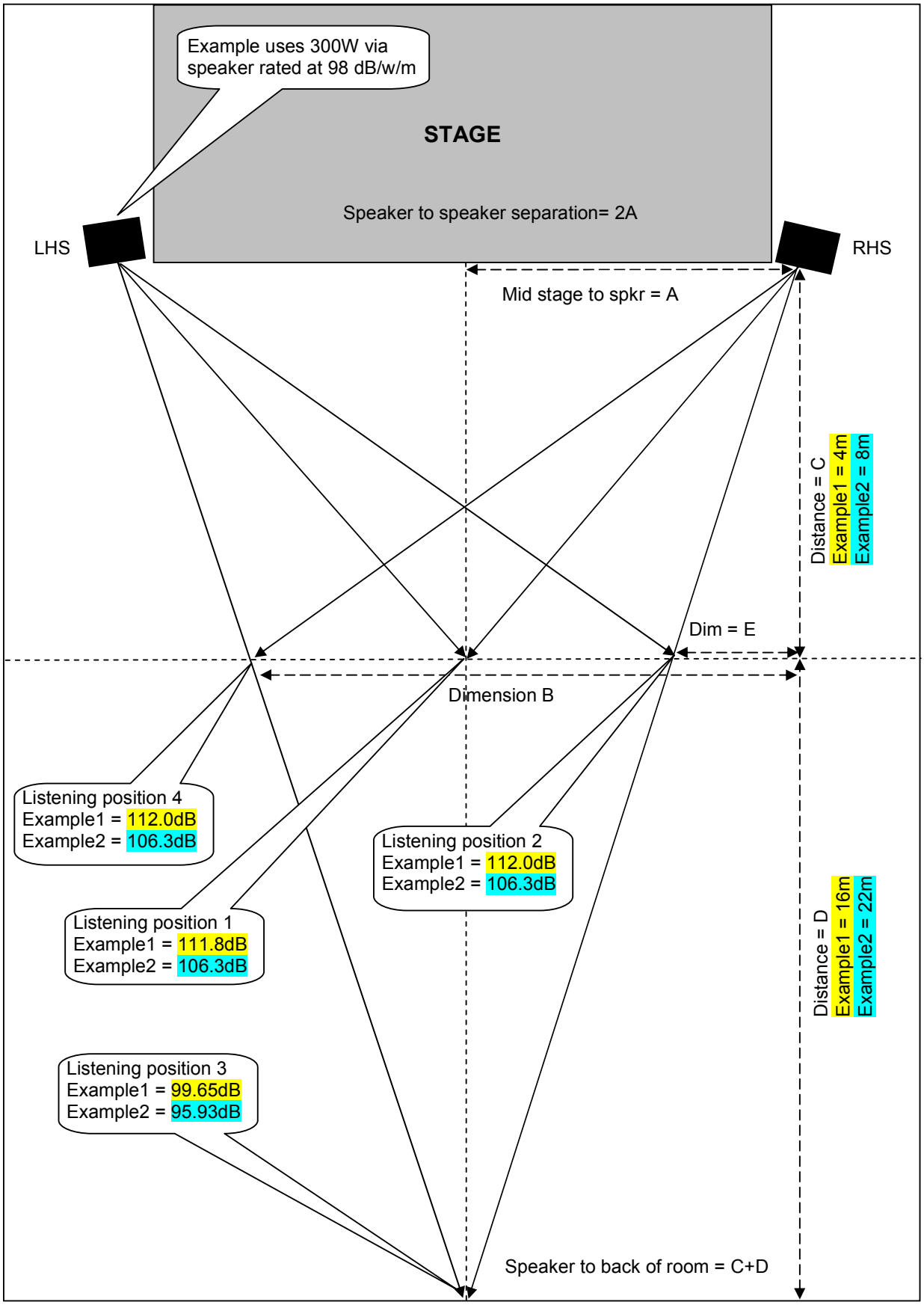
Example Sound Pressure Level (SPL) Calculations



Example 1: room dimensions (from front of stage) 20m x 10m

Calculations

- Assume mid-stage to speaker distance A = 3m and therefore the speaker-to-speaker separation is 6m.
- Assume Distance C = 4m and Distance D = 16m
- The distance from the stage to the back of the room is C+D = 20m
- Dimension E (using standard geometry) = 0.75m
- Dimension B = A + (A-E) = 5.25m
- The direct distance from one of the speakers to listening position 1 is $\sqrt{(A^2 + C^2)}$ = 5.00m
- The direct distance from one of the speakers to listening position 2 is $\sqrt{(E^2 + C^2)}$ = 4.07m
- The direct distance from one of the speakers to listening position 3 is $\sqrt{(A^2 + (C+D)^2)}$ = 20.22m
- The direct distance from the LHS speaker to listening position 2 is $\sqrt{(B^2 + C^2)}$ = 6.60m

For 300W output from the amplifier (to each speaker – ie 600W total)
Speaker sensitivity = 98 dB per W @ 1m
Max output is = 98 + 10*Log (300) = 122.77 dB

Listening Position 1
At listening position 1, the sound level due to one speaker is:
= 122.77 - 20*Log (5.00)
= 108.79 dB

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 1 = 111.8 dB

Listening Position 2
At listening position 2, the sound level due to the LHS speaker is:
= 122.77 - 20*Log (4.07)
= 106.38 dB

At listening position 2, the sound level due to the RHS speaker is:
= 122.77 - 20*Log (6.6)
= 110.58 dB

The formula for adding unequal values is $10*\text{Log}\ (10^{dB1/10} + 10^{dB2/10})$

So adding the two values above (106.38 dB and 110.58 dB) gives = 112.0 dB

Listening Position 3
At listening position 3 (ie the back of the room), the sound level due to one speaker is:
= 122.77 - 20*Log (20.22)
= 96.65 dB

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 3 = 99.65 dB

Listening Position 4
By symmetry, the result for listening position 4 is the same as for listening position 2.

Example 2 – room dimensions (from front of stage) 30m x 15m

Calculations

- Assume mid-stage to speaker distance A = 5m and therefore the speaker-to-speaker separation is 10m.
- Assume Distance C = 8m and Distance D = 22m
- The distance from the stage to the back of the room is C+D = 30m
- Dimension E (using standard geometry) = 1.82m
- Dimension B = A + (A-E) = 8.18m
- The direct distance from one of the speakers to listening position 1 is $\sqrt{(A^2 + C^2)}$ = 9.43m
- The direct distance from one of the speakers to listening position 2 is $\sqrt{(E^2 + C^2)}$ = 8.20m
- The direct distance from one of the speakers to listening position 3 is $\sqrt{(A^2 + (C+D)^2)}$ = 31.05m
- The direct distance from the LHS speaker to listening position 2 is $\sqrt{(B^2 + C^2)}$ = 11.44m

For 300W output from the amplifier (to each speaker – ie 600W total)
Speaker sensitivity = 98 dB per W @ 1m
Max output is = 98 + 10*Log (300) = 122.77 dB

Listening Position 1
At listening position 1, the sound level due to one speaker is:
= 122.77 - 20*Log (9.43)
= 103.3 dB

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 1 = 106.3 dB

Listening Position 2
At listening position 2, the sound level due to the LHS speaker is:
= 122.77 - 20*Log (11.44)
= 101.60 dB

At listening position 2, the sound level due to the RHS speaker is:
= 122.77 - 20*Log (8.20)
= 104.49 dB

The formula for adding unequal values is $10*\text{Log}\ (10^{dB1/10} + 10^{dB2/10})$

So adding the two values above (104.49 dB and 101.60 dB) gives = 106.3 dB

Listening Position 3
At listening position 3 (ie the back of the room), the sound level due to one speaker is:
= 122.77 - 20*Log (31.05)
= 92.93 dB

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 3 = 95.93 dB

Listening Position 4
By symmetry, the result for listening position 4 is the same as for listening position 2.