



**MOTOROLA**

**PERSONAL COMMUNICATIONS SECTOR**

**PRODUCT SAFETY AND COMPLIANCE  
EMC LABORATORY**

**EMC TEST REPORT**

**Test Report Number** – 9564-1

**Report Date** – March 7, 2003

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

As the responsible EMC Engineer, I hereby declare that the equipment tested as specified in this report conforms to the requirements indicated.

Signature 

Name: Mark Kien

Title: Electrical Engineer

Date : 03/07/03

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THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY A2LA OR ANY AGENCY OF THE U.S. GOVERNMENT.

A2LA Certificate Number: 1846-01



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**Test Report Details**

Field Strength

Tests Performed By:

Underwriters Laboratory Inc.  
333 Pfingsten Road  
Northbrook, IL 60062-2096  
PH (847) 272-8800 Fax (847) 272-8129  
FCC Registration Number: 91044  
Industry Canada Number: IC2180

All Other Tests Performed By:

Motorola Personal Communications Sector  
Product Safety and Compliance Group  
600 North US Hwy 45  
Libertyville, IL 60048  
PH (847) 523-3642 Fax (847) 523-8274  
FCC Registration Number: 100000  
Industry Canada Number: IC3908

Tests Requested By:

Motorola Inc.  
Personal Communications Sector  
600 North US Hwy 45  
Libertyville, IL 60048

Product Type:

Cellular Phone

Signaling Capability:

Analog, CDMA 800

Model Number:

C210

Serial Numbers:

2441927725, 2441927726, 2441927727  
2441927728

Received Date:

2/18/2003

Testing Start Date:

2/18/2003

Testing Complete Date:

3/6/2003

## **Applicable Standards**

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

- Part 15 Subpart B – Unintentional Radiators
- Part 22 Subpart H - Public Mobile Services
- Part 24 - Personal Communications Services
- Part 90 - Private Land Mobile Radio Service

Applicable Standards: TIA EIA 98-C, ANSI 63.4 2000, RSS-118, RSS-129, RSS-133

**Summary of Testing**

Test #	Test Name	Pass/Fail
1	RF Power Output	NA
2	ERP (Effective Radiated Power)	NA
3	Modulation Characteristics	Pass
4	Occupied Bandwidth	Pass
5	Spurious Emissions at Antenna Terminal	Pass
6	Field Strength of Spurious Emissions	Pass
7	Frequency Stability	Pass

Test #	Test Name	Margin with respect to the Limit
1	RF Power Output	NA
2	ERP (Effective Radiated Power)	NA
3	Modulation Characteristics	NA
4	Occupied Bandwidth	See Plots
5	Spurious Emissions at Antenna Terminal	4.1 dB
6	Field Strength of Spurious Emissions	33.6 dB
7	Frequency Stability	129 Hz

The margin with respect to the limit is the minimum margin for all modes and bands. ( ) indicates the margin at which the product exceeds the limit.

**General and Special Conditions**

The EUT was tested using a fully charged battery when applicable. Where a battery could not be used due to the need for a controlled variation of input voltage, an external power supply was utilized.

All testing was done in an indoor controlled environment with an average temperature of 22° C and relative humidity of 50%.

**Equipment and Cable Configurations**

The EUT was tested in a stand-alone configuration that is representative of typical use.

**Measuring Equipment and Calibration Information**

<b>Manufacturer Name</b>	<b>Item Name Description</b>	<b>Model #</b>	<b>Serial Number</b>	<b>Calibration Due Date</b>
Agilent	EMC Analyzer	E7405A	US40240219	3/27/2003
Hewlett Packard	QP Adapter	85650A	2811A01069	1/15/2004
Hewlett Packard	S/A Display	8566B	2542A12974	1/15/2004
Hewlett Packard	S/A	8566B	2637A03376	1/15/2004
Hewlett Packard	RF Preselector	85685A	2810A00692	1/15/2004
Rohde & Schwarz	S/A	FSEK20	DE2525315	1/14/2004
EMCO	Horn Antenna 1-18GHz	3115	8812-3032	3/23/2003
EMCO	Horn Antenna 1-18GHz	3115	2638	3/23/2003
Chase	Bi-Con Antenna 30-300MHz	VBA6106A	1246	6/18/2003
Chase	Log-Periodic Antenna	UPA6108	1120	6/20/2003
Weinschel	Attenuator Kit – 10, 6 dB	2	AS6-6675	10/11/2003
Thermotron	Environmental Chamber	F32-CHMV-15-15-2	18389	11/1/2003
Hewlett Packard	CDMA Mobile Test Set	8924C	US37392461	7/24/2003
Hewlett Packard	System DC Power Supply	6632A	3326A07674	5/29/2003
Hewlett Packard	PCS Interface	83236B	3711J03010	8/16/2004
Agilent	Wireless Communication Test Set	8960 Series 10	GB42360906	9/10/2003
Hewlett Packard	Modulation Analyzer	8901B	2441A00395	5/17/2003
Giga-tronics	Universal Power Meter	8652A	8650494	1/7/2004
Giga-tronics	Power Sensor	80701A	1833992	12/12/2003
Giga-tronics	Universal Power Meter	8652A	1836216	5/10/2003
Giga-tronics	Power Sensor	80601A	1832030	5/23/2003

**Measurement Procedures and Data**

**RF POWER OUTPUT**

**Measurement Procedure**

The RF output port of the equipment under test is directly coupled to the input of the 8650 series Gigatronics power meter through a specialized RF connector. The power meter is set for Modulated Average Power (MAP) mode. The power output is measured for all channels.

CFR Part 2.1046

**Measurement Results**

\* Data supplied by SAR Lab

**ANALOG**

Frequency (MHz)	Power (dBm)
824.04	26.95
836.52	26.73
848.97	27.01

**CDMA 800**

Frequency (MHz)	Power (dBm)
824.64	25.10
837.30	25.09
848.37	24.91

## **RADIATED (ERP)**

### **Measurement Procedure**

The phone was tested in a 16' cubical anechoic chamber with a 2-axis positioner system that permits taking complete spherical scans of the Equipment Under Test (EUT) radiation patterns. For all tests, the phone was supported in a free-space type environment, vertically oriented in the chamber. Tests were done for AMPS 800 frequency of (824.7, 836.52, and 848.37 MHz) and AMPS Analog frequency (824.04, 836.52, and 848.97 MHz) with a stubby antenna.

CDMA measurements were made with the phone placed in a call using the HP E8285A mobile station test set. The phone was weakly coupled to the test set and configured to transmit in full data rate mode. Radiated power was measured at every 15 degree step from theta=0 to 165 degrees and phi=0 to 360 degrees. The radiated power was measured using a Giga-tronics 8542C power meter in "Mod Avg" mode. From these measurements, the software calculates the angle at which maximum radiated power occurs for each case, and the radiated power at this angle was extracted from the data. The max radiated power results for the EUT follows, as EIRP in dBm. To get ERP (effective radiated power referenced to a half-wave dipole), subtract 2.1 dB from these numbers.

### **Measurement Results**

\* Data not supplied by EMC Lab

#### **AMPS 800 CDMA:**

824.04 MHz:	21.37dBm
836.52 MHz:	22.65 dBm
848.37 MHz:	21.74 dBm

#### **AMPS 800 Analog:**

824.04 MHz:	22.96 dBm
836.52 MHz:	22.90 dBm
848.97 MHz:	23.30 dBm

For all measurement, calibration was performed via gain substitution with a half-wave dipole.

Max EIRP in 800 CDMA mode is 22.65 dBm (max **ERP is 20.55 dBm**).  
 Max EIRP in 800 Analog mode is 23.30 dBm (max **ERP is 21.20 dBm**).

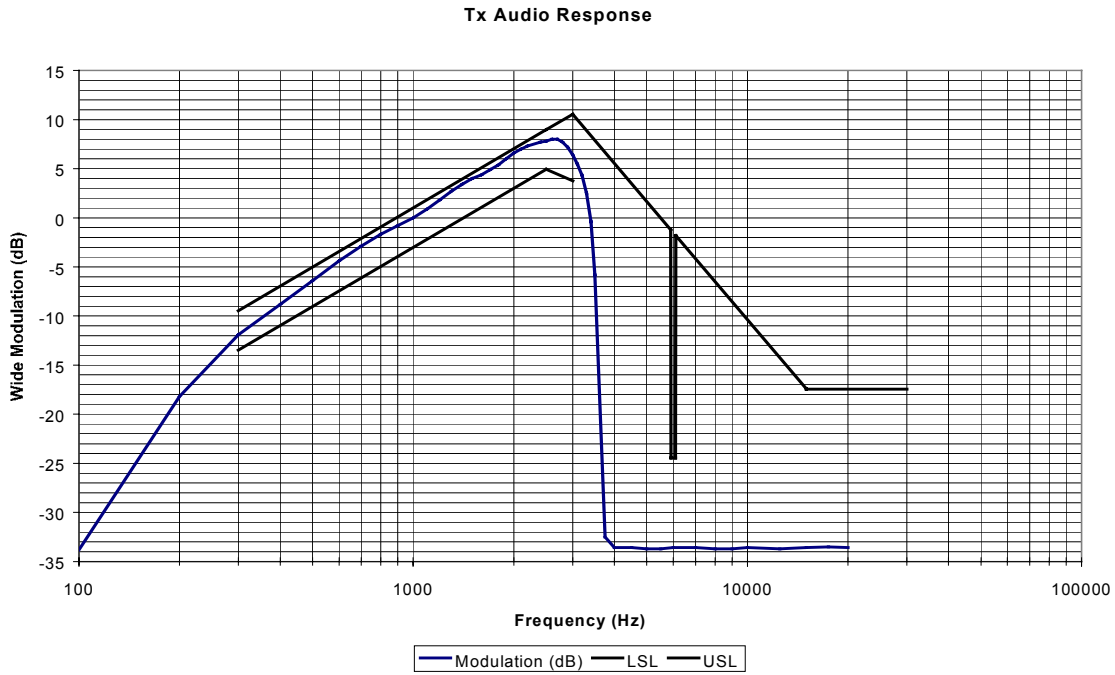
# MODULATION CHARACTERISTICS

CFR Part 2.1047, 22.915

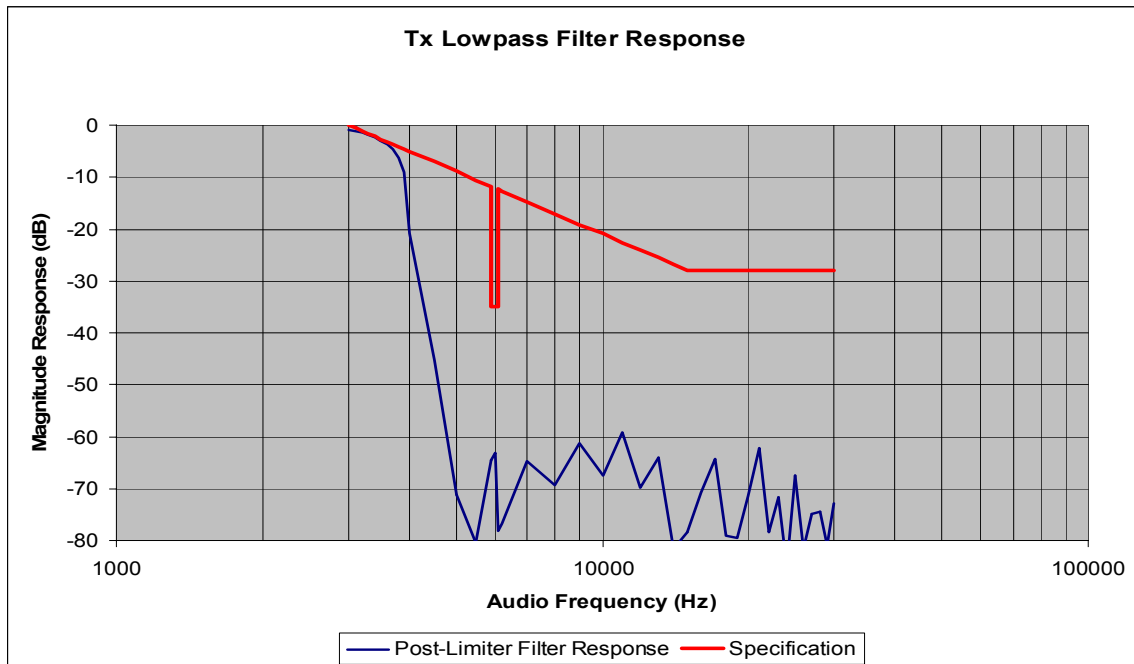
## Measurement Results -AMPS

\* Data supplied by product group

### Transmit Audio Frequency Response

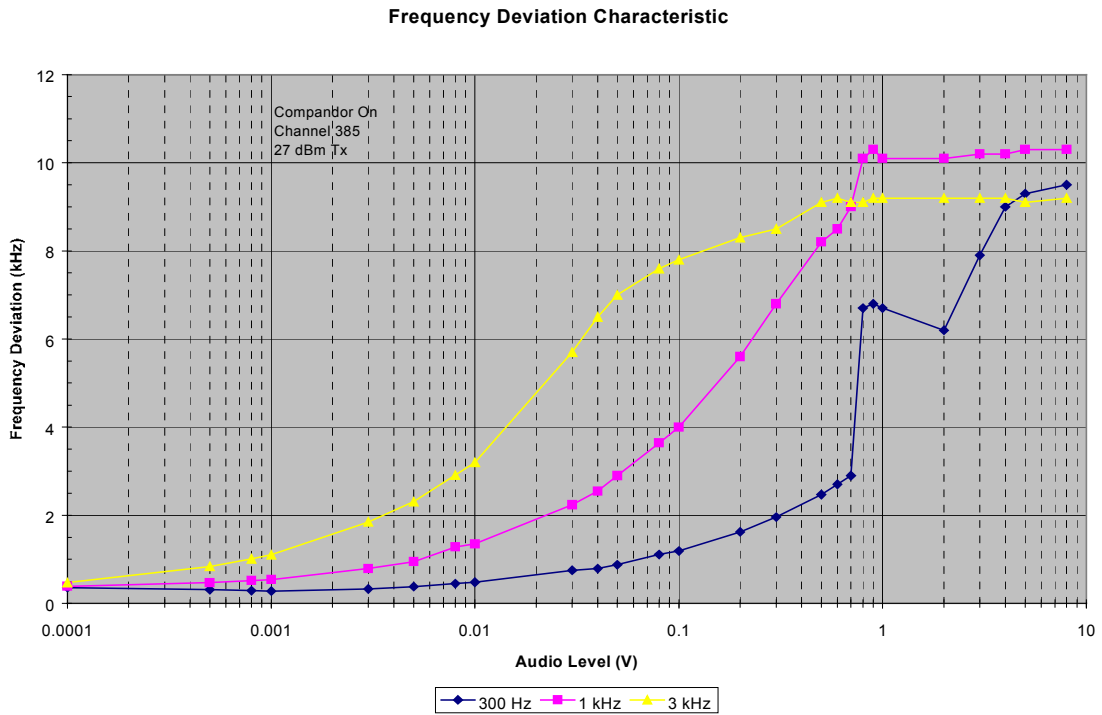


### Post Limiter Filter Attenuation

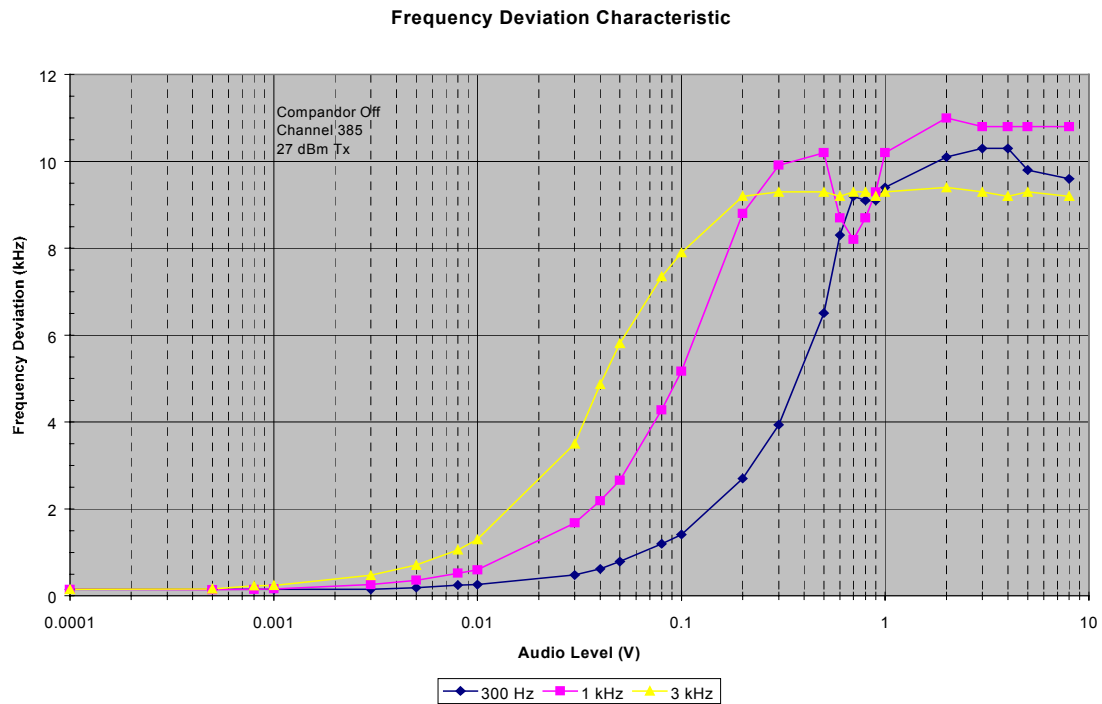


### Modulation Limiting vs. Modulation Input Voltage

#### Compandor On



#### Compandor Off



## **OCCUPIED BANDWIDTH**

CFR Part 2.1049, 22.917, 24.238

### **Measurement Procedure**

The RF output port of the equipment under test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. The amplitude of the spectrum analyzer is corrected for the attenuator and any other applicable losses. The analyzer is set for Peak Detector and each trace is set for Max Hold. A fully charged battery was used for the supply voltage.

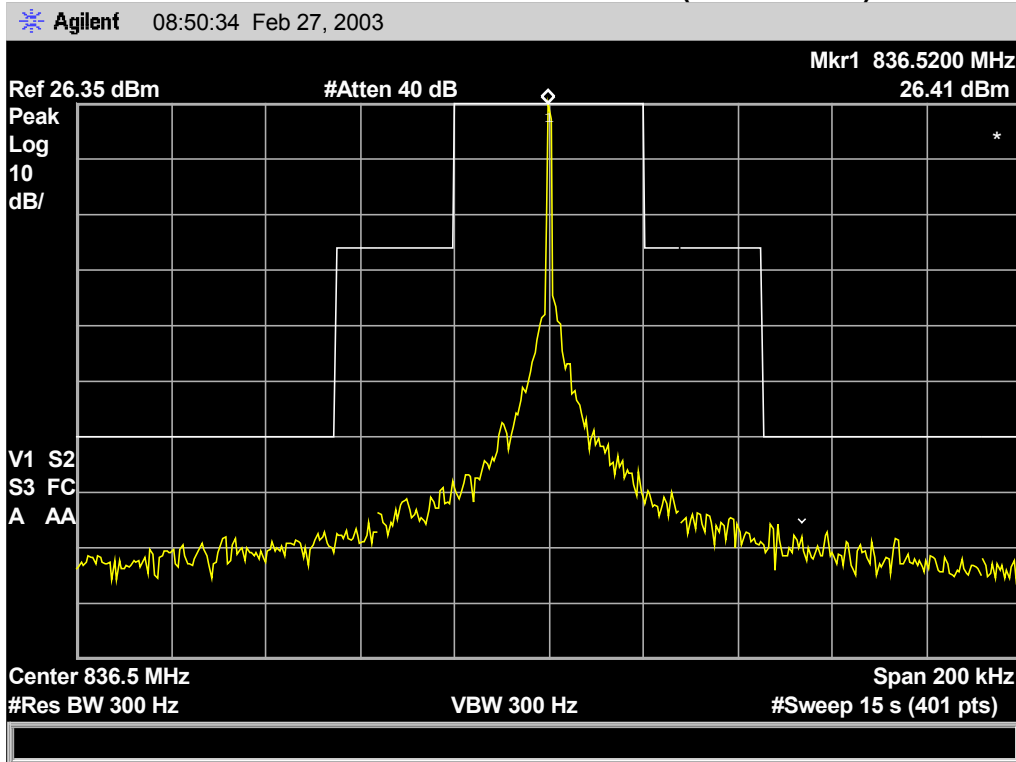
The middle channel within the designated frequency block was measured. For digital modulation, the lower and upper band edge plots are displayed.

### **Measurement Results**

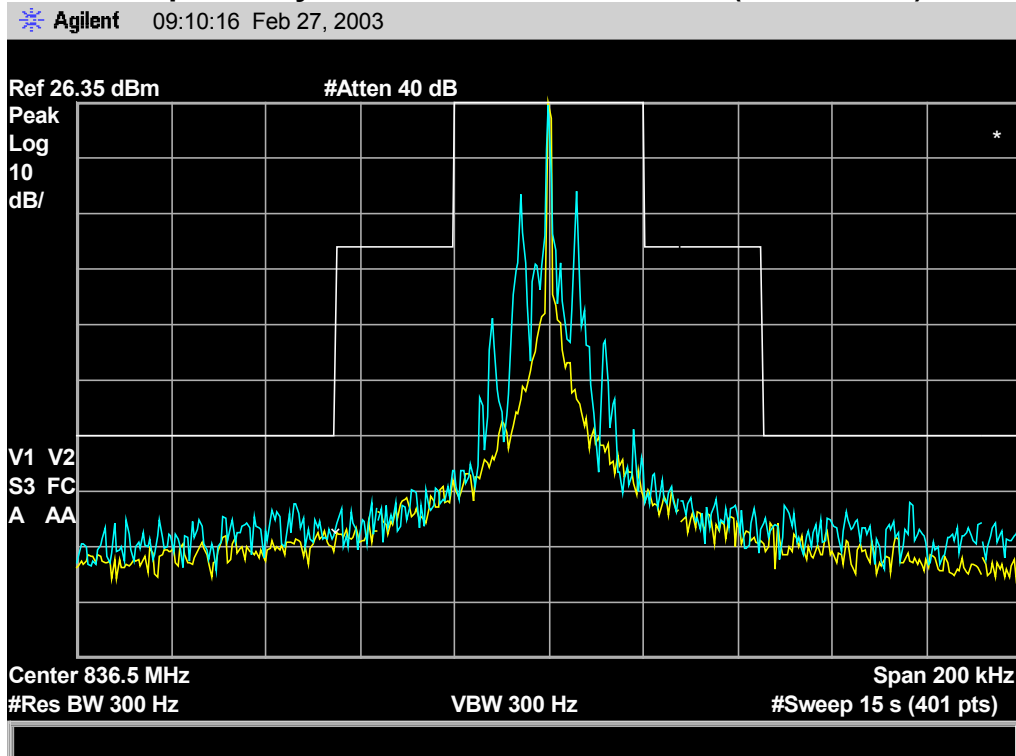
Attached

### Measurement Results – AMPS

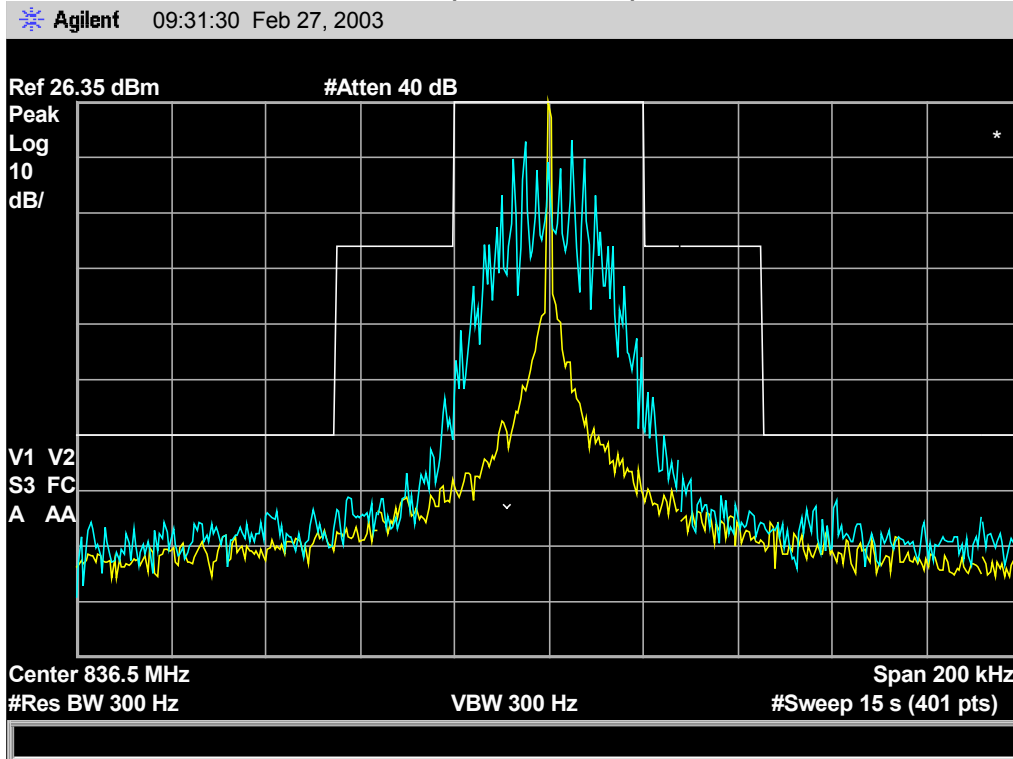
#### AMPS - Unmodulated Carrier – Channel 384 (836.52 MHz)



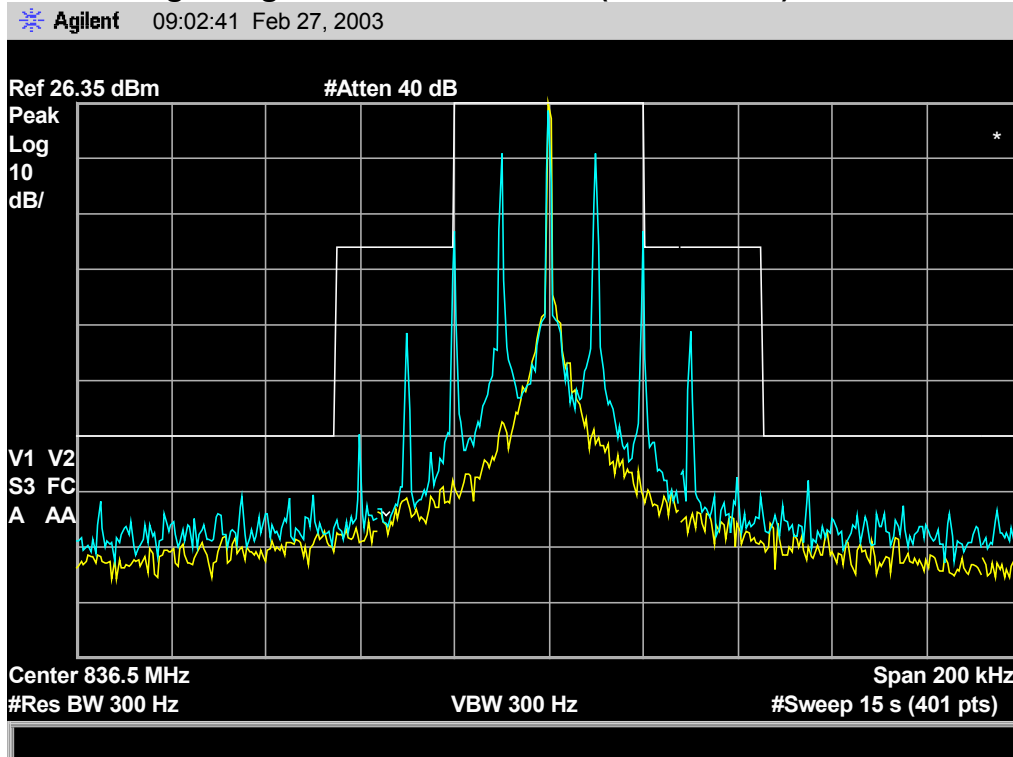
#### AMPS - Supervisory Audio Tone – Channel 384 (836.52 MHz)



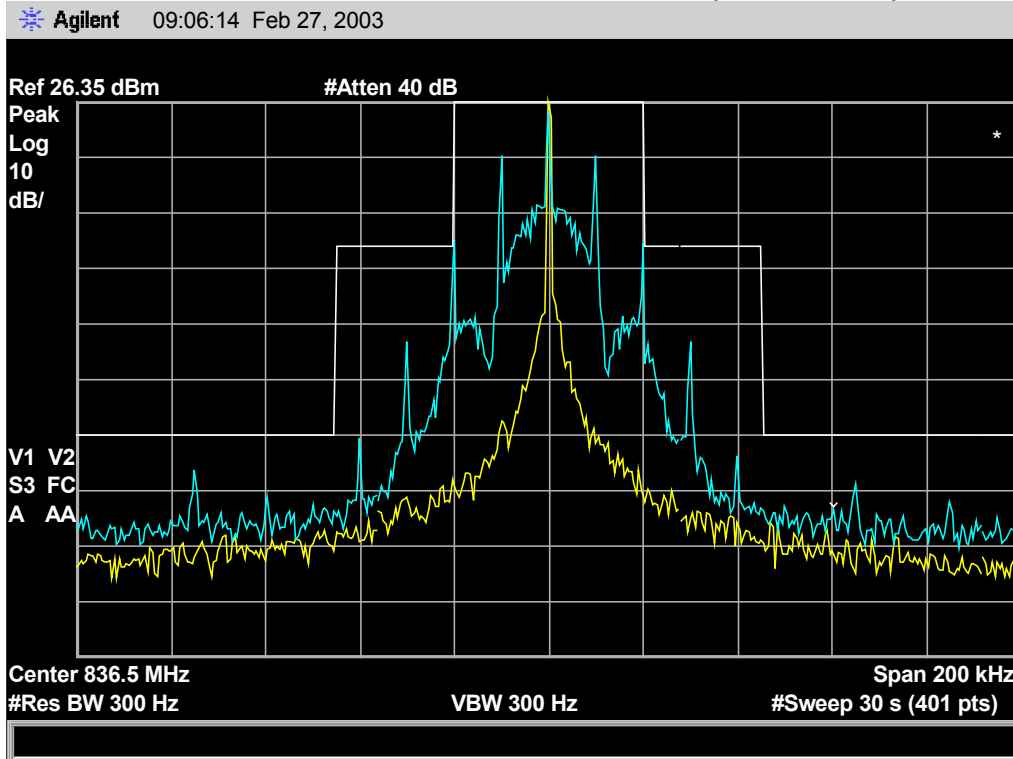
### AMPS - Voice – Channel 384 (836.52 MHz)



### AMPS – Signaling Tone – Channel 384 (836.52 MHz)

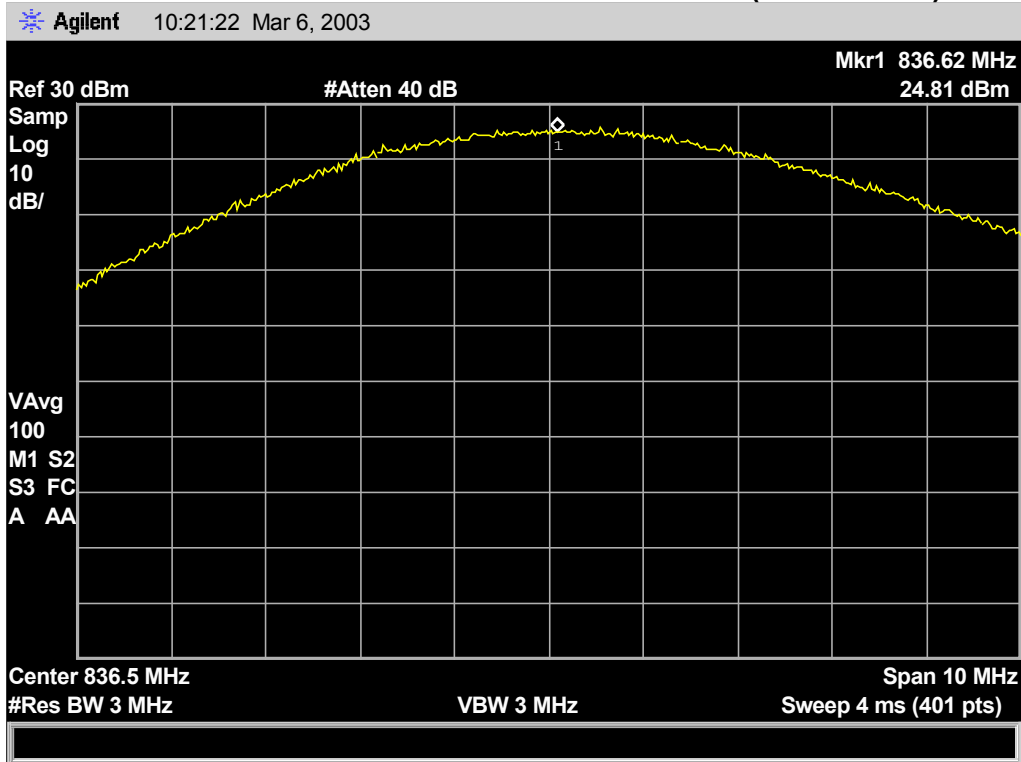


**AMPS – 10kb/s Wideband Data – Channel 384 (836.52 MHz)**

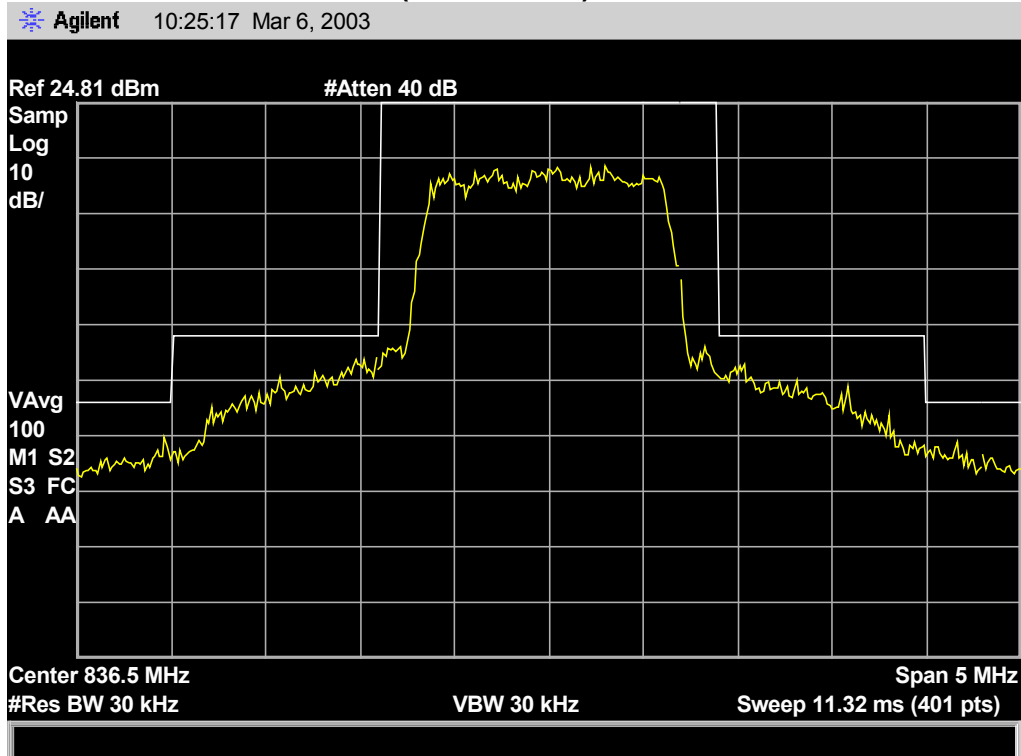


### Measurement Results – CDMA 800

#### CDMA 800 – Reference Level Plot – Channel 384 (836.52 MHz)



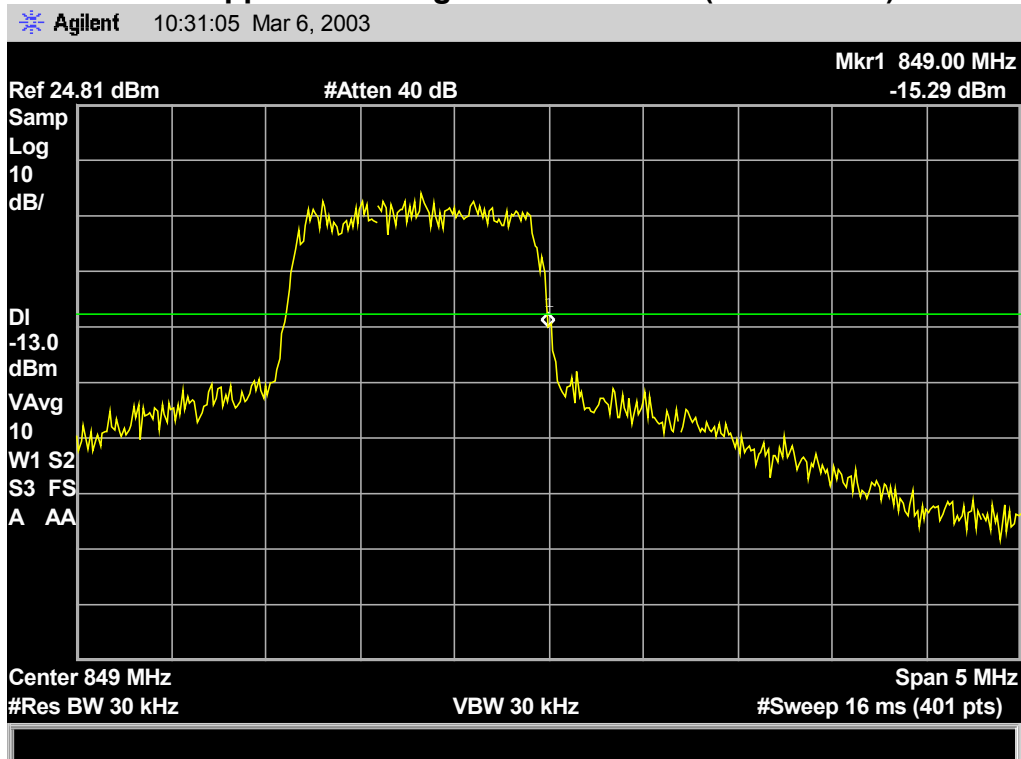
#### CDMA 800 – Channel 384 (836.52 MHz)



### CDMA 800 – Lower Band Edge – Channel 1013 (824.7 MHz)



### CDMA 800 – Upper Band Edge – Channel 777 (848.31 MHz)



## **SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

CFR Part 2.1051, 22.917, 24.238

### **Measurement Procedure**

The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

The spectrum was investigated from the lowest frequency signal generated, without going below 9 kHz, up to at least the tenth harmonic of the fundamental or 40 GHz, whichever is lower.

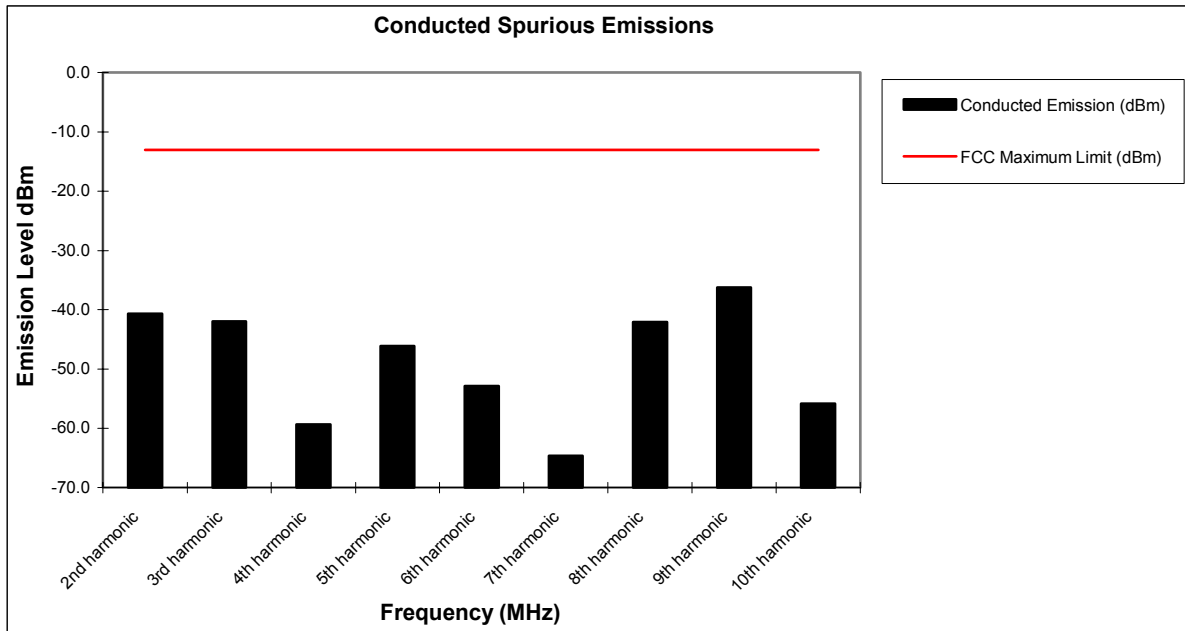
Measurements were made with the phone tuned to low, middle and high frequency within the valid mobile transmit frequency band. The worst case emissions of all three frequency configurations can be found below. Measurements for Spurious emission levels were also measured in the cellular base station frequency range (869-894 MHz).

### **Measurement Results**

Attached

**Measurement Results**  
**Modulation: AMPS**

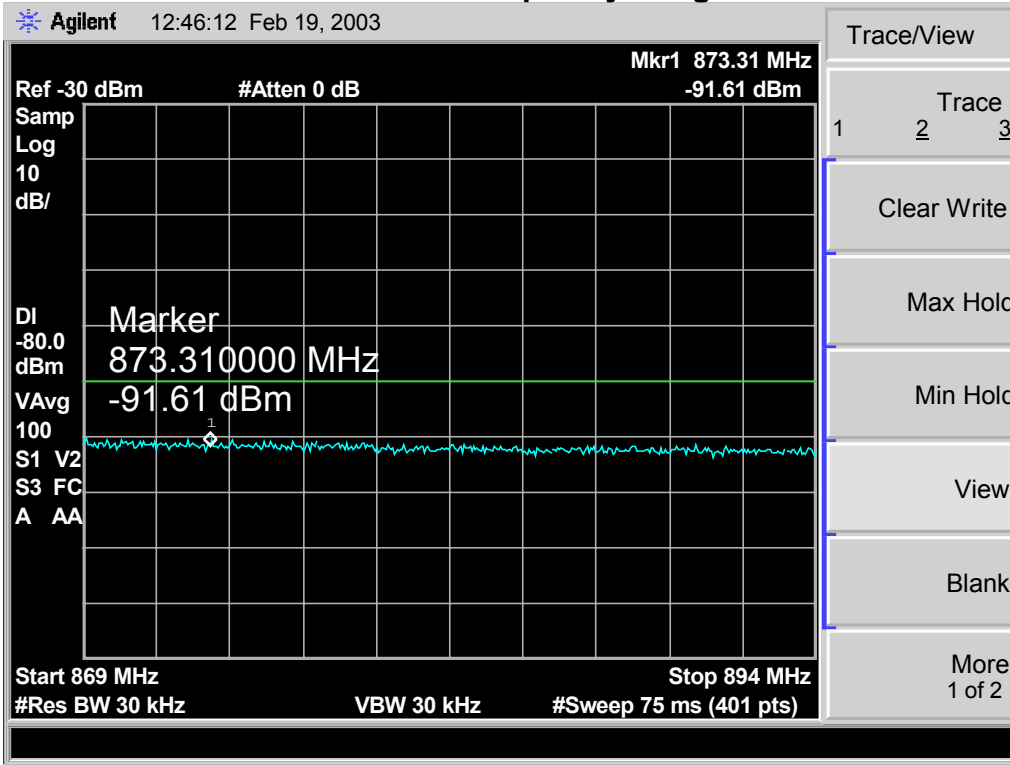
Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-40.7
3rd harmonic	-13	-42.0
4th harmonic	-13	-59.4
5th harmonic	-13	-46.1
6th harmonic	-13	-52.9
7th harmonic	-13	-64.7
8th harmonic	-13	-42.1
9th harmonic	-13	-36.2
10th harmonic	-13	-55.8



Notes:

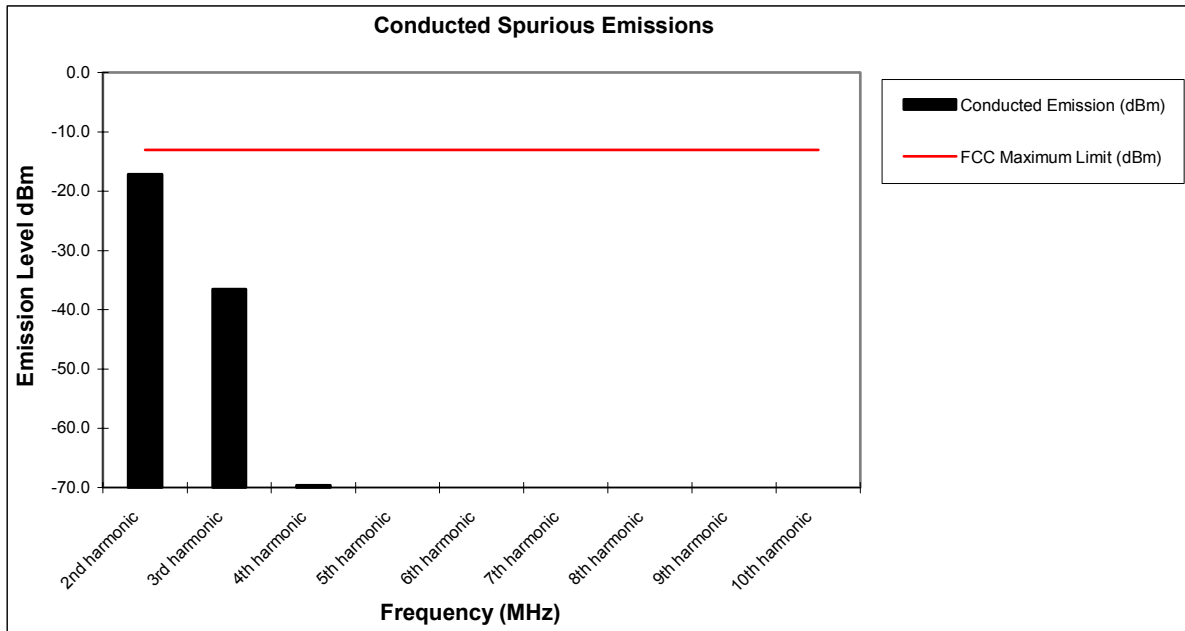
1. \* Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 9 kHz to the tenth harmonic of the fundamental.

### AMPS – Cellular Base Station Frequency Range



**Measurement Results**  
**Modulation: CDMA 800**

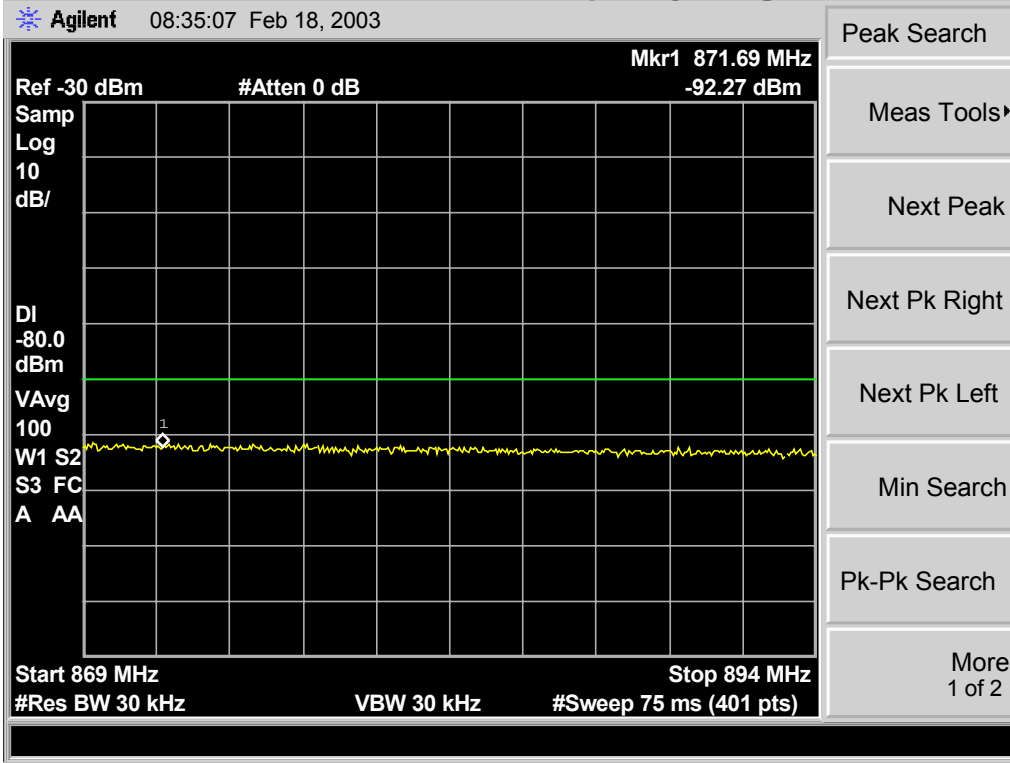
Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-17.1
3rd harmonic	-13	-36.5
4th harmonic	-13	-69.6
5th harmonic	-13	*
6th harmonic	-13	*
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



Notes:

1. \* Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 9 kHz to the tenth harmonic of the fundamental.

### CDMA 800 – Cellular Base Station Frequency Range



## FIELD STRENGTH OF SPURIOUS EMISSIONS

CFR Part 2.1053, 22.917, 24.238

### **Measurement Procedure**

The equipment under test is placed inside the semi-anechoic chamber on a wooden table at the turntable center. For each spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum reading on the spectrum analyzer. This is repeated for both horizontal and vertical polarizations of the receive antenna.

After all the spurious emissions were investigated and reported, the equipment under test is then replaced with a substitution antenna fed by a signal generator. With the signal generator tuned to a particular spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters to obtain a maximum reading at the spectrum analyzer. The output of the signal generator is then adjusted until a reading identical to that obtained with the actual transmitter is achieved.

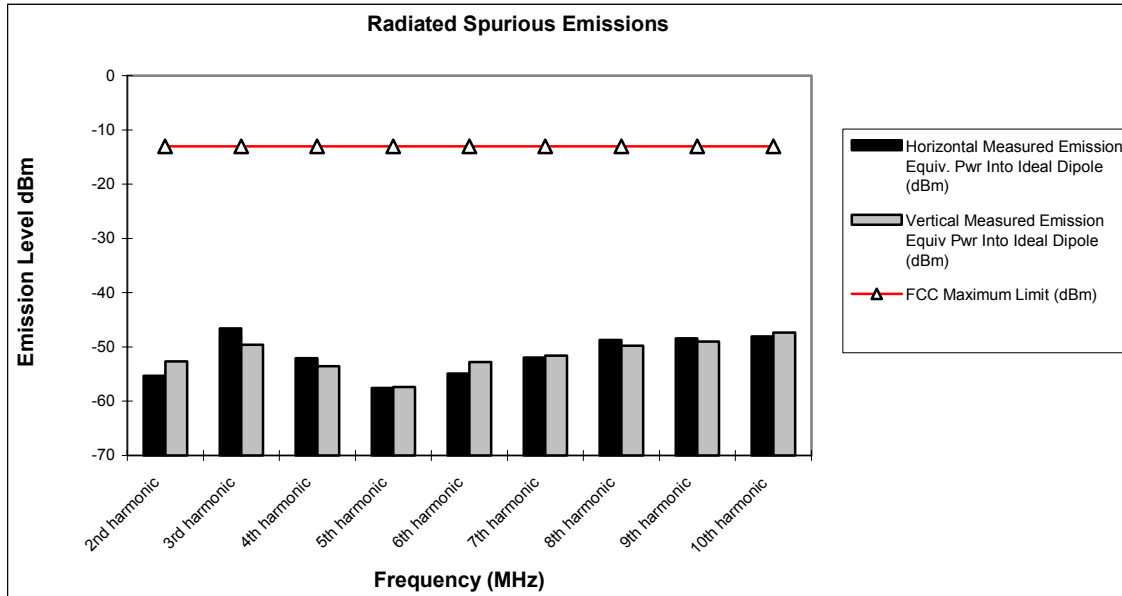
The power in dBm of each spurious emission is calculated by correcting the signal generator level for cable loss and gain of the substitution antenna referenced to a dipole. A fully charged battery was used for the supply voltage.

### **Measurement Results**

Attached

**Measurement Results**  
**Modulation: AMPS**

Frequency (MHz)	FCC Maximum Limit (dBm)	Horizontal Measured Emission Equiv. Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
2nd harmonic	-13	-55.3	-52.7
3rd harmonic	-13	-46.6	-49.6
4th harmonic	-13	-52.1	-53.6
5th harmonic	-13	-57.6	-57.4
6th harmonic	-13	-54.9	-52.8
7th harmonic	-13	-52.0	-51.6
8th harmonic	-13	-48.7	-49.8
9th harmonic	-13	-48.5	-49.0
10th harmonic	-13	-48.1	-47.4

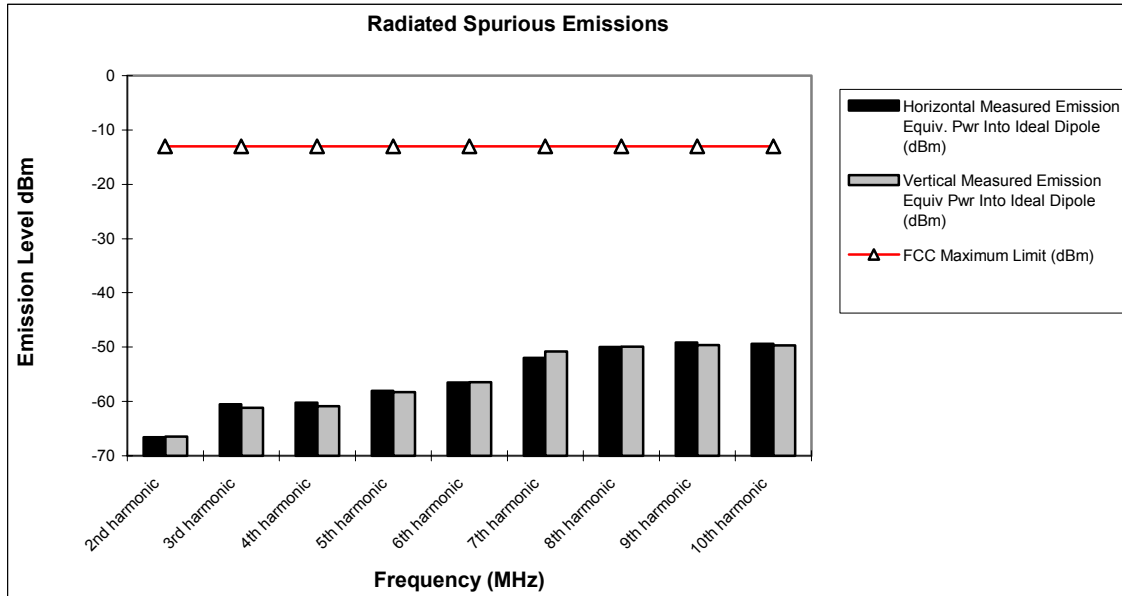


Notes:

1. \* Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, and high channels at maximum power.
3. The Spectrum was investigated from 30 MHz to the tenth harmonic of the fundamental.

**Measurement Results**  
**Modulation: CDMA 800**

Frequency (MHz)	FCC Maximum Limit (dBm)	Horizontal Measured Emission Equiv. Pwr Into Ideal Dipole (dBm)	Vertical Measured Emission Equiv Pwr Into Ideal Dipole (dBm)
2nd harmonic	-13	-66.6	-66.5
3rd harmonic	-13	-60.5	-61.1
4th harmonic	-13	-60.2	-60.9
5th harmonic	-13	-58.1	-58.3
6th harmonic	-13	-56.5	-56.5
7th harmonic	-13	-52.0	-50.8
8th harmonic	-13	-50.0	-49.9
9th harmonic	-13	-49.1	-49.6
10th harmonic	-13	-49.4	-49.7



Notes:

1. \* Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, and high channels at maximum power.
3. The Spectrum was investigated from 30 MHz to the tenth harmonic of the fundamental.

## FREQUENCY STABILITY

CFR Part 2.1055, 22.355, 24.235

### **Measurement Procedure**

The equipment under test is placed in an environmental chamber. The antenna port of the Equipment Under Test is directly coupled to the input of the measurement equipment through a specialized RF connector. A power supply is attached as the primary voltage supply.

Frequency measurements are made at the extremes of the temperature range  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  and at intervals of  $10^{\circ}\text{C}$  with the primary supply voltage set to the nominal battery operating voltage. A period of time sufficient to stabilize all components of the equipment is allowed at each frequency measurement. The maximum variation of frequency is measured.

At room temperature, the primary supply voltage is reduced to the battery operating endpoint of the equipment under test. The maximum variation of frequency is measured.

### **Measurement Results**

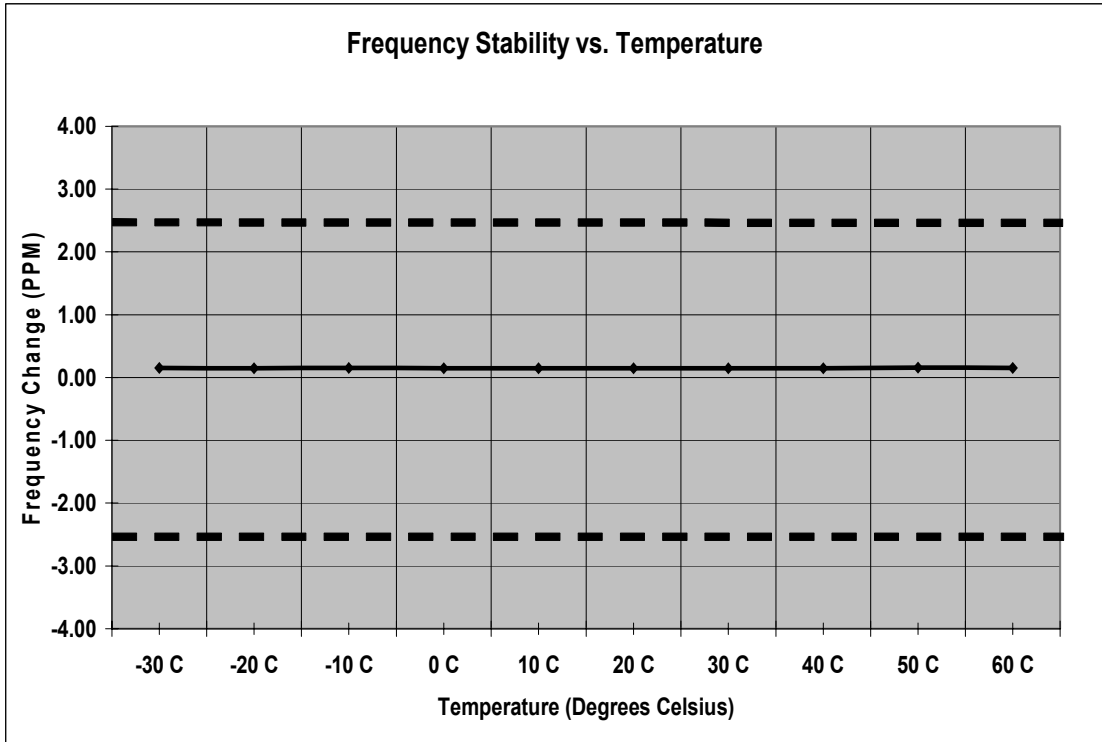
Attached

**Measurement Results**  
**Modulation: AMPS**

**Frequency Stability**

**Mode:** Analog      **Operating Frequency:** 836.52 MHz  
**Channel:** 384      **Deviation Limit (PPM):** 2.5ppm

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	125.00	0.149	100%	3.70
-20 C	123.00	0.147	100%	3.70
-10 C	128.00	0.153	100%	3.70
0 C	122.00	0.146	100%	3.70
10 C	122.00	0.146	100%	3.70
20 C	124.00	0.148	100%	3.70
30 C	121.00	0.145	100%	3.70
40 C	124.00	0.148	100%	3.70
50 C	129.00	0.154	100%	3.70
60 C	125.00	0.149	100%	3.70
20 C	123.00	0.147	Battery Endpoint	3.20



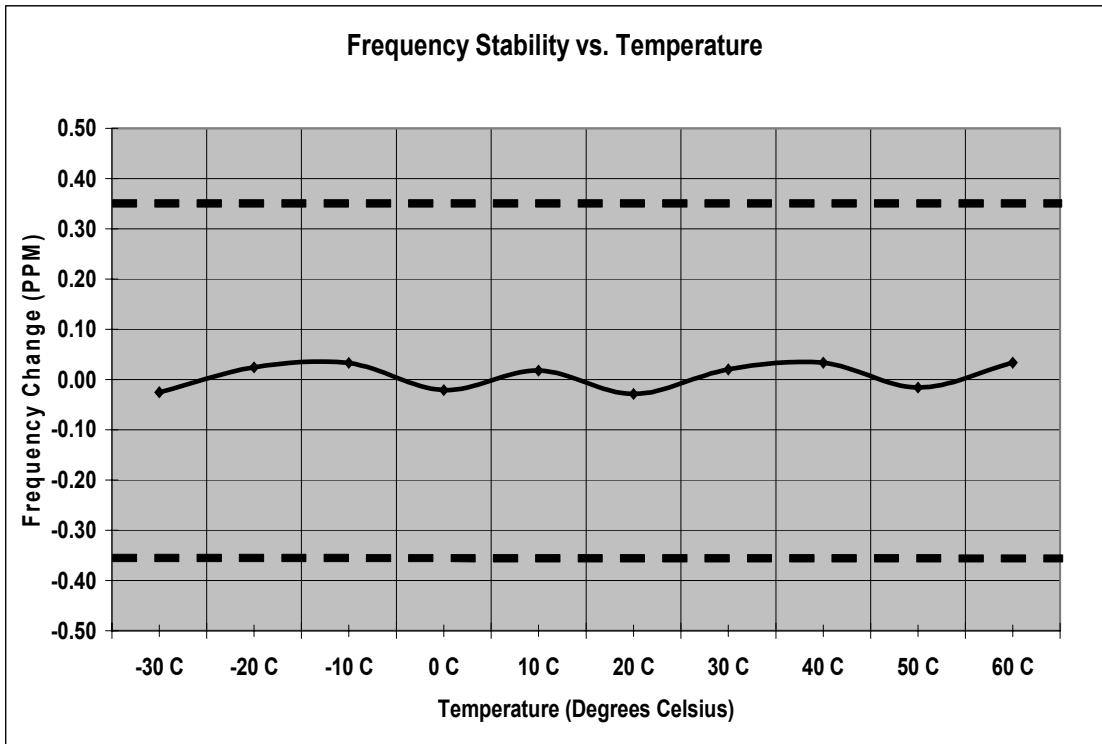
**Measurement Results**

**Modulation: CDMA 800**

**Frequency Stability**

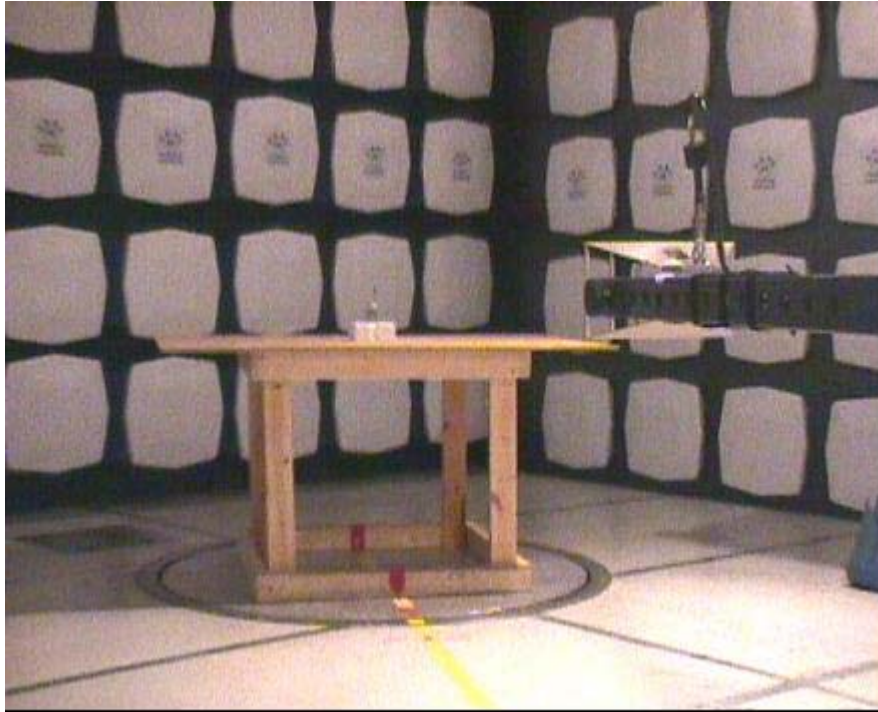
Mode: CDMA 800      Operating Frequency: 836.52 MHz  
 Channel: 384      Deviation Limit (PPM): 0.359ppm (+/-300 Hz)

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	-21.20	-0.025	100%	3.70
-20 C	20.10	0.024	100%	3.70
-10 C	27.70	0.033	100%	3.70
0 C	-18.00	-0.022	100%	3.70
10 C	15.00	0.018	100%	3.70
20 C	-23.90	-0.029	100%	3.70
30 C	17.00	0.020	100%	3.70
40 C	28.10	0.034	100%	3.70
50 C	-13.20	-0.016	100%	3.70
60 C	28.20	0.034	100%	3.70
20 C	24.90	0.030	Battery Endpoint	3.20

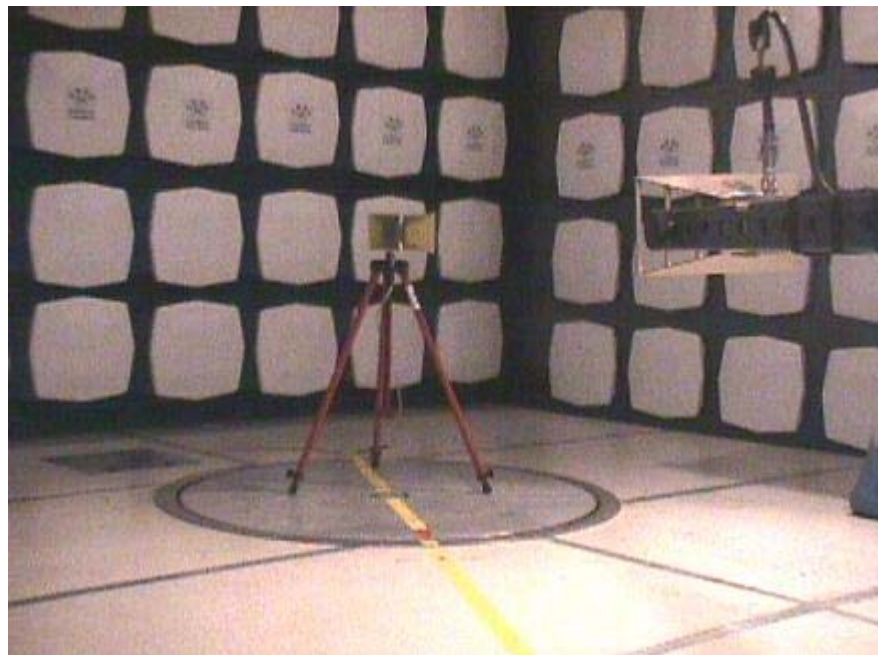


**Appendix A – Radiated Emissions Test Setup Photos**

Note: Photos are representative of the test house setup used.



A.1 Radiated Emissions Measurement



A.2 Substitution Measurement

**End of Test Report**