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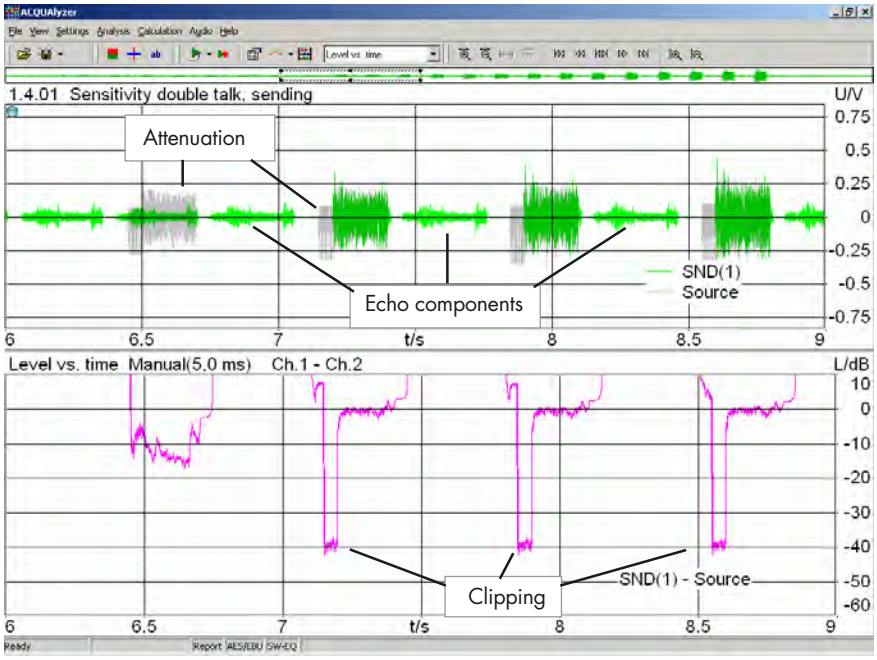
DATA SHEET

HQS-IP (Code 6769)
HQS-IP-Gateway(Code 6786)
HQS-IP-Phones (Code 6787)

HEAD Quality Standard
Speech Quality of VoIP Systems



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.

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, VAD/voice activity detection, jitter buffer, PLC/packet loss concealment). All these aspects have a significant influence on conversational speech quality. Current national and international standards, however, are not sufficient to assess all the relevant parameters.

To solve this problem the test suites HQS-IP, HQS-IP-Gateway and HQS-IP-Phones have 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***

For manufacturers, HQS-IP/IP-Gateway/IP-Phones provide objective guidelines to optimize their VoIP products. For administrations and network providers they offer selection criteria to ensure a high quality level.

DESCRIPTION

The tests implemented in HQS-IP/IP-Gateway/IP-Phones 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.

In addition, **recordings using real speech** under single talk, echo and double talk conditions are implemented. 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-IP-Gateway consists of a subset of HQS-IPwith the scenario "electrical to electrical".

HQS-IP-Phones consists of a subset of HQS-IPwith the scenarios "acoustical to eletrical" and "acoustical to acoustical".

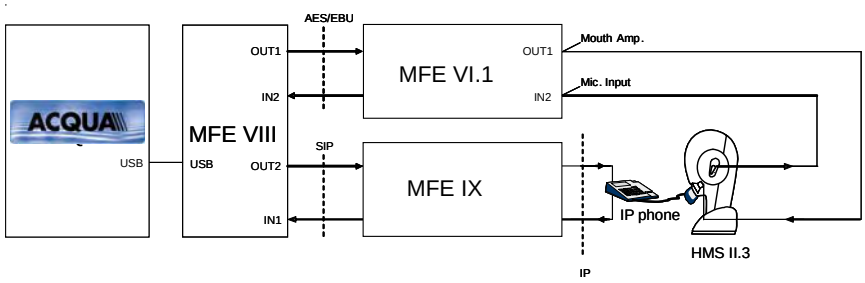
Some of the measurements and analysis methods are based on current **ITU-T** or **ETSI** standards. The main references for HQS-IP/IP-Gateway/IP-Phones are:

- **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 Test Methods for Speech Communication Systems Using Complex Test Signals
- **P.340**, Transmission Characteristics and Speech Quality Parameters of Hands-free Terminals
- **P.50**, Artificial Voices
- **G.168**, Digital Network Echo Cancellers

Further 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



Measurement setup electrical to acoustical: Communication analysis system ACQUA, reference gateway MFE VIII, IP network simulator MFE IX, measurement frontend MFE VI.1, artificial head measurement system HMS II.3, IP terminal

MEASUREMENTS

The following is a complete list of all measurements included in HQS-IP. HQS-IP-Gateway and HQS-IP-Phones are subsets of HQS-IP and only contain the measurements required for gateways or for terminals.

Preparation Measurements
- Delay: Single value / delay vs. time / echo delay

Measurements in Sending Direction
- Idle channel noise, with activation in sending / in receiving
- Frequency response
- Junction loudness rating JLR
- Variation of loudness rating
- AGC tests (Automatic gain and level control)
- Attenuation range, switch on / switch over / double talk
- ***Optional: One-way speech quality, German, MOS-LQO with TOSQA2001 (to ITU-T P.800.1) or PESQ (to ITU-T P.862)***
- PLC implementation, cross corr. vs. time
- ***Optional: PLC implementation, 'Relative Approach'***
- Distortion 300-3400 Hz (with and without activation)

Measurements in Receiving Direction
Same measurements as in sending direction, but with the following differences in the scenario acoustical to electrical:
- Sidetone characteristics, P. 50, nom.vol.
- Sidetone delay

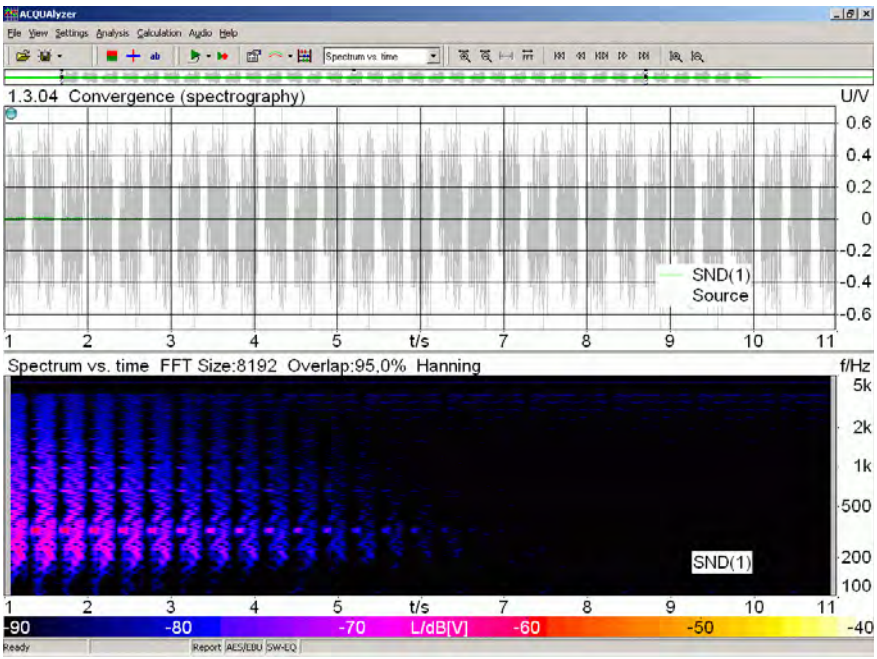
Echo Measurements
- Echo loss (G.122), single talk
- Convergence (G.168), NLP enabled / NLP disabled / spectrography
- Echo level vs. time, signal level -5 dB_{m0} / -25 dB_{m0}
- Spectral echo attenuation
- Adaptation on AM/FM signals
- Comparison SND signal with near end / with RCV signal
- Echo loss during double talk
- Echo measurements with realistic DECT echos (only HQS-IP electrical to electrical)

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

Measurements determining Quality of Background Noise Transmission
- Minimum activation level
- Background noise transmission with near end speech / with far end speech

Background Noise Transmission Using External Noise Playback
(only HQS-IP acoustical to electrical)
- Ambient Noise Rejection, D-Value: Café / Pink Noise
- Comfort Noise (Café): Level adjustment / Spectrum adjustment

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



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.

SYSTEM REQUIREMENTS

HQS-IP/IP-Gateway/IP-Phones requires the following system components:
- **ACQUA (Code 6810 etc.):** Advanced Communication Quality Analysis, Version 2.4.100 or later. ***Note: Valid SMA (Software Maintenance Agreement) required!***
- **PC with Windows(R) 2000/XP, 3x USB-Port**
- **MFE VI.1** USB Measurement Front End, Analog, with Integrated Mouth Amplifier (Code 6462)
- **MFE VIII** IP Reference Gateway (Code 6468)
- **MFE IX** IP Network Impairment Simulator & Monitor with WLAN/WiFi Access Point (Code 6480); ***Note: other simulators can also be used.***
- **HMS II.3** Artificial Head Measurement System (Code 1230)
- **HHP III** Handset Positioning Mechanism (Code 1400)
- **HAE-BGN** HEAD acoustics Automated Equalization for Background Noise Simulation in Laboratories according to ETSI EG 202 396-1 (Code 6971)

OPTIONS

- **ACOPT 10 (TOSQA2001)** Telecommunications Objective Speech Quality Assessment (Code 6820)
- **ACOPT 16 (PESQ)** Perceptual Evaluation of Speech Quality (Code 6836)
- **ACOPT 17 (Relative Approach)** (Code 6839)
- **Upgrade** HQS-IPC -> HQS-IP (Code 6778)

DELIVERY

- **HQS-IP/IP-Gateway/IP-Phones** (Code 6769/6786/6787), as ACQUA database on CD
- **Keyfile** on CD
- **Manual** on CD

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