



**MOTOROLA**

**PERSONAL COMMUNICATIONS SECTOR**

**PRODUCT SAFETY AND COMPLIANCE  
EMC LABORATORY**

**EMC TEST REPORT**

**Test Report Number** – 6003-2

**Report Date** – February 11, 2002

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

A handwritten signature in blue ink, appearing to read 'Kirby Munroe', written over a horizontal line.

Name: Kirby Munroe

Title: Compliance Engineer

Date : 2/11/2002

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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



**Test Report Details**

Tests Performed By: Motorola Personal Communications Sector  
Product Safety and Compliance Group  
1500 Gateway Boulevard  
Boynton Beach, FL 33426  
PH (561) 739-2179 Fax (561) 739-2131

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

Product Type: Cellular Phone

Signaling Capability: GSM 1900

Model Number: SUG2378A

Serial Numbers: EGB0035, EE30068, EGB0099

Received Date: February 7, 2002

Testing Start Date: February 7, 2002

Testing Complete Date: February 10, 2002

Measurement of Uncertainty: +/- 3.8 dB

**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 22 Subpart H - Public Mobile Services
- Part 24 - Personal Communications Services
- Part 90 - Private Land Mobile Radio Service

Applicable Standards: ANSI 63.4 2000

**Summary of Testing**

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

Test #	Test Name	Margin with respect to the Limit
1	RF Power Output	NA
2	EIRP	NA
3	Occupied Bandwidth	NA
4	Spurious Emissions at Antenna Terminal	17.6 dB
5	Field Strength of Spurious Emissions	12.8 dB
6	Frequency Stability	151.5 Hz
7	Field Strength of Radiated Emissions from Unintentional Radiators	2.8 dB

The margin with respect to the limit is the minimum margin for all modes and bands.

**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</b>	<b>Item</b>	<b>Item Version/</b>	<b>Serial</b>	<b>CALIBRATION</b>
<b>Name</b>	<b>Name</b>	<b>Model#</b>	<b>Number</b>	<b>DUE DATE</b>
	<b>Description</b>			
Rohde & Schwarz	EMI Test Receiver	ESI26	100001	3/13/2002
Rohde & Schwarz	EMI Test Receiver	ESI26	838386010	2/28/2002
Hewlett Packard	RF Amplifier	8347A	3307A01225	7/30/2002
Hewlett Packard	Pre-Amplifier	8449B	3008A00535	7/2/2002
ETS	DRG Horn Antenna	3115	6222	9/23/2002
A.H. Systems Inc.	DRG Horn Antenna	SAS-200571	265	8/21/2002
A.H. Systems Inc.	DRG Horn Antenna	SAS-200571	365	11/14/2002
ETS	Log-Periodic Antenna	3148	1188	12/6/2002
ETS	Biconical Antenna	3110B	3370	10/16/2002
Compliance Design	Biconical Antenna	B100	385	7/31/2002
Compliance Design	Biconical Antenna	B200	312	9/15/2002
Compliance Design	Biconical Antenna	B300	321	7/30/2002
Attenuator	Weinschel	AS-6	6675	10/10/2002
Attenuator	Weinschel	AS-6	6677	11/10/2002
EMCO	LISN	3810/2	2179	1/20/2002
Rohde & Schwarz	Mobile Test Set	CMD 80	DE29008	10/18/2002
Hewlett Packard	Signal Generator	83623B	3844A01195	1/16/2003
Themotron	Environmental Chamber	S-4	3158C	12/20/2002

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 not supplied by EMC Lab

**GSM 1900**

Frequency (MHz)	Power (dBm)
1850.2	30.84
1880.0	30.73
1909.8	30.78

## **RADIATED (EIRP)**

### **Measurement Procedure**

The phone was tested in Harvard Chamber 1, which is 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 for GSM 1900 three frequencies (1850.2, 1880.0 and 1909.8 MHz) with antenna stubby.

GSM measurements were made with the phone placed in a call using the HP8922M mobile station test set. The phone was weakly coupled to the test set and configured to transmit in full data rate mode, with a nominal output power setting of 29.5 dBm for 1900. 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 "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 Hummingbird GSM 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

#### **GSM 1900**

1850.2 MHz: 30.36 dBm

1880.0 MHz: 30.16 dBm

1909.8 MHz: 30.64 dBm

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

**Max EIRP is 30.64 dBm**

**Max ERP is 28.54 dBm**

## OCCUPIED BANDWIDTH

CFR Part 2.1049, 24.238

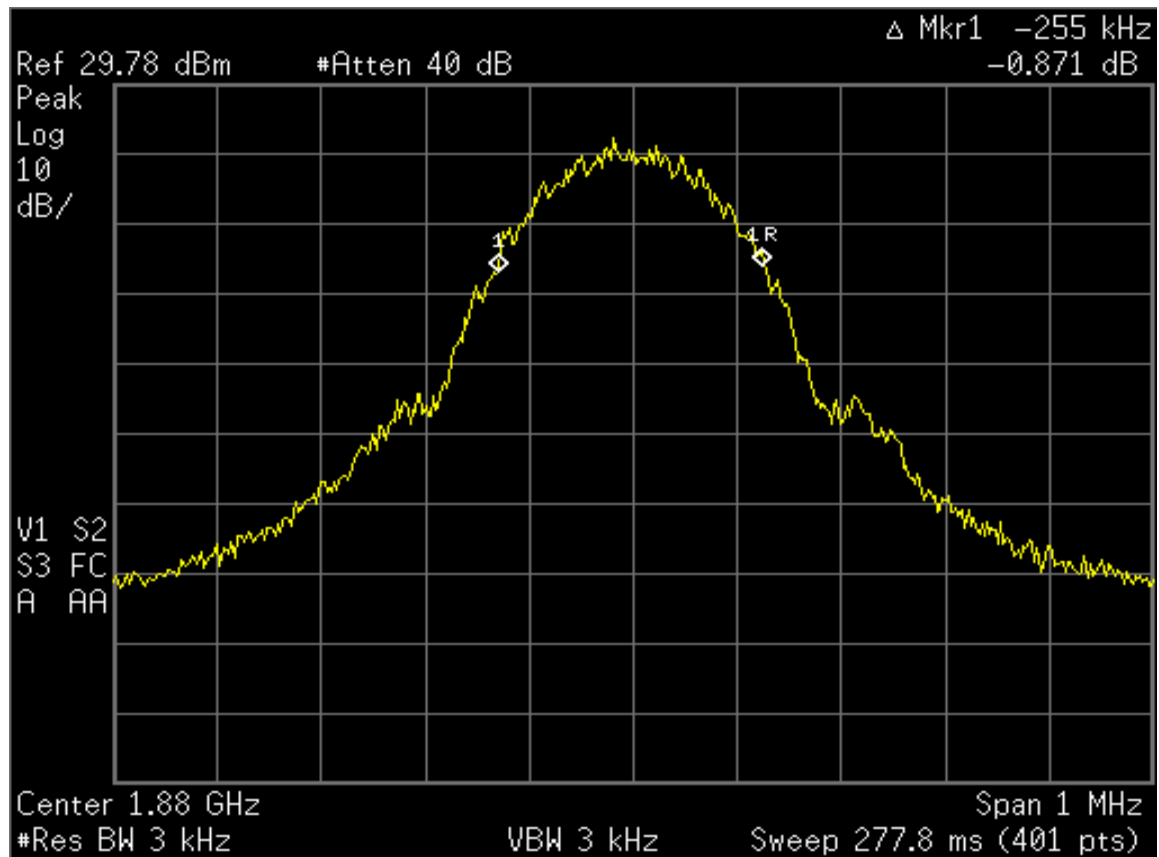
### Measurement Procedure

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. 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

#### GSM 1900



## **SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

CFR Part 2.1051, 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.

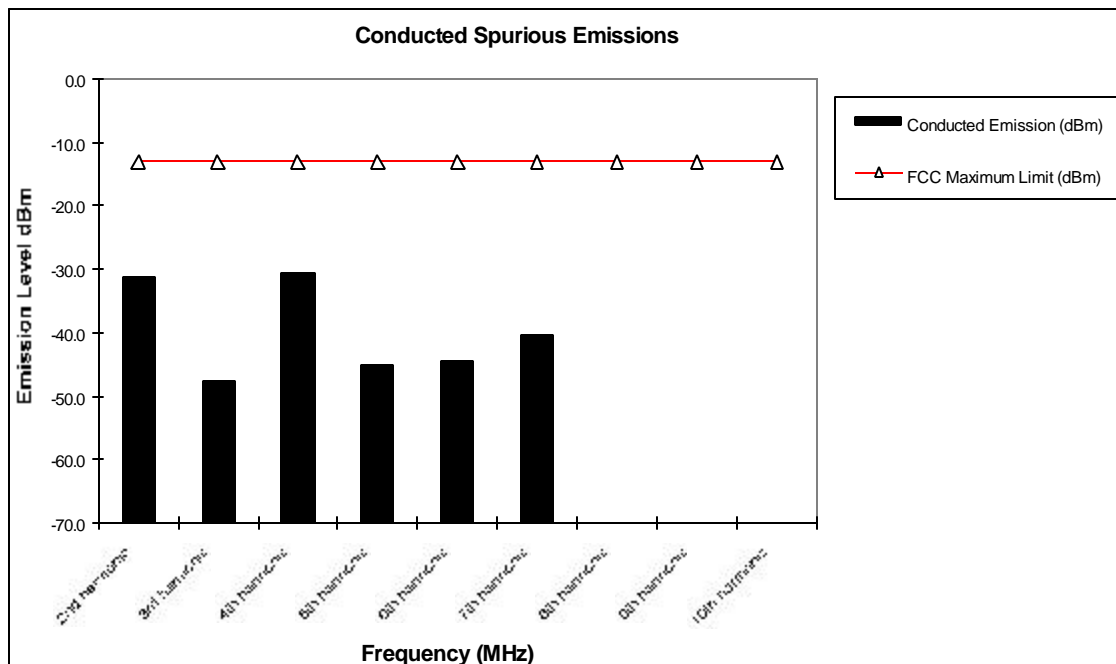
### **Measurement Results**

Attached

**Measurement Results**  
**Modulation: GSM 1900**

**Conducted Spurious and Harmonic Emissions**

Harmonic of Fundamental	FCC Maximum Limit (dBm)	Conducted Emission (dBm)
2nd harmonic	-13	-31.2
3rd harmonic	-13	-47.5
4th harmonic	-13	-30.6
5th harmonic	-13	-45.2
6th harmonic	-13	-44.4
7th harmonic	-13	-40.4
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, 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, 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.

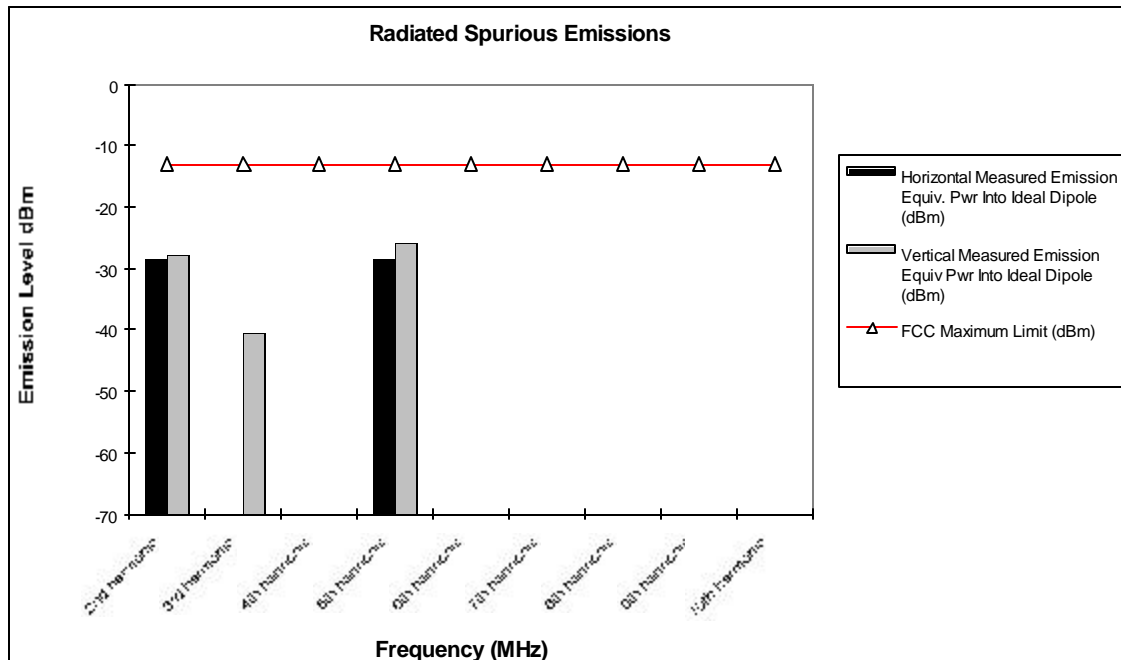
### **Measurement Results**

Attached

**Measurement Results**  
**Modulation: GSM 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	-28.3	-27.8
3rd harmonic	-13	*	-40.6
4th harmonic	-13	*	*
5th harmonic	-13	-28.6	-25.8
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

CFR Part 2.1055, 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**

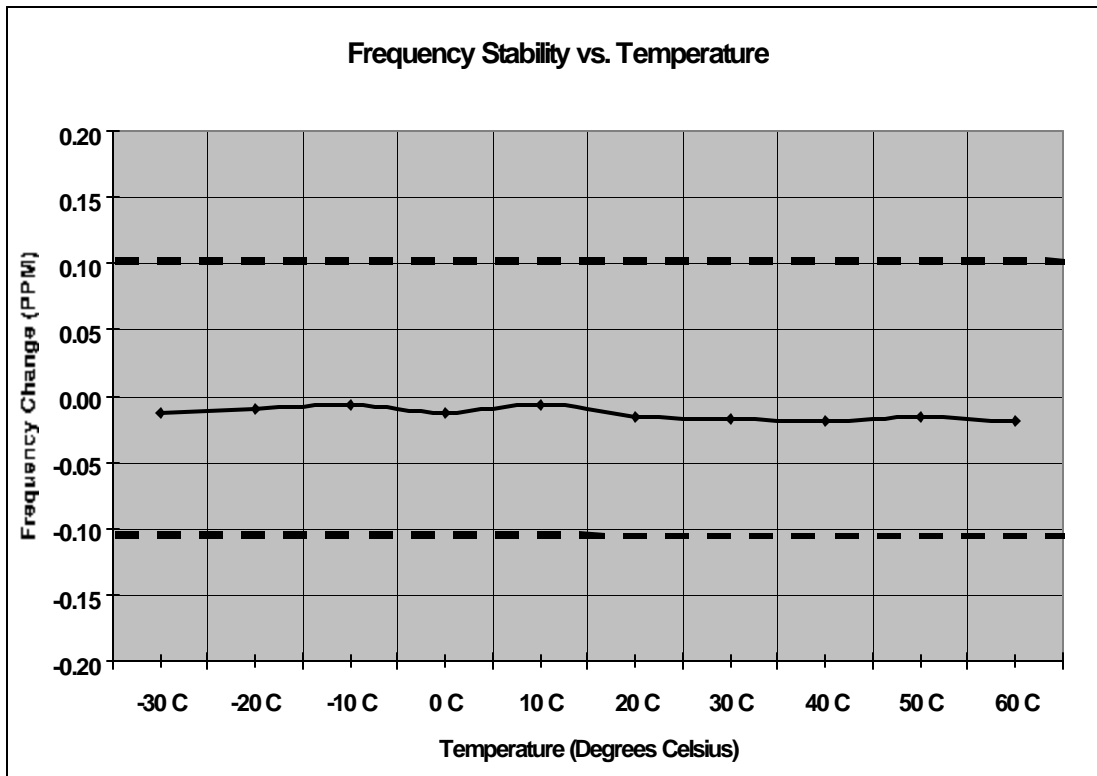
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**Measurement Results**  
**Modulation: GSM 1900**

**Frequency Stability**

<b>Mode:</b>	GSM 1900	<b>Operating Frequency:</b>	1880.0 MHz
<b>Channel:</b>	661	<b>Deviation Limit (PPM):</b>	0.1ppm
<b>Date:</b>	8-Feb-02	<b>Submission #:</b>	6003-1
<b>Product:</b>	V70	<b>SN:</b>	EGB0068

Temperature	Frequency Error	Frequency Error	Voltage	Power
C	HZ	(PPM)	(%)	(VDC)
-30 C	-23.00	-0.012	100%	3.60
-20 C	-18.00	-0.010	100%	3.60
-10 C	-12.80	-0.007	100%	3.60
0 C	-24.20	-0.013	100%	3.60
10 C	-11.60	-0.006	100%	3.60
20 C	-28.80	-0.015	100%	3.60
30 C	-32.40	-0.017	100%	3.60
40 C	-36.50	-0.019	100%	3.60
50 C	-29.40	-0.016	100%	3.60
60 C	-36.50	-0.019	100%	3.60
20 C	-27.40	-0.015	Battery Endpoint	3.20



## FIELD STRENGTH OF RADIATED 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)

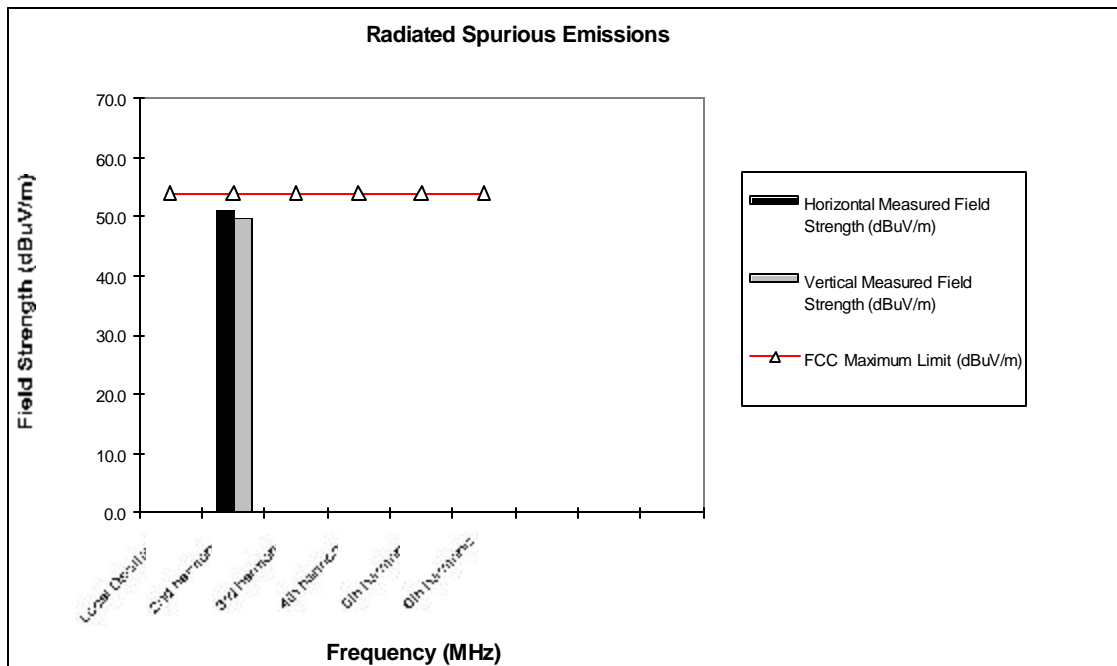
### Measurement Results

Attached

**Measurement Results**

**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	51.2	49.9
3rd harmonic	54	*	*
4th harmonic	54	*	*
5th harmonic	54	*	*
6th 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.

**End of Test Report**