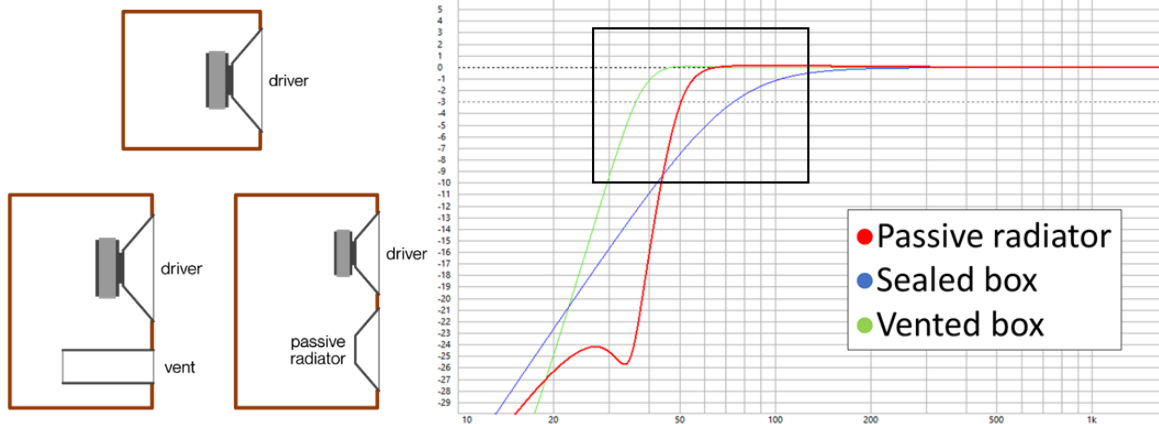


Exploration of Loudspeakers with Passive Radiators

A passive radiator is a membrane that can be integrated in a loudspeaker to amplify the bass sound. This loudspeaker variant has advantages when space and power are limiting factors and is well suited for exposure in outdoor environments.

There is no universal answer to what defines a good loudspeaker. First, sound is a complex phenomenon that can be evaluated from several aspects. Furthermore, it is of subjective character which means that people will assess the same sound differently. When designing a loudspeaker, it is also important to balance trade-offs regarding features and sound quality e.g., should the speaker be waterproof, should it be portable, should it produce loud bass etc.

The three most typical loudspeaker variants are the sealed enclosure, vented enclosure, and enclosure with passive radiator. They all have different advantages and disadvantages. It is more complex to design a loudspeaker incorporating a vent or a passive radiator and requires fine-tuning to achieve expected sound output.



The three main types of loudspeakers

Typical frequency response for the main types of loudspeakers. The rectangle highlights where bass amplification occurs

This master's thesis was conducted in collaboration with a technology company that wishes to explore the potential of implementing passive radiators into future audio products. After studying loudspeaker fundamentals, five relevant parameters concerning passive radiators were identified. An investigation of several utilities and test methods was performed to allow for measurements and determination of these parameters. Prototypes of loudspeakers incorporating passive radiators were then developed to perform sound recordings.

By plotting the sound pressure against frequency, the passive radiators' bass amplification could be quantitatively analysed. For many of the passive radiators the results showed that they had too small of an impact on the bass sound to be able to draw any significant conclusions. This may have depended on that the loudspeakers served a general testing purpose, rather than being optimised for specific passive radiators. From the passive radiators that did show a larger impact on the bass, the comparison between their measured and simulated charts made it evident that the methods for measuring the five selected passive radiator parameters involved errors. The reason for these errors is left unknown, however the methods and the results are discussed in the report and may contribute to further investigations.