Agilent Technologies

Agilent VQT

Getting Started Guide

Agilent Technologies

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The following warnings and operating information are shown in English followed by the French translation.

WARNING This product is a Safety Class I instrument with a protective earth terminal.

WARNING For protection from electric shock hazard, power cord ground must not be defeated.

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The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions with specific warnings in this manual violate safety standards of design, manufacture, and intended use of this instrument.

Grounding

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor AC power cable compatible with an approved three-contact electrical outlet. The power jack and mating plug of the power cord must meet International Electrotechnical Commission (IEC) safety standards.

Environment

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Service and Adjustment

Dangerous voltages exist within this instrument. Service and adjustment of this instrument is to be performed only by trained service personnel.

Do not replace components with the power cable connected. Dangerous voltages may be present even when the power cable is disconnected.

Do not perform internal servicing or adjustment unless another person, capable of rendering first aid and resuscitation is present.

Hazardous Material

Should the LCD be damaged the liquid crystal material can leak. Avoid all contact with this material, especially swallowing. Use soap and water to thoroughly wash all skin and clothing contaminated with the liquid crystal material.

Unauthorized Service

The installation of substitute parts or the installation of any instrument modification not authorized by Agilent Technologies is specifically forbidden. The performance of such unauthorized service can negate the instrument warranty or any maintenance agreements.

Return the instrument to an Agilent Sales and Service Office for authorized service and repair.

MISE ENGARDE Cet appareil répond aux normes de la «Classe de sécurité I» et est muni d'un fil de mise à la terre pour votre protection.

MISE ENGARDE Pour prévenir les risques de choc électrique, la broche de mise à la terre du cordon d'alimentation ne doit pas être désactivée.

Restrictions d'utilisation

L'utilisateur se doit d'observer les mesures de précaution énumérées ci-dessous pour toutes les phases d'utilisation, de service et de réparation de cet appareil. Le fait de ne pas s'y conformer équivaut à ne pas respecter les mises en gardes spécifiques contenues dans ce manuel et constitue une violation des normes de sécurité relatives à la conception, la fabrication et l'utilisation prévue de cet appareil. La société Agilent n'assume aucune responsabilité envers un client qui manquerait de se conformer à ces exigences.

Mise à la terre

Afin de minimiser les risques de choc électrique, le chÀssis et le cabinet de l'appareil doivent être mis à la terre. L'appareil est équipé d'un cordon d'alimentation muni d'une fiche homoloquée à trois lames, compatible c.a. La prise murale et la prise femelle de la rallonge électrique doivent respecter les normes de sécurité de la «Commision électrotechnique internationale» (IEC).

Environnement
Ne faites pas fonctionner cet appareil en présence de gaz inflammables ou de vapeurs dangereuses. L'utilisation de n'importe quel appareil électrique dans ces conditions constitue un risque élevé pour votre sécurité.

Service et ajustement
Des «tensions dangereuses» résident dans cet appareil. Par conséquent, le service et l'ajustement doivent être effectués uniquement par une personne qualifiée.

Ne remplacez pas de composantes lorsque le cordon d'alimentation est sous tension. Il pourrait y avoir présence de «tensions dangereuses» même lorsque l'appareil est déconnecté.

Ne faites pas de service interne ou d'ajustement sauf en présence d'une autre personne, capable de prodiguer les premiers soins et de pratiquer la réanimation.

Matière dangereuse
Si l'affichage LCD est endommagé, la matière constituant les cristaux liquides peut se répandre. Eviter tout contact avec cette matière, et en particulier ne pas l'avaler. Utiliser de l'eau et du savon pour nettoyer soigneusement la peau et les vêtements qui auraient été contaminés par la matière constituant les cristaux liquides.

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Explosion Hazard
Do not operate in the presence of flammable gases.

Fire Hazard
For continued protection against fire hazard replace only with fuse of same type and rating.

Cleaning
To clean the product, use a damp cloth moistened with a mild solution of soap and water. *Do not* use harsh chemicals. *Do not* let water get into the product.

Product Damage
Do not use this product when the product shows visible damage, fails to perform, has been stored in unfavorable conditions, or has been subject to severe transport stresses.

Whenever this product has become damaged or wet, make the product inoperative and secure it against any unintended operation. Contact your nearest Agilent Sales office for assistance.

Instruction book symbol - the product will be marked with this symbol when it is necessary for the user to refer to the instruction book in order to protect against damage.

A product marked with this symbol indicates it is a laser product. When necessary, this symbol will be included in the instruction book for the user to refer to in order to protect against personal injury and/or correct product handling.

Indicates potential for electrical shock.

WARNING
An operating procedure, practice, etc., that if not correctly followed could result in personal injury or loss of life.

CAUTION
An operating procedure, practice, etc., that if not strictly observed, could result in damage to, or destruction of, equipment or software.

This is an Installation Category II product.

This is a Pollution Degree 2 product.

This product is designed for indoor use only.

FCC Part 68 Disclaimer

This equipment must not be connected to the telephone network unless it is connected through protective circuitry that is registered pursuant to Part 68 of the Federal Communications Commission rules.

Contents

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Introduction

Introduction

This Getting Started Guide documents the Agilent Technologies VQT (Voice Quality Tester) Application, which runs on, or with, all of Agilent's Voice Quality Testers: VQT Portable Analyzer (J1981A), VQT Network Server (J1987A), and VQT Undercradle (J4630A).

Note The VQT Application was previously know as the Telegra VQT Application and the VQT Portable Analyzer was previously known as Telegra®R.

The VQT Application, used with one of the VQT devices, gives you the following analysis options for voice-over-packet environments that traditional tests do not.

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

The VQT Application's remote / distributed capabilities provide:

- A client/server architecture for centralized control across most TCP/IP networks.
- Flexible implementation options — You can perform remote/distributed testing or stand-alone testing all with the same equipment.
- Multiple hardware platforms.

The remaining sections of this chapter describe the Agilent VQT Application. To learn how to get started with the VQT Application, go to chapter 2. To see examples of how the VQT is used, go to chapter 3. To get detailed operating instructions, use the online Help. Additionally, you can refer to the Information Map, page 1-4, for a list of all Agilent VQT system documentation.

Information Map

This section lists the books and Help that describe Agilent Technologies' VQT test solution.

- VQT Software — *Agilent VQT Getting Started Guide* (this guide) or VQT Application's Help
- VQT Network Sever — *VQT Network Sever Setup Guide*
  Refer to Set Up the VQT Network Server, page 2-8, to get started quickly.
- VQT Portable Analyzer — *VQT Portable Analyzer Setup Guide*
- Agilent Advisor — *VQT Undercradle Setup Guide*

Overview of the Agilent VQT Test System

This section provides an overview of the Agilent VQT Test System and the role the VQT devices play. Refer to the VQT's online Help for a general description of voice quality testing concepts. Refer to the following sections for more information:

VQT System Components

Fundamentally, the VQT system is broken down into two main components:

- VQT Test Platforms
  The VQT system consists of several hardware platforms: the VQT Network Server, VQT Portable Analyzer, and Agilent Advisor (with VQT undercradle). Each hardware platform contains one or more sets of test interface ports / acquisition cards and analysis software. Depending on the type, these platforms can be locally controlled using their own keyboards and monitors, or remotely controlled using another PC. Both the Portable Analyzer and the Advisor can also be used to remotely control other VQT test devices (including the Network Server).
- VQT Application
  The VQT application is a highly intuitive and easy to use software package that is installed on one of the VQT's test platforms a VQT Portable Analyzer or the Advisor or a desktop/laptop PC. 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 system architecture is described later.) This software enables you to manage and secure VQT servers and provides an individual "client window" to run each server when performing remote / 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.

How the VQT Tests Voice Quality

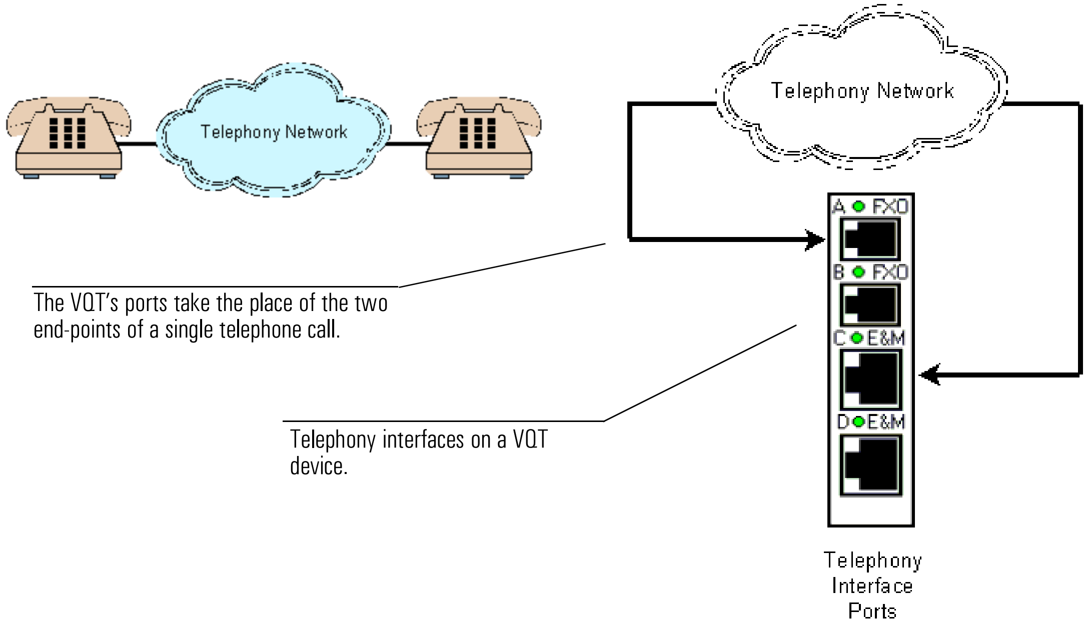
To test voice quality and measure other audio circuit characteristics, the VQT system does essentially two things:

- 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 circuit/system 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 on to the call and measures how those signals are affected by travel through the circuit/system under test. The VQT can send test signals in either direction on the established 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 many cases, to perform the necessary analysis, the VQT must also be able to receive test signals once they have passed through the circuit under test.

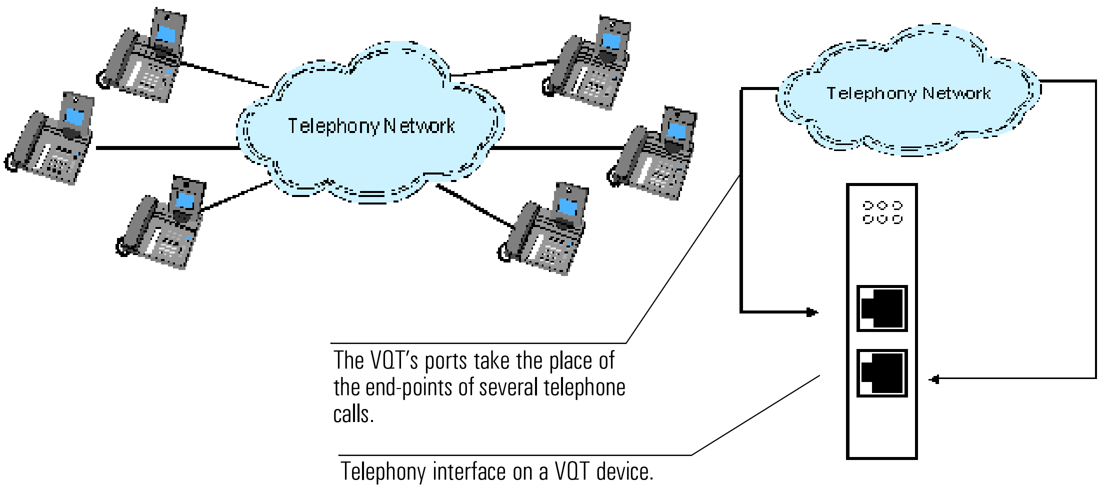
FXO and E&M Environments

The following diagram illustrates conceptually how a VQT device can play the role of two telephones in an end-to-end test environment.



T1/E1 Environments

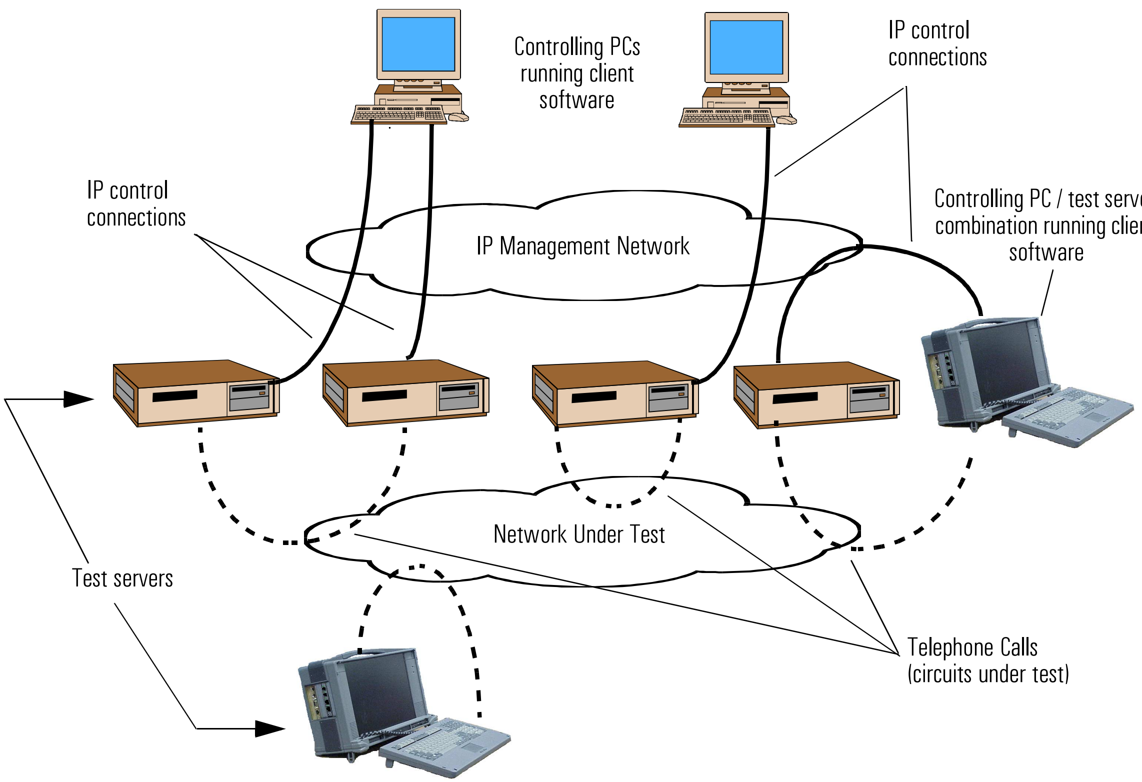
The following diagram illustrates conceptually how the VQT plays the role of several telephones/channels in an end-to-end test environment. Remember, that with T1/E1 connectivity, the VQT replaces the end trunks of the connection. The end trunks of a connection can consist of a variety of telephony network equipment like a PBX, router, CSU/DSU switch, and so on.



The previous two illustrations show the VQT controlling both ends of telephone calls using the same, single VQT device. However, the VQT can also be used in “call-only” and “answer-only” modes where one VQT device calls another. Refer to the VQT's Help for more information about these test options.

VQT System Testing Scenarios

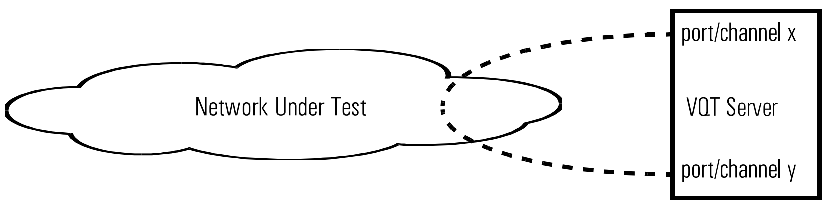
The VQT system uses a client / server architectural model that supports a number of testing options. You can run voice quality measurements using a single VQT test device, or you can implement a collection of locally controlled / remotely controlled test devices that can run measurements between each other. The following illustrations show an example.



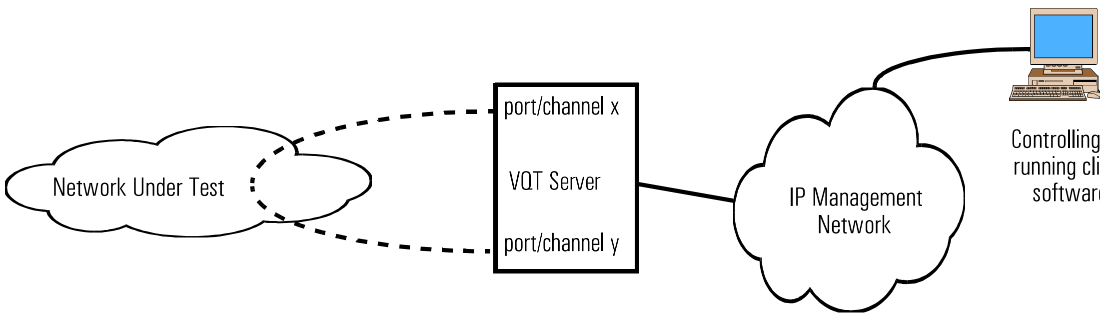
As shown above, the VQT system consists of "controlling PCs" (running "client" software) that manage "test servers". The controlling PC and the test server can be the same device, and the test server can be one of several Agilent VQT devices. The controlling PC communicates with one or more test servers via an IP management network. Voice quality tests are run between ports or channels on the test servers. As the diagram shows, there is a distinction between the IP management network and the network under test, although they could be the same network depending on how they are deployed.

VQT test equipment such as the VQT Portable Analyzer and the Agilent Advisor can be controlling PCs as can a desktop/laptop PC. The VQT Network Server cannot serve as a controlling PC. In addition, the VQT Portable Analyzer and the Agilent Advisor (with a VQT undercradle) can perform as test servers (i.e. be controlled by VQT software running on the controlling PC). The above architecture illustrates three basic modes of operation, which are described in more detail next.

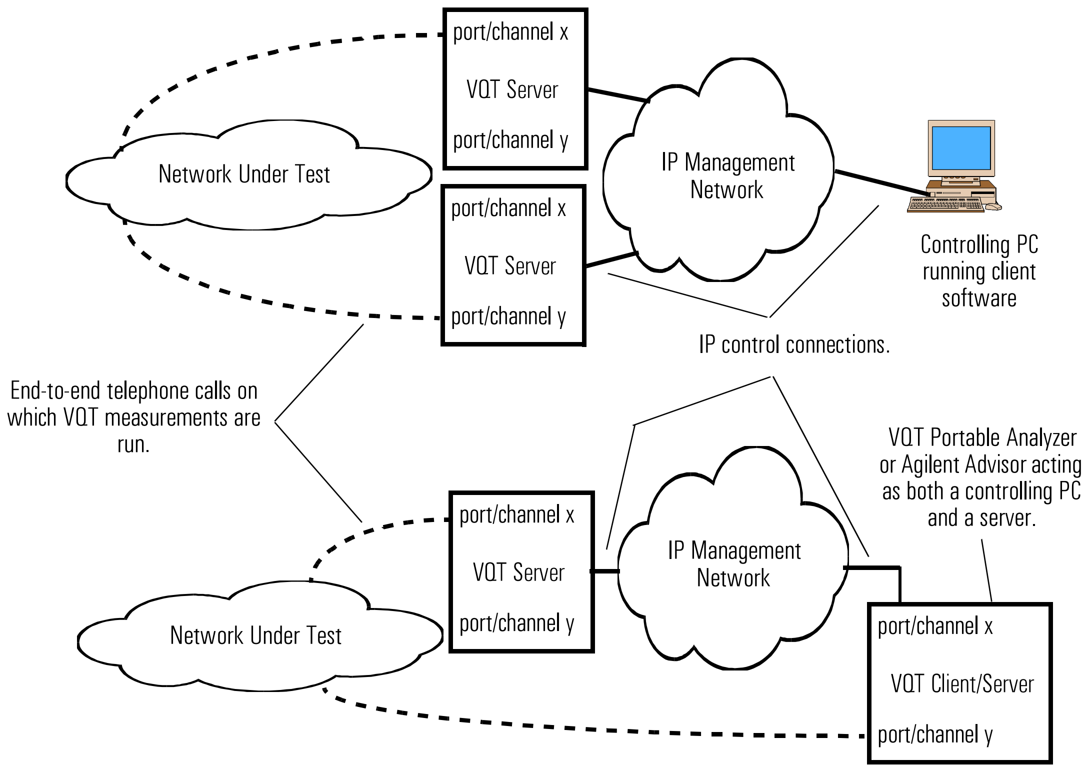
- Locally Controlled, Single-Server Testing
  Refers to the VQT Portable Analyzer or Agilent Advisor (with a VQT undercradle) operated from its keyboard and monitor. This common mode of operation (shown below) is covered in much more detail in the VQT application's Help.



- Remotely Controlled, Single-Server Testing
  Refers to the case where a single VQT Network Server is controlled by another PC to establish end-to-end connections for testing. This case also refers to a single VQT Portable Analyzer or the Advisor (with a VQT undercradle). The main difference between this mode and the one described previously is that the VQT server is being controlled via an IP connection by a PC running VQT software. Remember, this “controlling PC” can be a VQT Portable Analyzer, an Agilent Advisor, or a desktop or laptop PC.



- Locally and/or Remotely Controlled, Multiple-Server Testing
  Refers to the case where two VQT Network Servers place calls to each other to establish the circuit(s) under test. These calls are typically placed between ports/channels on one VQT and ports/channels on another, allowing end-to-end or round-trip measurements across voice circuits that terminate in different locations. Because VQT Portable Analyzers and Agilent Advisors can be run either as test servers or as controlling PCs (running VQT software), various configurations of local and remote control are possible (as shown below). This operational mode allows truly "distributed" measurements in which test signals are sent end-to-end for analysis.



Additional Notes on the Operational Modes

- VQT Network Servers cannot serve as a controlling PC.
- New VQT Portable Analyzers and Agilent 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.
- When controlling a VQT server from a PC, all interaction with the server is via the PC's user interface.
- Server software and VQT software cannot operate independently when running in a remote/distributed environment.
- Whether a VQT Portable Analyzer or an Agilent Advisor work as a controlling PC or as a dedicated server depends on configuration settings and a client license.
- 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.

Overview of Voice Quality Testing

To better understand how and when 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. Refer to the following VQT topics for more information. The VQT Application's Help provides an expanded version of the concepts discussed here.

- Why Test Voice Quality with a VQT?, page 1-14
- Voice Quality Defined, page 1-15
- Voice Quality Test Situations, page 1-17

Why Test Voice Quality with a VQT?

Public switched telephone networks (PSTN) 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. However, 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. Voice-over-packet 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:

- 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.

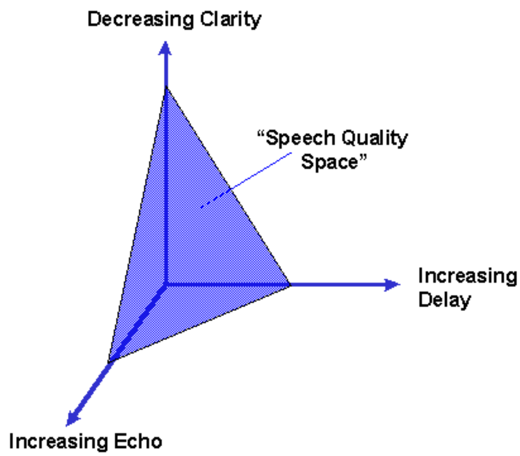
- Packet Loss — Packet networks, particularly TCP/IP, rely on retransmissions for lost packets. Data applications such as file transfers and email are less sensitive to the time it takes for this to occur, but real-time voice traffic cannot tolerate this delay. In addition, VoIP networks use connectionless transfer protocols such as 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.

Voice Quality Defined

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, 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 voice-over-packet 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 via the telephone.



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.

Important Note: The previous illustration is provided as a conceptual model only. 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 number. Any representation of voice quality, whether it be for individual devices, or voice-over-packet systems, should include at least a clarity and a delay component, and perhaps an echo component as well.

Voice Quality Test Situations

Voice-over-packet technologies (particularly VoIP) are maturing from ‘early adopter’ development environments to wider deployment in 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 voice-over-packet (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 VQT can be used in a number of test situations:

- 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 voice-over-packet processes. For example, it may be useful to confirm prior to product release that codec implementations on voice gateways provide predictable PSQM or PAMS scores, and that 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. These newly installed networks can be tested to ensure that the interactions between equipment and software from multiple vendors do not adversely affect voice quality.
- Network Baselining / 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.

- Network Optimization
  Operational networks can be 'fine-tuned' to increase performance and reduce the possibility of failure.
- 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 system components fail.
- Proactive Monitoring
  To find problems before they affect voice traffic, tests are performed at regular schedules across representative circuits.
- Remote / 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 / distributed measurement system 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 VQT's Help for a more detailed descriptions of testing scenarios, testing in a remote/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.

Overview of Measurement and Tool Features

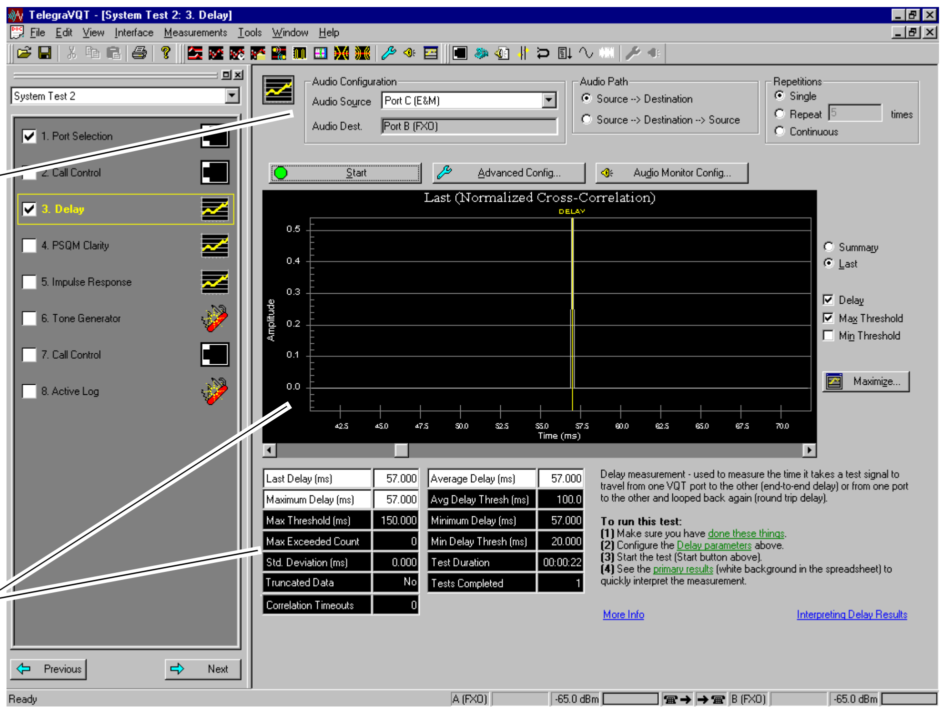
Refer to the following sections for on overview of the VQT Application's measurements and tools:

Measuring End-to-End Delay

Measure the latency introduced by devices and systems.

A major differentiating factor in voice-over-packet devices and systems is end-to-end delay (that is, the time it takes for voice signals to go from talker to listener). Delay is introduced as voice is digitized, packetized, and transmitted. From a voice quality standpoint delay can disrupt the rhythm of a conversation, and in extreme cases, make conversation impossible. The VQT's 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.

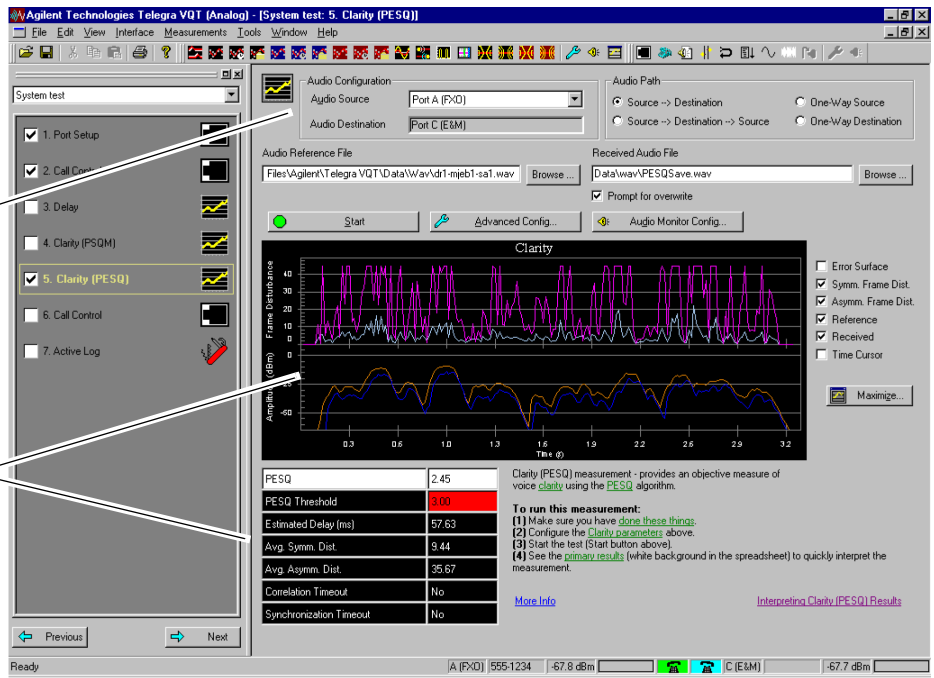


Delay results are shown in both graphical and spreadsheet formats.

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 lack of noise/distortion of a voice signal. In voice-over-packet 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 subjective phenomena, the Clarity measurement uses one of three analysis algorithms: PESQ, PSQM, or PAMS. The VQT provides multiple versions of this measurement, 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.



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

PESQ, PSQM, or PAMS results are shown in the upper part of the graph and voice signal amplitudes are shown in the lower. In addition, Clarity statistics are shown in the spreadsheet.

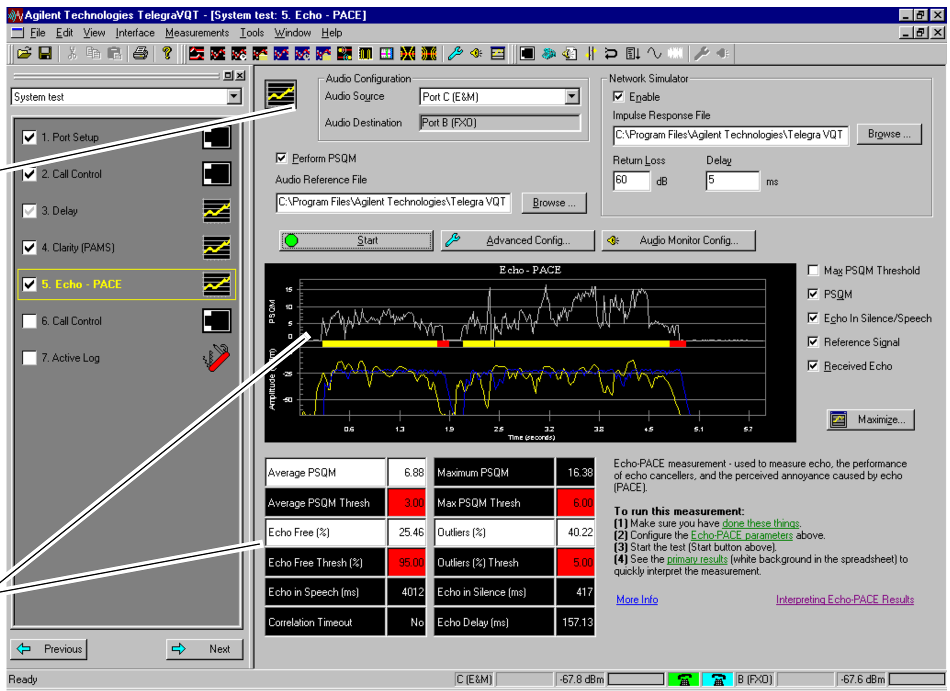
Note

Either Clarity (PESQ), Clarity (PSQM), or Clarity (PAMS) may not be available depending on the option you purchased. Contact your Agilent sales representative for more details.

Measuring Echo — PACE

Measure the Perceived Annoyance Caused by Echo (PACE).

Echo is a potential problem in telephony networks that can be made worse when voice-over-packet 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 Network Simulator to enhance the more traditional echo amplitude vs. time measurement result and the Echo-PACE (PESQ) measurement provides similar results using PESQ. Measurement statistics are also displayed in a spreadsheet.



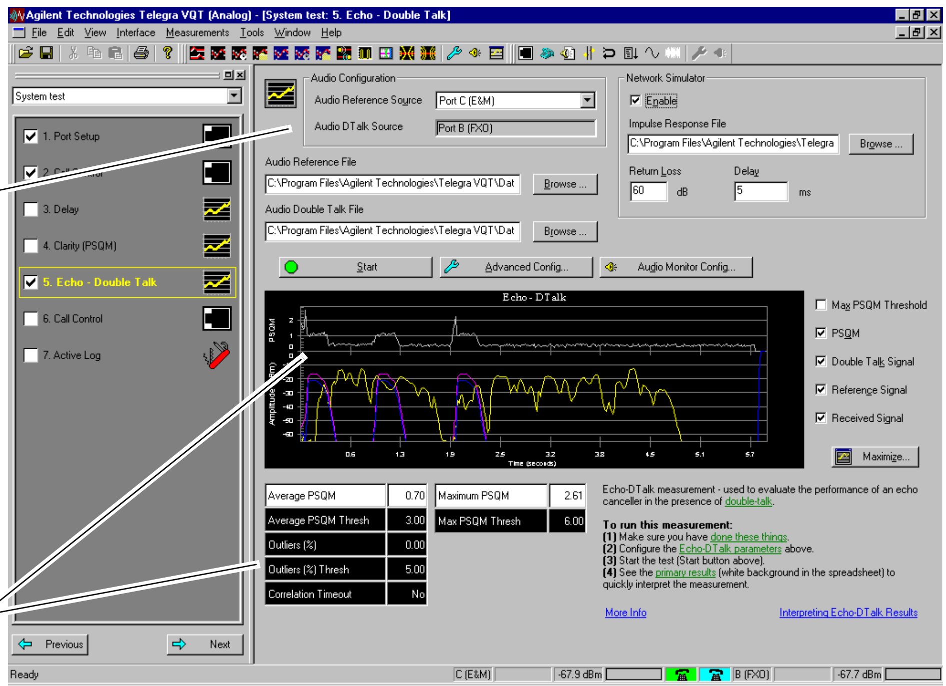
Configure the behavior of the measurement in the upper portion of the view.

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

Measuring Echo — DTalk

Measure echo in the presence of double-talk.

Echo cancellation during double-talk is an interesting problem and a possible failure mode that can impact overall voice quality. The Echo-DTalk measurement can help you evaluate the performance of an echo canceller in the presence of double-talk. Echo-DTalk can also help 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.

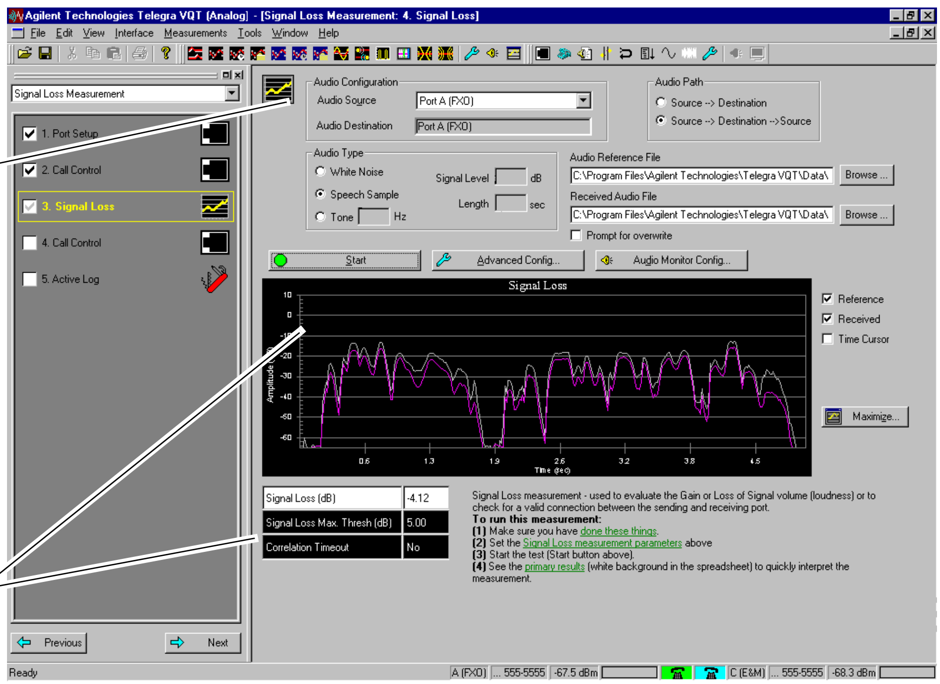
The graph displays the amplitude of the test signal and the "interrupting" DTalk signal. Resulting PSQM scores are displayed both graphically and in the spreadsheet.

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 and can affect voice circuit operations that depend on the reliable transmission of DTMF tones for signaling. The Signal Loss measurement can help you 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/loss results are shown in the spreadsheet.

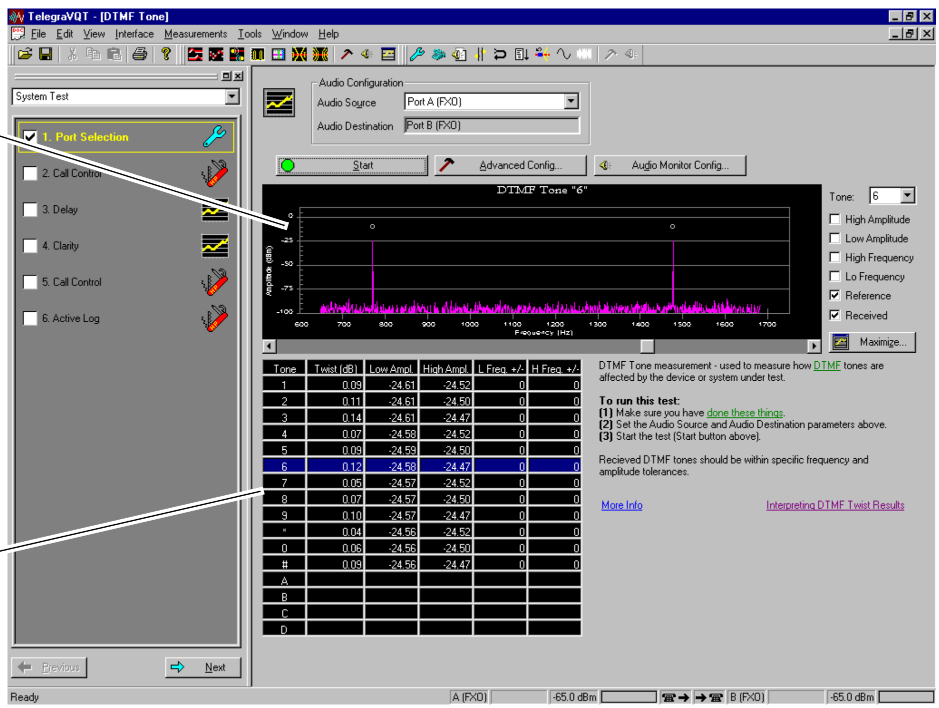
Measuring DTMF Tones

Evaluate the effect transmission has on DTMF Tones.

You 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 voice-over-packet (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.

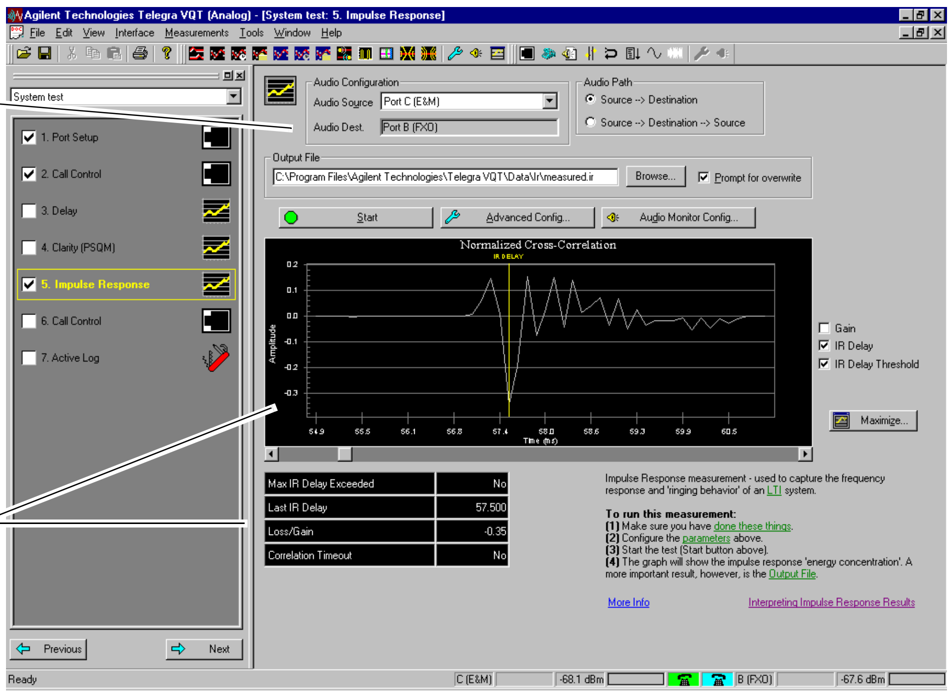


Measuring the Impulse Response

Capture and use the impulse response of an audio channel.

You 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 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 device and system tests.

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



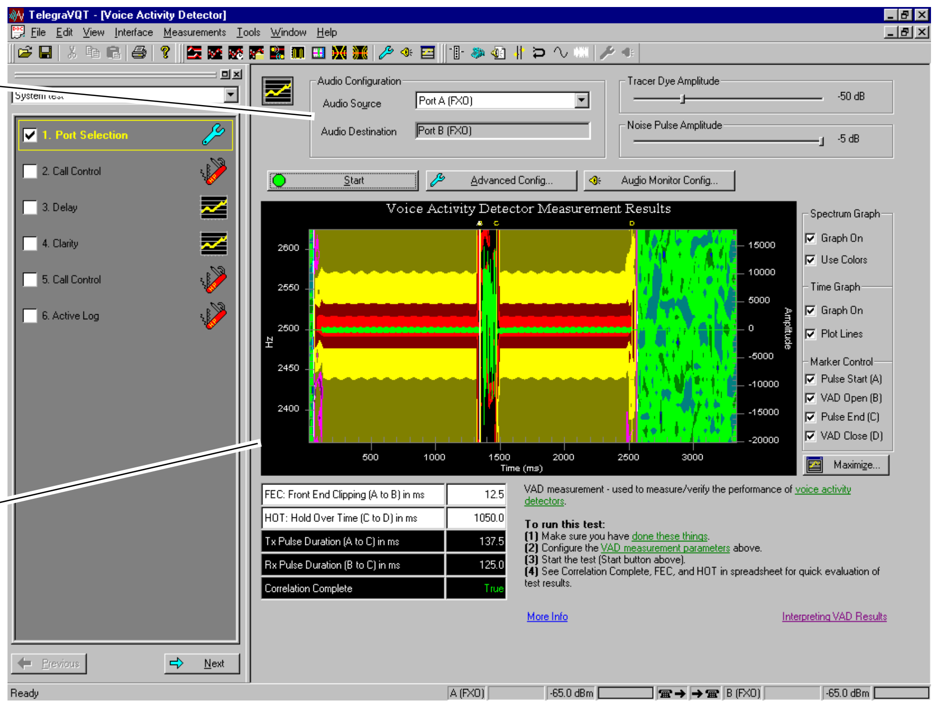
Time-domain impulse response is shown graphically, and measurement statistics are shown in the spreadsheet.

Evaluating Voice Activity Detection

Measure and verify VAD performance.

You use the VAD measurement to evaluate or verify the performance of voice activity detectors in gateways, routers, or other voice-over-packet 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 amplitudes for 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.

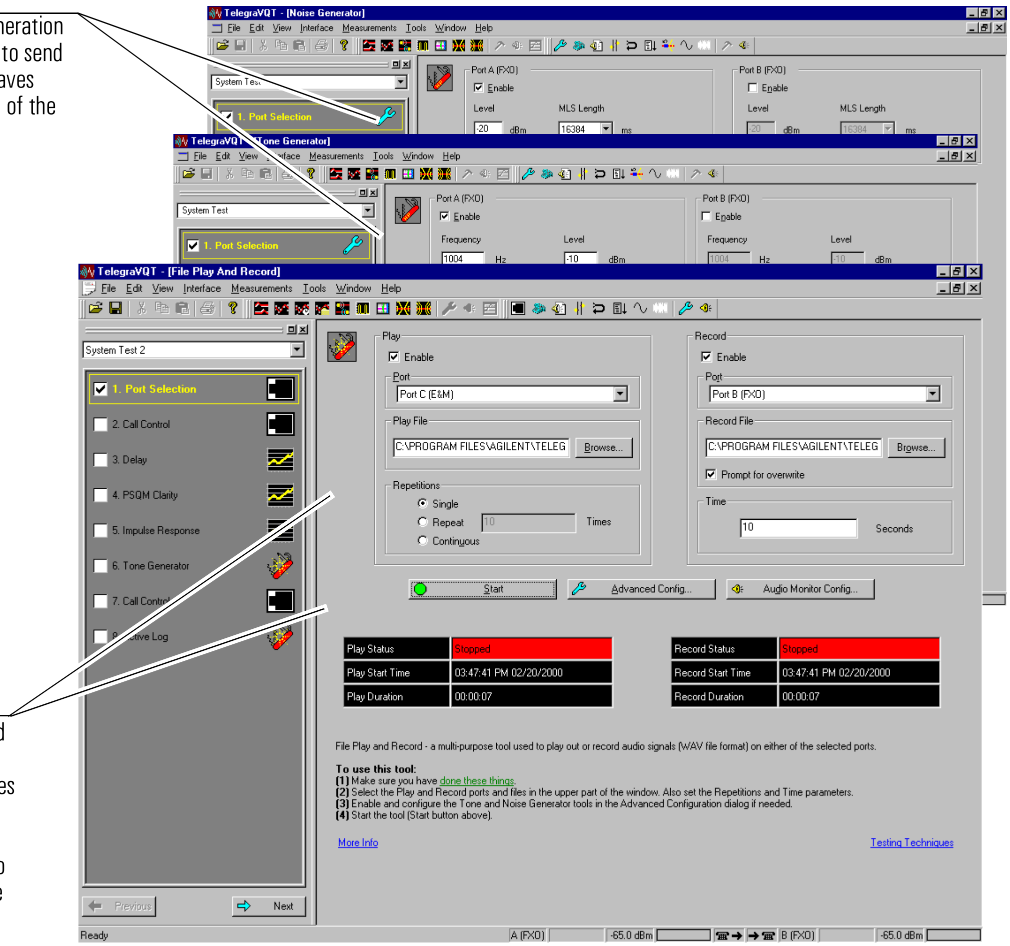
Using Other Voice Quality Test Tools

In addition to the voice quality and system component measurements described earlier, the VQT Application provides a number of versatile, multipurpose tools that can enhance your testing capabilities.

Tone and Noise Generation, File Play and Record

The Tone and Noise Generators, and the File Play and Record tool, each provide you with the ability to transmit audio signals onto the system under test.

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



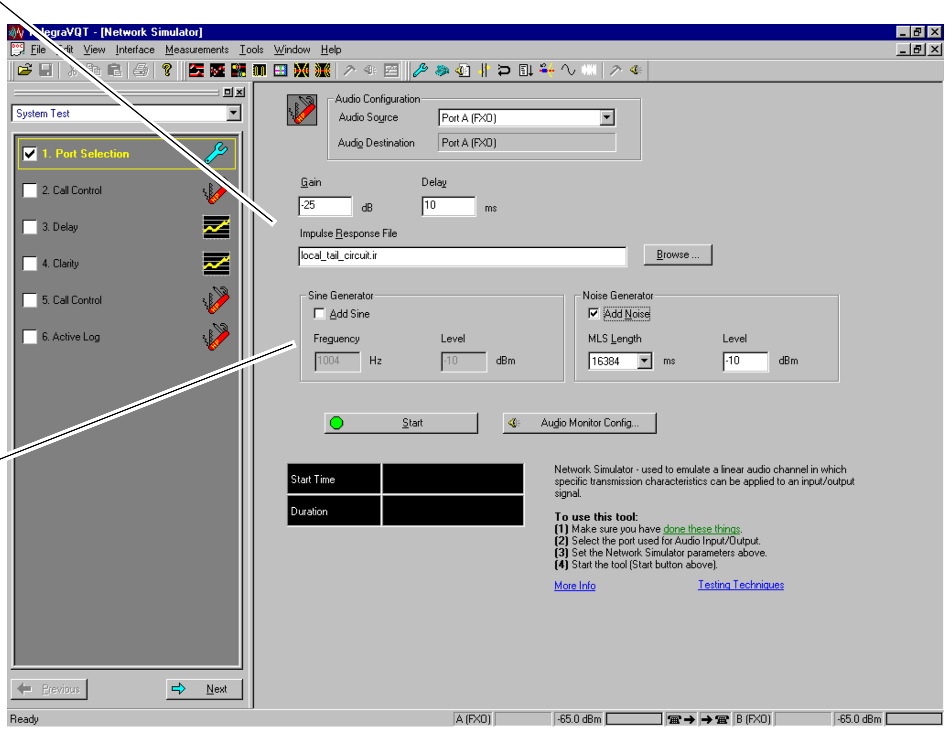
File Play and Record allows you to send and record wave files for any testing purposes you can devise. You can also add tones and noise to file playback.

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/attenuation characteristics.

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

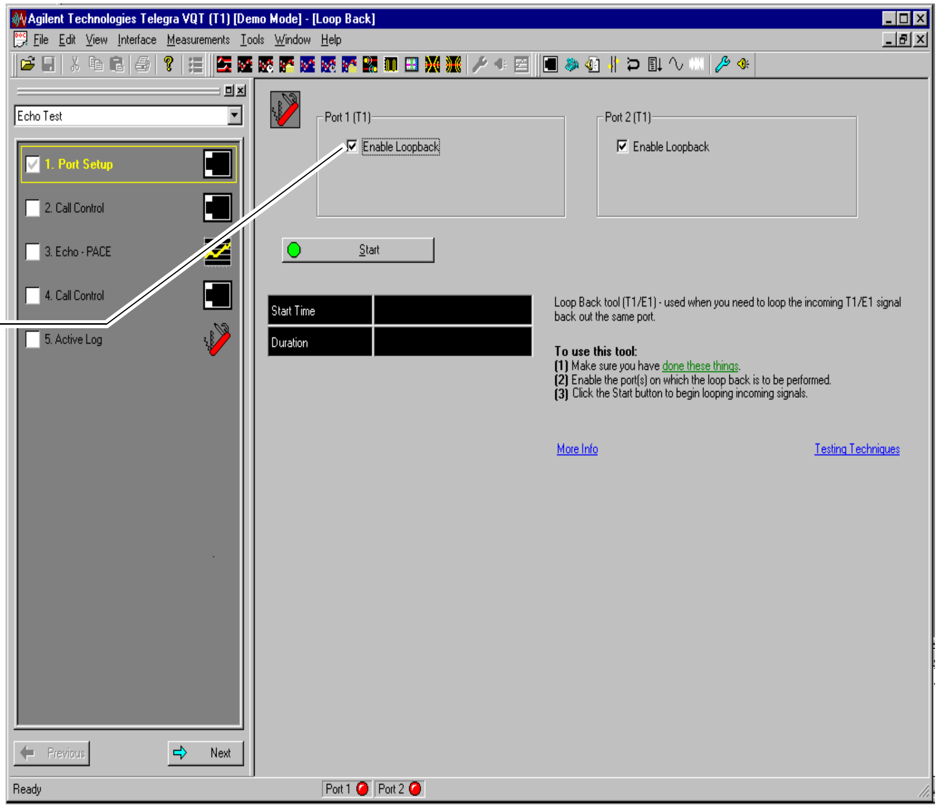
Add a sine wave or noise to the output audio signal in order to enhance your testing.



Use the Loop Back Tool to re-route an incoming signal.

You use the Loop Back tool to 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 or when you need a simple loop back for other test tasks.

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



Note

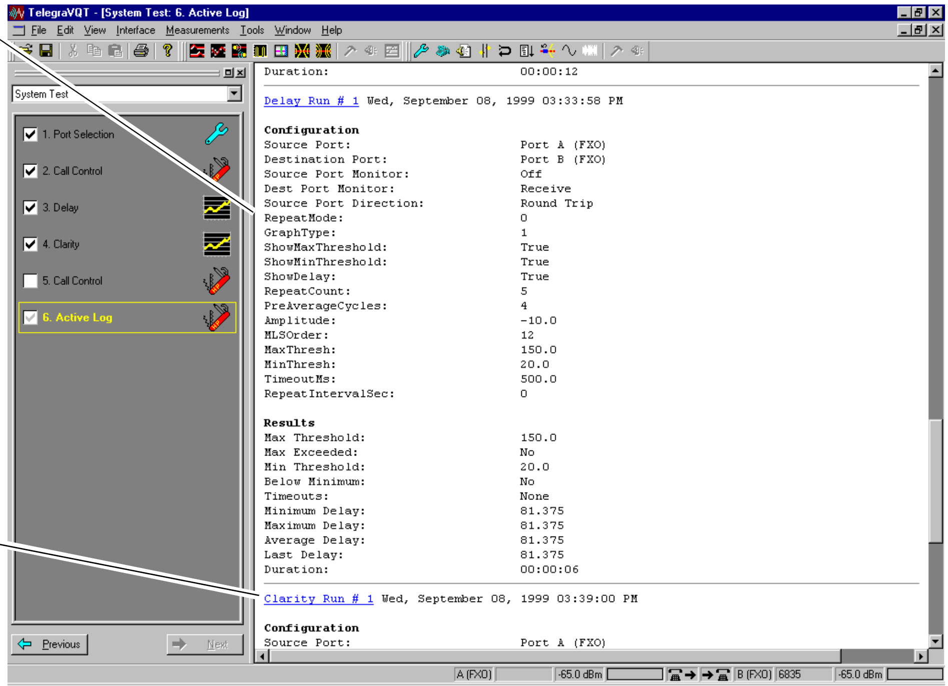
There are two versions of the Loop Back Tool, depending on the physical interface you are using. The loopback tool for the T1/E1 environment works differently than the loopback tool in the analog environment. For further details, refer to the Help.

Log measurement events

The VQT automatically creates a log of all your configuration and measurement activity. 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 measurement itself.

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

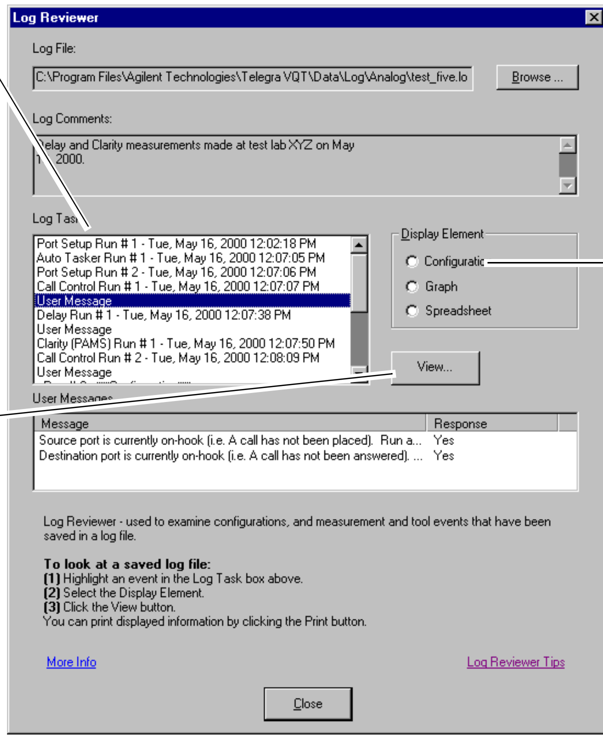
You can click on event hyperlinks to navigate directly to the tool or measurement used.



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

You can use the File menu to open saved log files into the Log Reviewer. 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.

You can select from the tasks and measurement events recorded by the log.



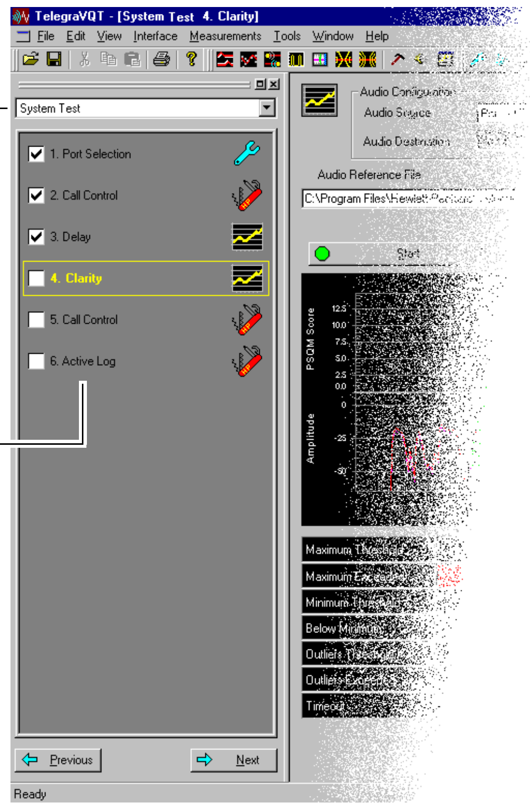
You can choose to see the configuration, graph (if available), or spreadsheet of the logged event.

View the selection once you display what you have selected.

Using the VQT TaskList Navigator

Set up and run using the TaskList Navigator

Initially located on the left side of the screen, the TaskList Navigator is a user interface 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, and for experienced users who want an easy way to repeat complex testing scenarios. The VQT ships with several useful TaskLists, and you can create your own.



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

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.

Note

You are not required to use the TaskList Navigator to operate the VQT. Once you are familiar with the testing process, you can remove the Navigator and access the measurements and tools via menus and tool bars.

Automating Voice Quality Testing

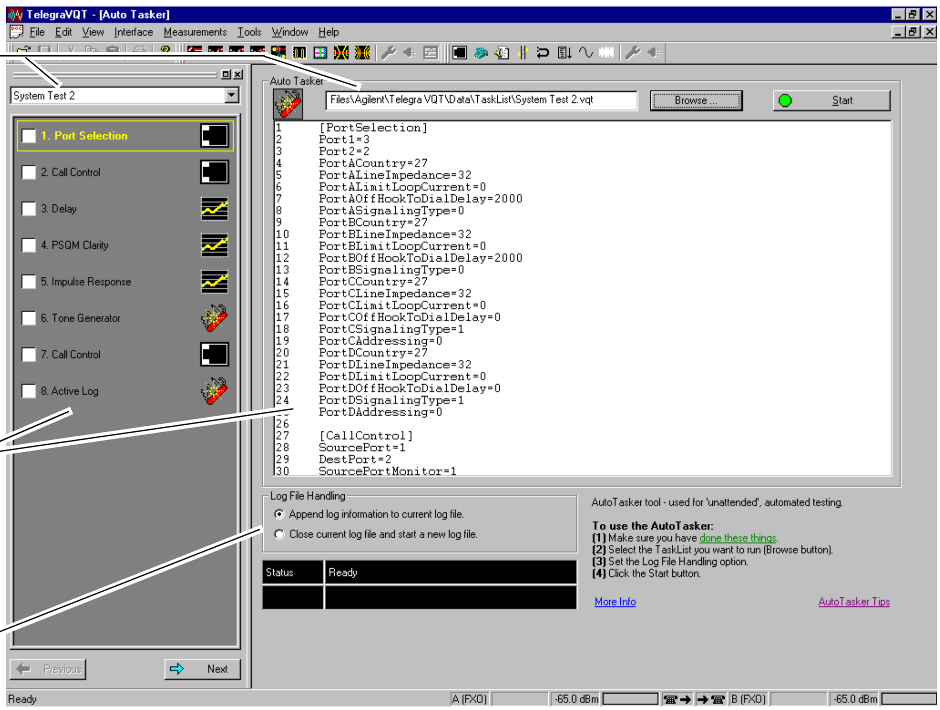
Run TaskLists and collect measurement results automatically.

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's 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 will be shown both in the TaskList Navigator and the AutoTasker display.

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

You can also control how setup and measurement data is logged.



You can also run VQT measurements and tools using the Windows command line. Refer to the Help for more detailed operating instructions.

2

Getting Started

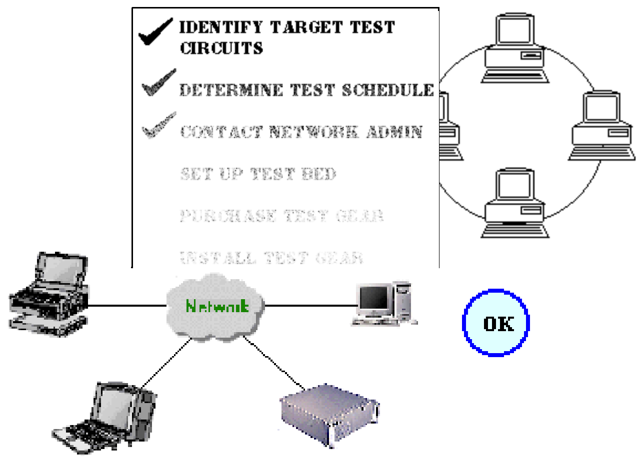
Getting Started

This chapter describes the steps you use to start testing with the Agilent VQT system. The steps are summarized next 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.

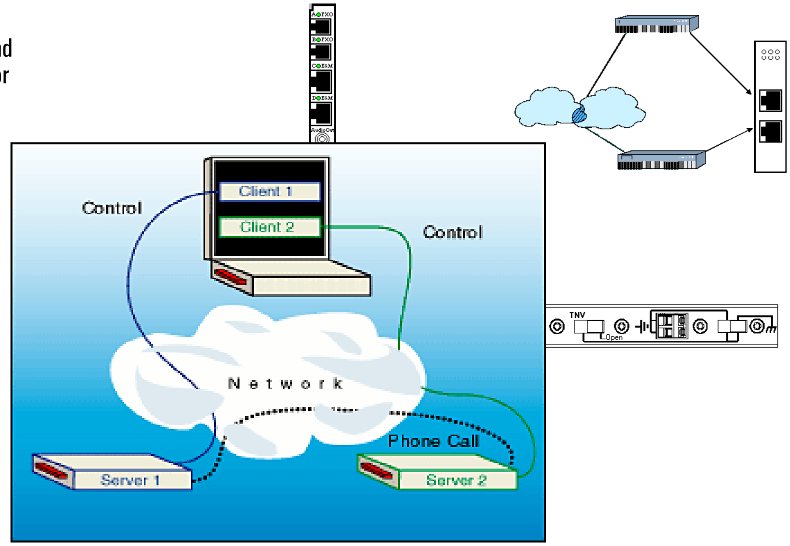
Note

For additional information on setting up and running a specific Agilent VQT device, refer to the appropriate documentation in the Information Map, page 1-4.

① Determine your network testing strategy.



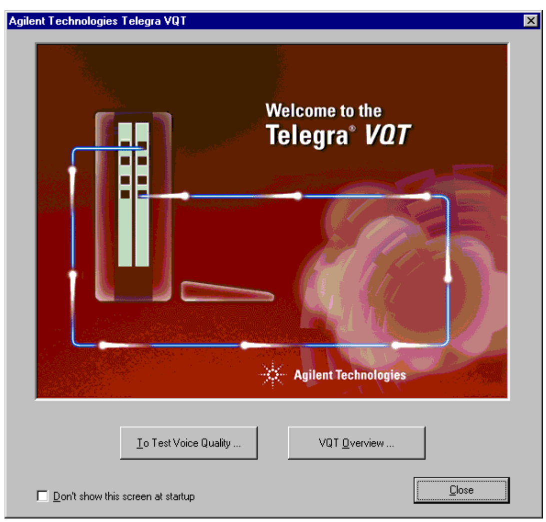
(2) Set up, configure, connect, and enable VQT system devices for operation.



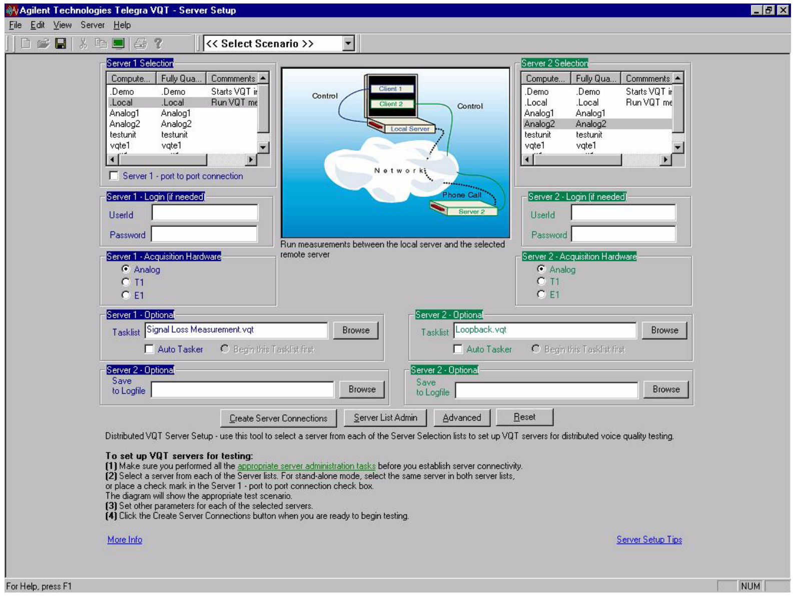
(3) Install (if required) and launch the VQT application.

VQT Icon

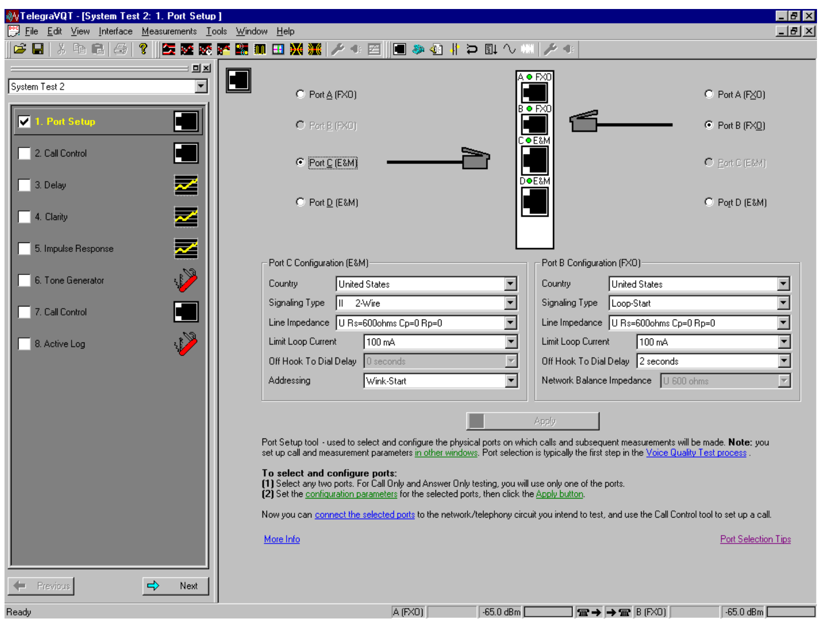
VQT Application Welcome Screen



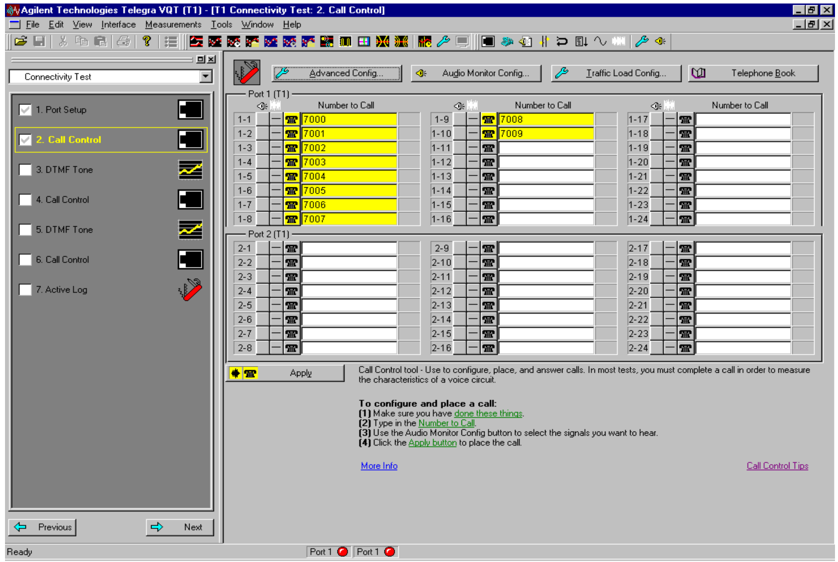
④ Use the Server Setup tool to add/select servers for testing.



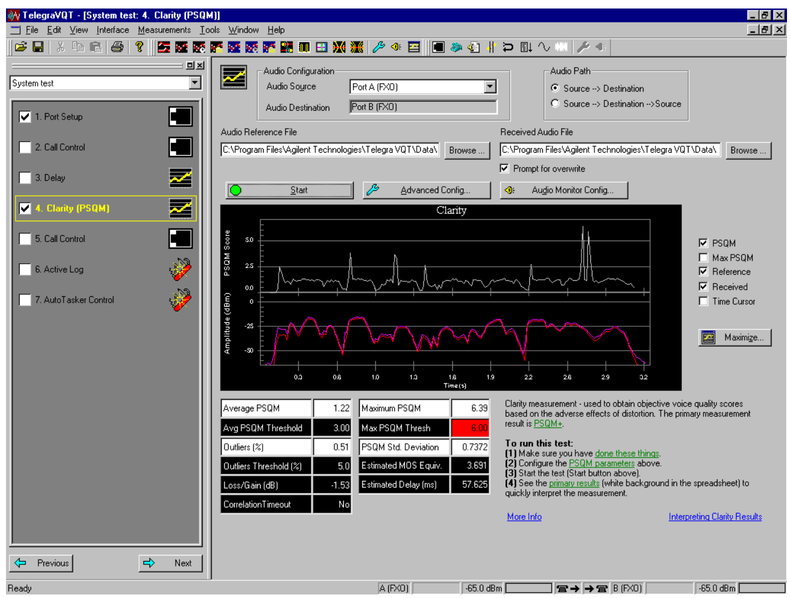
⑤ Select and configure the physical ports in each client window (for each server).



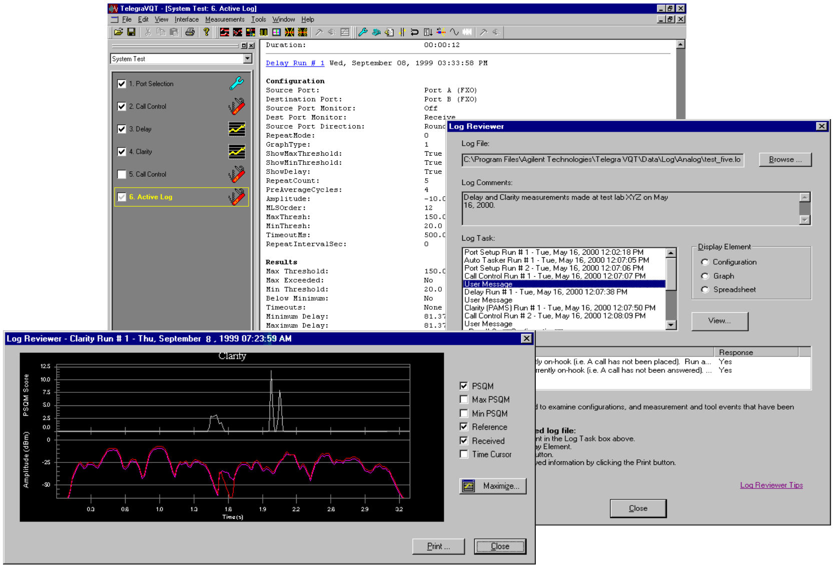
⑥ Place and answer the calls.



⑦ Run a measurement or tool, and view the results.



⑧ View and save the log file created during operation.



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

Plan VQT Network Test Strategy

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

- Testing Roles of VQT Equipment
  As discussed in chapter 1, any of your VQT Portable Analyzers or Agilent Advisors can play the "client" role or the "server" role and the VQT Network Server can play the "server" role. Existing networked computers can also play the "client" role if you plan to use desktop or laptop computers to control VQT equipment. The role each device will play determines how you set up your equipment (physical location and connections, software configuration, voice network management processes, etc.) 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/system under test. For remotely controlled VQT test equipment, or VQT equipment that will be 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.
- Logistical Concerns
  When performing remote / distributed testing, VQT devices will likely be installed in widely dispersed locations. Because of this, 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 — This should be allowed for in your network test planning.

Set Up the VQT Device

Setting up VQT devices is different for each device, but in general consists of the following:

- Installing software or hardware upgrades (if needed)
- Configuring the VQT device
- Connecting the VQT device to IP management network
- Connecting the VQT device to the device or system under test
- Launching the VQT application and running measurements

For specific information on setting up a VQT device, refer to the appropriate documentation listed in the Information Map, page 1-4.

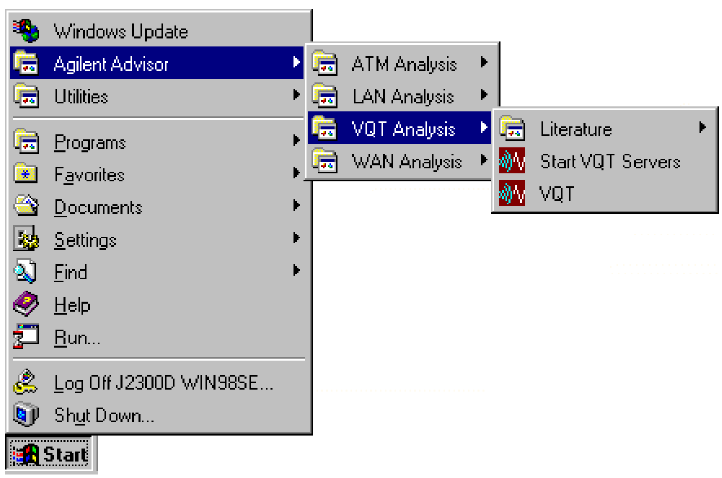
Starting the Application

Start the software.

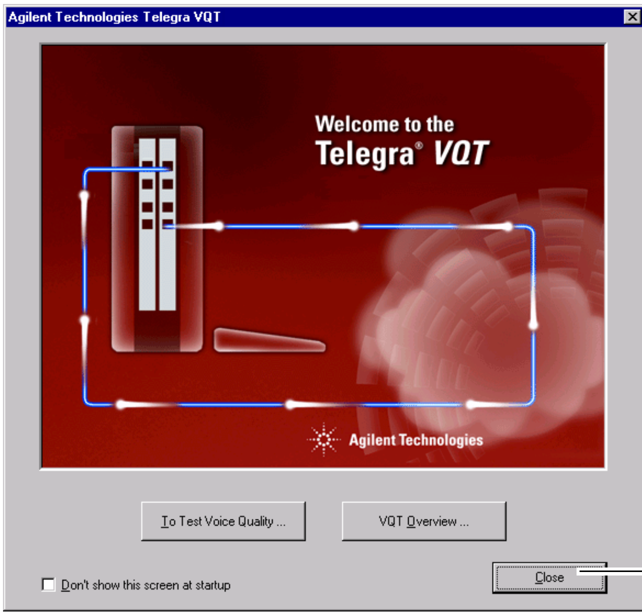
How you start the VQT Application on the VQT platform (VQT Portable Analyzer or Agilent Advisor) or controlling desktop/laptop PC depends on the device on which the application is installed. However, once you have started the application, you operate it the same way on each of the controlling PC platforms.

To start the VQT on the VQT Portable Analyzer or on a desktop/laptop PC: Double-click the VQT icon in the Windows desktop.

To start the VQT on the Agilent Advisor:
Click the Start button in Windows desktop, and go to the following menu option:



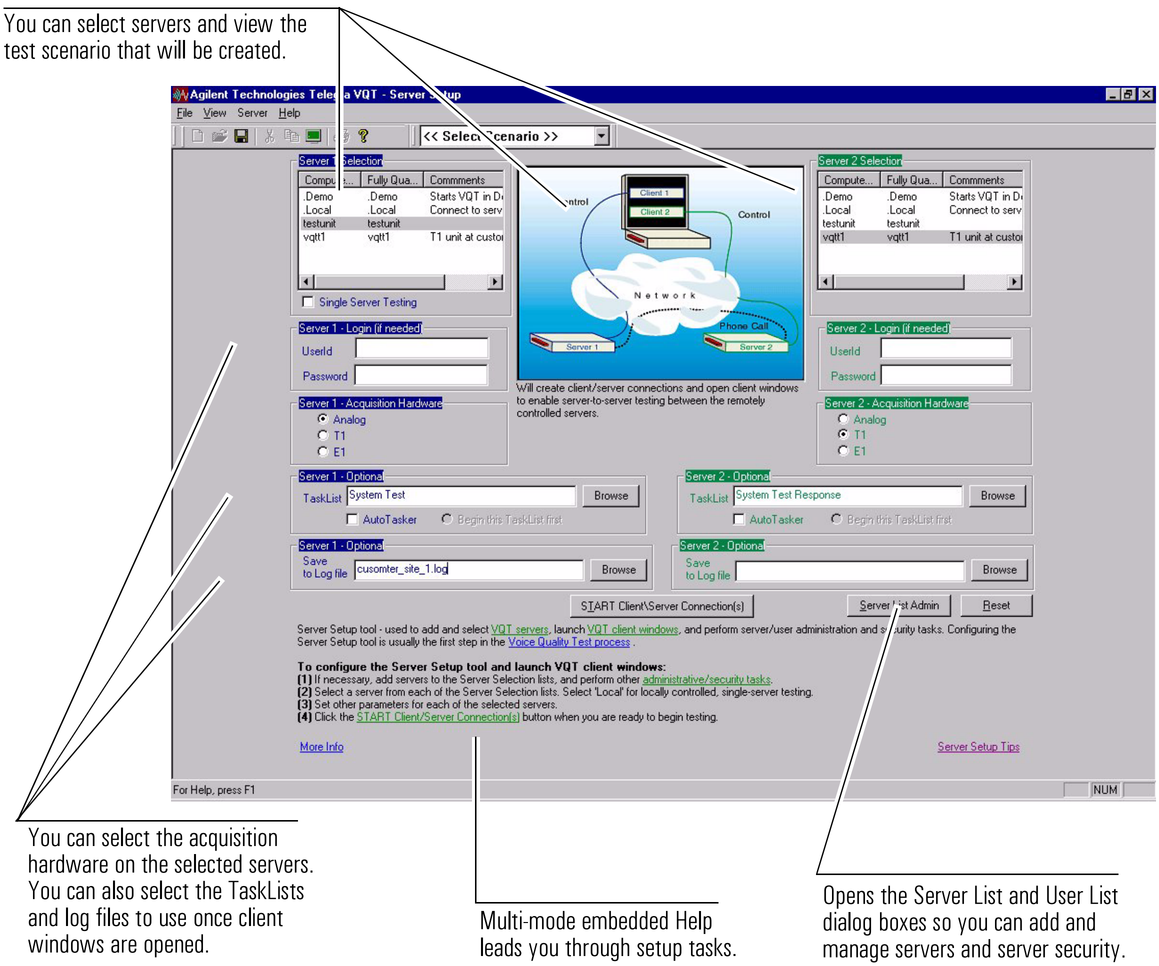
Once you have started the VQT Application, you see the following Welcome window. You can click on the buttons to learn more about how to use the VQT or you can close the window and start working with the application. If you close the Welcome window, the Server Setup tool appears. Using the Server Setup tool is covered next.



Clicking on the Close button opens the Server Setup Tool.

Using the Server Setup Tool

The Server Setup tool lets you perform all initial setup tasks related to local/remote, single-server, and multiple-server / distributed voice quality testing. You can add, configure, and select the VQT server(s) with which you want to run measurements and you can perform a number of important server administration and security functions. The selections you make in this tool depend on the type of testing you want to perform and how your network is set up.



Note the following about using the Server Setup tool:

- 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.
- Once you have clicked the START Client/Server Connection(s) button, one or two “client windows” will appear a certain way depending on how you configured the Server Setup tool. Use Alt-Tab to move easily between 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.
- If you are going to use the remote / distributed testing, the first time you start the VQT Application, you need to add servers.

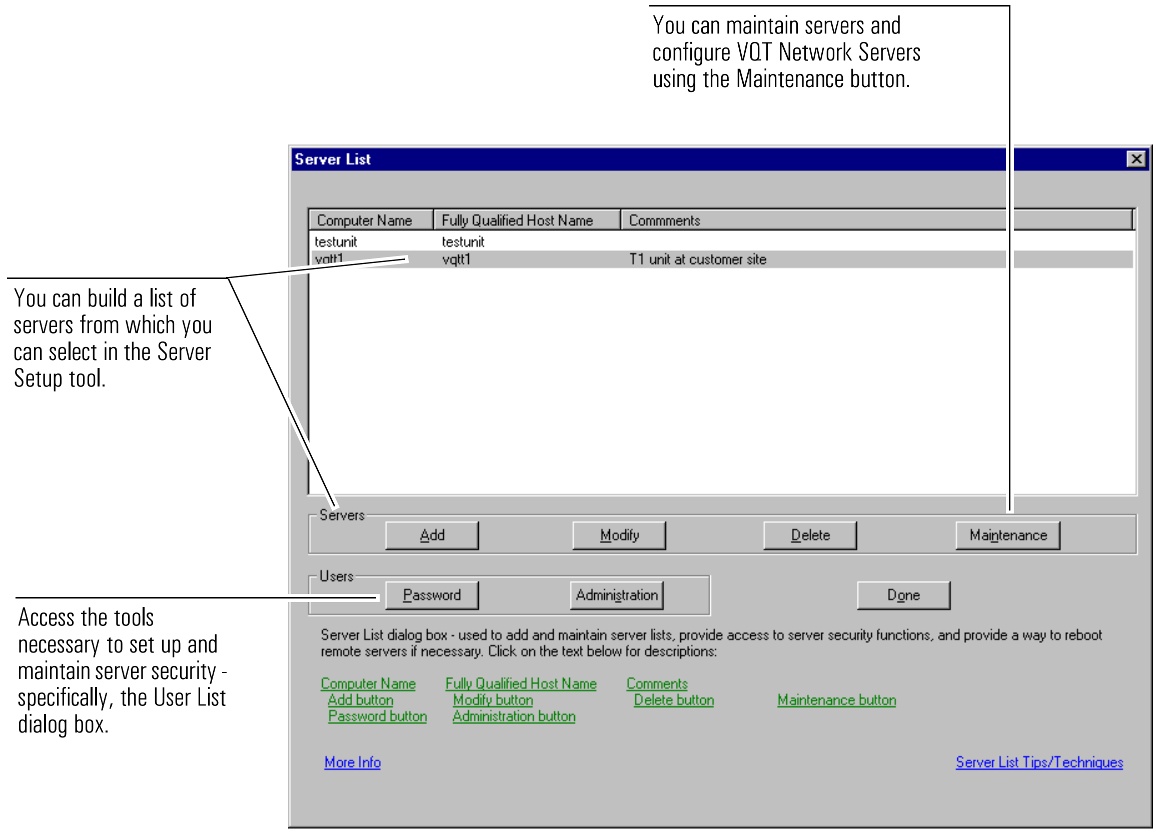
Note The first time you configure the Server Setup tool and open client windows, you will be prompted for your PESQ, PAMS, and/or PSQM software license keys that are provided in the VQT literature. Although you will be prompted for this information only once, you will have to enter it for each VQT server on which Clarity (PESQ), Clarity (PAMS), and/or Clarity (PSQM) is to be run by using the Enable Features option in the File menu.

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.

Adding and Managing Servers - Server List Dialog Box

You use the Server List dialog box to 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.

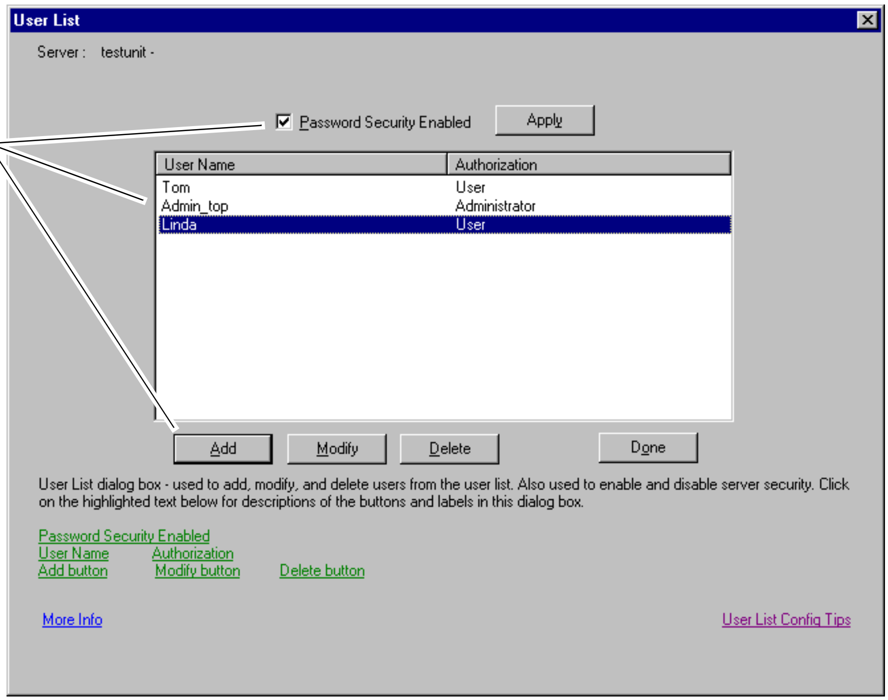
Note If you are doing locally controlled, single server testing with a VQT Portable Analyzer or the Advisor, you do not need to do this step.



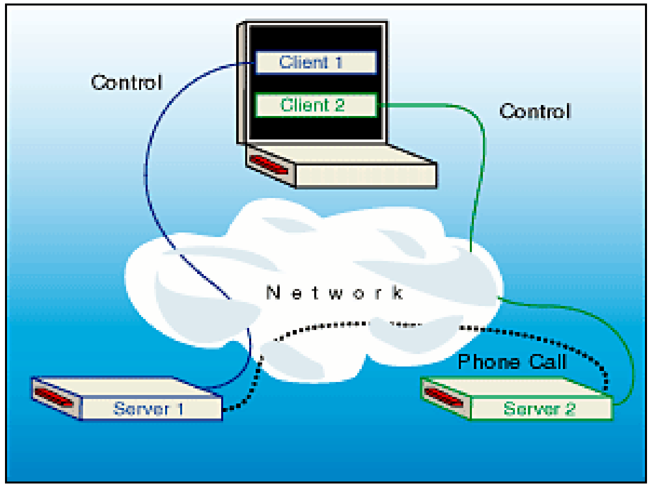
Server Security - User List Dialog Box

You use the User List dialog to specify and manage users, administrators, and password security for the selected VQT server. This dialog lets you limit or control who has access to VQT servers when controlling test access is important (e.g. when test equipment is connected to live voice networks).

You can create lists of users and administrators that can access servers and control server security.

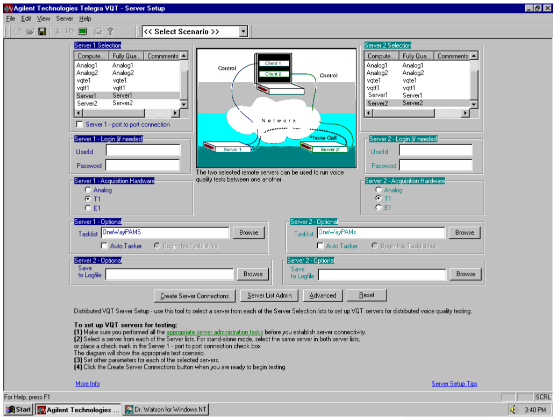


Once you have added servers, selected them in the Server Setup tool, and configured other aspects of your test scenario, you close the Server Setup tool and open the individual client windows that control each of the selected servers. Consider the test scenario shown below.



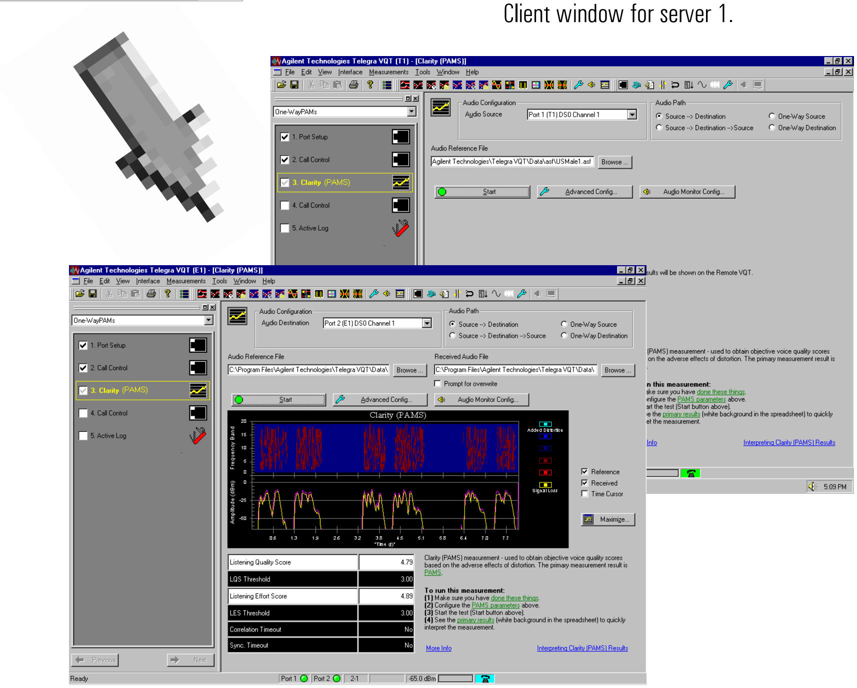
The illustration shows that two remote servers will be controlled by a PC running client software. (Remember, that the PC *and* the servers could be VQT Portable Analyzers or Agilent Advisors. The servers could also be VQT Network Servers. The controlling PC itself could be a VQT Portable Analyzer, an Agilent Advisor, or a desktop/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.

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



On the controlling PC, you select servers and set parameters in the Server Setup tool. Then when you are ready to run measurements, you click the START button which closes the Server Setup tool and opens a client window for each server.

Client window for server 1.



The client window for each server is displayed on the controlling PC. You interact with each window independently to control the server's behavior.

Client window for server 2.

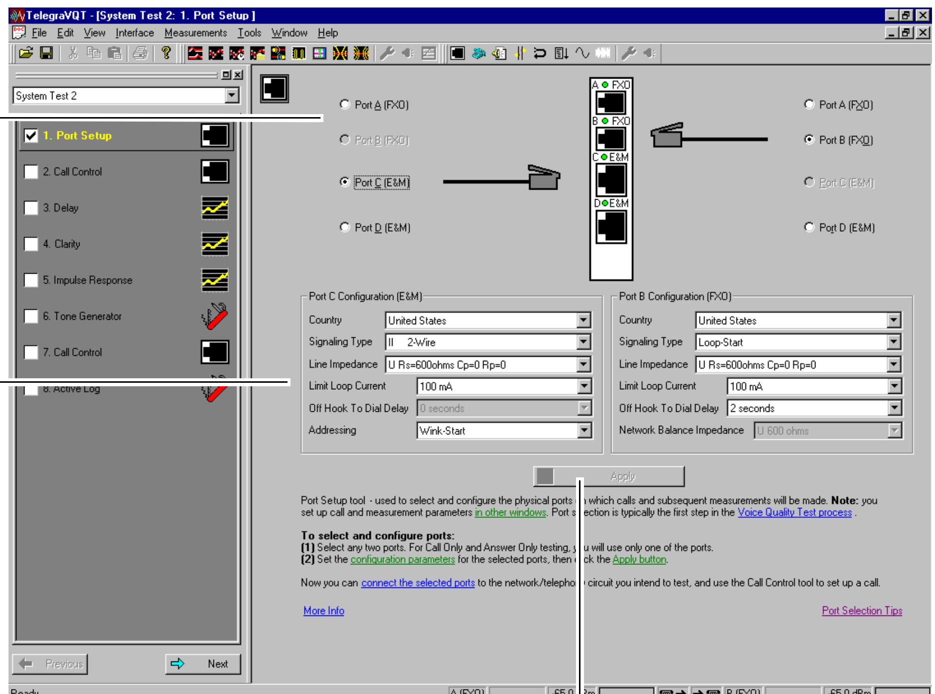
If you are using only one server (for example, if you select “local” in the Server Lists or use only one remotely controlled server), you will have only one client window open.

Selecting and Configuring Ports

Before you can place a call between ports/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 wiring/pinouts and on more information about FXO, E&M, T1/E1 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. See the Help for FXO and E&M wiring and pinouts and on more information about FXO and E&M connections in general.



Select the physical ports in the upper portion of the view.

Configure the electrical characteristics of each of the selected ports.

Apply the Configuration to the VQT's acquisition hardware.

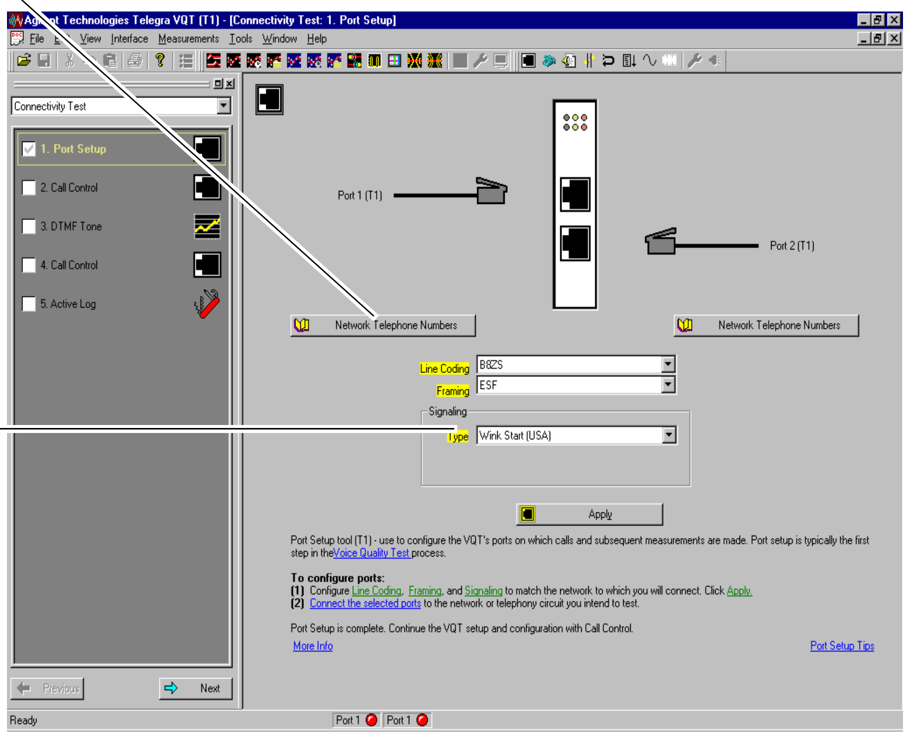
Note For both FXO/E&M and T1/E1 interfaces, the electrical state of the VQT's ports affect telephony network operation. Therefore, it is a good idea to know the electrical and protocol characteristics of the network you connect to, and make sure Port Setup parameters match these characteristics.

T1/E1 Environments

In almost all cases, configuring the physical ports is one of the first steps in the T1/E1 Voice Quality Test process. This is accomplished in the Port Setup Tool. See the Help for T1/E1 wiring and pinouts and on more information about T1/E1 connections in general.

Use this dialog button 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.



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

Call Control

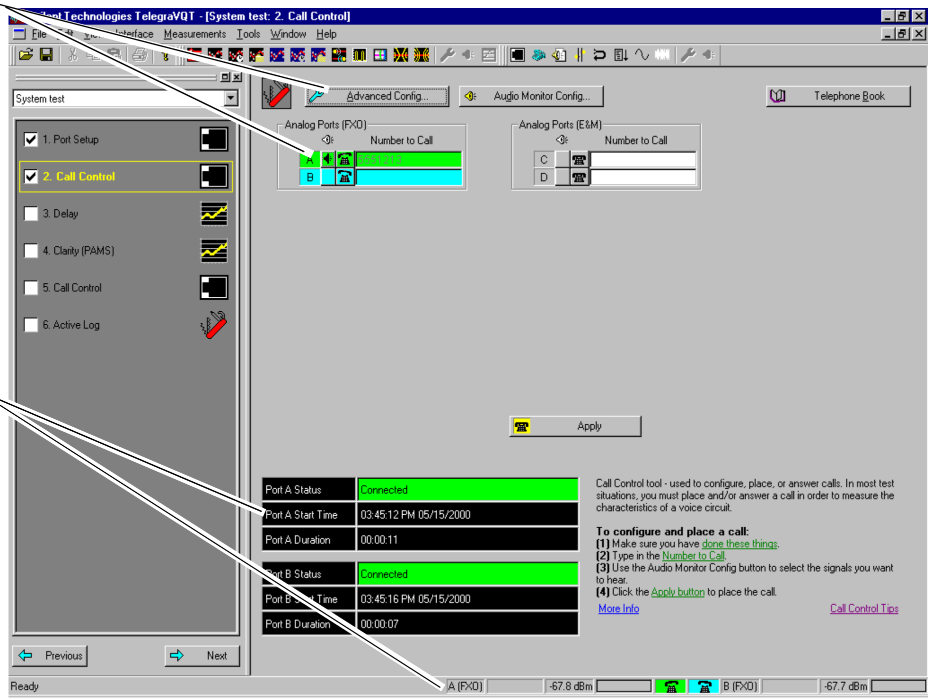
Once you have selected and/or configured the physical ports, you need to establish the test circuit. That is, you need to place and/or answer one or more calls. If you are performing single-server testing, you place and answer calls in the same client window. However, for multi-server testing, you place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

FXO/E&M Environments

In the FXO/E&M environment, you use the Call Control tool to place and/or answer a call on any of the VQT's selected and configured ports. In the analog environment, you can place only 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 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.

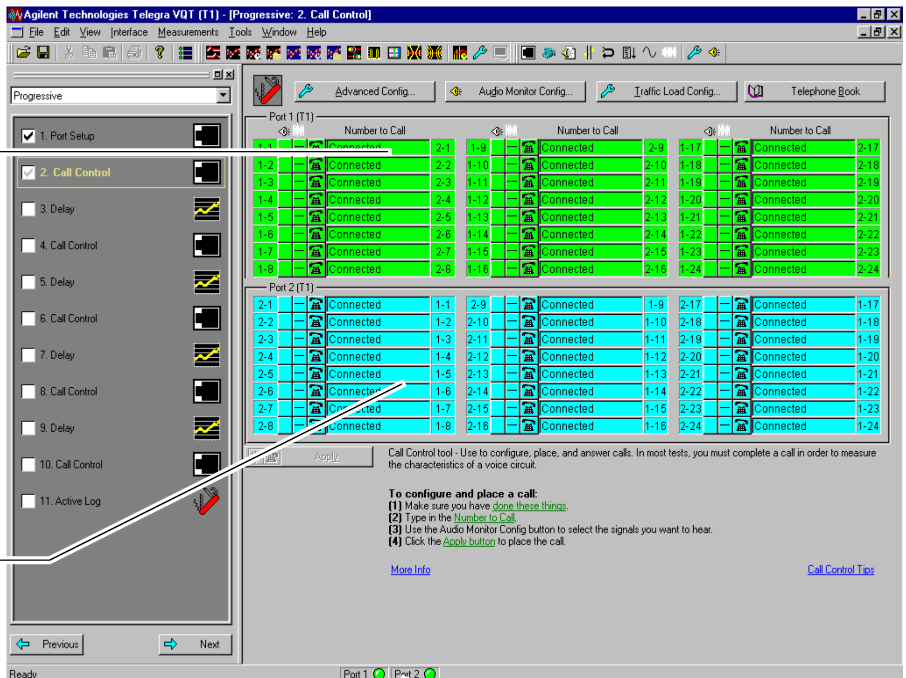


Note

The illustration above shows placing and answering a call in the same client window. In a multi-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/E1 Environments

In the T1/E1 environment, you use the Call Control tool to place and/or answer a call or several calls on any of the VQT's 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/port and calls made on channels port-to-port.



Note The illustration above shows placing and answering a call in the same client window. In a multi-server environment, you would place the call as shown above, and them open the “answering” client window to monitor the status of answered calls. The VQT supports calls made channel-to-channel on the same trunk/port, calls made on channels port-to-port.

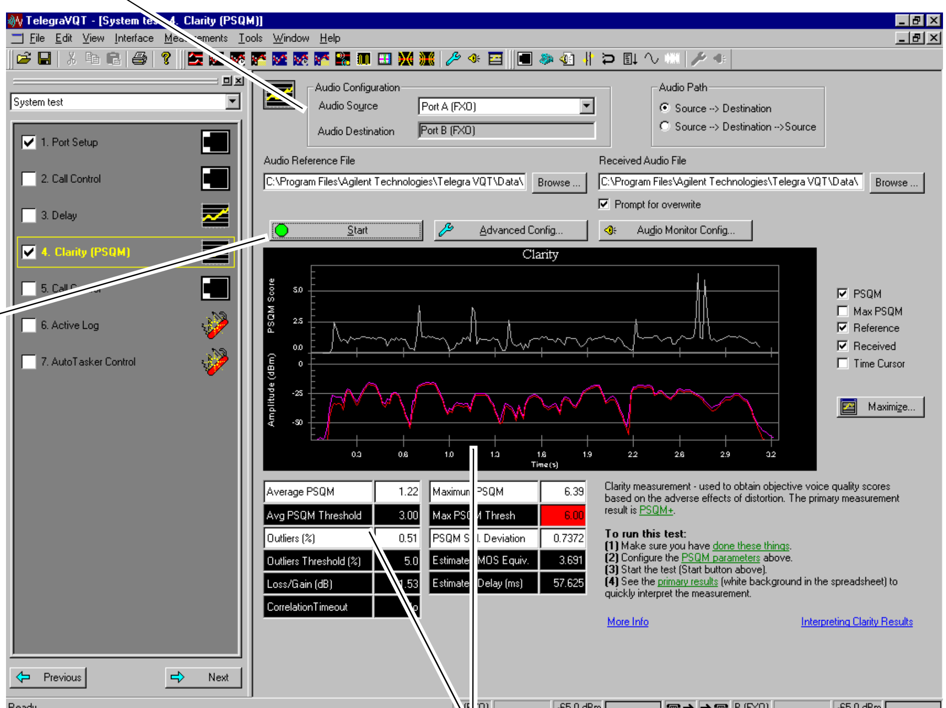
Running Measurements or Tools

With a telephony circuit established between two VQT ports, channels, or servers, you can now run any of the VQT's 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.

Note 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.

Configure the direction and path of test signals, and other measurement-specific parameters. Note: These parameters are set independent of the port that originates or answers the call.

Start the measurement.



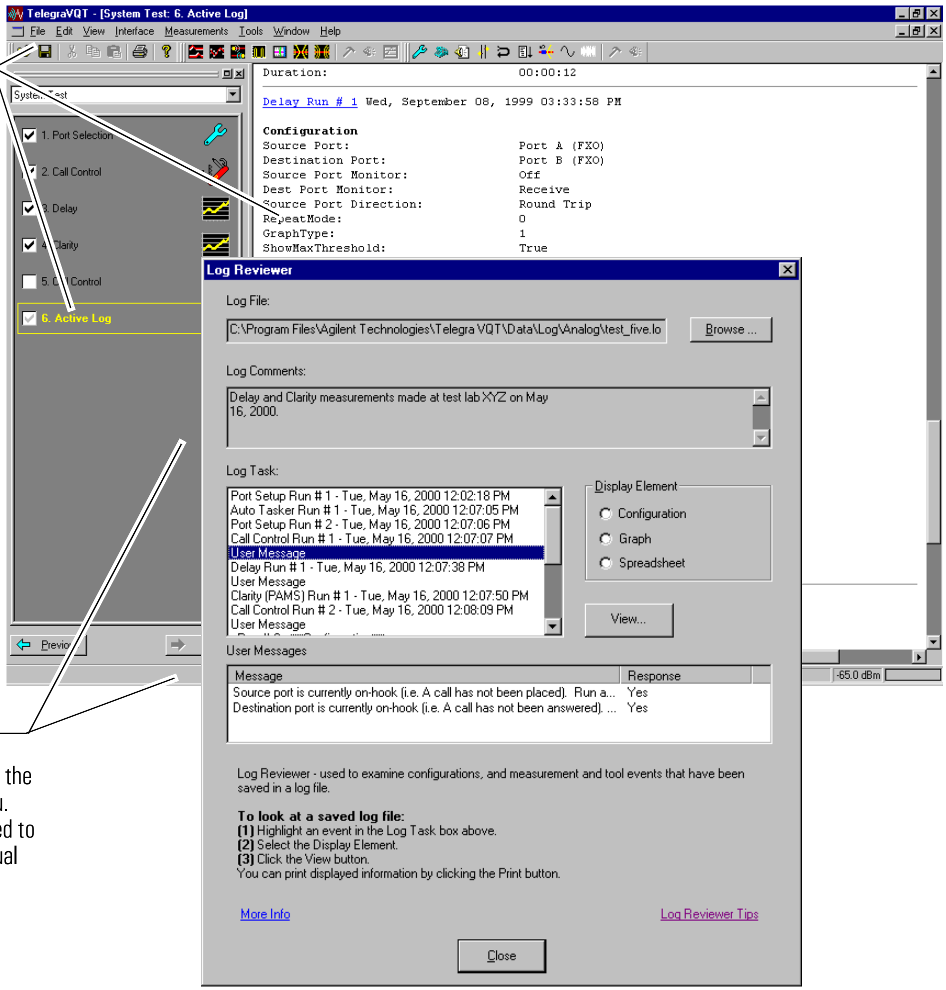
Examine test results in both graphical and spreadsheet formats. Important pass/fail results are highlighted in the spreadsheet.

Note 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 VQT's Help (Call Mode vs. Audio Path) for more detail.

Viewing and Saving Results

After a set of measurements or tools have been run, you can view a log of the test session, save the log to file, and review the log at a later date. Remember, however, that each client window generates its own log of its activities. You will need to use care when selecting file names and file locations.

For each set up, measurement, or tool task performed during a test session, configuration information and measurement results are automatically logged. View these logs during test sessions or immediately after with the Active Log viewer. To save this logged data to file, use the options in the File menu.



To open saved logs and review them, again use the options in the File menu. The Log Reviewer is used to select and open individual parts of the saved log.

3

Sample Tests

Sample Tests

This chapter provides several examples of how to use the VQT servers and the VQT Application to test voice quality on individual devices or integrated systems for FXO/E&M (analog) and T1/E1 (digital) environments. Refer to the following sections:

- Single Server Sample Tests, page 3-3
- Dual Server Sample Tests, page 3-53

Single Server Sample Tests

The following examples are designed to demonstrate common test techniques and to familiarize you with the use of this powerful tool. These examples show how you would use a single, locally or remotely controlled VQT Network Server, VQT Portable Analyzer or Agilent Advisor (with VQT undercradle) to test voice quality in a number of situations. These examples can be adapted to remote / distributed voice quality testing to include using the VQT Network Server. To learn more, refer to the VQT Application's online help or contact your Agilent sales representative.

FXO/E&M Sample Tests

- Placing/Answering a Call, Sending Test Signals in an Analog (FXO/E&M) Environment, page 3-5 — This FXO/E&M (analog) test shows you the basics of setting up and placing a call, configuring the audio monitor options so you can hear the test signals as they are transmitted and received, and setting up and running tools that transmit audio onto the device or system under test.
- Measuring Delay and Clarity, page 3-14 — This sample test for the analog environment shows you how to set up and run two of the most important voice quality measurements. It will build on the basic information provided in the first sample test.
- Measuring Echo and Verifying Echo Cancellation, page 3-19 — This sample test for the analog environment shows you how to set up and run the Echo-PACE measurement to characterize echo on an analog tail circuit.

T1/E1 Sample Tests

- Placing/Answering a Call, Sending Test Signals in a T1/E1 Environment, page 3-27 — This T1/E1 (digital) test shows you how to set up and place calls from port 1 to port 2 and vice versa, configure the audio monitor so you can hear the test signals as they are received, and run the DTMF Tone measurement to verify connectivity.
- Progressive Traffic Loading on T1/E1 Calls, page 3-38 — This sample test for the digital environment shows you how to set up and place calls on all carrier channels, load channels progessively with traffic, and measure the end-to-end delay of the system under test as traffic is loaded onto the network.
- Verifying Echo Cancellation with simulated Echo in a T1/E1 Environment, page 3-48 — This sample test for the digital environment shows you how to set up a call, transmit a simulated echo signal and measure the performance of your echo canceller.

The techniques shown in these sample tests are those often used when testing voice quality using the VQT server (a VQT Network Server, VQT Portable Analyzer, or Agilent Advisor) and VQT Application. You can adapt what you learn here for your own unique test situations.

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.

Placing/Answering a Call, Sending Test Signals in an Analog (FXO/E&M) Environment

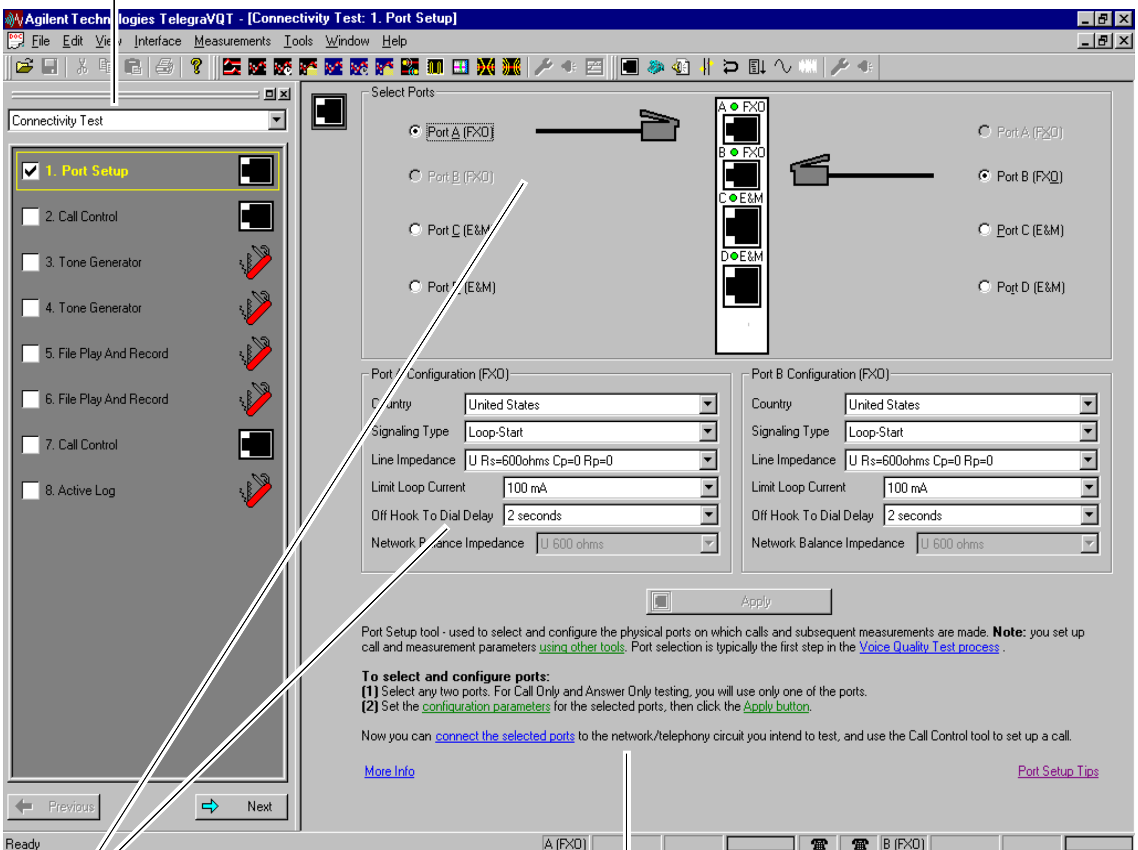
This example demonstrates the processes that are fundamental to analog voice quality testing with a VQT server and VQT Application — That is, the real-time testing concepts of call placement and audible signal verification. You will need to understand these techniques regardless of the other measurements you intend to run or the systems you intend to test. Specifically, this sample test for an analog connection shows you how to:

- Connect to the device or system under test.
- Select and configure the physical analog ports the VQT will use.
- Configure, place, and answer a call to set up the test circuit.
- Run the Tone Generator to verify connectivity.
- Terminate the call.
- Examine and save the log file that is automatically created during the test run.

To begin this test scenario, you need to have set up and powered on the VQT server, launched the VQT Application from the shortcut icon in the Windows desktop, and configured the Server Setup tool. See chapter 2 for more information.

Note Connecting, placing the call, and running measurements or tools are the most fundamental of VQT processes. You can adapt this example to your unique testing needs.

① **In the TaskList Navigator, select the TaskList called "Connectivity Test". The list shown below will be loaded and the Port Setup tool for an analog connection (the first item in the list) will be opened.**
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.

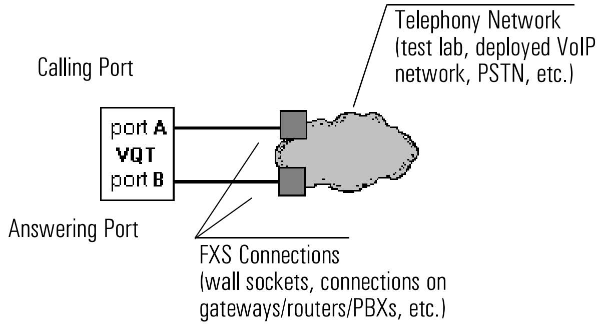


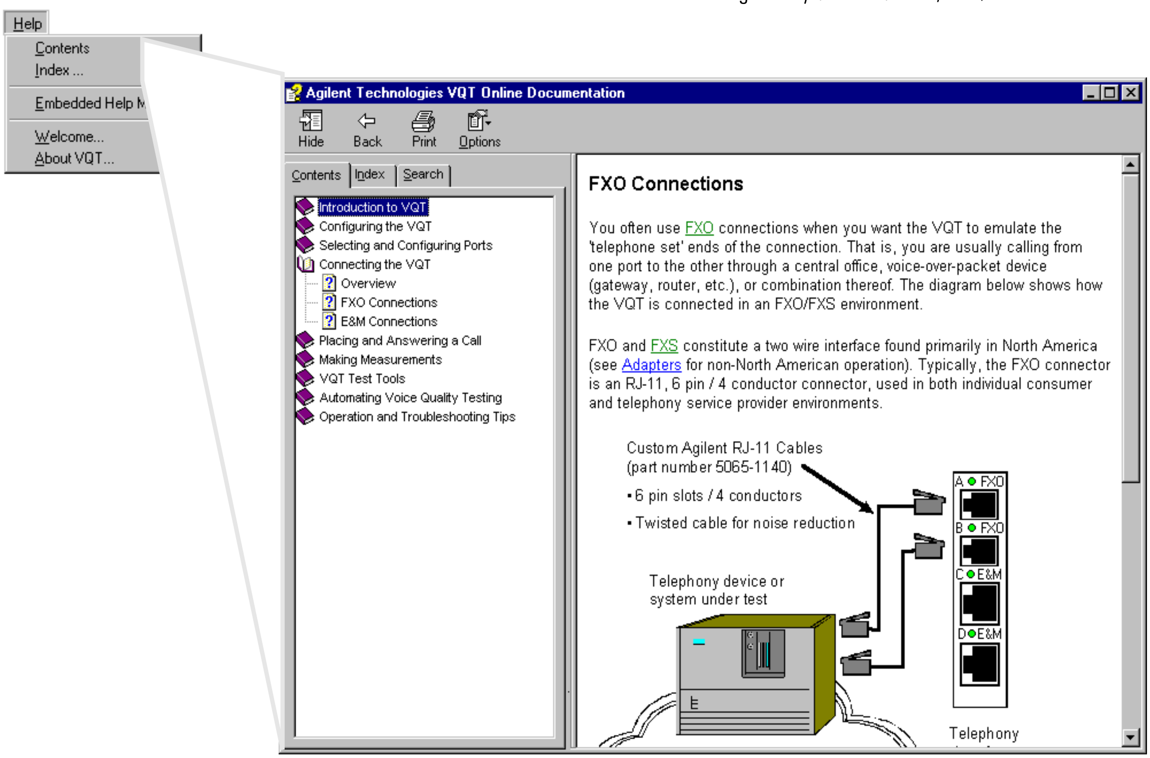
Notice that Ports A and B are selected (the FXO ports). Also note that you can configure the electrical characteristics of the ports. For this example, these selections and default configurations can be left as they are.

The embedded Help provides setup information and access to other related online documentation.
Note: All of the VQT's windows contain embedded Help to assist you in performing your testing tasks.

When adapting the TaskList above for your own unique test situation, remember to update the port configuration to match your network environment. The configurations shown throughout this example are for demonstrative purposes only.

(2) 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.



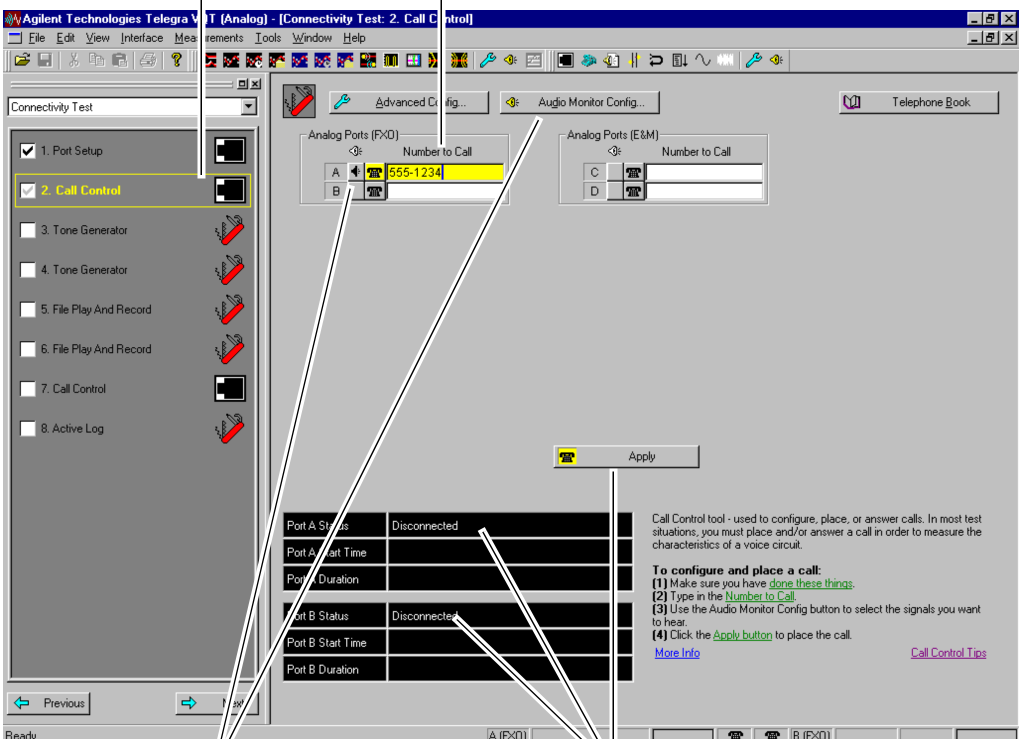


Note: You can open this Help topic from a link in the embedded Help of the Port Setup tool.

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

③ 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.

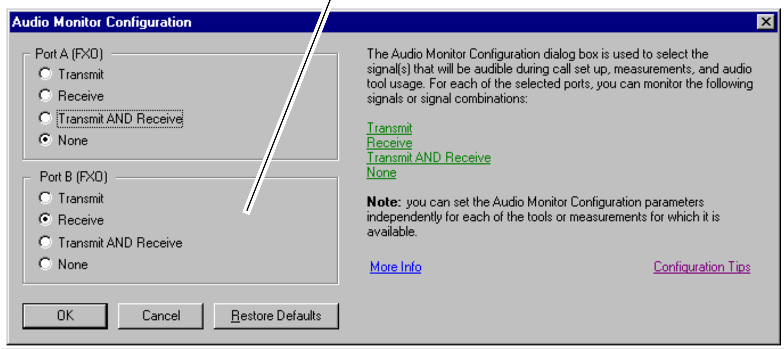


Select the port you want to monitor (in this case Port A). Then click the Audio Monitor Config button and set the parameter to "Transmit AND Receive". These two settings allow you to hear the dial tone, the DTMF dialing, and ringing.

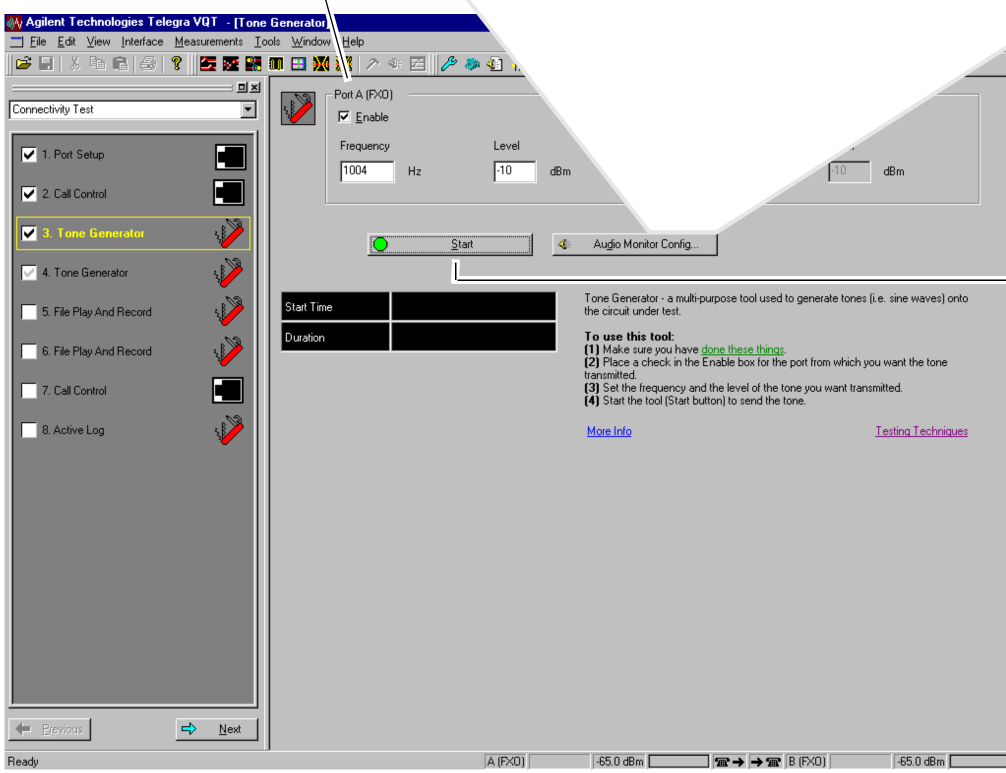
Click the Apply button to place the call from Port A to Port B. Once the call is connected, the telephone icons in the Analog Ports portion of the Call Control tool will go "off-hook", and the call status will be shown in the status indicators.

(4) Select the next task in the TaskList (Tone Generator). You will use this tool to verify that you have connectivity from port A to port B.

Set the Audio Monitor for Port A “None” and Port B “Receive”. This is so you will hear only the tone received at Port B.

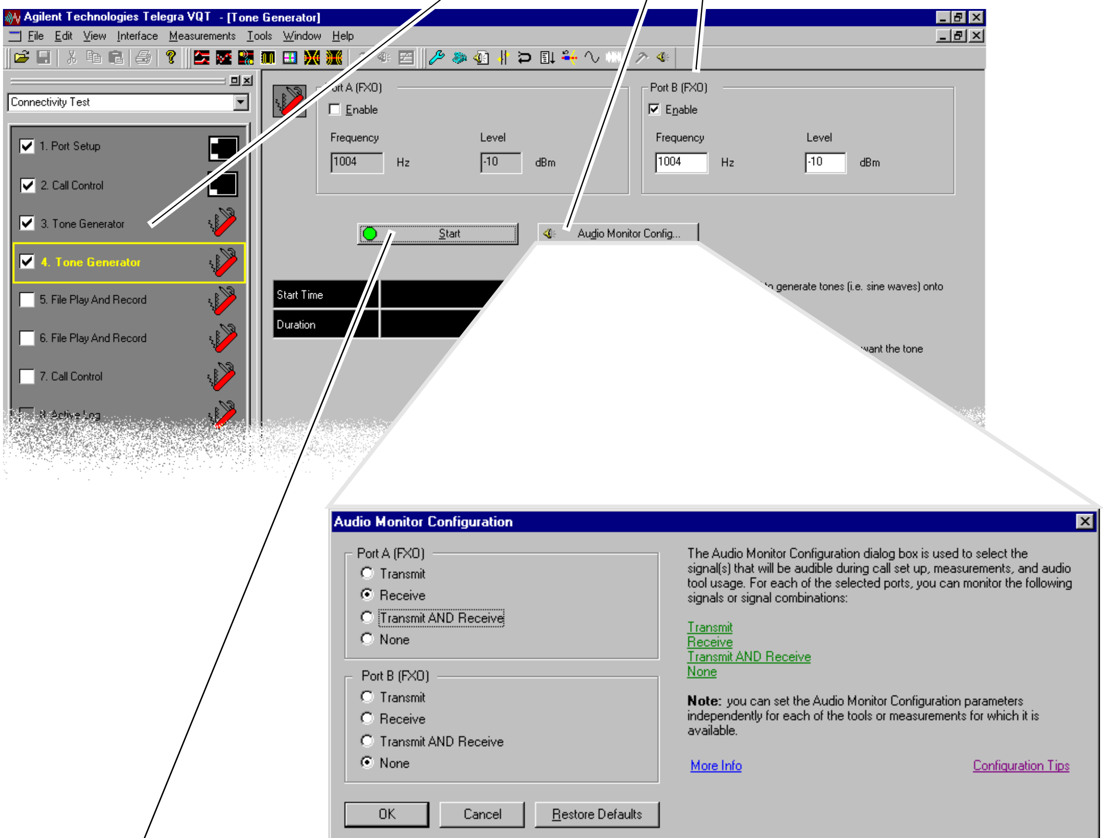


Enable Tone Generator for port A, and set tone configuration parameters.



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.

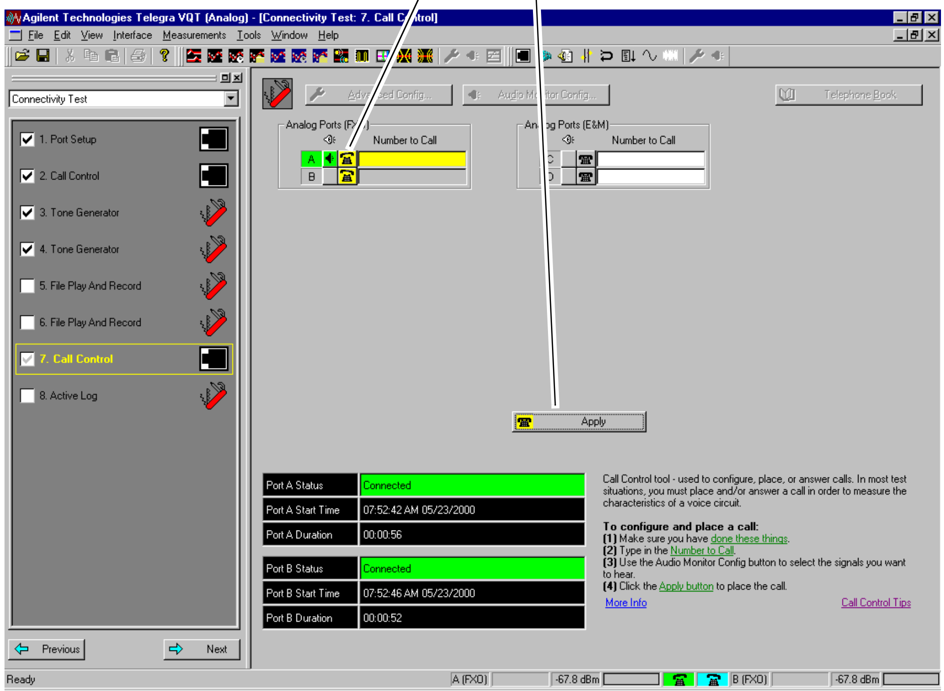
(5) **Select the fourth task in the TaskList (the second Tone Generator), disable Port A and enable Port B. Similar to the last set of steps,** set the Audio Monitor for Port A to "Receive" and Port B to "None". This is so you will hear only the tone received at Port A.



Start transmitting the tone from Port B. When you hear the tone, you will know that you have connectivity between Port B and Port A because of the way the Audio Monitor is configured.

Up to this point, you have placed a call between Ports A and B, and used the Tone Generator to verify a good connection in both directions between these ports. You could now run a series of measurements to test aspects of this voice circuit. However, the next several steps show you how to disconnect the call, and how to view and save a log of this session. The remainder of this chapter provides examples of setting up and running measurements.

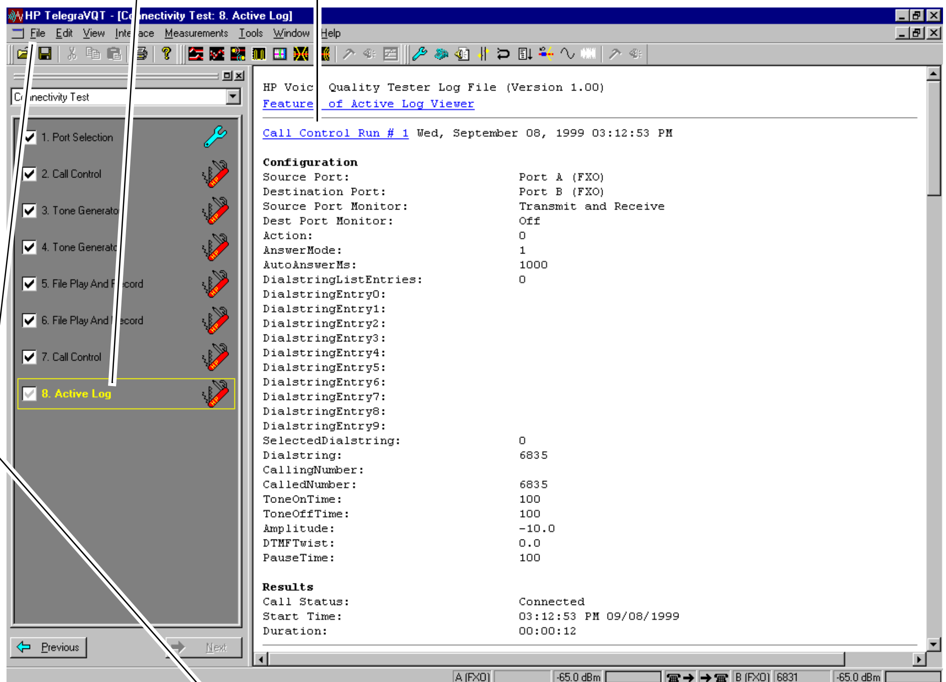
⑥ To disconnect the call, go to the second Call Control tool in the TaskList Navigator. Click each of the telephone icons to select them for hang-up. Notice that the handsets are “off-hook” indicating that the call is still in progress, but the background color turns yellow. Click the Apply button to hang up both ends of the connection.



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

⑦ Open the Active Log viewer by selecting it in the TaskList Navigator.

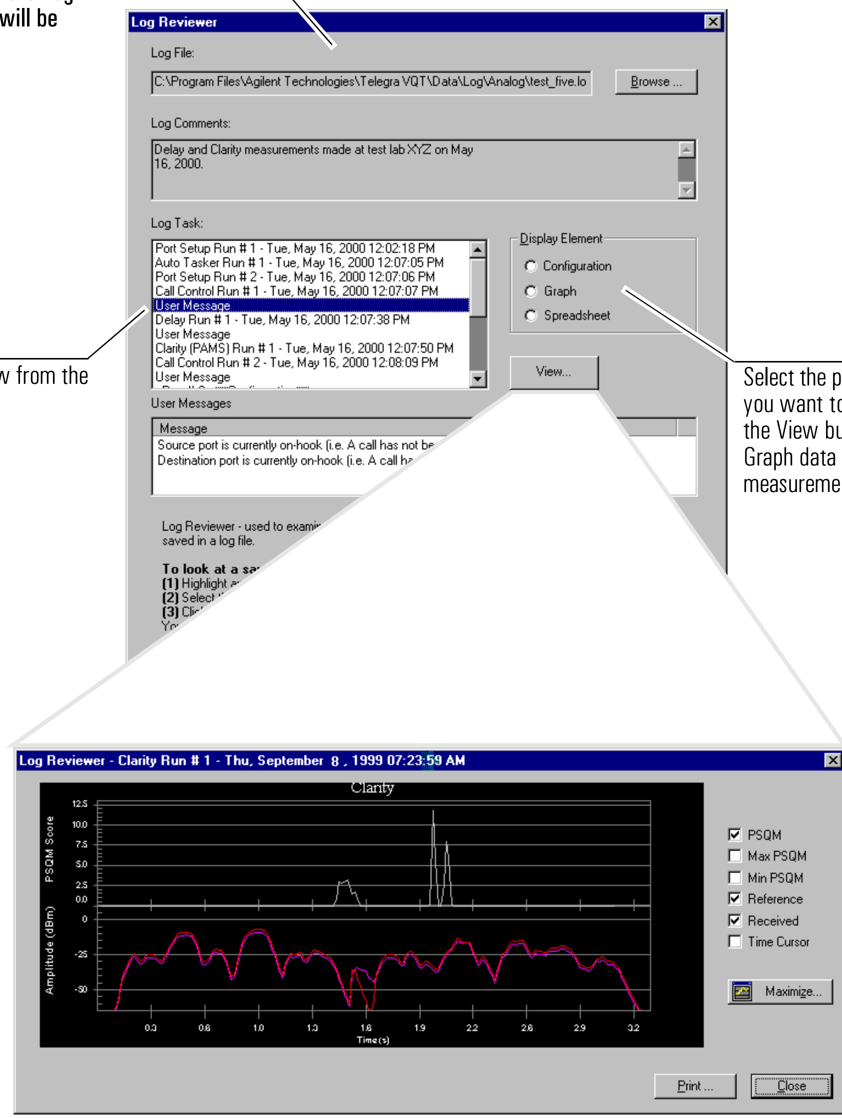
You can scroll through the log to see setup and measurement results. You can also click on the hypertext to open the measurement or tool so that it shows the configuration and data that was recorded in the log.



Save the log using the Save Log option in the File menu. The Save As dialog will be displayed.

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

(8) 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 will be displayed.



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.

Measuring Delay and Clarity

This example builds on the last by showing you how to use the Delay and Clarity measurements to gather basic voice quality information about the device or system under test. These are the kinds of measurements you would use to evaluate individual voice-over-packet devices or to test the quality exhibited by an individual call within a larger system. Specifically, this sample test will:

- Show you how to measure the end-to-end delay of the system under test.
- Show you how to measure the voice clarity (using PSQM) of the system under test.

Delay and Clarity are important voice quality metrics in voice-over-packet environments and, therefore, are used in many testing situations.

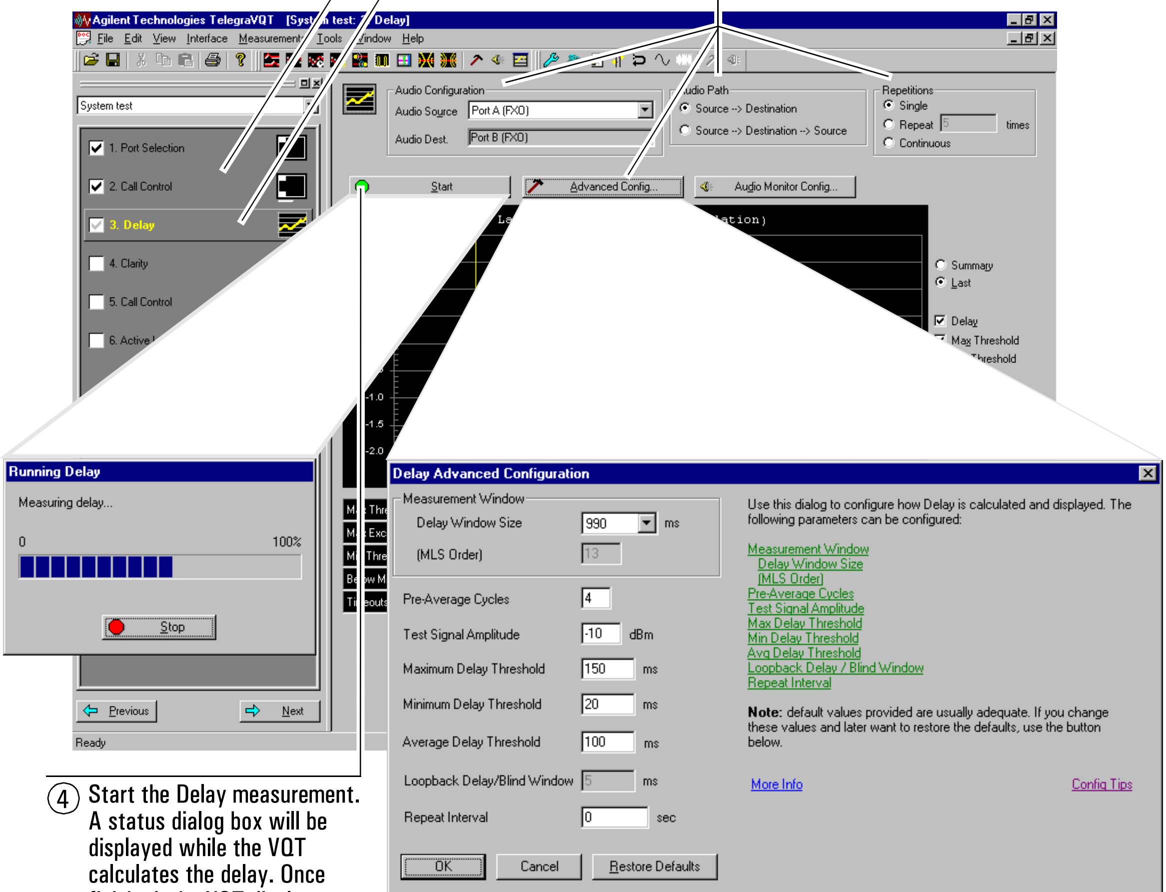
For the purposes of this example, assume that you need to measure the delay and clarity of a specific voice channel as shown at the beginning of the example on page 3-6. You will place a call from one analog (FXO) port to the other through a telephony network or device, and transmit test signals end-to-end.

Note Please use the Help to learn more about Clarity and Delay (particularly one-way Clarity), general voice quality test concepts and techniques, and the other measurements and tools provided by the VQT.

(1) Load the TaskList called “System Test” and then select and configure ports, connect to the system under test, and place a call from port A to port B, as shown in the Sample Test on page 3-6.

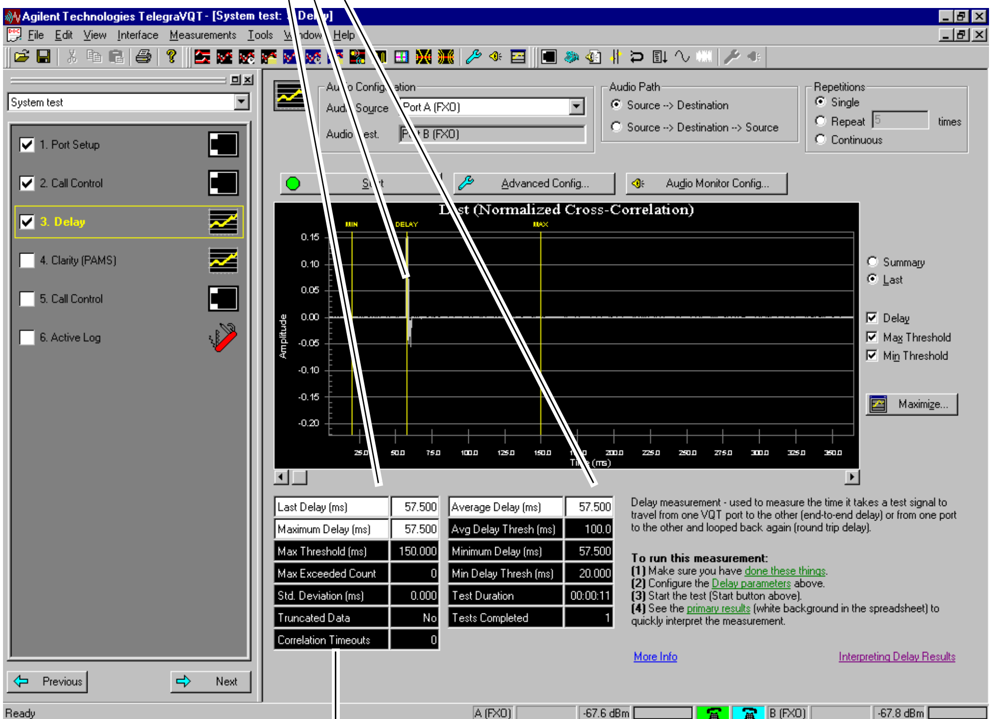
(2) Open the Delay measurement (shown here).

(3) 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 to set measurement thresholds consistent with your test criteria.



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

Note that in both the graph and in 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.

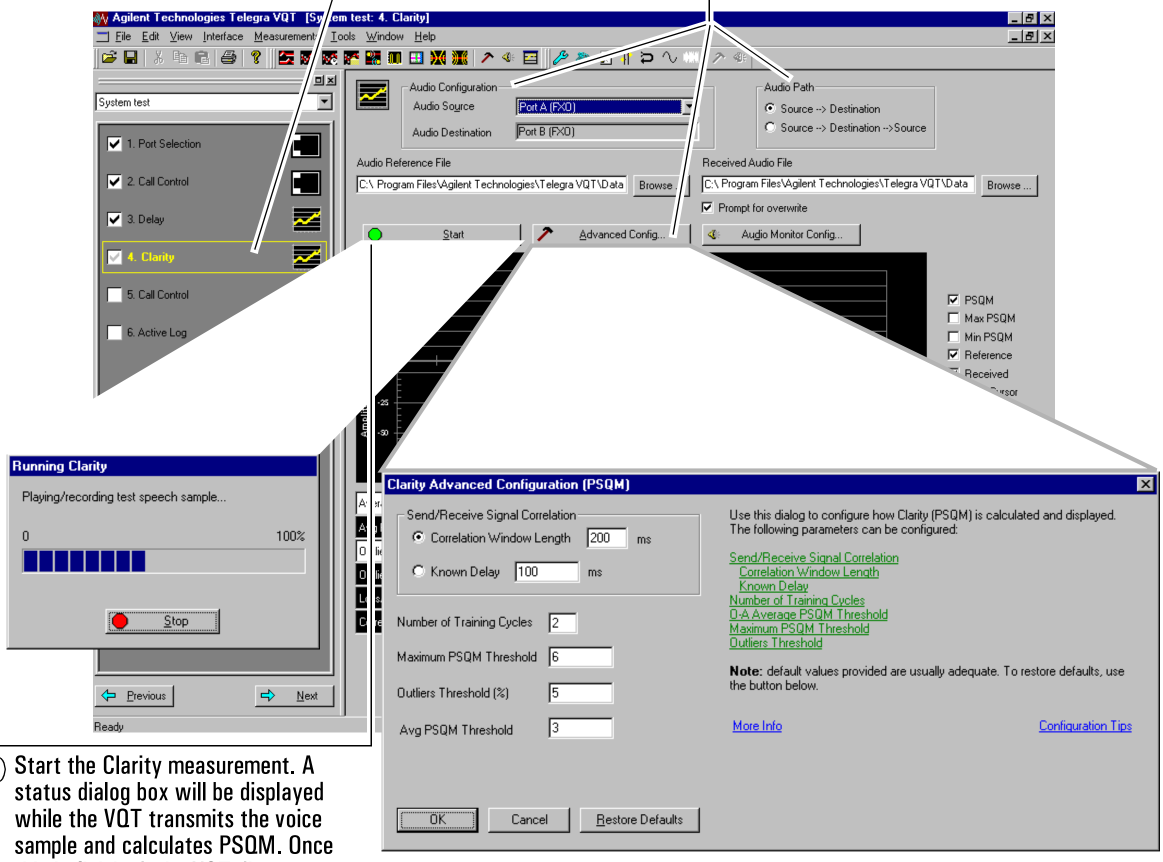


One very important parameter to look at when evaluating measurement results is the Correlate Timeout parameter. If this field is red, it is highly likely that measurement results are invalid. Correlation Timeouts can occur when excessive noise is present on the line or when the call is unexpectedly disconnected.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

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.

(5) Open the Clarity measurement from the TaskList.

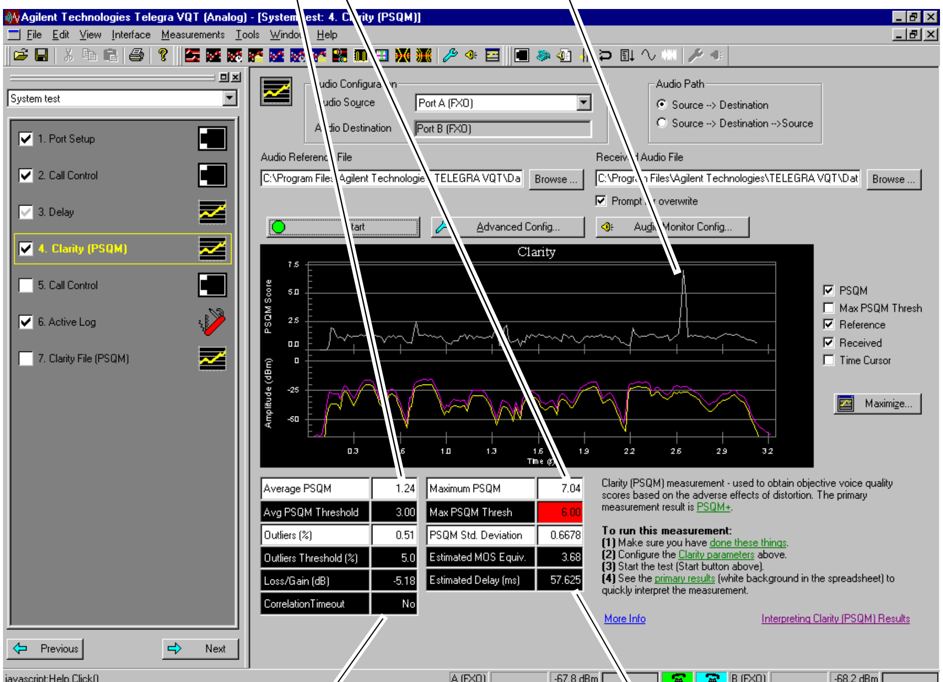
(6) Configure the measurement so that the test signal will pass from port A to port B and the measurement will be end-to-end. **Also:** Open the Advanced Configuration dialog to set measurement thresholds consistent with your test criteria.



(7) Start the Clarity measurement. A status dialog box will be displayed 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).

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 earlier 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.

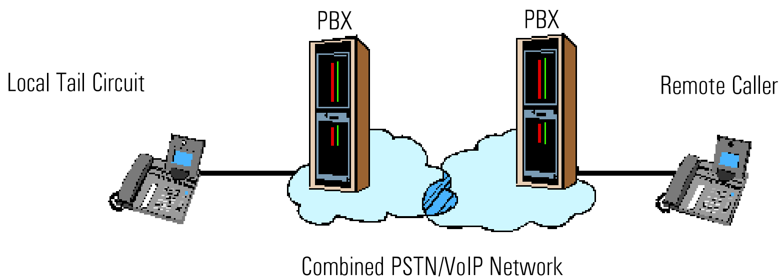
8. **When you finish testing, hang up the call as shown in the Sample Test that starts on page 3-5. You can also view and save a log of the measurement run (also described in the last Sample Test).**

Measuring Echo and Verifying Echo Cancellation

This example demonstrates how to use the Echo-PACE measurement to characterize echo on an existing telephony tail circuit. This example describes one of two important test capabilities provided by the Echo-PACE measurement. Specifically, this sample test will:

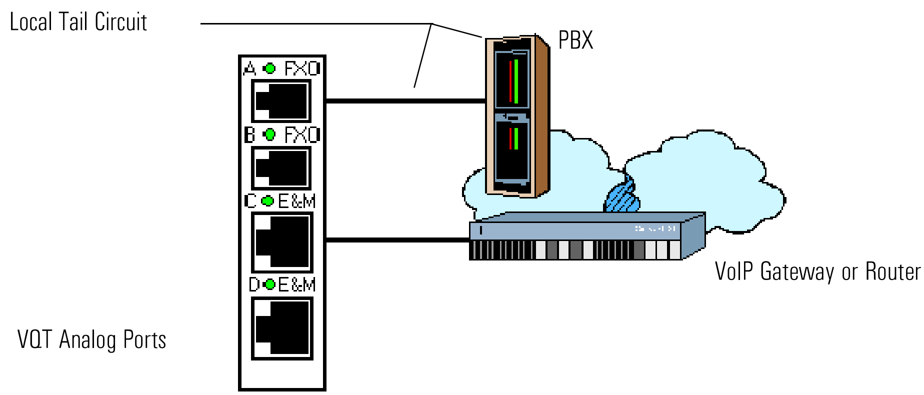
- Briefly describe an environment in which this measurement can be used.
- Show how to set up the VQT to measure existing echo.
- Describe how to read and interpret measurement results.

To set the stage for this example, consider the following illustration. A telephone call can be made between two telephones separated by some type of combined Public Switched Telephone Network (PSTN) and Voice-over-IP (VoIP) network. The only detail of the network that is important to this example is that there is an analog component and a VoIP component.



The “remote caller” has complained of excessive echo when she calls telephones on a particular local loop (shown on the left in the illustration above). Because of known characteristics of traditional PSTN circuits and the way VoIP circuits interact with them, you can assume that the echo experienced by the remote caller originates from the local tail circuit. In particular, echo is often caused when a four-wire interface such as E&M is converted to a two-wire interface such as FXO. (Refer to the Help for more information on this subject.) Using the Echo-PACE measurement, you can measure this echo and obtain objective metrics related to just how annoying or disruptive it is.

The following illustration shows conceptually how you would connect the VQT to measure the echo produced by the local tail circuit and experienced by the remote caller.

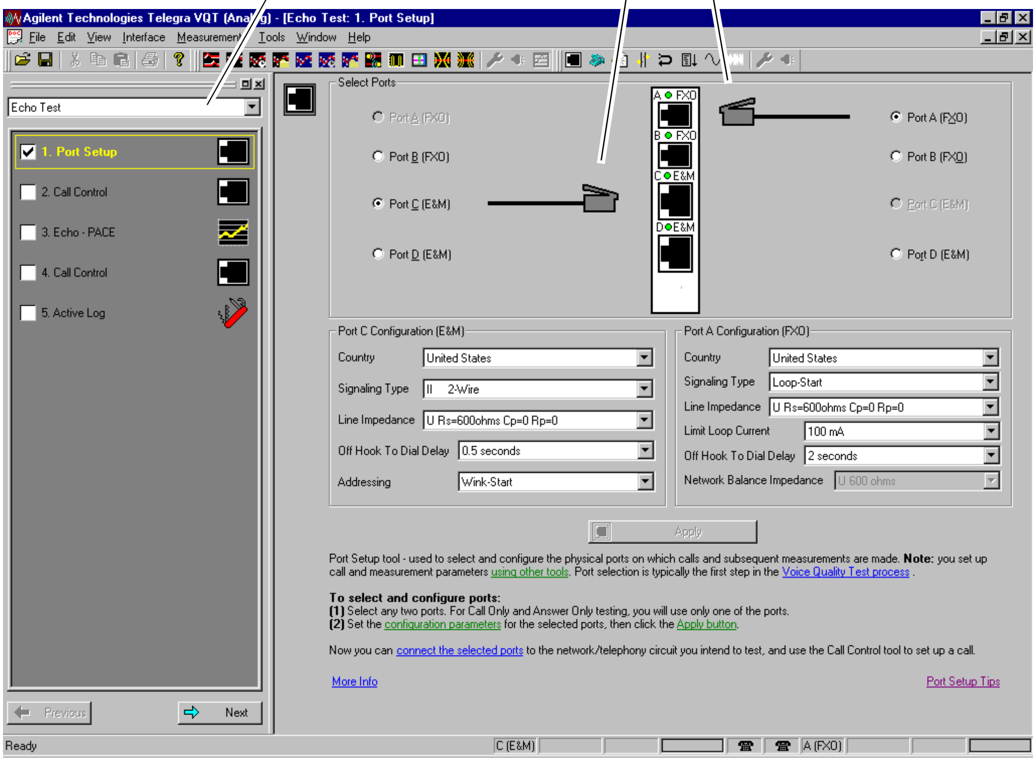


Port C (E&M) is connected to a gateway, router, or PBX that provides calling access to the local tail circuit. The end of the local tail circuit is connected to Port A (FXO). This connection scheme is important because the port what will detect the echo (port C) needs to be connected such that echo potentially originating between the gateway or router and port C does not dominate the measurement. Once you make the physical connection shown above, you will place a call from one port to the other to establish the circuit under test.

Note Please refer to the VQT Application's Help for more detail on echo, echo cancellation, and the Echo-PACE and Echo-DTalk measurements.

(1) Load the TaskList called “Echo Test”. This TaskList is designed to evaluate echo and echo canceller performance. However, Echo-PACE can be part of a more comprehensive TaskList containing Clarity, Delay, or any of the other VQT measurements.

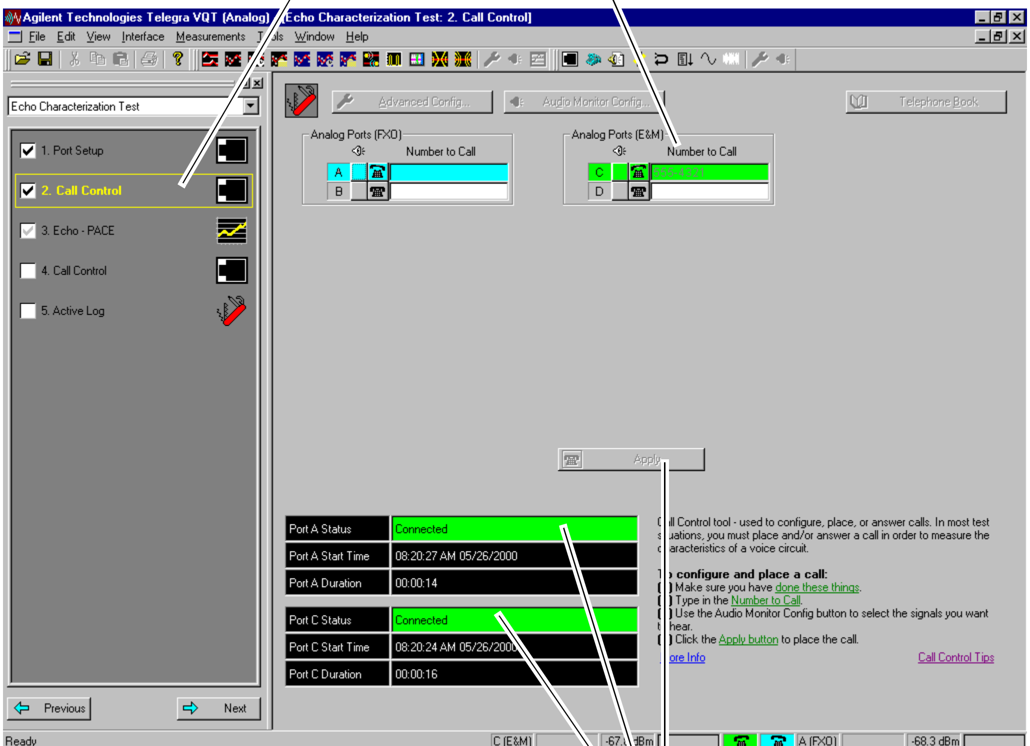
Notice the configuration in the Port Setup tool: Port C (E&M) and Port A (FXO) are selected. You will use Port C as the Audio Source port in the Echo-PACE measurement because this minimizes the chance of near-end echo. Near-end echo can prevent you from analyzing the echo produced by the far-end tail circuit.



When adapting this test scenario for your own unique test situation, remember to update the port configuration to match your network environment.

(2) Open the Call Control tool so that you can establish the call between Port C and Port A.

In the Number to Dial box next to Port C, type in the telephone number associated with Port A's FXO connection. Notice that the telephone icon turns yellow indicating that Port C has been selected to place a call. **Note:** Do not select Port A to answer — The VQT will answer the incoming call on Port A automatically.



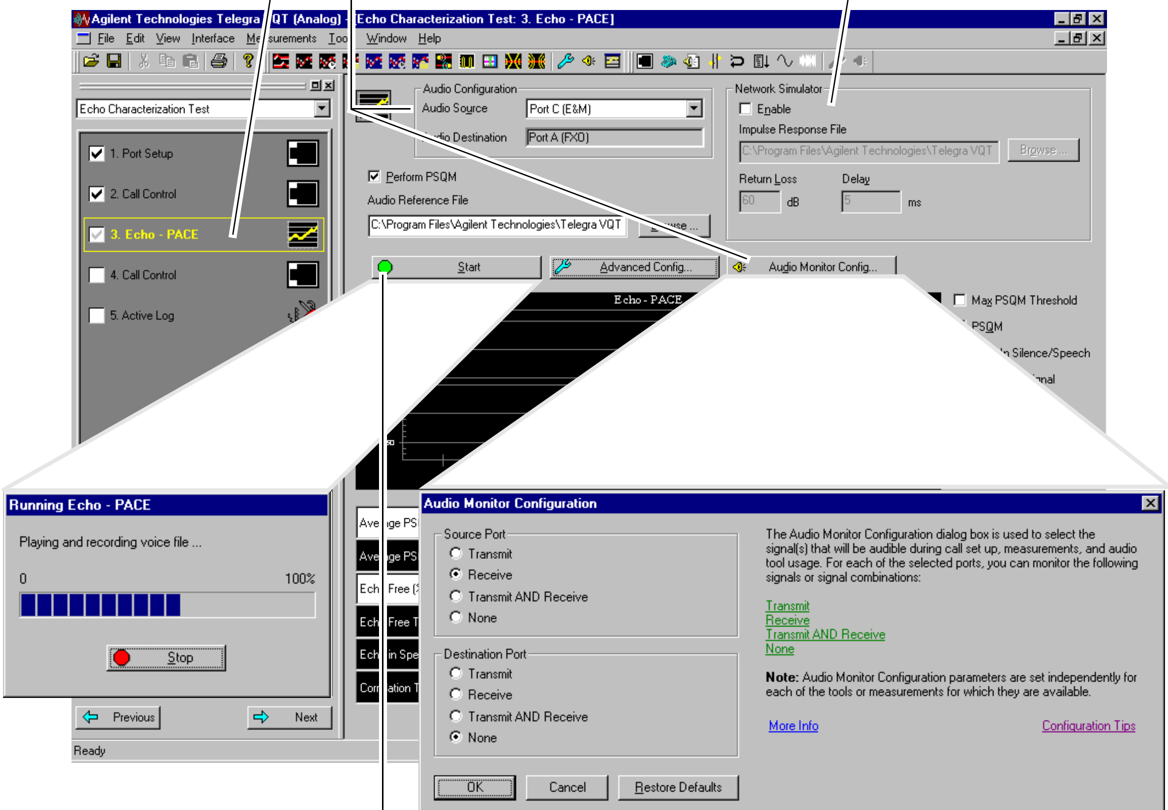
Remember to configure the Audio Monitor as described in the sample test that begins on page 3-5.

(3) Click the Apply button to place the call from Port C to Port A. Once the call is connected, the background colors of Ports A and C will turn blue and green respectively and the call status will be shown in the Status Indicators. **Note:** You could also call from Port A to Port C to establish the circuit.

(4) Open and configure the Echo-PACE measurement.

Select Port C as the Audio Source port. Port A is automatically selected as the Audio Destination port because of the Port Setup configuration shown in Step 1. Also, configure the Audio Monitor so that you can hear the received signal on the Audio Source port (Port C). This will allow you to hear returning echo if it exists.

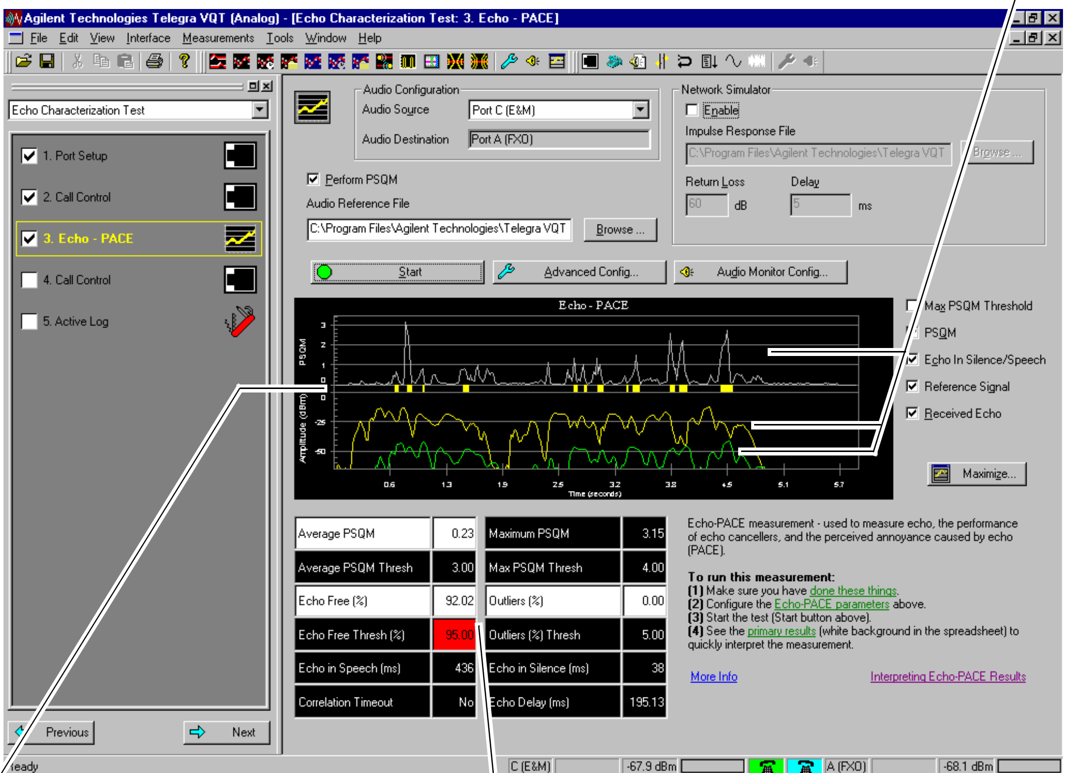
Make sure the Network Simulator is disabled so that the VQT **does not** create and transmit simulated echo from Port A.



(5) Start the Echo-PACE measurement. Test signals will be transmitted from the Audio Source port, and if or when echo returns, it will be analyzed and results will be displayed in the spreadsheet and the graph. Two examples of measurement results you might see are shown on the next two pages.

⑥ View Echo-PACE results:
This example shows returning echo that has been attenuated by about 20 dB and delayed by just under 200 milliseconds from the original test signal.

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. Echo in Speech and Echo in Silence 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. And while the Echo in Speech threshold was exceeded, most of the test signal (92%) was not interfered with by echo. These measurement results can be explained by either a strong echo return loss in the tail circuit or an echo canceller that is performing well. In either case, echo of this magnitude would probably not cause much annoyance to a caller.

⑦ View Echo-PACE results:
This example shows a returning echo signal that has been attenuated by only a few dB and is delayed by about 150 milliseconds.

Notice that, in this case, the echo signal's level is much closer to the original test signal.

The VQT reports much more Echo in Speech and Echo in Silence when the returning echo's level is not attenuated much in relation to the test signal. Also notice that sharp increases in PSQM scores.

The Average PSQM is higher than in the example on the previous page, and a larger percentage of the test signal was interfered with by the echo signal. The higher PSQM scores and larger Echo in Speech values indicate that a caller is likely to consider this echo annoying and disruptive. Inadequate echo return loss or a malfunctioning echo canceller could be the cause.

Once you finish testing, you can hang up the call and view logged measurement results as described in previous sample tests. The next page describes other echo measurement options the VQT provides.

Other Echo Measurement Strategies

The previous example showed how to measure existing echo and how to interpret Echo-PACE results when echo characterization is the goal. The VQT provides other echo measurement options.

- When you need to test an echo canceller directly (either in a lab or other tightly controlled environment), you can introduce simulated echo using the Echo-PACE measurement's Network Simulator. In this case, you would use E&M or T1/E1 connections at both ends of the call so that the possibility of "naturally" occurring echo is minimized. One of the VQT's ports or channels (the "Audio Destination") acts as an analog tail circuit such that a simulated echo signal constructed from the original test signal is looped back towards the audio source port/channel. The echo canceller located closest to the destination port/channel attempts to cancel the echo. Echo that is not cancelled arrives at the source port/channel and is analyzed as shown in the previous example. You can control the echo delay and level of the simulated echo to verify echo canceller performance and thresholds. An example of using simulated echo to test an echo canceler directly is shown on page 3-48.
- Echo cancellation in the presence of double-talk (interrupting voice signals originating from the same tail circuit as the echo) is a potential failure mode for echo cancellers. The Echo-DTalk measurement can be used similar to the example above to inject interrupting vocal phrases while the echo canceller is attempting to eliminate legitimate echo. This test option is best performed in a lab or other tightly controlled test environment.

Please refer to the VQT Application's Help for more information about echo measurement options.

Placing/Answering a Call, Sending Test Signals in a T1/E1 Environment

This example for connectivity demonstrates the processes that are fundamental to voice quality testing a VQT server and VQT Application in a T1/E1 environment — That is, the real-time testing concepts of call placement and audible signal verification. You will need to understand these techniques regardless of the other measurements you intend to run or the systems you intend to test. Specifically, this sample test for a T1/E1 connection shows you how to:

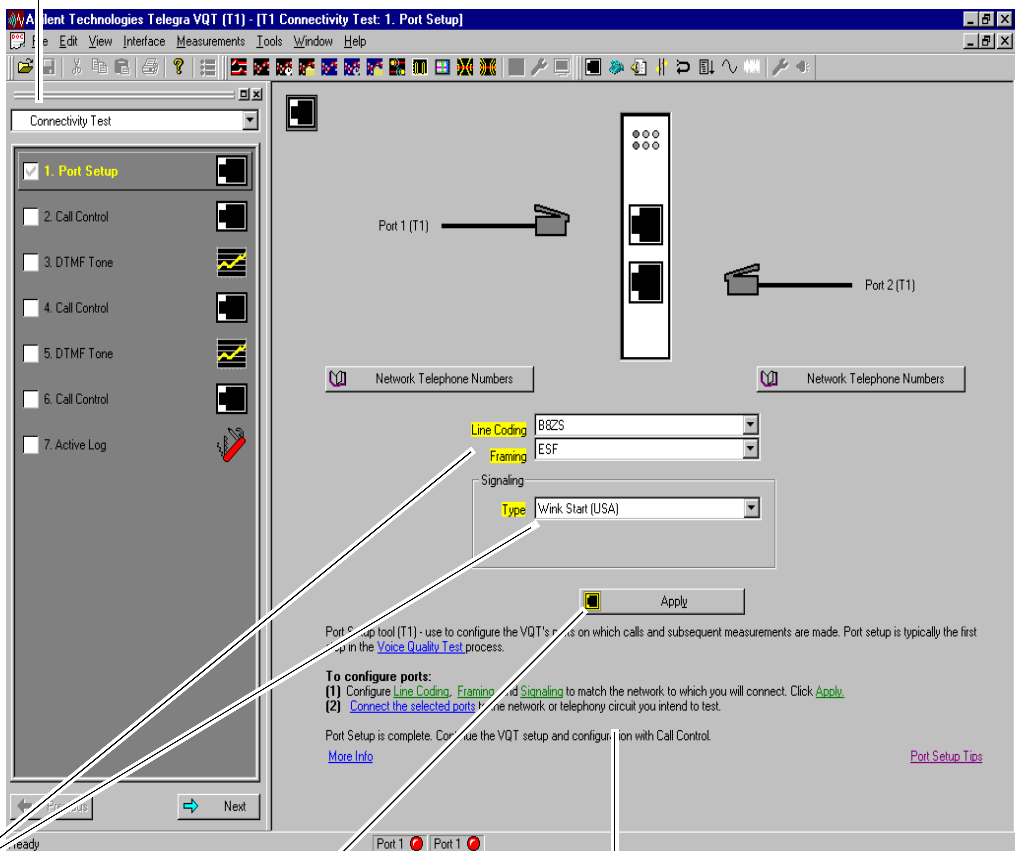
- Configure the physical T1/E1 ports the VQT will use.
- Connect to the device or system under test.
- Place and answer calls to set up the test circuit between T1 channels.
- Run the DTMF Tone measurement to verify connectivity.
- Terminate the calls.

To begin this test scenario, you need to have set up and powered on the VQT server, launched the VQT Application from the shortcut icon in the Windows desktop, and configured the Server Setup tool. See chapter 2 for more information.

Note

Connecting, placing the call, and running measurements or tools are the most fundamental of VQT processes. You can adapt this example to your unique testing needs. Remember when adapting this test scenario for your own unique test situation you need to update the port configuration to match your network environment. Also, you will need to replace the sample telephone numbers in the Call Control Tool with the telephone numbers that match your test situation. The configurations shown throughout this example are for demonstrative purpose only.

① **In the TaskList Navigator, select the TaskList called "Connectivity Test". The list shown below will be loaded and the Port Setup tool for a digital connection (the first item in the list) will be opened.**
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.

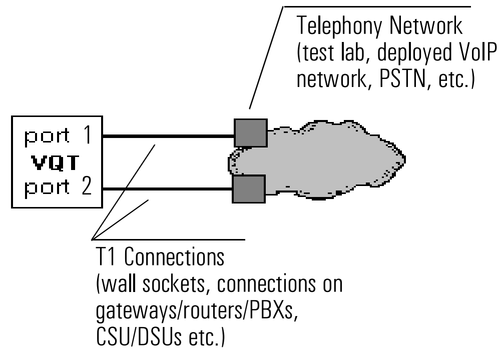


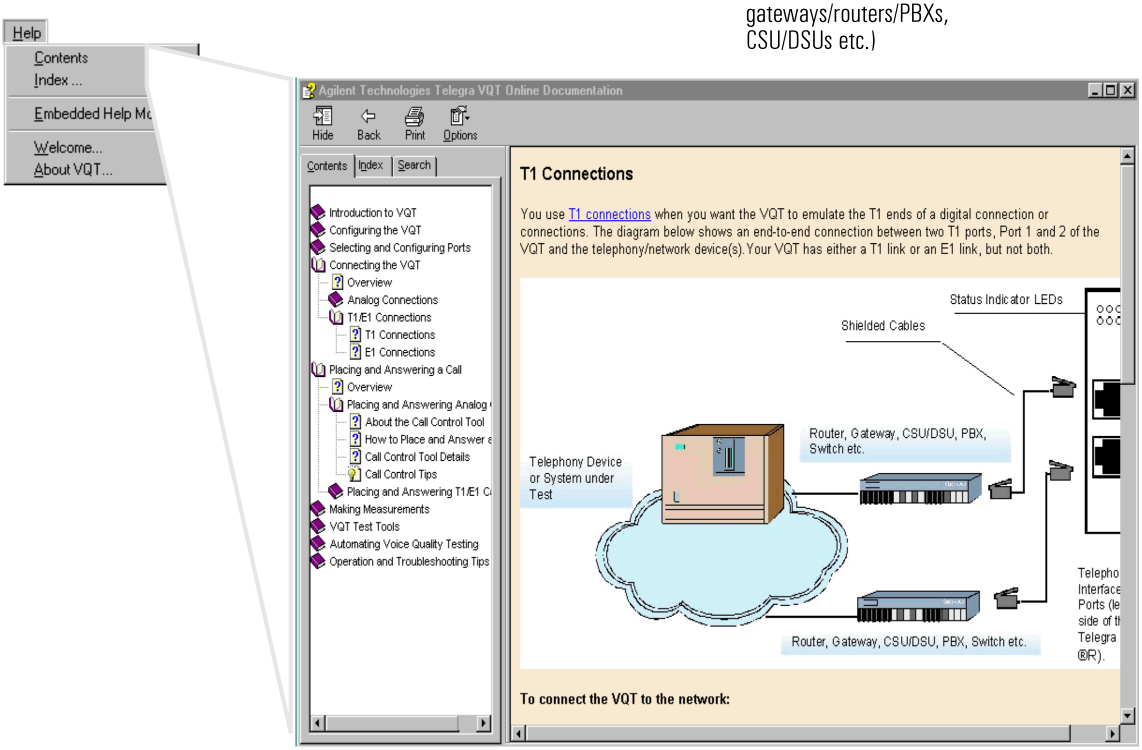
Select the Line Coding and Framing type. Configure the Signaling parameters by selecting the signal type.

Click Apply to configure the VQT's physical interface according to the parameters you set.

The embedded Help provides setup information and access to other related online documentation.
Note: All of the VQT's windows contain embedded Help to assist you in performing your testing tasks.

② Look in the Help for connection diagrams. The connection you use depends on whether you are testing an individual device or a system.



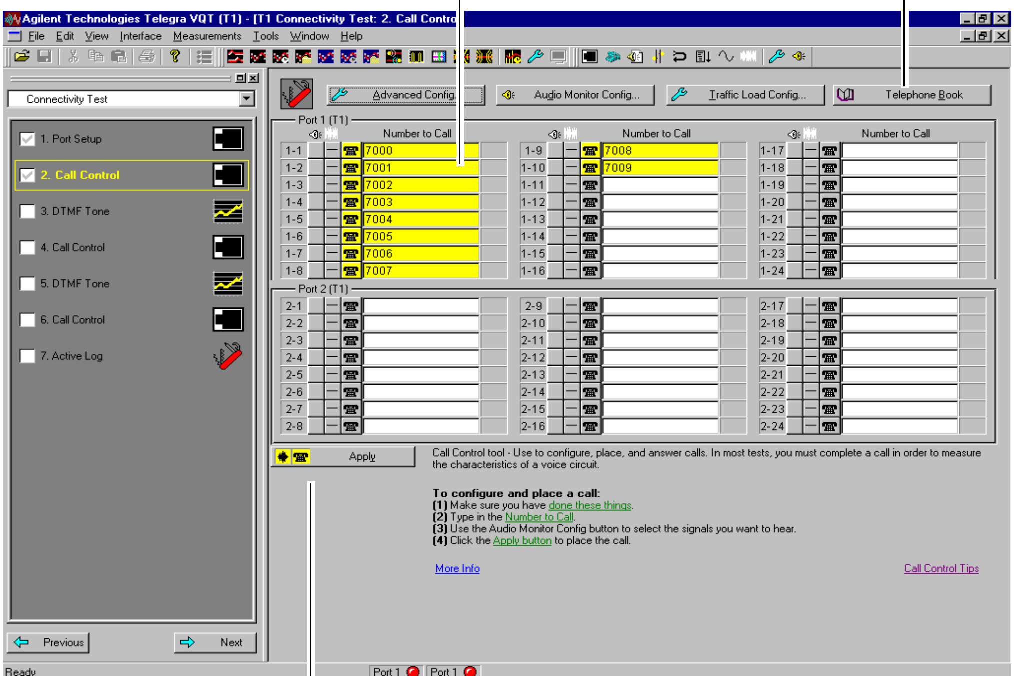


Note: You can open this Help topic from a link in the embedded Help of the Port Setup tool.

You can also access T1/E1 cable wiring and pinout diagrams from this Help topic.

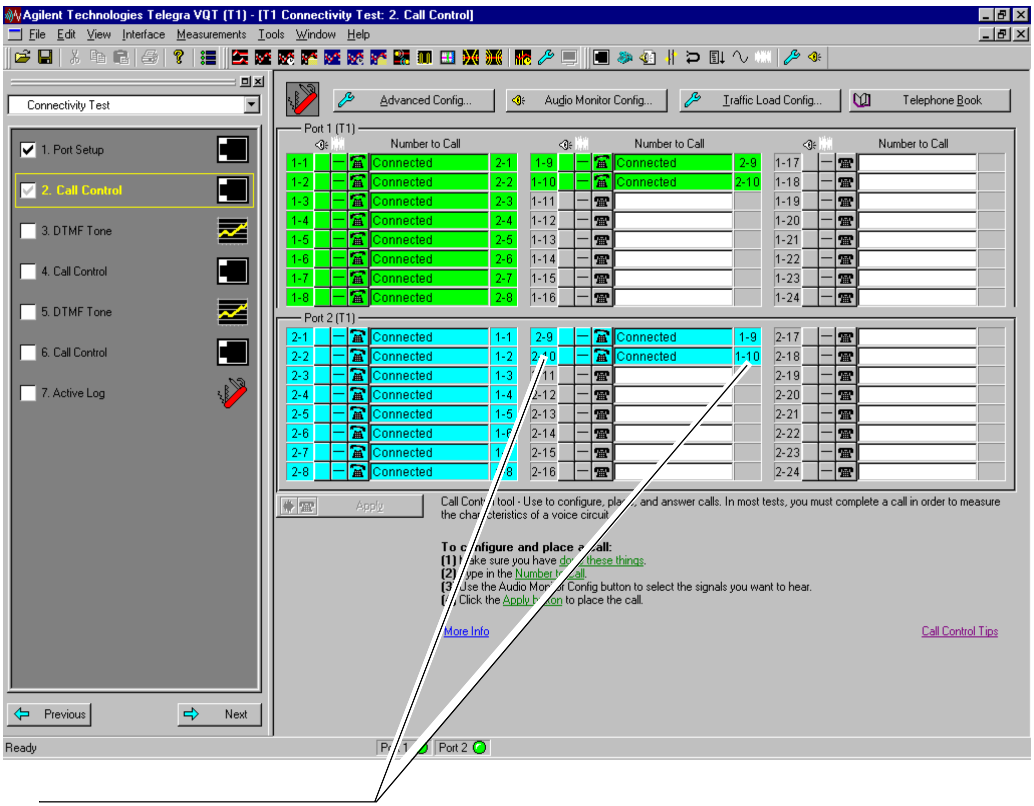
(3) Open the Call Control tool to set up and place the call or calls through the circuit you intend to test. In this case, type in ten destination numbers in the Number to Call field of the channel that will place the calls. Normally, the network determines which channels get answered.

You can use the Telephone Book to store your favorite telephone numbers.



Click the Apply button to place the calls.

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

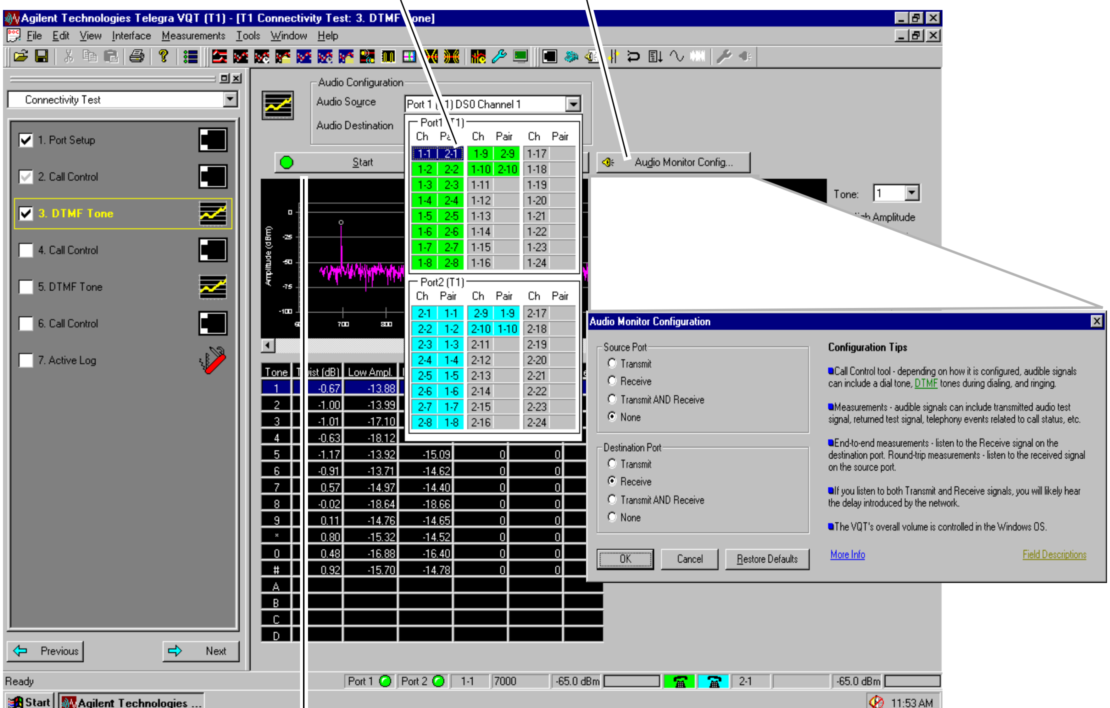


Notice that the channel pairing is shown in the box to the right of the Number to Call field. (In this example port 2, channel 10 is connected to port1, channel 10.) The channel pairing is determined by the setup of your network. The channel pairing above is shown for demonstration purposes only.

Note that it is possible for channels to be answered on the same port.

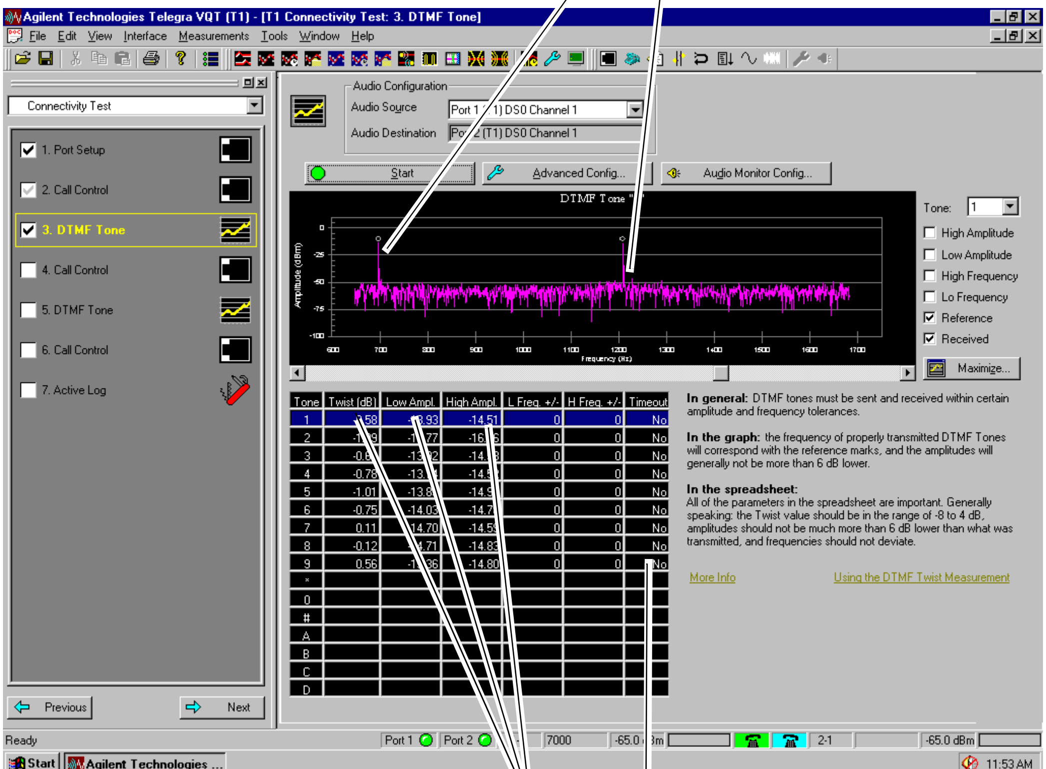
4 **Open The DTMF Tone measurement. In the Audio Source field, select the channel pair on which you will perform the DTMF Tone measurement.** In this case, choose channel pair 1-1 to 2-1.

Set the Audio Monitor for Port 1 to "None" and Port 2 to "Receive". This is so you will hear only the tone received at Port 2, channel 1.



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.

The DTMF Tone spikes in the graphic relate to the DTMF Tone digit pair 1. The spikes should align with the circular reference marks.

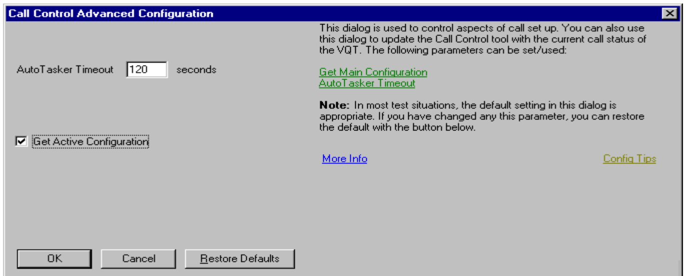


Note that the Twist value are within the range of -8db to 4dB and the low and high amplitude measurement are close together. This indicates that the DTMF tone pair was transmitted through the network properly.

Notice that the Correlation Timeout parameter shows “No”. This indicates that the DTMF measurement received the DTMF tones and was able to correlate them with the original test

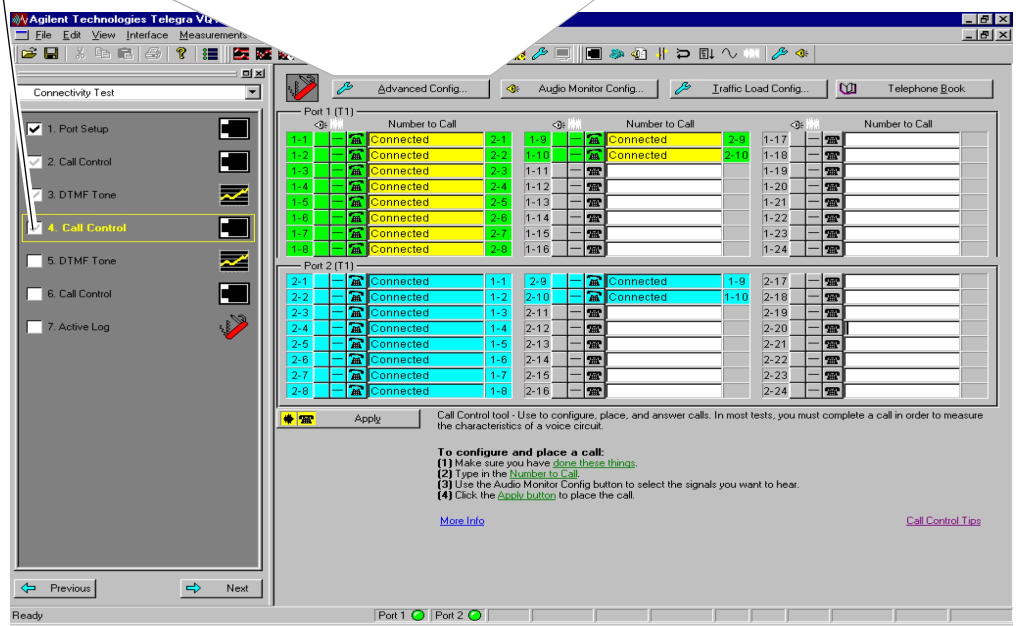
Up to this point, you have placed a calls between Ports 1 and 2, and used the DTMF tone to verify a good connection on one of the established calls. You could now use the DTMF Tone measurement to see what happens to the tones as they are transmitted across the network. Received DTMF tones should be within specific frequency and amplitude tolerances.

⑤ Go to the second Call Control tool in the TaskList Navigator.



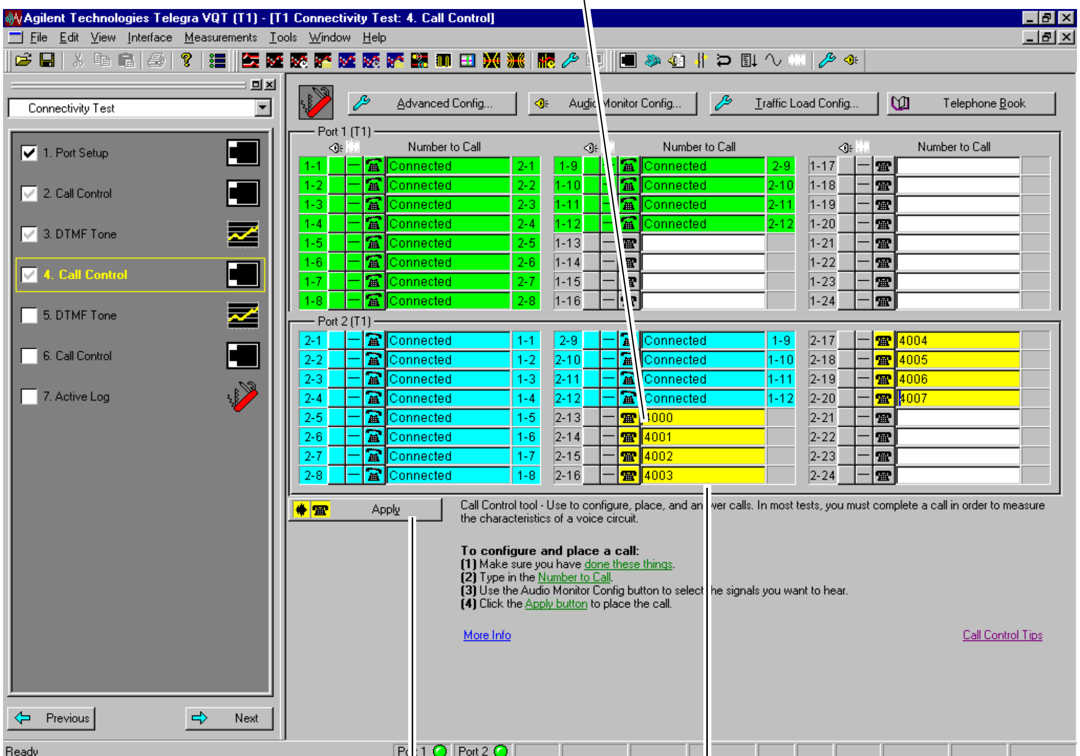
Notice that the handsets are "off-hook" indicating that the calls are still in progress, but the background color is yellow. This condition exists in the second call control tool because yellow indicates the difference between the desired configuration in the Call Control Tool and the current active configuration (state of calls).

You now need to update *this* Call Control Tool to the current call state before you can place additional calls. Click Advanced Config. Place a check mark into the Get Active Configuration box, then click OK.



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

6 To test for connectivity from Port 2 to Port 1, type in the telephone numbers that are associated with port 1 in the Number to Call section for Port 2 (In this example, channels 13 through 20).



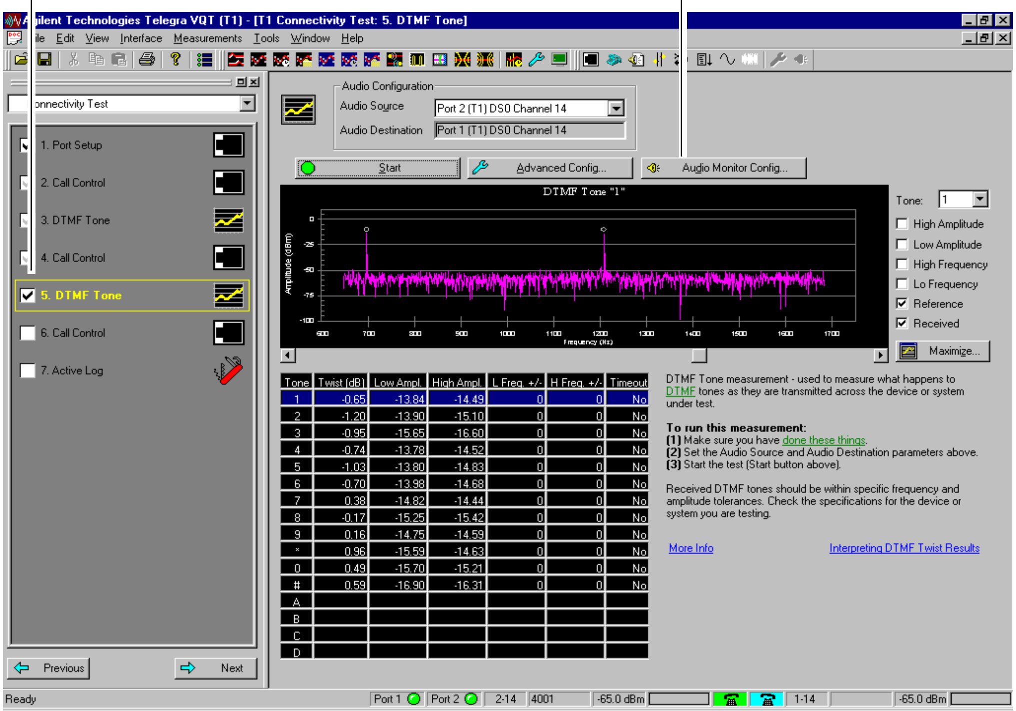
Click Apply to place this second set of calls.

Notice that the telephone icons turn yellow indicating that the channels have been selected to place calls.

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.

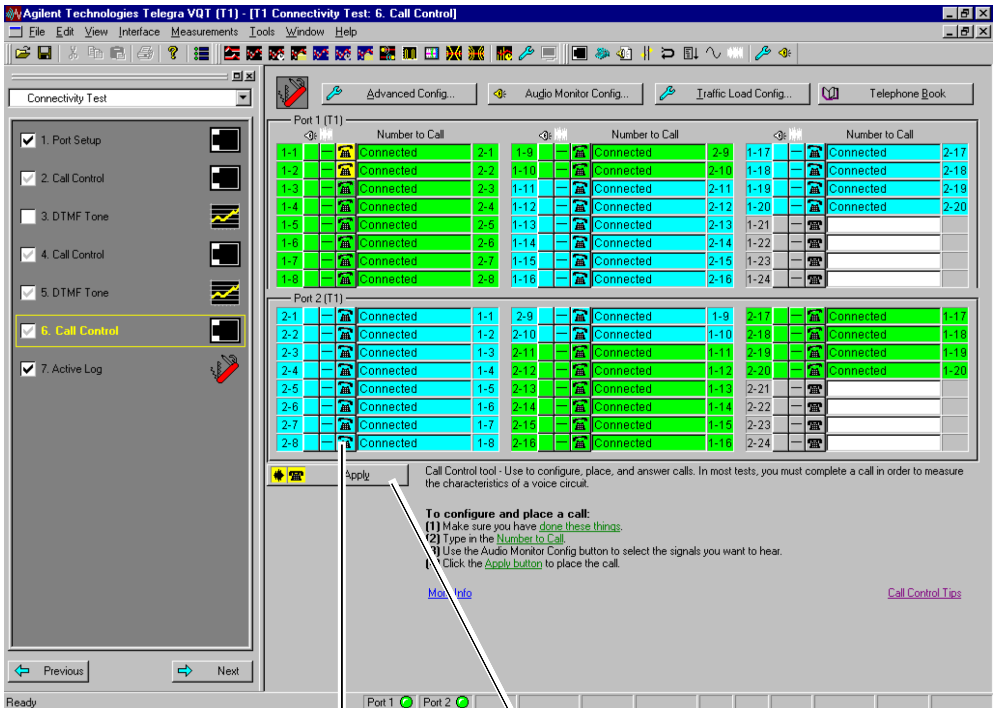
⑦ Open the second DTMF Tone measurement from the TaskList. Now perform the test on port 2 to verify that you established connectivity between ports 2 and 1 (in this example, channel 14).

Remember to configure the Audio Monitor, so that you can hear the DTMF tones at the receiving channel.



Notice the results. The frequency of the transmitted DTMF tones correspond with the circular reference marks and the twist values are within the acceptable range. The twist field would turn red if measured values were outside user-defined thresholds.

(8) Once you finished testing, you can hang up the calls and view the logged measurement results as described in previous sample tests, page 3-12.



To select the channels that you want to disconnect, click the telephone icon. If you want to disconnect a group of channels, leave the cursor on the telephone icon of the first channel that you want to disconnect, then hold down the Shift key and click or hold down the Arrow (up or down) key.

Once you have selected the channel or channels that you want to disconnect, click Apply to hang up the calls.

Progressive Traffic Loading on T1/E1 Calls

This example demonstrates how to characterize the behavior of your network based on varying load conditions. By progressively loading traffic onto a number of channels and performing a measurement on one of the channels after each transaction, you will be able to determine if the quality of the voice connection is impacted. For simplicity we will demonstrate the Delay measurement. You could run other measurements as well.

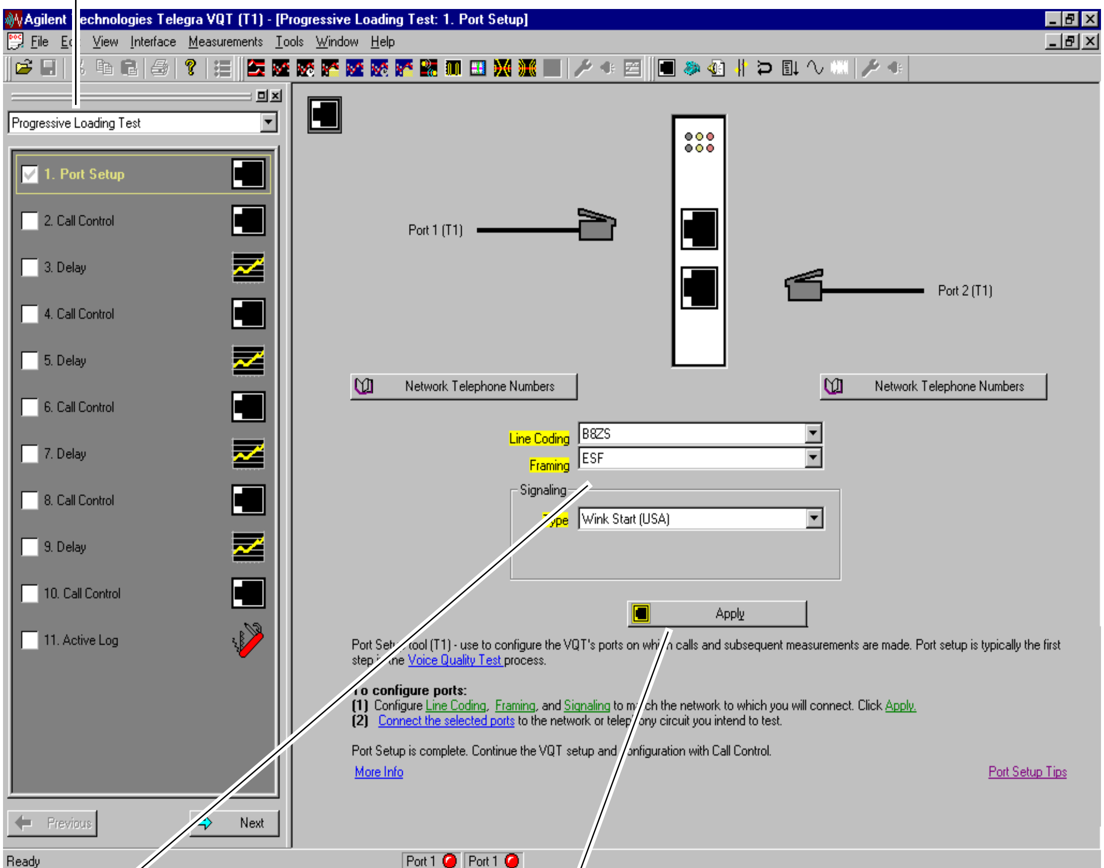
Progressive loading of T1/E1 calls could induce delay and impact the clarity of the call. This test can help you evaluate whether you have enough resources or capacity allocated to handle increased call traffic. Specifically, this sample test will show you how to:

- Select and configure the physical T1/E1 ports the VQT will use.
- Place and answer calls.
- Progressively load channels with traffic.
- Measure the end-to-end delay of the system under test as increasing amounts of traffic load is added.

Please use the Help for more information about Delay measurements, quality test concepts and techniques, and the other measurements and tools provided by the VQT.

Note Connecting, placing the call, and running measurements or tools are the most fundamental of VQT processes. You can adapt this example to your unique testing needs. Remember when adapting this test scenario for your own unique test situation to update the port configuration to match your network environment. Also, you will need to replace the sample telephone numbers in the Call Control Tool with the telephone numbers that match your test situation. The configurations shown throughout this example are for demonstration purposes only.

① In the TaskList Navigator, select the TaskList called "Progressive Loading Test". The list shown below will be loaded and the Port Setup tool (the first item in the list) will be opened.

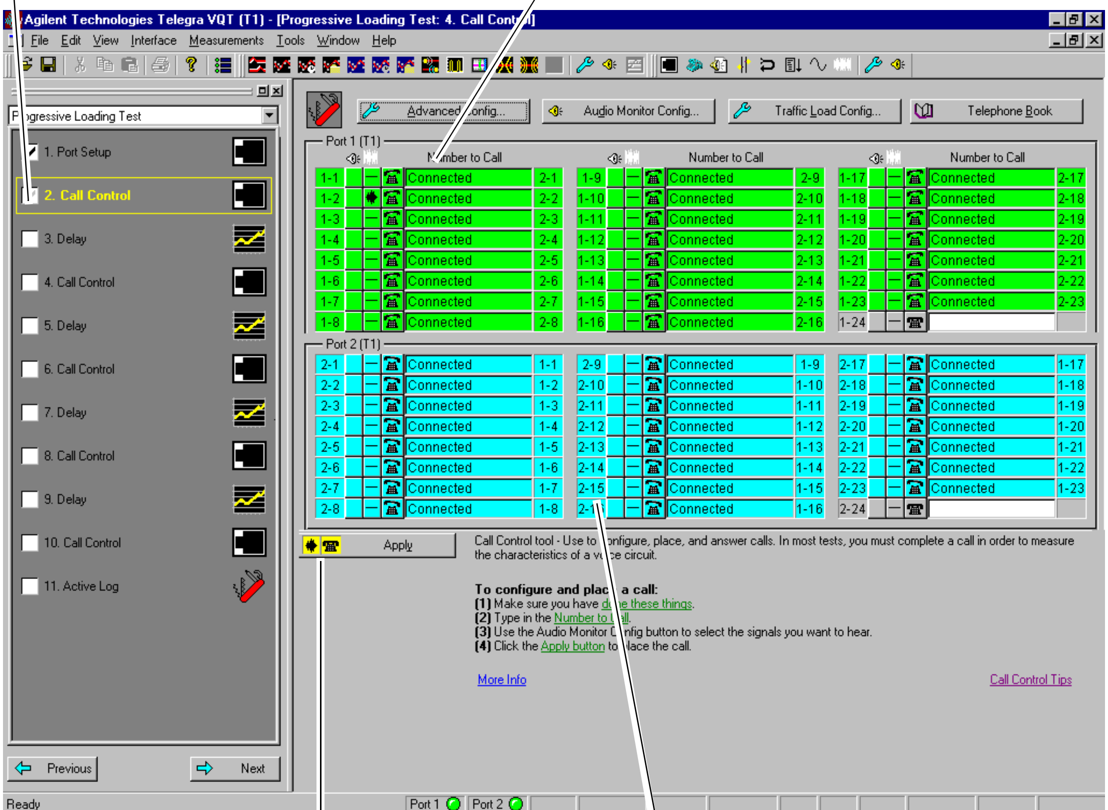


Select the Line Coding and Framing type. Configure the Signaling parameters by selecting the signal type.

Click Apply to set the port configuration that matches your network environment.

(2) Open the Call Control tool to establish calls on all channels from port 1 to port 2.

Type the destination telephone numbers in the channel's Number to Call field. **For this example, assume that the telephone numbers shown below will be answered on channels associated with port 2.**

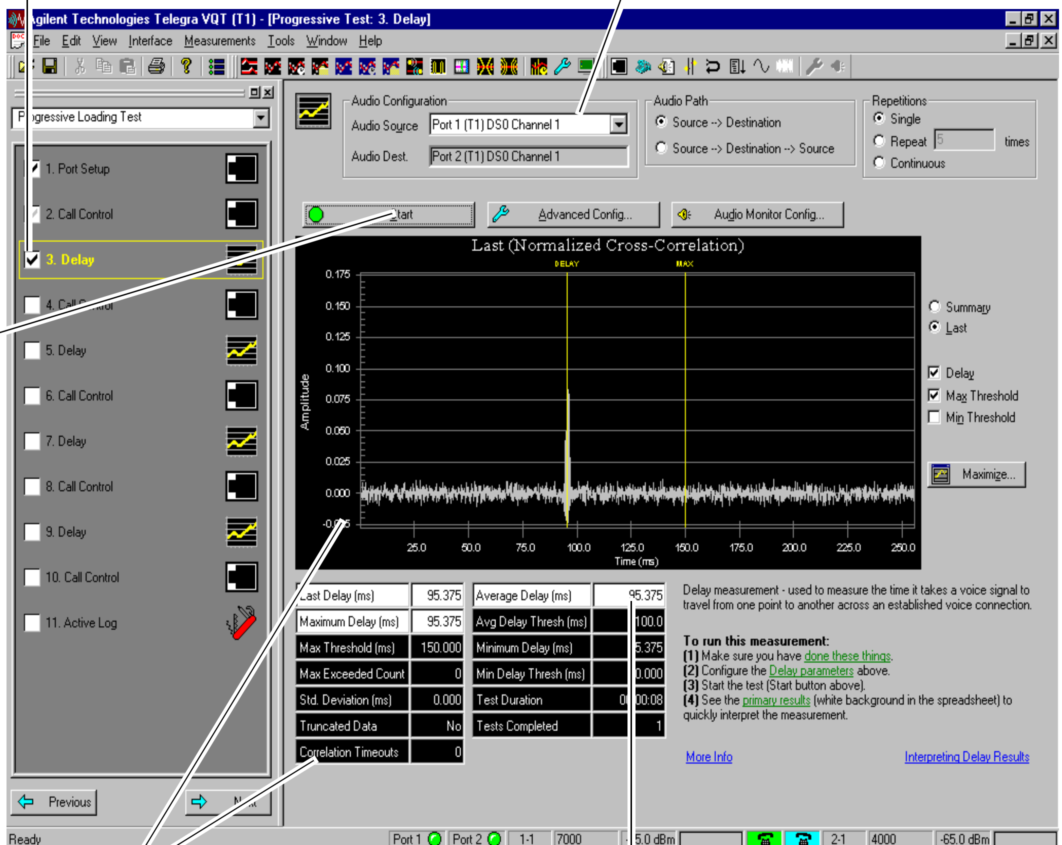


Click Apply to place the calls.

The pairing of the channels is determined by the setup of your network. It is possible for channels to be answered on the same port if you were not calling from every channel and your network was configured for that behavior.

(3) Select the next task in the TaskList (Delay).

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.

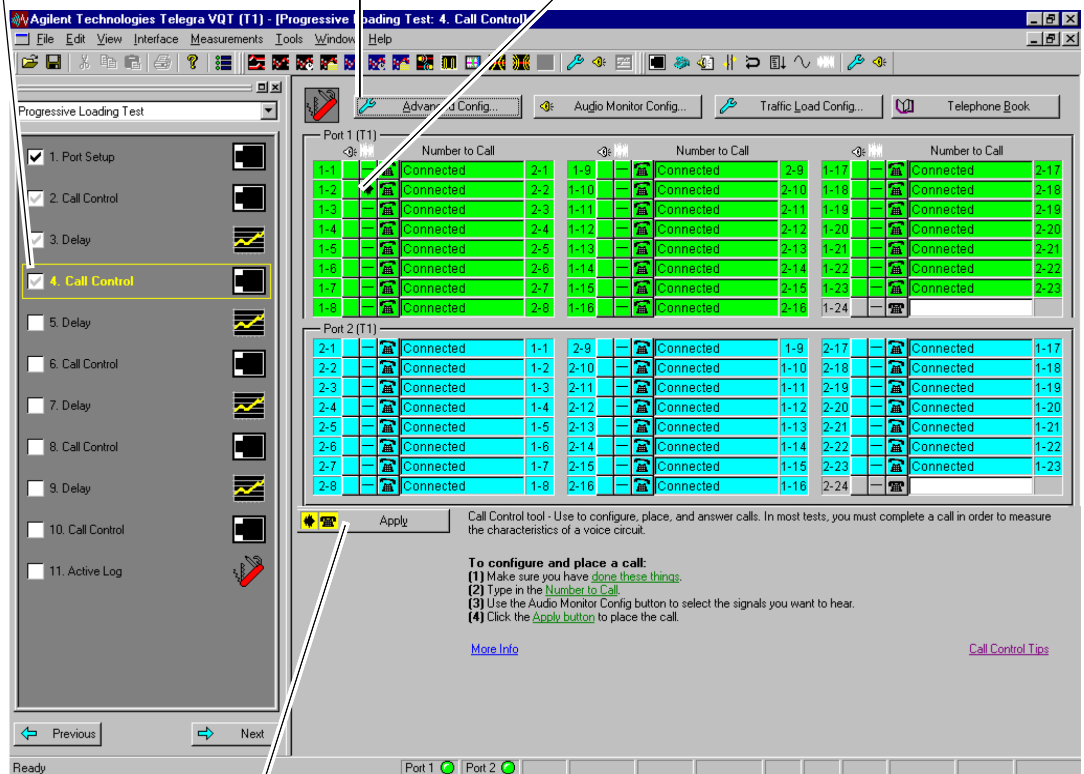
Once finished, the VQT displays results in the graph and spreadsheet.

Note the Average Delay value. This will be your baseline measurement against which you will compare subsequent measurements.

(4) Open the Call Control tool and load traffic unto the channel adjacent to the channel that you performed the delay measurements on.

Remember to update your current configuration in the Advanced Configuration dialog box by clicking Get Active Configuration in every Call Control dialog box throughout this sample test.

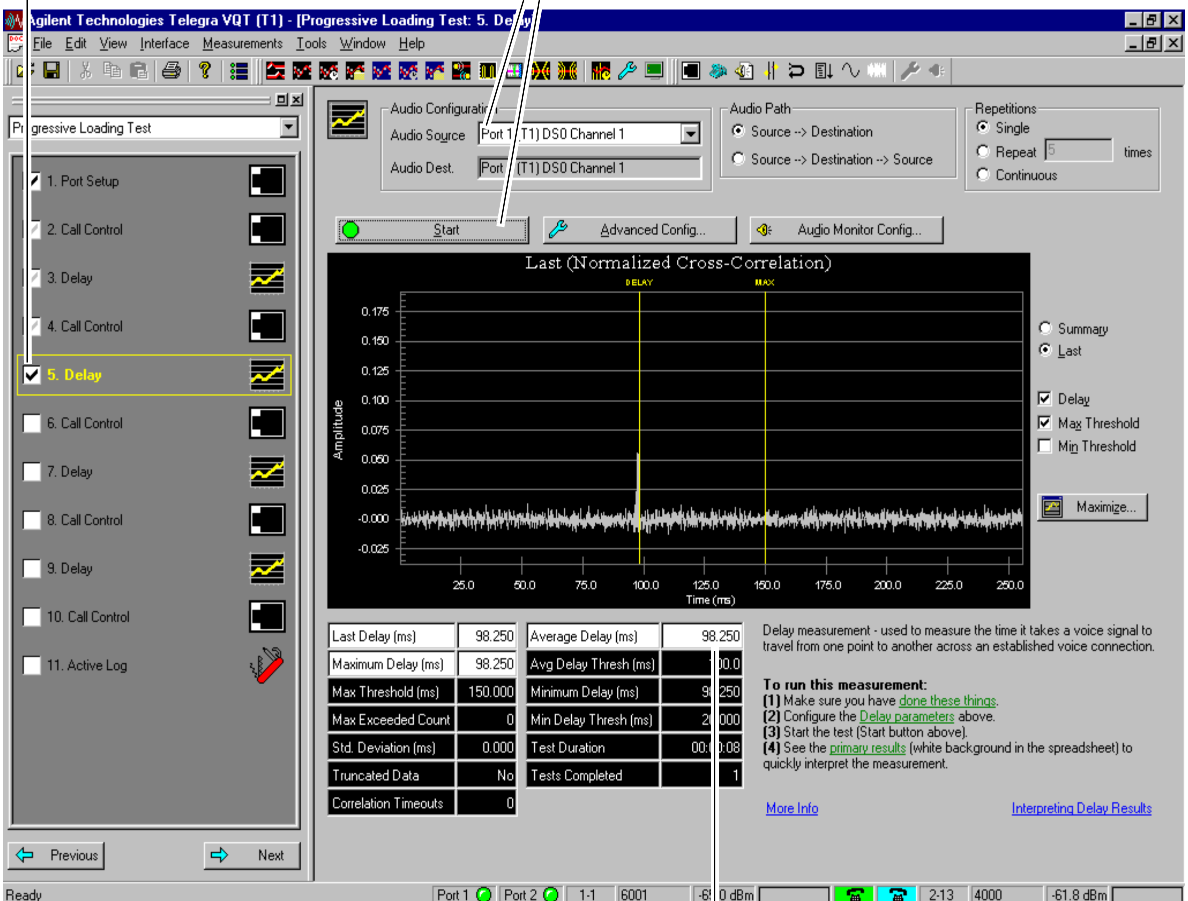
Load traffic unto the channel adjacent to the channel that you performed the delay measurements on. You can use Traffic Load Config. to select and control the type of traffic that can be injected onto T1 and E1 channels that are not under direct measurement.



Click Apply to begin transmitting traffic load from the selected channel.

⑤ Begin another Delay measurement to find out if loading channel 2 with traffic impacted channel 1's voice quality.

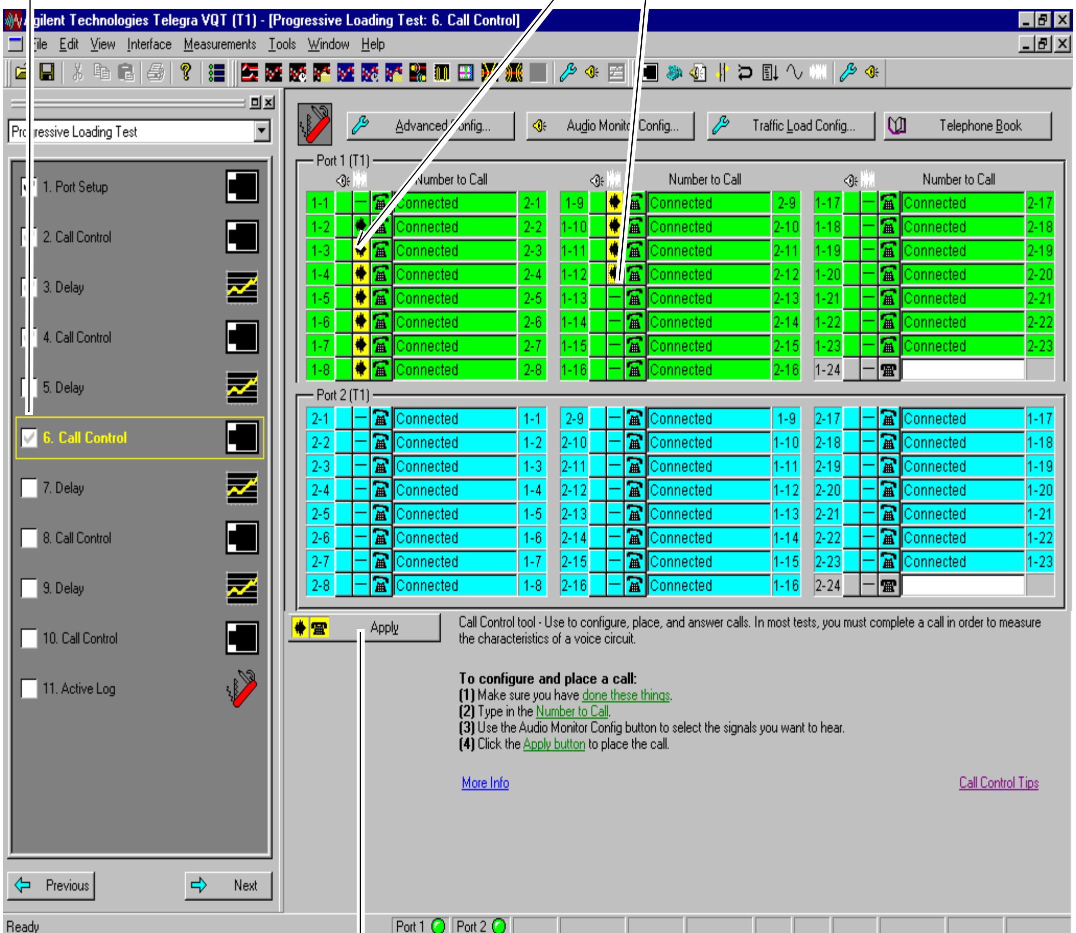
Select the Source and Destination port and click start.



Note that in both the graph and the spreadsheet, the measured delay increased from 95.375 milliseconds to 98.250 milliseconds after the channel adjacent to the measured channel was loaded with traffic. The 3 millisecond increase might not be due to traffic load, but simply because of slight fluctuations in the network.

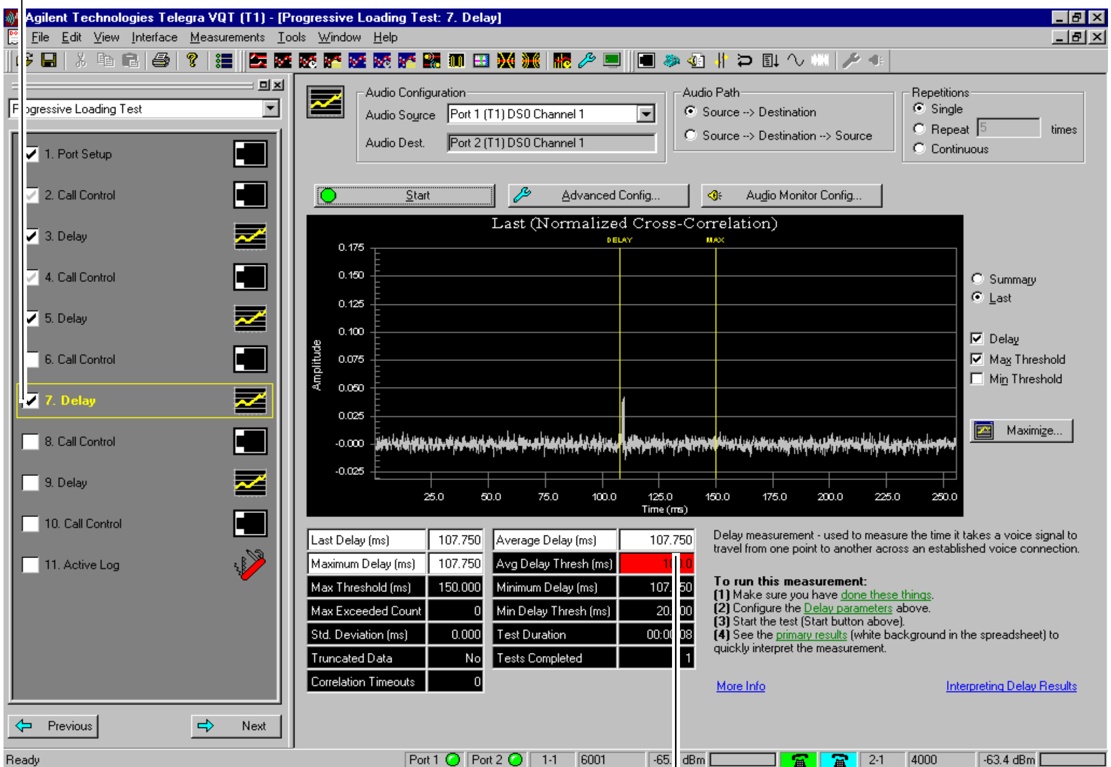
⑥ Continue to the third Call Control tool so that you can load a series of channels with traffic.

In this example, you load channels 2 through 12. This will place more traffic onto the line and help you determine if further delay will be induced.



Click Apply to add the load.

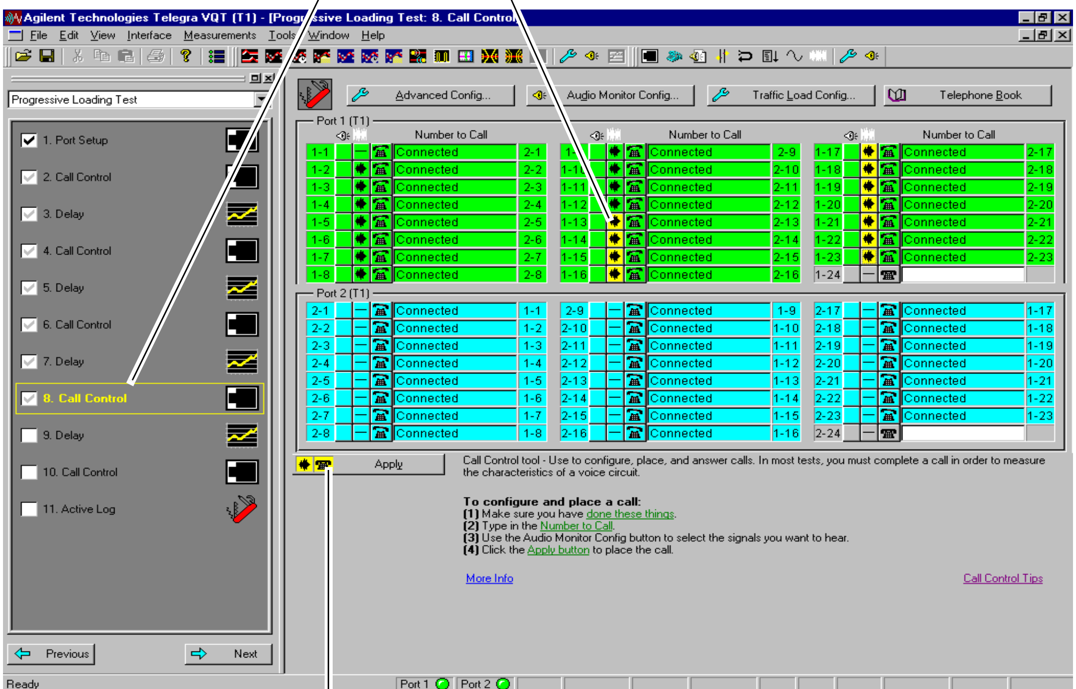
7 Go to the next task and perform another Delay measurement.



In this example, the time it took for the audio signal to travel through the device or system under test increased from 98.25 milliseconds to 107.75 milliseconds. Loading the series of channels with traffic might have caused the delay to increase.

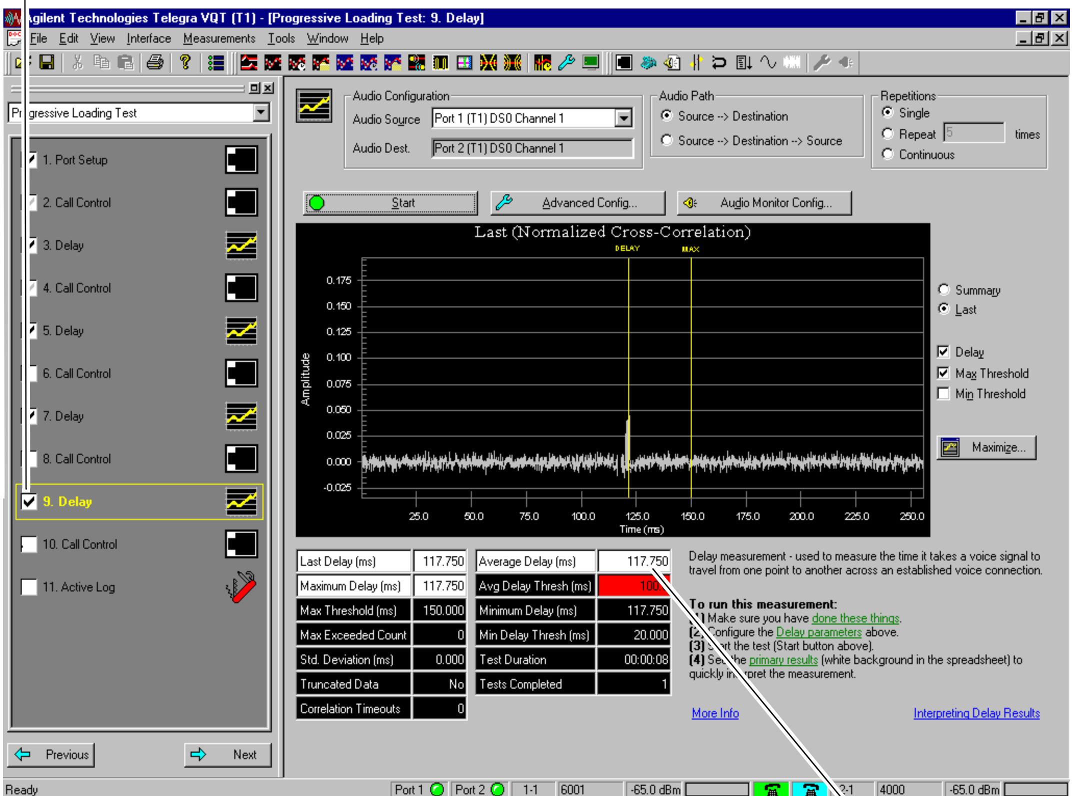
(8) Proceed to load the remaining carrier channels.

Remember to update your current configuration as described on page 3-34.



Click Apply to add the load.

⑨ Open 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 increased from 107.75 milliseconds to 117.75 milliseconds. Notice that every time you loaded a series of channels with traffic the delay increased. Even so, in this example, the delay increased only by 10 milliseconds. 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 the previous sample test on page 3-37.

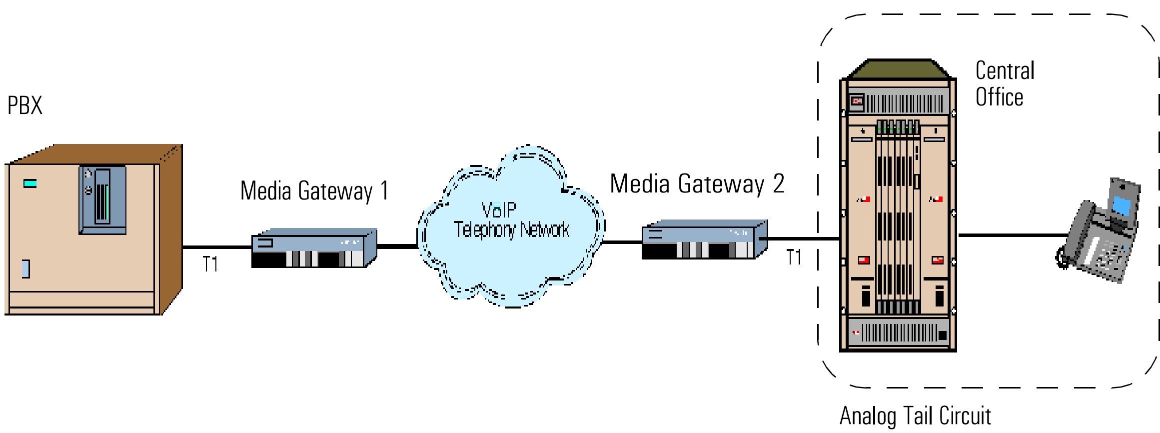
Verifying Echo Cancellation with simulated Echo in a T1/E1 Environment

This example demonstrates how to test an echo canceller either in a lab or other tightly controlled environment by introducing simulated echo using the Echo-PACE measurement's Network Simulator. Since we know that most echo is a result of electrical mismatches in analog circuits, we will emulate an analog tail circuit with the VQT to test an echo canceller.

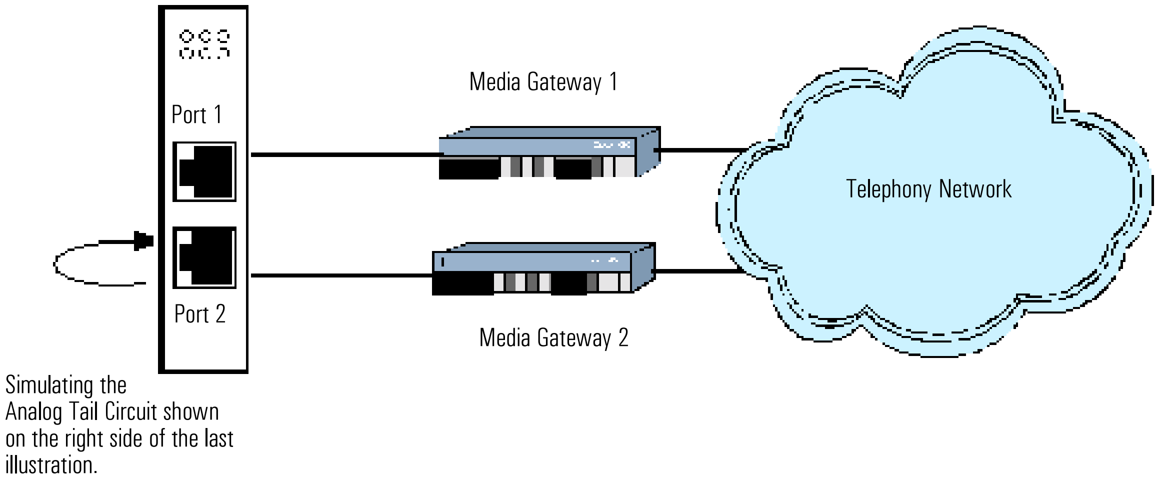
Consider the following end-to-end telephony circuit example:

- An enterprise PBX connected to a VoIP Network through a T1 trunk line and Media Gateway 1.
- A VoIP Telephony Network connected to Media Gateway 1 and Media Gateway 2.
- A PSTN Central Office that is connected to Media Gateway 2 through a T1 trunk line.

Because echo often originates from an analog tail circuit, Media Gateway 2 contains the echo canceller that is trying to eliminate echo so it does not travel back across the VoIP network.



To test the echo canceler in Media Gateway 2, you can connect the VQT as shown in the following figure.



In this case the destination port/channel (Port 2) acts as the analog tail circuit such that a simulated echo signal constructed from the original test signal is looped back towards the source port/channel (Port 1). The echo canceller located in Media Gateway 2 attempts to cancel the echo. Echo that is not cancelled arrives at the source port and is analyzed. You can control the delay and attenuation of the simulated echo to verify the performance and thresholds of the echo canceller.

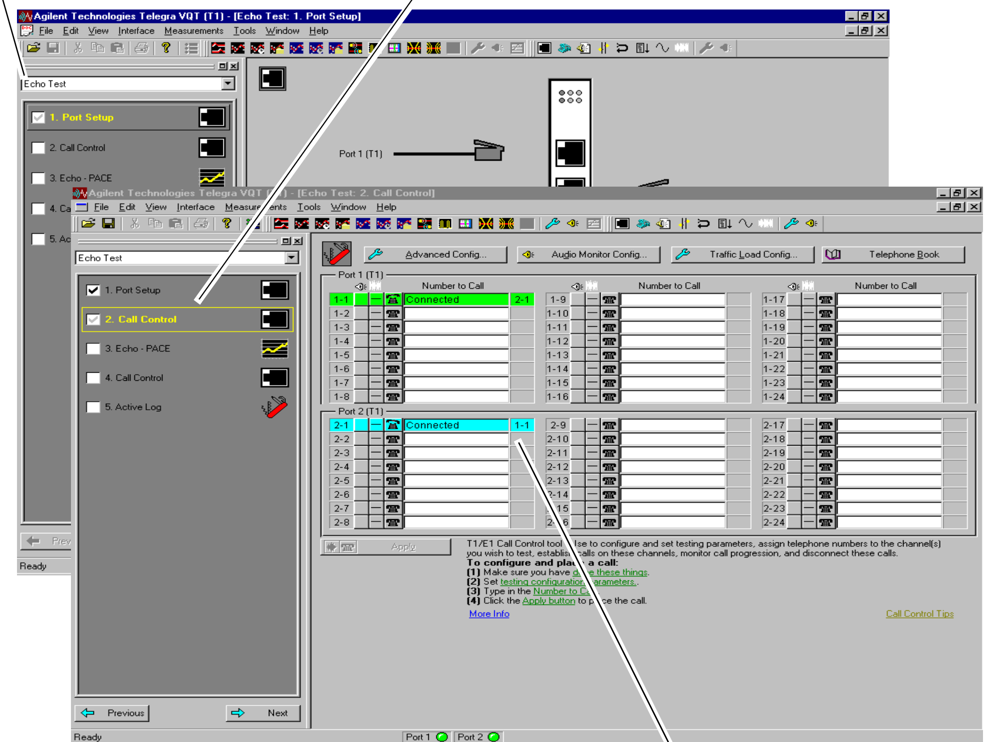
In this sample test you will:

- Place and answer a call from port 1 to port 2. (The VQT can also place calls from port 1 to port 1 or port 2 to port 2.)
- Transmit a test signal from port 1 to port 2, where it will be delayed and attenuated and then looped back as a simulated echo signal.
- Use the Echo-PACE measurement to analyze the simulated echo returning to port 1 and to determine how well the echo canceller worked in Media Gateway 2.

Note Please refer to the Help for more information on echo, echo cancellation, and the Echo-PACE measurements.

(1) In the TaskList Navigator, select the TaskList called “Echo Test”. The list shown below will be loaded and the Port Setup tool (the first item in the list) will be opened. Set up the ports to match your network

(2) Open Call control and place a call from port 1 to port 2.

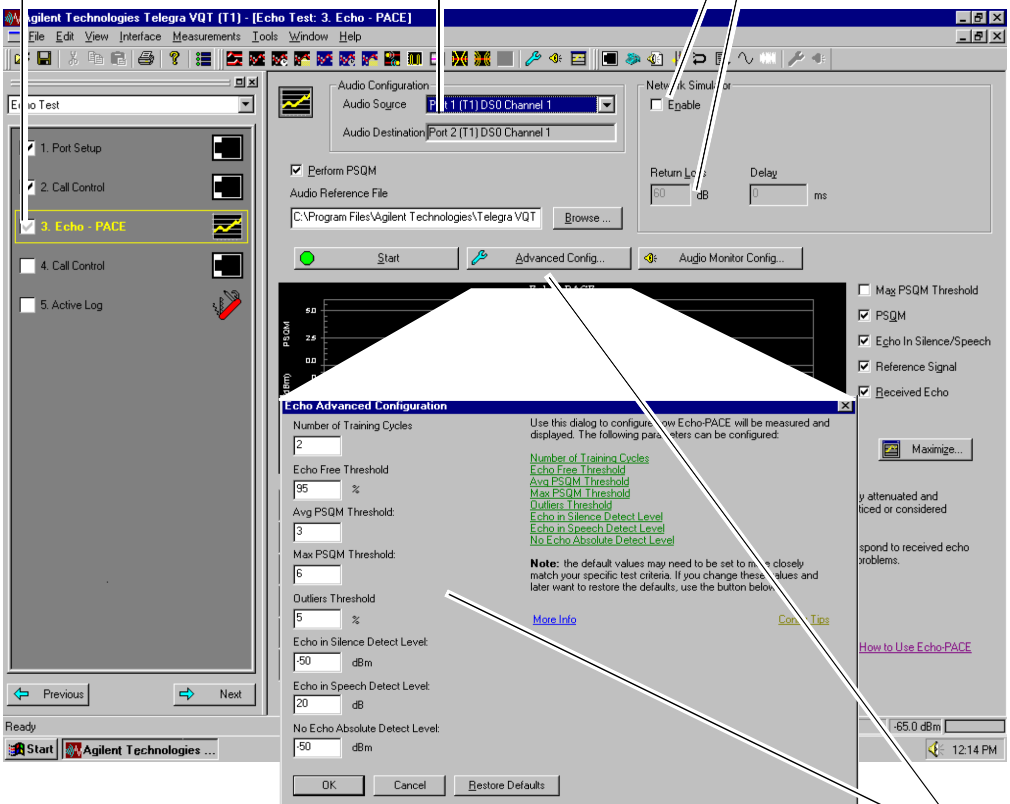


The pairing of the channels is often determined by the setup of your network.

③ **Open the Echo-Pace measurement.**

Select the channel pair on which you want to run the measurement. This is the channel pair that the call is placed on.

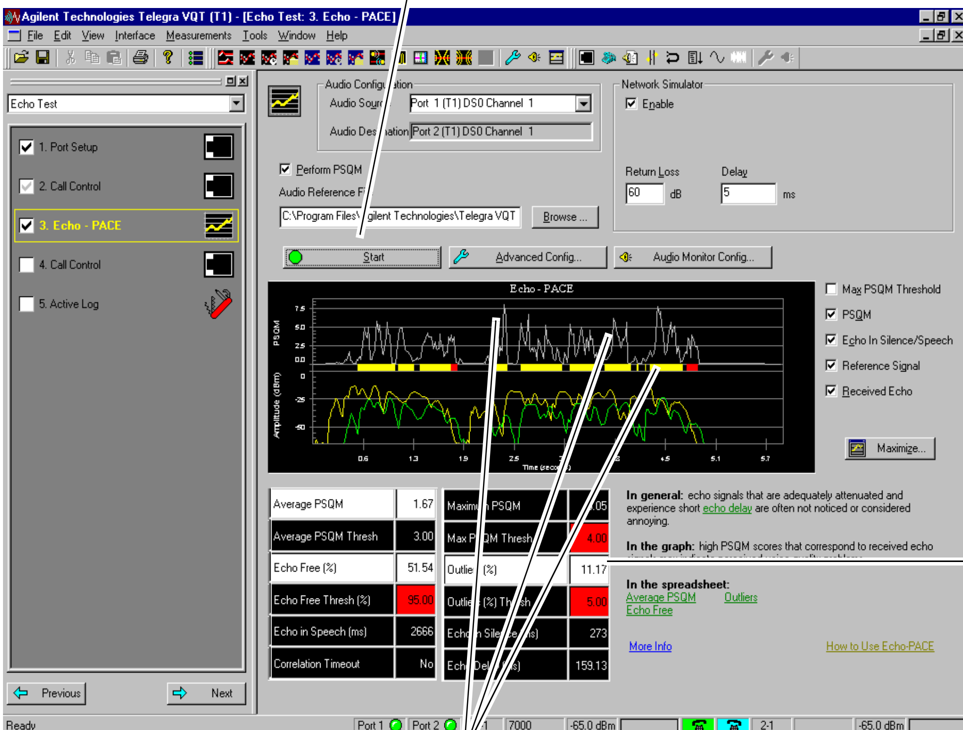
Enable the Network Simulator and set the characteristics of the “simulated echo”.



You can use the Echo Advanced Configuration dialog box to re-configure the measurement and set the measurement thresholds to match your test criteria. Usually, the default settings are adequate.

(4) Perform the Echo-PACE measurement.

Make sure you enabled the Network Simulator and then select the channel pair on which you want to perform the measurement.



Note that the outlines value is above the Maximum threshold.

Notice the large number of PSQM spikes and “Echo in Speech” in the graph. This indicates that echo is probably not being cancelled.

Also notice the high PSQM and large Echo in Speech value in the spreadsheet.This indicates that a large percentage of the test signal was interfered with by the echo signal. A malfunctioning echo canceller could be the cause.

With the calls still connected, you could re-configure the Echo-PACE measurement with varying degrees of delay and return loss to simulate different tail circuits and compare results. Once you finish testing, you can hang up the call and view the logged measurement results as described in previous sample tests. You could also perform this test on a channel with known echo behavior (for example a circuit with no echo, functional echo canceller, etc.) and then compare the measurement results.

Dual Server Sample Tests

This chapter provides two examples of how to use the VQT Application in a remote / distributed environment to test voice quality between two servers. The following examples are designed to demonstrate common test techniques and to familiarize you with the use of this powerful tool.

- Setting Up and Running Measurements, page 3-54 — Shows you the basics of setting up and placing a call, and running measurements server-to-server.
- Measuring Clarity in a Distributed Environment, page 3-67 — Shows you how to set up and run the Clarity (PAMS) one-way measurement server-to-server. It will build on the basic information provided in the first sample test.

Note

Remember to configure the VQT's ports to match your network environment when adapting the sample tests to your unique test situation.

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.

Setting Up and Running Measurements

This example demonstrates the processes that are fundamental to voice quality testing with a VQT server in a remote/distributed environment. You will need to understand these techniques regardless of the measurements you intend to run or the systems you intend to test. Specifically, this sample test (for an analog connection) shows you how to:

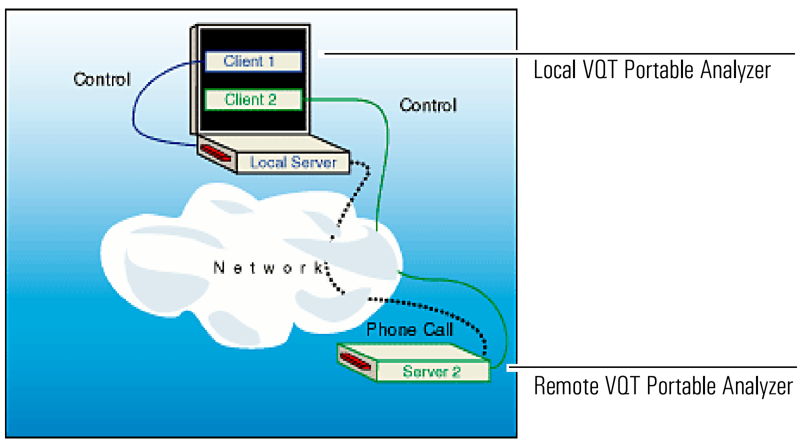
- Add servers.
- Perform basic server administration and security functions.
- Establish a logical connection from the controlling PC to the servers (in this example a local server and a remote server).
- Select and configure the physical ports the VQT will use.
- Configure, place, and answer a call from one server to the other to set up the test circuit.
- Run the Signal Loss measurement in a “round-trip” trip mode between servers.
- Terminate the call.
- Examine and save the log file that is automatically created during the test run.

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 analog system under test, the client license key has been entered correctly, and the VQT Application has been launched. Please go to Chapter 2 for more information.

Note 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/distributed environment. You can adapt this example to your unique testing needs.

To set the stage for this example, consider the following illustration. A VQT Portable Analyzer is being used as the “controlling” PC as well as the local server. Another VQT Portable Analyzer is being used as a remote server (Server 2 in the illustration). Each server is controlled by an individual client window visible on the local VQT Portable Analyzer.

This example shows how you would place a call from the local server to the remote server and run round-trip measurements between them (that is, the local server sends test signals to the remote server where they are looped back to the local server for analysis). Assume that the local server will be using analog port A (FXO) and the remote server will be using analog port C (E&M). Notice the distinction between the “control” connections from client to server and the telephone call between servers. Please refer back to Chapter 2 to learn more.

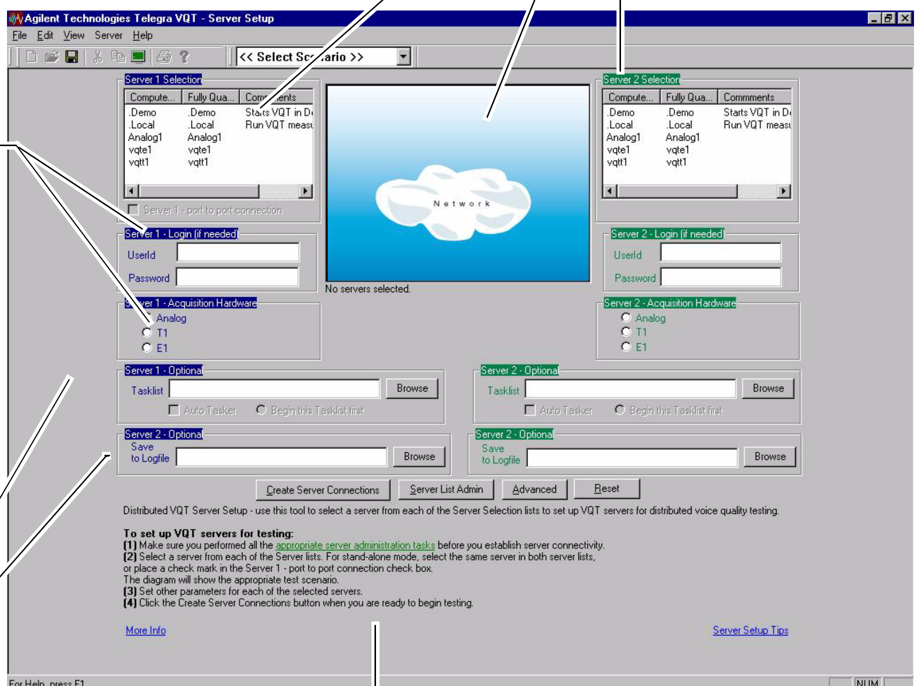


Note As discussed in Chapter 2 and in the VQT Application’s Help, the “controlling” PC can be a VQT Portable Analyzer, an Agilent Advisor (equipped with a VQT Undercradle), or a desktop/laptop PC. The remote server can be a VQT Network Server, VQT Portable Analyzer, or an Agilent Advisor (with undercradle).

1. The Server Setup tool is the entry point into the VQT Application. Before you establish server connectivity, make sure you performed all the appropriate server administration tasks. Server administration consists of adding, deleting, and modifying server listings.

Note that established server listings display in the Server Selection windows. Also note that the graphic updates dynamically as different server configurations are selected.

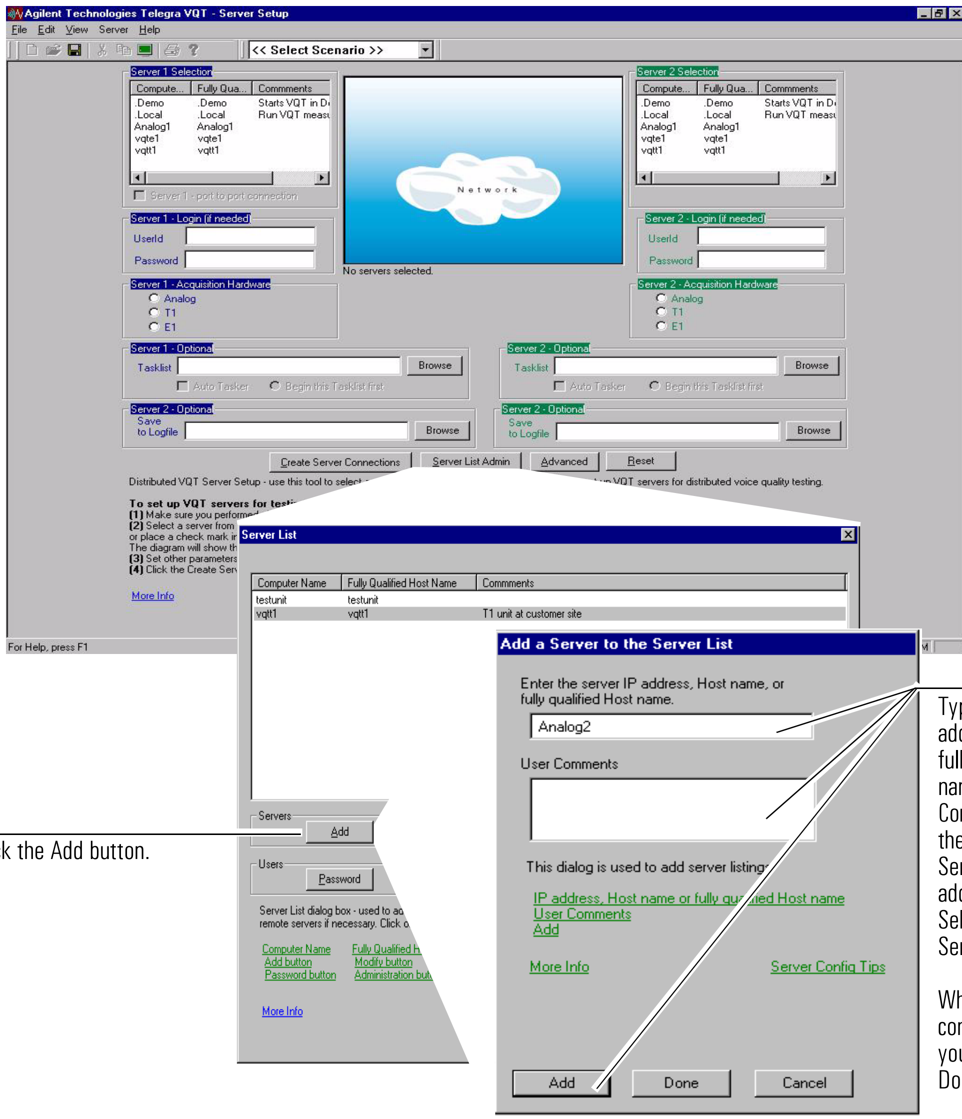
If your server is secured, you must enter a UserId and Password. You must always define the appropriate acquisition hardware for the server.



You can type in or select a TaskList and when the client window associated with that server opens, the tasklist will be displayed in the TaskList Navigator. Also, you can type in the path and file name of a logfile.

Notice that the embedded Help provides setup information and access to other related online documentation.

(2) For this sample test, assume you need to add a Server called "Analog2" (the remote server). Do this by clicking the Server List Admin button in the Server Setup tool. This will be Server 2 (see Page 3-55). Notice that you do not have to add the "Local"



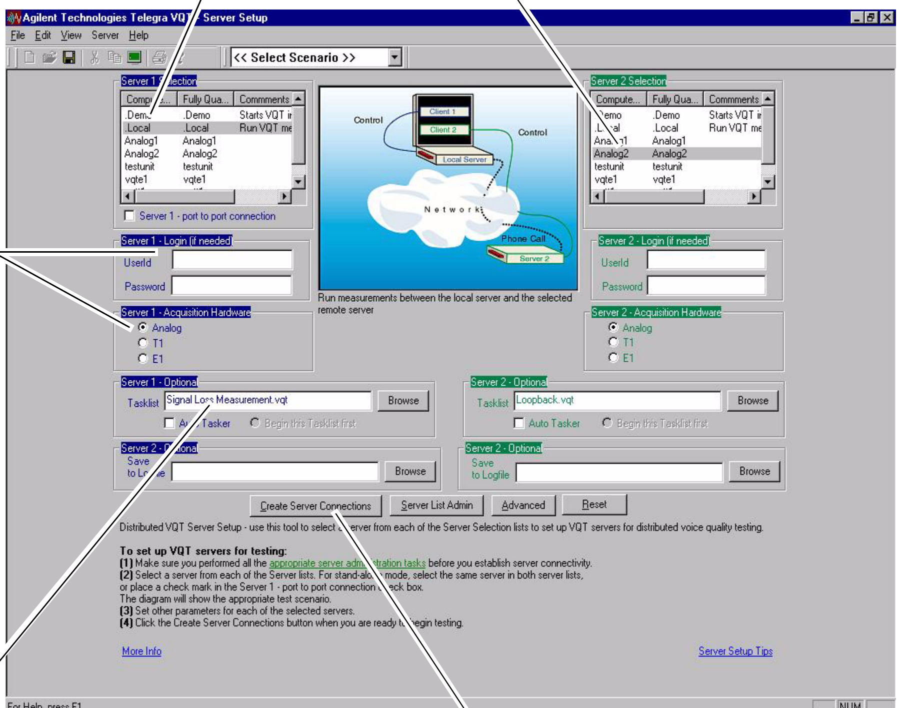
Click the Add button.

Type in the server IP address, Host name, or fully qualified host name and User Comments, then click the Add button. The Server list item will be added to the Server Selection list of the Server Setup screen.

When you are completed with all your entries, click the Done button.

(3) To set up VQT servers for testing, select a server from each of the Server lists. In this example, you will be testing between the Local and the remote server (Analog2).

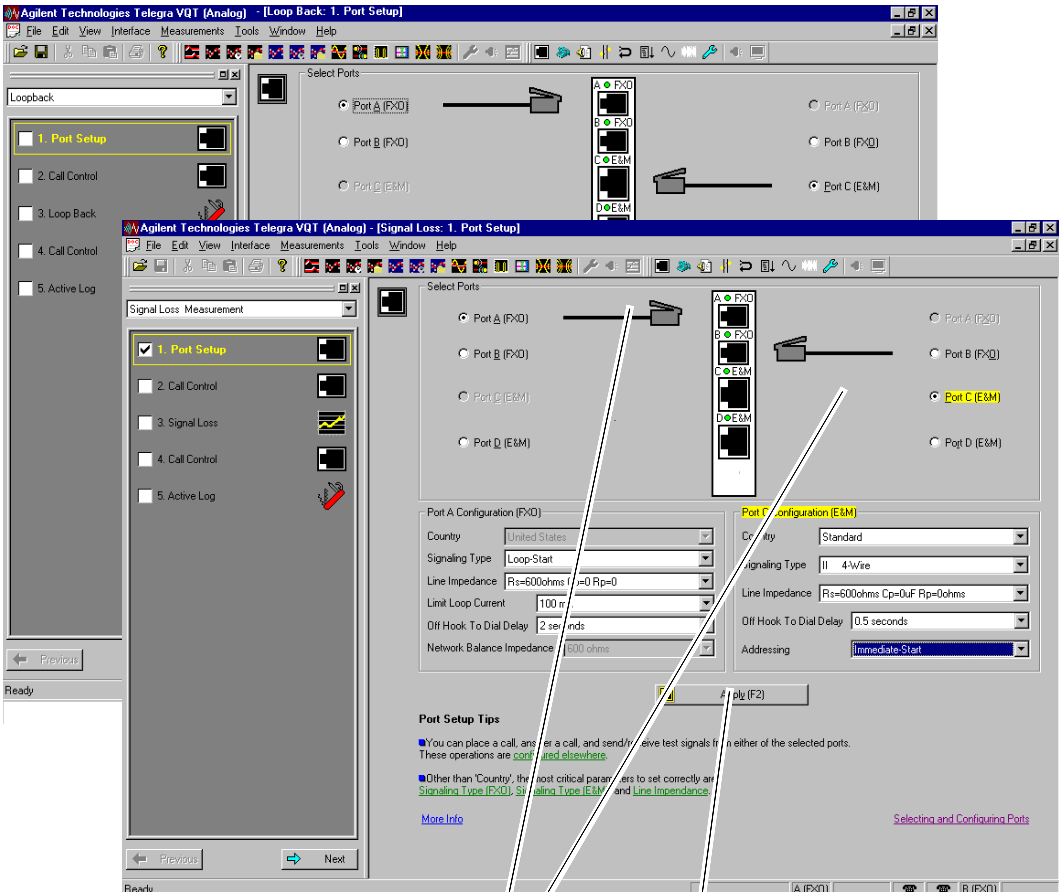
Set other parameters for each of the selected servers. If you are accessing a secured server, enter a UserId and Password. You must also select the appropriate server acquisition hardware.



First select the Signal Loss Measurement.vqt tasklist for the Local server, then the Loopback.vqt tasklist for the "Analog2" server. In this case, the Local server performs the measurement and the "Analog 2" server loops the voice signal back to the Local Server.

Click the START Client/Server Connection(s) button when you are ready to begin testing. Two client windows will display maximized, one for the Local server and one for the remote server (Analog2).

④ In the client window associated with the Local Server, notice the TaskList called "Signal Loss Measurement". This tasklist is designed to evaluate Signal Loss performance. Remember to configure Port Setup in both client windows.

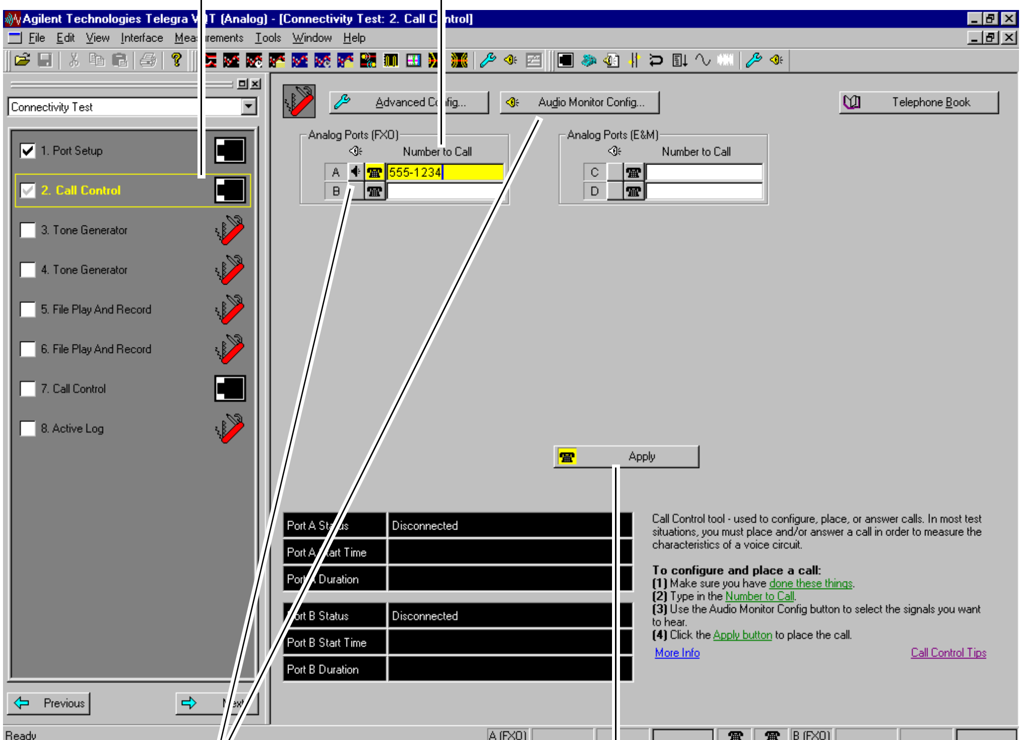


Ports A (Local server) and C (Analog2) are selected (the FXO and E&M ports). Make sure to configure the electrical characteristics of the ports in both client windows. For this example, these selections and default configurations can be left as they are.

Click Apply to set up the ports.

⑤ Open the Call Control tool for the Local Server 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 on the Local Server is placing the call to port C on the remote server. Make sure not to close the second client window or the phone connection will be disrupted.

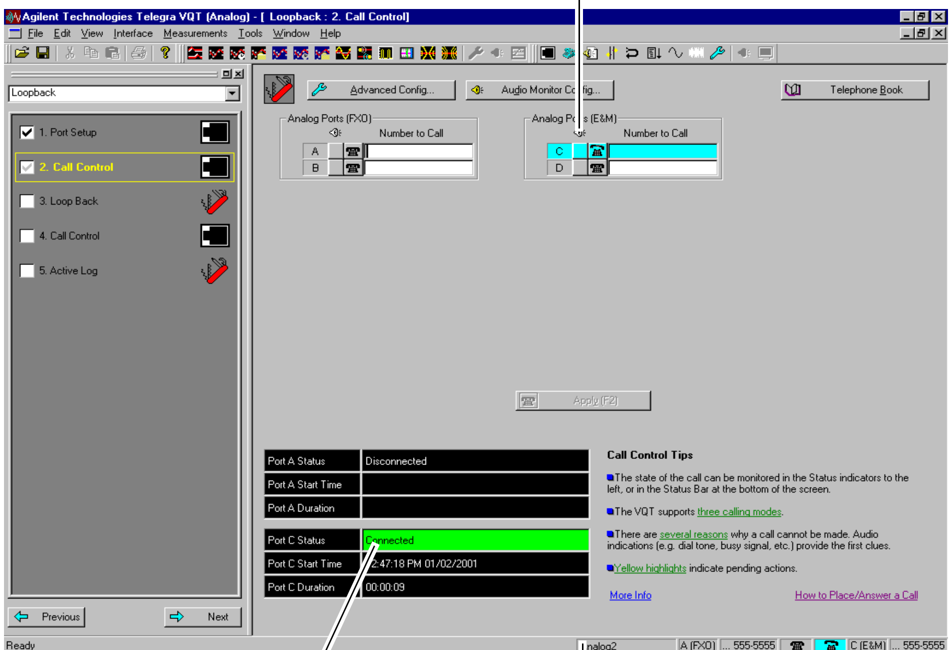


Select the port you want to monitor (in this case Port A). Then click the Audio Monitor Config button and set the parameter to "Record, Upload and Automatically Play". This setting allows you to hear the dial tone, the DTMF dialing, and ringing shortly after you established the connection.

Click the Apply button to place the call from Port A on local server to Port C on the remote server. Once the call is connected, the telephone icons in the Analog Ports portion of the Call Control tool will go "off-hook".

⑥ Open the Call Control tool for the Remote server (Analog2) so the call placed from the Local client window can be answered in the remote client (Analog2) window. You do not have to select Port C nor do you click apply to answer the call. The VQT answers incoming calls automatically.

Note that the call is being answered in the Remote client window (Analog2).

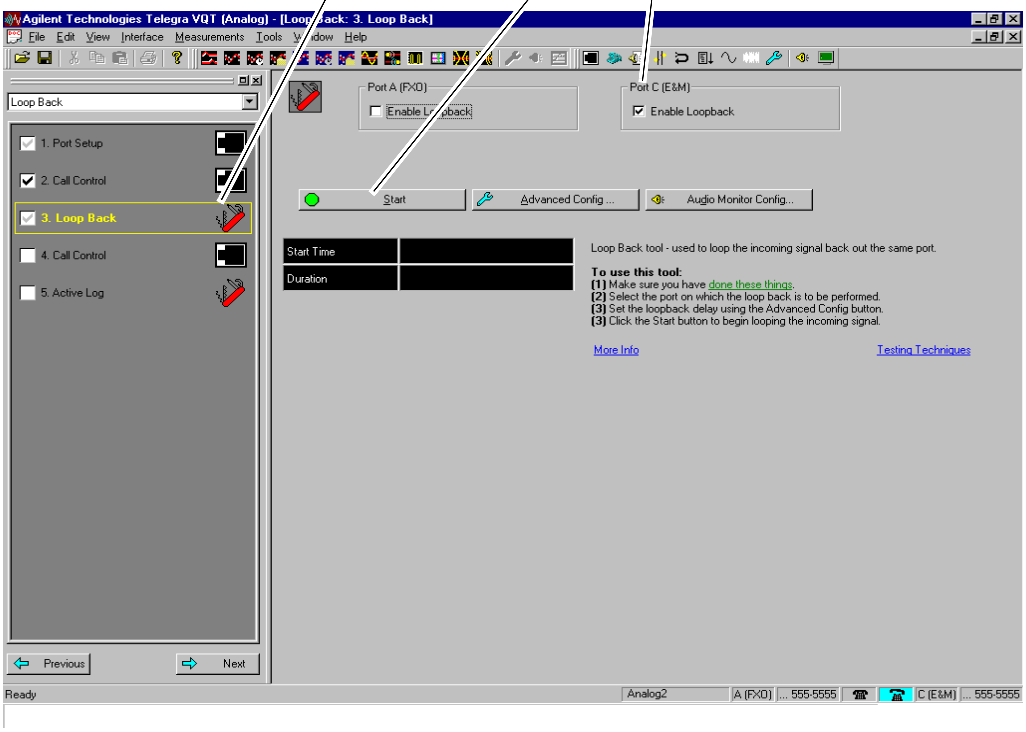


Note that Port C shows "connected".

Note that the name of server that is associated with this client window displays in the status bar (in this example, server "Analog2").

(7) Once the call is established, select the next task in the TaskList (Loop Back) of the window associated with the remote client (Analog2). You will use this tool to perform a loopback of the test signal from port A (Local server) to port C (Analog2) and back to port A (Local server).

Select the port on which the loopback is to be performed (port C) and then click the Start button.

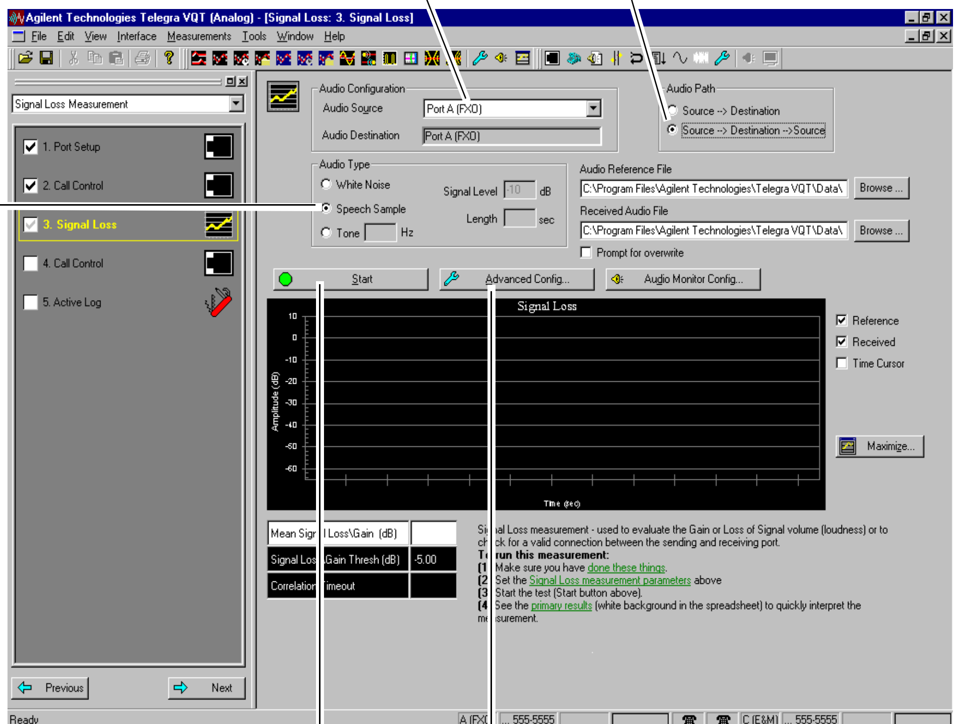


In this case, you are using the Loop Back tool to enable a “round-trip” Signal Loss Measurement. The Local server sends a test signal to the remote “looping” server (Analog2). When the test signal is looped back to the origination point, it can be correlated/analyzed by the Local test device.

(8) Select the Signal Loss Measurement task in the Local Server window, and select Port A as the Audio Source.

Set the Audio Path to Source > Destination > Source. This configures the Local server to expect returning test signals on port A.

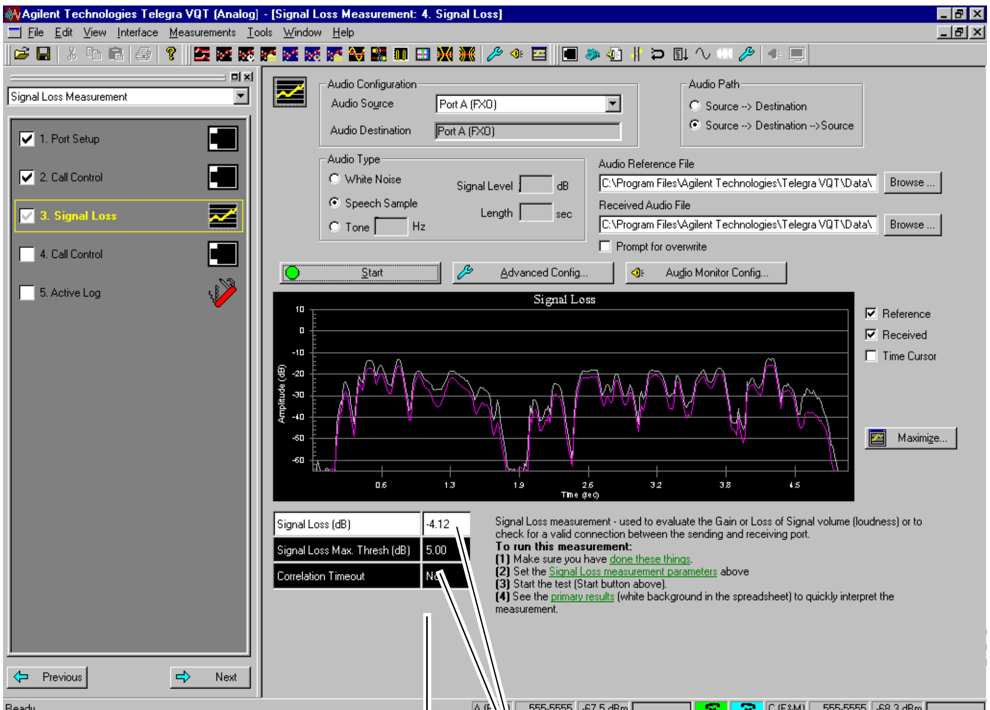
Select the Speech Sample and the file from which the audio test signal will be derived.



Start the measurement. The test signal will be transmitted from the Local server to the remote server (Analog2) where it will be looped. Refer to step 7.

The Signal Loss Threshold should be set between 6-9 dB. You can configure the Signal Loss Threshold and other advanced settings in the Advanced Configuration dialog.

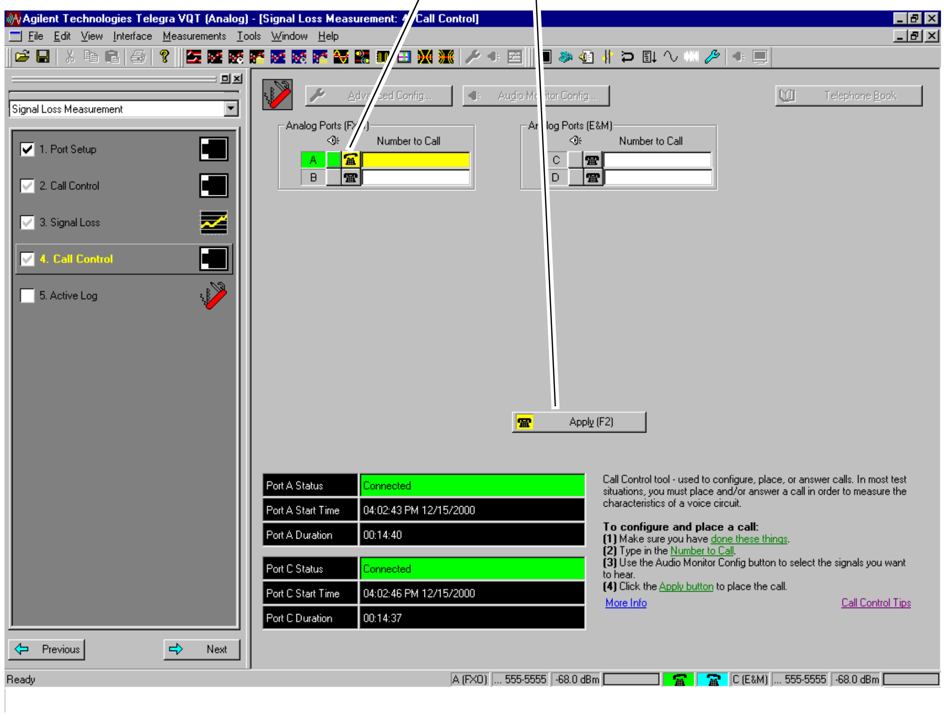
(9) Examine Signal Loss Measurement results. When the test signal is received at the local server (after having been looped back by Analog2). Signal Loss results are calculated. Note that these are “round-trip” results.



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

A gain of 10 dB or more is usually perceived as too loud by the listener and may result in distortion, while a loss of 10dB or more usually results in a barely audible voice signal. Note the Signal Loss value of -4.12 dB is still within this range and is below the user configurable maximum threshold.

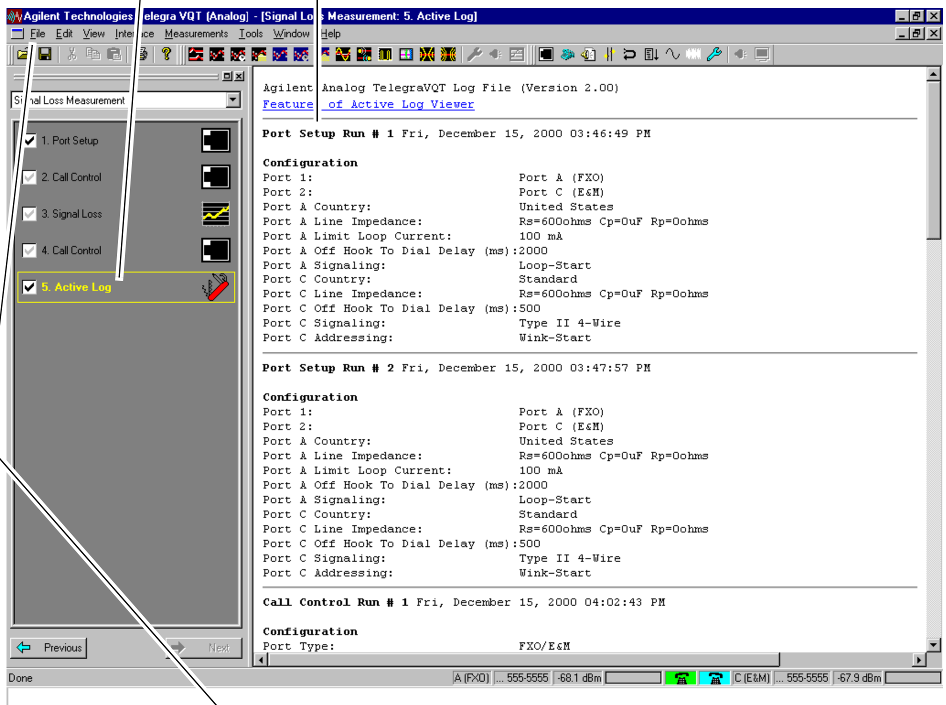
(10) To disconnect the call, go to the second Call Control tool in the TaskList Navigator of the window associated with the Local server. Click the telephone icon to select it for hang-up. Notice that the handset is "off-hook" indicating that the call is still in progress, but the background color turns yellow. Click the Apply button to hang up both ends of the connection.



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

(11) 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 that was recorded in the log.



Save the log using the Save Log option in the File menu. The Save As dialog will be displayed.

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

Measuring Clarity in a Distributed Environment

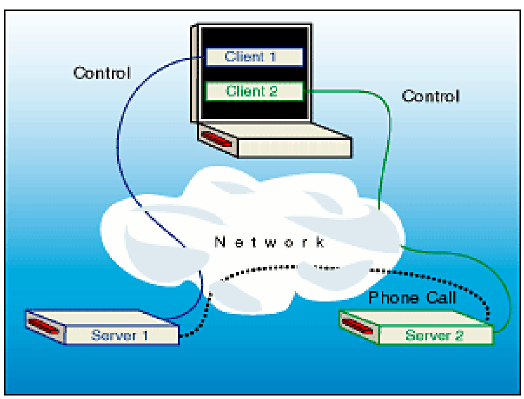
This example builds on the last by showing you how to use the Clarity measurement to gather basic voice quality information about the device or system under test. These are the kinds of measurements you would use to evaluate individual voice-over-packet devices or to test the quality exhibited by an individual call within a larger system. Clarity is an important voice quality metric in voice-over-packet environments and, therefore, is used in many testing situations.

Specifically, this sample test will show you how to:

- Set up two remote servers.
- Measure voice clarity (using PAMS) of the system under test.

You will control two remote servers, named Server 1 and Server 2 (both VQT Portable Analyzers) with a laptop or desktop PC via an IP management connection. For the purposes of this example, assume that you need to measure the clarity of a specific voice channel between the two servers.

For this example, assume that VQT servers have been installed into an IP management network, the appropriate client software has been installed onto the controlling PC, that the servers have been physically connected to the digital system under test, the client license key has been entered correctly, and the VQT Application has been launched. Please go to Chapter 2 for more information.

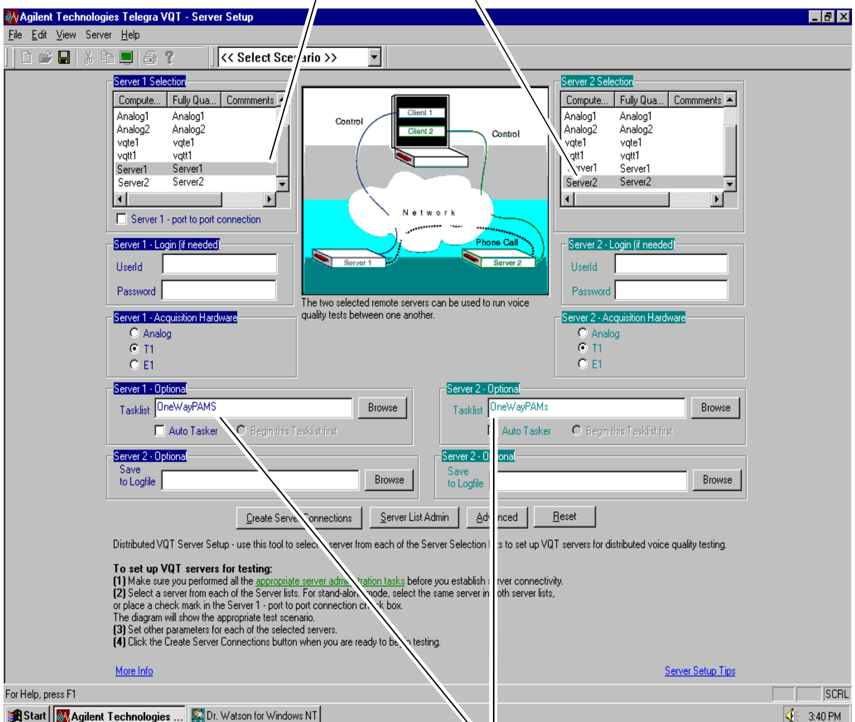


You will place a call from one digital port/channel of the first remote server (Server 1) to another digital port/channel server of the second remote (Server 2) through a telephony network or device. You will transmit test signals one way from Server 1 to Server 2.

Server 2 will perform the PAMS algorithm on the recorded file, then the PAMS measurement results will display in the client window that is associated with Server 2. These measurement results will reflect the one way PAMS results that were taken between Server 1 and Server 2.

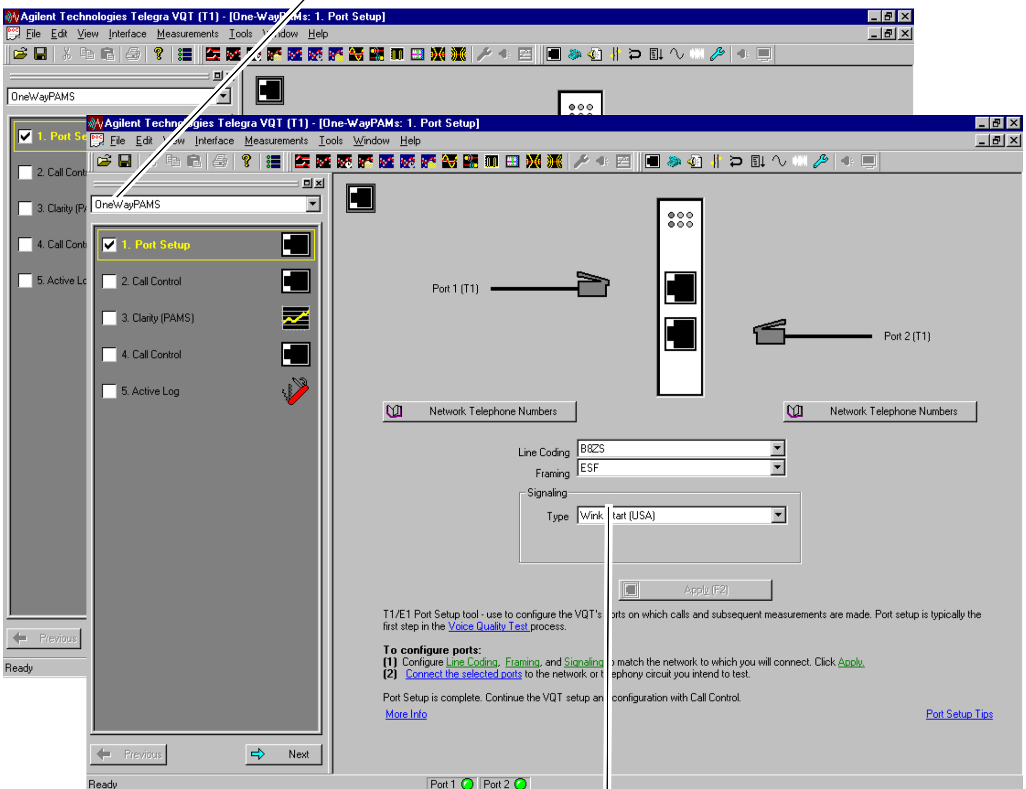
Note Please use the Help to learn more about Clarity, general voice quality test concepts and techniques, and the other measurements and tools provided by the VQT.

(1) Make sure you performed all the appropriate server administration tasks and added Server 1 and Server 2 to the Server Selection lists.To set up VQT servers for testing the OneWay PAMS measurement, select Server 1 and Server 2 from each of the Server lists.



Remember to load the OneWay PAMS tasklists: one for the transmitting server and one for the receiving/analyzing server. Each of these TaskLists play a distinct role.

(2) Notice the TaskList called “OneWay PAMS” and then select and configure ports. Remember to perform these tasks in both client windows.

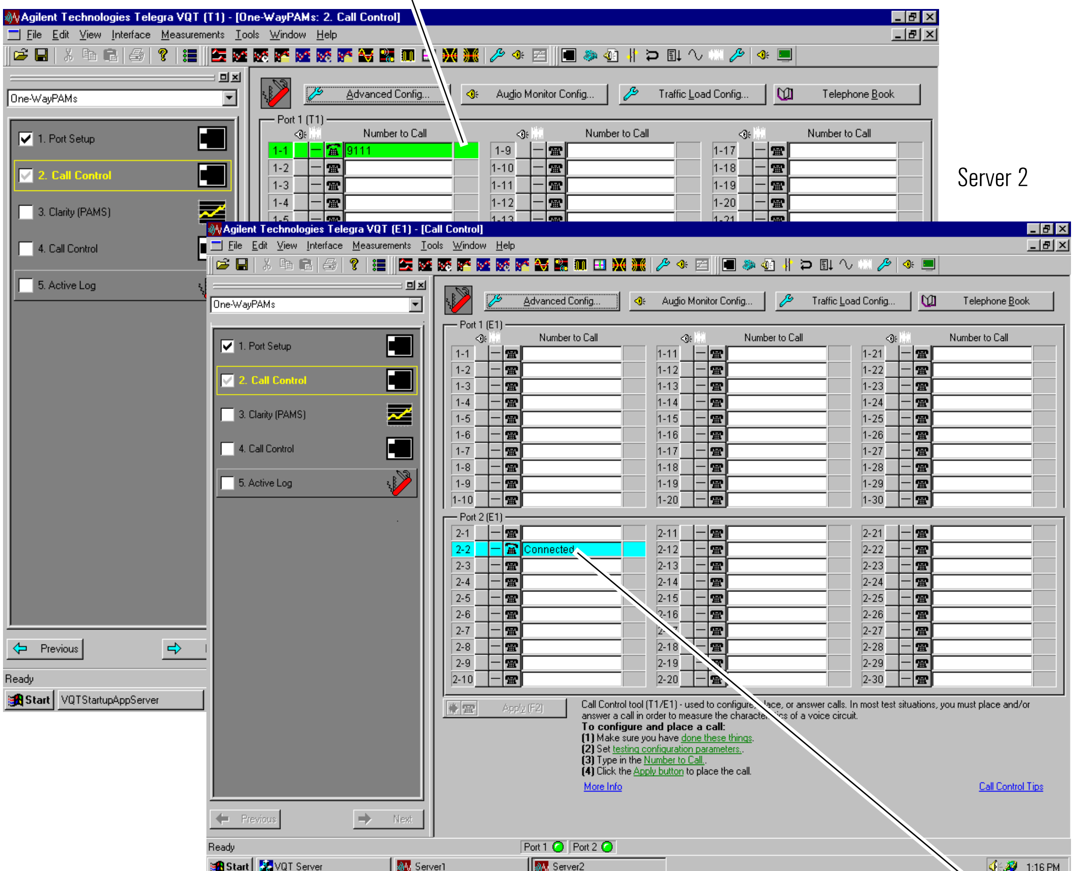


Make sure to set the port configuration that matches your network.

③ Open the Call Control tool in the client window associated with Server 1 and place a call from Server 1 to Server 2.

Server 1

Server 2

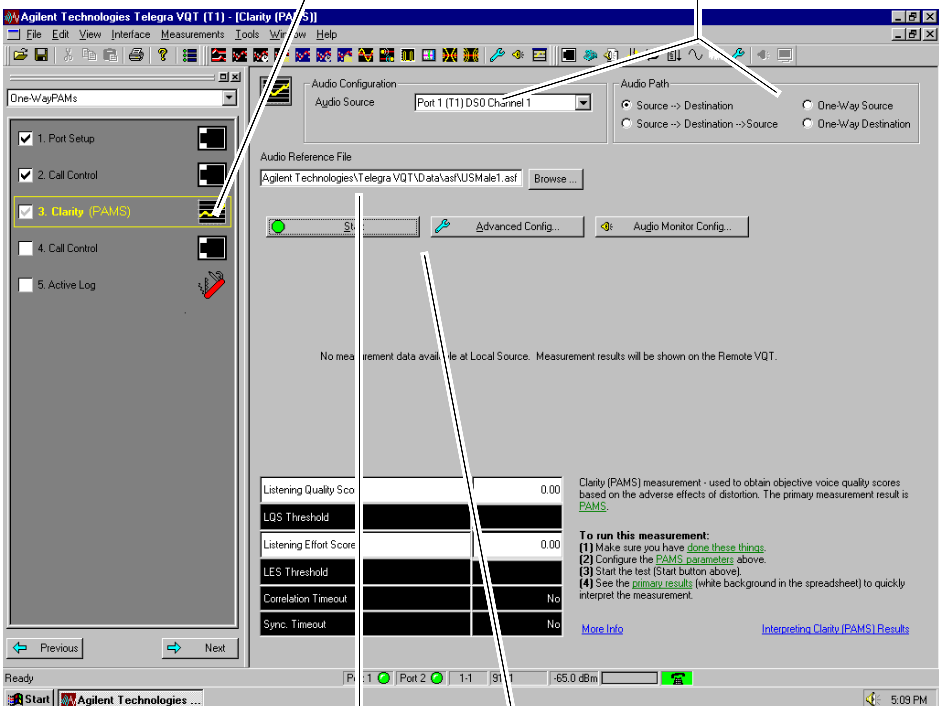


The server names that are associated with the client window display in the status bar.

Notice that the call is answered in the second client window. This indicates a successful connection to the second remote server (Server2).

(4) Open the Clarity (PAMS) measurement from the TaskList in the client window associated with Server 1.

In the first client window select the Audio Source and One-Way Source, so that the test signal will pass from the port/channel of Server 1 to the port/channel of Server 2 and the measurement will be end-to-end.



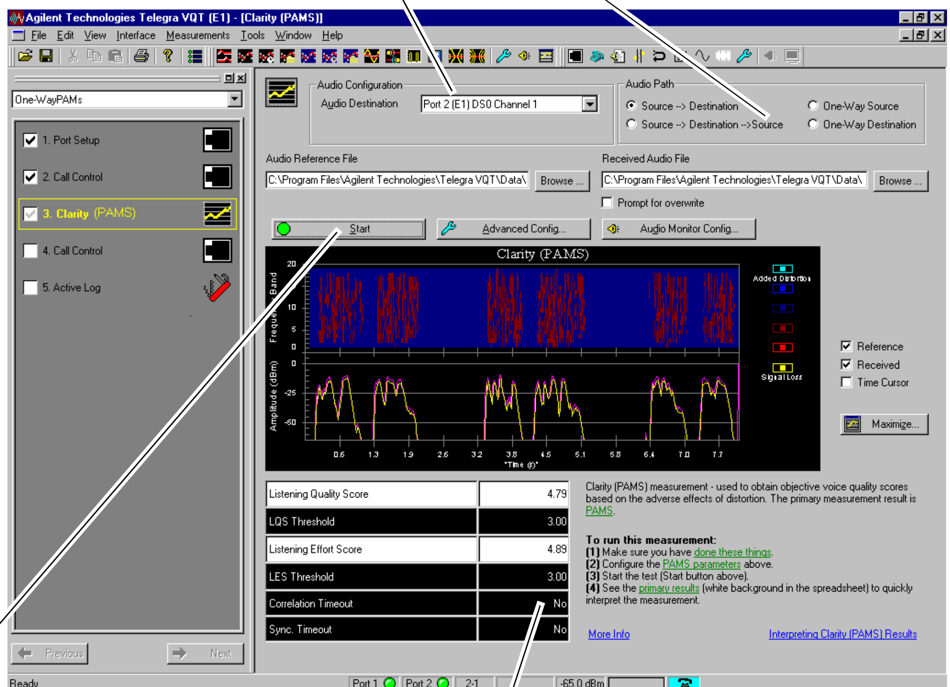
Note that the client window associated with Server 1 does not display the measurement results. The results are displayed in the graph and the spreadsheet in the client window associated with Server 2.

Make sure that the audio files are the same in the both client windows. Server 2 compares the recorded file against the source file. If the file names do not match you will experience correlation time-outs or inconclusive results.

Start the Clarity measurement. A status dialog box will be displayed while the VQT transmits the voice sample and calculates PAMS.

⑥ Open the client window associated with Server 2. Select the Audio Destination and One-Way Destination path setting.

Note: Make sure you selected the same Audio Reference file as in the first client window.



Click the Start button. The test signal will pass from the calling port/channel (Server 1) to the answering/analyzing port/channel (Server 2) and the measurement will be end-to-end.The two servers will synchronize their efforts and once this is completed, the VQT displays results in the graph and the spreadsheet in the client window associated with Server 2.

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.

Again, with the call still connected, you could use the Clarity Trend measurement to run repeated tests to see how clarity varies over time.

⑦ When you finish testing, hang up the call as shown in the Sample Test that starts on page 3-56. You can also view and save a log of the measurement run (also described in the last Sample Test).

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