



## Q-App OEM Library

Build your own on-device HD Voice Test App with OPTICOM's Building Blocks for Voice Quality Testing on Android Smartphones

### The Concept Behind Q-App

The Q-App Client is a QoE test App for embedded HD as well as traditional narrowband voice quality measurement on Android based handsets. OPTICOM's Q-App OEM Library provides the basic APIs to implement this functionality with minimal development cost and fast time to market. For customers who prefer to use their own modules for recording, call control etc., OPTICOM offers the stand alone POLQA OEM Library which allows for fast, standard conforming, implementations of voice quality measurements based on recorded signals.

The basic concept consists of one phone running the Q-App client and calling a Q-App Server or responder (in principle an answering machine). While the server plays a known reference speech signal, the client records the received downlink signal. After the test call the client compares the recorded signal with the known reference signal and determines the speech quality according to POLQA / ITU-T Rec. P.863.

### Key Features:

- Advanced MOS Voice Quality analysis for commercial off-the-shelf Android Smartphones
- App-to-App testing, software-only based
- Realization of inexpensive Walk-and Drive-Test Tools (DTT)
- Standard-conforming ITU-T P.863/POLQA and ITU-T P.862/PESQ support
- POLQA HD-Voice testing of HD enabled 3G mobile networks
- OEM support for latest Smartphone models
- Full featured OEM library for short time-to-market

### 3 Q-App - Client App

Based on the building blocks provided by OPTICOM's Q-App Library in combination with the POLQA OEM Library, it is quite straightforward to write your own Q-App application. With just a few function calls to our Q-App Library, an application as below could be implemented

- Q-App will setup a test call to the selected voice server, which will respond by playing back a reference voice file, just like an answering machine.
- While the server sends the reference voice sample over the network, Q-App will capture the downlink signal and store the voice sample into a file.
- Following server disconnection, Q-App proceeds to analyze the voice quality by comparing the captured voice sample to the stored reference to obtain the MOS-LQO

value. OPTICOM's advanced POLQA reference algorithm (ITU-T P.863) is applied for the voice quality measurement.

- The results of the measurement include the MOS for voice quality, together with additional indicators for signal strength, cell information and geographical position.

OPTICOM would also welcome enquiries for our feature packed Q-App Client App. Although this would need to be customized to meet your requirements, we will be happy to offer our services for such adaptations.

### 3 Q-App Client App

Q-App Library

- 2 Location API
- Call Control API
- Recording API
- 1 POLQA OEM Library

The Q-App OEM library is a software library intended for developers who want to implement functionality similar to OPTICOM's Q-App. It encapsulates all features which are required to set up a call, record the speech signal, and analyze the recorded signal with POLQA (ITU-T P.863). Additional, functions are provided to simplify the acquisition of

### 2 Q-App - Client OEM Library

indicators for geographical location, cell information and signal strength. The entire functionality is available through a few simple to use APIs.

The Q-App OEM Library requires no additional hardware components or accessories for recording the downlink signal. The internal microphone of the Smartphone is soft-muted to avoid acoustic ambience noise affecting the evaluated audio signal.

- Basic cell information, signal strength and position can be monitored and stored during the call.
- Recording of the downlink audio signal can be in narrowband (300-3500 Hz) or wideband (50-7000 Hz), depending on the handset capability.

- Basic checks of the signal integrity and completeness of the recording are performed prior to starting the analysis of the voice quality.

By making use of OPTICOM's POLQA OEM Library (available separately), the voice quality measurement will be performed by POLQA (ITU-T P.863).

Please note:

- At this time, Q-App variants support signal recording on the downlink only. Playing a voice signal to the uplink is currently not available.
- The server component is not part of the Q-App OEM library.

### 1 POLQA/P.863 Core OEM Library for Android

The voice quality measurement will typically be performed by POLQA (ITU-T P.863), making use of OPTICOM's separately available POLQA OEM Library. POLQA is a very high accuracy full reference measurement algorithm, which allows narrowband as well as super-wideband (50-14000Hz) measurements.

The main result is a MOS score representing the voice quality as it would be perceived and scored by a human listener. POLQA is the latest ITU recommendation for listening quality assessment, which was developed by OPTICOM, TNO and Swissqual. Licenses for POLQA are solely available through OPTICOM. OPTICOM's

implementation of POLQA is optimized for speed and it is 100% tested for conformance with the ITU recommendation. In addition to the plain MOS, a wealth of additional KPIs are provided. In contrast to the Q-App Library, the POLQA Library is highly device independent and will run on almost any Android based handset.

## POLQA Performance Figures

The speed of Q-App is mostly determined by the duration of the call plus the processing time for POLQA. While the call duration is fixed, device independent and can only marginally be varied by varying the length of the reference signal, the duration of the

POLQA calculation varies significantly for different Smartphone models. Some figures are shown in the table below.

Depending on the input data to POLQA, the processing time varies significantly. The processing times measured contain the

entire time spent in the POLQA OEM library. The time required for opening and reading the wave files is excluded. Table 1 gives an overview of the performance of the library when using POLQA for the voice quality measurement.

Device	Android Version	Performance narrowband (fs=8 kHz)	Performance super-wideband (fs=48 kHz)
SAMSUNG GT-I9100 (S2)	2.3.4	48.7%	131.9%
SAMSUNG GT-I9210 (S2-LTE)	2.3.6	60.3%	156.7%
SAMSUNG GT-I9300 (S3)	4.0.4	40.7%	106.2%
SAMSUNG GT-I9305 (S3-LTE)	4.1.2	41.0%	106.1%
SAMSUNG GT-I9505 (S4)	4.2.2	26.0%	77.0%

**Table 1:** Table 1: Performance of the OPTICOM POLQA OEM Library V1.7/V1.11 (Status: Feb 2014). All performance figures are given in processing time as a percentage of the speech file duration. E.g. 100% corresponds to real-time, i.e. a 10 s call is processed in 10 s. Consequently, 10% means execution is in 1 s, that is, ten times faster than real-time. Only the pure processor times are measured, excluding program start and file IO. Please note that the processing time of POLQA is depending on the degradations in the file and may vary by up to 100%. The numbers above are averaged over many file pairs.

## Commercial Availability

### 1 POLQA/P.863 Core OEM Library for Android

The POLQA/P.863 core algorithm OEM library is available for Android and various other O/S from OPTICOM under a POLQA license agreement for small- or large volume use. A starter package covers the contract setup-fee and development licenses. Per product licenses can be acquired on-demand.

### 3 Q-App – Client App

The stand-alone Q-App, along with its GUI is currently a prototype application and for demonstration only. If you are interested in a Q-App implementation, including a customized GUI and database upload, then please feel free to discuss with OPTICOM about availability on mobile devices and versions. Of course, Q-App is also built using the Q-App OEM library and OPTICOM’s POLQA Core OEM Library.

### 2 Q-App – Client OEM Library

The Q-App – Client OEM Library is available to POLQA/PESQ OEM licensees as an add-on to core OEM license agreements. A starter package includes executable code, a demo application, documentation and the development support. Run-time licenses may apply. While the Q-App – Client OEM Library builds on OPTICOM’s POLQA/PESQ core OEM libraries (1), POLQA (and/or PESQ) core libraries must be licensed separately.

### 4 Q-App Server/Responder

The Q-App Server/Responder accepts incoming calls from the Q-App Client App and responds by playing the stored reference voice file. OPTICOM’s Q-App Server/Responder consists of a commercial off-the-shelf (COTS) Smartphone, but with a special image flashed to it. As a major advantage, compared to VoIP or ISDN based responders, the Q-App Server/Responder on a COTS Smartphone fully supports HD-Voice mobile connections without transcoding.

The Q-App Server/Responder is currently not available as a software-only product and cannot simultaneously serve as a Q-App Client App, however ongoing development is expected to include integration of the Q-App Server/Responder within the Q-App OEM library.



## Supported Devices

The Q-App OEM library is currently available for the Android handsets listed in Table 2. If a phone is not listed in here, this does not necessarily mean that the Q-App APIs will not work, it purely means that the device has not been tested or that the functionality may be restricted. Please note that during the installation root privileges may be required for some devices. After installation there is no further requirement for root access.

Device	Chipset	Android Version	Rooting Required for Installation
SAMSUNG GT-I9100 (S2)	Samsung Exynos 4210	2.3.4	No
SAMSUNG GT-I9210 (S2-LTE)	Qualcomm APQ8060	2.3.6	Yes <sup>1</sup>
SAMSUNG GT-I9300 (S3)	Samsung Exynos 4412	4.1.2	Yes
SAMSUNG GT-I9305 (S3-LTE)	Samsung Exynos 4412	4.1.2	Yes
SAMSUNG GT-I9505 (S4)	Qualcomm APQ8064T	4.2.2	Yes

<sup>1</sup>A special device driver needs to be installed and controlled by the application.

**Table 2:** Devices supported by the Q-App OEM Library (Status: Feb. 2014).

### 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 audio-visual 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 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.

PEVQ-S, the novel test algorithm for QoE Measurement of Streaming Video marks the very latest achievement in the evolution of perceptual testing by extending existing International Standards to fit the needs of the industry's fast pace.

OPTICOM's proven OEM technology can be found in most state-of-the-art products of leading T&M vendors. OPTICOM GmbH is a privately owned company based in Erlangen, Germany.



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