



This Issue

Home Theatre LFE Placement **P.1**

Bryston 5.1 System Installed in Townhouse Master **P.1**

Bryston Nominated for 2000 TEC Award! **P.2**

**PMC/Bryston 5.1 System installed in Townhouse Master**

We are pleased to announce that London based post production and recording facility 'The Townhouse' has com-



pleted their latest installation of a full range PMC 5.1 system.

Mastering room three houses the all soffit mounted system consisting of PMC BB5/XBD for L,C,R and PMC MB1 3 way monitors at the rear. All channels are powered by a custom range of PMC series Bryston amplifiers and electronic crossovers. The system has phenomenal resolution and bandwidth (17Hz-25kHz) which negates the use of a separate sub unit for the .1 effects channel. This is simply folded back into the Left,

**Home Theatre LFE Placement**

As a follow up to our newsletter on optimizing the Bryston Theater Room: this will be the first of a number of articles showing how we accomplished our task.

This article deals with placement for the LFE or subwoofer channel. Future articles will deal with the placement of the LCR and Surround channels and finally the integration of all these speakers in our theatre room.

In this example experiment, we show how to optimize low frequency acoustic response in your room through trial and error measurements with various speaker placements. We used two basic positions in the room - one set of measurements in the 'Far Field' (front of the room) and one set of measurements in the 'Near Field' (rear of the room near the listener). Placing the subwoofer close to the listening position reduces the room effect on the bass response because the sound reaches your ear before the room boundaries have a chance to effect it.

In setting up the acoustics of home theatre systems, better speaker placement leads to smoother and more balanced frequency response across the hearing bandwidth and therefore better sound. Proper placement methods applied prior to further corrections such as passive treatments and equalizers will ease the requirements for these additional devices. The low frequency response is primarily determined by the dimensions of the room and the placement of the subwoofer within the room.

Only a single subwoofer should be used for this measurement. Main speakers should be turned off or disconnected. Any crossover circuits used for the subwoofer should be disconnected or set to the highest possible cut-off frequency. Furniture should be left in place, as it can effect the room response and may skew results if moved around. Approximate positions for trial subwoofer locations are shown in Figure A.

The highest frequency for placement optimization is 140 Hz for the subwoofer used in this test because our crossover point will be set at 70-80 Hz. We placed the subwoofer in the listening position and moved the microphone to the various test points. The microphone is placed where the cone center for the subwoofer would normally be relative to the floor. This method saves the heavy lifting of the subwoofer and provides very similar results as if the subwoofer was moved around the test locations with the microphone stationary at the listening position. We have a previous newsletter describing this test setup procedure. For a more detailed description please refer to Bryston Newsletter Volume 3 Issue 2.

I tested the subwoofer in the Far Field (front of room) and the Near Field (rear of room). The exact placement of these locations can be recorded using masking tape stuck to the floor in a test grid and labelling them appropriately. As you can see in 'Figure A' I labelled them A, B, C, etc. in both the front and rear of the room. This saves taking precise measurements of the location for each point. If you wish, the subwoofer can be measured later at the listening location after the best position(s) are found just to confirm the results. The letters A to H (far field) & A to H (near field) represent a set of 8 possible subwoofer test locations (Fig A).

The distances between the test locations can be optimized using the following formula: Spacing = (343 m/s or 1130 ft/sec divided by 4 times the upper frequency limit of the subwoofer). In our case the

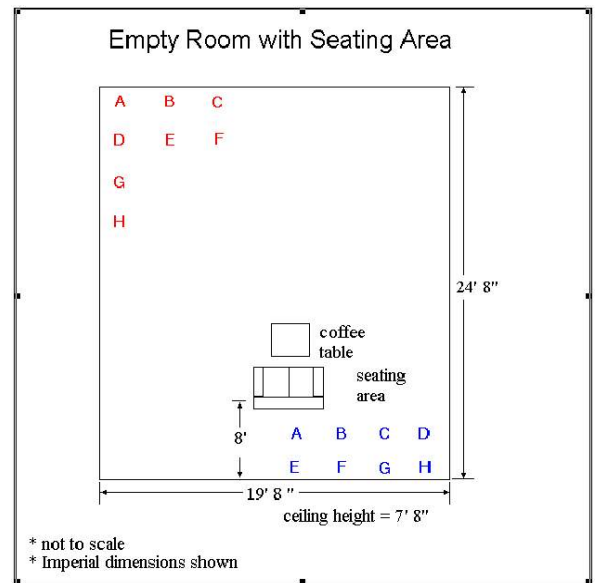


Figure A: Subwoofer Test Grid

upper limit will be considered as 140 Hz. We expect to find an optimal crossover point far below 140 Hz. Spacing = 1130 divided by (4x140) = approximately 2 ft. The grid spacing for the points A, B, C, D, E and H will be 2 feet. The subwoofer was placed on the sofa with the cone within 1 foot of the normal listeners ear location for the following tests. The microphone was placed at the various test positions to generate

Right main monitors.

With the installation of the latest monitoring technology, 5.1 compatible desk and state of the art EQ it ensures that The Townhouse remains at the forefront of post production, whether it be sound-to-picture, or surround music mixes.

'The use of PMC in 5.1 was the obvious choice.....It tells me all I need to know,' stated Mastering engineer Bunt Stafford.

## Bryston 14B-ST Pro Nominated for 2000 TEC Award!

Mix Foundation for Excellence in Audio has nominated the Bryston 14B-ST Professional Amplifier for their 2000 TEC award for outstanding achievement in the audio industry.

The award is given to the product that represents the best Technical Excellence and Creativity in the Category of Amplifier Technology.

A group of 300 recording industry professionals nominate several products that



the following measurements.

The following measurements illustrate test results with the microphone in the positions shown in Figure A at the front of the room (far field) and the subwoofer located at the listener location. I have only shown 2 (instead of 8) of the curves (best E and worst B) for simplicity in each case.

The measurements indicate that position E in the front of the room shows the flattest frequency response below 140 Hz and position B was the worst. The measurements in the near field (rear of room) shows two interesting position options as well. The rear corner placement, (Figure D - Position H). Position H has the most energy and is almost flat to 23 Hz. Locations closer to the listener provide flatter response (Figure E - Position B ) but has lower levels due to less boundary coupling.

If you wanted to use a parametric equalizer the best woofer position is in the rear corner (Position H - Fig. D). Equalizers can be employed to reduce excess levels and therefore cone excursion and distortion.

This optimum position can result in huge energy (cone excursion) savings after equalizer correction. The rear corner position appears to be one of the least desirable positions for sound quality but it is one of the best positions to choose when using a parametric equalizer because the actual output is greater at lower frequencies and therefore easier to correct without using EQ boost and the subsequent increase in cone excursion. I did not measure the front corner position but the same conditions would probably be present.

The overall best position in the near field was Position B (Fig. E) which has very smooth response due to the near field effect of this placement. This position illustrates no significant room mode spikes and therefore no audible room ringing or "room-boom". Boundary effects are comparatively small due to the near field effect. Placing the subwoofer closer to the listener as opposed to the best position at the front of room resulted in better overall response in this specific situation.

Conclusions: The above tests illustrated three possible optimum subwoofer placements. 1. Position E (Figure 1) gives the smoothest response for conventional placement in the Far Field (front of room). 2. Position B (Figure 1) gives the best placement for Near Field conditions (close to listener) and could possibly be the best location overall due to reductions in boundary effects. 3. If equalization is to be used, the best position with the highest sound pressure level at the lowest frequencies should be chosen (position H -rear corner). An equalizer can be used to optimize and flatten the response by reducing the

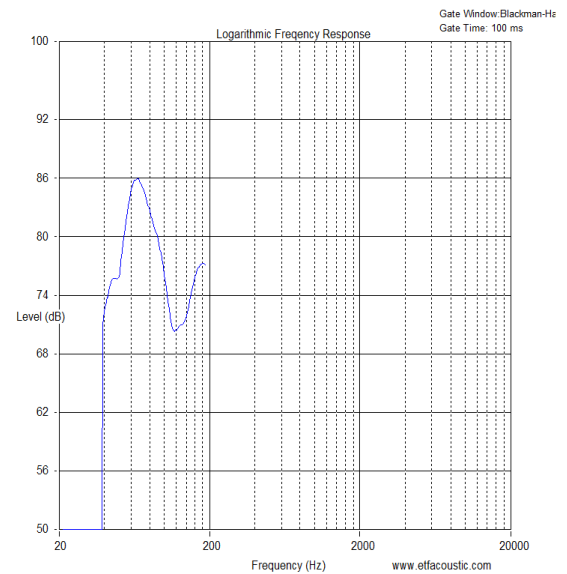


Figure B: Subwoofer Front of Room Position B

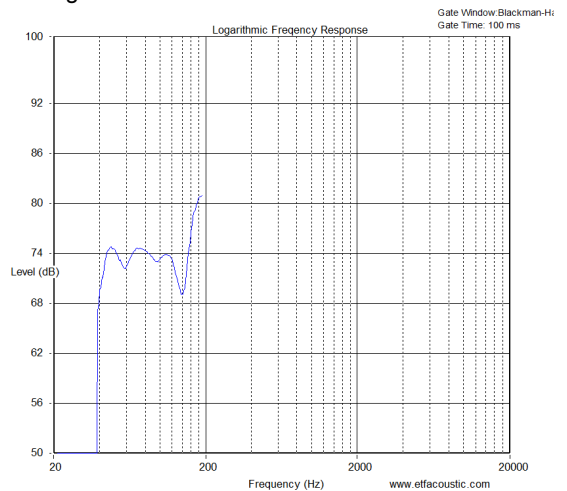


Figure C: Subwoofer Front of Room Position E

frequency spikes. The end result will be much less cone excursion (distortion) for a given volume level.

As you can see from the measurements the difference in response between the best and worst possible subwoofer placement (Figures B and C) can easily be as high as 10 dB over the frequency range of concern. Careful placement using these measurement techniques can result in a far superior bass response than may otherwise be achieved



have been in use over the previous year which they feel improves the technological state of the recording process. The ballots are tabulated by Mix Magazine and the top four or five items in each category are then placed on a ballot card which is attached to the June issue. The readers then vote for the products they like and the award is presented at a special awards dinner at the annual AES show.

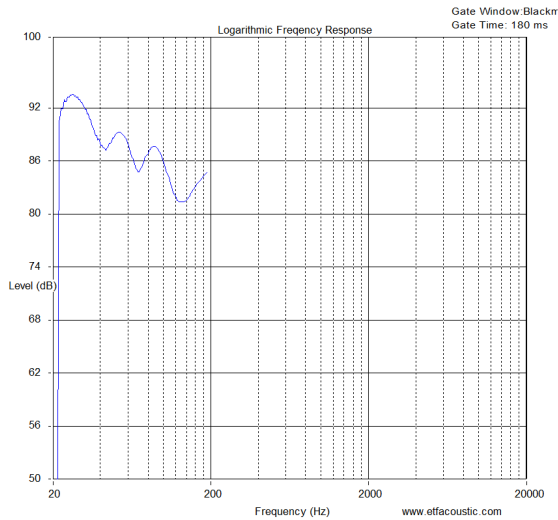
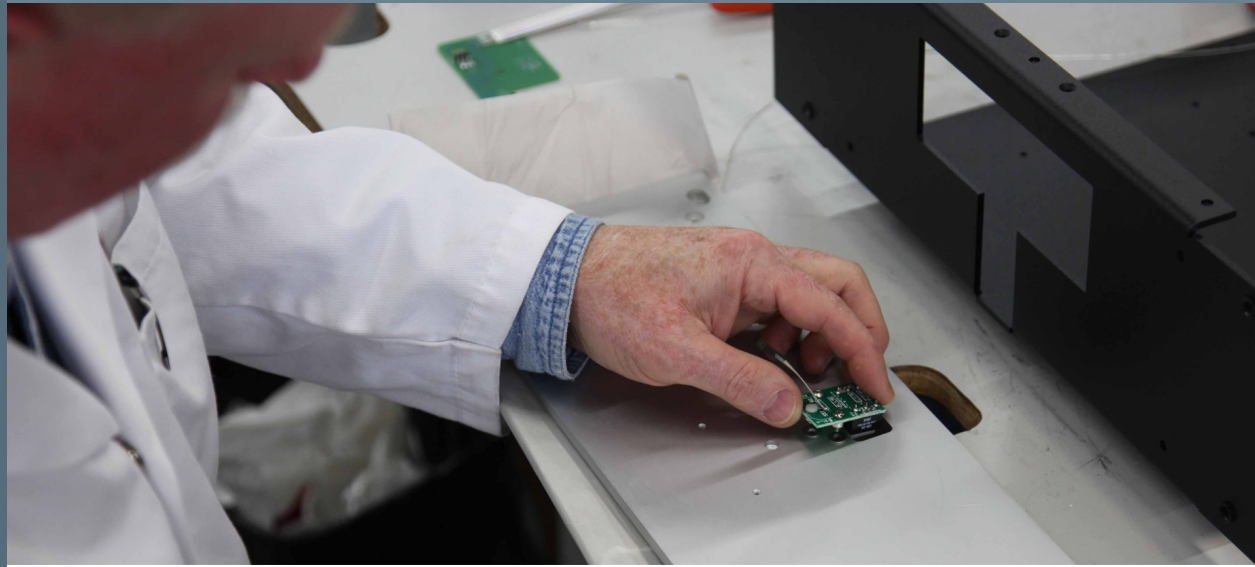


Figure D: Subwoofer in Rear Corner Position H with arbitrary placement.

Near Field placement can have some advantages over Far Field placement due to the reduction of room modes at the listening location (the bass pressure wave hits your ears before the room boundaries have had a chance to effect the response). Corner placement is certainly the most efficient position for optimizing the power coupling to the room but is usually the least desirable location if flat frequency response across as wide a band as possible is the goal. Implementing some type equalization is generally a good idea if corner positions are chosen. There is still a lot of discussion on this subwoofer corner placement (and therefore maximum power efficiency) vs. the flattest frequency response position (but poorer power coupling).

The other option you might consider implementing has to do with utilizing more than one subwoofer in the system. The theory is that if you place two subwoofers in the system the dips and peaks we see

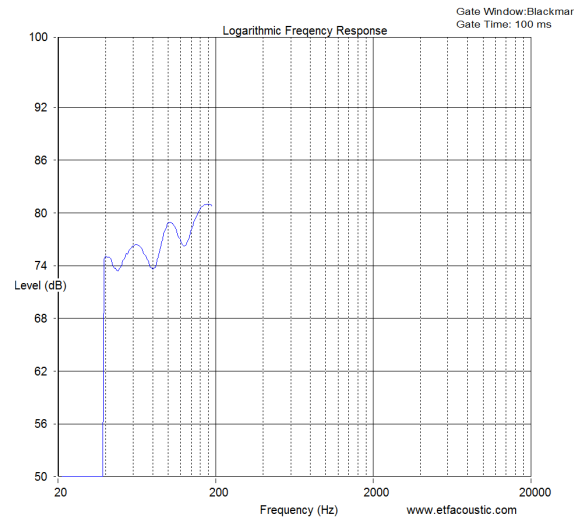


Figure E: Subwoofer Near Field Position B

are neutralized a little because the room is being 'driven' from two different locations and therefore some 'levelling out' of frequency response occurs. One suggestion I have heard is to place one subwoofer in the corner to maximize the power coupling and place a second subwoofer in a 'null position' in the room and between the two the effect is to achieve maximum power and flattest frequency response - but that's for a different newsletter.

The other obvious conclusion I reached as a result of this exercise was the need to actually 'measure' loudspeakers in your specific room. I know it is a real pain but long-term it will pay dividends. Most custom installers and high quality audio/video stores have the equipment available to run these tests for you. There are many mathematical formulas available as to where you should place speakers given your room geometry but as you can see from these tests the movement of a couple of feet produced changes of over 10 dB at the listening location.

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