# Noise Barrier Attenuation (Maekawa Fresnel Number)

Attenuation of a thin noise barrier from source, barrier and receiver geometry and frequency, via path difference and Fresnel number.

**Method:** Maekawa (1968) barrier chart approximated by IL = 10 $\log_{10}$(3 + 20N); the single-edge form also used in ISO 9613-2; ...

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Source height | 1.0000 | m |
| Barrier height | 4.0000 | m |
| Receiver height | 1.5000 | m |
| Source to barrier distance | 5.0000 | m |
| Barrier to receiver distance | 20.000 | m |
| Frequency | 500.00 | Hz |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Path difference | 0.98160 | m |
| Fresnel number | 2.8618 | |
| Barrier attenuation (dB) | 17.799 | |

**Notes for this case**

- Thin barrier, point source, no ground effect; practical barriers rarely give more than 15–20 dB. Treat each octave band separately.

## Formula and method

$$\delta = a + b - d, \quad N = \frac{2\delta}{\lambda}, \quad IL = 10\log_{10}(3 + 20N) \ \leq 20 \ \text{dB}$$

### Variables

| | | |
|---|---|---|
| $h_s$ | Source height | m |
| $h_b$ | Barrier height | m |
| $h_r$ | Receiver height | m |
| $d_s$ | Source to barrier distance | m |
| $d_r$ | Barrier to receiver distance | m |
| $f$ | Frequency | 1/s |
| $\delta$ | Path difference | m |
| $N$ | Fresnel number | - |
| $IL$ | Barrier attenuation (dB) | - |

### Method and standards

Maekawa's barrier chart, approximated by 10 $\log_{10}$(3 + 20N).

### Assumptions and limits

- Infinite thin barrier; point source; speed of sound 343 m/s (air at 20 °C), so λ = 343/f.
- When the receiver sees the source over the barrier (illuminated zone) the attenuation is taken as 0 dB and N is shown with a negative sign; the chart's small attenuation near grazing (up to about 5 dB at N = 0) is not modelled, so results just below the line of sight jump from 0 to about 4.8 dB.

### References

- Maekawa (1968) barrier chart approximated by IL = 10 $\log_{10}$(3 + 20N)
- the single-edge form also used in ISO 9613-2
- capped at 20 dB

## Report details

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|---|---|
| Report reference | FCC-GB0W-TG8H (the same inputs always give the same reference) |
| Generated | 17 November 2026, 19:37 UTC |
| Calculator | Noise Barrier Attenuation (Maekawa Fresnel Number) |
| Method last reviewed | 13 November 2026 |
| Software release | FireCAD Calc, release of 17 November 2026 |
| Release checks | 2 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/instrumentation/vibration-noise/noise-barrier-maekawa

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.