

PERSONAL COMMUNICATIONS SECTOR

PRODUCT SAFETY AND COMPLIANCE EMC LABORATORY

EMC TEST REPORT

Test Report Number - 10452-1

Report Date - March 31, 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: EMC Engineer

Date: 03/31/03

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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: DLS Electronic Systems, Inc.

166 South Carter

Genoa City, Wisconsin 53128

PH (262) 279-0210

FCC Registration Number: 90531 Industry Canada Number: IC2060-3

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, CDMA 1900

Model Number: V60p

Serial Numbers: A8EE64B6, A8EE64B3, A8EE64AF

A8EE64B2

Received Date: 3/24/2003

Testing Start Date: 3/24/2003

Testing Complete Date: 3/27/2003

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:

X Part 15 Subpart B – Unintentional Radiators
 X Part 22 Subpart H - Public Mobile Services
 X 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	Doog/Coil
#		Pass/Fail
1 2 3 4 5 6 7	RF Power Output ERP (Effective Radiated Power) Modulation Characteristics Occupied Bandwidth Spurious Emissions at Antenna Terminal Field Strength of Spurious Emissions Frequency Stability	NA NA Pass Pass Pass Pass
8	Field Strength of Spurious Emissions from Unintentional Radiators	Pass
Test #	Test Name	Margin with respect to the Limit
1 2 3 4 5 6 7	RF Power Output ERP (Effective Radiated Power) Modulation Characteristics Occupied Bandwidth Spurious Emissions at Antenna Terminal Field Strength of Spurious Emissions Frequency Stability	NA NA NA NA 24.6 dB 24.6 dB 128 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

Manufacturer Name	Item Name Description	Model #	Serial Number	Cal Due Date
Agilent	EMC Analyzer	E7405A	US539440191	11/06/03
Rohde&Schwarz	EMC Analyzer	ESI 40	837808/006	2/11/04
Miteq	Pre-Amplifier (1-10 GHz)	AMF-6D-010100-50	682425	5/8/03
Miteq	Pre-Amplifier (10-18 GHz)	AMF-6F-100200-50-10P	668382	5/8/03
Miteq	Pre-Amplifier (18-20 GHz)	AMF-8B-180265-40-10P	438727	8/26/03
EMCO	Horn Antenna (1-18GHz)	3115	9903-5731	4/3/03
EMCO	Horn Antenna (>18GHz)	3116	2549	4/2/03
EMCO	Bi-Con Antenna	3104C	9701-4785	2/12/04
EMCO	Log-Periodic Antenna	3146	9702-4895	2/13/04
Weinschel	Attenuator Kit – 10, 6 dB	AS6	6675	10/09/03
Thermotron	Environmental Chamber	S-4	31580	12/19/03
Hewlett Packard	System DC Power Supply	66311B	US38447252	10/18/03
Agilent	Wireless Communication Test Set	8960 Series 10	GB42360906	9/10/03
Hewlett Packard	Modulation Analyzer	8901B	2441A00395	5/17/03
Hewlett Packard	Audio Analyzer	8903A	2425A04111	5/17/03
Giga-tronics	Universal Power Meter	8652A	1836216	5/10/03
Giga-tronics	Power Sensor	80601A	1832030	5/23/03

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	27.76
836.52	27.78
848.97	27.85

CDMA 800

Frequency (MHz)	Power (dBm)
824.7	24.90
836.52	24.95
848.31	24.90

CDMA 1900

Frequency (MHz)	Power (dBm)
1851.25	24.90
1880.0	24.95
1908.75	24.96

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 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 AMPS 800 frequency (824.70) (836.52MHz)and (848.37) PCS 1900 frequency(1851.3) (1880.0) and (1908.75) and AMPS Analog frequency(824.04) (836.52 MHz) and (848.97) with antenna stubby.

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 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 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

AMPS 800 CDMA:

824.70 MHz: 24.03 dBm 836.52 MHz: 24.01 dBm 848.37 MHz: 23.37 dBm

PCS 1900 CDMA:

1851.30 MHz: 26.66 dBm 1880.00 MHz: 26.96 dBm 1908.75 MHz: 24.41 dBm

AMPS 800 Analog:

824.04 MHz: 23.78 dBm 836.52 MHz: 23.53 dBm 848.97 MHz: 23.44 dBm

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

Max EIRP is 23.78 dBm in AMPS 800 mode (max **ERP is 21.68 dBm, 0.15W**). Max EIRP is 24.03 dBm in CDMA 800 mode (max **ERP is 21.93 dBm, 0.16W**). Max **EIRP is 26.96 dBm, 0.5W** in PCS 1900 mode (max ERP is 24.86 dBm).

EXHIBIT 6

MODULATION CHARACTERISTICS

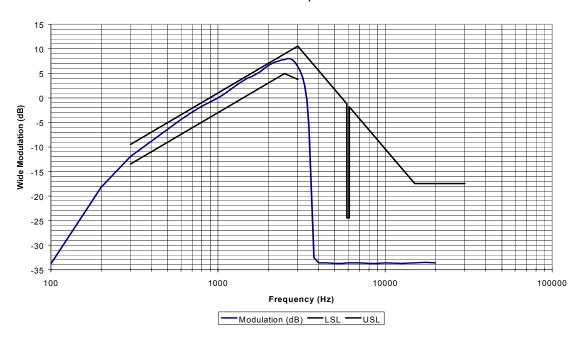
CFR Part 2.1047, 22.915

Measurement Results - AMPS

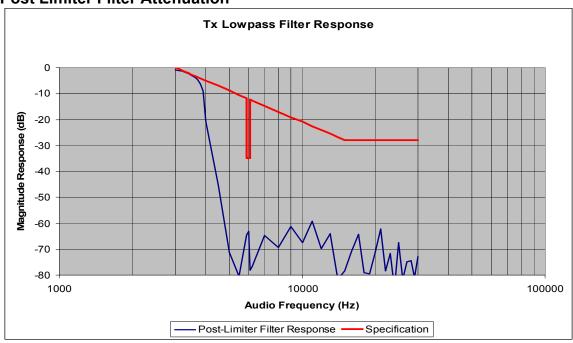
* Data supplied by product group

Transmit Audio Frequency Response

Tx Audio Response



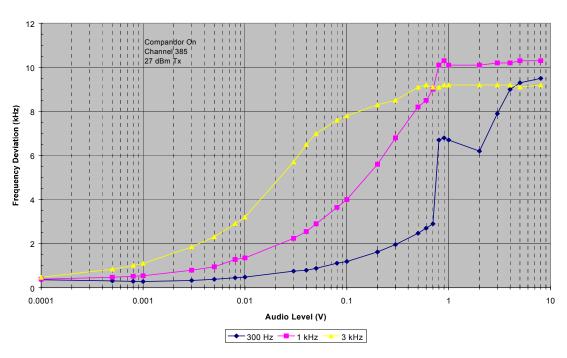
Post Limiter Filter Attenuation



Modulation Limiting vs. Modulation Input Voltage

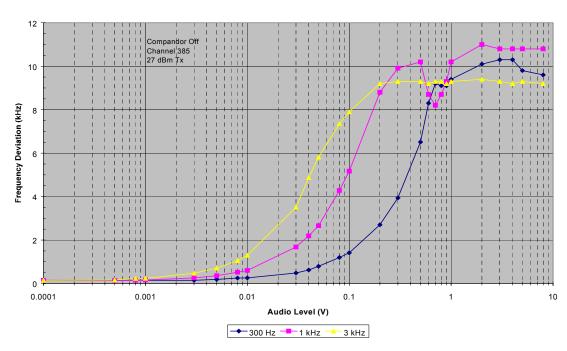
Compandor On

Frequency Deviation Characteristic



Compandor Off

Frequency Deviation Characteristic



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.

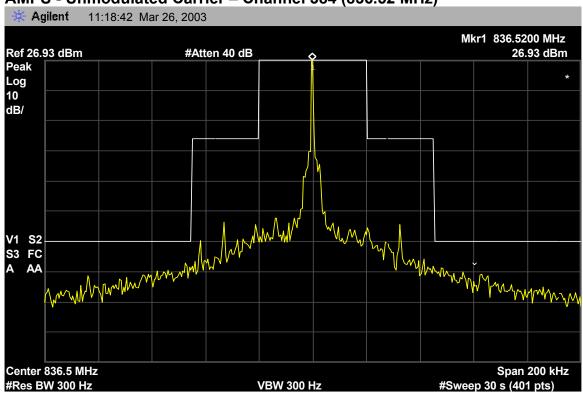
The middle channel within the designated frequency block was measured. For digital modulation, the lower and upper band edge plots are displayed.

Measurement Results

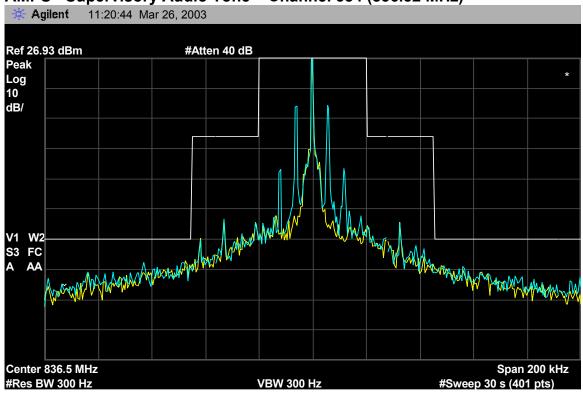
Attached

<u>Measurement Results – AMPS</u>

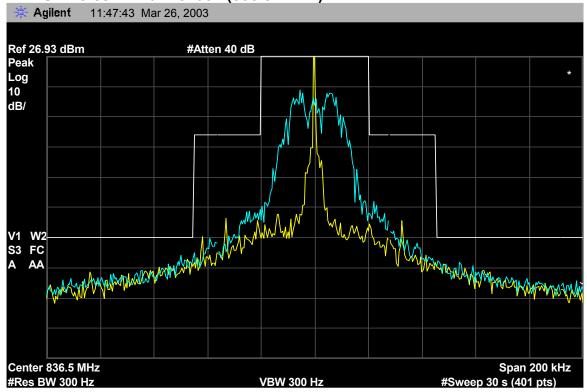
AMPS - Unmodulated Carrier – Channel 384 (836.52 MHz)



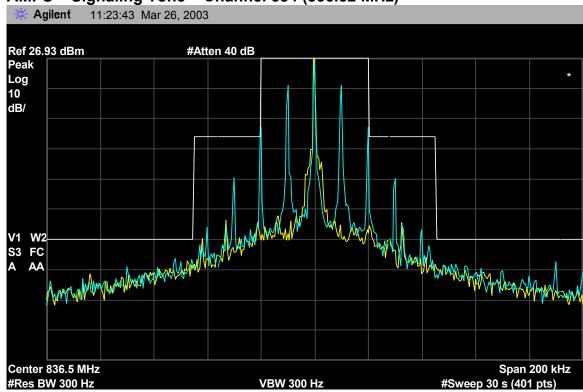
AMPS - Supervisory Audio Tone - Channel 384 (836.52 MHz)



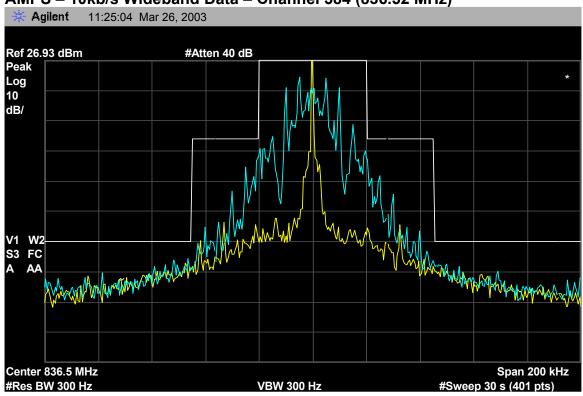
AMPS - Voice - Channel 384 (836.52 MHz)



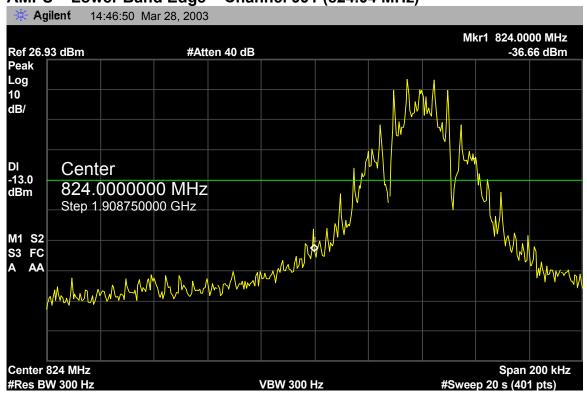
AMPS - Signaling Tone - Channel 384 (836.52 MHz)



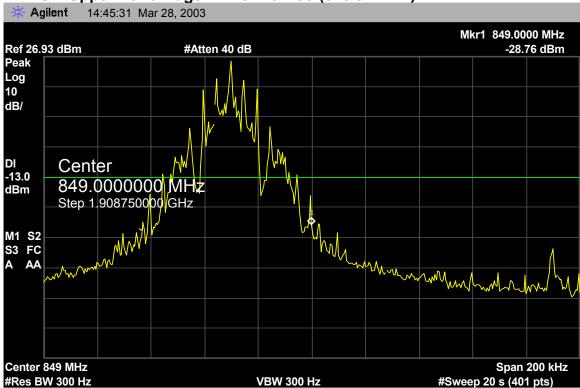
AMPS – 10kb/s Wideband Data – Channel 384 (836.52 MHz)



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

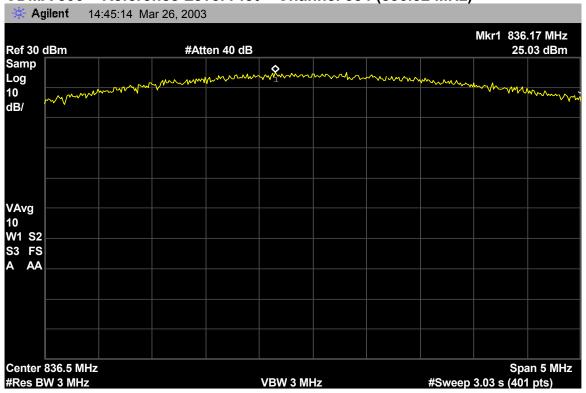


AMPS – Upper Band Edge – Channel 799 (848.97 MHz)

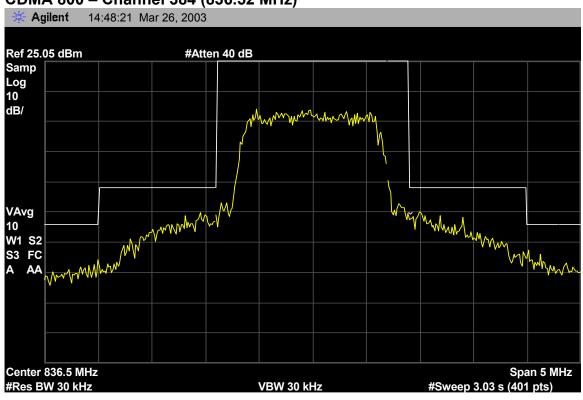


Measurement Results - CDMA 800

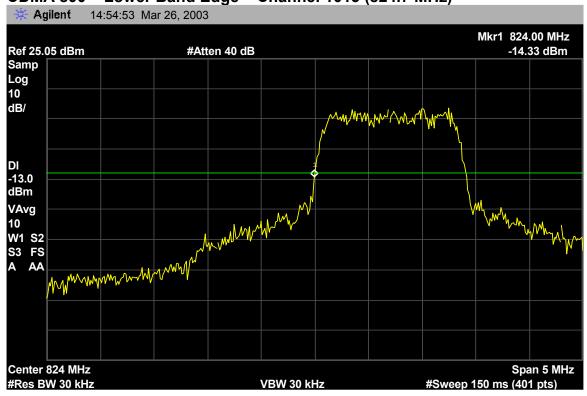
CDMA 800 – Reference Level Plot – Channel 384 (836.52 MHz)



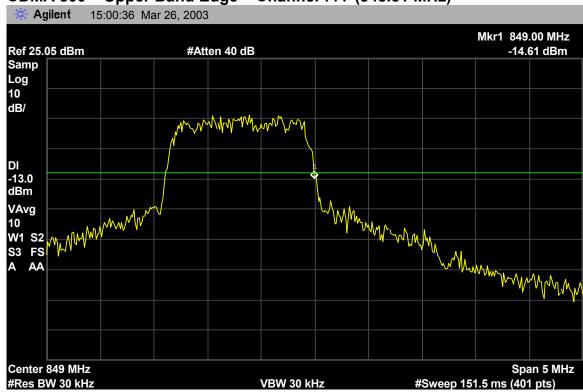
CDMA 800 – Channel 384 (836.52 MHz)



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

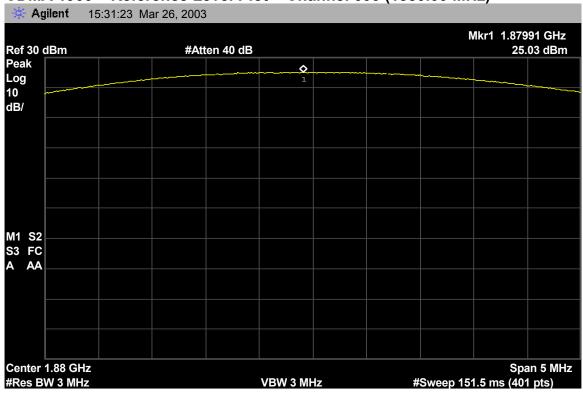


CDMA 800 – Upper Band Edge – Channel 777 (848.31 MHz)

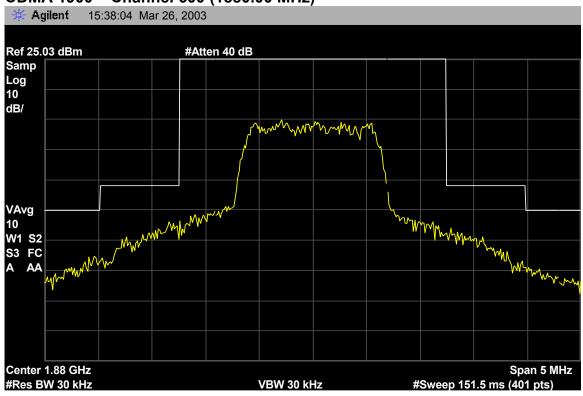


Measurement Results - CDMA 1900

CDMA 1900 - Reference Level Plot - Channel 600 (1880.00 MHz)



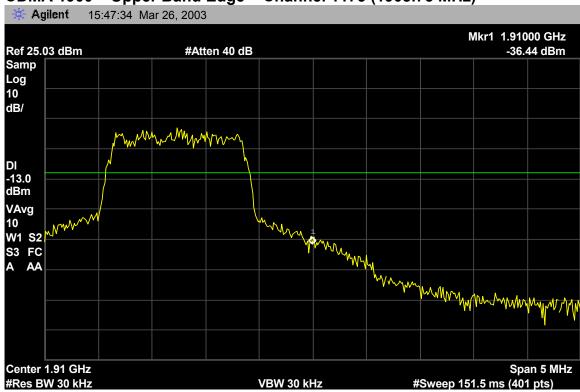
CDMA 1900 - Channel 600 (1880.00 MHz)



CDMA 1900 – Lower Band Edge – Channel 25 (1851.25 MHz)



CDMA 1900 – Upper Band Edge – Channel 1175 (1908.75 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.

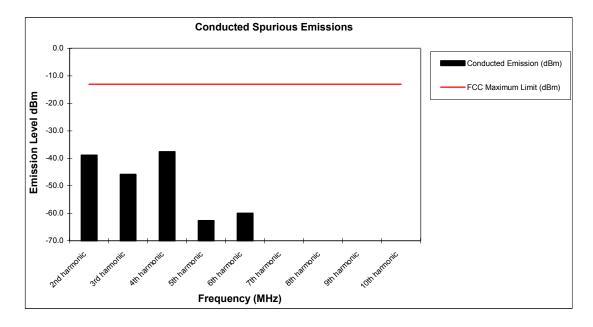
Measurements were made at the middle channel within the frequency band and within the base station frequency range (869-894 MHz) for cellular.

Measurement Results

Attached

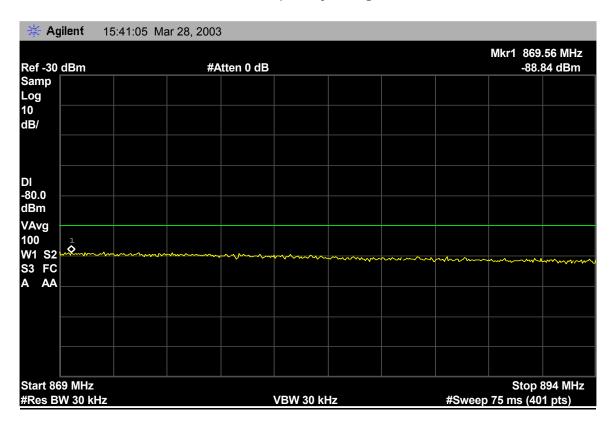
Measurement Results Modulation: AMPS

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-38.8
3rd harmonic	-13	-45.8
4th harmonic	-13	-37.6
5th harmonic	-13	-62.7
6th harmonic	-13	-60.0
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



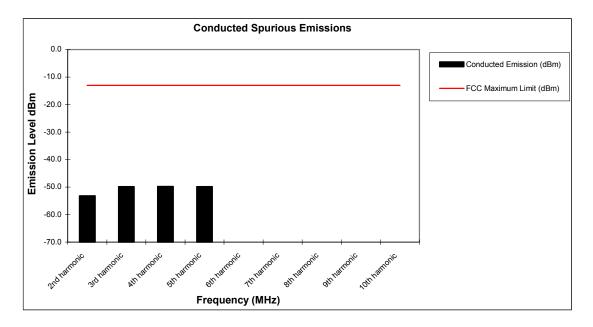
- 1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
- 2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
- 3. The Spectrum was investigated from 9 kHz to the tenth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

AMPS – Cellular Base Station Frequency Range



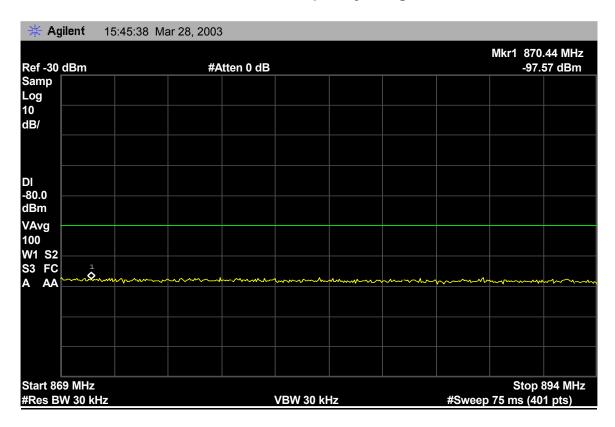
Measurement Results Modulation: CDMA 800

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-53.1
3rd harmonic	-13	-49.8
4th harmonic	-13	-49.8
5th harmonic	-13	-49.8
6th harmonic	-13	*
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



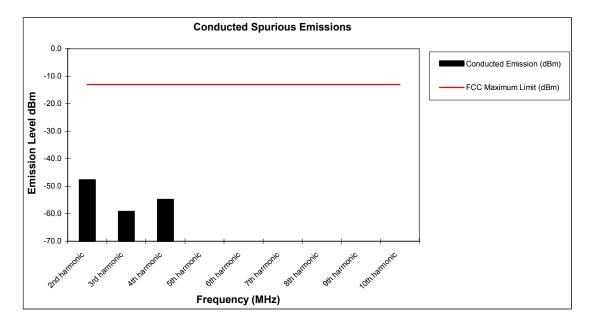
- 1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
- 2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
- 3. The Spectrum was investigated from 9 kHz to the tenth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

CDMA 800 - Cellular Base Station Frequency Range



Measurement Results Modulation: CDMA 1900

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-47.7
3rd harmonic	-13	-59.2
4th harmonic	-13	-54.8
5th harmonic	-13	*
6th harmonic	-13	*
7th harmonic	-13	*
8th harmonic	-13	*
9th harmonic	-13	*
10th harmonic	-13	*



- 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

An Open Air Test Site was used to measure all radiated emissions. The equipment under test is placed 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 maximum emission was recorded appropriately.

A fully charged battery was used for the supply voltage.

Photographs of the radiated test set-up are enclosed in Appendix A.

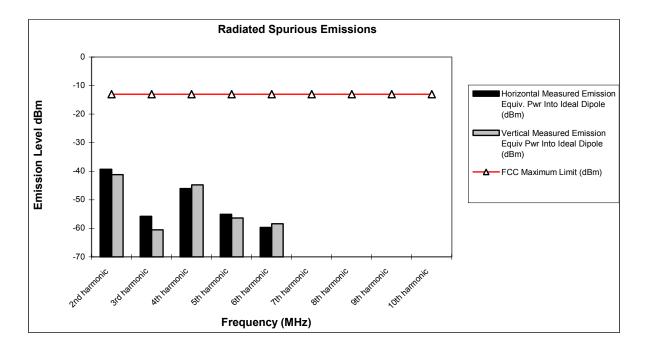
Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) – Amplifier Gain (dB) + Antenna Correction Factor (1/m)

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	-39.3	-41.2
3rd harmonic	-13	-55.8	-60.5
4th harmonic	-13	-46.1	-44.8
5th harmonic	-13	-55.1	-56.4
6th harmonic	-13	-59.7	-58.4
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*

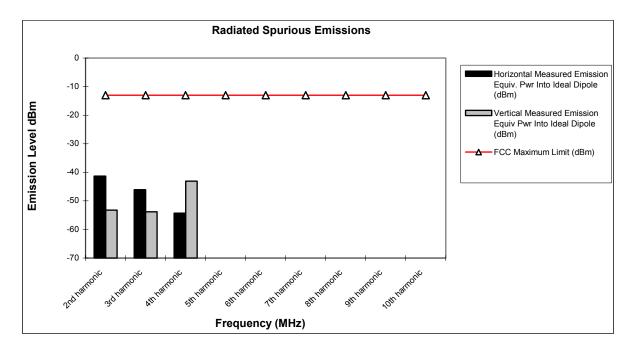


- 1. * Indicates the spurious emission could not be detected due to noise limitations or ambients.
- 2. Each emission reported reflects the highest absolute level at the specific harmonic for the low, and high channels at maximum power.
- 3. The Spectrum was investigated from 30 MHz to the tenth harmonic 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	-41.3	-53.2
3rd harmonic	-13	-46.1	-53.8
4th harmonic	-13	-54.3	-43.1
5th harmonic	-13	*	*
6th harmonic	-13	*	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*

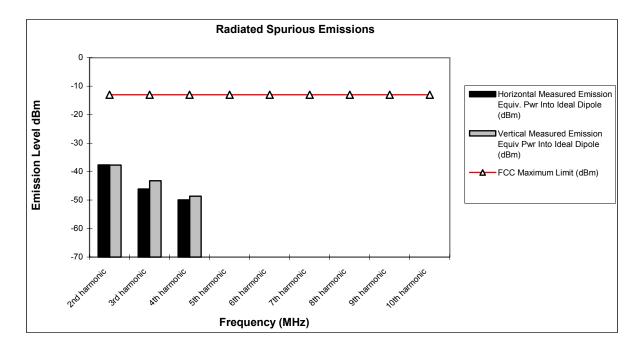


Notae:

- 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 1900

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	-37.6	-37.7
3rd harmonic	-13	-46.1	-43.2
4th harmonic	-13	-49.9	-48.6
5th harmonic	-13	*	*
6th harmonic	-13	*	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*



- 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° C to +60° 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

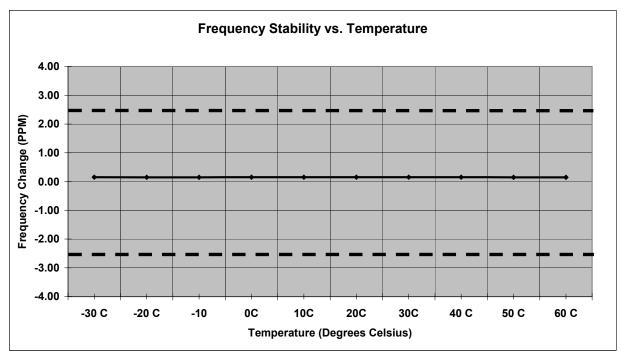
Attached

Measurement Results Modulation: AMPS

Frequency Stability

Mode:AnalogOperating Frequency:833.52 MHzChannel:284Deviation Limit (PPM):2.5ppm

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
С	HZ	(PPM)	(%)	(VDC)
-30 C	127.00	0.152	100%	3.60
-20 C	123.00	0.147	100%	3.60
-10	124.00	0.148	100%	3.60
0C	126.00	0.151	100%	3.60
10C	128.00	0.153	100%	3.60
20C	125.00	0.149	100%	3.60
30C	126.00	0.151	100%	3.60
40 C	125.00	0.149	100%	3.60
50 C	124.00	0.148	100%	3.60
60 C	123.00	0.147	100%	3.60
20 C	123.00	0.147	Battery Endpoint	3.20



Measurement Results

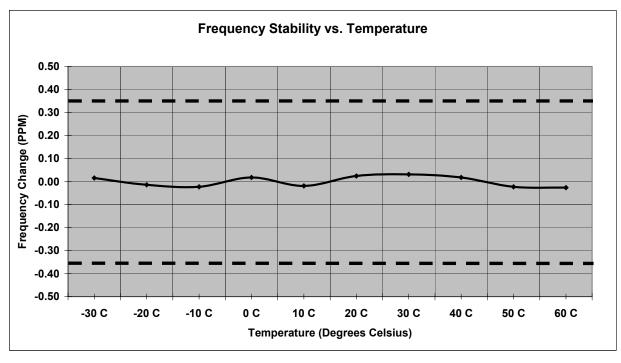
Modulation: CDMA 800

Frequency Stability

Mode: CDMA 800 Operating Frequency: 833.52 MHz

Channel: 284 Deviation Limit (PPM): 0.359ppm (+/-300 Hz)

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
С	HZ	(PPM)	(%)	(VDC)
-30 C	12.67	0.015	100%	3.60
-20 C	-11.80	-0.014	100%	3.60
-10 C	-19.00	-0.023	100%	3.60
0 C	15.00	0.018	100%	3.60
10 C	-16.00	-0.019	100%	3.60
20 C	20.00	0.024	100%	3.60
30 C	26.00	0.031	100%	3.60
40 C	15.00	0.018	100%	3.60
50 C	-19.00	-0.023	100%	3.60
60 C	-22.00	-0.026	100%	3.60
				•
20 C	-20.00	-0.024	Battery Endpoint	3.20

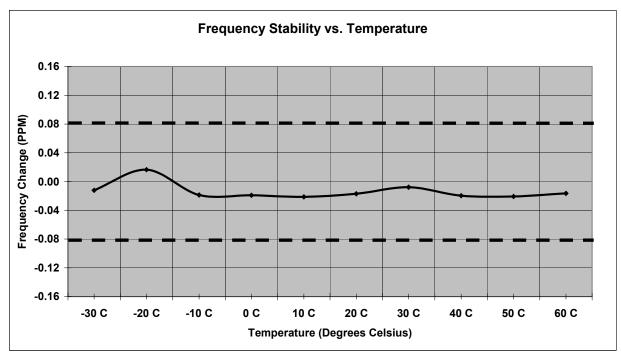


Measurement Results Modulation: CDMA 1900

Frequency Stability

Mode: CDMA 1900 Operating Frequency: 1880.0 MHz
Channel: 600 Deviation Limit (PPM): 0.08ppm (+/-150Hz)

Temperature	Frequency Error	Frequency Error	Voltage	Voltage
С	HZ	(PPM)	(%)	(VDC)
-30 C	-23.00	-0.012	100%	3.60
-20 C	31.00	0.016	100%	3.60
-10 C	-35.00	-0.019	100%	3.60
0 C	-36.00	-0.019	100%	3.60
10 C	-40.00	-0.021	100%	3.60
20 C	-32.00	-0.017	100%	3.60
30 C	-14.70	-0.008	100%	3.60
40 C	-37.00	-0.020	100%	3.60
50 C	-39.00	-0.021	100%	3.60
60 C	-31.00	-0.016	100%	3.60
20 C	-22.00	-0.012	Battery Endpoint	3.20



FIELD STRENGTH OF EMISSIONS FROM UNINTENTIONAL RADIATORS

CFR Part 15.109

Measurement Procedure

An Open Air Test Site was used to measure all radiated emissions. The equipment under test is placed 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.

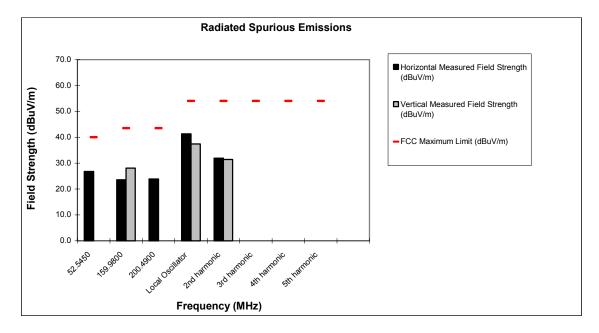
Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) Amplifier Gain (dB) + Antenna Correction Factor (1/m)

Measurement Results

Attached

Measurement Results Modulation: AMPS

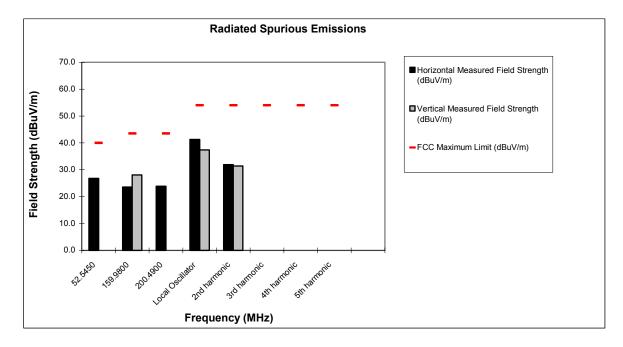
Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
52.5450	40	26.8	*
159.9800	43.5	23.6	28.1
200.4900	43.5	23.9	*
Local Oscillator	54	41.3	37.4
2nd harmonic	54	31.9	31.4
3rd harmonic	54	*	*
4th harmonic	54	*	*
5th harmonic	54	*	*



- 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 and high channels.

Measurement Results Modulation: CDMA 800

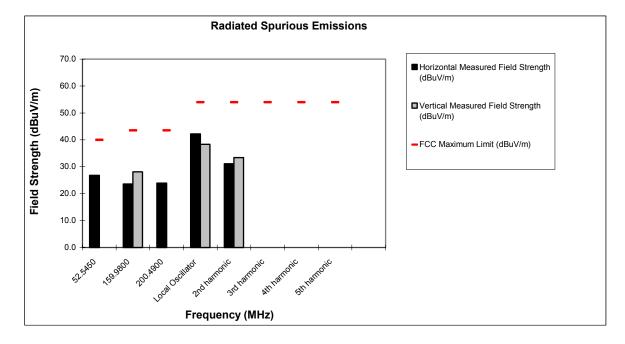
Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
52.5450	40	26.8	*
159.9800	43.5	23.6	28.1
200.4900	43.5	23.9	*
Local Oscillator	54	41.3	37.4
2nd harmonic	54	31.9	31.4
3rd harmonic	54	*	*
4th harmonic	54	*	*
5th harmonic	54	*	*



- 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 and high channels.

Measurement Results Modulation: CDMA 1900

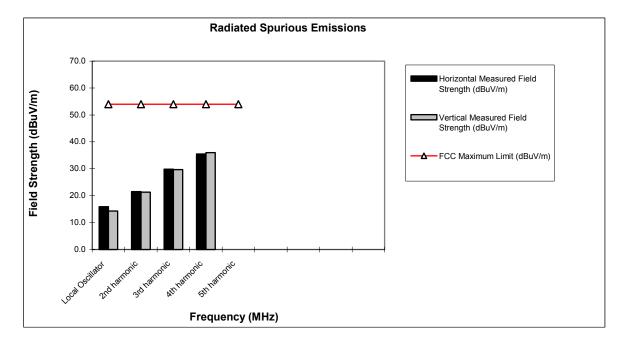
Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
52.5450	40	26.8	*
159.9800	43.5	23.6	28.1
200.4900	43.5	23.9	*
Local Oscillator	54	42.2	38.3
2nd harmonic	54	31.1	33.4
3rd harmonic	54	*	*
4th harmonic	54	*	*
5th harmonic	54	*	*



- 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 and high channels.

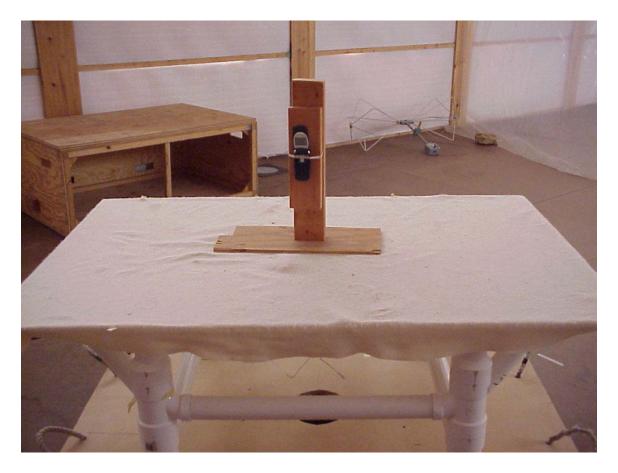
<u>Measurement Results</u> Modulation: GPS Mode Only

Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
Local Oscillator	54	15.9	14.3
2nd harmonic	54	21.5	21.3
3rd harmonic	54	29.8	29.7
4th harmonic	54	35.5	36.0
5th harmonic	54	*	*



- 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 and high channels.

Appendix A – Radiated Emissions Test Setup Photo(s)



A.1 Radiated Emissions Measurement

End of Test Report