SOUNDOCTOR

Test / Setup CD Version 3

1	Pink Noise LR -20dB 1 min.	18	HF Contoured noise -20dB 30 sec
2	120 Hz LR -1dB 30 sec	19	LF Contoured noise -20dB 30 sec
3	110 Hz LR -1dB 30 sec	20	Holly Cole *Jersey Girl*
4	100 Hz LR -1dB 30 sec	21	Holly Cole *Don't Smoke In Bed*
5	95 Hz LR -1dB 30 sec	22	Techmaster PEB
6	90 Hz LR -1dB 1 min.	23	Techmaster PEB
7	85 Hz LR -1dB 30 sec	24	Techmaster PEB
8	80 Hz LR -1dB 30 sec	25	White Noise LR -20dB 1 min.
9	75 Hz LR -1dB 30 sec	26	White Noise 180 degrees out of phase -20dB 1 min.
10	70 Hz LR -1dB 30 sec	27	80 Hz SINE WAVE BLIP test LR 1 min. 0dB FULL LEVEL ! One blip every 2 sec.
11	65 Hz LR -1dB 30 sec	28-36	Bonus Tracks ! Various DEMO surprises as I add them… The current listing is on page 12.
12	60 Hz LR -1dB 30 sec		
13	55 Hz LR -1dB 30 sec		
14	50 Hz LR -1dB 30 sec		
15	40 Hz LR -1dB 30 sec		
16	30 Hz LR -1dB 30 sec		
17	20 Hz LR -1dB 30 sec		

Thank you for getting this TEST CD ! You are in for a unique audio experience - ***and results***. This CD represents more than 40 years research into the best methodology for the easiest and most comprehensive system alignment and subwoofer integration, including speaker aiming (which means imaging). You will GET GREAT RESULTS where everything before has been disappointing or a dismal failure. This Version 3 has been redone in both track order and content from the earlier versions. These frequencies are all precision digitally generated in Wavelab and the CD is manually recorded (burned) *individually*, at a slow speed for the highest possible quality. This CD also has free bonus music partial sample tracks. There's also a new unique BLIP test, and dual white noise tracks, one "in" phase, one "out" of phase. **These instructions have been greatly expanded !**

Check boxes ☐ are included to assist you.

The **OVERALL setup procedure** (for ANY system) is:
a) room acoustics
b) mains placement and alignment
c) Sub(s) placement
e) Sub integration with a 2-channel system (if you have that) first; then
f) Sub integration with Home Theater / Surround system (if you have that)

SUB PLACEMENT

You actually have 3 places to put a sub (or subs):
1) where you think it / they should go
2) where your spouse tells you to put them
3) where it / they ACTUALLY belong… (for correct acoustic coupling back to YOUR preferred listening position)

Sub placement is FAR more critical than most people would like to believe. Even though the bass wavelengths are long, (an 80 Hz wave is 14 feet long; a 20 Hz wave is 55 feet!) a ONE foot difference in sub placement might amaze you.

Please do not obsess about flat response in a living room. It is *essentially* not possible. You might find Ethan Winer's page here: http://ethanwiner.com/audio_minutiae.htm VERY entertaining. Find the section where he says YOUR ROOM IS LYING TO YOU. Here is an empirical test you can do which requires NO test equipment and it can be done at any time, whether

or not your sub is in a good or bad position: Play ANY sine wave freq, (for example 70 Hz). Now walk completely across your room right in front of your chair from the left wall to the right wall. Notice all the peaks and dips (holes) Your room is a realtime 5-dimensional grid calculus problem (H x W x D x freq x time). EVERY frequency has peaks and nulls at EVERY DIFFERENT SPOT in your room. Scary, isn't it?

And further, for an interesting discourse on sub placement (and many other acoustic phenomena) I also suggest reading Art Noxon's articles here: www.asc-home-theater.com/ht-articles.htm

You do not actually NEED any test equipment other than **your ears** to use this disc, although you may find an SPL meter or a frequency measuring device interesting. (If you have an RTA system hide it in a closet.) BECAUSE you have purchased a JL Audio Sub (or even another good brand of sub) the sub is simply powerful enough to cancel the bass in your room coming from your main speakers, leaving you with sound worse than when you started. You **MUST** carefully and correctly set up and integrate modern sub(s) to both the room (first) AND the rest of your system (second) in order to receive the results you paid for.

If you haven't done so, please read my "SUBS" white paper here: www.soundoctor.com/whitepapers/subs.htm

Room acoustics is the major part of the overall equation - perhaps 70%. SUB PLACEMENT is at least 20% of the rest of the equation, and *everything else* (that means *ALL the gadgets* you think you need, but don't) is 10% or less. IF you have the ability to place the sub(s) WHERE THEY BELONG, then you will do yourself a great disservice if you don't. If you purchase two subs and each is coupling only 3 dB less than it could, you are throwing away the equivalent of *one entire sub.*

There is one more phenomena which everyone ignores: REVERBERATION TIME. You CANNOT fix issues in the TIME (phase) domain with "equalization". Further, with ANY "room correction" software (which is a lie; it's NOT correcting your room, it's messing with your speakers…) while you CAN *assist* in smoothing the frequency response by pulling DOWN a peak, you CANNOT fill in a hole**:** that hole in the frequency response is the mechanical physics of your room, caused by the reflections canceling each other out.

If these reflections continue for so long that the bass notes don't die away, then you will get muddy response or worse. The common knee jerk response is to add "more subs" in order to get "more bass". This is exactly backwards. Let's say you are playing a dance CD with 120 BPM. That's two bass (or kick drum) hits per second. If the reverberation time in your room is 1.5 (or more) seconds then the first note will not die away before the 2nd note shows up, and this will repeat, and you will get mud. The ONLY way to fix this is with acoustics treatment.

With ANY assistive software, such as the JL Audio ARO or DARO or others, I SUGGEST learning everything NEUTRAL FIRST, and setting everything up according to these guidelines, THEN run ONE software at a time and discern if it helps or if you like it (or don't like it). DO NOT ASSUME that if you run all these "computers" in a row it will be either correct or you will like it. Flat response in a living room is NOT the holy grail of audio: impulse response is.

SO PLEASE, if possible, do the empirical tests. *Even if you later put the sub where your spouse suggests*, you will have first ***learned*** what's actually best. Some people call this the "crawl around" test. That's the next step.

☐ **THE CRAWL-AROUND TEST:** Here is how you most EASILY move the sub: go to a hardware / home improvement store and get some Waxman Super Sliders. They come in multiple sizes AND versions for carpeted floors AND/OR hard floors. If you have a medium size sub such as a JL Audio e110, e112, f110, or f112 there is a version which STICKS on the bottom of the rubber foot of the sub. Larger versions simply sit on the floor and the sub rests on them. You can slide a JL f113 sub around a carpeted room easily with one finger. On carpets the larger surface area ones will slide easier.

☐ **TRACK 24** is very helpful for the "crawl-around" test because it covers many frequencies AND it is repetitive. **Place one sub AT YOUR LISTENING POSITION, FACING FORWARD**. Using the analog outputs of a CD player, plug them directly into the sub. Turn the sub's filters to off, and the e.l.f. trim to "0". Manually adjust the volume level of the sub to a good perceivable **loud** but comfortable level. Sit right in front of the sub and **LEARN** what it is capable of. Now walk and crawl around the perimeter of the room, and anyplace you think it *could* go, and listen for the various couplings of the sub. You should notice a few areas where the bass is thin and weak (the nulls) a couple of areas where the bass is boomy and the fundamentals are louder than the harmonics (often too close to a corner) and then a couple of spots (2 or 4 places) where the bass sounds GREAT! **Those are the spot(s) to put the subs** so they inverse couple the best to your listening chair. You can't fight with the laws of physics!

Some people say they are going to put a sub in the corner because there is "room gain". WRONG! There is no GAIN ! There is no AMPLIFIER ! The corner simply has the *most efficient coupling at all frequencies* (because the 2 walls act like a huge horn) and *everywhere else in the room has, in comparison,* ***loss*****.** Try not to put a sub in the "middle" of a wall or space.

Also I suggest never putting subs BEHIND your main speakers. The low frequencies will mechanically vibrate the mains causing frequency modulation (doppler modulation) of the higher frequencies coming out of the mains. This is exactly one of the types of distortion you are trying to eliminate by NOT putting bass frequencies in your mains in the first place.

THEN, if you have JL Audio subs, adjust the ARO for EACH sub relative to its position in the room, THEN adjust the phase relationship between the sub and its main channel using the method outlined below. However, as a suggestion, you might want to NOT USE any ARO or other computer setting (such as Audyssey, etc) until you LEARN the characteristics of your system at its neutral settings FIRST. Then you may wish to experiment by making ONE change at a time, or ONE computer "adjustment run" at a time. It is very difficult to determine a result if you change more than one thing at a time.

A note about the “master/slave” hookup for JL Audio subs: If your room is SYMMETRICAL, perhaps a 2-channel system, and the room is like a shoebox, and you can close the door, and you are sitting on the center line and your speakers and subs are placed symmetrically… then yes, you can get away with it. And it works very well. If your setup is anything OTHER than symmetrical, I highly suggest using each sub as a **master** and adjusting each ARO by itself (and each phase knob by itself, too). Why? If the room is NOT symmetrical then the low freq sound waves from each sub will have different multiple reflective pathlengths from each sub to you the listener (and the test microphone) and to the left wall to the test microphone, and to the right wall to the test microphone, and so on. Therefore the necessary EQ to assist in the “flattening out” of one sub CANNOT BE THE SAME as for the other sub. Therefore “copying” the EQ from one to the other will not work well.

There is one more subtle difference between so-called “Home Theater/Surround” setups and “2-channel” - inasmuch as *correct audio is correct audio no matter what the situation*. In HT situations you are dealing with bass management and that signal contains all the bass below the crossover point (which you have selected) from all 5 (or more) channels AND the LFE channel *IF IT EXISTS* on the DVD or Blue Ray. (There is no LFE channel on a CD since it’s only 2 channels) LFE noises in movies (typically 20-80 Hz) have very little phase coherency with signals above 80 (what is being fed to your main speakers). The DESIRED results in a HT setup is to get those sci-fi noises of planets blowing up convincingly at your chair.

One other industry bit of confusion/lie: the signal coming out of your Home Theater Receiver/Processor **IS NOT LFE!!!** It is MANAGED BASS! It is everything below a defined frequency from ALL the channels (L C R Ls Rs Lb Rb and more…), summed into mono, and added to the LFE channel from the DVD if it exists. You are NOT (nor should you) run your mains “full range” and attempt to send ONLY the LFE signal to your sub. This only works in large movie theaters because of their size; the walls are so far away that for all practical purposes there are no standing waves; exactly the opposite of a living room.

In 2-channel “stereo”, there **is** often a very tight relationship between the bass notes (coming out of the sub) and their harmonic structure (coming out of the mains). For example, a kick drum has a fundamental around 60 Hz; a subharmonic component an octave down (therefore around 30 Hz); and a series of both even and odd harmonics extending up to 8000 Hz. Your mechanism of hearing feels the fundamentals (which are coming from the sub) and *localizes* the harmonics (which are coming from your main speakers). All of this is MOST apparent in well recorded acoustic bass (perhaps jazz) and cello (perhaps classical) music. If the phase relationship of the sub(s) are set correctly, *even if the subs are behind you* in the room you will perceive the “musician playing the bass” to be in the front of the room where he/she belongs.

All modern, powered, sealed subs have an analog phenomena called group delay (in the digital world this is often referred to as latency) so to best integrate sub(s) you must fix that timing issue so the sub lines up in time with the mains at the crossover frequency area. Since you cannot remove this inherent delay in the sub you must add this delay to all the top channels. The PHASE knob on a modern sub ADDS MORE delay to the sub than its intrinsic approximately 10+ msec.

IN A HOME THEATER SYSTEM you do this by manually setting the speaker distance settings in the setup menu. Since consumer equipment operates sort of backwards, when you **increase the distance setting of the sub you are adding delay to all the other channels.** (!) I suggest setting **all** the speaker distance settings THE SAME and to 7 feet; then add 12 feet to the SUB distance only (so the sub distance now = 19 feet). Now you have added a bit more than the correct amount of delay to the REST of the system (the L C R Ls Rs) so you can then properly use the PHASE KNOB on the sub to FINE TUNE the timing match. This will give you the best possible impulse response through the entire system; the imaging and focus should then should be uncanny, and the bass focused and as tight as possible. Again, if this is done correctly, *even if the subs are behind you*, you will NOT localize them; it will seem as if the bass is playing from the front of the room, where it belongs, and this is true even if the crossover frequency is as high as 120 Hz. Here’s another audio non sequiter: people say that “bass is non directional.” This is completely wrong. Audio is more or less directional; the phrase should be bass is *NON-LOCALIZABLE* because the wavelengths are so much larger than your head and therefore there is no phase difference between your ears relative to the wavelength size. The higher you cross over, the more you *MAY* localize the bass IF the timing of the sub is so far off from the mains that it almost becomes a separate musical event in time. If the timing is correct you will feel the bass and localize on the harmonics.

IN A 2-CHANNEL SYSTEM you cannot usually add delay to the tops (mains) therefore the subs will always be 1 cycle (or 360 degrees) late at about 100 Hz. If you have a DUAL HT/2-channel system then set the distances for the HOME THEATER

part as above and then both “parts” (HT and 2-channel) will *essentially* line up. The HT part will be exactly “in-phase” and the 2-channel part will most likely be 360 degrees late, but still *apparently* in-phase.

IF YOU HAVE “BOTH” SYSTEMS do the phase/level match for the 2-channel part FIRST. Now leave the level control on the sub WHERE IT IS, and when you do the HT part use the SUBWOOFER LEVEL control in your setup menu or on the remote to ‘match’. Then when you go back and forth between HT and 2-channel you (essentially) won’t have to adjust anything!

DECIDING ON THE CROSSOVER FREQUENCY: I suggest *never* going below 80, even if you think your speakers go down to 40, or below. Even in a room where the existing "mains" have a pair of 12" drivers (each) you will get far better results if you correctly seal the ports and *correctly* cross them over at 80, (or higher) and of course you MUST match the phase and timing relationship so the whole transition between the sub and the mains will be valid. For Home Theater setups set the Mains=SMALL, Sub=YES, XOVER=80 Hz (or 90, or 95) and if you have a choice, 24dB/octave. Feed each sub with the same signal placing "Y" cords anywhere. For JL Audio subs, if the room is symmetrical and everything in it is placed symmetrically you may use the master/slave system, but it is far better (and yes, more work) to use each sub as a master and then adjust the phase of each to match with the main it is closest to carefully.

You may (hopefully) experiment with different crossover freqs. With MANY mains which have drivers smaller than 8” I suggest 90 or 95 Hz. You MUST always do the phase step as the LAST adjustment. If you change the crossover freq to “experiment” you MUST do the phase test again by playing a sine wave at the crossover freq and following the steps below.

If you have a 2-channel only system if you do **not** correctly use a crossover you are both wasting your time and you will be frustrated. You simply CANNOT match a modern, sealed sub to an existing so-called full range, probably ported speaker system unless it is done CORRECTLY. You CANNOT “just” use the Low-Pass filter in the sub. It is NOT a crossover. But you be the judge. At least with this test CD you have a guide to work with. Please investigate the JL Audio CR1 crossover, here: http://www.jlaudio.com/home-audio-electronics-subwoofer-crossovers

☐ If your speakers are ported, you SHOULD close (seal) the ports. Towels will do for a test but you might consider purchasing a 3", 4", or 5" thick slab of "foam" at a notions / sewing store; then using a suitable circle template (food can, peanut butter jar, etc) mark the foam and cut with a bread knife slowly. Then spray paint with flat black barbecue paint and you will have a professional port seal. Some better brands of speakers (B&W for example) come with port plugs for just this purpose. What you are trying to accomplish is to NOT have multiple sources of differing phase relationships (the main driver, the port air, and the sub driver) at or near the crossover freq. The filter slope of both the sub and the mains should be a mirror image in both the frequency and phase domain, and there should only be two LF sources attempting to couple and *cross over*: the LF driver in your main speaker and the driver in the sub cabinet.

☐ TRACK 8: 80 Hz, 2 min @ -1dBfs Using 80 Hz is an easy way to set the relative phase of the JL Audio and other modern subwoofers to match the "mains". If you are using a different XO frequency, use that frequency track, not 80!

Next we set the phase !

☐ **Method A (easier, but less accurate)** After you have placed the sub where you want it, put YOUR HEAD equidistant between the sub and the speaker it is CLOSEST TO (for example the LEFT FRONT). Disconnect the 'other' front speaker. Play the 80 Hz tone and adjust the PHASE CONTROL of the sub and the POLARITY SWITCH until the bass is loudest and cleanest - in other words, the peak.

☐ **Method B (FAR more accurate, and more work...)** Invert the polarity of the MAIN speaker the sub is CLOSEST TO. Disconnect all the other speakers in the room. Place your head equidistant between the sub and the speaker it is closest to. Play the 80 Hz tone. Adjust the phase control AND the level control and both settings of the polarity switch until you hear a distinct NULL. (IT MIGHT EVEN DISAPPEAR COMPLETELY) There should be some setting of the two controls on the JL sub which will provide a rather sharp null - this is a CRITICAL setting and you might find it to be very sharp. Now put the wiring back the correct way to that one speaker. Reconnect the other speaker and you're done.

☐ If you have 2 subs repeat either of the above procedures with the mains speaker the 2nd sub is closest to. All the sinewave tone tracks are recorded exactly the same on both channels therefore you can disconnect either L or R speaker for your convenience.

The REASON for **Method B**? When 2 waveforms are IN PHASE and they sum they may get 6dB louder, but when 2 signals are OUT OF PHASE and they sum, theoretically they cancel completely, therefore It is much easier to hear the NULL. In practice, LF signals coming from 2 spots in a room won't sum 6dB louder; they will sum perhaps 4 or 5 dB louder, because in a home size room the summation also includes the summation / cancellation of various standing waves and reflections.

☐ By using the accurate phase test above you will AUTOMATICALLY have set both the phase (timing) and LEVEL, since it has to be both the same level and exactly out-of-phase to cancel. But remember when you are ALL done with this, inasmuch

as your "system is calibrated", there is often a huge difference in the bass level and content between different sources. You may find that DVD's are more consistent and that music CD's are all over the map. You can then arbitrarily determine any reference point you like and work + or - from there; i.e. you might have to turn your subs UP 3dB to play rock CD's and DOWN 2 dB to play SCI-FI movies. It's up to you. **Do not think because "it's calibrated" you are stuck with that setting.**

TRACK DESCRIPTIONS

☐ **TRACK 1** : Pink Noise 2 minutes @ -20dBfs The L and R channels are IDENTICAL. Because the noise is at -20dB below full scale digital, it represents the same level as "THX" or "Dolby" "reference" level. That means that when your system volume is adjusted "normally" — and this is what people typically call "reference level" — (everyone in the *consumer* industry uses a different and arbitrary scale…) you should get 85dB SPL (slow weighted C of course...) at your sweet spot chair. Do not do this test before you do the phase adjustment!

This also means the CD is ***CAPABLE*** of 20dB MORE, which translates to 105dB SPL. You may use the pink noise for overall SPL measurement. Since the 2 tracks are identical (they are bit correlated) if you are playing one channel only and you turn on the 2nd channel the room level should (on paper) sum 6 dB. However, as mentioned above, because of phase anomalies and reflections in any given home-sized room, this almost never happens, but you can expect perhaps a 3, 4, or 5 dB increase.

☐ **TRACK 2 through TRACK 17**: Tones @ -1dBfs These tracks are all recorded 1dB below the MAXIMUM POSSIBLE ON THE CD. PLEASE BE VERY CAREFUL WHEN PLAYING THESE TRACKS. The highest frequencies are first. (120, then 110, then 100, then 95 etc.) Start with your system volume very low and move it upward until the desired result is obtained. The REASON these are recorded at this level is so you can determine if your subwoofer (or mains, or headphones, or entire system etc.) is CAPABLE of playing these frequencies and at these levels.

You can therefore determine the maximum possible output from your sub and your entire system — and how it is coupling into your room — at each given frequency. YOU are responsible for the careful and judicious use of these test tones. It is theoretically possible to damage your speakers, your amp(s) or your hearing with the careless use of these test tones or of the Techmaster PEB tracks below. Please be advised.

If, when playing individual bass tones (or the Techmaster PEB tracks, below) you find various objects, air conditioning grilles, drawer pulls, art objects, lamps, neighbors, etc. vibrating then I suggest you get some **museum gel** to stop their vibration. It's available here: www.detailsart.com/museumgel.aspx .

Tracks 18 and 19 offer a quick and dirty (but not fanatically accurate) method of getting the sub and the mains at the same level. You cannot use your SPL meter with the pink noise coming from your receiver. If you do the phase part above, YOU DO NOT NEED TO USE THESE 2 TRACKS. These were ORIGINALLY intended for when everyone was obsessed with Radio Shack SPL meters and in the olden days there was no phase control, only an incorrectly labelled phase "switch" (it isn't phase; it's polarity…) on MOST brands of subs… and it was a quickie way to set LEVELS. Notice it has nothing to actually do with phase or timing - and there is the downside. You might think the levels are fine but you haven't adjusted the phase correctly. Therefore the test is *essentially* a waste of time with more modern subs, but I have included it here anyway.

☐ **TRACK 18**: HF PRE-CONTOURED Noise at -20dBfs This High Frequency noise is pre-contoured to be used with a Radio Shack or similar SPL meter when setting up a Home Theater receiver which HAS bass management. Adjust the volume control so this track is playing through the MAIN SPEAKER(S) at 85dBa (slow weighted C) at the listening position.

☐ **TRACK 19**: LF PRE-CONTOURED Noise at -20dBfs This Low frequency noise is pre-contoured to be used with a Radio Shack or similar meter when setting up a Home Theater receiver which HAS bass management. Leave the volume where it was in the Track 17 test, above, and play this track. Adjust the SUBWOOFER level so the meter (set to SLOW WEIGHTED 'C') matches the 85dB as in the test above. By using these 2 tracks, it is not necessary to do any mathematical or mental conversions... just match the levels at the listening position. Since the SPL in the room is at 85dB, and the recording is at -20, that leaves 20 dB headroom for the Dolby / THX level of 105dB for peaks. Both of these tracks are only for an approximation and are NOT NECESSARY AT ALL if you use the sine wave method above, since it is FAR more accurate.

FREE BONUS **Tracks 20 and 21** - Holly Cole - Please purchase every Holly Cole CD you can find ! She deserves it and you will love it. While the recordings themselves are all superb, they are of a different enough flavor to keep you on your toes. The bass on Jersey Girl is a *little bit* heavy, perhaps 1-1/2 dB or so too 'much'. If you carefully adjust your system then you should perceive this. If the bass seems WAY too heavy, or not heavy enough, then I will venture a guess that either or both the phase relationships and the levels of your subs are not set carefully enough.

Don't Smoke in Bed tests the limit of the plain ol' 16 bit process. Her voice should be FLAWLESS and yet the sibilants on many / some systems might sound flawed - yet the CD is actually clean and the waveforms are pristine. This is a fabulous test track to A-B different connections, i.e. compare the analog vs the coaxial digital, or RCA vs Balanced connections, vs

whatever else your player has for outputs, and choose the cleanest. Her website is here: www.hollycole.com . While you're looking for Holly Cole recordings also try and find any of the now out of print Techmaster PEB CD's. You won't be sorry.

FREE BONUS TEST **Tracks 22, 23, 24** - Techmaster PEB – Newtown Records and Techmaster PEB were at the heart of the Bass Revolution, which started in Florida in the early 90's (!!!). Their work remains at the top of every list: engineering, musicality, style, quality, production. Track 24 is the Ultimate Bass test. If your system cannot play this at 105 dB it is either set up incorrectly or you need JL Audio Subwoofers! (and you need them correctly set up…)You can damage ANY brand of sub or main speakers with these tracks if abused. Be careful! Guess what: these tracks are from 1993 and are completely analog. And are still valid!

☐ **TRACK 25** - **White Noise, LR 4 min @-20dBfs.** Both channels are sample-accurate / identical.

☐ **TRACK 26** - **White Noise, LR, 180 degrees Out of Phase, 4 min @-20dBfs.** For use with HDMI connections, where you can't use "Y" cords, or if you CAN'T get at your actual speaker connections, or perhaps you have bi-wired mains and it's just way too much trouble to reverse the polarity of one side.

To use these, see my WHITE NOISE test section, on the next page.

☐ **TRACK 27**, the BLIP test. This test is quite unique. It presents one BLIP every 2 seconds. That BLIP is 1/2 a cycle of an 80 Hz sinewave, only going in the positive direction. It has a duration of 6.5 msec. Therefore that waveform looks like this:

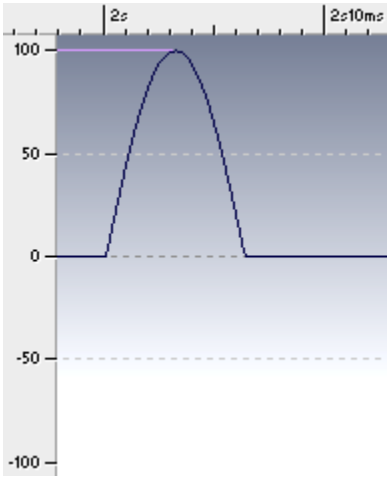


Fig. 1 "BLIP" signal

Notice the BLIP is POSITIVE-GOING (only) and the top of the sine wave is exactly at 100%, therefore this represents full possible level (modulation) on the TEST CD, i.e. 0dBfs. When you play this BLIP Test, the "end result" of the phase of your system, sometimes called absolute polarity, should make the Low Frequency cones move OUTWARD. This is also a fascinating, superb, and rather severe test to determine the delay time of the subwoofer relative to the rest of your system. As carefully outlined in my SUBS white paper, if your sub is 360 degrees (or even 720 degrees) late, you cannot measure it with a frequency-measuring device, and you will think the frequency response is flat but the impulse response will be smeared. That is the most important reason why measuring in the frequency domain is largely a waste of time, unless you FIRST fix the time domain.

Since this signal is at 80 Hz, and your crossover is set to 80 Hz, you should be able to hear this signal from either/both your mains and your sub(s). Therefore if you turn the volume down on the sub(s), you can use this test to determine absolute timing of other parts of the system. This will "rough in" speaker distance timing, and then you can use the WHITE NOISE test (below, and on the white noise page, here: www.soundoctor.com/testcd/whitenoise.htm), to really fine tune. Yes this blip test is a very obscure test.

Ideally, with this POSITIVE-GOING waveform, your low freq speaker cones and sub should move OUT of the cabinet towards you. This gives you the correct "absolute polarity" air pressure wave just as if it was coming from the front head of a kick drum, for example. Be aware that some / many records have gone through the entire recording / mixing / mastering process and have the WRONG polarity. It's interesting, but don't obsess about it too much… Do not be dismayed if you are totally confused by this track. Those of you enamored with audiophile headphones will find the comparison of this track on headphones vs speakers to be interesting.

FREE BONUS **Track 28** - a surprise or multiple surprises each time. Fun bass, sample music, and dynamic snippets...

Using white noise to learn, aim, and adjust speakers

Here is a method for "aiming" (and learning) the focus (imaging) of speakers — for determining the splay angle AND the "lobe" of the sound coming out of [any] speaker. This method is ***far*** more accurate than ANYTHING else, including lasers or tape measures. Doing it with your ears with this procedure takes EVERYTHING into account, including interchannel digital delays, latency, or anomalies, circuit group delay, phase shifts, if any, anywhere in the chain, including passive or active crossovers, and it also takes into account mechanical interchannel timing issues (often somewhat incorrectly called time alignment) caused by the simple fact that the speakers or the drivers are different distances from your face.

The physically larger your speakers are, such as with 7 foot tall floorstanders or large electrostatic panels, the more sensitive and revealing this test is. However this test is still very useful with smaller speakers such as 2-way "bookshelf" speakers, and VERY useful with very large systems such as clubs, discos, line arrays, halls, etc.

The procedure is this:

☐ 1) Use the WHITE (not pink) Noise Track #25 on the TEST CD. The track is now 4 MINUTES and "stereo" (Both channels are sample-accurate / identical, in-phase) and are recorded at -20dBFS.

Please note that -20dBFS (20 decibels below Full Scale Digital) is so-called "REFERENCE LEVEL".

Please be aware that OTHER tracks on the CD are recorded 19dB HOTTER, at -1dBFS. Set your CD player to NOT continue to the next track(s) ! However, if you play the white noise at 75dB, then even if the other tracks play they will not be louder than 95dB, so no damage will be done. (Nor will you be surprised!)

☐ 2) Ideally, use a separate CD (or DVD) player with ANALOG OUTPUTS. Connect ONE analog output (the LEFT CHANNEL) to a number of "Y" cords. You SHOULD do it this way . DO NOT use both the L and R outputs of the CD player and DO NOT attempt to use "mono" switches in the receiver or preamp. The setup should look like this:

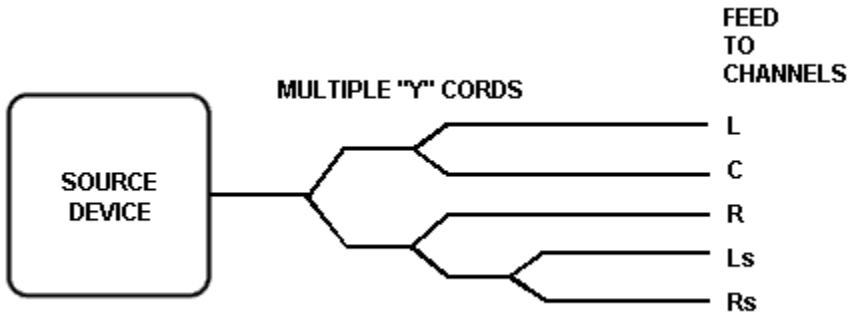


Fig 2. Method of using Y-cord adapters for multiple feeds.

This is the same thing as "daisy chaining" * and also the same thing as "connecting all the inputs in parallel".
* "daisy chaining" is a *ridiculously* untechnical phrase. Please do not use it.

☐ 2a) If you have a CD player where you CAN use the analog outputs (especially for a 2-channel setup) then use TRACK 25 (which has the L and R IN phase) for in-phase tests.

☐ 3) If you have a CD player where you CANNOT use the analog outputs then use an HDMI connection (or digital coax) and use TRACK 26 which has the L and R OUT of phase with each other when doing the cancellation test(s) (steps 15 + 16)

☐ 4) Disconnect the sub or turn its power off.

☐ 5) Make sure the TREBLE controls for each channel are set at "0". If your receiver or preamp has level trim adjustments, make sure they are all set the same, preferably to unity gain.

☐ 6) If you have the ability, I suggest turning all the BASS levels all the way down. If you are attempting to learn the splay pattern of speakers which are a flat panel, such as electrostatics (Quad, Sound Lab, Magnepan, Martin Logan, etc) then you might want do a separate test with the bass at "0" (or higher) in order to learn how the lower frequencies leave the dipole and bounce off the wall behind the speaker. But for now, please do the test with the bass turned down.

Since the wavelengths at high frequencies are so small, by turning the bass down you are simply removing the longer wavelengths from your auditory test. Please see my frequency-to-wavelength chart here: (it's also included in these papers)

www.soundoctor.com/freq.htm

☐ 7) If you have channel "delays" (sometimes called "distance settings" in a Home Theater receiver), MAKE SURE they are set ALL THE SAME. I suggest setting the distance settings for the ALL the TOP speakers (L C R Ls Rs) at 7 feet as the entire concept and in many cases the execution (bass management pickoff spot) is flawed. However, you CAN use this concept to "fix" the inherent group delay in a powered, sealed subwoofer, by adding an equivalent delay to all the top speakers to match the sub's delay. Please see my white paper here: www.soundoctor.com/whitepapers/subs.htm .

☐ 8) Make sure that the noise floor of the room is quieter than perhaps 50 to 55 dBA Slow weighted C. Turn off fans and air conditioners. The signal you will be listening to should be perhaps 18 - 20 dB louder than the noise floor of the room. The objective is to get the test signal loud enough to understand but not so loud that you get a headache, and not so loud that you excite room modes, which is another whole topic of discussion.

☐ 9) Plug in the LEFT channel only (for example, use the AUX ins, sometimes listed as "analog 5.1 inputs".) Advance the main volume control to give a MODERATE level in the room. My suggestion is to use about 70 - 75 dB SPL (use Slow weighted C), not higher than 85 dB. If you are using an HDMI / coax connection you will have to disconnect one speaker.

☐ 10) Start by sitting in your "sweet spot" chair. Now stand up. Try and discern the difference in the splay lobe from your SEATED to STANDING POSITION. You might hear a frequency change; you might hear some combing, especially if you have a tall line array. Notice that even if you DO hear a combing effect, you cannot hear it unless your body is moving! This is one reason why no one complains about multiple-driver combing in real-life use: you are not usually getting up and sitting down while listening critically.

☐ 11) Now walk around the L speaker in an arc and try to discern the high frequency splay or lobe pattern of the speaker. Learn the sound of the speaker from far away, to closer, until you get to the real near field, say, closer than 1 meter (3 feet). Get a feel for BOTH how the speaker is sending the waves out and HOW THEY ARE REACTING WITH THE ROOM. You should be able to discern the splay pattern of the speaker and get a mental picture of the sound almost as if it were a "theatrical flood" or "spotlight". Cup your ears so they are directional and face the back wall of the room and try to determine what sound, if any, is reflecting from back there.

☐ 12) Sit in the sweet spot and cup your ears and try and discern what is bouncing off the 1st reflection point on the side wall. Typically this is the most important spot to have a wideband absorber. Since the path length from each speaker to the side wall is different than the path length from the speaker to your face, the summation of these out-of-time (and therefore out-of phase) signals will often produce comb-filtering anomalies. There are also reflection areas on the floor between you and the speaker, and on the ceiling as well. You might be able to hear the localized reflection(s) by cupping your ears and directing your attention to the area in question. Another method to determine side reflections is to have a 2nd person hold a mirror flat on the wall on the sides until you can see the front of the speaker in the mirror when you are sitting in your chair. That is therefore the "main" spot to apply absorbtive treatment; specifically a wideband absorber.

☐ 13) Turn OFF the L and turn ON the R. Do the same test again with the Right channel.

☐ 14) Now turn on BOTH the L and R. Plug the Y cord into the L and R inputs. Assuming for the moment that the L speaker is already positioned "where it belongs" then have another person move the OTHER speaker (the R) while you are listening in the sweet spot. When the R speaker is aimed into the room correctly so it matches the L speaker, the high frequency signal should SNAP TO A "DOT" in the center. You should perceive a small "dot" of sound — NOT a large diffused ball or indeterminate globule of noise that seems to be everywhere. If you cannot get the sound to become this "dot" then something is wrong. It could be the wiring, the receiver, and of course the speakers and the room acoustics, but typically it is a combination of aiming and reflections which diffuses the focus. Once this focus is achieved your imaging should be better, if not uncanny.

☐ 15) The test above has the speakers set up "normally", that is, wired correctly, IN POLARITY with each other; (often incorrectly called IN PHASE) Now we are going to try a MUCH more critical test. Reverse the POLARITY of one of the speakers. If you are calling the LEFT channel the "reference channel" as far as positioning goes, then reverse the wiring to the RIGHT speaker, in case you accidently move it a little bit. Now the speakers are OUT OF POLARITY with each other.

☐ 16) Since the speakers are OUT OF POLARITY with each other, when you play the white noise through BOTH you should hear a NULL, i.e. "nothing". The more accurately you perform this test, the more the 2 sources will cancel out. If you still hear a loud diffused glob of sound then something else is wrong - I have been surprised many times that in a speaker that is a line array, ONE driver might be wired incorrectly. Leaving the LEFT channel in its reference position, have the other person adjust the RIGHT speaker. As the right speaker is pivoted and tilted, you should be able to mechanically "tune" it until the null becomes the sharpest. We can only assume (or hope) that whatever the internal [passive] crossover in your main speaker is — and that entire cabinet is an electro-mechanical and physical entity — the manufacturer has correctly set it up!

Note: When you SUM 2 "exactly the same" signals IN phase (in polarity) they algebraically sum so that the net result is 6dB louder, or twice the voltage or Sound Pressure Level. When you sum 2 signals OUT OF POLARITY they cancel completely, which would literally be 50 or 60 dB (or more) weaker. That is why it is so much easier to hear a NULL rather than a PEAK.

As a further corollary, when you add 2 speakers together in a room, because of the typically de-correlated signals AND the fact that the speakers are spaced apart and have slightly differing coupling modes to the room, do NOT expect a 6dB increase in the room; expect *maybe* a 4 or 5 dB increase. This is one reason why you are using y-cords; so there is absolute correlation to start with, which then passes through all the circuitry and anomalies in your system.

☐ 17) If you have electrostatic panels, this is where the tilt adjustment, both vertically and toe-in become most critical. Since the surfaces are FLAT and since the same signal is emanating from everywhere on the surface, this test becomes remarkably sensitive and you should be able to discern cancellation changes on the order of 1/4". It may take some time to learn this phenomena. IF your speakers are on a carpet then this is the ONLY time I would ever suggest using (and adjusting) spikes. In any event, you don't want the springback of the carpet to interfere with your tests. You want both speakers to be rock steady, and to stay where you put them

☐ 18) Also, with flat panel / electrostatic speakers, since they are dipoles there is an equal sound coming off the back, and hitting the wall behind the speaker, then bouncing around forward. When you turned the bass down earlier you are only listening to the higher frequencies coming off the panel. I suggest (read my SUBS white paper again...) that you completely absorb the back wave from a flat panel dipole and only attempt to match a sub up with the front wave; you will get FAR better imaging.

☐ 19) Put the polarity of the Right Channel back where it belongs.

☐ 20) If you have a Home Theater 5.1 setup, after you are FINISHED determining the L and R signals, listen to the C channel by itself. Then have someone else change back and forth between both the L and R wires and the C wire only. Now you are listening to determine how the REAL C sounds relative to how the PHANTOM C sounds. This part of the test is extremely critical. It will immediately point out room and acoustic issues which might smear the sound such as early reflections from the side walls and other reflections. Please note that in movie DVD's, the L and R are for Music & Effects and the C is for dialog. There is NO panning correlation that takes place between L C and R. Music is panned LR. This is another reason why attempting to set the speaker distances to real-room measurements is wrong; typically the signals coming from the LR, and C and Ls Rs have very little to do with each other. It is only the LR that are phase correlated.

☐ 21) Remember that you are going to try to get a number of perceptions:

☐ a) The direct signal from the L

☐ b) The direct signal from the R

☐ c) The direct signal from the C channel

☐ d) The PHANTOM CENTER channel image from the acoustic summation of the L and R

☐ e) Early reflections, such as off the side walls.

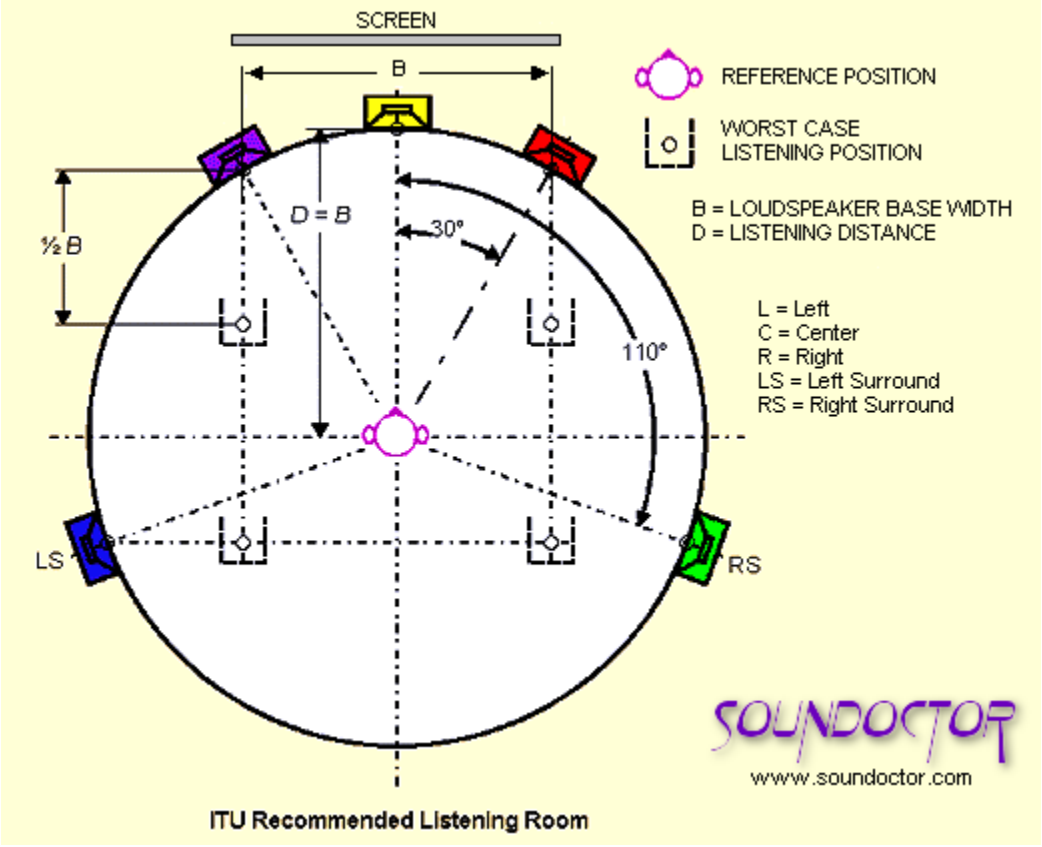
☐ f) The reverberant field

☐ g) The later echo field, including flutter echo and reflection(s) off the back wall.

☐ 22) Do not be surprised if you think you are getting results from this test that you may consider odd. This test is probably the MOST sensitive test you can ever do where your hearing is part of the measuring equipment.

☐ When switching between the C only (the 'real' center channel) and L and R only (the 'phantom center'), this is a VERY sensitive way to adjust the inter-channel balance. If you have trouble understanding dialog, turn the C up 1dB or so and turn the LR down 1dB or so.

☐ 23) If you have a Home Theater setup, when you are finished with the LCR part of the system, it is helpful and educational to learn how the Ls Rs are splaying into the room as well. One interesting test is to have someone hold the speaker at your ear level while you are sitting down and they then move in an arc from 90 degrees to 165 degrees when measured from the Center channel line, as in the diagram below. Note the Rs is shown at 110 degrees of arc from the C.



☐ You will usually find that the best place for the Ls Rs is when they are in the 'psychological' null of the listener which roughly corresponds to the acoustic null of the listener as well. This gives the smoothest surround field.

☐ 24) What does this mean? If and when sounds are from directly behind you, they tend to draw your attention AWAY from the movie and may be frightening to young children and elderly people, who are not prepared to expect loud noises from behind. The other extreme is sounds coming from directly to your left and right (90 degrees) which again, make you turn your head and turn your attention AWAY from the movie. But at an angle of about 110 degrees, something amazing happens: those sounds are no longer frightening and no longer divert the attention away from where it belongs, but they are integrated smoothly into the theatrical experience, and they integrate into the "surround field" smoothly.

☐ 25) Using this white noise test, you are now able to discern the splay pattern of your surrounds and how they are integrating into the room. If you have surrounds which may be switched or changed between front-firing to dipole mode to Tripole mode (such as M&K's) then you will find this part of the test to be exceptionally interesting.

These series of tests are not only very accurate but a rather inexpensive way (i.e. NO test equipment is required, other than your ears and some Y cords...) to get VERY precise results.

Good luck with your acoustics tests! And feel free to contact me with any questions.

These pages updated 7/16//2021

www.soundoctor.com email: barry@soundoctor.com

Barry's Handy Frequency-To-Wavelength-To-Period Chart V 3.11 at www.soundoctor.com/freq.htm

SEMITONE >	0	1	2	3	4	5	6	7	8	9	10	11	12
NOTE >	A	Bb	B	C	Db	D	Eb	E	F	F#	G	Ab	A
FREQ.	14080	14917	15804	16744	17739	18794	19912	21096	22350	23679	25087	26579	28159
INCH	0.96	0.91	0.86	0.81	0.76	0.72	0.68	0.64	0.61	0.57	0.54	0.51	0.48
PERIOD	71 usec	67 usec	66.3 usec	59.7 usec	56.3 usec	53.2 usec	50.2 usec	47.4 usec	44.7 usec	42.2 usec	39.9 usec	37.6 usec	35.5 usec
FREQ.	7040	7459	7902	8372	8870	9397	9956	10548	11175	11840	12544	13290	14080
INCH	1.93	1.82	1.72	1.62	1.53	1.44	1.36	1.29	1.21	1.15	1.08	1.02	0.96
PERIOD	142 usec	134 usec	126 usec	119 usec	113 usec	106 usec	100 usec	94.8 usec	89.4 usec	84.5 usec	79.7 usec	75.2 usec	71 usec
FREQ.	3520	3729	3951	4186 (C8)	4435	4699	4978	5274	5588	5920	6272	6645	7040
INCH	3.85	3.64	3.43	3.24	3.06	2.89	2.72	2.57	2.43	2.29	2.16	2.04	1.93
PERIOD	284 usec	268 usec	253 usec	239 usec	225 usec	213 usec	201 usec	190 usec	179 usec	169 usec	159 usec	150 usec	142 usec
FREQ.	1760	1865	1976	2093 C7)	2217	2349	2489	2637	2794	2960	3136	3322	3520
INCH	7.70	7.27	6.86	6.48	6.12	5.77	5.45	5.14	4.85	4.58	4.32	4.08	3.85
FEET	0.64	0.61	0.57	0.54	0.51	0.48	0.45	0.43	0.40	0.38	0.36	0.34	0.32
PERIOD	568 usec	536 usec	506 usec	477 usec	451 usec	426 usec	402 usec	379 usec	358 usec	338 usec	319 usec	301 usec	284 usec
FREQ.	880	932	988	1047 (C6)	1109	1175	1245	1319	1397	1480	1568	1661	1760
INCH	15.41	14.54	13.73	12.96	12.23	11.54	10.90	10.28	9.71	9.16	8.65	8.16	7.70
FEET	1.28	1.21	1.14	1.08	1.02	0.96	0.91	0.86	0.81	0.76	0.72	0.68	0.64
PERIOD	1.14 msec	1.07 msec	1.01 msec	955 usec	901 usec	851 usec	803 usec	758 usec	715 usec	676 usec	638 usec	602 usec	568 usec
FREQ.	440	466	494	523 (C5)	554	587	622	659	698	740	784	831	880
INCH	30.82	29.09	27.46	25.91	24.46	23.09	21.79	20.57	19.41	18.32	17.30	16.33	15.41
FEET	2.57	2.42	2.29	2.16	2.04	1.92	1.82	1.71	1.62	1.53	1.44	1.36	1.28
PERIOD	2.27 msec	2.1 msec	2 msec	1.9 msec	1.8 msec	1.7 msec	1.6 msec	1.5 msec	1.4 msec	1.35 msec	1.28 msec	1.2 msec	1.14 msec
FREQ.	220.0	233.1	246.9	261.6 (C4)	277.2	293.7	311.1	329.6	349.2	370.0	392.0	415.3	440.0
FEET	5.1	4.8	4.6	4.3	4.1	3.8	3.6	3.4	3.2	3.1	2.9	2.7	2.6
PERIOD	4.54 msec	4.3 msec	4 msec	3.8 msec	3.6 msec	3.4 msec	3.2 msec	3 msec	2.9 msec	2.7 msec	2.55 msec	2.4 msec	2.27 msec
FREQ.	110.0	116.5	123.5	130.8 (C3)	138.6	146.8	155.6	164.8	174.6	185.0	196.0	207.7	220.0
FEET	10.3	9.7	9.2	8.6	8.2	7.7	7.3	6.9	6.5	6.1	5.8	5.4	5.1
PERIOD	9.1 msec	8.6 msec	8.1 msec	7.6 msec	7.2 msec	6.8 msec	6.4 msec	6 msec	5.7 msec	5.4 msec	5.1 msec	4.8 msec	4.54 msec
FREQ.	55.0	58.3	61.7	65.4 (C2)	69.3	73.4	77.8	82.4	87.3	92.5	98.0	103.8	110.0
FEET	20.5	19.4	18.3	17.3	16.3	15.4	14.5	13.7	12.9	12.2	11.5	10.9	10.3
PERIOD	18.2 msec	17.2 msec	16.2 msec	15.3 msec	14.4 msec	13.6 msec	12.9 msec	12.1 msec	11.5 msec	10.8 msec	10.2 msec	9.6 msec	9.1 msec
FREQ.	27.5	29.1	30.9	32.7 (C1)	34.6	36.7	38.9	41.2	43.7	46.2	49.0	51.9	55.0
FEET	41.1	38.8	36.6	34.6	32.6	30.8	29.1	27.4	25.9	24.4	23.1	21.8	20.5
PERIOD	36.3 msec	34.4 msec	32.4 msec	30.6 msec	28.9 msec	27.2 msec	25.7 msec	24.3 msec	22.9 msec	21.6 msec	20.4 msec	19.3 msec	18.2 msec
FREQ.	13.75	14.6	15.4	16.4 (C0)	17.3	18.4	19.4	20.6	21.8	23.1	24.5	26.0	27.5
FEET	82.2	77.6	73.2	69.1	65.2	61.6	58.1	54.8	51.8	48.9	46.1	43.5	41.1
PERIOD	73 msec	68.5 msec	65 msec	61 msec	57.8 msec	54.3 msec	51.5 msec	48.5 msec	45.9 msec	43.2 msec	40.8 msec	38.4 msec	36.3 msec
FREQ.	6.9	7.3	7.7	8.2	8.7	9.2	9.7	10.3	10.9	11.6	12.2	13.0	13.75
FEET	164.4	155.1	146.4	138.2	130.5	123.1	116.2	109.7	103.5	97.7	92.2	87.1	82.2
PERIOD	145 msec	137 msec	130 msec	122 msec	115 msec	109 msec	103 msec	97 msec	92 msec	86 msec	82 msec	77 msec	73 msec

Barry's Handy Frequency-To-Wavelength-To-Period Chart V 3.11 at www.soundoctor.com/freq.htm

SEMITONES = the 12TH ROOT OF 2 = 1.O59463O94 x the PREVIOUS freq;
THE RECIPROCAL OF WHICH IS .943874312

This is a frequency and wavelength chart for real (and extrapolated out to beyond real) musical notes. Notice the lower frequencies are in [decimal] feet, the middle frequencies are in BOTH feet and inches and the highest frequencies are in inches only, for convenience.

The most recent addition is the period row! This assists in determining alignments in time for everything from subwoofers to individual drivers. msec = milliseconds; usec = microseconds. A VERY important point: the period is of course for a full wavelength. That means if you had a subwoofer with a group delay of 10 msec it would be a full wavelength late (360 degrees late) at 100 Hz. If you were to only measure using "frequency response" you might think the frequency response is "flat" or "neutral" however the far more important "impulse response" is off. Since 80 Hz is often the main freq of interest, it's wavelength is 14 feet and it's period is 12.5 msec. I'm going to do an even freq page and a 1/3 octave iso band page... "soon".

The boxes closest to 20 Hz and 20 KHz, the defined limits to human hearing, have pink backgrounds. A-440 is in a YELLOW box.

The area around 80-90 Hz, the suggested crossover freq area for Home theater /surround systems / subwoofers has 3 boxes marked in a recognizable tan color.

The fundamental frequency of the lowest note on a regular piano = A0 = 27.5 Hz and the highest is C8=4186 Hz. These boxes are white on black. The Boesendorfer Model 290 has 9 extra sub-bass notes down to the low C (C0) at 16.4 Hz.

FULL WAVELENGTHS ARE SHOWN. REMEMBER A HALF WAVELENGTH IS HALF AS LONG.

Since sound travels at about 1130 ft/sec at approx 68 degrees F, a frequency of 1130 Hz would have a wavelength of a foot. The closest box is in GREEN so it's easier to find.

The numbers shown are "fundamental" frequencies. The physical characteristic that enables your hearing to determine the difference between an "A" note played on a trumpet, a piano, a guitar, and a clarinet is due to the fact that each instrument has combinations of harmonics, both even and odd ordered. It is the ratio and the loudness envelope (attack / decay / sustain / release) of each of these harmonics, all playing in unison, which enables us to tell the difference between instruments.

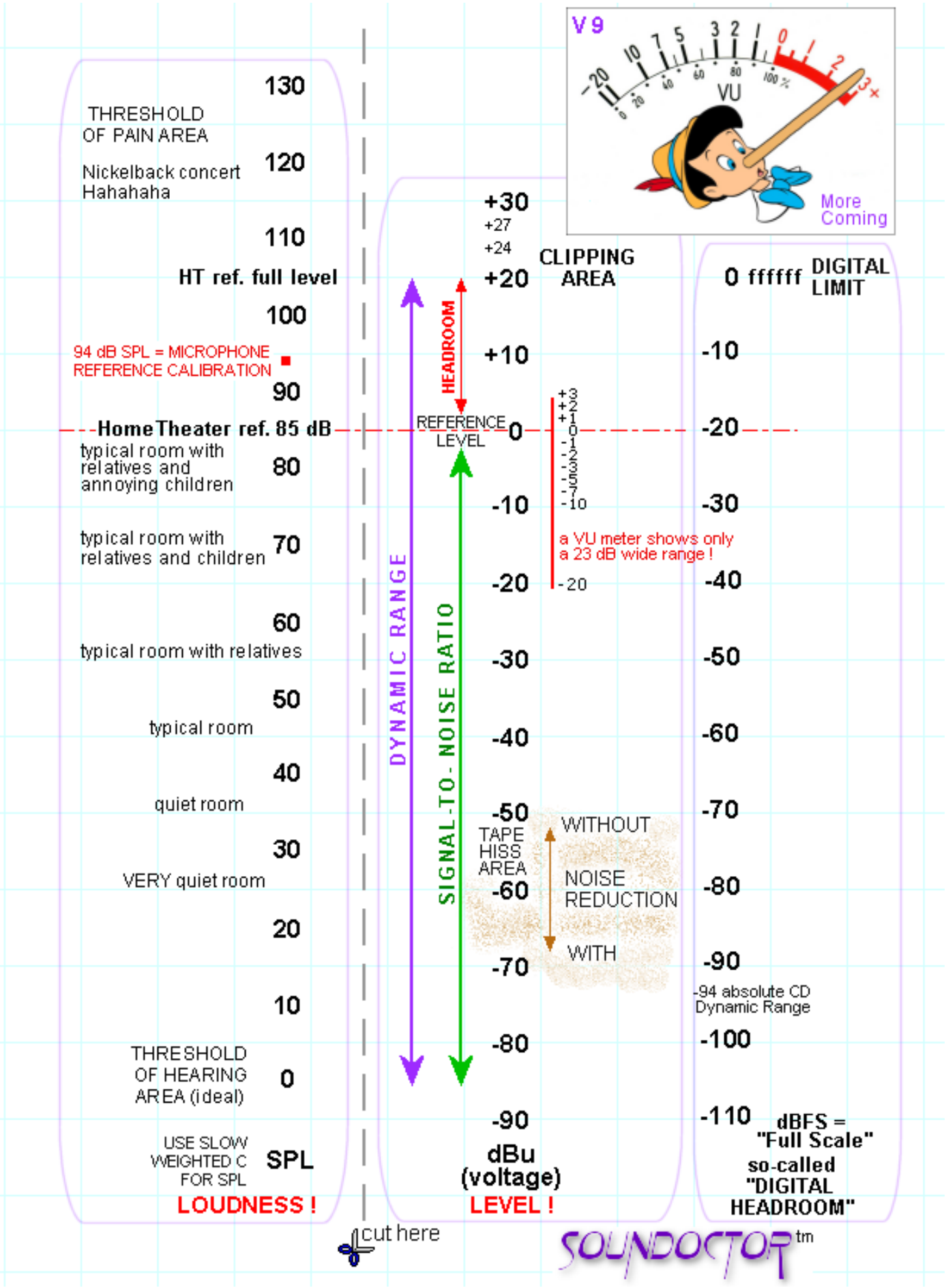
Only pure sine waves from a generator (or computer) are their stated numerical frequency. A "middle C" on a piano has a fundamental of 261.6 Hz, but also various combinations of both even numbered and odd numbered harmonics, typically all the way up to 16744 Hz. That's the 64th harmonic !

...and to see my entire blog about the speed of sound, go HERE:
http://www.bostonaudiosociety.org/barrys_page.htm#SPEEDFREQ

The current additional bonus sample track listings for the CD run batch :

Track 28: very short plucked bass solo recorded direct to board (that means NOT with a microphone)
Track 29: Famous Jurassic Park quick stomp and waterglass scene from 1993!
Track 30: Chinese Drums excerpt DEMO, stunning digital recording and noise floor.
Track 31: Marilyn Manson *Pale Emperor* track 1 DEMO
Track 32: Boz Scaggs *Thanks To You* excerpt. PLEASE buy his albums.
Track 33: Boz Scaggs *Skylark* excerpt. PLEASE buy his albums.
Track 34: Greg Brown *Bucket* DEMO excerpt from the album *The Evening Call*
Track 35: *Moot* bowed cello DEMO from Glen Moore *Nude Bass Ascending*
Track 36: Double bass bowed DEMO excerpt. Wait for it…

And don’t forget the fantastic Holly Cole, whose CD’s are wonderful collectors items!


V 9
VU
More Coming
130
THRESHOLD OF PAIN AREA
Nickelback concert Hahahaha
120
110
HT ref. full level
100
94 dB SPL = MICROPHONE REFERENCE CALIBRATION
90
Home Theater ref. 85 dB
typical room with relatives and annoying children
80
typical room with relatives and children
70
60
typical room with relatives
50
typical room
40
quiet room
30
VERY quiet room
20
10
THRESHOLD OF HEARING AREA (ideal)
0
USE SLOW WEIGHTED C FOR SPL
SPL
LOUDNESS !
+30
+27
+24
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
dBu (voltage)
LEVEL !
CLIPPING AREA
HEADROOM
REFERENCE LEVEL
DYNAMIC RANGE
SIGNAL-TO-NOISE RATIO
TAPE HISS AREA
WITHOUT
NOISE REDUCTION
WITH
a VU meter shows only a 23 dB wide range !
0 ffffff DIGITAL LIMIT
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-94 absolute CD Dynamic Range
dBFS = "Full Scale" so-called "DIGITAL HEADROOM"
cut here
SOUNDOCTOR tm