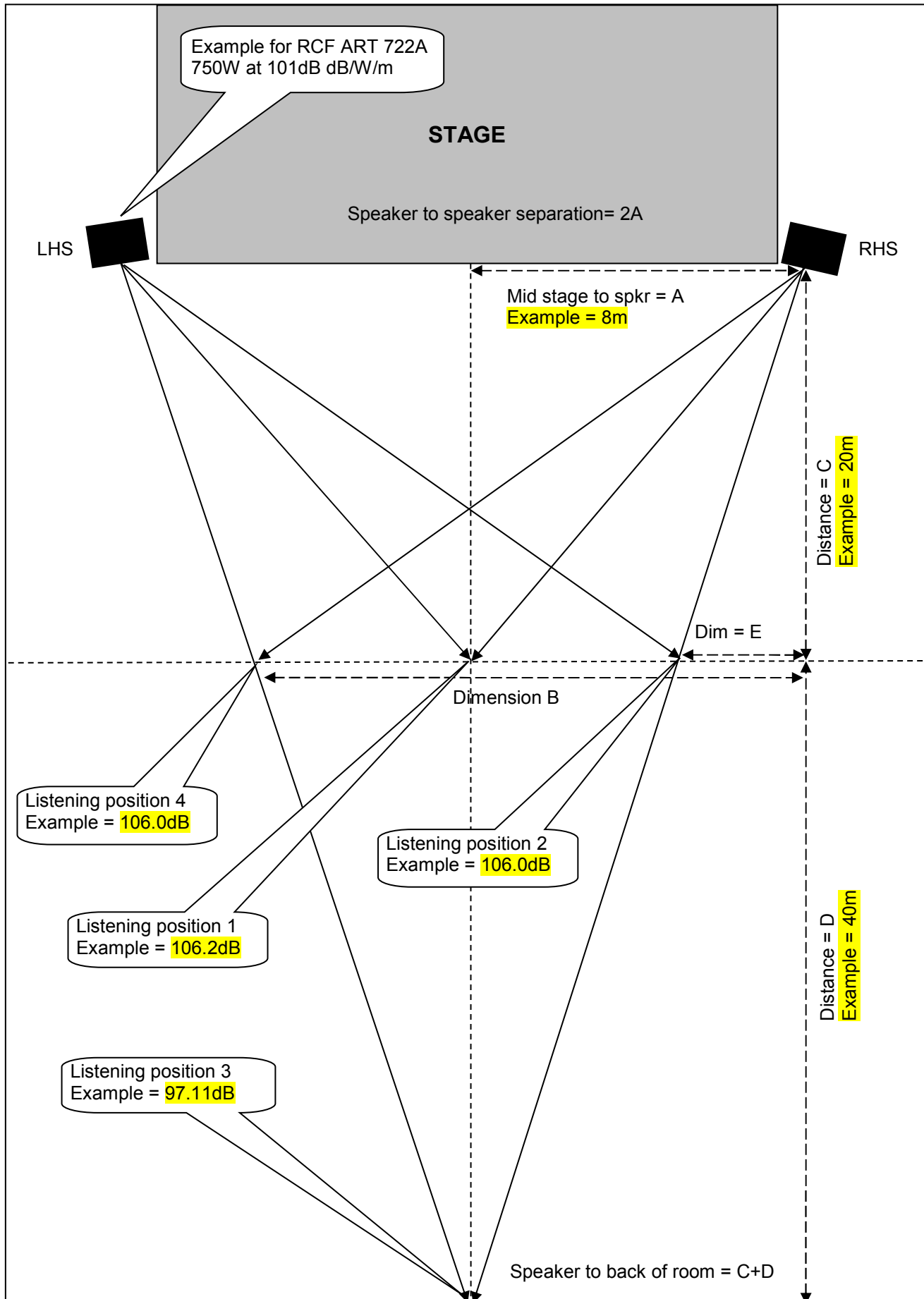


## Example Sound Pressure Level (SPL) Calculations



### Example: room dimensions (from front of stage) 60m x 20m

#### Calculations

- Assume mid-stage to speaker distance  $A = 8\text{m}$  and therefore the speaker-to-speaker separation is 16m.
- Assume Distance  $C = 20\text{m}$  and Distance  $D = 40\text{m}$
- The distance from the stage to the back of the room is  $C+D = 60\text{m}$
- Dimension  $E$  (using standard geometry)  $= 2.66\text{m}$
- Dimension  $B = A + (A-E) = 13.34\text{m}$
- The direct distance from one of the speakers to listening position 1 is  $\sqrt{(A^2 + C^2)} = 21.54\text{m}$
- The direct distance from one of the speakers to listening position 2 is  $\sqrt{(E^2 + C^2)} = 20.18\text{m}$
- The direct distance from one of the speakers to listening position 3 is  $\sqrt{(A^2 + (C+D)^2)} = 60.53\text{m}$
- The direct distance from the LHS speaker to listening position 2 is  $\sqrt{(B^2 + C^2)} = 24.04\text{m}$

For 750W output from the amplifier (to each speaker – ie 1500W total)

Speaker sensitivity = 101 dB per W @ 1m

Max output is  $= 101 + 10 \cdot \log(750) = 129.75 \text{ dB}$

#### Listening Position 1

At listening position 1, the sound level due to one speaker is:

$$= 129.75 - 20 \cdot \log(21.54)$$

$$= 103.1 \text{ dB}$$

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 1 = **106.2 dB**

#### Listening Position 2

At listening position 2, the sound level due to the RHS speaker is:

$$= 129.75 - 20 \cdot \log(20.18)$$

$$= 103.7 \text{ dB}$$

At listening position 2, the sound level due to the LHS speaker is:

$$= 129.75 - 20 \cdot \log(24.04)$$

$$= 102.1 \text{ dB}$$

The formula for adding unequal values is  $10 \cdot \log(10^{dB1/10} + 10^{dB2/10})$

So adding the two values above (103.7 dB and 102.1 dB) gives = **106.0 dB**

#### Listening Position 3

At listening position 3 (ie the back of the room), the sound level due to one speaker is:

$$= 129.75 - 20 \cdot \log(60.53)$$

$$= 94.11 \text{ dB}$$

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 3 = **97.11 dB**

#### Listening Position 4

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

#### Taking into account "headroom"

The calculations above use the full 750W power output. In practice, you allow a certain amount of amplifier "headroom" to avoid any distortion. Allowing for 6dB of headroom would still provide  $\approx 100\text{dB}$  at 20m and  $\approx 91\text{dB}$  at 60m from the stage.