



**MOTOROLA**

**PERSONAL COMMUNICATIONS SECTOR**

**PRODUCT SAFETY AND COMPLIANCE  
EMC LABORATORY**

**EMC TEST REPORT - Addendum**

**Test Report Number** – 11400-1BT

**Report Date** – August 17, 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 : 2003-08-17

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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**

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

Radiated Emissions  
Performed By: Underwriters Laboratories  
International EMC Services  
333 Pfingsten RD  
Northbrook, IL 60062  
Contact: Lubomir Madjarov  
(Tel) 847/664-3957  
(Fax) 847/313-3957

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

Product Type: Cellular Phone

Signaling Capability: GSM 1900, Bluetooth

Model Number: SUG2936A

Serial Numbers: L9505M009

Testing Complete Date: August 17, 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)

DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" published by the Federal Communications Commission was also used in the testing of this product.

**Summary of Testing**

Test #	Test Name	Pass/Fail
1	Carrier Frequency Separation	Pass
2	Number of Hopping Frequencies	Pass
3	Time of Occupancy (Dwell Time)	Pass
4	20 dB Bandwidth	Pass
5	Spurious RF Conducted Emissions	Pass
6	Field Strength of Spurious Emissions	Pass
7	Max Power	N/A
8	Band Edges	See plots
9	Conducted Spurious Emissions	Pass

Test #	Test Name	Results
1	Carrier Frequency Separation	1MHz
2	Number of Hopping Frequencies	79
3	Time of Occupancy (Dwell Time)	125µs
4	20 dB Bandwidth	28.8 dB
5	Spurious RF Conducted Emissions	See plots
6	Field Strength of Spurious Emissions	See plots
7	Max Power	-3.245dBm
8	Band Edges	See plots
9	Conducted Spurious Emissions	See plots

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

Hewlett Packard	RF Amplifier	8347A	3307A01225	9/17/2003
Hewlett Packard	Pre-Amplifier	8449B	3008A00535	10/11/2003
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
<b>U.L. Equipment List</b>				
Hewlett Packard	QP Adapter	85650A	2811A010169	1/15/2004
Hewlett Packard	S/A Display	8566B	2542A12974	1/15/2004
Hewlett Packard	S/A Display	8566B	2637A03376	1/15/2004
Hewlett Packard	RF Preselector	85685A	2810A00692	1/15/2004
Rohde & Schwarz	S/A Display	FSEK20	DE2525315	1/14/2004
EMCO	Horn Antenna 1-18GHz	3115	2638	7/10/2004
EMCO	Horn Antenna 18-26.5GHz	3160-09	9904-1165	N/A
Chase	Bi-Con Antenna 30-300MHz	VBA6106A	1246	6/23/2004
Chase	Log-Periodic Antenna	UPA6108	1120	6/18/2004

All equipment is on a one-year calibration cycle.

## **Description of Bluetooth Transmitter**

The A920 multimedia communicator offers Bluetooth as a feature. The Bluetooth spread-spectrum, frequency hopping transceiver is designed to operate between 2400 and 2483MHz. The Bluetooth antenna is mounted on the PCB inside of the EUT. The antenna installation is permanent.

As a Bluetooth transmitter, it is designed operate with other Bluetooth devices as defined by industrial standard. In this application, the device is battery-operated. Therefore conducted AC line emissions testing as described in CFR47, Part 15.207 was not necessary.

## **Measurement Procedures and Data**

### **CARRIER FREQUENCY SEPARATION**

CFR 47 Part 15.247

#### **Measurement Procedure**

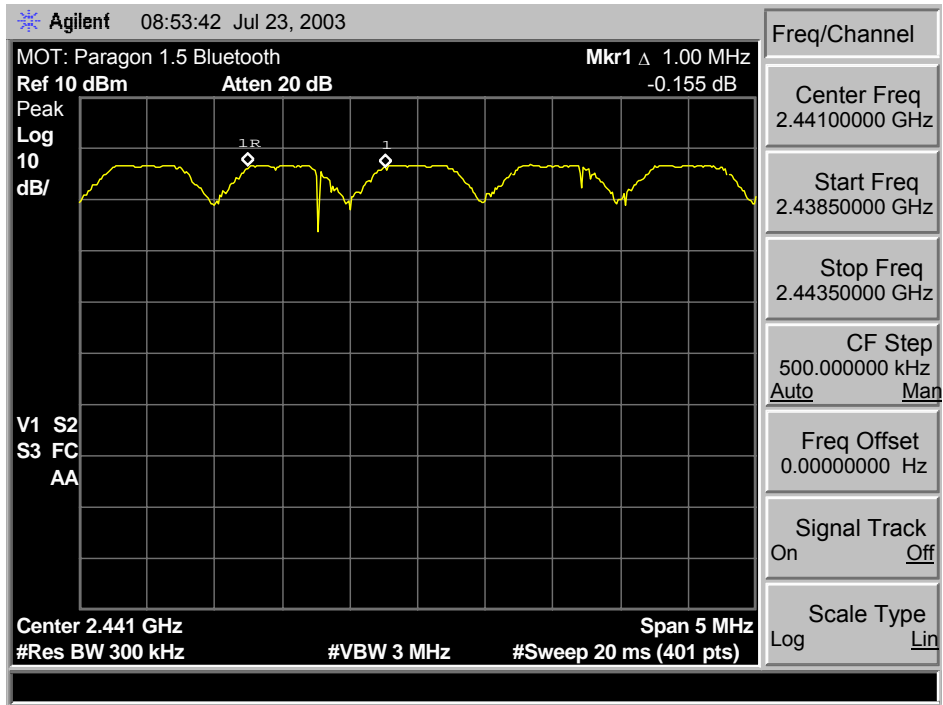
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

The Bluetooth transmitter of the A920 had its hopping function enabled. The following spectrum analyzer settings were used:

1. Span = wide enough to capture the peaks of two adjacent channels
2. Resolution (or IF) Bandwidth (RBW)  $\geq$  1% of the span
3. Video (or Average) Bandwidth (VBW)  $\geq$  RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

### Measurement Results



### Carrier Frequency Separation

## NUMBER OF HOPPING FREQUENCIES

CFR 47 Part 15.247

### **Measurement Procedure**

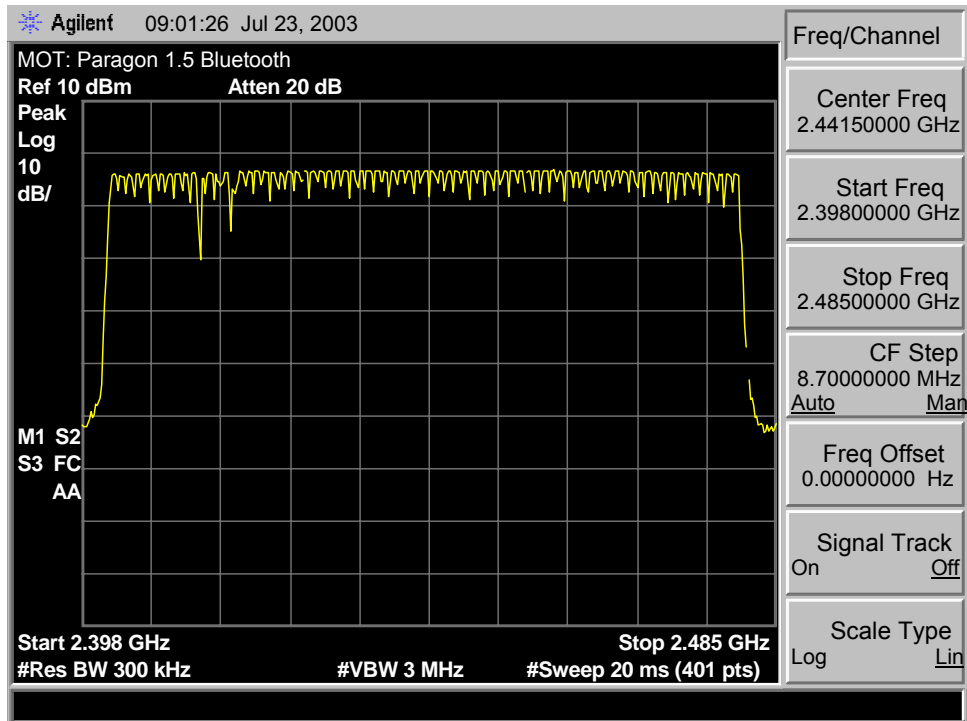
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = the frequency band of operation
2. RBW  $\geq$  1% of the span
3. VBW  $\geq$  RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

The trace was allowed to stabilize.

### Measurement Results



### Number of Hopping Frequencies

## TIME OF OCCUPANCY (DWELL TIME)

CFR47 Part 15.247

### **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 Bluetooth hopping function of the EUT was enabled. The following spectrum analyzer settings were used:

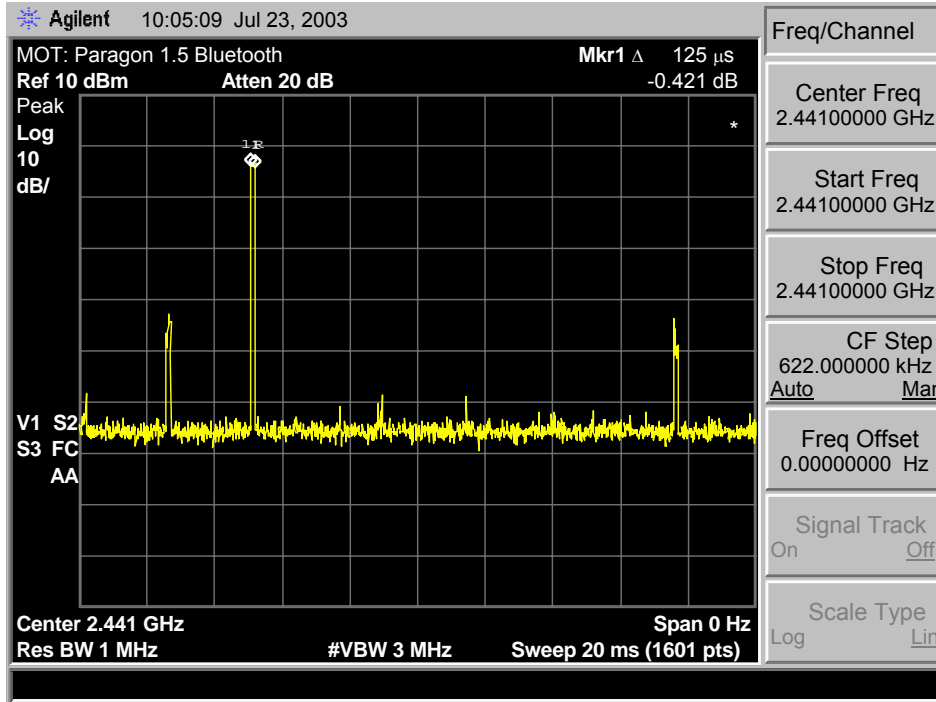
1. Span = zero span, centered on a hopping channel
2. RBW = 1 MHz
3. VBW  $\geq$  RBW
4. Sweep = as necessary to capture the entire dwell time per hopping channel
5. Detector function = peak
6. Trace = max hold

The marker-delta function was used to determine the dwell time.

### **Measurement Results**

Attached

**Measurement Results**



Dwell Time

## 20dB Bandwidth

CFR 47 Part 15.247

### **Measurement Procedure**

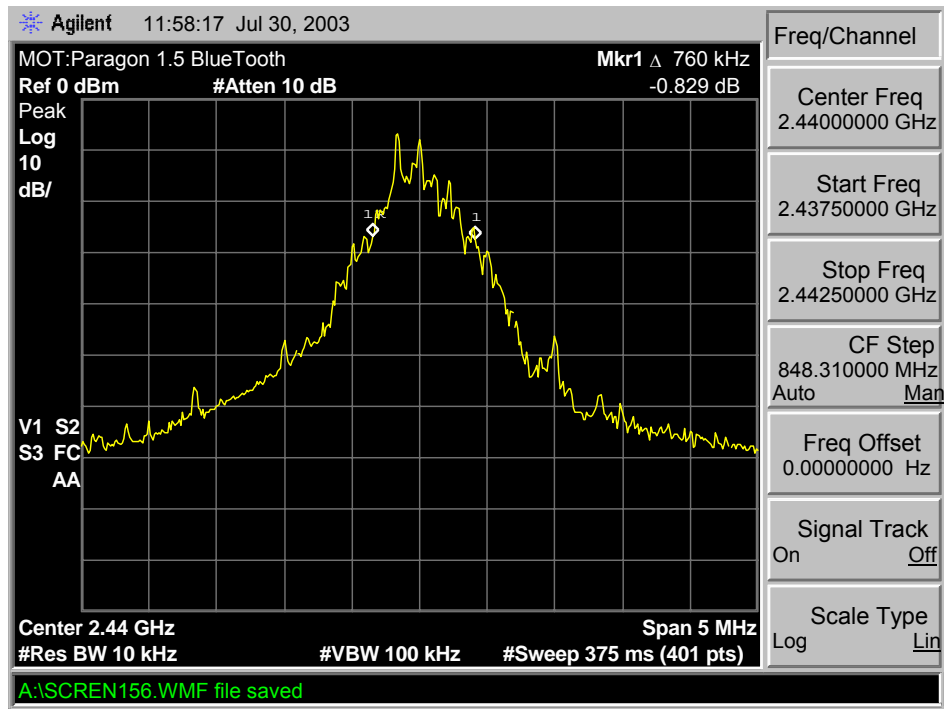
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = approx. 2 to 3 times the 20dB bandwidth, centered on a hopping frequency
2. RBW  $\geq$  1% of the 20dB span
3. VBW  $\geq$  RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

The trace was allowed to stabilize. The EUT was transmitting at its maximum data rate. The marker-to-peak function was used to set the marker to the peak of the emission. The marker-delta function was used to measure 20dB down one side of the emission. The marker-delta function and marker was moved to the other side of the emission until it was even with the reference marker. The marker-delta reading at this point was the 20dB bandwidth of the emission.

Measurement Results



**20 dB Bandwidth**

## FIELD STRENGTH OF SPURIOUS EMISSIONS

CFR Part 2.1053, 15.249

### 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.

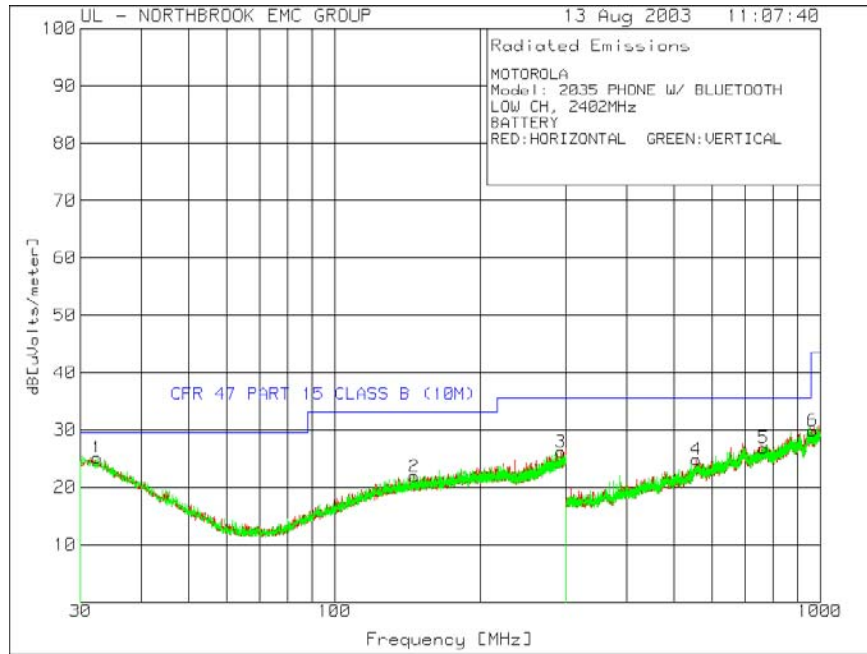
The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

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

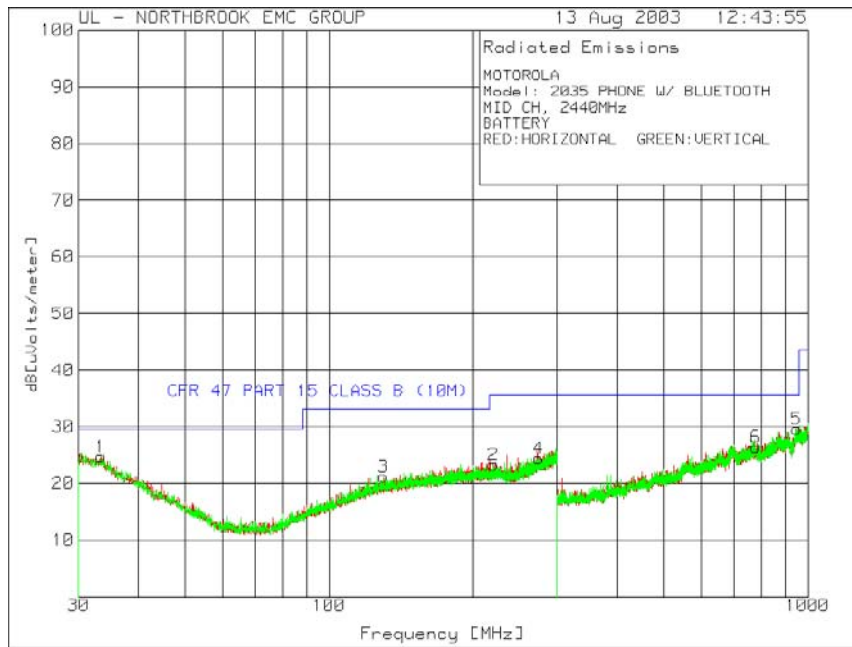
A fully charged battery was used for the supply voltage.

This data was taken at Underwriter's Laboratories.

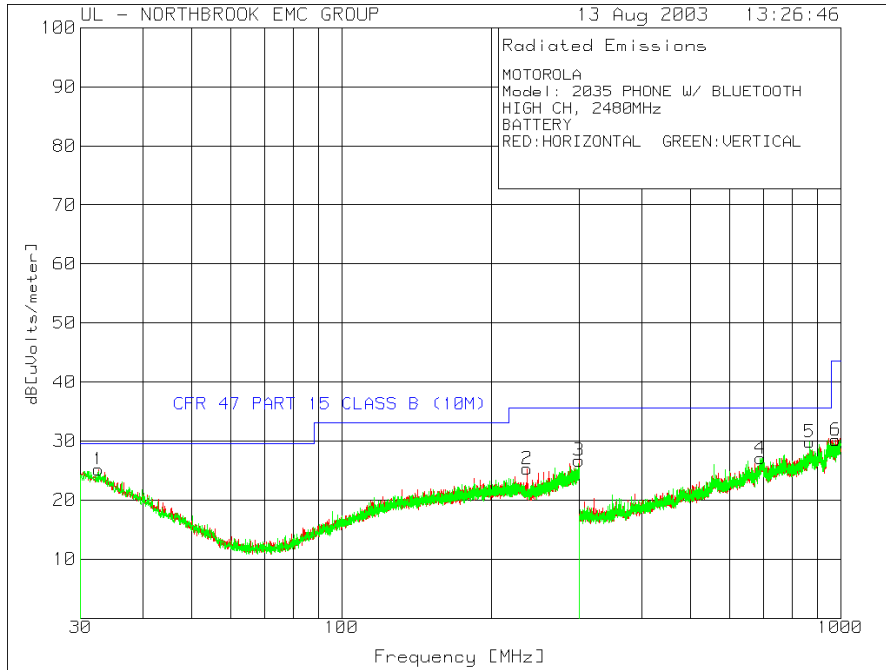
### Measurement Results



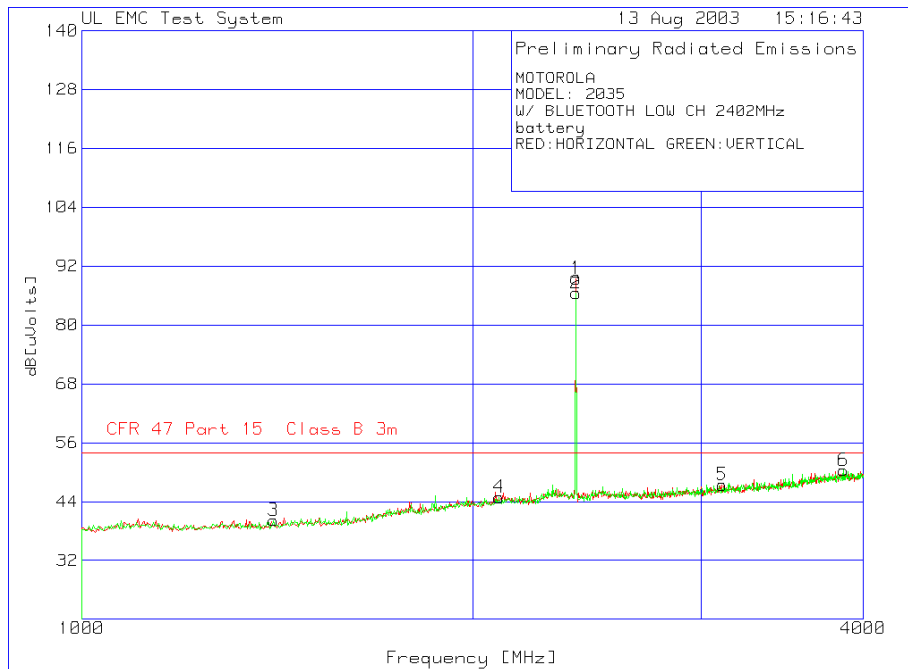
**30 -1000MHz Low Channel**



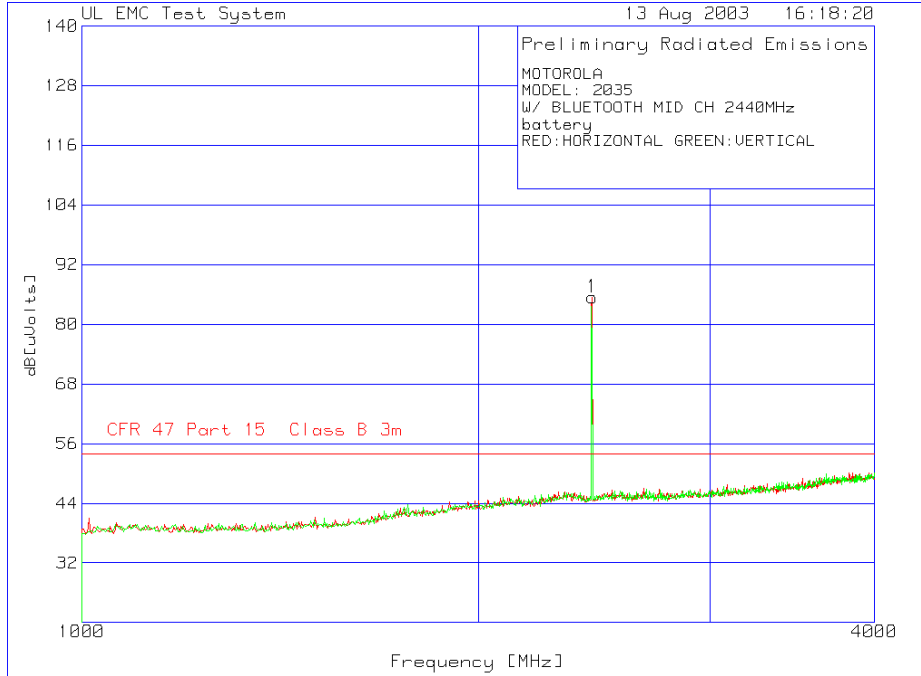
**30-1000MHz Mid Channel**



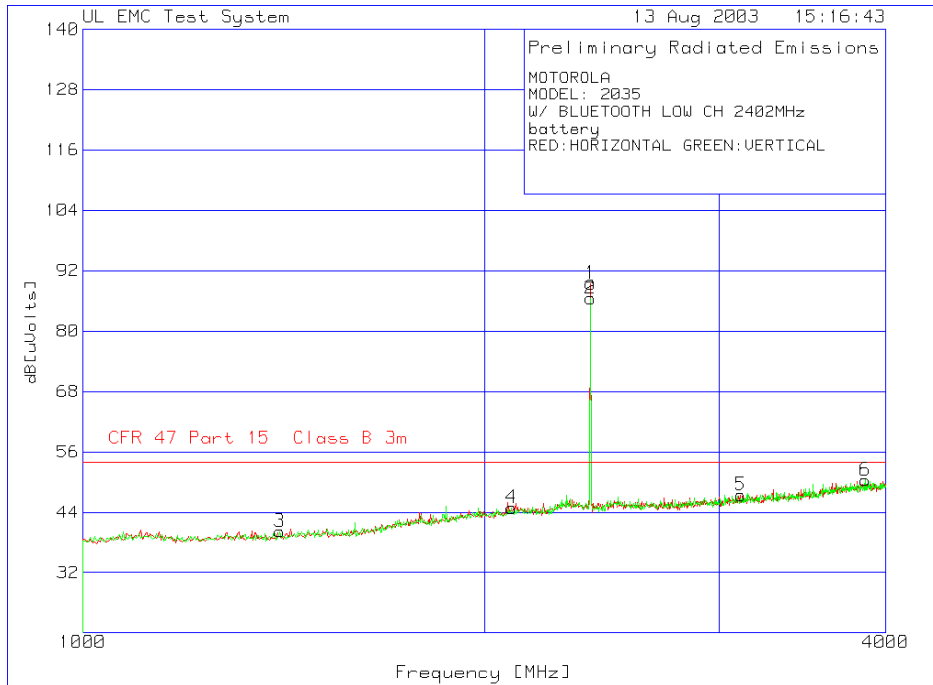
### 30-1000MHz High Channel



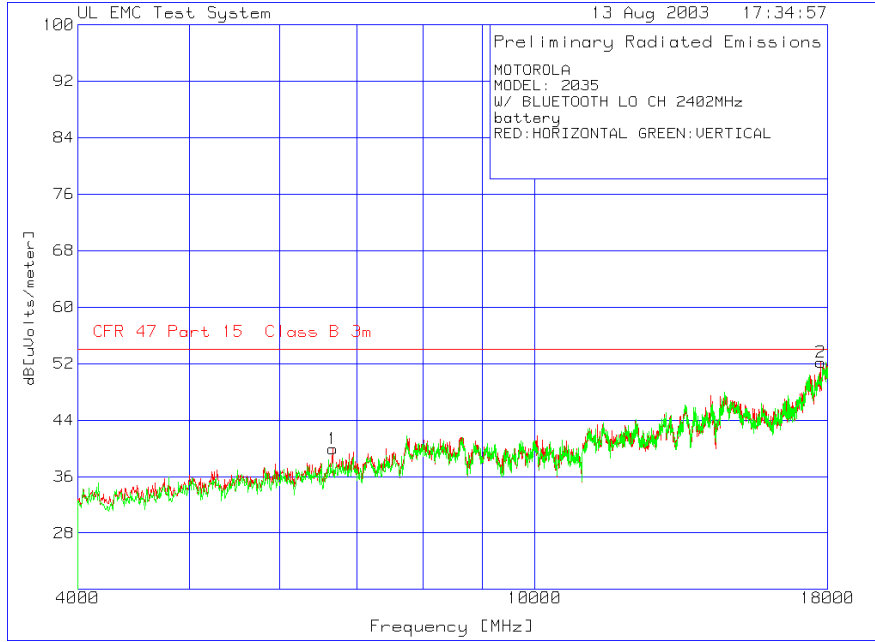
### 1-4GHz Low Channel



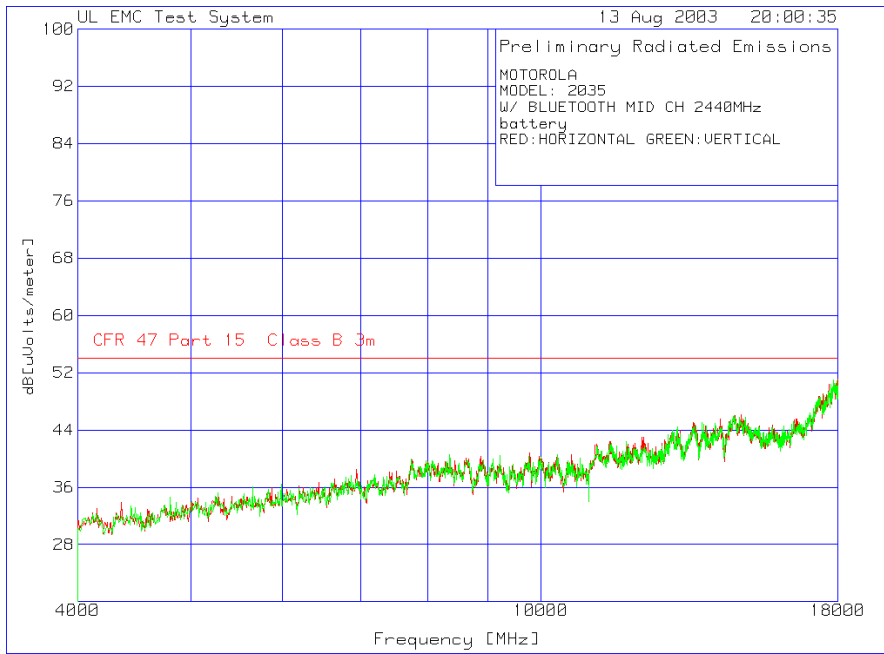
### 1-4GHz Mid Channel



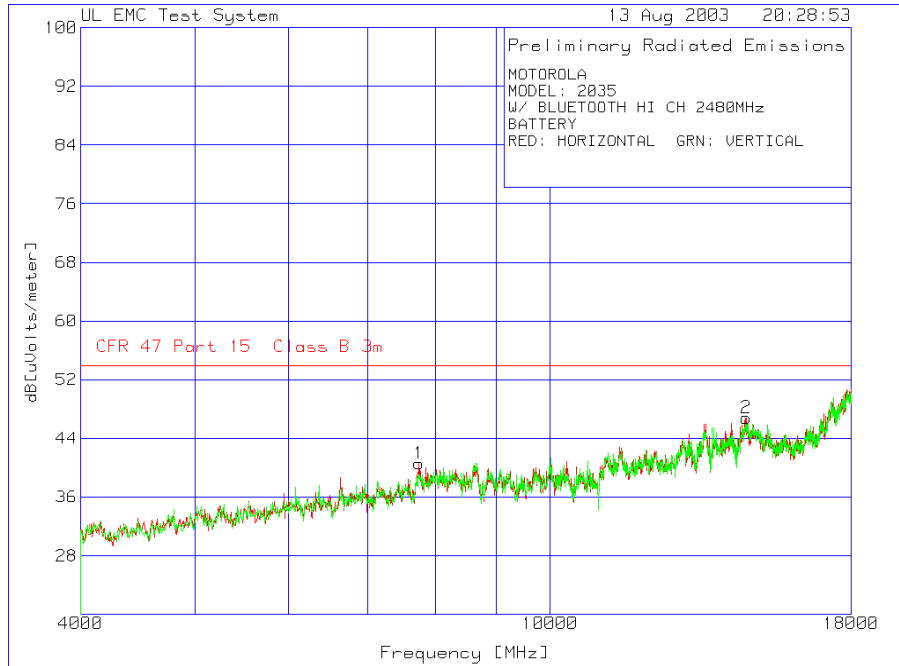
### 1-4 GHz High Channel



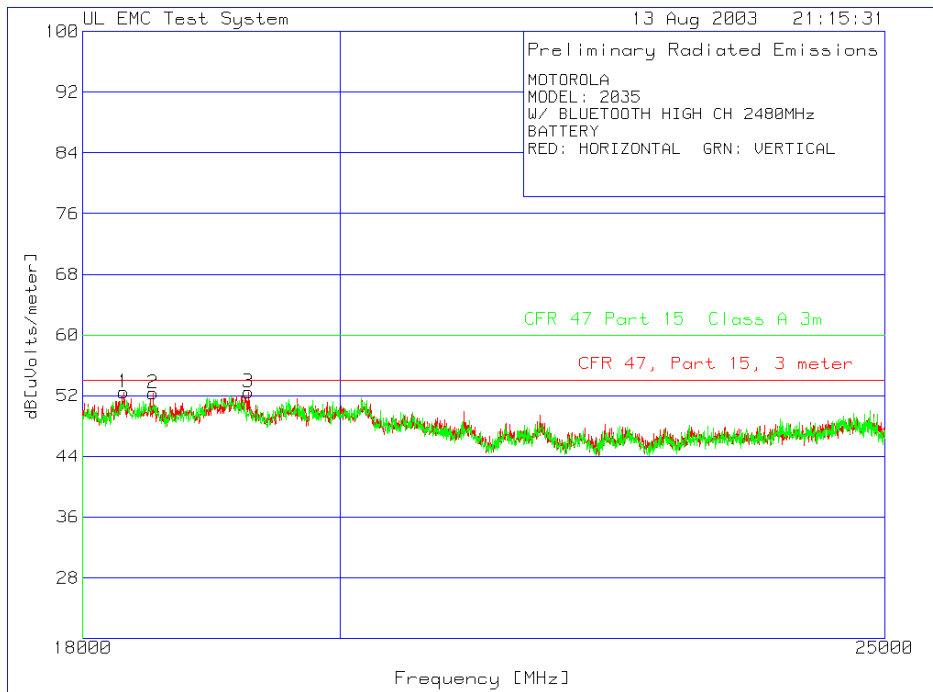
### 4 – 18GHz Low Channel



### 4-18GHz Mid Channel



### 4-18GHz High Channel



### 18-25GHz High Channel

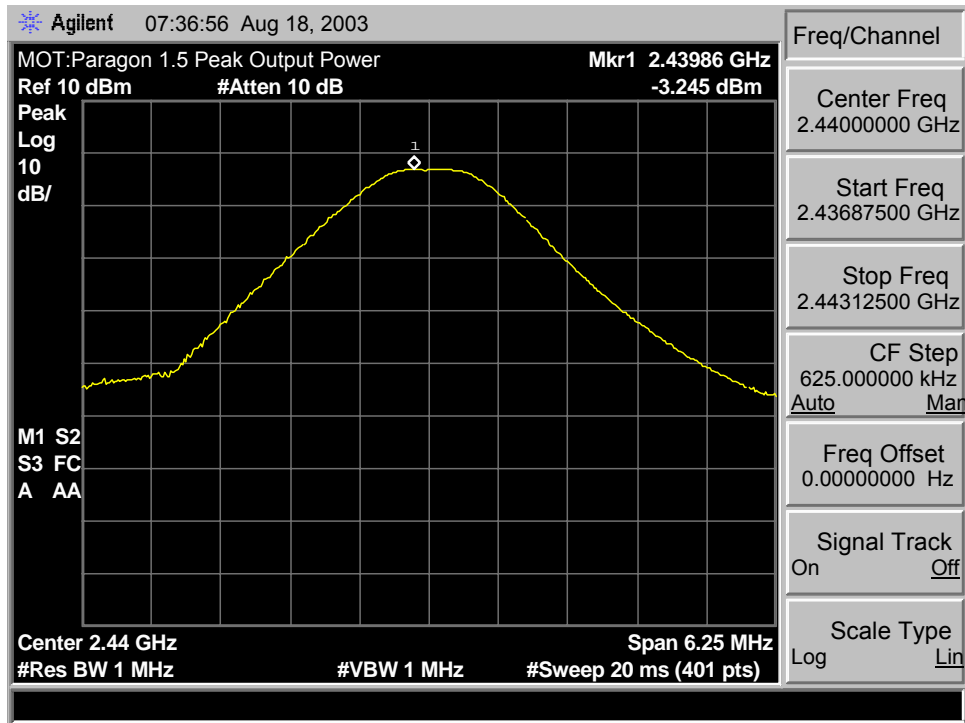
## PEAK OUTPUT POWER

CFR 47 Part 15.247

### 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.

### Measurement Results



Peak Output Power

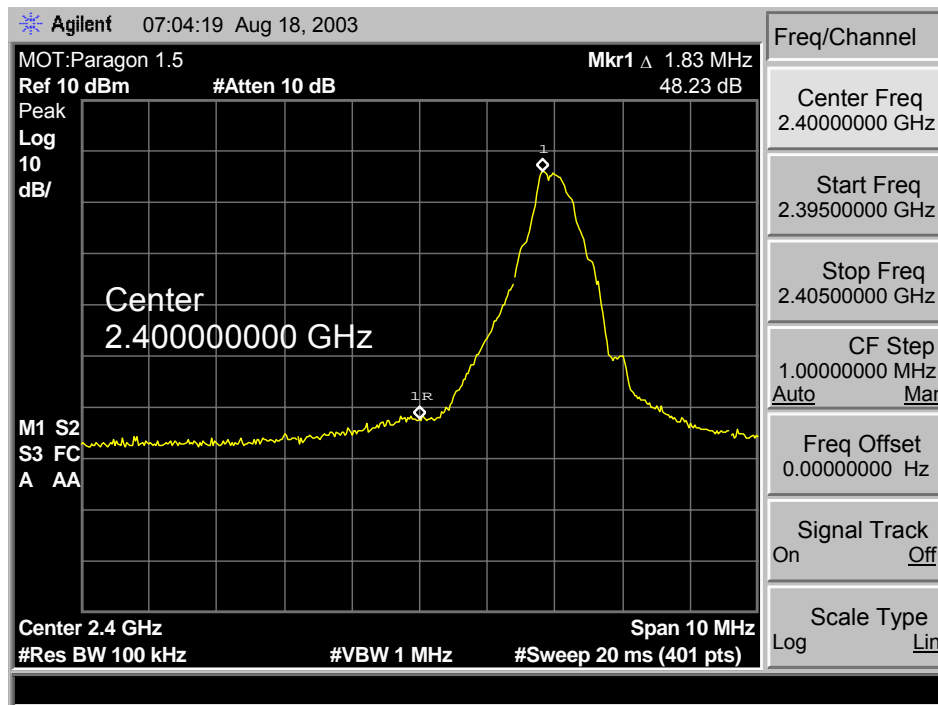
## BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

CFR 47 Part 15.247

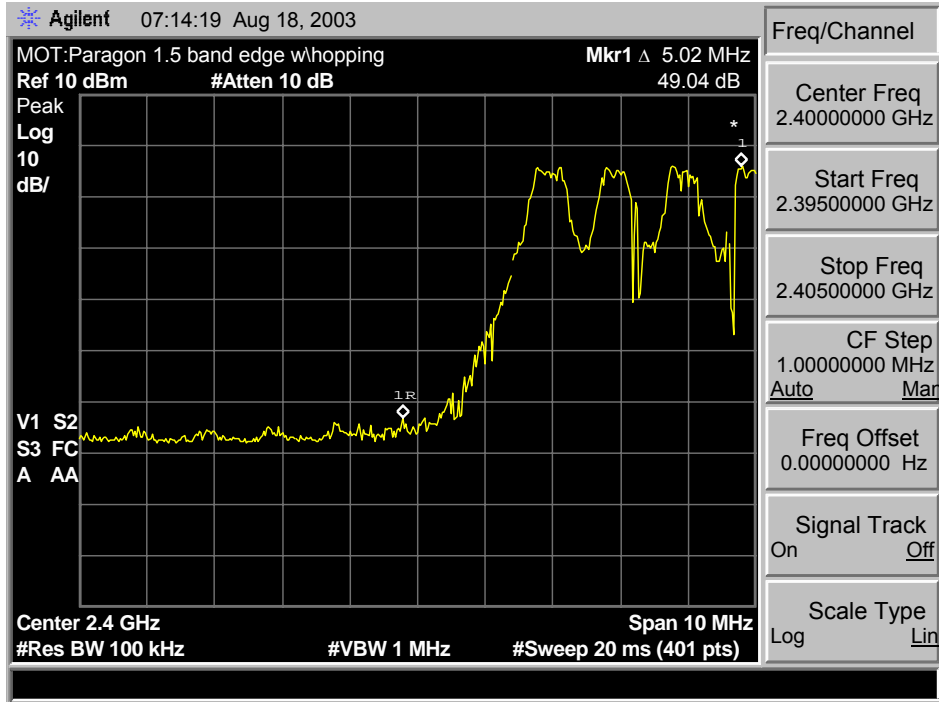
### Measurement Procedure

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.

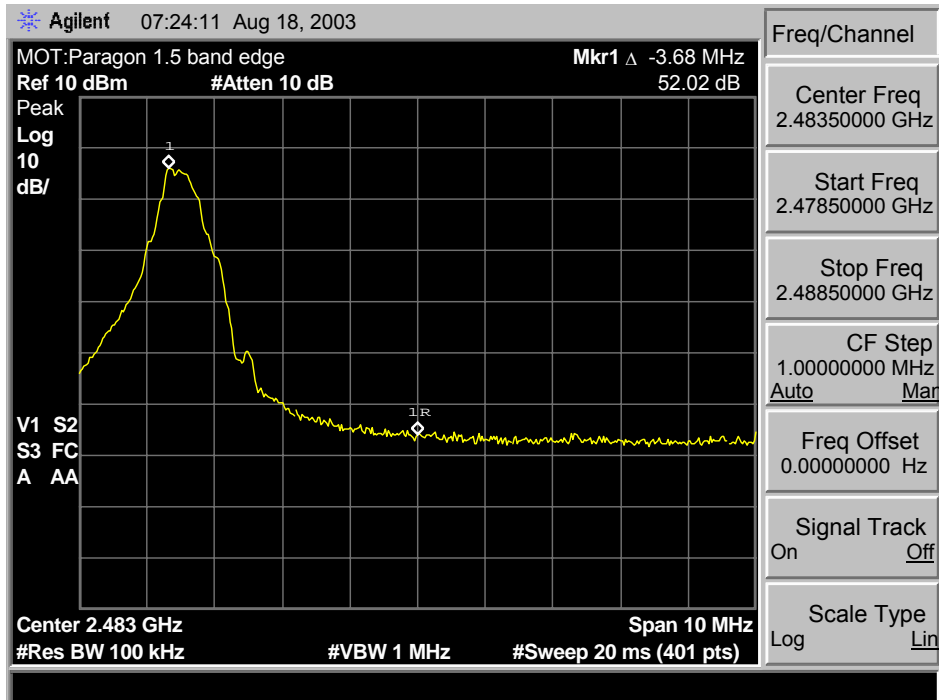
### Measurement Results



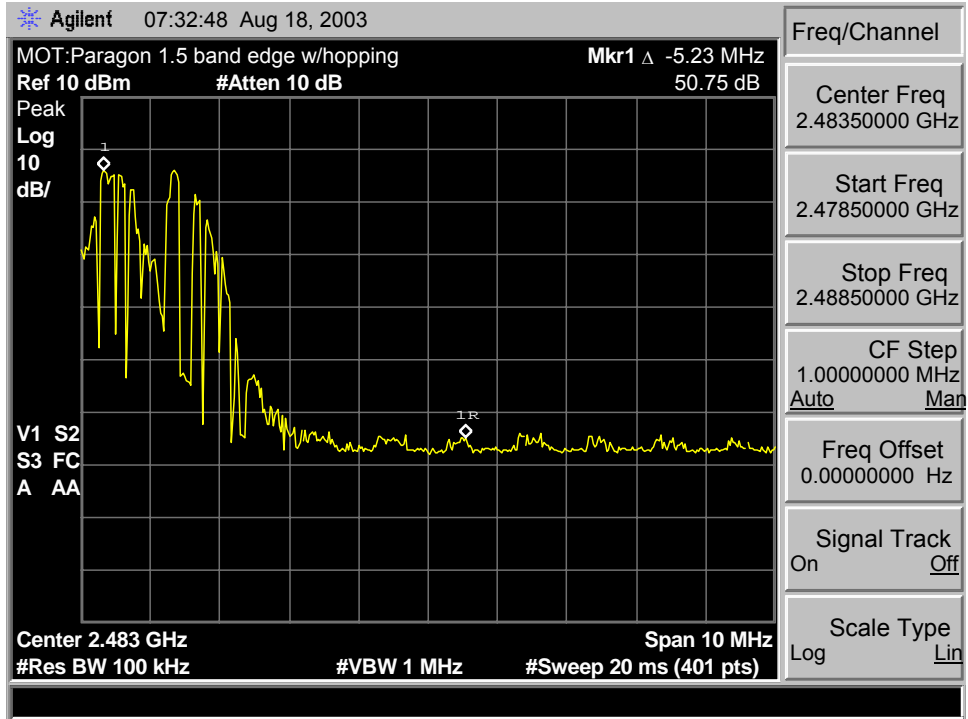
**Low Band Edge Hopping Disabled**



**Low Band Edge with Hopping Enabled**



**High Band Edge Hopping Disabled**



### High Band Edge Hopping Enabled

## **SPURIOUS RF CONDUCTED EMISSIONS**

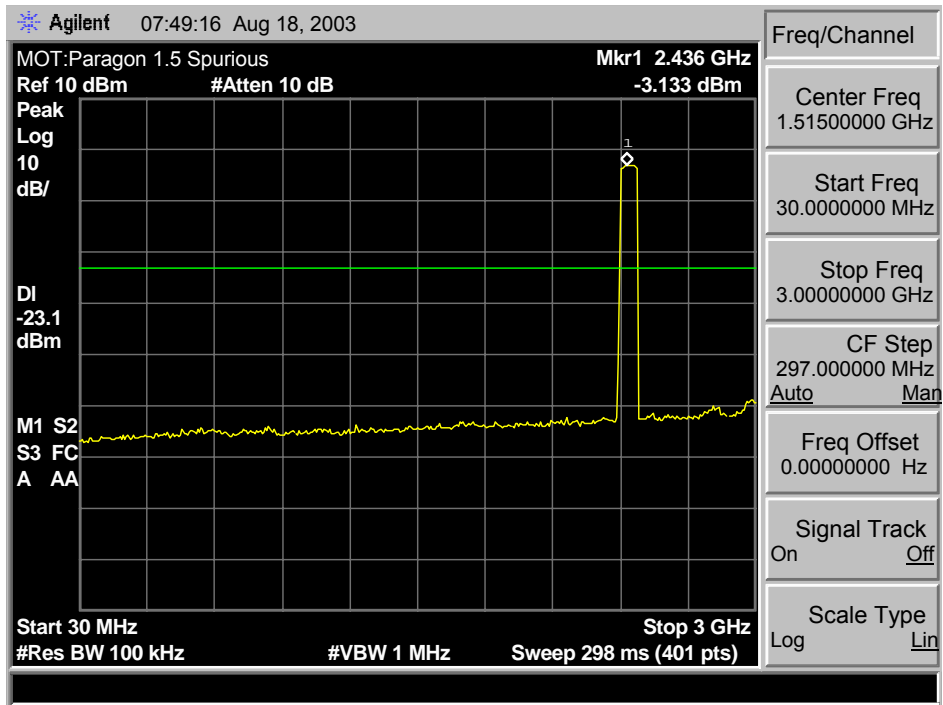
CFR 47 Part 15.247

### **Measurement Procedure**

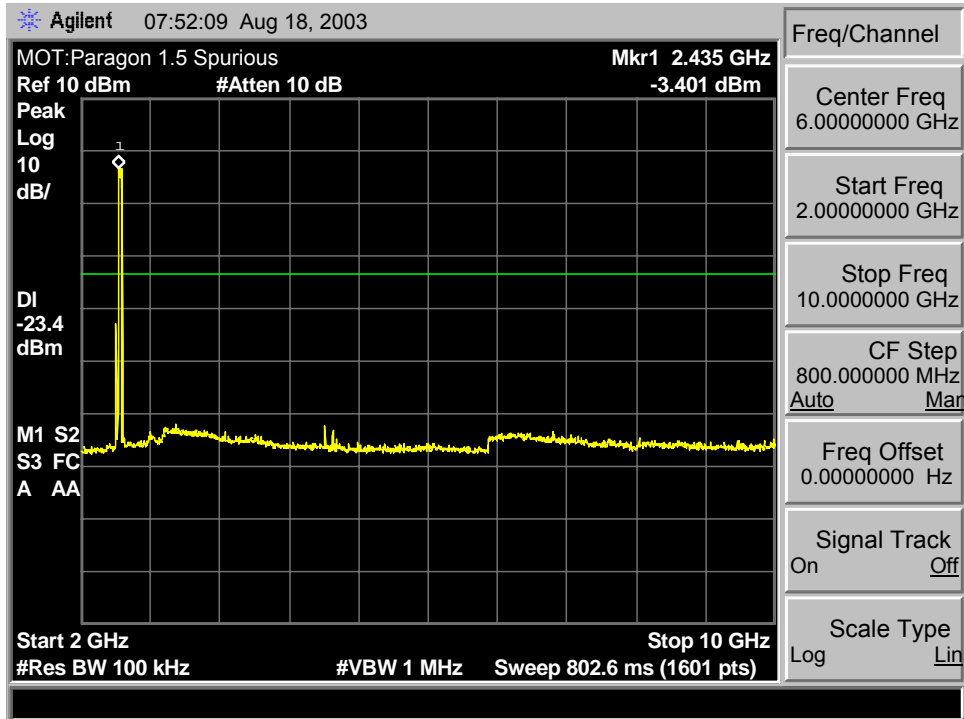
The RF output port of the Equipment Under Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

### **Measurement Results**

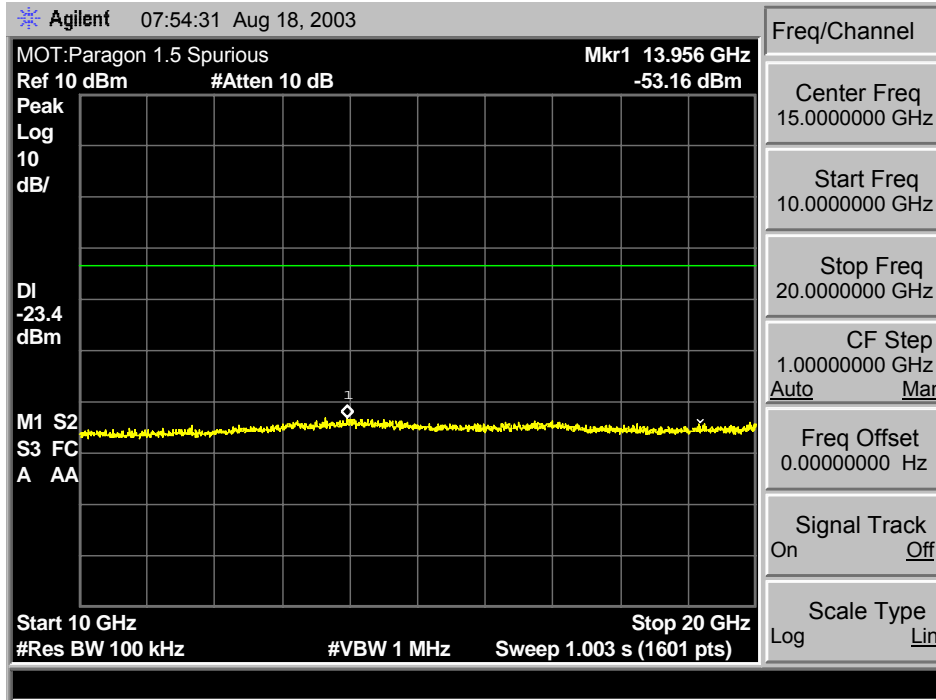
Attached



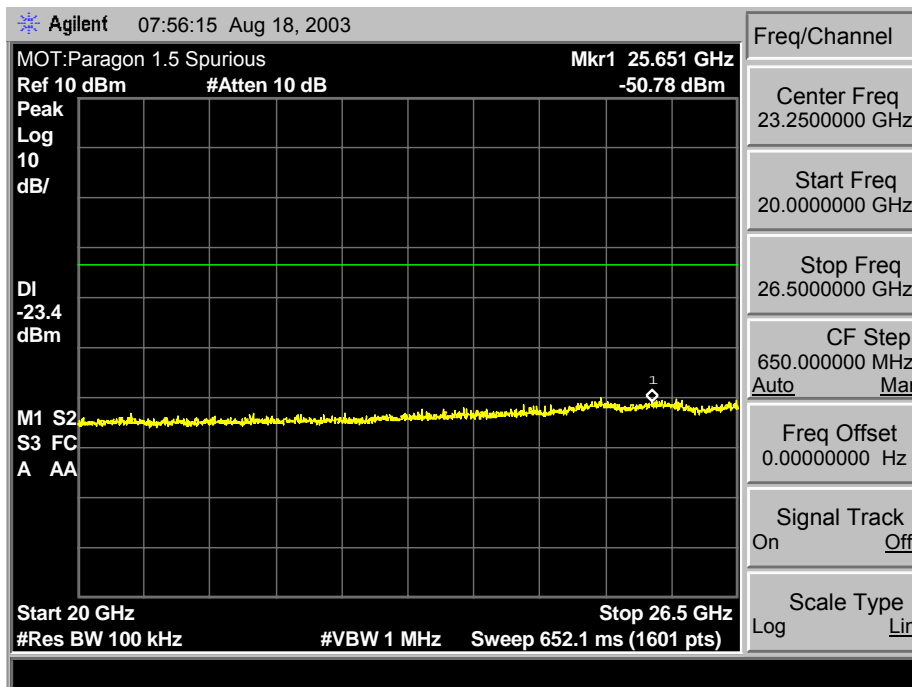
### Conducted Spurious Emissions 30-3000MHz



### Conducted Spurious Emissions 2-10GHz

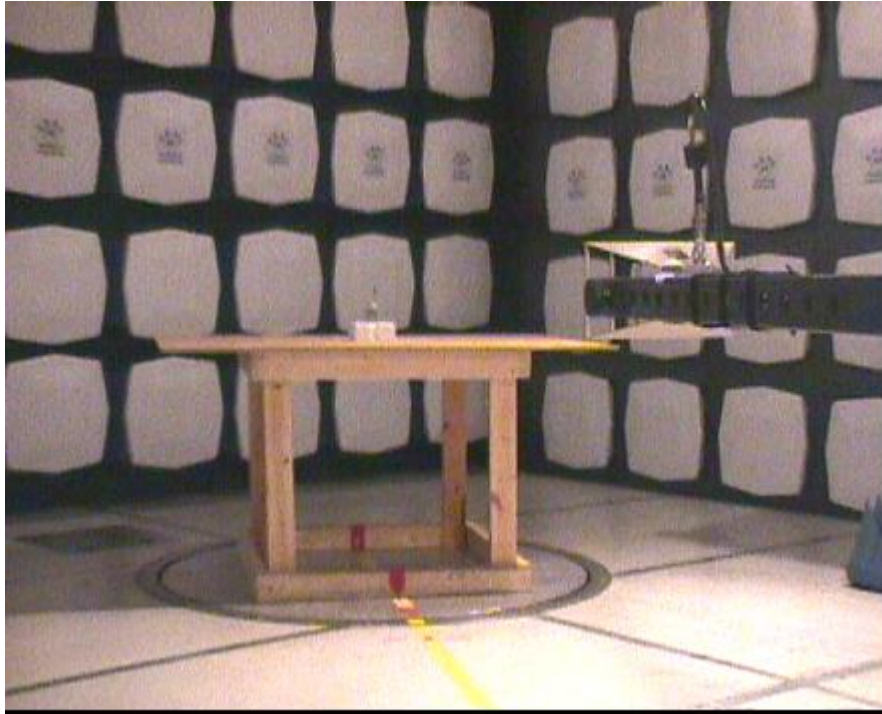


### Conducted Spurious Emissions 10-20GHz

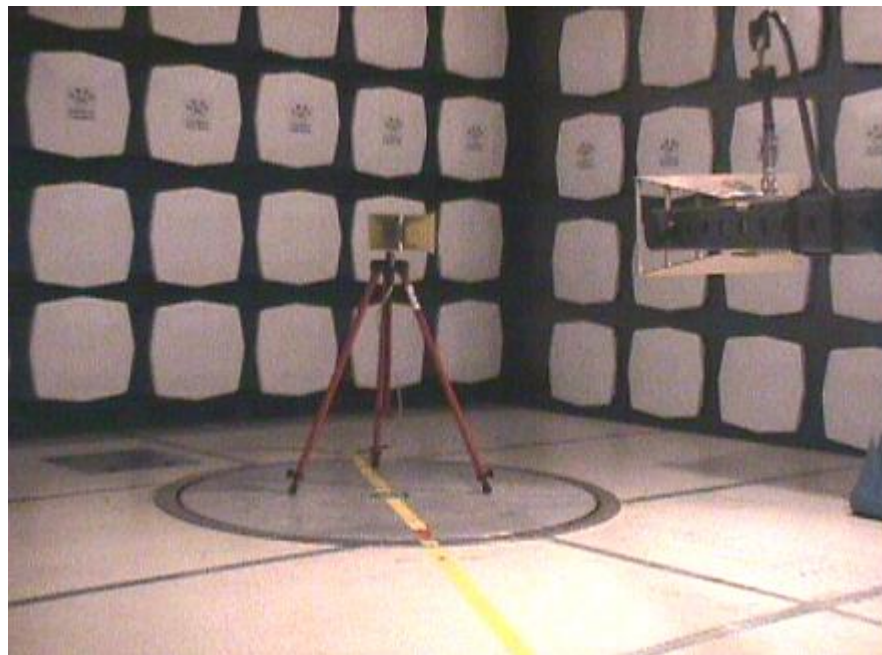


### Conducted Spurious Emissions 20-26.5GHz

**Appendix A – Radiated Emissions Test Setup Photos**



A.1 Radiated Emissions Measurement



A.2 Substitution Measurement

**End of Test Report**