HEAD acoustics GmbH

Ebertstraße 30a
D-52134 Herzogenrath
Tel: +49 (0)2407-577-0
Fax: +49 (0)2407-577-99
E-mail: telecom@head-acoustics.de
WEB: www.head-acoustics.de

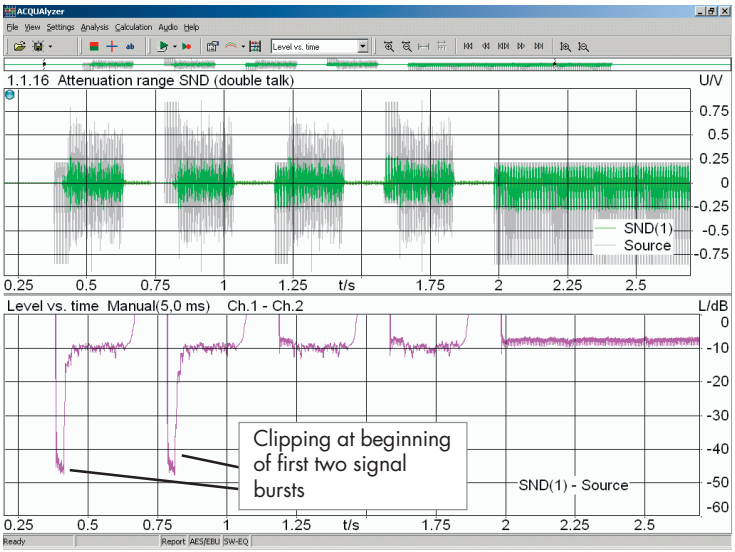
DATA SHEET

HQS-IP (Code 6769)
HQS-IPC (Code 6831*)

HEAD Quality Standard

Speech Quality Assessment of VoIP Systems

**HQS-IPC is only available as part of the analysis system ACQUA IP Compact (Code 6831)*



Example of attenuation range measurement result in ACQUA analysis module ACQUAlyzer. Upper window: Time sequence of measured signal (green) and source signal (gray). Lower window: Level vs. time analysis of the measured signal referred to the source signal.

Overview

Speech quality assessment of VoIP systems and components is quite a challenge due to the various kinds of signal processing involved (e.g. echo cancellers and non linear processors, various speech coders, voice activity detection, jitter buffer, packet loss concealment). All these aspects have a significant influence on conversational speech quality. Current national and international standards, however, are not suited to assess all the relevant parameters.

To solve this problem HQS-IP/IPC has been developed by HEAD acoustics, providing ***comprehensive tests*** for the analysis of

- ***Delay***
- ***Speech transmission quality***
- ***Echo***
- ***Quality during double talk***
- ***Quality of background noise transmission (HQS-IP only)***

For manufacturers HQS-IP/IPC provides objective guidelines to optimize their VoIP products. For administrations and network providers it offers selection criteria to ensure a high quality level.

DESCRIPTION

The tests implemented in HQS-IP/HQS-IPC cover all **conversational speech quality** aspects such as

- delay measurements in sending and receiving direction
- one-way speech quality tests under single talk conditions in sending and receiving direction
- echo tests
- quality during double talk
- quality of background noise transmission (HQS-IP only).

In addition, **recordings using real speech** under single talk, echo and double talk conditions are implemented in HQS-IP (not in HQS-IPC). Apart from the measured parameters these recordings also provide listening examples which can be used for audio demonstrations.

HQS-IP comprises all relevant tests in various IP scenarios:

- electrical to electrical (gateway tests)
- acoustical to electrical (IP terminals and gateways)
- acoustical to acoustical (two IP terminals)

HQS-IPC, the compact version of HQS-IP, implements the "electrical to electrical" and "acoustical to electrical" scenarios.

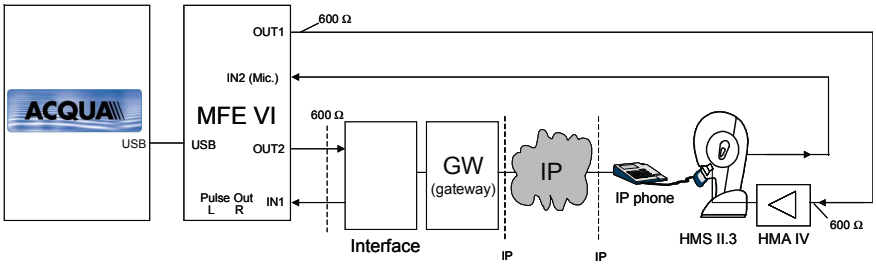
Some of the measurements check the analyzed results based on current **ITU-T** or **ETSI** standards. The main references for HQS-IP/IPC are:

- **TS 101 329-5**: Telecommunications and Internet Protocol Harmonization over Networks (TIPHON); End-to-end Quality of Service in TIPHON systems; Part 5: QoS measurement methodologies
- **P.501**, Test Signals for Use in Telephonometry
- **P.502**, Objective analysis methods for speech communication systems, using complex test signals
- **P.340**, Transmission Characteristics and Speech Quality Parameters of Hands-free Telephones
- **P.50**, Artificial Voices
- **G.168**, Digital Echo Canceller

Other tests determine speech quality parameters of the equipment under test without reference to ITU-T or ETSI standards. These measurements do not check requirements or limits, but are implemented in order to optimize VoIP systems.

APPLICATIONS

- **Automated analysis** of terminals, gateways and network configurations
- **Experimental development and optimization** of IP-configurations including terminals with objective evaluation of speech quality



Setup for measuring the connection between IP gateway (left hand side) and IP terminal (right hand side) using the communication analysis system ACQUA, the measurement frontend MFE VI and the artificial head HMS II.3 (electrical to acoustical scenario)

MEASUREMENTS

The following is a complete list of all measurements included in HQS-IP. HQS-IPC is the compact version of HQS-IP, i.e. some measurements are not included. Those measurements are listed in *Italics*.

Preparation Measurements - Delay
- *Delay - approximation in sending / receiving / echo*
- Delay - cross correlation, sending / receiving /echo
- Delay vs. time (2 min)

Measurements in Sending Direction
- *Idle channel noise, with activation in sending / in receiving*
- Frequency response, transformation / 1/12 and 1/3 octave / artificial voice
- Automatic gain and level control (AGC)
- AGC test during level variations 5 dB / 10 dB / 15 dB
- Junction loudness rating JLR
- *Activation sensitivity, switch on*
- Attenuation range, switch on / switch over / double talk
- optional: MOS-LQO, objective MOS (P.800.1) using TOSQA2001 or PESQ, German
- *'Relative Approach' for PLC optimization*
- PLC implementation, cross corr. vs. time
- Distortion 300-3400 Hz

Measurements in Receiving Direction
(same measurements as in sending direction)

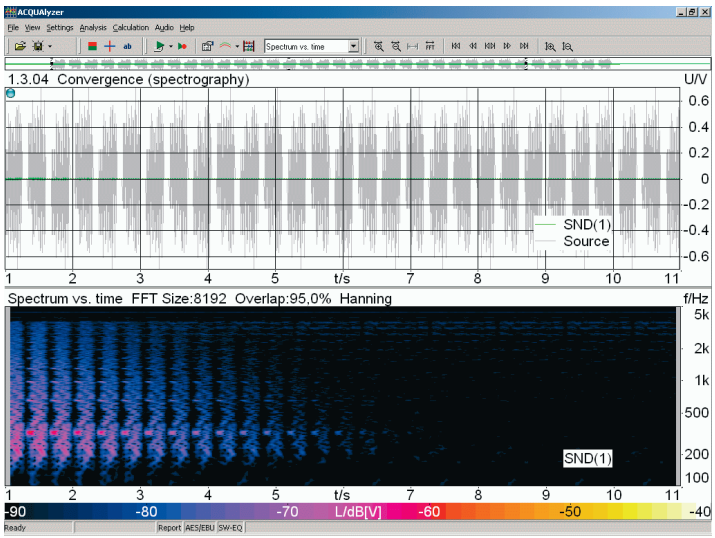
Echo Measurements
- Echo loss (G.122), single talk
- Convergence (G.168), NLP enabled / NLP disabled / spectrography
- *Echo level vs. time, signal level -5 dB_{m0} / -25 dB_{m0}*
- Spectral echo attenuation
- Adaptation on AM/FM signals
- Echo loss during double talk

Measurements determining Double Talk Performance
- Sensitivity double talk detection, sending
- *Simulated double talk, sending*

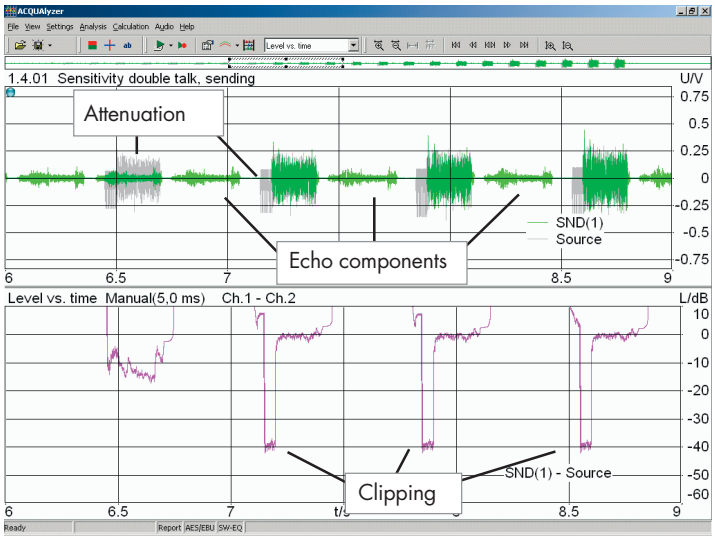
Measurements determining Quality of Background Noise Transmission
- *Minimum activation level*
- *Quality of background noise transmission, car / pub / café*
- *Direct sound sensitivity S (speech)*
- *Background noise sensitivity N, car / café*
- *Comparison of sensitivities S and N (D Value), car / café*
- *Background noise with far end CSS, car / pub / café*

Speech Recordings
- *Speech, single talk, sending / receiving / echo*
- *Speech, double talk, sending / receiving*
- *Speech, echo with near end background noise (car / pub / café)*

(Note: Measurements not included in HQS-IPC are listed in *Italics*)



Example of convergence measurement. Upper window: measured signal (green) and original far end signal (gray). Lower window: spectrography of the measured echo attenuation. The intensity vs. time and frequency is color-coded. A high echo attenuation is displayed in dark color.



Example of double talk sensitivity measurement (enlarged sequence). Upper window: time sequence of measured signal (green) and source signal (gray, applied in sending direction). Lower window: Level vs. time analysis of measured signal referred to source signal.

SYSTEM REQUIREMENTS

HQS-IP/IPC requires the following system components:
- **ACQUA** Communication Analysis System as one of the following versions:
  - Standard (Code 6810)
  - Standard Workplace (Code 6830, for analysis only)
  - Compact Systems
- **MFE VI** Measurement Frontend (Code 6460)

Depending on the measurement tasks, the following components may also be required:
- **HMS II.3** HEAD Measurement System (Code 1230)
- **HMA IV** HEAD Mouth Amplifier (Code 1411)

OPTIONS

- **TOSQA2001** Telecommunications Objective Speech Quality Assessment (Code 6820)
- **Upgrade** HQS-IPC -> HQS-IP (Code 6778)

represented by