Quick Start Guide

for Sound System Designers

JBL CBT Series

Constant Beamwidth Technology™ Column Loudspeakers

(Note: Some models shown with the included grilles removed to illustrate driver composition.)

Rev A3

CONTENTS

Introduction 3

- Understanding the Charts
  - o SPL Maps
  - o Frequency Response Charts
- Room Sizes Shown

Example #1 – Flat Listening Plane

CBT 50LA 4

CBT 100LA in Broad Setting 5

CBT 100LA in Narrow Setting 6

CBT 70J in Broad Setting 7

CBT 70J in Narrow Setting..... 8

CBT 70J+70JE in Broad Setting 9

CBT 70J+70JE in Narrow Setting 10

Example #2 – Highly Raked Seating

CBT 100LA in Broad Setting..... 11

CBT 70J in Broad Setting..... 12

CBT 70J+70JE in Broad Setting 13

Example #3 – Gentle Rake with Balcony

CBT 100LA in Broad Setting..... 14

CBT 70J in Broad Setting..... 15

CBT 70J+70JE in Broad Setting 16

Example #4 – Three-Tiered, Raked, Large Room

CBT 100LA in Broad Setting..... 17

CBT 70J in Broad Setting..... 18

CBT 70J+70JE in Broad Setting 19

Design Conclusions 20

- Vertical Coverage Setting vs. Installation Height
- Single vs. Multiple CBT Columns
  - o For Width
  - o For Depth
- Front Fill
- How Far Each CBT Model “Throws”

Excellent coverage of a wide variety of room types can be accomplished using JBL's CBT Line Array Column Loudspeakers. This guide shows some starting-point examples of placement, aiming and resulting performance of the various CBT models in a variety of simplified sectional-view examples. There are 16 simulations in total, comprised of 4 examples of room-size / seating-plane scenarios.

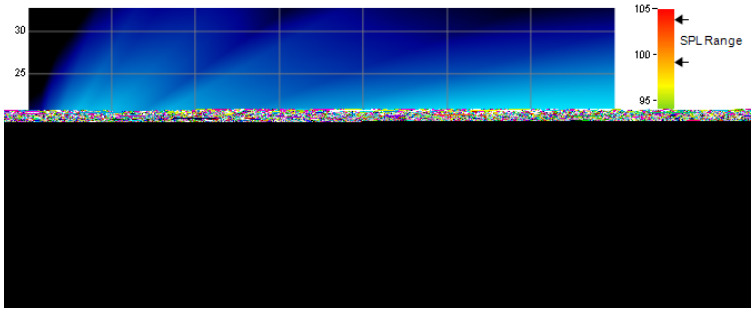
These simulations allow you to compare the 4 CBT models (3 full-range models plus the CBT 70J+70JE combination) and their settings as to:

- Overall SPL capability.
- Evenness of coverage.
- Consistency of SPL.
- Consistency of Frequency Response at various distances.
- How much sound goes outside the audience area.

Understanding the Charts:

SPL Map

All SPL maps use the same colors for the same absolute levels, allowing SPL comparison between various simulations.



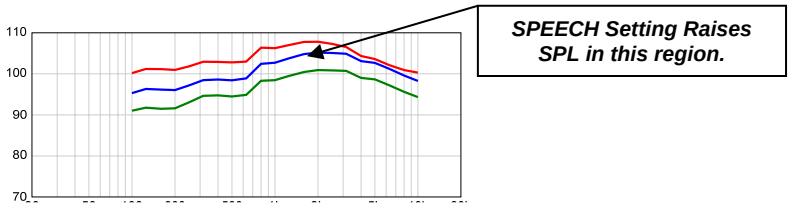
SPL Range Arrows – The SPL range of the microphone locations (at 4 kHz) is shown by the arrows on the SPL chart to the right of the SPL Mapping.

Frequency -- The frequency shown in the SPL mapping in this guide is 4 kHz, which is an especially challenging frequency at which to achieve acceptable coverage.

Power Drive Level & Air Absorption -- The SPL level represents the speaker as driven at full rated power (in low-impedance, for those models that are selectable between low-impedance and 70V/100V taps). Also note that air absorption, which in the real world reduces the high frequencies reaching the farther areas of the room, IS included in these simulations, so this is representative of real-world SPL levels.

Frequency Response

At Multiple Points: The examples where there are three mics represent Close, Mid, and Far seating points. All are shown in the SPEECH position and no external EQ equalization is being utilized. Of course, the speaker can be set in MUSIC (Flat) position, and/or the frequency response can be further EQ'd externally.



Red = Close Seating
Blue = Mid Seating
Green = Far Seating

Speaker Models Shown -- In the first application example (Example #1 – Flat Listening Plane) ALL CBT speaker models and all settings are included. The subsequent examples, (Examples #2, #3 and #4) show only those speakers that would be primary selections for that particular application.

Room Sizes Shown – The first three examples (the first 13 simulations) are shown using the SAME room size with a depth of 18 m (60 ft). This allows comparisons with only two variables – seating plane and speaker type – being changed (one at a time), however CBT's may be used in larger spaces.

Therefore, Example #4 (the last 3 simulations) shows a substantially larger room size with a depth of 38 m (125 ft). Note that even though the graphs are shown as the same size on the page, the room size in the #4 example is a much larger room, illustrating that CBT's can indeed be utilized in large rooms, depending on the SPL requirements of the application.

Example #1 -- Flat Listening Plane

Description -- This is the most basic of rooms. All four CBT models are shown, as well as both "Broad" and "Narrow" vertical coverage settings for those models that have the switchable coverage capability (CBT 100LA & 70J)

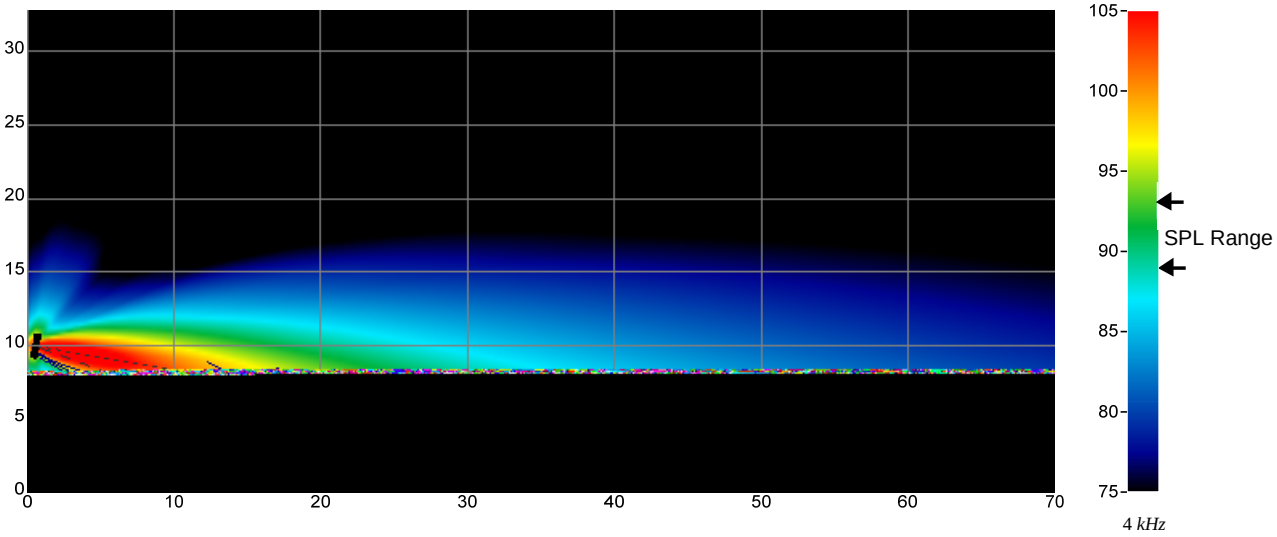
Listening Plane = 1.2 m (4 ft) above the floor

Mic Placement = 6.1 m (20 ft, red icon), 10.7 m (35 ft, blue icon) and 16.8 m (55 ft, green icon)

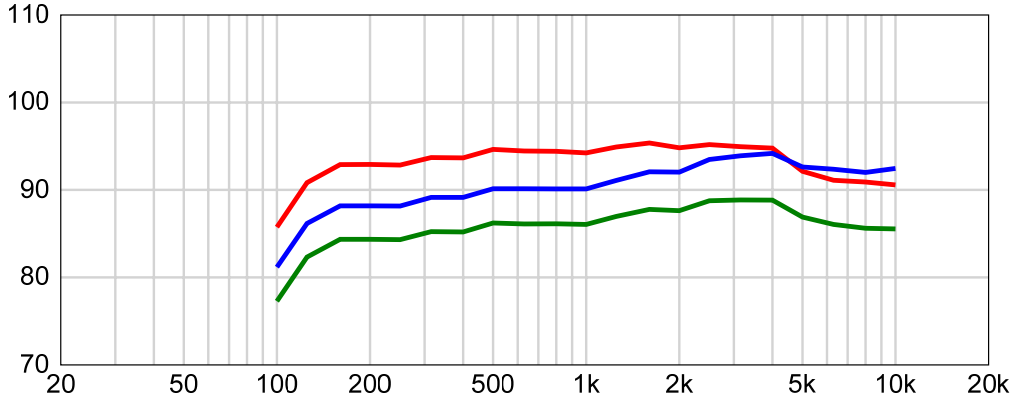
CBT 50LA

Trim Height = 3.4 m (11 ft, *Top of Speaker)*
Down Tilt = 10°

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



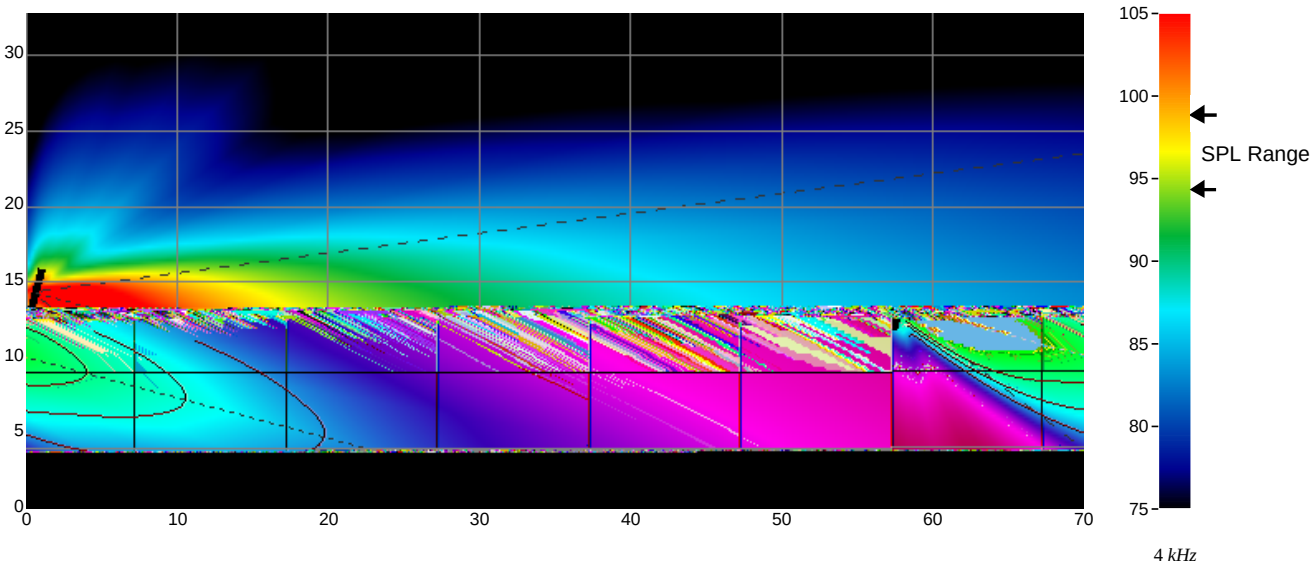
Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**



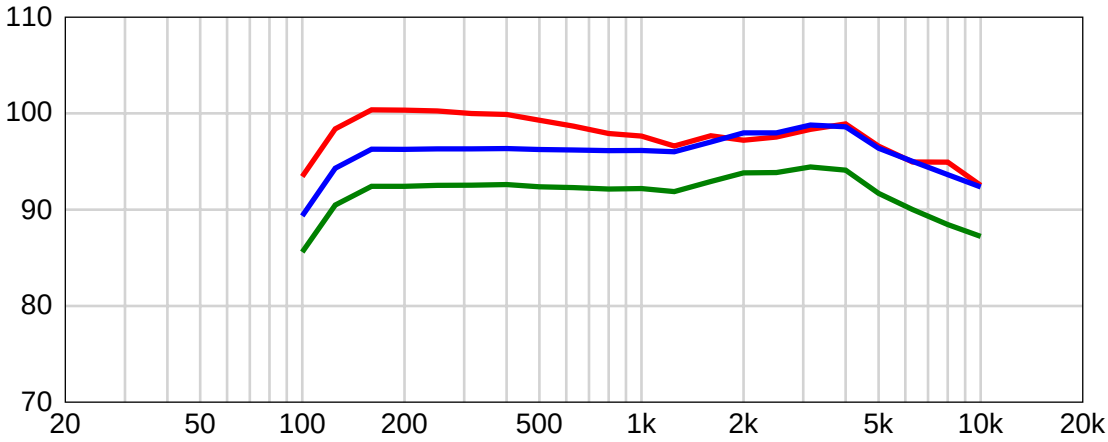
CBT 100LA in Broad Setting

Trim Height = 4.9 m (16 ft, *Top of Speaker)*
Down Tilt = 15°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

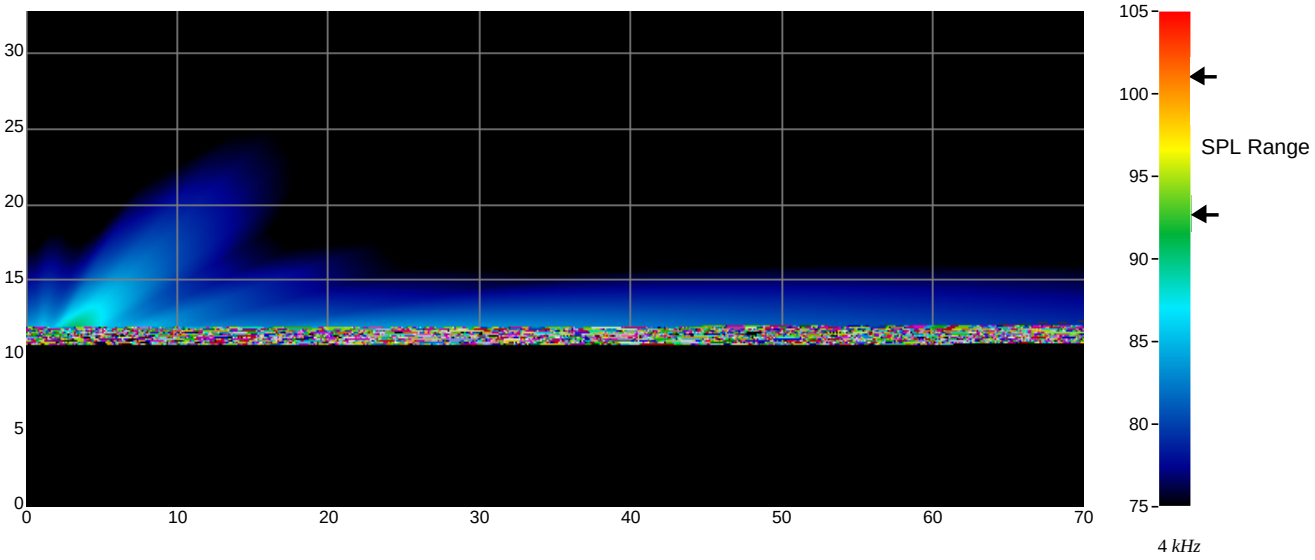


Example #1 -- Flat Listening Plane

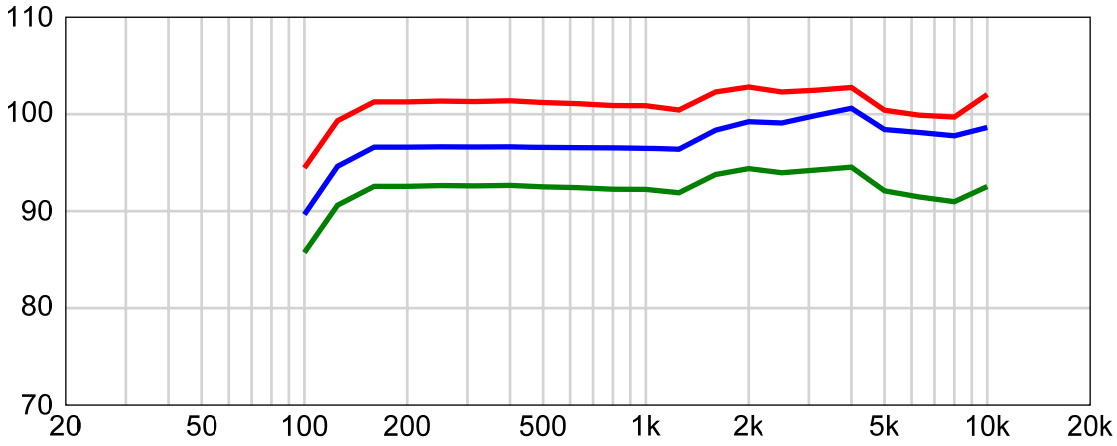
CBT 100LA in Narrow Setting

Trim Height = 3.4 m (11 ft, *Top of Speaker)*
Down Tilt = 10°
Vertical Coverage Setting = Narrow

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

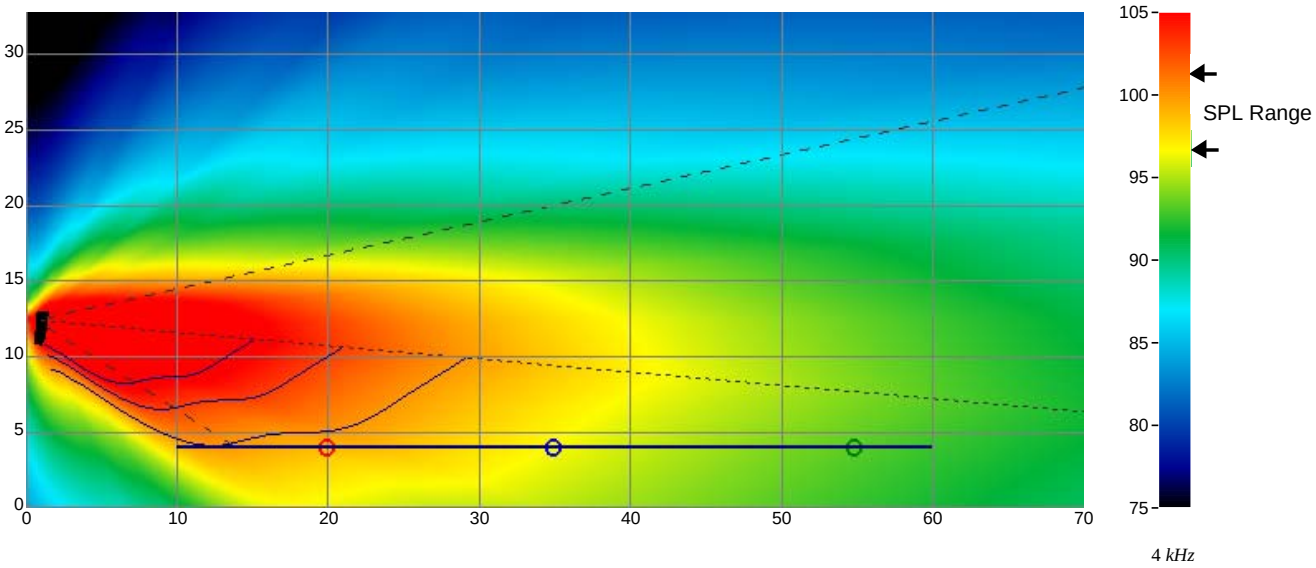


Example #1 -- Flat Listening Plane

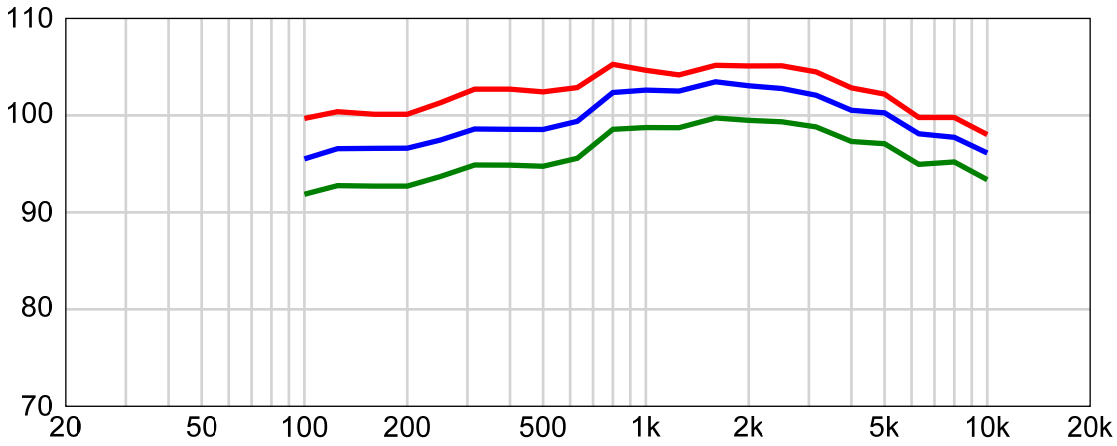
CBT 70J in Broad Setting

Trim Height = 4 m (13 ft, *Top of Speaker)*
Down Tilt = 5°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

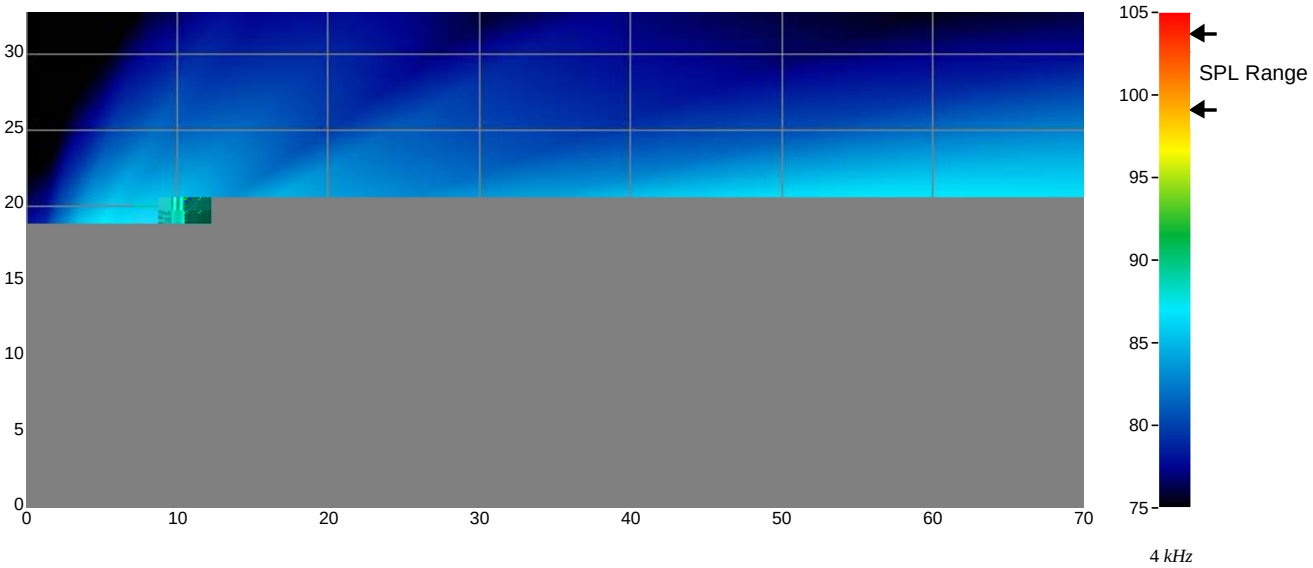


Example #1 -- Flat Listening Plane

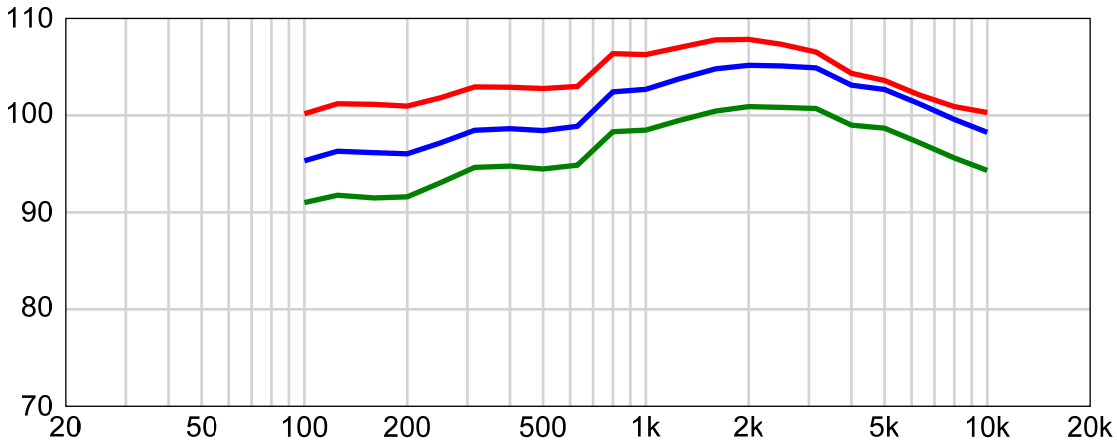
CBT 70J in Narrow Setting

Trim Height = 3.7 m (12 ft, *Top of Speaker)*
Down Tilt = 5°
Vertical Coverage Setting = Narrow

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

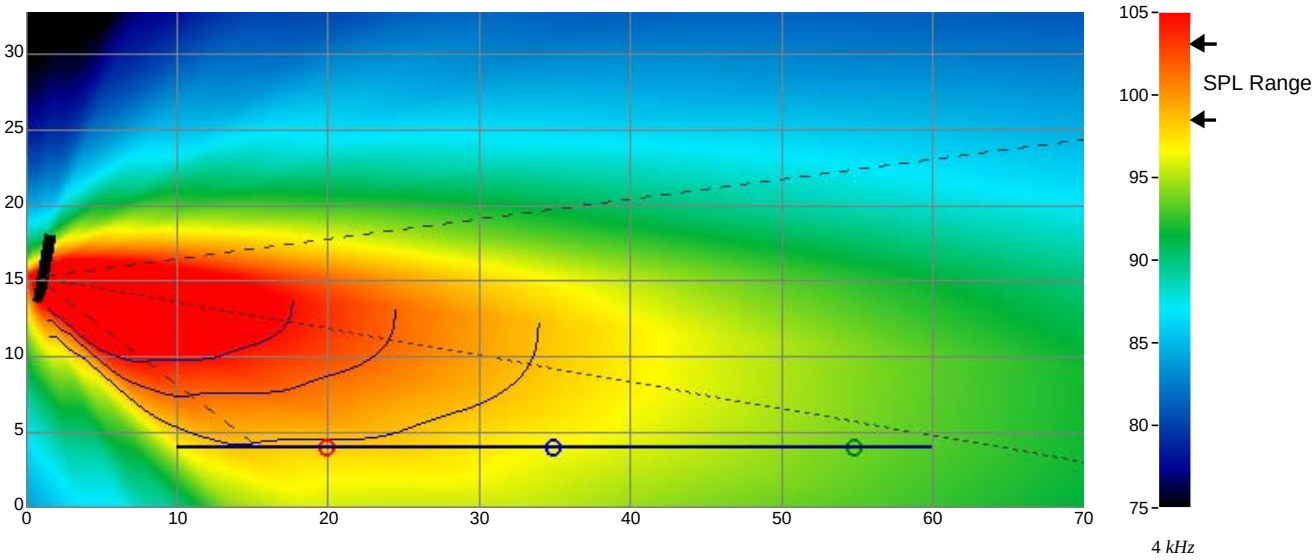


Example #1 -- Flat Listening Plane

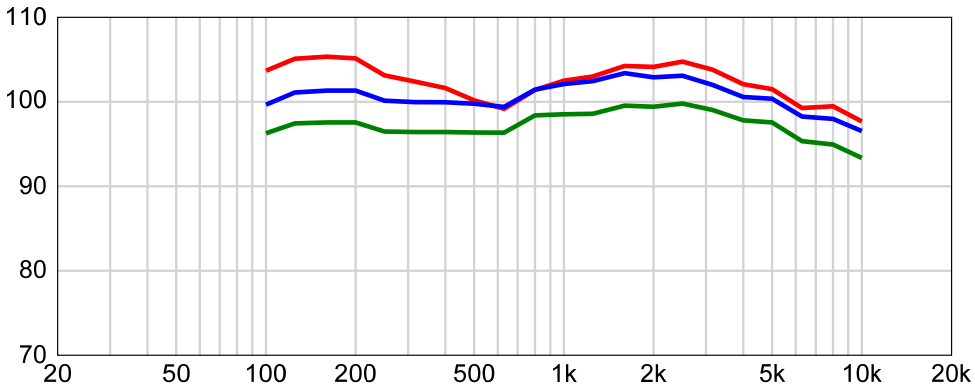
CBT 70J+70JE in Broad Setting

Trim Height = 5.5 m (18 ft, *Top of Speaker)*
Down Tilt = 10°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

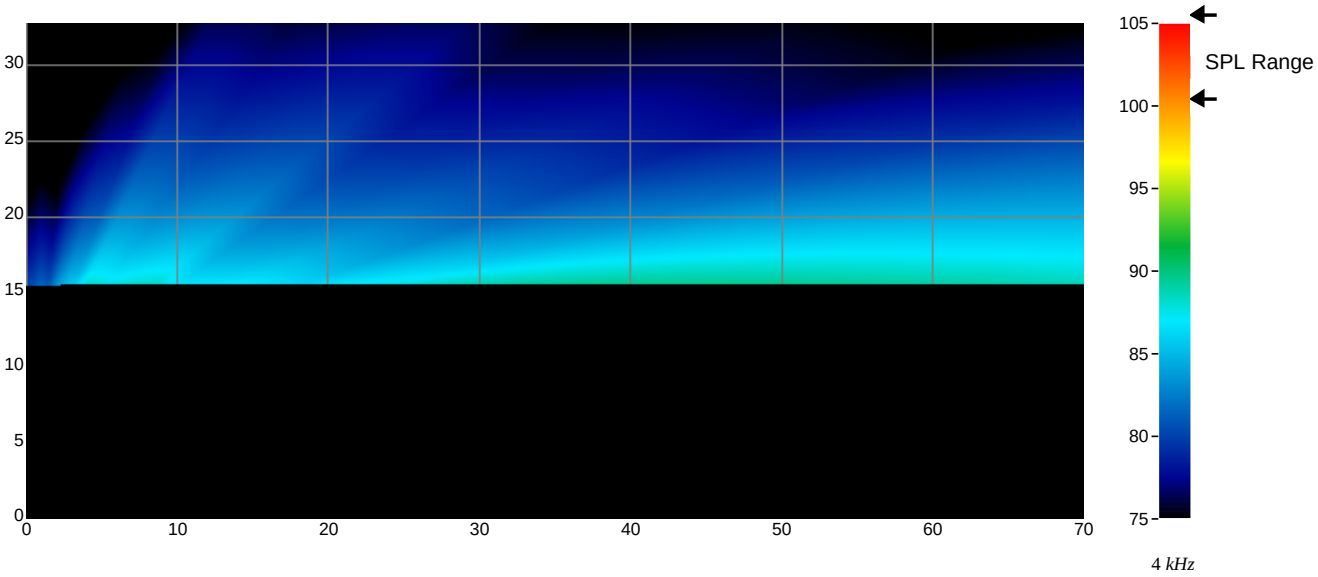


Example #1 -- Flat Listening Plane

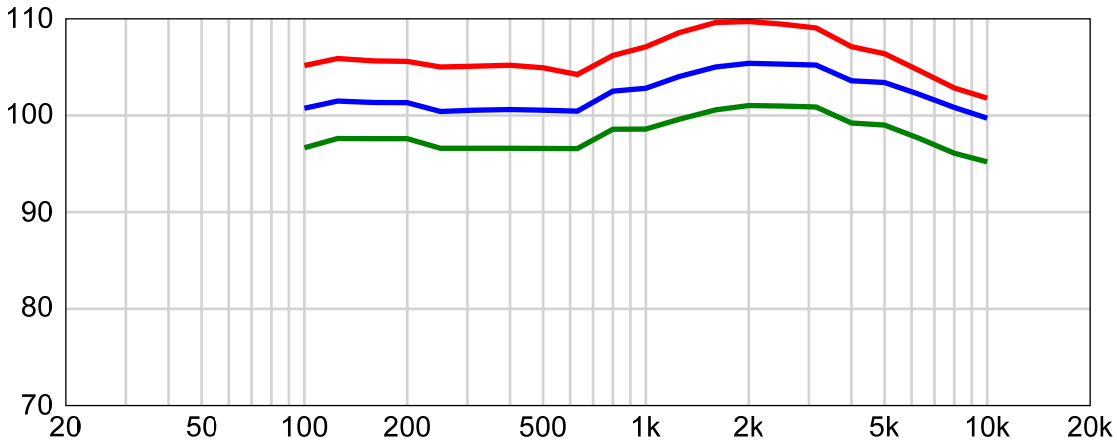
CBT 70J+70JE in Narrow Setting

Trim Height = 3.7 m (12 ft, *Top of Speaker)*
Down Tilt = 5°
Vertical Coverage Setting = Narrow

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**



Example #3 –Gentle Rake with Balcony

Description – This example is also common for performance spaces and auditoriums. Shown are the CBT 100LA, CBT 70J and the CBT 70J+70JE combination. All are set at the Broad Vertical Coverage setting.

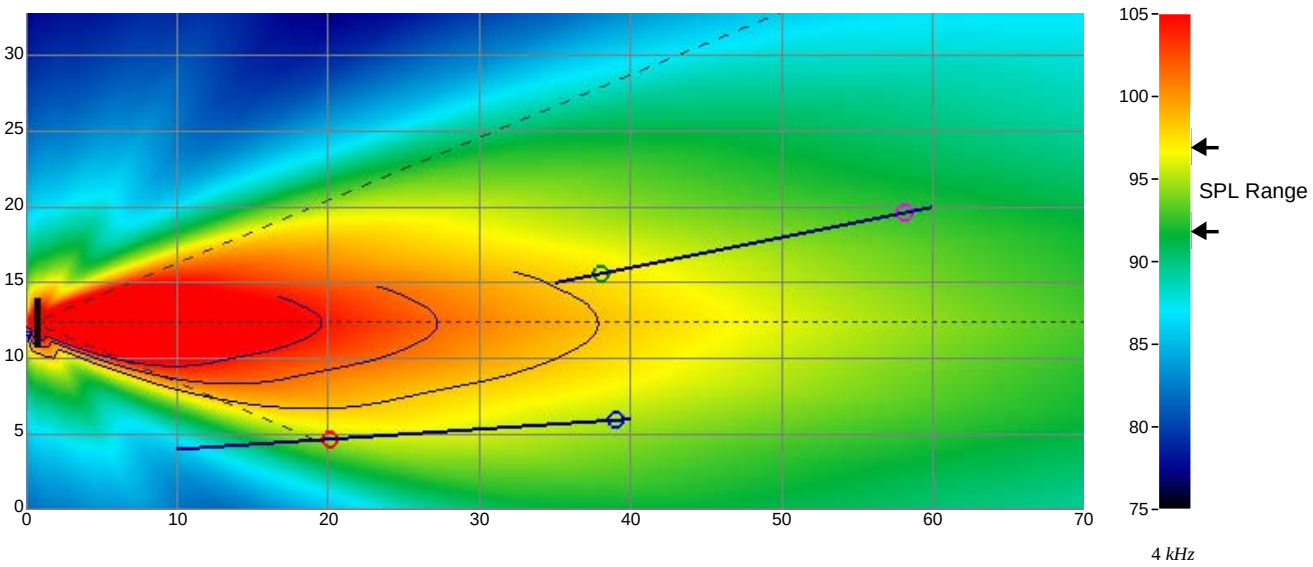
Listening Planes = Main: Rise of 0.6 m (2 ft) in 9.1 m (30 ft) of depth, beginning 1.2 m (4 ft) above the floor. Balcony: Rise of 1.5 m (5 ft) in 7.6 m (25 ft) of depth, beginning 4.6 m (15 ft) above the original floor.

Mic Placement = 6.1 m (20 ft, red icon) and 11.6 m (38 ft, blue icon) on main seating; 10.7 m (35 ft, green icon) and 16.8 m (55 ft, pink icon) on balcony.

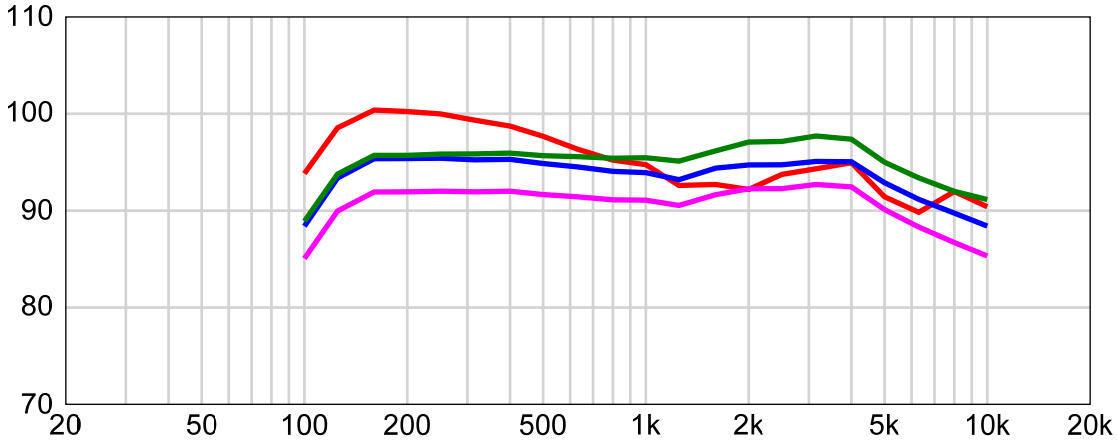
CBT 100LA in Broad Setting

Trim Height = 4.3 m (14 ft, *Top of Speaker)*
Down Tilt = 0°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

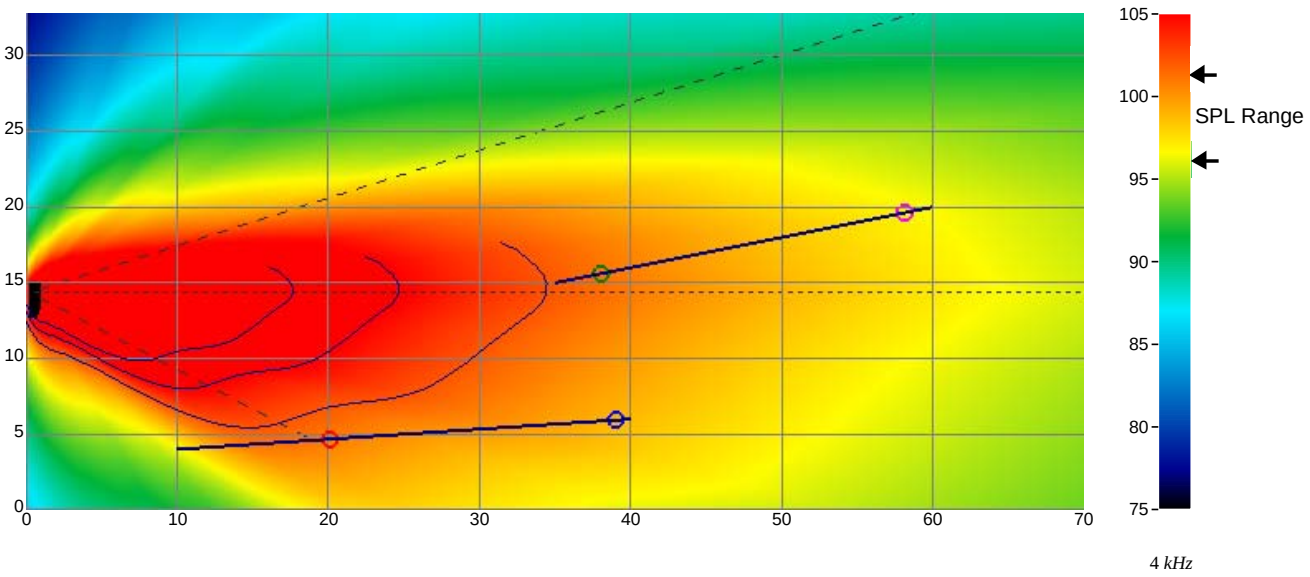


Example #3 – Gentle Rake with Balcony

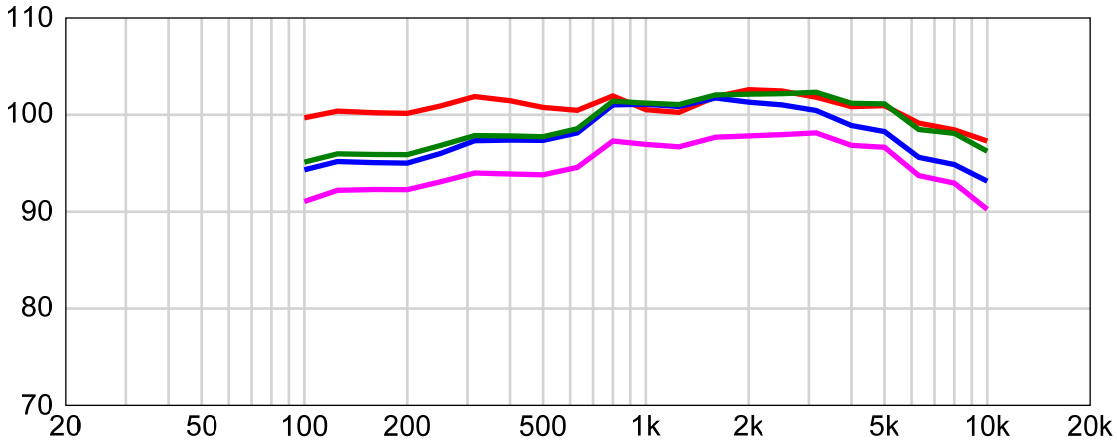
CBT 70J in Broad Setting

Trim Height = 4.6 m (15 ft, *Top of Speaker)*
Down Tilt = 0°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

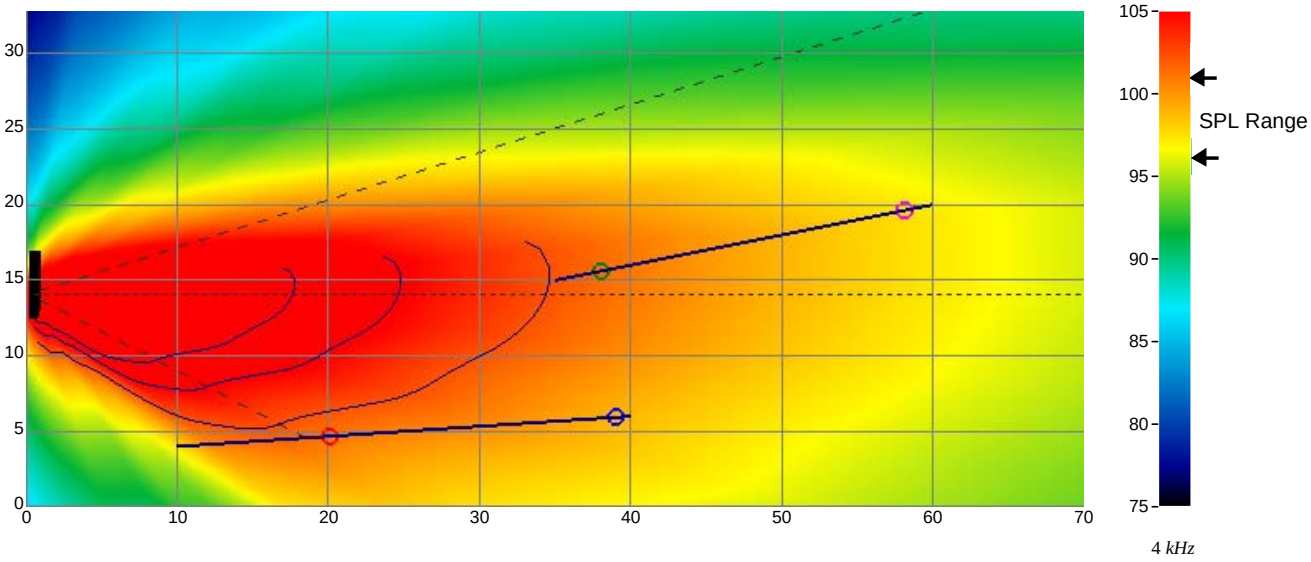


Example #3 – Gentle Rake with Balcony

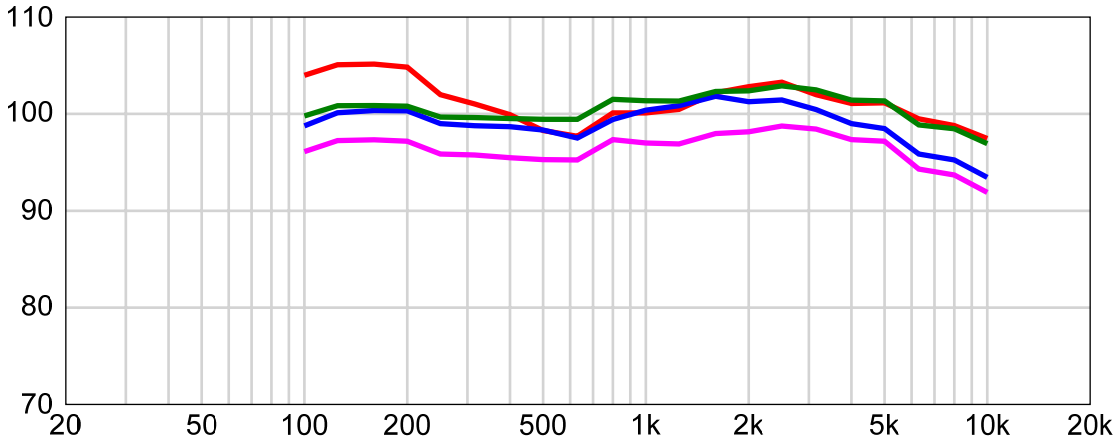
CBT 70J+70JE in Broad Setting

Trim Height = 5.2 m (17 ft, *Top of Speaker)*
Down Tilt = 0°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**



Example #4 –Three-Tiered Raked, Large Room

Description –This is a larger room with a depth of 39.6 m (130 ft). The room could represent a venue with dual balcony or it could represent an auditorium with a front section having a gentle rake and a back having a steeper rake. Shown are the CBT 100LA, CBT 70J and the CBT 70J+70JE combination. All are set at the Broad Vertical Coverage setting.

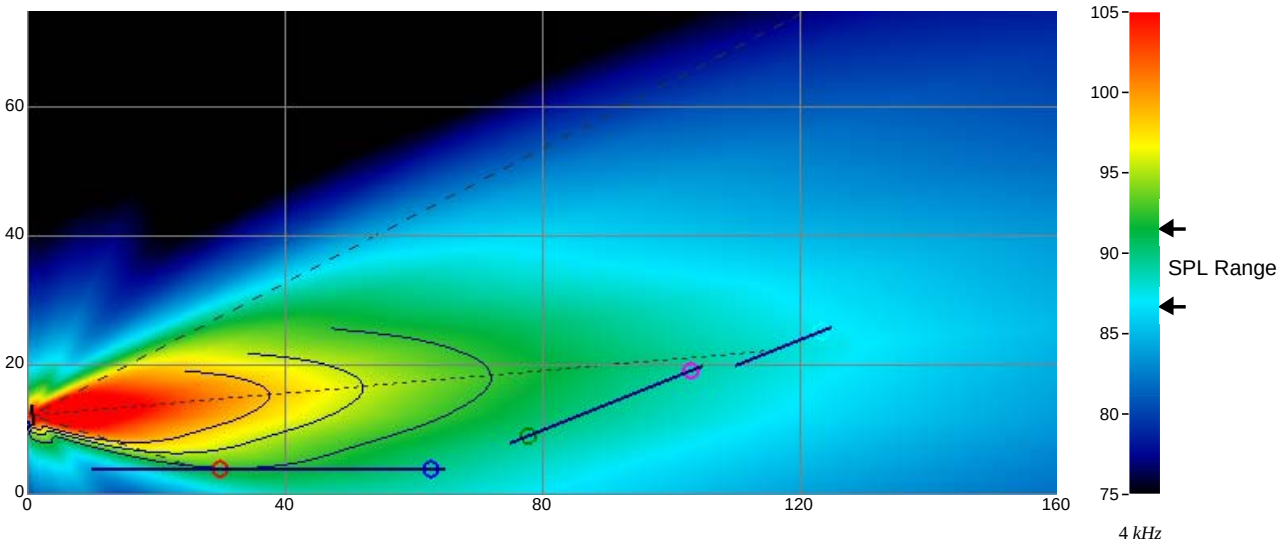
Listening Plane = Three tiers

Mic Placement = 7.6 m (25 ft, red icon) and 19.8 m (65 ft, blue icon) on main seating; 22.9 m (75 ft, green icon) and 32 m (105 ft, pink icon) on middle seating plane; the rear of the back seating plane at 38.1 m (125 ft, light-blue icon).

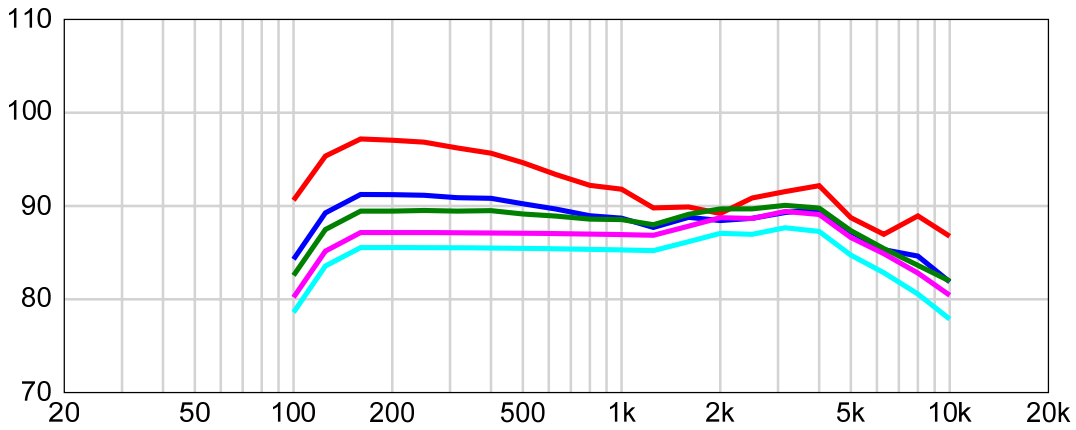
CBT 100LA in Broad Setting

Trim Height = 4.3 m (14 ft, *Top of Speaker)*
Down Tilt = 5°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

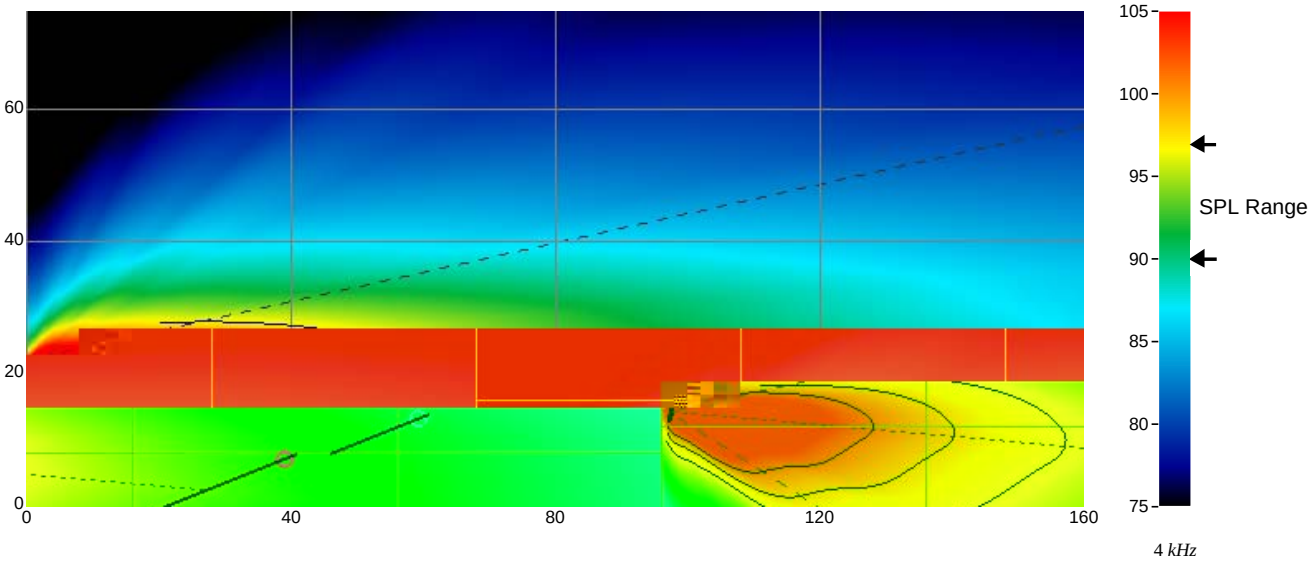


Example #4 – Three-Tiered Raked

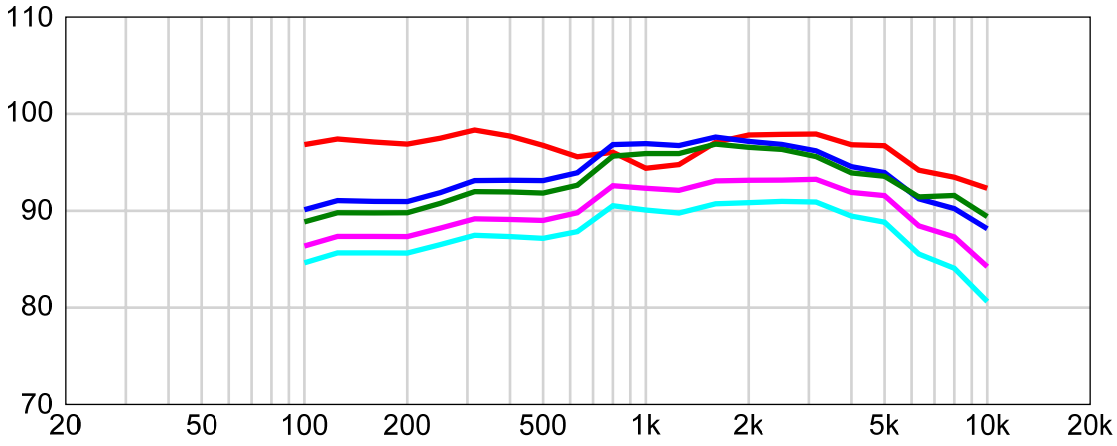
CBT 70J in Broad Setting

Trim Height = 7.6 m (25 ft, *Top of Speaker)*
Down Tilt = 5°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**

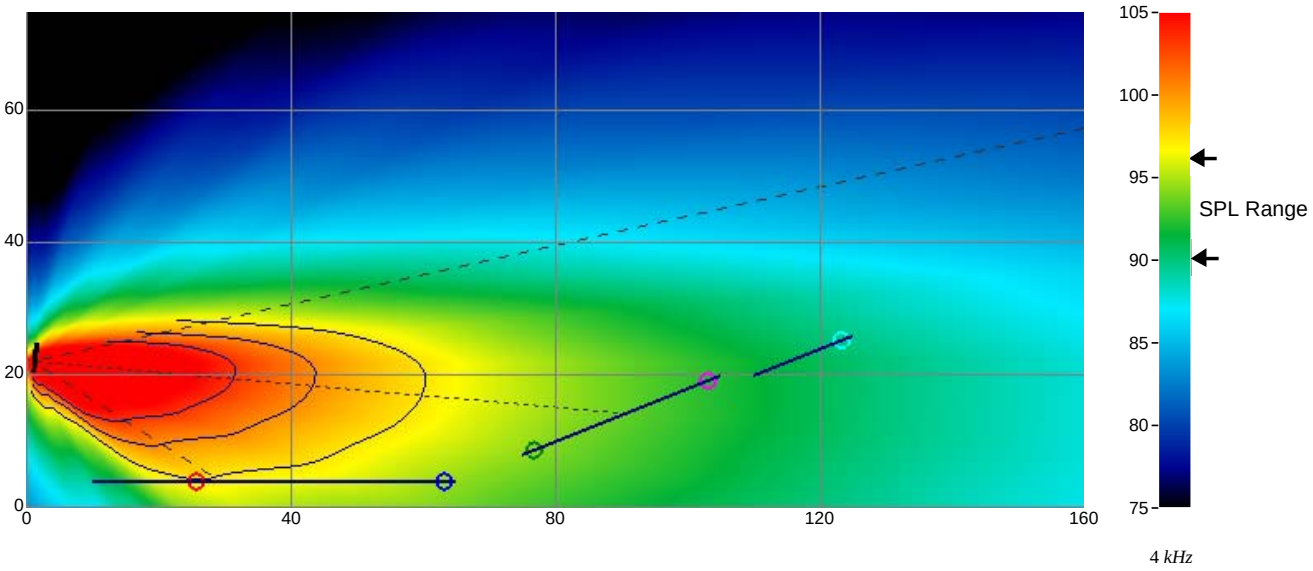


Example #4 – Three-Tiered Raked

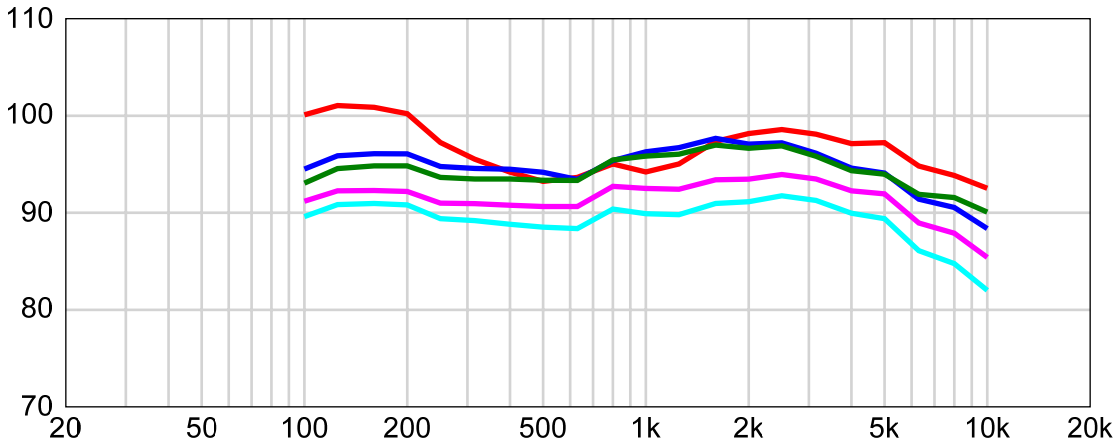
CBT 70J+70JE in Broad Setting

Trim Height = 7.6 m (25 ft, *Top of Speaker)*Down Tilt = 5°
Vertical Coverage Setting = Broad

SPL*(Full rated power, low-Z, SPEECH setting, 4 kHz, scale in feet)***:**



Frequency Response *(Full rated power, low-Z, speech setting, mic positions as designated above)***:**



Design Conclusions

Vertical Coverage Setting vs. Installation Height – In general, when the CBT speaker is set to the Narrow vertical coverage setting, the speaker tends to cover best when installed fairly low and angled at a fairly narrow down-tilt angle in relation to the seating plane.

Note that this mounting height may still be higher than is typically used with other competitive 'column' type loudspeakers which often exhibit a narrowing of the vertical beamwidth as the frequency range increases. By comparison, the CBT Series products maintain a much more even vertical beamwidth, allowing for more even coverage of the entire audience area.

When the speaker is set to the BROAD vertical coverage setting, it often results in best coverage with the speaker installed higher and then angling at a steeper down-tilt angle.

Single vs. Multiple CBT Columns – These examples show sectional views of the venues as being covered by a single CBT loudspeaker, but multiple speakers may be required.

- **For Width** -- Excellent coverage results can be achieved across the width of most rooms with CBT speakers allowing expanded left to right placement given the CBT's wider horizontal coverage pattern, more so than is typically expected with conventional speaker systems. However, multiple CBT's may be needed to cover the width of a room, so a horizontal coverage assessment via a plan-view should be done.

- **For Depth** -- It may be advisable to cover balconies or rear seating areas with a second CBT (or other speaker). The second CBT may be mounted much higher up on the same front wall and set at its Narrow vertical coverage setting to throw farther. Or, it may be positioned farther back in the room – closer to the listeners – and delayed to synchronize with any arrival from the front/main speaker (or with as much additional delay to keep localization to the front speaker, if that is desired in the application). In this case, the delay speaker would usually be set to the Broad coverage setting because it is closer to the listeners.

  The designer needs to determine the acceptability of time-offset vs. SPL for any overlap areas.

  An example of a venue where multiple speakers would be advisable would be a room where there could be an issue with reflection from the front of a balcony. Using a second speaker with each focusing sound on its own listening plane could reduce the amount of sound being sent to the front-of-balcony surface and thereby reduce the amount of sound that is reflected from it back to the stage (or to seats in the front, which could cause time-smear issues for those listeners).

Front-Fill – While the CBT columns do an admirable job of covering much of the seating area from a single speaker, it may be worthwhile to add some front-fill speakers to cover front corners of the listening space. In addition, it may also be useful in some cases to aim the speakers slightly higher or to change to the Narrow coverage mode and add some mid-high front-fill speakers to cover the first few rows. This can be a useful technique for further reducing sound reaching a stage area.

How Far Each CBT Model "Throws" – Speaker "throw" has many possible definitions, some of which require knowledge of venue-specific factors, such as acoustics, seating plane particulars, or SPL differences between one listening location and another.

One speaker-specific definition of "throw" would be the distance at which the speaker can project a useful sound level. Using that definition, following are the farthest distances at which each model (in each combination of Vertical Coverage and Voicing settings) can produce a continuous level of 85 dB (peaks of 91 dB).

85 dB Distance Chart (low-Z, full rated power, pink noise, 85 dB-SPL at 4 kHz octave band)

	BROAD Setting			**NARROW Setting**		
	Vert.°	Music Mode	Speech Mode	Vert.°	Music Mode	Speech Mode
CBT 50LA				20°	18 m (60 ft)	27 m (90 ft)
CBT 100LA	40°	30 m (100 ft)	46 m (150 ft)	15°	37 m (120 ft)	55 m (180 ft)
CBT 70J	45°	40 m (130 ft)	64 m (210 ft)	25°	52 m (170 ft)	67 m (220 ft)
CBT 70J+70JE	45°	40 m (130 ft)	64 m (210 ft)	25°	52 m (170 ft)	67 m (220 ft)

This stimulus signal for this chart is 1/3rd octave pink noise centered at 4 kHz at full rated power. This frequency band is utilized in this chart because it is a challenging range to "throw" long distances yet is important for articulation, speech intelligibility and musical clarity. 4 kHz also standardizes with the SPL Maps throughout this Guide.

The distances listed take into consideration the natural attenuation of sound due to air (22°C/72°F, 50% humidity) – otherwise the distances listed would be even farther.

It should be noted that it may not be advisable to throw these distances if there are also listeners at very close distances, because levels for the near audience areas may be louder than a normal comfort level.

It may also be noted from the chart that while CBT 70J + 70JE produces greater low frequency SPL and extended bass response, the mid-range throw is the same as the 70J by itself.

Applications Assistance -- More CBT applications assistance is available at JBL Professional's website www.jblpro.com or by calling JBL Pro installed-sound technical assistance (818) 894-8850.