

Direct Radiating Phase Plug For Ring Radiator Tweeter

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Abstract

The two most commonly used membrane profiles for sound reproduction of the high frequency audio band are the dome shape and the annular shape.

The annular (also known as ring) shape has some different basic design features if compared to a dome with the same outer size.

For example, the annular membrane permits a smaller voice coil diameter, potentially reducing the total moving mass while limiting power dissipation. However, it includes a second surround involved in displacement and the presence of the added surround implies that the resulting emitting surface is slightly smaller than that of the dome.

Another key point is that the annular shape doesn't suffer from the soft dome apex anti-phase behavior above the breakup frequency, but it is characterized by a side anti-phase behavior.

Anyway, a direct radiating high frequency transducer using a ring-shaped diaphragm is called ring radiator tweeter and it can offer interesting acoustic performances. COMSOL Multiphysics® (coupling Magnetic Fields (mf) - Pressure Acoustics, Frequency Domain (acpr) - Solid Mechanics (solid) - Thermoviscous Acoustics, Frequency Domain (ta)) together with the LiveLink™ for SOLIDWORKS® are used as a unique environment platform for designing and simulating a digital twin of a typical ring radiator tweeter for automotive applications, analyzing some limits and improving them adding a new phase plug, radiating sound directly toward the listener area.

Then a physical prototype has been developed and its measurements have been compared with simulations of the digital twin. This solution is patent pending.

Figures used in the abstract

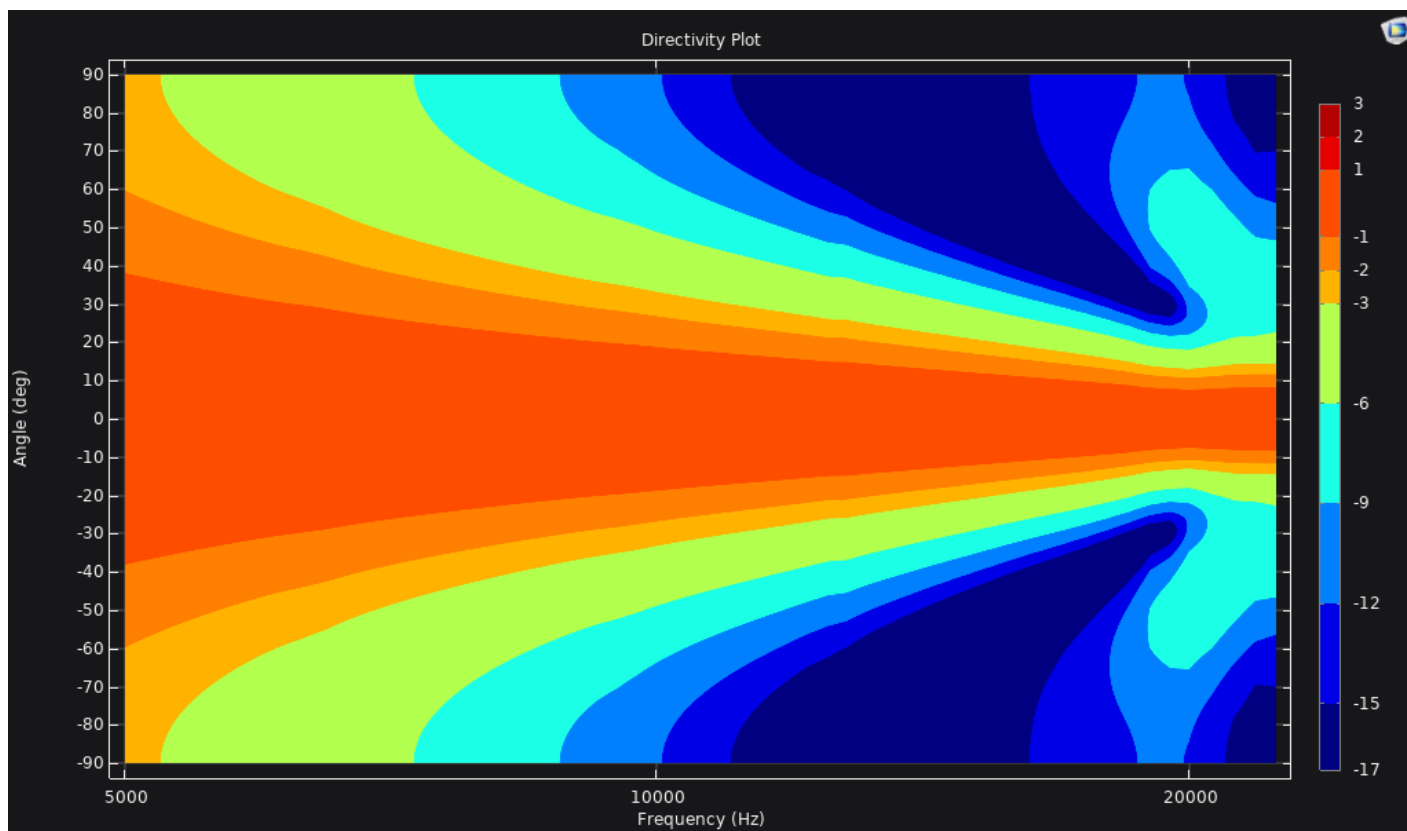


Figure 1 : Directivity TW Ring Radiator

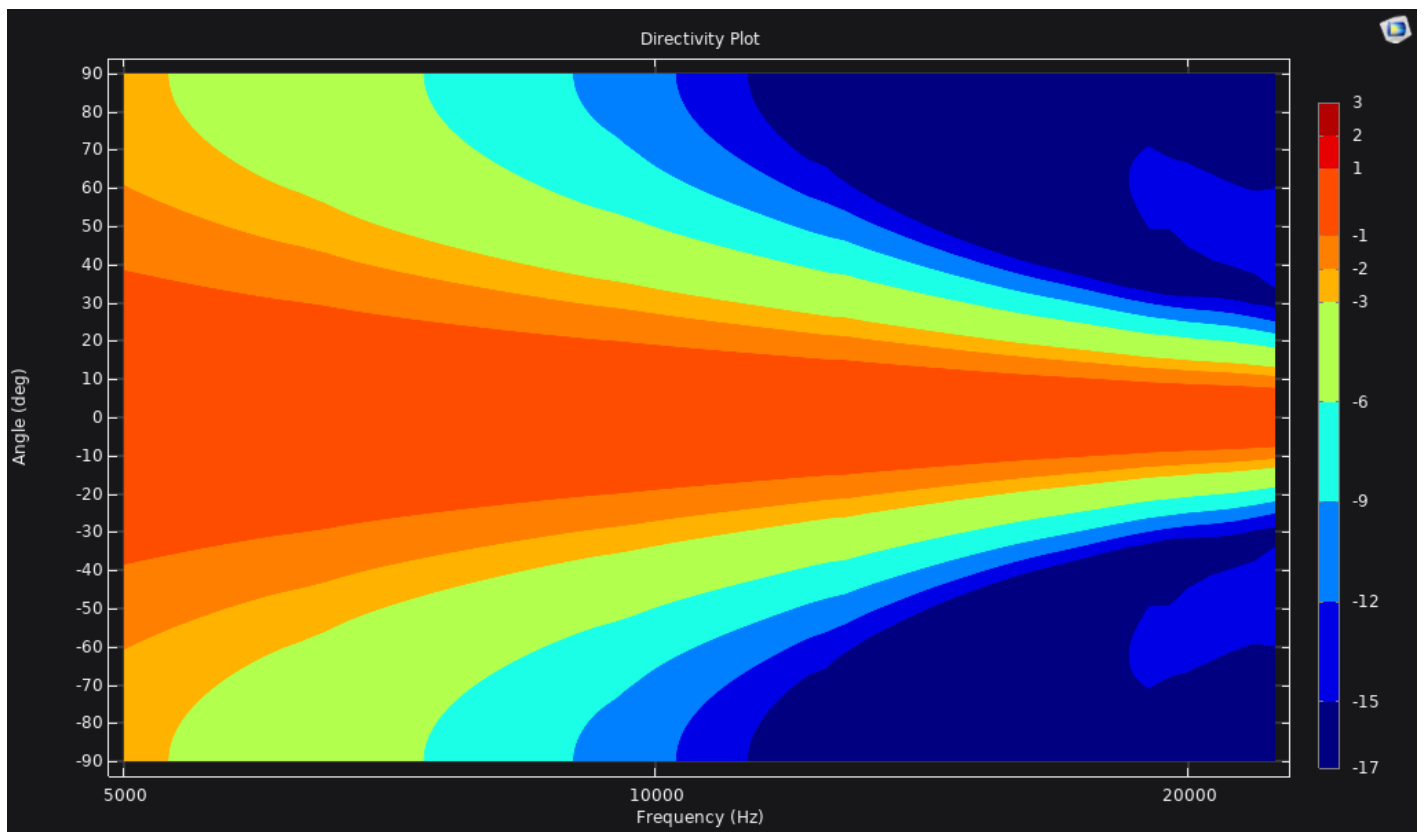


Figure 2 : Directivity TW Ring Radiator + Phase Plug

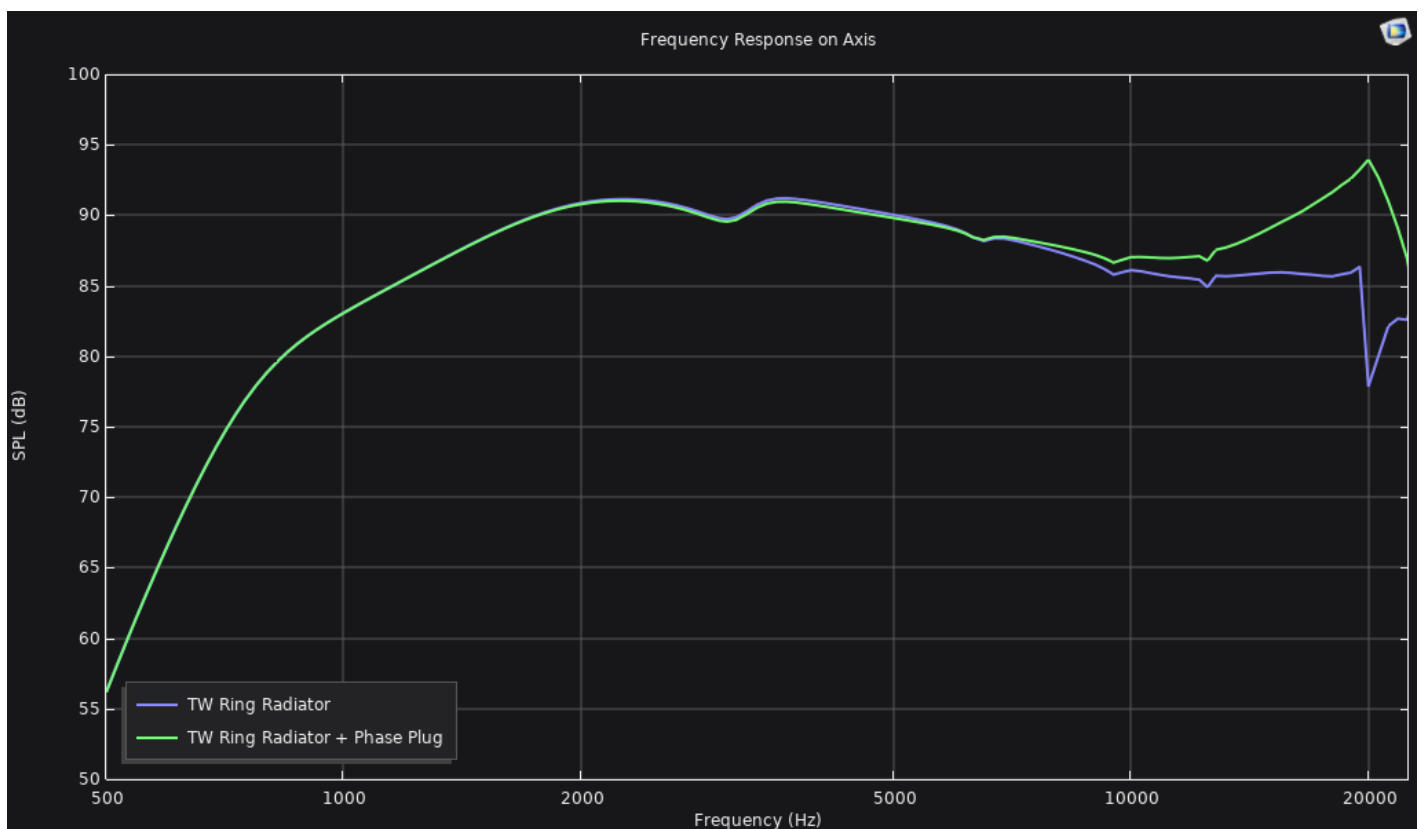


Figure 3 : Frequency Response on Axis

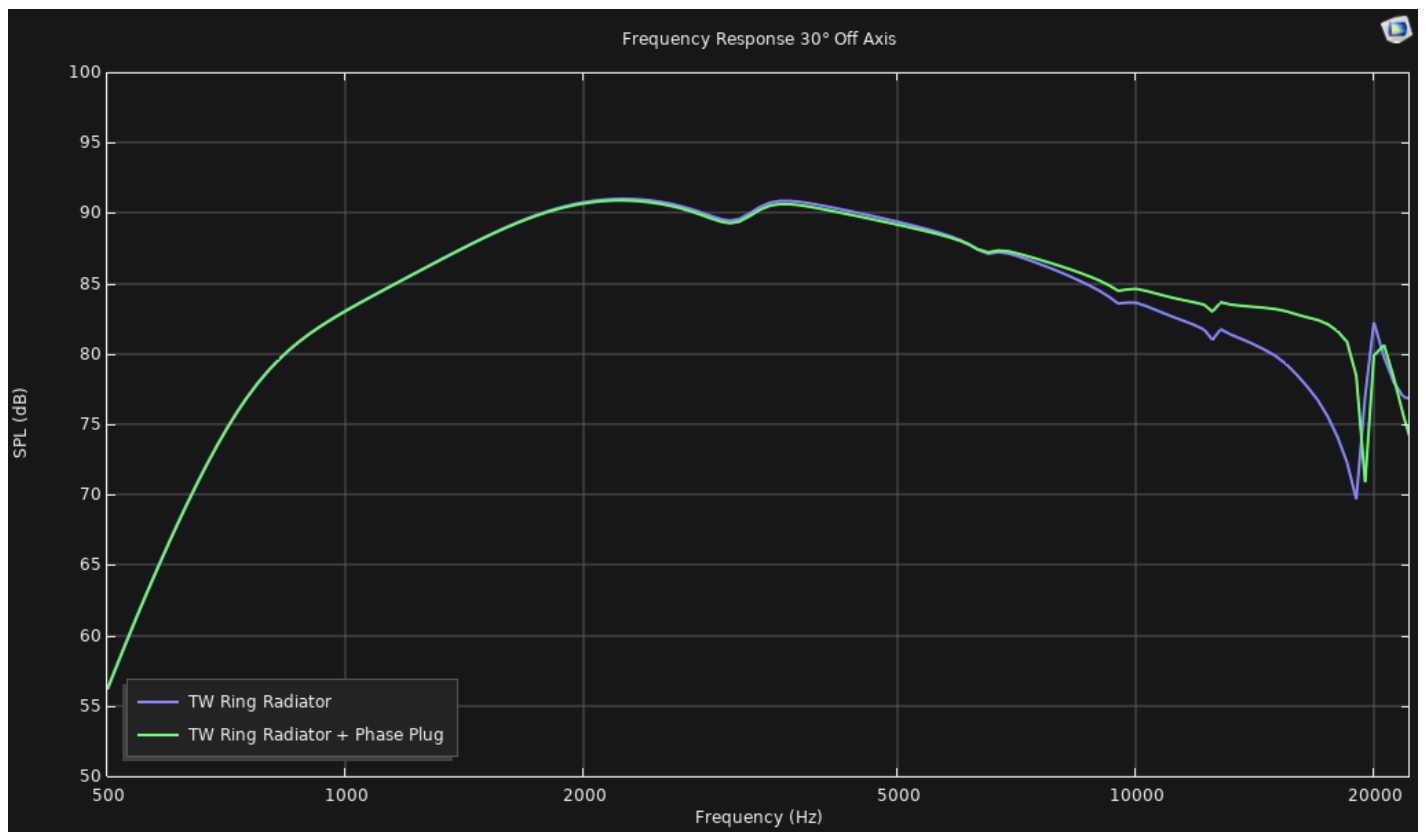


Figure 4 : Frequency Response 30° Off Axis