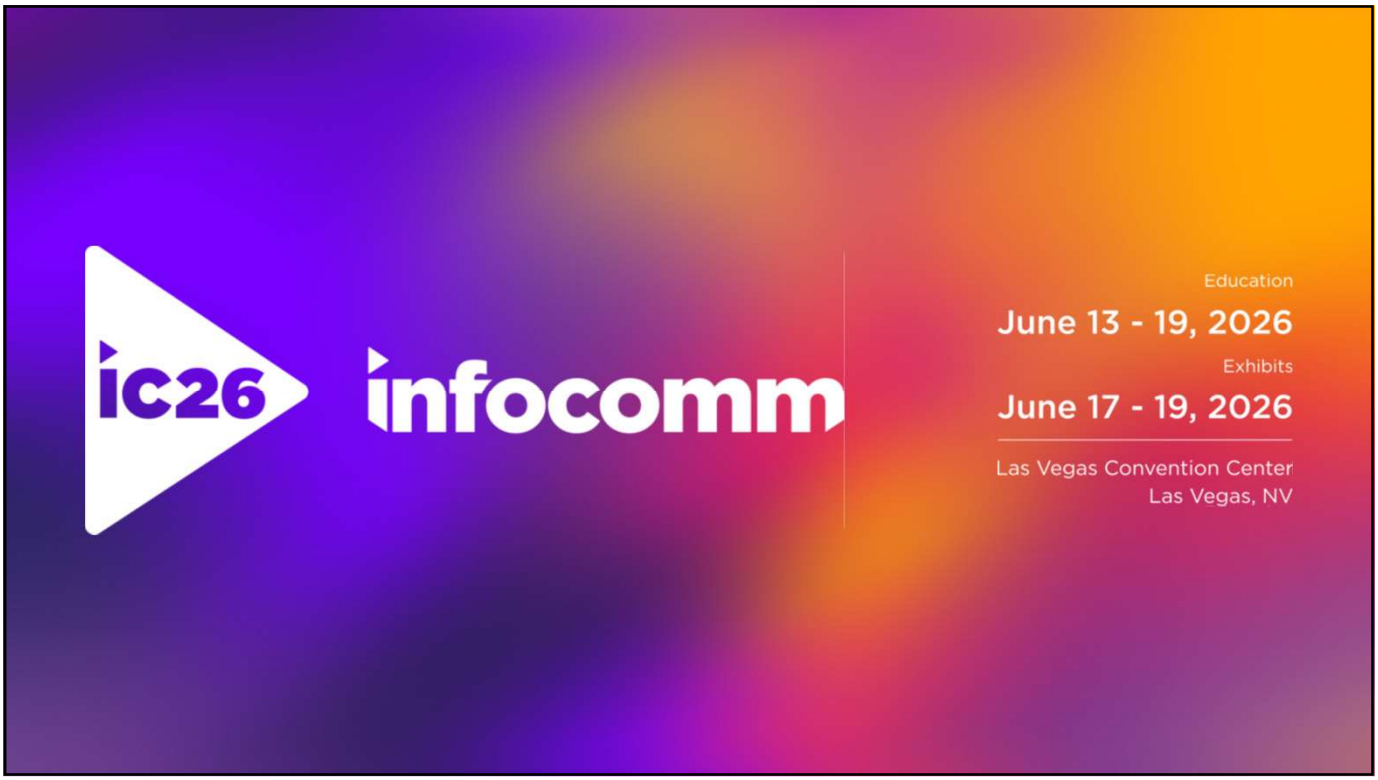

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ic26 infocomm

What is your current process for setting up audio systems?

Is it consistent across your team?

2

Balancing Audio Systems:
Documented Process for Finding that Sweet Spot

Jim Maltese, CTS-D, CTS-I, CQD, CQT

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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

Audio Commissioining Checklist

Version:	June 2024
Project:	
Tech:	
Date:	

Step	Item	Status
PRE	Verify room is ready for configuration	
PRE-A	Confirm DSP file has been reviewed	
PRE-A.1	Routes make sense	
PRE-A.2	AEC Reference is correct	
PRE-A.3	Adequate audio management available along the signal paths	
PRE-B	Confirm DSP file has been reviewed	
PRE-B.1	Take RT60 and NC of the room for performance prediction.	
PRE-B.2	Take STC of the room, if divisible and/or if privacy is a concern.	
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	
2.A.1	Use standard talker (60 dB @ 1m) to measure 0 dBu at the mixer input	
2.B	Wireless microphones	
2.B.1	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.2	Then set that output level with standard talker to 0 dBu at the mixer	

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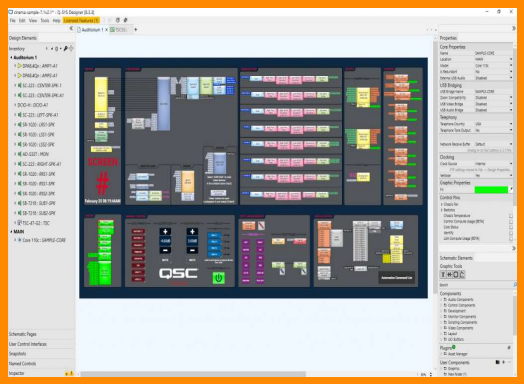
Assumptions for Today

- DSP Configuration was created per best practice
- Installation is complete
- The audio system is functioning and ready for “balancing”
- Acoustical dependencies have been delivered



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PRE: Acoustic Measurements

Able to predict/ justify performance

Key metrics:

- NC
- RT60
- Ambient Noise
- SNR @ mic
- STC

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Step 1: Confirm Physical Installation

Loudspeakers
- Location
- Taps
- Orientation

Microphones
- Location
- Orientation

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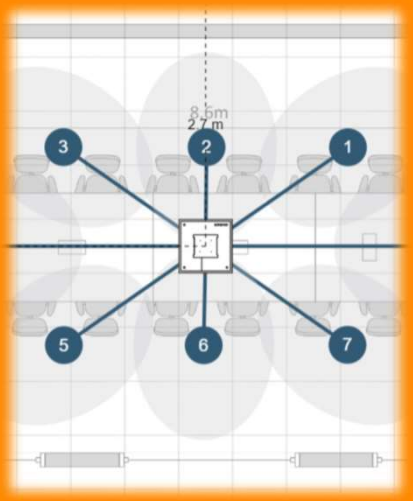
Step 1+: Confirm Physical Installation

- Mic physical AND digital location are critical
- Be sure room graphic is scaled in software
- Be sure microphone placement in software matches physical placement in room
  - Talkers & Tables
  - Ceiling Height



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Step 2: Set Listen Levels

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

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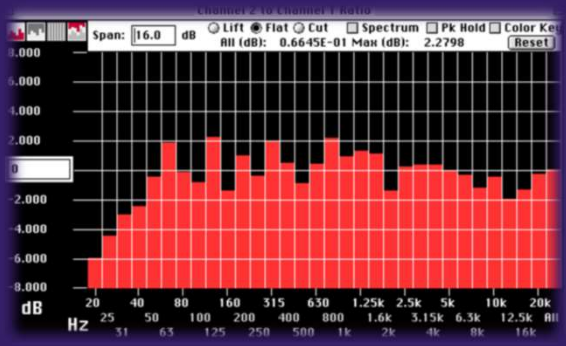
Step 3: EQ Loudspeakers

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



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Step 4: Set Mic Levels

Use standard talker
- 60 dB-SPL @ 1m

Wired
- 0 dBu at mixer input

Wireless/Processor
- "Nominal" at receiver
- 0 dBu at mixer input

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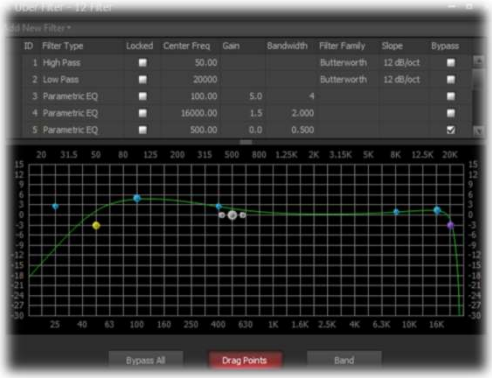
Step 5: EQ Microphones

- Roll off highs/low
- Ring out room to maximize stability
  - When applicable
- No more than 6 dB
  - Attenuate only
- 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 (60 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 7+: AEC Reference

- AEC Ref = 0 dBu
- Must include all audio sources that need to be cancelled
  - Rx
  - Program
  - Other Rein. Mics
- Verify ERL/ERLE (and RMLR)

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This is the big secret!

All levels set to “0 dBu”

- Mics
- Conference Rx
- Conference Tx
- AEC Reference

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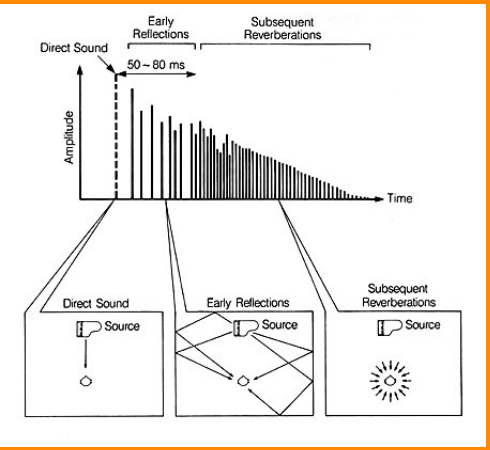
Why 0 dB?

- Comes down to signal to noise ratio
- Uber complex waveform in a multi-path environment
- DSP needs a robust signal without distortion to work with
- 0 dB is the answer
  - And it's easy to remember!



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Step 8: Conf Program Audio

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

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Step 9: Confirm All Presets

- DSP “gotcha”!
- Remember to re-test each preset
- Remember to save settings to each preset
  - Save it twice!
  - …or three times

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Step 10: Demonstrate

- Confirm operation
- Verify expectations were met

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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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Use a Checklist!

Audio Commissioining Checklist

Version: June 2024

Project:	
Tech:	
Date:	

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PRE-A	Confirm DSP file has been reviewed	
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PRE-A.2	AEC Reference is correct	
PRE-A.3	Adequate audio management available along the signal paths	
PRE-B	Take acoustical measurements of the room to confirm assumptions.	
PRE-B.1	Take RT60 and NC of the room for performance prediction.	
PRE-B.2	Take STC of the room, if divisible and/or if privacy is a concern.	
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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)	
1.B.3	Microphone arrays location/orientation in software matches physical location perfectly, as do table and talker locations	
2	Set listen levels	
2.A	Play pink noise out of the loudspeaker zones at 0 dBu from the output	
2.B	amplifiers to reach nominal listen levels in the room (65 dBA)	
3	Set EQ of the loudspeakers	
3.A	Play pink noise at listen levels	
3.B	Adjust EQ on the output of the system for a relatively flat (or preferred) response curve using an Real Time Analyzer	
3.C	Paramteric EQ may be the easiest/smoothese way to approach this	
3.D	In small rooms, you can do one loudspeakers and apply to all others as a good starting point.	
4	Set levels on microphones.	
4.A	Wired microphones	
4.A.1	Use standard talker (60 dB @ 1m) to measure 0 dBu at the mixer input	
4.B	Wireless microphones	
4.B.1	Set input levels at receiver, use standard talker (60 dB @ 1m) to set "nominal" level with no peaking at Lombard levels (70 dB @ 1m)	
4.B.2	Then set that output level with standard talker to 0 dBu at the mixer	
4.B.3	Set nominal program sources (-10 dBu) to 0 dBu at the mixer	
5	Set EQ on the microphones.	
5.A	Start with known-good EQ curve from template file (e.g. - Linkwist-Riley)	
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)	
5.B.1	Excite room by crowding the microphone, use the RTA to find unstable frequencies, and notch them out in the DSP	
5.B.2	Do not notch them out more than 6 dB per unstable frequency	
5.B.3	If room still rings, adjust gain of microphone (downstream of the pre-gain to the mixer at 0 dBu if possible)	
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	
7.B	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.C	Confirm the AEC Reference is properly built and is 0 dBu	
7.C.1	AEC Reference should have all audio that needs to be cancelled from "that" microphone (far end, program, other microphones)	
7.C.2	ERL/ERLE should be optimized to confirm good AEC operation	
7.C.3	Confirm AEC Ref Level matches System Mic Levels with standard talker (RMLR = 0 dB)	
7.D	Confirm no echo is heard.	
7.D.1	Confirm system has good double talk (full duplex operation).	
7.D.2	Only apply NLP conservatively, as this will affect double talk performance.	
8	Test conference program levels	
8.A	Near end shared program sources should provide a 65 dBA listen level.	
8.B	Far end shared program sources should provide a 65 dBA listen level.	
9	Confirm any and all presets are functioning in the site file.	
10	Demonstrate the performance of the system to the user, and confirm expectations have been met.	

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Questions? Discussion?

Reach out at:

jmaltese@L3AV.com

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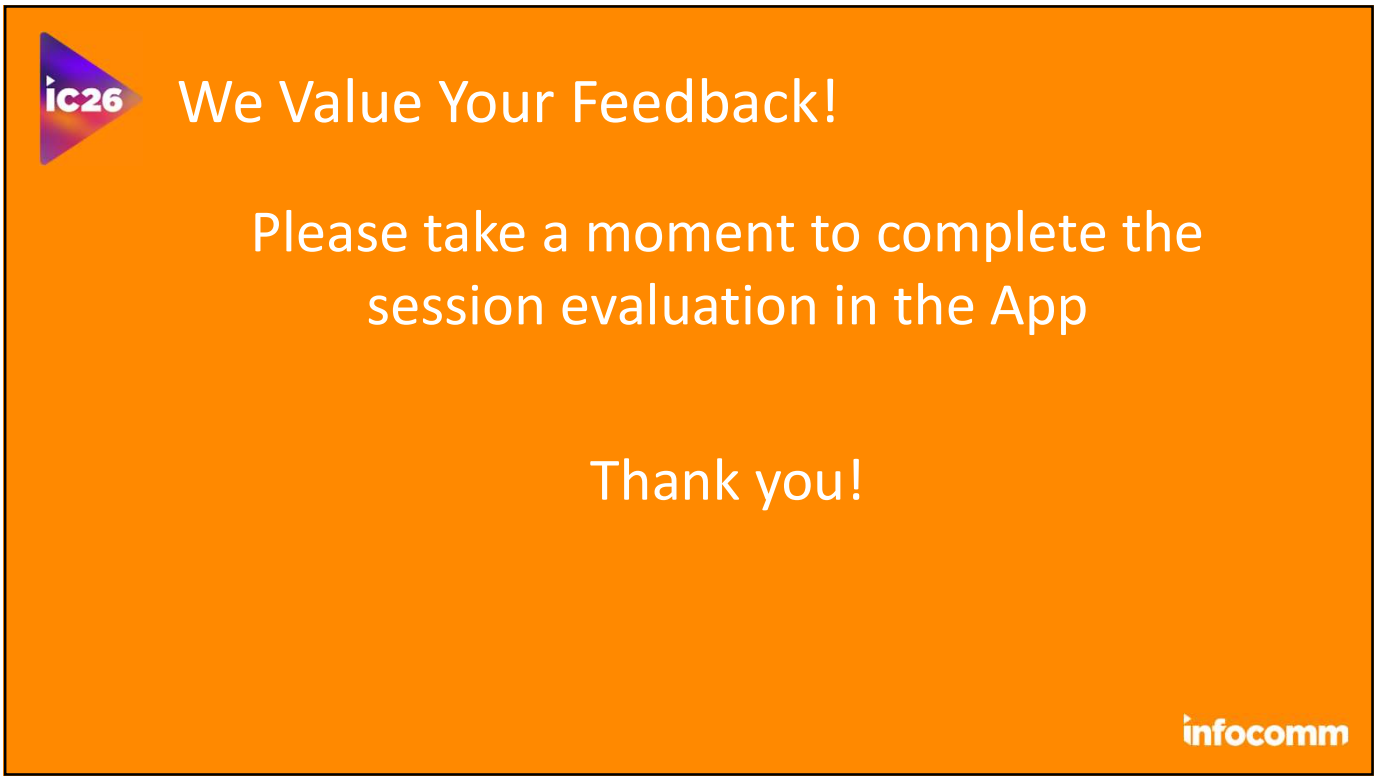
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