![Connect One - The Device Networking Authority]

iChipNet Box

Version 1.2

WARNING: THE iChipNet Box IS AN RF Device INTENDED FOR EXTERNAL USAGE OR 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.

Table of Contents

Revision History

Version	Date	Description
1.0	April 21st 2015	Initial preliminary version
1.1	April 29th 2015	Updating power consumption
1.2	April 30th 2015	Updating reset button functionality

1. Introduction

1) General Description

iChipNet Box is a secure serial-to-Wireless-LAN device that can perform as a WLAN / LAN client to connect serial devices to 802.11b/g or 802.11b/g/n Wireless LAN or LAN only. Additionally the iChipNet Box can function as an Access Point and router. It includes the iChip™ CO2144 IP Communication Controller™ a WiFi baseband and LAN RJ45 connector. It is packaged in a 124.3 X 65.3 X 25.1mm box with LAN connector, SMA Antenna connector, D-Type RS232 connector and a DC power inlet.

The default configuration of the iChipNet Box is Serial to WiFi. Please refer to Appendix B for additional configuration options

iChipNet Box 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 its LAN/WLAN interfaces and a WAN on any of its other interfaces
- Switch between its 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

iChipNet Box 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.

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.

iChipNet Box with its internal IP stack and Internet configuration parameters – are stored in a FLASH memory.

2) Hardware Description

Size:	124.3 X 65.3X 25.1mm box
Core CPU:	32-bit RISC ARM7TDMI,
	Low-leakage, 0.13 micron, at 48MHz
Operating Voltage:	6-24VDC
Operating Humidity:	90% maximum (non-condensing)
Operating Temperature Range:	+5°C to +50°C
	41°F to 122°F
Antenna:	RP-SMA antenna gain 2dBi SMA RF Connector
Ethernet Connection	RJ45 10/100 Base T LAN
Host Interface:	Serial, RS232

3) Performance Specifications

Host Data Rate:	Up to 1Mbps 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.

4) Internet Protocols

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

5) Security Protocols

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

Accelerated in HW: AES, 3DEC and SHA

6) Application Program Interface (API)

Connect One's AT+i protocol

7) Wireless Specifications

Standards supported:	IEEE 802.11b/g/n for iWL-NETBOX-N
	IEEE 802.11b/g for iWL-NETBOX-G
Frequency:	Europe: 2.412-2.472GHz
	USA: 2.412-2.462GHz (Default)
	Japan: 2.412–2.484GHz
Channels:	Europe: 13 channels
	USA: 11 channels
	Japan: 14 channels

8) Certification

Radio & EMC:

<u>*USA*</u>

Contain FCC Modular Approval

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

<u>*Canada*</u>

Contain Industry Canada Module Approval

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

<u>*EU*</u>

EN 300 328 V1.8.1

EN 301 489 V1.9.2 and V2.2.1

EN 62311

THIS DEVICE INCLUDES A MODULE WHICH 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. 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

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 (client mode only) 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),

SerialNet^{TM} Serial to WiFi Bridge - allowing transparent bridging of Serial over WiFi, using a 1Mbps fast UART. This is a true plug-and-play mode that eliminates any changes to the host application.

Full Internet Controller mode – allowing simple MCU to use the iChipNet Box'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. This mode includes a DHCP server and NAT to support multiple local systems communicating over a single link.
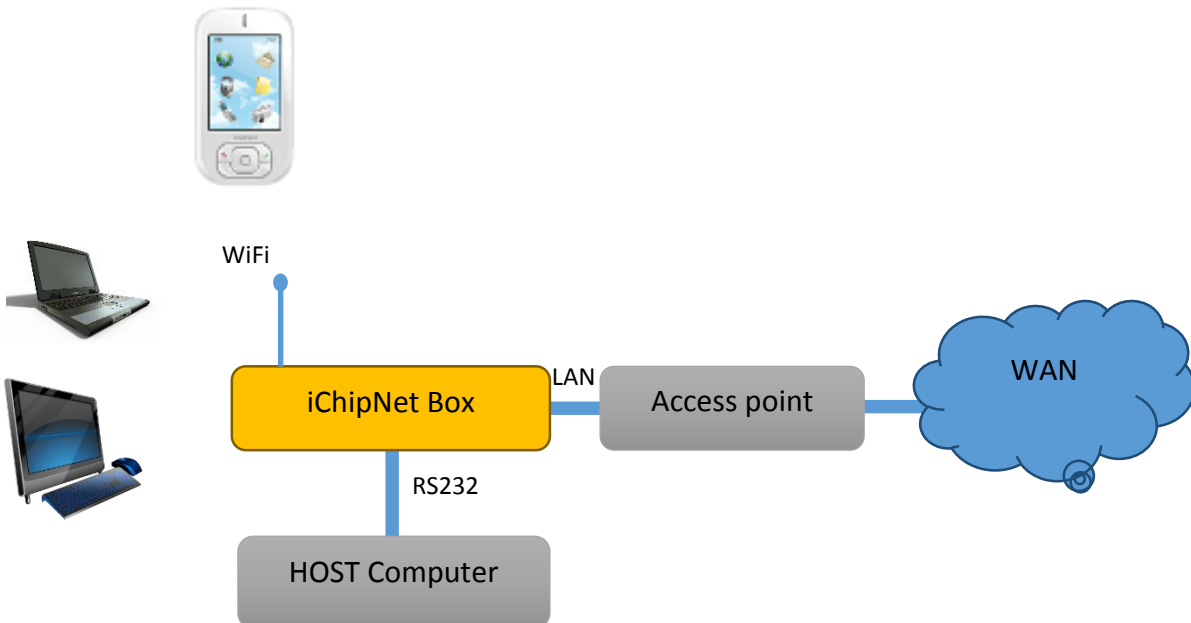
4. AT+i Command Set

The iChipNet Box 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 commends description and format of the entire AT+i command set.

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

5. Dimension and Connection Description
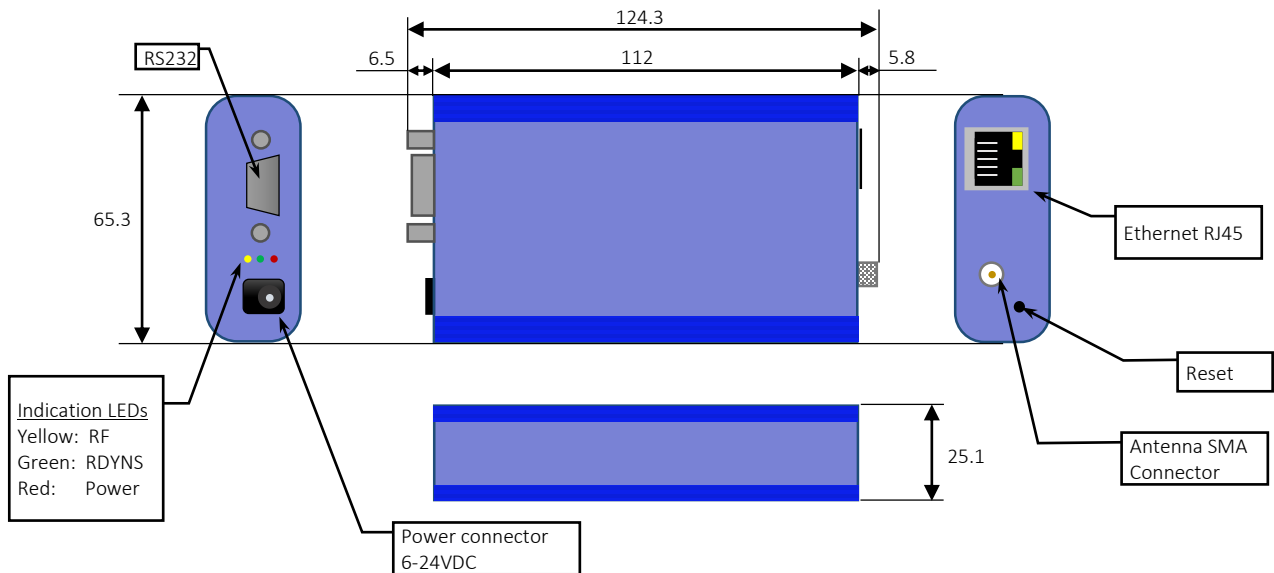
All measurements are in millimeters +/- 0.2mm

6. RS232 Pin Description

Pin #	Description	Direction
1	Readiness	Output
2	TXD	Output
3	RXD	Input
4	Short to pin 6	
5	GND	Power
6	Short to pin 4	
7	CTS	Input
8	RTS	Output
9	Vin (6-24VDC)	Power

7. Power Connector

The power connector is a 2.1mm power jack.

(Power supply could be ordered from Connect One, Please refer to the ordering instruction)

8. Reset Button functionality

The reset button is connected to the Msel signal in the iChip. Pressing the Reset button have several functionalities which are being activated upon pressing duration and power state. Please refer to Connect One's AT+i manual for further explanation of the Msel signal.

1) During power up

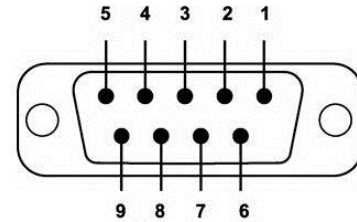A) Press less than 2 seconds – iChipNet Box goes to auto baud rate and auto host interface.

B) Press more than 4 seconds – iChipNet Box goes to Boot-Rom. In this case user can program F/W by using the iChipConfig software. (iChipConfig could be downloaded from Connect One website)

2) During normal operation

A) Press more than 5 second and less than 30 seconds - iChipNet Box goes to rescues mode. In Rescue mode, iChip performs the following operations:

   a. If in SerialNET mode — iChipNet Box exits SerialNET mode (SNMD is permanently changed to 0)

   b. If serial baud rate (in BDRF or BDRD) is set to a fixed value — iChipNet Box forces auto baud rate detection. BDRF/BDRD retain their values and will be used again upon the next power-up

    c. If Always Online mode is defined (TUP=2), or Automatic Router Start is enabled (ARS=1) — iChipNet Box bypasses this mode, which means that the iChipNet Box does not attempt to go online until the next software or hardware reset

    d. If LAN-to-WiFi Bridge mode is enabled and the BRM parameter contains a non-zero value — iChipNet Box disables Bridge mode and permanently assigns BRM=0.

    e. If the Host Interface parameter (HIF) is set to a fixed interface, it is forced to auto host interface detection mode (HIF=0)

  B) Press more than 30 seconds - iChipNet Box re-install parameter profile.

9. Electrical Specifications

1) Absolute Maximum Ratings

Parameter	802.11 b/g (iWL-NETBOX-G)	802.11 b/g/n (iWL-NETBOX-N)
Max power consumption	1.8W	2W
Operating Temperature	+5°C to +50°C +41°F to +122°F	+5°C to +50°C +41°F to +122°F
Storage Temperature	0°C to +70°C +32°F to +158°F	0°C to +70°C +32°F to +158°F

2) DC Operating Characteristics

Parameter	Min	Max	Units	Remark
Vin	6	24	Volts	
Radio Frequency Range	2.412	2.462	GHz	US (Default)
	2.412	2.472	GHz	EU
	2.412	2.484	GHz	JP

3) Transmit Specification

Item	Condition	802.11b/g/n (iWL-NETBOX-N)			802.11b/g (iWL-NETBOX-G)			Unit
		Min	Typ	Max	Min	Typ	Max	
Transmit Power Levels	802.11b	15	17	19	13	15	17	dBm
	802.11g	12	14	16	13	15	17	dBm
	802.11n	10	12	14	-	-	-	dBm

4) Receive Specifications

Item	Condition	802.11b/g/n (iWL-NETBOX-N)			802.11b/g (iWL-NETBOX-G)			Unit
		Min	Typ	Max	Min	Typ	Max	
Receiver Minimum Input Level Sensitivity	802.11b Data Rate = 11Mbps PER < 8%		-87			-85		dBm
	802.11b Data Rate = 1Mbps PER < 8%		-94			-87		dBm
	802.11g Data Rate = 54Mbps PER <10%		-73			-74		dBm
	802.11g Data Rate = 6Mbps PER <10%		-86			-86		dBm
	802.11n MCS0 PER <10%		-86					dBm
	802.11n MCS7 PER <10%		-70					dBm

10. Ordering Information

Part Number	Description
iWL-NETBOX-G	iChipNet Box supporting 802.11 b/g
iWL-NETBOX-N	iChipNet Box supporting 802.11 b/g/n
Accessories	
CABLE-DB9-F/M-G	Serial Cable with DB9 connector Female / Male
CABLE-DB9-F/F-G	Serial Cable with DB9 connector Female / Female
CABLE-DB9-F/M+P-G	Serial Cable with DB9 connector Female / Male + power cable
W-TR-110/9-P5-G	110VAC to 9VDC power supply
W-TR-220/9-P5-G	220VAC to 9VDC power supply
CABLE-RJ45	LAN Cable

Appendix A - Internet Protocol Compliance

iChipNet Box complies with the Internet standards listed in the following table

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