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KLEM ACOUSTIC CONSULTING

[Client Info Redacted]

Re: On-Site Acoustic Assessment of Room Acoustics for Rem Bashari

Dear [Client Info Redacted],

The summary report for the assessment of, and recommendations for, your mixing room is below.

Problem and Background:

Klem Acoustic Consulting (KAC) was asked to provide an on-site acoustical assessment for a room in a single-family residential dwelling. The chief concern was to assess the acoustical properties of a DIY-built mixing room in order to understand the nature of the existing space, which helps inform treatment suggestions that could improve its acoustic properties.

Assessment:

An on-site assessment was conducted on July 3, 2026. Activities performed during the assessment included: direct observation of room performance via music provided by the client; interviews to elucidate the client's concerns and needs; review of the built environment (sound pathways, dimensions, material composition of all boundaries and other objects of acoustical significance); discussion of sound properties and potential solutions. Homeowner's aesthetic considerations, preferences, and prioritizations were discussed to help to inform what solutions may be acceptable.

Room's Dimensions and Material Composition:

- The as-built room measures 158" (length) x 94-3/4" (width) x 85-86" height (varies per location measured). The only door to the room has an opening of 30" x 80".
- The boundary compositions are as follows:
- West and South (front) walls: Concrete foundation wall, light density kraft-faced fiberglass between 3.5" floating studs 16" on center (O.C.). Prefabricated slat wall product by MSI was installed directly against the studs as a final covering. This slat wall product does not provide any acoustic performance data such as sound absorption coefficients to ASTM C423 standards.[1] Felt density is also unlisted but estimated to be between 8-9 pounds per cubic foot (PCF).
- East and North (rear) walls: partition walls adjoining habitable spaces; from outside room to inward: 1/2" gypsum wall board (GWB), light density kraft-faced fiberglass between 3.5" floating studs 16" O.C. The same prefabricated slat wall product by MSI was installed directly against the studs as a final covering.
- Ceiling outward in: LVT flooring, subfloor of unknown composition or material, 2x10 (typical but unverified) joists partially full of unfaced insulation spaced 16" O.C. The same prefabricated slat wall product by MSI material was installed directly against the joists as a final covering.
- Flooring composition is concrete slab +/- plastic vapor barrier, carpet underlayment (typical but unverified), carpet.

See Figures in Appendix A for additional context.

Acoustical Measurements: Equipment and Methods

Sound measurements were taken at the listening position to assess the room's acoustic properties. All source sounds were emitted from a Neumann KH 120 II speaker placed directly above the client's speaker, which was verified to be at approximately 30 degrees toed-in and symmetrically spaced from the front and side walls. The microphone (calibrated UMIK-1) was placed at the listening position. The distance between each speaker and the listening position

[1] See https://www.msisurfaces.com/acoustic-wood-slat/natural-beige/#more-prdInfo

formed an equilateral triangle with each length 56”. This placed the mic at 73-1/2” from the front wall, and 47-1/2” from each side wall. The mic was calibrated to 83dB(A-weighted; dBA) via pink noise with a Class 1 Sound Level Meter (NTI XL3 Acoustic Analyzer, NTI M2230 microphone and MC230A preamp). This Class 1 system was successfully calibrated by NTI on June 12, 2026, and also field calibrated using a Larson Davis Cal200 Class 1 calibrator immediately before and after room measurements. All measurements were made with Room EQ Wizard v 5.40 Beta 128 using dBA units. Measurements were made of the left and right speaker position independently to isolate the performance of each speaker position in the room. See Figures in Appendix A for additional context.

There are numerous metrics in acoustic assessments. In order to stay aligned with the client’s stated goal of improving the room acoustics on a modest budget, the most relevant measurements to this goal are provided below. The most relevant acoustical measurements to this project are: Fourier Waterfall, Impulse Response/Energy Time Curve, and Reverberation Time.

Waterfall

A Fourier Waterfall is one of the most informative and holistic views of a sonic environment. It plots the sound pressure levels and decay times for all frequencies most often audible to human hearing (20-20kHz). Specifically, the graph shows the sound energy (Y axis) from the lowest to highest frequencies of human hearing (X axis), and the time (Z axis) it takes for the sound energy to decay to inaudible levels.

Figure 1: Waterfall from Left Speaker

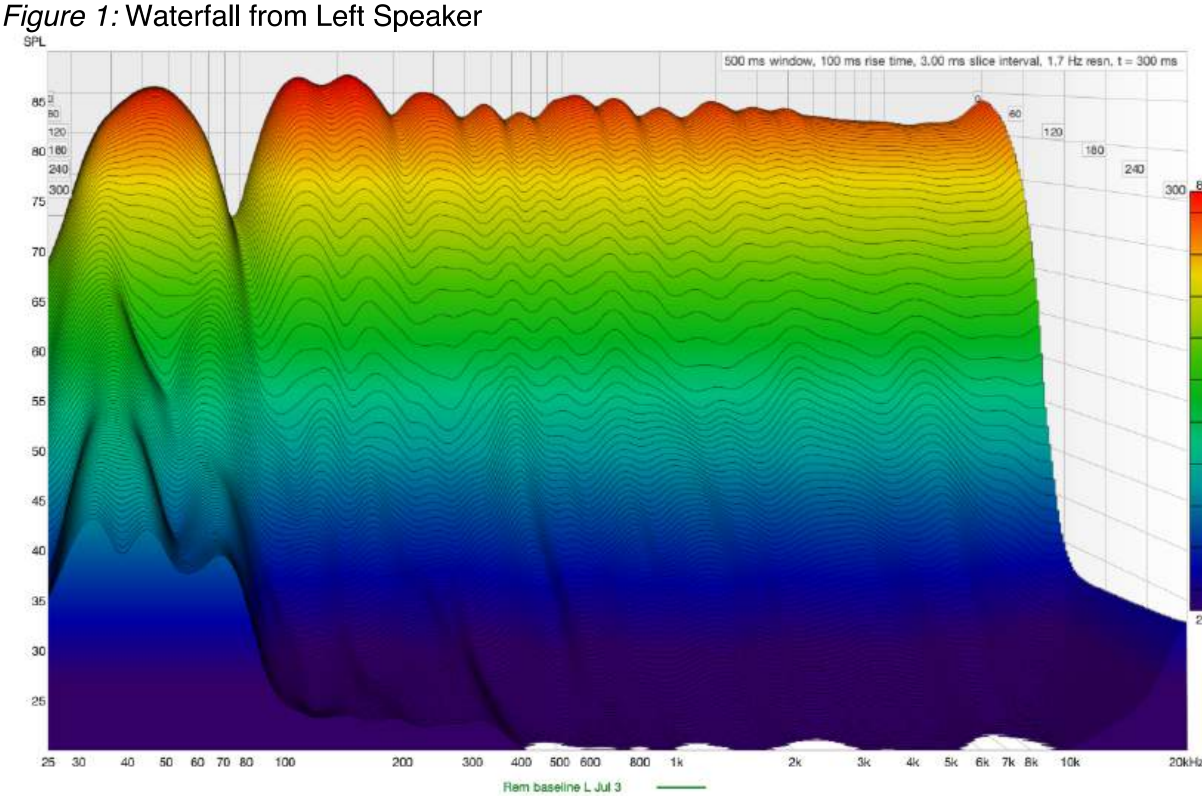
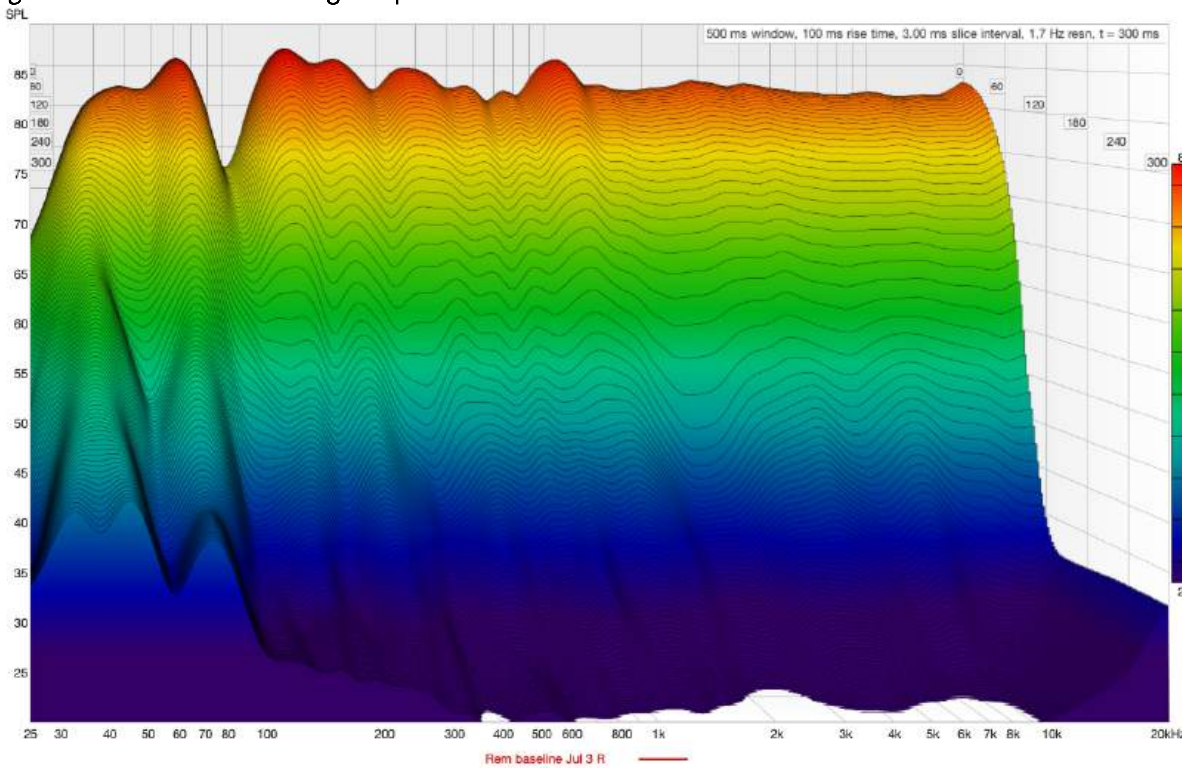


Figure 2: Waterfall from Right Speaker



Impulse Response and Energy Time Curve

The Impulse Response (IR) shows a speakers' attempt to reproduce a brief burst (AKA impulse) of sound. Data from the IR allows for the construction of an Energy Time Curve (ETC) graph, which shows how an IR interacts with the boundaries of a physical space to create direct and indirect sound paths to the listening position. Direct sound can be thought of as sound that does not encounter any interruptions in its path from the source speaker to the receiving position. In contrast, indirect sound is sound that first reaches a boundary surface and then reflects to the listening position. Indirect sounds naturally arrive later in time than the direct sound to a listening position. Early reflections refer to indirect sounds that arrive at the listening space within the first 15-20 ms after the direct sound.

The human brain struggles to differentiate between sounds that arrive within 20ms of each other, a psychoacoustic phenomenon known as the precedence effect. Therefore, critical listening spaces incorporate methods to decrease the strength (in dB) and when possible, the occurrence (in time) of early reflections. EBU Tech 3276 specifies all indirect sound should be at least 10dB below the direct sound for all frequencies between 1-8kHz. When reviewing IR plots, it is helpful to remember that sound travels through the air in a typical residential home at roughly 1.125 ft/ms. This helps one identify potential reasons for specific early reflections.

Figure 3: Impulse Response from Right Speaker

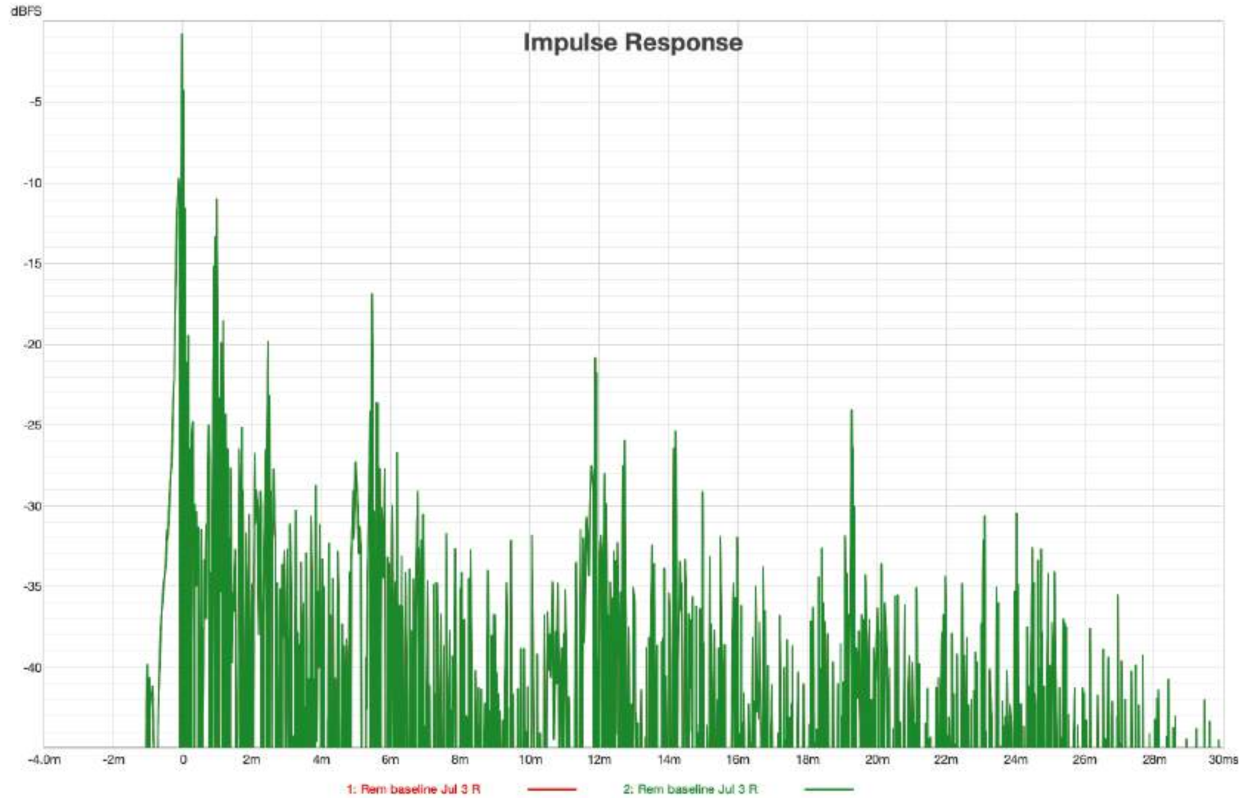
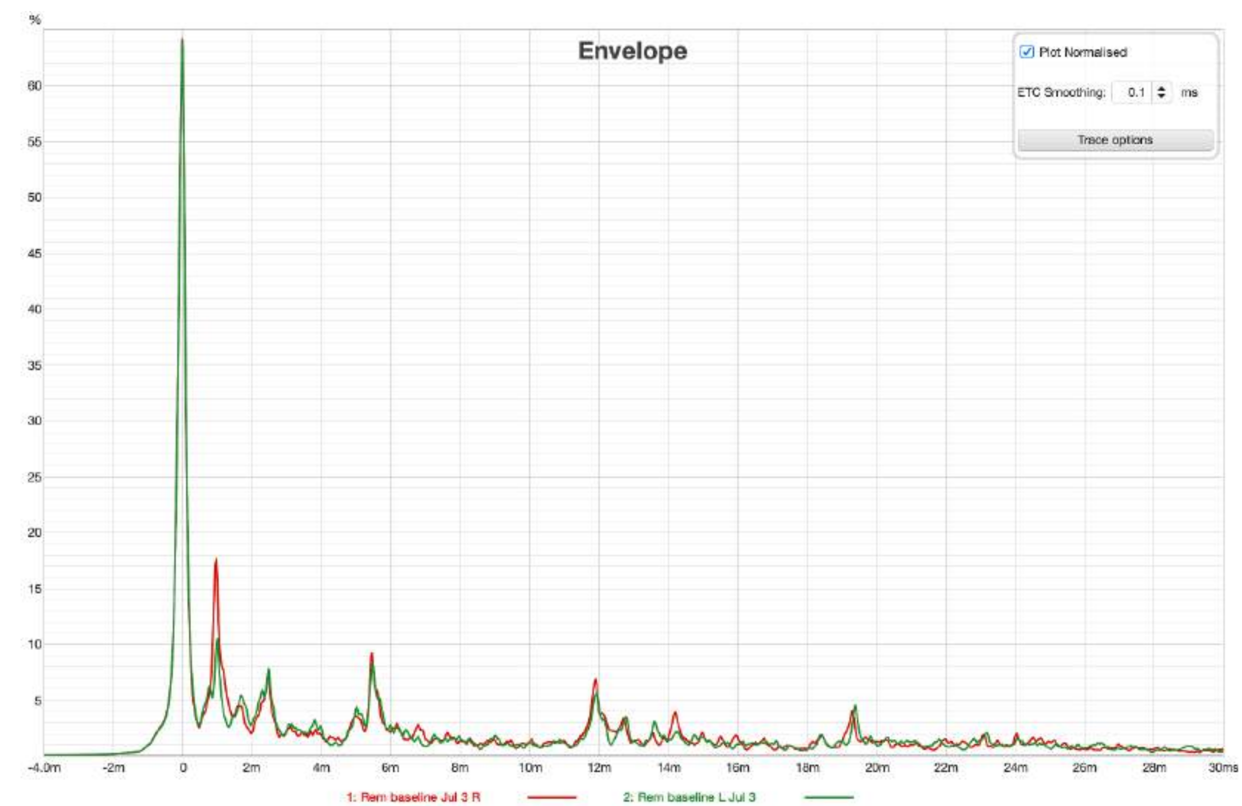


Figure 4: Energy Time Curve from Left and Right Speakers



Reverberation Time / T30

Reverberation Time (RT) measures the length of time it takes for an original sound to decay by a given number of decibels. RT60 is a measure of how long sound takes to decay by 60 dB in a space that has *a diffuse sound field*, meaning a room large enough that reflections from the source reach the mic from all directions at the same level. RT60 is not as useful a measure for small rooms at frequencies below approximately 300Hz, as modal resonances conferred by and endemic to such spaces overshadow any diffuse sound field decay. A more useful metric for such spaces is T30, which measures the decay of sound energy in a room from -5 dB to -35 dB below the initial level, then extrapolated to a 60 dB range. It is commonly used in performance spaces for better accuracy compared to other measurements like T20 or T60. The following graph shows T30 for each speaker position.

Figure 5: T30 (despite RT60 Title) from both Left and Right Speakers

Summary of Measurements

Waterfalls

The room has relatively even and smooth sound energy decay above 1kHz. Values below that show the destructive interference of sound energy reflecting back to the listening position later in time. These sounds combine to create peaks (additive) and nulls (subtractive) at any given location in the room. E.g., there is a deep (~10dB) and wide (75-150Hz) null. Also notable is the lack of sound decay below this null.

Energy Time Curve

There are early reflections that interfere with and degrade the perception of music. However, the early reflections do lessen in strength with time (the decreasing peaks as you move further along the x / time axis) which helps in domains such as coherence of the stereo image.

Reverberation Time

T30 value is well aligned with the room's materials properties of carpet, light density fiberglass insulation and higher density felt. The mid to high frequencies are heavily absorbed with T30 values below 100ms, and then dramatically increase by a factor of up to 4 below 150 Hz. The room suffers from a build-up of low frequency energy. This is a common occurrence in small room acoustics.

Summary of Suggested Treatments

Klem recommended the following actions to improve the acoustic qualities of the room:

- END OF REPORT EXCERPT -

Should you have any questions or want to further discuss this project, please feel free to contact me.

Sincerely,

Patrick Klem, MPH, CPH
Owner, Klem Acoustic Consulting LLC

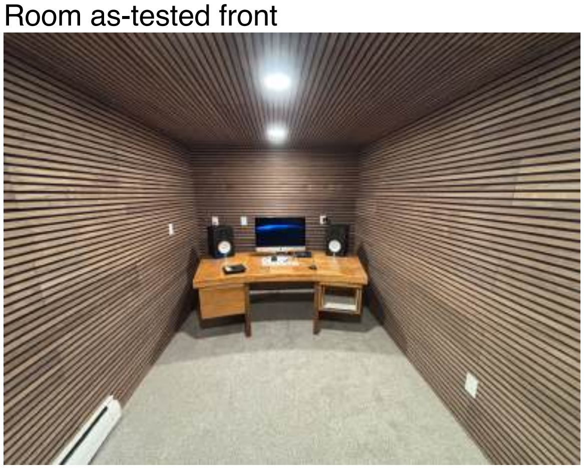
Appendix A: Additional Figures

Room composition under construction

Room as-tested rear

Testing in-situ

Room as-tested front



Appendix B: EBU Tech 3276

See pdf file included in the email with this report:

‘Listening conditions for the assessment of sound programme material: monophonic and two–channel stereophonic’. EBU Tech. 3276 – 2nd edition, May 1998. European Broadcasting Union; Case Postale 67, CH–1218 Grand–Saconnex (Geneva) Switzerland.