# THE B.A.S. SPEAKER

**EDITOR-IN-CHIEF:** Michael Riggs
**COORDINATING EDITOR:** Bernard Gregoire
**STAFF:** Henry Belot, Robert Borden, Joyce Brinton, Dana Craig, Frank Farlow, Robert Graham, Lawrence Kaufman, James Lindquist, Peter Mitchell, John Schlafer, Jack Stevens, James Topali, Peter Watters

**PUBLISHER:** James Brinton, President, BAS

**THE BOSTON AUDIO SOCIETY**
**P.O. BOX** 7
**BOSTON, MASSACHUSETTS 02215**

**VOLUME 5, NUMBER 10**
**JULY 1977**



## In This Issue

A1 Foster and Wally Swanbon have tested eight receivers ranging in price from $170 to $650. After applying an exhaustive series of tests, they conclude that there are some real bargains for under $300, and some that maybe aren't the bargains we might have thought they were.

We've balanced Al's long discourse on receivers with variety up front. There's information on a new glass loudspeaker and on the Star Wars sound system, featuring the Sound Concepts SD-50. You'll also find an interesting "speculation" about a new Quad electrostatic loudspeaker, designed for use with the company's 405 amplifier. On the psychoacoustic front, Dan Shanefield tells us how to uncrate our sound, and Richard Ranheim discusses the existence (or nonexistence) of "depth" information in live music. Bob Sellman reports on CrO2 open-reel tape. Read. Enjoy.

Direct from Cleveland

We have sold the first batch of the Telarc/Advent Direct from Cleveland records but if you haven't ordered yours as yet, don't worry, a second batch is on order. The mail-order prices are:

| | | |
|---|---|---|
| United States | | $8.75 |
| Other countries, surface rate (including Canada & Mexico) | | $9.45 |
| Other countries, via air mail: | Europe & South America | $11.25 |
| | Asia, Australia, & Islands | $12.30 |
| | Central America | $10.25 |

**Membership dues are $14 per year (October 1 to September 30) or portion thereof. Dues include a one-year subscription to the BAS Speaker. (Note that almost the full amount of dues is allocated to production of the Speaker. The local activities of the BAS are strictly self-supporting.) For further information and application form, write to: The Boston Audio Society, P.O. Box 7, Kenmore Square Station, Boston, Mass. 02215.**

**For Sale**

*Beveridge electrostatic speaker & amplifier, $2, 800; Dayton-Wright XG-8 Mk. 3 electrostatic speaker, $1,700; KEF Corelli, $300 pr., Ampzilla, $450; ERA turntable & dust cover, $150; Supex SD-900/E and Levinson JC-1, $150. Contact Larry Beiter, 4612 Henry, Pittsburgh, PA 15213, (412) 683-9550 eves. & Sat.

*Berning 150 W/ch. triode amplifier, hand made by designer, superb with planar-type speakers (see review in Audiogram), $1,100. Denon 103S cartridge, no stylus wear, $65. DB pre-preamp, $100, $150 with separate power supply (for use with preamps other than the DB). SME tonearm, damped by Music & Sound Ltd., $190. William H. Bell, (202) 544-4238 after 7 and weekends.

*Crown DC300A & case in mint condition, $550, Robert Leffert, (603) 837-9320.

*Heathkit AJ-15 FM stereo tuner, new, unassembled kit. Contact A. Soave, 192 Central Park Rd. , Plainview, NY 11803, (516) 935-1704.

*ADC-XLM (original model), mint condition (500 hrs. use), no stylus, $30. Will pay postage and insurance. Call Steve at (914) 779-3331 or (212) 350-2527 or (212) 350-2526.

*RTR ESR-6 electrostatic tweeters, $225 pr. Rappaport PRE-1 preamp, $425. (212) 454-3205.

*Lux M4000, $1,050. Black Widow tonearm & Grado Signature cartridge, $300. Gayle Glidewell, 7724 Querida, Dallas, TX 75248, (214) 239-4103.

*SP 10 turntable Mk1, with SME improved detachable head shell and 3 head shells. Contains base & dust cover. Also, dbx 124, new, $300. Write 230 Calvary St. , Waltham, MA 02154.

*Rabco SL-8E tonearm. Suitable for updating or for use as is. Complete Rabco literature. $100 or best offer. Call (203) 447-9957.

*Advent frequency balance control (ten band octave equalizer), $115. Sony TC-650 tape recorder with half track and quarter track head blocks, remote control, $345. Teac AN-80 Dolby unit, $70. Electro-voice RE-16 microphone, $100. Cary Lu, (617) 926-0319.

*Burwen DNF 1201, scratched case, but excellent condition electronically, $195 plus shipping; Revox A77's, brand new, specify model (1102 or 1104), $745 prepaid shipping, add $100 if you want HS model; Open reel tape -- Irish 277 LN/HO/backcoated, new, 1800', $2.25; 3600' bulk pak, $4.40; Dupont Crolyn Open Reel Chromium Dioxide Audio Tape, never used, incredibly good, 3600' bulk pak, $4.70; 1800' (respooled to 7" reel in blank box), $2.85. Please add shipping for all blank tape. Robert Sellman, 14 Station Ave. , Haddon Heights, NJ 08035.

*Audio Research SP-3a4 preamp, $475. Ted Macklin, 5514 Kingport Dr., Atlanta, GA 30342, (404) 255-2793.

*dbx-encoded discs: demo record, Sam Kenton Plays Chicago, Gershwin Plays Rhapsody in Blue, Susan McDonald Plays the Romantic Harp, The Virtuoso Harp (Susan McDonald), played only a few times each, $20 takes all. Also, pair KEF 104's (African walnut), $450. Gary Rancourt, (617) 369-1949.

Attention Tube Lovers! Harry Bromer of Somerset Associates, New York reports that a source for high quality vacuum tubes is Euro Electronics, 4100 N. Elston Ave. , Chicago, IL 60618, (312) 463-5151. They will ship C.O.D. An example is the Telefunken 12AX7 at $2.15.

-- Joel Cohen (Massachusetts)

**Wanted**

Someone to record 78-rpm records onto cassettes. Use of Burwen or other noise removal equipment would be helpful. Cassettes should not be Dolby or dbx encoded. Call Joyce, (617) 358-7185.

**Renewals for 1977-78**

Please hold your renewals for next year (October, 1977 through September, 1978) for another month. All current members will be receiving the September, 1977 issue, where the new renewal form will first appear. You will also receive the first issue of the next year (October, 1977) whether you renew or not. This gives two months for us to receive your application and check before the November issue, which is plenty of time for our small bureaucracy to grind. I expect no increase in dues.

-- Harry Zwicker, Treasurer

**Ark Record Sales**

The final order for Fulton Ark records will be placed on September 3, 1977. All orders for these discs must be received prior to that date. See the February 1977 BAS Speaker for pricing. Note, however, that disc number 5112-5 is now out of print. Also, prices for 3125-S and 5112-S were reversed in the listing; the Minnesota disc (3125-S) is a double, priced at $9.00 plus shipping, while the Robbinsdale 5112-S is a single at $4.50. -- Harry Zwicker (Massachusetts)

**New Boston Area Transportation Coordinator**

Tom Hahs of Boston has accepted the position of transportation coordinator for future local meetings of the BAS. Anyone willing to participate in a car pool to BAS meetings out of the downtown area, or anyone requiring a ride should contact Tom Hahs at 742 -2568.

**Caveat Emptor**

I recently had an unfortunate experience with ESS, Inc. and Audio Associates of Arlington, Virginia. In late April, 1976, the tweeter in one of my ESS AMT-1 Towers gave out (it was powered by a Dynaco Stereo 70). On May 1, I took the blown tweeter back to the dealer, Audio Associates, for repair. Seven months later (I had called dozens of times in the interim), I picked up the speaker. It had not been repaired.

Several letters to ESS later, I decided to complain to the Better Business Bureau. In March, 1977, I filed a complaint. On June 1, 1977, I received a letter from the Better Business Bureau saying that ESS had ignored their correspondence (two letters). Perhaps we should ignore ESS in the marketplace. -- Craig Herberg (Virginia)

**FCC - CB - Congress . . . and YOU**

In the most recent issue of The Stereophile (Spring 1977, Vol. 3, No. 12), there is a very alarming guest editorial by Jack Hannold about impending government legislation concerning RFI. It seems that the FCC would rather force audio equipment manufacturers to add bypass capacitors or series inductors to audio circuits than to force CB manufacturers to build the appropriate amount of harmonic suppression into the transmitters. And, of course, there is the problem of illegal linear amps and their high-power outputs.

The editorial very clearly sums up the whole situation and ends with a call to all audiophiles to write their congressmen, as Barry Goldwater has just introduced legislation that would empower the FCC to regulate the manufacturing of audio components. Mr. Holt will send free copies of the editorial to any who request them (Stereophile, Box 49, Elwyn, PA 19063). In fact, after you read the editorial you can forward it to your congressman to let him know how you feel.
-- Elliot Berger (Massachusetts)

**Shop Talk Bicycle is Rolling**

The response to the WBUR 'Shop Talk' article in the May 1977 Speaker is in, and I am pleased to report that it has been sufficient to allow the bicycle to roll. Members who responded to the article were notably enthusiastic in their replies, and I think that we can look forward to a closely knit group. All of the charter members are presently being contacted and asked to contribute the needed funding promptly so that tapes can be purchased and the cycling can begin.

As expected, responses came from members all across the country. It looks as if the bicycle

will roll best if the membership is divided into two geographical groups: an eastern group and a western/midwestern group. Hopefully, this arrangement will save a few extra days delay through the mails. The order of the membership in each group (first to last) was determined by the order in which the responses to the article were received. A first day reply put the bicycle member at the front of his geographical group. Second day replies, after the first, etc. There are openings for a few more members in each geographical group.

Most members expressed a preference for stereo cassettes with Dolby encoding, so this format has been adopted. Peter Mitchell has indicated that the first tape to be cycled is of a discussion of events and products seen at the CES show in June. This tape is scheduled to begin cycling on August 1, 1977. -- Dean Slindee (Wisconsin)

**Dixie Hi-Fi/Custom Hi-Fi Now Circuit City**

Two of the nation's capital's leading audio chains have been merged under the name of Circuit City, according to a report in the May 21 Billboard. A spokesman for the new firm announced that some of the stores from the two former chains will close and those remaining, in addition to new outlets, will feature a policy of emphasis on consumer service. There will also be an expansion of product lines to anything in consumer electronics. -- Dennis Boyer (Massachusetts)

**Update: AtlantaAudio Project/Michael Humphries**

As of this writing (5/4/77), I have not yet received any money from Michael Humphries of the now defunct Atlanta Audio Project. After much legwork, the Georgia Office of Consumer Affairs was able to trace Humphries through the Colorado Office of the Attorney General to a store he apparently owns. The address is Denver Audio, 1111 Lincoln St. , Denver, Colorado 80201. I strongly urge everyone to avoid doing any business with Humphries. Conversations I have had with people at the Georgia Consumer Affairs Office indicate that a number of other people have had problems with him. -- Robert Sellman (New Jersey)

**Incredible Breakthrough?**

Recently, word of a "new" speaker has been circulating (Newsweek, June 6; Shop Talk). This "incredible breakthrough" is the Barcus -Berry AudioPlate and I was amazed to see a paper presented at the recent convention of the Acoustical Society of America, concerning this particular "innovation. "

The speaker consists of a piece of glass driven into bending wave vibration by a piezoelectric type element bonded to one side of the plate.

The analysis that was presented concerned the speaker's directionality and frequency response, which although very good up to about 15 kHz, are not incredible. No other measurement data were presented. Although the impedance of the unit was not stated, it was mentioned that it has been driven by a 100-Volt source. It can play very loudly and would be virtually indestructible in home use.

Currently Barcus-Berry manufactures a two-way system using a dynamic woofer in conjunction with an AudioPlate. No units were available for auditioning. Newsweek's indication of the life-like reproduction available from the AudioPlate is summed up by the following quote: "The quality of the sound can be downright eerie. 'John and I were listening to a broadcast of a Dodger game on the AudioPlate,' recalls Barcus. 'We had switched from a conventional speaker, and suddenly we felt we had actually stepped outdoors into the game.'" (????) -- Elliot Berger (Massachusetts)

**Star Wars and Sound Concepts**

The surround-sound system being used in most theatres for the film Star Wars was designed and installed by Dolby Laboratories. The optical, two-channel sound track is Dolby and SQ encoded. The rear channels are combined after decoding and passed through a Sound Concepts SD-50 delay unit. The SD-50 is specially packaged by Dolby Labs and the delay and rolloff set for the particular theatre when the system is installed. Dolby also provides a center front channel, for a total of four. The net effect is that of remarkable fidelity with sounds that apparently emanate from overhead and behind the audience. The delay establishes precedence for front sounds and aids intelligibility toward the rear of the theatre by somewhat matching the arrival times of the front and rear sounds.

-- Jim Brinton (Massachusetts)

**Pioneer Bids For Audiophile Market**

With its FM tuners, RT-1050 tape deck, SG-9500 equalizer and Spec-2 power amp, Pioneer has already begun to establish itself as a maker of components for the serious audiophile as well as a mass hi-fi merchandiser. This year Pioneer plans to try harder. Forthcoming components include the C-21 preamp (in the Levinson and Yamaha C-2 mold, with minimum flexibility, no tone controls, exotic specs and elaborate facilities for tailoring the input capacitance and resistance of the phono preamp), M-22 power amp (a very wide-band class-A unit) and D-23 electronic crossover (with extremely flexible choice of crossover frequencies and slopes).

Pioneer is also about to introduce two new tape recorders which may become best-buys. Each will list at about $600 and so will retail generally for about $450. One is the RT-707 (quarter-track, 7-inch reels, solenoid operated, 3-motor, 3-head, with direct-drive capstan, variable pitch and one-hand threading); the other is the CTF -1000 (3-head, front-loading cassette, closed-loop dual-capstan transport, full monitoring with double Dolby, direct-drive capstan motor, variable pitch, solenoid operated, with 40-dB meters). I have had a brief chance to play with both machines, and they are very attractive. As soon as they become available I will evaluate them thoroughly and report. The cassette deck is especially intriguing: if it lives up to its promise, its $450 retail discount price will make Nakamichi and the other 3-head competition look silly.

-- Peter Mitchell (Massachusetts)

**Speculation**

Fact 1: The new Quad 405 power amplifier is too powerful to use with the existing Quad electrostatic loudspeaker without insertion of power-limiting resistors, and until now the Quad components have always been designed as a matching system.

Fact 2: Quad has a new patent (U.S. Patent #3,773,984, awarded 20 November 1973) on an electrostatic loudspeaker with constant current drive, which requires a feedback connection from the loudspeaker to the power amplifier driving it.

Fact 3: On the front edge of the printed circuit boards of the two channels of the Quad 405 amplifier is a short wire link joining two adjacent pads on the board. This seems pointless until one realizes that, if this link is removed, and the input wiring to the boards is rearranged, one now has access to the previously grounded non-inverting input of the operational amplifier which forms the first stage of the Quad 405. This input could thus be used to accept a feedback signal from a loudspeaker such as the one mentioned in "2."

Fact 4: There are four covered holes on the front (back?) panel of the Quad 405, two adjacent to each of the circuit boards, which could serve to mount input sockets for the loudspeaker feedback connection mentioned in "2." (This use seems far more likely than that of allowing the mounting of phono input sockets in place of the DIN socket furnished, especially in view of the location and number of these holes.)

Fact 5: It is rumored that Quad has a new electrostatic loudspeaker ready for release. Certainly, the patents on their existing model will be expiring shortly. (See Hi-Fi News & Record Review, April 1976, 64-65.)

Conclusion (Speculation): The Quad 405 power amplifier is designed to be used with a new Quad feedback-type electrostatic loudspeaker which may be due for imminent release.

-- Stanley P. Lipshitz (Ontario)

**Ball Brothers Reply to Maier**

I have read the March 1977 issue of the Speaker. Some of the items attributed to Dr. Bruce Maier of Discwasher are worthy of comment. I am with the Ball Corporation, which markets the Sound Guard record preservative to which Dr. Maier frequently referred.

Dr. Maier stated that the Pro-Disc coating is less than one-half the thickness of Sound Guard and only 1 Angstrom thick. The Sound Guard preservative coating is stated to be less than 3 millionths of an inch thick, and 3 millionths of an inch are 762 Angstroms, so if Pro-Disc is 1 Angstrom thick it definitely is less than one-half the thickness.

The claims of the Pro-Disc coating being 1 Angstrom thick and a mono-molecular layer are interesting. The small gaseous hydrogen and helium molecules are about 3 Angstroms in diameter, and much larger molecules are actually required in any type of permanent coating or surface layer formed by a reaction. A mono-molecular layer is a rare phenomenon, normally achieved with only limited success in a high-vacuum chamber, so I look forward to accomplishing this with the Pro-Disc fog application technique. During the demonstration of the Pro-Disc system at the January CES Show, I observed a very distinct spray pattern directed immediately onto the record, in contrast to what Dr. Maier reported at your meeting, but perhaps by now this has been modified.

As Dr. Maier states, there is a chemical similarity between the chlorofluorocarbon solvent used in the Sound Guard record preservative and the ones used in aerosols. We are maintaining contact with the National Academy of Science and the National Bureau of Standards, who are studying this problem. At the present time no legislative action has been taken against our version of chlorofluorocarbon material. We are working on a different fluid-type system to replace the current system if legislative action is forthcoming. The National Academy of Science, which is coordinating the scientific work on the ozone question, has recommended allowing two years for scientific work before any legislative action.

It appears that Dr. Maier has misunderstood "you can play the record immediately, although the anti-stat will take about fifteen minutes to become effective" in the Sound Guard record preservative instructions. It may take fifteen minutes for the anti-static agent to be fully effective as stated, and this is a function of the humidity. In no way does this relate, as Dr. Maier implies, to any action where the surface of the record is improperly softened and the coating "melts" into place. As stated, the record can be played immediately after applying Sound Guard preservative.

I have reviewed with one of our thermal analysts the reported thermal shock, or "trauma," mentioned by Dr. Maier, which is claimed to be reduced by a factor of four by the Pro-Disc coating. There is some heating below the surface caused by the concentrated pressure at the contact point with the stylus. The amount of heating in the record caused by compression is a function of the pressure, the velocity and the hardness of the record. The energy is dissipated primarily by conduction into the bulk of the record, convection in the air, and radiation, in addition to elastic recovery of the deformed material. It is very difficult to understand how a thin surface coating could increase this transfer of heat. I should be very interested in any test data showing that the "thermal shock" as described is reduced by a factor of four. Dr. Maier also stated that friction between the stylus and the disc is not the problem. Lowering friction does not reduce the slight amount of heat caused by pressure, but it does significantly reduce the heat caused by friction and wear. Wear is the basic factor destroying the performance characteristics on future playings. We make no claim in our data for any reduction in heating caused by pressure, as implied by Dr. Maier.

Dr. Maier stated that the Pro-Disc system is not compatible with DGG discs because they are

fogged with silicone. I contacted Jack Warfield, the classical expert at Phonodisc, Inc., in Los Angeles, who handles the DGG records. He was not aware that they are fogged with silicone, but he did state that the DGG discs and the Philips discs are made by the same manufacturing process, as they are part of the same corporation. Therefore, he would anticipate similar characteristics with Philips discs, so it appears that two major labels cannot be used with Pro-Disc. Both of these brands are compatible with the Sound Guard record preservative, as are all other brands.

An important feature of the Sound Guard record preservative is its built-in anti-static action, which has a very long life. The usual cleaners do eliminate temporarily the static charge, but they in no way restrict the build-up of a static charge after the cleaning is completed, when the record is dry-buffed or simply inserted in its sleeve and withdrawn. The need for the anti-static action can be easily demonstrated by dry buffing or inserting and withdrawing from a sleeve a record cleaned with a cleaner and one treated with the Sound Guard record preservative and holding these adjacent to a suspended piece of Christmas tree tinsel or lowering them over ashes in an ashtray. The ashes will actually jump about an inch to a dry-buffed, cleaned record but not to the dry buffed record protected with Sound Guard record preservative. The problem with doing the ashtray test is that ashes are very abrasive and difficult to remove, so I recommend the tinsel test.

-- Dr. Virgil Friebel, Manager, Lubrication Technology Department, Ball Corporation

**And a Response from Maier**

I am also in receipt of the Ball Brothers letter. Suffice it to say that some of the observations are correct, and I have been in very pleasant dialogue with Dr. Friebel concerning our similarities and differences.

Quotation errors in the Speaker article are substantive but minimal, and without this elevated response from Ball I would say nothing. Under the circumstances, I have the following observations to make, which are fairly simple.

The tape transcript indicates that I said our Pro-Disc compound was approximately one-half the Angstrom diameters of the Ball product. This is true. The Speaker said that it was about one Angstrom thick, and the Ball letter appropriately notes the impossibility of this condition. Both small size and flexible modulus of adhesion are essential characteristics for a good, non-occluding record coating. Our product was designed with these exceptional characteristics.

Our data concerning stylus pressure heat are accurate, and we measure heat with a higher standard of care and instrumentation than the Ball labs have exercised.

Our data indicates that reduction in the coefficient of friction does not solve all of the heat-generating problems, and our Pro-Disc formula was designed with extremely high heat transfer characteristics. Communication with Dr. Friebel indicates that he agrees that this is possible.

We acknowledge that the Sound Guard static reduction method is achieved by hygroscopy (attraction of moisture to the record surface). We fundamentally differ with this approach, because it does encourage, in the long run, microbial growth on the vinyl matrix (ask anybody in the tropics).

We concur with Dr. Friebel that the Sound Guard formulation does not soften the vinyl polymer, but it does soften many of the vinyl stabilizers. Furthermore, the application method lends itself to overdosing of the record.

The somewhat disparaging comments concerning application of our Pro-Disc product by Dr. Friebel are accurate relevant to the crude prototype delivery system. The final product will have an extremely fine fogging action, without droplet spray effect, and as such represents a more controllable application of micro-film lubricant that will not develop local excesses.

I have no good explanation for the absence of silicones currently experienced on some import pressings, as mentioned in Dr. Friebel's letter. I know that we have unimpeachable data and sight visit documentation that such lubrication is, has been or was applied to many foreign pressings. I note quite frankly that record cartel personnel do not know where different records have been

pressed, in which plants or under what conditions, and there is a legion of variations possible within any given imported label source of supply.

It is incorrect to say "not compatible" with any disc surface, and I do not believe I styled any product with that phraseology. If silicones are present on a surface, no dry film lubricant will function as well. We generally agree with Dr. Friebel that untreated surfaces, whatever label, are most chemically compatible for a dry film lubricant.

-- Dr. Bruce Maier, President, Discwasher, Inc.

**And Finally, a Response from the Author of the Meeting Summary**

Perhaps Dr. Maier has treated the BAS with too much kindness. Since May we have know that Dr. Maier found at least three errors in the meeting summary, yet he takes us to task for only one. Although as meeting summarizer I might thank him for being generous, I would have preferred complete accuracy with the help of his corrections. Translating an oral presentation into a written page is difficult, as many local members who have done so can attest, and a response from each guest speaker should really be part of our publishing routine.

Regarding the misquote of one Angstrom diameter for the Pro-Disc coating, perhaps it is worth discussing the source of the error. The tape transcript reads as follows:

... In point of fact we have an Angstrom diameter (pause) of our lubricant system (pause) which is less than half of the Ball ..." This was interpreted to mean "... we have an Angstrom thickness of our lubricant system, which is less than half of the Ball ..." Insertion of the mental comma (,) after "system" resulted in the "one Angstrom" interpretation of Dr. Maier's statement. Interpreted without the comma, the statement agrees completely with Dr. Maier's statement above -- Pro-Disc is half the diameter of the Sound Guard coating, but not as thin as one Angstrom. I agree with Dr. Maier's correction to my meeting report, and I apologize for any consternation the report caused at Ball Brothers.

No other points in Dr. Maier's letter seem related to the accuracy of the meeting summary.

BAS members should by now have the information required to choose one or the other, or neither, of these advanced disc care products. Given the low cost involved, this writer will be among the first in his block to be using his choice when it appears in the stores.

-- (Dr.) Harry R. Zwicker (Massachusetts) (With all the titles flying about, I couldn't resist)

**Controlling Test Parameters**

Too often audiophiles conduct tests without controlling all known variables. Controlling variables is a very time-consuming process, but an important one, for without careful control, one can never be certain that the parameter under test is responsible for what one hears. Nor do audiophiles always employ adequate testing equipment or test procedures free of bias. This partially accounts for the wide range of opinions, particularly in the "underground" magazines.

My. June 1976 Speaker article, "A Test for Preamplifier Audio Quality," is an excellent example of how not controlling one test parameter led to a misleading conclusion. In the article, I present evidence that a given white-noise test is a definitive test for subjective audio quality. I based this conclusion primarily on the assumption that I had eliminated all the phono frequency response deviations between the components. Mark Davis (MIT psychoacoustician) has suggested that the technique I used to determine the frequency response of the phono input stage was acceptable but not accurate enough for psychoacoustic purposes.

To eliminate frequency response variations as a factor, perfect matching is required. The components to be A/B-ed must have identical RIAA responses. To aid in matching components, I have in the past used the Holman cartridge interaction test (November 1975 Speaker) to determine the required matching capacitance, etc. Having eliminated (I thought) the cartridge interaction as

as a variable, I felt confident that the sine wave results would represent the true RIAA responses of the units.

My RIAA testing procedure was in error for two reasons: (1) the Holman cartridge-interaction test does not yield consistent results (I found that variations of 2 dB, when the same unit was tested at two different times, were quite common); (2) the frequency response deviations between two components varied unpredictably with temperature, cable capacitance, etc., thereby yielding erroneous data. I also separately plotted the frequency response of each preamp, using a test record, adding the appropriate capacitance, etc. , until the units were matched. Though this technique worked well a few times, more often the same cartridge and record one hour later would yield a slightly different response curve. This phenomenon is corroborated by Bernhard W. Jakobs, AES Preprint No. 700 [G-2].

To overcome the limitations of both the Holman cartridge interaction test and of the separate plotting of individual frequency responses, Mark Davis suggested that we should first match the preamp outputs precisely at a single frequency, e. g. , 1 kHz, with a sine wave generator and an AC/VTVM. The preamp switching box (see the May 1976 Speaker) should be non-interactive and capable of instantly alternating between the two preamp outputs to permit precise level matching on an AC/VTVM. Next, he recommended we disconnect the sine wave generator, and attach the output of the cartridge to the switchbox input. With a discrete frequency response test record (e.g., STR 151), sweep the entire test band as the frequencies are announced and instantly switch the cartridge output between preamps and note their responses on the AC/VTVM. Only after all frequency response variations have been eliminated can one say with confidence that such variations between the two preamps have been totally eliminated as possible causes of other audible differences.

Taking Mark's advice, I retested a few preamps tested earlier. To my chagrin, I could isolate no differences that could not be attributed to frequency response. The three categories I outlined in my June article are accurate; the preamps do sound as described. For example, I characterized the AGI 511 as excellent and the Marantz 7C as good. My error was that the 7C simply was not designed to drive the 100-kOhm input of the Phase Linear 700 (Saul B. Marantz, Absolute Sound, Vol. 2, No. 7) used for the listening tests. As a result, the 7C suffered from bass attenuation and possibly other aberrations. The frequency responses of the two preamps matched perfectly on the 1-MOhm input of an AC/VTVM but became dissimilar when the 7C was asked to drive a load for which it was not designed. I was unable to retest all the units mentioned in the June article, but, for the few that I did retest, the differences were most often caused by frequency response variations. -- A1 Foster (Massachusetts)

**Is There Front-to-back Information in Stereo?**

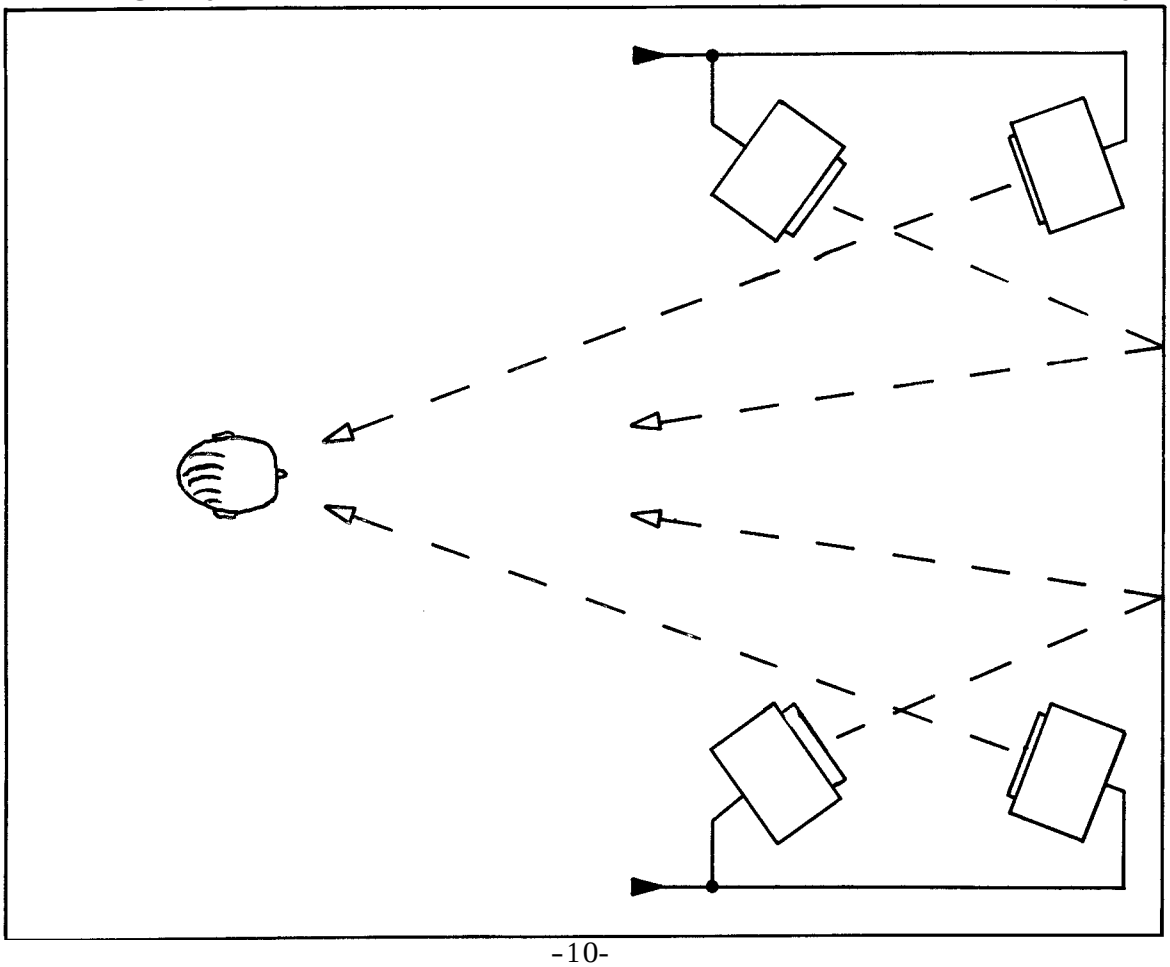
I am writing on behalf of what appears to me to be a very small minority of audiophiles: those of us who live in rural areas. Mansura is 150 miles north of New Orleans and deep in cotton/cane country. I subscribe to every -- yes, every -- stereo publication printed in the U.S. plus Gramaphone and Hi Fi News and Record Review. It appears to me that all these publications assume that one lives near symphony and opera halls, McIntosh Clinics, high-quality FM signals, reliable service and repair facilities, bumper numbers of friends who are also techno-freaks, and consumer oriented stereo salons. None of the above apply to me; I am the only person that I know in my parish (county) that has what would be considered a "high fidelity system." (Parish population is 37-38,000.)

I am 42 and as an M. D. I know what 42 years means so far as hearing is concerned. That plus new psycho-acoustic research on the differing ways we humans perceive sound may account for my question. In The Absolute Sound, Harry Pearson has bombarded us with his fixation on depth or front-to-back imaging in a stereo system. I have just returned from a vacation in London. While there, I heard Faust at Covent Garden (Nicolai Ghiaurov, Mirella Freni, Peter Maag) and went to Royal Festival Hall for the L.P.O. (Daniel Barenboim) who played Bruckner and Beethoven. I, consciously, kept Pearson in mind during these two performances. My seats weren't the best in the house for either performance -- I wouldn't imagine any tourist obtains the best seat in the house at Covent Garden. Nevertheless, I heard ZERO, absolutely zero, front to back information at these

live performances. My question to those of you who regularly attend live concerts and who may have better seats acoustically than those I had in London is this: "Do you hear front-to-back imaging at live performances?" And be careful to distinguish between volume differentials and front-to-back imaging. If there is no front-to-back imaging at a live performance, there should be none in a stereo system. And if, as one stereo writer recently inferred, only 5-10% of the U.S. population can hear front-to-back information (his claim was that this ability was inherited and most difficult or impossible to learn), I question the practicality of hardware manufacturers going to the expense of building this phenomenon into their product. As a Louisiana native, I have been to Preservation Hall, Al Hirt's bar, and Pete Fountain's bar, and others on numerous occasions. Looking back, I am not conscious of hearing any front to back imaging at "Dixieland" live performances either. Lateral stereo imaging is very real and very important. But is there really such a thing as front to back imaging? -- Richard Ranheim (Louisiana)

**Avoiding Consciousness of Loudspeakers**

Does your ear/brain system "lock on" to the location of your loudspeakers and refuse to let you imagine an orchestra ten rows or so beyond the wall of your listening room? There are several tricks for helping to beat this problem. One is to fill the "hole in the middle" with a third (center) microphone during recording, as suggested by Nakamichi on page 28 of the December 1975 issue of Audio magazine. But this solution is inaccessible for existing recordings. A blend channel and center speaker can be added during playback, but I find that it puts the orchestra too close to my listening chair. The best solution seems to be the addition of about 30% reflected sound, either from bipolar speakers or by some other means. If you've already invested in conventional speakers, the method depicted in the accompanying diagram can work quite well. The additional speakers for reflection can be of poorer quality than the direct radiators. They project a virtual image which is fairly far away, and yet the details of the music are still heard clearly, because the direct radiators provide most of the sound. (The reflections are absorbed somewhat by the walls.) The effect can add greatly to the illusion of realism. -- Dan Shanefield (New jersey)



**"Techno-freak"?**

I have a bone to pick with Alvin Foster over his definition of "techno-freak." In my experience, a techno-freak is frequently one who has technical knowledge relating to hi-fi gear or builds or modifies his own. I consider myself a techno-freak, but I will ignore or discount specifications for the simple reason, as Alvin points out, that specifications are misleading or incomplete. (There are three kinds of lies: lies, damn lies and specifications, in that order.) I consider myself better off for knowing how and why hi-fi gear works and for being able to build and repair my own. If Alvin wants to differentiate between two groups, I offer the following guidelines to separate the species. These are roughly classed as "listeners" and "nuts." The listener owns hi-fi gear so that he may better enjoy his music; he is not greatly concerned with super-low distortion, high power, dynamic range or ostentation. He will ignore minor mistracking, humpy frequency response, gadgets and chrome in favor of simpler, more reliable equipment, so that he can enjoy his music with minimum hassle and cost. Of the two types, he is a more mature, stable person, with some tendency toward introversion. The nut is often a neurotic-compulsive extrovert who must own the best and latest, and damn the cost! This type spends much time poring over equipment reviews, diddling with overhang settings and impressing his friends. If he is not completely whacko, he may have a very good reproduction system. The listener, on the other hand, through ignorance, or unconcern, may not be using his system to the best of its capabilities. The nut plays as much music as the listener, but he rarely listens to the music. The nut can teach a lot about the best equipment and its performance to the less experienced owner of hi-fi equipment. It can be a treat to go to his home and hear the glorious sound pouring from his speakers. If he is not completely exasperating because of his impatient jumping around, setting controls and selecting a couple of good grooves on each "demo quality" record, one can stand him for as much as an hour at a time. Obviously, these represent relative extremes in individuals. I know of local people, though, who conform closely to either of these examples. -- Damon Hill (Georgia)

**Looking for a "Best Buy" in Audiophile Magazines?**

Since audiophile magazines vary widely in issue size and subscription price, perhaps one easy way to rank them is in terms of the amount of reading material they provide per dollar. The following quick-and-dirty ranking is simply based on the cost per square foot of published text; the calculations were based on the most recent issue of each publication.

| | Number Of Pages | Text Area Per Issue | Cost Per Issue | Cost Per Unit Area |
|---|---|---|---|---|
| The Audio Amateur | 76 | 35 sq. ft. | $2.25 | 6.4¢/sq. ft. |
| The BAS Speaker | 32 | 13 | 1.17 | 9.0 |
| The Absolute Sound | 122 | 29 | 3.00 | 10.3 |
| The Stereophile | 58 | 13 | 1.75 | 13.5 |
| Sound Advice | 30 | 15 | 3.00 | 20.0 |
| The Audio Critic | 50 | 22 | 4.67 | 21.2 |
| Mr. Audio's Bimonthly | 37 | 8 | 3.00 | 37.5 |
| The $ensible Sound | 25 | 6 | 2.50 | 41. 6 |

Thus, The Audio Critic is by no means the most expensive audiophile journal; although its $28 annual price is steep, it promises to deliver 300 large pages of text during the year. Ironically, The $ensible Sound, which is devoted to finding the best price/performance ratio in audio gear, itself provides the worst price/text ratio among these magazines.

Of course, I hope no one will take this ranking too seriously. After all, one ought to pay a little attention to the quality of the service which these magazines provide, as well as the quantity! Even in terms of quantity, one might want to compensate the figures to account for print size (i.e. , number of words per square foot); then the Audio Amateur and Absolute Sound would look even more attractive in view of their small typeface, while The BAS Speaker and The Audio Critic would decline slightly in the scoring, because of their large print size. On the other hand, The Absolute Sound may also decline a bit in this ranking, as they are promising to produce smaller issues in order to get the magazine out more often. -- Peter Mitchell (Massachusetts)

**Quality Control?**

The Sony TC-355 was perhaps for reel-to-reel tape recorders in the late '60's/early '70's what the Advent 201 has been for cassette decks. Therefore even though this is an old unit, there are probably still enough around to warrant this note.

My deck is seven years old, is in continual use (when it is working) and has been maintained almost exclusively by myself for the duration. I have replaced the following parts: one motor, three capstan idlers, two take-up idlers, one rewind idler, two sets pressure pads, one play head, one record head, one flywheel, two flywheel bearings, two transistors -- playback amp, and repair on the headphone amp. Additionally, the TC-355 for a period of time seemed to need realignment every time I breathed too hard. The deck is currently alive and well with a response (at -15 VU) of +2 dB from 25 Hz to 20 kHz (7 1/2 ips) with an unweighted S/N ratio of at least 50 dB. Recently I replaced the take-up reel assembly, which includes a felt clutch. It is an easy part to replace and all seemed to go well, except for the next month it seemed that all of my reels of tape had warped. I discovered that the problem was that for $16, Sony cannot press fit the plastic top of the take-up table onto the metal shaft so that the top of the take-up table runs parallel to the plane of the chassis while the deck is in motion. I had to go through four of these parts before I could find one that was close enough to use. "Close enough" meant that the edges of the reel would no longer rub on the tape. -- Elliot Berger (Massachusetts)

**Public Education in High Fidelity?**

In the part of my job that includes selling high fidelity equipment to the public, I have noted an increasing trend toward a "system psychology. " A few of the people who come in to look at and listen to equipment are genuinely knowledgeable; others are at least aware of the flexibility and freedom of choice offered them by component hi-fi (as opposed to package systems and "consoles"). These people have no trouble choosing items from different makers and envisioning them together as a system, customized, as it were, to its owner's needs.

More often now than in the past, however, my customers shy away from good-quality equipment arranged for easy comparison in our sound room and gravitate to the three or four prematched systems on display elsewhere in the store. These customers -- and they are surprisingly numerous -- have no idea that they themselves are capable of exercising choice over, let's say, the speakers they buy when they choose an amplifier by Brand Z, or the cartridge which goes into the tonearm of their new Brand A turntable. If I suggest that a system might sound nicer with this or that changed around, such customers will look me in the eye and say: "But the speakers you are showing me go with THAT receiver (turntable, tape recorder, etc. ), not the one I want!"

The high fidelity industry, which grew out of the tiny hobbyist supply business may predictably respond to such buyer non-awareness by offering us increasingly inflexible equipment, or by -- heaven forbid -- destandardizing connections or even electrical values at inputs and outputs. It can afford to, but we, as enthusiasts who appreciate freedom of choice, cannot afford to let it. Isn't it easy to see, in the future, each manufacturer producing low-end equipment which will mate only with other equipment in their line, while preserving compatibility only in the most expensive and hobbyist-oriented products? Who can say where the dividing line might fall or how much more money we might be required to spend to build systems to suit us?

Input, please. Many BAS members are educators. Is there not room for a bit of hi-fi buying advice in home economics courses taught in schools? Doesn't nearly every household own at least one "stereo," in one form or another? Wouldn't everyone, including devoted audio buffs, benefit if everyone knew more about what he were buying when he walked into his audio shop? As an audio salesman, I can help some people choose wisely, but for those who won't believe a salesman (sometimes understandably), isn't there some way of helping people to pick what's best for them and to avoid unscrupulous sales people?

A footnote: many customers who return "defective" equipment and "unplayable" records to our store prove to have been operating their (perfectly ship-shape) equipment incorrectly and are

surprised to learn that everything works fine in the store after they've troubled to bring it back. But there's meat enough for another article in that. -- George Androvette (Massachusetts)

**Old Colony Pink-noise Filter - - Update**

If you plan on building the Old Colony Pink-Noise Filter, as described in the Audio Amateur and in these pages (April 1977) you (apparently) must be very careful of the transistors that you use.

I built the unit and as described in my first article it malfunctioned, giving a non-pink spectrum after about four hours of operation. With the help of Old Colony and some new parts, I remedied the problem with a new transistor. About two weeks later (after I sent in the article) the unit died again. In fact I went through six more Motorola 2712 transistors; they would work fine initially and then change characteristics. Through Old Colony, I got in touch with John Petzold, the author of the original article. It turned out that the transistor that he used in his unit was a Texas Instruments S98, for which the 2712 should be an adequate substitute in this seemingly non-demanding configuration. Apparently it is not.

I sent John some of my "bad" 2712's and he sent me a TI S98. My 2712's measured in his unit the same way that they did in mine, thus confirming that my unit was correctly constructed. His S98 worked fine in my unit and has been for 19 days during which the unit was left on almost continually. At this time it seems safe to say that the unit will work as intended if a TI S98 is used as the noise source. If my unit dies again, it will be faithfully recorded in these pages. If anyone can explain what physical changes are occurring in a transistor, when used in this circuit, which can change its noise output spectrum, please let me know!! -- Elliot Berger (Massachusetts)

**Open Reel (!) Crolyn**

I am sure that when chromium dioxide cassettes were introduced, many expected to see open reel chrome tape to be marketed within a short period of time. Like me, you may have assumed that it never was introduced because of the head-wear problems and its special bias and equalization requirements. Soon after introduction controversy about the abrasive properties of chrome surfaced. Only now has the issue been settled (maybe), with chrome being considered no more abrasive than iron-oxide tapes. Of course, today's more esoteric iron-oxide tape formulations may negate any advantage chrome may have had.

By a stroke of unusual luck I have found a supply of some 1-mil Dupont Crolyn audio tape and feel that other members may be interested in my impressions of the tape. My general impression is that it is a premium quality tape, very well made, with an extremely smooth polished oxide surface. However, I was initially concerned that it would be impossible to adjust my deck, a Revox A77 about six years old, to use the tape. I am happy to report that it adjusted well for the tape on both 3.75 ips and 7.5 ips. Recordings sounded extremely good and the tape did not appear to saturate easily at high frequencies with high recording levels. The S/N seemed similar to that of high-quality LN/HO tapes, although I do not have the equipment to measure it. Frequency response was better at high frequencies than with other tapes and extended as low as other tapes.

Adjustment of Crolyn tape on the Revox worked as follows:

1. With a 10 kHz input tone, adjust the bias (increase it) until you observe a 4 dB drop from peak value. (This works for both 3.75 ips and 7.5 fps.)

2. Adjust equalization for smoothest frequency response. (Minimum high frequency boost seems best.) You may have to change the bias slightly to get smoothest frequency response.

As you may have concluded, this is now my standard open-reel recording tape. You may also recall that in an earlier issue of The Speaker I mentioned that I am always looking for inexpensive high quality tape. I am happy to report that not only can I presently get Crolyn tape at a reasonable

price, but I have access to enough tape to be able to make it available to BAS members. If enough members agree with my high evaluation of Crolyn tape and are interested in more, I will consider negotiating to get more manufactured, although I am sure the price will rise.

Although you must readjust your deck to get best results from this tape, I believe many of you will find it well worth the effort.

I will supply Crolyn open reel tape for the following prices: 3600' bulk pak $4.70 each; 1800' reel (respooled from bulk paks, in plain white box) $2.85 each. Please add enough to cover shipping (see want ads). -- Robert Sellman (New Jersey)

**In the Literature**

Audio, July 1977

*E. T. Canby suggests that quadriphonic sound would have been better off if simply called four-channel stereo or surround stereo. (p. 8)
*Turntables and Noise: Joe Grado continues his valuable series with an analysis of rumble and other noises. (p. 22)
*Car Stereo Directory: A surprisingly large compendium of specs on auto stereo components. (p. 34)
*Test Reports: Three car stereo components, the Fosgate "Power Punch" amplifier (excellent), JIL 615 CB/FM stereo/cassette (better than average but not great), and Clarion PE-666A stereo radio/cassette (mediocre). (p. 56) Also, Richard Heyser reviews the Jensen 530 (mediocre). (p. 86)
*"Dynamic Range Requirements of Phono Preamplifiers": An expanded version of Tom Holman's BAS article. Likely to be the standard reference work on the subject for a long time. (p. 72)
*"Time and Frequency in Loudspeaker Measurements": Richard Heyser discusses the background of some of his speaker measurements, but still doesn't quite tell the reader what the measurements mean. (p. 80)

Gramophone (England), May 1977

*Quarterly Retrospective: The best instrumental records of the past three months. (p. 1669)
*"A Century of Recording, Part 2": A good survey of recording history. (p. 1761)
*"Paris in the Spring": New products seen at the AES Convention and the Festival du Son. (p. 1769)
*Reviews: Mostly enthusiastic reports on the Radford ZD22 preamp, ZD100 power amp, Ortofon MC20 pickup and Groovac III record cleaner. (p. 1773)

High Fidelity, July 1977

*"The Covert Revolution": A startling story of the corporate politics surrounding the introduction of electrical recording in 1925. (p. 79)
*Reviews: AR-10 (very favorable, though no curves are shown; note exceptionally low bass distortion at high levels), JVC S300 receiver, Elac 870 turntable, Dynavector 20B moving-coil pickup (spectacularly clean sound, and no head amp is needed), Scott 436 integrated amplifier.
*"Getting the Noise out of Your System": A comparative discussion of devices that reduce noise (Burwen DNF 1201A, Source Engineering Noise Suppressor and 78 rpm preamp, SAE 5000, MXR Compander, dbx 128 and dbx 3bx). (p. 64)
*"Direct-to-Disc Recordings": Hal Rodgers reviews the technical quality of five direct-cut records. (p. 122)

Hi-Fi News and Record Review (England), June 1977

*"Cassette vs. Disc, Part 2": In nose-to-nose comparisons of twenty-eight pre-recorded cassettes and the equivalent discs, Angus McKenzie finds that DGs tend to be superb in both formats, Londons variable, and Columbias mediocre in both versions. (p. 53)
*"Show Report": New products seen at the Heathrow Hi-Fi Show. (p. 72)
*"Subjective Sounds": Enthusiastic remarks about the serendipitous combination of Linn Sondek table, Grace 707 arm and Supex 900 Super cartridge. Compatibility really does matter. (p. 75)
*"Hearing and Musicality": Some good thinking about "subjective quality." (p. 87)
*"A Strange Device": A home-built arm with low mass and non-resonant construction. (p. 93)
*Review: The Hadcock GH 228 damped unipivot arm (very good). (p. 153)

Modern Recording, July 1977

*"Ambient Sound": Len Feldman discourses on TIM. (p. 64)
*Lab Reports: Enthusiastic reviews of the Sound Concepts SD-50 audio delay line ("a little electronic miracle") and the Dyna Mk. VI tube power amp, plus a moderately favorable review of the Phase Linear 1000 autocorrelator noise reduction system and dynamic expander. (p. 66)

Sound Advice, Vol. 1, No. 4

Fifty percent larger than the previous issue, this one has short reports on fifteen speakers and a longer report on the Allison One (mostly favorable, except for rolloffs below 50 Hz and above 10 kHz). Reports on six preamps: GAS Thoebe ("excellent value"), Audio Research SP-4 (pleasant but lacking clarity), Rappaport (sound excellent but reliability uncertain), Paragon 12 ("the best preamp on the market"), Trevor Lees Dyna mod ("muffled and veiled"), and Audire (okay). Three power amps: Audio Research D-100 (not liked), Audire Model One ("an excellent value"), and Quad 405 ("one of the great bargains in audio'). Seven phono pickups: AKG P8ES (a big disappointment), Microacoustics 2002e (poor), Satin M18-BX (painfully bright), Goldring 900SE (excellent except that it rides too low, rubbing the record), Grado Signature One (superb except in deep bass), Decca Mk. VI ("irritating"), Ortofon MC20 (measures good but does not sound first rate). Miscellaneous items: Verion transformer (excellent, but with reservations), Technics SP-10 Mk. II (the best turntable), Jecklin Float ("the most accurate headphone"), Ariston RD IIs turntable (recommended), Verion cables ("a godsend"), Linn head amp (competes with the Verion transformer), and Zerostat (marvelous). Plus reviews of assorted direct-disc and other good records.

Stereo Review, July 1977

*"Letters": Assorted comments on disc quality. (p. 6)
*"New Products": Note the humorous announcement of the recording centennial stamp. (p. 16)
*"Technical Talk": Julian Hirsch explains why he doesn't think that tonearms affect sound much. (p. 26)
*"Test Reports": Favorable reviews of Rotel 1024 tuner, Dual 919 cassette deck, TSI 110 and 120 speakers, Ortofon MC20 pickup with MCA -76 head amp, and Miida 3140 receiver. In the Ortofon review Hirsch straddles the fence rather awkwardly: "We never heard anything in the sound of the MC20 that we did not hear, more or less, when playing the same records with other good cartridges." On the other hand, "We eventually came to prefer it to other cartridges whose characteristics were not demonstrably different. The MC20 cartridge has a clarity and sense of definition that set it somewhat apart from most others." Which is, of course, why moving coils are preferred. (p. 27)
*"One Hundred Years of Recording": More good historical reading. (p. 62)
*"Two Hundred Years of Recording": Larry Klein's futuristic speculations. (p. 72)
*"Audio's Digital Future": Bob Berkovitz makes our digital destiny clear and simple. (p. 81)

Studio Sound, May 1977

*"Design Considerations for a PA Speaker System." (p. 38)
*Reviews: Several microphones (Calrec CM2050/51, Cambridge ribbon, Peerless 540, Sennheiser 415 and 435), plus the Ferrograph audio analyzer. (p. 68)

**June BAS Meeting**

Our June meeting was held outdoors, on the grounds of GTE/Sylvania in Waltham, where members and guests heard a demonstration of a truly formidable pair of indoor/outdoor loudspeakers manufactured by Interface, a Keene, New Hampshire, firm. Richard Levine, president of Interface, conducted the demonstration and explained the purpose and design of his loudspeakers.

The Interface loudspeakers are intended for commercial sound reinforcement and range from a relatively small nine-driver (eight forward and one rear firing) speaker for coffee house applications to the model Levine demonstrated at the meeting -- a fifty-two driver per cabinet system for indoor/outdoor concert use.

Levine went into considerable detail about the unique construction of these larger units and the advantages of their design. Each cabinet contains forty-eight 4 1/2" full-range drivers, similar to those used by Bose, and four high-frequency horns, all forward-firing. They were mounted in a six-foot tall cabinet made of thirteen-ply Russian birch. The internal baffling is arranged so that all of the 4 1/2" drivers look into a closed, folded transmission line. The considerable amount of wood used to form this internal chamber, along with additional wood bracing, bring the weight of

each cabinet to 430 pounds. This necessitates a built-in hand truck mounted on the back of each cabinet. A steel mesh screen protects the drivers in use, and each cabinet comes with a detachable plywood cover to protect them in transit. Urethane foam is used as a backwave absorber in the transmission/line chamber.

Electrically, the loudspeakers are quite simple. The systems are bi-amped via an external electronic crossover, with one amplifier driving only the four horn tweeters from 8 kHz up and a more powerful amplifier (up to 800 Watts) feeding the full-range drivers below that. There are no equalization circuits for the full-range drivers; they are wired together in a simple series-parallel arrangement. The price of these units is $2250 per cabinet.

Levine said that his design is intended to improve upon the Voice of the Theatre and similar systems commonly used for concert sound reinforcement. He maintained that his design is better in that it: (a) produces a more natural sound; (b) has better controlled dispersion, in that horizontal dispersion is wider and more toward the audience than with Voice-of-the-Theatre style systems at the expense of some vertical dispersion; (c) reproduces percussion more accurately; and (d) offers greater reliability since, because of the wiring configuration, any one blown driver will not only not disable the unit but, in fact, will be difficult to detect.

Levine explained that he uses a closed termination, rather than the conventional open-termination, transmission line because he has found that with the latter design the cone drivers are subject to excessive excursions at frequencies below 30 Hz. By closing the chamber, he argued, he is able to make the system behave as a transmission line down to 30 Hz but as an acoustic suspension system below that, thus damping the cone excursions.

After his short presentation he demonstrated the units, feeding them selections from taped copies of Sheffield discs. The system could indeed project a great distance, and many members stood as far as 300 feet away and reported reasonably clear reproduction. Many members questioned Levine on the seeming lack of bass response, and he replied that the loudspeakers are purposely "hot" at near distances so that at "concert-distance" (approximately 100 feet) they will have a more balanced sound, because of treble rolloff. During the break, several items of interest to BAS members came up. Jim Brinton noted that the FCC is seeking to regulate the design of audio components to insure their relative impregnability to radio-frequency interference. Brinton warned against letting the FCC get "their hands on our input circuits" and asked BAS members to write their congressmen expressing suitable outrage at this solution to the RFI problem.

Brinton also mentioned that audiophiles might want to catch Star Wars, as the sound track uses Dolby noise reduction and a Dolby rear-channel delay system built by Sound Concepts. Other members observed that it should be seen before it goes into general release in mid-July, because the six-channel general release version will be mixed-down to mono.

Brinton further suggested that the BAS formulate a policy concerning the inclusion of manufacturer's data sheets in the Speaker mailing envelopes. The issue arises now because we had previously asked Bruce Maier to furnish the technical data for the DiscTraker, and it was thought that these should be included with the next issue of the Speaker. Jim was worried about the precedent which might be set by this and asked for member comments. Reaction of the membership seemed to favor inclusion of selected manufacturer's materials, and members were assured that, as in the past, the BAS mailing list is private and will not be made available to outside parties.

Finally, Brinton asked whether members were interested in proposing a reduced-rate bulk purchase of the Sabtronics digital multimeter kits advertised in recent issues of Popular Electronics and Radio Electronics. The advertised price is $60, but he feels that if enough members were interested we could perhaps acquire the units at a savings. Approximately a dozen members expressed interest, and Jim promised to pursue the matter further and to report any progress at the next meeting.

Also during the break, Dr. Brian Leeming passed out order forms for the overseas record buying service, and Joyce Brinton sold the $15 Direct from Cleveland direct-to-disc records for $8. This record includes selections from de Falla, Bizet, Tchaikovsky, and Berlioz, and the pressings are exceptionally quiet. Members who would like a copy should send $8 plus $.75 handling to Joyce Brinton, c/o Box 7.

Consumer Electronics Show

The second half of the meeting consisted of a report from three members who had attended the Consumer Electronics Show in Chicago. Their comments were not endorsements of the products, as, in most cases, they had only very limited opportunities to hear and operate components at the show, but rather suggestions about products that look interesting and might warrant further examination by members. The three were Peter McLaughlin, Alvin Foster and, again, Richard Levine. Below is a list of the products that caught their respective eyes.

McLaughlin

In the Onkyo line: a rotary-knob equalizer, a high-end "bare-bones" preamp and power amp (110 Watts), and the T-9 tuner, which will retail for $280 and replaces their popular 4055 tuner.
A Sony turntable that turns the record over.
New cartridges and tonearms from ADC, including the new ZLM and an updated XLM, the Mk. 3.
A db Systems power amp (40 Watts per channel) with distortion specs similar to their preamp's.
A "doubled 400" from Dynaco, along with an updated PAT-5, the PAT-5fet.
A new receiver in the Harman/Kardon Citation line.

Levine

Commodore will be marketing a "pet computer," pre-programmed for BASIC, with a CRT readout and eight kilobytes of additional memory capability, for $595. Production is slated for this fall.
JVC video recorder, offering twice the record time of the Betamax in a smaller package.
JVC Super ANRD, which is said to offer an additional 10 dB of headroom over regular ANRS (or Dolby), is being offered on more machines in the JVC line.
Hitachi Class G amplifiers which, through a dual power supply system, promise peak power capability far above that of conventional amplifier designs.
A Hitachi developed Hall-effect playback head, which operates from DC up (i. e. , it can read a standing tape).
An Accutrack turntable that stacks and unstacks records.
An enlarged Luxman line, including receivers and some "bare-bones" high-end components.
A Cizek sub-woofer.
An Infinity air-bearing turntable, a mate for the Black Widow.

Foster

A Marantz 250-Watt-per-channel receiver, with scope -- just plain huge.
The Harman/Kardon Citation 17, which has passed all the preamp tests A1 has been able to throw at it. -- Dick Glidewell

A Publication of the BAS

# A Comparison of Eight Low-Priced Receivers

Alvin Foster
Wally Swanbon

In 1976, only one of the three major U.S. hi-fi publications, High Fidelity, carried a review of a receiver priced below $300. According to Sandy Ruby, Vice-President of Tech Hi-Fi, a large retail chain, under-$300 receivers account for almost 65% of all the receivers sold and are included in more than 50% of all hi-fi systems in the United States. Audio magazine's Annual Equipment Directory (October 1976) lists 64 receivers priced below $300.

All this raises two questions. Which is the best buy in terms of performance per dollar? What features or performance do you give up in this price range?

This article focuses on six receivers costing under $300, one costing $350, and one, the Marantz 2275 with a list price of $650, which we used as a reference. The lowest priced unit reviewed is the Technics SA-5060, which lists at $170.

Several unusual testing techniques were employed to separate the good investments from the "untouchables": measurements of power output below 4 Ohms, of phono input impedance, and of phono signal-to-noise ratio. These and the other tests are explained below.

## Testing the Phono Section

First we focused on the phono sections of the receivers. The results of our tests are presented in Table 1 and are explained below. All measurements were made at the tape output jacks.

1) The RIAA equalized frequency response of the unit's phono section was measured with the unit driving an AC/VTVM. The source was the output of a low-impedance sine wave generator feeding a pre-emphasis network. The numbers given are the deviation from the RIAA standard in dB. Errors of less than 0.25 dB are not listed. An ideal phono preamplifier would have all zeroes, i.e., no meaningful deviation from the RIAA standard, from 30 Hz to 20 kHz.

A sharp rolloff below 20 Hz is very effective in isolating the electrical results of tonearm/cartridge resonances and record warps from the speaker. The benefits are easily audible, particularly with speakers that are not damped at the lowest frequencies. Infrasonic filtering also reduces the power drain on the amplifier, which is especially important with low-powered receivers. A large negative deviation at 5 Hz is indicative of the presence of such a filter.

Rolling off inaudible high frequencies, above 20 kHz, before feeding the signals to the main amplifier can help prevent tweeter burn-out and high-frequency IM distortion. (Suprasonic energy may have audible consequences if distortion components appear in the audible range, as reported by McClain in the March 1976 AES Journal.) A large negative deviation at 100 kHz indicates a suprasonic filter. The Pioneer and the Advent fared best in this test, with the Advent having both infrasonic and suprasonic filters.

2) The 1-kHz total harmonic distortion (THD) of the various preamplifiers at 2 Volts output was measured with both channels driven into a low-impedance load of 10 kOhms and a high-impedance load of 10 MOhms. The former is a test for component compatibility, i.e., a unit's ability to drive low-impedance resistive loads from the tape output. Several popular amplifiers list minimum

input resistances of 10 kOhms. A 10-kOhm load at the tape output jack may be an unfair test, since most owners will never seek the option of driving a separate amplifier, and most tape recorders, equalizers, and noise reduction units have much higher impedances (see Scott Kent's note in the April 1976 Speaker). Happily, all the units fared well.

3) Also listed are the various harmonic distortion products (unwanted sine waves with frequencies that are integral multiples of the fundamental frequency, e.g., a wave that is twice the frequency of the fundamental is called the second harmonic). Knowing that distortion exists answers only half the question. The other half is, is it audible? A description of the distortion products and of their amplitudes yields a better idea of how the unit will sound. Second harmonic distortion is less audible than third harmonic.

4) The true RMS signal-to-noise ratio (i.e., the ratio of the magnitude of the input signal to that of the noise as measured at an output) was measured. A 1-kHz, 10-mV sine wave was fed to the preamp's phono input. The relative noise level, expressed in dB, is an indication of how far the noise is below the output level produced by the 10-mV input.

The "Gain" entry indicates in dB the amount of amplification available at the tape output jack from the phono input. The "Shorted" entry gives the signal-to-noise ratio when the preamp's inputs are terminated by a shorting plug. No filtering or weighting was used. This condition often produces the worst signal-to-noise figures.

Measuring the signal-to-noise ratio (S/N) with the input shorted indicates only the preamp noise voltage, ignoring the other two noise sources, the preamp's own current noise and the noise of the phono cartridge. The "Cartridge" entries attempt to overcome these limitations and, after weighting is applied, give a more accurate description of what we hear. The observed signal-to-noise ratio when the inputs are terminated by a real cartridge mounted inside an aluminum box located so as to minimize hum is listed. Attempts to use a cartridge mounted in a turntable were discarded because the results were unreliable. The turntable had to be physically moved about to find the position where noise was minimum. In general, this technique yielded figures about 2 dB worse than those obtained with the cartridge mounted in the metal box.

Passive C- and A-weighting filters were used in the cartridge noise measurements to reflect the ear's sensitivity. The C-weighting filter's response is about -3 dB at 30 Hz, about -11 dB at 20 kHz, and is generally flat but rolling between the two extremes. The A-weighted measurement is about -30 dB at 50 Hz and -10 dB at 20 kHz. The latter obviously yielded the best signal-to-noise figures. The results demonstrate that with A-weighting most of the units are achieving state-of-the-art, theoretically minimum noise (Hallgreen, AES Journal, Vol. 23, September 1975). (Variations of 3 dB between the receivers may not be overly significant and may result from the random nature of noise.) For example, the Levinson JC -2 and the AGI 511 measure no better than the best of these receivers.

How low must noise be? Currently there are no records with signal-to-noise ratios better than 70 dB. However, that may change. Therefore, the higher the signal-to-noise figure, the better. The moving-coil cartridge is capable of breaking the 84 dB barrier of the magnetic cartridge, providing the cartridge shielding and other factors are adequate.

5) Channel separation for the phono pre-amplifier at 1 kHz and at 20 kHz was measured. The units were measured by referencing the outputs to 2.5 Volts and terminating the unused input with a 600-Ohm resistor. The resistor was used to represent a typical cartridge with a DC resistance of 600 Ohms. All units fared well except the Toshiba at 1 kHz.

6) The phono input impedance (R) of the preamp was measured with the Mark Davis impedance bridge (Speaker, April 1977). An ideal preamp would have an input resistance of 47 kOhms, the IHF standard. Because cartridges are designed to operate most effectively into this load, deviations may produce frequency response errors. (Shure, however, specifies that the V-15 Type III can be operated successfully into a load as high as 70 kOhms with almost no audible effects.)

No standard has been established for the amount of input capacitance a phono preamp should have, and most cartridge manufacturers do not specify a recommended input capacitance. The high-frequency response of the average magnetic pickup may be increased by increasing the load

resistance. Increasing the capacitance has the opposite effect. Our experience demonstrates that a variation of 200 pF (300 to 500 pF total capacitance) with the V-15 III is not usually audible in A/B testing; therefore, a preamplifier should have less than 200 pF. Given the current state of the art in preamp design, zero capacitance is impossible to achieve and, furthermore, offers only one advantage in that the user can select a desired input capacitance. Preamp designs containing less than 100 pF are common. A standard of 100 pF would not require a major redesign effort for most of the current amplifiers.

The figures listed in the "R" section are accurate to about 5%, and those in the "C" section to 20%. As noted above, these measurements were made with an impedance bridge, essentially a nulling device. The nature of the null also tells something about the load. The null is characterized as either perfect, good, or bad. The "perfect" phono input circuit reflects pure resistance and capacitance. The "good" rating indicates that the load is more complex and that the impedance varies less predictably with frequency, with potential for minor cartridge interaction effects. The results may be inaudible with most cartridges. The "bad" rating indicates a very complex load whose deviations from a purely resistive and capacitive impedance are most likely audible, e.g., the Dynaco Pat-4. Some cartridges, such as the Micro/Acoustics, are relatively insensitive to input impedance, because their operating principles yield low internal resistances.

7) The 1-kHz output just prior to clipping driving 10-kOhm and 10-MOhm loads was measured. Ideally, the output will be about the same with either load. Large deviations indicate possible trouble driving low-impedance loads. The "In" section shows the input in millivolts required to drive the phono stage into clipping.

8) The subjective audio quality is the main point of the report. The audio quality is categorized as bright or excellent (Br and Ex in the table). Preamps rated excellent all sound alike. They are not tiring to listen to and represent the ultimate, most accurate sound possible -- the state of the art. Units that make the excellent category are indistinguishable from other highly touted preamplifiers (PSI, Levinson JC-2, AGI 511, etc.) under conditions of controlled frequency response testing. Preamps described as bright suffer from a lack of low-frequency response or detail or an accentuated high end. They are generally characterized as "edgy." We arrived at the subjective rankings after intensive A/B-ing and some long-term listening (two days) to the units meeting minimal specifications.

Testing the Amplifier Section

Unless specified otherwise, all measurements were made at the speaker output terminals, coupled to an 8-Ohm resistor with both channels driven. Generally we measured the right channel. Test results are presented in Table 2 and are explained below.

1) The frequency response of the amplifier section driving an 8-Ohm resistor was measured. An amplifier should be flat except at the inaudible extremes. Most of the units did fairly well in this test.

2) The 1-kHz output with both channels driven was measured using loads of 8, 4, 3, 2, and 1.3 Ohms. We used a wide range of resistances to get an idea of how these units will perform into a worst-case, low-impedance speaker, e.g., the AR-LST, the Ohm F, or the Infinity Quantum Line. An ideal amplifier will double in power output as the resistance is halved. This capability is expensive and requires heavy-duty power supplies, output transistors, and heat sinks. Given this, we were delightfully surprised by most of the units, particularly the Harman/Kardon 330G.

None of the tested units exhibited "clatter" when driven hard into low-resistance loads. Clatter occurs when the amplifier's protection circuits cut rapidly in and out. Such behavior is often audible and can cause tweeter failure. The GAS Son of Ampzilla, which costs $450, clattered when driven into clipping with a 2-Ohm load. Clatter is not uncommon in amplifiers.

3) The amount of 1-kHz input signal needed to produce clipping (nonsymmetrical wave form at the output) was measured across an 8-Ohm load. This is called the "sensitivity."

4) Total harmonic distortion was measured at 1 and 20 kHz. Two power levels were used for the 1-kHz figure, 100 mW and 12.5 Watts. 100 mW was used to test for crossover distortion, but

wave analysis showed that the THD figures listed are primarily measurements of noise rather than of harmonic distortion. The 12.5-Watt output level approximates the average power required to drive a typical, inefficient speaker to about 92 dB, an average-to-loud listening level.

5) This is explained in Item 3 of the phono preamp section.

6) The true RMS signal-to-noise ratio for each amplifier was measured. For this test, the amplifier's auxiliary input was terminated by 600-Ohm resistors to represent the source impedances of a typical preamp, tuner, etc. The measurements were all referenced to a 12.5-Watt output, again because it is a typical drive level. Most signal-to-noise specifications are referenced to the unit's maximum output, which yields highest figures. We believe this is unrealistic, because the most common playback level is around 12.5 Watts -- not full power. We wanted to find out how quiet a unit would sound under typical listening conditions. We passed the output of each amplifier through a C- or A-weighting filter to represent the ear's sensitivity.

The "Shorted" entry gives the S/N when the input is shorted and the output is unweighted. The "Gain" entry indicates in dB the amount of gain supplied by the amplifier.

7) The resistance and capacitance at the auxiliary input of the amplifiers were measured with the volume control in the minimum position. The level of resistance generally varies with the volume control setting. There is no best input resistance figure. In practice, for maximum compatibility, the input resistance should be no lower than 10 kOhms. There are no capacitance standards for amplifier inputs, but the amount of capacitance at the auxiliary input is academic, because the low source impedances of tape recorders, tuners, etc., renders them relatively insensitive to capacitance. The null is as explained in Item 6 under the phono preamp tests.

8) The maximum sound pressure level (SPL) produced by the amplifier just prior to clipping when driving one LST-2 loudspeaker with ASA random noise was measured. Music is an unreliable indicator of how loudly an amplifier will play. What is needed is a continuous source that resembles music in frequency, amplitude, and peak content while being constant enough to measure accurately with an SPL meter. The ASA switch position of the Scott 811-B noise generator is designed to simulate "noise of general character" as specified by the A.S.A. (now A.N.S.I., or American National Standards Institute). This "noise of general character" is used to calibrate all sound level meters and has the following frequency versus amplitude characteristics: -7 dB at 20 Hz, flat at 150 Hz, -10 dB at 1 kHz, -29 at 10 kHz, and -35 dB at 20 kHz. Its peak-to-average ratio (13 dB) also conforms nicely to that of recorded music.

ASA noise also conforms more closely to music in spectral character than pink or white noise. The latter two could also damage delicate tweeters if reproduced too loudly through high-fidelity speakers designed for music. The test setup consisted of connecting the amplifier's speaker output terminal simultaneously to the horizontal input of the scope and to the speaker. Another cable ran directly from the generator to the vertical scope input. The resulting pattern was generally a straight 45° line. The instant amplifier clipping occurred, the scope's trace would produce an additional horizontal line. Severe clipping produced a "Z" or flattened "S" pattern on the scope. When clipping occurred, we reduced the output until it was no longer indicated. We set the SPL meter (Radio Shack) at its "slow," or averaging, setting for greatest accuracy, and positioned it exactly three feet in front of and centered on the face of the LST-2 speaker. By judiciously reproducing this setup with each amplifier, we were able to obtain repeatable measurements, which gave us an indication of how loudly each receiver would drive a real speaker, the degree of amplifier phase shift, and the amount of amplifier distortion.

We chose the LST-2 speaker because it represents a worst-case situation. It has an autotransformer in series with a 1000-µF capacitor in parallel with a 10-Ohm resistor. The impedance versus frequency curve has all the usual dips and peaks that characterize a complex load consisting of capacitance, resistance, and inductance. If a receiver can successfully drive the LST-2, it probably will find other speakers easy sailing. The speakers are also capable of reproducing high playback levels without damage. An amplifier should drive the speaker to the SPL appropriate to its rated output.

9) The 20-kHz square-wave performance of the amplifiers was measured. The first section gives the performance of the amplifier when loaded with a 0.1-µF capacitor in parallel with an

8-Ohm resistor. This test was another attempt to simulate a severe speaker load, and a poor showing does not necessarily correlate with bad sound or amplifier instability. Whether any resulting ringing is audible or dangerous to loudspeakers (usually it's ultrasonic) depends on the amplitude, frequencies, and speaker load. Ideally, the performance of the amplifier will not change with the addition of the 0.1-μF capacitor. Some of the amplifiers rang excessively; none oscillated. To check for amplifier stability, Audio magazine sometimes uses a more difficult load recommended by an electrostatic speaker manufacturer (Audio, June 1971): 20 mH in series with 8 Ohms in parallel with 2 μF. Unfortunately, there is no standard worst-case speaker load for testing amplifiers. The absence of a standard is, partially the result of the speaker industry's failure to measure their products' impedances and to establish a reference for the amplifier manufacturers. (A local major speaker engineer was unable to completely characterize the complex impedance of his loudspeaker.) In the future, perhaps stated along with the price, manufacturers will give the worst-case values, with frequencies, for resistance, capacitance, and inductance.

We contacted several amplifier manufacturers who stated that knowing the complex impedance information would be extremely helpful. Some of the manufacturers felt it would probably lower their costs because their current simulated speakers used to test their amplifiers were, in their opinion, too difficult, i.e., unrealistic.

The "speaker" section describes the performance of the amplifier when driving the LST-2 with a 20-kHz square wave. The amplifier should exhibit no ringing into the speaker.

10, 11) The characteristics of the tone controls when set at their maximum clockwise position were measured. For the bass control the +3 and +9 dB positions are given along with the gain at 30 Hz and 5 Hz. The latter was included to indicate whether the manufacturer was farsighted enough to include an infrasonic filter to prevent inaudible but potentially dangerous frequencies from entering the speaker system. The treble control list includes the +3 and +9 dB points along with the gain at 20 kHz, 100 kHz, and the frequency at which treble gain is greatest.

What does an ideal tone control do? The ideal tone-control contour varies, of course, with the nature of the speaker's environment and the user's listening preferences. However, there are two tone control features that few designers will argue against -- infrasonic and suprasonic filters. The infrasonic filter protects the speakers from low-frequency garbage, and the suprasonic filter does the same at the other extreme. A tone control that boosts unnecessarily above 20 kHz could amplify potentially tweeter-damaging frequencies from tape recorder bias amplifiers, cartridge needle chatter, and some FM tuners' high-frequency carriers (e.g., the McIntosh MR78, which utilizes almost no filtering at 19 kHz, 38 kHz, or 67 kHz).

In interpreting the tone control results, consider that the +3 dB point is roughly related to the maximum gain of the unit at the particular frequency you desire, i.e., the Marantz 2220B is up about 5 dB at 30 Hz when the gain at the 300 Hz point is +1 dB.

Tests Omitted from Tables 1 and 2

The results of several tests were omitted from Tables 1 and 2 or not conducted: white noise, amplifier separation, power bandwidth, and overload versus frequency at clipping.

The white-noise test (see the June 1976 Speaker) was found to have no consistent correlation with the subjective audio quality of preamplifiers. The test is essentially an indication of slew rate, or the amplifier's ability to follow a rapidly changing input signal. According to Tomlinson Holman, formerly Advent's Chief Engineer, the highest slew-rate requirement that could ever be presented to a preamplifier is 0.026 Volt per microsecond. In his words, "What we are trying to do is to get an electrical circuit to follow accurately a mechanical one. Since the mechanical circuit is subject to definite limits owing to acceleration, it is not surprising that the preamp can be made to follow its input with ease. " Holman now concludes, after this research and some additional listening, that the ability to pass his phono "square-wave test" is not a determinant of the preamp's subjective quality.

The separation and power bandwidth tests for each amplifier were conducted but not reported, because each unit exceeded the theoretical minimum required for audio purposes. For example, all the receivers were capable of almost full power output at 100 kHz.

The overload versus frequency at clipping test results did not consistently correlate with audible results and were therefore omitted. The test is essentially a test of power bandwidth, slew rate, etc. Slew rate is important and does correlate with subjective sound quality if the unit is slower than its input signal. An example of the latter is an experiment conducted with the AGI 511's high level section. The AGI is normally supplied with a type 318 operational amplifier, which potentially has a high slew rate of 110 V/μs. The total gain of the high-level section is 18.8 dB. At the suggestion of the designer, we substituted for the 318 a 741 operational amplifier with a measured slew rate of .36 V/μs. (The circuit is compatible with both op-amps.) We then set up an A/B bypass test, i.e., we fed the output of a tape recorder either directly into the main amplifier or through the preamp's high-level amplifier. The 741 was audibly inferior. A frequency response curve taken at playback level revealed that the 741's response rolled off above 1 kHz. (The maximum output at 1 kHz was 8.6 Volts, but at 50 kHz it was only .6 Volt, or 0.07%; such a low ratio does indicate possible problems with that particular op-amp.)

Substituting faster operational amplifiers, e.g., type 357 (50 V/μs) or 356 (15 V/μs), produced no measurable frequency response deviations or subjective differences in audio quality. (The AGI's circuitry arbitrarily limits the high-level section's speed to 30 V/μs.)

The power-bandwidth-at-clipping test was abandoned because the slew-rate test is easier to perform and has more universal application. Jung (Audio Amateur, Vol. VIII, No. 1) argues for the permanent inclusion of slew rate in amplifier specifications. Perhaps rise time at one-half power should be quoted instead of slew rate. Slew rates cannot be understood or compared apart from output voltages. Rise time, on the other hand, is directly comparable and somewhat less vague. According to Scott Kent of BKM Associates, "a better specification would indicate rise time at its fastest (low level) maintained to 'x' Watts, e.g., Tr = 1.5 μs up to 45 Watts rms."

Testing the FM Section

Lacking adequate FM test gear, we resorted to listing the manufacturers' specifications (Table 3). We also connected each tuner to an antenna and listened, and we tuned in difficult stations and tested for FM drift, etc.

Features of the Various Receivers

Each receiver had on its front panel a volume-controlled headphone output jack, a stereo/mono FM reception selector, a loudness contour switch, one auxiliary input position, a stereo/mono amplifier mode switch, and bass and treble tone controls. Each receiver had the ability to produce at least 15 Watts/channel into an 8-Ohm resistor and each had phase locked-loop (PLL) FM circuitry. All the units are currently available.

All the receivers except the Advent had AM reception capability. All except the Harman/Kardon 330C and Technics SA-5060 had a center-of-channel tuning indicator. Meters were used as tuning aides throughout, with the exception of the Advent, which had two relatively difficult to use red LED's. The Marantz 2275, 2220B, and the Pioneer 550 had a deluxe, smooth feel to their AM/FM tuning dials, while the Harman/Kardon's was the least smooth. The Pioneer and both Marantz receivers had FM de-emphasis switches. The Harman/Kardon does not feature FM muting. The Advent was the only receiver with audible FM drift. Both Marantz receivers had "Quadradial" FM outputs, which the manufacturer claims doubles as a white-noise generator. The Advent lacks 75-Ohm antenna hookup facilities and a lighted tuning dial. The Advent had the smallest, most cramped tuning dial; stations were separated by only fractions of an inch.

The Pioneer had a microphone input jack on the front panel. The Marantz 2275 and the Advent had preamp-out jacks. Both Marantz receivers had mid-range tone controls, but only the 2275 had dubbing facilities, which were located on the front panel. All but the Technics SA-5060 had main and remote speaker outputs. The Advent used slide switches for most of its functions and provided a nominal 18-Volt DC output jack on the rear panel. The more expensive and easier to use push-in type speaker terminals were used on all the units except the Advent, Toshiba SA-420, and Nikko 3035. The Marantz 2275 and Toshiba had switchable scratch and rumble filters. The Marantz 2220B had only a scratch filter. Both Marantz receivers used easy to operate slide balance controls and featured excellent tone control contours (best of the lot) and relays to disconnect the speakers under excessively high current demand. All receivers with the exception of the Advent, Harman/

Kardon, and Technics offered two AC outlets. Dual tape monitoring facilities were available on the Pioneer, Toshiba, and Marantz receivers. The other units offered only one. The only units with stepped tone controls, the Pioneer and both Marantz receivers, measured flat when their tone controls were in their indicated center-off positions. The other receivers' controls had to be turned either to the right or left of their indicated centers to obtain a flat response. The Marantz 2275's tone controls could be switched out of the circuit, and two distinct turnover frequencies for the bass and treble were available.

Six of the units used long-lasting brushed aluminum faceplates; the Advent and Harman/Kardon used painted/coated metal front plates. The Advent, Harman/Kardon, and both Marantz receivers had all-metal cabinets. The Nikko and Toshiba had wood cabinets.

All the units were made in Japan except the Pioneer (Taiwan) and the Advent (some Japanese assembly, some Mexico, some USA).

Which Should You Buy?

We did not uncover the perfect receiver, though some units were outstanding in one or two of their three major functions. Putting the ideal aside, most came pretty close to meeting the specifications required for a high-quality playback system. For example, the Marantz 2275 ($650) can actually be out-classed by the Harman/Kardon 330C ($220) driving a 2-Ohm load.

The specifications and features do lend themselves to grouping the receivers into three value categories: best buy, average, and untouchable. The "best buy" category includes the units that had some deficiency but in our opinion represent the best dollar investment. The "average" category speaks for itself, while the "untouchable" group contains units with major design deficiencies that make them poor investments. The units are not ranked within the three groups.

The Best Buys

The Pioneer SX-550 clearly ranks as a best buy in all respects except one: it does not have an adequate sonic filter. In the looks department, it excels. The side panels are wood, while the top and bottom metal plates are coated with a simulated wood finish. Its phono section is indistinguishable from those of the Advent, the Harman/Kardon, the AGI 511, the Levinson JC-2, etc. It delivered all of its rated power into a loudspeaker. The unit has a flat, horizontal panel for auxiliary inputs, which is less convenient than the typical rear-mounted panel jacks. The microphone input overloads at 260 mV. The manufacturer states that the SX-450 is similar to the 550 but has an infrasonic filter, which cuts response at the tape-out jacks by 12 dB at 5 Hz. A filter in the amplifier section lops off another 10 dB at the speaker taps.

The Harman/Kardon 330C ranks as a best buy. The outstanding feature of the unit is its conservatively rated amplifier. Its power output doubles as the load resistance is decreased from 8 Ohms to 4 Ohms.

The Harman/Kardon, the Toshiba, and the Technics SA-5060 did not ring when loaded with an 8-Ohm resistor in parallel with a .1-µF capacitor. (The Marantz 15 and the Son of Ampzilla both rang under identical testing conditions. The latter power amplifier rang more than any of the receivers tested for this report.)

The phono section was matched and then A/B-ed with the Advent's. We could not determine which unit was playing. The H-K's infrasonic filter is slightly better than the Pioneer's but is still far from adequate.

The receiver has a large, plastic FM/AM tuning window, which is easily scratched. The tuner lacks center-channel tuning, but the factory representative told us that it has a "summation" meter. To take full advantage of its performance, first tune for maximum meter deflection, then rotate the antenna for maximum signal strength. In practice, the summation meter worked no better than a signal strength meter, i.e., it pinned on strong signals, rendering it virtually useless with some stations.

The unit also sports a tone control contour surpassed only by those of the more expensive Marantz receivers.

The Average Buys

The Marantz 2275 was initially our reference. If you are interested in more power at 3 Ohms and higher, superior FM specifications, and more features, this is the receiver for you. However, a design shortcoming of the phono section is its 4.5 dB rise at 100 kHz.

The 2275 has a preamp-out jack and defeatable tone controls. The latter is important to the serious audiophile because most of the receivers did not yield a flat frequency response when their tone controls were centered.

The 2275 was down 1 dB at 30 Hz, which was audible on critical A/B testing with LST loudspeakers. The input resistance is off by 3 kOhms. The Levinson JC-2, at $1,500, also specifies a non-standard input resistance of 49.9 kOhms. Combine this with the Levinson's non-standard RIAA rise above 1 kHz, and you may get a unit that sounds more "open" and "airy." Properly matching the units to be auditioned totally eliminates frequency response as a contributing factor.

The preamp-out feature can be added to most of the units by connecting a jack to the wiper of the volume control. To be safe, have the task performed by your neighborhood service department. (Scott Kent will do the job for $15.)

The Marantz 2220B shares many of the features of its big brother, the 2275. However, in one respect the 2220B excels: its infrasonic filter cuts response by 31 dB at 5 Hz. Unfortunately, its RIAA response is also down 4 dB at 30 Hz, which is quite audible. (This may be a peculiarity of our sample; we did not check a second unit.) The "Gyro-Touch" tuning on both Marantz receivers is extremely easy to use and feels smooth, accurate, and expensive.

The Toshiba SA-420 fails in one crucial design feature -- phono input resistance. Because the unit does yield a perfect null and has a higher than standard input resistance, its input can be returned to the standard 47 kOhms by adding 220 kOhms in parallel with the phono input. The formula for figuring the amount of resistance to be added is $R_1 = (R_2R_3)/(R_2 + R_3)$, where $R_1$ is the value to be added, $R_2$ is the actual input resistance, and $R_3$ is the desired input resistance. If the unit had had a resistance below 47 kOhms, major redesigning of the input might have been required. In most other respects, this receiver is first class. According to the manufacturer, the SA-420 is similar to the SA-320 for $200 and the SA-220C for $180.

If you believe in buying big, this unit was physically the largest unit tested. The Marantz 2275 was the heaviest, and the Advent was the smallest. The Toshiba looks cluttered, as do the Marantz 2275 and 2220B.

The Untouchables

The Technics SA-5060 is downrated because it lacks an adequate phono input null and because its amplifier section cannot deliver its rated power into the LST-2 speaker. When the amp was driving the speakers, the scope trace indicated phase shift (probably not audible) and the likelihood of distortion.

The Nikko 3035 is downrated because it does not have a perfect null or an easily correctable input resistance. Its frequency response is down 1 dB at 20 kHz, and the phono signal-to-noise results are confusing, perhaps erroneous. We repeated the test several times and came up with identically poor S/N results. The unit has a neat, expensive feel to it and output circuit breakers for each channel. As with the Technics, scope aberrations were observed.

The Advent 300 suffers from a multiplicity of flaws*, and it was the only receiver accompanied by misleading literature. The literature states that the "actual loudness it can achieve before clipping is as great as receivers rated at twice the power." The Advent did what most 15-Watt receivers do: it delivered +93 dB into the LST-2 loudspeaker. More importantly, it was the only unit tested that exhibited ringing when driving the LST. (We did not perform a spectrum analysis to determine whether this caused distortion or, if it did, how audible that distortion might be.)

*Because of this receiver's unexpectedly poor showing, two other Advent units were tested without significantly different results. -- Ed.

Andy Petite, Advent Product Manager, recently suggested on "Shop Talk" (a local hi-fi talk show) that buying Advent is buying American. Even that is only partially true, as most of the components (and subassemblies) inside the receiver are made in Japan, and the PC board is assembled in Mexico.

At maximum boost, the treble has a potentially dangerous 18.6 dB of gain at 40 kHz. At 100 kHz response is up 14 dB. You can't hear above 20 kHz, but that much gain could cause the high-frequency leakage from an inadequate tape recorder bias trap to enter your speakers, perhaps to burn out your tweeters.

The Advent tuner showed two problems: (1) the tuner audibly drifted off station; and (2) when tuning weak stations, lowest noise was often obtained when the LED's indicated mistuning. The tuner we tested had been serviced twice for drift. At the last service call, Advent assured us that the unit was within specifications; they realigned the tuner, replaced the LED's, and made some other modifications. On strong stations no audible drift occurred during warmup, although the lights did vary in intensity before stabilizing. But when a weak stereo station had been selected before turn-on, the tuner drifted audibly off station, i.e., the noise increased. This required that the tuner be reset after warmup. Petite confirmed that the unit does drift 20 to 40 kHz. Apparently, heat-sensitive tuner components are located too close to the power supply. The second tuner problem also occurs primarily on weak stations. With poor signals, the LED's had to be ignored, because the lowest noise position did not always correspond to the reading of the LED's. This indicates an alignment problem, possibly in the IF strip. The inadequacies of the tuning lights combined with the extremely small tuning window make the receiver difficult to tune, requiring great care.

The slide switches invite fingernail operation, which may result in scratches on the front panel after prolonged use. We vote for brushed aluminum front panels.

The 18-Volt DC tap on the back panel actually puts out 14.5 Volts (I have been assured that this is adequate to drive the Advent microphone preamplifier, though at a lower clipping level). Of course, this has no effect on its audible performance as a receiver.

Removing the cover of the Advent receiver led to some surprises. The unit uses a large PC board and hand wiring. The wiring, for the most part, is not color coded and crisscrosses the receiver. The insides look as if they might yield some interesting service headaches in the future.

The subjective audio quality of the phono section at the tape-out jack was excellent, but at the preamp-out tap the tone controls worsened the S/N ratio and had to be critically tuned slightly to the right of center for flat frequency response. The noise has been reported to be a problem with efficient loudspeakers. The Advent also has a mild turn-on thump.

Summary

The Pioneer 550 and H/K 330C offer almost uncompromising performance for considerably less cost than their competition. The phono and amplifier sections of both units offer "state-of-the-art" performance. If their FM performance on strong stations was audibly compromised, our testing did not reveal it.

Clearly, the better receivers in the under -$300 class deserve the title of the greatest value per dollar on the hi-fi market.

TABLE 1. PHONO PREAMP

| | Pioneer SX-550 (W13607814Y) $250 | Harman/Kardon 330C (20095) $220 | Marantz 2275 (U150513) $650 | Marantz 2220B (37574J4) $350 | Toshiba SA-420 (63540328) $250 | Technics SA-5060 (SGP310A) $170 | Nikko 3035 (D2341946) $250 | Advent 300 (J004480) $260 |
|---|---|---|---|---|---|---|---|---|
| 1) RIAA Response, Volts Out into 10 kOhms (dB) | | | | | | | | |
| 5 Hz | - 3 | - 9 | - 4 | -26 | -15 | -24.5 | - 8 | -32 |
| 30Hz | - .6 | - .8 | - 1 | - 4 | - 2 | - 3.6 | - 1.6 | + .6 |
| 400 Hz | 0 | +. 4 | 0 | 0 | +. 3 | 0 | + 1.7 | 0 |
| 1kHz | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5kHz | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10kHz | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15kHz | 0 | 0 | 0 | + .4 | - .3 | 0 | 0 | 0 |
| 20 kHz | 0 | 0 | +. 25 | +. 8 | 0 | 0 | 0 | 0 |
| 30 kHz | 0 | - 1. 8 | + 1 | + 2.4 | - .3 | 0 | 0 | 0 |
| 100kHz | - 1 | - 7 | +4.5 | +3.5 | - 7 | - .4 | -15 | -19 |
| 2) 1-kHz Distortion, 2 Volts Out, THD (%) | | | | | | | | |
| 10 kOhm | .01 | . 1 | .018 | .01 | .017 | .014 | .02 | .12 |
| 10 MOhms | .01 | .058 | .018 | * | * | * | .015 | .028 |
| 3) 1-kHz Distortion, 2 Volts Out, Harmonics (dB) | | | | | | | | |
| 2nd | - 99 | - 70 | - 93 | -101 | - 95 | - 96 | - 94 | - 66.5 |
| 3rd | -115 | - 94 | -111 | -111 | -113 | UM | -109 | - 73 |
| Higher | UM | UM | UM | UM | UM | UM | UM | - 84 |
| 4) RMS S/N (dB) | | | | | | | | |
| Gain | 38 | 37 | 39.8 | 39.4 | 35.5 | 36 | 37.2 | 35 |
| Shorted | 79 | 75.5 | 78 | 77 | 73.5 | 79 | 77.2 | 76 |
| Cartridge, C-Weighted | 79 | 74 | 73 | 76 | 78 | 80 | 60 | ** |
| Cartridge, A-Weighted | 84 | 82 | 81.5 | 84 | 84 | 84 | 65.5 | 83 |
| 5) Separation (dB) | | | | | | | | |
| 1 kHz | 68 | 62 | 73 | 67 | 39 | 71 | 70 | ** |
| 20 kHz | 68 | 62 | 73 | 67 | 75 | 70 | 70 | ** |
| 6) Input Impedance/Capacitance | | | | | | | | |
| R (kOhms) | 47 | 47 | 50 | 47 | 60 | 40 | 40 | 47 |
| C (pF) | 100 | 59 | 75 | 100 | 100 | 75 | 125 | 40 |
| Null | Perfect | Perfect | Good | Good | Perfect | Bad | Good | Perfect |
| 7) 1-kHz Overload | | | | | | | | |
| 10 kOhm (V) | 12 | 4 | 10.5 | 8.2 | 6.5 | 6.4 | 3.9 | 2.5 |
| High Z (V) | 12 | 6 | 10.5 | 8.2 | 6.5 | 6.4 | 8.2 | 5 |
| 10 kOhm, In (mV) | 200 | 58 | 112 | 110 | 114 | 112 | 105 | 72 |
| 8) Sound Quality | Ex | Ex | *** | Br | *** | *** | *** | Ex |

Notes:

UM = Unmeasurable.

*Not measured; a good measurement at low impedance will always result in a good measurement at high impedance.

**Some parameters were not measured for the Advent because it was the first unit we tested, before all our test criteria had been finalized. We did not have a sample readily available for retesting.

***These units were not tested subjectively because they measured poorly on one or more of the objective tests.

TABLE 2. AMPLIFIER SECTION

| | Pioneer SX-550 | Harman/Kardon 330C | Marantz 2275 | Marantz 2220B | Toshiba SA-420 | Technics SA-5060 | Nikko 3035 | Advent 300 |
|---|---|---|---|---|---|---|---|---|
| 1) Frequency Response (dB) | | | | | | | | |
| 5 Hz | - 2 | 0 | - 3 | - 6 | - 2.5 | - 6.5 | - 4 | - 5.2 |
| 1kHz | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20kHz | 0 | 0 | 0 | 0 | - .4 | 0 | - 1 | 0 |
| 100kHz | - .4 | - 3 | - 2 | - 1.8 | - 3.4 | - 3.4 | -16.4 | 0 |
| 2) 1-kHz Output (Watts) | | | | | | | | |
| 8-Ohm Load | 24.5 | 24.5 | 78 | 28 | 26.3 | 15.1 | 18 | 15. 1 |
| 4-Ohm Load | 33 | 42 | 127 | 33 | * | 18 | 24 | 19 |
| 3-Ohm Load | 33.3 | 48 | 120 | 21 | 27 | 18.7 | 22.4 | 16 |
| 2-Ohm Load | 28 | 44 | 41 | 9 | 19 | 17 | 22 | 13 |
| 1.3-Ohm Load | 21 | 40 | 21 | 4.8 | 12.3 | 12.3 | 12.3 | 6.9 |
| 3) Sensitivity (mV) | 113.5 | 180 | 200 | 210 | 180 | 150 | 159 | 90 |
| 4) Distortion, THD (%) | | | | | | | | |
| 1 kHz, 12.5 W | .04 | .058 | .012 | .01 | .036 | .042 | .054 | .012 |
| 1 kHz, 100 mW | .25 | .23 | .25 | .16 | .14 | .19 | .3 | .27 |
| 20 kHz, 12.5 W | . 084 | . 16 | .023 | .05 | .21 | .27 | .15 | .04 |
| 5) Distortion, Harmonics, 1 kHz, 12.5 W (dB) | | | | | | | | |
| 2nd | - 77 | - 70 | -101 | - 99 | - 81 | - 83 | - 72 | - 97 |
| 3rd | - 94 | - 82 | -115 | UM | - 80 | - 87 | - 70 | -112 |
| Higher | UM | - 89 | UM | UM | - 97 | - 77 | - 93 | UM |
| 6) RMS S/N (dB) | | | | | | | | |
| 12.5 W, 6W Ohm | | | | | | | | |
| C-Weighted | -84 | -78 | -93 | -91.5 | -80 | -92 | -82 | |
| A-Weighted | -86.5 | -89.5 | -96.5 | -92.5 | -97 | -94.5 | -89 | * |
| 12.5 W, Shorted | -77 | -76 | -85 | -80 | -76.5 | -94 | -78 | -93 |
| Gain | 40 | 37.5 | 32 | 42.5 | 37.6 | 37.3 | 38.5 | * |
| 7) Input Impedance | | | | | | | | |
| R (kOhms) | 45 | 40 | 90 | 125 | 45 | 200 | 68 | 100 |
| C (pF) | 200 | 300 | 350 | 250 | 300 | 75 | 300 | 350 |
| Null | Perfect | Perfect | Perfect | Perfect | Perfect | Perfect | Perfect | Perfect |
| 8) SPL (dB) | 95 | 95 | --- | 95 | 95 | 91 | 93 | 93 |
| 9) Square Wave, 20 kHz Oscillation (Cycles) | | | | | | | | |
| 8 ohm ,. 1 µF | 3 | None | 3 | 2 | None | None | Rounded | 6 |
| Speaker | None | None | None | None | None | None | Rounded | Rings |
| 10) Tone Controls, Bass | | | | | | | | |
| 5Hz(dB) | + 8 | + 10.4 | Similar | + 5.2 | * | - 6 | + 13 | + 7.5 |
| 30 Hz (dB) | + 10 | + 10.6 | | + 14 | * | + 5.7 | + 16 | + 12.4 |
| +3dB(Hz) | 560 | 360 | to | 300 | * | 600 | 440 | 460 |
| +9 dB (Hz) | 140 | 100 | | 110 | * | 140 | 180 | 150 |
| 11) Tone Controls, Treble | | | Marantz | | | | | |
| 20 kHz (dB) | +10.2 | +15 | | +11.5 | * | +12 | + 9 | +14.5 |
| 100 kHz (dB) | +11.7 | + 8.4 | 2220B | + 7 | * | +3 | - 7.6 | +14 |
| +3 dB (kHz) | 3.3 | 2.62 | Similar | 2 | * | 1.8 | 3.6 | 2.4 |
| +9 dB (kHz) | 12 | 5 | to | 6.6 | * | 5.2 | 20 | 6.9 |
| Max. (dB @ kHz) | 11.7@ 100 | 15.4@ 25 | Marantz 2220B | 11.5@ 20 | * | 12@ 20 | 9@ 20 | 18.6@ 40 |

UM = Unmeasurable.
*Not measured.

TABLE 3. FM SECTION (MANUFACTURERS' SPECIFICATIONS)

| | Pioneer SX-550 | Harman/Kardon 330C | Marantz 2275 | Marantz 2220B | Toshiba SA-420 | Technics SA-5060 | Nikko 3035 | Advent 300 |
|---|---|---|---|---|---|---|---|---|
| IHF Sensitivity (PV)* | 2/5.5 | --- | 2.3 | 2.5 | 1.9 | 2 | --- | 2.5/20 |
| Capture Ratio (dB) | 1 | 1.8 | 1.5 | 2.5 | 1 | 1.5 | 1.5 | 1.4 |
| 50 dB Quieting (PV)* | 4.5/50 | | 3.5/50 | 4/50 | -- | - | --- | 5/50 |
| 1-kHz THD (a)* | .15/.3 | --- | .25/.35 | .3/.5 | .2/.4 | --- | .5 | .2/.5 |
| Selectivity (dB) | 60 | 60 | 80 | 50 | 60 | --- | 35 | 65 |
| S/N (dB) | 70/65 | 75 | 70/60 | 70/60 | 70/65 | 70 | --- | 68/65 |

Notes:

*Mono/Stereo.