GLOBAL AUDIO SOLUTIONS



USER MANUAL

GLOBAL AUDIO UTILITIES

Version 1.0.0 · macOS and Windows



Global
Audio
Solutions

October 2026

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1. INTRODUCTION

Global Audio Utilities brings into one window the calculations a system engineer does again and again before and during a gig: how many front-fill boxes are needed, how to delay the subs, which threshold, ratio, attack and release to give each amplifier channel, how much the delays and the EQ change between the soundcheck and the show, how a room sounds, and a few quick tools. Every tab shows the result, a graph and, below them, the working step by step with the formulas and the numbers in, so it can be checked by hand.

- Front fill, subwoofers (end-fire, cardioid, line and arc), limiters, low-mid control, soundcheck vs show, room acoustics and four tools: delay, cables, converters and SPL.
- Everything is saved as a project, exported to PDF in the Global Audio Solutions style or copied as text.
- In five languages, like RiTA: English, Spanish, French, Portuguese and Chinese.
- It tells you when there is a newer version, just as RiTA does.
- It asks for no licence or activation, and needs no internet connection.

1.1 WHAT IT INCLUDES

TAB	WHAT IT IS FOR
Front fill	Spacing between front-fill boxes and how many are needed to cover the first row.
Subwoofers	End-fire, cardioid and line or arc: delays, polarity and a level map.
Limiters	Threshold, ratio, attack and release of the RMS limiter and the peak limiter of each channel.
Low-mid control	The all-pass filters that take up or widen the low mids of a line array.
Soundcheck vs show	The new delays and EQ when the temperature and the humidity change.
Acoustics	RT60, critical distance, Schroeder frequency and the modes of a room.
Tools	Delay, speaker cables, level converters and SPL with coverage.

1.2 REQUIREMENTS

COMPUTER	SYSTEM	INSTALLER
Mac with Apple Silicon (M1 or later)	macOS 11 Big Sur or later	Global Audio Utilities macOS Apple Silicon.pkg
Mac with an Intel processor	macOS 11 Big Sur or later	Global Audio Utilities macOS Intel.pkg
PC	Windows 10 or 11, 64-bit	Global Audio Utilities Setup.exe

- About 100 MB of free disk space and a screen of 1280 × 800 or more (the window does not get smaller than 960 × 640).
- On Windows, Microsoft Edge WebView2 is needed; it comes with Windows 11 and with current versions of Windows 10 (chapter 16 if the window comes up blank).
- No sound card, microphone, Python or any other program is needed.

1.3 ABOUT THIS MANUAL

This manual describes version 1.0.0 for Windows and macOS. All the screenshots are in English and show an example project, the second stage of a festival, not a real job. In another language the controls are in the same place; only the text changes.

- Menus are written as `Project > Save`: the menu and, after the arrow, the option in it.
- Buttons, fields and tabs are in **bold**, as they appear on screen.
- Decimals are written with a point, as in the app (2.5 m). When typing a number, either a point or a comma works: 2,5 and 2.5 are the same.

> **The calculations are a starting point; they do not replace measuring.** The air, the room and the equipment of each place have the last word.

2. INSTALLATION

Download the installer for your computer (table in section 1.2). If you already had an earlier version, the installer puts the new one in its place: there is no need to uninstall anything first.

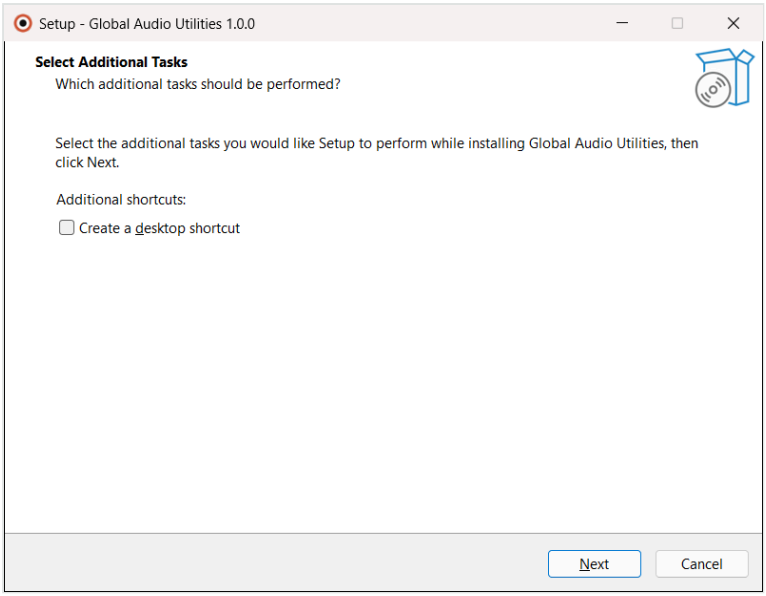
2.1 MAC

1. Double-click the installer (.pkg) for your Mac. To find out which one it is, open the Apple menu > About This Mac: if it says “Chip Apple M1” (or M2, M3...), it is the Apple Silicon one; if it says “Intel”, the Intel one.
2. If macOS warns that it cannot verify the developer, click OK and go to System Settings > Privacy & Security. The notice about the installer is at the bottom: click Open Anyway and confirm with your password or Touch ID.
3. Follow the steps of the installer and click Install. It will ask for the password of the computer.
4. When it finishes, click Close. Global Audio Utilities is left in Applications > GlobalAudioSolutions > Utilities.
5. Open Global Audio Utilities. There is no licence to activate and no permission to grant.

> **If there was already a Utilities folder, the installer replaces it whole.** Whatever was inside is deleted and the folder is created again, so do not keep your own files there. The rest of the GlobalAudioSolutions folder is not touched, and neither is what the app remembers or your .gau projects.

2.2 WINDOWS

1. Double-click Global Audio Utilities Setup.exe.
2. If “Windows protected your PC” appears, click More info and then Run anyway. Windows will ask for permission to make changes to the device: click Yes.
3. Choose the language of the installation and click OK.
4. If you want an icon on the desktop, tick “Create a desktop shortcut”. Click Next and then Install.



Additional tasks.

5. Click Finish. With “Launch Global Audio Utilities” ticked, the app opens straight away.



Installation completed.

Global Audio Utilities is left in the Start menu and in C:\Program Files\GlobalAudioSolutions\Utilities. The .gau projects now open with a double click and show the icon of the app.

The app needs no special permissions and opens no ports: the only thing it does on the internet is check whether there is a newer version (chapter 14).

2.3 UPDATING TO A NEW VERSION

- The app tells you by itself when there is a new version (chapter 14), and Check for Updates..., in the version menu, looks whenever you want.

- Download the installer for your computer and install it as explained above: there is no need to uninstall first.
- The .gau projects and the latest inputs are not touched.

2.4 UNINSTALLING

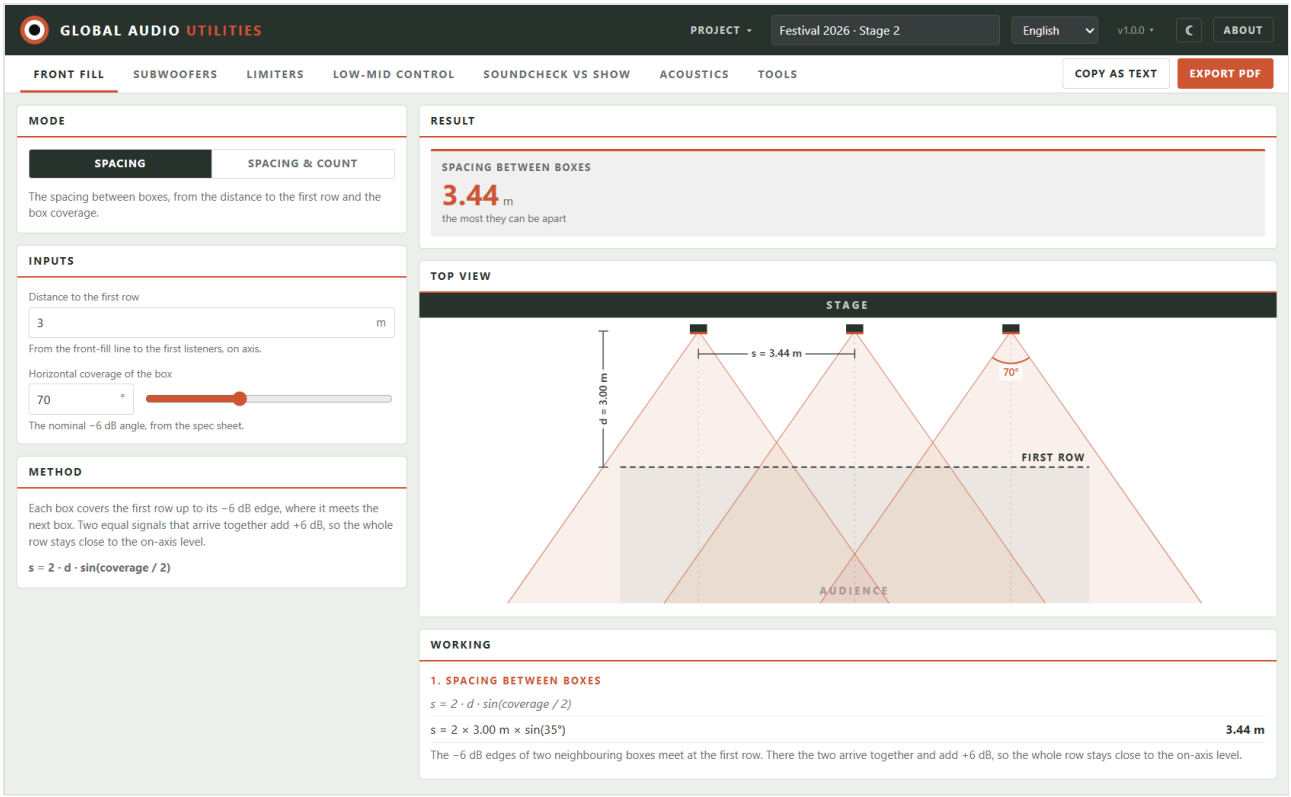
- Mac: drag the folder Applications > GlobalAudioSolutions > Utilities to the Bin.
- Windows: Settings > Apps > Installed apps, find Global Audio Utilities and click Uninstall.
- **Optional:** to also delete what the app remembers (inputs, recent projects, language and update choices), remove the folder `%APPDATA%\Global Audio Utilities` on Windows or `~/Library/Application Support/Global Audio Utilities` on a Mac.

> **Uninstalling does not delete your projects.** The .gau files are where you saved them and are not touched.

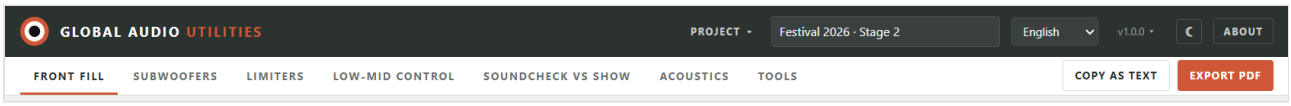
3. GETTING STARTED

3.1 THE WINDOW

At the top is the header, with the project menu, its name, the language, the version and the About button. Below it are the seven tabs and, on the right, the buttons that take the results of the open tab out. The rest is the tab itself: on the left what you type, on the right what comes out.



The window with the Front fill tab: inputs on the left; result, drawing and working on the right.



The header and the tabs.

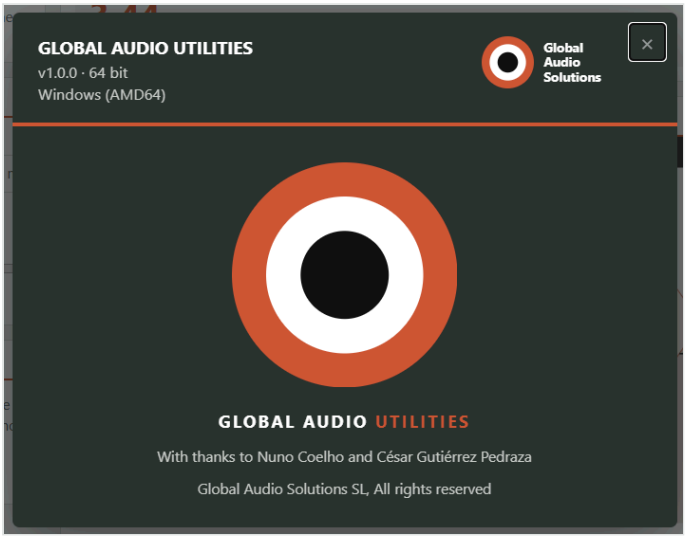
- **Project** ▾: new, open, save and recent projects (chapter 4).
- The **project name**: it goes on the PDF reports and the copied text. An orange ● next to it means there are changes not saved in the file.
- The **language** selector (chapter 13).
- The **version** of the app (v1.0.0 ▾): click it to open the updates menu (chapter 14).
- The **light or dark mode** button (☾ / ☀): changes the colours of the whole app. Until it is pressed the app follows the system; after that it remembers the choice. The PDF reports are always light.
- **About**: version, system and architecture, like RiTA's About box.

- **Copy as text** and **Export PDF**: take out the results of the open tab (chapter 12).

3.2 HOW IT WORKS

There is no Calculate button: every number is worked out again as you type. If an input is missing or makes no sense, the tab says so in a strip under the result, and the warnings (a small amplifier, a low load…) show in orange in the same place.

Every button, result and graph has a line of help: just leave the mouse on it for a moment. The inputs save themselves: close the app, open it again and everything is as it was, even if the project was not saved.



About: version, bits, system and architecture.

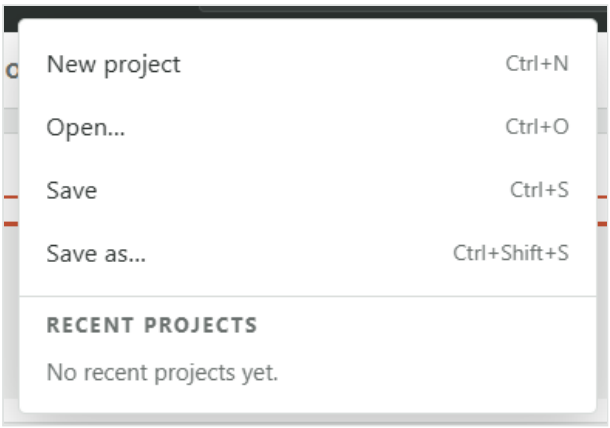
3.3 CHOOSING THE LANGUAGE

The first time the app starts in English, as RiTA does. The selector in the header, next to the Project menu, switches it to Spanish, French, Portuguese or Chinese at once, without restarting and without touching the inputs (chapter 13). It remembers the last language chosen.

4. PROJECTS

A project is a .gau file with the name of the job and every input of the seven tabs: limiter channels, soundcheck outputs and zones, room surfaces... It also remembers which tab was open. The file name is the project name.

4.1 THE PROJECT MENU



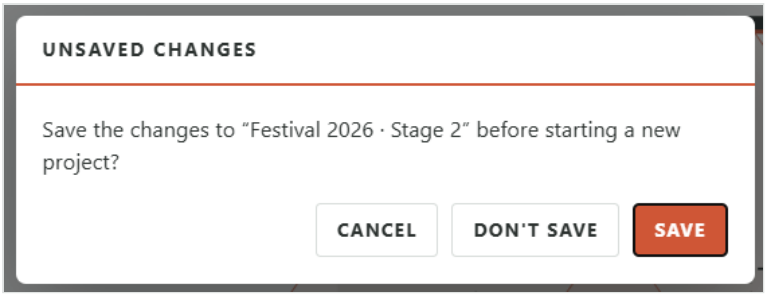
The Project menu.

OPTION	SHORTCUT	WHAT IT DOES
New project	Ctrl+N	Back to the starting values of every tab.
Open...	Ctrl+O	Opens a .gau file.
Save	Ctrl+S	Saves in the project file; if it has none yet, asks where.
Save as...	Ctrl+Shift+S	Saves in a new file.
Recent projects		The last eight opened or saved. The ones no longer there are greyed out.

On a Mac the shortcuts are ⌘**N**, ⌘**O**, ⌘**S** and ⇧⌘**S**.

4.2 UNSAVED CHANGES

- An orange ● appears next to the project name.
- Before starting a new project or opening another, the app asks whether to save: **Save**, **Don't save** or **Cancel**.
- When the window is closed with a file open and changes not saved in it, it asks on Windows. On a Mac it cannot ask from there, but nothing is lost (see the note).



The question before starting a new project.

> **Closing never loses anything:** the inputs, the open file and the unsaved mark are kept and come back when the app opens again. Saving the project is for having the job in a file, taking it to another computer or coming back to it later.

5. FRONT FILL

How many front-fill boxes are needed along the edge of the stage, how far apart and where they go, so that the first row is covered without gaps.

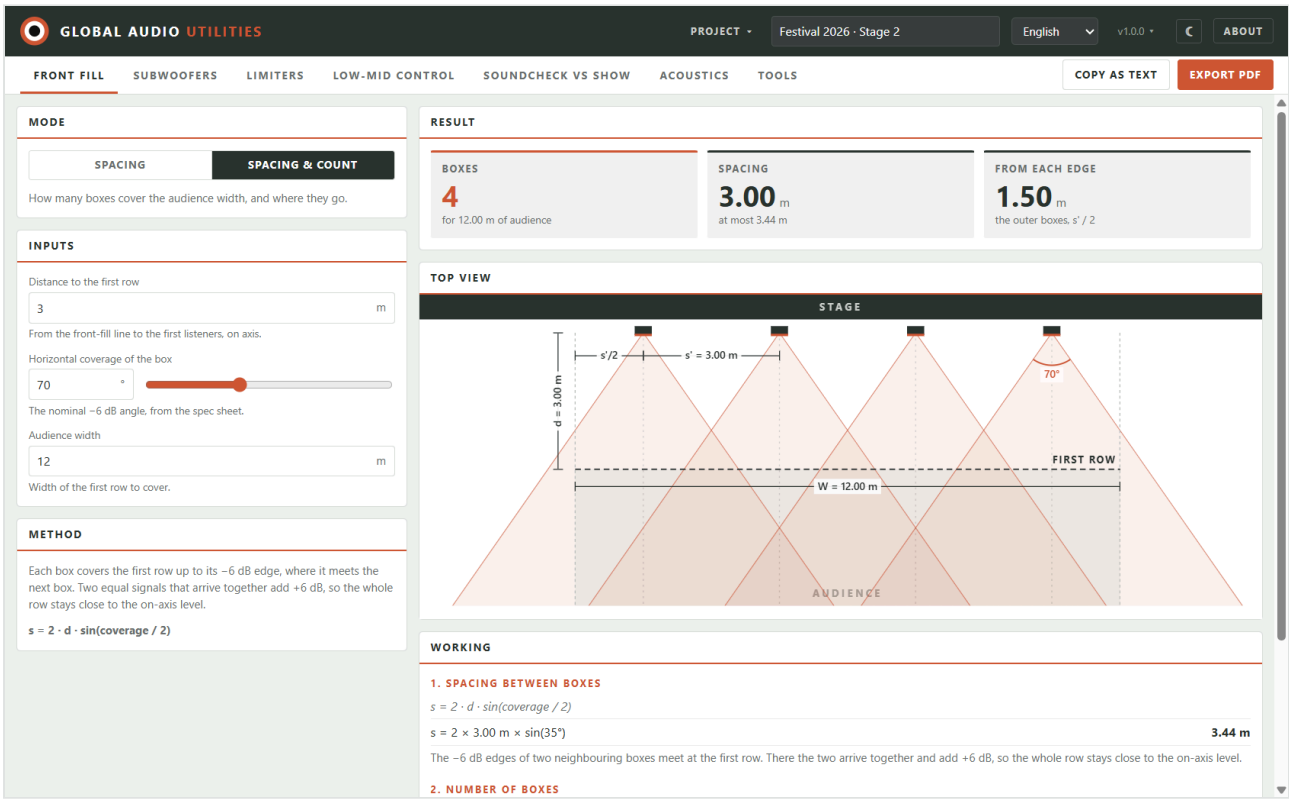
5.1 THE INPUTS

- **Distance to the first row** (d): from the front-fill line to the first listeners, on axis.
- **Horizontal coverage of the box**: the nominal −6 dB angle of the spec sheet. Type it or drag the slider.
- In **Spacing & count** mode, also the **Audience width** (W): the width of the first row to cover.

5.2 WHAT COMES OUT

- Spacing between boxes: **s = 2 · d · sin(coverage / 2)**. Each box covers the first row up to its −6 dB edge, where it meets the next one; there both arrive together and add +6 dB, so the whole row stays close to the on-axis level. With 3 m and 70° it comes to 3.44 m.
- With the width: **N = W / s** rounded up, the actual spacing **s' = W / N**, and the outer boxes at **s'/2** from each edge.

The top view shows the stage, the boxes with their coverage, the first row and the audience.



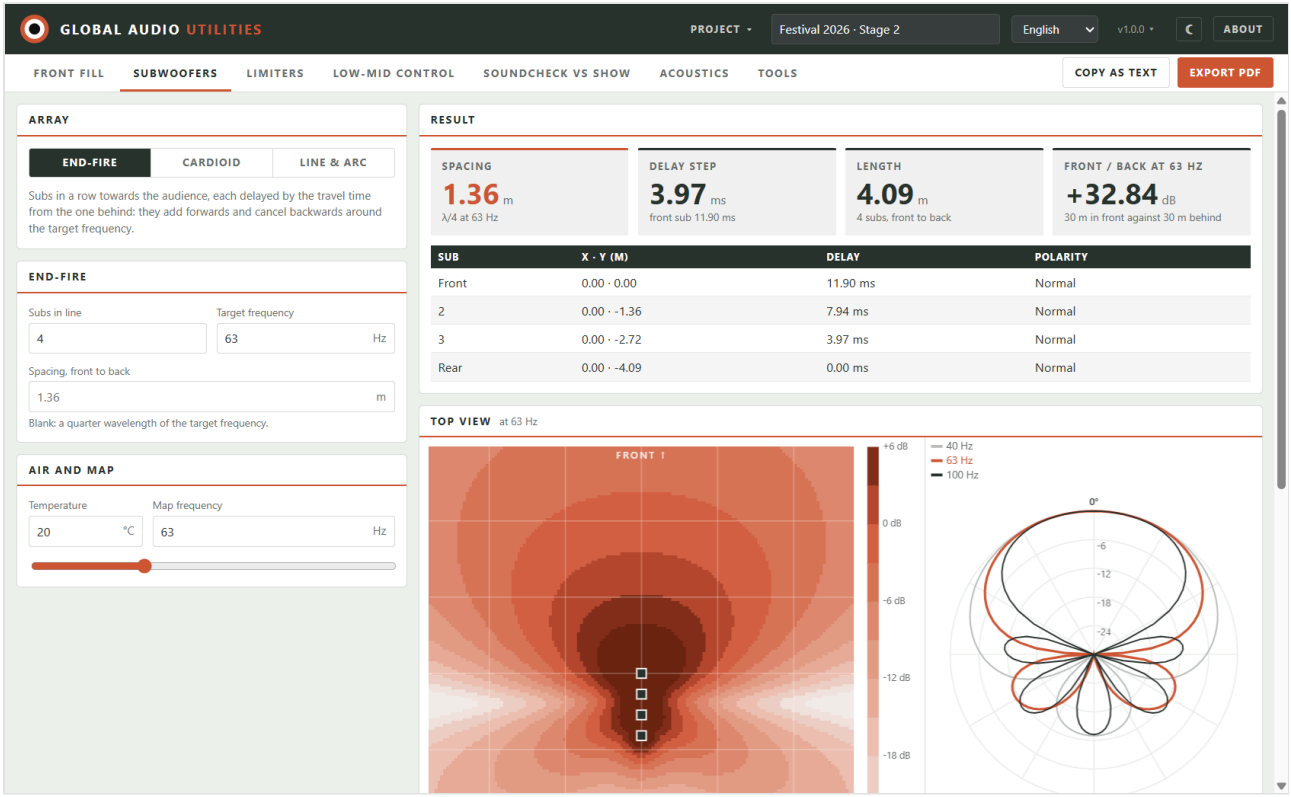
Spacing & count: a 12 m first row at 3 m, with 70° boxes.

6. SUBWOOFERS

Three sub arrays, chosen at the top left. For all three, the **Result** gives the table with the position, delay and polarity of every sub, ready to set in the processor.

6.1 END-FIRE

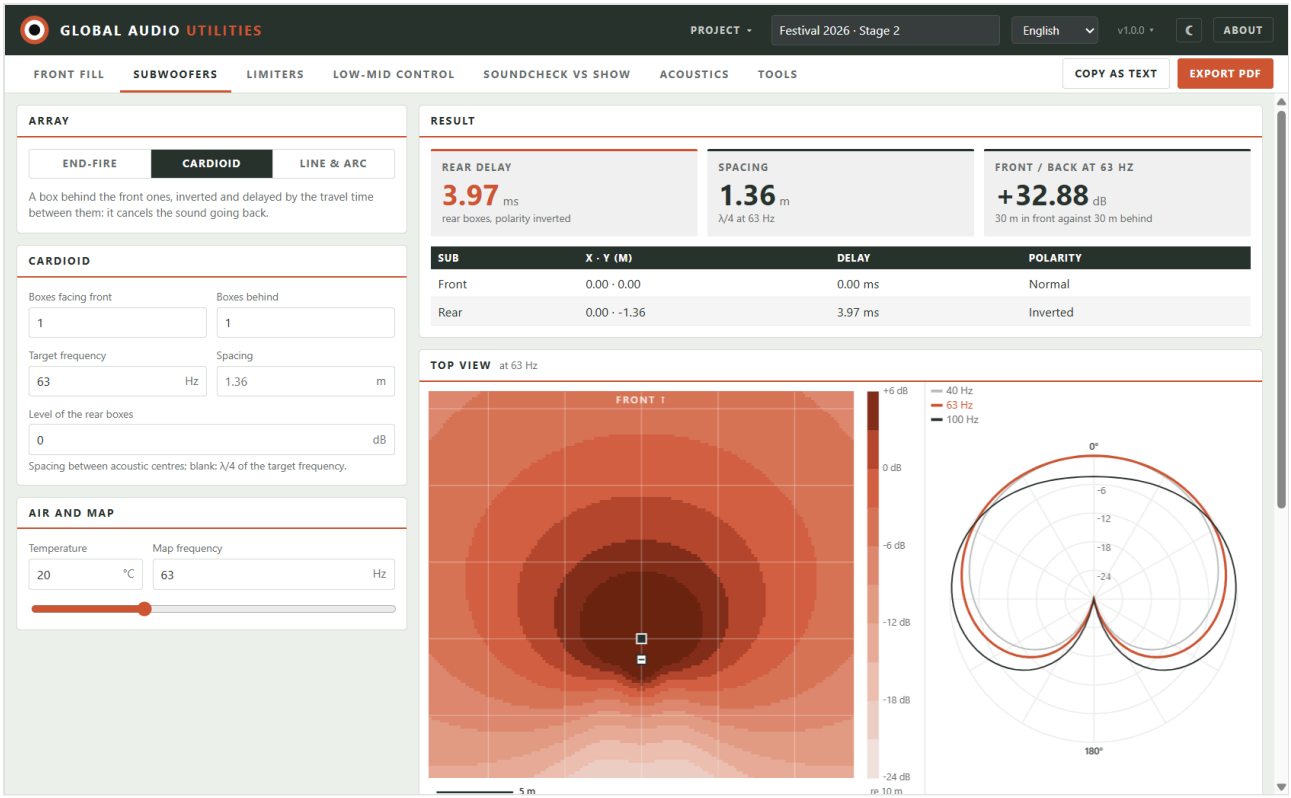
N subs in a row towards the audience, a quarter wavelength (λ/4) of the target frequency apart, or whatever is typed as spacing. Each one waits for the one behind it as long as sound takes to travel that spacing (d/c), so the front one gets (N−1)·d/c. In front they add in phase; behind they cancel.



An end-fire of four subs at 63 Hz.

6.2 CARDIOID

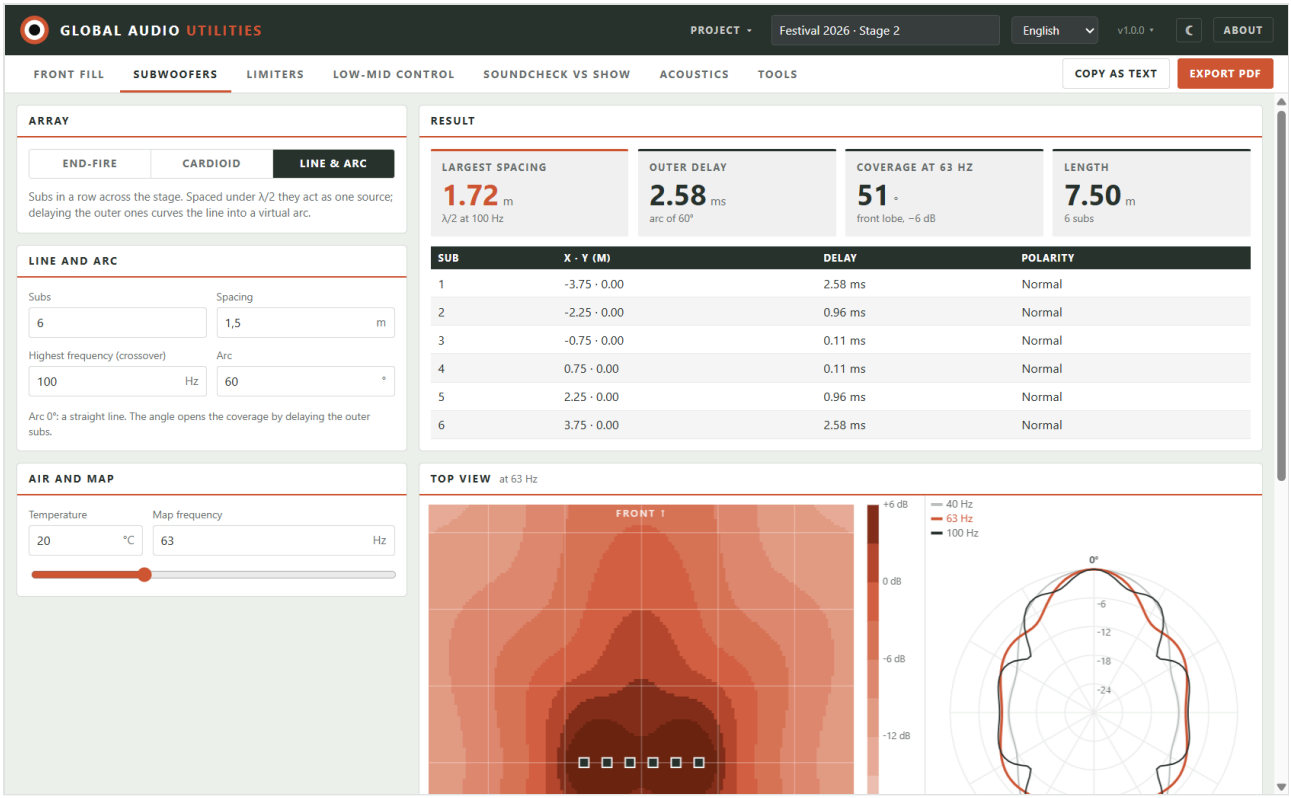
Gradient cardioid: the rear boxes, a distance d behind the front ones, are polarity-inverted and delayed by d/c. With a different number of boxes in front and behind, it says how much to trim the rear ones for the cancellation to work.



Cardioid: one box in front and one behind, inverted and delayed.

6.3 LINE & ARC

Subs in a row across the stage. The largest spacing for them to act as a single source, without lobes, is λ/2 of the highest frequency they play (the crossover). With an arc angle, the outer ones are delayed to bend the line into a virtual arc: $R = (L/2) / \sin(\theta/2)$, and each sub gets $(\sqrt{(R^2 + x^2)} - R)/c$. At 0° it is a straight line.



Six subs in a line, bent by delays into a 60° arc.

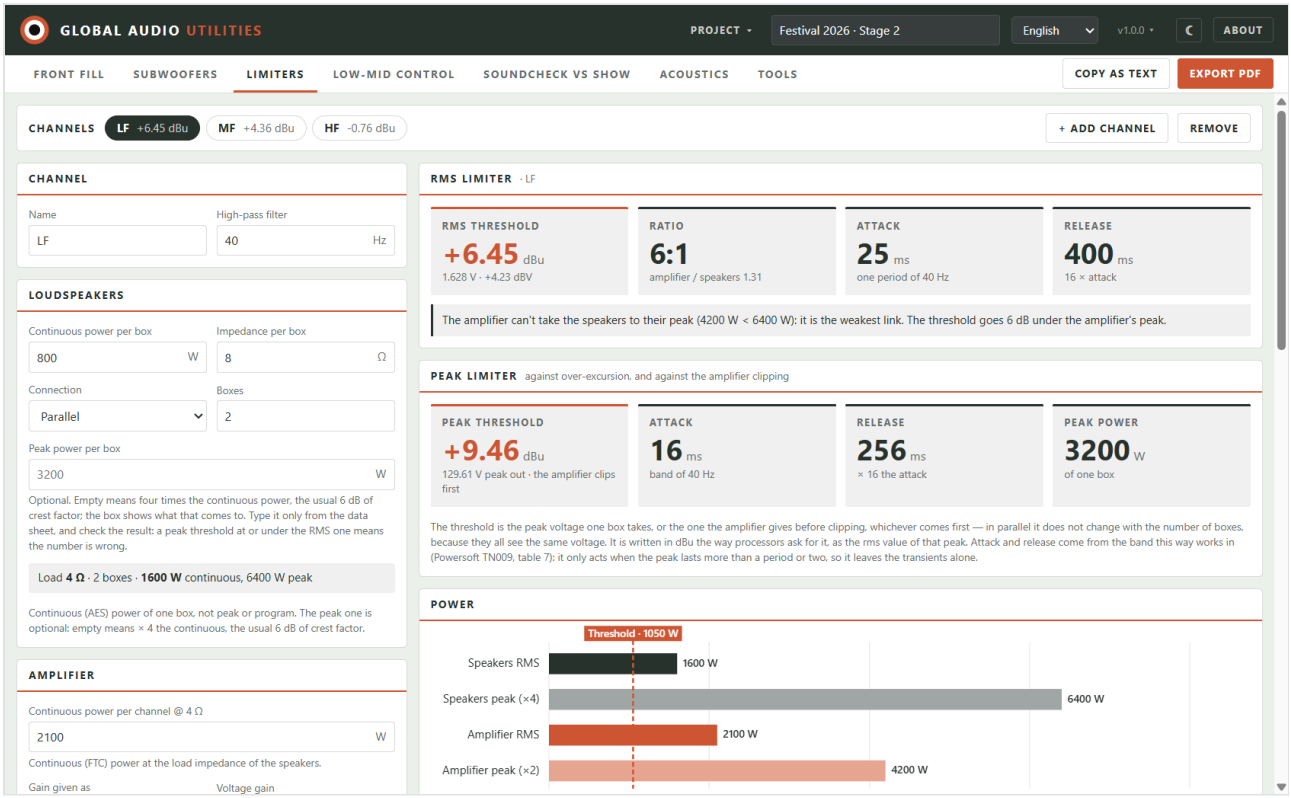
6.4 THE MAP

The **Top view** adds the subs as omnidirectional point sources in free field, at the **Map frequency** chosen (drag the slider to see it change). It is relative to 10 m in front of the centre, in 3 dB steps. Next to it is the polar plot at 30 m, at 40, 63 and 100 Hz, and the result gives the front-to-back ratio.

> **The map leaves out the floor and the room:** it shows how each array works and compares them, but the real result has to be measured.

7. LIMITERS

The threshold, ratio, attack and release of the RMS limiter of each amplifier channel, with the peak limiter next to it. It follows the method of «Amplificación y limitación de altavoces», by Pepe Ferrer.



The Limiters tab, with three channels: LF, MF and HF.

7.1 CHANNELS

The channels are at the top, each with its name and its threshold. **+ Add channel** copies the open one, so only what differs needs changing; **Remove** deletes it. At the end of the tab, **All channels** sums them up in a table, which is also the first page of the report.

7.2 THE INPUTS OF EACH CHANNEL

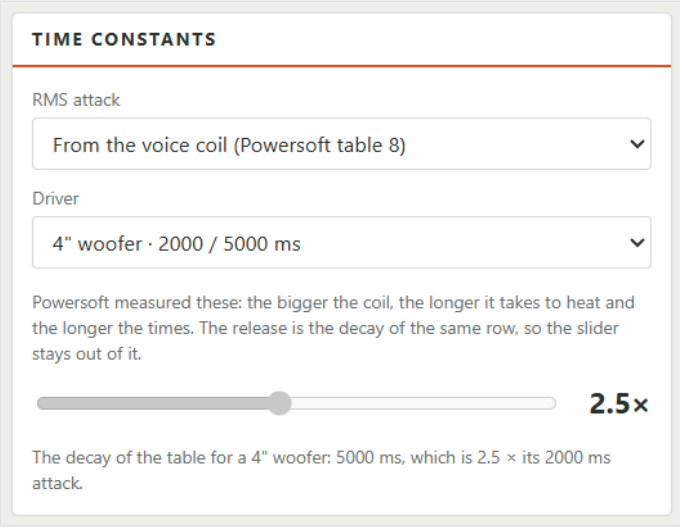
- **Loudspeakers**: the **continuous power per box** (the AES rating of the spec sheet, not peak or program), the impedance, how many boxes and how they are wired: in parallel (Z/n), in series (Z·n) or series-parallel, m branches of k boxes in series (Z·k/m). The peak power per box is optional: left empty, it is taken as 4× the continuous one.
- **Amplifier**: its continuous power per channel into the resulting load, and the gain, which can be given four ways: in dB, as a factor, as an input sensitivity in V or as an input sensitivity in dBu. If the maker rates the sensitivity at another power or impedance (8 Ω, say), type it in **Sensitivity rated at**. Switching between them converts the value, so the gain stays the same.
- The channel's **High-pass filter**, which sets the attack.

7.3 THE RMS LIMITER

- Peaks: loudspeakers are rated with AES pink noise (6 dB crest factor), so their peak is **4×** their continuous power; amplifiers with sine waves (3 dB), so theirs is **2×**.
- Threshold: if the amplifier can take the speakers to their peak (amplifier ≥ 2 × speakers), the threshold goes at the RMS voltage of the speakers, **$V = \sqrt{(P \cdot Z)}$**. If not, the weakest link is the amplifier and the threshold goes 6 dB under its peak: **$V = \sqrt{(2 \cdot P_{amp} \cdot Z)} / 2$**. That voltage is taken to the amplifier input by dividing by the gain factor, and given in dBu (0.775 V) and dBV.
- Ratio, from the amplifier / speakers ratio: ≥ 2 → **40:1**; ≥ 1.5 → **20:1**; otherwise **6:1**. With amplifier to spare it can be tight, because the limiter hardly works; with a just-enough one, a hard ratio would keep it sitting on the brake.
- Release: 10 to 20 times the attack, with the **Release factor** slider (16 by default).

Three ways to set the attack

RMS ATTACK	HOW IT COMES OUT	WHAT FOR
One period of the high-pass	1 / f of the high-pass	The course's criterion: protects the excursion and lets the music through. The default.
Thermal	100 / f in seconds, never under 50 ms	How long the voice coil takes to heat up. It only protects from burning: it needs the peak limiter in front.
From the voice coil	Powersoft table 8	Choose the driver and the attack and release (the table's decay) come out.

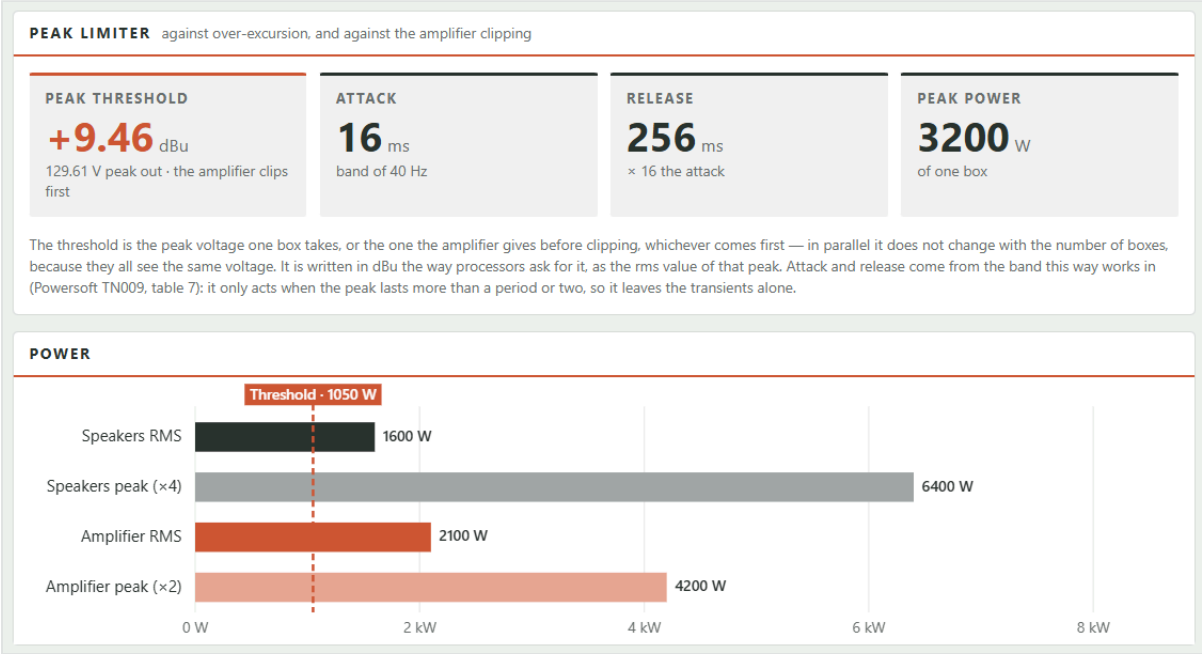


Attack from the voice coil: a 4" woofer, 2000 ms attack and 5000 ms release.

7.4 THE PEAK LIMITER

Under the RMS limiter comes the peak one, which protects against over-excursion and, on the way, against the amplifier clipping.

- Threshold: the peak voltage one box takes, **√(P peak × Z)** (times the boxes in series; in parallel they all see the same voltage), or the one the amplifier gives before clipping, **√(2 · P amp × Z load)**. The lower one rules, and the app says which.
- It is given in dBu as processors ask for it, that is, the RMS value of that peak (V peak / √2), and also in peak volts.
- Ratio **∞:1**: a peak limiter is a wall, whatever the ratio of the RMS one.
- Attack and release from the band the way works in, from table 7 of Powersoft's technical note TN009: below 63 Hz, 16 ms and ×16; from 1 kHz up, 0.5 ms and ×2. That way it only acts if the peak lasts more than one or two periods, and leaves the transients alone.



The peak limiter and the power graph, with the threshold marked.

7.5 WARNINGS

The tab warns when the amplifier is smaller than the speakers, the load drops under 2 Ω, the gain is outside 20–50 dB or the threshold goes over +20 dBu (many processors clip between +20 and +24 dBu).

> **The powers in this tab are continuous (average):** AES for the speakers and FTC for the amplifiers. They are not called «RMS» because there is no such thing as RMS power: what has an RMS value is the voltage. The RMS limiter, on the other hand, is called that because it is what it measures.

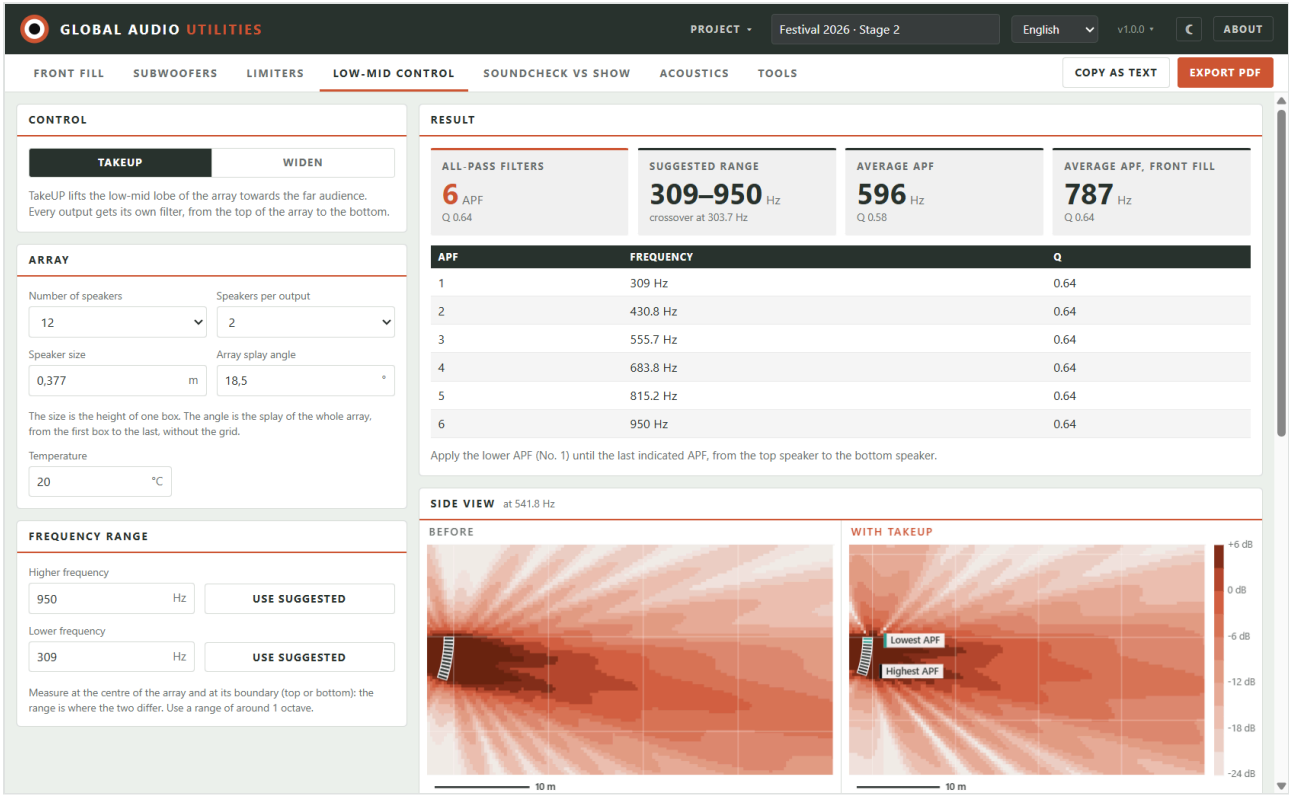
ALL CHANNELS

CHANNEL	SPEAKERS	LOAD	AMPLIFIER	GAIN	RMS THRESHOLD	RATIO	RMS ATTACK	RMS RELEASE	PEAK THRESHOLD	PEAK ATTACK	PEAK RELEASE
LF	2 × 800 W @ 8 Ω in parallel	4 Ω	2100 W	32.0 dB	+6.45 dBu (1.628 V)	6:1	25 ms	400 ms	+9.46 dBu (3.256 V peak)	16 ms	256 ms
MF	2 × 400 W @ 8 Ω in parallel	4 Ω	1300 W	32.0 dB	+4.36 dBu (1.281 V)	20:1	4 ms	64 ms	+7.37 dBu (2.562 V peak)	2 ms	16 ms
HF	2 × 100 W @ 8 Ω in parallel	4 Ω	600 W	32.0 dB	-0.76 dBu (0.710 V)	40:1	0.83 ms	13.3 ms	+2.26 dBu (1.421 V peak)	0.5 ms	1 ms

All channels at a glance.

8. LOW-MID CONTROL

A line array is far more directive in the highs than in the low mids, and down there its lobe does not point where the boxes point. A different all-pass filter (APF) on each processor output changes the phase of each box without touching its level, and that moves the lobe. This tab works those filters out. It is LMC GAS, Nuno Coelho's calculator, with the same numbers.



TakeUP for an array of 12 boxes, two per output: six all-pass filters.

8.1 THE CONTROL

- **TakeUP** lifts the low-mid lobe towards the far audience. Every output gets its own filter, from the top box to the bottom one.
- **Widen** opens the lobe. The filters work on half the array, mirrored: the same filter on the boxes at the same distance from the centre, from the outer ones inwards.

8.2 THE ARRAY

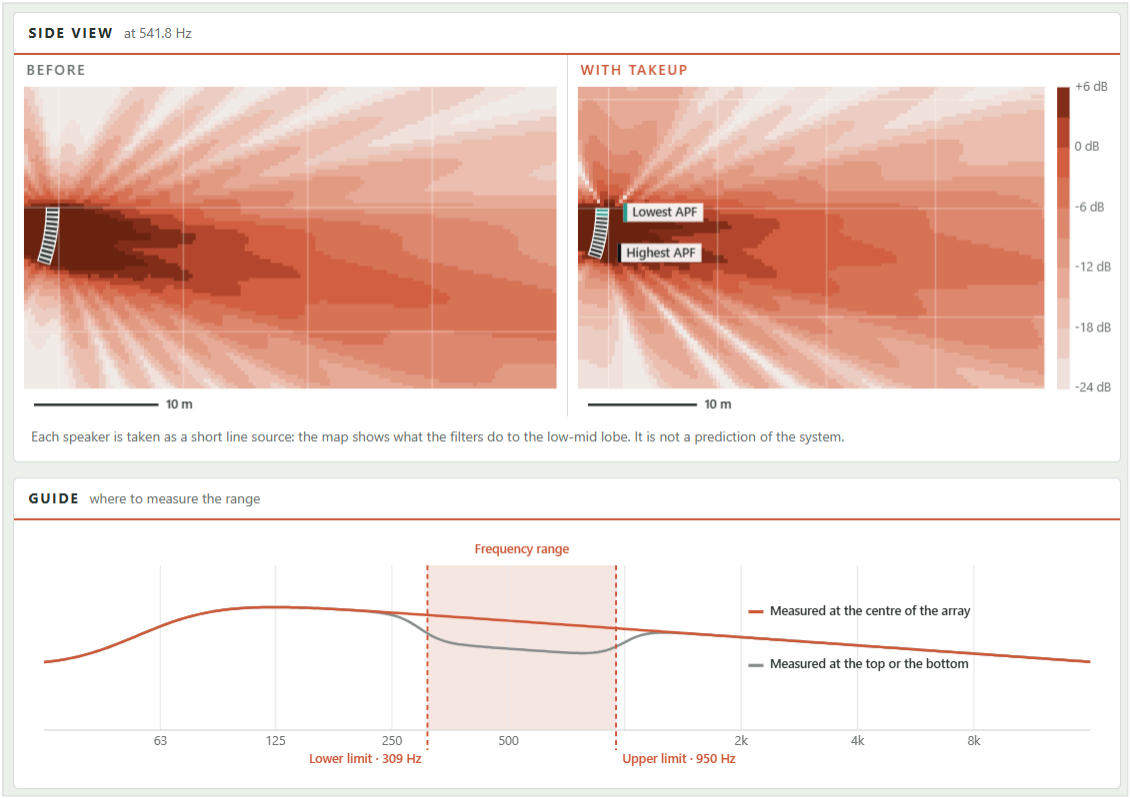
- **Number of speakers**, from 8 to 20, and **Speakers per output**: 1 or 2. With 2 per output the number of speakers has to be even.
- **Speaker size**: the height of one box, in metres.
- **Array splay angle**: the splay of the whole array, from the first box to the last, without the grid.
- **Temperature**, for the speed of sound.

That gives the crossover frequency of the array, **74 / angle × c / (height × boxes)**, and from it the frequency range each control suggests.

8.3 THE FREQUENCY RANGE

The filters are spread between a **Lower frequency** and a **Higher frequency**. Type them, or click **Use suggested** to put the one the array gives. Best of all, measure them:

1. Measure the response at the centre of the array and at its boundary, top or bottom.
2. The range is the low-mid region where the two measurements come apart.
3. Use a range of around one octave. If it is far from that, the tab says so.



The side view of the array before and after the control, and the guide to where the range is measured.

8.4 THE SIDE VIEW

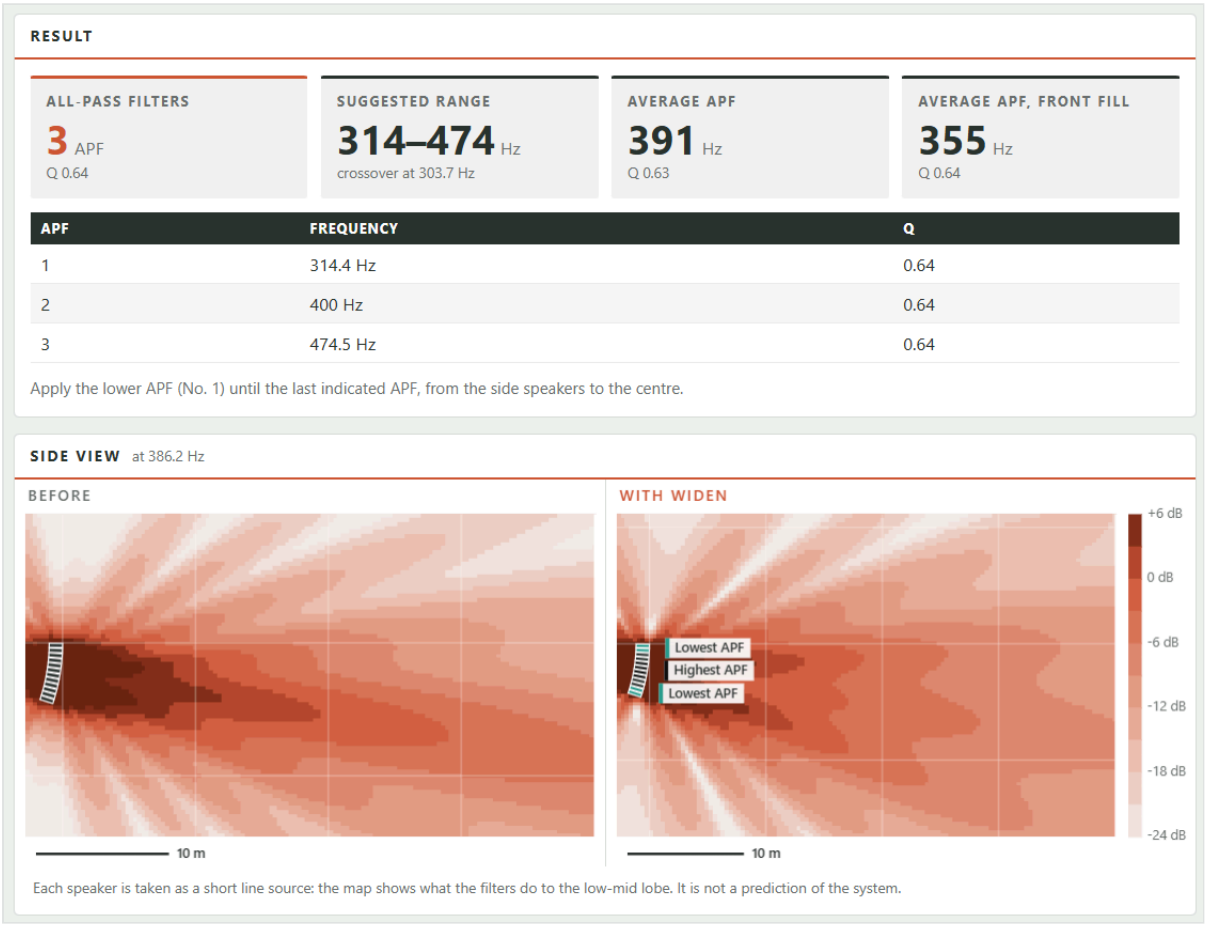
The tab draws the array seen from the side and the level around it, twice: as it comes and with the filters in. Both maps use the same reference, so they compare at a glance, and they are worked out in the middle of the range, with your number of speakers, their size and their angle. The second one marks the speakers that carry the lowest and the highest APF.

> **The map is not a prediction of the system.** Each speaker is taken as a short line source, all at the same level and without the directivity of the horn. It is there to show what the filters do to the low-mid lobe; for everything else there is the manufacturer's prediction software.

Below it, the guide is a reminder of where to measure: two example curves, the centre of the array and one of its ends, with the range shaded between the two limits that are typed in.

8.5 WHAT COMES OUT

- The list of **all-pass filters**: how many, the frequency of each and the Q, which is 0.64 for all of them. They go from the lower frequency (No. 1) to the higher one, in steps of a fixed ratio.
- The order to set them in: for TakeUP, from the top box to the bottom one; for Widen, from the outer boxes to the centre.
- **Average APF**: a single all-pass, with its frequency and Q, that does to the phase what all of them do together. It is for systems where each output cannot have its own filter.
- **Average APF, front fill**: the all-pass frequency to use on the front fills.



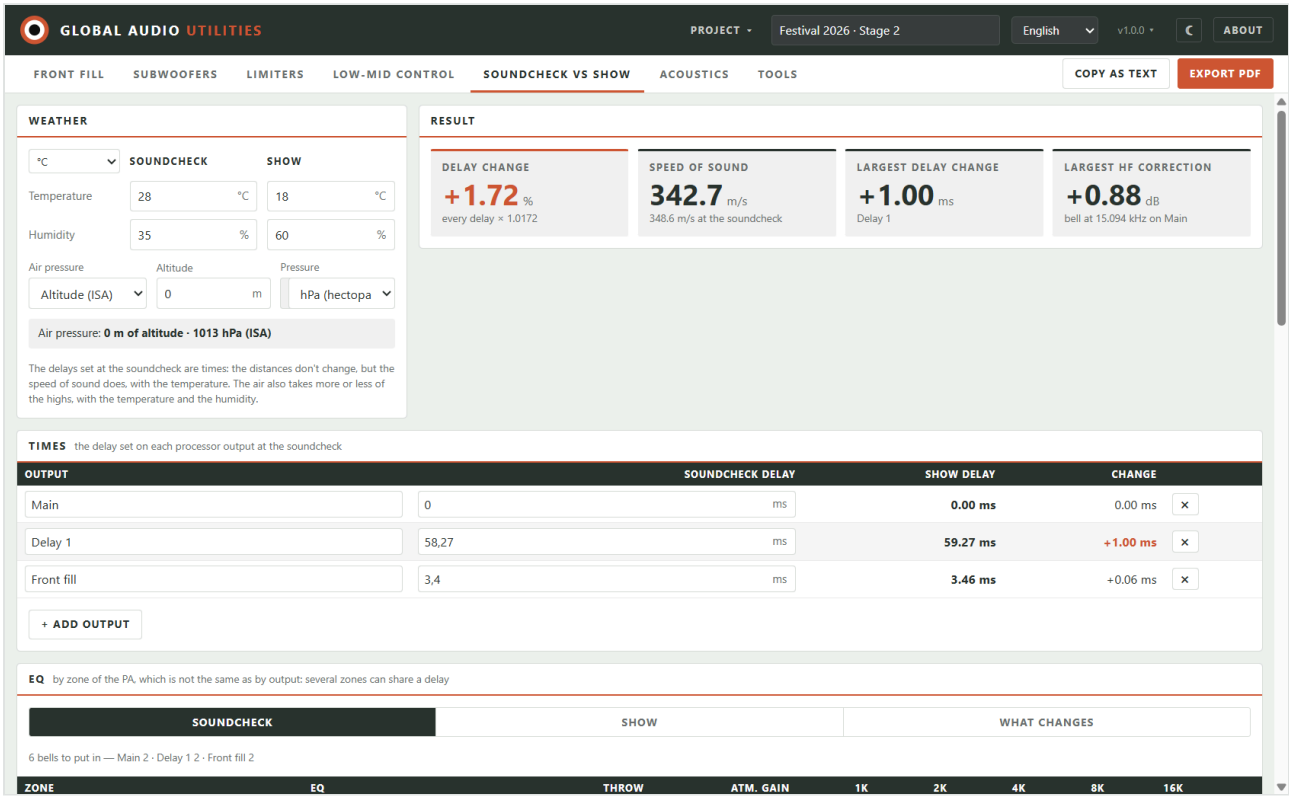
Widen with the same array: three filters, for half the array, and the lobe opened up.

The average APF is fitted between 80 Hz and 1 kHz. With very long or very short arrays the filters fall outside that region and the fit stops at its edge: the tab warns about it, and that number has to be reviewed.

The factors of this calculation come from measurements, not from a formula. They give a very good starting point, but the result has to be checked by measuring.

9. SOUNDCHECK VS SHOW

Between the soundcheck and the show the temperature and the humidity change: the speed of sound changes, and with it the delays, and so does what the air takes off the highs, and with it the EQ. This tab works out both corrections.



Soundcheck at 28 °C and 35 %, show at 18 °C and 60 %.

9.1 WEATHER

The temperature and humidity of the soundcheck and of the show, in °C or °F, and the pressure of the place: from its altitude (standard atmosphere, ISA) or measured with a barometer on site. The measured pressure is the one of the place, not the one in the weather report, which is reduced to sea level. It can be typed in hPa, mbar, mmHg, psi, atm and other units; changing the unit converts the value.

9.2 TIMES

One row per **processor output** (Main, Delay 1, Front fill…), with the delay set at the soundcheck. The distances do not change, but the speed of sound does: every delay is multiplied by c soundcheck / c show. From 28 °C and 35 % to 18 °C and 60 % that is ×1.0172, and 58.27 ms become 59.27 ms.

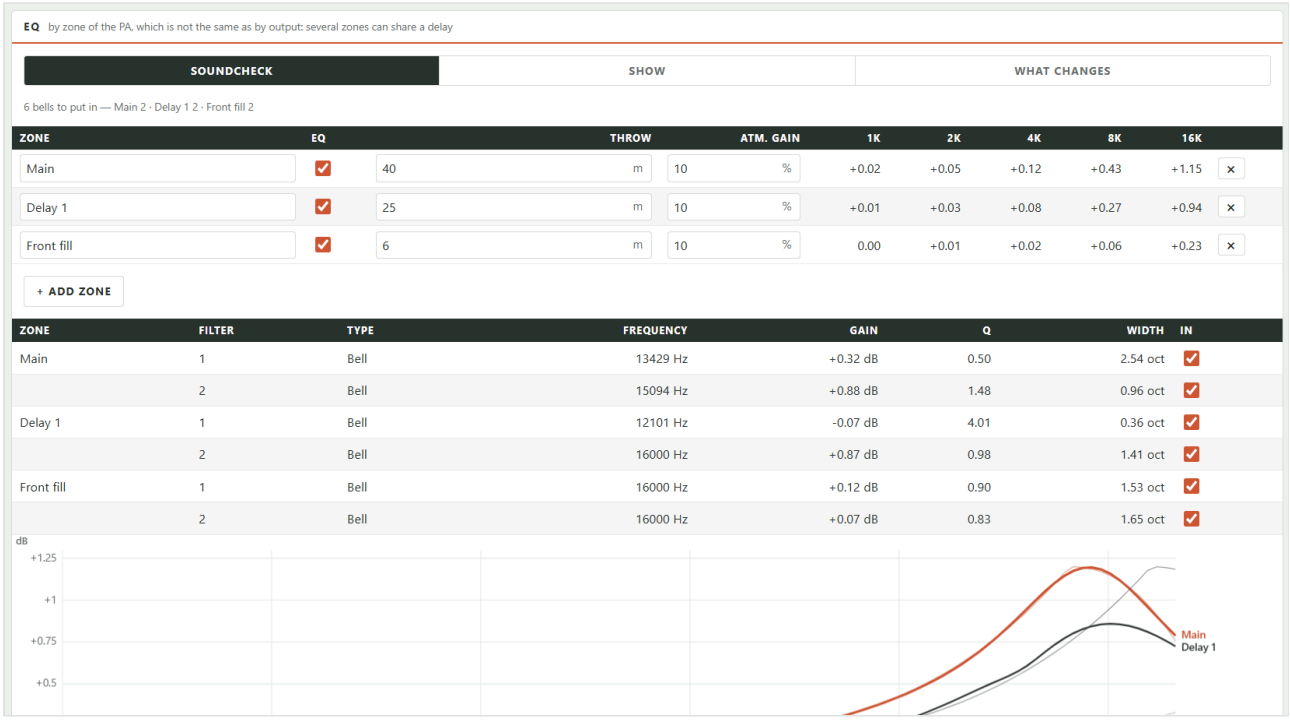
9.3 EQ

The EQ goes by **zone of the PA**, which is not the same as by output: several zones can share a delay, so the list is a different one, with its own **+ Add zone**. Each zone has:

- **Throw**: the distance to the audience it covers.
- **Atm. gain**: how much of the correction to put in, in %, like the atmospheric correction percentage of a processor. It starts at 10 %, which is what is usually put in.
- **EQ**: a tick box to leave the zone out without losing its numbers.

And three buttons choose what to look at:

- **Soundcheck** (the default): the whole correction the air asks for in the soundcheck conditions, shaped and scaled by the gain. It is the job a processor's atmospheric correction does.
- **Show**: the same in the show conditions. At show time one set of filters replaces the other; they are not added.
- **What changes**: only what moves from one condition to the other. It is the touch-up when the soundcheck turned out well and you don't want to start again.



The zones and, below them, the filters to set in each one.

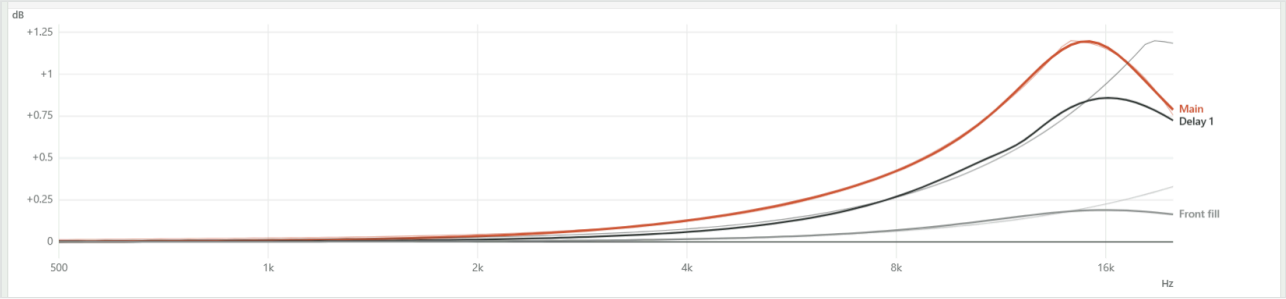
9.4 THE CEILING

In the whole-correction views the boost has a ceiling, and there is nothing to set: it is given back whole up to 12 dB and from there it bows out along a cosine until it gives up at 36 dB of loss, as a processor does. The gain factor goes after the ceiling. What changes has no cap: it is a difference between two conditions.

9.5 THE FILTERS

Two bells per zone, with nothing to choose: one falls short and a third one barely helps. The bells are those of RBJ's audio EQ cookbook, with their Q and their width in octaves next to it. They are searched on a grid and then refined all at once (frequency, Q and gain) with Levenberg–Marquardt, as Nuno's calculator does. Below 0.25 dB there is nothing to do, and the tab says so.

- Every filter has a tick box: untick it and it stays in the list in grey and leaves the graph, to see what remains without it.
- **Double-click** any number to copy it, to paste into the processor.
- The graph shows the curve of each zone as a thin line and what the ticked filters give, already rounded, as a thick one.

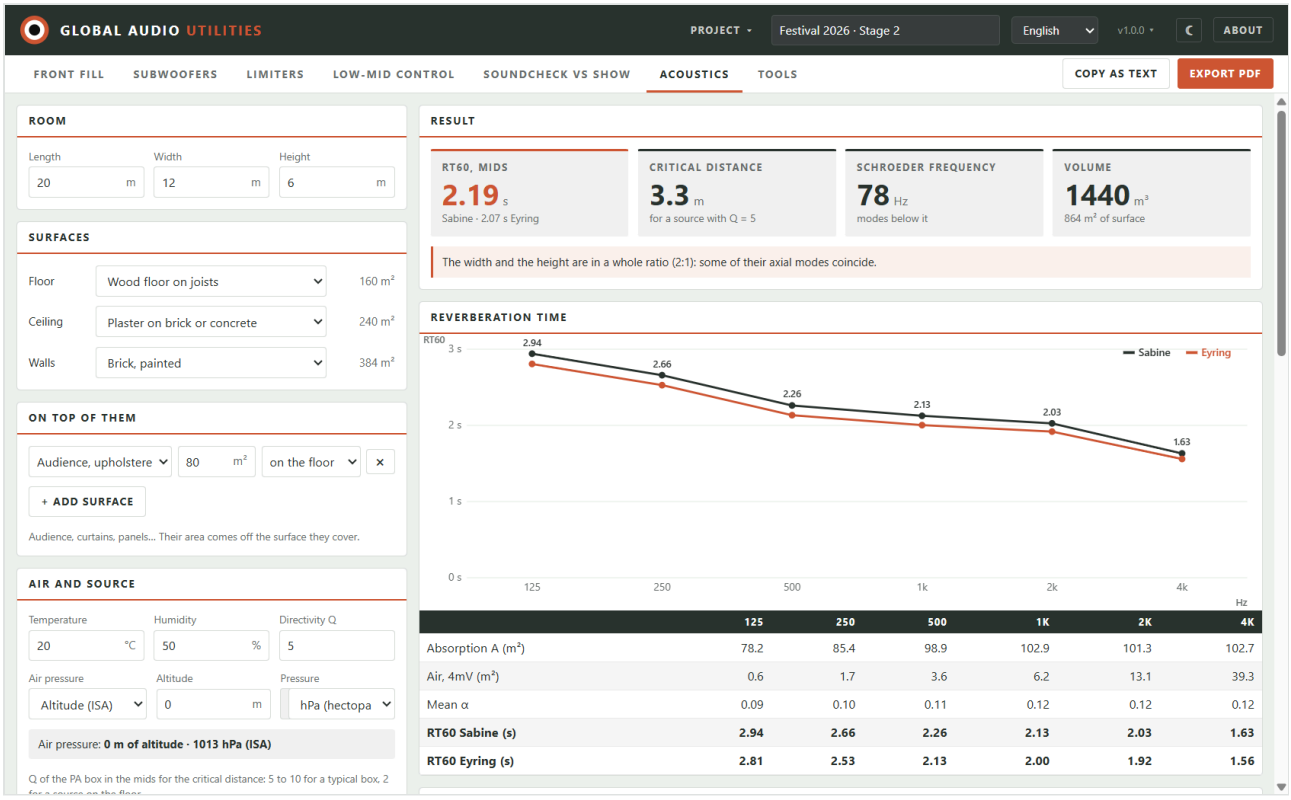


The correction the air asks for in each zone and what the two filters give.

In the Soundcheck and Show views the filters fall short at the top on purpose: they follow the air up to 12–13 kHz and drop in the last octave, just like a processor's atmospheric correction. Compared with a Galileo's over 375 conditions, the app's curve is 0.32 dB away on average from 1 to 16 kHz.

10. ACOUSTICS

The reverberation time of a rectangular room from its materials, the critical distance, the Schroeder frequency and the room modes.



A 20 × 12 × 6 m room with audience on the floor.

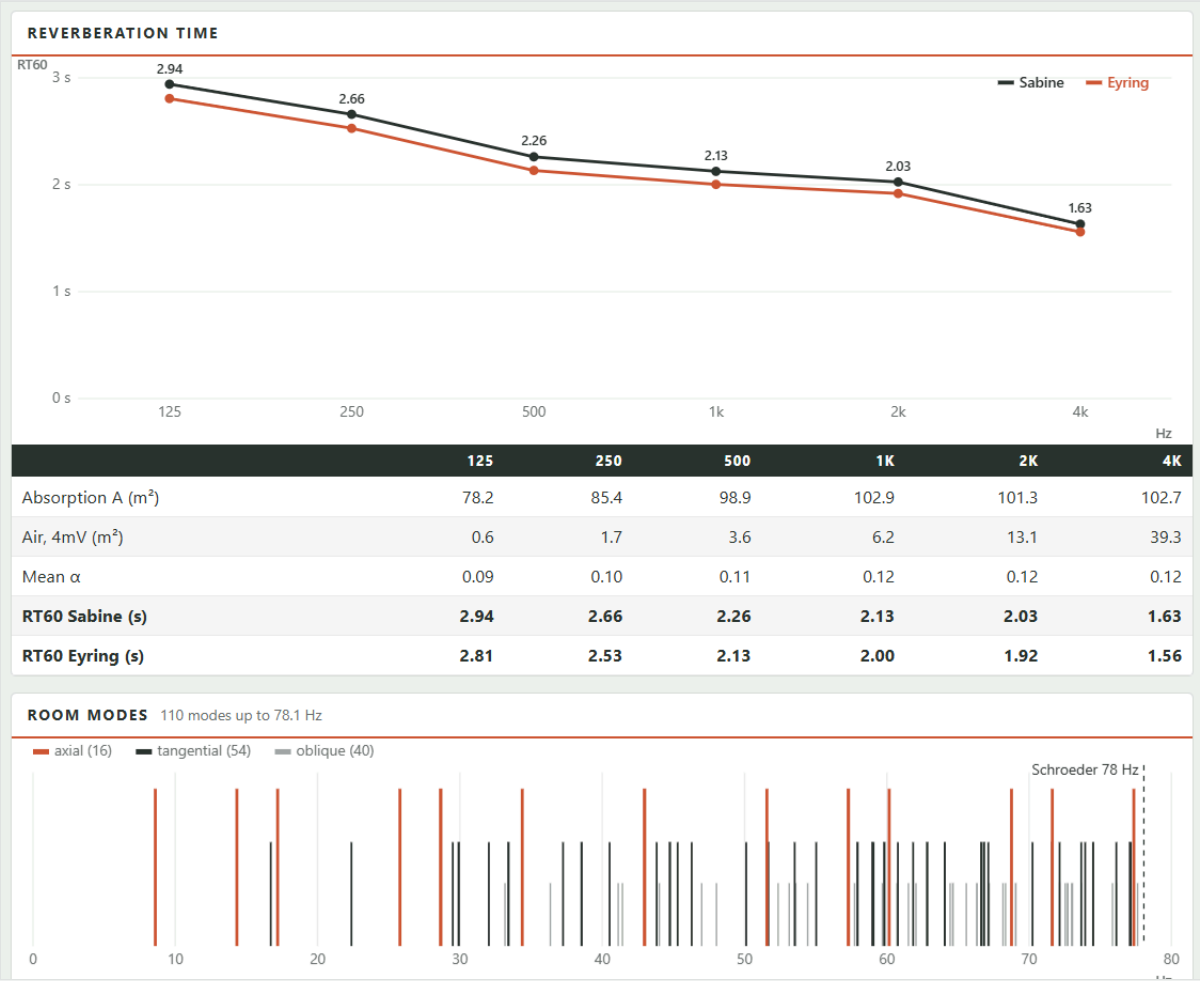
10.1 THE INPUTS

- Length, width and height of the room.
- The material of the floor, ceiling and walls, from a library of typical published values, in octaves from 125 Hz to 4 kHz.
- **+ Add surface**: audience, curtains, panels... with their area and what they cover; their area comes off that surface.
- Temperature, humidity and pressure (for the air absorption) and the directivity Q of the source: 5 to 10 for a typical PA box.

10.2 WHAT COMES OUT

- RT60 by octave with **Sabine**, 0.161·V / (A + 4mV), and with **Eyring**, 0.161·V / (−S·ln(1−ᾱ) + 4mV). The air absorption, 4mV, comes from ISO 9613-1.
- Critical distance: **0.057 · √(Q·V / RT60)**. Beyond it the reverberation is louder than the direct sound.

- Schroeder frequency: **2000 · √(RT60 / V)**. Below it the room rings at separate modes; above it, it sounds even.
- Axial, tangential and oblique modes up to the Schroeder frequency. It warns if two dimensions are equal or multiples, because their modes coincide and pile up.



	125	250	500	1K	2K	4K
Absorption A (m²)	78.2	85.4	98.9	102.9	101.3	102.7
Air, 4mV (m²)	0.6	1.7	3.6	6.2	13.1	39.3
Mean α	0.09	0.10	0.11	0.12	0.12	0.12
RT60 Sabine (s)	**2.94**	**2.66**	**2.26**	**2.13**	**2.03**	**1.63**
RT60 Eyring (s)	**2.81**	**2.53**	**2.13**	**2.00**	**1.92**	**1.56**

RT60 by octave with Sabine and Eyring, and the room modes.

The absorption coefficients are typical values; real materials change with how they are mounted. Sabine and Eyring assume a diffuse field: to be sure, measure the room.

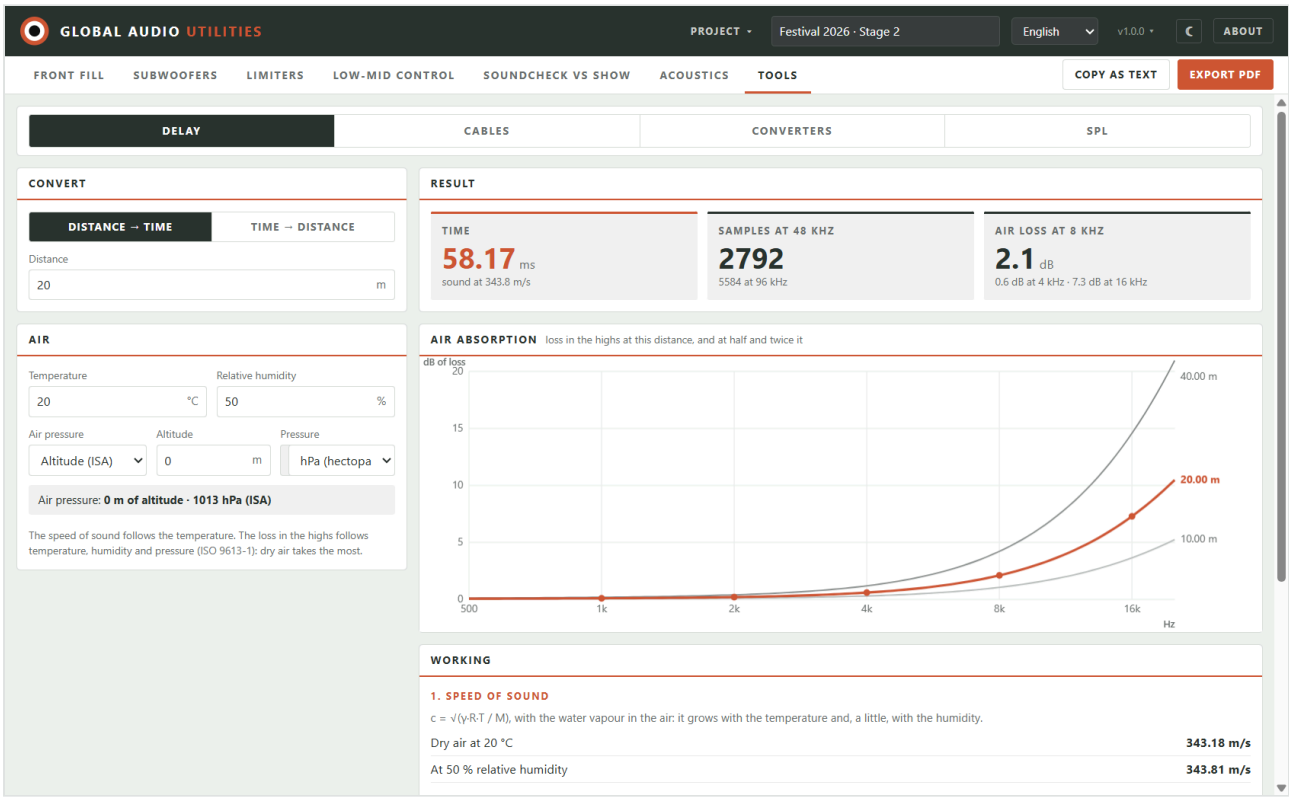
11. TOOLS

Four quick tools, chosen in the bar at the top of the tab: **Delay**, **Cables**, **Converters** and **SPL**.

11.1 DELAY

Distance → time or time → distance, with the speed of sound of the air at the time, and the time also in samples at 48 and 96 kHz.

- The speed of sound comes from the mixture of dry air and water vapour: at 20 °C and dry air, 343.2 m/s. Humid air is slightly faster: 343.8 m/s at 20 °C and 50 %.
- The air absorption follows ISO 9613-1, from 1 to 16 kHz, and adds to the 6 dB per doubling of distance. The graph shows it at that distance, at half and at twice it.
- The pressure, from the altitude or measured: it hardly touches the sound (hundredths of a dB in the highs), but it is there.

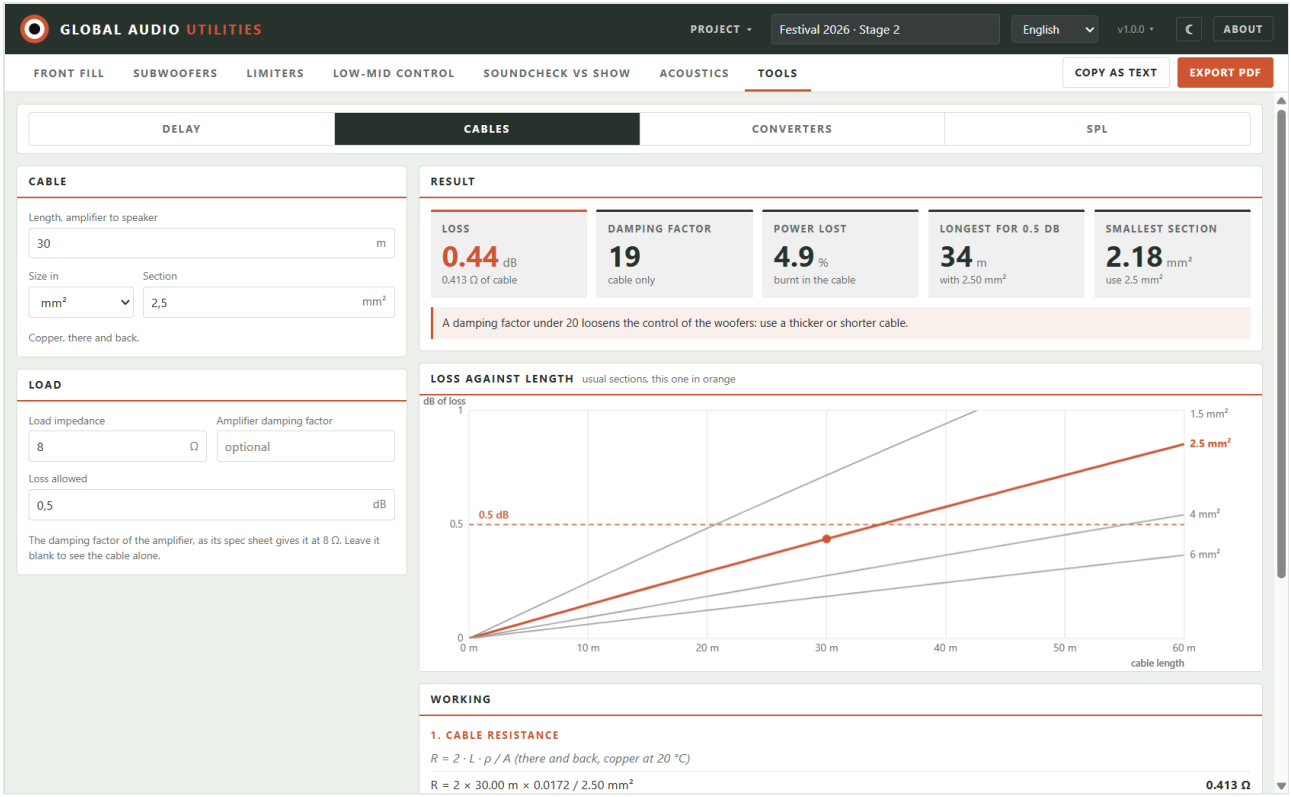


20 m at 20 °C and 50 %, and what the air takes off the highs.

11.2 CABLES

- Copper at 20 °C, there and back: **R = 2 · L · 0.0172 / A**. The section in mm² or AWG.
- Loss: **20 · log10(Z / (Z + R))**, and the share of the power that stays in the cable.
- Damping factor, of the cable alone or with the amplifier's if given. It warns if it drops under 20.

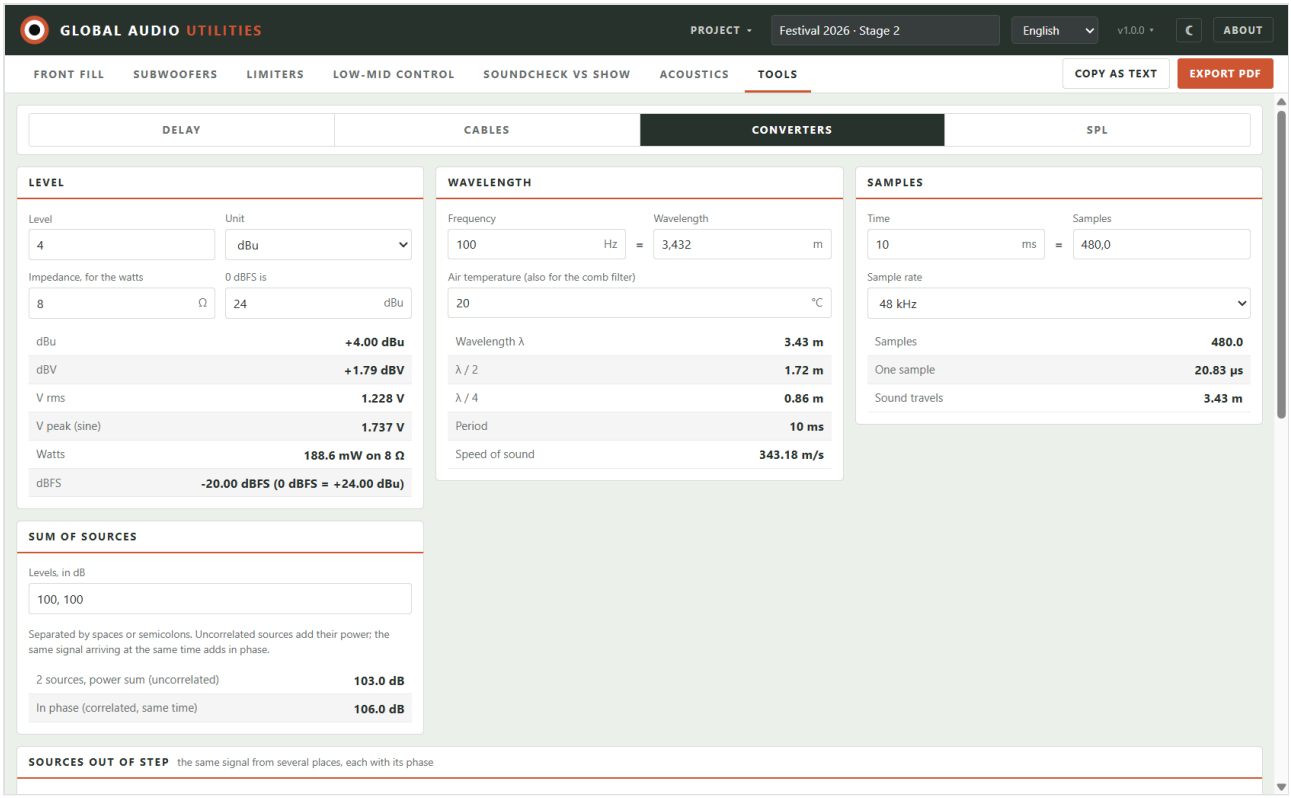
- The longest run and the smallest section for the loss allowed (0.5 dB by default).



30 m of 2.5 mm² into 8 Ω, and the loss against length for the usual sections.

11.3 CONVERTERS

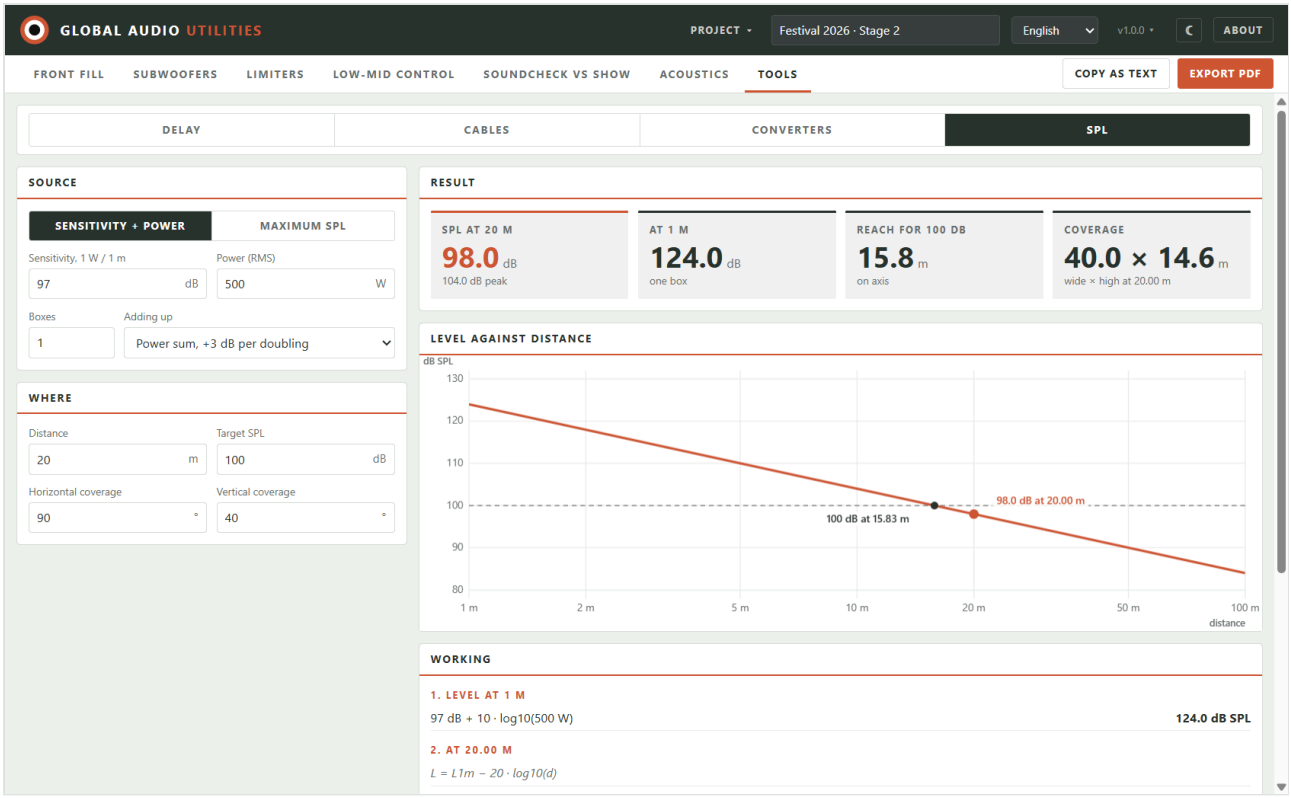
- Level in dBu, dBV, V, watts into an impedance and dBFS (0 dBFS = +24 dBu by default).
- Frequency ↔ wavelength, and time ↔ samples.
- Sum of sources: power sum (+3 dB per doubling) and in phase (+6 dB).
- Sources out of step: the same signal from several places, each with its level and phase. They add as arrows, not as numbers: two equal ones give +6 dB in phase, nothing in opposition and +3 dB a quarter turn apart. The graph sweeps the phase of the last source from 0 to 360°.
- Comb filter of two copies of a signal: the first cancellation at **1/(2Δt)** and then every **1/Δt**, with its graph.



The converters.

11.4 SPL

- Level at 1 m: sensitivity + 10 · log10(P), or the maximum SPL of the spec sheet. The peak, +6 dB (AES).
- N boxes, as a power sum or in phase. At distance d: −20 · log10(d).
- The distance at which a target SPL is reached, and the width and height the box covers at that distance: 2 · d · tan(angle / 2).



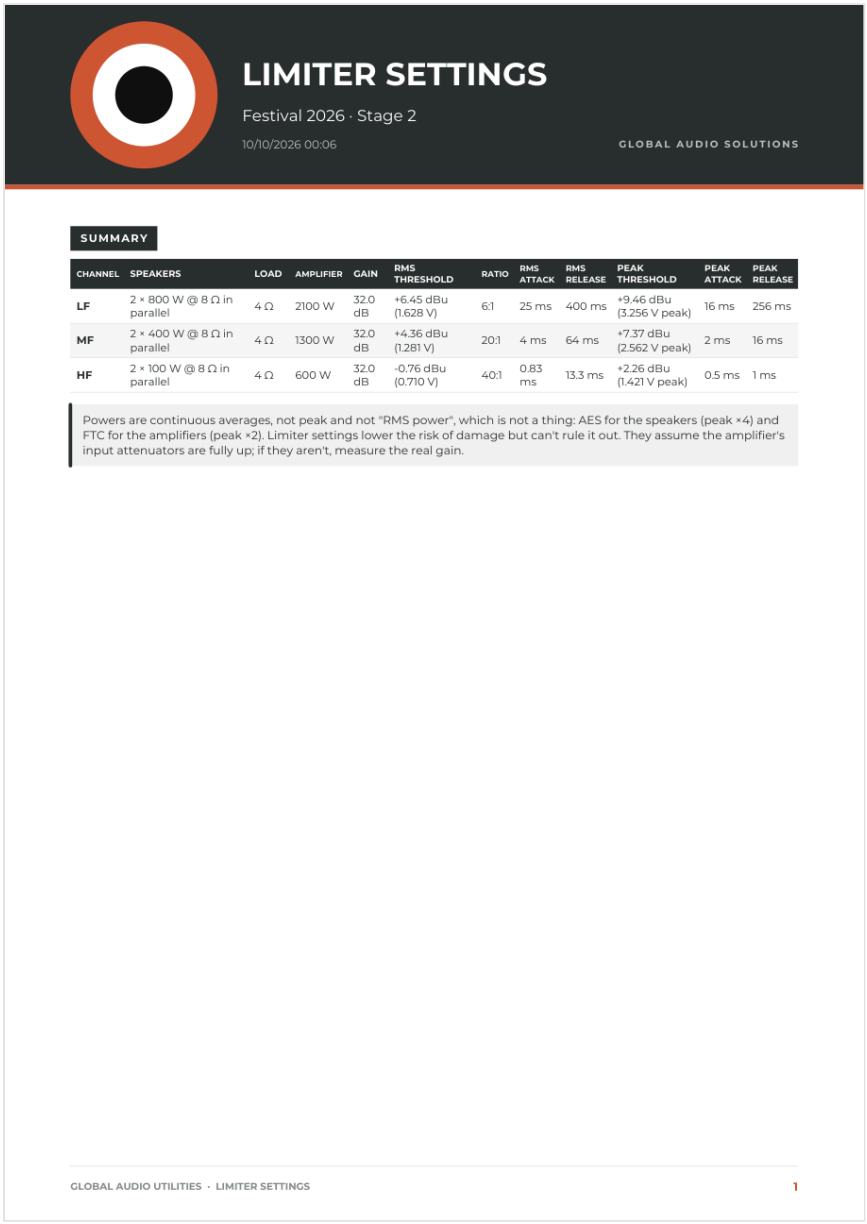
Level and coverage of a 97 dB box with 500 W, at 20 m.

> **SPL assumes a point source in free field.** A line array in its near field loses about 3 dB per doubling of distance, not 6.

12. PDF REPORTS AND TEXT

Each tab can be taken out in two ways, with the buttons on the right of the tab bar. They always take the **open tab**, with the inputs on screen.

- **Export PDF**: asks where to save and writes a report in the Global Audio Solutions style, like RiTA's DSP report: a dark band with the mark, the title, the project and the date, then the inputs, the result, the graphs and the working step by step. When it is done it offers to open it.
- **Copy as text**: puts a plain-text summary on the clipboard, to paste into an email, a chat or the notes of the gig.



LIMITER SETTINGS

Festival 2026 · Stage 2

10/10/2026 00:06

GLOBAL AUDIO SOLUTIONS

SUMMARY

CHANNEL	SPEAKERS	LOAD	AMPLIFIER	GAIN	RMS THRESHOLD	RATIO	RMS ATTACK	RMS RELEASE	PEAK THRESHOLD	PEAK ATTACK	PEAK RELEASE
LF	2 × 800 W @ 8 Ω in parallel	4 Ω	2100 W	32.0 dB	+6.45 dBu (1.628 V)	6:1	25 ms	400 ms	+9.46 dBu (3.256 V peak)	16 ms	256 ms
MF	2 × 400 W @ 8 Ω in parallel	4 Ω	1300 W	32.0 dB	+4.36 dBu (1.281 V)	20:1	4 ms	64 ms	+7.37 dBu (2.562 V peak)	2 ms	16 ms
HF	2 × 100 W @ 8 Ω in parallel	4 Ω	600 W	32.0 dB	-0.76 dBu (0.710 V)	40:1	0.83 ms	13.3 ms	+2.26 dBu (1.421 V peak)	0.5 ms	1 ms

Powers are continuous averages, not peak and not "RMS power", which is not a thing: AES for the speakers (peak ×4) and FTC for the amplifiers (peak ×2). Limiter settings lower the risk of damage but can't rule it out. They assume the amplifier's input attenuators are fully up; if they aren't, measure the real gain.

GLOBAL AUDIO UTILITIES · LIMITER SETTINGS 1

The Limiters report: the table of every channel on the first page.

The report comes out in the language of the app. If the file is open in a PDF viewer, Windows does not let it be written: the app says so, and it is enough to close it and export again.

13. LANGUAGES

The app is in the same five languages as RiTA: English, Spanish, French, Portuguese (from Portugal) and Chinese. The language is chosen in the selector in the header, next to the Project menu, and it changes at once, without restarting and without touching the inputs: results, graphs, warnings and reports switch to the chosen language.

- The first time it starts in English, as RiTA does. After that it remembers the last language chosen.
- The names of outputs, zones and channels belong to the user and are not translated.
- International abbreviations (dB, Hz, SPL, EQ, RMS) and proper names (Sabine, Eyring, Schroeder, Powersoft) stay the same in every language.

> **The translations are in text files, one per language, in the same format as RiTA's:** English, a tab and the translation. A text that is missing shows in English.

14. UPDATES

Like RiTA, the app tells you when there is a newer version. It finds out by reading a small file on the internet; it downloads and installs nothing, and sends no data: it only reads that file.

- Two seconds after starting, it looks for a new version, with a three-second limit. Without internet, or if there is no answer, it says nothing.
- If there is one, the notice shows what is new in the language of the app, with three buttons: **Download** opens the download page in the browser, **Later** leaves it for the next start, and **Do not notify me about this version** does not mention that one again (the next one, yes).

The version in the header (v1.0.0 ▾) is a button: click it to open the menu with the two update options.

- `v1.0.0 ▾ > Check for Updates...` looks whenever you want and always answers: a new version, the latest one already, or that it could not check.
- `v1.0.0 ▾ > Check for Updates at Startup` turns the check at start-up on or off. The ✓ means it is on.



The notice of a new version (with example data here).

To update, download the installer for your computer and install it as in chapter 2: there is no need to uninstall first. Projects and saved inputs are not touched.

15. MENUS AND SHORTCUTS

On a Mac the shortcuts use ⌘ and on Windows Ctrl; the shortcut for Save as is Ctrl+Shift+S (⇧⌘S on a Mac). The app has no menu bar of its own: everything is in the header and in the tab bar.

MENU	OPTION	SHORTCUT	WHAT IT DOES
Project	New project	Ctrl+N (⌘N)	Back to the starting values of every tab.
Project	Open…	Ctrl+O (⌘O)	Opens a project file (.gau).
Project	Recent projects		The last eight opened or saved.
Project	Save	Ctrl+S (⌘S)	Saves every tab in the project file.
Project	Save as…	Ctrl+Shift+S (⇧⌘S)	Saves in a new project file.
v1.0.0 ▾	Check for Updates…		Looks now for a newer version and always answers.
v1.0.0 ▾	Check for Updates at Startup		Turns the check at start-up on or off (✓ = on).
Header	Project name		It goes on the PDF reports and the copied text.
Header	Language		English, Spanish, French, Portuguese or Chinese, at once.
Header	☾ / ☀		Dark or light mode. Until pressed, it follows the system.
Header	About		Version, system and architecture.
Tab bar	Copy as text		Puts the results of the open tab on the clipboard.
Tab bar	Export PDF		Writes the report of the open tab.
General	Esc	Esc	Closes the menu, About and the notices (in a notice, the same as Cancel or Later).
General	Double-click a filter		Soundcheck vs show: copies that number, to paste into the processor.
General	Mouse over a control		Its line of help.

16. TROUBLESHOOTING

If it does not get solved, write to info@gaudiosolutions.com with the version (About) and the system you use.

PROBLEM	SOLUTION
Windows shows “Windows protected your PC”.	More info > Run anyway. The installer is not code-signed.
macOS will not let me open the installer.	Click OK on the warning and go to System Settings > Privacy & Security > Open Anyway. Confirm with your password or Touch ID.
On Windows the window comes up blank.	Microsoft Edge WebView2 is missing. Install the “Evergreen Runtime” from Microsoft's website and open the app again.
A result is empty or shows “—”.	An input is missing or makes no sense. Look at the strip under the result: it says which one and why.
I cannot export the PDF.	If it says the file is in use or read-only, close it in the PDF viewer and export again, or save it under another name.
The Soundcheck vs show filters do not match my processor.	A processor has its own ceiling and its own bells: the app gives a proposal that comes close to what it does, not a copy (section 9.4).
It does not tell me there is a new version.	Without internet, or with a firewall that blocks the check, it says nothing, and nothing happens. Check for Updates..., in the version menu, always says.
I want to start from scratch.	Project > New project. To also delete what the app remembers, remove its data folder (section 2.4).

17. TECHNICAL DATA

FEATURE	VALUE
Version	1.0.0
Systems	Windows 10 and 11, 64-bit · macOS 11 or later, Apple Silicon and Intel
Languages	English, Spanish, French, Portuguese (from Portugal) and Simplified Chinese
Speed of sound	From the mixture of dry air and water vapour: $c = \sqrt{(\gamma \cdot R \cdot T / M)}$. 343.2 m/s at 20 °C and dry air
Air absorption	ISO 9613-1, with temperature, humidity and pressure, in bands from 1 to 16 kHz
Pressure	From the altitude (standard atmosphere, ISA) or measured; in hPa, mbar, mmHg, bar, psi, atm, mH_2O, inHg or Pa
Reverberation	Sabine and Eyring by octave from 125 Hz to 4 kHz, with the air absorption
Soundcheck vs show filters	Two bells from RBJ's audio EQ cookbook per zone, fitted with Levenberg–Marquardt; ceiling of 12 dB down to 36 dB
Low-mid control	LMC GAS, by Nuno Coelho: second-order all-pass filters with Q 0.64; average APF fitted to the phase between 80 Hz and 1 kHz
Limiters	Pepe Ferrer's method; AES peaks ×4 (speakers) and FTC ×2 (amplifiers); Powersoft tables 7 and 8
Level references	0 dBu = 0.775 V · 0 dBFS = +24 dBu by default
Cable	Copper at 20 °C, 0.0172 Ω·mm²/m, there and back
Projects	.gau: JSON in UTF-8
Reports	PDF in A4, in the Global Audio Solutions style, and plain text
App data	state.json, recent.json, language.json, theme.json and updates.json in %APPDATA%\Global Audio Utilities (Windows) or ~/Library/Application Support/Global Audio Utilities (Mac)

Global Audio Utilities is not a measuring instrument. Its results are calculations with ideal models (point sources, free field, diffuse field). They are for preparing the job and understanding what is going on; to decide something important, measure on site.

18. ACKNOWLEDGEMENTS

Global Audio Utilities owes a great deal to two people, who have shared their work and their ideas.

18.1 NUNO COELHO

- The Low-mid control tab is his, whole: it is his LMC GAS calculator.
- Several ideas in Soundcheck vs show come from his atmospheric calculator: the speed of sound with humidity, the measured pressure instead of the altitude, temperatures in °F, the bells with their tick box, the atmospheric gain per zone and copying a value with a double-click.
- So does fitting the bells all at once with Levenberg–Marquardt, and the finding that made it possible to check the atmospheric correction against a processor's.

18.2 CÉSAR GUTIÉRREZ PEDRAZA

- The 40:1, 20:1 and 6:1 ratios come from his limiter calculator, as does leaving ∞:1 for the peak limiter.
- So do the attack and release times by voice-coil size, from Powersoft's table 8.
- And calling things by their name: RMS limiter, and continuous power instead of “RMS power”.

Thank you both.