EQUIPMENT **PROFILE**

COUNTERPOINT CLEARFIELD METROPOLITAN LOUDSPEAKER

Counterpoint has been making its Clearfield speakers only since January 1992, so the company is better known for the high-end electronics it's made since 1977. The latter include solid-state and hybrid amps and preamps, tube preamps, and solid-state D/A converters. The Clearfield line includes an $800 subwoofer and three speakers, ranging from a two-way system at $1,200 per pair up to the Metropolitan ($5,995 per pair) reviewed here.

The Metropolitan is a five-driver floor-standing system that stands 5 feet high and weighs 156 pounds. The system's front-panel width of only 10 inches, about the same as that of a small bookshelf system, should give it the latter's fairly broad, non-diffractive horizontal coverage. Spikes are provided for the system's base.

The low-frequency section is composed of two 8-inch drivers in what Counterpoint calls an aperiodic vented-box enclosure. Albert Von Schweikert, who designed the Clearfield speakers, feels that conventional vented-box systems sound somewhat boomy. To combat this, he filled the portion of the enclosure just behind the bass drivers with a lot of damping material, which sacrifices some of the bottom-octave reinforcement yielded by conventional vented boxes.

The Metro combines this damped aperiodic loading with a removable vent plug, which Counterpoint calls a Q cylinder, that lowers vent tuning along with restricting the flow of air in the vent. According to Counterpoint, the plug works by changing the port tube's ratio of diameter to length. Inserting the plug effectively lowers the Q of the system "from a theoretical value of 1, with a maximum of bass efficiency, to a

SPECS

System Type: Three-way, floor-standing, dynamic, point-source concentric array.

Enclosure Bass Loading: Critically damped fourth-order tuned air column with modified Thiele/Small alignment; damping (Q), adjustable from 0.5 to 1.0 by removing foam plug and changing stuffing.

Drivers: Two 8-in. cone woofers, two 6-in. cone midranges, and 1-in. aluminum-dome tweeter.

Frequency Response: 25 Hz to 25 kHz, ±3 dB; matching to prototype tone standard, typically within 1 dB from 35 Hz to 20 kHz.

Sensitivity: 90 dB at 1 watt/1 meter.

Crossover Frequencies: 125 Hz and 2 kHz.

Impedance: 4 ohms nominal, with conjugate circuitry to ensure impedance is stable and does not drop below 4 ohms at any frequency.

Recommended Amplifier Power: 75 to 500 watts per channel (unclipped signal).

Dimensions: 24 in. W × 60 in. H × 9 in. D (61 cm × 152.4 cm × 22.9 cm); front panel, 10 in. W (25.4 cm); base, 27 in. W × 15 in. D (68.6 cm × 38.1 cm).

Weight: 156 lbs. (70.9 kg) each.

Price: $5,995 per pair; available in cherry, walnut, black oak, or light oak.

Company Address: 2281 Las Palmas Dr., Carlsbad, Cal. 92009.

For literature, circle No. 91

damped alignment with a theoretical value of 0.5, which is very tight but lower in acoustic output." The removable plug allows you to change the system's low-frequency response to suit placement near the wall or out in the room. Von Schweikert feels that the truly critical high-end listener

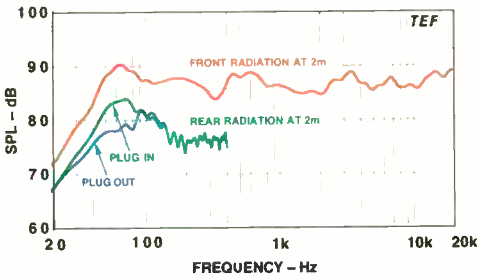

Fig. 1—Anechoic frequency response.

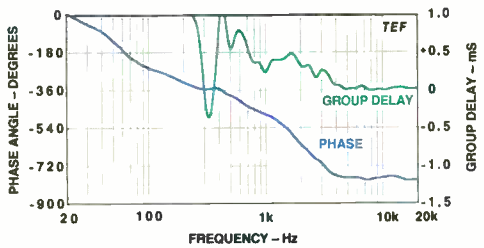

Fig. 2—Phase response and group delay.

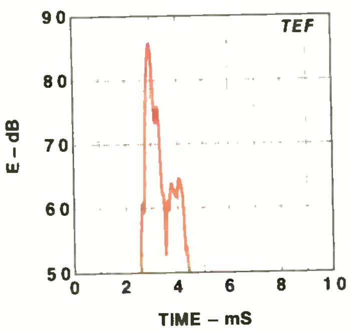

Fig. 3—Energy/time response.

will prefer the drier, leaner bass obtained with the plugs in place.

Two 6-inch midrange drivers, with their own sub-enclosure within the cabinet, take over from the woofers at a lowish 125 Hz. They are spaced rather far apart, 14 inches center-to-center. A 1-inch inverted-dome tweeter is mounted midway between the two midrange drivers, offset 1¾ inches from their center line towards the inside (the side nearer the other speaker of the pair). This offset makes the Metropolitan's horizontal coverage asymmetrical. The crossover from midrange to tweeter occurs at 2 kHz. The two midrange drivers and the tweeter are mounted on a separate board, 8 × 24 inches, which protrudes by ¾ inch from the front of the cabinet. My test samples had a flocked covering on this board for acoustical absorption; future units will have an acoustically dispersive covering.

The wide spacing between the midrange drivers restricts the vertical coverage in the upper midrange, to decrease floor and ceiling reflections. This often-used arrangement of a tweeter between two midranges forms what Counterpoint calls "an effective point source," creating a single, unified wave launch so as to sound like a single transducer. Effectively, this driver arrangement provides symmetrical vertical coverage by reducing lobing.

Counterpoint states that the controlled directivity of the Clearfield Metro ensures three-dimensional, transparent imaging and allows a wide choice of room placement. The Metro's cabinet features what Counterpoint calls a Stressed Monocoque Structure with computer-optimized bracing that minimizes cabinet resonances. The front panel is 1 inch thick. The massive, cloth-covered grille frame is made from high-density fiberboard, 1 inch thick, and is 10 inches wide × 5 feet high; it weighs nearly 8 pounds all by itself! The grille frame fits around the midrange/tweeter mounting board with the grille's cloth up tight against the drivers, causing minimal acoustic effect.

The crossover is separated into two sections and mounted on the rear panel on two beefy p.c. boards behind the upper and lower woofers. Parts count includes six resistors, seven capacitors, and four inductors for a total of 17 (not counting paralleled units). The low-pass section is second-order and uses an iron-core inductor with nonpolarized electrolytics. The midrange drivers are fed from a first-order,

high-pass filter (a single capacitor in series) and a third-order, low-pass filter. (The crossover's midrange polarity is inverted, as compared to its woofer and tweeter outputs, to compensate for the offsets between the voice-coil positions of the various driver types and to produce correct *acoustical* polarity in the driver outputs. According to Counterpoint, this also reduces group delay.) The tweeter is driven by a third-order, high-pass filter with a resistive attenuator. Driver impedance compensation is used throughout. All parts are of high quality, including large Solen capacitors and heavy-gauge Monster Cable Special 1A wire for the woofer hookups.

The input connections allow single or bi-wiring, with large jumpers connecting the upper and lower crossover sections for single-wired use. All input connections are mounted on a large, easily accessible rear panel. Tweeter level can be raised or lowered in 1- or 2-dB steps by changing jumpers on this rear panel.

Measurements

Figure 1 displays the smoothed, anechoic frequency response of the Metropolitan, together with the rear bass radiation with the port plug in and out. Measurements were taken 2 meters from the tweeter, on the enclosure's axis, with 5.66 V rms applied, and referenced back to 1 meter. The front and rear responses below 400 Hz were derived from ground-plane measurements at 2 meters.

The on-axis response is quite extended, although somewhat rough. Note, however, there are no significant peaks or dips, so that the overall response fits within a fairly tight window of 5 dB (±2.5 dB) from 42 Hz to 20 kHz, despite the bump in the bass range at 65 Hz. The vent plug hardly affected the ground-plane front response, but Fig. 1 shows a different story for the rear. With the plug in, there is a broad rise in the response between 25 and 90 Hz, with a peak boost of about 5 dB at 55 Hz in the rear bass radiation.

Averaged over the range from 250 Hz to 4 kHz, sensitivity measured 86.0 dB, 4 dB lower than Counterpoint's 90-dB rating. Right/left matching measured a fairly close ±1.4 dB from 100 Hz to 20 kHz. The deviations were about evenly distributed over the range from 100 Hz to 20 kHz. The grille caused only small effects on the response above 1 kHz, where it changed the response only about ±1.4 dB. Above 20 kHz (not shown), the response exhibited a bump at 21 kHz, followed by a sharp drop-off at higher frequencies.

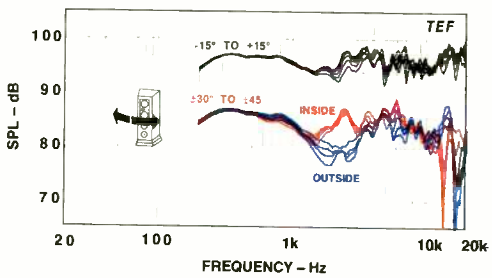

Fig. 4—Horizontal off-axis frequency responses.

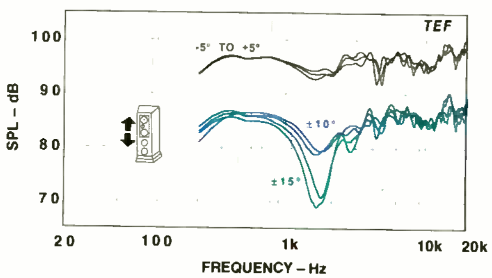

Fig. 5—Vertical off-axis frequency responses.

Figure 2 shows the phase and group-delay responses of the Metro, referenced to the tweeter's arrival time. The phase curve is well behaved but exhibits some undulations between 200 and 400 Hz. Between 1 and 20 kHz, the phase curve lags a significant 236°. This rotation is due to a combination of the crossover design and the offset between the acoustic centers of the tweeter and midranges. The group-delay curve indicates that between 1 and 3 kHz, the midrange output lags the tweeter by about 0.25 to 0.30 mS. A dip in this curve corresponds to the undulations in the phase curve between 200 and 400 Hz.

The Metro's energy/time response, shown in Fig. 3, accentuates the response from 1 to 10 kHz, which includes the upper crossover region. The main spike, at 3 mS, is fairly compact but exhibits a minor glitch at about 75 dB, about 0.3 mS after the main peak. All delayed responses are less than about 22 dB down from the main peak.

Figure 4 shows the unsmoothed sets of horizontal off-axis responses. The upper set of curves shows responses from –15° to +15° in 5° steps; the lower set shows responses from –45° to –30° and from +30° to +45°, again at 5° increments. The very close grouping in the top set indicates excellent coverage in the ±15° primary listening window. The lower set indicates response will differ in the mid-to-tweeter crossover range. Note that the response is flatter for inside orientations (the side where the tweeter is closest to the edge). On the outside, the response exhibits a broad dip between 1.5 and 3 kHz.

The unsmoothed vertical off-axis responses of the Metro are shown in Fig. 5. The top set of curves shows the responses at –5° (*below*), 0° (on axis), and +5° (*above*) the tweeter's axis. The very close grouping again indicates excellent vertical coverage in a 10° zone centered on the tweeter's axis. The lower curve set shows the responses at ±10° and ±15° around the tweeter's axis. These curves are also quite closely grouped, except for dips in the region of the 2-kHz crossover. The up/down response of the mid/tweeter array is quite symmetrical, which indicates in-phase operation with low lobing.

Figure 6 displays impedance versus frequency over the range from 20 Hz to 20 kHz, with the port plug inserted. Also shown is the impedance of just the high-frequency portion of the Metro.

The port plug causes only slight changes in the impedance curve. Removing the plug added about 1 ohm to the system impedance at 16 Hz, decreased the impedance by about 0.5 ohm at 40 Hz, and added about 0.3 ohm at 70 Hz. The overall curve exhibits a minimum impedance of 2.9 ohms at 70 Hz and a maximum of 25.5 ohms at about 1.3 kHz. I ran the impedance of the high-frequency portion separately because the crossover's high-pass filter did not seem to be rolling off low frequencies before they reached the midranges. Energizing the system with a 5-Hz signal 10 V rms revealed significant displacement of the woofers and midranges and also showed that they were not in phase with each other.

THE CLEARFIELD'S Q CYLINDER GIVES YOU A CHOICE OF BASS CHARACTERISTICS.

The crossover schematic showed a 160-μF capacitor in series with the midranges. Driving the overall system with +1.5 V d.c. applied to its red terminals caused a static outward displacement of the woofers and an inward displacement of the midranges, even though the 160-μF capacitor should have blocked d.c. from the midrange drivers. The midrange/tweeter impedance is about 16 ohms, rather than infinite, at low frequencies. When the mid/tweeter section is paralleled with the woofer section, the Metropolitan's overall impedance exhibits a low of 2.9 ohms rather than the manufacturer's stated minimum of 4 ohms.

Further investigation revealed that the 160-μF cap (formed by two 80-μF caps in parallel) was bypassed by two resistors in parallel, with a net resistance of about 3 ohms. These bypass resistors provided the observed low-frequency path around the caps, thus explaining the curious measurements. These resistors were not shown on the schematic, and were inserted to flatten the response of this particular Metropolitan's midrange drivers at crossover. According to the manufacturer, each Metropolitan's crossover is custom-tailored to its particular drivers, and records of these crossover modifications are kept, by serial number, at the factory.

From 20 Hz to 20 kHz, the max/min variation is a high 8.8 to 1 (25.5 divided by 2.9), which means that the system will be quite sensitive to cable resistance. Cable resistance should be limited to a maximum of about 0.038 ohm to keep cable-drop effects from causing response peaks and dips greater than 0.1 dB. For a typical run of about 10 feet, 12 to 14 gauge (or larger), low-inductance cable should be used to hook up the Metros.

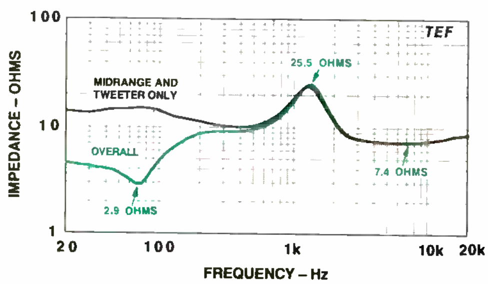

Fig. 6—Impedance; see text.

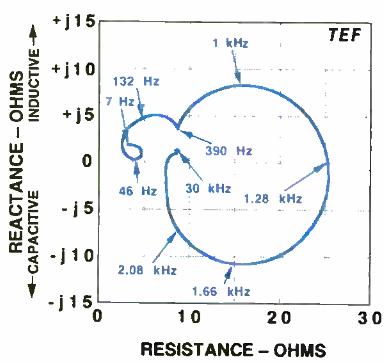

Fig. 7—Complex impedance.

Figure 7 shows the complex impedance, plotted from 7 Hz to 30 kHz; it is well behaved. The greatest changes in impedance (and phase) occur in the midrange, at about 1.3 kHz. The passband impedance phase (not shown) reached a maximum angle of +50° (inductive) at 100 Hz and a minimum angle of –41° (capacitive) at 1.9 kHz. The Metro's low 2.9-ohm impedance at 70 Hz means that it will be a fairly demanding load on a power amplifier in the bass range.

On a high-level, low-frequency sine-wave sweep, no significant cabinet resonances were noted. The woofer's linear excursion capability was about 0.4 inch, peak to peak (±0.2 inch). The woofers overloaded very gracefully and generated no bad sounds. No dynamic offset effects were noted. As noted before, however, the low-frequency sweep also generated significant displacement of the midrange drivers. Fortunately, the midrange drivers have nearly as much excursion capability as the woofers, so this did not add much additional distortion. With an input of 15 V rms at 20 Hz and the port plug removed, the woofer displacement was about 0.4 inch, peak to peak; the midrange displacement was about 0.15 inch, peak to peak, and about 90° out of phase.

Another effect was noted when driving the Metro's low- and high-frequency sections separately through the bi-wire inputs. The midrange cones would move if only the woofers were driven, and vice versa. This indicates significant acoustic leakage between the woofer and midrange enclosures.

No sharp minimum was noted in the woofer's excursion when driven by the high-level sine-wave sweep. With the port plug in, the woofer's excursion was constant between about 15 and 40 Hz and then decreased at higher frequencies. The displacement versus frequency of the woofers was very similar to that of a closed-box system. At 30 Hz and above, adding the port plug increased the woofer's displacement by about 5% between 40 and 65 Hz. Between 15 and 20 Hz, the woofers' excursion was reduced by about 25% when the port plug was inserted. Both cavities behind the woofers are completely stuffed with gray mineral wool, which greatly increases the damping of the vented system, thus reducing the port's output.

The 3-meter room response is shown in Fig. 8 with both raw and sixth-octave smoothed data. The Metro was in the right-hand stereo position, aimed at the listening position, and canted forward by about 5°; the test microphone was at ear height (38 inches), at the listener's position on the sofa. This placed the test mike on the tweeter's axis. The system was driven with a swept sine-wave signal of 2.83 V rms (corresponding to 2 watts into the rated 4-ohm load). The direct sound plus 13 mS of the room's reverberation are included. Excluding a dip at 210 Hz, the averaged curve fits a fairly narrow 10-dB (±5 dB) window from 100 Hz to 20 kHz. The general trend of the response is quite level and flat. Some midrange and high-frequency roughness is noted.

Single-frequency harmonic distortion versus power for the musical note E_1 (41.2

COUNTERPOINT TWEAKS THE CROSSOVERS IN EACH METROPOLITAN TO MATCH ITS PARTICULAR DRIVERS.

Hz) is shown in Fig. 9. The distortion spectra for A_2 (110 Hz) and A_4 (440 Hz) are not shown because the distortion levels were quite low and consisted of only low-order harmonics at 0.4% and below. A maximum power level of 100 watts (20 V rms into the rated system impedance of 4 ohms) was set as the upper limit. The E_1 (41.2-Hz) data shows that, at maximum power, the distortion reaches a significant 24% second, 32% third, and 11% fourth. The fifth and higher harmonics were no more than 1.6%. At 100 watts, the system generates a fairly loud 103 dB SPL at 1 meter at 41.2 Hz. Even though the 41.2-Hz distortion figures were quite high, during the listening tests the generated acoustic output did not sound distressed in any way. At higher frequencies, the distortion rapidly decreased and was essentially insignificant above 100 Hz.

Figure 10 displays the IM created by tones of 440 Hz (A_4) and 41.2 Hz (E_1) of equal input power. The IM distortion rises only to the low value of 4.5% at the 100-watt (full-power) level. This low level was seen even though the midranges were undergoing significant displacement due to the 41.2-Hz tone. It is fortunate that high-excursion midrange units were used in this design!

Figure 11 shows the Metro's short-term peak-power input and output capabilities, measured using a third-octave, 6.5-cycle tone burst. Input power was calculated by assuming that the measured peak voltage was applied to the rated 4-ohm impedance. The port plug was in for these tests.

The peak input power starts out fairly low, about 32 watts at 20 Hz, rises to 200 watts at 31 Hz, hesitates slightly, and then rises to a maximum of 8.1 kW (180 V, peak) in the range of the midrange drivers. In the tweeter's range above 2 kHz, the peak power capability falls to about 2.5 kW (100 V, peak), still a significantly high level. Between 80 and 125 Hz, the limit of the speaker was reached at about the same point that my test amplifier's limit was reached; this was due to the Metro's low impedance through this range.

The upper curve in Fig. 11 shows the maximum peak sound pressure levels the Metro can generate, at 1 meter on axis, for the input levels shown in the lower curve. Also shown is the "room gain" of a typical listening room at low frequencies, which adds about 3 dB to the response at 80 Hz and 9 dB at 20 Hz.

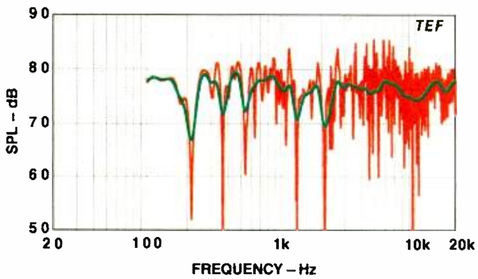

Fig. 8—Three-meter room response.

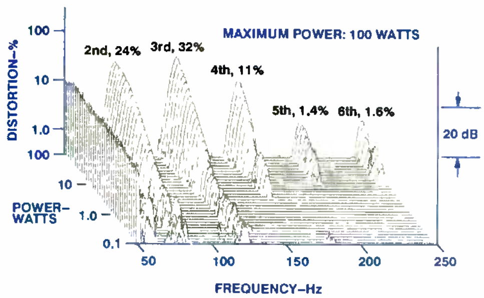

Fig. 9—Harmonic distortion for E_1 (41.2 Hz).

With room gain, the peak output starts at about 97 dB at 20 Hz and rises rapidly to the mid-120s between 100 Hz and 1.5 kHz. Above 2 kHz, the output mostly maintains a still quite respectable 120 dB SPL. With room gain, levels of 110 dB and above can be generated above 40 Hz, and 120 dB and above at 55 Hz and higher. Even if the 20- and 25-Hz levels are on the low side, at 32 Hz and above the speaker generates very respectable levels. A pair of Metros can generate even higher levels. They can easily create the peak SPLs of live music, in a typical room, with a power amp that has appropriately high peak-power capability.

Use and Listening Tests

As I stated at the start of this review, the Metropolitans *are* large and heavy. When their spikes are not attached, an adult can barely move them around adequately. With their spikes attached, it is impossible for one person to move them. The Metros have separately packed wooden bases that are attached to the bottom by the user on installation. This base widens the bottom by about 2 to 4 inches and very much improves stability. With the bases attached, the systems are quite resistant to being tipped in any direction.

Counterpoint recommends toeing in the systems to aim them toward the listener, especially if the speakers are widely separated. In addition, the company recommends tilting them forward by adjusting the front and rear spikes, so the listener is on the tweeter's axis. Counterpoint calls this a Vertical Rake Adjustment, or VRA. In my situation, with my ears about 36 inches above the floor (and 3 meters away) and the tweeter about 46 inches high, the Metros needed to be tilted over about 5°. This essentially required raising the rear of each speaker about 1¼ inches higher than the front. In this configuration, they indeed look precariously tipped forward. Fortunately, the center of gravity is far to the rear of the systems, so they were very stable.

My review samples were supplied in black, including the grilles. The Metros' cabinetry and workmanship are top-rate. Because the tweeters are offset on the front of the cabinets, the systems are supplied in handed pairs. The right system has the tweeter offset to the left, and vice versa for the left system. Fortunately, the serial numbers of the right and left speakers end in "R" and "L," respectively, so it's easy to tell which is which.

As mentioned, the Metros are supplied with Counterpoint's Q cylinders, which can be inserted into the vent to change bass response and Q. These inserts are foam cylinders that decrease the diameter of the vent and increase flow resistance. Without the plugs inserted, the port is 3 inches in diameter. With the plugs inserted, the diameter is reduced to 1¾ inches. As mentioned earlier, Counterpoint states that inserting the plug lowers the overall Q of the bass response, and thus the resonant amplification due to the output from the vent, from 1 (a high-efficiency alignment) to a tighter, more heavily damped, 0.5. Yet contrary to both this statement and my own intuition, the measurements in Fig. 1 showed that rear radiation *increased* in the range from 30 to 80 Hz with the plug in, rather than the other way around. I can't completely explain this disparity, although I do know that the manufacturer based his statement on comparative readings of impedance rather than on SPL data (such as I showed in Fig. 1). Looking back at my notes for the ground-plane measurement, I see that I wrote "Yes, less output with plug out (5 dB less at 65 Hz)! Doesn't make sense!" At the time, I repeated the tests that resulted in Fig. 1 twice, to make sure. Most of my listening was done with the plugs inserted, the factory-supplied configuration. I did do some comparative listening with the plugs removed, however, and found that this made a *very* subtle difference, difficult to pin down.

THE LOW BASSS WAS OF GOOD QUALITY, WITH RESPECTABLE EXTENSION AND TIGHT SOUND.

The Metropolitans come with an *excellent* 30-page owner's manual that is packed with useful information. Complete and in-depth information is supplied on all areas of operation, hookup, and room acoustics. These are expensive high-end systems, and one should expect this level of information; unfortunately, not all manufacturers provide it, even for speakers that cost more than $5,000 per pair.

The Metros' ability to let the user raise and lower their tweeter levels by 2 dB is useful for matching them to your acoustic environment. Making the level adjustment with jumpers is indeed the most reliable way to do this, well suited to a system of this caliber. Most of my listening was done

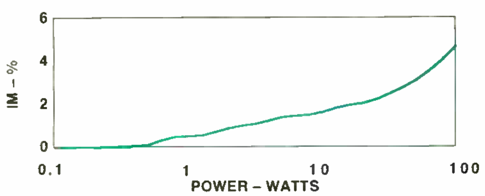

Fig. 10—IM distortion for 440 Hz (A_4) and 41.2 Hz (E_1).

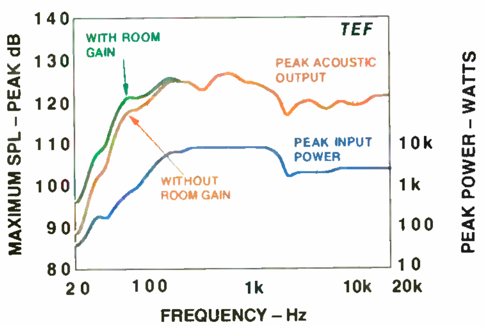

Fig. 11—Maximum peak input power and sound output.

with the factory jumper position (flat, without any boost or cut).

Counterpoint states that the Metros can be placed quite close to the rear wall due to the added bass-response adjustment range that the Q cylinders provide. I could not thoroughly explore this capability because my room's rear wall is covered with bookshelves and cabinets that are 17 inches deep. With the Metros in my usual speaker positions, away from the rear wall, there was somewhat less low bass than from my reference B & W 801s (which sometimes overemphasize bass in my room). However, the Metros' low bass was of quite good quality, exhibiting respectable extension and a tight, non-boomy, sound. Listening was done both with the Metros tilted forward, to place my ears on the tweeter's axis, and without tilting them. The sensitivity of the Metros was quite close to that of the 801s, although slightly lower.

My system includes Krell electronics along with Rotel and Onkyo CD players and Straight Wire cabling. In a departure from my usual practice, most of my listening to the Metros was done with their grilles on. Very few speakers have grilles that can be left on without causing substantial response changes.

For my first listening test, my son played choir material that he'd recorded onto a portable Sony MiniDisc unit. He had recorded it directly from the console at a concert he had mixed at his college, where he's the lead audio person. (This was my first listening experience with MiniDisc, and I thought it did a great job, both sonically and operationally.) I was quite impressed with the Metropolitans' overall response, lively dynamics, and cleanliness of sound, even at concert levels—and so was my son, who had heard the live *and* mixed sound.

Further listening demonstrated that the Metros are serious high-end contenders. I particularly liked their imaging capabilities and ability to let you listen through the systems and hear subtleties in a recording. The speakers' high vertical directivity presumably contributed to what I was hearing, lessening the room's effect on the reproduced sound.

Although the Metros sounded quite different from my references, especially spatially, I liked what I heard. Tonal balance was somewhat similar to my references, although with somewhat less low bass. These speakers are not for bass freaks, but for those who value quality over quantity.

With the Metros tilted forward about 5°, which placed my ears on the tweeter's axis, the speakers flunked the pink-noise stand-up/sit-down test; I heard a prominent upper-midrange crossover suckout when standing. When sitting, however, I thought the Metros sounded super. When I returned them to level (no forward tilt), they did very well on the stand-up/sit-down test; there was essentially no tonal change between the two positions (including all the points in between). With the Metros level,

I WAS IMPRESSED WITH THE OVERALL RESPONSE, LIVELY DYNAMICS, AND CLEAN SOUND.

my ears were about 5° below the axis when I sat and 5° above it when I stood. As Fig. 5 showed, the Metros' off-axis vertical response in the ±5° range is very uniform. I did all remaining listening with them level and not tipped forward.

On third-octave, band-limited pink noise, the output at 20 and 25 Hz was mostly unusable due to high values of low-order harmonic distortion. The effective output was better at 31.5 Hz and competed with my references on an equal basis from the 40-Hz band up.

On a wide variety of program material, the Metros always did very well. Only when the material required high levels of clean bass at 30 Hz and below did they stumble. As I have stated in the past, it is fortunate that our hearing is quite forgiving of high amounts of low-order harmonic distortion at low frequencies, particularly when the bass is accompanied by higher frequency sounds that help mask the distortion.

These speakers *will* play loud and clean. On the fire station sequence on *Sonic Booms 3*, recently released by Bainbridge (BCD 6289), they did incredibly, reproducing the sounds of fire engines and air horns in an extremely clean and realistic manner at ear-splitting levels. (This disc is the workout of the century for you bass freaks, with high levels down to 0.75 Hz!)

Everything considered, the Clearfield Metropolitan is a clear high-end contender. It has its own foibles and a distinct personality, but can't you say that about all high-end systems? *D. B. Keele, Jr.*