How much wireless power does a person absorb?

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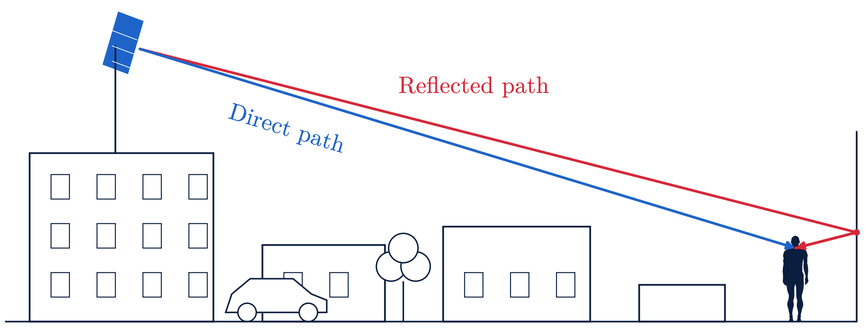
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Whole-thesis overview

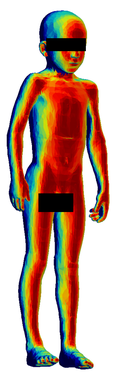
2 Full-wave reference	3 Indoor hybrid method	4 Outdoor hybrid method	5 Closed-form dosimetry	6 Measurements and cities

Radio waves carry information to a phone. Some of that energy is absorbed in the body. The task is to calculate this absorption from the antennas, the surroundings and the person. The methods include detailed body simulations, hybrid models for rooms and streets, and fast absorption formulas.

Wireless environment: ~100 m

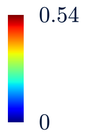


Human body: ~1 m



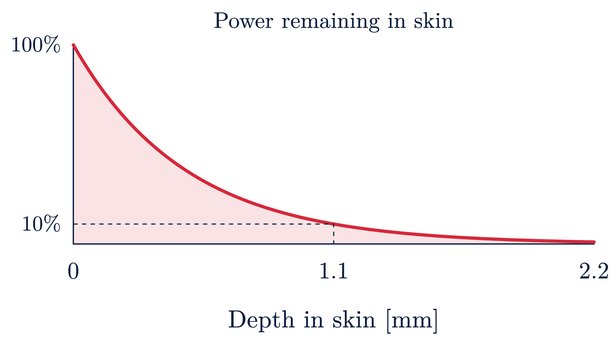
Example: 28 GHz
1 W/m² incident

Absorbed power density [W/m²]



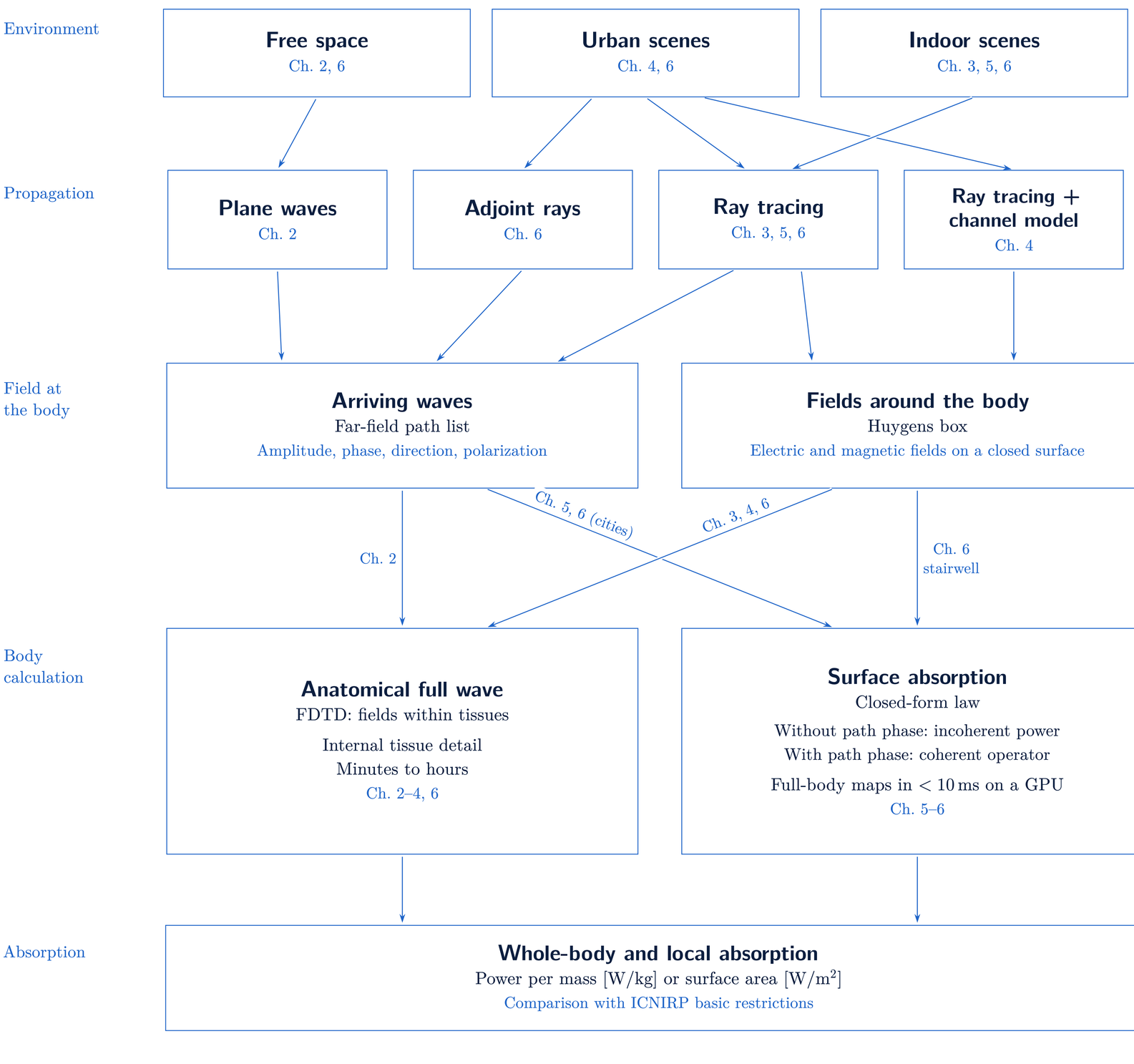
Absorbing tissue: ~ 1 mm

26 GHz: 90% absorbed within 1.1 mm



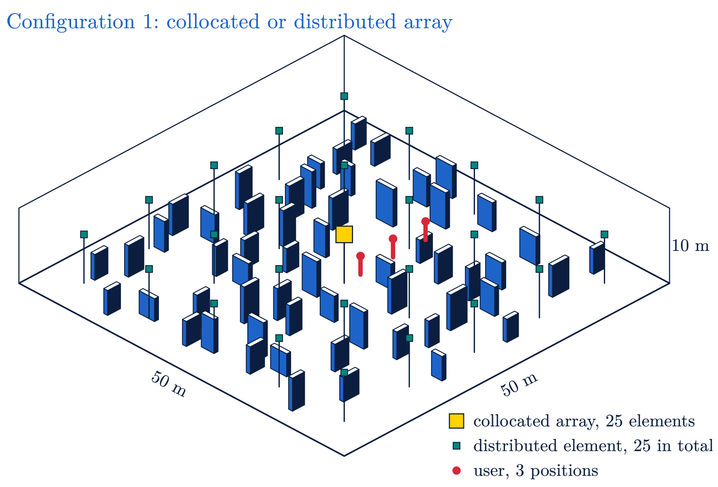
From the environment to absorbed power

The diagram shows how the propagation and body models fit together.

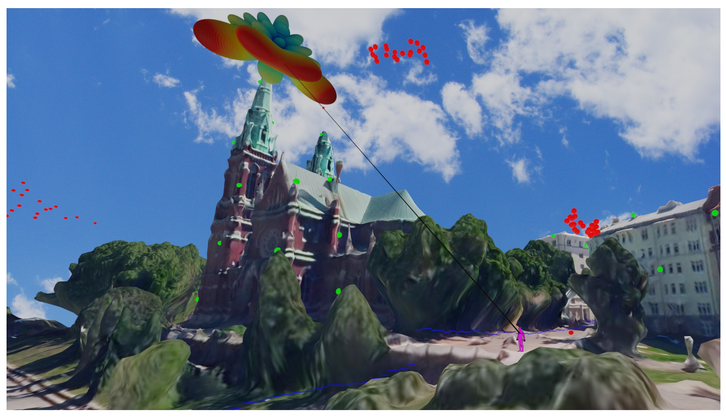


Indoor and outdoor scenes

Factory hall, Ch. 3



Helsinki at 28 GHz, Ch. 4



Antennas are either grouped on the church tower or distributed across building façades. Green: access points. Red: channel-model scatterers. The methods also have a city-scale application on ten routes in Chapter 6.

Exposure-aware beam design

Coherent operator, Ch. 5

Whole-body absorbed power: median 5.29-fold reduction at half the maximum signal power (simulation)

Body size and frequency

We ran 550 simulations with four bodies at 15 frequencies. Below 6 GHz, the child models absorb 1.5–1.9 times as much power per kilogram as the adults at the same incident power density, averaged over six directions.

Deployment and phase

At equal total radiated power, distributed arrays have 2–3 times lower exposure than collocated arrays in the factory. The outdoor cell-free case also has less variation along the walk.

Limits and open questions

We measured in an anechoic chamber and a stairwell. Absorption in idealized reference-level fields can be above a limit. The studied realistic scenarios are well below the limits. Outdoor validation, moving bodies and time averages are future work.

Sources R. Wydaeghe, *Hybrid computational methods for 6G exposure assessment*, PhD thesis, Ghent University, 2026, Chapters 2–7. The route map follows the Chapter 7 synthesis.
Selected papers: *Phys. Med. Biol.* (2026), doi: 10.1088/1361-6560/ae97ac. *IEEE Access* (2022), doi: 10.1109/ACCESS.2022.3227107. *npj Wireless Technology* (2026), doi: 10.1038/s44459-026-00031-4. Ch. 5 and the journal studies in Ch. 6 are submitted manuscripts. Exposure limits: ICNIRP 2020.

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Publications

imec waves wireless, acoustics, environment & expert systems

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