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# LAMPIRAN

## Lampiran 1. Surat Izin Penelitian (15 Oktober 2023)



**KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,  
RISET DAN TEKNOLOGI  
UNIVERSITAS HASANUDDIN  
FAKULTAS TEKNIK**

Jalan Poros Malino K.M. 6, Bontomarannu (92172) Gowa, Sulawesi Selatan, ☎ Fax.0411 –  
586 015 <http://eng.unhas.ac.id> Email: teknik@unhas.ac.id

Nomor : 21801/UN4.7.1/PT.01.04/2023  
Hal : Permohonan Data Penelitian Mahasiswa

Kepada  
Yth. : Pimpinan  
Hotel Unhas & Convention  
di-  
Tempat

Dengan hormat,

Kami sampaikan bahwa dalam rangka pengambilan data tugas mata kuliah **23D05140304 /Workshop Tugas Akhir Riset (LBE Sains dan Teknologi Bangunan)** pada Program Studi S1 Departemen Arsitektur Fakultas Teknik Unhas, maka kami mohon kebijakan Bapak/Ibu kiranya berkenan untuk memberikan kesempatan melakukan pengambilan data penelitian bagi mahasiswa :

Nama : Muhammad Firas Zayyan Muyassar / D051201047

Topik Penelitian :  
Analisis Tingkat Kebisingan pada Ballroom Hotel (Studi Kasus: Ballroom Hotel Unhas & Convention)

Demikian penyampaian kami, atas perhatian dan kerjasamanya diucapkan terima kasih

Ditetapkan di Gowa, 29 September 2023

a.n. Dekan,  
Wakil Dekan Bidang Akademik dan  
Kemahasiswaan



Dr. Amil Ahmad Ilham, S.T., M.IT  
NIP. 19731010 199802 1 001

Lampiran 2. Nilai koefisien serap bunyi pada material yang digunakan pada simulasi eksisting

MATERIAL / OBYEK	KOEFSIEN ABSORBSI ( $\alpha$ )					
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
BETON/TERASO	0.01	0.01	0.015	0.02	0.02	0.02
BETON dilapisi karpet	0.04	0.04	0.15	0.3	0.5	0.6
UBIN MARMER atau ubin mengkilap	0.01	0.01	0.01	0.01	0.02	0.02

PANEL KAYU	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
• di pasang di joist'	0.15	0.2	0.1	0.1	0.05	0.05
• untuk pintu	0.10	0.07	0.05	0.04	0.04	0.04
• pintu kayu	0.3	-	0.15	-	0.05	-
• tebal ¾ in	0.1	0.11	0.1	0.08	0.08	0.11
• tebal 3/8 - ½ inch, digantung, celah udara 2 - 4 inch	0.30	0.25	0.20	0.17	0.15	0.10

No	MATERIAL	KOEFSIEN SERAPAN BUNYI						NRC
		125	250	500	1000	2000	4000	
	LANGIT-LANGIT							
	Pemantul bunyi							
37	Beton	0,01	0,01	0,02	0,02	0,02	0,02	0,02
38	Papan gypsum setebal ½"	0,29	0,10	0,05	0,04	0,07	0,09	0,05
39	Papan gypsum setebal ½" –yang digantung	0,15	0,10	0,05	0,04	0,07	0,09	0,05

	250 Hz	500 Hz	1000 Hz	2000 Hz	
Beton, yang dituang, tanpa dicat	0,01	0,01	0,02	0,02	0,03
Kain, velour medium, 14 oz (0.48 kg per m <sup>2</sup> ), digantung sampai setengah luas	0,07	0,31	0,49	0,75	0,60
Lantai, beton atau teraso	0,01	0,01	0,015	0,02	0,02
Linoleum, vinyl, karet, atau lantai gabus pada beton	0,02	0,03	0,03	0,03	0,03
Pada sub lantai	0,02	0,04	0,05	0,05	0,10
Kayu	0,15	0,11	0,10	0,07	0,06
Panggung kayu, dengan ruang udara di bawahnya	0,40	0,30	0,20	0,17	0,10

		250 Hz	1000 Hz	4000 Hz
Kursi	Kosong dari kain	0,12	0,28	0,28
	Kosong dari besi	0,07	0,15	0,18

Floor materials	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Carpet	0.01	0.02	0.06	0.15	0.25	0.45
Concrete (unpainted, rough finish)	0.01	0.02	0.04	0.06	0.08	0.1

Lampiran 3. Nilai koefisien serap bunyi pada material yang digunakan pada simulasi alternatif desain

MATERIAL / OBYEK	KOEFSIEN ABSORBSI ( $\alpha$ )					
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
<b>KARPET ( lanjutan )</b>						
• di atas fiberboard bahan mineral, perforasi, tebal : 5/8 inch, dengan celah udara	0.37	0.41	0.63	0.85	0.96	0.92
• tebal 0.6 cm, berbulu, lunak, di atas lapisan busa	0.08	0.2	0.5	0.7	0.7	0.4
• tebal 1.0 cm, berbulu, lunak, di atas lapisan busa	0.05	0.1	0.3	0.5	0.65	0.7
• tebal 1.0 cm, tufted pile, di atas lapisan busa	0.08	0.09	0.3	0.6	0.7	0.8
• tebal 1.5 cm, pile tebal, berbulu, lunak, di atas lapisan busa	0.15	0.25	0.5	0.6	0.7	0.8

<b>LAPISAN ROCKWOOL</b>						
• tebal 2 inch :						
⇒ ditempelkan pada dinding keras	0.34	0.52	0.94	0.83	0.81	0.69
⇒ digantung, celah udara 1 inch	0.36	0.62	0.99	0.92	0.92	0.86
⇒ digantung, celah udara 2 inch	0.31	0.70	0.99	0.98	0.92	0.84

<b>FIBERGLASS INSULATION</b> blankets (selimut), pemasangan : no. 4 <sup>1)</sup>						
• AF100, tebal 1 inch,	0.07	0.23	0.42	0.77	0.73	0.70
• AF100, tebal 2 inch	0.19	0.51	0.79	0.92	0.82	0.78

<b>CEILINGS</b>		250 Hz	500 Hz	1000 Hz	2000 Hz	
Mineral wool tiles, 180mm airspace	0,42	0,72	0,83	0,88	0,89	0,80
Mineral wool tiles, glued/screwed to soffit	0,06	0,40	0,75	0,95	0,96	0,83
Gypsum plaster tiles, 17% perforated, 22mm	0,45	0,70	0,80	0,80	0,65	0,45

Lampiran 4. Hasil simulasi waktu dengung pada Ballroom (1)

**EKSISTING**

Spreadsheet - Classical theory of reverberation(EKSISTING)\Main results.gabe

Main results ×

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	-24.4	-0.00	2266.42	-24.4
63 Hz	0.00	1445.19	-25.4	-0.00	1445.19	-25.4
80 Hz	0.00	914.29	-26.4	-0.00	914.29	-26.4
100 Hz	0.51	488.97	-28.1	0.51	488.95	-28.1
125 Hz	21.03	54.95	-36.6	21.09	54.81	-36.6
160 Hz	0.00	263.84	-28.8	-0.00	263.84	-28.8
200 Hz	0.00	185.52	-29.3	-0.00	185.52	-29.3
250 Hz	281.61	4.59	-44.3	293.18	4.42	-44.5
315 Hz	0.00	101.49	-29.9	-0.00	101.49	-29.9
400 Hz	0.00	79.04	-30.0	-0.00	79.04	-30.0
500 Hz	269.68	4.61	-41.3	280.26	4.45	-41.5
630 Hz	0.00	54.15	-29.6	-0.00	54.15	-29.6
800 Hz	0.00	45.29	-29.4	-0.00	45.29	-29.4
1000 Hz	228.46	5.07	-37.9	235.99	4.93	-38.0
1250 Hz	0.00	30.98	-29.1	-0.00	30.98	-29.1
1600 Hz	0.00	23.75	-29.2	-0.00	23.75	-29.2
2000 Hz	267.13	3.91	-36.0	277.50	3.80	-36.2
2500 Hz	0.00	12.97	-29.8	-0.00	12.97	-29.8
3150 Hz	0.00	8.98	-30.4	-0.00	8.98	-30.4
4000 Hz	100.76	4.12	-32.8	102.19	4.10	-32.8
5000 Hz	0.00	4.00	-31.9	-0.00	4.00	-31.9
6300 Hz	0.00	2.62	-32.8	-0.00	2.62	-32.8
8000 Hz	0.00	1.68	-33.7	-0.00	1.68	-33.7
10000 Hz	0.00	1.11	-34.5	-0.00	1.11	-34.5
12500 Hz	0.00	0.74	-35.2	-0.00	0.74	-35.2
16000 Hz	0.00	0.49	-36.1	-0.00	0.49	-36.1
20000 Hz	0.00	0.34	-36.7	-0.00	0.34	-36.7
Global	NaN	NaN	-15.9	NaN	NaN	-15.9

**ALTERNATIF I**

Spreadsheet - ..cal theory of reverberation(ALTERNATIF I (KARPET 0.6))\Main results.gabe

Main results ×

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	82.44	15.61	30.0	83.39	15.43	30.0
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	457.06	2.87	51.5	488.63	2.68	51.2
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	699.52	1.86	49.6	777.40	1.68	49.2
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	833.75	1.54	48.8	947.75	1.36	48.3
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	863.64	1.43	48.5	986.81	1.26	47.9
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	83.21	4.35	39.5	84.18	4.34	39.4
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	58.9	NaN	NaN	58.7

**ALTERNATIF II**

Spreadsheet - ..ical theory of reverberation(ALTERNATIF II (KARPET 1))\Main results.gabe

Main results ×

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	56.12	22.52	31.6	56.56	22.35	31.6
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	369.34	3.53	52.4	389.59	3.35	52.2
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	524.08	2.46	50.8	566.17	2.28	50.5
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	658.30	1.93	49.8	726.65	1.76	49.4
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	819.78	1.50	48.7	929.66	1.33	48.2
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	83.21	4.35	39.5	84.18	4.34	39.4
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	59.4	NaN	NaN	59.2

**ALTERNATIF III**

Spreadsheet - ..l theory of reverberation(ALTERNATIF III (KARPET 1.5))\Main results.gabe

Main results ×

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	143.84	9.09	27.7	146.78	8.92	27.6
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	500.92	2.62	51.1	539.19	2.44	50.8
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	699.52	1.86	49.6	777.40	1.68	49.2
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	746.03	1.71	49.3	835.52	1.54	48.8
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	863.64	1.43	48.5	986.81	1.26	47.9
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	83.21	4.35	39.5	84.18	4.34	39.4
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	58.9	NaN	NaN	58.7

Lampiran 5. Hasil simulasi waktu dengung pada Ballroom (2)

**ALTERNATIF IV**

Spreadsheet - Classical theory of reverberation(FINAL-TREATMENT)Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	-24.4	-0.00	2266.42	-24.4
63 Hz	0.00	1445.19	-25.4	-0.00	1445.19	-25.4
80 Hz	0.00	914.29	-26.4	-0.00	914.29	-26.4
100 Hz	0.51	488.97	-28.1	0.51	488.95	-28.1
125 Hz	316.98	4.18	-47.8	331.75	3.99	-47.9
160 Hz	0.00	263.84	-28.8	-0.00	263.84	-28.8
200 Hz	0.00	185.52	-29.3	-0.00	185.52	-29.3
250 Hz	638.49	2.06	-47.8	702.52	1.88	-48.2
315 Hz	0.00	101.49	-29.9	-0.00	101.49	-29.9
400 Hz	0.00	79.04	-30.0	-0.00	79.04	-30.0
500 Hz	1000.84	1.31	-46.8	1171.74	1.12	-47.5
630 Hz	0.00	54.15	-29.6	-0.00	54.15	-29.6
800 Hz	0.00	45.29	-29.4	-0.00	45.29	-29.4
1000 Hz	890.02	1.45	-43.4	1021.61	1.27	-43.9
1250 Hz	0.00	30.98	-29.1	-0.00	30.98	-29.1
1600 Hz	0.00	23.75	-29.2	-0.00	23.75	-29.2
2000 Hz	919.97	1.35	-40.7	1061.60	1.18	-41.3
2500 Hz	0.00	12.97	-29.8	-0.00	12.97	-29.8
3150 Hz	0.00	8.98	-30.4	-0.00	8.98	-30.4
4000 Hz	701.36	1.45	-37.4	779.68	1.33	-37.7
5000 Hz	0.00	4.00	-31.9	-0.00	4.00	-31.9
6300 Hz	0.00	2.62	-32.8	-0.00	2.62	-32.8
8000 Hz	0.00	1.68	-33.7	-0.00	1.68	-33.7
10000 Hz	0.00	1.11	-34.5	-0.00	1.11	-34.5
12500 Hz	0.00	0.74	-35.2	-0.00	0.74	-35.2
16000 Hz	0.00	0.49	-36.1	-0.00	0.49	-36.1
20000 Hz	0.00	0.34	-36.7	-0.00	0.34	-36.7
Global	NaN	NaN	-16.1	NaN	NaN	-16.1

**ALTERNATIF V**

Spreadsheet - y of reverberation(ALTERNATIF V (D =GYPSUM PERFORASI))Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	384.83	3.45	23.5	406.89	3.26	23.2
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	758.60	1.74	49.3	851.42	1.55	48.9
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	835.61	1.56	48.9	950.16	1.38	48.3
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	818.64	1.57	48.9	928.16	1.39	48.4
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	744.12	1.63	49.1	833.10	1.47	48.6
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	464.56	1.94	36.0	497.23	1.85	35.8
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	58.5	NaN	NaN	58.3

**ALTERNATIF VI**

Spreadsheet - .. of reverberation(ALTERNATIF VI (P =GYPSUM PERFORASI))Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	542.16	2.45	22.0	587.38	2.27	21.6
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	992.20	1.34	48.2	1159.85	1.14	47.5
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	1157.99	1.14	47.5	1395.73	0.95	46.7
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	1128.62	1.15	47.5	1352.80	0.96	46.8
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	954.07	1.30	48.1	1107.62	1.13	47.5
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	574.50	1.68	35.3	625.62	1.57	35.0
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	58.0	NaN	NaN	57.8

**ALTERNATIF VII**

Spreadsheet - .l theory of reverberation(ALTERNATIF VII (FIBERGLASS))Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	9.19	106.95	38.4	9.20	106.85	38.4
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	767.20	1.72	49.3	862.32	1.53	48.8
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	1146.15	1.15	47.5	1378.35	0.96	46.7
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	1270.75	1.02	47.0	1565.54	0.84	46.2
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	1155.42	1.09	47.3	1392.00	0.91	46.5
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	41.54	5.03	40.1	41.78	5.03	40.1
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	58.1	NaN	NaN	57.9

Lampiran 6. Hasil simulasi waktu dengung pada Ballroom (3)

**ALTERNATIF VIII**

Spreadsheet - ..lcal theory of reverberation\ALTERNATIF VIII (LT + P)\Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	664.98	2.00	21.1	734.82	1.81	20.7
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	1211.52	1.10	47.3	1475.44	0.90	46.5
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	1587.82	0.83	46.1	2090.70	0.63	45.0
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	1646.17	0.80	45.9	2196.25	0.60	44.7
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	1550.59	0.82	46.1	2024.96	0.64	45.0
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	556.96	1.71	35.4	604.83	1.61	35.2
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	57.5	NaN	NaN	57.2

**ALTERNATIF IX**

Spreadsheet - ..sical theory of reverberation\ALTERNATIF IX (LT + D)\Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	426.04	3.12	23.0	453.30	2.93	22.7
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	841.22	1.57	48.9	957.49	1.38	48.3
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	1396.70	0.94	46.7	1765.19	0.75	45.7
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	1376.84	0.95	46.7	1732.89	0.76	45.7
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	1486.15	0.86	46.3	1913.89	0.67	45.2
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	655.91	1.52	34.9	723.72	1.41	34.6
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	57.8	NaN	NaN	57.5

**ALTERNATIF X**

Spreadsheet - ..lssical theory of reverberation\ALTERNATIF X (D + P)\Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	824.36	1.62	20.2	935.57	1.43	19.6
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	1332.50	1.00	46.9	1662.14	0.80	46.0
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	1855.17	0.71	45.5	2601.77	0.51	44.0
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	1759.46	0.75	45.7	2410.20	0.55	44.3
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	1576.60	0.81	46.0	2070.77	0.62	44.9
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	1147.21	0.98	33.0	1379.94	0.83	32.3
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	57.4	NaN	NaN	57.1

**ALTERNATIF XI dan XII**

Spreadsheet - ..al theory of reverberation\ALTERNATIF XI (LT + P + D)\Main results.gabe

Main results X

	A_Sabine m <sup>2</sup>	TR_Sabine s	L_Sabine dB	A_Eyring m <sup>2</sup>	TR_Eyring s	L_Eyring dB
50 Hz	0.00	2266.42	47.6	-0.00	2266.42	47.6
63 Hz	0.00	1445.19	46.7	-0.00	1445.19	46.7
80 Hz	0.00	914.29	45.7	-0.00	914.29	45.7
100 Hz	0.51	488.97	44.0	0.51	488.95	44.0
125 Hz	947.18	1.41	19.6	1098.25	1.22	18.9
160 Hz	0.00	263.84	43.3	-0.00	263.84	43.3
200 Hz	0.00	185.52	42.8	-0.00	185.52	42.8
250 Hz	1551.83	0.86	46.3	2027.19	0.66	45.1
315 Hz	0.00	101.49	42.1	-0.00	101.49	42.1
400 Hz	0.00	79.04	42.1	-0.00	79.04	42.1
500 Hz	2285.01	0.58	44.6	3613.33	0.37	42.6
630 Hz	0.00	54.15	42.4	-0.00	54.15	42.4
800 Hz	0.00	45.29	42.6	-0.00	45.29	42.6
1000 Hz	2277.02	0.58	44.6	3591.60	0.37	42.6
1250 Hz	0.00	30.98	43.0	-0.00	30.98	43.0
1600 Hz	0.00	23.75	42.8	-0.00	23.75	42.8
2000 Hz	2173.11	0.60	44.7	3321.69	0.39	42.9
2500 Hz	0.00	12.97	42.2	-0.00	12.97	42.2
3150 Hz	0.00	8.98	41.6	-0.00	8.98	41.6
4000 Hz	1129.67	0.99	33.0	1354.33	0.85	32.4
5000 Hz	0.00	4.00	40.1	-0.00	4.00	40.1
6300 Hz	0.00	2.62	39.3	-0.00	2.62	39.3
8000 Hz	0.00	1.68	38.3	-0.00	1.68	38.3
10000 Hz	0.00	1.11	37.5	-0.00	1.11	37.5
12500 Hz	0.00	0.74	36.8	-0.00	0.74	36.8
16000 Hz	0.00	0.49	35.9	-0.00	0.49	35.9
20000 Hz	0.00	0.34	35.4	-0.00	0.34	35.4
Global	NaN	NaN	57.2	NaN	NaN	56.8

## Lampiran 7. Hasil simulasi (Nilai SPL) pada Ballroom (1)

EKSISTING																			
60 dB					75 dB					90 dB									
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	53.49	53.84	54.52	53.34	A	68.58	68.88	69.41	68.38	A	83.56	83.90	84.42	83.33					
B	53.40	53.71	54.29	53.11	B	68.40	68.80	69.21	68.03	B	83.50	83.84	84.25	83.15					
C	53.48	53.68	54.56	53.41	C	68.59	68.76	69.57	68.36	C	83.53	83.75	84.54	83.33					
D	53.73	54.02	54.56	53.41	D	68.70	68.93	69.57	68.36	D	83.75	84.04	84.54	83.33					
E	53.11	53.68	54.14	53.14	E	68.22	68.63	69.17	68.09	E	83.27	83.59	84.19	83.07					
F	53.49	53.69	54.07	53.02	F	68.38	68.61	69.16	67.98	F	83.45	83.67	84.24	82.97					
G	53.39	53.61	54.14	52.91	G	68.39	68.58	69.04	67.96	G	83.40	83.71	84.04	82.92					
H	53.48	53.94	54.27	52.91	H	68.61	68.91	69.26	67.90	H	83.56	83.96	84.24	83.00					
I	53.34	53.78	54.33	53.23	I	68.44	68.78	69.32	68.19	I	83.40	83.80	84.26	83.28					
J	53.34	53.69	54.14	52.99	J	68.42	68.62	69.19	68.00	J	83.41	83.70	84.24	83.03					
K	53.31	53.61	54.10	52.89	K	68.27	68.60	69.08	67.77	K	83.42	83.56	84.17	82.82					
L	53.54	53.98	54.27	52.88	L	68.56	68.88	69.22	67.91	L	83.54	83.95	84.27	82.97					
M	53.63	54.01	54.51	53.39	M	68.61	68.89	69.45	68.35	M	83.58	83.91	84.47	83.37					
N	53.47	53.66	54.28	53.10	N	68.41	68.72	69.15	68.04	N	83.45	83.79	84.24	83.09					
O	53.47	53.67	54.24	53.02	O	68.55	68.67	69.27	68.04	O	83.41	83.74	84.21	83.01					
P	53.61	54.00	54.49	53.38	P	68.67	69.00	69.45	68.30	P	83.70	83.99	84.49	83.28					
Rata - rata	53.45	53.79	54.31	53.13	Rata - rata	68.49	68.76	69.28	68.10	Rata - rata	83.50	83.81	84.30	83.12					
Max	53.73	54.02	54.56	53.41	Max	68.70	69.00	69.57	68.38	Max	83.75	84.04	84.54	83.37					
Min	53.11	53.61	54.07	52.88	Min	68.22	68.58	69.04	67.77	Min	83.27	83.56	84.04	82.82					

ALTERNATIF I																			
60 dB					75 dB					90 dB									
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	51.59	50.13	49.11	48.81	A	66.60	65.08	64.23	63.83	A	81.70	79.96	79.21	78.82					
B	51.60	49.76	49.03	48.59	B	66.51	64.87	64.04	63.65	B	81.58	79.89	79.03	78.71					
C	51.67	49.79	49.24	48.69	C	66.67	64.95	64.17	63.77	C	81.67	79.86	79.14	78.74					
D	51.82	49.99	49.24	48.69	D	66.79	64.91	64.17	63.77	D	81.84	80.00	79.14	78.74					
E	51.57	50.02	49.44	49.09	E	66.59	65.11	64.46	64.10	E	81.68	80.16	79.54	79.00					
F	51.48	49.73	49.07	48.45	F	66.49	64.80	63.97	63.61	F	81.49	79.79	79.02	78.40					
G	51.63	49.90	49.17	48.59	G	66.59	64.82	64.17	63.60	G	81.69	79.70	79.10	78.60					
H	52.02	50.59	49.74	49.32	H	67.00	65.52	64.73	64.19	H	81.91	80.44	79.70	79.23					
I	51.66	49.99	49.44	49.02	I	66.66	65.05	64.52	64.04	I	81.59	80.20	79.57	78.88					
J	51.55	49.62	48.99	48.39	J	66.52	64.71	64.05	63.47	J	81.50	79.76	78.93	78.45					
K	51.55	49.77	49.12	48.77	K	66.61	64.91	64.21	63.61	K	81.50	79.66	79.02	78.53					
L	51.84	50.53	49.81	49.14	L	66.95	65.47	64.68	64.18	L	82.03	80.48	79.66	79.23					
M	51.60	50.00	49.08	48.67	M	66.60	64.88	64.21	63.63	M	81.68	79.91	79.02	78.80					
N	51.73	49.85	48.99	48.68	N	66.59	64.75	64.07	63.68	N	81.68	79.76	79.06	78.77					
O	51.73	49.80	49.15	48.66	O	66.60	64.75	64.25	63.79	O	81.59	79.83	79.08	78.84					
P	51.66	49.85	49.29	48.88	P	66.80	65.08	64.08	63.74	P	81.71	79.85	79.07	78.67					
Rata - rata	51.67	49.96	49.24	48.78	Rata - rata	66.66	64.98	64.25	63.79	Rata - rata	81.68	79.95	79.21	78.77					
Max	52.02	50.59	49.81	49.32	Max	67.00	65.52	64.73	64.19	Max	82.03	80.48	79.70	79.23					
Min	51.48	49.62	48.99	48.39	Min	66.49	64.71	63.97	63.47	Min	81.49	79.66	78.93	78.40					

ALTERNATIF II																			
60 dB					75 dB					90 dB									
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	52.47	51.29	50.31	48.89	A	67.51	66.33	65.28	64.13	A	82.57	81.35	80.30	79.16					
B	52.36	51.06	50.18	48.73	B	67.38	66.08	65.24	63.82	B	82.44	81.00	80.19	79.03					
C	52.60	51.03	50.38	49.17	C	67.54	66.15	65.38	63.96	C	82.40	80.96	80.34	78.75					
D	52.60	51.33	50.38	49.17	D	67.59	66.20	65.38	63.96	D	82.68	81.29	80.34	78.75					
E	52.21	51.25	50.39	49.20	E	67.21	66.22	65.42	64.21	E	82.17	81.11	80.46	79.32					
F	52.29	50.90	49.92	48.74	F	67.33	65.88	64.91	63.76	F	82.44	81.06	80.03	78.89					
G	52.45	51.15	50.20	48.91	G	67.38	66.05	65.22	63.85	G	82.47	81.11	80.02	78.87					
H	52.65	51.56	50.68	49.48	H	67.71	66.52	65.72	64.30	H	82.65	81.51	80.65	79.42					
I	52.42	51.19	50.44	49.17	I	67.41	66.22	65.43	64.20	I	82.44	81.23	80.46	79.28					
J	52.42	51.01	50.16	48.97	J	67.35	65.96	65.07	63.81	J	82.27	80.95	80.02	78.78					
K	52.54	51.09	50.25	48.84	K	67.40	66.15	65.03	63.89	K	82.44	80.97	80.09	78.75					
L	52.60	51.51	50.65	49.26	L	67.67	66.60	65.70	64.37	L	82.65	81.47	80.57	79.45					
M	52.52	51.29	50.39	49.03	M	67.41	66.25	65.28	64.04	M	82.40	81.26	80.18	79.09					
N	52.54	50.85	50.23	49.00	N	67.43	66.04	65.10	63.85	N	82.40	81.01	80.05	79.12					
O	52.47	51.15	50.20	48.92	O	67.37	66.03	65.16	63.94	O	82.45	81.07	80.14	78.75					
P	52.68	51.39	50.31	48.95	P	67.53	66.25	65.25	64.03	P	82.70	81.31	80.38	78.94					
Rata - rata	52.49	51.19	50.32	49.03	Rata - rata	67.45	66.18	65.29	64.01	Rata - rata	82.47	81.17	80.26	79.02					
Max	52.68	51.56	50.68	49.48	Max	67.71	66.60	65.72	64.37	Max	82.70	81.51	80.65	79.45					
Min	52.21	50.85	49.92	48.73	Min	67.21	65.88	64.91	63.76	Min	82.17	80.95	80.02	78.75					

Lampiran 8. Hasil simulasi (Nilai SPL) pada Ballroom (2)

ALTERNATIF III														
60 dB					75 dB					90 dB				
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	51.20	50.11	49.79	48.85	A	66.38	65.02	64.72	63.69	A	81.25	80.11	79.76	78.81
B	51.20	49.68	49.59	48.43	B	66.22	64.81	64.44	63.51	B	81.23	79.71	79.51	78.49
C	51.38	50.00	49.73	48.68	C	66.38	64.89	64.70	63.64	C	81.43	79.88	79.63	78.75
D	51.53	50.08	49.73	48.68	D	66.44	64.98	64.70	63.64	D	81.48	79.98	79.63	78.75
E	51.27	50.04	49.98	49.06	E	66.21	65.01	64.94	63.98	E	81.18	79.97	79.78	79.25
F	51.20	49.72	49.64	48.41	F	66.17	64.64	64.51	63.57	F	81.17	79.88	79.39	78.46
G	51.29	49.82	49.58	48.62	G	66.14	64.80	64.57	63.70	G	81.23	79.83	79.57	78.76
H	51.83	50.39	50.31	49.25	H	66.70	65.54	65.25	64.11	H	81.64	80.62	80.27	79.27
I	51.36	50.02	50.06	48.88	I	66.22	64.92	65.02	63.93	I	81.17	80.00	80.07	79.00
J	51.17	49.56	49.56	48.52	J	66.01	64.71	64.50	63.28	J	81.18	79.71	79.56	78.53
K	51.24	49.83	49.56	48.54	K	66.18	64.97	64.50	63.59	K	81.27	79.89	79.61	78.65
L	51.55	50.43	50.15	49.24	L	66.67	65.37	65.06	64.22	L	81.52	80.53	80.32	79.06
M	51.34	49.73	49.65	48.80	M	66.42	64.93	64.63	63.69	M	81.22	79.83	79.81	78.89
N	51.26	49.78	49.61	48.59	N	66.33	64.82	64.46	63.61	N	81.26	79.92	79.58	78.50
O	51.26	49.92	49.60	48.61	O	66.24	65.03	64.70	63.73	O	81.24	79.88	79.49	78.68
P	51.52	50.15	49.80	48.80	P	66.45	65.04	64.67	63.70	P	81.34	79.98	79.60	78.61
Rata - rata	51.35	49.95	49.77	48.75	Rata - rata	66.32	64.97	64.71	63.73	Rata - rata	81.30	79.98	79.72	78.78
Max	51.83	50.43	50.31	49.25	Max	66.70	65.54	65.25	64.22	Max	81.64	80.62	80.32	79.27
Min	51.17	49.56	49.56	48.41	Min	66.01	64.64	64.44	63.28	Min	81.17	79.71	79.39	78.46

ALTERNATIF IV														
60 dB					75 dB					90 dB				
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	49.02	45.26	46.52	46.32	A	64.24	61.18	62.20	61.66	A	79.26	75.96	77.12	76.74
B	49.06	46.04	46.77	46.31	B	64.41	61.80	62.46	61.88	B	79.44	76.59	77.45	76.75
C	49.28	46.36	47.00	46.68	C	64.66	62.04	62.68	62.28	C	79.59	77.12	77.58	77.19
D	49.22	45.89	47.00	46.68	D	64.56	61.64	62.68	62.28	D	79.68	76.56	77.58	77.19
E	49.16	46.36	46.81	46.77	E	64.43	61.80	62.53	62.39	E	79.25	76.98	77.66	77.01
F	49.40	46.34	47.09	47.03	F	64.47	62.09	62.48	62.27	F	79.60	77.30	77.84	77.38
G	49.39	46.59	47.48	46.73	G	64.58	62.08	62.64	62.32	G	79.81	77.17	77.59	77.31
H	49.59	46.51	47.45	46.56	H	64.71	62.28	62.78	62.28	H	79.86	77.33	77.61	76.98
I	49.22	46.53	47.16	47.05	I	64.63	62.11	62.95	62.45	I	79.48	77.15	77.67	77.37
J	49.04	46.36	47.27	46.82	J	64.41	62.18	62.64	62.41	J	79.34	76.84	77.60	77.29
K	49.45	46.57	47.32	46.78	K	64.56	62.14	62.55	62.29	K	79.65	77.00	77.76	77.27
L	49.33	46.37	47.20	46.76	L	64.75	62.21	62.74	62.03	L	79.66	77.30	77.65	77.03
M	48.76	45.56	46.61	46.23	M	64.42	60.80	62.00	61.81	M	79.13	76.04	76.89	76.58
N	49.05	46.04	46.82	46.39	N	64.48	61.61	62.49	62.02	N	79.50	76.59	77.25	76.98
O	49.20	45.96	47.15	46.73	O	64.52	61.94	62.54	62.06	O	79.52	76.57	77.55	77.04
P	49.24	45.88	46.65	46.40	P	64.54	61.64	62.33	61.97	P	79.62	76.55	77.46	77.07
Rata - rata	49.21	46.16	47.02	46.64	Rata - rata	64.52	61.85	62.54	62.15	Rata - rata	79.52	76.82	77.52	77.07
Max	49.59	46.59	47.48	47.05	Max	64.75	62.28	62.95	62.45	Max	79.86	77.33	77.84	77.38
Min	48.76	45.26	46.52	46.23	Min	64.24	60.80	62.00	61.66	Min	79.13	75.96	76.89	76.58

ALTERNATIF V														
60 dB					75 dB					90 dB				
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	47.73	47.13	47.34	47.90	A	62.82	62.03	62.21	62.95	A	77.86	77.15	77.43	77.91
B	48.11	47.48	47.58	47.95	B	63.13	62.45	62.78	63.02	B	78.17	77.59	77.73	78.11
C	48.44	47.86	47.83	48.29	C	63.43	63.02	62.77	63.27	C	78.50	77.96	77.74	78.40
D	48.18	47.87	47.83	48.29	D	63.24	62.74	62.77	63.27	D	78.27	77.80	77.74	78.40
E	48.21	47.75	47.83	48.46	E	63.13	62.87	62.94	63.14	E	78.12	77.77	77.74	78.28
F	48.36	47.84	47.98	48.20	F	63.23	62.71	62.88	63.28	F	78.34	77.95	77.91	78.23
G	48.56	48.16	47.93	48.11	G	63.63	62.91	63.07	63.07	G	78.36	77.76	77.86	78.19
H	48.85	48.11	47.93	47.98	H	63.57	63.27	62.77	63.03	H	78.59	78.05	78.07	78.20
I	48.29	47.99	48.00	48.47	I	63.31	62.90	63.17	63.44	I	78.21	77.85	78.10	78.45
J	48.32	47.78	47.72	48.19	J	63.32	62.89	62.95	63.21	J	78.43	77.73	77.97	78.12
K	48.47	47.99	47.85	48.17	K	63.26	62.86	63.09	63.28	K	78.56	77.93	78.04	78.21
L	48.60	48.13	47.89	48.10	L	63.45	63.07	62.95	63.28	L	78.74	77.90	77.83	78.20
M	47.76	47.08	47.19	47.90	M	62.40	61.99	62.43	62.88	M	77.80	77.44	77.24	77.99
N	48.18	47.65	47.56	47.91	N	63.12	62.51	62.59	63.18	N	78.16	77.64	77.72	77.90
O	48.25	47.65	47.81	48.08	O	63.36	62.62	62.69	62.97	O	78.19	77.92	77.63	78.19
P	48.13	47.59	47.78	48.04	P	63.17	62.62	62.72	63.30	P	78.21	77.71	77.72	78.19
Rata - rata	48.28	47.75	47.75	48.13	Rata - rata	63.22	62.72	62.80	63.16	Rata - rata	78.28	77.76	77.78	78.19
Max	48.85	48.16	48.00	48.47	Max	63.63	63.27	63.17	63.44	Max	78.74	78.05	78.10	78.45
Min	47.73	47.08	47.19	47.90	Min	62.40	61.99	62.21	62.88	Min	77.80	77.15	77.24	77.90

Lampiran 9. Hasil simulasi (Nilai SPL) pada Ballroom (3)

ALTERNATIF VI														
60 dB				75 dB				90 dB						
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	47.97	47.33	47.84	48.28	A	63.18	62.26	62.61	63.23	A	77.95	77.33	77.71	78.22
B	48.06	47.37	47.36	47.82	B	63.02	62.13	62.40	63.06	B	77.85	77.10	77.48	77.88
C	47.95	47.40	47.48	48.37	C	63.07	62.36	62.69	63.33	C	77.90	77.38	77.87	78.28
D	48.18	47.71	47.48	48.37	D	62.95	62.43	62.69	63.33	D	78.22	77.57	77.87	78.28
E	47.85	46.93	47.63	48.01	E	62.80	62.42	62.47	63.00	E	77.94	77.21	77.61	77.86
F	47.83	47.01	47.47	47.78	F	62.80	62.11	62.14	62.79	F	77.87	76.99	77.35	77.69
G	47.95	47.07	47.35	47.72	G	63.05	62.16	62.30	62.86	G	77.82	77.04	77.16	77.93
H	47.95	47.48	47.58	48.09	H	63.08	62.44	62.39	62.96	H	78.25	77.25	77.55	77.85
I	48.00	47.35	47.51	48.29	I	62.97	62.53	62.63	63.08	I	77.98	77.37	77.58	78.23
J	47.66	47.06	47.30	47.71	J	62.87	61.94	62.22	62.79	J	77.67	77.03	77.21	77.74
K	47.91	47.00	47.28	47.88	K	62.67	62.06	62.17	62.93	K	77.82	77.16	77.39	77.77
L	48.08	47.65	47.65	47.92	L	63.03	62.58	62.34	63.01	L	78.10	77.32	77.60	77.86
M	48.09	47.56	47.82	48.32	M	63.09	62.36	62.67	63.18	M	78.02	77.52	77.77	78.22
N	47.83	47.21	47.35	48.05	N	62.96	62.37	62.42	62.86	N	78.10	77.37	77.40	78.04
O	47.97	47.23	47.46	47.90	O	62.87	62.48	62.46	63.04	O	78.14	77.32	77.52	77.87
P	48.11	47.45	47.70	48.35	P	63.13	62.57	62.69	63.21	P	78.31	77.44	77.63	78.16
Rata - rata	47.96	47.30	47.52	48.05	Rata - rata	62.97	62.32	62.46	63.04	Rata - rata	78.00	77.28	77.54	77.99
Max	48.18	47.71	47.84	48.37	Max	63.18	62.58	62.69	63.33	Max	78.31	77.57	77.87	78.28
Min	47.66	46.93	47.28	47.71	Min	62.67	61.94	62.14	62.79	Min	77.67	76.99	77.16	77.69

ALTERNATIF VII														
60 dB				75 dB				90 dB						
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	49.34	47.54	47.28	47.50	A	64.10	62.68	62.25	62.50	A	79.18	77.28	77.07	77.44
B	48.99	47.16	46.84	47.24	B	64.17	62.33	61.86	62.23	B	79.01	77.06	76.87	77.00
C	49.06	47.41	47.14	47.34	C	64.10	62.27	62.03	62.42	C	79.15	77.39	77.30	77.48
D	49.12	47.51	47.14	47.34	D	64.23	62.51	62.03	62.42	D	79.38	77.53	77.30	77.48
E	48.92	47.18	46.86	47.23	E	63.78	62.08	61.97	61.99	E	78.98	77.23	77.00	77.30
F	49.01	47.07	46.76	46.85	F	64.09	62.02	61.71	61.95	F	78.89	77.32	76.72	76.88
G	48.93	46.91	46.73	47.02	G	64.13	62.13	61.83	61.89	G	79.06	77.13	76.89	76.87
H	49.17	47.58	46.99	46.95	H	64.20	62.30	62.06	62.21	H	79.23	77.42	77.17	77.10
I	49.10	47.23	47.07	47.16	I	63.97	62.43	62.01	62.25	I	79.03	77.34	77.14	77.35
J	48.87	47.12	46.81	46.88	J	64.07	62.01	61.76	61.99	J	78.91	77.12	76.67	76.99
K	49.04	47.24	46.80	46.94	K	63.95	62.18	61.81	61.83	K	79.17	77.19	76.98	76.87
L	49.29	47.59	47.11	47.01	L	64.19	62.44	62.00	62.11	L	79.19	77.44	77.21	77.07
M	49.16	47.51	47.35	47.47	M	64.34	62.41	62.17	62.46	M	79.20	77.48	77.33	77.36
N	49.16	47.34	46.94	47.20	N	64.13	62.38	62.05	62.10	N	79.11	77.35	76.80	77.23
O	49.08	47.35	46.80	47.18	O	64.16	62.38	61.86	62.14	O	79.24	77.42	77.07	77.32
P	49.22	47.48	47.18	47.33	P	64.35	62.54	62.16	62.51	P	79.40	77.54	77.16	77.50
Rata - rata	49.09	47.33	46.99	47.16	Rata - rata	64.12	62.32	61.97	62.19	Rata - rata	79.13	77.33	77.04	77.20
Max	49.34	47.59	47.35	47.50	Max	64.35	62.68	62.25	62.51	Max	79.40	77.54	77.33	77.50
Min	48.87	46.91	46.73	46.85	Min	63.78	62.01	61.71	61.83	Min	78.89	77.06	76.67	76.87

ALTERNATIF VIII														
60 dB				75 dB				90 dB						
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	47.34	46.33	46.17	46.02	A	62.91	59.00	59.41	58.84	A	77.71	74.14	74.41	73.91
B	47.10	46.05	46.26	46.25	B	62.70	59.40	59.70	59.22	B	78.04	74.45	74.70	74.23
C	47.53	46.37	46.22	46.22	C	63.05	59.82	59.47	58.64	C	78.03	74.89	74.60	74.15
D	47.47	46.30	46.22	46.22	D	63.07	59.24	59.47	58.64	D	78.15	74.16	74.60	74.15
E	47.45	46.24	46.45	46.56	E	62.98	60.17	60.76	60.10	E	78.13	75.05	75.50	75.38
F	47.16	46.06	46.03	46.12	F	62.99	59.75	59.89	59.47	F	78.02	74.87	74.81	74.26
G	47.31	46.16	45.98	46.16	G	63.16	60.10	60.12	59.68	G	78.02	74.99	75.13	74.52
H	47.55	46.61	46.53	46.62	H	63.79	60.94	60.98	60.51	H	78.71	75.89	76.09	75.62
I	47.39	46.48	46.57	46.62	I	63.19	60.18	60.65	60.01	I	78.11	75.06	75.49	74.79
J	47.22	45.85	46.01	45.87	J	62.80	59.57	60.06	59.12	J	77.98	74.71	74.65	74.27
K	47.38	46.04	45.92	46.19	K	63.14	59.95	60.14	59.42	K	78.23	75.01	75.08	74.50
L	47.49	46.61	46.64	46.50	L	63.51	60.90	61.06	60.49	L	78.60	75.91	76.08	75.36
M	47.25	46.11	46.37	46.22	M	62.63	58.94	59.30	58.72	M	77.52	73.77	74.19	73.73
N	47.25	46.20	46.19	46.11	N	62.77	59.12	59.54	59.27	N	77.79	74.41	74.70	74.02
O	47.47	46.21	46.15	46.32	O	63.00	59.52	59.97	59.21	O	77.96	74.57	74.72	74.24
P	47.33	46.14	46.19	46.22	P	63.04	59.06	59.19	58.82	P	78.16	74.24	74.39	73.98
Rata - rata	47.36	46.23	46.24	46.26	Rata - rata	63.05	59.73	59.98	59.39	Rata - rata	78.07	74.76	74.95	74.44
Max	47.55	46.61	46.64	46.62	Max	63.79	60.94	61.06	60.51	Max	78.71	75.91	76.09	75.62
Min	47.10	45.85	45.92	45.87	Min	62.63	58.94	59.19	58.64	Min	77.52	73.77	74.19	73.73

Lampiran 10. Hasil simulasi (Nilai SPL) pada Ballroom (4)

ALTERNATIF IX														
60 dB					75 dB					90 dB				
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	47.60	43.67	44.46	43.56	A	62.30	61.23	61.42	61.20	A	77.41	76.03	76.28	76.34
B	48.02	44.21	44.51	44.08	B	62.35	61.08	61.05	61.12	B	77.33	76.09	75.97	76.24
C	48.10	44.63	44.54	44.04	C	62.34	61.04	61.07	61.01	C	77.40	76.32	75.90	76.15
D	47.98	44.28	44.54	44.04	D	62.43	61.29	61.07	61.01	D	77.42	76.23	75.90	76.15
E	48.16	45.08	45.60	44.97	E	62.42	61.45	61.47	61.38	E	77.45	76.39	76.31	76.35
F	48.08	44.78	44.93	44.39	F	62.37	60.97	61.21	60.90	F	77.25	75.83	75.90	75.92
G	48.23	44.75	45.24	44.74	G	62.29	61.11	60.93	61.11	G	77.26	76.12	76.12	76.11
H	48.60	45.72	46.00	45.54	H	62.66	61.72	61.72	61.66	H	77.68	76.82	76.61	76.86
I	48.11	45.04	45.32	45.15	I	62.41	61.55	61.33	61.63	I	77.27	76.42	76.30	76.47
J	47.79	44.76	44.91	44.09	J	62.27	61.03	60.79	60.96	J	77.14	76.11	75.87	76.20
K	47.90	44.72	45.07	44.43	K	62.41	60.95	60.92	61.07	K	77.31	76.03	75.99	76.08
L	48.43	45.93	46.05	45.58	L	62.66	61.50	61.62	61.80	L	77.71	76.91	76.53	76.65
M	47.55	43.93	44.26	43.65	M	62.40	60.99	61.27	61.37	M	77.40	76.26	76.05	76.30
N	47.87	44.28	44.60	44.19	N	62.41	61.15	61.19	61.44	N	77.43	76.08	76.19	76.31
O	47.90	44.71	44.96	44.05	O	62.29	61.28	61.13	61.45	O	77.16	76.24	76.19	76.18
P	47.93	44.38	44.64	43.95	P	62.53	61.33	61.19	61.02	P	77.57	76.21	76.26	76.10
Rata - rata	48.02	44.68	44.98	44.40	Rata - rata	62.41	61.23	61.21	61.26	Rata - rata	77.39	76.26	76.15	76.28
Max	48.60	45.93	46.05	45.58	Max	62.66	61.72	61.72	61.80	Max	77.71	76.91	76.61	76.86
Min	47.55	43.67	44.26	43.56	Min	62.27	60.95	60.79	60.90	Min	77.14	75.83	75.87	75.92

ALTERNATIF X														
60 dB					75 dB					90 dB				
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	45.23	42.01	42.65	43.43	A	60.26	56.91	57.93	58.41	A	75.29	72.07	72.83	73.38
B	45.33	42.57	42.89	43.92	B	60.23	57.81	58.37	59.02	B	75.28	72.59	73.09	73.81
C	45.57	43.09	43.00	44.22	C	60.45	58.17	58.45	58.76	C	75.37	73.56	73.15	74.16
D	45.64	42.46	43.00	44.22	D	60.57	57.70	58.45	58.76	D	75.41	72.64	73.15	74.16
E	45.25	42.92	43.34	44.34	E	60.58	58.15	58.72	59.42	E	75.28	73.15	73.46	74.02
F	45.36	43.29	43.59	44.21	F	60.19	57.85	58.54	59.22	F	75.61	72.79	73.39	74.03
G	45.47	43.15	43.20	44.15	G	60.51	58.28	58.57	59.06	G	75.23	73.20	73.76	74.03
H	45.61	43.36	43.98	44.16	H	60.71	58.55	58.76	59.35	H	75.61	73.49	73.73	74.11
I	45.28	43.25	43.86	44.42	I	60.56	58.15	58.76	59.06	I	75.39	72.99	73.55	74.42
J	45.52	42.95	43.34	44.30	J	60.31	58.08	58.41	58.99	J	75.47	73.11	73.49	74.07
K	45.43	43.06	43.58	44.31	K	60.63	58.08	58.42	59.13	K	75.42	72.99	73.54	74.26
L	45.79	43.50	43.92	43.95	L	60.60	58.59	58.64	59.28	L	75.69	73.20	73.69	73.98
M	45.27	41.86	42.68	43.51	M	60.22	56.72	57.95	58.29	M	75.26	71.82	72.51	73.28
N	45.36	42.57	43.13	43.81	N	60.50	57.34	58.06	58.76	N	75.29	72.60	73.22	73.51
O	45.41	42.67	42.83	44.05	O	60.37	57.62	58.29	58.82	O	75.34	72.93	73.63	74.29
P	45.44	42.62	43.30	43.95	P	60.35	57.80	58.12	58.79	P	75.37	72.71	73.06	73.88
Rata - rata	45.43	42.83	43.27	44.06	Rata - rata	60.44	57.86	58.40	58.94	Rata - rata	75.39	72.87	73.33	73.96
Max	45.79	43.50	43.98	44.42	Max	60.71	58.59	58.76	59.42	Max	75.69	73.56	73.76	74.42
Min	45.23	41.86	42.65	43.43	Min	60.19	56.72	57.93	58.29	Min	75.23	71.82	72.51	73.28

ALTERNATIF XI														
60 dB					75 dB					90 dB				
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	44.47	40.73	41.37	41.75	A	59.56	55.77	56.00	56.37	A	74.51	71.22	71.32	71.95
B	44.55	41.65	42.29	42.44	B	59.67	56.60	57.02	57.40	B	74.64	72.06	71.52	72.49
C	45.04	42.00	41.88	41.93	C	60.03	56.80	56.75	56.76	C	74.95	71.99	71.49	71.88
D	44.64	41.55	41.88	41.93	D	59.82	56.61	56.75	56.76	D	74.95	71.37	71.49	71.88
E	44.76	42.34	42.63	42.90	E	60.11	57.25	57.81	57.99	E	75.06	72.61	72.66	72.88
F	44.76	41.82	42.09	42.39	F	59.76	56.91	57.34	57.44	F	74.75	71.80	72.56	72.52
G	44.86	42.01	42.15	42.63	G	59.99	56.92	57.13	57.54	G	74.89	72.29	72.39	72.66
H	45.34	42.96	43.18	43.46	H	60.55	57.83	58.15	58.38	H	75.45	72.99	73.28	73.52
I	44.87	42.31	42.62	42.82	I	59.95	57.18	58.00	57.68	I	75.11	72.42	72.57	73.26
J	44.76	41.90	42.33	42.29	J	59.71	57.23	56.87	57.43	J	74.93	72.02	72.16	72.24
K	44.71	42.18	42.58	42.77	K	59.97	57.23	57.31	57.71	K	74.83	72.25	72.52	72.42
L	45.65	43.02	42.96	43.10	L	60.19	58.13	58.22	58.69	L	75.59	73.28	73.12	73.35
M	44.40	40.73	41.20	41.68	M	59.72	55.90	56.08	56.92	M	74.81	70.69	71.27	71.21
N	44.70	41.44	41.67	42.35	N	59.92	56.57	57.12	57.27	N	74.80	71.89	72.01	72.45
O	44.80	41.66	41.92	42.13	O	60.00	56.77	56.84	57.52	O	74.69	71.65	71.99	72.26
P	44.79	41.34	41.40	41.94	P	59.57	56.28	56.53	56.89	P	74.50	71.27	71.60	71.80
Rata - rata	44.82	41.85	42.13	42.41	Rata - rata	59.91	56.87	57.12	57.42	Rata - rata	74.90	71.99	72.12	72.42
Max	45.65	43.02	43.18	43.46	Max	60.55	58.13	58.22	58.69	Max	75.59	73.28	73.28	73.52
Min	44.40	40.73	41.20	41.68	Min	59.56	55.77	56.00	56.37	Min	74.50	70.69	71.27	71.21

Lampiran 11. Hasil simulasi (Nilai SPL) pada Ballroom (5)

ALTERNATIF XII (+ ATAP)														
60 Db (-28 dB)				75 dB (-28 dB)				90 dB (-28 dB)						
	250	500	1000	2000		250	500	1000	2000		250	500	1000	2000
A	16.60	13.26	13.20	14.09	A	31.32	28.51	28.43	28.81	A	46.61	43.00	43.15	43.81
B	16.80	13.64	14.05	14.49	B	31.84	28.83	29.28	29.35	B	46.80	43.74	43.95	44.23
C	17.26	13.85	13.80	14.12	C	31.87	28.79	28.28	29.19	C	47.02	44.10	43.73	44.20
D	16.74	13.40	13.80	14.12	D	31.92	28.06	28.28	29.19	D	46.87	43.55	43.73	44.20
E	17.00	14.30	14.56	15.19	E	31.86	29.12	30.02	30.03	E	46.79	44.15	44.62	44.86
F	16.88	13.76	14.09	14.50	F	32.10	28.79	29.42	29.33	F	46.89	44.22	44.32	44.44
G	17.04	14.19	14.61	14.90	G	31.76	29.46	29.67	29.77	G	47.02	44.46	44.41	44.70
H	17.22	14.96	15.24	15.39	H	32.42	30.14	29.74	30.46	H	47.44	45.16	45.30	45.53
I	16.82	14.71	14.66	15.04	I	32.06	29.20	29.56	29.45	I	46.86	44.42	44.55	44.77
J	16.94	13.89	14.33	14.41	J	31.90	28.81	29.16	29.31	J	46.97	43.71	44.23	44.54
K	17.04	14.23	14.46	14.58	K	32.19	29.09	29.45	29.57	K	46.92	44.42	44.29	44.51
L	17.48	14.86	15.12	15.42	L	32.40	29.94	30.51	30.34	L	47.40	44.82	44.91	45.42
M	16.55	13.06	13.60	13.64	M	31.19	28.31	28.50	28.62	M	46.54	42.81	43.29	43.68
N	16.84	13.71	14.08	14.32	N	31.75	29.01	28.64	29.41	N	46.75	43.74	44.26	44.23
O	16.98	13.74	13.71	14.37	O	32.06	28.46	28.80	29.77	O	46.82	43.61	44.31	44.18
P	16.85	13.23	13.69	13.72	P	31.67	28.53	28.64	28.96	P	46.76	43.26	43.52	43.79
Rata - rata	16.94	13.92	14.19	14.52	Rata - rata	31.89	28.94	29.15	29.47	Rata - rata	46.90	43.95	44.16	44.44
Max	17.48	14.96	15.24	15.42	Max	32.42	30.14	30.51	30.46	Max	47.44	45.16	45.30	45.53
Min	16.55	13.06	13.20	13.64	Min	31.19	28.06	28.28	28.62	Min	46.54	42.81	43.15	43.68

Lampiran 12. Hasil Pengukuran Lapangan dan Simulasi yang dilakukan pada 15 Oktober 2023

PENGUKURAN 15 OKTOBER 2023					
BALLROOM ---> UNDER - TREATMENT (60%)					
Pengukuran Lapangan			Simulasi		
Titik Pengukuran	Nilai RT Lapangan (detik)		Frekuensi	RT Simulasi (detik)	
				Sabine	Eyring
A	2.25		250 Hz	2.64	2.46
B	2.31		500 Hz	1.83	1.65
C	2.49		1000 Hz	2.02	1.85
D	1.90		2000 Hz	1.82	1.67
E	2.59		<b>Rata - Rata</b>	<b>2.08</b>	<b>1.91</b>
F	2.69				
G	2.10				
H	2.91				
<b>Rata - Rata</b>	<b>2.40</b>				
Frekuensi	RT Simulasi (Sabine)	RT Lapangan			
250 Hz	2.64	Rata - rata dari seluruh titik pengukuran			
500 Hz	1.83				
1000 Hz	2.02				
2000 Hz	1.82				
<b>Rata - Rata</b>	<b>2.08</b>		<b>2.40</b>		
<b>Kalibrasi Terhadap RT Lapangan</b>	<b>13.33%</b>	<b>0.00%</b>			
<b>JADI, RT SIMULASI LEBIH RENDAH 13% DARI RT LAPANGAN</b>					

Lampiran 13. Dokumentasi pengukuran lapangan (15 Oktober 2023)

