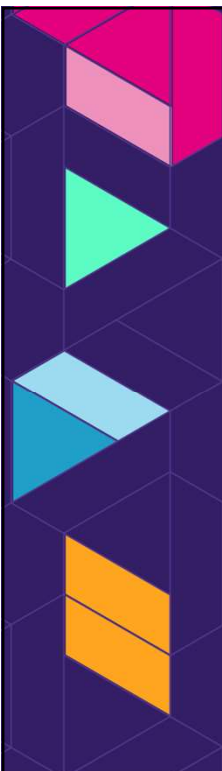




1



Welcome!

Create/Join a group of 4 and discuss this question:

What challenges are you currently facing that you would like to help with today?



2



Balancing Audio Systems: Documented Process for Finding that Sweet Spot

Trevor Flynn, CTS-D, MSc
Jim Maltese, CTS-D/I, CQD/T

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Goals for Today

- Discuss tuning the audio of a room in minutes
- Use a documented process
- Get the system to 95%

Follow along with the checklist



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Step 1: Physical Install

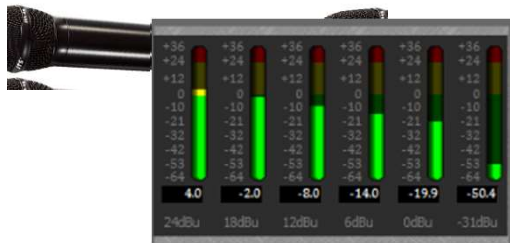


- Loudspeakers
 - Location
 - Taps
 - Orientation
- Microphones
 - Location
 - Orientation



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Step 2: Set mic levels



- Use standard talker
- Wired
 - 0 dBu at mixer input
- Wireless
 - “Nominal” at receiver
 - 0 dBu at mixer input



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Step 3: Set Listen Levels

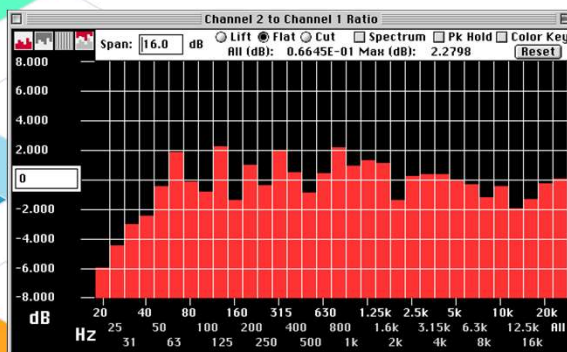


- Mixer output 0 dBu
- Pink Noise source
- Adjust amplifier until listen level is met (65 dBA)



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Step 4: EQ Loudspeakers



- Pink noise source
- Adjust EQ to a relatively flat curve (or preferred)
- Parametric EQ may be easier



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Step 5: EQ Mics

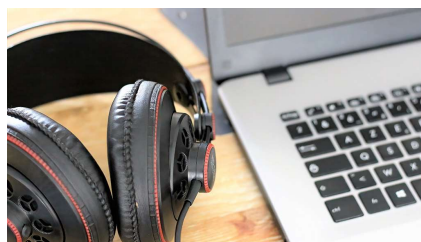


- Roll off highs/low
- Ring out room to maximize stability
- No more than 6 dB
- Know when enough is enough



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Step 6: Set program levels



- Nominal program source (-10 dBu)
- Pink noise is easiest
- Adjust input to achieve listen levels (65 dBA)



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Step 7: Conference Audio



- Tx = Rx = 0 dBu in mixer
- Rx distributed at listen levels
- Test for echo
- Test for double talk (full duplex operation)
- Use NLP and NR sparingly



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Step 8: Conf Program Audio



- Remember the program audio in conferencing
- Tx should be heard at listen levels
- Rx should be heard at listen levels



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Step 9: Confirm all presets



- DSP gotcha!
- Remember to re-test each one
- Remember to save settings to each one



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Step 10: Acoustic Measurements



- Able to predict/justify performance
- Key metrics:
 - NC
 - RT60
 - Ambient Noise
 - SNR @ mic
 - STC



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Still some art to it...



- SOP can get us 95% there in minutes
- Does not account for:
 - Difficult rooms
 - Challenging preferences
 - Unique solutions



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Benefits of Tuning SOP



- Consistent deployment
- Knowledge sharing
- Continual Improvement



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Audio Commissioning Checklist

Version: June 2024

Project:

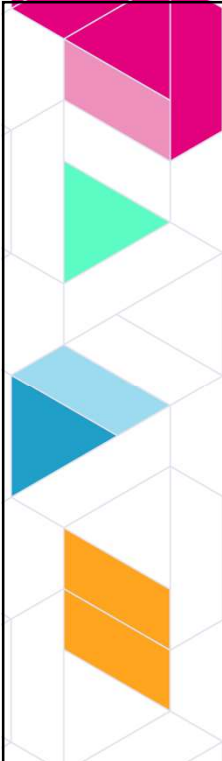
Tech:

Date:

Step	Item	Status
1	Confirm the physical layout and installation of the audio system.	
1.A	Loudspeakers	
1.A.1	Zones make sense, installed as designed.	
1.A.2	Loudspeakers are tapped correctly.	
1.A.3	Loudspeakers/logos are oriented the same direction in the room	
1.B	Microphones	
1.B.1	Wired properly, physically located as designed.	
1.B.2	Ceiling microphones are oriented the same direction in the room (Logos to front)	
2	Set levels on microphones.	
2.A	Wired microphones	
	Use standard talker (60 dB @ 1m) to measure 0 dBu at the mixer input	
2.A.1		
2.B	Wireless microphones	
	Set input levels at receiver, use standard talker (60 dB @ 1m) to set "nominal" level with no peaking at Lombard levels (70 dB @ 1m)	
2.B.1		
2.B.2	Then set that output level with standard talker to 0 dBu at the mixer	
2.B.3	Set nominal program sources (-10 dBu) to 0 dBu at the mixer	
3	Set listen levels	
	Play pink noise out of the loudspeaker zones at 0 dBu from the output	
3.A		
	Adjust amplifiers to reach nominal listen levels in the room (65 dBA)	
3.B		
4	Set EQ of the loudspeakers	
4.A	Play pink noise at listen levels	
	Adjust EQ on the output of the system for a relatively flat (or preferred) response curve using an Real Time Analyzer	
4.B		
4.C	Parametric EQ may be the easiest/smoothest way to approach this	
4.D	In small rooms, you can do one loudspeakers and apply to all others as a good starting point.	

5	Set EQ on the microphones.	
	Start with known-good EQ curve from template file (e.g. - Linkwitz-Riley)	
5.A		
5.A.1	and/or roll off harshly (48 dB/octave) at 8k	
5.A.2	and/or roll off easily (12 dB/octave) at 250 Hz	
5.B	Ring out/mix minus microphones for stability (if not unconditionally stable)	
	Excite room by crowding the microphone, use the RTA to find unstable frequencies, and notch them out in the DSP	
5.B.1		
5.B.2	Do not notch them out more than 6 dB per unstable frequency	
	If room still rings, adjust gain of microphone (downstream of the pre-gain to the mixer at 0 dBu if possible)	
5.B.3		
5.B.4	If more than five filters are required to improve stability, simply drop the overall gain of the microphone.	
6	Set program levels in the room	
6.A	Use nominal sources to send -10 dBu pink noise into the system.	
6.B	Adjust gain to (65 dBA) in the room as a nominal listen level	
7	Test conferencing levels	
7.A	Confirm far end (Rx) has a listen level of 65 dBA in the room	
	Confirm near end (Tx) and far end (Rx) levels are measuring 0 dB at the mixer. (Note: Balancing Tx and Rx levels are crucial for good double talk performance.)	
7.B		
7.C	Confirm no echo is heard.	
7.C.1	Confirm system has good double talk (full duplex operation).	
	Only apply NLP conservatively, as this will affect double talk performance.	
7.C.2		
8	Test conference program levels	
	Near end shared program sources should provide a 65 dBA listen level.	
8.A		
	Far end shared program sources should provide a 65 dBA listen level.	
8.B		
9	Confirm any and all presets are functioning in the site file.	
	Take acoustical measurements of the room to justify system performance.	
10		
10.A	Take RT60 and NC of the room for performance justification.	
10.B	Take STC of the room, if divisible and/or if privacy is a concern.	

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Think - Reflect - Share

- What strategies from this session will you consider implementing?



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