

12-TONE EQUAL-TEMPERED

	SR = 48.1 kHz			SR = 6.25 kHz		
	Desired	Meas	Cts err	Meas	Cts err	
C	1046.5	1046.2	0.5	1047.4	1.5	
C#	1108.7	1108.7	0.0	1108.2	0.8	
D	1174.7	1174.8	0.1	1173.5	1.8	
D#	1244.5	1244.3	0.3	1242.9	2.2	
E	1318.5	1318.7	0.3	1316.8	2.2	
F	1396.9	1397.1	0.3	1395.1	2.2	
F#	1480.0	1480.6	0.7	1477.7	2.7	
G	1568.0	1568.1	0.1	1568.9	1.0	
G#	1661.2	1661.3	0.1	1660.2	1.0	
A	1760.0	1760.0	0.0	1760.1	0.1	
A#	1864.7	1864.3	0.4	1864.5	0.2	
B	1975.5	1975.5	0.0	1977.4	1.7	
C	2093.0	2092.3	0.3	2094.8	1.5	
Mean Cents Error			0.24		1.45	

HARMONIC SCALE

	SR = 48.1 kHz			SR = 6.25 kHz		
	Calc	Meas	Cts err	Meas	Cts err	
C	960	959.6	0.7	959.8	0.4	
C#	1040	1039.0	1.7	1036.3	6.2	
D	1120	1119.9	0.2	1121.2	1.9	
D#	1200	1199.3	1.0	1197.6	3.5	
E	1280	1280.1	0.2	1278.3	2.3	
F	1360	1359.6	0.5	1359.0	1.3	
F#	1440	1439.8	0.2	1439.7	0.4	
G	1520	1519.9	0.1	1520.4	0.5	
G#	1600	1600.0	0.0	1601.1	1.2	
A	1680	1680.1	0.1	1681.7	1.8	
A#	1760	1758.9	1.1	1758.2	1.8	
B	1840	1837.8	2.1	1838.9	1.0	
Mean Cents Error			0.64		1.86	

CONCLUSIONS

From this data a formula can be derived: $R = 625000 / (SR * (V+1))$, where R is the EPS's resolution in Hertz, SR is its sampling rate in Hertz, and V is the number of voices. No two frequencies can be closer together than R. This effectively sets up a gamut of available EPS pitches, separated by R hertz.

In real-world use, although the minimum separation of any two frequencies at the maximum sampling rate is 0.6 Hz, the maximum deviation from any desired frequency will be 0.3 Hz, and the average deviation will be about 0.15 Hz.

The data suggests that better accuracy might be obtained in the case of certain just tunings by carefully selecting a fundamental frequency to accommodate the EPS's resolution at the sampling rate used. For instance, at the 48.1 kHz sampling rate, a tuning whose frequencies lie somewhere close to the EPS's effective 0.6-Hz gamut should have a smaller mean error than an arbitrary tuning.

REFERENCES

Rich, Robert. "Tuning Facilities in the Ensoniq EPS Sampling Keyboard". 1/1, Ov. 4, n.3.

Bio: Carter Scholz is a free-lance writer for Keyboard, Electronic Musician, and Music Technology, and has written science fiction. ■ RC030823

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