B&W 801 Matrix Series 3 vs. Audio Artistry CBT36 Ground-Plane Measurements

Measurements and Power Point by

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Audio Artistry

www.AudioArtistry.com)

(And I take full responsibility for the content, warts and all!)

(With the able assistance of Marshall Kay of Audio Artistry and Rick Craig of Selah Audio, www.SelahAudio.com)

Introduction

- **General Comments:**
  - This presentation compares the B&W 801 loudspeaker system with the Audio Artistry CBT36 curved-line array by showing frequency response measurements of both systems taken over an acoustically reflective ground plane (the floor). Measurements were gathered over a concrete floor in the workshop of Audio Artistry on Oct. 8, 2011. These measurements assess the sound field generated by the systems when operated in a non-anechoic environment but over a reflective ground plane.
- **Test Conditions:**
  - All frequency response curves were gathered with custom software written by Don Keele based on Angelo Farina's log-sweep technique. Impulse responses were windowed with a 50 ms half-Hann window and all time-of-arrival offsets were compensated before converting to the frequency domain. All frequency response curves were smoothed with a $1/12^{th}$-octave filter.
- **Effect of Carpet:**
  - Measurements taken with a carpet on the floor (not shown) were materially the same except for HF rolloff near the floor. The HF loss was a primarily a result of the sound grazing the floor and was evident at heights of 10" and less above the floor.

Introduction: Cont.

The following measurements were taken:

- **Frequency Response Versus Height:**
  - Data was gathered at five vertical locations in front of the systems: 0.0, 0.5, 1.0, 1.5. and 2.0 m; and four distances in front of the systems: 0.1, 1.0, 2.0, and 3.0 m. ***Measured for both B&W 801 and CBT36.***
- **Frequency Response Versus Distance:**
  - Data was gathered at two heights: Sitting: 1 m (40”) and Standing: 1.7 m (68”); and seven distances in front of the systems: 0.1, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 m. ***Measured for CBT36 only.***
  - Data was gathered at two heights: Sitting: 1 m (40”) and Standing: 1.7 m (68”); and four distances in front of the systems: 0.1, 1.0, 2.0, and 3.0 m. ***Measured for both B&W 801 and CBT36.***
- **Off-axis Frequency Response:**
  - Data was gathered at seven angles: 0°, 15°, 30°, 45°, 60°, 75°, and 90°; and two heights: 0 (on the ground plane) and 1 m (40”). Data was measured on the side with tweeters closest to the edge of the enclosure. ***Measured for CBT36 only.***
- **Near-field Frequency Responses:**
  - Data was gathered on the CBT36 at a height of 1 m; and distances of 2”, 4”, 8”, and 16” in front of the enclosure. ***Measured for CBT36 only.***

B&W 801 Matrix Series 2

Specifications

Note: The B&W 801 Matrix Series 2 systems were Don Keele's reference systems for all his *Audio Magazine* loudspeaker reviews from 1991 to 2000.

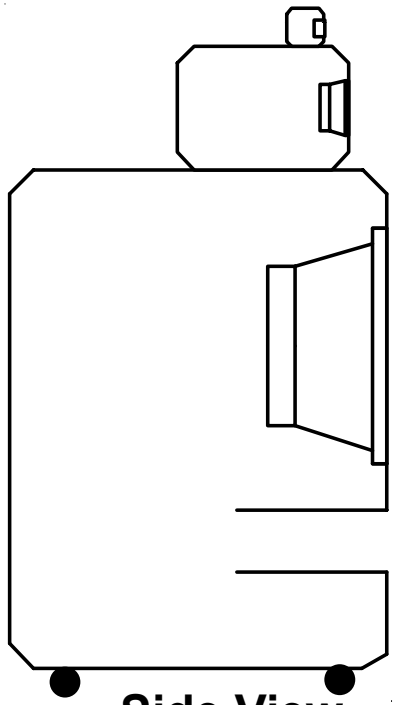
B&W Matrix 801 Series 2 loudspeaker Specifications

(Circa 1988)

Sidebar 1: Specifications

Description: Three-way, reflex-loaded, floorstanding loudspeaker. Drive-units: 1" (26mm) metal-dome tweeter, 5" (126mm) Kevlar-cone midrange unit, 12" (300mm) high-power polymer-cone woofer. Crossover frequencies: 380Hz and 3kHz. Frequency response: 20Hz-20kHz ±2dB free-field. Sensitivity: 87dB/W/m. Nominal impedance: 8 ohms (not falling below 4 ohms). Amplifier requirements: 50-600W.
Dimensions: 39 11/16" H by 17" W by 22" D. Weight: 110 lbs.
Price: $4500/pair in black ash or walnut, $5200/pair in rosewood. External bass-alignment filter, and pair of 11" speaker stands (both optional), $150 each. Approximate number of dealers: 100.

Oblique View



Side View

Front View

Audio Artistry CBT36

Specifications

CBT36 Specifications:

Description: A two-way floor standing circular-arc high-end loudspeaker line array. Each system contains 18 ea 3-1/2" full-range drivers used as mid woofers and 72 ea 3/4" diameter wide-band tweeters that are crossed over at 1 kHz. The 3-1/2" drivers utilize a Neo-Balanced 1" underhung motor that is capable of 20 mm peak-to-peak excursion and features a shorting ring to keep distortion under control.

The very-small 3/4" wide-range tweeters feature a 0.5" edge-driven inverted aluminum dome that utilizes a high-energy neodymium magnet for low distortion and high efficiency. The drivers are mounted on a 36° circular-arc front panel which provides an extremely-even wide-band narrow vertical coverage of 28°.

CBT which stands for ***C***onstant ***B***eamwidth ***T***ransducer is a loudspeaker line array theory that provides extremely even coverage and flat frequency response at all locations in the listening room with a system that has broadband constant-directivity (CD).

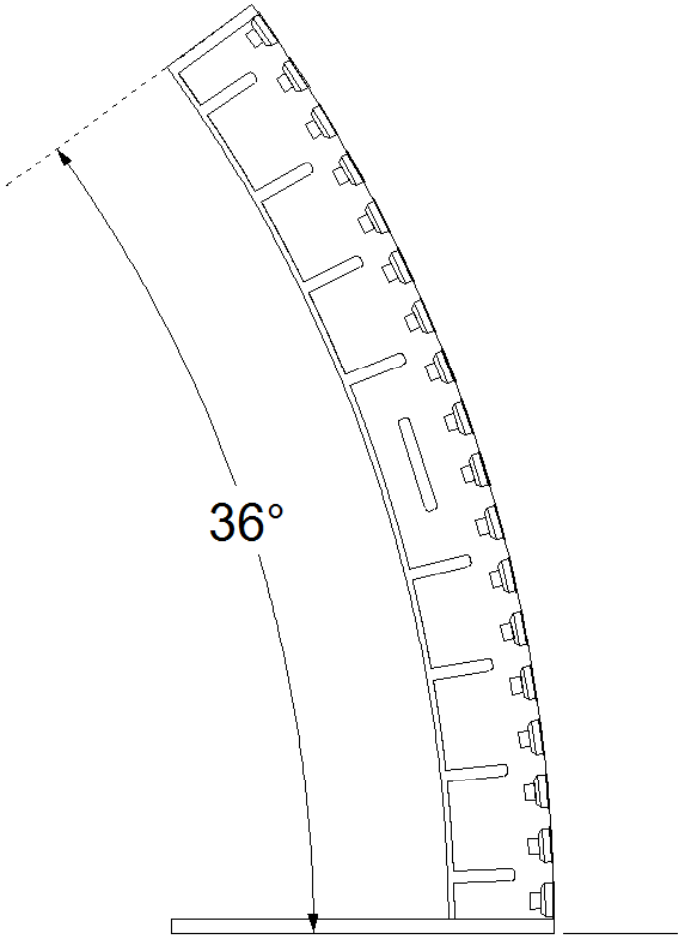
The drivers of the CBT36 are not equally driven but are passively "shaded" in five banks that attenuates the upper drivers with respect to the lower drivers. This is shown in the diagram on the right. The curved front panel and shading vastly improves the vertical coverage of the system as compared to a straight-line array.

The system must be bi-amped and requires a DSP-based speaker EQ/processor along with two stereo power amplifiers. For extended bass response below 60Hz, one or two powerful subwoofers are required. Note that the system can't be used without the EQ/processor.

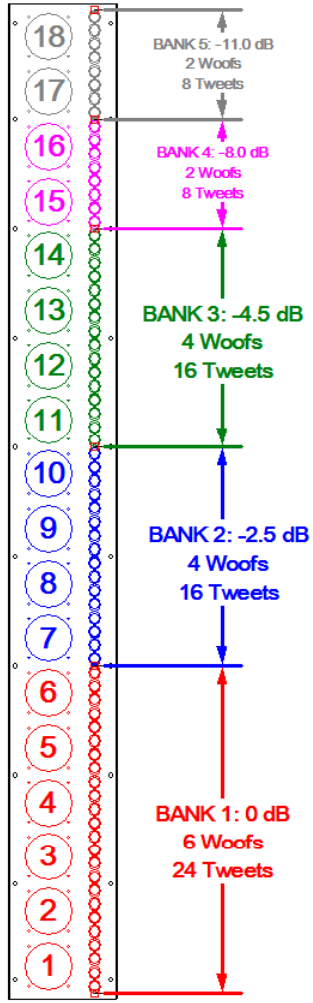
Dimensions: H x W x D: 61.0 x 7.0 x 25.0 inches, (154.9 x 17.8 x 63.5 cm)

Weight: 55 lbs (25 kg)

Price: $2,999 USD per pair DIY Kit unfinished, $8,500 USD per pair assembled and finished.



Side View

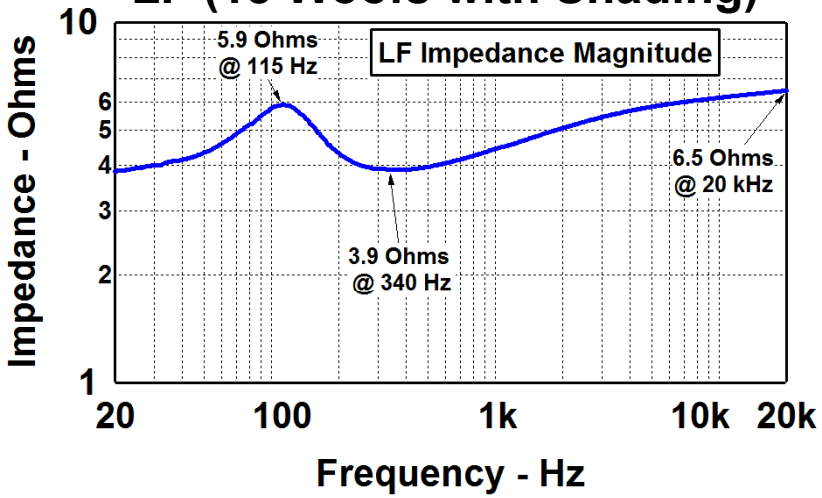


Front Panel

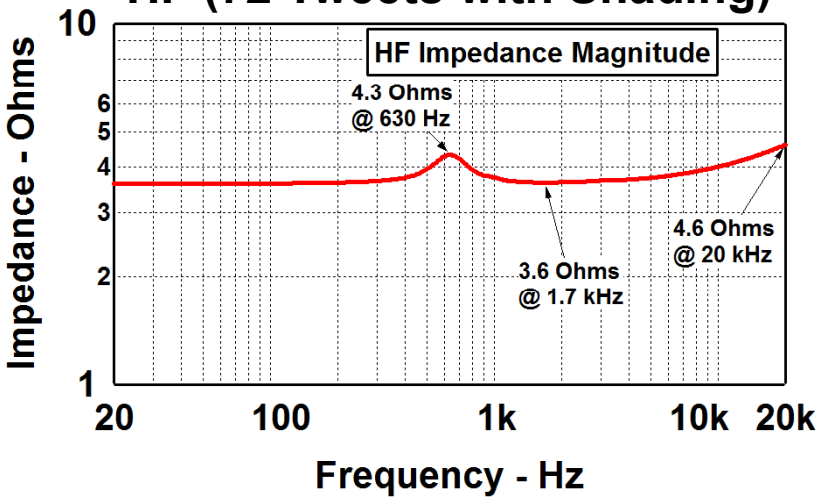
CBT36 Specifications, Cont.: Complex Impedance vs. Frequency

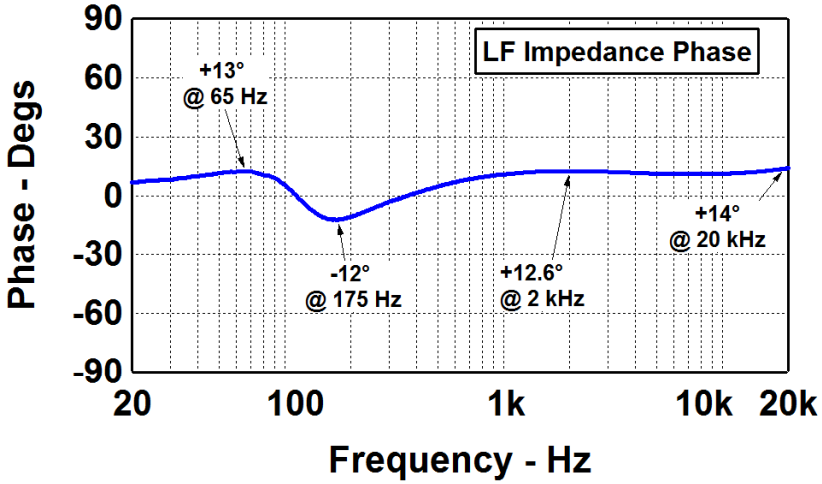
Your amplifiers and cables are going to love these impedances!

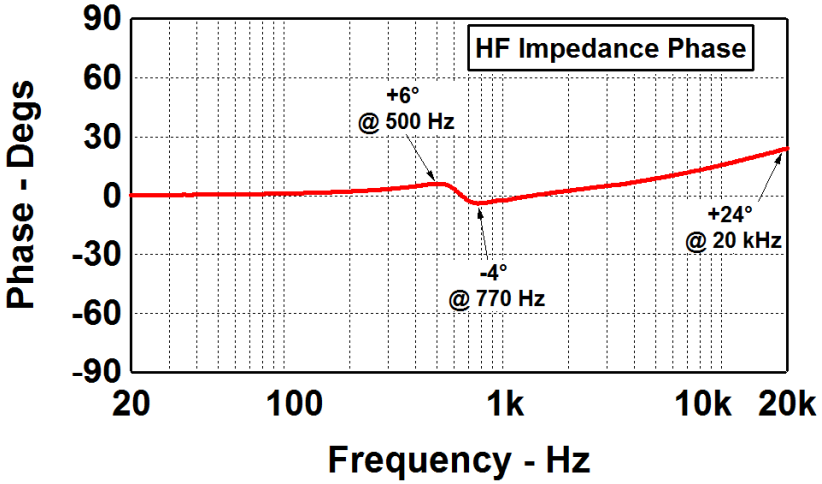
LF (18 Woofs with Shading)



HF (72 Tweets with Shading)



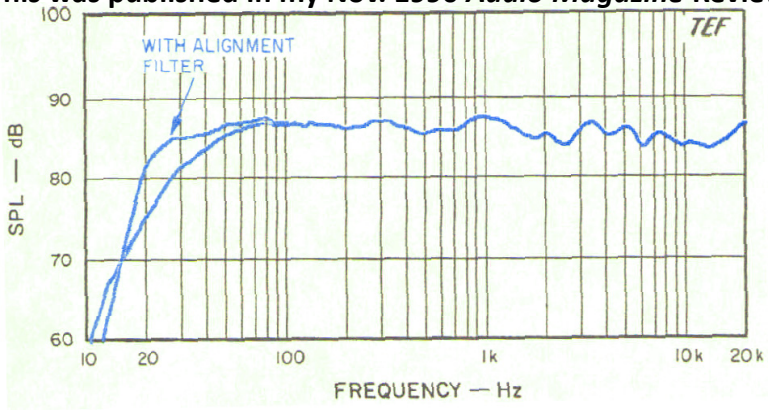




On-Axis Measurements

B&W 801

This was published in my Nov. 1990 *Audio Magazine* Review

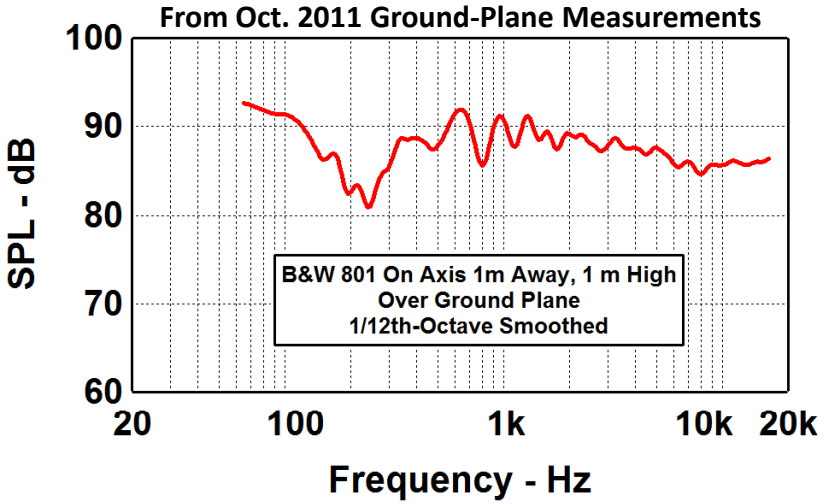


The curves below illustrate that the CBT36's frequency response is much flatter than the B&W 801 when measured over the ground plane.

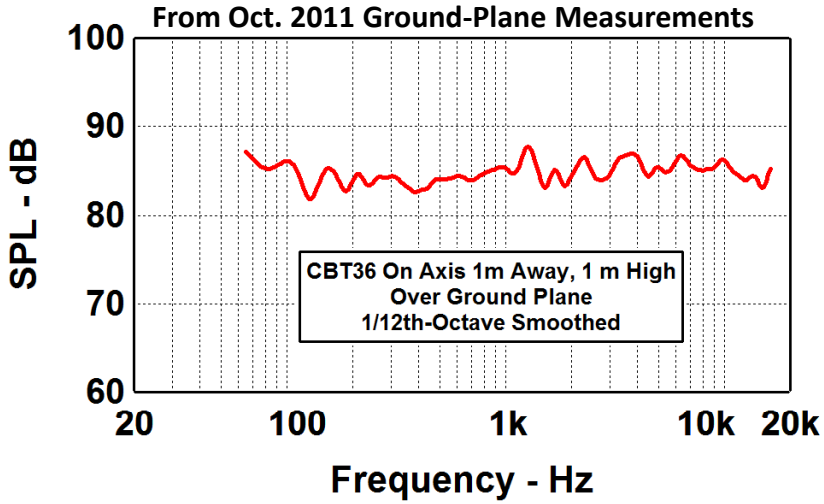
All the following CBT36 measurements were taken with the system crossed over and equalized with the DEQX HDP Express DSP processor.

The B&W measurements were done with no processing except for constant voltage 2.83 Vrms input. The level of the CBT36 was adjusted so that its level roughly equaled the B&W at 1m away and 1m high.

B&W 801



CBT36

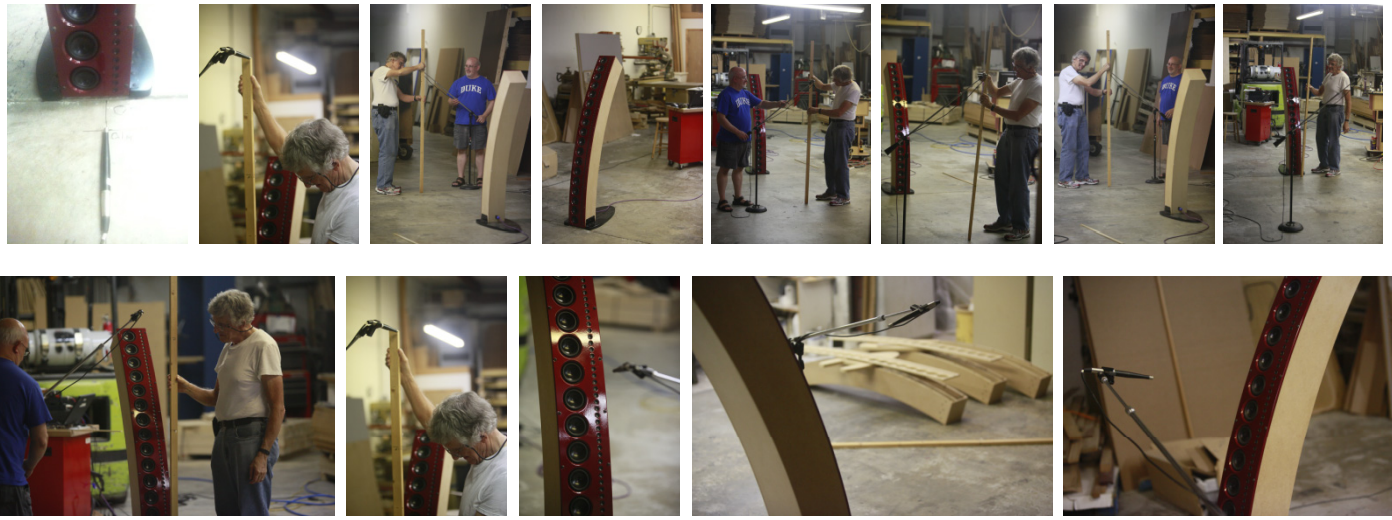


Measurement Photo Gallery

That crazy bushy-headed grey-haired old guy in the white "T" shirt is Don Keele!
The bald-headed guy in shorts, and blue "T" shirt is Rick Craig of Selah Audio.

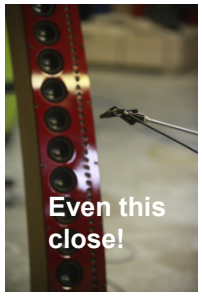
B&W 801

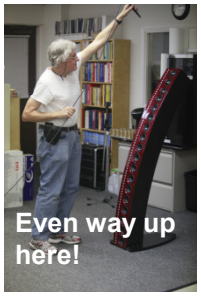
CBT36

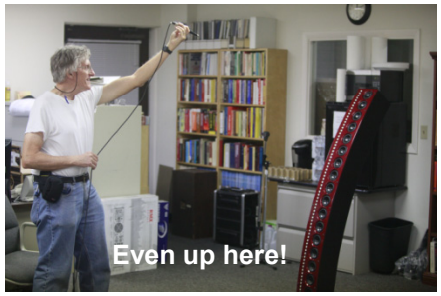


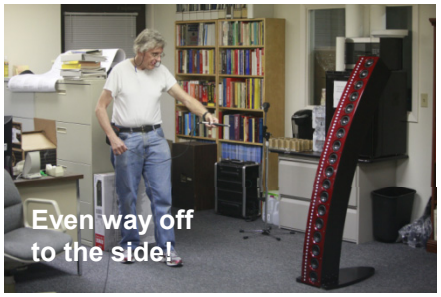
Note: This CBT36 was loaded with black-dome tweeters. The response with silver-dome tweeters is exactly the same.

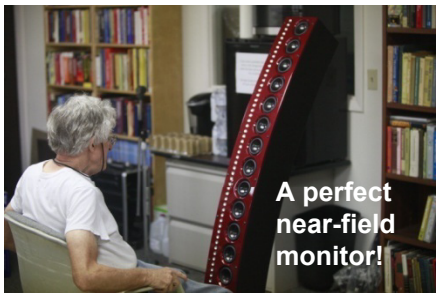
Perfect Sound Everywhere!







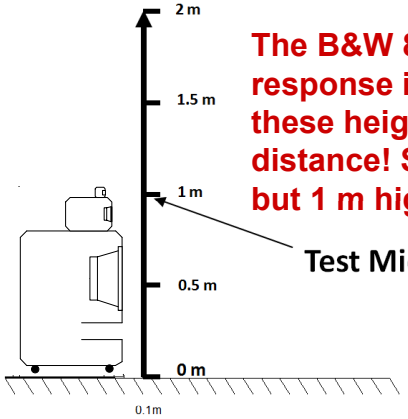




B&W 801 vs. CBT36

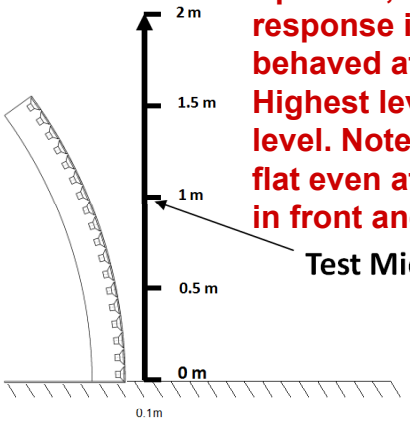
Response vs. Height

Response vs. Height at 0.1 m (4”) in Front of System



The B&W 801 frequency response is quite erratic at all these heights at this close distance! Severe HF rolloffs at all but 1 m high (tweeter axis).

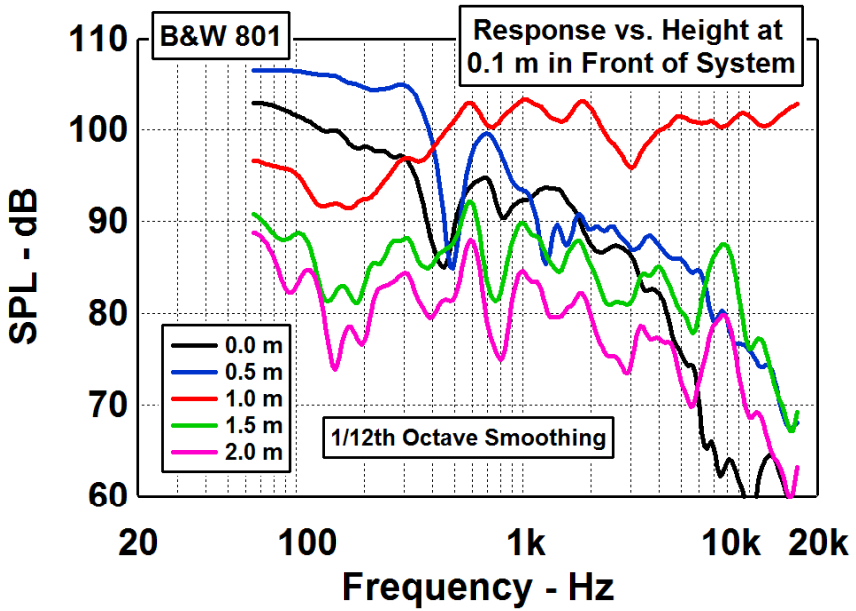
Test Mic Locations



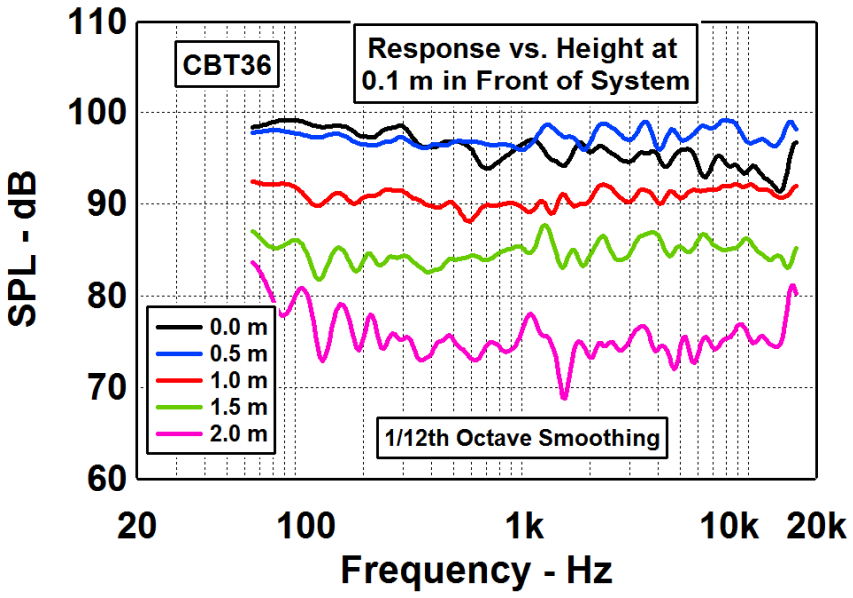
Up close, the CBT36 frequency response is quite flat and well behaved at all these heights! Highest level is close to floor level. Note that response is fairly flat even at 2 meters high directly in front and above the array!

Test Mic Locations

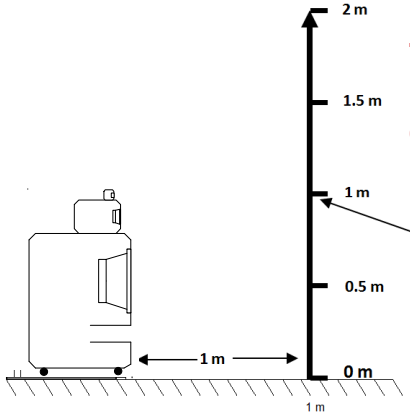
B&W 801



CBT36

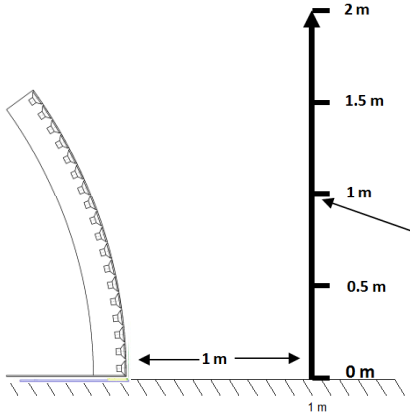


Response vs. Height at 1 m in Front of System



The B&W 801 frequency response is still quite erratic at all these heights at 1 meter away!

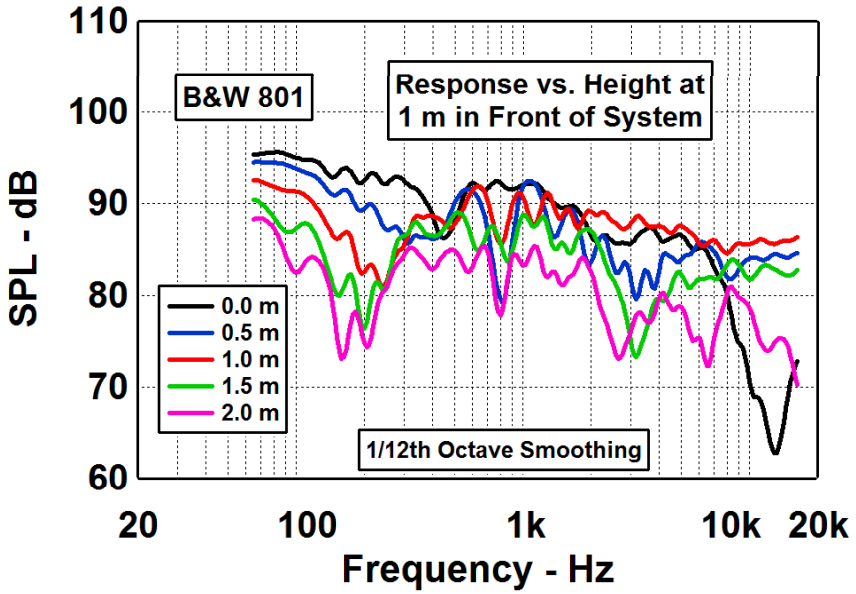
Test Mic Locations



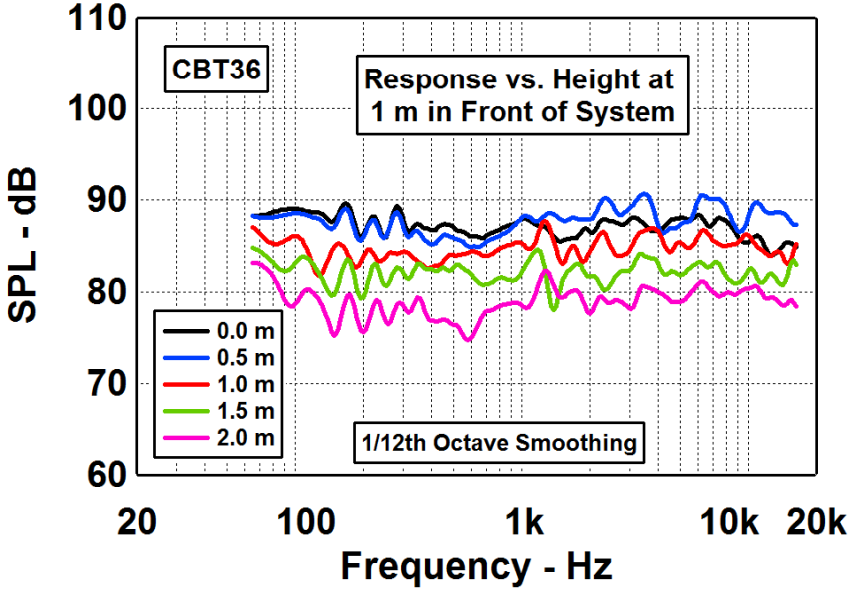
The CBT36 frequency response is quite flat and well behaved at all these heights!

Test Mic Locations

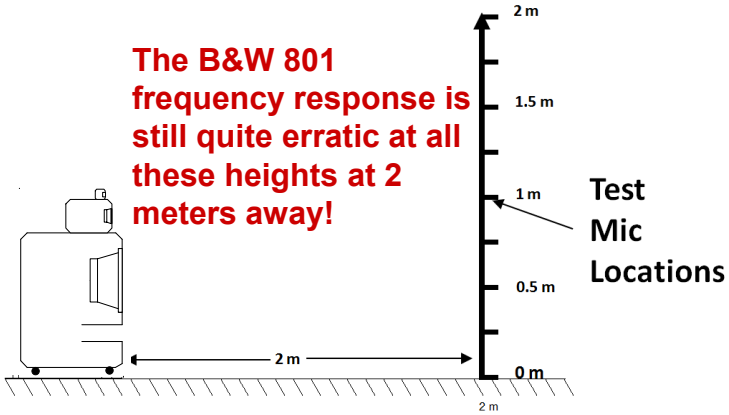
B&W 801

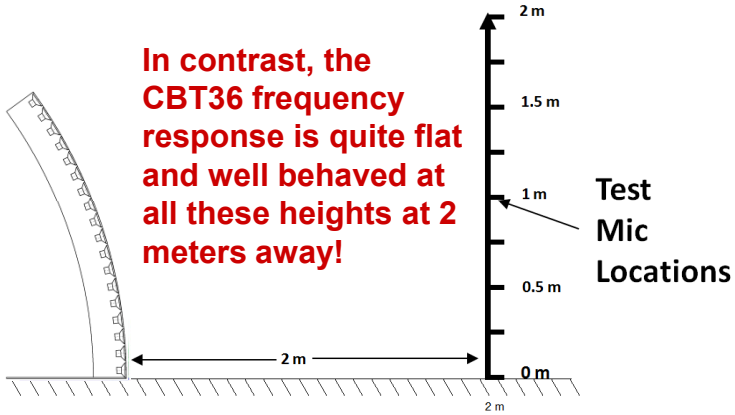


CBT36

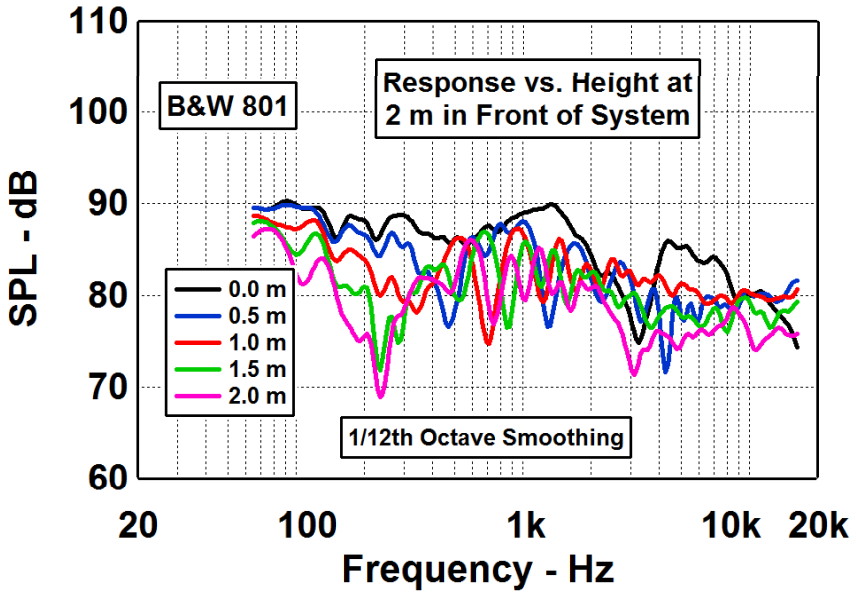


Response vs. Height at 2 m in Front of System

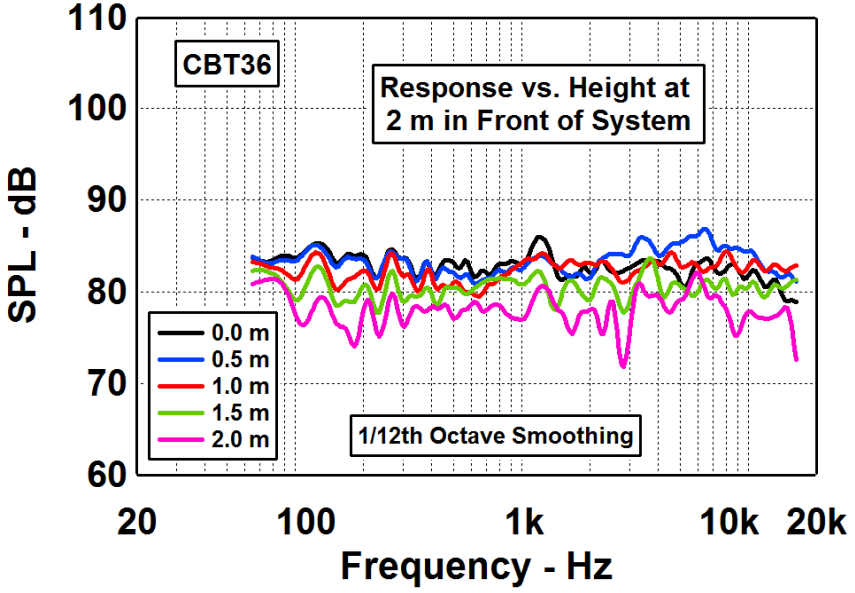




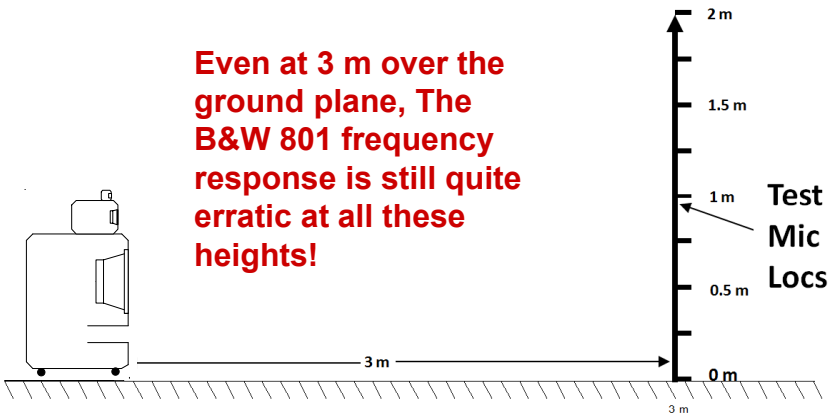
B&W 801

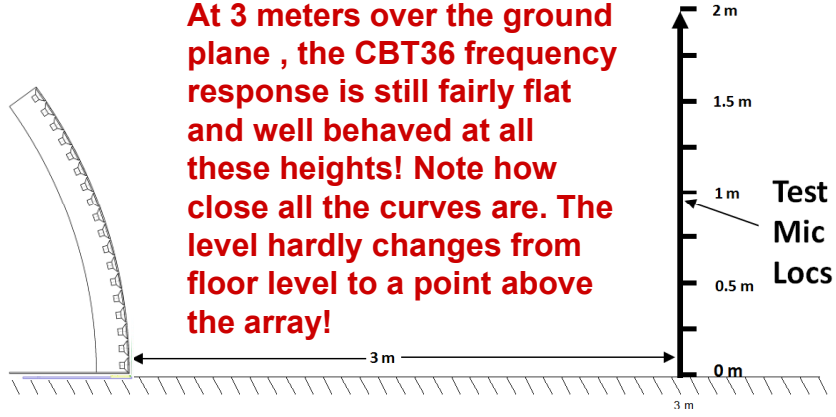


CBT36

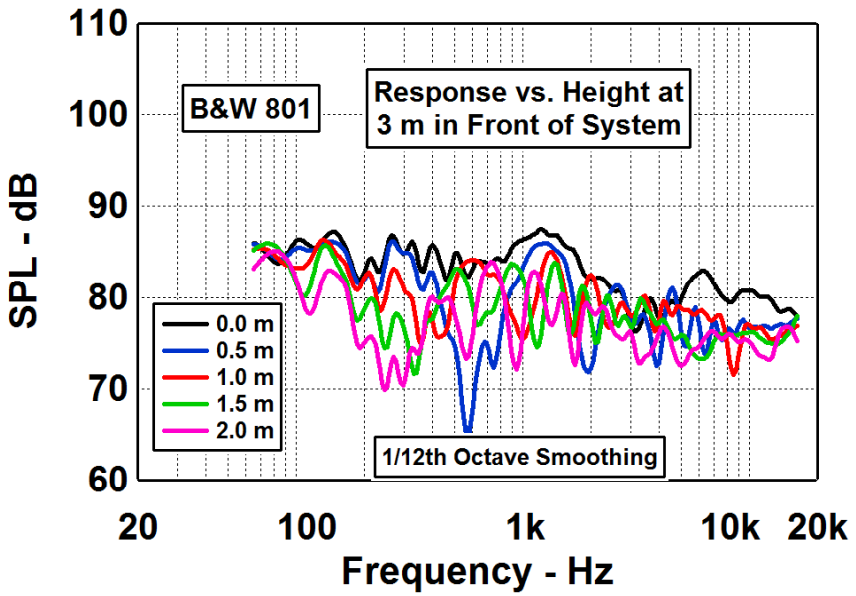


Response vs. Height at 3 m in Front of System

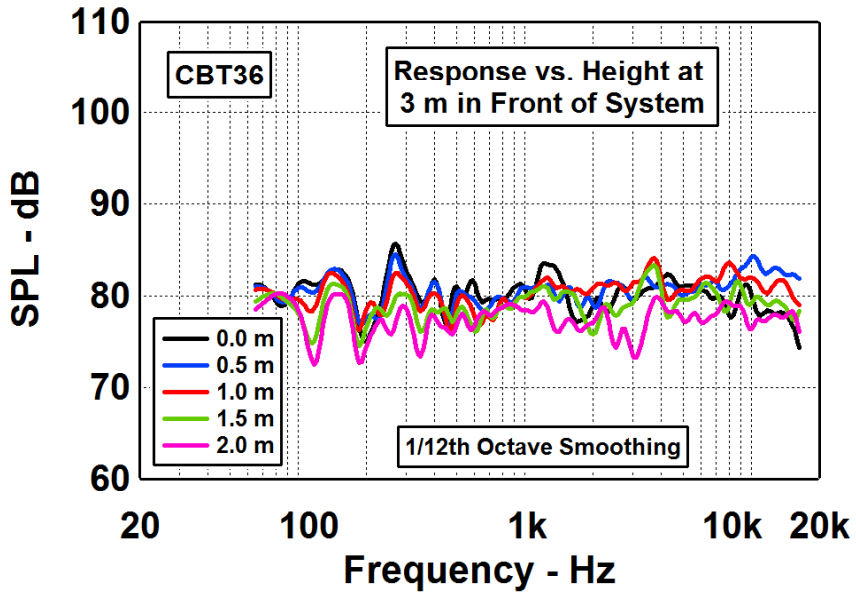




B&W 801



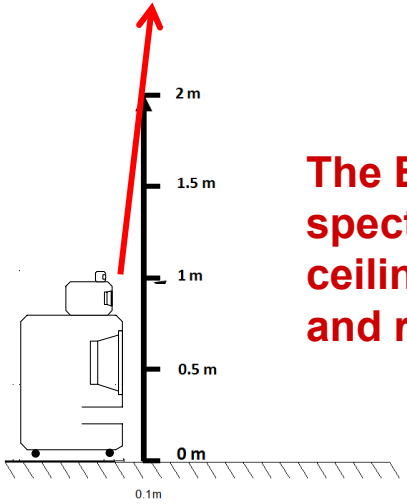
CBT36



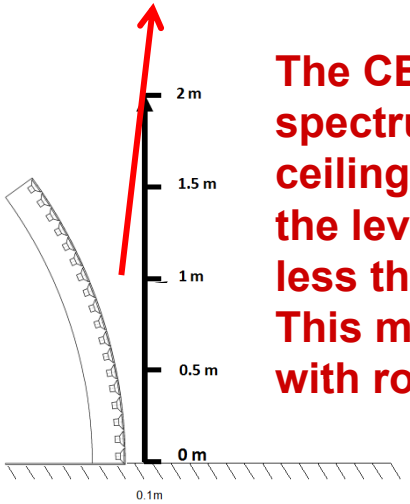
B&W 801 vs. CBT36 Ceiling Coverage

Based on Frequency Responses Measured at 2 m High

Ceiling Spectrum at +82°

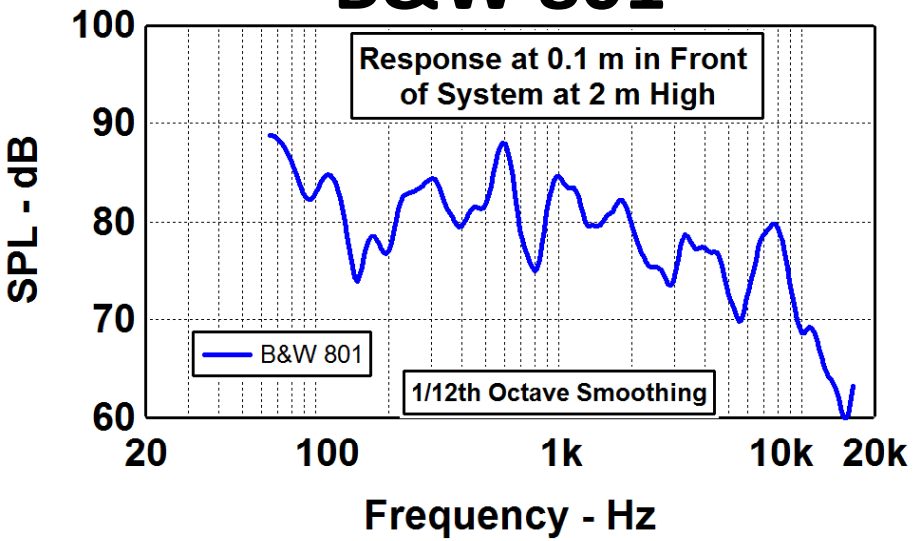


The B&W 801 energy spectrum aimed at the ceiling is very erratic and rough!

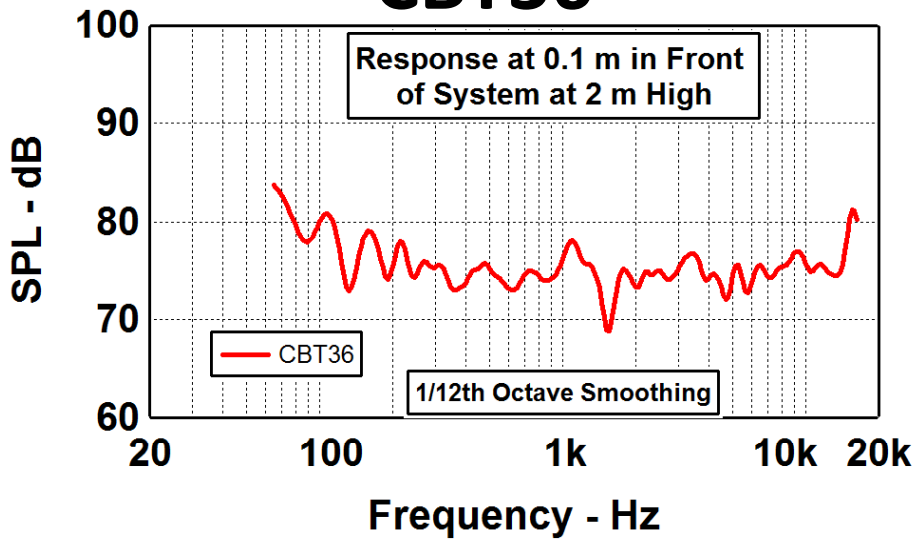


The CBT36's energy spectrum aimed at the ceiling is relatively flat and the level is significantly less than the B&W 801! This means less interaction with room acoustics!

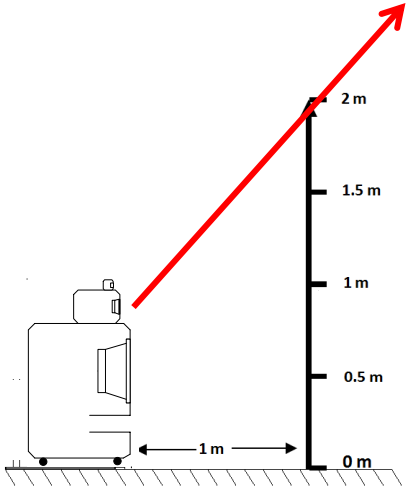
B&W 801



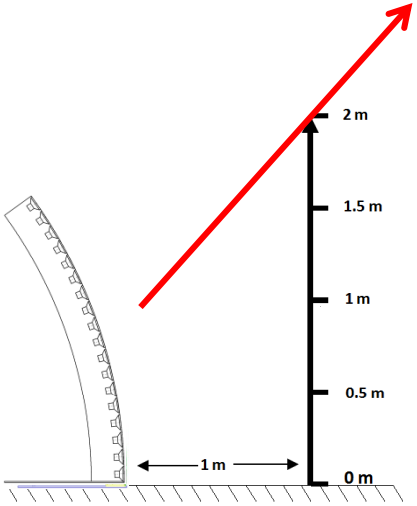
CBT36



Ceiling Spectrum at +45°

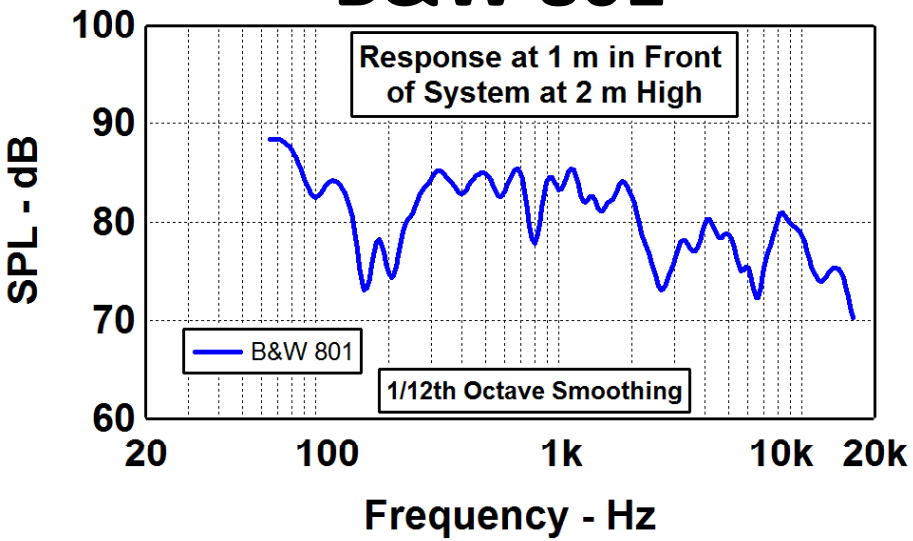


Rough!

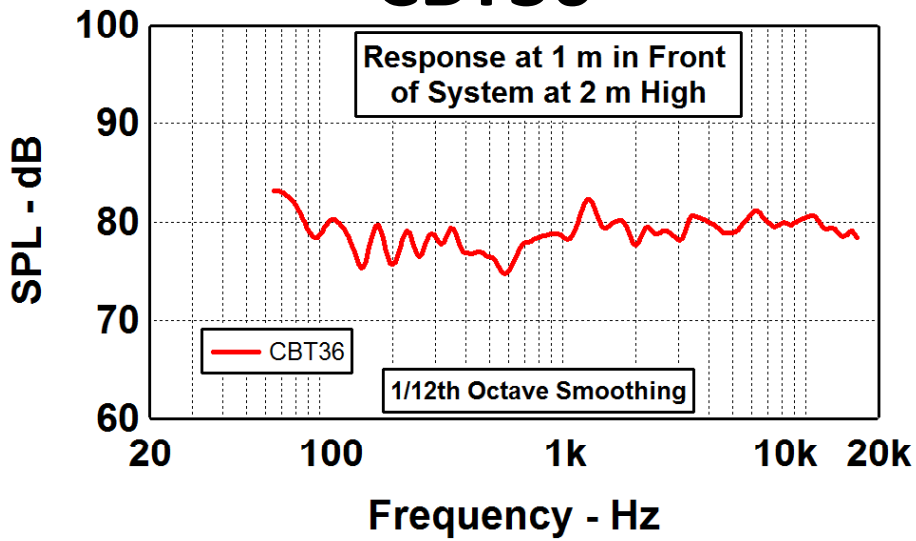


Smooth, flat, and lower in level than B&W 801!

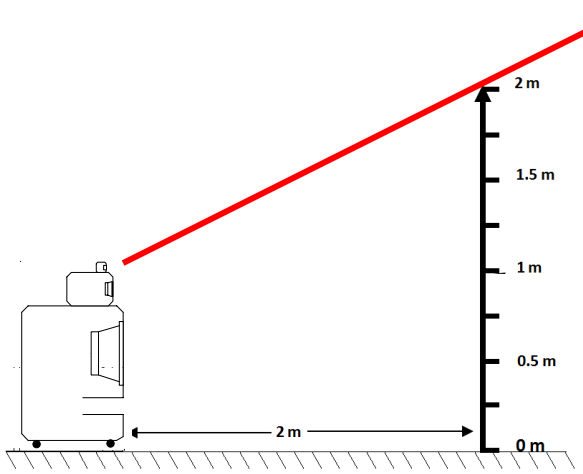
B&W 801



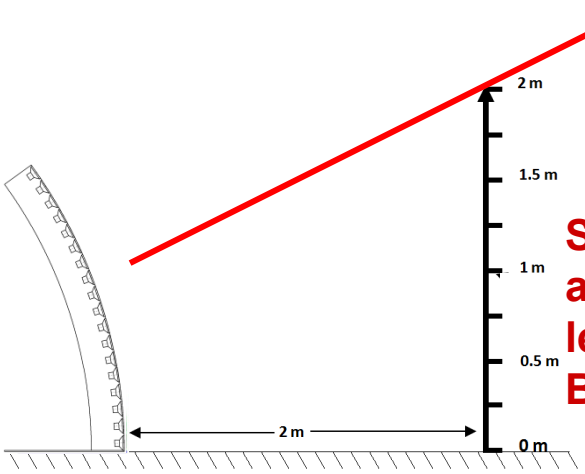
CBT36



Ceiling Spectrum at +27°

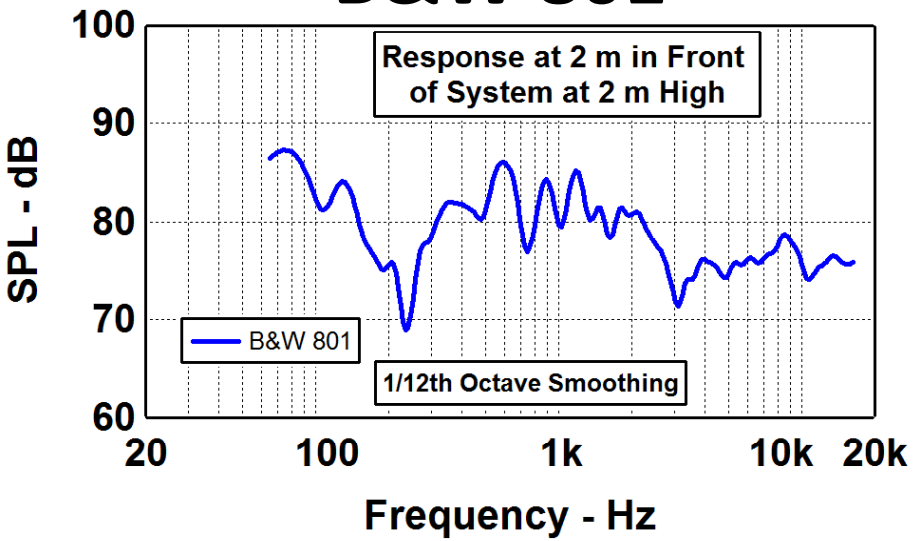


Rough!

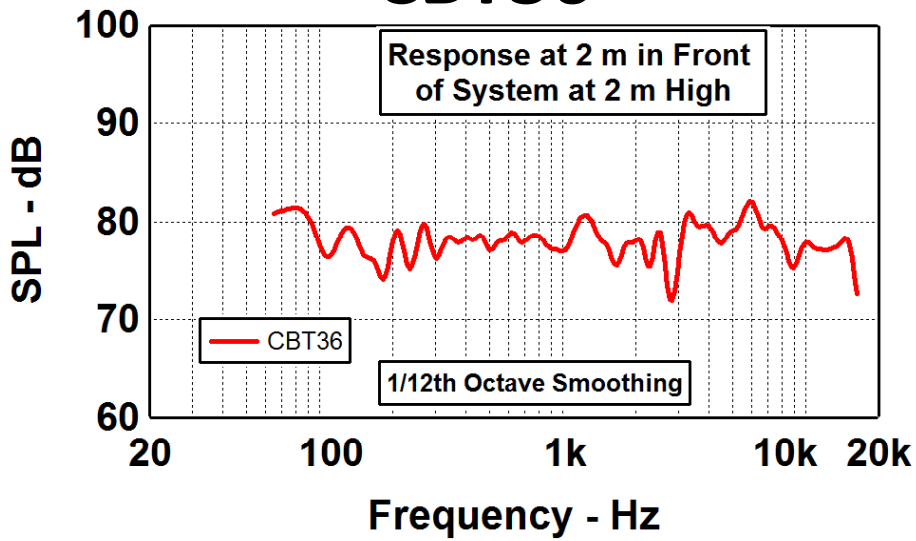


Smooth, flat, and lower in level than B&W 801!

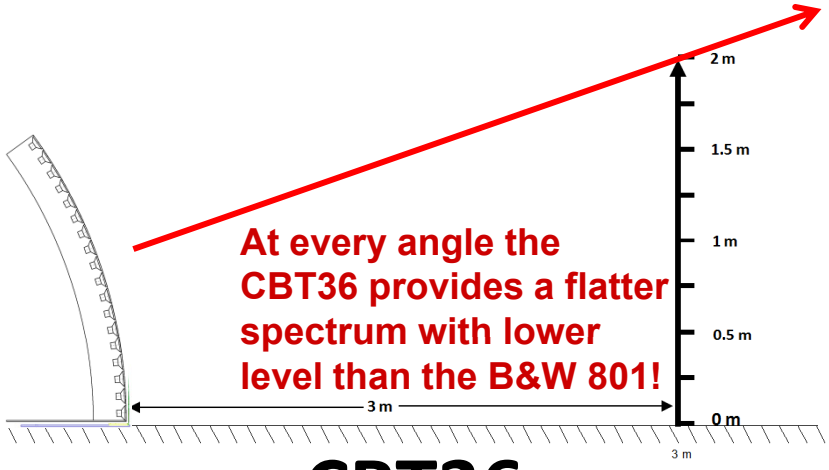
B&W 801



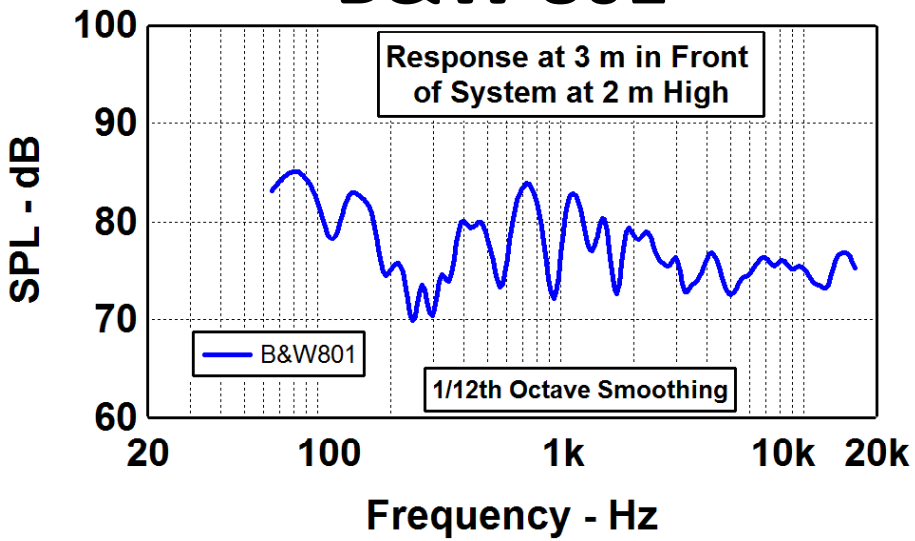
CBT36



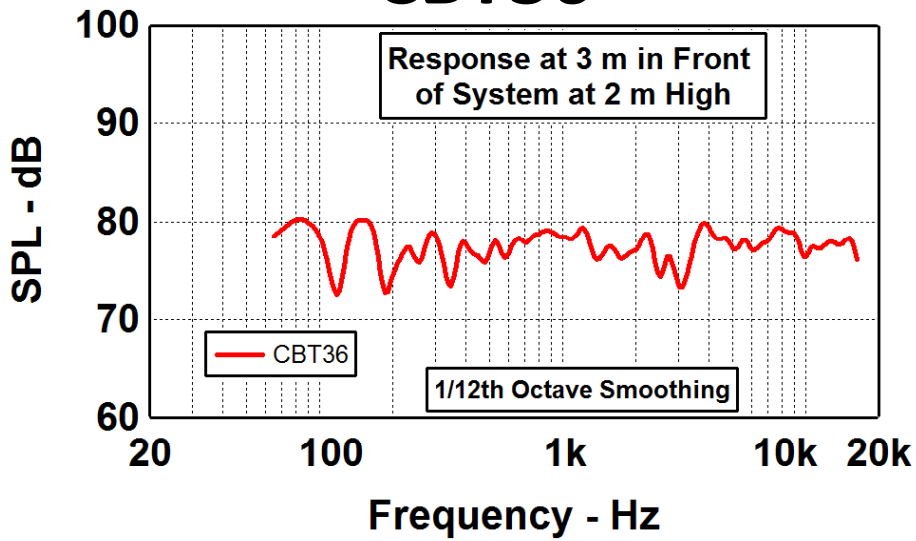
Ceiling Spectrum at +18°



B&W 801



CBT36

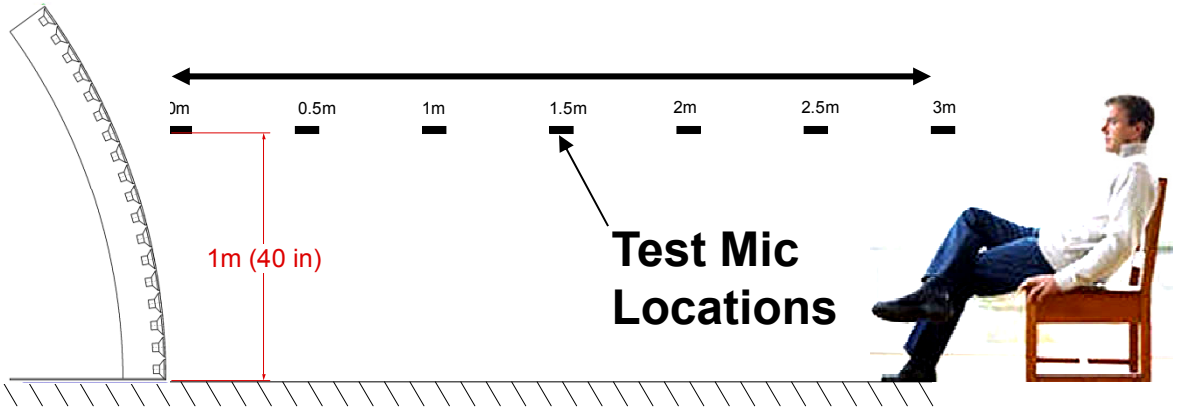


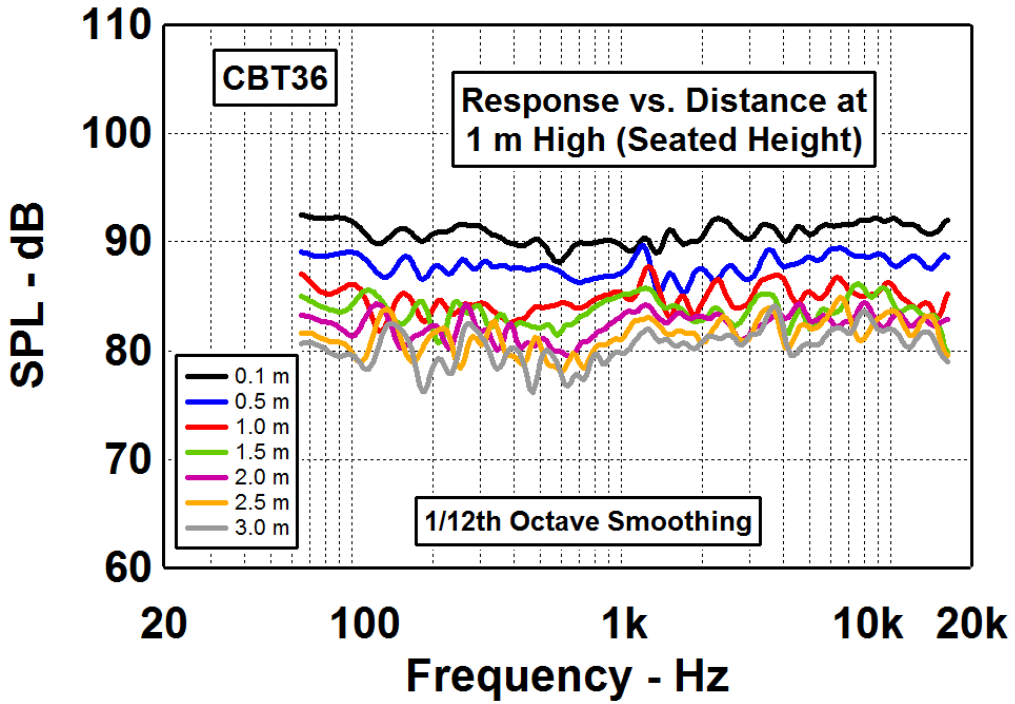
CBT36

Response vs. Distance

CBT36 Response vs. Distance at Seated Height (1 m)

At seated height, the level only decreases 10 dB from directly in front to 10 ft away and stays relatively flat!

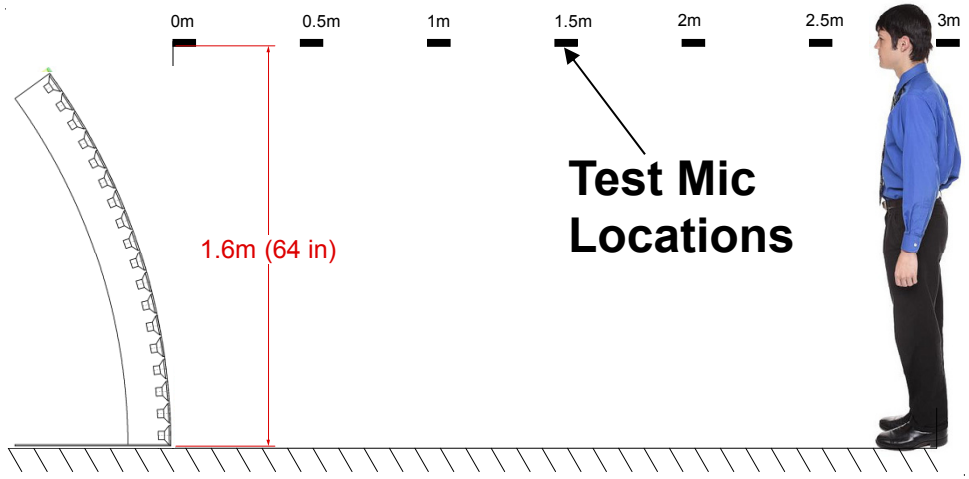


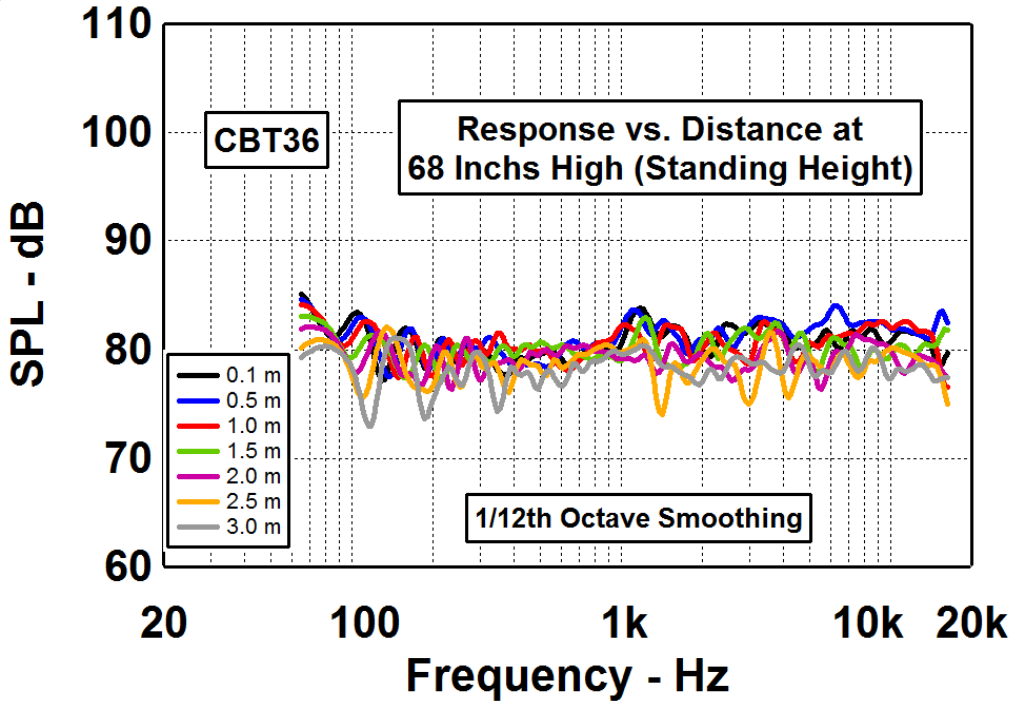


CBT36 Response vs. Distance at Standing Height (68”)

System defies inverse square law!

No level change from directly in front to 10 ft away and stays flat!





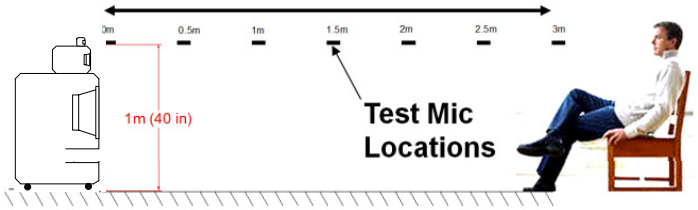
B&W 801 vs. CBT36

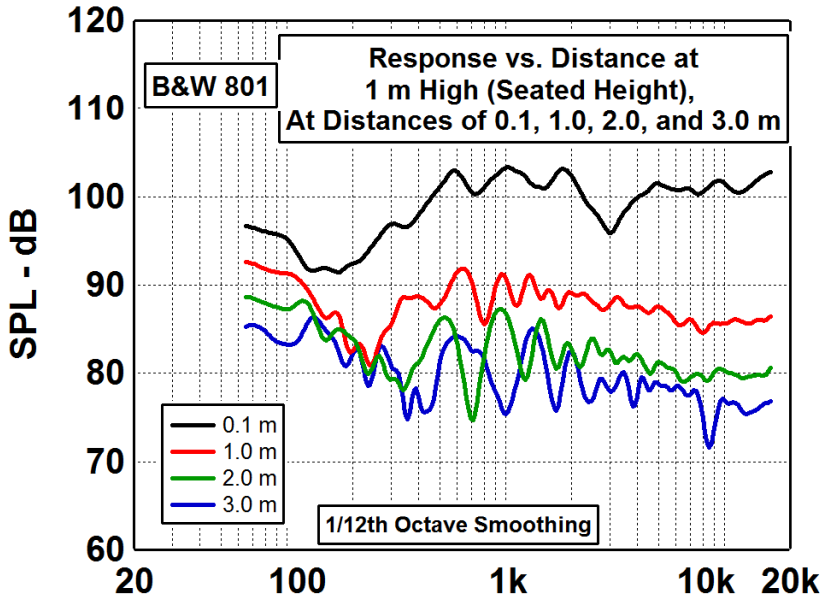
Response vs. Distance

Response vs. Distance at Seated Height (1 m)

B&W 801

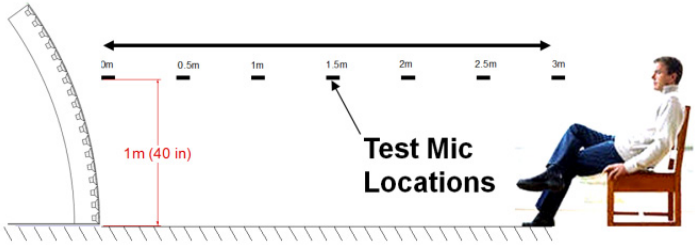
At seated height, the frequency response envelope spans nearly 30 dB from directly in front of the system to 10 ft away and is quite rough and uneven! Note that at a distance of 0.1 m, the mic is directly in front of the tweeter and only 4" away (top black curve)!

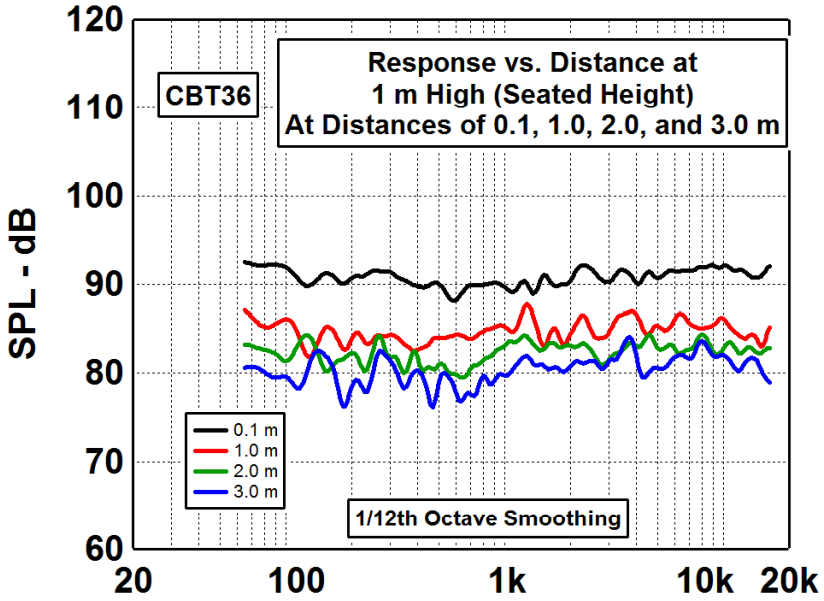




CBT36

At seated height , the level changes only about 10 dB from directly in front of the array to 10 ft away and stays relatively flat!

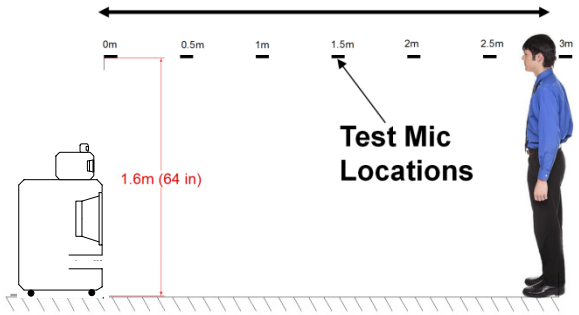


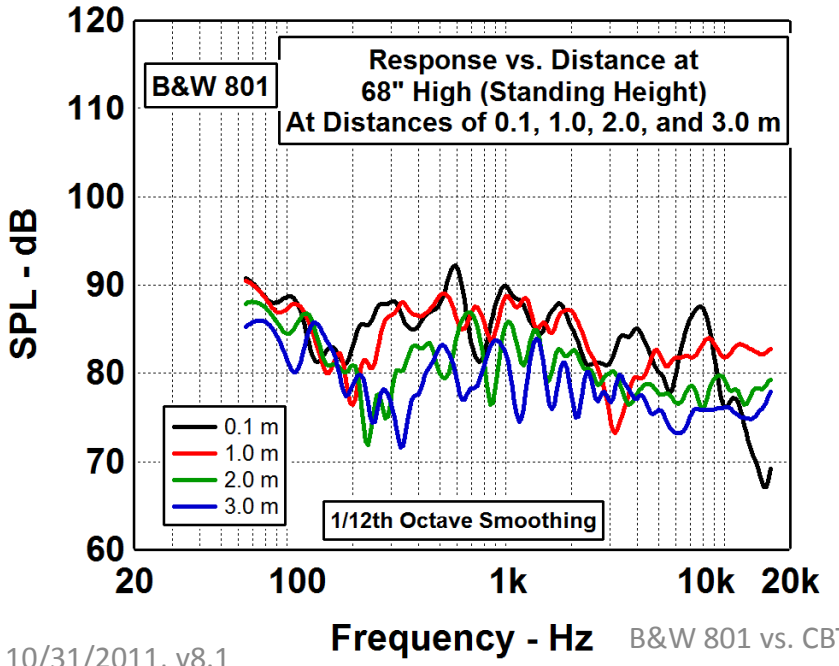


Response vs. Distance at Standing Height (68”)

B&W 801

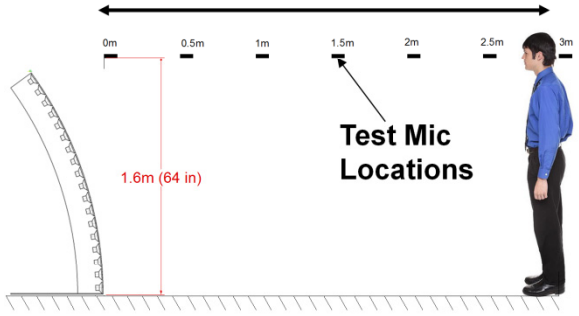
At standing height, the response is quite erratic with distance and barely fits within a large 20 dB envelope!

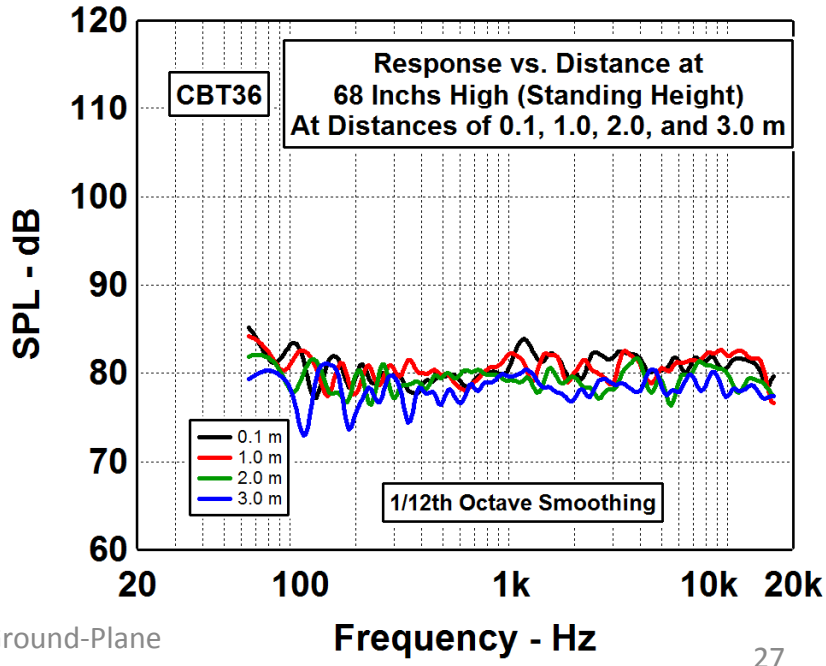




CBT36

Hardly any level change from directly in front to 10 ft away and stays quite flat! System defies inverse square law!



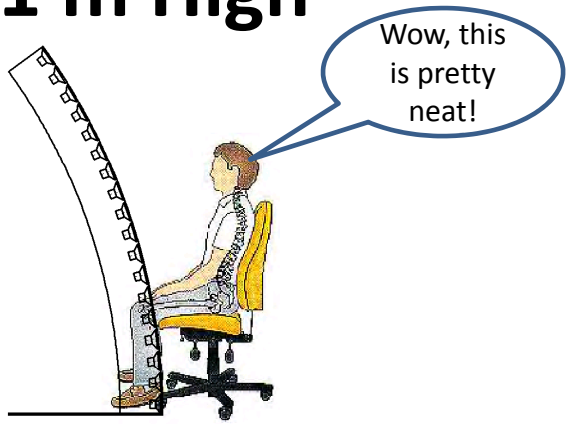


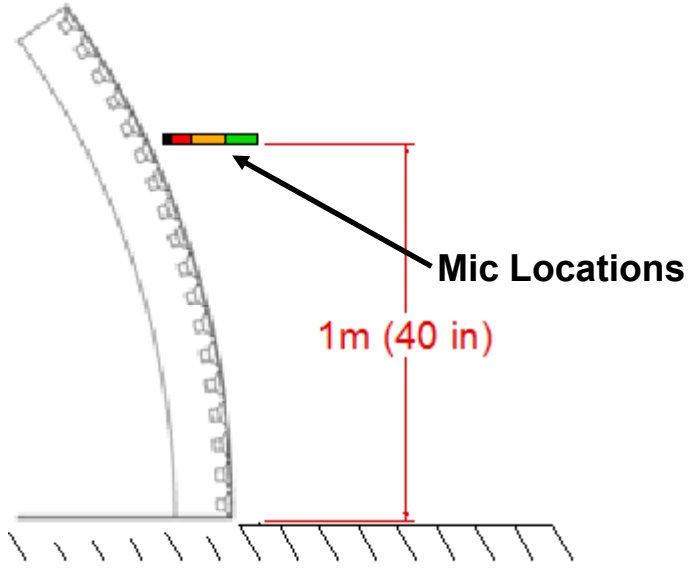
CBT36

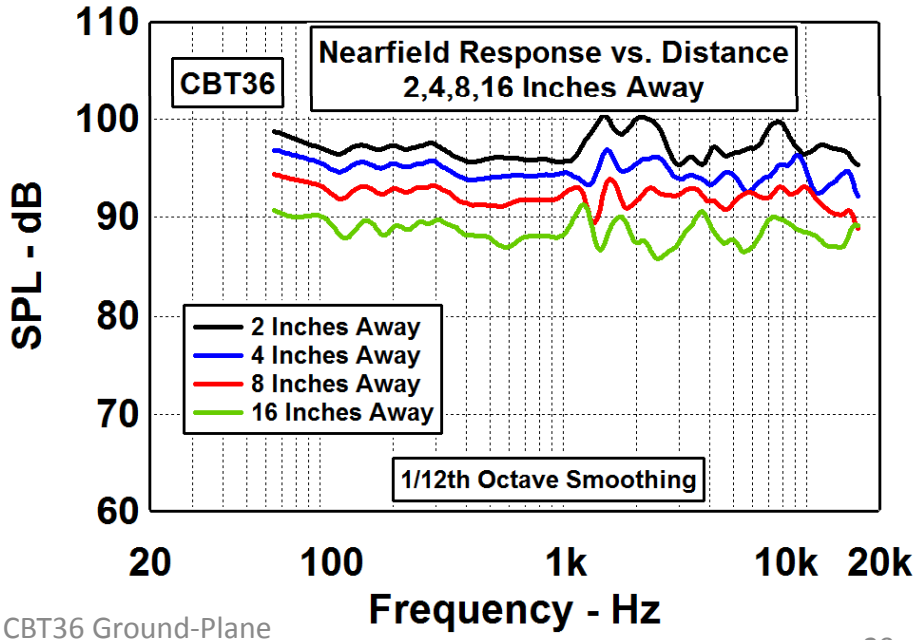
Nearfield Response

CBT36 Near-field Response vs. Distance 2, 4, 8, 16 Inches Away at 1 m High

Note uniformity of very-close response! Is a perfect near-field monitor!



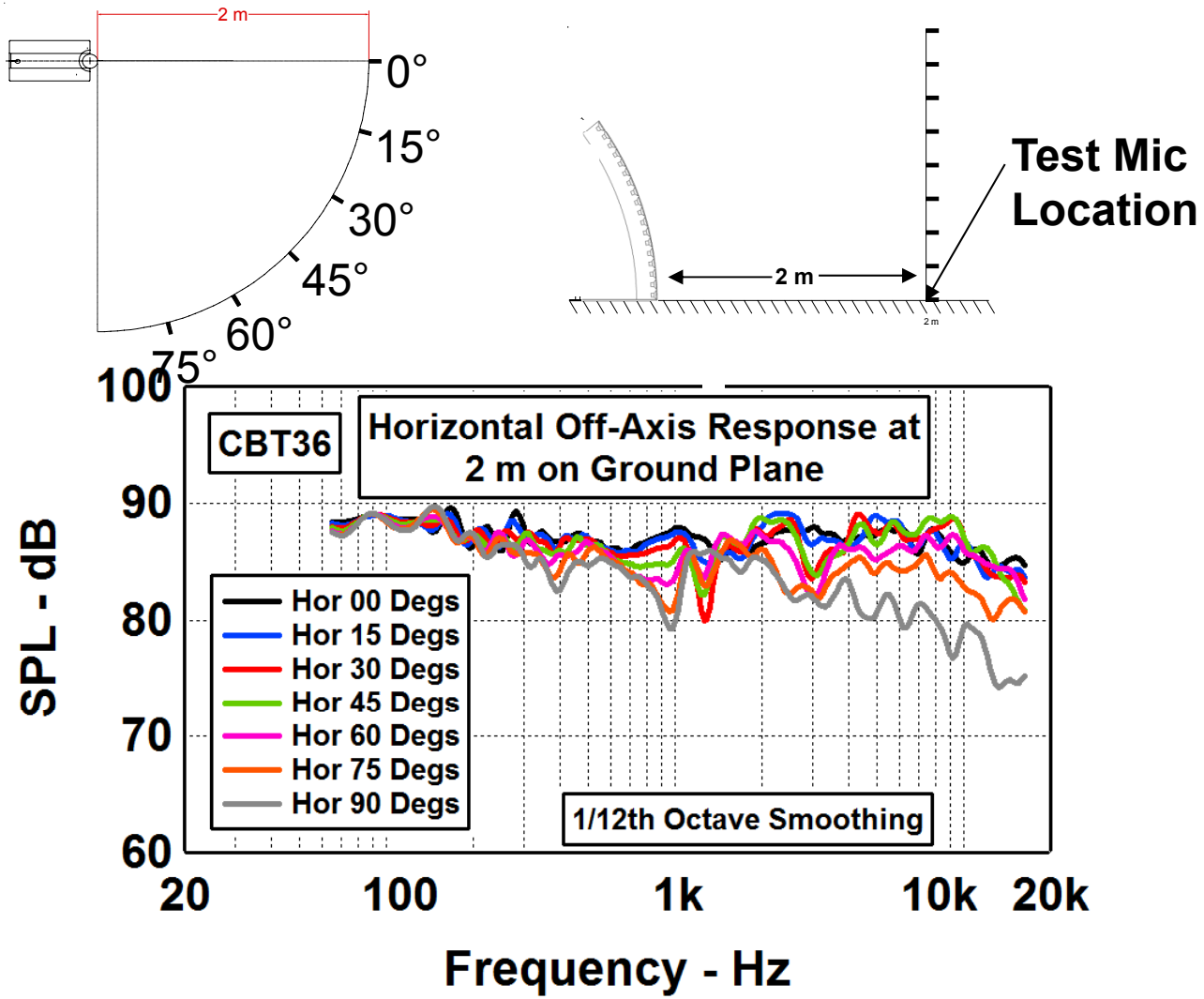




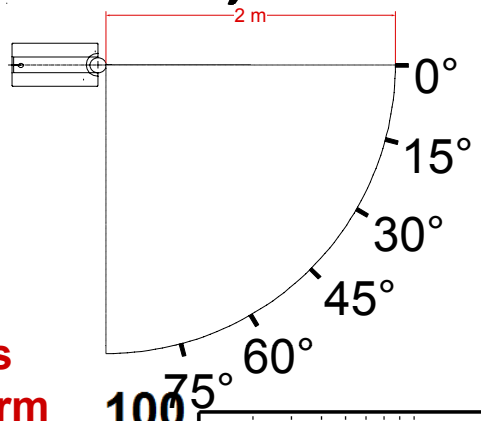
CBT36

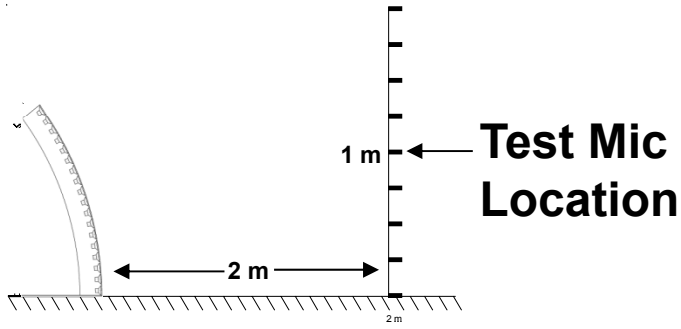
Horizontal Off-Axis Response

CBT36 Horizontal Off-Axis Response at 2 m on Ground Plane

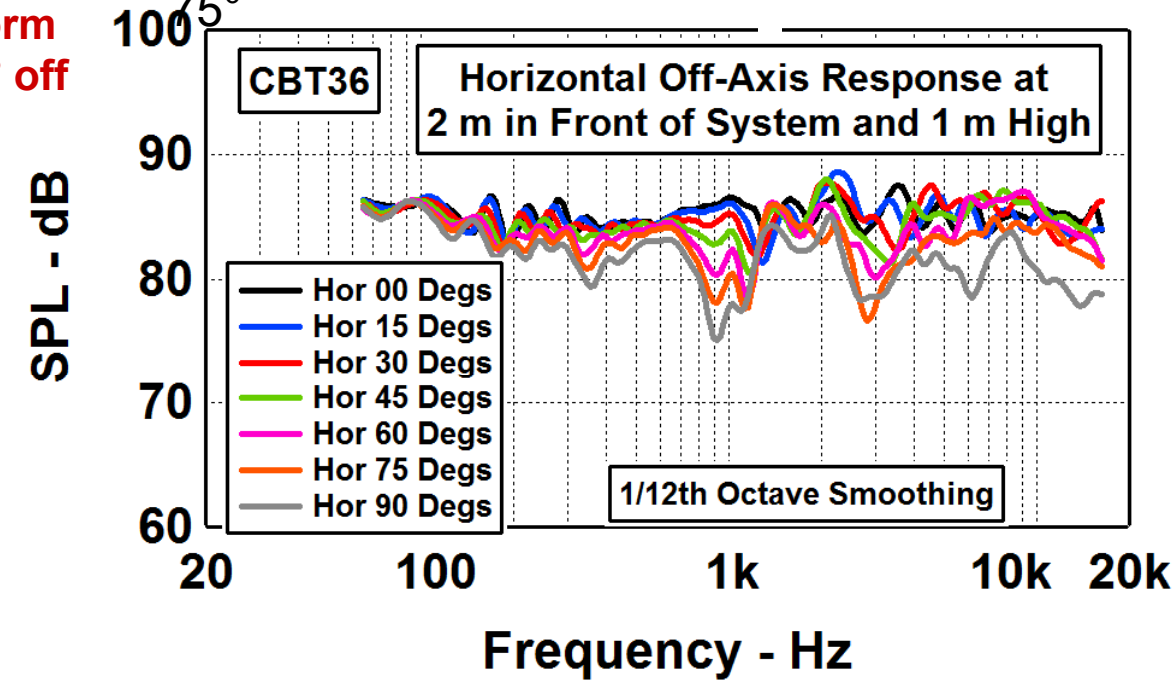


CBT36 Horizontal Off-Axis Response at 2 m, 1 m Above Ground Plane





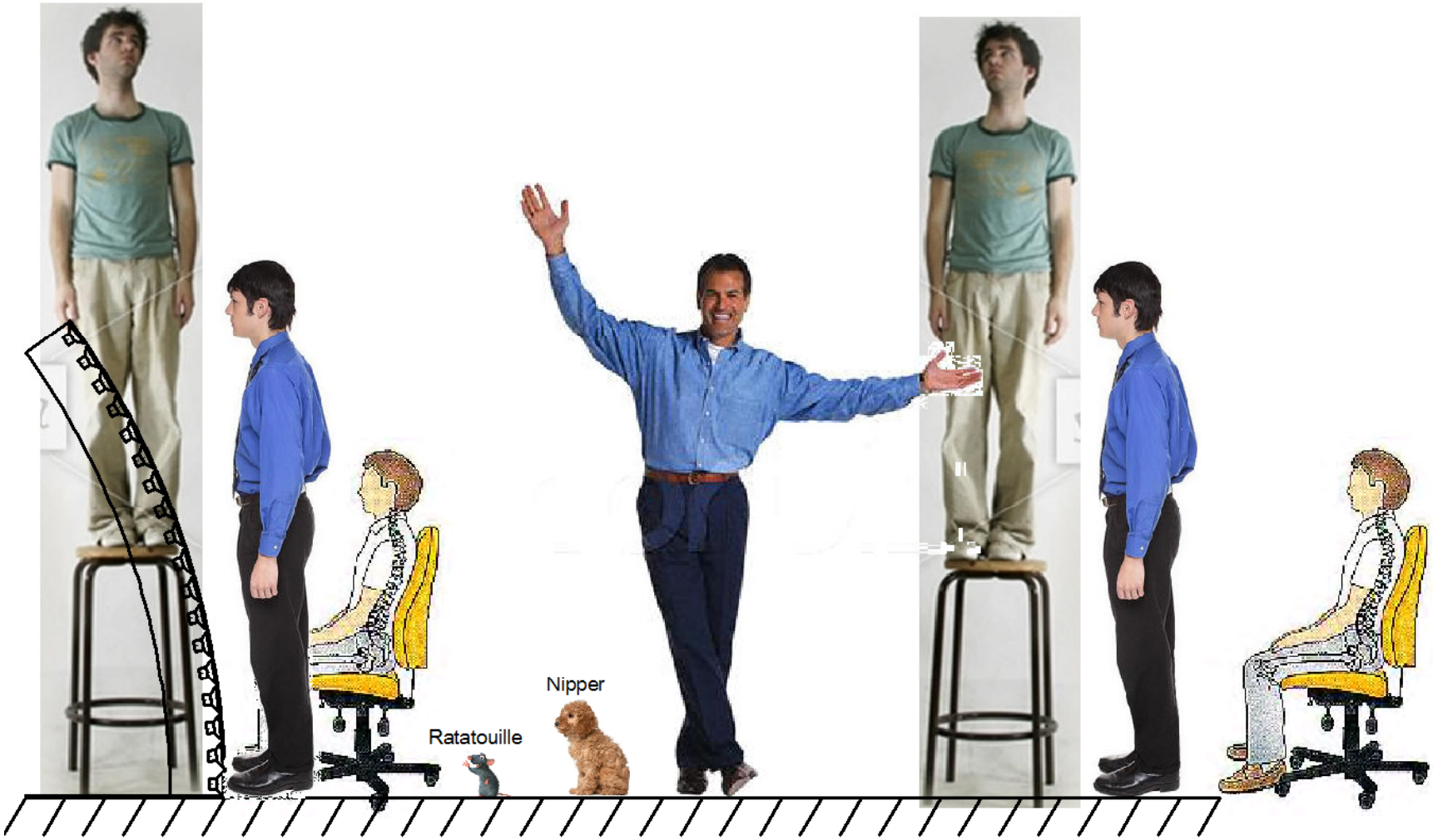
Frequency response is fairly uniform out to ±90° off axis!



B&W 801 vs. CBT36 Ground-Plane Measurements Observations:

- Note the extremely even frequency response over the floor as compared to the B&W 801. No floor bounce!
- At standing height, the volume and frequency response of the CBT36's hardly changes over a very wide distance range of 0.1 m to 3 m (4 in to 10 ft)! It doesn't blast you out when you are up close!
- Note that in every case, for equal 1 m axial levels, the CBT36 illuminates the ceiling with less energy than the B&W 801! In addition, the CBT36 energy that is directed up towards the ceiling (or the side walls for that matter, these measurements are soon to come) has a much flatter spectrum than that provided by the B&W 801.
- Also notice the very well behaved near-field curves. It is a perfect near-field monitor!
- The horizontal off-axis frequency response of the CBT36 is quite well behaved and extended out to ±90° from on axis!

Great Sound Everywhere!



Hey, I had fun with this slide!

Vintage Photographs

The photo on the right was taken on Oct. 27, 2004 at the Harman Tech Meeting at the Renaissance Parc 55 Hotel which occurred during the San Francisco AES Convention. It shows Floyd Toole (with wine glass in hand) and Don Keele standing on chairs listening to the first CBT ground-plane circular-arc prototype, the CBT45. We were standing on chairs to illustrate that the sound coverage was excellent at points high and close to the array. Note grins on both faces! The prototype was a one-way system that utilized 48 headphone transducers and was constructed of clear plastic PVC pipe. The photo on the left was taken in 2004 of the CBT45 prototype at Harman/Becker Automotive System's workshop in Martinsville, Indiana.

- CBT 45°-Arc Curved Array
- Ground-Plane Design
- Height = 1.35m (54in)
- Uses 48 AKG XXL-V5 Headphone Drivers
- Operating range of 100 Hz to 12 kHz
- Composed of Eight 5.625° Straight Segments
- Each segment is constructed of 4in-ID clear PVC pipe (www.harvelplastics.com)
- Each module tuned to 120 Hz
- Provides a 34° vertical beamwidth (-6 dB)
- Controls coverage down to 200 Hz
- Qualifies for a true wide-band constant directivity source!

The End