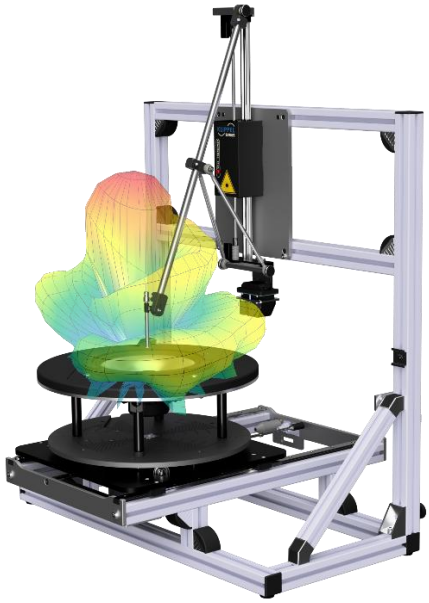
What's New in KLIPPEL ANALYZER SYSTEM
dB-Lab 212 – QC 7

Document Revision 15



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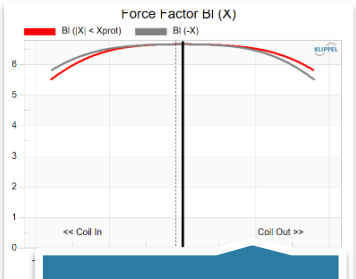

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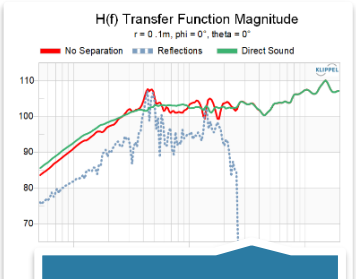

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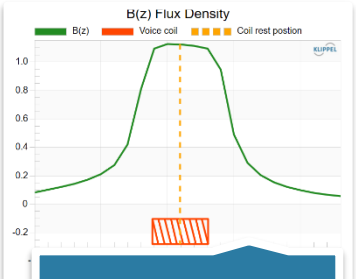

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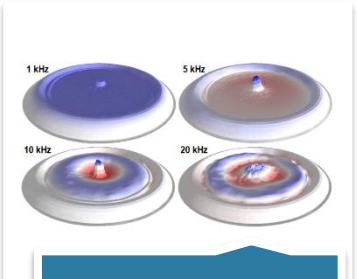

Mechanical Testing

Overview

Minor Update dB-Lab 212.810 / QC 7.9 (November 2025) 3

Updates in dB-Lab (R&D and QC) 3

Updates in R&D Modules 3

QC 7.9 Update 3

Hardware / System Updates 3

Main Features Explained 4

Maintenance Update dB-Lab 212.806 / QC 7.8b (June 2025) 5

Minor Update dB-Lab 212.805 / QC 7.8 (March 2025) 5

New R&D Module 5

Updates in R&D Modules 5

QC 7.8 Update 5

Hardware / System 5

Main Features Explained 6

Maintenance Update dB-Lab 212.716 / QC 7.7 (January 2025) 7

Maintenance Update dB-Lab 212.715 / QC 7.7 (November 2024) 7

Maintenance Update dB-Lab 212.710 / QC 7.7 (September 2024) 7

Minor Update dB-Lab 212.707 / QC 7.7 (July 2024) 7

Updates in R&D Modules 7

QC 7.7 Update 7

Updates for Kippel Controlled Sound 7

Main Features Explained 8

Minor Update dB-Lab 212.704 (June 2024) 9

Maintenance Update dB-Lab 212.620 / QC 7.5b (January 2024) 9

Minor Update dB-Lab 212.616 / QC 7.5 (October 2023) 9

Updates in R&D Modules 9

QC 7.5 Update 10

Updates for Kippel Controlled Sound 10

Main Features Explained 10

Minor Update dB-Lab 212.534 / QC 7.4 (February 2023) 12

New Modules 12

Updates in R&D Modules 12

QC 7.4 Update 12

Main Features Explained 13

Minor Update dB-Lab 212.332 / QC 7.3 (August 2022) 15

Updates in R&D Modules 15

QC 7.3 Update 15
Main Features Explained 17
Minor Update dB-Lab 212.240 / QC 7.2 (March 2022) 19
Updates in R&D dB-Lab 212 19
QC 7.2 Update 19
Main Features Explained 21
Minor Update dB-Lab 212.116 / QC 7.1 (November 2021) 23
Updates in R&D dB-Lab 212 23
QC 7.1 Update 23
Major Update dB-Lab 212 / QC7 (July 2021) 24
New KLIPPEL Software Module 24
Updates in Existing KLIPPEL Products 25
Updates for KLIPPEL Hardware 26
Compatibility 26
Main Features Explained 27

Minor Update dB-Lab 212.810 / QC 7.9 (November 2025)

The 2025-Fall update is free of charge for any customer of the Klippel R&D and QC software 212 version.

Updates in dB-Lab (R&D and QC)

- By default, the power scheme is not altered anymore by Klippel software. Windows 11 update 24H2 is known to cause communication errors in testing hardware (e.g., KA3). See **TechNote 21** for details.
- Replaced the Example Database (700MB) with a smaller one (100MB) based on a physical example speaker
- Physical example speakers are available for a smooth start and a verification of the test setup
- The previous example Database is now web-based and is available from the Klippel download area. It is linked in the user manuals accordingly

Updates in R&D Modules

- **Near Field Scanning (NFS / SCN-NF)**
  - Visualization: New parameters to set axis limits of polar angle and frequency in contour plots
  - Visualization Template for on-axis measurement @ 1m
  - Measurement: New Options for a final parking position. NFS can move automatically to a defined position after the scan.
  - SCN-based: New templates added for full scan and for line scan on SCN hardware
- **In-Situ Room Compensation (ISC)**
  - Checks of In-Situ Measurement and Correction Curve to ensure quality and reliability of In-Situ testing
  - Energy Time Curve of In-Situ Measurement
  - Consistency check of NFS Visualization: ISC shows a warning when user-defined distance or voltage scaling is active
  - Consistency Check of measurement setup of In-Situ and NFS Reference: ISC shows a warning when the settings of both measurements are not compatible
  - New Curve in Frequency Response Window that shows the Reference Response with level adjustments
  - New Batch Template for In-Situ measurement with NFS Reference
- **Klippel Endurance Test (KET)**
  - KET Unica: Ensure gapless peak detection
  - Increase stability for long-term tests

QC 7.9 Update

- QC-Remote API now supports entering/leaving limit calculation mode
- Speeding up the read-out of TEDS microphone data at login time
- QC-Start: Display the newest test instructions (either from local test or from master test)

Hardware / System Updates

- KA3 Firmware: Generic Update to v0.282

Main Features Explained

The latest dB-Lab update delivers a smoother start, clearer workflows, and greater reliability across R&D and QC applications. The software now ships with a streamlined example database based on a physical loudspeaker, reducing installation size while improving relevance for first-time users. Physical example speakers are available for setup verification, and the previously delivered large example database has been moved online.

Figure 1: Example speaker

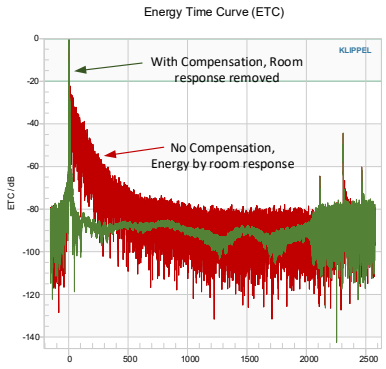

Figure 2: In-Situ Compensation of room effects

In the R&D environment, the interaction between Near Field Scanning (NFS/SCN-NF) and In-situ room compensation (ISC) has been improved with a more intuitive workflow, automatic quality checks, consistency checks against NFS references, and a new ISC measurement template.

New visualization options include axis limits for 3D charts. Measurement routines now support automatic parking positions after scans, and additional templates are available for SCN-based full and line scans.

QC 7.9 introduces improved automation and faster device handling, including extended QC-Remote API functions for limit calculation and significantly quicker TEDS microphone readout during login.

QC-Start now always shows the latest valid test instructions for operators, whether local or from a network-based master test. This supports the automated rollout of new test instructions to any QC station.

On the hardware side, the KA3 firmware has been updated to version 0.282, ensuring compatibility and stability across the system.

Figure 3: Operator Instruction Sheet

Maintenance Update dB-Lab 212.806 / QC 7.8b (June 2025)

- **R&D System:**
  - LSI2: Fix measurement and display of thermal parameters, fixed content of state table, and setting of duration of non-linear mode.
  - TRF: Preserve existing overlay curves. Note: Curve overlay is no longer available since 212.805
  - FLSI: Improved server connection performance, new total DC force caused by the identified nonlinearities.
- **KA3 Hardware:**
  - Firmware: Due to a conflict, KA3 firmware files will be installed into an installation-specific folder starting with this release.

Minor Update dB-Lab 212.805 / QC 7.8 (March 2025)

New R&D Module

- **Fast Large Signal Identification Professional (FLSI Pro) – Pre Release**
  - Small and large signal lumped speaker parameter measurement
  - For electrodynamic transducers of all kind
  - Supports drivers in free air, closed, vented and passive radiator systems
  - Minimal measurement time (20 sec … 3 min)
  - Fully automatic measurement
  - Finds the root causes of distortion
  - Creates accurate linear and nonlinear parameters for simulations
  - Fast thermal characterization

Updates in R&D Modules

- **Klippel Endurance Test (KET)**
  - Laser Measurement supported (AN83)
  - Calibration process available for amplifier gain, voltage and current sensors
  - Improved temperature monitoring by 2Hz pilot tones for Unica amplifier series and optimized processing
  - Compensate amplifier high pass for low frequency pilot tones
  - Warnings and Errors at Output Compression due to amplifier limitation reworked
- **NFS Visualization**
  - Export-Interface to EASE Speaker Lab improved (AN85)
  - New window that visualizes Multisource Configurations

QC 7.8 Update

- New Login Mode: Non-listed Windows users are logged in as operators
- Speed optimization in SAN and SPL Task

Hardware / System

- New Revision 2.0 of QC Card
- New Firmware for KA3 and Klippel Dongle

Main Features Explained

The pre-release Fast Large Signal Identification Professional (FLSI Pro) marks the next step in the small and large signal lumped parameter identification. It combines the previously separate measurements for the small (LPM) and large signal parameters (LSI3) into a single measurement. The previous import of LPM results is no longer necessary, which enables a more streamlined and efficient workflow for the user. This is further improved and simplified by new protection limits: The maximum working range can now be limited by specifying a maximum allowed voice coil displacement measured with a laser sensor. If a microphone is available, an impulsive distortion (Rub&Buzz) limit can be activated to protect the transducer from critical overload.

An improved speaker model maximizes the accuracy in less measurement time. Multiple speakers of the same type can be measured very fast (<1 minute per speaker) by using the measurement settings of a previously performed FLSI measurement. Thermal parameters are identified and help to approximate the power handling capability of the transducer.

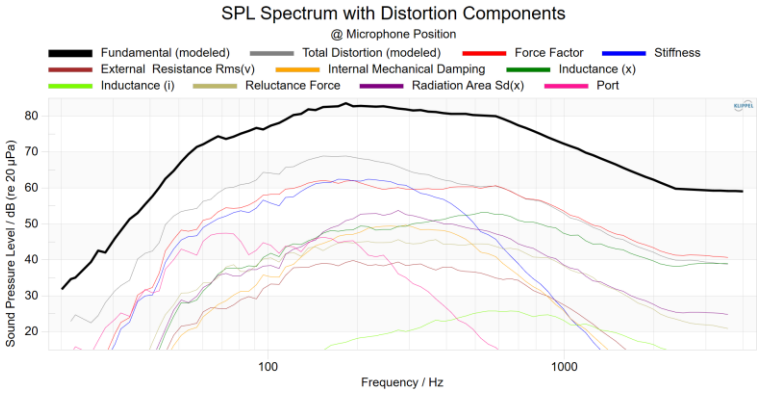

Figure 2: Nonlinear Distortion Components of a vented speaker system

The nonlinear distortion components of each nonlinear parameter are calculated based on the identified nonlinear lumped parameters. They are visualized as single relative distortion values and as spectra. Hence, the nonlinear distortion's dominant and negligible physical causes can be identified at a glance. This provides valuable diagnostics information to gain additional insight for confident design and development decisions.

The Klippel Endurance Test (KET) now supports laser measurements. Peak-to-peak excursion as well as the instantaneous DC coil position, can be monitored. Plug-and-play software for integrating Keyence laser sensors and a detailed application note AN83 help to extend the monitoring of voltage, power, and temperature with excursion for long-term testing.

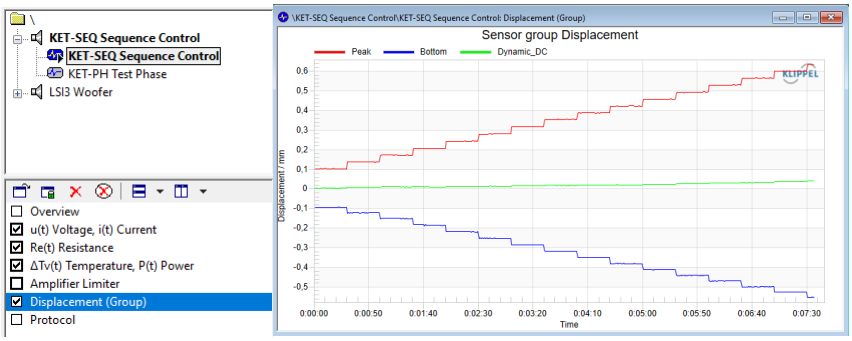

Figure 2: Displacement monitoring for a stepped test signal provides peak, bottom, and DC excursion

KET is based on smart amplifier models providing U/I monitoring. For the powerful Unica series (up to 200V peak, 50A peak), the temperature monitoring was improved by very low pilot tones added to the test signal. Those tones close to DC minimize errors caused by intermodulation distortion or back-induced voltage artefacts. Smooth and fast temperature monitoring is now available for all supported amplifier models (Powersoft Mezzo and Unica).

The amplifier gains and V/I reading can now be calibrated and adjusted to ensure precise and traceable measurements. This can be done locally at the customer's site or by certified laboratories. Software tools and instructions are provided for the calibration process.

Maintenance Update dB-Lab 212.716 / QC 7.7 (January 2025)

- QC System:
  - Fixed incompatibility in repeat mechanisms of SeqCtrl-FLib (SeqCtrl_RepeatsIfFail) and PNI (Autorepeat) that could overwrite the verdict when used together

Maintenance Update dB-Lab 212.715 / QC 7.7 (November 2024)

- Maintenance

Maintenance Update dB-Lab 212.710 / QC 7.7 (September 2024)

- Maintenance

Minor Update dB-Lab 212.707 / QC 7.7 (July 2024)

- dB-Lab Software
  - New verification procedure for R&D microphone sensors (in Hardware configuration dialogues)
  - New options for clipboard editor/processing: x-axis log-reduction and integration to user-definable resolution (R-series or n-th octave)

Updates in R&D Modules

- Klippel Endurance Test (KET)
  - Supports Powersoft-UNICA series for higher power applications
  - Strongly improved accuracy for temperature measurement

- Tone Burst Measurement (TBM)
  - Supports open-loop measurement

- Transfer Function Measurement (TRF)
  - Separate modes for calibration and verification of microphone sensitivity

- B-Field Scanner (BFS)
  - New calibration method for B-field sensors (Hall sensor) compensating DC offset

QC 7.7 Update

- Maintenance

Updates for Kippel Controlled Sound

- KCS Monitor Software
  - Nuvoton G60NAD full eval board support

Main Features Explained

In June 2024, the Klippel Endurance Test (KET) received a two-fold update. The KET software now supports the advanced Unica amplifier platform by Powersoft, extending the U/I range up to 220Vpeak and 80Apeak. There are 8 and 4-channel versions available, which can be mixed with the existing Mezzo amplifier platform for low and medium power requirements. All amplifiers are connected via Dante® digital audio to a dedicated PC for seamless monitoring of test progress via the test dashboard locally and within the local network. Similar to Mezzo-based tests, KET allows for comprehensive monitoring of power, coil temperature, input resistance, voltage, current, and external sensors, including ambient conditions. Additionally, KET provides control over climate chambers.

Figure 1: UNICA amplifier platform by Powersoft.

The second significant update focuses on improving temperature monitoring accuracy in KET. Internal test stimuli have been optimized to minimize variations in temperature measurement, especially at high levels. These stimuli have an identical spectral and probability density function (PDF) as natural noise stimuli. They are based on relatively short, periodic multitone signals with a pink or white spectral distribution. Through comprehensive comparisons of excursion and power, it was found that there is very good agreement between classical dense noise and the new stimuli. In comparison to the deprecated Powertest Module (PWT), the new temperature reading can track rapid changes in temperature faster, which is important for microspeakers and tweeters. However, KET continues to support both modes of stimuli. Test templates have been provided to accommodate the improved reading.

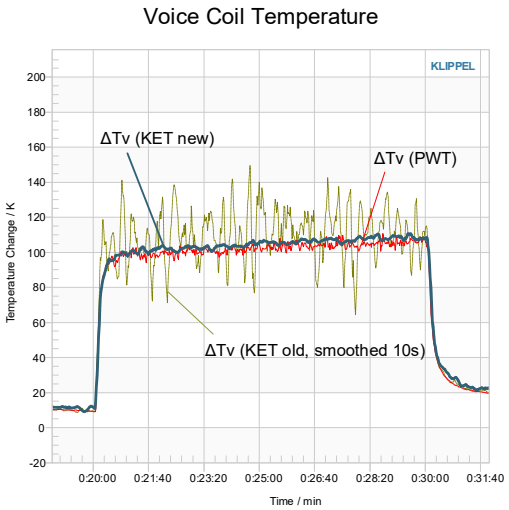

Figure 2: Accuracy of voice coil temperature reading.

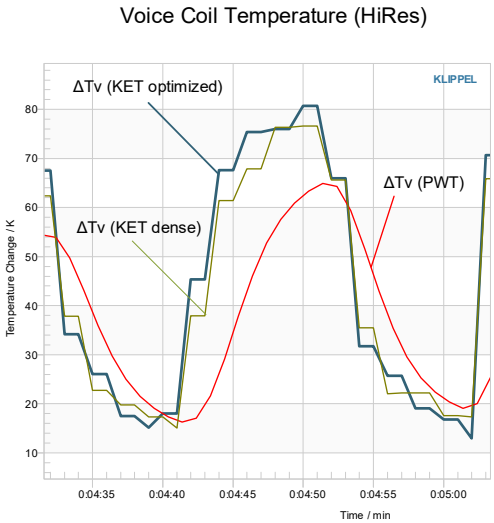

Figure 3: Time resolution of voice coil reading.

Minor Update dB-Lab 212.704 (June 2024)

- KLIPPEL Endurance Test (KET) Update
  - Supports Powersoft-UNICA series for higher power applications
  - Strongly improved accuracy for temperature measurement

Maintenance Update dB-Lab 212.620 / QC 7.5b (January 2024)

- Maintenance

Minor Update dB-Lab 212.616 / QC 7.5 (October 2023)

- dB-Lab Software
  - Extract comprehensive TEDS sensor data

- KA3 Firmware
  - Supports new KA3 version 1.3

Updates in R&D Modules

- Klippel Endurance Test (KET)
  - Individual channel calibration of voltage measurement for Mezzo amplifiers. This semi-automatic process increases accuracy. Check the new KET setup video.

- Near Field Scanner System (NFS)
  - Microphone calibration curve integrated into NFS Processing modules to compensate for high-frequency roll-off and increase the precision of spatial data

- Transfer Function Measurement (TRF)
  - Calculation methods of Integrated bands and band averages modified for consistency with IEC 60268-21/23

- Time-Frequency Analysis (TFA)
  - Global and frequency-dependent reverberation time calculation with automatic detection of the analysis time range
  - User-defined time window for Cumulative Spectral Decay (CSD) calculation
  - Updated user interface and additional guidance to simplify operation

- Rocking Mode Analysis (RMA)
  - Added option to split HTML result windows into tables and charts to optimize reports and overview

- Multi-Tone Measurement (MTON)
  - Probability Density Function of excursion: visualize dynamic deviation from rest position (DC)

QC 7.5 Update

- QC Automation: new examples using Python, contact our support team for details
  - Open database, run operation, save results to txt file, and exit
  - List all tasks of operations
  - Extract and plot results from running QC instance
  - List properties of reference units such as serial number and status
- Minor improvements and maintenance changes, e.g., sensor handling for wave files
- Please refer to full list of changes on dB-Lab Welcome Page.

Updates for Kippel Controlled Sound

- **KCS Monitor Software**
  - Supports new Nuvoton NAUG60 chip series and evaluation board

Main Features Explained

Klippel Endurance Test (KET) has now the ability to calibrate the individual channels of Mezzo power amplifiers to increase the accuracy of voltage reading and voltage at amplifier output. A fast, semi-automatic procedure guides the user through the voltage reading calibration. It is now an integral part of the hardware setup. External measurement equipment is not required. A short video shows the full hardware setup (calibration starts at 1:50).

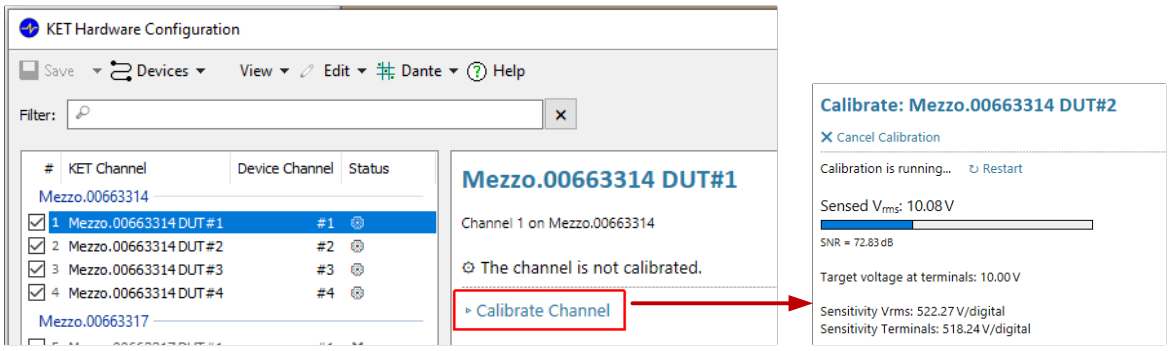

Figure 1: Calibration of individual KET channels.

The Multi Tone Measurement (MTON) module extended its analysis of statistical signal distribution. Probability density analysis is available not only for the stimulus but also for related states with similar wideband content, like sound pressure, voltage and current. These can be compared side by side with diaphragm displacement, which potentially shows a quite different probability density distribution (due to low pass filtered characteristic with a cut-off at fundamental resonance). Of special interest for a speaker designer is the dynamically generated offset. The shown example (figure 2) it moves the coil inwards by 20 % of the peak excursion (note the normalized x-axis) and may cause instabilities or defects.

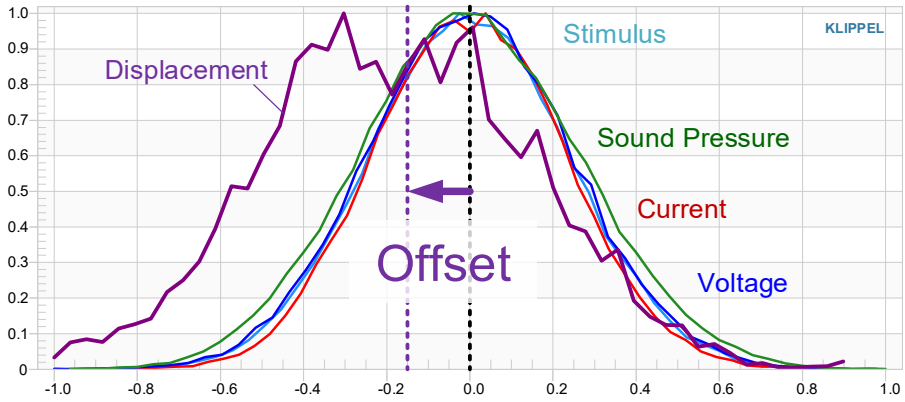

Figure 2: Normalized probability density functions.

The Time Frequency Analysis (TFA) received updates both concerning its user interface – now featuring synchronized cursors for time and frequency range selection – as well as additions to reverberation time analysis. The latter is now available per frequency-band, fully compliant with IEC 60268-23 and features a new, convenient way to check validity of results in each band. Green bars indicate valid data with sufficient signal-noise ratio to derive reverberation time, as shown in the example below. TFA automatically checks for noise corruption and insufficient impulse response length and shows appropriate warnings and errors. The global reverberation time is marked as a dashed line.

Important applications for frequency-dependent reverberation time are the analysis and design of listening rooms as well as the calculation of the room transfer function or room gain defined in IEC 60268-23.

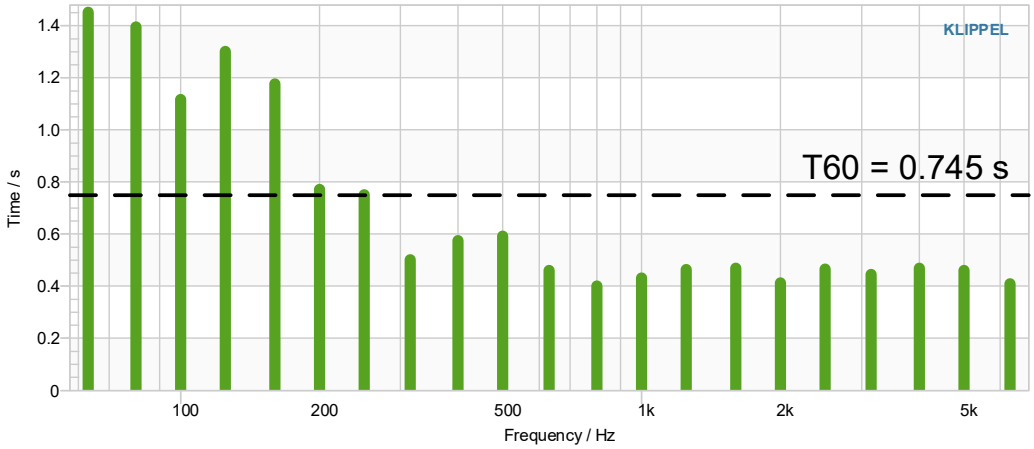

Figure 3: Frequency dependent reverberation time T60.

Minor Update dB-Lab 212.534 / QC 7.4 (February 2023)

- **New Online Help System / Manuals for R&D and QC**
  - Choose between off-line (local) and online (web) help using Western or China server
- **Support for any operating system version before Windows® 10 is discontinued**

New Modules

- **Klippel Endurance Test (KET) - Pre-Release**
  - Dedicated solution for long-term, power, and accelerated life tests
  - Any transducer: woofers, micro-speakers, headphones; also passive systems
  - Monitors power, temperature, resistance, voltage, current
  - Reveals the destruction process at high-time resolution
  - User-defined failure limits
  - Monitors up to 32 DUTs simultaneously and independently
  - Cost-efficient multi-channel solution using smart amps (*Powersoft MEZZO,* up to 600 W)
  - Noise, single and multi-tone, and custom wave file stimuli
  - Amplifier output voltage control with stepping and cycling
  - Monitors data of user-defined, external sensors (e.g., temperature & humidity)
- **Nonlinear Residual Analyzer (NRL) - Pre-Release**
  - Applicable to audio systems and transducers
  - Linear modeling and distortion analysis with arbitrary stimuli (e.g., music)
  - Monitoring of time-variant and time-invariant linear transfer function (frequency response)
  - Distortion and noise separation (harmonic, intermodulation, impulsive, Rub & Buzz)
  - Listen to isolated distortion, and get meaningful samples for listening tests

Updates in R&D Modules

- **Time-Frequency Analysis (TFA)**
  - Cumulative spectral decay analysis added
  - Reverberant time analysis
- **Polytech data converter to Klippel Scanner (Poly2SCN)**
  - New option to rotate the Polytec mesh

QC 7.4 Update

- **Equalization & Alignment (EQA)**
  - Windowing of impulse response added

Main Features Explained

The Winter 2023 KLIPPEL Software Update features a completely new approach to long-term testing. **Klippel Endurance Testing (KET):** An easy-to-use, multi-channel, long-term, power, and accelerated life test solution for typical quality assurance (QA) applications such as validation checks or type approvals. Relying on commercial smart amplifier hardware, KET can easily be scaled cost-efficiently up to 64 channels per control PC.

Choose between various test signals flexibly either using predefined stimuli or custom wave files, along with optional level stepping and cycling. Each device under test (DUT) is monitored individually. Failures are automatically detected through user-defined limits. Open and short circuits are detected by general limits. A "Death Report" reveals details of the monitored states at the highest available update rate for the time interval just before the detected failure.

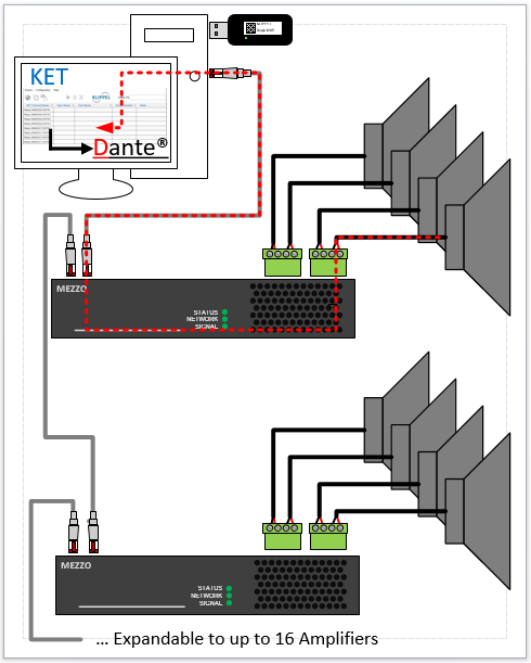

Figure 1: Klippel Endurance Test Setup.

The solution is Windows®-PC based and includes one or multiple power amplifiers as well as control and analysis software. A simple interface allows to connect external sensors and control peripheral devices such as heating chambers.

32 DUTs can be measured using one PC and a virtual soundcard. Up to max. 64 channels (depends on PC performance and Dante® interface) is possible. For each device under test, the test procedure can be started, paused, and terminated, independently. Each DUT can have an individual test sequence and configuration. A dashboard visualizes the current test status of all DUTs locally. Within the network this information is available also via a web browser remotely. »

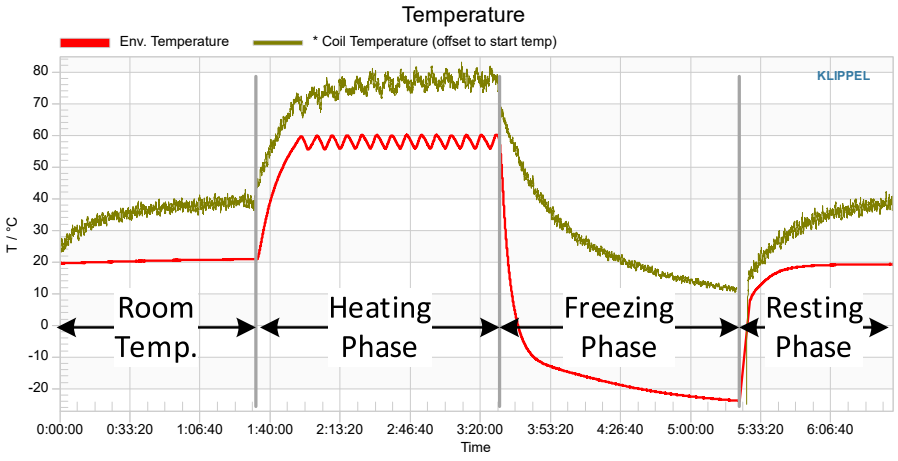

Figure 2: Coil and environmental temperature in a stress test.

The KLIPPEL **measurement software dB-Lab** received a new **browser-based** Help System.

By using online manuals, the latest information can be accessed anytime, anywhere. Crosslinking and links to our website were added to provide comprehensive help and knowledge resources. Servers are located in Europe and China for fast access and availability. Local offline help is still available to provide the manuals for PCs without internet access.

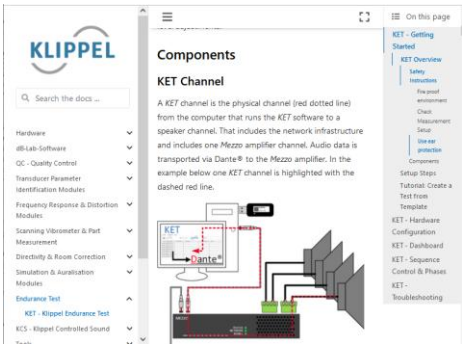

Figure 3: New dB-Lab Online Help System.

The Nonlinear Residual Analyzer (NRL) is a tool dedicated to measuring any audio playback device with arbitrary signals such as music or speech. The NRL analyzes the transfer function between system input and output based on adaptive identification. This can be used to monitor the long-term behavior as well as variations of loudspeaker systems. Applications include the investigation of heating effects, the drift of transfer function, and durability tests.

NRL can predict the linear (ideal) output of a loudspeaker system and separate a residual signal that contains all nonlinear distortion of the DUT as well as additional noise and irregular disturbances. Those artefacts can be scaled and mixed with the linear signal to provide meaningful program material for listening tests and to explore intuitively how different nonlinear effects influence the sound quality.

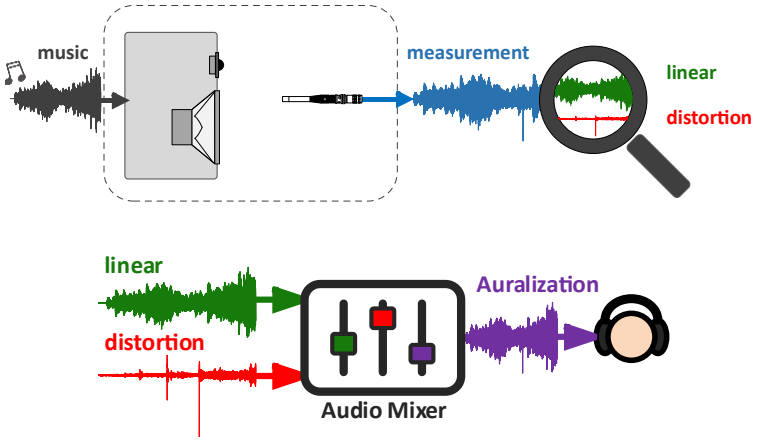

Figure 4: NRL separates and auralizes distortion.

Minor Update dB-Lab 212.332 / QC 7.3 (August 2022)

- **dB-Lab Software**
  - TEDS Integration for KA3 / QC-Card IEPE inputs added for any microphone-based measurement

Updates in R&D Modules

- **Documentation (DOC):**
  - New module enabling users to document their measurements right next to the measurement operation or add instructions on how to perform a measurement
  - Documentation according to IEC 60268-21/-22 standards or customized documentation
  - Works also as data container to add pictures of the measurement setup and datasheets of the DUT

- **Programmable Post-Processing (PPP):**
  - The module added three new templates for the calculation of frequency response characteristics according to the IEC 60268-23 standard (draft):
    - Mean sound pressure level in rated frequency range
    - Effective frequency range
    - Regression line deviation
    - Spectral balance
    - Narrow band variation

QC 7.3 Update

- **QC Software Framework:**
  - New multi-channel data aggregation option
    - Power average (e.g., frequency response) or global peak (e.g., *Rub & Buzz*) of microphone array response
    - For automotive testing applications (compatible with AES White paper on *In-car Acoustic Measurements*, Draft)
    - Exclusively for multi-channel, 3rd party capture devices and wave file processing
    - Supported by SPL, EQA and SAN Task
  - TEDS integration for microphones
    - Automatic check of sensitivity at login
    - Easy TEDS data to sensor file conversion
    - Comprehensive documentation for traceability
    - Compliant to TEDS IEEE 1451

- **QC Stand-alone Software:**
  - Replacement of older licenses required (free of charge)
  - Improved Integration of testing with Dante® audio network compatible smart amps (e.g., *Powersoft MEZZO*)
    - 3rd party calibration extended for voltage/current sensors (impedance testing: IMP, MSC)
    - New Tech Note TN17 for setting up Powersoft Dante® smart amplifiers with KLIPPEL QC Stand-alone
    - New Application Note: AN79b for Efficient, Mobile Quality Assurance of PA Speakers

        - Alternative, subscription-based license model for QC Stand-alone software for rental testing applications: temporal licenses as an alternative to purchasing life-long licenses

- **Sound Pressure Task (SPL)**
    - Band level metric was extended by a relative calculation mode (relative to average level)
        - Fully compatible with normalized frequency response
        - Application: simplify testing of multi-way speakers with universal limits
    - New result metric: IDR (Maximum Impulsive Distortion Ratio) according to IEC 60268-21
        - Relative metric for benchmarking and simplified limit setting in testing loud-speaker defects (Rub&Buzz)
        - Simple single value number reflecting relative peak level of impulsive distortion
    - Spectrogram 3D Limits (3DL): The time frequency analysis for QC)
        - Production Noise Immunity (PNI) added. Automatic repetition if disturbed by noise
        - Time Frequency Analysis (TFA) setups and results are now fully compatible with 3DL

- **Sound Pressure and Impedance Task (SPL-IMP)**
    - Band level metric was extended by a relative calculation mode (relative to average level)

Main Features Explained

The **Summer 2022** Klippel Software Update features the new **Documentation module (DOC)** for any dB-Lab operation (R&D or QC). The primary goal is documenting measurements in a standard-conform way (IEC 60286) as an easy process. Most conditions and properties to be stated by the manufacturer are directly available and simply need to be filled out. Each manufacturer can customize those documentations, and select which properties are important for the particular measurement. Storing such configurations as operation templates simplifies the most often neglected, but valuable process of documentation. Thus, besides actual measurement data, the description of the device under test and test conditions are displayed. Consequently, communication with suppliers and customers becomes simpler and more meaningful.

Also, instructions and guidelines can be stored and displayed to ease the operator's work. Datasheets or any other supplementary documents or pictures can be stored in the measurement database together with test results. The DOC module is free of charge and available without license.

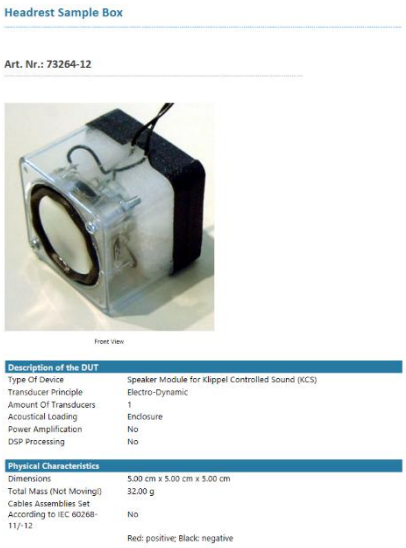

Figure 1: Compiled documentation according to IEC 60268-5, 21, and 22.

TEDS has been made available for any KA3 having QC-Card(s) installed. TEDS is an electronic datasheet (IEEE 1451) storing sensitivity and meta data such as manufacturer and sensor type information. Any data stored in TEDS compatible microphones can be converted easily into KLIPPEL sensor files. This information can be used with any input, even those which do not support TEDS, such as Klippel Analyzer (KA3) Laser card, Distortion Analyzer (DA2) and Production Analyzer (PA) hardware as well as 3rd party audio interfaces or soundcards. For any QC test using the QC card, the connected microphones are checked at login and the TEDS data are used for measurement whereas unknown sensors are detected and rejected. Full traceability is provided, proper calibration is ensured, and measurement problems due to non-confirmed sensors are avoided.

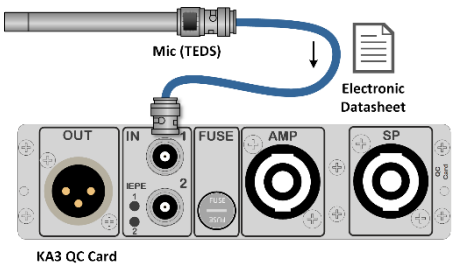

Figure 2: TEDS compatible microphones with KA3 QC Card

Klippel **QC Stand-alone Software** is designed to work with 3rd party audio interfaces or to measure PC-connected audio devices (such as USB audio or smart speakers). In particular, it works smoothly with digital amplifiers or devices that can measure and stream current and / or voltage via audio-over-IP (e.g., Dante®). QC 7.3 version now supports the calibration of such devices. Sensor files are available for selected amplifiers.

The Tech-Note *TN17 - Setting up DANTE & Powersoft Mezzo for QC Stand-alone Software* explains the use of those amplifiers using *Powersoft* installed amplifiers series as an example. Any impedance-based measurement task of the QC software such as **Impedance Task (IMP)**, **Motor and Suspension Check (MSC)**, **Balanced Armature Check (BAC)**, **Multitone Distortion (MTD)** and others support 3rd party **streaming V/I amplifiers**.

Application Note *AN 79b Efficient, Mobile Quality Assurance of PA Speakers* illustrates the use of those amplifiers and describes a low-effort solution for reliable incoming quality checks of professional audio equipment. All of the hardware can be stored in a compact 2 height, 19" rack. Please contact Klippel support team for more information.

Figure 3: Fast and cost-efficient quality check of rental Sound Reinforcement Equipment using streaming V/I amplifiers and QC Stand-alone Software.

Klippel QC now provides **channel aggregation** for multiple microphone measurements. A typical use case for aggregating data is testing microphone arrays, measuring spatially averaged sound field characteristics. Depending on the particular result parameter, this aggregation can be a power average (e.g., magnitude of SPL frequency response), or the overall maximum value (e.g., impulsive distortion "Rub&Buzz") of all channels.

Aggregation of multi-channel microphone data is the measurement data acquired in cars to assess the sound field for each passenger using a **microphone array**. Related to this feature, there is current activity by the AES Technical Committee on Automotive Audio. A white paper *In-car Acoustic Measurements* shall suggest a standardized assessment and comparison of acoustic properties in cars. Klippel contributes to this activity and supports these proposed measurements.

Figure 4+5: Acoustic in car test setup using microphone array on AES Automotive Audio conference in Detroit July2022.

Minor Update dB-Lab 212.240 / QC 7.2 (March 2022)

Updates in R&D dB-Lab 212

- **Time Frequency Analysis (TFA):**
  - Complete revision of user interface, graphical appearance, processing and feature scope
  - Processing:
    - Simple setup mode for most common tasks
    - Flexible reduction of time resolution for wavelet and filter bank analysis (peak, rms)
    - Dedicated processing mode for impulse responses (waterfall etc.)
    - Compatibility with QC 3DL –Spectrogram 3D Limits module
  - Player and auralization functionality added:
    - Playback of imported wave files (Windows default audio device)
    - Change of playback rate (slow down)
    - Frequency (bandpass) and time filter to cut sections of interest
    - Intuitive cursor control and dedicated playback control window
    - Export of filtered wave file
  - Import:
    - Import impulse responses from wave files
    - Import of long wave files supported
    - Generic import of all waveform data generated by modules of the KLIPPEL Analyzer System
    - Easy clipboard import
  - Reworked display settings and graphical appearance
  - New operation and report templates, new examples

- **Large Signal Identification (LSI3):**
  - Enlargement headroom increased
    - Headroom is limited by amplifier and not by internal processing any more
    - Level of U_{small} is not critical any more

QC 7.2 Update

- **QC Stand-alone Software version**:
  - No Klippel hardware (KA3, PA) required
  - Minimal test setup using sound card and microphone for acoustic testing
  - Comprehensive tests of active systems (personal / smart devices, Bluetooth®)
  - Any impedance-related modules (IMP, SPL-IMP, MSC, BAC) support 3rd party data acquisition hardware (e.g., power amplifier with voltage / current sensing)
    - Calibration of voltage and current measurement provided
    - Calibration of Amplifier gain supported.
    - Dante® and other audio streaming protocols supported

- **3D Spectrogram Limits (3DL):** **Full release**
  - Integrated ambient noise detection and PNI – Production Noise Immunity (replace all mode only)
  - Limit calibration added
  - New operation and test templates
  - Compatibility with TFA - Time Frequency Analysis

- New Add-On "Adjust Limits"
  - Allows adjustment of frequency response limits by operators
  - Password protection available

    - Flexible, iterative adjustment of limits with full traceability
- Separated serial numbers for passed and failed verdicts
- New frequency response option: full signal versus windowed response (fundamental response only)
- **External Synchronization (SYN):**
    - Show delays between measurements in open loop scenarios
    - Allow Wave Export (store sensor signals) in open loop import mode

- **Post-Processing Task (PPT):**
    - New processing mode: Analysis of single curve input
    - New results including limit calculation and verdicts:
        - Band Values: Calculation of max, min, rms or mean value of user defined bands of a measured curve
        - Band Values - X Axis value: search of x-axis position where max or min band values are located

- **IO & Prompt Task (IO Task):**
    - Supports manual input of data or queries including limits and verdicts

- **Spectrum Analysis (SAN):**
    - Now supports input signal sharing (e.g., for multi-channel testing)

Main Features Explained

The KLIPPEL Analyzer System has received a first minor software update for version 212 in 2022 providing various new features for both R&D and QC applications. The update is free of charge for all users running dB-Lab 212 or QC7.

The **Time Frequency Analysis (TFA)** module has faced a major revision and feature update. As a dedicated post-processing tool for the analysis of waveforms in time and frequency domain it can import any signal or impulse response generated by the KLIPPEL Analyzer System or imported from wave file. In addition to the spectrogram analysis options based on STFT, wavelet transform or auditory filter banks with superior time resolution, this powerful post-processing tool now provides an interactive band-pass filter and playback function for subjective distortion analysis and diagnostics. Replacing the PLAY module, the TFA can now load very long wave files in order to obtain signal characteristics and pick a time range for detailed analysis. Overall performance and usability and graphical appearance were improved.

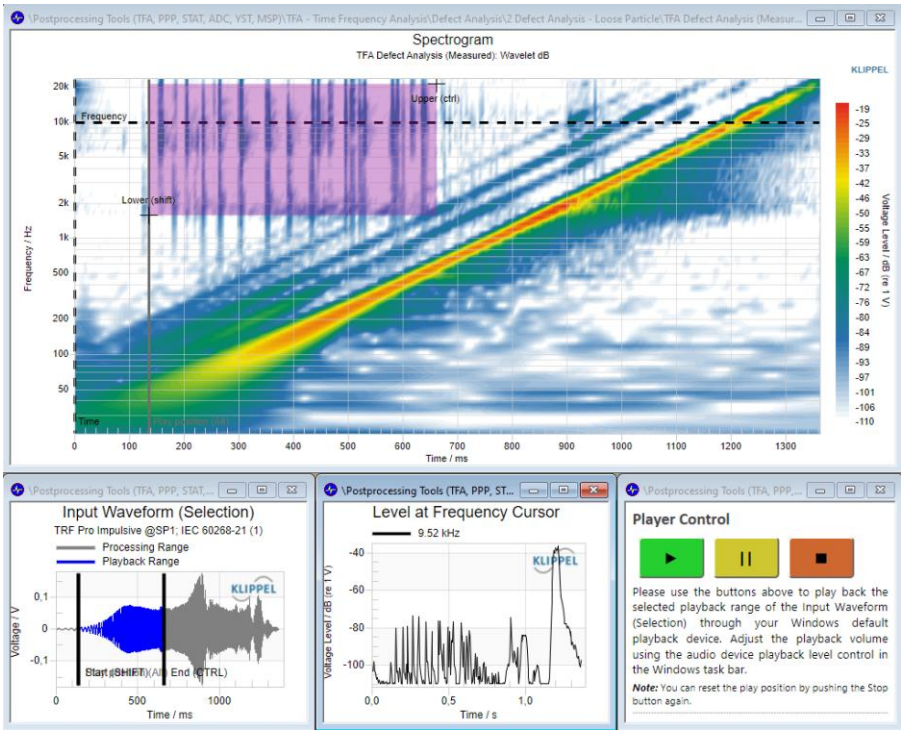

Figure 3: TFA wavelet transform of chirp response and filtered playback feature; playback time and frequency range is adjusted using the cursors in the spectrogram plot.

Now officially released, the **QC 3D Spectrogram Limits (3DL)** is an offspring of the TFA, dedicated to the particular requirements of QC testing. This add-on for the chirp-based **Sound Pressure Task (SPL)** of the KLIPPEL QC software uses the auditory filter bank shared with the TFA to generate a time-frequency plot of the measured DUT's response. The 3DL applies automatically generated "3D Limits" to the spectrogram based on golden reference DUTs to reveal the signature of irregular distortion and abnormal sound caused by loudspeaker defects (Rub&Buzz, loose particles, …). Any exceedance of the limit threshold is highlighted clearly in the dedicated result plots. As an addition to the well-established "Rub&Buzz" measurement in time domain (impulsive distortion, IEC 60268-21) providing best sensitivity for even tiniest loose particles, the 3DL provides new benefits such as detecting abnormal behavior anywhere in the spectrum, identifying external (uncorrelated) disturbance, detailed defect root cause analysis as well simplified Rub&Buzz filter setting. 3DL now also supports **ambient noise detection** feature and **Production Noise Immunity (PNI)** add-on.

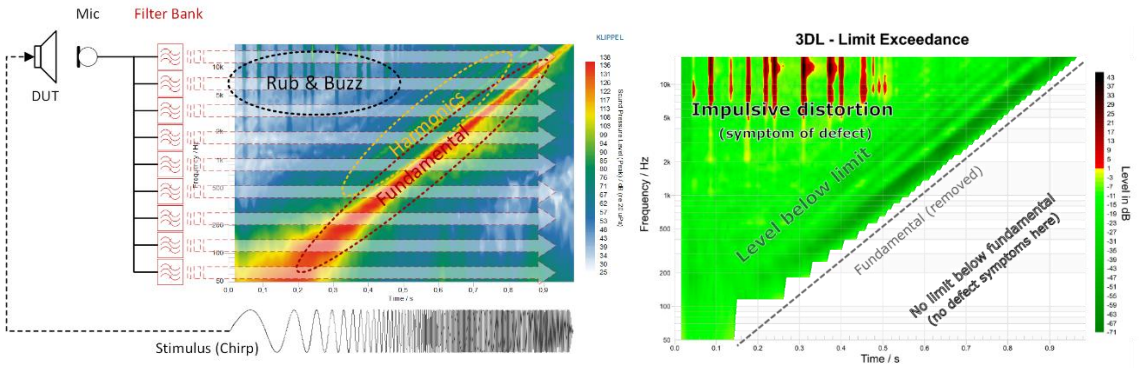

Figure 4: Schematic of filter bank analysis (left); detected loose particle failure in spectrogram 3D limit surface; limit area is defined by harmonic order of chirp signal (right)

The **QC Stand-alone Software** version is dedicated to all test scenarios where the KLIPPEL Analyzer Hardware is not required or cannot be applied. Together with the **External Synchronization (SYN)** add-on it is highly suitable for any closed or open loop test scenario using 3rd party hardware (e.g., audio interface) or wave-file-based analysis. It only requires PC, laptop or tablet running Windows® and a KLIPPEL USB license dongle.

In addition to output-based audio testing according to IEC 60268-21, the QC Stand-alone now also supports all tasks and features of the QC software that are based on voltage and current measurement such as **Impedance (IMP)** for T/S parameter testing and **Motor + Suspension Check (MSC)** for patented nonlinear parameter testing (e.g., voice coil offset). This allows creating powerful and yet price-efficient test setups using smart amplifiers with built-in voltage and current sensing such as *Powersoft Mezzo* series that are capable of streaming sensor signals via *DANTE* network for professional quality control in cost-sensitive applications (such as rental companies, service stations and many more).

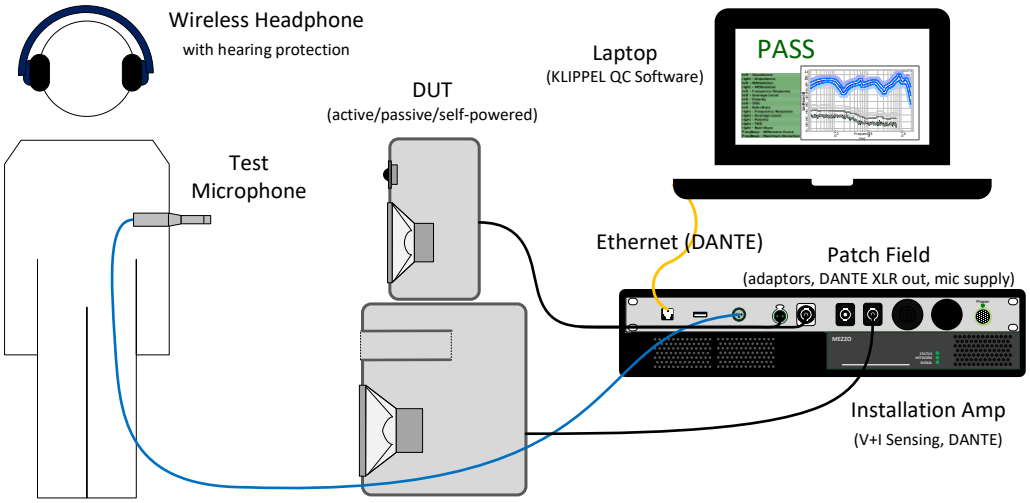

Figure 5: Mobile quality control test setup for rental companies based on QC Stand-alone Software and smart amplifier with DANTE interface

Minor Update dB-Lab 212.116 / QC 7.1 (November 2021)

Updates in R&D dB-Lab 212

- Near Field Scanning Software **(applied to Carousel (NFS) and Workbench hardware):**
  - Asynchronous testing for half space measurement (e.g., Bluetooth®)
  - Half space Scanning of compact devices. Enables smaller grids and increased measurement precision for very small DUTs
  - Visualization: new normalization options (to listening point) for Contour plot and Beam width
  - Listening Zones: Smoothing, Iso Frequencies, Distance Scaling (1/r), Voltage Scaling
- Multi-Tone Measurement (MTON)**: Update**
  - Full compatibility with QC MTD Task
  - Multi-tone distortion calculation: energy ratio of distortion in bands to fundamental
  - Single value result and limit: total multi-tone distortion to fundamental ratio
  - New charts: Multi-Tone Response, Total MD Ratio vs Step
  - Limits now available in single measurement mode
  - Probability density function and higher moments of measured signals
  - Complex room correction curve applied to microphone waveform and transfer function
- Linear Parameter Measurement (LPM) & Large Signal Identification (LSI):
  - Support of amplifiers with steep high-pass filter slope below pass band

  (e.g., Class D, DSP processed amplifiers with HP <= 24 dB/oct. @ 10 Hz)
- 3D Distortion Measurement (DIS):
  - Revision of graphical display and chart configuration
- SCN Vibration Scanning Software:
  - New Lasers supported: LK-H022 (all scan modes), LK-H082 (flat scan only)
  - Upper Frequency Limit increased: Scans with KA3 are supported up to 66 kHz
  - Geometry Export: Units included and new 2D *.dxf export formats
- Poly2SCN **(Converter from Polytec Scan Data to Klippel Software):**
  - New visualization and remeshing of Polytec measurement grid
  - Geometry Detection: Supports rectangular and asymmetrical grids
  - Detects non-scanned areas within the measured grid (e.g., to isolate vibrating enclosure from driving speakers).

QC 7.1 Update

- Multi-Tone Distortion Task (MTD)**: Major Revision**
  - Full compatibility with MTON module of R&D system
  - Transfer function and emulated frequency response added in addition to fundamental
  - Level result added (AC RMS response level)
  - Multi-tone distortion calculation: energy ratio of distortion in bands to fundamental
  - Single value result and limit: total multi-tone distortion to fundamental ratio
  - New test templates with MTD for passive and self-powered audio systems
  - Settings and limit import added
- Calibration:
  - Microphone Calibration of microphones using wave files
  - Calibration process can now be automated (QC Automation)
- Sound Pressure (SPL) & Sound Pressure and Impedance (SPL+IMP):
  - Frequency bands of band levels can now be defined independently (overlap allowed)
- Preconditioning: sweep generator settings harmonized with SPL task (Level and Speed Profile added)

Major Update dB-Lab 212 / QC7 (July 2021)

New KLIPPEL Software Module

SCN Nearfield Add-On (SCN-NF): Acoustic testing using holographic identification technique

- Add-On for KLIPPEL SCN Scanning Vibrometer
- Acoustic measurement of transducers and small devices in half-space (baffle)
- Comprehensive near/ far field radiation data
- Directional characteristics and sound power
- Direct Sound Separation, suppression of room reflections and modes
- No anechoic room required
- Compact hardware setup

Multi-Tone Distortion Measurement (MTON): Full release

- New: Flexible multi-tone stimuli with user definable crest factor
- Fundamental and distortion measurements
- SPL Max and max. voltage according to IEC 60268-21
- Continuous Max. SPL related to ANSI/CEA-2010-B and ANSI/CEA-2034
- New: Compression vs. frequency
- Customizable cycling and stepping
- Protection limits to avoid damage of test objects
- Testing transducers, active and passive speakers
- Compensating frequency jitter induced by digital audio devices or transmission

Linear Simulation (LSIM): Full release

- Linear signal modeling from digital input to acoustical output
- Lumped parameters modeling
- Analyzing electrical, mechanical, acoustical state spectra and transfer behavior
- Automatic equalization to target alignments
- Small signal performance considering properties of typical program material
- Efficiency and voltage sensitivity versus frequency
- Calculates parameters from geometrical input
- New: Post-filter simulating room response
- New: Phase and group delay

Rocking Mode Analysis (RMA): Full release

- Solve Rub&Buzz problems caused by rocking modes
- Improve speaker balance for safe operation at high output levels
- Find the dominant root cause for rocking
- Assess imbalances in mass, stiffness or force factor and locate them
- All important results on a single page
- New: Improved user assistance with prioritized instructions
- New: Traffic-light coded severity grading for rocking level

Updates in Existing KLIPPEL Products

dB-Lab:

- New sensor management, unified for R&D and QC
- Improved chart graphics, performance and interactions
- Measurement protocol holds hardware configuration, timeline and errors
- New operation icons, warnings, errors
- Separate signal configurations for each device
- User defined chart annotations
- Report Generator: new report templates for all modules, new style
- Manual Sweep for R&D: Simple, intuitive sine generator with fundamental and distortion analysis, optionally operated by 3D-mouse

End-of-Line testing software QC 7:

- New software remote control interface
  - Automation API replaces IO-Monitor API (still supported)
  - Automate QC testing (measurement control, SN input, GPIO, result access,)
  - Supports flexible integration with your favorite programming or scripting language (e.g., Python)
- New sensor management
  - Sensor setup simplified and unified with R&D applications
  - Dedicated configuration for KLIPPEL Analyzer 3, Production Analyzer, 3rd party audio interface and wave file import – no more confusion
  - Tasks support various sensor types (result units, dB level references)
- Multi-channel test capabilities expanded
  - 3rd party audio interface (sound card) - support up to 15 I/O channels
  - Wave file analysis - up to 128 channels (e.g., for smart speaker testing)
  - Dedicated channel-based routing options
- New template for power amplifier testing
  - Stereo amp check with dummy load resistor
  - Voltage/current frequency response, distortion
  - Quick power test with large signal multi-tone
- External Synchronization (SYN):
  - Multi-channel open loop analysis improved - analyze multiple wave files in one test sequence
  - Terminology and handling of sequence *Execution Modes* for closed and open loop testing improved – better integration in automated sequences
- Time-frequency analysis of chirp response (3DL): Absolute limit option added
- Acoustic test tasks (SPL, SPL-IMP):
  - New limit alignment option *Absolute (normalized)* for floating limits - fixed tolerance for normalized frequency response → test frequency response shape independent of level/sensitivity (e.g., powered speakers, uncalibrated device test)
  - Harmonize handling of phase and polarity and removing cross-dependencies (delay correction)
- Electric test tasks (IMP, TSX):
  - Now also supports *Signal Sharing* with other IMP tasks – test two devices/speaker channels with only one measurement

Statistics (STAT):

- Dependency analysis plots for single values reveal correlation and dependency versus time, sample or other measure (e.g., temperature)

Near Field Measurement Software (NFS):

- Improved Postprocessing: ISO frequencies, smoothing, distance scaling
- New 3D graphics integrated into dB-Lab
- Better interactive analysis
- Near Field Visualization of spatial sound pressure distribution
- Overlay of multiple polar plots vs frequency

Time-Frequency Analysis (TFA):

- Signal Statistics: mean, rms, peak, bottom, kurtosis, crest factor
- Probability density function of wave form
- Energy-time curve of impulse responses

Vibration Scanner Software (SCN):

- Automatic Laser Calibration for KA3
- Direct Step Motor Control available from dB-Lab

Updates for KLIPPEL Hardware

SCN Multi-Scanning Workbench:

- SCN vibration scanner hardware includes now add-on for half-space (baffle) acoustic testing

Compatibility

Klippel R&D Software is compatible with data measured in dB-Lab 206 and higher

Klippel QC7 Software supports any data measured with QC4 and higher

Main Features Explained

The Klippel Software received a major update in early summer 2021. The main software platform *dB-Lab* 212 for both, *QC 7* and *R&D*, now provides a shared sensor management. The ***Klippel Multi-Scanning Workbench*** is now fully released bringing the near field holographic sound field scanning technology that provides directivity, sound power and room correction to a much smaller form factor. For comprehensive measurement of distortion using multi-tone stimuli, the MTON module is now released. Simulation tools are complemented by a new linear simulation module LSIM, dedicated to speaker and enclosure design.

Klippel QC software has been upgraded with a new automation control interface and multi-channel support for any Windows or ASIO audio interface, as well as wave-file based open loop testing. It includes more flexible options for testing and synchronization and for smart or stand-alone audio devices. Many small but useful tools and updates in existing modules round up this new major release. Read about, get your update, and explore or start with a free trial version.

General New Features in dB-Lab

dB-Lab is the platform software for the Klippel Analyzer System. It is used to setup, operate, analyze and post-process measurements or simulations. In the new software version, all four aspects of the frame have been updated. For **setup,** the sensor handling for any supported hardware or wave files was reworked and is now unified for R&D and QC. Sensors are either calibrated and stored in new sensor files or selected from a pool of commonly used sensors. The routing setup of the hardware is streamlined and more flexible when using multiple test hardware devices. Available sensors can be assigned to any signal path.

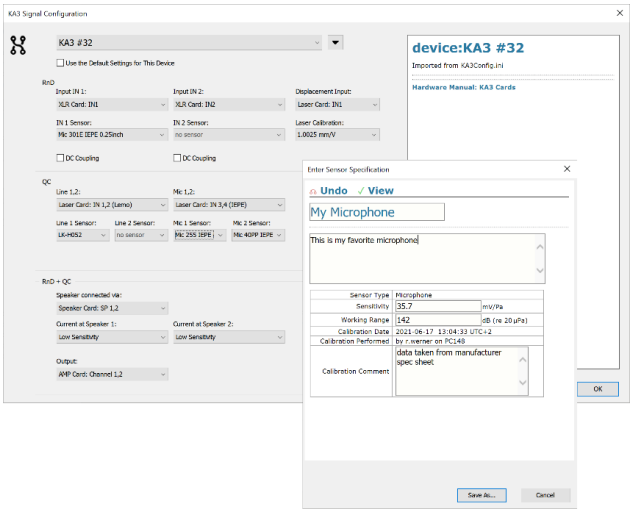

Figure 6: Signal Configuration dialog for KLIPPEL Analyzer 3 and new microphone form.

When **operating** a measurement, new operation icons indicate if problems may have occurred during the measurement. Errors and warnings are clearly marked and, in most cases, directly linked to the manual. This allows for quick identification of problematic procedures and shortens your workflow. A new measurement protocol window lists meta and progress information of the measurement including a time line, hardware configuration, and errors and warnings. **Analyzing** results has been made easier by improved graphics, harmonized terminology, better customization, and annotations within the graph for illustration of interesting details. The graphics export to many formats has been extended and includes annotations and user customizations. For **post processing**, all results can be exported directly to pdf reports based on new report templates and for the most common applications. The *Manual Sweep* live scope function as known from the QC framework is now also freely available for R&D and allows simple analysis of sinusoidal stimuli. This function can be smoothly operated by a handy 3D mouse.

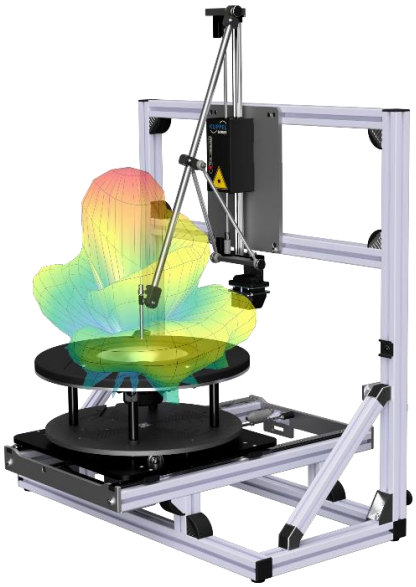

Figure 7: Woofer mounted on the SCN scanning workbench using new near field add-on (SCN-NF).

Comprehensive Scanning Solutions

A gap has been filled for **acoustic spatial measurements** using a smaller form factor than the well-known, large Near-Field Scanning System (NFS). Based on the popular vibration scanner hardware (SCN), the automated acoustic scanning and the full spatial characteristics of sound sources by holography is now available. A hardware add-on (SCN-NF) extends existing vibration scanners to a multi-scanning workbench for other useful sensors such as microphone, probes, and magnetic sensors. The main application is acoustic scanning in normal rooms. Thus, no anechoic room is required for accurate acoustic measurements. Typical devices under test are transducers and small audio devices (mobiles, smart speaker).

Advanced holographic analysis suppresses room reflections as well as modes. Based on far less points then required for a conventional directivity measurement on a fine acoustic grid in greater distance, a near field measurement reveals an analytical description of the source and therefore can provide spatial data at any distance outside the scanning surface and at any resolution. Important output results include directional characteristics such as balloon plots, directivity plots, sound power and many more. Whereas the large Near-Field Scanner allows full and half space measurements, the ***Multi-Scanning Workbench*** is focused on half space configuration (using a baffle).

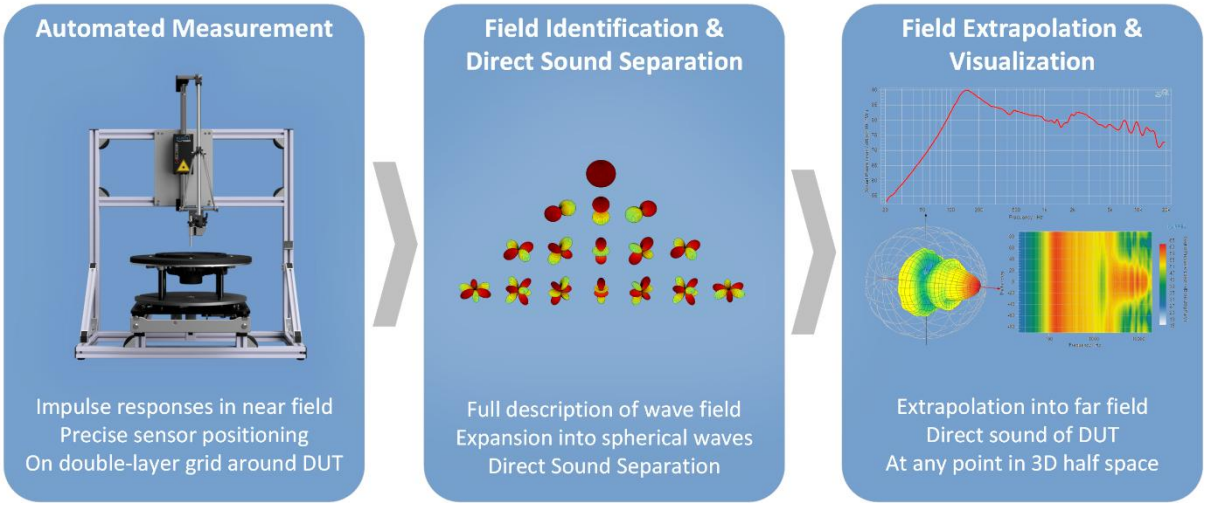

Figure 8: Principle and results of the holographic measurement principle.

The typical test time starts from as low as 5 minutes when assuming rotational symmetry. A full scan without any symmetry assumptions takes about 1 hour. The ***Multi-Scanning Workbench*** (formerly SCN hardware) now comes as complete hardware platform for vibration and sound pressure (or other domain) scans. Two separate software packages are available for mechanical and acoustical analysis. Please check the website for more information and an explanation video.

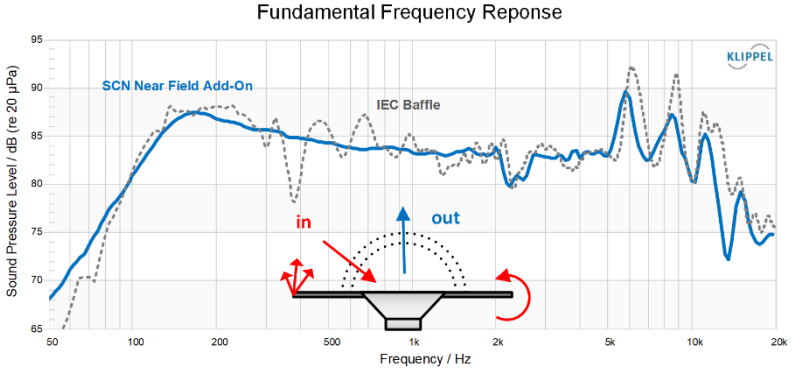

Figure 9: Comparison of a transducer frequency response measured in a traditional IEC baffle vs SCN Near Field add-on (SCN-NF).

The **vibration scanning** software now supports an automated laser calibration and verification. To position sensors at any location, a simple positioning frontend for the individual axis has been added. Based on vibration data, rocking modes can be detected reliably and the root cause of rocking can be identified. The Rocking Analysis Module (RMA) is released now and has received substantial improvements to guide the user effortlessly from measurement to analysis. A clear indication is given if the device under test has a critical rocking behavior which may result in reduced output audible distortion (Rub&Buzz) and early failure (field rejects). The actual scanning time for a rocking analysis takes usually less than 10 minutes. This allows testing multiple devices of one batch to isolate systematic behavior from random effects.

The graphical output and user interface of the NFS near field scanner **visualization software** was completely reworked and is now natively integrated in dB-Lab. Distance scaling is now available from the scanning surface to far field. The license structure was also simplified. Refer to the current price list.

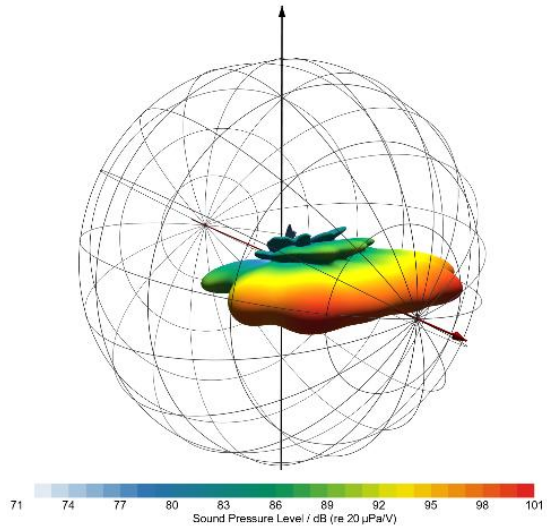

Figure 10: Balloon plot generated with the new NFS visualization in dB-Lab.

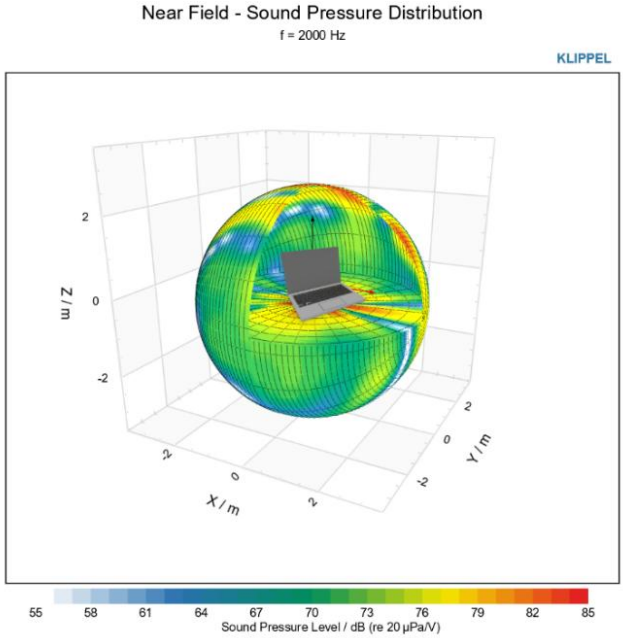

Figure 11: Visualization of the near field SPL distribution of a laptop scanned with NFS.

Distortion Analysis

MTON, the **multi tone-based analysis** module is now released. Multi-tone stimuli are quite useful test signals due to their music-like properties with the advantage of direct distortion measurement at the non-excited spectral bins. Therefore, multi-tone distortion provides a much more realistic picture than a pure sine tone measurement and the corresponding harmonic distortion analysis. MTON has a new option to specify the crest factor (impulsiveness - ratio of peak and rms value of the stimulus) which is important for high power tests and for accurate imitation of real-world music material. Stepping and cycling tests allow automatic thermal and non-linear compression measurements.

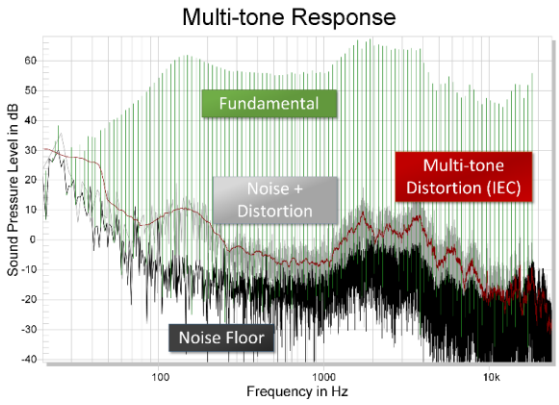

Figure 12: Main result plot of the MTON module.

To protect the device under test, several limits can be defined to avoid damaging when increasing test levels automatically. For transducer or passive systems, electrical, mechanical and acoustical signals can be analyzed and conclusions can be drawn for distortion generating mechanisms. MTON supports testing of any active audio systems with wireless connection (e.g., Bluetooth®) and compensates for potential frequency jitter.

The Sound Pressure Analysis (SPL) in QC software is extended by an add-on for time-frequency analysis. This three-dimensional surface plot (spectrogram) reveals the signature of distortion and abnormal sound, and can now be checked against user-defined **3D-limits** (3DL) relative to a reference or as an absolute limit.

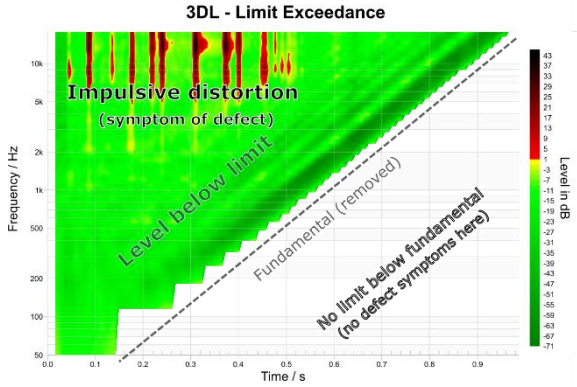

Figure 13: Detected loose particle failure of 3D spectrogram limit surface; limit area defined by harmonic order of chirp.

Simulation

The well-known non-linear simulation modules SIM and SIM-AUR received a corresponding tool for linear simulation (LSIM). In contrast to many available tools, the LSIM targets the overall design for green speakers (efficient, light weight, small). Maximum peak voltage, voltage sensitivity and efficiency for a given program material can be tuned easily to application requirements. Automatic EQ-tuning is available and with just one click, the effects on peak displacement and spectral properties of the response are predicted. A full set of all relevant states is analyzed and the corresponding transfer behavior is plotted.

LSIM is optimized to work with the Klippel Controlled Sound (KCS) solution. A simple user interface, interactive networks and enclosure configuration, as well as geometry-based parameter input, help considerably when starting to work with the module.

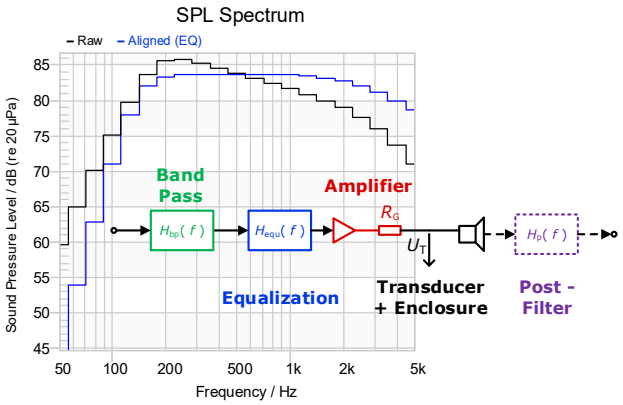

Figure 14: Comparison of simulated SPL spectrum of raw loudspeaker vs aligned response using LSIM.

End of Line Testing

A wider range of applications can now be tested with Klippel QC software. Complex test scenarios can be implemented and controlled using the new **Automation API** software interface. This API is the successor of the long existing IO-Monitor interface, which is still supported. It can be integrated easily in popular script languages such as *Python*. The above-mentioned sensor management routine is available for Klippel analyzers, soundcard-based interfaces, digital audio devices and wave file analysis. Sensor files can be shared with R&D software and result charts are correspondingly scaled and labeled.

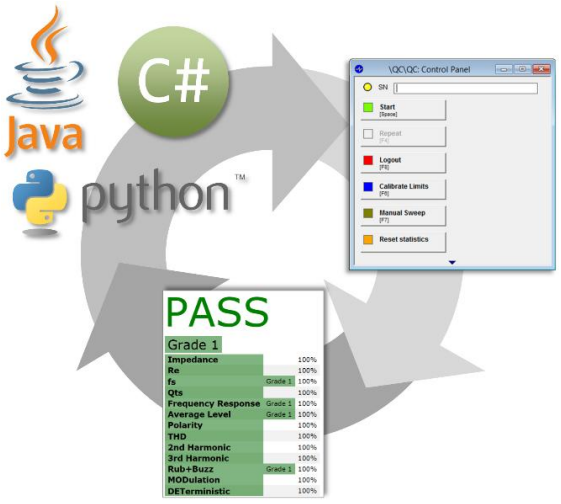

Figure 15: Flexible Automation API integration for QC software remote control.

Especially for directivity-controlled devices (beam forming, speaker and microphone arrays) multi-channel capabilities are expanded. For any non-Klippel front-end, up to 15 channels are supported as well as 128 channels for wave file processing. Using

the input signal sharing feature, one measurement can capture many signals that are automatically distributed to multiple analysis tasks. This considerably reduces test and setup time.

Open loop testing was improved to analyze multiple wave files in one test sequence, as well as better support for mixed configurations of Klippel hardware and external audio devices. Typical examples are testing sound emitting devices and microphones without audio streaming access using wave file stimuli and responses.

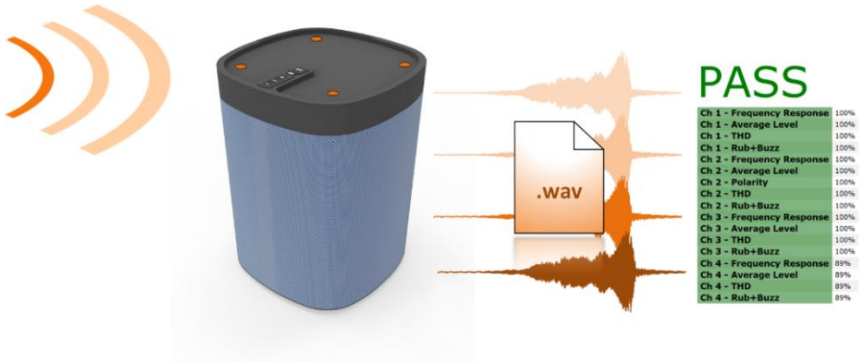

Figure 16: Wave file-based testing a smart speaker's four microphone responses using KLIPPEL QC.

Tools

A huge number of small features and bug fixes are included in dB-Lab 212 and QC7. For a complete list check the *history.txt* file available at the welcome page in dB-Lab. Two features shall be mentioned here:

The Time-Frequency Analysis (TFA) tool (a twin of QC-3DL module) is improved with additional diagnostics of the imported wave file. A comprehensive signal analysis (mean, rms, peak, bottom, kurtosis, crest factor) is now available and the probability density function of the amplitude distribution is plotted.

The new energy-time plot is especially useful when analyzing impulse responses.

A statistical analysis of almost any KLIPPEL result can be done by the Statistics (STAT) module, in particular for QC results. It can now map single value results or curve data at a certain frequency or abscissa versus time, sample, or other results. The latter reveals mutual dependencies of results which are useful for understanding and optimizing production processes. However, STAT can also analyze results from R&D software modules.

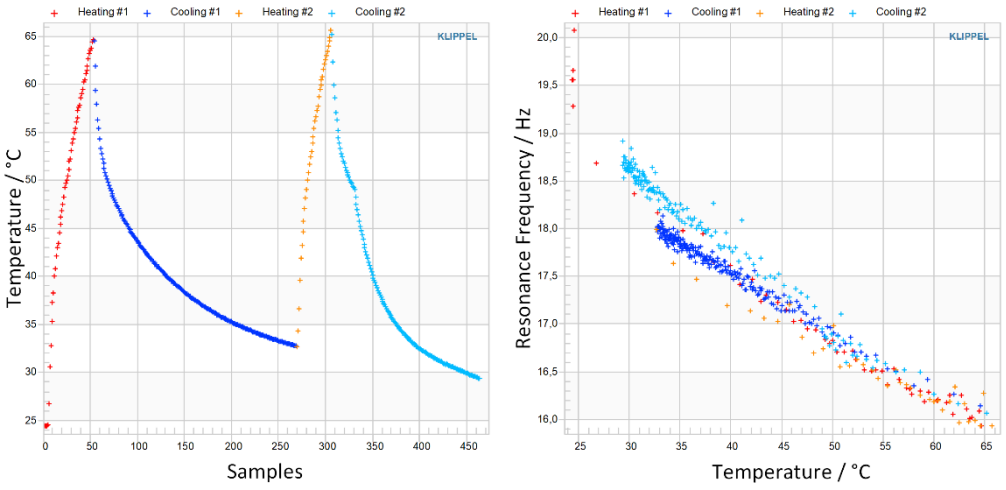

Figure 17 Dependency plots generated with STAT module (left: ambient temperature vs. time/samples; right: resonance frequency of a subwoofer vs. ambient temperature)