MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587-3201 ● PHONE (510) 489-6300 ● FAX (510) 489-6372

February 10, 2003

Skybility
2236 Rutherford Roads, Suite 103
Carlsbad, CA 92008

Reference: 800 MHz Cellular Module

Dear Mr. Paul A. Wardner,

Enclosed is the EMC Test Report for the Skybility, 800 MHz Cellular Module tested to the requirements of the FCC Rules and Regulations, Part 22 Subpart H, of Title 47 of the CFR, for a Cellular Radiotelephone Service.

Thank you for using the testing services of MET Laboratories. If you have any questions regarding these results or if MET can be of further assistance to you, please feel free to contact me. We appreciate your business and look forward to working with you again soon.

Kindest Regards,
MET LABORATORIES, INC.

Cheryl Anicete
Documentation Department

Enclosures: (\Skybility\EMCS13166-FCC22.rpt)

DOCTEM-23 Jan 02
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Electro-Magnetic Compatibility
Test Report

for the

Skybility
800 MHz Cellular Module

Tested Under

FCC Part 22, Subpart H
Title 47 of the CFR
for Cellular Radiotelephone Service

MET REPORT: **EMCS13166-FCC22**

February 10, 2003

PREPARED FOR:

Skybility
2236 Rutherford Roads, Suite 103
Carlsbad, CA 92008

PREPARED BY:

MET Laboratories, Inc.
33439 Western Avenue
Union City, California 94587

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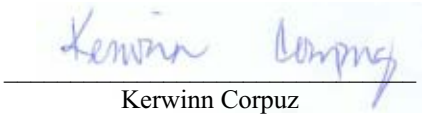
PREPARED FOR:

Skybility
2236 Rutherford Roads, Suite 103
Carlsbad, CA 92008

Alvin Ilarina, Manager
Electromagnetic Compatibility Testing

Cheryl Anicete
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 22, Subpart H, of the FCC Rules under normal use and maintenance.



Kerwinn Corpuz
Project Engineer

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REPORT STATUS SHEET

Revision	Report/Revision Date	Reason for Revision
⌀	February 10, 2003	Initial Issue.

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TABLE OF CONTENTS

I. Executive Summary . . . 1
A. Purpose of Test . . . 2
B. Executive Summary . . . 2
II. General . . . 3
A. Test Site . . . 4
B. Description of Test Sample . . . 4
C. General Test Setup . . . 4
D. Mode of Operation . . . 4
F. Modification . . . 7
G. Disposition of Test Sample . . . 7
III. Electromagnetic Compatibility RF Power Output Requirements . . . 8
A. RF Power Output . . . 9
IV. Electromagnetic Compatibility Modulation Characteristics Requirements . . . 11
A. Modulation Characteristics . . . 12
V. Electromagnetic Compatibility Occupied Bandwidth Requirements . . . 13
A. Occupied Bandwidth . . . 14
VI. Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements . . . 19
A. Spurious Emissions at Antenna Terminals . . . 20
B. Mobile Emissions in Base Frequency Range . . . 23
VII. Electromagnetic Compatibility Radiated Emissions Requirements . . . 26
A. Radiated Emissions (Substitution Method) . . . 27
VIII. Electromagnetic Compatibility Frequency Stability Requirements . . . 33
A. Frequency Stability . . . 34
IX. Test Equipment . . . 37
X. Certification Label & User's Manual Information . . . 39
A. Certification Information . . . 40
B. Label and User's Manual Information . . . 43

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LIST OF TABLES

Table 1. Summary of Test Results vi
Table 2. Summary of Test Data vi
Table 3. References 2
Table 4. Low Channel Test Results 30
Table 5. Middle Channel Test Results 31
Table 6. High Channel Test Results 32
Table 7. Temperature Vs. Frequency Test Results 36
Table 8. DC Voltage End Point Test Results 36
Table 9. Temperature Vs. Output Power Test Results 36
Table 10. Test Equipment 38

LIST OF PHOTOGRAPHS

Photograph 1. RF Power Output Test Setup Photo 9
Photograph 2. Maximum Power Output 10
Photograph 3. Occupied Bandwidth Test Setup Photo 14
Photograph 4. Spurious Emissions at Antenna Terminals Test Setup Photo 20
Photograph 5. Mobile Emissions in Base Frequency Range at Antenna Terminals Test Setup Photo 23
Photograph 6. Radiated Emissions Test Setup Photo (Substitution Method) 27
Photograph 7. Radiated Emissions Test Setup Photo (Substitution) 28
Photograph 8. Frequency Stability Test Setup Photo 34

LIST OF FIGURES

Figure 1. Test Configuration 5

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LIST OF TERMS AND ABBREVIATIONS

AC	**A**lternating **C**urrent
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBm	**d**ecibels **B**elow 1 **m**illiwatt
dBμA	**D**eci**b**els above one **micro**amp
dBμV	**D**eci**b**els above one **micro**volt
dBμA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBμV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
CISPR	**C**omite **I**nternational **S**pecial des **P**erturbations **R**adioelectriques (International Special Committee on Radio Interference)
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
μH	**micro**henry
μF	**micro**farad
μs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane
W	**W**atts

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Summary of Test Results

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 22, Subpart H. All tests were conducted using measurement procedure ANSI C63.4: 2001.

Type of Submission/ Rule Part:	Certification / Part 22 Subpart H
EUT:	Skybility, 800 MHz Cellular Module
FCC ID:	APV01030
Equipment Code:	TNB
Type of Emissions:	36K0F1D
RF Power Output:	Conducted Output Power at 834.99 MHz: Power Level 1 = 1.26 Watts Power Level 2 = 1.03 Watts Power Level 3 = 404 milliwatts Power Level 4 = 152 milliwatts Power Level 5 = 62.66 milliwatts Power Level 6 = 20.79 milliwatts Power Level 7 = 10.61 milliwatts
Frequency Range (MHz):	824.04 - 848.97
Frequency Stability:	within 2.5 ppm

Table 1. Summary of Test Results

Name of Test	FCC Rule Part/Section	Results
RF Power Output	2.1046; 22.913(a)	Complies
Modulation Characteristics	2.1047(a)	N/A - EUT is non-voice, data only.
Occupied Bandwidth	2.1049; 22.917(d)	Complies
Spurious Emissions at Antenna Terminals	2.1051; 22.917(e)	Complies
Mobile Emissions in Base Frequency Range	22.917(f)	Complies
Radiated Spurious Emissions	2.1053; 22.917(e)	Complies
Frequency Stability over Temperature Variations	2.1055(a) (1); 22.355	Complies
Frequency Stability over Battery Power	2.1055(d) (2)	Complies

Table 2. Summary of Test Results

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I. Executive Summary

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I. Executive Summary

A. Purpose of Test

An EMC evaluation to determine compliance of the 800 MHz Cellular Module (referred to as EUT hereafter) with the requirements of Part 22, Subpart H, was conducted. (All references are to the most current version of Title 47 of the Code of Federal Regulations in effect). In accordance with §2.1033, the following data is presented in support of the Certification of the EUT. Skybility should retain a copy of this document and it should be kept on file for at least five years after the manufacturing of the EUT has been **permanently** discontinued.

B. Executive Summary

The EUT, as supplied to MET Laboratories, complied with the requirements stated in this test report.

References	Description
Purchase Order #25092-000 0W	Skybility Purchase Order for the 800 MHz Cellular Module Testing
ANSI-C63.4: 2001	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
TIA/EIA-603-A-2001	Land Mobile HM or PM Communications Equipment Measurement and Performance Standards
FCC 47CFR, Chapter 1, Part 2	Title 47 Code of Federal Regulations Part 2 - Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
FCC 47CFR, Chapter 1, Part 15	Title 47 Code of Federal Regulations Part 15 - Digital Devices
FCC 47CFR, Chapter 1, Part 22	Title 47 Code of Federal Regulations Part 22 - H

Table 3. References

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II. General

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II. General

A. Test Site

All testing was conducted at MET Laboratories, Inc., 4855 Patrick Henry Drive, Building 6, Santa Clara, California 95054. Radiated Emissions measurements were performed inside a 10 meter semi-anechoic chamber. In accordance with §2.948(a)(2), a complete site description is filed with the Commission's Laboratory in Columbia, Maryland. MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

B. Description of Test Sample

The EUT consisted of a 800 MHz Cellular Module. These modules are simplified 800 MHz cellular transceiver modules (OEM) intended to work with specialized technologies that utilize control channel signaling for data transfer. The module contain no voice circuitry and cannot establish voice calls.

The products represented in these authorization filings will be marketed and sold only as OEM modules for integration into OEM products. These products are sold in sub-assembly form and require additional integration work to incorporate them into a final product. These products are not offered for sale to the general public.

The models CMM7910 and CMM8910 have identical RF, digital, analog and other designs. Only firmware, not affecting the RF performance, differentiates the two models.

The models CMM7900 and CMM8900 have identical RF, digital, analog designs with a different interface connector and longer PCB length dimension to retrofit older models.

All models have identical RF, digital & analog PCB layout sections.

C. General Test Setup

The EUT was configured with an external DC power supply, and PC (HOST) interface to program the EUT controlling the Power Level, Channel Allocation and setting the modulation. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated with the confines of typical usage to maximize each emission.

D. Mode of Operation

The EUT was configured in accordance with the manufacturer's instructions and was operated as follows for all testing contained in this report unless stated otherwise:

Basic operation involves a +5 Vdc and ground for power, CMOS/TTL digital connection with transmit/receive lines to a host microprocessor. Stand-alone operation is also possible with only + 5Vdc and ground and I/O interface for event input triggering or output enabling.

Modem mode - Commands are given from a host microprocessor or PC to the unit in order to send or receive data.

Stand-alone mode - simple I/O functions trigger a "send data" message or reception of a message can trigger an output for external control.

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II. General

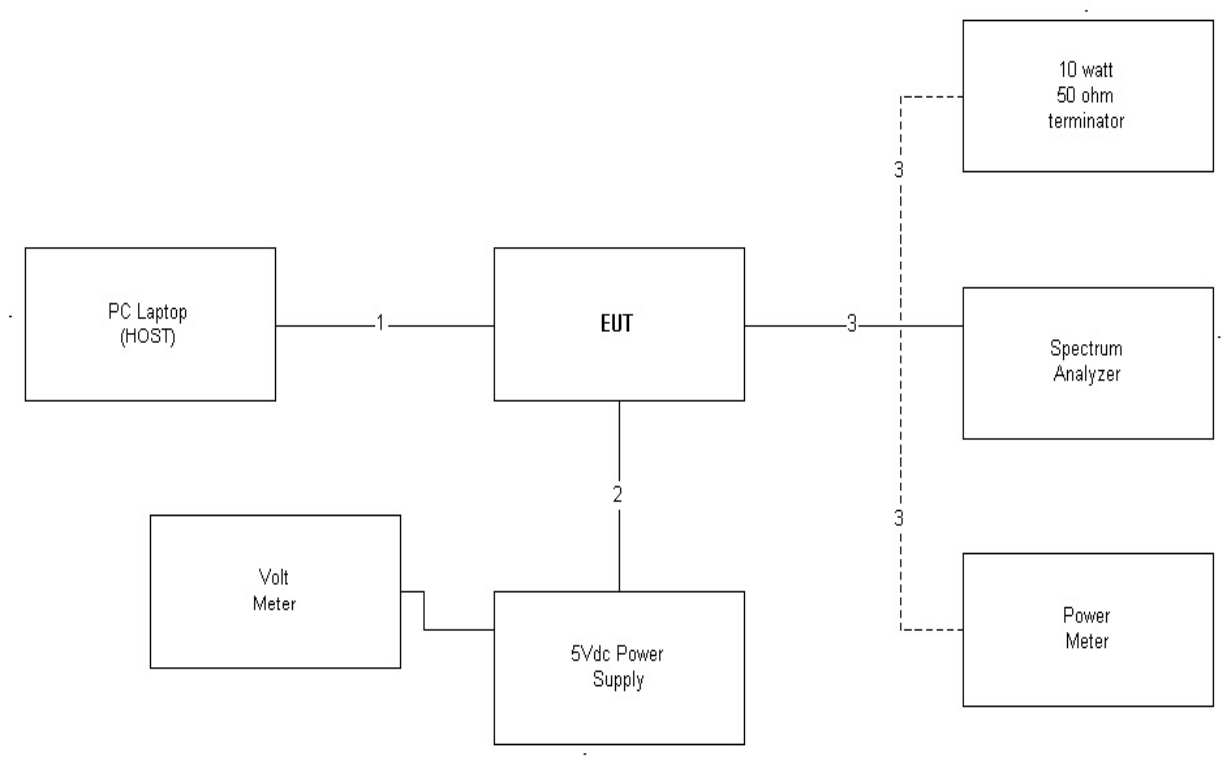

Figure 1. Test Configuration

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II. General

EUT

Reference to Test Configuration	Description / Nomenclature	Model #	Serial #	Revision
Figure 1	800 MHz Cellular Module	CMM7900, CMM8900, CMM7910, CMM8910	N/A	N/A

Support Equipment

Reference to Test Configuration	Description / Nomenclature	Model #	Serial #	Revision
Figure 1	DELL Laptop	Latitude Cpt	JLRX501	N/A

Ports and Cabling Information

Reference to Test Configuration [Figure 1]	Port Name at the EUT	Cable Description	Shielded (?)	Length	Termination Point
1	RS232	DB25	Yes	1 meter	Host
2	DC Harness	18 Gauge Wire	No	1 meter	Power Supply
3	RF Port	2.92 mm(K)	Yes	1 meter	Spectrum Analyzer or Power Meter or 50 Ω Load

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II. General

F. Modification

No modifications were made during testing.

G. Disposition of Test Sample

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Skybility upon completion of testing.

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III. Electromagnetic Compatibility RF Power Output Requirements

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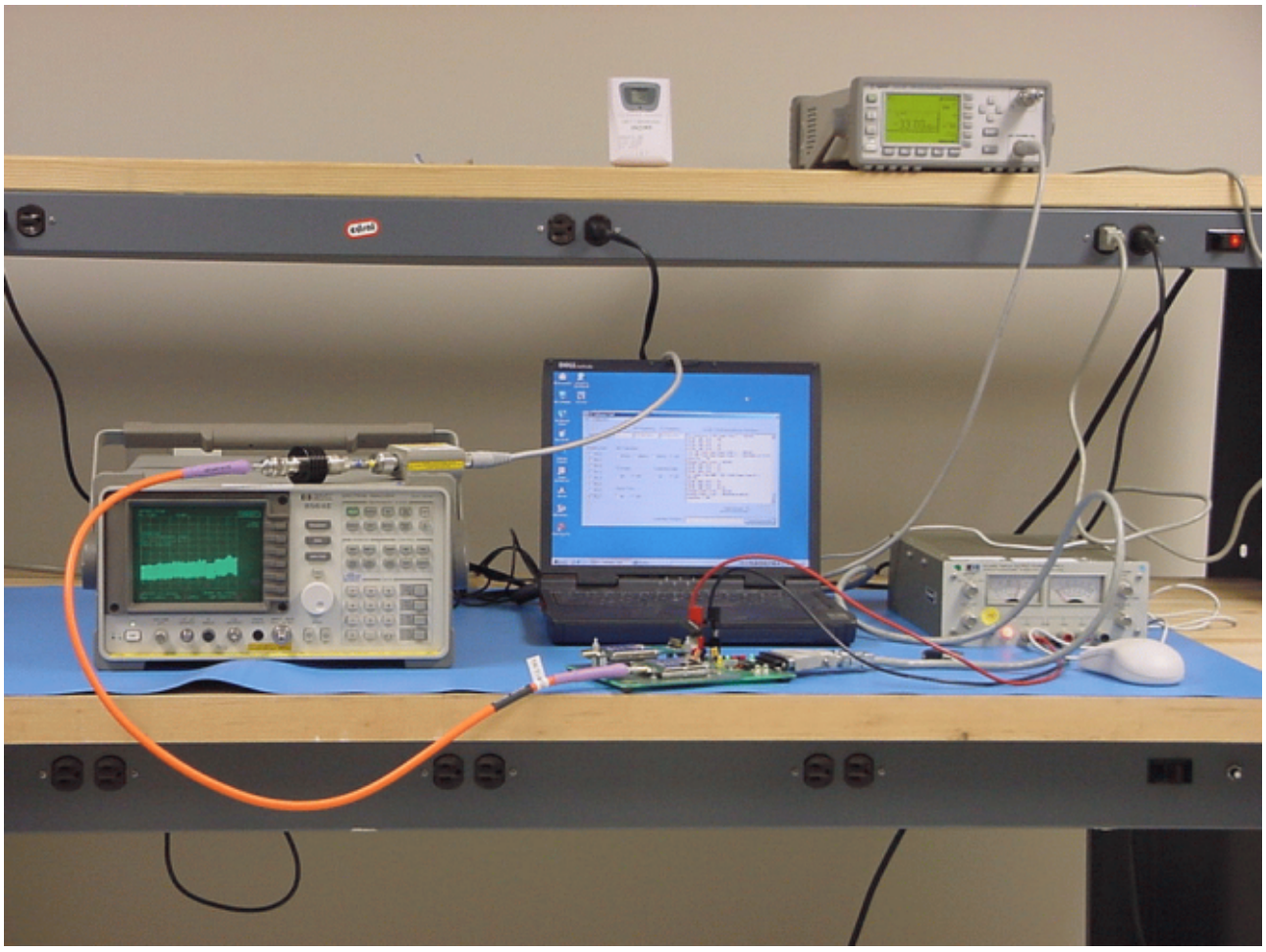
III. Electromagnetic Compatibility RF Power Output Requirements

A. RF Power Output

Technical Specifications: §2.1046 and 22.917(a)

Test equipment: Test equipment for RF Power Output is listed in Section IX of this report.

Photograph:



Photograph 1. RF Power Output Test Setup Photo

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III. Electromagnetic Compatibility RF Power Output Requirements

Measurement Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using a 10 dB attenuator and a Power Meter connected with a Sensor.

Set a 10.5 dB Reference level Offset to Power Meter. The EUT was set to transmit in the middle of the operating frequency range. The EUT was limited to have a burst of 5 second when transmitting at full power. To record the full power, activated the EUT at the lowest power then set the maximum power level button from HOST. Documented the Power Meter reading of the RF output Power in tabular format. Repeated measurements with 6 other Power Levels.

Results: Equipment complies with 47CFR 2.1046 and 22.913(a). The 800 MHz Cellular Module does not exceed 7 W (38.5 dBm) at the carrier frequency.

All RF Power output measurements were direct connection to RF output Terminal of EUT.

The following page show measurements of RF Power output which is recorded below:

Photograph 2. Maximum Power Output

Power Level (PLC)	Measured Output Power (dBm / Watts)
1	31.02 / 1.26
2	30.13 / 1.03
3	26.07 / 0.4
4	21.82 / 0.15
5	17.97 / 0.063
6	13.18 / 0.021
7	10.26 / 0.010

Test Engineer: Kerwinn Corpuz

Test Date: 01/30/03

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IV. Electromagnetic Compatibility Modulation Characteristics Requirements

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IV. Electromagnetic Compatibility Modulation Characteristics Requirements

A. Modulation Characteristics

Technical Specifications: §2.1047 and §22.915

Test equipment: Test equipment for Modulation Characteristics is listed in Section IX of this report.

Measurement Procedures: As required by 47 CFR 2.1047, *Modulation Characteristics measurements* were made at the RF output terminals.

Results: EUT is not required for this test.
The EUT contain no voice circuitry and cannot establish voice calls. Data transfer only.

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V. Electromagnetic Compatibility Occupied Bandwidth Requirements

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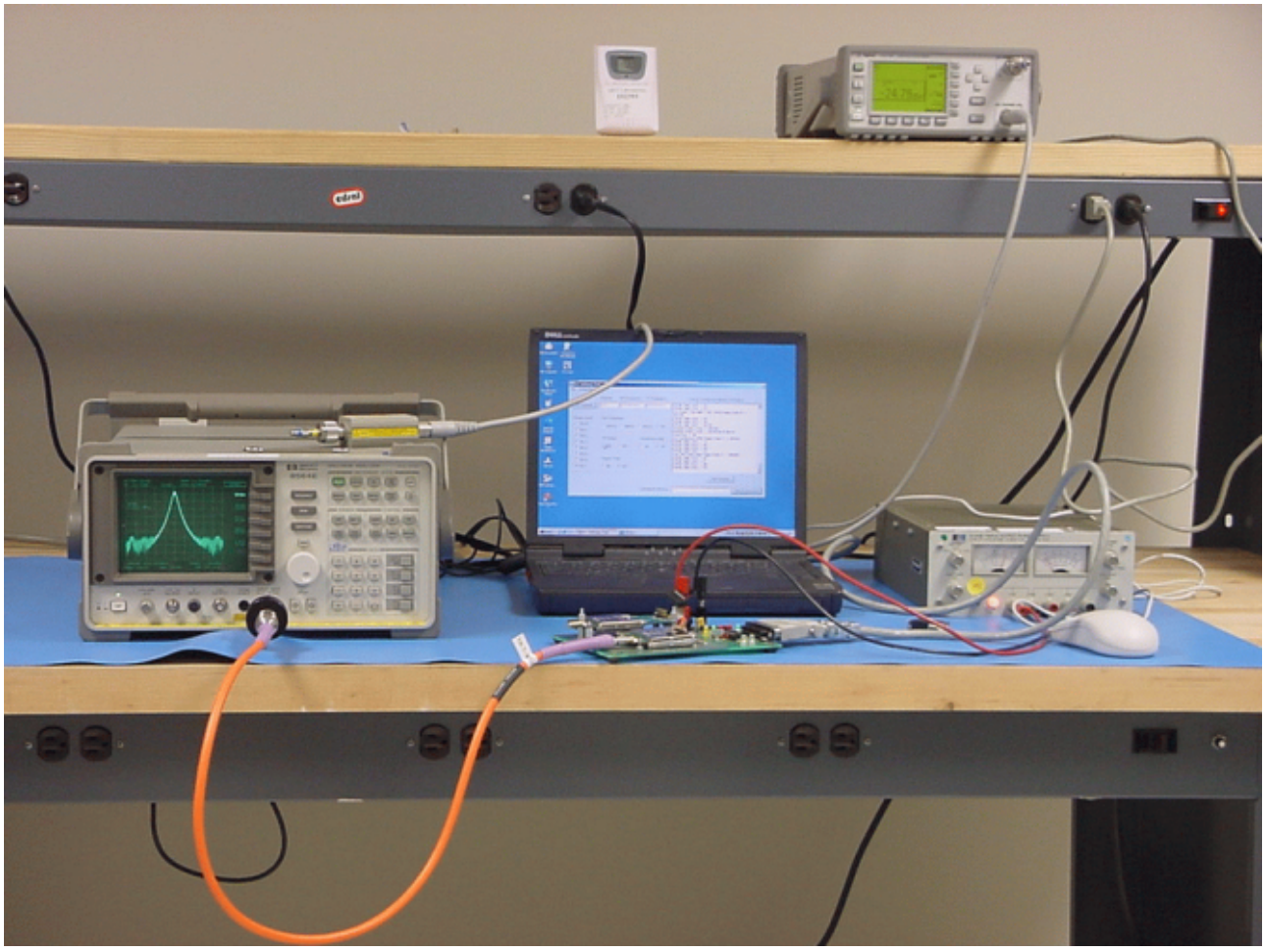
V. Electromagnetic Compatibility Occupied Bandwidth Requirements

A. Occupied Bandwidth

Technical Specifications: §2.1049 and §22.917(d)

Test equipment: Test equipment for Occupied Bandwidth is listed in Section IX of this report.

Photograph:



Photograph 3. Occupied Bandwidth Test Setup Photo

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V. Electromagnetic Compatibility Occupied Bandwidth Requirements

Measurement Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a 10 dB attenuator and a Spectrum Analyzer.

Set a 10.5 dB Reference level Offset and RBW = VBW = 300 Hz to Spectrum Analyzer. The EUT was set to transmit in the lowest of the operating frequency range. The EUT was limited to have a burst of 5 second when transmitting at full power. To capture the modulated full power of the envelope, activated the EUT at the lowest power then set the maximum power level button from HOST. Set the Emission Mask +/-20.5 kHz away from the center of the carrier and continue on per 22.917(d). Plotted the Emission Mask graph. Repeated measurements for mid and highest channel with both 10 kHz NRZ FSK and 6 kHz FM modulation.

Results: Equipment complies with Section 2.1049 and 22.917(d). The following pages show measurements of Emission Mask plots which is recorded below:

10 kHz NRZ FSK Modulation	
Plot #	**Comment**
1	Lowest Channel (824.04 MHz) Occupied Bandwidth (Emission Mask)
2	Middle Channel (834.99 MHz) Occupied Bandwidth (Emission Mask)
3	Highest Channel (848.97 MHz) Occupied Bandwidth (Emission Mask)
6 kHz FM Modulation	
Plot #	**Comment**
4	Lowest Channel (824.04 MHz) Occupied Bandwidth (Emission Mask)
5	Middle Channel (834.99 MHz) Occupied Bandwidth (Emission Mask)
6	Highest Channel (848.97 MHz) Occupied Bandwidth (Emission Mask)

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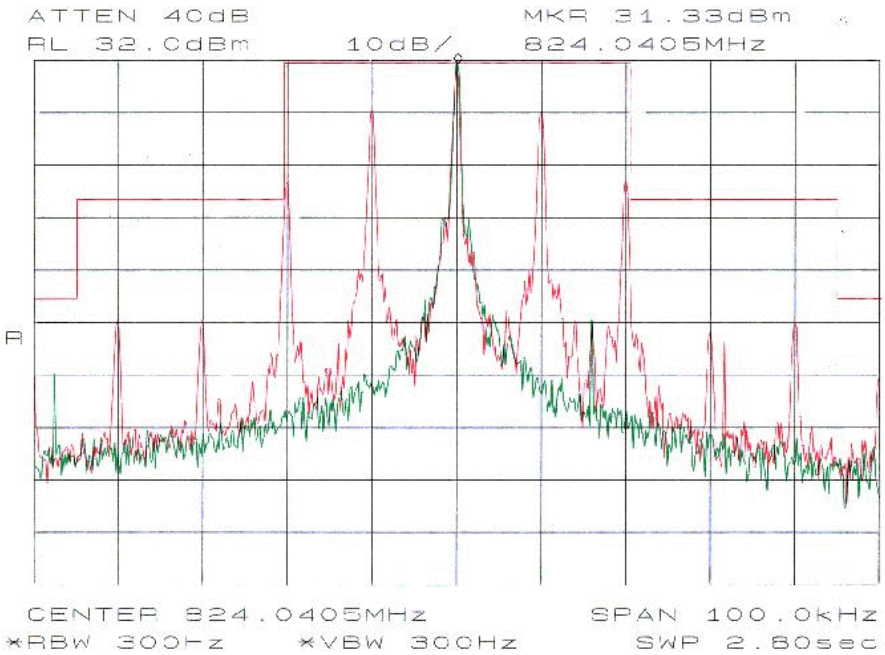
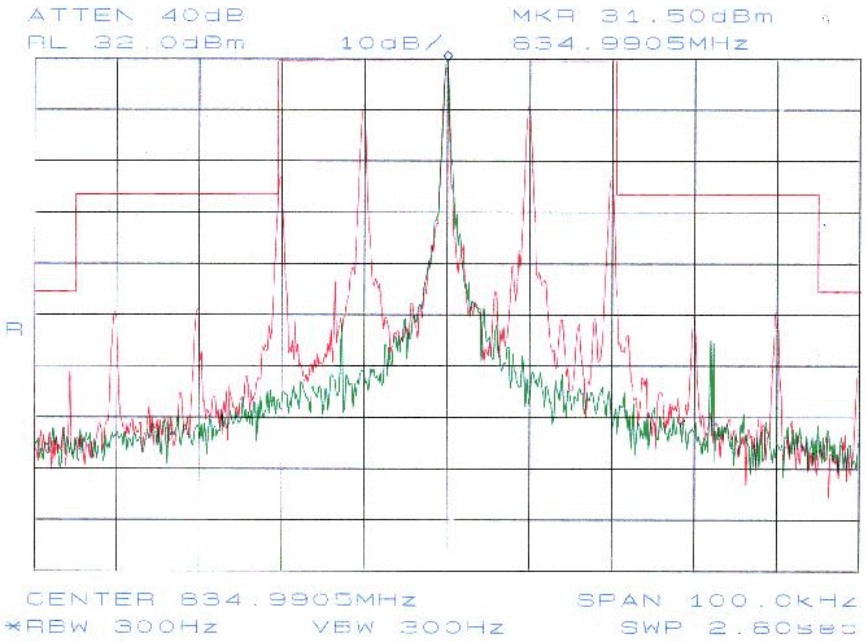
V. Electromagnetic Compatibility Occupied Bandwidth Requirements



Plot #1: Lowest Channel (824.04 MHz) Emission Mark



Plot #2: Middle Channel (834.99 MHz) Emission Mask

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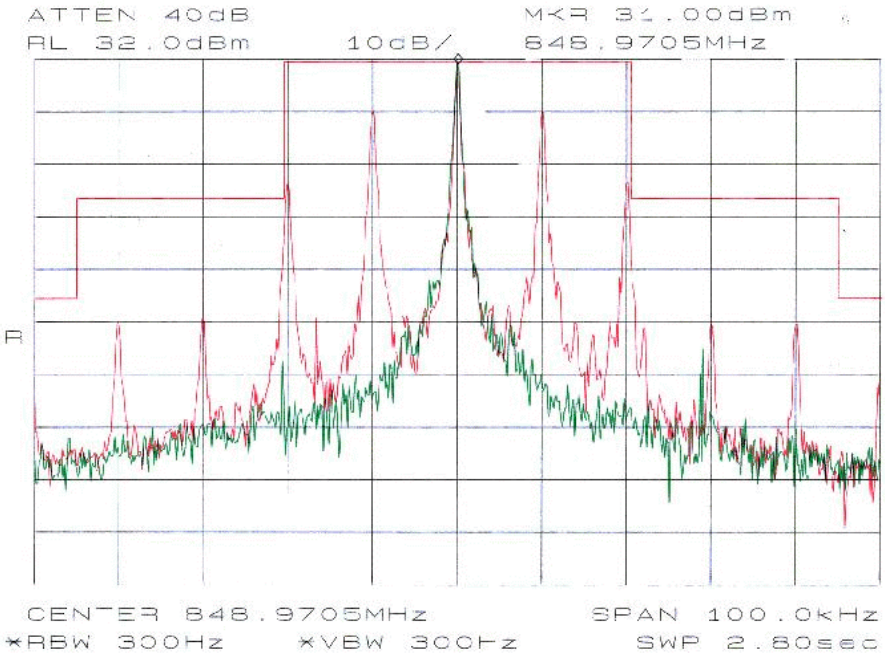
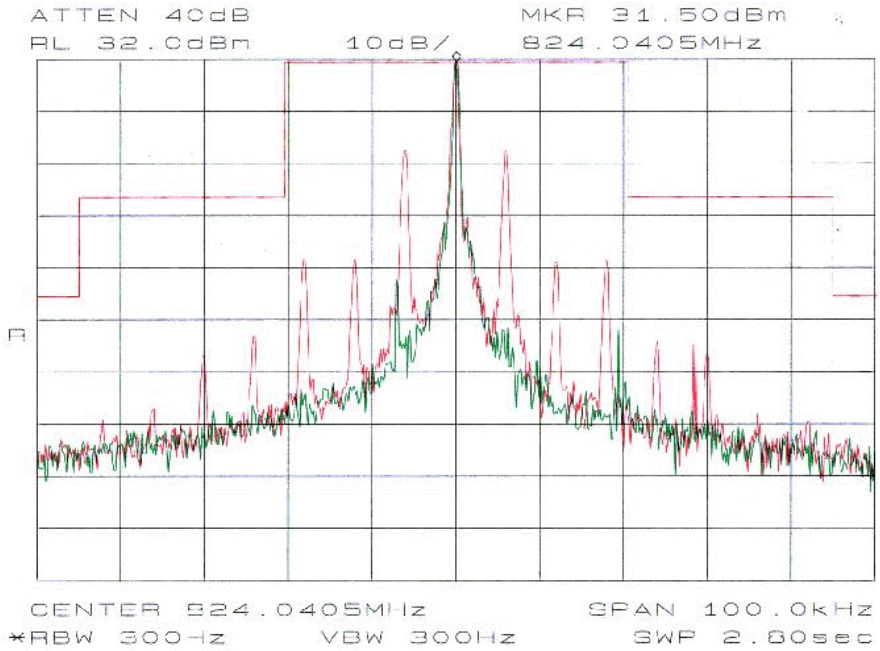
V. Electromagnetic Compatibility Occupied Bandwidth Requirements



Plot #3: Highest Channel (848.97 MHz) Emission Mask



Plot #4: Lowest Channel (824.04 MHz) Emission Mask

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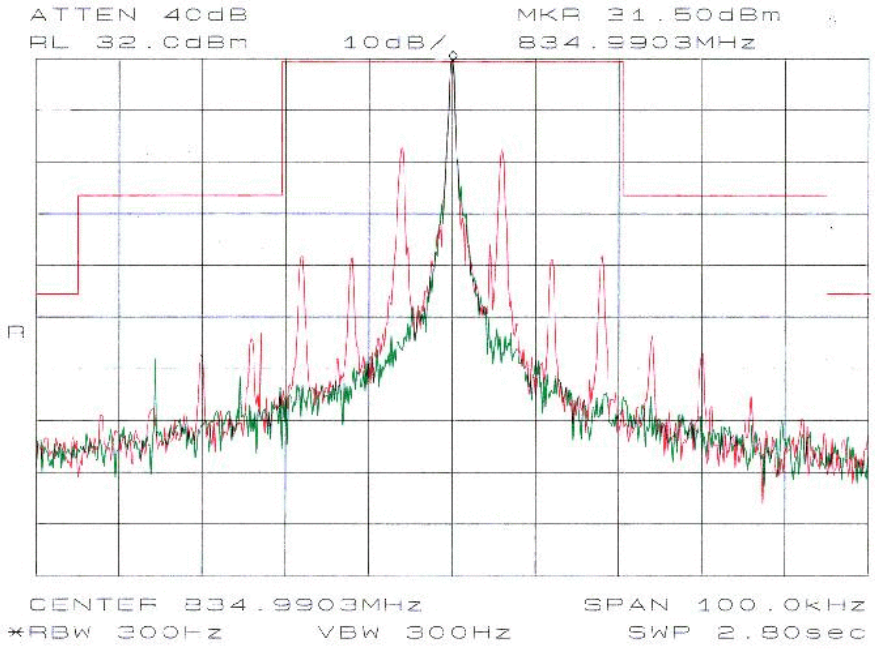
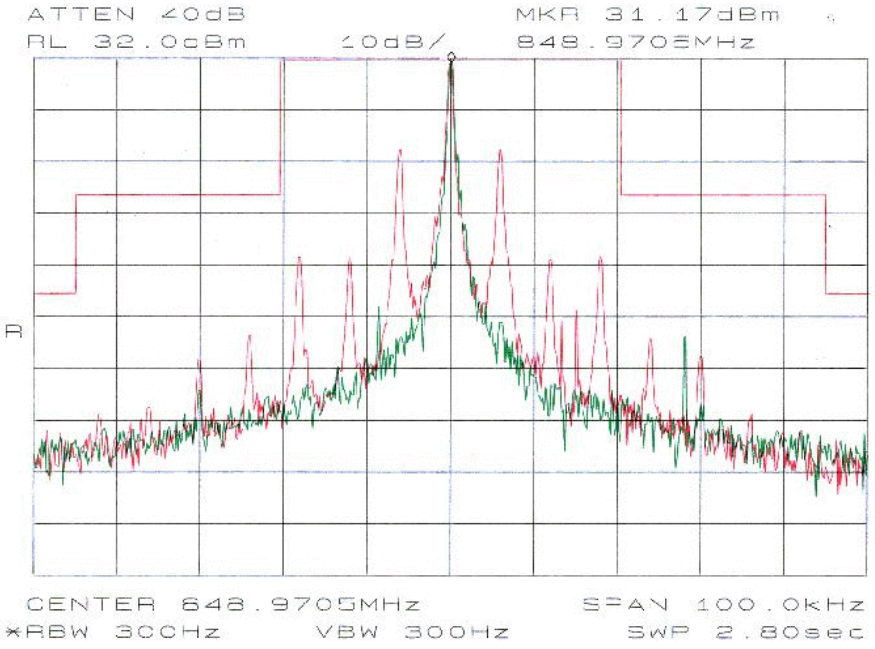
V. Electromagnetic Compatibility Occupied Bandwidth Requirements



Plot #5: Middle Channel (834.99 MHz) Emission Mask



Plot #6: Highest Channel (848.97 MHz) Emission Mask

Test Engineer: Kerwinn Corpuz

Test Date: 01/30/03

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VI. Electromagnetic Compatibility Spurious Emissions at Antenna Terminal Requirements

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