ethertronics

Ansoft, San Diego 10/12/01

ethertronics

Company History:
- Created in May 2000
- Funded by Sevin Rosen and US trust

Located:
San Diego Tech Center
9605 Scranton Road, suite 850
San Diego, CA 92121

Targeted markets and applications:
- Embedded antennas for Cell Phones
- Laptops and all wireless applications between 800 MHz and ISM

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Antenna isolation

for wireless communications systems

Gregory Poilasne, S. Rowson, L. Desclos

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OVERVIEW

1 - Antenna and Surrounding Interaction
- a) Antenna placement
- b) Radiation pattern - Efficiency evaluation
- c) Bit rate Measurements

2 - Isolation Measurements
- a) Interaction with the case and the components
- b) Interaction with the user

3 - Internal antenna isolation
- a) Experimental and numerical results

CONCLUSION

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a) Antenna placement

Home-RF solution

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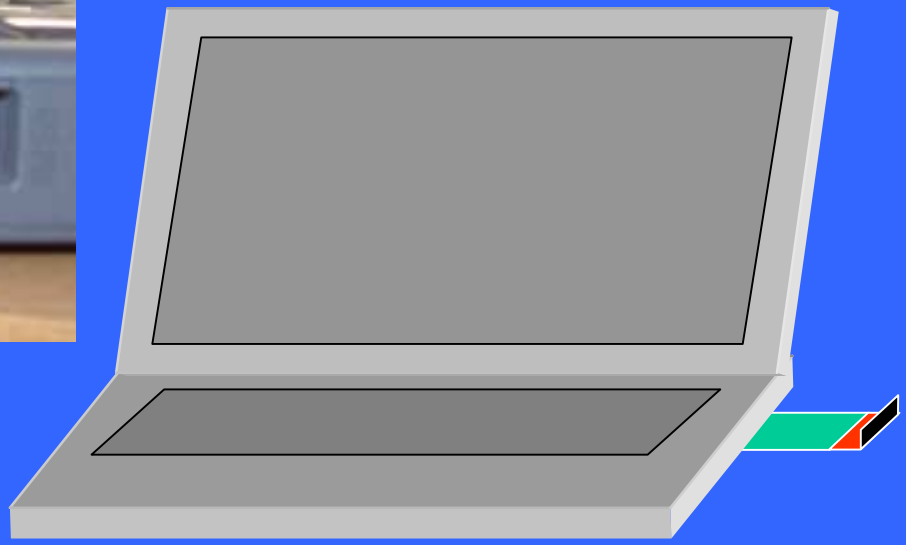
a) Antenna placement

Proposed solution

Antenna position



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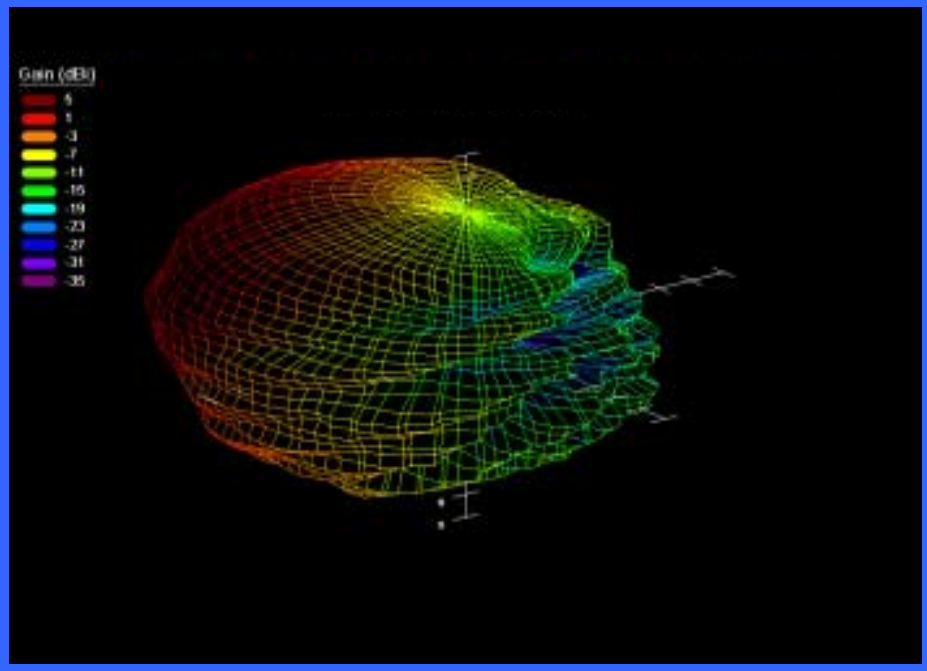
1 - Antenna and Surrounding Interaction

b) Radiation pattern - Efficiency evaluation

$$\text{Efficiency} = \frac{\text{radiated power}}{\text{power at the antenna input}}$$

Takes into account:

- input mismatch
- loss into the antenna
- loss into the surroundings



Measured by comparing:
free space dipole
to
the antenna inside the system

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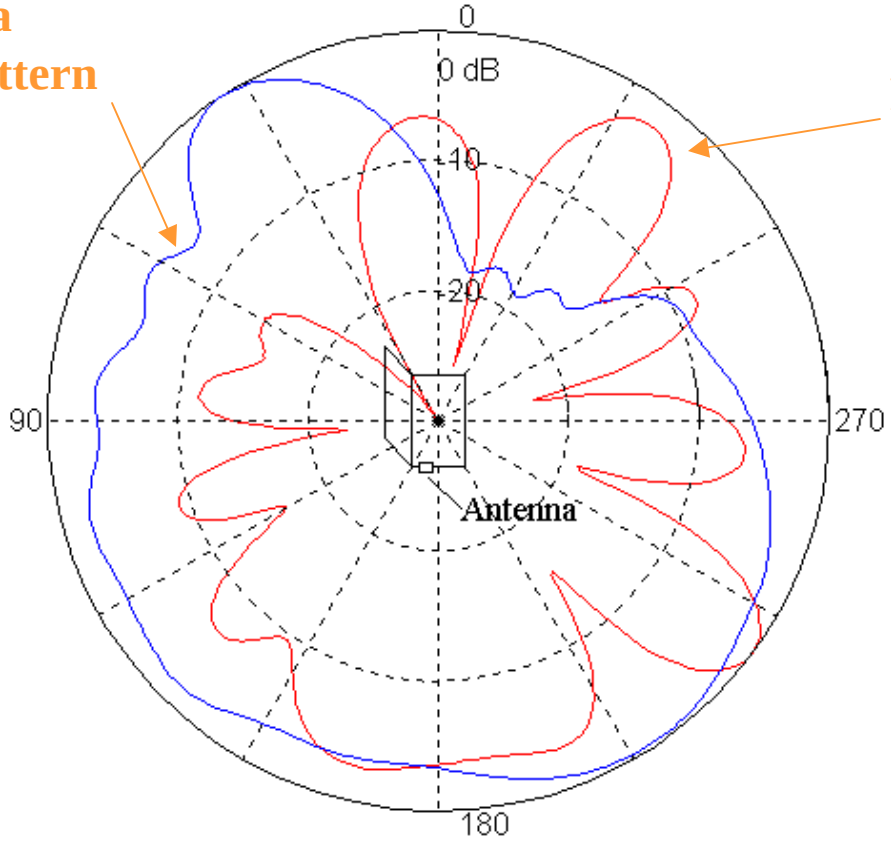
1 - Antenna and Surrounding Interaction

b) Radiation pattern - Efficiency evaluation

4dB Efficiency difference

Isolated Antenna
Smooth radiation pattern



Antenna X
Ripples due to the interactions

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c) Bit rate Measurements

Practical efficiency measurement:

Bit rate measurement
versus
the distance between the two laptops

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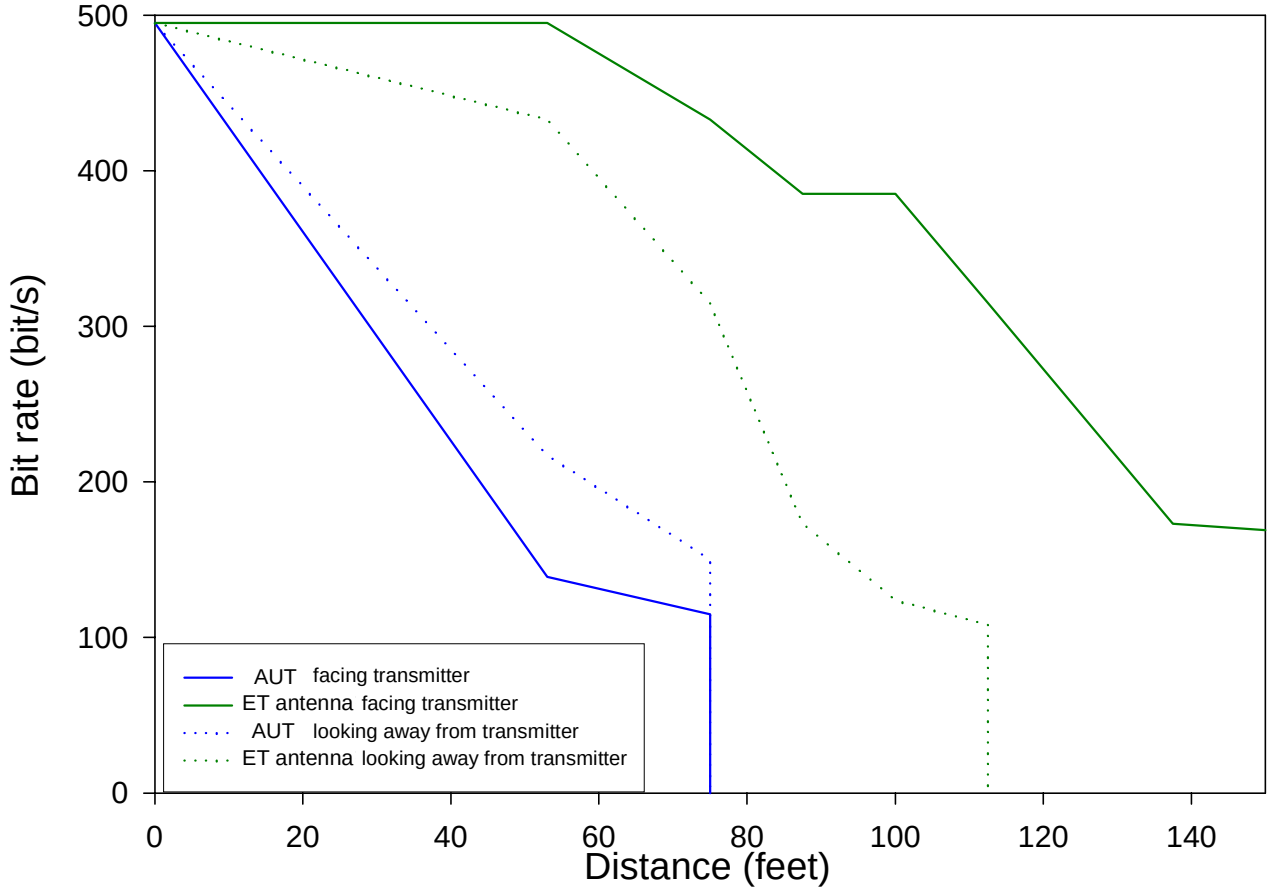
Parking Lot Test - Minimum Possible Multipath (Office test is Isotropic)



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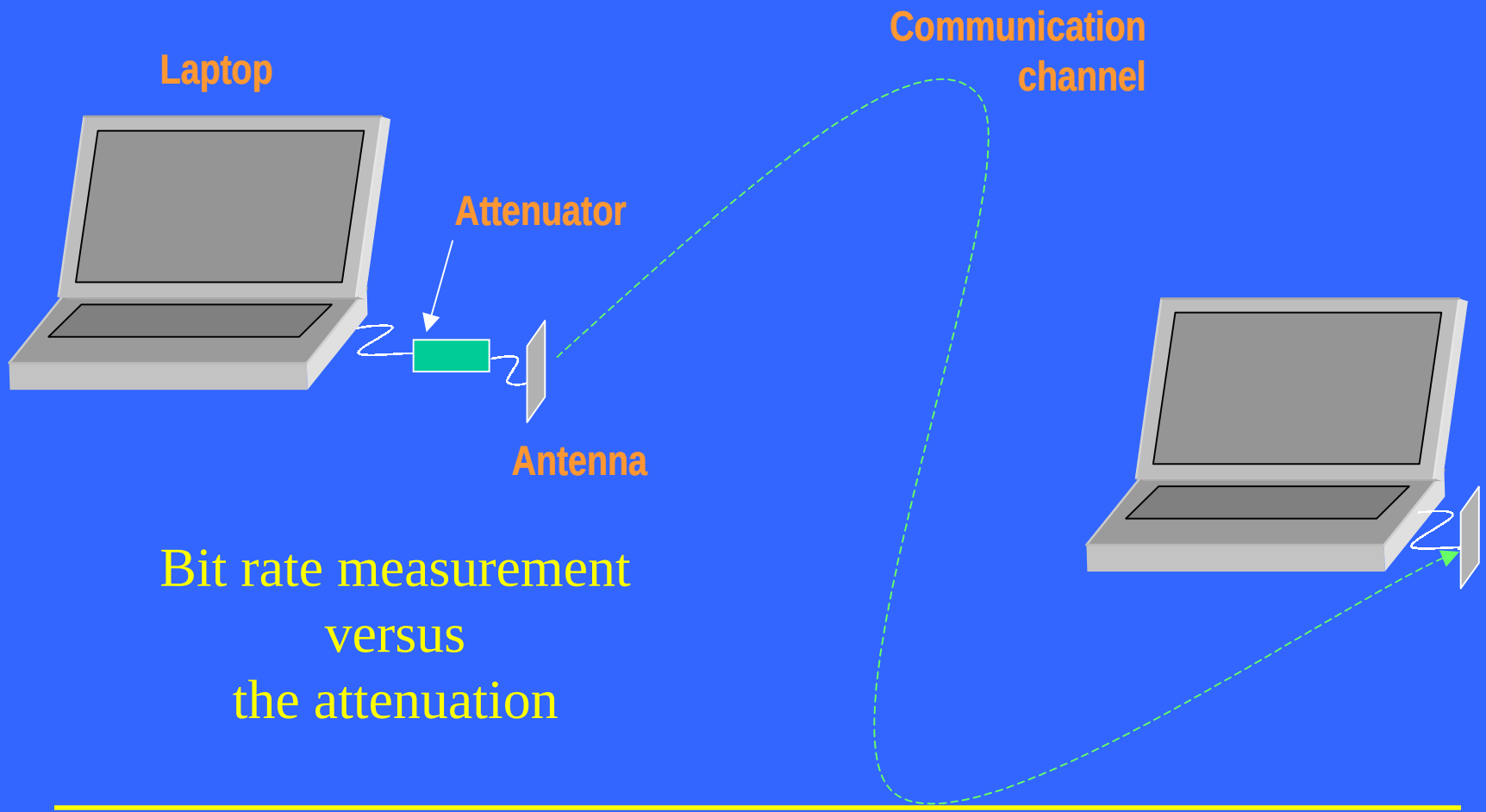
c) Bit rate Measurements

Practical efficiency measurement:



Bit rate measurement
versus
the attenuation

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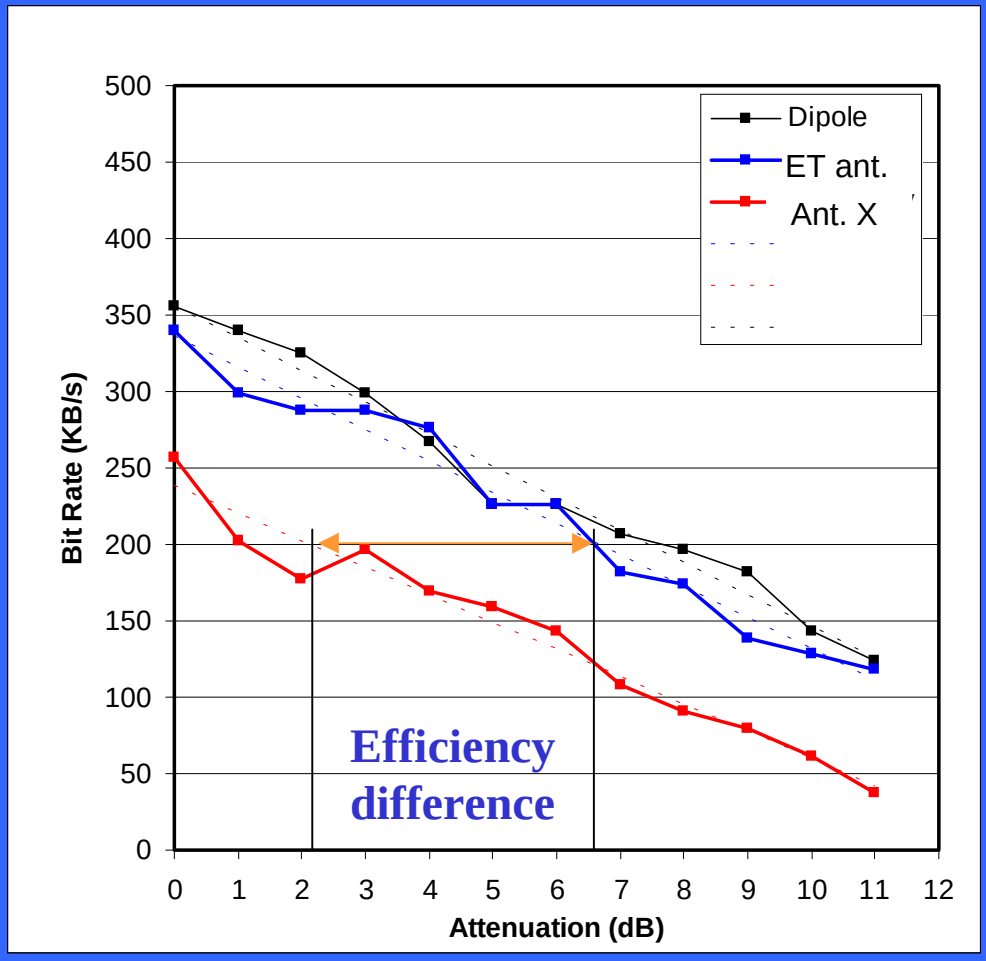
c) Bit rate Measurements



Ref : Ideal dipole away from any absorber.

ET ant: Isolated antenna

Antenna X: antenna sold with the Home RF card.

Approximately 4.5dB of efficiency difference

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The problem of Efficiency: Isolation

Interaction between the antenna and the case: Reduction of efficiency

Need for a tool to measure the interaction: Antenna Isolation

Multiple applications in the same enclosure

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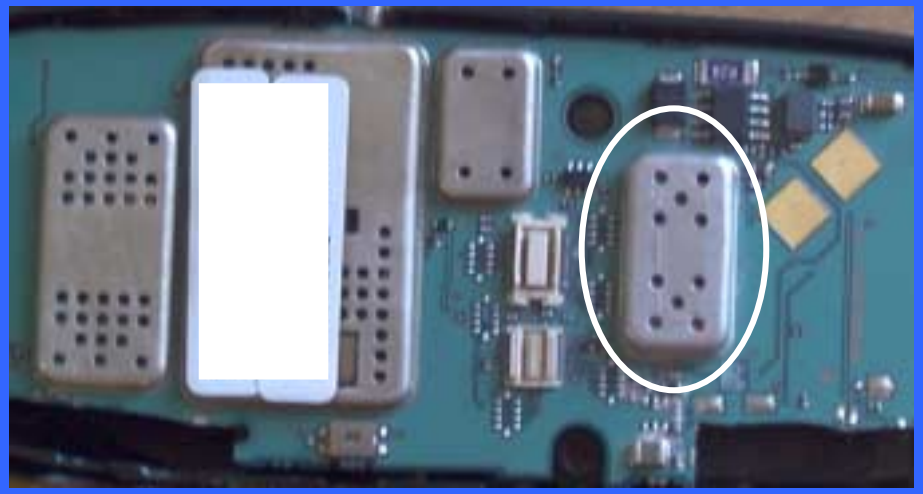
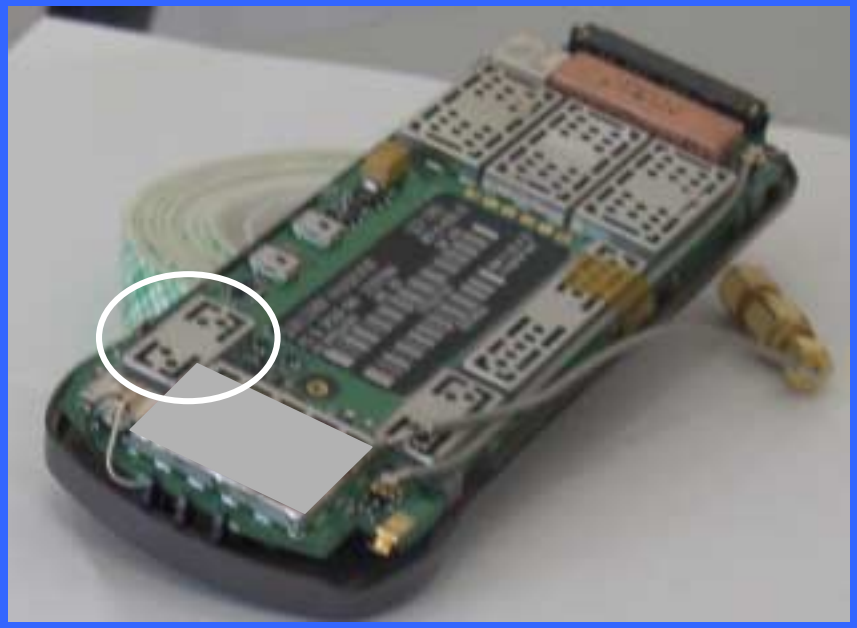
2 - Isolation Measurements

a) Interaction with the case and the components





Shields tend to short circuit antennas

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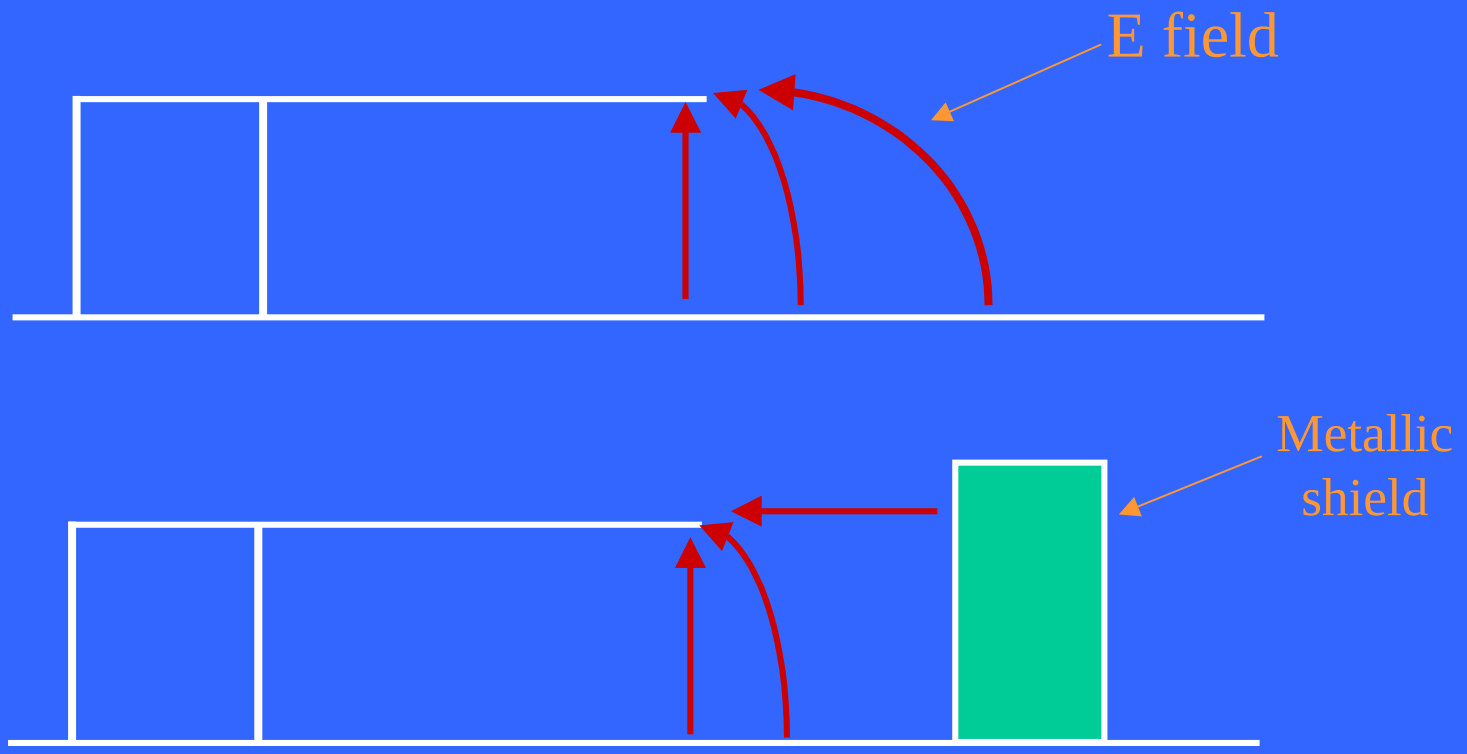
a) Interaction with the case and the components

Example of a PIFA



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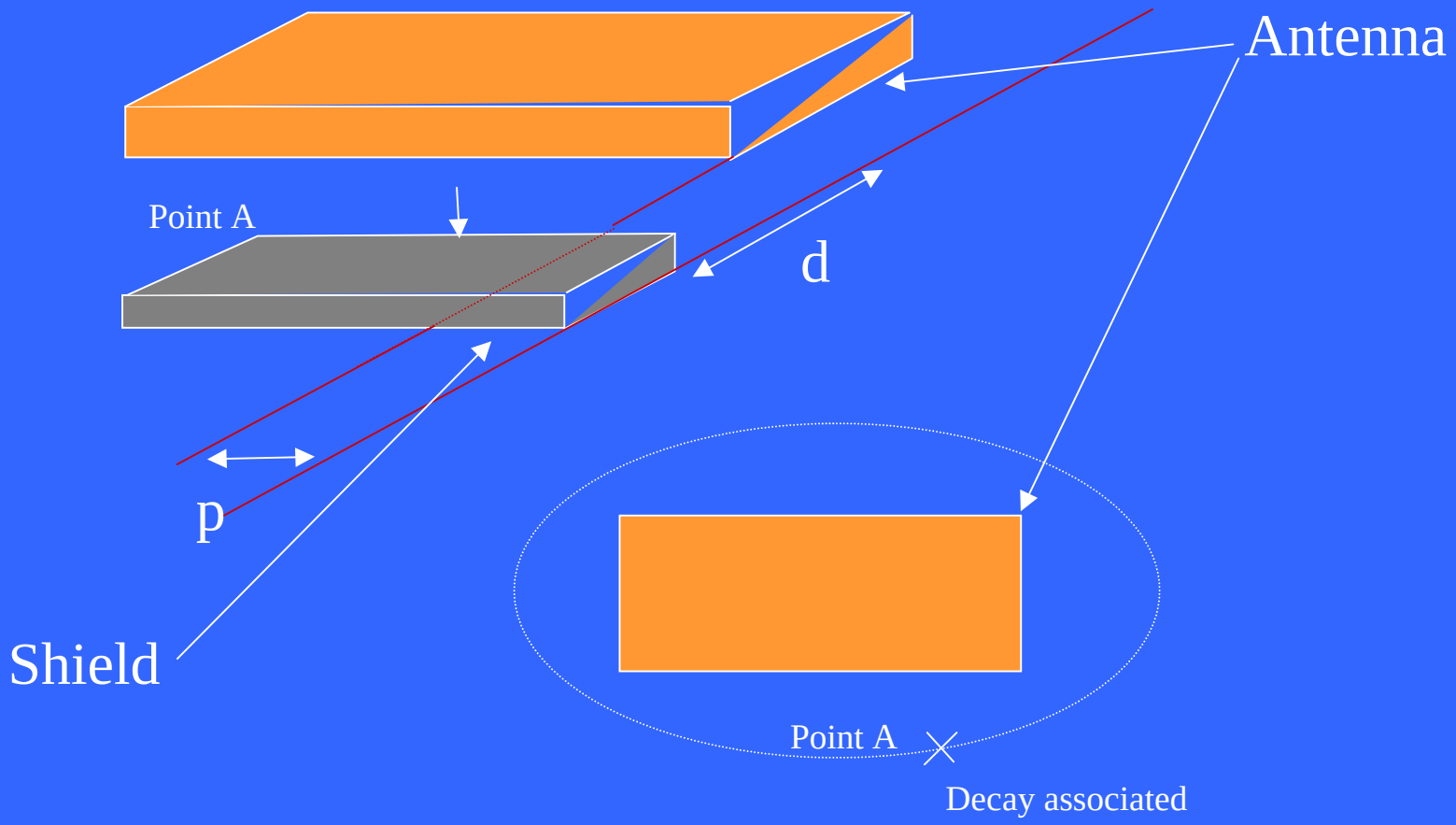
2 - Isolation Measurements

a) Interaction with the case and the components



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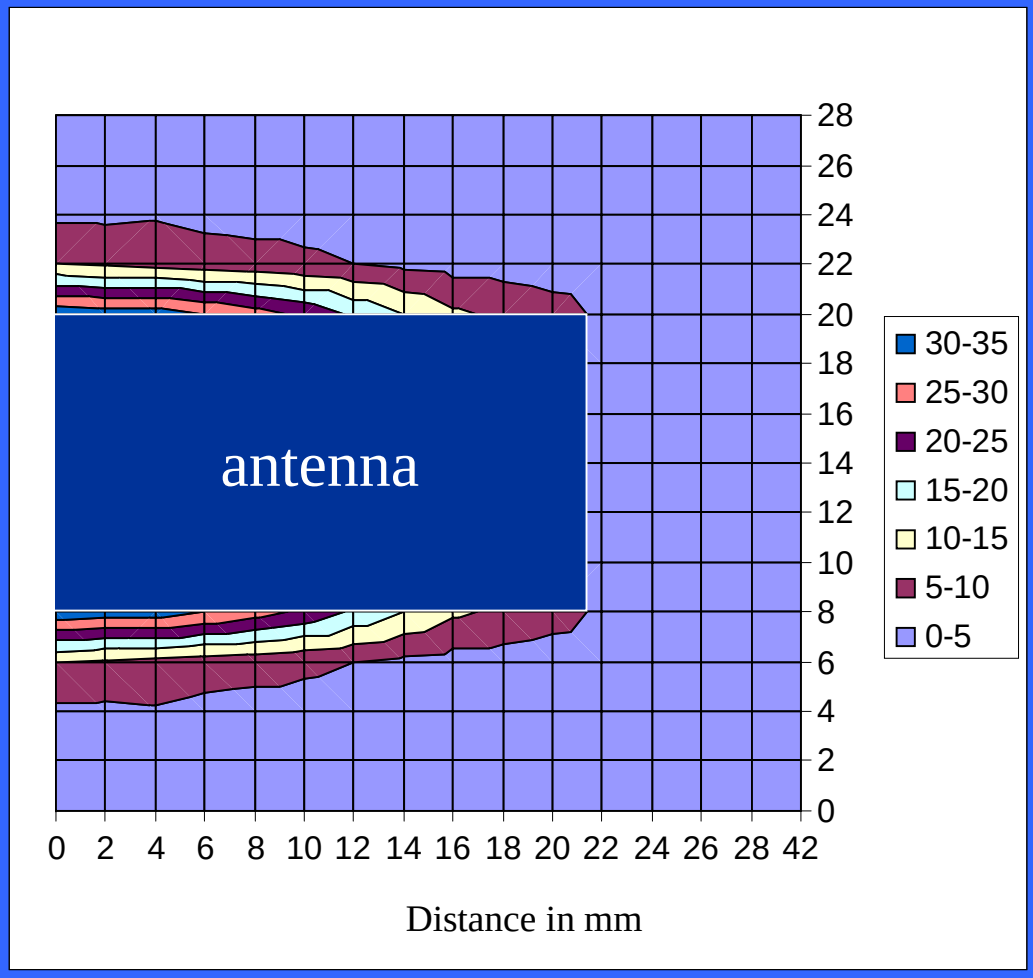
2 - Isolation Measurements

a) Interaction with the case and the components



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2 - Isolation Measurements

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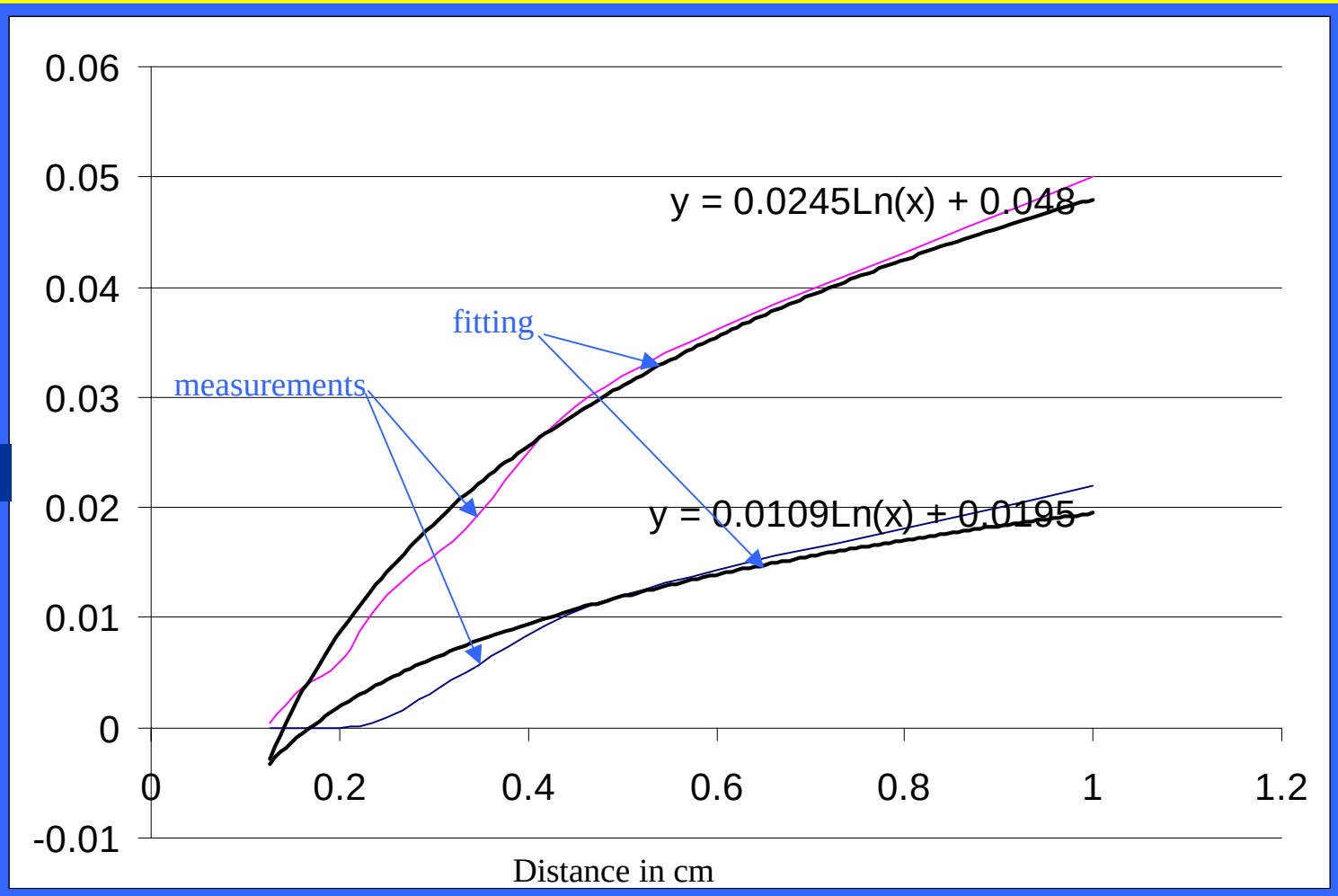

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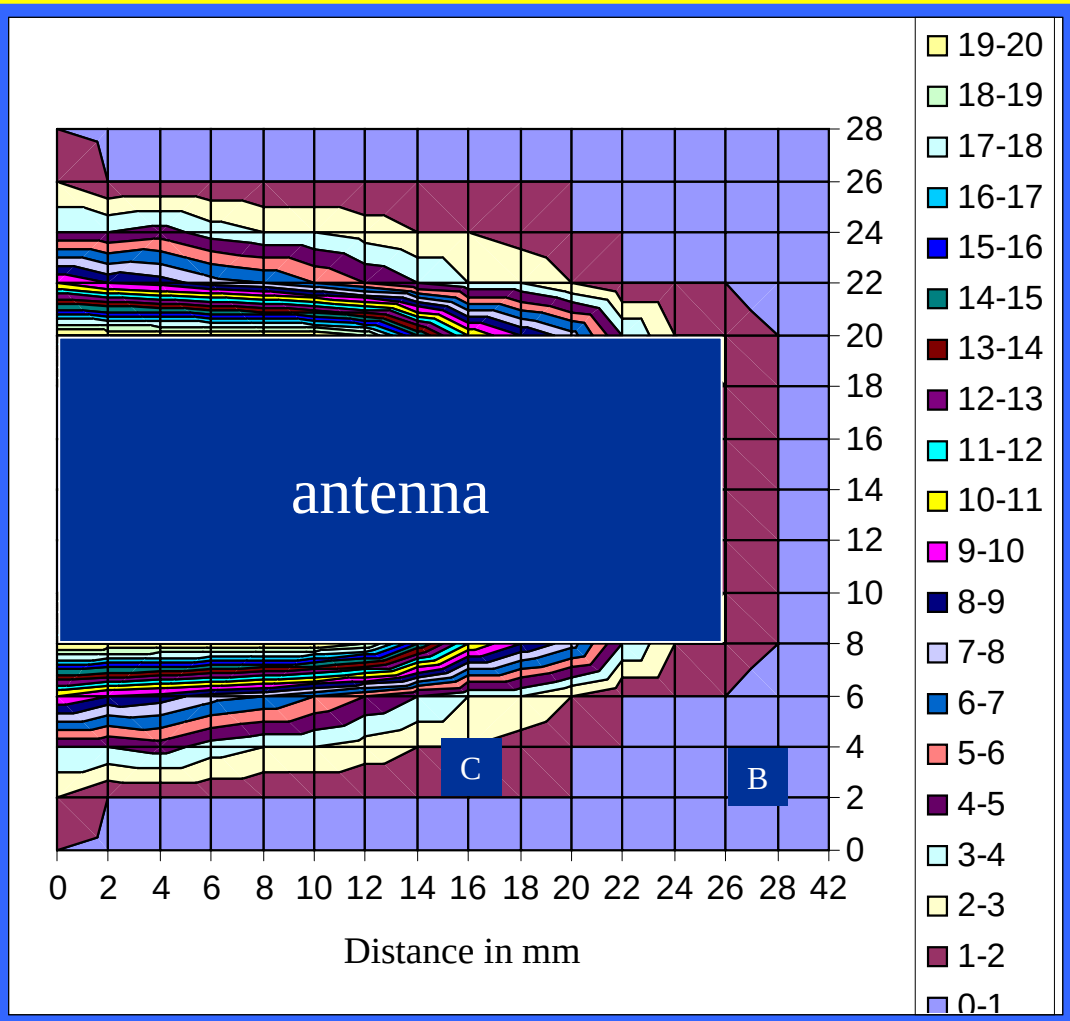
2 - Isolation Measurements

a) Interaction with the case and the components



Shift in MHz

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2 - Isolation Measurements

b) Interaction with the user

Loss into the user body

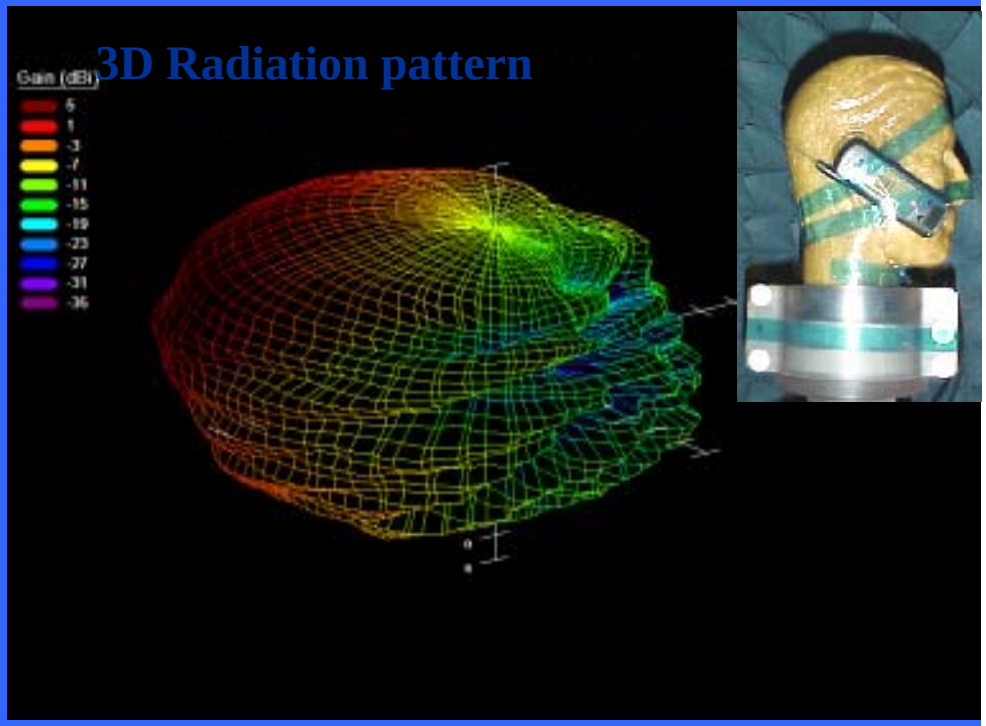
Need to shield the user

- Performance
- Health

Frequency shift/matching

Need for isolated antennas

- Performance



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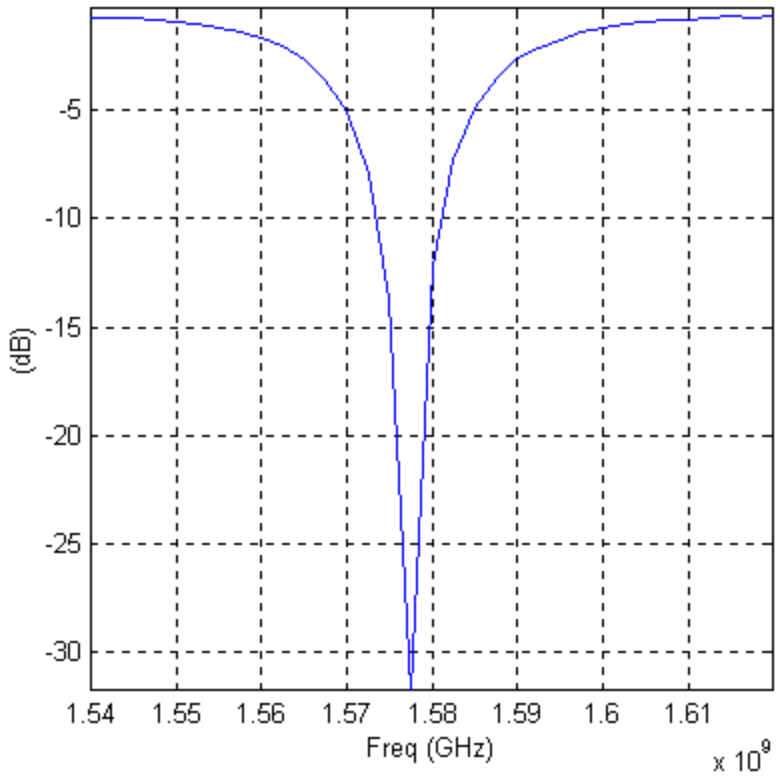
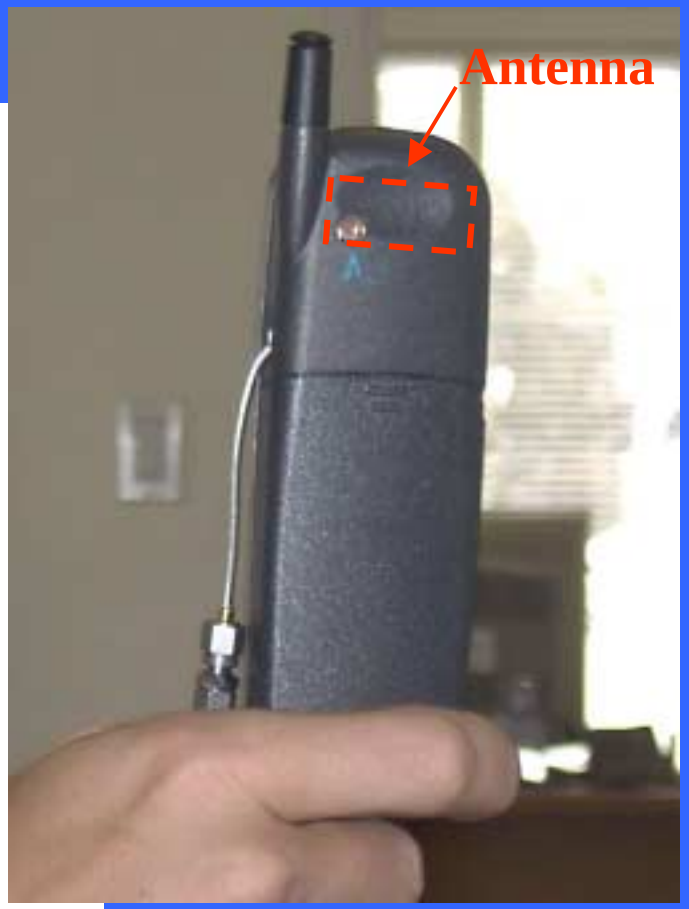
2 - Isolation Measurements

b) Interaction with the user

Critical case

Frequency: 1.575GHz
Bandwidth: 8MHz





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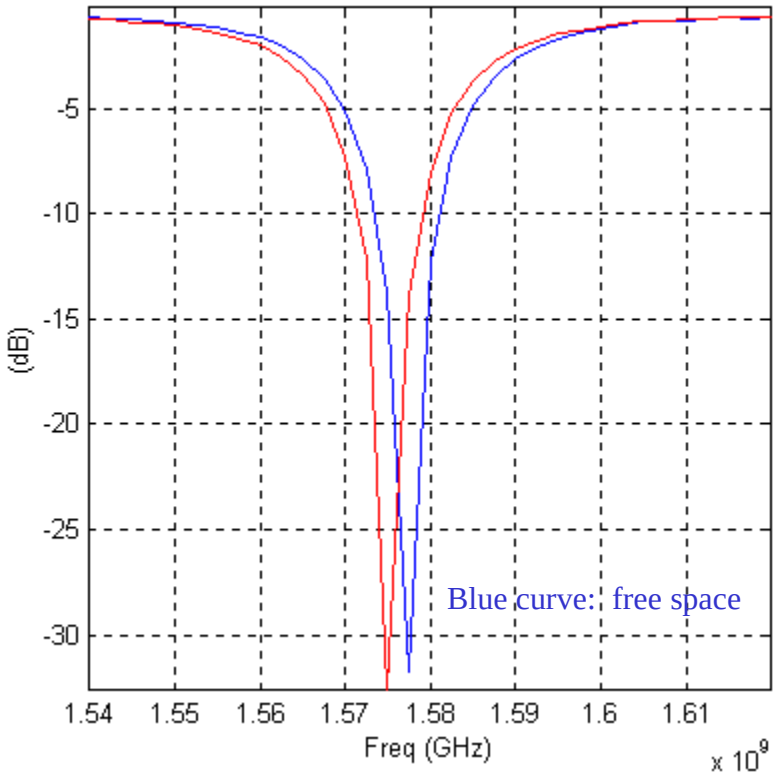
2 - Isolation Measurements

b) Interaction with the user



Frequency shift: 2.5MHz

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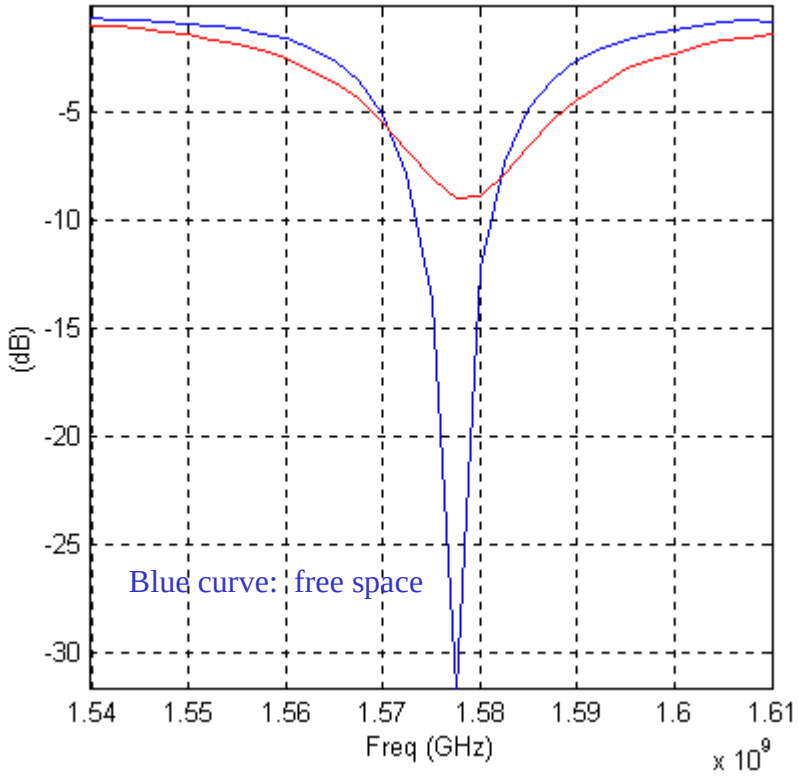
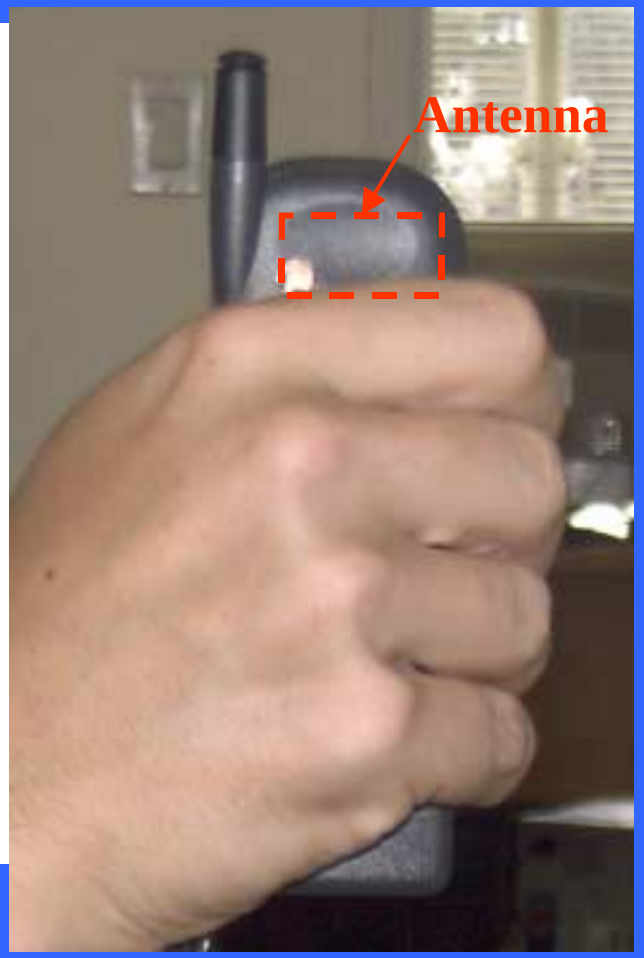
2 - Isolation Measurements

b) Interaction with the user

Hand over the side of the antenna





Frequency shift: 1MHz

Increase of the reflection

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Improving Antenna Isolation

Current distribution:

It has to be confined nearby the antenna.

Nearfield distribution:

The nearfield has to be shaped away
from parasitic elements
Confined the field as much as possible

Nearfield probing: long and no so accurate

Simulation tools: Faster and faster, easy to visualize

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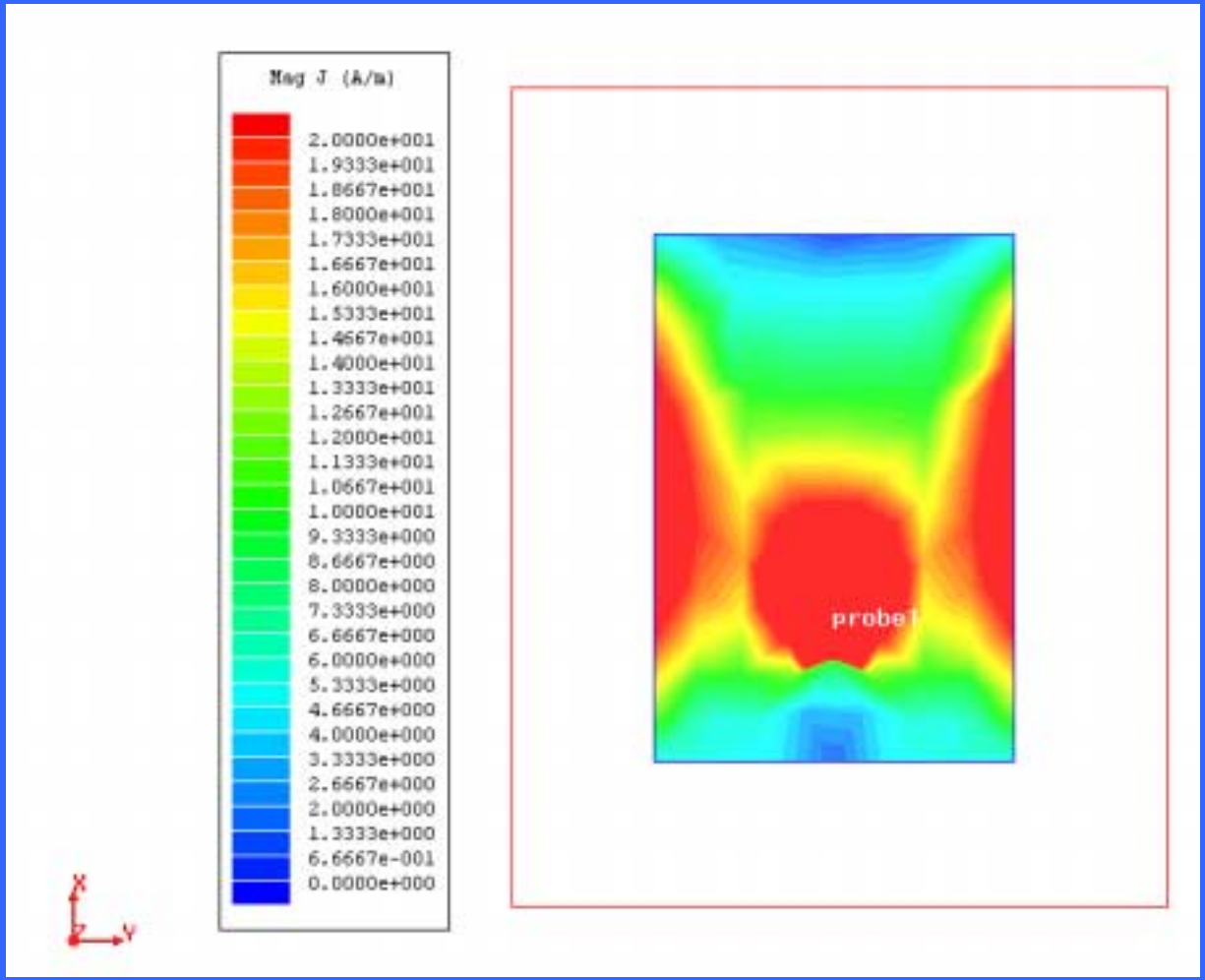
3 - Improving the antenna isolation

Experimental and numerical results

PIFA:

Currents are leaking on the sides.



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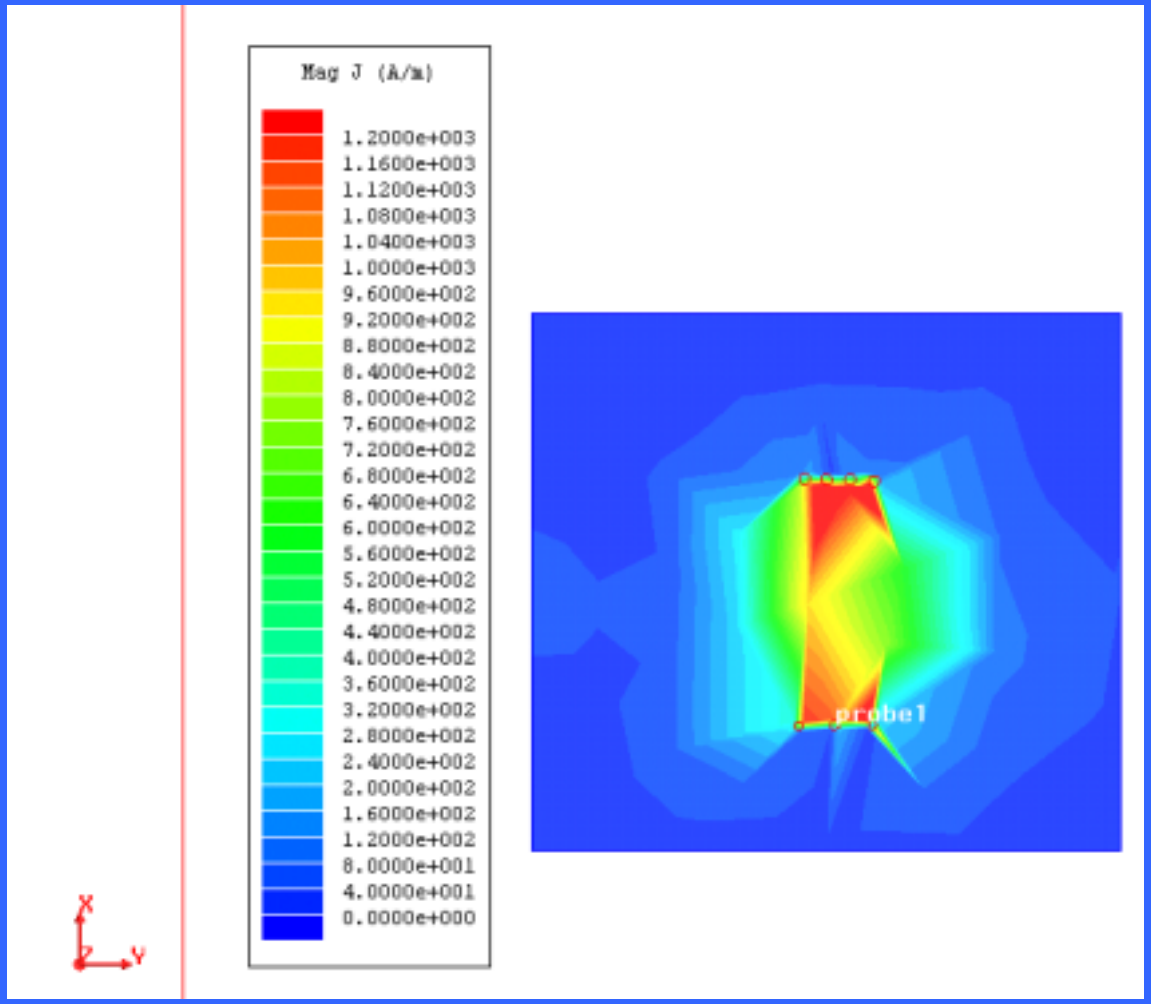
3 - Improving the antenna isolation

Experimental and numerical results

Isolated Antenna:

Low currents outside the antenna.



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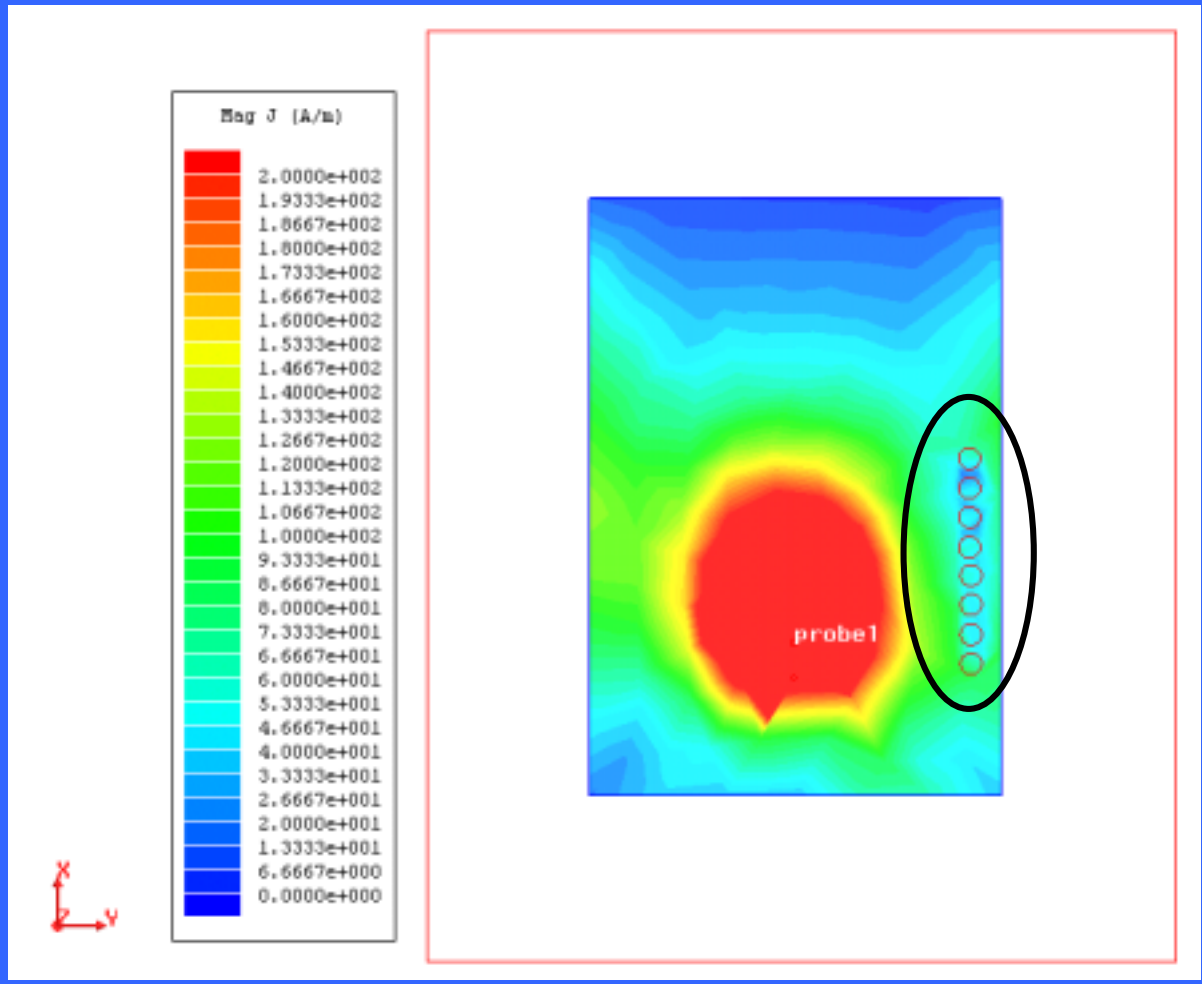
3 - Improving the antenna isolation

Experimental and numerical results

PIFA with shield:

Coupling with the shield.

Frequency shift: 9%



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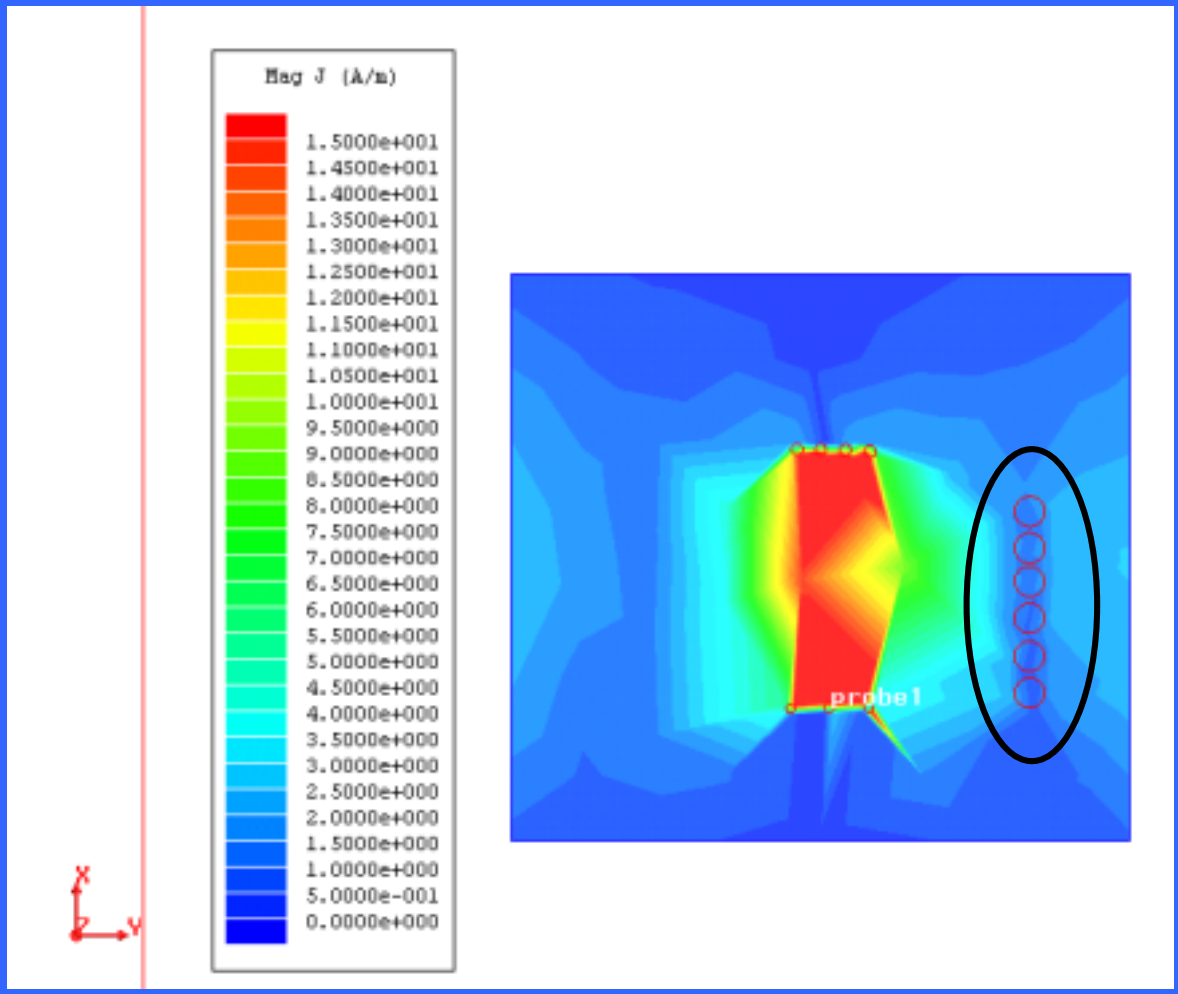
3 - Improving the antenna isolation

Experimental and numerical results

Isolated antenna with shield:

Low coupling with the shield.

Frequency shift: 3%



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CONCLUSION

Isolation means:

- Low interaction between an antenna and its surroundings
  - Inside the enclosure: components, case
  - Outside the enclosure: user body, table,...
- Better efficiency in real world applications
- Semi-standard products
  - drop-in component
  - fast turn-around design and optimization

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