



MOTOROLA

PERSONAL COMMUNICATIONS SECTOR

**PRODUCT SAFETY AND COMPLIANCE
EMC LABORATORY**

EMC TEST REPORT

Test Report Number – 11230-2

Report Date – August 4, 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.

A handwritten signature in blue ink that reads "Michael E. Hill".

Signature

Name: Michael E. Hill

Title: Senior Electrical Engineer

Date : 8/04/2003

This report must not be reproduced, except in full, without written approval from this laboratory.

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



Table of Contents

Description	Page
Test Report Details	3
Applicable Standards	3
Summary of Testing	4
General and Special Conditions	4
Equipment and Cable Configurations	4
Measuring Equipment and Calibration Information	4
Measurement Procedures and Data	
RF Power Output	6
Radiated Power (ERP)	7
Occupied Bandwidth	8
AMPS 800 SAT	9
AMPS 800 Reference Plot	9
AMPS 800 10KBs Wideband	9
AMPS 800 Rx Base ST	10
AMPS 800 Signal Tone	11
AMPS 800 Block A/A* (Lower) Min. Edge	12
AMPS 800 Block A* (Lower) Max Edge	12
AMPS 800 Block A Max Edge/Block B Min. Edge	13
AMPS 800 Block B Max Edge/Block A*(Upper) Min. Edge	13
AMPS 800 Block A* (Upper) Max Edge/B* Min. Edge	14
AMPS 800 Block B* Max Edge	14
TDMA 800 Rx Base ST	15
TDMA 800 Reference Plot	15
TDMA 800 Lower Band Edge	16
TDMA 800 Upper Band Edge	16
TDMA 800 Block A/A* (Lower) Min. Edge	17
TDMA 800 Block A* (Lower) Max Edge	17
TDMA 800 Block A Max Edge/Block B Min. Edge	18
TDMA 800 Block B Max Edge/Block A*(Upper) Min. Edge	18
TDMA 800 Block A* (Upper) Max Edge/B* Min. Edge	19
TDMA 800 Block B* Max Edge	19
Spurious Emissions at Antenna Terminals	20
AMPS 800 Tabular and Graphical Data	21
TDMA 800 Tabular and Graphical Data	22
Field Strength of Spurious Emissions	23
AMPS 800 Tabular and Graphical Data	24
TDMA 800 Tabular and Graphical Data	25
Frequency Stability	26
AMPS 800 Tabular and Graphical Data	27

TDMA 800 Tabular and Graphical Data	28
Field Strength of Spurious Emissions From Unintentional Radiators	
AMPS 800 Tabular and Graphical Data	30
TDMA 800 Tabular and Graphical Data	31
Appendix A - Radiated Emissions Test Setup Photos	
Figure A.1 – Radiated Emissions Measurement	32
Figure A.2 – Substitution Measurement	32

Test Report Details

Tests Performed By: Motorola Personal Communications Sector
Product Safety and Compliance Group
600 North US Hwy 45
Libertyville, IL 60048
PH (561) 739-2179 Fax (561) 739-2131
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, TDMA 800

Model Number: SJWF0181AA

Serial Numbers: 3990321507, 3990321227, 3990321516

Testing Complete Date: August 4, 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	Pass
4	Occupied Bandwidth	Pass
5	Spurious Emissions at Antenna Terminal	Pass
6	Field Strength of Spurious Emissions	Pass
7	Frequency Stability	Pass
8	Field Strength of Spurious 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	Modulation Characteristics	NA
4	Occupied Bandwidth	See Plots
5	Spurious Emissions at Antenna Terminal	16.9 dB
6	Field Strength of Spurious Emissions	16.2 dB
7	Frequency Stability	50 Hz
8	Field Strength of Spurious Emissions from Unintentional Radiators	7.6 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

ETS	DRG Horn Antenna	3115	6222	9/30/2003
A.H. Systems Inc.	DRG Horn Antenna	SAS-200/571	265	4/29/2004
ETS	Log-Periodic Antenna	3148	1189	4/29/2004
ETS	Biconical Antenna	3110B	3369	4/29/2004
ETS	Biconical Antenna	3110B	3370	10/25/2003
Attenuator	Weinschel	AS-6	6675	10/3/2003
Attenuator	Weinschel	AS-6	6677	10/3/2003
Rohde & Schwarz	Mobile Test Set	CMD 80	DE29008	N/A
Hewlett Packard	Signal Generator	83623B	3844A01195	5/20/2004
Thermotron	Environmental Chamber	S-4	31580	12/19/2003
Hewlett Packard	Pre-Amplifier	8347A		
Hewlett Packard	Pre-Amplifier	8447F	2805A03419	5/19/2004
Agilent	Power Meter	EE4418B		11/26/2003
Agilent	Sensor	E4412B		11/23/2004

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 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.

CFR Part 2.1046

Measurement Results

* Data supplied by SAR Lab

AMPS 800

Frequency (MHz)	Power (dBm)
824.04	26.37
836.52	26.38
848.97	26.39

TDMA 800

Frequency (MHz)	Power (dBm)
824.04	27.26
836.52	27.38
848.97	27.46

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 848.97) and TDMA 800 three frequencies (824.04, 836.52, and 848.97 MHz) with antenna stubby.

TDMA measurements were made with the phone placed in a call using the HP8960 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 "Burst 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 IHDT5DL1 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:

824.04 MHz: 24.08 dBm

836.52 MHz: 24.46 dBm

848.97 MHz: 24.89 dBm

TDMA 800

824.04 MHz: 28.75 dBm

836.52 MHz: 29.15 dBm

848.97 MHz: 29.62 dBm

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

Max EIRP in AMPS 800 is 24.89dBm mode (max **ERP is 22.79 dBm**)

Max EIRP in TDMA 800 is 29.62 dBm mode (max **ERP is 27.52 dBm**)

OCCUPIED BANDWIDTH

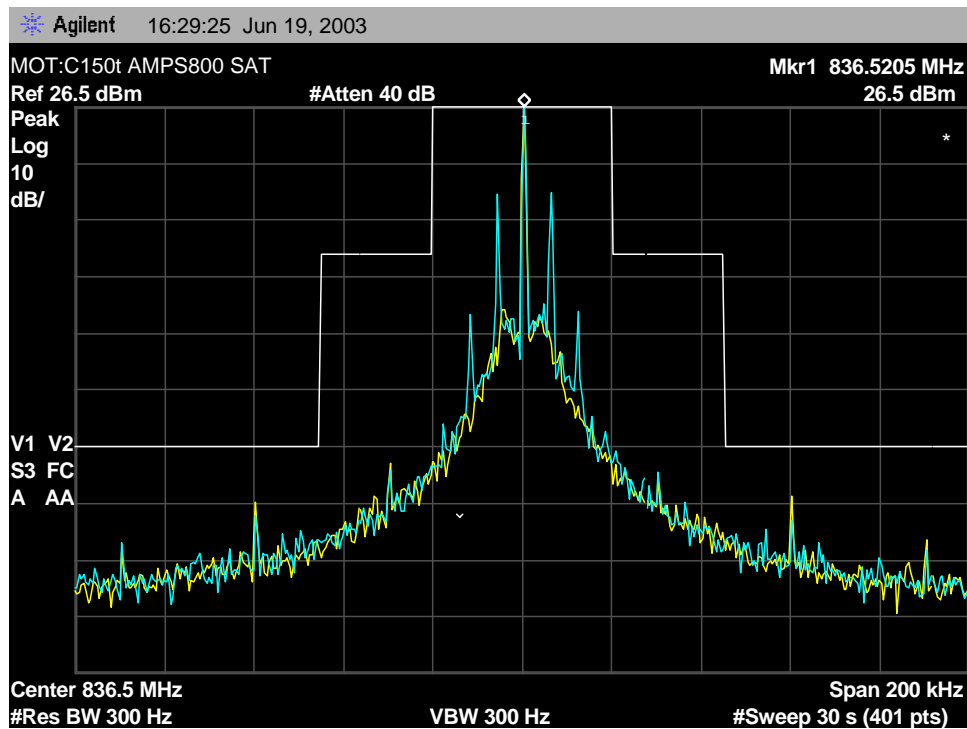
CFR Part 2.1049, 24.238, 22.917

Measurement Procedure

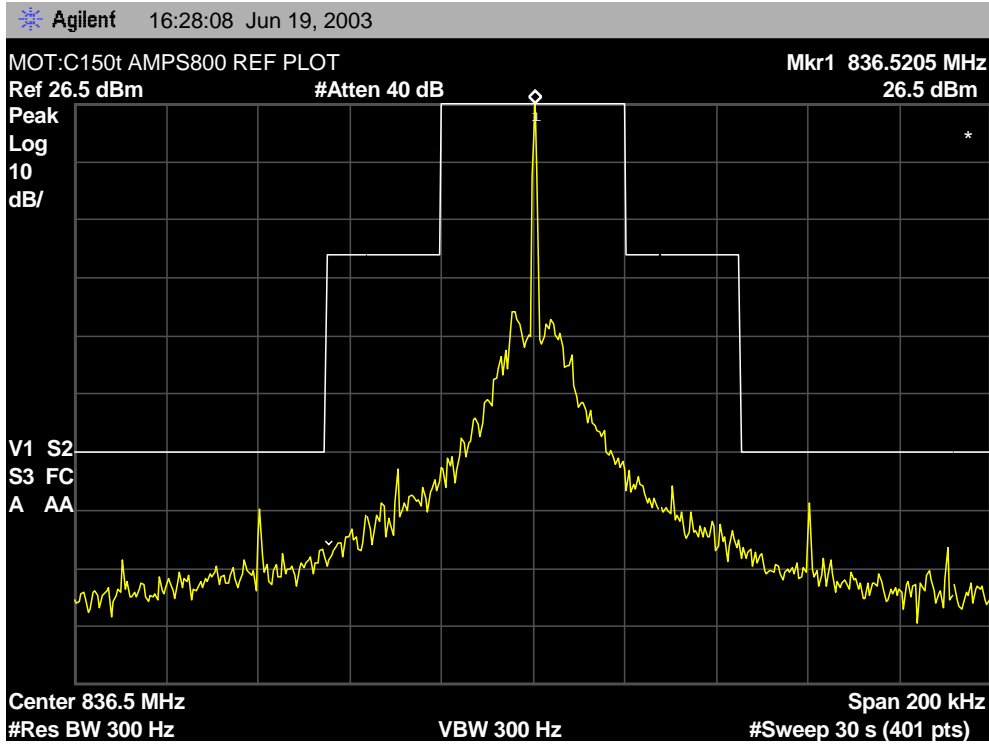
The RF output port of the equipment under test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. The amplitude of the spectrum analyzer is corrected for the attenuator and any other applicable losses. A fully charged battery was used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

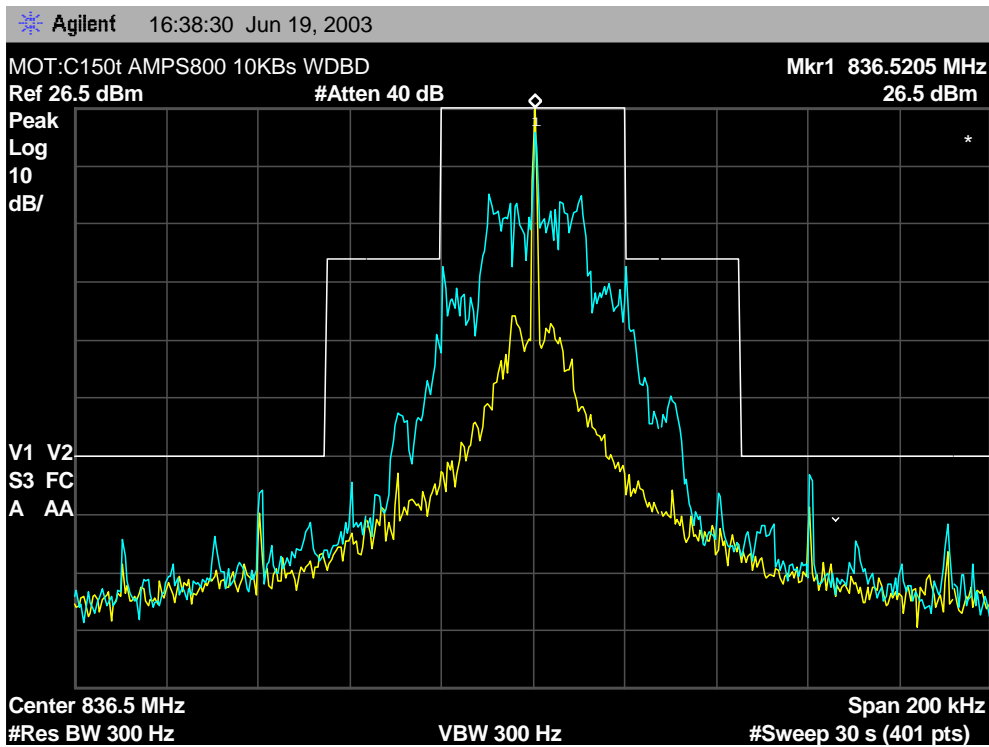
Measurement Results – AMPS 800



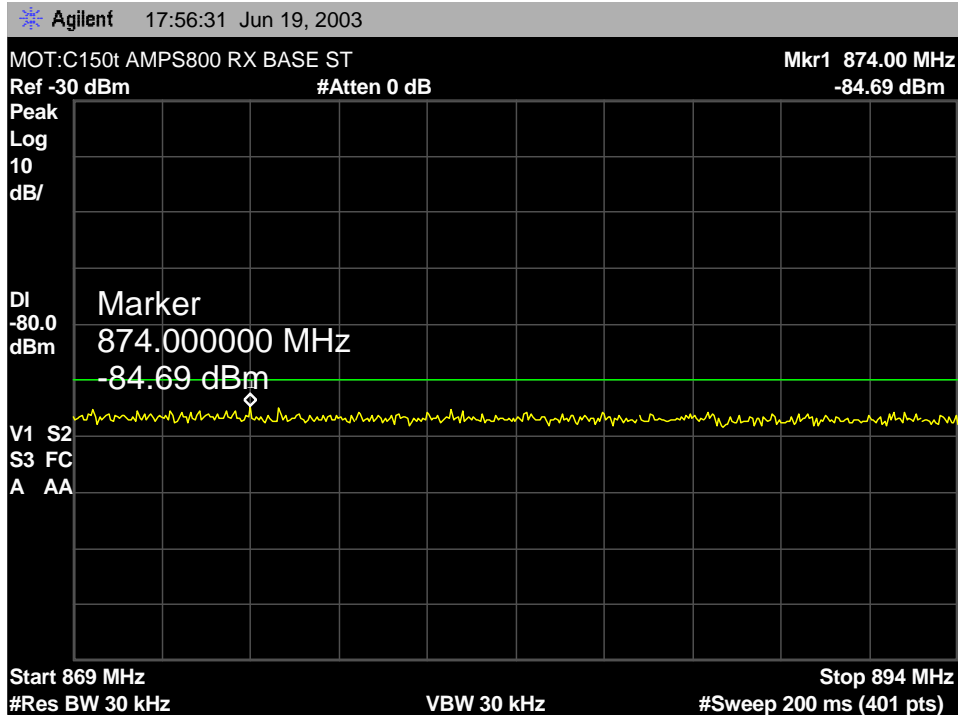
AMPS 800 SAT



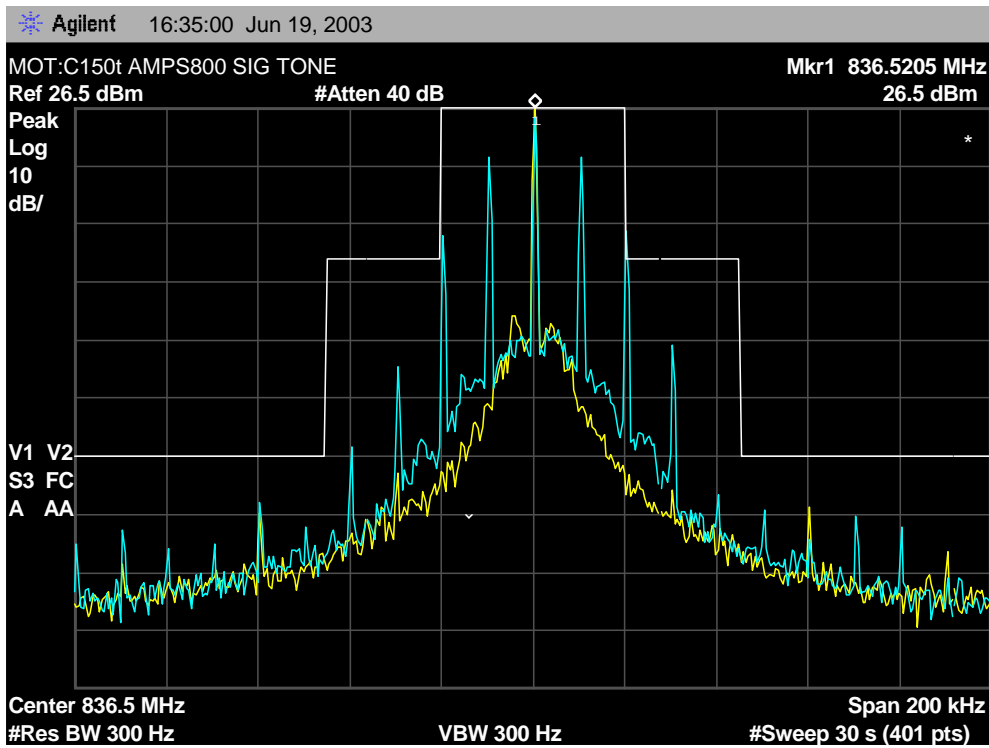
AMPS 800 Reference Plot



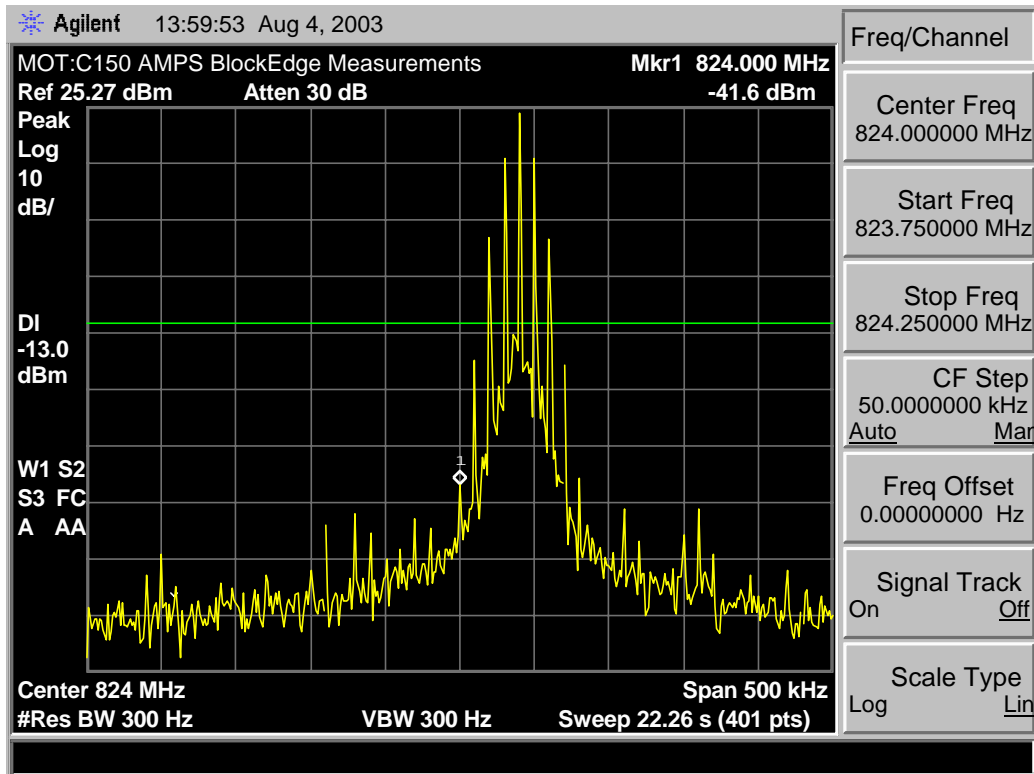
AMPS 800 10KBs Wideband



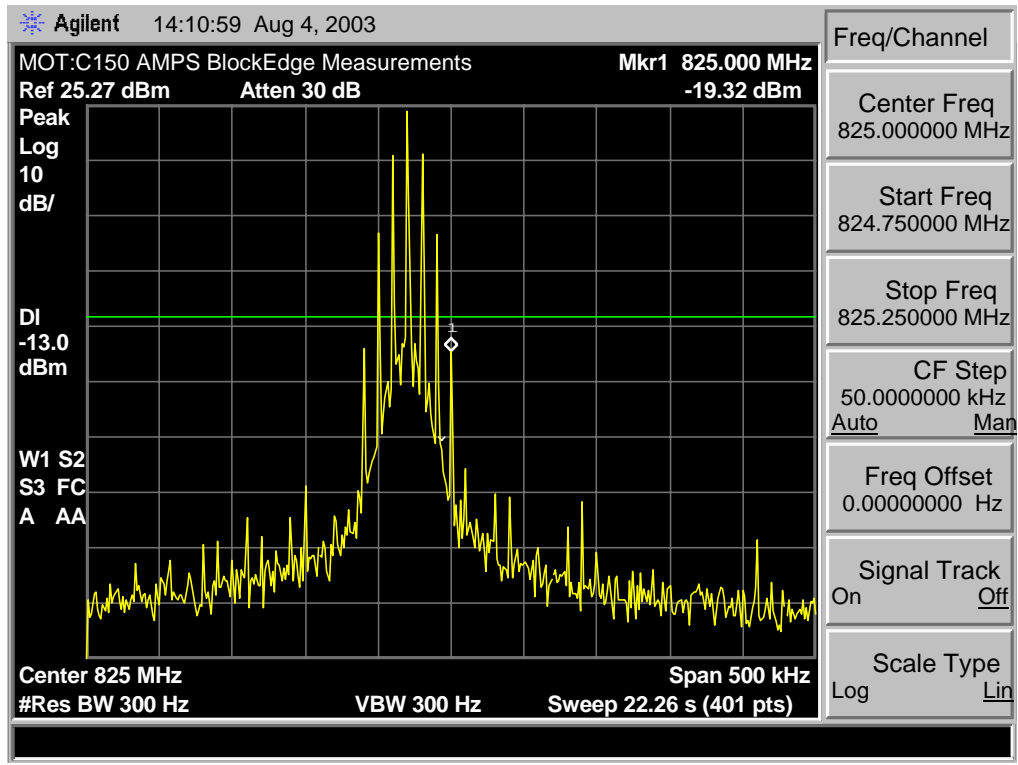
AMPS 800 RX BASE ST



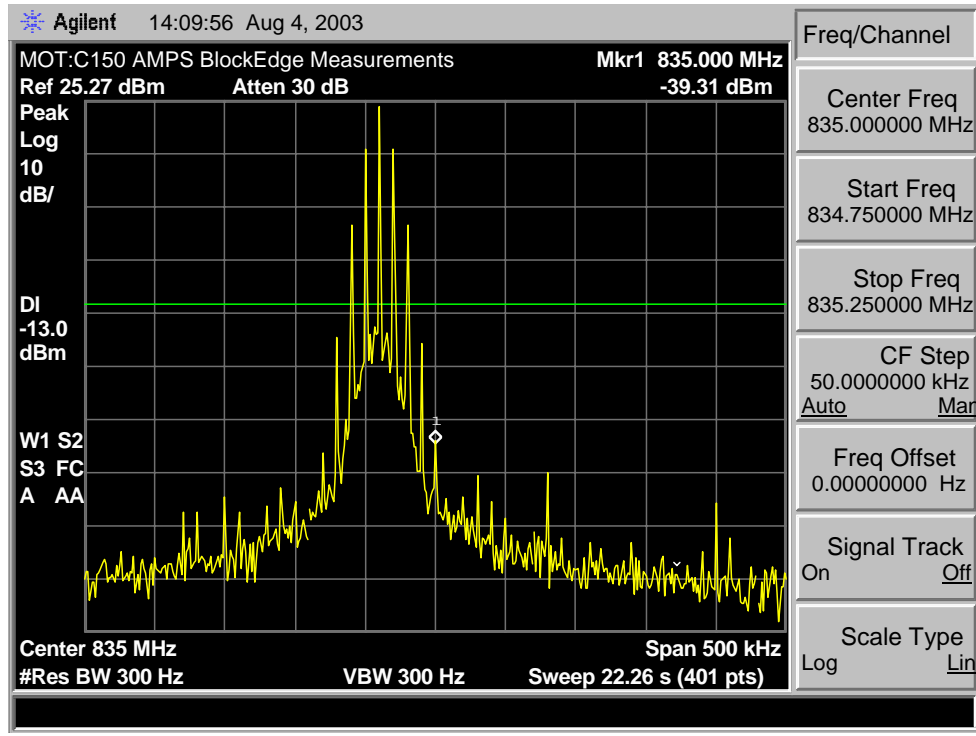
AMPS 800 Signal Tone



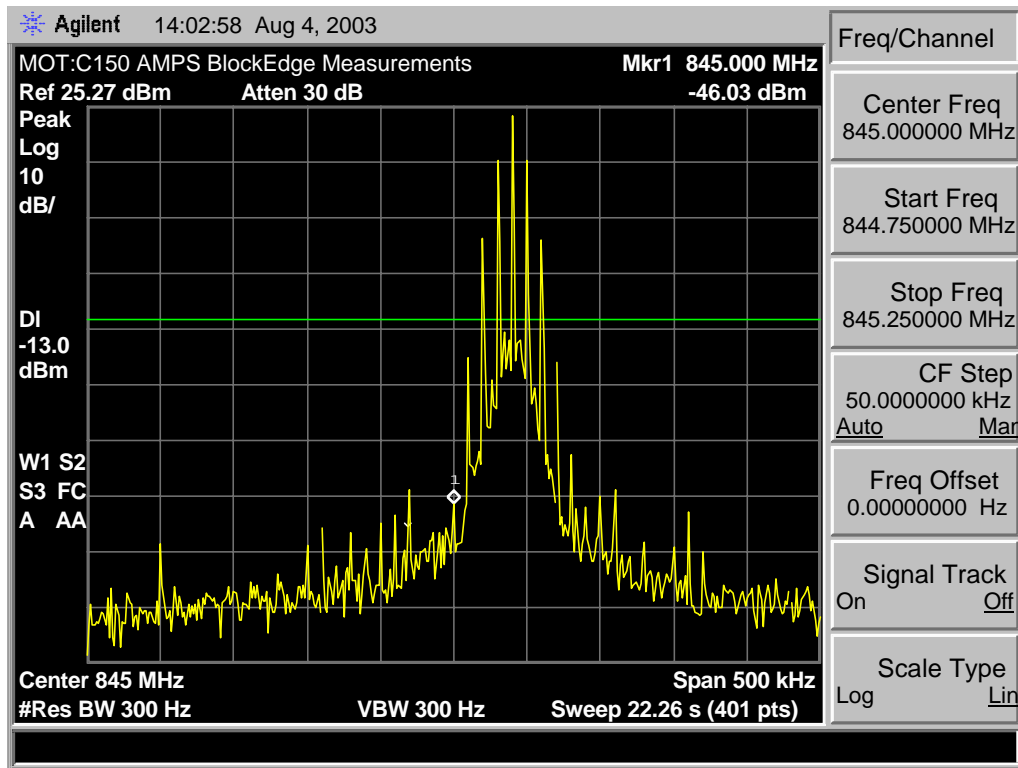
BlockA/A* (Lower) Min. Edge



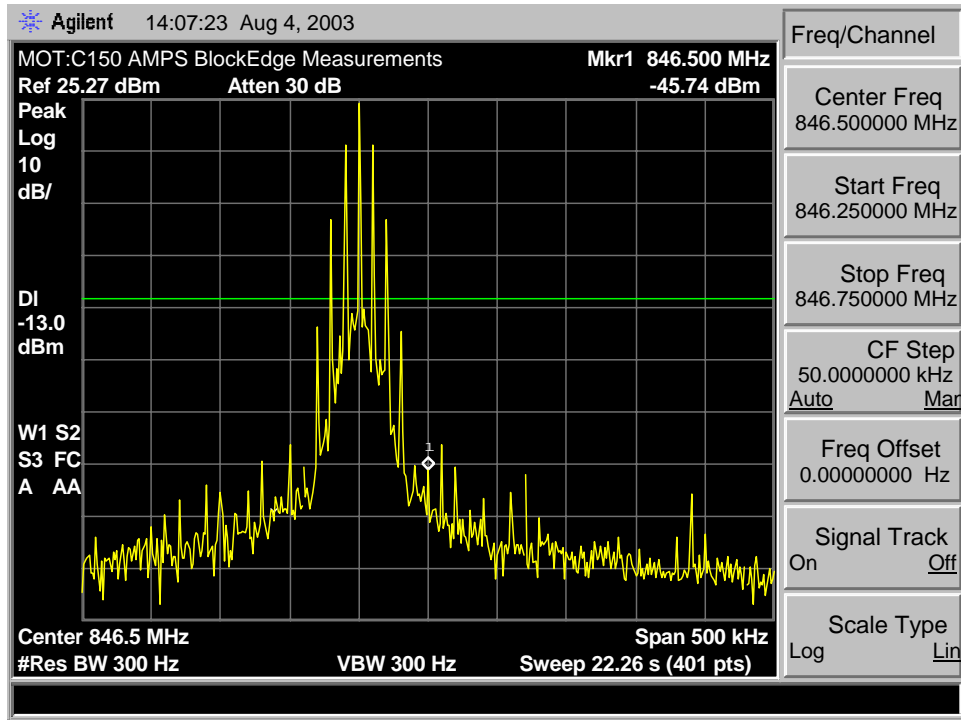
Block A* (Lower) Max Edge



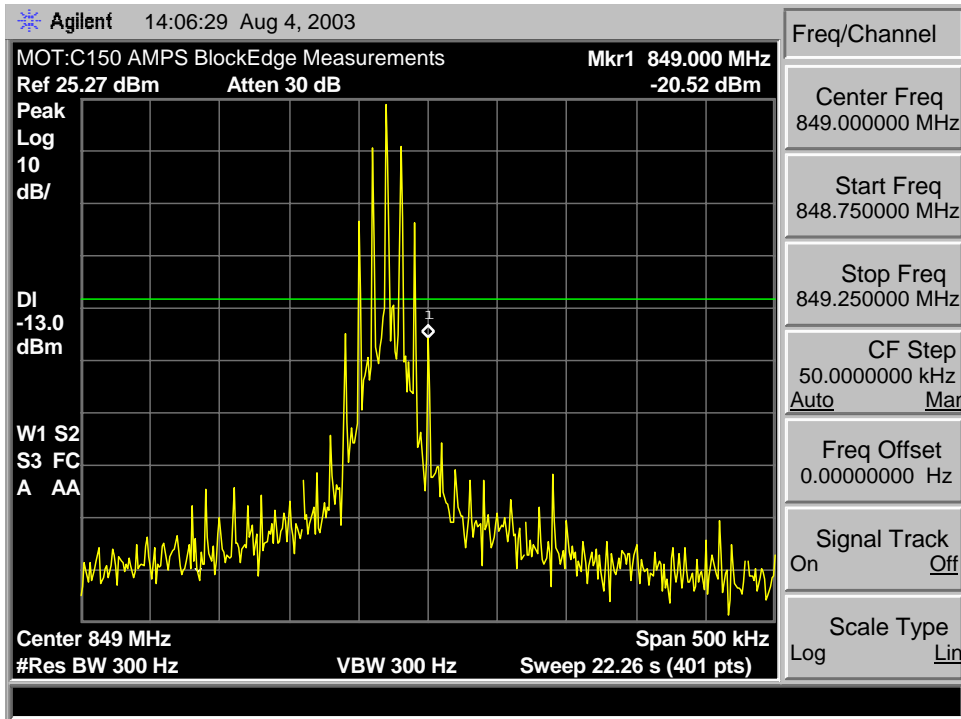
Block A Max Edge/Block B Min.



Block B Max Edge/Block A* (Upper) Min. Edge

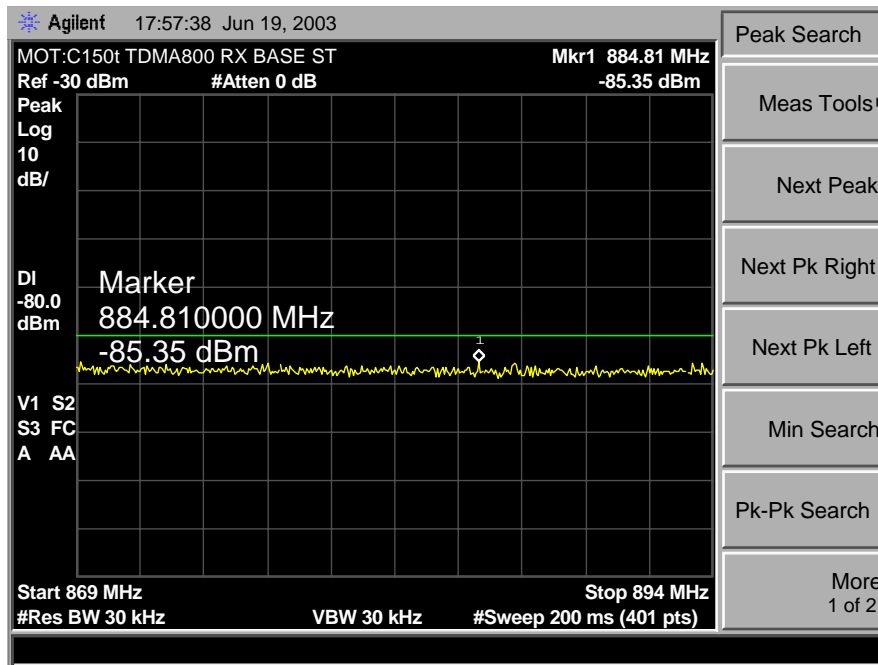


Block A* Upper Max Edge/B* Min.

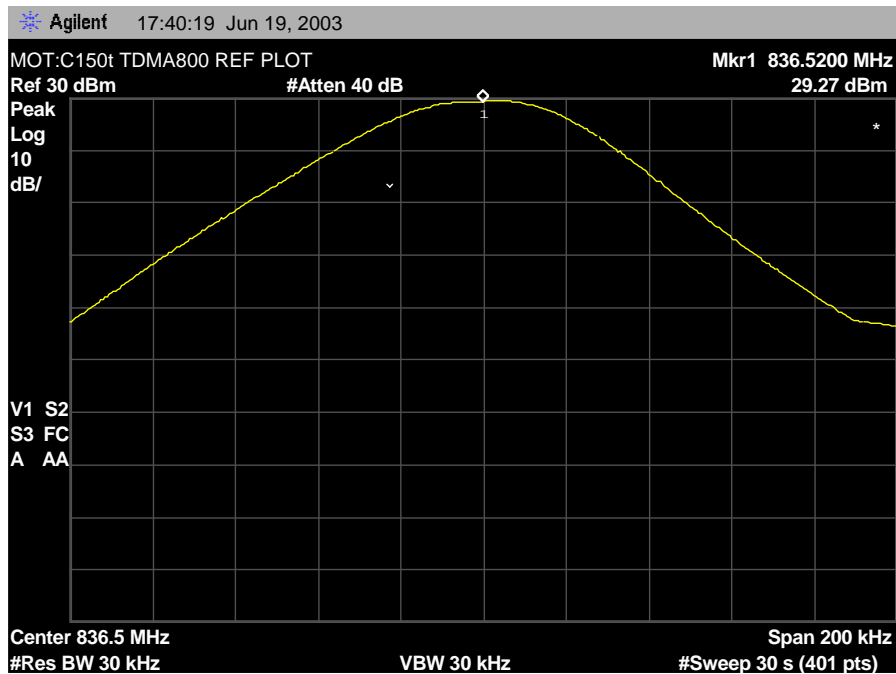


Block B* Max Edge

Measurement Results – TDMA 800



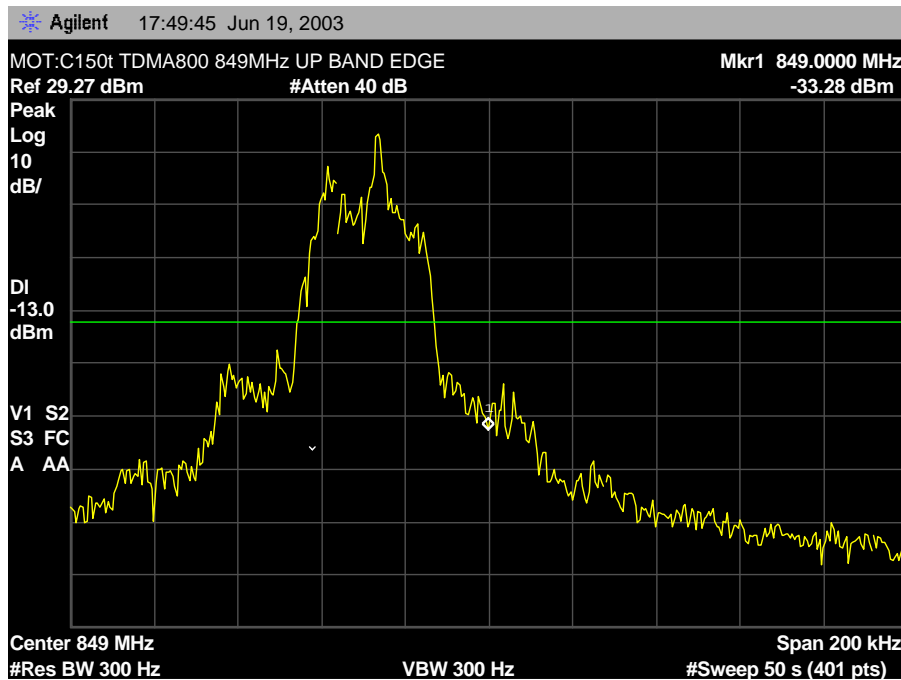
TDMA 800 RX BASE ST



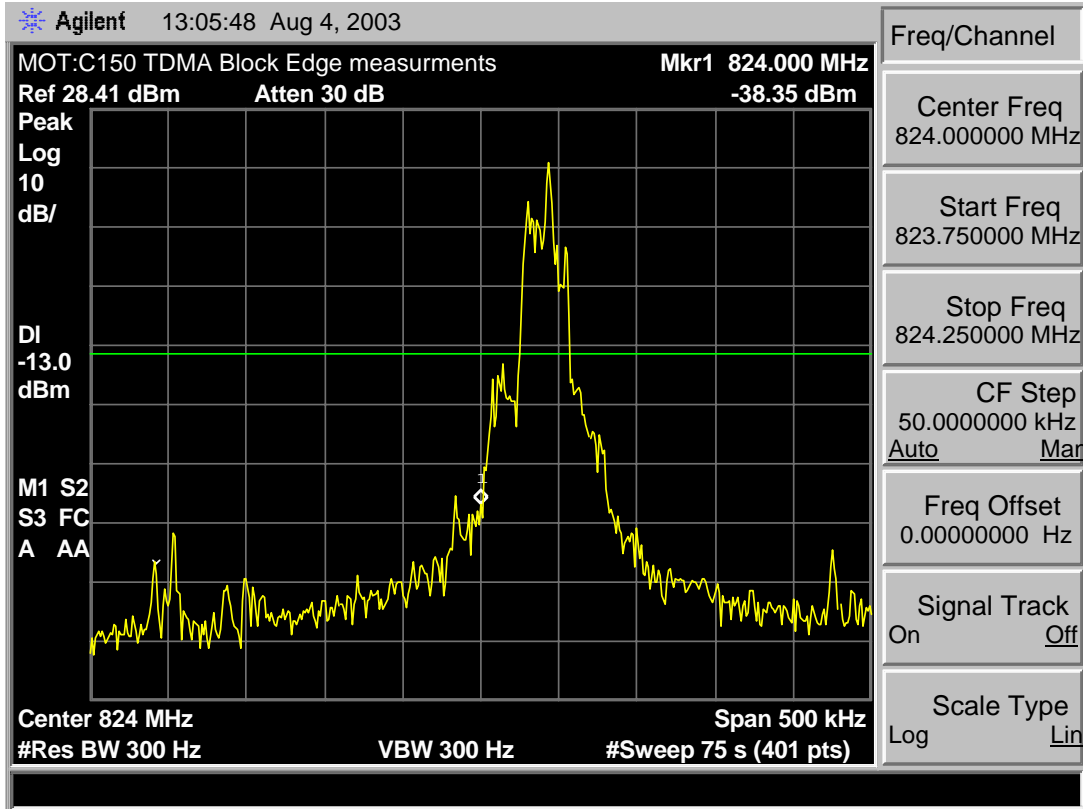
TDMA 800 Reference Plot



TDMA 800 Lower Band Edge



TDMA 800 Upper Band Edge



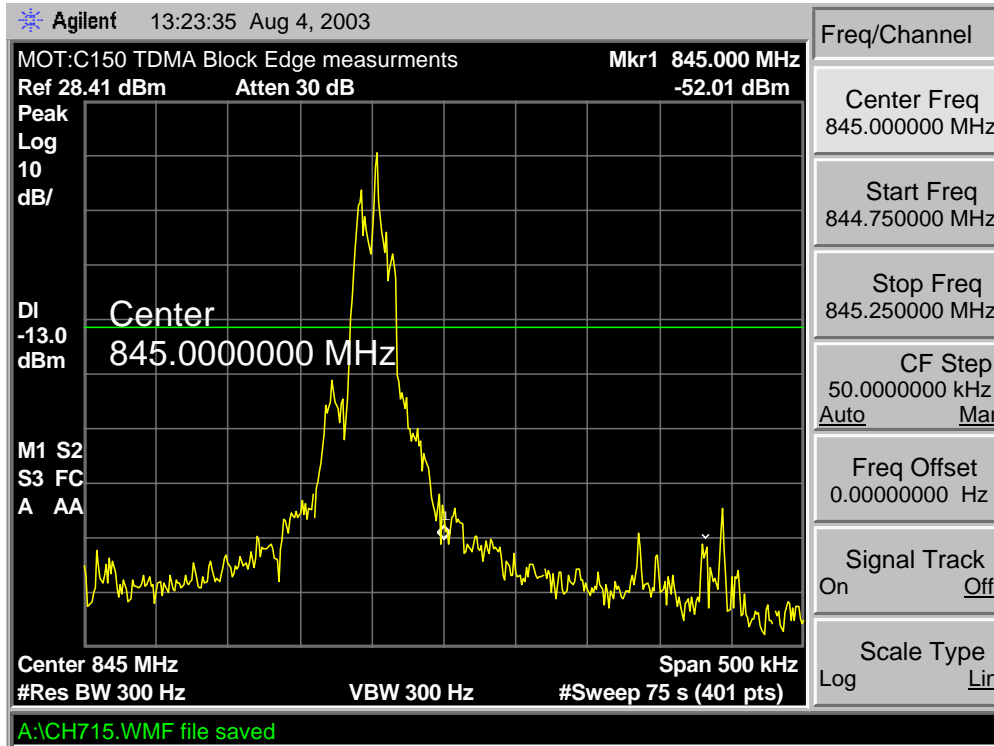
BlockA/A* (Lower) Min. Edge



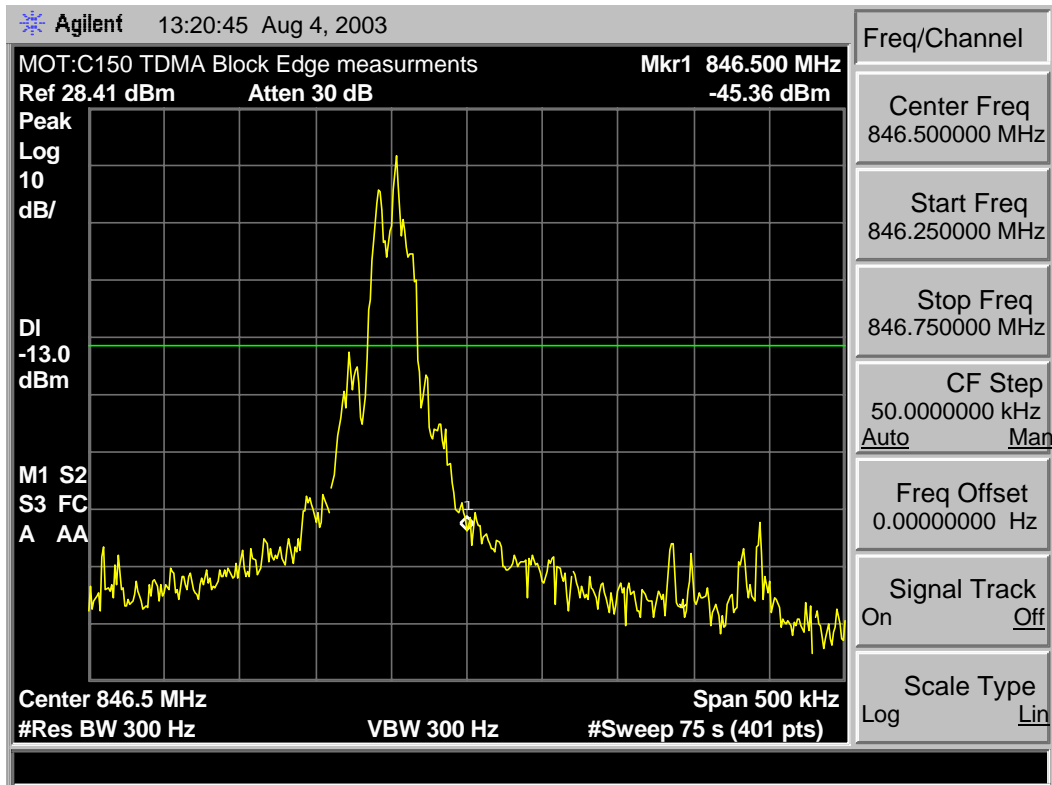
Block A* (Lower) Max Edge



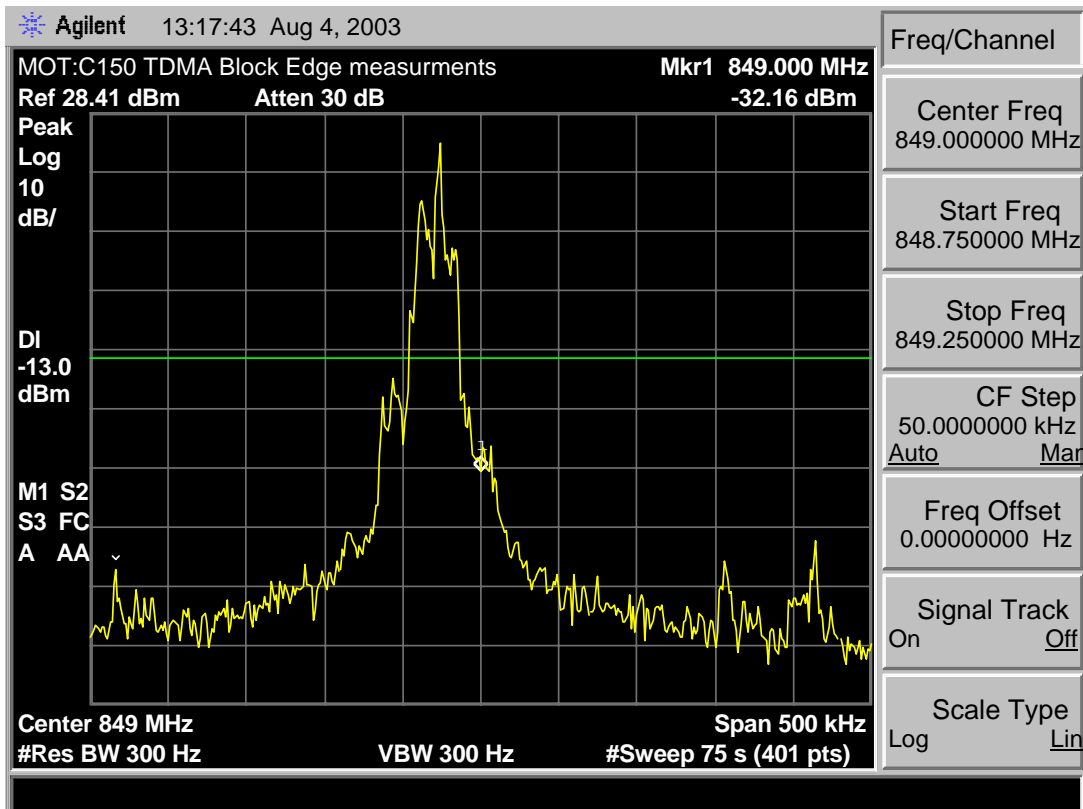
Block A Max Edge/Block B Min.



Block B Max Edge/Block A* (Upper) Min. Edge



Block A* (Upper) Max Edge/B* Min. Edge



Block B* Max Edge

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.

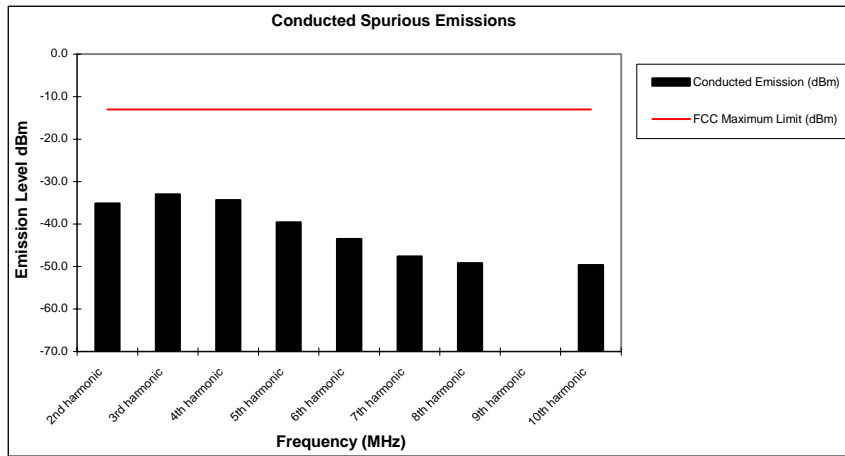
Measurement Results

Attached

Measurement Results
Modulation: AMPS 800

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-35.1
3rd harmonic	-13	-33.0
4th harmonic	-13	-34.4
5th harmonic	-13	-39.6
6th harmonic	-13	-43.5
7th harmonic	-13	-47.6
8th harmonic	-13	-49.2
9th harmonic	-13	*
10th harmonic	-13	-49.7



Notes:

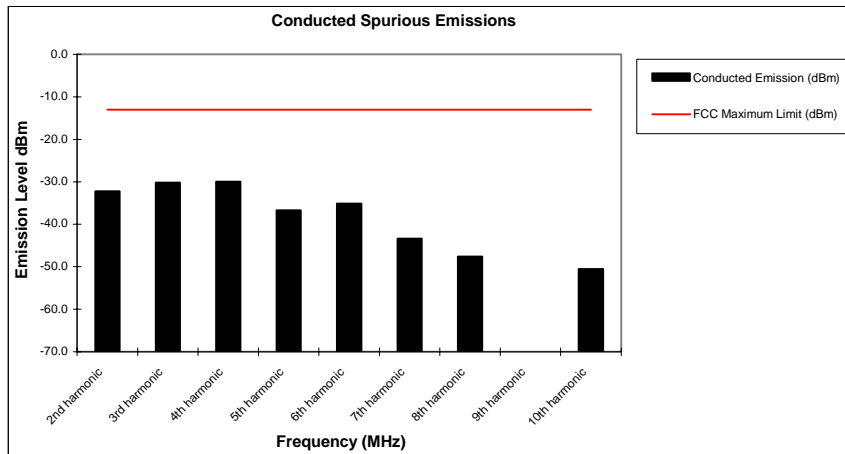
- * Indicates the spurious emission could not be detected due to noise limitations or ambients.
- Each emission reported reflects the highest absolute level at the specific harmonic for the low, mid, and high channels at maximum power.
- The Spectrum was investigated from 9 kHz to the tenth harmonic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

Measurement Results

Modulation: TDMA 800

Conducted Spurious and Harmonic Emissions

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-32.2
3rd harmonic	-13	-30.2
4th harmonic	-13	-29.9
5th harmonic	-13	-36.8
6th harmonic	-13	-35.1
7th harmonic	-13	-43.4
8th harmonic	-13	-47.6
9th harmonic	-13	*
10th harmonic	-13	-50.5



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.

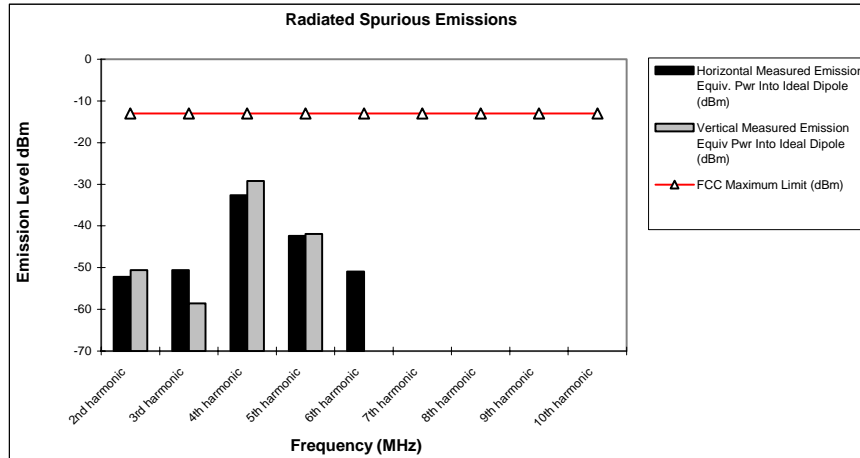
The power in dBm of each spurious emission is calculated by correcting the signal generator level for cable loss and gain of the substitution antenna referenced to a dipole. A fully charged battery was used for the supply voltage.

Measurement Results

Attached

Measurement Results
Modulation: AMPS 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	-52.2	-50.6
3rd harmonic	-13	-50.6	-58.6
4th harmonic	-13	-32.6	-29.2
5th harmonic	-13	-42.4	-41.9
6th harmonic	-13	-50.9	*
7th harmonic	-13	*	*
8th harmonic	-13	*	*
9th harmonic	-13	*	*
10th harmonic	-13	*	*



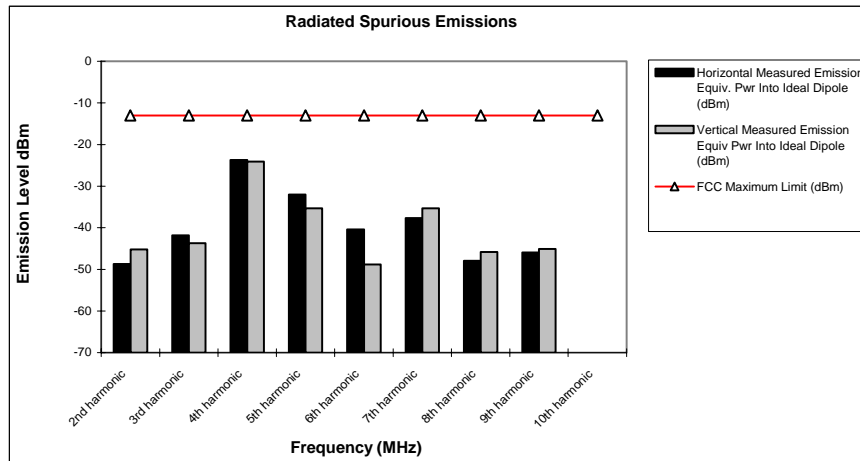
Notes:

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.

Measurement Results

Modulation: TDMA 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	-48.7	-45.2
3rd harmonic	-13	-41.8	-43.7
4th harmonic	-13	-23.7	-24.1
5th harmonic	-13	-32.0	-35.3
6th harmonic	-13	-40.4	-48.8
7th harmonic	-13	-37.7	-35.3
8th harmonic	-13	-47.9	-45.8
9th harmonic	-13	-45.9	-45.1
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°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. A battery eliminator was used for the input supply voltage.

Measurement Results

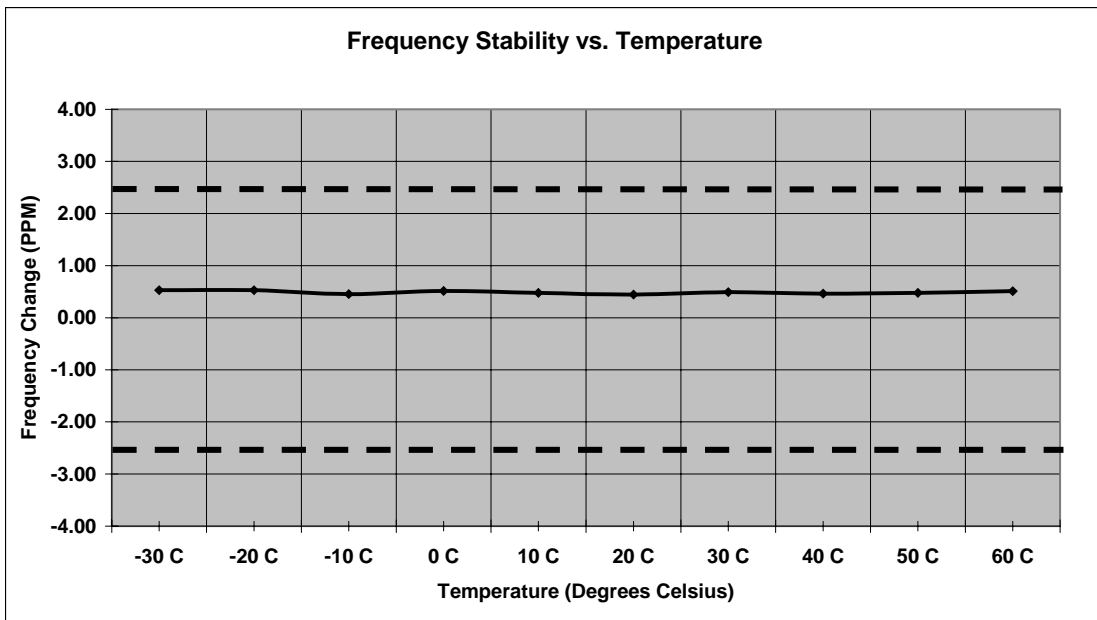
Attached

Measurement Results
Modulation: AMPS 800

Mode: Analog
 Channel: 384

Operating Frequency: 836.52 MHz
 Deviation Limit (PPM): 2.5ppm

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	442.00	0.528	100%	3.60
-20 C	440.00	0.526	100%	3.60
-10 C	380.00	0.454	100%	3.60
0 C	432.00	0.516	100%	3.60
10 C	399.00	0.477	100%	3.60
20 C	372.00	0.445	100%	3.60
30 C	409.00	0.489	100%	3.60
40 C	386.00	0.461	100%	3.60
50 C	399.00	0.477	100%	3.60
60 C	427.00	0.510	100%	3.60
20 C	401.00	0.479	Battery Endpoint	3.20

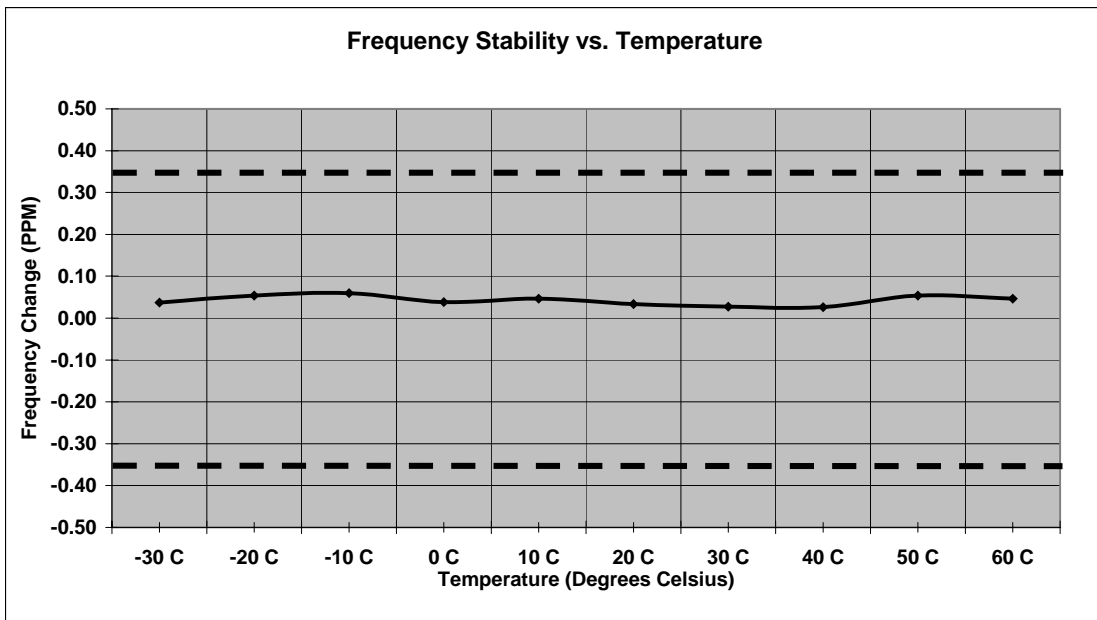


Measurement Results
Modulation: TDMA800

Mode: TDMA 800
 Channel: 384

Operating Frequency: 836.52 MHz
 Deviation Limit (PPM): 0.359ppm (+/-300 Hz)

Temperature C	Frequency Error HZ	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	31.00	0.037	100%	3.60
-20 C	45.00	0.054	100%	3.60
-10 C	50.00	0.060	100%	3.60
0 C	32.00	0.038	100%	3.60
10 C	39.00	0.047	100%	3.60
20 C	28.00	0.033	100%	3.60
30 C	23.00	0.027	100%	3.60
40 C	22.00	0.026	100%	3.60
50 C	45.00	0.054	100%	3.60
60 C	39.00	0.047	100%	3.60
20 C	41.00	0.049	Battery Endpoint	3.20



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)

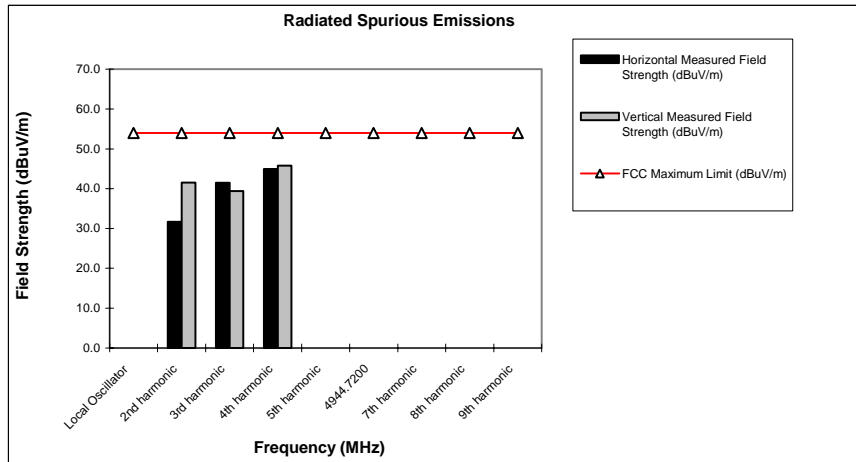
Measurement Results

Attached

Measurement Results
Modulation: AMPS 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	*	*
2nd harmonic	54	31.7	41.5
3rd harmonic	54	41.5	39.4
4th harmonic	54	44.9	45.8
5th harmonic	54	*	*
4944.7200	54	*	*
7th harmonic	54	*	*
8th harmonic	54	*	*
9th harmonic	54	*	*
10th harmonic	54	*	*



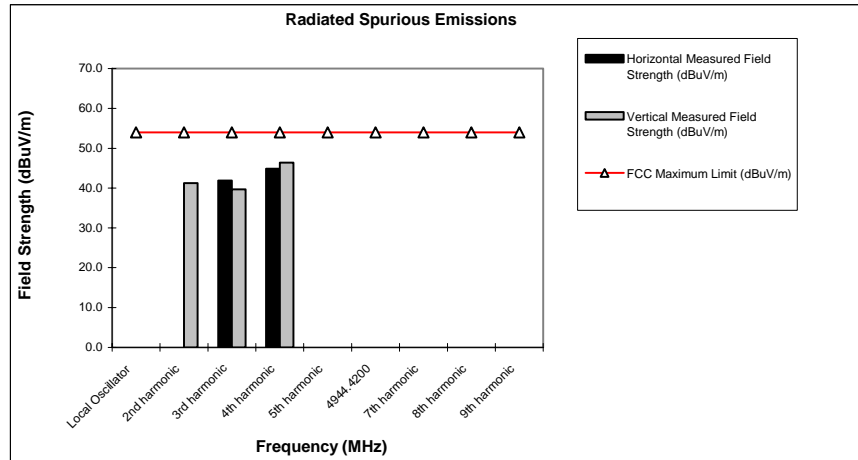
Notes:

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: TDMA 800

Receiver Radiated Spurious Emissions

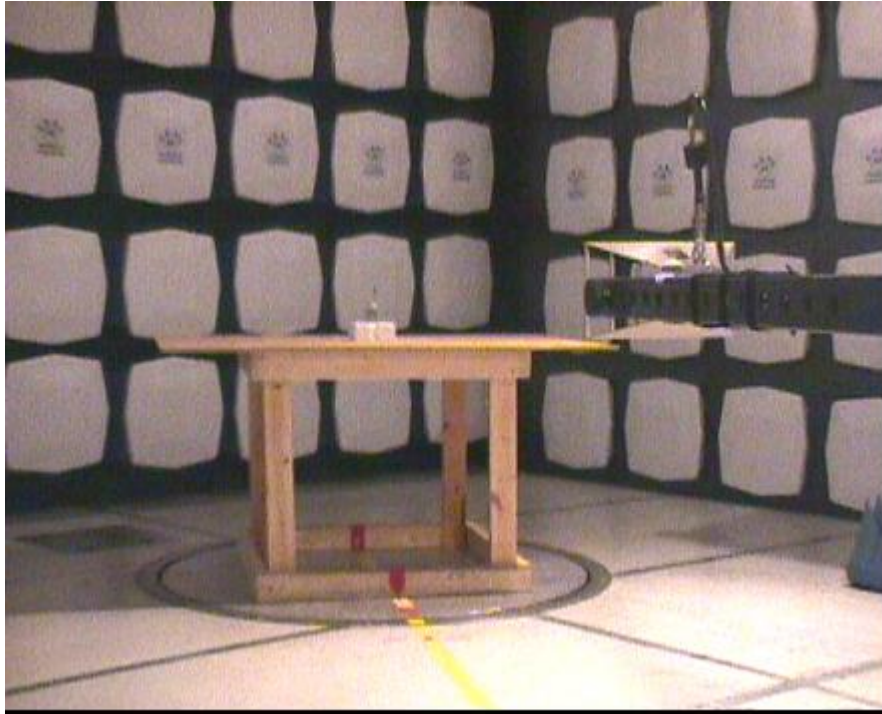
Frequency (MHz)	FCC Maximum Limit (dBuV/m)	Horizontal Measured Field Strength (dBuV/m)	Vertical Measured Field Strength (dBuV/m)
Local Oscillator	54	*	*
2nd harmonic	54	*	41.2
3rd harmonic	54	41.9	39.7
4th harmonic	54	44.8	46.4
5th harmonic	54	*	*
4944.4200	54	*	*
7th harmonic	54	*	*
8th harmonic	54	*	*
9th harmonic	54	*	*
10th harmonic	54	*	*



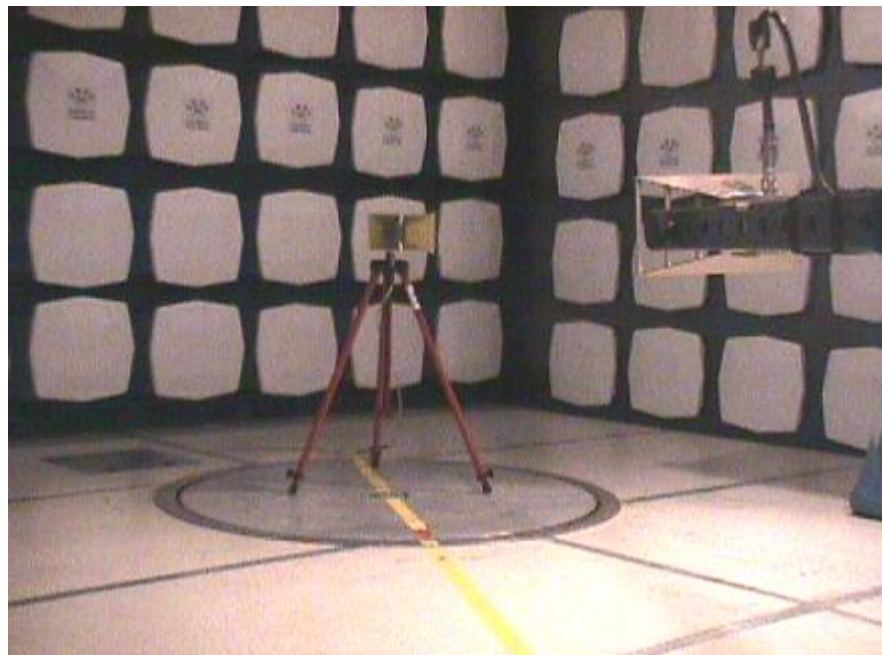
Notes:

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