

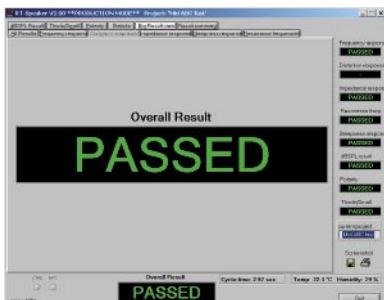
PureSound Speaker Analyzer

PureSound is a comprehensive speaker test solution, comprising a unique and reliable defects analysis. The typical cycle time for a complete speaker test is less than three (3) seconds including the outstanding Rub&Buzz analysis with its 100% correlation to the human ear.

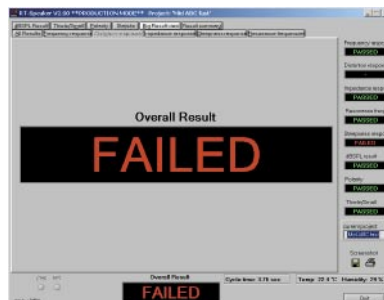
The test system is based on the high-speed audio analyzer RT-2M operated via the PC-based turnkey production software RT-Speaker™. The test system provides a comprehensive set of measurements for the total quality control of drivers, tweeters, woofers, headphones, speaker boxes and 100V speakers:

- Frequency Response
- Distortion THD, THD+N, k2, k3, k4, k5
- Impedance Response
- Resonance Frequencies f_0
- Sound Pressure Level dB SPL
- Speaker Polarity
- Rub&Buzz defects analysis with a 100% correlation to the human ear
- Thiele/Small Parameters
- Statistical Process Control (SPC) incl. CPK/PPK

RT-Speaker™ quickly and consistently measures all audible imperfections of your transducers or speakers, based on the PureSound™ technology. PureSound™ detects any audible manufacturing flaws of speakers or transducers, such as air-leaks, coils out of center, rubbing voice coils, loose particles, touching wires, etc.



Screenshot, PASSED



Screenshot, FAILED

System components:



Audio Analyzer RT-2M



Impedance Box RT-IB



M2010 Measurement Microphone

Accessories:

- PureSound Amplifier
- Environmental Sensor
- Input & Output Switcher
- 100Volt Impedance Box RT-IB

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Less noise • More sound

Speaker Test System

Simple and intuitive operation

The concise user interface simplifies the operation for every access level. The complete system setup and -configuration for a new transducer is completed in less than 30 minutes. Changes in the test properties are conducted a few seconds, maximizing the yield of your production lines.

RT-Speaker™ software grants a very detailed view of all speaker parameters to the system specialist but is kept very simple in its operation at the same time. Complete test procedures may be load by a mouse click, thus minimizing the conversion time between batches.

Customized tolerance definition

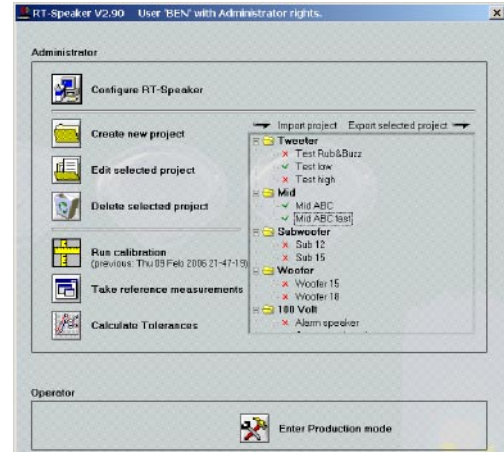
RT-Speaker™ turnkey production software features custom specific test setups and tolerance band definitions. All conducted measurements are compared in real-time against user-defined relative or absolute QC tolerances resulting in reproducible PASSED/FAILED status of each device under test.

The smart “learn” mode simplifies tolerance definition by feeding the system with a representative set of “Golden Samples”. RT-Speaker™ derives then its tolerance criteria automatically, following the predefined QC rules.

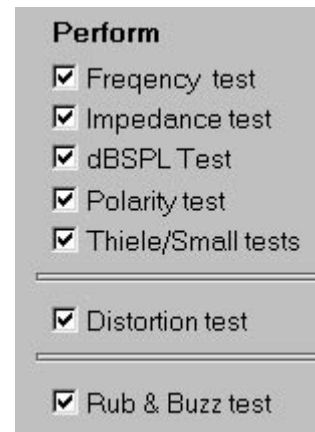
The unique tolerance management supports five different product quality clusters such as “excellent”, “decent”, “acceptable” and “reject”, allowing you to charge a premium for selected “excellent” products. This feature also supports the automated discrimination of manufacturing flaws at the same time.

Integration into production lines

The system can be easily integrated into existing production lines or connected to host controllers. The extremely short test cycle time enables the system to especially cope with high volume production lines. The implemented, patented measurement algorithms have been optimized for factory noise immunization. Ambient factory noise is suppressed and thus not affecting the test results in optimized test configurations. This maximizes your production line yield and allows to conduct the same measurement in R&D environment as well as in the noisy production floor.



Screenshot, main menu



Screenshot, select measurements



Screenshot, frequency response. absolute



Speaker Test System

Frequency Response

A fast sweep signal with custom-defined resolution serves as the stimulus to simultaneously measure:

- Frequency Response
- Impedance Response
- Resonance Frequencies f_0
- Sound Pressure Level dB SPL
- Speaker Polarity
- Thiele/Small Parameter

This highly accurate and repeatable set of measurements occupies the device under test for less than a second.

Distortion Test

Simultaneously or conducted as a more detailed separate test, the harmonic distortion behavior of the device may be assessed. The available distortion measurements comprise: THD+N, THD, k2, k3, k4 or k5 harmonics order analysis. Needless to say that all the measurements are optimized in speed to the physical limits, offering maximized utilization of the production lines.

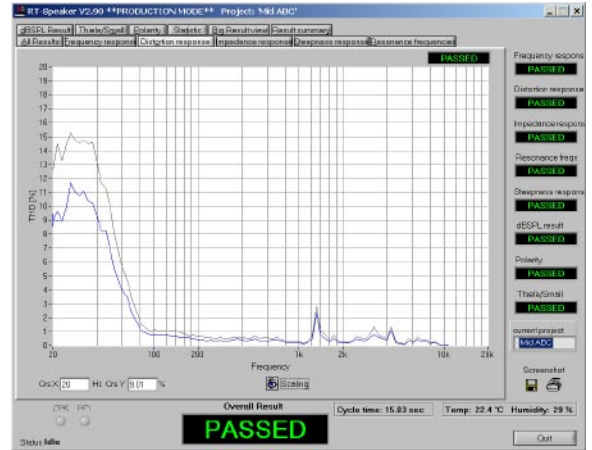
Rub&Buzz Test with 100% correlation to the ear

Customers can enjoy fast and reliable Rub&Buzz test results even in noisy factory environments. The typical Rub&Buzz test time is less than one second (< 1.0 sec.).

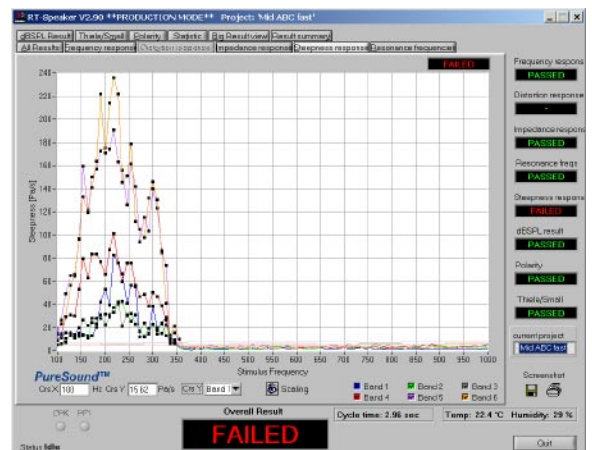
The patented PureSound™ technology is a revolutionary new approach for perceptual audio testing. The algorithms model the human ear as a transient analyzer, effectively measuring every audible manufacturing imperfection with an unmatched correlation to the acuity of “Golden Ears” – “you measure what you hear”.

PureSound™ detects the even subtle manufacturing flaws of speakers or transducers enabling the automatic qualification of the nature of these defects.

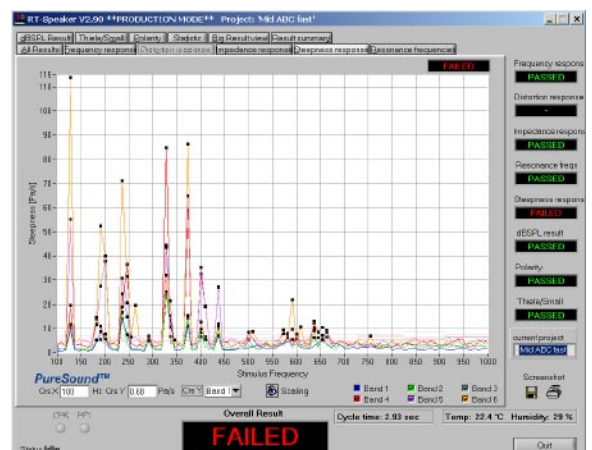
Hundreds of systems around the globe are in day to day operation, benchmarking against the best human golden ears performance. PureSound™ repeatedly provides consistent, objective test results with a 100% correlation to the human ear.



Screenshot, distortion



Screenshot, Rub & Buzz, rubbing voicecoil



Screenshot, Rub & Buzz, loose particles



Speaker Test System

Other test systems using conventional FFT analysis or high order harmonic tracking filters typically fail to discriminate timely short appearing Rub&Buzz effects like loose particles as the energy content of the signal is not sufficient for a reliable detection. This insufficiency may result in shipping production badges to clients with audible defects, leading to warranty returns and unnecessary shipping costs.

Serial Number Handling

RT-Speaker™ also supports bar code readers for manual and automatic serial number handling. Flexible barcode interpretation supports extraction of the speaker type and steering the automatic loading of the corresponding speaker test parameter. All measured speaker test results are logged to a data file including the bar code. This also permits detailed quality monitoring in the after-sales service and simplifies data comparisons of returned speakers, being extremely supportive for speaker manufacturers or rental companies.

Thiele/Small Parameter

The production test software RT-Speaker™ supports the individual assessment of Thiele/Small parameters R, Rs, R0, Qms, Qes, Qts, C, L and df without prolonging test time. The sensitive T/S parameter are an excellent monitoring base for the CPK / PPK module, effectively supervising the stability of your manufacturing line.

Multiple Measurements

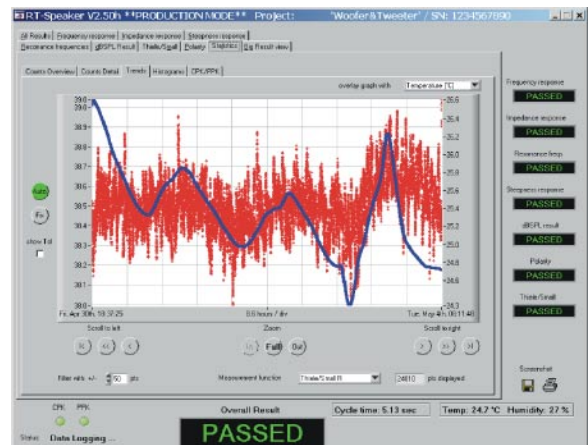
The optional Input Switcher RT-IS and Output Switcher RT-OS support automated sequential measurements of e.g. assembled speaker sets with crossovers or testing of speaker parameters with two or more microphones placed at different locations, such as at the front & rear side of woofers.

Remote Monitoring

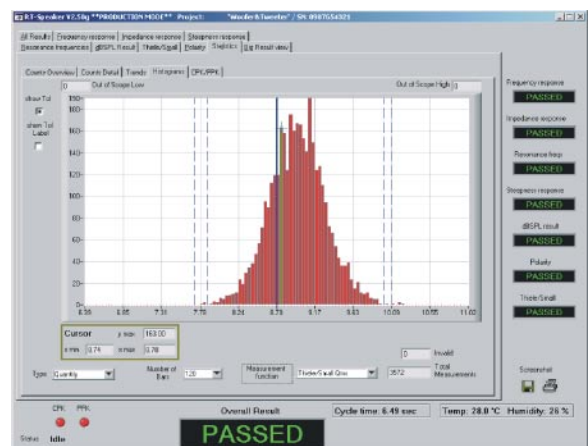
The integrated data socket server decouples the data storage from the physical location of the manufacturing lines. The data socket viewer supports remote monitoring of one or more production lines from any remote PC for quality assessment purposes. Communication is established via a simple TCP/IP link.



Screenshot, serial number handling



Screenshot, statistical trend analysis correlated with the environmental temperature



Screenshot, statistical histogram



Speaker Test System

Statistical Process Control (SPC)

Statistical data are calculated on the fly while the production test is running. Detailed histogram, trend analysis and CPK/PPK values provide a clear assessment of the currently manufactured quality. Speaker parameter are sensitive to changing environmental factors like temperature and humidity. The PureSound™ supports the detailed online correlation of test results with the actual temperature & humidity with the “Environmental Sensor” connected. This is a powerful tool for tracing the cause of failed speaker batches or initiating necessary calibrations or reference sampling to achieve accurate PASSED/ FAILED test results.

Data Logging

All test results are automatically stored as ASCII files for later evaluation by using e.g. Microsoft Excel. The user may choose between single, batch, daily or weekly logging files with individually specified logging data.

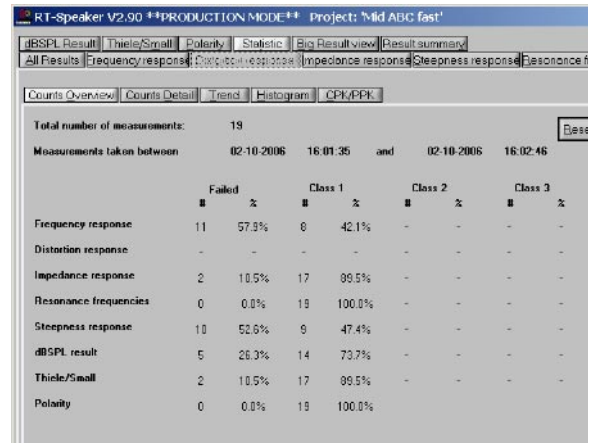
Further Applications:

R&D Speaker Evaluation

PureSound™ also supports R&D test requirements such as high resolution frequency response measurements with up to 500 points. The PureSound™ technology acquires important non-linearity finger-prints, enabling the comparison of every design stage of a speaker over its entire life. Such a continuous Rub&Buzz monitoring process supports the objective quantification of the impact of design changes to audible effects, minimizing design flaws.

QC Sampling Inspection

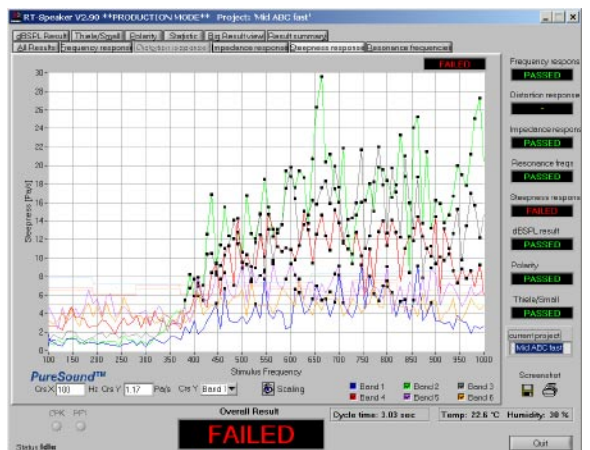
“RT Compliance for Speakers” is a functional extension of the RT-Speaker software conducting detailed speaker parameter measurement, according to the international standard IEC 60268-5 for QC sampling inspection or product developments. RT-Compliance supports measurements of the complete Thiele/Small parameters using the added mass method.



Screenshot, statistical histogram



Screenshot, frequency response relative



Screenshot, Rub & Buzz measurement



Less noise • More sound

Speaker Test System

RT-Speaker V2.90 **PRODUCTION MODE** Project: 'Mid ABC'

dB SPL Result Thiele/Small Polarity Statistic Big Result view Result summary

All Results Frequency response Distortion response Impedance response Steepness response Resonance frequencies

Impedance response PASSED

Freq & Dist response PASSED

Steepness response PASSED

Frequency response PASSED

Distortion response PASSED

Impedance response PASSED

Resonance freqs PASSED

Steepness response PASSED

dB SPL result PASSED

Polarity PASSED

Thiele/Small PASSED

current project: Mid ABC

Screenshot

Temp: 22.4 °C Humidity: 29 %

Quit

Overall Result **PASSED**

Cycle time: 15.03 sec

Status: Idle

PureSound™

Resonance frequencies

80.09	Hz
	Hz
	Hz
	Hz
	Hz

Thiele/Small

R	12.26	Ohm
Rs	3.64	Ohm
R0	15.90	Ohm
Qms	4.14	
Qes	1.23	
Qts	0.95	
C	672.90	uF
L	5.91	mH
f0	80.09	Hz
df	9.87	Hz
Rx	3.91	Ohm

Sound Pressure Level

110.48	dB SPL
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Polarity (overall)

PASSED

Band 1 **Band 2** **Band 3** **Band 4** **Band 5** **Band 6**

Impedance response

Freq & Dist response

Steepness response

Screenshot, view all results