AWS Setup

*The AWS (**A**daptive **W**oofer **S**ystem) is a powerful tool that enables you to get optimum sound performance from your ACI speaker system. AWS allows you to tune the speaker to your room and placement. The instructions for using AWS are presented in the manual and on the CD.*

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Sound that Satisfies…

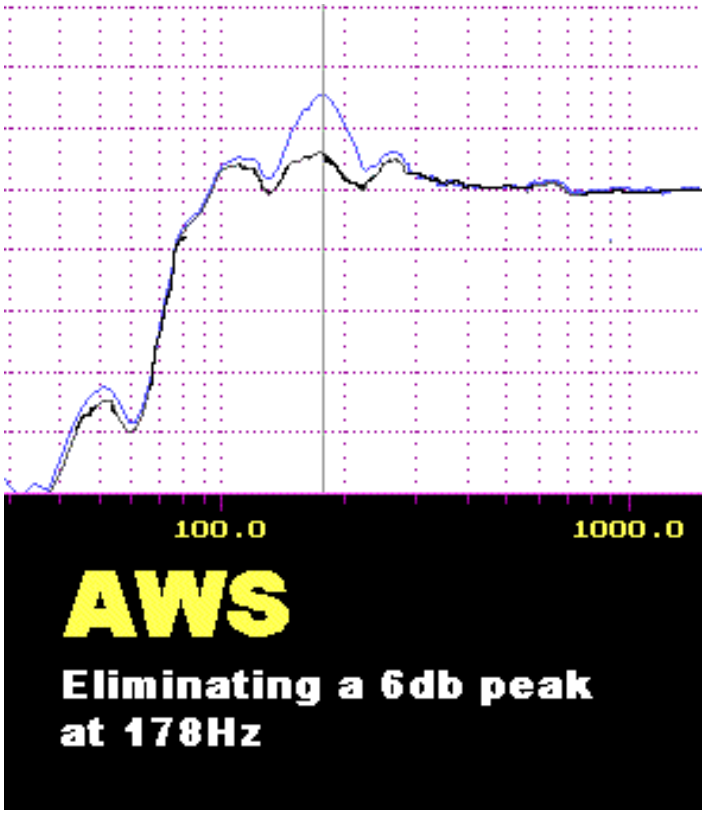
1. Purpose of Equalization

Most of us listen to our speakers in less than ideal conditions. Typical rooms are rectangles or at least rooms with some parallel walls. Most rooms have a great number of standing waves that interact with the original signal, either constructively or destructively. An example of a constructive interaction is when the standing wave is in phase with the original signal, resulting in a peak at a given frequency. Destructive interaction is when the signal is out of phase with the original signal, resulting in a dip of the frequency.

A standing wave occurs when the distance between two walls is equal to half the length of the wavelength. This effect is seen throughout the whole frequency range. So why should we equalize the bass and ignore the standing waves at higher frequencies? First, it is much easier to treat higher frequencies with room treatments. Carpet, rugs, plants, and furniture do a fairly good job at absorbing and dispersing higher frequencies. Lower frequencies are quite a bit more difficult to absorb. For example, given a 40 Hz wave, it would take seven feet, (1/4 wavelength) of absorbing material to reduce a reflection of that particular wave. At 2KHz, it would only take about an inch and a half of absorbing material. Our ears average the midrange and high frequencies for us. We don't hear each individual peak or dip. It would be extremely difficult to equalize the huge number of peaks and dips in the midrange and high frequencies.

Bass is a different story, in most domestic listening spaces there will be one or two dominant resonant peaks in the bass response. These are the bass notes that just jump out at you, that cause that excessive "boom". These notes hang on long after they should stop. These resonances often cause the entire bass range to sound "slow" or bloated. Audiophiles have often dealt with this by using speakers with a very lean bass or turning their subwoofers way down. However, it is possible to have powerful ***and*** accurate bass response if we can significantly reduce the amplitude of these major peaks. This is one of the two major functions of what the AWS is designed to do.

AWS is also designed to give you the power to control the tonal balance of the speaker. The perceived tonal balance of a speaker will change depending on its placement within the room. Placing the speaker closer to room boundaries or large furniture increases bass output. These boundaries act much like a mirror behind a light bulb focusing the energy. An example would be a stand mounted Veritas vs. a Veritas that is mounted flush in a large entertainment center. The Veritas mounted in the entertainment center will have a bass heavy balance compared to the stand mounted Veritas. The bass volume control in the AWS will easily adjust for either placement.



What about dips or holes in the bass response? Missing information is far less objectionable than too much information. Our ears tend to fill in missing information so it sounds “right”. This is a good thing because an equalizer is ***not*** effective at filling in holes in the response. If fact, trying to add a lot of boost to one part of the spectrum will usually result only in increased distortion and possible woofer damage. We do not recommend using the AWS to boost parts of the response. It is far more effective to reduce the peaks to get a smoother overall response.

2. Using the AWS Controls

There are two sections to the EQ controls. The first section is preset at the factory. The High pass frequency and Phase control should be left at the factory settings. The Volume control may be adjusted up or down to compensate for speaker placement and desired total balance. Test tones are provided to calibrate the volume level to neutral in your setting. Adding additional bass volume beyond neutral will give the system a warmer overall balance. Decreasing the bass level below neutral will result in a leaner balance with more perceived detail.

The second section includes the two parametric EQ controls. There are three adjustments and in/out switches for each band. The Gain controls the amount of volume you want to subtract or add. The Frequency selection control adjusts the frequency you are trying to alter. The Q control adjusts the width of the band. The in/out control turns the particular EQ section on or off.

Note the Gain control has adjustable range from –9 to +6. *It should be noted that trying to fill in holes should generally be avoided*. It is usually better to play around with speaker/ listener placement to avoid dips. Increased distortion and dynamic limitation are usually the only things gained by trying to fill in response dips.

3. Measurement and Adjustment Methods

1. **By Ear:** Recommended only for those who are very brave and possess well-trained ears. Certainly you can use the test tones to spot frequencies that sound to loud in relation to the other frequencies, but it will be difficult.

2. **Using the Radio Shack SPL meter and AWS Excel spreadsheet:** This method is relatively easy, inexpensive, and quite accurate. It can be rather time consuming compared to methods four or five.

3. **Using the Radio Shack SPL meter and hand plotted graphs:** Very similar to #2 but you'll have to do a little math when hand plotting.

4. **Using a test system such as ETF, CLIO or MLSSA:** If you have this type of equipment you can run the measurements quickly and accurately. Usually the most expensive option. Most of these instruments are extremely powerful and can have a relatively steep learning curve. Separate measurement microphone and possibly microphone pre-amp will also be required.

5. **Using a RTA (Real Time Analyzer):** This is probably the fastest method as you can see the results of your adjustments on-screen, in real time. RTAs used to be quite expensive. Computers with soundcards have drastically changed that! The CD contains a free Demo version of Praxis, which is an extremely powerful RTA and more. We also provide a link to the relatively inexpensive, powerful and easy to use RTAs by TrueAudio. Separate measurement microphone and possibly a microphone pre-amp will also be required.

4. Using the Radio Shack SPL meter and AWS Excel spreadsheet Radio Shack Cat No. 33-2050

Sine waves were chosen for EQ setup because of their ease of use, accuracy of the results, and simplicity.

Please follow the directions below for setting your EQ:

1. The volume control of your speaker system was calibrated to a nominally "flat" balance at the factory. Depending on your room and placement, you may need to adjust the relative level of the bass drivers.

2. Insert the test disc in your CD player. Position the SPL meter at approximate listening position. The meter should be aimed toward the

speakers. Most accurate results will be obtained with the meter approximately where your head would normally be. A camera tripod can be used as the SPL meter has ¼ -20” threaded insert on the bottom.

3. Set the SPL meter to “C” weighting and response to slow.

4. Start with the system volume turned down. Play track number 1 or 2, (60 Hz for Talisman or 100 Hz for Veritas or Veritas V), and adjust the volume to read 70dB on the SPL meter.

5. To adjust the relative bass level you will be using track #25 for the Talisman and LFM or #26 for the Veritas. Play the correct track for your speaker. Note and record the reading from the SPL meter. Next, play track #27. Adjust the bass volume control on the AWS until your meter is reading the same level as it did for track #25 or #26. Your bass level is now set.

6. Open the “Frequency Response” MS Excel worksheet. Click on the “Data Entry Sheet” tab at the bottom and print it out.

7. Play tracks 3-24 and write down the measurements in the “Data Entry Sheet”.

8. Go back and plot the written numbers into the Frequency Response worksheet.

9. Evaluate the graphs for one or two dominant elevations in the response. These are your targets for EQ.

10. You have two bands of EQ to use. You may use them individually or combine them to work on one large peak. For these instructions we'll do the explanation for using one band of EQ to remove one peak in the response.

11. Determine the approximate center frequency of the peak in the response. Peaks are rarely textbook symmetrical so you will have to make a judgement of where to set your target frequency. Set the frequency on the EQ to this target.

12. Determine the approximate amplitude of the peak in decibels, (dB). This is the amount to set your cut at.

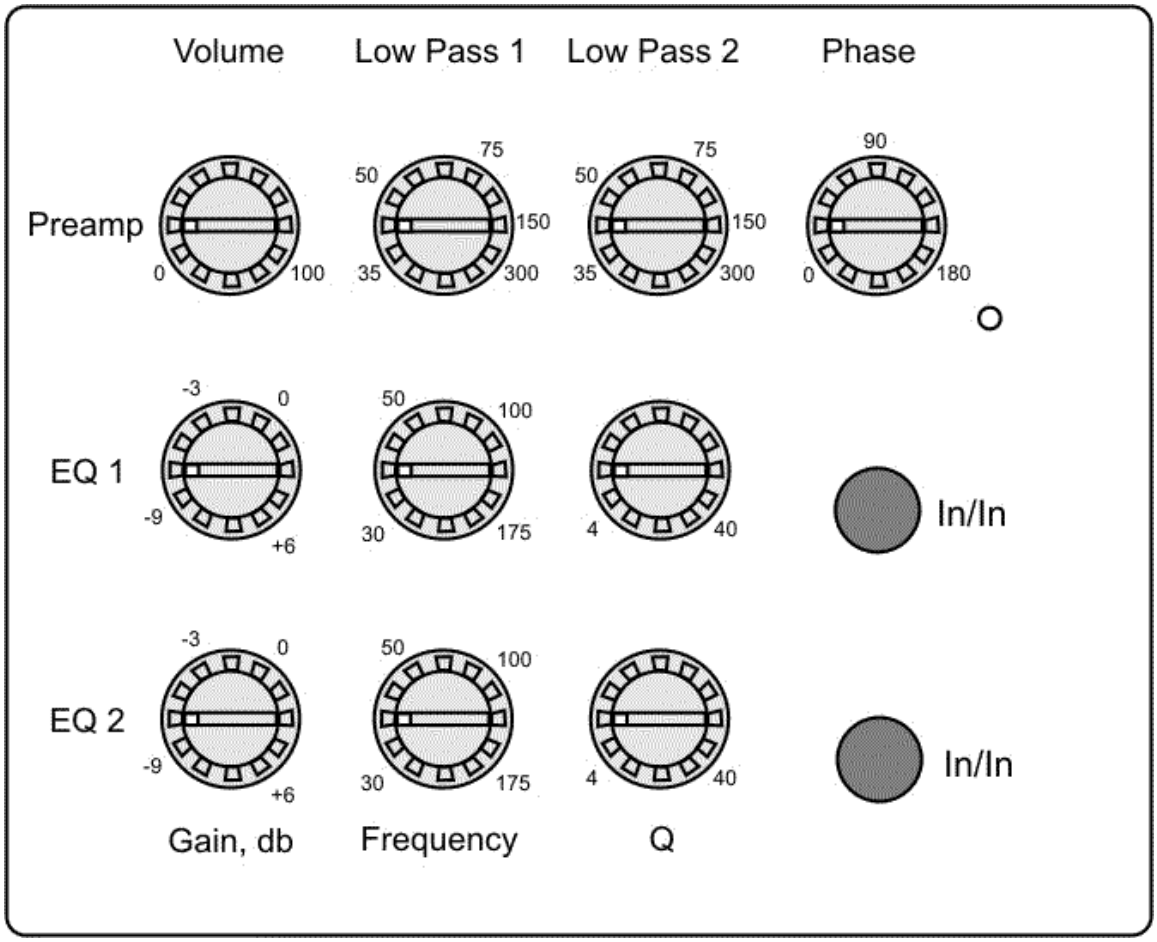
13. Determine the approximate width of the peak. Is it relatively broad or more of a sharp peak? Set the Q toward 40 for a broad peak and toward 4 for a sharper peak. There is no easy method to "know" what will be correct. You will need to take another measurement to see if you need to go with greater or less Q.

14. Take another measurement as in steps five and six. Evaluate the change. Is the center frequency optimum? Is the cut at the right level? Does the Q need to be higher or lower? Make the desired adjustments and take another measurement. Don't be surprised if it takes you five to ten tries or even more to get the flattest possible measurement. You may want to take a break at some point and do some listening to evaluate the changes you've made. You may even decide to "re-tweak" in the future. The goal is to get the most accurate and pleasing sound your system is capable of. The more time you invest, the more accurate your results.

15. Go back and do Step #5 again. Having done the equalization you may find that the balance needs to be re-adjusted.

16. We suggest you mark your measurements on the supplied drawing. If someone accidentally changes them, you'll be able to get the optimum settings back without all the work.

17. Relax and enjoy your ACI system!



5. Using the Radio Shack SPL meter and hand plotted graphs

Your steps will be the same as above. However, for steps five and six you will need to manually plot your graph using the supplied graph paper. Be sure to add or subtract the required correction for the meter.

6. Alternative Means of Measurement and Equalization

Some of you may own or have access to a RTA such as the 1/3 octave unit manufactured by Audio Control. This type of unit will allow you to quickly see the changes as you make adjustments. The disadvantage is that 1/3 octave resolution is rather marginal. We have found 1/6 octave to be ideal for optimizing systems. These types of analyzers are available as software based systems using your computer sound card. Another excellent option is the ETF system, which takes quick, high-resolution measurements of not only frequency, but time as well.

Software based analyzers are inexpensive, (in some cases free), and very powerful. That power comes with a price. The learning curve to setup and use some of these programs can be rather steep. The Praxis demo for example can do all sorts of accurate audio measurements. It will give you powerful tools that can help you with far more than just setting up the AWS system. Other factors to keep in mind; 1) Most of the software programs have certain requirements for the computer hardware and the soundcard used. 2) Separate measurement microphone and possibly microphone pre-amp will be required for any software based RTA or Analyzer.

7. Website based updates

If new information becomes available on the AWS system and system equalization it will be added at: www.audioc.com/information/aws.htm

8. Supplemental Materials

These are all found on the CD. This manual is provided in PDF format. All files are for download or personal use only. This information and these files may not be distributed / sold, etc. with out the express written permission of Audio Concepts, Inc. Copyright 2003

AWS Excel Spreadsheet: Requires Microsoft Excel 97 or newer. Quickly computes and plots your graphs.

Printable Graph for Hand Plotting: Hard copies are printed in the paper manual and the file may also be printed.

Drawing of AWS Control Panel: Use this copy to mark your final settings. If the controls are accidentally changed, you'll be able to reset them quickly without measuring again.

Praxis Files: If interested, go to the Praxis website to see if Praxis will work for you and if your computer will be able to run the program. Go to: **www.libinst.com.** Then, copy the files from the CD to your hardrive and click on PraxisinstalF to install the program on your computer.

True Audio RTA Audio Analyzer: A great, easy to use soundcard based RTA at a very fair price. We recommend the 1/6 octave version for setting up the AWS system and most audio setup work. A free, one-octave version is available for demo download. This allows you to make sure the program will work on your system. We recommend getting the free download to see if this might be the system for you. Go to: ***www.trueaudio.com***

**Note, Audio Concepts, Inc. assumes no responsibilities or liabilities for any of the software described in this manual. Downloading, installing programs etc. is done solely at the individual users discretion. ACI staff people are not trained in installing or using any of these programs and cannot assist with their use.*

EQ TEST TONES ON DISC

1. 60 sine wave
2. 100 sine wave (Veritas)
3. 16 sine wave
4. 18 sine wave
5. 20 sine wave
6. 22 sine wave
7. 25 sine wave
8. 28 sine wave
9. 32 sine wave
10. 36 sine wave
11. 40 sine wave
12. 45 sine wave
13. 50 sine wave
14. 56 sine wave
15. 63 sine wave
16. 71 sine wave
17. 80 sine wave
18. 89 sine wave
19. 100 sine wave
20. 111 sine wave
21. 125 sine wave
22. 143 sine wave
23. 160 sine wave
24. 200 sine wave
25. 60 Hz warble tone (level matching subwoofer)
26. 150 Hz warble tone (level matching mid) (Veritas)
27. 600 Hz warble tone (level matching woofer) (Veritas)
28. 16-200 Hz sweep short
29. 16-200 Hz sweep long
30. 60-200 Hz sweep short (Veritas)
31. 60-200 Hz sweep long (Veritas)
32. Pink noise
33. White noise

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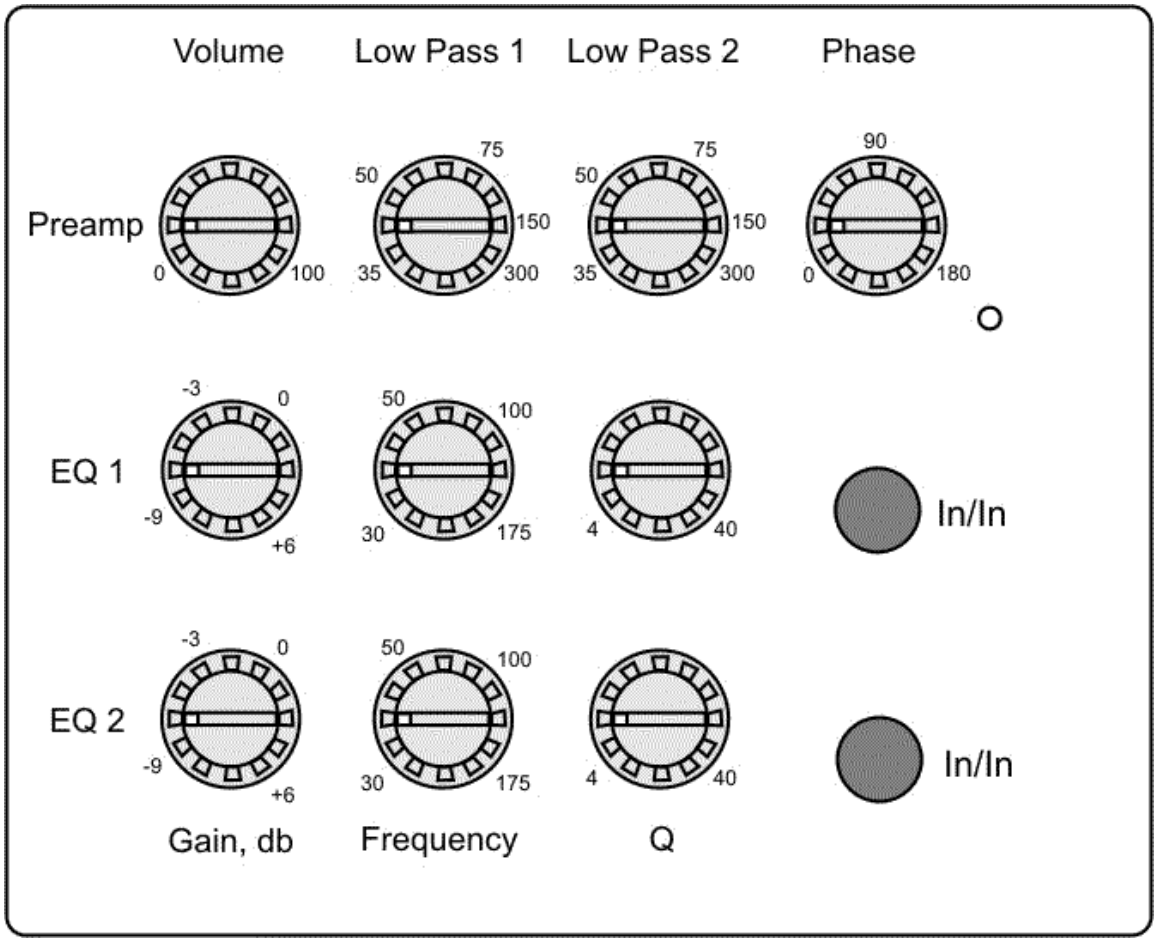
Volume
Low Pass 1
Low Pass 2
Phase
Preamp
0
100
50
75
150
35
300
50
75
150
35
300
90
0
180
EQ 1
-3
0
-9
+6
50
100
30
175
4
40
In/In
EQ 2
-3
0
-9
+6
50
100
30
175
4
40
In/In
Gain, db
Frequency
Q

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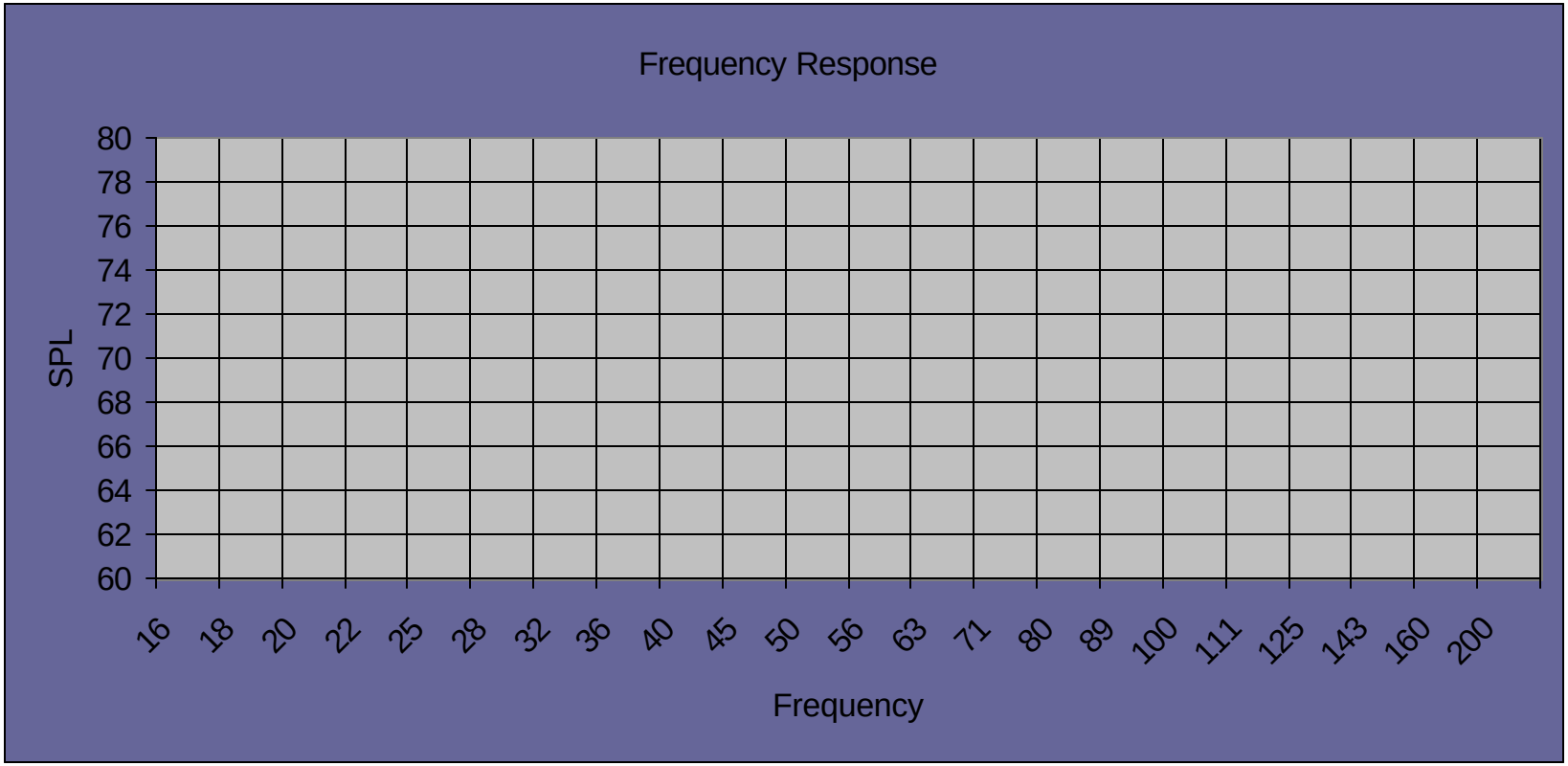
AWS Worksheet #Two

Manual Plotting For Those Without Excel



Frequency	16	18	20	22	25	28	32	36	40	45	50	56	63	71	80	89	100	111	125	143	160	200
Measured SPL																						
Add	10	7.3	6.2	5.4	4.4	3.8	3	2.5	2	1.7	1.3	1	0.8	0.7	0.5	0.4	0.3	0.25	0.2	0.15	0.1	0
Actual SPL																						

Track	3	4	5	6	7	8	9	10	11	12	13	14	151	16	17	18	19	20	21	22	23	24
FR	16	18	20	22	25	28	32	36	40	45	50	56	63	71	80	89	100	111	125	143	160	200
SPL																						

Track	3	4	5	6	7	8	9	10	11	12	13	14	151	16	17	18	19	20	21	22	23	24
FR	16	18	20	22	25	28	32	36	40	45	50	56	63	71	80	89	100	111	125	143	160	200
SPL																						

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SPL																						

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FR	16	18	20	22	25	28	32	36	40	45	50	56	63	71	80	89	100	111	125	143	160	200
SPL																						

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SPL																						