BOSE

PROFESSIONAL

# EdgeMax
# EM90 / EM90-LP
# EM180 / EM180-LP

proprietary directional loudspeakers

Design Guide

English

## Overview 3

System Design Resources....3

Designing with EdgeMax Loudspeakers....4

Technical Specifications....6

## Design Considerations 7

## Design Worksheet 8

Choosing a Model....8

Step 1. Loudness....8

Step 2: Ceiling Height....8

Step 3: Response....9

Step 4: Coverage....9

Step 5: Calculate Required Amplifier Size....11

## Design Examples 13

Small Conference Rooms....13

Bars & Hospitality....14

Retail & Event Spaces....14

## Tap Charts 15

EM90....15

EM90-LP....15

EM180....16

EM180-LP....16

## Graph Paper 17


All information is subject to change. For the latest documentation and technical information, please visit **BoseProfessional.com**.

DesignMax, EdgeMax, FreeSpace, and Modeler are trademarks of Transom Post OpCo LLC. Bose is a trademark of Bose Corporation. All other trademarks are the property of their respective owners.

# Overview

All system designs begin with a set of requirements. The system requirements can be as simple as, “it has to sound great” or as detailed as, “it must play background-level music at 5 dB above the ambient noise level of the restaurant’s main dining room, which is 65 dB.” The challenge is to gather the right set of requirements, and then turn them into a set of criteria that you can use to create your design. It is important to remember that you are the designer and should use your own intuition and decision skills when planning a project in addition to calculations. Applications with mounting heights between 2.4 meters and 10 meters (8 feet and 32 feet) are supported through the in-ceiling loudspeaker models listed in this guide.

There are four key requirements that need to be identified to deliver the right system:

**Loudness:** What sound pressure level (SPL) is required for this application?

**Ceiling Height:** What loudspeakers will work best for my room’s ceiling height?

**Response:** What bandwidth is required for the type of program material that will be used?

**Coverage:** How consistent must the sound be across the entire coverage area?

Each of these requirements can be easily converted into a specification that we can use to create our system design. If we understand the customer’s needs in these four areas, we can deliver a design that will — at a minimum — meet their needs and — at best — exceed their expectations.

For the purposes of this design guide, we will assume that you are familiar with the system requirements for a commercial audio system and are ready to focus on loudspeaker selection, creation of a loudspeaker layout, and defining the necessary amplifier power needed to power the design.

## System Design Resources

In addition to this guide, we offer the following tools at **BoseProfessional.com** on the software and individual loudspeaker product pages:

**Modeler:** Advanced acoustical design simulation tool, with direct and reflected energy, and Speech Transmission Index (STI). Free to download at **BoseProfessional.com**.

**EASE GLL files:** For use in the AFMG EASE application, and the EASE GLL Viewer application. EASE allows the simulation of reverberation times, speech intelligibility, and other acoustical parameters. EASE is a paid download. EASE GLL Viewer is free to download.

**EASE Address files:** For use in the AFMG EASE Address (2D tool, direct field coverage) or EASE Evac. EASE Address is free to download.

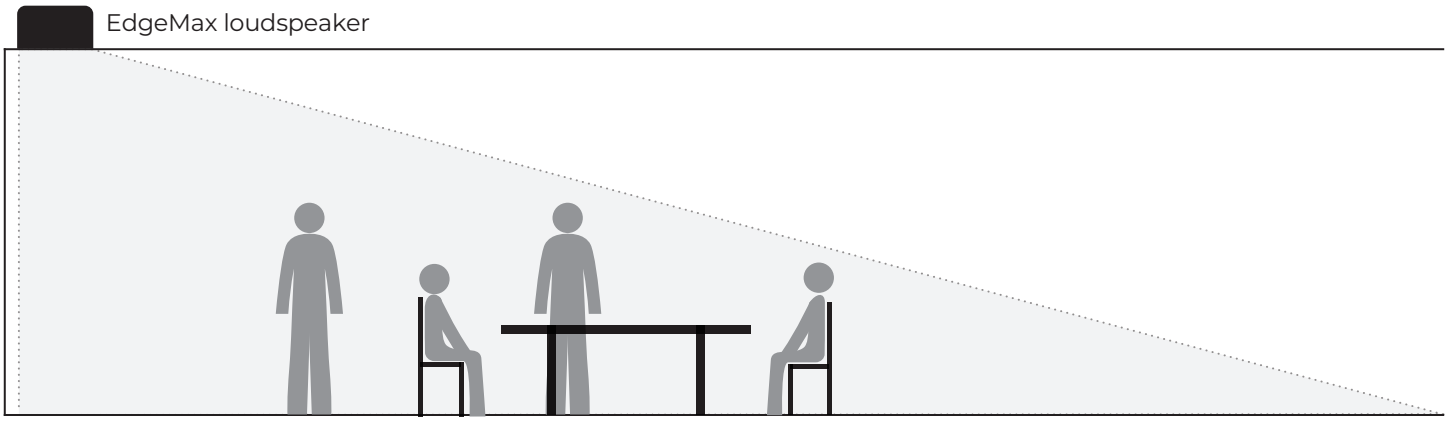
**BIM files:** Includes the Revit format. Revit is a paid download.

## Designing with EdgeMax Loudspeakers

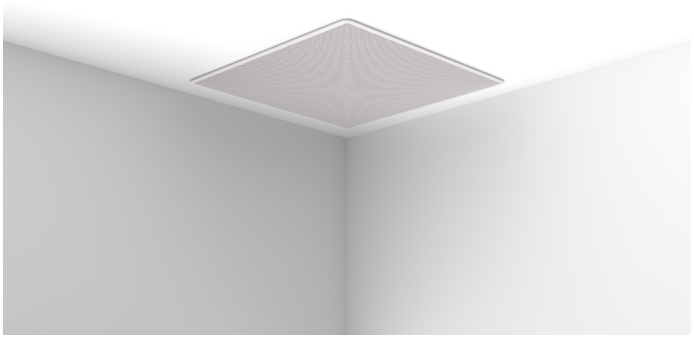
This guide covers topics related to system design with Bose Professional EdgeMax loudspeakers and their use in specific applications. Designed for in-ceiling mounting near wall-ceiling boundaries, EdgeMax loudspeakers provide improved audio quality and coverage, while reducing the number of required units, compared to conventional dome-tweeter ceiling speakers.

EdgeMax loudspeakers represent the best aspects of both conventional loudspeaker types — the coverage and performance of surface-mounted loudspeakers and the aesthetic benefits of in-ceiling loudspeakers. The asymmetrical vertical coverage angle (75° for EM90/EM180, 80° for EM90-LP/EM180-LP) enables EdgeMax loudspeakers to be installed in corners or along room perimeters.

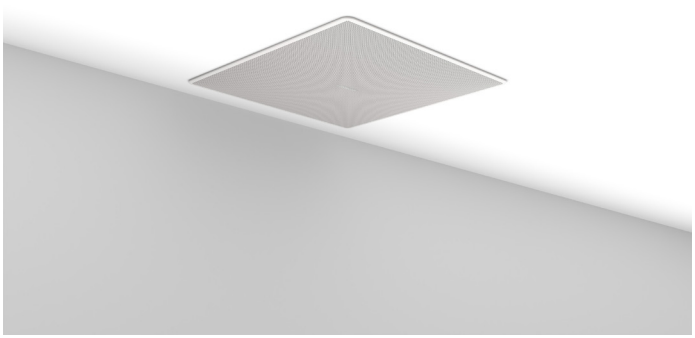
EdgeMax loudspeakers benefit from boundary-loading to deliver more low-frequency output than conventional in-ceiling loudspeakers. Similar to surface-mount loudspeakers, the coverage pattern of EdgeMax will also allow stereo playback for some rooms (when the room dimensions allow sufficient overlap of coverage).




EdgeMax loudspeakers deliver controlled, vertically asymmetrical high-frequency coverage from a wall-ceiling boundary.



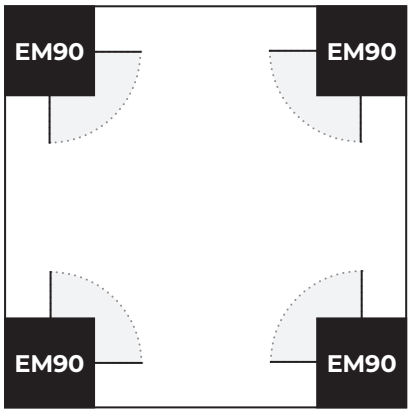
EdgeMax EM90/EM90-LP



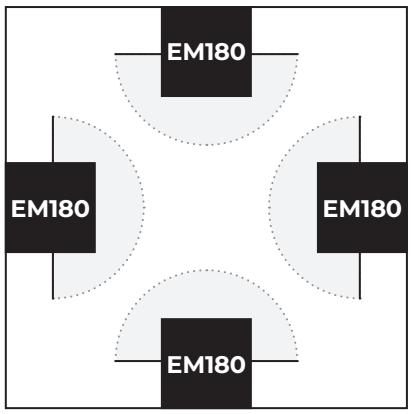
EdgeMax EM180/EM180-LP

The EdgeMax family includes two horizontal coverage patterns:

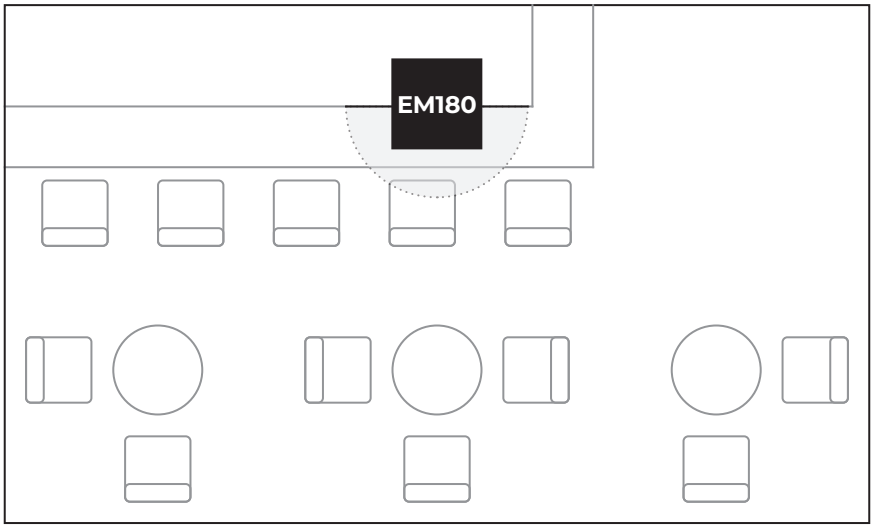
**EM90** and **EM90-LP** offer 90° horizontal coverage for mounting in room corners.




**EM180** and **EM180-LP** offer 180° horizontal coverage for mounting along the room perimeter.




An EdgeMax loudspeaker can also be placed in a more central location of a room, not just at a wall-ceiling boundary. This allows for even more possibilities, such as applying directional coverage to an area from a location where only in-ceiling loudspeakers can be installed. This optimizes both coverage and efficiency.




An EdgeMax EM180 loudspeaker directing sound into a bar. The patrons are in the coverage area while bartender is behind it.

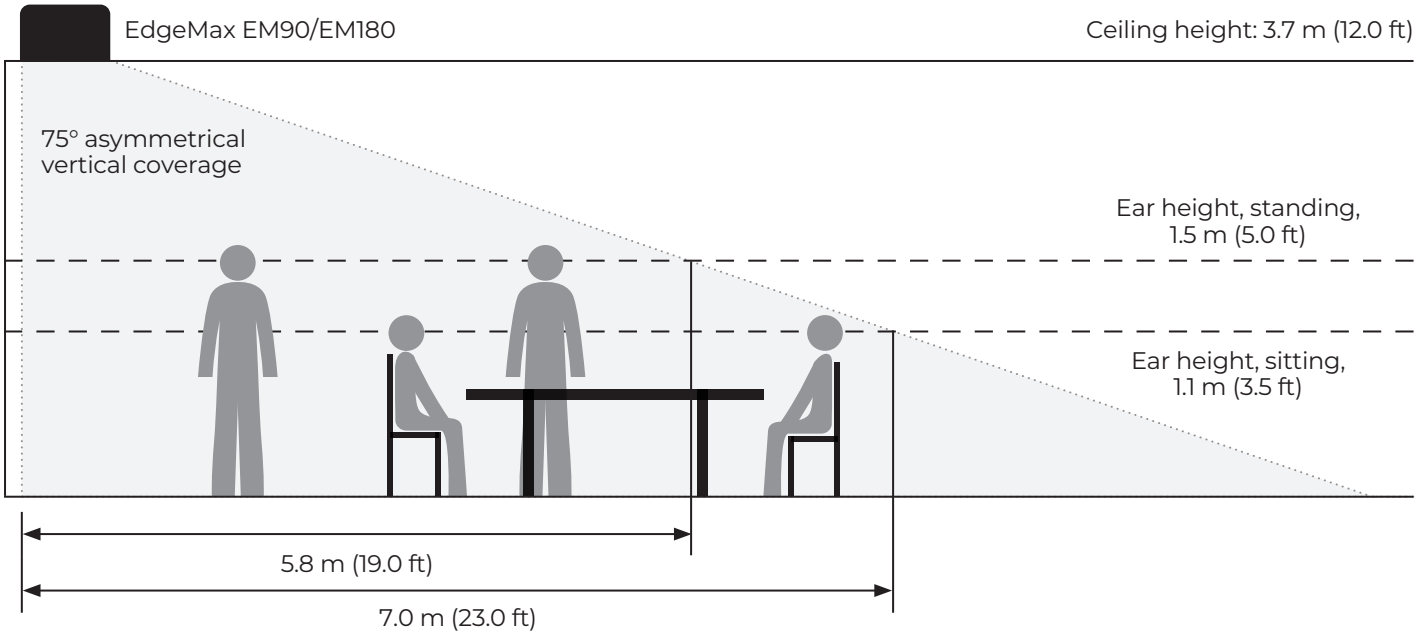
# Technical Specifications

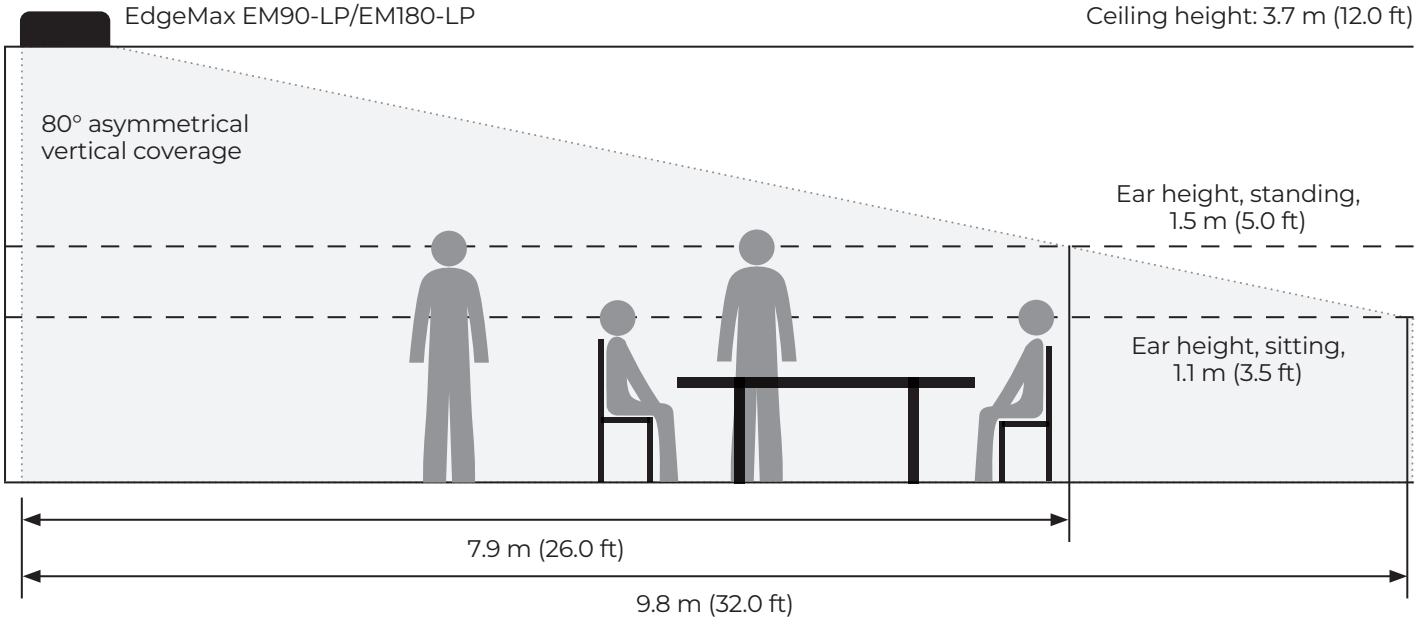
| | EM90 | EM90-LP | EM180 | EM180-LP |
|---|---|---|---|---|
| Frequency range (-10 dB)[1] | 45 – 20,000 Hz | 45 – 19,000 Hz | 45 – 20,000 Hz | 45 – 19,000 Hz |
| Power handling, long-term continuous[2] | 125 W | 32 W | 125 W | 32 W |
| Sensitivity (SPL @ 1 W/1 m, pink noise)[3] | 96 dB | 95 dB | 93 dB | 91 dB |
| Impedance | 70/100V or 8 Ω (bypass) | 70/100V or 8 Ω (bypass) | 70/100V or 8 Ω (bypass) | 70/100V or 8 Ω (bypass) |
| Maximum SPL @ 1 m[4] | 117 dB | 110 dB | 114 dB | 106 dB |
| Coverage, horizontal | 90° | 90° | 180° | 180° |
| Coverage, vertical | 75° asymmetrical | 80° asymmetrical | 75° asymmetrical | 80° asymmetrical |
| Product dimensions (height × width × depth) | 339 × 339 × 236 mm (13.4 × 13.4 × 9.3 in) | 339 × 339 × 100 mm (13.4 × 13.4 × 3.9 in) | 339 × 339 × 236 mm (13.4 × 13.4 × 9.3 in) | 339 × 339 × 100 mm (13.4 × 13.4 × 3.9 in) |
| Net weight | 10.0 kg (22.0 lb) | 7.5 kg (16.6 lb) | 10.1 kg (22.2 lb) | 7.6 kg (16.7 lb) |

1. Frequency response and range measured on-axis in one-eighth-space (corner-loaded, EM90/EM90-LP) or one-quarter-space (wall-loaded, EM180/EM180-LP) environment with recommended active EQ.
2. Extended-lifecycle test using pink noise filtered to meet IEC 268-5, 6-dB crest factor, 500-hour duration.
3. Sensitvity measured on-axis in one-eighth-space (corner-loaded, EM90/EM90-LP) or one-quarter-space (wall-loaded, EM180/EM180-LP) environment with recommended active EQ.
4. Maximum SPL calculated from sensitivity and power handling specifications exclusive of power compression.

# Design Considerations

For most applications, EdgeMax loudspeakers should be spaced such that the overlap between adjacent loudspeakers occurs where the vertical coverage intersects with the ear height of the listener while standing (approximately 1.5 meters [5.0 feet] high).



# Design Worksheet

Follow the steps below to create a design with EdgeMax loudspeakers.

## Choosing a Model

### Step 1. Loudness

#### Maximum SPL Capability

Confirm that your chosen loudspeaker model will meet your loudness requirement based on the ceiling height. Models with a higher sensitivity and higher tap settings will be able to play at higher levels. Individual model tap charts are available at the end of this document.

**Maximum continuous output level**

| Ceiling height | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| m | 2.4 | 3.0 | 3.7 | 4.3 | 4.9 | 5.5 | 6.1 | 6.7 | 7.9 | 9.8 |
| ft | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 26 | 32 |
| EdgeMax EM90 | 111 | 109 | 106 | 104 | 102 | 100 | 99 | 98 | 96 | 95 |
| EdgeMax EM90-LP | 107 | 105 | 102 | 100 | 98 | 96 | 95 | 94 | 92 | 91 |
| EdgeMax EM180 | 108 | 106 | 103 | 101 | 99 | 97 | 96 | 95 | 93 | 92 |
| EdgeMax EM180-LP | 97 | 95 | 92 | 90 | 88 | 86 | 85 | 84 | 82 | 81 |

dB SPL

> **Note:** The above table assumes standing ear height at 1.5 meters (5 feet), in minimum overlap configuration. Room reverberation could add as much as 4 dB system gain, which is not factored into the measurements above. Use of the transformer on 70/100V systems will introduce an insertion loss of 1–2 dB.

When installed at wall-ceiling boundaries, the sensitivity of the EM180/EM180-LP is approximately 3 dB less than that of the EM90/EM90-LP due to the difference in their horizontal coverage. To achieve equivalent loudness when designing a “mixed 90-180” system, set the power level of each EM90/EM90-LP 3 dB lower than the EM180/EM180-LP. To do the same for a 70/100V constant-voltage application, set each EM90/EM90-LP one tap setting lower than the EM180/EM180-LP.

### Step 2: Ceiling Height

If the ceiling height is **2.7–6.1 meters (9–20 feet)**, we recommend using the EM90 and EM180 models, which perform best in higher ceilings due to their 75° asymmetrical vertical coverage of the EM90/EM180.

If the ceiling height is **2.4–3.7 meters (8–12 feet)**, we recommend using the EM90-LP and EM180-LP models, which perform best in this range due to their 80° asymmetrical vertical coverage.

If the clearance above the ceiling is less than **23.6 centimeters (9.3 inches)**, choose the EM90-LP or EM180-LP, which has a smaller backcan than the EM90 or EM180.

Choose the models that will work with your ceiling heights and rule out the other models.

## Step 3: Response

Confirm the EdgeMax loudspeaker will meet your response requirement:

| Vocal Range | Low Frequency (-10 dB) | Full Range | Low Frequency (-10 dB) | Extended Range | Low Frequency (-10 dB) |
|---|---|---|---|---|---|
| DesignMax DM2C-LP | 85 Hz | FreeSpace FS4CE | 70 Hz | EdgeMax EM90 | 45 Hz |
| FreeSpace FS2C | 83 Hz | DesignMax DM5C | 65 Hz | EdgeMax EM180 | 45 Hz |
| DesignMax DM3C | 75 Hz | DesignMax DM6C | 59 Hz | EdgeMax EM90-LP | 45 Hz |
| | | DesignMax DM8C | 52 Hz | EdgeMax EM180-LP | 45 Hz |

> **Note:** EdgeMax loudspeakers have a usable frequency range down to 45 Hz, so additional subwoofers may not be required. However, if the design needs additional bass, subwoofers can be added.

## Step 4: Coverage

### Determining Loudspeaker Quantity and Spacing

Use the graph paper on the last page to sketch the layout of the room. Place loudspeakers in your sketch of the layout to meet your coverage requirement. Calculators or software can simplify this process.

If the room does not require full coverage and can use localized sound (e.g., conference rooms, spaces with a video display), simply place EdgeMax loudspeakers as needed. Be mindful of the room size and the **usable throw distance** (UTD) — see the **Usable throw distance** table in Step D to determine this). If there are unwanted gaps in coverage, consider adding more loudspeakers within the UTD to cover them. After that, skip to **Step 5: Calculate Required Amplifier Size**.

If the room requires full coverage without gaps (e.g., retail or restaurant spaces with background music, fitness clubs or performance spaces with high-output music and voice), follow the steps below.

A. Calculate the **loudspeaker spacing distance** (LSD).

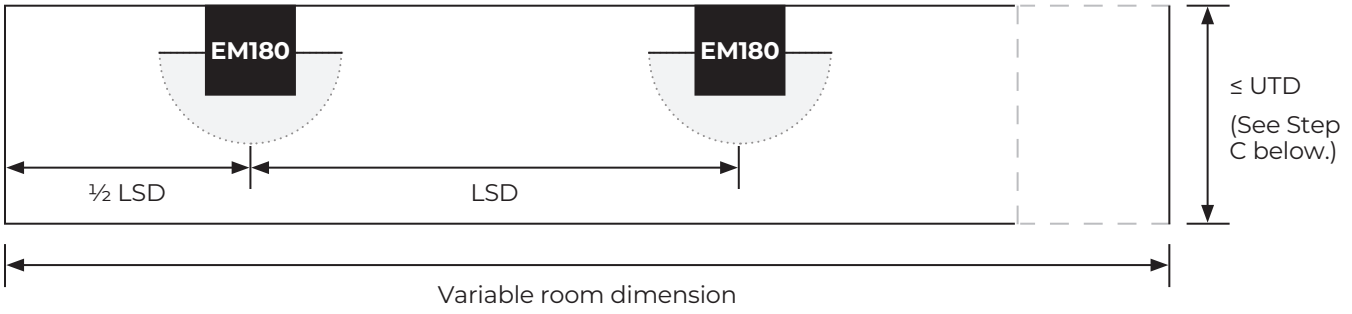
Use the table below to determine the LSD based on the mounting height and required coverage quality. **Edge-to-edge** coverage can provide fidelity in fixed-location seating/standing and can generally work well for installations on a budget. It also works well for ambient-level and low-level background music. **Minimum overlap** coverage may be needed if critical communication is happening over the system. Modeler or EASE software can help with speech intelligibility evaluation.

**Loudspeaker spacing distance, EM180/EM180-LP**

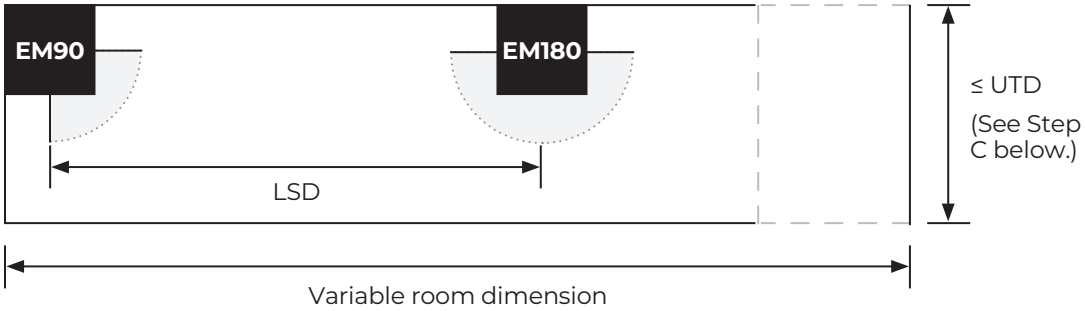
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Loudspeaker mounting height | | m | 2.7 | 3.0 | 3.7 | 4.3 | 4.9 | 5.5 | 6.1 |
| | | ft | 9 | 10 | 12 | 14 | 16 | 18 | 20 |
| Coverage quality | Minimum overlap | m | 3 | 4 | 6 | 8 | 9 | 11 | 13 |
| | | ft | 11 | 15 | 20 | 25 | 30 | 35 | 40 |
| | Edge to edge | m | 7 | 9 | 12 | 12 | 12 | 12 | 12 |
| | | ft | 20 | 30 | 40 | 40 | 40 | 40 | 40 |

Loudspeaker spacing distance based on coverage quality at various heights. Standing position assumes 1.5 m (5.0 ft) ear height. Sitting position assumes 1.0 m (3.5 ft) ear height.

B. Place the first EM180/EM180-LP against the wall at ½ LSD from any corner of the room. Continue to place EM180/EM180-LP loudspeakers along the wall at the LSD.




Alternatively, place an EM90/EM90-LP in the corner of the room, and then continue to place EM180/EM180-LP loudspeakers along the wall at the LSD.




C. Arrange the remaining loudspeakers on a square grid pattern using the LSD. If a loudspeaker would be placed on or beyond the perimeter of the room, delete that row/column of loudspeakers.

D. Use the table below to determine the **usable throw distance** (UTD) Like a surface-mounted loudspeaker, the mounting height of an EdgeMax loudspeaker determines its UTD, the greatest distance from the loudspeaker where the listener receives a balanced frequency response and adequate loudness.

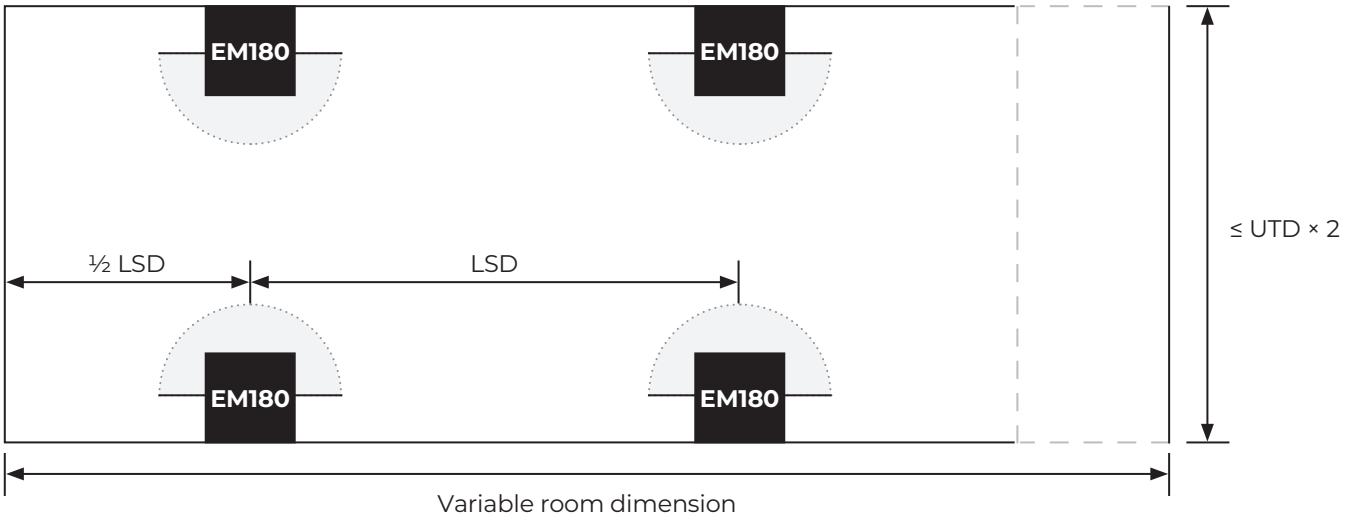
**Usable throw distance**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ceiling height | m | 2.4 | 2.7 | 3 | 3.4 | 3.7 | 4 | 4.3 | 4.5 | 4.9 | 5.5 | 6.1 |
| | ft | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 20 |
| Listener ear height: Standing — EM90/EM180 | m | 2.6 | 3.4 | 4 | 5 | 6 | 7 | 7.6 | 8.2 | 9 | 11 | 13 |
| | ft | 8 | 11 | 14 | 17 | 19 | 22 | 25 | 27 | 30 | 35 | 40 |
| Listener ear height: Standing — EM90-LP/EM180-LP | m | 3.5 | 4.6 | 5.8 | 6.9 | 8.1 | 9.2 | 10.3 | 11.2 | 12.6 | 14.9 | 17.2 |
| | ft | 11 | 15 | 19 | 23 | 26 | 30 | 34 | 37 | 41 | 49 | 56 |
| Listener ear height: Sitting — EM90/EM180 | m | 4 | 4.6 | 5.4 | 6 | 7 | 8 | 8.8 | 9.4 | 10 | 12 | 14 |
| | ft | 12 | 15 | 18 | 20 | 23 | 26 | 29 | 31 | 34 | 40 | 45 |
| Listener ear height: Sitting — EM90-LP/EM180-LP | m | 5 | 6 | 7 | 8 | 10 | 11 | 12 | 13 | 14 | 16 | 19 |
| | ft | 17 | 20 | 24 | 28 | 32 | 35 | 39 | 42 | 46 | 54 | 61 |

Usable throw distance based on coverage quality at various heights. Standing position assumes 1.5 m (5.0 ft) ear height. Sitting position assumes 1.1 m (3.5 ft) ear height.

If the width of the room is less than or equal to the UTD, go to Step E.

If the width of the room is greater than the UTD, add identical loudspeaker models along the opposite wall using the same spacing as in Step B. The supported room width can be up to 2 × UTD, assuming loudspeakers are facing in from each opposing wall.




Example of identical EdgeMax loudspeakers added along opposite wall. The width of the room can be up to twice the UTD.

E. After placing the last loudspeaker, center the loudspeakers in that row to create new offset distances out from each wall/corner, which may be different from ½ LSD (if using all EM180/EM180-LP models) or 1 LSD (if EM90/EM90-LP models are in the corners).

## Step 5: Calculate Required Amplifier Size

All EdgeMax loudspeakers are compatible with 70-volt, 100-volt, and low-impedance amplifiers.

**Use the Tap Charts to determine which loudspeaker tap is required for this design.**

A. Locate the loudspeaker tap chart and find the column for mounting height for this design.

B. Follow the column to the desired maximum SPL.

C. Follow the row across the chart to determine the required loudspeaker tap.

D. Calculate the required amplifier power:

| | | | | |
|---|---|---|---|---|
| _____ | × | _____ | = | _____ |
| Number of loudspeakers required | | Loudspeaker tap required | | Power required |

E. Calculate the required amplifier size:

| | | | | |
|---|---|---|---|---|
| _____ | × | 1.10 | = | _____ |
| Power required | | Headroom | | Amplifier size |

### Amplifiers: Example Amplifier Configurations

Modern amplifiers come in a variety of channel counts and configuration options to allow for different output configurations, zoning options, and varying loudspeaker quantities. A properly optimized system may only need a low 1- or 2-watt tap setting to achieve 70 dB in a typical room. The below example lists how many EdgeMax loudspeakers can be handled at the loudspeaker's highest 70/100V tap settings.

| Amplifier example | Models | Maximum number of loudspeakers at the highest tap settings | |
|---|---|---|---|
| FreeSpace IZA 190-HZ | EM90/EM180 | 1 loudspeakers at 80 W | 2 loudspeakers at 40 W |
| | EM90-LP/EM180-LP | 2 loudspeakers at 32 W | 5 loudspeakers at 16 W |
| FreeSpace IZA 2120-HZ | EM90/EM180 | 1 loudspeakers at 80 W | 2 loudspeakers at 40 W |
| | EM90-LP/EM180-LP | 3 loudspeakers at 32 W | 6 loudspeakers at 16 W |
| PowerShare PS404D | EM90/EM180 | 4 loudspeakers at 80 W | 9 loudspeakers at 40 W |
| | EM90-LP/EM180-LP | 11 loudspeakers at 32 W | 22 loudspeakers at 16 W |
| PowerSpace P4150+ | EM90/EM180 | 1 loudspeaker at 80 W | 3 loudspeakers at 40 W |
| | EM90-LP/EM180-LP | 4 loudspeakers at 32 W | 8 loudspeakers at 16 W |

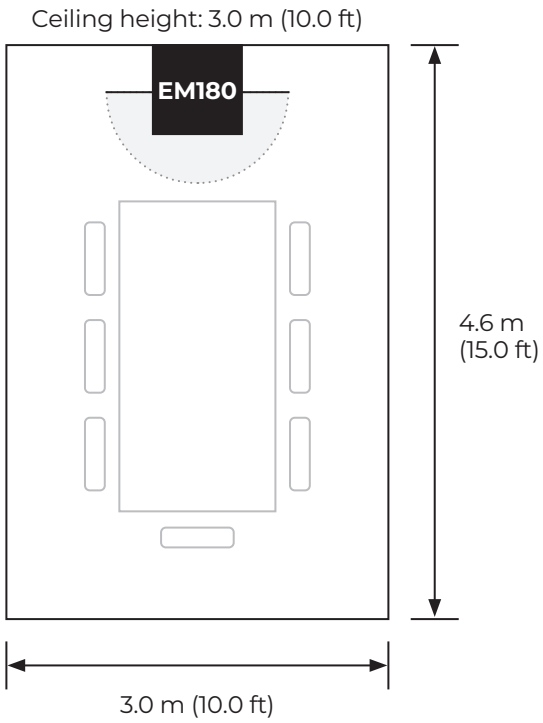
# Design Examples

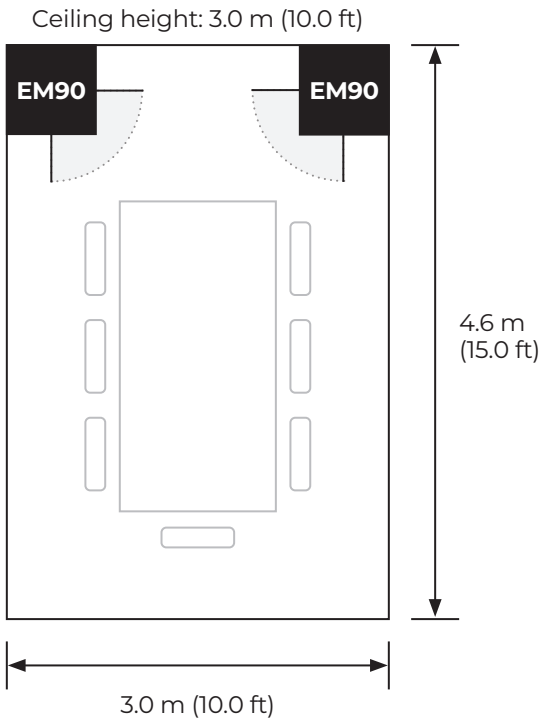
## Small Conference Rooms

For rooms smaller than 3 × 4.5 meters (10 × 15 feet) with a ceiling height of 2.7–3.7 meters (9–12 feet), place one EM180/EM180-LP above the display screen.

Alternatively, if stereo playback of program material is required, two EM90s can be installed in the corners on either side of the display.

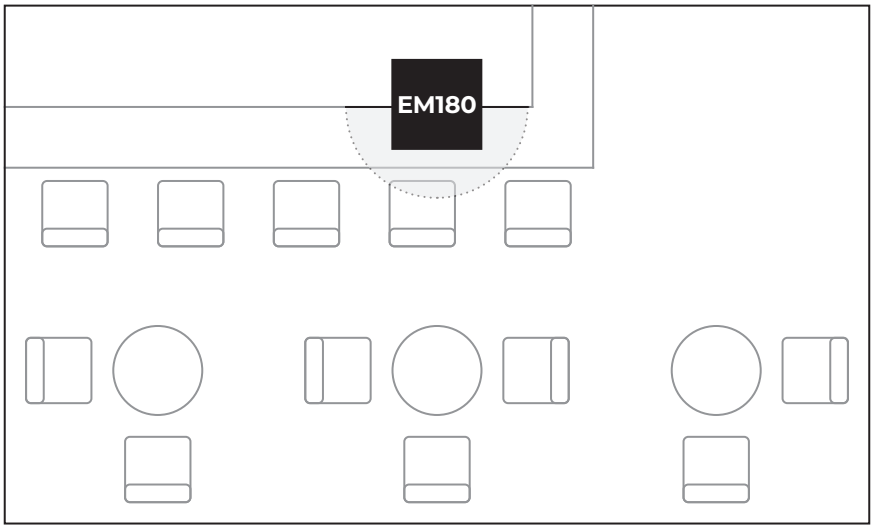
For longer conference rooms, place additional EdgeMax loudspeakers along the walls at the back of the room. Ensure the loudspeakers that cover the rest of the room use a lower output level than the loudspeaker above the display screen to provide adequate localization.



## Bars & Hospitality

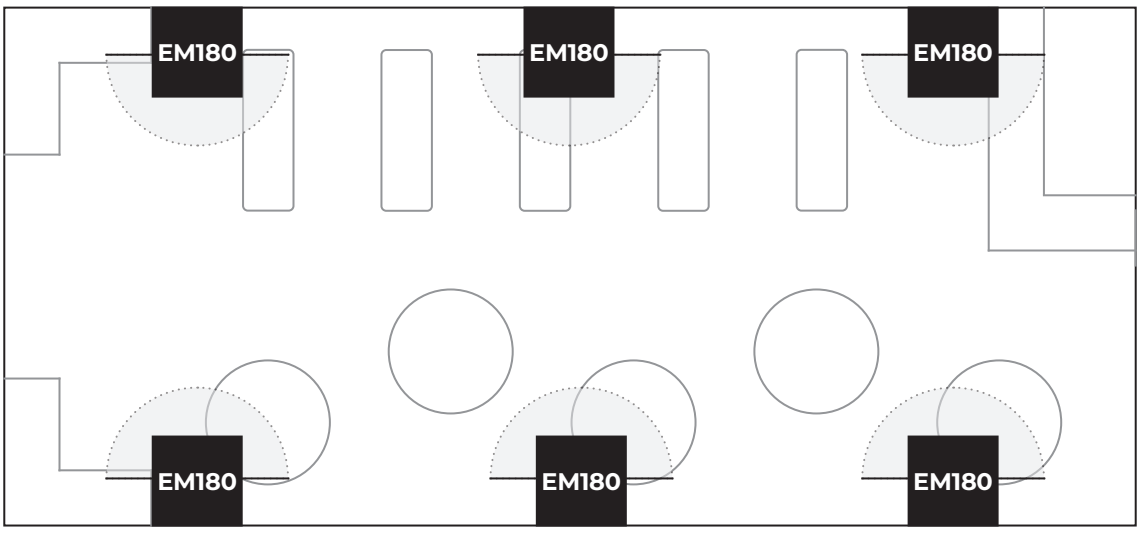
In rooms where service staff are placed in one area while patrons remain in another, you can use the coverage pattern of EdgeMax loudspeakers to effectively create separate zones. Place an EdgeMax loudspeaker in a more central location of a room, not just at a wall-ceiling boundary, to apply directional coverage from an in-ceiling location. This optimizes both coverage and efficiency.




An EdgeMax EM180 loudspeaker directing sound into a bar. The patrons are in the coverage area while bartender is behind it.

## Retail & Event Spaces

In rooms where consistent coverage is required throughout the space but in-ceiling loudspeakers are preferred, EdgeMax loudspeakers can cover the space efficiently and discreetly from wall-ceiling boundaries — and will often require fewer loudspeakers to than traditional in-ceiling or pendant models would.




EdgeMax EM180 loudspeakers directing sound into a large space with consistent coverage. 8–10 in-ceiling or pendant loudspeakers may typically be required to achieve the same coverage.

# Tap Charts

**Individual Loudspeaker Continuous Output Level**

> **Note:** The following tap charts assume standing ear height at 1.5 meters (5 feet). Room reverberation could add as much as 4 dB system gain, which is not factored into the measurements. Designing without room gain will ensure you do not under-plan your design, and amplifier attenuation is possible onsite if you exceed the average room SPL target during measurement.

## EM90

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ceiling height | m | 2.7 | 3.0 | 3.7 | 4.3 | 4.9 | 5.5 | 6.1 | 6.7 | 7.9 | 9.1 |
| | ft | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 26 | 30 |
| Tap setting | 2.5 W | 94 | 92 | 89 | 87 | 85 | 83 | 82 | 81 | 79 | 78 |
| | 5 W | 97 | 95 | 92 | 90 | 88 | 86 | 85 | 84 | 82 | 81 |
| | 10 W | 100 | 98 | 95 | 93 | 91 | 89 | 88 | 87 | 85 | 84 |
| | 20 W | 103 | 101 | 98 | 96 | 94 | 93 | 91 | 90 | 88 | 87 |
| | 40 W | 106 | 104 | 101 | 99 | 97 | 96 | 94 | 93 | 91 | 90 |
| | 80 W | 109 | 107 | 104 | 102 | 100 | 99 | 97 | 96 | 94 | 93 |
| | 8 Ω | 111 | 109 | 106 | 104 | 102 | 100 | 99 | 98 | 96 | 95 |

dB SPL

## EM90-LP

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ceiling height | m | 2.7 | 3.0 | 3.7 | 4.3 | 4.9 | 5.5 | 6.1 | 6.7 | 7.9 | 9.1 |
| | ft | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 26 | 30 |
| Tap setting | 4 W | 98 | 96 | 93 | 91 | 89 | 87 | 86 | 85 | 83 | 82 |
| | 8 W | 101 | 99 | 96 | 94 | 92 | 90 | 89 | 88 | 86 | 85 |
| | 16 W | 104 | 102 | 99 | 97 | 95 | 93 | 92 | 91 | 89 | 88 |
| | 32 W | 107 | 105 | 102 | 100 | 98 | 96 | 95 | 94 | 92 | 91 |
| | 8 Ω | 107 | 105 | 102 | 100 | 98 | 96 | 95 | 94 | 92 | 91 |

dB SPL

## EM180

| Ceiling height | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | m | 2.7 | 3.0 | 3.7 | 4.3 | 4.9 | 5.5 | 6.1 | 6.7 | 7.9 | 9.1 |
| | ft | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 26 | 30 |
| Tap setting | 2.5 W | 91 | 89 | 86 | 84 | 82 | 80 | 79 | 78 | 76 | — |
| | 5 W | 94 | 92 | 89 | 87 | 85 | 83 | 82 | 81 | 79 | 78 |
| | 10 W | 97 | 95 | 92 | 90 | 88 | 86 | 85 | 84 | 82 | 81 |
| | 20 W | 100 | 98 | 95 | 93 | 91 | 90 | 88 | 87 | 85 | 84 |
| | 40 W | 103 | 101 | 98 | 96 | 94 | 93 | 91 | 90 | 88 | 87 |
| | 80 W | 106 | 104 | 101 | 99 | 97 | 96 | 94 | 93 | 91 | 90 |
| | 8 Ω | 108 | 106 | 103 | 101 | 99 | 97 | 96 | 95 | 93 | 92 |

dB SPL

## EM180-LP

| Ceiling height | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | m | 2.7 | 3.0 | 3.7 | 4.3 | 4.9 | 5.5 | 6.1 | 6.7 | 7.9 | 9.1 |
| | ft | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 26 | 30 |
| Tap setting | 4 W | 88 | 86 | 83 | 81 | 79 | 77 | 76 | 75 | 73 | 72 |
| | 8 W | 91 | 89 | 86 | 84 | 82 | 80 | 79 | 78 | 76 | 75 |
| | 16 W | 94 | 92 | 89 | 87 | 85 | 83 | 82 | 81 | 79 | 78 |
| | 32 W | 97 | 95 | 92 | 90 | 88 | 86 | 85 | 84 | 82 | 81 |
| | 8 Ω | 97 | 95 | 92 | 90 | 88 | 86 | 85 | 84 | 82 | 81 |

dB SPL

# Graph Paper


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

# Graph Paper


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

©2024 Transom Post OpCo LLC. All rights reserved.
BoseProfessional.com
Rev. 02
November 2024