MTA Loopback VoIP Testing

Reduce Truck Rolls Through Remote Fault Isolation with the Speech & DTMF Loopback Test Agent

- True user-perceived speech quality (MOS, R-factor) tested over an actual DQoS voice-priority channel
- Complete VoIP quality assessment including call volume, noise, distortion, clipping, DTMF transparency and call connectivity performance
- Industry-unique softswitch integration for fully NCS compliant loopback testing that keeps the CMS in sync with subscriber status during testing
- Reference-quality measurements that allows for benchmarking of competing technologies and services

Identify Network Issues Before Your Customers Start to Complain

With Tektronix' MTA loopback testing, Cable MSOs can remotely test to multimedia terminal adapters (MTAs) to monitor and troubleshoot VoIP service quality as perceived by their subscribers. No field test equipment is required.

Tektronix' unique test method uses softswitch integration to activate the Voice or RTP loopback test mode in any PacketCable™ 1.x (and above) compliant MTA from suppliers such as Motorola, Arris, and Scientific Atlanta. With over 50 VoIP QoS measurements, operators can quickly identify service quality issues using advanced, standards-based algorithms, while detecting DTMF transparency and call connectivity problems.

The Speech & DTMF Loopback Test Agent uses the MTA as an RTP packet reflector to assess media transmission performance over the HFC or VoIP network to the subscriber's premises.

The audio loopback feature tests the MTA's internal circuitry (including the codec) to evaluate the true user-perceived speech-quality, including the impairments caused by the codec's D/A & A/D speech conversion and compression.

Features & Benefits	Applications
▪ Measures key call-quality metrics such as MOS, Clipping, DTMF transparency, and Noise ▪ Evaluate codec performance ▪ Enables market-wide quality reporting ▪ Launch calls from both PRI and MGCP interfaces ▪ Remotely isolate inside wiring issues to lower opex	▪ Hub to edge QoE testing without field test equipment ▪ Long-term monitoring and pro-active fault detection ▪ Remote fault isolation reduces truck rolls ▪ Verify subscriber connectivity unobtrusively before and after network modifications

Tektronix® Communications

True Voice-Path Testing

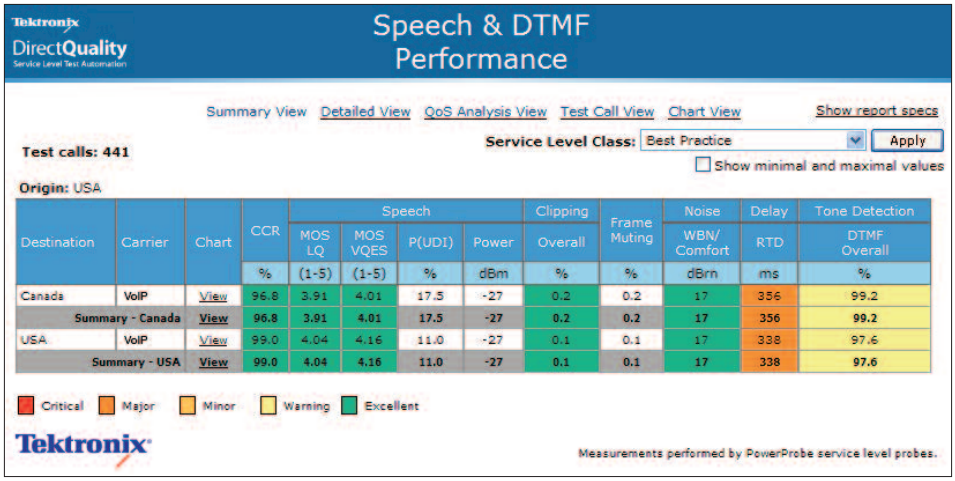
Tektronix' MTA loopback tests conduct measurements of true user-perceived service quality. This allows you to identify and resolve problems before your subscribers know about them.

Softswitch Integration

Tektronix' patent-pending MTA loopback technique is fully integrated with Call Management Servers (CMS / Softswitches) to reserve and activate PacketCable voice-priority Dynamic Quality of Service (DQoS) channels for loopback test calls. This ensures that the CMS always has the correct subscriber / network status.

Competing MTA-loopback techniques bypass the CMS and cannot properly establish voice-level priority in PacketCable networks as Cable Modem Termination Systems (CMTS) ignore non-DQoS traffic prioritization schemes including IP ToS/DiffServ and VLAN tags. This leaves the switch desynchronized with the subscriber's status.

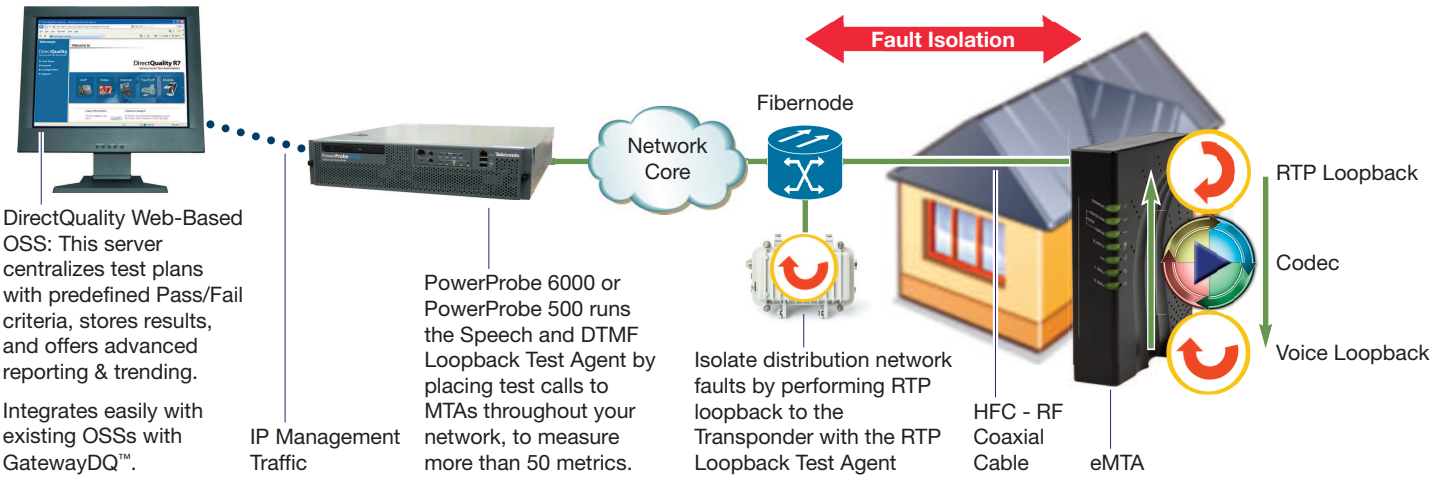
Tektronix MTA loopback testing will not interfere with residential phone service availability: We comply with PacketCable specifications to ensure a call is never interrupted, and that a dial-tone is always available.



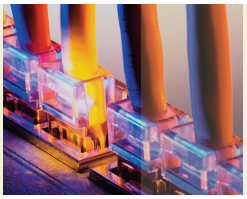
Summary View of Test Results From DirectQuality's web-based OSS

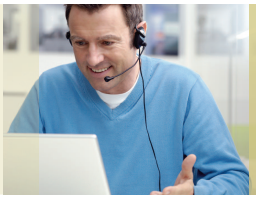
Network Fault Isolation with the RTP Loopback Test Agent

Cable MSOs can remotely isolate distribution network faults that occur between the fibernode and the MTA by performing a loopback test to the transponder with our RTP Loopback Test Agent as shown below.



Network Architecture for MTA Loopback VoIP Testing





Origin: Japan

Destination	Carrier	Chart	Test Calls		CCR	PDD	Speech					Clipping			Hangover		Frame Muting	Noise		Echo		Delay	Tone Detection		
			Attempts	Answered			MOS LQ	MOS VQES	P (UDI)	Power	Loss	Overall	Events	Avg. Dur.	Events	Avg. Dur.		WBN/ Comfort	C-Msg.	EPL	EPD	RTD	DTMF Overall	Fax CNG	Fax CED
			Calls	Calls	%	sec	(1-5)	(1-5)	%	dBm	dB	%		ms		ms	%	dBrn	dBrnC	dB	ms	ms	%	%	%
Canada	NONE	View	3	3	100	0.1	3.71	-	-	-19	-3.9	0.1	2	1	1	24	0.2	0	0	0	<1	-	100	100	100
Summary - Canada		View	3	3	100	0.1	3.71	-	-	-19	-3.9	0.1	2	1	1	24	0.2	0	0	0	<1	-	100	100	100

Origin: USA

Destination	Carrier	Chart	Test Calls		CCR	PDD	Speech					Clipping			Hangover		Frame Muting	Noise		Echo		Delay	Tone Detection		
			Attempts	Answered			MOS LQ	MOS VQES	P (UDI)	Power	Loss	Overall	Events	Avg. Dur.	Events	Avg. Dur.		WBN/ Comfort	C-Msg.	EPL	EPD	RTD	DTMF Overall	Fax CNG	Fax CED
			Calls	Calls	%	sec	(1-5)	(1-5)	%	dBm	dB	%		ms		ms	%	dBrn	dBrnC	dB	ms	ms	%	%	%
Canada	NONE	View	2	2	100	0.1	2.84	3.65	52.5	-11	-6.0	29.4	2	500	0	0	29.6	0	0	>90	<1	1501	50.0	50.0	50.0
Summary - Canada		View	2	2	100	0.1	2.84	3.65	52.5	-11	-6.0	29.4	2	500	0	0	29.6	0	0	>90	<1	1501	50.0	50.0	50.0

Create Reports by origin, destination, city, region, or breakout for any testing period for network monitoring, troubleshooting, and trending

Characteristics

Speech Quality
- PESQ LQ MOS
- VQES MOS
  - The MOS measures speech quality in terms of end-user perception using a scale from 1 (worst) to 5 (best)
- Unsatisfied Users Ratio
- Speech Power, Loss & Distortion

Noise
- C-Message Noise
- Wideband Noise
- Noise Gain
- C-Notch Noise Gain
- Signal-To-Noise Ratio

Voice Transmission
- Jitter & Jitter Buffer Usage
- Packet Loss & Transmission
- Packet Discard & Out-of-Order
- Burst Density & Duration
- Gap Density & Duration
- Frame Muting Ratio
- Comfort Noise
- Clipping Events (Front-End, Back-End, & In-Between)
- Clipping Ratio (Front-End, Back-End, & In-Between)
- Average Clipping Duration (Front-End, Back-End, & In-Between)
- Hang-Over Events
- Average Hang-Over Time
  - Detect speech clipping problems caused by Voice Activity Detectors (VADs) using Front-End and Back-End Clipping measurements, and analyze the impact of silence suppression by measuring Hangover events.

Tektronix DirectQuality Service Level Test Automation

Speech & DTMF Performance

Summary View | Detailed View | QoS Analysis View | Test Call View | Chart View | Show report specs

Test calls: 5 — **Service Level Class:** Best Practice — Apply

Origin: Japan

Node ID	Phone Number	Date and time	Overall	Connection Status	Network Timers	Speech Quality	VoIP Transmission	Voice Path Delay	Echo	Noise	VF Response	DTMF Detection	Fax Tone Detection	Test Plan
	71	2007-04-02 22:40	Fail	Pass	Pass	Fail	Pass	Fail	Fail	Pass	Pass	Pass	Pass	118
	71	2007-04-02 22:43	Fail	Pass	Pass	Fail	Pass	Fail	Fail	Pass	Pass	Pass	Pass	118
	99	2007-03-20 13:44	Fail	Pass	Pass	Fail	Pass	Fail	Fail	Pass	Pass	Pass	Pass	112

Origin: USA

Node ID	Phone Number	Date and time	Overall	Connection Status	Network Timers	Speech Quality	VoIP Transmission	Voice Path Delay	Echo	Noise	VF Response	DTMF Detection	Fax Tone Detection	Test Plan
	8792003	2007-03-20 13:37	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	109
	8792004	2007-03-20 13:44	Fail	Pass	Pass	Fail	Fail	Fail	Pass	Pass	Pass	Pass*	Fail	111

Critical | Major | Minor | Warning | Excellent

In the QoS Analysis View, User-Defined Service Level Classes are Used to Present Results in Highly-Identifiable Pass / Fail Categories

Delay
- Round-Trip Delay

Frequency Response
- Loss (1100 Hz, 2100 Hz)
- RSL (1100 Hz, 2100 Hz)

DTMF Detection & Validation
- Verify a network's ability to transmit DTMF (Touch) Tones.
- 0 to 9, *, #

Fax Tone Detection
- Test Fax-over-IP tone transmission performance to ensure codecs support continuous Fax frequencies.
- CNG Tone Detection & Duration
- CED Tone Detection & Duration

Network Timers
- Dial Tone Delay
- Post Dial Delay
- Billing Duration
- Call Duration

Connection Status
- Call Disposition Code
- PRI Cause Number & Location
- MGCP Return Code
  - Complete Call Progress Analysis is performed for each test call according to Tektronix's exclusive Enhanced E.180 algorithm.

NOTE: Test measurement availability varies according to the network protocol the PowerProbe is used with.

Benchmark Competing Technologies with Industry-Standard Speech Quality Algorithms

The Speech and DTMF agent incorporates standards-based VQES and PESQ algorithms that provide quality measurements that are ideal for the benchmarking of competing technologies and services.

VQES Algorithm

Monitors the end-to-end quality of your voice services using MCI Labs' statistics-based Voice Quality Evaluation System (VQES) algorithm. It calculates VQES MOS and Unsatisfied User Ratio, as well as conducting a full connectivity performance analysis.

PESQ Algorithm

Assesses the end-to-end quality of voice services using the ITU-T PESQ algorithm, to implement the PESQ Listening Quality MOS, frame muting for packet-loss detection, distortion, and voice clipping.

TDM / IP Interface Testing

Unique to the industry, Tektronix' PowerProbes can conduct loopback tests from the PSTN-side of media gateways. This permits full assessment of the effects PSTN/IP conversion has on VoIP quality while verifying the subscriber-experience when receiving off-net calls from outside the cable operator's network.

DirectQuality Web-Based OSS

Advanced Test Automation

DirectQuality anticipates measurement requirements and will generate and execute testing plans based on your QoS objectives. Automate test plans or start tests on-demand.

Color-Coded Service Levels

DirectQuality simplifies the monitoring of service faults by displaying results using user-definable Service Level Classes. Service violations can be forwarded to fault management systems via SNMP.

Business-level QoS Reports

DirectQuality provides a set of business-driven report templates with high-level and drill-down views.

About Tektronix:

Tektronix Communications provides network operators and equipment manufacturers around the world an unparalleled suite of network diagnostics and management solutions for fixed, mobile, IP and converged multi-service networks.

This comprehensive set of solutions support a range of architectures and applications such as LTE, fixed mobile convergence, IMS, broadband wireless access, WiMAX, VoIP and triple play, including IPTV.

For Further Information:

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology.

Please visit www.tektronix.com/communications

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