

Preliminary issue - Limited distribution only!



# Tech-X Flex<sup>®</sup> (NG2)

## User Guide



June 01, 2016

Includes the base unit and optional MoCA/RF module

Supports firmware version v06.50

# Preliminary issue - Limited distribution only!

## **Spirent Communications, Inc.**

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## Tech-X Flex<sup>®</sup> (NG2)



Tech-X Flex User Guide -  
Firmware v06.50

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*Tech-X Flex® (NG2)*

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# 1: Introduction

The Tech-X Flex is a versatile and modular handheld test set with extensive testing capabilities, including:

- Ethernet and Wi-Fi connectivity, including 1 Gb Ethernet, Wireless AC, and spectrum analysis.
- MoCA network synchronization with comprehensive statistics reporting.
- RF signal analysis, including digital and analog channels up to 1 GHz.
- A full suite of IP and video testing capabilities over the Wi-Fi, Ethernet, and MoCA interfaces.
- A broad feature set to facilitate the integration of field units with a centralized back-office system.

The remainder of this section provides general information about the product and this document.

## 1.1 Product purpose

The unit is designed to assist with the setup and troubleshooting of home networks, especially as related to broadband services delivered by high-speed DSL, cable, and fiber-to-the-premises (FTTP) architectures. It serves as a small and versatile residential service tester for technicians who are increasingly required to troubleshoot networking issues from within or nearby the home, including the isolation of trouble to the provider or subscriber sides of the network.

Primarily, the unit is able to emulate various devices within a home network and perform testing to sectionalize problems. For example, if a subscriber cannot access the internet, the unit can emulate a home computer and verify whether ISP connectivity is actually available. The unit can also perform a variety of other connectivity-related and statistics-gathering functions. Using detachable modules, the unit can be expanded to support different types of protocols and devices, such as the MoCA/RF module which provides an interface for in-home RF measurements and MoCA network testing.

## 1.2 User prerequisites

To use the unit and this documentation effectively, you should have some knowledge of network architectures, especially Ethernet-based networks typically found in the home. While this document attempts to explain unit functionality in reasonable detail, it cannot substitute for a basic understanding of networking principles. If you are new to networking and related technologies, consider additional training before attempting to use the unit and/or understand this document.

## 1.3 Documentation notes

### 1.3.1 Firmware version support

This document was issued in support of firmware release 6.50. Note, however, that updates may have occurred since publication due to hardware and/or firmware upgrades.

The latest version of this document, as well as other documents for this product, may be found in the Spirent Knowledge Base (<http://support.spirent.com/>). The Knowledge Base gives you access to tens of thousands of documents that help answer your network analysis and measurement questions. New content is added daily by Spirent's communications and networking experts.

Sign in with your user ID and password to gain access to additional content that is available only to customers – user manuals, help files, release notes, tech bulletins, and more. When you sign in, you can also use the Knowledge Base to download software and firmware, and to manage your Service Requests (SRs).

### 1.3.2 Document purpose and scope

This document is intended for field technicians and other personnel who use the product for circuit and network testing. **Depending upon your licensing agreement, your unit may not include all the functionality presented in this document.** For more information about licensing arrangements, please contact a Spirent account manager.

**NOTE:** A general knowledge of networking, analog and digital cable television, MoCA standards, Ethernet, and hybrid fiber-coaxial (HFC) networks is required to understand the purpose, functionality, and documentation for this equipment. If you do not have this prerequisite knowledge, consider obtaining some training in these areas before attempting to understand this document and/or use the unit. While this document provides technical data as necessary to understand how the product operates, it does not attempt to serve as a tutorial for these and other networking concepts.



## 1.3.3 Definitions of terms and acronyms

For clarity, the following general terms are defined:

- **Unit** - A Tech-X Flex device in general, with or without a module attached, as applicable to the respective context.
- **Base Unit** - The core handheld component to which modules attach. The base unit has an independent suite of functionality which is described in this document. The use of modules does not change base unit functionality.
- **Module** - A modular hardware component designed to attach and interface with the Tech-X Flex base unit that provides additional functionality.
- **Provider** - A broadband service provider, such as a telephone or cable company.
- **Subscriber** - A customer receiving broadband services from a provider.

Additional MoCA-related terms:

- **MoCA** - Multimedia over Coax Alliance (see [MoCA overview](#) on page 7-31).
- **FTTP** - Fiber to the Premises, a broadband service architecture where fiberoptic cable carries the provider service all the way to the residential or business premises, where it may terminate and use another form of transport and physical media in the premises, such as MoCA/coaxial cable
- **CPE** - Customer Premises Equipment, a general term used to describe devices in the customer/subscriber network that interface with the service provider network. Typically, CPE refers to devices such as personal computers, digital set-top boxes (STBs), and other LAN equipment.
- **NT** - Network Terminal, a general term for a device that terminates the physical plant owned by the provider and interfaces with the transport medium inside the premises. An example is an optical network terminal (ONT) which terminates the broadband access network in an FTTP architecture, normally just outside the premises. In the case of a residential FTTP/MoCA architecture, the ONT would provide the interface between the broadband access network and the MoCA over coaxial cable network within the premises. For more information, see [Example physical MoCA network](#) on page 7-32.
- **RG** - Residential Gateway, the term used sometimes in this document to indicate the gateway router device in the residence/subscriber premises. The RG provides the interface between the provider network (WAN) and the residential network (LAN) and may also incorporate a modem, dependent upon the architecture. Within the networking industry, this device may also be referred to as a Broadband Home Router or BHR.
- **BHR** - Broadband Home Router, another term for an RG.
- **LAN** - Local Area Network, the term used to describe the network inside the home, “downstream” from the residential gateway/router, which interconnects the residential equipment. In a MoCA architecture, the LAN runs on a specific MoCA channel that each device must be able to join.

- **WAN** - Wide Area Network, the term normally used to describe the provider network “upstream” from the residential gateway/router which delivers the broadband services. In the case where both a LAN and WAN operate over MoCA on the same cable, the WAN uses a different channel.
- **Node** - A MoCA-compliant device that is synchronized with and communicating on a MoCA network.
- **NC** - Network Coordinator, the device (node) in the MoCA network that manages MoCA functionality such as network admission, media access, and link maintenance. For more information, see [Example physical MoCA network](#) on page 7-32.
- **STB** - Set-Top Box, a device used to decode analog and digital TV signals for use by a television, often simply called a “cable box.” The word “set” is short for “television set.”




Additional RF-related terms:

- **RF** - Radio Frequency, referring to a frequency range of about 3 Hz to 300 GHz, commonly used for the transmission of a variety of communications signals such as radio and TV. While better known for over-the-air broadcast, frequencies in the RF range are also used to transport audio and video services over physical media by cable TV and other providers.
- **Analog** - In the context of audio and video transmission, refers to the practice of using composite analog signals to deliver these services. Analog transmission has historically been the dominant method (versus digital) due to overall reliability and efficiency, and simply because analog transmission has historically been adequate to deliver the intended services. However, digital transmission is gradually replacing analog transmission, due to the wide expansion of capabilities that digital offers.
- **Digital** - In the context of audio and video transmission, refers to techniques for modulating a digital signal (that is, a bit stream) over analog carrier RF frequencies. In concept, digital transmission allows a virtually limitless expansion of services, including a broad range of interactive features between the subscriber and provider. However, the transition to digital is a gradual process because it requires substantial changes to infrastructure and operational practice.
- **QAM** - Quadrature Amplitude Modulation. See [About QAM and the constellation graph](#) on page 8-18.

Common acronyms:

- **FTTH/FTTP** - Fiber To The Home/Fiber To The Premises
- **IP** - Internet Protocol
- **IPTV** - IP Television
- **VNC** - Virtual Network Computing

Symbology:

-  - Earth ground, a symbol that may appear on the unit and/or related diagrams indicating a component that must be grounded to Earth.
-  - A symbol which may appear on the module indicating that the outer conductor of a connected coaxial cable (the “shield”) should be properly grounded to earth.
-  - A symbol which may appear on the module indicating that this documentation should be reviewed thoroughly before using the product.

## 1.3.4 Additional documentation

Additional documentation (including an electronic version of this document) can be found on Spirent's Customer Service Network. Use the URL below to register and gain access:

<http://support.spirent.com/>

## 1.4 About hardware models and variations

Two hardware models currently exist for the product:

- **T5100** - The original “NG2” (next-generation) unit, with separate internal radios for wireless B/G/N and wireless AC. Because of the separate circuitry, the Wi-Fi testing menu required separate commands for the respective functionality (see [Wi-Fi Testing Menu](#) on page 3-1).
- **T5300** - The next evolution of the NG2 unit, with the following improvements:
  - Common circuitry for all Wi-Fi protocols, which allows a corresponding common menu item for all Wi-Fi connections.
  - New circuitry to support the Wi-Fi spectrum analysis feature (see [Wi-Fi Spectrum Analysis](#) on page 3-17).

Both units look identical. Aside from the Wi-Fi differences noted, the functionality is also identical. For more information on T5100 upgrade options, please contact Spirent.

## 1.5 Important safety notes

- **For operator safety**, this equipment is intended to be used on cable communications equipment that is grounded in accordance with the NEC Articles 800 and 830.
- The maximum input voltage is 42 VDC.
- The coaxial input/output circuitry is classified as CAT-II.

- This equipment should be used only by qualified personnel with a strong knowledge of the equipment and the networks on which it is designed to operate. In all cases, all local safety and operational protocols should be followed.
- Any usage of the equipment in a manner not specified by the manufacturer may impair features related to safety and user protection. Additionally, such usage may void certain terms of the warranty.

## 1.6 Consignes de sécurité importantes

- **Pour la sécurité de l'opérateur**, cet équipement est destiné à être utilisé sur les équipements de communications par câble qui est relié à la terre en conformité avec les articles 800 et 830 de NEC.
- La tension d'entrée maximale est de 42 VDC.
- Le circuit d'entrée/sortie coaxiale est classé comme CAT- II.
- Cet équipement doit être utilisé uniquement par un personnel qualifié avec une forte connaissance de l'équipement et les réseaux sur lesquels il est conçu pour fonctionner. Dans tous les cas, la sécurité locale et tous les protocoles opérationnels doivent être suivies.
- Toute utilisation de l'équipement d'une manière non spécifiée par le fabricant peut altérer les fonctions relatives à la sécurité et à la protection de l'utilisateur. En outre, une telle utilisation peut annuler certains termes de la garantie.

## 1.7 Documentation references

1. Multimedia over Coax Alliance. 09 Sept. 2008. <<http://www.mocalliance.com>>.
2. Federal Communications Commission. "Multichannel Video and Cable Television Service." Sec. §76.605 "Technical standards." 18 Dec. 2008. <<http://www.fcc.gov/mb/engineering/605.html>>
3. National Cable & Telecommunications Association. "NCTA Recommended Practices For Measurements On Cable Television Systems." Third Edition. 2002.
4. Electronic Industries Association. "Cable Television Channel Identification Plan." EIA IS-132. May 1994.

## 1.8 Technical support

If you need product assistance or want to report problems with the product or the documentation, please contact us.

**E-mail:** [support@spirent.com](mailto:support@spirent.com)

**Phone:**

# Preliminary issue - Limited distribution only!

Tech-X Flex® (NG2)

Tech-X Flex User Guide - Firmware v06.50

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Tech-X Flex® (NG2)

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Intro

## 2: Product Overview

This section provides an overview of the Tech-X Flex product and includes the following information:

- [Introduction to the workflow interface](#) on page 2-1 - Describes the new workflow-based user interface.
- [Product overview](#) on page 2-16 - Describes the physical unit and includes a high-level overview of system features and capabilities.
- [General product handling and operation](#) on page 2-21 - Describes basic procedures for handling and operating the unit.
- [Handling the MoCA/RF module](#) on page 2-30 - Describes basic procedures for handling the detachable MoCA/RF module.
- [Remote control of the unit](#) on page 2-33 - Describes how to operate the unit from another networked device such as a PC, tablet computer, or smartphone.
- [Licensed feature details](#) on page 2-53 - Describes the different licenses available for the unit.
- [Maintenance](#) on page 2-55 - Describes maintenance requirements and procedures for the unit.
- [FTP information](#) on page 2-57 - Describes FTP-related functions and parameters.
- [Technical support](#) on page 2-61 - Provides contact information.

### 2.1 Introduction to the workflow interface

When the unit initially starts up, it presents the “workflow automation interface,” designed to guide you through a variety of common tasks in a partially-automated manner. The following figure shows the initial screen when a MoCA/RF module is connected. Without the module, the screen would be similar, but missing the **MoCA-RF** icon.



**Figure 2-1 Workflow splash screen**

The initial screens represent an icon-based menu system, which you can navigate similar to a common mobile device interface. When you reach an actual workflow, the unit may present instructional videos and/or request input parameters, then run any variety of testing or administrative functions. For more information, see:

- [About the workflow interface vs. the “classic” view](#) on page 2-2
- [Workflow usage example \(Wi-Fi INSTALLATION\)](#) on page 2-3
- [Overview of existing workflows](#) on page 2-8

## 2.1.1 About the workflow interface vs. the “classic” view

The workflow interface is a modern alternative to the “classic” view which the product has included since its inception. Driven by text menus, the classic view is designed for single-function activities that require full manual setup. Generally, the user must know how to set up a particular function and interpret the results afterwards. Alternatively, workflows provide guided assistance and automation while operating the unit, including the ability to combine multiple functions in single operation.

To access the classic view from the workflow interface, navigate to **SYSTEM > EXIT TO CLASSIC** from the main screen. Once in classic view, you can return to the workflow interface with **System > Wizard GUI** or the “magic wand” icon that appears above top-level menus:



**Figure 2-2 Magic wand icon**



Note the following important items about the two interfaces:

- Workflow scripting covers a focused subset of unit functionality only. The classic view provides access to all core features and functions. The decision whether to use a particular view may involve:
  - The comfort of the user with the view, and
  - Whether the view supports the desired task
- All workflow results are saved automatically (see [Record Manager](#) on page 5-1).
- Most of this document describes unit functionality from the perspective of the classic view, because this view presents all functionality in a logical, hierarchical order. Many workflows request input and present results similar to classic view screens, and some present actual classic screens. When workflow functionality is described in this document, it includes links to the corresponding classic view content elsewhere. While some interpretation may be required to correlate the material, remember that both interfaces invoke the same basic features supported by the unit.
- Internally, workflow scripting is separated from the unit firmware. By default, scripts are automatically downloaded during a firmware update; however it is possible to implement an architecture where scripts download independently. This type of architecture allows a more flexible system for updating workflows. For more information, please contact Spirent.

## 2.1.2 Workflow usage example (Wi-Fi INSTALLATION)

This section provides a detailed overview of how to run a workflow, using the Wi-Fi **INSTALLATION** workflow as an example. This workflow provides a scripted routine to verify a complete service installation within a residence, where a Wi-Fi router provides connectivity to multiple data and/or video devices. Key workflow steps and features include:

- Layer 4 or NDT speed testing at the router, to verify the bandwidth provided by the provider WAN. This testing includes both wired and wireless versions as necessary to rule out problems specific to Wi-Fi.
- Room-by-room performance testing to verify acceptable service at each location (LAN validation). This testing includes a detailed analysis of Wi-Fi signal parameters, such as power levels, physical-layer bit rates, channel overlap, and channel utilization.
- Animations and tips to help set up testing and troubleshoot issues.

Once the overall service is deemed acceptable, the results of a final workflow run may represent a “birth certificate” record for the account.

### The workflow

The workflow begins with a typical instructional screen. As the first part of this workflow is WAN testing at the router, the instructions and optional animation guide you to the router location.

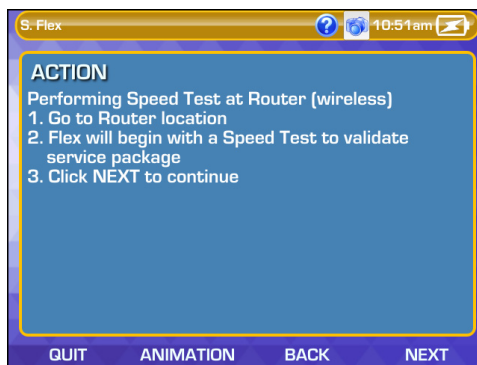


Figure 2-3 Wi-Fi INSTALLATION workflow - Router testing instructional screen

At the bottom of this screen, you can see the common navigational tools for workflows, including **QUIT**, **ANIMATION**, **BACK**, and **NEXT**. These controls are the most intuitive method of navigation, although some screens provide alternative methods such as buttons and mouse click responses. Any provided method is acceptable.

The first testing action of the workflow is a speed test, for which you have the option of a **L4 Performance Test** or an NDT-based **Speed Test**. So, the next screen of the workflow requires this selection:

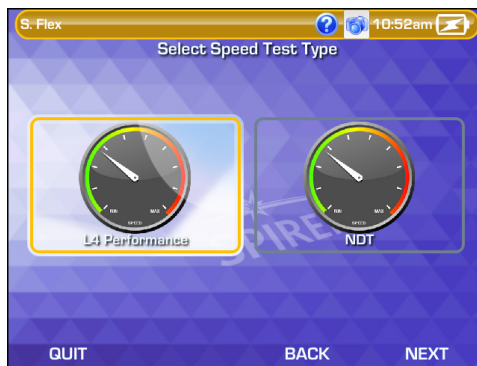
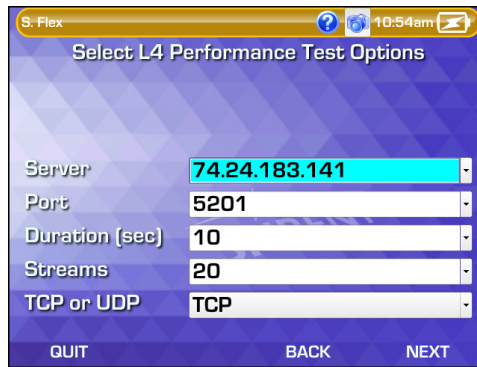


Figure 2-4 Wi-Fi INSTALLATION workflow - Speed test type selection

After you select the test type, you must enter the applicable setup parameters. For this example, the **L4 Performance Test** was selected.



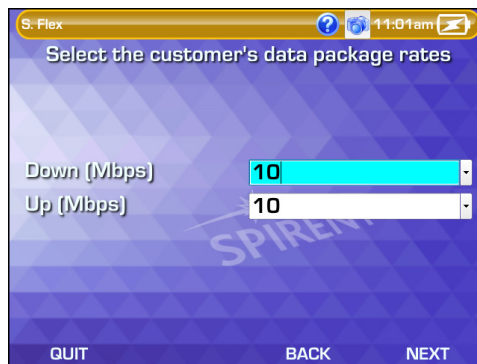
**Figure 2-5 Wi-Fi INSTALLATION workflow - Speed test setup**

At this point, for detailed information on the test setup, you must refer to the applicable part of this document that describes the underlying test. The tables under [Overview of existing workflows](#) on page 2-8 provide applicable links for all supported workflows. For this workflow specifically, see one of:

- [L4 Performance Test](#) on page 6-7
- [Speedtest](#) on page 6-17

**NOTE:** In most circumstances, it is likely that the proper setup parameters are pre-determined by administrators and/or other subject-matter experts, then provided to testers as some form of common work instruction.

The workflow then requests the data rates for the customer. The workflow uses these numbers as pass/fail thresholds for the subsequent speed testing.



**Figure 2-6 Wi-Fi INSTALLATION workflow - Data rate selection**

Noting that a Wi-Fi connection has yet to be established, the workflow begins the connection setup. The first screen is a modification of the classic Wi-Fi **Scan**, where you can select the proper customer network. After this screen, the workflow requests the authentication parameters, similar to the classic Wi-Fi **Connect** function (see [Wi-Fi Setup > Connect](#) on page 3-7).

SSID	Sig. Str.	SNR	CH#	Freq Band	802.11 Type
shortward	-21	61	5u	2.4	b,g,n
shortward5.0	-24	71	48u	5	n
CCHRA-Tower2	-75	20	165u	5	n
NETGEAR	-82	13	6	2.4	b,g

Buttons: QUIT, PAUSE, NEXT

**Figure 2-7 Wi-Fi INSTALLATION workflow - Wi-Fi scan results**

Once the connection parameters are submitted, the workflow enters a state of automatic processing where it attempts to connect to the selected network, obtain an IP address, run the speed testing, and compare the results with the specified thresholds. At any point, if the process cannot complete, the workflow provides a warning and begins to exit.

If the testing completes without issue, the workflow presents the results. If the data rates do not meet the thresholds, the workflow initiates a wired Ethernet speed test to determine whether the issue is associated with the Wi-Fi connection or the upstream WAN. At this point, if either test reveals issues, you might decide to terminate the workflow and troubleshoot accordingly.

**Test Results: FAIL**

Name	Value	Min	Max
Upload speed (Mbps)	6.45	8	850
Download speed (Mbps)	22.33	8	850

Buttons: SHOW ALL, NEXT

**Figure 2-8 Wi-Fi INSTALLATION workflow - WAN speed testing results**

Assuming that WAN throughput is acceptable and you are ready to continue, the workflow moves to its second major stage, LAN testing. To complete the workflow, independent testing must be run at the location of each Wi-Fi client (STB, computer, etc.), or any other location where you want to verify the service. Before this testing procedure proceeds, the workflow requests the selection of either **Video** or **Data**:



Figure 2-9 Wi-Fi INSTALLATION workflow - Installation type selection

The primary difference between these options is the pass/fail thresholds applied to the results. The testing procedure is the same for both, where you should:

1. Move the unit to an appropriate testing location; that is, a place where Wi-Fi performance is important.
2. In the workflow setup, specify a “name” (**Room**) for the location, which serves as an identifier within the results only.
3. Initiate the testing and wait for it to finish.
4. Repeat this procedure for all desired testing locations.

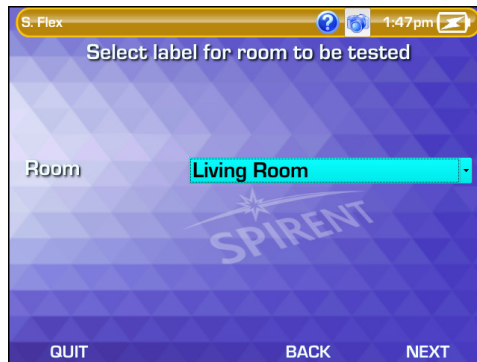


Figure 2-10 Wi-Fi INSTALLATION workflow - Room label selection

Once you have completed all the rooms, you can navigate to the completion of the workflow. The workflow will present some recommendations based on the results of testing, then allow you to view the complete set of results for each location.

**NOTE:** Where applicable, pass/fail evaluations are presented based on scripted thresholds. Likely, these thresholds will be customized for any specific deployment, based on site-specific requirements.

Name	Value	Min	Max
Living Room			
Wi-Fi Connect	Success		
Phy Rate (Mbps)	148.93		
Signal Strength (dBm)	-41		
Noise (dBm)	-97		
SNR (dB)	56		
Channel Overlap Count	1		
RF Utilization (%)	24.48		
RF Interference (%)	4.51		

Figure 2-11 Wi-Fi INSTALLATION workflow - Final results

Once the workflow exits, you are complete. Like all workflows, the results are saved automatically in the **Record Manager** for future upload.

## 2.1.3 Overview of existing workflows

The following information briefly describes the default workflows provided with the unit, organized by top-level functional area.

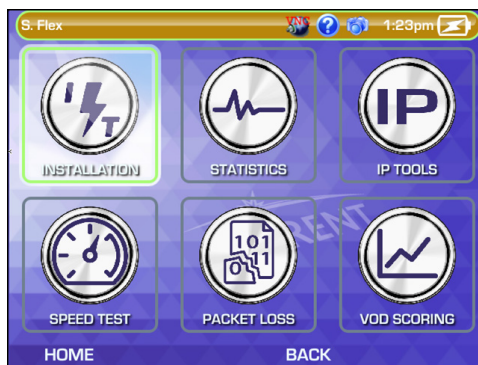


Figure 2-12 MoCA-RF > MoCA workflow menu

Table 2-1 MoCA workflow descriptions

Workflow	Description/notes	For more information
<b>INSTALLATION</b>	Synchronizes with a MoCA network, then runs a <b>MoCA Quick Test</b> . Pass/fail criteria is applied based on normal thresholds configured for MoCA testing.	<ul style="list-style-type: none"> <li>On the input parameters required for the synchronization, see <a href="#">Join MoCA network setup parameters</a> on page 7-5.</li> <li>On the input parameters, thresholds, and results related to the <b>MoCA Quick Test</b>, see <a href="#">MoCA Quick Test</a> on page 7-23.</li> </ul>
<b>STATISTICS</b>	Synchronizes with a MoCA network and produces comprehensive MoCA statistics. It does not set up an IP interface.	<ul style="list-style-type: none"> <li>On the input parameters required for the synchronization, see <a href="#">Join MoCA network setup parameters</a> on page 7-5.</li> <li>On the results that display on standard classic screens, see <a href="#">MoCA Network Statistics</a> on page 7-9.</li> </ul>
<b>IP TOOLS</b>	Synchronizes with a MoCA network and sets up an IP interface using DHCP. Then, it guides the user through <b>Ping</b> , <b>Traceroute</b> , and/or <b>Web Browser</b> testing, where the user must provide standard input parameters related to test destinations.	<ul style="list-style-type: none"> <li>On the input parameters required for the synchronization, see <a href="#">Join MoCA network setup parameters</a> on page 7-5.</li> <li>On <b>Ping</b> testing, see <a href="#">Ping</a> on page 6-4.</li> <li>On <b>Traceroute</b> testing, see <a href="#">Traceroute</a> on page 6-6.</li> <li>On <b>Web Browser</b> testing, see <a href="#">Web Browser</a> on page 6-10.</li> </ul>

Workflow	Description/notes	For more information
<b>SPEED TEST</b>	Synchronizes with a MoCA network and then runs either a <b>L4 Performance Test</b> or an NDT-based <b>Speed Test</b> . Standard input parameters for the speed testing apply.	<ul style="list-style-type: none"><li>• On the input parameters required for the synchronization, see <a href="#">Join MoCA network setup parameters</a> on page 7-5.</li><li>• On the input and result parameters for the <b>L4 Performance Test</b>, see <a href="#">L4 Performance Test</a> on page 6-7.</li><li>• On the input and result parameters for the <b>Speed Test</b>, see <a href="#">Speedtest</a> on page 6-17.</li></ul>
<b>PACKET LOSS</b>	Synchronizes with a MoCA network and then guides the user through a <b>Packet Loss Test</b> . Standard test input parameters apply.	<ul style="list-style-type: none"><li>• On the input parameters required for the synchronization, see <a href="#">Join MoCA network setup parameters</a> on page 7-5.</li><li>• On <b>Packet Loss Test</b> testing, see <a href="#">Single Device PLT</a> on page 6-11.</li></ul>
<b>VOD SCORING</b>	Synchronizes “inline” with a MoCA network and then runs a <b>Video QoS</b> test. This workflow requires several setup steps, including the connection of the unit inline with the network, the physical initiation of a VoD stream on the network and the entry of several complex setup parameters. The setup and results of the <b>Video QoS</b> test use classic view screens.	<ul style="list-style-type: none"><li>• On the input parameters required for the synchronization, see <a href="#">Join MoCA Network In-Line (Bridging and passive testing)</a> on page 7-19.</li><li>• On the setup and results of the <b>Video QoS</b> test, see <a href="#">Video QoS (Quality of Service)</a> on page 6-23.</li></ul>





Figure 2-13 MoCA-RF > RF workflow menu

Table 2-2 RF workflow descriptions

Workflow	Description/notes	For more information
<b>INSTALLATION</b>	Runs a <b>Channel Sweep Test</b> on a series of specified channels. Like the same test launched from the classic view, the workflow version requires you to select a test location, which determines the set of thresholds to apply. All setup and results use customized workflow screens, but have the same meaning as their classic view equivalents.	On the setup and results of the <b>Channel Sweep Test</b> , see <a href="#">Channel Sweep Test</a> on page 8-2.
<b>SINGLE CHANNEL</b>	Launches the classic view of the <b>Single Channel Test</b> .	See <a href="#">Single Channel Test</a> on page 8-4.
<b>RF CLASSIC</b>	Switches to the classic <b>RF</b> menu. This action closes the workflow view completely.	See <a href="#">MoCA/RF - RF Testing</a> on page 8-1.



Figure 2-14 Wi-Fi workflow menu

Table 2-3 Wi-Fi workflow descriptions

Workflow	Description/notes	For more information
<b>INSTALLATION</b>	Runs a series of tests to verify a complete service installation with a Wi-Fi router.	See <a href="#">Workflow usage example (Wi-Fi INSTALLATION)</a> on page 2-3.
<b>SPECTRUM</b>	Launches the classic view of the <b>Wi-Fi Spectrum Analysis</b> .	See <a href="#">Wi-Fi Spectrum Analysis</a> on page 3-17.
<b>WI-FI CLASSIC</b>	Switches to the classic <b>Wi-Fi</b> menu. This action closes the workflow view completely.	See <a href="#">Wi-Fi Testing Menu</a> on page 3-1.



Figure 2-15 ETHERNET workflow menu

Table 2-4 ETHERNET workflow descriptions

Workflow	Description/notes	For more information
<b>IP TOOLS</b>	Establishes an IP interface using DHCP, then guides the user through <b>Ping</b> , <b>Traceroute</b> , and/or <b>Web Browser</b> testing, where the user must provide standard input parameters related to test destinations.	<ul style="list-style-type: none"> <li>On <b>Ping</b> testing, see <a href="#">Ping</a> on page 6-4.</li> <li>On <b>Traceroute</b> testing, see <a href="#">Traceroute</a> on page 6-6.</li> <li>On <b>Web Browser</b> testing, see <a href="#">Web Browser</a> on page 6-10.</li> </ul>
<b>SPEED TEST</b>	Establishes an IP interface using DHCP, then runs either a <b>L4 Performance Test</b> or an NDT-based <b>Speed Test</b> . Standard input parameters for the speed testing apply.	<ul style="list-style-type: none"> <li>On the input and result parameters for the <b>L4 Performance Test</b>, see <a href="#">L4 Performance Test</a> on page 6-7.</li> <li>On the input and result parameters for the <b>Speed Test</b>, see <a href="#">Speedtest</a> on page 6-17.</li> </ul>
<b>PACKET LOSS</b>	Establishes an IP interface using DHCP, then guides the user through a <b>Packet Loss Test</b> . Standard test input parameters apply.	See <a href="#">Single Device PLT</a> on page 6-11.

Workflow	Description/notes	For more information
<b>VOD SCORING</b>	Establishes an IP interface using DHCP, then runs a <b>Video QoS</b> test. This workflow requires several setup steps, including the physical initiation of a VoD stream on the network and the entry of several complex setup parameters. The setup and results of the <b>Video QoS</b> test use classic view screens.	See <a href="#">Video QoS (Quality of Service)</a> on page 6-23.
<b>CABLE TEST</b>	Initiates an <b>Ethernet Cable Test</b> , with no user input required. Assuming a connection with an active Ethernet signal, the following conditions cause a failed condition: <ul style="list-style-type: none"><li>• The link status is not 1 Gbps full duplex -or- if auto-negotiation fails.</li><li>• The link is not 1 Gbps link due to one or more open pairs.</li><li>• Pair polarity or straight-through mapping is incorrect.</li><li>• Any skew value is greater than 16 ns.</li></ul>	See <a href="#">Ethernet Cable Test</a> on page 4-6.
<b>WI-FI CLASSIC</b>	Switches to the classic <b>10/100/1G</b> menu. This action closes the workflow view completely.	See <a href="#">10/100/1G Testing Menu</a> on page 4-1.



Figure 2-16 SYSTEM workflow menu

Table 2-5 SYSTEM workflow descriptions

Workflow	Description/notes	For more information
<b>VIDEO MONITOR</b>	Launches the <b>Video Monitor</b> feature. The normal dongle and associated setup is required.	See <a href="#">Video &gt; Video Monitor</a> on page 5-11.
<b>SYSTEM SETUP &gt; INITIAL SETUP</b>	Guides the user through some basic unit setup, as a shortcut to areas available in the classic <b>System</b> menu. This setup includes base unit and date/time settings.	<ul style="list-style-type: none"> <li>On general unit settings, see <a href="#">System/Module Settings &gt; Base Unit</a> on page 5-16.</li> <li>On the date/time setup, see <a href="#">Set Date and Time</a> on page 5-6.</li> </ul>
<b>SYSTEM SETUP &gt; VERSION INFO</b>	Launches the classic <b>Version Info</b> screen.	See <a href="#">Version Info</a> on page 5-7.
<b>SYSTEM SETUP &gt; UPGRADE FIRMWARE</b>	Guides the user through a firmware upgrade process using either the 10/100/1G or Wi-Fi interface.	See <a href="#">Update Firmware</a> on page 5-13.
<b>SYSTEM SETUP &gt; REMOTE CONTROL</b>	Guides the user through a “remote control” setup, using either the “local access point” or VNC-over-WAN approach.	See: <ul style="list-style-type: none"> <li><a href="#">Local remote control (via a Wi-Fi access point) setup</a> on page 2-45</li> <li><a href="#">Remote site remote control (via the internet) setup</a> on page 2-46</li> </ul>

Workflow	Description/notes	For more information
<b>EXIT TO CLASSIC</b>	Switches to the classic <b>SYSTEM</b> menu. This action closes the workflow view completely.	See <a href="#">System Menu</a> on page 5-1.

## 2.2 Product overview

The following sections provide a high-level overview of the unit.

### 2.2.1 Base unit features

**NOTE:** Your unit may or may not include all of the features described here, dependent upon your licensing agreement with Spirent. Please contact Spirent for more information.

- **Ethernet and IP connectivity testing** - With its 10/100/1G interface, the unit can link to an Ethernet network at any standard transport device such as a home router, hub, or Ethernet switch. Once linked, the unit can join an IP network and perform testing such as ping, traceroute, and internet webpage access. These abilities make the unit ideal for verifying connectivity within the home and isolating problems to either the provider or subscriber networks.
- **Wi-Fi testing** - The unit includes a Wi-Fi interface that can sync with wireless devices using standard 802.11 protocols such as b, g, n, and ac, including support for WEP and WPA security. Similar to Ethernet testing, the Wi-Fi interface allows you to join a wireless network and perform IP-based testing to verify connectivity and sectionalize issues.
- **IP video analysis** - The unit is able to join a video stream and measure video quality and channel change time. In this fashion, it can emulate a set-top box (STB) and provide a comprehensive evaluation of IPTV quality. It can also bridge an existing stream on a link for passive monitoring. For example, it can be placed between a home router and a real STB to passively monitor the video communications between the devices, even while the video is simultaneously displaying on a TV.
- **Expansion of features with modular hardware** - The unit is designed for expansion by attaching feature-specific modules, such as the MoCA/RF module for testing of home MoCA networks. For more information on available modules, please contact Spirent. For more information on the operation of any specific module, see the documentation for that module.

## 2.2.2 Front panel controls

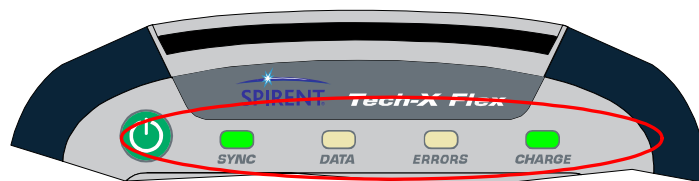


Figure 2-17 Front panel controls

**Table 2-6 Front panel feature descriptions**

Indicator	Function
<b>Power on/off</b>	Powers the unit on and off, and is also used to place the unit into sleep mode (see <a href="#">Powering on/off</a> on page 2-22).
<b>LED indicators</b>	See <a href="#">LED indicators</a> on page 2-18.
<b>Strap mount</b>	See <a href="#">Attaching the strap</a> on page 2-22.
<b>Enter</b>	Engages the active control on the screen, such as a button or a text entry box.
<b>Exit</b>	Halts the current action or test, often returning the display to the previous screen.
<b>Brightness</b>	Adjusts the brightness of the display. Also, this button can be used to take a screen capture (see <a href="#">Capturing a screen image (screenshot)</a> on page 2-28).
<b>Help</b>	Used as a backspace on the text entry pad. Some screens also allow access to the online help documentation with this button.
<b>N1</b>	Used for miscellaneous, specialized functions. For example, it is used to enter special characters on the standard keypad, such as periods. For more information, see <a href="#">Running a function or test</a> on page 2-24.
<b>Function keys</b>	Used to select the active test interface and/or functional area, such as the Wi-Fi interface or the System configuration menu.
<b>Arrow keys</b>	Provide navigational control over numerous display items, such as scroll bars, multi-item lists, parameter entry screen controls, tabs, and more.
<b>Alphanumeric keypad</b>	Used for text entry.

## 2.2.3 LED indicators





**Table 2-7 LED indicator description**

Indicator	Function
<b>SYNC</b>	<p>Indicates the status of the link over the active interface. For example, when using the Wi-Fi interface, the LED indicates the status of the Wi-Fi link. The general behavior is as follows:</p> <ul style="list-style-type: none"><li>• <b>Solid green</b> - The unit is properly linked and/or synchronized with a comparable far-end device. For the 10/100/1G interface, the LED is solid green any time the interface is configured with IP information, but does not necessarily indicate that the information is valid and routable.</li><li>• <b>Red</b> - The unit is attempting to configure the active interface and/or link with a far-end device.</li></ul> <p>Note that some module interfaces use the SYNC LED differently. For module-specific LED behavior, see the respective module documentation.</p>
<b>DATA</b>	<p>Flashes when sending or receiving data over the active interface. For example, when using the 10/100/1G interface, the LED flashes when an Ethernet frame is sent or received.</p>
<b>ERRORS</b>	<p>Indicates errors at the data link level on the active data stream. For example, on the 10/100/1G interface, the LED may indicate Ethernet frame CRC errors.</p>
<b>CHARGE</b>	<p>Indicates power source and charging status, as follows:</p> <ul style="list-style-type: none"><li>• <b>Solid red</b> - Unit is connected to an external power source and the battery is charging</li><li>• <b>Solid green</b> - Unit is connected to an external power source and the battery is nearly or fully charged</li><li>• <b>Off</b> - Unit is not connect to external power (unit on or off) and/or the unit has no battery installed</li></ul> <p>Note that the unit includes a system feature for reporting detailed information about battery status. For more information, see <a href="#">Battery Status</a> on page 5-8.</p>

## 2.2.4 Base unit physical interfaces (ports)

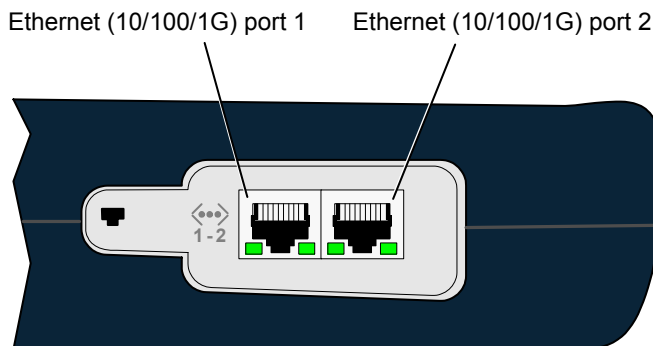


Figure 2-18 Base unit right side

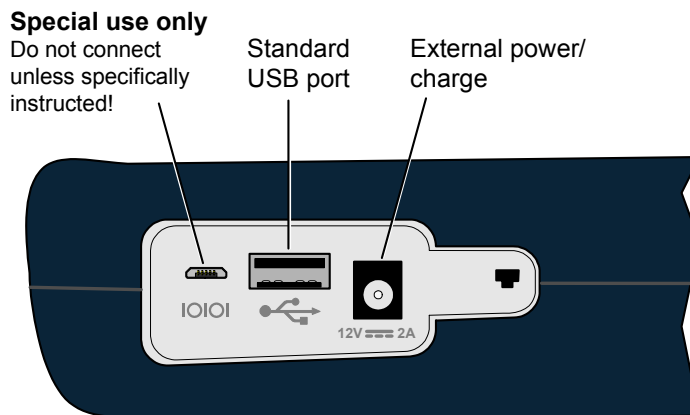


Figure 2-19 Base unit left side

Note the following:






- Modules have their own physical interfaces. See the documentation for the respective module for more information.
- The two Ethernet interfaces are used for 10/100/1G testing and for administrative functions on the unit, such as upgrading firmware. LED behavior is as follows:

- When connected to a 10/100 network, the LED towards the bottom of the base unit will illuminate green and flash when there is data activity
- When connected to a 1G network, the LED towards the top of the base unit will illuminate green and flash when there is data activity
- The USB port is used for specialized functions related to transferring files to and from the unit. This port and related functions are described elsewhere in the product documentation as applicable.

## 2.2.5 Unit symbols

The following table describes symbols that may appear on the physical body of the unit.

**Table 2-8 Unit symbols**

Symbol	Description
	DC power input.
	Ethernet port.
	Port for special use only. <b>Do not plug anything into this port unless specifically instructed by Spirent. Improper use could damage the unit.</b>
	USB port.
	A symbol which may appear on the unit indicating that this documentation should be reviewed thoroughly before using the product.

## 2.3 General product handling and operation

This section provides basic information for general operation. For most functions and tests, the buttons, display, and other components operate in a similar fashion. Once you become familiar with general operation, you should be able to set up and run most functions and tests, referring to this document only as necessary for specific technical details, contained elsewhere in this document.

## 2.3.1 Protection from water and dust ingress

Although the basic unit provides some protection from water and dust ingress for outdoor use, Spirent recommends the use of the optional jacket to increase the level of protection. For information about purchasing the jacket, please contact your account representative.

## 2.3.2 Important battery charging note

The battery will not charge if its internal temperature is 113° F. (45° C.) or higher. However, upon connection to external power, the unit may still report that it is charging in the system status and/or the **CHARGE** LED may illuminate green. The following paragraphs describe this behavior in more detail.

The Li-Ion battery used in the unit is a “smart” battery that communicates important metrics to the unit CPU. Included in these metrics is the desired charge current. When the battery exceeds the temperature limit, it indicates that no charge current is desired, which the unit interprets as fully-charged. Because the battery does not report the overtemperature condition, the unit must default to indicating a fully-charged state.

Because of this temperature limit, use caution when leaving the unit in direct sunlight or any other warm environment. For example, a unit resting on a dashboard in direct sunlight can heat to very high temperatures in a very short amount of time. If a battery heats up beyond the temperature limit, simply allow it to cool and charging will resume normally when the temperature reaches an acceptable level.

Note that the battery status screen accurately reports the current battery temperature, whether or not charging is enabled. For more information, see [Battery Status](#) on page 5-8.

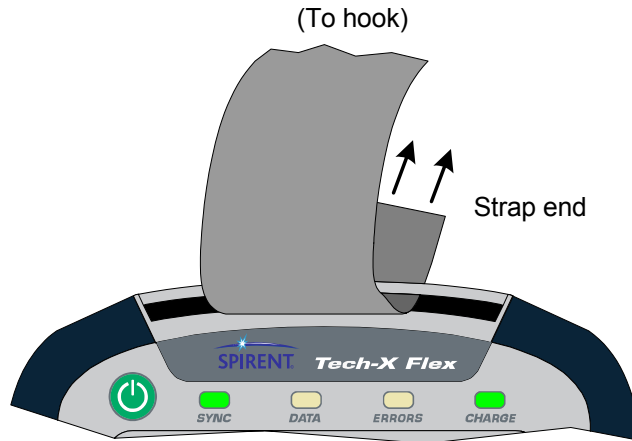
## 2.3.3 Powering on/off

When the unit is off, the power button turns it on. When the unit is on, the power button prompts you whether to power off the unit.

While on battery power, the unit supports automatic shutdown after a specified amount of idle time. For more information, see [System/Module Settings > Base Unit](#) on page 5-16.

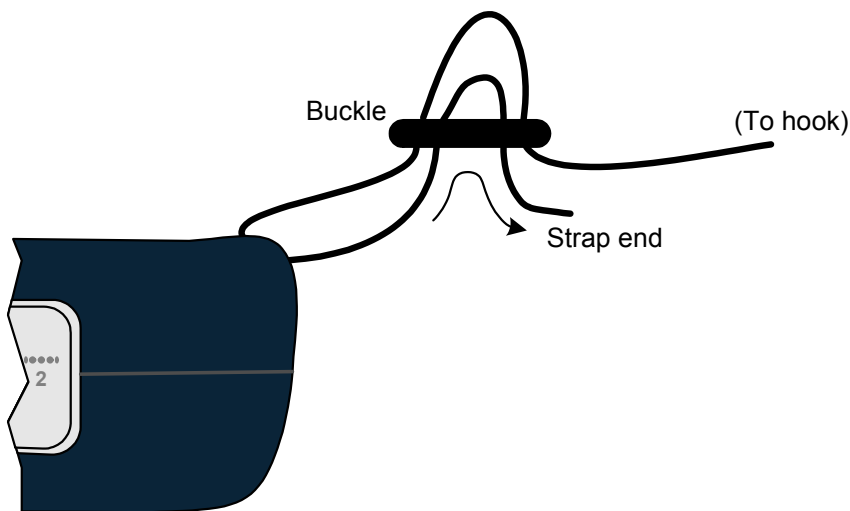
## 2.3.4 Attaching the strap

A strap with a hook is provided to hang the unit while working. To attach the strap, first make sure that the buckle is facing up, then slide the open end around and through the strap mount at the top of the unit:



**Figure 2-20 Sliding the open strap end through the strap mount**

Next, feed the open end through the bottom of the buckle as shown in the following figure:



**Figure 2-21 Feeding the strap through the buckle**

## 2.3.5 About the touchscreen display

The unit display includes touchscreen functionality which allows you to operate most display controls by touching the screen. You should use the provided stylus or a similar device. It is recommended to avoid using your fingers because it is difficult to control selections with precision.

**CAUTION:** Never use a sharp or metallic object, pen, pencil, or other such instrument which will mar the screen.

For new units, units with new firmware, or units with a new battery, a calibration of the touchscreen should be performed. For more information, see [Cal Touchscreen](#) on page 5-12.

## 2.3.6 Selecting the active interface

While testing with the unit, the first step is to select the appropriate interface with one of the function keys, such as the 10/100/1G or Wi-Fi interface, or perhaps another interface associated with an attached module. The interface and any associated hardware remain active only while testing in the respective area continues. If you switch to a different interface, the previous interface shuts down and loses its IP configuration, if any. For example, if you switch from the Wi-Fi interface to the 10/100/1G interface, the Wi-Fi interface will shut down and any IP configuration will be lost.

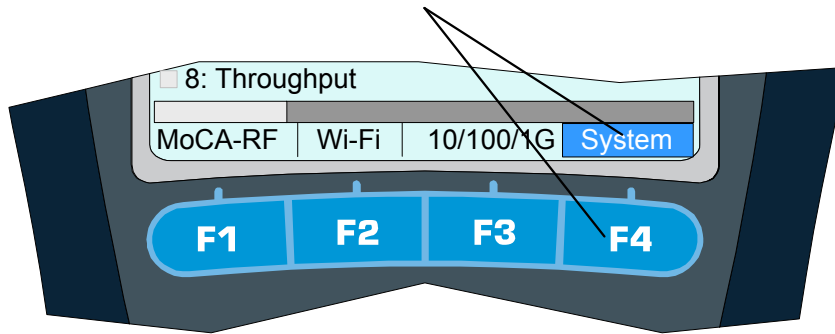
An exception exists with the Wi-Fi interface, which can be optionally configured to remain active all the time. For more information, see [System/Module Settings > Base Unit](#) on page 5-16.

## 2.3.7 Running a function or test

To run any function or test, the following steps generally apply:

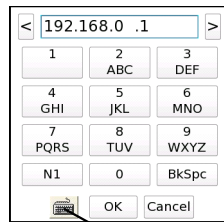
1. Using the function keys or the touchscreen, select the correct menu/interface.

A function key selects the function/test/menu directly above

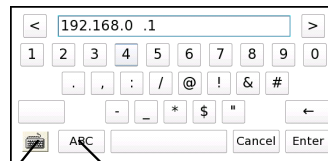


2. Using the up/down arrows, number pad, and/or touchscreen, select the desired menu item and possibly submenu items to activate the desired function/test.
3. For tests that require input parameters, adjust those parameters as necessary, using the navigation arrows and/or touchscreen. For free-form text entries, place the cursor in the field and press any number key (or "double-tap" the field on the touchscreen) to produce the text entry keypad.

### Standard keypad



### "QWERTY" keypad



Toggle between numeric and alphabetic

Toggle keypad type

Using the onscreen keypad and/or the physical number keys, enter the desired data. Note the following:

- The standard keypad is similar to a standard text message device, where you must press a key multiple times to cycle through the associated letters. For example, to enter a "b", press the "2" key three times quickly, then pause.
- On the standard keypad, the **N1** key allows you to enter special characters, such as a parenthesis or angle bracket. On the QWERTY keypad, special characters are entered with the "numeric"

- screen and the **N1** key has no effect. In all cases, the unit will disallow the entry of an invalid character, such as illegal characters when entering a file name.
- If you enter a value that is out of range for the underlying entry field, the **Enter** key on the screen becomes disabled (grayed out). For example, if the underlying field requires a value from 1-99 and you type “100” into the keypad, the **Enter** key will become disabled when you type the second “0”.
  - In the **System** menu, you can set the default keypad type that appears when you initiate text entry (see [System/Module Settings > Base Unit](#) on page 5-16).
  - The **Help** button on the physical keypad acts as a backspace.
4. Press the appropriate button to start the respective action, normally **Start** or **OK**.”

**NOTE:** The unit is designed to be controlled by either the keypad or the touchscreen, or a combination of both. You should become familiar with both methods of unit control, because you may find that a combination of the two provides the most efficiency.

## 2.3.8 Repeating a function or test

See the “retest” button under [Screen title bar buttons/icons](#) on page 2-26.

## 2.3.9 Screen title bar buttons/icons

The following table describes the buttons and icons that may appear in the title bar of menu and testing screens:

**Table 2-9** Title bar buttons








Image	Name	Description
	<b>Back</b>	Returns to the previous screen or the most logical previous menu. In many cases, this button has the same effect as the <b>Back</b> button on the physical keypad.



Image	Name	Description
	<b>Retest</b>	<p>Repeats (reruns) the most recent function/test, using the same setup as the previous test. Note the following:</p> <ul style="list-style-type: none"> <li>• This feature can also be invoked by pressing the <b>N1</b> key on the physical keypad.</li> <li>• Only the most recent test can be repeated. For example, you can't run a ping test, then a traceroute, then repeat the ping test.</li> <li>• Whenever a new test setup screen is entered, the unit automatically disables this button.</li> <li>• In any other case, if this button is disabled and the <b>N1</b> key does nothing, a retest is not feasible due to technical limitations. For example, if you run a test with the MoCA-RF module and then switch to the <b>10/100/1G</b> testing menu, the MoCA/RF hardware will shut down and prevent a repeat of any previous test.</li> </ul>
	<b>Help</b>	<p>Launches the online help system, which produces an onboard viewer of this document set.</p>
	<b>Capture screen</b>	<p>Launches a screen capture. For more information, see <a href="#">Capturing a screen image (screenshot)</a> on page 2-28.</p>

**Table 2-10 Title bar icons**

Button	Description
	Indicates that an <b>Admin Port</b> is currently configured (see <a href="#">Admin Port</a> on page 5-5).
	The unit is plugged into an external power source
-or-	
	The unit is using battery power. For this icon, the number of green bars provides a rough indication of remaining charge. For comprehensive details on current battery status, use <b>System &gt; Battery Status</b> (see <a href="#">Battery Status</a> on page 5-8).
-or-	

## 2.3.10 Capturing a screen image (screenshot)

Most screens provide a screen capture feature, invoked with the screen capture button in the title bar:



Figure 2-22 Screen capture button (title bar)

...or by pressing and holding the brightness button on the physical keypad:



Figure 2-23 Brightness button (physical keypad)

Following the initial capture, the unit produces a screen that allows you to specify a filename and image file type, after which the image is saved to the **Record Manager**.

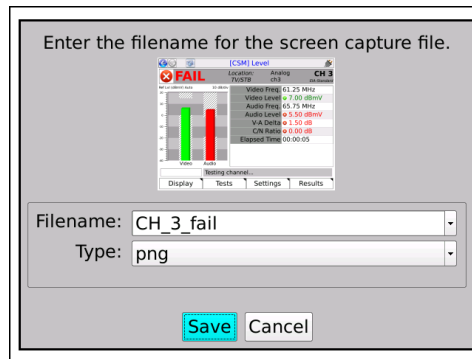


Figure 2-24 Screen capture screen

Note the following:

- For more information on managing and downloading screen capture files, see [Record Manager](#) on page 5-1.
- To capture extended drop-down lists, focus indicators, and other field-oriented artifacts, you must use the brightness button for the capture. The title bar button will remove the focus from the current field, collapsing any lists, etc.

- When using the brightness button for the capture, the screen brightness will change momentarily, then return to the original setting once the capture is taken.
- For most screens, the PNG (Portable Network Graphics) format provides the best compromise between image quality and file size. The BMP (bitmap) format provides lossless quality (that is, produces an exact replica), but uses a larger file size.

## 2.3.11 Stopping a test

Some tests provide a “stop” shortcut (typically **F3** or **F4**) which may be required to stop the test. For most other tests, the **EXIT** key will stop a test immediately. Also, the “back” button in the upper left corner of the screen may sometimes be used instead of **EXIT**. Some tests may require a small amount of shutdown time before terminating completely.

## 2.3.12 Saving results

Most tests allow you to save the results using the **Save** button on the results screen (**F4** key). For some long-running continuous tests, the **F4** key shows the command **Save Start** instead, which causes results to be saved continuously until the test is stopped or **F4** is pressed again. Other continuous tests do not allow results to be saved until the test is stopped.

When you initiate a **Save** action, the unit prompts you for the results file to which the results should be written. You can either select an existing file or type a new filename to create a new file. If you select an existing file, the unit will prompt you whether to append to or overwrite the file. If you create a new file, it becomes part of the normal record file collection that can be managed using the **Record Manager** (see [Record Manager](#) on page 5-1).

**NOTE:** To account for ranging, custom settings, and other factors, some tests may use different units to display the same result. For example, a resistance measurement with the WB Copper Module might display results in ohms, kohms, or MOhms. For consistency, however, saved results always use the same units, with conversion from the results screen units as necessary.

## 2.3.13 Maximum test duration for continuous tests

For any test that can run continuously, such as a video quality of service test, the maximum duration is four hours.

## 2.3.14 Interpreting results

In some cases, this document and related documents provide results samples and references to industry standards for pass/fail criteria. None of this information should be construed as a recommendation or

mandate on how any given organization should interpret results. In all cases, you should consult local and corporate protocol for the standards by which you interpret results. This document does not intend in any way to serve as an authorized or approved standard for the operation and maintenance of any telecommunications network.

## 2.4 Handling the MoCA/RF module

The following sections provide important information about attaching, detaching, and connecting the optional MoCA/RF module. For comprehensive information on module functionality, see:

- [MoCA/RF - MoCA Testing](#) on page 7-1
- [MoCA/RF - RF Testing](#) on page 8-1

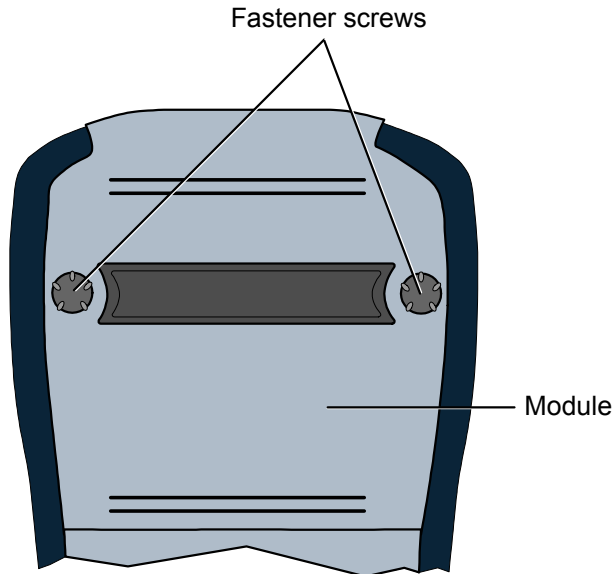
Note that the normal functionality of the base unit (**Wi-Fi, 10/100/1G**, etc.) remains unchanged while the module is attached.

### 2.4.1 Attaching, detaching, and handling the module

**CAUTION:** Before attaching or detaching a module, the unit must be powered off or placed into sleep mode. Failure to do this could result in damage to the module or base unit firmware. For more information on initiating sleep mode, see [Powering on/off](#) on page 2-22.

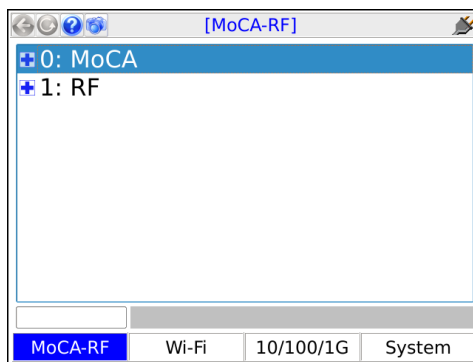
**NOTE:** To prevent damage to the module bay and to keep electrical connections clean, you should keep the module placeholder (the “dummy” module) installed when no module is in use. New units are shipped with the placeholder attached.

A modules is fastened to the base unit using fastener screws attached to the upper “feet” of the unit. To remove a module, loosen/disengage the two screws and gently pull the module from its electrical connection. Likewise, to attach a module, gently press the module into the base unit to seat the electrical connection, then finger-tighten the screws.



**Figure 2-25 Rear of unit with a module installed, showing the fastener screws**

Once a module is attached and has booted up, a menu corresponding to the module functionality will appear over the **F1** function key. For example, when the MoCA/RF module is attached, the **F1** menu shows **MoCA-RF**. If no module is attached, the **F1** key shows no menu.



**Figure 2-26 MoCA-RF main menu**

## 2.4.2 Connecting the module to the coax network

The module has two 75 ohm F-type cable connections that can be connected to the coaxial cable network at any suitable location. Typically, the unit is connected at a location where troubleshooting and/or verification is specifically required, such as a set-top box (STB) or a LAN router. An adapter is normally required for the unit connector (see [How to attach/replace the coax port adapters](#) on page 2-32).

## 2.4.3 How to attach/replace the coax port adapters

Each module has two F-type coax ports which require an adapter to attach a typical coax cable terminated by another F-type connector. Any necessary adapters are included with the module and are intended to be replaceable, allowing them to receive the brunt of normal wear and tear rather than the module hardware itself.

If an adapter is not attached when you receive the module, attach it according to the following diagram. For best results, insert the “shorter” end into the module. The adapter needs to be tight enough to prevent it from loosening when cables are removed, but it should not be overtightened. Also, note the following:

- When tightened, the pre-fastened nut on an adapter may not be flush with the module connector. This is OK.
- Any additional hardware supplied with an adapter, such as a nut and washer, is not used.

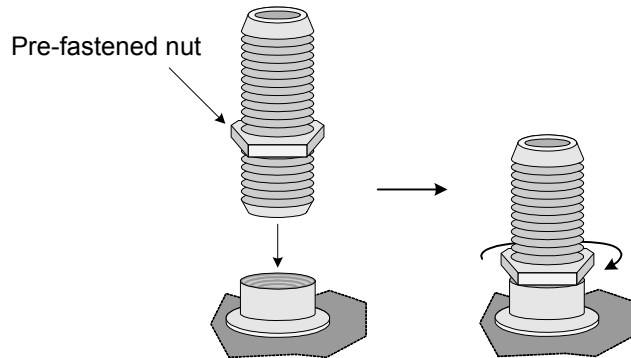


Figure 2-27 Attaching a coax port adapter

## 2.4.4 Which coaxial port to use

For all RF and single-ended MoCA testing, use the left port as viewed from the front of the unit (port **A**). The other port (**B**) is used as the second connection for MoCA inline testing only.

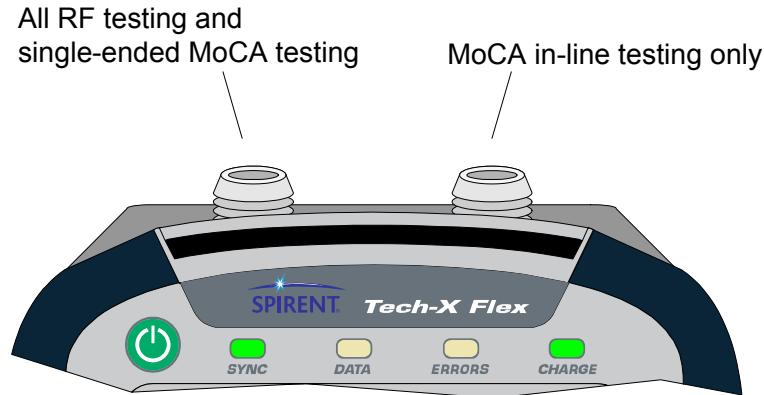


Figure 2-28 Coaxial port functions

## 2.4.5 SYNC LED behavior

The **SYNC** LED generally operates as follows, with respect to activities within the **MoCA** and **RF** menus:

- **MoCA** - Solid green when the unit is actively synchronized to a MoCA network, off otherwise.
- **RF** - Solid green when locked on a channel, red if a channel lock attempt failed, off otherwise.

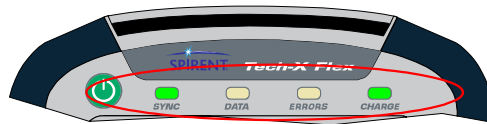


Figure 2-29 Unit LEDs, including the SYNC LED

## 2.4.6 Calibration requirements

No regular calibration is required. If your local protocol dictates calibration anyway, please contact Spirent for information on calibration options.

## 2.5 Remote control of the unit

With a VNC client on a PC or mobile device, you can operate the unit remotely over a network connection, instead of using the actual touchscreen and physical keypad.

## 2.5.1 About VNC

VNC (Virtual Network Computing) is a technology that allows the graphical interface of one computer (such as the display screen of the unit) to be rendered on another networked computer, where it can be operated as if it were the original. In the case of the Tech-X Flex, VNC control means that the screen can be displayed on a client PC or mobile device, where:

- On a PC, the unit accepts mouse clicks and keyboard entries on the VNC screen as if they were physical touches on the touchscreen and keypad entries, respectively.
- On a mobile device, the device touchscreen assumes identical functionality to the unit touchscreen, with respect to taps and other physical interactions.

In all cases, when the screen is manipulated on the PC or mobile device, the actual screen on the unit responds and changes as if it were being used directly.

Many users may find important uses for VNC remote control, such as:

- A technician who needs to physically connect the unit at some place, then work at other locations while running tests.
- A technician or manager at a remote location (perhaps a support center) who needs to see and/or operate a unit currently in use at a subscriber site.
- Any person who might need to render the interface on another computer for training, reporting, and/or screen capture activities.

In all cases, the PC or mobile device to be used for remote control must have a VNC client (viewer) application installed. For more information:

- On installing a VNC viewer, see [Installing a VNC client \(viewer\)](#) on page 2-34.
- On VNC as a general technology, visit [http://en.wikipedia.org/wiki/Virtual\\_Network\\_Computing](http://en.wikipedia.org/wiki/Virtual_Network_Computing).

## 2.5.2 Installing a VNC client (viewer)

From the factory, the unit firmware includes a display driver that is ready to serve the screen to a VNC client running on another computer. Therefore, the preliminary requirement to VNC control is the installation of that client. The following table provides some recommendations for clients tested by Spirent:

**Table 2-11 VNC client support/installation**

Platform	VNC client support/installation
<b>Windows operating system (PCs and mobile devices)</b>	VNC control has been tested with the following versions of RealVNC viewer: <ul style="list-style-type: none"><li>• <b>4.1.3</b> - See <a href="#">RealVNC 4.1.3 installation and setup</a> on page 2-35</li><li>• <b>5.0.5</b> - See <a href="#">RealVNC 5.0.5 installation and setup</a> on page 2-35</li></ul>



Platform	VNC client support/installation
<b>Android operating system (mobile devices)</b>	VNC control has been tested with the Mocha VNC Lite app, v2.1. The app is free and may be downloaded from the normal app store on the device. Follow the instructions provided during the download/installation.

Note that other hardware platforms, operating systems, and/or VNC clients may also allow proper remote control. However, is not feasible for Spirent to track and test all of them. If you would like to use a different client, etc., you should feel free to test it and implement the solution once you are comfortable with its reliability.

## RealVNC 4.1.3 installation and setup

RealVNC 4.1.3 can be downloaded from:

[http://www.filehippo.com/download\\_realvnc/changelog/4977](http://www.filehippo.com/download_realvnc/changelog/4977)

Once the EXE file is downloaded, run the file and follow the wizard prompts. Default installation settings are adequate to establish proper functionality; however, if you have expertise with the software, you may choose some customizations. For example, you could choose not to install the VNC server component, as the client component is the only necessary component.

Once installed, RealVNC has a variety of options related to VNC connections, accessible from the setup screen and from a VNC window. Normally, default settings are adequate, however the following settings may require attention:

- **Colour level (Colour & Encoding tab)** - If you notice problems with performance or other display functionality, consider trying a different setting such as **Low** or **Full**.
- **Pass special keys directly to server (Inputs tab)** - Normally, this setting should be unchecked for best results. If checked, you may have trouble with operations such as using a PC **PrtScn** key to capture a screenshot, because the keyboard input will be passed to the unit, not the PC.
- **Rate-limit mouse move events (Inputs tab)** - Normally, this setting should be checked for best results. This setting limits the amount of hover/movement-related events sent to the unit, which are less critical for proper operation. Without this setting, on fast networks the unit may receive more input than necessary, causing a processing backlog and thus delays in control.

## RealVNC 5.0.5 installation and setup

RealVNC 5.0.5 can be downloaded from:

<http://www.realvnc.com/download/viewer/>

Once installed, the **Advanced** options (accessible with the **Options** button) must be configured as follows:

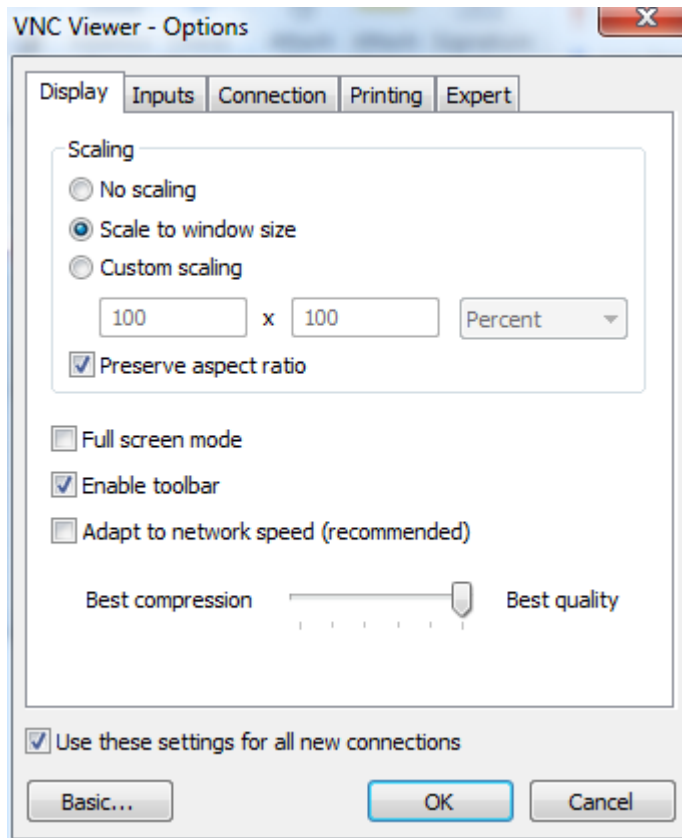


Figure 2-30 Advanced options - Display tab

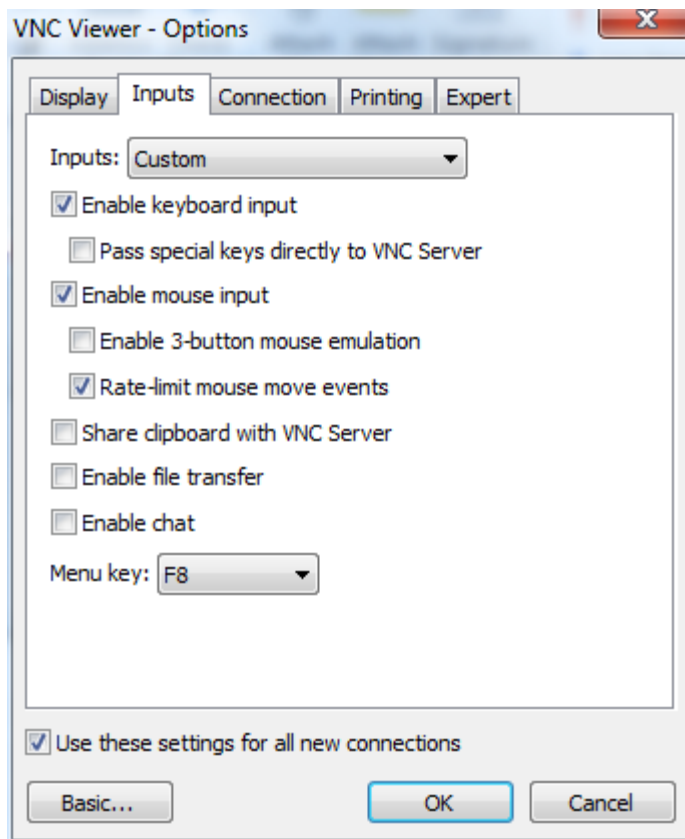


Figure 2-31 Advanced options - Inputs tab

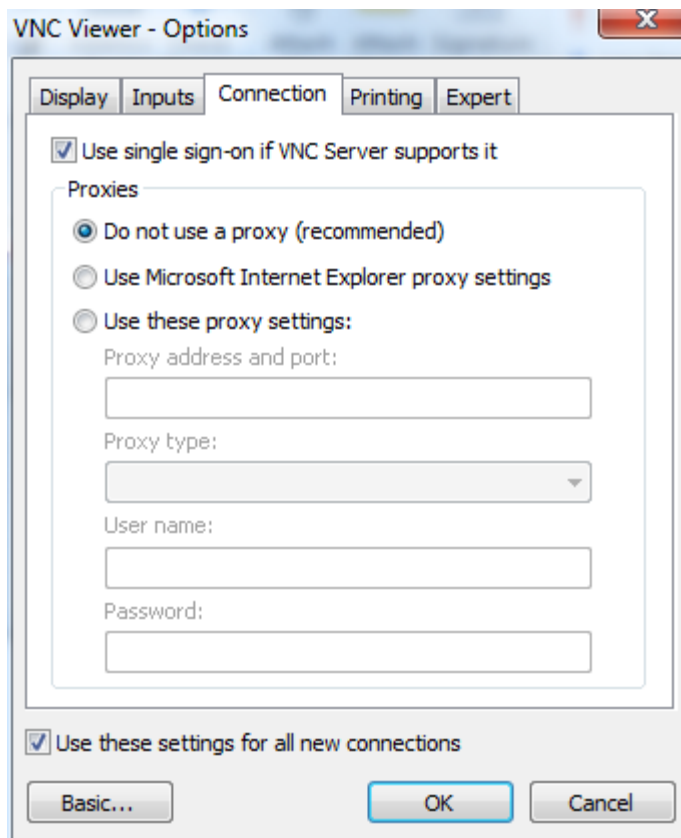


Figure 2-32 Advanced options - Connection tab

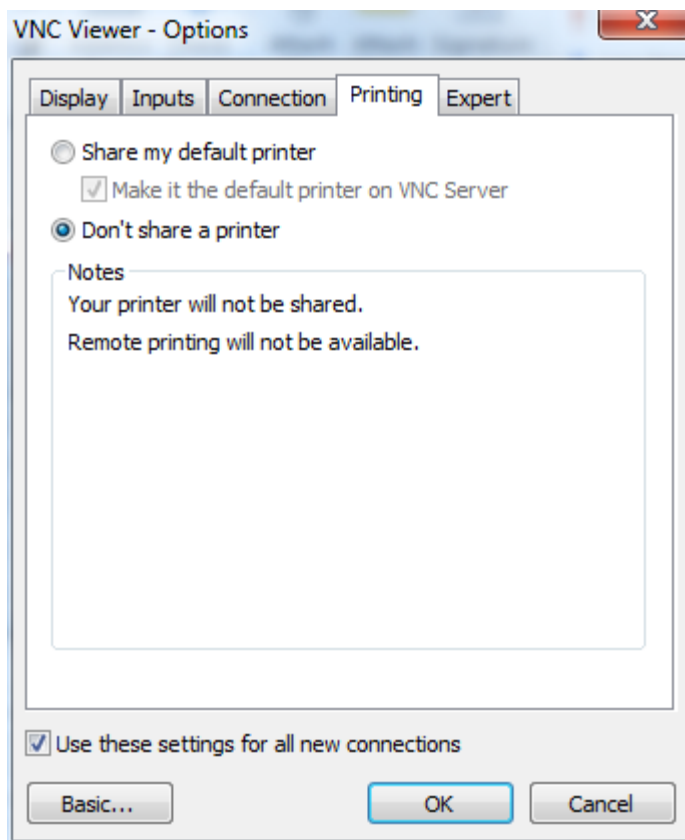


Figure 2-33 Advanced options - Printing tab

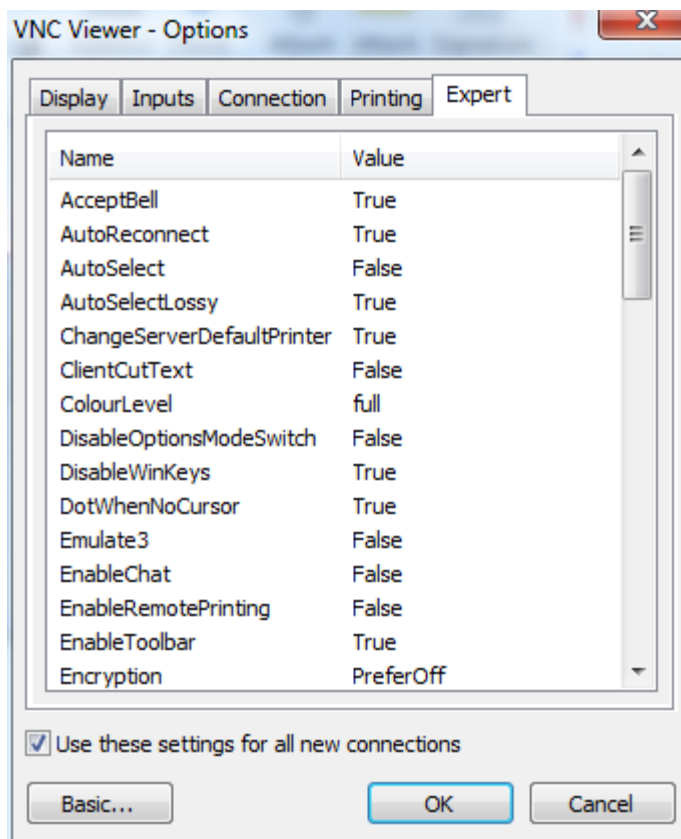


Figure 2-34 Advanced options - Expert tab (First set)

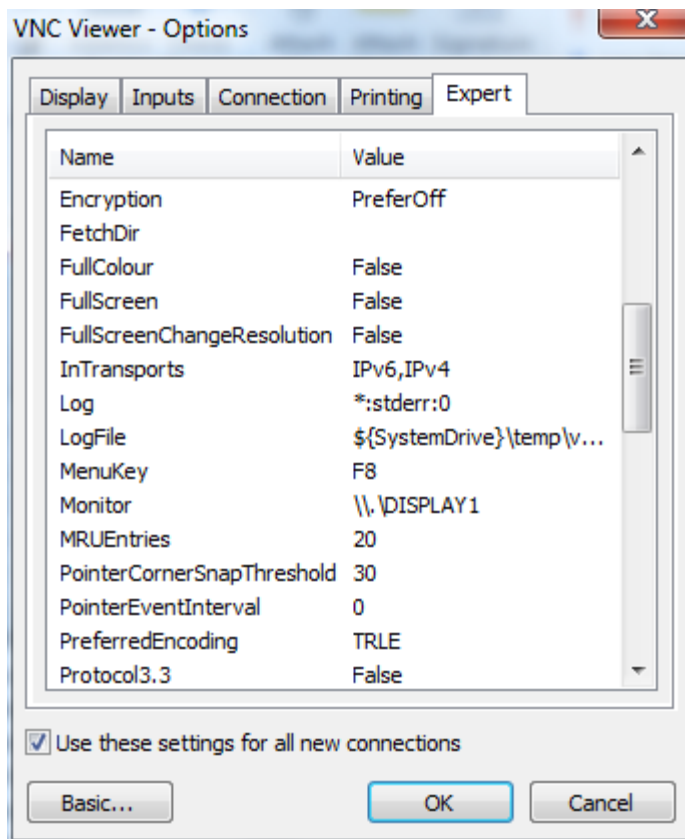


Figure 2-35 Advanced options - Expert tab (Second set)

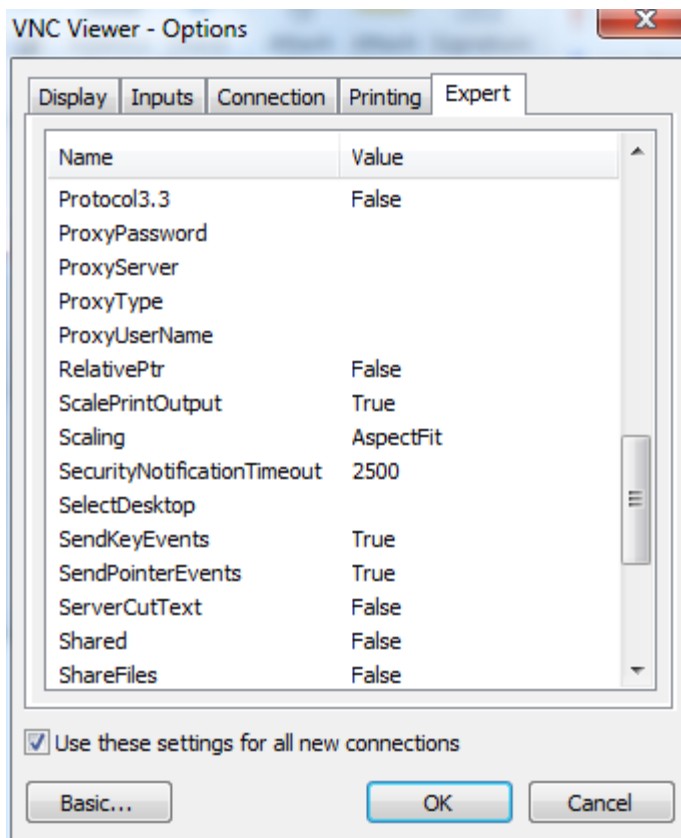


Figure 2-36 Advanced options - Expert tab (Third set)



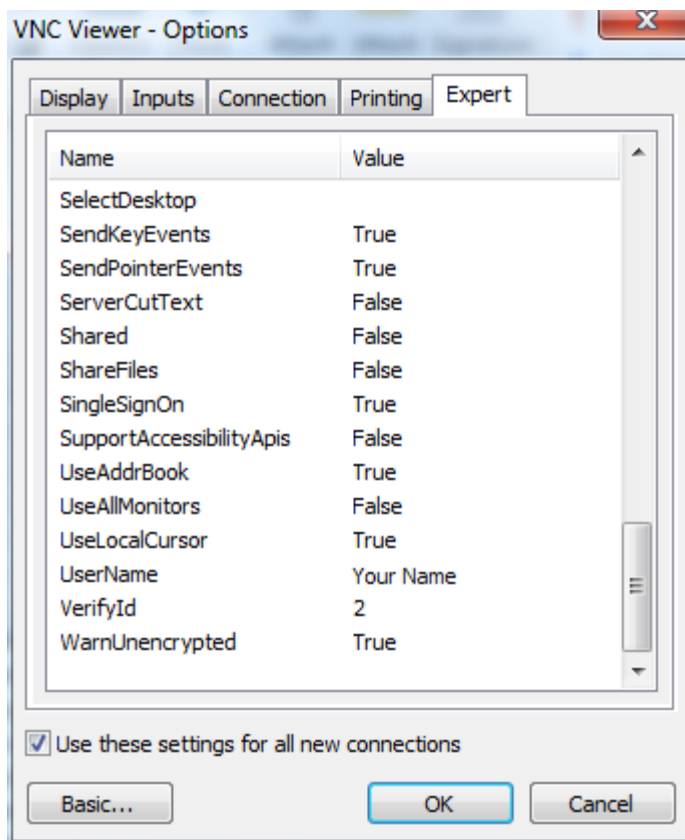


Figure 2-37 Advanced options - Expert tab (Fourth set)

## 2.5.3 Remote control setup scenarios

To establish a remote control session over VNC, an IP connection is required between the built-in VNC server on the unit and a VNC client on a separate PC, tablet, or smartphone device. This IP connection may be made using one of the following scenarios:

- [Local remote control \(via a router/LAN\) setup](#) on page 2-44
- [Local remote control \(via a Wi-Fi access point\) setup](#) on page 2-45
- [Remote site remote control \(via the internet\) setup](#) on page 2-46

## Local remote control (via a router/LAN) setup

This setup is intended to allow local remote control over a residential LAN or similar. For example, it might be used by a technician who needs to connect the unit at some point on a residential network, then control the unit from elsewhere in the residence.

With this setup, the unit connects to a switch or router device (such as a BHR) with either:

- A Wi-Fi link, or
- An Ethernet/Cat-5 cable

The VNC client device then connects to same network (often through the same router), typically over a standard Wi-Fi link. Once both devices are fully networked at the IP level, the VNC client application can initiate a remote control session. Consider the following diagram which represents a typical residential configuration with a BHR:

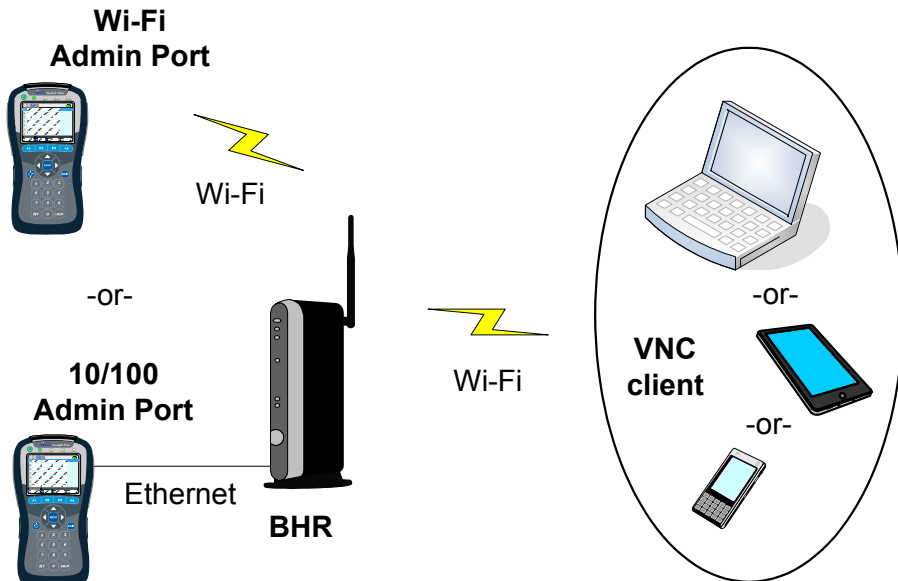


Figure 2-38 Remote control over an Admin Port connection

This type of remote control allows access to nearly all test and management functions on the unit, including module testing menus. To set it up:

1. If you plan to use a **10/100/1G Admin Port**, connect the unit to the router with a physical 10/100 (Ethernet) cable.
2. Set up a **Wi-Fi Admin Port** or a **10/100/1G Admin Port** on the unit, as applicable (see [Admin Port](#) on page 5-5).

**NOTE:** Remote control over a **Wi-Fi Admin Port** will not allow access to functions within the **Wi-Fi** menu (**F2**).

3. Note the IP address that was assigned and then initiate the VNC session on the client device (see [Initiating a VNC connection on the client](#) on page 2-49).

## Local remote control (via a Wi-Fi access point) setup

**NOTE:** This feature is available as a purchasable option. For more information, see [Licensed feature details](#) on page 2-53.

This setup allows local remote control over a direct wireless connection to the unit, where the unit sets up a small Wi-Fi network to which another device can connect. As an example, it might be used by a technician who needs to physically connect the unit at some point on a residential network, then control the unit from elsewhere in the residence. Because the devices connect directly, it may be more convenient than using the residential LAN to establish connectivity.

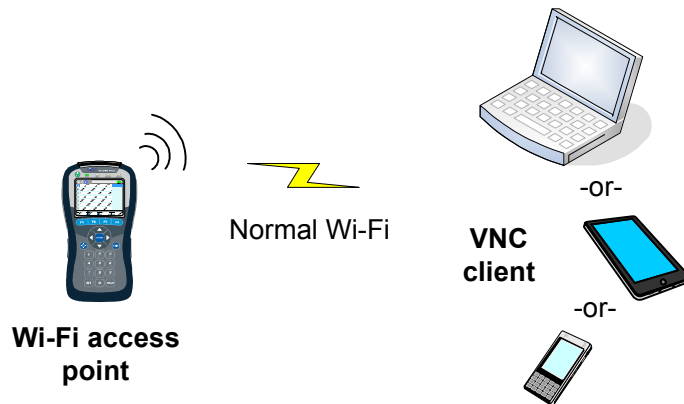
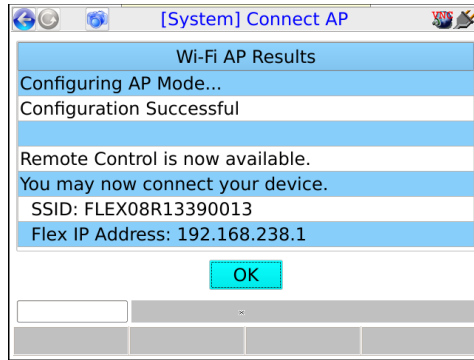


Figure 2-39 Remote control via a Wi-Fi access point

To establish the access point, select **System > Admin Port > Wi-Fi Admin Port > AP Remote Control**. The process launches immediately and the unit presents a results screen that includes its SSID and IP address:



**Figure 2-40 AP Remote Control results screen**

Afterwards, you can use any Wi-Fi enabled device to connect to the network using standard methods. The network is unsecured and requires no credentials, other than knowledge of the SSID. Once connected, use the IP address shown to initiate the VNC connection, 192.168.238.1 in this example. Note that a unit access point will only provide a single IP address, so only a single device may connect to its network at any given time.

## Remote site remote control (via the internet) setup

**NOTE:** This feature is available as a purchasable option. For more information, see [Licensed feature details](#) on page 2-53.

With this setup, the unit can be controlled over an internet connection, perhaps by a technician in a remote support center. It assumes that the unit is connected on a LAN behind a UPnP-enabled router, whose WAN side interface is configured with a public IP address. For example:

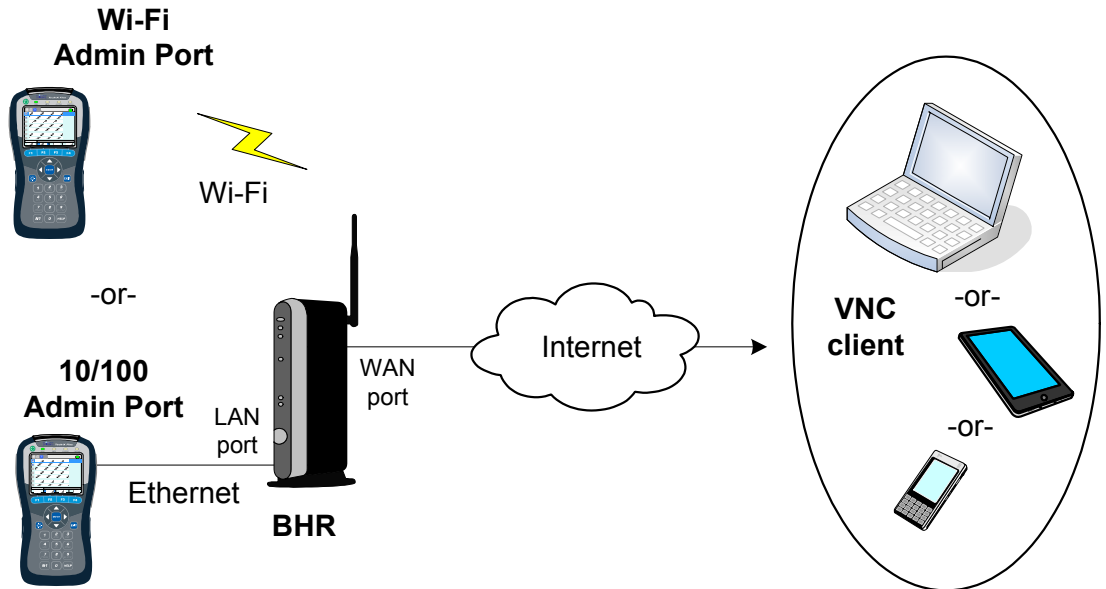
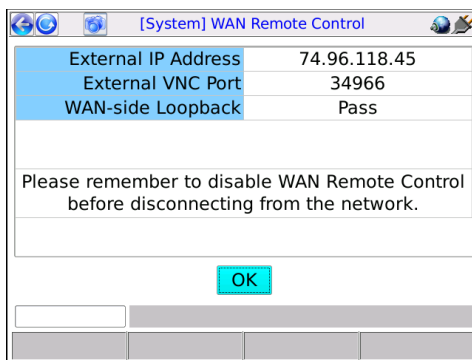


Figure 2-41 Remote control over an internet connection

This type of remote control allows access to nearly all test and management functions on the unit unless you connect the unit over a **Wi-Fi Admin Port**, in which case all functions within the **Wi-Fi** menu (**F2**) will be unavailable. To set it up:

1. At the subscriber site, if you plan to use a **10/100/1G Admin Port**, connect the unit to the router with a physical 10/100 (Ethernet) cable.
2. On the unit, set up a **Wi-Fi Admin Port** or a **10/100/1G Admin Port** port (respectively) with connectivity to the LAN, in a standard manner. For more information, see [Admin Port](#) on page 5-5.
3. Select **System > Admin Port > WAN Remote Control > Enable WAN Remote Control**. Note that this step configures the router, in order to establish a VNC traffic path to the unit.
4. In the **Enable WAN Remote Control** results, make note of the following information which will be required for the remote VNC client user:
  - **External IP Address** - The address assigned to the WAN interface
  - **External VNC Port** - The port that incoming VNC traffic must use



**Figure 2-42 Enable WAN Remote Control results screen**

Note the following:

- If this function fails, the router may not support UPnP management or it may have been configured in a manner that prevents the unit from performing the necessary tasks. Router administration is beyond the scope of this document. If you continue to have trouble, consult the router documentation and/or a network specialist.
  - In rare cases, this function will pass but report an address of 0.0.0.0. Again, certain router configurations may cause this behavior. If you already know or can determine a valid WAN side address, VNC control may still be possible.
  - Following the router configuration, the unit attempts a test connection with the WAN interface, using the newly-configured path. If the test is successful, it reports **Pass** for **WAN-side Loopback**, which generally indicates that the path from the interface to the unit is good. Otherwise, it reports **Fail**; however, note that hardware limitations and/or other anomalies may obstruct the test and that the path may still be good. In other words, a result of **Fail** does not necessarily indicate a problem and you should always attempt the VNC session anyway.
5. Forward the IP address and port to the remote VNC user, who must then launch a VNC session with those parameters (see [Initiating a VNC connection on the client](#) on page 2-49).
  6. When the VNC session is complete, select **System > Admin Port > WAN Remote Control > Disable WAN Remote Control** to restore the router to its original configuration.

### Additional technical details

This remote control functionality is based on port-forwarding technology that is typically supported by residential routers. In summary, a router can be configured to accept packets at its public WAN address using a specific port, then translate to a different port and forward the packets to a specific (non-public) host on the LAN. In this manner, standard firewalls can remain in place, with a path for very specific traffic to reach a specific LAN host.

In this case, the traffic is VNC and the host is the unit, whose VNC server expects traffic on port 5900. During the **Enable WAN Remote Control** step, the unit configures the router to accept traffic on some other port (as reported for **External VNC Port**) and forward the traffic to its LAN address on port 5900. In this way, the unit appears to the VNC client as any other host on the internet and full VNC functionality is supported. Note that this general methodology is commonly used by other devices such as internet-based gaming systems, where non-public hosts must communicate with one another across the internet. These systems automatically configure their respective routers much like the unit.

With respect to the persistence of the router configuration, note the following:

- If you never manually undo the router configuration (**Disable WAN Remote Control**), the forwarding path may remain indefinitely. This may or may not be of concern. While it represents a path through the firewall that did not exist previously, its scope is limited to traffic on port 5900 reaching the address that the unit was using during the VNC session. A network administrator should provide advice and procedures related to this possibility.
- The **Disable WAN Remote Control** setting is always enabled, in the event that it must be executed some time in the future, perhaps some time after the end of the VNC session.
- Port forwarding can be manually configured through the administrative interface of a router. If you use this interface to make changes to settings that were configured by the unit, the **Disable WAN Remote Control** function may fail afterwards. Therefore, it is strongly recommended to allow the unit to perform all router configuration tasks and to use the router interface only if absolutely necessary.

The unit uses UPnP (Universal Plug and Play) technology when configuring the router. UPnP has other applications as well. For more information, see <http://www.upnp.org/>.

## 2.5.4 Initiating a VNC connection on the client

To initiate a VNC connection and thus begin a remote control session, you must first:

1. Be sure that a functional VNC client is properly installed on the client device (see [Installing a VNC client \(viewer\)](#) on page 2-34).
2. Establish IP connectivity with the unit in a manner suitable for VNC control (see [Remote control setup scenarios](#) on page 2-43).

Once these steps are complete and you know the IP address assigned to the unit, you can initiate a VNC session as follows:

### Initiating a VNC session with RealVNC

1. In the initial setup screen that appears when you launch the viewer, enter the IP address of the unit and click **OK**.

**NOTE:** If you are connecting over the internet using the **WAN Remote Control** feature, you must include a colon and the port expected on the subscriber router WAN interface. Otherwise, the application will use the standard VNC port 5900, which will not transit the router. For more information on internet-based remote control, see [Remote site remote control \(via the internet\) setup](#) on page 2-46.

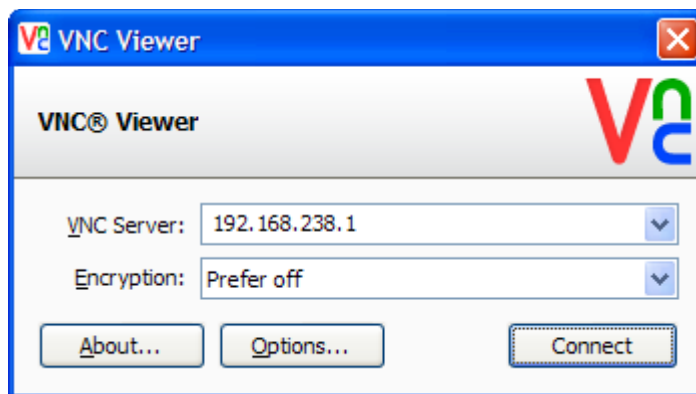


Figure 2-43 RealVNC v5.0.5 setup screen - Local remote control example



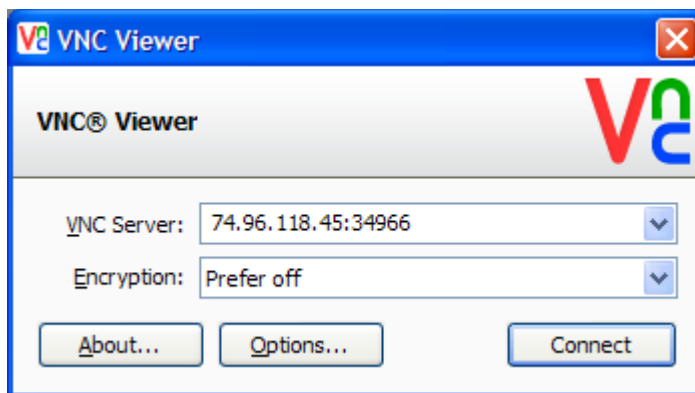


Figure 2-44 RealVNC v5.0.5 setup screen - Internet (remote site) remote control example

2. When the VNC window appears, operate the unit using the computer mouse, keyboard, etc. as if operating the unit directly.

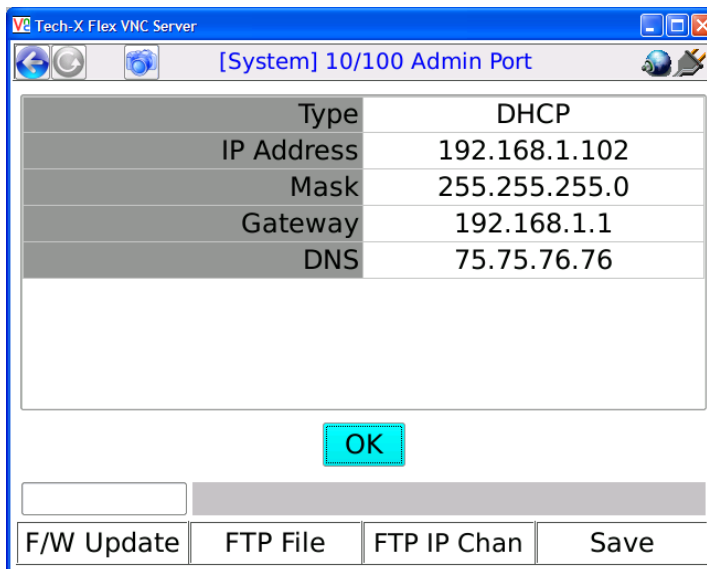


Figure 2-45 RealVNC window showing the unit screen

Initiating a VNC session with Mocha VNC Lite

1. On the mobile device, make sure that the Wi-Fi interface is enabled. Refer to the documentation of the specific device for more information.
2. Launch Mocha Lite.

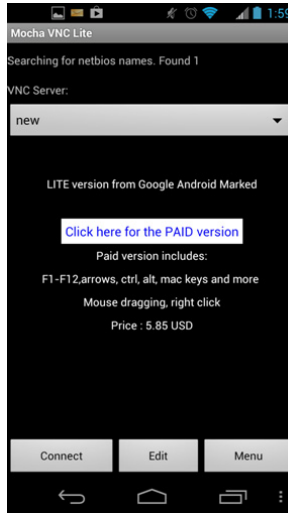


Figure 2-46 Mocha VNC Lite initial setup screen

3. Tap **Edit** in the initial setup screen.
  4. In the **Edit session** screen, configure the following:
    - **VNC Server IP** - Enter the IP address of the unit.
    - **Password** - Enter a pound sign (#) to indicate that no password is required.
    - **Port** - Specify the destination TCP port, typically either:
      - The default of **5900** when using local remote control over a LAN or an ad hoc Wi-Fi network, or
      - The port reported for **External VNC Port** in the **Enable WAN Remote Control** results, when controlling the unit over the internet (see [Remote site remote control \(via the internet\) setup](#) on page 2-46).
- ...and tap **Ok**.

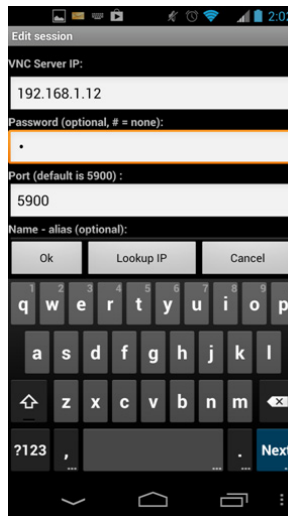


Figure 2-47 Mocha VNC Lite Edit session screen

5. When the VNC window appears, operate the unit using the mobile device touchscreen as if operating the unit directly.

**NOTE:** Remember that you can double-tap any text entry field to produce the unit keypad, just like when using the actual unit touchscreen.

## 2.6 Licensed feature details

The following table provides details on the optional licenses available for purchase and the specific features that they control. Any feature not explicitly listed is normally functional without a special license or license key. Note the following:

- In most cases, general module functionality does not require a separate license, as the purchase of the physical hardware is considered a general operational license. However, some specific features of certain modules may require a license.
- At any time, you can use the **System** menu to view the status of current licenses and enable features with new license keys. For more information, see [Licensed Options](#) on page 5-12.

**Table 2-12 License details**

License	Affected hardware component	Description
Constellation	MoCA/RF module	Enables the constellation graph for RF testing (see <a href="#">About QAM and the constellation graph</a> on page 8-18).
Dual Ethernet	Base unit	Enables passive testing on the 10/100/1G interface. More specifically, it allows the unit to be connected in-line with an existing Ethernet link and mirror traffic internally for analysis. Without this license, both 10/100/1G ports will operate normally for any other type of testing, including the ability to bridge an existing Ethernet link, but without traffic mirroring. For more information, see <a href="#">Passive testing</a> on page 4-4.
Dual MoCA	MoCA/RF module	Allows the MoCA module to synchronize “in-line” with a MoCA network; that is, act as a bridge for the purpose of analyzing network traffic and related testing. Without this option, the unit supports single-port synchronization in a single direction only and the <b>Join MoCA Network In-Line</b> menu item is disabled. For more information, see <a href="#">Join MoCA Network In-Line (Bridging and passive testing)</a> on page 7-19.
High Speed Data	All	Enables the use of the <b>All Devices Packet Loss</b> test on all applicable IP interfaces. For more information, see <a href="#">All Devices Packet Loss (Device Discovery)</a> on page 6-19.
IP Video	All	Enables IP video quality and channel change testing on all applicable interfaces. For more information, see <a href="#">IP Video testing</a> on page 6-22.
L4 Performance Testing	All	Enables iPerf-based TCP testing (see <a href="#">L4 Performance Test</a> on page 6-7).

License	Affected hardware component	Description
Remote Control	Base unit	<p>Enables the following commands:</p> <ul style="list-style-type: none"> <li>• <b>System &gt; Admin Port &gt; Wi-Fi Admin Port &gt; Ad-Hoc Remote Control</b></li> <li>• <b>System &gt; Admin Port &gt; WAN Remote Control</b></li> </ul> <p>For more information, see <a href="#">Remote control of the unit</a> on page 2-33.</p>
RF Testing	MoCA/RF module	Enables overall RF testing (see <a href="#">MoCA/RF - RF Testing</a> on page 8-1).
Web Browser	All	Enables the internet web browser on all applicable interfaces.
Wi-Fi	Base unit	Enables the <b>Wi-Fi</b> testing menu as well as the ability to establish a Wi-Fi <b>Admin Port</b> (see <a href="#">Admin Port</a> on page 5-5).
Wi-Fi Spectrum	Base unit	Enables the <b>Wi-Fi Spectrum Analysis</b> (see <a href="#">Wi-Fi Spectrum Analysis</a> on page 3-17).
Any other licenses listed in the <b>Licensed Options</b> screen	- - -	Related to beta, customer-specific, or in-development features and are normally not relevant to general users.

## 2.7 Maintenance

The only maintenance task that should be performed by users is battery replacement. For all other maintenance requirements, return the unit to Spirent. Do not remove the cover of the unit during battery replacement or at any other time. For more information on battery replacement, see [Battery installation/replacement](#) on page 2-55.

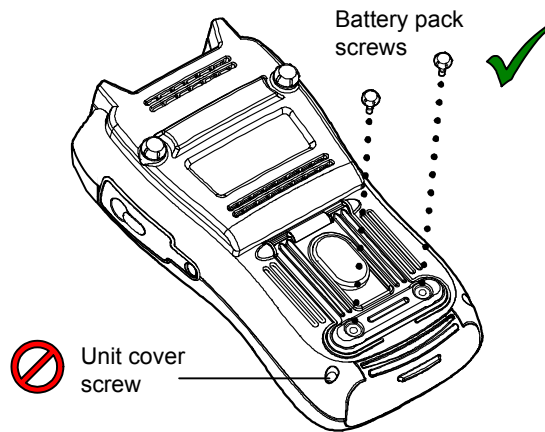
### 2.7.1 Battery installation/replacement

A new unit may require the battery to be installed before its first use. Additionally, users may perform field replacement of the battery pack as necessary. No tools are required. Note the following:

- New battery packs should be ordered from Spirent (MPL# T5411). **The use of any other battery could damage the unit and create a safety hazard for users.**
- Batteries contain hazardous contaminants and should be disposed of according to local regulations. It may be illegal to discard batteries in the general trash.

### To replace the battery pack

1. On the back of the unit, remove the two battery pack hand screws at the base of the kickstand. Be careful not to accidentally remove the unit cover screws which require a screwdriver (see [Figure 2-48](#)).



**Figure 2-48 Battery pack screws**

2. Gently slide the old battery pack out (with the cradle) from the bottom of the unit and insert the new battery pack. For new units, the battery chamber may have a placeholder instead which can be discarded once a battery is installed.

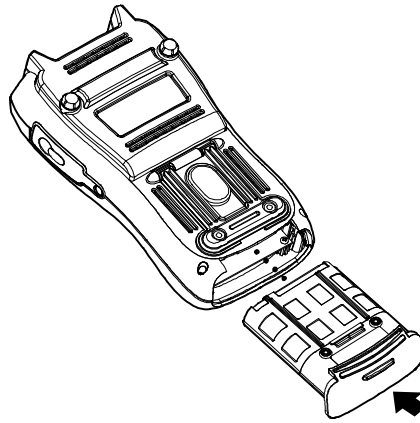


Figure 2-49 Inserting a battery pack

3. Following battery insertion, reinstall the hand screws.

**NOTE:** Do not overtighten the screws, which could cause the plastic to crack.

## 2.8 FTP information

The unit has several features that may involve transferring files to and/or from the unit. In most cases, this transfer is handled by an FTP operation, during which the unit acts as an FTP client, invoking functions on an external FTP server. Therefore, to complete an FTP exchange, you must have an FTP server installed, properly configured, and actively running on a computer that is networked to the unit.

This section describes general information associated with FTP server setup. Information about specific file transfer operations is provided elsewhere in this document as appropriate.

### 2.8.1 Admin Port setup

Before any FTP action is possible, you must have the **Admin Port** configured with routable IP information. This port is effectively the gateway to the “outside world.” For more information, see [Admin Port](#) on page 5-5.

## 2.8.2 FTP server installation and setup

Currently, the only extensively tested and approved FTP server is FileZilla, a free, open-source application available at <http://filezilla-project.org/> at the time of this writing. The FileZilla server runs on the Windows platform only and may run on any Windows computer. Typically, a networked desktop PC is the best choice to host the server.

The primary tasks involved with server setup are generally performed one time and include:

- Installation of the server software
- The configuration of one or more user accounts for the server, which the unit will use to log in and transfer files.

To set up FileZilla on a host computer:

1. Download the FileZilla server installation package (not the client).
2. Launch the package and install according to default settings, unless customization is desired. In the installation wizard, note that the **Port** option applies to the server management port, not the FTP listening port. In most cases, the default of 14147 is adequate.
3. Open the server management interface, normally with a new icon on the desktop or perhaps **Start > FileZilla Server > FileZilla Server Interface**. If you are running the server on a local computer, the default **Server Address** and **Port** should be correct. For new installs, you can leave the password blank.
4. In the interface window, select **Edit > Users**.
5. In the **Users** window, click **Add** to add a new FTP user account, which the unit will use to transfer files to and/or from the computer.
6. In the **Add user account** window, specify a user name (such as `techFLEX_ALL`) and click **OK**. This user name will be a required entry when the file transfer is initiated on the unit. It is good practice to set up separate user accounts for each transfer activity required by the unit, such as channel guide import versus results export.
7. Back in the **Users** window, under **Page**, click the **General** page link and create a password if desired. **Important!** The password is optional. If you create one, it will be required when a file transfer is initiated on the unit.
8. In the **Users** window, under **Page**, click the **Shared folders** page link, then under **Shared folders** click **Add** to specify a home folder for the user account. When an FTP connection is established for this account, this is the default folder from which files are transferred.

**NOTE:** Some unit FTP activities involve the transfer of data from the unit to the FTP server, in which case you should be sure to click the **Write** checkbox under **Files**, for the shared folder you added. By default, new user accounts have writing disabled, which will cause any export function from the unit to fail.



At this point, the user account should be complete. The dialog box should appear something like the following:

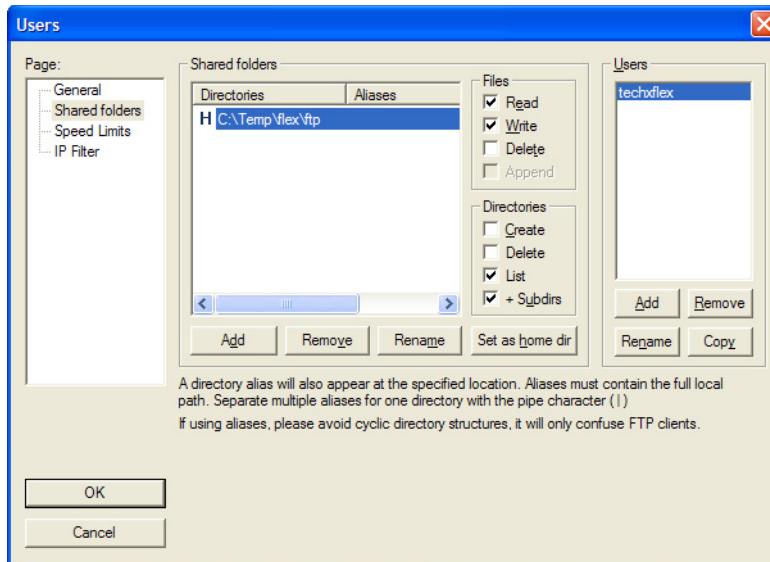


Figure 2-50 Completed user account in FileZilla

9. In the **Users** window, click **OK** to save the new user.
10. Back in the management interface, if necessary select **Server > Active** to ensure that the server is actively listening for FTP requests.

**NOTE:** FileZilla includes a variety of configuration options, including whether to automatically launch and enable the server upon Windows startup. Further information is beyond the scope of this document. See the FileZilla documentation for more information.

## 2.8.3 FTP connection parameters

When an FTP-related operation is invoked, the unit requires standard connection parameters to reach the FTP server and perform the file transfer. These parameters may include:

<b>Server</b>	IP address or domain name of the computer where the FTP server is running. This computer will be the source for any files transferred to the unit and/or the destination for any files transferred from it. The specific folder on the computer is generally determined by the user account configured as described under <a href="#">FTP server installation and setup</a> on page 2-58 and specified below ( <b>User ID</b> ).
<b>Port</b>	TCP port used by the FTP server, typically <b>21</b> (standard FTP port). The server port can be changed in the server management application - see the server documentation for more information.
<b>User ID Password</b>	FTP authentication information, valid for a user account currently configured on the FTP server. This account will be associated with a folder on the server computer where files will be transferred to or from. For more information, see <a href="#">FTP server installation and setup</a> on page 2-58.
<b>Server Folder</b>	Subfolder where files should be transferred to or from, relative to the user folder configured as described under <a href="#">FTP server installation and setup</a> on page 2-58. This parameter is only applicable to some unit functions and may be optional. If it remains unspecified or does not appear at all, all files will be transferred to or from the “home directory” associated with the FTP user account ( <b>User ID</b> ).
<b>Ping Before Transfer</b>	Runs a ping test to the server computer before the FTP attempt. If all ping attempts fail, the FTP attempt is aborted. Not all FTP-related operations support this parameter.
<b>Admin port information</b>	<p>FTP transaction screens also normally include information about the <b>Admin Port</b>, which is the interface through which the FTP transaction will occur. If the FTP action is a “download” action where a file is transferred to the unit, this information is normally found in a <b>Destination</b> tab. Otherwise, it is found in a <b>Source</b> tab. In either case, the screen provides:</p> <ul style="list-style-type: none"><li>• IP information about the currently-established <b>Admin Port</b>, if there is one. -and-</li><li>• Buttons to set up an <b>Admin Port</b> which transport you to the standard <b>Admin Port</b> setup screen, after which you will be returned to the applicable FTP screen.</li></ul> <p>In all cases, you must have an <b>Admin Port</b> configured to complete the FTP transaction, whether you have configured it beforehand or through the shortcuts in the FTP area.</p>

## 2.8.4 FTP connection troubleshooting

Following an FTP attempt, the unit will report whether the action was successful. If the attempt fails, ensure that:

- You are using an approved FTP server and that it is configured correctly.
- You have specified the FTP input parameters exactly right. A single character mistake in any of them will cause a connection failure.
- The FTP server computer and the unit have IP-level connectivity. Either device should be able to ping the other.
- The traffic between the unit and the FTP server is not blocked by a firewall. In particular, if the FTP server is on a Windows computer, it is not uncommon for the default settings of an active Windows Firewall to prevent the transfer. When a firewall blocks FTP activity, the server administration interface will show zero activity while the unit is attempting the transfer, because there is ultimately no connection between the two entities.

Firewall configuration is beyond the scope of this document. For more information, see the Windows Firewall documentation, the FTP server documentation, and/or contact an IT administrator.

## 2.9 Technical support

If you need product assistance or want to report problems with the product or the documentation, please contact us.

**E-mail:** [support@spirent.com](mailto:support@spirent.com)

**Phone:**

<b>North America</b>	1-800-SPIRENT
<b>China</b>	+86 (10) 8233 0033
<b>China mainland only</b>	+86 (800) 810-9529
<b>France</b>	+33 (1) 6137 2270
<b>UK (EMEA TAC)</b>	+44 1803 546333

# Preliminary issue - Limited distribution only!

Tech-X Flex User Guide - Firmware v06.50

Tech-X Flex® (NG2)

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Overview

## 3: Wi-Fi Testing Menu

Wi-Fi testing on the unit includes:

- Scanning for available wireless access points
- Connecting to an existing network and obtaining IP information
- Basic network-level testing such as ping, traceroute, and web browsing

All Wi-Fi testing is performed from the **Wi-Fi** menu. When this menu is active, all testing uses the Wi-Fi interface only. That is, no other interface will process test requests.

**NOTE:** You must have a Wi-Fi connection established before any other Wi-Fi functions become available. Furthermore, when you leave the **Wi-Fi** menu, the Wi-Fi interface is shut down and the existing connection, if any, is dropped unless you have the unit configured to keep the interface active.

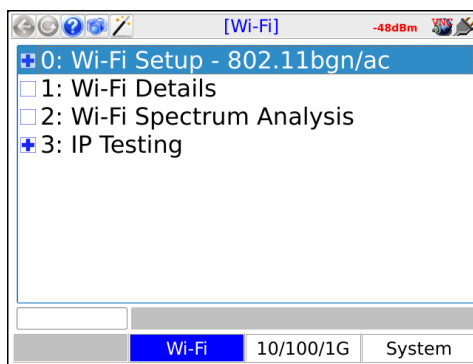


Figure 3-1 Wi-Fi main menu (T5300 units)

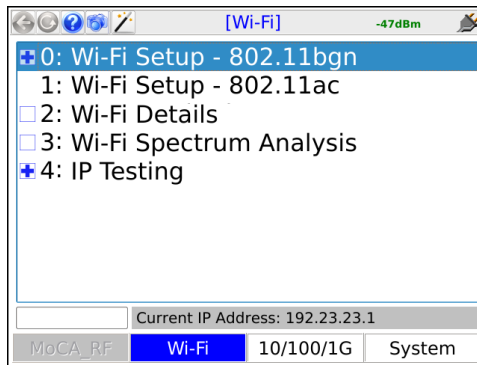


Figure 3-2 Wi-Fi main menu (T5100) units

## 3.1 Important wireless 802.11ac note (T5100 models only)

For T5100 models only, when the unit is actively transmitting in 802.11ac mode, the unit should be placed on a horizontal surface with a minimum distance of 20 cm from any part of a human body. Note that this restriction only applies when the unit is actively connected to a network, not while scanning for networks. Other modes (for example, 2.4 GHz 802.11b/g/n) do not involve any such restrictions.

## 3.2 Functionality note

Wi-Fi connection and testing is a purchasable option. Please contact Spirent for more information.

## 3.3 Wi-Fi overview

The following sections describe general information about the unit and Wi-Fi.

### 3.3.1 Wi-Fi support details

The unit supports:

- Connection to IEEE 802.11 standards including b, g, n, and ac.
- Open and secured networks, including:

- Wired Equivalent Privacy (WEP) authentication, both WEP-64 (40-bit key) and WEP-128 (104-bit key)
- Wi-Fi Protected Access (WPA and WPA2) authentication, using pre-shared key (PSK) mode

**NOTE:** The unit cannot connect to a network that does not broadcast its SSID. A network such as this may appear within **Scan** results; however, the controls related to connection will be disabled.

By emulating a wireless PC in the home, you can perform troubleshooting activities such as:

- Verifying ISP availability and therefore ruling out the provider network as the cause of internet connectivity problems. If the unit can access the internet but a subscriber PC cannot, it is likely that the problem resides in the PC and/or its wireless interface.
- Determine whether Wi-Fi “dead zones” exist at the premises and whether they are affecting network performance. In some cases, wireless network troubles may be caused by equipment that is simply out-of-range of the source.

Detailed technical information about Wi-Fi and 802.11 is beyond the scope of this document. If you are having trouble connecting, see [If you cannot connect \(troubleshooting tips\)](#) on page 3-4.

## 3.3.2 Wi-Fi testing diagram

The following diagram shows a typical setup for Wi-Fi testing.

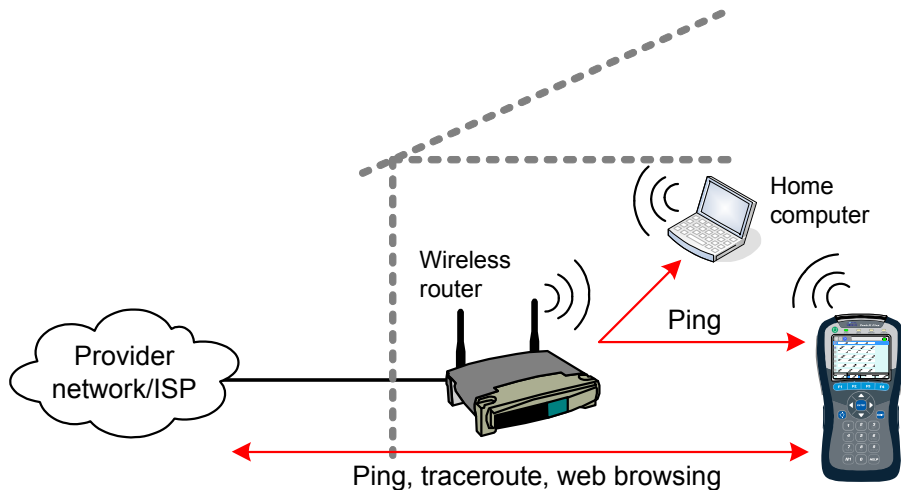


Figure 3-3 Typical Wi-Fi testing diagram

### 3.3.3 If you cannot connect (troubleshooting tips)

If you are in range of a wireless access point but cannot connect, verify the following:

- If entering all information manually, you have properly identified the network. Because this is an error-prone process, it is recommended that you use the auto-scan feature to find the network and prepopulate many of the parameters (see [Wi-Fi Setup > Scan](#) on page 3-5.)
- The network *is not* an “ad hoc” network, which the unit does not support within the normal **Wi-Fi** menu tools.
- You have identified the proper security protocol in use and have the necessary information for connection. If the network uses WEP or WPA-PSK, you must have the required authentication information. If it uses a different protocol that the unit does not support, such as WPA-EAP or MAC address restrictions, you will not be able to connect.

### 3.3.4 About WPS support

The unit supports several Wi-Fi Protected Setup (WPS) options for connection. To enable WPS, select **Security Type=WPA-WPS** in the connection setup screen, then one of the following for **Key Type**:

- **PUSHBUTTON** - This option prepares the unit for normal WPS “pushbutton” mode. When the connection parameters are submitted, the unit will first prompt you to press the WPS button on the wireless gateway/router. Once the button is pushed, you should dismiss the prompt and allow the connection to proceed. Be sure to complete the process before the gateway/router times out and denies access to the unit.
- **PIN** - This option assumes that a WPS PIN is pre-configured on the gateway/router, using its administrative tools. You must know what the PIN is. To connect, enter the PIN in the **Key** field and submit the connection request. If the PIN is specified correctly, the gateway/router should allow the connection. See the gateway/router documentation for more information on configuring WPS PINs.
- **GENERATE PIN** - This option is similar to the **PIN** option, except that it assumes that no PIN is currently configured on the gateway/router for the device. When you submit the connection parameters, the unit will present a prompt with the PIN to use, which must then be entered into the gateway/router WPS configuration. Once configured, you should dismiss the prompt on the unit and allow the connection to proceed. Again, see the gateway/router documentation for more information on configuring WPS PINs.

Upon a successful WPS connection, the unit attempts to store the underlying WPA authentication information for the link. Afterwards, the unit can rejoin the network without the WPS step. This feature is the most useful for pushbutton mode, allowing you to bypass the button push for all subsequent attempts to join the network.

Note the following:



- For any WPS option to function, the gateway/router must support it. If not, the option is not applicable to the current network.
- WPS options are available for all supported Wi-Fi protocols.
- For more information on WPS, visit [http://en.wikipedia.org/wiki/Wi-Fi\\_Protected\\_Setup](http://en.wikipedia.org/wiki/Wi-Fi_Protected_Setup). Otherwise, further information on WPS is beyond the scope of this document.

## 3.4 Wi-Fi Setup

The **Wi-Fi Setup** menus contain all the functions associated with finding and connecting to Wi-Fi networks, including:

- [Wi-Fi Setup > Scan](#) on page 3-5
- [Wi-Fi Setup > Connect](#) on page 3-7

These functions operate generally identically for all wireless protocols.

### 3.4.1 Wi-Fi Setup > Scan

This function scans for all wireless networks within range of the unit and lists them on the display. Once the list is produced, you can select the desired network and use the **Tests (F1) > Connect** shortcut to connect. This method of connecting to a wireless network is preferred because:

- You can ensure that you are connecting to the correct network on the correct channel. In densely-populated areas, it is not unusual for multiple wireless networks to be available within any given residence, including networks with the same SSID (name).
- When the connection action is initiated, the unit prepopulates many of the parameters which would otherwise need to be entered manually with potential for error.
- Even if the network is familiar and/or you know all the parameters, the **Scan** function will verify that it is actually available.

Once you successfully connect to the network through the **Scan** function, it is added to the history of networks where it is available for the manual connection process (see [Wi-Fi Setup > Connect](#) on page 3-7).

### Setup - Scan (Wi-Fi Setup)

The Wi-Fi **Scan** requires no setup parameters. The process launches immediately following the menu selection.

## Results - Scan (Wi-Fi Setup)

The scan lists all networks within range of the unit, displaying the SSID (name), an icon that denotes whether the network is secure (WEP, etc.), and other relevant parameters. The scan reruns periodically and updates the table. For more information on the fields in the table, see the descriptions under [Wi-Fi Details](#) on page 3-11.

SSID	Sig. Str.	SNR	CH#	Freq Band	802.11 Type
🔒 FIOS-H2EXF	-41	54	149	5GHz	n,ac
🔒 FIOS-H2EXF	-41	34	1	2.4GHz	b,g,n
🔒 ARRIS-EB22	-41	54	6	2.4GHz	b,g,n
🔒 QA_TEST_NET...	-49	46	165	5GHz	n
🔒 3YRL7	-49	46	6	2.4GHz	b,g,n
🔒 hdserver-5G	-53	42	153	5GHz	n,ac
🔒 red	-53	16	1	2.4GHz	b,g,n
🔒 green	-53	16	1	2.4GHz	b,g,n

Scanning Available Network...

Tests View Pause Save

**Figure 3-4 Wi-Fi Scan results**

Note the following:

- As an option, results may be filtered by geographic region. If you do not see an expected SSID, it may be due to an applied filter. For more information, see [System/Module Settings > Base Unit](#) on page 5-16.
- A network that does not broadcast its SSID will still be listed, but the **SSID** value will be blank and the unit will not allow connection to it.

Results screen shortcuts:

- **Tests (F1)** - Via a submenu, launches one of:
  - [Wi-Fi Setup > Connect](#) on page 3-7
  - [Wi-Fi Analyzer](#) on page 3-10
- **SSID Info (F2)** - Produces a summary of parameters for the selected network (see [Wi-Fi Details](#) on page 3-11).
- **Pause/Resume (F3)** - Stops and starts the continuous scan
- **Save (F4)** - Saves the **Scan** results (see [Record Manager](#) on page 5-1)

## 3.4.2 Wi-Fi Setup > Connect

The **Connect** function attempts a connection with a wireless network according to the specified parameters. If you used the **Wi-Fi Setup > Scan** function results to launch the **Connect**, many of the parameters are automatically populated. For this reason, the **Scan** function is generally recommended as a prerequisite.

Once the unit successfully connects, the network parameters are saved in memory under the respective SSID (name). If you have trouble connecting, see [If you cannot connect \(troubleshooting tips\)](#) on page 3-4.

### Setup - Connect (Wi-Fi Setup)

**Table 3-1 Connect (Wi-Fi Setup) - Setup parameters page 1**

Parameter	Description
<b>SSID</b>	(Service Set Identifier) Network name.
<b>Channel Number</b>	Network channel, managed automatically by the unit. If the connect request was initiated from the <b>Scan</b> results screen, it will be populated with the same value from that screen. Otherwise, it is populated as <b>Auto</b> . In all cases, no user input is required. <b>NOTE:</b> Reported channel numbers may deviate from expected values due to the various methods by which channels are identified. Wi-Fi standards have concepts of “primary” and “center” channels that represent different frequencies within the full channel bandwidth. According to their interpretation of the respective standard, different Wi-Fi devices may interpret channel numbers differently. A difference between a channel number configured on another Wi-Fi node and the number reported by the unit will not affect the ability to connect.
<b>Network Type</b>	Type of network: <b>INFRASTRUCTURE</b> - A centralized network where the unit will negotiate with a single access point that manages the network overall. <b>NOTE:</b> Connection to “ad hoc” Wi-Fi networks is currently not supported.

Parameter	Description
<b>Security Type</b>	<p>Type of security in use on the network:</p> <ul style="list-style-type: none"> <li>• <b>WEP-64</b> - Wired Equivalent Privacy using a 40-bit key</li> <li>• <b>WEP-128</b> - Wired Equivalent Privacy using a 104-bit key</li> <li>• <b>WPA-PSK</b> or <b>WPA2-PSK</b> - Wi-Fi Protected Access (WPA or WPA2), pre-shared key mode</li> <li>• <b>WPA-WPS</b> - Enables the WPS options. The specific WPS option to use should be specified for <b>Key Type</b>. For more information on WPS, see <a href="#">About WPS support</a> on page 3-4.</li> <li>• <b>NONE</b> - No security (open access)</li> </ul>

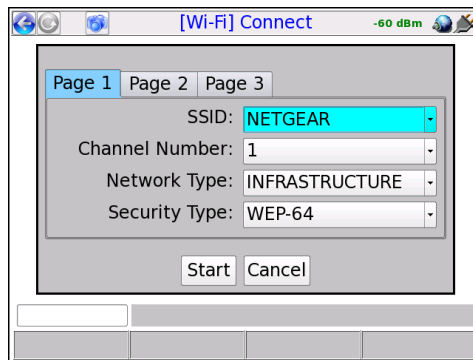
**Table 3-2 Connect (Wi-Fi Setup) - Setup parameters page 2**

Parameter	Description
<b>Key Type and Key</b>	<p>Type of key and the key itself, as follows:</p> <ul style="list-style-type: none"> <li>• If <b>Security Type=WPA-WPS</b>, see <a href="#">About WPS support</a> on page 3-4 for a description of options for these fields.</li> <li>• If <b>Key Type=HEX</b>, the <b>Key</b> must be a hexadecimal number. A hex digit occupies four bits, so for WEP-64, a hex <b>Key</b> must be 10 digits (40 bits total). For WEP-128, a hex <b>Key</b> must be 26 digits (104 bits total). For WPA-PSK, the <b>Key</b> must be 64 digits (256 bits total).</li> <li>• If <b>Key Type=PASSPHRASE</b>, the key must be the appropriate string that can be converted to the correct key using the respective algorithms. For WEP-64, a passphrase <b>Key</b> must be 5 characters/digits. For WEP-128, a passphrase <b>Key</b> must be 13 characters/digits. For WPA-PSK, a passphrase <b>Key</b> must be 8 to 63 characters.</li> </ul> <p>Also, note that after a successful WPS connection, the unit attempts to store the underlying WPA authentication for future connection attempts. When successful, the <b>Key</b> field will show <b>WPS Acquired Key</b>. For more information, see <a href="#">About WPS support</a> on page 3-4.</p>

Parameter	Description
<b>WEP Authentication</b>	<p>For WEP only, Type of initial authentication used by the wireless access point:</p> <ul style="list-style-type: none"><li>• <b>OPEN</b> - Effectively no authentication to associate and connect; however, all communications following the connection will be WEP-encrypted and therefore the unit must still have the correct key specified.</li><li>• <b>SHARED</b> - Requires matching keys to establish the initial connection, which involves a more detailed handshake transaction between the devices. Afterwards, all communications are WEP-encrypted similar to open authentication.</li></ul> <p><b>NOTE:</b> This setting does not affect how you specify the <b>Key Type</b> and <b>Key</b>. It controls how the unit attempts initial negotiations only. Both <b>OPEN</b> and <b>SHARED</b> WEP require a valid key.</p>
<b>WEP Key Slot</b>	For WEP only, the slot associated with the specified <b>Key</b> .

**Table 3-3 Connect (Wi-Fi Setup) - Setup parameters page 3**

Parameter	Description
<b>DHCP After Connect</b>	Causes the unit to attempt a DHCP-based IP network setup if the connection is successful. Otherwise, IP network setup will be a separate task following the connection (see <a href="#">IP Testing &gt; IP Network Setup</a> on page 3-18).

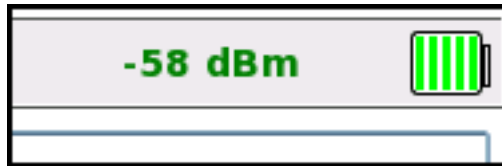


**Figure 3-5 Wi-Fi Connect parameters (Page 1)**

## Results - Connect (Wi-Fi Setup)

The unit reports whether the connection was successful or not. If the connection is successful, the **SYNC** LED lights as solid green. If the connection failed and you don't know why, see [If you cannot connect \(troubleshooting tips\)](#) on page 3-4.

While a connection is active, the unit maintains the current signal strength level in the upper right corner:



Additionally, upon a successful connection, the unit proceeds to the **Details** screen (see [Wi-Fi Details](#) on page 3-11).

**NOTE:** After connection, you must obtain an IP address if you want to do any IP-based testing, if you did not request an automatic DHCP request in the connection setup. For more information, see [IP Network Setup](#) on page 6-1.

### 3.4.3 Wi-Fi Analyzer

The analyzer produces a graphical display of the Wi-Fi channel spectrums within range of the unit. It can be launched from:

- The Wi-Fi **Scan** results (see [Results - Scan \(Wi-Fi Setup\)](#) on page 3-6). When launched from this screen, the analyzer draws a vertical line through the center frequency of the selected channel.
- The Wi-Fi **Details** screen, following a successful connection (see [Wi-Fi Details](#) on page 3-11). When launched from this screen, the analyzer draws a vertical line through the center frequency of the connected channel.

The analyzer plots each detected device/SSID within range as a parabolic line, where the height of a plot indicates the RSSI power level and the width represents the general span of channel usage. The peak of a plot should generally align with the channel number displayed within other screens; however, variations may occur depending on bandwidth usage.

The overall frequency range can be set with the **Band** menu (**F1**). Additionally, if the Wi-Fi spectrum feature is licensed, the screen also allows you to set the following with the **View** menu (**F2**):

- **Spectrum** - Toggles a basic overlay of a spectrum power level graph, which updates in real time similar to the full spectrum display (see [Wi-Fi Spectrum Analysis](#) on page 3-17).
- **Peak Hold** - Toggles an additional peak amplitude graph (see [Wi-Fi Spectrum Analysis](#) on page 3-17).

The following figure shows a sample 2.4 GHz (wireless B and G) analysis:

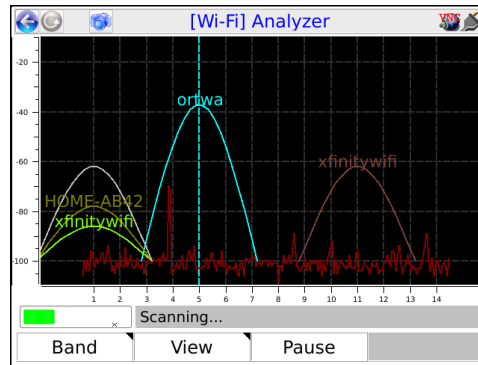


Figure 3-6 Sample Wi-Fi analyzer screen - 2.4 GHz spectrum

Due to the extent of the 5 GHz spectrum (wireless N and AC), the full graph for this spectrum is spread over three tabs.

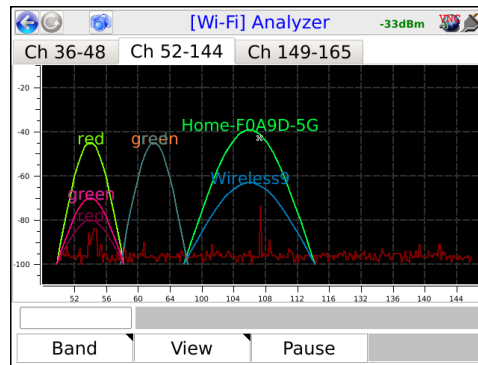


Figure 3-7 Sample Wi-Fi analyzer screen - 5 GHz spectrum

## 3.5 Wi-Fi Details

The **Details** function differs according to the area from which it was launched, as follows:

**When launched from the Wi-Fi Scan results (Wireless B, G, or N only)**, the screen shows a basic table of network parameters, limited to the information available without a connection. See [Table 3-4](#) on page 3-14 for a description of these parameters.

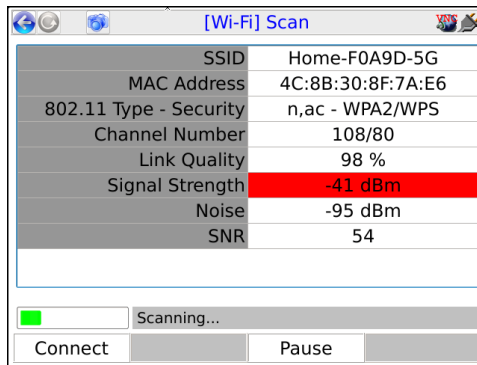


Figure 3-8 Wi-Fi Details screen - Wireless AC connection

When launched from the Details command following a successful Wi-Fi Admin Port connection, the screen shows similar information in a more graphical format. The screen also includes some additional information that is only available following the connection. See Table 3-4 on page 3-14 for a description of these parameters.

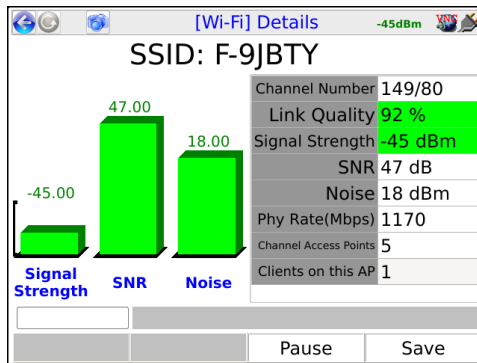


Figure 3-9 Wi-Fi Details screen - Wireless AC connection

When launched from the Details command following any other successful connection, the screen shows the most comprehensive information available, in a mostly graphical format. This information includes:



- Bar graphs for the **Phy rate**, **RSSI**, **Noise**, and **SNR** (see [Table 3-4](#) on page 3-14). The **Phy rate** measurement requires the interface to be configured with IP information.
- A **Channel** bar graph composed of segments for each detected network/SSID using the current channel, with the currently-connected SSID segment at the bottom. The total number of SSID segments in the graph is displayed underneath. The unit attempts to size each segment proportional to the measured signal strength. Because the graph may represent a compilation of signals, the overall height of the graph has no functional meaning.

Also, the channel number displays above the graph. For channels in the 5 GHz range, the number may include a second value; for example, **36/80**. The meaning of the second value varies according to the carrier bandwidth, as follows:

- For an 80 MHz channel, the value is **80**; for example, **36/80**.
- For a 40 MHz channel, the value is **u** or **i**, depending on whether the carrier is in the upper or lower part of the channel; for example, **36u**.
- For a 20 MHz channel, only the channel number appears, for example, **36**.

Note that in all cases, this notation may vary from the value reported by the access point or other Wi-Fi tools, because of inconsistent interpretations by different vendors.

- Graphs showing the RF utilization/interference and **Devices** for the network (see [Table 3-4](#) on page 3-14).

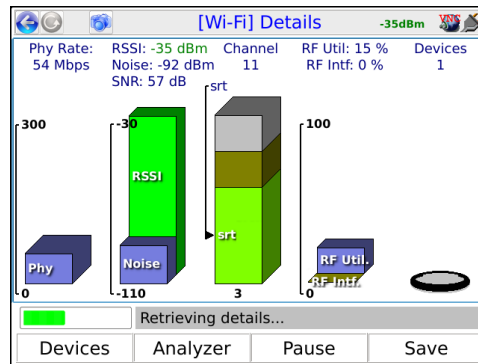


Figure 3-10 Wi-Fi Details screen - Wireless AC connection

The screen also provides the following shortcuts:

- **Devices (F1)** - Displays a table of devices connected to the network, including the unit. For more information, see [Wi-Fi Details > Devices table](#) on page 3-15.
- **Analyzer (F2)** - Launches the Wi-Fi Analyzer (see [Wi-Fi Analyzer](#) on page 3-10).
- **Pause/Resume (F3)** - Stops/starts the regular refresh of data.
- **Save (F4)** - Saves the **Details** results (see [Record Manager](#) on page 5-1)

The following table describes the Wi-Fi parameters presented in the different screens:

**Table 3-4 Details (Wi-Fi Setup) - Results**

Result	Description
<b>SSID</b>	(Service Set Identifier) Network name, as configured in the wireless router.
<b>MAC Address</b>	The hardware address of the physical interface at the wireless access point. This should be a unique identifier of the hardware.
<b>802.11 Type - Security</b>	The type of Wi-Fi network ( <b>b</b> , <b>g</b> , <b>n</b> , or <b>ac</b> ) and the type of security implemented, if any (for example, <b>WPA2</b> ).
<b>Channel Number</b>	<p>Channel used by the network, typically:</p> <ul style="list-style-type: none"> <li>• 1 to 11 for channels in the 2.4 GHz spectrum (Wireless B or G)</li> <li>• 36 to 165 for channels in the 5 GHz spectrum (Wireless N or AC)</li> </ul> <p>Note that variances are possible based on the country of operation and applicable regulations. A Wi-Fi connection is based on a single channel which you must have correctly specified when attempting to connect.</p>
<b>Link Quality</b>	<p>General signal quality, as a percentage. This value is based on the measured signal strength using the following equation, if the signal-to-noise ratio (SNR) is less than 18:</p> $((\langle signal\_dbm \rangle + 110) / 70) * 100 - (3 * (18 - \langle snr \rangle))$ <p>...otherwise:</p> $((\langle signal\_dbm \rangle + 110) / 70) * 100$ <p>...where the value is clipped at 0 or 100 if necessary to remain within the logical 0-100% range. Note that this value is subjective in nature and provides no positive indication of whether you can successfully connect, or of the reliability or throughput following a connection. In many respects, the concept is similar to the signal strength icons that may appear on other Wi-Fi devices.</p>
<b>Signal Strength</b>	Signal power level in dBm.
<b>RSSI</b>	(Received Signal Strength Indicator) Overall measured signal power level, in dBm.
<b>Noise</b>	Measured noise level, in dBm.
<b>SNR</b>	Signal-to-noise ratio of the signal, as the difference between the measured RSSI and the measured noise.

Result	Description
<b>Phy Rate</b>	Bit rate of the physical layer bitstream, in Mbps. This value is related to the basic number of bits that can be transported by the QAM modulation of the analog waveforms. A stronger signal typically means that QAM symbols can carry more bits and thus the transport layer data throughput may be higher. Therefore, this value may provide some indication how well the link can carry digital data.
<b>RF Util</b> <b>RF Intf</b>	<p>Percentages of time that the channel is occupied with usable wireless packet data and unusable interference. While measuring, the unit performs a cursory analysis of all activity on the channel, above a set noise threshold. The utilization rate represents the percentage of total measurement time that the channel showed any activity. The interference rate represents a subset of the utilization rate, during which the channel was occupied with activity that could not be decoded as valid Wi-Fi traffic (in other words, excessive noise.)</p> <p>Note that the utilization rate applies to the entire channel and all connected devices, not just traffic that involves the unit. On any given channel, all devices must share time using CSMA technology to avoid collisions.</p>
<b>Channel Access Points</b>	Total number of independent networks/SSIDs broadcasting on the current channel.
<b>Clients on this AP</b> -or- <b>Devices</b>	Estimated total number of hosts connected to the current access point, including the unit. This count is generated by the same process that populates the <b>Devices</b> screen and may not be precise. For more information, see <a href="#">Wi-Fi Details &gt; Devices table</a> on page 3-15.

### 3.5.1 Wi-Fi Details > Devices table

The **Devices** table presents a list of devices currently communicating with the same access point on the connected channel. It is a “best-effort” estimation based on periodic samplings of Wi-Fi packets on the network. Because the unit cannot monitor all packets continuously, the results are only accurate for the time periods that it observes. It is possible that connected devices may not appear in the list at all if their traffic occurs outside of the sampling periods.

All numeric results represent the most recent sampling period only; that is, the unit does not average previous results. However, a detected device always remains in the table for at least 30 seconds, even if it is not detected in future samples. When a listed device has no representation in the most recent sample, all numeric results display as zero (0) because the unit has no data for calculations. Note that sampling periods correspond with the regular refresh periods of the main **Details** screen, as all data for both screens is collected during these times.

The **Devices** table includes the following columns:

**Table 3-5 Devices table fields**

Result	Description
<b>MAC Address</b>	Hardware address of the device Wi-Fi interface.
<b>Vendor</b>	<p>Device vendor, based on a simple lookup of the MAC address. This lookup uses an internal table that contains data similar to any publicly-available address lookup. Therefore, its accuracy cannot be guaranteed.</p> <p>Possible vendors for a unit include:</p> <ul style="list-style-type: none"> <li>• Spirent</li> <li>• Atheros</li> <li>• Broadcom</li> <li>• SparkLAN</li> </ul>
<b>RF Util %</b>	<p>Estimated total utilization of the entire channel capacity by the respective device. This value is effectively a “percentage of a percentage,” described in further detail below.</p> <p>The Wi-Fi hardware provides an overall channel utilization by all devices, which is displayed in the main <b>Details</b> screen. Because this circuitry and associated firmware have direct and constant knowledge of the physical layer bitstream, the overall utilization remains accurate. For a single device in the <b>Devices</b> screen, the unit:</p> <ul style="list-style-type: none"> <li>• Calculates the percentage of time that the device occupied in the most recent sample period, effectively a utilization percentage within the sample only.</li> <li>• Multiplies this calculated percentage against the overall channel utilization to determine the usage by that device.</li> </ul> <p>For example, if overall channel utilization is 30% and the sampled device utilization is 10%, the <b>RF Util %</b> is calculated as 3%. That is, the device is using 3% of the total channel capacity.</p> <p>Note that because this value is partially based on a limited sample period only, its accuracy cannot be guaranteed.</p>
<b>Captured %</b>	<p>The total amount of data sampled with respect to the total amount of data traversing the channel. Knowledge of the physical layer bitstream allows the unit to interpolate the total amount of data, even though it did not sample it all. Note that:</p> <ul style="list-style-type: none"> <li>• This value provides a rough indication of how accurate the other calculations may be.</li> <li>• Because this calculation applies at the channel level, the value is the same for all devices, except lingering devices that display all zeros.</li> </ul>

Result	Description
Packet Retries	Within the sample for the device, the total number of Wi-Fi packets sent as a retransmission. Due to the uncertain nature of a wireless connection, each packet must be acknowledged by the receiver, otherwise a retransmission occurs. The unit uses the retransmission flag in these packets to produce this count.

## 3.6 Wi-Fi Spectrum Analysis

**NOTE:** The spectral analyzer is a licensable feature and requires the newer T5300 hardware to operate. For more information on hardware models, see [About hardware models and variations](#) on page 1-5.

The **Wi-Fi Spectrum Analysis** tool provides a graph of measured power levels across a set frequency range within the Wi-Fi spectrum. Its general operation is similar to any common spectral analyzer. In cases where Wi-Fi quality is poor, the analyzer can help determine whether the spectrum around the applicable channel has excessive activity and likewise help determine a better channel for connectivity.

The following figure is a sample analysis of the 2.4 GHz band, where the frequencies around channels 10-12 show a significant amount of activity. If connectivity is poor in this channel range, the graph suggests that a lower channel might be less congested.

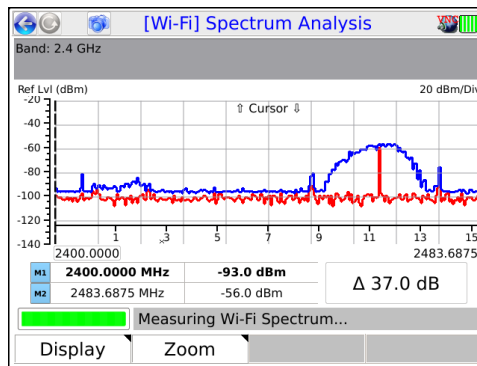


Figure 3-11 Sample spectral analysis of the 2.4 GHz range

The **Display** menu (F1) provides the following commands:

- **Running** - When toggled, pauses and resumes graph updates.
- **Peak Hold** - Enables an additional graph that represents the maximum power levels seen at all points on the spectrum, since the peak hold was activated. To reset the graph, toggle this command. The blue line on [Figure 3-11](#) is a peak hold plot.
- **2.4 GHz** and **5 GHz** - Toggles the analysis between the two respective spectrum ranges.
- **M1 Cursor** and **M2 Cursor** - Toggles the focus on the respective marker. A graph includes two vertical line markers that may be moved across the graph to update the tables below with specific values for the respective points. Note that the up/down arrow keys move the active marker, not the left/right keys.

The **Zoom** menu allows you to incrementally zoom in to the following frequency spans: 80 MHz, 40 MHz, and 20 MHz. When zooming in, the center of the graph is established at the active marker (M1 or M2).

## 3.7 IP Testing > IP Network Setup

This function allows you to assign IP routing information to the unit in order to perform IP-based testing. This function operates similarly to other interfaces; however, note that when launched from the **Wi-Fi** menu, the assigned IP information applies to the wireless interface/connection only.

After a successful setup, the main menu shows an **IP Network Disconnect** command which will terminate the IP network connection. If an IP address was obtained via DHCP, it will be released. This termination will happen automatically if you navigate away from the **Wi-Fi** menu.

For more information on parameters and results, see [IP Network Setup](#) on page 6-1.

**NOTE:** The unit must have an active wireless connection before this function is available (see [Wi-Fi Setup](#) on page 3-5).

## 3.8 IP Testing options over Wi-Fi

The Wi-Fi interface provides a suite of IP testing functions that are generally identical to their counterparts launched from other interfaces. The following table provides links to the central locations in this document that describe these tests in detail, along with any additional notes that may be relevant to the Wi-Fi interface.

**Table 3-6 IP testing options from the Wi-Fi interface**

Test	For more information	Additional notes
<b>Connection Info</b>	<a href="#">Results - IP Network Setup</a> on page 6-3	This function reports the IP information that is currently assigned to the 10/100/1G interface and is identical to the results screen from any successful <b>IP Network Setup</b> .
<b>Device Discovery</b>	<a href="#">All Devices Packet Loss (Device Discovery)</a> on page 6-19	The <b>Device Discovery</b> test is the same test as <b>All Devices Packet Loss</b> , named differently because its likely purpose is to discover devices on the current subnet, which is the initial phase of the <b>All Devices Packet Loss</b> test. If desired, you can continue with the packet loss portion of the testing or cancel the test after the discovery phase.
<b>L4 Performance Test</b>	<a href="#">L4 Performance Test</a> on page 6-7	- - -
<b>Passive Tests</b>	<a href="#">Video QoS (Quality of Service)</a> on page 6-23	- - -
<b>Ping</b>	<a href="#">Ping</a> on page 6-4	- - -
<b>Single Device PLT</b>	<a href="#">Single Device PLT</a> on page 6-11	- - -
<b>Speed Test</b>	<a href="#">Speedtest</a> on page 6-17	- - -
<b>Traceroute</b>	<a href="#">Traceroute</a> on page 6-6	- - -
<b>Web Browser</b>	<a href="#">Web Browser</a> on page 6-10	- - -

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WIFI



## 4: 10/100/1G Testing Menu

With the **10/100/1G** testing menu, the unit is able to join a 10/100/1G Ethernet link and run a variety of functions and tests.

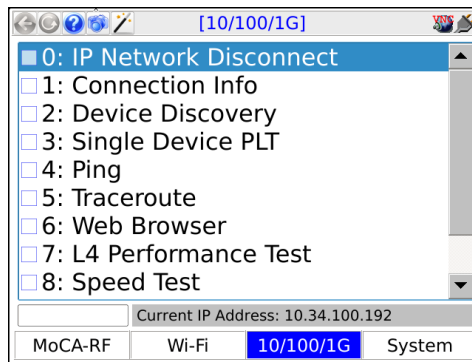


Figure 4-1 10/100/1G main menu

**NOTE:** On the unit, you can use either 10/100/1G port for single-ended tests such as ping and traceroute. For more information, see [About the 10/100/1G ports and connections](#) on page 4-2.

### 4.1 Functionality note

Your unit may or may not include all the functionality described in this section, dependent upon your licensing agreement with Spirent. Please contact Spirent for more information.

## 4.2 About the 10/100/1G ports and connections

The unit has two physical 10/100/1G ports which are connected internally by a functional Ethernet switch. Therefore, when performing single-ended tests such as ping or traceroute, you may use either port. When setting up an Ethernet bridge for passive tests, the order of the ports is likewise not important.

**NOTE:** On the physical port, the unit is able to auto-detect the receive and transmit channels; therefore you may use straight-through or crossover Ethernet cables for any application.

## 4.3 10/100/1G testing diagram

The following diagram shows a typical setup for active, single-ended tests. For more information on the setup for bridged, passive testing, see [Passive testing](#) on page 4-4.

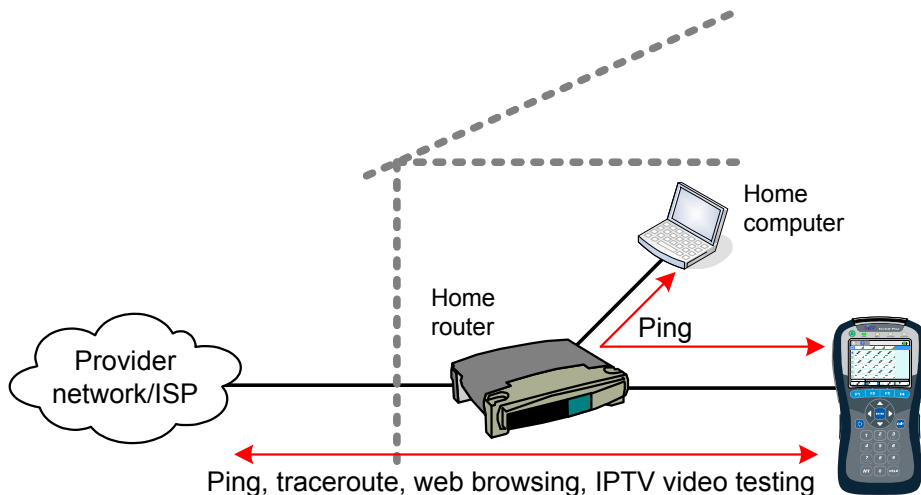


Figure 4-2 Typical 10/100/1G testing diagram

## 4.4 IP Network Setup

(10/100/1G > IP Network Setup)

This function allows you to assign IP routing information to the unit in order to perform IP-based testing. This function operates similarly to other interfaces; however, note that when launched from the **10/100/1G** menu, the assigned IP information applies to the 10/100/1G interface/connection only.

For more information on parameters and results, see [IP Network Setup](#) on page 6-1.

Note the following:

- The unit must be connected to a suitable access device before attempting **IP Network Setup** (see [10/100/1G testing diagram](#) on page 4-2).
- After a successful setup, the main menu shows an **IP Network Disconnect** command which will terminate the IP connection. If an IP address was obtained via DHCP, it will be released. This termination will happen automatically if you navigate away from the **10/100/1G** menu.

## 4.5 IP testing options over Ethernet

The 10/100/1G interface provides a suite of IP testing functions that are generally identical to their counterparts launched from other interfaces. The following table provides links to the central locations in this document that describe these tests in detail, along with any additional notes that may be relevant to the 10/100/1G interface.

**Table 4-1 IP testing options from the 10/100/1G interface**

Test	For more information	Additional notes
Connection Info	<a href="#">Results - IP Network Setup</a> on page 6-3	This function reports the IP information that is currently assigned to the 10/100/1G interface and is identical to the results screen from any successful <b>IP Network Setup</b> .
Device Discovery	<a href="#">All Devices Packet Loss (Device Discovery)</a> on page 6-19	The <b>Device Discovery</b> test is the same test as <b>All Devices Packet Loss</b> , named differently because its likely purpose is to discover devices on the current subnet, which is the initial phase of the <b>All Devices Packet Loss</b> test. If desired, you can continue with the packet loss portion of the testing or cancel the test after the discovery phase.
IP Video Tests	<a href="#">IP Video testing</a> on page 6-22	- - -
L4 Performance Test	<a href="#">L4 Performance Test</a> on page 6-7	- - -
Packet Capture	<a href="#">Packet Capture</a> on page 6-55	- - -
Ping	<a href="#">Ping</a> on page 6-4	- - -

Test	For more information	Additional notes
Single Device PLT	<a href="#">Single Device PLT</a> on page 6-11	---
Speed Test	<a href="#">Speedtest</a> on page 6-17	---
Traceroute	<a href="#">Traceroute</a> on page 6-6	---
Video QoS	<a href="#">Video QoS (Quality of Service)</a> on page 6-23	---
Web Browser	<a href="#">Web Browser</a> on page 6-10	---

## 4.6 Passive testing

**NOTE:** Passive testing is a purchasable option. Please contact Spirent for more information.

Passive testing allows non-intrusive testing on a bridged Ethernet link. The following sections describe passive testing and bridge setup in more detail.

### 4.6.1 Unit setup for passive testing

Because the two 10/100/1G ports are joined internally by a functional Ethernet switch, the unit is inherently capable of bridging an Ethernet link when placed in the middle. With a bridged link, the unit can passively monitor traffic between the ports (that is, the traffic flowing across the “bridge”), such as during a passive measurement of video quality. The ports are always active; therefore, the bridge capability is always active, with the monitoring feature activated when a passive test is run.

With a passive test, the unit does not send any traffic on the link, nor does it interfere with any traffic passing through the link. However, an active link will be naturally disrupted when the unit is physically placed in the middle. For a passive test to run, it is required that the desired traffic is activated or restored between the bridged endpoints before the testing begins. Using the example of passive video testing, consider the following typical setup:

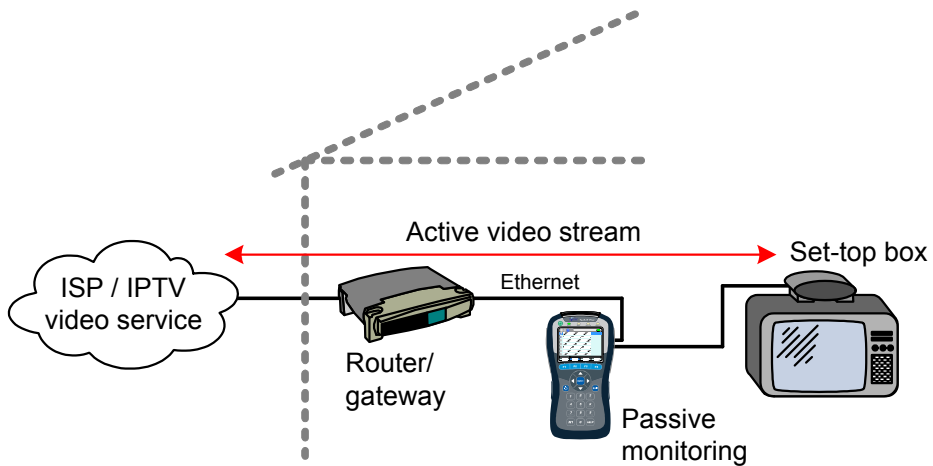


Figure 4-3 Bridged (passive) video testing

To set up the video test in this example, you should:

1. Connect the physical wires between the endpoints, from router-to-unit and unit-to-STB.
2. Verify that communications between the bridged endpoints are restored. In this example, you should be able to see the video on the TV.
3. Set up and run the test on the unit.

The following notes apply:

- Following successful **IP Network Setup**, you can also perform single-ended active tests while the link is bridged, in either direction. In the previous example, you should be able to ping the STB if you know its IP address, as well as anywhere upstream, including the internet.
- You can use either crossover or straight-through Ethernet cables for any connections to the unit.

## 4.6.2 Passive Video QoS (Quality of Service)

(10/100/1G > Passive Tests > Unicast Video QoS)

-or-

(10/100/1G > Passive Tests > Multicast Video QoS > Video QoS)

From a quality analysis standpoint, passive video quality testing is generally identical to active testing, except that instead of actively joining a video stream, the unit monitors an existing stream on a bridged

link. Therefore, the video stream must be active between the bridged endpoints before the test can begin.

For detailed information on the video QoS test parameters and results, see [Video QoS \(Quality of Service\)](#) on page 6-23.

## 4.7 Ethernet Cable Test

The **Ethernet Cable Test** evaluates low-level details about an Ethernet connection and the physical cable characteristics. It includes TDR capabilities to determine the overall cable length, which may be useful to detect a short or open on individual pairs.

Note that:

- Some prerequisite knowledge of TDR analysis and Ethernet cable wiring may be required to understand the results of this test.
- This functionality is driven by native functionality of the onboard Ethernet interface, as an accessory feature only. It does not involve a dedicated and/or precisely-calibrated test component. Therefore, the results should be considered general in nature. Furthermore, Spirent firmware can initiate testing and retrieve results only. It cannot alter the core functionality or accuracy.

### 4.7.1 Setup - Ethernet Cable Test

The test setup requires the desired physical port to analyze. Refer to the labeling near the 10/100/1G ports to determine port numbering.

The test may be run on a cable with or without an active signal. With an active signal, the test can produce a more comprehensive set of results.

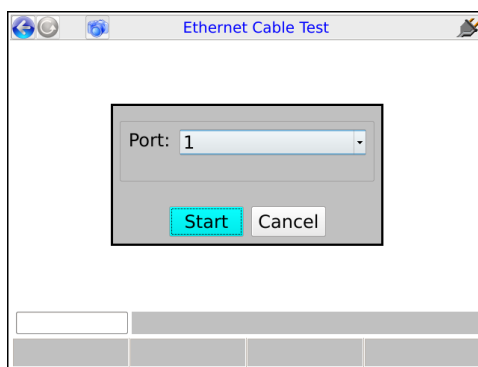


Figure 4-4 Ethernet Cable Test - Setup

## 4.7.2 Results - Ethernet Cable Test

The following table describes the full set of possible results. Note that if Ethernet connectivity is not possible due to a disconnected cable or any other reason, the results contain pair lengths only.

Table 4-2 Ethernet Cable Test - Results

Result	Description
<b>Pair Polarity</b>	<p>For each MDI pair in a standard cable (4 pairs total out of 8 conductors), indicates whether the conductors are connected with the proper “polarity,” where:</p> <ul style="list-style-type: none"><li>• <b>Positive</b> - Proper polarity connection</li><li>• <b>Negative</b> - Reverse polarity</li></ul> <p>For each pair, the two pins at each physical port are designated “+” and “-”, according to Ethernet protocol. With a properly-wired cable, the “+” pin on one end connects to the “+” pin on the other, and likewise for the “-” pins. Note that although proper polarity is desired, normally an Ethernet interface can detect a reversed polarity and internally adjust to allow a connection.</p>
<b>Pair Swap</b>	<p>For each pair in the cable, indicates the respective mapping to standard Ethernet channels (1 or 2 sets of transmit and receive channels). For a properly-wired straight-through cable, the pairs should map sequentially with channels A through D. Any other mapping may indicate an improperly-wired cable. It is possible that improper wiring can support 10/100 Mbps but not 1 Gbps Ethernet, because 1 Gbps requires all four pairs instead of the two used by 10/100 Mbps.</p>

Result	Description
<b>Pair Skew</b>	<p>For each pair, the difference in signal propagation time; that is, the time required for an electrical signal to traverse the respective loop. Ideally, all pairs associated with a common signal should have identical or very close propagation times, because a large skew can disrupt high-bandwidth signals with a low tolerance for timing variations. The primary causes of skew include differing conductor lengths due to inconsistent twist ratios and differing insulation types.</p> <p>The skew results are presented in nanoseconds (ns) and are relative to the pair with the shortest propagation time. The pair with the shortest time shows a skew of zero (0), while the skew of each other pair represents the additional length of time required for its respective propagation.</p> <p>Industry practice varies with regard to the maximum amount of skew that is acceptable. Additionally, the type of signal, length of cable, and other factors influence that determination. For these reasons, it is beyond the scope of this document to provide recommendations on acceptable skew values.</p>
<b>Cable Len</b>	<p>For each pair, the estimated 1-way cable length based on a TDR trace. This value normally indicates the end of the pair, or possibly the first short or open. Note that:</p> <ul style="list-style-type: none"><li>• The maximum measurable cable length is approximately 656 ft. (200 meters).</li><li>• At a minimum, the accuracy may deviate by +/-7 ft. (+/-2 meters).</li></ul>
<b>Cable Test Result</b>	<p>For each pair, a general pass/fail recommendation based on the following two TDR-related analyses:</p> <ul style="list-style-type: none"><li>• <b>Maximum Peak Check</b> - The TDR trace is analyzed for the highest interim "peak," where a peak is analogous to an upward rise in a standard graphical TDR result. A peak typically occurs when the TDR pulse encounters a point of high impedance, causing a larger reflection. Internally, the unit applies a threshold to determine the amplitude necessary to indicate an unacceptable peak.</li><li>• <b>First Peak Check</b> - Similar to the maximum peak, the unit sets a different threshold to determine the first unacceptable peak in the trace. Note that the first peak is usually the same as the maximum peak, but may differ.</li></ul> <p>For each case on each pair, if the respective interim peak is not detected, the test assumes a proper termination of the pair and reports a status of "pass." Otherwise, the test reports the approximate location of the associated impedance change with suggestions of the possible cause.</p>



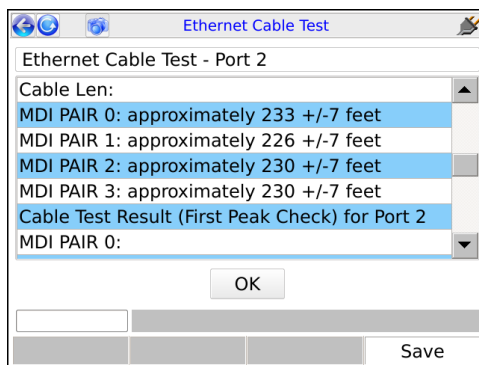


Figure 4-5 Ethernet Cable Test - Results, showing cable lengths

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Ethernet

## 5: System Menu

The **System** menu provides access to general system configuration.

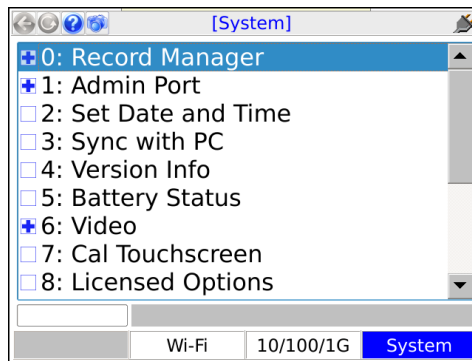


Figure 5-1 System main menu

### 5.1 Record Manager

(System > Record Manager)

The **Record Manager** is used to manage, view, and transfer record files, which are special files used to store test results, screen captures, and other related data. When you invoke the **Save** function in a results screen, they are saved to a record file. For non-continuous, self-terminating tests, the full results set is saved at the end of testing. For continuous tests, you can control when saving is active, during which time a full results set is saved following the end of each reporting interval.

For test results, at any given time a single record file is considered the active file, which is presented as the default when you manually initiate a **Save** action in a test results screen (see [Saving results](#) on page 2-29). If you have never created any record files, the unit uses a "**DEFAULT**" record file until you

specify otherwise. If you do not have the need for multiple record files, the default record may be sufficient for general use.

For screen capture files, each capture is stored in a separate file that is named at the time of the capture. For more information, see [Capturing a screen image \(screenshot\)](#) on page 2-28).

**NOTE:** All files in the **Record Manager** remain on the unit until purposefully deleted. A unit shutdown will not delete record data.

The unit has no specific maximum number of record files or maximum amount of results that any record can contain. However, it does have a certain overall limit related to the constraints of physical memory. A general rule which might be useful is to have no more than 30 general record files on the unit at once, each with no more than 20 sets of test results. The actual numbers can vary, though, especially considering the type of results you are saving. For example, the results data set from a video test is many times larger than a ping test. Additionally, the presence of screen capture files can reduce the space available for test results.

The following sections describe the individual **Record Manager** functions in more detail:

- [Record Manager > Test Result Files](#) on page 5-2 - Provides a viewer for test result files, along with file management tools
- [Record Manager > Signature Cap Files](#) on page 5-3 - Reserved for future use
- [Record Manager > Screen Capture Files](#) on page 5-4 - Provides tools to view and/or delete screen capture files
- [Record Manager > Upload Files](#) on page 5-4 - Provides tools for transferring **Record Manager** files from the unit to a remote computer, including test result and screen capture files

## 5.1.1 Record Manager > Test Result Files

This function allows you to view and manage files currently on the unit. The actions that may be invoked by the respective function key include:

**Table 5-1 Record Manager functions**

Function	Description
<b>New</b>	Creates a new record file. The name can have any alphanumeric name, often reflecting a work order number or a customer location. <b>NOTE:</b> Do not begin a record name with a period ( <b>N1</b> key), otherwise it will not appear in the <b>Record Manager</b> .

Function	Description
<b>Delete</b>	Deletes the selected file. This action cannot be undone. <b>NOTE:</b> Files that begin with <b>INVRES</b> (INVENTORY/RESuLts) are normally generated by testing that saves results automatically. They contain a broad scope of information that is designed for incorporation by a custom, back-office management system. For more information, please contact Spirent.
<b>Active</b>	Makes the selected file the active file, which then appears as the default when a <b>Save</b> action is initiated in a test results screen.
<b>View</b>	Opens the selected file for viewing in the form of a tree view of results. Normally, a results set includes one branch with shows details on the original test setup, with a second branch indicating the success or failure of the operation with additional details as applicable. <b>NOTE:</b> For some tests, a “mode” parameter appears in the setup area, such as <b>mode:POLLED</b> and <b>mode:NEXT</b> . The “polled” mode indicates the first interval of a repeating test and the “next” mode applies to all subsequent intervals of the respective test. In many cases, this parameter can be simply ignored.

**NOTE:** The currently-active file is shown with an asterisk (\*) in the left column.

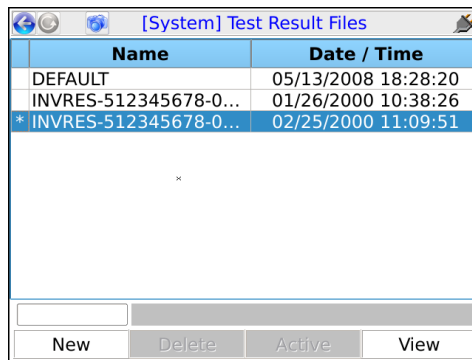


Figure 5-2 Record Manager > Test Result Files

## 5.1.2 Record Manager > Signature Cap Files

Reserved for future use.

## 5.1.3 Record Manager > Screen Capture Files

This area allows you to preview and/or delete screen capture files currently stored in the **Record Manager** (see [Capturing a screen image \(screenshot\)](#) on page 2-28). To upload screen capture files to a remote computer, see [Record Manager > Upload Files](#) on page 5-4.

## 5.1.4 Record Manager > Upload Files

This function allows you to transfer record files from the unit to a remote computer, using one of the following:

- **FTP** - Using one of the interfaces such as the **Admin Port**, files are transferred to a running FTP server on a remote computer.

**NOTE:** FTP server setup is a separate task. For more information, see [FTP information](#) on page 2-57.

- **USB** - Using the physical USB port on the unit, allows the files to be transferred to a USB storage device such as a removable flash drive, then transferred from that device to a computer.

**NOTE:** Do not plug the unit directly into a computer.

At the bottom of the screen, the **Start** button initiates the transfer. The following table describes the parameters in the various tabs that should be reviewed carefully before you click **Start**:

**Table 5-2 Record Manager > Upload Files parameters**

Tab	Description
<b>Destination</b> tab	Defines the method for the transfer: <ul style="list-style-type: none"><li>• <b>FTP</b> - Requires FTP connection parameters for the remote FTP server. For more information, see <a href="#">FTP connection parameters</a> on page 2-59.</li><li>• <b>USB</b> - Requires a USB storage device, such as a removable flash drive, to be physically connected to the unit. FTP connection parameters are not applicable.</li></ul>
<b>Source</b> tab	For FTP only, defines the interface from which the FTP connection will be attempted. If the interface is not currently configured with routable IP information, this tab also provides fields for that information. When the transfer action is initiated, the unit will attempt to configure the selected interface first.
<b>Files</b> tab	Used to select the specific files that should be transferred and whether they should be deleted from the unit following a successful transfer. Note that the list in this area includes both test result files and screen capture files, as applicable.

## 5.2 Admin Port

(System > Admin Port)

This function assigns IP data to the internal management interface of the unit, a prerequisite connection step for management activities such as firmware upgrades and other actions requiring an FTP exchange. In this document, all activities that require an **Admin Port** connection are specifically indicated as such. Note that this function does not provide general access to the operating system of the unit.

The **Admin Port** can be connected via two different interfaces, the choice of which is shown in the initial **Admin Port** screen:

- **10/100/1G Admin Port** - Initiates a connection through the 10/100/1G Ethernet interface. Either physical 10/100/1G connector may be used. Once in this area, the process of establishing a connection is very similar to establishing a 10/100/1G connection for testing purposes with the **10/100/1G** menu. For more information on behavior and parameters, see [IP Network Setup](#) on page 4-2.
- **Wi-Fi Admin Port** - Initiates a connection through the Wi-Fi interface. Once in this area, the process of establishing a connection is very similar to establishing a Wi-Fi connection for testing purposes with the **Wi-Fi** menu. Note that all considerations and limitations involved with a test-related Wi-Fi connection also apply to the **Wi-Fi Admin Port**. For more information on behavior and parameters, see [Wi-Fi Setup](#) on page 3-5.

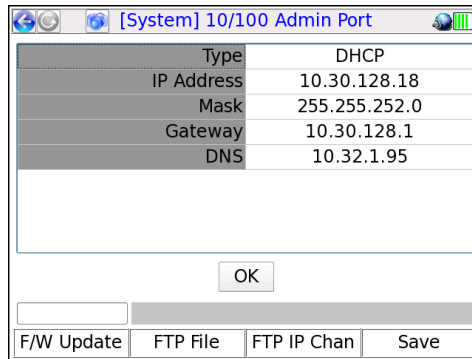


Figure 5-3 Admin Port results screen following a successful connection

Once an admin port is established, you can view the IP address and other connection info at any time under **System > Admin Port > Connection Info**. The information presented is similar to the connection parameters available from any IP setup (see [Connection Info](#) on page 6-4).

Additionally, this area includes two additional commands related to remote control of the unit (see [Remote control of the unit](#) on page 2-33):

- **System > Admin Port > WAN Remote Control** - See [Remote site remote control \(via the internet\) setup](#) on page 2-46.
- **System > Admin Port > Wi-Fi Admin Port > AP Remote Control** - See [Local remote control \(via a Wi-Fi access point\) setup](#) on page 2-45.

Upon a successful **Admin Port** connection, the results screen includes shortcuts to the following:

- **F/W Update** (Firmware update - see [Update Firmware](#) on page 5-13)
- **FTP File** (Record manager file upload - see [Record Manager > Upload Files](#) on page 5-4)
- **FTP IP Chan** (IPTV channel guide download - see [Download IPTV Channel Guide](#) on page 5-8)

In all cases, when a shortcut is launched, any applicable information from the **Admin Port** configuration is automatically transferred to the respective setup screen.

Note the following important items:

- In some situations, an active **Admin Port** may conflict with Ethernet/IP traffic on other interfaces, especially if multiple interfaces are attempting to host traffic on the same subnet. For example, if you are attempting to host IP traffic over a MoCA interface while you have an active **10/100/1G Admin Port** with the same router, issues may occur depending on the type of router. If any particular scenario exhibits trouble, please contact Spirent for a feasibility analysis.
- An active **10/100/1G Admin Port** is known to prevent proper functionality of the **Bridge (ECB) mode** feature of the MoCA Module.

## 5.3 Set Date and Time

(**System > Set Date and Time**)

The date and time are used to timestamp all saved results in the **Record Manager**. They are also used for various internal functions, described in this document elsewhere as appropriate.

The date and time must be entered using the following formats:

- **Date** - *yyyy-mm-dd*
- **Time** - *hh:mm:ss*

To set the date or time, select either parameter and press a number on the keypad to initiate the numeric entry screen. You must enter all characters that are requested, using leading zeros as necessary to pad empty spaces. For example:

09:10:00



...would set the time to 9:10 a.m. Note that the unit uses 24 hour time. For example, 9:10 p.m. would be set as 21:10:00.

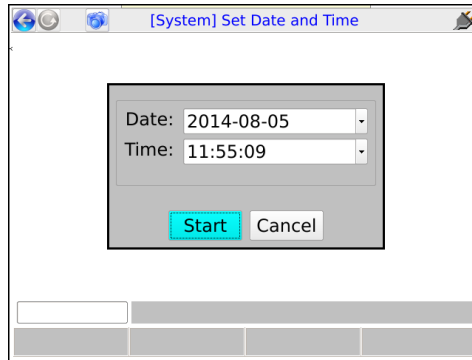


Figure 5-4 Set Date and Time screen

## 5.4 Version Info

(System > Version Info)

This function provides information about hardware and firmware versions currently applicable to the unit, including the attached module, if any. This information may be required when obtaining technical support from Spirent. It may also be useful for verification before and/or after firmware upgrades.

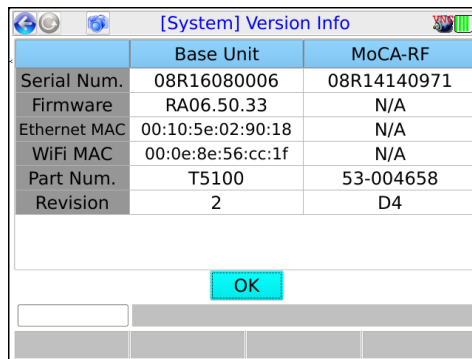


Figure 5-5 Version Info

## 5.5 Battery Status

(System > Battery Status)

This function provides detailed information about the battery and current charging conditions. Note the following:

- The charging information in this screen may not be accurate if the battery is overheated. For more information, see [Important battery charging note](#) on page 2-22.
- The temperature may be displayed in degrees Fahrenheit or Celsius, according to system settings (see [System/Module Settings > Base Unit](#) on page 5-16).

## 5.6 Video

This area contains various functions and settings related to video testing.

### 5.6.1 Download IPTV Channel Guide

(System > Download IPTV Channel Guide)

This function is used to transfer video testing channel guide files to the unit using FTP. To transfer files, you must have:

- A supported FTP server running on a networked computer. For more information, see [FTP server installation and setup](#) on page 2-58.
- The channel guide files in a folder on that networked computer in the proper location (see [File preparation and general handling notes](#) on page 5-9).
- The unit connected to a 10/100/1G Ethernet network that can reach the FTP server computer.

Once these steps are complete, the download may be initiated. For more information, see [Download procedure](#) on page 5-9. For general information about channel guide functionality, see [About channel guides](#) on page 6-53.

**NOTE:** A working knowledge of FTP is helpful for server setup and successful file transfer.

## File preparation and general handling notes

- Every transfer action deletes all existing channel guides from the unit, even if the server folder does not contain any valid files to replace them.
- On the FTP server computer, the files to transfer must be placed in the “home directory” associated with the FTP user account that you intend to use. For any given transfer action, only the files in a single folder are transferred to the unit.
- Channel guides must be in the proper XML format as described under [About channel guides](#) on page 6-53.
- All files with an \*.xml extension (case-insensitive) are transferred. Any other files in the designated folder are ignored.

**NOTE:** If a file named `thresholds.xml` exists (case-insensitive), it will also be ignored. For this reason, a channel guide file cannot use this name.

- Other than general limitations of internal disk space, the unit has no functional limitation on how many channel guide files it may contain.

## Download procedure

1. Connect the unit to a 10/100/1G Ethernet network that can access the computer running the FTP server.
2. Select **System > Download Channel Guide** and specify the required parameters for download. If you do not have a **Admin Port** currently set up, these parameters information must include **Admin Port** configuration information. For more information, see [FTP connection parameters](#) on page 2-59.

### 5.6.2 Video > View/Edit Thresholds

This screen allows you to view thresholds that affect the coloring/shading of results for certain **Video QoS** test results (VQM version, see [Video QoS \(Quality of Service\)](#) on page 6-23). Currently-supported results include the “percent degradation” due to loss, jitter, codec type, and delay.

Thresholds are specified as ranges, where a result will be colored:

- **Red**, if the metric falls outside the specified range
- **Green**, if the metric falls within the specified range, inclusive

Along with ranges, each threshold can be individually enabled or disabled. If a threshold is disabled, the corresponding result receives no coloring regardless of its value.

Additionally, note the following:

- When specifying thresholds, the unit enforces theoretical/technical limitations. For example, a percentage cannot be less than zero or greater than 100. In general, if the inherent lower or upper range of a threshold represents a technical limit, the unit restricts the editing of the field altogether.
- For results that are represented as a percentage, where an increasing percentage normally indicates a worsening condition, the unit will enforce zero as the lower range limit.

As an example, with the following setup, any related percentage would be colored red if measured greater than 25%:

	From	To	Enabled
Pass Loss Degradation (%)	0	25	Yes
Pass Jitter Degradation (%)	0	25	Yes
Pass Codec Degradation (%)	0	25	Yes
Pass Delay Degradation (%)	0	25	Yes

Figure 5-6 Video Thresholds screen

System

## 5.6.3 Video > Download Thresholds

This function allows you to download a thresholds file to set all video thresholds as a batch. This action completely overwrites all existing thresholds on the unit.

For more information on the parameters required for the FTP transaction, see [FTP connection parameters](#) on page 2-59. The remainder of this section describes the required threshold file format.

A threshold file uses a simple CSV format with lines in the following syntax:

```
thld_name,from_value,to_value,enabled
```

For example:

```
Pass Loss Degradation (,),--,25,Yes
```

It must have the following filename:

```
VideoThresholds.dat
```

Note the following:

- The best way to prepare a threshold file is to start with a working sample. Contact Spirent to obtain a sample.
- You should never change a threshold name (first field), otherwise the threshold will become unrecognizable and the unit will use a default instead.
- If any value exceeds a theoretical limitation, the unit will reset it to a valid value. For example, if a percentage value exceeds 100, it will be reset to 100 upon import. For fields that inherently require a theoretical minimum or maximum, you can specify two hyphens (--) instead of an explicit value.
- You can precede any line with an exclamation point (!) to restrict the setting from editing onboard the unit, for example:

```
!Pass Loss Degradation (%),--,25,Yes
```

In this case, the threshold range will be viewable on the unit, but will not be editable. Note that this condition cannot be undone except by importing another thresholds file to the unit.

## 5.6.4 Video > Video Monitor

The **Video Monitor** feature allows the unit to serve as a basic video display monitor, similar to a television that is connected to an STB. The primary purpose of this feature is to allow video and STB verification in the absence of an actual television; however, it may also be used for any situation where a monitor is required for an analog video feed.

Using a required dongle, the unit accepts a simple analog video signal as provided by tuning devices such as STBs, DVD players, etc. The dongle must be ordered from Spirent and should be connected as follows:

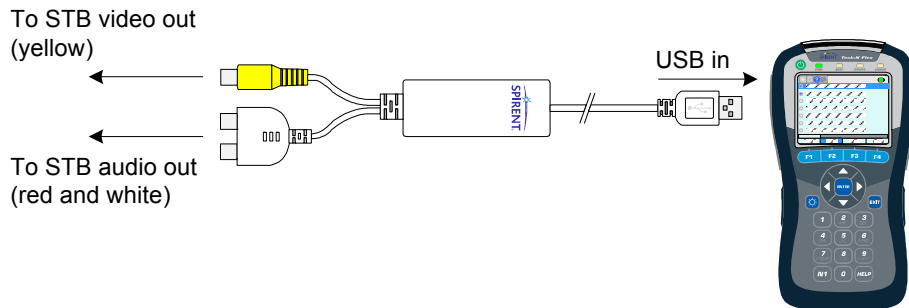


Figure 5-7 Video Monitor dongle connection

With the dongle properly connected and a video signal active, the video should begin to display as soon as you select **Video Monitor**. Note the following:

- The unit has no tuning or decoding capabilities. A simple signal feed from a “video out” source is required.
- The **ENTER** key on the physical keypad toggles the zoom on and off. When the zoom is on, the arrow keys allow navigation around the screen.
- The video may lag slightly as compared to a normal television.
- The audio connection is optional. Additionally, certain internal hardware is required for the unit to play audio, which may not be present in some older units. Please contact Spirent for more information.
- An external VNC viewer cannot render the video and will show a blank screen while the **Video Monitor** is active.

## 5.7 Cal Touchscreen

(System > Cal Touchscreen)

This function calibrates the touchscreen display for optimal response. Calibration should be done after firmware upgrades, after battery replacement, or if the screen response begins to degrade after heavy use.

The process requires you to touch the screen in several places with a stylus or other approved device. Follow the instructions on the screen.

## 5.8 Licensed Options

(System > Licensed Options)

This function reports which optional features are currently enabled for the base unit and modules (if any), which may be required when seeking technical support. It also allows you to manually enable features by entering valid key codes, which is may be required to enable licensed features on a new unit. To enter a key code, press **Update Key (F1)** and enter the key exactly as provided by Spirent. Note the following:

- For more information on what the individual licenses do, see [Licensed feature details](#) on page 2-53.
- Firmware upgrades include a provision to automatically apply licensing codes if properly configured in a file and located on the server from which the firmware is retrieved. For more information, see [Update Firmware](#) on page 5-13.
- The unit requires a unique key code for each licensed feature. For example, to enable both the web browser and IP video testing, you need to enter two different codes.
- For manual code entry, you do not need to enter anything except the code itself. The unit will recognize the feature to which it applies and then list that feature as enabled.

- A key code is specific to a unit and will not work on any other unit.
- Key codes must be provided by Spirent. In some cases, the codes required for your licensed feature set are shipped in the package with the unit. If you have trouble with the codes or require new codes for any reason, please contact Spirent.

## 5.9 Update Firmware

### (System > Update Firmware)

This function initiates the unit firmware upgrade process. The firmware package must reside on a remote computer with a properly-configured rsync server running and with IP-level connectivity to the unit. Spirent hosts one such rsync server which may be available for your use, dependent upon your arrangement with Spirent and preferences as an organization. Alternatively, you may set up your own server for private, internal use. The remaining information in this section (including [Table 5-3, Update Firmware parameters](#) on page 5-14) assumes the use of the Spirent-hosted server. For more information on setting up your own server, please contact Spirent for additional documentation.

Before an update may be initiated, you must configure an **Admin Port** with connectivity to the rsync server (see [Admin Port](#) on page 5-5). Additionally, note the following:

- The unit **should not** be powered down or lose network connectivity during the update process. For this reason:
  - **The use of a 10/100 (versus Wi-Fi) Admin Port is recommended.** If you do use a Wi-Fi connection, it is highly recommended that you connect with **Wireless G or higher**, as Wireless B may not be stable enough to reliably handle the volume of firmware data.
  - The unit requires external power to be connected before allowing an update.

**If an update is interrupted, in most cases you should be able to restart the unit and at least attempt the update again. However, there is a very short window during the process when an interruption will render the unit unusable and require it to be returned for repair. For this reason, all precautions against an interruption are highly recommended.**

- Firmware may be updated at any time, especially if you are using the Spirent-hosted server. Regular updates help ensure that your unit is performing at its peak capacity. Note that you can view the current firmware version on the unit with the **Version Info** function (see [Version Info](#) on page 5-7).
- You do not need to connect a specific module or any module at all to run a firmware upgrade. All firmware is installed on the base unit, which then transfers it to modules as necessary. If a disconnected module component is affected by an upgrade (such as the ADSL/VDSL2 module modem, which has its own firmware), the unit will warn you and then proceed to upgrade that component when the module is reconnected.

The **Update Firmware** setup screen includes the following parameters:

**NOTE:** The middle column indicates the values to use if you are updating from the Spirent-hosted server. All values should be considered case-sensitive.

**Table 5-3 Update Firmware parameters**

Parameter	Value to use for the Spirent-hosted server	Additional description
Server	<b>SPIRENT</b>	If you are not using the Spirent-hosted server, this must be the IP address or domain name of the computer where the rsync server and firmware files reside. The unit is provisioned to recognize the <b>SPIRENT</b> keyword to automatically reach the Spirent server.
Firmware	<b>latest</b>	This is an alias that designates the desired firmware package to install, normally <b>latest</b> when using the Spirent-hosted server unless you have been instructed otherwise. Aliases must be preconfigured on the server computer in a specific fashion, which is a topic addressed in the additional documentation available for custom rsync server setup.
License File	<b>TXH_LICENSE_KEYS</b>	The name of the file on the server that contains licensing information for the unit you are upgrading. Licensing is always updated during the upgrade process unless one or more of the following are true, in which case licensing remains in its original state: <ul style="list-style-type: none"> <li>• The file is missing or set up incorrectly</li> <li>• The unit cannot find its licensing information in the file</li> </ul> For custom rsync server setup, additional documentation from Spirent is available on the management of this file.
Update License Only	<b>No</b>	This setting specifies whether to do a licensing update only and skip the firmware upgrade. In most cases, the two are done concurrently.
Ping Before Download	<b>Yes</b> (recommended)	Indicates whether to perform a ping test to the designated <b>Server</b> before attempting the upgrade. If the ping fails, the upgrade action will abort.
Timeout	<b>15</b>	Indicates a maximum amount of time to allow for the upgrade process, after which it is aborted. An aborted process leaves the unit in its original functional state.



Parameter	Value to use for the Spirent-hosted server	Additional description
User	(leave blank)	Authentication information for the rsync server, configured when the server is set up. The Spirent-hosted server does not require authentication.
Password		

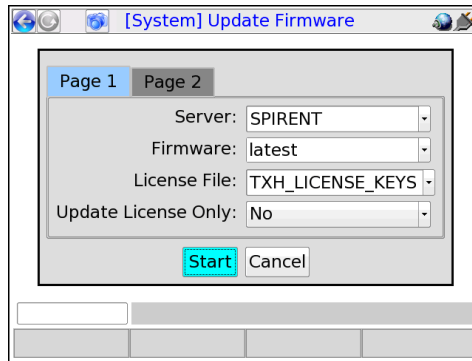


Figure 5-8 Setup for use of the Spirent-hosted server

## 5.10 System/Module Settings

(System > System/Module Settings)

This function is used to configure the base unit and/or the attached module and its behavior varies according to the type of module attached, if any. This section describes the base unit parameters only. For more information on module settings, see the respective module documentation.

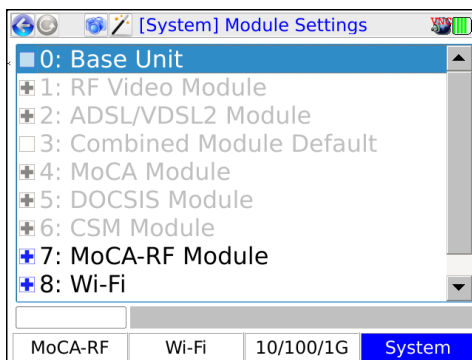


Figure 5-9 Module Settings menu

## 5.10.1 System/Module Settings > Base Unit

Table 5-4 Base Unit settings

Tab	Description
<b>Auto Power Off</b>	Sets the maximum amount of idle time after which the unit automatically shuts down to save battery power. This setting has no effect when the unit is connected to external power.
<b>Primary Keyboard</b>	Selects the default keypad that appears when text entry is initiated. For more information, see <a href="#">Running a function or test</a> on page 2-24.
<b>Imperial/Metric</b>	Selects the global measurement system for the unit, affecting display items such as the battery temperature, Fahrenheit vs. Celsius (see <a href="#">Battery Status</a> on page 5-8).
<b>First Name</b> <b>Last Name</b>	General user information, contained in all results files saved to the <b>Record Manager</b> .
<b>ID Number</b>	A general purpose ID that can be assigned to the unit. This ID is contained in all results files saved to the <b>Record Manager</b> .
<b>Speed Test Region</b>	Default region to use for the <b>Speed Test</b> , including a test launched by any “quick test” or similar script. Normally, this value may be changed in the respective setup screen.

Tab	Description
<b>WiFi Region</b>	<p>Optional filter for Wi-Fi channel tuning. If set to any value other than <b>International</b>, the unit filters SSIDs during a Wi-Fi <b>Scan</b> according to the valid spectrum available at the specified region. In other words, the <b>Scan</b> results will omit any SSIDs that do not fall within the valid spectrum.</p> <p>Spectral consideration and filtering are based on common industry standards. For additional explanation of international spectrum usage, visit <a href="https://en.wikipedia.org/wiki/List_of_WLAN_channels">https://en.wikipedia.org/wiki/List_of_WLAN_channels</a>.</p>
<b>RF Bandwidth</b>	<p>For RF module testing, the expected bandwidth of channels, either 6 MHz or 8 MHz. Channel bandwidth varies in different countries.</p> <p>If <b>WiFi Region=International</b>, you can set this value manually. Otherwise, it is set automatically based on the configured <b>WiFi Region</b>.</p>

## 5.10.2 System/Module Settings > RF Video Module

See [System menu settings/controls \(for RF\)](#) on page 8-22.

## 5.10.3 System/Module Settings > ADSL/VDSL2 Module

See the *ADSL/VDSL2 Modem Module User Guide*.

## 5.10.4 System/Module Settings > Combined Module Default

Reserved for future use.

## 5.10.5 System/Module Settings > MoCA Module

See [System menu settings/controls \(for MoCA\)](#) on page 7-27.

## 5.10.6 System/Module Settings > DOCSIS Module

See the *DOCSIS Module User Guide*.

## 5.10.7 System/Module Settings > CSM Module

See the *Cable Services Module User Guide*.

## 5.10.8 System/Module Settings > MoCA-RF Module

See:

- [System menu settings/controls \(for MoCA\)](#) on page 7-27
- [System menu settings/controls \(for RF\)](#) on page 8-22

## 5.10.9 System/Module Settings > Wi-Fi

These settings are currently not used.

## 5.11 Signature Capture

This feature allows you to capture a signature using the unit touchscreen. It is generally reserved for future use.

**NOTE:** This feature will not function correctly when operating the unit over remote control, even if the remote device has a touchscreen.

## 5.12 Language Selection

This function allows you to set the language used by the unit. Note the following:

- Language support is limited. Please contact Spirent for more information.
- On the unit, a language is represented by a special file that contains all the strings associated with that language. Optionally, you can download another language file to the unit, either to add a new language or update an existing language. This functionality is recommended for advanced users only, because the management of language files is complex with many considerations. For more information, please contact Spirent.

## 5.13 Help and Support

Launches the onboard help system, similar to pressing **Help** on the physical keypad.

## 5.14 System Information

This function provides basic information on current disk space usage. If the available disk space falls below 10%, the unit will start deleting result files automatically, oldest files first. File deletion occurs silently during unit shutdown.

## 5.15 Wizard GUI

Closes the “classic” view and launches the workflow interface. For more information, see [Introduction to the workflow interface](#) on page 2-1.

# Preliminary issue - Limited distribution only!

Tech-X Flex User Guide - Firmware v06.50

Tech-X Flex® (NG2)

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System