



**OPERA**  
YOUR DIGITAL EAR!

## Voice/Audio Quality Analyzer

The Objective Perceptual Signal Quality Analyzer setting the Standards

### Comprehensive, end-to-end quality analysis based on perceptual measurement

The OPERA™ Voice/Audio Quality Analyzer represents the latest developments to objectively evaluate and assure the quality of compressed voice and wide-band audio signals, based on modeling the human ear. With OPERA you can achieve a comprehensive analysis of the end-to-end quality of today's and next generation networks, such as 3G VoIP, VoDSL, VoATM, ISDN, GSM, POTS, from the caller to the callee. Also, you can test the audio quality of compression formats such as MP3,

AAC, AC3, Microsoft Windows Media, from the studio source to the receiver, or from the server to the client.

For the test engineer, one of the issues is how to apply a computer model of the human ear to a test circuit, or to a live network environment. For this reason, OPTICOM developed OPERA as an open, easy to configure hardware platform that can process perceptual models, which are implemented just by software. The basis of the OPERA system is a portable 'lunch

box' type of PC host system. Four slots can take various kinds of interfaces. Alternatively, OPERA is now also available in a rack-mountable form factor. For R&D and lab applications, a cost effective software-only version with reduced functionality is offered, as well. Supported Operating Systems are Microsoft Windows NT™, Windows™ 2000, Windows™ XP, Windows™ 2003.

# Key Functionality at a Glance

## Voice Quality Measurement

- **PESQ**, the new state-of-the-art perceptual evaluation of speech quality according to **ITU-T rec. P.862** [2001], combines PSQM with PAMS, optimized for VoIP and hybrid end-to-end applications, MOS and MOS-LQ calculations. PESQ wideband functionality (PESQ-WB) is also included.
- **PSQM/IP**, perceptual speech quality measure according to **ITU-T rec. P.861** [1996], incl. advanced delay compensation for end-to-end measurements, developed by OPTICOM
- **PSQM+**, advanced perceptual speech quality measure according to ITU-T COM 12-20 [1998]
- **Echo** measurement based on real speech, Echo Return Loss ERL<sub>peak</sub>, ERL vs. delay
- **Transmission Rating Factor R** according to ITU-T G. 107 (E-Model), available with PESQ only
- **One way delay measurement**, with PESQ also **delay jitter vs. time** and delay distribution
- Measurement under **double talk** conditions
- One way and two way measurements
- **Bulk call** generation
- **H.323** interface functionality using Windows NetMeeting™ and audio interfaces
- **VAD analysis**, Front-end clipping **FEC**, hold-over time **HOT** and dropout measurement
- **Background noise** measurement
- Signal-to-noise **SNR** measurement of speech and silent parts of a test signal
- User definable state machines supported for E1 MFC-R2, E1 CAS-R2, T1 CAS

## Audio Quality Measurement

- **PEAQ**, perceptual evaluation of audio quality according to **ITU-R rec. BS.1387** [1999], Basic and Advanced Model
- **48 kHz** and **44.1 kHz** sampling rates supported
- Result logging functionality, including user definable log intervals and quality score threshold
- Trigger functionality for targeted analysis of on-line or long duration test signals

## Common Functionality

- Advanced delay compensation for end-to-end measurements, suitable for constant and variable delays (VoIP), developed by OPTICOM
- Delay measurement with real speech/music. Results in samples as well as ms
- Attenuation measured in dB
- On-line real time acquisition and analysis capability
- Comprehensive scripting interface
- Remote Control over IP
- **DDLC™** improved timing accuracy (Dynamic Driver Latency Compensation)
- Play and record functionality for wide band audio as well as voice signals
- Easy-to-use graphical user interface
- Extensive scripting and command line options

## OPERA™ Control Center: Easy Scheduling and Remote Control Functionality

- User friendly graphical interface for setting up a schedule of test calls between OPERA™ systems
- Automated remote control of a single or various OPERA™ systems via IP connection
- More than 3.000 measurements per day, more than 20.000 BHCA (call attempts per hour)
- Automatic synchronisation and allocation of the resources
- Commands may be automatically repeated and rescheduled after a certain time (e.g. every Monday)
- Applicable to telecom and wide band audio applications
- All result values as in the voice and audio quality measurement functionality are available (except for graphical diagrams), like PESQ, PSQM/IP, PSQM+, PEAQ, Echo scores etc.
- PDD measurements (Post dial delay)
- Total call duration measurements
- Termination cause indicator
- All measurement results available at a glance
- Result view filtering by connections and/or QoS results (e.g. only connections with poor listening quality are shown)
- Measurement results may be exported to any spread sheet, data base program or network management system for further analysis
- Statistics and charts

## Graphical Displays

- Time signal displays, zoomable
- FFT Spectra, zoomable
- Excitation and various psycho-acoustic parameters, like NMR, Masked Threshold and Loudness
- Audible distortion measurement
- Result summary display with MOV, PSQM MOS, PESQ MOS and PEAQ ODG numerical scores and bar graphs
- Delay Jitter vs. Time min/max scores and graph (PESQ)
- Echo Return Loss vs. Delay
- and many other features (list not comprehensive).

## Interfaces

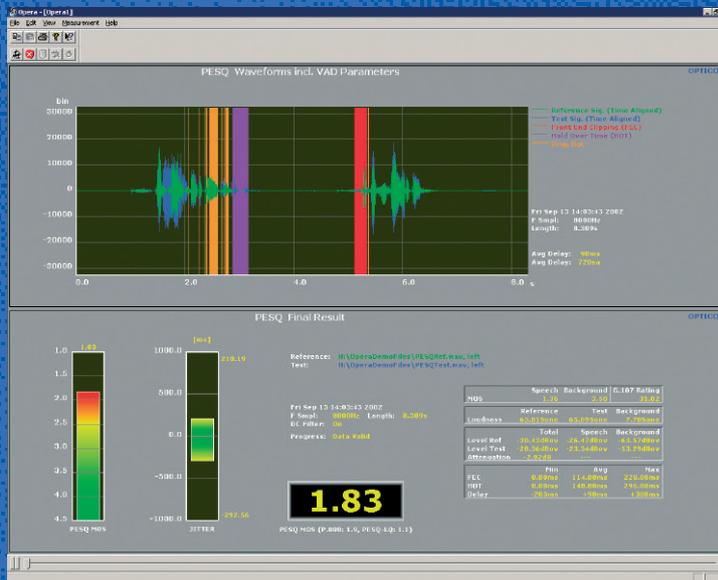
- Four port analog POTS interfaces
- Dual- or quad-port E1/T1 trunk interfaces, fully software configurable for a variety of protocols: ISDN PRI, E1 MFC-R2 CAS, E1 CAS-R2, T1 CAS/Robbed Bit, both, FXO and FXS types. 120 Ohm RJ48C, optional adapter kit for 75 Ohm Coax
- Professional stereo 24 bit analog/digital audio interfaces, XLR balanced, AES/EBU. With optional multimedia adapter kit **also applicable to VoIP terminal and IP phone testing**
- **Interfaces can be freely combined** in a system

# Applications and Features

## A Flexible and Reliable Tool to Assess a Large Variety of Systems Under Test

- End-to-end voice quality testing of 3G, VoIP, VoDSL, VoATM, ISDN, GSM, POTS, based on real world speech signals
- Measure VAD behaviour, echo cancellers and signal enhancers with any speech signal
- End-to-end wide band audio quality testing of MP3, AAC, AC3 and Microsoft™ Windows Media™
- Interactive or automated unattended measurements
- Immediate overview of the QoS of your network based on standardized metrics
- Plenty of detailed views and graphs provided for further fault analysis, incl. voice or wide band audio quality, echo, delay, jitter, VAD behaviour and call timing

- Stress your network in order to observe the effects on the transmission quality (bulk call generation)
- Monitor the QoS of any corporate, public or long distance network
- Remote control a single or numerous OPERA™ analyzers via an IP connection. Share a pool of OPERA™ systems in your test lab with other developers. Conveniently control the pool from your office PC
- Freely combine various interface types in every measurement (e.g. VoIP calls from POTS to a VoIP terminal)
- Include the acoustical path in the measurement using a head and torso simulator (HATS)
- Monitor broadcast networks on-line



OPERA Control Center

Start	Stop	Edit Comands	Edit Resources	Continue Refresh	Pause Refresh	Refresh	Select Columns												
Origin	Termination	Comment	CommentO	CommentT	Index	Tpdd	TermCause	Attenuation	EchoDelay	ERL	PesqMOS	PesqAvgDelay							
<b>Total Average</b>						<b>3 0</b>	<b>2</b>	<b>119</b>	<b>19</b>	<b>4</b>									
<b>Average (Los Angeles)</b>						<b>2.69 0.00</b>	<b>2.43</b>	<b>115.47</b>	<b>19.16</b>	<b>3.61</b>	<b>-35.1</b>								
4	2.69	connect				2.21	114	18.6521	3.74035	5.288									
29	2.63	connect				2.22	114	18.5031	3.73768	3.288									
31	2.69	connect				2.21	99	18.4707	3.7344	3.288									
22	2.69	connect				2.22	99	18.4653	3.75155	3.288									
13	2.69	connect				2.21	97	18.4218	3.7395	3.288									
18	2.69	connect				2.22	98	18.298	3.74393	3.288									
<b>Shortcuts</b>																			
1	ResourceName	Comment	SystemName	LineInterface	PhoneNumber														
3	Boston	-	localhost	1	102														
2	Dallas	-	localhost	3	104														
3	Los Angeles	-	localhost	2	103														
2	New York	-	localhost	0	101														
Add Edit Delete Read again Close																			
Record 3																			
<b>DisPatcherCmd</b>																			
Enable	Comment	Origin	Termination	Filename	StartTime	EndTime	Repetitions	Delay	Reschedule										
<input checked="" type="checkbox"/>	Day	New York	Boston	c:\programme\opera\DefaultRefFile.wav	01/04/2000 12:25:00	01/04/2002 12:25:00	10000	0	Immediately										
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<input checked="" type="checkbox"/>	Night	New York	Boston	c:\programme\opera\DefaultRefFile.wav	01/04/2000 12:25:00	01/04/2002 12:25:00	10000	0	Immediately										
<input checked="" type="checkbox"/>	Night	Los Angeles	Boston	c:\programme\opera\DefaultRefFile.wav	01/04/2000 12:25:00	01/04/2002 12:25:00	10000	0	Immediately										
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<input checked="" type="checkbox"/>	Night	New York	Boston	c:\programme\opera\DefaultRefFile.wav	01/04/2000 12:25:00	01/04/2002 12:25:00	10000	0	Immediately										
Add Edit Delete Read again Close																			
Record 1																			

# Why OPERA sets the Standards:

- Objective perceptual evaluation of compressed voice/audio signals modelling recognized listening test procedures, based on natural speech/music
- Original reference implementations from the co-developers and originators of the ITU standards, incl. KPN, BT, OPTICOM
- Direct relation of measured QoS to customer's satisfaction
- Efficient diagnostic tool for next generations hardware/networks design

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## Common System Specifications:

### OPR-1XX-XXX-P Objective Perceptual Analyzer, OPERA™

Basic portable framework system, incl.

- Dual Pentium IV Architecture
- 15" XGA TFT Display, 1024x768
- German, US or International keyboard
- Integrated Trackpad
- Power Supply Unit 240/120 V
- Microsoft™ Windows 2000
- OPERA Framework Software v3.5
- Control Center Light
- OPERA User's Manual
- Trolley Soft Case
- 1 year extended maintenance and support
- Alternatively available as rackmounted version

## Voice Testing Configurations:

### OPR-101-ESQ-P OPERA™ voice quality tester, incl.

- PESQ/P.862/P.862.1
- PSQM/P.861, PSQM+, PSQM/IP
- Echo return loss and delay (w/ real speech)
- Four port analog POTS interface
- OPTICALL™ Signal Acquisition Software

### OPR-111-ESQ-P same as OPR-101-ESQ-P, add. incl.

- 2x 24 bit analog/digital audio I/O interface option for multimedia terminal testing (e.g. PC-to-phone)

### OPR-121-ESQ-P same as OPR-101-ESQ-P, add. incl.

- 2 x Stereo 24bit analog/digital audio I/O interface option for multimedia terminal testing (e. g. PC-to-phone)

### OPR-101-SQM-P OPERA™ voice quality tester, incl.

- PSQM/P.861, PSQM+, PSQM/IP
- Echo return loss and delay (w/ real speech)
- Four port analog POTS interface
- OPTICALL™ Signal Acquisition Software

### OPR-111-SQM-P same as OPR-101-SQM-P, add. incl.

- 2x 24 bit analog/digital audio I/O interface option for multimedia terminal testing (e.g. PC-to-phone)

## Options for Voice Testing Configuration

### OPR-002-E1T-P E1/T1 Option for OPERA Voice Testing Configuration

- Dual Port E1/T1 Interface, software configurable
- 120 Ohm RJ48C

### OPR-000-EAQ-P PEAQ s/w option for OPERA Voice Testing Configuration

- wide band audio testing algorithm (software only)
- PEAQ/BS.1387 Advanced
  - PEAQ/BS.1387 Basic Model

### OPERA™ Control Center server software for automated use incl.

Remote control OPERA systems over TCP/IP

### OPR-003-CTR-X

- 3-User license

### OPR-010-CTR-X

- each user license from 4 up to 10 users (others on request)

## Audio Testing Configurations

### OPR-120-EAQ-P OPERA™ audio quality tester, incl.

- PEAQ/BS.1387 Advanced Model
- PEAQ/BS.1387 Basic Model
- 2x Stereo 24bit analog/digital audio interface option, sym. XLR, AES/EBU

## Combined Voice+Audio Testing Configurations

### OPR-121-ASE-P OPERA™ voice+audio quality tester, incl.

- PESQ/P.862/P.862.1
- PSQM/P.861, PSQM+, PSQM/IP
- Echo return loss and delay (w/ real speech)
- Four port analog POTS interface
- OPTICALL™ Signal Acquisition Software
- PEAQ/BS.1387 Advanced Model
- PEAQ/BS.1387 Basic Model
- 2x Stereo 24bit analog/digital audio interface option, sym. XLR, AES/EBU

### OPR-121-ASQ-P OPERA™ voice+ audio quality tester, incl.

- PSQM/P.861, PSQM+, PSQM/IP
- Echo return loss and delay (w/ real speech)
- Four port analog POTS interface
- OPTICALL™ Signal Acquisition Software
- PEAQ/BS.1387 Advanced Model
- PEAQ/BS.1387 Basic Model
- 2x Stereo 24bit analog/digital audio interface option, sym. XLR, AES/EBU

## Other Options for Voice and Audio Testing Configuration

### OPR-991-SUP-X

1 year extended maintenance and support, available to all OPR-xxx products

### OPR-810-XXX-X OPERA™ multimedia adapter set, 1 set

(e.g. for PC-to-phone, multimedia terminal testing)

- incl. stereo XLR(m)-to-jack(3,5mm), stereo XLR(f)-to-jack(3,5mm)
- incl. 2x XLR(m)-to-Cinch, 2x XLR(f)-to-Cinch

[Note: one set required, except for OPR-x2x-xxx-x two sets required]

### OPR-820-FMA-X OPERA™ fixed and mobile phone adapter box (for connecting the OPERA audio interface to hand- sets, headsets, IP phones, etc.)

[Note: OPR-x1x-x or OPR-x2x-x required]

## Software-only configurations

### Common S/W Specifications

OPERA software suite v3.5, restricted functionality (.wav) file-based only, no real time/on line streaming, basic framework system, incl.:

- installation guide
- OPERA User's Manual
- 1 year support

### Hardware Requirements for OPERA software suite:

- Pentium III PC, 500MHz or above
- min. 128MB RAM, 256MB recommended
- OpenGL capable graphics adapter, min. 8 MB required, nVIDIA RIVA, TNT2 or similar;

## optionally available with:

### OPR-000-ESQ-S

- PESQ/P.862/P.862.1, includes also
- PSQM/P.861, PSQM+, PSQM/IP

### or OPR-000-EAQ-S

- PEAQ/BS.1387 Advanced Model
- PEAQ/BS.1387 Basic Model

### or OPR-000-ASQ-S

- PSQM/P.861, PSQM+, PSQM/IP, includes also
- PEAQ/BS.1387 Advanced Model
- PEAQ/BS.1387 Basic Model

### or OPR-000-ASE-S

- PESQ/P.862/P.862.1, includes also
- PSQM/P.861, PSQM+, PSQM/IP
- PEAQ/BS.1387 Advanced Model
- PEAQ/BS.1387 Basic Model

**DEMO FOR EVALUATION**  
**OPR-000-DEM-S**  
OPERA software suite v3.5,  
limited trial demo version  
• functionality as OPR-000-ASE-S  
• limited number of trials