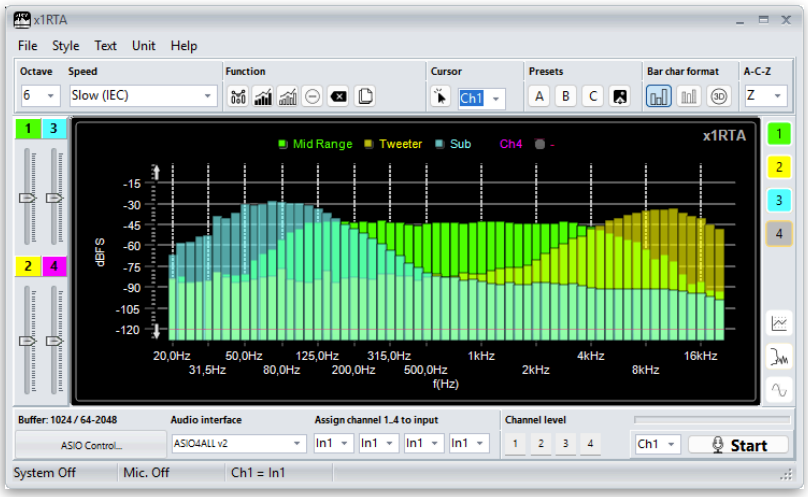
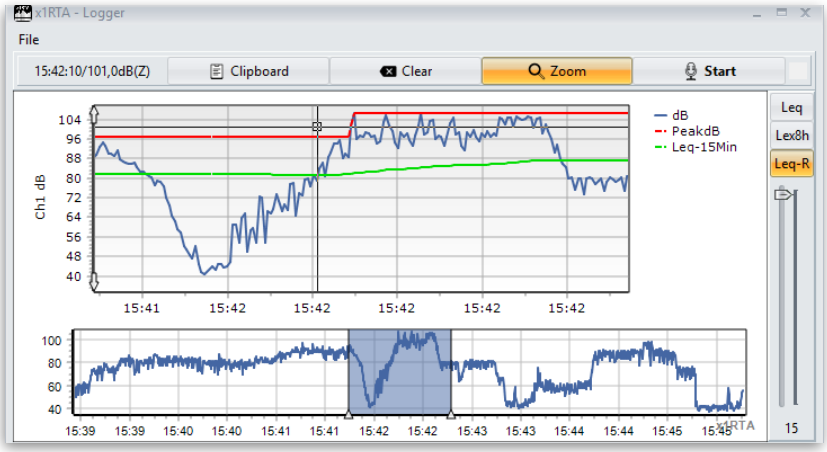
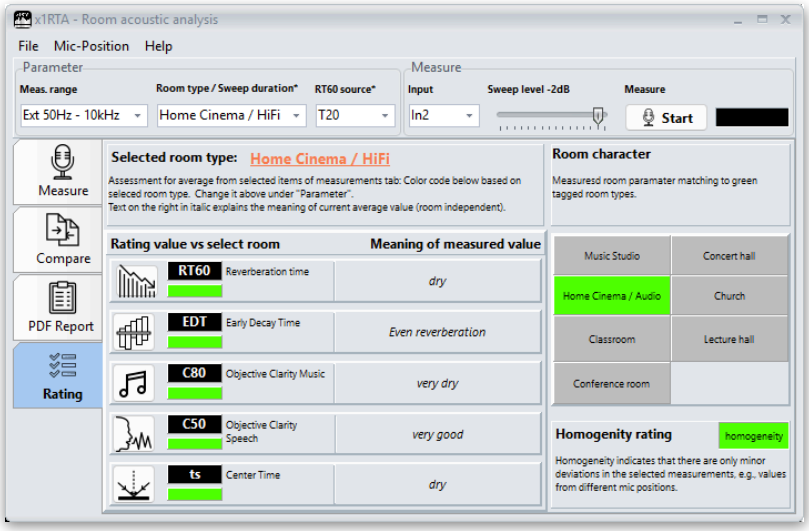






x1RTA

RTA Analyser and acoustic room assessment

1. Introduction

1.1. Application Area

With x1RTA you get a modern and powerful acoustic analyser software. Application areas of x1RTA are:

- Evaluation of car, HiFi, PA, and home cinema sound systems
- Evaluation of room acoustics such as RT60 reverberation time or clarity index for music C80
- Noise level measurement (Leq)
- Measurement of the sound emission of machines or devices

1.2. RTA Octave Band Measurement or FFT?

RTA octave band measurements may initially seem coarse compared to an FFT. However, this reduced resolution is actually an advantage in many practical applications. The crucial point: octave bands are aligned with the frequency-dependent resolution of human hearing and also comply with common technical standards. As a result, they provide a more interpretable and practical representation than a high-resolution FFT.

1.3. Why is room acoustics so important?

Room acoustics determine whether speech is clearly understandable, music is engaging, or a room feels tiring. But each room has different requirements: a control room needs maximum precision, a conference room perfect speech intelligibility, and a concert hall the right balance of clarity and fullness.

x1RTA makes room acoustics measurable – and immediately assessable. The software analyzes all relevant parameters and automatically evaluates them according to the selected room type. This way, you can instantly see whether your room is optimally tuned.

1.4. Which Hardware is required?

x1RTA is a hardware-open system. Commercial available USB audio interface and suitable measurement microphones can be used for measurements. x1RTA supports multi-channel sound cards with up to ten inputs, enabling measurement series to be carried out quickly on different microphone positions. For room acoustic measurements, a sound source – such as an active speaker or a loudspeaker with an amplifier – is also required. The sound source should have a sound pattern as close as possible to omnidirectional.

1.5. Software installation

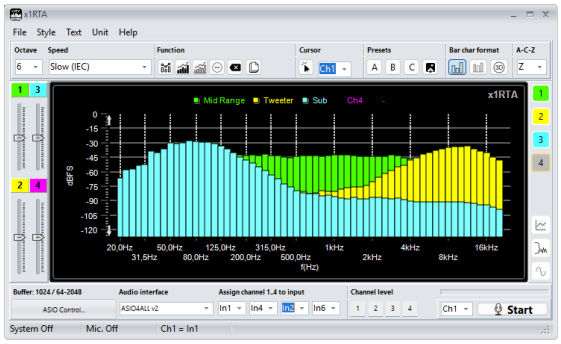
You can download both the free demo version and the full version from our website.

To start installation download the setup file to your PC. Then run the installation with administrator rights (right-click on the file in File Explorer). Once the installation is complete, you will find the icon on your desktop.

2. Overview moduls

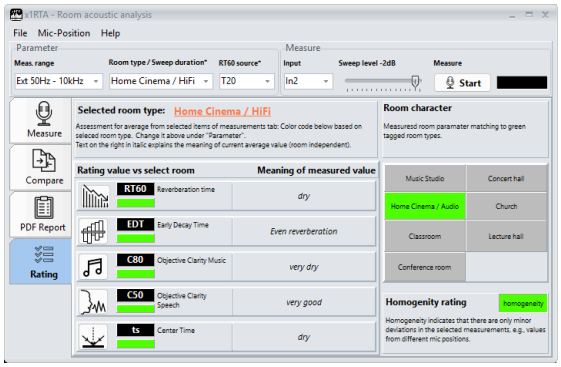
2.1. Module RTA (Octave-band measurement)

- Comfortable 4-channel measurement display
- Up to 10 microphones for direct access
- Sound profiles (reference curves) for tuning car audio systems
- IEC 61260 centre frequencies, Class 1 filter slope
- Rise time constants: Impulse, Fast and Slow
- A-C-Z frequency weighting
- Audio interface calibration
- Microphone correction (0°, 90°) per interface input
- Graphical view Peak, Peak & Decay, Difference, Snapshot
- Text input for display channel
- Archiving: Save, export, print



2.2. Module Room acoustic analysis

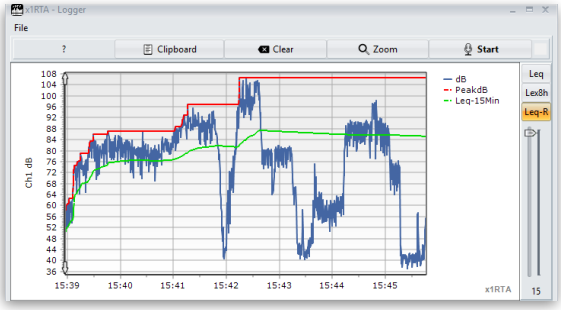
- Room analysis with pass/fail assessment, based on predefined room types
- Support for up to 10 microphones: position the microphones in the room and carry out the measurement step by step without repositioning or reconnecting them
- Logarithmic sine sweep test signal. This method enables the precise determination of the impulse response in accordance with ISO 3382
- Extended measurement range up to 50 Hz – 10 kHz
- Efficient workflow for averaging and labelling measurement series
- Use pre-designed report templates to quickly present results to your customers, including your company logo



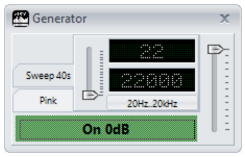
- Calculation of the sound field radius as a guideline for the minimum distance between the loudspeaker and the microphone
- Archiving: Print, save, PDF, CSV export

2.3. Module Logger (Sound Level)

- Logger module for measuring sound levels over time (including A/C weighting)
- RMS value, RMS Peak, Leq (Equivalent Continuous Sound Level), $L_{EX,8h}$ A-weighted equivalent continuous sound pressure level for an 8-hour working day (similar to ISO9612, DGUV), running Leq
- Averaging of measured values between data acquisition points
- Zoom function during measurement
- Archiving: Save, clipboard

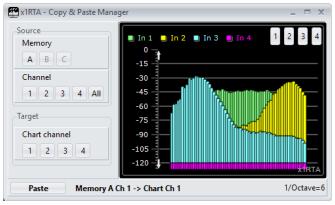


2.4. Module Generator



- Tool for RTA measurements
- Signals: Log. Sweep & Pink Noise

2.5. Module Copy&Paste Manager



With the Copy&Paste Manager, measurements from the display channels in the RTA module can be temporarily stored and reinserted. This applies to individual display channels or all 4 channels. 3 memory banks with 4 channels each are available.

3. Warnings

- Please pay close attention to the following warnings:
- Mute or turn off the amplifier when connecting the audio interface to the amplifier.
- Perform initial playback tests of the test signal at low volume.
- Only use test signals that will not damage your speakers, amplifier, or your hearing.
- If a clearly audible measurement signal produces no measurement display, please check the measurement chain, e.g. correct audio interface input selected, sound card gain set to 0, etc.
- Avoid feedback: Some audio interface have a monitoring function that routes the microphone signal directly back to the output. Disable the monitoring function or set the monitor control so that no feedback occurs, e.g., during playback or in the DAW. Details can be found in your audio interface manual.
- Room assessment: Use suitable loudspeakers for the required sound level and frequency range. The test signal for the widest measurement range has a frequency response of approximately 30 Hz to 15 kHz. Use a low resolution if necessary. SPL level: Depending on the room size, an SPL of >100 dB may be required.
- Set the MS Windows sound scheme to ‘No sounds’ (avoid system sounds).
- You use x1RTA at your own risk.

4. First Steps

4.1. Preparation

- Install the ASIO drivers for your audio interface. Alternatively, you can use the free ASIO4ALL drivers.
- Connect the audio interface to your PC.
- Install the x1RTA software via the setup file with administrator rights.
- Open x1RTA. You can find the icon on your PC desktop.
- Select the audio interface from the bottom tool bar.
- Check the ASIO buffer setting (default 1024): Open the control window via the “ASIO Settings” button. Set the buffer size to 1024.
- x1RTA supports audio interfaces with up to 10 inputs. These can be assigned to one of the 4 display channels (Ch) in the RTA module (multiple assignments of the same input to a display channel are allowed). Assign the display channels (Ch) to the interface inputs, e.g., Ch1 to Input 1 and Ch2 to Input 2, etc.

4.2. Calibrating the audio interface

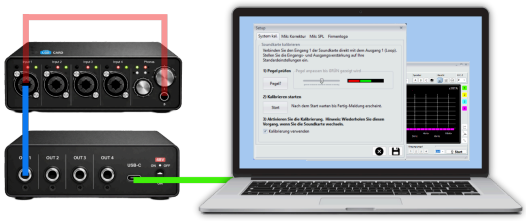
x1RTA detects and corrects frequency response deviations of the audio interface. This requires a loop between output and input. Connect the first/left input of the interface to an output or headphone output. Set the gain knobs for the inputs, if available, to 50%. Set the gain knob of the output or headphones to 50%.

Steps:

- Open the setup via the menu in the header: “File / Setup”
- Select the “System Cal.” tab
- Press the “Level?” button under 1)
  - The level indicator to the right of the button must end with a green bar in the middle
  - Signal ok: A message confirms signal ok
  - Signal not ok:
    - Level indicator shows red on the left => move the level knob to the right OR
    - Level indicator shows red to the right of green => move the knob to the left
    - In both cases, adjust the level until the message “ok” appears. If necessary, adjust the output levels on the audio interface.
    - Additional signal check: The RTA bar graph shows a 1 kHz signal.
- After the “Signal ok” message, start hardware calibration. Press the “Start” button under 2).
- Wait for the “Calibration complete” message
- Finally, under 3), select “Use Calibration”
- Exit the setup window with “Save”
- The audio interface calibration is complete.

Tip: Microphone correction for free-field & diffuse-sound as well as SPL level settings can be found in the “Setup” chapter.

Illustration: Connection between output and input 1. Output opportunities: either blue (rear outputs) or red (headphones).



4.3. Measuring with an audio interface (Brief Version)

Tip: A detailed guide can be found in the “Measurement Procedures” chapter.

Connect the measurement microphone to an input of the audio interface. If your microphone operates with +48V phantom power, switch on the power on the interface. Initially set the gain knob at the audio interface input to 50%. Note: Use the XLR connector for the microphone when using +48V.

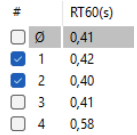
For measurements with test signals from the x1RTA signal generator (e.g. measurement room acoustic), you must connect at least one output or the headphone output of the audio interface to an input (e.g. of the active loudspeaker box or the amplifier with speaker). Initially set the output gain knobs from audio interface to low gains for first tests.

x1RTA can now perform RTA measurements with and without test signals as well as room evaluation.

5. Overview

5.1. Terms

- Popup Menu: A popup menu, also called a context menu (right-click menu), is a graphical control element that displays application-specific functions and actions in a popup window based on the selected object. It allows quick access to functions. You open it with a right mouse click over the mentioned control element.

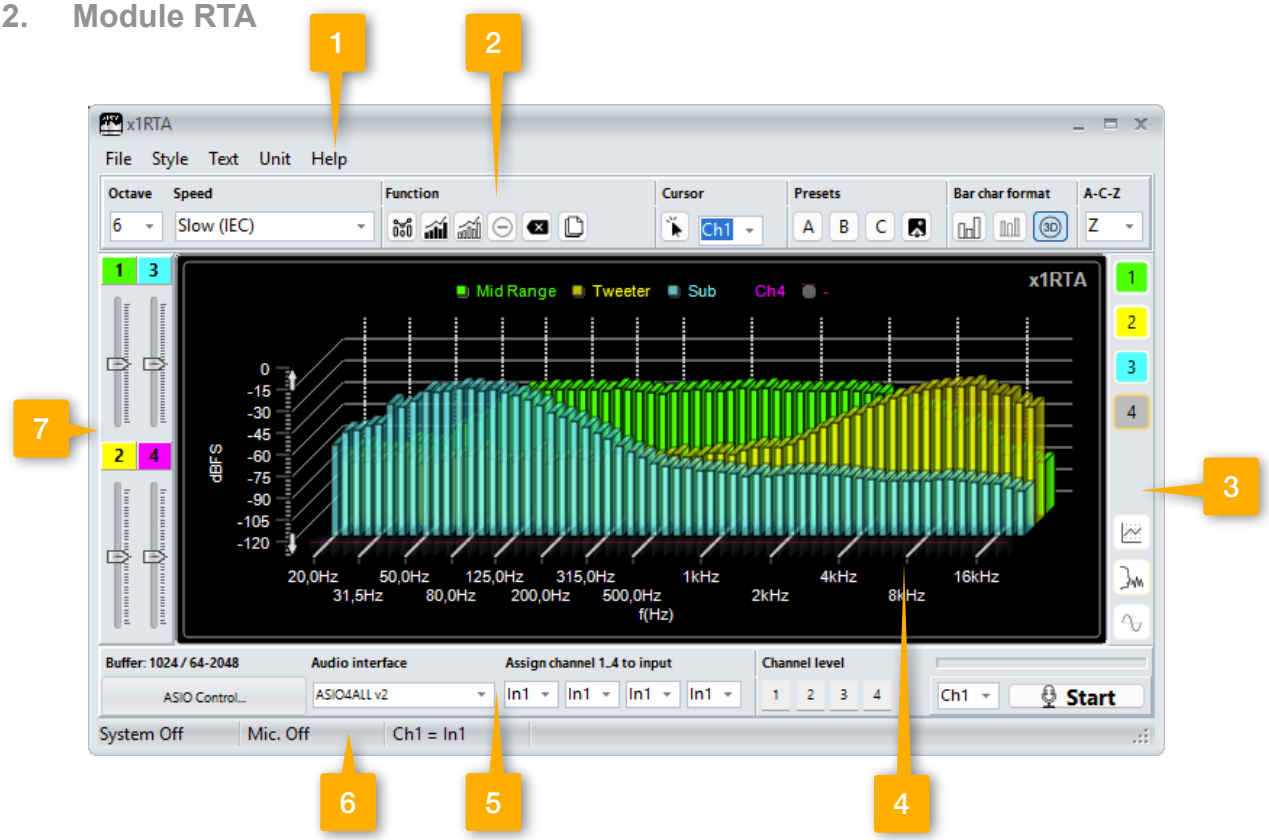


- Click Box: Some tables display a click box at the beginning of the row. You can select or deselect the entry for further editing through this.
- Ch: Refers to one of the 4 display channels in the RTA module and should not be confused with the inputs (Inputs In1..10) of the audio interface.

5.1.1. Zoom in charts via mouse gestures

- Zoom in: Drag a rectangle from left to right with the mouse over the area to be enlarged
- Zoom out: Drag a rectangle from bottom right to top left

5.2. Module RTA



5.2.1. Main menu

Menu File (1)	
Open	Open a saved measurement
Speichern	Save measurement
PDF Export	Export chart as PDF file

Load Sound Profile Ch1 (reference chart)	Select the sound profile from a file, e.g., SUV vehicle. The target curve is loaded into display channel 1 (green). Now perform the measurement in vehicle display channel 2 (yellow). Use the EQ/Audio DSP to match the measurement curve in channel 2 to the target curve. *Tip: Use the offset controls in the left toolbar to adjust the level of the measurement curve and target curve at 1 kHz. For more information on the procedure, see "Work with Sound Profiles"*
Save as Sound Profile (Ch1)	Save the measurement from display channel 1 (Ch1) as a sound profile. Pre-conditions: • Set the RTA octave to "3" • Set "Speed" to "Slow IEC" • Perform the measurement using pink noise. For more information, see "Working with sound profiles".
Print	Print chart
Clipboard	Copy chart to clipboard
Setup	Open program configuration
Quit	Close program

Menu Style

Style	Switch the software's theme: light <-> dark

Menu Text

Ch1	Text entry for display channel 1. The text appears in the caption of the bar chart (4)
Ch2..Ch4	Same as channel Ch1 for channel 2,3,4
Std	Set channel text to default value (Ch1, Ch2,..)

Menu Unit

dBFS	The y-axis is scaled in dBFS as the RMS value. For a sine wave with a peak value of 100% of the maximum input voltage, the RMS value shown is -3 dBFS
dBFS RMS	The y-axis is scaled in dBFS as the root-mean-square (RMS) value. For a sine wave signal with an RMS value of 100% of the maximum input voltage, the displayed RMS value is 0 dBFS.
SPL dB	SPL correct scaling of the y-axis in dB when the microphone was calibrated during setup using a 94 dB calibrator. *Important: Once the audio interface's gain has been calibrated, it must not be adjusted again to ensure accurate SPL measurements!*
Peak Hold	This function affects the peak value display in the bottom right-hand corner of the bar graph. Enabled: The highest peak value is recorded. Disabled: The peak value shows the current peak value of the measurement signal.

Menu Help

Help (Web)	Displays the latest version of this manual from the Internet.

Info	Displays the program version and the software installation ID.

5.2.2. Top toolbar

Toolbar top (2)

Octave (a)	Toggles the x-resolution (1/n octave)
Speed (b)	Time weighting: Impulse, Fast, Slow, and Smooth 100 Hz & 20 Hz for optimized bass response with pink noise
Functions (c), icons from left to right	• Snapshot : Capture current measurement • Peak + Decay : Peak value with delayed decay • Peak : Absolute peak value • Difference : Subtract: Ch1-Ch2, Ch2-Ch3, Ch3-Ch4, Ch4-Ch1. **Select using the cursor selection (d): Ch1 => Sub Ch1-Ch2, Ch2= Ch2-Ch3…** • Hide : Hides the 5th channel • Apply : Copies the values of the 5th channel to the currently selected display channel, see function bar (5) *Note: The functions are displayed in a 5th display channel (shown in red). The functions appears for the selected channel from Cursor field (d); see below*
Cursor (d)	• Button : Turn cursor on/off • Channel selection : Display cursor for selected channel. Cursor readings appear on the left side of the footer of the bar graph (4). The channel is also relevant for the functions listed under (c), such as Peak or Difference ***Important: The channel is also relevant for the functions listed under c), such as Peak or Difference (determines which channels are subtracted)***
Copy&Paste (e)	• A, B, C : Copy current measurement values from channels 1 to 4 to memory block A, B, or C • Button : Open the Copy&Paste Manager *Note: The Copy&Paste Manager allows you to insert temporarily stored measurements into the bar graph (4). You can copy 1 to 4 display channels. Select the block, then source channel (stored measurement) and the destination channel in the bar graph.*
View (f), icons from left to right	Format of the bar chart (4) • Default: Overlapping bar view, display channel 4 is in front • Offset: Bars for each channel are slightly offset. Measurements for each bar can be easily compared • 3D: 3D view. Good for comparisons; enable “Channel Transparency” (see pop-up menu)
A-C-Z Frequency weighting	• Z : Linear, no weighting • A : Weighting with A-filter • C : Weighting with C-filter

5.2.3. Right toolbar

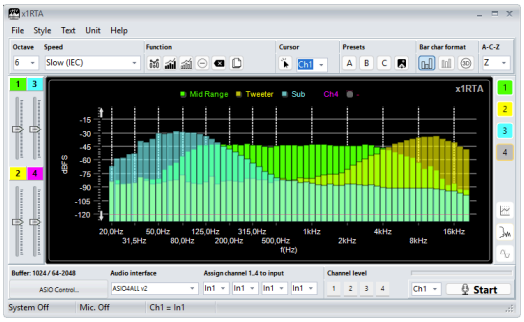
Toolbar right (3), icons top down

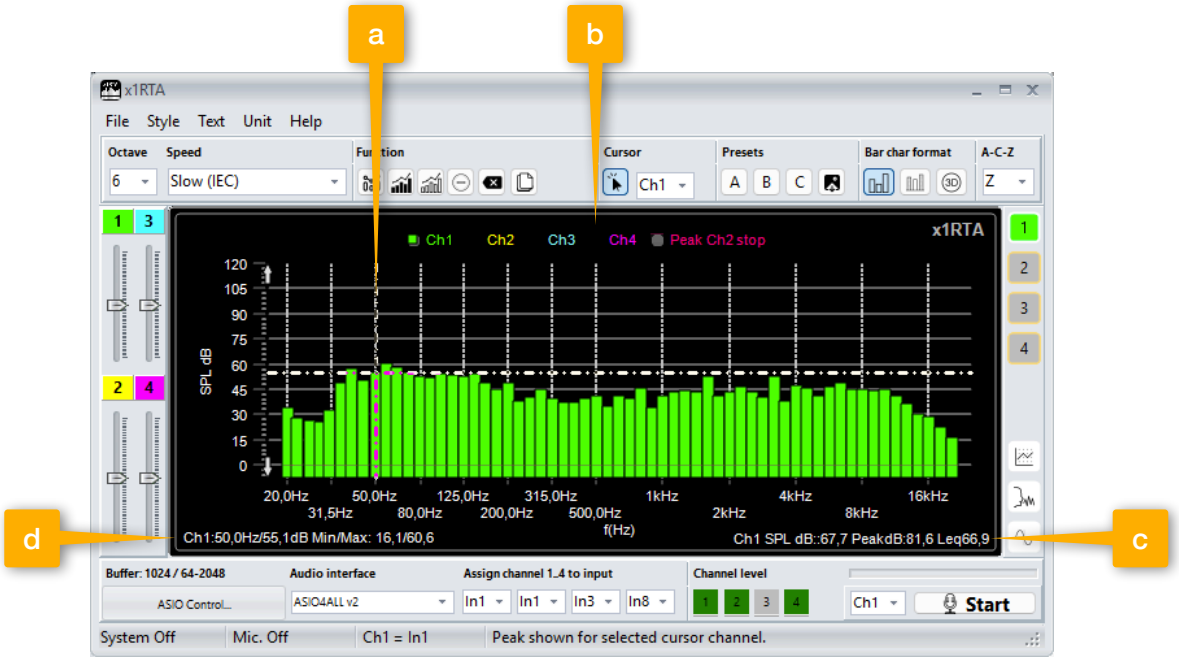
Button 1,2,3,4	Show or hide the display channel x from the bar chart (4). Pressed = Hide
Module Logger	Opens the data logger module to record the sound level. The sound level for the selected display channel from the bottom toolbar (5) is recorded
Module Room analysis	Opens the room analysis module: Determine and evaluate parameters for the acoustic assessment of the room, and generate a report
Module Signal-Generator	Opens the module single generator to output test signal: Logarithmic sweep or pink noise *Tip: In combination with the Peak display in the top toolbar (2.c), the speaker's frequency response can be easily determined using pink noise or a 20 Hz–20 kHz sweep at 30 seconds + "IEC Fast".*

5.2.4. Bar chart (4)

Tip:

- *You can move overlapping graphics vertically using the offset sliders in the left toolbar (7), or*
- *make them visible by enabling transparency and using the 3D view, if necessary with transparency set to "on" or the offset sliders (5).*





Chart

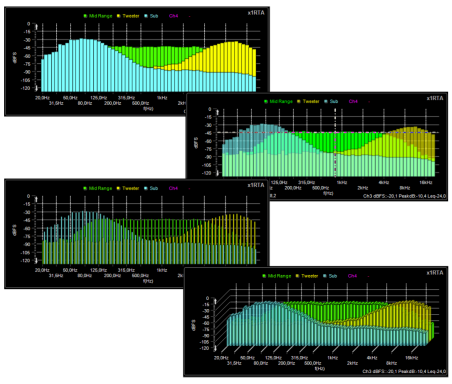
Cursor (a)	The cursor displays the x/y measurement values for a display channel. It is activated via the top function bar (2), where the display channel is also selected. It 'sticks' to the bar height for each frequency of a display channel. Therefore, the display channel must be selected beforehand. Under (d) are the measured values for the position as well as the min/max values of the display channel.
Header Legend (b)	Displays a short text for the measurement matching the channel color. You can change it via the header menu „Text" from RTA module. *Tip: If the small coloured rectangle in front of the text is missing, the channel is hidden (see Ch4).*
Measurements (c)	x1RTA displays the measured values: Leq, PeakdB, as well as, depending on the selected unit, dBFS, dBFS RMS, or SPL dB. If the measurement is weighted, e.g., with an "A" filter, the measured values are dBFS(A), dBPeak(A), SPL dB(A) and LAeq. *Note: „**H** Peak" => Peak Hold function enabled (see header menu „Unit")*
Measurements Cursor (d)	x1RTA displays the measured values at cursor position

Popup Bar Char

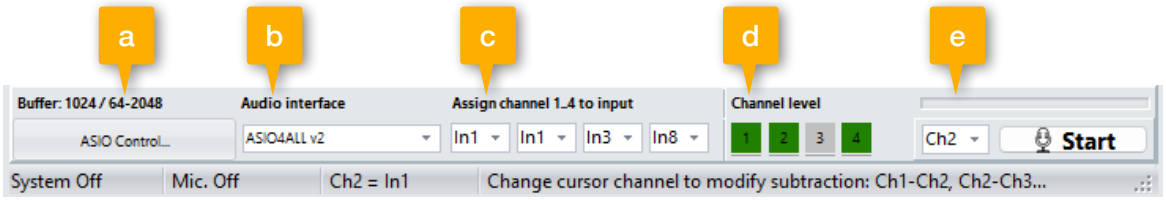
y/2:	y axes Minimum/Maximum divide by 2
y*2:	y axes Minimum/Maximum multiple by 2
xy Standard:	Set x & y axes to default
y-Auto	Scale the y-axis to measured values
Transparency on:	The bars for display channels 2–4 are slightly transparent, allowing other channels to show through. Ideal for comparing channels
Transparency off:	Transparency for display channels 2–4 off
Clipboard	Copy the bar chart to the clipboard
Reset	Reset the peak and Leq readings. Clear the bar chart
CH1 <-> CH2… :	Swap the order of the displayed channels. This allows a display channel with an overlay to be brought to the front. *Note: Channel 4 is at the very front.* *Please note: This function is not available in measurement mode. Alternatively, use the channel input assignment (lower toolbar 5c)*

5.2.4.1. RTA bar chart formats

From top to bottom: Standard, Standard with transparency, Shifted, 3D.



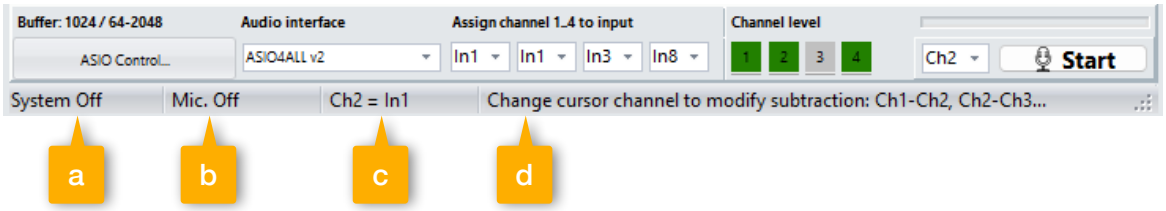
5.2.5. Lower toolbar



Lower toolbar (5)

ASIO Control (a)	Open the ASIO driver settings provided by the sound card manufacturer or an alternative such as ASIO4ALL. Here you can adjust the ASIO buffer size. The default setting is 1024. If you hear noise in the audio output or the display fluctuates unusually, increase the buffer size gradually to higher values.
Audio interface (b)	Select an audio interface.
Assign channel 1..4 to input (c)	Assign a sound card input to each of the 4 display channels: the left side starts with display channel 1, followed by 2 and 3. The right side ends with display channel 4. Audio interface inputs can be assigned multiple times.
Channel level (d)	The four fields for display channels 1–4 use colour codes to indicate the input levels. If, as shown in the diagram above, Ch4 is assigned to input 8 of the sound card, then the level applies to input 8. Colour codes: Grey: No signal. Green: Low signal. Light green: Ideal signal. Red: Signal overloaded.
Button Start (e)	Select a display channel (Ch1–4) for the measurement. Press the ‘Start’ button to begin the measurement. Pressing it again stops the measurement. *Tip: You can change the display channel whilst in measurement mode.*

5.2.1. Footer



Footer (6)

System On (a)	Audio interface frequency correction: • System On: Sound card calibration is taken into account during measurement • System Off: Sound card calibration is NOT taken into account *Tipp: You can perform the calibration and enable it in the Setup module.*
Mic Off (b)	Microphone frequency correction: • Mic Off: Microphone is not corrected • Mic 0°: Microphone correction using the free-field measurement file • Mic >0°: Microphone correction using the diffuse sound measurement file *Tip: You can assign the calibration files ‘Free-field’ (0°) or ‘Diffuse’ (>0°) to each audio interface input and activate them in the „Setup" module.*
Chx = Iny (c)	The bar graph displays the measurement from display channel x, which receives signals from audio interface input y

Notes (d)	Information on functions or the measurement procedure

5.2.1. Left toolbar (7)

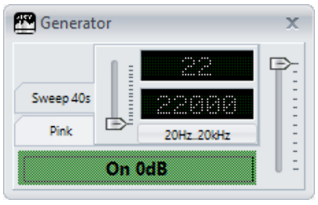
Toolbar left

Slider 1 to 4	The 4 controls shift the bar graph channel 1..4 vertically by +/- 20dB (offset). This allows overlapping measurements to be made visible. *Tip: Alternatively, select a different display mode, such as 3D, or enable transparency mode (bar graph pop-up menu).*

Popup Menu toolbar left

Ch1 Offset 0:	Set Offset of Ch1 to 0
Ch2 Offset 0 to Ch4 Offset 0:	Same as Ch1 Offset 0 for channel 2..4
All Offset 0	Set for all 4 channels the offset to 0

5.3. Module Generator (Test Signals)



The generator outputs test signals as logarithmic sweeps and pink noise through all outputs of the sound card. It is accessed via the right function panel (3).

The volume is set in the software using the right-hand slider. The display corresponds to the dBFS Peak of the audio interface D/A converter. The peak value of a sine signal corresponds to 0 dBFS. The “On” button shows the level from the software.

Tipp: In addition, the output level can be adjusted, if available, using the sound card’s output controls (see the sound card manual).

5.3.1. Signal Type Pink (Pink Noise)

Playback of “Pink Noise,” also known as “Rosa Rauschen.” There are no special parameters for this test signal.

5.3.2. Signal Type Sweep

Single playback of a logarithmic sweep signal. The following parameters are available:

- **Start/Stop**: Start and stop frequency of the sweep signal in Hz. Change the value by clicking in the LED display. Enter the new value using the PC keyboard numeric keys and confirm with Enter.
- **Duration Slider**: Adjusts the duration of the sweep signal. Slider at the top = 10s, slider at the bottom = 40s.

5.3.3. Start/Stop Signal Output

Press the “On” button to prepare the next signal output for measurement. To start playback, press the “Start” button in the RTA module from the lower function panel (5).

5.4. Module Logger (YT)

The Logger module records the sound pressure level from the current display channel over time. For measurement, first select the unit (e.g., SPL dB) and the display channel in the RTA module.

Functionen

Master-Diagram (1)	• Button „Zoom“ NOT pressed: Diagram (1) shows the entire measurement duration • Button „Zoom“ pressed: Diagram (1) shows the selected area from selection window (2)
Zoom Selection window (2)	The window displays the complete time period when the zoom button is pressed. To zoom in on a section of the complete diagram, drag here the ends of the blue-highlighted area with the mouse.
Menu File (3)	• Open: Open a saved YT measurement (file extension *.x1RY) • Save: Save the YT measurement • Exit: Close the window, end the measurement

Header (4) - Icons from left to right	• Pair of measured values; pair of measured values at the cursor position
	• Clipboard: Copy graph to clipboard
	• Delete: Reset YT measurement
	• Zoom: The zoom function allows you to view a detailed section of any from the overall view (see also 1 and 2) .
	  • Zoom button pressed: The zoom selection window appears in the lower half, showing the entire time period. By dragging the edges of the blue section window within the zoom selection window (2), you can define the zoom range to be displayed in the master diagram (1) above.
	  • Pressing the zoom button again hides the window (2), so that the entire measurement is visible in the upper master diagram (1).
	• Start: Start/stop logger measurement

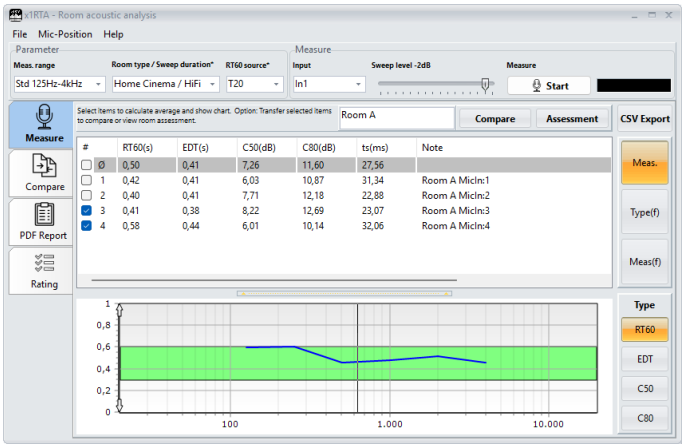
Leq-measurement (5)	• **Leq**: Rather than measuring the constant fluctuations in a sound, the LEQ calculates the average energy content of the sound over the time elapsed since the start of the measurement. • **Lex,8h**: 8-hour daily noise exposure level. The start time is shown in the legend (see DGUV) • Note: The default is weighting according to the A-filter. Enable weighting in the RTA module. Values below 8 hours are predicted. The result becomes increasingly accurate with a longer measurement duration • **Leq-R**: Same as Leq, but the average energy content of the sound is calculated over a specified period (e.g. 15 minutes as a moving window). Use the slider to set the period from 1 minute to 600 minutes (see also ‘Leq’ setup).

Popup Menu Logger chart

y-Auto	Automatic scaling of the y-axis to the measured readings
x-Auto	Automatic scaling of the y-axis to the measured readings
dB-Peak	Active: Records the maximum dBFS or SPL value for each time interval. Otherwise, records the average value

5.5. Module Room Acoustic Analysis

x1RTA makes room acoustics measurable – and instantly assessable.



The software analyses all relevant parameters and evaluates them according to the selected room type. This allows you to see at a glance whether your room is optimally tuned.

Optimised workflow: To ensure meaningful results, averaging across multiple measurement points is recommended. x1RTA supports this by allowing you to select up to 10 microphones directly. This enables you to carry out the measurement series without having to repeatedly reposition individual microphones. The ability to label each measurement individually ensures you don't lose track of the data.

Important:

- **Avoid or minimise all background noise during the measurement.**
- **The loudspeaker used must cover the selected frequency range as linearly as possible (-3dB).**

5.5.1. Room acoustics parameters

5.5.1.1. RT60 – Reverberation Time

RT60 describes how long a room "rings" after the sound source has stopped. It is one of the central parameters for assessing room acoustics.

Short RT60: dry, clear

Long RT60: reverberant, warm

5.5.1.2. EDT – Early Decay Time

- EDT describes the early decay time of a room, i.e., how quickly the sound level drops in the first 10 dB after the source is turned off. Unlike RT60, EDT correlates more strongly with subjective perception as it reflects the room's behaviour immediately after the sound ends.
- Small EDT values: dry, clear, direct, good localisation
- Large EDT values: reverberant, full, stronger spatial impression

5.5.1.3. C50 – Speech Clarity Index

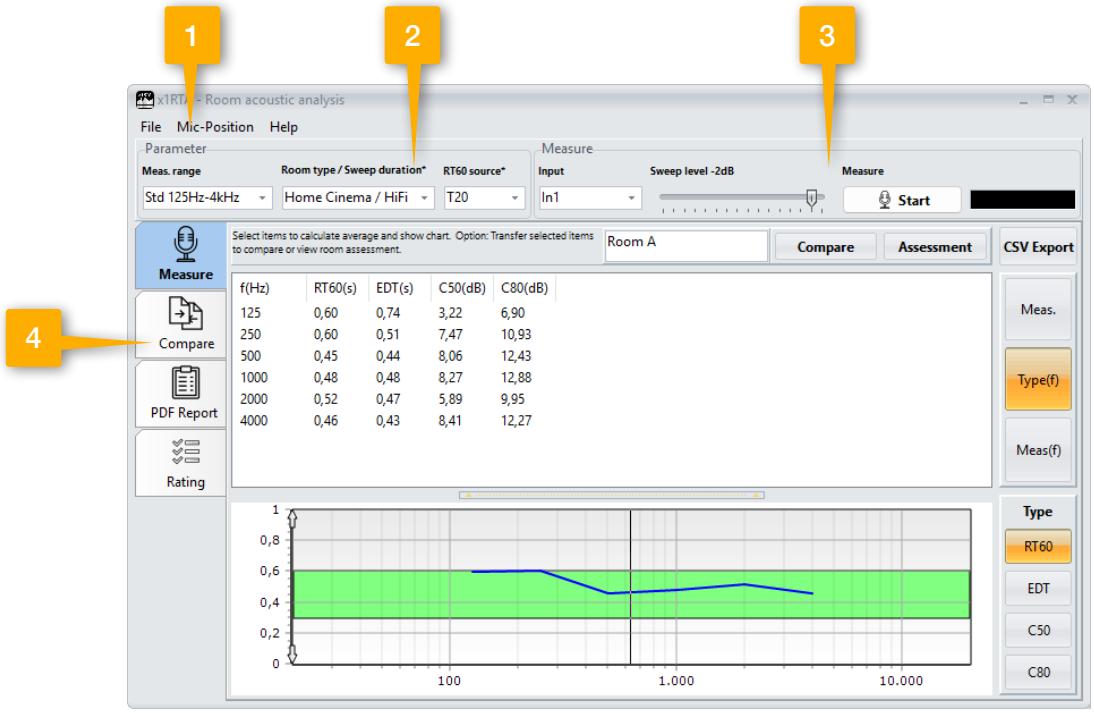
- C50 indicates the ratio of early-to-late sound energy within the first 50 ms.
- High C50: high speech intelligibility
- Low C50: blurred, less intelligible speech

5.5.1.4. C80 – Music Clarity Index

- C80 evaluates the clarity of musical signals
- High C80: precise, clear sound (e.g., chamber music, HomeCinema / Hifi)
- Low C80: warmer, fuller sound (e.g., orchestra)

5.5.1.5. ts – Center Time

- ts is the temporal center of the sound energy
- Small ts: early energy, clear, direct
- Large ts: late energy, warm, reverberant
- ts is a direct indicator of the balance between direct and diffuse sound



5.5.2. Main menu

Room analyser main menu (1)

File	• Open: Read room acoustics measurement series from file (file extension *.x1R6) • Save: Save measurement series as a file • Exit: Close module

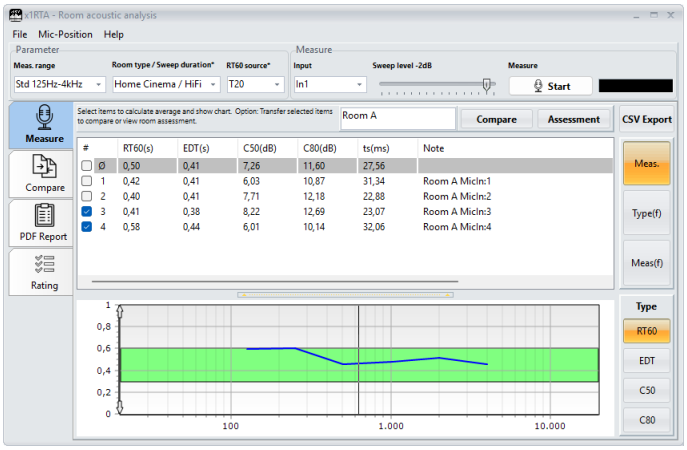
Mic-Position	Via the window you calculate the recommended distance between the loudspeaker and the microphone based on the reverberation radius. To do this, proceed as follows: • Measure the room. Position the microphone approximately 1.5 m away from the loudspeaker at a medium room height. The microphone should not be on the direct axis of the loudspeaker and should be pointing upwards towards the ceiling. • Press menu item “Mic Position” • Enter the room width, height and depth under 1) • Under 2), apply the T20 value by pressing the “Read T20” button • Under 3), calculate the recommended distance by pressing the “Calculate” button *Tip: The window also displays helpful tips on how to carry out the room measurement.*
Help	Displays the latest version of this manual from the internet.

5.5.3. Parameter

Parameter (2)

Meas range	Select the frequency range for the room measurement (IEC3382): • Std 125Hz - 4kHz (1/1 Octave) • Std 63Hz - 8kHz (1/1 Octave) • Ext 100Hz - 5kHz (1/3 Octave) • Ext 50Hz - 10kHz (1/3 Octave) *Tip: To change the frequency range after taking a measurement, save the measurement, change the range, and then reopen the measurement. The results displayed will be based now on the newly set frequency range. Note: The speaker must cover the frequency range!*
Room type	Select the appropriate room type from the list for your project. This selection affects • the duration of the sweep signal and • the settings for the ‘Good/Bad’ room rating on the ‘Rating’ page.
RT60 source	The RT60 measurement requires a dynamic range of 60 dB. As a full 60 dB decay is not often achievable, RT60 is extrapolated from partial intervals of 20 dB (T20) and 30 dB (T30). *Tip: We recommend the T20 as standard. Please also refer to the information in the FAQ section regarding room acoustics measurements.*

5.5.4. Measure



Measure (3)

Input	Select the sound card input for the next measurement here, regardless of the RTA module. Depending on the number of inputs on the sound card, a selection ranging from 1 to 10 will appear.

Sweep Level	Regardless of the volume control on the sound card or amplifier, the sweep level can also be adjusted here. The maximum level is at the far right (0dBFS), the minimum at the far left (-30dBFS). The level meter and status messages will indicate if the levels are unsuitable. Important: A level that is too low will result in inaccurate measurements. See the FAQ section regarding room acoustics measurements.
Button „Start“	Pressing this button starts the measurement. A logarithmic sweep signal is played. A brief note is automatically added to each measurement, consisting of the room name (see the ‘Measurements’ page) and the selected microphone input. **Important: Avoid or minimise all background noise during the measurement!**
Level bar	Indicates whether the measured signal is sufficient. OK = Only the yellow and green bars are visible. Yellow only: Increase the sweep level. Alternatively, adjust the volume on the sound card or amplifier/active speaker. Red: Reduce the level Note: The green range differs for the RT60 source T20 & T30.

5.5.5. Analysis (Pages)

Pages (4)

Measure	This page serves as the basis for room acoustics data analysis. It lists all individual measurements, displays the frequency response for the selected measurement parameter, and allows for the input of a short description. To calculate an average, select individual measurements using the checkboxes at the beginning of each row. For a before/after comparison, e.g., after optimising the room acoustics, mark two sets of measurements one after the other: one set taken before and one after. Transfer both to the “Comparison” page. You will then have an informative chart, whether you are comparing RT60, EDT, or C50.
Compare	Use the ‘Comparison’ page to compare ‘before’ and ‘after’ measurements of a room parameter (e.g. RT60) or to display different room parameters, such as RT60 and C80, in a single graph. To do this, select several measurements on the ‘Measurements’ page to calculate the average. Select the room parameter type, e.g. RT60. Then transfer the mean values to the comparison page at the touch of a button. Repeat the process for further graphs if necessary. *Tip: Enlarge table/graph: Use the slider between the table and the measurement graph to reduce or enlarge the views of the table versus the measurement graph.*
PDF Report	On the "PDF Report" page, create meaningful reports in PDF format for each measurement. Enhance the measurements with additional information, such as the measures taken for acoustic optimization, an interpretation of the measurement values, or details about the measurement setup. You can also include the measurement conditions (room dimensions, temperature, etc.). In a professional context, your company logo completes the report.
Rating	Different areas of use for rooms also require different acoustic properties. This means there are no uniform specifications. A music hall has different requirements for acoustic parameters than a conference room. Compared to many other systems, x1RTA interprets the measurement results based on a selected room type and thus helps with evaluation and optimization.

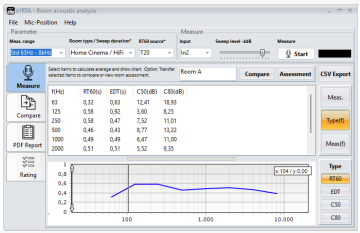
5.5.5.1. Page “Measure”

Notes:

- Tip enlarge Table / Chart. Use the bar between the table and the measurement chart to reduce or enlarge the views of the table versus the measurement chart.
- The green band indicates the target zone for the selected room and parameter type.

Page „Mesure"

Table measurements	The room parameters are entered here after each measurement has been carried out via the button „Start“. You can calculate the average value from several measurements (set) by ticking or unticking the checkboxes at the start of the row. The first row of the table shows the average value of the selection and a graph of the frequency response for the selected “parameter type”, e.g. RT60 You can edit the measurement notes under “Note” via the table’s pop-up menu. Important: If the row is highlighted in red after the measurement, this indicates that the measurement is inadequate (e.g. a brief increase in ambient noise or incorrect microphone position). It must be repeated. Delete the entry via the table’s pop-up menu (see explanation of the pop-up menu). The Type(f) and Measure(f) buttons display the room parameters as a frequency response and the measured values as a table. Enlarge table / graph: Use the slider between the table and the measurement graph to reduce or enlarge the views of the table versus the measurement graph.
Field Room A	Short name of the measured room. It is automatically displayed in the table under ‘Note’ alongside the microphone input
Button „Compare“	Copies the average values of the room parameters (absolute and across the frequency range) for the selected measurements to the ‘Comparison’ page for graphical comparisons and reporting. You can use the text input box shown to add a descriptive text to the entry.
Button „Assessment“	Transfers the average values of the selected measurements to the ‘Evaluation’ page for the ‘Good/Bad’ display based on the selected room type.
Button „CSV Export“	Export the selected measurements to a file in CSV format. Delimiter: “;” “Measurement” button The table displays a list of all measurements and the room parameters as absolute values. The graph below shows the trend for the selected “parameter type”.
Button „Type(f)“	The table shows the mean values for parameter types RT60, EDT, C50… from the selected measurements across the individual measurement frequencies, e.g. from 50 Hz to 10 kHz. Under ‘Type’, to the right of the graph, select the parameter, such as ‚C50’.



Button „Meas(f)“	The table shows, for the selected parameter type (e.g. RT60), the individual measurement values for all selected measurements across the frequency range, as well as their average value.

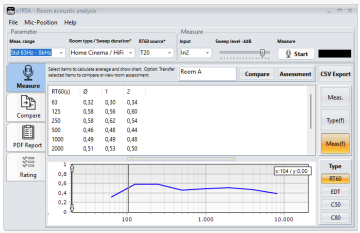


Chart frequency response	The graph below the ‘Measurement’ table shows the frequency response of the average values from the measurements highlighted in the table. You can select which response / parameter type is displayed using the buttons in the ‘Type’ field (see below).
Type (RT60, EDT,…)	Use the RT60, EDT, C50 or C80 buttons to change the parameter type and view the frequency response in the graph.

Popup Menue Table

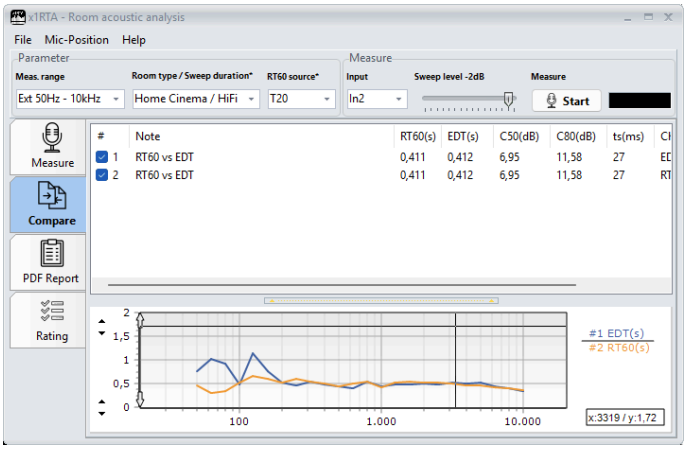
Select all items	Select all measurements in the table (tick the checkbox)
Deselect all items	Deselect all measurements in the table (clear the tick box)
Note to selected item	Change or delete the text under the ‘Note’ column for the selected measurements
Delete selected item	Clear all text entries

Popup Menu Grafik Messen

Clipboard	Copy chart to clipboard
Auto y-Min/Max	Automatic scaling of the y-axis to the displayed readings

5.5.5.2. Page "Compare"

Tip enlarge Table / Chart. Use the bar between the table and the measurement chart to reduce or enlarge the views of the table versus the measurement chart.



Popup Menu Table Compare

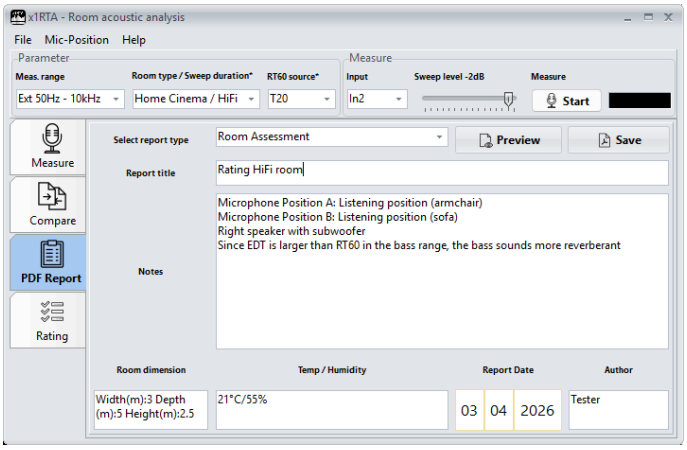
Note	Add or edit a note regarding the measurement from the ‘Note’ column
Delete item	Delete the selected rows (measurement items) in the table
Clear all items	Delete all rows (measurement entries) here.

Popup Menu chart compare

Auto y-Min/Max	Rescale the axis so that all data points from all curves are displayed
Marks	Displays the y-values for frequency directly on the measurement graph
Clipboard	Copies the measurement graph to the clipboard

5.5.5.3. Page „PDF Report“

On this page, you can create informative reports based on the measurements and the ready-to-use templates.



Inputs:	
Title	The report title. He is displayed in the footer of the report
Notes	Information on measurement, measures for acoustic optimisation, or interpretation of measurement results
Room dimension	Dimensions such as width x depth x height
Temp/Humidity:	Temperature and humidity at the time of measurement
Date	Date of the measurement
Author	Name of the author

Tip: Company logo – Create reports featuring your own company logo. Upload your logo during setup.

Report output

Select a template from "Report type“ list. The following templates are available:

Report templates	
Rating	The „Rating“ report displays the results from the ‘Rating’ page as well as the highlighted measurements from the ‘Measure’ page.
Typ(f)	The „Typ(f)“ report displays a table with values across frequencies for all selected measurements from the “Measure” page. The values based on the chosen parameter under “Type” on the “Measure” page (e.g. EDT)
Meas(f)	The „Meas(f)“ Report displays the table corresponding to the ‘Meas(f)’ button on the ‘Measurements’ page. It shows the selected measurements as numeric values across the frequency range including the average
Compare	The „Compare“ Report displays the content of the ‘Compare’ page. This includes the measured values as numeric values and as a graph

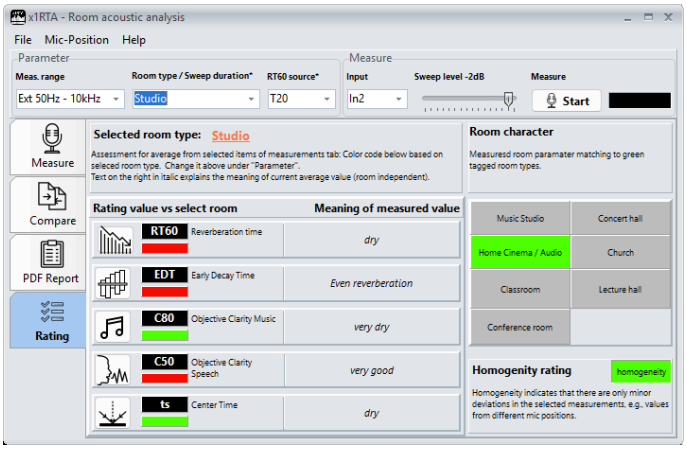
Preview & Export	
Button „Preview“	Displays a preview of the report with the option to save and print

Button „PDF Report“ Saves the report as a PDF file. Enter the destination and file name in the dialogue box

5.5.5.4. Page „Rating“

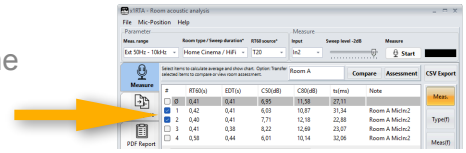
Based on the selected metrics from the ‘Metrics’ page, the evaluation is carried out across four categories:

1. How well do the measured room parameters (RT60, EDT, etc.) match the specifications for the selected room type, e.g. ‚Studio’? Result as coloured code: Green = Passed
2. What does the measured value x mean for RT60, EDT, C50…?
3. Inversely to 1): Which room type do the measured room parameters correspond to?
4. How good is the acoustic homogeneity of the room?



Process

To evaluate, mark the relevant measurements (averaging) on the “Measure” page. When you switch to the “Rating” page, the page will display the results. The coloured passed / failed rating based on selected room type from „Parameter“ in the header.



Category 1: Do the room parameters match the selected room type?

The color fields show the result. Green means: parameter is within the target range, red means: outside the range. *Note: You can change the room type under “Parameters.”*

Category 2: What do the measured values mean?

Explains in plain language the meaning of all acoustic parameters, e.g., what an RT60 value of 0.45 means for the room’s acoustics (reverberant or dry?). Rating is independent of the room type.

Category 3: Which room type do the acoustic room parameters correspond to?

Based on the measured room parameters, x1RTA determines the appropriate room type.

Category 4: Homogeneity

Typically, room parameters are measured in a series of measurements at different locations, and the results are then averaged. The homogeneity in green indicates that there were only small deviations between individual measurement points, meaning similar acoustics in the measured area.

5.6. Modul Setup

5.6.1. Page “Cal. system”

x1RTA corrects frequency response deviations caused by the audio interface. Follow the procedure from chapter “Calibrate the audio interface.”

5.6.2. Page „Mic. response“

For each input on the audio interface, a frequency response correction file for 0° (free field) and >0° (diffuse acoustics) can be stored here. Use the pop-up menu to add or remove the file.

To do this, select an input via the “Input” column. Now open the pop-up menu by right-clicking the mouse over the table and select a function:

Popup Menu microfon correction	
Change file 0°	Select correction file: Free field
Change file >0°	Select correction file: Diffuse acoustics
Remove file 0°	Delete file free field
Remove file >0°	Delete file diffuse acoustics

To apply the correction, select Free Field (0°) or Diffuse acoustics (>0°) under “Correction” and close the setup dialogue by clicking “Save”. Select “Off” to disable the correction.

5.6.3. Page „Mic. SPL“

To ensure accurate SPL measurements, the combination of microphone and audio interface input gain must be calibrated. Standard sound level calibrators are used for this purpose. Calibration is carried out separately for each input.

Important: The calibration applies only to the combination of the microphone input with the set gain and the microphone. Any subsequent changes to the gain will render the SPL measurement unusable. Please recalibrate.

Please note: The opening for the microphone in the SPL calibrator must fit your microphone. The opening can be adjusted using adapters. These are supplied by the manufacturer either with the microphone or with the calibrator. Standard sizes for microphones include, for example, the 1/2” type (outer diameter 13.2 mm) or the 1/4” type (outer diameter 7.0 mm).

Hardware steps:

- Connect the microphone to the audio interface
- Adjust the input gain with the microphone to your needs, e.g. to 50%
- If required, switch on +48V phantom power
- Insert the microphone into a microphone calibrator
- Start the 94 dB output on the calibrator (wait for the warm up start phase if necessary)

x1RTA steps:

- Open the setup and go to the “Mic:SPL” tab.

- Under step 1, select the microphone input in the “Input” column.
- Under step 2, press the “Start” button.
- Wait until the offset value appears in the text field.
- Under step 3, transfer the offset to the sound card input in the list under step 1.

Done. You can now measure SPL accurately in the RTA module. Set the unit to SPL dB via the menu in the header.

5.6.3.1. Tip: Is your microphone not compatible with a sound level calibrator?

You can also calibrate your microphone using a second calibratable microphone, perhaps one borrowed from a friend:

1. Please check the following first
    1. Setup page “Mic SPL”: The offset for Input 2 is 0. If not, set the value to 0 as follows:
        1. Select Input 2
        2. Enter “0” in the Offset field using the keyboard
        3. Click the “Apply” button and exit the setup with “Save”
    2. RTA module: Left function bar. Offset for all 4 channels is 0
2. Connect microphone A (calibratable) to input 1 of the audio interface
    1. Gain for input 1: 50% (adjust if necessary if the signal is overloaded)
3. Connect Microphone A to the sound level calibrator. Proceed the SPL calibration (see previous steps under Hardware / x1RTA for procedure)
4. Measurement with microphone A in the RTA module using the “Pink Noise” test signal. Time weighting “Slow”, 1/3 octave, **unit “SPL dB”**
    1. Measure pink noise via a loudspeaker
    2. Note the measured value at 1 kHz. Read it out using the cursor if necessary
5. Connect microphone B to input 2 of the sound card
    1. Set the gain to a value between 50% and 75%
    2. Measurement on display channel 2
6. Perform the measurement as in step 3. Note the measured value for 1 kHz
    1. Formula: Offset = SPL B - SPL A, e.g.: SPL B = 42 dB and SPL A = 42 dB => Offset = -18
7. Enter the offset in the table
    1. Select the sound card input via the row
    2. Enter the offset in the text field
    3. Click the “Apply” button
8. Exit the setup by saving

Note: You can also perform a similar calibration using sound sources with a known SPL, e.g. loudspeakers and a sine wave signal. For example, according to the datasheet, the SPL is 88 dB at 2.83 V at 1 m and 1 kHz. Start with step 5. In this case, SPL A is 88 dB.

5.6.4. Page „Leq“

The settings here determine which Leq reading is displayed in the bottom-left corner of the RTA view and in the Logger module.

- **Leq**: Rather than measuring the constant fluctuations in a sound, the LEQ calculates the average energy content of the sound over the time elapsed since the start of the measurement.
- **Lex,8h**: 8-hour daily noise exposure level. The start time is shown in the legend (see DGUV)
  - Note: The default is weighting according to the A-filter. Enable weighting in the RTA module. Values below 8 hours are predicted. The result becomes increasingly accurate with a longer measurement duration
- **Leq-R**: Same as Leq, but the average energy content of the sound is calculated over a specified period (e.g. 15 minutes as a moving window). Use the slider to set the period from 1 minute to 600 minutes.
-

Tip: The settings can also be changed in the Logger module.

5.6.5. Page „Your logo“

Select the logo for the PDF reports here. Accepted file types are JPG and PNG. The optimal size is 3.4 cm x 1.2 cm.

Functions

Button “Logo...”	Select the logo from a file on your computer.
Button “Delete”	Delete enty. The default x1RTA icon is used

6. Measurement Workflows

6.1. RTA Measurement

For measurements with the RTA module, connect one or more microphones to the audio interface. Turn on the +48V phantom power if your microphones require it.

6.1.1. Measurements with Pink Noise as Test Signal

Hardware

Connect the output or headphone output to the active speaker or amplifier. Switch on the active speaker/ amplifier only after making the connection. Ensure that the volume is not too high.

x1RTA

- Start the “Generator” from the right function panel
- Select the “Pink” tab
- Set the level to -10 dB
- Press the “On” button
- Continue with “Measurement without Pink Noise…”

6.1.2. Measurements without Pink Noise as Test Signal

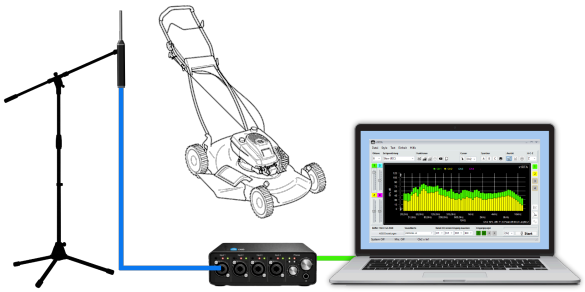
(e.g., measuring the sound spectrum of a device or ambient noise)

Hardware

See previous section “Measurement with Test Signal…”.

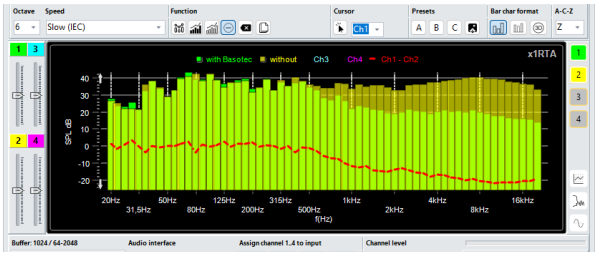
x1RTA

- Select the frequency resolution: Recommended is 1/3 or 1/6 octave in the RTA module header
- Determine time weighting, e.g., IEC Fast
- Select a display channel Chx (left of the “Start” button)
- Press “Start” to begin the measurement



Options (see “Top Toolbar“):

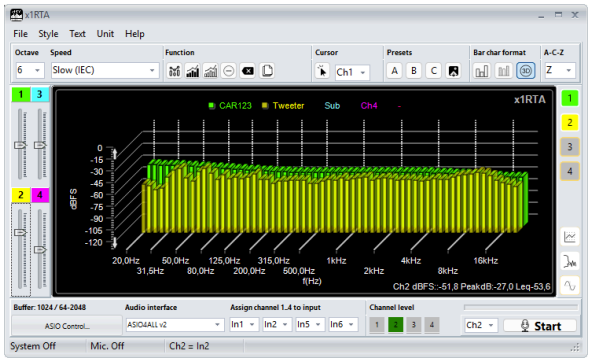
- Peak or differential measurement
- Frequency weighting A or C; Z is unweighted (linear)



6.1.3. Differential measurement

Differential measurement is very useful for comparative measurements, such as those involving sound profiles. One channel contains the reference value and the other contains the current measurement. The difference is shown in red.

6.2. Work with Sound Profiles (e.g. Car-Hifi)



Car audio systems should not be tuned linearly due to the spatial structure and materials. But what does proper tuning look like? Our reference curves = sound profiles provide guidance.

They are loaded into x1RTA display channel 1 and compared with the current measurement on channel 2. Use the car’s EQ or audio DSP to match the live measurement to the target profile.

x1RTA comes with a standard profile. Additional profiles are available for free from our product download page.

The workflow is as follow:

Hardware

- Microphone: Connect to Input 2 (right) of the audio interface, pointing upwards. Use >0° (diffuse) correction if available

Test Signal Output

- Pink Noise via x1RTA: Connect the audio interface output to the car Hi-Fi system while it is switched off
- External Option: Play pink noise from an audio CD
- Ensure that the volume is not too high

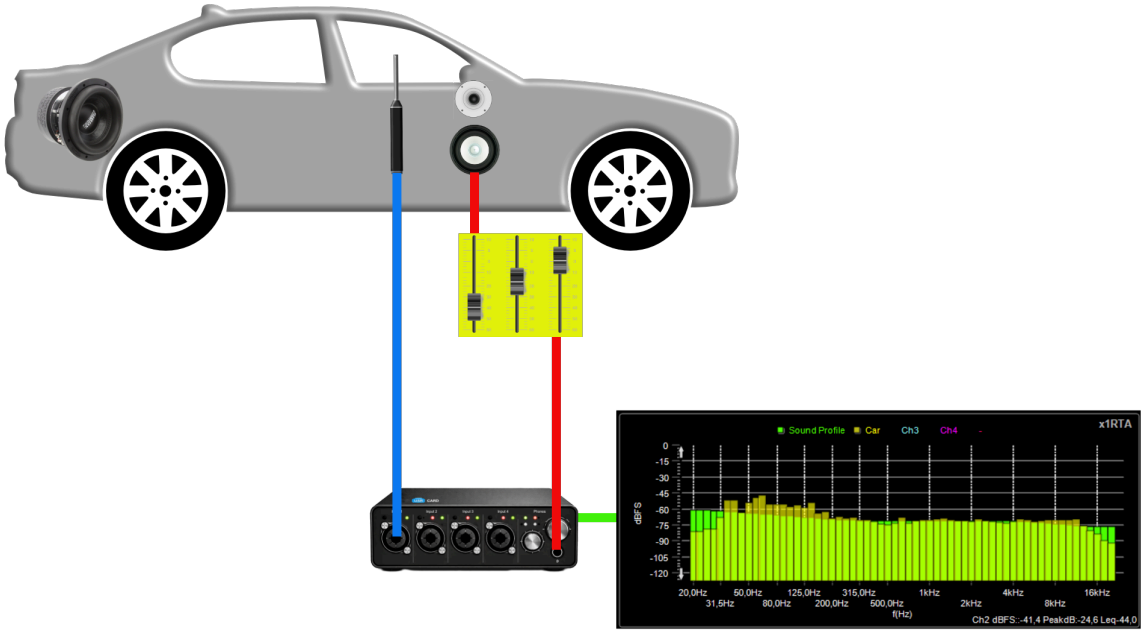
Measurement Procedure

- Assign Input 2 to display channel 2 (lower x1RTA function bar)
- Select “File / Load Sound Profile”

- Choose the sound profile. RTA display channel 1 now shows the profile
- Set the display channel to Ch2
- Open the generator:
  - Select “Pink”
  - Set level to -10 dB
  - Press the „On“ button
- RTA module: Start the RTA measurement by pressing “Start”
- Use the offset control (left x1RTA panel) to align channel 2 with the reference curve at 1 kHz
- Adjust the EQ/Audio DSP until the yellow Ch2 curve matches the profile

Tip: Use the difference between Ch1 and Ch2 to help with the balancing. The aim is to get the difference curve as close to 0dB as possible across all frequencies.

Illustration: Sound adjustment using sound profiles. The three yellow controls represent the sound controls, EQ or audio DSP fitted in the vehicle.



6.2.1. Create your own Sound-Profiles

Tip: Sound profiles aren’t just for car audio. As shown in the example, you can also create templates for live performance or home cinema sound and recall them for fine-tuning as needed.

There are two ways to create profiles:

1. Measurement in the RTA module

- Use 1/3 octave, speed „IEC slow“ and select channel Ch1 for measurement
- Use pink noise to measure your ‘sound template’ in the RTA module
- Stop the measurement
- Save the measurement via the main menu: ‘File / Save as Sound Profile’
- Adjust the profile as required using the “Sound Profile Editor” tool (see point 2 below)

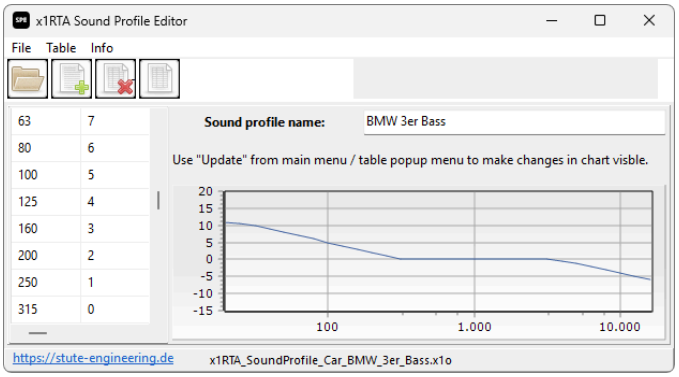
2. With the Tool Sound Profil Editor

- Enter the frequency response using pairs of values

- A pair of values consists of a frequency and the gain, as is common with many microphone correction files
- A positive gain value indicates that the frequency is boosted (it should be reproduced at a higher volume)

Tip: You can also import the data pairs from a TXT file, using the delimiter ";"

You can download the editor for free from the Download section on our website.



6.3. Measuring and Evaluating Room Acoustics

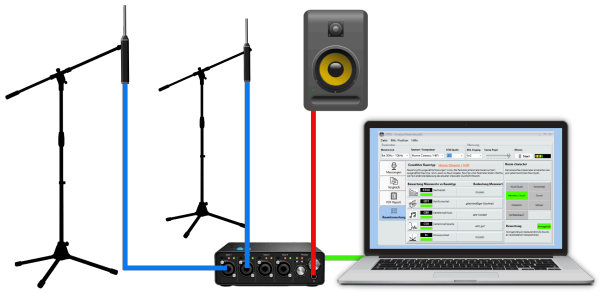
Measurement tips:

- *Multiple speakers spread around the room? If you have several speakers spread around the room, use just one. An omnidirectional speaker is ideal. The speaker must cover the required frequency range, e.g. 63 Hz to 8 kHz, with a slight overlap.*
- *Speaker placement: Not against a wall, in a corner, or in the exact room center. Good rule: ~1/4 room length, ~1/4 room width, ear height (~1.0–1.3 m)*
- *Recommended distance? Start with 1 m from the speaker off-axis. Use the hall radius function in x1RTA to calculate the optimal distance*
- *Microphone placement: Point toward the ceiling, slightly off-axis (20–40 cm offset). Keep 50–80 cm from walls, avoid corners and ceilings. Best: around room center ±0.5 m but not exact center, ear height (~1.1–1.3 m)*
- *Measurement: Average of 3–5 measurement points in the room. Typical points: Listening position + slightly in front of it + slightly behind it + slightly to the side (to prevent measurement errors from a single measurement). If available: Use microphone correction >0° (diffuse).*

Hardware

- Position microphone(s) and connect to the audio interface

x1RTA



- Choose measurement range, e.g., 63 Hz to 8 kHz (matching to the loudspeaker)
- Select room type and sweep length, e.g., Home Cinema or Conference Room
- Select RT60 source: Default T20. In very quiet environments with low-noise hardware, you can use T30
- Sweep level: Start with -15 dB
- Select microphone input
- Start measurement with "Start".
  - Ensure the peak of the level indicator remains in the green zone
  - Adjust the level if necessary: a message appears saying "Level too low" or the level indicator shows only yellow or red
- Results are displayed in a table and graph. Repeat and average multiple positions
  - Use the 'Type(f)' and 'Measure(f)' buttons to view further details about the measurement

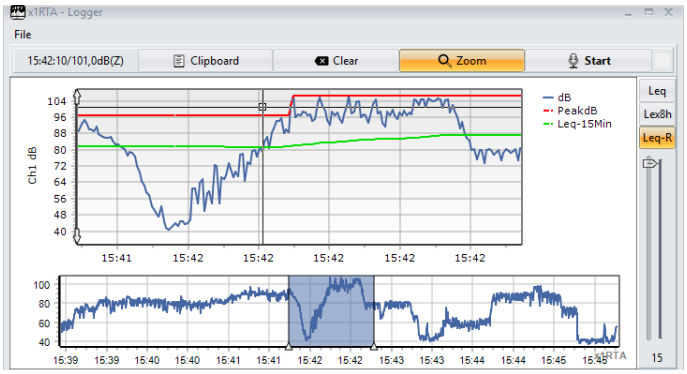
Evaluation

- Click “Room Evaluation” for a passed/fail assessment and parameter explanation
- To view various room parameters graphically, transfer the measurements to the ‘Compare’ page, or to visualise improvements in room acoustics before and after optimisation

Caution

- Avoid noise during measurement
- If the test signal is weak, select T20 as RT60 source or increase the sweep level or adjust the sound card output
- A red-marked parameter line indicates disturbances. Repeat the measurement

6.4. Sound Level Logger Measurement



The logger module records SPL (dB), Peak, Leq, Lex,8h or running Leq over time, incl. A or C weighting.

Hardware

- Place the microphone and connect it to the audio interface
- Note: Accurate SPL measurement is only possible after prior SPL calibration; see chapter "Setup"

x1RTA

- Select “SPL” from the RTA module header menu „Unit“
  - Optional: Choose weighting A or C
  - For $L_{EX,8h}$ „A“ is mandatory
- Open the logger module from the left function bar
  - Set the time interval. Multiple points within the interval are averaged.
  - Start logging with “Start” in the „Logger" module

Tip: Use the zoom function to view detailed time windows during recording. To do this, drag the blue bar shown in the lower graphic at either end whilst the zoom function is active.

7. Specifications

7.1. Module RTA Analyzer

- Up to 10 microphones (In 1..10)
- 4 display channels (Ch 1..4)
- Octave: 1/1, 1/3, 1/6, 1/9, 1/12
- IEC 61672 time weighting: Impulse, Fast, Slow + smoothing
- Frequency range: 20 Hz to 20 kHz
- Sound card frequency response correction

- Microphone frequency response correction per input: free-field (0°) and diffuse acoustics (>0°)
- SPL calibration with 94 dB calibrator
- A-C-Z frequency weighting
- Bar char views (4 channels): overlapping, offset, 3D with transparency
- Offset ±20 dB per channel
- Display options: Peak, Peak + Decay, Snapshot, Difference
- Temporarily save measurements (Copy & Paste)
- Cursor with measurement values
- Save, print or copy measurements to the clipboard
- Measurement values: Leq, Peak, dBFS or dBFS RMS

7.2. Module Room Assessment

- Measurement: Select directly from up to 10 microphones
- Measurement frequencies
  - Std: 1/1 Octave: 125Hz - 4kHz or 63Hz - 8kHz
  - Ext: 1/3 Octave: 100Hz - 5kHz or 50Hz - 10kHz
- Room parameters
  - Reverberation time RT60 (based on T20 or T30)
  - EDT centre time
  - Speech clarity C50
  - Music clarity C80
  - ts decay time
- Averaging of any measurements
- Text input for measurement
- Room types with target values for room parameters
  - Music: Control room, Hi-Fi/Home Cinema, Concert hall, Church
  - Speech: Conference room, Classroom, Reading room
- Passed/Failed rating based on selected room type
- Meaning of measurement values, such as ‘reverberant’ or ‘dry’
- Output of various PDF reports based on templates, including your company logo
- Print, save measurement
- Copy measurement graph to clipboard

7.3. Module Generator

- Level: -60 to 0 dBFS
- Log Sweep
  - Min: 15 Hz, Max: 22 kHz
  - Duration 10s - 40s
- Pink Noise

7.4. Module Logger

- Values:
  - A/C/Z weighting
  - Level as SPL dB, dBFS or dBFS RMS
  - Peak unit as for level
  - Leq : Equivalent continuous sound level. It is a key parameter in acoustics and noise studies and represents the average sound level over a specific period of time
  - $L_{EX,8h}$: Daily noise exposure level, an energy-equivalent continuous sound level normalised to 8 hours (similar to ISO9612, DGUV 209-023)
  - Leq-R: Leq running with a time window from 1 Min. to 600 Min.
- Measurement saving

8. System Requirements

8.1. PC

- Windows 10/11, 32/64-bit
- Intel i3 2 GHz or faster
- Screen 1024×768 or higher
- Keyboard, mouse

8.2. Audio interface

- ASIO drivers required (WDM is not supported)
- Adjustable mic input channels 1–10
- 48 V phantom power
- Sample rate: 48 kHz
- Resolution: 16/24/32 bit
- Min. 1 adjustable audio or headphone output
- Examples:
  - Multi channel (4+): Behringer UMC1820/404HD
  - Stereo: Behringer UMC202HD, Mackie Onyx Producer 2.2, Steinberg UR22 mkII

8.3. Measurement microphones

- Frequency response: 20 Hz to 20 kHz, as linear as possible
- A sound level calibrator with a 94 dB output is required for SPL calibration of the microphone.

8.3.1. Example measurement microphones

Note: This list is not exhaustive.

- iSEMcon EMX-7150
- Earthworks M23R or Audio M30
- Audix TM1
- Audio Line OMNI 1 *)
- Sonar Works SoundID

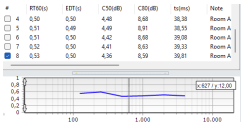
*) The SPL must be calibrated using a reference microphone or sound source (see Setup). This model is not suitable for SPLI calibrators.

9. FAQ

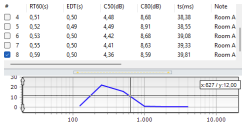
9.1. Room acoustics

Question: Why do I see a significantly different measurement curve / different measurement data after switching from T20 to T30 following a measurement?

T20

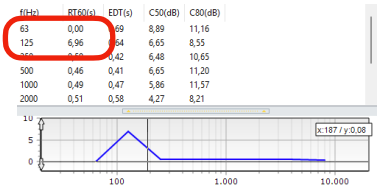


T30



Answer: For an assessment based on T30, a difference between the measured signal and ambient noise of at least 35 dB is required across the set frequency range. If the difference is smaller, this behaviour will be evident. In that case, please use only the data based on T20.

Question: My RT60 measurement shows very high values at low frequencies – 6.96 instead of 0.49 or 0.00. Why is that?



Answer: In many cases, the problem lies with the loudspeaker. It does not cover the required frequency range evenly, e.g. 63 Hz to 8 kHz. Try

- reduce the measurement range
- or use a better loudspeaker
- try again at a higher volume