Product Review

Testing the Parts Express MTM Kit

By Joe D'Appolito

Listening Critique by Dennis Colin

FIGURE 1: PE MTM KIT IMPEDANCE MAGNITUDE (BOTTOM) AND PHASE (TOP).

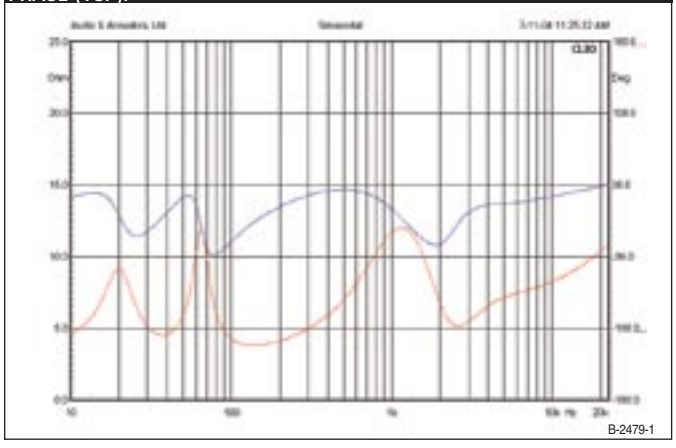
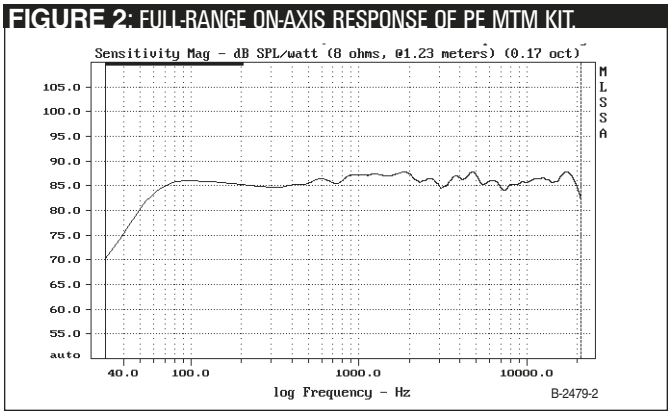


FIGURE 2: FULL-RANGE ON-AXIS RESPONSE OF PE MTM KIT.



I ran a series of impedance, frequency response, polar response, and distortion tests on the Parts Express MTM kit that Ed Dell built (March '05 *aX*).

IMPEDANCE

Figure 1 is a plot of system impedance magnitude (bottom) and phase (top). At low frequencies the plot displays the double peaked curve typical of vented systems. The impedance minimum between the peaks at 39.3Hz indicates the vented-box tuning frequency (Fb). There is an absolute impedance minimum of 3.12Ω at 136Hz. Impedance phase angles range from +32° to –34°. I would rate this a 4Ω speaker.

FREQUENCY RESPONSE

Figure 2 shows the full-range frequency response of one of the pair of MTM speakers. This response is obtained as a combination of the far-field quasi-anechoic response in the freestanding position and a ground plane measurement[1]. I placed the microphone along the tweeter axis at a distance of 1.23m to produce the far-field freestanding response. I took the ground plane measurement with the mike placed at 2m on the tweeter axis. I then spliced ground plane and far-field responses together at 200Hz to produce the full-range response[1]. The response data is ⅙ octave smoothed. In the two octaves between 500Hz and 2kHz sensitivity averages 87dB SPL/2.83V/1m. Relative to this level, response varies by +0.9dB and –3dB over the range of 100Hz to 20kHz. The low-frequency point –3dB is at 58Hz.

The PE MTM is not configured for bi-wiring, so I could not determine responses for the individual drivers. But from data to be shown later, the crossover point appears to be somewhere in the range of 2000 to 2500Hz.

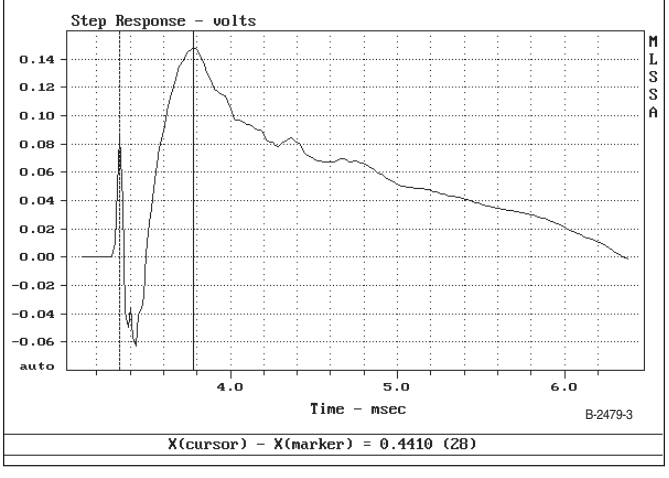
WOOFER/TWEETER TIMING

The PE MTM step response is plotted in *Fig. 3*, showing two separate arrivals of acoustic energy. The initial sharper positive spike is the tweeter arrival. It is followed by the woofer arrival, also positive, beginning about 160µs (0.16ms) later. The woofer peak is delayed relative to the tweeter peak by 440µs. These peaks are not, however, a good measure of the average tweeter/woofer delay. Although not shown, a detail examination of the excess group delay plot[1] shows the woofer pair to be exactly 290µs (0.29ms) behind the tweeter. Although both drivers connected with positive polarity, the system is not time-coherent.

CUMULATIVE SPECTRAL DECAY

The PE MTM cumulative spectral decay (CSD) response is presented in *Fig. 4*. This waterfall plot shows the frequency content of the system response following a sharp impulsive input at time zero. On the CSD plot, frequency increases from left to right and time moves forward from the rear. Each slice represents a 0.2ms increment of time. The total vertical scale covers a 30dB dynamic range.

FIGURE 3: PARTS EXPRESS MTM STEP RESPONSE.



Ideally the response should decay to zero instantaneously. Inertia and stored energy that take a finite amount of time to die away, however, characterize real loudspeakers. A prominent ridge parallel to the time axis indicates the presence of a strong system resonance.

The first time slice in *Fig. 4* (0.00ms) represents the system frequency response. There are major response ridges at 3.1kHz and 5kHz decaying slowly and extending out to 5ms. I suspect these come from the woofer pair. The tweeter generates a fair amount of "hash" above 10kHz extending out to 2ms followed by a series of ridges disappearing at about 4.5ms. This is characteristic of many metal dome tweeters. Compared to other loudspeakers I have tested for *audioXpress*, this is rather poor decay performance. See Dennis Colin's reaction to this performance in the accompanying Listening Critique.

HORIZONTAL POLAR RESPONSE

Horizontal polar response is examined in *Figs. 5* and *6*. *Figure 5* is a waterfall plot of horizontal polar response in 10° increments from 60° right (+60°) to 60° left (–60°) when facing the speaker. All off-axis plots are referenced to the on-axis response, which appears as a straight line at 0.00°. For this reason, the plotted curves show the *change* in response as you move off-axis. For good stereo imaging the off-axis curves should be smooth, evenly spaced replicas of the on-axis response with the possible exception of some tweeter rolloff at higher frequencies and larger off-axis angles.

Within ±30°, the off-axis curves are indeed fairly smooth replicas of the on-axis response. The –3dB coverage at 15kHz is ±22°. At 10kHz the –3dB coverage extends to ±30°. This is typical of 25mm

FIGURE 4: PE MTM KIT CUMULATIVE SPECTRAL DISPLAY.

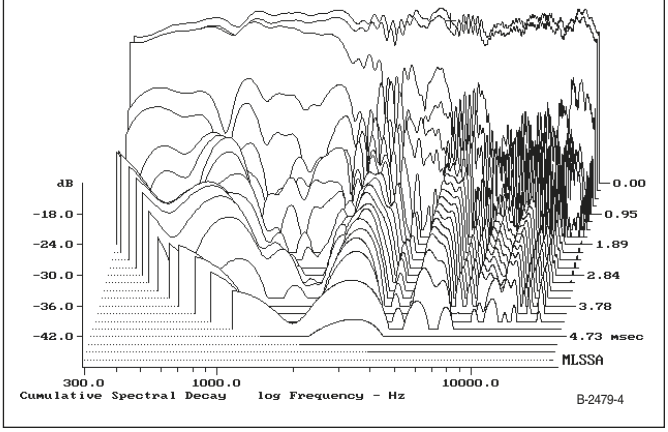
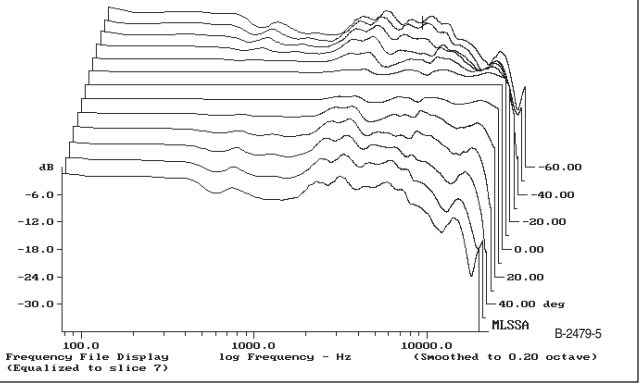


FIGURE 5: PE MTM KIT HORIZONTAL POLAR RESPONSE.



dome tweeters. The 60° curve shows the transition from the woofer pair to the tweeter starting just above 2kHz. Here you can see change from the narrowing response of the woofers to the broader response of the tweeter.

Within the woofer pair active range the worst case –3dB width occurs at 1.4kHz and ±35°. This is due to the woofer pair directivity at that frequency. At ±60° off-axis and 1.44kHz response is down 7.2dB. By 3kHz the system output has fully transitioned from the woofer pair to the tweeter. At 3kHz and ±60°, response is down only 2.1dB. The response at large off-axis angles is typical of two-way systems.

The average response over a 60° horizontal window (±30°) in the forward direction is a good approximation of the way a speaker will sound in a typical listening environment. This response is plotted in *Fig. 6* (solid line) and compared to the on-

FIGURE 6: AVERAGE HORIZONTAL RESPONSE OVER ±30°.

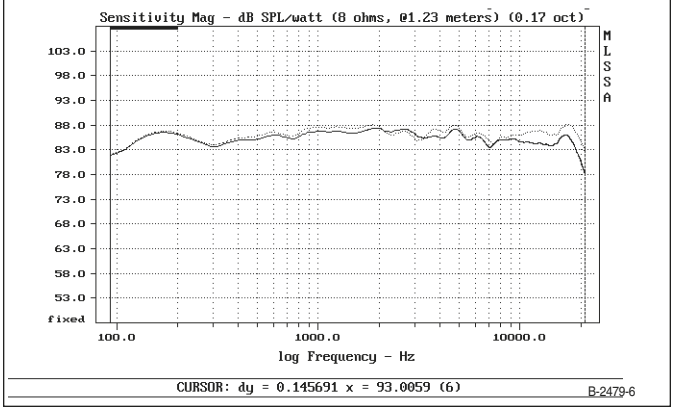


FIGURE 7: PE MTM KIT VERTICAL POLAR RESPONSE.

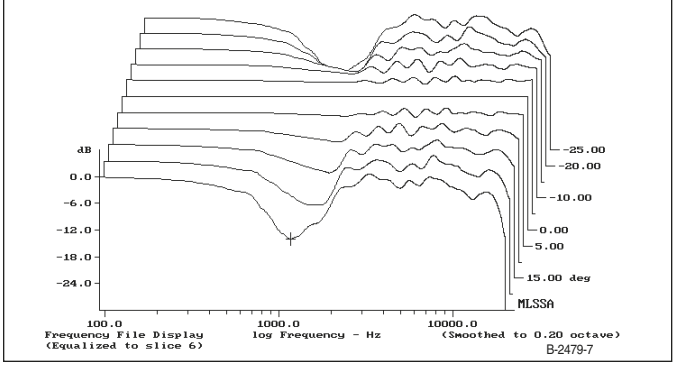
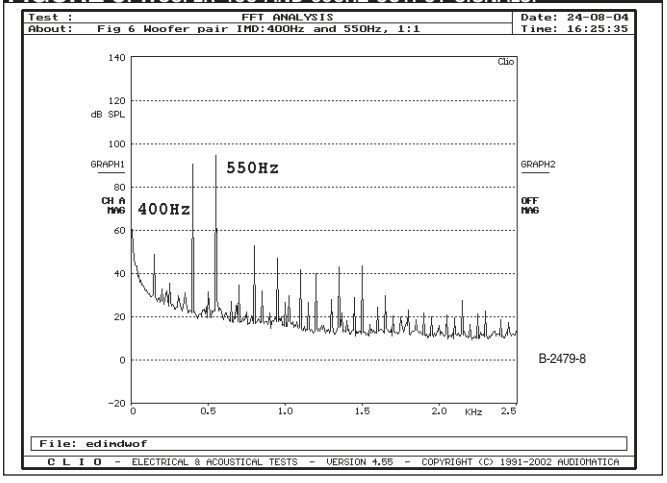


FIGURE 8: WOOFER 400 AND 550HZ OUTPUT SIGNALS.



LISTENING CRITIQUE

By Dennis Colin

My first impression (and one that persisted) was that this speaker has a reasonably well-balanced sound, smooth and extended highs, reasonable bass (for its size), and the very good image focus and staging that you expect from minimum-width-baffled MTM arrays. But there's something about the midrange that I would describe as an indistinctness, a lack of clarity and immediacy. Without benefit of reviewing Joe D'Appolito's measurements, I'd say the midrange response sounded somewhat uneven, and also emphasized in the 1–3kHz "presence" region.

These characteristics were not severe enough to be constantly disturbing. Depending on the music, the midrange coloration could be moderately noticeable, able to be ignored, or almost inaudible. Strangely perhaps—considering that 1–3kHz is where the ear is most sensitive and where voice detail and harmonics are most prevalent—voice was not unpleasantly or unnaturally affected. Voices sounded good. Most affected were violins and massed strings, horns, clarinet, and (to a lesser degree) piano and lower pitch-range percussion.

SPECIFIC RECORDING IMPRESSIONS

Turtle Creek Chorale, **Reference Recording RR-905CD:**
I've waxed poetic about the haunting depth and quality of these male voices singing "Alleluia" on the Thor speakers (May '02 *aX*). I wrote, "I've never heard more natural-sounding voice reproduction, period." Well, that's a tough act to follow, but the MTM units did a good job with Turtle Creek—the voices were smoothly reproduced and focused, though of course not stunningly so, as on the Thors. I noticed only a slight midrange emphasis.

Jacintha, **FIM XRCD020**
There was a slight sibilance (emphasized "s" sound), but otherwise her voice and the instruments, including string bass, were good-sounding in tonality and spatial depth.

Carmen Fantasy, Percussion Fantasia, **FIMCD017**
From deeply pitched drums to tiny triangles, this recording is an excellent test track for transient clarity, impact, and frequency response extremes. With these speakers, the HF response and transients were very good; midrange was somewhat indistinct and "presence region" emphasized; and the bass drums were reasonably solid and deep.

Swing Live with Bucky Pizzarelli, **Chesky SACD223**
This is a hybrid multichannel SACD of very high quality, recorded in a New York City jazz club. Instruments are guitar, vibes, drums, clarinet, and acoustic bass. Everything sounded good except the clarinet, whose spectrum is apparently too sensitive to these speakers' (as I perceived) midrange emphasis. The intimate, well-recorded venue space was very well-reproduced. The audience's uninhibited applause and conversations were realistic, if somewhat overly, present. Overall, the colorations could be forgotten, because the sensation of being there in that warm and intimate jazz club was very convincing.

K622, **Musical Fidelity MFSACD017**
The speakers' (as I perceived) midrange indistinctness and emphasis unfortunately affected the beautifully played and recorded strings and clarinet. Not so much, however, to prevent Ed Dell, Joe D'Appolito, and me from becoming lost in the ethereal beauty of this music. Incidentally, this is a first-rate recording (if you have an SACD player) for auditioning these format differences.

RECOMMENDATIONS

I express some reservations with orchestral music, regarding string tonality. The effect, however, is neither serious nor unpleasant. For jazz, rock, and much vocal and popular music, these speakers can be quite satisfying, and appear to be worth their modest price. I'd guess that the tweeter is of good quality but the mid/woofers are not as good in their midrange. Considering the excellent and beautiful cabinets, it might be worth your while to replace the mid/woofers (if my guess is correct) with units commensurate in smoothness with the tweeter.

COMMENTS ON MEASUREMENTS

Looking at the frequency responses on-axis and ±30° averaged, I'm happy for the speaker, but not for my ability to correlate these responses with my sonic perceptions. I had guessed that the midrange area was uneven and emphasized around 1–3kHz. On-axis,

axis response (dotted line). The average horizontal response is within 1.2dB of the on-axis response out to 10kHz and is only 2dB down at 15kHz. This is excellent horizontal performance and suggests good direct field coverage in the primary listening area. There will be little change in spectral balance with changing position. Image stability should be very good.

VERTICAL POLAR RESPONSE

Figure 7 is the waterfall plot of vertical polar response. Responses are shown in 5° increments from 25° below (–25°) the tweeter axis to 25° above it. Off-axis responses out to ±5° track the on-axis response with little error. At ±10°, off-axis vertical response is down 3dB at 1845Hz. As angles approach ±20° and more, deep symmetric notches develop just below 2kHz. This performance is typical of the MTM geometry, and is actually one of its major advantages, greatly reducing floor and ceiling bounces that may confuse imaging.

INTERMODULATION DISTORTION

In past reports I have listed results for both harmonic and intermodulation distortion (IMD) tests. However, I believe IMD tests are more revealing of loudspeaker performance and more demanding of loudspeaker linearity. So in this and future reports I will list only IMD results.

In this test two frequencies are input to the speaker. IMD produces output frequencies that are not harmonically related to the input. These frequencies are much more

1–3kHz *is* elevated, but by only about 2.5dB; what I heard sounded like about 5dB.

The CSD might explain this: Joe said, "rather poor decay performance." The prominent 3kHz ridge "looks like what I heard"—the indistinctness, lack of clarity. The time-domain "hanging on" of 3kHz and higher-frequency "hash" would explain not only a loss of clarity, but perhaps also a sense of tonal emphasis.

Furthermore, both horizontal and vertical off-axis responses show the 2–4kHz region elevated relative to the depressed 1–2kHz octave.

This is an (unusual) example of sound not correlating well with the ±30° horizontal averaged frequency response. But the overall measurement picture, including the CSD and dispersion responses, does appear to correlate with what I heard. I have yet to hear a speaker whose predominant sonic characteristics can't be related to some physically measurable phenomenon visible somewhere within Joe's extensive acoustic tests.

Manufacturer's response:

Part I: Assembly Process

Unfortunately, Mr. Dell (*aX* 3/05) was under the impression that the kit sent to him had the front baffle already permanently installed. This caused numerous problems throughout the assembly process related to driver, crossover, and foam installation. The truth of the matter is the cabinets are indeed shipped with the baffle in place on the front of the cabinet, but they are not *permanently* attached. The cabinets have the baffle merely screwed in place with four Philips-head screws for shipping purposes (the same holds true with all of the PE kits). As it states in the "getting organized" portion of the manual, the baffles should be removed upon unpacking of the cabinets. It also states within the first few paragraphs of the instructions: "if there are any questions during the assembly process, please feel free and contact our Technical Support staff at 1-800-338-0531." If Mr. Dell would have taken a moment to inquire about his baffle situation, he could have quickly cleared up the issue and saved a lot of unnecessary difficulties.

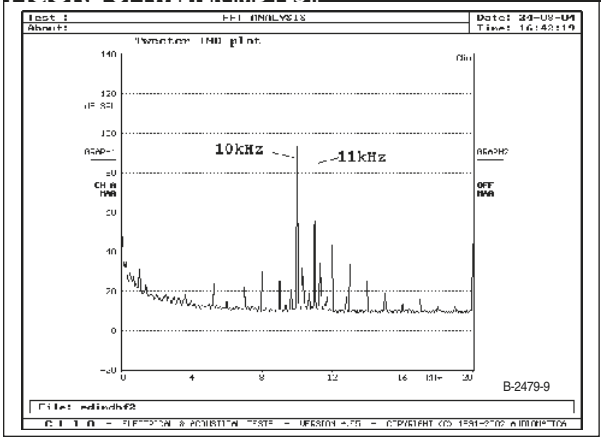
A few other minor inaccuracies within the article are worth commenting on, even though they are somewhat insignificant. First, the cabinets are constructed out of Medium Density Fiberboard, not particleboard as stated in the article. They have ¾" panels for the top, bottom, sides, and rear, but use a 1" thick front baffle. The inductors that are shipped with the kit do come with pre-stripped and tinned leads, so no extraneous stripping is necessary as long as you don't insert the leads too far. Regarding the woofer hookup to the crossover boards, the woofer "plus" and "minus" terminals are clearly marked—the cause for confusion on this matter is unclear.

Overall, we feel that Mr. Dell did a good job keeping the review unbiased, and in describing the assembly process in matter-of-fact terms. It is a shame that the baffle installation issue was not brought up earlier in the process, as Mr. Dell's experience would likely have been quite

audible and annoying than harmonic distortion. Let the symbols f_1 and f_2 represent the two frequencies used in the test. Then a second-order nonlinearity will produce intermods at frequencies of $f_1 \pm f_2$. A third-order nonlinearity generates intermods at $2f_1 \pm f_2$ and $f_1 \pm 2f_2$.

First, I examined woofer intermods by inputting 400Hz and 550Hz signals at equal levels. These frequencies should appear predominantly in the woofer output. Total SPL with the two signals was adjusted to 90dB at 1m. *Figure 8* is a plot of the resulting output spectrum. The principal output frequencies of 400 and 550Hz are highlighted on the graph.

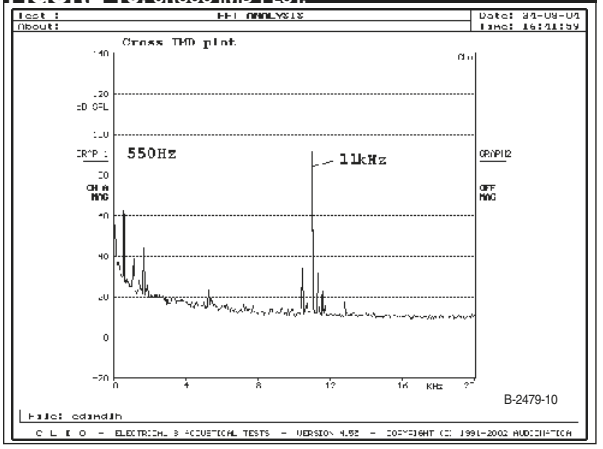
FIGURE 9: TWEETER IMD PLOT.



In addition to these frequencies, you will see many additional vertical lines representing both IMD products and harmonics of the 400 and 550Hz signals. Counting only the IMD products, there are significant lines at 150, 950, 1350, and 1500Hz. The overall level is only 0.66%. Although not bad in an absolute sense, this level of IMD is higher than most other woofers I have tested for *audioXpress*.

Next, I measured tweeter intermods with a 10kHz and 11kHz input

FIGURE 10: CROSS-IMD PLOT.



different without the extra difficulties the baffle presented. Nevertheless, Mr. Dell's main ideas still come through: these kits are relatively easy to put together, require only a few tools, and have a minimal chance for assembly error.

Part II: Measurement and Listening

Mr. D'Appolito has, of course, done a very thorough job with the measurements of this speaker system. There is little doubt of the accuracy of the information he has provided, but some of the data still warrants a few comments and interpretations. First, these speakers are indeed not time-coherent, and nor are they claimed to be. In reality, it is next to impossible for any speaker of this same physical configuration to be time-coherent. This is not a flaw of the Vifa/Dayton MTM kit design, but merely a characteristic of its construction. Second, it is worth considering whether the less-than-stellar performance in the spectral decay plots may be related to the poorly secured front baffles. Our own in-house CLIO waterfall plots of the kit prototypes do not show issues at the cited frequencies, nor do the individual responses of the aluminum cone woofers.

Mr. Colin mentions that the Vifa/Dayton MTM speakers are being auditioned on the heels of the Seas Thors. The Thors, being designed by Joe D'Appolito and with a cost of over $1600 including cabinets, are indeed a tough act to follow. It is important to keep in mind that the Vifa/Dayton speakers cost less than one-third of the Thor system and were designed to maximize the sound quality, ease of assembly, and aesthetic appeal *for their price*.

Some of the issues with the tonal balance of the Vifa/Dayton MTM could be related to the speakers' room positioning and the characteristics of the listening environment. The speakers do exhibit a slight rise in the presence region when measured anechoically, but this can help provide a more balanced sound and greater clarity when used in a typical home listening environment. Since the Thors measure extremely flat anechoically, and Mr. Colin very much likes their sound, it stands to reason that unlike a typical living room, his listening room has very little low-frequency reinforcement.

As with any speaker that you would build from a kit, build from scratch, or purchase from a store, each speaker has its own strengths and weaknesses. Mr. Dell chose this particular kit for his own reasons, and Parts Express did not offer any advice or suggestions on which kit to review. If the specific goal was to have a very clean midrange presentation, then a different kit might have been the better choice. But, by looking at the individual sonic ratings done by Mr. Colin, you will see that the Vifa/Dayton MTM speaker system does very well in most categories, and when you consider the price, is an excellent value.

Darren Kuzma
Parts Express Product Manager of Speaker Building

pair adjusted to produce a 90dB SPL at 1m. Results are plotted in *Fig. 9*. The major IM products occurred at 8, 9, 12, and 13kHz. Total IMD was 0.26%, a result in line with many other tweeters I have tested.

The last IMD test examines cross-intermodulation distortion between the woofer and tweeter using frequencies of 550Hz and 11kHz, again at a 90dB level. Results for this test are graphed in *Fig. 10*. Ideally, the crossover should prevent high-frequency energy from entering the woofer and low-frequency energy from entering the tweeter. Tweeter sidebands appeared at 10,450 and 11,550Hz at an overall level of 0.11%. This is a very good result and indicates good inter-driver isolation by the crossover.

SPEAKER MATCHING

All of the test results reported so far were obtained from a single sample. Now look at how well the two speakers match in frequency response. A frequency response plot of the *difference* between the two samples is shown in *Fig. 11*.

The two PE MTM samples match quite well below 2kHz. Above 2kHz the second system is within ±1.4dB of the first out to 20kHz. This is fairly good matching, especially for a kit, and bodes well for image stability.

GRILLE EFFECTS

I conducted all of these tests with the grille off. *Figure 12* shows the PE MTM response with the grille on, but referenced to the response with grille off. That is, it plots the *change* in response under the two conditions.

The grille has a fairly substantial effect on response at all frequencies above 300Hz. Overall response variations of +2.5dB to –1.4dB are shown. Response with the grille on is particularly ragged above 2kHz. As usual, the grille is there only for cosmetic effect and to protect the drivers from prying fingers.

A note on testing: The PE MTM loudspeaker was tested in the laboratories of Audio and Acoustics, Ltd. using the MLSSA and CLIO PC-based acoustic data acquisition and analysis systems. Acoustic data were measured with an ACO 7016 ¼″ laboratory grade condenser microphone and a custom designed wideband, low-noise preamp. Polar response tests were performed with a computer controlled OUTLINE turntable on loan from Old Colony Sound Laboratory. ***aX***

TABLE1

Sonic Characteristics Ratings	
Presence	8
Freedom from distortion	8
Frequency response smoothness	7
L-M-H balance	7
Treble quality	8
Midrange quality	6
Bass quality	8
Bass extension	7
Immed. transient response	7
Image focus	8
Stereo soundstage realism	8
Ambience	8

REFERENCE

1. J. D'Appolito, "Testing Loudspeakers," Old Colony Sound Laboratory (PO Box 876, Peterborough, NH, 888-924-9465, custserv@audioXpress.com), 1998.

FIGURE 11: MATCH BETWEEN TWO PE MTM KITS.

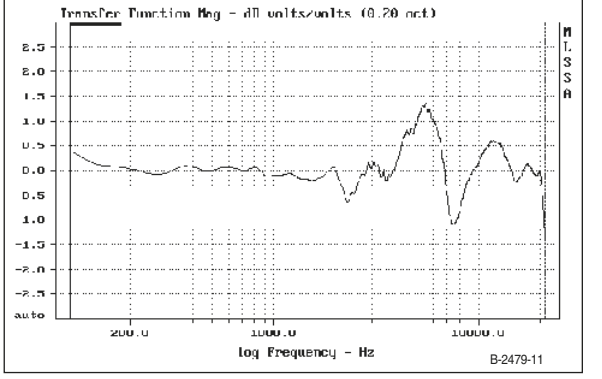


FIGURE 12: EFFECT OF GRILLE ON PE MTM KIT RESPONSE.