

Complementing dBA with **dBH**

Ears –



dBA

Body –



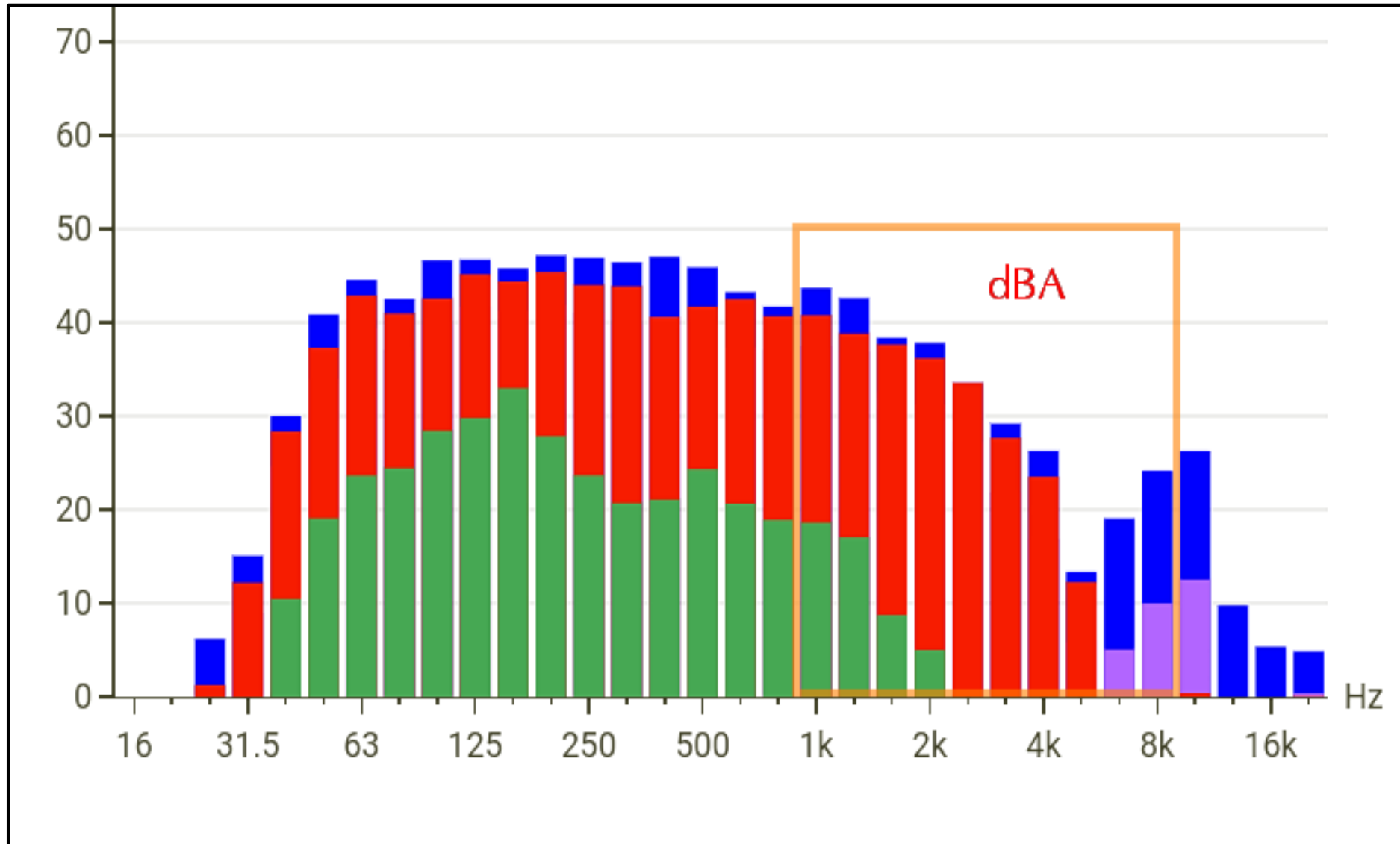
BH

Healthy –

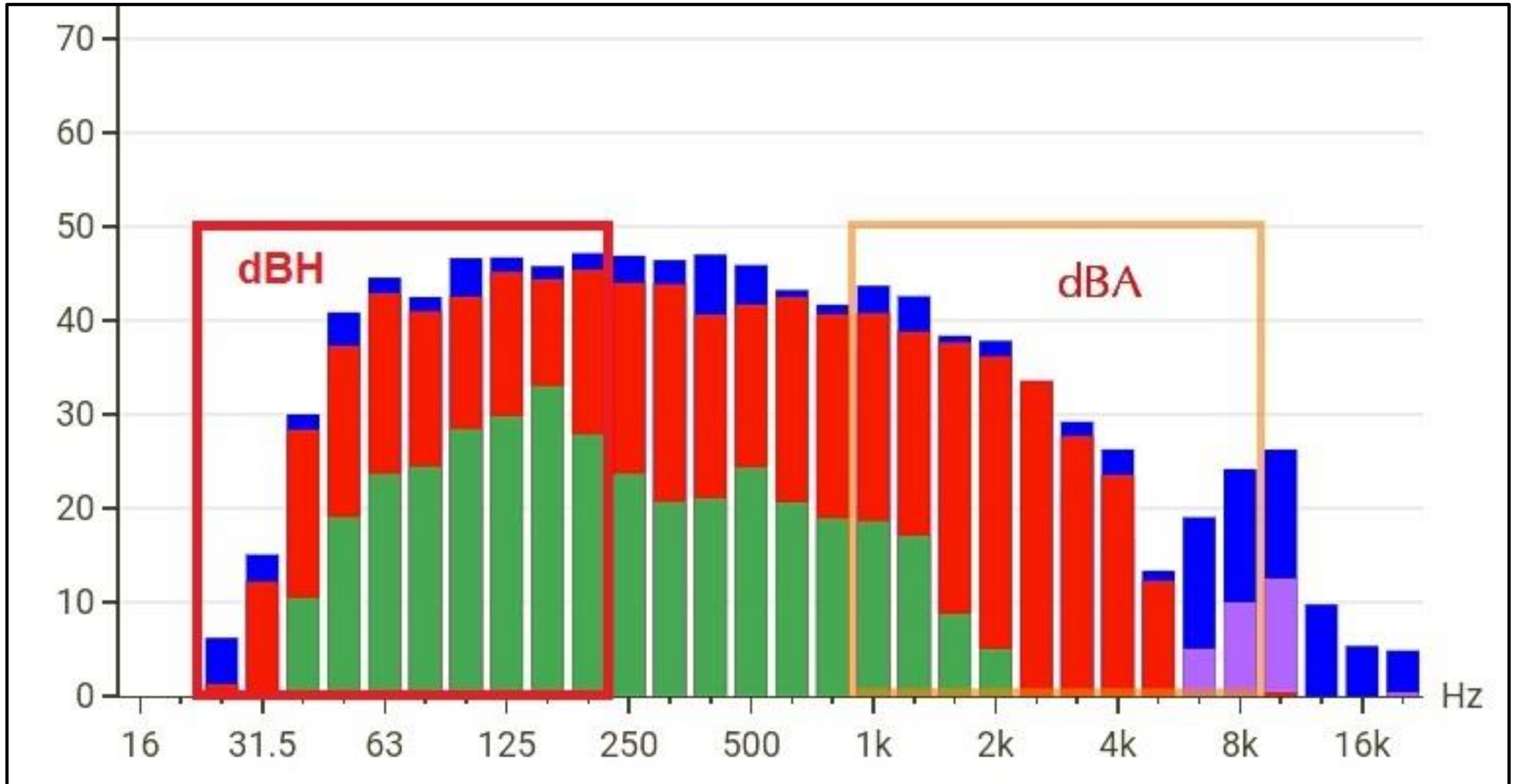


dBA + dBH

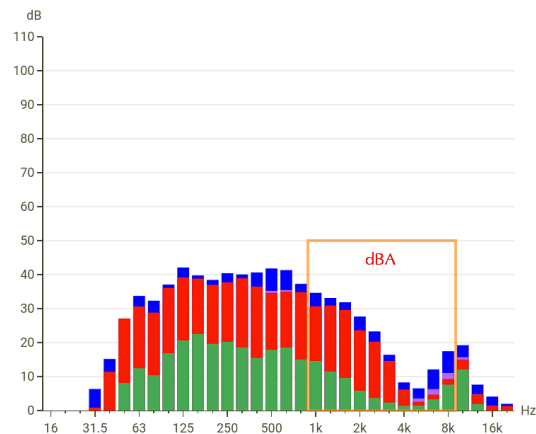
The audible aircraft noise annoying you is *not* the low frequency noise harming you.



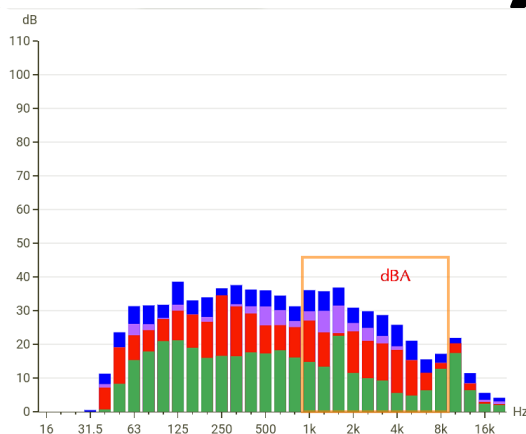
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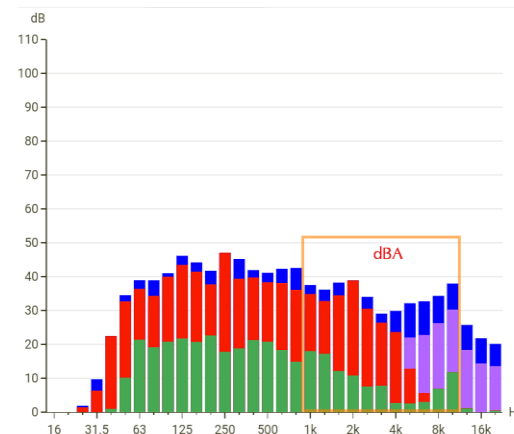
Medium & Heavy Jet Noise Spectra



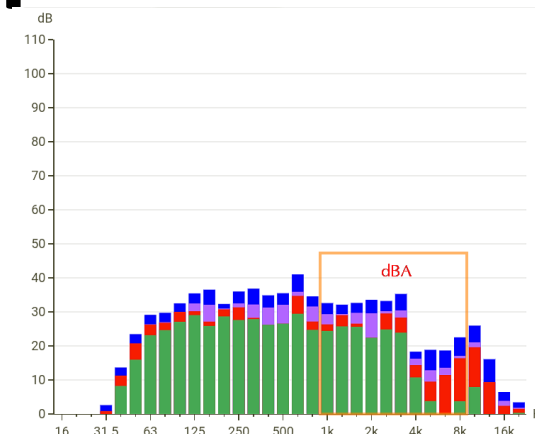
B737



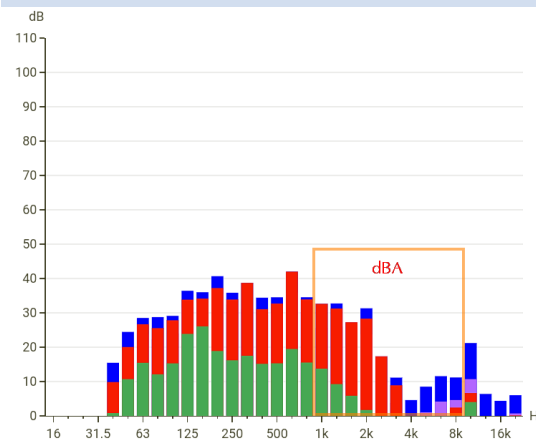
B737 MAX



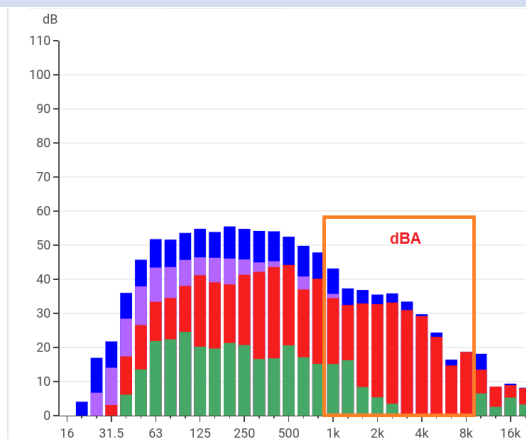
B767



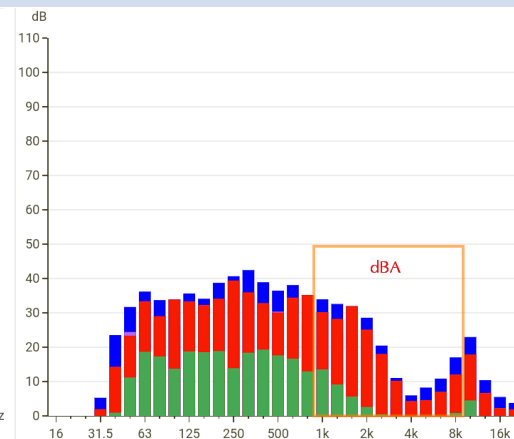
B787



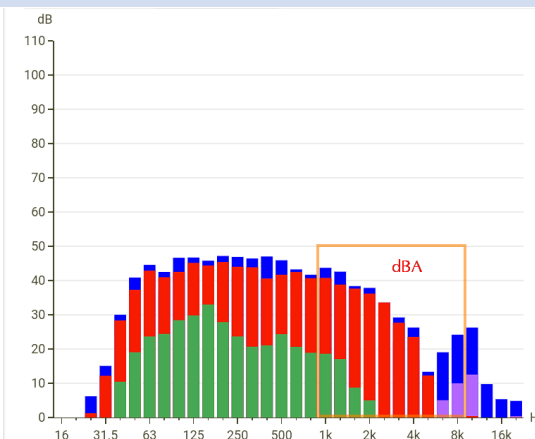
A320



A320 NX



A350



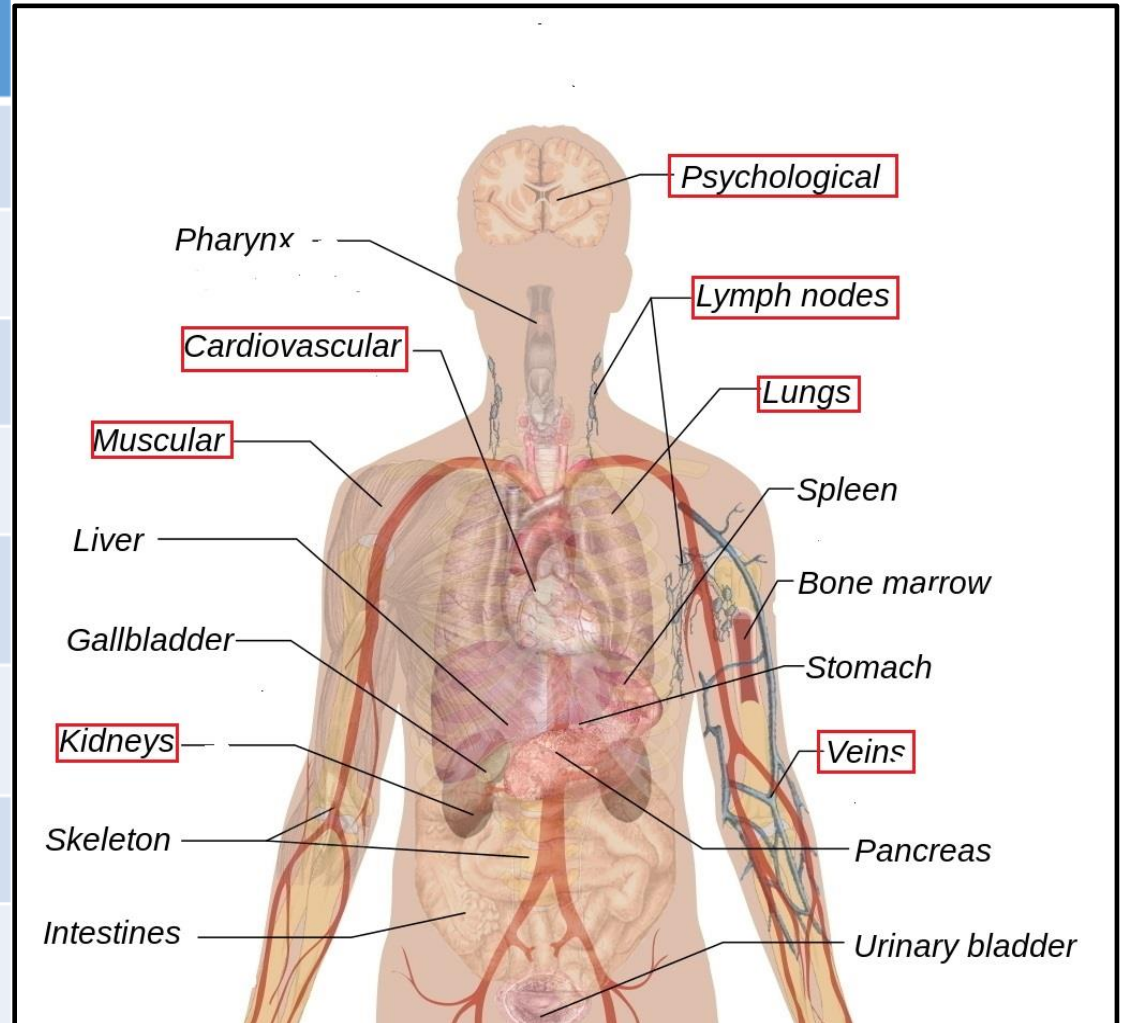
A380

Where the Noise Is and Goes ...

- Majority of the aircraft noise is low frequency <500 Hz
- The most harmful noise is below about 200 Hz
- Low frequency, long wave length noise carries furthest
- Low frequency noise & infrasound passes through solid walls
- Low frequency noise causes resonances in human tissue
- Low frequency noise causes harmful changes at cellular level

Health Impacts of Low Frequency & Infraound

Organ, Process	Effect	Frequency Range
Thyroid function	Increased activity	14 Hz
Brain function	Response rate	12 & 36 Hz
Cognitive learning	Reduced	6-25 Hz, peak 13 Hz
Balance	Interference	40 Hz
Blood pressure	Significant increase	Systolic 6 & 16 Hz
Blood pressure	Significant increase	Diastolic 12 & 16 Hz
Heart rate	Increase	2.14 Hz
EEG rhythms	Variations in morphology	13 Hz

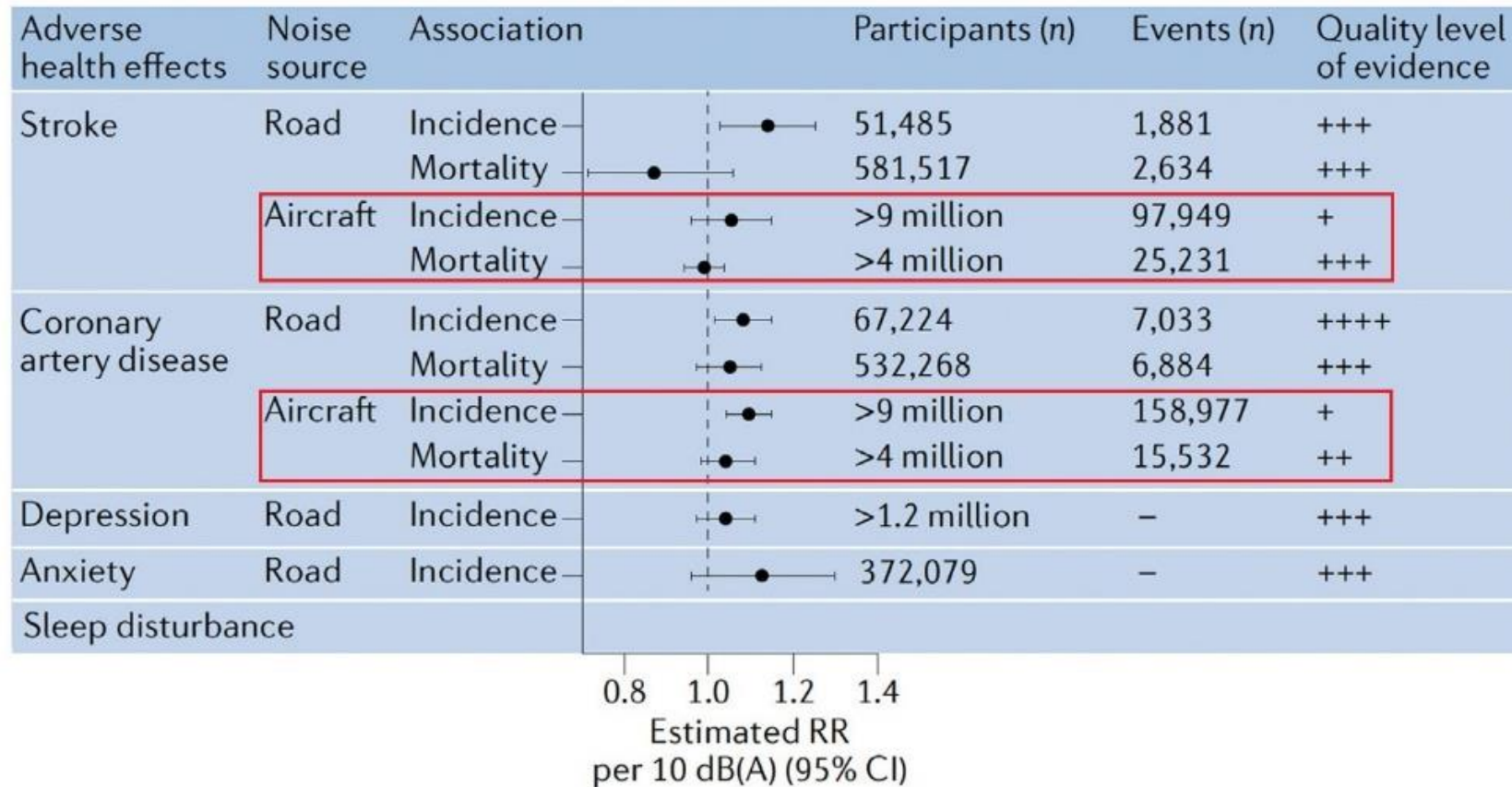


Aircraft Noise & Cardiovascular Disease

A Decibel scale [dBA]



B Adverse health effects of noise exposure

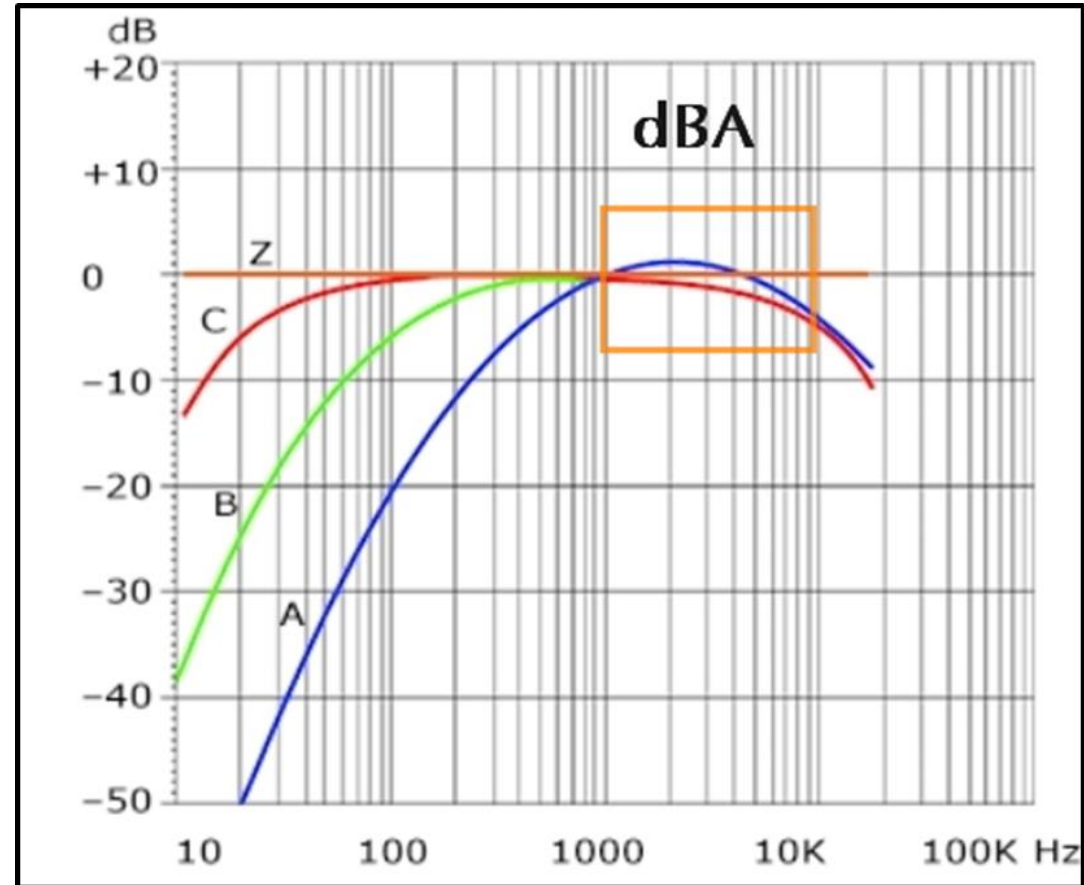


C 2018 WHO Environmental noise guidelines

Chronic noise exposure
$L_{den} >45$ dB(A) for aircraft noise
$L_{den} >54$ dB(A) for road and railway noise
$L_{night} >40-42$ dB(A)

Numbers & Graphs – A, C and Z Filters

Centre Frequency (Hz)	Wave Length (m)	Effective Band (Hz)	A Weighting (dBA)	C Weighting (dBC)
31.5	11	22.1 - 44.2	-39.4	-3
63	5.4	44.2 - 88.4	-26.2	-0.8
125	2.7	88.4 - 177	-16.1	-0.2
250	1.4	177 - 354	-8.6	0
500	0.69	354 - 707	-3.2	0
1000	0.34	707 - 1,414	0	0
2000	0.17	1,414 - 2,828	1.2	-0.2
4000	0.09	2,828 - 5,657	1	-0.8
8000	0.04	5,657 - 11,314	-1.1	-3



Pros and Cons of the A-Filter (dBA)

Pros

- Good for measuring 'annoying' noise – a 'subjective' metric
- Only measures a small portion of the aircraft noise spectrum
- Useful for monitoring socio-psychological impacts of aircraft noise

Cons

- Excludes almost all low frequency noise and all infrasound
- Excludes frequencies known to cause clinical harm
- Not useful for mitigating or managing harmful noise frequencies

Summary Recommendations

- Consider making mandatory using the Full Spectrum Metric (FSM) – 0 Hz -20 kHz - for aircraft noise monitoring and reporting.
- Revise research protocols to ensure low frequency and infrasound frequencies (FSM) are monitored to ensure effects are documented.
- Regulatory and commercial organisations notified to ensure low frequency and infrasound aircraft noise is monitored and controlled.
- Manufacturers notified and requested to make necessary equipment modifications.
- Having adopted FSM as a national standard urge governments to advocate its adoption, beginning with the EU and UN ICAO.
- Propose the name *dBH* for revised policy, protocols and practice for the low frequency (20-200 Hz) and infrasound (0-20 Hz) metric.