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Agilent Technologies Voice Quality Tester (VQT)

Getting Started Guide



Agilent Technologies

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[1] Note this exception: You can exchange Line Interface Modules with the power cable connected and power applied.

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Information Map

VQT devices and the measurements that run on them are described in these documents.

- This *Agilent VQT Getting Started Guide* describes the VQT software. Also see the online Help.
- The *VQT Network Server Setup Guide* describes the setup and use of the VQT Network Server device.
- The *VQT Portable Analyzer Setup Guide* describes the setup and use of the VQT Portable Analyzer device.
- The *VQT on the Agilent Advisor Setup Guide* describes the setup and use of VQT on the Advisor device.
- The *VQT Responder Setup Guide* describes the setup and use of the VQT Responder device.

To get started with any new VQT device, start with the appropriate Setup Guide to set up, install, and configure it for operation. Then use this document and the Help for detailed information about running VQT measurements and tools.

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1 Introduction

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The VQT software, used with one of the VQT devices, gives you analysis options for voice-over-packet (VoP) environments that traditional tests do not. See the following features:

- Access, manage, and run VQT tests from a remote location to test voice quality end-to-end across widely deployed voice networks.
- Test VoP network components such as routers, gateways, PBXs, and switches.
- Directly compare VoP quality with existing toll quality networks.
- Test VoP systems to gather end-to-end voice quality information.
- Augment other traditional telephony test suites such as Transmission Impairment Measurement Set (TIMS).
- Measure fundamental voice quality metrics such as clarity and delay.
- Measure echo, evaluate the performance of echo cancellers, and measure signal loss across voice circuits.
- Evaluate VoP operations such as voice activity detection and Dual Tone Multi-Frequency (DTMF) tone detection.
- Use audio test tools such as tone and noise generation and wave file playback and record.
- Execute simple or complex automated test sequences.

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The remote or distributed capabilities of the VQT software provide:

- A client/server architecture for centralized control across most TCP/IP networks.
- Flexible implementation options so that you can perform remote or distributed testing or stand-alone testing using the same equipment.
- Support for multiple hardware platforms.

The remaining sections of this chapter describe the VQT software, including the overall system architecture and some basic voice quality test concepts. To learn how to get started with the VQT software, go to Chapter 2. To see examples of how the VQT is used, go to Chapter 3. For detailed operating instructions, use the VQT software online Help. Go to “Information Map” on page 6 for a complete list of the VQT documentation.

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Overview of the Agilent VQT Test System

The information in this section is important to your understanding of how the VQT system works. Refer to the following sections for more information:

- "VQT System Components" on page 11
- "How the VQT Tests Voice Quality" on page 14

Information about voice quality testing in general is provided later in this document.

VQT System Components

The VQT system consists of two main components — the VQT test platforms and the VQT software.

VQT Test Platforms

The VQT system consists of several hardware platforms (also known as VQT servers):

- VQT Portable Analyzer - a powerful and rugged personal computer that offers full VQT functionality and is designed to act as the client or the server in a voice quality test scenario. This platform supports FXO, E&M, digital T1/E1, and digital 10/100 Ethernet interfaces.
- VQT Network Server - a headless rackmountable platform that offers full VQT functionality and is specifically designed to support widely deployed remote or distributed voice quality testing. This platform supports FXO, E&M, T1, E1, and 10/100 Ethernet interfaces.

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- VQT Responder - a low-cost, remotely controlled end point that provides call response, signal loopback, and wave file play and record. This device enables many voice quality measurements across FXO and 10/100 Ethernet interfaces when used in tandem with a VQT Portable Analyzer, Agilent Advisor, or VQT Network Server. In addition the VQT Responder can be configured in autonomous mode, which means no external connection to another VQT server. Refer to the *VQT Responder Setup Guide* for details.
- Advisor - Agilent's highly rated protocol analyzer that can be equipped with a VQT undercradle to provide analog FXO or E&M interfaces or a 10/100 Ethernet port (through its PCMCIA card slot) to provide full 10/100 Ethernet test capabilities.

Depending on the type, these platforms can be locally controlled using their own keyboards and monitors, or remotely controlled using another PC. Both the VQT Portable Analyzer and the Advisor can be used to remotely control other VQT test devices or be remotely controlled themselves. The VQT Responder and VQT Network Server must be remotely controlled. VQT servers are remotely controlled across an IP network by a controlling client PC (for example, a desktop or laptop PC or a VQT Portable Analyzer or Advisor).

NOTE The capabilities of a VQT server depend on its type and available test interfaces. Remote control is enabled using a client license key that is usually purchased separately.

VQT Software

The VQT software is a highly intuitive and an easy-to-use software package that is installed on one of the VQT devices. Depending on where it is installed and the testing you plan to perform, this application can be run as one or more clients, each controlling a VQT server, or as a server being controlled by a client. The VQT software enables you to manage and secure VQT servers and provides an individual

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client window to run each VQT server when performing remote or distributed testing. In addition, the application can be customized for your unique testing situations with user-configurable server scenarios, customizable TaskLists, and persistent configuration settings.

VQT Software for PC/Notebook Besides using the VQT software on the VQT Portable Analyzer, the VQT software can also be installed on your PC or notebook to perform active VoIP testing and measurements in 10/100 Ethernet environment. This allows greater flexibility and mobility in voice testing.

NOTE Before installation of the VQT software on PC or notebook, Agilent strongly recommends that you stop all processes, exit all programs, and disable anti-virus software running on your PC or notebook. It is also advisable to close all applications when running the VQT Software, for optimum voice testing performance.

The following are the recommended PC or notebook requirements for installing the VQT software:

- Operating System: Windows 98 SE, Windows NT 4.0 SP5, Windows 2000
- CPU: Pentium III, 1GHz
- Memory: 256 Mbytes
- Hard Disk Drive: 300 Mbytes available
- Screen Resolution: 1024x768

With the VQT software on your PC or notebook, you will be able to perform similar 10/100 Ethernet voice tests and measurements as on the VQT Portable Analyzer. For test setup and procedures, please see “Starting the VQT Software” on page 62.

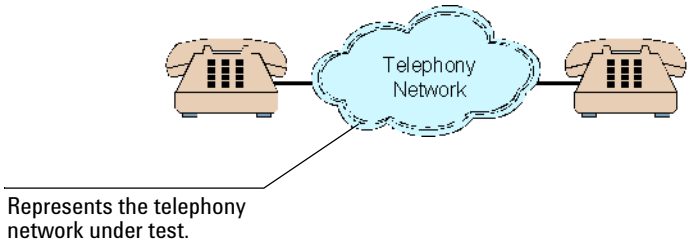
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How the VQT Tests Voice Quality

To test voice quality and measure other audio circuit characteristics, the VQT system does two things:

- It places and/or answers one or more telephone calls to establish voice connections. This voice connection (and the transmission media and equipment of which it is comprised) becomes the *network under test*. Think of the VQT system as telephones or other telephony devices positioned at the ends of voice circuits.



- Once the VQT system has established at least one telephone call, it transmits audio test signals onto that circuit and measures how those signals are affected by travel through the network under test. The VQT can send test signals in either direction on the voice circuit regardless of how that circuit was established.

For the VQT system to measure voice quality, it must control one or both ends of a voice circuit (depending on the type of measurement that is run) and be able to actively transmit specific test signals onto that circuit. In most cases, to perform the necessary analysis, the VQT system must also be able to receive test signals once they have passed through the circuit or system under test.

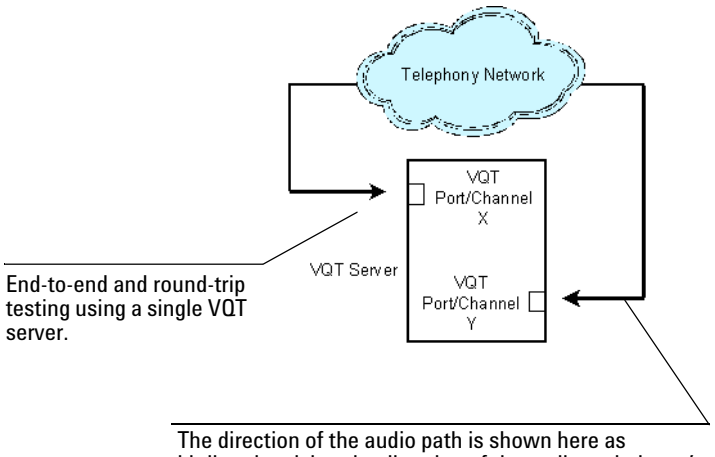
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VQT Call Modes

There are three ways the VQT system can access and place calls over the network under test. These call modes are described next.

1 The first call mode consists of a single VQT server that places a call from one of its ports or channels to another of its ports or channels (see figure below). In other words, the VQT server. controls both ends of the call.



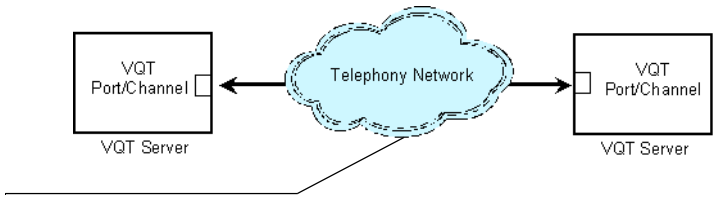
The above call mode is the most commonly used, providing more measurements than any other; however, it does require that both ends of the call be accessed by the same single VQT device.

The above call mode can be performed by a VQT Portable Analyzer, a VQT Network Server, and an Advisor with a VQT Undercradle.

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The above call mode cannot be performed by a VQT Responder or by any VQT server using a 10/100 Ethernet test interface.

2 Another call mode is one in which a VQT server places a call from one of its ports or channels to a port or channel on another VQT server (see figure below).



End-to-end and round-trip testing using two VQT servers.

The above call mode allows voice quality tests across circuits when the end points are physically remote from each other. This call mode usually requires that at least one of the VQT servers be remotely controlled.

The above call mode can be performed by any of the four VQT servers and across all interfaces; however, some VQT measurements are not supported in a two-server test environment.

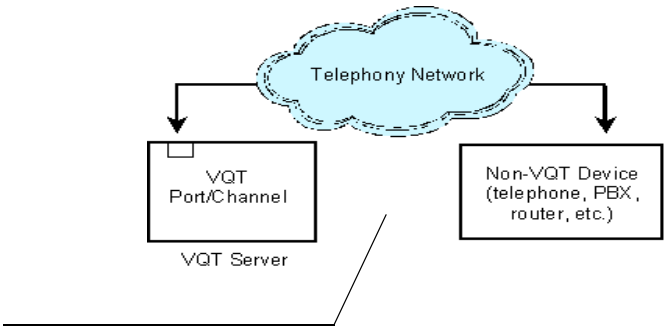
NOTE This call mode is preferred when using the 10/100 Ethernet test interface or when using the VQT Responder.

3 The third call mode is one in which a VQT server places a call to (or answers a call from) a non-VQT device such as a telephone, another test device, or other telephony

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equipment (see figure below). In this case, the VQT system controls only one end of the call.



Testing in which a VQT server controls only one end of the call.

The above call mode is the least commonly used, but it is supported by all VQT servers and across any VQT interfaces. Only a few VQT measurements are supported in this mode, but all of the VQT transmission tools can be used.

The diagrams in this section are presented from the perspective of a single call. Some VQT servers, however, can establish multiple calls simultaneously. The call modes and audio paths described here apply to each channel-to-channel connection. See the Help for additional information about call modes and audio paths.

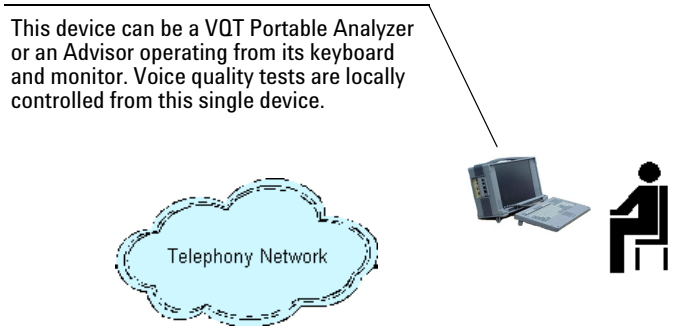
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VQT Control Modes

Another aspect of a VQT test system is how VQT servers are controlled. There are three control modes, and these are described next.

1 The first control mode is local control in which the VQT server's keyboard and monitor are used to operate the software and run voice quality measurements across the server's test interfaces. This control mode is only supported by the VQT Portable Analyzer and the Advisor.

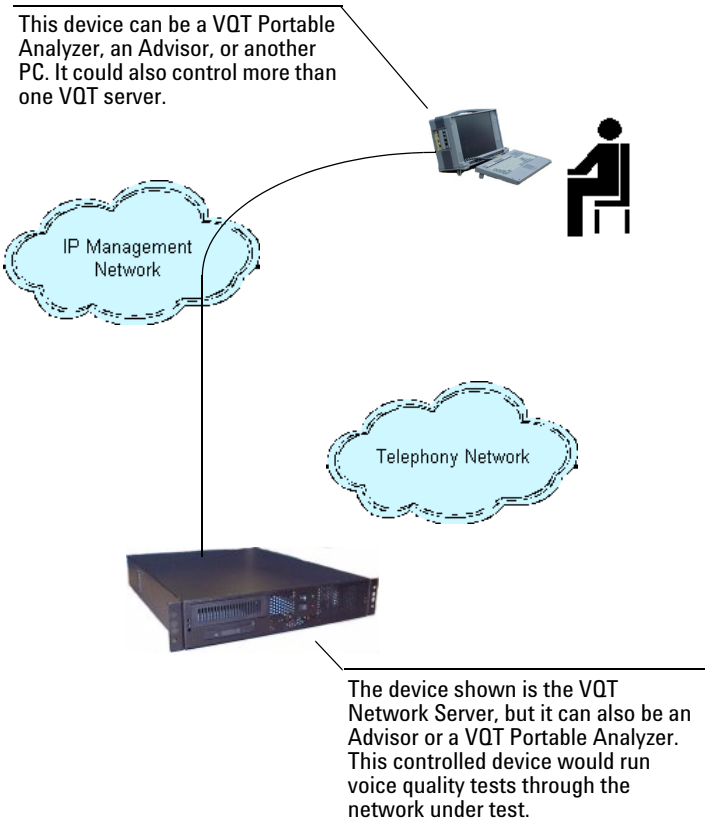


2 The second control mode is remote control in which the VQT server is accessed and controlled by a PC (that is, the controlling PC) running VQT client software. All four VQT servers can be remotely controlled, and both the Portable Analyzer and the Advisor can be controlling PCs as well. When performing voice quality testing using two

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VQT servers, remote control is required for at least one of the devices.

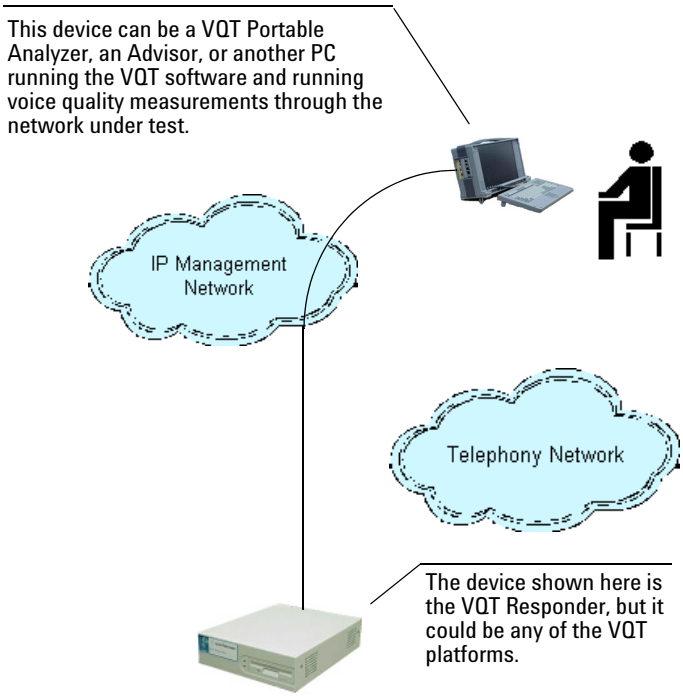


3 The third control mode is a combination of both local and remote control. This control mode is possible only when using a VQT Portable Analyzer or Advisor. For example, using the Portable Analyzer's keyboard and monitor, you

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can locally control its test interface ports and remotely control the test interface ports on another VQT device.



Whether a VQT server is locally controlled or remotely controlled is determined by how these servers are installed and configured and how you select servers in the Server Setup tool after you start the VQT software. Please see the individual *Setup Guides* for more information about setting up VQT servers. Please see Chapter 2 to learn more about using the Server Setup tool and the rest of the VQT software to locally and remotely control VQT servers.

VQT System Deployment Examples

As previously described, the VQT system uses a client/server architectural model that supports several testing options. You can run voice quality measurements using a single VQT

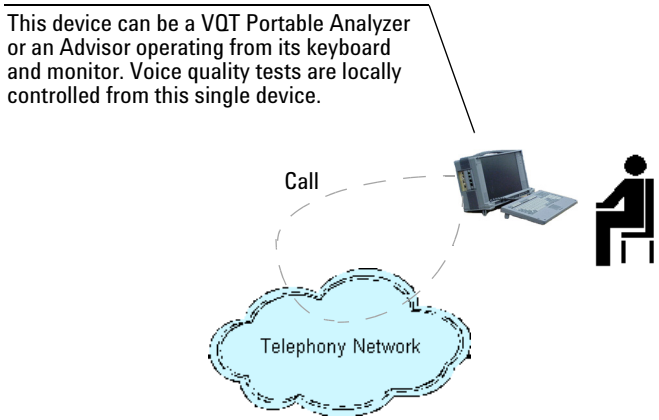
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server, or you can implement a collection of locally controlled or remotely controlled test servers to run measurements between each other.

Voice quality tests are run between the ports or channels on the test servers. As the diagrams below show, there is a distinction between the IP management network and the network under test, although they could be the same network depending on how the test is deployed.

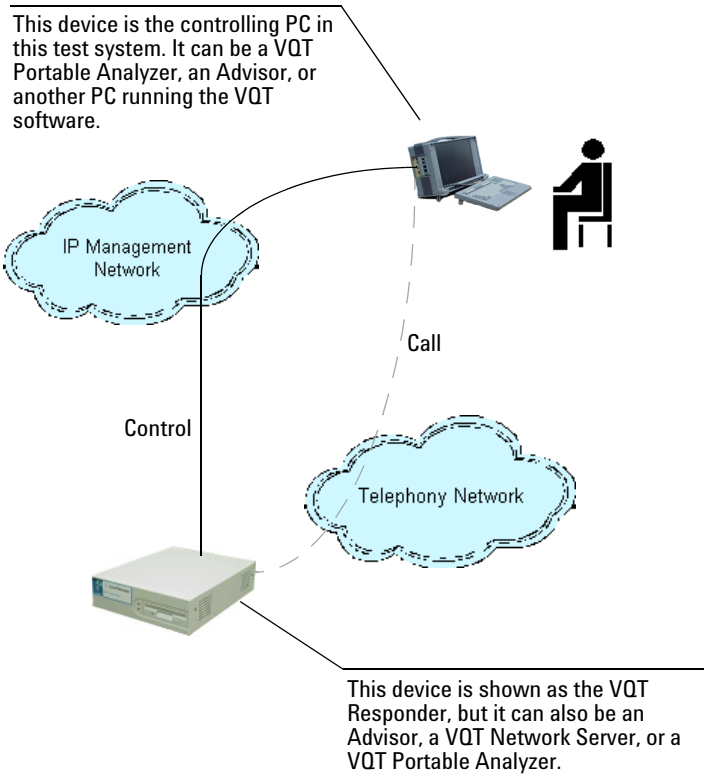
1 In the following diagram, a single, locally controlled device is running voice quality test measurements through the telephony network under test.



2 The following diagram shows another VQT test system example with a single, locally controlled device that is also controlling another VQT device. Voice quality test

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measurements are run between the VQT test devices through the telephony network under test.

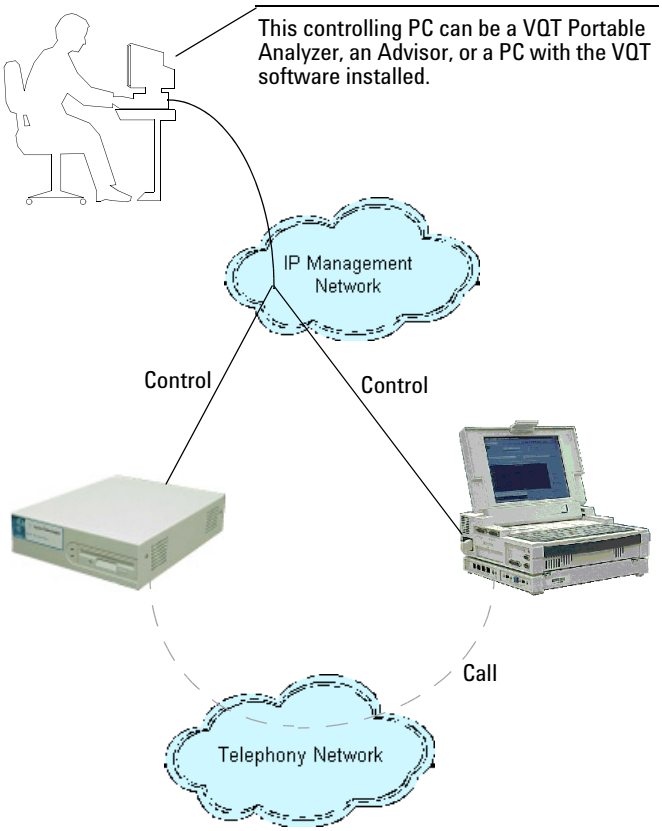


3 The following diagram shows another VQT test system example with two remotely controlled VQT devices

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running voice quality measurement tests between them through the telephony network under test.



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Additional Notes on the Operational Modes

The following are additional notes you should understand about the operational modes of the VQT system:

- New VQT Portable Analyzers and Advisors can be used in the local, single-server mode by default; however, remote control of a VQT server requires a client license that is purchased separately. Contact your Agilent sales representative for information.
- When controlling a VQT server from a PC, all interaction with the server is through the PC's client user interface.
- In a remote or distributed environment, you cannot run VQT measurements using the VQT server client windows without being connected to the controlled VQT device.
- Two controlling PCs cannot control a single server at the same time; however, a single, controlling PC can have up to four client windows open and running simultaneously.

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Overview of Voice Quality Testing

To better understand how and when the VQT is used, it is useful to understand why voice quality is a concern, the components of voice quality, and the general test approaches that can be used. This section provides information about why the VQT is used to test quality. In addition, this section includes a definition of voice quality and a discussion of voice quality test situations.

- "Why Test Voice Quality with the VQT?" on page 25
- "What is Voice Quality?" on page 26
- "What are Some Voice Quality Test Situations?" on page 28

See the Help for additional information regarding the concepts discussed in this section.

Why Test Voice Quality with the VQT?

Public switched telephone networks (PSTNs) have long since addressed the voice quality problem by optimizing their circuits for the dynamic range of the human voice and the rhythms of human conversation. Users have become accustomed to PSTN levels of voice quality, and comparisons are often made in this context; that is, voice quality is viewed as relatively standard and predictable. Significant technical changes are occurring in the telephony world that not only affect the quality of voice signals, but also make them more difficult to measure. VoP technologies, particularly Voice-over-IP (VoIP), have made maintaining voice quality more complex by adding non-linear compression and the need for timely packet delivery to networks not originally set up for these operations. Transmission conditions that pose little real threat to non-real-time data traffic can introduce severe problems to real-time packetized voice traffic. These conditions are:

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- Real-time Bandwidth — Many data networks are not designed for the real-time bandwidth requirements of speech. As voice signals are introduced into these networks, methods are employed to ensure this real-time transport, but voice quality can still suffer if these methods do not work properly. Bandwidth capacity can also be an issue. Although many service providers have adequate capacity to handle real-time voice traffic on their data networks, linear and non-linear voice compression techniques are still being used, particularly when voice is transmitted to the desktop. Non-linear compression can be a major cause of reduced voice quality.
- Packet Loss — Packet networks, particularly TCP/IP, rely on retransmissions for lost packets. Data applications such as file transfers and e-mail are less sensitive to the time it takes for this to occur, but real-time voice traffic cannot tolerate this delay. In addition, VoIP networks use connectionless transfer protocols such as User Datagram Protocol (UDP) that do not guarantee delivery at all. Lost packets mean lost voice information.
- Delay — The time it takes for a voice signal to be digitized, packetized, transmitted, routed, and buffered contributes to the delay experienced by a user. This delay can interfere with normal conversations and can exacerbate existing problems on the network such as echo.

What is Voice Quality?

Voice quality can best be expressed (and therefore measured) with respect to the talker and the listener who experience it. Voice quality should be approached from an end-to-end perspective. That is, regardless of the systems, devices, and transmission methods used, any voice quality metric should be expressed in the context of the user's experience. This implies very specific measurement criteria. But the end-to-end aspect of voice quality is accompanied by the inherent subjective nature of qualitative evaluation. What a listener considers high quality (or, for that matter,

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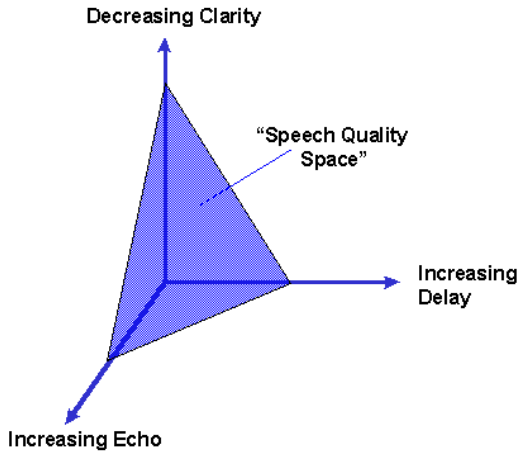
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low quality) is influenced by expectations, context, physiology, and mood. This makes defining and measuring voice quality an interesting challenge.

Ultimately, to measure voice quality, we need to understand the factors that contribute to it. In the context of VoP environments, a model that describes voice quality as the combined effect of three components is useful:

- Clarity — Audio fidelity, clearness, and lack of distortion.
- End-to-end delay — The time it takes voice signals to pass from talker to listener.
- Echo — The sound of the talker's voice returning to the talker's ear through the telephone.

See the following diagram:



The relationships between clarity, delay, and echo can be quite complex as shown in the three-dimensional figure above. If you think of voice quality as a single plotted point in the graph, you can see that voice quality improves as the point is plotted closer to the intersection of the three lines. In other words, as the distance between the voice quality point and the intersection increases, voice quality decreases.

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The illustration above is provided only as a conceptual model. It is true that voice quality is influenced by clarity, delay, and echo, and that their relationship is roughly represented by the graph; however, there is no clear mathematical relationship that allows us to derive a single voice quality measurement number. Any representation of voice quality, whether for individual devices, or VoP systems, should include at least a clarity and a delay component, and perhaps an echo component as well.

What are Some Voice Quality Test Situations?

VoP technologies, particularly VoIP, are maturing from the early development environments to wider deployment in the service provider and enterprise network environments. Voice quality measurement systems must span the various test situations represented by this evolution. For example, test systems must be able to easily measure single VoP devices, isolated systems, and VoP networks of limited deployment. Voice quality test systems must also be capable of measuring voice quality end-to-end across wide geographical regions and across full production voice networks.

As mentioned earlier, voice quality is dependent on the experience of the human talkers and listeners at the end points of the voice circuits. Therefore, voice quality test systems must be capable of evaluating voice quality from this perspective, particularly when the end points are not in the same physical location. The logistical challenge of any voice quality test system, then, is to be able to deploy test devices and applications in such a way as to satisfy test scenarios ranging from R&D labs to fully-deployed VoIP networks.

The Agilent VQT can be used in a number of test situations:

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- Telephony hardware and software development–The VQT can be used during hardware and software development to test voice quality on new devices and new implementations of VoP processes. For example, it may be useful to confirm prior to product release that codec implementations on voice gateways provide predictable PESQ, PSQM, or PAMS scores, and that measured delay is within acceptable ranges.
- Certifying New Network Deployment – Newly installed voice equipment and processes need to be tested to verify that they are providing the expected levels of voice quality and are integrating well with legacy systems. The VQT can be used to ensure that intersections between newly installed equipment and software from multiple vendors do not adversely affect voice quality.
- Network Baselining or Characterization – It is often necessary to measure the performance of deployed voice networks (with regard to voice quality) under normal operating conditions. This provides useful information that can be used when optimizing networks or when troubleshooting problems. The VQT system can be used to measure network performance for baselining and characterization of networks.
- Network Optimization – Operational networks can be fine-tuned to increase performance and reduce the possibility of failure. The VQT system can be used to identify areas of improvement on your network.
- Network Troubleshooting – Voice quality measurements are essential when identifying and addressing network impairments or operational problems. These problems can occur when traffic loads increase, network components are replaced, or when system components fail. The VQT system can be used to identify network problems before they affect your users.
- Proactive Monitoring – To find problems before they affect voice traffic, tests are performed at regular schedules across representative circuits. The VQT system is essential to ensuring your network is operating at its best.

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- Remote or Distributed test environments — On widely deployed voice networks, the end points of a telephone call are usually not in the same physical location. In addition, test personnel often require access to multiple test devices from a centralized location. A remotely controlled or distributed measurement system using the VQT can provide more convenient testing capabilities for R&D engineers and other technical personnel, or it can provide essential test functionality for those tasked with troubleshooting and maintaining fully deployed networks.

Please refer to the Help for more detailed descriptions of testing scenarios, testing in a remote or distributed environment, and voice quality in general. You can also find information in a number of Agilent white papers and application notes. Contact your Agilent sales representative for more information.

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Overview of VQT Measurements and Tools

This section provides an overview of the VQT measurements and the VQT tool features.

- "Measuring End-to-End Delay" on page 32
- "Measuring Voice Clarity" on page 33
- "Measuring the Perceived Annoyance Caused by Echo" on page 35
- "Measuring Echo in the Presence of Double-Talk" on page 36
- "Measuring Signal Loss" on page 37
- "Measuring Impulse Response" on page 39
- "Evaluating Voice Activity Detection" on page 40

In addition, some information about using the VQT software is provided in this section. See the following list:

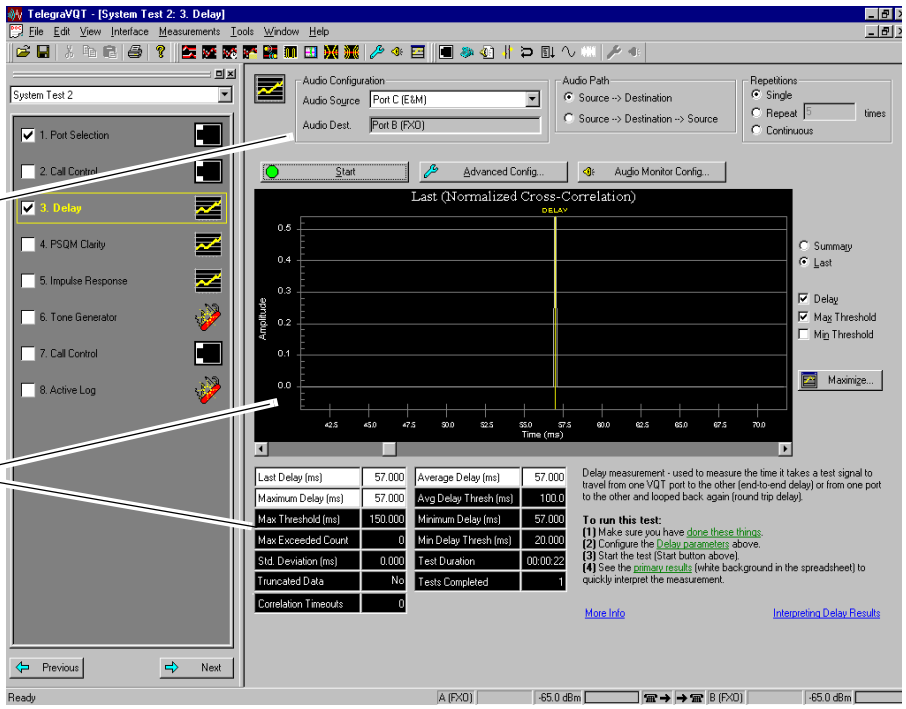
- "Using Other VQT Tools" on page 41
- "Using the VQT TaskList Navigator" on page 47
- "Automating Voice Quality Testing" on page 48
- "Using the Command Line Interface" on page 51

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Measuring End-to-End Delay

Measure the delay introduced by devices and systems

A major differentiating factor in VoP devices and systems is end-to-end delay (that is, the time it takes for voice signals to go from the talker to the listener). Delay is introduced as the voice signal is digitized, packetized, and transmitted. From a voice quality standpoint, delay can disrupt the rhythm of a conversation, and in extreme cases, delay can make conversations impossible. The VQT Delay measurement provides this end-to-end evaluation in both graphical and spreadsheet formats.



Configure the behavior of the measurement in the upper portion of the view.

View results in both graphical and spreadsheet formats.

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Measuring Voice Clarity

Measure the clarity of a particular voice channel using PESQ, PSQM, or PAMS

Another important voice quality metric is clarity. In the context of the VQT, clarity is the measure of the clearness, fidelity, and a lack of noise or distortion on a voice signal. In VoP environments, clarity can be affected by packet loss, noise, non-linear codec compression, and common analog signal degradation. To get objective, reliable, and repeatable measures of this subjective phenomena, the VQT Clarity measurement uses one of three analysis algorithms: Perceptual Evaluation of Speech Quality (PESQ), Perceptual Speech Quality Measure (PSQM), or Perceptual Analysis Measurement System (PAMS).

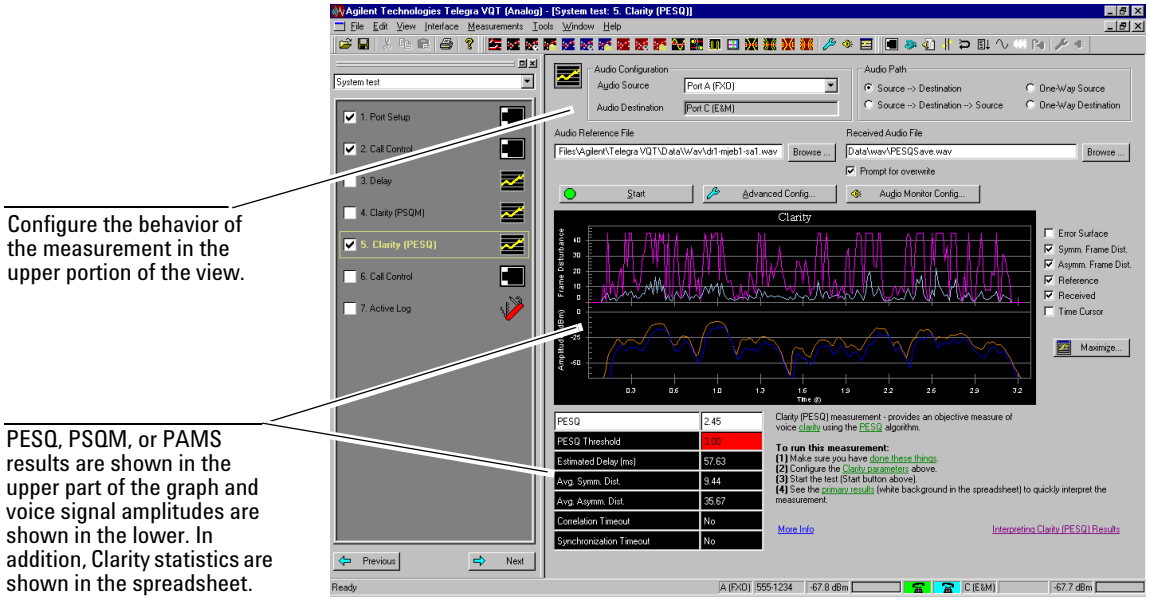
NOTE

The Clarity (PESQ), Clarity (PSQM), or Clarity (PAMS) measurements are separately licensed. Depending on the options you purchased, some measurements may not be available. Contact your Agilent sales representative to purchase measurement licenses.

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1 Introduction

The VQT provides multiple versions of clarity measurements, including one that can be performed in a distributed way (one-way clarity). Clarity (PESQ) is shown below and an example of Clarity (PSQM) is shown in Chapter 3.



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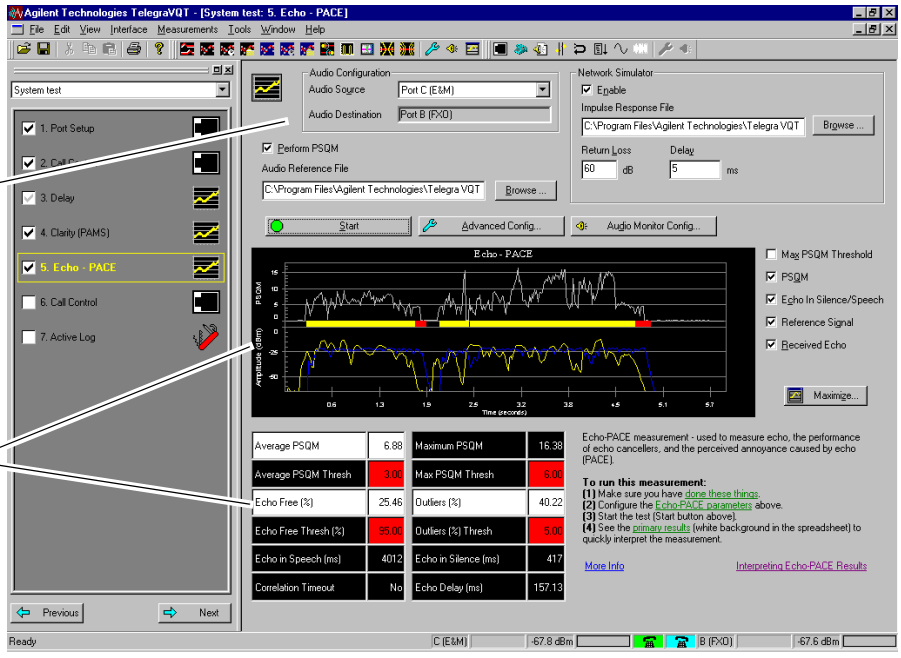
Measuring the Perceived Annoyance Caused by Echo

Measure the perceived annoyance caused by echo (PACE)

Echo is a potential problem in telephony networks that can be made worse when VoP technologies are introduced. The Echo-PACE measurement can help you measure echo characteristics, evaluate the performance of echo cancellers, and objectively quantify the perceived annoyance caused by echo (PACE). The Echo-PACE (PSQM) measurement provides various options including the use of PSQM and a network simulator to enhance the more traditional echo amplitude versus time measurement result. In addition, the Echo-PACE (PESQ) measurement provides similar results using PESQ. Measurement statistics are also displayed in a spreadsheet.

Configure the behavior of the measurement in the upper portion of the view.

The graph displays the amplitude of the test signal the returning echo, PSQM scores, and whether echo occurs during periods of speech or silence. In addition, numerical statistics are displayed in the spreadsheet.



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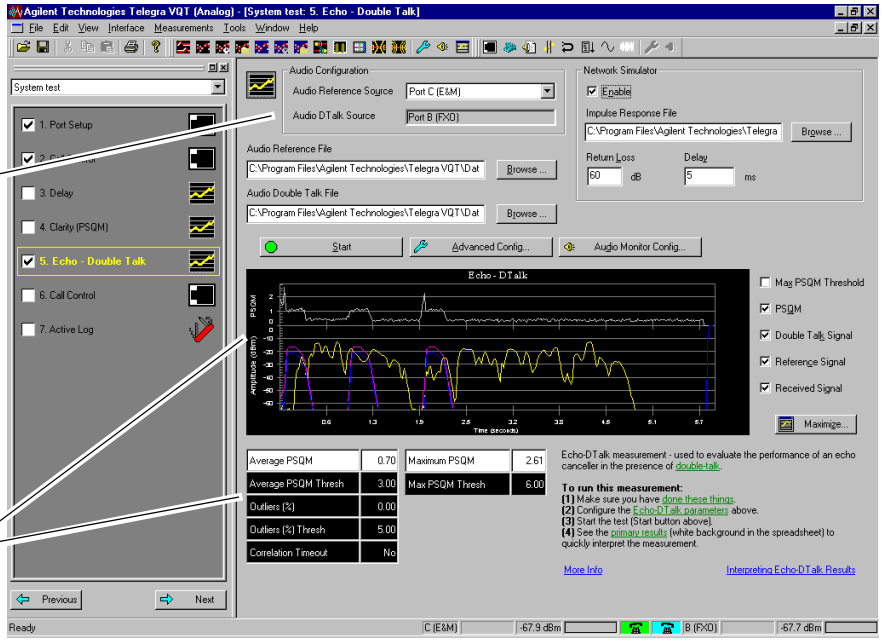
Measuring Echo in the Presence of Double-Talk

Measure echo in the presence of double-talk using PSQM and PESQ

Echo cancellation during double-talk is an interesting problem and a possible failure mode that can impact overall voice quality. You will use the Echo-DTalk measurement to evaluate the performance of an echo canceller in the presence of double-talk. The Echo-DTalk measurement can also help you objectively measure the level of perceptually important distortion in an interrupting voice signal as the echo canceller attempts to compensate for echo. The Echo-DTalk (PSQM) measurement does this using PSQM, and the Echo-DTalk (PESQ) measurement does this using PESQ.

Configure the behavior of the measurement in the upper portion of the view.

The graph displays the amplitude of the test signal and the interrupting DTalk signal. The resulting PSQM scores are also displayed.



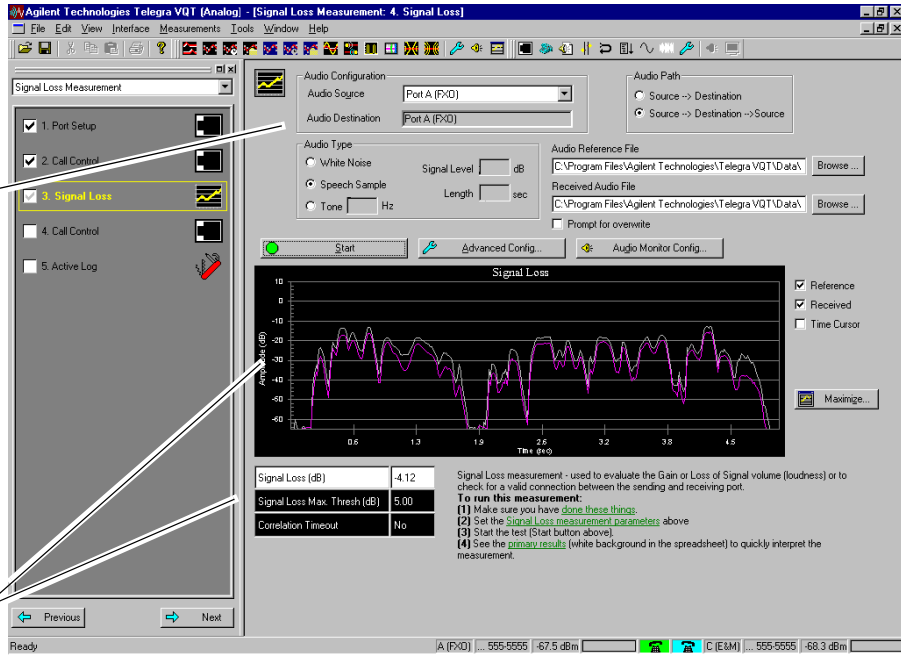
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Measuring Signal Loss

Measure attenuation or gain across a voice channel

Excessive signal attenuation or gain can have a significant impact on perceived voice quality. It can also affect voice circuit operations that depend on the reliable transmission of DTMF tones for signaling. You will use the Signal Loss measurement to evaluate the gain or loss behavior across a particular voice circuit or across a telephony device. Various test signals are available and measurement results are displayed in graphical and spreadsheet formats.



Configure the behavior of the measurement in the upper portion of the view.

The graph displays the amplitude of both the transmitted and received test signal. Mean gain and loss results are shown in the spreadsheet.

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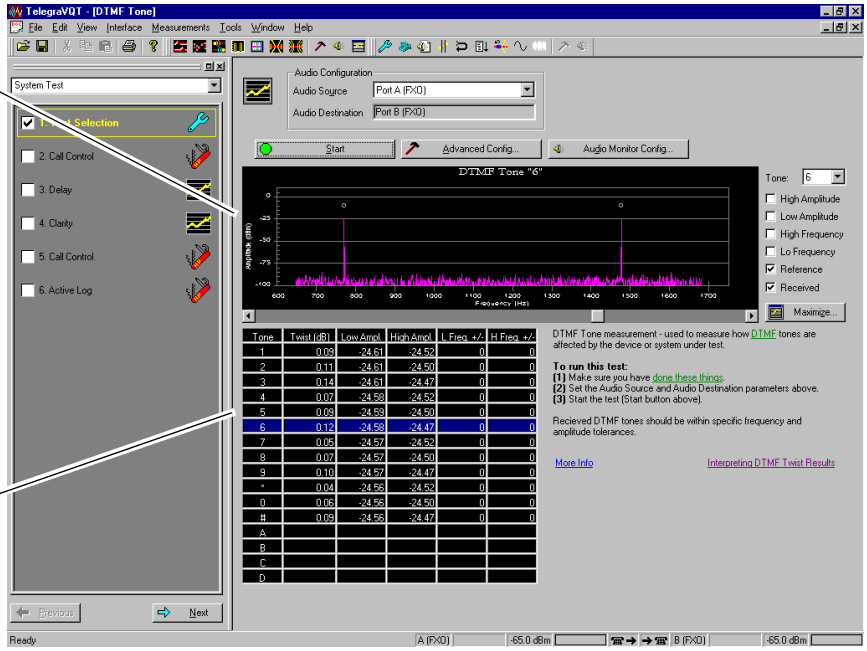
Measuring DTMF Tones

Evaluate the effect transmission has on DTMF tones

Use the DTMF Tone measurement to evaluate what happens to DTMF tones as they are transmitted through a telephony device or system. While this measurement is valuable in both a traditional and a VoP telephony environment, it is of particular value in situations where tone pairs are processed by low-bit-rate codecs on voice over IP networks. Because these codecs recreate the sound of an audio signal without necessarily recreating the waveform, tones could become distorted in frequency or amplitude.

Both the reference tones and the received tones are shown in the graph.

Twist, amplitude, and frequency statistics for each measured tone pair are shown in the spreadsheet.



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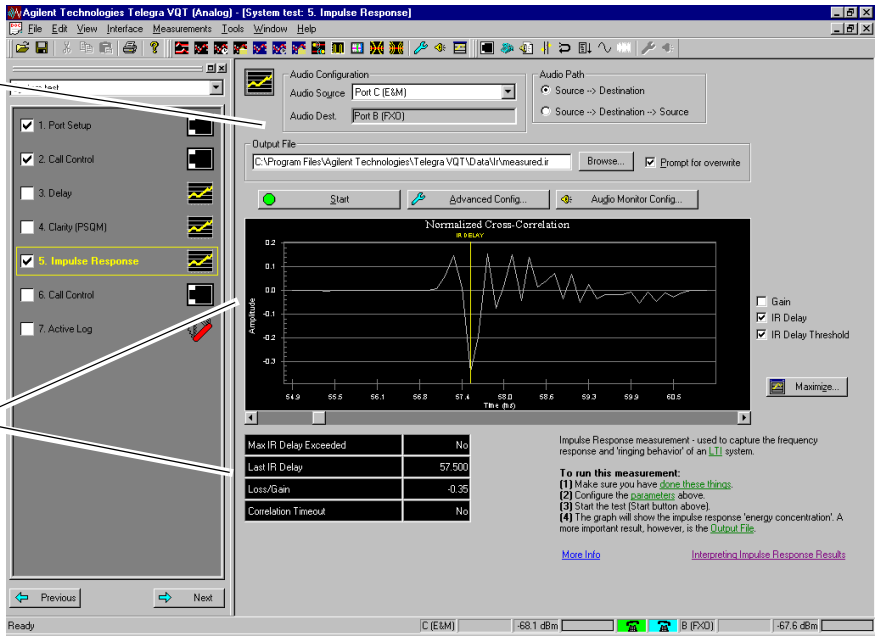
Measuring Impulse Response

Capture and use the impulse response of an audio channel

Use the Impulse Response measurement to characterize the input - output relationship of an LTI (linear and time-invariant) system. This is a very powerful measurement that can be used to capture the behavior of a specific audio channel so that you can later emulate it with the Network Simulator tool or other Digital System Processor (DSP) application. Impulse response measurements are often used by R&D engineers and test bed technicians to recreate a specific network behavior as part of other types of devices and system tests.

Configure the port on which the measurement is run and the file that will contain the resulting impulse response information.

The time-domain impulse response is shown in the graph, and measurement statistics are shown in the spreadsheet.



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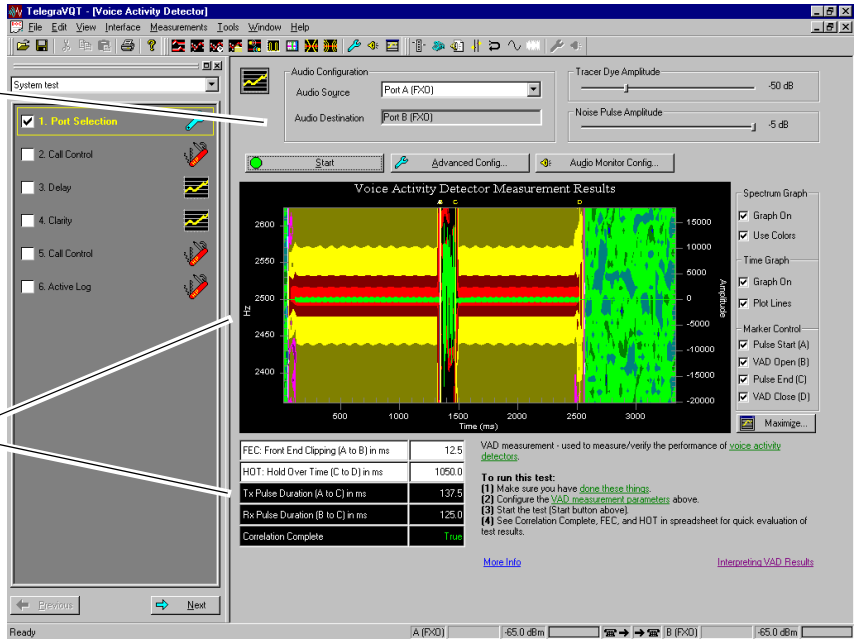
Evaluating Voice Activity Detection

Measure and verify VAD performance

Use the Voice Activity Detector (VAD) measurement to evaluate or verify the performance of voice activity detectors in gateways, routers, or other VoP devices. The VAD measurement calculates and displays front-end clipping (FEC) and hold-over time (HOT), and in some cases, can provide information related to comfort noise generation match.

Configure the path of the measurement and set the amplitudes for the test signal components.

The multi-dimensional graph shows spectrum, intensity, and time-domain information so you can see VAD activity. FEC and HOT and other statistics are also shown in the spreadsheet.



In addition to the voice quality and system component measurements described earlier, the VQT provides a number of versatile, multi-purpose tools that can enhance your testing capabilities. These tools are described in the next section.

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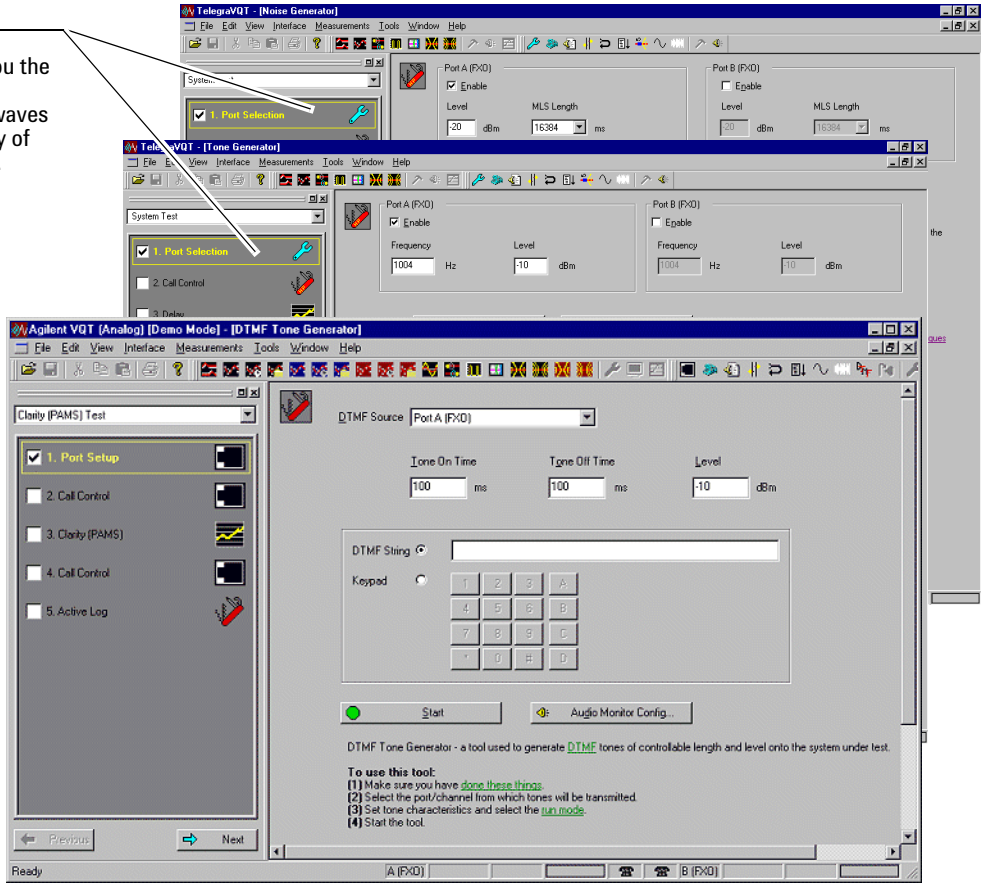
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Using Other VQT Tools

The VQT software provides additional testing tools including tone and noise generators, DTMF tones, file play and record, loop back, remote audio, logging, and more.

The Tone and Noise Generators and DTMF Tone Generator allow you to transmit audio signals onto the system under test. See the Help for additional information.

Tone and Noise Generation give you the ability to send controllable sine waves and noise from any of the selected ports.

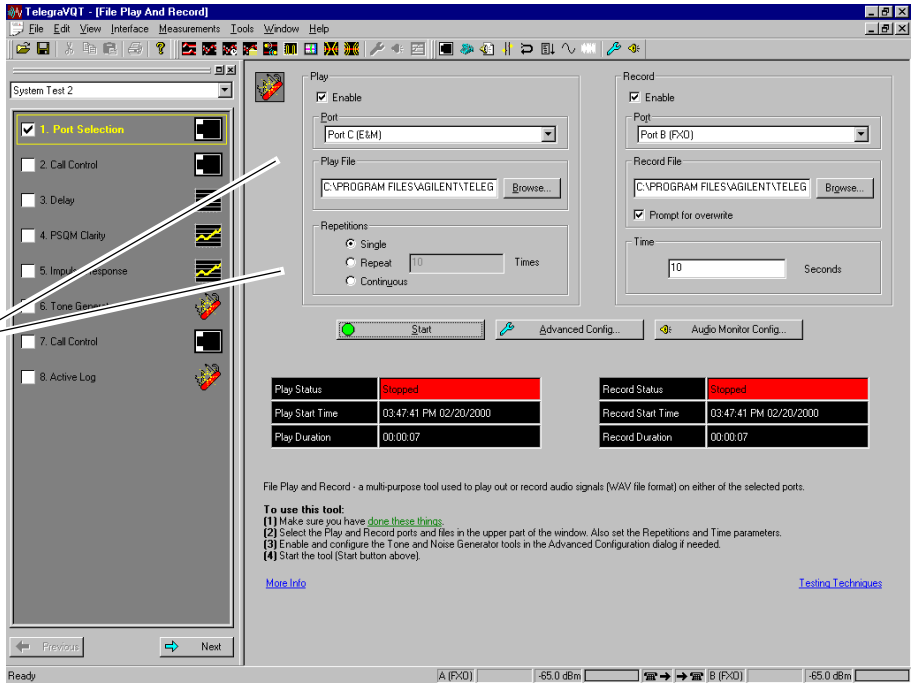


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1 Introduction

Play and record audio signals for testing

File play and record is a multi-purpose testing tool that allows you to record incoming audio signals to file (.wav format) and to play audio files (in .wav format) from either of the ports and/or on any connected channel. The file play and record is useful when creating files that are later analyzed using the Clarity File measurement.



File Play and Record allows you to send and record wave files for any testing purposes you can devise. You can also add tones and noise to file playback.

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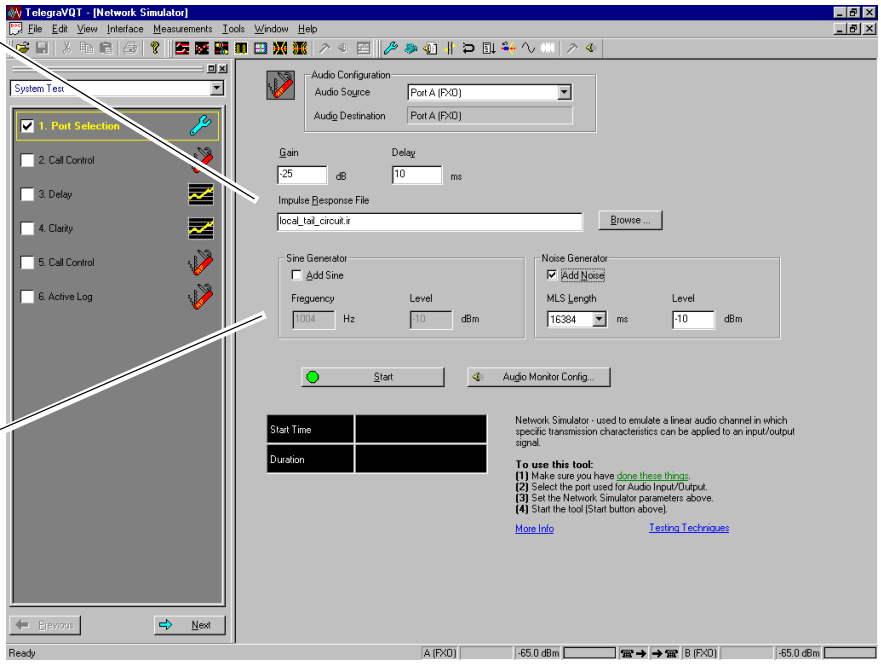
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Emulate audio channels with the Network Simulator

The Network Simulator provides audio channel emulation capabilities for those situations in which you need to alter an audio stream in some controllable way. Network Simulator is very often used to emulate tail circuits and linear audio channels that have very distinct frequency responses and delay or attenuation characteristics.

Set the parameters that will alter or influence the output audio signal.

Add a sine wave or noise to the output audio signal to enhance your testing.

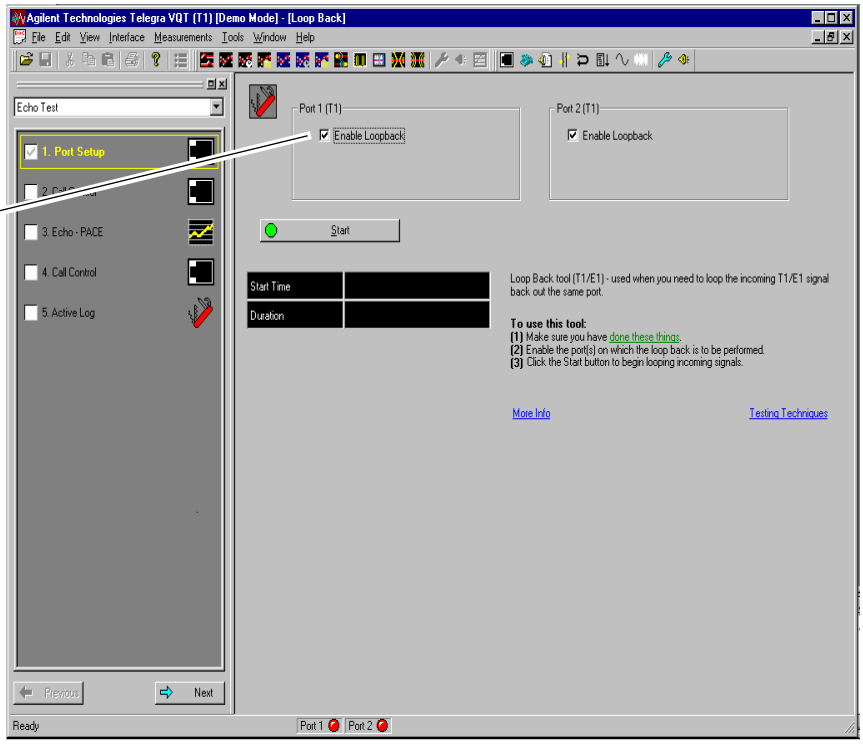


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1 Introduction

Re-route incoming signals with the Loop Back tool

With the Loop Back tool, you can re-route an incoming signal back out the same port or channel. This tool is useful when you need to perform single-ended tests with another VQT device or when you need a simple loop back for other test tasks.



Enable the port(s) on which the loop back will be performed.

There are two versions of the Loop Back tool, depending on the physical interface you are using. The Loop Back tool for the T1/E1 and 10/100 Ethernet environments works differently than the Loop Back tool for the analog environment. For further details, refer to the Help.

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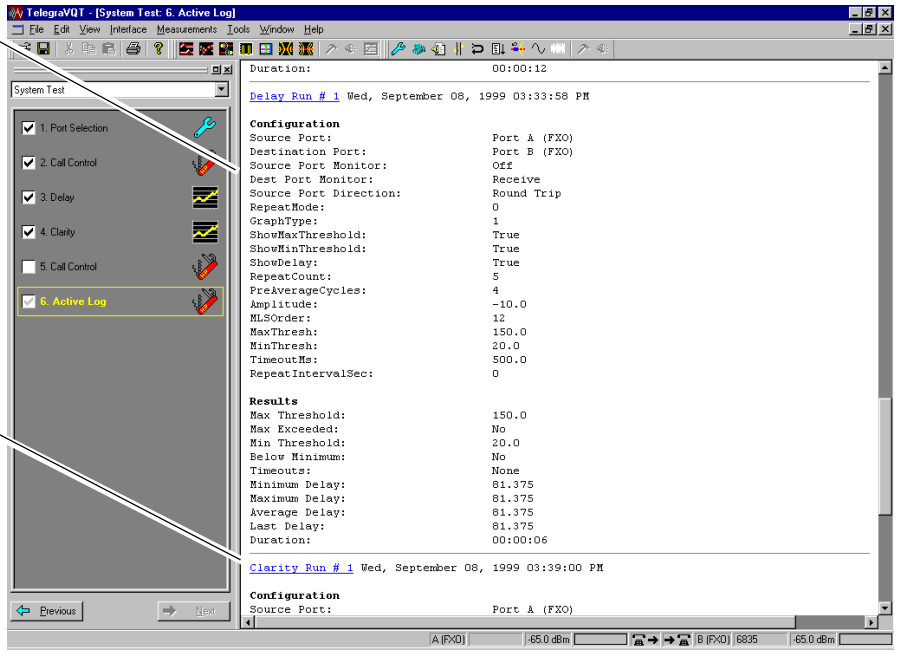
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Logging the measurements

The VQT automatically creates a log of all your configuration and measurement activity for each test. At any point during a test session, you can open the Active Log Viewer and see a record of your testing tasks. You can navigate directly from the log to view measurement results in the graph and spreadsheet of the measurement itself.

Configuration information and measurement statistics are logged in this easy-to-read format.

Click event hyperlinks to navigate directly to the tool or measurement used.

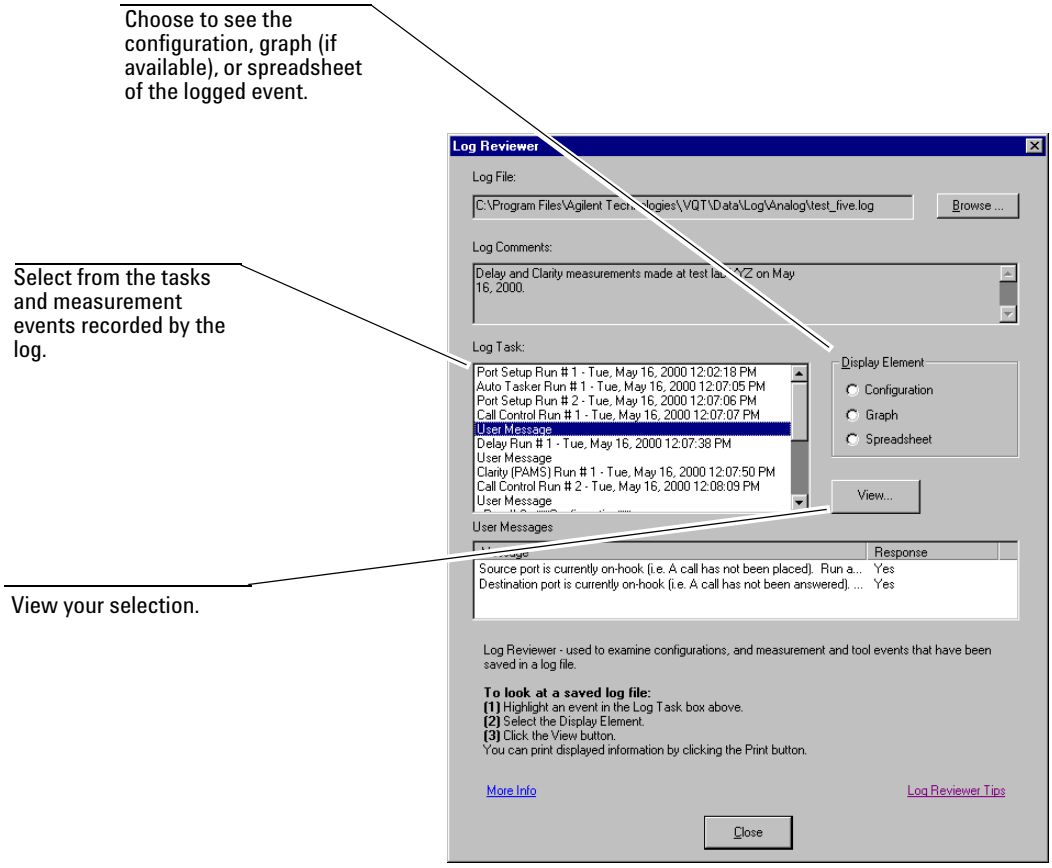


Once you have viewed the log, you can save it using the File menu. Opening and viewing saved log files is covered next.

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View and save your log files

With the File menu, you can open saved log files in the Log Reviewer dialog box. With the Log Reviewer, you can view the configuration, graph, or spreadsheet statistics in the context of the user interface in which it was set up or invoked.



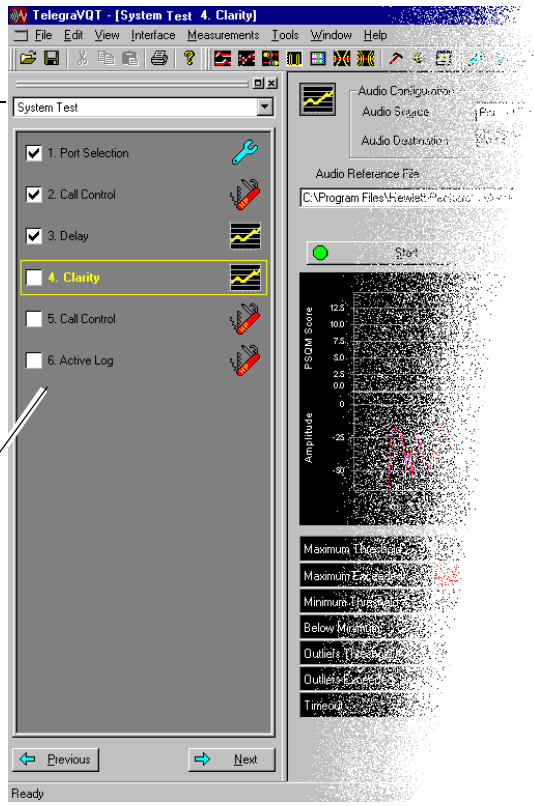
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Using the VQT TaskList Navigator

Set up and run tests using the TaskList Navigator

Initially located on the left side of the screen, the TaskList Navigator is a navigational aid that directs you through the necessary steps to set up and run voice quality tests. The TaskList Navigator is an excellent tool for new users, or for experienced users who want an easy way to repeat complex testing scenarios. The VQT ships with several useful TaskLists, but you can also create your own.



Select one of the TaskLists shipped with the VQT, or you can create and use one of your own.

The VQT measurements and tools are accessed by clicking on the tasks shown in the list. Check marks show the tools or measurements you have used or visited.

You are not required to use the TaskList Navigator to operate the VQT software. Once you are familiar with the testing process, you can remove it and access the

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measurements and tools using the menus and tool bars. See the Help for additional information and instructions about using the TaskList Navigator.

Automating Voice Quality Testing

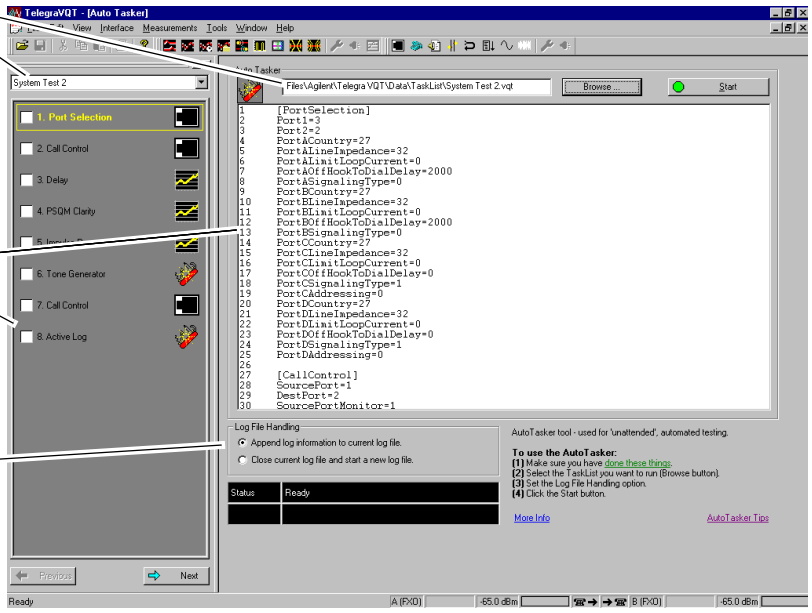
Run TaskLists and automatically collect measurement results

Voice quality testing, like most network testing, can be enhanced by automation. The ability to launch unattended test sequences has numerous advantages because data obtained in this way sheds light on device or system performance in ways that manual testing does not. The VQT AutoTasker tool allows you to automatically execute the steps shown in a TaskList when you need to run many measurements over extended periods of time, when you need to run tests at inconvenient hours, or when an inexperienced or extremely busy user needs to run a specific test sequence to produce a routine report.

When you select the TaskList you want the AutoTasker to run, it appears in the TaskList Navigator and the AutoTasker display.

As the TaskList is run, each task is highlighted so you can monitor the AutoTasker's progress.

Control how setup and measurement data is logged.



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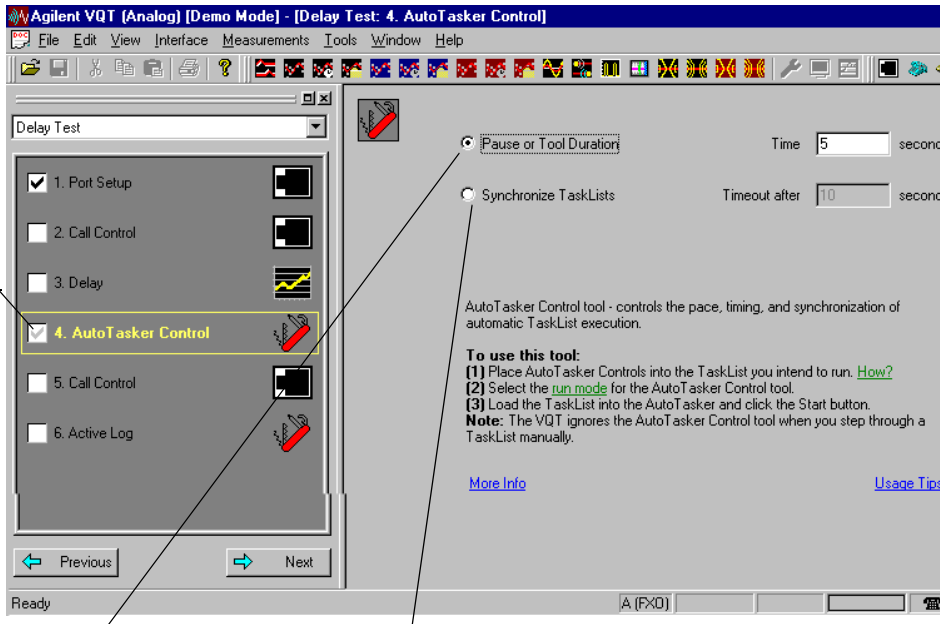
NOTE If you are running measurements continuously for more than 24 hours, Agilent strongly recommends using the Auto-Reboot option. See VQT Help for more details.

Since the AutoTasker tool controls only one VQT server, a TaskList that is intended to interact with another Tasklist (in another client window) must be carefully constructed, particularly when you are using the AutoTasker tool to synchronize TaskLists that will control different VQT servers.

Synchronize or pause your TaskLists for multiple VQT servers

The VQT AutoTasker tool controls the pace, timing, and synchronization of automatic TaskList execution. You can configure the AutoTasker to synchronize one TaskList with another. Two synchronize tasklist options are available: Out of Band or In Band. The Out of Band option is used with VQT servers that are remotely controlled on separate channels. The In Band option is required when a VQT Server is connected on the same channel with an autonomous VQT Responder.

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Click the AutoTasker tool in the TaskList Navigator to set the parameters.

The AutoTasker tool will either pause the AutoTasker or limit the run duration of some tools executed by the AutoTasker.

The AutoTasker tool will attempt to synchronize with another AutoTasker tool that is controlling another VQT server.

See the Help for complete instructions to automate your TaskLists and synchronize or pause your TaskLists.

In addition to using the VQT graphical user interface (GUI), you can also run VQT measurements and tools using the Windows command line. The command line interface is discussed next.

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Using the Command Line Interface

The VQT software provides a command line interface as an alternative to the Windows-based GUI. Essentially, the command line is another way to start and run the VQT's AutoTasker tool. The command line interface is a method of providing instructions to the VQT software using a command line prompt. Using the command line interface, you can start and run the VQT using another computer (such as a UNIX workstation), other applications (such as schedulers and other programmatic controls), and batch files.

The following methods can be used to start and operate the VQT using the command line interface:

- The explicit parameter method is used to start and run a single VQT server when you need to explicitly set multiple parameters.
- The scenario file method is used to start two VQT servers that will place calls and run voice quality measurements between them.
- The batch file method is used to repeat TaskLists numerous times, simplify the use of the explicit parameter method, or implement more advanced programmatic control of the VQT servers.

Each of these methods is explained in detail in the Help.

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1 Introduction

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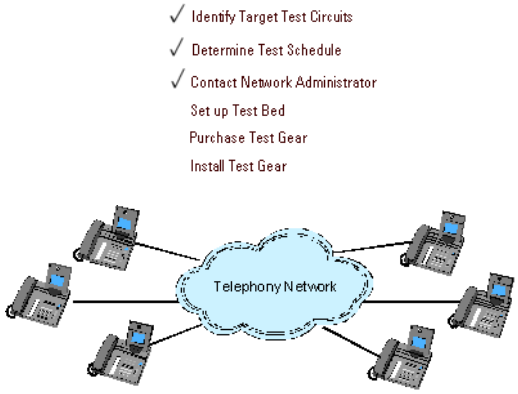
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Overview

This chapter describes the steps to start testing with the Agilent VQT system. The steps are summarized first and then described in more detail later in the chapter. Once you become more familiar with this powerful voice quality test tool, you can deviate from the procedures outlined here to suit your own test needs.

Step 1. Plan your network test strategy (see page 59).





VQT Devices

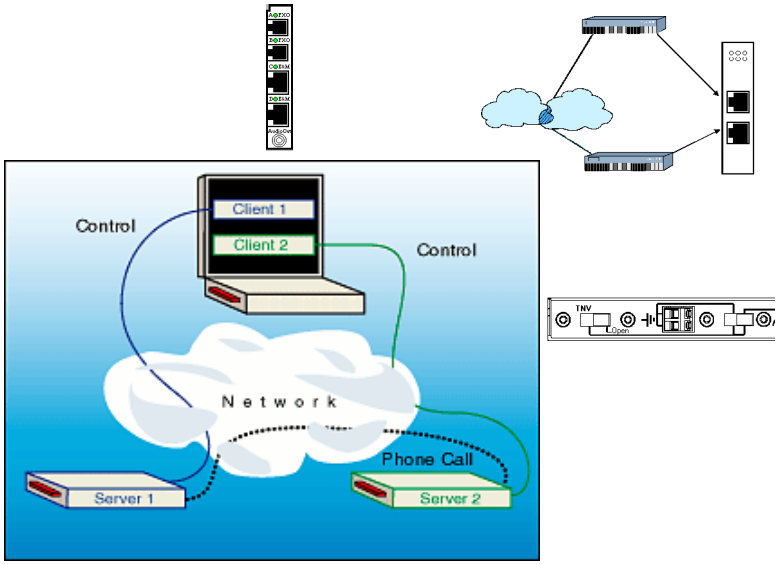


For additional information about setting up and running a specific VQT device, refer to the appropriate documentation listed in “Information Map” on page 6.

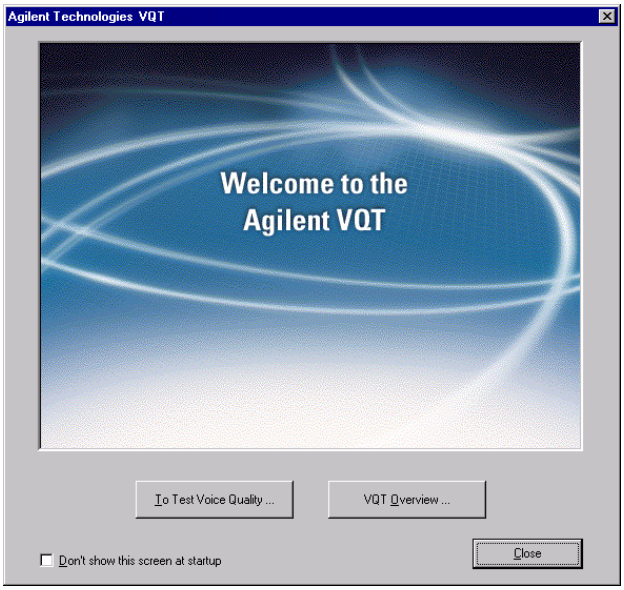
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Step 2. Set up, configure, connect, and enable the VQT system for operation (see page 61).

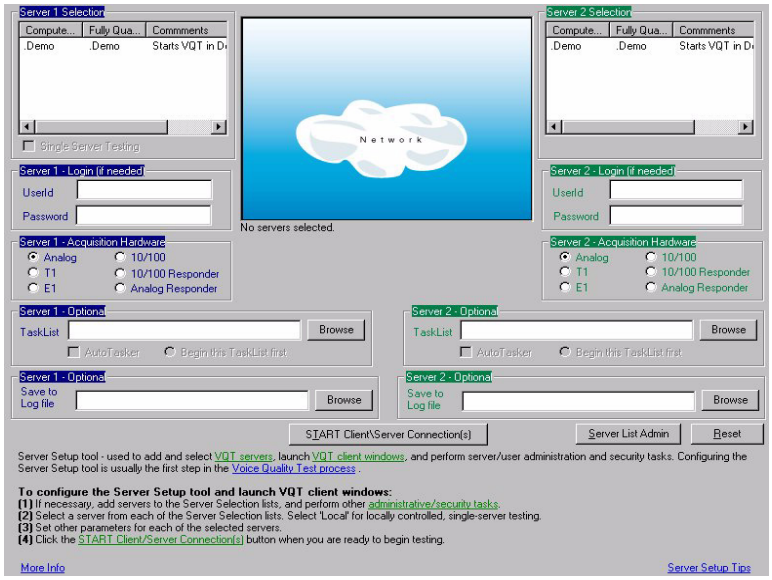


Step 3. Install the software and launch the VQT software (see page 62).

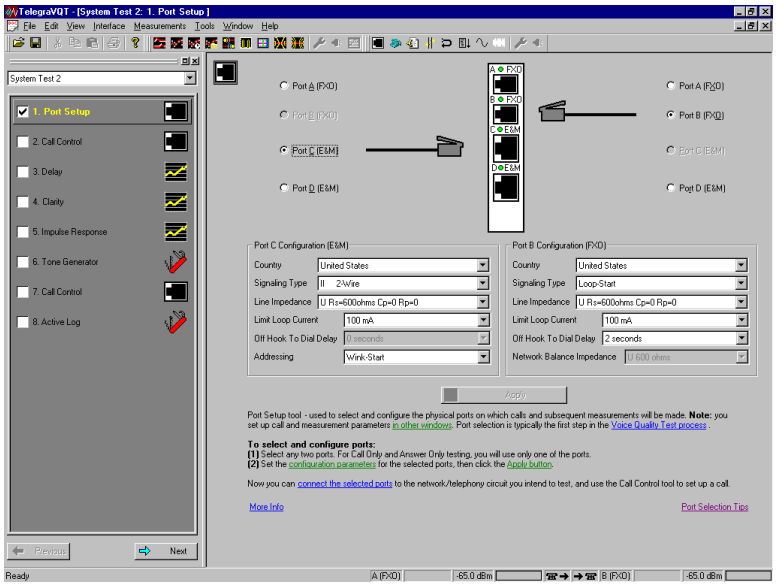


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Step 4. Add or select VQT servers for testing using the Server Setup tool (see page 66).



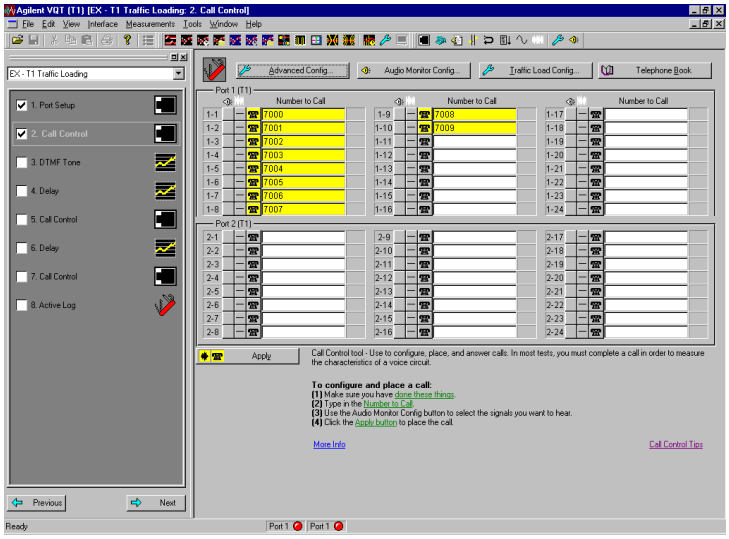
Step 5. Select and configure the physical ports in each client window for each VQT server using Port Setup (see page 73).



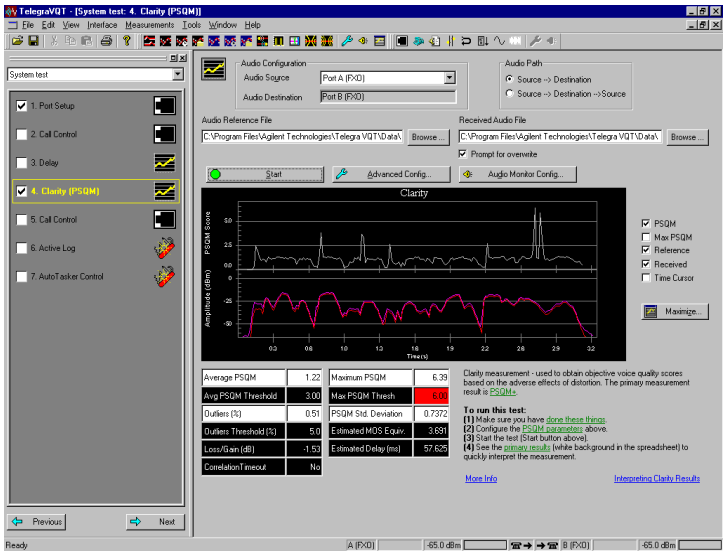
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Step 6. Place and answer calls using Call Control (see page 76).

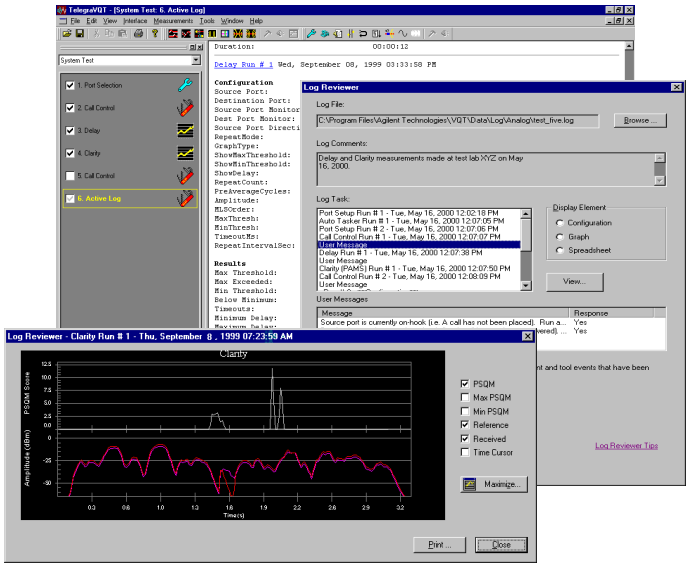


Step 7. Run a measurement or tool and view the results (see page 79).



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Step 8. View and save the log file created during the operation (see page 80).



The remaining sections of this chapter cover each of the previous high-level steps in more detail.

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Planning Your VQT Network Test Strategy

While you may have done some of the planning as part of your purchasing process, it is a good idea to spend some time reviewing how to deploy your VQT system. Consider the following:

- Testing Roles of VQT Equipment–As described in Chapter 1, the VQT Portable Analyzer and Advisor can be locally controlled or remotely controlled. The VQT Network Server and the VQT Responder can only be remotely controlled. All four devices can be remotely controlled by a networked laptop or desktop computer. How each device is used and the role that it plays in a larger VQT test system depends on its capabilities and how it is configured. You need to consider each VQT server's physical location, connections, and software configuration both initially and later as testing needs and roles change.
- IP Management Network vs. Network Under Test–Remember the distinction between the IP management network and the network under test. For remotely controlled VQT test equipment, or VQT devices that are used as controlling PCs, TCP/IP network connections need to be physically near the connections you make to the network under test. It is also possible that the management network and the network under test would be the same network. In addition, it may be necessary to work with network administrators when configuring and connecting VQT equipment to the IP network – You might need to obtain various permissions and IP addresses, and react to other network conditions.

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- Logistical Concerns–When performing remote or distributed testing, VQT devices will likely be installed in widely dispersed locations. For this reason, you will need to coordinate the installation and configuration of each component. For existing VQT equipment, software (and perhaps hardware) upgrades will need to be performed. For all involved equipment, IP connectivity will need to be configured and arranged, and server security will often need to be coordinated. Once the initial setup has been performed, IP and network under test connections will need to be verified. Keep in mind, that subsequent changes to configurations and software may have to be done on location, and should be allowed for in your network test planning.

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Setting Up Your VQT Test System

Setting up each of the VQT devices is slightly different depending on the device, but, in general, the setup consists of the following high-level steps:

- Installing the VQT software and performing hardware upgrades, if necessary
- Configuring the VQT server (Remember, a VQT server can be one of four devices depending on your configuration.)
- Connecting the VQT server to the IP management network
- Connecting the VQT server to a PC, laptop, or VQT device and the network under test

For specific information on setting up a particular VQT server, refer to the appropriate documentation listed in “Information Map” on page 6.

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Starting the VQT Software

How you start the VQT software depends on the device on which the application is installed and the role it plays in the VQT test system.

You can start the application by double-clicking the VQT icon on the Windows desktop:



NOTE

You must start a VQT Network Server or a VQT Responder from another device because these devices do not contain their own keyboard or monitor. These devices act as VQT servers in the VQT test system, so the server is automatically running when you start up these devices.

You can also use the Agilent VQT option in the Windows Start menu and choose one of the following:

Literature	Select this option to access the Agilent VQT Getting Started Guide (this guide) PDF.
Start VQT Server	Starts the VQT server for remote or distributed voice quality testing.
VQT	Starts the VQT client for voice quality testing. This is the same as double-clicking the VQT icon on a Windows desktop.
WavScale	Opens the WavScale utility used to scale the supplied VQT wave files to specific levels to better match your network's transmission characteristics.

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Once the VQT software is started, the VQT Welcome window appears:



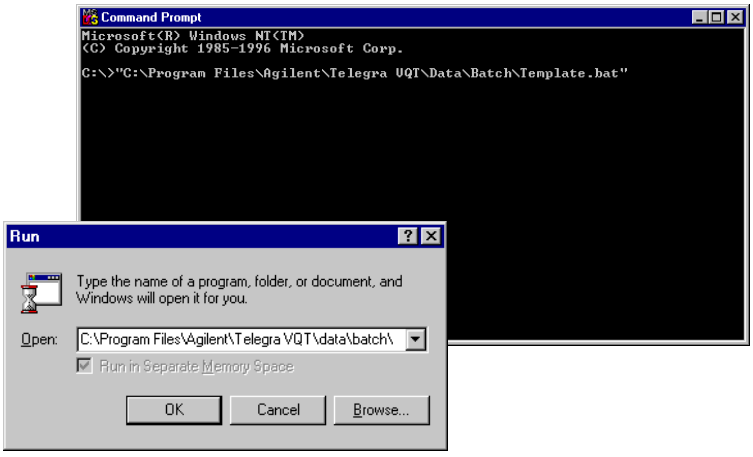
You can click the buttons to learn more about how to use the VQT, or you can close the window and start working with the application. If you close the Welcome window, the Server Setup tool appears. Using the Server Setup tool is discussed later.

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In addition to the above method, the VQT provides the following ways to start and run the AutoTasker tool using the command line interface:

- Explicit Parameter Method – used to start and run a single VQT server when you need to explicitly set multiple parameters.
- Scenario File Method – used to start two VQT servers that will place calls and run voice quality measurements between them.
- Batch File Method – used to repeat TaskLists numerous times, simplify the user of the explicit parameter method, or implement more advanced programmatic control of VQT servers. The VQT software is shipped with a batch file template you can use to build new batch file methods.



The complete instructions for starting the VQT using the command line interface are provided in the Help.

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License Information

Several license keys are required for full use of the VQT system. You can purchase separate VQT options, and you will be prompted by the VQT system to enter your license keys. See the following list for a description of the license keys:

- Clarity measurement license key – Clarity (PESQ, product number J1997A), Clarity (PAMS, product number J1982A), and Clarity (PSQM, product number J1983A) are measurements that are purchased and enabled as individual options within the VQT software for VQT Portable Analyzers, Advisors (with the 10/100 Ethernet NIC installed), and VQT Network Servers. To run voice quality tests over a 10/100 Ethernet network, you must have the Ethernet VoIP Interface license and at least one of the Clarity measurement licenses for each VQT device. Without at least one Clarity license, you can do limited 10/100 measurements. If you have previously purchased a clarity software license for each VQT device, you do not have to purchase an new one. Use the Enable Features dialog box to type in the software license keys.
- VQT Client license key – Remote control of VQT servers is an option that can be purchased for any VQT Portable Analyzer, Advisor, or desktop or laptop PC with the VQT software installed. To control VQT servers and test voice quality using the remote servers, you must enter the client license key using the File menu.
- Ethernet VoIP Interface License key– If the VQT server has not previously been enabled with a 10/100 license key, you will be prompted to enter the key when you start to run 10/100 voice quality test. The 10/100 license enables your VQT server to run 10/100 voice quality test measurements.

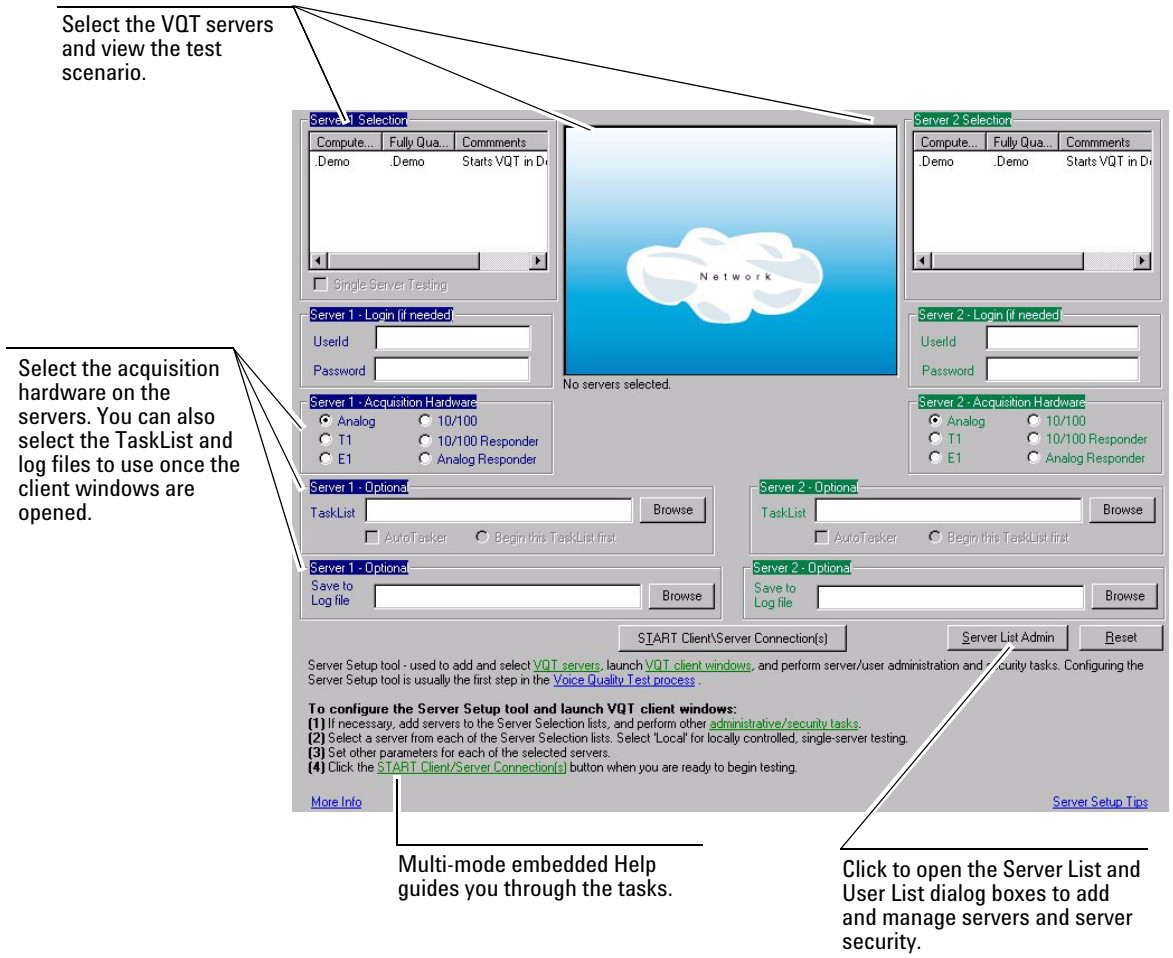
Each of the license keys is delivered with the product. See the product documentation for the license keys. Contact your Agilent sales representative if you do not have the license information you need. See the Help for information specific to typing the license keys in to the software.

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Using the Server Setup Tool

With the Server Setup tool, you can perform initial setup tasks related to local or remote, single-server and multiple-server, distributed voice quality testing. The selections you make in this tool will determine the type of testing you will perform.



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Note the following about using the Server Setup tool:

- For local, single-device testing, you can select the Local option in the first server list and then select the Single Server Testing checkbox. Using this combination, you can perform voice quality testing using your local machine as a single-device test system.
- Before you can connect to a remote server to run voice quality tests, you will need to enter your client license key. Select Client License Key from the File menu to do this. This numerical key is delivered with the VQT's system literature.
- If you are going to use the remote or distributed testing, the first time you start the VQT software, you need to add VQT servers using the Server List Admin dialog box from the Setup Server tool.
- Once you make your selections and click the START Client/Server Connection(s) button, either one or two client windows will appear depending on your configuration. You can use Alt-Tab to move between the client windows.
- You can see which server each client window is associated with by looking at the status bar at the bottom of the screen.
- The first time you configure the Server Setup tool and open client windows, you are prompted for your PESQ, PAMS, and/or PSQM software license keys. You will find the key in the literature delivered with the product. Although you will be prompted for this information only once, you will have to enter it for each VQT server on which Clarity (PESQ), Clarity (PAMS), and/or Clarity (PSQM) measurement is to be run. Using the Enable Features option in the File menu, type the license key in the Key Entry dialog box.

From the Server Setup tool, you can open a number of dialog boxes that allow you to add and manage servers, and set up server security. These features are described next.

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Click the Server List Admin button on the Server Setup tool

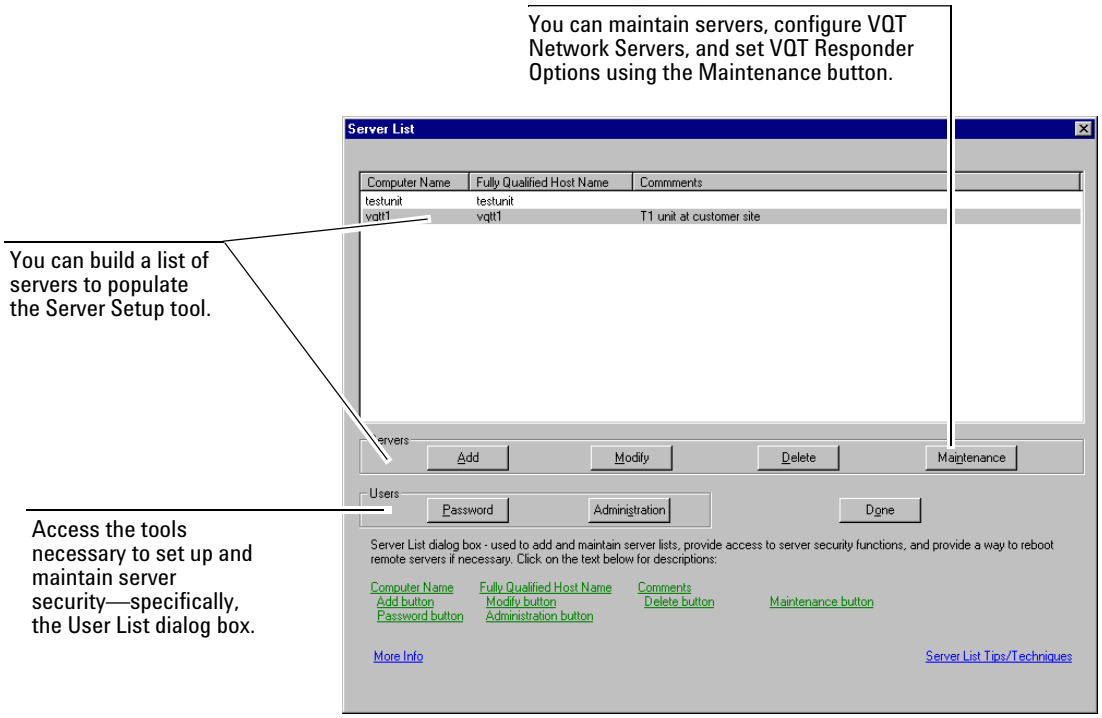
With the Server List dialog box, you can add, modify, and delete VQT servers that are shown in the Server Setup tool, and to access the dialog boxes you use to set up and maintain server security. From the Server List dialog box, you can click Maintenance and update the VQT software on the headless VQT devices, the VQT Network Server, and the VQT Responder. In addition, you can configure the VQT Responder to be an automated analog Responder or an automated 10/100 Responder. See the *VQT Responder Setup Guide* for details.

NOTE

If you are doing locally controlled, single-server testing with a VQT Portable Analyzer or the Advisor, you do not need to do this step. Instead, on the Setup Server tool you can select Local, select the acquisition hardware, and click Start to begin your testing.

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In the Users portion of the Server List dialog box, you can click the Password or Administration buttons to access the User List dialog box which is described next.

Use the User List dialog box

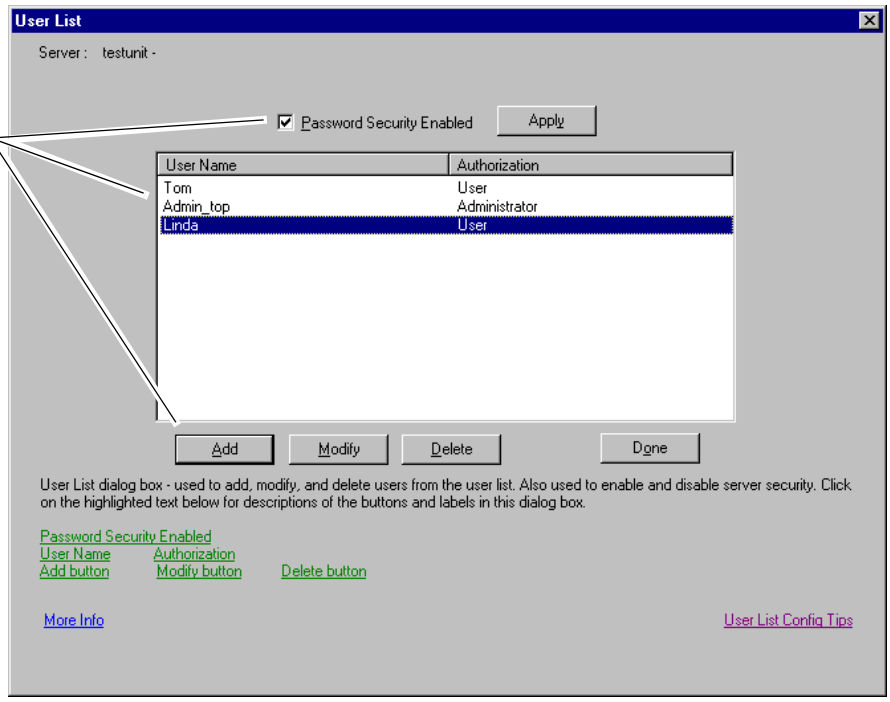
With the User List dialog box, you can specify and manage users, administrators, and password security for the selected VQT server. This dialog box lets you limit or control the

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access to VQT servers when controlling test access is important, such as when test equipment is connected to live voice networks.

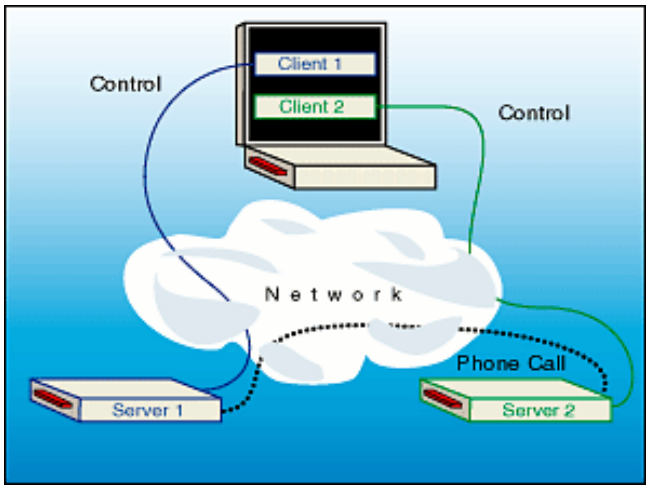
Using this dialog box, you can control server security and create lists of users and administrators who can access servers.



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Once you have added servers, selected them in the Server Setup tool, and configured other aspects of your test scenario, you close the Server Setup tool and open the individual client windows that control each of the selected servers. Consider the test scenario shown below.

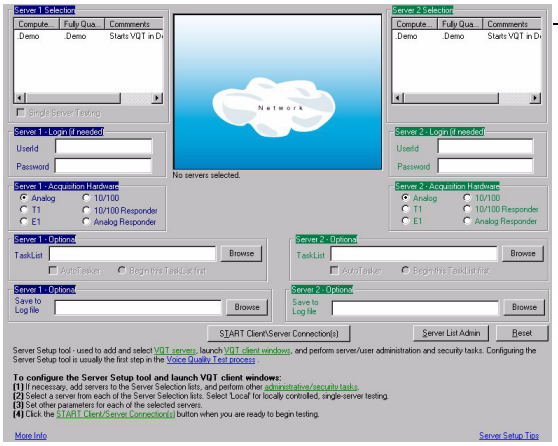


The illustration shows that two remote servers will be controlled by a PC running client software. Remember that the PC and the servers could be VQT Portable Analyzers or Advisors. The controlling PC itself could be a VQT Portable Analyzer, an Advisor, or a desktop or laptop PC. Once an IP connection is established between the controlling PC and the servers, you can place calls between the servers to run measurements and tools.

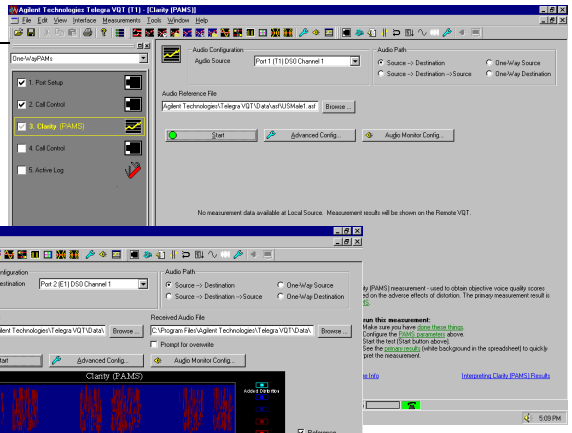
If you are using only one server (for example, if you select local in the Server List or use a single, remotely controlled server), a single client window will open.

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The following diagram shows conceptually how you would interact with the VQT user interface to set up and perform the above scenario.

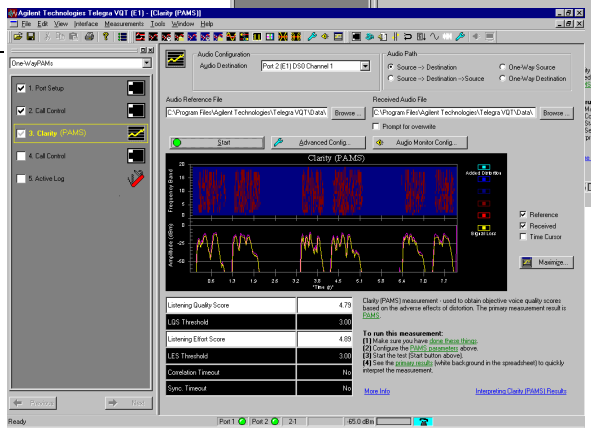


Using the Server Setup tool on the controlling PC, select the servers and set the parameters. When you are ready to run measurements, click the START button to close the Server Setup tool and open a client window for each server.



Client window for server 1

Client window for server 2



The client window for each server is displayed on the controlling PC. You interact with each window independently to control the server's behavior. Use Alt-Tab to move between the client windows.

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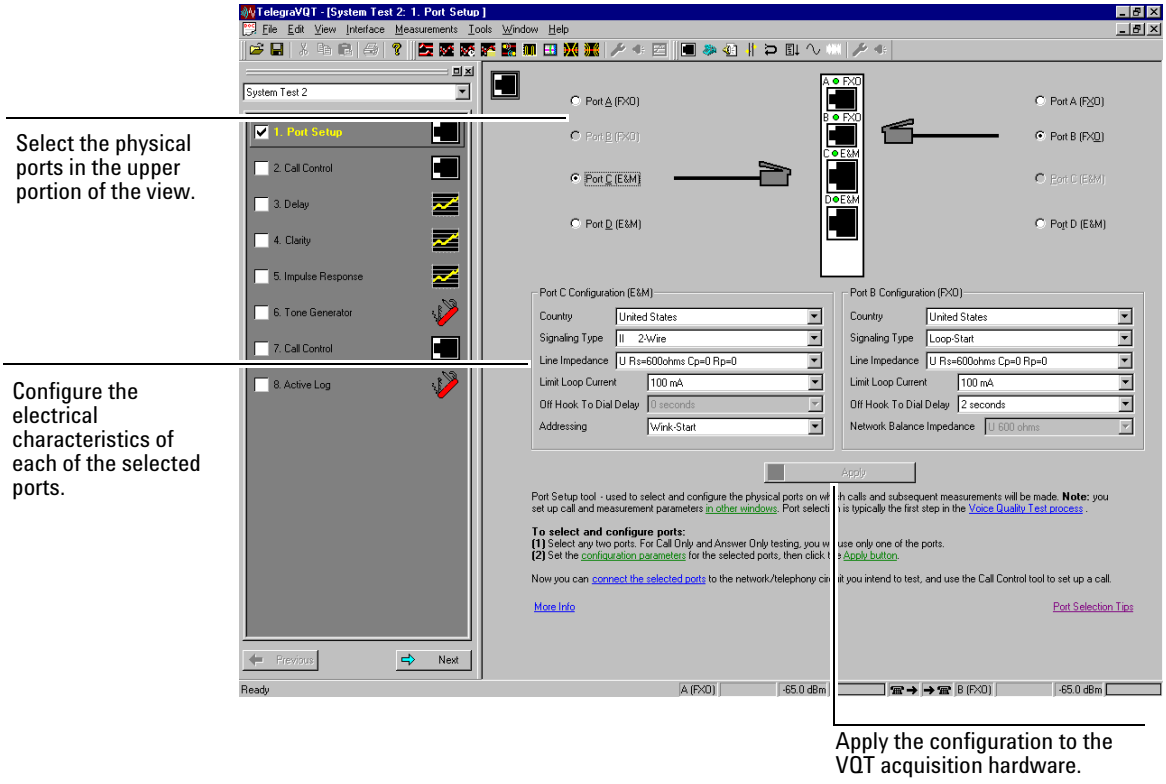
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Selecting and Configuring Ports

Before you can place a call between ports or channels on a single server or between servers, you must select and/or configure the physical ports of each server with which you plan to test. You do this in the Port Setup tool of the client window associated with each server. See the Help for FXO and E&M wiring and pinouts and more information about FXO and E&M connections in general.

FXO and E&M Environments

Selecting and configuring ports is one of the first steps in real-time voice quality testing with the VQT in an analog environment. This is accomplished in the Port Setup tool.



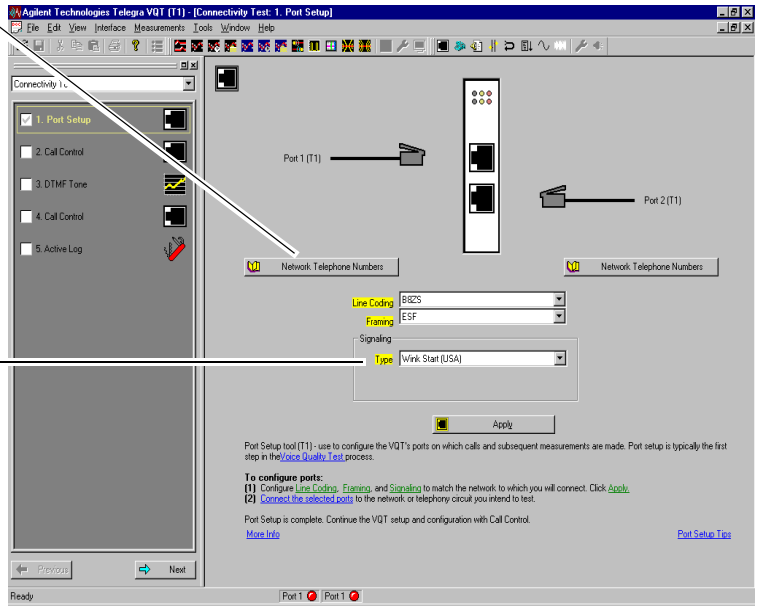
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For both FXO and E&M and T1 and E1 interfaces, the electrical state of the VQT ports affects telephony network operation. Therefore, it is a good idea to know the electrical and protocol characteristics of the network you connect to, and make sure the Port Setup parameters match these characteristics.

T1 and E1 Environments

In almost all cases, configuring the physical ports is one of the first steps in the T1 and E1 voice quality test process. This is accomplished in the Port Setup tool. See the Help for T1 and E1 wiring and pinouts and on more information about T1 and E1 connections in general.

Click to create, add, and maintain a list of telephone numbers specifically associated with the T1 or E1 channels on your network. You can have different telephone directories for each VQT port.



Configure Line Coding, Framing, and Signaling.

Make sure that the port setup is consistent with your network setup. Failure to configure the ports prior to network connectivity may adversely effect network operation.

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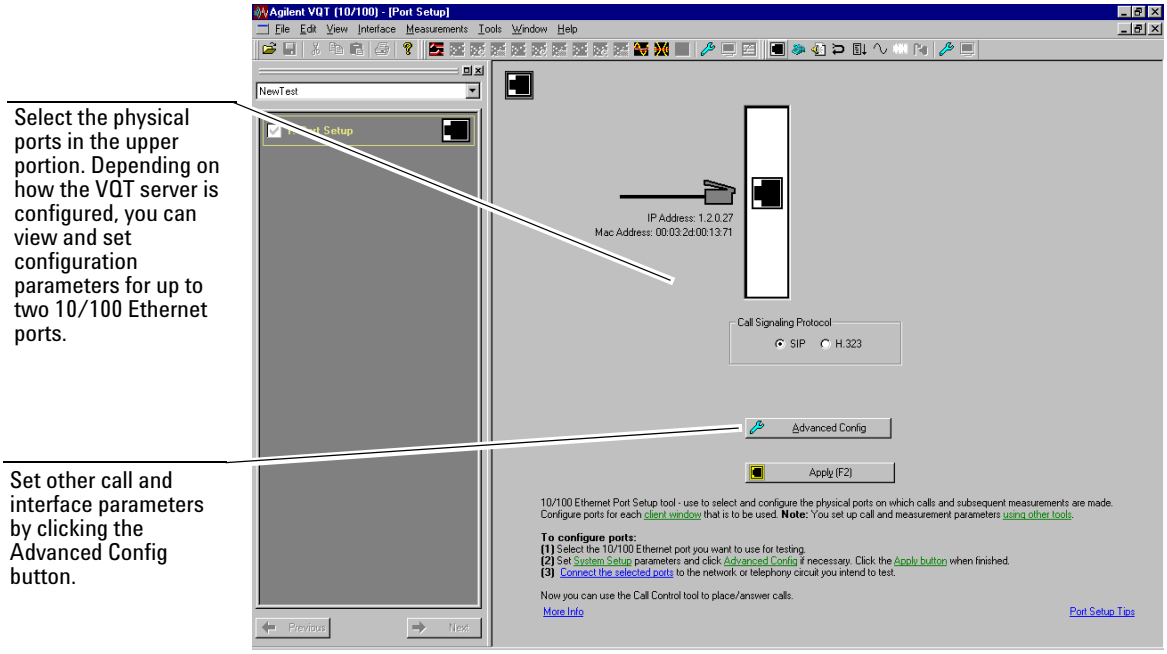
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10/100 Ethernet Environments

Configuring the physical ports for the 10/100 Ethernet environment voice quality testing is one of the first steps in the process. This is accomplished using the Port Setup tool. Under certain conditions, a single NIC will appear in the 10/100 Port Setup tool (as shown in the diagram):

- Using an Advisor, a single NIC will appear in the 10/100 Port Setup tool.
- Using the VQT Portable Analyzer, a single NIC will appear in the 10/100 Port Setup tool if you choose not to install the PCMCIA.

Using the Port Setup tool, you will select the 10/100 Ethernet port on which you want to place a call and run measurements or tools.



You can now go to the 10/100 Ethernet Call Control tool to place or answer the call on which VQT measurements and tools can be run.

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Using Call Control

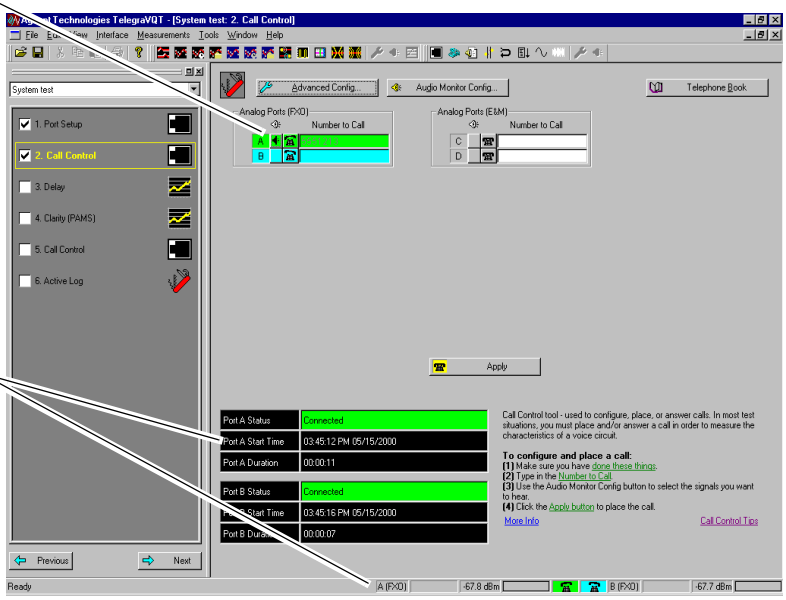
Once you have selected and configured the physical ports, you need to establish the test circuit. That is, you need to place and/or answer one or more calls. If you are performing single-server testing, you can place and answer calls in the same client window. If you are performing multiple-server testing, however, you can place calls from ports or channels in one client window to ports or channels in another.

FXO and E&M Environments

In the FXO and E&M environments, you use the Call Control tool to place and/or answer a call on any of the VQT selected and configured ports. In the analog environment, you can place one call at a time. Not only can you test end-to-end voice quality with the VQT (port-to-port through the system under test), you can also perform tests that are call-only or answer-only. See the Help for details.

Select the calling port, type in the destination telephone number, and set other aspects of call setup and termination.

Monitor the status of the call in the status indicators and the status bar of the application.



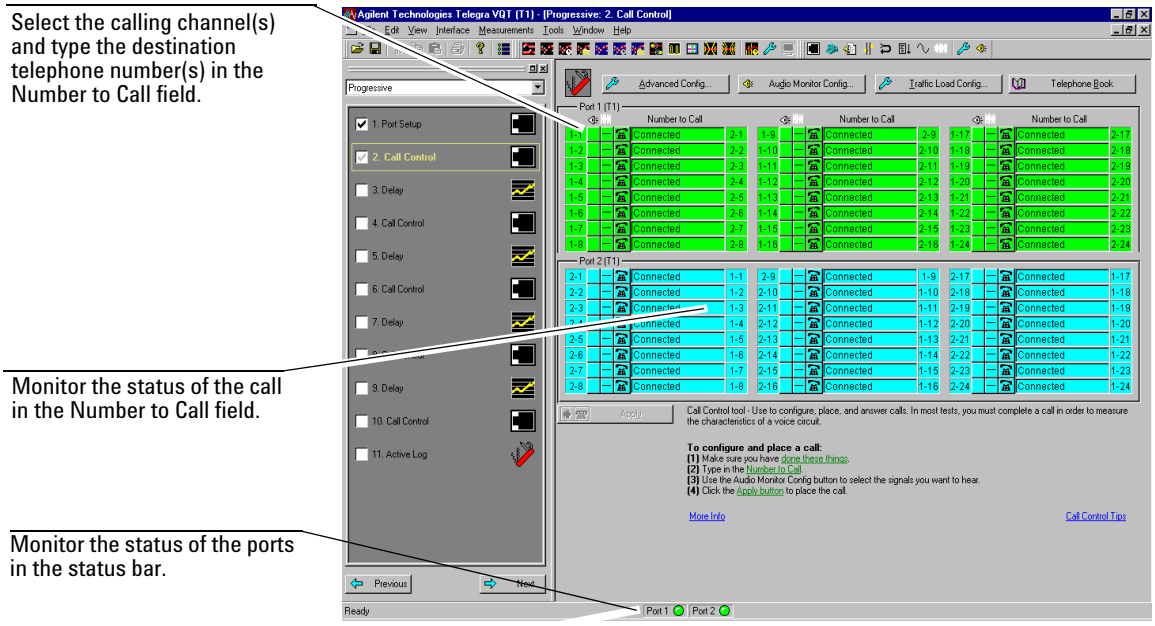
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The illustration shows placing and answering a call in the same client window. In a multiple-server environment, you would place the call as shown above, and then open the answering client window to enable the VQT to answer the incoming call.

T1 and E1 Environments

In the T1 and E1 environment, you use the Call Control tool to place and/or answer a call or several calls on any of the VQT selected and configured channels. In the T1 environment, you can place up to 24 calls at a time. In the E1 environment, you can place up to 30 calls at a time. The VQT supports calls made channel-to-channel on the same trunk or port and calls made on channels port-to-port.



The illustration shows placing and answering a call in the same client window. In a multiple-server environment, you would place the call as shown above, and then open the answering client window to monitor the status of answered calls.

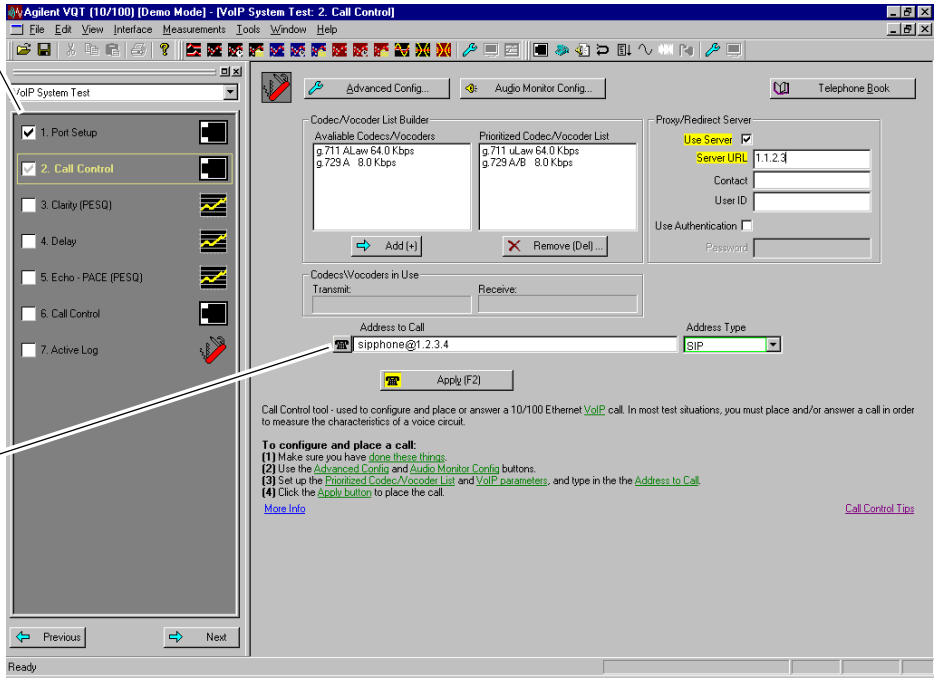
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10/100 Ethernet Environments

In the 10/100 Ethernet environment, you use the Call Control tool to place or answer VoIP calls. The call-only or answer-only modes are the only modes supported by VQT Responders or VQT servers when using the 10/100 Ethernet interface. You can also use the Call Control tool to monitor the status of established calls and the audio signals transmitted and received during call setup and disconnect.

The TaskList Navigator can display more than one Call Control tool. You can use the first Call Control tool to place the call and the second to hang up.

Type the destination IP address or telephone number the 10/100 Ethernet port will call.



Because the 10/100 Ethernet Call Control tool can place or answer a call (but not both), some measurements are not available in a 10/100 Ethernet environment. See the Help for additional information.

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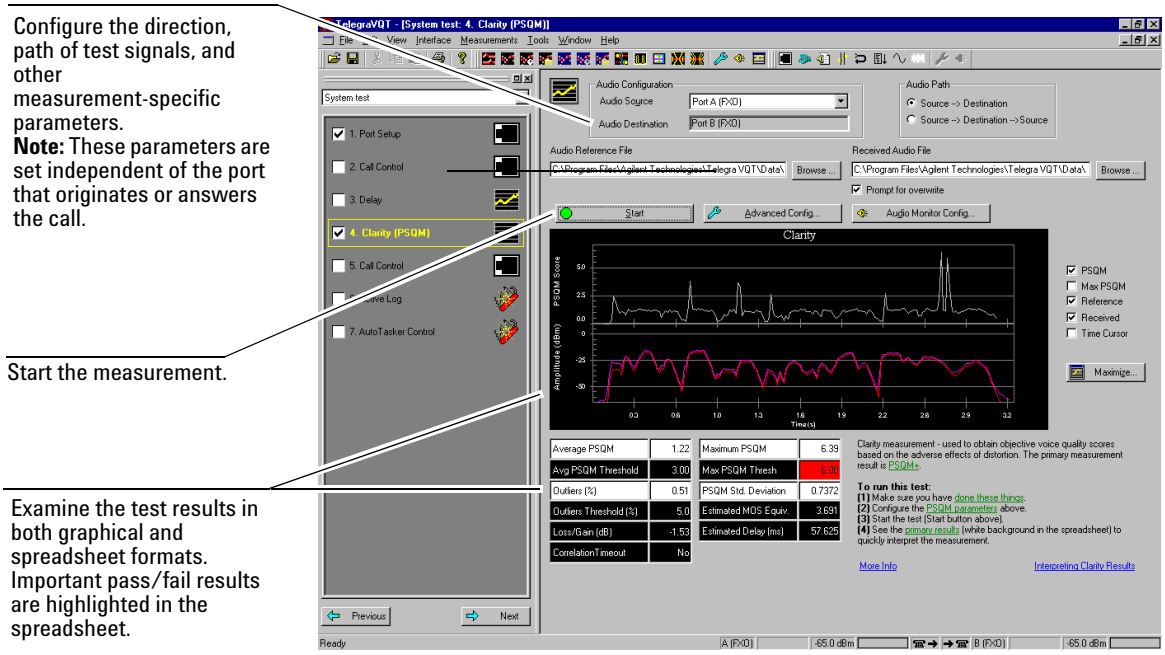
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Running Measurements and Tools

With a telephony circuit established between two VQT ports, channels, or servers, you can now run any of the VQT voice quality measurements or testing tools. If you are performing measurements between two VQT servers, you will need to interact with each client window depending on the type of measurement.

Start the measurements

Whether a device or system under test passes or fails a particular measurement depends entirely on how you have the measurement configured. You set test criteria that match your own test situation.



Remember that each VQT measurement or tool may work differently depending on whether you are performing single or multiple server testing. Please refer to Chapter 1 or the Help (Call Mode vs. Audio Path) for more detail.

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Viewing and Saving Results

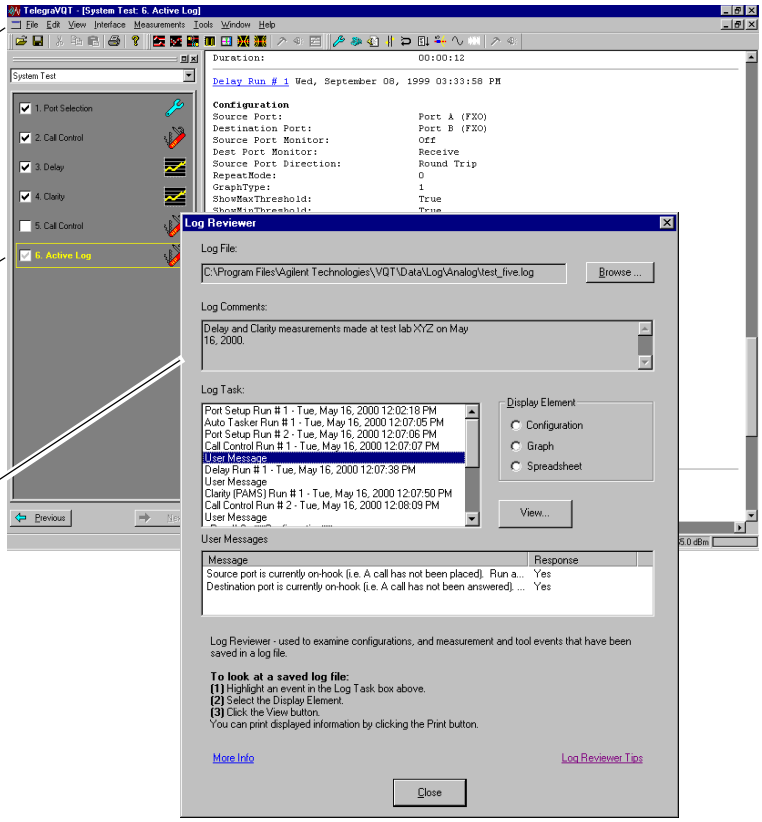
Viewing and saving the log files

A log file is created automatically when you setup, configure and run measurements. You can view the log file during the test or after the test is complete. After a set of measurements or tools is complete, you can save the log file for later review. Remember that each client window generates its own log of activities, so you must take care when selecting file names and file locations so as not to overwrite existing log files.

Save the log file using the File menu options.

View the log files during the test sessions or after the test is complete using the Active Log viewer.

Open and review saved log files using the File menu options. The Log Reviewer appears if you select Open from the File menu and select a log. The Log Reviewer displays the configuration, measurements, and tools that are saved in a log file.



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3 Sample Tests

This chapter provides several examples of how to use VQT servers and the VQT software to test voice quality on various systems and over several interfaces. There are four examples:

Sample Test One

Starting on page 83, this example demonstrates the basics of voice quality testing with a VQT server.
Server Type: VQT Portable Analyzer
Control: Local control of single server
Test Scenario: A single call between ports
Interface: Analog FXO
Measurements/Tools: Port Setup, Call Control, Tone Generator, Clarity (PSQM), Delay, Active Log and Log Reviewer

Sample Test Two

Starting on page 97, this example demonstrates the basics of remotely controlling a VQT server to perform measurements.
Server Type: VQT Network Server
Control: Remote control of single server
Test Scenario: Multiple calls between T1 channels
Interface: T1
Measurements/Tools: Port Setup, Call Control, DTMF Tone, Delay

Sample Test Three

Starting on page 110, this example demonstrates the basics of combined local and remote control. It also shows how to perform a basic VoIP call.
Server Types: VQT Portable Analyzer, VQT Network Server
Control: Combination of coordinated local and remote control
Test Scenario: 10/100 Ethernet call between servers to evaluate an IP network for VoIP deployment
Interfaces: 10/100 Ethernet, IP, SIP on the VQT Servers
Measurements/Tools: Port Setup, Call Control, Clarity, Delay

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Sample Test Four

Starting on page 118, this example demonstrates full remote control and a further example of placing VoIP calls.
Server Type: VQT Network Server, VQT Responder
Control: Full remote control from a laptop/desktop PC
Test Scenario: Simulating one-way Clarity using File Play & Record and Clarity File, Echo-PACE
Interface: 10/100 Ethernet and FXO, IP, H.323 (VoIP technology)
Measurements/Tools: Port Setup, Call Control, File Play and Record (to do Clarity File later), Echo-PACE

NOTE

When adapting the sample tests to your unique test situation, remember to update the port configuration to match your network environment.

To learn more...

Each measurement and tool contains basic usage information and interpretive/testing tips in the embedded Help window. You can also easily access the main Help from either the Help menu or from the More Info link within the embedded Help.

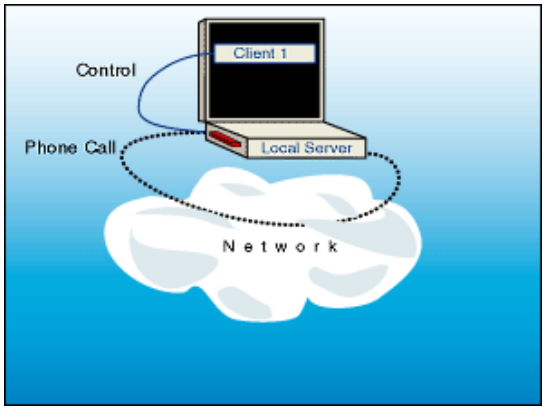
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Sample Test One

This example demonstrates fundamental voice quality testing processes with a single, locally controlled VQT server such as a VQT Portable Analyzer or an Advisor with a VQT Undercradle. These processes include placing and answering a telephone call, transmitting test signals, running measurements, and viewing and saving log files. These techniques are applicable regardless of the measurement you intend to run, the systems you intend to test, or how you use the VQT system. Specifically, this sample test shows you how to:

- Connect the VQT server to the device or system under test.
- Select and configure the physical ports the VQT server will use.
- Configure, place, and answer a call to set up the circuit under test.
- Run the Tone Generator tool to verify connectivity.
- Run Clarity and Delay measurements to evaluate basic voice quality.
- Terminate the call.
- Examine and save the automatically created log file.



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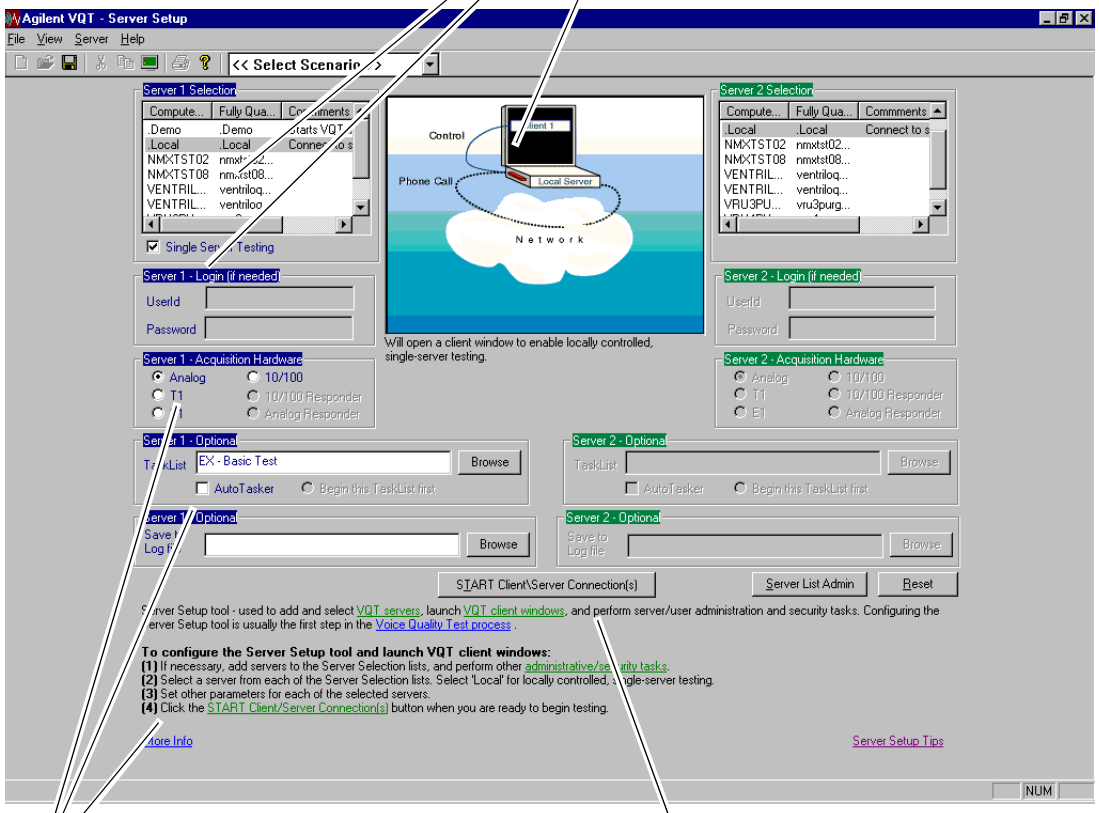
This example begins after the VQT server has been turned on and the VQT software has been started. See Chapter 2 for more information.

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(1) After you start the VQT software, the first screen you see is the Server Setup tool. You use this tool to select and initially configure the VQT server(s) you want to use.

Since this example demonstrates local control of a single VQT Portable Analyzer, select "Local" and check the Single Server Testing check box. Notice how the illustration in the Server Setup tool changes to show the test scenario.

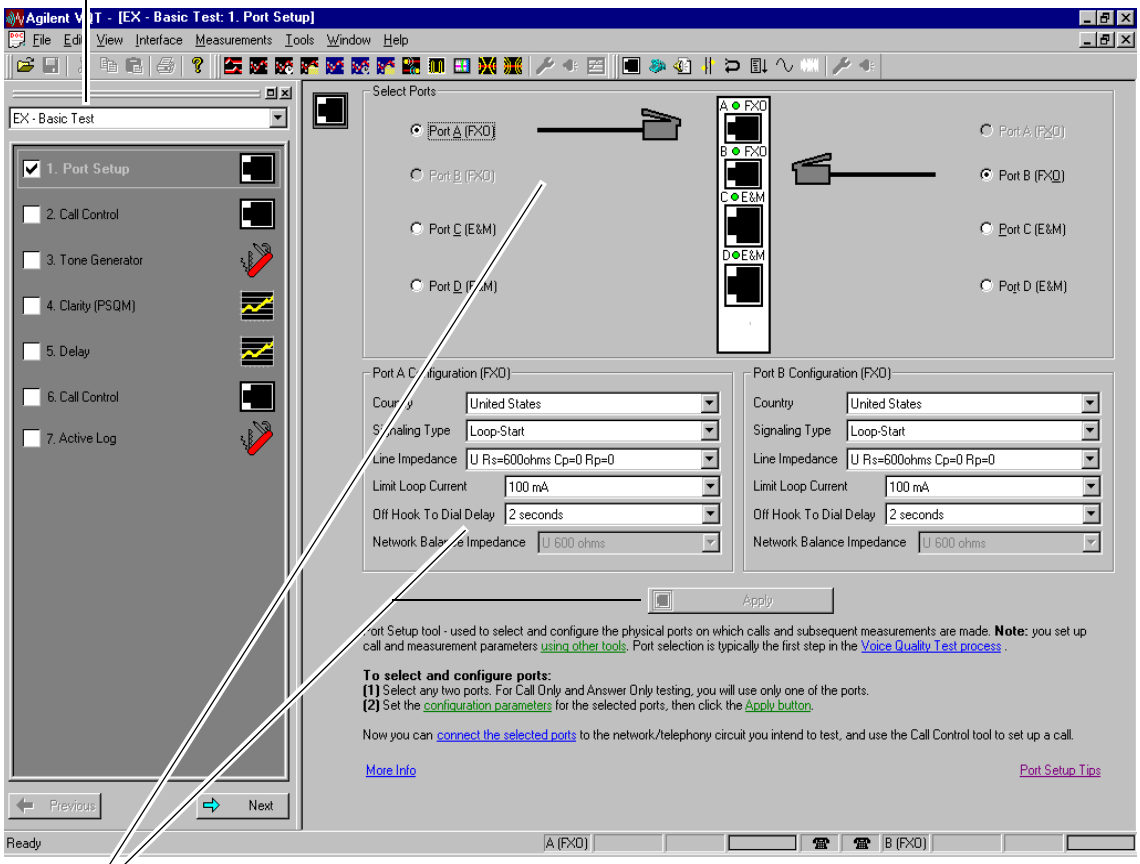


This example demonstrates the use of the analog FXO ports, so select "Analog" Aquisition Hardware. Optionally, you can also specify a TaskList to be loaded. The TaskList "EX - Basic Test" is shown above. **Note:** the embedded Help provides setup information and access to other online documentation. All of the VQT windows contain embedded Help to assist you in performing your testing tasks.

Once you have finished configuring the Server Setup tool, click this button to open a client window. The client window is where you configure and control each VQT server you have selected. In this case, there will be only one client window.

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(2) The client window opens to the first task (i.e., the Port Setup tool) in the TaskList called "EX - Basic Test". You can also select TaskLists in the client window even if you did not specify one in the Server Setup tool.
Note: Each step of this test is shown in the TaskList. To go to each measurement or tool, simply click on each "task" in the order shown.



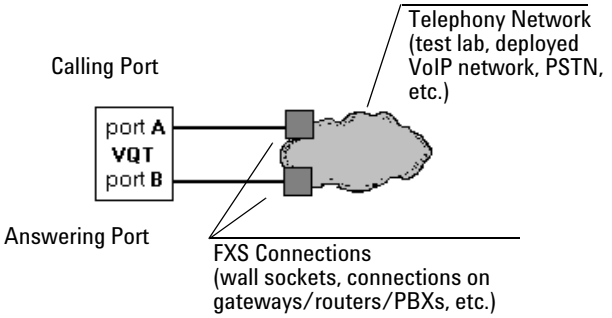
Notice that ports A and B are selected (the FXO ports). Also note that you can configure the electrical characteristics of the ports. For this example, these selections and default configurations can be left as they are; however, if you make changes to the port settings or select different ports, you must click Apply.

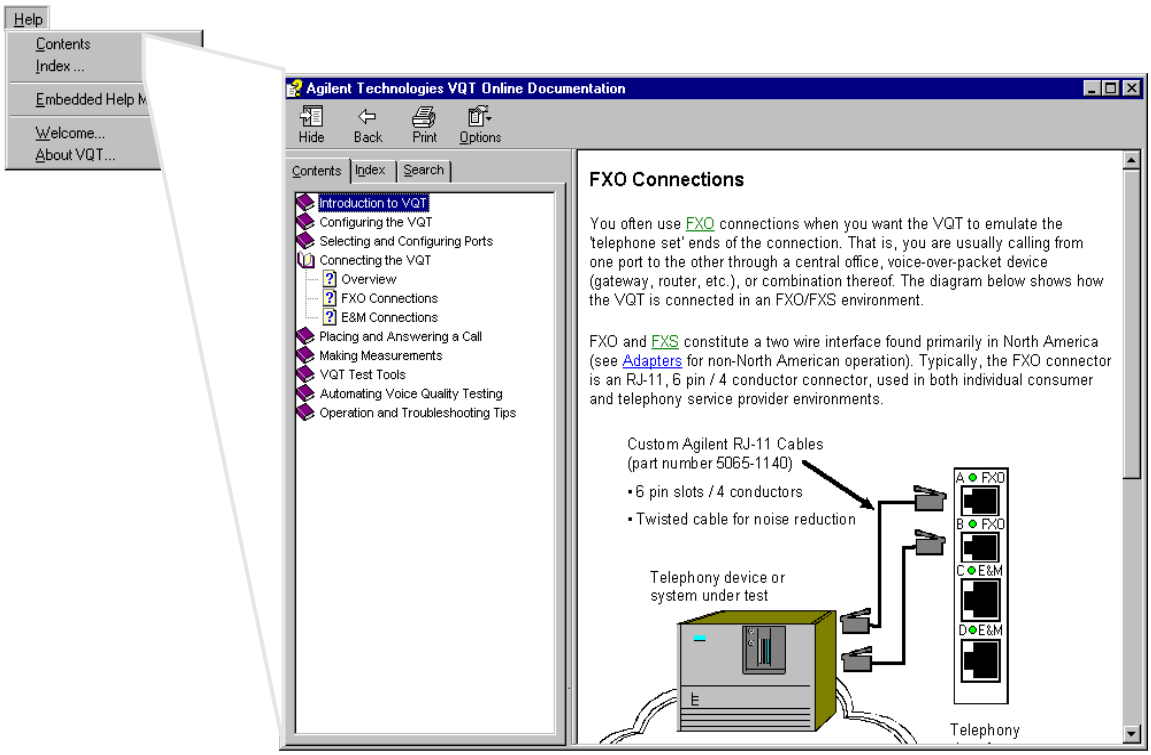
When adapting TaskLists for your own unique test situation, remember to configure the ports to match your network environment. The configurations shown throughout this example are for demonstration purposes only.

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3 Look in the Help for connection diagrams. The connection you use depends on whether you are testing an individual device or a system. For this example, you will need a connection that allows the VQT to place a call from one port and answer it on the other.





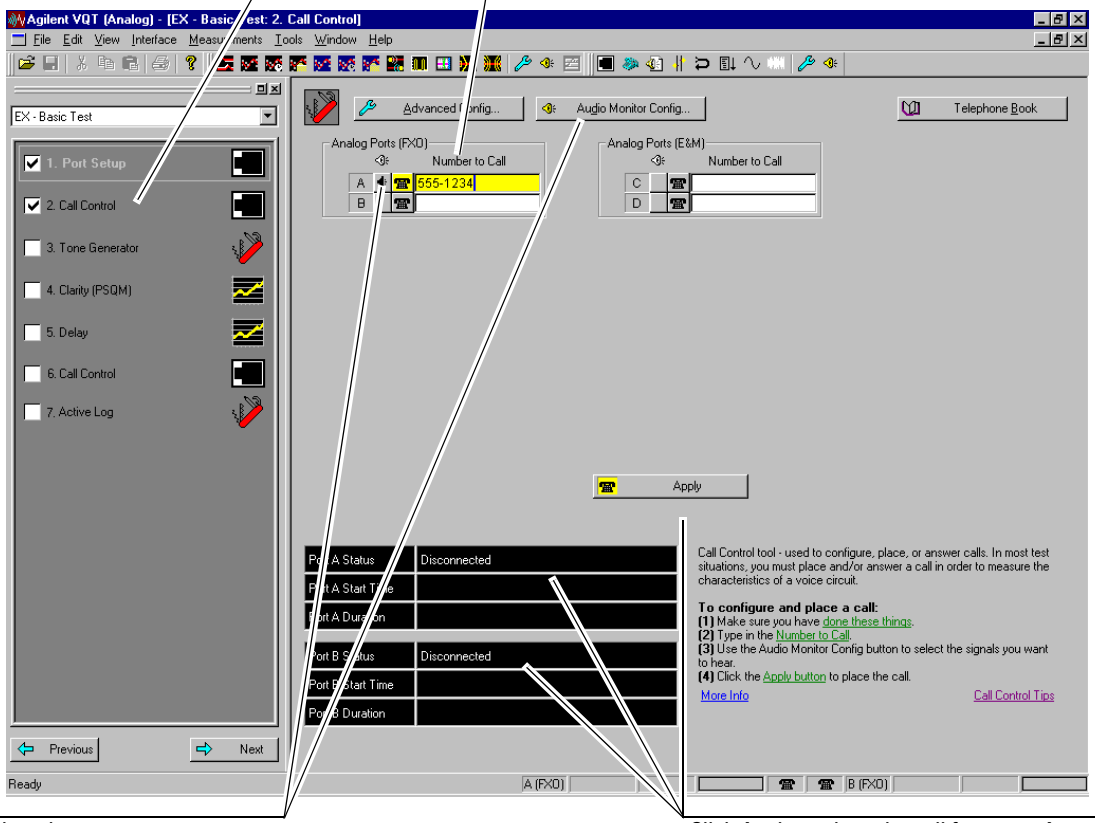
Note: You can open this Help topic from a link in the embedded Help of the Port Setup tool.

You can also access FXO cable wiring and pinout diagrams from this Help topic.

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(4) Open the Call Control tool to set up and place the call through the circuit you intend to test.

Type the telephone number you want to call into the box associated with the port that will place the call. In this example, port A is placing the call. Remember, the number you type in is the one to which port B is connected.



Select the port you want to monitor (in this case port A). Then click the Audio Monitor Config button and set the parameter to "Transmit AND Receive". These two settings allow you to hear the dial tone, the DTMF dialing, and ringing.

Click Apply to place the call from port A to port B. Once the call is connected, the telephone icons in the Analog Ports portion of the Call Control tool will appear "off-hook" and the call status will be shown in the status indicators.

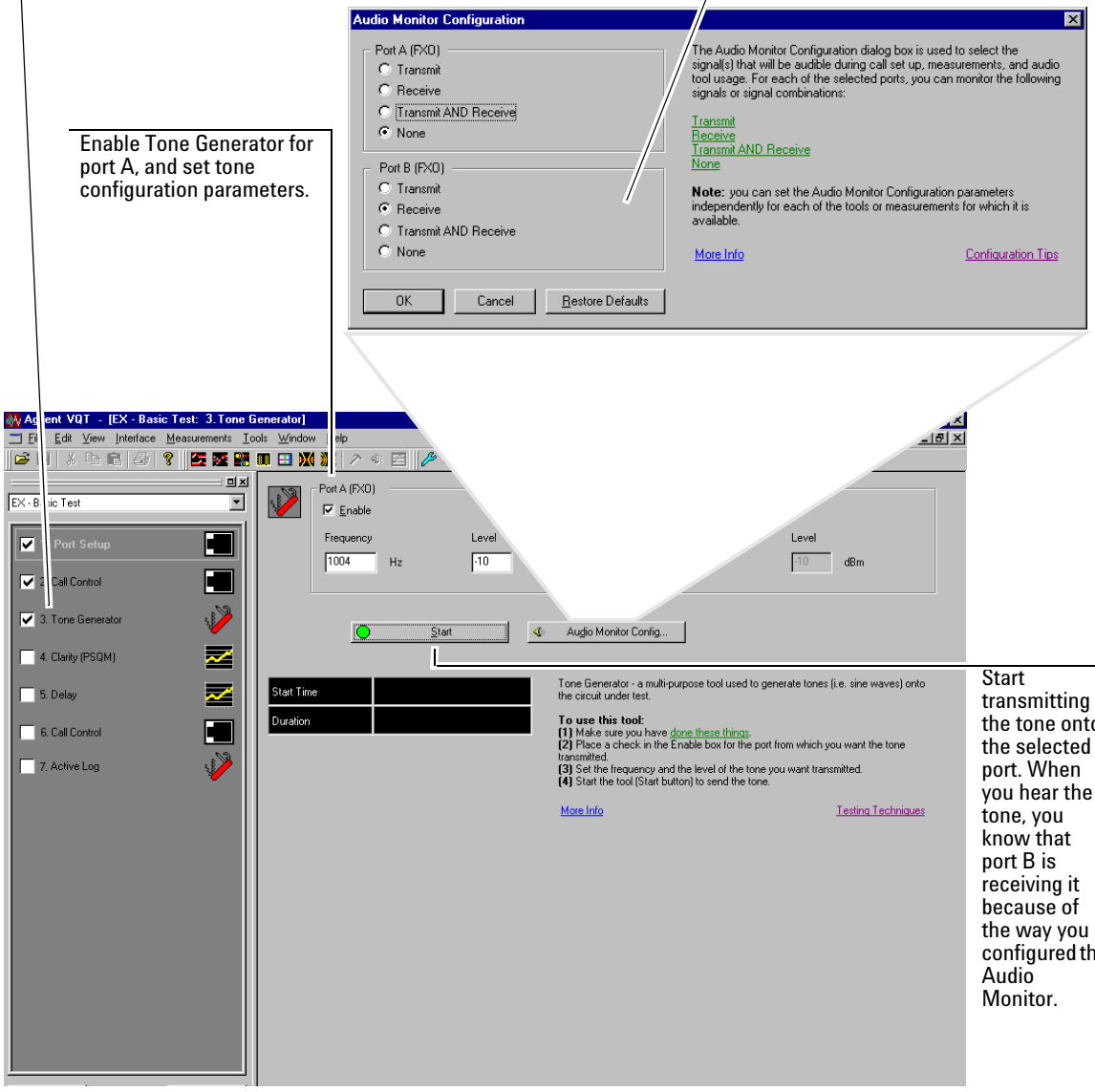
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5 Select the next task in the TaskList (Tone Generator). You will use this tool to verify that you have connectivity between ports A and B.

Set the Audio Monitor for port A to "None" and for port B to "Receive". This ensures you will hear only the tone received at port B.

Enable Tone Generator for port A, and set tone configuration parameters.

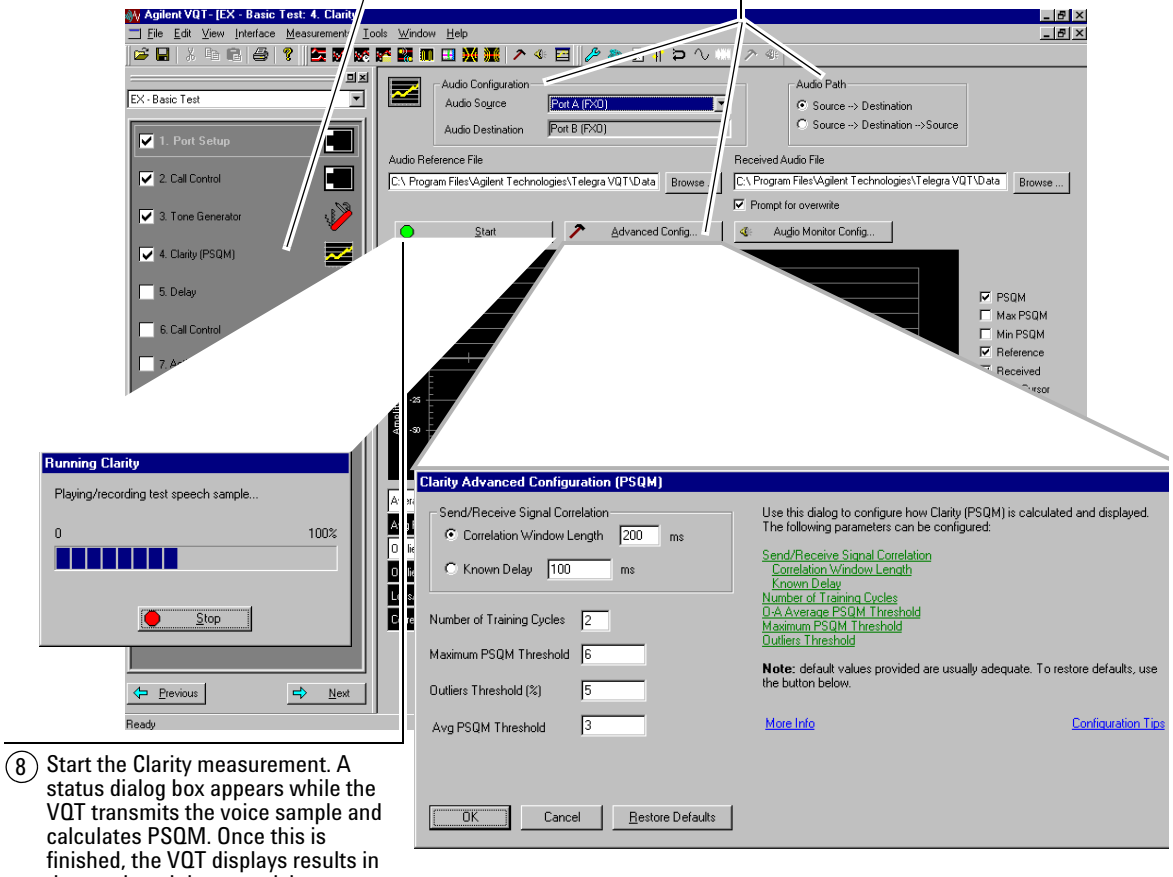


Start transmitting the tone onto the selected port. When you hear the tone, you know that port B is receiving it because of the way you configured the Audio Monitor.

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6 Open the Clarity measurement from the TaskList.

7 Configure the measurement so that the test signal will pass from port A to port B - that is, an end-to-end measurement. Open the Advanced Configuration dialog box to set measurement thresholds consistent with your test criteria.



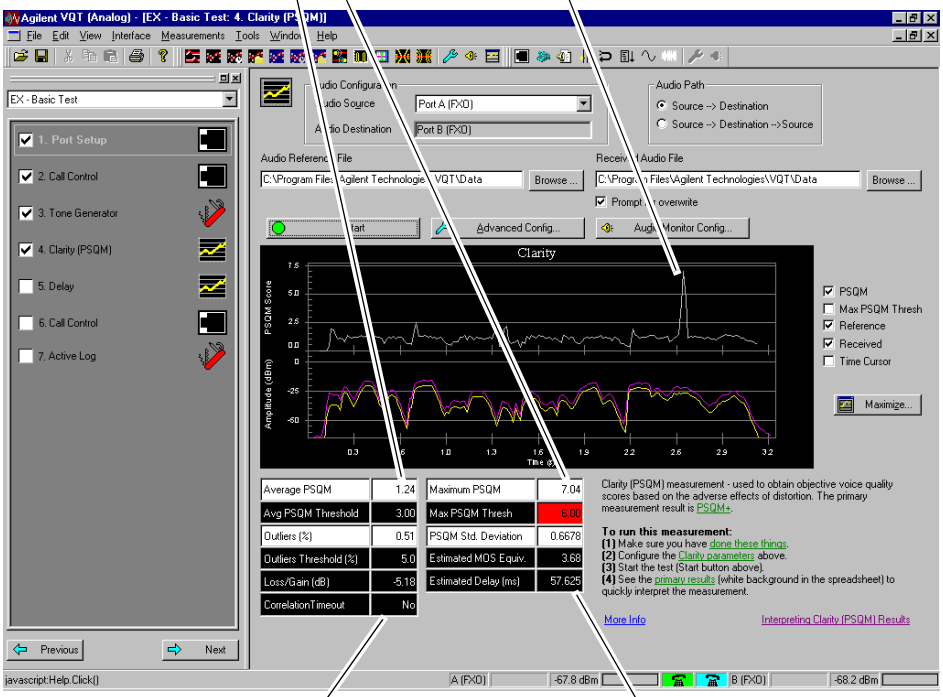
8 Start the Clarity measurement. A status dialog box appears while the VQT transmits the voice sample and calculates PSQM. Once this is finished, the VQT displays results in the graph and the spreadsheet (shown on the next page).

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Notice that, while the user-configured Maximum PSQM Threshold was exceeded and the Maximum PSQM was 7.04 (generally not very good), the Average PSQM was just above 1.2. This probably indicates a good quality voice signal with short periods of perceptible distortion.

The large but narrow PSQM spike might indicate packet loss or some other isolated noise burst that distorted the voice signal for a short period of time.



Notice that the Correlation Timeout parameter shows “No”. This indicates that the Clarity measurement received the distorted test signal and was able to correlate it with the original test signal.

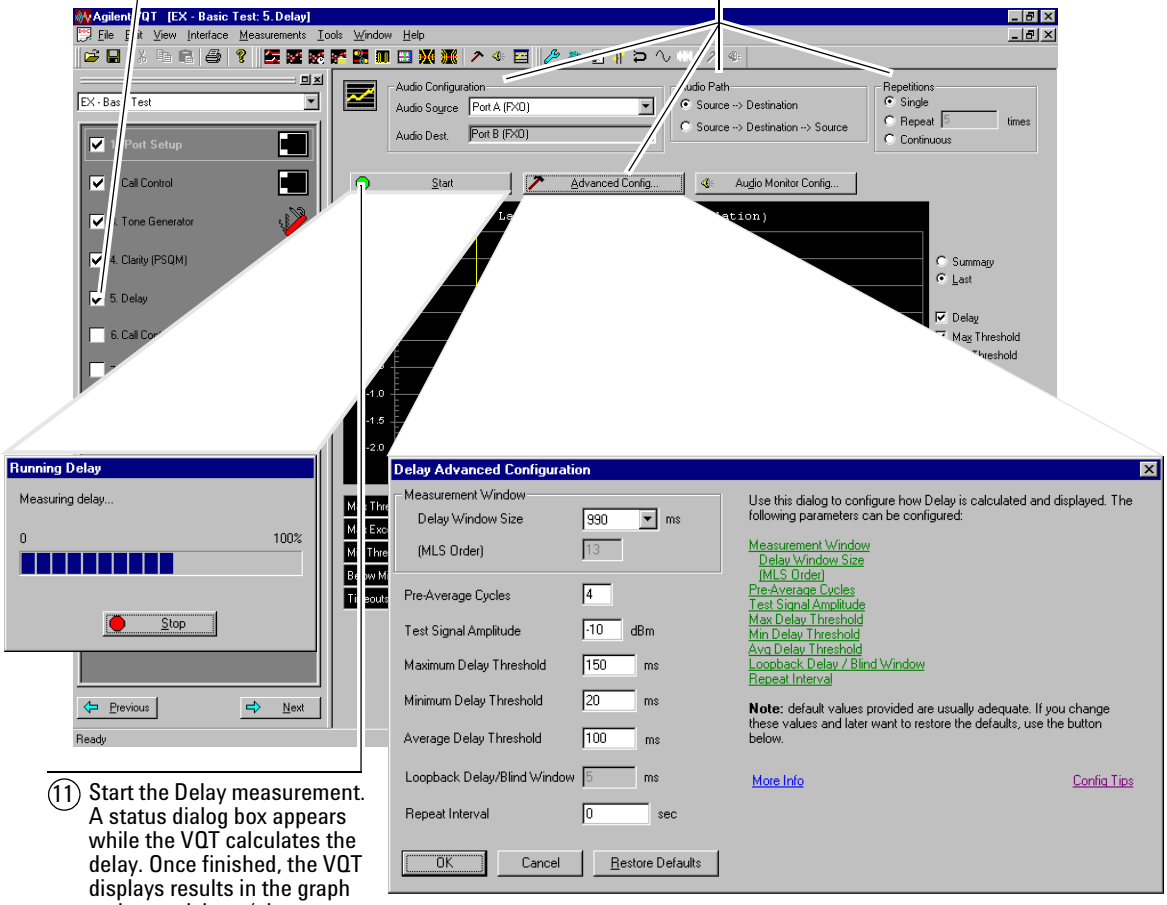
Notice the delay value of just over 57 milliseconds. This is consistent with the Delay measurement result later in this test sequence. This indicates, at first glance, a relatively stable system.

Again, with the call still connected, you could re-configure the measurement to test clarity from port B to port A, or you could use the Clarity Trend measurement to run repeated tests to see how clarity varies over time.

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⑨ Open the Delay measurement (shown here).

⑩ Configure the measurement so that the test signal will pass from port A to port B, the measurement will be end-to-end, and only one measurement will be run. **Also:** Open the Advanced Configuration dialog box to set the measurement thresholds consistent with your test. criteria.

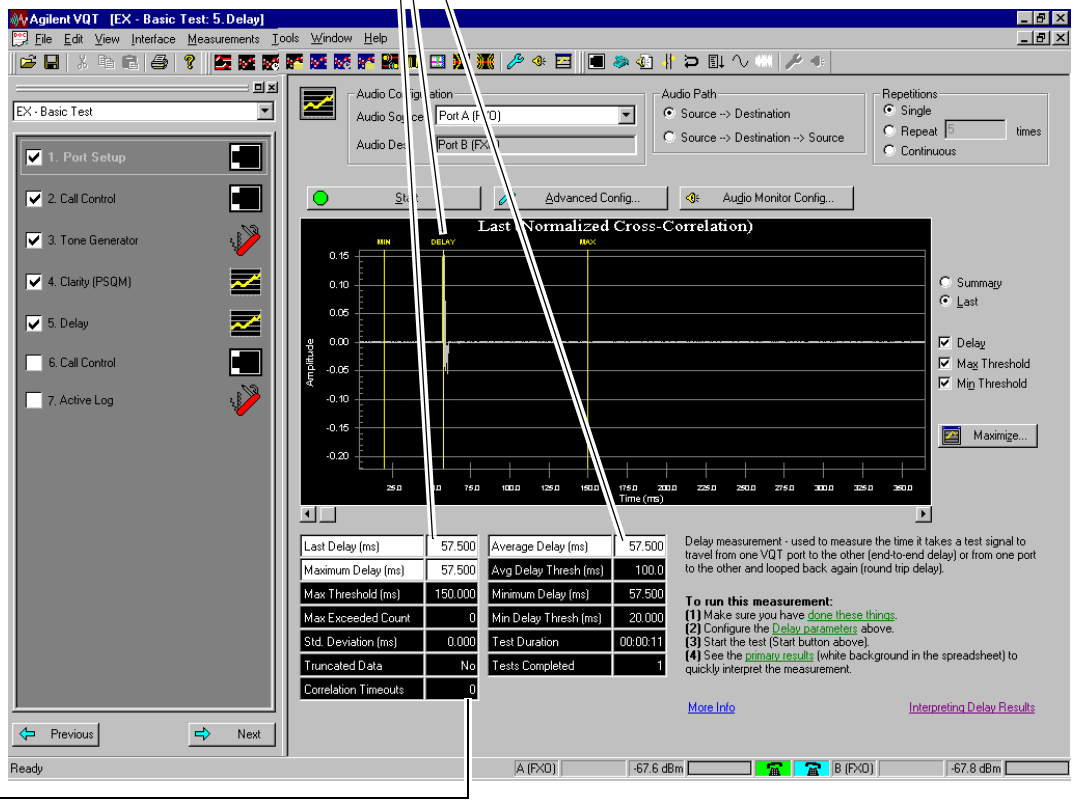


⑪ Start the Delay measurement. A status dialog box appears while the VQT calculates the delay. Once finished, the VQT displays results in the graph and spreadsheet (shown on the next page).

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Note that in both the graph and the spreadsheet, the measured delay is just over 57 milliseconds. This value is well below that which is perceptible to listeners. Also note that no user-defined thresholds were exceeded.

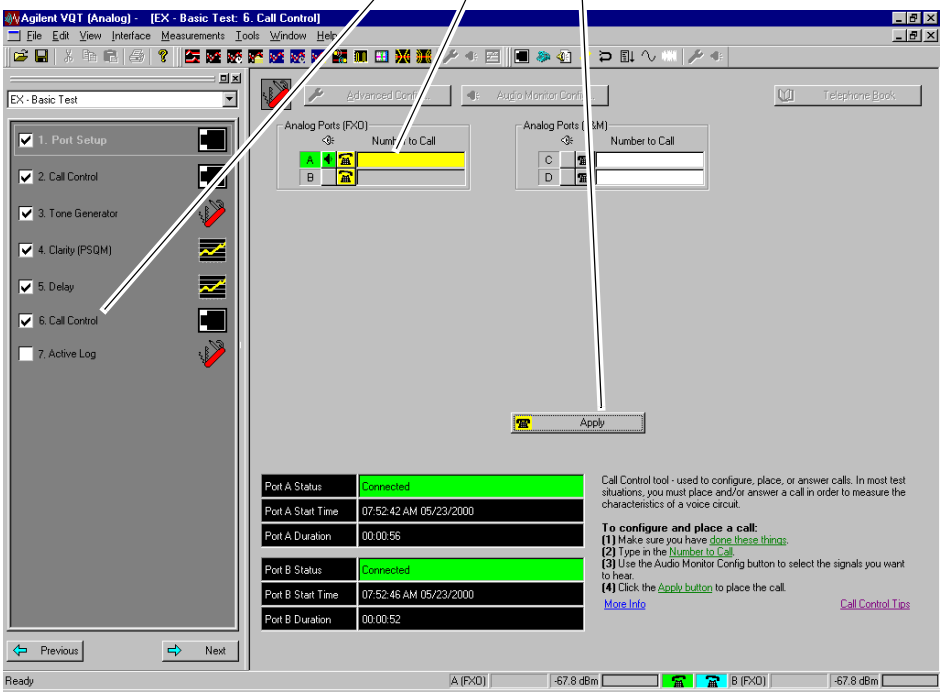


One very important parameter to look at when evaluating measurement results is the Correlation Timeouts parameter. If this field is red, it is highly likely that the measurement results are invalid. Correlation Timeouts can occur when excessive noise is present on the line or when the call is unexpectedly disconnected. In the example above, the measurement did not time out.

With the call still connected, you could re-configure the Delay measurement to test the delay in the other direction (port B to port A) or for multiple automated runs to gather statistically valid averages. It is often a good idea to run several Delay measurements to thoroughly characterize the behavior of the device or system you are testing.

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⑫ To disconnect the call, go to the second Call Control tool in the TaskList Navigator. Click each of the telephone icons to select them for hang-up. Notice that the handsets are "off-hook" indicating that the call is still in progress, but the background color turns yellow. Click Apply to hang up both ends of the connection.



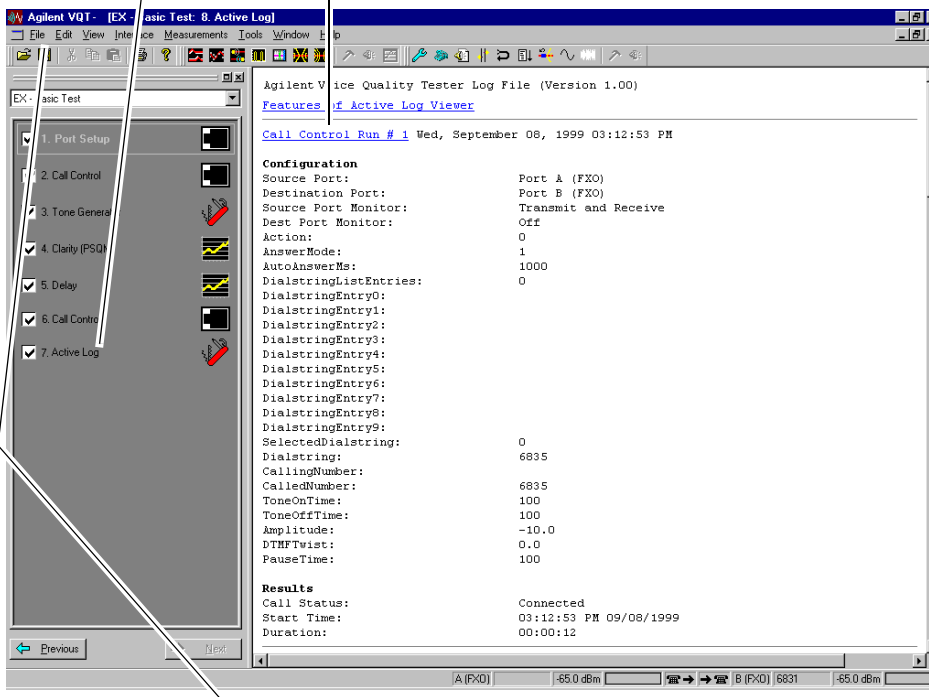
Once you have finished testing, you can review a log of the set up, call, measurement, and tool tasks performed during this session. This is covered on the next page.

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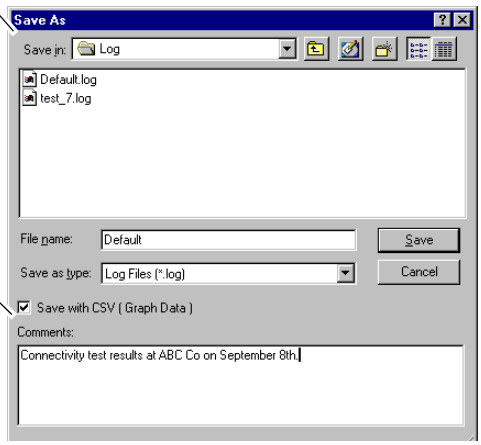
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⑬ Open the Active Log viewer by selecting it in the TaskList Navigator.

You can scroll through the log to see setup and measurement results. You can also click on the hypertext to open the measurement or tool so that it shows the configuration and data recorded in the log.



Save the log using the Save Log option in the File menu. The Save As dialog box appears.



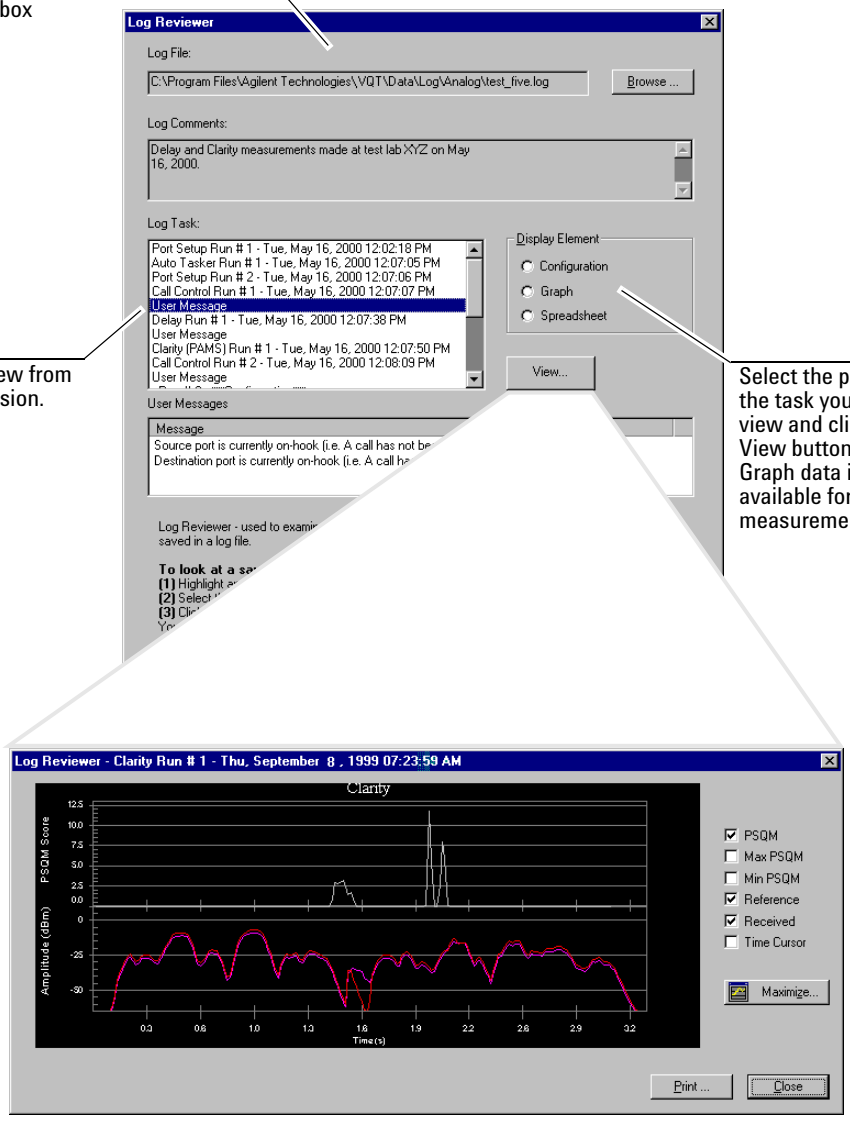
Make sure the Save with CSV option is checked so that graph data will be available when you view the log file later.

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(14) To open a saved log file, use the File menu. Once you select the log file and click the Open button, the Log Reviewer dialog box appears.

Select a task to view from the saved test session.

Select the portion of the task you want to view and click the View button. **Note:** Graph data is available for measurements only.



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Sample Test Two

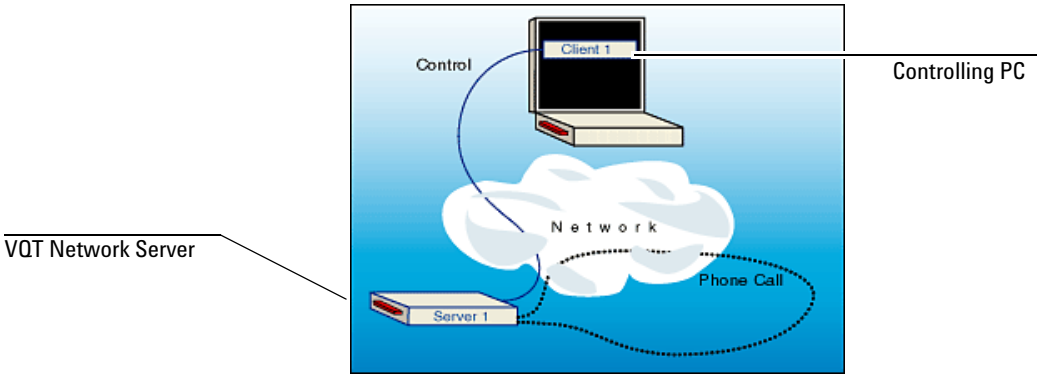
This example demonstrates how to set up and *remotely control* a VQT Network Server to place multiple T1 calls, load those calls with traffic, and measure network delay under traffic load conditions. These techniques are fundamental to T1/E1 voice quality testing and remotely controlling any VQT server. Specifically, this sample test shows you how to:

- Add a server - in this case, a rackmountable VQT Network Server.
- Perform basic server administration and security functions.
- Establish a logical connection from the controlling PC to the server.
- Select and configure the physical ports the VQT will use.
- Configure, place, and answer T1 calls and load those calls with noise traffic.
- Run DTMF Tone and Delay measurements.

Adding and connecting servers, placing and answering calls between servers, and running measurements or tools are the most fundamental of VQT processes in a remote or distributed environment. You can adapt this example to your unique testing needs.

To set the stage for this example, consider the following diagram. A VQT Network Server is to be remotely controlled by a PC to perform voice quality measurements between the two T1 ports. As the diagram shows, there is an IP/Ethernet control connection between the controlling PC and the VQT Network Server. The test connection is established between the ports on the VQT Network Server.

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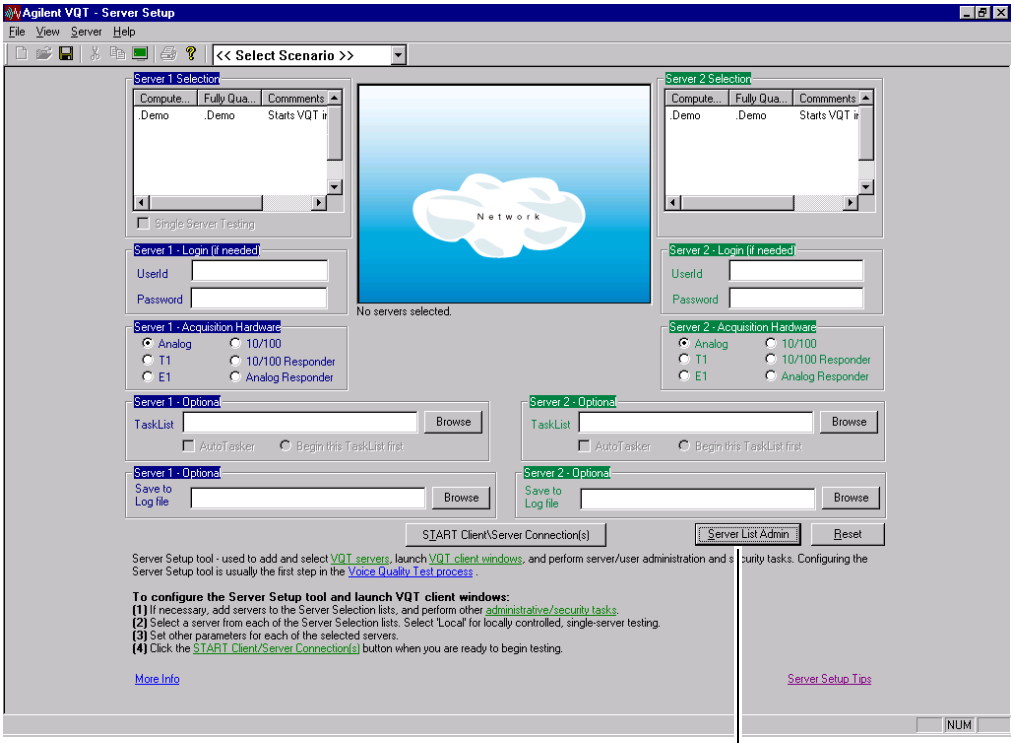
As discussed in Chapter 2 and in the Help, the “controlling” PC can be a VQT Portable Analyzer, an Advisor (equipped with a VQT Undercradle), or a desktop/laptop PC. And while this example shows a VQT Network Server, the “controlled” server can also be a VQT Portable Analyzer or an Advisor (with undercradle). Please see “Sample Test Four” for examples of remotely controlling a VQT Responder.

This example assumes that the VQT Network Server has been installed into an IP management network, the appropriate VQT software has been installed on the controlling PC, the VQT Network Server has been physically connected to the network under test, the client license key has been entered correctly, and the VQT software has been launched. Please go to Chapter 2 or to the *VQT Network Server Setup Guide* for more information.

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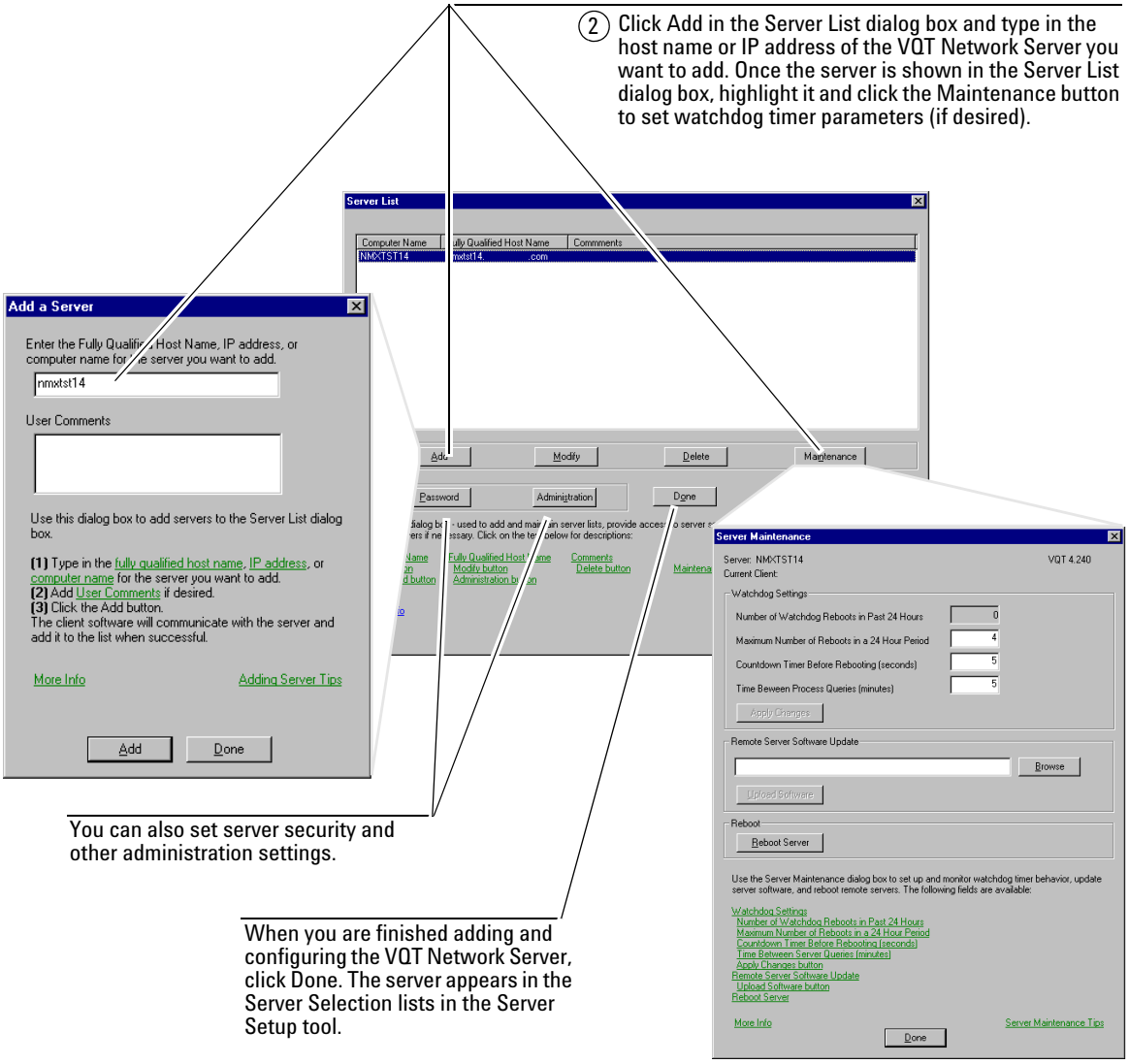
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(1) The first step to remotely control a VQT Network Server (or any VQT device) is to add the server in the Server Setup tool and perform some administration tasks.



To add a VQT Network Server to the Server Selection lists, and to perform other server configuration and maintenance tasks, click the Server List Admin button. This will open the Server List dialog box shown on the next page.

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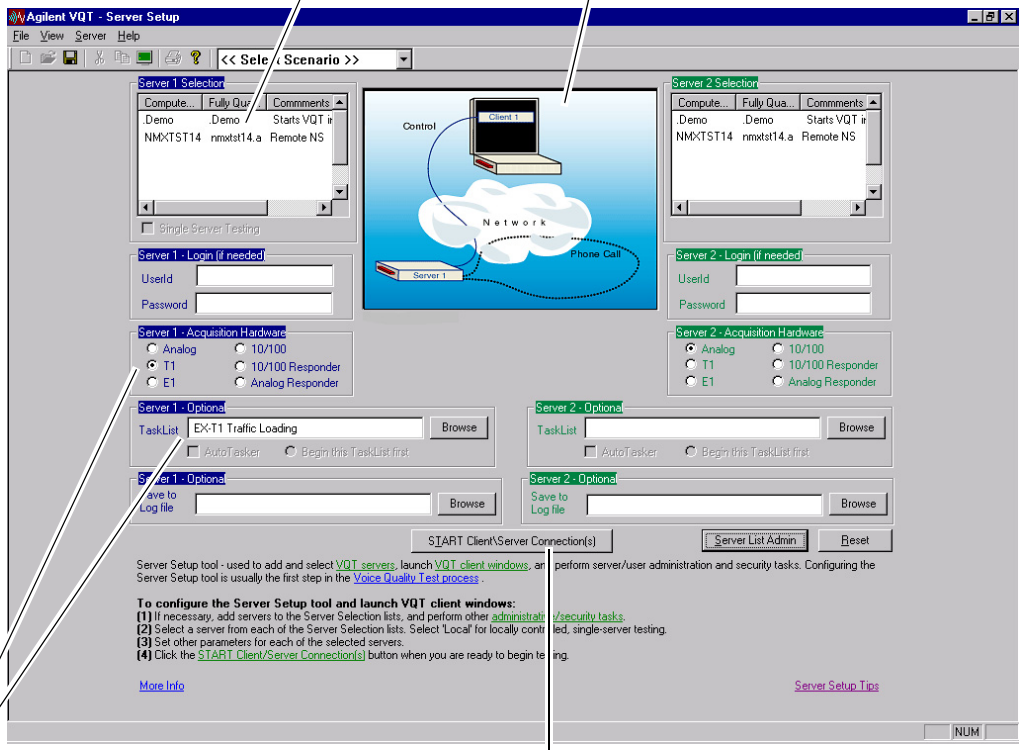
Note: The configuration performed in this step is preserved. In other words, the next time you start the VQT software, you will not have to re-add the VQT Network Server unless some change (IP address, computer name, etc.) has changed.

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3 Now that the VQT Network Server is added to the Server List, select it from the Server Setup tool.

Notice how the picture in the Server Setup tool changes to show the configuration you select.

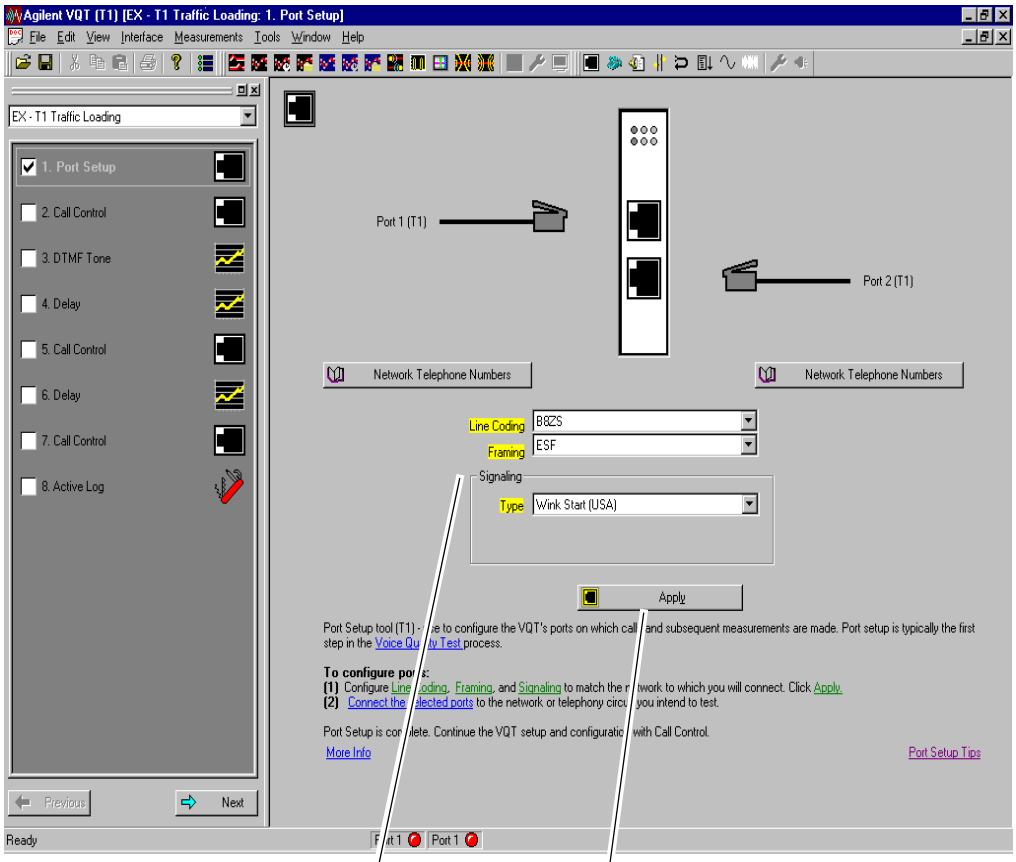


Select the T1 interface and type or browse for the TaskList you want. For this example, the TaskList name is “EX - T1 Traffic Loading”.

Click the START Client\Server Connection(s) button when you are ready to begin testing. One client window will be displayed to control the remote VQT Network Server called “NMXTST14”.

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4 The client window opens to the first task (i.e., the Port Setup tool) in the TaskList you specified in the Server Setup tool. In a T1 environment, the Port Setup tool must be configured prior to any voice quality testing.



Set Line Coding, Framing, and Signaling Type parameters. **Note:** It is important to make sure Port Setup configuration settings in T1 or E1 environments match the network under test. The network's behavior could be affected if the configuration is not correct.

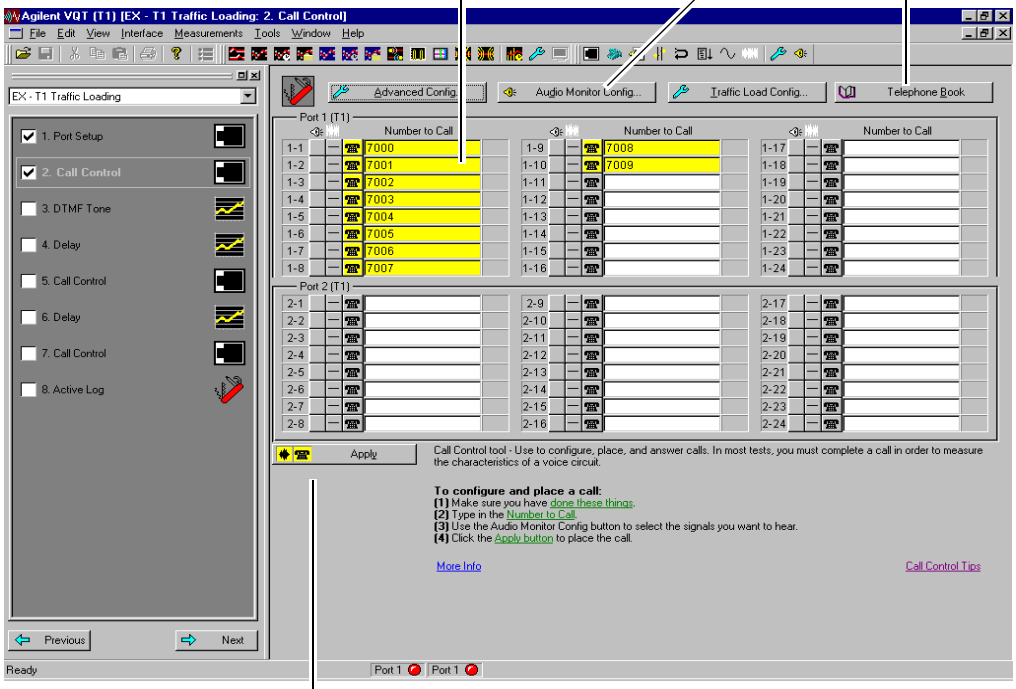
Click Apply to set up the ports.

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(5) Open the Call Control tool to set up and place the call or calls through the circuit you intend to test. In this case, type ten destination numbers in the Number to Call field of the channel that will place the calls. Normally, the network determines which channels are answered.

You can configure the Call Control Audio Monitor and use the Telephone Book to store your favorite telephone numbers.

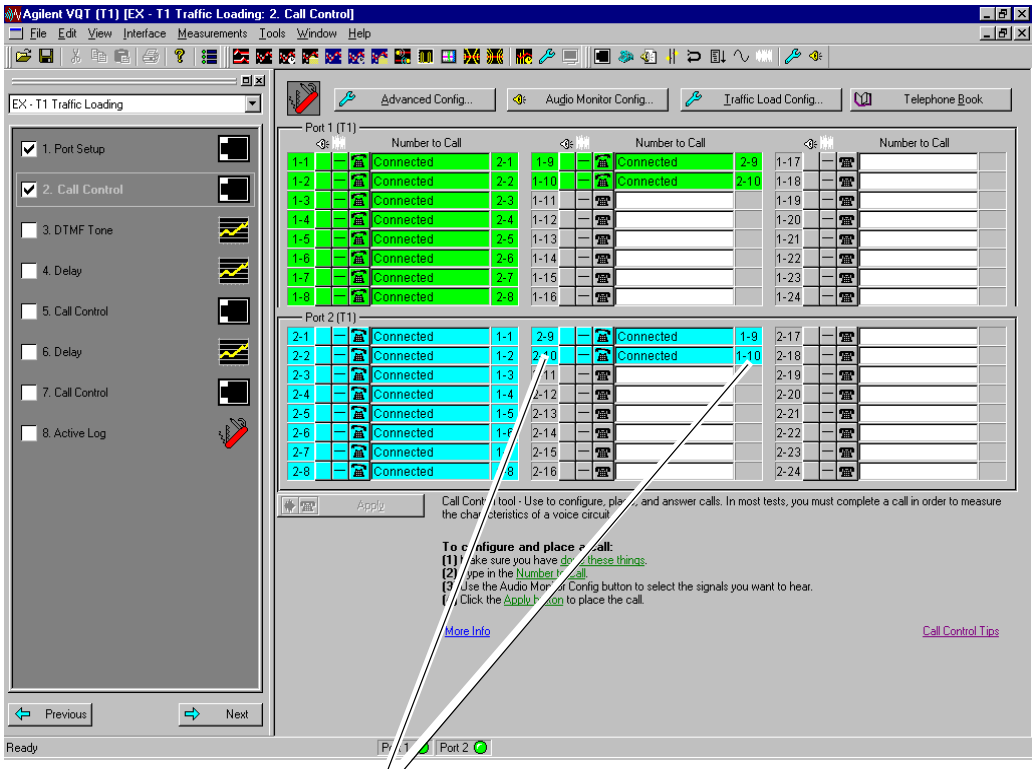


Click Apply to place the calls.

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3 Sample Tests

Once calls are connected, the telephone icons in the Call Control tool will appear "off-hook" and the call status will be shown in the Number to Call boxes.



Notice that the channel pairing is shown in the box to the right of the Number to Call field. (In this example port 2, channel 10 is connected to port1, channel 10.) The channel pairing is determined by the setup of your network. The channel pairing above is shown for demonstration purposes only.

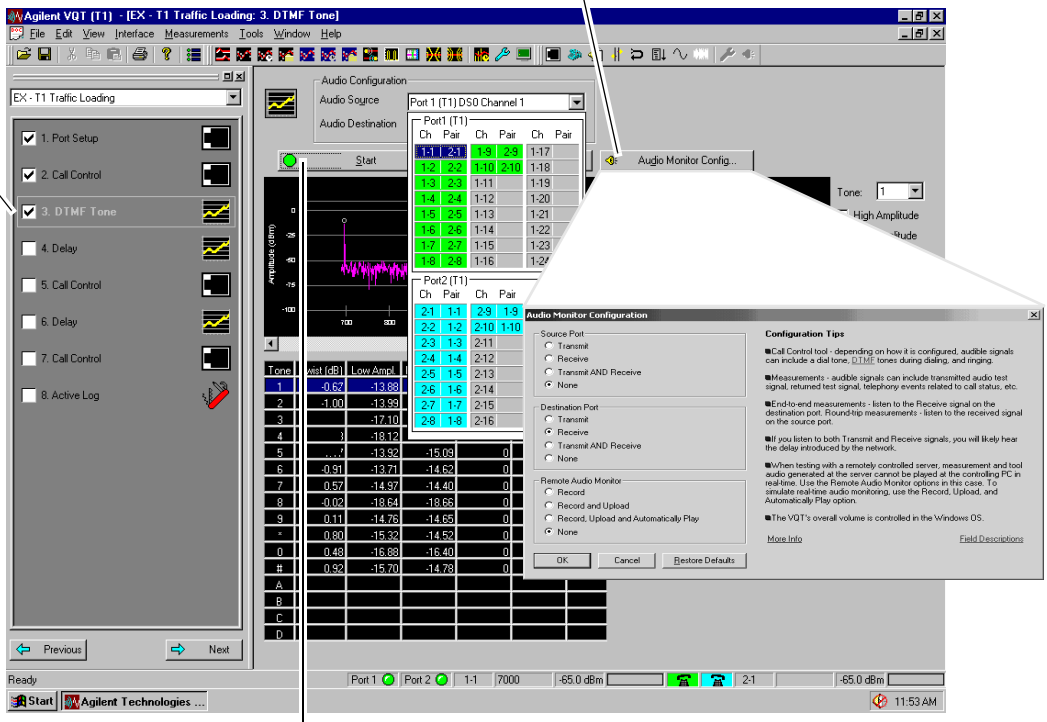
Note: it is possible for channels to be answered on the same port (or elsewhere in the network). For this example, assume that each of the calls is answered on port 2, as shown above.

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6 Open the DTMF Tone measurement. In the Audio Source field, select the channel pair on which you will perform the DTMF Tone measurement. In this case, choose channel pair 1-1 to 2-1.

Set the Audio Monitor for port 1 to “None” and port 2 to “Receive”. This ensures you will hear only the tone received at port 2, channel 1. Set remote audio - Record, Upload, Play.

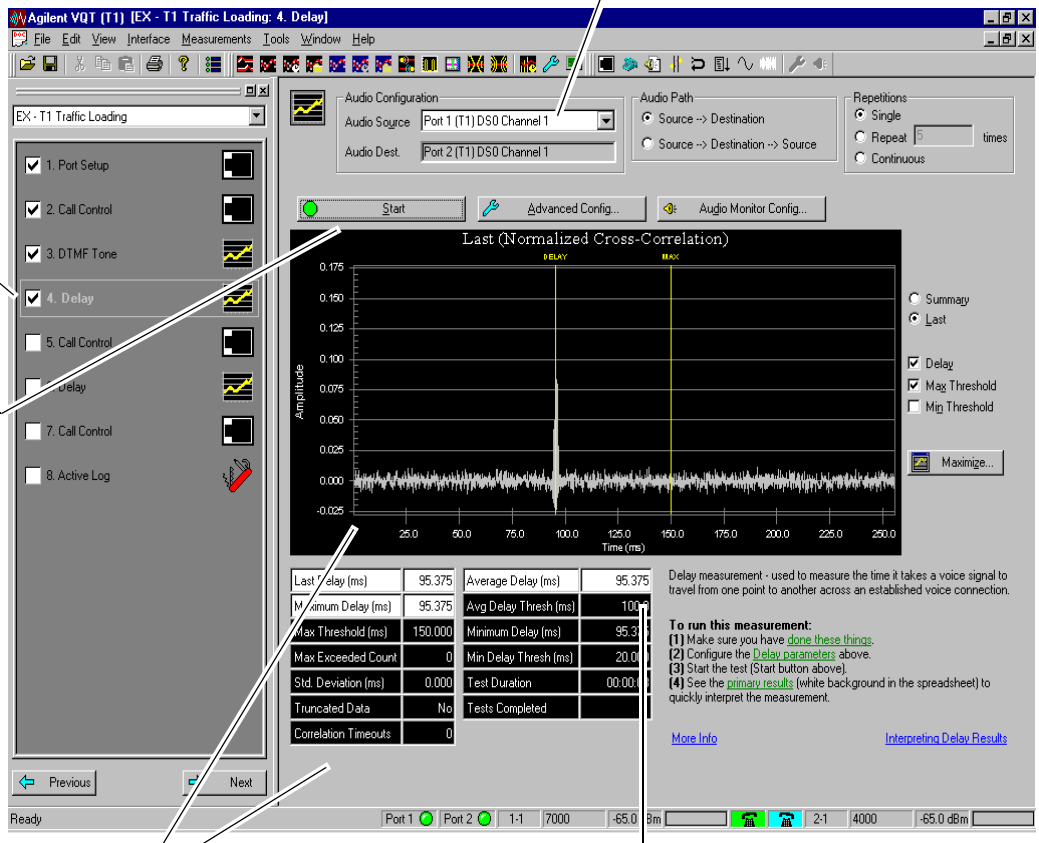


Start transmitting tones from Channel 1, port 1. When you hear the tones, you will know that you have connectivity between the paired channels because of the way the Audio Monitor is configured.

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7 Open the Delay measurement so that you can establish a baseline to be used to compare to a Delay measurement after traffic is loaded onto T1 channels.

Select port 1/channel 1 as the audio source channel. In this example, this will cause the test signal to be transmitted between port 1/channel 1 and port 2/channel 1.



Click Start.

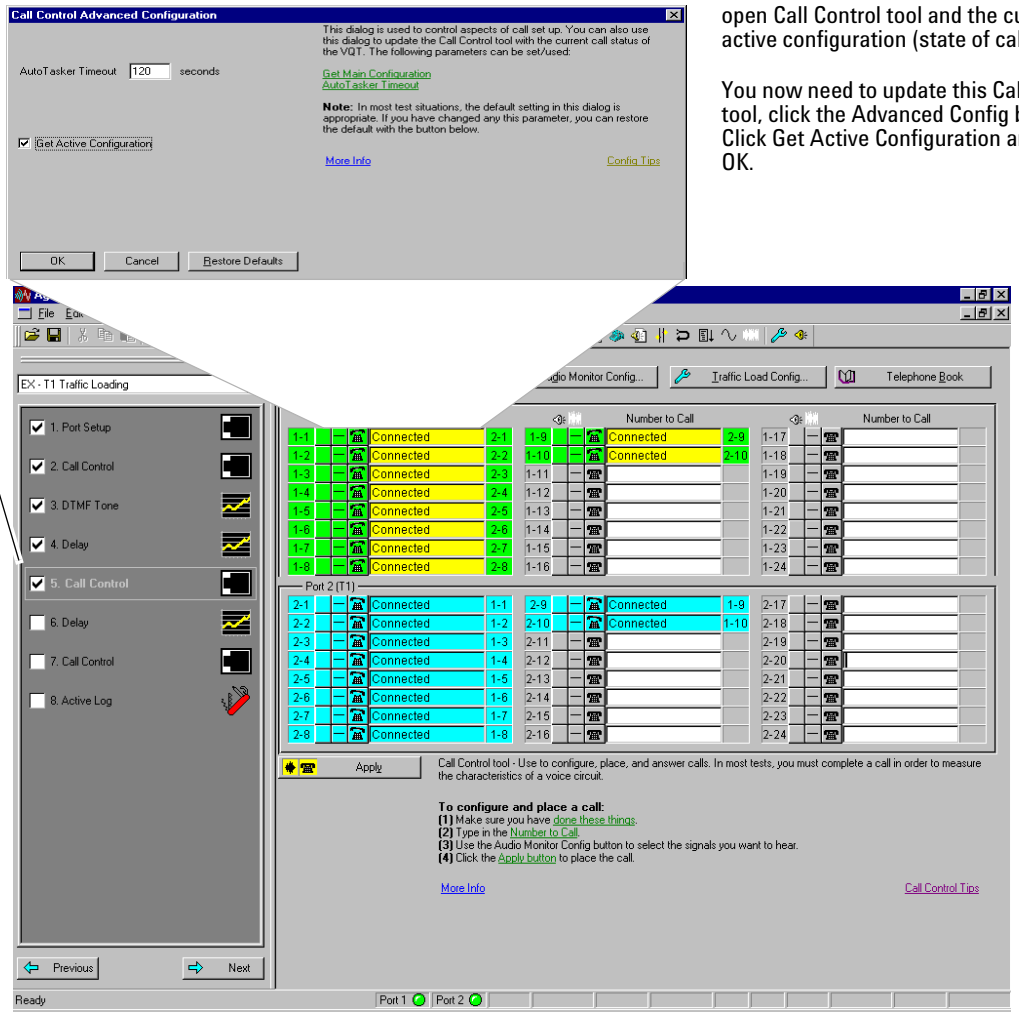
Once finished, the VQT displays results in the graph and spreadsheet.

Note the measured delay of 95.375 milliseconds. This will be your baseline measurement against which you will compare subsequent measurements.

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8 Go to the second Call Control tool in the TaskList Navigator. Before placing more calls, it is necessary to update the second call control tool with the current call state.



Notice that the handsets appear "off-hook" indicating that the calls are still in progress, but the background color is yellow. In this case, yellow indicates the difference between this open Call Control tool and the current active configuration (state of calls).

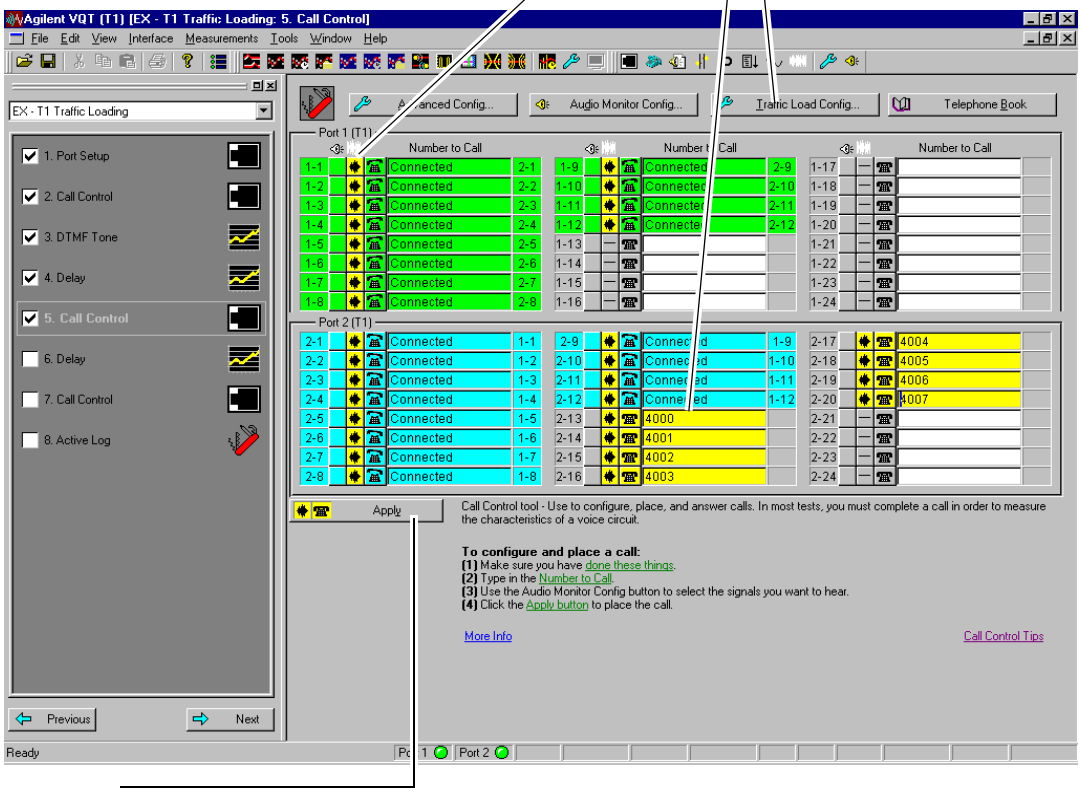
You now need to update this Call Control tool, click the Advanced Config button. Click Get Active Configuration and click OK.

Please note that clicking Apply before you update the Call Control tool using the Advanced Configuration dialog box will disconnect your calls at both ends of the connection.

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(9) Now you can place additional calls and load all channels with traffic as shown below.

Type additional telephone numbers and select all channels for traffic loading. Notice that the telephone icons and the traffic load indicators turn yellow to indicate that they have been selected for change.



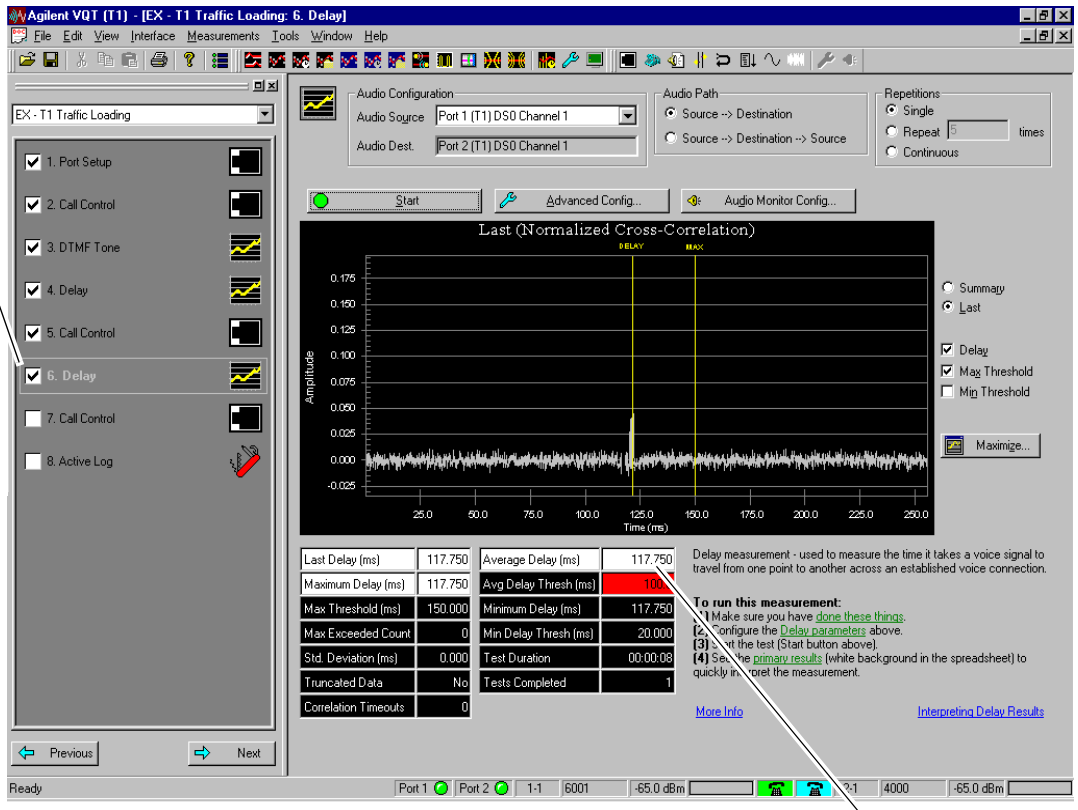
Click Apply to place this second set of calls and to load all the channels with traffic.

Remember, in your test environment, calls may not be answered on the channels or ports shown above. The channel pairing above is shown for demonstration purposes only.

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⑩ Open, configure, and run the last Delay measurement in the Tasklist to see if the additional load affects delay.



In this measurement, the time it took for the audio signal to travel through the device or system under test was measured to be 117.75 milliseconds. Notice that when you loaded a series of channels with traffic, the delay increased from 95.375 milliseconds which could be due to increased processing on network equipment. Even so, the value of 117.75 ms is below what is perceptible to listeners. Delay above 300 to 400 milliseconds is usually obvious to the user. You can now hang up the calls as shown in a previous example.

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Sample Test Three

This example shows how you can evaluate an existing IP network for possible VoIP deployment. This testing process, often done as part of a “pre-VoIP assessment”, involves placing a VoIP call from one VQT server to another and then transmitting voice packets across that call to test Clarity and Delay. Testing Clarity and Delay in this way can help determine if the existing IP network can support VoIP calls and voice packet transmissions.

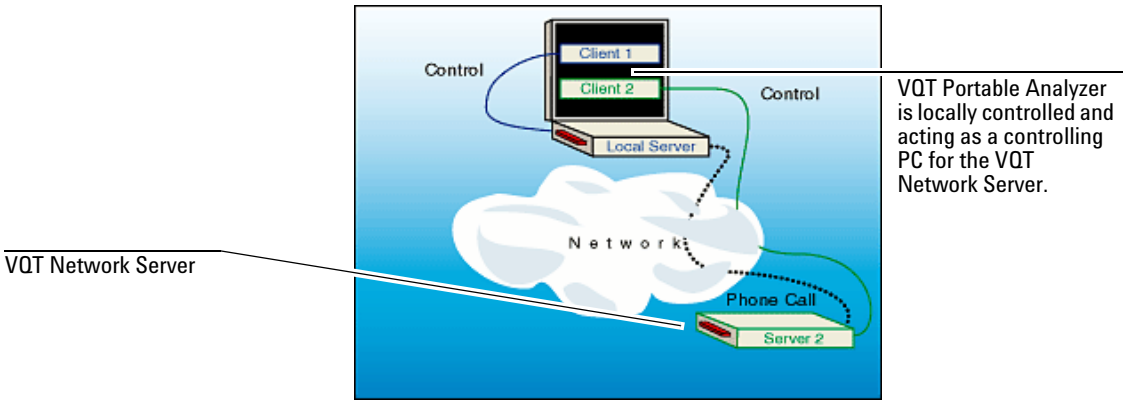
This sample test shows you how to:

- Configure the 10/100 Ethernet ports for SIP testing.
- Place a SIP call from one VQT to another.
- Run a one-way Clarity measurement from one VQT to another.
- Run a round-trip Delay measurement between the two VQT servers.

To set the stage for this example, consider the following diagram. Both a VQT Portable Analyzer and a VQT Network Server are connected to an IP network over which VoIP services are being considered but not yet implemented. The connection points are 10/100 Ethernet and the two servers are physically separated such that transmission between them will traverse a representative portion of the network’s infrastructure. The VQT Portable Analyzer will be locally controlled and the VQT Network Server will be remotely controlled by a VQT client running on the VQT Portable Analyzer.

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As the diagram shows, there are two connections or communication paths: (1) an IP/Ethernet control connection between the controlling VQT Portable Analyzer and the VQT Network Server and (2) the test connection between the two servers. The connections can pass through the same physical network, or the “management” network can be distinct from the network/system under test.

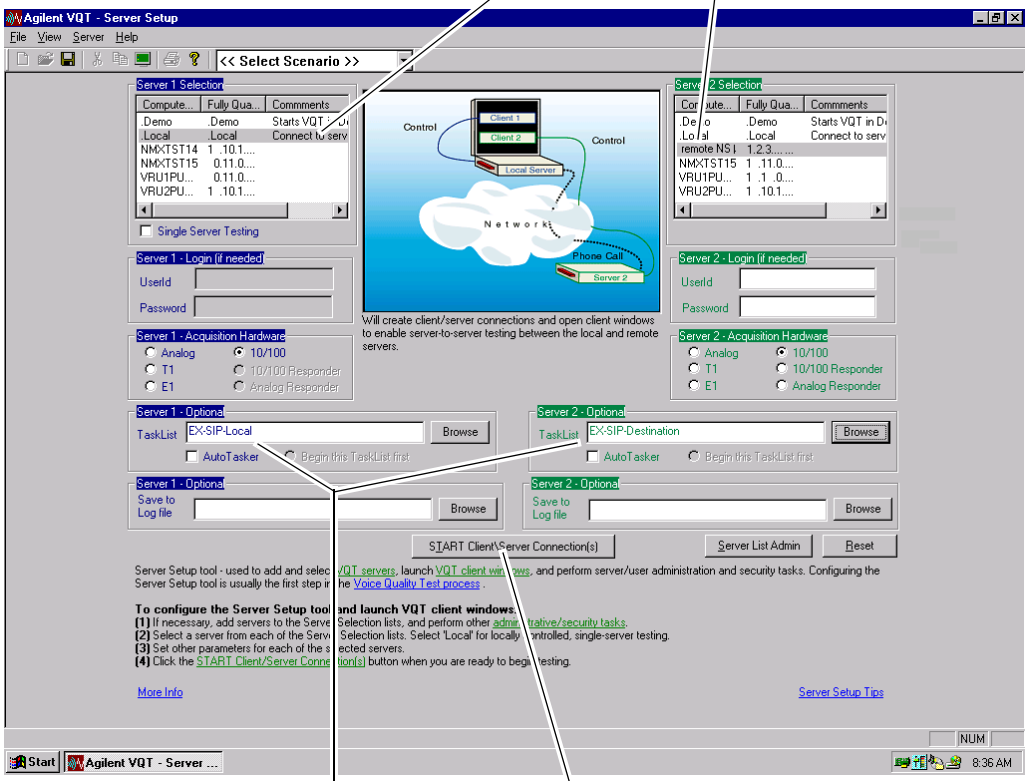
Because each end point is a VQT server and each server is connected to the IP network via the 10/100 interface, it is possible to place a VoIP call from one server to the other without requiring VoIP services on the network itself. This is because the VQT servers handle all call signaling between them. See Sample Test Five to learn how a VQT is configured to interact with existing VoIP equipment.

This example assumes that VQT servers have been installed into an IP management network, the appropriate VQT software has been installed, the servers have been physically connected to the IP network under test, the client license key has been entered correctly, and the VQT software has been launched. Please go to Chapter 2 for more information.

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3 Sample Tests

(1) Usually the first step is to select servers in the Server Setup tool. In this example, you select "Local" for the VQT Portable Analyzer and "remoteNS" for the remotely controlled VQT Network Server. See Sample Test Two to see how servers are added and configured prior to selection in the Server Setup tool.



For this example, two TaskLists are used. "EX-SIP-Local" on the VQT Portable Analyzer and "EX-SIP-Destination" on the VQT Network Server.

Once the Server Setup tool is configured, click the START Client\Server Connection(s) button to open a client window for the selected servers.

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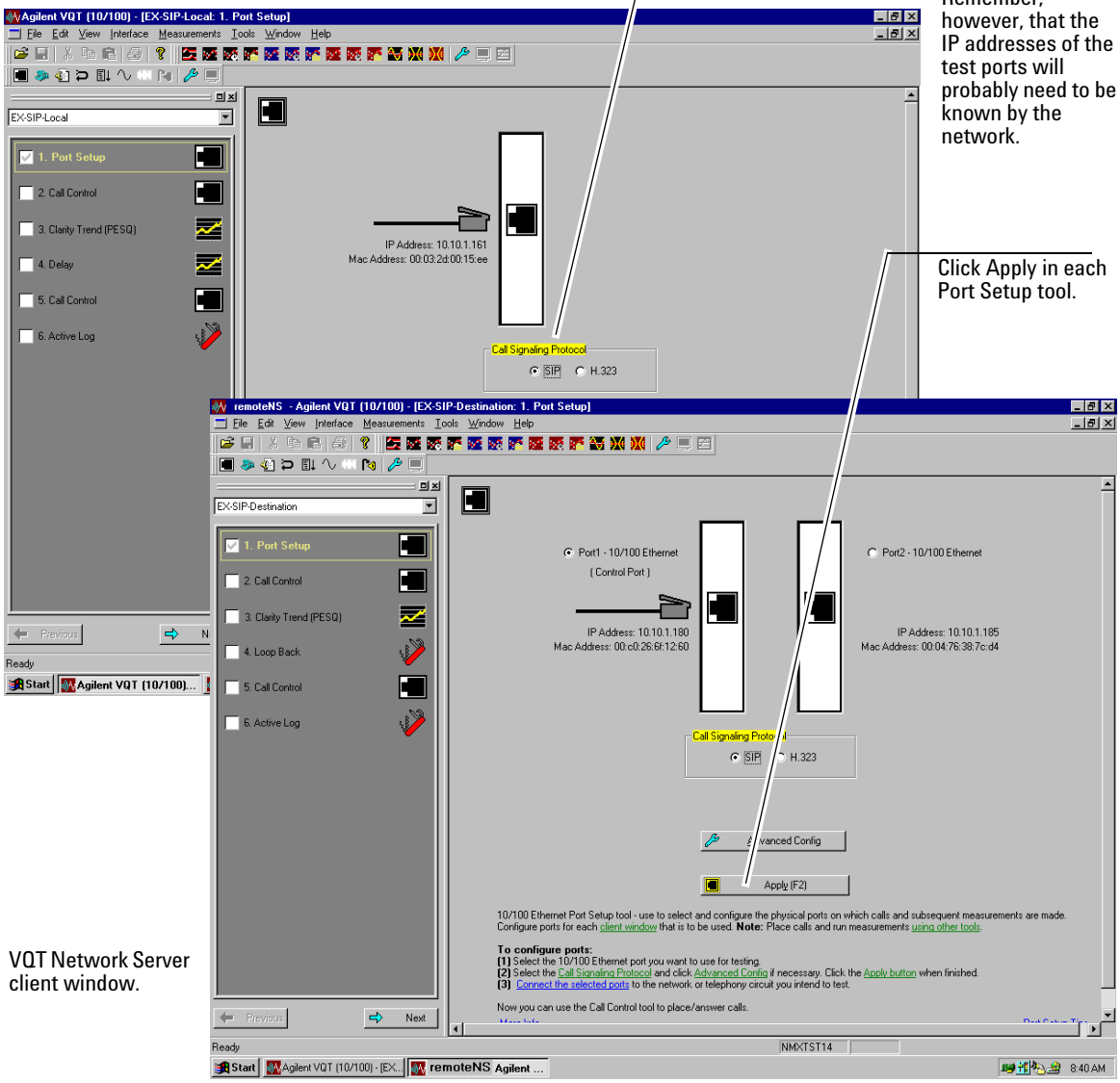
② Configure the Port Setup tool for each VQT server as shown in previous Sample Tests.

VQT Portable Analyzer client window.

SIP is selected in each of the Port Setup tools. Since this is a server-to-server test over an IP network with no VoIP services, no further configuration is required.

Remember, however, that the IP addresses of the test ports will probably need to be known by the network.

Click Apply in each Port Setup tool.

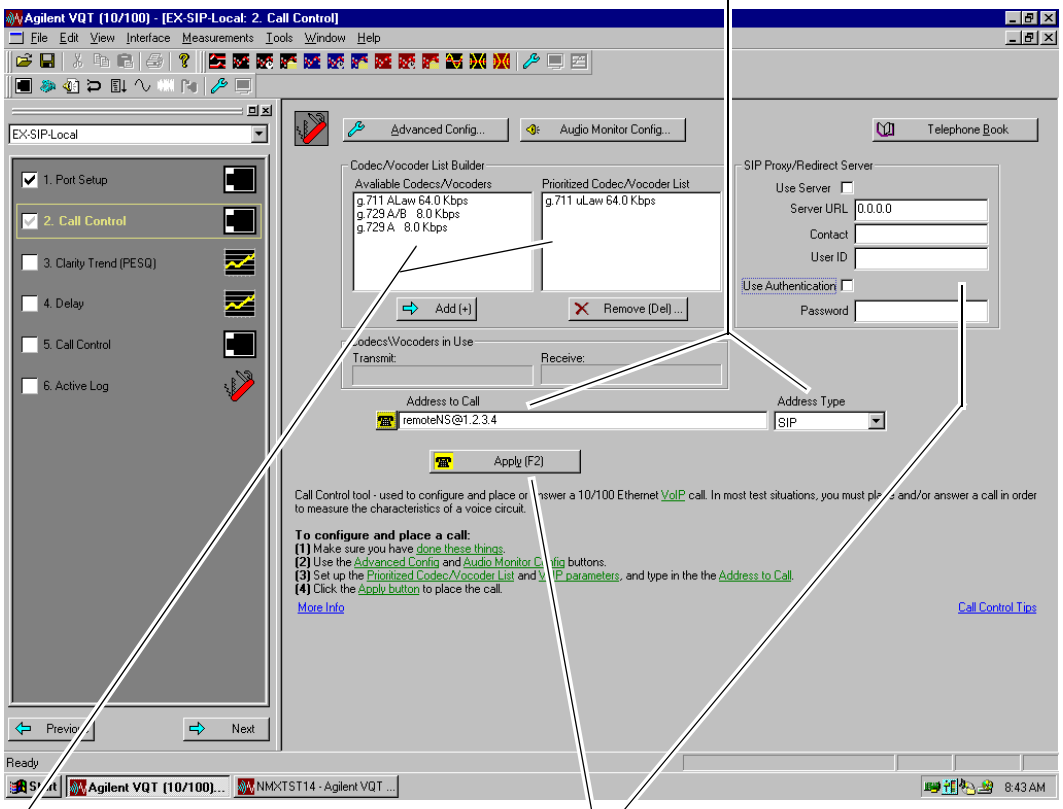


VQT Network Server client window.

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3 Use the Call Control tool for each of the servers to place a call between them. For this example, a call will be placed from the VQT Portable Analyzer to the VQT Network Server.

First, set the Address Type to SIP. Then type in the SIP address of the remote VQT Network Server. In this case, the SIP address is similar to the VQT Network Server's computer name.



Then set up the Prioritized Codec/Vocoder List. This determines the codec/vocoder to use during testing. For this example, G.711 is selected because it is likely to consume the most network bandwidth.
Note: This configuration should be the same in both VQT Call Control tools.

Click Apply to place the call.

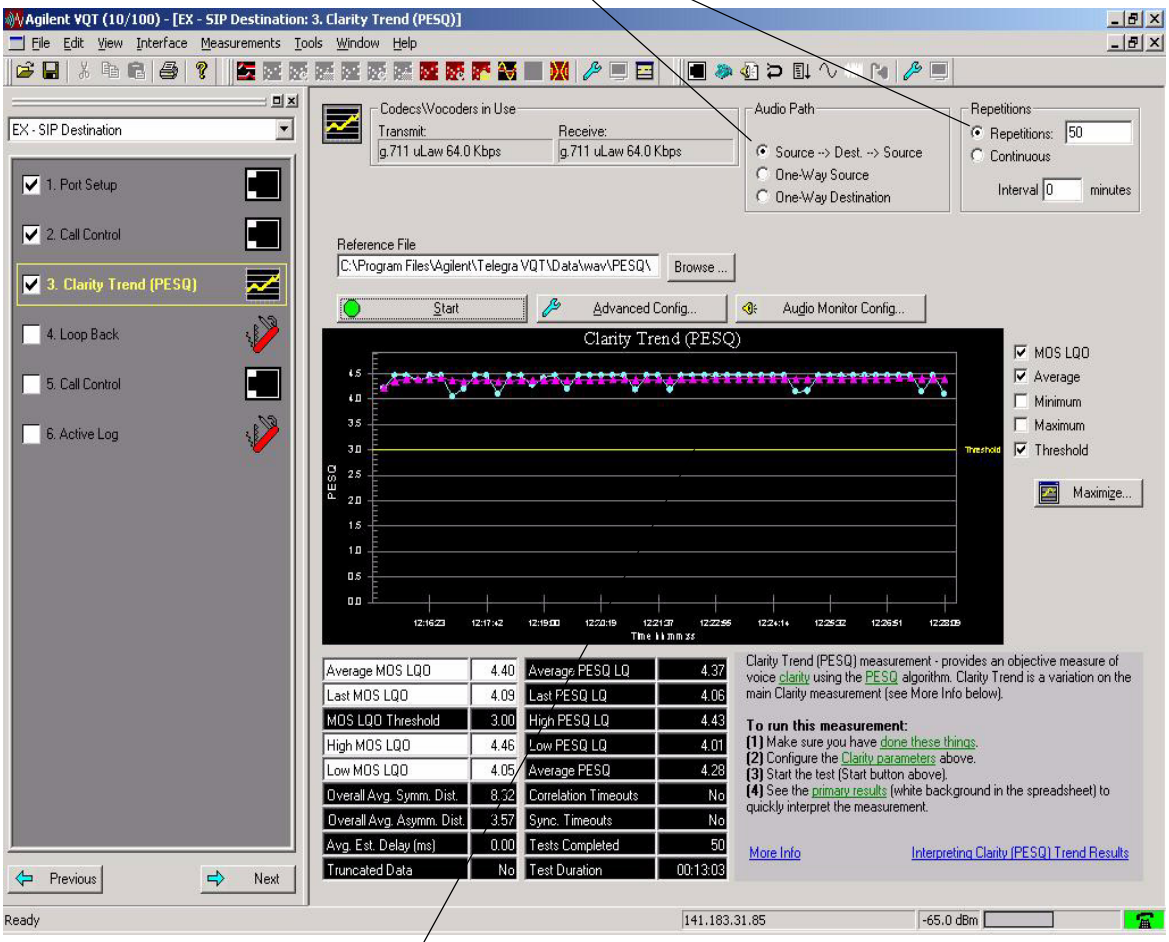
Note: There is no need to configure the VQT to interact with a SIP proxy or redirect server because VoIP is not deployed on the network under test.
Also Note: There is also no need to click Apply in the "answering" Call Control tool. The VQT answers incoming calls automatically if possible.

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4 With a call set up between the two VQT servers, you can run a Clarity Trend (PESQ) measurement. Setting up and starting a Clarity measurement has been covered in previous examples, but note the following:

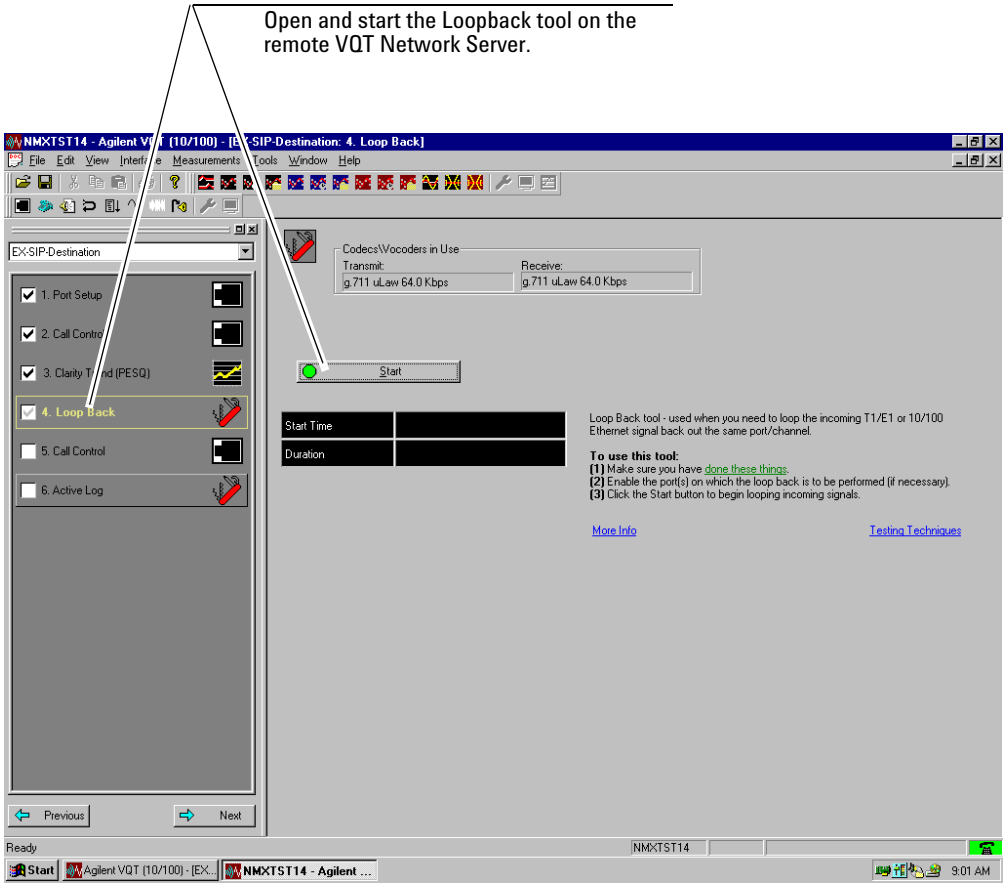
This measurement was configured for "source-destination-source" and set to run for 50 iterations.



Over the life of the run, you can see that the PESQ score is above the minimum threshold, but there are occasional drops in quality. This could be due to bursts of packet loss or delay on the IP network. These factors are good to consider prior to deploying VoIP on an existing IP network.

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(5) You can now run a round-trip Delay measurement in which test signals are transmitted from the VQT Portable Analyzer, looped back from the VQT Network Server, and analyzed at the VQT Portable Analyzer.

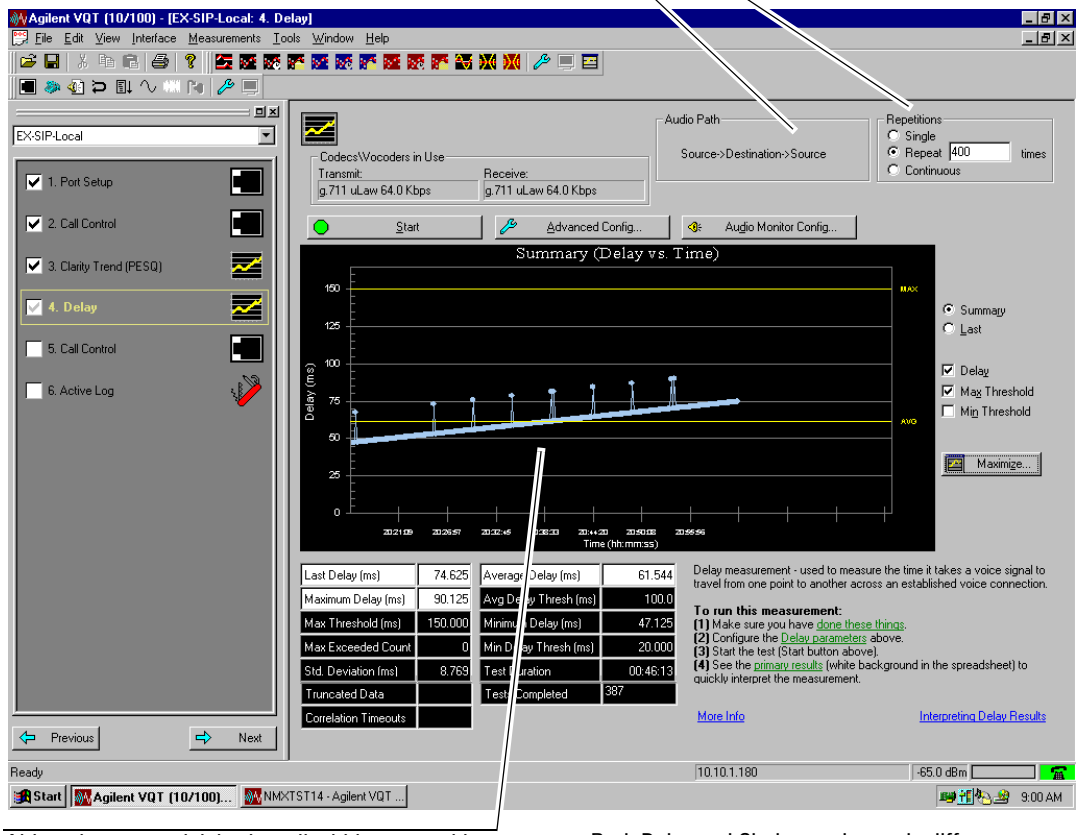


Once the Loopback tool is started, go to the Delay measurement on the VQT Portable Analyzer and configure it for round-trip (i.e., Source->Destination->Source) and multiple repetitions. Then start the measurement. (Configuring and running the Delay measurement was covered in earlier examples.) Measurement results are shown on the next page.

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Note the configuration for round-trip and multiple repetitions.



Although measured delay is well within acceptable limits for VoIP, note the gradual increase and the occasional delay spikes. These could be caused by periodic and/or increasing utilization problems. VoIP introduces delay of its own. Existing network delay combined with fundamental VoIP delay can cause some voice quality problems.

Both Delay and Clarity can be run in different ways to "pre-assess" the IP network. For example, you can run them both from different directions. In addition, you can change physical location of the VQT Portable Analyzer to exercise other parts of the network.

To end the testing session, hang up the SIP call in the same way you hang up analog or T1/E1 calls.

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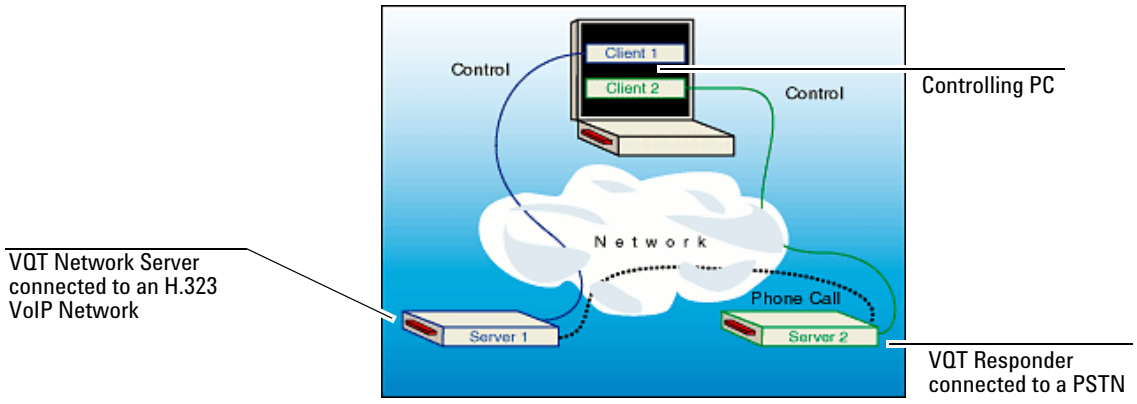
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Sample Test Four

This example demonstrates how you can test voice quality between a VoIP end point and a PSTN end point. This kind of testing is often done to evaluate whether voice quality is maintained across integrated VoIP and PSTN networks. Specifically, this sample test shows you how to:

- Place an H.323 call to an FXO end point.
- Use the File Play and Record tool to enable a Clarity File measurement.
- Run the Echo-PACE measurement.

To set the stage for this example, consider the following diagram. A VQT Network Server and a VQT Responder are remotely controlled by a PC to perform voice quality measurements between the two VQT servers. The network under test is an integrated H.323/PSTN network. The intent is to place a call from the VQT Network Server to the VQT Responder and run voice quality measurements between them.



In this case, the network consists of a VoIP network interoperating with a PSTN. The IP control connections may or may not pass through the VoIP network.

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As the diagram shows, there are two connections or communication paths: (1) an IP/Ethernet control connection between the controlling PC and the VQT servers and (2) the test connection between the two VQT servers.

The “controlling” PC can be a VQT Portable Analyzer, an Advisor (equipped with PCMCIA 10/100 Ethernet NIC), or a desktop/laptop PC. The remotely controlled VQT servers can be any of the four supported VQT devices; however, the testing shown here is not possible with two VQT Responders. Please see the Help or *Setup Guides* for more information.

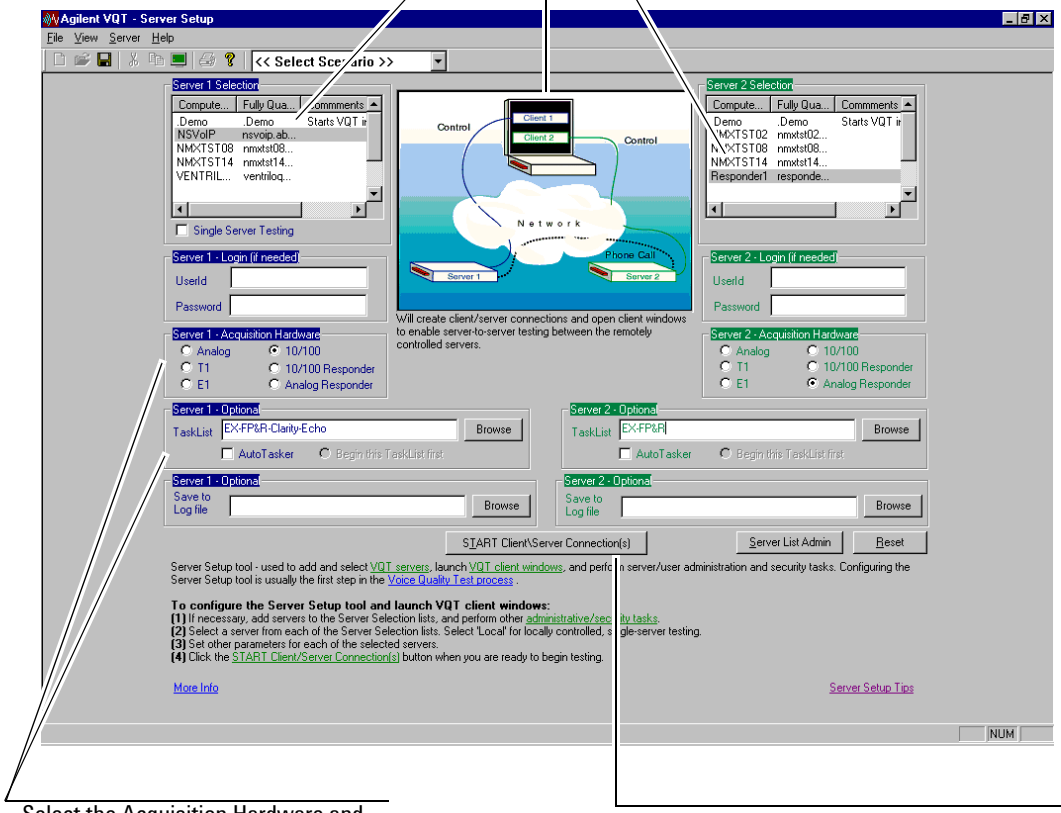
This example assumes that the VQT servers have been installed into an IP management network, the appropriate VQT software has been installed, the servers have been physically connected to the network under test, the client license key has been entered correctly, and the VQT software has been launched. Please go to Chapter 2 for more information.

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3 Sample Tests

(1) Select each of the VQT servers you intend to use. In this example, the VQT Network Server is "NSVoIP" and the VQT Responder is "VQT Responder1".

.Select the servers in the Server Selection lists. Notice the diagram in the center of the screen updates to show the selected configuration.



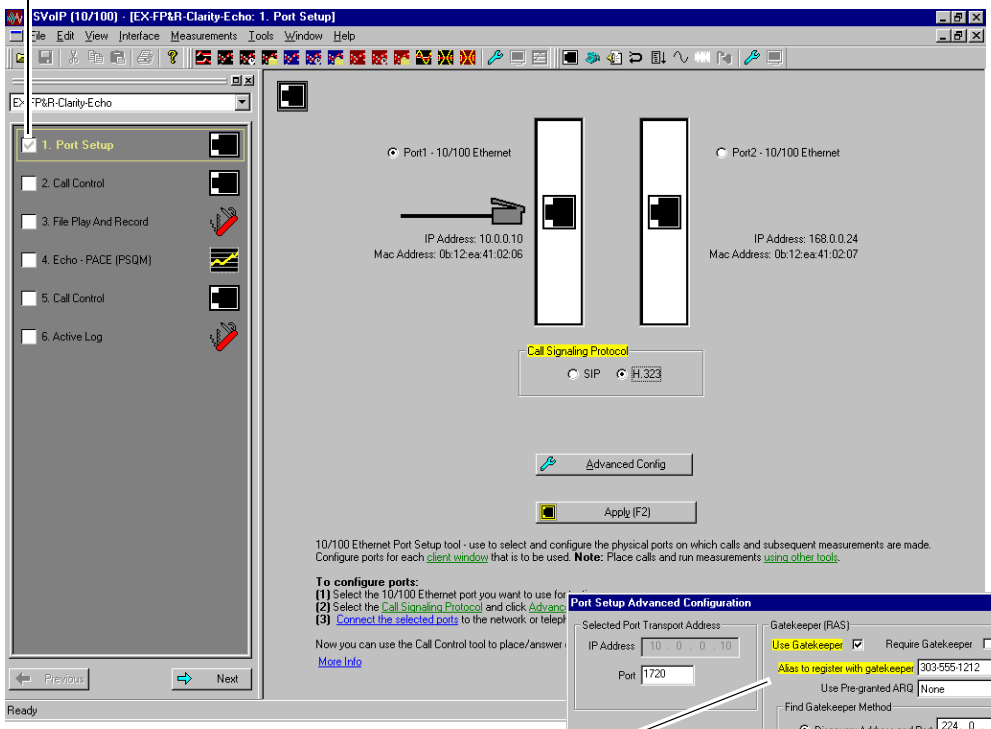
Select the Acquisition Hardware and TaskList for each of the VQT servers.

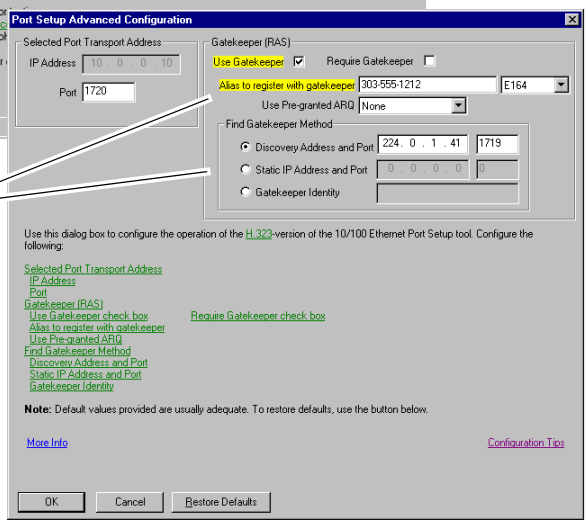
Click START Client\Server Connections to open a client window for each of the selected VQT servers.

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(2) In the Port Setup tool for the VQT Network Server, select the Call Signaling Protocol and click the Advanced Config button to open the Advanced Configuration dialog box.

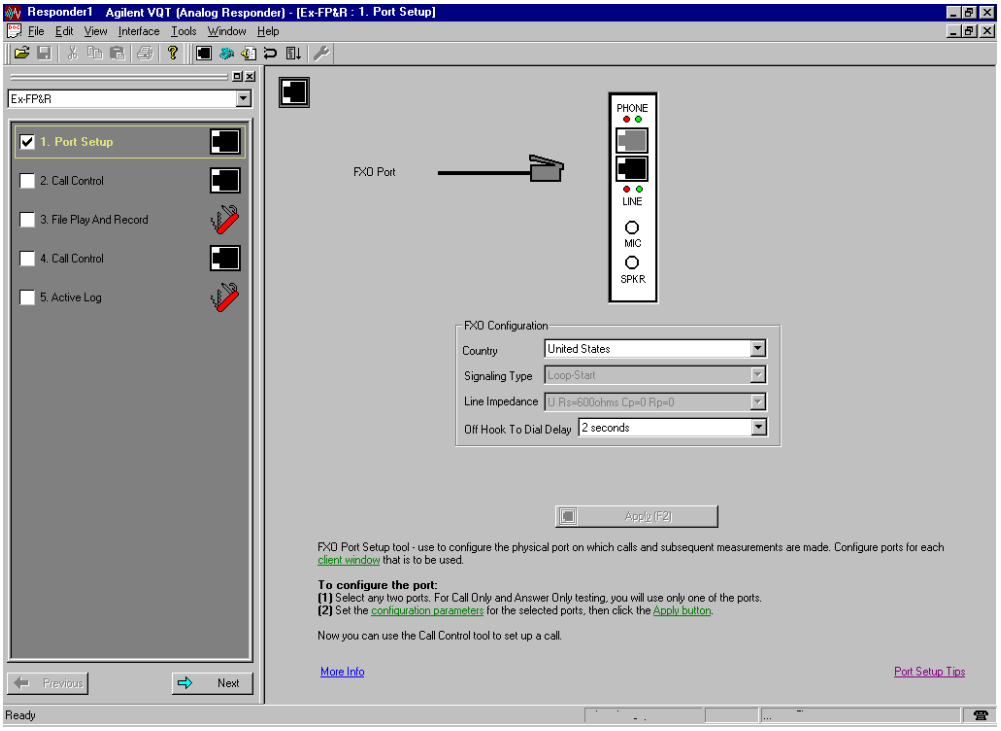




Since this example assumes a deployed VoIP/H.323 network, and since the called VQT server is outside the VoIP network, you must set various H.323 parameters. In Port Setup, these parameters enable gatekeeper registration and gatekeeper zone access.

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③ Go to the VQT Responder's Port Setup tool and configure it to match the network to which it is connected.



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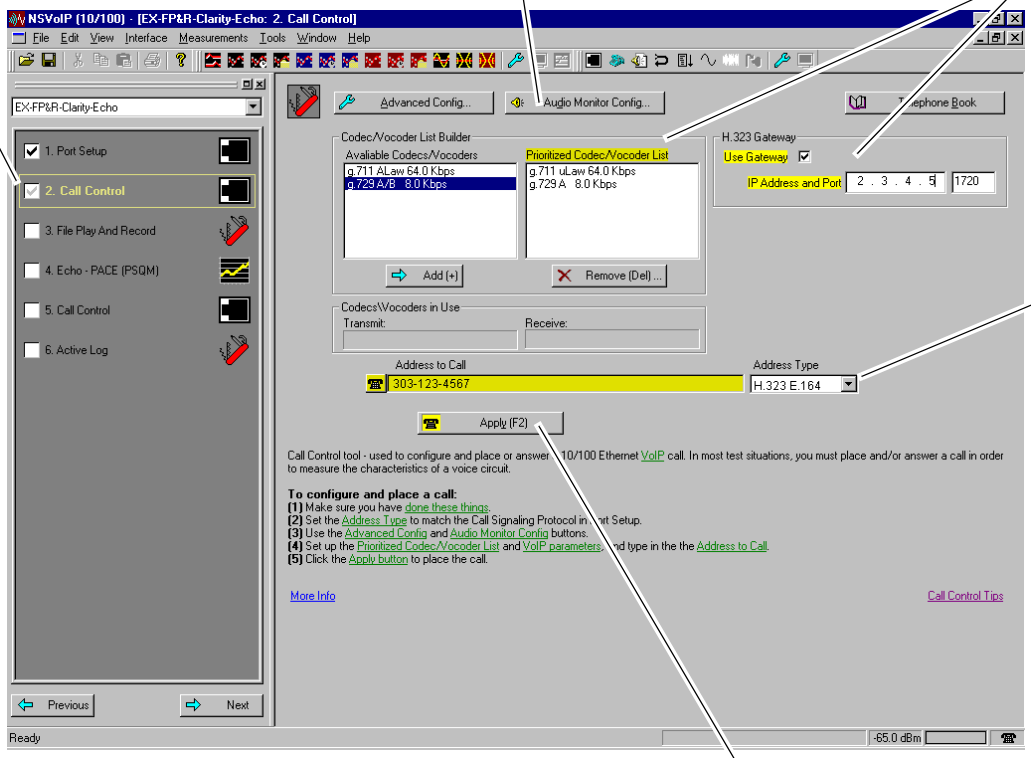
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④ To place the call from the VQT Network Server to the VQT Responder, go to the VQT Network Server's Call Control tool.

First, set the Address Type to one of those used for H.323. E.164 is the most common selection.

Then, select the codecs/vocoders you want to use and identify the H.323 gateway that will provide access to the PSTN. In most situations, if you plan to call outside the H.323 network, you will need to use a gateway.

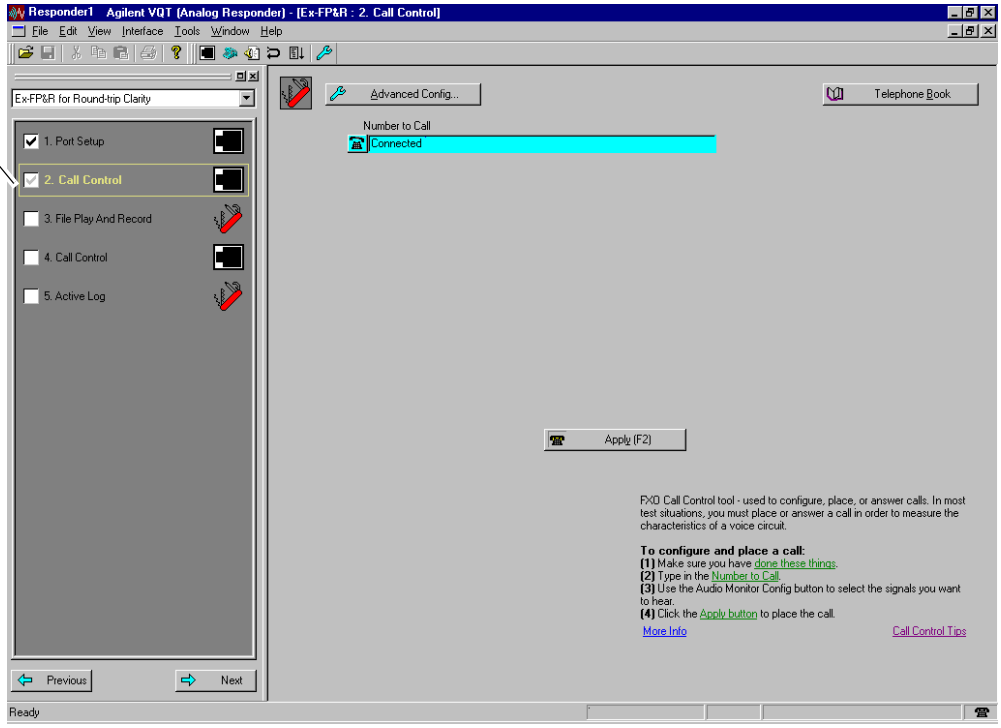
Set other H.323 and Call Control parameters in the Advanced Configuration dialog box if necessary.



Finally, type in the telephone number of the VQT Responder you want to call, and click Apply to place the call.

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5 To answer the call on the VQT Responder, open the VQT Responder's Call Control tool. Make sure there are no yellow highlights. You do not need to click Apply to answer the call - it happens automatically once the window is opened.



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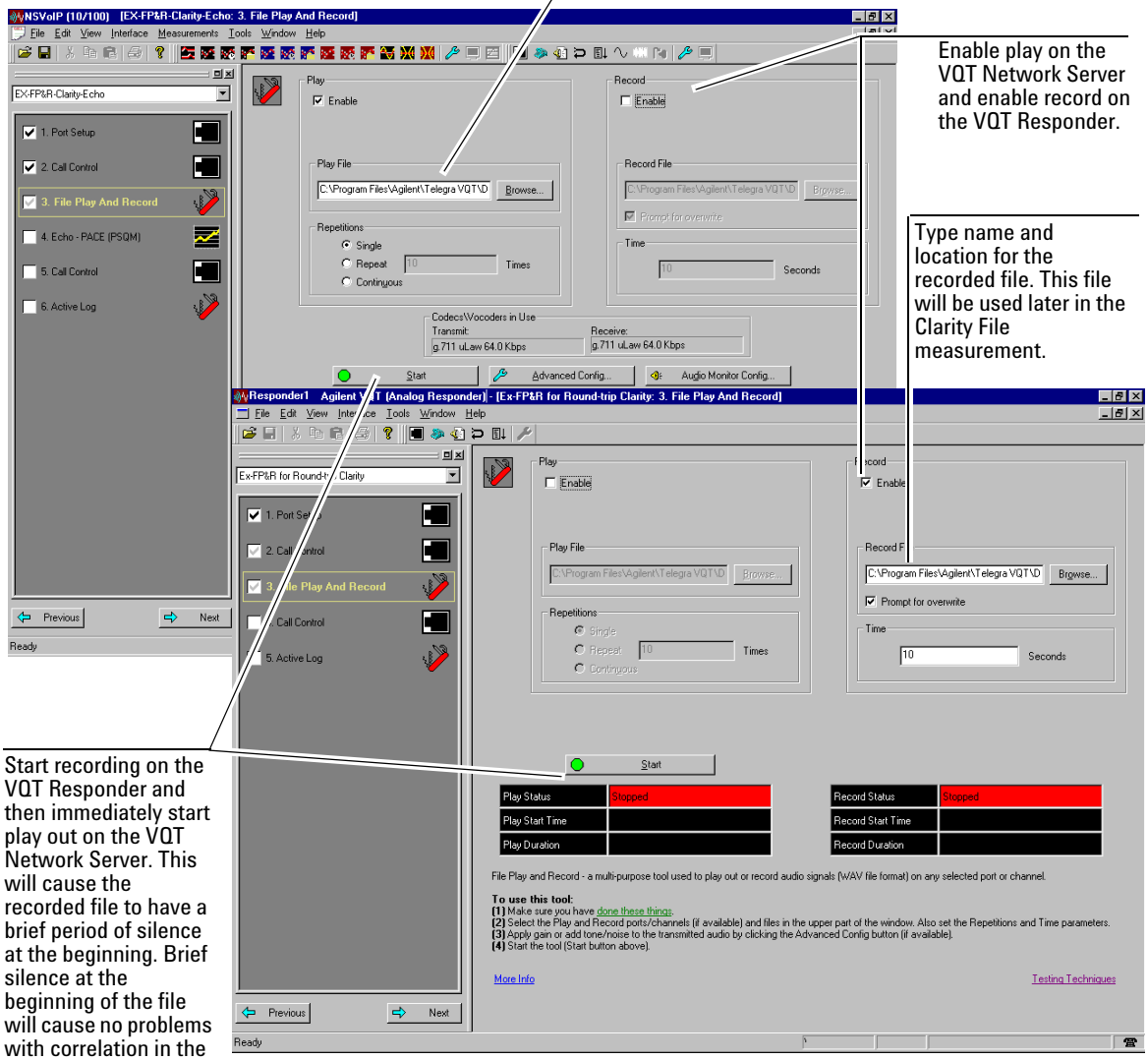
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6 To play a file out on the VQT Network Server and record it on the VQT Responder, open the File Play and Record tool in both client windows.

Select the file you want played. This is the same file that will be compared to the recorded file later in the Clarity File measurement. Use a wave file for PESQ or PSQM, or an asf file for PAMS.

Enable play on the VQT Network Server and enable record on the VQT Responder.

Type name and location for the recorded file. This file will be used later in the Clarity File measurement.



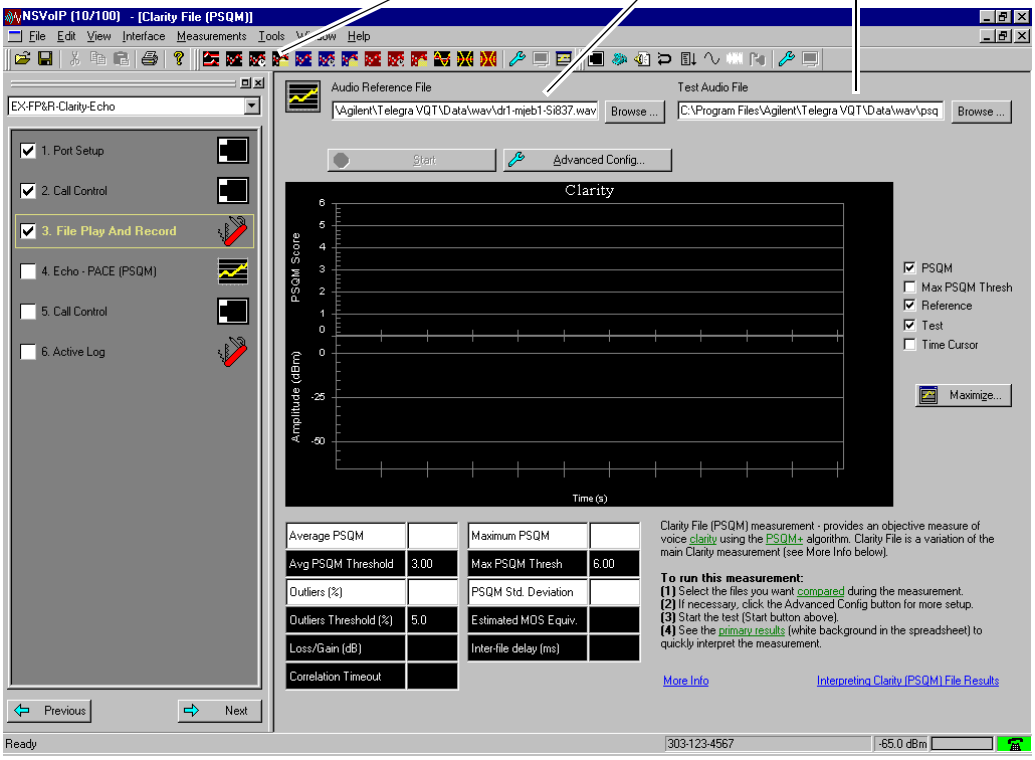
Start recording on the VQT Responder and then immediately start play out on the VQT Network Server. This will cause the recorded file to have a brief period of silence at the beginning. Brief silence at the beginning of the file will cause no problems with correlation in the Clarity File measurement.

Although files are played from the VQT Network Server and recorded on the VQT Responder, they will be automatically transferred to the controlling PC.

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3 Sample Tests

⑦ In the client window for the VQT Network Server, click the Clarity File toolbar button to open the measurement. You can now select the recorded file and compare it to a copy of the played file. This will give you the equivalent of a one-way Clarity measurement between the Network Server and the VQT Responder.



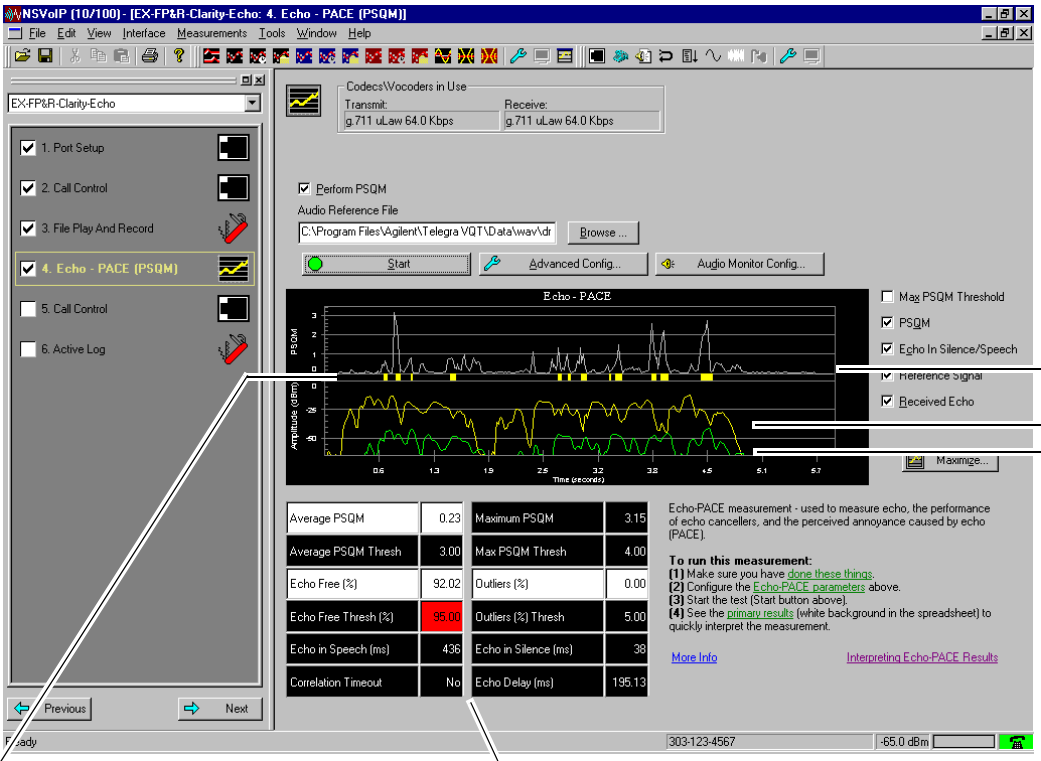
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8 Open the Echo-PACE measurement on the VQT Network Server to measure echo generated at or near the VQT Responder's FXO connection.

When using the 10/100 Ethernet interface, the Echo-PACE measurement is automatically configured to transmit the test signal and analyze returning echo. Simply start the measurement.

In the graph, you can see the original test signal, the attenuated and delayed echo signal, and the corresponding PSQM scores. Notice that PSQM values increase dramatically when the echo signal is strong enough to be considered "Echo in Speech".



This band shows where the VQT reports periods of Echo in Speech and Echo in Silence. These results depend on user-defined thresholds that determine absolute signal levels and levels relative to the original test signal.

The results in the spreadsheet and graph show that the Average PSQM is very low with a few isolated spikes. While the Echo in Speech threshold was exceeded, most of the test signal (92%) was not interfered with by echo. Echo of this magnitude would probably not cause much annoyance.

You can now hang up the call as demonstrated in an earlier example.

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3 Sample Tests

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