



MOTOROLA

**PERSONAL COMMUNICATIONS SECTOR
PRODUCT SAFETY AND COMPLIANCE
EMC LABORATORY**

EMC TEST REPORT

Submission Number – 3277-2

Report Date – June 29, 2001

Test Report Details

Tests Performed By: Motorola Personal Communications Sector
 Product Safety and Compliance Group
 1500 Gateway Boulevard
 Boynton Beach, FL 33426

Test Report Number: 3091-2

Test Report Date: June 29, 2001

Product Type: Cellular Phone

Signaling Capability: CDMA 800
 CDMA 1900

Model Number: N/A

Received Date: June 4, 2001

Testing Start Date: June 5, 2001

Testing Complete Date: June 27, 2001

Summary of Testing

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

Test #	Test Name	Comply	Does Not Comply
1	RF Power Output	X	
2	Occupied Bandwidth	X	
3	Spurious Emissions at Antenna Terminal	X	
4	Field Strength of Spurious Emissions	X	
5	Frequency Stability	X	
6	Receiver Radiated Emissions	X	

Introduction

All measurements contained in this report were performed at the Motorola Inc. Product Safety and Compliance EMC Laboratory located at 1500 Gateway Boulevard, Boynton Beach, FL 33426. The FCC and Industry Canada recognize this measurement facility as a valid test site.

Physical Description of Test Facility

Shielded Enclosure

The EMC radiated test facility consists of a 3-meter semi-anechoic shielded enclosure. The interior shield to shield dimensions of the indoor semi-anechoic chamber are approximately 28 feet long by 20 feet wide by 17 feet 10 inches high.

Turntable and Ground Plane

The turntable is an electrically driven EMCO model 2088-1.53 with a 1.5 m diameter metal top and is capable of supporting 2200 lbs. An EMCO Model 2090 Multi-device Controller controls the turntable rotation with IEEE-488 data/control for automation.

The chamber's 6 inch raised ground plane consists of a continuous metallic surface with a vinyl top finish.

Antenna Mast

An EMCO Model 2071-2 electrically powered, air-polarized, antenna tower mast is used. It also is controlled by an EMCO Model 2090 Multi-device Controller with IEEE-488 data/control for automation.

Control Area

The control area is a RF shield enclosure attached to the semi-anechoic chamber with a connector panel for RF, fiber optic and control cables.

Quiet Zone and Test Range

The quiet zone for the 3m test range is a cylinder two (2) meters in diameter per volumetric quiet zone testing requirements specified in ANSI C63.4 1992.

Measuring Equipment and Calibration Information

Manufacturer	Item	Item Version/	Serial	CALIBRATION
Name	Name	Model #	Number	DUE DATE
	Description			
Rohde & Schwarz	EMI Test Receiver	ESI26	838386/010	2/28/2002
Hewlett Packard	EMC Analyzer	8593EM	US40240219	8/7/2001
Hewlett Packard	EMC Analyzer	8593EM	3536A00118	10/12/2001
Hewlett Packard	RF Amplifier	8347A	3307A01225	7/10/2001
Hewlett Packard	Pre-Amplifier	8449B	3008A00535	7/10/2001
A.H. Systems Inc.	DRG Horn Antenna	SAS-200/571	265	7/23/2001
A.H. Systems Inc.	DRG Horn Antenna	SAS-200/571	365	10/26/2001
Chase	Bilog Antenna	CBL6121	1008	6/12/2001
ETS	Log-Periodic Antenna	3148	1189	11/3/2003
ETS	Log-Periodic Antenna	3148	1188	11/3/2003
ETS	Biconical Antenna	3110B	3369	11/2/2003
ETS	Biconical Antenna	3110B	3370	11/2/2003
EMCO	Log-Periodic Antenna	3147	9311-1124	6/22/2001
Hewlett Packard	CDMA Mobile Test Set	E8285A	US39220601	10/15/2001
Hewlett Packard	TDMA Mobile Test Set	8920B	US39225370	1/24/2002
Hewlett Packard	TDMA Cellular Adaptor	83206A	US39402234	1/24/2002
Hewlett Packard	GSM Mobile Test Set	8922M	3639U01033	4/10/2002
Hewlett Packard	GSM DCS/PCS RF Interface	83220E	3639U01057	4/12/2002
Hewlett Packard	Signal Generator	83623B	3844A00935	6/26/2001
Hewlett Packard	Signal Generator	83623B	3844A01195	7/9/2001
Thermotron	Environmental Chamber	S-4	31580	12/20/2001

Does not include measurement equipment required for RF Power Output Test.

RF POWER OUTPUT

Measurement Procedure

The RF output port of the equipment under test is directly coupled to the input of a HPE4406A Vector Signal Analyzer through a 10dB passive attenuator, adaptor (if needed), and specialized RF connector. The peak power output is measured for all channels.

Measurement Results

800 MHz

ch 1013	24.85 dBm
ch 384	25.16 dBm
ch 779	25.05 dBm

1900 MHz

ch 25	27.33 dBm
ch 600	26.90 dBm
ch 1175	25.14 dBm

RADIATED RF POWER OUTPUT

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 AUT'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 CDMA 800 frequencies of (824.7, 836.52, and 848.37) and PCS 1900 frequencies (1851.25, 1880.0, and 1908.75).

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 and "always up". 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 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.

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

Measurement Results

800 MHz:

Maximum EIRP: 23.1 dBm
Maximum ERP: 21 dBm (0.13 Watt)

1900 MHz:

Maximum EIRP: 29.4 dBm (0.9 Watt)

OCCUPIED BANDWIDTH

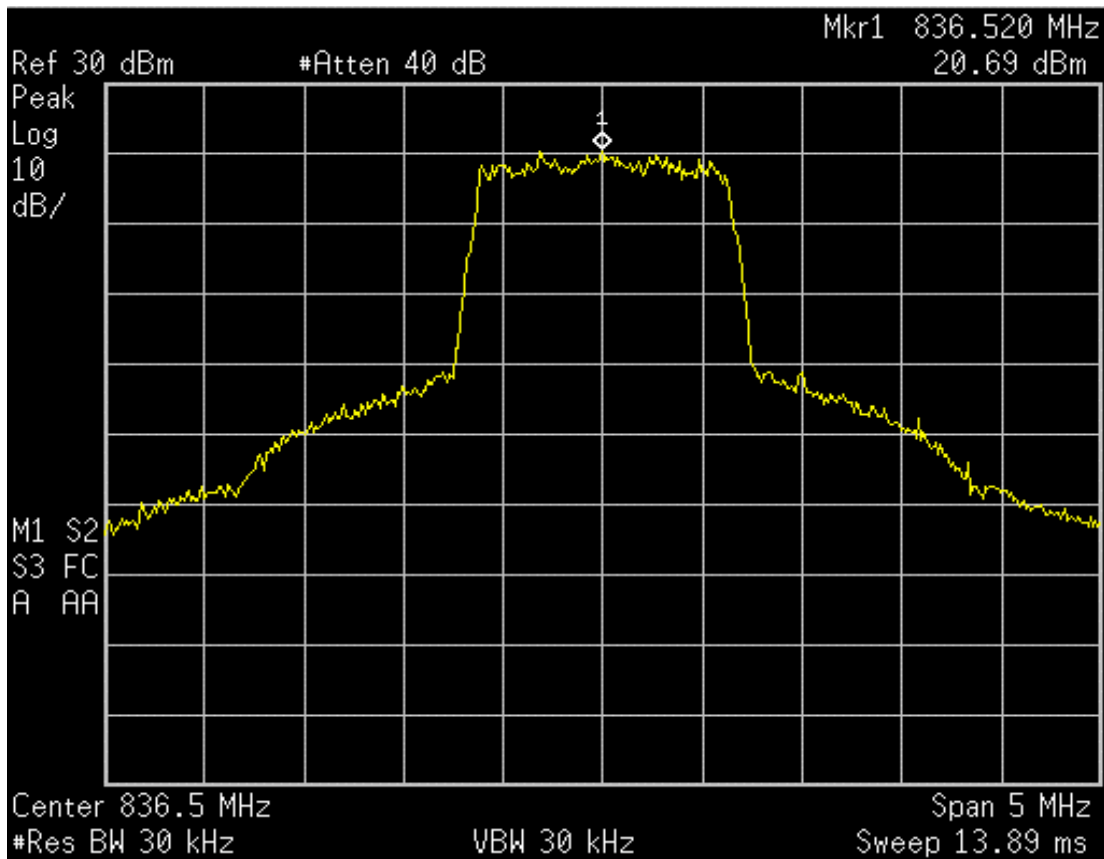
Measurement Procedure

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.

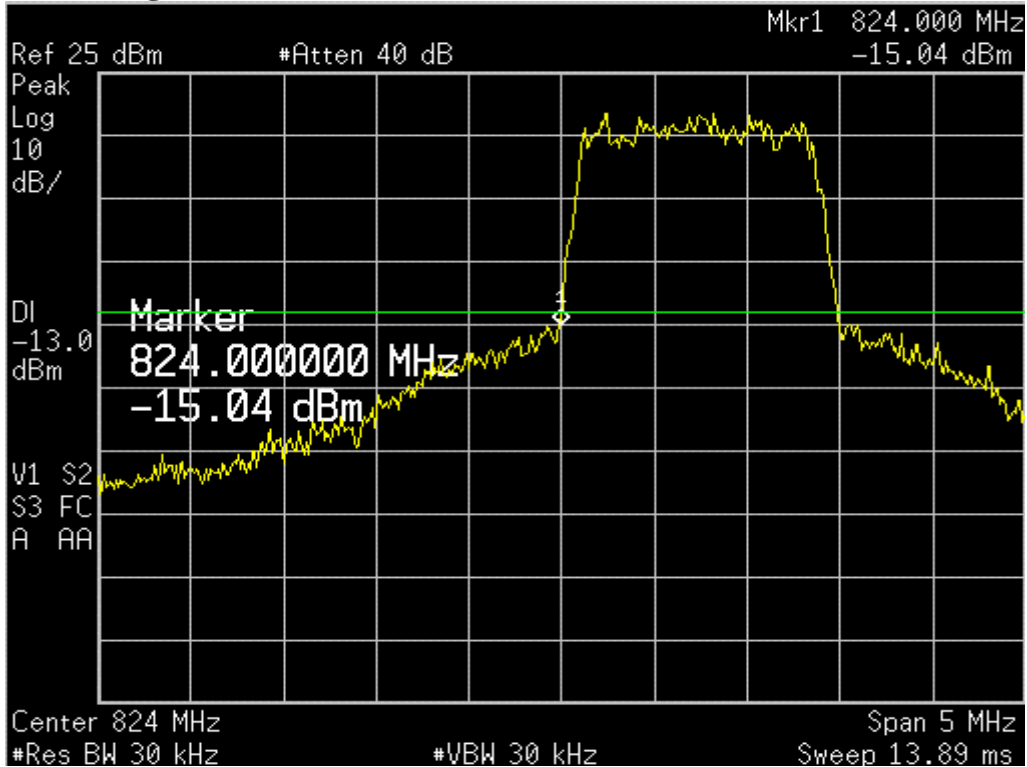
The middle channel within the designated frequency block was measured. For digital modulation, the lower and upper band edge plots are displayed.

Measurement Results

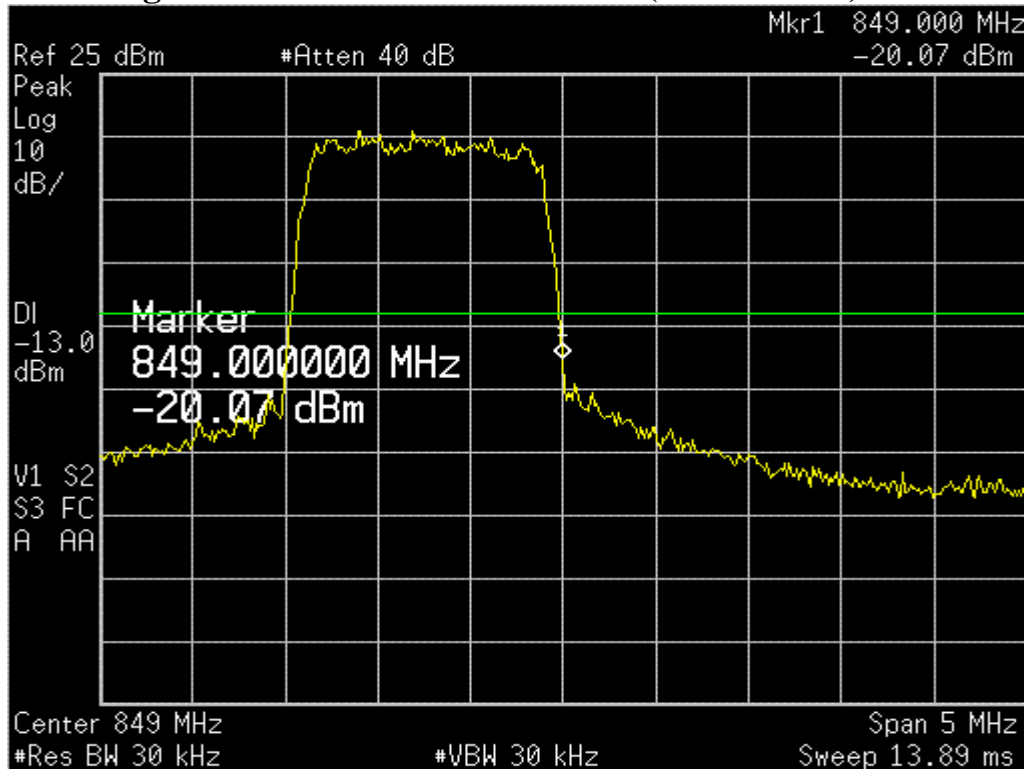
CDMA 800 – Channel 384



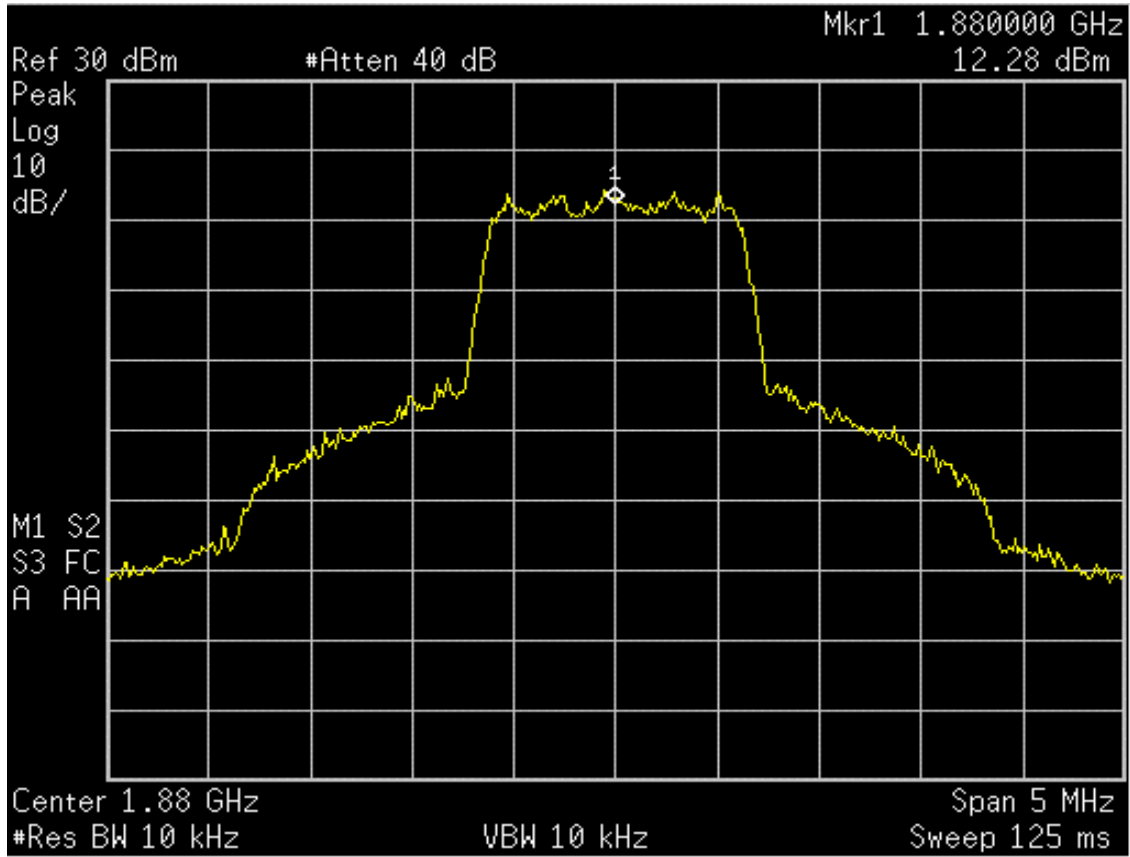
Lower Band Edge – CDMA 800 – Channel 1013 (824.7 MHz)



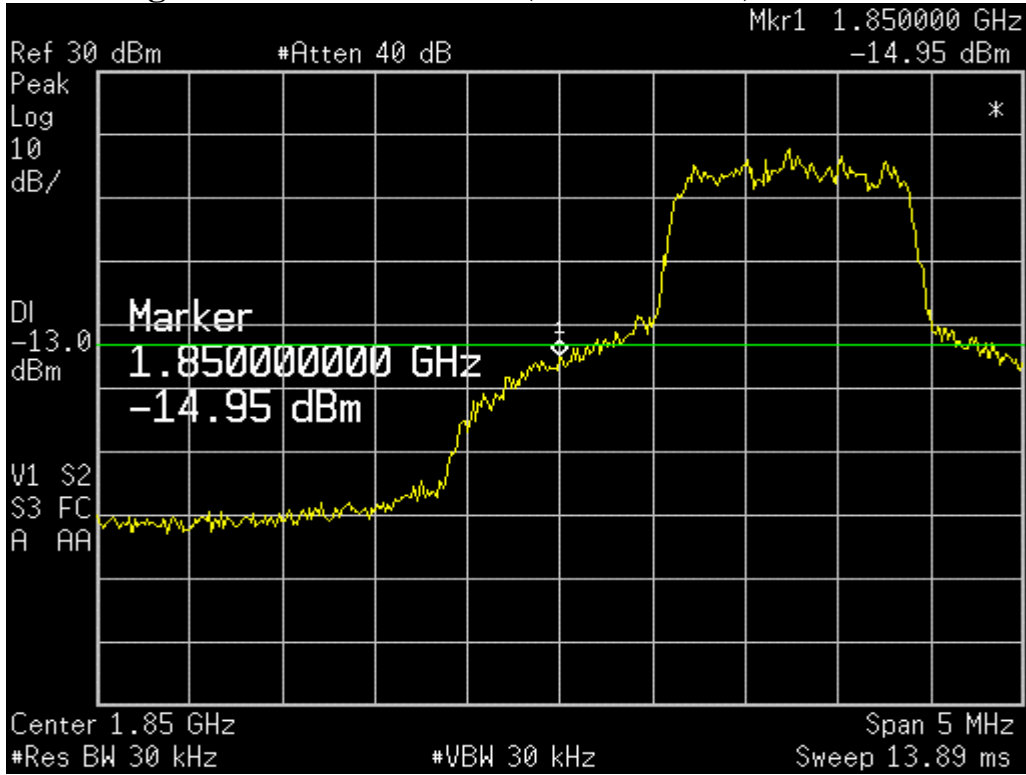
Upper Band Edge – CDMA 800 – Channel 777 (848.31 MHz)



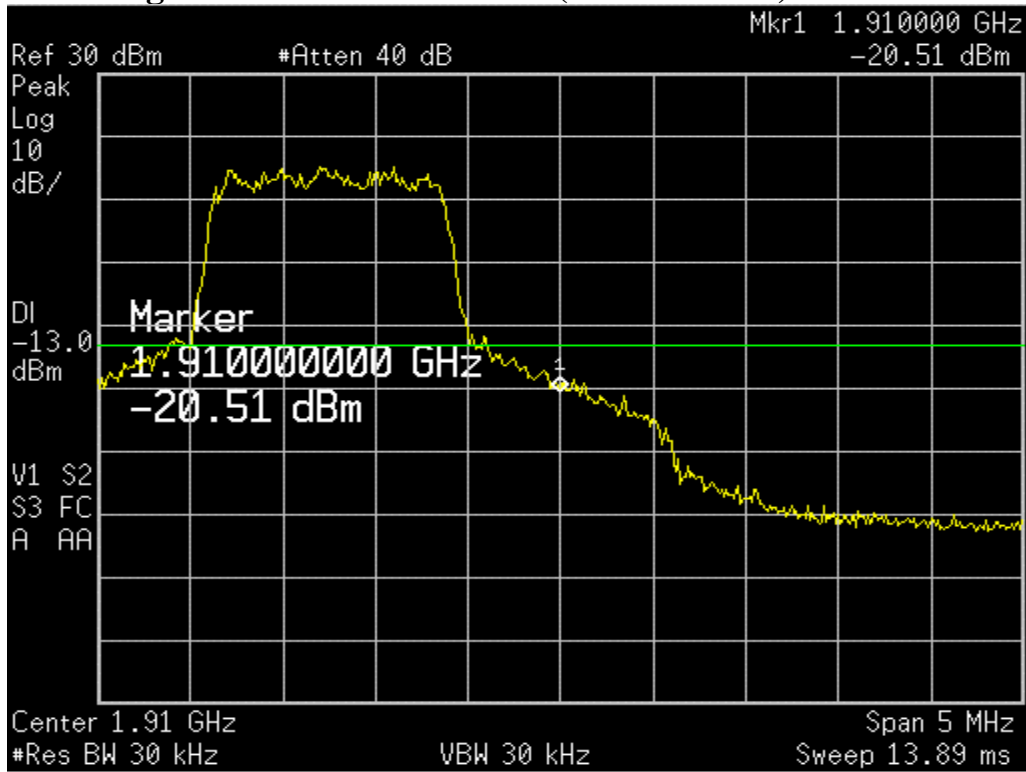
CDMA 1900 – Channel 600



Lower Band Edge – PCS – Channel 25 (1851.25 MHz)



Upper Band Edge – PCS – Channel 1175 (1908.75 MHz)



SPURIOUS EMISSIONS AT ANTENNA TERMINALS

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 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.

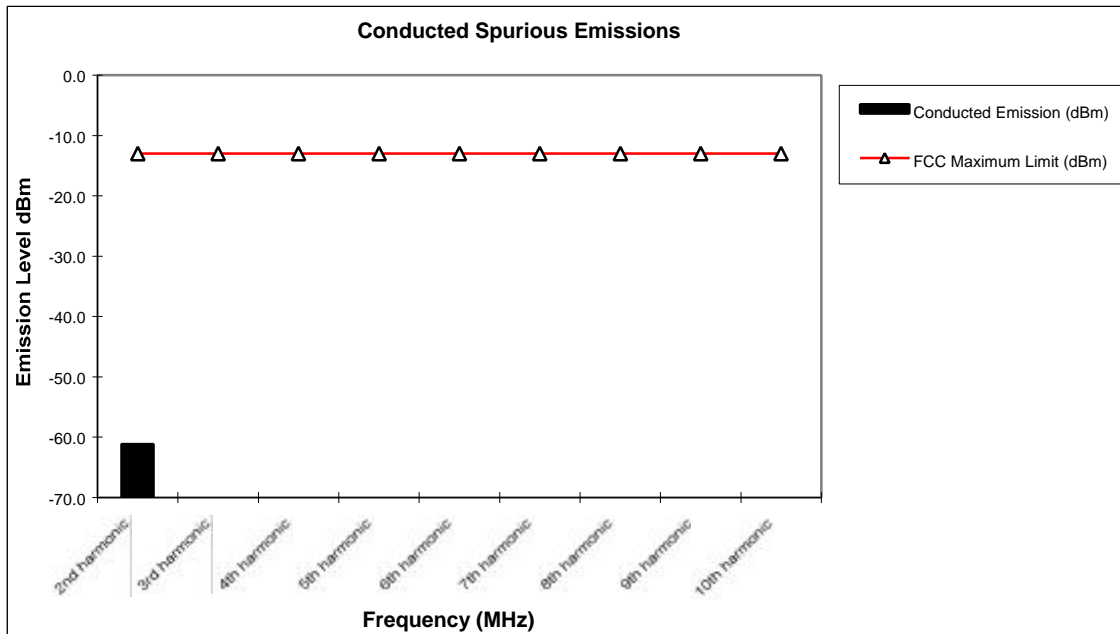
Measurement Results

See Following Page

Modulation: CDMA 800

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-61.2
3rd harmonic	-13	*
4th harmonic	-13	*
5th harmonic	-13	*
6th harmonic	-13	*
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



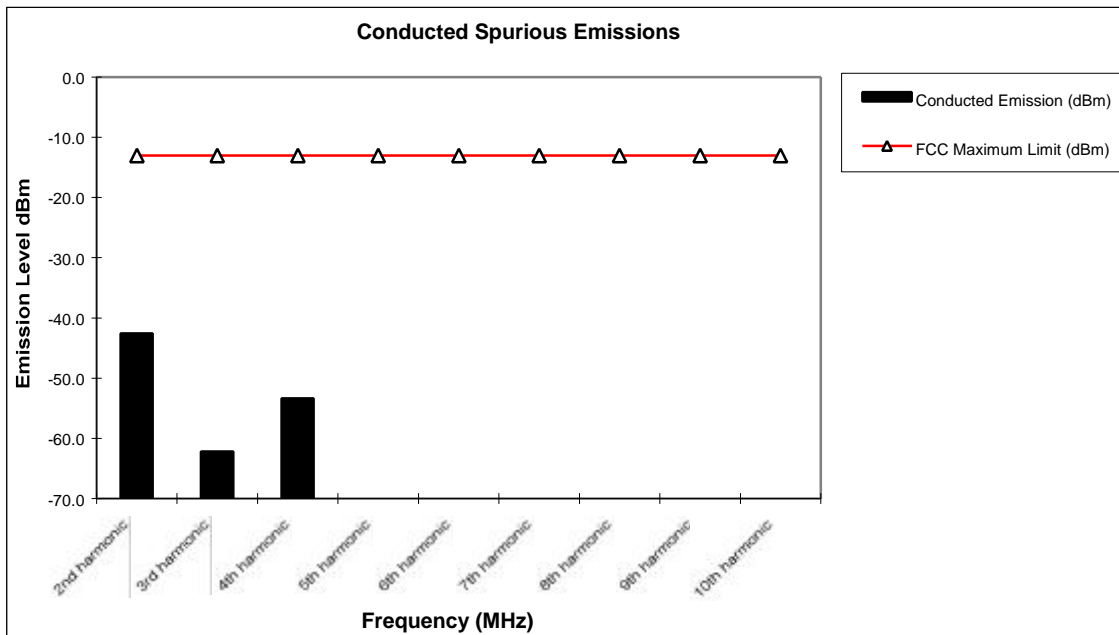
Notes:

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 kHz to the tenth harmonic of the fundamental.
4. No emissions were detected above -80dBm in the frequency range 869-894 MHz.

Modulation: CDMA 1900

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-42.6
3rd harmonic	-13	-62.2
4th harmonic	-13	-53.4
5th harmonic	-13	*
6th harmonic	-13	*
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



Notes:

- * Indicates the spurious emission could not be detected due to noise limitations or ambients.
- Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
- The Spectrum was investigated from 30 kHz to the tenth harmonic of the fundamental.
- No emissions were detected above -80dBm in the frequency range 1930-1990 MHz.

FIELD STRENGTH OF SPURIOUS EMISSIONS

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.

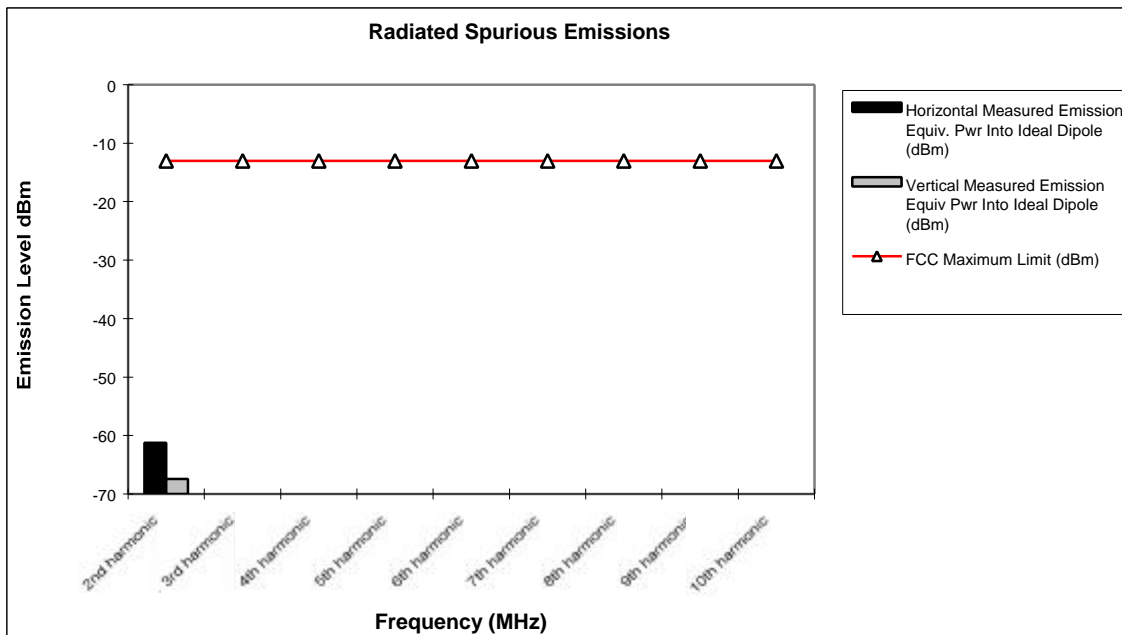
Measurement Results

See Following Page.

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	-61.3	-67.4
3rd harmonic	-13	*	*
4th harmonic	-13	*	*
5th harmonic	-13	*	*
6th harmonic	-13	*	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*



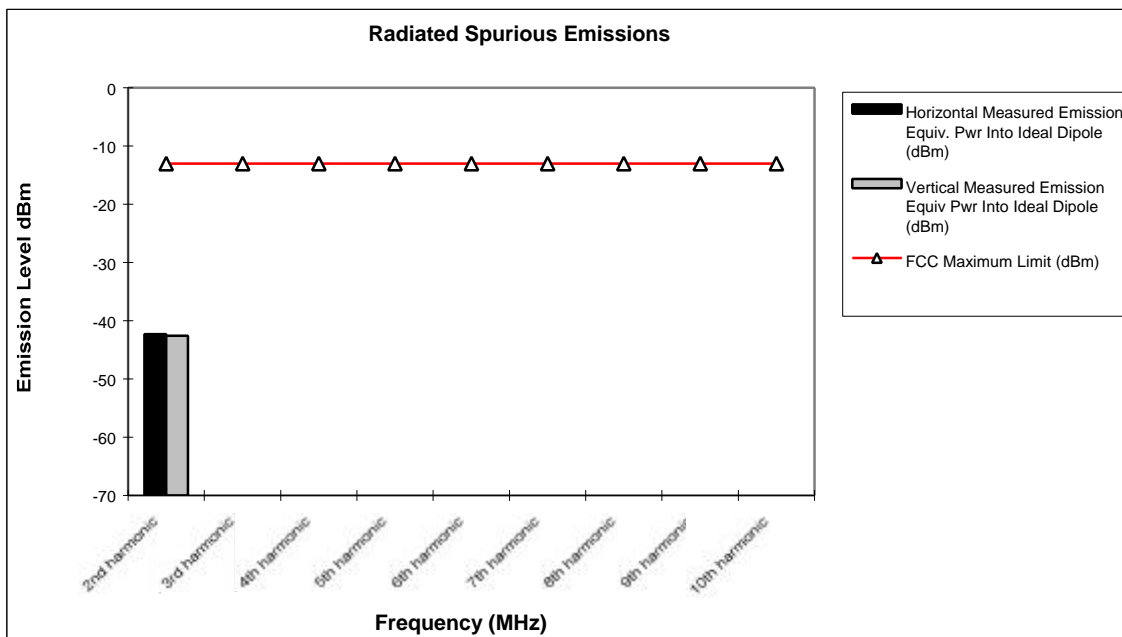
Notes:

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.

Modulation: CDMA 1900

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	-42.3	-42.6
3rd harmonic	-13	*	*
4th harmonic	-13	*	*
5th harmonic	-13	*	*
6th harmonic	-13	*	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*



Notes:

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

FREQUENCY STABILITY

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°C to $+60^{\circ}\text{C}$ and at intervals of 10°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

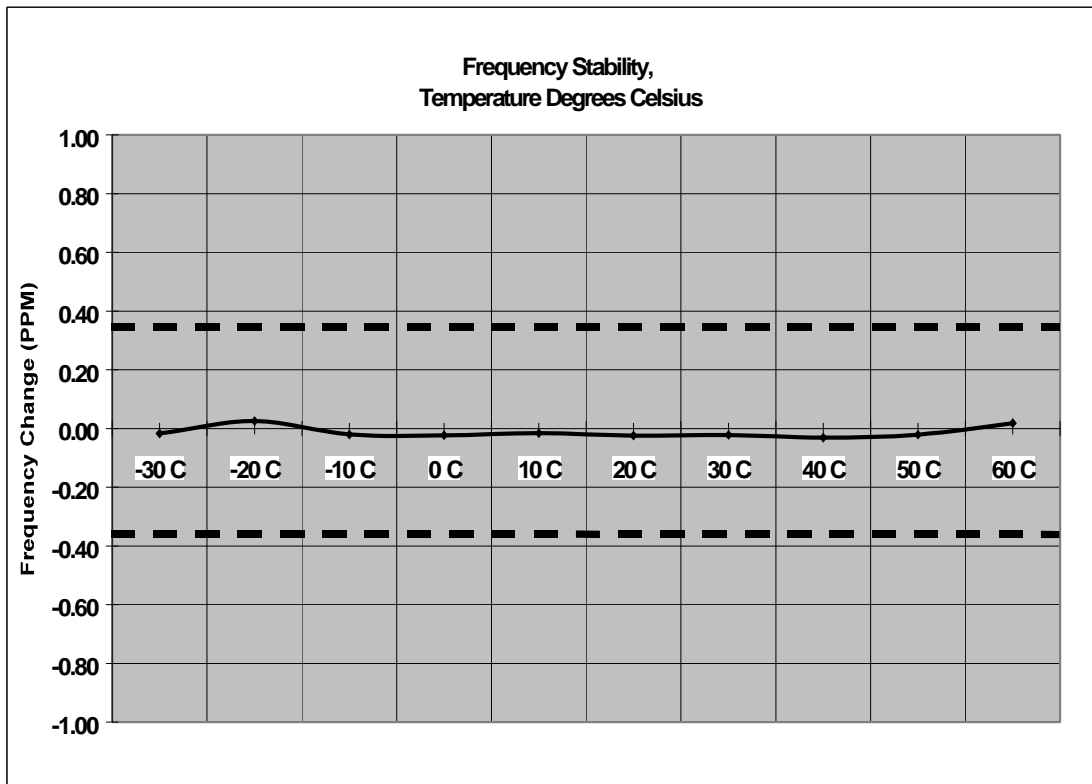
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Modulation: CDMA 800

Frequency Stability

Date: 15-Jun-01 **Operating Frequency:** 836.52
Mode: CDMA 800 **Deviation Limit (PPM):** 0.359
Channel: 384

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Power (VDC)
-30 C	-31.80	-0.017	100%	3.70
-20 C	47.60	0.026	100%	3.70
-10 C	-36.80	-0.020	100%	3.70
0 C	-42.30	-0.023	100%	3.70
10 C	-29.70	-0.016	100%	3.70
20 C	-44.00	-0.024	100%	3.70
30 C	-40.70	-0.022	100%	3.70
40 C	-56.40	-0.030	100%	3.70
50 C	-37.60	-0.020	100%	3.70
60 C	34.50	0.019	100%	3.70
20 C	41.70	0.023	Battery Endpoint	3.10

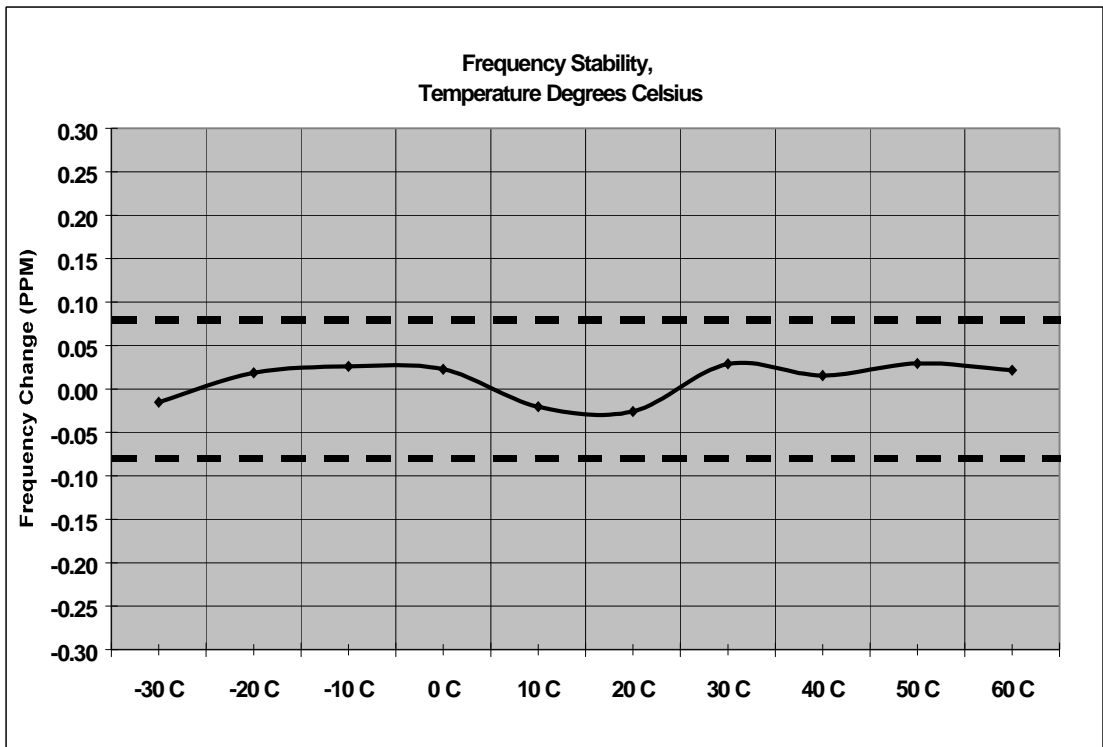


Modulation: CDMA 1900

Frequency Stability

Date: 15-Jun-01 **Operating Frequency:** 1880
Mode: CDMA 1900 **Deviation Limit (PPM):** 0.08
Channel: 600

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Power (VDC)
-30 C	-28.40	-0.015	100%	3.70
-20 C	34.60	0.019	100%	3.70
-10 C	48.10	0.026	100%	3.70
0 C	42.40	0.023	100%	3.70
10 C	-37.70	-0.020	100%	3.70
20 C	-47.50	-0.026	100%	3.70
30 C	53.30	0.029	100%	3.70
40 C	28.90	0.016	100%	3.70
50 C	54.80	0.030	100%	3.70
60 C	39.90	0.022	100%	3.70
20 C	46.40	0.025	Battery Endpoint	3.10



FIELD STRENGTH OF EMISSIONS FROM UNINTENTIONAL RADIATORS

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.

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

Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) - Amplifier Gain (dB) + Antenna Correction Factor (1/m)

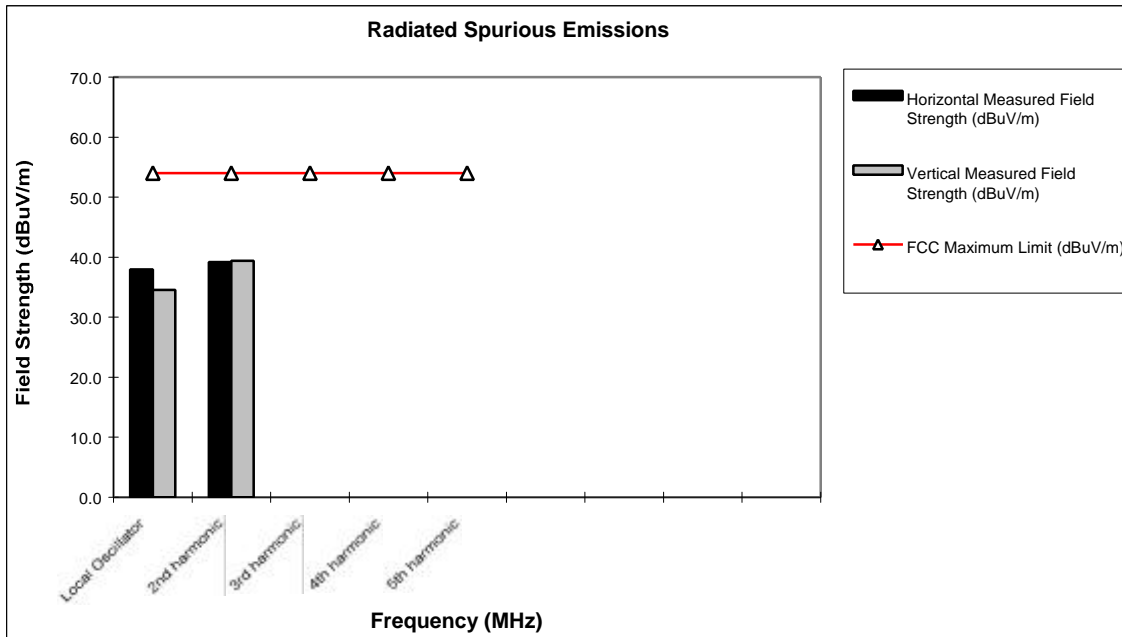
Measurement Results

See Following Page.

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	38.0	34.6
2nd harmonic	54	39.2	39.4
3rd harmonic	54	*	*
4th harmonic	54	*	*
5th harmonic	54	*	*



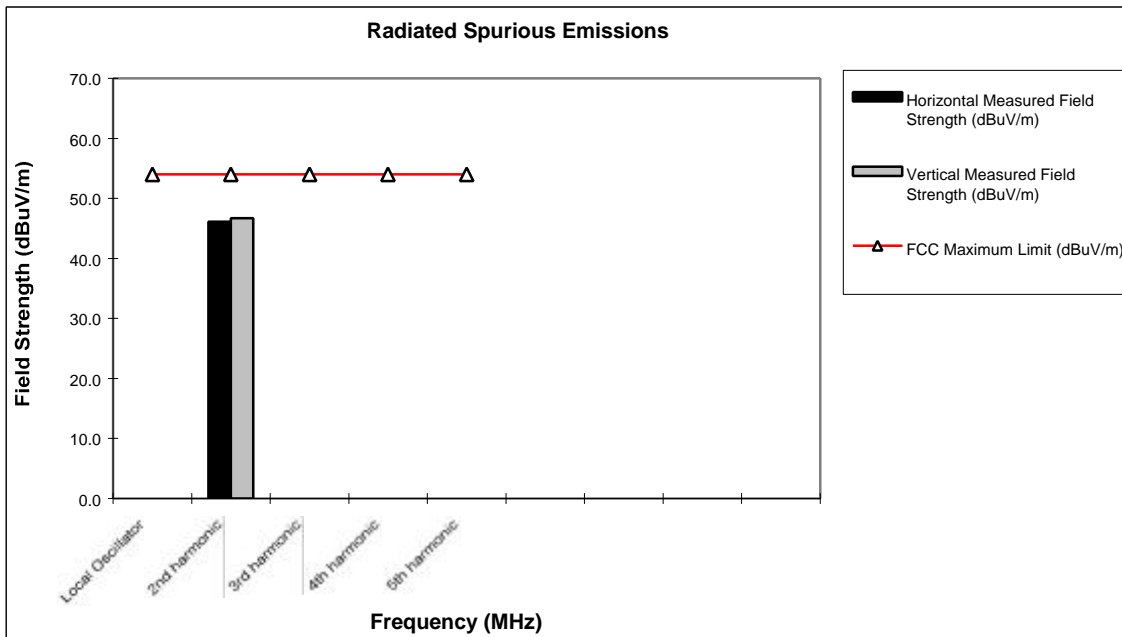
Notes:

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.

Modulation: CDMA 1900

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	*	*
2nd harmonic	54	46.1	46.7
3rd harmonic	54	*	*
4th harmonic	54	*	*
5th 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.