NEWS FROM

OPTICOM

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POLQA®

Introducing the Next-Generation Mobile Voice Quality Testing Standard for HD-Voice, VoIP, 3G and 4G/LTE

NEW: POLQA approved as ITU-T Rec. P.863

Largely supported by OPTICOM's perceptual quality experts, the technology upgrade and designated successor for PESQ steered its course through International Standardization and received approval in January 2011 as the new ITU-T Recommendation P.863. POLQA represents the next-generation of voice quality testing technology for fixed, mobile and IP-based networks and can be applied to HD Voice, 3G and 4G/LTE.

> *continued on page 2*

The Perceptual Quality Experts.

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Introducing the Next-Generation Mobile Voice Quality Testing Standard for HD-Voice, VoIP, 3G and 4G/LTE

The new POLQA standard was in development since 2006 by leading experts, as the result of a competition carried out by Study Group 12 of the ITU-T, with the objective of defining a technology update for PESQ/P.862. During its development more than 100,000 fixed, mobile and VoIP test calls were gathered by experts from all over the world, thus representing the largest and most accurate database ever used in the development of a perceptual quality algorithm.

POLQA – an acronym for "Perceptual Objective Listening Quality Analysis" - will offer a new level of benchmarking capability to determine the voice quality of mobile network services. The POLQA perceptual measurement algorithm is a joint development of OPTICOM, SwissQual and TNO, protected by copyright and patents, and made available under license as software tools for various platforms.

OPTICOM offers standard-setting POLQA reference implementations, along with legacy PESQ and ECHO-TQ (Talking Quality) measurements for various platforms/OS:

POLQA form factors	Desktop PC	OEM	Smartphone
Use Case:	Stand-alone (End-User)	OEM Libraries	OEM Apps
Application Scenario:	S/W-Tools with GUI for lab use	To be embedded in DTT probes and stand-alone T&M-systems	On-Device Test Tools for Mobiles & Smartphones
Available Platforms/Versions:	**PEXQ Software-Suite for Windows,** incl. Voice*plus* option • POLQA/P.863	• **POLQA/P.863 OEM lib for Windows** • **POLQA/P.863 OEM lib for Linux**	• **POLQA/P.863 Q-App for Android Smartphones** • PESQ/P.863 OEM lib for Android
Can be combined with:	Voice*plus* option • PESQ/P.862 • ECHO-TQ Video option • PEVQ/J.247	Voice*plus* option • PESQ/P.862 • ECHO-TQ Video option • PEVQ/J.247	• PESQ/P.862 Q-App for Android Smartphones • PESQ/P.862 OEM lib for Android
Optional:		• Other platforms and O/S on request • Conformance Testing	• Symbian and other O/S on request

POLQA – the PESQ/P.862 Successor

With more than 20.000 licensed test units, the Perceptual Evaluation of Speech Quality (PESQ/P.862) algorithm, has evolved as the most successful industry standard for voice testing since its definition in 2000. Naturally, voice coding technology and IP based transmission standards have further advanced, so the timing is appropriate for an update of the state-of-the-art benchmarking method. POLQA, the designated successor for PESQ was approved in 2011 as the new ITU-T Standard P.863.

Measurement Accuracy

In the super-wideband mode, POLQA covers an extended audio frequency range up to 14 kHz, suitable to assess modern HD-Voice applications. Apart from the 2005 wideband extension P.862.2, PESQ originally was limited to 'vintage' narrowband telephony applications (POTS), only. Consequently, POLQA would clearly be the choice for any modern benchmark that targets at wideband and super-wideband voice services. For "classical" narrowband use cases like mobile network benchmarking, POLQA clearly offers a huge advance in measurement accuracy. Therefore the question *"Is it worth migrating?"* should easily be answered. The following comparison gives a general idea on the improvements.

Algorithm Performance

One frequently asked question in the context of the new POLQA algorithm is *"How does it compare performance-wise?"* As a general answer, it will require some more processing in narrowband mode than PESQ. However, OPTICOM is continuously progressing and optimizing the performance for various operating systems. Besides the default version, which was input to ITU-T for standardization, there are already fast and advanced versions available that offer significant optimization (see the following performance data for INTEL processors).

For any particular application, we would recommend to check your performance requirements directly with OPTICOM's experts.

	rmse*		
Narrowband	**PESQ P.862.1**	**POLQA P.863**	**Improvement**
Averaged rmse*	0.1857	0.1363	**27%**
Wideband	**PESQ P.862.2**	**POLQA P.863**	**Improvement**
Averaged rmse*	0.3450	0.1506	**56%**

Comparison of the prediction error for POLQA with PESQ: The root mean square error (RMSE) is a measure of the differences between scores predicted by an algorithm and the corresponding scores obtained from subjective tests. It is a more suitable measure of precision than the commonly used correlation factor. The rmse is similar to the rmse, but also takes the accuracy of the subjective experiment into account.*

"One of the most motivating experiences from the last ITU-T SG12 meeting was hearing experts in the field recognising POLQA as a major step forward from PESQ, and eagerly await to get their hands on it. POLQA performs up to 56% better than PESQ, opens new application areas and eliminates the weak points of PESQ, one such aspect being EVRC under-prediction when compared to AMR codecs"

Dipl.-Ing. Christian Schmidmer, OPTICOM's CTO and Standards Developer

Operating Mode	NB (8kHz)			SWB (48kHz)		
POLQA Version	**Default**	**Fast**	**Very Fast**	**Default**	**Fast**	**Very Fast**
Core 2 Duo 2.13 GHz	**0.13**	0.11	0.10	**0.35**	0.25	0.22
Core i5 2.27 GHz	**0.10**	0.08	0.08	**0.28**	0.19	0.16
Core i7 3.07 GHz	**0.07**	0.05	0.05	**0.20**	0.14	0.11

Performance figures reported without file I/O and are reported in fractions of real-time (e.g. 0.20 corresponds to five times real-time). Performance may vary due to test call characteristics.

NEW: POLQA Q-App for Android On-device testing on Smartphones in Real-Time

Right from the start of POLQA, the new ITU-T Recommendation P.863, OPTICOM also offers its OEM reference library toolset in a mobile form factor for Android Smartphones. The POLQA Q-App complements OPTICOM's PESQ/P.862 Q-App for Android, Symbian and Windows Mobile, originally premiered at the 2010 Mobile World Congress.

Check the Voice Quality of your Mobile, coverage and network transmission at your fingertips. Should you experience poor speech intelligibility that you are not willing to pay for, compare and benchmark competing operators, or just generate hard facts by standard mean opinion scores (MOS) on your screen. Where, up to now, you would have required a test engineer to show up with high-end measurement gear, you will now be able to download an App. Quality conscious operators could even consider giving-away Q-Apps as part of their premium mobile offering, and adjust future business models based on quality.

Use Cases and Applications

Q-Apps are available under OEM license to mobile manufacturers, walk & drive test tool vendors, system integrators and network operators. Applications might include indoor walk testing, premium mobile offerings based upon agreed QoE levels, network testing by clouds of friendly users, unobtrusive QoE benchmarking at mission critical or high security venues and many more.

Device Performance	Best Case*	Typical*	Worst Case*
POLQA Q-App for Android			
HTC Desire Z, Qualcomm MSM 7230, 800 MHz, Android 2.2.1	0.65	**0.92**	2.13
PESQ Q-App for Android			
HTC Desire Z, Qualcomm MSM 7230, 800 MHz, Android 2.2.1	0.11	**0.14**	0.20
PESQ Q-App for Symbian			
NOKIA 6720 C, S60, 3rd Ed., FP 2, ARM 11, 600 MHz	0.87	**1.11**	1.64
PESQ Q-App for Win Mobile			
HTC Diamond 2 Smartphone, Qualcomm MSM7201A, 528 MHz	1.08	**1.51**	2.48

** Performance may vary due to test call characterisitics and is reported in fractions of real-time (e.g. 0.20 corresponds to five times real-time).*

New Business Development

OPTICOM recently welcomed Mr. Graham Rousell (centre) to join OPTICOM in the new position of 'Business Development Manager'. He will reinforce the key account team for OEM licensing of OPTICOM's advanced voice, audio and video quality algorithms. Graham brings a great deal of professional experience previously performing product management for voice quality enhancement systems within Tellabs. He is well aware of both sides of the coin, as he used to employ OPTICOM's PESQ tools to demonstrate the benefits in network quality improvement of VQE products. To get in touch with our business development team, feel free to use the contact form on www.opticom.de, send us an email to info@opticom.de, or just give us a call: +49 - 9131 - 5 30 20 - 0

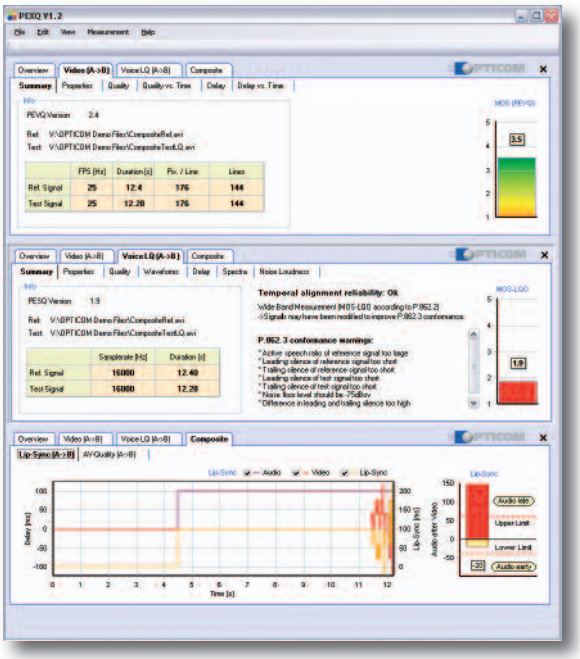
OPTICOM's CEO Michael Keyhl (right) and Key Account Manager Linda Polster (left) introduce Graham Rousell, BDM (centre) to the latest German mobile operator benchmark.

POLQA and PEVQ – the Video Dream-Team

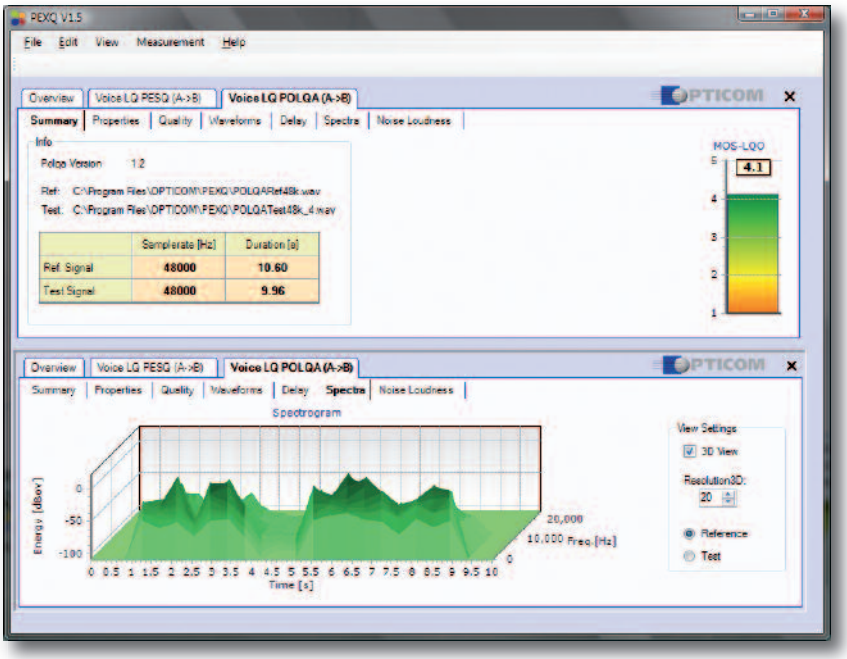
With POLQA, OPTICOM's PEVQ for Video MOS testing of Mobile-TV, video streaming, video telephony and video conferencing just found an adequate partner for audio-visual testing. PEVQ was standardized in 2008 as ITU-T Rec. J.247, and is a full-reference picture quality measurement for multimedia quality testing of QCIF, CIF and VGA image sizes. PEVQ also extends to SD and HD resolutions, with similar performance as ITU-T J.341 (a new recommendation for HDTV digital cable television).

In the HDTV use case, PEVQ should be complemented with PEAQ, the ITU-R Recommendation BS.1387 for evaluation of audio (music) quality. An extension of PEAQ from stereo to multi-channel home cinema is currently under development. For video conferencing and telepresence applications, however, the focus is on voice communication, so PEAQ might not be the algorithm of choice. Instead, an HD-Voice measure like POLQA will be the ideal combination. It will allow audio-visual quality assessment of narrowband, wideband (8 kHz) and super-wideband (14 kHz) voice codecs in a communication scenario of a video conference.

OPTICOM offers end-users an optional combination of PEVQ and POLQA in the PEXQ software suite for Windows. OEM licensees can realize the similar functionality from bundling OPTICOM's PEVQ and POLQA OEM libraries.



New in PEXQ: *The composite result view for audio-visual quality analysis reporting the video MOS (PEVQ) (upper frame) and the audio MOS (PESQ) (middle frame). The combination of perceptual video and audio quality measures allows for detailed lip-sync analysis (lower frame).*



New in PEXQ: *The comprehensive graphical analysis toolset now fully supports POLQA/P.863 in narrow-band (8 kHz) and super-wideband (48 kHz) mode. To ease backward compatibility, the voiceplus option comes with POLQA/P.863, in combination with legacy PESQ/P.862 and OPTICOM's proven ECHO-TQ (Talker Quality Measure).*

First POLQA Benchmark of German Mobile Networks

German P3 communications GmbH, a leading provider of engineering services for network test and optimization, as well as a long-term customer of OPTICOM's OEM voice quality test technology, worked with OPTICOM to investigate the application of POLQA/P.863 to recent network tests. During the latter part of 2010, in cooperation with Germany's popular "connect" magazine, P3 communications published their annual results of mobile network benchmarks, comparing the QoE offerings of T-Mobile, Vodafone, E-plus and O2.

As a premiere, the latest benchmark also included a new test scenario based on mobile-to-mobile call quality analysis (most common drive test tool scenarios only assess a mobile-to-landline scenario). While the mobile-to-mobile test case is deemed to take end user behaviour into account which better reflects increasing adoption of mobile QoE, it is also suitable to better reveal the network performance for a more challenging configuration.

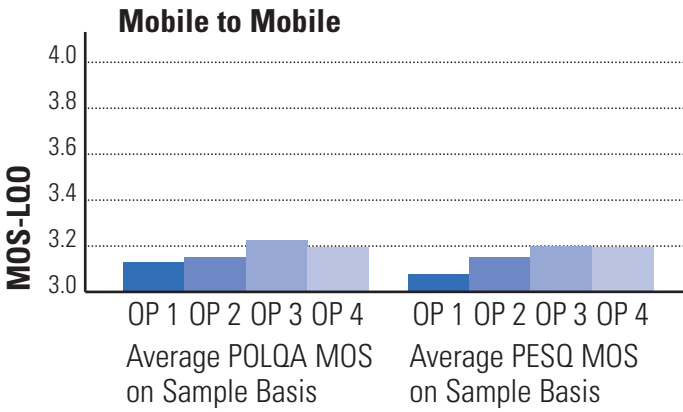
Historically, voice quality analysis has been based on the industry standard PESQ/P.862. Now, OPTICOM and P3 communications jointly investigated how this benchmark would look like when applying POLQA/P.863, instead. At first glance, the comparison of POLQA and PESQ in the diagrams does not reveal any big surprises. While generally being the more accurate measure, POLQA does not show any great difference in an established 3G/UMTS test case that is well within the scope of P.862.

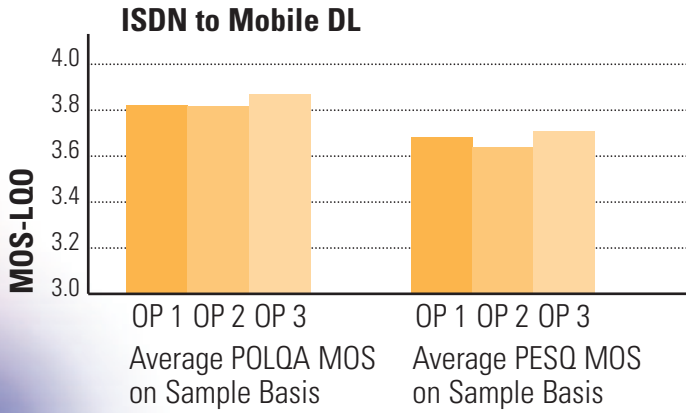
This might change immediately for CDMA and TD-SCDMA networks, along with 4G. On the other hand these results confirm that operators can easily migrate to POLQA today – thus paving the grounds for comparability with existing test data, while being readily positioned for moving towards 4G/LTE and HD-Voice analysis.

For more details on benchmark comparison or effects of applying POLQA, please feel free to contact P3 communications. Furthermore, OPTICOM's experts will be pleased to offer their support wherever possible for a seamless migration to POLQA.

Contact: Peter Seidenberg, Managing Director, P3 communications GmbH, http://www.p3-group.com/communications/

First results from POLQA benchmark of German mobile networks (top): Although minor deviations need to be further investigated, the overall trend when presenting the ranking of the mobile-to-mobile scenario, for all four operators, confirms a similar QoE level. In a further evaluation of test data, the quality gain for a mobile-to-landline scenario was also verified with POLQA (below).





OPTICOM's Technology Portfolio

Voice Quality

- **POLQA** – Next-Generation Mobile Voice Quality Testing Standard for HD-Voice, VoIP, 3G and 4G/LTE
- **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

Audio Quality

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

Video Quality

- **PEVQ** – Perceptual Evaluation of Video Quality for MOS scoring of video-telephony, -streaming and -conferencing according to ITU-T J.247

Data Quality

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

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About OPTICOM

OPTICOM GmbH is the leading vendor for Voice, Audio and Video quality measurement technology and OEM products for the analysis of mobile and IP based networks. Since its foundation as a spin-off from Fraunhofer's MP3 development team, the pioneers in perceptual quality testing have been providing by now six International world-class standards for audiovisual quality evaluation, including PESQ, PEAQ and PEVQ.

After the great success with PESQ – the industry standard for telephony voice quality testing with more than 20.000 licensed installations worldwide – the experts from Germany have been the driving force behind POLQA, the new ITU-T Recommendation P.863 and designated PESQ successor. POLQA forms the next-generation mobile voice quality testing standard for HD-Voice, VoIP, 3G and 4G/LTE, and is being offered by OPTICOM in distinct form factors for PC lab testing, OEM libraries and mobile apps.

- PEXQ is the ideal 'all-in-one' lab test suite for developers, manufacturers and operators. The 'X' just symbolizes the ongoing evolution of perceptual QoE metrics: Based on POLQA/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.
- Q-Apps mark the very latest achievement in the evolution of perceptual testing by seamlessly integrating POLQA/PESQ-based MOS scoring to mobiles and smartphones.
- 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 owned company based in Erlangen, Germany.