Hardware Interface Specification for Expedite™ Wireless IP Modem

Novatel Wireless, Inc.
6540 Lusk Boulevard, Suite C-166
San Diego, CA 92121
888-888-9231
www.novatelwireless.com

OM - 01016529

Revision 1

The information disclosed herein is the exclusive property of NOVATEL WIRELESS, INC. and is not to be disclosed without the written consent of NOVATEL WIRELESS, INC. No part of this publication may be reproduced or transmitted in any form or by any means including electronic storage, reproduction, execution or transmission without the prior written consent of NOVATEL WIRELESS, INC. The recipient of this document by its retention and use, agrees to respect the security status of the information contained herein.

The information disclosed herein is the exclusive property of Novatel Wireless, Inc. and is not to be disclosed without the written consent of NOVATEL WIRELESS, INC. No part of this publication may be reproduced or transmitted in any form or by any means including electronic storage, reproduction, execution or transmission without the prior written consent of NOVATEL WIRELESS, INC. The recipient of this document by its retention and use, agrees to respect the security status of the information contained herein.

The information contained in this document is subject to change without notice and should not be construed as a commitment by NOVATEL WIRELESS, INC. unless such commitment is expressly given in a covering document.

© Copyright 1999 NOVATEL WIRELESS, INC. All rights reserved.
Expedite is a trademark of NOVATEL WIRELESS, INC.

Table of Contents

1 WARNING

All persons must be at least 20 cm from the antenna when transmitter operating to meet FCC RF exposure requirements. Refer to the Installation Instructions section for specific requirements for the antenna used with module.

2 INTRODUCTION

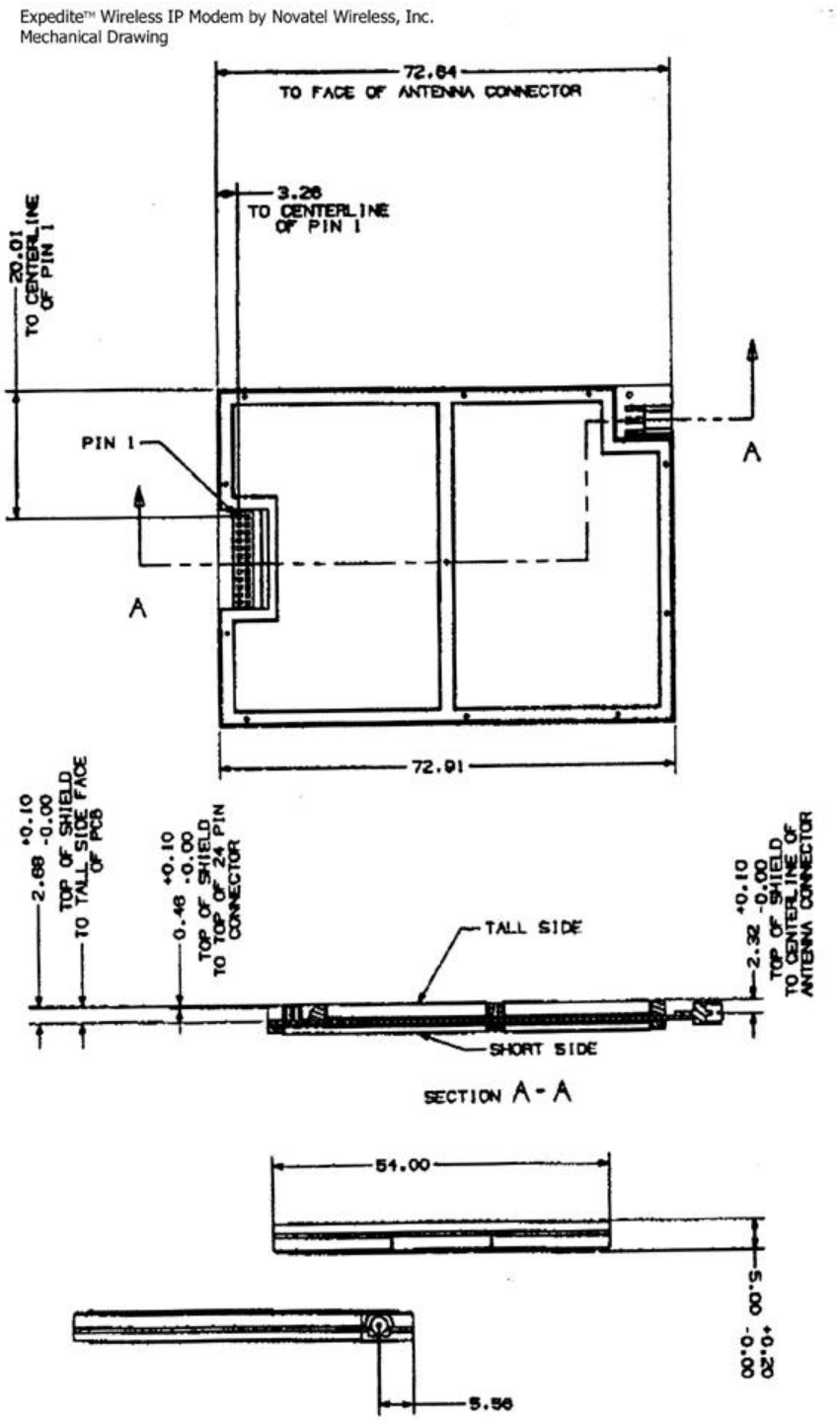
This document describes the hardware interface for the Novatel Wireless Expedite Wireless IP Modem. The Expedite Wireless IP Modem is an OEM module designed for integration into a host product to provide two-way wireless data communication capability via the CDPD (Cellular Digital Packet Data) Network.

3 SCOPE

The scope of this document includes all pertinent information for describing the capabilities and operating requirements for the product in order to determine suitability for specific market applications. Internal design issues, detailed operating instructions and cost information is not included in this document.

4 SPECIFICATIONS

4.1 Physical Interface



4.1.1 Data/Power Connection

One connector is used to physically connect the power supply and 3.3 volt logic level host communication interface signals to the Expedite Wireless IP Modem.

4.1.1.1 Data/Power Connector Type

Description: 24-pin, 1.27 mm pitch, SMT, double row low profile socket type
Samtec part number: CLP-112-02-F-D

Some interface connector options are provided here for reference. Contact Samtec for the latest connector mating options.

4.1.1.2 Surface Mount Mating Connector Options

Description: 24-pin, 1.27 mm pitch, SMT, double row, zero profile, pin type header
Samtec part number: DIS5-112-52-F-D-VS
NOTE: This connector provides the lowest profile interface solution.

Description: 24-pin, 1.27 mm pitch, SMT, double row, low profile, pin type header
Samtec part number: FTS-112-03-F-DV

4.1.1.3 Through-Hole Mating Connector Options

Description: 24-pin, 1.27 mm pitch, T/H, double row, zero profile, pin type header
Samtec part number: DIS5-112-52-F-D

Description: 24-pin, 1.27 mm pitch, T/H, double row, low profile, pin type header
Samtec part number: FTS-112-03-F-D

4.1.2 RF Antenna Connector Type

Expedite Wireless IP Modem antenna connector:

Description - MMCX Coaxial Connector
Manufacturer - Huber and Suhner
Part Number - 82MMCX-S50-0-2
NOTE: An equivalent connector by the same or another manufacturer may be used.

Impedance - 50 ohm

Expedite Wireless IP Modem mating antenna connector:

Mating connector: - AEP 8905-1521-003 or equivalent with RG316 cable.

4.1.3 Pin Descriptions

Pin #	Name	Direction	Power-on Reset State	Description
13, 14	Vcc1	POWER		POWER SUPPLY CONNECTION TO THE MODEM FOR ALL CIRCUITRY EXCEPT FOR THE RF POWER AMPLIFIER.
15, 16	Vcc2	POWER		POWER SUPPLY CONNECTION TO THE MODEM FOR THE RF POWER AMPLIFIER ONLY
1,2 & 23,24	GND	POWER		MODEM GROUND
3	PWR_IND	OUTPUT		POWER INDICATOR: HI: INDICATES THAT THE MODEM IS ON LO INDICATES THAT THE MODEM IS OFF
5	SM_IND	OUTPUT		SLEEP MODE INDICATOR: HI: INDICATES THAT THE MODEM IS IN SLEEP MODE LO INDICATES THAT THE MODEM IS NOT IN SLEEP MODE
4	WKUP	INPUT		WAKE UP INPUT: (ACTIVE HI PULSE) A PULSE APPLIED TO THIS PIN WILL TURN ON THE MODEM IF THE MODEM IS OFF, OR WAKE UP THE MODEM IF THE MODEM IS IN SLEEP MODE. REFER TO THE APPLICATIONS INFORMATION SECTION FOR MORE DETAILS ON USING THE WAKE UP PIN.
6	DTM	INPUT		DATA TO MODEM: (3.3 VOLT LOGIC LEVEL) IN RS232 TERMS, THIS IS CALLED "TXD".
7	DFM	OUTPUT		DATA FROM MODEM: (3.3 VOLT LOGIC LEVEL) IN RS232 TERMS, THIS IS CALLED "RXD".
11	RTS	INPUT		READY TO SEND: (3.3 VOLT LOGIC LEVEL)
10	CTS	OUTPUT		CLEAR TO SEND: (3.3 VOLT LOGIC LEVEL)
8	DTR	INPUT		DTE READY: (3.3 VOLT LOGIC LEVEL)
9	DSR	OUTPUT		DCE READY: (3.3 VOLT LOGIC LEVEL)
12	GPIO1	BI-DIRECTIONAL	INPUT WITH PULLUP	GENERAL PURPOSE CONFIGURABLE INPUT OR OUTPUT: REFER TO THE AT COMMAND SET FOR THE DEFAULT STATE.
17	GPIO2	BI-DIRECTIONAL	INPUT WITH PULLUP	GENERAL PURPOSE CONFIGURABLE INPUT OR OUTPUT: REFER TO THE AT COMMAND SET FOR THE DEFAULT STATE.
18	GPIO3	BI-DIRECTIONAL	INPUT WITH PULLDOWN	GENERAL PURPOSE CONFIGURABLE INPUT OR OUTPUT: REFER TO THE AT COMMAND SET FOR THE DEFAULT STATE.
19	GPIO4	BI-DIRECTIONAL	INPUT WITH PULLUP	GENERAL PURPOSE CONFIGURABLE INPUT OR OUTPUT: REFER TO THE AT COMMAND SET FOR THE DEFAULT STATE.
20	GPIO5	BI-DIRECTIONAL	INPUT WITH PULLDOWN	GENERAL PURPOSE CONFIGURABLE INPUT OR OUTPUT: REFER TO THE AT COMMAND SET FOR THE DEFAULT STATE.
22	GPIO6	BI-DIRECTIONAL	INPUT WITH PULLUP	GENERAL PURPOSE CONFIGURABLE INPUT OR OUTPUT: REFER TO THE AT COMMAND SET FOR THE DEFAULT STATE.
21	ADC_IN	ANALOG INPUT	ADC INPUT	ADC INPUT: THIS PIN IS CONNECTED TO ONE CHANNEL OF AN 8-BIT ADC. REFER TO THE AT COMMAND SET ON HOW TO READ THIS ADC VALUE.

4.2 Host Interface Specifications

4.2.1 Serial Data Rate and Format

The Expedite supports asynchronous data transmission of the following rate and format:

Baud Rate (bits/second)	1200, 2400, 4800, 9600, 19200, 38400
Data bits	7, 8
Parity	Even, None, Odd Mark
Stop Bits	1, 2

4.3 Radio Specifications

4.3.1 Airlink Data Rate

Rate - 19200 bits per second

Error correction - Reed Solomon (63,47)

Transmission standard (CDPD System Specification Part 401, Section 4.5.)

4.3.2 Recommended Antenna Type

Type	-	Half-Wave Dipole
Impedance	-	50 ohm nominal
VSWR	-	1.5:1 nominal, 2.0:1 maximum

Note that the module is aligned assuming a 1.2 dB antenna gain (cable loss included in antenna gain).

4.3.3 Frequency Range

Mode	Frequency Range
Transmit	824 MHz - 849 MHz
Receive	869 MHz - 894 MHz

4.3.4 Duplex Mode

Full-Duplex
(CDPD System Specification Version 1.1 part 409, paragraph 4.2)

4.3.5 RF Power Class

Class III (0.6 Watt ERP)

(CDPD System Specification Version 1.1 part 409, paragraph 4.3)

4.4 Electrical Specifications

4.4.1.1 Operating Characteristics (Ta = 0ºC to 60ºC, VCC1 & VCC2 = 3.6V, unless otherwise noted.)

SYMBOL	PARAMETER / CONDITIONS	MIN	TYPICAL	MAX	UNITS
VCC1	MODEM SUPPLY VOLTAGE	3.45	3.6	4.5	V
VCC2	RF POWER AMPLIFIER SUPPLY VOLTAGE	3.45	3.6	4.5	V
ICC1	MODEM OFF VCC1 = 3.6V		5		µA
	SLEEP MODE VCC1 = 3.6V		8		mA
	RECEIVE MODE VCC1 = 3.6V		130		mA
	TRANSMIT MODE VCC1 = 3.6V		175		mA
ICC2	MODEM OFF VCC2 = 3.6V		5		µA
	SLEEP MODE VCC2 = 3.6V		5		µA
	RECEIVE MODE VCC2 = 3.6V		5		µA
	TRANSMIT MODE VCC2 = 3.6V	50		725	mA
TWAKEUP	WAKE-UP PULSE WIDTH FROM SLEEPMODE FROM POWER UP	 10 500			mSec
VIL1(NOTE 1)	INPUT VOLTAGE – LOW (EXCEPT FOR WKUP) MODEM ON MODEM OFF	 -0.5	 0	 0.8 0	V
VIH1(NOTE 1)	INPUT VOLTAGE - HIGH (EXCEPT FOR WKUP) MODEM ON MODEM OFF	 2.0	 3.3	 3.7 0.0	V
VIL2(NOTE 2)	INPUT VOLTAGE - LOW (WKUP ONLY) WKUP ONLY	-0.5	0	0.5	V
VIH2(NOTE 2)	INPUT VOLTAGE - HIGH (WKUP ONLY)	3.0		4.5	V
VOL(NOTE 1)	OUTPUT VOLTAGE - LOW (I_{OL} = 1.0mA)			0.78	V
VOH(NOTE 1)	OUTPUT VOLTAGE - HIGH (I_{OH} = -200µA)	2.6	3.3	3.4	V
IOL(NOTE 1)	MAXIMUM SINK CURRENT			-1.0	mA
IOH(NOTE 1)	MAXIMUM SOURCE CURRENT			1.0	mA
VADC	ADC INPUT VOLTAGE ADC READABLE VOLTAGE RANGE ABSOLUTE MAXIMUM INPUT VOLTAGE	 1.5		 5.50 8.50	V
RESADC	ADC RESOLUTION		8		BITS
			24		mV
REFADC	ADC REFERENCE VOLTAGE		2.048		V
DIVADC	ADC DIVIDER RATIO		1:3		
ZADC	ADC INPUT IMPEDANCE		300k		OHMS

NOTE 1 - The specifications apply to all pins on the serial interface connector except for the following pins: GND, VCC1, VCC2 & ADC_IN. All pins have except VCC1, VCC2 and GND are filtered via a 470pF shunt capacitor and a 330 ohm series resistor which affects the sink and source capability of the pin.

NOTE 2 - The WKUP pin is not connected directly to the CPU, it is connected though a resistor to the base of an NPN transistor.

4.5 Mechanical Specifications

4.5.1 Dimensions

5.00 mm x 54.00 mm x 72.91 mm

4.5.2 Weight

Approximately: 27g

4.6 Environmental Specifications

4.6.1 Temperature Range

The temperature is defined as per the CDPD System Specification Version 1.1 part 409, paragraph 5.2.1

Mode	Lower Limit	Upper Limit
Operating (Compliant)	0 Degrees C	+60 Degrees C
Storage	-40 Degrees C	+85 Degrees C

4.6.2 Humidity

CDPD Part 409 paragraph 5.2.2
50 degrees C
40% RH
8 hours

4.6.3 Shock Stability

CDPD Part 409 paragraph 5.2.3.1
Half sine wave, 20g peak acceleration, 7 to 11 ms
3 impact on each of 6 faces

4.6.4 Vibration Stability

CDPD Part 409 par. 5.2.3.2 (non-operational)
Sinusoidal vibration at 1.5g acceleration swept through 5Hz to 500Hz, 0.1 octave/second

4.6.5 Regulatory compliance

FCC title 47, parts 15 (class B) and 22. Resubmission is not required for the changes made in this product, including the changes made to name and part number.

4.6.6 ESD Protection

No ESD protection is provided for the Expedite Wireless IP Modem. Expedite is intended to be used in an OEM application. It is the responsibility of the OEM manufacturer to provide the necessary ESD protection for their application.

4.7 CDPD Part 409 Compliance

The module will meet the CDPD System Specification Part 409, Small Form-Factor Devices.

CDPD Part 409	Specification Parameter	Condition	Upper Limit	Lower limit
7.1.2.2	RX sensitivity in AWGN (Note a: small form factor M-ES)	less than 5% block error rate	-111 dBm	
7.1.2.3	RX sensitivity in Raleigh fading (Note b: small form factor M-ES)	-8 km/hr, 1% ber -50 km/hr, 1% ber -100 km/hr, 1% ber	-98 dBm -100 dBm -101 dBm	
7.2.3	Co-channel interference rejection and delay	8 us delay		17 dB rejection
7.3.3	Adjacent/Alternate channel selectivity	+/-30 kHz from carrier +/-60 kHz from carrier		16 dB 60 dB
7.4.3	Intermodulation spurious response			57 dB
7.5.3	RSSI		+ 6 dB absolute + 3 dB relative	- 6 dB absolute - 3 dB relative
7.6.1.2	Radiated spurious emissions	25 - 70 MHz 70 - 130 MHz 130 - 174 MHz 174 - 260 MHz 260 - 470 MHz 470 - 1000 MHz	-45 dBm -41 dBm -41 to -32 dBm -32 dBm -32 to -26 dBm -21 dBm	
7.6.2.2	Conducted spurious emissions	450 kHz - 2600 MHz 869.01 - 893.07 MHz 824.01 - 848.97 MHz	-47 dBm -80 dBm -60 dBm	
8.1.3	Frequency stability		+2.5 PPM	- 2.5 PPM
8.2.3	Phase noise	1 kHz 10 kHz	-55 dBc/Hz -75 dBc/Hz	
8.3.3	Emission spectrum	adjacent channel alternate channel second alternate channel	-26 dBc -45 dBc -60 dBc / –23dBm (whichever is lower)	
8.4.3	Channel switching time		40 ms	
8.5.3.3	Power stability (PA power levels)		+2 dBm	-4 dBm
8.5.4.3	Switching time requirements – on to off		2 ms	
8.5.5.3	Release time requirements		2 ms	
8.6.1.3	Modulation type		0.5 + 5% 19.2kbps + 50ppm	0.5 – 5% 19.2kbps – 50ppm
8.7.1.3	Radiated harmonic and spurious emissions			43 + 10 log(mean output power in Watts) dB
8.7.2.3	Conducted harmonic and spurious emissions			43 + 10 log(mean output power in Watts) dB

5 INSTALLATION INSTRUCTIONS

Unless the final product satisfies SAR (Specific Absorption Ratio) compliance through separate FCC approval, integration of this module into other products has some requirements which are outlined below.

5.1 Antenna Mounting

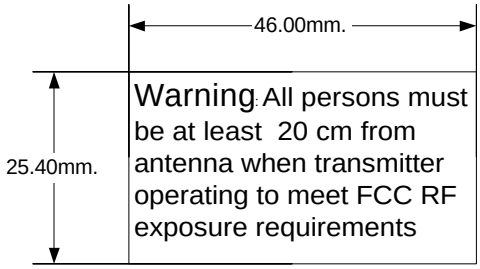
The antenna must be mounted at a location such that no person(s) can come closer than 20 cm (7.9 inches) to the antenna when the transmitter is operating.

5.2 Antenna

This module is limited to operate with an antenna with maximum of 2.15 dBi nominal gain or not to exceed 1.5 Watts ERP for any type of remotely mounted outdoor external antenna.

5.3 Labeling

The following label, visible to all persons exposed to the transmitter, must be provided on the end product unless SAR compliance can be demonstrated:



5.4 User Manual

You must also provide the above warning in the user manual for the end product and also include the following:

Do not substitute any antenna for the one supplied by the manufacturer. You may be exposing person(s) to harmful radiation. contact the supplier or manufacturer for further instruction.

6 PACKAGING REQUIREMENTS

6.1 Shipping Packaging

Packaging shall be appropriate for the shipping method.
If the modem is to leave the ESD controlled environment, it should be packaged in an antistatic bag.

6.2 Labeling

The modem labeling shall include:
Product Label with FCC ID, country of origin, serial number, part number, and FCC compliance statement.