CHAPTER VI

Result

6.1 System Performance

The measurements are made of the input frequency, output frequency using a digital frequency counter. A sine wave signal generator is used as a signal source.

The result shows that the system provides an excellent accuracy in shifting the input frequency in the range of 50 Hz to 20 kHz by an amount of 4.3 Hz without any observable error.

Frequency in hertz*

f_{in}	f_s	f_{out}	$f_s + f_{in}$	Error.
50	4.3	54.3	54.3	0
60	4.3	64.3	64.3	0
70	4.3	74.3	74.3	0
80	4.3	84.3	84.3	0
90	4.3	94.3	94.3	0
100	4.3	104.3	104.3	0
200	4.3	204.3	204.3	0
300	4.3	304.3	304.3	0
400	4.3	404.3	404.3	0
500	4.3	504.3	504.3	0
600	4.3	604.3	604.3	0
700	4.3	704.3	704.3	0
800	4.3	804.3	804.3	0
900	4.3	904.3	904.3	0
1000	4.3	1004.3	1004.3	0
2000	4.3	2004.3	2004.3	0
3000	4.3	3004.3	3004.3	0
4000	4.3	4004.3	4004.3	0
5000	4.3	5004.3	5004.3	0
6000	4.3	6004.3	6004.3	0
7000	4.3	7004.3	7004.3	0
8000	4.3	8004.3	8004.3	0
9000	4.3	9004.3	9004.3	0
I0000	4.3	10004.3	10004.3	0
20000	4.3	20004.3	20004.3	0

Fig.6.1 Data of Input Frequency And Output Frequency

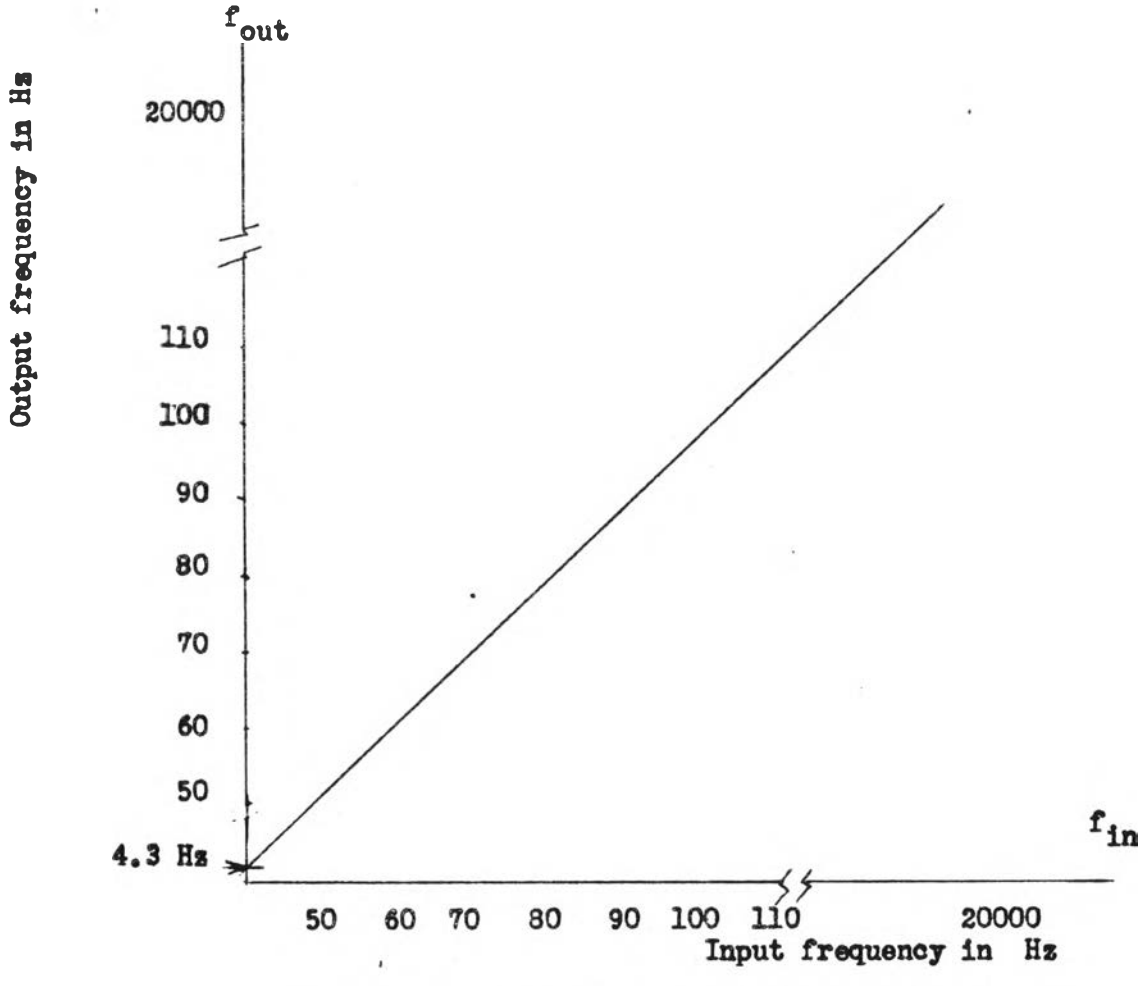

Fig. 6.2 Relationship between Input Frequency and Output Frequency.

$$f_{out} = f_{in} + f_s$$

$$f_{out} = f_{in} + 4.3 \text{ Hz}$$

6.2 The Additional Stable Gain

The data and graph in Fig. 6.3 - Fig. 6.8 show the additional stable gain due to frequency shifting. The measurements are made in two rooms, the volume of room No. I is 12900 ft^3 and the volume of room No. II is 8500 ft^3. The reverberation time for both rooms are shown in appendix B. The signal source is a sine wave signal generator and the microphone is placed in such a position that direct sound transmission between the microphone and the loudspeaker is kept to a minimum. The result shows that average value of the additional stable gain is about 6 dB. Because of the beating effect, the system is less effective by 3 dB from what expected in theory.

The Measurement of The Additional **Stable Gain Due to Frequency Shifting**

Place The Siam Film Development Recording Studio

Volume 12900 ft^3

The reverberation time 0.66 second at 512 Hz

The shifted frequency 4.3 Hz

Room No. I

f Hz	G_m in dB	G_o in dB	Experimented Δl in dB	Calculated Δl in dB	Less effective gain in dB
200	70	75.8	5.8	9.32	3.52
300	72	77.6	5.6	9.22	3.62
400	71	76.8	5.8	9.17	3.37
500	73	78.7	5.7	9.12	3.42
600	72	77.5	5.5	9.09	3.59
700	70	75.9	5.9	9.09	3.19
800	71	76.9	5.9	9.09	3.16
900	75	81.0	6.0	9.06	3.06
1000	70	75.7	5.7	9.04	3.34
2000	71	76.8	5.8	9.04	3.24
3000	72	77.6	5.6	9.03	3.43
4000	70	75.9	5.9	9.03	3.13
5000	73	77.7	5.7	9.01	3.31
6000	71	76.6	5.6	8.99	3.39
7000	70	75.9	5.9	8.94	3.04
8000	73	78.4	5.4	8.92	3.52
9000	71	76.2	5.2	8.86	3.66
10000	70	75.1	5.1	8.80	3.70

Fig. 6.3 Data of Addition Gain due to Frequency Shifting in Room I

The Measurement of The Additional Stable Gain Due to Frequency Shifting

Place	The lecture room in E.E. Department
Volume	8500 ft^3
The reverberation time	1.91 second at 512 Hz
The shifted frequency	4.3 Hz
Room	No. II

f Hz	G_m in dB	G_o in dB	Experimented Δ l in dB	Calculated Δ l in dB	Less effective gain in dB
200	61	67.5	6.5	10.22	3.72
300	62	68.5	6.5	10.14	3.64
400	62	68.4	6.4	10.10	3.70
500	63	69.5	6.5	10.06	3.56
600	60	66.3	6.3	10.03	3.73
700	60	66.3	6.3	10.02	3.82
800	61	67.1	6.1	10.01	3.91
900	60	66.0	6.0	10.01	4.01
1000	62	68.2	6.2	10.00	3.80
2000	61	67.2	6.2	10.00	3.80
3000	60	66.0	6.0	9.99	3.99
4000	61	67.1	6.1	9.99	3.89
5000	61	67.0	6.0	9.97	3.97
6000	60	65.8	5.8	9.96	4.16
7000	60	65.9	5.9	9.92	4.02
8000	60	66.0	6.0	9.90	3.90
9000	61	67.1	6.1	9.85	3.75
10000	62	67.6	5.6	9.80	4.20

Fig. 6.4 Data of Addition Gain due to Frequency Shifting in Room II

The Calculate Additional Stable Gain Due to Frequency Shifting

The extra gain $\Delta 1 = 10 \log.\log \frac{W T_{60}}{22} + 6.3$ dB

The band width $W = 3500-743 = 2757$ Hz

The reverberation time T_{60}, see Appendix B.

f Hz	Room No.I		Room No. II	
	$10 \log.\log \frac{W.T_{60}}{22}$	$\Delta 1$ in dB	$10 \log.\log \frac{W.T_{60}}{22}$	$\Delta 1$ in dB
200	3.02	9.32	3.92	10.22
300	2.92	9.22	3.84	10.14
400	2.87	9.17	3.80	10.10
500	2.82	9.12	3.76	10.06
600	2.79	9.09	3.73	10.03
700	2.78	9.09	3.72	10.02
800	2.76	9.06	3.71	10.01
900	2.76	9.06	3.71	10.01
1000	2.74	9.04	3.70	10.00
2000	2.74	9.04	3.70	10.00
3000	2.73	9.03	3.69	9.99
4000	2.73	9.03	3.69	9.99
5000	2.71	9.01	3.67	9.97
6000	2.69	8.99	3.66	9.96
7000	2.64	8.94	3.62	9.90
8000	2.62	8.92	3.60	9.90
9000	2.56	8.86	3.55	9.85
10000	2.50	8.80	3.50	9.80

Fig. 6.5 Calculated Data of Addition Gain due to Frequency Shifting.

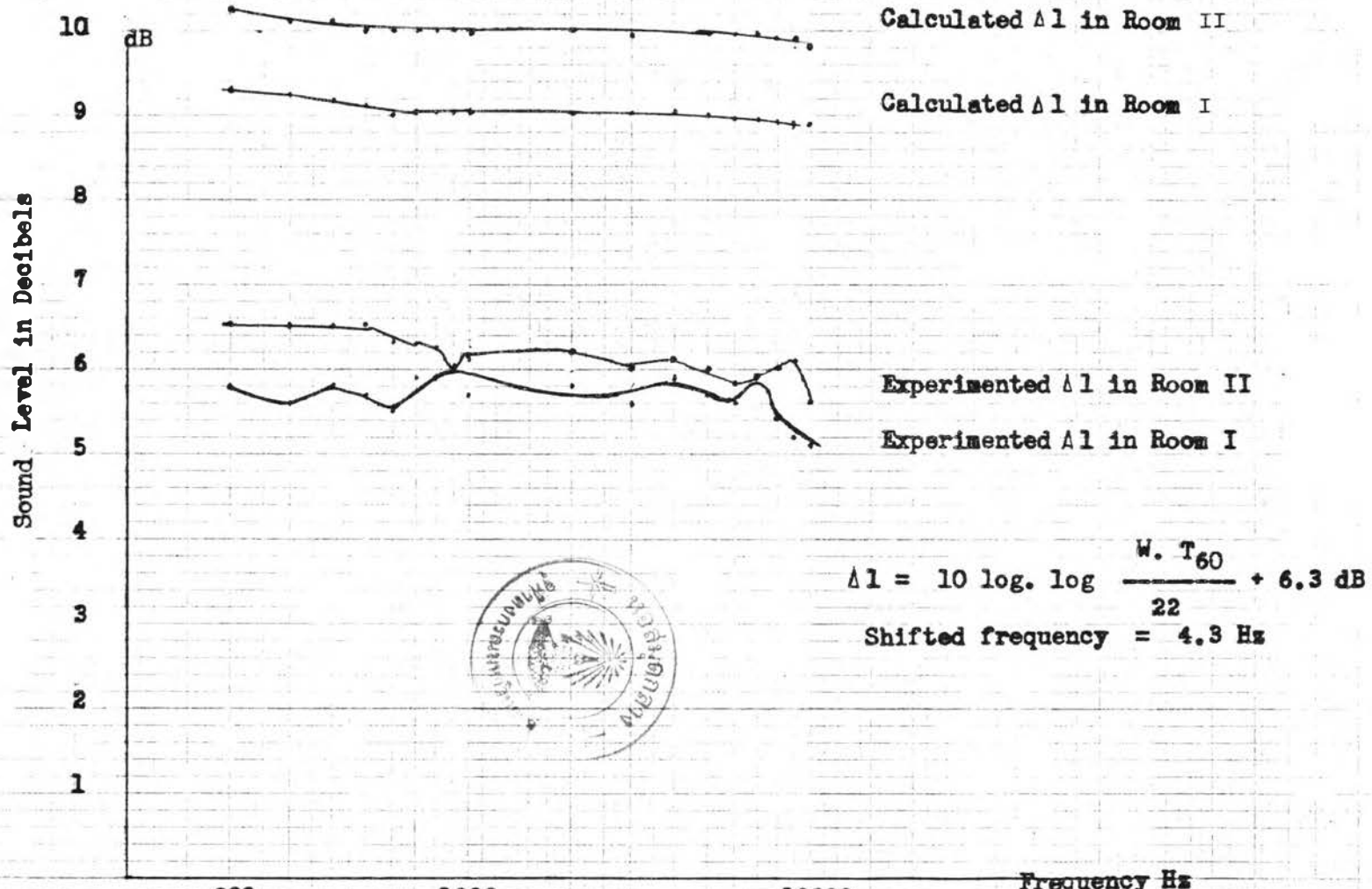

Fig. 6.6 Graph Showing Extra Gain.

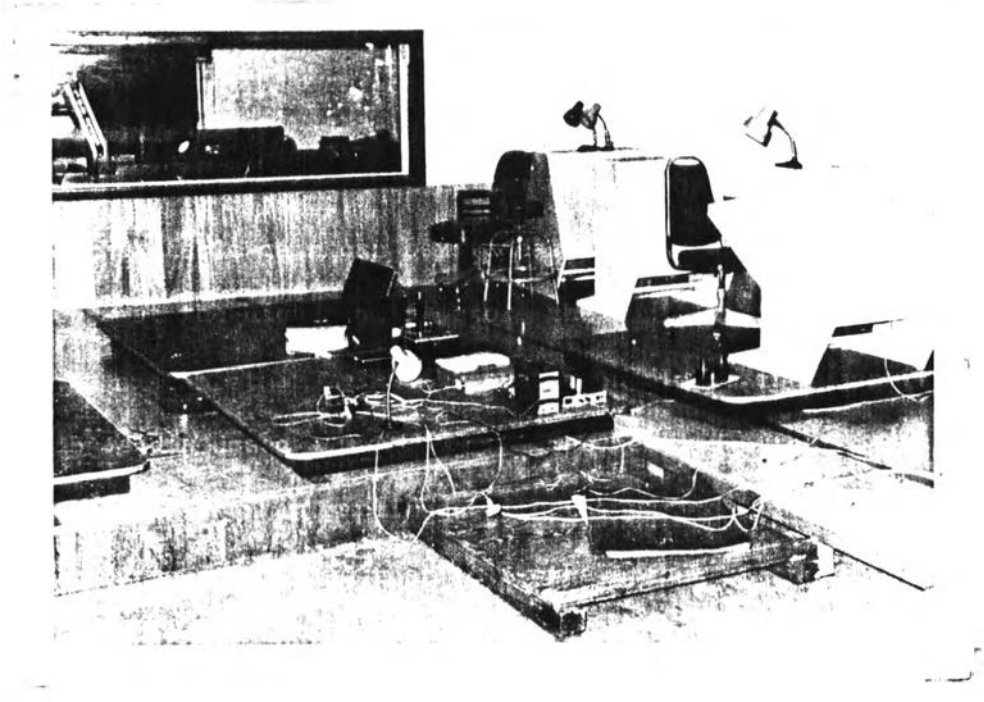

Fig. 6.7 Photo of Room I

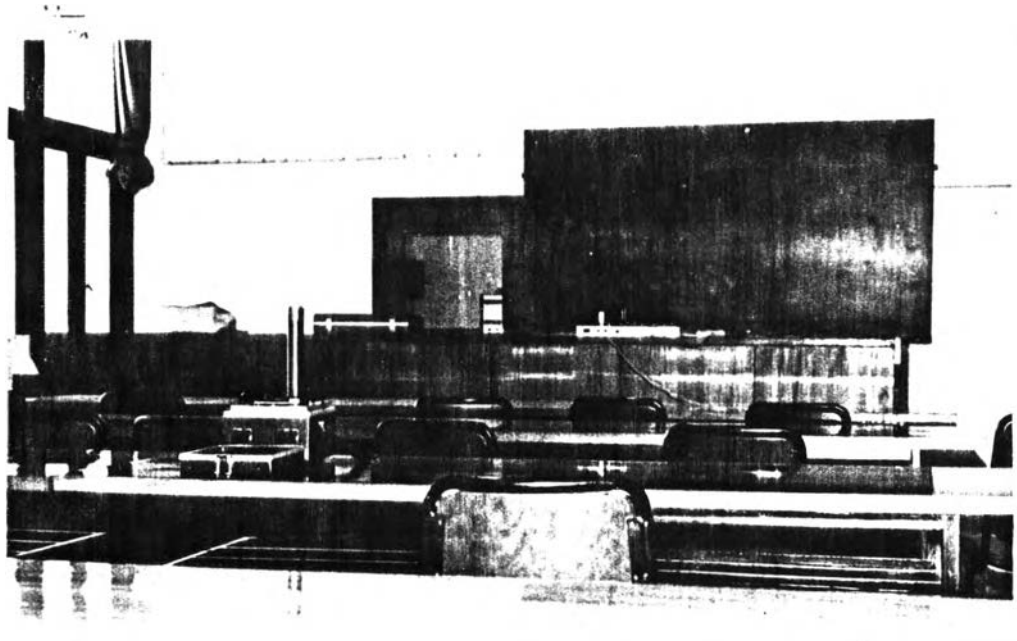

Fig. 6.8 Photo of Room II