

**FCC Part 15 Sub-Part B
Declaration of Conformity Report**

on
LM 2500 Internet Location Modem

model
LM 2500

provided for evaluation by
**At Road, Incorporated
47370 Fremont Boulevard
Fremont, California 94538 USA**

tests and evaluation performed by
**International Technology Company (ITC)
9959 Calaveras Road, Box 543
Sunol, California 94586-0543**
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Fax: (925) 862-9013
Email: itcemc@aol.com
Web Site: www.itcemc.com

Test Summary

FCC Part 15 Sub-Part B, Class B EMI

General Information

Product Name	iLM 2500 Internet Location Modem
Model	iLM 2500
Applicant's Name	At Road, Incorporated
Address	47370 Fremont Boulevard Fremont, California 94538 USA
Contact	▪ Tel: [510] 668-1638 ▪ Fax: [510] 353-6021 Messrs. Mike Walker & Hung Phan
Test Laboratory	International Technology Company (ITC) 9959 Calaveras Road, PO Box 543 Sunol, CA 94586-0543
	▪ Tel: [925] 862-2944 ▪ Fax: [925] 862-9013 ▪ Email: itcemc@aol.com ▪ Web Site: www.itcemc.com
Test & Report Numbers	▪ 20001102-3 ▪ 0011FRS102-3/F
Test & Issue Dates	▪ November 6, 2000 ▪ November 17, 2000
Test Results	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Total Number of Pages	30 Pages

According to testing performed at International Technology Company, the above-mentioned unit complies with the EMI requirements defined in ANSI C63.4-1992 per FCC Part 15 Sub-Part B, Class B. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained. International Technology Company as an independent testing laboratory, declares that the equipment tested as specified above conforms to:

Emissions Requirements

1. Radiated emissions in a 3- meter open area site. Part 3 of this report contains details.

The result show that the sample equipment tested as described in this report complies with the **Class B** Radiated Emission Limits of FCC Rules Part 15, SubPart B.

Applicant: At Road, Incorporated
File No.: 0011FRS102-3/F

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Michael Gbadebo, PE
Engineering Manager

Applicant: At Road, Incorporated
File No.: 0011FRS102-3/F

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Declaration/Disclaimer

International Technology Company (ITC) reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Technology Company (ITC) shall have no liability for any deductions, inferences or generalizations drawn by the client or others from International Technology Company (ITC) issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any US Government agency.

International Technology Company (ITC) is:

Accepted by the Federal Communications Commission (FCC) for FCC Methods, CISPR Methods and AUSTEL Technical Standards (Ref: NVLAP Lab Code 200172-0)

Approved by the Industry Canada for Telecom Testing

Certified by Rockford Engineering Services GmbH for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001

Certified by Reg. TP for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001 for RES GmbH (DAR-Registration number: TTI-P-G 159/98-00)

Certified by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI) for EMC testing, in accordance with the Regulations for Voluntary Control Measures, Article 8, Registration Numbers - Site 1: C-714 and R-696; Site 2: C-715 and R-697

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Engineering Services Offered by ITC

1) Reliability / Environmental Consulting And Services

- Reliability Svcs. for Systems & Components
- MTBF Calculations
- MTTF Calculations
- Temperature Cycling Testing
- Thermal Shock Testing
- Vibration Shock Testing

2) Engineering Evaluation & Testing

- OSHA Third Party Evaluations
- SEMI S2 Reviews, 1993
- USB Specification Evaluations/Testing
- SAE Specification Evaluations/Testing
- EIA/TIA Specifications i.e. 571-A and 631
- MIL-STD i.e. 461,462,1541/EMC, 883/ESD

3) Compliance Design Consultation and Regulatory Testing Services

US: EMI/Telecom (FCC)

FCC 15 /Class A
FCC 15 /Class B and DoC
FCC 15 /SubPart C
FCC 24
FCC 68 (Analog and Digital)
FCC 90
FCC 95

Product Safety (UL/NRTL)

All UL Standards, Including:

UL 1950 /ITE
UL 2601/Medical
UL 1459 /Telecom
UL 1411 /Audio, Radio, TV
UL 813 /Commercial Audio
UL 1604 /Hazard. Location
UL 508 /Energy Mgmt. Equip.

EU: EMI/EMC (EN)

EN 50081-1 /50081-2
EN 50082-1 /50082-2
EN 55103-1/ 55103-2
EN 60601-1-2
EN 55011 /55013 /55014
EN 55015 /55020 /55022
EN 60555-2 /60555-3
EN 61000-3-2 /61000-3-3
EN 61000-4-2 /61000-4-3
EN 61000-4-4 /61000-4-5
EN 61000-4-6 /61000-4-8 /61000-4-11

Canada: EMI, Safety, Telecom

RSS 210 & RSS 221
Industry Canada /IC CS-03
All c-UL Standards for Canada
All CSA Standards, including:
CSA No. 950/ ITE
CSA No. 601-1/Medical
CSA No. 1010-1/ Lab, Measurement
CSA No. 225/ Telecom

Asia - Australia/ International

CISPR 11, 13, 14, 15, 16, 20, 22
VCCI Class 1 & 2 /Japan
AS/NZ 3548: C-Tick Mark, EMC
CNS 13438 - 1996/Taiwan
ITU Standards
IEC /ETSI Standards
BellCore Standards
IEEE /ANSI Standards

EU: Safety/Machinery (EN)

EN 60950 /61010-1
EN 60204 /60065
EN 60601-1-1
TÜV
*Competent Body Representation/EU

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Our comprehensive capabilities, friendly environment & fast project turn-around time makes ITC the ideal **one-stop-shop** for your engineering services needs, providing manufacturers with compliance design consultation, reliability & compliance engineering. We are committed to delivering the highest-quality engineering services & expertise you can expect at reasonable, competitive rates. We look forward to working with you on your next

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ILM 2500 Internet
Location Modem
Model: iLM 2500

FCC Part 15 SubPart B, Class
B

Rev. No 1.0

design, reliability compliance or engineering consultation project. For more information, contact our Business Services Department.

You can call or e-mail us at:

Toll-Free: 1-888-336-7625 – **Internet:** <http://www.itcemc.com> – **E-mail:** itcemc@aol.com

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Document Control

In accordance with the FCC Public Notice 64009,
I have reviewed this DoC report, Report Number 0011FRS102-3/F,
prepared on November 17, 2000; by International Technology Company (ITC),
under authority of FCC, document number NVLAP Lab Code 200172-0

on
iLM 2500 Internet Location Modem
iLM 2500

I hereby confirm that all EMI related parts of this report as described in appendix B
shall be included on all shipments of this model intended for marketing in the United
States of America.

I also declare that the equipment specified above conforms to the above Directive

For: At Road, Incorporated

Name:

.....

Signature:

.....

Applicant: At Road, Incorporated
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Model: iLM 2500

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Title:

.....

Date:

.....

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NVLAP Accredited (code 200172-0)

Declaration of Conformity

(FCC Part 15, SubPart B)

I hereby certify that the equipment which test and report is referenced below has been found to meet the requisites of FCC ET Docket No. 95-15 and that the energy emitted by this equipment was found to comply with the FCC Class B limits. I further certify that based on the measurements taken at the International Technology Company (ITC) facility, 9959 Calaveras Road, Sunol - California 94586 USA; the equipment tested is capable of operation in compliance with the conditions set forth in the FCC Rules and Regulations Part 15 SubPart B. The measurement results are deemed satisfactory evidence of compliance with the technical EMC requirements of the Radio Interference Regulations of the Industry Canada.

International Technology Company (ITC) hereby certifies compliance to applicable FCC/ANSI C63.4-1992 Rules, Radiated Emissions

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Type of Equipment: iLM 2500 Internet Location Modem
Model Number(s): iLM 2500

Test Number: 20001102-3
Test Report Number: 0011FRS102-3/F
Test Date(s): November 6, 2000

Applicant: At Road, Incorporated
File No.: 0011FRS102-3/F

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Model: iLM 2500

FCC Part 15 SubPart B, Class
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Certified By:

Mr. Michael Gbadebo, PE
Chief Engineer/Principal Consultant

November 17, 2000

Date

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File No.: 0011FRS102-3/F

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Part 1. Genera l

Test Methodology

The electromagnetic interference tests, which this report describes, were performed by an independent electromagnetic compatibility consultant, International Technology Company (ITC), in accordance with the FCC test procedure ANSI C63.4-1992.

Test Facility

The open area test site, the conducted measurement facility, and the test equipment used to collect the emissions data is located in Sunol, California, and is fully described in site attenuation report. The site attenuation description is currently on file at the Federal Communications Commission.

Accuracy of Test Data

The test results contained in this report accurately represent the radiated electromagnetic emissions generated by the sample equipment under test.

Data Table Legend and Field Strength Calculation

'Margin' indicates the degree of compliance with the applicable limit. For example, a margin of -8 dB means that the emissions are 8 dB below the limit (in compliance); a margin of +4 dB means that the emission is 4 dB over the limit (out of compliance). The margin calculated as follows:

Margin = Corrected Amplitude - Limit; where Corrected Amplitude = Amplitude + Antenna Correction Factor + Cable Loss - Distance Factor, measured in quasi peak mode. p = Peak q = Quasi Peak

a = Average

Part 22.901(d) Compliance Information

The equipment under test is an Internet Location Modem, model iLM2500. The iLM2500 comprises of two main parts: (1) The CDPD Modem (an OEM RF Modem) and (2) GPS Receiver Section.

The iLM2500 has been tested to FCC Part 15 Class B rules and has been verified to comply with the specified limits. The CDPD modem incorporated in the iLM2500 has already been certified pursuant of FCC rules 22.901(d), with FCC Identifier NBZNRM-6832.

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**Part 2.
Powerline Conducted
Emissions
Per FCC Part 15 Sub-Part
B**

Justification

Powerline conducted tests were not necessary because the device is DC powered (12Vdc).

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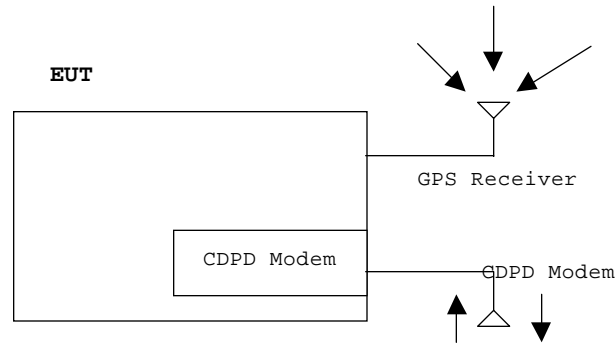
Part 3

Open Field Radiated Emissions

Per FCC Part 15 Sub-Part B

EUT Configuration

The iLM 2500 Internet Location Modem was set up in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-1992. The measurement instrumentation used was a Hewlett Packard 8567A Spectrum Analyzer with detector and bandwidth parameters as stipulated in C63.4-1992. The EUT was set up on a wooden table, 80cm above the ground reference plane in an open field. The EUT was tested in a normal operational mode to exercise functionality. The battery pack and RTC/System Controller model DS1670E were placed underneath the table.



Test Procedure

Maximum emissions were obtained by varying the height of the antennas and then rotating the turntable over a 360- degree angle. The highest emissions were also analyzed in detail by operating the spectrum analyzer in fixed tuned quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables were moved around and the antenna height was varied between one and four meters. The antenna polarization was varied between vertical and horizontal.

Spectrum Analyzer Configuration (during Swept frequency Scans)

Start Frequency 30KHz
Stop Frequency 1000MHz
Sweep Speed Manual
Measurements Below 1GHz

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RES & Video Bandwidth..... 100KHz
 Quasi Peak Adapter Mode.....Normal
 Quasi Peak Adapter Bandwidth 120KHz
 Measurements Above 1GHz (unless otherwise stated)
 Analyzer mode..... Video Filter
 RES Bandwidth 1MHz
 Video Band Width.....10Hz
 Frequency Span..... 7MHz
 Offset 0dB
 Quasi Peak Adapter Bandwidth Disabled

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Open Field Radiated Emissions per FCC Part 15 SubPart B

Administrative Details

Date(s) of Test: November 6, 2000
Emission Limits: Class B
Test Technician(s): O'Lanre Owoborode
Antenna Used: Biconical Antenna, model # 3104, S/N 3459 and Log Periodic Antenna, model # 3146, S/N 2075 (calibrated June 25, 1999, next calibration due date is June 25, 2000)

Test Results

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarizations, and EUT orientations.

Indicated Frequency MHz	Amplitude dBuV/m	Antenna dB	Cable dB	Corrected Amplitude dBuV/m	Turntable Angle Degree	HG T M	Antenna Polarization	FCC 15 Limit dBuV/m	Class B Margin dB
38.26	20.6	7.0	2.6	30.1	180	1.0	VB	40.0	-9.9
76.52	27.7	5.3	3.2	36.2	180	1.0	VB	40.0	-3.8
76.52	22.1	5.3	3.2	30.6	180	1.0	VB	40.0	-9.4
112.14	11.0	13.4	3.8	28.3	180	1.0	VB	43.0	-14.7
115.21	15.0	14.2	3.9	33.1	90	4.0	HB	43.0	-9.9
115.21	9.3	14.2	3.9	27.4	180	1.0	VB	43.0	-15.6
153.04	16.3	12.2	4.5	32.9	90	1.0	HB	43.0	-10.1
153.04	23.2	12.2	4.5	39.8	180	0.0	VB	43.0	-3.2
208.91	8.6	9.3	5.4	23.3	270	0.0	VL	43.0	-19.7
220.61	27.5	9.5	5.5	42.5	180	1.0	HL	46.0	-3.5
220.61	25.1	9.5	5.5	40.1	180	1.0	VL	46.0	-5.9
229.57	24.3	10.1	5.6	40.0	270	1.0	HL	46.0	-6.0
229.57	22.1	10.1	5.6	37.8	90	1.0	VL	46.0	-8.2
251.82	14.2	12.4	5.8	32.4	45	1.0	VL	46.0	-13.6
267.83	16.8	12.0	6.2	35.0	270	1.0	VL	46.0	-11.0
267.83	20.0	12.0	6.2	38.2	270	1.0	HL	46.0	-7.8
306.10	15.5	13.3	7.1	35.9	90	1.0	VL	46.0	-10.1
382.61	10.5	12.7	7.8	31.0	45	1.0	VL	46.0	-15.0
420.87	16.1	13.0	8.2	37.3	180	1.0	HL	46.0	-8.7
420.87	10.9	13.0	8.2	32.1	315	1.0	VL	46.0	-13.9
497.39	9.3	14.4	9.0	32.7	270	1.0	VL	46.0	-13.3
497.39	14.1	14.4	9.0	37.5	0	1.0	HL	46.0	-8.5
591.25	9.3	15.4	10.0	34.7	180	1.0	VL	46.0	-11.3

No emissions of significant levels were observed between 30 MHz and the lowest frequencies shown in the above

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data. No emissions of significant levels were observed between the highest frequency shown in the above data and 1000 MHz.

Conclusion: The iLM 2500 Internet Location Modem, Model iLM 2500 meets the requirements of the test reference for Open Field Radiated Emissions.

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Test Setup Photographs

Front View, Open Field Radiated Maximized Emissions

(See Test Setup Photographs)

Rear View, Open Field Radiated Maximized Emissions

(See Test Setup Photographs)

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Appendix A Test Equipment

Some or all of the following test equipment is currently used to measure the conducted and/or radiated emissions from the equipment under test:

Test Equipment	Model	Serial Number	Calibration Date	Next Calibration Due Date
Spectrum Analyzer	Hewlett Packard 8590A	2752 A02715	03/01/2000	03/01/2001
Spectrum Monitor	Rhode & Schwarz EZM	881 334/025	03/01/2000	03/01/2001
Test Receiver (9 KHz - 30 MHz)	Rhode & Schwarz ESH3	RES 0753	03/01/2000	03/01/2001
Test Receiver (20-1300 MHz)	Rhode & Schwarz ESVP	RES 0749	03/01/2000	03/01/2001
Spectrum Analyzer	Hewlett-Packard 8566B	2618A02909	03/01/2000	03/01/2001
Spectrum Analyzer	Hewlett-Packard 8567A	2602A00239	03/01/2000	03/01/2001
Spectrum Analyzer Display (Site 1)	Hewlett-Packard 8590A	2542A11954	03/01/2000	03/01/2001
Spectrum Analyzer Display (Site 2)	Hewlett-Packard 85662A	2542A12593	03/01/2000	03/01/2001
Quasi Peak Adapter (Site 1)	Hewlett-Packard 85650	2521A00871	03/01/2000	03/01/2001
Quasi Peak Adapter (Site 2)	Hewlett-Packard 85650A	2521A00737	03/01/2000	03/01/2001
Preselector (Site 1)	Hewlett-Packard 85685A	2620A00265	03/01/2000	03/01/2001
Preselector (Site 2)	Hewlett-Packard 85685A	2648A00462	03/01/2000	03/01/2001
Preamp	Hewlett-Packard 8447D	2648A04855	03/01/2000	03/01/2001
Preamp	Hewlett-Packard 8449B	3008A00101	03/01/2000	03/01/2001
Computer	Hewlett-Packard 9000/300	RES 449	N/A	N/A
Absorbing Clamp	MDS21	891 092/025	05/16/2000	05/16/2001

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Antenna Cable (OPTK45)	RG8/u	Not Provided	N/A	N/A
Antenna System	EMCO 3230	Not Provided	N/A	N/A
Biconical Antenna (Site 1)	EMCO 3104	3549	02/07/200 0	02/07/200 1
Biconical Antenna (Site 2)	EMCO 3104C	9111-4463	02/07/200 0	02/07/200 1
Log Periodic Antenna (Site 1) (200-1000 MHz)	EMCO 3146	2075	02/07/200 0	02/07/200 1
Log Periodic Antenna (Site 2) (200-1000 MHz)	EMCO 3146	9510-4202	02/07/200 0	02/07/200 1
Adj. Element Dipole Antenna (28 MHz-1 GHz)	EMCO 3120	2632	02/07/200 0	02/07/200 1
Horn Antenna	Eaton 96001	2632	02/07/200 0	02/07/200 1
LISN (25 Amp)	EMCO 38825/2	9210-2008	02/07/200 0	02/07/200 1
LISN (100 Amp)	Solar 8610-50-TS-100N	Not Provided	02/07/200 0	02/07/200 1
LISN	EMCO 3825/2R	1188/1001	02/07/200 0	02/07/200 1

Applicant: At Road, Incorporated
File No.: 0011FRS102-3/F

Prepared By: International Technology Company (ITC)		Rev. No 1.0
9959 Calaveras Road, PO Box 543		
Sunol, CA 94586-0543		
Tel: (925) 862-2944	Fax: (925) 862-	ILM 2500 Internet
9013		Location Modem
Email: itcemc@aol.com	Web:	Model: iLM 2500
www.itcemc.com		FCC Part 15 SubPart B, Class B

Test Equipment

Test Equipment	Model	Serial Number	Calibration Date	Next Calibration Due Date
Remote Controlled 8 ft Rotating Table	RES RT1	Not Provided	N/A	N/A
Remote Controlled 25 ft Rotating Table	RES RT2	Not Provided	N/A	N/A
Remote Controlled 4 ft Rotating Table	RES RT3, RT4, RT5	Not Provided	N/A	N/A
Remote Controlled 4 m Antenna Mast	RES AM1	Not Provided	N/A	N/A
Remote Controlled 6 m Antenna Mast	RES AM2, RES AM3	Not Provided	N/A	N/A
3 Phase 220 VAC/50 Hz Generator	Not Provided	DB7130B40	05/16/2000	05/16/2001
Oscilloscope (300 MHz)	Tektronix 2465		05/16/2000	05/16/2001
Digital Scope	Hitachi VC-6075		05/16/2000	05/16/2001
Power Analyzer	Valhalla Scientific/2101	RES 574	05/16/2000	05/16/2001
Digital Thermometer	Omega 440		05/16/2000	05/16/2001
DC Power Supply	Kepco JQE 150-1.5m	H177085	05/16/2000	05/16/2001

The spectrum analyzers are self-calibrated before every test and are calibrated to NIST standards annually.
All of the other EMI equipment are calibrated on a monthly basis using the spectrum analyzers as standards.

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Tel: (925) 862-2944	Fax: (925) 862- Location Modem
9013	Model: iLM 2500
Email: itcemc@aol.com	Web:
www.itcemc.com	

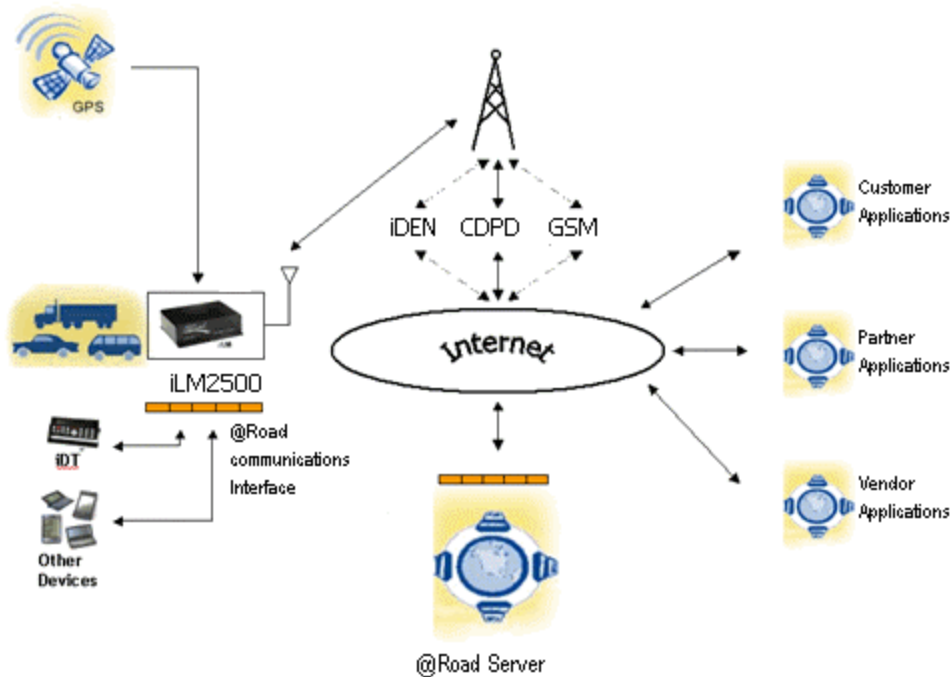
Appendix B EUT Technical Description

iLM 2500 Operational Description



The iLM 2500 Internet Location Modem combines GPS with a wireless data modem to provide vehicle location specific information. The intended use is to monitor location, speed and travel direction of vehicles. It is also designed to monitor PTO and activity based events such as ignition status, door open/close and tow lifts. It provides a serial interface for computers and peripheral devices like a printer, smart card reader, bar code scanner and temperature sensor.

Automatic Vehicle Location (AVL) System Diagram



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Fax: (925) 862-
Web:

ILM 2500 Internet
Location Modem
Model: iLM 2500

Rev. No 1.0

FCC Part 15 SubPart B, Class
B

GPS Radio Specification

Receiving Frequency: 1575.42 MHZ GPS interface does not transmit

CDPD Modem Radio Specification

Receiving Frequency Range: 869MHz - 894MHz

Transmitting Frequency Range: 824 MHz – 849 MHz

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ILM 2500 Internet

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Fax: (925) 862-

Location Modem

FCC Part 15 SubPart B, Class

9013

Model: iLM 2500

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Email: itcemc@aol.com

Web:

www.itcemc.com

iLM 2500 Operational Description

System Description

The iLM2500 has a GPS receiver, which receives location specific information from satellites. The GPS engine translates the receiving signal into data information and passes it on to the CPU. The CPU computes vehicle location, based on the information received. The location data is sent to the Rover Server/Database over the CDPD network. The information is retrieved via the Internet. The data is updated at intervals defined by the user.

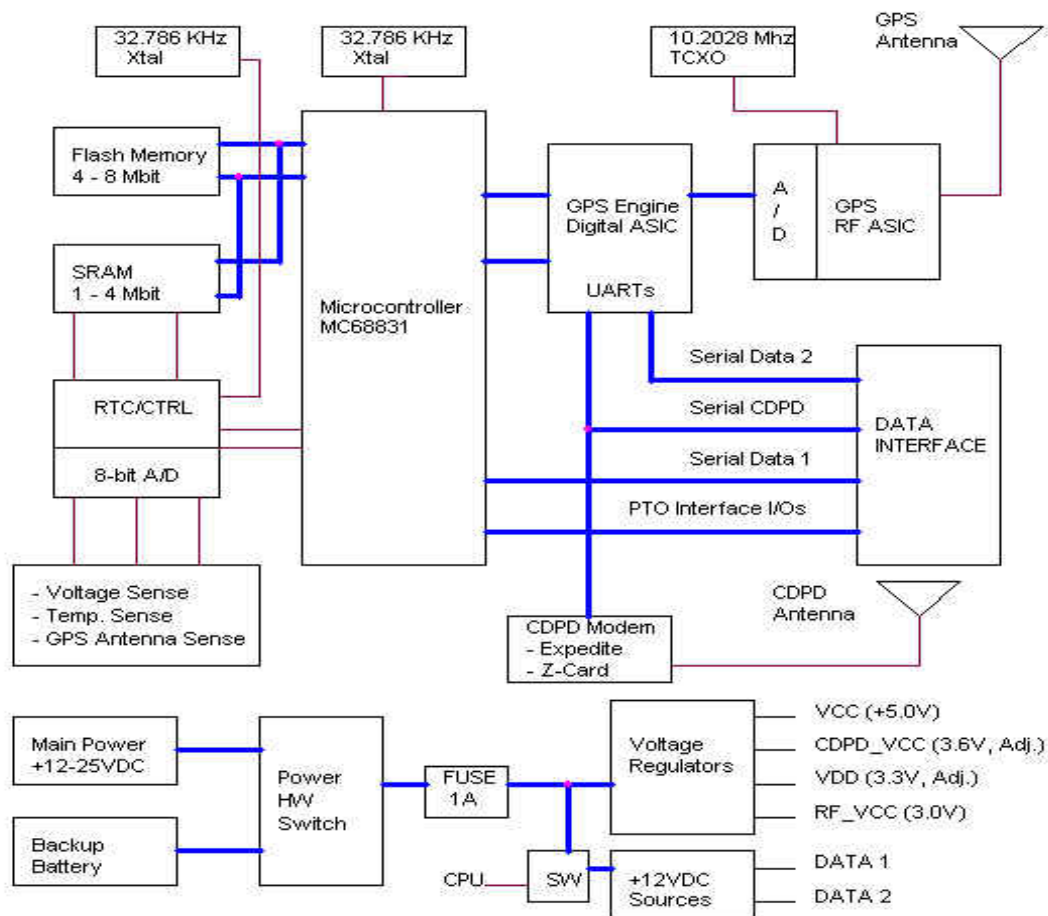
Hardware Description

The Main components used in iLM2500 design include Motorola's MC68331 processor, Flash, SRAM, Vista™ chip set from @Road, RTC/System Controller, and various different 3rd party CDPD OEM modules. Power to the system is drawn from a vehicles +12VDC source. A few voltage regulators use this source to generate power and supply it to different areas on the PCB. The iLM2500 has a backup battery feature. The backup battery kicks in automatically when the main power falls below operating voltage or is absent. The power supplied to external devices via Data Port 1 and Data Port 2 can be switched ON/OFF by the CPU. This was added to enhance power management.

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Tel: (925) 862-2944	Fax: (925) 862-	Location Modem	FCC Part 15 SubPart B, Class
9013		Model: iLM 2500	B
Email: itcemc@aol.com	Web:		
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System Architecture



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Web:

ILM 2500 Internet
Location Modem
Model: iLM 2500

FCC Part 15 SubPart B, Class B

Rev. No 1.0

iLM 2500 Operational Description

CPU

Motorola's MC68331 processor is used as the main controller of the system. It runs at 16Mhz, which is generated from an external 32.768Khz crystal. The CPU interfaces with flash memory, SRAM, GPS Asic and other I/Os in the system. An internal watchdog timer is used to generate the system reset.

Flash Memory

Flash ROM is used to store all the firmware and other information such as manufactures ID, user code, and other permanent codes. The board layout can be configured to use 4Mbit or 8Mbit Flash.

Flash Memory contains the following key components:

1. Boot block (OTAP capable in 96 and above firmware version)
2. Configuration data (IP addresses, device ID etc.)
3. GPS lookup tables.
4. Main program executable.

SRAM

SRAM is used to store all volatile and non-volatile data including PVT (Position, Velocity, Time) points and retain the data through use of a small battery.

Vista™ GPS Chipset

An @Road proprietary chipset comprised of two chips, GPS Signal Processing ASIC (VGP-12) and RF ASIC (VRF-12).

GPS Signal Processing ASIC

VGP-12 is the GPS Digital ASIC that combines twelve satellite correlator channels with other GPS system control peripherals. VGP-12 is designed to work with L1-CA dual bit down converter RF ASIC chip, VRF-12 by @Road.

VGP-12 is designed to process up to 4 VRF-12 down converted signals for applications requiring multiple antenna connections. Concurrent processing of multiple antenna signals:

- a) Delta phase measurements between down converted signals.
- b) Independently down converted signal processing,
- c) Cross strapping for redundancy.

VGP-12 contains six types of functional blocks: A CPU interface, GPS clock controller, GPS correlator channels with their common control logic, receiver magnitude gain control, 8-bit parallel port and two serial ports (UART). The VGP-12 device is packaged in 100-pin PQFP and operates from 2.7 to 3.7 volt supply.

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9013		Model: iLM 2500	B
Email: itcemc@aol.com	Web:		
www.itcemc.com			

RF ASIC

VRF-12 has an integrated dual conversion front end for a Global Positioning System (GPS) receiver application. The input is L1 (1575.42 MHz) GPS signal. Output is a down converted, band pass 2-bit quantized signal, ready for digital processing.

VRF-12 is a dual conversion super-heterodyne receiver featuring an on-chip low noise amplifier (LNA), an image-reject front end, voltage-controlled-oscillator (VCO) with on-chip resonator, phase lock loop (PLL) synthesizer, automatic gain control (AGC), reference oscillator, 2-bit A/D and power control. VRF-12 device is packaged in 48-pin TQFP and operates from 2.7 to 3.7 volt supply.

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Email: itcemc@aol.com	Web:	FCC Part 15 SubPart B, Class
www.itcemc.com		B
		Model: iLM 2500

iLM 2500 Operational Description

CDPD Modem

The CDPD modem is used to transmit location specific information from the iLM2500 to @Road's Server. The data is sent over periodic intervals defined by users and governed by different cost plans. The CDPD modem interface is through the UART from the Digital ASIC, VGP-12. The supply power to the modem can be turned ON/OFF via CPU control.

RTC and System Controller

A DS1670E IC from Dallas Semiconductor is used for real time clock and NVRAM control, including automatic battery backup. It also has three A/D inputs. The CPU uses an 8-bit A/D Converter to monitor supply voltage, temperature and GPS antenna.

External Interfaces

There are two external interface connectors available. One 26 pin for data and one 16 pin for power and high current I/O interface. The supported interfaces are Data Port1, Data Port2, PTO I/Os, Relay Drivers, Nextel Modem, and power I/Os. There are also two RF connectors for GPS and CDPD Modem antennas.

Data Port1

Data Port1 is solely used for the iDT, manufacturing, configuring, and debugging.

Data Port2

Data Port2 can be treated as the auxiliary data port. It interfaces with external devices such as a temperature sensor, smart card reader, printer, barcode scanner and magnetic stripe reader.

PTO I/Os

These I/Os allow a customer to monitor up to 4 contact-based switch events. The iLM can be programmed to transmit additional points when a switch transition occurs. Each time a switch transition, ON→OFF or OFF→ON occurs, an update is transmitted to the server.

Relay Drivers

There are two +12VDC relay drivers that can be used to turn ON/OFF the external relays.

Nextel Modem

Allows the user to interface an iLM2500 with an iDEN700 Nextel phone. The phone is data capable for communicating with the network server.

RF Connector

An SMA jack used for GPS antenna connection.

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Tel: (925) 862-2944	Fax: (925) 862-	ILM 2500 Internet
9013		Location Modem
Email: itcemc@aol.com	Web:	Model: iLM 2500
www.itcemc.com		FCC Part 15 SubPart B, Class B

Power I/Os

+12VDC from the vehicle is the main input power source to the iLM2500. Another alternate source is the backup battery. With the backup battery installed, the iLM will continue to operate if main power is absent or the voltage level falls below +12VDC. The iLM uses the input power to provide two +12VDC supply lines. These supply lines provide power to external devices via RJ45 connector Data1 and Data 2. These lines can be switched ON/OFF by the CPU.

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iLM 2500 Operational Description

Power Consumption

Table 1: iLM2500 Current consumption in mA @ VDD = 3.3V

Mode of Operation	Normal (MAX)	Standby
CPU	75	3
Digital ASIC	110	30
RF ASIC	43	4
Flash Memory	7	0.0005
SRAM Memory	40	0.0005
Peripherals	~20	~15
Total	295	52

Over the Air Programming Function (OTAP)

This unique feature enables us to reprogram an iLM with new firmware, via CDPD modem. It is designed for maximum flexibility and minimum code development on the network side. This is achieved by using the standardized TFTP (Trivial File Transfer Protocol).

Specifications:

Dimensions:	5.0" x 3.5" x 0.8" (127mm x 89mm x 20mm) (LWD)
Weight:	0.72 pounds (270 grams)
Electrical	Input Voltage: 10 to 24V DC Input Current: 340mA at 12V DC Voltage Spikes: Up to 30V DC for 0.1 second Current Consumption: Standby: <1mA at 12V DC & Operating: 310mA
Memory	4MB Flash (System firmware and user programming), upgrade to 8MB 128KB RAM (System and user data), upgrade to 4MB
Environmental	Operating Temperature: -4° to 140° F (-20° to 60° C) Storage Temperature: -40° to 221° F (-40° to 105° C) Humidity: 0 to 95% RH, non-condensing Shock/Vibration/Mechanical: Tested per SAE J1455 Aug 94, ASTM D-3580, ASTM D-4728-95, ASTM D-5176 ESD: 4kv contact, 8kv air
Connectors and I/O	Data Port 1, utilized by iDT only Data Port 2, serial data port for external devices such as temperature sensor PTO I/O, two ground sense and two +12V sense, interface for up to 4 contact-based switch events External Modem, interface to iDEN700, Nextel phone
RF	SMA jack, GPS antenna

Applicant: At Road, Incorporated
File No.: 0011FRS102-3/F

Prepared By: International Technology Company (ITC) 9959 Calaveras Road, PO Box 543 Sunol, CA 94586-0543 Tel: (925) 862-2944 9013 Email: itcemc@aol.com www.itcemc.com	Fax: (925) 862-	iLM 2500 Internet Location Modem Model: iLM 2500	Rev. No 1.0 FCC Part 15 SubPart B, Class B
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Connectors	
LED Indicators	GPS – Solid when operating normally, blinking when initializing COMM – Solid when operating normally, blinking indicates antenna, coverage or connection issue DATA – Solid when data is waiting to be transmitted, off when no data is in the buffer ACTIVE – Blinking when operating normally, solid when insufficient power to iLM

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Tel: (925) 862-2944	Fax: (925) 862-	ILM 2500 Internet	
9013		Location Modem	FCC Part 15 SubPart B, Class
Email: itcemc@aol.com	Web:	Model: iLM 2500	B
www.itcemc.com			

Appendix C Modification Letter

To Whom it May Concern:

This is to certify that **modifications** (details listed below) were performed on:

iLM 2500 Internet Location Modem, model iLM 2500

in order to comply with the **Class B** Radiated Emission Limits of **FCC Rules Part 15, SubPart B**

Fundamental frequency: 38.26 MHz

Initial Test Results

The initial test results have shown the emission level had exceeded the **Class B** Radiated Emission Limits of FCC Rules Part 15, SubPart B by a margin of less than 3dB at 2nd and 3rd harmonic.

Troubleshooting and Modifications

By changing the cables position the result could be varied from 3dB up or down. Found that most of RF energy exited the box via the CDPD modem cable. By connecting the shielding of the CDPD modem cable to the ground plane of the board it overcame and passed the requirement of **Class B** Radiated Emission Limits of FCC Rules Part 15. Hence, the PCB was re-layout to provide ground connection between the CDPD connector housing, which is connected to the shielding of the cable, and ground plane of the board. Please see photos attached for more clarification.

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Email: itcemc@aol.com
www.itcemc.com

iLM 2500 Internet
Location Modem
Model: iLM 2500

FCC Part 15 SubPart B, Class
B

Rev. No 1.0

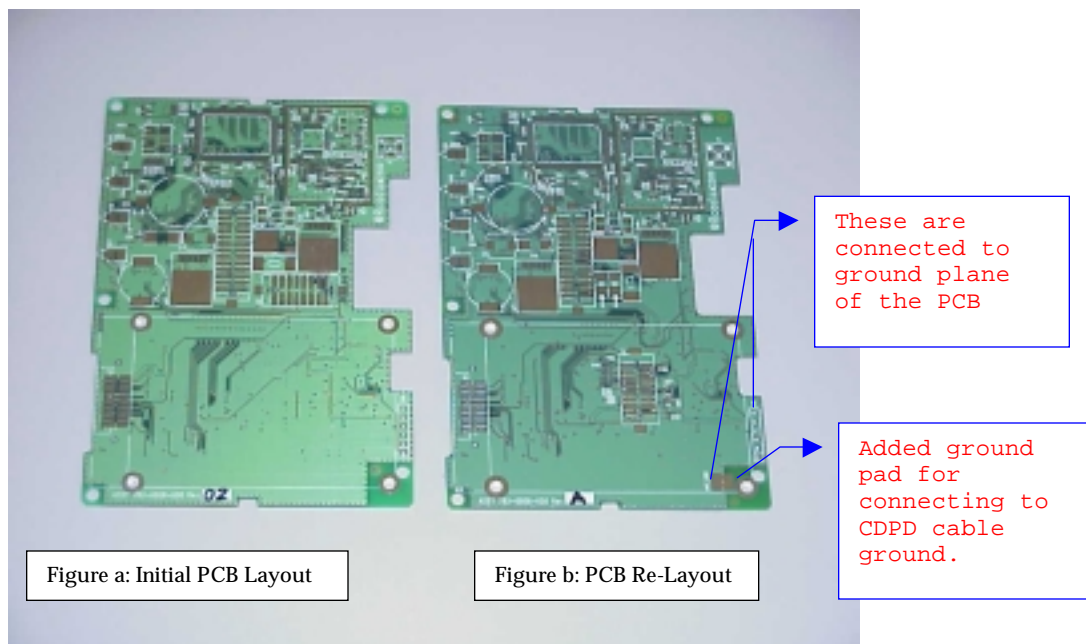


Photo 1: iLM2500 Bare PCB

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ILM 2500 Internet
Location Modem
Model: iLM 2500

FCC Part 15 SubPart B, Class
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Rev. No 1.0

Modification Letter

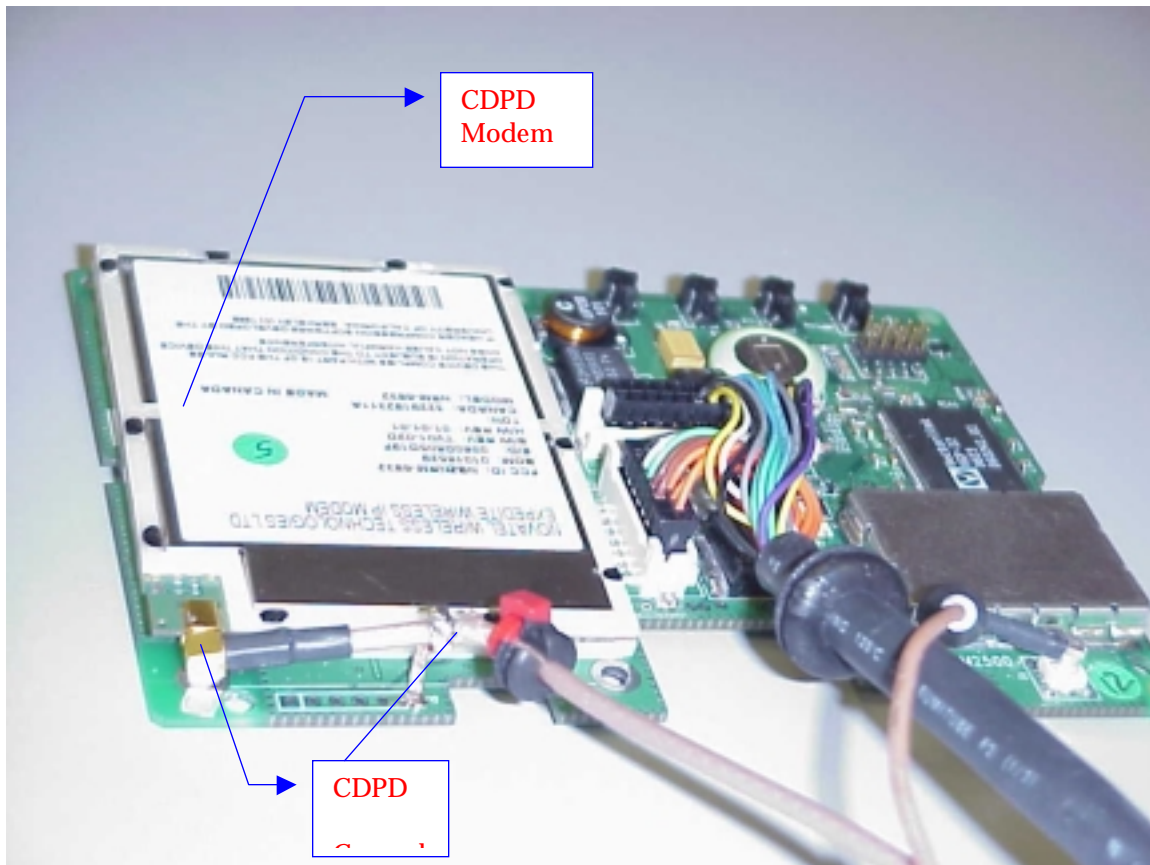


Photo 2: Complete PCB Assembly with the CDPD Modem.

For further information, please contact the manufacturer at:

At Road, Incorporated
47370 Fremont Boulevard
Fremont, California 94538 USA
Tel: [510] 668-1638
Fax: [510] 353-6021
Attention: Messrs. Mike Walker & Hung Phan

Applicant: At Road, Incorporated
File No.: 0011FRS102-3/F

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ILM 2500 Internet
Location Modem
Model: iLM 2500

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Appendix D EUT Photographs

iLM 2500

EUT Layout
(See External Photographs - EUT Layout)

External Layout
(See External Photographs)

External Layout
(See External Photographs)

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ILM 2500 Internet
Location Modem
Model: iLM 2500

Rev. No 1.0

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EUT

Photographs

iLM 2500

Internal Layout of iLM 2500
(See Internal Photographs)

Internal Layout of iLM 2500
(See Internal Photographs)

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www.itcemc.com		B
Model: iLM 2500		

Appendix E

Declaration of Conformity Procedure

- (a) A Declaration of Conformity is a procedure where the responsible party, as defined in Part 2.909 of the CFR47 rules, makes measurements or takes other necessary steps to ensure that the equipment complies with the appropriate technical standards. Submittal of a sample unit or representative data to the Commission demonstrating compliance is not required unless specifically requested pursuant to Part 2.1076 of the CFR47 rules.
- (b) The Declaration of Conformity attaches to all items subsequently marketed by the responsible party which are identical, as defined in Part 2.908 of the CFR47 rules, to the sample tested and found acceptable by the responsible party.

Responsible Party:

The following parties are responsible for the compliance to radio frequency equipment with the applicable standards:

- (a) In the case of equipment subject to authorization under the Declaration of Conformity procedure:
- (1) The manufacturer or, if the equipment is assembled from individual component parts and the resulting system is subject to authorization under a Declaration of Conformity, the assembler.
- (2) If the equipment, by itself, is subject to a Declaration of Conformity and that equipment is imported, the importer:

Submittal of Equipment Authorization Application or Information to the FCC:

Any information or equipment samples requested by the FCC pursuant to the provisions of the Part 2.913 of the CFR47 rules shall, unless otherwise directed, be submitted to:

Federal Communications Commission
Equipment Authorization Division
7434 Oakland Mills Road
Columbia, Maryland 21046

Equipment Defect and/or Design Change

When a complaint is filed with the FCC concerning the failure of equipment subject to comply with pertinent requirements of the FCC rules. And the FCC determines that the complaint is justified and arises out of an equipment fault attributable to the responsible party, the FCC may require the responsible party to investigate such complaint and report the results of such investigation to the FCC. The report

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		Model: iLM 2500

shall also indicate what action if any has been taken or is proposed to be taken by the responsible party to correct the defect both in terms of future production and with reference to articles in the possession of users, sellers and distributors.

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Declaration of Conformity Procedure

Sampling Tests of Equipment Compliance

The FCC, from time to time, will request the responsible party to submit equipment to determine the extent to which subsequent production of such equipment continues to comply with the data filed by the applicant (or on file with the responsible party for equipment subject to notification or a Declaration of Conformity. Shipping costs to the FCC's laboratory and return shall be borne by the responsible party.

Penalty for Failure to Provide Test Samples and Data

- (a) Any responsible party, as defined in CFR47, Part 2.909, or any party who markets equipment subject to a Declaration of Conformity, shall provide test sample(s) or data upon request by the FCC. Failure to comply with such a request with the time frames shown below may be cause for forfeiture or other FCC sanctions such as suspending action on any applications for equipment authorization submitted by such party while the matter is being resolved.
- (1) When the equipment is subject to authorization under Declaration of Conformity procedure, data shall be provided within 14 days of delivery of the request and test sample(s) shall be provided within 60 days of delivery of the request.
- (2) For all other devices, test sample(s) or data shall be provided within 60 days of the request.
- (b) In the case of equipment involving harmful interference or safety or life or property, the FCC may specify that test samples subject to the provisions of this section be submitted within less than 60 days, but not less than 14 days. Failure to comply within the specified time period will be subject to the sanctions specified in paragraph (a) of this section.

Responsibilities

- (a) The responsible party, as defined in Part 2.909 of the CFR47 rules, must warrant that each unit of equipment marketed under a Declaration of Conformity procedure is identical to the unit tested and found acceptable with the standards. Also the records maintained by the responsible party must continue to reflect the equipment being produced under the Declaration of Conformity procedure within the variation that can be expected due to quantity production and testing on a statistical basis.
- (b) The responsible party, if different from the manufacturer, may upon receiving a written statement from the manufacturer that the equipment complies with the appropriate technical standards rely on the manufacturer or independent testing agency to determine compliance. However, the test records required by Part 2.1075 of the CFR47 rules shall be in the English language and shall be

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www.itcemc.com		B
		Model: iLM 2500

made available to the FCC upon a reasonable request in accordance with the provisions of Part 2.1076.

- (c) In the case of transfer of control of the equipment, as in the case of sale or merger of the responsible party, the new responsible party shall bear the responsibility of continued compliance to the equipment.

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www.itcemc.com			

Declaration of Conformity Procedure

Responsibilities

- (d) Equipment shall be tested to demonstrate continued compliance with the applicable technical standards if any modifications or changes that could adversely affect the emanation characteristics of the equipment are made by the responsible party. The responsible party bears responsibility for the continued compliance of subsequently produced equipment.
- (e) If any modifications or changes are made by anyone other than the responsible party for the Declaration of Conformity, the party making the modifications or changes, if located within the US, becomes the new responsible party. The new responsible party must comply with all provisions for Declaration of Conformity, including having test data on file demonstrating that the product continues to comply with all of the applicable technical standards.

Identification

Devices subject only to a Declaration of Conformity shall be uniquely identified by the responsible party. This identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified, type accepted or type approved equipment. The responsible party shall maintain adequate identification records to facilitate positive identification for each device.

Retention of Records

- (a) The responsible party for each product subject to a Declaration of Conformity, shall maintain the records listed below:
 - (1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the requirements.
 - (2) A record of the procedures used for production, inspection and testing (if tests were performed) to insure the conformance required by the FCC rules (Statistical production line emission testing is not required).
 - (3) A record of the measurements made on an appropriate test site that demonstrates compliance with the applicable regulations. This record shall contain:
 - (i) The actual date of dates testing was performed.
 - (ii) The name of the test laboratory, company, or individual performing the testing. The FCC may request additional information regarding the test site, the test equipment or the qualifications of the company or individual performing the tests.

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- (iii) A description of how the device was actually tested, identifying the measurement procedure and test equipment that was used.

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Retention of Records

- (iv) A description of the equipment under test (EUT) and support equipment connected to, or installed within, the EUT.
 - (v) The identification of the EUT and support equipment by trade name and model number and, if appropriate, by FCC Identifier and serial number.
 - (vi) The types and lengths of connecting cables used and how they were arranged or moved during testing.
 - (vii) At least two photographs showing the test set-up for the highest line conducted emission and showing the test set-up for the highest radiated emission. These photographs must be focused originals which show enough detail to confirm other information contained in this report.
 - (viii) A description of any modifications made to the EUT by the testing company or individual to achieve compliance with regulations.
 - (ix) All of the data required to show compliance with the appropriate regulations.
 - (x) The signature of the individual responsible for testing the product along with the name and signature of official of the responsible party, as designed in Part 2.909 of the CFR47 rules.
 - (xi) A copy of the compliance information statement, as described in Part 2.1077 of the CFR47 rules, required to be provided with the equipment.
- (b) If the equipment is assembled using modular components that, by themselves, are subject to authorization under a Declaration of Conformity procedure. And/or a grant of certification, and the assembled product is also subject to authorization under a Declaration of Conformity procedure but, in accordance with the applicable regulations, does not require additional testing, the assembler shall maintain the records listed below in order to show the basis on which compliance with the standards was determined:
- (1) A listing of all of the components used in the assembly.
 - (2) Copies of the compliance information, as described in Part 2.1077 of the CFR47 rules, for all of the modular components used in the assembly.

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- (3) A listing of the FCC Identifier numbers for all of the components used in the assembly that are authorized under a grant of certification.
- (4) A listing of equipment modifications, if any that were made during assembly.

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Retention of Records

- (5) A copy of any instructions included with the components that were required to be followed to ensure the assembly of a compliant product, along with a statement, signed by the assembler, that these instructions were followed during assembly. This statement shall also contain the name and signature of an official of the responsible party, as designated in Part 2.909 of the CFR47 rules.
- (c) The records listed in paragraphs (a) and (b) of this section shall be retained for two years after the manufacture or assembly, as appropriate, of said equipment has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the responsible party is officially notified that an investigation or any other administrative proceeding involving the equipment has been instituted. Requests for the records described in this section and for sample, units are also covered under the provisions of Part 2.946 of the CFR47 rules.

FCC Inspection and Submission of Equipment for Testing

- (a) Each responsible party, upon receipt of a reasonable request, shall submit to the FCC the records required by Part 2.1075 of the CFR47 rules and one or more sample units for measurements at the FCC laboratory.
- (b) Shipping costs to the FCC Laboratory and return shall be borne by the responsible party. In the event the responsible party believes that shipment of the sample to the FCC Laboratory is impractical because of the size or weight of the equipment, or the power requirement, or for any other reason, the responsible party may submit a written explanation why such shipment is impractical and should not be required.

Compliance Information

- (a) If a product must be tested and authorized under a Declaration of Conformity procedure, a compliance information statement shall be supplied with the product at the time of marketing or importation, containing the following information:
 - (1) Identification of the product, e.g., name and model number.
 - (2) A statement, similar to that contained in Section 15.19(a)(3) of this chapter, that the product complies with Part 15 of the regulations.

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- (3) The identification, by name, address and telephone number, of the responsible party, as defined in Section 2.909 of this chapter. The responsible part for a Declaration of Conformity must be located within the United States.
- (b) If a product is assembled from modular components that, by themselves, are authorized under a Declaration of Conformity procedure and/or a grant of certification. The assembled product is also subject to authorization under a Declaration of Conformity procedure but, in accordance with the applicable regulations, does not require additional testing, the product shall be supplied, at the time of marketing or importation, with a compliance information statement containing the following information:

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Compliance Information

- (1) Identification of the modular component used in the assembly. A modular component authorized under a Declaration of Conformity procedure shall be identified as specified in paragraph (a)(1) of this section. A modular component authorized under a grant of certification shall be identified by name and model number (if applicable) along with the FCC Identifier number.
 - (2) A statement that the product complies with Part 15 of the CFR47 regulations.
 - (3) The identification, by name, address and telephone number, of the responsible party who assembled the product from modular components, as defined in Part 2.909 of the CFR47 rules. The responsible part for a Declaration of Conformity must be located within the United States.
 - (4) Copies of the compliance information statements for each modular component used in the system that is authorized under a Declaration of Conformity rules.
- (c) The compliance information statement shall be included in the user's manual or as a separate sheet.

Part 15.19 Labeling Requirements

- (1) Where a device is constructed, in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.
- (2) When the device is so small or for such use that it is not practical to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.
- (3) Products subject to authorization under a Declaration of Conformity shall be labeled as follows:
 - (a) The label shall be located in a conspicuous location on the device and shall contain the unique identification described in Section 2.1074 of this chapter and the following logo:


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Part 15.19 Labeling Requirements

- (i) If the product is authorized based on testing of the product or system:

Trade Name	Model Number
	Tested to Comply with FCC Standards

- (ii) If the product is authorized, based on assembly using separately authorized components and the resulting product is not separately tested:

Trade Name	Model Number
	Assembled from Tested Components (Complete System not Tested)

- (4) When the device is so small, or for such used that it is not practicable to place the statement specified under paragraph (b)(1) of this section on it, such as for a CPU board or a plug-in circuit board peripheral device, the test associated with the logo may be placed in a prominent location in the instruction manual or pamphlet supplied to the user. However, the unique identification (trade name and model name) and the logo must be displayed on the device.

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- (5) The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase, as described in Section 2.925 (d) of this chapter. "Permanently affixed" means that the label is etched, engraved, stamped, silk-screened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting, or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable.

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