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SURROUND SPECTACULAR

Disc 1 — The Music

1 **Strauss:** Also Sprach Zarathustra (excerpt) • Gerard Schwarz, conductor; Seattle Symphony (1:58)

2 **Respighi:** Roman Festivals, *Ottobrata* (excerpt) • James DePreist, conductor; Oregon Symphony(3:58)

3 **York:** Bantu • Los Angeles Guitar Quartet (2:09)

4 **Palestrina:** Alma Redemptoris • Dennis Keene, conductor; Voices of Ascension (3:55)

5 **Handel:** Water Music, *Alla Hornpipe* • Gerard Schwarz; Los Angeles Chamber Orchestra (3:43)

6 **Bach:** Toccata in D Minor • Robert Noehren, organ (2:51)

7 **Wagner:** Lohengrin, Prelude to Act III • Gerard Schwarz, Seattle Symphony (3:25)

8 **Grofé:** Grand Canyon Suite, *On the Trail* (excerpt) • Gerard Schwarz; Seattle Symphony (3:04)

9 **Copland:** Fanfare for the Common Man • Gerard Schwarz; Seattle Symphony (3:35)

10 **Duruflé:** Requiem, *Sanctus* • Dennis Keene; Voices of Ascension (3:25)

11 **Satie:** Gymnopédie No. 1• Wendy Kerner Lucas, harp (2:30)

12 **Debussy:** Arabesque No. 1 • Carol Rosenberger, piano (3:40)

13 **Dvořák:** Serenade for Winds, *Minuet* (excerpt) • Chamber Music Society of Lincoln Center (4:08)

14 **Vivaldi:** The Four Seasons, *Autumn*, Movement III • Gerard Schwarz, Los Angeles Chamber Orchestra (3:11)

15 **Gershwin:** Porgy and Bess Medley (excerpt) • Eugene Rousseau, saxophone; Frederick Fennell, conductor; Indiana Wind Ensemble (3:29)

16 **Falla:** The Three Cornered Hat (excerpt) • Della Jones,soprano; Gerard Schwarz; London Symphony Orchestra (3:28)

17 **Dvořák:** Stabat Mater, Movement V (excerpt) • Zdenek Macal, conductor; Westminster Choir; New Jersey Symphony (2:30)

18 **Bach:** Jesu, Joy of Man's Desiring • Todd Wilson, organ (3:21)

19 **Piccolo:** O hear us, Lord • Donald Pearson, conductor; St. John's Cathedral Choir (2:00)

20 **Hanson:** Dies Natalis (excerpt) • Gerard Schwarz; Seattle Symphony (3:40)

21 **Tchaikovsky:** 1812 Overture (excerpt) • James DePreist; Oregon Symphony (2:32)

Disc 1 Total Playing Time: 66:31

<u>Warning:</u> Protect your speakers!
Some of the tracks on this program contain sounds which could cause damage to your speakers if played at too high a volume level.

Printed & Manufactured in USA

Disc 2 - The Tests

SOUND EFFECTS

1 Jet flyover (USMC MkLk, Bangalors & FA-18s) (0:16)
2 Fire Department Code 3 (0:52)
3 Canadian Pacific Railroad (1:32)
4 Hawaiian surf (1:38)
5 Light rain with thunder (0:52)
6 WW II Aircraft (Reno Air Races) (1:36)
7 Steam Locomotive 4501 passes in a thunderstorm (1:36)

STEREO SETUP AND IMAGING

8 Stereo channel identification (1:00)
9 Stereo phase (1:00)
10 Stereo balance (1:00)
11 Left-Right frequency balance (1:00)
12 Stereo center imaging (1:11)
13 Stereo half-left & half-right imaging (2:17)
14 Continuous wideband stereo pan (1:00)
15 Stepped wideband stereo pan (1:01)
16 Continuous narrowband stereo pan (1:01)
17 Stepped narrowband stereo pan (1:01)
18 Speaker comparison level-matching (1:00)

SUBWOOFER EVALUATION AND SETUP

19 Low-frequency sweep with voiceover (1:16)
20 Low-frequency sine wave sweep with harmonic (1:15)
21 Subwoofer level (with meter) (1:01)
22 Subwoofer phase: 200Hz (1:01)
23 Subwoofer phase: 160Hz (1:00)

24 Subwoofer phase: 125Hz (1:00)
25 Subwoofer phase: 100Hz (1:00)
26 Subwoofer phase: 80 Hz (0:58)
27 Subwoofer phase: 62Hz (1:00)
28 Subwoofer blend (slow) (1:00)
29 Subwoofer blend (fast) (1:13)

SURROUND SOUND SETUP AND IMAGING

30 Surround-Sound channel identification (0:57)
31 Surround-Sound speaker balance (1:00)
32 Surround-Sound speaker balance with subwoofer (1:00)
33 Surround-Sound center speaker phase (1:03)
34 Surround half-left & half-right imaging (2:18)
35 Ambience/Reverberation clicks (1:00)
36 Continuous wideband Surround-Sound frontal pan (1:00)
37 Stepped wideband Surround-Sound frontal pan (1:02)
38 Continuous narrowband Surround-Sound frontal pan (1:00)
39 Stepped narrowband Surround-Sound frontal pan (1:01)

REFERENCE TONES

40 Band-limited pink noise (1:00)
41 Stereo pink noise (1:00)
42 Left-channel pink noise (1:00)
43 Center-channel pink noise (1:01)
44 Right-channel pink noise (1:01)
45 Surround-channel pink noise (1:01)
46 Left-channel match tone (1:00)
47 Center-channel level-match tone (1:01)
48 Right-channel level-match tone (1:00)
49 Surround-channel level-match tone (1:01)

DISC 2 TOTAL PLAYING TIME: 58:47

DOLBY SURROUND™ in music? Why not! With a carefully monitored high-quality mix it can help recreate the live music experience. That's why attending a concert conveys the excitement that it does — you're hearing the sound not only from the front of the hall, but from all the reflections of the environment around you. Now the excitement of Academy Award® - winning Dolby Surround™ is available on music CDs from Delos, bringing you the natural sound of the concert hall.

This two-disc set has been conceived as an "ultimate" demo and test collection, with everything you'll ever need to get the most out of your surround sound and/or home THX® system. Disc One is a 70 minute Surround Sound classical music sampler supervised by acclaimed audio guru **John Eargle**. Disc Two features ultra-precision test tones created by ***Stereo Review's*** Technical Editor, **David Ranada**, which will assist in setting up your system. As a bonus (and preceding the test tone section), **Brad Miller** from **Mobile Fidelity Productions of Nevada** has provided a sensational collection of sound effect tracks.

DISC 1 — THE MUSIC

Notes by **John Eargle**,
Delos Director of Recording

In selecting the music for this Surround Sound program, we carefully surveyed the Delos catalog, choosing those items that we felt could truly benefit in the best musical sense from Surround Sound presentation. Most of these movements and excerpts are presented here exactly as they exist in the stereo catalog, while others have been given a slight image widening treatment to make them more suitable for presentation over Surround Sound playback systems, with their matrix and its associated five-loudspeaker setup. Everything on this program is stereo compatible and may be enjoyed in that format as well.

The subjective qualities of both intimacy and grandeur, elusively sought after by recording engineers in normal stereo recording, are far easier to achieve in a multi-loudspeaker setup. The marriage of two-channel stereo and five-loudspeaker seems to be a natural one, if care is taken in preserving musical values.

What better to begin with than the dramatic opening to Strauss' **Also Sprach Zarathustra**, with its weighty organ pedal tone, big brass, and timpani strokes [1]. Listen for the full enveloping quality of Surround Sound and the natural sense of ambience.

The varied orchestral colors of Respighi's *Ottobrata* from **Feste Romane** lend themselves aptly to surround presentation [2]. Listen for the off-stage horn calls from the rear!

This is the premiere of Andrew York's **Bantu**, played here by the Los Angeles Guitar Quartet, of which York is a member [3]. The medium size ambience of the recording venue is clearly apparent against the percussive sounds.

Choral music is a "natural" for Surround Sound, and Palestrina's **Alma Redemptoris**, sung by the Voices of Ascension, clearly demonstrates this [4]. Listen for the reverberant signature of the Church of the Ascension coming from all loudspeakers, while the direct sound of the chorus comes primarily from the front.

The ambience in the **Hornpipe** movement of Handel's **Water Music** is essential to its stereo sound staging. But in Surround Sound the effect is even more dramatic, especially as it envelops the horns [5].

The grandeur of organ music sounds to great advantage over the five loudspeakers of a Surround Sound system. Listen for the natural ring-out of reverberation in the many "open spaces" that Bach provided in his famous **Toccata in D Minor**, as played by Robert Noehren [6].

The natural acoustics of Seattle's Opera House can be clearly heard in this performance of Wagner's **Prelude** to the third act of **Lohengrin**. The clear sound staging of the brass is contrasted with the more diffuse woodwind sound heard in the middle section [7].

Grofe's **On the Trail** has been edited for this program to make it something of a miniature. Listen for the sense of space and ambience around the celesta obbligato toward the end of the piece [8].

Copland's **Fanfare for the Common Man**, like the Strauss work that opens this program, is a natural for Surround Sound. Listen for the various brass entries coming from around you [9].

Maurice Durufle's **Requiem** is a twentieth century gem, and the **Sanctus** movement again presents the Voices of Ascension, this time with organ and small orchestra [10].

While we normally associate Surround Sound with large performing groups and large spaces, it is surprising how naturally it enhances the solo harp, as heard here in Satie's **Gymnopédie** No. 1. The effect is that of sitting in a rather live, but small, performance space [11].

Much the same can be said for Debussy's **Arabesque** No. 1, played here by Carol Rosenberger on the Bösendorfer Imperial Grand piano [12].

Like the Handel work presented earlier, this movement from Vivaldi's **Four Seasons** benefits from Surround Sound presentation. Here, the effect is like hearing the work in a typical eighteenth century performance space [13].

The Dvořák **Serenade** captures in Surround Sound the warm ambience of the hall at New York's Academy of Arts and Letters, which lends a "soft focus" to the wind instruments in the group [14].

This synthesis of Gershwin's **Porgy and Bess** for wind ensemble, with noted saxophonist Eugene Rousseau and conductor Frederick Fennell, is performed by students and faculty of the School of Music at Indiana University. Listen for natural sound staging and balances [15].

Several sections of Falla's **Three Cornered Hat** ballet have been telescoped here into a single presentation [16]. Soprano Della Jones' off-stage passages will be heard as just that!

The impact of the Westminster Symphonic Choir, singing with the New Jersey Symphony Orchestra, is heard in this movement from Dvořák's **Stabat Mater** [17]. This is an example of how Surround Sound can enhance large scale concert hall recordings.

Bach's **Jesu, Joy of Man's Desiring**, in a setting for organ, is played here by Todd Wilson in Atlanta's St. Philip's Cathedral [18]. Anthony Piccolo's anthem, **Hear Us, O Lord**, is performed by the choir and organ of St John's Cathedral in Denver [19]. Both of these works demonstrate the ultimate in "wrap-around" acoustics of very large spaces, as the effect can be recreated by current two-channel matrix playback technology.

Hanson's **Dies Natalis** presents the Lutheran chorale "How Brightly Shines the Morning Star" in a lavish setting for orchestra, with prominent brass passages [20]. Again, the rich acoustics of the Seattle Opera House are clearly evident in Surround Sound.

We end this program with the final pages of Tchaikovsky's **1812 Overture**. The glorious cacophony of cannons and bells will come at you from all directions [21]!

Disc 2 — Sound Effects and more...

Notes by **David Ranada**, Technical Editor, *Stereo Review*

Most of the test tones on this disc were developed for use in equipment listening tests at *Stereo Review*. With them, you can follow some of the same sonic procedures and make some of the same types of evaluations we do when setting up and reviewing stereo and home-theater equipment.

All the test signals were digitally generated using custom-written computer programs; most are not available from standard laboratory equipment. While every test tone was designed to make what it is testing for very vivid, most of the tones are also useable beyond their intended primary purpose. Because of space restrictions, only some of the most important secondary uses can be mentioned in these notes.

Most of the test signals last far longer than you need for setup and evaluation, especially if you've had some practice with them. Don't feel obligated to listen to a whole track if you've heard what you needed to hear after the first few seconds. But the tracks are also long enough for you to get up from and return to your primary listening position after making equipment adjustments. In those cases where the test tone is too short, you can always activate your player's track-repeat mode.

In all but two cases in the first three major groupings of test signals, the tones are intended to be listened to and *not* measured. In fact, the content of some tones makes useful measurements difficult without a rather sophisticated spectrum analyzer, which, of course, is precisely what your hearing system is. Furthermore, the tones are intended for listening over loudspeakers, not headphones. Over headphones they may not produce the described sonic effects.

All the tones' levels have been chosen so that a volume-control setting suitable for the music selections on the first disc will produce an appropriate test-tone sound level that is also safe for your equipment and hearing. Still, it's a good idea to familiarize yourself with the test tones by playing through all of them at a slightly reduced level. Then, for actual testing, you can raise the volume control to its typical setting for music.

Many tones in sections A and C are intended for either two-speaker stereo or five-speaker surround sound playback, but not both. At first hearing, some tracks in sections A and C may sound identical [14-17 vs. 36-39, 13 vs. 34]. However, such "duplicate" test signals contain subtle differences in encoding and will not produce the intended effects when played back using the wrong system settings.

For many signals, and especially for the imaging tests, it is important that you listen from the conventional prime listening position—a location that is equidistant from the front-left and front-right speakers and approximately as far from them as they are apart (see Fig. 1 for stereo and Fig. 3 for surround sound).

SECTION A. STEREO SETUP AND IMAGING

[8] Stereo Channel Identification

The sound from a recorded left channel should emerge from the speaker that is to your left as you face a pair of stereo speakers (Fig. 1). For many recordings — such as those on the first disc of full symphony orchestras — a simple mix-up of the channels actually creates an sonic image that is impossible to obtain in a live concert.

If your system produces the opposite orientation from the voice-plus-tone announcements, check the connections of your disc player or the connections between your amplifier/receiver and the loudspeakers.

[9] Stereo Phase

To produce correct stereo imaging the two speakers of a stereo pair must be "in-phase." That means that when both speakers are fed identical signals their diaphragms simultaneously move in the same direction. The stereo phase test signal consists of alternating long and short bursts of noise. The long burst is recorded in-phase and its sonic "phantom" image should appear to the ears like a fuzzy sound-emitting "sphere" between the two speakers (Fig.1). The short burst is recorded out-of-phase and should sound diffuse and hard to localize. If the longer tone is more diffuse-sounding and the short tone images well, your speakers are out of phase. To correct this problem, reverse the leads to *one* speaker (left or right, it doesn't matter which) at the point where the speaker cable attaches to the speaker *or* at the point where the cable attaches to the amplifier (exchange the wire attached to the + or red terminal with the wire attached to the - or black terminal).

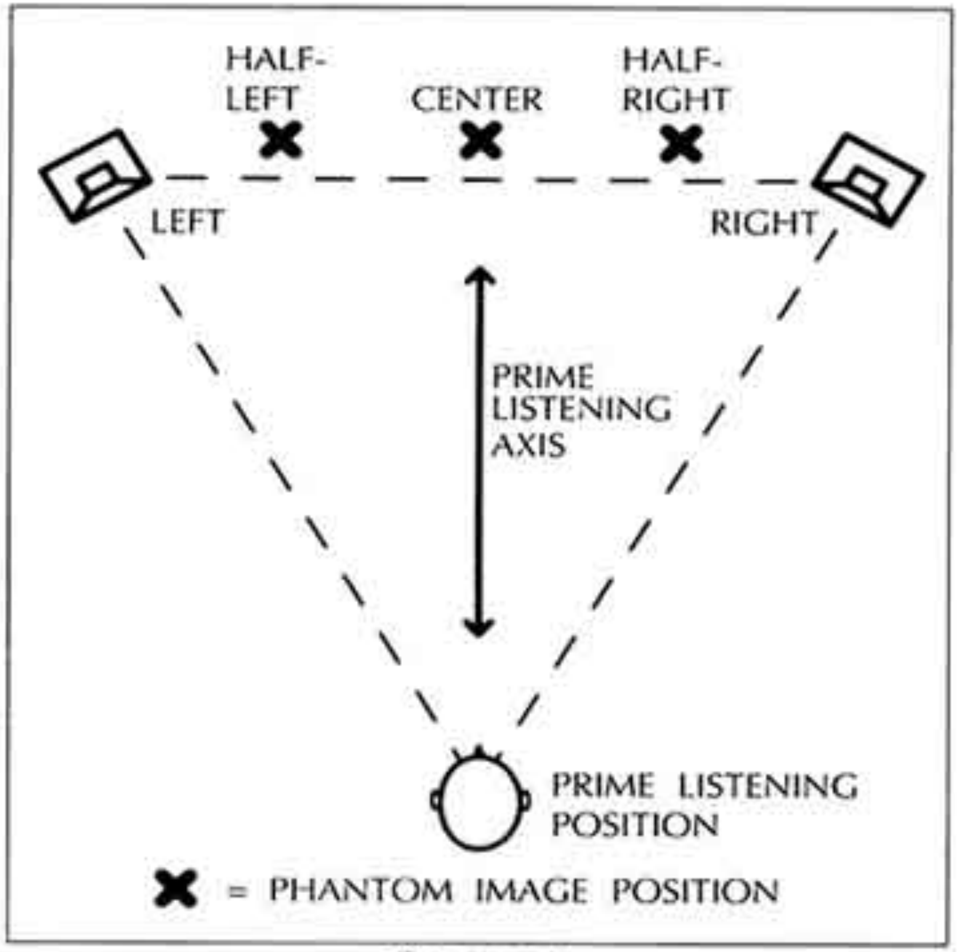

Figure 1

[10] Stereo Balance

While playing this tone, adjust your balance control so that the phantom aural image of this tone is centered halfway between the left and right speakers (Fig.1). Your speakers must be in-phase for this adjustment to work properly. Stereo phasing can be checked with [9].

[11] Left - Right Frequency Balance

This tone consists of full-band pink noise flipping between left and right channels. If your listening setup is left-right symmetrical, the sounds from the left and right speakers should be identical in tone color (timbre). If they sound grossly unmatched, asymmetry in any of the following may be to blame: the spatial sound-emission characteristics of the two speakers (their "radiation patterns"), their frequency responses, the speakers' or the listener's distances from the walls, floors and ceilings as well as the positioning of furniture and other large acoustic absorbers and reflectors in the room. Damaged equipment (an inoperative speaker driver) or system misadjustments (unequally set tone controls) may also cause gross mismatches. Don't worry if you cannot obtain a precise match; even the best systems may produce slight audible differences from side to side. It is often difficult, in fact, to tell when a very close match has actually been obtained.

[12] Stereo Center Imaging

Portions of this track, the next [13] and their surround-sound counterpart [34] are among the most difficult signals on this disc to get "right." Even the best systems may have trouble with them.

This test cannot work correctly if the speakers are out of phase [9].

The first thing you hear in this track is 5 seconds of mono midband noise. Use this "preamble" to check that you are listening on the prime listening axis (Fig.1). Assuming that both stereo phase and stereo balance have been set correctly, the preamble should image halfway between the left and right speakers ("center" in Fig. 1).

Step	Reference Frequency
1	12,699 Hz
2	10,079
3	8,000
4	6,350
5	5,040
6	4,000
7	3,174
8	2,520
9	2,000
10	1,587
11	1,260
12	1,000
13	794
14	630
15	500
16	397
17	315
18	250
19	198
20	157
21	125
22	99
1	Sequence Repeats

Centers of frequency bands during imaging sweeps [12], [13], [34]

Figure 2

The test signal proper consists of narrow bands of noise that descend from approximately 13 kHz down to 100 Hz in twenty-two equal steps (Fig. 2). The signal on both channels is identical so, ideally, each band of noise should also image halfway between left and right speakers.

Any asymmetry in the listening setup can "pull" the image to one side or the other (see the list of possible image degraders in the note for [11]). Of particular importance are asymmetrical reflections from the listening room's side walls. You might find that center imaging degrades slightly at those frequency bands covering the tweeter crossover (this generally occurs between tones 7 and 11 in the descending sequence) and that it is inherently hard to image the first two or three steps. Listeners with severe high-frequency hearing loss may not hear the first of the descending frequency bands.

[13] Stereo Half-Left & Half-Right Imaging

Experience has shown that this signal as well as its surround-sound counterpart [34] are by far the most difficult test tones on this disc to reproduce correctly. Although systems that do well in these two tests may deliver better imaging performance — meaning better delineation, and with more but not exaggerated "depth" — don't expect perfection. Furthermore, as difficult as these tracks are, *do not* use them as the sole criterion for loudspeaker selection. There are other aspects of speaker performance, such as overall frequency balance, that are more important and that are best assessed using music.

This test will not work correctly if the speakers are out of phase [9].

The test sequence starts with a "preamble" of 5 seconds of center-position midband noise (Fig.1). During the preamble, adjust your listening position for best center imaging.

The test signal proper consists of the same descending noise bands as in [12] but with the downward sweep placed alternately at the half-left and half-right image positions. Ideally, every segment of the downward sweep will image at the same half-left and half-right locations as the preamble. With otherwise fine-sounding speakers it is entirely typical for the image to be unstable, diffuse, or slightly misplaced during the first three or four steps in the sweep and, because of head-diffraction effects and the spacing between your ears, during steps seven to eleven.

Speakers with limited vertical sound dispersion seem to perform better on this test than others. Reflections from furniture and room surfaces can also greatly affect the outcome of this test (see the note for [11]).

[14] Continuous Wideband Stereo Pan
[15] Stepped Wideband Stereo Pan
[16] Continuous Narrowband Stereo Pan
[17] Stepped Narrowband Stereo Pan

If your system did well with tracks [12] and [13], it should have no trouble with these four tracks, which test imaging with broadband signals that more closely resemble the frequency content of complex sounds.

Tracks [14] and [16] consist of noise signals that sweep evenly and continuously back and forth between left and right sides. From the prime listening position, neither the apparent volume nor the timbre nor the "size" of the image should change as it moves. Tracks [15] and [17] jump, in sequence, from full-left to half-left to center to half-right to full right. Speakers with better imaging will have a smaller phantom image "sphere" that remains the same size at each position.

Full-band signals such as [14] and [15] may not image as "tightly" as narrower-band signals [16] and [17]. Preliminary judgments as to imaging quality should therefore use the latter tracks.

[18] Speaker Comparison Level-Matching

Matched levels are a prerequisite for any critical comparative listening and the primary purpose of this signal is to aid in matching speaker levels during speaker comparisons in a dealer showroom. The signal consists of a tone that flips between left and right channels. In showrooms with an A/B system-selector switch you should throw the switch frequently while playing this track. Adjust the two systems' volume controls so that the tones reproduced by either seem equal in loudness. Tracks [46-48] may also be used in this way.

In situations where there is no system-selector switch, you can feed the left channel disc-player output into the left channel of system A, and the *right* channel player output into the *left* channel of system B so that the tone flips between both systems' left channels. Adjust volumes so that the tones' sound levels are equal. Then reconnect the disc player in its normal configuration but do not change relative settings of the two systems' volume controls until you are finished with the comparison test.

SECTION B. SUBWOOFER EVALUATION AND SETUP

[19] Low-Frequency Sweep with Voiceover

This test tone is a sine wave that slowly sweeps from 160 Hz down to 20 Hz with voice announcements of the approximate frequency made at 3/4-second intervals. The announcements start 1/4 second before the tone reaches the announced frequency. (The sweep rate is, not coincidentally, one musical semitone every 3/4 second.) This signal has several uses.

a. Checking woofer-module bass extension and distortion.

By listening for the point at which you hear the frequency announcements, but no longer hear any substantial woofer output, you can get some idea of a woofer's lowest usable frequency. Woofer positioning as well as listener location can greatly affect what you hear in this test. But even if perfectly reproduced, the perception of the sine wave will change as it falls in frequency. From 160 Hz to somewhere below 50 Hz, it will have a distinct feeling of musical "pitch" (you'll be able to hum along.) Below 50 Hz, the perception will change to a pitchless sonic "presence." High amounts of woofer distortion below 50 Hz may produce a misleading sense of pitch.

b. Checking for room resonances.

The loudness of the sine wave will increase and decrease as it passes through the resonance and null frequencies of your room. The severity of the peaks and dips and, to some extent, their frequencies are greatly influenced by woofer and listener positioning.

c. Checking for spurious vibrations.

It is common for this tone to excite vibrations of nearby objects, which may then rattle or buzz. These extraneous noises should be eliminated.

[20] Low-Frequency Sine Wave Sweep with Harmonic

This tone resembles [19] but with the voiceover replaced by a synchronized harmonic of the low tone that lets you "track" the lower tone as they both descend. This composite signal can be used for the same purposes as [19].

[21] Subwoofer Level (with meter)

Consisting of alternating bands of low- and mid-frequency noise, this signal is meant to help you set the proper level for a separate woofer module. It *must* be used with a sound-level meter (Radio Shack's inexpensive Model 33-2050 is sufficiently accurate for this test). *Using this track to adjust woofer level by ear alone can result in a grossly incorrect setting.*

With the sound meter set to slow needle response and C-weighting (*do not* use A-weighting) the *measured* sound level of the woofer unit when reproducing the low-frequency tone should be adjusted to equal the *measured* sound level of the mid-frequency tone. Results will be most accurate when the measured sound level is between 70 and 80 decibels.

Woofer level is partly a matter of taste, and listening tests with music may encourage you to deviate slightly from the settings produced by this track. Note: This track may not produce accurate results with systems having a woofer crossover frequency lower than approximately 80 Hz.

[22] Subwoofer Phase: 200 Hz
[23] Subwoofer Phase: 160 Hz
[24] Subwoofer Phase: 125 Hz
[25] Subwoofer Phase: 100 Hz
[26] Subwoofer Phase: 80 Hz
[27] Subwoofer Phase: 62 Hz

These six tones are intended for checking the phasing of separate woofer modules with the main system speakers. To use them you have to know your woofer crossover frequency. This is usually stated in the woofer manual or, if it is adjustable, it may be indicated on a dial located on the woofer.

a. Play the track whose listed frequency is closest to your woofer crossover frequency.

b. Flip the phase of the woofer. This can be done either by using its phase switch (common on powered woofer modules) or by reversing the speaker cables feeding it (exchange the wire attached to the + or red terminal with the wire attached to the - or black terminal). If the woofer system has no phase-invert switch and is fed by line-level signals, you will have to flip instead the phases of the main left and right speakers, taking care to flip their phases identically.

c. If the sound level of the track goes down after performing step b., restore the original settings or hookup.

d. If the sound level goes up, keep the new connections. You should rebalance the woofer level with the main speakers [21].

Sometimes it is difficult to decide if the level has gone up or down when you perform step b. A sound-level meter will help greatly (see note for [21]). You might also try the test with the balance control turned completely over to the side of the main front speaker that is closest to the woofer module.

[28] Subwoofer Blend (slow)
[29] Subwoofer Blend (fast)

These two signals can be used to assess the crucial "join" between the main speakers and the woofer. They consist of the same six

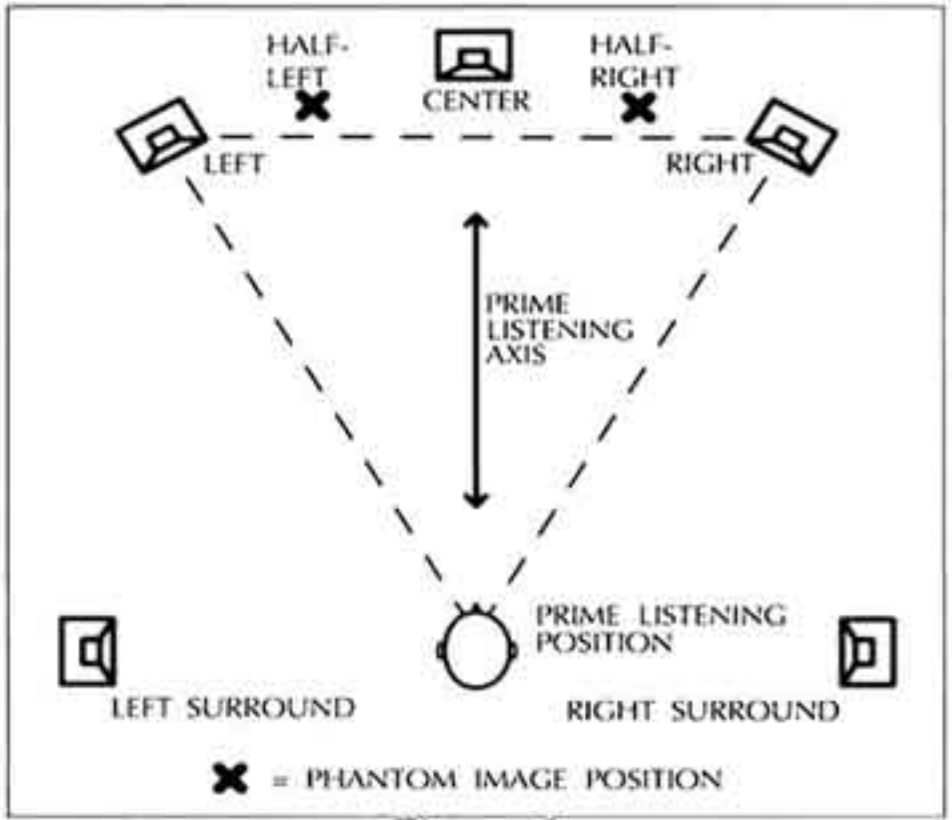

Figure 3

frequency bands as in tracks [22-27] but edited in series. As the band of noise descends in frequency, listen for an evenness in sound level as the woofer crossover frequency is passed. If there is a large increase or, more likely, a decrease in level through the crossover frequency, you may wish to confirm proper woofer phasing [22-27] or to adjust slightly the crossover frequency for a smoother blend. The slow track [28] is useful when you have a sound-level meter while the faster track [29] is usually less revealing but works better when you are just listening.

SECTION C. SURROUND-SOUND SETUP AND IMAGING

[30] Surround-Sound Channel Identification

You should set your system for Dolby Pro Logic or Home-THX operation for this and all the other tracks in this section [30-39] except possibly for [38]. For best performance on the surround-sound tests, you should have a real center-channel speaker and not be operating in the "phantom" center-channel mode. You should have at least one surround speaker (placed above or behind the prime listening position) or, preferably, two surround speakers (placed to the sides). The preferred layout for the speakers in these tests is shown in Fig. 3. The left, center, and right tones and announcements should emerge from their respective speakers in sequence. The sound for the surround speakers will be emitted from both surrounds simultaneously.

[31] Surround-Sound Speaker Balance

A tone is emitted in sequence from the

left, center, right and surround speakers. Levels of the center and surround speakers should be adjusted with the appropriate system controls so that the apparent sound level of all five tones is the same. Use of a sound-level meter would be extremely helpful here.

Dolby Pro Logic and Home-THX equipment come equipped with an internal speaker-balance test tone generator. While use of the recorded tone will enable you to compensate for any imbalances in your disc player's output, the settings derived using the built-in test tone will in most cases be very close to those produced by this track, especially if a sound meter is used.

[32] Surround-Sound Speaker Balance with Subwoofer

This signal is identical to [31] with the addition of a woofer-module setup tone in the circulating sequence. You *must* use a sound-level meter with this track (Radio Shack's inexpensive Model 33-2050 is sufficiently accurate for this test). *Using this track to adjust woofer level by ear alone can result in a grossly incorrect setting.*

With the meter set to slow response and C-weighting (*do not* use A-weighting) the *measured* levels of the center and surround speakers and the woofer module should be adjusted with the appropriate system controls so that the sound level of all five tones in the sequence is the same. Results will be most accurate when the measured sound level is between 70 and 80 decibels.

Woofer level is partly a matter of taste, and listening tests with music or soundtracks may encourage you to deviate from the settings produced by this track. Note: This track may not produce accurate results with systems having a woofer crossover frequency lower than approximately 80 Hz.

[33] Surround-Sound Center Speaker Phase

For this test to work properly, the left and right front speakers must already be in-phase with each other [9].

The test tone here continuously jumps, in sequence, from full-left to full-right to half-left to half-right positions (Fig. 3). When listening from the prime location, if the center speaker is out-of-phase in comparison to the front-left and -right speakers, the half-left and half-right positions will not image correctly if at all. If this occurs, flip the phase of the center speaker: reverse the connections at the point where the speaker cable attaches to the speaker *or* at the point where the cable attaches to the amplifier (exchange the wire attached to the + or red terminal with the wire attached to the - or black terminal). Check the speaker balances again before continuing [31 or 32].

[34] Surround Half-Left & Half-Right Imaging

Experience has shown that this signal and its stereo counterpart [13] are by far the most difficult test tones on this disc to reproduce correctly. Although systems that do well in these two tests can deliver better imaging performance — meaning better delineation-with more but not exaggerated "depth" — don't expect perfect behavior. Furthermore, as difficult as these tracks are, *do not* use them as the sole criterion for loudspeaker selection. There are other aspects of speaker performance, such as overall frequency balance, that are more important and that are better assessed with music.

This track cannot work correctly if the three front speakers are out of phase [9, 33]

The test sequence starts with a "preamble" of 6 seconds of midband noise that alternates between the half-left and half-right positions. During the preamble, adjust your listening position for best left-right image symmetry at the half-left and half-right positions.

The test signal proper consists of a descending band of noise that steps from approximately 13 kHz to 100 Hz in 22 equal steps (Fig. 2). The downward sweep is placed alternately at the half-left and half-right image positions. Ideally, every segment of the downward sweep will image at the same half-left and half-right locations as the preamble. With otherwise fine-sounding speakers it is entirely typical for the image to be unstable, diffuse, or slightly misplaced during the first three or four steps in the sweep and, because of head-diffraction effects and the spacing between your ears, during steps seven to eleven.

This test can be used to evaluate center-speaker matching. Systems using three identical front speakers for left, center and right will do better at this test than those with an unmatched center speaker. Speakers with limited vertical sound dispersion seem to perform better on this test than wider-dispersion speakers. Reflections from furniture and room surfaces can also greatly affect the outcome of this test (see notes for [11-13]).

[35] Ambience/Reverberation clicks

This track, which consists of groups of clicks jumping from left to center to right to surround-encoded channels, is provided as a convenience to help evaluate digital ambience-recovery/synthesis and artificial-reverberation settings. This track starts with four left-channel clicks followed by groups of five clicks in the center, right, and surround channels. The sequence repeats with five-click groups.

When such systems are in use, the recorded click will generate very discrete-sounding echoes (from ambience recovery/synthesis devices) or a smoothly decaying reverberant field (from artificial reverb systems). Differences between settings of such devices are often difficult to hear with music, but the clicks will often make the effects of small adjustments plainly audible.

Some ambience/reverberation systems have modes that process only center- or surround-channel signals. This track will help you find those modes.

[36] Continuous Wideband Surround-Sound Frontal Pan
[37] Stepped Wideband Surround-Sound Frontal Pan
[38] Continuous Narrowband Surround-Sound Frontal Pan
[39] Stepped Narrowband Surround-Sound Frontal Pan

If your system did well with track [34], it should have no trouble with these four tracks, which test imaging with broad-band signals that more closely resemble the frequency content of complex sounds.

Tracks [36] and [38] consist of noise signals that sweep continuously from left to center to right and back. From the prime listening position, neither the apparent volume nor the timbre nor the "size" of the phantom image should change as it moves. There may be slight changes in apparent volume as the tone moves from side to side. These seem to depend, among other things, on the amount of vertical dispersion of the front speakers, with limited dispersion speakers producing a more even-volume movement. Even with perfectly matched front speakers, there may be a slight change of timbre as the noise passes through the center position.

Tracks [37] and [39] jump, in sequence, from full-left to half-left to center to half-right to full right positions. Speakers with better imaging will have a smaller phantom image "sphere" that remains the same "size" at each position.

Full-band signals such as [36] and [37] may not image as tightly as narrower-band signals as in [38] and [39]. Preliminary judgments as to imaging quality should therefore use the latter tracks.

While these tracks are different from [14-17] and are intended for Dolby Pro Logic or Home-THX playback, it's interesting to play [36 and 38] in simple stereo to hear the differences between a signal encoded for stereo left-right panning and for surround left-center-right panning.

SECTION D. REFERENCE TONES

[40] Band-Limited Pink Noise

This signal can be used with surround decoders as a quick check that all channels, except any woofer modules, are connected and operating. It should play through all channels at approximately equal levels. Other tracks must be used to adjust surround-sound speaker balances [31 or 32] and phases [33] and for subwoofer setup [21-29].

[41] Stereo Pink Noise
[42] Left-Channel Pink Noise
[43] Center-Channel Pink Noise
[44] Right-Channel Pink Noise
[45] Surround-Channel Pink Noise

These tracks all contain wideband pink noise (20 Hz to 20 kHz) and can be used to verify, among other things, the accuracy of spectrum analyzer displays: when fed directly into a multi-band spectrum analyzer the readout should be a flat line. The pink noise here has been digitally generated and is extremely even in frequency content (flat to better than 0.2 dB). Even with the superimposed response of a typical disc player it surpasses the flatness of typical analog-filtered pink-noise generators.

Due to the special signal processing employed in such Dolby Pro Logic and Home-THX circuits, spectrum measurements of such systems may not show flat response with these signals.

[46] Left-Channel Match Tone
[47] Center-Channel Level-Match Tone
[48] Right-Channel Level-Match Tone
[49] Surround-Channel Level-Match Tone

These tracks are intended for those who wish to have surround-sound speaker-balance test-tones that dwell on a single channel at a time (such as installers using sound-level meters to set levels). Automatically circulating surround speaker-balance tones are available in [31 and 32].

How the test signals were generated:

All the test signals were generated on a 33 MHz 386 IBM-type computer running custom-written or custom-modified computer programs in Microsoft FORTRAN, Microsoft QuickBASIC, or Borland Turbo C++. The output of each program was a Windows .WAV sound file.

Basic editing of these files was performed on hard disk using the editing program supplied with the sound card employed, which was the CardD from Digital Audio Labs (Minneapolis, MN). This card was selected because it had an optional companion card (now available separately) that provided standard digital-audio SPDIF connections. The generated signals were played in digital form through this interface directly into a DAT recorder for transferral to Delos for final editing and disc-master preparation. Only the voice announcements originated in the analog domain.

Executive Producer: *Amelia S. Haygood*
Recording Engineers: *John Eargle, Stephen Basili, Al Swanson*
Editing: *Stephen Basili*
Project Coordinator: *Rudi Simpson*

Design: *Tri-Arts, Inc.*
Graphics: *Bruce Dizon*
Layout: *Mark Evans*

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harman/kardon

Recorded with MONSTER CABLE®

P.O. Box 343, Sonoma, California 95476-9998
(800) 364-0645 • (707) 996-3844
contactus@delosmusic.com • www.delosmusic.com
Made in U.S.A.