MX180 Speaker Setup and Bass Management Guide. V1, 3-18-22

Contents

Introduction

This document will explain some of the details of the speaker setup and how it works.

The purpose of the speaker setup is to tell the system which speakers and subwoofers are available and how big those are, i.e. how much bass they are capable of reproducing.

When this document refers to “speakers” this only refers to “normal” speakers and does not include any subwoofers.

Notice the difference between “LFE sub”, which is the output labelled “LFE” and the sub connected to it, and “LFE channel”, which is the actual LFE channel. A setup without an LFE sub can still play the LFE channel, it will just be played by other subs or speakers.

The speaker setup allows for subwoofers labelled “Sub L” and “Sub R” as well as “Sub LR” and “Sub RR”. These will be referred to in the document as “front subs” and “rear subs” respectively.

Initial Setup Considerations

In order to get the optimal surround sound performance from your processor, you should consider, which audio format and post processing you want to perfect. In general minimum 5 low-level speakers must be installed, before you can add high-level speakers for a 3D surround sound experience.

Subwoofer(s)

- The bass performance is an essential part of the overall surround sound experience. Even with very large front speakers (LF-RF) the Low Frequency Effects (LFE) audio channel and bass-part of surround speakers will seriously stress your front speakers.

- A single subwoofer must be designated LFE. Position in the front corner is recommended.

- Using two subwoofers allows for a stereo setup for improved left to right panning. Positions in the front corners of the room is recommended. If two subwoofers cannot be positioned correctly for stereo, you should connect them both to the LFE output using a splitter.

- Three subwoofers will allow for having one as a dedicated LFE subwoofer and the remaining two in the front as Sub L and Sub R supporting the speakers with good stereo performance.

- Rear subwoofers can be added in order improve the experience in the back of a large room. The bass from the rear surround speakers will be directed to these subwoofers, which will improve both the left to right as well as the front to rear panning. Without a dedicated LFE subwoofer, the LFE audio track will be spread into all front and rear subwoofers.

PCM 5.1 / 7.1

- Include a Center Speaker in order not to require post processing for having the dialogue from the center channel mixed into the Left/Right speakers. Post processing will result in a reduction of the dynamics of the overall performance.

- With smaller front speakers, using two Subwoofers in a Left/Right configuration will improve the left/right panning and the overall stereo performance.

Dolby Surround

- A combination of high-quality, low-level surround speakers is essential for a good surround sound experience. Rather use the budget for a good basic surround sound system than spread the budget on a 3D setup with mediocre speakers.

- No matter WHERE these speakers are positioned in the room, these speakers MUST be specified as Center (C), Left and Right Surround (LS-RS) – and optionally Left and Right Rear Surrounds (LRS-RRS).

Dolby Atmos / DTS:X

-If you want to add TWO high-level speakers in order to improve the 3D performance, you MUST specify these as Left and Right Top Middles (LTM-RTM). This will ensure that all the audio designed to be over your head will be routed correctly. Position of these speakers should be according to Dolby's recommendations for optimal performance.

- If you want to add FOUR high-level speakers, you MUST specify these as Left and Right Top Fronts (LTF-RTF) and Left and Right Top Rears (LTR-RTR) no matter how you actually position these speakers in the ceiling. Position of these speakers should of course be according to Dolby's recommendations for having the optimal experience.

- You will not have any benefit from adding a Top Speaker (TOP aka. Voice of God), as this speaker designation is not recognized by these decoders.

Note: DTS:X is a format using up to 12 speakers in decoding and postprocessing. DTS:X Pro has the capacity of decoding/processing up to 16 speakers.

AURO

- In order to have the optimal performance from the Auro decoder and post processing, the speakers should be positioned according the Auro recommendations and in this menu, they should be designated Height Speakers and optionally as Top Speaker.

- Position of these speakers should of course be according to Auro's recommendations for having the optimal experience.

Bass Management

Speaker Cutoff Frequency

For all the speakers in the system, a speaker size must be chosen. The speaker size informs the system of how much bass, the speaker is capable of playing, by selecting a cutoff frequency. Signal below this frequency will then be redirected to another speaker or subwoofer in the system.

Available selections for speaker size are:

- None (Means the output is unused)
- XXL and XL (Plays full range signal, the difference will be explained later in the document)
- L (Cutoff frequency 40Hz)
- M (Cutoff frequency 80 Hz)
- S (Cutoff frequency 100Hz)
- XS (Cutoff frequency 120Hz)
- Custom (User selectable cutoff frequency)

Which cutoff frequency should you choose?

When selecting a cutoff frequency for your speakers, you should select a frequency higher than the lowest frequency, your speaker is able to play.

If the redirected bass will be played by a subwoofer (and not a full range speaker), you should also make sure that the cutoff frequency is lower than the highest frequency the subwoofer can play.

XL and XXL Speakers

Selecting the speaker size as XL or XXL designate the speaker as capable of playing a full range signal. The difference is, that the XXL-size tells the system, that the speaker can also play bass from other channels in the system.

The system can only redirect bass to XXL speakers placed at the LF/RF, LS/RS and LRS/RRS positions.

In a system with front/rear subs present, there will be no difference between XL and XXL, since the redirected bass is played by the subs instead.

In a system with only an LFE sub, the LFE sub will be playing the LFE channel, while the XXL speakers will be playing the redirected bass.

In a system with no subs at all, the XXL speakers will be playing the redirected bass as well as the LFE channel.

When XXL speakers are playing the redirected bass, the system will distribute the channels on Left and Right side. This means that in a setup with XXL speakers in front for instance, while the bass from the center channel will be split into both left and right front speakers, the bass from the left surround channel will be played only by the left speaker and the bass from the right surround speaker will be played only by the right front speaker.

Similarly, when there are XXL speakers in front as well as the surround or rear speakers, the system will distribute channels between them. For instance, a Dolby Atmos setup with 4 top channels and XXL on both front and surround will send bass from LTF and RTF channels to the front speakers, while bass from LTR and RTR channels will be send to the surrounds.

Normally a system without any subs will need to have XXL speakers to receive LFE and redirected bass. There is however one exception; it is possible to make a system without subs and with all XL speakers. Since there is no redirected bass, the system can handle this without XXL speakers, but in such a system, the LFE channel will not be played by any speakers.

Front and Rear Subs

The front and rear subs in the speaker setup is a way to add more than a single sub to the system. Typically, the front subs will be placed in each corner behind the front speakers, while the rear subs are placed in the corners of the room behind the listening position. It is possible to use front/rear subs alone or in combination with an LFE sub.

If front/rear subs are used without an LFE in the system, they will play both the LFE channel and the redirected bass.

If front/rear subs are used in combination with an LFE sub, then the LFE sub will play the LFE channel while the front/rear subs will play the redirected bass.

When front/rear subs are playing the redirected bass, the system will distribute the channels on left and right side and between front and rear the same way as was mentioned for XXL speakers.

When setting up the subs, there is an option to select the size of the sub. This frequency is only used to add a low pass filter to the LFE channel. So, if the subs are not playing LFE, then this setting has no effect. If subs are playing the LFE, then the LFE channel will be low pass filtered before being send to the subs. This setting has no influence on the redirected bass, the filter frequency for that has already been selected when setting up the speakers.

LFE Sub

The LFE sub is the traditional LFE subwoofer output.

When used in combination with either XXL speakers or front/rear subs, the LFE sub will only play the LFE channel.

When used alone, the LFE sub will play the LFE channel as well as the redirected bass.

According to the Dolby specifications, this channel should only contain audio up to 120 Hz. In practice it has been found to occasionally hold audio with much higher frequencies, which is why it possible to select a Low Pass filter for this channel, if your subwoofer cannot reproduce these frequencies. It is possible to add a cut-off for the LFE channel and you can choose to direct the higher frequencies to the Left and Right Front speakers if they have the capacity to perform this audio as well.

When setting up the LFE sub, there is an option to select the size of the sub. This frequency is only used to add a low pass filter to the LFE channel. This setting has no influence on the redirected bass, the filter frequency for that has already been selected when setting up the speakers.

Gain

For each speaker channel you can adjust the gain. This is used to roughly even out the levels of all speakers with relation to the gain in each amplifier channel and sensitivity and distance to the speaker. Use a sound pressure measuring application for your phone, while activating the Verify Speakers feature. This would only be for ensuring, that all speakers are within the optimal measurement levels, when RoomPerfect™ will perform the final calibration.

Amplifier Delay

The objective with this setting is to easily adjust for differences in delays through the connected amplifiers. This could be related to using Subwoofer(s) with digital processing, which employ an A/D plus a subsequent D/A conversion causing a delay to the signal passing. Adding a delay to a subwoofer output will result in the signal to all other outputs to be delayed accordingly.

Bi-amping

For the front speakers, it is possible to select an option to use bi-amping. By enabling this option, the system will route a copy of the signal for the left and right front speakers to a pair of the AUX outputs.

This signal is an exact copy of the existing signal for the front speakers. If the front speakers have been given a size with a cutoff frequency, that high pass filter is applied to these outputs as well. This means it is possible to use bi-amping for speakers and still have bass management redirect the bass to a sub instead.

Natural Roll-off

When natural roll-off is used, it means that the main speaker will receive the full range signal and be allowed to roll-off naturally as it would do on its own. The bass cutoff frequency will still be used to

send the bass to a subwoofer or XXL speaker, but it will not be applied to the main (high pass) output.

This feature is used for speakers which have an abrupt decline in their capacity for low frequencies, and you need to have the cross-over frequency very close to this lowest capacity, as having the cut-off filter on top of the abrupt natural decline would result in a poor integration with the subwoofer. The feature should NOT be used to increase the overall bass output, as having the same bass part played by two units simultaneously will result in serious phase problems and deteriorate the subsequent RoomPerfect™ calibration.

Assignment of speakers to bass positions

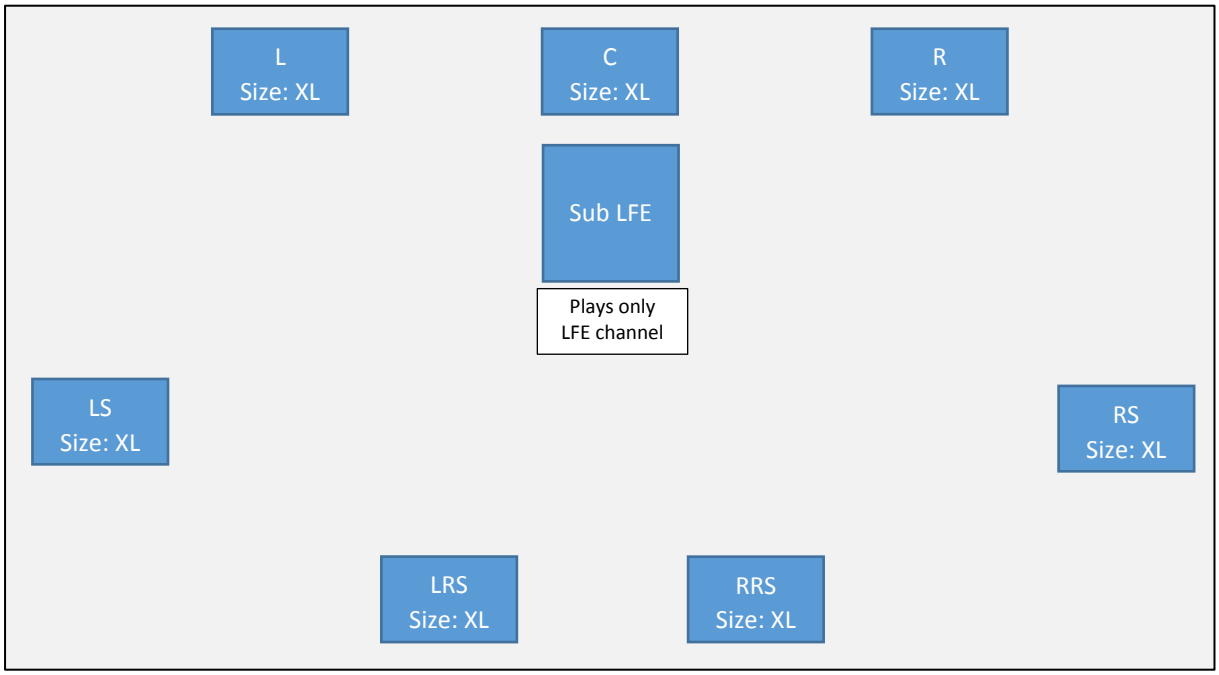
When XXL or front/rear subs are used, the redirected bass from speakers will be distributed to left or right side and when rear subs or XXL surround or rear speakers are involved also between front and rear. This table shows, where each speaker has their bass directed to in these situations.

Position	Description	Left / right	Front / rear
L	Left	Left	Front
R	Right	Right	Front
C	Center	Both	Front
LS	Left surround	Left	Rear
RS	Right surround	Right	Rear
LRS	Left rear surround	Left	Rear
RRS	Right rear surround	Right	Rear
CB	Center back	Both	Rear
LW	Left wide	Left	Front
RW	Right wide	Right	Front
LTF	Left top front	Left	Front
RTF	Right top front	Right	Front
LTM	Left top middle	Left	Front
RTM	Right top middle	Right	Front
LTR	Left top rear	Left	Rear
RTR	Right top rear	Right	Rear
HL	Height left	Left	Front
HR	Height right	Right	Front
HLS	Height left surround	Left	Rear
HRS	Height right surround	Right	Rear
HC	Height center	Both	Front
TOP	Top ceiling / VoG	Both	Front

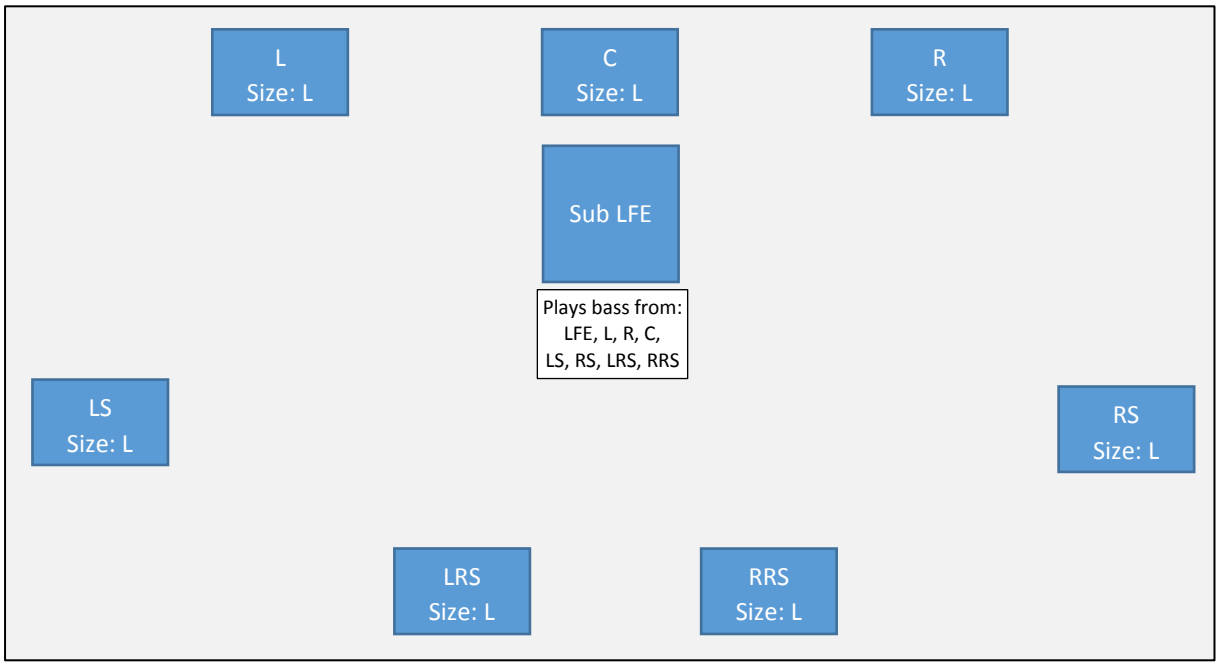
Bass Management Examples

The following examples show some different setups and how the bass is routed in them. The examples only mention where the LFE channel and the redirected bass is played; the high part of any channel is always played by the speaker for that channel. The same goes for bass that is not redirected, so this will not be specifically mentioned.

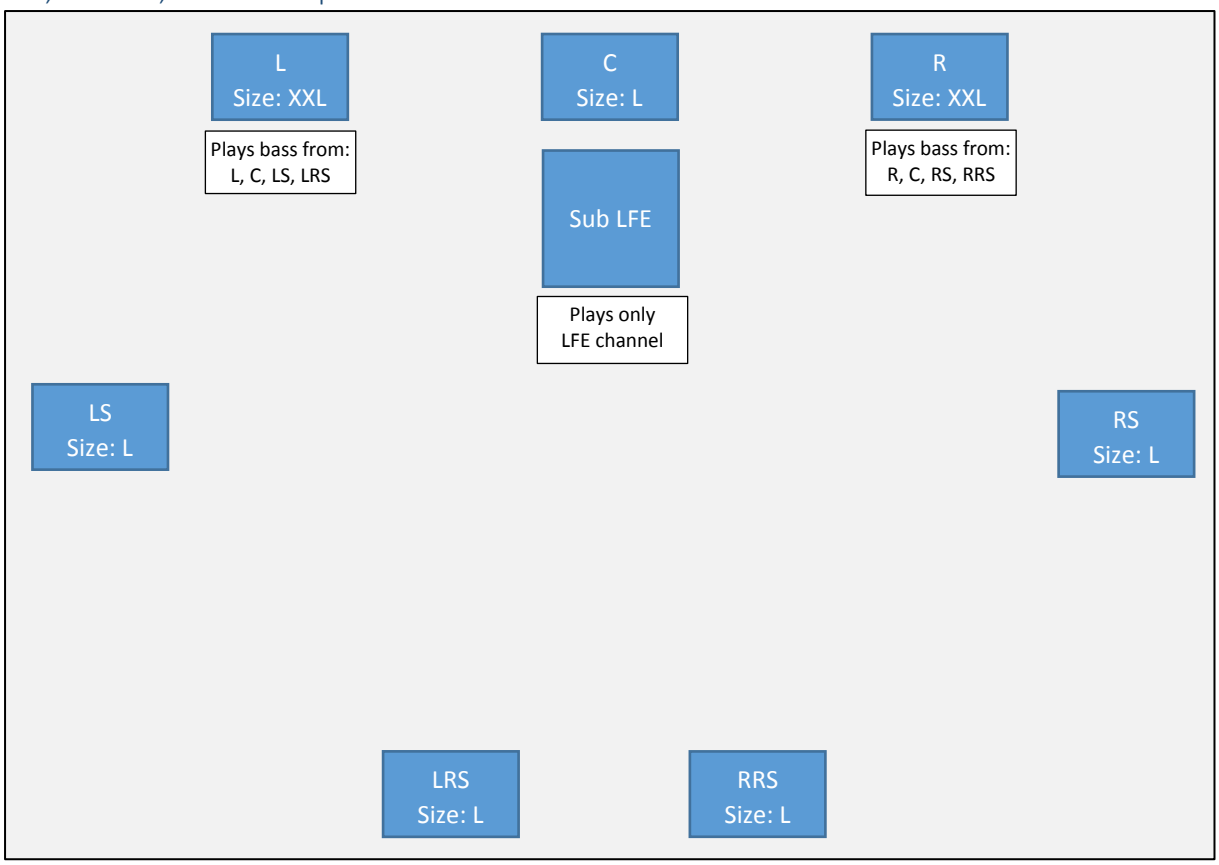
7.1, LFE Sub, all XL speakers



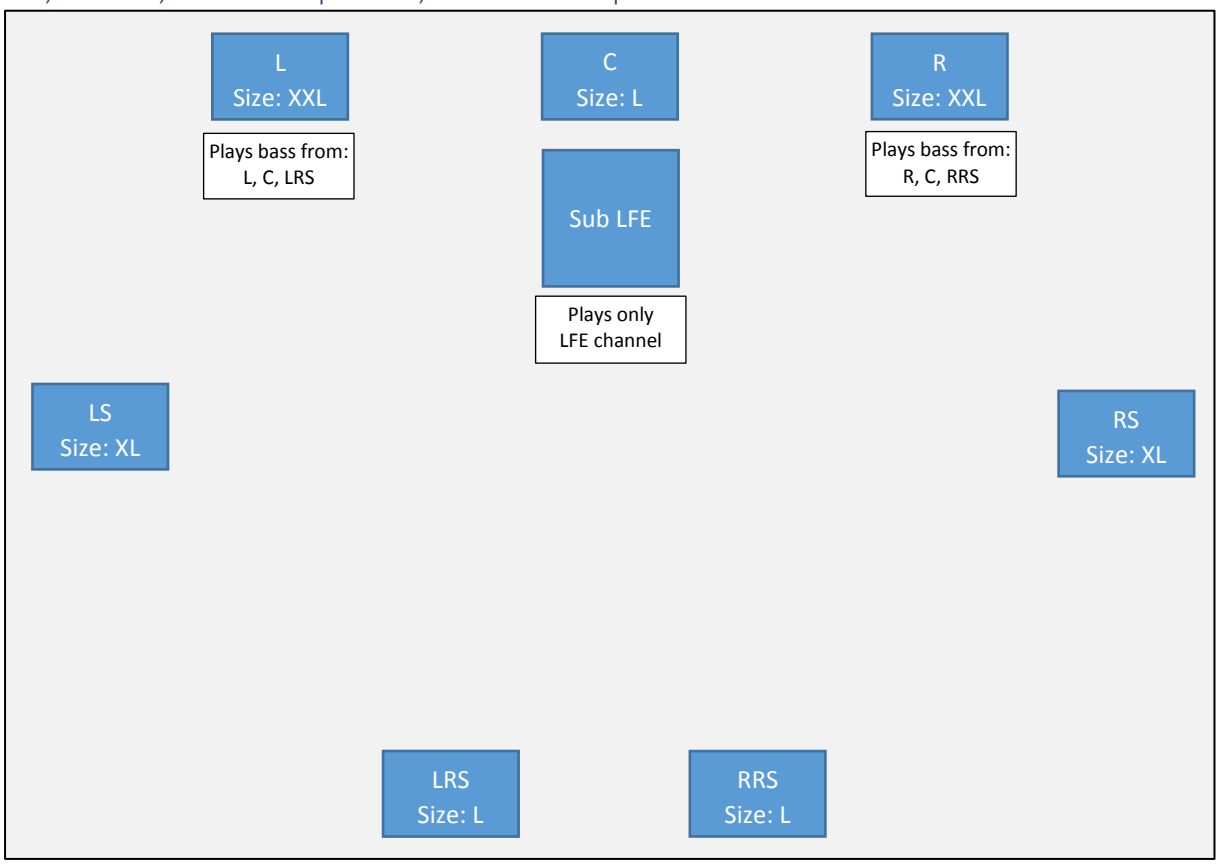
7.1, LFE Sub



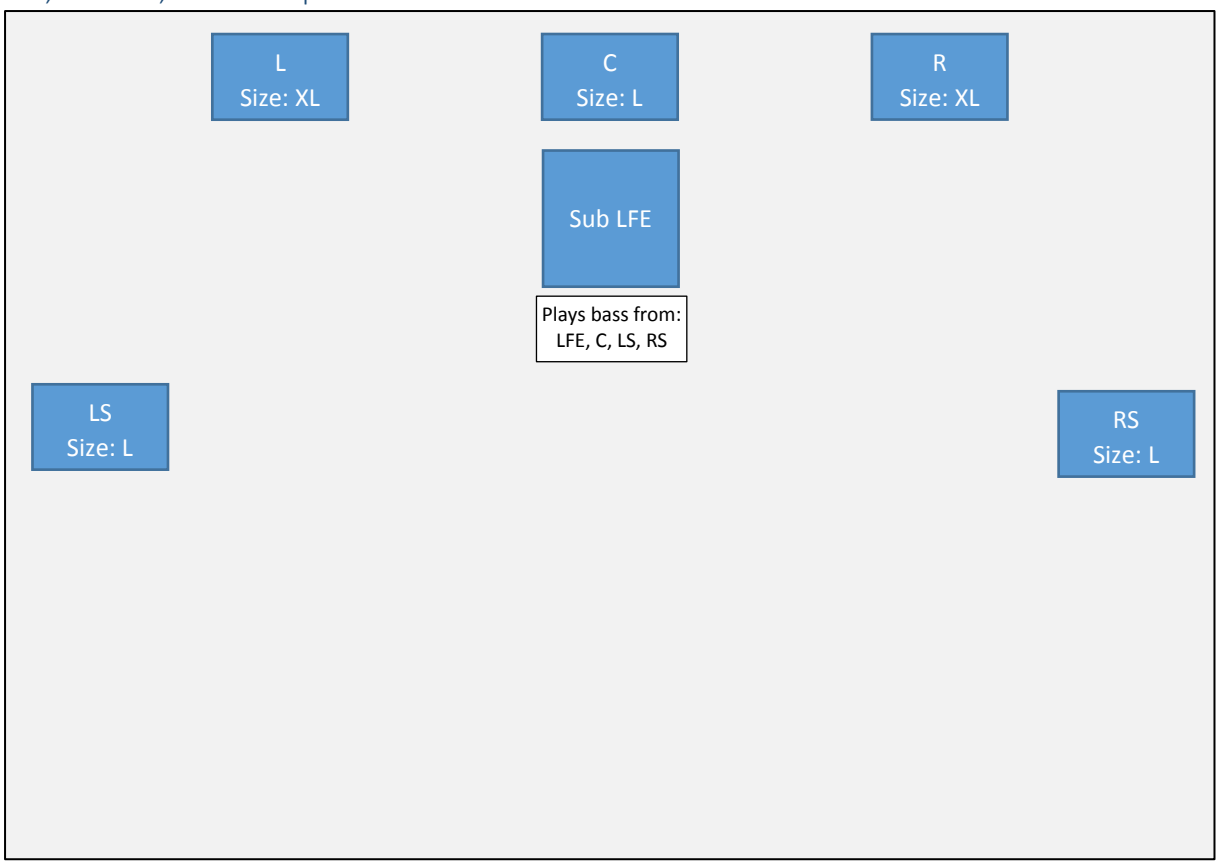
7.1, LFE Sub, Front XXL Speakers



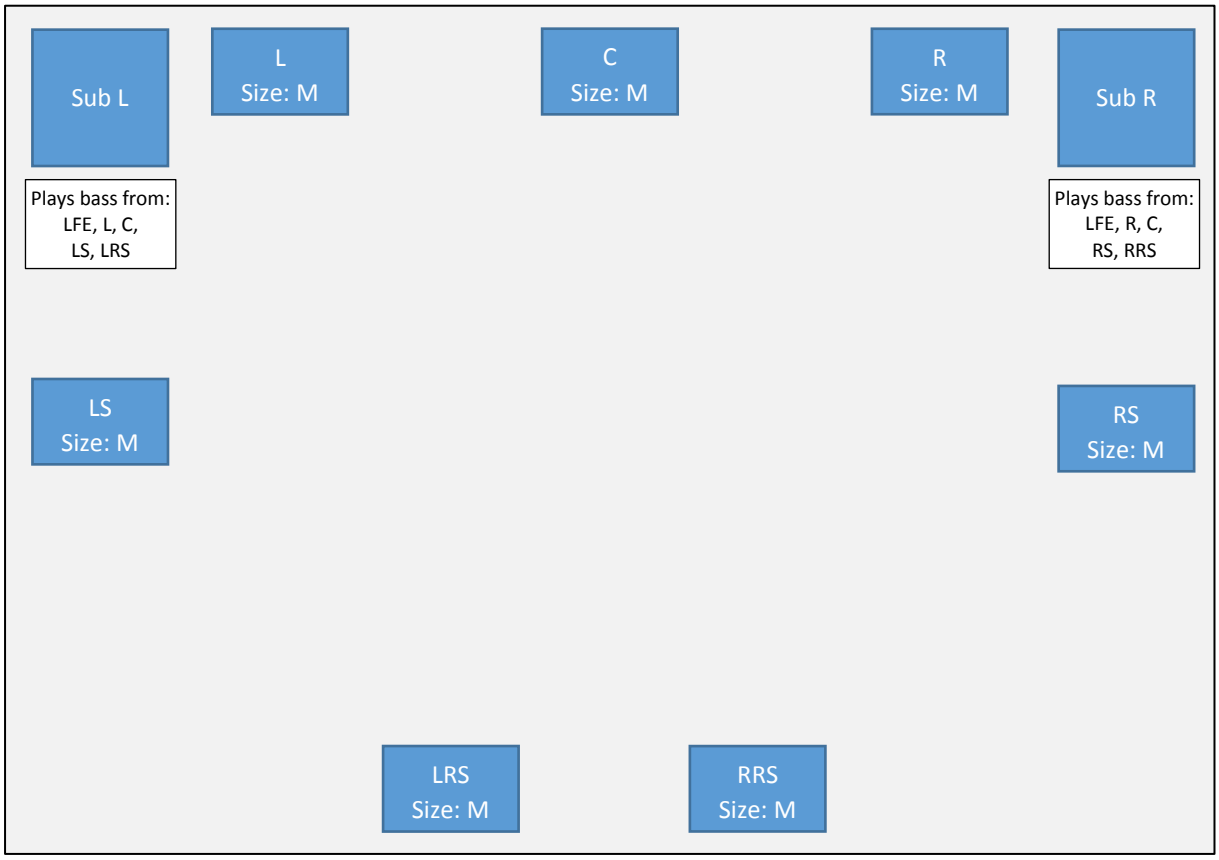
7.1, LFE Sub, Front XXL Speakers, Surround XL Speakers



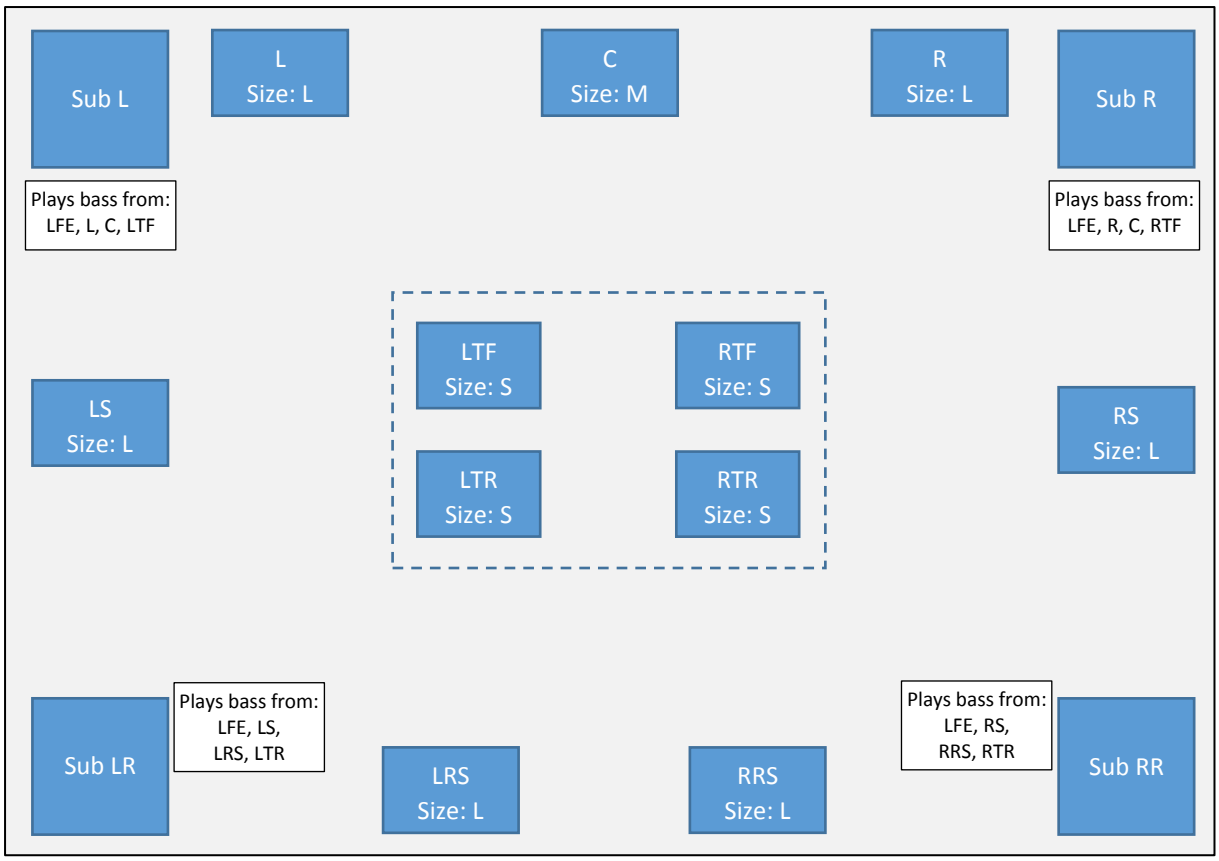
5.1, LFE Sub, Front XL Speakers



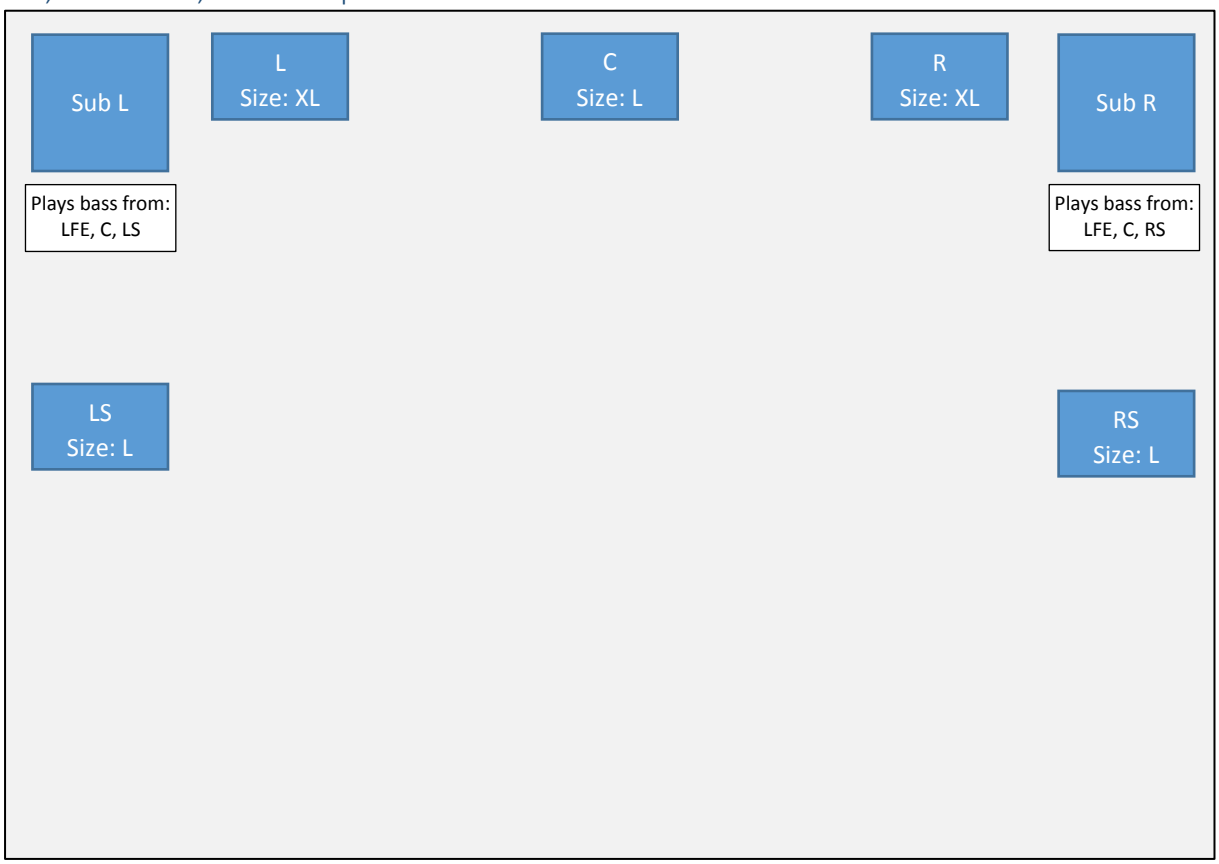
7.1, Front Subs



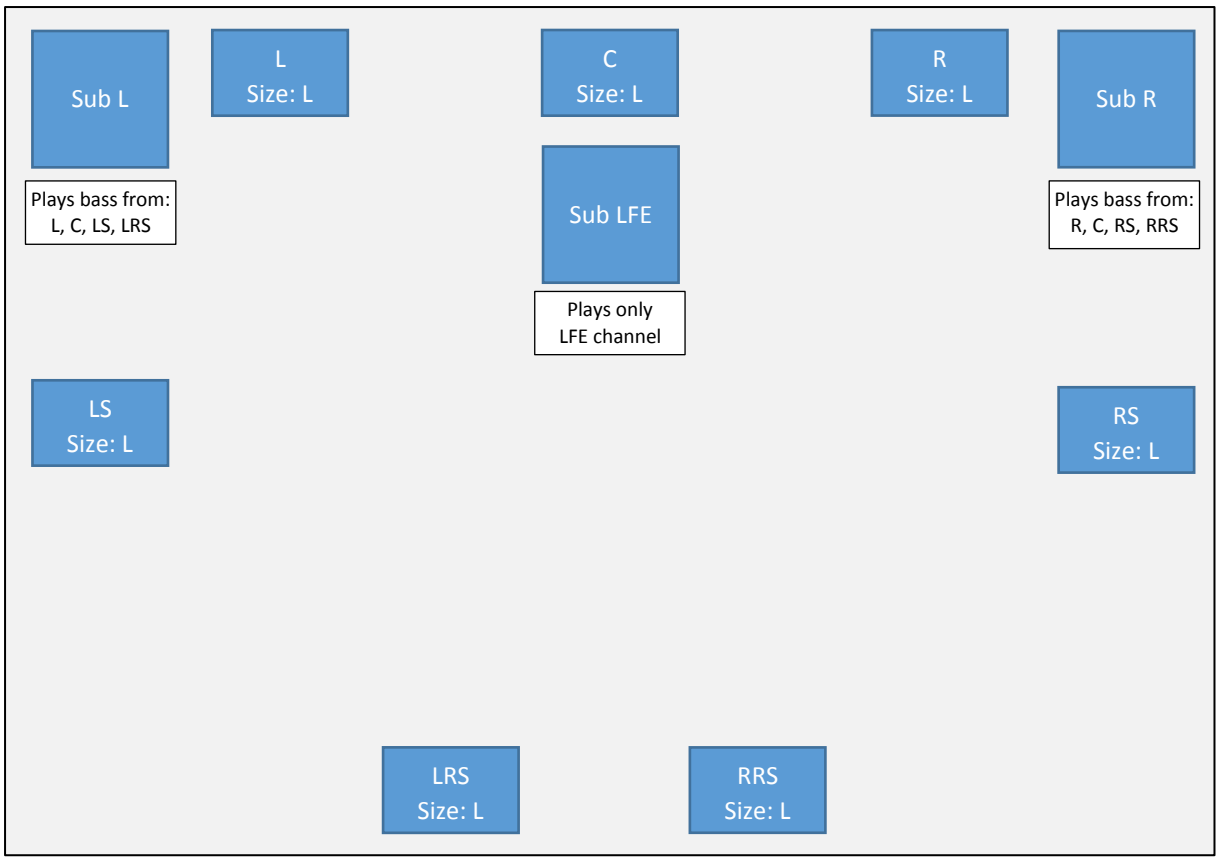
7.1.4, Front and Rear subs



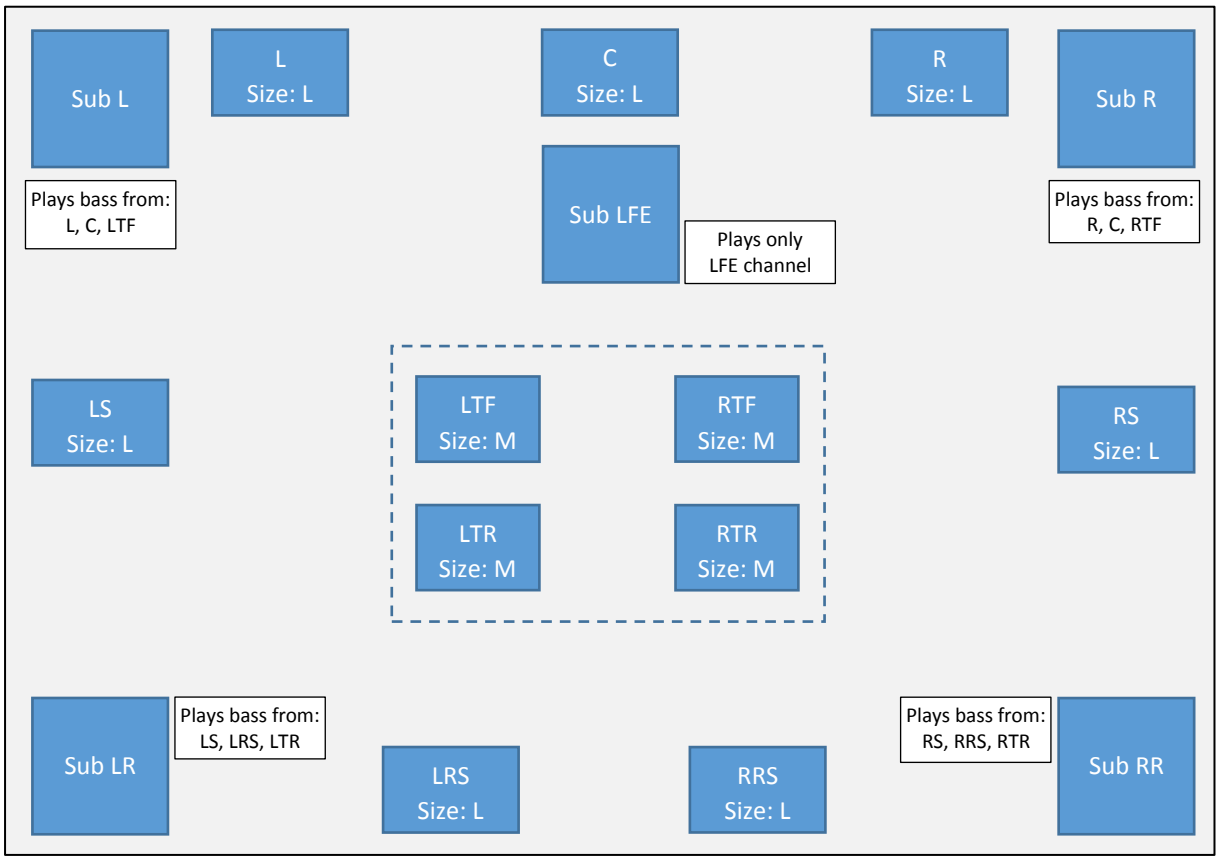
5.1, Front Subs, XL Front Speakers



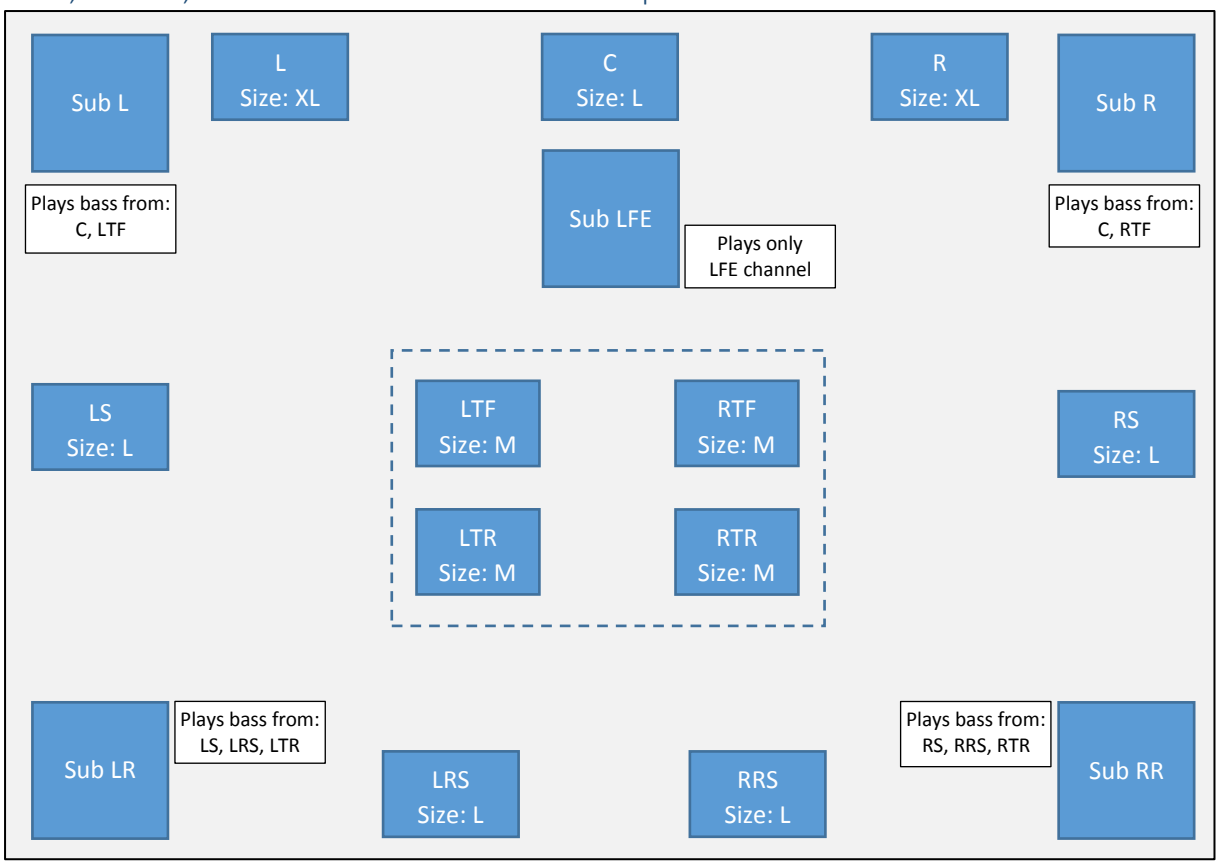
7.1 LFE Sub and Front Subs



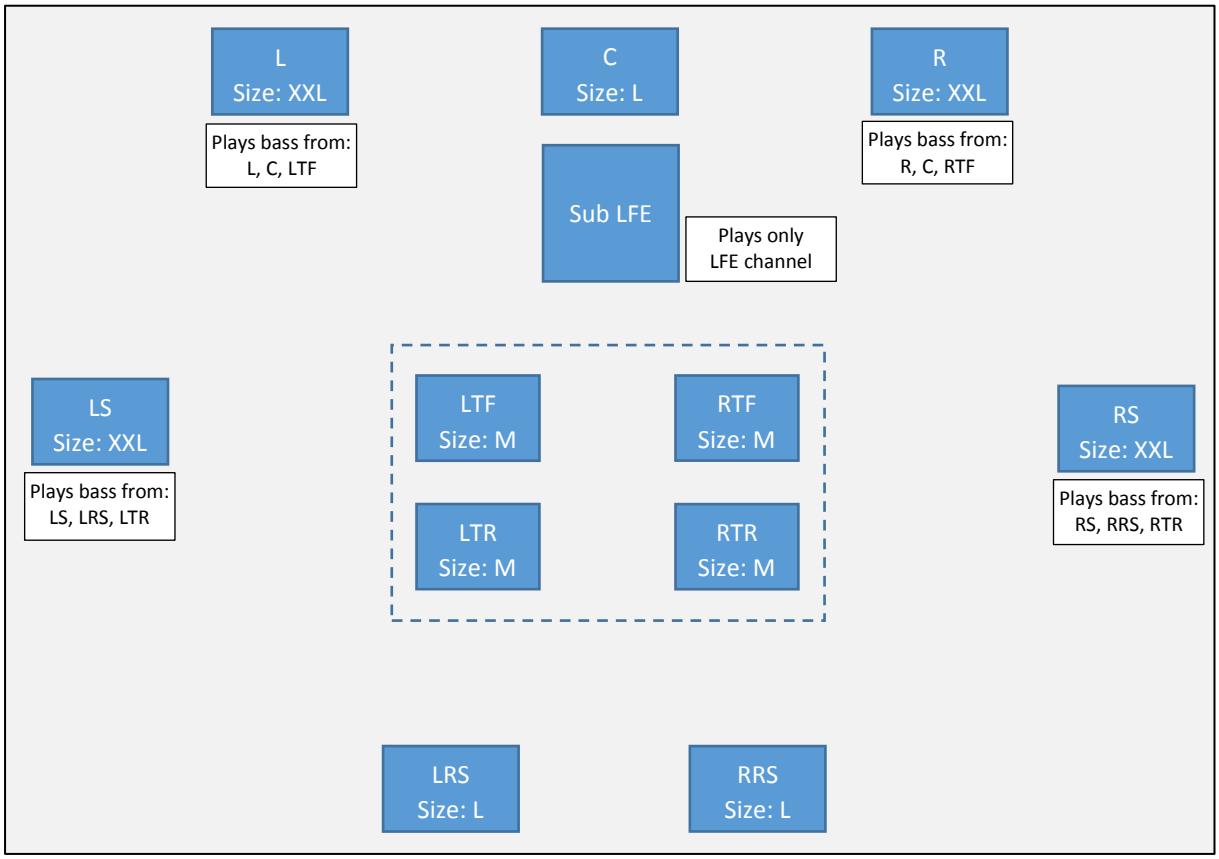
7.1.4, LFE Sub, Front and rear Subs



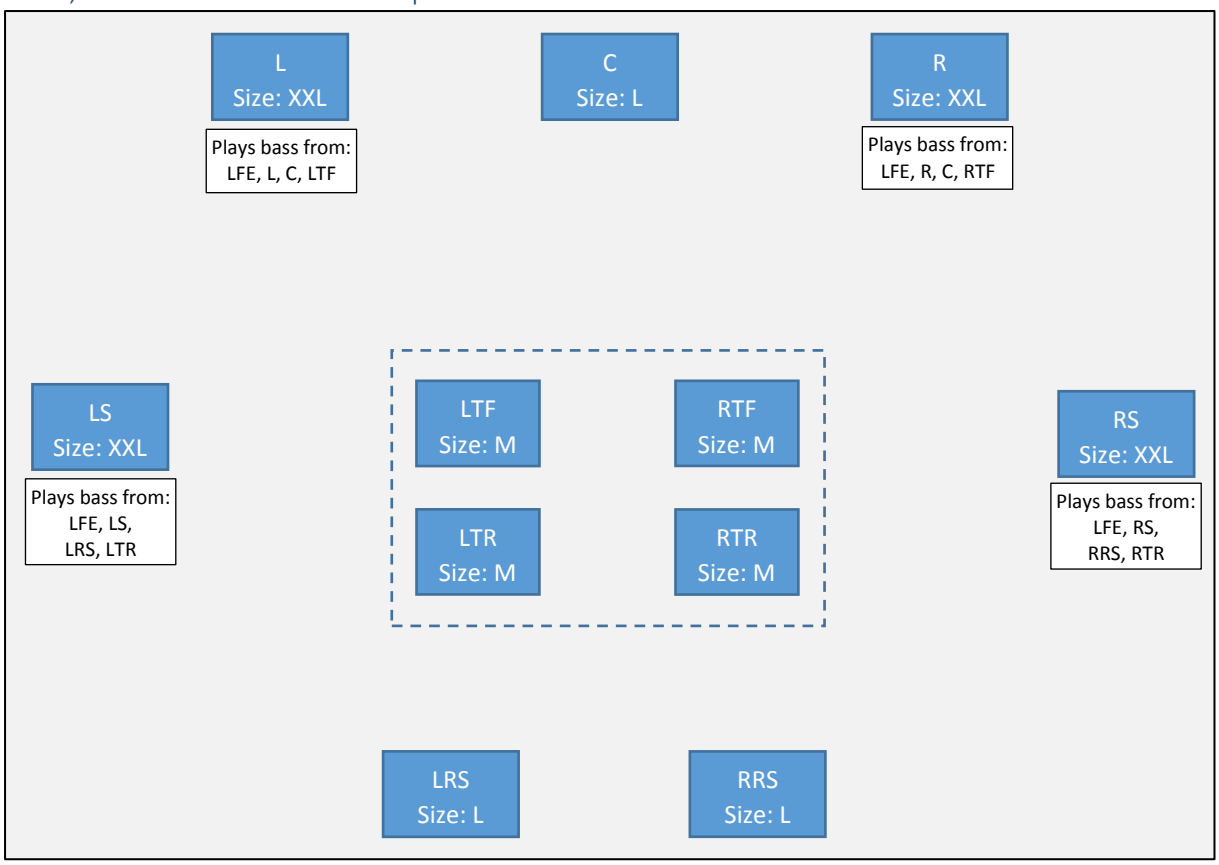
7.1.4, LFE Sub, Front and rear Subs and XL Front Speakers



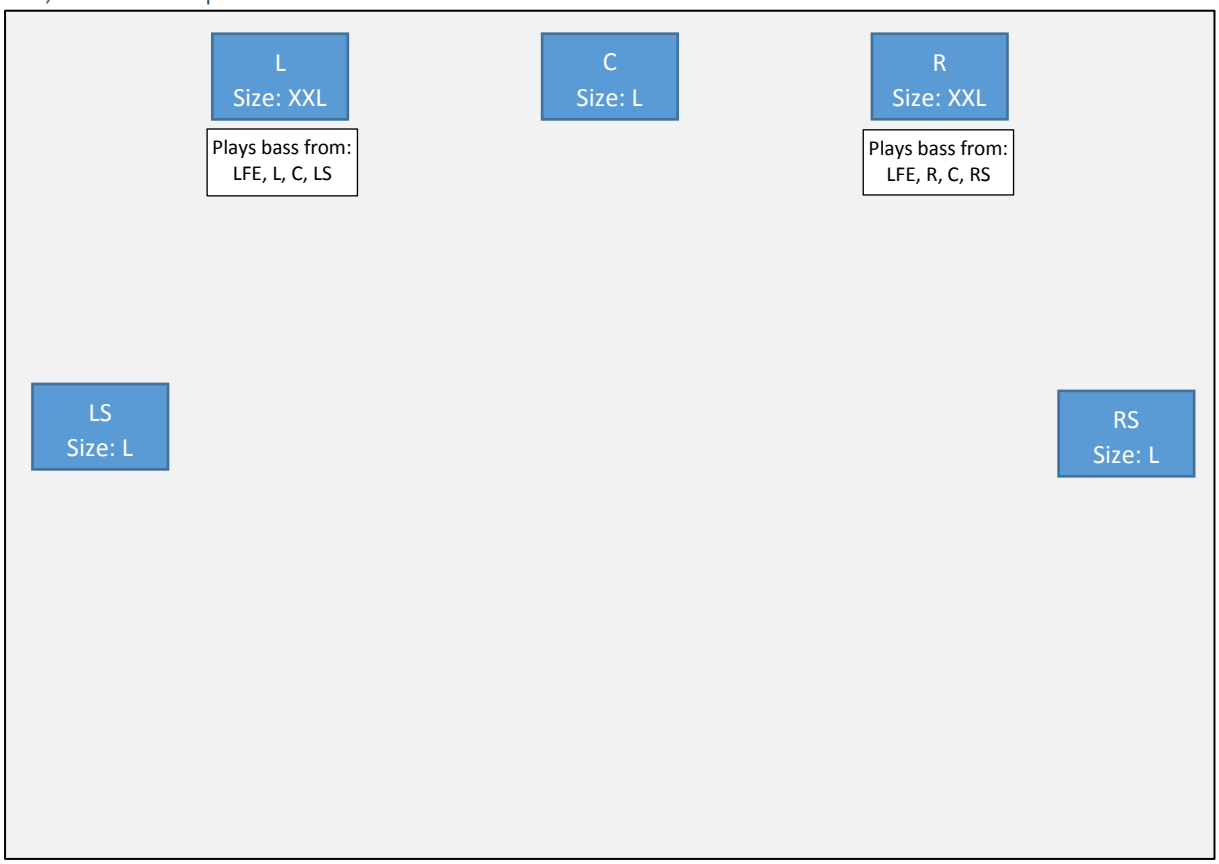
7.1.4, LFE Sub and XXL Front and Surround Speakers



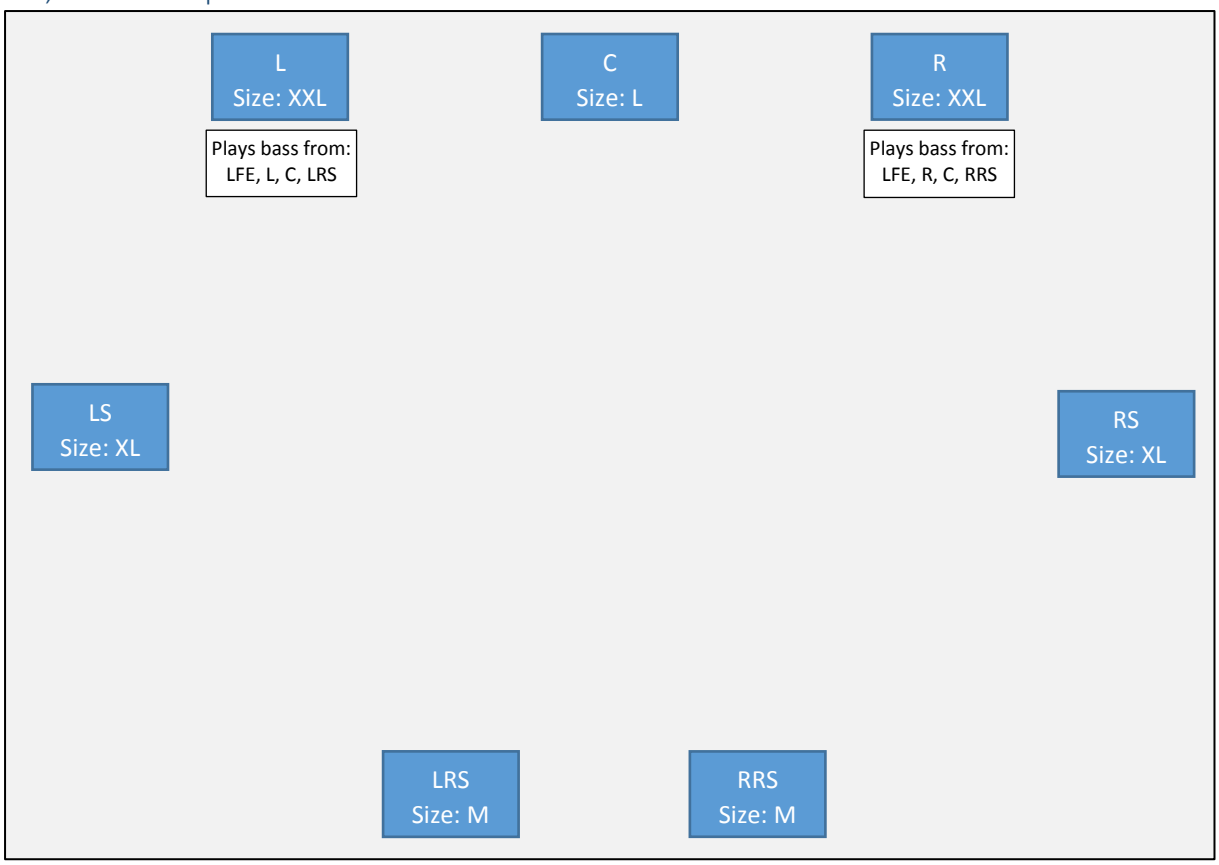
7.1.4, XXL Front and Surround Speakers



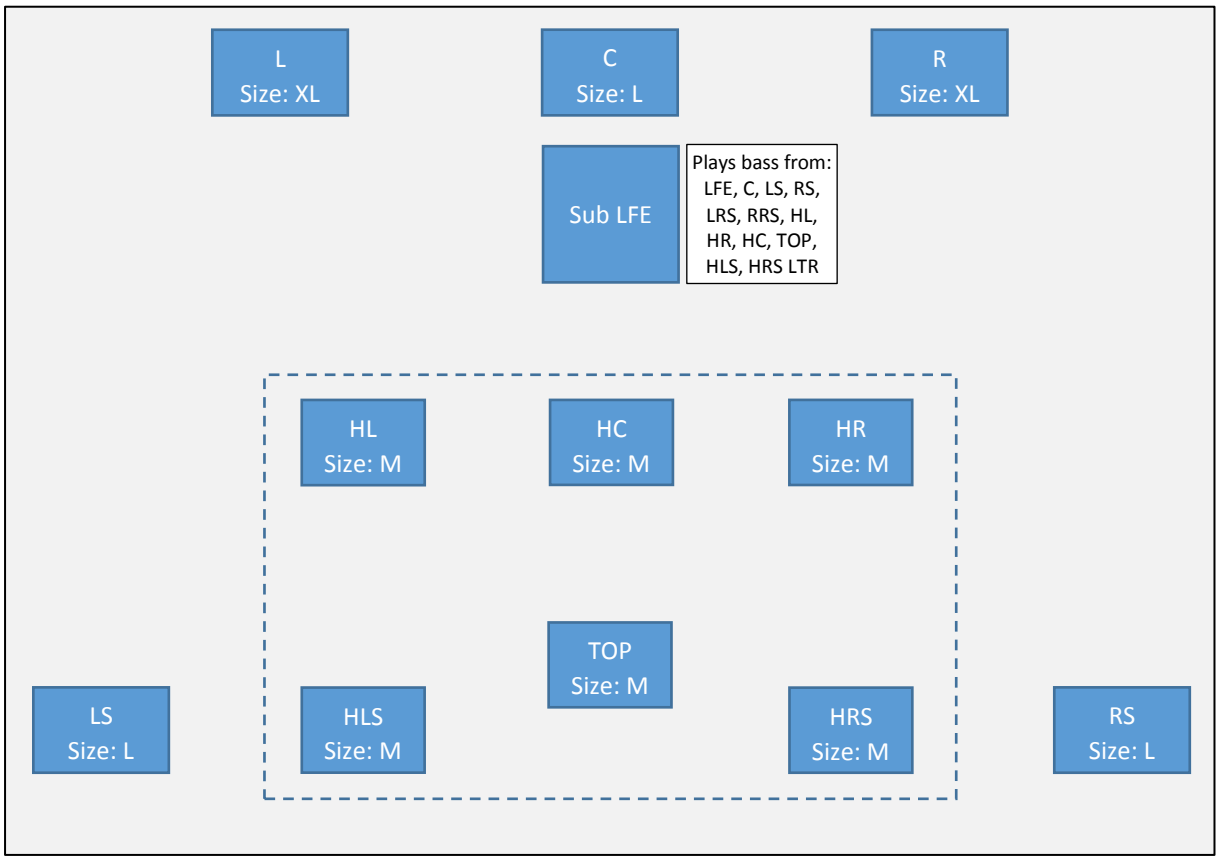
5.1, XXL Front Speakers



7.1, XXL Front Speakers and XL Surrounds



11.1, LFE Sub



Dolby Atmos and Auro-3D

The system supports Dolby Atmos as well as Auro-3D. The speakers supported for those two systems are:

Auro-3D:

- HL (Height Left)
- HC (Height Center)
- HR (Height Right)
- HLS (Height Left Surround)
- HRS (Height Right Surround)
- TOP (Top ceiling, AKA VoG / Voice of God)

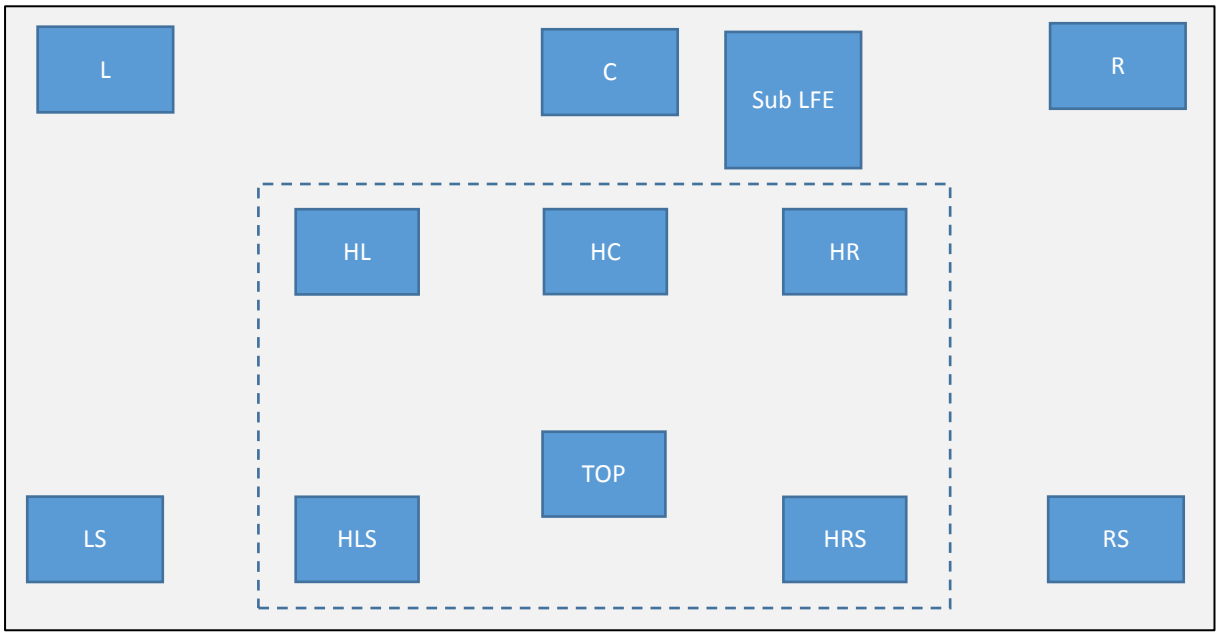
Dolby Atmos:

- LTF (Left Top Front)
- RTF (Right Top Front)
- LTM (Left Top Middle)
- RTM (Right Top Middle)
- LTR (Left Top Rear)
- RTR (Right Top Rear)
- LW (Left Wide)
- RW (Right Wide)

If Dolby Atmos material is played in an Auro-3D setup, the system will try to match the Auro-3D specific speakers to the nearest Dolby Atmos equivalent, the same goes for playing Auro-3D material on a Dolby Atmos setup. The system will also handle hybrid setups with both types of speakers.

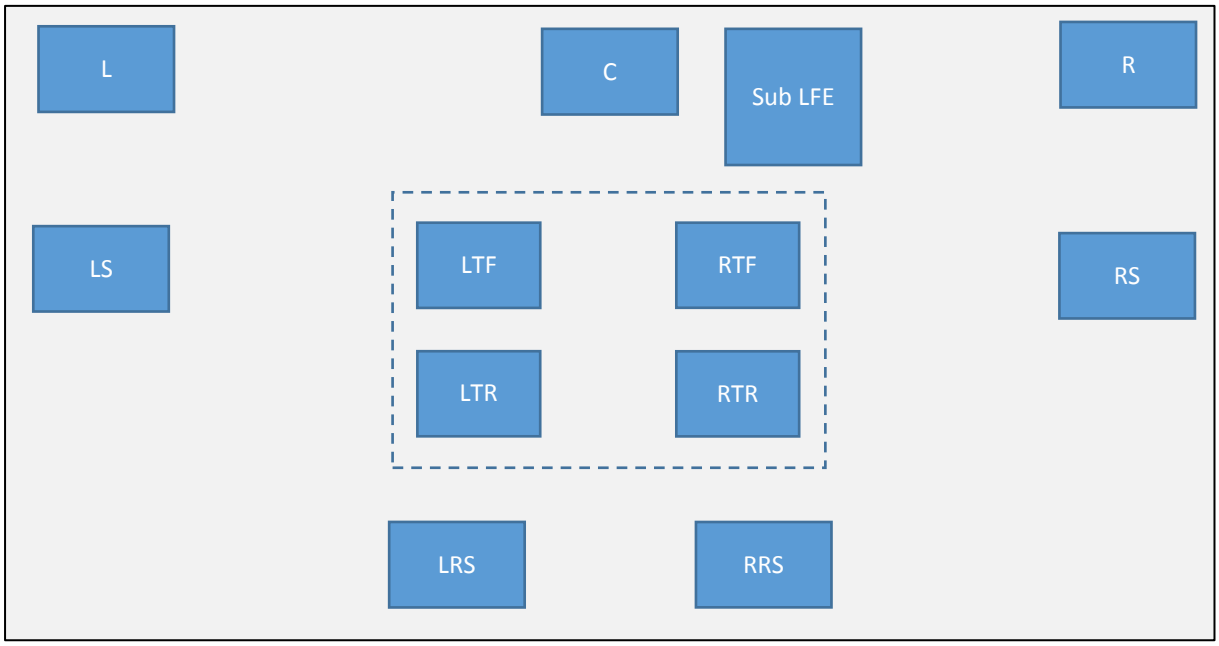
Note: Some speakers might not be playing, when you play one format of audio on a speaker setup using the designations of another format.

Auro-3D example: 11.1



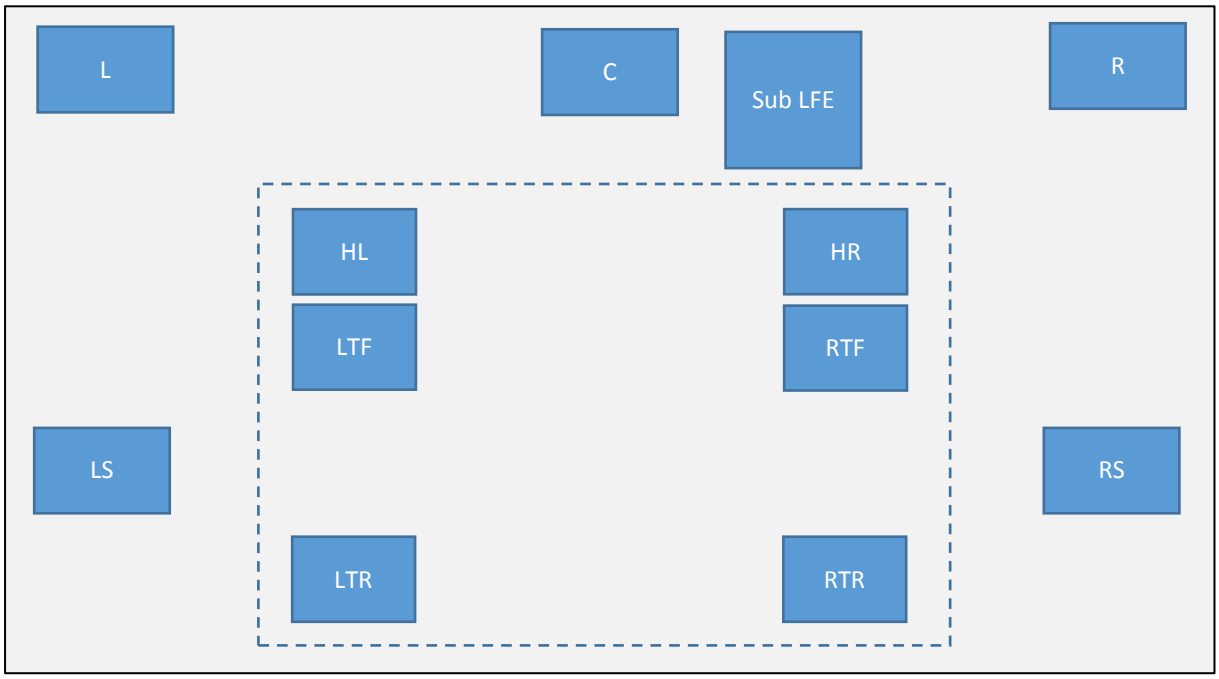
If Dolby Atmos material is played on the above Auro-3D setup, the system will match the speakers, so the LTF/RTF channels are played through the HL/HR speakers and the LTR/RTR channels are played through the HLS/HRS speakers. The HC and TOP speakers will not be used.

Dolby Atmos Example: 7.1.4



If Auro-3D material is played on this setup, the system will play the HL/HR channels through the LTF/RTF speakers and the HLS/HRS channels through the LTR/RTR speakers. The LRS and RRS speakers will not be used.

Hybrid Auro-3D and Dolby Atmos Example



In this Hybrid system, there are LTF/RTF and LTR/RTR speakers for Dolby Atmos, while there are only HL/HR speakers for Auro-3D. Playing back Dolby Atmos material in this system will use the LTF/RTF and LTR/RTR speakers as usual, while not using the HL/HR speakers. When playing back Auro-3D material in this setup, the system will map the HLS/HRS channels to the LTR/RTR speakers, so the

HL/HR speakers and the LTR/RTR speakers will be playing the HL/HR and HLS/HRS channels respectively.

Dolby-enabled speakers

For Dolby Atmos setups, it is possible to add Dolby Enabled Speakers instead of using top speakers mounted in the ceiling.

Dolby Enabled Speakers are extra speakers placed on top of or build into the speakers on the main positions in the system (front, surround and rear surround). These extra speakers fire sound upwards toward the ceiling. The sound is then reflected to give the listener the sound from above without having actual top speakers installed.

To add Dolby Enabled Speakers to your system, add them to the speakers, they are placed on top of. So, if you have Dolby Enabled Speakers on top of your front and surround speakers, go to the settings for these speakers and activate the Dolby Enabled Speaker option. This will then give you the option to select the size of the Dolby Enabled Speaker. Once this is done, the system will find out which signal is to be routed for this speaker and will add an output for it.

Notice that playback of Auro-3D material will not make use of Dolby Enabled Speakers.

Verify speakers

This menu allows you to do check the connections of speakers and amplifiers to the correct outputs of the processor.

Adjust Sub

As the subwoofers are handling the bass information from multiple speaker channels, it is essential that the subwoofer(s) are aligned with each other and with the relevant speaker channels. Without alignment you risk having an inferior performance due to stress on the subwoofer's internal amplifier.

With one or more active subwoofer(s) connected to the MX180, this menu will guide you into setting the volume level on each subwoofer's controls. Follow the instructions on the display to go through two phases:

1. Find the correct **system volume** to do the Subwoofer adjustment (tones through speakers)

2. Adjust the volume setting **on each subwoofer** for the RoomPerfect™ calibration. Instructions on the screen.