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Broadband Patch Antenna

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- Prerequisites
- Patch Design
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- Verification of the Design
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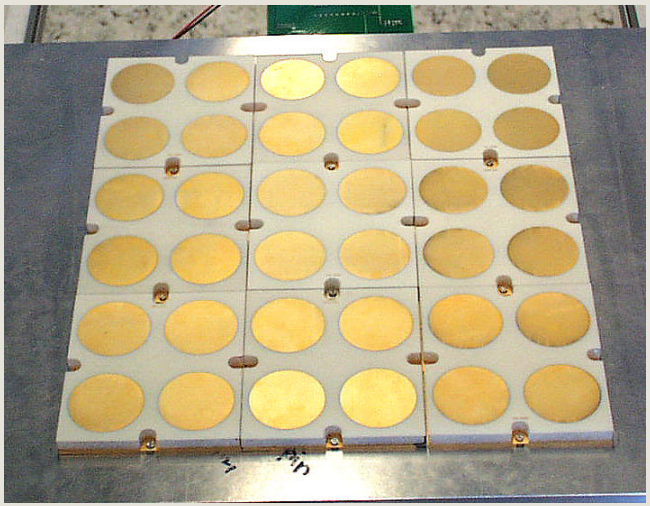
Introduction

- Broadband antenna elements
- Balanced feed
- Simulated without balun



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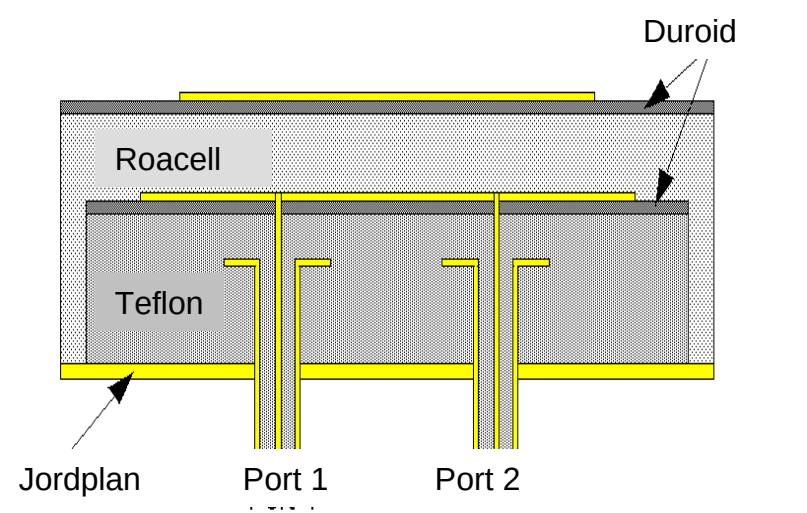
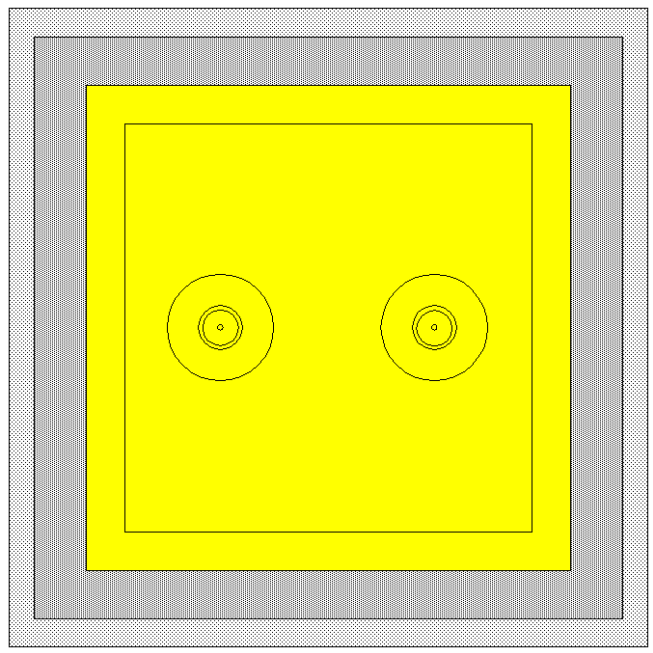
Prerequisites

- 1 octave bandwidth
- Frequency 1-2 GHz
- Infinite array
- Element spacing $\lambda/2$= 75*75mm (2GHz)
- Stacked patch antenna
- Balanced feed
- Ideal 180° hybrid

Basic Patch Design

- Dielectric puck
- Balanced coaxial feed
- Probe inductance compensation





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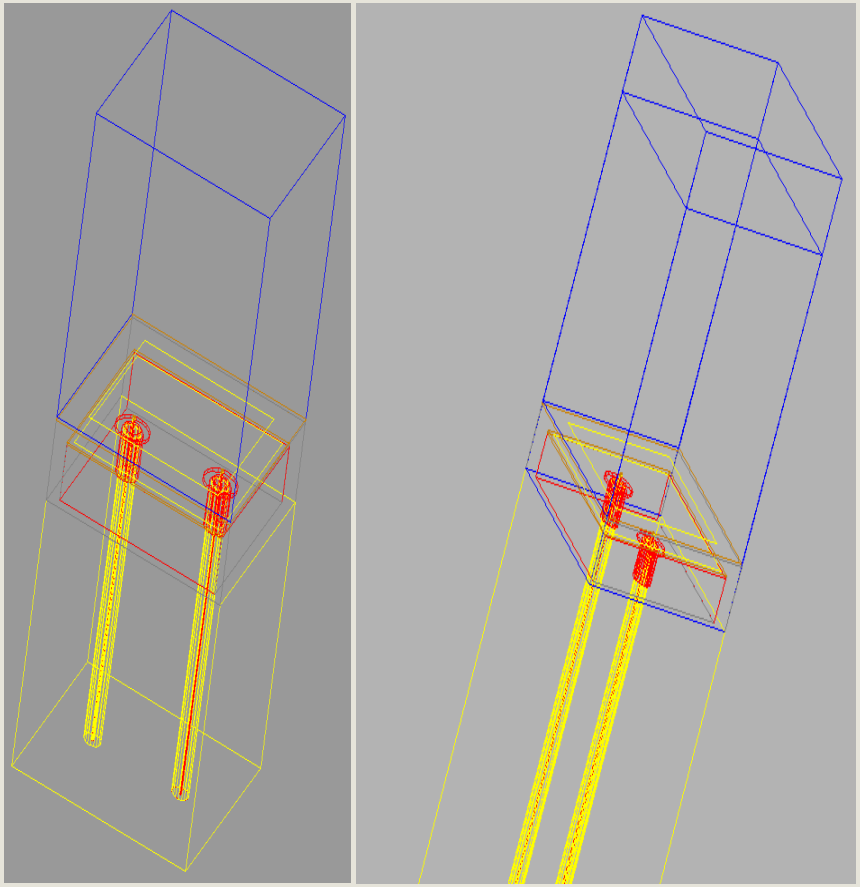
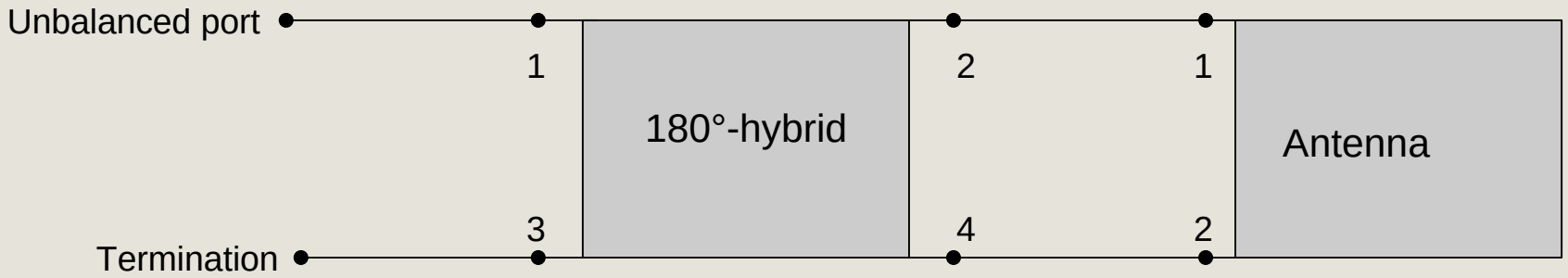
Modeling in Ansoft HFSS

- Perf_conductor
- Master-/Slave-boundaries
- Radiation boundary
- PML-layer



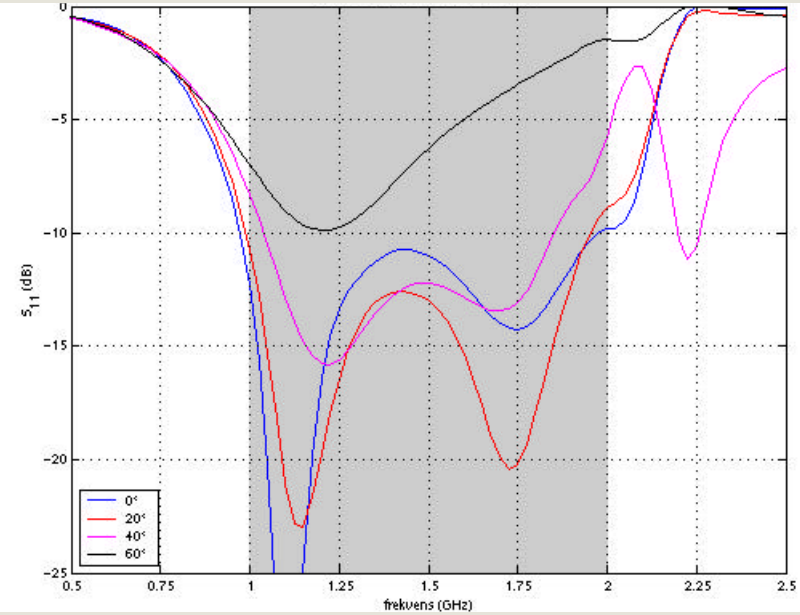
Ideal 180° Hybrid

- Hybrid calculated with MatLab

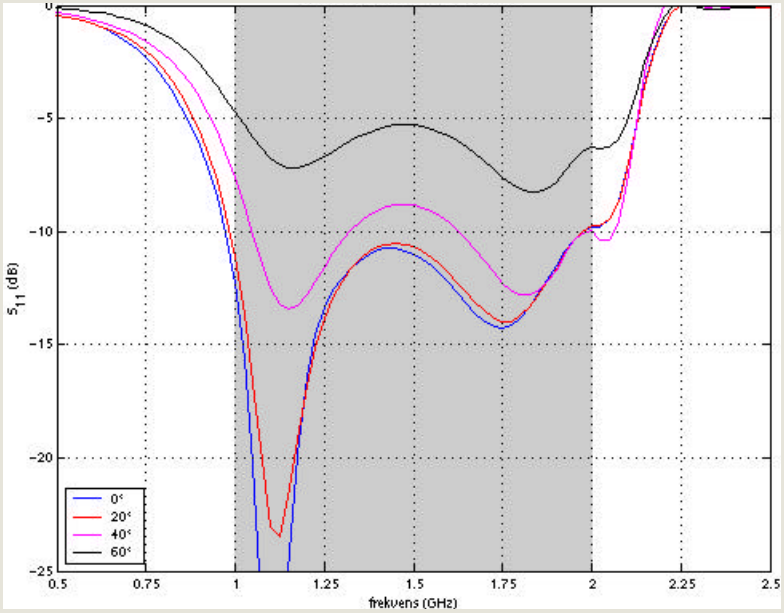


$$S_{11,total} = 0.5(S_{11,antenna} + S_{22,\ antenna} - S_{12,antenna} - S_{21,antenna})$$

Simulation Results



E-plane scanning



H-plane scanning

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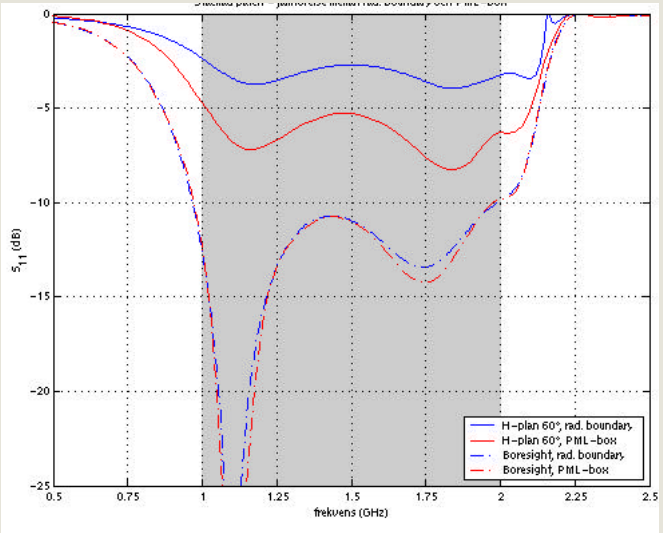
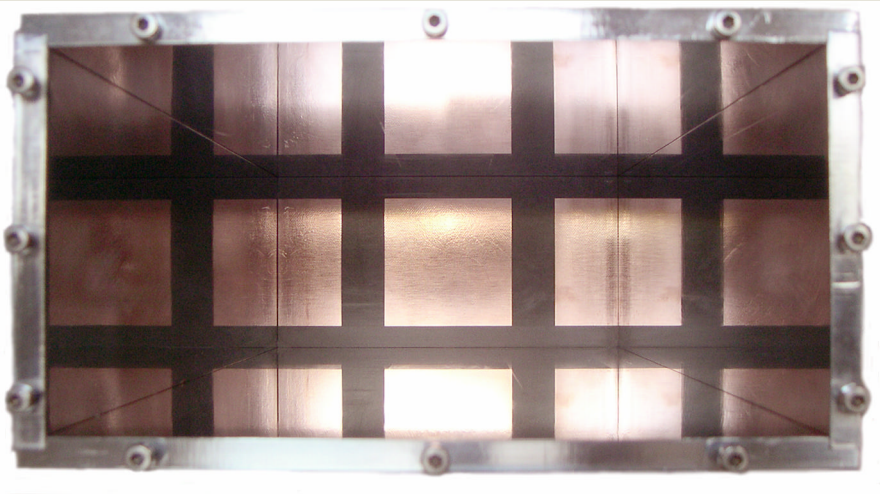
Difficulties

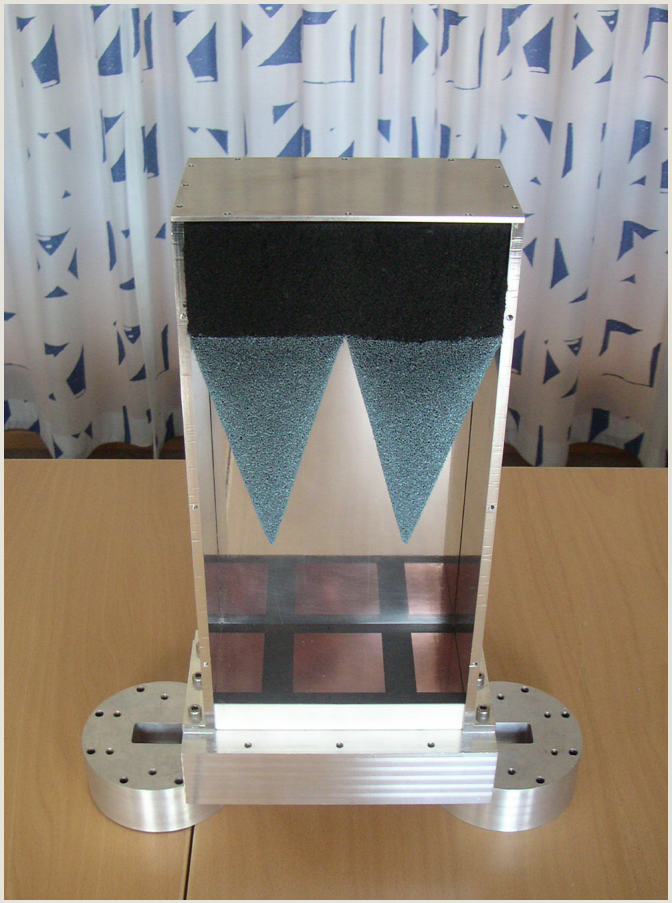
- Problems with radiation boundary for scanned examples
- Results are very convergence sensitive when using an ideal 180°-hybrid



Array Simulator Principle

The reflections off the walls of the waveguide are used to make the element behave as though in an array.





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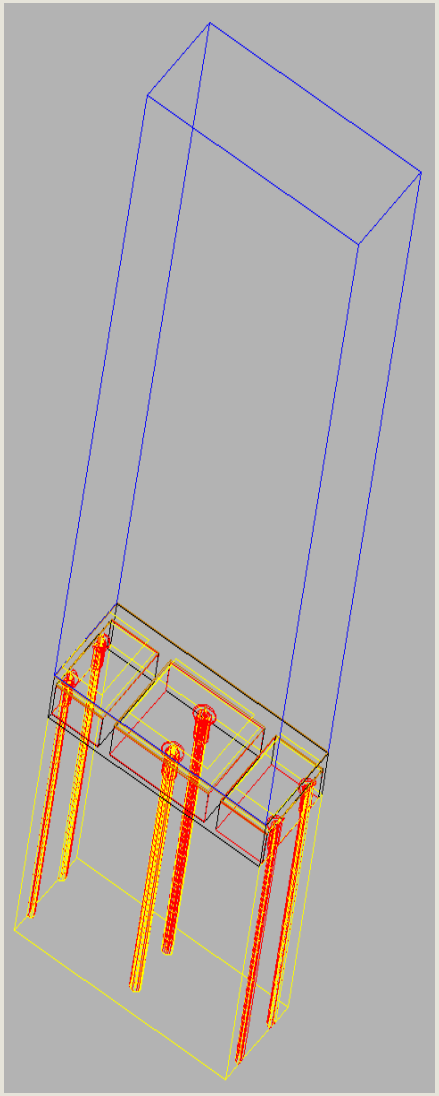
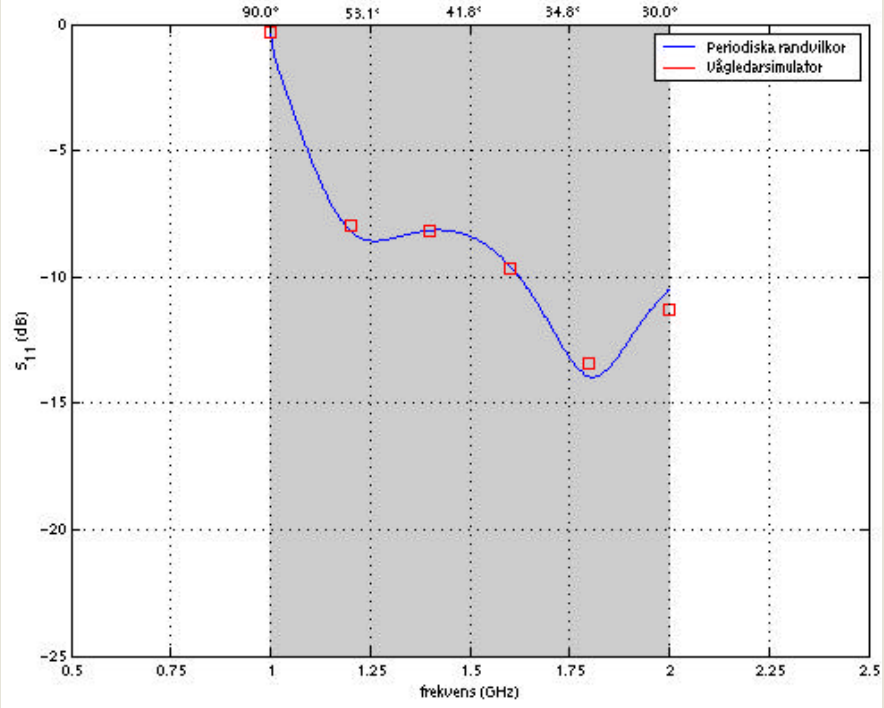
Array Simulator Model

- ½+1+½ elements are used
- Only gives information about one scan-angle for every frequency



Comparing an Array Simulator and an Infinite Array

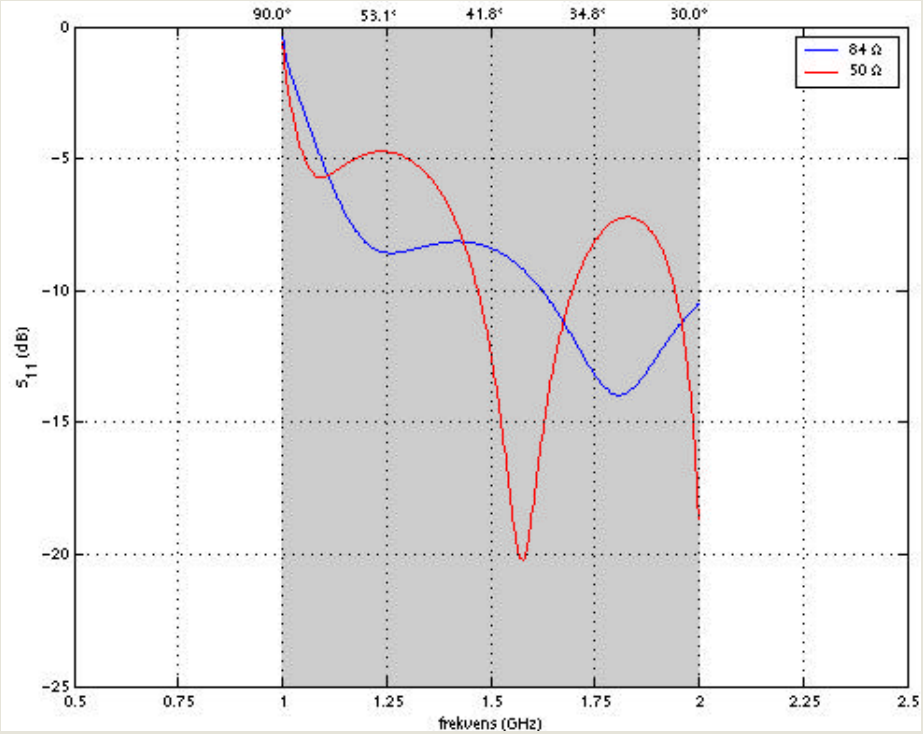


Port Adaption

The measured and simulated ports have different impedances

- Coaxial port on patch is 84 Ω
- Measured port is 50 Ω

Solution: simulate measured port



Measured Results Compared to the Simulation

- Excellent match between measured and simulated results!