



MOTOROLA

PERSONAL COMMUNICATIONS SECTOR

**PRODUCT SAFETY AND COMPLIANCE
EMC LABORATORY**

EMC TEST REPORT

Test Report Number – 11559-1

Report Date – July 22, 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 : 07/22/03

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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) 523-3642 Fax (847) 523-8274
FCC Registration Number: 316588
Industry Canada Number: 46405-3908

Tests Requested By: Motorola Inc.
Personal Communications Sector
600 North US Hwy 45
Libertyville, IL 60048

Product Type: Cellular Phone

Signaling Capability: CDMA 1900

Model Number: C210

Serial Numbers: 3D5FE456, 3D5FE44F, 3D5FE3E7
3D5FE3ED

Received Date: 7/14/2003

Testing Start Date: 7/16/2003

Testing Complete Date: 7/21/2003

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	Occupied Bandwidth	Pass
4	Spurious Emissions at Antenna Terminal	Pass
5	Field Strength of Spurious Emissions	Pass
6	Frequency Stability	Pass
7	Field Strength of Emissions From Unintentional Radiators	Pass

Test #	Test Name	Margin with respect to the Limit
1	RF Power Output	NA
2	ERP (Effective Radiated Power)	NA
3	Occupied Bandwidth	See Plots
4	Spurious Emissions at Antenna Terminal	10.7 dB
5	Field Strength of Spurious Emissions	6.4 dB
6	Frequency Stability	71.4 Hz
7	Field Strength of Emissions From Unintentional Radiators	1.2 dB

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	Calibration Due Date
Agilent	EMC Analyzer	E7405A	US40240219	04/04/2004
Agilent	EMC Analyzer	E7405A	US39440191	06/11/2003
Rohde & Schwarz	S/A	ESI26	838786/010	04/29/2004
ETS	Horn Antenna 1-18GHz	3115	6222	09/30/2003
A.H. System	Horn Antenna 1-18GHz	SAS-200/571	265	04/29/2004
ETS	Bi-Con Antenna 30-300MHz	3110B	3370	10/25/2003
ETS	Log-Periodic Antenna	3148	1189	04/29/2004
Weinschel	Attenuator Kit – 10, 6 dB	2	AS6-6677	10/09/2003
Weinschel	Attenuator Kit – 10, 6 dB	2	AS6-6675	10/11/2003
Thermotron	Environmental Chamber	S4	31580	12/19/2003
Hewlett Packard	1 – 26.5 GHz Preamplifier	8449B	3008A00535	10/11/2003
Hewlett Packard	1 – 26.5 GHz Preamplifier	8449B	3008A01442	06/18/2004
Hewlett Packard	0.1 - 1300 MHz Amplifier	8447F	2805A03419	06/19/2004
Hewlett Packard	CDMA Mobile Test Set	8924C	US38513585	05/02/2004
Hewlett Packard	System DC Power Supply	66311B	US38447252	10/18/2003
Hewlett Packard	PCS Interface	83236B	3711J04427	05/02/2004
Agilent	Wireless Communication Test Set	8960 Series 10	GB42360906	09/10/2003
Giga-tronics	Universal Power Meter	8652A	8650494	1/7/2004
Giga-tronics	Power Sensor	80701A	1833992	12/12/2003

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

CDMA 1900

Frequency (MHz)	Power (dBm)
1851.25	25.10
1880.00	24.98
1908.75	25.05

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 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 on PCS 1900 (1851.25, 1880, and 1908.75 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 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 maximum radiated power follow, as EIRP in dBm. To get ERP (effective radiated power referenced to a half-wave dipole), subtract 2.1 dB from these values.

Measurement Results

PCS 1900 CDMA:

1851.25 MHz:	22.07 dBm
1880.0 MHz:	21.25 dBm
1908.75 MHz:	22.32 dBm

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

Maximum EIRP in 1900 CDMA mode is 22.32 dBm

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.

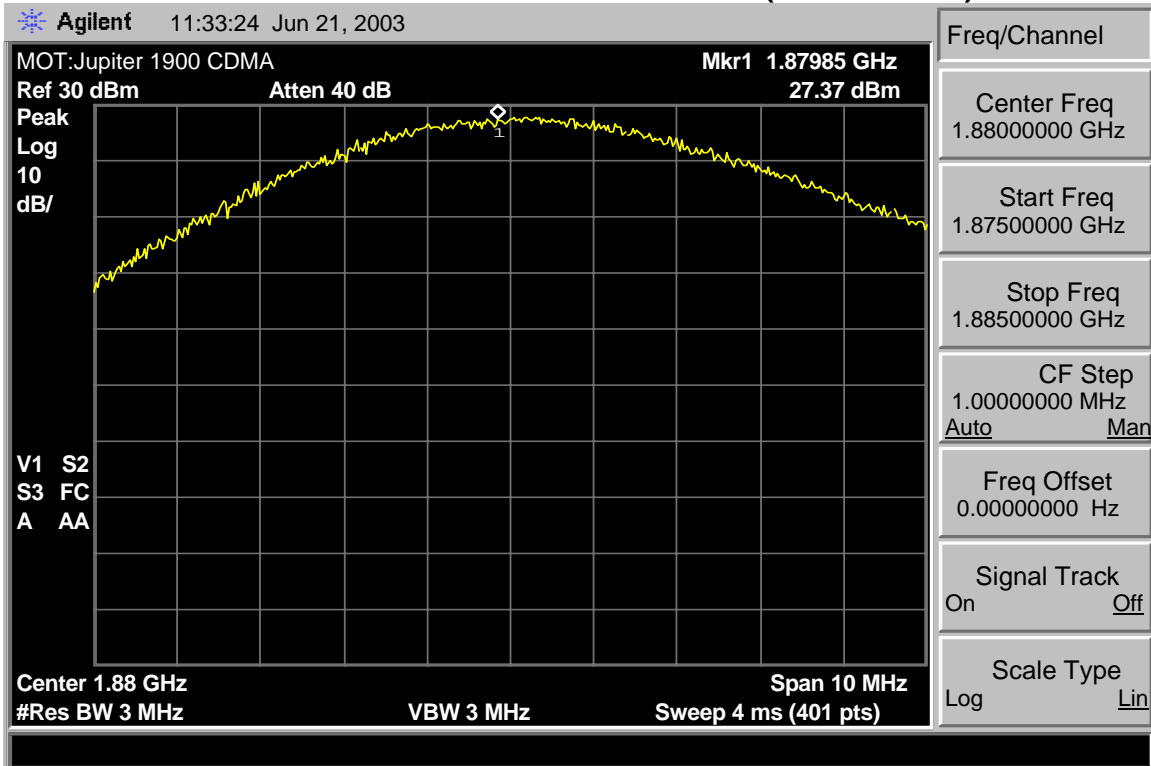
The middle channel within the designated frequency block was measured. For digital modulation, the lower and upper band edge plots are displayed.

Measurement Results

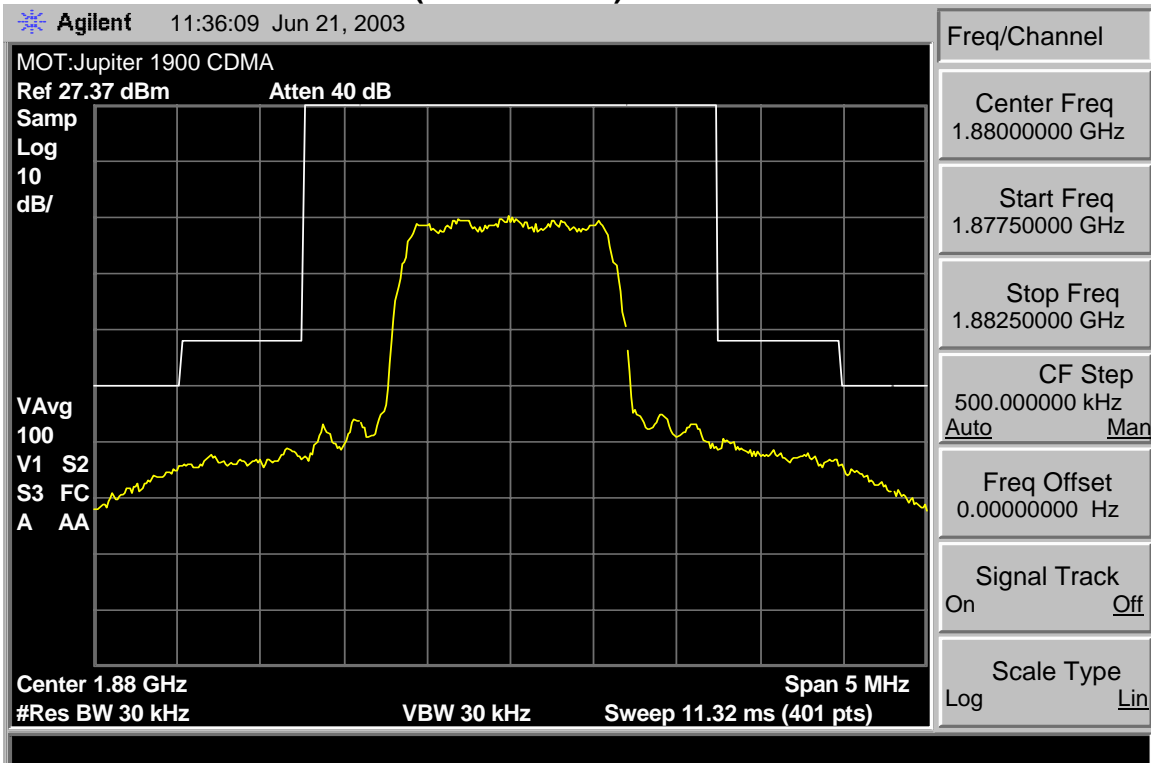
Attached

Measurement Results – CDMA 1900

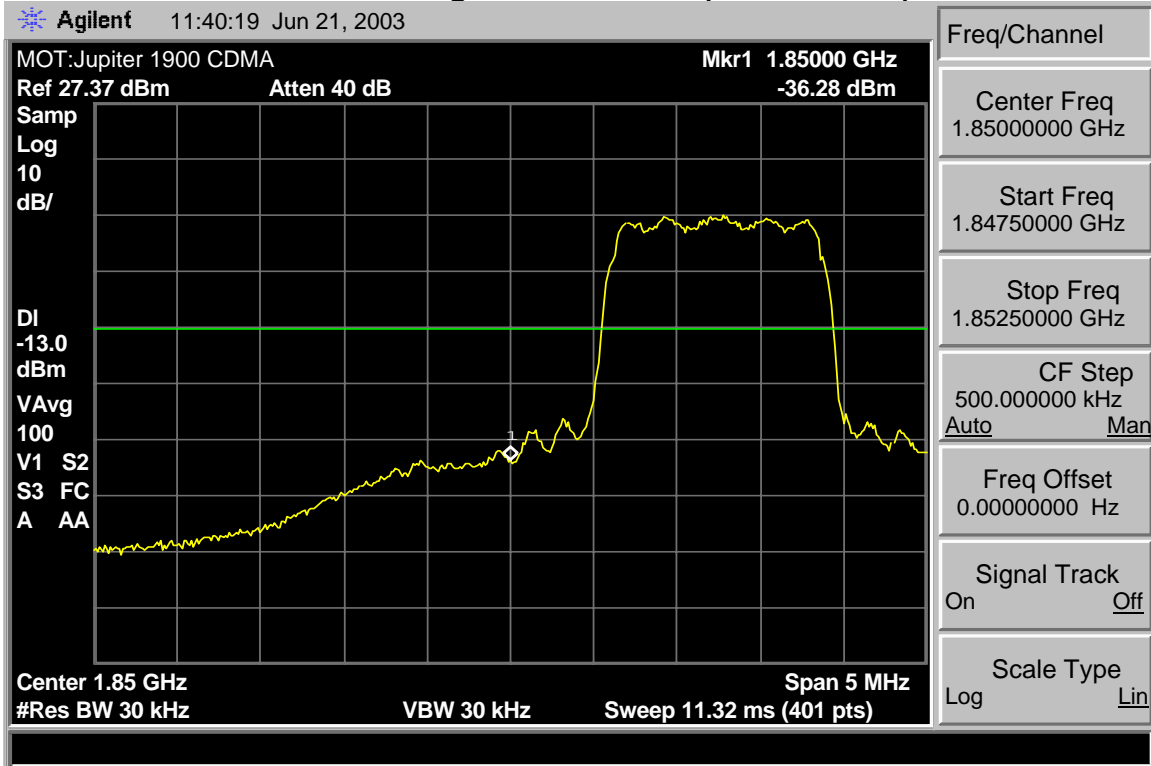
CDMA 1900 – Reference Level Plot – Channel 600 (1880.00 MHz)



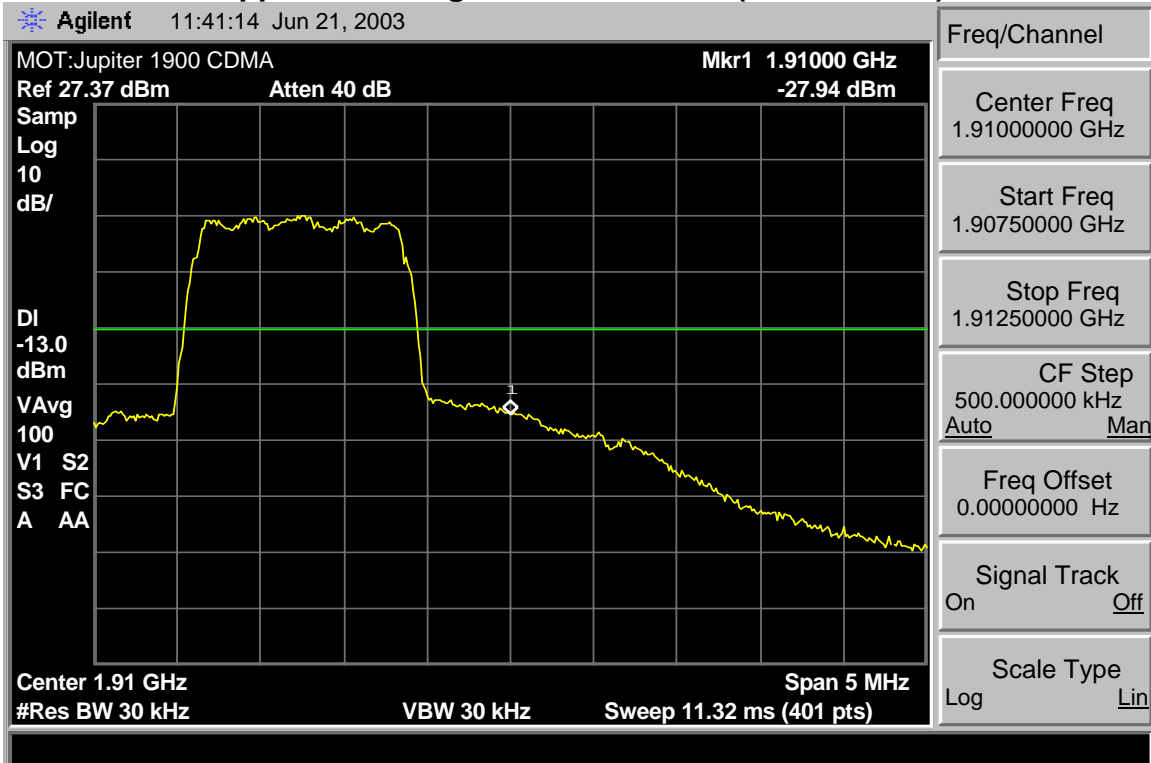
CDMA 1900 – Channel 600 (1880.00 MHz)



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.

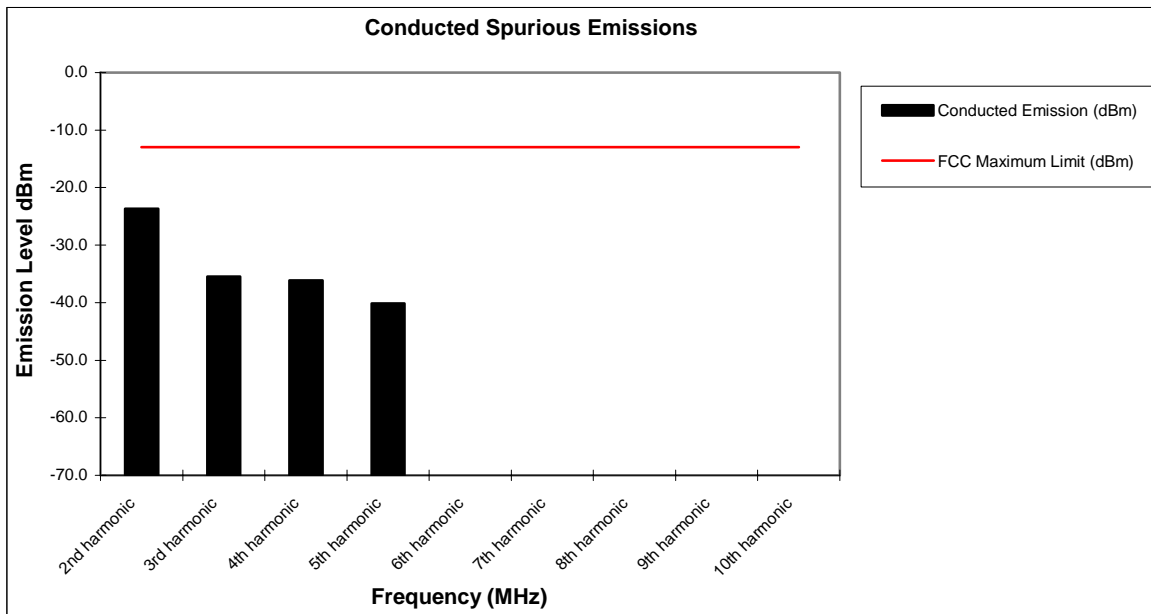
Measurements were made with the phone tuned to low, middle and high frequency within the valid mobile transmit frequency band. The worst case emissions of all three frequency configurations can be found below.

Measurement Results

Attached

Measurement Results
Modulation: CDMA 1900

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-23.7
3rd harmonic	-13	-35.4
4th harmonic	-13	-36.1
5th harmonic	-13	-40.1
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.

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.

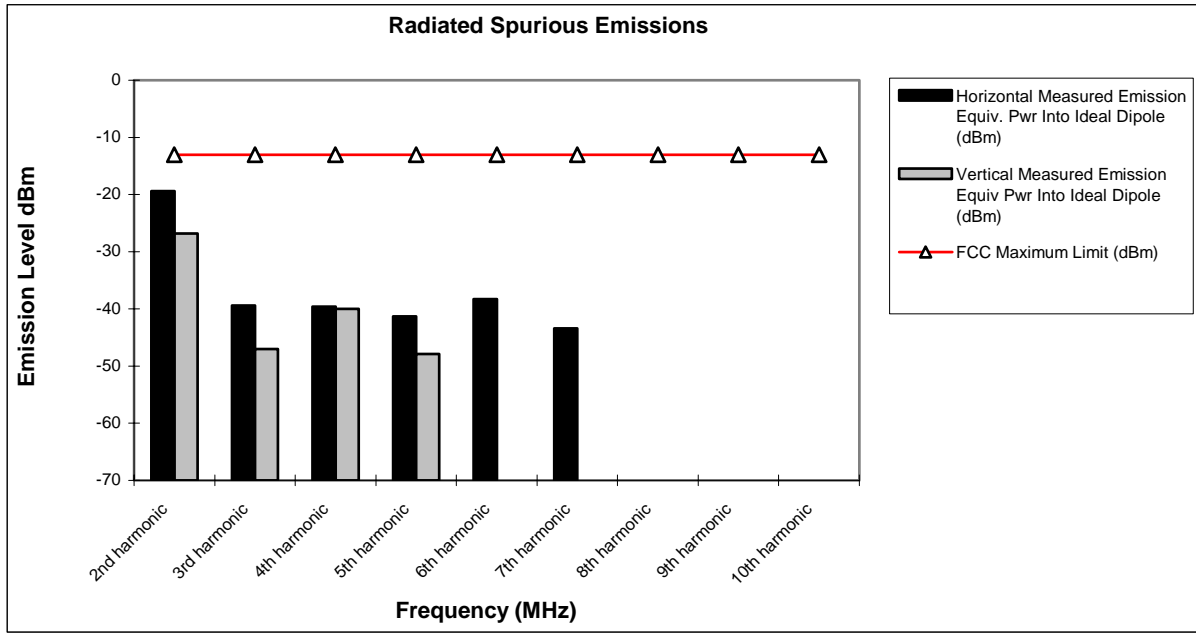
The power in dBm of each spurious emission is calculated by correcting the signal generator level for cable loss and gain of the substitution antenna referenced to a dipole. A fully charged battery was used for the supply voltage.

Measurement Results

Attached

Measurement Results
Modulation: 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	-19.4	-26.8
3rd harmonic	-13	-39.4	-47.0
4th harmonic	-13	-39.6	-40.0
5th harmonic	-13	-41.3	-47.9
6th harmonic	-13	-38.3	*
7th harmonic	-13	-43.4	*
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, 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 $+60^{\circ}\text{C}$ 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

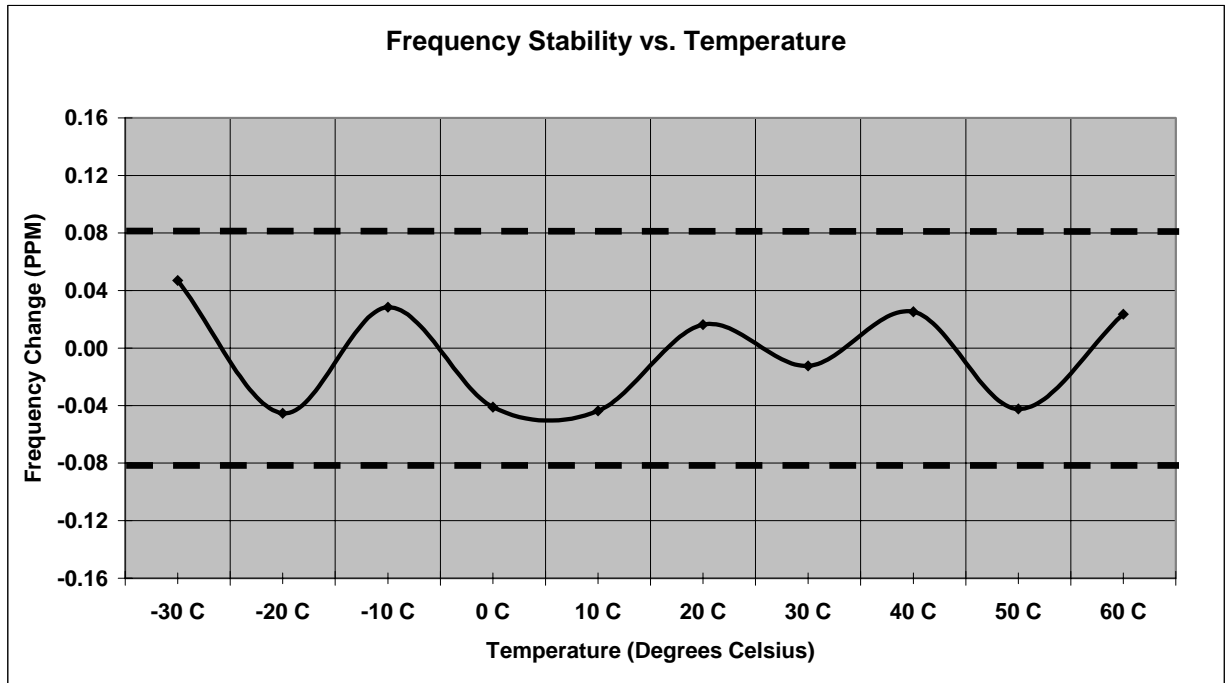
Attached

Measurement Results
Modulation: CDMA 1900

Frequency Stability

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

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	88.20	0.047	100%	
-20 C	-85.26	-0.045	100%	
-10 C	53.40	0.028	100%	
0 C	-77.24	-0.041	100%	
10 C	-82.00	-0.044	100%	
20 C	30.50	0.016	100%	
30 C	-23.30	-0.012	100%	
40 C	47.40	0.025	100%	
50 C	-79.70	-0.042	100%	
60 C	44.25	0.024	100%	
20 C	-79.40	-0.042	Battery Endpoint	



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.

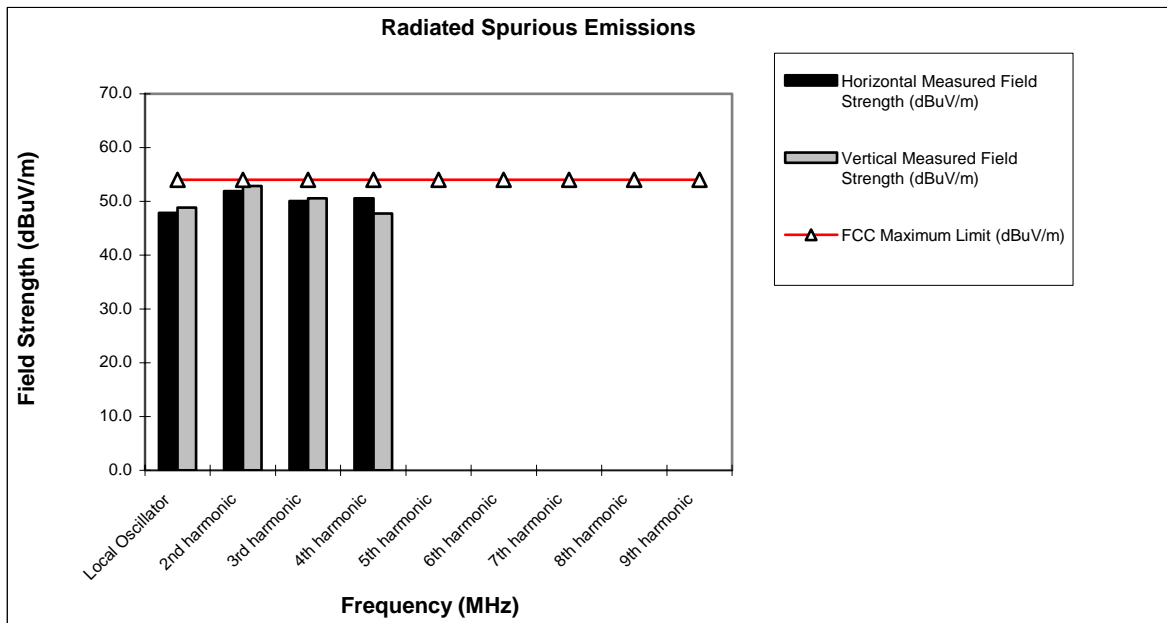
Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) -
Amplifier Gain (dB) + Antenna Correction Factor (1/m)

Measurement Results

Attached

Measurement Results
Modulation: CDMA 1900

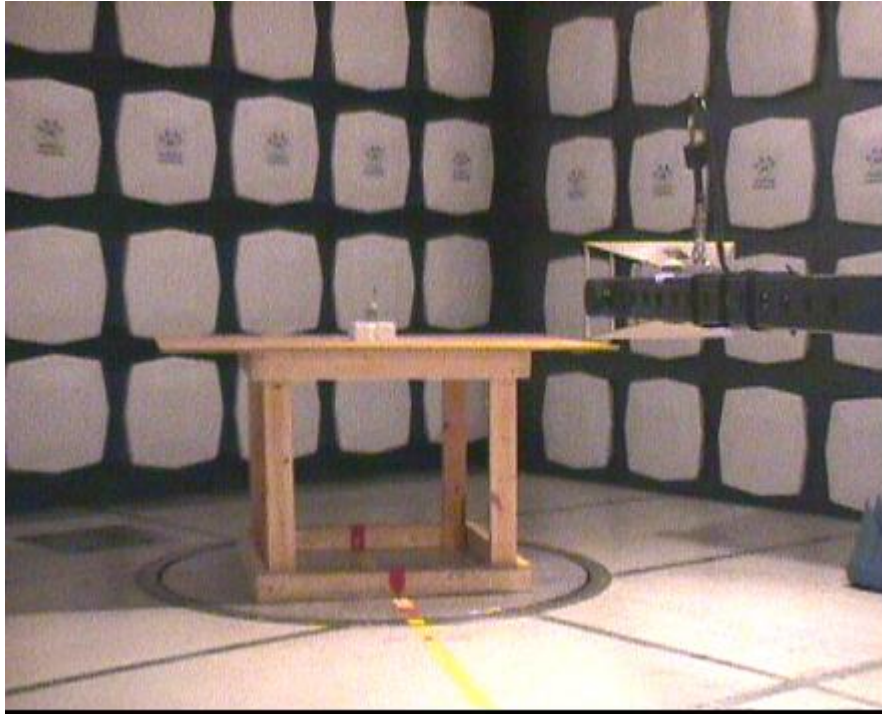
Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
Local Oscillator	54	47.8	48.9
2nd harmonic	54	51.9	52.8
3rd harmonic	54	50.1	50.6
4th harmonic	54	50.6	47.8
5th harmonic	54	*	*
6th harmonic	54	*	*
7th harmonic	54	*	*
8th harmonic	54	*	*
9th harmonic	54	*	*
10th harmonic	54	*	*



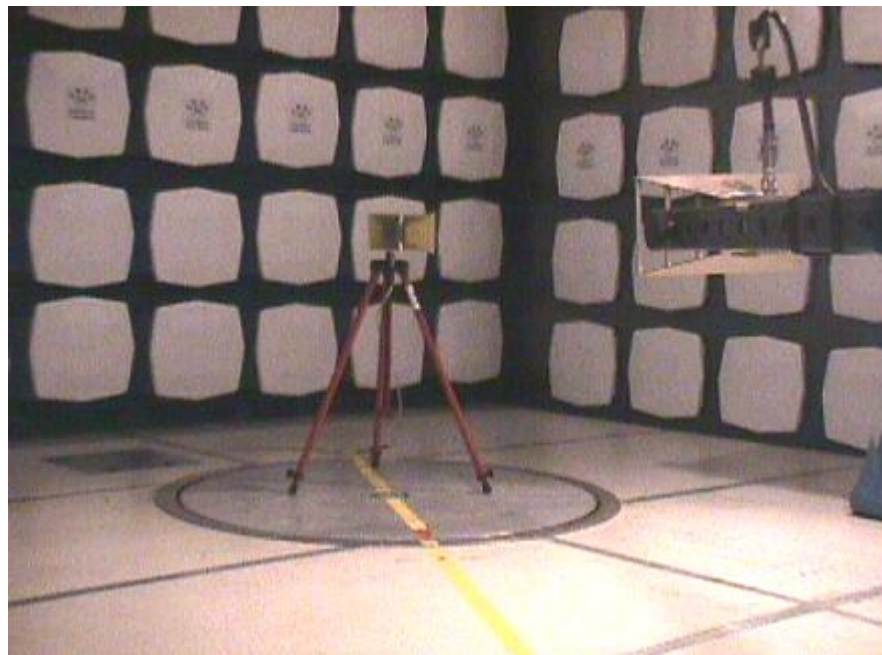
Notes:

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 and high channels.

Appendix A – Radiated Emissions Test Setup Photos



A.1 Radiated Emissions Measurement



A.2 Substitution Measurement

End of Test Report