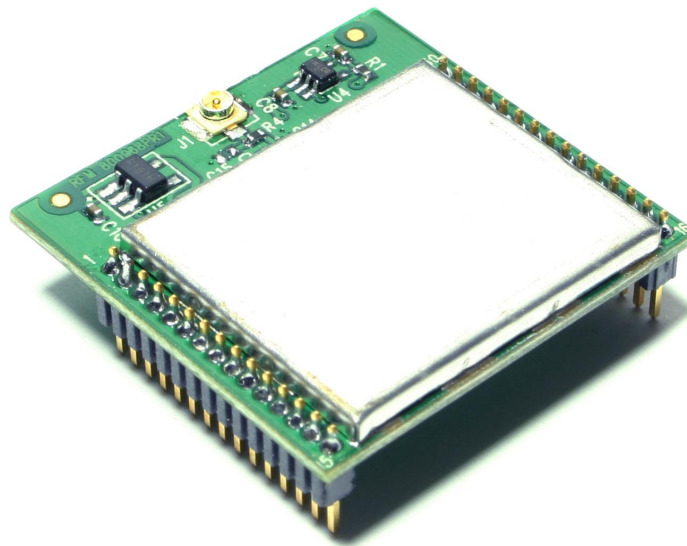




WSN802G Series

802.11g Wireless Sensor Network Modules



Integration Guide

Important Regulatory Information

**RFM Product FCC ID: HSW-WSN802G
IC 4492A-WSN802G**

Note: This unit 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 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 their expense.

The WSN802G has been designed to operate with any dipole antenna of up to 9 dBi of gain, or any patch antenna of up to 12 dBi gain.

See Section 3.10 of this manual for regulatory notices and labeling requirements. Changes or modifications to a WSN802G not expressly approved by RFM may void the user's authority to operate the module.

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1.0 WSN802G Introduction

The WSN802G transceiver module is a low cost, robust solution for 802.11b/g sensor networks. The WSN802G is unique in that it is able to sleep while still remaining a member of an 802.11b/g network. The WSN802G's low active current and very low sleep current makes long life battery operation practical. The WSN802G module includes analog, digital and serial I/O, providing the flexibility and versatility needed to serve a wide range of sensor network applications. The WSN802G module is easy to integrate and is compatible with standard 802.11b/g routers.

802.11b/g Network with WSN802G Sensor Nodes

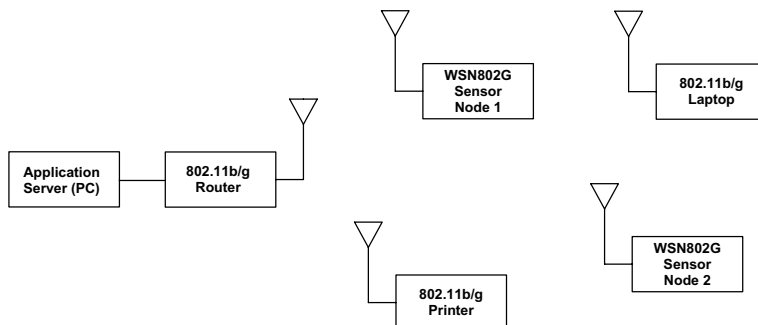


Figure 1.0.1

An example 802.11b/g network with WSN802G sensor nodes is shown in Figure 1.0.1. A sensor network application running on a server or PC communicates with one or more WSN802G sensor nodes through a commercial 802.11b/g router. WSN802G sensor nodes can be used with 802.11b/g routers that are also serving other applications.

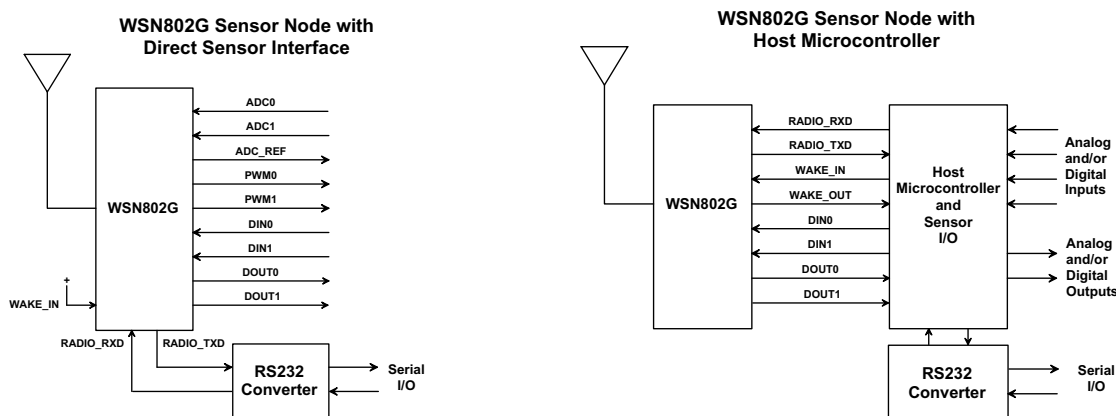


Figure 1.0.2

A WSN802G module is integrated with other components to create a complete sensor node. These components include a host circuit board, a power supply (battery), sensor I/O electronics and/or a host microcontroller, an antenna and a housing. Two common configurations are shown in Figure 1.0.2. Serial data communication between a WSN802G and its host microcontroller requires no protocol formatting. The WSN802G formats data received from its host into UDP packets for RF transmission, and delivers the payload data from received UDP packets to its host. The sensor network application on the server or PC uses a simple protocol to send and receive data from WSN802G sensor nodes, as detailed in Section 4.

1.1 Features

WSN802G modules provide a unique set of features for wireless sensor network applications:

- Compatibility with commercial and industrial 802.11b/g routers
- Low power consumption for long life battery operation including sleep mode
- Full -40 to +85 °C industrial temperature range operation
- Analog and digital I/O plus data and diagnostic UART ports
- Separate data and diagnostic ports
- System/application set up using just two Management Information Blocks (MIBs)
- Full 14 channel 802.11b/g coverage for world wide operation
- FCC, Canadian IC and European ETSI certifications
- Choice of plug-in or solder reflow configurations
- Automatic or manual I/O data reporting

1.2 Applications

WSN802G sensor networks are well suited to applications where IEEE 802.11b/g router compatibility, industrial temperature range operation and long battery life are important. Many applications match these criteria, including:

- Energy Monitoring and Management
- Physical Asset Management
- Cold Chain Data Logging and Food Safety
- Security and Access Control Systems
- Environmental Monitoring
- Many More

2.0 WSN802G Operation

WSN802G operation is designed to support long battery life by allowing the module to stay in sleep mode to the maximum extent possible. Compared to 802.11b/g cards used in notebook and handheld computers, the WSN802G's active current is also very low.

2.1 Active and Sleep Modes

Once the SNMP Server IP address has been set, the default state of the WSN802G is sleep mode. The WSN802G has a dedicated input to switch it from sleep to active mode, WAKE_IN (Pin 26). There are five events that will wake the WSN802G from sleep mode:

- Applying a logic high signal on the WAKE_IN pin
- Expiration of the *AutoReport* timer
- Expiration of Linkup trap timer
- Expiration of the Config trap timer
- Module's SNMP Server IP address has not been set (this will not wake it, it prevents it from sleeping)

The WAKE_IN and *AutoReport* can be enabled/disabled. The Linkup timer sends a keep alive packet to the router every 60 seconds by default. The Config timer cannot be disabled and will generate a Config trap every 10 seconds by default.

When the module wakes to an active state due to either the WAKE_IN pin or the *AutoReport* timer, it remains awake for a time period controlled by the *WakeTimeout* timer. The module returns to sleep mode when the *WakeTimeout* timer expires, subject to the conditions listed below. The *WakeTimeout* timer is held in reset and the module remains in active mode when any of the following events occur:

- A logic high signal is held on the WAKE_IN pin
- A serial byte is received
- An RF packet is sent or received
- Module's SNMP Server IP address has not been set

The *WakeTimeout* feature is used to support scenarios such as a server application parsing the I/O report and sending back a serial string or I/O output change command, or a host processor sending a serial string and waiting for a response.

As discussed in Section 5, the SNMP Server IP address can be set in a short period of time, allowing the module to switch to sleep mode for battery conservation. The SNMP server IP address only needs to be set one time.

A WSN802G module that has an SNMP Server IP Address but is not linked to an 802.11b/g router will cycle between sleep and active mode under the control of the scanning algorithm, even if none of the wake events discussed above are present.

Whenever the module is in active mode, a logic high is asserted on WAKE_OUT (Pin 27). WAKE_OUT can be used to signal an external processor. When the WSN802G is in sleep mode, WAKE_OUT is set to logic low.

2.2 Automatic I/O Reporting

The WSN802G sends an I/O report when one of the following events occur:

- A logic high signal is applied to the WAKE_IN pin
- The *AutoReport* timer fires (module in either active or sleep mode)

2.3 Data Serial Port

The data serial port of the WSN802G supports baud rates from 1.2 to 921.6 kb/s. The following serial port configurations are supported:

- 5, 6, 7 and 8-bit character lengths
- 1 or 2 stop bits
- Even, odd, mark, space or no parity

The default serial port configuration is 9.6 kb/s, 8, N,1. See Section 7.2 for serial port configuration details. Serial port operation is full-duplex. Data is sent and received on the serial port transparently. No protocol formatting is required. The WSN802G includes an acknowledgement and retry mechanism to minimize data loss on RF transmissions. However, the UDP/IP protocol being carried by the RF transmissions does not provide guaranteed end-to-end delivery. The user must make provisions for detecting and re-sending data lost on an end-to-end transmission. The WSN802G is a three-wire interface; hardware flow control will be provided in a future firmware release.

2.4 Analog I/O

The WSN802G includes two 10-bit ADC inputs. Input ADC0 is on Pin 18 and input ADC1 is on Pin 19. Pin 25 provides a full-scale reference voltage to support ratiometric ADC measurements. ADC measurements are triggered and added to the automatic I/O report when a logic high signal is first applied to the WAKE_IN pin or the *AutoReport* timer fires, as discussed in Section 2.2. An ADC reading is also made on the internal buss voltage of the WSN802G and included in the automatic I/O report. These readings can also be retrieved anytime the WSN802G is in active mode using the IO_REPORT application protocol command as discussed in Section 4.1.

The WSN802G also includes an active 16-bit pulse width modulated output, PWM0 (Pin 9). The PWM output is low-pass filtered to provide an analog output voltage with ripple suppressed to 7 bits. External low-pass filtering can be added to further suppress ripple. The full-scale PWM output is referenced to the regulated supply voltage (Pin 24). The PWM output is set using the IO_WRITE_PWM application protocol command, as discussed in Section 4.3.

2.5 Digital I/O

The WSN802G includes two digital inputs, DIN0 (Pin 4) and DIN1 (Pin 11). The states of the DIN pins are captured as part of the automatic I/O report when a logic high signal is applied to the WAKE_IN pin or the *AutoReport* timer fires, as discussed in Section 2.2. These readings can also be retrieved anytime the WSN802G is in active mode using the IO_REPORT application protocol command as discussed in Section 4.1. The WSN802G also includes two digital outputs, DOUT0 (Pin 10) and DOUT1 (Pin 12). The states of the DOUT pins are set using the IO_WRITE_GPIO application protocol command as discussed in Section 4.2.

3.0 WSN802G Hardware

WSN802G Block Diagram

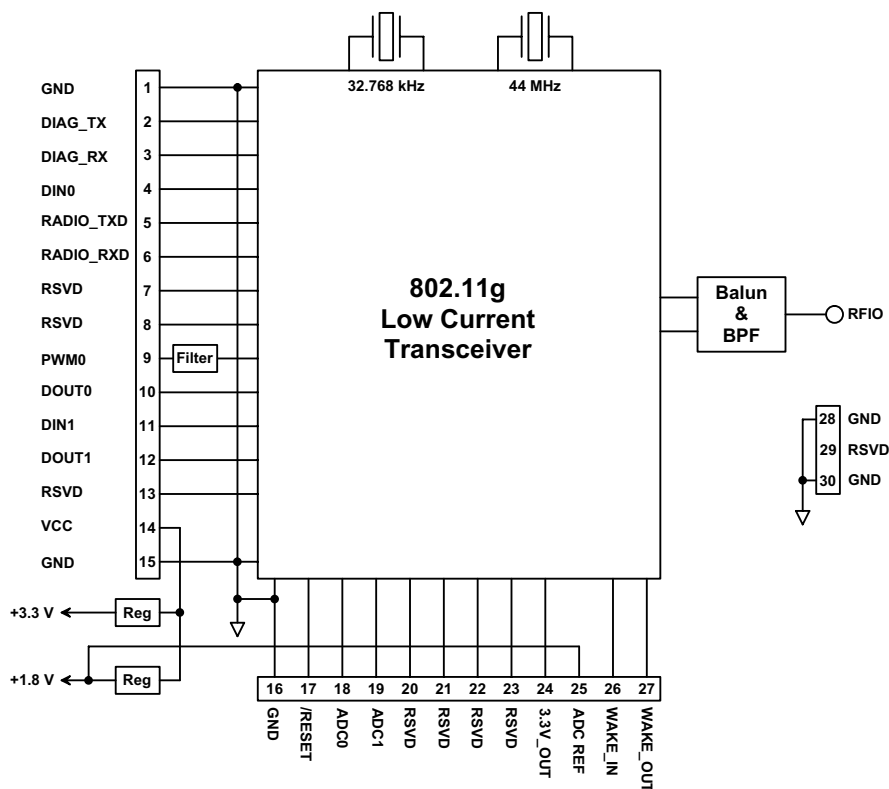


Figure 3.0.1

The WSN802G operates in the international 2.4 GHz ISM band over the frequency range of 2401-2474 MHz, with a nominal RF output power of 10 mW. The WSN802G supports two standard 802.11g RF data rates, 1 and 2 Mb/s. The WSN802G transceiver module provides a variety of hardware interfaces. There are two serial interfaces, one for data and a second for diagnostics. The data port supports standard serial baud rates from 1.2 to 921.6 kb/s, and the diagnostic port operates at a fixed baud rate of 9.6 kb/s. Hardware flow control is not currently implemented on either serial port. The WSN802G includes two 10-bit ADC inputs, a 16-bit PWM (DAC) output, two digital inputs and two digital outputs to support sensor network applications.

The WSN802G is available in two mounting configurations. The WSN802GC is designed for solder reflow mounting, and the WSN802GP is designed for plug-in connector mounting.

3.1 Absolute Maximum Ratings

Rating	Sym	Value	Units
Input/Output Pins Except ADC Inputs		-0.5 to +3.63	V
ADC Input Pins		-0.5 to 1.98	V
Non-Operating Ambient Temperature Range		-40 to +85	°C

Table 3.1.1

3.2 Specifications

Characteristic	Sym	Minimum	Typical	Maximum	Units
Operating Frequency Range		2401		2474	MHz
Spread Spectrum Method		CCK Direct Sequence			
RF Chip Rate		11			Mc/s
RF Data Rates		1 or 2			Mb/s
Modulation Type		BPSK at 1 Mb/s, QPSK at 2 Mb/s			
Number of RF Channels			11		
RF Channel Spacing			5		MHz
Receiver Sensitivity, 8% PER:					
1 Mb/s RF Data Rate			-92		dBm
2 Mb/s RF Data Rate			-90		dBm
RF Transmit Power			10		mW
RF Connector		U.FL Coaxial Connector			
Optimum Antenna Impedance			50		Ω
ADC Input Range		0		1.8	V
ADC Input Resolution			10		bits
ADC Input Impedance		1			M Ω
PWM Output Resolution				16	bits
Data Serial Port Baud Rates		1.2, 2.4, 4.8, 9.6 (default), 19.2, 28.8, 38.4, 57.6, 76.8, 115.2, 230.4, 460.8, 921.6			kb/s
Diagnostic Serial Port Baud Rate			9.6		kb/s
Digital I/O:					
Logic Low Input Level		-0.3		0.7	V
Logic High Input Level		2.24		V _{CC}	V
Input Pull Up/Down Resistor		50		1000	K Ω
Logic Low Output Level		0		0.4	V
Logic High Output Level		2.4		V _{CC}	V
Power Supply Voltage Range	V _{CC}	+3		+3.63	Vdc
Power Supply Voltage Ripple				10	mV _{P-P}
Receive Mode Current				150	mA
Transmit Mode Current				200	mA
Sleep Mode Current			7.5		μ A
WSN802GC Mounting		Reflow Soldering			
WSN802GP Mounting		Socket			
Operating Temperature Range		-40		85	$^{\circ}$ C
Operating Relative Humidity Range, Non-condensing		10		90	%

Table 3.2.1

3.3 Module Interface

Pin	Name	I/O	Description
1	GND	-	Power supply and signal ground. Connect to the host circuit board ground.
2	DIAG_TX	O	Diagnostic serial port output.
3	DIAG_RX	I	Diagnostic serial port input.
4	DIN0	I	Digital input port 0.
5	RADIO_TXD	O	Serial data output from the radio.
6	RADIO_RXD	I	Serial data input to the radio.
7	RSVD	-	Reserved pin. Leave unconnected.
8	RSVD	-	Reserved pin. Leave unconnected.
9	PWM0	O	16-bit pulse-width modulated output 0 with internal low-pass filter. Filter is first-order, with a 159 Hz 3 dB bandwidth, 10K output resistance.
10	DOUT0	O	Digital output port 0.
11	DIN1	I	Digital input port 1.
12	DOUT1	O	Digital output port 1.
13	RSVD	-	Reserved pin. Leave unconnected.
14	VCC	I	Power supply input, +3.0 to +3.63 Vdc.
15	GND	-	Power supply and signal ground. Connect to the host circuit board ground.
16	GND	-	Power supply and signal ground. Connect to the host circuit board ground.
17	/RESET	I	Active low module hardware reset.
18	ADC0	I	10-bit ADC input 0. ADC full scale reading can be referenced to the module's +1.8 V regulated supply.
19	ADC1	I	10-bit ADC input 1. ADC full scale reading can be referenced to the module's +1.8 V regulated supply.
20	RSVD	-	Reserved pin. Leave unconnected.
21	RSVD	-	Reserved pin. Leave unconnected.
22	RSVD	-	Reserved pin. Leave unconnected.
23	RSVD	-	Reserved pin. Leave unconnected.
24	3.3V_OUT	O	Module's +3.3 V regulated supply, available to power external sensor circuits. Current drain on this output should be no greater than 50 mA.
25	ADC_REF	O	Module's +1.8 V regulated supply, used for ratiometric ADC readings. Current drain on this output should be no greater than 5 mA.
26	WAKE_IN	I	Active high interrupt input to wake the module from timer sleep. Can be used to wake module on event, etc.
27	WAKE_OUT	O	Active high output asserted when module wakes from timer sleep. Can be used to wake an external device.
28	GND	-	RF ground for the WSN802GC only. Connect to the host circuit board ground plane.
29	RSVD	-	Reserved pin. Leave unconnected.
30	GND	-	RF ground for the WSN802GC only. Connect to the host circuit board ground plane.

Table 3.3.1

3.4 WSN802G Antenna Connector

A U.FL miniature coaxial connector is provided on both WSN802G configurations for connection to the RFIO port. A short U.FL coaxial cable can be used to connect the RFIO port directly to an antenna. In this case the antenna should be mounted firmly to avoid stressing the U.FL coaxial cable due to antenna mounting flexure. Alternately, a U.FL coaxial jumper cable can be used to connect the WSN802G module to a U.FL connector on the host circuit board. The connection between the host circuit board U.FL connector and the antenna or antenna connector on the host circuit board should be implemented as a 50 ohm stripline. Referring to Figure 3.4.1, the width of this stripline depends on the thickness of the circuit board between the stripline and the groundplane. For FR-4 type circuit board materials (dielectric constant of 4.7), the width of the stripline is equal to 1.75 times the thickness of the circuit board. Note that other circuit board traces should be spaced away from the stripline to prevent signal coupling, as shown in Table 3.4.1. The stripline trace should be kept short to minimize its insertion loss.

Circuit Board Stripline Trace Detail

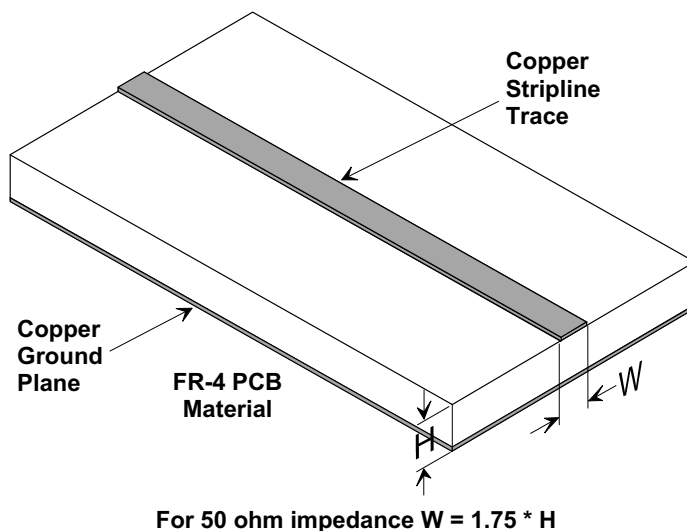


Figure 3.4.1

Trace Separation from 50 ohm Microstrip	Length of Trace Run Parallel to Microstrip
100 mil	125 mil
150 mil	200 mil
200 mil	290 mil
250 mil	450 mil
300 mil	650 mil

Table 3.4.1

3.5 Input Voltage

WSN802G radio modules can be operated from an unregulated DC input (Pin 14) in the range of 3.0 V (trough) to 3.63 V (peak) over the temperature range of -40 to 85°C. *Applying AC, reverse DC, or a DC voltage outside the range given above can cause damage and/or create a fire and safety hazard. Further, care must be taken so logic inputs applied to the radio stay within the voltage range of 0 to 3.3 V. Signals applied to the analog inputs must be in the range of 0 to ADC_REF (Pin 25). Applying a voltage to a logic or analog input outside of its operating range can damage the WSN802G module.*

3.6 ESD and Transient Protection

WSN802G circuit boards are electrostatic discharge (ESD) sensitive. ESD precautions must be observed when handling and installing these components. Installations must be protected from electrical transients on the power supply and I/O lines. This is especially important in outdoor installations, and/or where connections are made to sensors with long leads. *Inadequate transient protection can result in damage and/or create a fire and safety hazard.*

3.7 Interfacing to 5 V Logic System

All logic signals including the serial ports on the WSN802G are 3.3 V signals. To interface to 5 V signals, the resistor divider network shown in Figure 3.7.1 below must be placed between the 5 V signal outputs and the WSN802G signal inputs. The output voltage swing of the WSN802G 3.3 V signals is sufficient to drive 5 V logic inputs. Figure 3.7.1 refers to the DNT500

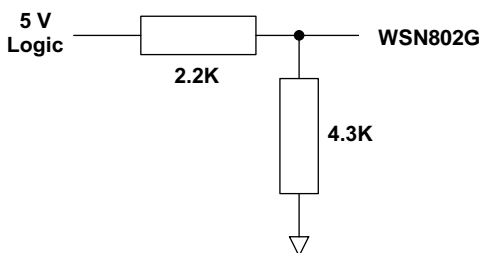


Figure 3.7.1

3.8 Power-On Reset Requirements

When applying power to the WSN802G, the /RESET pin should be held low until the power supply voltage reaches 3.3 volts for 100 milliseconds.

3.9 Mounting and Enclosures

WSN802GC radio modules are mounted by reflow soldering them to a host circuit board. WSN802GP modules are mounted by plugging their pins into a set of mating connectors on the host circuit board. Refer to Section 10.3 and/or the WSN802G Data Sheet for mounting details.

WSN802G enclosures must be made of plastics or other materials with low RF attenuation to avoid compromising antenna performance where antennas are internal to the enclosure. Metal enclosures are not suitable for use with internal antennas as they will block antenna radiation and reception. Outdoor enclosures must be water tight, such as a NEMA 4X enclosure.

3.10 Labeling and Notices

WSN802G FCC Certification - The WSN802G hardware has been certified for operation under FCC Part 15 Rules, Section 15.247. *The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.*

WSN802G FCC Notices and Labels - *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.*

A clearly visible label is required on the outside of the user's (OEM) enclosure stating "Contains FCC ID: HSW-WSN802G."

WARNING: This device operates under Part 15 of the FCC rules. Any modification to this device, not expressly authorized by RFM, Inc., may void the user's authority to operate this device. Canadian Department of Communications Industry Notice - IC: 4492A-WSN802G

This apparatus complies with Health Canada's Safety Code 6 / IC RSS 210.

ICES-003

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of Industry Canada.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de Classe B prescrites dans le reglement sur le brouillage radioelectrique edicte par Industrie Canada.

ETSI EN 300 328

The WSN802G module has passed ETSI EN 300 328 testing conducted by an independent test laboratory.

4.0 Application Protocol

In most applications, the auto-reporting functions of the WSN802G will be used to send data from nodes to the application removing the need for the application to poll nodes. However, applications can read and write data to and from WSN802G nodes if desired. WSN802G modules only accept commands over the air; commands cannot be entered through either the data or diagnostic serial ports. Obviously, WSN802G modules must be in active mode (awake) to receive commands. The WSN802G supports this type of operation through use of the auto-reporting function and the *AutoReport* and *WakeTimeout* timers. For example, a WSN802G module has been configured to wake up once every minute. When the module wakes up, it will send its I/O report. While the data may not be of interest, it will serve as a notification to the application that the module is awake. Setting the *WakeTimeout* timer to 2 seconds will keep the module awake giving the application 2 seconds to send any application commands to the module. The module will remain awake past the 2 seconds if commands are being received or processed. Once the application commands are completed the module will return to sleep immediately if the *WakeTimeout* time has elapsed. Typically, this mode will be used when the application needs to write data to the WSN802G module.

All commands and responses between a server and its WSN802G clients are formatted as UDP/IP packets. The IPv4 UDP/IP packet format is shown in Figure 4.0.1 below. WSN802G commands and responses are carried in the UDP datagram payload area. In the text below, commands and responses will be referred to as datagrams with the understanding they are the payload of a UDP datagram. Automatically generated I/O reports from the WSN802G module due to timeouts or event interrupts take the form of the I/O_Report application command.

Byte 0		Byte 1	Byte 2		Byte 3
IP Version	Header Length	Type of Service	Total Length		
ID			Flags	Fragment Offset	
Time to Live		Protocol	Header Checksum		
Source IP Address					
Destination IP Address					
Source Port			Destination Port		
UDP Length			Checksum		
Payload (Application Command)					

Figure 4.0.1

WSN802G modules only accept application commands from and send application command data/replies to the IP address of the server running their sensor application. As shown in Figure 4.0.2 below, WSN802G application protocol datagrams use a standard header beginning with a protocol identifier to discriminate WSN802G protocol messages from other message types. Datagrams are in 32-bit, big-endian format. The standard header fields are:

- Protocol Identifier:** Unique identifier for all WSN messages, 0x52464D49
- Opcode:** Code indicating the type of command or response
- Transaction ID:** This is an incrementing transaction reference counter. Each end of the link must keep its own counter for transactions that it originates. The most significant bit of the transaction ID will be set for all transactions that the server originates.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Opcode		Transaction ID	
Data (variable length)			

Figure 4.0.2

The WSN802G application protocol commands are listed in Table 4.0.1 below. The port number that the module sends and receives application messages on is defined by the *SensorServerPortNum* parameter, as discussed in Section 7.2. A WSN802G module will accept messages specifically addressed to it, or that are broadcast (addressed to all modules). If a command is received through a broadcast, the WSN will reply with a broadcast.

Opcode	Direction	Description
0x0000	Server-to-Module	IO_REPORT_REQUEST
0x0001	Module-to-Server	IO_REPORT
0x0002	Server-to-Module	IO_WRITE_GPIO
0x0003	Server-to-Module	IO_WRITE_PWM
0x0004	Module-to-Server	IO_WRITE_REPLY
0x0005	Bidirectional	SERIAL_DATA

Table 4.0.1

4.1 I/O Report Request

The IO_REPORT_REQUEST datagram is used to request current I/O values, as shown in Figure 4.1.1.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Opcode = 0x0000		Transaction ID = varies	

Figure 4.1.1

The module responds to an IO_REPORT_REQUEST with an IO_REPORT

4.2 I/O Report

The IO_REPORT datagram is used to report current I/O values, as shown in Figure 4.2.1.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Timestamp High Bytes			
Timestamp Low Bytes			
Opcode = 0x0001		Transaction ID = varies	
ADC0		ADC1	
VOLT		RSSI	
DIN			

Figure 4.2.1

The fields specific to this datagram are:

- ADC0:** Current ADC0 reading, only the low 10 bits are significant
- ADC1:** Current ADC1 reading, only the low 10 bits are significant
- VOLT:** Current module voltage reading, only the low 10 bits are significant
- RSSI:** RSSI of this IO_REPORT message, only the low 10 bits are significant
- DIN:** Current digital input states, only bit positions 0 (DIN0) and 1 (DIN1) are valid

The module generates an IO_REPORT based on the AutoReportInterval (see Section 7.4) and in response to an IO_REPORT_REQUEST.

4.3 I/O Write GPIO

The IO_WRITE_GPIO datagram is used by the server to set module outputs, as shown in Figure 4.3.1.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Opcode = 0x0002		Transaction ID = varies	
DOUT			

Figure 4.3.1

The fields specific to this datagram are:

- DOUT:** Digital output settings, only bit positions 2 (DOUT0) and 3 (DOUT1) are valid. Setting a bit to 1 sets the DOUT to 3.3 V, setting a bit to 0 sets the DOUT to 0 V.

The module responds to an IO_WRITE_GPIO with an IO_WRITE_REPLY.

4.4 I/O Write PWM

The IO_WRITE_PWM datagram is used by the server to set the PWM0 output , as shown in Figure 4.4.1.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Opcode = 0x0003		Transaction ID = varies	
PWM0		Reserved	

Figure 4.4.1

The fields specific to this datagram are:

- PWM0:** PWM0 setting, 16-bit unsigned value

The module responds to an IO_WRITE_PWM with an IO_WRITE_REPLY.

4.5 I/O Write Reply

An IO_WRITE_REPLY is sent by the WSN802G to confirm receipt of an IO_WRITE_GPIO, IO_WRITE_PWM or SERIAL_DATA datagram, as shown in Figure 4.5.1.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Opcode = 0x0004		Transaction ID = varies	
Status			

Figure 4.5.1

The field specific to this datagram is:

Status: 0x0000 = successful, 0x0001 = failed

4.6 Serial Data

The SERIAL_DATA datagram shown in Figure 4.6.1 is used by the sensor application on the server to send or receive WSN802G serial data. Note that data sent or received on the WSN802G serial port is unformatted.

Byte 0	Byte 1	Byte 2	Byte 3
WSN802G Protocol Identifier = 0x52464D49			
Opcode = 0x0005		Transaction ID = varies	
Serial Data, 0-256 bytes			

Figure 4.6.1

The field specific to this datagram is:

Serial Data: Serial data, 0-256 bytes

Whenever the module is in active mode and receives a string on its serial port, it sends a SERIAL_DATA message to its server. If the module receives a SERIAL_DATA message, it will output the received data on its serial port.

5.0 IP Address Discovery Protocol

The WSN802G module supports a separate UDP client port that provides a discovery protocol. The discovery protocol is used to find IP addresses of modules in a network when the IP addresses have been assigned by a DHCP server. The discovery protocol is also used to set the module's SNMP Server IP address which enables module commissioning. This protocol uses port 24776. The discovery protocol datagrams are shown in Table 6.0.1.

Opcode	Direction	Description
0x0071	Server-to-Module	IP_HUNT_QUERY
0x0072	Module-to-Server	IP_HUNT_REPLY

Table 6.0.1

Since the IP addresses of potential recipients may not be known, both query and reply messages are sent as UDP broadcasts. UDP broadcasts are not routed, so only nodes on the same network segment as the sender will respond. All nodes that hear an IP_HUNT_QUERY will respond with an IP_HUNT_REPLY. Ordinarily these commands are only used to initially commission a module. Since a WSN802G module must be in active mode to hear a command, an un-commissioned module stays in active mode until its Primary SNMP server address has been set.

5.1 IP Hunt Query

The IP_HUNT_QUERY datagram shown in Figure 5.1.1 is broadcast by a commissioning server to discover WSN802G modules:

Byte 0	Byte 1	Byte 2	Byte 3
I	P	h	u
n	t	e	r
Opcode = 0x0071		Primary SNMP Server IP Address [31:16]	
Primary SNMP Server IP Address [15:0]		Secondary SNMP Server IP Address [31:16]	
Secondary SNMP Server IP Address [15:0]			

Figure 5.1.1

The fields specific to this datagram are:

SNMP Server Address: The Primary and Secondary SNMP server address fields inform WSN802G modules of the SNMP server addresses to solicit for configuration parameter updates (destination addresses for Config traps). If either or both server address fields are set to 0.0.0.0, a module hearing the message will retain its current SNMP server setting for the respective field(s). The default IP addresses for the Primary SNMP server is 0.0.0.0. The default IP address for the Secondary SNMP server is 192.168.3.200. The Primary SNMP Server IP address must be set to a different value to allow the module to enter normal sleep mode.

5.2 IP Hunt Reply

The IP_HUNT_REPLY datagram shown in Figure 5.2.1 is sent by a module in response to an IP_HUNT_QUERY command:

Byte 0	Byte 1	Byte 2	Byte 3
I	P	h	u
n	t	e	r
Opcode = 0x0072		MAC Address [47:31]	
MAC Address [30:0]			
IP Address			
Subnet Mask			
Device Code = 0x0102		Hardware Version	
Firmware Version			

Figure 5.2.1

The fields specific to this datagram are:

MAC Address:	MAC address of the module
IP Address:	IP address of the module
Subnet Mask:	Subnet mask of the module
Device Code:	Unique WSN802G device code - 0x0102
Hardware Version:	Hardware version of the module
Firmware Version:	Firmware version in the module

6.0 SSID and Security Keys

WSN802G modules support three SSID and security key pairs. A channel number is also specified for each SSID/security key pair. SSID and security keys are scanned in priority order. If the entry 1 is not found, entry 2 will be scanned, and then entry 3. To allow the recovery of a module with an unknown configuration, entry 3 is permanently mapped to:

SSID	Security Key	Channel
WSN-COMMISSION	Key corresponding to passphrase "RFM-WIRELESS"	11

Table 6.7.1

SSID/security key pairs 1 and 2 are user configurable.

6.1 Router Scanning

To establish an 802.11b/g router connection, WSN802G modules use the following scanning method:

Attempt 1: Node scans SSID/Key/Channel 1 for up to *MaxScanInterval*

Attempt 1: Node scans SSID/Key/Channel 2 for up to *MaxScanInterval*

Attempt 1: Node scans SSID/Key/Channel 3 for up to *MaxScanInterval*

Attempt 2: Node scans SSID/Key/Channel 1 for up to *MaxScanInterval*

Attempt 2: Node scans SSID/Key/Channel 2 for up to *MaxScanInterval*

Attempt 2: Node scans SSID/Key/Channel 3 for up to *MaxScanInterval*

Repeat the scan sequence above for up to *NumOfRetry* attempts

Module sleeps for *RetryInterval*

If commissioned, the entire scan sequence and sleep interval above is repeated until an 802.11b/g router or access point is found.

If a module loses connection to its wireless router/access point, it uses the same scanning method to attempt to reconnect.

7.0 Module Configuration

The WSN802G is configured through SNMP commands sent over the wireless link in response to SNMP configuration requests from the module. The default setting has the module issuing Config Traps every 10 seconds. The Config Traps are sent to the SNMP server address sent in the IPHunter device discovery communications. The interval between Config Traps is one of the configuration parameters. The less frequently Config Traps are issued by the WSN802G module, the longer the battery life will be but the longer it takes to change the module's configuration.

The WSNConfig utility included with the developer's kit was designed to operate as a commissioning utility for the WSN802G. Alternatively, a third party SNMP server or utility may be used to serve the same function.

The WSNConfig utility allows for each node to be configured independently or as a whole. Individual settings may be configured or a list of configuration parameters can be queued for transmission when the node or nodes wake up and issue the Config Trap.

The configuration parameters for the WSN802G can be divided into two main types: System Configuration Parameters; and Application Configuration Parameters. To simplify the configuration process, separate SNMP Management Information Blocks (MIBs) have been created. The System Configuration Parameters are primarily concerned with the 802.11b/g configuration. The Application Configuration Parameters are primarily concerned with the serial port and I/O configuration, including sleep and wake times.

7.1 SNMP Traps

The WSN802G uses two periodic SNMP traps to control signaling. The port numbers used for SNMP are 162 for traps and 161 for SNMP commands.

The Linkup trap is a message sent periodically by the module to maintain its association with its 802.11b/g router. No information is conveyed, just "I'm here". The period of the Linkup trap is set by the *LinkupTrapInterval* system parameter. For compatibility with the majority of 802.11b/g routers, the default period is 60 seconds.

The Config trap is a message sent periodically by a WSN802G to poll the SNMP server to see if it has any commands waiting for it. After sending the trap, the module remains awake for a period of two seconds in order to allow the server to send it commands. The period of the Config trap is set by the *ConfigTrapInterval* system parameter. The default value is once every 10 seconds. Because Config trap activity requires a significant amount of energy to execute, for battery-powered deployments the user should set this interval to once an hour or a few times a day to conserve battery life. At the end of the configuration trap, the server should send a SET_PARAM request to the *ConfigComplete* register to indicate it has no more commands to send. This allows the module to go back to sleep mode immediately, rather than remaining in active mode for rest of the configuration window.

7.2 SNMP Management Information Blocks

The WSN802G supports two Simple Network Management Protocol (SNMP) Management Information Blocks (MIBs) to hold module parameters: one for system parameters, and one for application parameters, as detailed in Sections 7.3 and 7.4 below. The parameters in both MIBs can be read or updated using SNMP and Config Trap as discussed in Section 7.3, or with RFM's *WSNConfig* utility. These parameters are stored in the System MIB.

7.3 System Configuration Parameters

Table 7.3.1 lists the system configuration parameters required for WSN802G module commissioning. These parameters are stored in the System MIB.

Parameter	OID	Type	RW	Description	Default
PreferredSSID1	1.3.6.1.4.1.28295.1.1.4.5.1.2.1	OCTET-STRING	RW	First of two user defined SSIDs (highest priority). The third SSID is fixed to a preset commissioning SSID.	WSN-Default
PreferredSSID2	1.3.6.1.4.1.28295.1.1.4.5.1.2.2	OCTET-STRING	RW	Second user defined SSIDs.	WSN-Default
PreferredSSID3	1.3.6.1.4.1.28295.1.1.4.5.1.2.3	OCTET-STRING	RW	SSID reserved for commissioning.	WSN-Default
PreferredSSIDChannelNo1	1.3.6.1.4.1.28295.1.1.4.5.1.3.1	INT32	RW	Channel number for SSID1	1
PreferredSSIDChannelNo2	1.3.6.1.4.1.28295.1.1.4.5.1.3.2	INT32	RW	Channel number for SSID2	6
PreferredSSIDChannelNo3	1.3.6.1.4.1.28295.1.1.4.5.1.3.3	INT32	R	Channel number for SSID3	11
PreferredSSIDPsKey1	1.3.6.1.4.1.28295.1.1.2.10.0	OCTET-STRING	W	Preshared security key for SSID1	-
PreferredSSIDPsKey2	1.3.6.1.4.1.28295.1.1.2.11.0	OCTET-STRING	W	Preshared security key for SSID2	-
PreferredSSIDPsKey3	1.3.6.1.4.1.28295.1.1.2.12.0	OCTET-STRING	-	Preshared security key for SSID3	-
ApPskPassphrase1	1.3.6.1.4.1.28295.1.4.5.1.7.1	OCTET-STRING	W	PSK preshared passphrase for SSID1	WSN-PASSWORD
ApPskPassphrase2	1.3.6.1.4.1.28295.1.4.5.1.7.2	OCTET-STRING	W	PSK preshared passphrase for SSID2	WSN-PASSWORD
ApPskPassphrase3	1.3.6.1.4.1.28295.1.4.5.1.7.3	OCTET-STRING	W	PSK preshared passphrase for SSID3	WSN-PASSWORD
ApWepKeyId1	1.3.6.1.4.1.28295.1.1.4.5.1.4.1	INT32	W	WEP Key ID for SSID #1 (0..3)	1
ApWepKeyId2	1.3.6.1.4.1.28295.1.1.4.5.1.4.2	INT32	W	WEP Key ID for SSID #2 (0..3)	2
ApWepKeyId3	1.3.6.1.4.1.28295.1.1.4.5.1.4.3	INT32	W	WEP Key ID for SSID #3 (0..3)	3
ApWepKeyLen1	1.3.6.1.4.1.28295.1.1.4.5.1.5.1	INT32	W	WEP Key length (5..13) for SSID #1 (5..13)	
ApWepKeyLen2	1.3.6.1.4.1.28295.1.1.4.5.1.5.2	INT32	W	WEP Key length (5..13) for SSID #2 (5..13)	
ApWepKeyLen3	1.3.6.1.4.1.28295.1.1.4.5.1.5.3	INT32	W	WEP Key length (5..13) for SSID #3 (5..13)	

Table 7.3.1

Parameter	OID	Type	RW	Description	Default
ApWepKeyVal1	1.3.6.1.4.1.28295.1.1.4.5.1.61	OCTET-STRING	W	WEP Key value for SSID #1	-
ApWepKeyVal2	1.3.6.1.4.1.28295.1.1.4.5.1.62	OCTET-STRING	W	WEP Key value for SSID #2	-
ApWepKeyVal3	1.3.6.1.4.1.28295.1.1.4.5.1.63	OCTET-STRING	W	WEP Key value for SSID #3	-
WepAuthMode1	1.3.6.1.4.1.28295.1.1.4.5.1.81	INT32	RAW	WEP authorization mode (1..2) for SSID #1 1 = open 2 = shared	1
WepAuthMode2	1.3.6.1.4.1.28295.1.1.4.5.1.82	INT32	RAW	WEP authorization mode (1..2) for SSID #1 1 = open 2 = shared	1
WepAuthMode3	1.3.6.1.4.1.28295.1.1.4.5.1.83	INT32	RAW	WEP authorization mode (1..2) for SSID #1 1 = open 2 = shared	1
IsStaticIP	1.3.6.1.4.1.28295.1.1.3.4.0	INT32	RAW	Set to 0 for DHCP 1 for Static IP	0
MacAddress	1.3.6.1.4.1.28295.1.1.3.5.0	OCTET-STRING	RAW	MAC address	0x003066500000
IPAddress	1.3.6.1.4.1.28295.1.1.3.1.0	SNMP-IP	RAW	IP address	N/A
SubnetMask	1.3.6.1.4.1.28295.1.1.3.2.0	SNMP-IP	RAW	IP subnet mask	N/A
GatewayIPAddress	1.3.6.1.4.1.28295.1.1.3.3.0	SNMP-IP	RAW	IP gateway address	0x00000000
PrimaryDnsIpAddress	1.3.6.1.4.1.28295.1.1.3.7.0	SNMP-IP	RAW	Primary DNS IP address	0x00000000
SecondaryDnsIpAddress	1.3.6.1.4.1.28295.1.1.3.8.0	SNMP-IP	RAW	Secondary DNS IP address	0x00000000
SNMPsvrAddress	1.3.6.1.4.1.28295.1.1.4.3.0	SNMP-IP	RAW	Primary SNMP manager server address	0xC0A803C8 (192.168.3.200)
BkupSNMPsvrAddress	1.3.6.1.4.1.28295.1.1.4.4.0	SNMP-IP	RAW	Secondary SNMP manager server address	0xC0A803C8 (192.168.3.200)

Table 7.3.1 (continued)

Parameter	OID	Type	RW	Description	Default
LinkupTrapInterval	1.3.6.1.4.1.28295.1.1.4.8.0	INT32	R/W	Sets the Linkup trap period (time between keep-alive packets), in units of ticks (1/131072 s)	0x000C0F30 (60s)
ConfigTrapInterval	1.3.6.1.4.1.28295.1.1.4.7.0	INT32	R/W	Sets the Config trap period (time between checks for configuration commands), in ticks (1/131072 s)	0x0002088 (10s)
RebootNode	1.3.6.1.4.1.28295.1.1.1.6.0	INT32	R/W	Forces a cold reboot	
BatteryWarningLevel	1.3.6.1.4.1.28295.1.1.1.8.0	INT32	R/W	Battery level below which a Battery Warning trap will be sent (0 .. 1023)	0x00000000
BatteryStandbyLevel	1.3.6.1.4.1.28295.1.1.1.9.0	INT32	R/W	Battery level below which the node will switch to standby (0..1023)	0x000003FF
BatteryReadFreq	1.3.6.1.4.1.28295.1.1.1.10.0	INT32	R/W	Sets the interval the OS will check the battery voltage in trap intervals	0x00 (Disabled)
FwUpdateIp	1.3.6.1.4.1.28295.1.1.6.1.0	SNMP-IP	R/W	IP address of server to obtain firmware update	0x00000000
FwUpdatePort	1.3.6.1.4.1.28295.1.1.6.2.0	INT32	R/W	Port number of server to obtain firmware update	
FwUpdateNeeded	1.3.6.1.4.1.28295.1.1.6.3.0	INT32	W	Write 4359 to initiate a firmware update.	
ScanType	1.3.6.1.4.1.28295.1.1.2.1	INT32	R/W	Active = 0, Passive = 1	0
RestoreFactoryCfg	1.3.6.1.4.1.28295.1.1.1.4.0	INT32	R/W	Write any value to restore factory configuration	
MaxActiveScanTime	1.3.6.1.4.1.28295.1.2.1.10.0	INT32	R/W	Sets the amount of time the module will look for an access point (default 150 ms)	0x96 (150)
ConfigComplete	1.3.6.1.4.1.28295.1.1.4.6.0	INT32	R/W	Write 1 to this to signal the radio to go back to standby at the end of a Config trap	
MulticastFilterOn	1.3.6.1.4.1.28295.1.2.2.6.0	INT32	R/W	Enables/disables multicast packet filtering	0x00 (Off)

Table 7.3.1 (continued)

7.4 Application Configuration Parameters

Table 7.4.1 lists the application configuration parameters. These parameters are stored in the Application MIB.

Parameter	OID	Type	R/W	Description	Default
SensorName	1.3.6.1.4.1.32345.88.1.1.0	OCTET-STRING	R/W	User-assignable name for the sensor. For example, "Util Room".	"WSN sensor"
SensorServerIPAddress	1.3.6.1.4.1.32345.88.1.3.0	SNMP-IP	R/W	IP address of server to send UDP sensor data re-ports.	0xC0A803C8 192.168.3.200
SensorServerPortNum	1.3.6.1.4.1.32345.88.1.4.0	GAUGE32	R/W	Port number to send UDP sensor data reports.	8255
AutoReportInterval	1.3.6.1.4.1.32345.88.1.2.0	GAUGE32	R/W	Interval at which the sensor will send periodic re-ports. Parameter scaling is 1 ms/count.	0x1388 (5 s)
WakeOutPredelay	1.3.6.1.4.1.32345.88.1.5.0	GAUGE32	R/W	Duration for which the WAKE_OUT pin should turn on to activate an external user circuit prior to the rest of radio module waking up.	0x0A (10 ms)
WakeOutPostdelay	1.3.6.1.4.1.32345.88.1.6.0	GAUGE32	R/W	Duration for which the WAKE_OUT pin should turn on to activate an external user circuit SUBSEQUENT to the rest of radio module waking up.	0x0A (10 ms)
WakeTimeout	1.3.6.1.4.1.32345.88.1.7.0	GAUGE32	R/W	Duration of inactivity after which the sensor will go back to sleep after being awoken, in milliseconds.	0x96 (150 ms)
Reserved	1.3.6.1.4.1.32345.88.1.8.0	N/A	N/A	N/A	N/A
GPIO_In	1.3.6.1.4.1.32345.88.2.1.0	GAUGE32	R/W	Bitmask of GPIO input values (read-only). Only bits corresponding to GPIOs set as inputs will be valid.	-
GPIO_Out	1.3.6.1.4.1.32345.88.2.2.0	GAUGE32	R/W	Bitmask of GPIO output values. Only bits corresponding to GPIOs set as outputs have any effect.	0x00000000
ADC_Values	1.3.6.1.4.1.32345.88.2.3.0	INT32	R	Array of last ADC readings, 0..1, in format 00000000000000000000000000000000, where y = ADC1 and x = ADC0, 10-bit readings right registered	-
BattRSSI_Values	1.3.6.1.4.1.32345.88.2.4.0	GAUGE32	R/W	Current battery and RSSI readings, in format 00000000000000000000000000000000, where y = Battery voltage and x = last RSSI, 10-bit readings	-
PWM_Value	1.3.6.1.4.1.32345.88.2.5.0	GAUGE32	R/W	PWM0 setting, in format: 00000000000000000000000000000000, where b = PWM0	b =00000000000000000000
DHCPRenewalInterval	1.3.6.1.4.1.32345.88.1.12.0	GAUGE32	R/W	Sets DHCP renewal interval during wake periods	0xA8C0 (12 hr)

Table 7.4.1

Parameter	OID	Size in Bytes	R/W	Description	Default
SerialDivisor	1.3.6.1.4.1.32345.88.3.1.0	GAUGE32	R/W	Serial divisor for the main serial port. Baud rate = 460800 / SerialDivisor	0x30 (9600 b/s)
SerialCharFormat	1.3.6.1.4.1.32345.88.3.2.0	GAUGE32	R/W	Data serial port character format. 0 = 5 bits 1 = 6 bits 2 = 7 bits 3 = 8 bits	0x03 (8 bits)
SerialStopBits	1.3.6.1.4.1.32345.88.3.3.0	GAUGE32	R/W	Data serial port stop bits 0 = 1 stop bit 1 = 2 stop bits	0x00 (1 stop bit)
SerialParity	1.3.6.1.4.1.32345.88.3.4.0	GAUGE32	R/W	Data serial port Parity setting. 0 = odd parity 4 = no parity 1 = even parity 2 = mark parity 3 = space parity	0x04 (no parity)
SerialRXTimeout	1.3.6.1.4.1.32345.88.3.5.0	GAUGE32	R/W	Receive timeout for the data serial port, in milliseconds.	0x20 (32 ms)
SerialFlowControl	1.3.6.1.4.1.32345.88.3.6.0	GAUGE32	R/W	Enables use of GPIO4/5 as RTS/CTS pins for serial flow control. 0 = disabled, 1 = enabled.	0 (no flow control)
DiagDivisor	1.3.6.1.4.1.32345.88.3.7.0	GAUGE32	R/W	Serial divisor for the diagnostic serial port. Baud rate = 460800 / SerialDivisor	0x04 (115200 b/s)
DiagEnable	1.3.6.1.4.1.32345.88.3.8.0	GAUGE32	R/W	Enables output of debugging trace information on the diagnostic port.	0x00
HardwareRevision	1.3.6.1.4.1.32345.88.1.9.0	OCTET-STRING	R	Revision code of the hardware. "00" = Rev A	0x3030
FirmwareRevision	1.3.6.1.4.1.32345.88.1.10.0	OCTET-STRING	R	Revision code of the firmware.	
FirmwareBuildDate	1.3.6.1.4.1.32345.88.1.11.0	OCTET-STRING	R	Build date and timestamp of the module firmware	

Table 7.4.1 (continued)

8.0 WSN802GDK Developer's Kit



Figure 8.1.1

8.1 WSN802GDK Kit Contents

- One WSN802GP transceiver module installed in a developer board with one U.FL jumper cable
- One patch antenna and one dipole antenna with MMCX to SMA-R adaptor cable
- One 9 V wall-plug power supply, 120/240 VAC, for developer board power, and one 9 V battery
- One RJ-45/DB-9F cable assembly, one RJ-11/DB-9F cable assembly and one A/B USB cable
- One pre-configured NETGEAR WGR614 Wireless-G Router with wall-plug power supply and Ethernet cable
- One WSN802GDK documentation and software CD

8.2 Additional Items Needed

- One PC with Microsoft Windows XP or Vista Operating System.

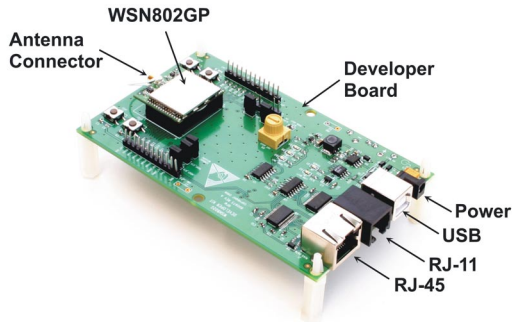


Figure 8.3.1

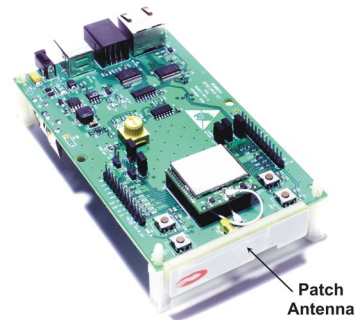


Figure 8.3.2

8.3 Developer Kit Assembly and Testing

Note: the NETGEAR WGR614 router has been preconfigured for use with the WSN802GDK developer's kit. *Do not reconfigure the router.*

1. Observe ESD precautions when handling the WSN802GDK developer board. Install an AC plug on the 9 V developer board power supply. Plug the power supply cable into the developer board power connector. See Figure 8.3.1.
2. Referring to Figures 8.3.1 and 8.3.2, install the patch antenna on the developer board antenna connector. The antenna “snaps” onto the connector with moderate pressure. Plug the 9 V power supply in.
3. If using a PC with WiFi, connect the NETGEAR wall-plug power supply cable to the NETGEAR router and plug the power supply in. No other connections to the router are required. Confirm the PC is configured for DHCP. Open the *Wireless Network Connection* dialog box on the PC. The NETGEAR router will be operating on channel 11 with an SSID of WSN-Default in secure mode. The security passphrase to allow router access is WSN-PASSWORD. Establish a wireless connection to the router.
4. If using a PC without WiFi, connect the Ethernet cable between the PC and one of the LAN ports on the NETGEAR router. Confirm the PC is configured for DHCP. Connect the NETGEAR wall-plug power supply cable to the NETGEAR router and plug the power supply in.
5. Copy WSNConfig.exe and WSNApp.exe from the *Programs* folder on the kit CD to a convenient folder on the PC. These programs run using ordinary Window's resources and do not require any framework installations, registry entries, etc., to run.

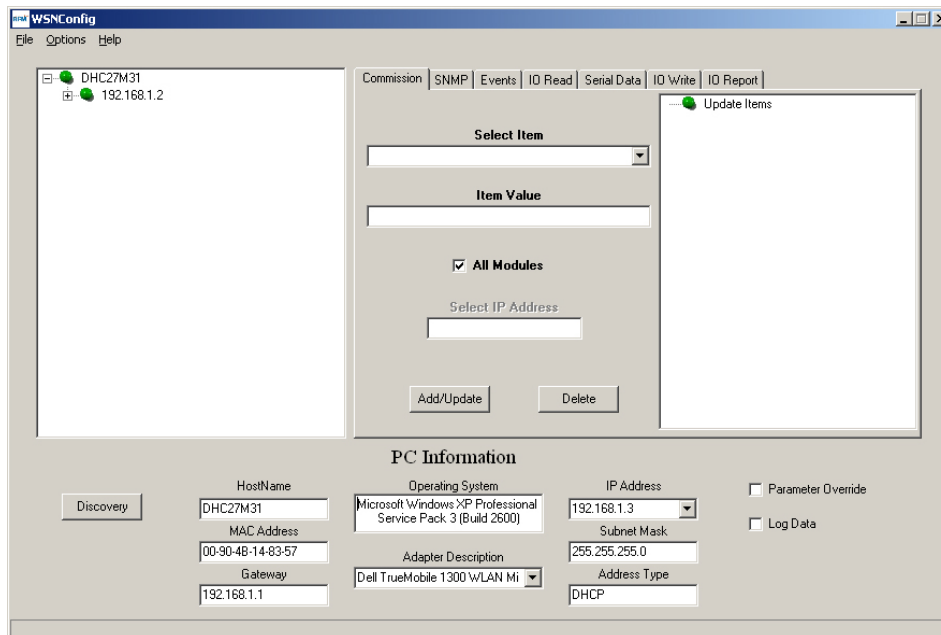


Figure 8.3.3

6. Start the WSNConfig.exe program. Click on the WSNConfig.exe *Discovery* button. In a few moments the IP address of the WSN802G module will be displayed near the top of the left hand text box on the WSNConfig window, as shown in Figure 8.3.3.

7. Select *Sensor Server IP Address* from the *Select Item* drop-down box on the *WSNConfig.exe Commission* tab. Enter the IP Address from the *PC Information* area in the *Item Value* text box. Then click the *Add/Update* button. See Figure 8.3.4. This action configures the WSN802G module to send its periodic I/O report data to the PC running *WSNConfig.exe*.

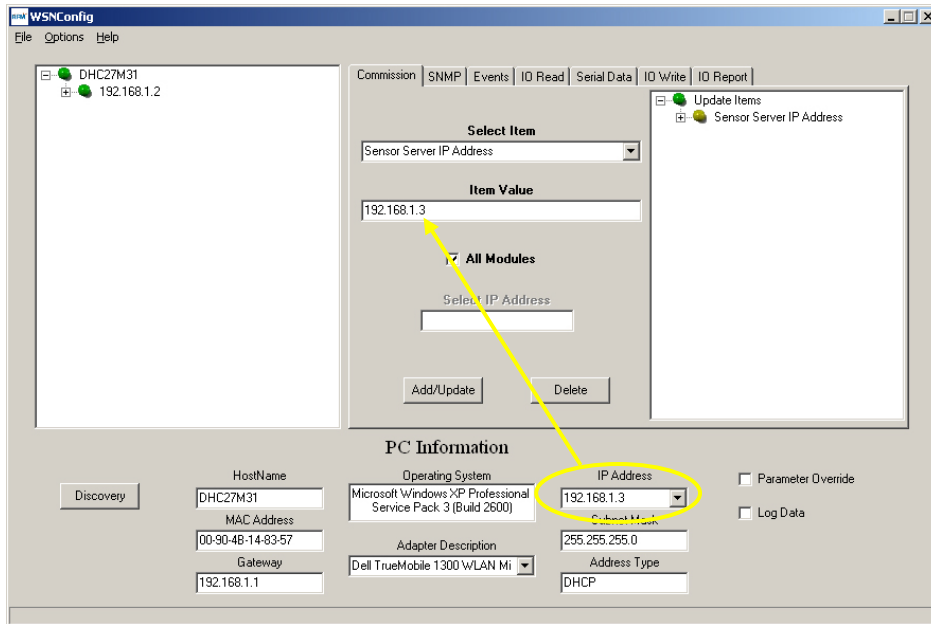


Figure 8.3.4

8. Start *WSNApp.exe*. Data will automatically begin filling the charts at a 10 s update interval, with data first appearing 20 to 30 s after starting the program. Adjusting the pot on the developer board can be observed in the Pot (ADC0) chart, as shown in Figure 8.3.5. The developer kit is now ready for use.

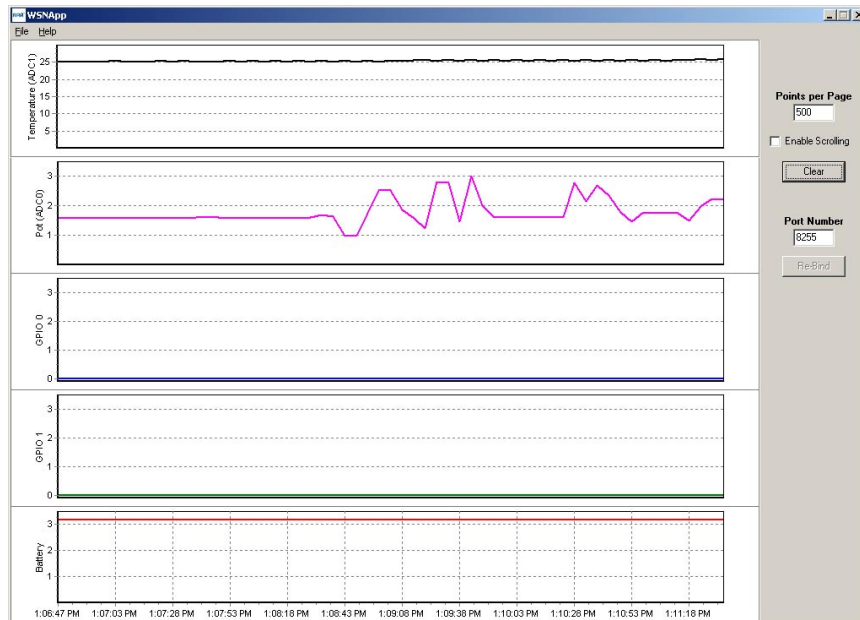


Figure 8.3.5

9. If any difficulty is encountered in setting up your kit, contact RFM's module technical support group. See Section 10.2 for contact details.

8.4 Developer Board Features

A schematic of the WSN802GDK developer board is provided in the Appendix Section 10.4. The location of key components is shown in Figures 8.4.1 and 8.4.2.

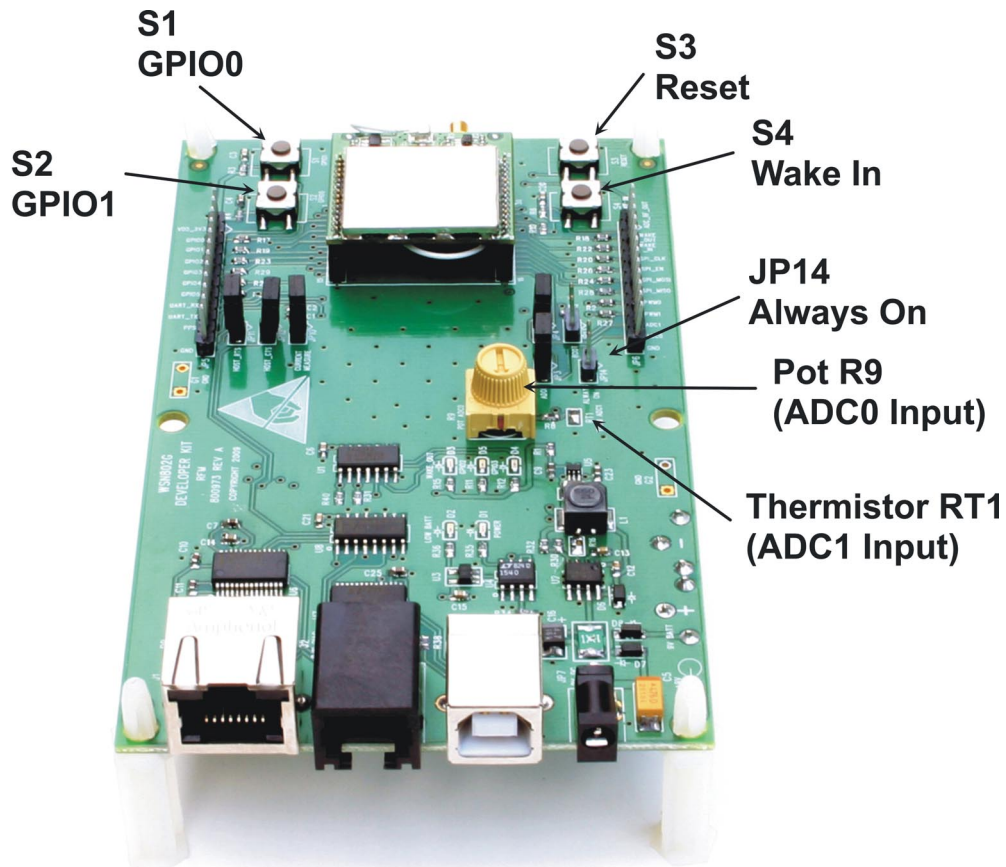


Figure 8.4.1

Switch S1 is connected to the WSN802G's GPIO0 input and switch S2 is connected to the GPIO1 input. These normally open, momentary contact switches present a logic low unless pressed, when they present a logic high. Note: the silkscreen on some developer boards have the GPIO labels reversed on switches S1 and S2. Switch S3 provides a hardware reset for the WSN802G module. Switch S4 asserts a hardware wake input to the WSN802G module.

Placing a jumper on JP14 provides a continuous wake input to the module. Pot R9 is the input to ADC0 on the WSN802G module. Thermistor RT1 is part of a voltage divider driving the ADC1 input of the WSN802G module.

LED D1 illuminates when the developer board is powered. When run from a battery, D2 will illuminate when the battery voltage declines to the minimum operating voltage. D3 illuminates when the WSN802G's WAKE_OUT line is high. D4 illuminates when GPIO3 on the module outputs a logic high. D5 illuminates when GPIO2 on the module outputs a logic high.

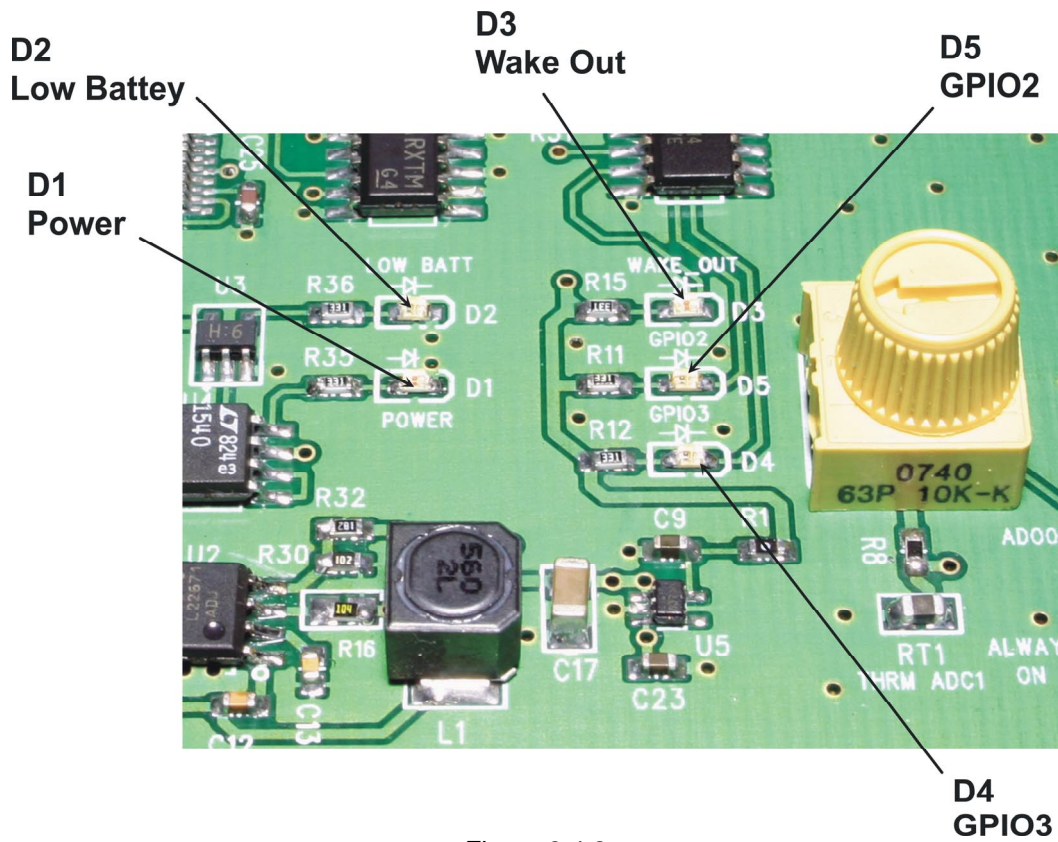


Figure 8.4.2

8.5 WSNConfig Program Operation

WSNConfig.exe provides a number of useful functions in addition to those covered above. WSNConfig.exe can be run separately or at the same time as the customer's application program to provide WSN802G module configuration support. WSNConfig.exe configuration commands run on Port 161, and WSNConfig.exe listens for SNMP traps on Port 162. The application (sensor server) runs on Port 8255 by default. When active, the customer program runs as the sensor server. Only one program at a time can run as the sensor server. In Section 8.3, WSNApp.exe is an example customer application program.

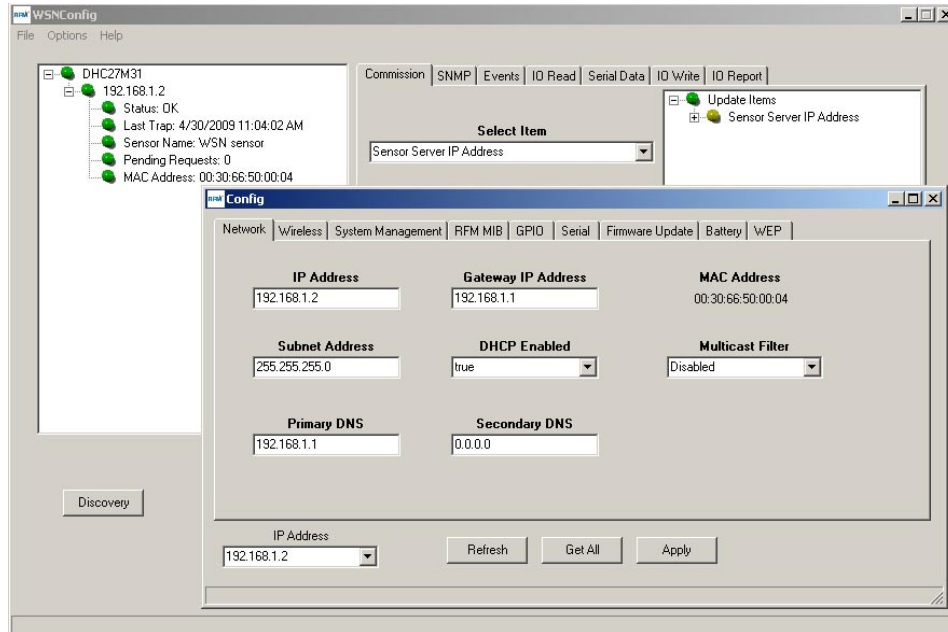


Figure 8.5.1

Double clicking on a module IP address in the left text box of the main WSNConfig frame launches a multi-tab configuration dialog box for the module, as shown in Figure 8.5.1.

All tabs in the *Config* dialog frame have *Refresh*, *Get All* and *Apply* buttons. WSNConfig.exe maintains a local buffer that holds a copy of all MIB configuration parameters (see Table 7.3.1). Clicking the *Refresh* button loads the configuration parameters from the local buffer into various tabs in the *Config* dialog box.

Clicking the *Get All* button queues a request to the WSN802G module to send a new copy of all its configuration parameters. How quickly the module responds depends on the *ConfigTrapInterval* system parameter and when in the trap interval the request was queued. As a new copy of the configuration parameters is received, the local buffer is updated. Clicking the *Refresh* button after the local buffer is updated will, in turn, update the data in the various tabs in the *Config* dialog box.

Clicking on the *Apply* button will queue a request to the WSN802G module to modify parameter values that have been changed in a *Config* dialog tab. Again, how quickly the module updates parameter values depends on the *ConfigTrapInterval* system parameter and when in the trap interval the request was queued.

The *IP Address* in the lower left of each tab in the *Config* dialog box is the WSN802G module IP address.

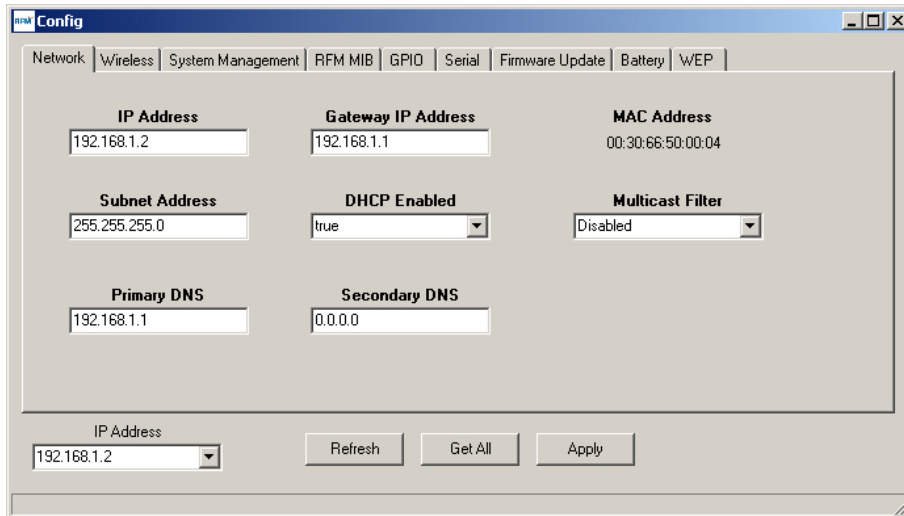


Figure 8.5.2

The *Network* tab displays basic network parameters information. *Note: Unless you are familiar with IP networking contact RFM module technical support before making any changes on this tab. A parameter entry error on this tab can irreversibly disable a WSN802G module.*

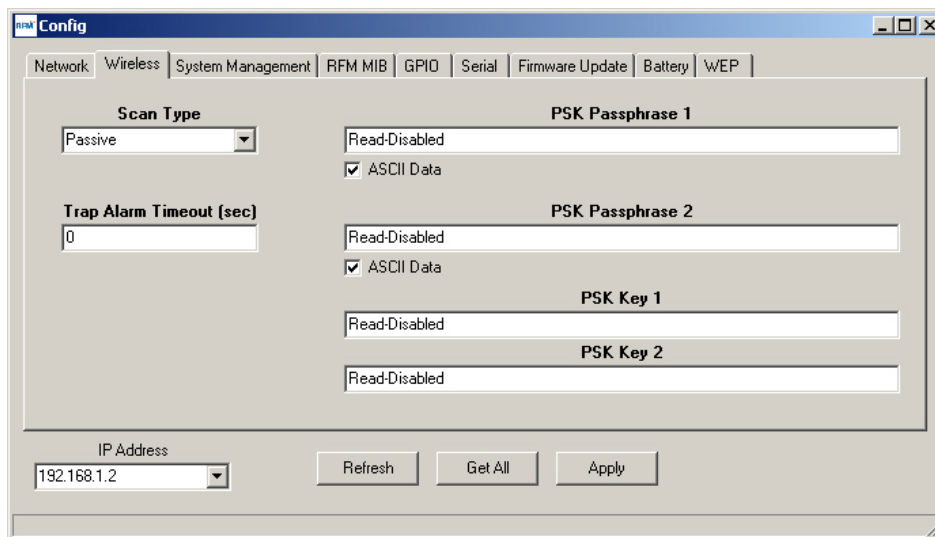


Figure 8.5.3

The *Wireless* tab accepts inputs for *Scan Type* (active/passive), *Trap Alarm Timeout* (0 disables the alarm), the *IP Address* of the WSN802G module, and the *PSK Passphrase* or *PSK Key* inputs for SSIDs 1 and 2. Note that you can only enter passphrases or keys. Clicking the *Refresh* button loads the ASCII byte string *Read-Disabled* in the *PSK Passphrase* and *PSK Key* text boxes. Clicking the *Apply* button queues a request to update the module with changes entered in this tab.

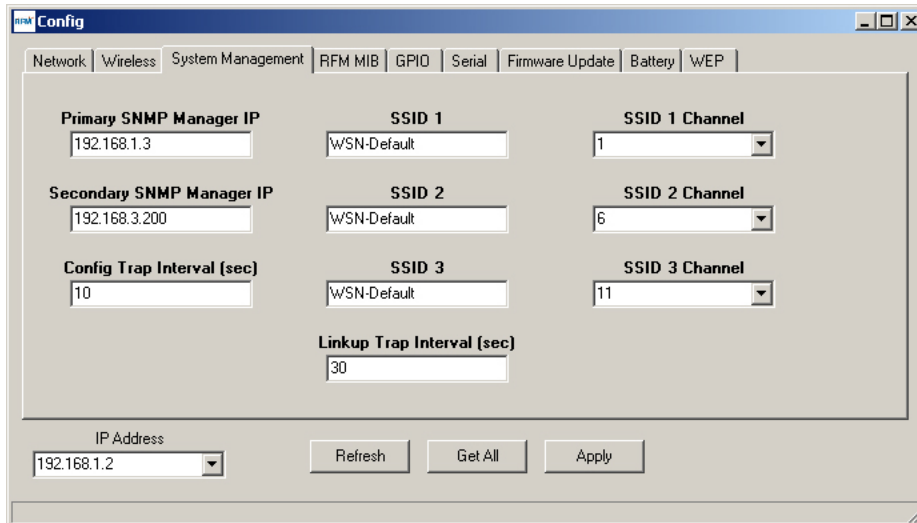


Figure 8.5.4

The *System Management* tab displays and accepts inputs on the *Primary* and *Secondary SNMP Manager IP* addresses, the *Config Trap Interval*, the module *IP Address*, and SSIDs and channel assignments for SSIDs 1 and 2 (SSID3 is read only).

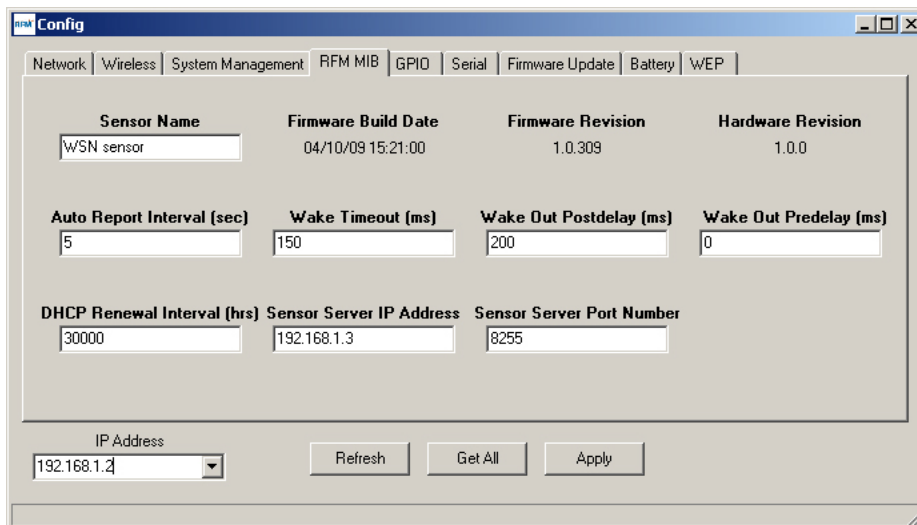


Figure 8.5.5

The *RFM MIB* tab displays and accepts inputs related to MIB application parameters. The *Sensor Server IP Address* can be set and applied in this tab as an alternative to Step 7 in Section 8.3.

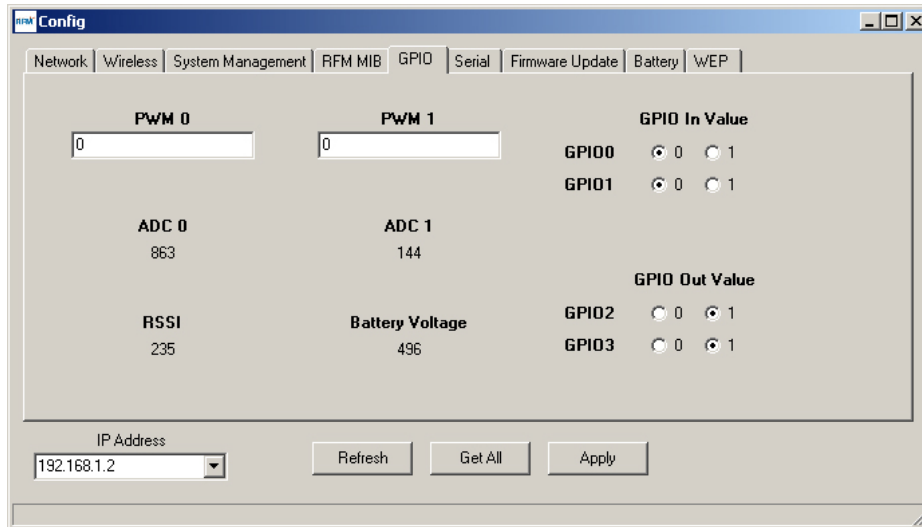


Figure 8.5.6

The *GPIO* tab displays analog and digital module inputs and displays and accepts changes in analog and digital module outputs. Numerical data is displayed and entered in decimal format. Note: the PWM 1 text box is not used by the current version of the WSN802G module.

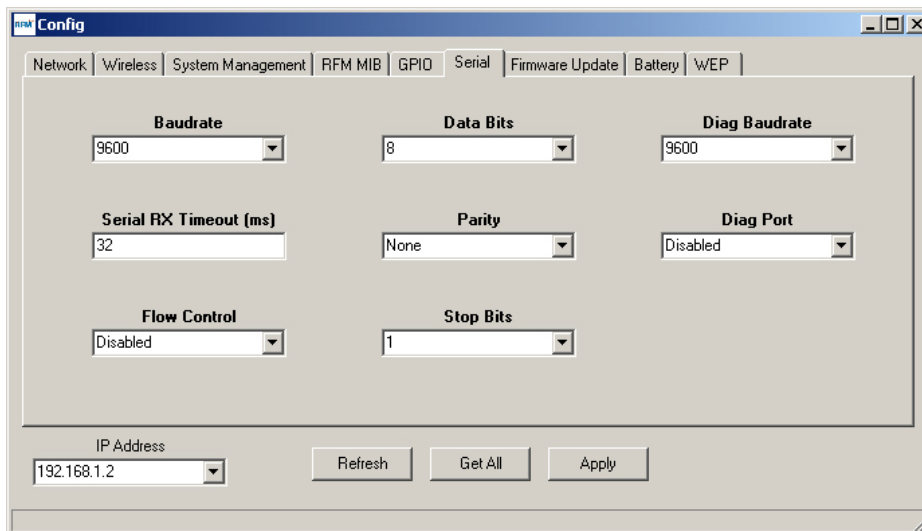


Figure 8.5.7

The *Serial* tab displays and accepts changes for parameters related to the module's serial ports. The *Diag Port* is not used for operational diagnostics in the current firmware.

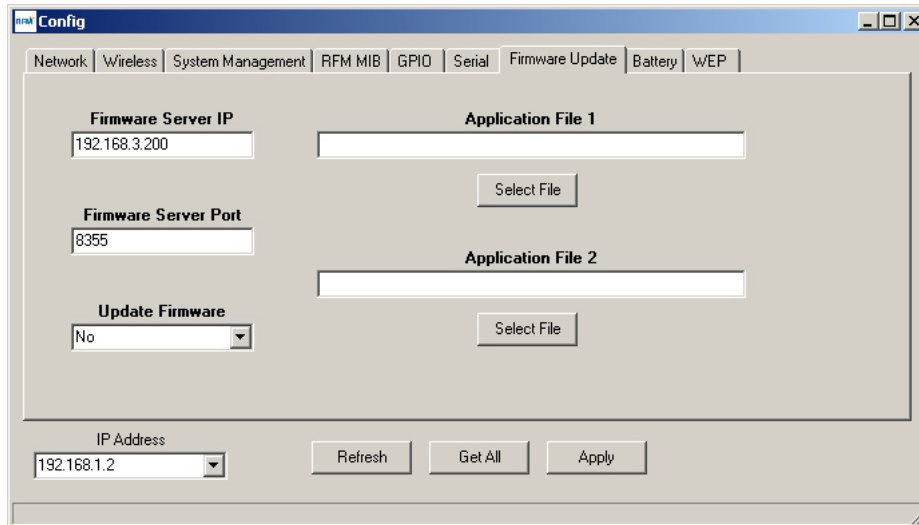


Figure 8.5.8

The *Firmware Update* tab allows new firmware to be loaded into a WSN802G module. Input the names of the two firmware *Application Files* including the paths to the files if they are not located in the same folder as WSNConfig.exe. Click on each *Select File* button. Set the *Firmware Server IP* address and *Firmware Server Port* number. Select *Yes* from the *Update Firmware* drop-down box and click on *Apply*.

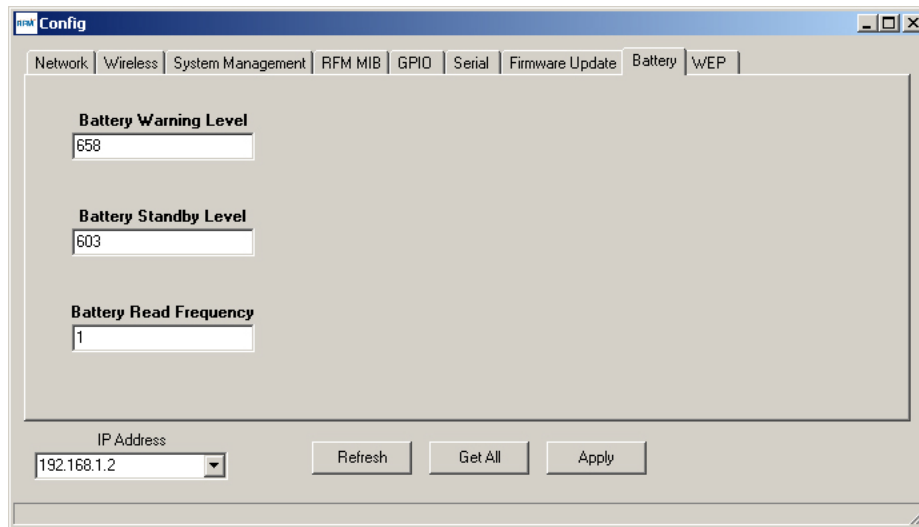


Figure 8.5.9

The *Battery* Tab allows the power supply voltage levels that send a warning and place the module in standby to be read and/or modified. The read frequency is in units of seconds. *Note: contact RFM module technical support before making changes to the default warning and standby levels.*

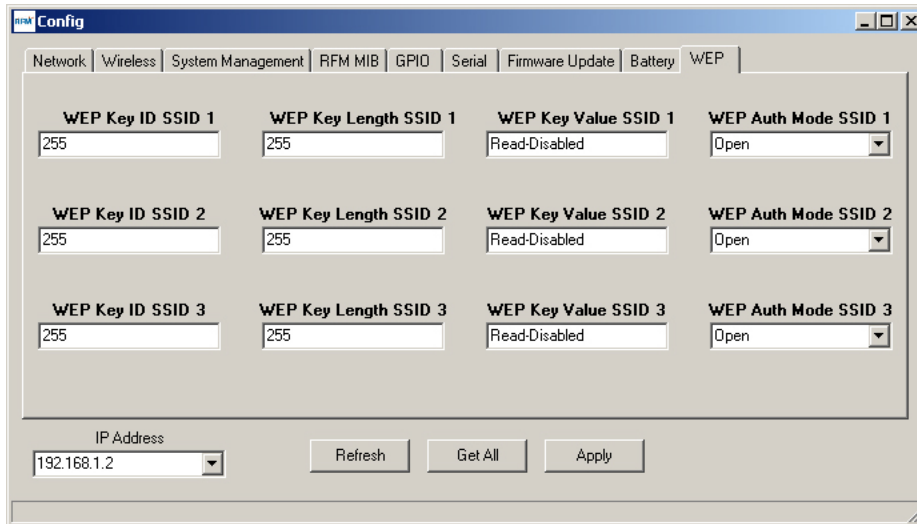


Figure 8.5.10

WEP encryption can be used instead of PSK encryption for compatibility with legacy WiFi routers. WEP encryption is not implemented in the current version of the module firmware.

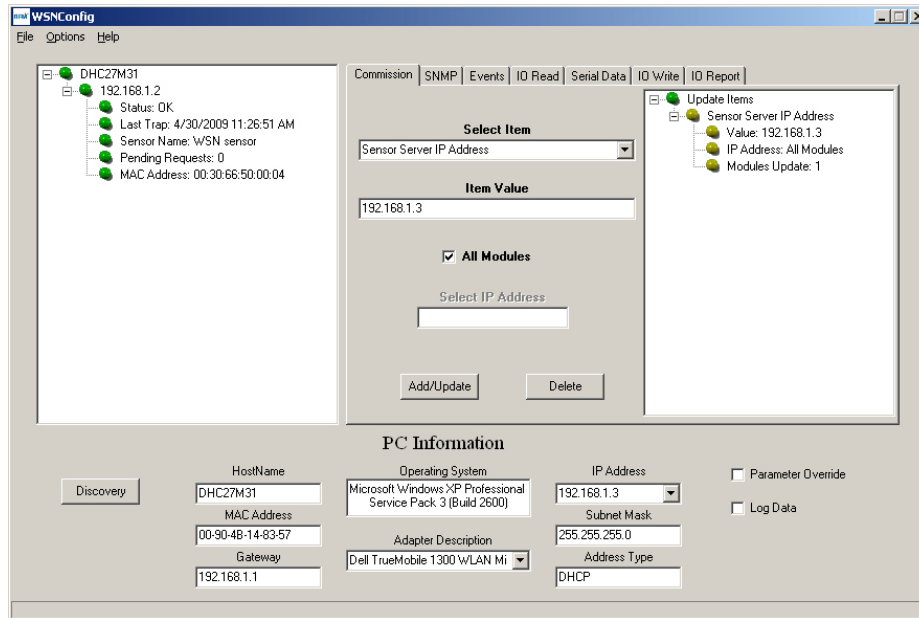


Figure 8.5.11

Figure 8.5.11 shows the same *WSNConfig* main screen as Figure 8.3.4, but with the module IP address tree expanded on the left and the Sensor Sever IP Address tree expanded on the right.

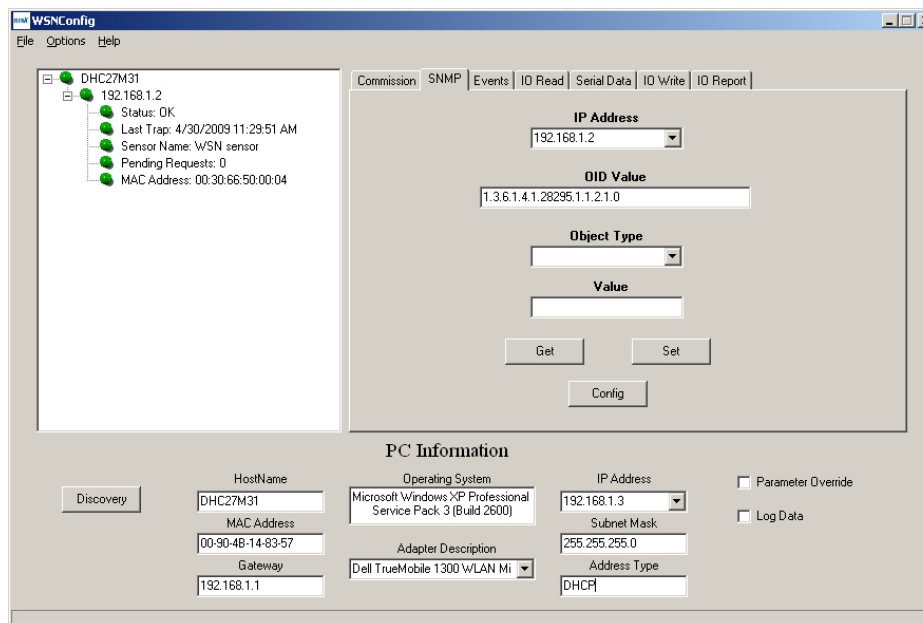


Figure 8.5.12

The *SNMP* tab allows individual MIB parameters to be manually displayed and modified. The *OID Values* and the *Object Types* for the various MIB parameters are listed in Tables 7.3.1 and 7.4.1. Clicking the *Get* button queues a request to retrieve the value of a parameter. Clicking the *Set* button queues a request to change the value of a parameter. How quickly the module responds to *Set* or *Get* depends on the *ConfigTrapInterval* system parameter and when in the trap interval the request was queued. Clicking the *Config* button launches a multi-tab *Config* dialog box discussed earlier.

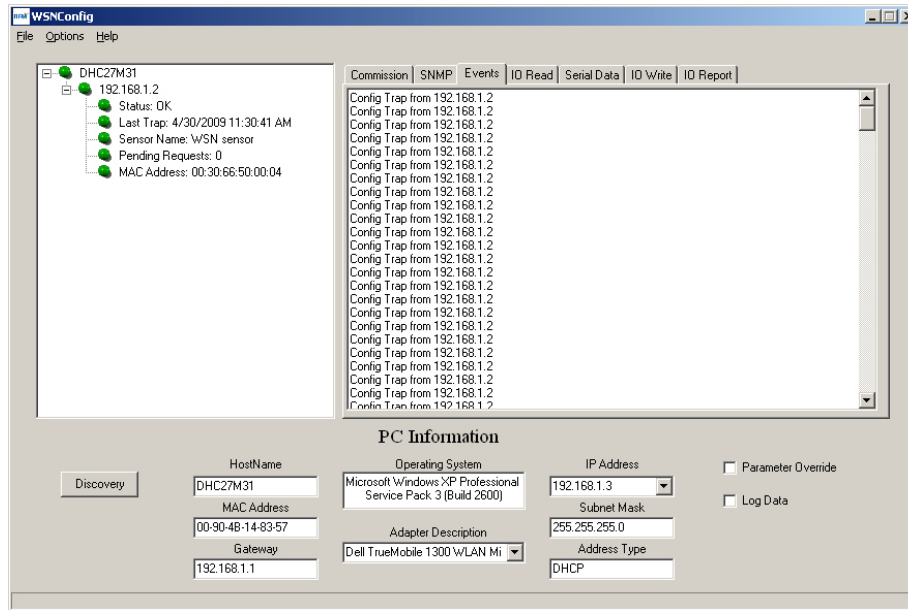


Figure 8.5.13

The *Events* tab displays a running history of events received from the WSN802G module.

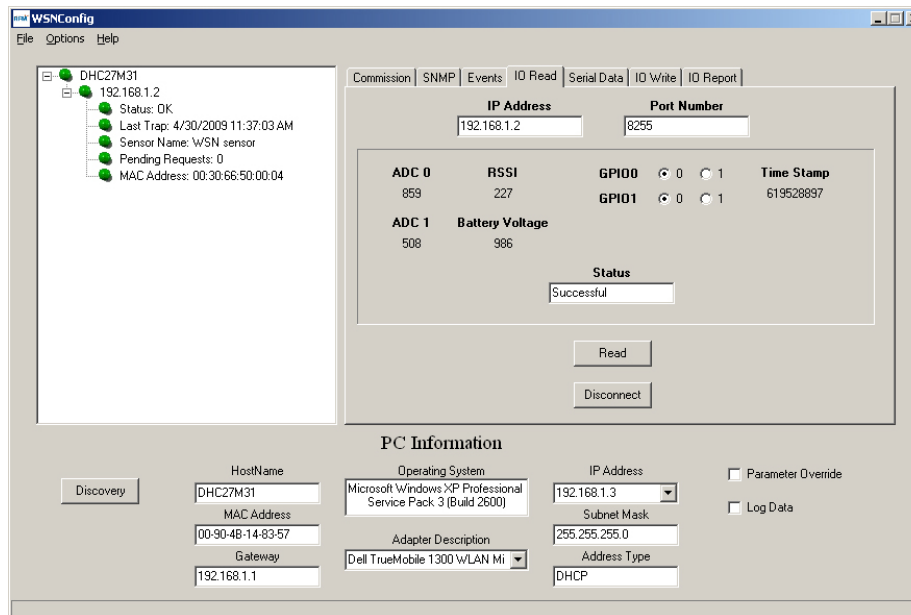


Figure 8.5.14

The WSN802G module must be awake in order to use the *IO Read* tab. To hold the module awake, place a jumper on JP14, which is labeled ALWAYS ON or push and hold the WAKE IN button. The *IP Address* and *Port Number* on the *I/O read* tab refer to the WSN802G module's Sensor socket. Clicking *Read* sends an *IO_REPORT_REQUEST* to the module. Note that *ADC0* is reading the voltage from pot R9, and *ADC1* is reading the voltage from a voltage divider consisting of a fixed resistor and thermistor RT1. *GPIO0* reads the state of switch S1 and *GPIO1* reads the state of switch S2. A *GPIO* value of 1 indicates the switch is closed. Note: the silkscreen on some developer boards have the *GPIO* labels reversed on switches S1 and S2. A quick reply to the *IO_REPORT_REQUEST* is indicated by a *Successful Status*. A *Failure Status* is usually caused by forgetting to install a jumper on JP14.

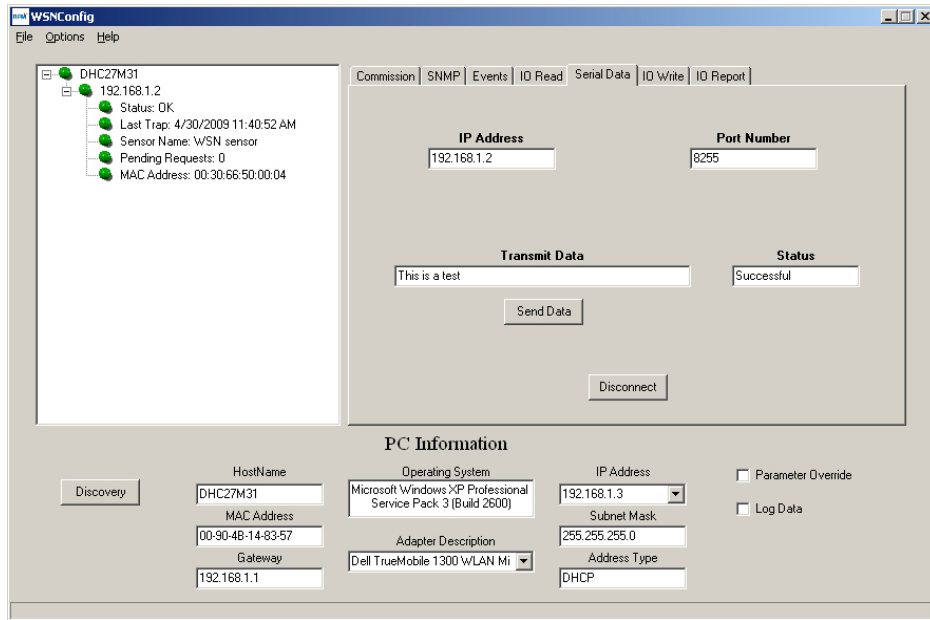


Figure 8.5.15

The WSN802G module must be awake in order to use the *Serial Data* tab. To hold the module awake, place a jumper on JP14, which is labeled ALWAYS ON or push and hold the WAKE IN button. The *IP Address* and *Port Number* on the I/O read tab refer to the WSN802G module's Sensor socket. Clicking *Send Data* sends the string in the *Transmit Data* text box in a SERIAL_DATA command to the module. A quick reply to the command is indicated by a *Successful Status*. A *Failure Status* is usually caused by forgetting to install a jumper on JP14.

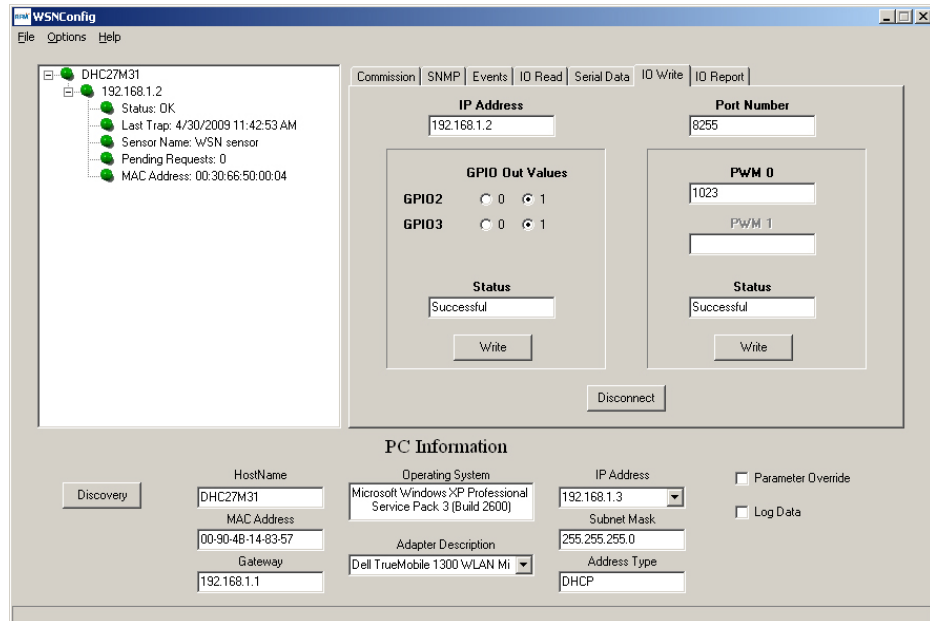


Figure 8.5.16

The WSN802G module must be awake in order to use the *IO Write* tab. To hold the module awake, place a jumper on JP14, which is labeled ALWAYS ON or push and hold the WAKE IN button. The *IP Address* and *Port Number* on the I/O read tab refer to the WSN802G module's Sensor socket. Clicking the *Write* button under *GPIO Out Values* sends an IO_WRITE_GPIO to the module. Clicking the *Write* button under

PWM 0 sends an *IO_WRITE_PWM* command to the module. A quick reply to either write command is indicated by a *Successful Status*. A *Failure Status* is usually caused by forgetting to install a jumper on JP14. On the developer board, GPIO2 and 3 are connected to LEDs such that the LEDs light when the module pin is set to 1.

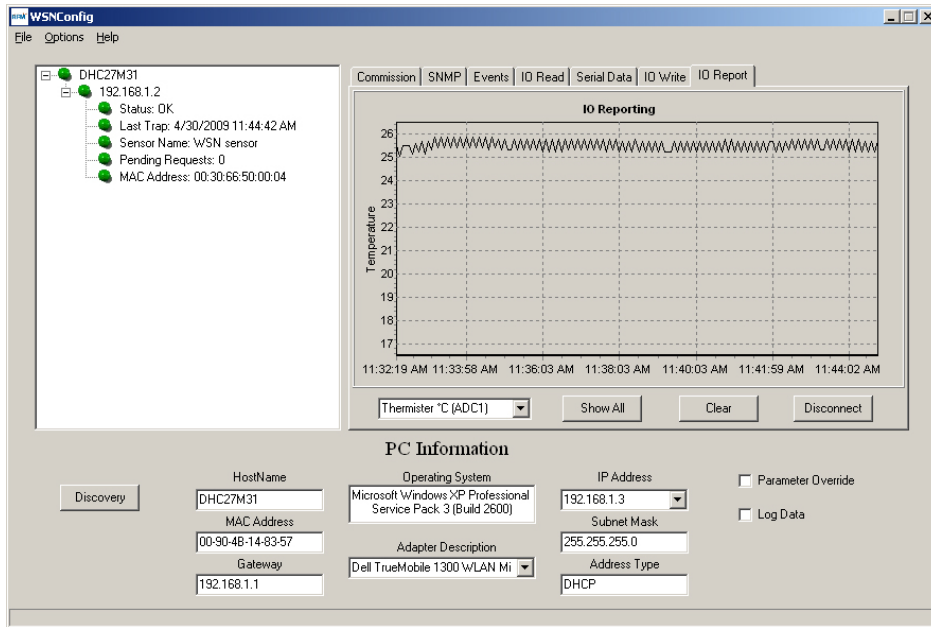


Figure 8.5.17

The WSN802G module must be awake in order to use the *IO Report* tab. To hold the module awake, place a jumper on JP14, which is labeled ALWAYS ON or push and hold the WAKE IN button. Either a single parameter can be selected for charting from the drop-down box in the lower left corner of the *IO Report* tab, or all parameters can be selected for charting by clicking on the *Show All* button. The chart area can be cleared and reset by clicking the *Clear* button.

9.0 Troubleshooting

WSNConfig.exe does not communicate with a WSN802G module - The wireless router and the WiFi in the PC running WSNConfig.exe must be set to match the WSN802G Wireless configuration. The default is channel 11 with an SSID of WSN-Default (case sensitive) in secure mode. The security passphrase to allow router access is WSN-PASSWORD. Note: the NETGEAR router shipped in the WSN802GDK is preconfigured for use with the WSN802G module. Do not reconfigure the router. The WSN802G module must be connected to an antenna to work.

WSN802G will not accept sensor application commands - the module must be awake to accept application commands. Either assert a logic high on the WAKE_IN hardware line or queue the sensor application command to immediately follow an automatic (timer) I/O Report. Use the *RFM MIB* tab on the *Config* dialog window in WSNConfig.exe to check for suitable *AutoReport* and *WakeTimeout* values. See Section 8.6 for additional information.

Range is extremely limited - this is usually a sign of a poor antenna connection or the wrong antenna. Check that the antenna is firmly connected. If possible, remove any obstructions near the antenna.

10.0 Appendices

10.1 Ordering Information

WSN802GC: transceiver module for solder-pad mounting

WSN802GP: transceiver module for pin-socket mounting

10.2 Technical Support

For WSN802G product support contact RFM's module technical support group. The phone number is +1.678.684.2000. Phone support is available from 08:30 AM to 5:30 PM US Eastern Time Zone, Monday through Friday. The e-mail address is tech_sup@rfm.com.

10.3 WSN802G Mechanical Specifications

WSN802GC Outline and Mounting Dimensions

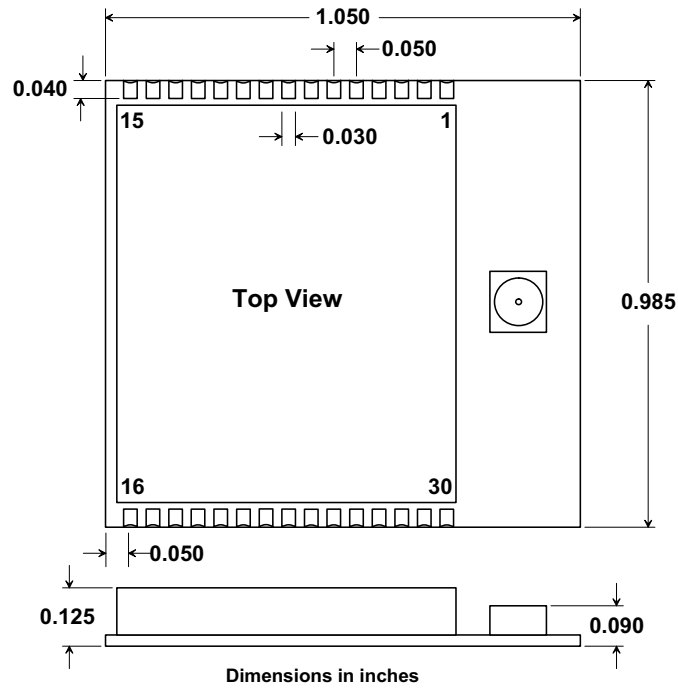


Figure 10.3.1

WSN802GC Solder Pad Dimensions

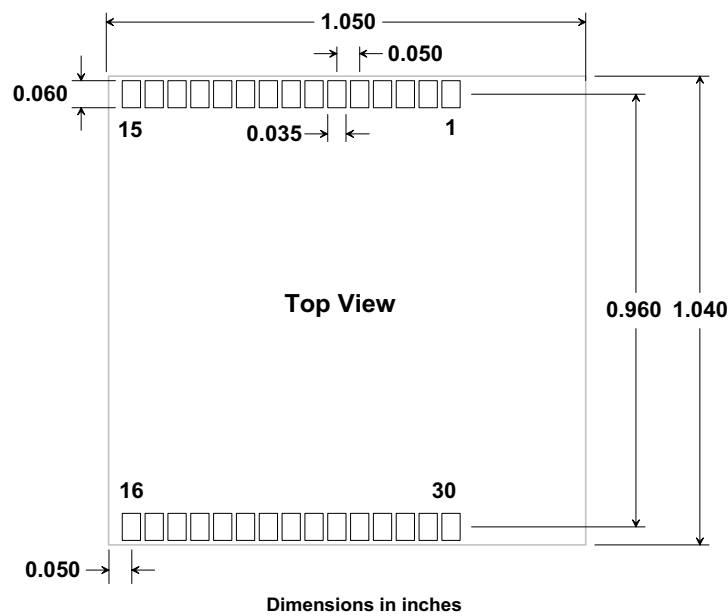


Figure 10.3.2

WSN802GP Outline and Mounting Dimensions

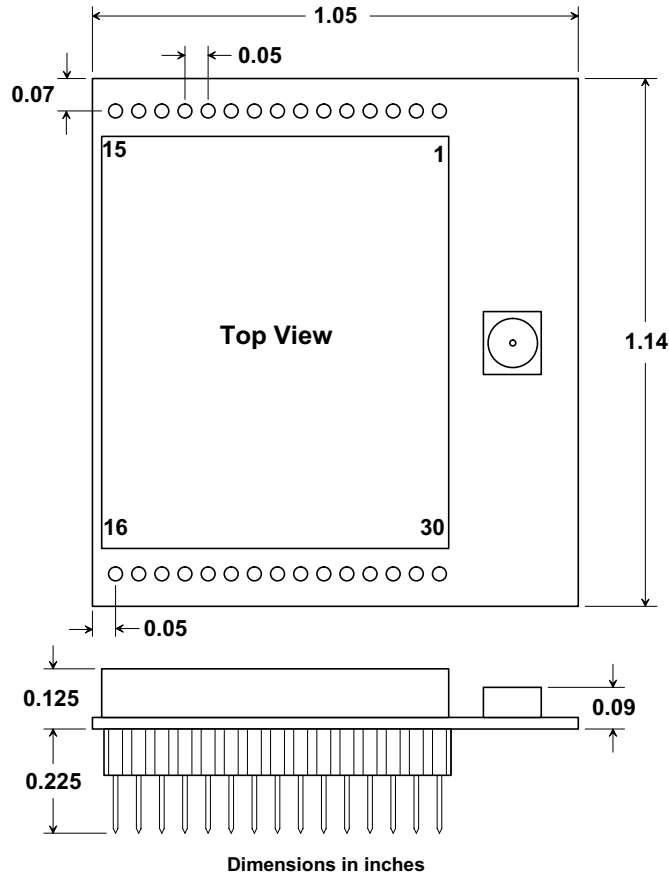


Figure 10.3.3

WSM802GP Interface Connector PCB Layout Detail

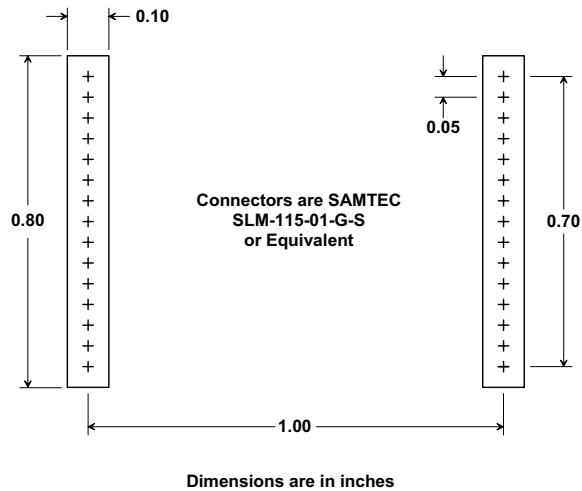
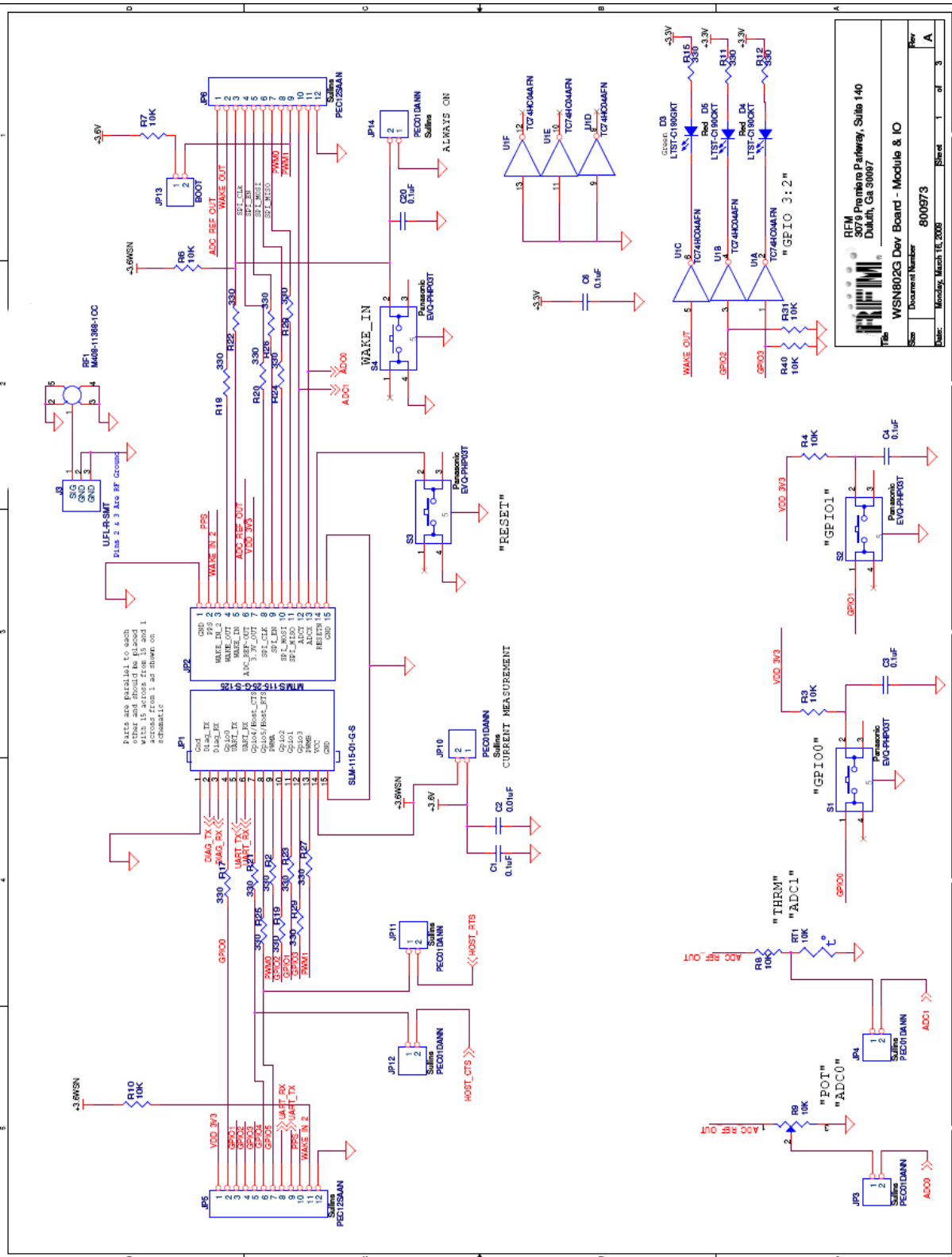
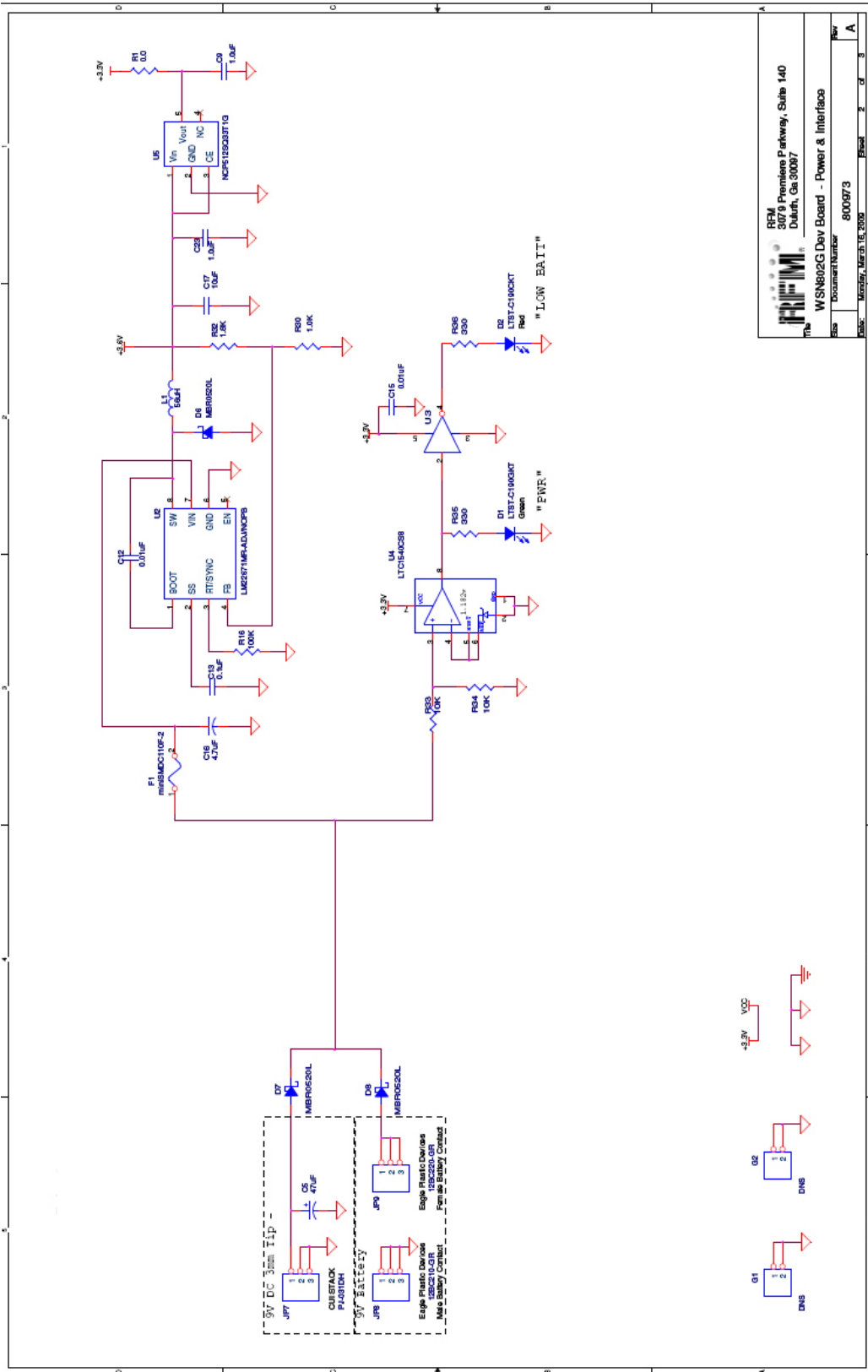


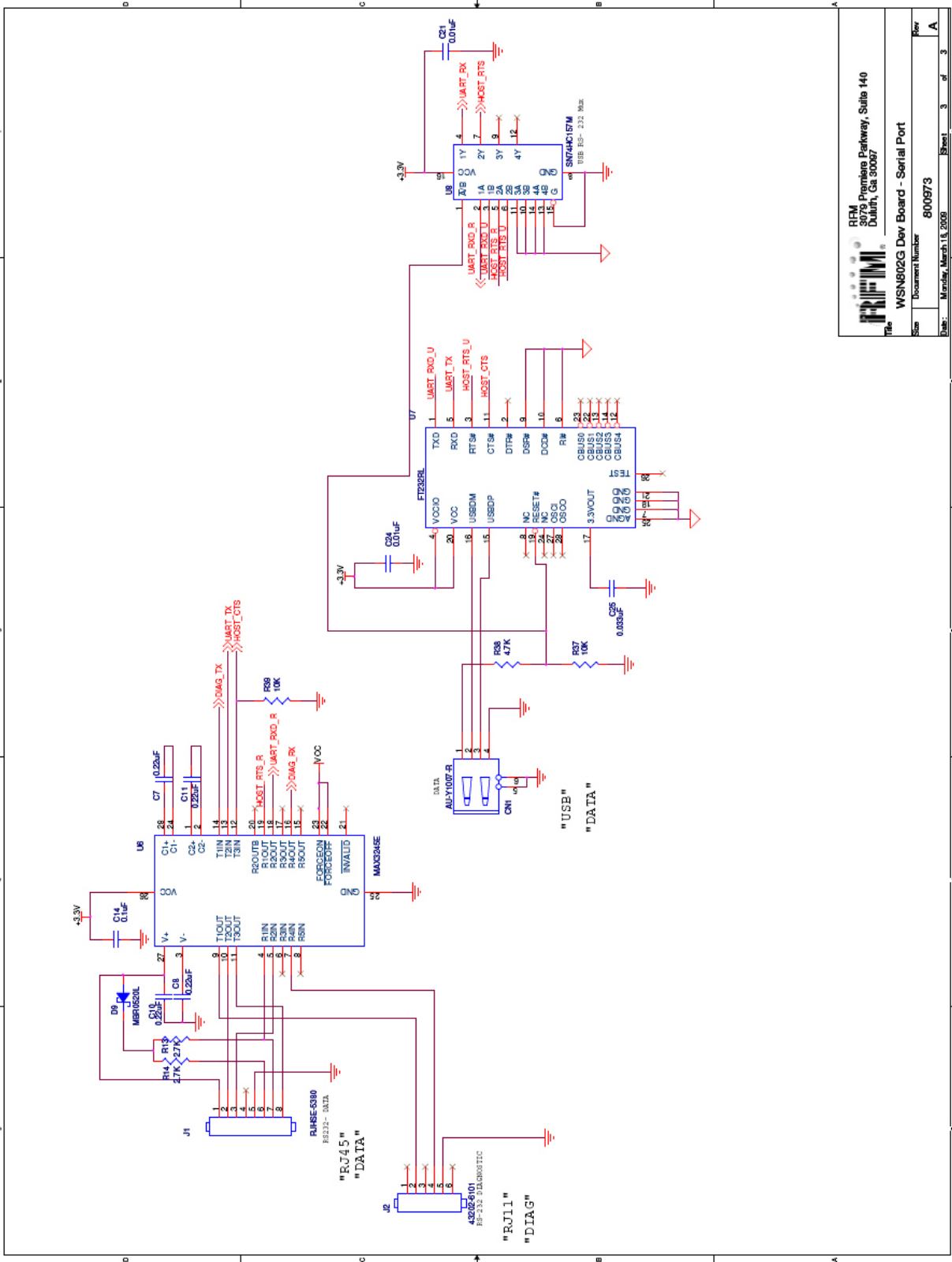
Figure 10.3.4

10.4 WSN802G Developer Board Schematic





RFM 3079 Premiere Parkway, Suite 140 Duluth, Ga 30097	
Doc No	WSN802G Dev Board - Power & Interface
Doc Rev	800673
Doc Date	Monday, March 16, 2009
Sheet	2 of 3
Rev	A



11.0 Warranty

Seller warrants solely to Buyer that the goods delivered hereunder shall be free from defects in materials and workmanship, when given normal, proper and intended usage, for twelve (12) months from the date of delivery to Buyer. Seller agrees to repair or replace at its option and without cost to Buyer all defective goods sold hereunder, provided that Buyer has given Seller written notice of such warranty claim within such warranty period. All goods returned to Seller for repair or replacement must be sent freight prepaid to Seller's plant, provided that Buyer first obtain from Seller a Return Goods Authorization before any such return. Seller shall have no obligation to make repairs or replacements which are required by normal wear and tear, or which result, in whole or in part, from catastrophe, fault or negligence of Buyer, or from improper or unauthorized use of the goods, or use of the goods in a manner for which they are not designed, or by causes external to the goods such as, but not limited to, power failure. No suit or action shall be brought against Seller more than twelve (12) months after the related cause of action has occurred. Buyer has not relied and shall not rely on any oral representation regarding the goods sold hereunder, and any oral representation shall not bind Seller and shall not be a part of any warranty.

THE PROVISIONS OF THE FOREGOING WARRANTY ARE IN LIEU OF ANY OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL (INCLUDING ANY WARRANTY OR MERCHANT ABILITY OR FITNESS FOR A PARTICULAR PURPOSE). SELLER'S LIABILITY ARISING OUT OF THE MANUFACTURE, SALE OR SUPPLYING OF THE GOODS OR THEIR USE OR DISPOSITION, WHETHER BASED UPON WARRANTY, CONTRACT, TORT OR OTHERWISE, SHALL NOT EXCEED THE ACTUAL PURCHASE PRICE PAID BY BUYER FOR THE GOODS. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR ANY OTHER PERSON OR ENTITY FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, LOSS OF DATA OR LOSS OF USE DAMAGES ARISING OUT OF THE MANUFACTURE, SALE OR SUPPLYING OF THE GOODS. THE FOREGOING WARRANTY EXTENDS TO BUYER ONLY AND SHALL NOT BE APPLICABLE TO ANY OTHER PERSON OR ENTITY INCLUDING, WITHOUT LIMITATION, CUSTOMERS OF BUYERS.

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