

**Integration Guide:
EDG0208IG001**

**Enfora Enabler IIE Quad-Band
GSM/GPRS/EGPRS Modem
Integration Guide**

Version 1.00

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1.0 Safety Precautions

1.1 Important Safety Information

The following information applies to the devices described in this manual. Always observe all standard and accepted safety precautions and guidelines when handling any electrical device.

- Save this manual: it contains important safety information and operating instructions.
- Do not expose the Enfora Enabler EDG0208 product to open flames.
- Ensure that liquids do not spill into the devices.
- Do not attempt to disassemble the product; doing so will void the warranty. With the exception of the Subscriber Identification Module (SIM), this product does not contain consumer-serviceable components.

2.0 Regulatory Compliance FCC

2.1 Integration Considerations and Installation Requirements

The Enabler IIE modem is designed for use in a variety of host units, "enabling" the host platform to perform wireless data communications.

- Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
- In order to use the Enabler IIE modem without additional FCC certification approvals, the installation must meet the following conditions:

Maximum RF output power and antenna gain to meet Maximum Permissible Exposure Requirements:

- GSM850 mode: Maximum antenna gain is 6.5 dBi.
- GSM1900 mode: Maximum antenna gain is 3.0 dBi.
- If used in an application such as a handheld or body worn 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 and the device will require it's own FCC ID and FCC testing.
- 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.

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

- If the FCCID 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 GSM/GPRS/EDGE transmitter module
FCC ID: MIVEDG0208
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: MIVEDG0208
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.

- Any antenna used with the modem must be approved by the FCC or as a Class II Permissive Change (including MPEL or SAR data as applicable). The "professional installation" provision of FCC Part 15.203 does not apply.
- 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 collocated
or operating in conjunction with any
other antenna or transmitter. Failure to observe
this warning could produce an RF exposure
condition.**

2.2 Disclaimer

The information and instructions contained within this publication comply with all FCC, GCF, PTCRB, R&TTE, IMEI and other applicable codes that are in effect at the time of publication. Enfora disclaims all responsibility for any act or omissions, or for breach of law, code or regulation, including local or state codes, performed by a third party.

Enfora strongly recommends that all installations, hookups, transmissions, etc., be performed by persons who are experienced in the fields of radio frequency technologies. Enfora acknowledges that the installation, setup and transmission guidelines contained within this publication are guidelines, and that each installation may have variables outside of the guidelines contained herein. Said variables must be taken into consideration when installing or using the product, and Enfora shall not be responsible for installations or transmissions that fall outside of the parameters set forth in this publication.

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The Enabler IIE platform is designed with features to support a robust connection. There are instances where the module performance is beyond the control of the intended design. Integrated designs that require 24 by 7 operation must implement power control via an external circuit or by implementing power management as specified within this design guide.

3.0 Manual Overview

This document describes the hardware interface of the Enabler EDG0208 GSM/GPRS OEM Modem. The purpose of this document is to define the electrical, mechanical and software interfaces while providing detailed technical information in order to streamline the process of hardware and system integration.

3.1 Reference Documents

3.1.1 Enfora Enabler EDG0208 Product Documentation

Manuals

- EDG0208AT001 - Enfora Enabler IIE AT Command Set

Application Notes

- GSM0000AN001 - Enabler-G PPP Configuration for Windows 98
- GSM0000AN002 - Enabler-G PPP Configuration for Windows 2000
- GSM0000AN003 - Enabler-G Data Circuit Switched Call Configuration and Use
- GSM0000AN004 - Enabler-G SMS Configuration and Use
- GSM0000AN005 - Enabler-G Automated Network Connection Configuration and Use
- GSM0000AN006 - Enabler-G Module Status Query
- GSM0000AN007 - Enabler-G Status Reporting
- GSM0000AN008 - Enabler-G PPP Configuration for Windows XP
- GSM0000AN013 - Enabler-G Sleep Mode Configuration and Use
- GSM0000AN016 - How to Send SMS Messages to an E-Mail Address

Technical Notes

- GSM0000TN001 - Enabler-G Firmware Upgrade
- GSM0000TN002 - Enabler-G PPP Negotiation Sequence
- GSM0000TN008 - Enabler Power Supply Requirements
- GSM0000TN013 - Enabler III-G and IIE CMUX Description

3.1.2 GSM Device Specifications: www.3gpp.org

- 3GPP TS 51010-1 (850, 900,1800,1900 MHz devices)

3.1.3 Federal Communications Commission (FCC)

Internet: <http://www.fcc.gov/>

- FCC Rules, Part 24
 - 47 CFR Subpart E--Broadband PCS
 - 47 CFR § 24.52, sections 1.1307(b), 2.1091, and 2.1093
- FCC Rules, Part 22 for GSM 850
- FCC Rules, Part 15
- FCC Rules, Part 2
 - Subpart J--Equipment Authorization Procedures
 - Section 2.925

3.1.4 FCC Office of Engineering and Technology (OET)

Internet: <http://www.fcc.gov/oet/>

- Bulletin Number 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
- Supplement C "Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Exposure to Radio Frequency Emissions"

3.1.5 Industry Canada

- RSS-132
- RSS-133
- ICES-003

3.1.6 Environmental Regulations

- National Environmental Policy Act (NEPA) of 1969 (Part 1, Subpart 1)

3.1.7 Mechanical Specifications

- ASTM D999
- ASTM D775
- IEC 68-2-27
- Bellcore Gr-63-CORE
- ETS 300 019-1-1 Class 1.2
- ETS 300 019-1-2 Class 2.1
- ETS 300 019-1-3 Class 3.1

3.1.8 RF and EMI Specifications

- ETSI Standards
 - EN 61000-4-6
 - EN 61000-4-3
- TS 51.010-1, Section 12.2
- EN 55022 Class B

4.0 Introduction

4.1 Product Overview

Enfora Enabler EDG0208 GSM/GPRS Radio modem is a compact, wireless OEM module that utilizes the Global System for Mobile Communications (GSM), GPRS (General Packet Radio Services) and EDGE international communications standard to provide two-way wireless capabilities via GSM services. The Enfora Enabler EDG0208 module is a fully Type-approved GSM/GPRS/EDGE device, enabling application-specific, two-way communication and control. The Enfora Enabler EDG0208 module is available as a quad band version.

The Enfora Enabler EDG0208 module is designed to be a drop in replacement for the Enabler II E EDG0108 module. It's physical size, electrical specifications and physical connectors are identical to the EDG0108 for a seamless transition.

4.2 Key Features of the GSM/GPRS OEM Module

The following table summarizes the main features of the Enfora Enabler EDG0208 Radio Module.

Interface	Data input/output interface	60 position
	Primary serial port	V.24 protocol, 3 V levels
	Voice	Supports four vocoder modes: full-rate (FR), enhanced full-rate (EFR), half-rate (HR) and adaptive multi-rate (AMR)
	Antenna Interface	ultra Miniature Coaxial Interconnect
	Command protocol	GSM AT command set
	Subscriber Identification Module (SIM)	Optional mini-SIM carrier and interface on board
	Optional remote SIM	Accessible via the 60-pin connector
Power	Electrical power	3.3 to 4.5 Vdc
	Peak currents and average power dissipation	Refer to the Operating Power table in the Technical Specifications for peak currents and average power dissipation for various modes of operation.
Radio Features	Frequency bands	EGSM 900, DCS 1800, PCS 1900 and GSM 850 capability.
	GSM/GPRS/EGPRS features supported	Provides for all GSM/GPRS/EGPRS authentication, encryption, and frequency hopping algorithms. GPRS Coding Schemes CS1-CS4 supported. Multi-Slot Class 10 (4RX/2TX, Max 5 Slots). EGPRS Coding Schemes MCS1-MCS9 supported. Multi-Slot Class 10 (4RX/2TX, Max 5 Slots)
Regulatory	Agency approvals	<ul style="list-style-type: none"> • GCF Type Approval (Version 3.17.0) • PTCRB Type Approval (NAPRD 3.2.1) • FCC Certification • R&TTE • CE (European Community Certification) • IC (Industry Canada) Approval
GSM/GPRS/EGPRS Functionality		<ul style="list-style-type: none"> • Mobile-originated and mobile-terminated SMS messages: up to 140 bytes or up to 160 GSM 7-bit ASCII characters. • Reception of Cell Broadcast Message • SMS Receipt acknowledgement • Circuit Switched Data (Transparent & Non-transparent up to 9.6 Kbps) • Voice (EFR, FR, HR, AMR) • Supports Unstructured Supplementary Service Data (USSD) • Multi-Slot Class 10 Supported (4Rx/2TX), (5 Slot Max) • PBCCH/PCCCH Supported • EGPRS Release 99
SIM		1.8 & 3 V Mini-Subscriber Identity Module (SIM) compatible

Table 1 - Enabler EDG0208 Key Features

4.3 Providing Multi-Band Operation

The Enfora Enabler EDG0208 module provides by default the appropriate multi-band operation, it is also possible to select the operating frequency by AT Command. There are two modes of multi-band environment available:

- The GSMS850 / PCS1900 bands are available for use in North America and places where these bands have been provisioned.
- The GSM900 / DCS1800 MHz bands are available for use in Europe and the rest of the world.

4.4 Wireless Data Application Possibilities

A variety of applications can use the Enfora Enabler EDG0208 module for transmitting and receiving data and voice, such as:

- Automated Meter Reading (AMR)
- Point of Sale Applications
- E-mail and Internet access
- Automated Vehicle Location (AVL)
- Telematics
- Telemetry
- Wireless Security
 - Smart Phones
 - Telemedicine

4.5 General design guidelines for utilizing Enfora GSM modules

The following guidelines are provided in an effort to allow Enabler IIE module users to successfully implement their PCB layout to obtain the best performance. This includes the lowest possible EMI emissions, maximum thermal conduction, mechanical integrity, and voice quality. The Enabler IIE module is a very compact, high performance design, yet it is easy to interface into the final product. In order to realize its full potential, designers should pay close attention to ground structures, the routing of RF and Digital traces, and the size of the power supply lines.



These design tips are strictly guidelines and are not meant to be a complete list of items that guarantee actual performance. Each application is different and may require variation from these guidelines, however, care should be given to utilize these sound engineering principles whenever possible.

4.6 Advanced tips for an RF friendly layout

Ground Plane

To ensure the lowest possible EMI emissions and maximum thermal conductivity, it is recommended that all metal tabs on the GSM module shield must be soldered down onto a continuous ground plane that runs under the entire module. Ample ground vias should be provided around the metal tabs to create a low impedance ground. It is recommended to minimize the number of I/O and power traces and vias under the GSM module to allow for as much ground plane as possible. If the integrated unit includes more than one board, the design must guarantee a good RF ground connection between the boards in order to make sure the ground planes are at the same RF potential. An example of a good ground structure and pad layout is shown below in Figure 1.

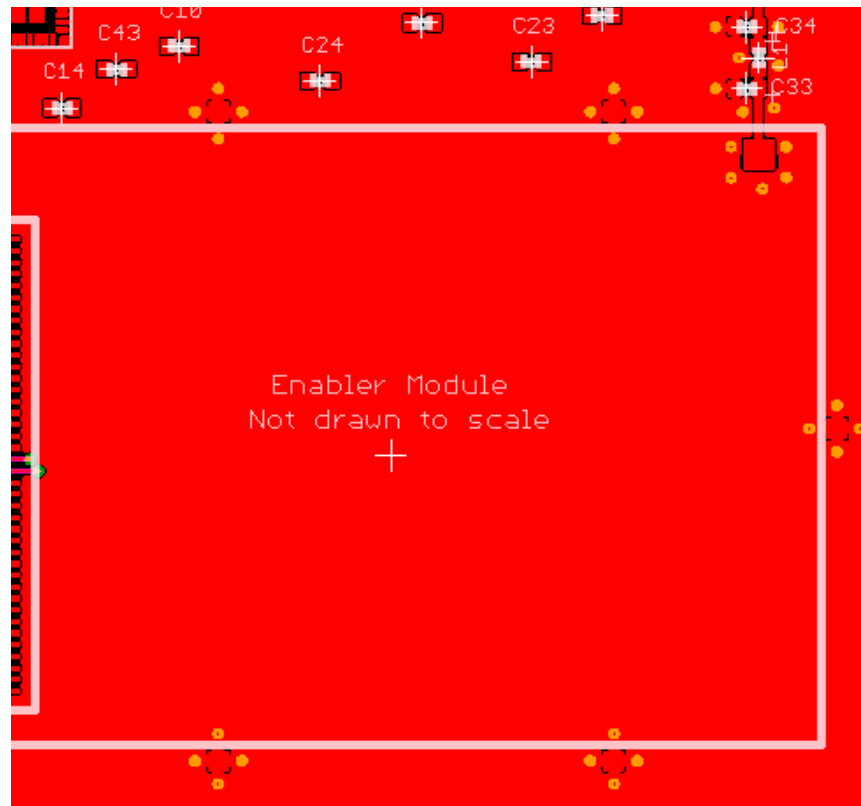


Figure 1 - Example of good ground plane for GSM modules

Thermal Relief

Because the ground plane acts as a large heat sink, it can affect the solderability of components. A common method to reduce this effect is to use thermal relief around the pad in question. However, great care must be taken when using thermal relief for high current or high frequency applications

For example, a large thermal relief like the one shown in Figure 2 can serve the purpose for general applications such as low current, low speed data lines, DC connections and audio frequency applications. Such thermal relief structures should be avoided for applications where high current and/or high frequency is involved, such as those using the Enabler Module. Depending on the frequency of operation, the long narrow thermal relief traces between the pad and the ground plane act like an RF choke. These RF chokes become higher impedance at harmonics of the fundamental frequency making it problematic for high frequency suppression. This can make it difficult to pass type approval testing.

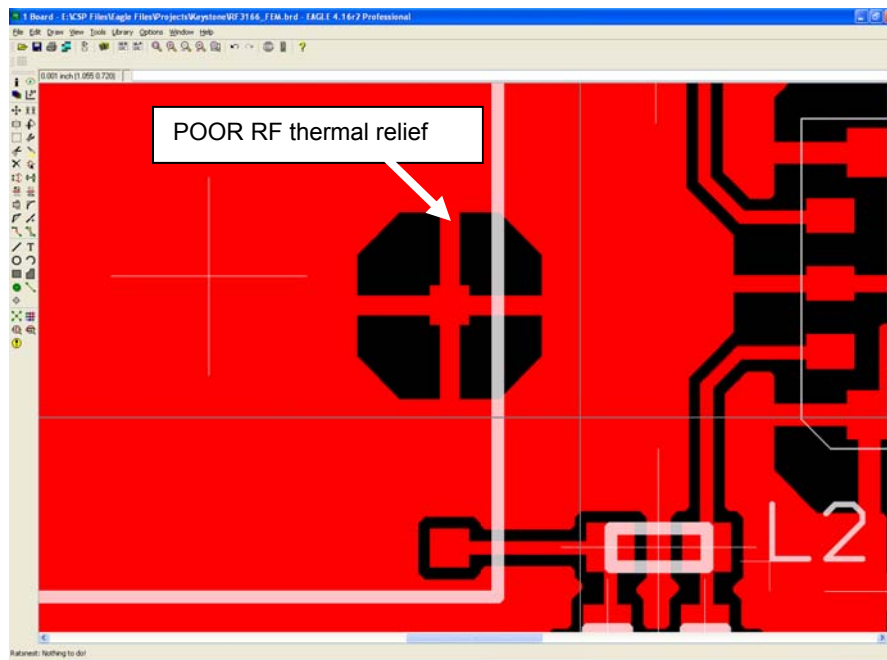


Figure 2 - Example of a POOR RF Thermal Relief

If thermal relief is necessary, it is recommended that you use short, fat traces similar to those shown in Figure 3. This will still provide a solderable connection, while providing a better RF connection. Making them shorter also allows for a more continuous ground plane due to less copper being removed from the area. It is also recommended to have ground vias around all thermal relief of critical ground pins such as the five Enabler shield tabs.

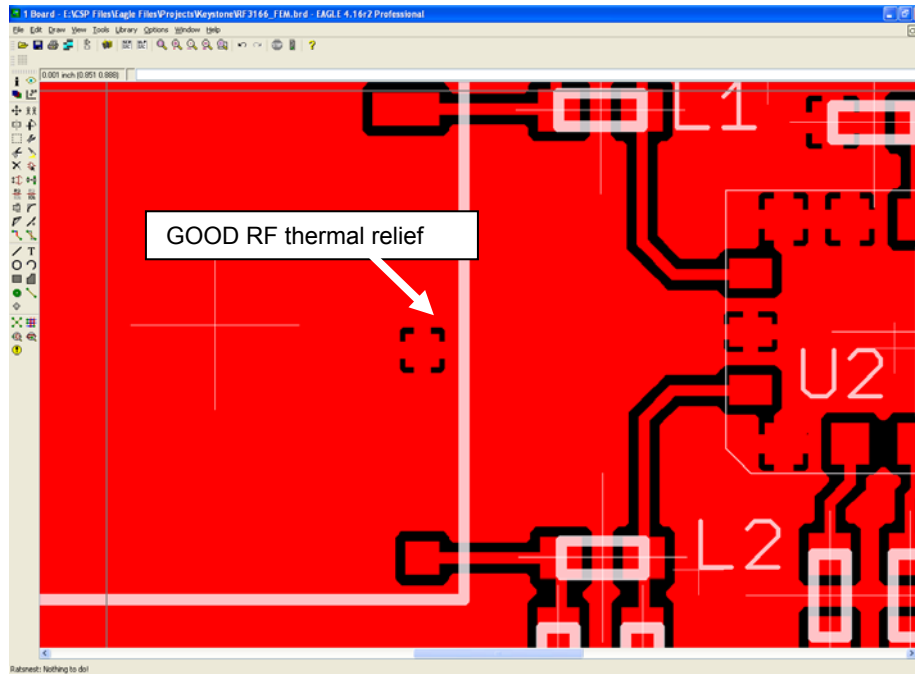


Figure 3 - Example of a GOOD RF Thermal Relief

Antenna and RF Signal Trace

The PCB trace that feeds the RF output port must be designed for a 50 ohm characteristic impedance, coplanar, or routed into internal layers to keep the top layer continuous around and underneath the Enabler module. Ample ground vias should be provided around the RF contacts, the RF trace and launch pad. If possible, keep I/O and power traces away from the RF port. This includes traces running parallel or orthogonal to it. Thermal relief should not be used on the antenna output port ground pads. The designer must pay close attention to the size of the pad and thickness of the dielectric beneath the signal pad and trace. Most PCB manufacturers can adjust the trace width to maintain 50 ohms impedance if the traces are identified and instructions are included on the FAB drawing. This service is typically provided at no or minimal additional cost.

For minimum RF emissions due to the fundamental frequency of operation, the Enabler module works best with an antenna load that has a VSWR of 1.5:1 or better. The antenna should not have gain at the harmonic frequencies, otherwise, the conducted harmonics could get amplified to a point where the product no longer passes type approval. However, for applications where antenna quality is less than ideal, it is recommended to have a low pass filter (Pi structure with N=3) in the RF path to the antenna. This is a secondary plan should there be a need to lower harmonic levels at frequencies above the PCS band. The pad structure may also be used to match the antenna load impedance, if required. If it is not needed, a capacitor of low reactance may be used to bridge the Pi structure.

The RF cable going between the Enable module and the antenna is very lossy, therefore, the length of this cable should be kept as short as possible.

If multiple antennas are used in their design, care should be taken during placement selection to minimize the coupling between the GSM antenna and the other antennas.

Vbat Input

The Enabler Vbat input can have a relative high current draw that can fluctuate rapidly, especially when transmitting at max power and burst mode. The Vbat interface must be designed to provide the required instantaneous voltage and current with minimal voltage droop. This includes both sufficient bulk decoupling capacitance as well as adequate layout provisions.

When laying out the connections to the Enabler interface connector, it is tempting to use traces of the same width as the connector pins. However, this is a very compact connector and traces of that width will not have sufficient copper. Similar to the discussion on thermal relief, the use of narrow traces to connect the Vbat pins to the source voltage can act like a high impedance and cause a significant voltage droop when higher currents are required as shown in Figure 4.

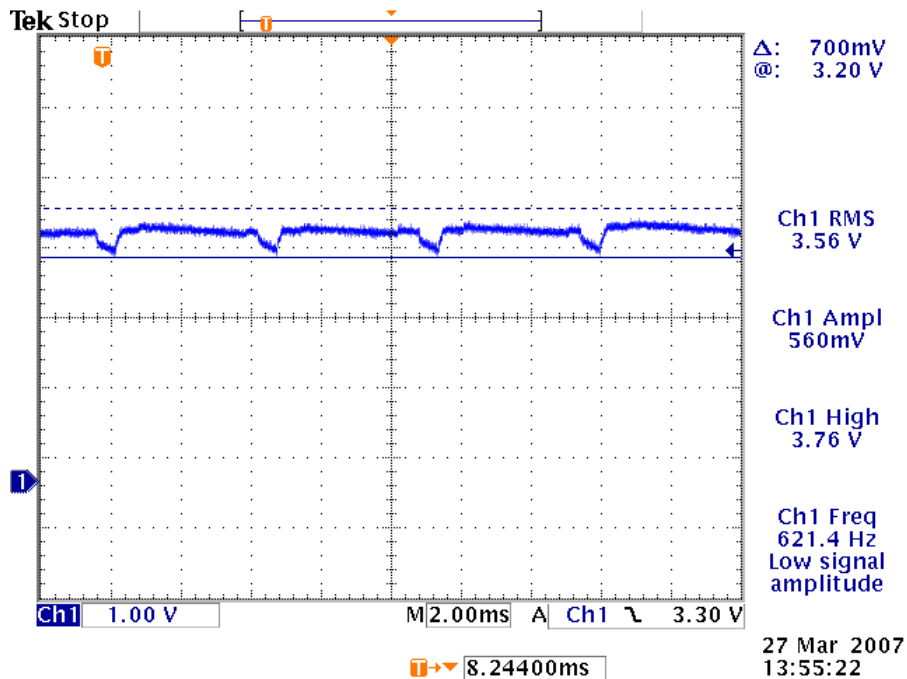


Figure 4 - Example of Vbat Voltage Droop

If the Vbat drops too low, the Enabler modules will reset. To minimize the trace loss, it is suggested to use a larger trace that spans several pins as shown in Figure 5. Any concern about solderability can be mitigated by using solder mask with cutouts for the individual pins as shown by the blue lines in the figure. The layout should provide sufficient trace width over the entire trace from the Enable modules all the way to the source of the Vbat voltage. Any transitions between layers for this trace should utilize multiple vias.

Since even the best layout will have some impedance from the source to the Enabler module, sufficient bulk decoupling capacitance is required at the Vbat input to the Enabler module. It is suggested to use at least two 1000 uF, low ESR, tantalum capacitors located very close to the Enabler interface connector Vbat pins. Any thermal relief used on these capacitors should comply with the information given above in order to provide the lowest impedance possible. The grounding of these capacitors is critical. Therefore, it should be a low impedance and should utilize multiple vias to the internal ground plane close to the capacitor as well.

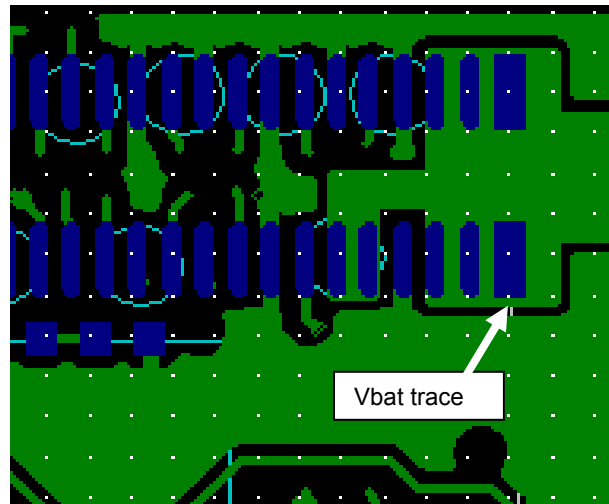
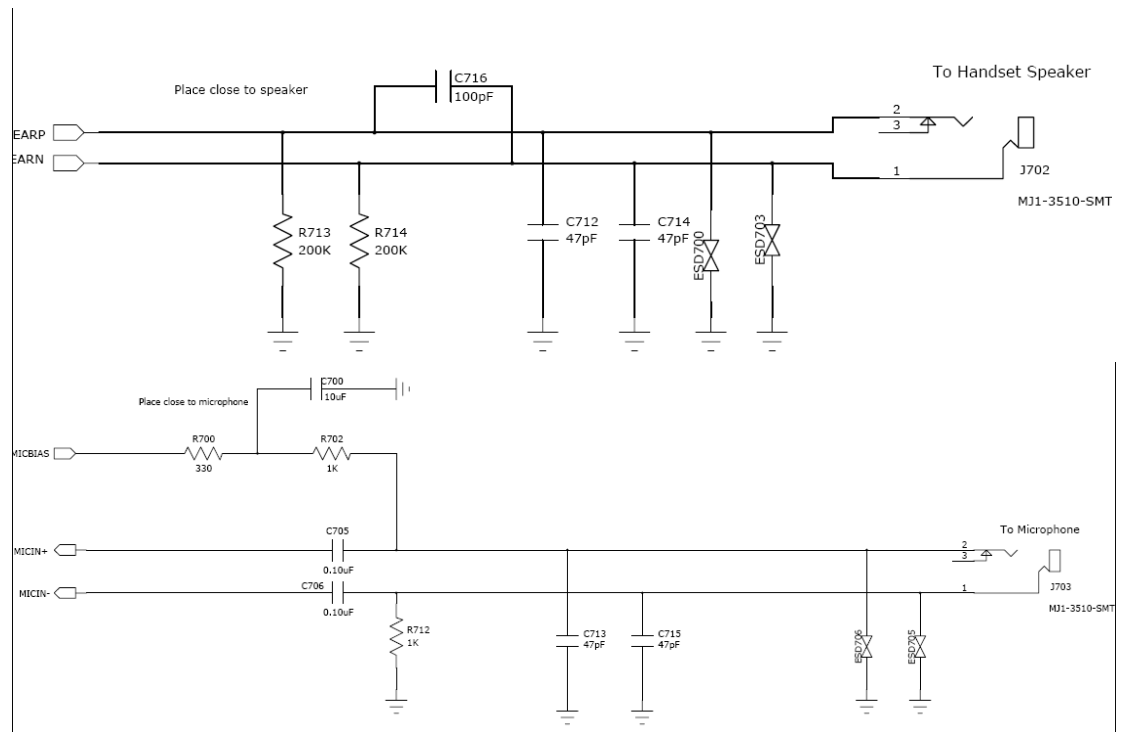


Figure 5 - Example of GOOD Vbat layout

4.7 Audio Reference Design

The audio quality is very dependent on the circuit design and layout. As an aid to obtaining good audio quality, a reference design has been included below. It has been proven to provide good performance on the SDK module.

Audio Schematics



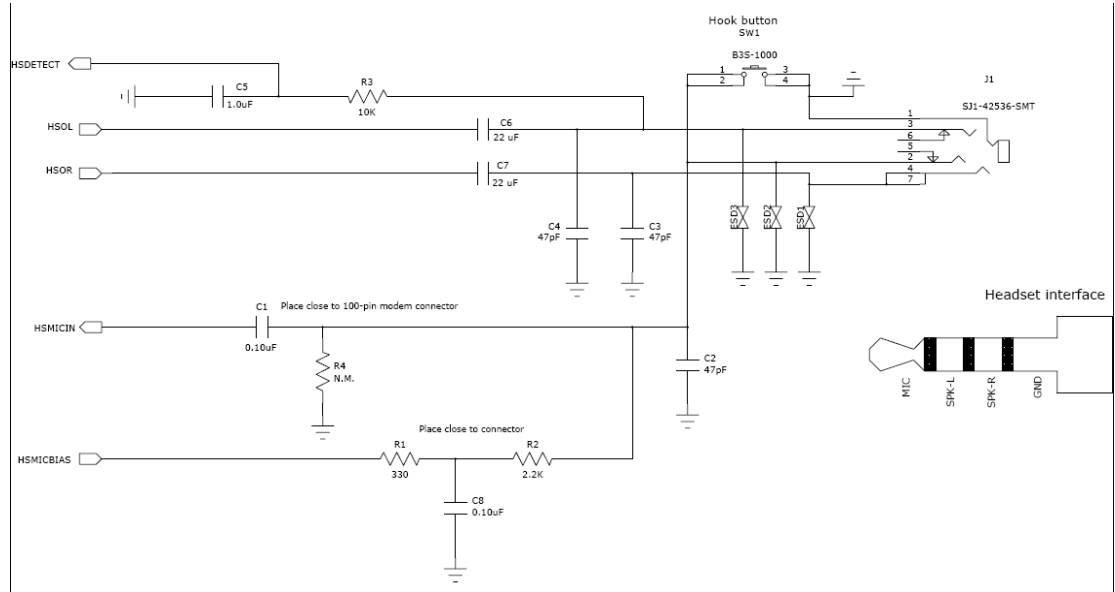


Figure 6 - Audio Reference Design Schematic

Audio Layout

Layout plots for the audio section of the SDK are available upon request.

5.0 Technical Specifications

5.1 Enabler EDG0208 Module Block Diagram

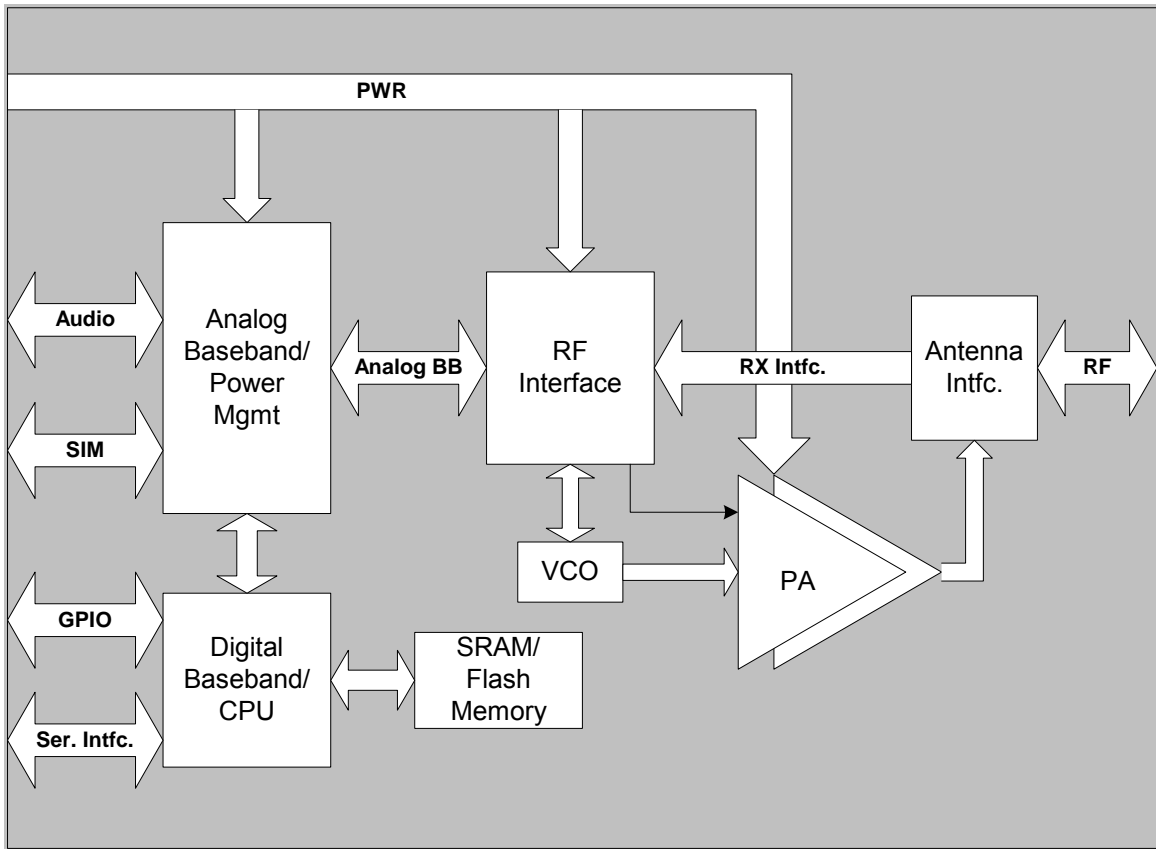


Figure 7 Enabler EDG0208 Module Block Diagram

5.2 Detailed Product Specifications

Physical Dimensions and Weight	
Size (L x W x H)	46.3 mm x 30.2 mm x 3.1 mm
Weight	8.2 grams.
Climatic: Operational	
Operating temperature	-20°C to +60°C
Relative humidity	5 - 95%
Solar radiation	Not Applicable
Air pressure (altitude)	70 kPa to 106 kPa (-400 m to 3000 m)
Climatic: Storage and Transportation	
Duration	24 months
Ambient temperature	-40C to +85C
Relative humidity	5% to 95%, non condensing (at 40C)
Thermal shock	-50C to +23C, +70C to +23C; < 5 min
Altitude	-400 m to 15,000 m
Mechanical: Operational	
Operational vibration, sinusoidal	3.0 mm disp, 2 to 9 Hz; 1 m/s ² , 9 to 350 Hz
Operational vibration, random	0.1 m ² /s ³ , 2 to 200 Hz
Mechanical: Storage and Transportation	
Transportation vibration, packaged	ASTM D999
Drop, packaged	ASTM D775 method A, 10 drops
Shock, un-packaged	150 m/s ² , 11 ms, half-sine per IEC 68-2-27
Drop, un-packaged	4-inch drop per Bellcore GR-63-CORE
Mechanical: Proposed Standards	
Transportation	ETSI Standard ETS 300 019-1-2 Class 2.3 Transportation
Operational	ETSI Standard ETS 300 019-1-3 Class 3.1 Operational
Storage	ETSI Standard ETS 300 019-1-1 Class 1.2 Storage

Electromagnetic Emissions	
Radiated spurious	FCC Part 24 / Part 15 Class \ B TS 51.010-1 Section 12.2 EN 55022 Class B

Electromagnetic Immunity (per ETSI ETS 300 342-1)	
Radio Frequency (RF) Electromagnetic Field	3 V/m 800 – 1000 MHz; 1 kHz 80% EN 61000-4-3
Electrostatic discharge (ESD)	Contact discharge to coupling planes: ± 2 kV, ± 4 kV Air discharge to coupling planes: ± 2 kV, ± 4 kV, ± 8 kV
RF common mode	3 V rms (Level 2) 150 kHz – 80 MHz EN 61000-4-6

5.3 Operating Power

5.3.1 GSM Operating Power

GSM Operation		Input Current			
Band	Mode	Low	Nom/Avg	High/Peak	Units
1900	1 RX/1 TX, Full Power		350	1086	mA
1800			361	1118	mA
900			407	1410	mA
850			428	1540	mA
ALL	Idle (lowest dynamic value; not an average that includes paging, which varies by network)			<5	mA
N/A	Shutdown		~ 10		uA

5.3.2 GPRS Operating Power

GPRS Operation		Input Current			
Band	Mode	Low	Nom/Avg	High/Peak	Units
1900	4 RX/1TX, Full Power		383	1070	mA
	2 RX/2TX, Full Power		485	1230	mA
	1 RX/1TX, Full Power		335	1066	mA
1800	4 RX/1TX, Full Power		391	1094	mA
	2 RX/2TX, Full Power		487	1270	mA
	1 RX/1TX, Full Power		338	1086	mA
900	4 RX/1TX, Full Power		436	1390	mA
	2 RX/2TX, Full Power		575	1610	mA
	1 RX/1TX, Full Power		386	1370	mA
850	4 RX/1TX, Full Power		462	1540	mA
	2 RX/2TX, Full Power		621	1790	mA
	1 RX/1TX, Full Power		406	1540	mA
ALL	Idle (lowest dynamic value; not an average that includes paging, which varies by network)			<5	mA
N/A	Shutdown		~ 10		uA

5.3.3 EGPRS Operating Power

EGPRS Operation		Input Current			
Band	Mode	Low	Nom/Avg	High/Peak	Units
1900	3 RX/1TX, Full Power		398	1038	mA
	2 RX/2TX, Full Power		483	1078	mA
	1 RX/1TX, Full Power		357	938	mA
1800	3 RX/1TX, Full Power		413	1078	mA
	2 RX/2TX, Full Power		513	1210	mA
	1 RX/1TX, Full Power		372	1034	mA
900	3 RX/1TX, Full Power		432	1220	mA
	2 RX/2TX, Full Power		564	1370	mA
	1 RX/1TX, Full Power		395	1170	mA
850	3 RX/1TX, Full Power		440	1260	mA
	2 RX/2TX, Full Power		567	1410	mA
	1 RX/1TX, Full Power		395	1200	mA
ALL	Idle (lowest dynamic value; not an average that includes paging, which varies by network)			<5	mA
N/A	Shutdown		~ 10		uA

5.3.4 Transmit Power

Transmit Power Class

Band	GSM Power Class	EGPRS
1900	Class 1 (1 W) (30 dBm ± 2 dB @ antenna connection)	Class E2 (0.4W) (26 dBm ± 3 dB @ antenna connection)
1800	Class 1 (1 W) (30 dBm ± 2 dB @ antenna connection)	Class E2 (0.4W) (26 dBm ± 3 dB @ antenna connection)
900	Class 4 (2W) (33 dBm ± 2 dB @ antenna connection)	Class E2 (0.5W) (27 dBm ± 3 dB @ antenna connection)
850	Class 4 (2W) (33 dBm ± 2 dB @ antenna connection)	Class E2 (0.5W) (27 dBm ± 3 dB @ antenna connection)

5.3.5 Receiver Sensitivity

The EDG0208 modem conforms to all of the GSM 3GPP requirements as verified according to 3GPP TS 51.010-1. The sensitivity is at 25 °C - TCH/FS Class II (RBER) Static Conditions.

Band	Sensitivity	Mode
1900 MHz	-105 dBm	
1800 MHz	-105 dBm	
900 MHz	-105 dBm	
850 MHz	-105 dBm	

6.0 Mechanical

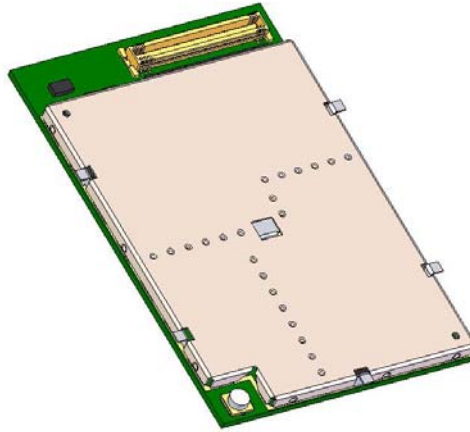


Figure 8 – Front of EDG0208-00 & -01

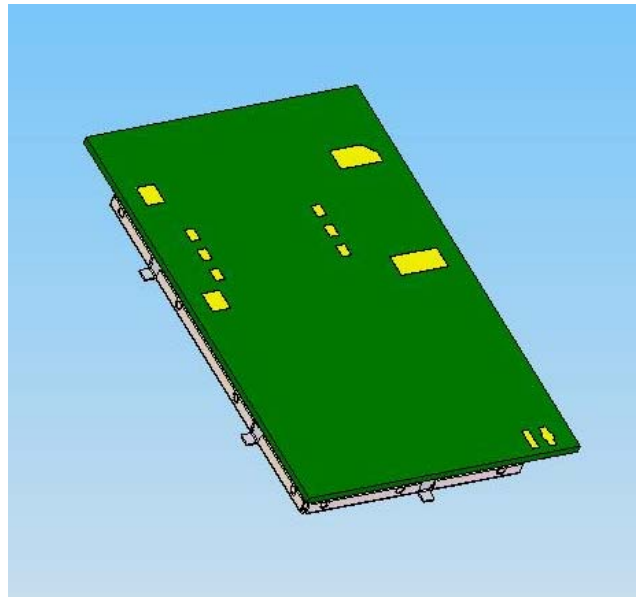


Figure 9 – Back of EDG0208-00

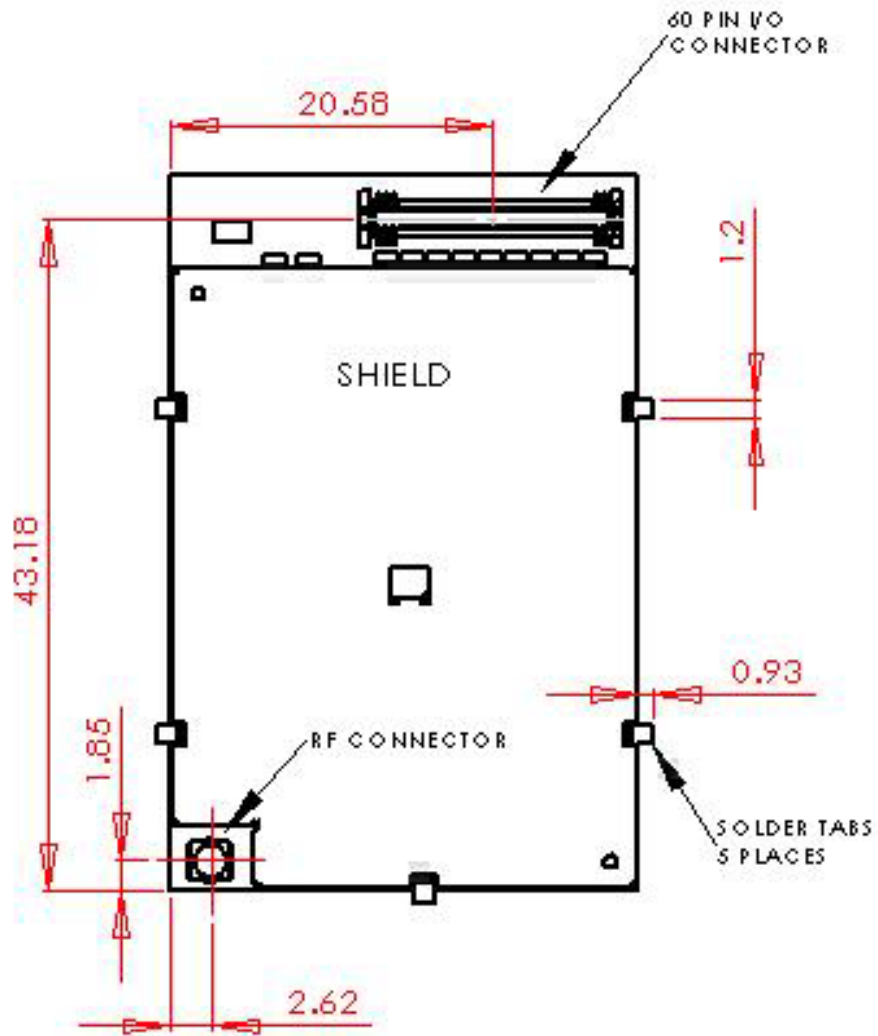


Figure 10 - I/O, RF Connector, & Mounting Tabs

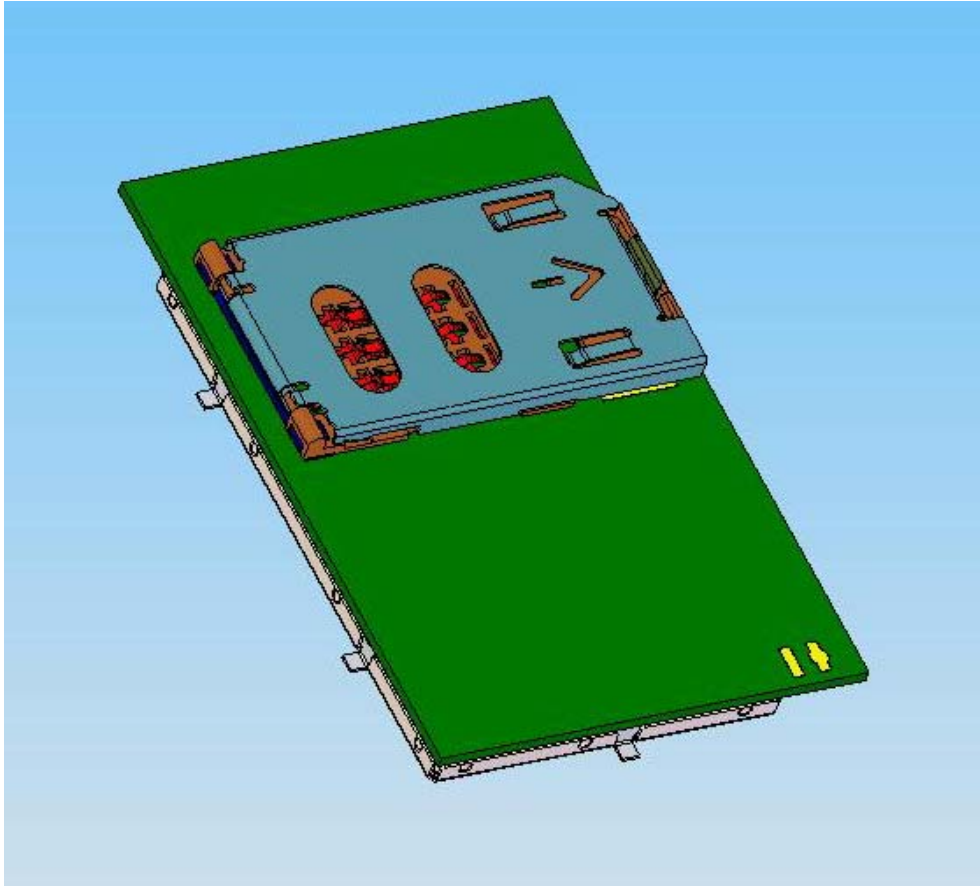


Figure 11 – Back of EDG0208-01

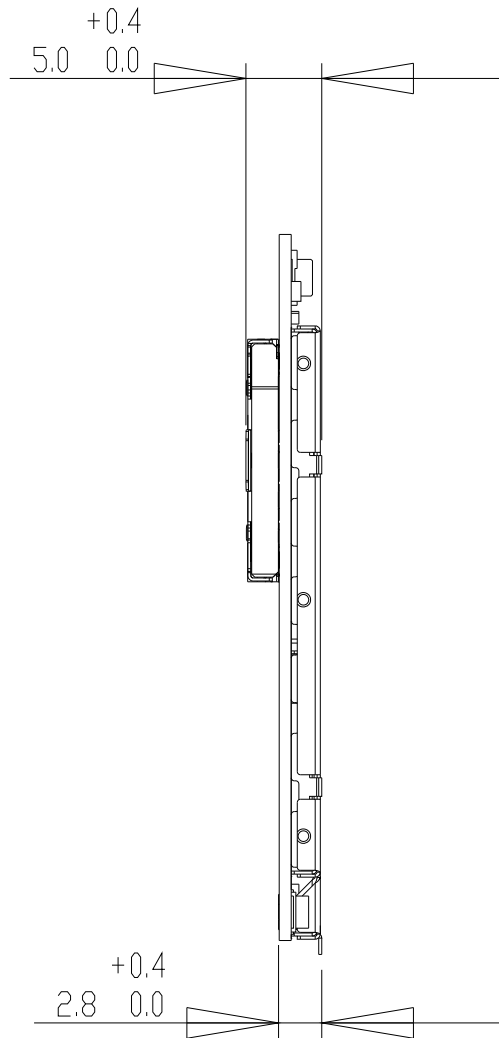


Figure 12 - EDG0208-01 Side View (mm)

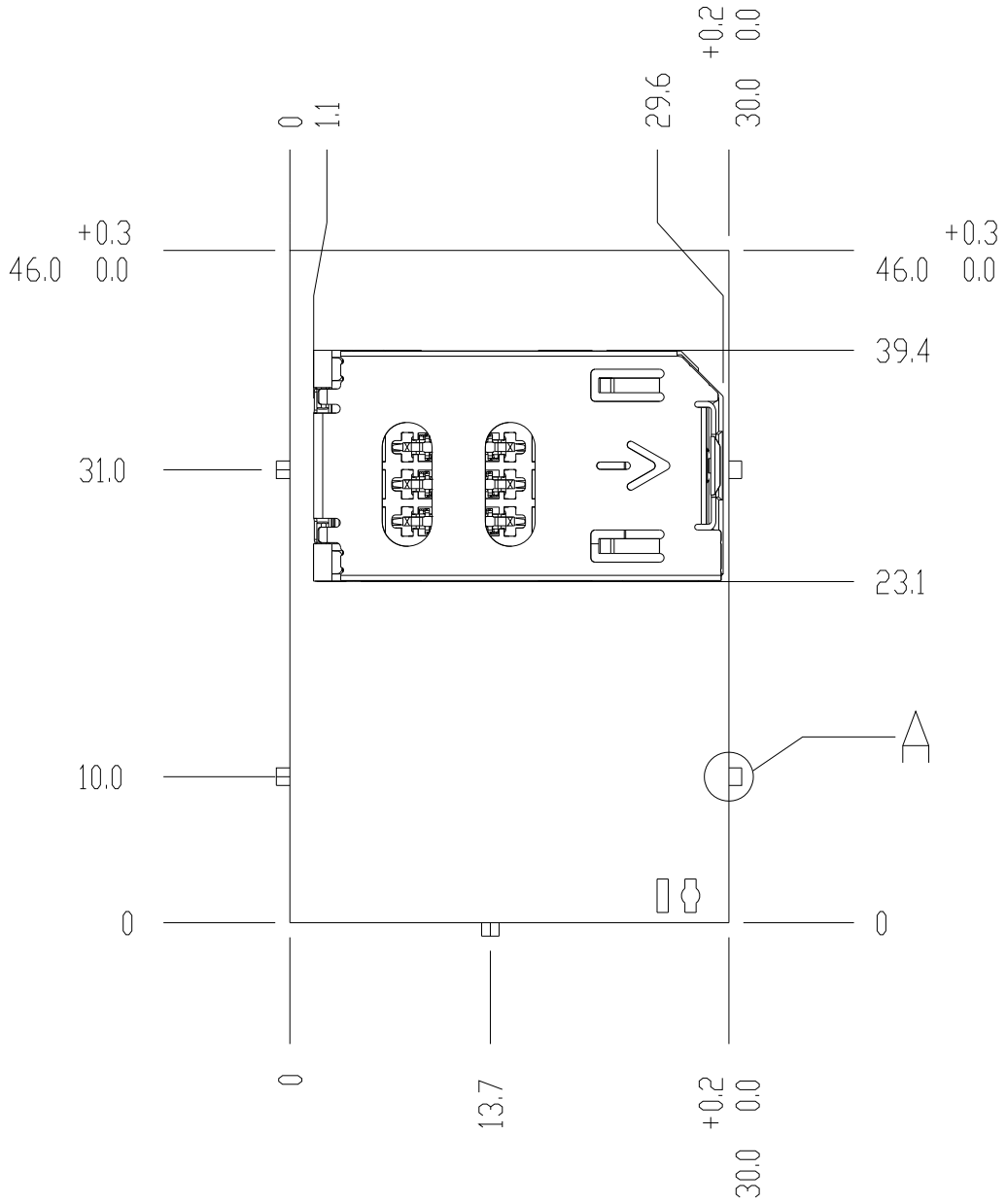


Figure 13 - Back of EDG0208-01

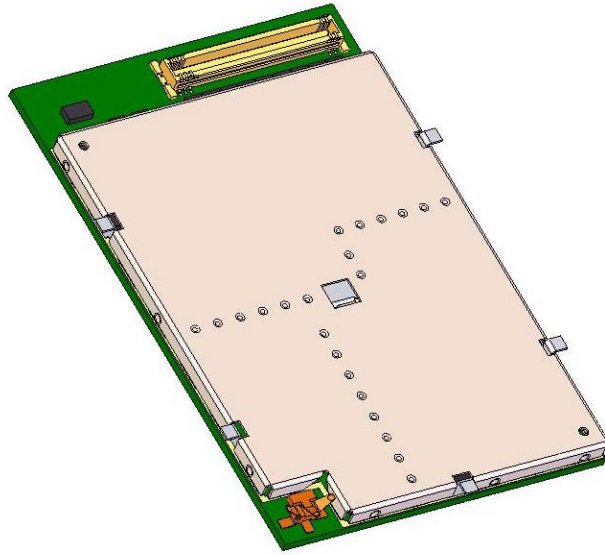


Figure 14 – Front of EDG0208-02

6.1 Enabler II-E Mounting to Host Board (Reference)

The Enabler II-E provides mounting tabs that can be soldered to a PCB. These tabs provide circuit grounding for the module and their use is recommended.

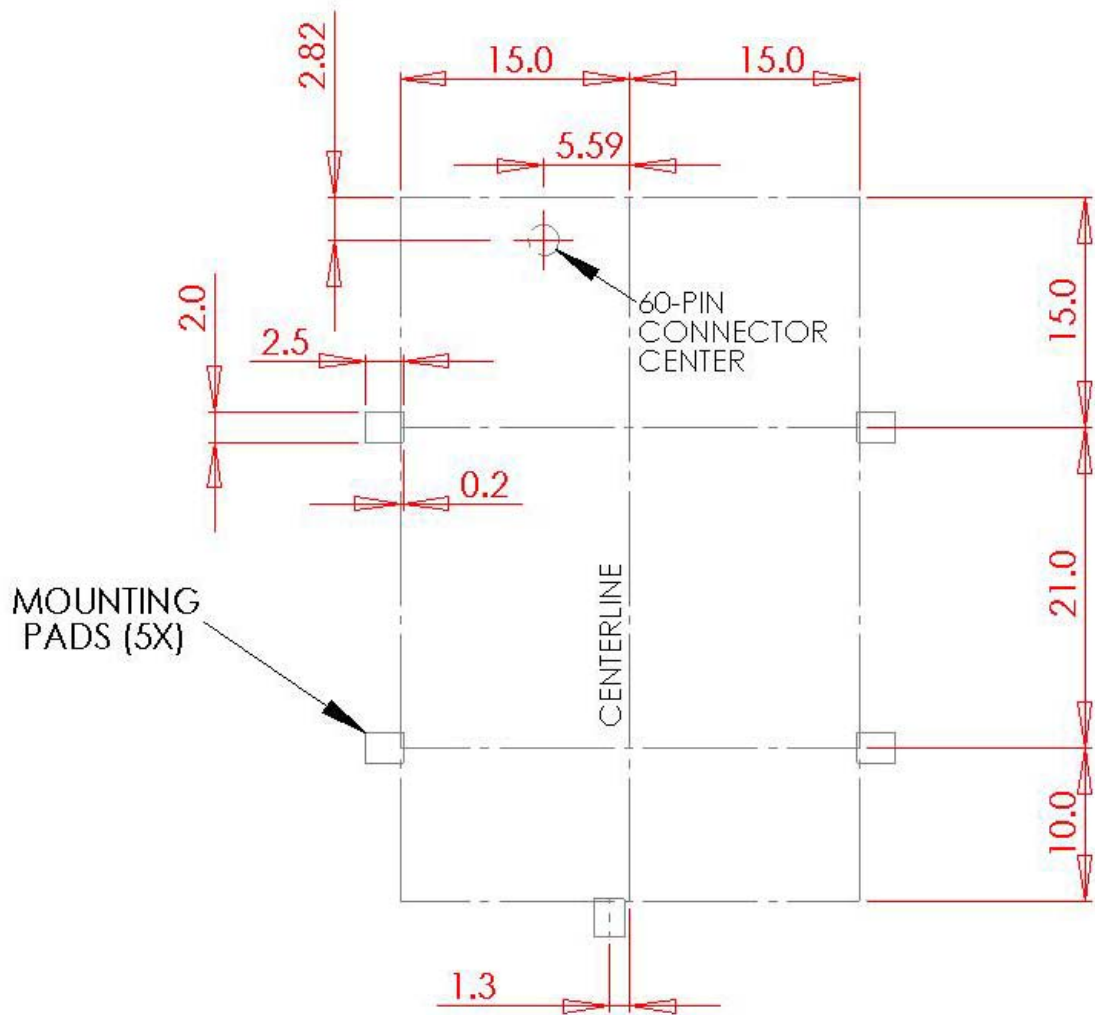


Figure 15 – Enabler II-E Mounting

6.2 I/O Connector

60-Pin I/O Connector, SMT, Dual Row, 0.5 mm (.020") Pitch

The 60-pin connector on the modem is a Molex 53729-0608.
The 60-pin connector required on the host board is a Molex 52974-0604 (or -0608).
The mated height of the two connectors is 2.00 mm.

6.3 RF Connection

-00 & -01

A custom antenna can be attached via the on-board connector or soldered directly to the modem.

Antenna Solder Pads

The antenna direct connect solder pad is 1.02 mm wide x 2.54 mm high and the antenna ground pads are 2.03 mm wide x 2.54 mm high.

RF Connector

The Module utilizes an ultra Miniature Coaxial Interconnect from Sunridge (MCB-ST-00T) as the on-board antenna connector. A compatible mating connector is the Sunridge MCB2-xx-xx-xxx-x series component. The cable assembly is made to order. Maximum stack height of cable connector and PCB connector is 2.0 mm.

6.4 I/O Signal Connector on the Enfora Enabler EDG0208 Module

The Enfora Enabler EDG0208 module communicates with the carrier board of the application via the 60-pin I/O signal connector. The following table describes the pin assignments for the connector, sorted by pin number.

6.4.1 I/O Connector Pin Assignments

The following table shows the pin assignments for the input/output connector.

PIN #	FUNCTION	Serial Pin	I/O	Description	Description/Comments
1	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
2	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
3	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
4	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
5	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
6	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
7	Ground		R	GND	Power return for digital and analog grounds.
8	Ground		R	GND	Power return for digital and analog grounds.
9	Handset Speaker (-)		O	INTERNAL_SPK(-)	Handset speaker output (negative).
10	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
11	Ground		R	GND	Power return for digital and analog grounds.
12	Power Input		P	Batt/Vcc	Power input to Enabler EDG0208 module.
13	Handset Speaker (+)		O	INTERNAL_SPK(+)	Handset speaker output (positive).
14	GPIO-1		I/O	GPIO-1	General-purpose Input/Output.
15	Ground		R	GND	Power return for digital and analog grounds.
16	Ground		R	GND	Power return for digital and analog grounds.
17	Microphone Bias		O	VMIC	Microphone Bias.
18	GPIO-5		I/O	GPIO-5	General-purpose Input/Output.
19	Ground		R	GND	Power return for digital and analog grounds.
20	Reserved				Reserved for future use.
21	Handset Microphone (-)		I	INT_MIC(-)	Handset microphone input (negative).
22	Reset		I	RESET	Module Reset
23	Ground		R	GND	Power return for digital and analog grounds.
24	Power Control Signal		I	PWR_CTL_SIGNAL	Power Control Signal.
25	Handset Microphone (+)		I	INT_MIC(+)	Handset microphone input (positive).
26	Reserved				Reserved for future use.
27	GPIO-3		I/O	GPIO-3	General-purpose Input/Output.
28	GPIO-2		I/O	GPIO-2	General-purpose Input/Output.
29	Reserved				Reserved for future use.
30	GPIO-4		I/O	GPIO-4	General Purpose Input-Output
31	Reserved				Reserved for future use.
32	GPIO-6		I/O	GPIO-6	General Purpose Input-Output
33	Ground		R	GND	Power return for digital and analog grounds.
34	GPIO-7		I/O	GPIO-7	General Purpose Input-Output
35	Reserved				Reserved for future use
36	Reserved				Reserved for future use.
37	TX Active		O	TX Active	
38	Stereo Headset - (+) Left		O	HEADSET_SPK (Left) (+)	Stereo Headset Earphone – Left (positive)
39	GPIO-8		I/O	GPIO-8	General Purpose Input-Output
40	Reserved				Reserved for future use.
41	Ground	5	R	GND	Power return for digital and analog grounds.
42	Headset Microphone (+)		I	HEADSET_MIC(+)	Headset Microphone (positive).
43	Serial Receive Data	2	O	RXD_RADIO	Serial Data to Host.
44	Ground		R	GND	Power return for digital and analog grounds.
45	Data Set Ready	6	O	DSR_RADIO	DSR Signal to Host.
46	A to D Input		I	ADC2	Analog-to-Digital Converter Input 2.
47	Data Carrier Detect	1	O	DCD	DCD Signal to Host.

PIN #	FUNCTION	Serial Pin	I/O	Description	Description/Comments
48	SIM Clock		O	SIM_CLK	SIM Clock.
49	Ring Indicator	9	O	RI	RING Indicator.

50	Ground		R	GND	Power return for digital and analog grounds.
51	Serial Transmit Data	3	I	TXD_RADIO	Serial Data from Host.
52	SIM Data I/O		I/O	SIM_IO	SIM I/O Data.
53	Request To Send	7	I	RTS_RADIO	RTS Signal from Host.
54	SIM Reset		O	SIM_RST	SIM Reset.
55	Clear To Send	8	O	CTS_RADIO	CTS Signal to Host.
56	A to D Input		I	ADC1	Analog-to-Digital Converter Input 1.
57	Data Terminal Ready	4	I	DTR_RADIO	Data Terminal Ready Signal from Host.
58	SIM Power		O	SIM_VCC	SIM Power.
59	Ground		R	GND	Power return for digital and analog grounds.
60	Ground		R	GND	Power return for digital and analog grounds.

Table 2 - Enabler EDG0208 Pin Assignments

I=Input into Enabler; O=Output from Enabler; P=Power Input to Enabler; R=Power Return from Enabler;
I/O=Input/Output into/from Enabler

 Reserved for future use

 NO CONNECT if on-board SIM holder is used

6.5 Circuit Protection

Other than the basic low level ESD protection within the module's integrated circuits (typically 2000 V), the Enabler EDG0208 does not have any protection against ESD events or other excursions that exceed the specified operating parameters.

The only exception is that the remote SIM lines on the main I/O connector do have additional ESD protection that should handle standard human-model contact ESD events.

Generally, ESD protection (typically TVS/Transzorb devices) should be added to all signals that leave the host board. This includes V_{BAT}/V_{CC} .

Series resistors (typically 47 Ω) can also be added in series with data lines to limit the peak current during a voltage excursion.



Caution – It is the Integrator's responsibility to protect the Enabler EDG0208 from electrical disturbances and excursions that exceed the specified operating parameters.

6.6 Antenna

The Enabler EDG0208 utilizes an ultra Miniature Coaxial Interconnect from Sunridge (MCB-ST-00T) as the on-board antenna connector. A compatible mating connector is the Sunridge MCB2-xx-xx-xxx-x series component. The cable assembly is made to order. Maximum stack height of cable connector and PCB connector is 2.0 mm.

6.7 Control Connector Signal Descriptions and Functions

6.7.1 Input Power

The Enfora Enabler EDG0208 module uses a single voltage source of VCC=+3.3V to 4.5V. (exact values of the uplink currents are shown in Tables 5.3.1 GSM Operating Power and 0

GSM Operation		Input Current			
Band	Mode	Low	Nom/Avg	High/Peak	Units
1900	1 RX/1 TX, Full Power		350	1086	mA
1800			361	1118	mA
900			407	1410	mA
850			428	1540	mA
ALL	Idle (lowest dynamic value; not an average that includes paging, which varies by network)			<5	mA
N/A	Shutdown		~ 10		uA

GPRS Operating Power). The V_{CC} lines (pins 1 to 6) should be connected on the application board.

The uplink burst will cause strong ripple on the voltage lines and should be effectively filtered. It is recommended that 1000 to 2500 μ F of capacitance be placed as close to the modem I/O connector as possible.



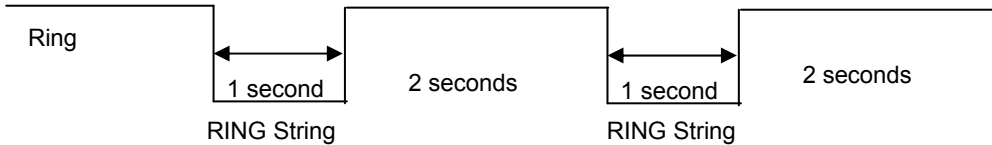
It should be noted that the input voltage level should not drop below the minimum voltage rating under any circumstances, especially during the uplink burst period.

6.7.2 Ring Indicate

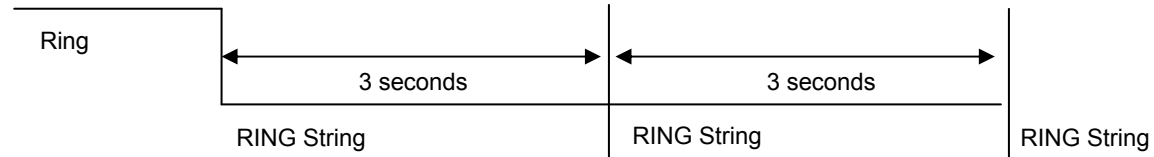
The Enabler EDG0208 module is capable of using the Ring line to discern the type of incoming call. The indicator can be monitored via a hardware line available on the 60 pin I/O signal connector. The Ring Indicator pin is #49.

The function of the Ring line depends on the type of the call received.

When the module is receiving a *voice call*, the Ring line goes low for 1 second and high for another 2 seconds. Every 3 seconds the ring string is generated and sent over the Receive (Data Out) (Rx) line. If there is a call in progress and call waiting is activated for a connected handset or hands free device, the Ring pin switches to ground in order to generate acoustic signals that indicate the waiting call.



When a *data call* is received, Ring goes low and will remain low. Every 3 seconds a ring string is generated and sent over the Receive (Data Out) (Rx) line.



An incoming SMS can be indicated by an Unsolicited Result Code (URC) causing the Ring line to go low for 1 second only. Using the AT+CNMI command, the Enabler EDG0208 can be configured to send or not to send URCs upon the receipt of SMS. See Enfora **Enabler-III AT Command Set Reference - EDG0208AT001**.

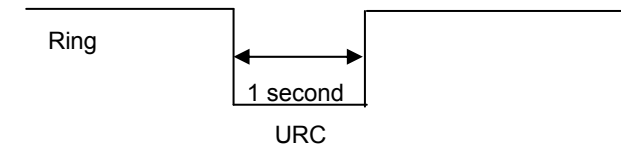


Figure 16 Ring Indicate Timing

6.7.3 Radio Power/Reset (Pin 22)

A pulse on this Active-High input resets/restarts the module. This input has a “weak pull-down” resistor internal to the module and can be left open-circuit or grounded if it is not going to be used. To initiate a reset, provide a high-pulse of at least 50 ms duration.

Radio Power/Reset” should not be used as a routine start or wake-up function. “Module Reset” should only be attempted when the modem does not respond to a Power Control Signal command.

PARAMETER	PARAMETER / CONDITIONS	MIN	TYP	MAX	UNIT
V _{IL}	Input Voltage – Low or float	0		0.3 x V _{BAT}	Vdc
V _{IH}	Input Voltage – High	0.7 x V _{BAT}		V _{BAT}	Vdc
I _{PD}	Internal Pull-Down Resistor	-40		-2	μA
Pulse Duration	High Pulse Duration	50			mS

6.7.4 Using the Power Control Signal

The input is equivalent to the “phone ON-button”. This is a hardware-controlled pin on power-up. It must be grounded momentarily or continuously to start the modem. Subsequent signals to this pin (active high-to-low transition) will cycle power to the module. When the modem is OFF, a high-to-low pulse of > 100 mS will turn the modem ON. When the modem is ON, a high-to-low pulse of XXX mS will deregister from the network and turn the modem OFF. XXX is > 100 mS and can be configured via AT Command for pulses up to 10000 mS. This input has a “weak pull-up” resistor internal to the module. If this pin is not being controlled manually with the micro controller (or other device), the pin must be grounded.

PARAMETER	PARAMETER / CONDITIONS	MIN	TYP	MAX	UNIT
V _{IL}	Input Voltage – Low or float	0		0.3 x V _{BAT}	Vdc
V _{IH}	Input Voltage – High	0.7 x V _{BAT}		V _{BAT}	Vdc
I _{PU}	Internal Pull-Up Resistor	-20		-2	μA
ON Pulse Duration		100			mS
OFF Pulse Duration	Programmable	100		10000	mS

6.7.5 Serial Interface (9 Pin I/F) (See table in section 6.4.1 I/O Connector Pin Assignments)

The modem provides a standard 16550 UART serial interface to the host. The data interface operates at CMOS level.

PARAMETER	PARAMETER / CONDITIONS	MIN	TYP	MAX	UNIT
V _{IL}	Input Voltage – Low	0		0.8	Vdc
V _{IH}	Input Voltage – High	2.0			Vdc
V _{OL}	Output Voltage – Low			0.65	Vdc
V _{OH}	Output Voltage – High	2.4			Vdc
I _{OL} / I _{OH}	Rated Output Current			4	mA

The Enabler EDG0208 is designed to be used like a DCE device. RxData is the serial data from the modem to the host. TxData is the serial data from the host to the modem.

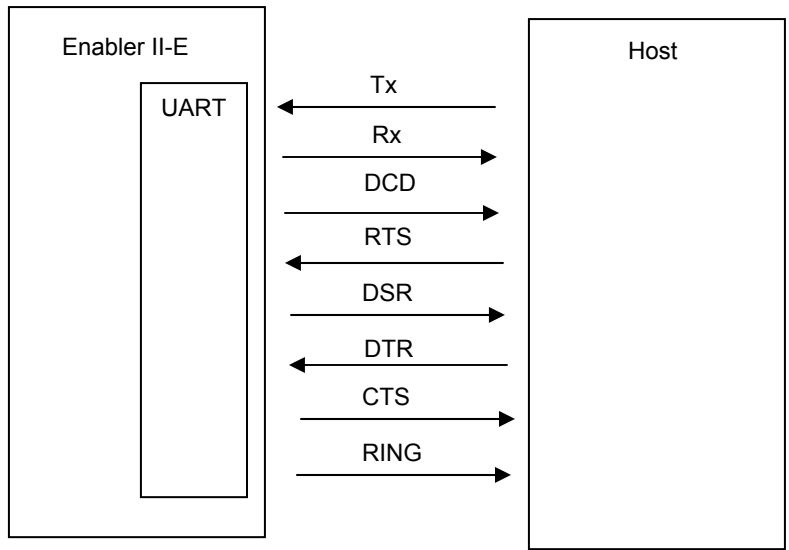


Figure 17 Enabler EDG0208 Serial Interface

This data may contain 7 or 8 data bits, 1 or 2 stop bits, even/odd/no parity bits. The baud rate may be adjusted to [9600](#), [14400](#), [28800](#), [38400](#), [57600](#), [115200](#), [230400](#), [460800](#).

Default settings are 8 data, 1 stop, no parity, and 115200 baud. DTR may be used to force the modem into AT command mode from online data mode (See AT Command Document, command AT&D). 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 a variety of incoming calls.

For a minimal implementation, connect RxData and TxData to the COM port serial data lines, connect DTR and RTS to GND.

6.7.6 Analog-To-Digital Input

Analog-To-Digital Input	Parameter/Conditions	MIN	TYP	MAX	UNIT
ADC _{BRES}	ADC Binary Resolution		10		Bits
ADC _{REF}	ADC Reference Voltage		1.75		Vdc
V _{ADC}	ADC Range	0		1.75	Vdc
Integral/Differential Non-Linearity		-2		+2	LSB
Input Leakage				1	μA
Retuning Frequency			1		MHz
Input Capacitor	Maximum settling time for the input signal is 16*t		12		pF

6.7.7 Handset Microphone Input

Parameter	Parameter/Conditions	MIN	TYP	MAX	UNIT
Maximum Input Range – Mic(+) to Mic(-)	Inputs 3 dBm0 (Max. digital sample amplitude when PGA gain set to 0 dB)		32.5		mV _{RMS}
Nominal Ref. Level – Mic(+) to Mic(-)			-10		dBm0
Differential Input Resistance – Mic(+) to Mic(-)			36		kΩ
Microphone Pre-Amplifier Gain			25.6		dB

6.7.8 Microphone Bias Output

Parameter	Parameter/Conditions	MIN	TYP	MAX	UNIT
Bias Voltage on Mic(+)	Set to 2.0 V	1.9		2.1	Vdc
	Set to 2.5 V	2.4		2.6	Vdc
Mic Bias Current Capability		0		2	mA

6.7.9 Handset Speaker Output

Parameter	Parameter/Conditions	MIN	TYP	MAX	UNIT
Max Differential Resistive Load	Output Swing 3.9 V _{PP}		120		Ω
	Output Swing 1.5 V _{PP}		33		Ω
Maximum Differential Capacitive Load				100	pF
Common Mode Minimum Resistive Load	At Internal Speaker (+) or (-)		200		kΩ
Common Mode Maximum Capacitive Load	At Internal Speaker (+) or (-)			10	pF
Amplifier Gain			1		dB

Enfora recommends an external audio amplifier for loads of less than 16 Ω or if volume is inadequate.

6.7.10 Headset Microphone Input

Parameter	Parameter/Conditions	MIN	TYP	MAX	UNIT
Maximum Input Range	Inputs 3 dBm0 (Max. digital sample amplitude when PGA gain set to 0 dB)			78	mVrms
Nominal Ref. Level			-10		dBm0
Microphone Pre-Amplifier Gain			25.6		dB

6.7.11 Headset Speaker Output

Parameter	Parameter/Conditions	MIN	TYP	MAX	UNIT
1.1.1. Maximum Swing	$R_L = 32 \Omega$ & 2% distortion VSP input level = +3 dBm0	1.60	1.96		Vp-p
Maximum Capacitive Load				100	pF
Maximum Resistive Load			32		Ω
Amplifier Gain			-5		dB
Amplifier State in Power Down			HighZ		

The headset speaker output is a single ended output. Enfora recommends an external audio amplifier for loads of less than 32Ω or if volume is inadequate.

6.7.12 Audio Design Note

Speaker and microphone PCB traces should be run in pairs and buried between two ground planes for best results. The following figure provides a sample circuit design for connection of Mic and Speaker pins.

NOTE: The audio circuitry shown is left as a placeholder and is to be considered preliminary.

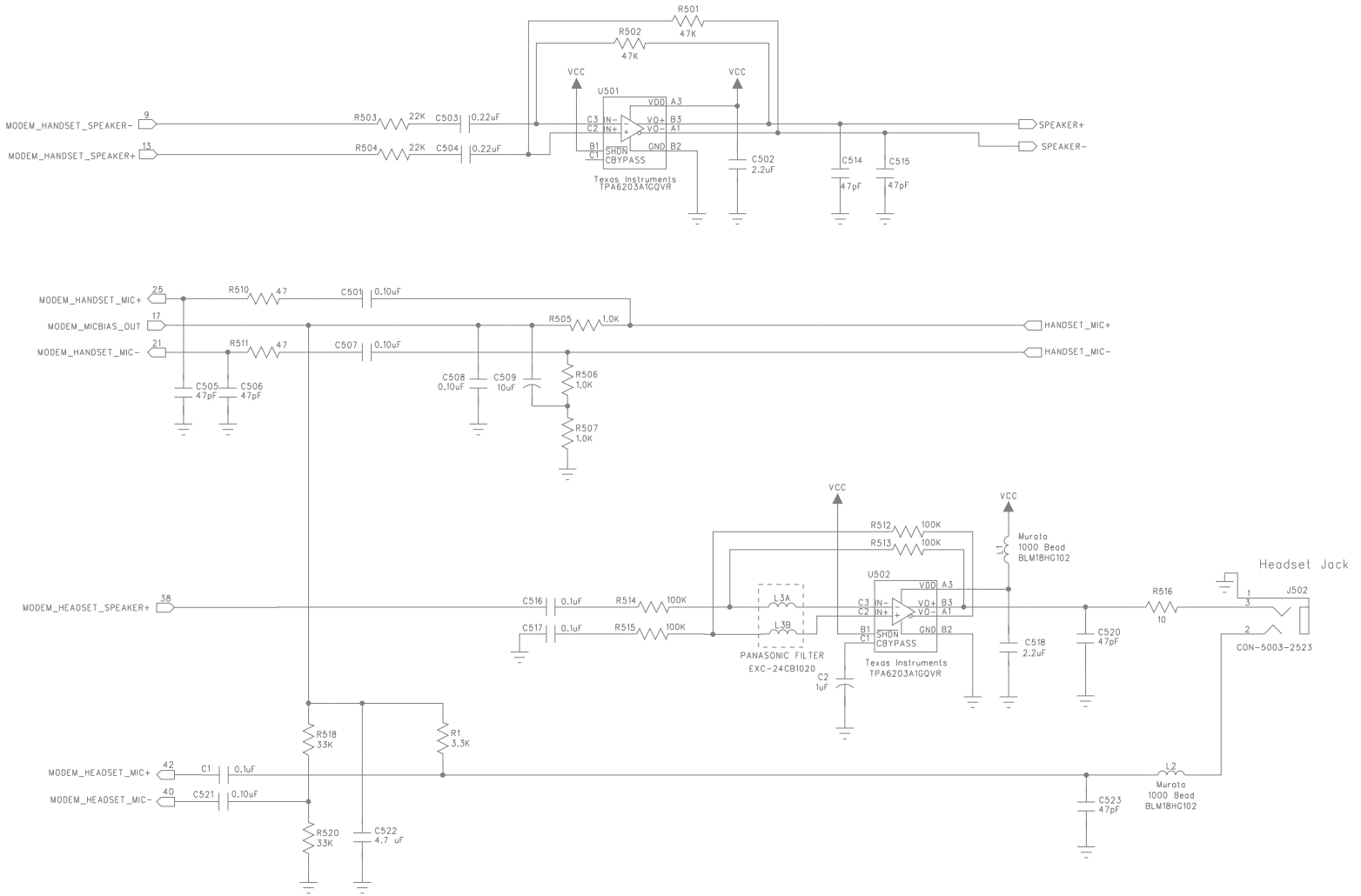


Figure 18 Audio Reference
(Please note that this schematic can be zoomed to read the detail)

6.7.13 Transmit Active Output (Pin-37)

Logic-output that signals when the transmitter is active. A HIGH output indicates that the transmitter is ACTIVE.

Transmit Active	Parameter/Conditions	Min	Typ	Max	Units
V _{OH}	I _{OH} = -100 μ A		2.7	2.8	Vdc
	I _{OH} = -4 mA	2.2			Vdc
V _{OL}	I _{OL} = 100 μ A			0.1	Vdc
	I _{OL} = 4 mA			0.45	Vdc

6.8 Subscriber Identity Module (SIM) Carrier

The SIM, an integral part of any GSM terminal device, is a “smart card” that is programmed with subscriber information:

- The user information consists of an International Mobile Subscriber Identity (IMSI) number, which is registered with the GSM provider, and an encryption Ki (pronounced "key"). This information consists of a microprocessor and memory installed on a plastic card.

Note: The SIM is not provided with the Enfora Enabler EDG0208 module. The SIM must be obtained from the GSM service provider and must be provisioned by the operator for data and/or voice. Always take care to protect the SIM: the GSM terminal will not operate without the SIM installed.

The SIM provides the IMSI for authentication. To gain access to the GSM network, the network must recognize the IMSI number, and the terminal must be able to properly decrypt the data sent by the network. The SIM also serves as a buffer for SMS messages, storing the message for transmission until a radio link is available and buffering received messages until retrieved.

6.8.1 SIM Integration for the Enfora Enabler EDG0208 Module

The Enabler EDG0208 default configuration does not include an on-board SIM carrier. Enfora provides a separate product SKU for the Enabler EDG0208 module with the integrated SIM carrier.

6.8.2 Using a Remote SIM with the Enfora Enabler EDG0208 Module

The Enabler EDG0208 default configuration does not include an on-board SIM carrier. If the module is going to be integrated using a remote SIM, the following guidelines are provided:

- To utilize a remote SIM, the integrator must provide a suitable SIM connector on the Application.
- The maximum distance from the Enabler EDG0208 to the remote SIM connector must not exceed 25.4 cm (10 inches).

Parameter	Parameter/Conditions	MIN	TYP	MAX	UNIT
V _{DD}	Supply Voltage: 1.8 V Mode + Active	1.7	1.8	1.95	Vdc
	Supply Voltage: 3 V Mode + Active	2.75	2.85	3.0	Vdc
	Supply Voltage: 1.8 V Mode + Sleep	1.7	1.83	1.95	Vdc
	Supply Voltage: 3 V Mode + Sleep	2.75	2.9	3.1	Vdc
I _{DD}	1.8 or 3 V Modes			20	mA

Remote SIM Line	Description
SIM_VDD	Remote SIM power supply
SIM_RST	Remote SIM reset
SIM_CLK	Remote SIM clock
SIM_I/O	Remote SIM serial data interface
GND	Use module ground (GND) as Return for SIM Power & Data

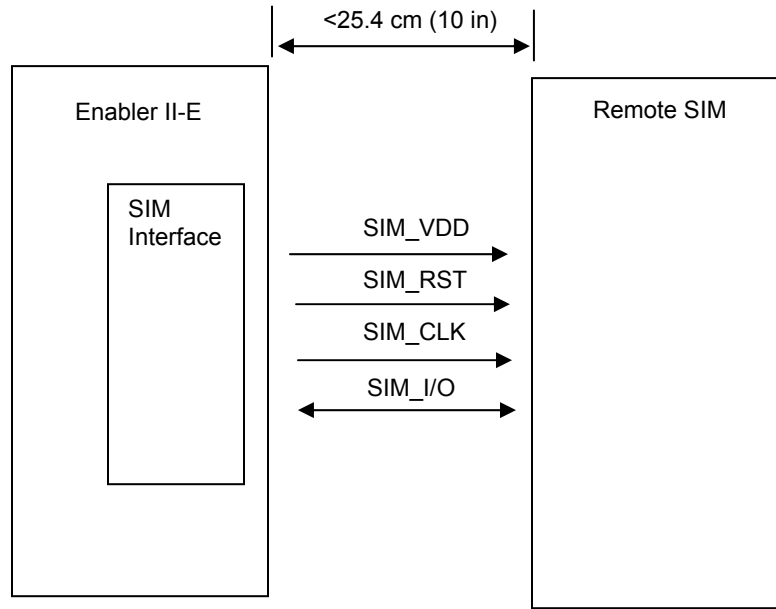


Figure 19 Remote SIM Interface

- ESD Protection
 - 15 kV Air Discharge
 - 8 kV Contact Discharge

6.8.3 Remote SIM Component Information

A SIM carrier compatible for use on the Enabler EDG0208 is a JAE Plug-In SIM Card carrier with hinge; JAE part number SF7W006S1BE1000. [JAE Plug-in SIM Card with hinge cover SF7 Series](#).

7.0 Modes of Operation

GSM/GPRS/EGPRS supports many optional services and modes. The Enfora Enabler EDG0208 module supports the following services:

- Circuit-switched data
- Short-Message Services (SMS)
- Class B/C GPRS Functionality
- Voice communication
- EGPRS

7.1 Enabling the Transmission Modes for the GSM/GPRS/EGPRS Services

Each of the GSM/GPRS/EGPRS services has two modes that can be enabled separately:

- Mobile-originated (MO): allows the making of a service request (such as, making a telephone call or sending an SMS)
- Mobile-terminated (MT): allows receiving a service request (such as receiving a telephone call or an SMS)

Note: Contact your local GSM operator to ensure that the services and modes have been provisioned for the SIM.

7.2 Voice Communication

The Enfora Enabler EDG0208 module has full voice capabilities, provided the necessary connections have been made for the speaker and microphone pins on the 60-pin I/O connector. The Enfora **Enabler-IIE AT Command Set Reference - EDG0208AT001** has the entire list of commands that can be used to control the voice functionality. The quick start guide in this manual provides a basic command set that can be used to initialize and test the voice functionality.

The Enfora Enabler EDG0208 module supports three standard vocoder compression algorithms for voice communication: Full-Rate, Enhanced Full-Rate (EFR), and Half-rate (HR), and also provides support for the Adaptive Multi-Rate (AMR) codec.

7.3 Circuit-Switched Data

In this mode, the Enfora Enabler EDG0208 module supports both of the connection modes of transmission that are provided by GSM:

- Non-Transparent mode delivers a constantly low error rate but with a non-guaranteed throughput or delay. The Non-Transparent service provides a performance that is closest to using a modem over a fixed Public Switched Telephone Network (PSTN) line.

Note: All GSM service providers may not support Transparent mode. In those cases, the Enfora Enabler EDG0208 module can be configured to switch automatically to Non-Transparent mode. This capability depends on the settings in the AT+CBST command.

7.4 SMS: Short Message Services

- Short Message Services (SMS) is a feature-rich GSM service. The Enfora Enabler EDG0208 module can perform the following tasks:
- Sending and receiving binary messages of up to 160 characters (7-bit characters)
- Sending and receiving text messages of up to 140 bytes (8-bit data)
- Submitting a SMS Protocol Data Unit (PDU) to a SMSC (Short Message Service Center) and storing a copy of the PDU until either a report arrives from the network or a timer expires
- Receiving a SMS PDU from a SMSC
- Returning a delivery report to the network for a previously received message
- Receiving a report from the network
- Notifying the network when the module has sufficient memory capacity available to receive one or more SMS messages (after the module had previously rejected a message because its memory capacity was exceeded)

7.5 SMS Features Supported by the Enfora Enabler EDG0208 Module

The following list details the key characteristics and assumptions regarding the form of SMS supported in the Enfora Enabler EDG0208 module.

- Supports both mobile-originated (MO) and mobile-terminated (MT) SMS
- Delivers the message to a telephone
- Supports 8-bit data
- Supports Message Class 0, Class 1, & Class 2
- Provides a status report indicator
- Allows the definition of a validity period
- Provides the Service Center Time Stamp
- Alerts the SMSC
- USSD
- Replace SMS

8.0 SIM Operation

8.1 Provisioning the SIM

The SIM can support optional features or services. Most operators typically configure the SIM to send/receive voice calls and to receive SMS; however, some may require an additional tariff to enable the SIM to send SMS. The transmission of circuit switched and GPRS data are also additional services that may be required to allow the service:

- Mobile-originated (MO): allows making a service request (such as, making a call or sending an SMS)
- Mobile-terminated (MT): allows receiving a service request (such as, receiving a phone call or an SMS)

It is imperative for the Enfora Enabler EDG0208 module that the SIM be configured for the optional services that are required for the application.

8.2 GSM Services Supported by the Enfora Enabler EDG0208 Module

The Enfora Enabler EDG0208 module supports four GSM services (modes of operation) that must be enabled by the operator:

- Voice calls (MO and MT): requires a telephone number;
- SMS (MO and MT): uses the telephone number for voice;
- Circuit-switched data calls (MO and MT): requires a telephone number;
- The GSM SIM can have multiple telephone numbers.

8.3 GPRS Services Supported by the Enfora Enabler EDG0208 Module

The Enfora Enabler EDG0208 module supports the following GPRS (modes of operation) that must be enabled by the operator:

- GPRS Packet Connectivity (MO and MT) with Both Dynamic and Static IP option;
- GPRS SMS (MO and MT): uses the IP (Dynamic or Static) set by the operator;
- Multiple APN Setting;
- Quality of Service Options;
- Multi-slot 10 Class of Service.

8.4 EGPRS Services Supported by the Enfora Enabler EDG0208 Module

The Enfora Enabler EDG0208 module supports the following EGPRS (modes of operation) that must be enabled by the operator:

- EGPRS Packet Connectivity (MO and MT) with Both Dynamic and Static IP option;
- EGPRS SMS (MO and MT): uses the IP (Dynamic or Static) set by the operator;
- Multiple APN Setting;
- Quality of Service Options;

- Multi-slot 10 Class of Service.

8.5 Selecting the Modes of Operation

When provisioning the SIM for the Enfora Enabler EDG0208 module, enable the following modes of operation:

- Voice calls: configure the SIM for both MO and MT service (to send and receive);
- SMS: configure the SIM either for MT alone (to receive) or for both MO and MT (to send and receive);
- Circuit Switched Data: configure the SIM either for MO alone (to send) or for both MO and MT (to send and receive).

Voice	SMS	CS Data	GPRS	Function
MO/MT	MT	MO		Voice calls, receive SMS, make data calls
MO/MT	MO/MT	MO		Voice calls, receive / send SMS, make data calls
MO/MT	MO/MT	MO/MT		Voice calls, receive / send SMS, make / receive data calls (requires an additional data telephone number)

9.0 Software Interface

9.1 Software Interface

The application sends commands to the Enfora Enabler EDG0208 module via the I/O signal connector. These commands use the Enfora AT Command Set.

The Enfora Enabler EDG0208 module operates in one of the following modes:

- **Command mode:** Used for configuring the Enfora Enabler EDG0208 module, for interrogating the GSM network, and for placing and receiving calls. It uses the AT command set via the serial port for communication.
- **On-line mode:** Used after a circuit-switched data call has been established. Data is passed between the Enfora Enabler EDG0208 module and the controlling application without command interpretation. The only AT command that is interpreted in On-line mode is the +++ command. (This command places the Enfora Enabler EDG0208 module in Command mode but does not terminate the circuit-switched data call.)

The AT command driver of the Enfora Enabler EDG0208 module never exits the Command state, that is, it never enters the “On-line” mode.

- In the Command state, characters that are received from the Customer Premise Equipment (CPE) are treated as AT commands by the Enfora Enabler EDG0208 module.
- In response to the commands received from the CPE, the Enfora Enabler EDG0208 module sends characters (AT commands) to the CPE.
- Various events can also trigger the Enfora Enabler EDG0208 module to send characters (AT commands) to the CPE.

9.2 Format for the AT Commands

The general format of the command line is: **<prefix> <command> <CR>**

<prefix>	AT
<command>	See AT Command Manual
<CR>	0X0D

The prefix AT obtains synchronization, identifies the character parameters, and indicates that a command may be in the following characters.

AT commands are not case sensitive: use either capital letters or lower-case letters for the AT command.

Note: Some AT Command parameter values **ARE** case sensitive and are documented in the Enfora **Enabler-IIE AT Command Set Reference - EDG0208AT001**.

9.3 Enfora AT Command Set

For a full description of the AT commands, refer to the Enfora **Enabler-IIE AT Command Set Reference - EDG0208AT001**.

Note: A command description that includes an asterisk (*) denotes that the GSM service provider must enable supplementary services functionality before the command is available.

10.0 Setup and Initialization

10.1 General Setup

The data modem is controlled through the Modem RS232 port on the development board. Connect a nine-pin straight through serial cable from the Modem RS232 connector to the serial port on the controlling computer.

Hook up the power supply, connect the antenna, and install the SIM into the modem.

10.1.1 HyperTerminal Configuration for Enabler EDG0208

The following provides an example for setting up a Windows HyperTerminal session that can be used to experiment with various configurations on the Enabler EDG0208 for controlling computer:

1. Select the connection interface, Direct to Com 1 (or whatever port is the serial port).



Figure 20 HyperTerminal Definition

2. Configure the COM port as displayed below.

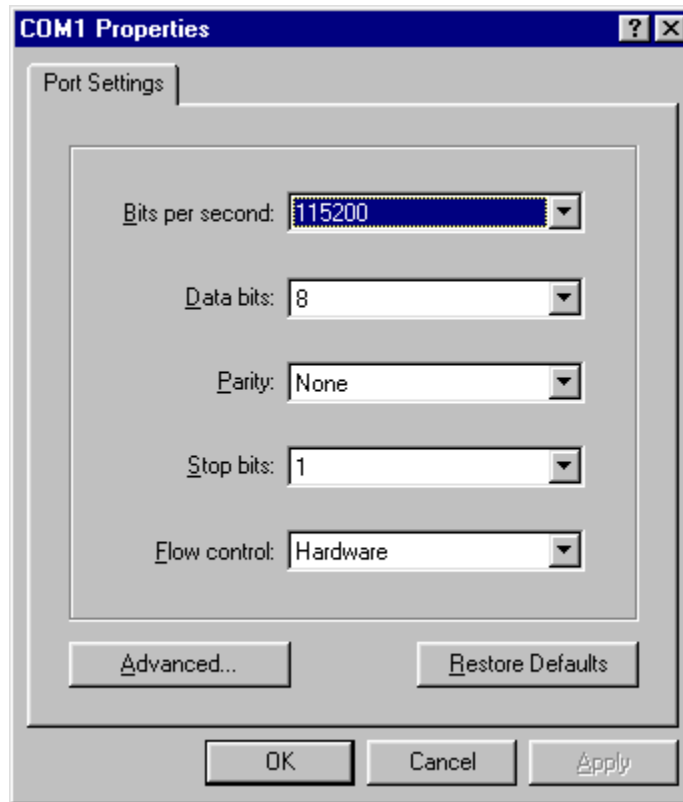


Figure 21 COM Port Settings

10.1.2 Initialization (AT Command Interface)

In the GSM vocabulary, a call from GSM mobile to the PSTN (Public Switched Telephone Network) is called a "mobile-originated call" or "outgoing call". A call from the fixed network to a GSM mobile is called a "mobile-terminated call" or "incoming call."

In the following examples, "Entry" refers to the application. The following convention describes the direction of the data exchange:

- The data exchange from the customer application to the Enfora Enabler EDG0208 module is designated as:

Entry

- The data exchange from the Enfora Enabler EDG0208 module to the customer application is designated as:

Response

Note: With the exception of the +++ command (Online Escape Sequence), all commands must be preceded by the AT attention code (or command prefix) and terminated by pressing the <CR> character.

In the following examples, the <CR> and <CR><LF> are intentionally omitted for clarity and space.

10.1.3 Initial Response to the AT Command

After power is applied to the Enfora Enabler EDG0208 module, the module performs a power-up self-test. The self-test completes within one (1) second. When queried with the AT command, the Enfora Enabler EDG0208 module responds with one of the following result codes:

- “OK” signifies that the Enfora Enabler EDG0208 module is ready, that it correctly interprets the AT command, and that it has executed the command.
- “ERROR” signifies that the Enfora Enabler EDG0208 module does not understand the command or that the command is invalid.

Entry	AT	
Response	OK	Command valid: module is ready

The Enfora Enabler EDG0208 module must be in AT Command mode (please refer to section 10.3 GPRS Packet Examples for packet mode initialization and setup) when any command is entered (with the exception of the online escape sequence). Commands entered when the module is in On-line mode are treated as data, and are transmitted as such to the receiving module. (i.e. If the module is in PPP or SLIP mode, AT commands cannot be entered.)

10.1.4 Sending an Initialization String to the Enfora Enabler EDG0208 Module

The following example provides the sample AT commands and responses for the following initialization tasks:

- Reset the module to the factory defaults;
- Disable character echo;
- Transmit Result Codes;
- Set the module to Verbose mode (to display result codes as words);
- Set the DCD to match the state of remote modem;
- Ignore the DTR.

Entry	AT&FE0Q0V1&C1&d0	Initialization string
Response	OK	Command is valid
Entry	ATSO=1	Auto answer on 1st ring
Response	OK	Command is valid

10.1.5 Setting Up the Communication Mode for the Enfora Enabler EDG0208 Module

The following example sequence provides the AT command and response for setting the Enfora Enabler EDG0208 module for full phone functionality, automated operator selection, 9600 baud, non-transparent mode.

Entry	AT+CFUN=1	FULL phone functionality
Response	OK	Command is valid
Entry	AT+COPS=0	Automatic operator selection
Response	OK	Command is valid
Entry	AT+CBST=7,0,1	9600 baud, non-transparent mode
Response	OK	Command is valid

10.1.6 Querying the Status of the Enfora Enabler EDG0208 Module

This topic is addressed in the Enfora Application Note *GSM0000AN006 – Enabler-G Module Status Query*.

10.1.7 Setting Module Reporting Parameters for GSM and GPRS

This topic is addressed in the Enfora Application Note *GSM0000AN007 - Enabler-G Status Reporting*.

10.2 GSM/SMS Examples

10.2.1 Initialize the Enfora Enabler EDG0208 Module to Send and Receive SMS Text Messages

This topic is addressed in the Enfora Application Note *GSM0000AN004 - Enabler-G SMS Configuration and Use*.

10.2.2 Managing SMS Messages

This topic is addressed in the Enfora Application Note *GSM0000AN004 - Enabler-G SMS Configuration and Use*.

10.2.3 Data Call Configuration

This topic is addressed in the Enfora Application Note *GSM0000AN003 - Enabler-G Data Circuit Switched Call Configuration and Use*.

10.2.4 Voice Call Configuration

This topic is addressed in the Enfora Application Note *GSM0000AN003 - Enabler-G Data Circuit Switched Call Configuration and Use*.

10.3 GPRS Packet Examples

10.3.1 GPRS/EGPRS ATTACH and ACTIVATE

This topic is addressed in the Enfora Application Note *GSM0000AN005 - Enabler-G Automated Network Connection Configuration and Use*.

10.3.2 Windows PPP Setup

The Enabler EDG0208 module can be used in a Windows operating system environment as a standard serial modem device. The required setup and configuration process is contained in Enfora Application Notes *GSM0000AN001 - Enabler-G PPP Configuration for Windows 98* and *GSM0000AN002 - Enabler-G PPP Configuration for Windows 2000*.

11.0 Integration and Testing

The Enfora Enabler EDG0208 module has been designed to minimize the amount of time required for integration and testing the application. By being fully certified by the appropriate bodies, the Enfora Enabler EDG0208 module provides seamless integration into the GSM network.

The integration issues for the application can be narrowed to the utilization of the AT commands and the use of the GSM functionality. Coverage and signal quality may be evaluated by using the RSSI commands. Additional network information can be determined by using AT commands.

Integration of the GPRS Packet capabilities is more complicated than using AT command sequences to initiate the connection and begin transferring data. The following Application Notes should be used to integrate the GPRS packet capabilities:

GSM0000AN002 - Enabler-G PPP Configuration for Windows 2000

GSM0000AN008 - Enabler-G PPP Configuration for Windows XP

GSM0000AN010 - Enabler-G PPP Configuration for PocketPC 2002

GSM0000AN005 - Enabler-G Automated Network Connection Configuration and Use

11.1 Integrating the Enfora Enabler EDG0208 Module

Note: Generally, all interfaces that are externally available to the end user need to be ESD-conditioned and terminated in some way. Many of these interfaces should not be connected with power applied.

At the highest level, this is done using some type of GSM test equipment (such as, Racal 6103E), a computer, and a serial interface tester. The GSM test equipment must be able to simulate a GSM call and measure the key parameters related to the module.

Additionally, the serial interfaces and some minimal SIM functionality can be verified by sending AT commands to the Enfora Enabler EDG0208 module.

All of these conditions need to be verified at ambient as well as extreme conditions.

As part of integration, each of the following interfaces must be verified:

Information	Recommendations
SIM	The maximum line length of the SIM interface is 25.4 cm (10 inches). The Enfora Enabler EDG0208 module takes care of the signal conditioning As a minimum, an external application with a remote SIM will require a standard SIM carrier. Filter the SIM VCC signal with a 10 uf / 10 V capacitor to help with the line length.
Primary and secondary serial Interfaces	The Enfora Enabler EDG0208 module uses a 3 V digital interface. The RS-232 signals must be level-shifted to get standard levels. These signals must be ESD-protected.
Reset Interface Audio/Microphone Interface	Resets the Enfora Enabler EDG0208 module when tied low. Preliminary balancing on Enfora Enabler EDG0208 module. Maximum length TBD

Testing the following parameters verifies the RF parameters that may be affected by such things as RF path loss, power supply noise, and external interference.

Functionality	Parameters to be Tested
Transmitter	Frequency Error Phase Error PA Ramp Modulation Spectrum RF Power Steps Timing Advance
Receiver	BER Based RX Tests (RXQUAL RXLEV) BER Based Sensitivity

Testing the following GSM functionality verifies proper network communication.

Functionality	Parameters to be Tested
Transmitter	Frequency Error Phase Error PA Ramp Modulation Spectrum RF Power Steps Timing Advance
Receiver	BER Based RX Tests (RXQUAL RXLEV) BER Based Sensitivity

Testing the following GSM functionality verifies proper network communication.

Functionality	Parameters to be Tested
Network Function	Synchronization and registration Call set-up and call termination (both MT and MO calls) SMS and/or data calls

11.2 APPENDIX A - LIMITED WARRANTY

11.2.1 Scope

Enfora warrants to the original purchaser of the product that, for a period of one (1) year from the date of product purchase, the product hardware, when used in conjunction with any associated software (including any firmware and applications) supplied by Enfora, will be free from defects in material or workmanship under normal operation. Enfora further warrants to such original purchaser that, for a period of ninety (90) days from the date of product purchase, any software associated with the product will perform substantially in accordance with the user documentation provided by Enfora, and any software media provided with the product will be free from defects in material or workmanship under normal operation. Enfora does not warrant that (a) the product hardware or any associated software will meet the purchaser's requirements, (b) that the operation of the product hardware or software will be uninterrupted or error-free, or (c) the product, when integrated in, or combined with, other products or software not supplied by Enfora, will continue to perform substantially in accordance with the user documentation. This limited warranty is only for the benefit of the original purchaser and is not transferable. No other party may act on behalf of such purchaser for the purpose of claiming or exercising any rights or benefits under or in connection with this limited warranty except as may be provided in a written agreement between Enfora and such other party.

11.2.2 Hardware

During the warranty period applicable to the product hardware, Enfora, at its expense and in its sole discretion, will repair or replace the product if it is determined to have a covered hardware defect, provided that the purchaser first notifies Enfora of any such defect, furnishes Enfora with a proof of purchase, requests and obtains a return merchandise authorization (RMA) number from Enfora, and returns the product, shipping charges prepaid, to Enfora under that RMA. If, upon reasonable examination of the returned product, Enfora does not substantiate the defect claimed by purchaser, or determines that the defect is not covered under this limited warranty, Enfora will not be required to repair or replace the product, but may instead reship the product to the purchaser, in which case purchaser shall be responsible for paying Enfora's usual charges for unpacking, testing, and repacking the product for reshipment to purchaser. Purchaser shall bear the risk of loss or damage in transit to any product returned by purchaser to Enfora, or any returned product not found to be defective or covered under this warranty and reshipped by Enfora to purchaser. In the event Enfora repairs or replaces a defective product, the repaired or replacement product will be covered under this limited warranty for the remainder of the original warranty period on the defective product. If Enfora is unable to repair or replace a defective product, the purchaser's exclusive remedy shall be a refund of the original purchase price. Any returned and replaced product, or any product for which Enfora has refunded the original purchase price, becomes the property of Enfora.

11.2.3 Software

During the warranty period applicable to the software or its media, Enfora, at its expense, will replace any defective software or media if purchaser gives written notification of the defect to the technical support department at Enfora during the applicable warranty period. Enfora will ship or otherwise transmit the replacement software or media to purchaser, and purchaser shall be responsible for incorporating any replacement software in the product. Enfora shall not have any obligation to provide any software bug fixes, upgrades or new releases except as may be necessary to correct any covered defect of which purchaser notifies Enfora in writing during the applicable warranty period. Enfora, from time to time and in its sole discretion, may make available for download on its website (www.enfora.com) certain software bug fixes, upgrades or new releases for the product. The purchaser should periodically visit such website to determine whether any such bug fixes, upgrades or new releases have become available. Download and use of any such bug fixes, upgrades or new releases is subject to all of the applicable terms and conditions of Enfora's technical support policy as posted and updated on its website.

Exceptions and Disclaimers

Enfora shall have no obligation under this limited warranty for (a) normal wear and tear, (b) the cost of procurement of substitute products or (c) any defect that is (i) discovered by purchaser during the warranty period but purchaser does not notify or request an RMA number from Enfora, as required above, until after the end of the warranty period, (ii) caused by any accident, misuse, abuse, improper installation, handling or testing, or unauthorized repair or modification of the product, (iii) caused by use of any software other than any software supplied by Enfora, or by use of the product other than in accordance with its documentation or (iv) the result of electrostatic discharge, electrical surge, fire, flood or similar causes. Unless otherwise provided in a written agreement between the purchaser and Enfora, the purchaser shall be solely responsible for the proper configuration, testing and verification of the product prior to deployment in the field.

ENFORA'S SOLE RESPONSIBILITY AND PURCHASER'S SOLE REMEDY UNDER THIS LIMITED WARRANTY SHALL BE TO REPAIR OR REPLACE THE PRODUCT HARDWARE, SOFTWARE OR SOFTWARE MEDIA (OR IF REPAIR OR REPLACEMENT IS NOT POSSIBLE, OBTAIN A REFUND OF THE PURCHASE PRICE) AS PROVIDED ABOVE. ENFORA EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, SATISFACTORY PERFORMANCE AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL ENFORA BE LIABLE FOR ANY INDIRECT, SPECIAL, EXEMPLARY, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OR INTERRUPTION OF USE, DATA, REVENUES OR PROFITS) RESULTING FROM A BREACH OF THIS WARRANTY OR BASED ON ANY OTHER LEGAL THEORY, EVEN IF ENFORA HAS BEEN ADVISED OF THE POSSIBILITY OR LIKELIHOOD OF SUCH DAMAGES.

11.2.4 Other Considerations

Some jurisdictions may require a longer warranty period than specified above and, accordingly, for products sold in those jurisdictions the applicable warranty period shall be extended as required under the laws of those jurisdictions. Furthermore, some jurisdictions may not allow the disclaimer of implied warranties or the exclusion or limitation of incidental or consequential damages, so the above disclaimer, limitation or exclusion may not apply to products sold in those jurisdictions. This limited warranty gives the purchaser specific legal rights and the purchaser may have other legal rights that vary from jurisdiction to jurisdiction.

In some instances, certain aspects of the product warranty may also be covered in a separate written agreement between Enfora and the distributor or reseller, if any, from whom purchaser purchased the product. That agreement may provide, for example, a different product return procedure that may also be available to purchaser (e.g., the product may be returned to Enfora through that distributor or reseller).

Governing Law

This limited warranty shall be governed by the laws of the State of Texas, United States of America, without regard to conflict of laws principles. This limited warranty shall not be governed in any respect by the United Nations Convention on Contracts for the International Sale of Goods.

11.3 APPENDIX B - Regulations and Compliance

This section summarizes the responsibilities and actions required of manufacturers and integrators who incorporate OEM versions of the Enfora Enabler IIE module into their products. In certain situations and applications, these products will require additional FCC, CE, GCF, PTCRB or other regulatory approvals prior to sale or operation. Appropriate instructions, documentation and labels are required for all products. For more information concerning regulatory requirements, please contact Enfora.

11.3.1 GCF/PTCRB Approval (Formerly FTA)

The Enfora Enabler IIE module is type approved in accordance with the requirements of and through the procedures set forth by the GSM industry association. The relevant conformance specification is 3GPP TS 51010-1. Any OEM changes in the SIM interface, antenna port, software or the physical makeup of the unit may require an incremental FTA to ensure continued compliance with the above-mentioned standard. For more information concerning type approval, please contact Enfora.

11.3.2 Electromagnetic Compatibility (EMC) and Safety Requirements

The Enfora Enabler IIE module has been tested and approved for application in the United States of America (US) and the European Union (EU). The compliance details for each of these markets follow. For other markets, additional or alternative regulatory approvals may be required. Always ensure that all rules and regulations are complied with in every country that the OEM application is to be operated. Regardless of the country or market, the OEM must comply with all applicable regulatory requirements.

11.3.3 EMC/Safety Requirements for the USA

Compliance to the US rules and regulations falls under two categories:

- Radio approvals: Federal Communications Commission (FCC)
- Transmitter: FCC Rules, Part 22 & 24
- Unintentional emission: FCC Rules, Part 15

Although the Enfora Enabler IIE module has been authorized by the FCC and listed as a component by an NRTL, products and applications that incorporate the Enfora Enabler IIE module will require final verification of EM emission and product safety approval.

Note: Particular attention should be made to the following statements regarding RF Exposure:

11.3.4 Human Exposure Compliance Statement

EDG0208 GSM/GPRS Module

Enfora certifies that the Enfora Enabler IIE 850/900/1800/1900 MHz GSM Radio Module (FCC ID: MIV/EDG0208) complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 24, Subpart E and Part 22 of the FCC Rules and Regulations. This certification is contingent upon installation, operation and use of the Enfora Enabler IIE module and its host product in accordance with all instructions provided to both the OEM and end user. When installed and operated in a manner consistent with the instructions provided, the Enfora Enabler IIE module meets the maximum permissible exposure (MPE) limits for general population / uncontrolled exposure at defined in Section 1.1310 of the FCC Rules and Regulations.

Note: Installation and operation of this equipment must comply with all applicable FCC Rules and Regulations, including those that implement the National Environmental Policy Act of 1969 (Part 1, Subpart I), with specific regard to antenna siting and human exposure to radio frequency radiation. For further guidance, consult the FCC Rules, a certified FCC test house, or Enfora.

11.3.5 Compliance with FCC Regulations

The Federal Communications Commission (FCC) is the agency of the Federal Government that oversees all non-governmental radio frequency transmitters that operate within the United States. Unintentional emissions from digital devices are regulated by Part 15 of the FCC Rules and Regulations, which distinguishes between the environments in which these devices may operate. Intentional radiators operating as a GSM-1900 radio transmitter are regulated under Part 22 & 24, Subpart E—Broadband PCS of the FCC Rules and Regulations.

11.3.6 Unintentional Radiators, Part 15

Equipment designated as Class A is intended for use in a commercial, industrial or business environment. The Enfora Enabler IIE module has been tested and found to comply with the limits for a Class A digital device and can be integrated into equipment or applications intended for use in commercial, industrial or business environments.

The following statement must be included in the user manual for such products:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Equipment intended for use in a residential environment (notwithstanding use in commercial, industrial or business environments) is designated as Class B. The Enfora Enabler IIE module has been tested and found to comply with the limits for a Class B digital device and can be integrated into equipment or applications intended for use in residential environments.

The following statement must be included in the user manual for such products:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on 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 between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

11.3.7 Intentional Radiators, Part 22 & 24

Products incorporating the Enfora Enabler IIE transceiver operate as Personal Communications Services (PCS) devices under the authority of Part 22 & Part 24, Subpart E—Broadband PCS, of the FCC Rules and Regulations. All such transmitters must be authorized by the FCC through its Certification process, as detailed in Part 2, Subpart J - Equipment Authorization Procedures. Through the Certification process, the FCC verifies that the product complies with all applicable regulatory and technical requirements, including those that address human exposure to radio frequency radiation. In general, radio frequency transmitters cannot be sold or operated in the US prior to FCC approval.

11.3.8 Instructions to the Original Equipment Manufacturer (OEM)

To comply with the requirements of the National Environmental Policy Act (NEPA) of 1969, operation of an FCC-regulated transmitter may not result in human exposure to radio frequency radiation in excess of the applicable health and safety guidelines established by the FCC. Further information on RF exposure issues may be found in the FCC's Office of Engineering and Technology (OET) Bulletin Number 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields" and Supplement C, "Additional Information for Evaluating Compliance of Mobile and Portable devices with FCC Limits for Human Exposure to Radio Frequency Emissions." Both of these documents are available via the Internet at the OET web site: <http://www.fcc.gov/oet>

The Enfora Enabler IIE products are GSM radio transceivers, which operate under the authority of 47 CFR Part 24, Subpart E and Part 22 of the FCC Rules and Regulations. When installed and operated in accordance with the instructions provided in this manual, these devices comply with current FCC regulations regarding human exposure to radio frequency radiation.

The following installation and operation restrictions apply to all Enfora Enabler IIE products:

- This device may only be used in fixed and mobile applications.
- Portable applications, as defined by the FCC, are prohibited.
- The use of this device for desktop and other applications where the antenna can easily be relocated are considered by the FCC to be mobile applications.
- A separation distance of at least 20 cm (7.87 inches) between the antenna and the body of the user and other persons must be maintained at all times
- End products must provide instructions to ensure compliance with radio frequency radiation exposure requirements.
- A warning label visible to all persons exposed to the antenna and identical to that described in this manual must be displayed on or next to the antenna.
- Separate FCC approval for RF exposure compliance is required for end products that do not meet these conditions.

Note: Additional care must be taken by the installer and/or user of the Enfora Enabler IIE products to ensure proper antenna selection and installation. Adherence to the above conditions is necessary to comply with FCC requirements for safe operation regarding exposure to RF radiation.

Depending upon the application and type of product into which the Enfora Enabler IIE module has been incorporated, specific OEM actions and responsibilities required to meet these conditions vary. However, in all cases the primary concern is to ensure compliance with current FCC guidelines and regulations that limit human exposure to radio frequency radiation.

Definitions

For the purpose of determining compliance with current FCC rules addressing human exposure to radio frequency radiation, the FCC has established the following three categories of transmitting devices:

- Portable Devices – devices where the antenna is located within 20 cm (7.87 inches) of any person, including the user, if applicable. Portable devices operating under the authority of Part 22 or 24 (broadband PCS) are limited to a maximum of 2 W EIRP.
- Mobile Devices – devices designed to be used in other than fixed locations and generally such that the antenna is located at a minimum of 20 cm (7.87 inches) from any person, including the user, if applicable. Mobile devices operating under the authority of Part 22 or 24 (broadband PCS) are limited to a maximum of 2 W EIRP.
- Fixed devices – devices in which the antenna, either integral to the product or remotely located, is physically secured at one location and is not able to be easily moved to another location. The antenna for a fixed device is mounted on an outdoor permanent structure with a minimum separation distance of 2 meters (79 inches)

11.3.9 OEM Responsibilities for All Products Containing the Enabler IIE module

In addition to any other regulatory requirements, OEMs and integrators must include or provide the following information, instructions, warnings and labels with any device or product into which the Enfora Enabler IIE GSM1900 GSM transceiver has been incorporated:

Information	Description	
<p>Detailed Operating Instructions for ensuring compliance with current FCC guidelines which limit human exposure to radio frequency radiation</p>	<p>The OEM must provide an operating/installation manual with the final product which clearly indicates that these operating conditions and restrictions must be observed at all times to ensure compliance with current FCC guidelines which limit human exposure to radio frequency radiation. 20 cm (7.87 inch) separation distance between the antenna and all persons must be maintained at all times for all fixed and mobile products and applications Portable devices and applications are prohibited unless such devices and products are specifically authorized by the FCC Maximum antenna gain is limited to 3 dBi @GSM1900 and 6.5dBi @GSM850 in mobile products and applications</p>	
<p>Antenna Avoidance Label</p>	<p>Attach the following warning label directly to or displayed next to the antenna. Furthermore, this label must be visible to and easily readable by all persons in the immediate vicinity of the antenna</p>	<p style="text-align: center;">WARNING</p> <p style="text-align: center;">To comply with FCC RF exposure requirements, a separation distance of 20 cm (7.87") or more must be maintained between this antenna and all persons</p>
<p>Human Exposure Compliance Statement</p>	<p>Include the following statement in the instruction / operation manual.</p>	<p>Enfora certifies that the Enfora Enabler IIE GSM Radio Module (FCC ID: MIVEDG0208) complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 22 or Part 24, Subpart E of the FCC Rules and Regulations. This certification is contingent upon installation, operation and use of the Enfora Enabler IIE module and its host product in accordance with all instructions provided to both the OEM and end user. When installed and operated in a manner consistent with the instructions provided, the Enfora Enabler IIE module meets the maximum permissible exposure (MPE) limits for general population / uncontrolled exposure at defined in Section 1.1310 of the FCC Rules and Regulations.</p>

11.3.10 Specific OEM Responsibilities for Portable Products and Applications

Each device or product, into which the Enfora Enabler IIE PCS-1900 GSM transceiver has been incorporated, and which is intended to be used in an application that meets the definition of "portable" MUST be separately authorized by the FCC for the purposes of determining compliance with current FCC guidelines limiting human exposure to radio frequency radiation.

Portable devices must be evaluated for RF exposure based on Specific Absorption Rate (SAR) limits; further information on such evaluations are available from the FCC via the Internet.

11.3.11 Specific OEM Responsibilities for Mobile Products and Applications

Separate or additional FCC approvals are NOT required for devices or products, into which the Enfora Enabler IIE PCS-1900 GSM transceiver has been incorporated, that are used in applications that meet the definition of "mobile."

For all end products, the OEM or integrator must provide instructions, warnings and labels to ensure that the product complies with current FCC guidelines limiting human exposure to radio frequency radiation.

11.3.12 Specific OEM Responsibilities for Fixed Products and Applications

Separate or additional FCC approvals are not required for devices or products, into which the Enfora Enabler IIE GSM transceiver has been incorporated, that are used in applications that meet the definition of "fixed."

For all end products, the OEM or integrator must provide the instructions, warnings and labels to ensure that the product complies with current FCC guidelines limiting human exposure to radio frequency radiation.

11.3.13 EMC/Safety Requirements for the Countries of the European Union (EU)

The European Union (EU) is comprised of fifteen countries that follow a harmonized set of standards, utilizing the CE mark as a uniform mark of acceptance.

11.3.14 EMC/Safety Requirements for Other Countries

In most other countries that have not been listed above there are similar rules and regulations that must be met for importing the Enfora Enabler IIE module. Each may require a different mark of approval (for example, the CB Scheme) as an acceptance requirement. For each of these cases the country should be identified, and the appropriate steps should be taken to meet the requirements set forth in the intended market.

11.4 APPENDIX C - Glossary and Acronyms

API	Application Programming Interface.
App Application	Refers to the Application which sends or receives commands/responses from the Enfora Enabler IIE Module
AT Command Set	Commands issued by intelligent device to a modem to perform functions, such as to initiate call, to answer call, or to transmit data.
BER Bit Error Rate	Bit Error Rate
CMUX	Multiplexer protocol that operates between an MS and a TE and allows a number of simultaneous sessions over a normal serial asynchronous interface
CPE Customer Premise Equipment	A terminal in fixed location on the customer's premises.
CSD Circuit Switched Data	Data link from a terminal through the network allowing real-time, duplex connectivity at 9600 bytes/second.
dBi	Decibels referenced to an isotropic radiator
DCE Data Communications Equipment	Data Communications Equipment
DCS Digital Cellular System	A collection of services and capabilities providing flexibility of access and mobility through a combination of wireless and wire-line networks, utilizing the 1800 MHz bandwidth.
DTE Data Terminal Equipment	Data Terminal Equipment
EFR Enhanced Full Rate	Voice (vocoder) compression algorithms which offer the highest quality voice communication.
EIR Equipment Identity Register	A database used to store International Mobile Equipment Identity (IMEI) of a locally issued terminal.
EIRP Equivalent Isotropic Radiated Power	In a given direction, the gain of a transmitting antenna multiplied by the net power accepted by the antenna from the connected transmitter.
EMC Electromagnetic Compatibility	The ability of a device to function satisfactorily in its electromagnetic environment without inducing intolerable disturbance to that environment (or to other devices)
ESD Electrostatic Discharge	Static electricity that can damage electronic equipment.
EU European Union	An organization of 15 European states whose purpose is to organize relations between the Member States and between their peoples.
FTA Full Type Approval	GSM Full Type Approval
GPRS General Packet Radio Service	Standard for packet communications utilizing Global Standard for Mobility (GSM) infrastructure.
GSM Global System for Mobile Communications	Standard for digital communications. Allows consistent communications in various parts of the world despite variations in RF spectrum allocations. Transferring the SIM (see below) permits users to roam by changing terminal equipment.
HLR Home Location Register	Stores the identity and user data for all subscribers belonging to the area of the related MSC.
IMEI International Mobile Equipment Identity	A unique number for each GSM Terminal tracked by the GSM operators in their Equipment Identity Register (EIR) database.
IMSI International Mobile Subscriber Identification	A unique number identifying the subscriber stored in the SIM card. Number is used in conjunction with the network for call routing.
Ki	A secret code used in authentication and encryption by the terminal.
MO Mobile Originated	Any GSM/GPRS service originated at the mobile terminal.
MT Mobile Terminated	Any GSM/GPRS service originated from or routed through the network and sent to the mobile terminal.
MSC	The central switch of the GSM network. Performs call routing, collects call detail

Mobile Switching Center	records for billing, and supervises system operations.
Non-Transparent Mode	Delivers a constantly low error rate but with a non-guaranteed throughput or delay. The Non-Transparent service provides a performance that is closest to using a modem over a fixed PSTN line.
NRTL Nationally Recognized Test Laboratory	OSHA-approved Nationally Recognized Testing Laboratory
OEM	Original Equipment Manufacturer.
PA	Power Amplifier.
Packet	A collection of data transmitted over a digital network in a burst.
PCS	Personal Communication Services.
PDA	Personal Digital Assistant.
PDU	Packet Data Unit.
PPP	Point-To-Point Protocol.
SIM	Subscriber Identity Module.
SMS	Short Message Service.
SMSC	Short Message Service Center.
SUPL	Secure User Plane Location
UDP	User Datagram Protocol.

11.5 APPENDIX D – Tables And Figures

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11.6 APPENDIX E - Contacting Enfora

For technical support and customer service dealing with the modem itself, contact the company where you purchased the product. If you purchased the product directly from Enfora, visit the SUPPORT page on the Enfora website: <http://www.enfora.com>.