

ACOPT 01 (Code 6811)* Signal Generator and Editor

ACQUA option for generation of mathematically definable functions and for editing of signals.

Features:

- Signal generator for following signals: sine, square, triangle, sweep, stepped sweep, white and pink noise, pseudo noise for different FFT lengths, Fourier generator
- Universal signal generator (corresponding to mathematical formula)
- Signal editor for editing of individual time signals, e.g. composite source signal
- Various possibilities for signal operation and manipulation

ACOPT 02 (Code 6812) Signal Analysis

ACQUA option as a tool for experimental development and optimization of single components or complex transmission paths.

Features:

- Post analysis of archived signals in the frequency and time domains

ACOPT 03 (Code 6813) Project Orientated Signal Analysis

ACQUA option for project orientated processing, evaluation and administration of excitation signals and measurement results. Based on ArtemiS (integrated special licence for ACQUA users).

Features:

See data sheet ArtemiS (Code 4600)

ACOPT 04 (Code 6814) Advanced Signal Analysis

(requires ACOPT 03)

ACQUA option for further signal analyses.

Features:

- Modulation spectral analysis (vs. time and vs. frequency band)
- Wavelet Analysis

- Gated Fourier Transformation (vs. time)
- VFR - Spectral analysis with variable frequency resolution
- Kurtosis (vs. time)
- Cepstrum (vs. time)
- Filtered level analysis vs. time
- Sound Power Measurement acc. to DIN 45635
- Calculation of the envelope (of a signal)
- Tone-to-Noise Ratio
- Tonality acc. to DIN 45681 vs. time
- Speech Transmission Index (STI: STITEL / STIPA / RASTI)

ACOPT 05 (Code 6815) Filter Based 1/n Octave Analysis

(requires ACOPT 03)

This ACQUA option allows to use recursive filters to calculate 1/n octave analyses. The time structure of audio signals is better retained by the use of recursive filters than by using the DFT-method.

Features:

- Filters of the 6th order comply with ANSI Norm S 1.11
- 3rd octave band filters of the 4th and 6th order are in accordance with DIN 45652
- Besides the octave and 3rd octave resolution, further partial octave resolutions are available

ACOPT 06 (Code 6816) Advanced Filter Module

(requires ACOPT 03)

This ACQUA option allows to modify time signals with FIR filters, tracking filters and variable filters. Furthermore, it extends the number of simultaneously activatable filters in one filter array from 4 to 16.

Features:

- FIR filters with filter characteristic adjustable in the frequency domain, e.g. from measured transfer functions
- Parametric IIR filters
- Variable filters/ variable tracking filters with user defined amplitude response
- Interactive configuration of all filters via mouse, the impact on the signal is clearly visualized with spectrum morphing
- Variable filter element for filters, which are variable over the time and frequency domain
- Time-stretching or compressing of audio signals without affecting the pitch
- Changing the pitch of audio signals without affecting the signal length

DATA SHEET

ACQUA Options (ACOPTs)

(*separate datasheets on certain ACQUA options are available, these are marked with an asterisk)

OVERVIEW

ACQUA is a dual channel analysis system for diagnosis of acoustic and/or electric transmission paths up to 24 kHz.

A variety of options allows the individual tailoring of the software and its performance to specific fields of application which may range from the evaluation of frequency responses to psychoacoustic models and speech quality analysis systems.

ACOPT 07 (Code 6817) Psychoacoustics

(requires ACOPT 03)

ACQUA option for assessment of sound measurements with psychoacoustic variables.

Features:

- Calculation of loudness acc. to ISO 532 or HEAD Algorithm
- Loudness vs. time / specific loudness (vs. time)
- Calculation of total roughness vs. time and specific roughness (vs. time)
- Calculation of sharpness vs. time
- Tonality vs. time
- Specific fluctuation strength (vs. time)
- Calculation of specific prominence (vs. time)
- Calculation of the (regular and advanced) articulation index vs. time
- Speech intelligibility index
- Display of the analysis results in Hz or Bark
- Percentile display of the psychoacoustic parameters

ACOPT 08 (Code 6818) Advanced Psychoacoustics

(requires ACOPT 03)

ACQUA option for advanced psychoacoustic examinations which go beyond the psychoacoustics parameters of ACOPT 07.

Features:

- Hearing model: based on the physiology of human hearing, offers special analysis functions in the frequency domain, where time and frequency resolution correspond to those of the human ear.
- Relative Approach: based on the hearing model, reacts to fast changing and spectral structures in signals similar to the pattern recognition of human hearing.
- HSA: improves the analysis of tonal components and has clear advantages compared to the FFT analysis especially with regard to short signal sections.

ACOPT 09 (Code 6819) SLVM P.56

ACQUA option, speech level voltmeter according to international standard ITU-T P.56 (method B).

ACOPT 10 (Code 6820) TOSQA

ACQUA option for determination of speech quality according to TOSQA method. Output as MOS and TMOS values including impairment factor.

ACOPT 11 (Code 6821) CLIP

ACQUA option for output of freely definable CLIP data according to European standard ETS 300 778-1.

Features:

- Automatic adaptation to connected measurement front ends
- Support of all three activation methods: Dual Tone Alerting Signal (DT-AS), Line reversal followed by DT-AS, Ringing Pulse Alerting Signal
- Free choice of transferrable data
- Free choice of all signalization frequencies and levels

ACOPT 12 (Code 6822) DTMF

ACQUA option for analysis of DTMF signals according to standard TBR 21 (multi-frequency dialing method) sent by measuring object.

Features:

- Output of all recognized signals
- Check of following parameters:
 - min/max level of high/low frequency,
 - min/max level difference,
 - min signal to noise ratio,
 - max frequency deviation,
 - min/max dial/pause time,
 - max rise/fall time

ACOPT 14 (Code 6824)* TBR 21

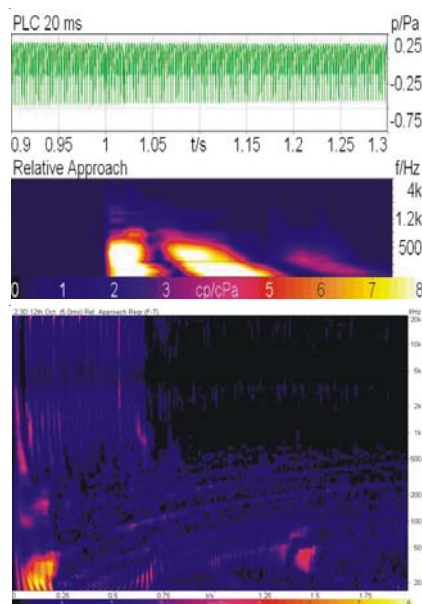
ACQUA option for measurement of analog telephones according to European standard TBR 21. Apart from all measurement descriptors this option also includes a high-resolution A/D PC card as well as technical data.

ACOPT 15 (Code 6825) TBR 37

ACQUA option for measurement of analog telephones according to European standard TBR 37. Apart from all measurement descriptors, this option also includes a high-resolution A/D PC card as well as technical data.

ACOPT 16 (Code 6836) PESQ

ACQUA option for determination of MOS values (Mean Opinion Scores) according to PESQ (Perceptual Evaluation of Speech Quality, advanced quality measure for determination of perceived speech quality in telecommunication according to ITU-T P.862).



ACOPT 17 (Code 6839)* Relative Approach

Optional psychoacoustic method patented by HEAD acoustics for the analysis of audible impairments in the time and frequency domain. Allows the evaluation of dominant time and spectrum structures based on the sensitivity of the human ear.

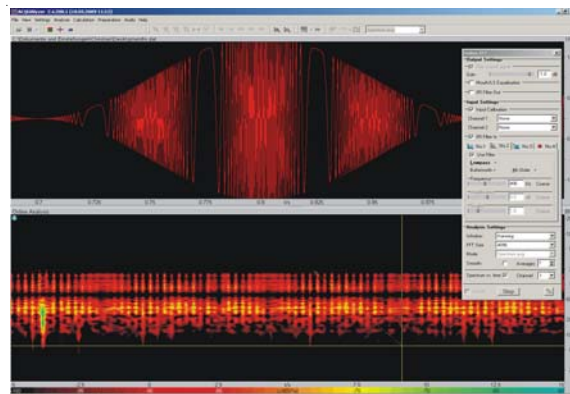
ACOPT 18 (Code 6840) Remote Control ACQUA via COM Interface

ACQUA option for external control of automated measurement sequences.

Via the COM interface, prepared ACQUA sub-projects can be listed and selected. An existing ACQUA measurement object as well as the corresponding settings for various front ends can be selected and the complete measurement sequence can be carried out. New ACQUA measurement objects can be generated if required. Feedback on the progress of the measurement sequence is given via COM events.

ACOPT 19 (Code 6842)* Online Analysis

Provides the functions „Online Level“, „Online FFT“ and „Online Distortion“ for realtime analysis during simultaneous continuous signal playback under modifiable measurement setup conditions (e.g. frequency-dependent convergence behavior of echo cancellers, application-force-dependent transfer functions between handset and artificial ear).

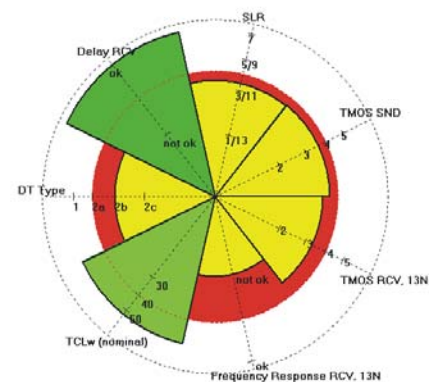


Features:

- Online Level: Realtime calculation of input level.
- Online FFT: Realtime analysis of the spectral transmission behavior.
- Online Distortion: Realtime analysis of the distortion behavior.

ACOPT 20 (Code 6843)* Quality Pie

With this tool the representation of results in the form of pie diagrams according to ITU-T Recommendation P.505 becomes quick and easy. Pre-defined templates with all parameter settings and limit values can be loaded for various test cases, e.g. IP phones, gateways, mobile phones, hands-free terminals. Alternatively, users can generate and save their own templates for individual test result evaluation.



ACOPT 21 (Code 6844)* 3QUEST

3QUEST (3-fold Quality Evaluation of Speech in Telecommunications) is an optional calculation method for the communication analysis system ACQUA which allows the objective speech quality evaluation of telecommunication terminals. It is based on the ETSI standard EG 202 396-3, covering both wideband and narrowband scenarios including background noise.

Essential parts of the wideband database from the ETSI project STF 294 which was carried out in preparation of EG 202 396-3 as well as the complete narrowband database were created by HEAD acoustics. The databases consist of numerous samples from listening tests with subjective evaluation by test persons carried out according to ITU-T Rec. P.835.

**ACOPT22 (Code 6847)*
ES 203 021**

The ETSI Standard ES 203 021 is the successor of the standard TBR 21 and like its predecessor specifies a series of harmonized requirements for the analog connection of terminals to existing public telephone networks in Europe. It covers all relevant requirements of Directive 91/263/EEC regarding terminals which are capable of establishing or receiving a switched connection via Dual Tone Multi Frequency (DTMF) signalling.

The measurements required by Standard ES 203 021 have been implemented by HEAD acoustics into an automated test suite for the communication analysis system ACQUA.

SMD	ES 203 021 Subject	Comment	Active	Ref.	Single Use
41	41 Impedance: impedance about earth	ES 203 021		41.mmd	
42	42 Sending level limitations	42.mmd		42	
42	42 Sending level limitations - Handset	42 Handset		42	
42	42 Sending level limitations - Handstree	42 Other		42	
42	42 Sending level limitations - Other devices	42 Other		42	
43	43 Power feeding limitations	43.dum		44 T94	
44	44 Automatically repeated call attempts	44 T94		44	
44	44 General requirements in quiescent state	ES 203 021		44.mmd	
44	44.1 DC resistance	44.1.mmd		44.1	
44	44.2.1 Impedance of TE for ringing signals	44.2.1.mmd		44.2.1	
44	44.2.2 Transient Response	44.2.2.mmd		44.2.2	
44	44.2.3 DC current - DC component of the ringing current	44.2.3.mmd		44.2.3	
44	44.3 Resistance to earth	44.3.mmd		44.3	
44	44.4 Impedance	44.4.mmd		44.4	
45	45 Ringing signal detector sensitivity				
46	46 Transition from quiescent to loop state				
47	47 Loop steady state characteristics				
47	47.1 DC characteristics				
47	47.2 Impedance (Loop state)				
47	47.3 Resistance to earth (Loop state)				
48	48 Call attempt				
48	48.1.1 Dialing without dial tone	48.1.1.TDR		48.1.1	
48	48.1.2 Dialing with dial tone detection				
48	48.2 DTMF signaling				
48	48.5 Call attempt on a low voltage line	48.5.TDR		48.5	
48	48 Transition from loop to quiescent state				

**ACOPT 23 (Code 6848)*
GCF**

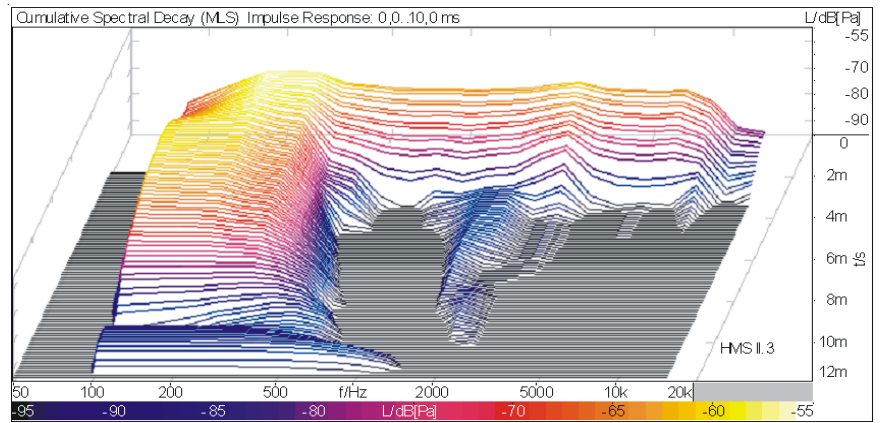
The Global Certification Forum (GCF) has defined test criteria for certification of 2G and 3G mobile equipment. As a member of GCF, HEAD acoustics is able to offer the GCF-approved test platforms TP89 and TP90 which cover audio test cases for 2G and 3G according to 3GPP TS 26.131/TS 26.132 and TS 51.010-1.

In combination with TP89 or TP90, option GCF (ACOPT 23) enables manufacturers and test laboratories to submit test cases of 2G and 3G mobile equipment validated on any of these two test platforms to the Global Certification Forum for official GCF approval.



**ACOPT 24 (Code 6849)*
PTCRB**

The PCS Type Certification Review Board (PTCRB) has defined test criteria for certification of 2G and 3G mobile equipment. As a member of PTCRB, HEAD acoustics is able to



offer the PTCRB-approved test platforms TP89 and TP90 which cover audio test cases for 2G and 3G according to 3GPP TS 26.131/TS 26.132 and TS 51.010-1.

In combination with TP89 or TP90, option PTCRB (ACOPT 24) enables manufacturers and test laboratories to submit test cases of 2G and 3G mobile equipment validated on any of these two test platforms to the PCS Type Certification Review Board for official PTCRB approval.

**ACOPT 25 (Code 6852) -
Psychoacoustic SMDs**

(This option offers a single measurement descriptor (SMD) which allows to conduct various psychoacoustic analyses (also selectable from the ACQUAlyzer menu "Analysis").

The following analysis methods are provided:

- Loudness vs. Time
- Spec. Loudness
- Spec. Loudness vs. Time
- Sharpness vs. Time
- Roughness vs. Time (Hearing Model)
- Spec. Roughness (Hearing Model)
- Spec. Roughness vs. Time (Hearing Model)

**ACOPT 26 (Code 6853) -
Roomacoustics**

This option offers a single measurement descriptor (SMD) which allows to conduct room acoustics measurements based on maximum length sequence (MLS) signals (also selectable from the ACQUAlyzer menu "Analysis").

Features:

- Measuring Impulse responses with MLS signals

- Reverberation time vs. bands (Octave, 3rd/6th/12th Octave)
- Cumulative spectral decay plots
- Measurement of single values acc. to DIN EN ISO 3382:
 - Reverberation time RT60, RT30
 - Early decay time EDT, D50, D80, center time
 - Clarity C50, C80
 - Directness D50, D80
 - Center time Ts
- EEB (Early Energy Balance) acc. to ITU-T P.340: objectively represents the subjective impression of reverberance.

The following analysis methods are provided:

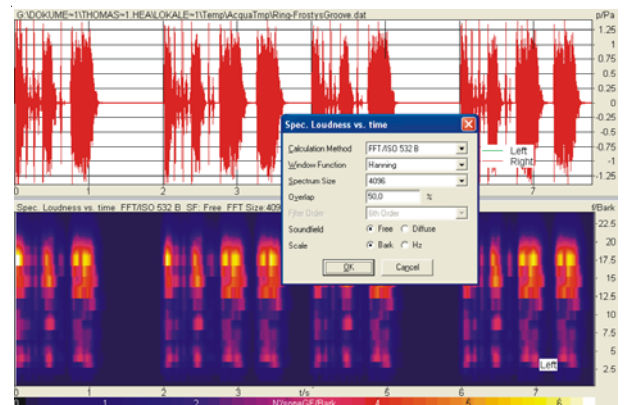
- Impulse Response (MLS)
- Decay vs. Bands (MLS)
- Cumulative Spectral Decay (MLS)

**ACOPT 27 (Code 6854) -
Speech Transmission Index**

This option offers a new single measurement descriptor (SMD) which allows to conduct measurements for calculation of the speech transmission index. (also selectable from the ACQUAlyzer menu "Analysis").

Features:

Method for measuring speech intelligibility. Based on the measurement of the modulation applied to the intensity envelopes of signals. STITEL, STIPA, RASTI: simplified methods that allow calculating the STI from a single measurement.

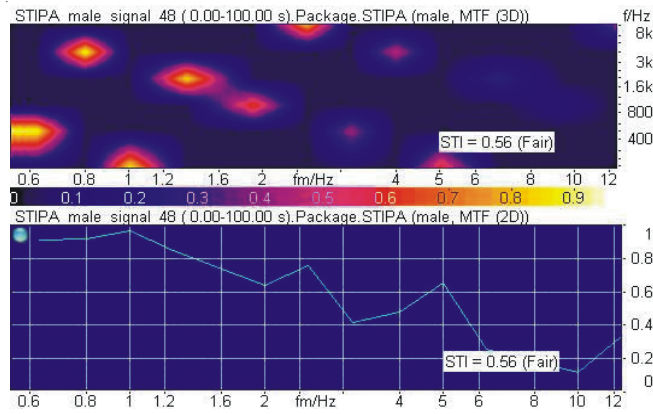


ACOPT 28 (Code 6855)
SNRI & TNLN Calculation According to
ITU-T G.160 (App. II, Amd. 1)

This option offers a new single measurement descriptor (SMD) which allows to conduct measurements for calculation of values according to ITU-T G.160 (Appendix II, Amendment 1, 11/2009) as summarized in the list below. Moreover, this option provides a new menu item in the ACQUAlyzer "Calculation" menu which allows to apply this calculation method to the signal currently displayed in the time window.

Main Values:

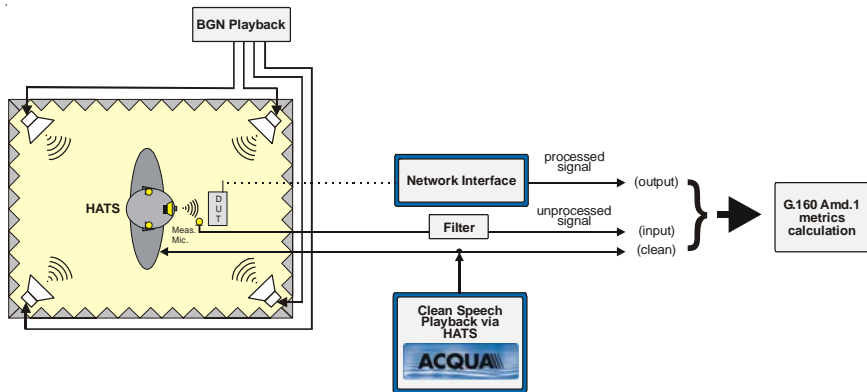
- SNRI (Signal-to-Noise Improvement): The difference of signal-to-noise ratios between processed and unprocessed signal.
- TNLN (Total Noise Level Reduction): The difference of background noise levels between processed and unprocessed signal in the signal parts with no speech activity.
- NPLR (Noise Power Level Reduction): The difference of background noise levels between processed and unprocessed signal in the signal parts with short speech pauses. Thus this metric estimates the noise level reduction during speech.
- DSN (Difference between SNRI and NPLR): Describes the balance between TNLN and NPLR. Should be around zero.



Additional Single Values:

- SNR High / Mid / Low: Signal-To-Noise ratio for speech frames with high, mid and low speech power acc. to ITU-T G.160. Available for unprocessed and processed signal.
- ASL Clean: The active speech level of the clean speech signal acc. to ITU-T P.56.
- Speech activity: Speech activity acc. to ITU-T P.56, calculated with clean speech signal.
- ASL Unprocessed / Processed: The active speech level of the noisy speech signals are calculated over the signal segments with low / mid / high speech power (ITU-T P.56 due to additional background noise not applicable here).

- Delay Processed vs. Unprocessed: Delay calculated with cross-correlation between processed and unprocessed signal.
- Delay Processed vs. Clean: Delay calculated with cross-correlation between processed and clean signal.
- Delay Unprocessed vs. Clean: Delay calculated as the difference of the (Proc vs Unproc) and (Proc vs Clean).
- SNR Processed / Unprocessed: Alternative calculation of SNR; uses the active speech and background noise levels of processed and unprocessed signal.
- BGN Level Processed / Unprocessed: The background noise level of the processed / unprocessed signal, determined in parts with no speech activity.



SYSTEM REQUIREMENTS

All ACOPTs require the latest ACQUA Version.

DELIVERY

ACOPTs are either delivered on the HASP USB dongle delivered with ACQUA (for new customers) or as V2C file (for existing customers).
 Note: ACOPT 16 (PESQ) is delivered on a different dongle type (old Sentinel USB dongle).

