This document (found at http://gamefreaks.net/defrag/carbon_pi/files/equalization.doc, and supposedly originally from www.bossarea.com) has some interesting things to say about guitar EQ. Bits and pieces of this article appear to have been plagiarized all over the Net, but at least part of it appears to have been written by Don Smith as it appears as a quote attributed to him in Bobby Owinski's Mixing Engineer's Handbook (p. 181).

-djh

USING THE EQUALIZER EFFECTIVELY

Equalization is the most used, most misused, most over-used & most under-used signal processing device. It is also the most powerful. By definition an equalizer is a gain control that raises or lowers gain at a specific set of frequencies without affecting the gain at other frequency ranges. I learned a lot about equalization by sitting down with a graphic equalizer & lots of records. After about 30 hours of listening to the effect of different bands of equalization on the records, I began to "hear" the effect of certain frequencies on overall mixes. Since I had a job in mastering, this was a direct application as to how I was going to use equalizers. Doing an exercise like this is the very beginning of training in using equalization. There are commercial CD packages which attempt to duplicate this type of test. They are no real substitute for switching the equalization on & off as the CD (or music source) plays.

The next step in the training is to apply specific equalization to specific instruments. Recommended or "key" frequencies are used & the equalization is switched on & off while soloing the instrument & then while listening to the instrument in the mix. The point of this "ear" training is to gain the ability to hear what frequencies would be needed to bring up or down in a specific mixdown. Until one obtains the ability to "hear" frequency, one has only limited ability to use equalization. A key to understanding equalization is to gain an understanding of the effect of different frequency ranges on music & instrument sounds.

One of the biggest mistakes to make when using an equalizer is to boost or cut frequencies above or below the dominant energy of the instrument. As mentioned earlier, these ranges extend far past the fundamental frequency of the instrument. The following paragraphs outline specific equalization applications for various instruments as well as some settings that should be avoided. I use EQ different from some people. I don't just use it to brighten or fatten something up; I use it to make an instrument feel better. Like on a guitar, making sure that all the strings on a guitar can be heard. Instead of just brightening up the high strings & adding mud to the low strings, I may look for a certain chord to hear more of the A string. If the D string is missing in a chord, I like to EQ & boost it way up to +8 or +10 & then just dial through the different frequencies until I hear what they're doing to the guitar. So I'm trying to make things more balanced in the way they lay with other instruments.

OVERALL EQUALIZATION

The pitch of a note is almost entirely determined by the frequency: high frequency for high pitch & low for low. For example, 110 vibrations per second (110 Hz) is the frequency of vibration of the A string on a guitar. The A above that (second fret on the G string) is 220Hz. The next A (5th fret on top E string) is 440 Hz, which is the orchestral tuning A. (The guitar A string plays the A normally written at the bottom of the bass clef. In guitar music, however, it is normally written an octave higher.) We can hear sounds from about 15Hz to 20kHz (1kHz = 1000 Hz). The lowest note on the standard guitar is E at about 83 Hz, but a bass guitar can play

down to 41Hz. The ordinary guitar can play notes with fundamental frequencies above 1kHz. Human ears are most sensitive to sounds between 1 & 4kHz - about two to four octaves above middle C. Although the fundamental frequency of the guitar notes do not usually go up into this range, the instrument does output acoustic power in this range, in the higher harmonics of the most of its notes.

It is obvious that most instruments like the guitar, having the highest string on the last fret played, represents a frequency equally significant to the harmonic content of the lowest string (E) played open. The highest note playable on a 24 fret guitar is a (D octave 7) note. This has a fundamental frequency of 1175Hz. If you played the lowest frequency string of a guitar (E octave 3) at 82 Hz, you would find that the setting of an equalizer at the 1175Hz would dramatically alter the sound of the low note, especially with bright new strings. 1175Hz is just below the 4th octave of the 82Hz E string. In summary, the frequency equalization settings that affect the quality & shape of an instrument's sound far surpass the fundamental or tuning pitches of the instrument.

Excessive boosts of cuts in the main system EQ will drastically effect the decisions made at the individual channel EQ. One method of enhancing vocal clarity is to make sure that all other instrument individual mixer channel equalizations do not occupy the 3.5kHz to 4kHz band so much. The perception of presence of vocals & instruments can also be simulated by restricting other instruments to have dominant energy in that band.

One common mistake for a sound engineer to make by listening to each instrument individually is to make each instrument sound very clear & present. It is easy to boost all instruments in this 3kHz to 4kHz range. The separation of sounds is more often achieved by spacing their dominant energy in bands not significantly occupied by others. The most obvious mistake is excessive amounts of equalization. Experimentation with an equalizer in a home stereo system is a valuable tool to recognition of the various frequency bands. In summary, live or recorded mixing is very objectionable, & remember, not everyone will have the same opinion.

COMPENSATE FOR THE FLETCHER-MUNSON EFFECT

Fletcher-Munson told us that ears are less sensitive to bass frequencies (& extreme high frequencies) at low listening levels. Unfortunately if the bass frequencies are hard to hear at low levels than it is quite possible that bass frequency instruments such as the bass guitar & foot drum can also be hard to hear at low listening levels. The mixing engineer should make sure that the parts played by these instruments are not lost at low level listening levels, even though the body of these instruments most surely will be because of the Fletcher-Munson effect.

Keeping The Bass Guitar In its first octave, the bass guitar generates fundamental frequencies between 40Hz & 80Hz. Thus you could say that the fundamental notes that the bass puts out are between 40 & 100Hz. The instrument also puts out harmonics between 200 & 400 hertz, two octaves up. If you take an equalizer & dip, using a shelving curve at 100Hz & reduce the first octave of the bass guitar, all of the harmonics of the instrument become accented. You can also "replace" the energy lost in the bass by accenting 300Hz with a boost of about 5dB. Once you do this you will find the instrument sounds like this:

1. It has adequate lows & body at loud listening levels. If you cannot say this, reduce the first octave roll off to 1 or 2db.

2. The bass will have a more even sound as it plays different notes, often making a compressor unnecessary to even out the bass line.

3. The bass guitar part will be very distinguishable at low listening levels.

GOLDEN RULES OF EQ

1. If it sounds muddy, cut some at 250Hz.
2. If it sounds honky, cut some at 500Hz.
3. Cut if you're trying to make things sound better.
4. Boost if you're trying to make things sound different.
5. You can't boost something that’s not there in the first place.

QUICK GUIDE

31Hz	Rumble, "chest"	**1KHz**	Whack
63Hz	Bottom	**2KHz**	Crunch
125Hz	Boom, thump, warmth	**4KHz**	Edge
250Hz	Fullness or mud	**8KHz**	Sibilance & definition
500Hz	Honk	**16KHz**	Air

Use a narrow Q (bandwidth) when cutting; use wide Q’s when boosting. If you want something to stick out, roll off the bottom; if you want it to blend in, roll off the top

Try some mid-range cut to the rhythm section to make vocals & other instruments heard more clearly.

If your mix sounds 'muddy', boost the main frequency range of each of the principal instruments.

If you can't get your tracks to blend together in the mix, cut the main frequency range of the principal instruments.

For extra clarity, cut the bass element of instruments which are not meant to be bass instruments.

Changing EQ changes the level & proper EQ cuts feedback frequencies.

Clear (subtract & assign) low frequencies first.

Sweep to find rich frequencies with parametric EQ then boost to taste.

Increase midrange commensurate with volume increases.

Mid-scooped guitars don't punch through drums.

Mid-scoop EQ at lower listening levels though due to the Fletcher-Munson Effect.

Boosting EQ adds noise & leads to clipping; consider reducing channel gain.

If you want bottom, the 60-120hz area works. If you need shimmer, the 10k-20k range does that. If you want definition, somewhere in the 1k-8k range might help.
If you are muddy, cut in the 200hz-700hz.

If you use EQ to reduce feedback, don’t take too much level out over a wide a range of important frequencies, particularly the vocal 'presence' range around 3kHz.

If your mixing console has an EQ Off button, use it frequently to check that you really are improving the sound.

Always low-cut microphones, vocals lack many desirable frequencies below 100Hz.

Feedback Compensation

1. Turn main faders down & center EQ levels
2. Slowly raise mains until feedback then backoff
3. Raise single EQ band slowly until feedback then cut
4. Proceed through bands cutting as necessary

FIRST OCTAVE

The first usable octave for most recording is the 40 - 80Hz range, with equalization settings centered around 50Hz. This range of frequencies is often referred to as "Low Bass" There is sound between 20Hz & 40Hz but little or no sound from instruments. The lowest pipes of a pipe organ will get into this range but more "ordinary" instruments like Bass Guitar, Upright Bass & Foot Drums do not. The lowest pitch on a bass guitar or string bass is at 41Hz. Thunder, earthquakes & rumble from the building shaking extend below 40Hz.

While mixing, watch out for objectionable sounds below 40Hz caused by building shifts & mic stands moving with heavy footsteps. If there are objectionable sounds in this range, the range can usually be taken entirely out with a filter. The first octave that we deal with (40 - 80Hz) gives more of a "feeling" & sense of "power" to the sound. This range is way down or non-existent in smaller stereo systems. This range is difficult to hear at all at medium & low volume levels because of the Fletcher Munson Effect.

To properly set the amount of low bass in your mix or in your instrument sound, you must listen both loud & soft. You also may want to listen to the mix or instrument on large & small speaker systems. Too much energy in this range will make the mix sound muddy on large speakers played loud & still sound good on small speakers played at a medium volume. You want the mix or instrument to sound larger & more powerful over large speakers without sounding muddy.

Rap, Hip Hop & "Dance" music (under various names) often have extra energy in the low- bass range. This is what causes cars equipped with sub-woofers to shake. Usually, however, it is not the entire mix that is boosted below 80 Hz, but just, for example, the kick drum. By boosting the energy on only one or two instruments, "clarity" can be achieved without "mud."

BASS RANGE

Covering about 1.5 octaves, from 80Hz to 250 Hz, this range of frequencies determines the "fatness" & "fullness" of the instrument's sound. Equalization is usually applied centered around two frequencies, 100Hz & 200Hz. For guitars & bass, the 100Hz range tends to add body & fullness. Excessive energy in this range tends to make these instruments sound "boomy". This range of frequencies is still greatly affected by the Fletcher-Munson Effect; this means you will need to listen to the mix & instrument both loud & soft. Similar to how the 50Hz range affects the bass & kick, the guitars should sound fatter when played loud, not boomy.

Reducing the 100Hz energy on the guitar will usually cause distinction between the bass & guitar parts. The lowest fundamental frequency on a guitar is around 80Hz. For vocals the 200Hz range determines the fullness of the vocal. This range can often be reduced to increase distinction on the vocal. If however, boosting in higher frequencies on the vocal makes the sound "thin" or "small" a boost of 200Hz. will restore fullness. When 100Hz is reduced on a guitar or bass to reduce "boom,"

at small boost at 200Hz can be helpful to keep the instrument from sounding "lumpy" (certain notes hard to hear & others standing out).

The guitar & bass have almost equal energy at their fundamental & 2nd harmonic frequencies. Thus if a range of notes becomes hard to hear because of a at lot of 100 Hz, reducing energy at 100Hz & adding energy at 200Hz will help the notes be heard again.

BASS PRESENCE / LOWER MID RANGE

The midrange between 250Hz & 2000Hz contains the low order harmonics of most musical instruments & can introduce a telephone-like quality to the music if boosted too much. Boosting the 500Hz to 1000Hz octave makes the instruments sound horn-like, while boosting the 1kHz to 2kHz octave makes them sound tinny. Excess output in this range can cause listening fatigue.

Covering about one octave from 250Hz to 500 Hz, this range accents ambience of studio & adds clarity to the bass & lower-string instruments (Cello & Upright Bass). Too much boost can make higher-frequency instruments muffled sounding & low-frequency drums (foot & toms) have a cardboard box quality. Equalization in this range is applied at many frequencies but most often between 300Hz & 400Hz. The lower part of this range (250Hz to 350 Hz) is sometimes referred to as "Upper Bass" & is used to increase distinction & fullness on the vocal, especially on female singers.

The Lower Mid Range in general can be viewed as the "Bass Presence Range" Increasing this range gives clarity to the bass line & the lower-register of pianos & organs. Clarity & distinction can be obtained between the foot drum & bass guitar by both reducing the foot & increasing the bass guitar in this range, at the same frequency. This range is often reduced for overhead drum & cymbal microphones to increase clarity & presence on these instruments' & reduced on lower drums (foot & toms) to reduce boxiness.

MID RANGE

The Mid Range band of frequencies covers two octaves from 500Hz to 2kHz. This range can give a horn-like quality to instruments (500Hz to 1 kHz) & a "tinny" sound (1kHz to 2 kHz) or a telephone-like quality (all of the range). Equalization usually centers around 800Hz & 1,.5kHz. The mid-range also tends to accent the presence (800 Hz) & attack (1.5 kHz) of the bass guitar. The lower pitches of a rhythm guitar can be given more attack by a boost at 1.5kHz. For your Mid Range Instruments (vocals, guitars & piano) this range is most-often reduced rather than accented. Reducing 500 - 800Hz on an acoustic guitar can remove the "cheep" sound & make it sound more "silvery." Reducing 800Hz on a vocal makes it sound less nasal & have more body & presence. For snare drums, a reduction of 800Hz can take the tinny, cheep sound out of the drum & make the snares have more sizzle rather than rattle.

UPPER MID RANGE

The upper midrange between 2kHz & 4kHz can mask the important speech recognition sounds if boosted, introducing a lisping quality into a voice & making sounds formed with the lips such as "m", "b", & "v" indistinguishable. Too much boost in this range (especially at 3kHz) can also cause listening fatigue. Dipping the 3kHz range on instrument backgrounds & slightly peaking 3kHz on vocals can make the vocals audible without having to decrease the instrumental level in mixes where the voice would otherwise seem buried.

Covering about one octave, this range of frequencies is responsible for the attack on percussive & rhythm instruments & the "projection" of mid range instruments. Equalization can be applied at any frequency in this range but still somewhat centers around 3kHz. On the foot drum, boosting 2.5kHz or 4kHz increases the attack. 2.5kHz sounds more like a felt beater & 4kHz sounds more like a hard-wood beater. These frequencies can also be used to increase the attack or "hit" sound on toms & snare drums. Guitar lines often get more attack & distinction with

equalization added at this range. A small boost (1-3 dB) for the vocal will increase projection. Adding too much energy, in this range, makes it hard to distinguish the syllables of the vocal & can cause listening fatigue. This range of frequencies is often reduced on background vocals to give them a more "airy" & "transparent" sound.

PRESENCE RANGE

The presence range between 4kHz & 6kHz is responsible for the clarity & definition of voices & instruments. Boosting this range can make the music seem closer to the listener. Reducing the 5kHz content of a mix makes the sound more distant & transparent. Although this range covers a mere half-octave of 4kHz to 6 kHz, it is an often- used band of frequencies. This range makes most vocals & melody instruments sound closer & more distinct. Over-boosting causes a irritating & harsh sound. Equalization centers around 5kHz.

TREBLE RANGE

Covering approximately that last two octaves of sound (6kHz to 20 kHz), this band of frequencies is responsible for the brilliance & clarity on instruments. Equalization centers around 7 kHz, 10kHz & 15kHz. The vocal "S" sounds are at about 7 kHz, making this a frequency that is avoided for vocals. Care must be exercised in reducing 7kHz on vocals, however, because the vocal will sound dull very fast.

The breath sound of the vocal is at 15kHz & above, giving a breath quality without much accent on the "S": sound of the vocal. The 7kHz frequency is also the "metallic attack" frequency on drums The "sizzle" of cymbals is at 15kHz. When equalizing, 10kHz & above is often used as a general "brilliance" frequency band. The 6kHz to 16kHz range controls the brilliance & clarity of sounds. Too much emphasis in this range, however, can produce sibilance on the vocals.

50Hz

Boost: To thicken up bass drums & sub-bass parts.

Cut: Below this frequency on all vocal tracks. This should reduce mic pops.

70-100Hz

Boost: For bass lines & bass drums.

Cut: For vocals.

General: Be wary of boosting the bass of too many tracks. Low frequency sounds are particularly vulnerable to phase cancellation between sounds of similar frequency. This can result in a net 'cut of the bass frequencies.

200-400Hz

Boost: To add warmth to vocals or to thicken a guitar sound.

Cut: To bring more clarity to vocals or to thin cymbals & higher frequency percussion.

Boost or Cut: to control the 'woody' sound of a snare.

400-800Hz

Boost: To add warmth to toms.

Boost or Cut: To control bass clarity, or to thicken or thin guitar sounds.

General: In can be worthwhile applying cut to some of the instruments in the mix to bring more clarity to the bass within the overall mix.

800Hz-1KHz

Boost: To thicken vocal tracks. At 1kHz apply boost to add a knock to a bass drum.

1-3KHz

Boost: To make a piano more aggressive. Applying boost between 1KHz & 5KHz will also make guitars & bass lines more cutting.

Cut: Apply cut between 2kHz & 3KHz to smooth a harsh sounding vocal part.

General: This frequency range is often used to make instruments stand out in a mix.

3-6KHz

Boost: For a more 'plucked' sounding bass part. Apply boost at around 6KHz to add some definition to vocal parts & distorted guitars.

Cut: Apply cut at about 3KHz to remove the hard edge of piercing vocals. Apply cut between 5KHZ & 6KHz to dull down some parts in a mix.

6-10KHz

Boost: To sweeten vocals. The higher the frequency you boost the more 'airy/breathy' the result will be. Also boost to add definition to the sound of acoustic guitars or to add edge to synthesizer sounds or strings or to enhance the sound of a variety of percussion sounds. For example boost this range to:

Bring out cymbals.
Add ring to a snare.
Add edge to a bass drum.

10-16KHz

Boost: To make vocals more 'airy' or for crisp cymbals & percussion. Also boost this frequency to add sparkle to pads, but only if the frequency is present in the original sound, otherwise you will just be adding hiss to the recording.

<80Hz

While a standard six-string guitar isn't capable of producing musical notes below about 88Hz, the rest of your rig may still produce sound in this range. Unless you're playing through a 1000w P.A. with 18" subwoofers & crossovers, any sound in this range will come out as pure noise, not a heavier guitar sound (unfortunately). Noise in this range can also easily damage equipment.

Blown speakers are almost always destroyed by strong pulses of ultra-low bass frequencies. If your EQ allows you to adjust these frequencies, cut them completely out of your signal. You won't lose any audible bass, & you'll save wear & tear on your speakers, as well as make your soundman happy since you'll no longer be spiking his meters.

100-120Hz

This is the sweet spot range for audible bass frequencies with the electric guitar. It's responsible for the heavy, heart-thumping palm-muted chugs in heavy metal. Most graphic EQ's give you a slider in this range, which can be used modestly up to, say, a 6 to 8db maximum boost, usually less. More than this & you risk damage to most typical guitar speakers & your sound can begin to get muddy.

200-250Hz

Mudville. This is the range most responsible for what is known as the undesirable "muddy" sound. Unfortunately for Recto owners, the Recto amps provide copious amounts of bass response in this range. Recto's that are accused of sounding too muddy can often be easily improved simply by reducing this frequency range by as little as 2 & up to about 6db. Don't go overboard, though. As is true with all frequency ranges, it acts as both strength & a weakness. Too much of this range & your sound turns to muddy sludge, too little & you will suck all the warmth out of your sound, leaving your guitar sounding wimpy. Experiment to find where it sounds best to you.

400Hz

This is what I call the "Les Paul" frequency range, since Les Pauls often provide a little more of this range naturally due to their mahogany construction. It's also where I define the low-mids of the guitar's frequency range. Some people will call frequencies as low as 250Hz part of the low-mids, but let's be clear, 250Hz is bass, not mids. 400Hz starts to get into the actual mids of the guitar. If your guitar sounds a little thin & cold (such as can happen when your clean sound is dripping with lots of digital modulation effects), you may find it helpful to boost this range by as little as 2db to add back some "body" to your guitar sound. It should be used subtly; too much & you'll sound like you're playing in a closed cardboard box

with a moving blanket draped over it. Likewise if your darker-sounding guitar is having a hard time providing a light, chimey clean sound, you can very subtly cut this range & it will tend to emphasize your guitar's treble frequencies more.

650Hz

This range isn't quite as vital, though it can provide a noticeable boost or cut in the warmer (bassier) mid-range frequencies. It becomes more important when you're trying to EQ a good tone for soloing, especially in recording situations. Many modern amps, again unfortunately including the Recto, are lacking in rich, mid-range response, & as a result, the unaffected tone from these amps can often actually sound quite thin & wimpy when it comes time to rip a searing, singing, melodic solo, especially if the presence control is set particularly high. A boost here of 4 to 6db can help.

800Hz

The "Singing" frequency of the guitar. This is one of the most important frequencies on any EQ. It is this frequency, when severely cut, that provides the classic mid-scooped thrash metal Metallica sound. This same frequency, when strongly boosted, is also responsible for the singing solo tone of many 70's classic rock songs, especially those associated with the classic Les Paul/Marshall combo. A very large boost in this range is a key factor in achieving the singing solo tone of Boston songs. Subtler levels of boost in the 2 to 4db range are a key part of achieving the power chord & solo tones of much of 80's hair metal. Think "Round & Round" by Ratt, or any solo by George Lynch of Dokken. These are heavy with 800Hz boost.

Queen's Brian May is famous for his signature fixed-wah lead tone. Setting the wah at 800Hz is a key to achieving his tone. While this frequency range can be altered more severely than many others & still yield useable guitar tones, start off by altering it sparingly. Too little of this range & you'll get completely buried in the mix with your band. Too much of this range & your guitar will sound like it's singing through its nose.

1.6kHz

After 800Hz, this is one of the most important ranges to cut when trying to get the scooped-mid sound. When playing sparkly clean passages on a dark-sounding guitar, boosting this range by 2db as well as a subtle cut at 400Hz can sometimes do the trick.

3-4kHz

This range is one of the most psycho-acoustically active for the human voice, meaning it plays a big role in how we determine "tone of voice". For the guitar, a subtle boost of 2 to 4db can emphasize "crunch" & add just a bit of bite to solos. Eddie Van Halen's early guitar sound had a healthy boost at this range, allowing him to emphasize dynamics in his playing & take advantage of pick scratches to full effect. Think of the opening guitar on Van Halen's "You Really Got Me". In between chords, Eddie does a very quick down- up scratch across all six strings that's very prominent.

10-14kHz

This range is another two-edged sword. It's the "presence" range on most amps, & used correctly, can take the blanket off of an otherwise muffled sounding guitar. However, it's also the range most responsible for sibiliance...that nasty "sssss" sound that plagues vocal microphones.

Adjustments in this range can also sometimes be sneaky in that it's easy not to notice the difference in tone an adjustment here has made, often resulting in the player making larger & larger adjustments. However, walking away from the project & coming back to it later can often reveal dramatic & harsh effects on tone that large adjustments can produce. Keep it subtle.

ELECTRIC / STEEL GUITAR

The most important rule for equalizing guitars is to realize that harmonic series content not available at the source cannot be generated or synthesized at the mixer. Most guitar & steel guitar energy lie between 80Hz & 5kHz. Boosting the 3 to 5kHz range will add clarity to clean guitars but will sometimes add harsh harmonics to a distorted guitar.

Boost midrange a lot (9dB or so) & sweep the frequencies until you hear the range where the guitar sounds thick but yet still bright enough to cut through. Now, back the boost down to about +4 or so until the guitar cuts through the mix without being too bright. The oomph shows up at 240 to 500Hz; to make them cut, you'll want some boost around 1.5 to 3kHz.

General: Apply a little boost between 100Hz & 250Hz & between 10KHz & 12KHz.

ACOUSTIC GUITARS

The same frequency range applies to the acoustic guitar as the lead electric guitar. One common mistake is to listen to the acoustic guitar too much by itself rather that with the entire band. One common mistake with the solo acoustic guitar is to add too much bass. A solo acoustic guitar seems to need more low frequency boost to round out the sound than it does when played with a set of other instruments. If the low frequencies are excessively boosted, this results in a very muddy relationship with the overall mix. Remember that the acoustic rhythm guitar is as much a percussive timing component as a melodic component. Its high frequency spectrum is most essential to the "sizzle" of the program material. Get size & dimension between 80 & 130Hz; warmth, body & a little boom around 250Hz; strumming detail opens up from 2 to 5kHz, while you'll want to look at 5 to 10kHz for serious zing.

Add Sparkle: Try some gentle boost at 10KHz using a Band Pass Filter with a medium bandwidth.

SUB-BASS

The very low bass between 16Hz & 60Hz that encompasses sounds that are often felt more than heard, such as thunder in the distance. These frequencies give the music a sense of power even if they occur infrequently. Too much emphasis on this range makes the music sound muddy.

BASS GUITAR

As with drums, boosting lower frequencies to try to create more depth than what is available is a common mistake. Most bass guitar energy lies around 100Hz with definition in the 1kHz to 2kHz region. Boosting of very low frequencies will result in a "muddy" clash with the kick drum. Letting the kick drum produce the fundamental, & the bass guitar rounding out the low midrange just above the kick drum results in a more clear discernible mix. The kick drum can have high definition attack for the initial hit while the bass guitar string harmonics can provide the sustaining definition for the sound.

The bass between 60Hz & 250Hz contains the fundamental notes of the rhythm section, so EQing this range can change the musical balance, making it fat or thin. Too much boost in this range can make the music sound boomy. The heaviest lows (or "subs") are best found between 60 & 100Hz, but there's warmth to be had in the 100 to 300Hz range; for more string detail & fret buzz, a good range is 2 to 4.5kHz. The ratio between the low bass (80-120Hz) & the mid-bass (130Hz-200Hz) is important. Try using two fairly narrow peaking bands, one at 100Hz & another at 140Hz & boost one & cut the other. If the bass is too warm, sometimes reducing the upper band can make it more distinct without removing the deeper fundamentals that live in the 100Hz band. Also, try boosting some of the 1kHz area since this is where a lot of the sound of the Fender bass lives.

STRINGS

The weight of basses & cellos like the area around 250Hz; your main detail is in the 3 to 5kHz range; for more sizzle, bowing & glassiness, look to upwards of 7kHz.

KEYBOARDS

This one varies considerably, but most pianos & organs get their fullness down around 100Hz, with detail in the 2 to 5kHz range; synth bass can profit from 60 to 90Hz, while pads & leads will open up in the 2 to 5kHz range; add some 10kHz boost for serious "air".

HORNS & BRASS

Brass gets warmed up nicely in the 200 to 400Hz range, while midrange "honk" is located in the "nasal" regions around 1 to 3kHz. For a little shrill blast, look to the 8 to 11kHz zone.

VOCALS

Low frequency boosts are almost never effective for female vocals, but may be effective on male vocals to a limited extent. Boosting of lower frequencies from 500Hz to 800Hz will add body & warmth to the vocal. The most distinct vocal clarity range is from about 3.5 to 6kHz. This range will enhance breath effects as well as increase the overall intelligibility of singing & speech. This boost does not come without penalty. Excessive boost in this range increases the sibilant [pronounced sib·i·lant (sîb¹e-lent)] effect of the voice. Sibilance occurs when the vocalist pronounces words with the letter "s". If a vocalist naturally has this problem, cutting the 3.5kHz to 6kHz range can cure the problem. Beware that this is the presence range of intelligible speech & too much cut will make the vocal sound

muddy. Also presence may be added in the 1kHz to 3kHz range although, the 3.5kHz to 6kHz range is generally suited better for overall clarity.

The other problem with boosts in this range is vocal microphone feedback. Directional cardioid dynamic microphones are almost always used for live vocal performances. The cardioid pickup pattern created by the design of the microphone is quite effective. The overall mic pattern & monitor, or main speaker tend to be less directional & predictable at the 3.5kHz to 6kHz region. It is unfortunate that this vocal clarity range must have the inherent pitfalls of transducer physics. Feedback will inherently occur freely at this range.

Deep resonance emerges at or below 120Hz (also a good place to cut "plosives"), with boom at 250Hz; clarity & articulation occupy the 3 to 5kHz range, while serious detail, "air" & closeness can be accentuated between 7 & 12kHz. Boost a little at 125Hz to 250Hz to accentuate the voice fundamental & make it more chesty-sounding. The 2kHz to 4kHz range accentuates the consonants & makes the vocal seem closer to the listener.

General: Roll off below 60Hz using a High Pass Filter. This range is unlikely to contain anything useful, so you may as well reduce the noise the track contributes to the mix.

Treat Unclear Vocals: Apply some cut to the guitar between 1KHz & 5KHz to bring the vocals to the front of the mix.

Treat Harsh Vocals: To soften vocals apply cut in a narrow bandwidth somewhere in the 2.5KHz to 4KHz range.

Get An Open Sound: Apply a gentle boost above 6KHz using a shelving filter.

Get Brightness, Not Harshness: Apply a gentle boost using a wide-band Bandpass Filter above 6KHz. Use the Sweep control to sweep the frequencies to get it right.

Get Smoothness: Apply some cut in a narrow band in the 1KHz to 2KHz range.

Bring Out The Bass: Apply some boost in a reasonably narrow band somewhere in the 200Hz to 600Hz range.

Radio Vocal Effect: Apply some cut at the High Frequencies, lots of boost about 1.5KHz & lots of cut below 700Hz.

Telephone Effect: Apply lots of compression pre EQ, & a little analogue distortion by turning up the input gain. Apply some cut at the high frequencies, lots of boost about 1.5KHz & lots of cut below 700Hz.

BASS DRUM

A lot of music has samples in it & that gives the producer the luxury of pretty much getting the sound you want from the start. In the old days you always pulled out a little 400 on the kick drum. You always added a little 3 & 6 to the toms. That just doesn't happen as much any more because when I get the tape, even with live bands, the producer’s already triggered the sound he wanted off the live performance & the drums are closer.

It is hardly ever effective to boost frequencies of a kick drum below about 60 Hz. There are applications on some modern dance music where synthesized drum patches will have dominant energy below 50Hz. These 20 to 40Hz fundamentals are the type

that easily propagates through the closed windows of automobiles & other structures. These low frequency waves encounter little acoustical attenuation in materials & may be heard from great distances. For the generalized kick drum application, the "thump" is usually realized in the 60Hz to 100Hz range.

The definition or "slap" of the kick drum is very essential
for its relationship to the bass guitar. Boosting the kick drum at 60 to 100Hz for the "thump" & boosting 1.5kHz to 3kHz for the "slap" will provide a "spectral saddle" for the bass guitar to reside. Boosting bass drum frequencies from 100Hz to 2kHz in excess will often cause the kick drum & bass guitar relationship to be very boomy & muddy. Letting the kick drum initial attack in the 1.5kHz to 3kHz region start off the event, & letting the bass guitar fresh string harmonics provide the sustaining clarity, provide a pleasing spectral combination.

For a modern sound, boost slightly in the 6kHz to 12kHz region, to accentuate the transient click as the beater hits the skin. The thump of the beat can be brought out by boosting between 2kHz & 3kHz. To give a deep, powerful 'thud' to the sound, boost between 75Hz & 100Hz. If the sound has a tendency resonate, try cutting between 200Hz & 400Hz. For fat, punchy subs, look between 80 & 100Hz; to hear the warm ring, try around 300Hz; get the snap of the beater between 2.5 & 6kHz.

Often the kick drum is still heard at low listening levels due to the attack of the instrument. Sometimes the kick has a "cardboard" type quality to the sound which can be reduced with a 300 to 400Hz dip using the equalizer. Use the amount of dip that makes the drum sound the best - usual amounts vary between 3 dB & 9db. When you reduce this frequency on the kick drum, you also tend to get better distinction between the kick drum & bass guitar. You can also boost 50Hz to give the drum proper fullness but be careful not to over-boost this. To make the kick more prominent in the mix for low-level listening boost the "beater" frequencies as follows:

3kHz - boost to give a hard felt beater sound
5kHz - boost to give a hard wood beater sound
7kHz - boost for a metallic beater sound

General: Apply a little cut at 300Hz & some boost between 40Hz & 80Hz.

Control The Attack: Apply boost or cut around 4KHz to 6KHz.

Treat Muddiness: Apply cut somewhere in the 100Hz to 500Hz range.

SNARE DRUM

Older audio references will refer to snare drum dominant frequencies being in the 1kHz to 2kHz region. If you are mixing sound for modern rock or country music you will find a potpourri of snare drum frequencies. Starting with disco in the 70's & the urban cowboy country craze of the early 80's, snare drum became spectrally similar with a bass drum. Experiment with a multi-octave equalizer on a stereo system with an early to mid 1980's country record, like George Strait. You will find very dominant snare drum spectral content in the 150 to 200Hz region. Mixes of that era as well as today use caution in not having the snare & the kick drum both being dominant in the mix since it would be difficult to tell the difference between the two drums. This often results in a "double time" effect.

There are no general rules to the equalization of the snare drum with one exception. When using a real snare with a microphone, be aware that if the drum is tuned very high like a marching band snare, excessive low frequency boosts will not create a fat snare. Listen to the real drum sound up close & realize that

fundamental frequencies that are not available from the drum cannot be created or synthesized by equalization. Excessive boost at low frequencies will pickup other drums undesirably.

Generally, if a trigger snare patch or drum has energy in the 150Hz range & you desire a fat snare, then use it accordingly. Some crisp quality can be added in the 2kHz to 5kHz region. Remember however that excessive boosting of any frequency of a snare drum means you are probably trying to get a sound that is not available from the source & you are likely picking up extraneous sounds from other nearby sources. Snare drum reverb is a diverse topic alone. The reverb usage will greatly affect overall equalization used.

To find the point on the snare, boost the upper midrange starting at about +5 or 6dB at 2kHz or so. Open up the bandwidth (if that parameter is available) until you get the snare to jump out, then tighten the bandwidth until you get only the part of the snare sound that you want most. Then fine-tune the frequency until you need the least amount of boost in order to make it jump out of the mix.

To accentuate the stick impact & rim shots, boost at about 5kHz. The rattle of the snares lies mostly between 5kHz & 10kHz. The 'bang' of the drum is in the region of 1-3kHz. The body resonance of the drum can be found at 100-250Hz. For weight, you could look as low as 150 to 400Hz; boxy "toonk" comes out around 900Hz, crisp detail at roughly 3 to 6kHz, & extra head-shearing snap at 10kHz. The attack can be adjusted by boosting or cutting at around 1kHz to 3kHz. Resonance can be augmented or reduced by EQ-ing from around 100Hz up to 300Hz. Be careful in boosting frequencies below 500Hz, because a confused, muddied sound can result. To improve clarity, cut frequencies between 200Hz & 400Hz.

TOM-TOMS

The tom-tom sound can be made more dynamic by boosting at around 6-8kHz for the stick impact & 3kHz for the 'thwack'. The body of the sound generally lies between 100Hz & 500Hz depending on the size of the drum. Depending on context, you may wish to boost the lower registers to add power & coloration, or cut these frequencies to emphasize the impact rather than the body & decay of the sound. For full resonance, look to the 250 to 500Hz range; sharper definition & better attack will be found between 5 & 7kHz. For floor toms, shake the floor between 80 to 120Hz; hear the rattle of the heads at 5kHz. Depending on the tuning of the toms, most of the effective range is from 150 Hz to 2kHz. The lows are good for deep percussive effects but definition that cuts through the mix is usually about 1kHz to 3kHz. One advantage of toms in particular in a country or contemporary mix is that they are only played occasionally. That means their level & occupancy of spectral space may be loud & wide. They don't need to repetitively compete with other instruments like kick drum & bass guitar. The application of reverb also effects equalization as mentioned in the snare drum topic.

HI-HAT & CYMBALS

The major components of the hi-hat sound are the ring, from 7-10kHz, the stick noise, at about 5kHz, & a clang in the region of 500Hz to 1kHz. Below 1kHz, but principally in the range from 75Hz to 300Hz, lies the main resonance of the instrument. The real sizzle takes place at 8 to 12kHz, but you'll get thickness & stick quite a bit lower, around 200 to 300Hz, & sweet overtones between 4 & 6kHz. From 1kHz to 3kHz is the 'bang' of the beat. From 5kHz to 10kHz is the 'click' as the stick impacts with the drum or cymbal. From 8kHz to 15kHz is the resonance of cymbals. Boosting in the region between 8kHz & 10kHz will make the cymbals more

prominent & sparkling. Boost applied in the 5-8kHz area will bring out the stick noise on both snare & hi-hat.

Fortunately, cymbals remain fairly constant & predictable over many types of music. Their dominant energy lies in the 2kHz to 5kHz region. Cymbal harmonics extend up to & past the range of human hearing. Boosting of cymbals in the 10kHz to 12kHz region results in a very brittle sound. Usually, boosts in the dominant area of 2kHz to 3kHz makes the overall mix less "wet" or "noisy" than boosting in the upper region.

Get Definition: Roll off everything below 600Hz using a High Pass Filter.

Get Sizzle: Apply boost at 10KHz using a Band Pass Filter. Adjust the bandwidth to get the sound right.

Treat Clangy Hats: Apply some cut between 1KHz & 4KHz.