

# Advanced Perceptual ECHO Measurement Tool



OPTICOM's Advanced ECHO measurement tool provides accurate and repeatable estimates of multiple audio signal echoes in a telephony network. Each detected echo is characterized by an Echo Return Loss (ERL) and its echo delay plus it is tested whether each echo is likely to be perceived as acceptable or annoying by a customer. The ERLs and the echo delays are measured by analyzing audio signals sent (reference audio signal) to and received (echo audio signal) from a network.

The Advanced ECHO measurement technology is the latest out of OPTICOM's family of products for network quality assessment tools. Compared to other echo measurement algorithms OPTICOM's approach is unique because it uses real voice signals for the measurement rather than e.g. sine tones. OPTICOM's ECHO tool can be widely used in active testing in both lab environments and in network test equipment.

## Voice Quality Testing

### OPTICOM Product Line:

#### Voice/Audio Quality

PESQ ITU-T P.862

3SQM ITU-T P.563

PSQM ITU-T P.861

#### ECHO

PEAQ ITU-T BS.1387

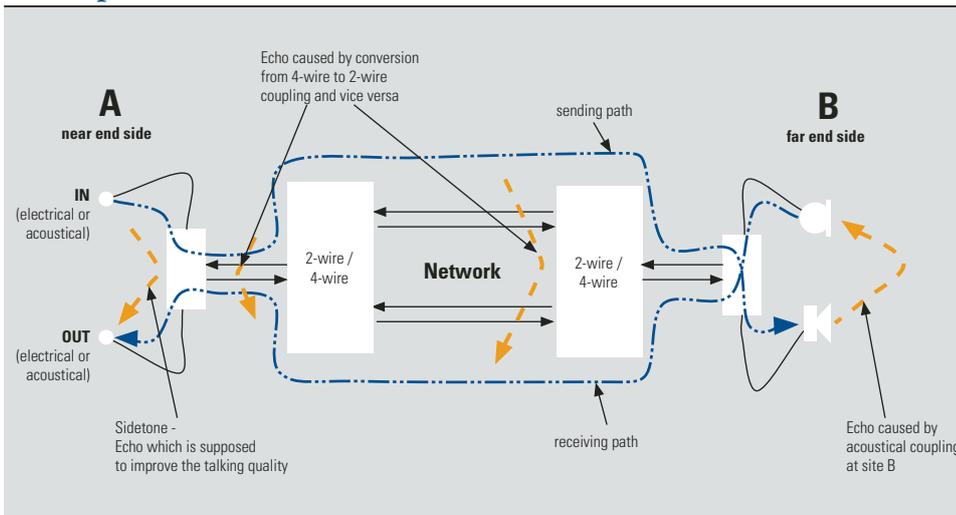
#### Video Quality

PEVQ

#### Network Quality

VQmon

## Principle



OPTICOM's Advanced ECHO algorithm determines the echoes with the help of long term correlations of the speech signals at a voice network's input and output (see figure above). One advantage of using real voice signals over ordinary sine tones – as other algorithms propose – is that a voice signal is closer to the real world telephony situation. Sine tones might be treated more or less rigid by a network compared to real voice signals. For example echo cancellation devices employed in the network might be able to easily filter out detected sine tones but they might have difficulties handling a complex voice

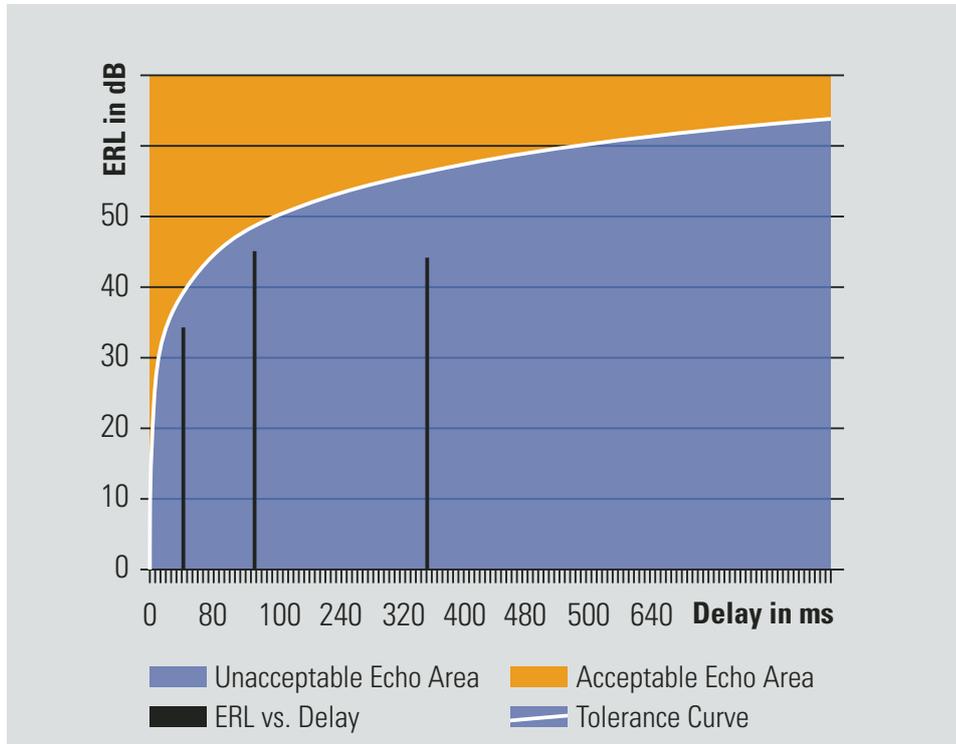
like signal. Using real speech signals for the measurement becomes even more valuable in digital e.g. VoIP networks, where signal delays increase due to the additional requirement for signal processing and without active echo cancellation methods or suppressors the echo signal would return to the talker annoyingly unattenuated. Another advantageous side effect is that through the speech signal's natural modulation a best match of the two correlated signals can be found with higher accuracy than with sine tones. Therefore the results become more robust against clipping and noise.

### Key Features:

- Echo Return Loss (ERL) and echo delays
- OEM product available as DLL/Library optimized in performance and memory requirements
- Detailed statistics of the occurrence of echoes for e.g. comprehensive graphical display and further analysis
- Robust measurements even if the echoes are heavily distorted
- Multiple echo detection

The diagram below gives you an example of the results of a typical measurement with OPTICOM's ECHO after the data was evaluated with a spread-sheet program. The diagram is divided into two distinct areas separated by an extrapolated and approximated talker echo tolerance curve derived from the ITU-T standard G.131. All echoes (peaks) that do not reach out of

the blue area are generally likely to be perceived as annoying while all peaks that reach into the orange area are sufficiently attenuated and are tolerable – if perceived at all. Here, easily three echo peaks can be identified which lie in the blue area of the diagram. These echoes are too loud to be negligible and are very likely to be perceived as annoying by a customer.



### About OPTICOM

With PSQM, PESQ and PEAQ, OPTICOM GmbH, the pioneer in perceptual quality testing has been providing three international world-class standards for voice and audio quality measurement since its foundation in 1995. With their new single-sided speech quality measure 3SQM™, a joint development with partners, the perceptual experts from Germany now presented their fourth ITU standard. At its 10th anniversary, the presentation of the new PEVQ™ video measure leverages the company's huge experience towards the multimedia testing domain. Recognized an industry reference, OPTICOM's OPERA voice/audio quality test tools are available to users world wide. And while specialized on OEM customers in particular, the directory of OEM licensees today reads like the 'Who-is-Who' of the Telecoms industry. OPTICOM is a privately held company located in Erlangen, Germany.

## Specifications

### Advanced Perceptual ECHO Measurement Tool

#### Functionality

- Echo Return Loss (ERL); echo attenuation in dB
- ERLs and echo delays for multiple echoes
- Perceptual estimation of echo annoyance, using subjective analysis results as stated in ITU-T G.131
- Additional measurement outputs for comprehensive analysis
- Narrowband and Wideband operation
- Real speech signals for analysis

#### Input

- Two audio signals required: Reference speech signal and echo signal
- 16 bit linear audio sampled at 8kHz and 16kHz
- 6 to 20 seconds in length

#### Output

- ERL / Delay for multiple echoes
- Statistical information of the echo analysis, e.g. ERL / Delay histogram
- Comprehensive evaluation of the echoes influence on conversationally perceived quality

#### Platform

- Windows
- Linux

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