

High performance four way, Pro driver loudspeaker design using Danville Sound crossover / DSP

<https://www.danvillesignal.com/audio>

Driver sims below assume a sealed box design but can all drivers be used in open baffles if preferred.

Driver choice:

Beyma TPL 200 - 2 KHz to 20KHz. Sensitivity of 100dB @ 1 meter with 1 watt / 8 Ohms. Superb sonic and measured performance with super clean CSD. Very flexible with mounting ie Just placed on a Sorbothane pad on top of the midrange cabinet, or in a 1.5 liter sealed box filled with Twaron or similar dampening material or full open backed / open baffle. They all sound great! I have never used the matching horn but I have heard it sounded great! **Just 4 watts per channel = 109 dB SPL!**

https://www.beyma.com/speakers/Fichas_Tecnicas/beyma-speakers-data-sheet-amt-TPL200B.pdf

PHL 1752 NdU - 300 Hz to 2 KHz. 12.2g Mms / 11.9 BI = 1.02. This is a "fast" driver with Ref efficiency of 2.2%. This is around **100% more efficient** than a typical audiophile midrange driver, this driver really is exceptional. **16 watts per channel = 109dB @ 300Hz.**

https://www.phlaudio.com/fileadmin/user_upload/phl_audio/1752NdU_SpecSheet.pdf

Beyma 15P Fe/N - 70 Hz to 300 Hz. 70 Hz to 300 Hz. 88g Mms / 22.1 BI = 3.98. This is also a "fast" driver, typical audiophile mid bass drivers have higher Mms and lower BI (weaker motor) giving a "slower" ratio of around 5 or 6. **32 watts = 109dB @ 70Hz.**

https://www.beyma.com/speakers/Fichas_Tecnicas/beyma-speakers-data-sheet-low-mid-frequency-15P8

Beyma 18 QLEX 1600 Fe - 20 Hz to 70 Hz. 323g Mms / 36.4 BI = 8.8. Again this is a "fast" driver given its size, most audiophile 18 inch sub woofers have fat rubber surrounds with even heavier cones and weaker motors resulting in slow power to weight ratios of around 10 to 15. **256 watts = 109dB at 30 Hz.** (Actually room gain ie locating subs in corners adds a good 6 dB to the SPL so real world amp power will actually be much lower)

https://www.beyma.com/speakers/Fichas_Tecnicas/beyma-speakers-data-sheet-low-mid-frequency-18QLEX1600Fe.pdf

DSP / Eq tips

- (1) The most important principle is you are going to "cut down, **not** boost up. Please do not look at your 100dB sensitive TPL 200 tweeter and think "Ok the 18 inch bass is only 80 dB sensitive at 30Hz so lets throw in 20 dB Eq boost and lets party!!" No that would be a sonic train wreck, even the best DSP will have audible issues with this level of Eq'ing. There is a better way... A 20 dB or even 30 dB gap is easily filled with **NO SONIC ISSUES** with the right choice of power amps ie 500 watt power amp on your 18 inch sub, and an 8 watt (SET time baby!) tube amp or low powered class A solid state on your mid and top.
- (2) Remember just **8 watts** driving a pair (you add 3dB to the single driver sims) of PHL 1752 mids will hold 106dB at 1 meter all day long and the driver will NEVER distort as its only moving +/- 0.4mm which is only 15% of its Xmax! (See 4th Sim below)
- (3) Less is more! When Eq'ing the frequency response most narrow deep notches (especially in the bass) and narrow spikes can be ignored.
- (4) Look at the big picture and start with as few correction points as possible - First attempt should be limited to just three correction points and try to use lower Q values, typically below 1.4 with a maximum of around 2.8 and avoid any large amplitude boost (big cuts are ok) as you can start to push cone travel too much.

- (5) From the above, 256 watts on your 18 inch subs, 64 watts on the 15 inch Beyma, 32 watts on PHL mids and just 8 watts on the Beyma TPL all blend beautifully to make a closely matched easy to crossover and Eq system capable of very high SPL with very low distortion.

Cabinet tips:

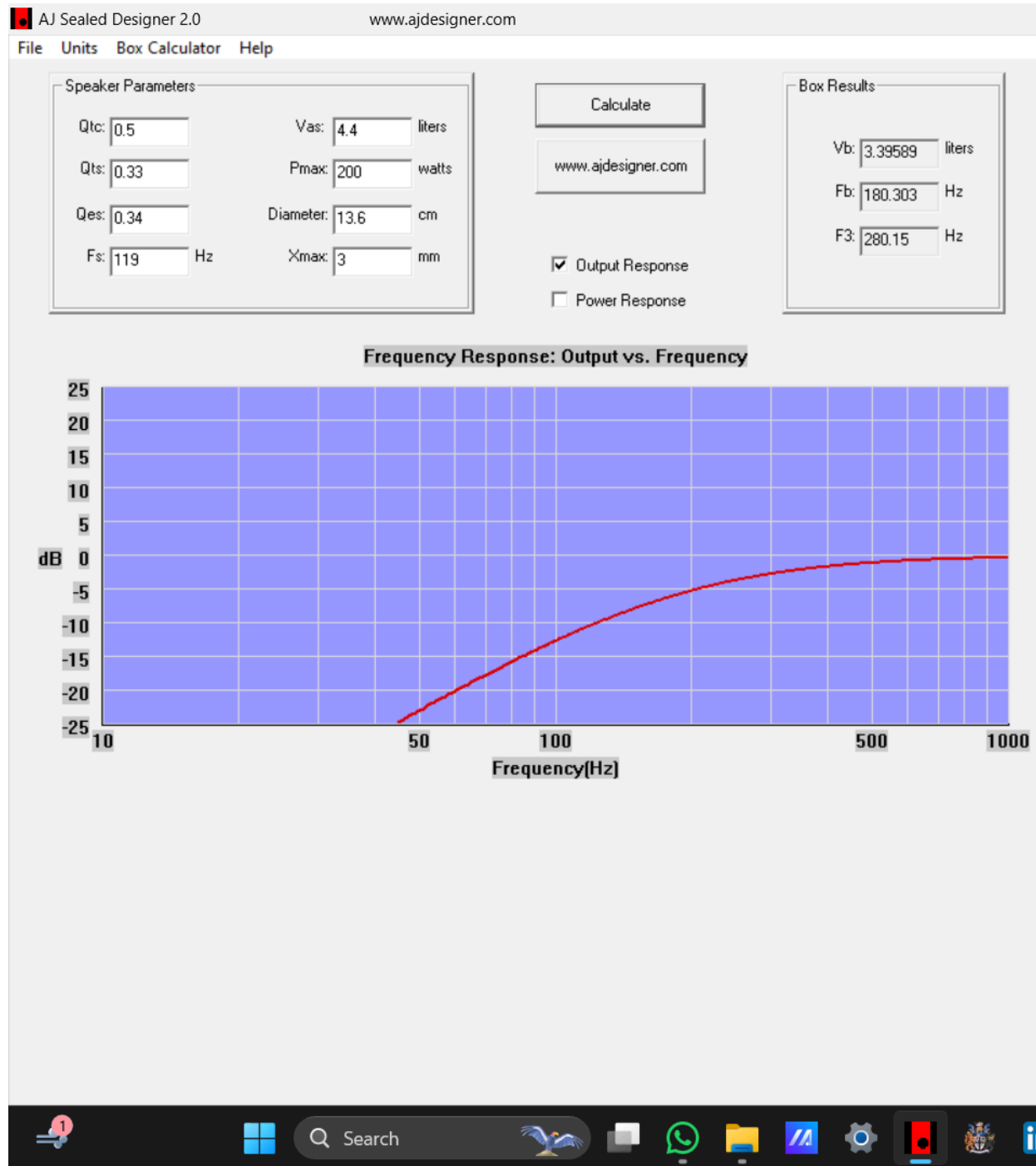
- (1) Use separate cabinets for each driver "way" and heavy cabinets are important, even in open baffle.
- (2) The target ratio of cabinet weight to driver cone weight (Mms) is 500 to 1. ie if your mid bass Mms is 100g the cabinet should weigh 50Kg. You can compromise a bit on this but remember the driver prob weighs around 12 Kg so adding another 35Kg for the cabinet is not too extreme.
- (3) Stranded bamboo is great but expensive, MDF is the worst and yes, low cost steel plate is better than Magico's expensive alloy... Automotive paint shops can turn "ugly" steel into works of art!
- (4) Always slightly "oversize" your cabinet volume to allow for the air volume occupied by the driver and any internal bracing and cabinet dampening material.

Driver Simulations

All sealed box with optimum "Critically Damped" Qtc of around 0.5.

All driver Sd / cone travel calculations are based on the actual cone diameter plus half of the width of the surround, **not** the driver nominal diameter.

PHL 1752, 6.5 inch midrange - Output response: -3dB at 280 Hz.



1

Search

WhatsApp

File Explorer

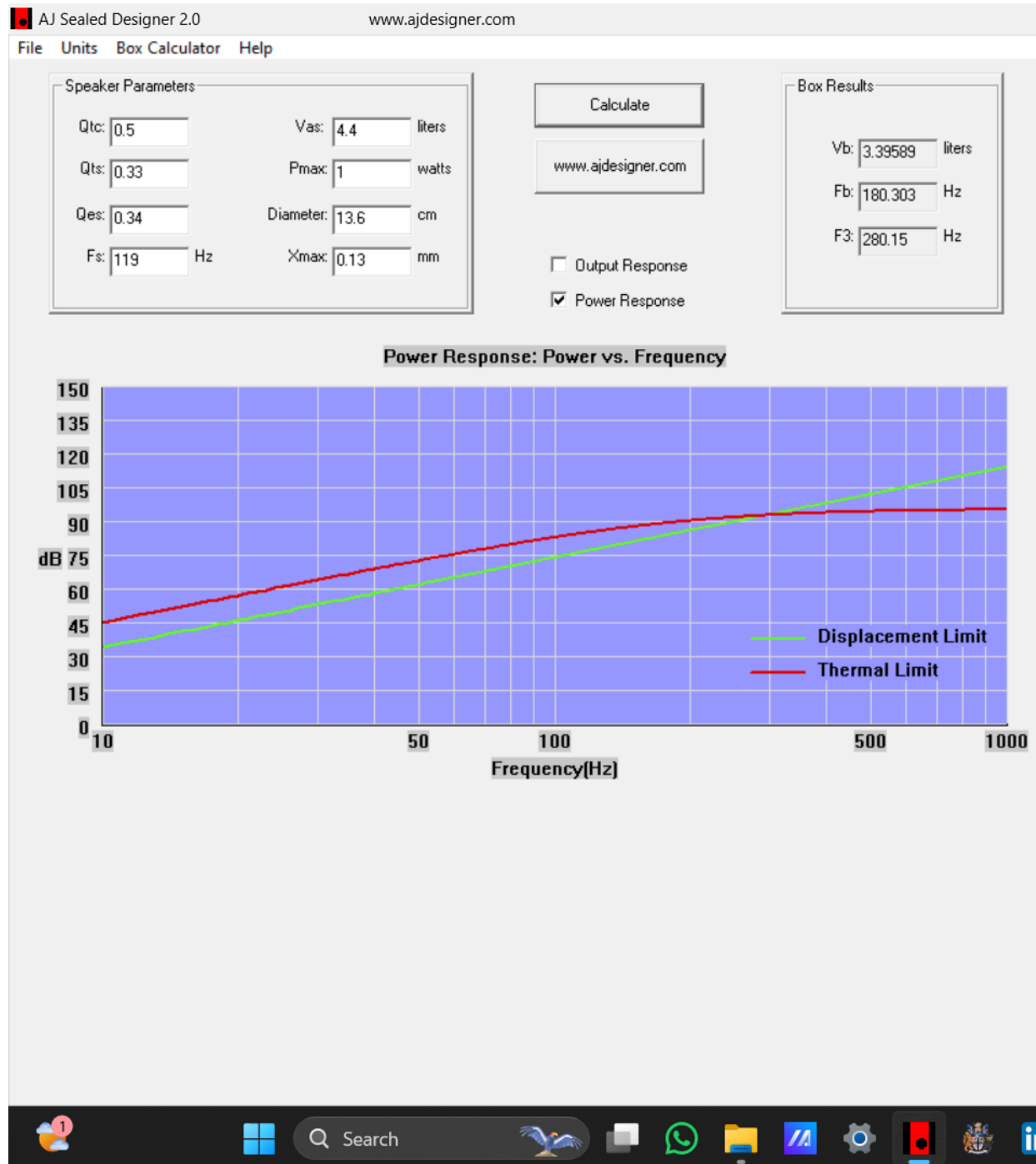
Microsoft Edge

Settings

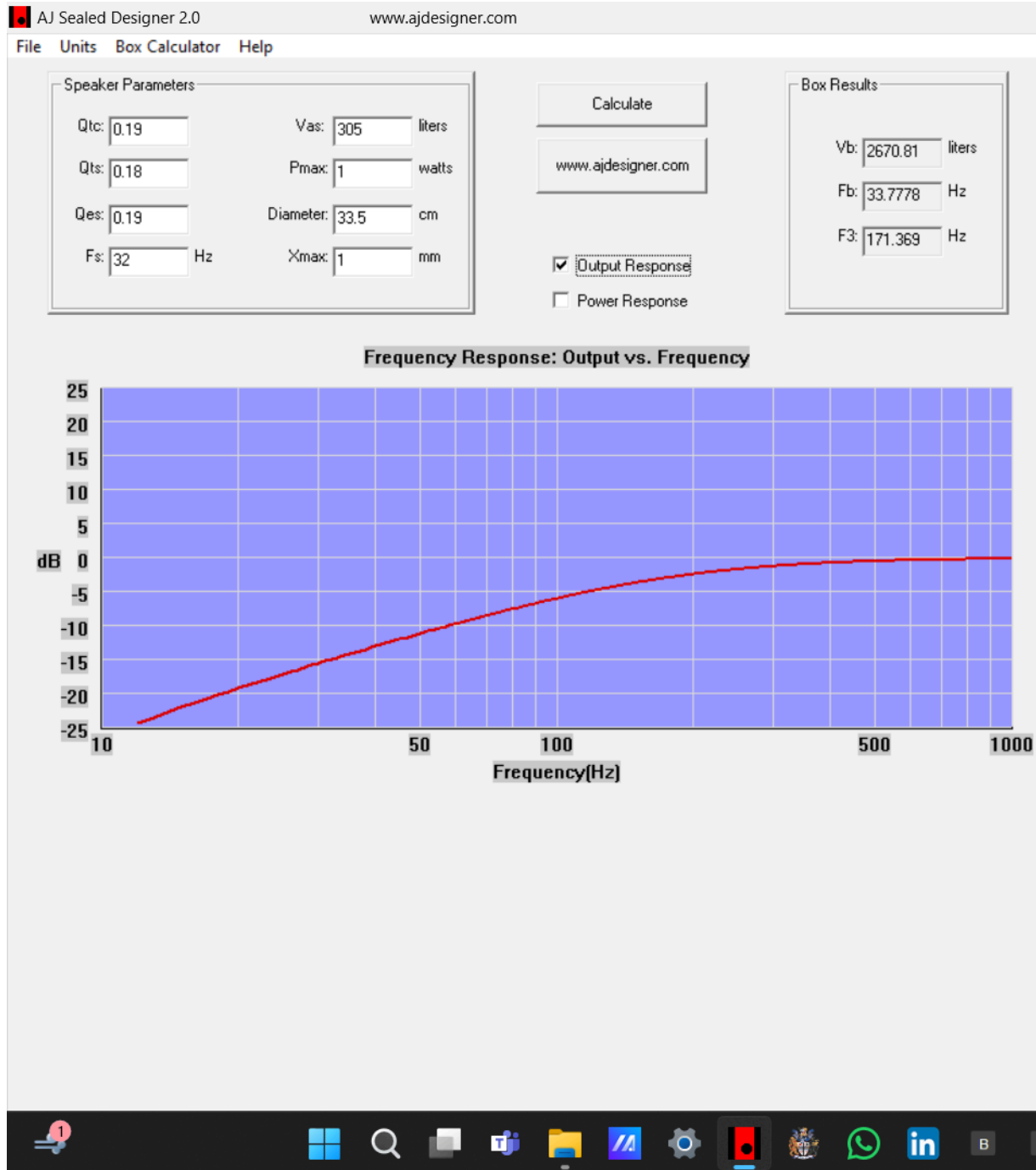
AJ Sealed Designer 2.0

Taskbar icons: Windows Start, Search, Task View, WhatsApp, File Explorer, Microsoft Edge, Settings, AJ Sealed Designer 2.0, System Tray icons (Network, Volume, Date/Time).

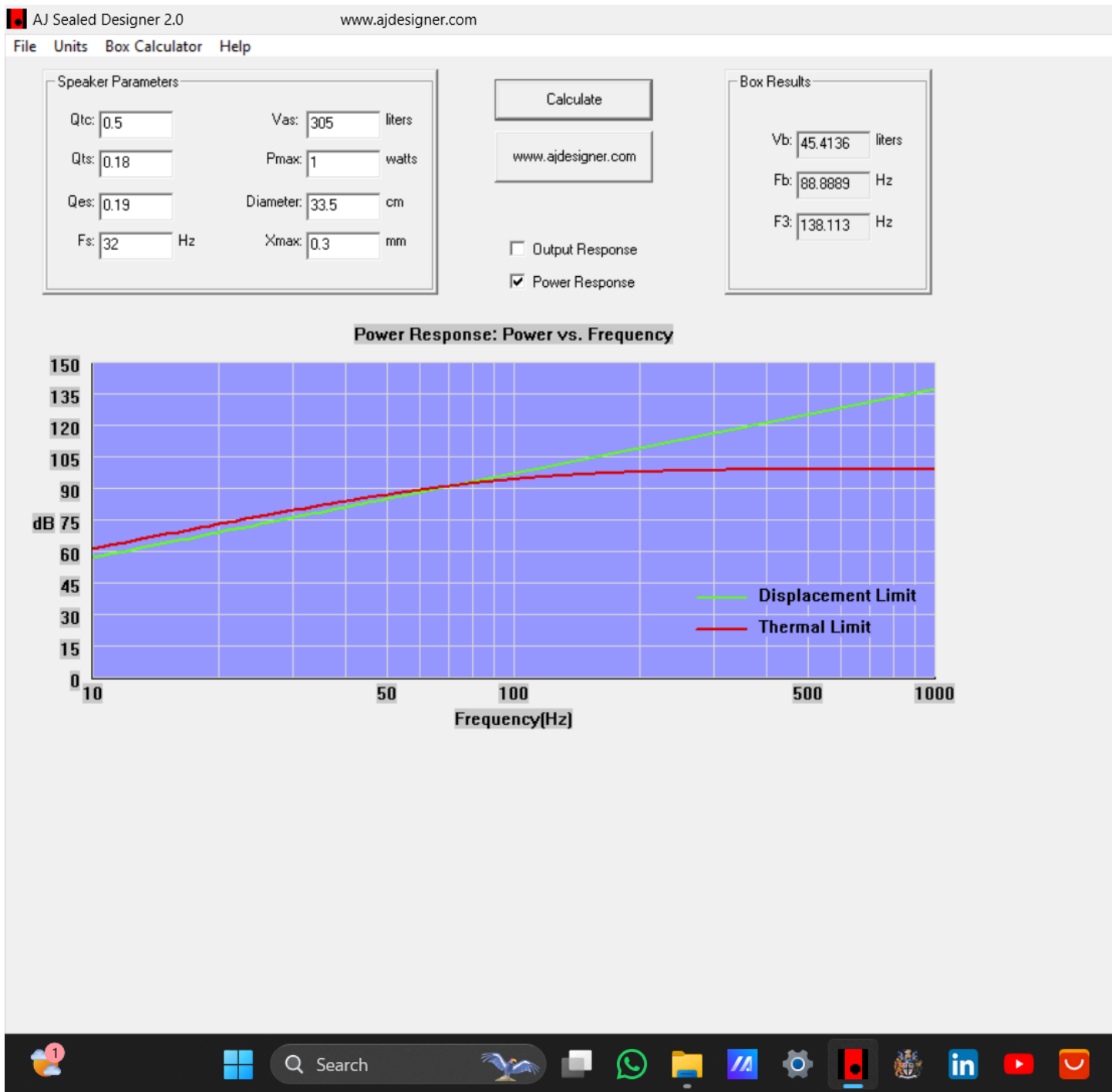
Single PHL 1752 Nd power response with 1 watt = 94dB @300Hz with 0.13 mm cone travel.



Beyma 15P 80/Fe/N output response: $M_{ms} 88g / B_l 22.1 = 3.98$. Typical audiophile 15 inch drivers have a much “slower” ratio of around 5 or 6 with heavy cones and weaker motors. Ref efficiency = 5%. Again, this is around 100% more efficient than a typical 8, 10 or 12 inch audiophile midbass driver.



Beyma 15 P 80/Fe/N power response with 1 watt = 91dB @ 70Hz with 0.3 mm cone movement.



1

Search

WhatsApp

Folder

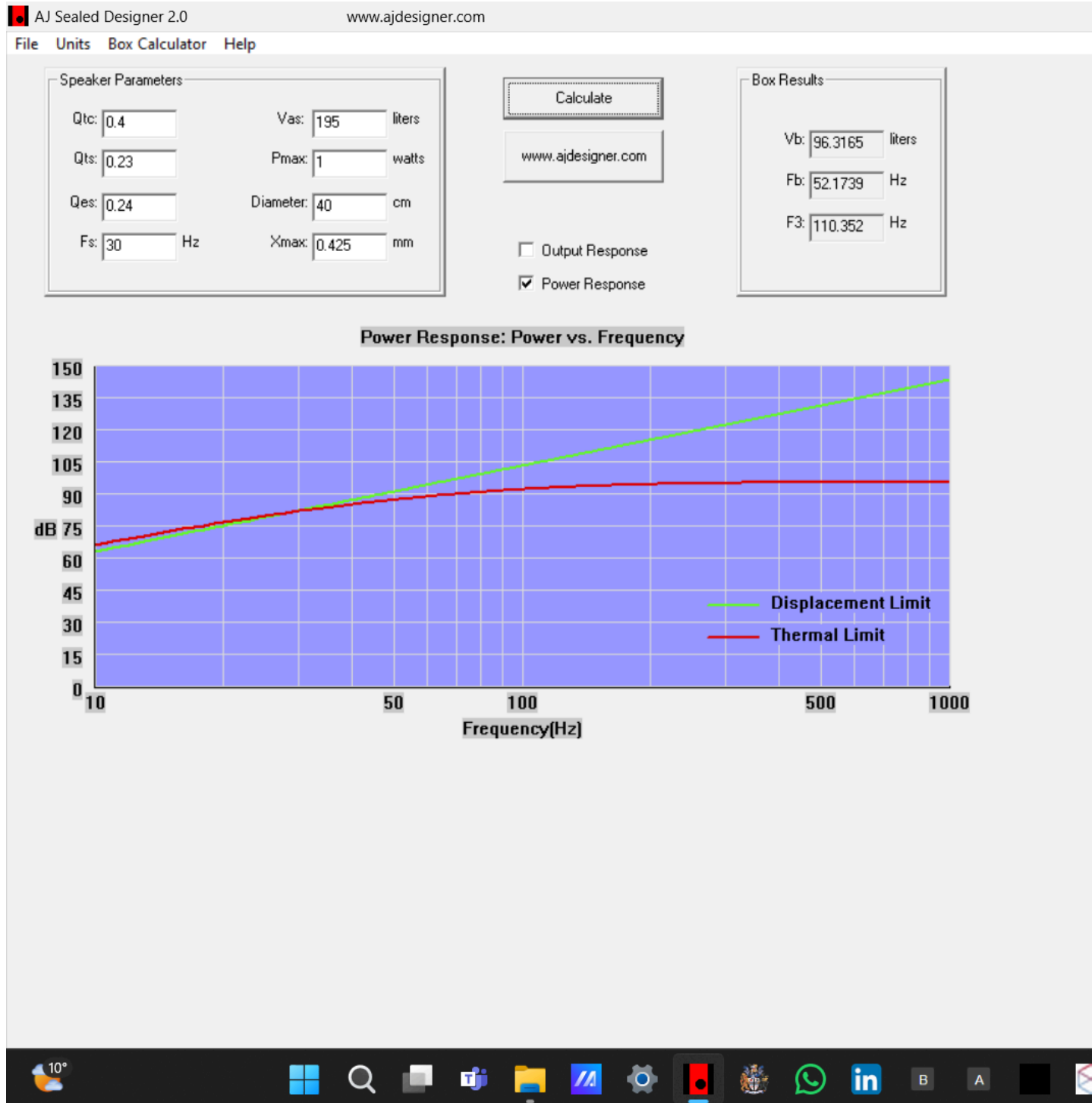
Settings

System Tray Icons

Beyma 18 QLEX 1600 Fe - Output = - 6dB @ 70 Hz and -14dB @ 30Hz = effective -8dB @30Hz after room gain. 323g Mms / 36.4 BI = 8.8. AES = 1,600 watts. 13 mm Xmax with +/- 30mm before damage. Ref efficiency = 2.1%. 14.6 Kg. Driver vol = 8 liters. Can easily use 0.5 Q to reduce cabinet size.

Beyma 18 QLEX 1600 Fe with 1 watt @30Hz = 82dB with 0.425mm cone travel.

A pair in room = around 90dB @ 30Hz ie plus 3dB for the second driver 5dB for room gain.



Beyma 18 QLEX 1600 Fe with 256 watt @30Hz = 106dB with 7mm cone travel. Add 3dB for second sub and around 4 dB room gain for a real world SPL at 30 Hz of 112dB....**And this is with just 16% of AES rated continuous power and 50% of Xmax!!**

