HDSS™ - THE HIGH DEFINITION SOUND STANDARD

HDTV allows high-resolution electronic digital video signals to be shown as intended. However, the high definition viewing experience is flawed without the accompanying sound having a similar degree of resolution. There are no objectively comparable sound-monitoring devices for High Definition Audio (HDA).

Audiophiles and the supporting high-end industry have typically sought solutions for the monitoring of high- resolution audio however their efforts have produced results which are highly subjective, difficult to replicate and have no consideration for cost or size. The **HDSS™** standard must accomplish what the high-end industry is attempting to achieve in simple objective monitors that replicate HDA sonically. In essence, the sound must be reproduced as objectively as the picture for all situations. In the simplest applications the human voice should be naturally intelligible.

The official name for **HDSS™** certified speakers is that of HDSS™ **Audio Monitor.** Size is a consideration for effective general application of **HDSS™** audio monitors when they must be externally added to an existing product. Small size also considers all of the necessary elements for full **HDSS™** certification. Larger **HDSS™** qualified products will typically deviate from the standard by nature of design. Embedded speaker products can qualify for **HDSS™** certification but typically not 100% as they are fixed in position.

DIGITAL AUDIO MEDIA:

HDA is available for transmission, recording and playback but at the point of audible playback the high resolution of the electronic signals is obscured by loudspeaker distortions. The preservation of the original audio signal is enhanced due to high sampling rate digital technology while no attempt is made to improve loudspeaker resolution. Currently extremely high-resolution digital files such as SACD and DVD audio have no monitoring standard to assure that their detail will be heard. All digital audio files, even lossy, are enhanced with higher resolution at the loudspeaker. Presently HDA is only resolved objectively using high quality headphones, which is not the goal of sound content producers.

DIGITAL TELEVISION AUDIO:

HDA/HDTV must be monitored using high-resolution audio monitors. The digital audio portion of the HDTV signal must use a suitable audio transducer that allows for presentation of detail. This objective must be met for normal acoustic conditions without regard to placement, as will be the situation with the video monitor. The visual objective for panel TV is to show no external speakers while maintaining High Definition Sound apparently originating from the screen itself. The audio for HDTV must be observable at the close distances available for viewing the screen itself or other positions within the viewing area while maintaining intelligibility and a natural character. Headphones are rarely used to monitor television audio resulting in no currently available standard for HDA/HDTV sound monitoring devices.

HDSS™ TECHNICAL REQUIREMENTS:

1. SINGLE DRIVER - The audio signal for each channel can only be reproduced by one transducer. The audio signal immediately loses its resolution when it is split and reproduced from more than one driver in the frequency range above 100 Hz. A single driver also allows for the micro dimensions required for multi-applications of the **HDSS™** Audio Monitor.

The ear cannot interpret the detail due to the many negative issues resulting from signal splitting:

- The ear loses resolve when the source signal is reproduced at more than one physical location (woofer-midrange-tweeter) to include coaxial arrangements.
- The ear loses resolve when drivers of different physical characteristics produce the signal. Cone (diameter – material – angle), magnetic strength, voice coil characteristics and suspension related differences all cause resolution loss.
- The ear loses resolve when the signal is split electrically or electronically. The ability of a crossover network to be phase perfect assuming identical transducer characteristics is not feasible. The high costs of crossover networks attributed to high-end speaker designs illustrate the diminishing value and impractical use of this approach. Simple systems cannot be developed under these conditions.
- The ear loses resolve because distance is required for multiple driver integration.
- The ear loses resolve when signal splitting speaker systems are used for multi-channel operation due to the exponential increase of phase related errors.

2. PISTONIC OPERATION: The single transducer representing the sound monitor for the HDA signals must operate as a piston over the entire audio range to include frequencies from 80 Hz to 20 kHz with little phase error. The angular response must be reasonably flat to 10 kHz and to at least 45 degrees off axis at vertical and horizontal angles. The ability to respond to low frequencies below 80 Hz is essential for operation without a subwoofer even though the output will be with gradual loss. The subwoofer must be an option for **HDSS™** qualified audio monitors.

The ear cannot interpret detail due to many negative issues related to non-pistonic operation of the single speaker driver.

- The ear loses resolve when cone breakup is present at the transducer.
- The ear loses resolve when the acoustic impedance is not maintained constant for all frequencies.
- The ear loses resolve when the phase is intentionally shifted to extend high frequency response. This can be mechanically as with the transducer design or electrically using frequency boost or cut controls.
- The ear loses resolve when the angular dispersion is not constant with frequency.
- The ear loses resolve when the reflections from the room surfaces cause a dynamic change in the nominal acoustic radiation impedance.
- The ear loses resolve when the acoustic energy output is non-linear with level.
- The ear loses resolve when the lower bass frequencies are not represented audibly. Rapid loss of bass response is interpreted as unnatural by the ear.

- The ear loses resolve when the amplifier powering the monitors cannot perform as designed due to loudspeaker induced electrical anomalies present at its output.

3. NON RESONANT BASS EXTENSION- The support of extended lower frequencies can only be accomplished using non-resonant devices. **HDSS™** low frequency extension cannot be accomplished without adequate control of the resonant characteristics of the driver(s) involved. Poor bass extension should be avoided to maintain required detail.

The ear cannot interpret detail due to many negative issues related to poorly resolved lower bass frequencies.

- The ear loses resolve when the resonant character of the main driver dominates the character of the input signal.
- The ear loses resolve when more than one resonant frequency is involved in reproducing the low frequencies. Typically this condition refers to a signal of the same origin being reproduced by more than one driver in different alignments.
- The ear loses resolve when the bass extension technique involves the use of the drivers' resonance energy regardless of methods used to dampen the output.
- The ear loses resolve if the bass extension device is crossed over when its group delay is not at or near zero. This is a period when its time response is shifting.
- The ear loses resolve when the bass extension device is separated by great physical difference from the main audio monitor (s).
- The ear loses resolve when the room reflections dynamically alter the acoustic radiation resistance of the extension device. This characteristic of immunity to reflections is even more important for lower frequencies and objective performance of the full audio range.

The first two requirements listed above must be met with a minimum of negative issues for **HDSS™** certification. Sound is analogous therefore maximum detail is resolved when all three conditions above are met. Each negative issue carries weight relative to its degree of influence. A fully resolved **HDSS™** system will have a degree of resolution equal to 100%. Each negative issue described above will lower that score. To qualify as an entry-level **HDSS™** monitor the product score must be at least 50%. Anything lower will not be able to officially bear the **HDSS™** logo.

The major specifics of **HDSS™** require that:

A) The audio monitor has wide dynamic range with the ability to respond to very low-level signals, with a great degree of linearity. Maximum level is relative to application.

B) The audio monitor maintains that range at all vertical and horizontal angles within the room so as to include room reflections at the ear. Intelligibility must not suffer.

C) The audio range must be high-pass limited to include sub 100 Hz signals while having a moderate slope below that low cutoff frequency. Subwoofer is optional for **HDSS™.**

The objective values are presently being established for the weight of the negative issues.