

Common Autosound Quality Errors

Abstract: Tom Nousaine has tested over a thousand OEM and aftermarket car sound systems over the past 20 years. He discloses the most common sound quality errors found in automotive audio systems in terms of tonal balance, spatial and dynamic attributes.

Background: Automotive Audio systems have been evaluated using the Listening Technology method originally developed at DLC Design in Michigan. The system rates 38 individual sound quality attributes on a numerical scale of 1 to 5 compared to a reference high quality home audio system. The individual scores are combined on a spreadsheet and weighted in order of importance to reproduce a single numerical score for each car. All systems are evaluated while the vehicle is being driven at approximately 45 miles per hour on suburban streets or test tracks with both front seats occupied.

Tonal Balance:

Tonal balance is the most important sound quality attribute category defining whether the system can produce natural sound quality. By far, the single most common sound quality error is uneven bass where individual or small groups of low frequencies will be rendered either too loudly or not loudly enough. This condition occurred in over half the vehicles tested in the last two years. Another common, but less prevalent (roughly one of every five vehicles), problem area is excessive sibilance where the vocalization of the letter S or similar sound has an annoying tearing quality.

Uneven Bass: The first case, where certain frequencies are too loud, will usually be characterized by individual notes lacking distinctiveness or tending to sound unnaturally similar having “One Note Bass.” Voices may also seem to have over emphasized baritone quality. On the other hand, different bass frequencies may sometimes seem to be unnaturally soft or even absent. The latter case can be heard in walking bass lines on acoustic bass instruments where some notes are natural while others all but disappear. It should be noted that these conditions are different from excessive bass, lack of bass or insufficient bass extension.

Excessive Sibilance: There are recordings, in particular with female voice, where the pronunciation of “s” sounds will have a shrill strident quality. This is similar to the “fingernails on a chalkboard” but at a higher frequency.

Occasionally the effect will also occur with male voice. With many systems this effect may also overemphasize percussive instruments such as cymbal.

Spatial Rendition:

Many vehicles will have significant spatial rendition shortcomings but the most common are near-side-bias, masking of low level ambience and a lack of frontal stage depth.

Near Side Bias: This condition, found in well over half the vehicles evaluated in the past two years, occurs when the soundstage is unnaturally formed on or toward the near door. For driver side listeners this often has the center image appearing directly in front of the driver but the left side of the soundstage foreshortened with individual images sandwiched between the center image and the driver door. This often leaves a “hole” in the soundstage between center and the far right of the soundstage where no instruments, ambience or voices can be heard.

Typically the situation is exaggerated for the passenger seat listener where the right side soundstage images are stacked up on, or sometimes pulled downward, into the passenger side door itself. Both of these conditions frequently are accompanied by poorly defined center images.

Masking of Subtle Reverberation and Ambience: Another common problem is the masking of ambience and subtle reverberation by vehicle and environmental noise. The condition occurred in roughly a quarter of the vehicles tested in recent years.

Lack of Frontal Stage Depth: A typical condition is that, although the soundstage is firmly placed in front of the front seat listeners, the stage itself is placed unnaturally close to the listeners face with little sense of frontal depth to the stage. That is, all the instruments in an orchestra seem to be at the very front of the sound stage and the listener feels placed too close to the orchestra itself. The condition is quite common, occurring in all vehicles with near side bias.

Dynamics: Modern systems usually have adequate loudness but it is still relatively common for systems to display compression artifacts and high volume distortion on programs that have wide dynamic range or intense

deep low frequency content. In recent times such conditions were encountered in roughly one out of every five vehicles tested.

Summary: The addition of multichannel systems, with center channel speakers in premium systems seems to be ameliorating the occurrence and intensity of soundstage and imaging issues while the tonal balance and distortion characteristics have remained roughly constant over the last several years. I believe that some of the errors are a function of system tuning that may not rely on a driven listening verification; that is, many systems appear to be tuned in a bay without even the engine even running so the system will nearly always sound quite different when being driven.

References:

Clark, David L; “Listening Technology for Automotive Sound Systems”
AES 114th Convention, March 2003

“Uneven Bass Reproduction in Automobiles” W19 Workshop, AES 123rd
Convention, October 2007

“Near Side Bias” W4 Workshop, AES 122nd Convention, May 2007

Typical Vehicle Scoring including Common Sound Quality Errors

Vehicle/Sound System/Seats _____ Vehicle Illustration - Typical Scores including Common SQ Errors _____

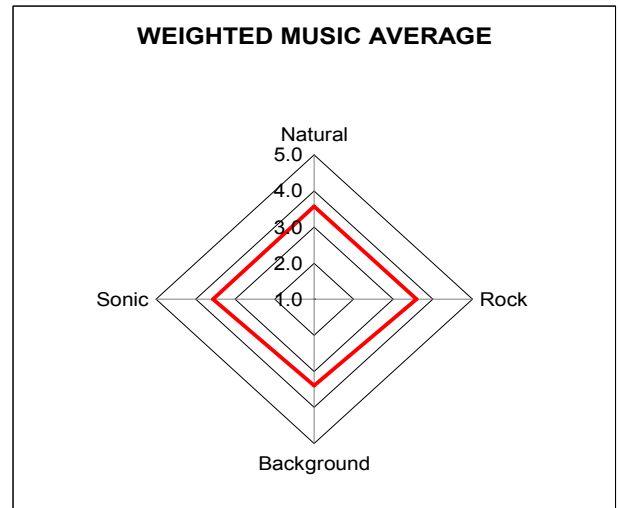
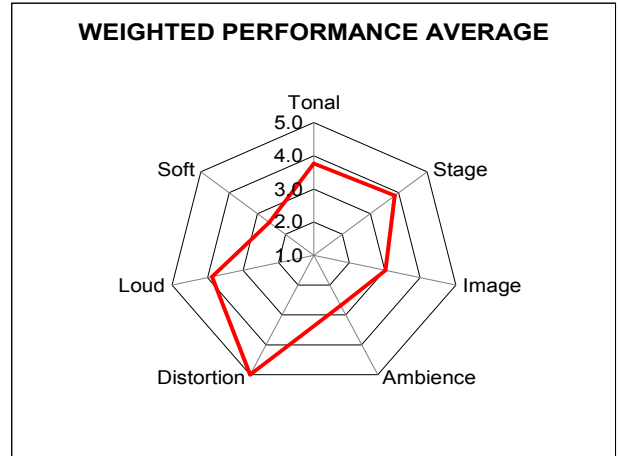
Date/Name/Controls _____

June 4, 2009 tn _____

Kill? _____

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	FORE	BACK	Weighted PERF.
1 Tonal balance			3.8
1.1 Octave balance	3.5	3	
1.2 Narrow band peakiness	4		
1.3 Balance, bass to treble	4		
1.4 High-frequency extension	4		
1.5 Low-frequency extension	4		
2 Sound stage			3.9
2.1 F/B stage	4		
2.2 U/D stage	4		
2.3 Stage symmetry	3.5		
2.4 Stage width	4		
3 Image			3.0
3.1 L,C,R image distribution	3		
3.2 L,C,R localization	3		
3.3 Depth localization	2.5		
3.4 Image separation	4		
3.5 Split stage / stability	4		
4 Ambience			2.7
4.1 Open, transparent	2.5		
4.2 Envelopment	2.5		
4.3 Size of space	2.5		
4.4 Ambience spectral bal.*	5		
4.5 Free of phaseyness*	5		
5 Distortion and noise			5.0
5.1 Time distortion	5		
5.2 Volume distortion	5		
5.3 Ringing / coloration	5		
5.4 Interference / whine / clicks	5		
5.5 Artifacts / flutter	5		
6 Maximum output			3.9
6.1 Maximum loudness	4		
6.2 System gain	4		
6.3 Punch	4		
6.4 Compression artifacts	3.5		
6.5 Intermodulation	4		
6.6 Dynamic spectral shift	4		
6.7 High volume distortion	3.5		
6.8 Trim buzz	4		
6.9 Free of strain / glare	4		
7 Soft clarity			2.6
7.1 Soft clarity	2.5		
7.2 Intelligibility	3	2.5	
7.3 Contends with road noise	2.5		
Additional observations			
Road noise	2.5		



Natural	3.6
Rock	3.6
Back	3.4
Sonic	3.6
Weighted music aveg.	3.5