED SPURIOUS EMISSIONS 30 MHZ – 20 GHZ

## G.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | Cell Mode: FCC Part 22.917<br>PCS Mode: FCC Part 24.238, RSS 129/133<br>(RSS GEN for Receiver Spurious emissions) |
| **Test Basis** | FCC 2.1053 |
| **Test Method** | ANSI/TIA/EIA-603-C-2004 |

## G.2. Specifications

**TX Spurious emissions**

**Cell Mode:**

**FCC 22.917 Emission limitations for cellular equipment**

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

**PCS Mode:**

**FCC 24.238 Emission limitations for Broadband PCS equipment.**

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power

**FCC 2.1053 Measurements required: Field strength of spurious radiation**.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

**RSS 129 / RSS 133 Test Method (Transmitter Spurious Emissions)**

TIA 603-C-2004, using signal substitution. The spurious signal is maximized for worst case emission level and the maximum field strength is recorded. The EUT is replaced with a ½ wave dipole tuned to the frequency of interest driven by a signal source. The signal generator level is adjusted until the field strength level is equal to the field strength measured from the EUT. The signal generator level is recorded and corrected for cable losses and antenna gain to arrive at the final ERP/EIRP value. For all radiated measurements the peak power was reported using the following instrument settings:

**SA Settings:**

RBW: 1 MHz
VBW: 3 MHz
Detector: Peak

**RSS Gen Receiver Spurious Emissions Test Method:**

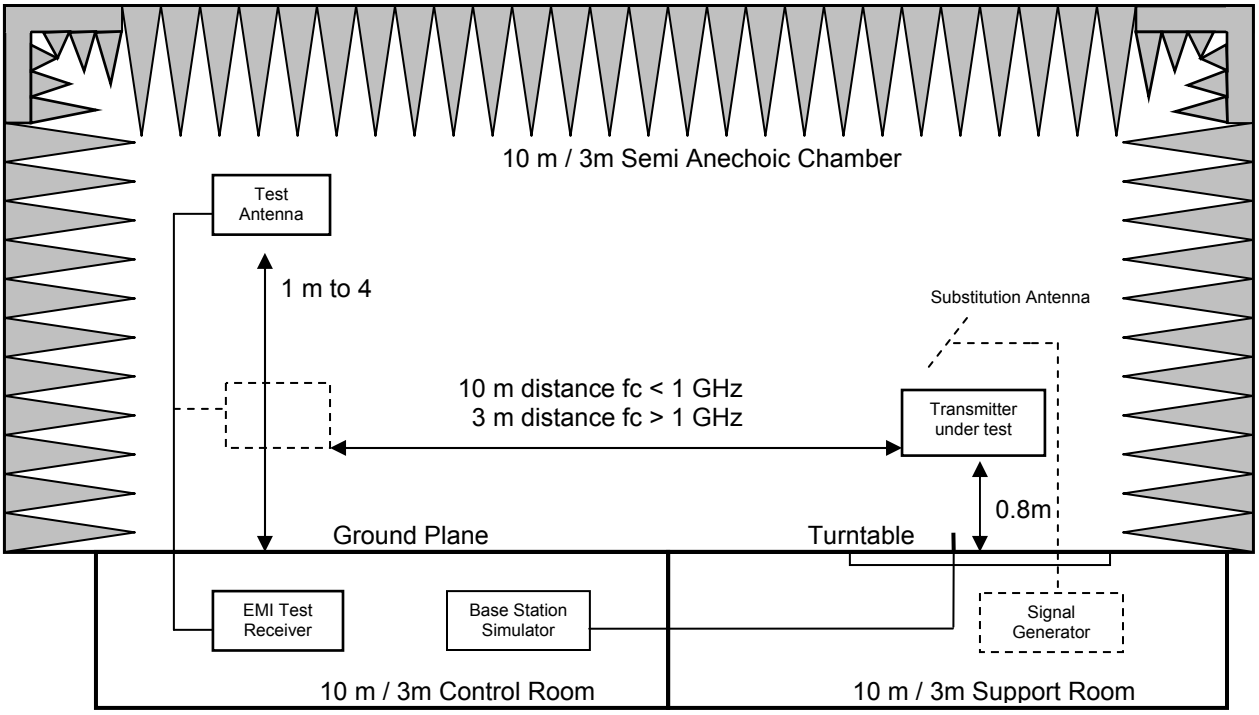
ANSI/TIA/EIA-603-C-2004 (2.1.1) Radiated spurious emissions
RSS Gen; The following receiver spurious emission limits shall be complied with:
If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

**Table 1 - Spurious Emission Limits for Receivers**

| Spurious Frequency (MHz) | Field Strength (microvolt/m at 3 metres) |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above 960 | 500 |

If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

## G.3. Test Setup Diagram




## G.4. Operating Mode During Test

The EUT was tested to determine worst case operating modes to produce maximum peak spurious emissions for the different modulation types. The following modes and associated configurations produced the highest power levels and spurious levels. The worst case results are reported in tables

CELL 850 GPRS – 1up 1down, Ms Tx level burst 5 to 0
CELL 850 EDGE – 1up 1down, Ms Tx level burst 8 to 0
PCS GPRS - 1up 1down, Ms Tx level burst 0
PCS EDGE - 1up 1down, Ms Tx level burst 2 to 0
PCS WCDMA – All up bits, 12.2 kbps RMC
For Receiver spurious emissions the EUT was operated in all receive modes

## G.5. Test Results

No Transmitter spurious emissions were detected within 20 dB of the limit in any operating mode or band.
For Receiver spurious emissions the EUT was scanned and no emissions were detected.
Detected emissions in transmit mode are reported below.

### G.5.1 850 MHz CELL GPRS Mode

| Channel | Frequency (MHz) | Polarization | Measured level (dBuV/m) | Substitution Signal Generator level (dBm) | *Substitution Antenna gain (dBd) | Cable loss (dB) | erp Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 128 | 1648.55 | V | 50.39 | -51.90 | 6.26 | 1.23 | -46.87 | -13 | 33.87 |
| | 2472.59 | H | 47.81 | -55.20 | 7.26 | 1.55 | -49.49 | -13 | 36.49 |
| | 2472.77 | V | 52.67 | -50.30 | 7.26 | 1.55 | -44.59 | -13 | 31.59 |
| 190 | 1673.06 | V | 46.79 | -55.60 | 6.30 | 1.24 | -50.54 | -13 | 37.54 |
| | 1673.34 | H | 44.01 | -58.30 | 6.30 | 1.24 | -53.24 | -13 | 40.24 |
| | 2509.59 | H | 50.87 | -52.20 | 7.30 | 1.57 | -46.47 | -13 | 33.47 |
| | 2509.97 | V | 58.77 | -44.60 | 7.30 | 1.57 | -38.87 | -13 | 25.87 |
| 251 | 1697.73 | H | 49.09 | -53.40 | 6.33 | 1.25 | -48.32 | -13 | 35.32 |
| | 1697.72 | V | 49.89 | -52.60 | 6.33 | 1.25 | -47.52 | -13 | 34.52 |
| | 2547.09 | H | 50.43 | -52.80 | 7.33 | 1.58 | -47.05 | -13 | 34.05 |
| | 2546.61 | V | 54.73 | -48.70 | 7.33 | 1.58 | -42.95 | -13 | 29.95 |

### G.5.2 850 MHz CELL EDGE Mode

| Channel | Frequency (MHz) | Polarization | Measured level (dBuV/m) | Substitution Signal Generator level (dBm) | *Substitution Antenna gain (dBd) | Cable loss (dB) | erp Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 128 | 1648.78 | H | 50.51 | -52.60 | 6.26 | 1.23 | -47.57 | -13 | 34.57 |
| | 2472.68 | H | 43.10 | -59.70 | 7.26 | 1.55 | -53.99 | -13 | 40.99 |
| | 1648.96 | V | 47.56 | -54.70 | 6.26 | 1.23 | -49.67 | -13 | 36.67 |
| | 2472.89 | V | 53.47 | -49.40 | 7.26 | 1.55 | -43.69 | -13 | 30.69 |
| 190 | 1673.34 | H | 50.13 | -53.00 | 6.30 | 1.24 | -47.94 | -13 | 34.94 |
| | 1673.40 | V | 51.28 | -51.10 | 6.30 | 1.24 | -46.04 | -13 | 33.04 |
| | 2510.24 | H | 50.73 | -52.10 | 7.30 | 1.57 | -46.37 | -13 | 33.37 |
| | 2509.81 | V | 62.75 | -40.40 | 7.30 | 1.57 | -34.67 | -13 | 21.67 |
| 251 | 1697.74 | H | 50.94 | -51.60 | 6.33 | 1.25 | -46.52 | -13 | 33.52 |
| | 1697.48 | V | 53.44 | -49.10 | 6.33 | 1.25 | -44.02 | -13 | 31.02 |
| | 2546.87 | H | 50.86 | -52.40 | 7.33 | 1.58 | -46.65 | -13 | 33.65 |
| | 2546.65 | V | 51.78 | -51.70 | 7.33 | 1.58 | -45.95 | -13 | 32.95 |

### G.5.3 PCS Band - GPRS Mode

| Channel | Frequency (MHz) | Polarization | Measured level (dBuV/m) | Substitution Signal Generator level (dBm) | *Substitution Antenna gain (dBd) | Cable loss (dB) | erp Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 512 | 3700.00 | H | 57.67 | -46.00 | 7.77 | 2.00 | -40.23 | -13 | 27.23 |
| | 3700.40 | V | 57.17 | -47.00 | 7.77 | 2.00 | -41.23 | -13 | 28.23 |
| | 5551.00 | H | 51.30 | -53.40 | 9.12 | 2.50 | -46.78 | -13 | 33.78 |
| | 5550.60 | V | 54.61 | -50.00 | 9.12 | 2.50 | -43.38 | -13 | 30.38 |
| | 7400.10 | V | 56.57 | -48.00 | 9.41 | 2.87 | -41.46 | -13 | 28.46 |
| 661 | 3760.00 | H | 58.10 | -45.60 | 7.77 | 2.02 | -39.85 | -13 | 26.85 |
| | 3759.45 | V | 59.23 | -44.80 | 7.77 | 2.02 | -39.05 | -13 | 26.05 |
| | 5640.00 | H | 52.92 | -51.80 | 9.16 | 2.52 | -45.16 | -13 | 32.16 |
| | 5640.00 | V | 56.69 | -48.00 | 9.16 | 2.52 | -41.36 | -13 | 28.36 |
| 810 | 3820.00 | H | 55.52 | -48.00 | 7.77 | 2.04 | -42.27 | -13 | 29.27 |
| | 3819.20 | V | 56.45 | -47.70 | 7.77 | 2.04 | -41.97 | -13 | 28.97 |
| | 5730.00 | H | 51.65 | -53.10 | 9.19 | 2.54 | -46.45 | -13 | 33.45 |
| | 5729.40 | V | 55.64 | -49.00 | 9.19 | 2.54 | -42.35 | -13 | 29.35 |
| | 7640.00 | V | 52.67 | -51.80 | 9.30 | 2.92 | -45.42 | -13 | 32.42 |
| | 9549.00 | V | 50.27 | -53.80 | 9.69 | 3.25 | -47.36 | -13 | 34.36 |

### E.5.4 PCS Band – EDGE Mode

| Channel | Frequency (MHz) | Polarization | Measured level (dBuV/m) | Substitution Signal Generator level (dBm) | *Substitution Antenna gain (dBi) | Cable loss (dB) | erp Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 512 | 3699.97 | H | 59.84 | -44.00 | 7.77 | 2.00 | -38.23 | -13 | 25.23 |
| | 3700.42 | V | 54.49 | -50.30 | 7.77 | 2.00 | -44.53 | -13 | 31.53 |
| | 5555.11 | V | 50.80 | -54.10 | 9.12 | 2.50 | -47.48 | -13 | 34.48 |
| | 7400.85 | V | 48.10 | -56.00 | 9.41 | 2.87 | -49.46 | -13 | 36.46 |
| 661 | 3759.84 | H | 56.95 | -46.70 | 7.77 | 2.02 | -40.95 | -13 | 27.95 |
| | 3759.45 | V | 54.59 | -50.00 | 7.77 | 2.02 | -44.25 | -13 | 31.25 |
| | 5639.78 | V | 52.34 | -52.60 | 9.16 | 2.52 | -45.96 | -13 | 32.96 |
| | 9401.23 | V | 49.76 | -54.20 | 9.58 | 3.21 | -47.83 | -13 | 34.83 |
| 810 | 3817.63 | H | 55.03 | -49.40 | 7.77 | 2.04 | -43.67 | -13 | 30.67 |
| | 3817.64 | V | 52.86 | -50.70 | 7.77 | 2.04 | -44.97 | -13 | 31.97 |
| | 5728.89 | V | 52.08 | -52.60 | 9.19 | 2.54 | -45.95 | -13 | 32.95 |
| | 7640.25 | V | 49.50 | -54.50 | 9.30 | 2.92 | -48.12 | -13 | 35.12 |
| | 9549.45 | V | 49.10 | -55.00 | 9.69 | 3.25 | -48.56 | -13 | 35.56 |

### E.5.5 PCS Band WCDMA Mode Band II

| Channel | Frequency (MHz) | Polarization | Measured level (dBuV/m) | Substitution Signal Generator level (dBm) | *Substitution Antenna gain (dBd) | Cable loss (dB) | erp Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 9262 | 3706.74 | H | 43.08 | -60.70 | 7.77 | 2.00 | -54.93 | -13 | 41.93 |
| | 3706.66 | V | 42.43 | -61.40 | 7.77 | 2.00 | -55.63 | -13 | 42.63 |
| | 7410.00 | V | 48.44 | -55.70 | 9.41 | 2.87 | -49.16 | -13 | 36.16 |
| 9400 | 3757.90 | H | 45.03 | -58.60 | 7.77 | 2.02 | -52.85 | -13 | 39.85 |
| | 3757.74 | V | 43.90 | -60.70 | 7.77 | 2.02 | -54.95 | -13 | 41.95 |
| | 13160.00 | V | 53.27 | -52.00 | 10.52 | 3.91 | -45.39 | -13 | 32.39 |
| | 13160.00 | H | 52.99 | -52.30 | 10.52 | 3.91 | -45.69 | -13 | 32.69 |
| 9538 | 3817.14 | H | 43.68 | -60.70 | 7.77 | 2.04 | -54.97 | -13 | 41.97 |
| | 3817.18 | V | 44.09 | -60.40 | 7.77 | 2.04 | -54.67 | -13 | 41.67 |

***** Substitution Antenna gain (dBd) = Substitution Antenna gain (dBi) – Dipole Antenna gain (dBi)

### G.6. Tested By

| | | |
|---|---|---|
| Name: | Deniz Demirci | Lixin Wang |
| Function: | Senior Wireless/EMC Technologist | EMC Technologist |

### G.7. Test dates

**Started:** September 15, 2010 **Completed:** October 01, 2010

## APPENDIX H: MEASUREMENT EQUIPMENT LIST

| Manufacturer | Type/Model | | Asset # | Cal Due | Cal Date |
|---|---|---|---|---|---|
| Bilog Antenna | Teseq | CBL 6112D | CG1177 | 14SEP12 | 06OCT09 |
| Horn Antenna (Rx)<br>1 GHz – 18 GHz | EMCO | 3115 | CG0368 | 08SEP11 | 08SEP09 |
| Standard Gain Horn (Rx)<br>18 GHz – 26.5 GHz | EMCO | 3160-09 | CG0075 | N/A (1) | 27NOV01 |
| Dipole Antenna Set<br>(Substitution) | EMCO | 3121 | CG0104 | 12MAR11 | 12MAR10 |
| Horn Antenna<br>(Substitution) | EMCO | 3115 | CG0103 | 06MAR11 | 30SEP08 |
| Standard Gain Horn<br>(Substitution) | EMCO | 3160-09 | CG0076 | N/A (1) | 27NOV01 |
| LNA<br>1 GHz < f < 18 GHz | Miteq | JSD00121 | CG0761 | 29MAR12 | 29MAR10 |
| LNA<br>18GHz < f < 26.5GHz | Miteq | JSD00119 | CG0482 | 02OCT11 | 02OCT09 |
| High pass filter<br>f > 1000 MHz | MicroTronics | HPM14576 | CG0963 | 29MAR12 | 29MAR10 |
| High pass filter<br>f > 2800 MHz | MicroTronics | HPM50111 | CG0964 | N/A | N/A |
| Spectrum Analyzer<br>9 kHz – 40 GHz | Rohde & Schwarz | FSEK-20 | CG0118 | 13SEP11 | 13SEP10 |
| Spectrum Analyzer<br>3 Hz – 44 GHz | Agilent | E4446A | CG-R-1292 | 09SEP12 | 09SEP10 |
| Test Receiver | Rohde & Schwarz | ESMI | CG0433 | 04MAY11 | 04MAY09 |
| Signal Generator | R & S | SMP-04 | CG0435 | 22DEC10 | 22DEC08 |
| Wireless Communication Test Set | Agilent | 8960 | CG-R-1254 | 12OCT11 | 12OCT10 |
| Environmental Simulation Chamber | Thermotron | SM-8C | CG0001 | 23FEB11 | 23FEB10 |
| Data Acquisition unit | Agilent | 34970A | CG0934 | 07JAN11 | 07JAN10 |
| 20 Channel Multiplexer | Agilent | 34901A | CG0006 | 07JAN11 | 07JAN10 |
| Voltmeter | Fluke | 87 | CG0384 | 09NOV10 | 09NOV09 |
| DC Power Source | HP | 6675A | CG1362 | N/A | N/A |
| HPIB Extender | HP | 37204 | CG0181 | N/A | N/A |
| Mast Controller | EMCO | 2090 | CG0179 | N/A | N/A |
| Turntable Controller | EMCO | 2090 | CG0178 | N/A | N/A |

(1): As per manufacturer recommend, this item does not require periodic calibration. Its electromagnetic performance is almost exclusively depended on the physical dimension of the horn. A thorough mechanical check is all that is needed to guarantee the antenna performance.

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