



Case Study: Klipsch HQ – Home Theater Demo Room

Auralex Acoustics, Inc. recently provided acoustical consulting services and acoustical treatment products for the new Home Theater Demo Room at the expanded *Klipsch* headquarters in Indianapolis, IN. The *Auralex* team reviewed the size and shape of the room, its intended function and together with the very knowledgeable *Klipsch* team, developed the following plan:

- 1. Test the rooms prior to any treatments being installed. Time and frequency responses were evaluated across the entire audible range.
- 2. Control mid and high frequency problems with the all new *ELiTE™* Acoustical Treatment System on the walls.
- 3. Control low frequency problems with MegaLENRD™ "Bass Traps."
- 4. Test the rooms after acoustical treatments to verify performance. Testing was performed using roughly the same loudspeaker/microphone placement as in #1 above.

Treatment Overview

A plan and layout of the room is shown in <u>Figure 1</u>. Pre-treatment testing and observation revealed many acoustical problems. Among them:

- The room was "too live" for the purposes of evaluating home theater audio systems.
- The low frequency response was inconsistent with obvious modal build-ups.

Klipsch desired a room that was fairly "dry" for the purposes of evaluating prototype loudspeaker designs in a room that is not truly anechoic, but is set up to approximate a real-world home theater. To achieve this, absorption and diffusion would be required. To ensure a smooth bass response, low frequency "traps" would be required. Based on these needs, as well as the aesthetic requirements of the overall building décor, *Auralex* developed the following treatment approach:

- Treat the walls with a combination of absorption and diffusion. *Klipsch* Engineers voiced a desire to keep the front of the room reflection free in the mid and high range, but were open to using roughly 50% coverage with diffusion in the rear half of the room to retain some natural "liveness."
- The low frequency problems would be addressed using *MegaLENRD* "Bass Traps" in/near the corners. Enough *MegaLENRDs* would be available to experiment with amounts and placements.



Figure 2 – EliTETM Wall Treatments

<u>Figure 2</u> shows the room finished with the *ELiTE* treatments on the walls.¹ The fabric finish of *ELiTE* met the aesthetic requirements for the room. The use of the 1" *ELITE* absorption material and the 1" *ELITE* diffusors provided excellent control of mid and high range sound above roughly 500 Hz.

Placing the *MegaLENRDs* (Figure 3) in the corners tamed the low frequency problems to a very high degree. By adding twelve *MegaLENRDs* – three in each vertical corner of the room – the bass was much more defined and "smooth."



Figure 1 - Plan View of Home Theater



Figure 3 – MegaLENRDsTM

¹ Reflections from the ceiling were tamed using non-Auralex acoustical diffusors.



LS13 Mic 1 2000 Klipsch HT Room 1 5/29/2002 2:31:18 PM Cursor = -6.66 dB at +42 45 ms (11.99 feet) Relative Cursor = 63.73 dB at 10.61 ms (+47.96 feet)



Figure 4 - Time Response Before ELiTE™

HT Room 2000 Klipsch HT Room 10/30/2002 9:38:26 AM







Figure 6 - Very Low Frequency Response (Before and After)



Test Results

Mid and High Frequency Results: <u>Figure 4</u> shows the time response² measured at the listening position for the room before treatments. Note the reflection marked with the cursor. It is arriving at the listening position – with other reflections – within 50 milliseconds, but only about 6-7 dB lower than the direct sound. This interferes with the direct sound, causing an image shift. Listening in the untreated room would result in inaccurate imaging, comb filtering and myriad other psychoacoustic problems. In short, the sound you would hear would contain too much "room."

<u>Figure 5</u> shows the time response after *ELiTE* treatments are completely installed. Note the reduction of early reflections. The cursor has been placed at the same arrival time as <u>Figure 4</u> for easy cross-reference. The listening experience post-treatment is free of any distracting acoustical anomalies.

Low Frequency Results: Figure 6 shows very low frequency measurements at the listening position from 20 to 50 Hz – a major concern for *Klipsch* engineers evaluating subwoofer performance. The red "Before" curve shows the effects of an untreated room – a modal unevenness. The low frequency response is much smoother after the addition of all twelve *MegaLENRDs* shown by the blue curve. This provides the listener with a "tight," less "muddy" bass – an environment where a subwoofer can be evaluated. This is the low frequency equivalent of "removing" the room from the listening experience. While some may be skeptical of the effects foam "traps" can have at low frequencies, the testing in the *Klipsch* Home Theater Demo Room have shown that they can be quite effective indeed!

Conclusions

The completed *Klipsch* Home Theater Demo Room is a great listening environment; especially considering that it will be used to evaluate prototype home theater loudspeakers. Sound reproduction is free of flutter echoes, bass "ringing" and other acoustical anomalies. The combination of the *ELITE Acoustical Treatment System* and the low frequency control provided by the *MegaLENRDs* has turned an otherwise acoustically imperfect room into a room that is acoustically comfortable and usable.

For more information about Auralex products and services – <u>www.auralex.com</u>. For more information about Klipsch products and service – <u>www.klipsch.com</u>.

² Time response measurements cited used a TDS signal spanning the 2000 Hz octave band.