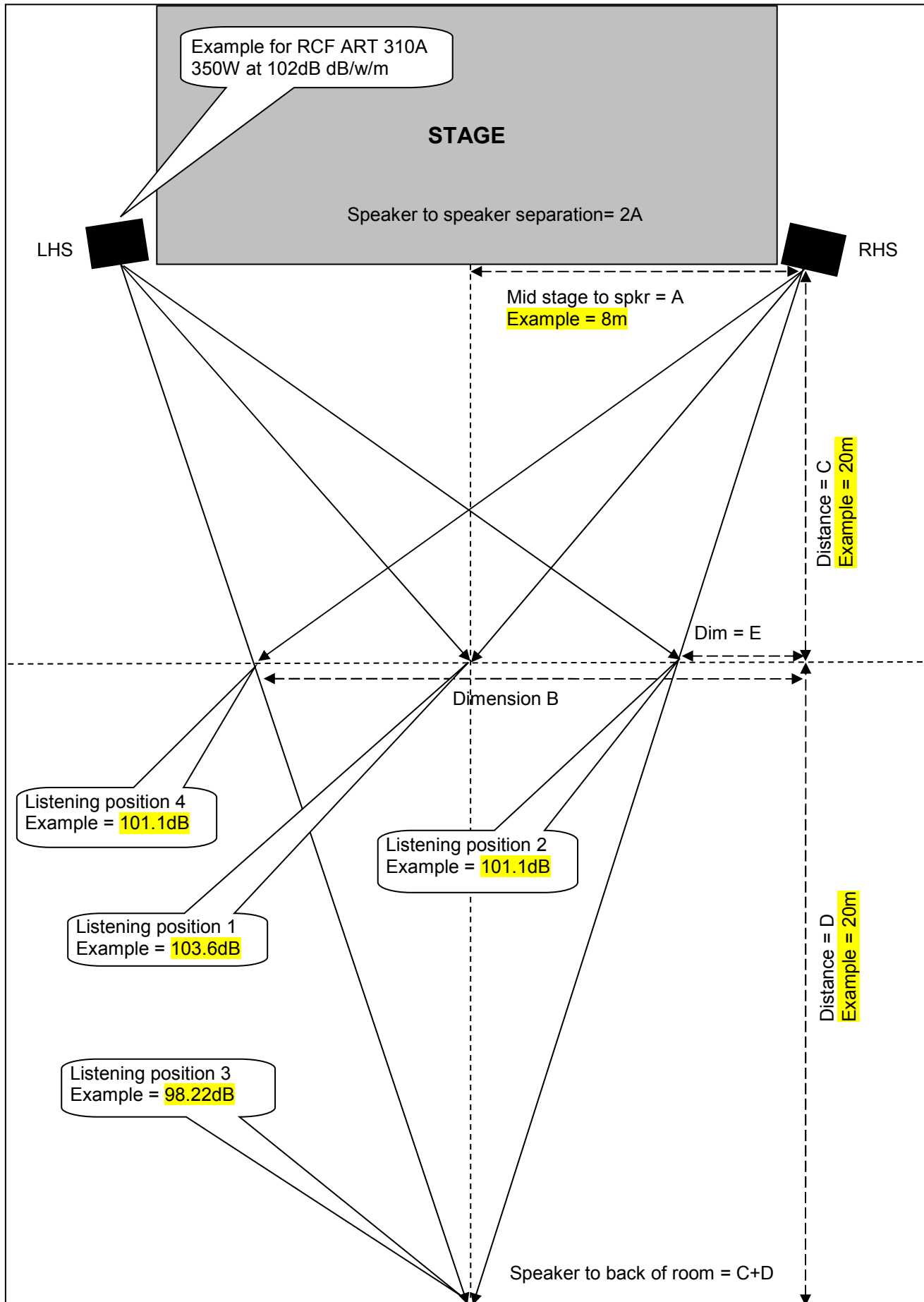


## Example Sound Pressure Level (SPL) Calculations



### Example: room dimensions (from front of stage) 40m 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  $D = 20\text{m}$
- The distance from the stage to the back of the room is  $C+D = 40\text{m}$
- Dimension  $E$  (using standard geometry) = 4m
- Dimension  $B = A + (A-E) = 12\text{m}$
- 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  $\sqrt{(E^2 + C^2)} = 23.32\text{m}$
- The direct distance from one of the speakers to listening position 3 is  $\sqrt{(A^2 + (C+D)^2)} = 40.79\text{m}$
- The direct distance from the LHS speaker to listening position 2 is  $\sqrt{(B^2 + C^2)} = 20.8\text{m}$

For 350W output from the amplifier (to each speaker – ie 700W total)

Speaker sensitivity = 102 dB per W @ 1m

Max output is =  $102 + 10 \cdot \text{Log}(350) = 127.44 \text{ dB}$

#### Listening Position 1

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

$$= 127.44 - 20 \cdot \text{Log}(21.54)$$

$$= 100.8 \text{ dB}$$

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 1 = **103.8 dB**

#### Listening Position 2

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

$$= 127.44 - 20 \cdot \text{Log}(20.8)$$

$$= 101.1 \text{ dB}$$

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

$$= 127.44 - 20 \cdot \text{Log}(23.32)$$

$$= 100.1 \text{ dB}$$

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

So adding the two values above (101.1 dB and 100.1 dB) gives = **103.6 dB**

#### Listening Position 3

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

$$= 127.44 - 20 \cdot \text{Log}(40.79)$$

$$= 95.22 \text{ dB}$$

Taking account of the second (identical) speaker adds 3 dB so the total level at listening position 3 = **98.22 dB**

#### Listening Position 4

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

#### Taking amplifier “headroom” into account

The calculations above use the full power output of 350W. In practice, it is usual to allow amplifier “headroom” to avoid any distortion. Allowing for 6dB of “headroom” provides 95-97dB at 20m and 92dB at 40m from the stage.