1/3 Octave Frequency Chart

Audio Octave Ranges

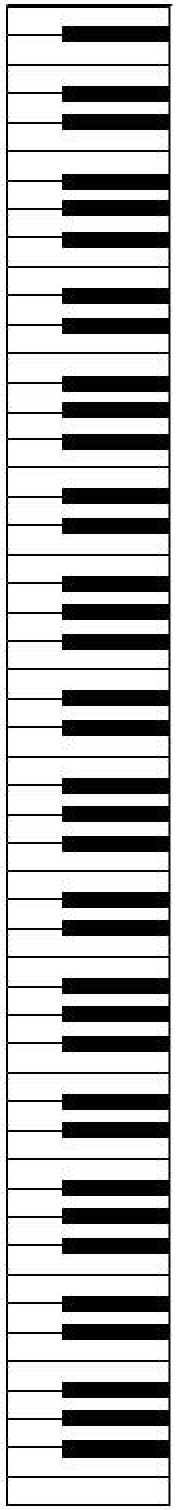
Frequency Range	When Used Produces This Effect	When Used Too Much Produces This Effect
16Hz to 60 Hz	Sense of power, felt more than heard	makes music muddy
60Hz to 250Hz	Fundamentals of rhythm section, EQing can change musical balance making it fat or thin	makes music boomy
250Hz to 2KHz	Low order harmonics of most musical instruments	telephone quality to music 500 to 1KHz horn-like, 1K to 2KHz tinny, listening fatigue
2KHz to 4KHz	Speech Recognition	3KHz listening fatigue, lisping quality, "m”, "v", "b" indistinguishable
4KHz to 6KHz	Clarity and definition of voices and instruments, makes music seem closer to listener, adding 6db at 5KHz makes entire mix seem 3db louder	sibilance on vocals
6KHz to 16KHz	Brilliance and clarity of sounds	sibilance, harshness on vocals

Key Frequencies For Instruments

Instrument	Key Frequencies
Bass Guitar	Attack or pluck at 700 or 1KHz; Bottom at 60 or 80Hz; string noise at 2.5KHz
Bass Drum	Slap at 2.5KHz; Bottom at 60 or 80Hz
Snare Drum	Fatness at 240Hz; Crispness at 1 to 2.5KHz; Bottom at 60 or 80 Hz
Hi-Hat and Cymbals	Shimmer at 7.5 to 10KHz; Klang or gong sound at about 200Hz
Toms	Attach at 5KHz; Fullness at 240Hz
Floor Toms	Attach at 5KHz; Fullness at 80 or 240Hz
Electric Guitar	Body at 240Hz; Clarity at 2.5KHz
Acoustic Guitar	Body at 240Hz; Clarity at 2.5KHz; Bottom at 80 or 120Hz
Piano	Bass at 80 or 120Hz; Presence at 2.5 to 5 KHz; Crispness at 10KHz; Honky-tonk sound at 2.5KHz as bandwidth is narrowed; Resonance at 40 to 60Hz
Horns	Fullness at 120 or 240Hz; Shrill at 2.5 or 5KHz
Voice	Fullness at 120Hz; Boominess at 200 to 240Hz; Presence at 5KHz; Sibilance at 2.5KHz; Air at 12 to 15 KHz
Harmonica	Fat at 240Hz, bite at 3 to 5KHz
Conga	Resonant ring at 200 to 240Hz; Presence and slap at 5KHz

Ref…http://www.bcpl.net/~musicman/freqchrt.htm

The Fundamental Frequencies (Pitch) of Notes



Note	Frequency	Sharp	Frequency
A0	27.5	A0#	29.135
B0	30.868		
C1	32.703	C1#	34.648
D1	36.708	D1#	38.891
E1	41.203		
F1	43.654	F1#	46.249
G1	48.999	G1#	51.913
A1	55.000	A1#	58.270
B1	61.735		
C2	65.406	C2#	69.296
D2	73.416	D2#	77.782
E2	82.407		
F2	87.307	F2#	92.499
G2	97.999	G2#	103.83
A2	110.00	A2#	116.54
B2	123.47		
C3	130.81	C3#	138.59
D3	146.83	D3#	155.56
E3	164.81		
F3	174.61	F3#	185.00
G3	196.00	G3#	207.65
A3	220.00	A3#	233.08
B3	246.94		
C4	261.63	C4#	277.18
D4	293.66	D4#	311.13
E4	329.63		
F4	349.23	F4#	369.99
G4	392.00	G4#	415.30
A4	440.00	A4#	466.16
B4	493.88		
C5	523.25	C5#	554.37
D5	587.33	D5#	622.25
E5	659.25		
F5	698.46	F5#	739.99
G5	783.99	G5#	830.61
A5	880.00	A5#	932.33
B5	987.77		
C6	1046.5	C6#	1108.7
D6	1174.7	D6#	1244.5
E6	1318.5		
F6	1396.9	F6#	1480.0
G6	1568.0	G6#	1661.2
A6	1760.0	A6#	1864.7
B6	1979.5		
C7	2093.0	C7#	2217.5
D7	2349.3	D7#	2489.0
E7	2637.0		
F7	2793.8	F7#	2960.0
G7	3136.0	G7#	3322.4
A7	3520.0	A7#	3729.3
B7	3951.1		
C8	4186.0		

PIANO KEYBOARD

The number beside each key is the fundamental frequency in units of cycles per seconds, or Hertz.

OCTAVES

For example, the A4 key has a frequency of 440 Hz.

Note that A5 has a frequency of 880 Hz. The A5 key is thus one octave higher than A4 since it has twice the frequency.

OVERTONES

An overtone is a higher natural frequency for a given string. The overtones are "harmonic" if each occurs at an integer multiple of the fundamental frequency.

Ref…http://www.vibrationdata.com/piano.htm

A note played on an instrument, such as middle "C" played on a piano, is not made up of just one frequency, but is complex and made up of many frequencies that combine to give the sound we hear. The first or predominant frequency we hear is called the *fundamental* frequency. Additional frequencies that make up that note are referred to as *harmonics*. Here is an example of Middle C and it's initial harmonics…

Middle C	C4	262 Hz	- Fundamental
	C5	523 Hz	-first harmonic, (octave)
	G5	785 Hz	-second harmonic, (fifth)
	C6	1046 Hz	–third harmonic, (octave)
	E6	1318 Hz	–fourth harmonic, (third)
	G6	1568 Hz	–fifth harmonic, (fifth)
	Bb6	1865 Hz	–sixth harmonic, (dominant seventh)
	C7	2093 Hz	–seventh harmonic, (octave)

- A harmonic is one of a series of sonic components of a sound.
- A sounding pitch comprises a *fundamental,* and a number of *harmonics* above that fundamental, the totality being called a *harmonic spectrum* or *harmonic series.*
- The make-up of a spectrum (which harmonics are present, and in what proportion) produces the *timbre,* or *tone color,* of an instrument or voice.
- The relative amplitudes (loudness) of the various harmonics primarily determine the timbre of different instruments and sounds.
- Some sounds, such as a cymbal or gong, are more complex in it's harmonic makeup and include *overtones* which are *not* harmonics(non-harmonics are frequencies that are not integer multiples of a fundamental frequency). Because of this, a fundamental frequency is harder to determine; that's why the gong's sound doesn't seem to have a very definite pitch compared to the same fundamental note played on a piano.

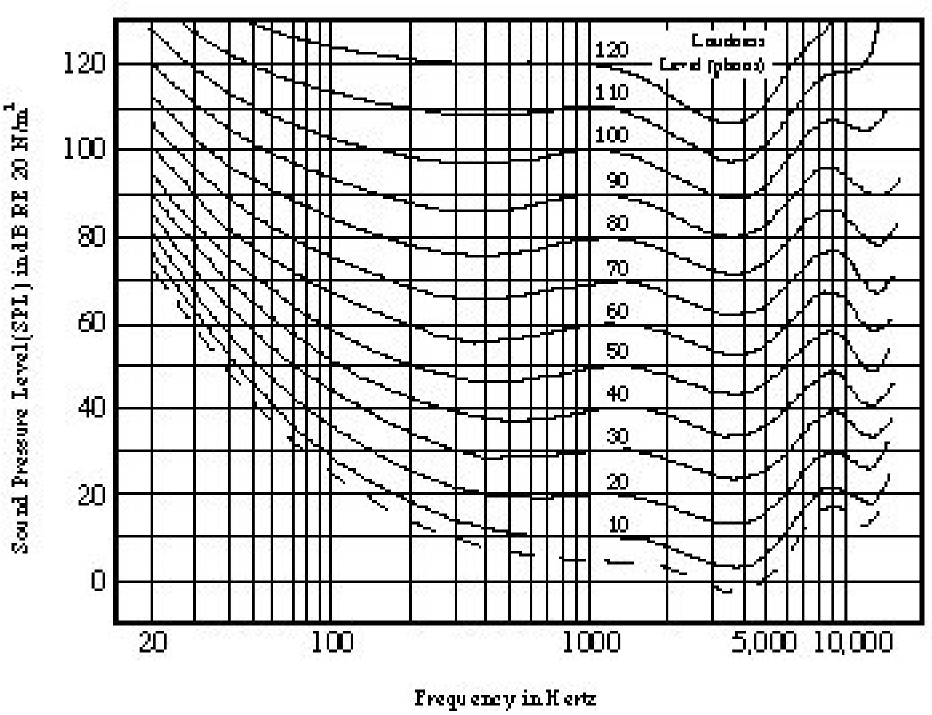
Ref… http://en.wikipedia.org/wiki/Harmonic_series_(music)

YOUR BAND IS JUST WAY TOO LOUD!!

Are you sure about that? Maybe we're just too harsh or loud in some frequencies!

I've heard bands that were just as loud if not louder than another band, but were more tolerable to listen to due to their overall sound quality….have you ? Try this, put your ear next to someone playing a bass guitar at a certain decibel level, and then do the same thing with someone banging a cymbal … you should perceive the cymbal as being "louder". This is because humans don't hear all frequencies of sound at the same level. That is, our ears are more sensitive to some frequencies and less sensitive to other frequencies. Not only that, but the sensitivity changes with the *sound pressure level* (SPL), too. This is called the **Fletcher Munson Equal Loudness Curve** and if you are a sound engineer or work with sound, it is something you need to be aware of. Take a look at the chart below. You'll notice it's marked horizontally with a scale denoting the frequency of sound. Vertically it's marked in SPL. On the chart are a number of curved lines, each with a number (loudness level) marked. Let's begin by looking at the lowest solid line marked with a loudness level of 10 phons. (The loudness level in phons is a subjective sensation--this is the level we perceive the sound to be at.) From about 500Hz to roughly 1,500Hz the line is flat at 10dB SPL on the graph. This means that for us to perceive a sound to be at a loudness level (LL) of 10 phons, frequencies from 500Hz to 1,500 Hz must be at 10dB. Make sense so far? OK, now look further into the higher frequencies, say 5,000Hz. Notice the line dips here--this says we perceive 5,000Hz to be 10 phons when the source is actually only 6dB. To perceive 10,000Hz at the same level (10 phons), it would need to be about 20dB. From this we can clearly see the ear is more sensitive in the 2,000Hz to 5,000Hz range, yet not nearly as sensitive in the 6,000Hz and up range. Ref… http://www.allchurchsound.com/ACS/edart/fmelc.html

Fletcher-Munson Free Field Equal Loudness Contours



Just How Loud Is LOUD??

Here are some interesting numbers, collected from a variety of sources that help one to understand the volume levels of various sources and how they can affect our hearing.

Ref… http://www.gcaudio.com/resources/howtos/loudness.html

Environmental Noise	
Weakest sound heard	0dB
Normal conversation (3-5')	60-70dB
Telephone dial tone	80dB
City Traffic (inside car)	85dB
Train whistle at 500'	90dB
Subway train at 200'	95dB
Level at which sustained exposure may result in hearing loss	*90 - 95dB*
Power mower	107dB
Power saw	110dB
Pain begins	*125dB*
Pneumatic riveter at 4'	125dB
Jet engine at 100'	140dB
Death of hearing tissue	180dB
Loudest sound possible	194dB
Perceptions of Increases in Decibel Level	
Imperceptible Change	1dB
Barely Perceptible Change	3dB
Clearly Noticeable Change	5dB
About Twice as Loud	10dB
About Four Times as Loud	20dB
Sound Levels of Music	
Normal piano practice	60 -70dB
Fortissimo Singer, 3'	70dB
Chamber music, small auditorium	75 - 85dB
Piano Fortissimo	84 - 103dB
Walkman on 5/10	94dB
Symphonic music peak	120 - 137dB
Amplifier rock, 4-6'	120dB
Rock music peak	150dB

Just What is a Decibel (db)?

Early acousticians came up with a simple method of comparing two sounds. A sound that was perceived to be twice as loud as another was said to be one Bel greater in sound level. The Bel was used as a unit of comparison. It is not a unit of measure. Its namesake, Alexander Grahm Bell, was a pioneer in the science of audiology (the study of human hearing). It soon became apparent this unit of comparison was not very useful in describing the difference between similar sounds. A small unit of comparison, the decibel, was established. One decibel (1 dB) is one-tenth of a Bel. Since a decibel is one-tenth of a Bel, then 10 decibels (10 dB) would equal one Bel. In other words, a sound that is twice as loud as another sound could be described as being 10 decibels (10 dB) louder. By definition, one decibel (1 dB) represents the smallest change in volume a human ear can perceive. The average ear, however, can only detect a 3 dB change.

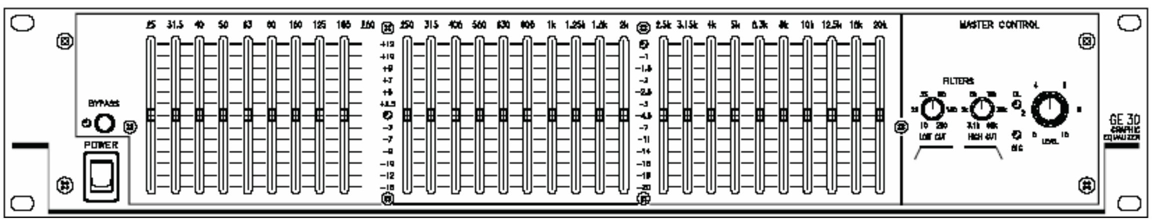
Ref…http://www.soundinstitute.com/article_detail.cfm/ID/95

Equalizers EQ

The three main types of EQ are: Shelving, Graphic, and Parametric

- **SHELVING**
  - Found in most mixers (including Ramsa and Mackie)
  - "Bass" (LF) and "Treble" (HF) controls boost or cut begining at a certain point ("knee")
  - Sometimes midrange (MF) is included, and sometimes with adjustable midpoint frequency

- **GRAPHIC**
  - Octave, 1/2 Octave and 1/3 octave varitites
  - Separate boost/cut adjustment (usually a slide pot) for each band
  - Display of slide pots in a row shows a "graphic" picture of EQ



- **PARAMETRIC**
  - Separate adjustment of Boost/Cut, Center Frequency, and Q (sharpness of peak/dip)