

PEVO

Road to Success for Quality IP Video

Fixed/Mobile Convergence and the new Broadband Home generate demand for new key performance indicators (KPIs) that tackle all dimensions of Quality of Experience (QoE), as perceived by customers. It's still a long way for mobile TV podcasts and IPTV in particular to match the perceived quality standards of the incumbent TV broadcast. Various metrics, often passive tests based on protocol analysis, are proposed, but do say nothing about the payload's shape. No-Reference payload analysis produces at least some estimates of user experience, but still lacks core information about the basic quality it all started with. For instance, your passive video stream analysis might indicate transmission artefacts, while the

picture is fuzzy and blurred. How do you know what a Pop music video stream should look like without a reference? Experience at OPTICOM reaches back to the launch of the first perceptual test tool almost 20 years ago. An experience which clearly shows that only intrusive, reference-comparison based testing, weighted by accurate models of human perception will produce accurate KPIs representing the user's perceived quality: This has been the core business development of OPTICOM. In this newsletter, you will find a stunning update on the use cases of partner products that rely on OPTICOM's proven OEM technology to pave the road to success for Quality IP Video!

continued on page 4/5



"With the increasing number of PEVO OEM licensees, we have reason to believe from our customers' independent evaluations and their feedback that we currently offer the best algorithm for multimedia video quality testing in the market space. Combined with PESQ and PEAQ this is not only the most trusted A/V Quality Test Suite in the Industry, but in fact the one KPI set for all Quad-Play applications".

**Michael Keyhl, CEO,
OPTICOM GmbH**

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The Perceptual Quality Experts.



Voice Quality testing for converging Fixed and Mobile Networks

- **PESQ** – Perceptual Evaluation of Speech Quality for MOS scoring of narrow and wide-band telephony voice signals (Listening Quality) according to ITU-T P.862/P.862.1 (narrow-band) and P.862.2 (wide-band)
- **PESQ-TQ** – Perceptual Evaluation of Speech Quality (Talking Quality) for MOS scoring of the talker's perception of his own voice (echo and sidetone)
- **3SQM** – Single-sided Speech Quality Measurement according to ITU-T P.563
- **ECHO** – OPTICOM's advanced Echo Evaluation

Voice telephony still being the core basis for wireless 3G and Quadruple-Play services, the range today includes voice-conferencing, -messaging and PTT services. The issue of listening quality ('How do I perceive the other party's voice!?!') is complemented more and more by talking quality aspects (The talker's own voice sounding distorted with significant echo) and con-

versational quality limits with two or more parties interacting. New subjective and objective metrics to tackle Talking and Conversational Quality are currently under development within the ITU-T, whereas for Listening Quality metrics are already well established:

OPTICOM, as the sole vendor in 1996 originally introduced PSQM, the first objective listening quality MOS measurement recommended by the ITU as P.861. PESQ – today's state-of-the-art MOS scoring algorithm is available since 2001 from OPTICOM and builds on an advanced PSQM-like core. Advanced PESQ OEM versions for various platforms have been devised by OPTICOM since then. The latest complement is P.862.2, a recent extension for the assessment of wide-band speech transmissions. Besides the MOS value, a number of supplementing KPIs are provided, like measurement of (variable) delay and separately calculated values for speech active and silence parts, thus giving useful indications for cause analysis on an expert level. The who-is-who of the Telecom's industry has licensed OPTICOM's PESQ core, so if you came across some MOS



Video Quality testing for Multimedia and

Video-telephony is the entrance card to 3G, and there is video-conferencing, -messaging and -streaming. With 3.5G and HSDPA high quality movie and TV streaming becomes reality on mobile devices. And IPTV is the key to the new Broadband Home. Again, we are talking content based business models. And this time customer's QoS expectations have been adjusted higher-than-average by stable TV reception and DVD home cinema standards. OPTICOM's family of testing algorithms provides PEVQ, the perceptual evaluation of video quality. First premiered at the 3GSM 2005 congress in Cannes, OPTICOM just released a major technology update to PEVQ™, the industry counterpart

for video testing complementing PESQ and PEAQ. PEVQ builds on earlier developments of KPN Research, the developers behind PSQM and PESQ, and has been further advanced by OPTICOM for low bit-rate 3G formats (CIF and QCIF) together with leading industry and university partners. PEVQ is OPTICOM's proposed candidate for standardization of a FR (full reference) video model within VQEG (the Video Quality Experts Group), which is in the process of starting verification tests for future standardization. While MOS undoubtedly is again the key KPI figure for perceived picture quality, a number of traditional (unweighted) KPIs like e.g. Blur, Blockiness, Jerkiness, Delay and PSNR are

Audio Quality testing for streaming MP3

value before, there is a high chance that it was processed by our code.

OPTICOM's advanced ECHO measurement is offered to adequately evaluate key aspects of talking quality, and it has not only become a most successful key feature of OPTICOM's OPERA voice/audio quality tester, but - besides PESQ - it is also serving as the second most important troubleshooting KPI when OPTICOM experts are hired by operators for consultancy projects. Within the new PEXQ Software Suite OPTICOM now also introduces PESQ-TQ, a new metrics for MOS scoring of Talking Quality.

In collaboration with two partners, in 2004 OPTICOM could finalize 3SQM (P.563) as a no reference complement to P.862, thus building the 4th International Perceptual Measurement Standard in OPTICOM's stunning business development.

And last but not least, due to OPTICOM's strategic collaboration with Telchemy, the IP based QoS company, we will be able to support VQmon analysis in our PEXQ QoS testing solution.

New non-voice business models finally have taken the center stage: Portable MP3 player with integrated mobile phone, or vice versa? Even business phones cannot do without MP3, AAC+/++ support today – there are growing business models behind music-on-demand services, still you have no KPI to monitor that? Again, OPTICOM provides the answer: PEAQ, the ITU standard for perceptual evaluation of audio quality, authored by OPTICOM in 1998 and developed during a four years cooperation with leading experts is the proper tool for sound quality testing of music streams. PEAQ can handle stereo signals with CD-like sampling frequencies up to 48kHz and report the proper MOS in the context of ITU-R listening test standards.

- **PEAQ** – Perceptual Evaluation of Audio Quality for MOS scoring of stereo sound accompanying video streams according to ITU-R BS.1387



Telephony, Broadband

- **PEVQ** – Perceptual Evaluation of Video Quality for MOS scoring of video-telephony, -streaming and -messaging as proposed within VQEG, including 3G and IPTV

provided by the new PEVQ version V2.1 due to popular customer requests and for backward compatibility reasons. Future versions will also include optional J.144 support. And not to forget – of course we have an audio-visual KPI pair at our hands, based on combined PEAQ+PEVQ, which makes a great fit to detect one of the most prominent and nasty artefacts of video transmissions: Lip-sync problems.

Testing Web-browsing and Data services

- **PEDQ** – Perceptual Evaluation of Data-Services Quality for MOS scoring of perceived data download and browsing QoS

Sure you can characterize packet arrival time in milliseconds and throughput bit rate in kbit/s – but what does it say? Again, you need a KPI that copes with user's perceived experience. And again, OPTICOM is working at the forefront of standardization and expects to release PEDQ, the perceptual evaluation of data-services quality very soon. PEDQ will provide a MOS that copes with the user's perceived web browsing experience.



Video Quality Testing for Video Telephony, Mobile TV and IPTV

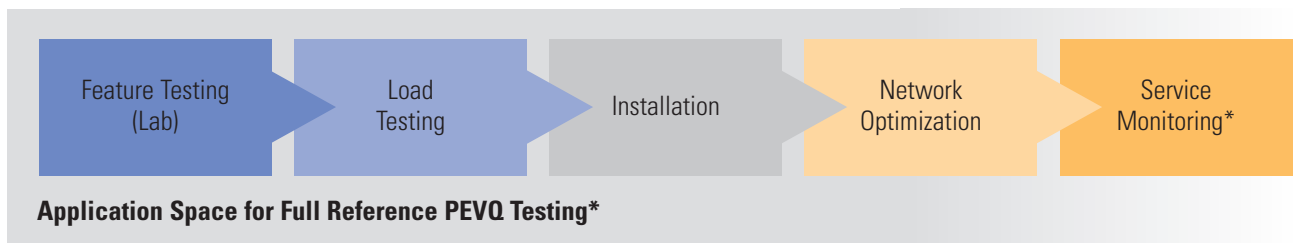
A Market Overview on PEVQ Products

OPTICOM's PEVQ provides MOS scores of the video quality for IPTV, streaming video, mobile TV and video telephony. Perceptual Evaluation of Video Quality measures degradations occurring through a network by analyzing the degraded video signal output from the network. This Quality-of-Experience (QoE) testing is based on modelling the behaviour of the human visual tract and besides the overall quality abnormalities in the video signal are quantified by a variety of KPIs, including PSNR, distortion indicators and lip-sync delay.

OPTICOM offers its new PEVQ video quality measurement as part of the PEXQ software suite for Windows (see page 6/7), and has been licensing PEVQ to a range of OEM products from leading T&M manu-

facturers. The solutions cover different use cases from codec evaluation, over drive test tools for video telephony to IPTV test and monitoring equipment. Products address various stages in the life cycle of employing new equipment for NGNs. See the following reference product guide to identify the PEVQ test tool of your choice, or contact us for further information.

The reference product guide on the opposite page shows the current status and is subject to change. Further products are in preparation. You may want to check the on-line version of this directory under www.pevq.org



In our market overview we will differentiate between five product categories, reflecting the application space for test tools in the life cycle of NGNs, while extending from pre-deployment (lab testing) to service monitoring of live networks.

** Currently available Video QoE test tools embedding PEVQ cover all areas except in-service monitoring, where often **passive availability monitoring** and **IP-based transport stream analysis** is required. OPTICOM recommends Telchemy's VQmon/SA-VM for this application space (see www.telchemy.com).*



Market Overview on PEVQ OEM Test Tools

	Vendor	Product	Category	Test Applications	Customers targeted
	AudioCodes www.audiocodes.com	--- ⁽¹⁾	Feature Testing (Lab)	R&D, Feature Test, Production Test	---
	Danet www.danet.de	--- ⁽¹⁾	Feature Testing (Lab)	Feature Test, Production Test, Mobile Network Testing	---
	ITD www.itd-home.de	--- ⁽¹⁾	Feature Testing (Lab)	Mobile Network Testing, Video Telephony, Video Streaming	---
	OPTICOM www.opticom.de	PEXQ Software Suite for Windows	Feature Testing (Lab)	R&D, Feature Test, Production Test	Network Equipment Manufacturer, System Integrators, Service Providers
	Surf Communication Solutions www.surf-com.com	SurfExpress/PCle (1)	Feature Testing (Lab)	R&D, Feature Test, Production Test	Network Equipment Manufacturer, System Integrators, Service Providers
	TestQuest www.testquest.com	TestQuest Mobile Video Testing Technology	Feature Testing (Lab)	Mobile Network Testing, Video Telephony, Video Streaming	Service Provider, Mobile Operators, Cell Phone Vendor
	IXIA www.ixiacom.com	Aptixia IxLoad	Load Testing / Installation	IPTV/Triple Play test system	Service Providers, Equipment Manufacturer
	Shenick www.shenick.com	diversifEye	Load Testing / Installation	IPTV/Triple Play test system	Service Provider, Infrastructure Vendor
	Ascom www.ascom.com	Ascom QVoice	Installation / Network Optimization	Mobile Network Testing, Video Telephony	Network Operators, Service Provider, Infrastructure Vendor, System Integrators
	Inno Wireless www.innowireless.co.kr	OPTis/XCAL-W	Installation / Network Optimization	Mobile Network Testing, Video Telephony	Mobile Operators, Network Operator, Cell Phone Vendor
	Keynote Sigos www.keynote-sigos.com	SITE Test System	Installation / Network Optimization	Mobile Network Testing, Video Telephony	Mobile Operators, Network Operators, Service Provider
	Rohde & Schwarz www.rohde-schwarz.com		Installation / Network Optimization		Mobile Operators
	Spire Technology www.spiretech.co.kr	Netimizer DML, Netimizer MDM, Netimizer QMS	Installation / Network Optimization	Mobile Network Testing, Video Telephony	Mobile Operators, Network Operator, Service Provider, Equipment Manufacturer

⁽¹⁾ No T&M product available, vendor applies PEVQ tools internally for optimization of video embedding products.

This reference product guide shows the current status and is subject to change.
Further products are in preparation.



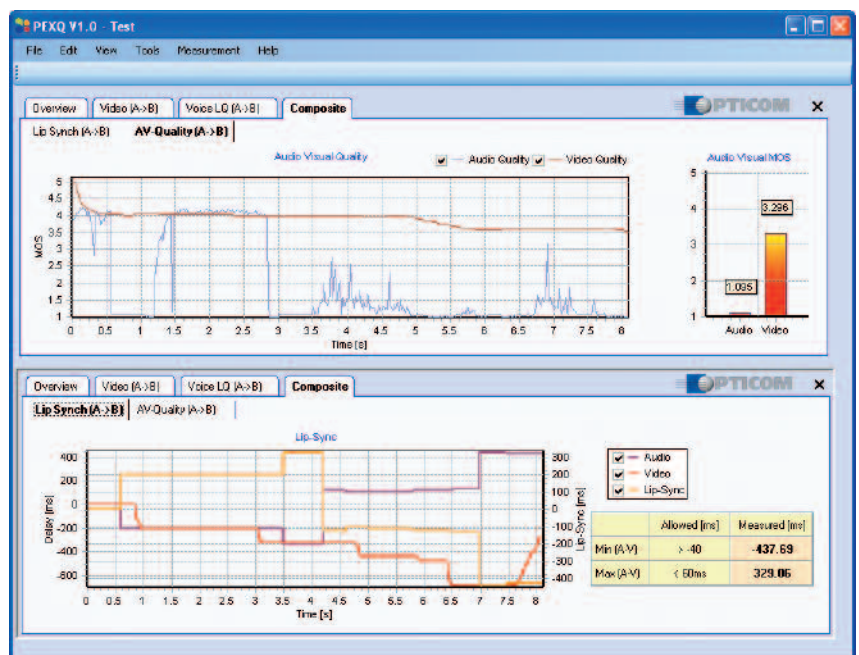
PEXQ™

The Next Level of Perceptual Quality by OPTICOM

PEXQ is OPTICOM's latest product for Windows offering a complete portfolio of quality measurement tools for voice, audio/visual and data payload analysis based on human perception. PEXQ provides mandatory features in the area of R&D for the development of new multimedia codecs as well as for multimedia equipment manufacturers. Besides lab testing PEXQ is also ideal for network

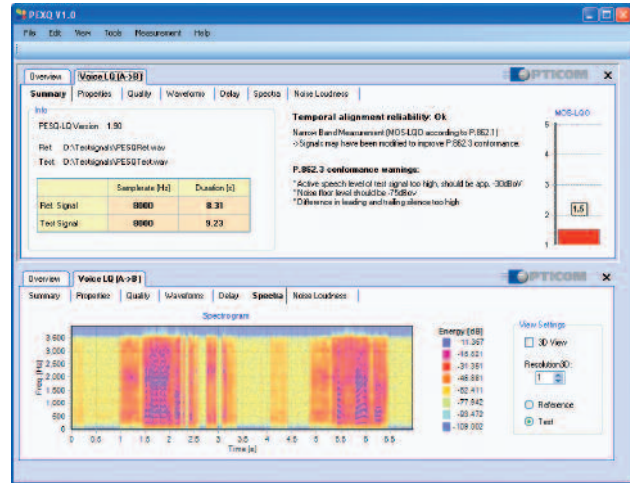
operators and carriers to measure quality of service. PEXQ is founded on well established internationally standardized measurement algorithms such as PESQ (ITU-T Rec. P.862, P.862.1 (narrow band), P.862.2 (wide band); Perceptual Evaluation of Speech Quality) and completely new metrics for video quality testing like PEVQ (Perceptual Evaluation of Video Quality).

New in PEXQ: Composite result view for Audio-Visual Quality testing reporting Audio and Video MOS KPIs (upper diagram) and detailed lip-sync analysis window (lower diagram)





Comprehensive analysis of Talking Quality: Echo Return Loss analysis and PESQ-TQ MOS (upper diagram), Echo Delay Histogram (lower diagram)



PESQ Analysis of Listening Quality (upper diagram) with Spectrogram of test signal (lower diagram). Note the easy configurable tab selection for multifaceted result views.

The PEXQ feature overview:

Employment of the latest standards for perceptual quality testing: The current version offers measurement algorithms for voice signals (P.862.x, ECHO and PESQ-TQ) and for video signals (PEVQ). Measurement algorithms for data i.e. web-browsing (PEDQ) and for audio signals (PEAQ) will be available very soon, too.

Audio-Visual quality testing: Combined evaluation of audio and video information to form an overall multimedia quality estimate as well as metrics for lip-synchronicity and many more.

Conversational quality testing: Providing the complete quality picture of a real life telephony situation considering the aspects of listening and talking quality such as echoes.

Easy to use and comprehensive Graphical User Interface: Only a few clicks are needed to run a measurement. Charts and diagrams help you to interpret your results quickly.

Extended Video Quality Analysis Support: Watch your video sequences with additional diagnostic information such as frame differences of degraded and original sequence after a temporal and color alignment.

Automatic measurement algorithm selection: Let your PEXQ suite do the work and have it configure your measurement setup automatically.

Export/Import your measurement configuration settings: Once you have configured your setup you can save your settings to a configuration file (XML) and repeat your measurement with the exact same settings without the need to reconfigure PEXQ again.

Export/Import your measurement results: Archive your measurements to an XML-file and if you want to reanalyze your data again simply import your results again to PEXQ.

Reporting functionality: Copy your measurement results to your documents via the MS Clipboard.

Scalability and Flexibility: The new PEXQ suite is available as a stand-alone software solution for lab testing under MS Windows as well as for OEM licensing for T&M manufacturers and system integrators.

Command Line Functionality: Evaluate hundreds of test files in batch mode by using PEXQ's command line functionality.

Future versions of PEXQ will also include:

Enhanced data acquisition features: Acquire data streams, run the measurements and analyze the results all in one single tool!

Inclusion of audio quality and data quality metrics: PEXQ will provide you with a complete multimedia measurement solution.

Extended audio/voice analyzing support: For example you will be able to listen to your wav-files.

The following PEXQ product versions are available:

PEXQ Suite for Windows

- Graphical User Interface Single-User License
- Graphical User Interface Multi-User License

PEXQ Developer's Edition for Windows

- Graphical User Interface including OPTICOM's Advanced OEM Developer Toolkit¹ for developers of T&M equipment and system integrators

¹ The OPTICOM Advanced OEM Developer Toolkit is a set of software libraries containing measurement and signal preprocessing algorithms. OPTICOM's OEM software libraries are available for Windows and Linux.



Candela Technologies leverages PESQ MOS in LANforge products

Candela Technologies recently integrated their LANforge WiFIRE 802.11a/b/g VoIP and traffic generator with OPTICOM's PESQ to provide a leading Spanish telecommunications operator a solution to test and evaluate next generation WLAN infrastructure solutions. By combining LANforge VoIP and traffic generators with OPTICOM's PESQ, Candela Technologies has provided SMB service providers with the means to test networks prior to deployment and provide ongoing monitoring and problem resolution of voice quality issues.

www.candelatech.com

Hun-Kyi Wynn, Vice President, Candela Technologies: "We chose OPTICOM PESQ because we wanted to provide our customers with the very best industry standard voice quality evaluation that would integrate easily with LANforge. On both counts we feel that we made the right choice."

Azimuth PESQ Toolkit for FMC Voice Quality Measurement



Azimuth's PESQ toolkit is an optimized Voice Quality Measurement solution that embeds OPTICOM's PESQ for use as a standalone tool or as part of an automated voice performance test solution like Azimuth's FMC performance Test Suite.

As part of a comprehensive FMC and VoWi-Fi test solution, Azimuth has developed a cost effective and easy to automate PESQ Toolkit which allows users to make objective end-to-end voice quality measurements while providing a streamlined interface for easy configuration and results analysis.

Designed to be an integral component to the FMC Performance Test Solution, this toolkit is fully automated and can be directly controlled from any of the Azimuth voice benchmarks. It also includes an open TCL API that provides the toolkit with increased flexibility to be used for custom test development as well as integration into other automated test harnesses.

www.azimuthsystems.com

ANTS for Service Assurance includes PESQ and ECHO



Leveraging more than twenty years of collaboration with leading European telecom operators as a solution provider, Elsas Datamat has created and continuously develops ANTS, its Service & Revenue Assurance solution enabled by end-to-end active testing. ANTS permits to accelerate and strengthen new services roll-out, supporting service Operation in guaranteeing the expected user experience, both during large scale deployment and for local troubleshooting thanks to the extensive set of measures and traces provided by the system. ANTS solutions cover all mobile



voice, video and data services with a rich set of QoS verification features, including PESQ and OPTICOM's ECHO, applicable to all various mobile and fixed line voice services.

www.ants.datamat.it

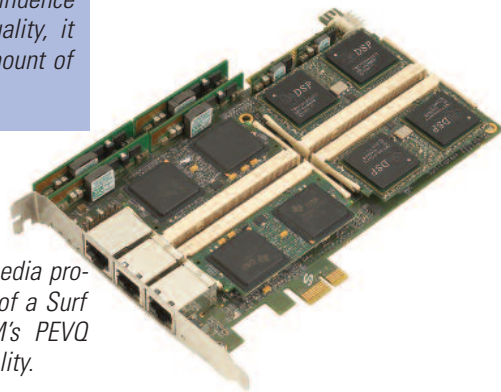
PEVQ to advance video gateways for transcoding, resizing and conversion

SURF Communication Solutions® provides a wide range of media processing, media transport and call setup functions, integrated with robust, field-proven hardware platforms, to enable rapid development and deployment of full-featured video gateways.

Supported transcoding functionality includes codec conversion (H.263, MPEG-4, H.264); resizing; bit rate and frame rate conversion; conferencing; lip sync; dynamic addition of graphic overlay, text and logos; and background/foreground manipulation.

For manufacturers of telecom infrastructure equipment, this translates into easy connection between varying types of IP video phones and 3G mobile phones, video optimization according to terminal capabilities, and the addition of advertisements, messages or any other dynamic changes to the video stream.

Levana Fouks, QC Manager at Surf, says "It is imperative that the video quality be preserved during the transcoding, resizing and overlay operations performed by our media processing products. Incorporating OPTICOM's PEVQ software into our automated tests not only improves our confidence level with regard to video quality, it also saves us an incredible amount of time in the testing lab."



The SurfExpress/PCIe™ multimedia processing solution is an example of a Surf product that utilizes OPTICOM's PEVQ software to guarantee video quality.

Learn more about this product at VON Fall, booth #712, or at www.surf-com.com.

Qosmotec Relies on OPTICOM's Quality Assessment Engines

Qosmotec provides complete solutions for automation of laboratory test, field test and drive test of wireless networks.

Qosmotec is offering OPTICOM's quality assessment solutions as part of its LTS family of tools.

Based on the end-to-end testing paradigm, Qosmotec's Lab Test System LTS is aimed at automatic load & stress testing, regression tests, performance evaluation as well as function testing during system and integration test in a lab environment. The user can rely on predefined test scripts or create scripts himself by means of a Graphical Test Script Editor, controlling dozens to hundreds of terminals.

Powered by OPTICOM's PESQ, ECHO and PEVQ solutions, LTS gathers measurements on MOS, speech latency, and other KPIs

LTS furthermore integrates with Qosmotec's own Air Interface Simulator AIS and Channel Effects Replicator QPER, as well as with 3rd party tools such as a SIM Server and a Mobile Robot. Highlights of LTS include tracing of the air interface of GSM-R, UMTS and HSDPA, interfacing the network nodes directly from within test cases, and support of WiMax 802.16f terminals.

www.qosmotec.com



PESQ gives Polystar's SOLVER an edge in the load test tool market

SOLVER
BY POLYSTAR



SOLVER is a high-performance load and stress test tool for GSM and UMTS mobile telecommunication networks which simulates real signalling and user plane traffic. SOLVER can start providing load to the Core Network within an hour and is operated through its flexible GUI, where traffic patterns are created to run simultaneously or in sequence.

Voice quality can be measured through PESQ between all supported interfaces. SOLVER has a highly appreciated applica-

"Through the cooperation with OPTICOM Polystar T&M were able to add the PESQ quality functionality in SOLVER. PESQ has given SOLVER an edge in the load test tool market. In combination with our GEMINI HW it provides a stable, unchallenged high-performance platform for voice quality measurements."

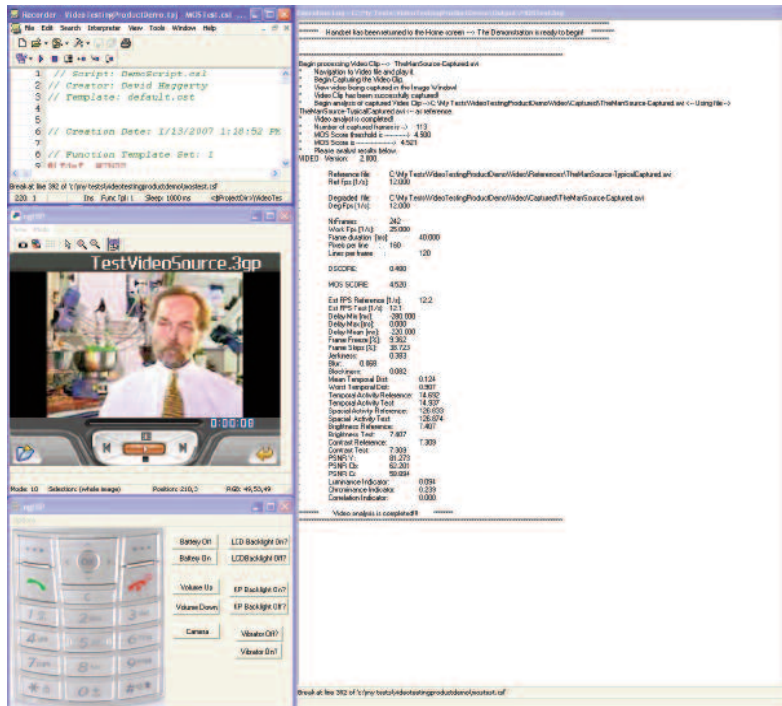
Hans Edman, CTO, Polystar T&M

tion for managing PESQ files, results and statistics.

The new 4.3 release, available by mid-November, makes SOLVER even more suitable for voice quality testing with the ground-breaking PESQ measuring tool for TFO.

www.polystar.com

Automated objective video quality and functional testing for 3G multimedia



TestQuest provides highly reusable software test automation, test management, and video quality test solutions to the largest mobile device manufacturers, wireless operators, and mobile application developers in the world. The TestQuest Mobile Video Test Platform enables automated video MOS testing and quality monitoring of any mobile multimedia device over any transport service/protocol. TestQuest automates the mobile device interaction and captures the streaming video while using OPTICOM PEVQ to perform analysis and MOS scoring at up to 30 frames per second. The TestQuest approach to mobile video quality testing eliminates time-consuming and costly quality evaluations using traditional manual "expert panel" processes.

www.testquest.com



VIERLING decides for PESQ in TiQoS

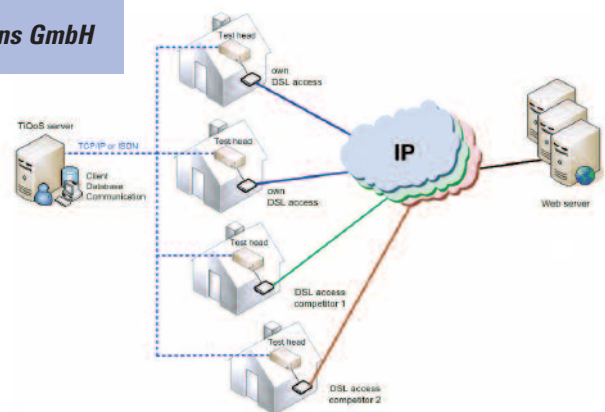
Carriers and service providers have new requirements for QoS test systems due to heterogeneous structures of next generation networks (NGNs) and special issues related to IP-based services. Applications using VIERLING's TiQoS platform (Testing in Quality of Service) allow quality tests for VoIP (TiQoS.VoIP), xDSL Internet access points (TiQoS.InternetAccess) and video streaming (TiQoS.Video). Using end-to-end tests, they are suitable for test campaigns and ad hoc tests and are modular for easy adaptation to customer-specific requirements. Continuous monitoring and troubleshooting are two important TiQoS application areas. The platform also helps support marketing arguments with benchmark data. TiQoS systems are used internationally by leading carriers and service providers.

www.vierling.de

"Leading carriers and service providers around the globe are using TiQoS.VoIP to test the quality of VoIP connections. These customers are interested in tests that are dependable and provide maximum insight. This is why we integrated powerful PESQ measurement algorithms from OPTICOM into TiQoS."

Georg Herrmann, Director Measurement Solutions, VIERLING Communications GmbH

VIERLING



Focus Infocom's Test and Measurement Systems incorporate OPTICOM's PEVQ and PESQ

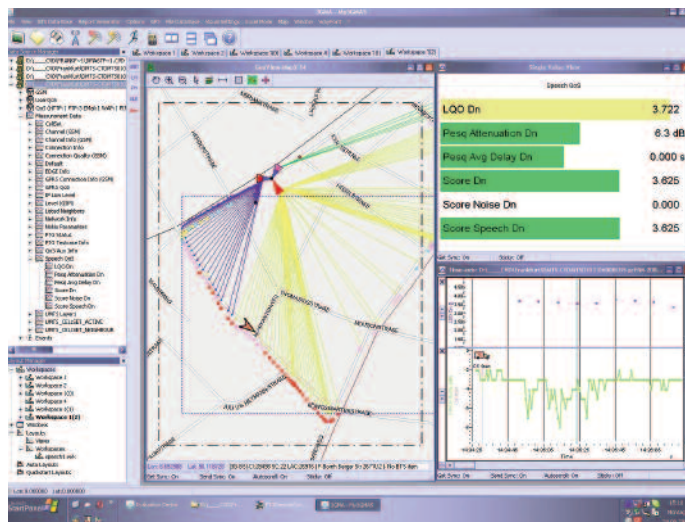
Video Telephony using the 3GPP H.324 standard is very demanding from an implementation point of view in test and measurement systems. Focus Infocom is one of very few companies in this market segment who developed a full and flexible H.324 protocol stack.

To deal with all demands for the Video MOS (perceptive quality) component OPTICOM's PEVQ has been the choice of Focus Infocom.

This decision was based both on technical performance considerations, as well as on PEVQ's favorable business model.

Already for years Focus Infocom's tools are equipped with OPTICOM's PESQ as algorithm for speech quality testing; that's the interactive measurement and analysis tool 3GMA, the Autonomous Coverage Tester (ACT) system and the "driver-only" DMTS Multi-processor benchmarking test system.

www.focus-infocom.de



Dr. Wolfgang Balzer, Managing Director of Focus Infocom:

"We not only value the performance and quality of OPTICOM's PESQ and PEVQ – we also appreciate the competent support and the positive and productive relationship with OPTICOM."

Focus Infocom

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About OPTICOM

OPTICOM GmbH is the leading vendor for voice, audio and video quality measurement technology and OEM products for mobile and IP based network testing. With PSQM, PESQ, PEAQ and P.563, the pioneers in perceptual quality testing have been providing by now four international world-class standards for voice and audio quality measurement since the foundation of OPTICOM as a spin-off from Fraunhofer's MP3 development team in 1995.

After the great success with PESQ - the International Standard for voice quality testing, the experts from Germany now also source PEVQ, the new industry standard to measure a perceptual video quality KPI for streaming, conferencing and messaging applications.

PEXQ, the next level of Perceptual Quality Measurement, is the ideal 'all-in-one' test suite for developers, manufacturers and operators, while the 'X' just symbolizes the ongoing evolution of perceptual QoE metrics: Based on PESQ, PEAQ, PEVQ and PEDQ the software provides the most comprehensive standards-based MOS-KPI set to score voice, audio/visual and data quality as experienced by subscribers. OPTICOM's proven OEM technology can be found in most state-of-the-art products of leading T&M vendors, see also www.opticom.de/company/customers-licensing.html.

OPTICOM GmbH is a privately held company located in Erlangen, Germany.