

# *Easy Network Configuration*

## **Theory of Operation**

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# Easy Network Configuration

A simple first-time configuration methodology is available for iChip devices in situations where:

- A Host port is not readily available to accept AT+i commands
- It is preferable to configure iChip over the network.

This methodology is available starting with firmware version 804 and beyond.

## **Introduction**

iChip may be configured using a combination of the following methods:

1. Issue AT+i commands to the iChip Host port (Serial, USB or SPI). AT+i commands allow setting each individual parameter value. Since the iChip parameters are non-volatile, this setting may be a one-time procedure.
2. Connect the iChip USB or Serial port to a PC running Windows and activate the iChipConfig GUI application. This application provides a convenient Windows GUI with which to configure iChip. The actual configuration is taken care of in the background with AT+i commands.
3. Activate iChip's Web server and use a standard Browser to surf to iChip's configuration Web site, where most of iChip's parameters may be viewed and updated.
4. Upload an RPF file via iChip's Configuration Web site. The iChip Webserver must be active. An RPF file contains iChip parameter names and value settings. Loading an RPF has the equivalent affect of setting the iChip's parameters to the specified values.

Methods 1 and 2 require a physical connection to the iChip Host port (Serial, USB or SPI). Methods 3 and 4 require an active IP connection to the network in order to properly allow parameter configuration.

In many cases, neither of these connections is readily available **before** a preliminary configuration is made.

Therefore, an additional method has been added to provide for an easy preliminary configuration over a network, in what is called "**Easy-Configuration**" mode.

## **Preliminary Network Based Configuration**

The Easy-Configuration mode supports a simple configuration methodology in cases where the physical iChip Host port is not available and iChip needs to be configured (in

at least several parameters) in order to connect to the network. This methodology is based on the Parameter Profile feature.

It is assumed that in these cases, a Parameter Profile will be devised and stored in iChip to allow setting up a temporary IP connection, which may then be used for preliminary configuration purposes. For example, given a WPA secured WiFi network, it is required to configure an SSID and Pass-Phrase to connect to the Access point. In this case a temporary network connection may be devised to support an Ad-Hoc connection on a specific (pre-known) channel, SSID and a fixed IP address. The AP SSID and Pass-Phrase may then be configured through that network using a standard browser.

## **iChip Facilities to support Easy Configuration**

Several iChip facilities have been made available to support Easy-Configuration:

### **1. Auto Start Web Server**

The +iAWS (Auto Web Server) parameter behavior has been enhanced. When +iAWS>0 iChip enables its Web Server under all circumstances. Furthermore, when enabled, the Web server is accessible from any iChip network interface. For example, if iChip supports both a LAN network interface and a cellular network interface, when +iAWS>0 the iChip configuration site may be accessed from the LAN network in order to configure the cellular parameters required to create a connection on the cellular network.

### **2. Network Configuration Mode**

A new mode of operation has been added. This mode is dedicated to Network configuration and is governed by a special set of values that may be assigned to the +iAWS parameter:

- 200                               -- Use SSL3 Secure Web Server for network configuration
- 201, 202 or 203               -- Use Web Server with 2, 4 or 6 sockets respectively for network configuration

When +iAWS $\geq$ 200 the iChip Configuration Web site (which is part of the iChip firmware) displays a special Network Configuration page. This page is dedicated to configuring the required parameters that need to be defined in order to connect to a specific network.

It is envisioned that this configuration shall be a one-time configuration, under a temporary profile. It shall be used for a first time configuration to get iChip connected to a specific network, whose configuration is unknown at the time of manufacturing the product.

After the one-time configuration, it is assumed that the +iAWS parameter is assigned a value less than 200 and therefore iChip will connect to the required network and the regular iChip Configuration Web site shall be displayed and used to fully configure the remaining iChip parameters.

### 3. Stored Parameter Profile

The Parameter Profile is a snap-shot of all iChip parameter settings at a specific instance. The Parameter Profile is stored in iChip memory and may be recalled with an AT+I command or by holding the MSEL signal LOW for more than 30 seconds.

Creating a Parameter Profile involves setting iChip's individual parameters and issuing:

AT+i SPRF[:*n*]

Where *n* is an optional profile number (currently can only be 1).

As mentioned above, this command stores the current values of all iChip parameters in a separate storage, which may be referenced to at a later time in order to load the stored profile into active iChip parameters. Profile loading is achieved with the following AT+i command:

AT+iLPRF[:*n*]

Where *n* is the optional stored profile number (currently must be 1).

An additional command allows displaying a report of the stored profile. The report includes one line for each iChip parameter, using the following syntax:

<Parameter Name>=<Value>

where, *Parameter Name* is an AT+i parameter name.

The syntax of the profile display command is:

AT+iDPRF[:*n*]

where, *n*=0 displays current (active) iChip parameters and

*n*=1 displays the stored Parameter Profile values.

### 4. New iChip Network Configuration Web Page (when +iAWS≥200)

The network configuration web site is divided into four configuration sections:

- WiFi
- LAN
- Dialup
- Miscellaneous

See Fig 1 below.

The WiFi section contains dialog boxes to configure an Ad-Hoc connection or an AP (infrastructure) connection, as well as security related modes, pass-phrases and certificates. It also includes a subsection which lists the available AP's and Ad-Hoc networks in the near vicinity.

The LAN section contains dialog boxes to configure the iChip's IP and gateway, or may be left clear to obtain IP addresses from a DHCP server.

The dialup section contains dialog boxes to configure a modem, dialup and PPP related parameters.

The last section contains several miscellaneous fields related to future configuration capability:

- AWS: The AWS parameter, which defines the availability of the Web server after power-up.
- LATI: The LATI parameter may contain a non-zero port number, which iChip will Listen on. When configured, a TCP socket connection to this port will allow an alternative route for iChip AT+I commands and replies (see AT+I Programmers Manual).



Web Server Status Message:OK

Network Configuration			
Parameter	Value	Limitations	Description
<b>WIFI</b>			
WLCH	<input type="text" value="0"/>	1..13	Wireless Lan Channel (Ad-Hoc)
WST0	<input type="text" value="3"/>	0-6,105,106	Wireless Security Type
WLK1	<input type="text"/>	32 Chars	Wireless Lan WEP Key
WLPP	<input type="text" value="*****"/>	8-63 Chars	Wireless Lan WPA Passphrase
EUSN	<input type="text"/>	64 Chars	Enterprise Domain/Username
EPSW	<input type="text"/>	64 Chars	Enterprise Password
<input type="button" value="upload CA file"/>			
WLSI	<input type="text" value="INET"/>	32 Chars	Wireless Lan SSID
Available APs and Ad-Hoc networks (SSID, ADHOC or AP, BSSID, Security Type, Channel, RSSI)			
RTL8188-default,AP,00:E0:4C:81:88:88,NONE,1,82			
liat_adhoc,ADHOC,02:26:16:4C:F2:44,NONE,3,85			
Yuval,AP,00:18:4D:DE:D8:35,NONE,5,58			
Jetta,AP,06:14:6C:89:4A:7C,WPA2,6,49			
GANG_TEST,AP,00:17:3F:9F:89:6E,NONE,7,53			
Blue-I The Lab,AP,00:1B:2F:57:65:62,WEP,7,86			
Bora,AP,00:14:78:F7:11:BA,NONE,7,48			
Levanto,AP,00:14:D1:4A:4C:A3,WEP,7,57			
Sirocco,AP,00:18:4D:DE:D7:DF,WPA,7,58			
Ela,AP,00:0E:2E:EB:C0:87,WPA2_ENT,7,70			
INET,AP,00:14:7C:4D:22:F3,WPA,7,59			
Mistral,AP,00:11:6B:3B:55:E2,WEP,9,61			
Zohar,AP,00:0E:2E:C6:B6:E1,WPA_ENT,11,61			
INET,AP,00:0E:2E:FD:F0:69,WPA,11,49			
<b>LAN</b>			
DIP	<input type="text" value="0.0.0.0"/>		Default IP
SNET	<input type="text" value="255.255.0.0"/>		Subnet
IPG	<input type="text" value="172.20.0.1"/>		IP Gateway
<b>Dialup/Cellular</b>			
ISP1	<input type="text"/>	96 Chars	ISP's Primary Phone Number
ATH	<input type="text" value="1"/>	0..2	Authentication
USRN	<input type="text"/>	64 Chars	ISP Username
PWD	<input type="text"/>	63 Chars	ISP Password
MTYP	<input type="text" value="0"/>	0..12,100..112,98	Modem Type
MIS	<input type="text"/>	126 Chars	Modem Initialization String
PPP	<input type="text" value="0"/>	0..2	PPP ACFC Handling
<b>Misc</b>			
AVVS	<input type="text" value="0"/>	0..3, 100	Automatic Web Server activation
LATI	<input type="text" value="0"/>	0..65,535	Listen port to enable remote AT+i

Figure 1: Special Network Configuration Web Page

## Summary of Network Configuration Methodology

The following guidelines summarize the Easy-Network-Configuration methodology:

- Create and store a temporary network configuration Parameter Profile in iChip. The parameter values configured, should reflect a standard preliminary state, which is a convenient starting point from which to manage the final configuration onsite. Make sure to assign  $+iAWS=20x$  in the Parameter Profile, so the special network-configuration page is displayed.
- When in the field pull the MSEL signal LOW for +30 seconds
- Use the temporary network settings (as defined in the stored profile) to browse to iChip's configuration Web site
- Because  $+iAWS \geq 200$  you will receive the special Network-Configuration Web page discussed above
- Configure the relevant Network parameters for the specific environment
- Assign  $+iAWS < 200$  and SUBMIT the configuration
- iChip should reboot and connect to the specific network it was configured for
- Try accessing the iChip from the current network. Optionally, continue configuring iChip using its normal configuration Web site
- If iChip did not successfully connect to the specific Network, pull MSEL LOW for +30 seconds to reinforce the parameter profile and start over from the 3<sup>rd</sup> step.

## Case Study Example

Assume iChip is embedded in a monitoring apparatus, which includes several sensors, an application MCU and connects over WiFi to an external AP. The iChip is interfaced to the application MCU on its serial port.

Since the monitoring apparatus does not include a keyboard and display – nor does it contain any external communication connectors such as serial or USB – configuring the device to connect to the AP presents a problem, since it necessitates specifying the required SSID, security type and security Pass-Phrases or keys.

This problem may be overcome with the Easy-Configuration method in iChip.

Starting from iChip's initial Factory-Defaults state, the following parameters are preconfigured and then stored in the Parameter Profile:

AT+iWLCH=11	<Define a WiFi channel>
AT+iSSID=!easyconf	<Configure an Ad-Hoc network called <i>easyconf</i> >
AT+iDIP=192.168.1.1	<Define a default IP address>
AT+iDPSZ=1	<Configure iChip as a DHCP server for a single client>
AT+iRPG=mypass	<Configure a Remote (Web) Update Password>
AT+iAWS=201	<Configure iChip for 1 <sup>st</sup> -time Network-Configuration>
AT+iSPRF	<Store this configuration in a Parameter Profile>

When the monitoring apparatus arrives in the field, the technician collects the relevant configuration info for the current venue. After powering up the device, the technician may use a standard PC, Laptop or PDA to find and connect to the *easyconf* Ad-Hoc network, which iChip creates. If the technicians system is configured for obtaining its IP addresses from a DHCP server, it shall be allocated IP 192.168.1.2 as it connects to iChip's Ad-Hoc network.

The technician may then open a standard browser and surf to: <http://192.168.1.1/iChip>, which is iChip's standard configuration Web site.

The following dialog shall be displayed:

Passwords	
Password required to change parameter values.	
Password (AT+iRPG) :	<input type="text"/>

Since in this case the +iRPG password parameter has been set to *mypass* – enter that password and click on submit.

The network configuration page shall be displayed, as seen in Fig 1 above.

Using this dialog it is possible to configure the current venue's SSID and security parameters, as well as iChip's default IP (or 0.0.0.0 to use the venue's DHCP server).

Note that the +iAWS parameter is cleared to 0, but may be configured to any other value. For example, setting AT+iAWS=1 shall enable iChip's Web server after rebooting.

When the network configuration is complete, click on the submit button. iChip should now configure its parameters with the new settings and reboot. The changes made on the network configuration page should cause iChip to connect to the current venue's network. Assuming this was successful and that the +iAWS parameter was configured to enable the iChip Web server – iChip's configuration Web site can now be browsed over the current venue's network. Additional iChip parameters can then be configured.

If, however, the network configuration was not successful, the iChip MSEL signal may be pulled LOW for just above 30 seconds in order to re-instate the Parameter Profile, in which case iChip shall return to create the preconfigured Ad-Hoc network, through which it may be configured again.