CAC GROUP INVESTMENTS LLC.

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March 20, 2023

Prepared for:

816 NW 11th Street, Apt 902 Miami Fl 33136

Subject:

Acoustic testing per ASTM-1007-19 & ASTM-E336-20

TEST DATE	03/15/23
DATA FILE #	#167280
CLIENT	*Salvador Lee*
TEMPERATURE	*72° F*
DESCRIPTION	Surface: Tile Underlayment: SM05MM Slab: 203 mm concrete
FIIC	Bedrooms- 51 Living-room: 51
FSTC	Bedrooms- 65 Living-room: 56

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Introduction:

The aim of this report is to accuratly quantify and document the field measurements and findings of a set of sound tests that were done in apartments #902 and #802 located at 816 NW 11st St, Miami Fl 33136 ;on the morning of March 15, 2023. The focus of our testing involve the sound transmited between apartments.

To accurately quantify the noise that will be produced by the upstairs and the downstairs rooms a variety of instruments and noise levels were tested; including a dodecahedron speaker producing pink noise (used in finding apparent airborne sound transmission class (ASTC) and a tapping machine (used in finding apparent impact insulation class (AIIC). This combination of testing parameters will be thorough in documenting the type of sound that would be expected to be transmitted through the floor-ceiling assemblies and associated supporting structures during peak times "worst case" scenario.

The Impact insulation test was conducted in compliance with ASTM-1007-19 and ISO 140/7 Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Trough Floor – Ceiling Assemblies.

Airborne sound attenuation test between rooms was conducted in compliance with ASTM E-336-20 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.

Noise fundamentals:

It is important to have a brief understanding of the fundamentals that the measurements and acoustic recommendations we will provide are based upon. For this reason, we include this short section.

Sound and noise are caused by the change in air pressure in a given space. These changes in air pressures are quantified by relating them to a base sound pressure level with an equation [1]. The decibel, dB, is commonly used to communicate sound measurements. However, in our practice we will be using the A-weighted scale denoted, dBA, this frequency weighting attunes the units to match the auditory perception of the average person.

A general summary as to how the human ear responds to sounds measured is described as follows:

- Laboratory conditions, a change in sound level of 1dB cannot be perceived.
- A doubling of the energy of a sound source corresponds to a 3dB increase.
- Outside of the laboratory, a 3dB change in sound level is considered a barely discernible difference.
- A 6dB increase is equivalent to moving half the distance towards a sound source.
- A 10dB increase is subjectively heard as an approximate doubling in loudness.

Impact noise fundamentals:

The act of walking across a floor generates noise due to mechanisms such as footfall and structural deflection. Footfall noise is created by the impact of a hard object, such as a heel, striking the surface of a floor. Impact noise can be measured using a standard tapping machine as a source which leads to an Impact Insulation Class (IIC) rating. The IIC test measures the reaction of a floor system to a series of small hammers dropped from a standard height, the higher the IIC rating, the more the impact noise isolation between the two spaces.

The level of impact noise in the receiving space is primarily dependent on the softness of the floor covering. Hard surface floors must be installed on thick resilient underlayment and used in conjunction with a vibrationally-isolated ceiling to achieve medium quality results.

Airborne noise fundamentals:

Sound Transmission Class (STC) - STC rates the effectiveness of building components-walls, floors, windows, doors, etc. as barriers to airborne sound. The greater the value of STC, the less sound is transmitted through the building component. FSTC, or Field Sound Transmission Class value, considers the overall effect of flanking paths.

Changes in STC Rating	Effect
+/- 1 STC Points	Almost Imperceptible
+/- 3 STC Points	Just Perceptible
+/- 5 STC Points	Clearly Notable
+/- 10 STC Points	Twice (or half) as loud.

Table 1; Examples of effects of changing STC rating.

Measureing equipment:

Instrument	Manufacturer	Model	Date of Calibration
CESVA Sound Level Analyzer	CESVA	SC 420	09/07/2022
Acoustical Calibrator	CESVA	C 140	09/07/2022
Dodecahedron Speaker	NTI-AUDIO	DS3	N/A
Power Amplifier	NTI-AUDIO	PA3	N/A
Tapping Machine	CESVA	M 1005	08/17/20

Table 2; Measuring equipment.

NOTE: The sound level meter was calibrated immediately prior to and immediately after the measurements was carried out.

Scope of work:

For the sake of clarity this section breifly summarizes the work that was carried out and that will be discussed in this report.

- Measurement of *Apparent Impact Insulation Class (AIIC)* per ASTM-E1007-19.
- Measuremnt of *Apparent Sound Transmission Class (ASTC)* per *ASTM-E336-20.*
- Field observations detailing the context of the measurements to properly understand the environment being tested.
- Recommendations of noise control surfaces for walls, ceilings and floors if necessary.

Field observations

Throughout the measurements observations regarding the likely causes, concerns, or note-worthy occurrences were documented. It is important to consider the context in which sound pressure level measurements were taken so one can aptly decide on the relevancy of measurement in informing future decision making. Below we present a summary of the notes taken on site.

We arrived at the specimen area around 11:45 a.m. and began unpacking the gear that would be used througout the testing.

Before transmission and receiving sounds were recorded to calculate the STC an assesment of the area was carried out. Images depicting the two tested apartment areas can be found below on *Figures 1-3*. The there were not many disturbances, besides the noise produced from a few talking neighbors that was audible duirnig the measurements in apt. 802.

Transmission and receiving sounds were recorded to calculate the STC between apartments. Later a tapping machine was placed upstairs and measurements were recorded downstairs, two different locations one in the master bed-room (from here on simply refered do as “bedroom”) and one in the living-room . After the tapping machine measurements were recorded the ambient sound of the downstairs was measured to ensure the backround levels were not high enough to interfere with the measurements previously taken. Finally the reverbation times of the bed-room and living-room in apt.802 were recorded.

Figure 1; During measurements in living-room of apt.902

Figure 2; During FIIC measurements in living-room of apt.802

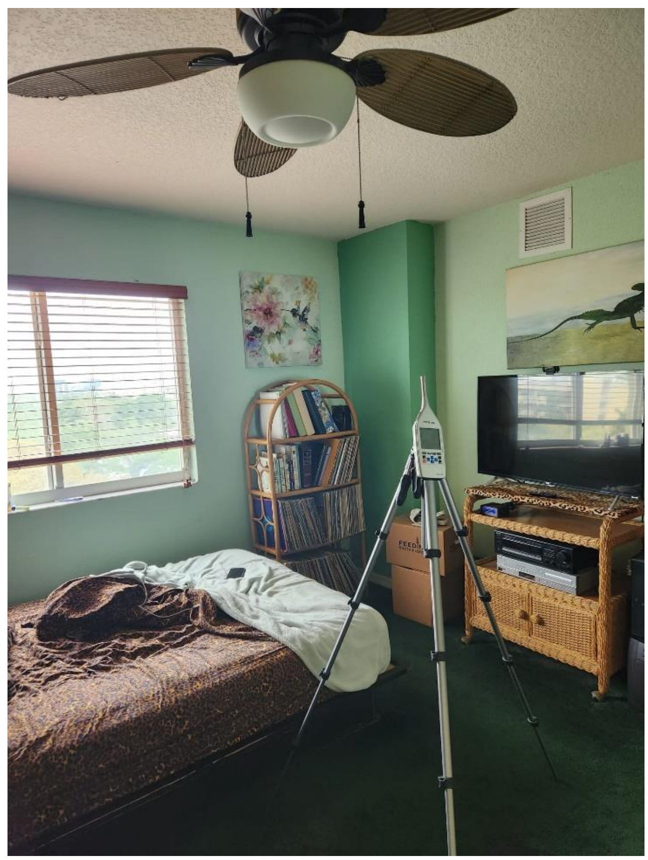

Figure 3; During FIIC measurements in bedroom of apt.802

Conclusion and recommendations:

The results of the ASTC and AIIC tests are shown below on *Table 3*;.These results were within the typical county and state ordinances requirements and for this reason we believe that continuing with the existing finish is sufficient in obtaining the desired sound attenuation.

Rating unit	Desired rating	Measured rating
FSTC(1) Between bedrooms of apt.902 and 802	50	65
FSTC(2) Between living-rooms of apt 902 and 802	50	56
FIIC(1) Between bedrooms of apt.902 and 802	45	51
FIIC(2) Between living-rooms of apt 902 and 802	45	51

Table 3; FIIC and FSTC results compared to desired ratings.

Thank you for your time and consideration. If you have any further questions or concerns, please do not hesitate to contact.

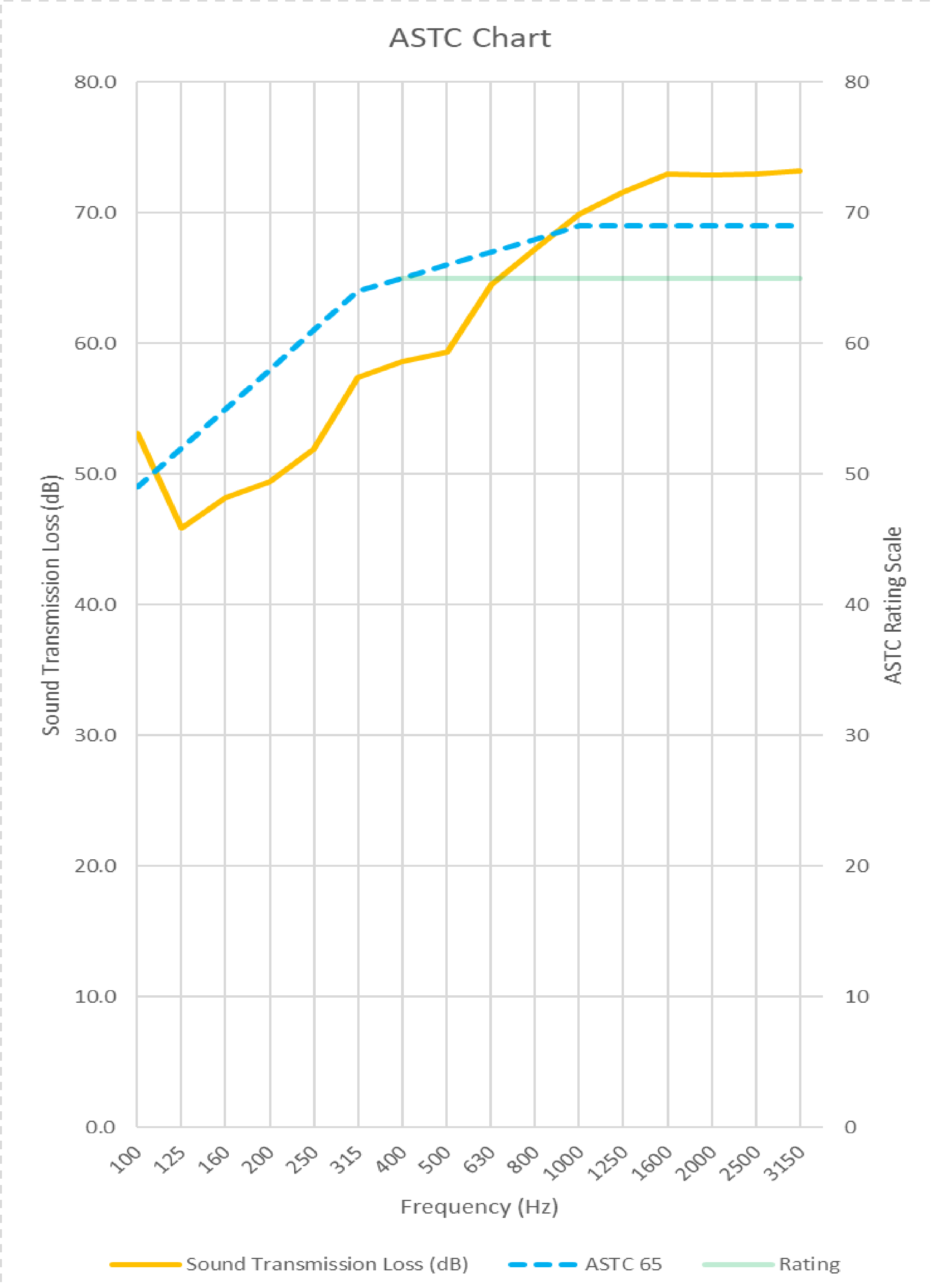

Figure 5; FSTC(1) Between bedrooms of apt.902 and 802 [FSTC: 65].

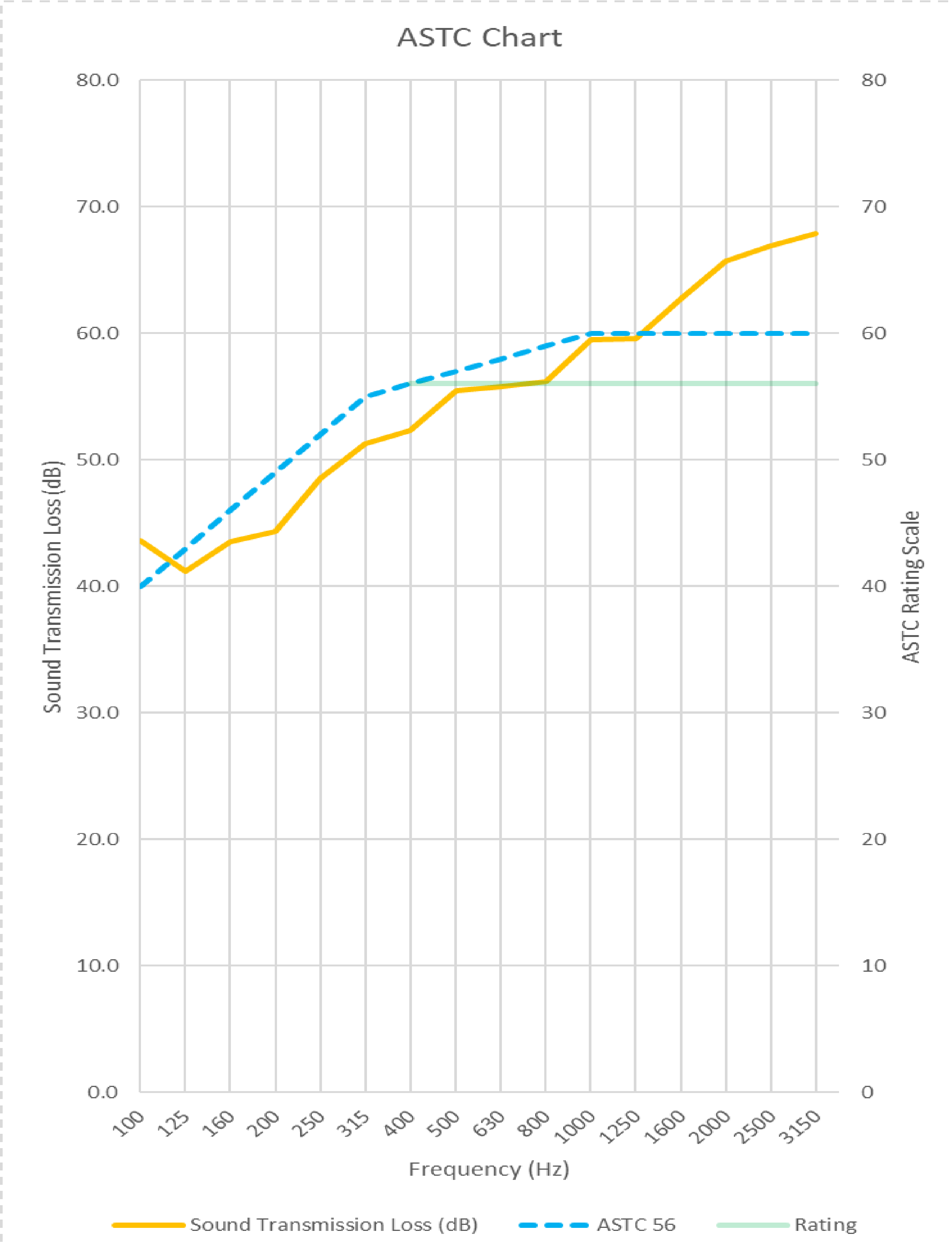

Figure 6; FSTC(2) Between living-rooms of apt 902 and 802 [FSTC: 56].

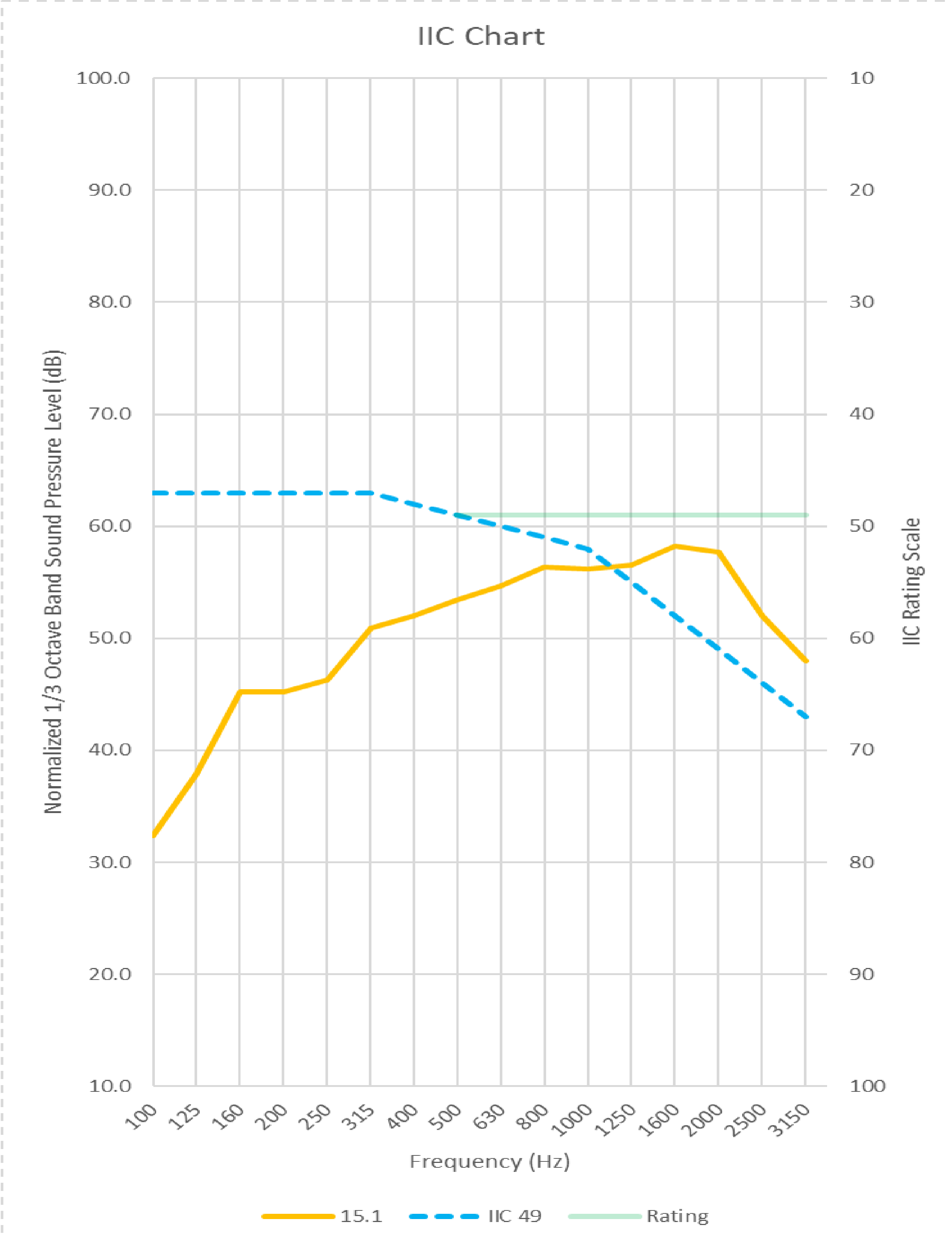

Figure 7; FIIC(1) Between bedrooms of apt.902 and 802
***[FIIC: 51]*.**

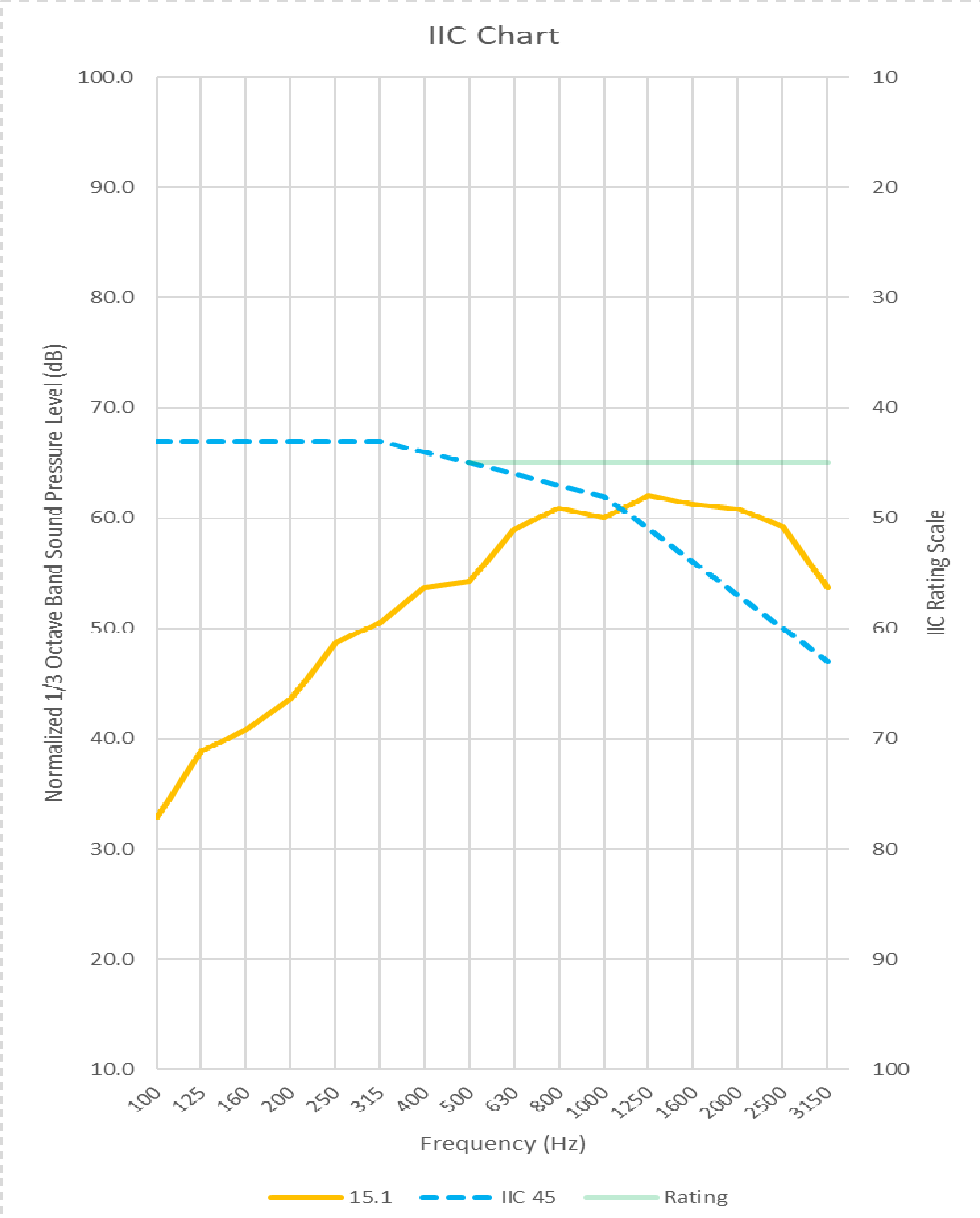

Figure 8; FIIC(2) Between living-rooms of apt 902 and 802 [FIIC: 51].

Appendix I – Glossary of acoustical terms

Ambient noise - All pervasive noise associated with a given environment.

Attenuate - To reduce the level (volume, loudness, energy) of an acoustical (or electrical) signal.

A-Weighted Sound Level - A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies, by reducing the effects of the low and high frequencies with respect to the mid-range frequencies. The resultant sound level is said to be A-weighted, and the units are dBA.

Decibel (dB) - The measuring unit of sound pressure, and hence loudness. The decibel is a numerical ratio between the sound pressure of a given sound and the sound pressure of a reference.

Frequency - The speed of vibration of a sound wave, measured in cycles per second, or Hertz. Frequency determines pitch, the faster the frequency, the higher the pitch.

Hertz - The measuring unit of frequency or the speed of vibration of a sound wave. Synonymous with "cycles per second" (CPS).

Isolation - Resistance to the transmission of sound by materials and structures. The separation of airborne or mechanically transmitted energy.

Noise - Unwanted sound. Interference of an electrical or acoustical nature. Random noise is a desirable signal used in acoustical measurements.

Octave band - A frequency spectrum which is one octave wide (i.e. all frequencies from 125 Hz to 250 Hz). In recording and audio testing, the octave itself is divided into thirds for increased accuracy.

Pink noise - Broadband noise whose energy content is inversely proportional to frequency.(-3dB per octave) This gives the noise equal energy per octave

Pitch - The human perception of frequency. In general, the higher the frequency, the higher the pitch.

Apparent Sound Transmission Class (ASTC) -Describe the apparent sound insulation of a partition separating two spaces as influenced by flanking in the supporting structure.

Apparent impact insulation class (AIIC) n-a single-number rating derived from values of ANISPL in accordance with Classification E492.

Reverberation - The persistence of sound in an enclosure after a sound source has been stopped. This is a result of the multiple reflections of sound waves throughout the room arriving at the ear so closely spaced that they are indistinguishable from one another and are heard as a gradual decay of sound.

Reverberation time - The time, in seconds, required for sound pressure at a specific frequency to decay 60 dB after the source is stopped. 60 dB of decay is equal to one millionth of their original level. The reverberation time of a room varies with frequency and is a function of the room volume as well as the total number of absorption units in the room. It can be determined by the Sabine equation.

Sabin - A measure of sound absorption of a surface. One sabin is equal to 1 square foot of open window. Sabins are calculated by multiplying the absorption coefficient of a material multiplied by its area.

Sound - Energy that is transmitted by pressure waves in air (as well as water or solids) and is the objective cause of the sensation of hearing. The phenomenon caused by the vibration of the eardrum. The drum itself is set into motion by pressure waves traveling through the air, originating at the sound source.

Sound pressure - A dynamic variation in atmospheric pressure. The pressure at a point in space minus the static pressure at that point.

Sound Pressure Level (SPL) - The fundamental measure of sound pressure. The measurement of what sound we hear expressed in decibels in comparison to a reference level.

Sound transmission (airborne) - The conduction of a sound wave through air. The speed of airborne sound transmission varies with temperature and humidity, and is 1130 feet/second in air at 70°F.

Sound transmission (structure borne) - The conducting of a sound wave through a physical structure (such as a wall, floor, ceiling or door).

Sound Transmission Class (STC) - A single number rating for describing sound transmission loss of a wall or partition. A rating system designed to facilitate comparison of the sound transmission characteristics of various architectural materials and constructions.

Sound transmission loss - Ratio of sound energy emitted by an acoustical material or structure to the energy incident

[1] – Sound pressure level $L_p = 20\ log_{10}\left(\frac{p}{20}\right)\ dB$

Note: the reference sound pressure in air is 20 micropascals (i.e., 20 μPa)

Apendix II – Measurements

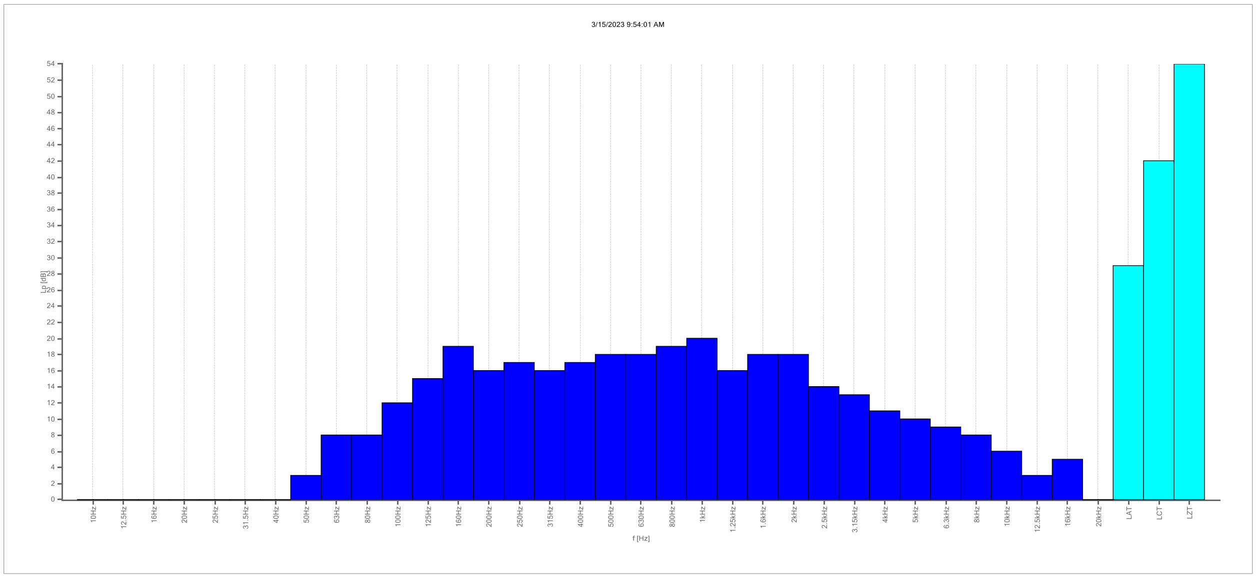

Figure 9; Ambient noise, apt.802 living-room.

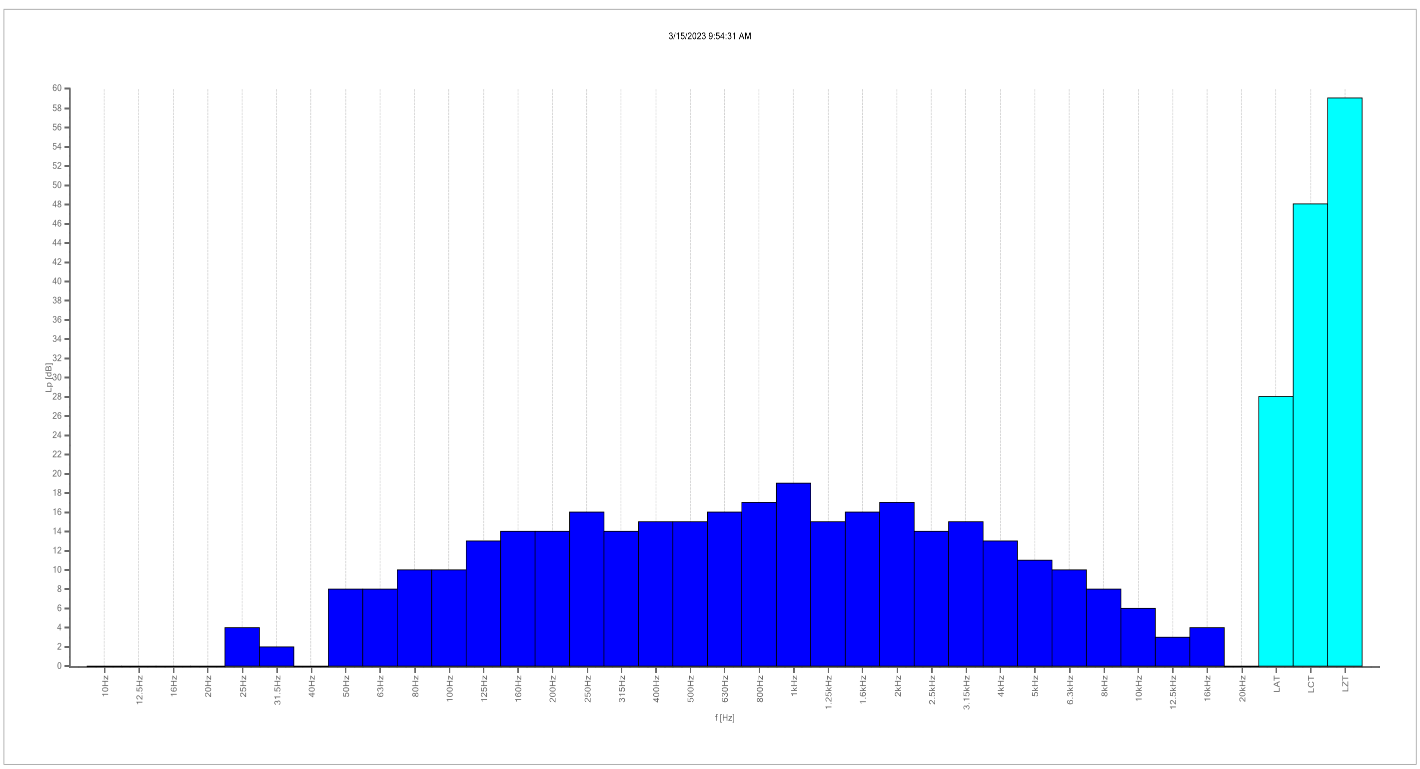

Figure 9; Ambient noise, apt.802 bedroom.

Hz	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
T20	--	--	0.37	0.34	0.44	0.34	0.78	0.21	0.38	0.43	0.52	0.63	1.62	0.54	0.48	0.59	0.59	0.49	0.44
T30	--	--	--	0.46	--	0.45	0.48	0.37	0.46	0.42	0.5	0.53	0.42	0.51	0.5	0.56	0.5	0.46	0.43

Table 4; Reverberation times within receiving living-room.

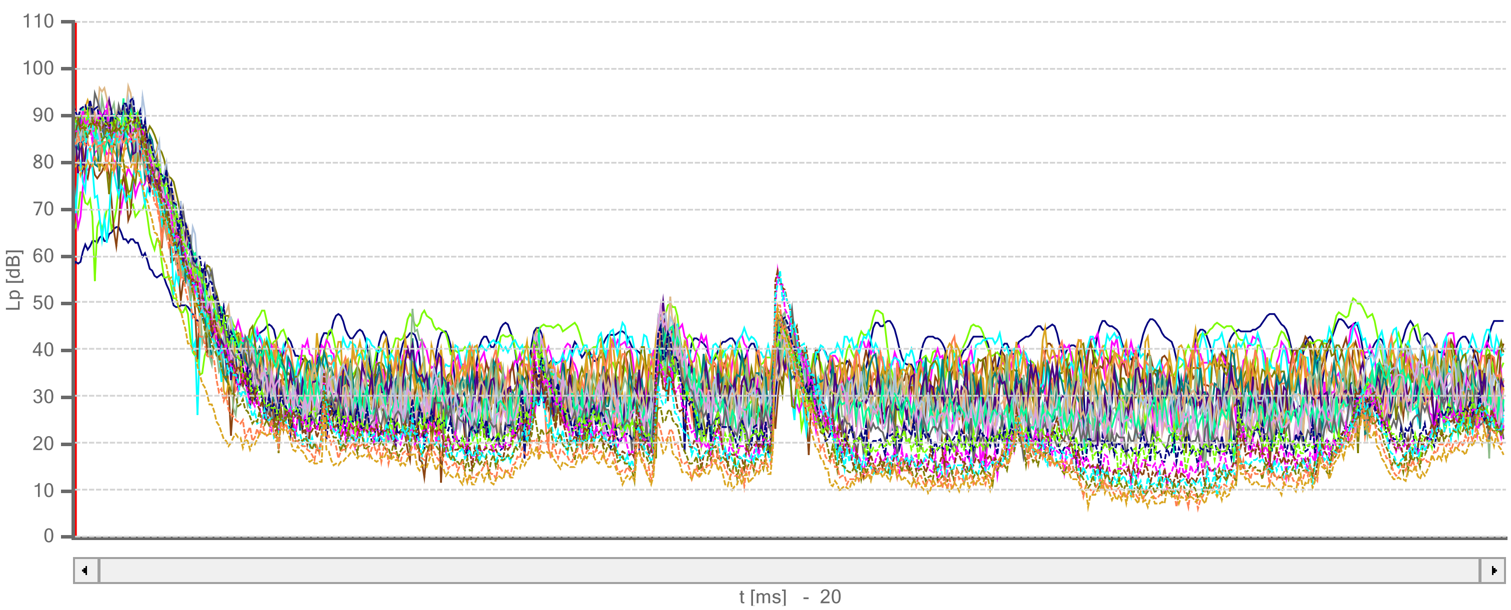

Figure 18; Reverberation times within receiving living-room.

Hz	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
T20	--	--	0.61	0.28	0.44	0.26	0.42	0.3	0.46	0.43	0.31	0.28	0.37	0.36	0.35	0.29	0.41	0.32	0.36
T30	--	--	--	0.5	0.26	0.26	0.35	0.33	0.41	0.33	0.29	0.36	0.35	0.32	0.34	0.32	0.35	0.32	0.36

Table 4; Reverberation times within receiving bedroom.

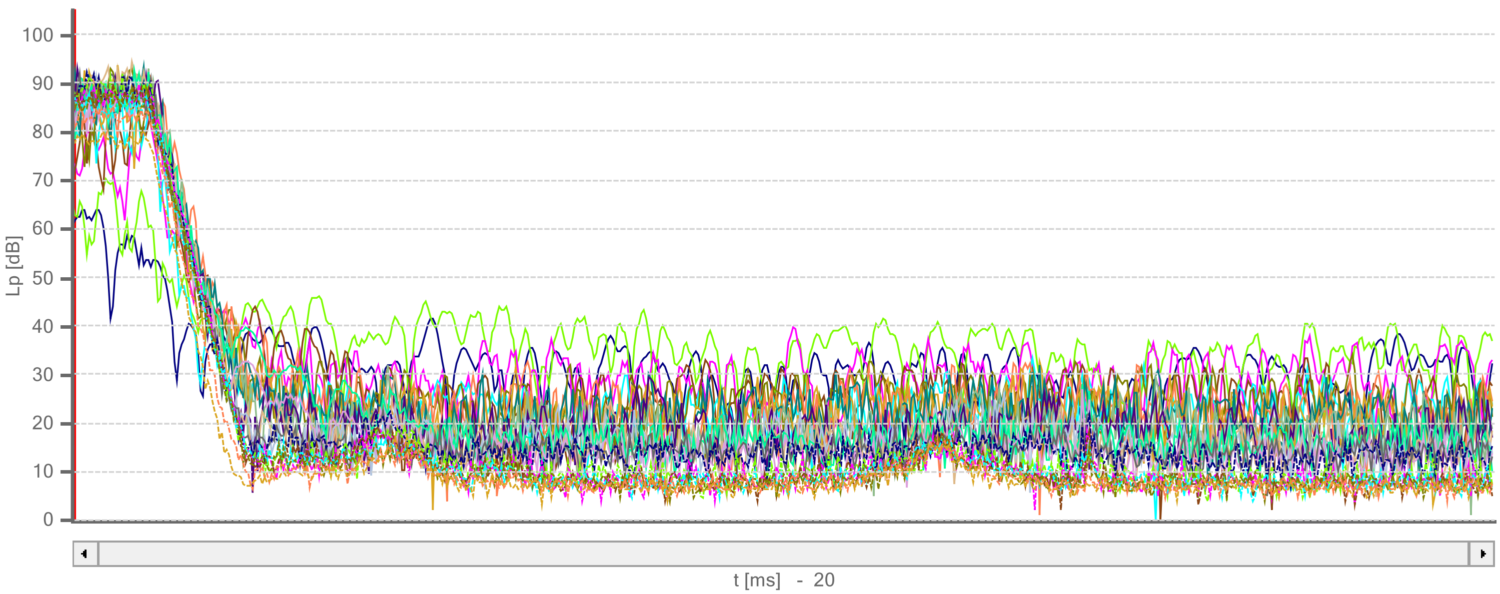

Figure 18; Reverberation times within receiving bedroom.