



MET Laboratories, Inc.

Safety Certification - EMI - Telecom Environmental Simulation

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November 23, 2004

Mr. Joe Murphy
Firefly Mobile
250 Parkway Drive, Suite 220
Lincolnshire, IL 60069

Reference: Firefly Spark F100
FCC ID: R7C-F100

Dear Mr. Joe Murphy:

Enclosed is the EMC Test Report for the Firefly Mobile Firefly Spark F100. The Firefly Mobile Firefly Spark F100 was tested to the requirements of the FCC Rules and Regulations, Part 24 of Title 47 of the CFR, for a Broadband PCS device.

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.

Christina M. Karlhoff
TCB Administrator

Enclosures: (Firefly Mobile EMC16267-FCC24)

DOCTEM-23 Dec 2003

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Firefly Mobile
FCC ID: R7C-F100

Firefly Spark F100

November 23, 2004

**Electro-Magnetic Compatibility
Test Report**

for the
Firefly Mobile
Firefly Spark F100

Tested Under

FCC Part 24
Title 47 of the CFR
for Broadband **PCS** Devices

MET REPORT: EMC16267-FCC24

November 23, 2004

PREPARED FOR:

Firefly Mobile
250 Parkway Drive, Suite 220
Lincolnshire, IL 60069

PREPARED BY:

MET Laboratories, Inc.
914 West Patapsco Avenue
Baltimore, Maryland 21230-3432

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for the**

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PREPARED FOR:

Firefly Mobile
250 Parkway Drive, Suite 220
Lincolnshire, IL 60069

Kevin A. Mehaffey, Manager
Electromagnetic Compatibility Testing

Christina M. Karlhoff
EMC Administrator

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 24 of the FCC Rules under normal use and maintenance.

Liming Xu
Project Engineer



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REPORT STATUS SHEET

Revision	Report/ Revision Date	Reason for Revision
Ø	November 23, 2004	Class II permissive change



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List of Terms and Abbreviations

AC	Alternating Current
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB μ A	Decibels above one microamp
dB μ V	Decibels above one microvolt
dB μ A/m	Decibels above one microamp per meter
dB μ V/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
CISPR	Comite International Special des Perturbations Radioelectriques (International Special Committee on Radio Interference)
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	microhenry
μ F	microfarad
μ s	microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane



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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 24, Subpart E. All tests were conducted using measurement procedure ANSI C63.4-2001.

Type of Submission/ Rule Part:	Class II permissive change /Part 24 See page 4
EUT:	Firefly Mobile Firefly Spark F100 Pre-Production Unit
FCC ID:	R7C-F100
Type of Emissions:	238KGXW (Up link)
RF Power Output:	GSM 0.7 Watts (28.22 dBm) for Up Link
Frequency Range (MHz):	1850.2-1909.8 MHz (Up Link)
Frequency Stability:	40 Hz

Table 1 Summary of Test Result

Name of Test	FCC Rule Part/Section	Results
RF Power Output	2.1046; 24.232(a),(c)	N/A
Modulation Characteristics	2.1047 (a)	N/A
Occupied Bandwidth	2.1049	N/A
Spurious Emissions at Antenna Terminals	2.1051; 24.238(a)	N/A
Spurious Emissions at Antenna Terminals Frequency Block Edges	2.1051; 24.238(b)	N/A
Radiated Spurious Emissions	2.1053; 24.238(a)	Complies
Frequency Stability over temperature variations	2.1055 (a) (1)	N/A
Frequency Stability over battery power	2.1055 (d) (2)	N/A
Frequency Stability over supply voltage variations	2.1055 (d) (1)	N/A

Table 2 Summary of Test Data



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I. Executive Summary



Executive Summary

A. Purpose of Test

An EMC evaluation to determine compliance of the **Firefly Spark F100** with the requirements of Part 24, Subpart E 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. Firefly Mobile should retain a copy of this document, and it should be kept on file for at least five years after the manufacturing of the Firefly Spark F100 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 # T46394	Firefly Mobile Purchase Order for the Firefly Spark F100 Testing
ANSI-C63.4:2001	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz
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 - Radio Frequency Devices
FCC 47CFR, Chapter 1, Part 24	Title 47 Code of Federal Regulations Part 24

Table 3. References



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II. General



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A. Test Site

All testing was conducted at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, Maryland 21230-3432. Radiated Emissions measurements were performed inside of a 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 is a Wireless Mobile Phone.

C. General Test Setup

The Firefly Mobile Firefly Spark F100 was configured to program the EUT to output a GMSK Modulation type RF signal. The EUT was configured for maximum signal gain and bandwidth. 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 Firefly Mobile Firefly Spark F100 was configured in accordance with the manufacturer's instructions and was operated as follows for all testing contained in this report unless stated otherwise:

E. Antenna Specifications:

New Integrated antenna(See picture) was used for this EUT. This antenna was modified for the 850MHz band performance

F. Modifications:

The antenna was modified for the 850MHz band performance.

G. Disposition of Test Sample:

Mr. Joe Murphy
Firefly Mobile
250 Parkway Drive, Suite 220
Lincolnshire, IL 60069



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III. Electromagnetic Compatibility RF Power Output Requirements



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Test Type: RF Power Output and EIRP (Substitution Method):

Technical Specifications: §2.1046 and 24.232(a).

Measurement Procedures: As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by a TDMA-TDD modulated signal.

Test Results: Equipment complies with 47CFR 2.1046 and 24.232(a). The EUT conducted power does not exceed limit at the all carrier frequency.

All RF Power output measurements were conducted peak envelope power with instrument set RBW= 2 MHz; the results are the same, which verified by a digital power meter (HP4418A power meter and HP8482A power sensor).

The following pages show measurements of RF power output (**Conducted and EIRP**):

GSM 0.7 Watts (28.22 dBm)EIRP for Up Link

Substitution Equivalent Isotropic Radiated Power (E.I.R.P)

Procedure:

Radiated Measurements were made on a GSM1900Mhz Mobile phone. The EUT was placed on a 0.8-m high wooden table inside a shielded enclosure. An Antenna was placed 1meter from the EUT and measurements were made for frequencies and amplitude of field strengths in three channel settings (Low, Mid and High). For EIRP Substitution method EUT was replaced with a horn antenna, which was driven by a signal generator whose level, were adjusted to obtain the same level as received via the radiated method. EIRP is calculated by adding the gain of the horn antenna to the level on the signal generator. Measurements were made according to the Substitution Method of ANSI/TIA/EIA-603-A.

Configuration:

Measurement was made with the Mobicom GSM1900MHz mobile phone **Result:**

Frequency (MHz)	Conducted Level (dBm)	EIRP (dBm)	EIRP (W)
1850.2(512)	28.22	28.05	0.7
1880.2(662)	28.13	28.55	0.7
1909.8(810)	28.05	28.01	0.7

* there is no significant change for the EIRP.

* There are no detectable emissions between 1GH and 20GHz.

* The emissions (30MHz – 1GHz) are reported in Pt.15B report.

Test Engineer: Liming Xu

Test Date: November 22, 2004



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Photograph 1 EIRP measurement Setup Photo





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Radiated Emissions

Technical Specifications: **§2.1053 and 24.238(a)**

Measurement Procedures:

As required by §2.1053, *field strength of spurious radiation measurements* were made in accordance with the general procedures of ANSI C63.4-2001 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" and TIA/EIA 603 substitution method.

Preliminary radiated emission measurements were performed inside a shielded chamber. The EUT was operated in a manner representative of the typical usage of the equipment. During testing, system components were manipulated with the confines of typical usage to maximize each emission. Preliminary measurements were used as a guide for making final measurements in free space. The unit was scanned over the frequency range of the lowest system oscillator value to 20 GHz.

The Radiated Spurious Emissions *Limit* is obtained by the following:

Based on an output power (as measured at the output of the Amplifier) of 0.7 watts:

$$P_o = 0.7 \text{ W}$$

the radiated power level of all spurious emissions must be attenuated by at least $43 + 10\log(P_o)$ below P_o , yielding:

$$P_o - [43 + 10\log(P_o)] = -13 \text{ dBm}$$

Test Results:

All of the measurable radiated emissions (EIRP) are related to the digital device portion of the EUT, and thus are compared to the 47CFR 15 Class B field strength limit. Mathematical calculations indicate that these field strengths yield radiated power levels greater than 30 dB below the -13 dBm limit for spurious emissions from the transmitter portion of the EUT calculated above. There were no observable radiated emissions from the transmitter portion of the EUT.

The Spurious Radiated Emissions were measured from 1GHz to 20 Ghz for the EUT. There were no detectable spurious emissions in that frequency range. The device complies with 47 CFR 2.1053; **24.238(a)**



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VIII. Test Equipment



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Table 4 Test Equipment List

MET #	Equipment	Manufacturer	Model	Cal Date	Cal Due
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	4/9/04	4/9/05
1T2665	Horn antenna	EMCO	3115	3/12/04	3/12/05
1T4351	Spectrum analyzer	Agilent	E 7405A	8/21/04	8/21/05
1T2511	Horn antenna	EMCO	3115	7/14/04	7/14/05
1T4080	EMI Receiver	HP	8546A	6/16/04	6/16/05



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IX. Certification Information



A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.
- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device May be operated, but not marketed, for the following purposes and under the following conditions:
 - (i) Compliance testing;
 - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;



- (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production stages; or
- (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service

wherein the equipment is to be operated.¹ In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, or the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant, whichever is applicable.

§ 2.907 Certification.

(1) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

¹In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart C (of Part 15), which deals with intentional radiators.



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(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.



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END OF REPORT