



# Nano WiReach G2 N1

Version 1.3

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**WARNING:** THE Nano WiReach G2 N1 IS AN RF MODULE INTENDED FOR EMBEDDING IN A HOST DEVICE. LOCAL RELEVANT RF REGULATIONS SUCH AS ALLOWED FREQUENCIES AND USAGE IN COMMERCIAL FLIGHTS MUST BE OBSERVED. SAFETY INSTRUCTIONS MUST BE INCLUDED IN THE MANUALS OF THE HOST DEVICE. CONNECT ONE ASSUMES NO LIABILITY FOR CUSTOMER FAILURE TO COMPLY WITH THESE PRECAUTIONS.

**Modifications**

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Option could void the user's authority to operate the equipment.

**This device complies with Part 15 of the FCC rules.**

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.

**Exposure Information to Radio Frequency Energy**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

*" Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication."*

*" Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante."*

*" This radio transmitter (SM2144N2-BIO) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device."*

*" Le présent émetteur radio (SM2144N2-BIO) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur."*

*" This device complies with Industry Canada license-exempt RSS standard(s). 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."*

*" Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."*

*Antennas: Air Wave (EA-79F); Tekfun C. (M04-SR); YC Communication (Q24-24W); Pulse (W1030). Maximum Gain all: 2dBi.*

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## Revision History

Version	Date	Description
1.0	May 22 <sup>nd</sup> 2014	Initial preliminary version
1.0.1	June 16 <sup>th</sup> 2014	Adding module image
1.1	July 7 <sup>th</sup> 2014	Security support update
1.2	September 16, 2014	Certification update, mechanical drawings, appendix B update
1.3	November 24, 2014	RMII pin out descriptions

# 1. Introduction

## 2) General Description

Nano WiReach™ G2 N1 is a secure serial-to-Wireless-LAN device module that can perform as a WLAN client or Access Point to connect serial devices to 802.11b/g/n Wireless LANs. It includes the iChip™ CO2144 IP Communication Controller™ chip and Broadcom BCM43362 WiFi chipset. It is packaged 33.76X18mm RoHS-compliant low profile module with 30 PIN Board to Board connector and UFL connector for external antenna.

Nano WiReach G2 N1 offers and supports large variety of features which among them:

- Ten simultaneous TCP/UDP sockets
- Two listening sockets
- Webserver with two websites
- SMTP and POP3 clients
- DHCP client/server
- POP3 SMTP client with MIME attachment
- FTP client
- TELNET client
- SerialNET™ mode for serial to IP bridging
- Gateway between a local network on it's LAN/WLAN interfaces and a WAN on any of it's other interfaces
- Switch between it's WLAN interface and the Ethernet interface when acting as a WLAN access point
- An Ethernet to WiFi bridge to connect an ETH client to a WiFi network (cable replacement)
- Security gap between the application and the network

Nano WiReach G2 N1 supports the SSL3/TLS1 protocol for secure sockets, HTTPS, FTPS and secure web server. On the WLAN interface it supports: WEP, WPA and WPA2 WiFi encryption.

Nano WiReach G2 N1 minimizes the need to redesign the host device hardware. It easily inserts into a 30 pin Board to Board connector host PCB and connects to an external antenna. Minimal or no software configuration is needed for Nano WiReach G2 N1 to access the Wireless LAN.

Connect One's high-level AT+i™ API eliminates the need to add WiFi drivers, security and networking protocols and tasks to the host application. The AT+i SerialNET operating mode offers a true plug-and-play mode that eliminates any changes to the host application.

Nano WiReach G2 N1 firmware – the IP stack and Internet configuration parameters – are stored in an external FLASH memory.

The II-EVB-363-G2-N1 evaluation board provides an easy environment for testing the Nano WiReach G2 N1 prior to designing it into your product.



### 3) Hardware Description

Size:	33.76 x 18.0 x 5.5 mm
Core CPU:	32-bit RISC ARM7TDMI, Low-leakage, 0.13 micron, at 48MHz
Operating Voltage:	+3.3V+/-10%
Operating Humidity:	90% maximum (non-condensing)
Operating Temperature Range:	-30°C to +85°C -22°F to 185°F
Power Consumption (max):	Transmit – 350mA@11Mbps, 310mA@54Mbps, 310mA@72Mbps Receive – 130mA
Antenna:	U.FL RF Connector
Connection:	Low profile 30 pin Board to Board connector
Host Interface:	Serial, SPI, USB Device
A/D Input	
10/100 Base T LAN Interface:	RMII (w/ext. PHY)

### 4) Performance Specifications

Host Data Rate:	Up to 3Mbps in serial mode
Serial Data Format (AT+i mode):	Asynchronous character; binary; 8 data bits; no parity; 1 stop bit
SerialNET mode:	Asynchronous character; binary; 7 or 8 data bits; odd, even, or no parity; 1 stop bit
Flow Control:	Hardware (-RTS, -CTS) and software flow control.

### 5) Internet Protocols

ARP, ICMP, IP, UDP, TCP, DHCP, DNS, NTP, SMTP, POP3, MIME, HTTP, FTP and TELNET

### 6) Security Protocols

SSL3/TLS1, HTTPS, FTPS, RSA, AES-128/256, 3DES, RC-4, SHA-1, MD-5, WEP, WPA and WPA2

Accelerated in HW: AES, 3DEC and SHA

### 7) Application Program Interface (API)

Connect One's AT+i protocol

## 8) Wireless Specifications

Standards supported:	IEEE 802.11b/g/n
Frequency:	Europe: 2.412-2.472GHz USA: 2.412-2.462GHz Japan: 2.412–2.484GHz
Channels:	Europe: 13 channels USA: 11 channels Japan: 14 channels

## 9) Recommended Antenna

Connect One's iW-ANT2-BL:	2.4GHz, 2.0dBi, 50Ω, Omni-directional, 1/4 wavelength Dipole configuration, VSWR≤2.0 Height - 82.5mm, Weight – 6.3 grams
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## 10) Certification

### **Radio & EMC:**

#### USA

*FCC Modular Approval*

FCC CFR Title 47 Part 15 Subpart C Section 15.247:2013

#### Canada

*Industry Canada Module Approval*

*Industry Canada ICES-003, RSS-Gen issue 3, RSS-210 issue 8*

#### EU

*EN 300 328 V1.8.1*

*EN 301 489 V1.9.2 and V2.2.1*

*EN 62311*

### **Safety:**

*EN 60950-1, Low Voltage Directive*

*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 UNDESIRE OPERATION. THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT*

## 11) Installation Requirements

The Nano WiReach N1 G2 must be installed within a full-enclosure device that is safety certified.

## 2. Features

### 1) Security

Acts as a security gap between the host application and the network

One secure SSL3/TLS1 socket

Provides WEP, WPA and WPA2 Wireless LAN security

Supports multiple Certificate Authorities and both client-side and server-side authentication

Secure FTP and HTTP clients (over SSL3)

Secure Web Server

Includes a true hardware random number generator

AES, 3DES and SHA accelerated in hardware

### 2) Protocols

Up to 10 simultaneous TCP/UDP sockets and two listening sockets

HTTP client

HTTP web server with two on-chip websites: configuration site and application site

FTP and TELNET clients

DHCP client and server

POP3 or SMTP client allows sending and receiving textual and binary email with MIME attachments

### 3) Additional Features

Supports infrastructure Wireless LAN networks

SerialNET mode for serial-to-IP bridging (port server mode)

Local firmware update

Remote configuration and firmware update over the Internet

**Note:** For a detailed description of all available features, see the *AT+i Programmer's Manual*.

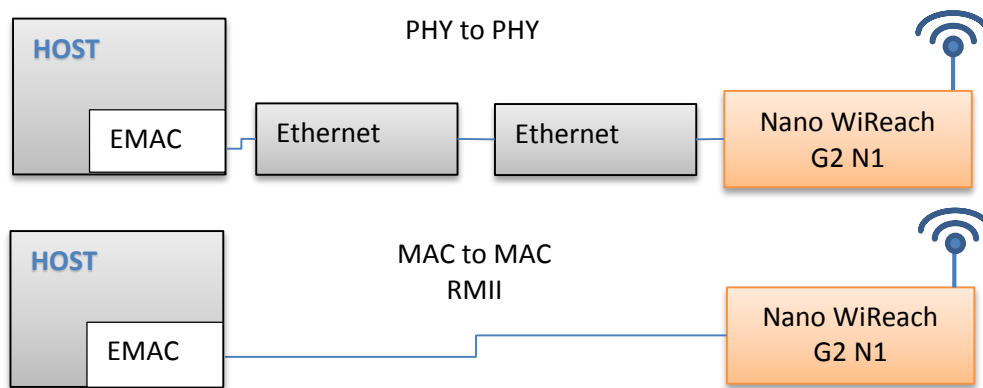
### 3. Typical Applications

Adding IP communications over WiFi to serial embedded devices.

Replacing a LAN cable with a WiFi connection.

Adding SSL security to M2M solutions.

**LAN to WiFi Bridge** - allowing transparent bridging of LAN client over WiFi (Cable replacement), using direct RMII connection to existing MAC hardware or direct PHY-to-PHY connection.

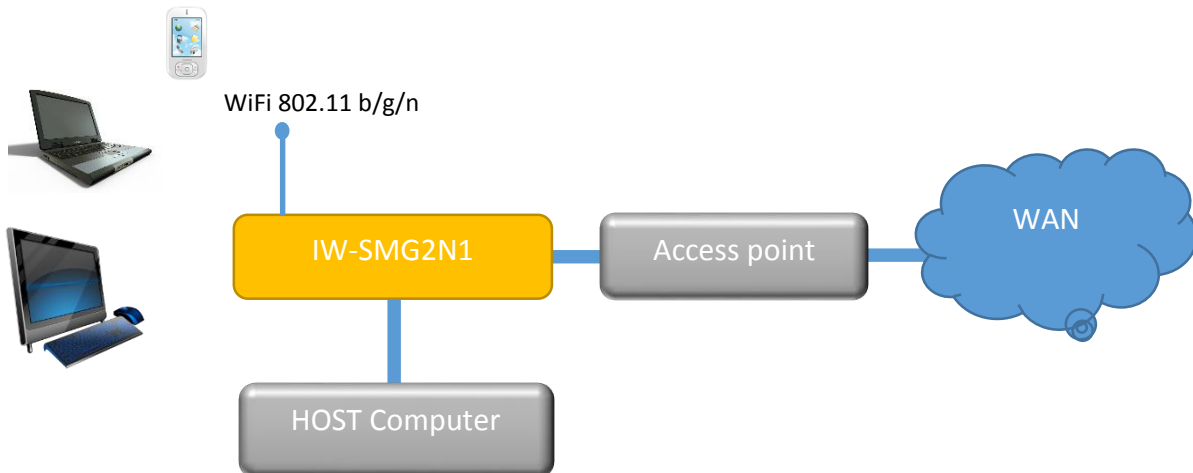


**SerialNet™ Serial to WiFi Bridge** - allowing transparent bridging of Serial over WiFi, using a 3Mbps fast UART. This is a true plug-and-play mode that eliminates any changes to the host application.

**PPP modem emulation** – allowing existing (i.e. modem) designs currently using PPP to connect transparently over WiFi.

**Full Internet Controller mode** – allowing simple MCU to use the Nano WiReach G2 N1's rich protocol and application capabilities to perform complex Internet operations such as E-mail, FTP, SSL, embedded Web server and others. It also acts as a firewall, providing a security gap between the application and the network.

**LAN ↔ WiFi / WiFi ↔ LAN Gateway** – allowing local systems, communicating over LAN and/or WiFi, to gain WAN access to the Internet. The WAN can be implemented using WiFi / LAN. A user configurable parameter allows the WAN to be configured to one of the iChip network interfaces. This mode includes a DHCP server and NAT to support multiple local systems communicating over a single link.



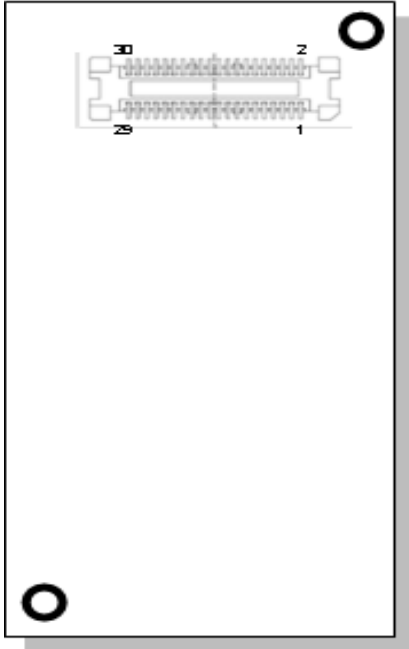
## 4. AT+i Command Set

The iW-SMG2N1 is configured and controlled using proprietary AT+i protocol. You can create a quick configuration using our AT+i Configuration Wizard located in Connect One's website <http://www.connectone.com>. In addition, the AT+i Programmer's Manual includes commands description and format of the entire AT+i command set.

Please refer to Appendix B for examples of module configuration using AT+i command set.

## 5. Layout and Pin Description

### 1) Layout



Connector: Molex [53748-0308](#)

Mate with: Molex [52991-0308](#)

### 2) Pin Functional Description

Pin	Signal	Type	Description
1	VDD	Power	
2	GND	Power	
3	RXD0	Input	UART 0 receive
4	TXD0	Output	UART 0 Transmit
5	nCTS0	Input	UART 0 clear to send
6	nRTS0	Output	UART 0 request to send
7	DATA_RDY	Output	Data ready. Signals incoming Internet data.
8	MSEL	Input	Mode select. Used for inducing rescue mode and forced local FW-update.
9	nRESET	Input	Reset Module
10	nRF_LED	Output	RF LED indicator

11	nSPI1_CS	Input	SPI 1 chip select for host
12	SPI1_CLK	Input	SPI 1 clock for host (Max 12MHz)
13	SPI1_MISO	Output	SPI 1 slave out for host master in
14	SPI1_MOSI	Input	SPI 1 slave in for host master out
15	SPI1_INT	Output	SPI 1 have data on his buffer
16	Readiness	Output	iChip Ready status line. See AT+I programmers manual.
17	DDP	Analog	USB device positive
18	DDM	Analog	USB device negative
19	VDD	Power	
20	GND	Power	
21	ETX_EN	Output	RMII Transmit Enable
22	RMII-REFCLK	Input	RMII Reference Clock
23	CRSDV	Input	RMII Carrier sense and Data Valid
24	ERXER	Input	RMII Receive Error
25	EMDIO	I/O	Management data I/O
26	EMDC	Output	Management data Clock
27	ETX1	Output	RMII Transmit Data 1
28	ERX1	Input	RMII Receive Data 1
29	ETX0	Input	RMII Transmit Data 0
30	ERX0	Input	RMII Receive Data 0

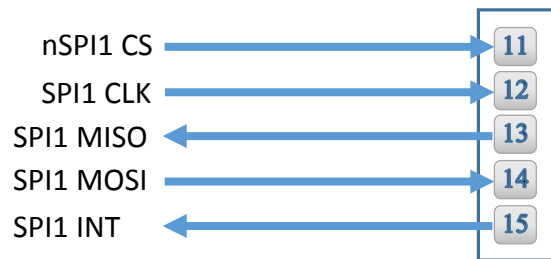
## 6. Interfaces

### 1) Serial Interface



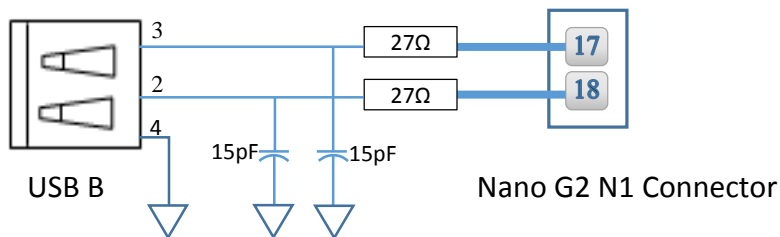
Nano G2 N1 Connector

### 2) SPI Interface



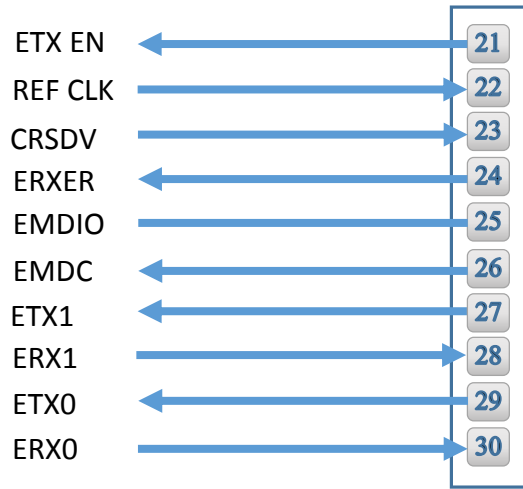
Nano G2 N1 Connector

### 3) USB 2.0 Device Interface





#### 4) RMII Interface



Nano G2 N1 Connector

## 7. Electrical Specifications

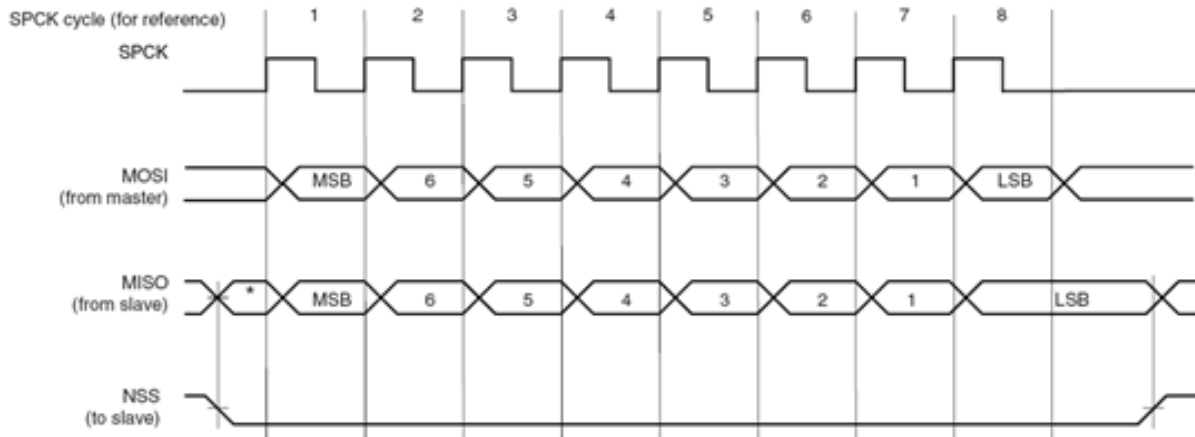
### 1) Absolute Maximum Ratings

Parameter	Rating
Voltage at any pin with respect to ground	-0.3V to +3.6V
Operating Temperature	-30°C to +85°C    -22°F to +185°F
Storage Temperature	-40°C to +85°C    -40°F to +185°F

### 2) DC Operating Characteristics

Parameter	Min	Typical	Max	Units
VDD	3.0	3.3	3.6	Volts
High Level Input	2.0		VDD I/O +0.3	Volts
Low Level Input	-0.3		0.8	Volts
High Level Output @2mA	VDD I/O -0.4			Volts
High Level Output @0mA	VDD I/O-0.2			Volts
Low Level Output @2mA			0.4	Volts
Low Level Output @0mA			0.2	Volts
Input Leakage Current			10	μA
Power Supply Current from VDD (Tx. Mode)			350	mA
Power Supply Current from VDD (Rcv. Mode)			130	mA
Power Supply Current from VDD (Power Save Mode)			TBD	mA
Input Capacitance			5.3	pF
Radio Frequency Range	2.412		2.484	GHz

### 3) AC Operating Characteristics



### 4) Transmit Specification

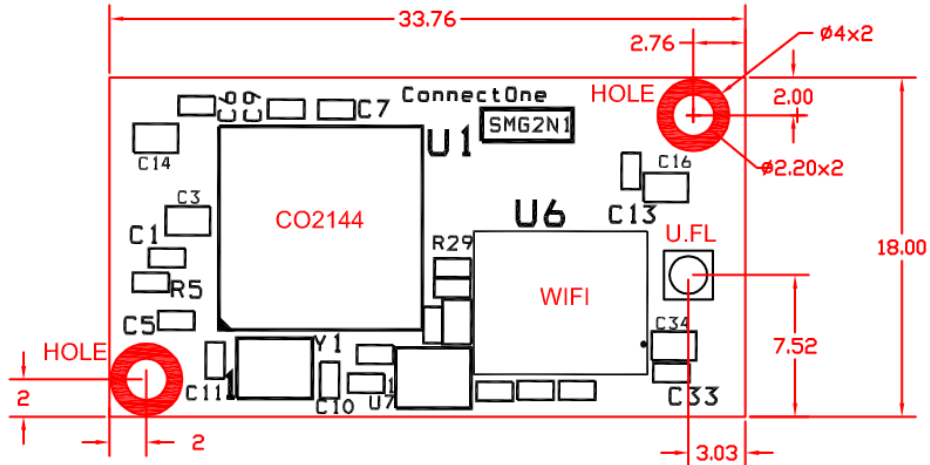
Item	Condition	Min	Typ	Max	Unit	
Transmit Power Levels	802.11b	15	17	19	dBm	
	802.11g	12	14	16	dBm	
	802.11n	10	12	14	dBm	
Transmit Error vector Magnitude	802.11b	11Mbps		-13	-11	dB
		1Mbps		-13	-11	dB
	802.11g	54Mbps		-30	-25	dB
		6Mbps		-30	-22	dB
	802.11n	HT20M@MCS0		-30	-22	dB
HT20M@MCS0			-30	-28	dB	

### 5) Receive Specifications

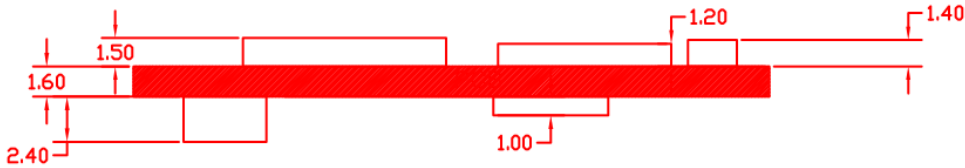
Item	Condition	Min	Typ	Max	Unit
Receiver Minimum Input Level Sensitivity	802.11b Data Rate = 11Mbps PER < 8%		-87	-83	dBm
	802.11b Data Rate = 1Mbps PER < 8%		-94	-89	dBm
	802.11g Data Rate = 54Mbps PER <10%		-73	-68	dBm
	802.11g Data Rate = 6Mbps PER <10%		-86	-81	dBm
	802.11n MCS0 PER <10%		-86	-81	dBm
	802.11n MCS7 PER <10%		-70	-65	dBm

## 8. Mechanical Dimensions

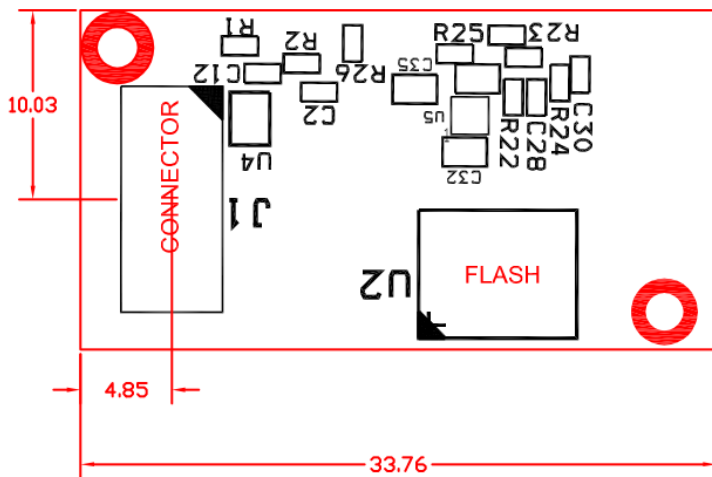
### UPPER VIEW



### SIDE VIEW



### BOTTOM VIEW

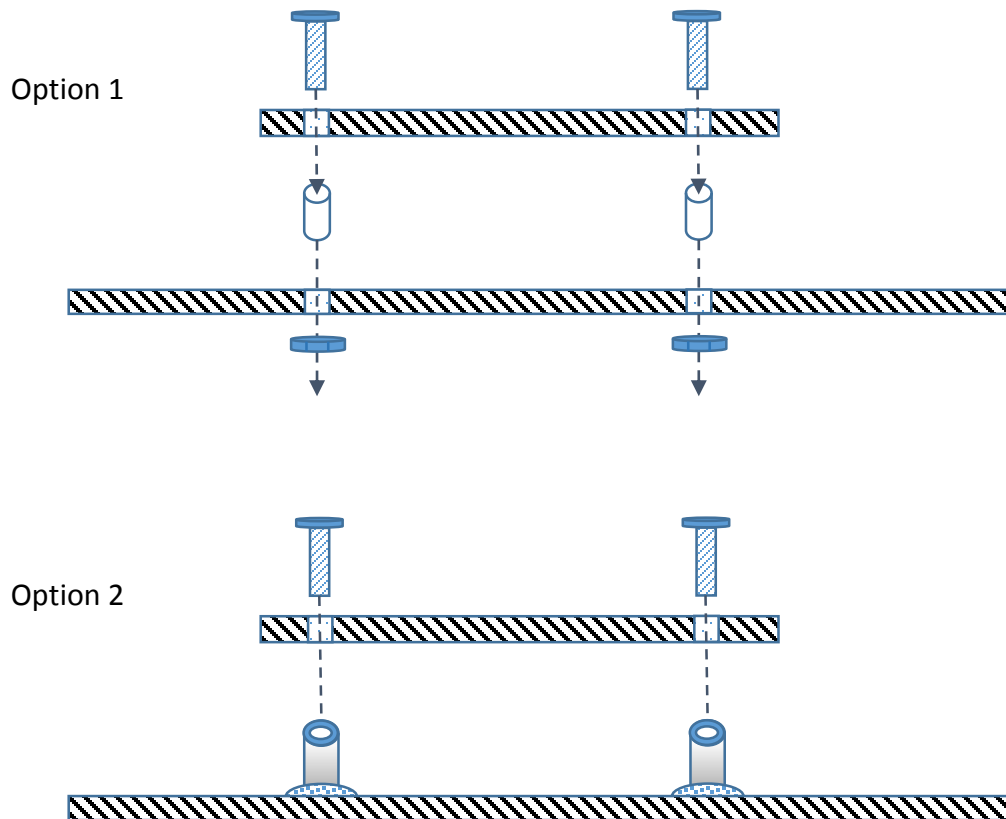


All measurements are in millimeters +/- 0.2mm

## 9. Nano WiReach G2 N1 Mounting Options

Option 1 – using spacers 3mm high

Option 2 – Using soldered Standoffs from MAC8 P/N: 2SSB-3.0 or compatible. With screws 4mm high and 2mm thick. M2 X 4mm



## 10. Evaluation Board

The II-EVB-363-G2-N1 evaluation board enables you to evaluate the Nano WiReach G2 N1 without changing anything in your current development environment. Using a simple Windows-based application on a PC, you can issue AT+i commands.

AT+i commands are used to configure parameter values into iChip’s flash memory and activate Internet tasks such as email send, sockets, FTP sessions, configuration, and more.

A full description of AT+i commands can be found in the *AT+i Programmer’s Manual* on Connect One’s website.

To help you evaluate the Nano WiReach G2 N1, Connect One supplies the iChip Config Utility. This is a Windows-based application that contains intuitive dialog boxes to fully configure iChip CO2144. It doesn’t require any knowledge of AT+i commands. It also contains local firmware update tools. The iChip Config Utility allows you to perform specific Internet communication tasks such as sending and receiving emails, activating iChip’s websites, entering SerialNET mode, and more. The latest iChip Config Utility version and user manual can be found on Connect One’s website under the Support section.

On board connectors allow a choice of Host interfaces:

- RS232 COM port
- SPI
- USB Device

## 11. Ordering Information

Part Number	Description
iW-SMG2N1	Nano WiReach G2 N1 WiFi Module

## Appendix A - Internet Protocol Compliance

Nano WiReach G2 N1 complies with the Internet standards listed in the following table

<b>RFC 768</b>	User datagram protocol (UDP)
<b>RFC 791</b>	Internet protocol (IP)
<b>RFC 792</b>	ICMP – Internet control message protocol
<b>RFC 793</b>	Transmission control protocol (TCP)
<b>RFC 821</b>	Simple mail transfer protocol (SMTP)
<b>RFC 822</b>	Standard for the format of ARPA Internet text messages
<b>RFC 826</b>	Ethernet address resolution protocol (ARP)
<b>RFC 959</b>	File transfer protocol (FTP)
<b>RFC 854</b>	TELNET protocol specification
<b>RFC 857</b>	Telnet ECHO option
<b>RFC 858</b>	Telnet suppress go-ahead option
<b>RFC 1034</b>	Domain names (DNS) - concepts and facilities
<b>RFC 1035</b>	Domain names (DNS) - implementation and specification
<b>RFC 1073</b>	Telnet window size option
<b>RFC 1091</b>	Telnet terminal type option
<b>RFC 1321</b>	MD5 message digest algorithm
<b>RFC 1939</b>	Post office protocol - version 3 (POP3)
<b>RFC 1957</b>	Some observations on the implementations of the post office protocol (POP3)
<b>RFC 2030</b>	Simple network time protocol (SNTP)
<b>RFC 2045</b>	Multipurpose Internet mail extensions (MIME) part one: internet message body format
<b>RFC 2046</b>	MIME part two: media types
<b>RFC 2047</b>	MIME part three: message header extensions for non-ASCII text
<b>RFC 2048</b>	MIME part four: registration procedures
<b>RFC 2049</b>	MIME part five: conformance criteria and examples
<b>RFC 2068</b>	Hypertext transfer protocol HTTP/1.1
<b>RFC 2131</b>	Dynamic host configuration protocol (DHCP)
<b>RFC 2132</b>	DHCP options (only relevant parts)
<b>RFC 2228</b>	FTP security extensions
<b>RFC 2246</b>	The TLS protocol version 1.0

## Appendix B – AT+I Configuration Examples

*Automatically connect to a specific Access Point:*

AT+iFD	(restore to factory defaults)
AT+iHIF=1	(set the serial interface to RS232)
AT+iBDRF=9	(fix baud rate to 115200 after power cycle)
AT+iRP20	(list visible networks)
AT+iWLSI=My_WiFi	
AT+iWST0=4	(WPA2 security)
AT+iWPP0=<WPA2 passphrase>	
AT+iAWS=1	(enable website upon reboot)
AT+iDOWN	(reboot to apply settings)

*Create an Access Point to allow connection from mobile devices:*

AT+iFD	(restore to factory defaults)
AT+iHIF=1	(set the serial interface to RS232)
AT+iBDRF=9	(fix baud rate to 115200 after power cycle)
AT+iWLSI=My_AP	
AT+iDIP=10.0.0.1	(IP address)
AT+iDPSZ=8	(Enable internal DHCP server, up to 8 clients)
AT+iWST0=0	(open security)
AT+iAWS=1	(enable website upon reboot)
AT+iSTAP=1	(switch to Access Point mode)
AT+iDOWN	(reboot to apply settings)

*LAN – WiFi switch mode - merges Ethernet station(s) with WiFi client(s) into one logical subnet*

AT+iFD	(restore to factory defaults)
AT+iHIF=1	(set the serial interface to RS232)
AT+iBDRF=9	(fix baud rate to 115200 after power cycle)
AT+iwlsi=SWITCH	
AT+idpsz=8	(Enable internal DHCP server, up to 8 clients)
AT+iwst0=0	(open security)
AT+iltyp=4	(LAN type: WiFi+Ethernet)
AT+idip=192.168.0.1	(WiFi side IP address)



AT+isnet=255.255.255.0	(WiFi side subnet mask)
AT+iedip=192.168.0.100	(Ethernet side IP address)
AT+iesnt=255.255.255.0	(Ethernet side subnet mask)
AT+istap=1	(WiFi in Access Point mode)
AT+iswen=1	(Enable Switch Mode)