



**MOTOROLA**

**PERSONAL COMMUNICATIONS SECTOR**

**PRODUCT SAFETY AND COMPLIANCE  
EMC LABORATORY**

**EMC TEST REPORT**

**Test Report Number** – 12503-1

**Report Date** – November 14, 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: Michael Hill

Title: Senior Electrical Engineer

Date: 11/14/03 (revised 12-18-03)

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A2LA Certificate Number: 1846-01



## **Table of Contents**

Description	Page
Test Report Details	4
Applicable Standards	5
Summary of Testing	6
General and Special Conditions	6
Equipment and Cable Configurations	7
Measuring Equipment and Calibration Information	7
Measurement Procedures and Data	
RF Power Output	8
Radiated Power (ERP)	9
Modulation Characteristics	11
Transmit Audio Frequency Response	11
Post Limiter Filter Attenuation	11
Modulation Limiting vs. Modulation Input Voltage	12
Occupied Bandwidth	13
800 AMPS Unmodulated Carrier	14
800 AMPS Supervisory Audio Tone	14
800 AMPS Voice	15
800 AMPS Signal	15
800 AMPS Wide Band Data	16
800 AMPS Lower Band Edge	16
800 AMPS Upper Band Edge	17
800 CDMA Reference Plot	18
800 CDMA Bandwidth Plot	18
800 CDMA Occupied Bandwidth Measurement	19
800 CDMA Lower Band Edge	19
800 CDMA Upper Band Edge	20
Spurious Emissions at Antenna Terminals	24
AMPS Tabular and Graphical Data	25
CDMA 800 Tabular and Graphical Data	26
Field Strength of Spurious Emissions	28
AMPS Tabular and Graphical Data	29
CDMA 800 Tabular and Graphical Data	30
Frequency Stability	32
AMPS Tabular and Graphical Data	33
CDMA 800 Tabular and Graphical Data	34
Field Strength of Spurious Emissions From Unintentional Radiators	
AMPS Tabular and Graphical Data	18
CDMA 800 Tabular and Graphical Data	

Appendix A - Radiated Emissions Test Setup Photos	
Figure A.1 – Radiated Emissions Measurement	36
Figure A.2 – Substitution Measurement	36

## **Test Report Details**

Tests Performed By: Motorola Personal Communications Sector  
Product Safety and Compliance Group  
600 North US Hwy 45  
Libertyville, IL 60048  
PH (847) 523-3630 Fax (847) 523-4538  
Motorola PCS FRN: 0004321311  
FCC Registration Number: 316588  
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: AMPS, 800 CDMA

Model Number: C357

Serial Numbers: 0x33881E00, 0x33881E01, 0x33881E02,  
0x33881E03

Version: SJWF0200BB

Testing Complete Date: November 13, 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 137-A, TIA EIA 98-C, ANSI 63.4 2001, RSS-118 (AMPS), RSS-128 (TDMA), RSS-129 (CDMA), RSS-133 (PCS)

**Summary of Testing**

Test #	Test Name	Pass/Fail
1	RF Power Output	NA
2	ERP (Effective Radiated Power)	NA
3	Modulation Characteristics	N/A
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	13.9 dB
6	Field Strength of Spurious Emissions	12.2 dB
7	Frequency Stability	41 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	US53944019	11/13/03
Hewlett Packard	QP Adapter	85650A	2811A01069	1/15/04
Hewlett Packard	S/A Display	8566B	2542A12974	1/15/04
Hewlett Packard	S/A	8566B	2637A03376	1/15/04
Hewlett Packard	RF Preselector	85685A	2810A00692	1/15/04
Rohde & Schwarz	S/A	FSEK20	DE2525315	1/14/04
EMCO	Horn Antenna 1-18GHz	3115	2638	7/10/04
EMCO	Horn Antenna 18-26.5GHz	3160-09	9904-1165	N/A*
Chase	Bi-Con Antenna 30-300MHz	VBA6106A	1246	6/23/04
Chase	Log-Periodic Antenna	UPA6108	1120	6/18/04
Weinschel	Attenuator Kit – 10, 6 dB	AS6	6675	10/12/04
Thermotron	Environmental Chamber	S-4	31580	12/19/03
Hewlett Packard	System DC Power Supply	66311B	US38447252	10/13/04
Rohde & Schwarz	Mobile Test Station	CMD80	DE29008	03/17/04
Giga-tronics	Universal Power Meter	8652A	8650494	01/07/04
Giga-tronics	Power Sensor	80701A	1833992	12/12/03

All equipment is on a one-year calibration cycle.

**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 Giga-Tronics 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

**AMPS**

Frequency (MHz)	Power (dBm)
824.04	27.03
836.52	27.02
848.97	26.91

**CDMA 800**

Frequency (MHz)	Power (dBm)
824.70	25.19
836.52	25.20
848.31	25.12

## **RADIATED (ERP)**

### **Measurement Procedure**

The phone was tested in a 16' cubical anechoic chamber with a 2-axis position system that permits taking complete spherical scans of the EUT's radiation patterns. For all tests, the phone was supported in a free space type environment, vertically oriented in the chamber. Tests were done for Analog three frequencies (824.04, 836.52, and 848.87) and CDMA 800 three frequencies (824.70, 836.52, and 848.37 MHz with antenna stubby).

CDMA measurements were made with the phone placed in a call using the CMD80 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 each 15 degree step. The radiated power was measured using a Gigatronics 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 IHDT5DY1 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  
See Attached.

**AMPS:**

824.04 MHz:	23.71 dBm
836.52 MHz:	23.43 dBm
848.97 MHz:	23.37 dBm

**CDMA 800**

824.70 MHz:	21.94 dBm
836.52 MHz:	21.41 dBm
848.37 MHz:	21.61 dBm

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

Max EIRP in AMPS 800 is 23.71 dBm (**max ERP is 21.61 dBm**)

Max EIRP in CDMA 800 is 21.94 dBm (**max ERP is 19.84 dBm**)

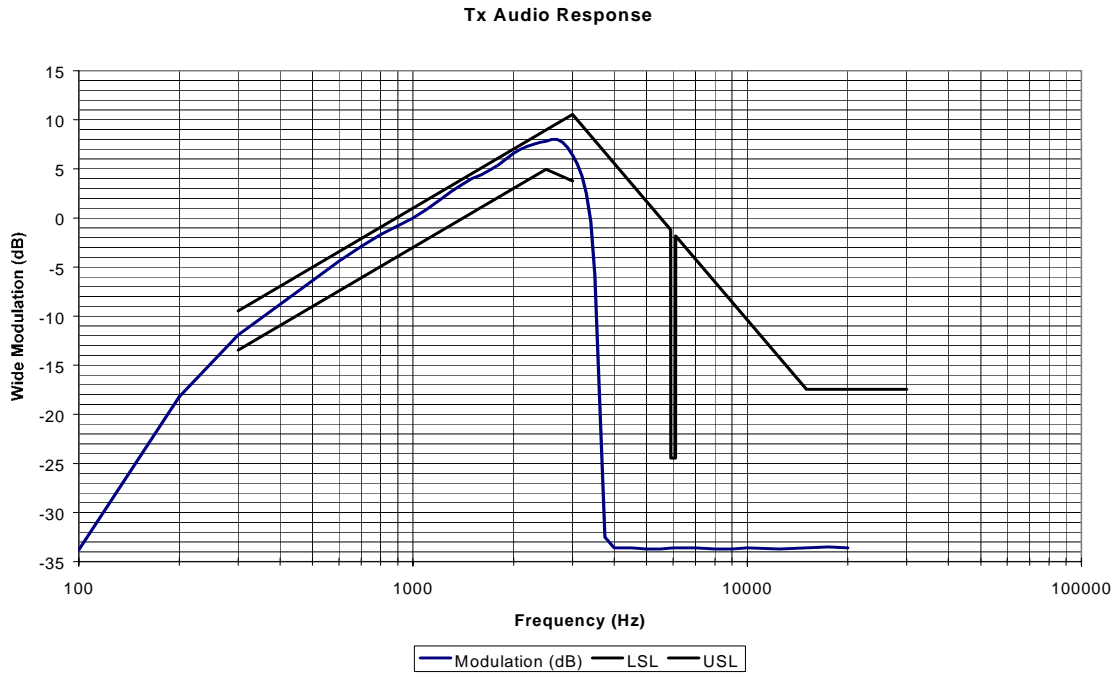
# MODULATION CHARACTERISTICS

CFR Part 2.1047, 22.915

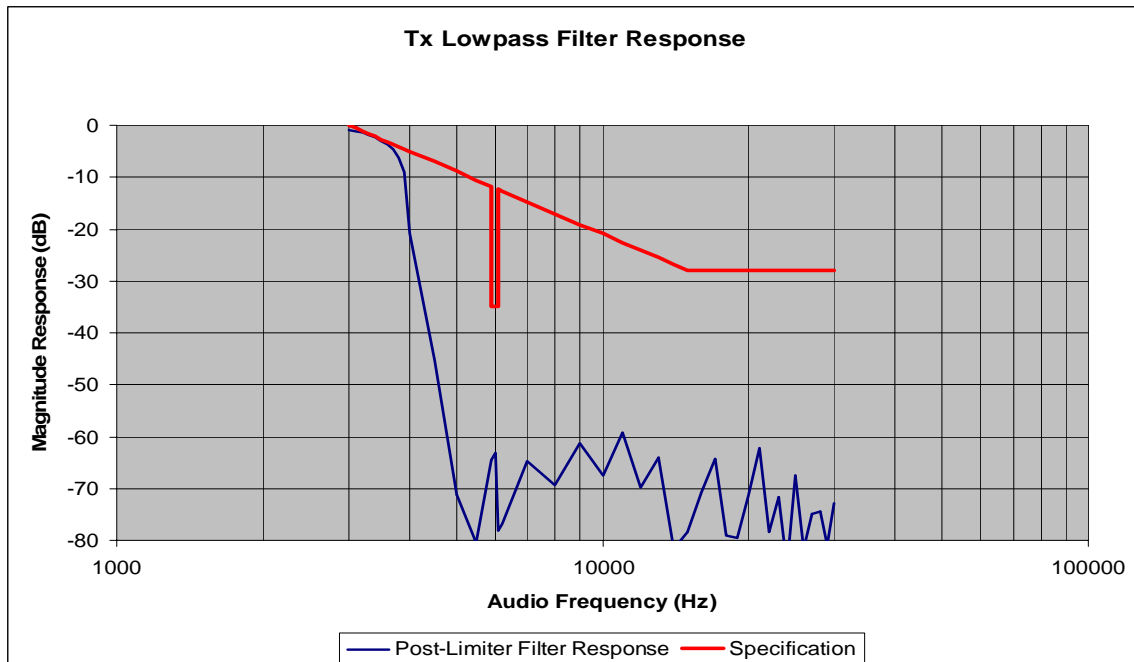
## Measurement Results -AMPS

\* Data supplied by product group

### Transmit Audio Frequency Response

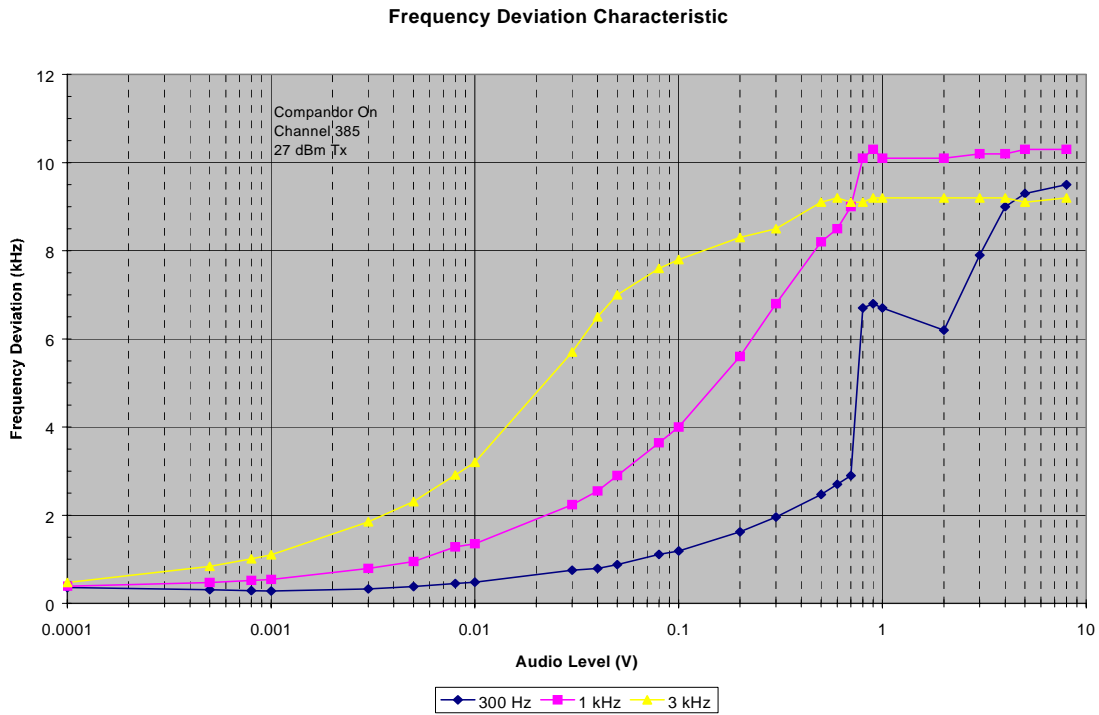


### Post Limiter Filter Attenuation

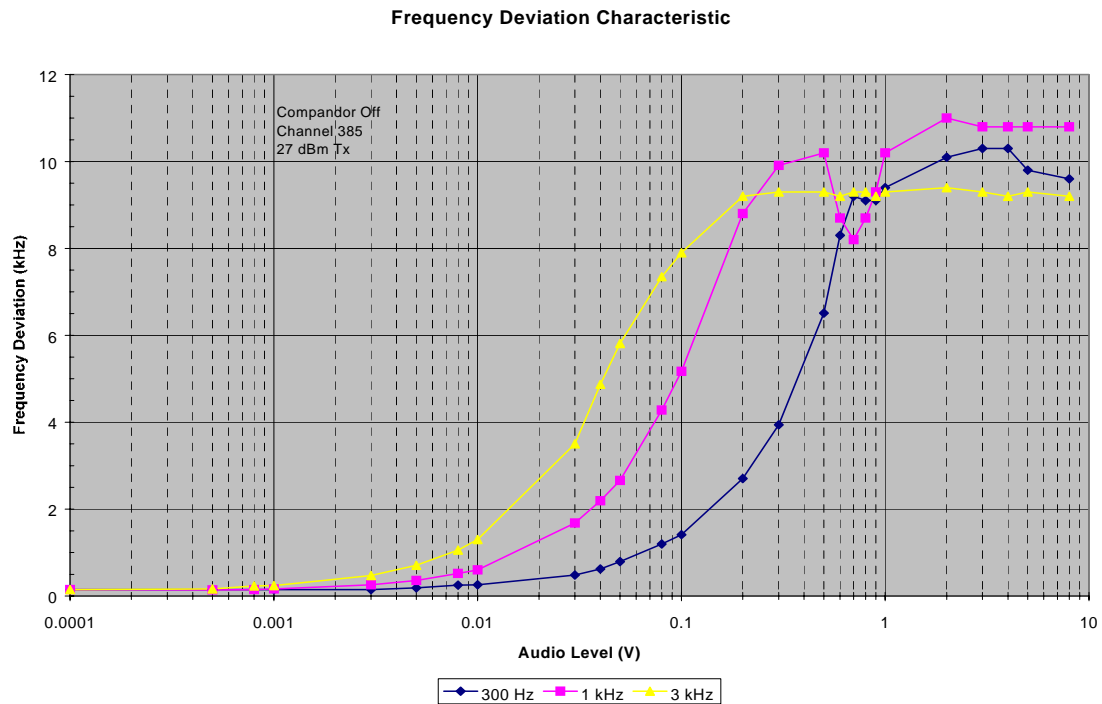


### Modulation Limiting vs. Modulation Input Voltage

#### 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.

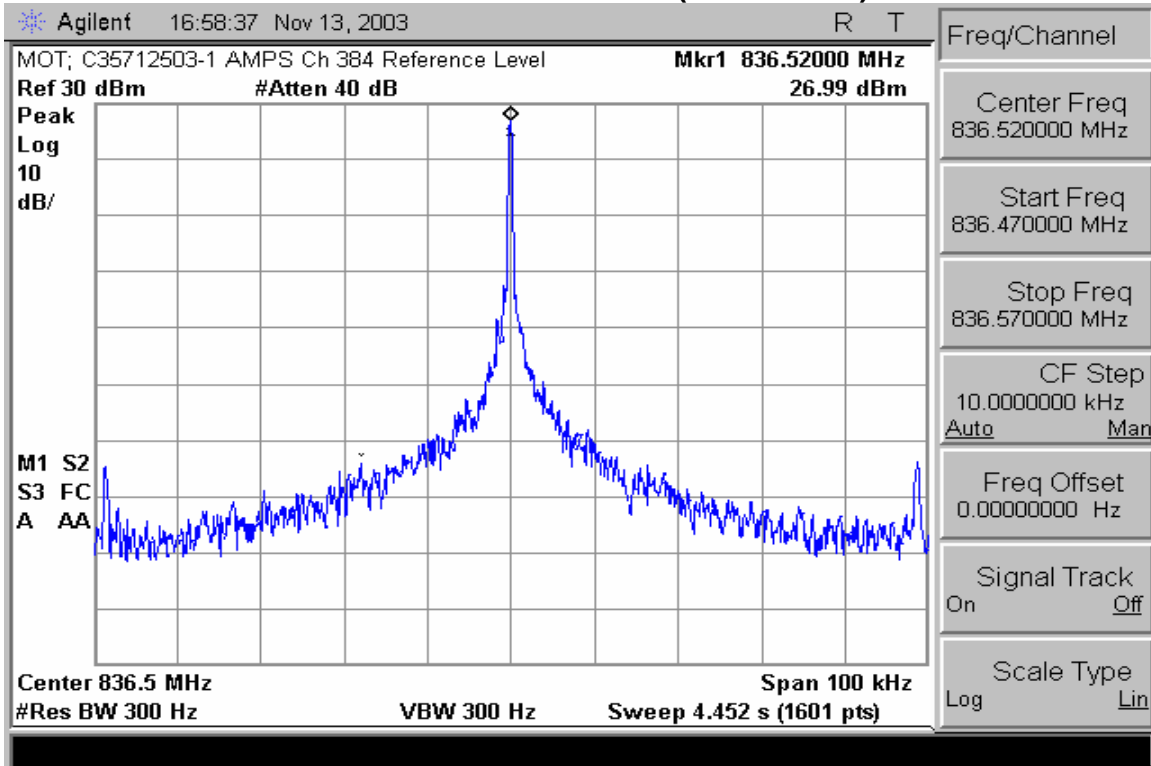
The middle channel within the designated frequency block was measured. For digital modulation, the lower and upper band edge plots are displayed.

### Measurement Results

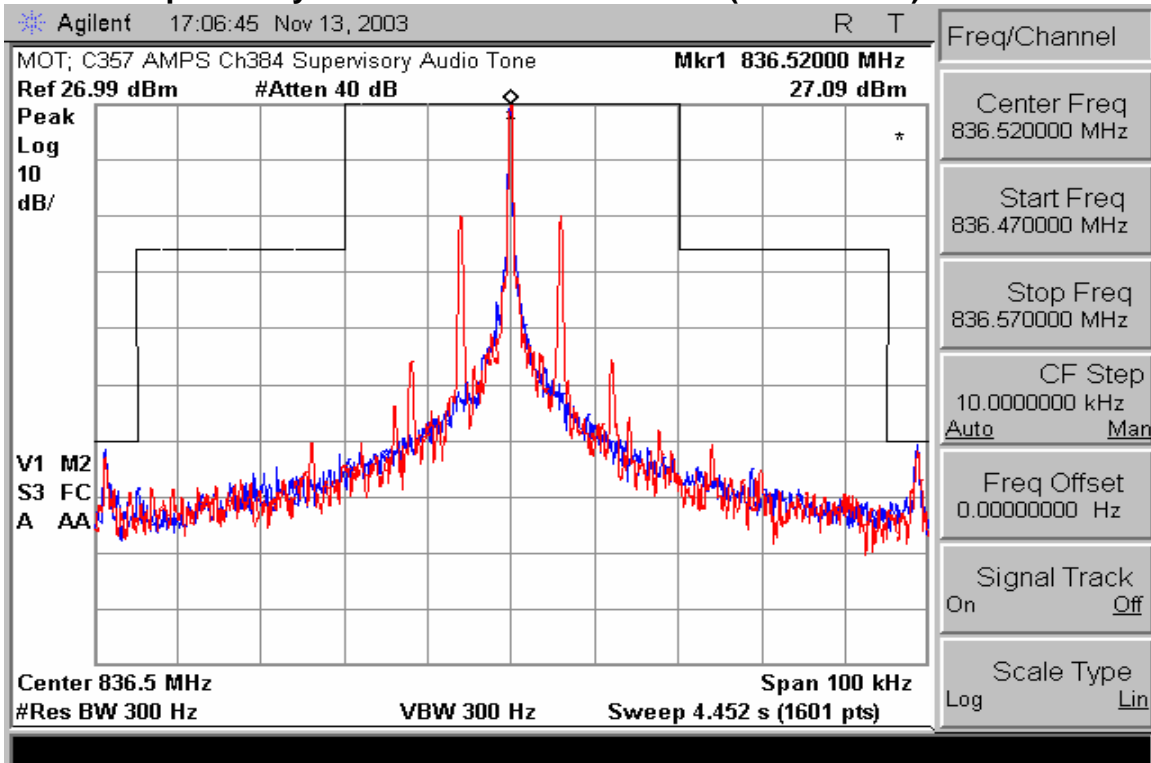
Attached

### Measurement Results – AMPS

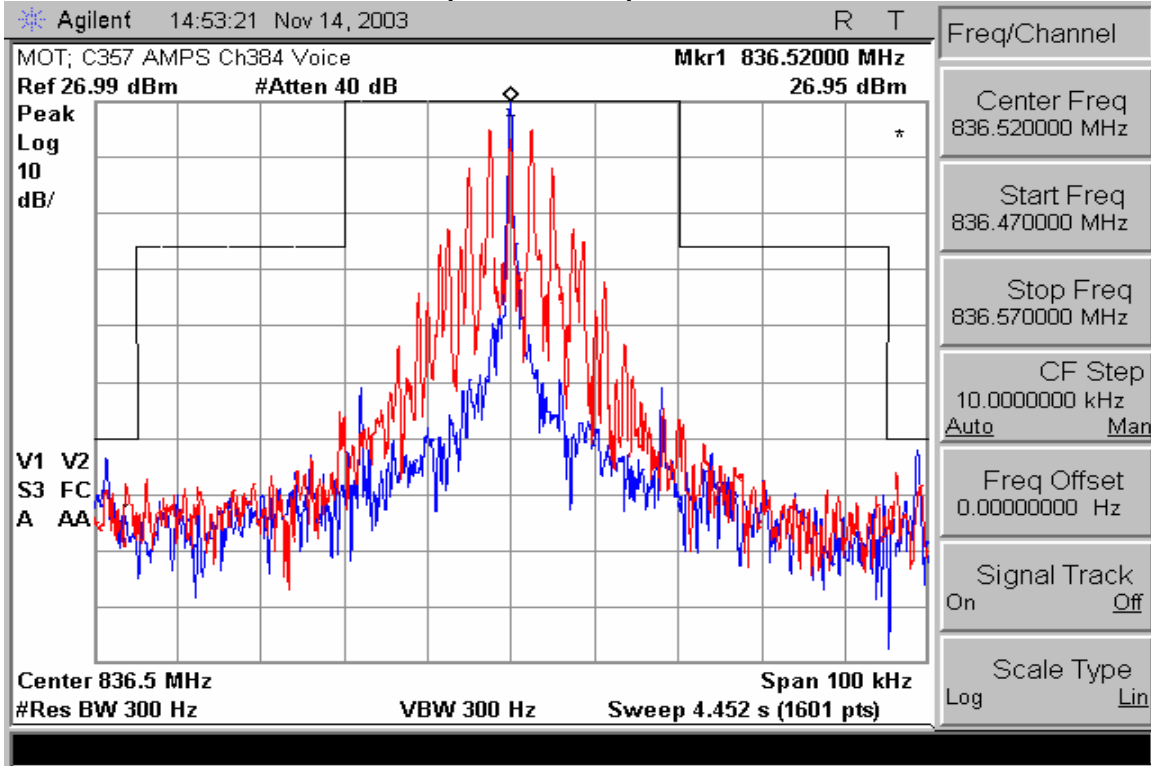
#### AMPS - Unmodulated Carrier – Channel 384 (836.52 MHz)



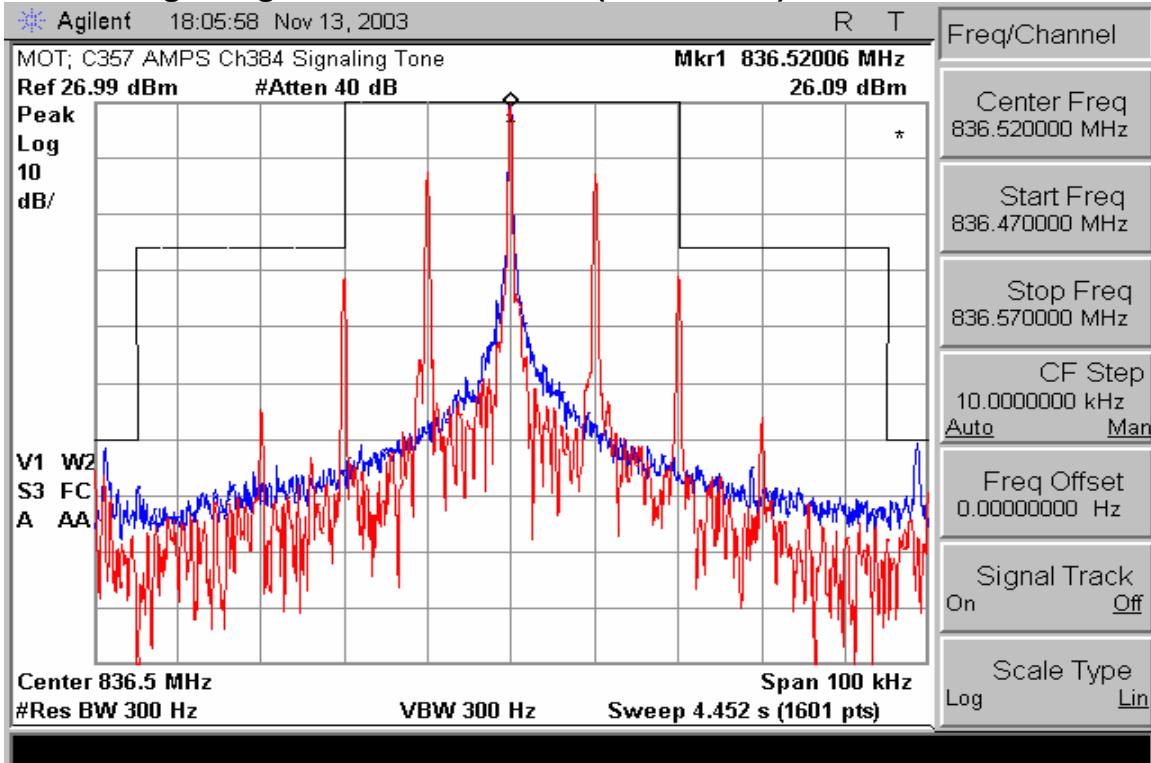
#### AMPS - Supervisory Audio Tone – Channel 384 (836.52 MHz)



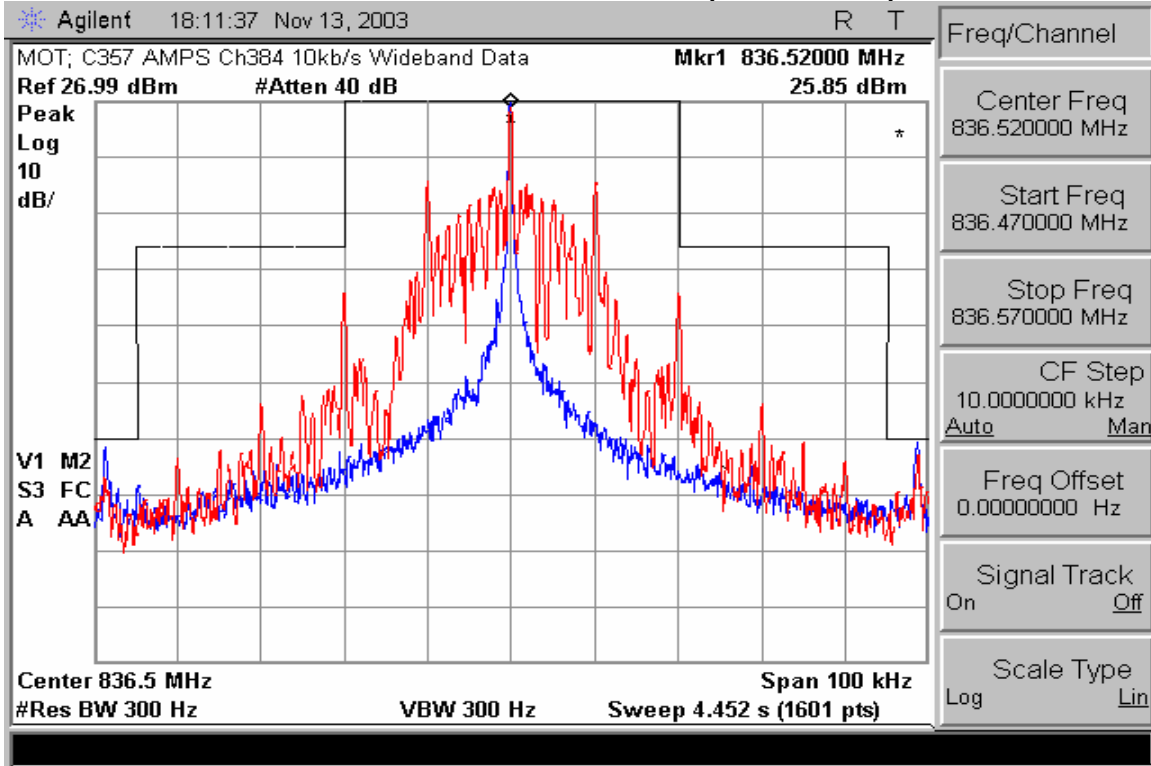
**AMPS - Voice – Channel 384 (836.52 MHz)**



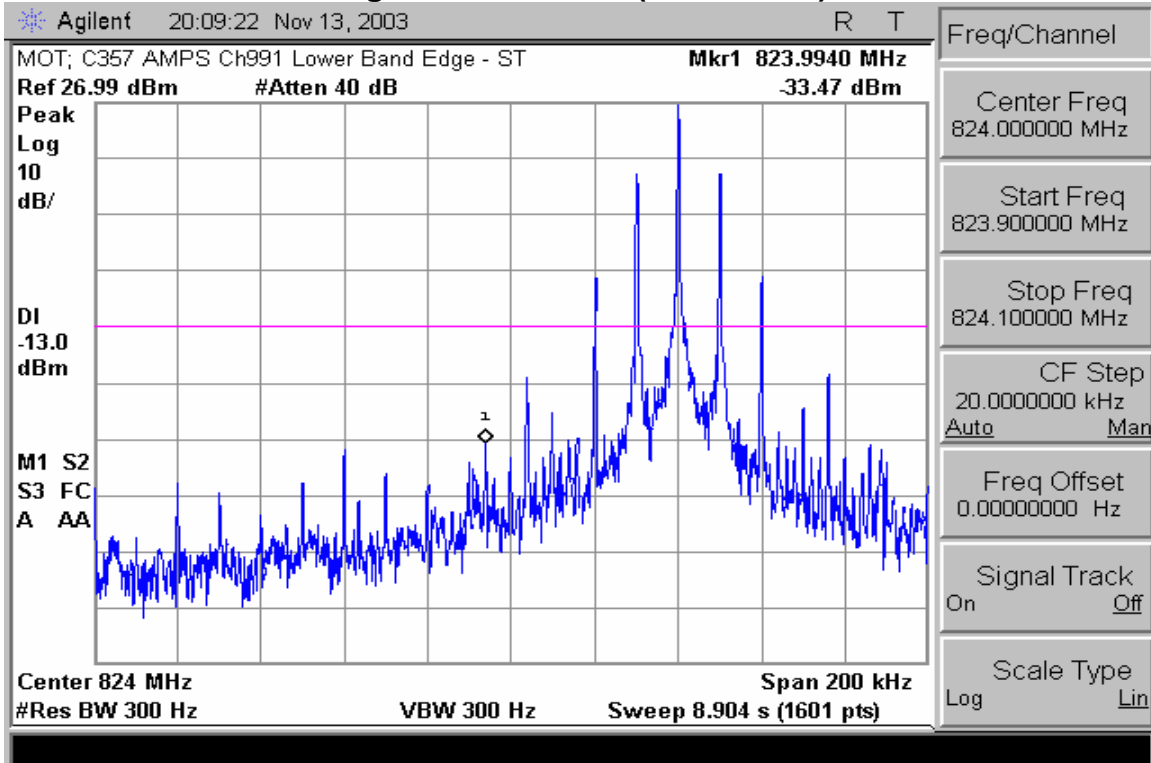
**AMPS – Signaling Tone – Channel 384 (836.52 MHz)**



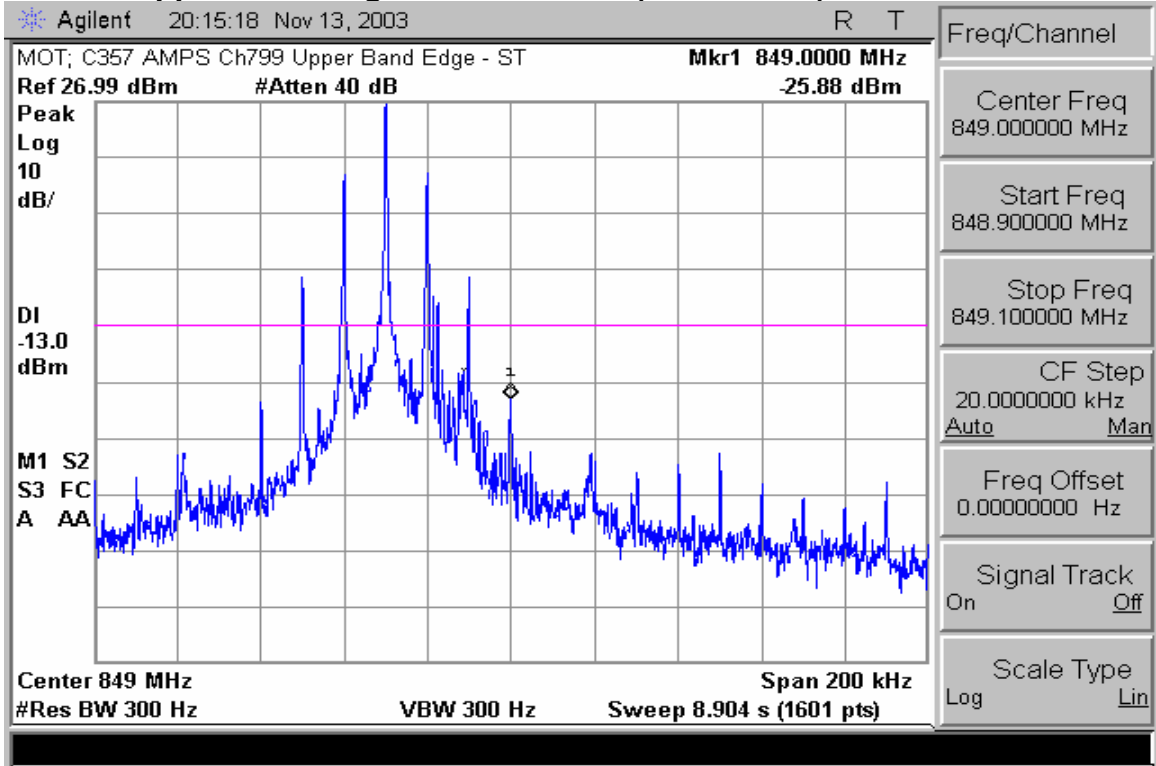
**AMPS – 10kb/s Wideband Data – Channel 384 (836.52 MHz)**



**AMPS – Lower Band Edge – Channel 991 (824.04 MHz)**

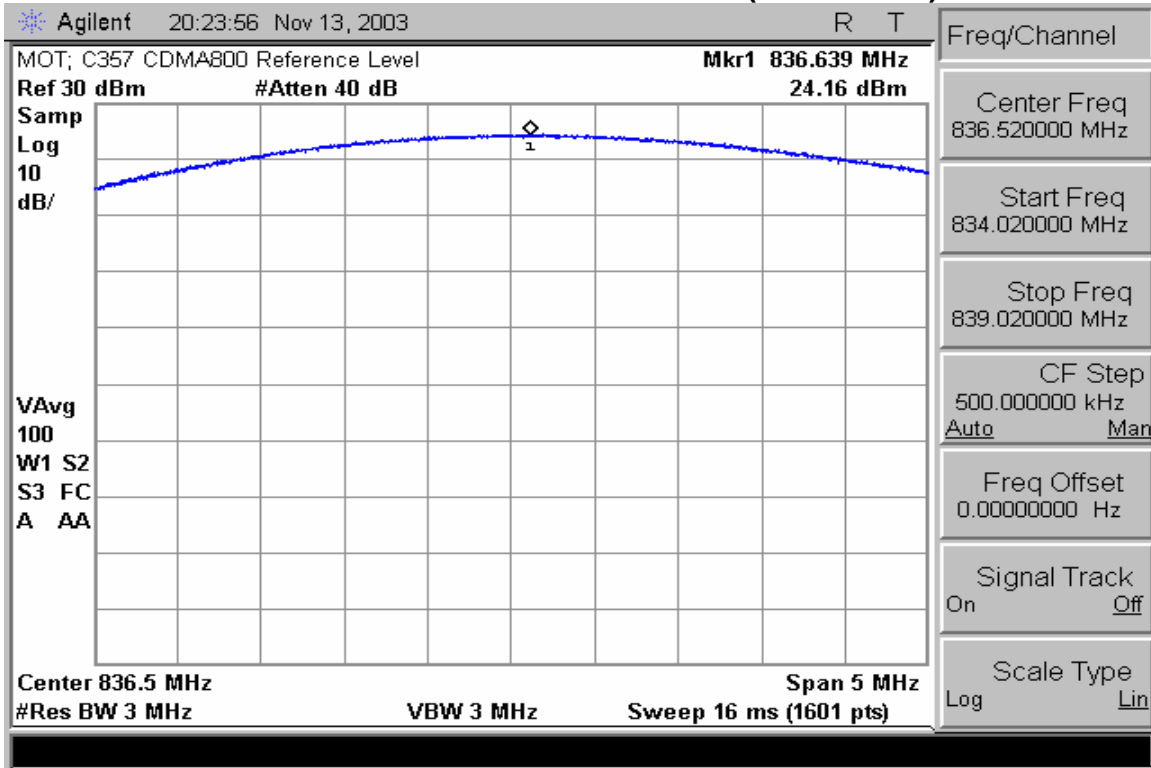


### AMPS – Upper Band Edge – Channel 799 (848.97 MHz)

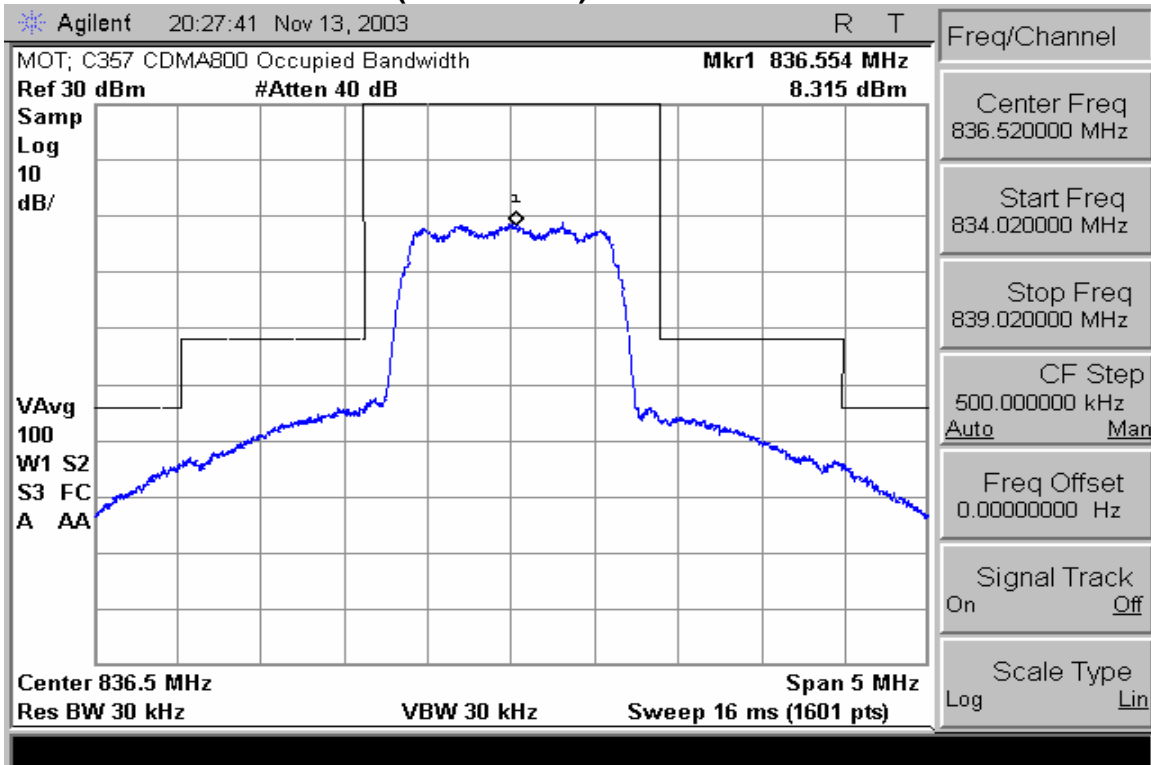


### Measurement Results – CDMA 800

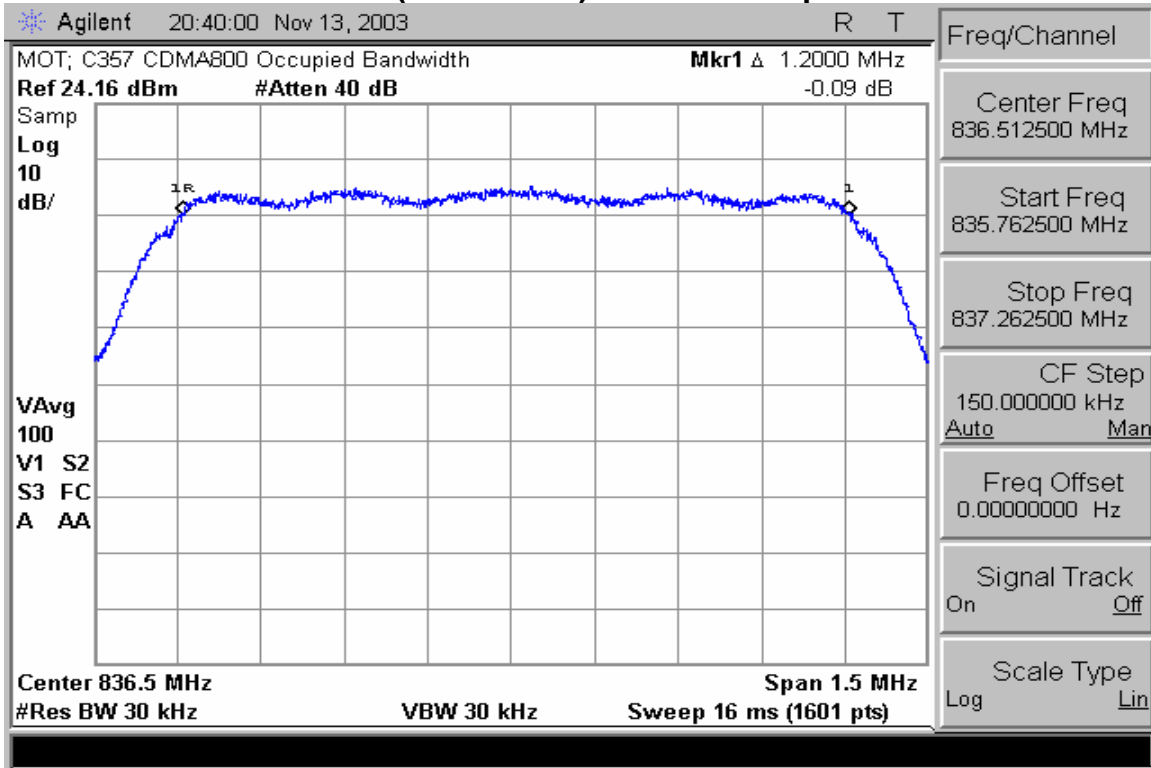
#### CDMA 800 – Reference Level Plot – Channel 384 (836.52 MHz)



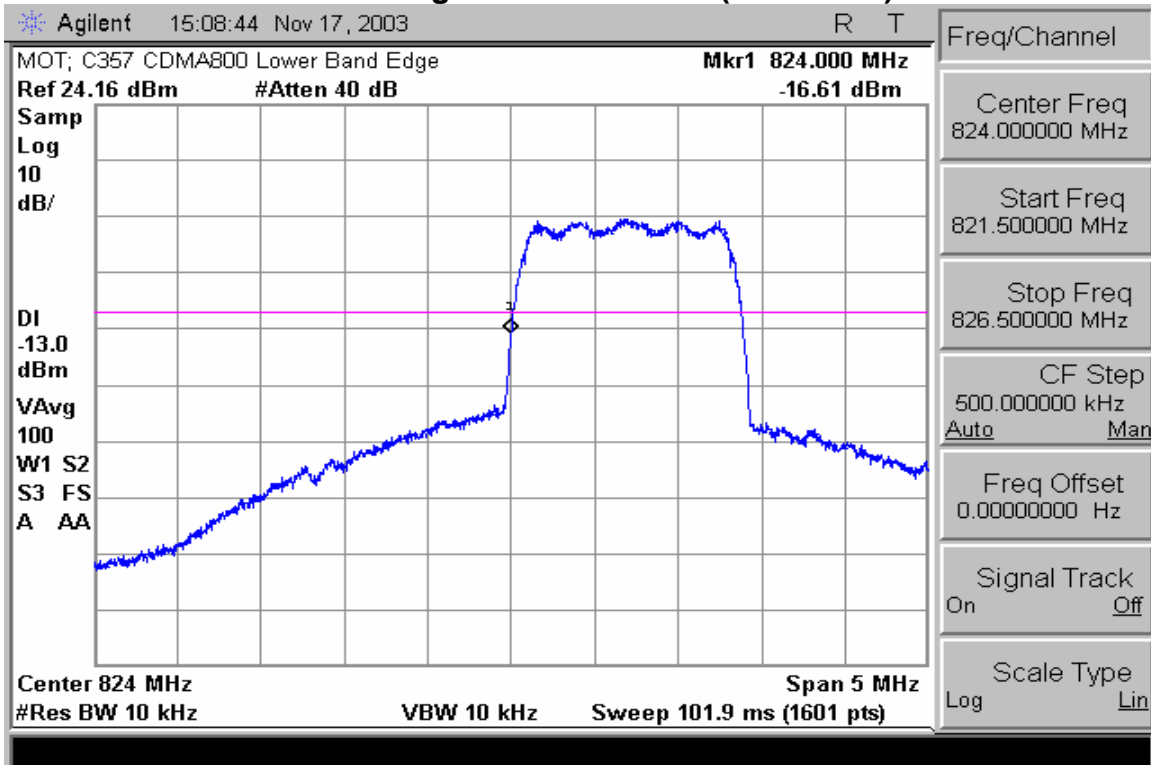
#### CDMA 800 – Channel 384 (836.52 MHz)



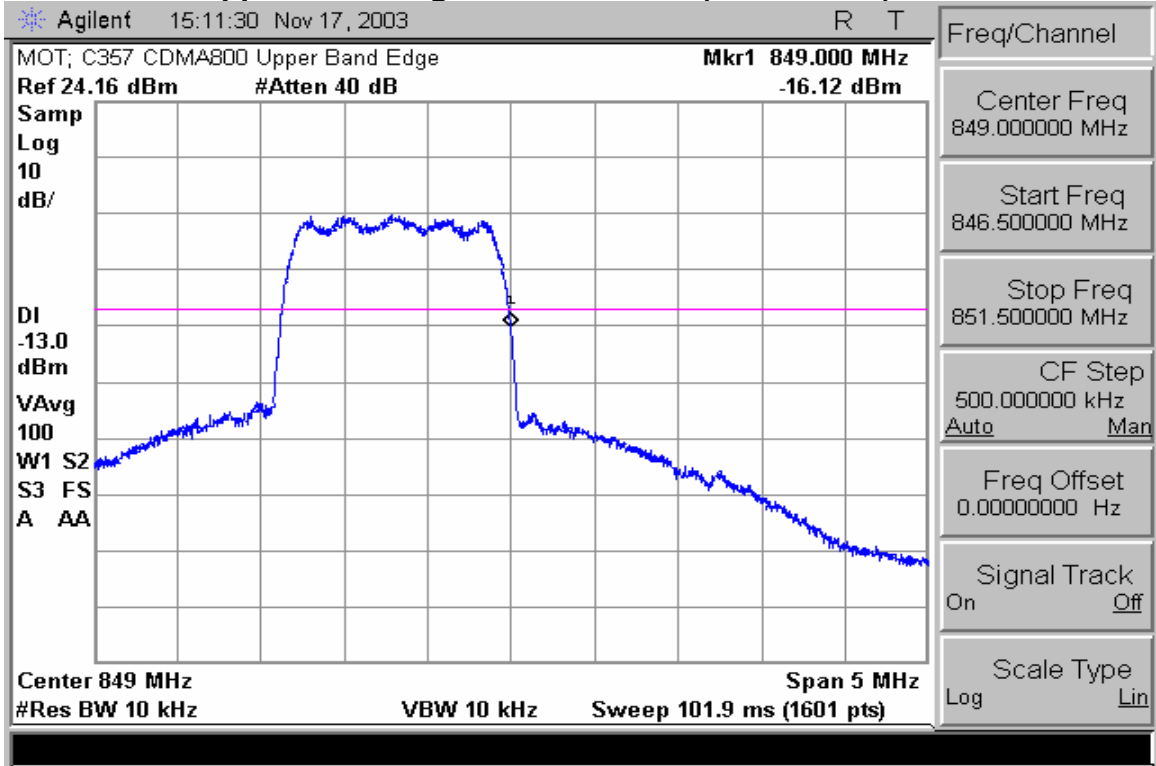
**CDMA 800 – Channel 384 (836.52 MHz) Actual Occupied Bandwidth**



**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 at the middle channel within the frequency band and within the base station frequency range (869-894 MHz) for cellular.

### **Instrument Settings**

Resolution Bandwidth: 1 MHz (PCS), 100 kHz (GSM 850)  
Video Bandwidth:  $\geq$  RBW  
Detector: Peak  
Sweep: Auto – Cal  
Trace: Max Hold

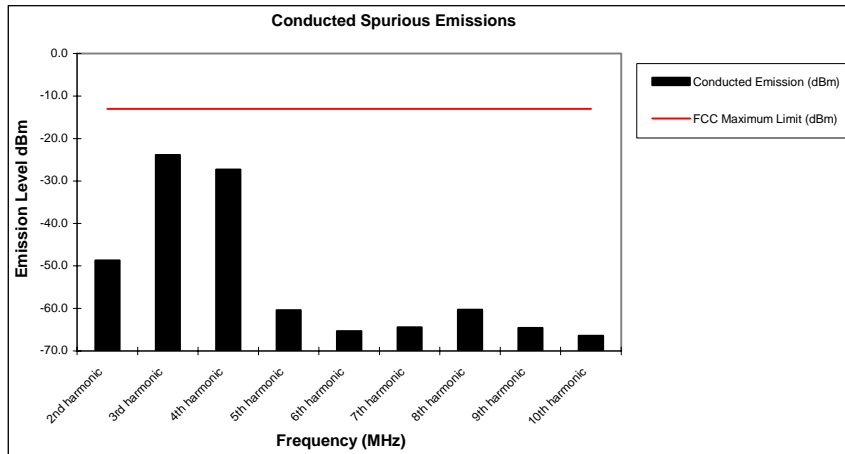
### **Measurement Results**

Attached

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

**Conducted Spurious and Harmonic Emissions**

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-48.7
3rd harmonic	-13	-23.9
4th harmonic	-13	-27.3
5th harmonic	-13	-60.4
6th harmonic	-13	-65.3
7th harmonic	-13	-64.4
8th harmonic	-13	-60.3
9th harmonic	-13	-64.6
10th harmonic	-13	-66.4



Notes:

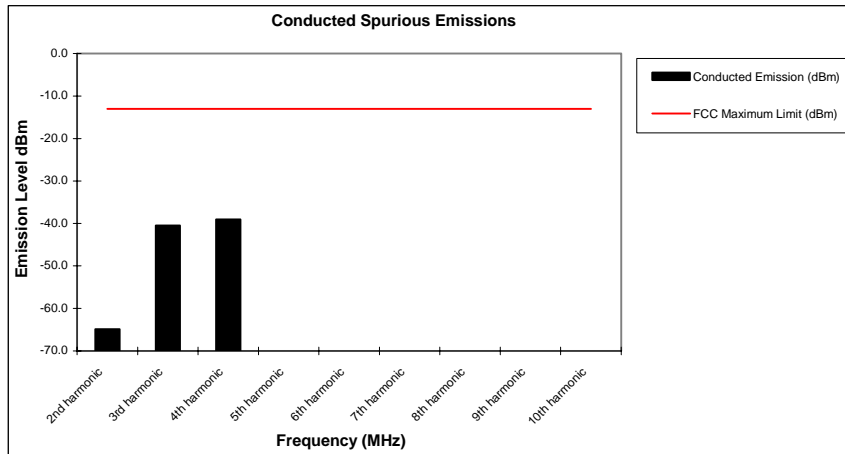
1. \* Indicates the spurious emission could not be detected due to noise limitations or ambients.
2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
3. The Spectrum was investigated from 9 kHz to the tenth harmonic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

**Measurement Results**

**Modulation: CDMA 800**

**Conducted Spurious and Harmonic Emissions**

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-64.9
3rd harmonic	-13	-40.5
4th harmonic	-13	-39.1
5th harmonic	-13	*
6th harmonic	-13	-79.9
7th harmonic	-13	-79.4
8th harmonic	-13	-77.1
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.

## 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.

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.

### Instrument Settings

Resolution Bandwidth: 1 MHz (PCS Band), 30 kHz (Cellular Band)  
Video Bandwidth:  $\geq$  RBW  
Detector: Peak  
Sweep: Auto – Cal  
Trace: Max Hold

### Measurement Results

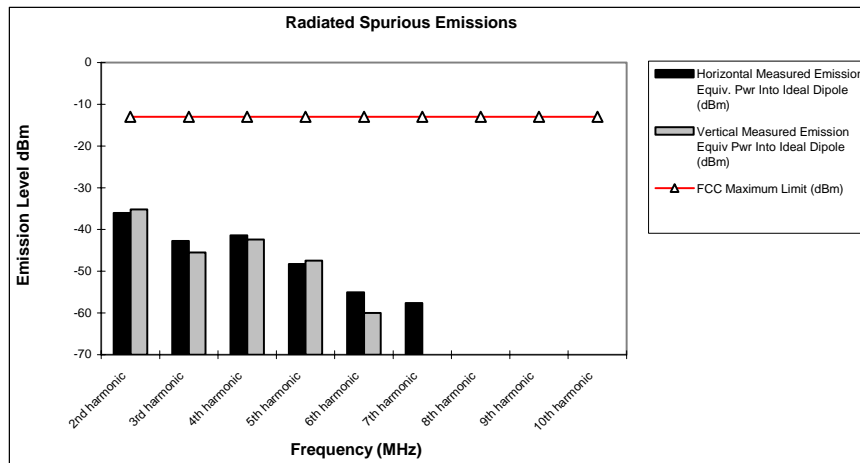
Attached

**Measurement Results**

**Modulation: AMPS**

**Radiated Spurious and Harmonic Emissions**

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	-36.1	-35.2
3rd harmonic	-13	-42.7	-45.5
4th harmonic	-13	-41.4	-42.4
5th harmonic	-13	-48.3	-47.5
6th harmonic	-13	-55.0	-60.0
7th harmonic	-13	-57.6	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*



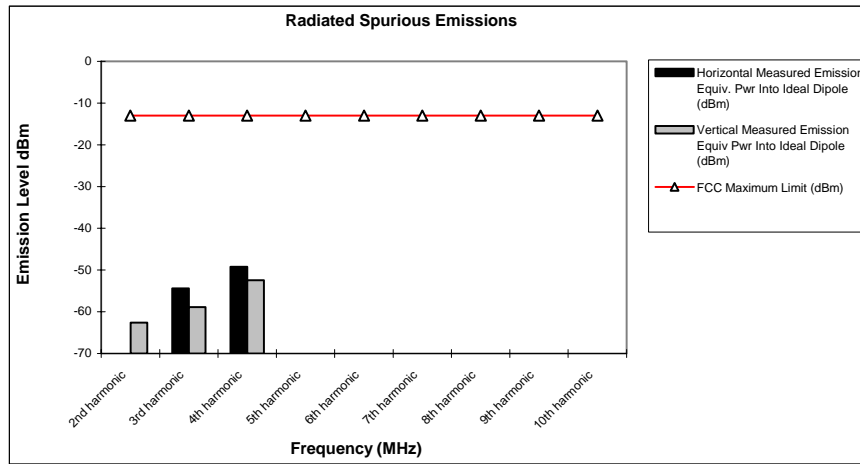
Notes:

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 30 MHz to the tenth harmonic of the fundamental.

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

**Radiated Spurious and Harmonic Emissions**

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	*	-62.6
3rd harmonic	-13	-54.4	-58.9
4th harmonic	-13	-49.2	-52.5
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 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. A battery eliminator was used for the input supply voltage.

### **Measurement Results**

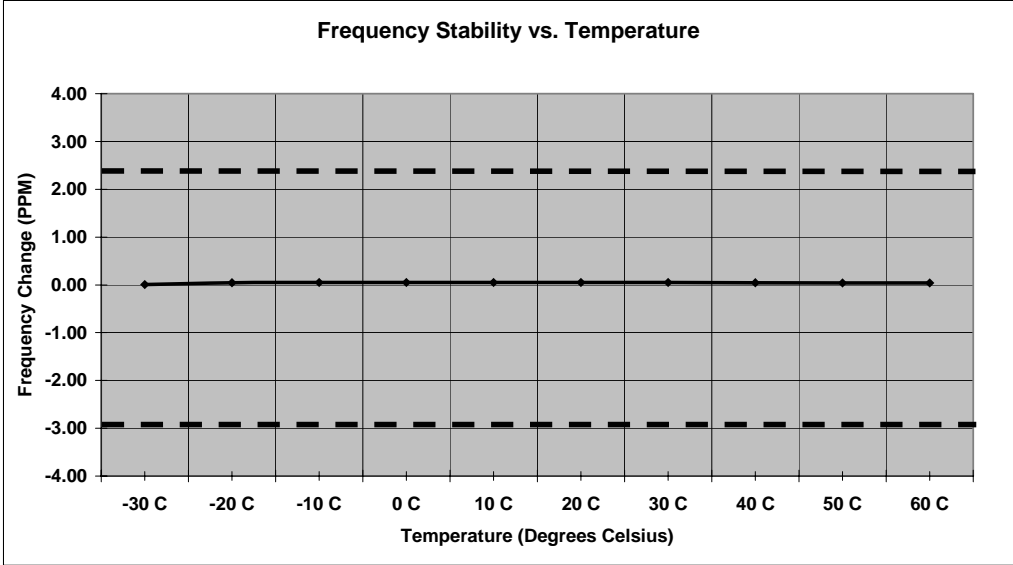
Attached

**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	5.00	0.006	100%	3.70
-20 C	36.00	0.043	100%	3.70
-10 C	40.00	0.048	100%	3.70
0 C	41.00	0.049	100%	3.70
10 C	41.00	0.049	100%	3.70
20 C	39.00	0.047	100%	3.70
30 C	39.00	0.047	100%	3.70
40 C	37.00	0.044	100%	3.70
50 C	33.00	0.039	100%	3.70
60 C	35.00	0.042	100%	3.70
20 C	41.00	0.049	Battery Endpoint	3.30



Technician: Kien  
 Date: 11/11/2003  
 Product Name: C357  
 Submission #: 12503-1  
 S/N: 33881E02  
 8924 S/N: US38513585

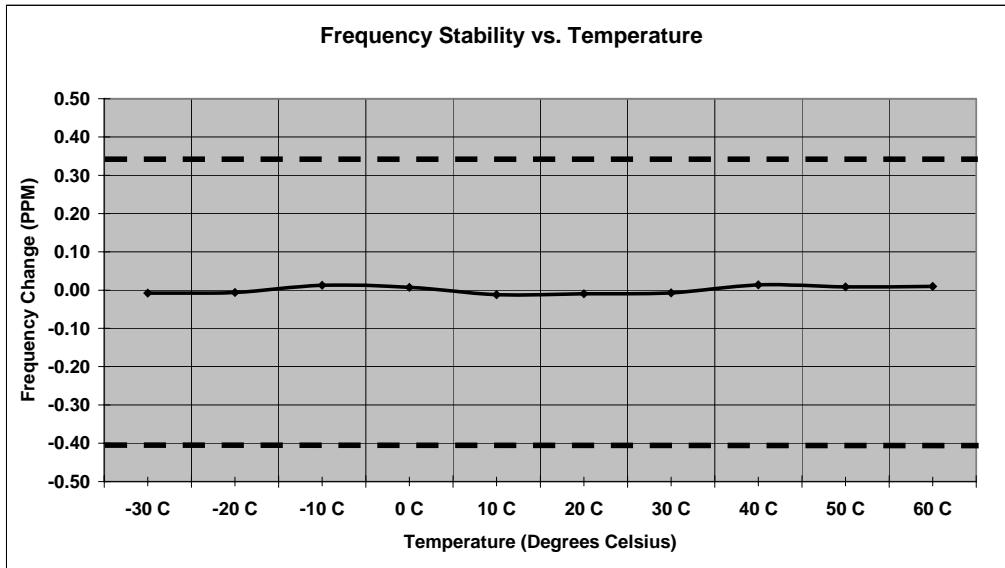
(Uncontrolled When Printed)

Form Control Number: FCD-0192, Rev. 3

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

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

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
C	HZ	(PPM)	(%)	(VDC)
-30 C	-6.70	-0.008	100%	3.70
-20 C	-4.90	-0.006	100%	3.70
-10 C	10.60	0.013	100%	3.70
0 C	6.00	0.007	100%	3.70
10 C	-9.90	-0.012	100%	3.70
20 C	-8.00	-0.010	100%	3.70
30 C	-6.10	-0.007	100%	3.70
40 C	11.30	0.014	100%	3.70
50 C	7.20	0.009	100%	3.70
60 C	7.90	0.009	100%	3.70
20 C	-10.00	-0.012	Battery Endpoint	3.30



Technician: Kien  
 Date: 11/11/2003  
 Product Name: C357  
 Submission #: 12503-1  
 S/N: 33881E02  
 8924 S/N: US38513585

(Uncontrolled When Printed)

Form Control Number: FCD-0192, Rev. 3

**FIELD STRENGTH OF EMISSIONS FROM UNINTENTIONAL RADIATORS**

CFR Part 15.109

**Measurement Procedure**

The Equipment-Under-Test is placed inside the semi-anechoic chamber on a wooden table at the turntable center. For each radiated emission, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum peak reading on the spectrum analyzer. The radiated emissions are then measured using an EMI receiver employing a CISPR quasi-peak detector function below 1000 MHz and an average detector function above 1000 MHz. This is repeated for both horizontal and vertical polarizations of the receive antenna. A fully charged battery was used for the supply voltage.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

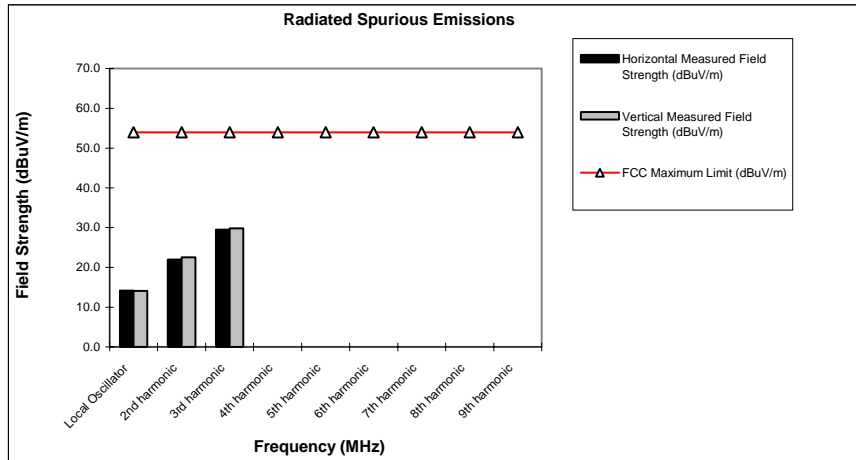
$$\text{Field Strength (dBuV/m)} = \text{EMI Receiver Level (dBuV)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)} + \text{Antenna Correction Factor (1/m)}$$
**Measurement Results**

Attached

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

**Receiver Radiated Spurious Emissions**

Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
Local Oscillator	54	14.2	14.1
2nd harmonic	54	22.0	22.6
3rd harmonic	54	29.5	29.8
4th harmonic	54	*	*
5th harmonic	54	*	*
6th harmonic	54	*	*
7th harmonic	54	*	*
8th harmonic	54	*	*
9th harmonic	54	*	*
10th harmonic	54	*	*



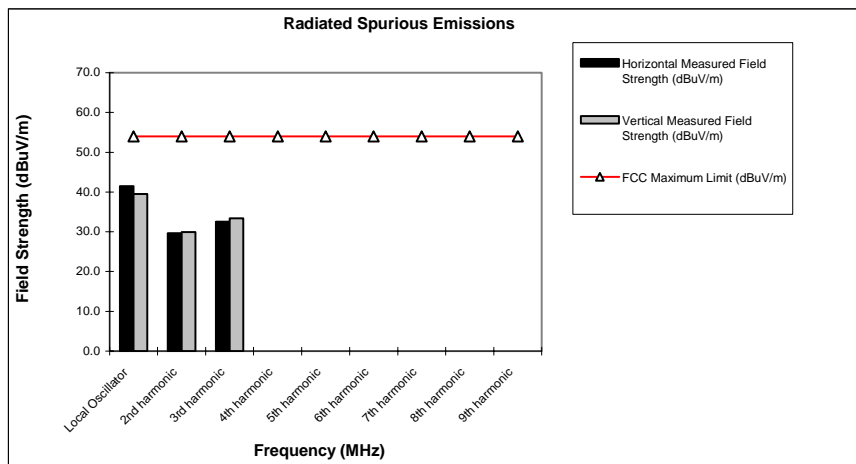
Notes:

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 frequency for the low, mid, and high channels.

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

**Receiver Radiated Spurious Emissions**

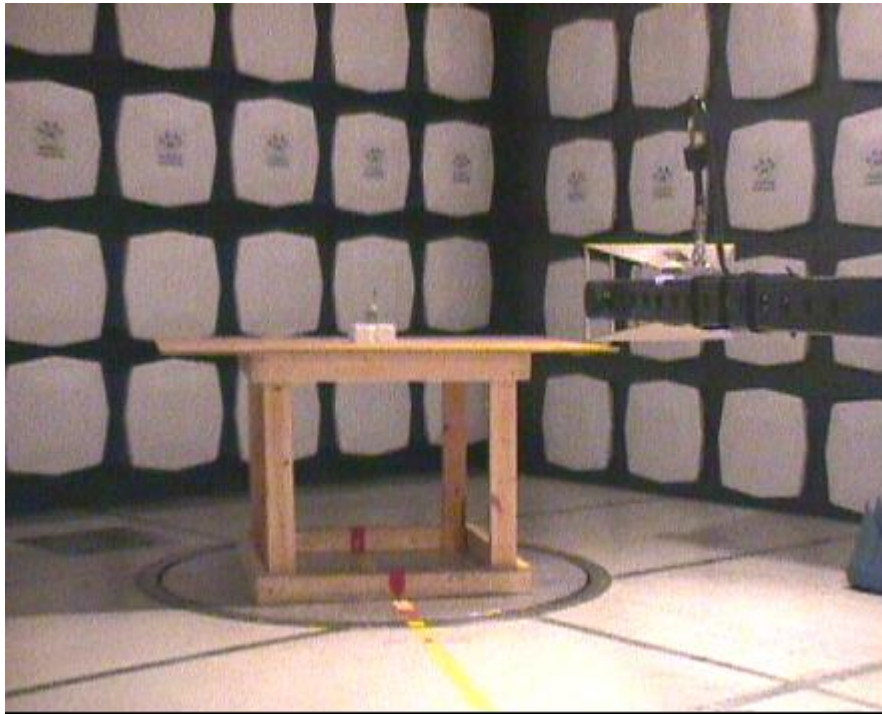
Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
Local Oscillator	54	41.5	39.5
2nd harmonic	54	29.6	29.9
3rd harmonic	54	32.6	33.4
4th harmonic	54	*	*
5th harmonic	54	*	*
6th harmonic	54	*	*
7th harmonic	54	*	*
8th harmonic	54	*	*
9th harmonic	54	*	*
10th harmonic	54	*	*



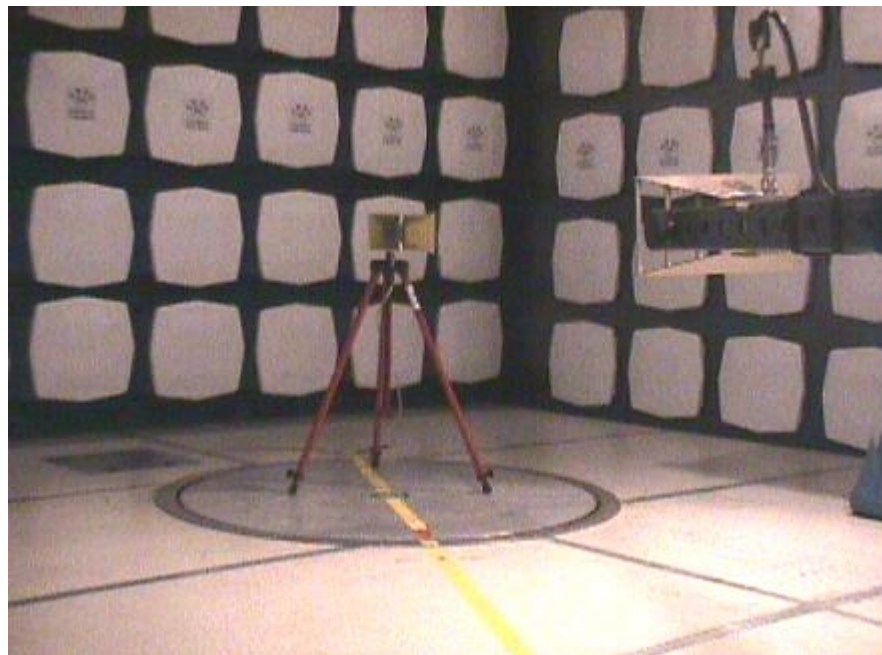
Notes:

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 frequency for the low, mid, and high channels.

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



A.1 Radiated Emissions Measurement



A.2 Substitution Measurement

**End of Test Report**