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Enabler-G

User's Manual

Revision History

Rev	Date	ECN No.	Author	Description
A	11/19/2001	N/A	M. Cutchins / D. Rutledge	Initial Release

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Technical Support

For problems stemming from your network access, contact your GPRS carrier service.

For technical support and customer service dealing with the modem itself, contact Enfora, inc. by any of the following methods:

Web site: **www.enfora.com**

Phone: 972-633-2373

Email: techsupport@enfora.com

Before you contact Technical Support, please have your modem's Equipment Identifier (**EID**) number ready for the Technical Support representative.

1.0 Introduction

This document includes a feature overview, product specifications, mechanical information, and basic user information for Enfora's Enabler-G, an embedded OEM GPRS Class C modem. This low cost device is packaged in a small form-factor to facilitate a variety of embedded applications. It offers features and functions similar to Enfora's Enabler-A and Spider-O CDPD modems.

2.0 General Description

The Enabler-G is a self-contained General Packet Radio Service (GPRS) Class-C modem containing all functionality, to include RF and digital control, required to perform wireless data transfer over a GPRS network. Enabler-G has been designed to work as an embedded component in lap top PCs and other mobile platforms as well as handheld or portable host devices.

3.0 Safety and Regulatory Compliance

This unit complies with specifications for a GPRS Class-C full-duplex modems with a maximum transmit output power of 0.6 Watts. This Enabler-G complies with US CFR 47, Part 24 Subpart E and Part 15 of the FCC Rules and Regulations and Canada RSS-188. Detailed Regulatory and safety statements are provided following Section 10.0 of this Manual.

Basic safety precautions and guidelines for such devices must be observed, such as:

- Do not expose the device to fire, open flames, or extreme thermal conditions.
- Do not spill liquids on the device.
- Do not disassemble or attempt to modify the device without he express written consent of Enfora.
- Do not attempt to repair the device

The Enabler-G complies with the FCC RF emission and hazard requirements when installed and operated within the constraints and limitations specified in this manual. Enfora is not liable for injury to personnel

4.0 GPRS Background

General Packet Radio Services (GPRS) is a packet based wireless communication service that can deliver variable data rates as a function of assigned timeslots and maintain continuous connection to the Internet for mobile subscribers on Global System for Mobile (GSM) Network worldwide. Since GPRS is based on GSM communication, it can be single, dual or triple band depending on the area of the service, it will complement existing services such as circuit switched cellular phone connections and the Short Message Service (SMS).

In general, GPRS packet-based service should cost users less than circuit-switched services, since their communication channels are being used on a shared-use, as-packets-are-needed basis rather than dedicated only to one user at a time. Once GPRS becomes available, mobile users of a virtual private network (VPN) will be able to access their private networks continuously rather than through a dial-up connection. GPRS will also complement Bluetooth, a standard for replacing wired connections between devices with wireless radio connections. In addition to the Internet Protocol (IP), GPRS supports X.25, a packet-based protocol that is used mainly in Europe and Asia Pacific. GPRS is an evolutionary step toward Enhanced Data GSM Environment (EDGE) and Universal Mobile Telephone Service (UMTS).

The key benefit with GPRS is the ability to sustain a permanent data connection allowing a free flow of information for the mobile user. The data through put in GPRS will be significantly higher due to the ability of GPRS mobile terminals to transmit and receive more information than standard GSM terminals.

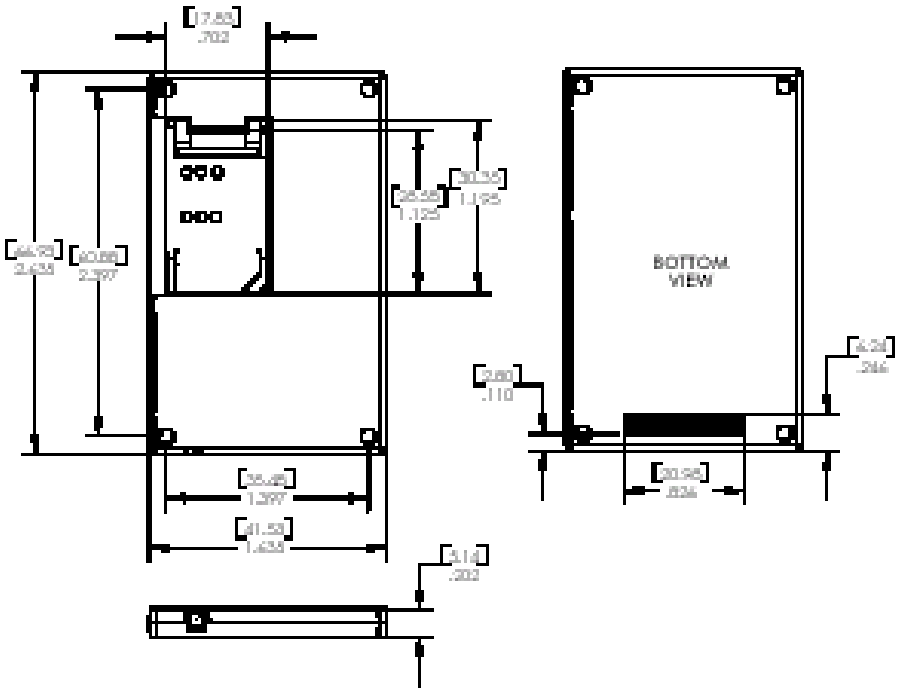
The GSM communication system, in general, is standardized to operate in multiple bands, primarily, the 900 MHz band which is assigned PGSM, EGSM, RGSM for short, 1800 MHz band which is assigned DCS and the 1900 MHz band which is assigned PCS. Both the GSM and DCS band are used globally for mobile voice communication. The PCS 1900 is used in North, Central and South America.

- Enabler-G Model No. GSM0102 900/1800 MHz
- Enabler-G Model No. GSM0103 900/1900 MHz

Although the GSM digital voice standard has existed for well over a decade, it wasn't until recently that the demand for wireless data capability has increased. GPRS is a protocol within the GSM standard which was developed to address the need for data only transmission. Although the GSM voice protocol does support data transmission, it is limited in data rate due to overhead within the voice protocol. What the GRPS allows is a faster data rate that is adaptive as well as being packet based.

5.0 Mechanical Characteristics

Basic package dimensions and form factor information is provided in the following figures.



5.1 Connectors

Control Connector

The connector used to interface to the host is a 40-position socket header that is 2 rows by 20 columns at 1 mm pitch, part number Samtec CLM-120-02-F-D.

RF Connector

The modem's RF connector is a MMCX jack.

Antennas

The user will supply the antenna. The antenna must have a nominal impedance of 50 Ohms. The VSWR must be less than 2.0:1. System antenna gain should be 0 to +2 dBi for optimum performance

40 Pin Connector Assignments

Connector pin assignments are shown in the following table.

Table 1

DESCRIPTION	I/O	REF	PIN #		REF	I/O	DESCRIPTION
Ground	-	GND	1	2	GND	-	Ground
UART receive	I	RX	3	4	TX	O	UART transmit
UART Data carrier detect	O	DCD	5	6	RTS	I	UART ready to send
UART Data set ready	O	DSR	7	8	DTR	I	UART data terminal ready
UART Clear to send	O	CTS	9	10	Ring	O	UART ring indicator
General Purpose I/O	I/O	GPIO1	11	12	GPIO2	I/O	General Purpose I/O
General Purpose I/O	I/O	GPIO3	13	14	GPIO4	I/O	General Purpose I/O
General Purpose I/O	I/O	GPIO5	15	16	GPIO6	I/O	General Purpose I/O
General Purpose I/O	I/O	GPIO7	17	18	GPIO8	I/O	General Purpose I/O
3.8 volt supply	-	VCC	19	20	VCC	-	3.8 volt supply
3.8 volt supply	-	VCC	21	22	VCC	-	3.8 volt supply
* Reserved	*	Reserved	23	24	Reserved	*	* Reserved
* Reserved	*	Reserved	25	26	Reserved	*	* Reserved
* Reserved	*	Reserved	27	28	ADC_1	I	Analog voltage monitoring
Transmitter is active	O	TX IND	29	30	ADC_2	I	Analog voltage monitoring
Wake command	I	RemoteOn	31	32	Reserved	*	* Reserved
* Reserved	*	Reserved	33	34	Reserved	*	* Reserved
* Reserved	*	Reserved	35	36	Reserved	*	* Reserved
* Reserved	*	Reserved	37	38	Reserved	*	* Reserved
Ground	-	GND	39	40	GND	-	Ground

6.0 Electrical Characteristics

6.1 Input Voltage and Power

The modem operates from an input voltage range of 3.15 Vdc to 4.50 Vdc. Input voltage may be directly applied from a 3.6V Li-Ion or Nickel Metal Hydride battery. The digital input and output signals are 3.3 Vdc tolerant.

6.2 Power Consumption

The modem has four power consumption modes:

Mode	Current	Power @ 3.3 Vdc Input
Off/Stand-by	< 100 µA	< 330 µW
Sleep	< 5 mA	< 16.5 mW
Receive	< 150 mA	< 495 mW
Transmit @ 28 dBm	< 1000 mA	< 3300 mW

The modem has three hardware sections. Each is powered separately. These hardware sections are (a) the digital circuitry, (b) the RF receiver circuitry, and (c) the RF transmitter circuitry. The following chart describes which sections are powered on during each power consumption mode.

Mode	Digital Circuitry	RF Receiver Circuitry	RF Transmitter Circuitry
Off/ Standby	Off	Off	Off
Sleep	Low power most of time	Off most of time	Off
Receive	On	On	Off most of time
Transmit	On	On	On

Modem Off/ Standby Mode

In the Modem Off mode, a FET switch inside the modem is turned off. All power within the modem is removed. A WAKE command or power cycle is required to come back to functional status. Standby mode allows the unit to be put in deep sleep. A WAKE command or power cycle is required to return to functional status.

Sleep Mode

Sleep mode is defined by the GPRS specification. If Sleep mode is enabled (user option), the modem will enter Sleep mode after a user-specified period of time if there is no IP data traffic across the serial port. The modem then disables its RF receiver, disables its RF transmitter, and places the digital circuitry in a low power state for the sleep timeout period negotiated with the GPRS network (typically 60-90 seconds). The modem will enable its RF receiver and digital circuitry after the specified sleep timeout and check if any new message is waiting from the GPRS network. If no new message is available, the modem disables its circuitry and returns to sleep for the specified timeout period before waking up again. If a new message is available from the GPRS network, the modem remains in Receive mode and reads the message. After receiving a message, the modem will remain in Receive mode until the next period of serial port inactivity occurs. If the host computer sends a message to the serial port, the modem immediately exits Sleep mode, returns to Transmit mode, and transmits the message to the GPRS network.

Receive Mode

The unit is in Receive mode anytime it is trying to register or maintaining registration but has no data to transmit. During this mode, the transmit circuit is turned off, but the receive circuitry is turned on. The GPRS protocol requires occasional transmit bursts to maintain registration even if no data traffic is occurring.

Transmit Mode

During Transmit mode, the modem is fully operational. The transmitter and receiver are both on since the unit is a full duplex modem. The transmit power required varies based on the received signal power.

Transmit power level varies based upon the proximity of the modem to the cell site, RSSI measured by the modem, and maximum power level allowed by the cell site.

7.0 Radio Performance

The following table shows the standard channel allocation for the EGSM 900 and PCS 1900 band. The EGSM transmitter transmits at exactly 45 MHz below the receive frequency. The PCS transmitter transmit at exactly 80 MHz below the its received frequency.

Channel Number for E-GSM 900 (0-124)	Mobile Station Transmit Frequency = 890 MHz + 0.2(n)	Mobile Station Receive Frequency = 890 MHz + 0.2(n) + 45 MHz
Channel 0	890.0MHz	935.0MHz
Channel 31	896.2 MHz	941.2 MHz
Channel 62	902.4 MHz	947.4 MHz
Channel 93	908.6 MHz	953.6 MHz
Channel 124	914.8 MHz	959.8 MHz
Channel Number for E-GSM 900 (975-1023)	**Mobile Station Transmit Frequency = 890 MHz + 0.2(n-1024)**	**Mobile Station Receive Frequency = 890 MHz + 0.2(n-1024) + 45 MHz**
Channel 975	880.2 MHz	925.2 MHz
Channel 1000	885.2 MHz	930.2 MHz
Channel 1023	889.8 MHz	934.8 MHz

MS Tx Band

Ch 955	Ch1023	Ch 0	Ch 62	Ch 124
876.2 MHz	889.8MHz	890.0 MHz	902.4 MHz	914.8 MHz

MS Rx Band

Ch 955	Ch 1023	Ch 0	Ch 62	Ch 124
921.2 MHz	934.8 MHz	935.0 MHz	947.4 MHz	959.8 MHz

Channel Number for PCS 1900 (512-810)	Mobile Station Transmit Frequency = 1850.2MHz + 0.2(n-512)	Mobile Station Receive Frequency = 1850.2MHz + 0.2(n-512) + 80 MHz
Channel 512	1850.2 MHz	1930.2 MHz
Channel 587	1865.2 MHz	1945.2 MHz
Channel 662	1880.2 MHz	1960.2 MHz
Channel 737	1895.2 MHz	1975.2 MHz
Channel 810	1909.8 MHz	1989.8 MHz

MS Tx Band

Ch 512	Ch 662	Ch 810
1850.2 MHz	1880.2 MHz	1909.8 MHz

MS Rx Band

Ch 512	Ch 699	Ch 885
1930.2 MHz	1960.2 MHz	1989.8 MHz

The primary advantage of the GSM standard is that, regardless of the band of operation, they all share the same technical features. This specification applies to the GSM voice, voice & data, and data only (GPRS) transmission. With TDMA, one GSM RF channel can support up to 8 mobile users simultaneously. Each user is allowed to transmit once every frame period for a 1 timeslot duration. Because of the TDMA scheme, timing accuracy in the software and hardware implementation is very critical. The Enabler has the following common specifications.

Key Technical Feature	*Specification*
Modulation Data Rate	270.833Kbit/s
Bit Period	3.692 us
TDMA Timeslot	8 timeslot / RF channel
1 Timeslot Period	576.9 us
Bits/timeslot	156.25 bits
Timeslot Composition	148 (data bits) + 8.25 (guard bits)
Timeslot Allocation	0 to 7
Frame Period	4.615 ms (8 timeslot period)
Channel Spacing	200 KHz
Modulation Scheme	0.3 GMSK

8.0 Monitoring

Monitoring the state of the modem may be done both locally and remotely. This is accomplished by using the UDP API to monitor configuration settings, GPIO states, and A to D measurements. Modification to the modem's configuration settings and GPIO outputs states is also facilitated through the UDP API.

8.1 Temperature

The temperature of the Modem is monitored internally by an analog input. When the temperature exceeds the specified range, the operator is notified through the Modem Manager.

8.2 Host Voltage

The voltage being supplied to the Host is monitored internally by an analog input. When the supply voltage exceeds the specified range the operator is notified through the Modem Manager and RF transmission is suspended.

9.0 Control Connector Signal Descriptions

9.1 Serial Interface

The modem provides a standard 16550 UART serial interface to the host. It provides a full 9-pin, RS-232 interface at logic level (3.3 V). TxData is the serial data from the modem. RxData is the serial data from the host to the modem. This data may contain 7 or 8 data bits, and 1 stop bit. The baud rate may be adjusted to 19200 or 38400 bits per second. Default settings are 8 data, 1 stop, no parity, and 38400 baud. DCD may be set to be always on or to indicate GPRS connection status. DTR may be used to force the modem into AT command mode from online data mode. RTS and CTS may be used for hardware handshaking. DSR is always active (connected to ground) while the modem is on. RING may be used to alert the host to incoming messages by pulsing when the modem is in sleep state and a new message arrives from the network. For a minimal implementation, connect RxData and TxData to the COM port serial data lines, connect DTR and RTS to GND.

9.2 GPIO

Eight general-purpose signals (GPIO1-8) are provided. Each of these signals may be selected as inputs or outputs. They may be used independently as a user-specified function, or may be used to provide modem

control and status signals. Two examples of modem control signals are: register/deregister on GPRS network command and transmitter disable. One modem status signal example is GPRS registration status. These GPIO pins are controlled with AT commands and/or by the UDP control interface. GPIO signals will only be active when the modem is in receive or transmit power consumption mode.

9.3 Wake Circuit

The WAKE signal is used to wake the modem up from sleep.

9.4 A-to-D Inputs

Two analog-to-digital conversion signals are provided for the user; ADC1 and ADC2. The binary resolution is 8 bits that have a readable input voltage range of 3.0 to 3.2V. These signals may be read with AT commands or the API control interface.

9.5 Transmit Indicator (TX IND)

The transmit indicator output alerts the Host when the modem is in transmit mode. The transmitter indicator will be high when the modem is in transmit mode.

10.0 Software

10.1 Operating Systems

The Enabler-G Host Modem Manager software supports Windows CE 3.0 (Windows for Pocket PC 2000) and Windows 98 Second Edition. Future versions of the Enabler-G Modem Manager will support other Windows operating systems.

10.2 Modem Manager

The Enabler-G Modem Manager will allow configuration of the modems parameters as well as real time monitoring of the GPRS network details such as sensitivity and channel.
The Modem manager will also automatically detect the modem when the application is launched.

10.3 Communication Protocol

Enabler-G supports a common AT command set, ICMP, and UDP PAD. Enabler-G also supports TCP/IP, and SLIP protocols initiated through Dial-Up networking. With this configuration, Internet Explorer, Netscape, MS Outlook, and other TCP/IP protocol based applications are supported by the modem.

11.0 Environmental Characteristics

11.1 Temperature

-20^{oC} to 70^{0}C, operating
-40^{oC} to 85^{0}C, non-operating

11.2 Altitude

15,000 feet, operating
45,000 feet, non-operating

11.3 Humidity

5-95% non-condensing

11.4 Vibration

Operating		
	Sinusoidal	**Random**
Amplitude	1.5G pp	1.5G rms
Freq. Range	10-500 Hz	10-500 Hz
Freq. Sweep Rate	.5 octave/min, linear	
Duration	2 hours per axis	1 hour per axis

Non-Operating		
	Sinusoidal	**Random**
Amplitude	3G pp	3G rms
Freq. Range	5-500 Hz	10-500 Hz
Freq. Sweep Rate	.5 octave/min, linear	
Duration	2 hours per axis	1 hour per axis

11.5 Shock

	Operating	**Non-Operating**
Amplitude	10G	80G
Wave Form	½ sine, 11 msec. duration	½ sine, 11msec. Duration
Repetitions	6 per axis	6 per axis

11.6 Electrostatic Discharge

The Enabler-G is compliant with EN50082-1 and IEC801-2 (Level 4), and can withstand an 8 kV discharge from a 180 pF/300 Ohm source probe without sustaining any hard failures. The discharge is performed with the card installed on a host board and the voltage is discharged at user accessible points.

12.0 Regulatory Information

FCC REGULATORY COMPLIANCE
INTEGRATION AND USE INFORMATION

INTEGRATION CONSIDERATIONS AND INSTALLATION REQUIREMENTS

The Enabler-G OEM GPRS modem is designed for use in a variety of host units, "enabling" the host platform to perform wireless data communications. However, there are certain criteria relative to integrating the modem into a host platform such as a PC, laptop, handheld or PocketPC, monitor and control unit, etc. that must be considered to ensure continued compliance with FCC compliance requirements.

The modem was tested and certified to meet FCC Parts 15 and 24 in a stand-alone configuration, demonstrating that the Enabler-G complies with Part 15 emission limits regardless of the device into which it may be installed. Further, to provide relief in certain applications for the host integrator, the Enabler-G was approved under the "modular approval" process for a transmitter. This approach, described by FCC Public Notice DA 00-131407 released June 26, 2000, is intended to afford relief to equipment manufacturers by eliminating the requirement for obtaining a new equipment authorization for the same transmitter when installed in a new device.

However, the host platform integrator must follow all installation instructions and cautionary information necessary to comply with FCC RF exposure requirements.

In order to use the Enabler-G without additional FCC certification approvals, the installation must meet the following conditions. Otherwise, additional FCC approvals must be obtained.

1. "**Fixed"** and **"mobile"** applications: At least 20 cm (7.9 in.) separation distance between the antenna and the user's body must be maintained at all times. For the transmitter to meet the MPE categorical exclusion requirements of 2.1091, the ERP must be less than 1.5 watts for personnel separation distance of at least 20 cm (7.9 in).

   a. In "Fixed" applications, antenna gain is limited to a maximum of 7 dBi, with a corresponding Equivalent isotropic Radiated Power (EIRP) of 37 dBm / 5 W.

   b. In "mobile" applications, antenna gain is limited to a maximum of 3 dBi, with a corresponding Equivalent isotropic Radiated Power (EIRP) of 37 dBm /25 W

   c. If greater than 1.5 watts exists, then additional testing and FCC approval is required (e.g., see 3 below).

2. If used with a desktop or other application where the antenna can be easily relocated to meet the 20 cm criteria, then this is considered a **"mobile"** application.

   If used in a **"mobile**" application where the antenna is normally separated at least 20 cm (7.9 in) from the human body during device operation, then an appropriate warning label must be placed on the host unit adjacent to the antenna.

   The label should contain a statement such as the following:

   WARNING
   RF exposure. Keep at least 20 cm (7.9 in) separation distance from the antenna and the human body.

3. "**Portable"** applications**:** If used in a "portable" application such as a **handheld device** with the antenna less than 20 cm (7.9 in.) from the human body when the device is operating, then the integrator is responsible for passing additional "as installed" testing.

Separate FCC approval for RF exposure compliance is required for end products that do not met the separation or maximum antenna gain criteria.

a. **SAR** (Specific Absorption Rate) testing, with results submitted to the FCC for approval prior to selling the integrated unit. If unable to meet SAR requirements, then the host unit must be restricted to "mobile" use (see 3 below).

b. **Unintentional emissions**, FCC Part 15; results do not have to be submitted to the FCC unless requested, although the test provides substantiation for required labeling (see 5 below).

4. Host unit user manuals and other documentation must also include appropriate caution and warning statements and information.

5. If the FCC ID for the modem is not visible when installed in the host platform, then a permanently attached or marked label must be displayed on the host unit referring to the enclosed modem. For example, the label should contain wording such as:

Contains CDPD modem transmitter module
FCC ID: MIVGSM0103

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

or

Contains FCC ID: MIVGSM0103

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

6. Any antenna used with the modem must be approved by the FCC as either a Class II Permissive Change (including MPEL or SAR data as applicable). The "professional installation" provision of FCC Part 15.203 does not apply.

7. The transmitter and antenna must not be co-located or operating in conjunction with any other antenna or transmitter. Violation of this would allow a user to plug another transmitter in to the product and potentially create an RF exposure condition.

WARNING
The transmitter and antenna must not be co-located or operating in conjunction with any other antenna or transmitter. Failure to observe this warning could produce an RF exposure condition.

Regulatory Information (Continued)

The equipment certifications appropriate to your device are marked on the device and product specific information. The use of the equipment is subject to the following conditions:

FCC COMPLIANCE STATEMENT

This device complies with Part 15 of FCC Rules of operation subject to the condition that this device does not cause harmful interference. This device also complies with FCC Part 24.

WARNING

This device has been tested to determine compliance with FCC RF exposure requirements. It has been found to comply with Maximum Permissible Exposure limits (MPEL) requirements for uncontrolled exposure at 20 cm (7.9 in.) or greater.

CAUTION

Since this is an OEM device, and since variables such as the interfacing antenna may affect performance characteristics, it is incumbent upon the host platform integrator to ensure the integrated system maintains compliance with FCC regulations.

CAUTION

Changes or modifications without the express consent of Enfora, Inc. voids the user's authority to use the equipment.

This equipment has been tested and found to comply with the limits pursuant to Part 15 Subpart B and Part 24 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in an appropriate installation. This equipment generates, uses, and can radiate radio frequency energy and, if not used in accordance with instructions, can cause harmful radiation to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If the equipment does cause harmful interference in radio and television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation distance between the equipment and the receiver
- Contact Enfora, Inc. Technical Support for assistance.

INDUSTRY CANADA COMPLIANCE

This digital apparatus does not exceed Class B limits for radio noise emissions or electromagnetic interference (EMI) from digital apparatus as set out in the interference-causing equipment requirements of Industry Canada.

WARRANTY

The Enabler-G is covered by a 36-Month Limited Warranty.

Enfora, Inc. warrants the products that it manufactures to be free from defects in materials and workmanship for a period of 36 months from the date of shipment from Enfora. This warranty is limited to the original purchaser of the product and is not transferable.

During the 36-month warranty period, Enfora will repair or replace, at its option, any defective products or parts at no additional charge provided that the product is returned, shipping prepaid, to Enfora. The purchaser is responsible for insuring any product so returned and assumes the risk of loss during shipping. All replaced parts become the property of Enfora.

During the 36-month warranty period, Enfora will also provide any software maintenance releases at no additional charge.

THIS LIMITED WARRANTY DOES NOT EXTEND TO ANY PRODUCT THAT HAS BEEN DAMAGED AS A RESULT OF ACCIDENT, MISUSE, ABUSE, OR AS A RESULT OF SERVICE OR MODIFICATION BY ANYONE OTHER THAN ENFORA.

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