Serial-to-WiFi AT Commands Sample Examples

To Create TCP and UDP Connection

User Guide

GS2K-SMP-EXP-UG-001207

Modules
GS2011M and GS2100M

GainSpan® 802.11b/g/n Ultra-Low Power Wi-Fi® Series Modules

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About This Manual

This manual provides GS2000 based module evaluation kit sample examples for using Serial-to-WiFi AT commands to create TCP or UDP connections for Open and Secure networks.

Refer to the following sections:

- Revision History, page 5
- Audience, page 6
- Standards, page 6
- Documentation Conventions, page 7
- Documentation, page 10
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Revision History

This version of the *GainSpan GS2000 Based Module Sample Examples User Guide (for using Serial-to-WiFi AT Commands to Create TCP or UDP Connection)* contains the following new information listed in Table 1, page 5.

Table 1 Revision History

Version	Date	Remarks
1.0	May 2014	Initial Release
1.0.1	September 2014	Added instructions on how to setup Infrastructure and Limited AP mode in a secure network environment. See 1.2.1 Joining Open or Secure Network (WPA2-PSK), page 18 and 1.5.2 Creating Limited AP WPA2-PSK Mode (Secure Network), page 30.

Table 1 Revision History (Continued)

Version	Date	Remarks
1.1	February 2015	Beacon Interval range to configure and provision web pages in limited AP, changed from 100-1600 milliseconds, to 50-1500 milliseconds. See 2.2.2 Limited AP Settings, page 54.
1.2	April 2015	Added notation outlining the minimum and maximum characters for username under Administrator Settings for Limited AP mode. See 2.2.4 Administrator Settings, page 59.

Audience

This manual is designed to setup, create, and run connection examples for UDP client/server and TCP client/server. This manual also provides instructions for provisioning the board, setting up Limited AP mode, and WiFi Protected Setup (WPS).

Standards

The standards that are supported by the GainSpan GS module are IEEE 802.11b/g/n.

Documentation Conventions

This manual uses the following text and syntax conventions:

- Special text fonts represent particular commands, keywords, variables, or window sessions
- Color text indicates cross-reference hyper links to supplemental information
- Command notation indicates commands, subcommands, or command elements

Table 2, page 7, describes the text conventions used in this manual for software procedures that are explained using the AT command line interface.

Table 2 Document Text Conventions

Convention Type	Description
command syntax monospaced font	This monospaced font represents command strings entered on a command line and sample source code. `AT XXXX`
Proportional font description	Gives specific details about a parameter. `<Data> DATA`
UPPERCASE Variable parameter	Indicates user input. Enter a value according to the descriptions that follow. Each uppercased token expands into one or more other token.
lowercase Keyword parameter	Indicates keywords. Enter values exactly as shown in the command description.
[ ] Square brackets	Enclose optional parameters. Choose none; or select one or more an unlimited number of times each. Do not enter brackets as part of any command. `[parm1|parm2|parm3]`
? Question mark	Used with the square brackets to limit the immediately following token to one occurrence.
<ESC> Escape sequence	Each escape sequence <ESC> starts with the ASCII character 27 (0x1B). This is equivalent to the Escape key. `<ESC>C`
<CR> Carriage return	Each command is terminated by a carriage return.
<LF> Line feed	Each command is terminated by a line feed.
<CR> <LF> Carriage return Line feed	Each response is started with a carriage return and line feed with some exceptions.

Table 2 Document Text Conventions (Continued)

Convention Type	Description
< > Angle brackets	Enclose a numeric range, endpoints inclusive. Do not enter angle brackets as part of any command. `<SSID>`
= Equal sign	Separates the variable from explanatory text. Is entered as part of the command. `PROCESSID = <CID>`
. dot (period)	Allows the repetition of the element that immediately follows it multiple times. Do not enter as part of the command. `.AA:NN can be expanded to 1:01 1:02 1:03.`
A.B.C.D IP address	IPv4-style address. `10.0.11.123`
X:X::X:X IPv6 IP address	IPv6-style address. `3ffe:506::1` Where the : : represents all 0x for those address components not explicitly given.
LINE End-to-line input token	Indicates user input of any string, including spaces. No other parameters may be entered after input for this token. `string of words`
WORD Single token	Indicates user input of any contiguous string (excluding spaces). `singlewordnospaces`

Table 3, page 9, describes the symbol conventions used in this manual for notification and important instructions.

Table 3 Symbol Conventions

Icon	Type	Description
	Note	Provides helpful suggestions needed in understanding a feature or references to material not available in the manual.
	Alert	Alerts you of potential damage to a program, device, or system or the loss of data or service.
	Caution	Cautions you about a situation that could result in minor or moderate bodily injury if not avoided.
	Warning	Warns you of a potential situation that could result in death or serious bodily injury if not avoided.
	Electro-Static Discharge (ESD)	Notifies you to take proper grounding precautions before handling a product.

Documentation

The GainSpan documentation suite listed in Table 4, page 10 includes the part number, documentation name, and a description of the document. The documents are available from the GainSpan Portal. Refer to Accessing the GainSpan Portal, page 15 for details.

Table 4 Documentation List

Part Number	Document Title	Description
GS2K-QS-001205	GainSpan GS2000 Based Module Kit Quick Start Guide	Provides an easy to follow guide on how to unpack and setup GainSpan GS2000 based module kit for the GS2011M and GS2100M modules.
GS2K-EVB-FP-UG-001206	GainSpan GS2000 Based Module Programming User Guide	Provides users steps to program the on-board Flash on the GainSpan GS2000 based modules using DOS or Graphical User Interface utility provided by GainSpan. The user guide uses the evaluation boards as a reference example board.
GS2K-SMP-EXP-UG-001207	GainSpan GS2000 Based Module Sample Examples for using Serial-to-WiFi AT Commands to Create TCP or UDP Connection User Guide	Provides an easy to follow instructions on how to setup, create, and run connection examples for UDP client/server and TCP client/server. This manual also provides instructions for provisioning the board, setting up Limited AP mode, and WiFi Protected Setup (WPS), and Web provisioning over Ad-hoc.
GS2011-S2W-APP-PRG-RG-001208	GainSpan Serial-to-WiFi Adapter Application Programmer Reference Guide	Provides a complete listing of AT serial commands, including configuration examples for initiating, maintaining, and evaluating GainSpan WiFi GS2011M series modules.
GS2100-S2W-APP-PRG-RG-001208	GainSpan Serial-to-WiFi Adapter Application Programmer Reference Guide	Provides a complete listing of AT serial commands, including configuration examples for initiating, maintaining, and evaluating GainSpan WiFi GS2100M series modules.
GS2K-SDK-DB-UG-001209	GS2000 Based Module Software Development Kit and Debugging User Guide	This manual provides SDK user installation instructions, IAR IDE workbench application, and I-Jet hardware used for JTAG Serial-to-WiFi (S2W) and TLS application development and debugging.

Table 4 Documentation List (Continued)

Part Number	Document Title	Description
GS2K-EVB-HW-UG-001210	GainSpan GS2000 Based Module Evaluation Board Hardware User Guide.	Provides instructions on how to setup and use the GS2000 based module evaluation board along with component description, jumper settings, board specifications, and pinouts.
GS2011M-DS-001211	GainSpan GS2011M Low Power WiFi Module Data Sheet	Provides information to help WiFi system designers to build systems using GainSpan GS2011M module and develop wireless applications.
GS2100M-DS-001212	GainSpan GS2100M Low Power WiFi Module Data Sheet	Provides information to help WiFi system designers to build systems using GainSpan GS2100M module and develop wireless applications.
GS2K-HTTP-EAP-UG-001213	GainSpan GS2000 Based Module Configuration Examples for using Serial-to-WiFi AT Commands to Create HTTP, HTTPS, and EAP Connection User Guide	Provides an easy to follow instructions on how to setup, create, and run connection examples for HTTP, HTTPS, and EAP.
GS2011MxxS-DS-001214	GainSpan GS2011MxxS Low Power WiFi Module Data Sheet	Provides information to help WiFi system designers to build systems using GainSpan GS2011MxxS module and develop wireless applications.
GS2K-SDK-BLDR-UG-001223	GainSpan GS2000 Based Module Software Developer Kit (SDK) Builder User Guide	Allows OEMs and system developers to configure and generate custom firmware binary images for GainSpan low power embedded GS2000 based WiFi modules. The SDK Builder supports the GainSpan GEPS software released, including the corresponding WLAN firmware.
GS2K-SDK-QS-001225	GainSpan GS2000 Based Module Software Development Kit Quick Start Guide	Provides an easy to follow guide that will walk you through easy steps to setup, evaluation, develop, and debug the full capabilities and features of the GS2011M or GS2100M embedded platform software.

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can send your comments by logging into GainSpan Support Portal. If you are using e-mail, be sure to include the following information with your comments:

- Document name
- URL or page number
- Hardware release version (if applicable)
- Software release version (if applicable)

References

The GainSpan references listed in Table 5, page 12 are available on the GainSpan Portal. Refer to Accessing the GainSpan Portal, page 15 for details.

Table 5 Other Documents and References

Title	Description
Schematics	GS2000 Based Module Evaluation Board schematics supporting: • GS2011M • GS2100M
Module Firmware and Programming Utilities	• Serial-to-WiFi (S2W) based firmware • Temperature and Light Sensor (TLS) based firmware – For use with GS2011M EVK only • Firmware Release Notes • GSFlashprogram utility for programming the modules
Smart Phone Applications	• Smart Phone applications for iOS and Android to evaluate and demonstrate the Temperature and Light Sensor (TLS) firmware. – For use with GS2011M EVK only
Software Utilities	Serial terminal program to evaluate and demonstrate Serial-to-WiFi (S2W) applications

Contacting GainSpan Technical Support

Use the information listed in Table 6, page 13, to contact the GainSpan Technical Support.

Table 6 GainSpan Technical Support Contact Information

North America	1 (408) 627-6500 - techsupport@gainspan.com
Outside North America	Europe: EUsupport@gainspan.com China: Chinasupport@gainspan.com Asia: Asiasupport@gainspan.com
Postal Address	GainSpan Corporation 3590 North First Street Suite 300 San Jose, CA 95134 U.S.A.

For more Technical Support information or assistance, perform the following steps:

1. Point your browser to http://www.gainspan.com.
2. Click **Contact**, and click **Request Support**.
3. Log in using your customer **Email** and **Password**.
4. Select the **Location**.
5. Select **Support Question** tab.
6. Select **Add New Question**.
7. Enter your technical support question, product information, and a brief description.

The following information is displayed:

- Telephone number contact information by region
- Links to customer profile, dashboard, and account information
- Links to product technical documentation
- Links to PDFs of support policies

Returning Products to GainSpan

If a problem cannot be resolved by GainSpan technical support, a Return Material Authorization (RMA) is issued. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

NOTE: *Do not return any components to GainSpan Corporation unless you have first obtained an RMA number. GainSpan reserves the right to refuse shipments that do not have an RMA. Refused shipments will be returned to the customer by collect freight.*

For more information about return and repair policies, see the customer support web page at: https://www.gainspan.com/secure/login.

To return a hardware component:

1. Determine the part number and serial number of the component.
2. Obtain an RMA number from Sales/Distributor Representative.
3. Provide the following information in an e-mail or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number
   - Description of the failure
4. The support representative validates your request and issues an RMA number for return of the components.
5. Pack the component for shipment.

Guidelines for Packing Components for Shipment

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in electrostatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

CAUTION! *Do not stack any of the components.*

Accessing the GainSpan Portal

To find the latest version of GainSpan documentation supporting the GainSpan product release you are interested in, you can search the GainSpan Portal website by performing the following steps:

NOTE: *You must first contact GainSpan to set up an account, and obtain a customer user name and password before you can access the GainSpan Portal.*

1. Go to the GainSpan Support Portal website.
2. Log in using your customer **Email** and **Password**.
3. Click the **Getting Started** tab to view a Quick Start tutorial on how to use various features within the GainSpan Portal.
4. Click the **Actions** tab to buy, evaluate, or download GainSpan products.
5. Click on the **Documents** tab to search, download, and print GainSpan product documentation.
6. Click the **Software** tab to search and download the latest software versions.
7. Click the **Account History** tab to view customer account history.
8. Click the **Legal Documents** tab to view GainSpan Non-Disclosure Agreement (NDA).

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Chapter 1 Serial-to-WiFi Connection Examples

This chapter describes the Serial-to-WiFi procedures on how to setup, test, and evaluate UDP (client/server) and TCP (client/server) connection examples on GainSpan® GS2011M or GS2100M modules.

- Requirements, page 17
- Infrastructure Mode, page 18
- UDP, page 19
- TCP, page 24
- Limited AP Mode, page 29

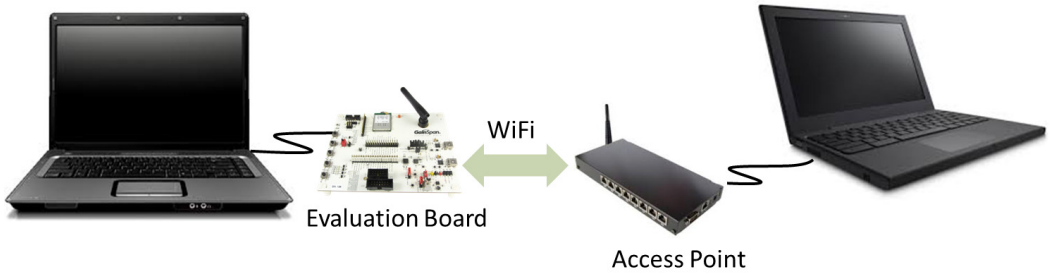
1.1 Requirements

The Serial-to-WiFi application firmware binaries must be loaded onto the GainSpan GS2011M or GS2100M module. For details on how to install the firmware and binaries. Refer to *GainSpan Serial-to-WiFi Adapter Application Programmer Reference Guide*.

1.2 Infrastructure Mode

Figure 1, page 18 illustrates Infrastructure Mode setup.

Figure 1 Infrastructure Mode Setup



1.2.1 Joining Open or Secure Network (WPA2-PSK)

The instructions below outline how to join an Open or Secure Infrastructure network.

1. If a network has security enabled, set the security password using the AT command below. If joining an Open network, skip **Step 2** below.
2. Set the WPA2-PSK Passphrase.

   ```
   AT+WWPA=<PASSPHRASE>
   ```

3. Set device to infrastructure mode. This step is optional, since default mode is infrastructure mode.

   ```
   AT+WM=0
   ```

4. Enable DHCP, if disabled previously.

   ```
   AT+NDHCP=<disable=0/enable=1> (default is enable)
   ```

5. Join the infrastructure network.

   ```
   AT+WA=<SSID>[,[<BSSID>][,<Ch>]]
   ```

Example

```
AT+WWPA=test12345
AT+WM=0
AT+WA=GainSpanDemo,,11
```

NOTE: *The TCP/UDP example is common to whether you associate with an open or secure network.*

1.3 UDP

1.3.1 UDP Server

This section describes how to setup the UDP Server on the GainSpan GS2011M or GS2100M evaluation board using the AT commands.

NOTE: *A socket test tool is used for this example. You can use a socket test tool like "Sockettest." This can be downloaded from http://socketest.sourceforge.net.*

Run a terminal emulation program (like Tera Term) on the computer that is connected to the evaluation board and enter the following commands (see Figure 2, page 20):

1. Disassociate from the current network (if applicable).

   ```
   AT+WD
   ```

2. Enable DHCP, if disabled previously.

   ```
   AT+NDHCP=<disable=0/enable=1>
   ```

3. Associate to an Access Point (AP): AT+WA=<SSID>[,[<BSSID>][,<Ch>]]

   ```
   AT+WA=GS_Limited_AP,,11
   ```

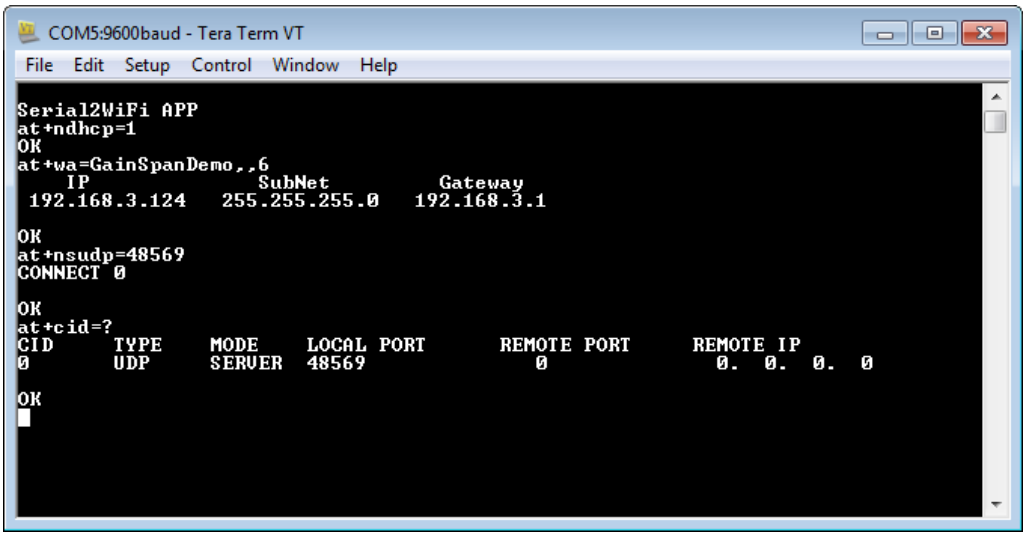
4. Start a UDP server on a specific port number: AT+NSUDP=<port>

   ```
   AT+NSUDP=48569
   ```

5. Upon successful creation of the UDP server, you will see a "CONNECT <CID>" message, where CID is the newly allocated connection identifier. Check for the new CID by issuing the command: AT+CID=?

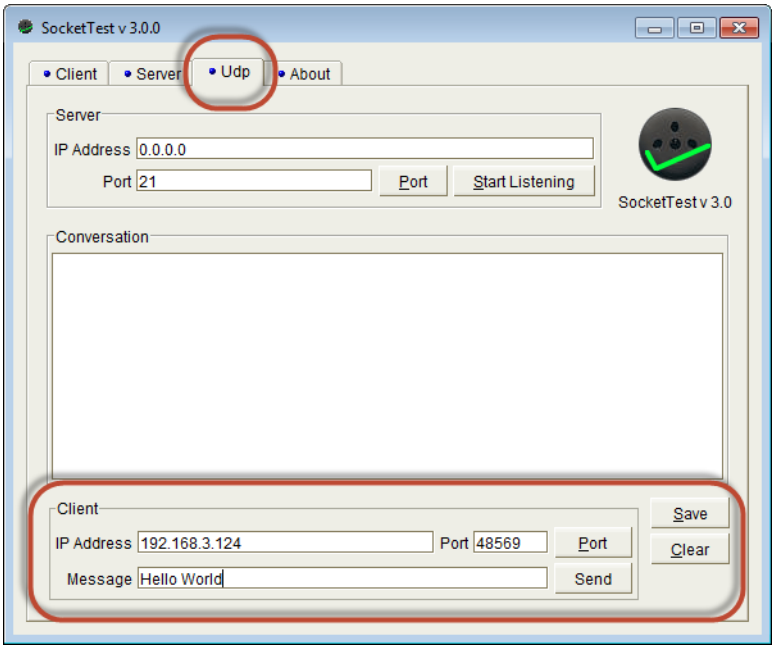
   ```
   AT+CID=?
   ```

Figure 2 Creating a UDP Server



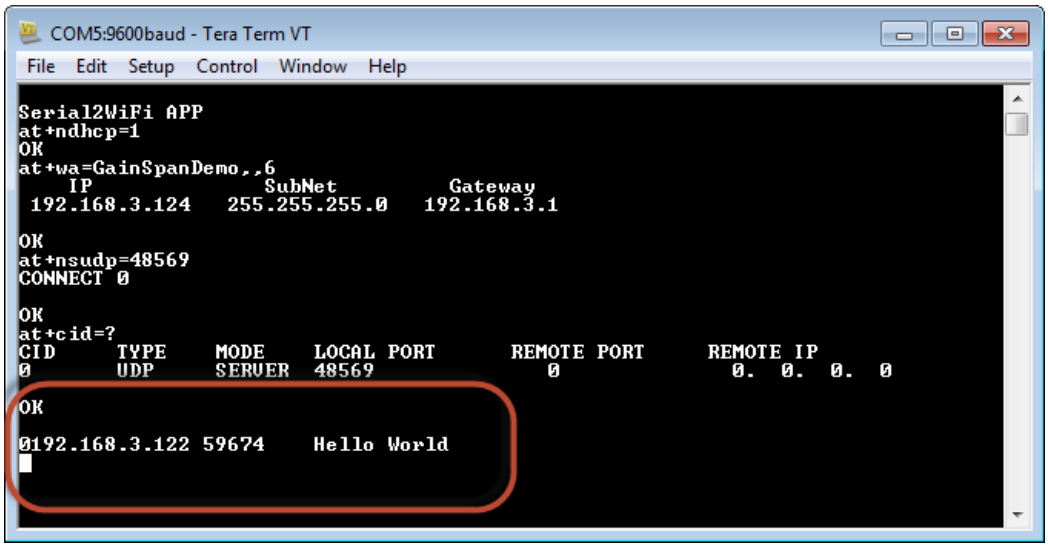
6. Connect to the UDP server by:
   - Have a PC associate to the Access Point (AP).
   - Using the SocketTest tool, have the UDP client send data to the UDP server (see Figure 3, page 20).
   - Under the UDP tab, enter the Client IP address (192.168.3.124) and Port associated with the AP (48569).

Figure 3 Connect to a UDP Server



7. Click the **Send** button. The data will be received on the module side as shown in Figure 4, page 21 below.

Figure 4 Data Received on the Module

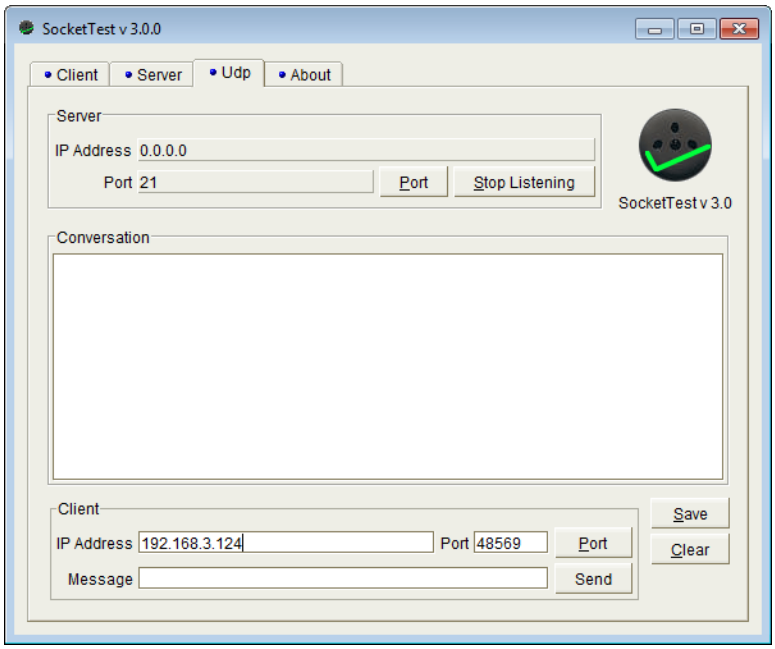


1.3.2 UDP Client

This section describes how to setup the UDP Client on the GainSpan GS2011M or GS2100M evaluation board using AT command mode or auto-connect mode.

1. Connect your PC to an Access Point (AP), and start a UDP Server session. Figure 5, page 22 shows the UDP Client Server is used. This tool can be downloaded from: http://www.softpedia.com.

Figure 5 UDP Client Server Session



Run a terminal emulation program (like Tera Term) on the computer that is connected to the evaluation board and enter the following commands.

2. Enable DHCP, if disabled previously.

```
AT+NDHCP=<disable=0/enable=1>
```

3. Associate to the Access Point (AP). This should be the same AP as the PC is also associated to: AT+WA=<SSID>[,[<BSSID>][,<Ch>]]

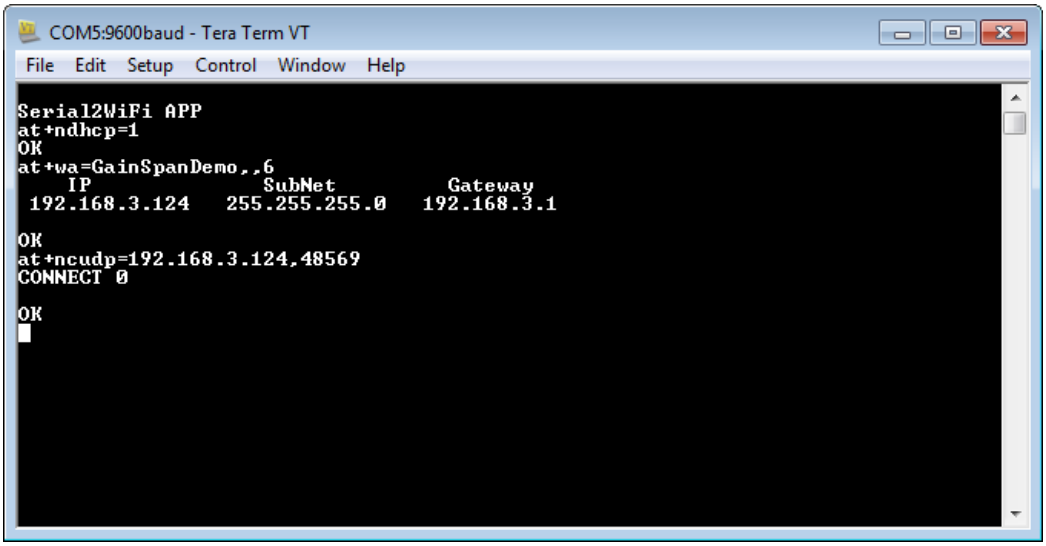
```
AT+WA=GainSpanDemo,,6
```

4. Start the UDP Client and connect to the UDP Server: AT+NCUDP=<Dest-Address>,<Port>>[<,Src.Port>]

```
AT+NCUDP=192.168.3.124,48569
```

5. Upon successful connection to the UDP Server, you will see a “CONNECT <CID>” message, where CID is the newly allocated connection identifier (see Figure 6, page 23).

Figure 6 UDP Destination Address and Port Identified

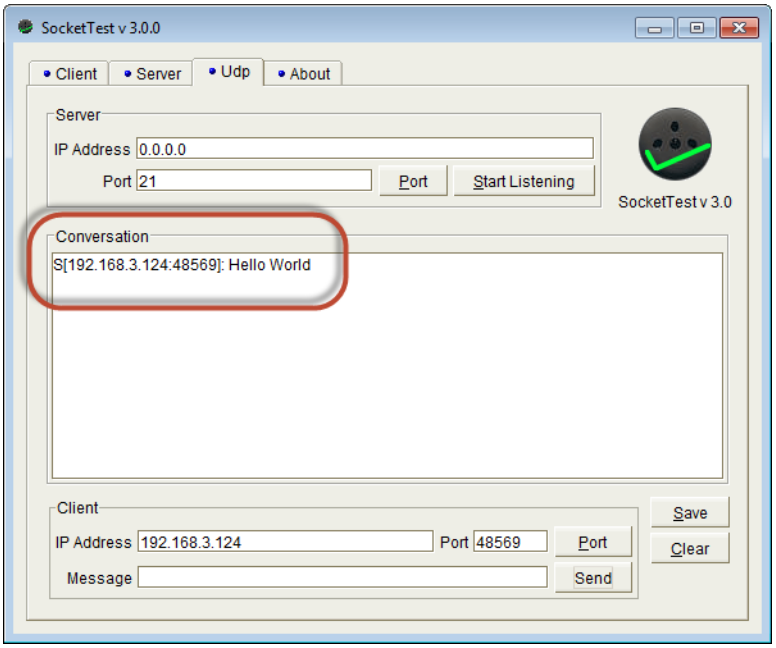


6. GainSpan GS2000 module can send data to the UDP Server using the following sequence: <ESC>S<CID><Data><ESC>E

   `<ESC>S0HELLOWORLD<ESC>E`

   The text “Hello World” is now received at the UDP Server (see Figure 7, page 23).

Figure 7 UDP Server Hello World



1.4 TCP

1.4.1 TCP Server

This section describes how to setup the TCP Server on the GainSpan GS2011M or GS2100M evaluation board using the AT command mode.

To setup the TCP Server, perform the following (see Figure 8, page 24):

1. Disassociate from the current network.

   ```
   AT+WD
   ```

2. Enable DHCP, if disabled previously.

   ```
   AT+NDHCP=<disable=0/enable=1>
   ```

3. Associate to an Access Point (AP): AT+WA=<SSID>[,[<BSSID>][,<Ch>]]

   ```
   AT+WA=GainSpanDemo,,6
   ```

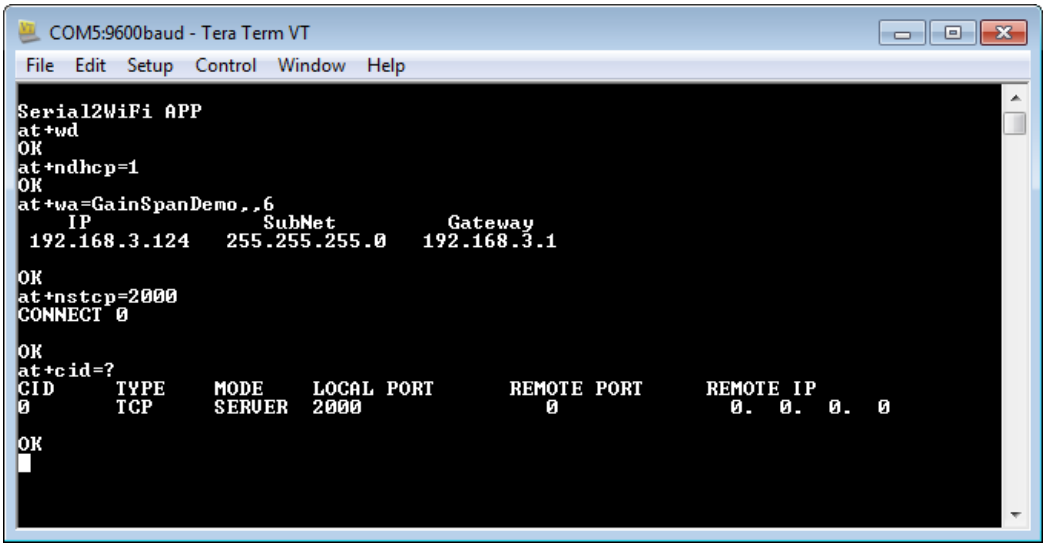
4. Start a TCP Server: AT+NSTCP=<port>

   ```
   AT+NSTCP=2000
   ```

5. Upon successful creation of the TCP Server, you will see a “CONNECT <CID>” message where CID is the newly allocated connection identifier. You can check for this new CID by issuing the following command: AT+CID=?

   ```
   AT+CID=?
   ```

Figure 8 Creating a TCP Server

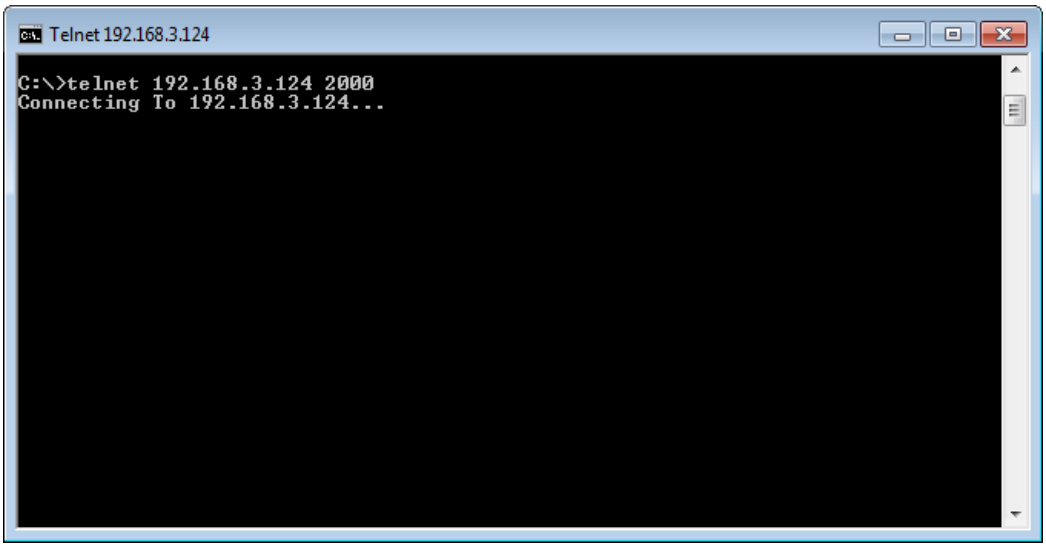


6. The user can Telnet into this server:
   - Have a PC connected to the *GainSpanDemo* Access Point (AP)
   - In the PCs command prompt, issue the following command:

     ```
     Telnet <IP address > <port number>
     ```

     For example: Telnet 192.168.3.124 2000 (see Figure 9, page 25)
   - Anything that is typed in the command prompt window will display on the Tera Term VT.

Figure 9 Connecting Telnet to Access Point



1.4.2 TCP Client

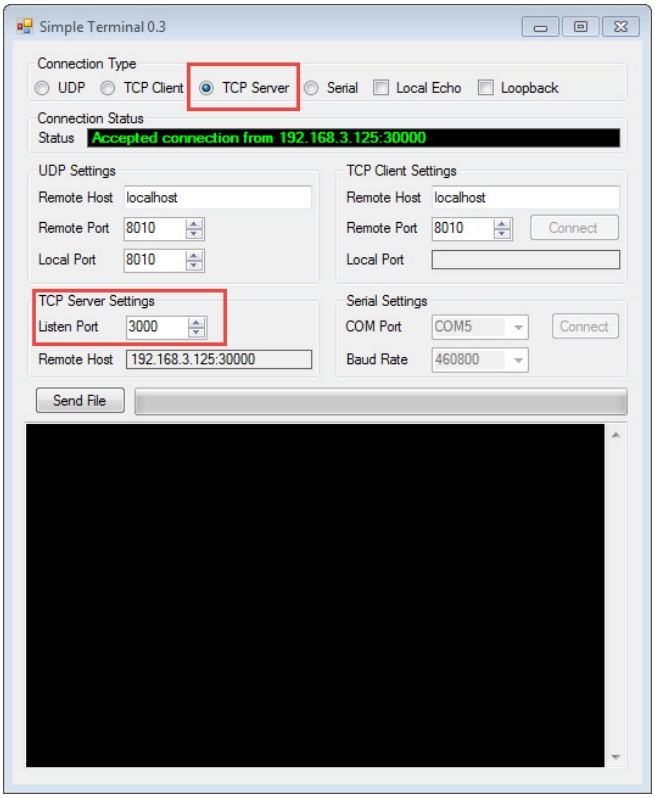
This section describes how to setup the TCP Client on the GainSpan GS2011M and GS2100M evaluation board using the AT command mode.

Before you begin connect your PC or Laptop to the GainSpanDemo.

Run Simple Terminal

1. Run Simple Terminal to create TCP server on port 3000. Simple Terminal can be found under the SW Utilities folder of the Evaluation Kit software.
2. Setup the TCP Client connection by selecting TCP Server radio button under the Simple Terminal window (see Figure 10, page 26).
3. Type 3000 under the TCP Server Settings Listen Port field and press Enter (see Figure 10, page 26).

Figure 10 TCP Server Connection



Create TCP Connection

1. Disassociate from the current network.

   ```
   AT+WD
   ```

2. Enable DHCP, if disabled previously.

   ```
   AT+NDHCP=<disable=0/enable=1>
   ```

3. Associate to an Access Point (AP): AT+WA=<SSID>[,[<BSSID>][,<Ch>]]

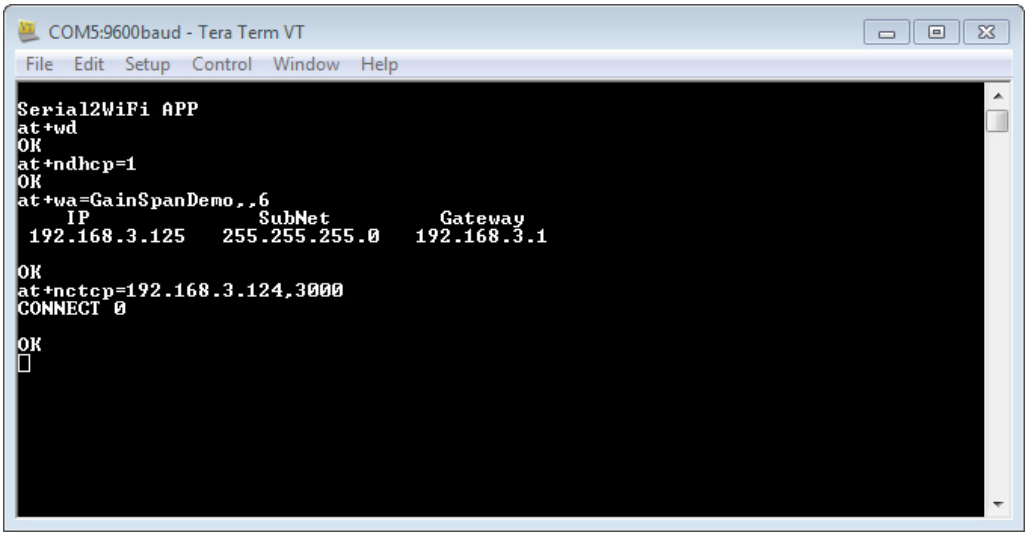
   ```
   AT+WA=GainSpanDemo,,6
   ```

4. Start a TCP Client: AT+NCTCP=<Dest-Address>,<Port>

   ```
   AT+NCTCP=192.168.3.124,3000
   ```

   Upon successful connection to the TCP Server, you will see a "CONNECT <CID>" message, where CID is the newly allocated connection identifier (see Figure 11, page 27).

Figure 11 TCP Client Session



Example

```
AT+NDHCP=1
OK
AT+WA=GainSpanDemo,,6
    IP          SubNet          Gateway
192.168.3.125:255.255.255.0:192.168.3.1
OK
AT+NCTCP=192.168.3.124,3000
CONNECT 0
OK
```

5. Send “Hello” string over the TCP connection.

   Notes:

   1. <Esc> means the “Esc” key on the PC or Laptop.
   2. The string “<Esc>S0Hello<Esc>E” will not be echoed by the GS2000, so you won’t see it in the Tera Term window where you are typing.
   3. The digit after ‘S’ is the CID number given in the “CONNECT” message - typically 0.
   4. The string “Hello” will appear in the Simple Terminal window.

Send Data from the Simple Terminal Window to the Tera Term Window via the GS2000

Type “HI THIS IS A TEST” in the Simple Terminal window.

Note: You will not see characters echoed in Simple Terminal. You will see the information displayed in the Tera Term window as you type.

Example Output on Tera Term Window

```
0H
0I
0
0T
0H
0I
0S
0
0I
0S
0
0A
0
0T
0E
0ST
```

Note: The characters are displayed as Simple Term sends them over the TCP connection. The ‘0’ before each character is the connection ID the data arrived over. Tera Term doesn’t display the <Esc>S and <Esc>E sequences that surround each line. The actual bytes arriving look more like this:

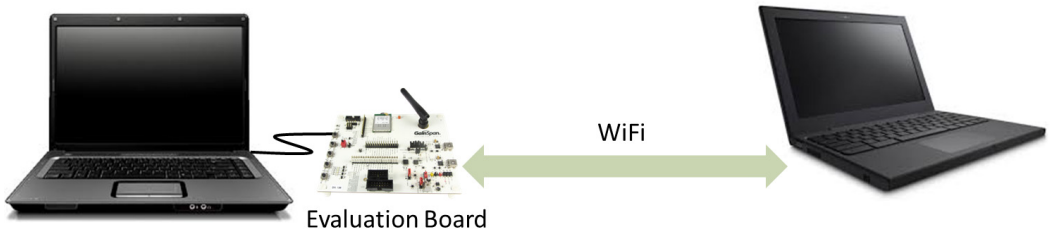
```
<Esc>S0H<Esc>E<Esc>S0I<Esc>E<Esc>S0 <Esc>E<Esc>S0T<Esc>E …
```

1.5 Limited AP Mode

1.5.1 Creating Limited AP Mode With No Security

Figure 12, page 29 illustrates Limited AP mode setup.

Figure 12 Limited AP Mode (Open)



Use the following steps to create limited AP mode.

1. Configure network stack parameter.

   ```
   AT+NSET=<SrcAddr>,<Net-Mask>,<Gateway>
   ```

2. Configure wireless mode to Limited AP.

   ```
   AT+WM=<infrastructure=0, adhoc=1,limited AP=2>
   ```

3. Create the limited AP network.

   ```
   AT+WA=<SSID>[,[<BSSID>][,<Ch>]]
   ```

4. Enable DHCP server.

   ```
   AT+DHCPSRVR=<disable=0/enable=1>
   ```

5. (*Optional*) Start the DNS server and specify a DNS name.

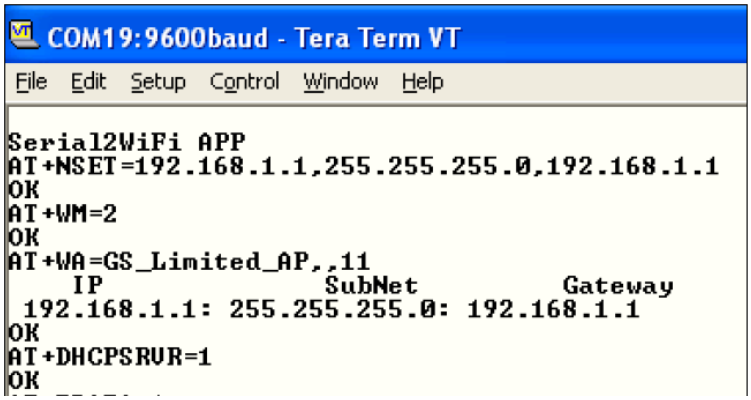
   ```
   AT+DNS=<disable=0/enable=1,<url>
   ```

Example

```
AT+NSET=192.168.1.1,255.255.255.0,192.168.1.1
AT+WM=2
AT+WA=GS_Limited_AP,,11
AT+DHCPSRVR=1
```

Figure 13, page 30 illustrates Limited AP mode created.

Figure 13 Creating Limited AP Mode (Open)



1.5.2 Creating Limited AP WPA2-PSK Mode (Secure Network)

The instructions below outline how to create limited AP in WPA2-PSK mode with DHCP and DNS sever enabled. Figure 14, page 31 illustrates Limited AP mode (secure network) setup.

1. Configure network stack parameter.

   ```
   AT+NSET=<Src Addr>,<Net-Mask>,<Gateway>
   ```

2. Compute WPA2-PSK from a given SSID and Passphrase.

   ```
   AT+WPAPSK=<SSID>,<PASSPHRASE>
   ```

3. Configure security to WPA2-PSK.

   ```
   AT+WSEC=<n>
   ```

4. Configure authentication mode to NONE.

   ```
   AT+WAUTH=<none,WPA/WPA2=0, open=1, WEP=2>
   ```

5. Configure wireless mode to Limited AP.

   ```
   AT+WM=<infrastructure=0, ad hoc=1, limited AP =2>
   ```

6. Enable DHCP server.

   ```
   AT+DHCPSRVR=<disable=0/enable=1>
   ```

7. Create the infrastructure network.

   ```
   AT+WA=<SSID>[,[<BSSID>][,<Ch>]]
   ```

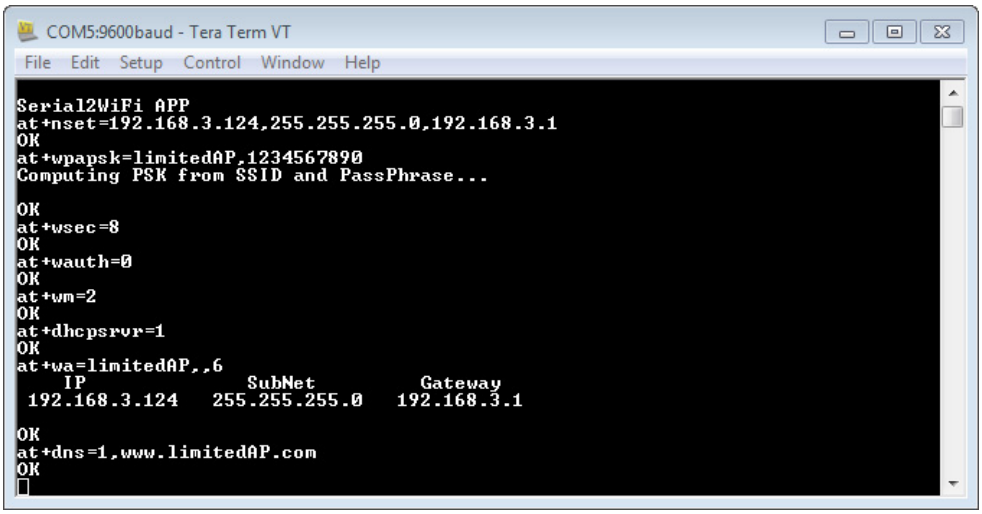
8. Start the DNS server and specify a DNS name.

   ```
   AT+DNS=<disable=0/enable=1, <url>
   ```

Example

```
AT+NSET=192.168.3.124,255.255.255.0,192.168.3.1
AT+WPAPSK=limitedAP,1234567890
AT+WSEC=8
AT+WAUTH=0
AT+WM=2
AT+DHCPSRVR=1
AT+WA=limitedAP,,6
AT+DNS=1,www.limitedAP.com
```

Figure 14 Creating Limited AP Mode (Secure Network)



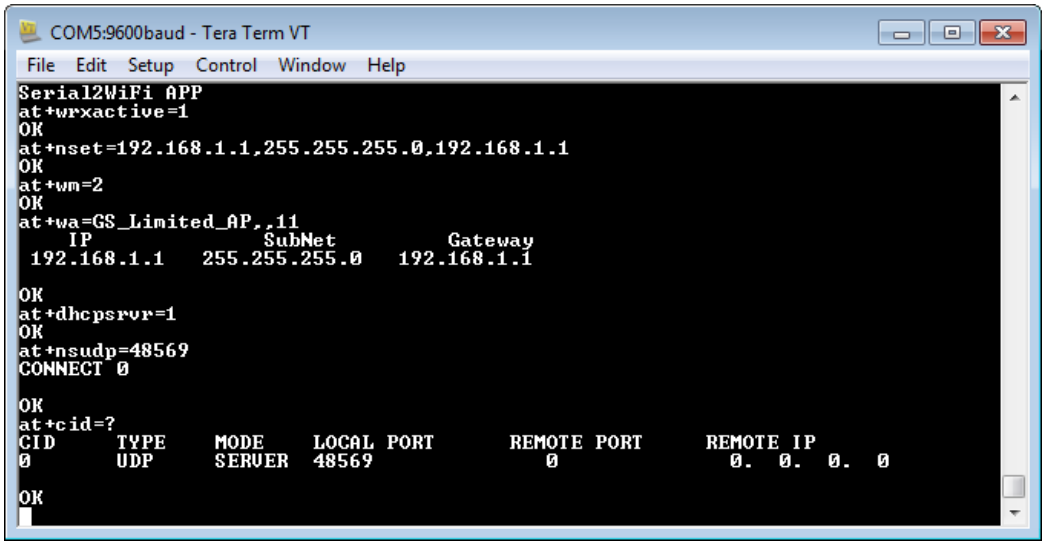
NOTE: *The TCP/UDP example is common to whether you associate with an open or secure network.*

1.5.3 UDP Server

1. Configure the GainSpan module to operate in Limited AP Mode and start the UDP server (see Figure 15, page 32).

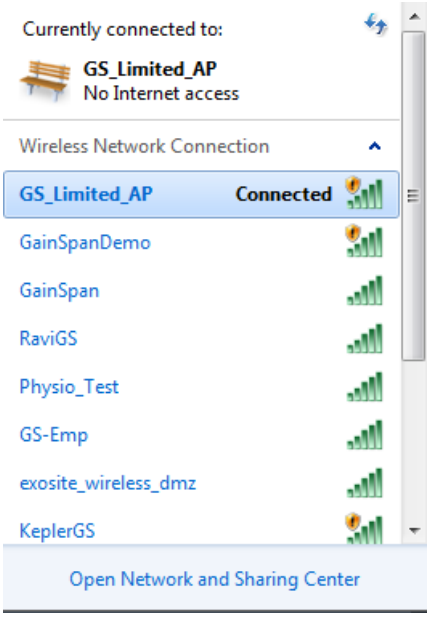
```
AT+WRXACTIVE=1
AT+NSET=192.168.1.1,255.255.255.0,192.168.1.1
AT+WM=2
AT+WA=GS_Limited_AP,,11
AT+DHCPSRVR=1
AT+NSUDP=48569
AT+CID=?
```

Figure 15 Starting UDP Server in Limited AP Mode



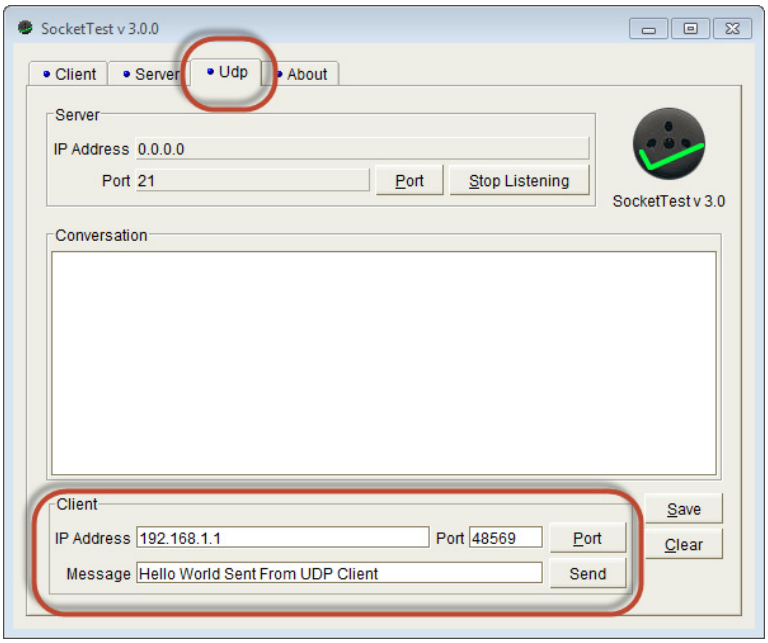
2. Have PC associate to the Limited AP (see Figure 16, page 33).

Figure 16 Associate PC to the Limited AP for UDP Server



3. Using the "SocketTest" tool, have the UDP Client send data to the UDP Server (see Figure 17, page 33).

Figure 17 UDP Client Sends Data to UDP Server



4. Data should be received on the module side (see Figure 18, page 34).

Figure 18 Data Received on the Module

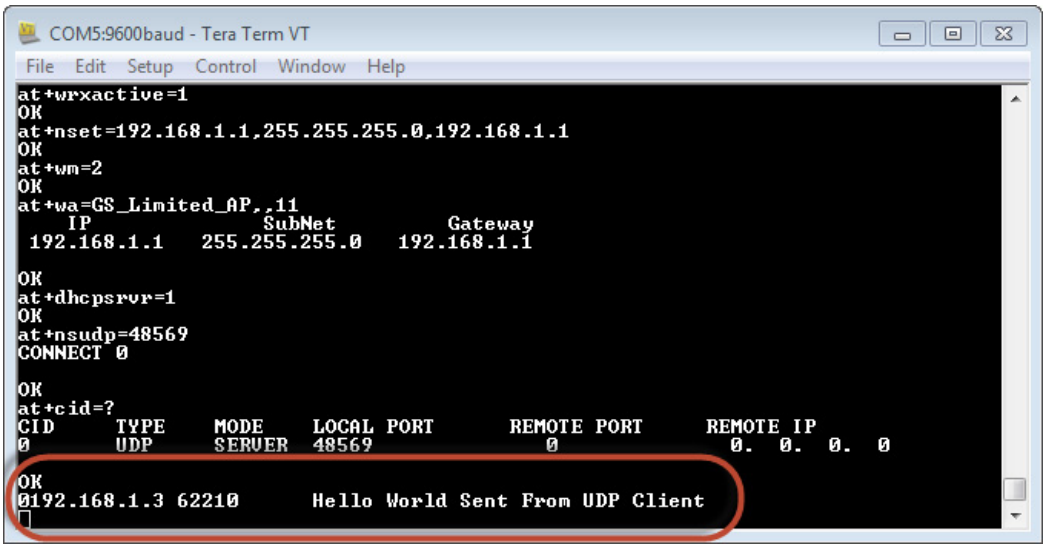
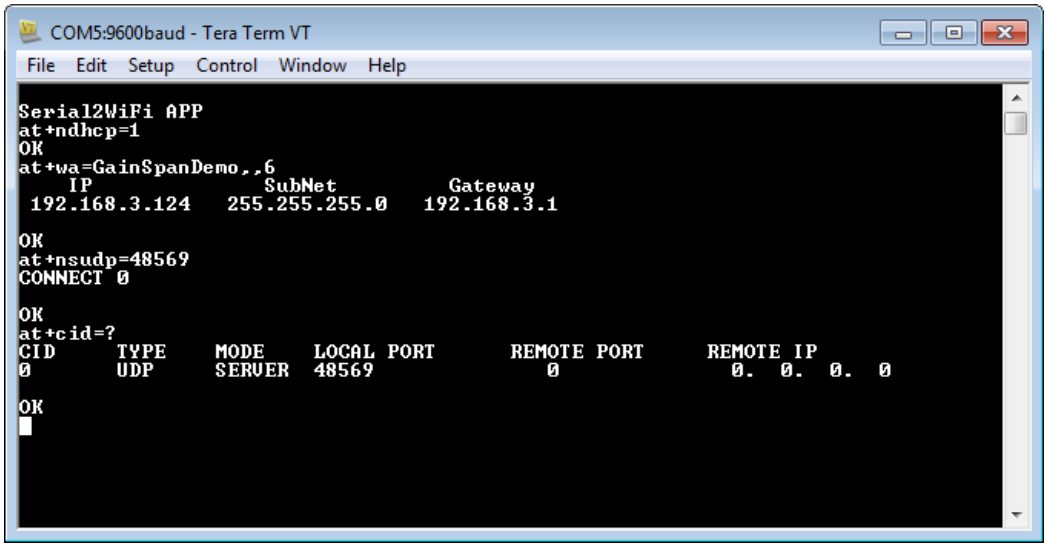


Figure 19 Creating a UDP Server



1.5.4 UDP Client

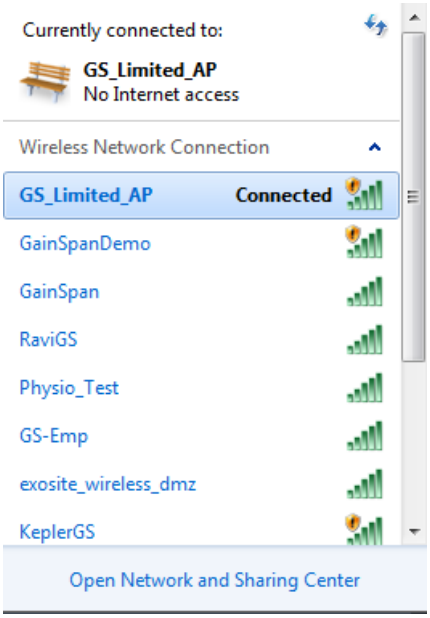
To configure the GainSpan module to operate in Limited AP mode and UDP Client, perform the following:

1. Enter the following AT commands.

```
AT+NSET=192.168.1.1,255.255.255.0,192.168.1.1

AT+WM=2

AT+WA=GS_Limited_AP,,11

AT+DHCPSRVR=1
```

2. Have PC associate to the Limited AP (see Figure 16, page 33).

Figure 20 Associate PC to the Limited AP for UDP Client

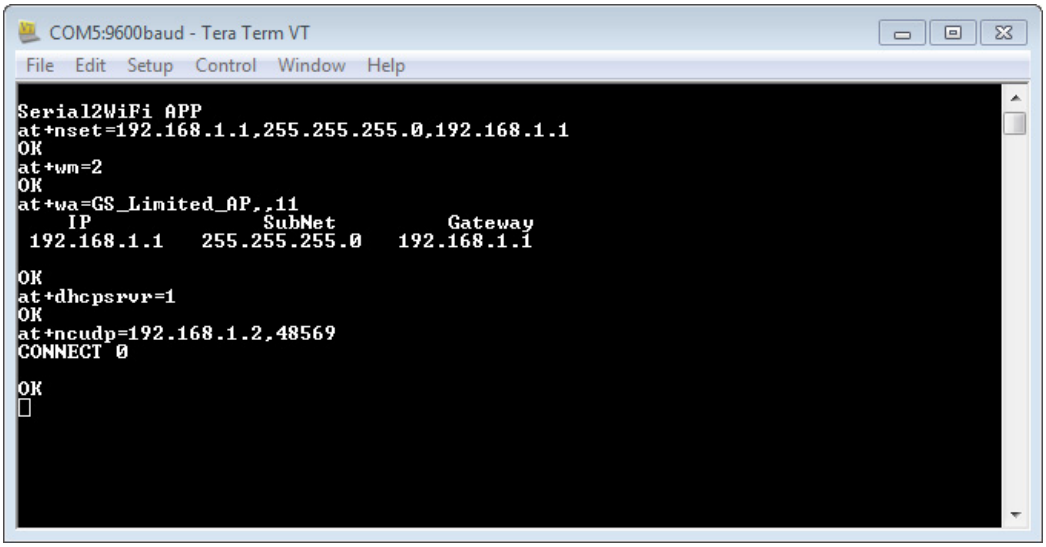


3. Start the UDP Server on the PC. UDP Server automatically picks up the IP address once the PC is connected to Limited AP on the evaluation board.

4. Connect GainSpan module to the UDP Server (see Figure 21, page 36).

```
AT+NCUDP=192.168.1.2,48569
```

Figure 21 Connect Module UDP Server



Upon successful connection to the UDP server, you will see a “CONNECT <CID>” message, where CID is the newly allocated connection identifier (see Figure 21, page 36).

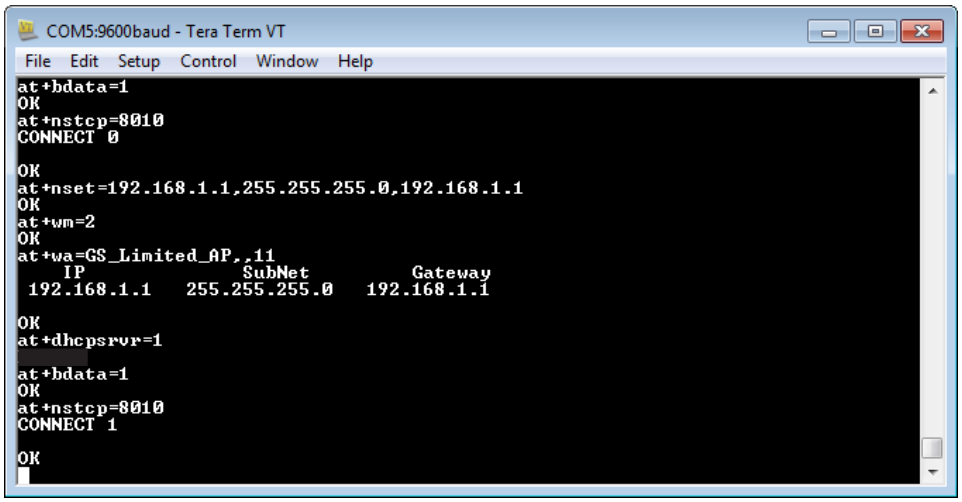
1.5.5 TCP Server

1. Issue the following AT command sequence to create a Limited AP and start TCP server on port 8010.

```
AT+NSET=192.168.1.1,255.255.255.0,192.168.1.1

AT+WM=2

AT+WA=GS_Limited_AP,,11

AT+DHCPSRVR=1

AT+BDATA=1

AT+NSTCP=8010
```

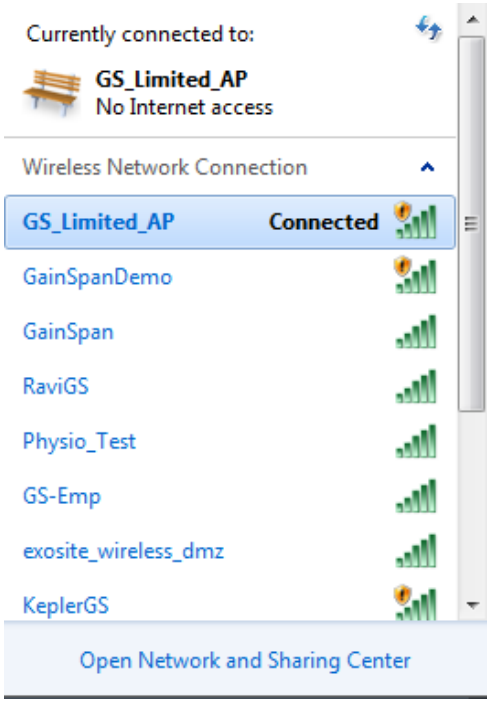
2. A sample output will display in the Tera Term VT window (see Figure 22, page 37).

Figure 22 Sample Output in Tera Term VT



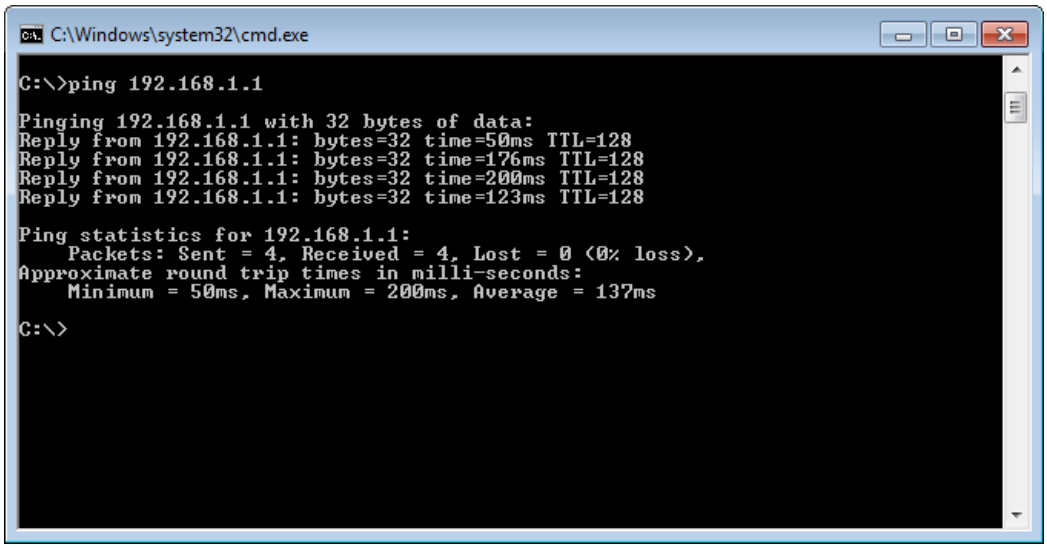
3. In the Wireless Network Connection window, the "GS_Limited_AP" will show being connected (see Figure 23, page 38).

Figure 23 PC Connected to GS_Limited_AP



4. Confirm that the connection is established by sending a ping to **192.168.1.1** from the PC (see Figure 24, page 38).

Figure 24 Confirm Connection Established

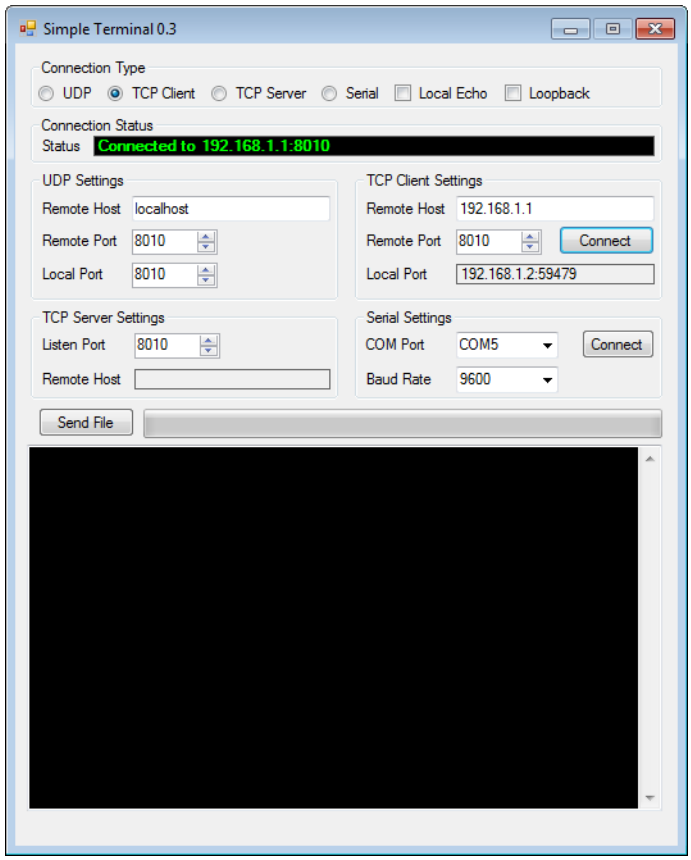


5. Launch the Simple Terminal application and connect to the GainSpan module (e.g., GS2011M or GS2100M) (see Figure 25, page 39).

NOTE: *The Simple Terminal application can be open from the SW Utilities directory from the evaluation software folder.*

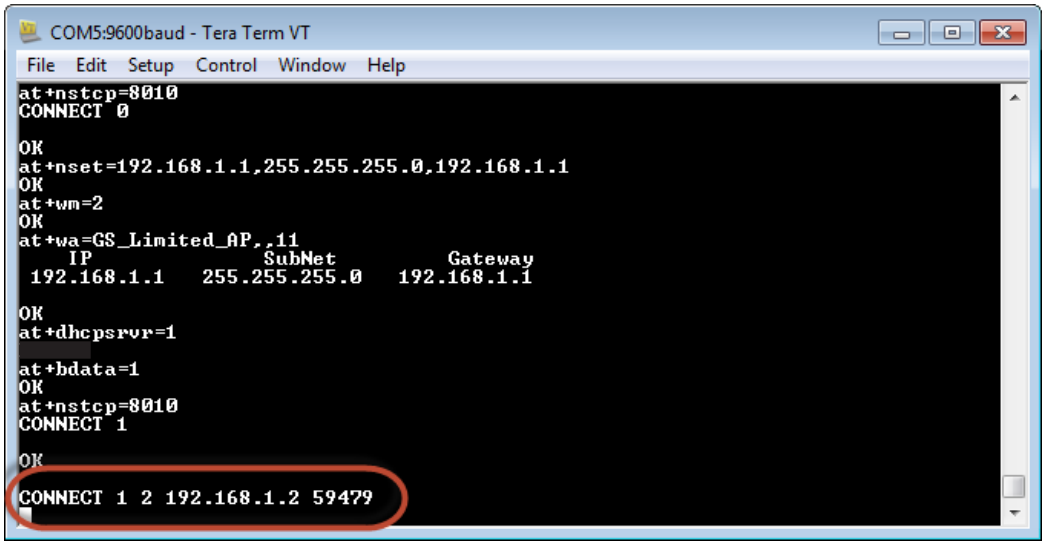
```
192.168.1.1,8010
```

Figure 25 Simple Terminal Connected to TCP Client



6. Upon successful TCP connection, locate the “CONNECT <CID> <CID> <IP Address> <Port number>” message displayed on Tera Terminal VT (see Figure 26, page 40).

Figure 26 TCP Connection Message Displayed on Tera Term VT Window

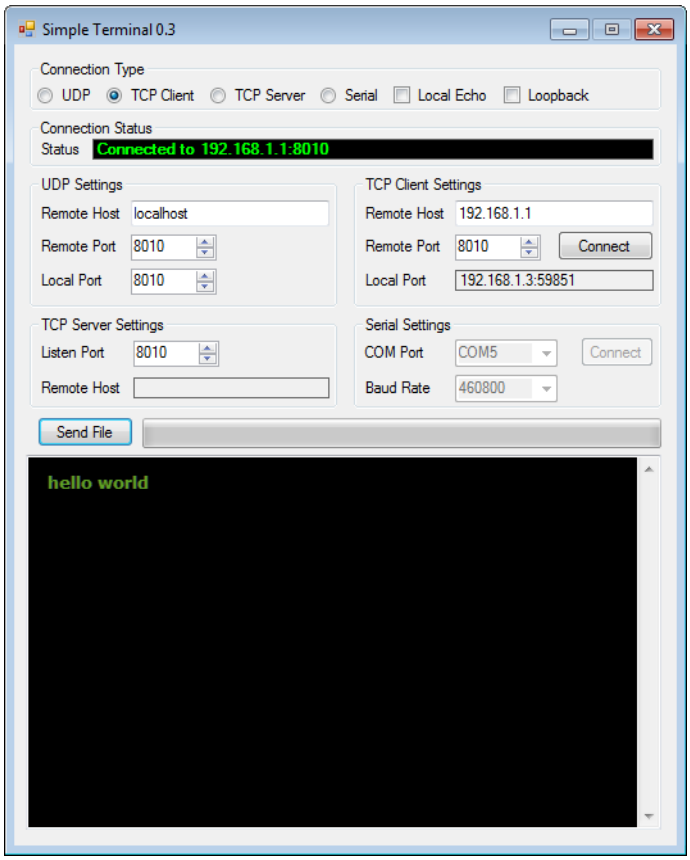


7. To send data (for example: hello) from the TCP Server (for example: GS2011M) to TCP Client (Simple Terminal), go to Tera Term VT and enter:

```
<ESC>Z10005hello
```

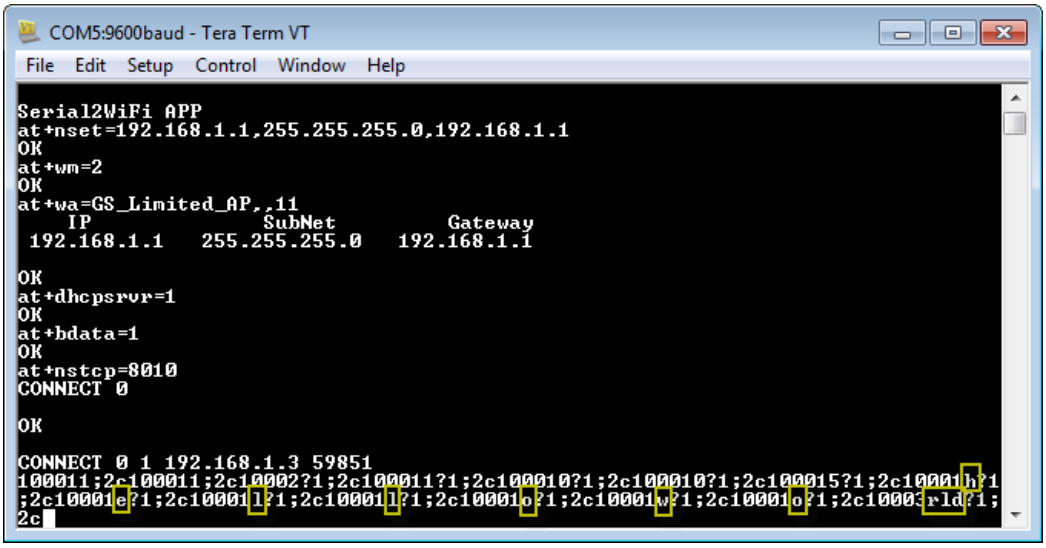
You should now see “hello” received in the Simple Terminal window (see Figure 27, page 41).

Figure 27 Sending Data from TCP Server to TCP Client



8. If you want to send data from TCP Client to TCP Server, simply enter any text in the Simple Terminal window. In the example shown below the user entered the text "world" in the Simple Terminal, and the text is seen received on the Tera Term VT screen (see Figure 28, page 42).

Figure 28 TCP Server Text Received Within Tera Term Window



For additional security AT commands, refer to the *GainSpan Serial-to-WiFi Adapter Application Programmer Reference Guide*.

Chapter 2 Serial-to-WiFi Provisioning

This chapter provides procedures on how to provision the GainSpan® GS2011M or GS2100M for Serial-to-WiFi Web Provisioning and WiFi Protected Setup (WPS).

- Introduction, page 43
- Setting Up Web Provisioning Using Limited AP Provisioning Mode, page 44
- Setting Up WPS Based Provisioning, page 60

2.1 Introduction

The Serial-to-WiFi application supports multiple methods of provisioning the device to connect different Access Points (AP).

- Web Provisioning using Limited AP Provisioning Mode
- WiFi Protected Setup (WPS) Based Provisioning

The Web Server based provisioning allows the user to scan and choose a WiFi Access Point (AP) to connect to using a web browser either on your PC or Hand Held device. You may then select an AP and input the security pass code to connect to the AP.

WiFi Protected Setup (WPS) enables you to connect your GS2000 based module device to your WPS enabled AP without having to input any pass codes. This method requires the AP to support WPS and have enabled either push button method or pin method for association and authentication.

2.2 Setting Up Web Provisioning Using Limited AP Provisioning Mode

In the Serial-to-WiFi application, you may also access the embedded web pages by putting the device into the Limited AP Provisioning Mode. In this mode, the device acts as an Access Point (AP) for other devices, such as Smart Phones, Tablets, etc., to connect as a client and provision the device.

***NOTE:** The parameters, such as IP addresses, SubNet addresses, and Gateways used throughout this document are examples only.*

***NOTE:** The GS2011M and GS2100M evaluation boards have to be programmed before running these procedures.*

In the Tera Term VT terminal emulation window, execute the following AT commands:

1. Set the Static IP Address on the GS2000 based module evaluation board.

   ```
   AT+NSET=192.168.1.1,255.255.255.0,192.168.1.1
   ```

2. Set the wireless mode to limited AP mode so that the adapter can act as a limited wireless Access Point (AP).

   ```
   AT+WM=2
   ```

3. Set the AP network (example - created using *SSID GS_Limited_AP on channel 11*).

   ```
   AT+WA=GS_Limited_AP,,11
   IP              SubNet          Gateway
   192.168.1.1:255.255.255.0:192.168.1.1
   ```

4. Start the DHCP server.

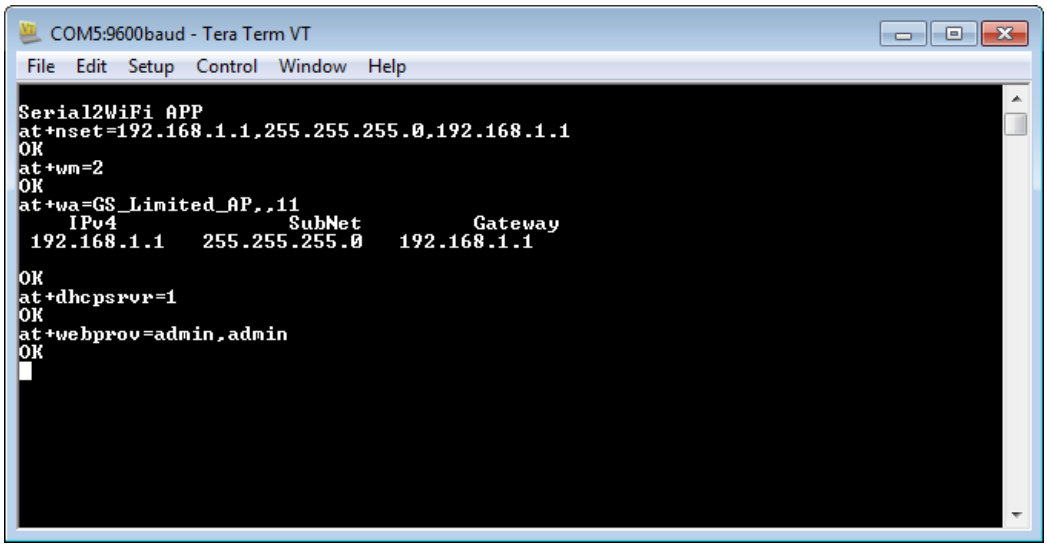
   ```
   AT+DHCPSRVR=1
   ```

5. Start provisioning through web pages. Enable saving profile and start a new NCM (network connection manager). (see Figure 29, page 45).

   ```
   AT+WEBPROV=admin,admin
   ```

Refer to the *GainSpan GS2000 Based Module Programming User Guide* for instructions on how to program the GS2011M and GS2100M evaluation boards.

Figure 29 Provisioning GainSpan Web Site



6. Associate the PC acting as the configuring device to provision the GS2000 based module evaluation board.
7. Select the Wireless Network created in **Step 3**. In this example it is **GS_Limited_AP**, and click **Connect** (see Figure 30, page 45).

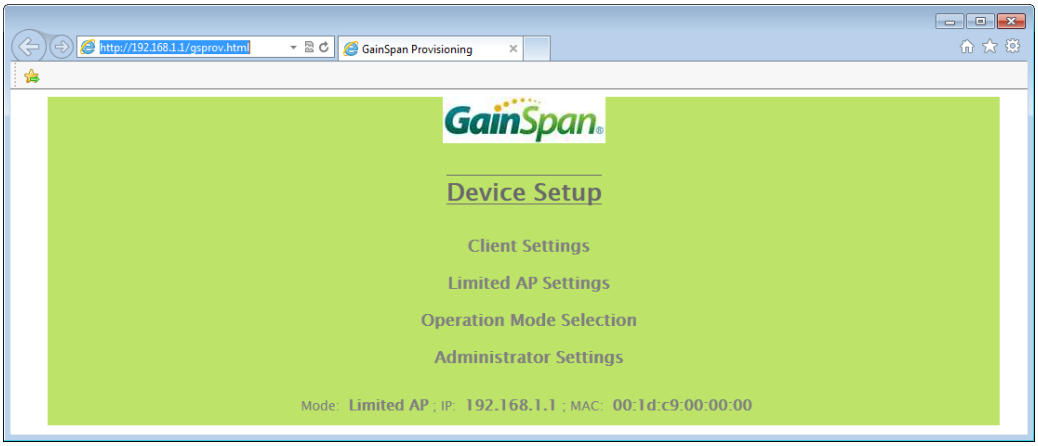
Figure 30 Connecting to a Wireless Network Connection

8. Once the connection is established, open a web browser and type the IP address and the URL of the GS2000 based module evaluation board (in this example, it is http://*192.168.1.1/gsprov.html*). The IP address 192.168.1.1 was set in the previous steps. This will you prompt for a User name and Password. Enter the **User name** and **Password** and press **Enter** or click **OK** (see Figure 31, page 46).

Figure 31 Enter User Name and Password

9. The GainSpan Device Setup web provisioning page will display (see Figure 32, page 46).

Figure 32 GainSpan Device Setup



You can navigate to different pages:

- Client Settings
- Limited AP Settings
- Operation Mode Selection
- Administrator Settings

2.2.1 Wireless and Network Configuration

You can connect to a Wireless network by one of the following methods:

- Select an Existing Network
- Manually Configure to Join a Network

2.2.1.1 Select an Existing Network

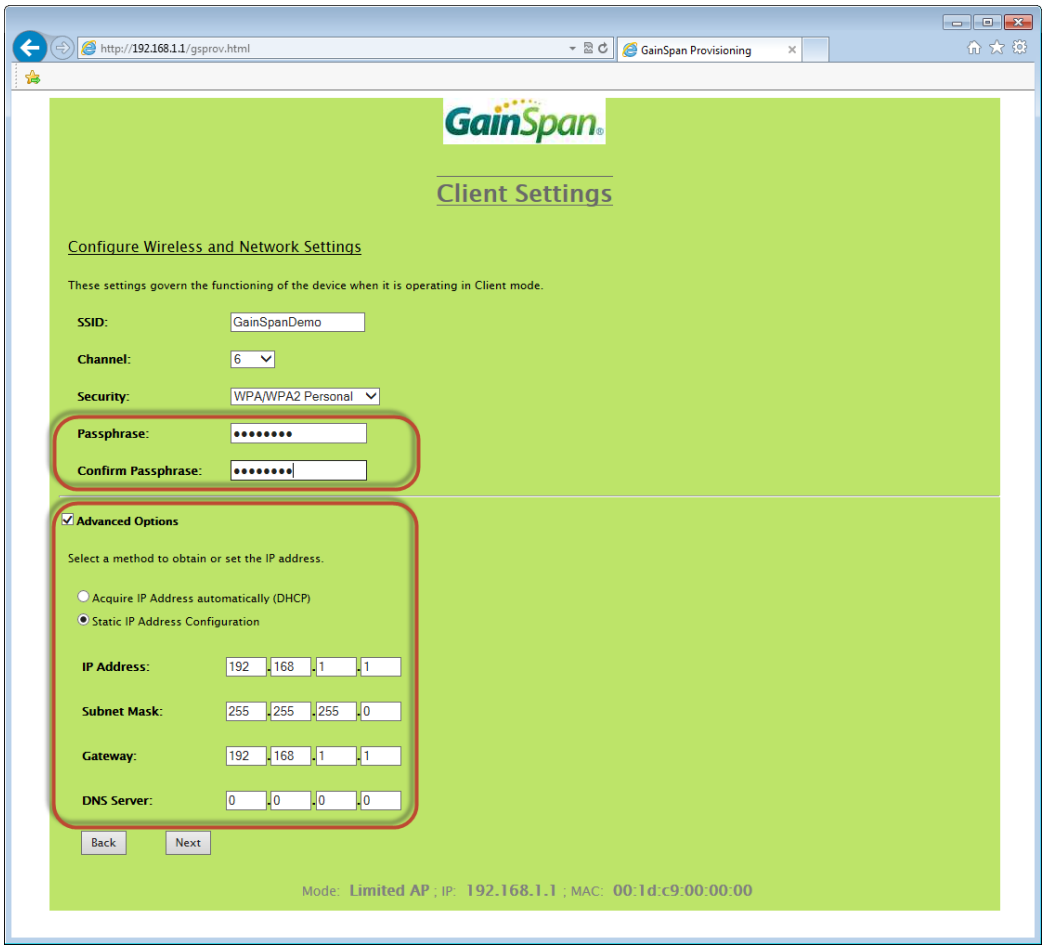
When selecting an existing network, the node will start scanning and displaying a list of available APs.

1. Click the **Select** button to connect to the selected AP by providing required credentials (Passphrase) (see Figure 33, page 47).

Figure 33 Selecting Existing Network

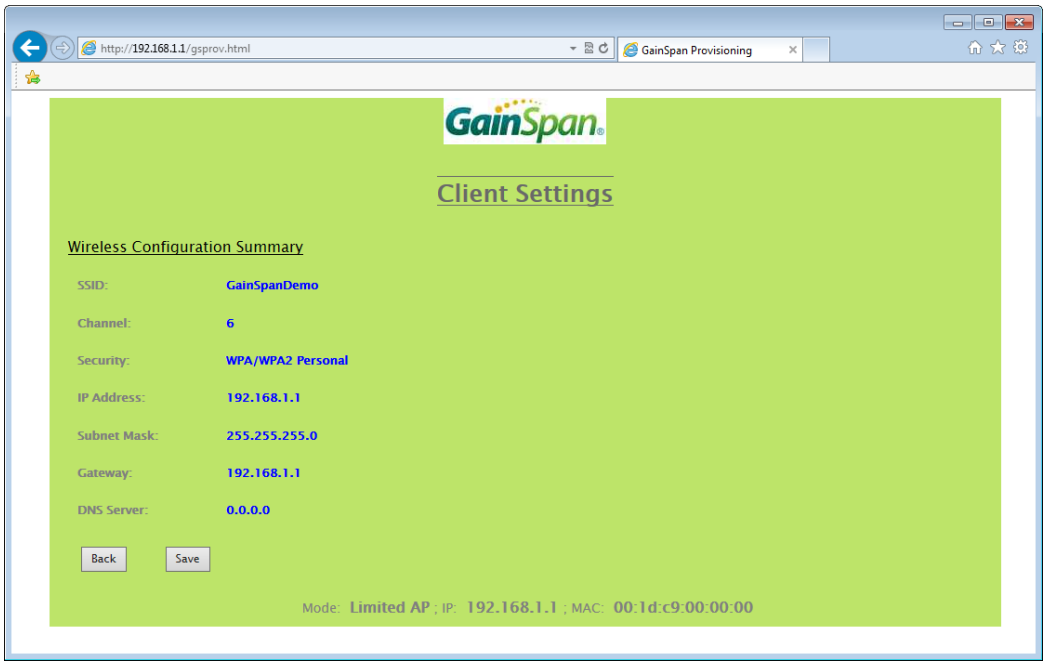
2. After entering a passphrase, you can select the advanced options, which displays the selection methods for obtaining an IP address (see Figure 34, page 48). You can get the IP address in two ways.
   – DHCP
   – Static IP

Figure 34 Enter Passphrase and Advanced Options



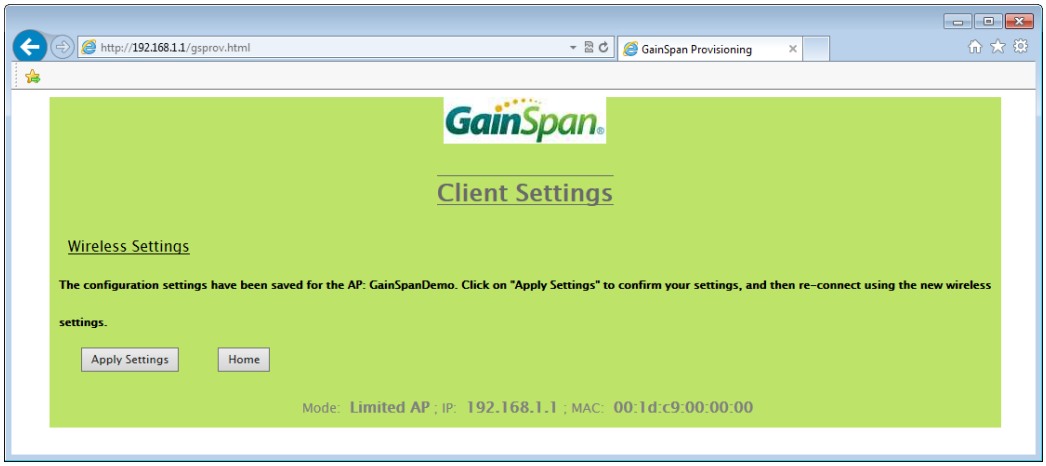
3. Click the **Next** button to navigate to the Wireless Configuration Summary page. This page displays the information about the SSID, Channel, Security type and provides an option to save and apply the settings or go back to make changes (see Figure 35, page 49).

Figure 35 View Wireless Configuration Summary



4. Click **Save** and the **Apply Settings** buttons to save the wireless settings that will be applied to connect the GainSpan device to the GainSpanDemo network (see Figure 36, page 49).

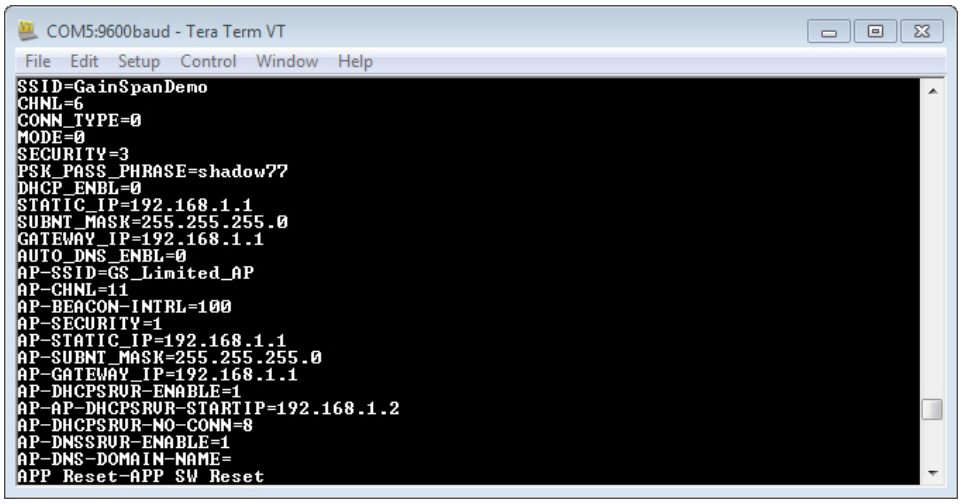
Figure 36 Save and Apply Wireless Settings to the GainSpan Device



NOTE: *The SSID GainSpanDemo is an example.*

5. The GainSpan device will now reset and connect to the GainSpanDemo network and start a network connection (see Figure 37, page 50).

Figure 37 Connecting Device to the Network



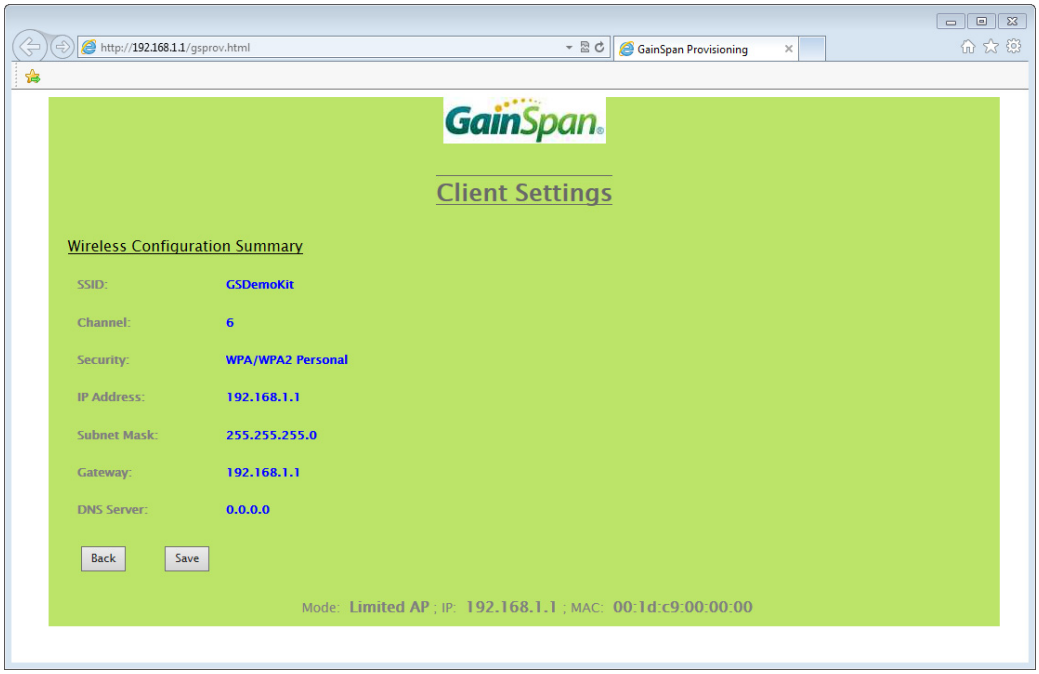
2.2.1.2 Manual Configuration

The Device Setup can also allow you to manually configure the WiFi related setting SSID, Channel, Security, and Passphrase (see Figure 38, page 51). There are also Advanced Options to obtain the IP address either by DHCP or by Static IP configuration.

Figure 38 Manually Configure Wireless Settings

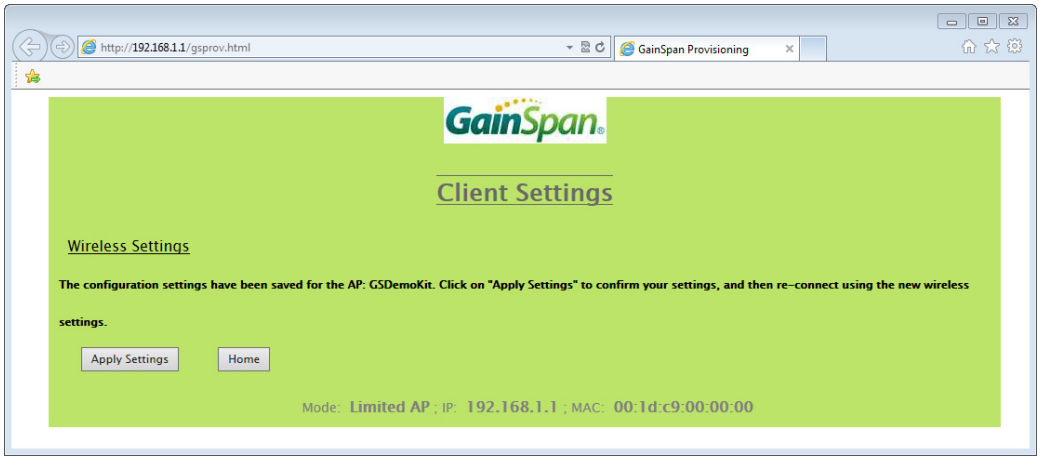
1. Click the **Next** button to navigate to the Wireless Configuration Summary page (see Figure 39, page 52).
2. Click the **Save** button to save the manually configured wireless settings.

Figure 39 Save Manually Configured Wireless Settings



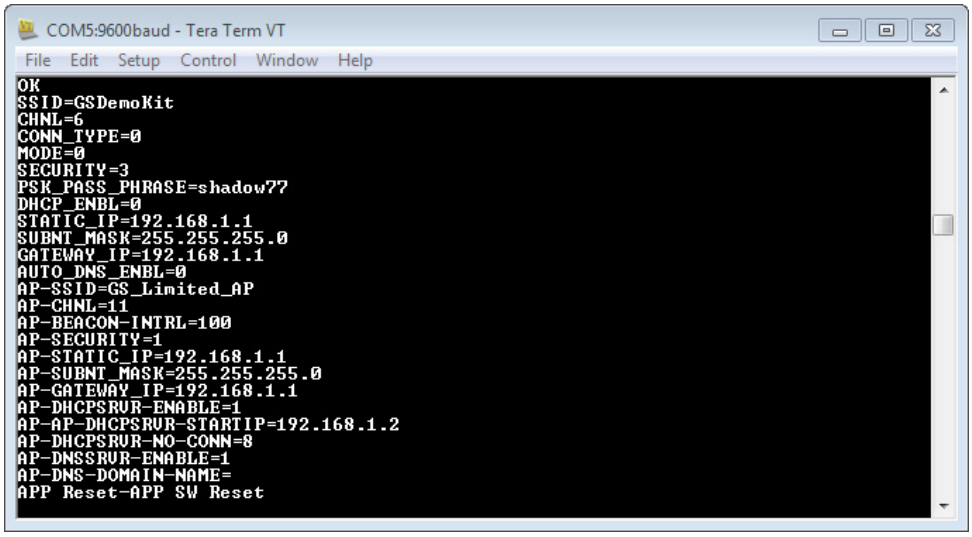
3. Click **Apply Settings** button to apply the selected wireless settings and connect the GainSpan device to the new network (see Figure 40, page 52).

Figure 40 Apply Settings and Connect to a New Network



4. The GainSpan device will now reset and connect to the GSDemoKit network and start a new network connection (see Figure 37, page 50).

Figure 41 Connecting Device to a New Network

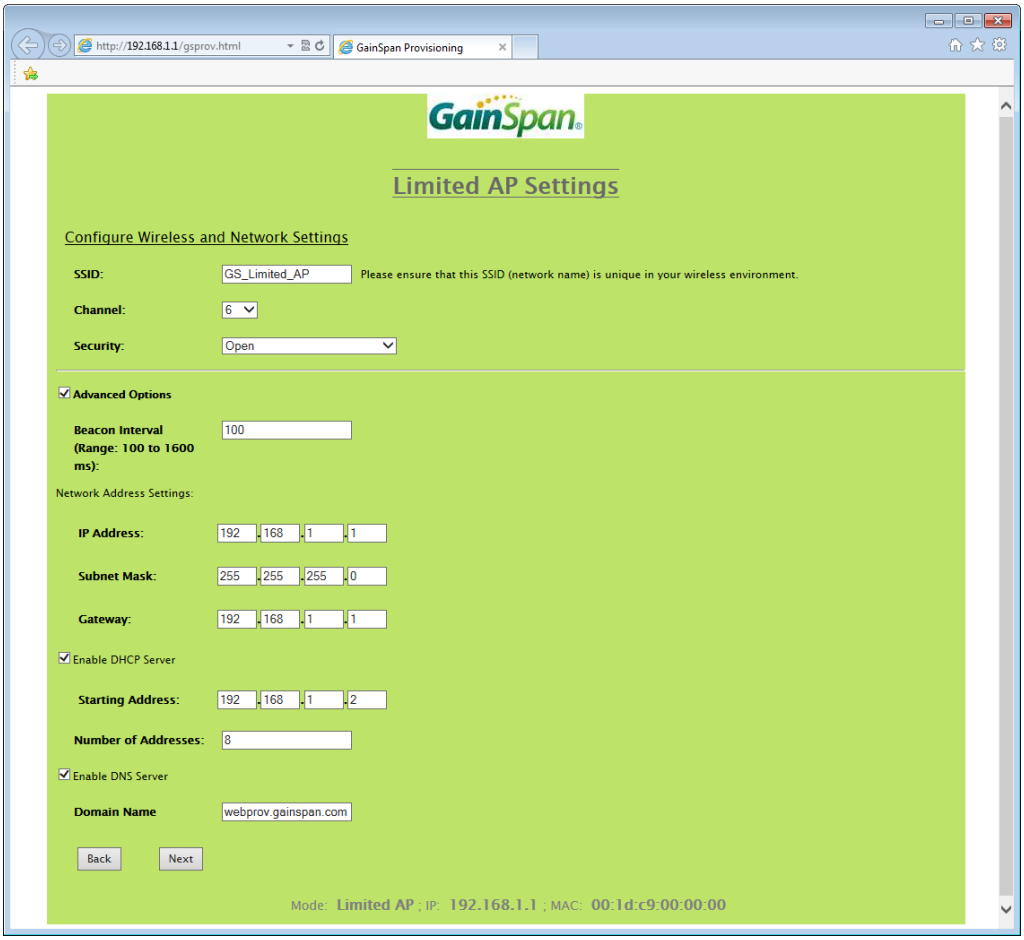


NOTE: *The SSID GSDemoKit is an example.*

2.2.2 Limited AP Settings

The Limited AP Settings page displays the information that was entered in the Tera Term VT window using AT commands. You can change anyone of the wireless and network settings (see Figure 42, page 54).

Figure 42 Limited AP Settings



From this page, you can change the following:

- SSID
- Channel
- Security (Open, WEP-40 Open, WPA2 Personal (AES+TKIP)
- Advanced Options (check box):
  - Beacon Interval (Range: 50 to 1500 msec)
  - Network Address Settings (IP Address, Subnet Mask, Gateway)
  - Enable DHCP Server (check box):
    - Starting Address

- Number of Addresses

– Enable DNS Server:

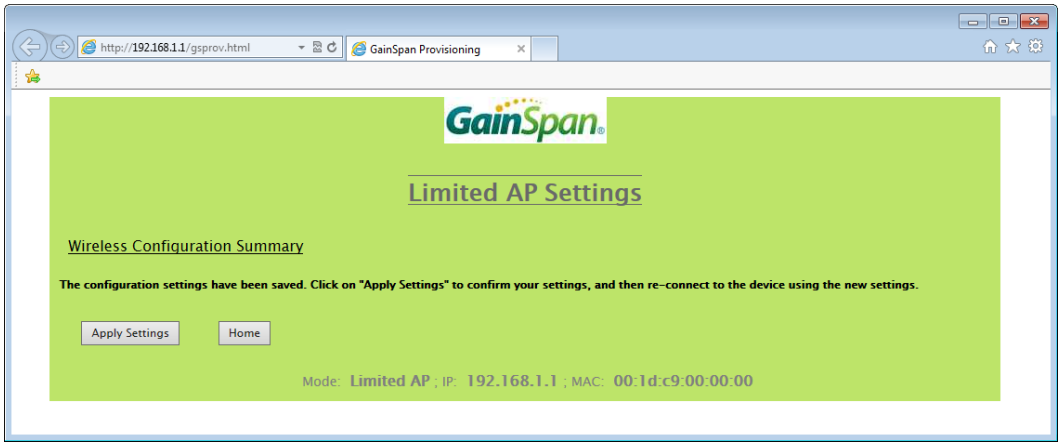
- Domain Name

1. Click **Next** to view a summary of the wireless configuration (see Figure 43, page 55).

Figure 43 Save the Limited AP Wireless Configuration Settings

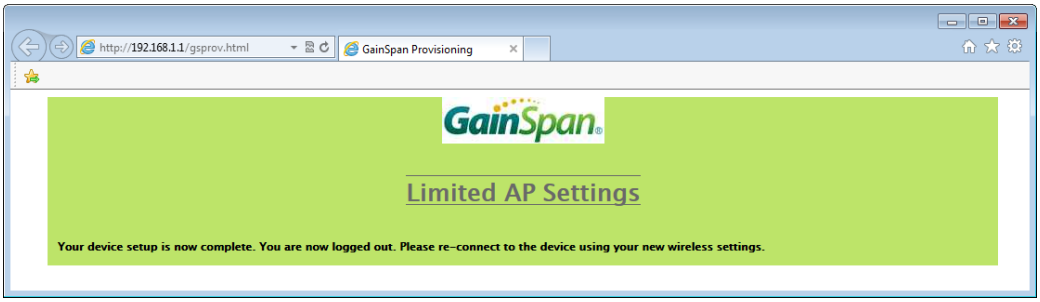
2. Click **Save** and click **Apply Settings** (see Figure 44, page 56). This will confirm that the wireless configuration settings have been saved and the device setup is complete.

Figure 44 Confirming Wireless Configuration Settings Are Saved



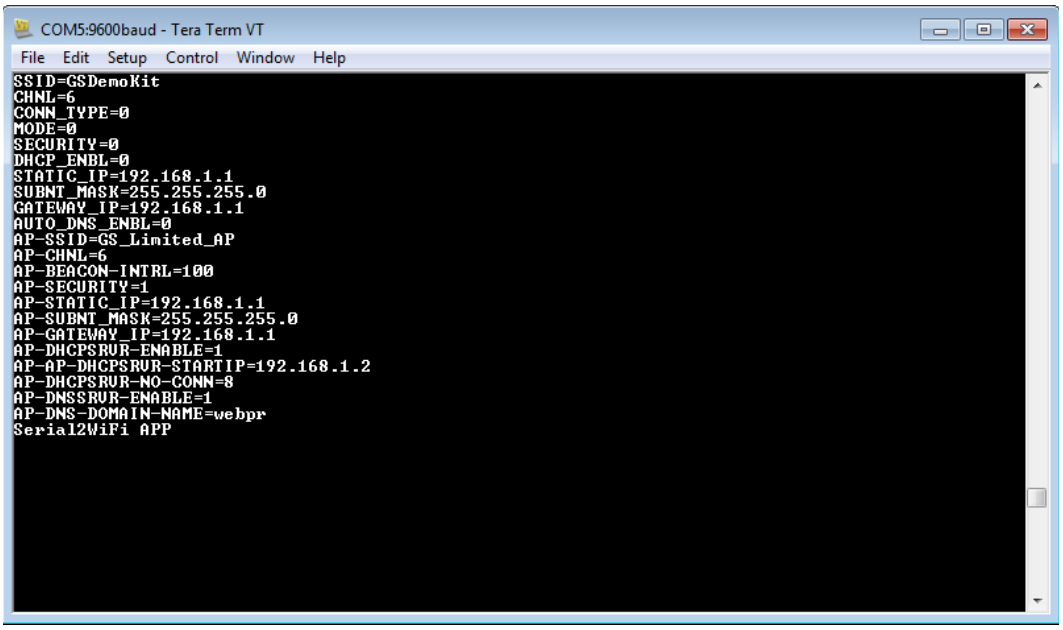
3. Re-connect to the device using any new settings you created and/or updated in the settings screen (see Figure 45, page 56).

Figure 45 Device Setup is Complete



4. When the Limited AP Settings are applied the open Tera Term VT window will display all the AP settings for the Limited AP mode (see Figure 46, page 57).

Figure 46 Limited AP Settings Displayed in Tera Term Window



2.2.3 Operation Mode Selection

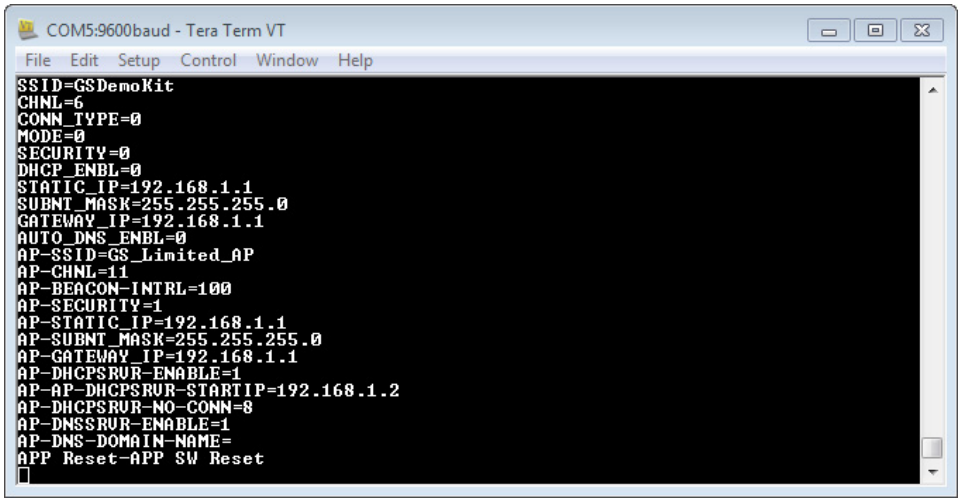
This option allows you to select the mode of operation, **Client** or **Limited AP**.

1. Click the **Set Mode** button (see Figure 47, page 58). See , page 68.

Figure 47 Select Mode of Operation

2. When the Client mode is selected, the open Tera Term VT window will display all the AP settings for the Client mode (see Figure 48, page 58).

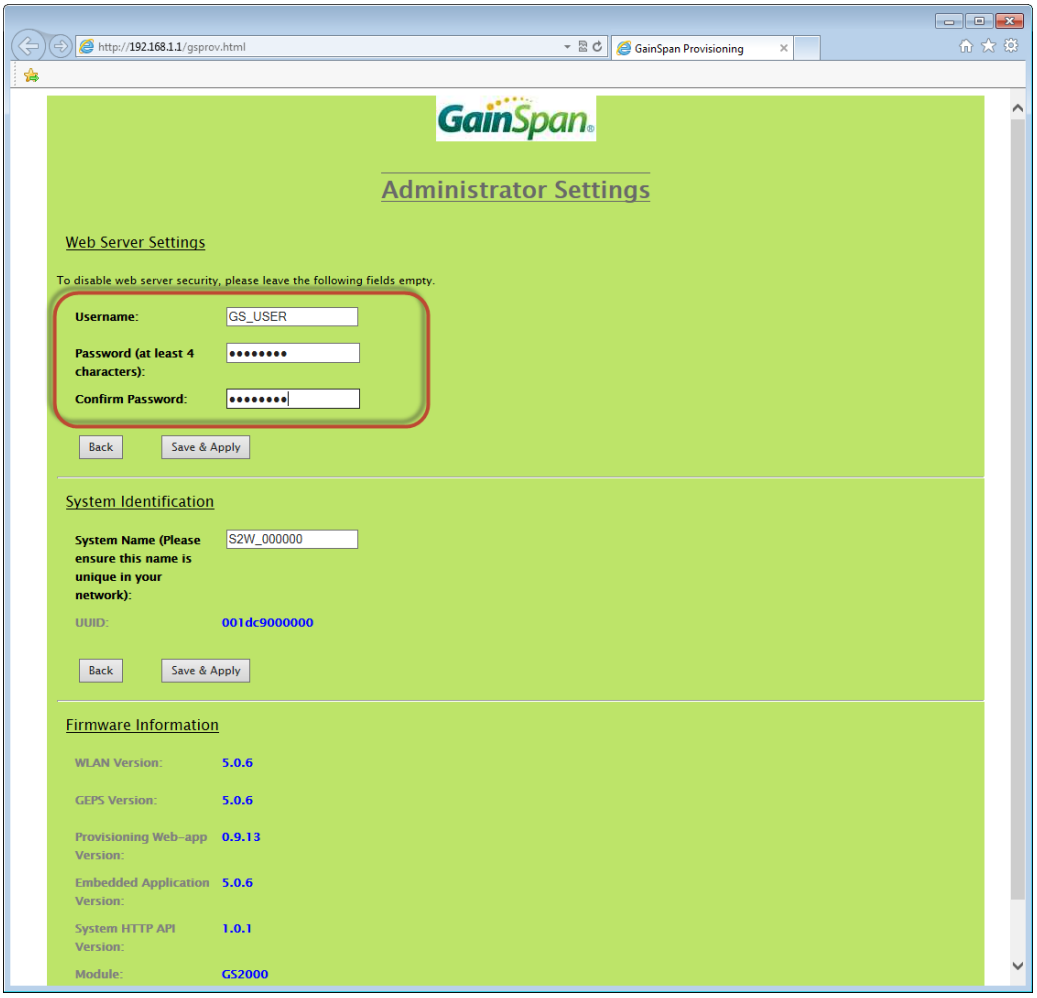
Figure 48 Client Mode Settings Displayed in Tera Term Window



2.2.4 Administrator Settings

The Administrator Settings allow you to change the Username and Password of the node. You can also change the System Identification Name. When you completed your selection, click the **Save & Apply** button (see Figure 49, page 59). The information will be sent to the Host Processor and reset the module. The Host Processor will send the information back to the module for provisioning.

Figure 49 Administrator Settings



NOTE: *The Minimum character limit for Username is 4. The Maximum character limit for Username is 11.*

2.3 Setting Up WPS Based Provisioning

In order to simplify the processing of establishing a secure network, the WiFi Alliance has defined a simplified WiFi Protected Setup protocol allows credentials to be exchanged between a client and Access Point (AP) without the need to manually create an entry for SSID or PSK. There are two modes of operation provided:

- WPS Push Button Configuration (PBC) Mode, page 61
- WPS Personal Information Number (PIN) Mode, page 65

In PIN operation, a unique PIN number can be permanently associated with a client device or entered at the time of use. In PBC mode, the button on the Access Point (AP) must be pressed within a 2-minute period of providing the command to enable WPS on the client (either via button press or AT command). An exchange takes place between the client and AP providing the SSID and randomly-generated passphrase that can thereafter be used for secure communications. In both cases, security is, in part, dependent on the low likelihood of interception during the brief initial setup period.

Refer to the *GainSpan GS2000 Based Module Programming User Guide* to program the Flash on the evaluation board.

2.3.1 WPS Push Button Configuration (PBC) Mode

For the Push Button Configuration (PBC) mode, perform the following:

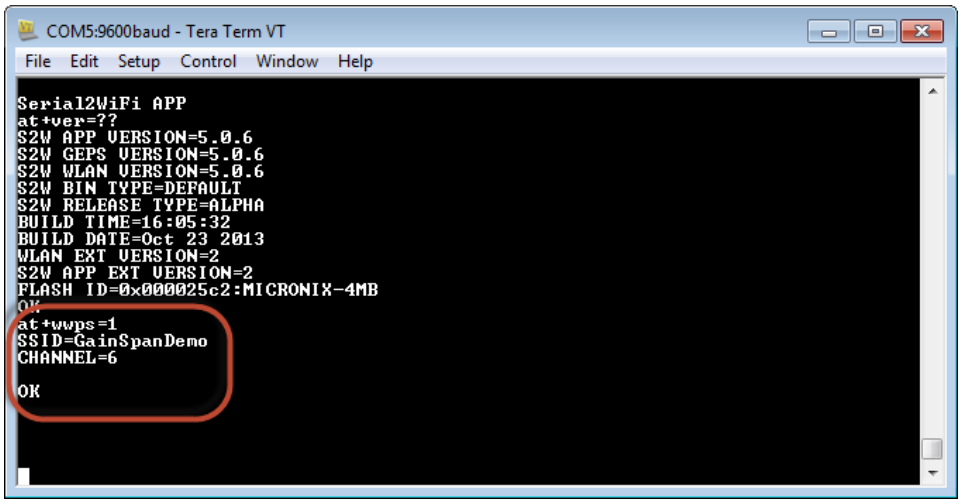
1. Issue the following AT command in the Tera Term VT window to start the WPS process.

   ```
   AT+WWPS=1
   ```

   "1" indicates the Push button mode.

2. Once the connection is complete, a message is sent to the host processor with the SSID, Channel, Passphrase, and Status (see Figure 50, page 61).

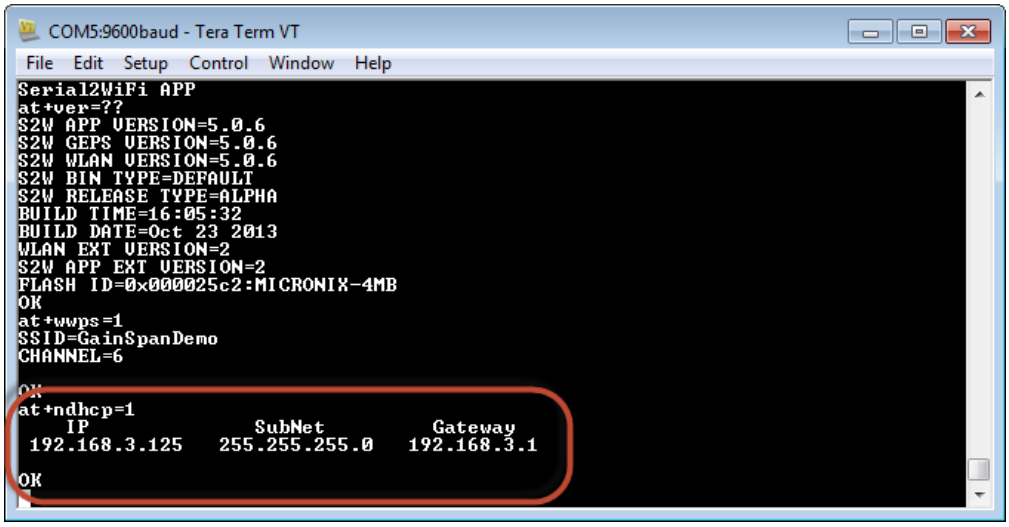
Figure 50 Starting the WPS Process



If the connection is not a success, an ERROR message is sent to the host processor.

3. The evaluation board is now associated with the AP, you can issue the AT command (AT+NDHCP=1) to get the IP address from DHCP server running or set the IP address statically using the AT+NSET command. At this point, you should be able to communicate with the board from the APs network (see Figure 51, page 62).

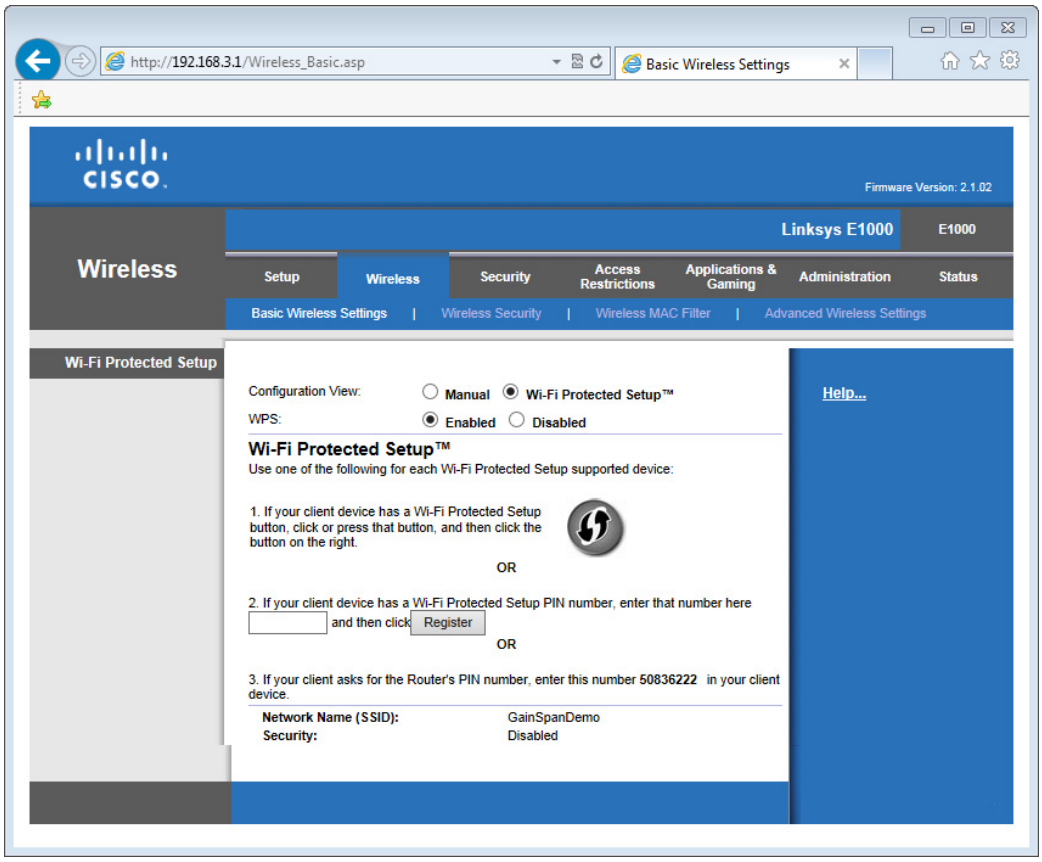
Figure 51 Getting IP Address from DHCP Server



When the Serial-to-WiFi receives the AT command, it scans all the available radio channels looking for beacons whose Selected Register flags are set. The AP corresponding to each such beacon is stored. If the board finds a second Selected Register AP it stops scanning, having detected a session overlap (this is a precaution to prevent connection to the wrong AP). It is presumed that the user has only pressed one button, so a second AP may belong to a different network or even be an attacker. If at the end of scanning all the channels, the Serial-to-WiFi evaluation board has found a single Selected Register AP, it will connect to that AP to perform WPS registration.

4. Open a URL and enter the IP address (*http://192.168.3.1*) and press the **Enter** key. The virtual Cisco AP will display (see Figure 52, page 63).

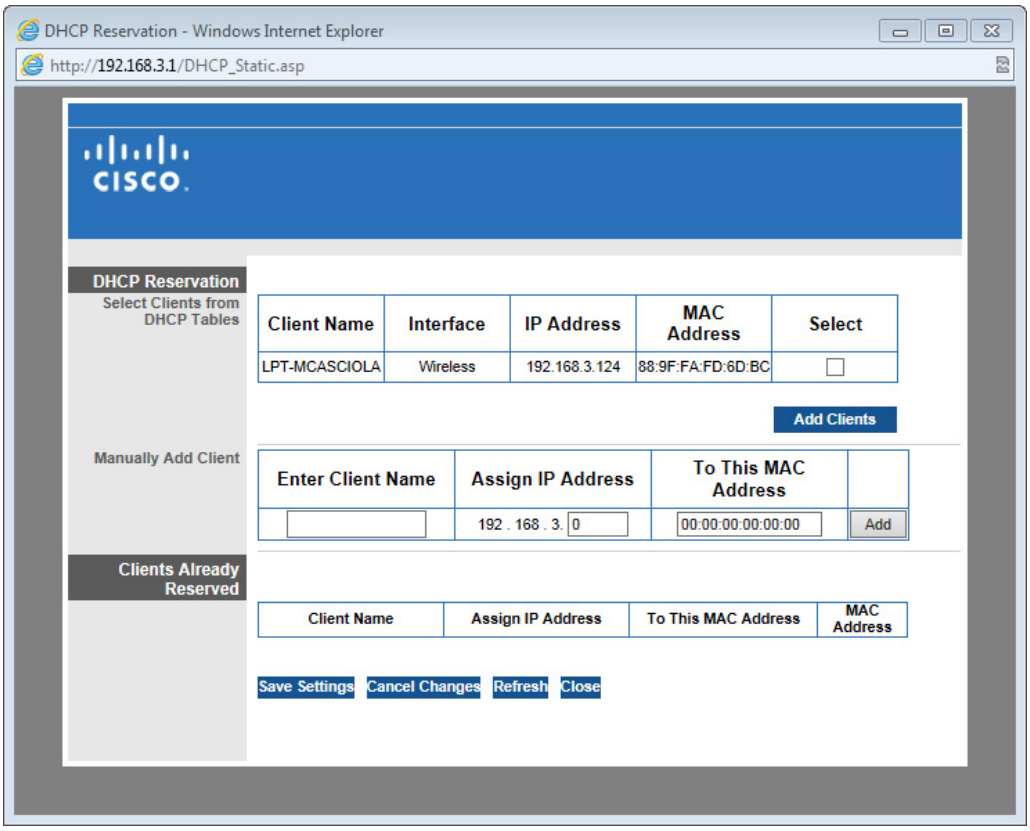
Figure 52 Example of Virtual Push Button (Cisco AP)



NOTE: *In this example, we are using a Cisco Access Point (AP). You can use your own AP.*

5. Select the **DHCP Reservation** option under **Basic Network Setup** to get a list of Client devices. From this screen you can add or remove Clients (see Figure 53, page 64). At this point you can issue a PING command from the node to the AP and to the node IP address from any host computer in the same subnet.

Figure 53 DHCP Reservation Select Clients

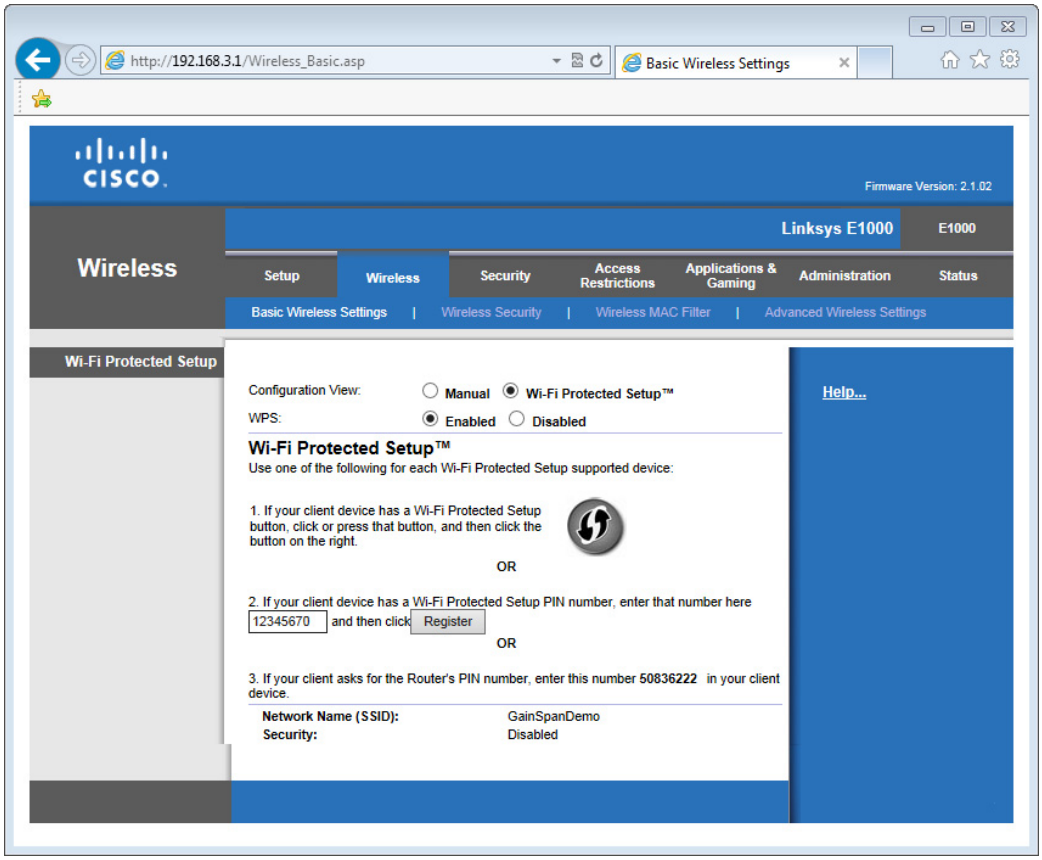


2.3.2 WPS Personal Information Number (PIN) Mode

To setup a valid PIN to the Access Point (AP) which supports the WPS, perform the following:

1. Enter a **WiFi Protected Setup PIN number** for the client device (see Figure 54, page 65).
2. Click the **Register** button.

Figure 54 Enter Client Device WiFi Protected Setup (WPS) PIN Number



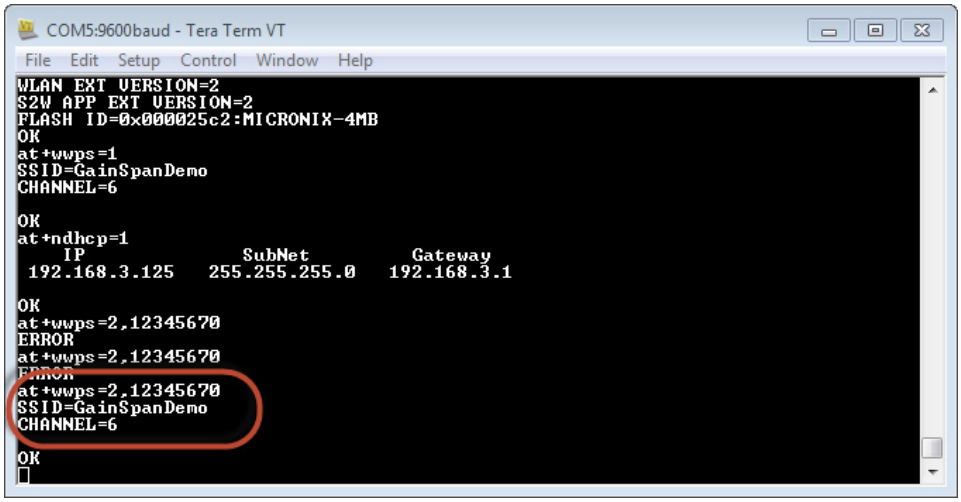
3. Issue the AT command for starting the WPS process.

   ```
   AT+WWPS=2,12345670
   ```

   Here: 2, indicates the PIN mode, and the second parameter is the WPS PIN.

4. Once the connection is complete, a message is sent to the host processor with the SSID, Channel, Passphrase, and Status (see Figure 55, page 66). If the connection is not successful an ERROR message is sent to the host processor.

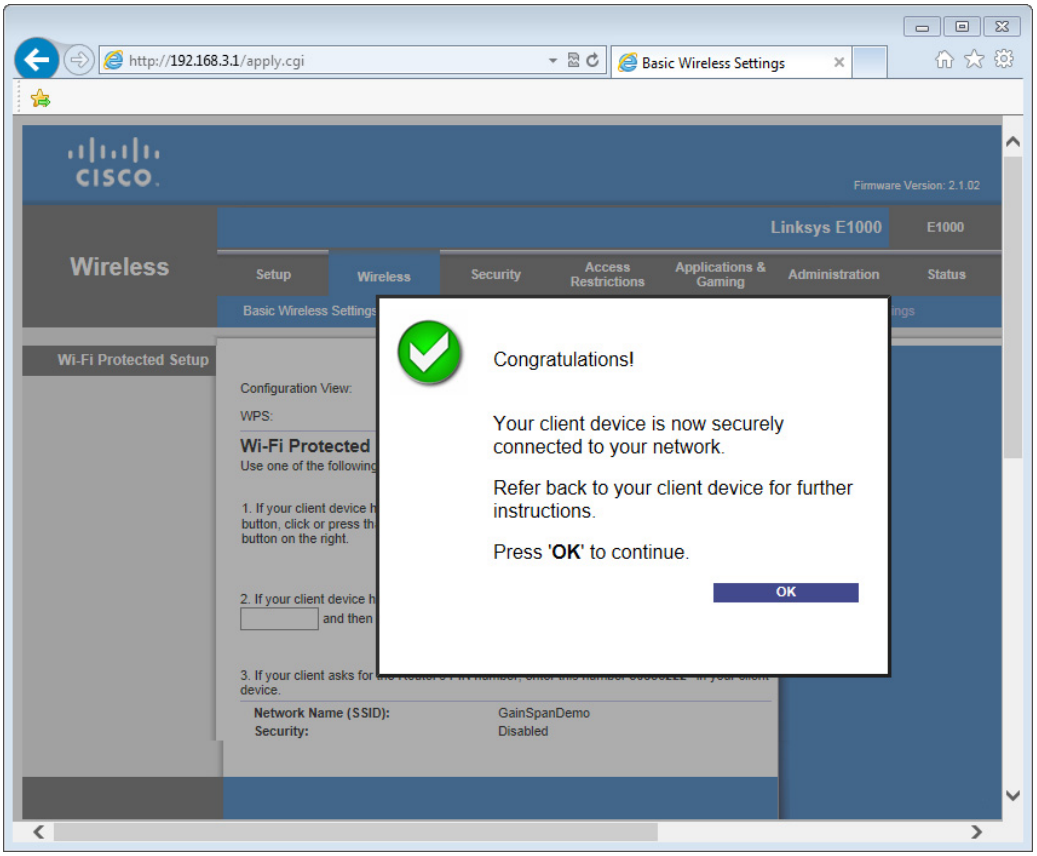
Figure 55 Issuing AT Command Indicating WPS PIN Mode



The AP interface will generally inform the user when a client device has been successfully configured and connected. Other APs may have different GUI, messages, etc.

You can always check the DHCP client table of the AP to ensure that the device is properly connected. Once the evaluation board is associated with the AP, you may issue the AT command (AT+NDHCP=1) to get the IP address from the DHCP server running or set the IP address statically using the AT+NSET command. At this point, you should be communicating with the evaluation board from the APs network. Use the APs Active Client list to discover the IP address the new device has received. You should be able to issue a PING command directed to that IP address from any host computer in the same subnet (see Figure 56, page 67).

Figure 56 Client Device is Securely Connected to the Network



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