Kit Report

Audio Concepts' Sapphire II

By Gary Galo, Contributing Editor

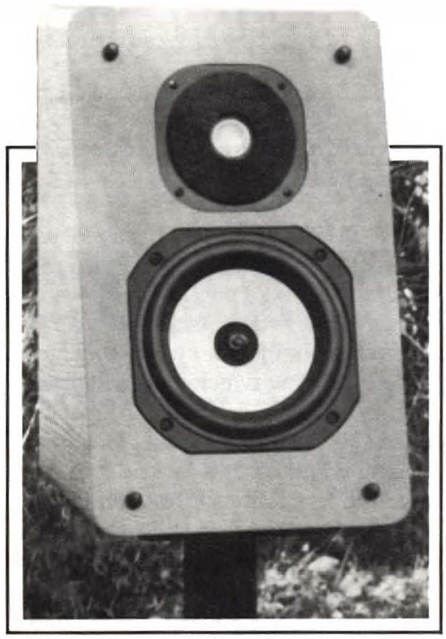

PHOTO 1: Front view of the Sapphire IIs mounted on the AC Stands. The grille cloths are attractive, but should be removed for the best stereo imaging.

Manufacturer's Specifications: Tweeter: Modified Focal T120KT; Woofer: Focal 7K011DBL; Frequency response: 65Hz-20kHz ± 3dB; Crossover: Minimum phase design; Tweeter: Quasi first-order; Woofer: First-order on voice coil 1; Upper midrange response shaping network on voice coil 2. Crossover frequency: 3kHz; Sensitivity: 89dB, 1M/1W; Impedance: 7Ω nominal, 4Ω minimum; Dimensions: 16" × 10" × 10"; Height on stands is 40".

Price: Full kit—$699/pr. plus $30 shipping; Parts kit—$479/pr. plus $15 shipping; Assembled—$759/pr. plus $30 shipping; Optional stands—$99 (black), $119 (white) plus $15 shipping. Manufacturer: Audio Concepts, Inc., 901 South Fourth St., La Crosse, WI 54601, (800) 346-9183 (orders only), FAX (608) 784-6367, technical help, (608) 784-4570.

Audio Concepts has been offering high-quality loudspeaker components and kits to speaker builders since 1977. Under the guidance of its president, Mike Dzurko, Audio Concepts has offered loudspeaker builders many kits known for their attention to detail and technical refinement. Supplying drivers and other components, the firm has been selective in choosing product offerings, unlike many other distributors, who offer nearly every driver made by nearly every manufacturer.

The Audio Concepts catalog contains what they believe are the best products in each component and price category. They carry several products not found in other distributors' catalogs, including AC Spikes for coupling speakers to the floor, gold-plated spade lugs which will fit around the largest amplifier binding posts, AC Foam for enclosure lining and room treatment, as well as the excellent AudioQuest loudspeaker cables.

The Sapphire II is based on Audio Concepts' older Sapphire loudspeaker, but is housed in a smaller enclosure. The Sapphire II falls into the "mini-monitor" class, and can be used as a stand-alone system. They can also be used as satellites, along with a pair of subwoofers, if you wish truly deep bass. My review samples arrived in four well-packed cartons, one containing the two enclosures, one containing the drivers, crossovers, and hardware, and two containing the optional black stands. When purchased as a full kit, The Sapphire II is just that. Every item needed to complete the loudspeakers is included, down to the last screw.

Drivers and Loading

The Sapphire II enclosure design was a joint effort between Audio Concepts and Jack Caldwell, a familiar name to builders of high-quality loudspeaker kits. Caldwell has designed several loudspeakers for Audio Concepts, and is well-known for the SOTA Panorama. Like the earlier model, the Sapphire II enclosure is an aperiodic design containing a vent stuffed with damping material which relieves internal pressure in the region near system resonance. Aperiodic loading provides much better control over the woofer's cone motion than acoustic suspension designs.

In an acoustic suspension enclosure, the trapped air inside the enclosure is quite

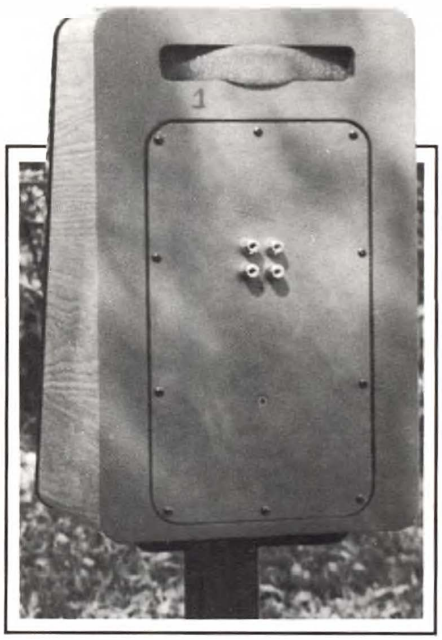

PHOTO 2: Rear view of the Sapphire II showing the four gold-plated binding posts, which allow bi-wiring. The rear panel, fastened with 12 screws, doubles as the crossover mounting board.

reactive at low frequencies. Its "springiness" causes the woofer to make large excursions in the area around system resonance. The excessive cone motion, in turn, substantially raises the system's impedance at the resonance frequency.

The Sapphire II enclosures contain a slot in the rear which is stuffed with a foam plug, and they are also heavily damped internally. Each is filled with a synthetic damping material which Audio Concepts calls AC Stuff.

The aperiodic loading effectiveness is illustrated in *Fig. 1*, which is the Sapphire II's impedance curve. The system resonance frequency was impossible to pinpoint. The impedance rises to 5.1Ω between 70Hz-80Hz, with no further rise at any specific frequency in this region. This shows exceptionally well-controlled cone motion at low frequencies. The system is also very low Q. Caldwell claims the Q is slightly higher than 0.5.

The impedance falls to 3.5Ω at 20Hz. Although this is well below the system's low-frequency cutoff, your amplifier will

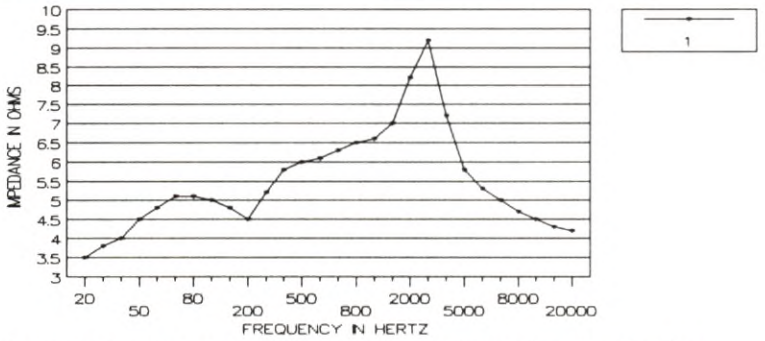

FIGURE 1: Impedance curve for the Sapphire II. Both samples were identical.

still be driving the loudspeaker at this frequency. I recommend a power amplifier with sufficient current capability to drive low impedance loads with low distortion levels. Audio Concepts says as little as 40W per channel is adequate for the II, but recommend 50-150W per channel for optimum performance.

Remember, power output alone is not the issue. An amplifier which delivers 100W per channel into an 8Ω resistor, but falls apart trying to drive a 3.5Ω load, isn't a good choice. A lower power amplifier maintaining low distortion and stability into low impedance loads, will deliver much better performance than a high-power amplifier which can only maintain low distortion into 8Ω resistors. The Sapphire II is not particularly efficient, so a 100W per channel amplifier is *not* overkill.

Each Sapphire II contains one Focal 7K011DBL woofer, and one Focal T120KT tweeter. The woofer cone uses Focal's patented K2 Kevlar 1mm sandwich, consisting of a compound of synthetic resin (serving as a bonding agent) and microballs of foam between two layers of Kevlar cloth. The sandwich combines low mass with excellent rigidity, and the cone is suspended with a rubber surround. The cast frame further improves the driver assembly's rigidity.

The 7K011DBL is a dual-voice coil driver, each having a nominal impedance of 8Ω. Focal recommends designing the crossover so one voice coil operates in both the bass and midrange frequencies, while the other covers low frequencies only. By designing a response-tailoring network for the second voice coil, the low-frequency response of the driver can be extended. The second voice coil has a different purpose in the Sapphire II, which I'll explain shortly.

The tweeter's concave dome, made of Kevlar cloth, is actually larger than the voice coil, allowing the driver to operate as a nearly point source at high frequencies. Focal manufactures several T120 tweeter variations, but the KT version in the Sapphire II has a rear-vented pole piece. Audio Concepts modified the tweeter, adding aperiodic damping and sealing off the rear vent. The result is a tweeter with well-controlled internal resonances. Audio Concepts uses an AC felt tweeter ring on each tweeter to control diffraction.

Crossover Design

Jack Caldwell designed the minimum phase crossover. Audio Concepts does not supply a schematic with the kit, although a pictorial illustration is included in the manual. I sketched out the crossover circuit, but Caldwell wants it to remain proprietary and asked us not to publish it with the review. I believe this runs contrary to the spirit of kit building and the philosophy of *Speaker Builder*, but we have respected his wishes. I don't believe that publishing this schematic does any harm to the designer.

Anyone wishing to steal the design for commercial purposes would surely want to hear the loudspeaker first. You would normally have to purchase the kit in order to do this. After buying the loudspeaker, you will be free to sketch out the schematic yourself. No one would borrow a design strictly on the strength of a review.

The crossover frequency is around 3kHz, and the high-pass filter looks like a second-order, 12dB/octave filter. The tweeter's actual acoustical rolloff, however, is quasi first-order. A first-order, 6dB/octave filter feeds the primary woofer voice coil. As mentioned, the second voice coil is not used to extend the woofer's bass response, instead, a series LCR network forms a small notch filter centered at 3.7kHz. This corrects for a small time domain aberration in this region. The design goal was to reproduce a holographic, three-dimensional soundstage with very precise imaging.

Cabinet Construction

The enclosures, (*Photos 1* and *2*) are superbly constructed. No effort was spared in making the enclosure as acoustically inert as possible. Extensive internal bracing helps eliminate enclosure panel flexing. They are are braced top to bottom, side to side, and front to back. The design uses a sloping front panel, which improves the drivers' alignment by time, and breaks up resonances which can develop in conventional rectangular enclosures.

The enclosure is made of ¾" medium density fiberboard (MDF). Mike Dzurko said he experimented with several MDF densities before finding the one he believed would best control cabinet resonances.

The sloping front panel is routed to ¼" to allow mounting the drivers flush. The enclosure's interior is coated with Acoustical Magic, a latex-based paint containing titanium, and other ingredients which resistively absorb cabinet resonances. The brand name may sound like high-end audio mysticism, but it appears to be highly effective.

The cabinets are as attractive as any commercial loudspeaker I've seen. The four front-to-rear corners, top and bottom, are rounded and a one-piece walnut veneer surrounds the top and sides, joined on the bottom where the joint won't be visible.

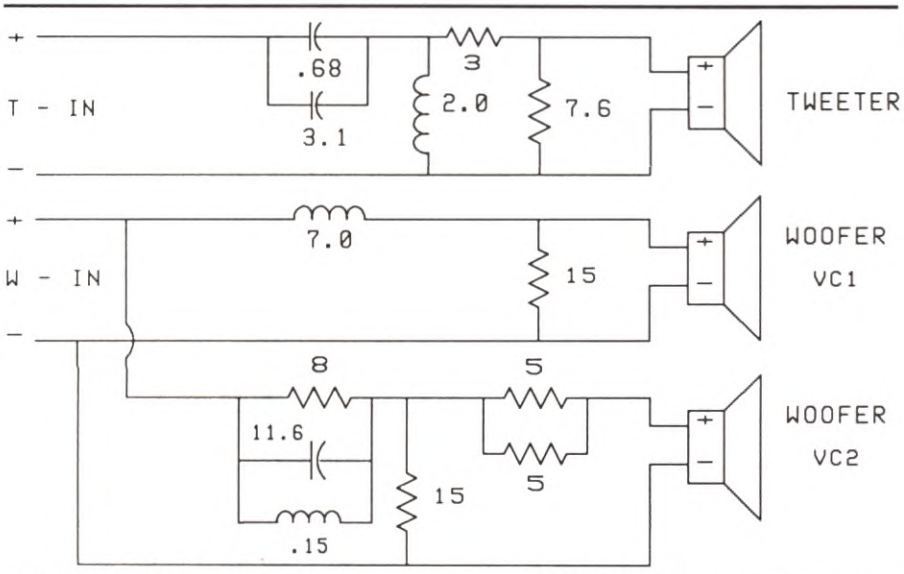

FIGURE 2: The Sapphire II minimum phase crossover. The LCR notch filter on the second woofer voice coil corrects a time domain abberation at 3.7kHz.

The veneer work is *outstanding*. (The joints are so perfect I had difficulty finding them.) The front and back are painted gray, and the attractive black grille cloths can easily be removed. The enclosure is a first-class piece of cabinetwork.

The rear panel has a large routed opening where the crossover board is mounted. The crossover is not mounted onto a printed circuit board, instead crossover components are glued to a two-layer Masonite laminate, which when fastened to the enclosure forms the main portion of the rear panel. Two ½" PVC spacers are placed between the laminate and the internal bracing. A pair of long screws go through the rear panel and spacers, and are threaded into the internal brace, tightly coupling the rear panel laminate to the internal bracing, reducing the possibility of rear panel resonances. *Photo 2* shows a rear view of the loudspeaker.

The inside of the laminate is coated with Acoustical Magic, and the back is painted gray to match the rest of the enclosure's rear panel. Silicon sealant and epoxy fasten crossover components. The coils are first glued with the silicon seal, then after the silicon has cured four beads of epoxy are added to increase the mounting's strength—yet another step to ensure the absence of enclosure vibration. The crossover components, properly glued, further deaden the enclosure's rear panel. The manual claims this arrangement is sonically superior to mounting crossover components on a printed circuit board, and I agree.

The crossover uses premium grade components, including IAR Wonder Caps and Chatteauroux polypropylene capacitors. AudioQuest F-14 cable is used for all internal wiring, and contains four solid core, high-purity copper conductors. It is a high-quality, cost-effective cable, flexible enough to make it practical for internal wiring.

Audio Concepts made provisions for bi-wiring the Sapphire IIs. Two pairs of gold-plated binding posts are mounted on the rear panel, one feeding the woofer crossover section, and another for the tweeter. The posts are the ones Audio Concepts supplies with their AC Cup, but the plastic cup is not used on the IIs. They are mounted directly on the Masonite. I'm sure Jack and Mike believe, as I do, a plastic cup would compromise the rear panel's structural integrity. The posts (among the finest quality I've seen) stick out beyond the back panel, making easier connections. The heavy-duty posts can accept 10-gauge wire, or be used with banana plugs, or the large gold spade connectors.

Assembly

The kit includes a 15-page illustrated manual covering assembly, setup, and operating instructions. For builders adventurous enough to purchase the parts kit, helpful suggestions for constructing the cabinets are included. Unless you own quality power tools and possess woodworking skills to match, you're probably better off purchasing the full kit with factory-assembled enclosures. Illustrations are included for all cabinet dimensions, including the complex internal bracing.

The manual warns: "These drawings may be used as a guide for building your own cabinets... and should not be taken as certified diagrams..." The complex angles of the sloping front panel and internal bracing will require a fair amount of custom fitting. To duplicate performance the full kit offers, you'll must use the *exact* materials supplied with the full kit, including the same MDF grade. I don't mean to discourage the hard-core builder, but I wish to present a realistic assessment of the task.

Assembling the full kit is an enjoyable project. Although the assembly instructions are generally good, a few points need clarification. What follows are assembly instructions, (in *italics*) along with my

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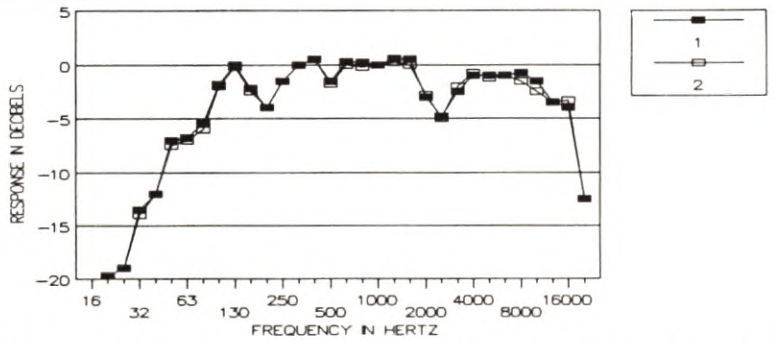

FIGURE 3: One-third octave warble tone response with the microphone on-axis and positioned midway between the woofer and tweeter.

additional comments. I have quoted the manual as written.

1. Carefully unpack your parts kit. Check to see that you have all the parts listed on the parts list. NOTE: Hardware for installation of the speakers is in a small bag stapled to the inside of the cabinets when ordering a full kit. Both of my bags had broken loose during shipment, and I found them elsewhere in the carton. Locate the staples used to fasten the bags to the enclosure and remove them.

2. Vacuum the inside of the cabinets to make sure that they are totally free of any dust or chips.

3. Use silicon sealant to attach the plastic spacers around the two inside screw holes on the crossover board. Note that the longer spacer is for use on the hole closest to the binding posts. Allow to dry. The two screw holes will probably be filled with Acoustical Magic. Ream them out with an awl, or the supplied screws. You may have to bend crossover leads slightly in order to make room for the spacers. To ensure the spacers are tightly coupled to the rear panel, I recommend using long 6/32 bolts, washers, and nuts to hold the spacers in place while the glue is curing. Put washers on the bolts, and insert the bolts through the holes in the rear panel. Place a bead of silicon sealant around one end of each spacer. Put the spacers over the bolts and fasten in place with another flat washer and nut. Tighten the bolts just enough to pull the spacers snug against the rear panel. After the silicon seal has cured overnight, remove the no longer needed bolts.

4. Install the AC Stuff™ into the enclosure. There are four 13" × 18" pieces of AC Stuff™ per speaker. The internal bracing divides the enclosure into four vertical partitions. Install one piece of AC Stuff in each partition.

5. You will notice that there is an aperiodic port on the upper cabinet rear. This is to be stuffed with one 2" × 7" piece of convoluted foam. Refer to Sheet 2 in the back of the manual. The contoured side of the foam faces the inside of the enclosure. Be sure the foam is tight against the enclosure's inside edges.

6. Mount the crossover into the back of the cabinet using foam tape to seal. Do not overtighten. It is important to get a secure air-tight seal. Use caution with the three long center screws. They are inserted in straight to avoid splitting the cabinet brace. Cut a length of foam tape two inches longer than necessary to cover the outer perimeter of the crossover board cutout. Peel off the backing and carefully press the sticky side against the cabinet. Press firmly to make sure the tape doesn't peel off. After covering the opening's entire perimeter, trim the foam to an exact fit. You can even cut it 1/16" longer than necessary. The foam will compress to form a tight fit with the other end.

Carefully push the crossover leads between the AC Stuff and the front/rear brace. Route the wires so the tweeter leads come through the small driver hole and the woofer leads come through the larger one. Place one pair of woofer leads on each side of the brace. Carefully press the crossover board into position, making sure none of the wires are caught between the plastic spacers and the brace. Make sure the foam tape remains in position. Install the 10 black screws around the board's perimeter. Note there are only two long center screws per enclosure.

7. Install the foam tape around the driver mounting holes. The tape should be installed with the sticky side toward the cabinet. It should be such that it is on the outside edge of where the driver will be. See notes on installing tape, which I added to Step 6.

8. Hook up the leads from the crossover to the tweeter. The tweeter has a polarity marking, (usually a red dot), near the positive terminal. Take your time pushing the connectors on, they are delicate. This is probably the hardest part of the whole kit assembly, but Tweak™ or Cramolin™ will help slide the connectors on. Be patient. You may find a small needle nose pliers helps. Install the tweeter using the small screws, and do not overtighten.

The contacts the push-on connectors add will compromise loudspeaker performance, albeit to a small degree.

Audio Concepts, understandably, doesn't wish to bear responsibility for warranty replacement of drivers damaged due to improper soldering technique. If you're competent at soldering, I recommend removing the connectors and soldering the wiring to the terminals to avoid damaging the drivers. First, test each driver's continuity from the terminals to the voice coil using a Volt-Ohm-Milliameter (VOM) on the RX1 scale. There should be very low resistance, and a clicking sound each

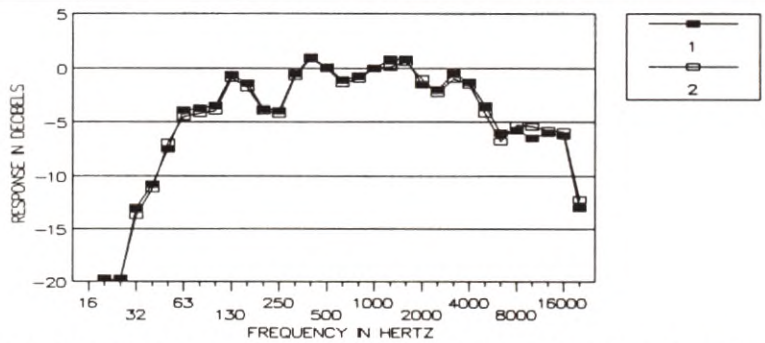

FIGURE 4: One-third octave warble tone response with the microphone 15° off-axis and at a height of 28".

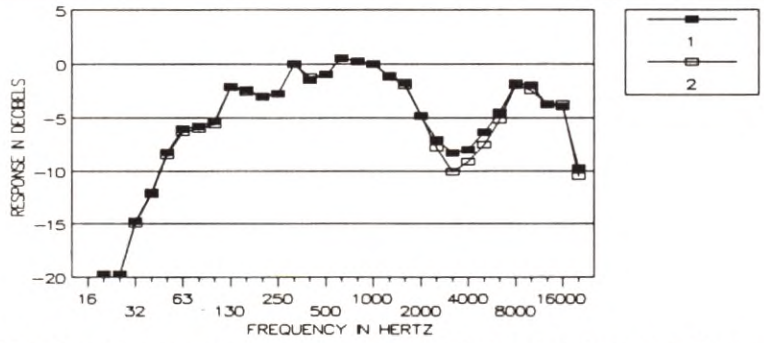

FIGURE 5: One-third octave warble tone response with the microphone 15° off-axis and at a height of 41".

time you make the connection. Most digital meters don't click due to high internal resistance, which is why I recommend the primitive analog VOM.

If the driver is "open" after soldering, you'll know your error, not the manufacturer's, caused the failure. Caveat: soldering the terminals will void the drivers' warranty, so give this recommendation careful consideration. The Focal drivers are well-constructed, so they should stand up to any careful soldering procedure. Pressing the tweeters into the cutout, be sure the wires are not pinched between the driver magnets and the bracing.

9. Attach the wires to the woofer observing the polarity markings near the terminals. Note that there are two sets of wires and that the woofer has two sets of terminals. The connections are interchangeable. All the comments I made in Step 8 apply here, as well.

10. Install the woofers using even pressure on all attachments. Caution: it is easy to press too hard or unevenly and push your tool through the cone. Be careful! Again, don't pinch the wires between the magnets and the bracing.

11. Hook up the Sapphire IIs to your system and try at low volume level to ensure correct hookup.

12. Allow 20–30 hours of break-in time before the speakers sound their best.

When you finish assembly, gently push each woofer cone inward a short way. If the foam stuffing in the aperiodic vent has been installed properly, the woofer will appear sluggish when it returns to its resting position. If it bounces back quickly, you have a leak around the stuffing. You can pull the foam back to ensure the foam is tight against the enclosure's inside edges. Give each enclosure a few knuckleraps—you'll be impressed by the enclosure's deadness.

The AC Stands are screwed into the bottoms of the Sapphire IIs ensuring tight coupling, but be sure to *center* the stand on the enclosure's bottom. The AC Spikes contain ¼-20 threads and are screwed into the MDF at the base of the stands, allowing easy leveling. Be sure all four spikes make contact with the floor beneath your carpet.

Measurements

I ran frequency response curves on the Sapphire IIs using an Old Colony ⅓ octave Warble Tone Generator (which I built) and a Josephson Engineering Measurement Microphone. All measurements were made at 1W, with the microphone at one meter. The grille cloths were removed. My initial measurement was directly on axis, the mike vertical and midway between the woofer and tweeter (*Fig. 3*). Sample 1 is the loudspeaker I used as the left channel, and Sample 2 the right.

Both loudspeakers were moved to the same position for the measurements. You'll notice the two samples are within 0.5dB of each other throughout their operating range—very good, indeed. It's easy to misinterpret this graph. There are two noticeable dips in response, one at −4dB and another at −5dB. Notice there is little activity above the 0dB reference (set at 1kHz). Over most of their range, the Sapphire IIs are actually flat ±2.5dB.

Since first-order crossovers are more sensitive, vertically, to microphone (and ear) position than even order crossovers, or D'Appolito arrangements, I thought it would be worth investigating other microphone position responses. Caldwell told me the loudspeaker's high-frequency balance was best with the ear 15° off the tweeter axis. He recommended "toeing them in" slightly, but having the two speakers' intersection behind the listening position so the listener is 15° off-axis, and the *ideal* vertical position is near the bottom of the woofer.

I normally sit in a director's chair when I'm critically listening. My ears are 41 inches from the floor, one inch above the II's top. I decided to measure them at two vertical positions, both with the mike 15° off-axis. *Figure 4* shows the response at woofer bottom 28" off the floor. Here, the high frequencies roll off sooner, and the low-frequency roll-off is more gradual, relative to *Fig. 3*.

I also measured response at my normal listening position. This mike position produced the most erratic upper midrange response (*Fig. 5*). *Figure 6* shows the

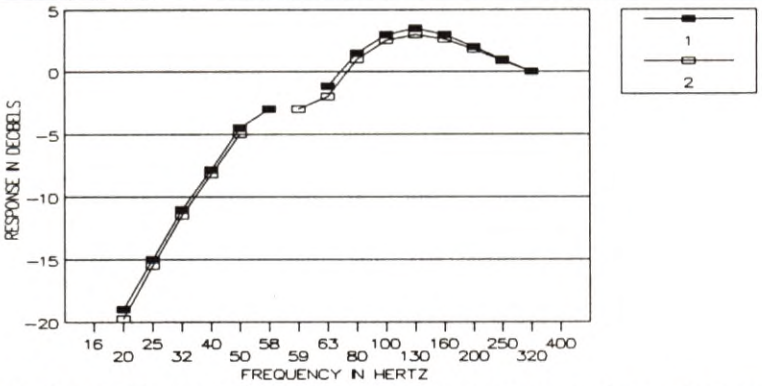

FIGURE 6: The Sapphire II near field response using 1/3-octave warble tones. The curve is expanded to show the −3dB point for each sample.

woofers' near field response from 20Hz-320Hz. Note the horizontal axis expansion at the low-frequency cutoff point. The −3dB point was 58Hz for Sample 1 and 59Hz for Sample 2.

Listening Evaluations

My evaluations were conducted using pre-production prototypes of two Adcom power amplifiers which Victor Campos, Adcom's director of product development, lent to me. The first was the GFA-585, a stereo version of the GFA-565 monaural amplifier, now on the market for several months. The 585 contains circuitry identical to the 565, but has fewer output devices and operates at a lower power output level. It is rated at 250W/channel into 8Ω, but 8Ω doesn't indicate its real capabilities. The 585 will drive low impedance, reactive loads with ease, due to its high current design.

The 585 offers more than brute power. It's a refined amplifier, featuring exceptional inner detail, a large soundstage, natural highs, with dynamics and low-end to burn. Most impressive, it reveals subtle dynamic shadings and articulations other amplifiers mask. The 585 production units should be on the market soon at a price of about $1,200. (A comparably-powered Krell costs nearly $6,000.)

I also used a prototype of the GFA-545 II amplifier, an updated version of Adcom's 100W/channel GFA-545. The old 545 was a good amp, except for a somewhat edgy high-end. The 545 II's high- and low-end, and the imaging have been improved. Both Adcom amps contain circuitry flat to DC, due to the absence of capacitors in the feedback loop. A servo circuit keeps the output DC offset at a low level. A premium quality film coupling capacitor at the input prevents introduction of any DC to the circuitry which the servo might not correct. The 545 II performed very well with the Sapphire IIs.

Other equipment consisted of my "way beyond POOGE-4" Magnavox CDB-650 CD player and an Adcom GFP-565 pre-amplifier. I also recruited a second pair of ears for evaluative listening. Those belong to Lorelei Murdie, concert halls manager at the Crane School of Music, and an avid audiophile and music lover. Her work exposes her, like myself, daily to live classical music, and she is perceptive and critical about music reproduction.

Her system consists of an Adcom GFP-565 pre-amp, a POOGE-4 Plus CDB-650 and an Adcom GFA-545 power amp. Her loudspeakers are Vandersteen 2CIs. I have spent many hours listening to her system, and know its characteristics well. We evaluated the new Adcom power amps on her system before I connected them to the speakers.

The Real Test Begins

Before listening to the Sapphire IIs, I broke them in for about 45 hours on FM interstation noise. Even after break-in, the sound continued to improve for about a week. Mike said he noticed continuous improvement for up 80 hours, which reinforces my findings. A somewhat hollow quality in the lower-midrange/upper bass region disappeared after complete break-in. All listening was done with the grille cloths removed, (Dzurko agrees this provides the best sound) since the grille frame introduces diffraction which degrades the imaging.

So, how do the Sapphire IIs sound? In a word, marvelous. It is one of the finest loudspeaker systems I have ever auditioned. No loudspeaker in the "mini monitor" class is expected to deliver any real low bass. The Sapphire IIs don't, but their second order rolloff (*Fig. 6*) is gradual enough to provide a semblance of the bass, even if the bottom octave and a half is missing. Their low-end is clean and well-defined.

What strikes you first about the Sapphire IIs is their imaging. They reproduce a three-dimensional soundstage as realistically as any I've heard from a dynamic loudspeaker. Depth perspective is so convincing you'll often think you're listening to a dipole. The depth is so great Lorelei thought it was almost too deep compared to the width. I recently purchased one of the new Mercury Living Presence CDs, the Schoenberg/Berg/Weber disc with Antal Dorati and the London Symphony (Mercury 432 006-2). The spatial cues they reproduced are uncanny. Within the first five seconds of the Schoenberg *Five Pieces for Orchestra*, you'll hear the orchestral sections jump around the soundstage, ending with the trombones way back, and slightly right of center. Try finding a loudspeaker with more accurate imaging than the Sapphire IIs.

I found the depth/width relationship becomes much more realistic with careful speaker positioning. I followed Caldwell's advice, angling them so my listening chair was 15° off-axis. Angled this way, the soundstage is wider, even though there is a very slight reduction in depth. The Sapphire IIs reproduce a more realistic rectangular soundstage with the 15° off-axis positioning. I also found bi-wiring the loudspeakers (double runs of AudioQuest indigo blue cable) opens up the soundstage even more.

The Sapphire IIs have excellent inner detail in the midrange and treble. At moderate listening levels, they have an almost electrostatic-like transparency. They never sound like typical "box" loudspeakers. Audio Concepts has successfully eliminated the sound of the enclosure. Lorelei and I did notice the midrange loses some resolution at higher volumes, particularly if the recording contains a lot of bass. Forcing the driver to attempt to reproduce the low-end taxes the cone, causing some resolution loss in the midrange. They lose far less midrange detail, when driven hard, than most small dynamic loudspeakers. Aperiodic loading used to control woofer cone motion has really paid off.

I'm amazed how powerful these little loudspeakers can sound, within their frequency range limits. Aside from the lack of low bass, the Sapphire IIs fill a fairly large room with clean, natural sound. Their tonal balance is neutral. Various vertical listening positions I tried revealed *no* changes in tonal balance as significant as the frequency response curves might suggest. Ear level is less critical at a normal listening distance than it is when you're only one meter away from the loudspeaker.

No portion of the frequency spectrum is more prominent than any other. The extreme top doesn't have quite the ease or extension of the Dynaudio D-28/D-21 combination I use in my own reference system. The Sapphire II, however, is superior to my loudspeaker (*SB* 1, 2/82) in midrange detail and soundstage presentation. The woofer and tweeter integration is seamless.

They reproduce instrumental timbres with amazing accuracy, again resembling a fine electrostatic in this regard. In fact, I've heard more than one electrostatic with far more sonic coloration than they

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have. I rarely hear a loudspeaker which "disappears," allowing you to concentrate on the music.

Many reviewers, myself included, have probably overused the phrase "musical as well as accurate," but it best describes these speakers. This loudspeaker remains musically satisfying hour after hour, without any listening fatique. The Sapphire IIs demand clean electronics, and are accurate enough to reveal any changes you might make in your system. I would have no problem using them to evaluate other components' sonic characteristics, particularly if a subwoofer were added to fill in the missing bass.

Comparisons

I connected them to Lorelei's system for a few days. We spent two evenings listening and comparing them to her Vandersteen 2CIs. Her Vandersteens are also bi-wired, so connecting her cables to the Sapphire IIs was easy. The Vandersteens are among the best dynamic loudspeakers for soundstage reproduction, re-creating a three-dimensional soundstage which reminds you of a dipole. They also have fairly good low-frequency extension. Their one objectionable characteristic is harshness, or grit, in the upper midrange/lower treble region. This problem is most noticeable on massed strings and choral passages.

They gave the Vandersteen soundstage a run for its money. They equalled the Vandersteen's imaging and depth capa-

bilities in every respect, and were free of the Vandersteen harshness. I believe the Sapphire IIs are more musically accurate than the Vandersteens—if you're willing to part with the 2CIs' low bass. Lorelei isn't, and says, "I really want to hear them with the Saturn subwoofers." If that combination delivers the goods in the low-end, I think Lorelei will be in the market for a new loudspeaker system.

Lorelei's listening chair is somewhat lower than my director's chair, and I believe they produced a better image in her room than mine, despite the fact her electronics and CD player are not as refined as mine. I also noticed an improvement in imaging sitting on a lower chair in my listening room, confirming Caldwell's views about optimum vertical position.

Conclusion

The Sapphire II is a refined audiophile loudspeaker which, within its frequency range, will give the best dynamic loudspeakers stiff competition. Any reader who doubts that a loudspeaker kit can compete with the finest factory-assembled products should think again. The Sapphire II is an outstanding kit, and an excellent way to learn about loudspeaker construction and design. Beginners and advanced builders should find this an educational, as well as a musically satisfying project. You may find, however, starting with this kit is a problem. This design is so refined and well-executed that building a better loudspeaker "from the ground up" will be difficult. I admit to being intimidated by Caldwell's expertise level which produced the crossover network. I have a lot of homework to do.

I love deep, clean, accurate low bass. The bass is the foundation of most music, and I wouldn't permanently install a system in my listening room without the bottom octaves intact. I have talked to Dzurko about reviewing the Saturn subwoofers. I have even conducted some preliminary experiments using my own transmission line woofers as subwoofers for the Sapphire II. The results have been impressive.

If the Sapphire II/Saturn combination delivers the low bass, with proper integration of the two loudspeakers, Audio Concepts has a full-range system to be reckoned with.