NEWS FROM MOBILE WORLD CONGRESS
Barcelona | 27 February - 1 March 2012

OPTICOM

QoE Measurement can be so simple.
POLQA App-2-App HD Voice Testing.
Now available from OPTICOM.

Managing the OTT Challenge:
App-2-App QoE Testing on Smartphones

At this year's Mobile World Congress, OPTICOM is promoting 'Smart Testing', that is embedding Quality-of-Experience (QoE) measurement capabilities on commercial off-the-shelf (COTS) Smartphones. As an alternative to the expensive wireless communications drive test equipment owned by Telcos, OPTICOM's App-based measurement, best described as 'App-2-App Testing', offers OTT service providers the chance to manage their QoE with Standards based end-to-end testing on the Smartphone.

> continued on page 2

Meet us at the Mobile World Congress or at one of these trade shows in 2012:

CTIA Wireless 2012
8-10 May 2012,
New Orleans, LA

CommunicAsia 2012
19-22 June,
Marina Bay Sands,
Singapore

GSMA Mobile Asia Expo
20-22 June 2012,
Shanghai

4G World 2012, Chicago
29 Oct.-1 Nov. 2012,
McCormick Place

The Perceptual Quality Experts.

Managing the OTT Challenge:
App-2-App QoE Testing on Smartphones

> Last year, the perceptual quality experts from Germany had launched POLQA, the new ITU-T Recommendation P.863 and designated PESQ successor, as an App for on-device voice quality measurement on Android Smartphones. A POLQA Q-App turns a COTS Smartphone into a powerful measurement probe that will record and analyze voice calls received from a landline call server.

Now, the POLQA downlink analysis App has been complemented by a corresponding uplink App, realizing the functionality of the called party. As with a typical call server, a second Smartphone will automatically accept any incoming calls and respond by sending back a reference voice sample. As a result Mobile-2-Mobile – that is to say App-2-App based – test calls can now be established between a pair of Smartphones, without need for expensive test equipment or special add-on hardware.

Starting with a pair of COTS Smartphones, complete walk and drive test tool systems can be realized with OPTICOM's Q-Apps. Benchmark results can easily be reported to a network monitoring centre, or uploaded and archived in 'the Cloud'. The latter approach enables sharing of benchmark data among users, or 'crowd sourcing' applications across the subscriber base. Also, as a novelty, true HD Voice network quality can be assessed during operation with POLQA operating in super-wideband mode (SWB).

Use Cases and Applications

OPTICOM's App-2-App testing solutions and Q-Apps are available under OEM license to T&M, walk & drive test tool vendors, system integrators, network operators and OTT service providers. Applications might include low-cost drive and indoor walk testing, network testing by subscriber-based crowd sourcing, premium mobile offerings based upon agreed QoE levels, unobtrusive QoE benchmarking at mission critical or high security venues and many more.

Crowd Sourcing/MOS

A recently much discussed approach to replace dedicated centralized structures, e.g. of expert subjects, by decentralized scores retrieved from a crowd. The approach also works for aggregating scores from the subscriber base rather than trying to model user behaviour with dedicated test and measurement architectures. If Q-Apps are installed on test mobiles of 'friendly users', or on subscriber's Smartphones, then QoE benchmark results could be retrieved from gathering on-device test data of any COTS Mobile instead of deploying dedicated test probes.

Cloud Archiving

By uploading and archiving voice quality scores to 'the Cloud' instead to dedicated servers under the control of a service provider, or operator, QoE results can be aggregated across DTT vendors, service providers and operators.

App-2-App

Mobile-to-Mobile on-device QoE testing by means of Apps which – while talking to each other – turn each Mobile into a measurement device for generation or analysis of test calls, video streams and data downloads.

Q-App

An App for on-device Quality-of-Experience testing on commercially available off-the-shelf Smartphones. Functionalities currently offered by OPTICOM include POLQA/P.863 and PESQ/P.862 based Listening Quality analysis (MOS-LQO), or Talker Quality analysis (ECHO, MOS-TQO).

POLQA

Perceptual Objective Listening Quality Assessment, an algorithm co-developed by OPTICOM for perceptual voice quality measurement according to ITU-T Recommendation P.863 (2011), the designated successor to PESQ/P.862.

POLQA SWB

The Super-wideband Mode of POLQA/P.863 (left), employing a sampling frequency of 48 kHz to cover higher audio bandwidth, including HD Voice, or even near CD Quality with a uniform MOS metrics.

Smart Testing

Embedding Apps for end-to-end QoE testing into commercially available Smartphones as an alternative or complement to expensive test and measurement equipment.

Mobile-2-Mobile

A test case where the voice quality of a Mobile-to-Mobile call is to be analyzed. Because the voice signal will travel through the mobile network twice, it is likely to be transcoded (almost certainly within 2G) and severely exhibited to RF distortions, this test case is more demanding and usually leads to lower voice quality scores when compared to Mobile-to-Fixed connections. Traditionally, most drive-test-tool (DTT) benchmark equipment employs a fixed line call server which is called from the Mobile. Recently, more and more benchmarks use the M2M test case to more accurately model subscriber behaviour.

HD Voice Testing

In general: *Analyzing the Listening Quality of a voice connection, capable of HD Voice service, i.e. voice transmission of higher audio bandwidth (e.g. 7 kHz or 15 kHz) compared to the legacy narrow-band telephony bandwidth of 3.4 kHz (POTS). While originally HD Voice was introduced as a feature of Next-Gen VoIP networks, it has now been introduced to various 3G mobile networks. Note that there is no HD interconnectivity between VoIP and 3G yet.*

In this context: *Analyzing AMR-WB (G.722) connections in 3G mobile networks that are enabled for HD Voice services. In Europe these include e.g. Orange (in various European countries), A1, Three (UK and Austria), Telstra, T-Mobile (Austria and Germany).*

OTT

'Over the top' voice or video services: With the increasing deployment of mobile broadband, e.g. by 4G/LTE, voice and video services can be offered by third parties 'on top' of the Internet-based infrastructure provided by Telcos, while the service provider has no knowledge, or control of the transport network infrastructure. In case of QoE issues in this highly competitive arrangement between service provider and Telco, OPTICOM's end-to-end based perceptual algorithms, like POLQA for voice and PEVQ for video are just what is needed to evaluate the quality as perceived by the users of end-to-end OTT services and without a measurement tool to be placed inside of the network.

New: On-Device App-2-App Voice Quality Analysis

POLQA Q-App initiates test call to Q-App Responder

Q-App Responder automatically answers and plays HD Voice reference sample

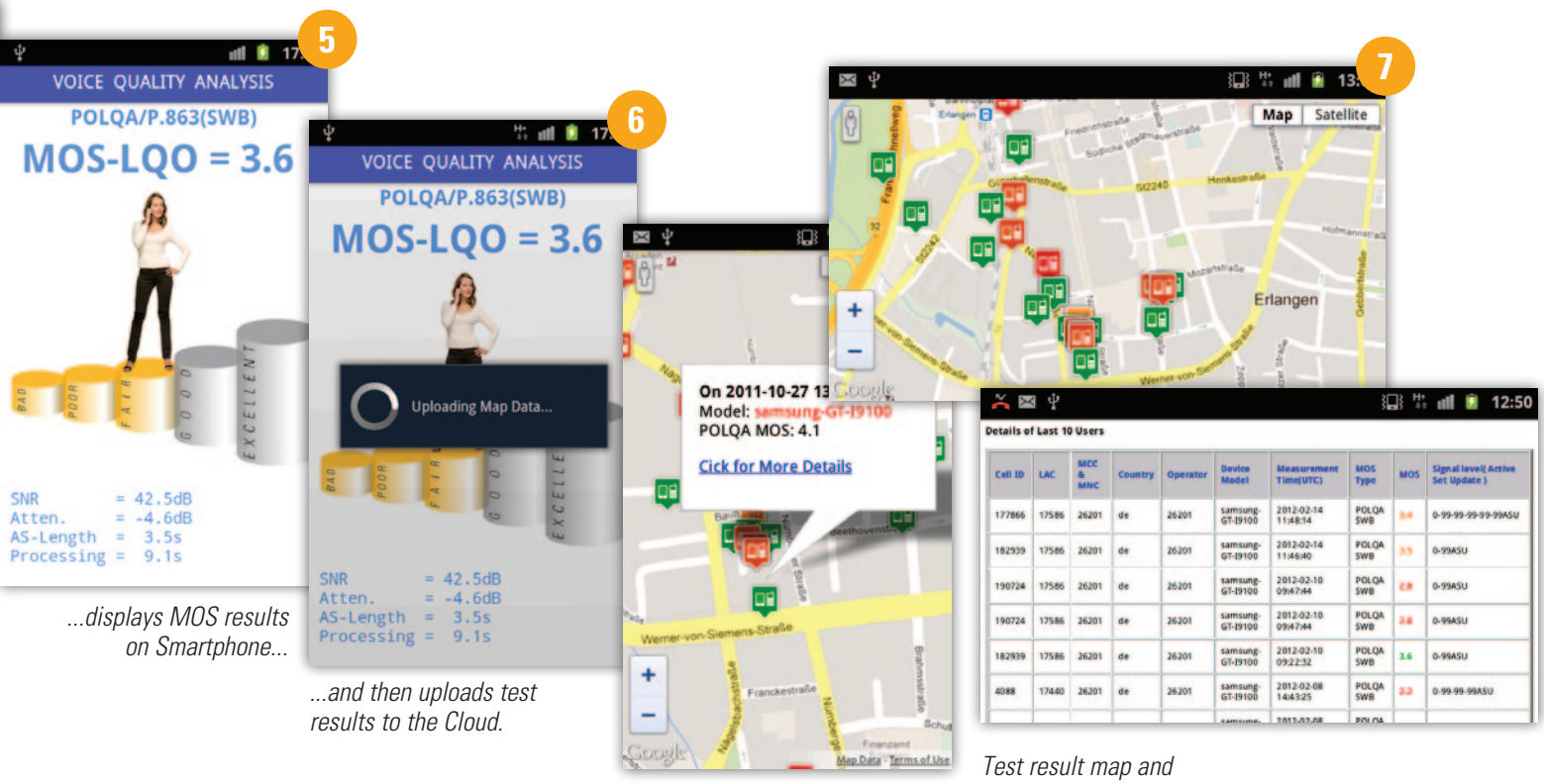
POLQA Q-App records audio signal...

...runs POLQA measurement...

NEW: App-2-App based Echo and Talker Quality Testing

With the availability of 'talking Apps', OPTICOM also announces further Q-App functionalities to address annoying echo artefacts at the talker side of a mobile call. Depending on the proper operation and combination of echo cancellers employed in both, the network and the Mobile's signal processing circuits, a mobile conversation can get very annoying if the talker is distracted by hearing his own voice with significant delay.

In contrast to POLQA, which analyzes the Listening Quality by a MOS-LQO at the downlink side, echo artefacts must be captured at the uplink - i.e. the talker - side while actively talking. By means of a tricky combination of Q-App's recording and playback functionality and based on OPTICOM's proven ECHO measurement algorithm, it is possible to accurately measure KPIs like echo attenuation and delay. Based on using true reference voice samples and adding advanced POLQA-based perceptual measurement, a MOS score characterizing the severity of the echo annoyance can be processed. In order to distinguish this Talker Quality measure from the common listening quality MOS score, it is referred to as MOS-TQO in accordance to ITU-T Recommendation P.800.1. OPTICOM's ECHO Q-App is expected to be available for OEM licensing later this year.



...displays MOS results on Smartphone...

...and then uploads test results to the Cloud.

Test result map and detailed analysis are accessable from any web browser

NEW: POLQA App-2-App HD Voice Testing

Testing mobile HD-Voice networks can be quite a challenge: Most network test equipment, like drive-test-tool (DTT) systems are composed of mobile probes and landline call servers. A test mobile establishes a call to the server, which responds by sending a reference voice sample as the signal-under-test. Up until now, most benchmarks were based on mobile-to-fixed connections, with call servers connected at the fixed network end through POTS or ISDN interfaces. These of course, are limited to the narrow-band 3.4 kHz legacy audio bandwidth.

With the increased use of mobile phones, the mobile-to-fixed approach no longer sufficiently models real subscriber behaviour. In fact the percentage of mobile-to-mobile calls has significantly increased, as have voice quality issues. Consequently, more and more benchmarks target at the more critical M2M scenario as a test case. For HD Voice, the mobile-to-fixed approach is of no avail, as the current narrow-band fixed network end will eliminate any wide-band endeavours. And even though HD Voice was originally introduced as a feature for Next-Gen VoIP networks, until now, a (transcoder-free) HD handover to VoIP is not available.

Consequently, HD-Voice calls can only be assessed within a network if the call is initiated between HD-capable Mobiles, where the operator enables the wide-band speech codec and transcoder-free operation is guaranteed thereafter. OPTICOM's Q-Apps can make use of HD-Voice enabled COTS Smartphones like the Samsung Galaxy S2 (I9100). In order to start an HD measurement, the user selects the super-wideband mode of POLQA/P.863. The POLQA Q-App will establish a test call in HD-Voice mode and connect the call server Q-App, which will respond by playback of a 16 kHz wideband reference voice sample, down-sampled from 48 kHz super-wideband. The POLQA analysis will then run at 48 kHz on the Smartphone and deliver a score almost in real time.

POLQA/P.863
on its Road to Success

A continuously updated and growing list references all licensed POLQA/P.863 companies on POLQA.INFO, the joint website of the POLQA Coalition.

Since the beginning of this year, the increasing adoption of POLQA/P.863 is not only visible by the steady growth of the entries of licensed companies listed on our reference list on www.polqa.info/licensees.html. In fact, the reference list now also comprises the five largest global players in the wireless communications drive test equipment market. Consequently, POLQA/P.863, the designated successor technology for PESQ/P.862 can soon be expected to be available on all major DTT product lines.

OPTICOM is significantly supporting the transition from PESQ to POLQA by offering preferred bundle OEM packages. Currently, this offer is limited until December 2012. By combining P.862 and P.863 based metrics in one product, users can 'softly' switch to the new metrics, but still maintain backward compatibility with a large base of well established PESQ capable measurement devices. So, this offering will protect CapEx spent, if existing PESQ based platforms are to be extended, but will also ease the decision to invest in the latest Standard's technology.

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 v1.7 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 OEM lib for Java**	• **POLQA/P.863 Q-App for Android Smartphones , now also incl. HD Voice** • 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	• ECHO-TQ Q-App for Android Smartphones • 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	• Other O/S on request

In addition to POLQA IPR licensing, OPTICOM optionally offers a variety of advanced OEM libraries for various platforms and operating systems.

Introducing the **POLQA Conformance Certification Programme**

Even though employing a POLQA OEM software library from OPTICOM already guarantees for a high degree of conformance with the ITU-T Reference design, a number of issues can occur in a product implementation, that may have an effect on the final product conformance. Experience has shown that memory limitations, RF shielding, or audio interface quality, just to name a few can significantly impact the measured MOS scores. For that reason, OPTICOM introduced a conformance testing programme for PESQ, which is now also available for POLQA.

What does the POLQA Hallmark guarantee?

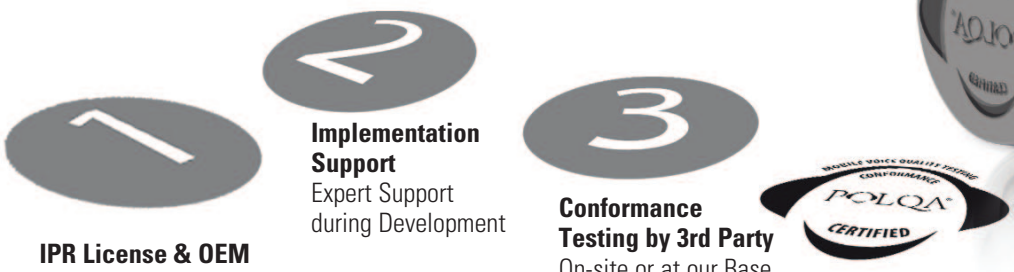
Only licensed POLQA vendors who offer products of proven conformance to ITU-T P.863 are entitled to use the POLQA 'Hallmark' logo on their products. Approaches or vendors that do not feature the POLQA 'Hallmark' logo have not reached the rigorous standard of reliability and testing required to receiving this distinction. Please feel free to contact us for further information on our POLQA conformance certification programme.

Under an OEM license agreement OPTICOM will provide the following:

1. Licensing advanced OEM libraries of proven performance for most platforms and O/S
2. Providing expert technical support during product development and implementation (off-site and optionally on-site)

In addition, we can optionally optimize the value chain for OEM vendors by

3. An independent 100% Conformance Test carried out on a product sample by OPTICOM
4. Issuing a conformance certification of the end product with the „Certified POLQA Hallmark"



IPR License & OEM Software for common O/S
‚Leapfrogging' by Advanced OEM S/W

Implementation Support
Expert Support during Development

Conformance Testing by 3rd Party
On-site or at our Base

POLQA Conformance Hallmark
Excellent Marketing Vehicle & Product Differentiator

OPTICOM, the Sole Point of POLQA OEM Licensing

The parties to the POLQA Coalition have arranged for a joint P.863 patent pool with OPTICOM as the sole licensing agent. OPTICOM, acting as a one-stop source for the POLQA technology on behalf of the POLQA Coalition, is now offering commercial license agreements for POLQA/P.863. OPTICOM provides professional one-stop IPR licensing along with advanced POLQA OEM software tools for Windows, Linux and Android for a quick time-to-market integration.

As an independent OEM technology vendor with plenty of experience in technology licensing, OPTICOM also acts as a firewall between competitive vendors and members of the POLQA coalition. All license agreements will be based on fair, reasonable and non-discriminatory terms and conditions according to the ITU-T IPR policy. SwissQual, TNO and KPN have agreed to take a passive role and will not actively engage in POLQA licensing.

In addition to the POLQA IPR license to essential patents, OPTICOM can optionally offer a variety of advanced OEM libraries for various platforms and operating systems. These OEM libraries are ideally suited to leapfrog costly design and implementation efforts during the product development phase, thus not only leading to a faster time-to-market, but also to an accurate and conforming product implementation.

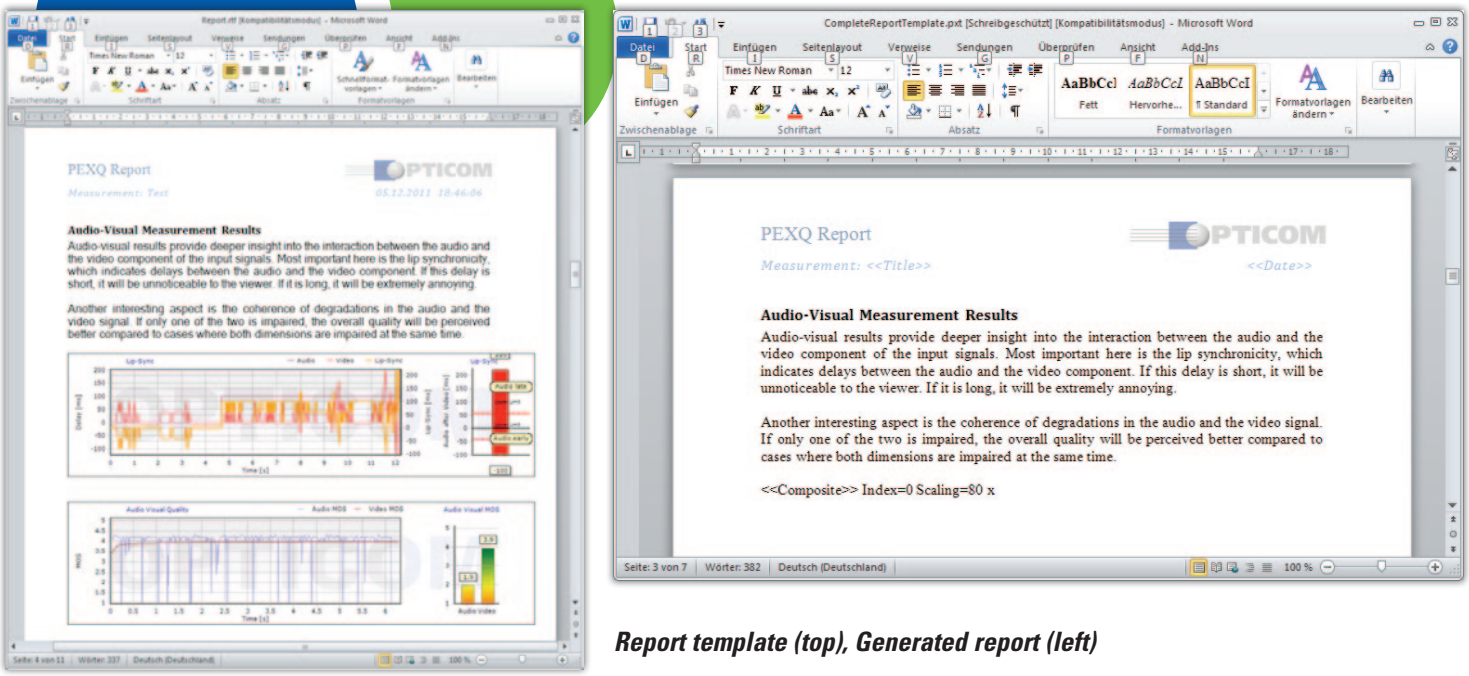
New Features
in the PEXQ Software Suite

PEXQ is OPTICOM's all-in-one solution when it comes to perceptual measurement of voice or video quality. It features all KPIs generated by our PEVQ, POLQA, PESQ, Echo and PESQ-TQ algorithms. It is easy to use through a graphical user interface and results are presented well-structured and where applicable in a graphical way. PEXQ is ideal for everyone who needs a detailed analysis of voice or video quality. Starting from February 2012, Version 1.7 of PEXQ will be released, which further extends its user friendliness and applicability.

Enhanced Reporting

Reporting not only numbers, but also graphs has always been an important feature of PEXQ. In V1.7 this has been greatly enhanced. So far it was possible to copy and paste individual graphs from the screen into e.g. MS Office documents. Now, also complete and customizable reports can be generated with a simple mouse click. Reports are based on templates which are essentially RTF documents with some special fields that will be replaced by measurement results when the report is generated. Since RTF is a standard document format which is supported by many different tools, e.g. MS Word, it is easy to customize the templates to match each organizations needs as well as look.

PEXQ™



Report template (top), Generated report (left)

The resulting reports are also RTF documents and are compatible with all recent versions of MS Office and other wide spread office suites.

Extended Scripting

A command line interface for scripting with PEXQ has always been part of the package. However, support for scripting was very basic and lacking any feedback if wrong parameters were specified. This has been completely revamped. The command line interface now supports all features of PEXQ including report generation, and of course, it gives feedback. Using the new interface it is possible to

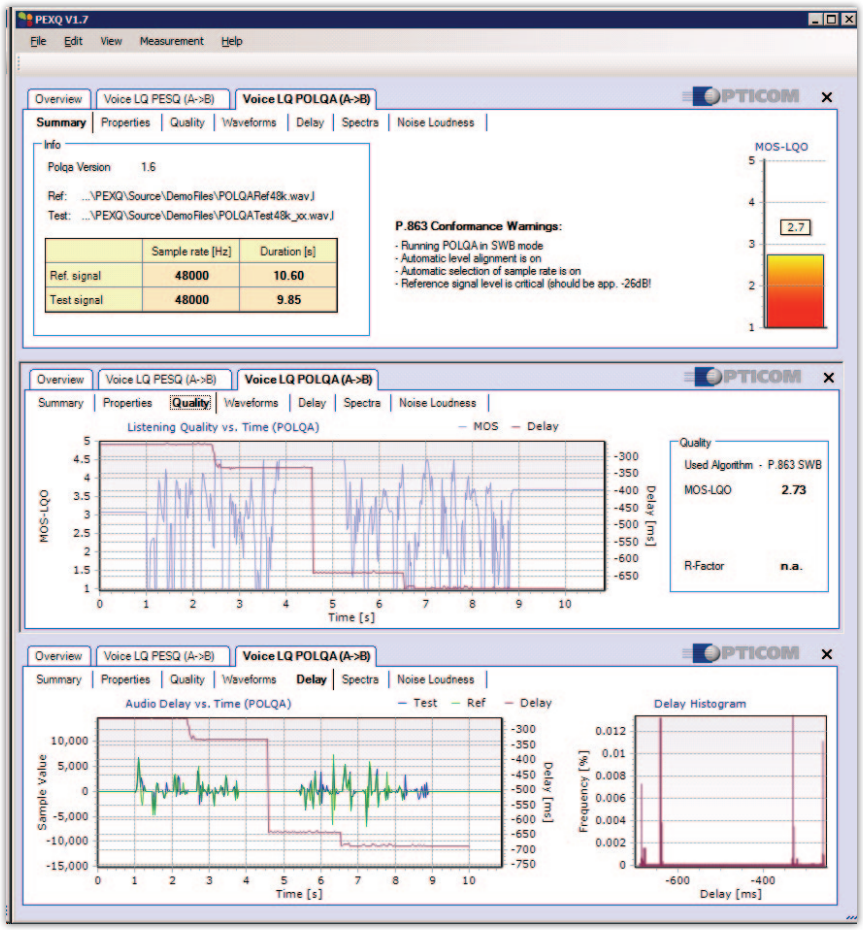
- start the PEXQ GUI in a specific configuration
- start the PEXQ GUI with script defined test files and initiate the measurement
- start a measurement with script defined test files and write the results to a file (XML or tab separated values)
- start a measurement with script defined test files and generate a report

POLQA Delay Histogram

When assessing a voice connection, the one way delay of the link is a very important key performance indicator. A frequent mistake is however to report the average delay only. While this is ok for most circuit switched networks where the delay is almost constant, it is completely wrong for packet based transmission, where delay changes occur frequently. In this case a delay of 120 ms may sound excellent, but if it is only the result of averaging two delay values of 80 ms and 160 ms which occur with the same frequency, then those 120 ms are useless information. To emphasize this, PEXQ V1.7 now also shows delay histograms for all POLQA measurements. Of course, those histograms can also be included with reports.

Compressed Result Files

PEXQ's default format for storing results is XML. Due to the wealth of results, those XML files can become very long. Starting from V1.7, these are therefore automatically compressed with the ZIP algorithm.

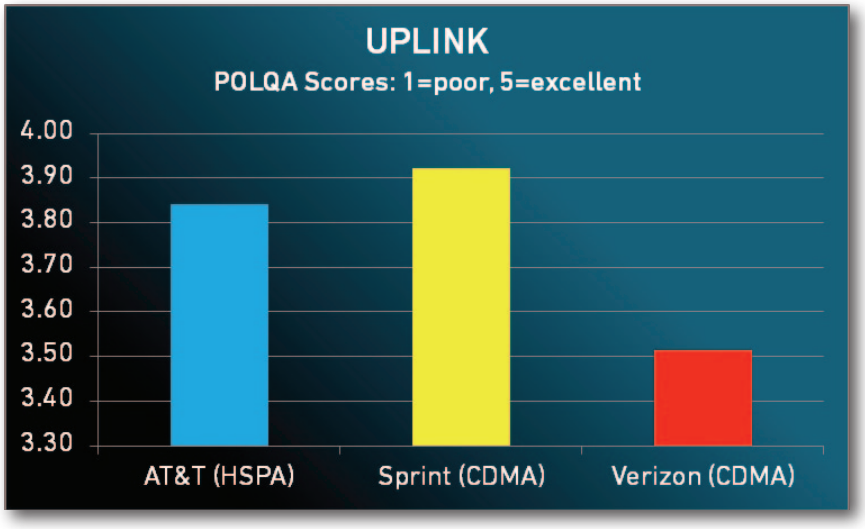


New in PEXQ V1.7:

The comprehensive graphical analysis toolset now fully supports POLQA/P.863 in narrow-band (8 kHz) and super-wideband (48 kHz) HD Voice mode (as depicted in this example). Main view with POLQA SWB MOS (top), detailed MOS versus time diagram (middle), delay versus time diagram, including the new delay histogram (bottom).

iPhone 4S Voice Quality differs among U.S. Networks

POLQA Case Study by Metrico



Voice Quality Analysis of iPhone 4S on three U.S. Networks

One of OPTICOM's OEM customers for voice quality algorithms reports to have integrated POLQA/P.863 into its global voice quality measurement system, infrastructure and services, to meet growing demand for performance evaluation on next-generation networks.

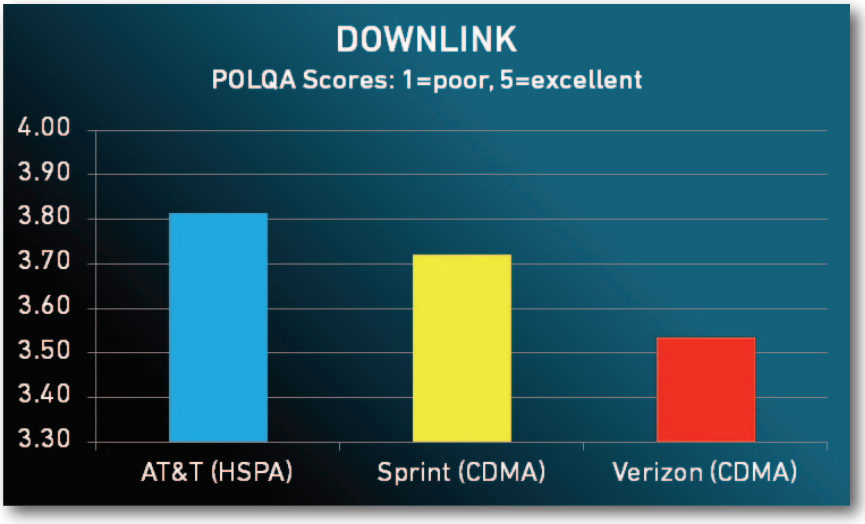
Metrico Wireless is a leading provider of device performance analytics to operators and OEMs. As the mobile experience is increasingly centered on the device, and as industry competition to deliver the best device continues to heat up, operators and OEMs need objective and representative information on how these products perform – from the subscriber point of view.

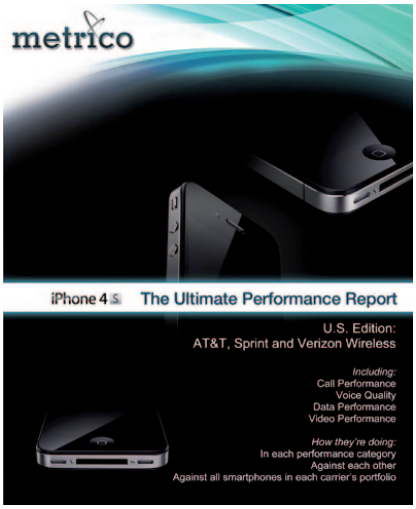
Since 2003, Metrico has certified over 700 handset models as "Fit4Launch," and has rated over 150 models after launch, on critical performance areas such as voice quality, call performance, data throughput and reliability, video performance and battery life. The company has supported PESQ/P.862 to become the standard by which five of the top seven U.S. operators evaluate voice quality.

Three industry trends are compelling Metrico to enhance its voice quality measurement platform with P.863 POLQA. First, unlike the rest of the world, U.S. mobile voice networks are still based on a diversity of technologies – including GSM, UMTS and CDMA – and comparative metrics across technologies are needed.

Second, with four of the top U.S. operators in advanced stages of deploying LTE, the need for the next generation of voice quality algorithm has become more critical.

By Courtesy of Metrico taken from:





And third, device OEMs are learning from Apple's example of truly global devices, to deliver products that work across technologies and world regions. This approach results in increased efficiencies for the producer, as well as a consistent experience for the consumer.

The commercial introduction of POLQA is therefore ideally timed to address these trends. Upon the launch of the Apple iPhone 4S, a common device for UMTS and CDMA networks, Metrico was able to evaluate and publish voice quality across technologies for the first time. Metrico collected approximately 9,000 downlink and uplink samples across three diverse geographic markets, utilizing two iPhone 4S's and one reference device on each operator's network to normalize results for network variability. The results provided unprecedented insights into the differences in voice quality, for the same device, on different end-to-end architectures. For example, even though Sprint and Verizon use the same radio access technology – CDMA – they have significantly different performance, especially on the uplink.

The industry is seeking to measure performance with a uniform approach, not just across technologies but across geographies as well. OEMs are planning to release common devices for all operators. Metrico is addressing this requirement by enabling POLQA in its Nomad Call & Voice Measurement System, connected through the global cloud to call and voice servers distributed in multiple regions. Manufacturers – and operators, chipset suppliers, and other industry players – can implement large-scale, automated yet centralized tests of device performance.

Contact: Amit Malhotra, Vice President of Marketing, Metrico Wireless

http://www.metricowireless.com

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 30.000 licensed installations world-wide – 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.