



## Procedure for properly tuning a system with a real time analyzer (RTA):

The reason you will need to tune a system with an RTA are:

- 1) Speakers do not have a “flat” frequency response”. All speakers sound differently.
- 2) The vehicle will change the way the sound is heard.
- 3) The sound will change as you get more off axis with the front of the speaker. This will change the way you hear sound from two identical speakers. That is why it is important to equalize left and right speakers separately in an automobile.

**All of these differences will drastically affect how the system sounds and performs**

How to use the RTA:

- 1) Make sure all radio tone controls are set flat and loudness is off and eq. settings are flat
- 2) Turn off all speakers except left front
- 3) Make sure you have a source for quality pink noise (CD preferred)
- 4) Set the RTA microphone as close to the listening position as possible
- 5) Play pink noise and set dB level to approximately 85 – 90dB
- 6) Begin to smooth out eq. curve as much as possible. It is better to make cuts in frequencies rather than boosting them. It is less likely to have distortion. It is not important to have a completely flat response. Just make sure there are not huge differences between eq. bands. No more than 6 dB steps. Most people do not prefer a flat response because it will sound very lifeless and sterile. You may choose to initially flatten the response curve and then go back and retune the system to the listener’s liking.
- 7) Measure the dB level after eq. has been adjusted
- 8) Turn off left front and turn on right front speaker
- 9) Set dB level to 85 – 90 dB
- 10) Smooth out eq. curve as much as possible
- 11) Compare RTA curve to left side and try to match curve as close as possible
- 12) Measure dB level and match to left front speaker as measured in step 7
- 13) Turn on left front speaker and look at eq. curve with both playing.
- 14) If there is a big dip in certain frequencies, reverse polarity of one speaker to see if it improves
- 15) Once you have the left and right matched and the time alignment set, you can then tune the sound to your taste. Make sure your eq. changes affect both channels at the same time when tuning.
- 16) RTA tuning of the rear speakers is not as critical as the front since they will not be as audible as the front speakers are. You can tune them if you wish. You can even tune them specifically for the rear passengers. Just make sure to put the RTA microphone in the center of the two seats if there are frequently passengers on both sides. If only one rear passenger is more common, put the microphone where that passenger’s head would be.



## Setting time alignment for proper staging:

The reason you need to set time alignment is because speakers in a car are different distances from the listener. Recordings assume that you are the same distance from all speakers. If you are closer to one speaker, this speaker's sound will reach you before the sound from the other speakers and will not stage properly. The closer speaker will also sound louder so you will have to adjust gain levels as well to properly balance the system.

- 1) To set time alignment, you will need to measure the distance each speaker is away from the chosen listening position. Use the farthest away speaker as your reference or starting point. This is generally subwoofer, but not always. The speaker that is farthest away will not get any time delay. Calculate the difference in the distance between the reference speaker and the one you are setting the delay for.
- 2) You will delay the sound .82ms for each foot and .07ms for every inch of difference in the distances of the speakers to the listening position. Some DSP processors will set the delay automatically by making the calculations from the distance measurements you input during set up.

### Example:

**The subwoofer is 86" away and left front speaker is 32" away. The difference is 54" so you would multiply 54" x .07milliseconds and get a delay of 3.78ms delay for the left front speaker.**

- 3) You will complete this process for all of the speakers in the vehicle. This will assure that all the speakers sound will reach the intended listener at the same time as the recording was meant to.
- 4) You may need to fine tune the time alignment. Measuring is a great place to start but it cannot account for everything in the vehicle. Start by adding or subtracting time from the left front speaker slowly while listening to a good quality recording with a single vocalist. You should be able to move the location where the singer seems to be located either left or right on the dash. There is no right or wrong here. It is listener preference.

## Rear fill:

Q. What is rear fill and why is it important to adjust properly?

A. Rear fill is generally any sound that comes from behind the listener.

Most of the time, people want the same sound coming from the front and rear speakers in a car at the same volume. When playing a stereo or 2 channel audio, this is not the correct way to set up a properly tuned system. Rear fill is usually just loud enough to barely notice a difference when it is turned on or off. It is supposed to mimic the reflection of sound from the stage as it reflects back forward in a concert hall. It should never be as loud as the front image. If you go to a concert, the



performers are only in front of you. You will generally only hear crowd noise from behind you, if you can even hear that depending on how loud the concert is. You should only hear the sound of the performers from in front of you. The performers are not in front of you and behind you at the same time. This would be physically impossible. For some reason, we have convinced ourselves that we want this total immersion of sound in a car, and it is not correct. The car is the only environment that is made this way. Rear fill should complement the front and is the least important to the overall sound quality. I suggest you only use rear fill for the people that sit in the back of the car. Most of the time in my personal car, I have the rear completely shut off. There is enough reflection of sound coming from the rear of the car to give the effect of rear fill. Just remember that rear fill is totally subjective to the listener, there is no right or wrong. It is whatever the listener wants.

### **Rear fill in multichannel recordings:**

If you have a system that has the ability to play more than just a stereo signal, like 5.1 Dolby Digital or DTS, the rear speakers do become much more important. (5.1 refers to 5 separate audio channels and a dedicated subwoofer output). There is also usually a center channel speaker that will give you the center image similar to the one you are trying to achieve with the tuning methods described above for a 2 channel system. A true center channel and rear speakers will have their own discrete channels from the amplifier. True multichannel systems will also have surround speakers in the rear. These speakers play a specifically recorded signal that is independent of the front image. This signal has been recorded to add spaciousness to the recording and is not just a duplicate of the front image. In this type of system, it is more critical to tune the sound and set the delay for the center and rear speakers to sound correct for the driver.

If you are playing a video, the sound from anything that you can see on the screen should not be heard coming from the rear speakers. You should only hear ambient sounds from the rear or something that is not seen on the screen. This type of system is the most natural sounding but is difficult to achieve in most cars with music because most music is only recorded in 2 channels and most radios can't decode a multichannel signal. There is some music that is recorded in multiple channels but they are not easy to find and are usually live concerts, but not always.