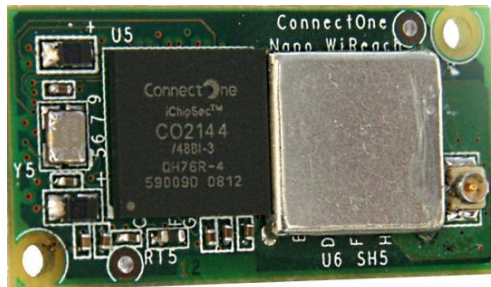


Nano WiReach™

# Nano WiReach™



## Data Sheet

Ver. 1.31

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**WARNING:** THE Nano WiReach 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.

iChip, Nano WiReach, IP Communication Controller, SerialNET, AT+i and Connect One are trademarks of Connect One Ltd.

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## Revision History

### 11-4100-11

| Version | Date          | Description   |
|---------|---------------|---|
| 1.00    | October 2008  | Initial preliminary version   |
| 1.10    | November 2008 | Corrections to Mechanical Schematics, Pin descriptions and addition of Interface Schematics |
| 1.11    | November 2008 | Added Nano WiReach image.   |
| 1.12    | November 2008 | Updated Mechanical Dimensions   |
| 1.13    | November 2008 | Updated Mechanical Dimensions   |
| 1.20    | January 2009  | Fixed signal directions in J6 serial interface  |
| 1.25    | February 2009 | Updated RMII_REFCLK signal direction  |
| 1.26    | February 2009 | Miscellaneous   |
| 1.27    | July 2009     | Added mounting information  |
| 1.30    | August 2009   | Updated Mounting screw P/N  |
| 1.31    | August 2009   | Added certification information   |

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# 1 Introduction

## 1.1 General Description

Nano WiReach™ is a secure serial-to-Wireless LAN device server module that also acts as a bridge to connect serial devices to 802.11b/g Wireless LANs. It includes the iChip™ CO2144 IP Communication Controller™ chip and Marvell 88W8686 WiFi chipset. It is packaged in RoHS-compliant ultra-slim form factor and uses an industry standard pin-out.

Nano WiReach offers much more than many other device servers on the market. It acts as a security gap between the application and the network; supports up to 10 simultaneous TCP/UDP sockets; two listening sockets; a web server with two websites; SMTP and POP3 clients; MIME attachments; FTP and TELNET clients, and SerialNET™ mode for serial-to-IP bridging.

Nano WiReach supports the SSL3/TLS1 protocol for secure sockets, HTTPS and FTPS, WEP, WPA and WPA2 WiFi encryption.

Nano WiReach minimizes the need to redesign the host device hardware. It easily inserts into headers on the host PCB and connects to an external antenna. Minimal or no software configuration is needed for Nano WiReach 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 firmware – the IP stack and Internet configuration parameters – are stored in an external flash memory. The module is power-efficient: the core operates at 1.2V, while I/Os operate at 3.3V. Power Save mode further reduces power consumption.

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

## 1.2 Hardware Description

- Size: 33.76 x 18.0 x 5.5 mm
- Core CPU: 32-bit RISC ARM7TDMI, low-leakage, 0.13 micron, running at 48MHz
- Operating Voltage: +3.3V+/-10%
- Operating Humidity: 90% maximum (non-condensing)
- Operating Temperature Range: -20° to 75°C (-4° to 167°F)
- Power Consumption:
  - Transmit – 250mA @16dbm
  - 235mA @12dbm (typical)
  - Receive – 190mA (typical)
  - Power Save mode – 8mA
- RF Connector: U.FL of Hirose
- Connector: Low profile 30 pin
- Host Interface: TTL Serial, SPI and USB device.
- RMII Interface
- RoHS-compliant; lead-free

## 1.3 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.

**Internet Protocols**

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

**Security Protocols**

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

**Protocols Accelerated in HW**

AES, 3DES and SHA

**Application Program Interface**

Connect One's AT+i protocol  
SerialNET mode for transparent serial data-to-Internet bridging

**Wireless Specifications**

Standards Supported: IEEE 802.11b, IEEE 802.11g

- Frequency:
  - Europe – 2.412-2.472GHz
  - USA – 2.412-2.462GHz
- Channels:
  - Europe – 13 channels
  - USA – 11 channels

**Recommended Antenna**

iW-ANT2-BL Antenna: 2.4GHz, 2.0dBi, 50Ω, omni-directional, 1/4 wavelength dipole configuration, VSWR≤2.0, height - 82.5mm, weight – 6.3 grams

**Warranty**

One year

**Certifications****• Radio and EMC:**

- USA
  - o FCC Modular Approval, FCC ID: FCC ID: XM5-SM2144N1
  - o CFR Title 47 FCC Part 15, Subpart B and C
- Canada
  - o Industry Canada Module Approval IC: 8516A-SM2144N2
  - o Industry Canada ICES-003, RSS-Gen, RSS-210
- EU

- o EN 300 328 (R&TTE Directive 1999/5/EC)
- o EN 301 489 (EMC Directive 2004/108/EC)

**• Safety:**

- o UL 60950
- o CAN/CSA-C22.2 No. 60950
- o EN 60950, Low Voltage Directive (2006/95/EC)

**Installation Requirements**

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



## 2 Features

### 2.1 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)
- Includes a true hardware random number generator
- AES, 3DES and SHA accelerated in hardware

### 2.2 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
- Sending and receiving textual email and binary email with MIME attachments

### 2.3 Additional Features

- Non-volatile, on-chip operational parameter database
- Supports infrastructure and ad-hoc Wireless LAN networks
- SerialNET mode for serial-to-IP bridging (port server mode)
- Local firmware update
- Remote configuration and firmware update over the Internet
- Retrieval of time data from a Network Time Server

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

## 3 Typical Applications

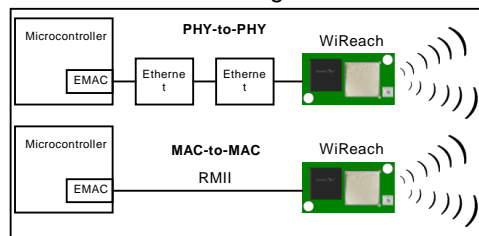
Adding IP communications over WiFi to serial embedded devices.

Replacing a LAN cable with a WiFi connection.

Adding SSL security to M2M solutions.

### **Nano WiReach supports several operational modes:**

- **LAN to WiFi Bridge** - allowing transparent bridging of LAN over WiFi, 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'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.

## 4 Connector Pin Description

The Nano WiReach module includes the iChip CO2144 IP Communication Controller and the Marvell 88W8686 802.11b/g WiFi chipset mounted on a socket form-factor module.

### 4.1 Pin Numbers

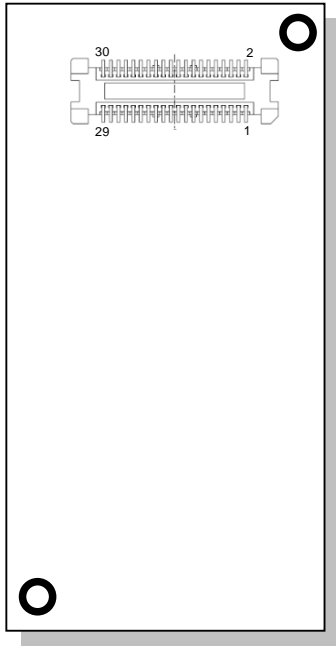


Figure 3-4-1: Pin-out for Nano WiReach

Connector: Molex [53748-0308](#)

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

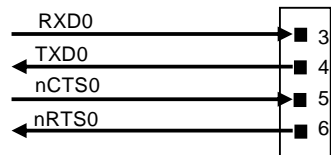
## 4.2 Pin Functional Description

| Pin | Signal          | type   | Description                        |
|-----|-----------------|--------|------------------------------------|
| 1   | V <sub>DD</sub> | 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                         |
| 8   | MSEL            | Input  | Mode select                        |
| 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  | Readyness       | Output | iChip Ready                        |
| 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            | Output | RMII transmit Data 0               |
| 30  | ERX0            | Input  | RMII Receive Data 0                |

Table 3-1: Connector Signal Description

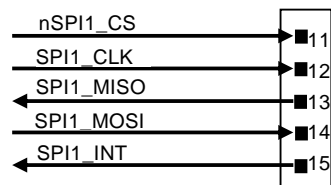
## 5 Interfaces

### 5.1 Serial Interface



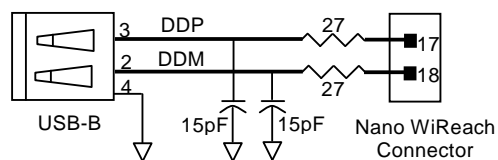
Nano WiReach  
Connector

### 5.2 SPI Interface

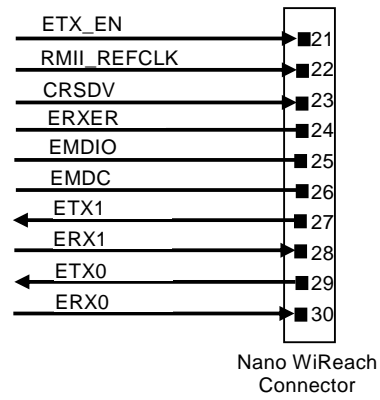


Nano WiReach  
Connector

### 5.3 USB Interface



## 5.4 RMII Interface



## 6 Electrical Specifications

### 6.1 Absolute Maximum Ratings

| Parameter                                 | Rating                          |
|---|---------------------------------|
| Voltage at any pin with respect to ground | -0.3V to +3.6V                  |
| Operating temperature                     | -20°C to 75°C (-4°F to 1675°F)  |
| Storage temperature                       | -65°C to 125°C (-85°F to 257°F) |

Table 4-1: Absolute Maximum Ratings

### 6.2 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 (Transmit Mode)       |             | 260     | 280         | mA    |
| Power supply current from VDD (Receive Mode)        |             | 190     | 210         | mA    |
| Power supply current from VDD (Power Save Mode)     |             | 8*      |             | mA    |
| Input Capacitance                                   |             |         | 5.3         | pF    |
| Radio Frequency Range (subject to local regulation) | 2.412       |         | 2.484       | GHz   |

Table 4-2: DC Operating Characteristics

(\*) **Note:** Power supply current as measured in firmware version i2128d722B05.

### 6.3 AC Operating Characteristics

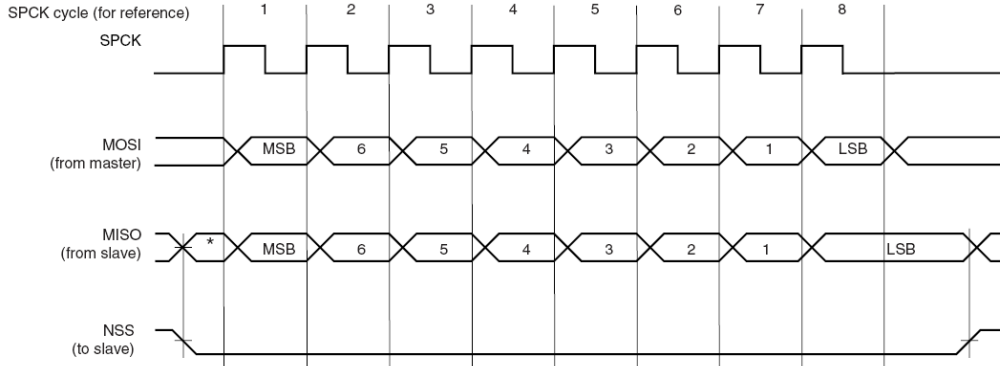


Figure 6-1: SPI Interface Waveforms

### 6.4 Tx Specifications

| Item                                | Condition        | Min        | Typ | Max | Unit |
|-------------------------------------|------------------|------------|-----|-----|------|
| Transmit Power Levels               | 11b              |            | 15  |     | dBm  |
|                                     | 11g              |            | 15  |     | dBm  |
| Transmit Spectrum Mask              | 11b              | Fc+/-11MHz |     | 40  | dBc  |
|                                     |                  | Fc+/-22MHz |     | 60  | dBc  |
|                                     | 11g              | Fc+/-11MHz |     | 30  | dBc  |
|                                     |                  | Fc+/-20MHz |     | 40  | dBc  |
| Fc+/-30MHz                          |                  | 50         | dBc |     |      |
| Transmit Center Frequency Tolerance | Temperature=25°C |            | ±10 |     | ppm  |

Table 4-3: Tx Specifications

### 6.5 Rx Specifications

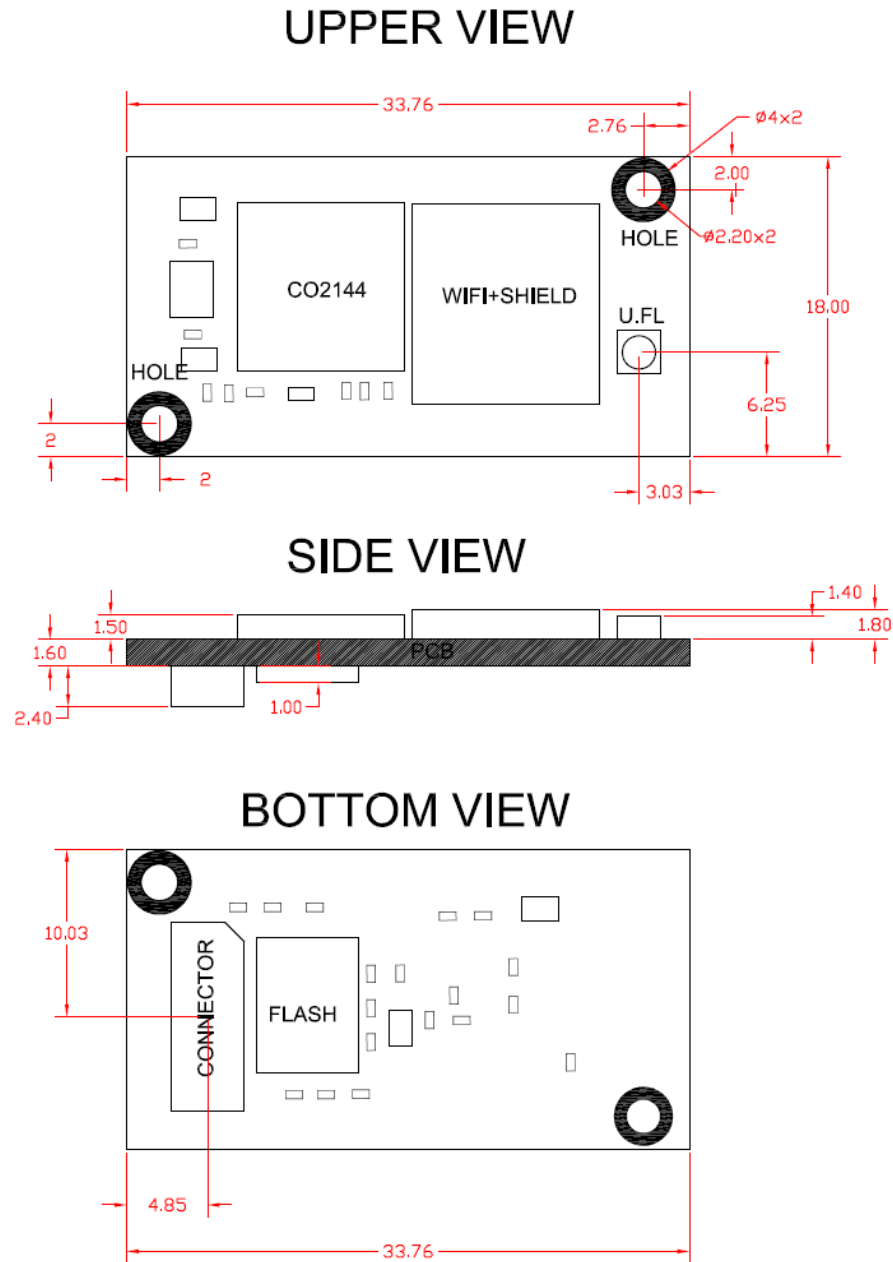
| Item   | Condition                         | Min | Typ | Max | Unit |
|--|-----------------------------------|-----|-----|-----|------|
| Receiver Minimum Input Level Sensitivity                               | 802.11b Data Rate=11Mbps, PER<8%  |     | -88 |     | dBm  |
|  | 802.11g Data Rate=54Mbps, PER<10% |     | -74 |     | dBm  |
| Adjacent Channel Rejection<br>Desired channel is 3dB above sensitivity | 802.11b Data Rate=11Mbps, PER<8%  |     | 48  |     | dBc  |
|  | 802.11g Data Rate=54Mbps, PER<10% |     | 15  |     | dBc  |

Table 4-4: Rx Specifications

$$PER(\%) = \frac{\text{Number of all packets} - \text{Number of received packets}}{\text{Number of all packets}} \times 100$$



## 7 Mechanical Dimensions



**Note:** All measures are in millimeters

Figure 5-7-1: Mechanical Dimensions

# Mounting Options

The mounting holes can be used with #2 size fasteners.

Recommended method: Threaded metal studs soldered onto the main board.

For example: SMT Standoffs from MAC8, P/N: 2SSB-3.0.

Screw: M2 X 4mm.

Nut is not needed.

## 8 Evaluation Board

The II-EVB-363-NW evaluation board enables you to evaluate the Nano WiReach without changing anything in your current development environment. Using a simple Windows-based application on a PC, you can issue AT+i commands to the iChip CO2144 and get responses.

*Note: The evaluation board supports serial host data rates of up to 1Mbps.*

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 at: <http://www.connectone.com/support.asp?did=35>

To help you evaluate the Nano WiReach, 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 functionality. 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

## 9 Ordering Information

| Ordering Information  |   |
|-----------------------|---|
| Part Number           | Description   |
| iW- SM2144N1-US-0     | Nano WiReach module, for USA, External Antenna  |
| iW- SM2144N1-EU-0     | Nano WiReach module, for Europe, External Antenna   |
| II-EVB-363NW-US-0-110 | Evaluation board for Nano WiReach module for USA, with 110V power supply adaptor, External Antenna    |
| II-EVB-363NW-EU-0-220 | Evaluation board for Nano WiReach module for Europe, with 220V power supply adaptor, External Antenna |
| iW-CAB-150            | Miniature coaxial w/ pigtail cable. UFL-SMA connectors. 150mm length.                                 |
| iW-ANT2-BL            | 2.4GHz WiFi antenna, 2.0dBi, 50Ω, omni-directional, 1/4 wavelength dipole configuration               |

# 10 Internet Protocol Compliance

Nano WiReach 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  |

*Table 10-1: Internet Protocol Compliance*