



Power Distribution Networks in Multilayer LTCC for Microwave Applications

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EASTON

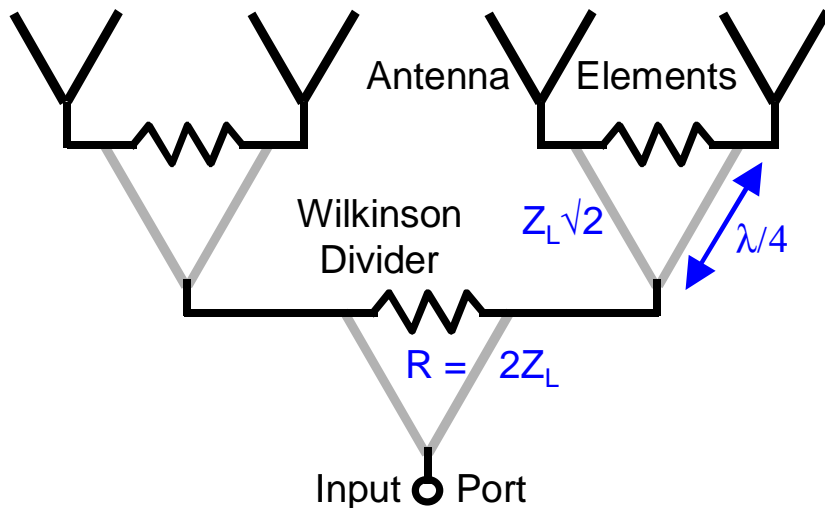


Projekträger des



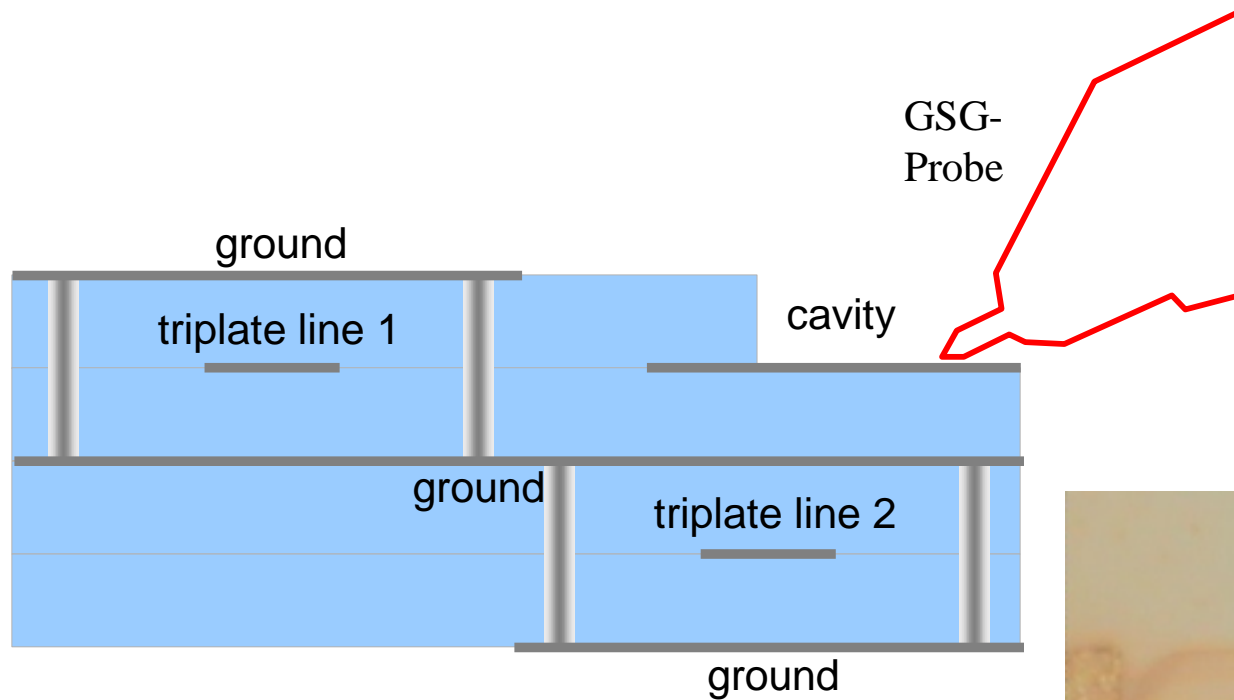
Förderkennzeichen:
50 YB 0007

Overview



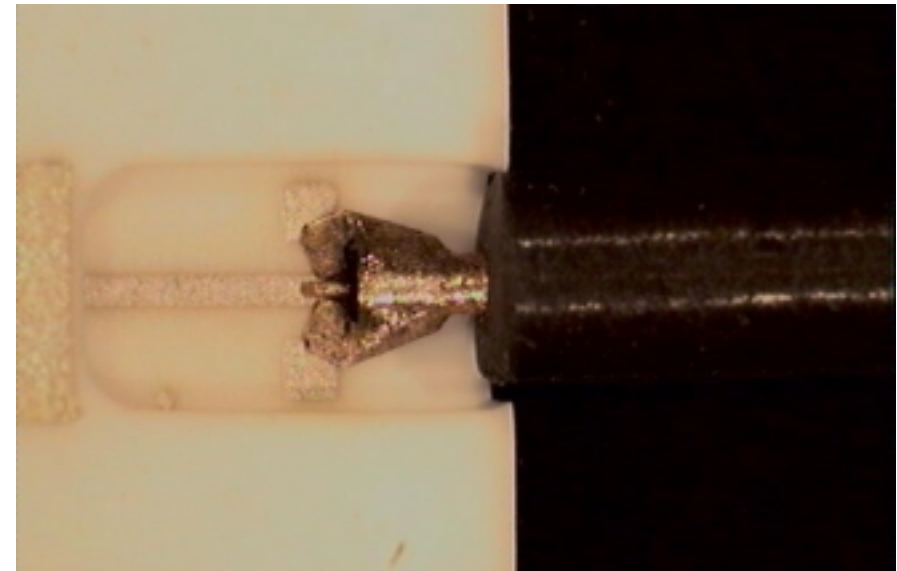
- Design and Measurement
- Components
- System Integration

On Wafer Probe

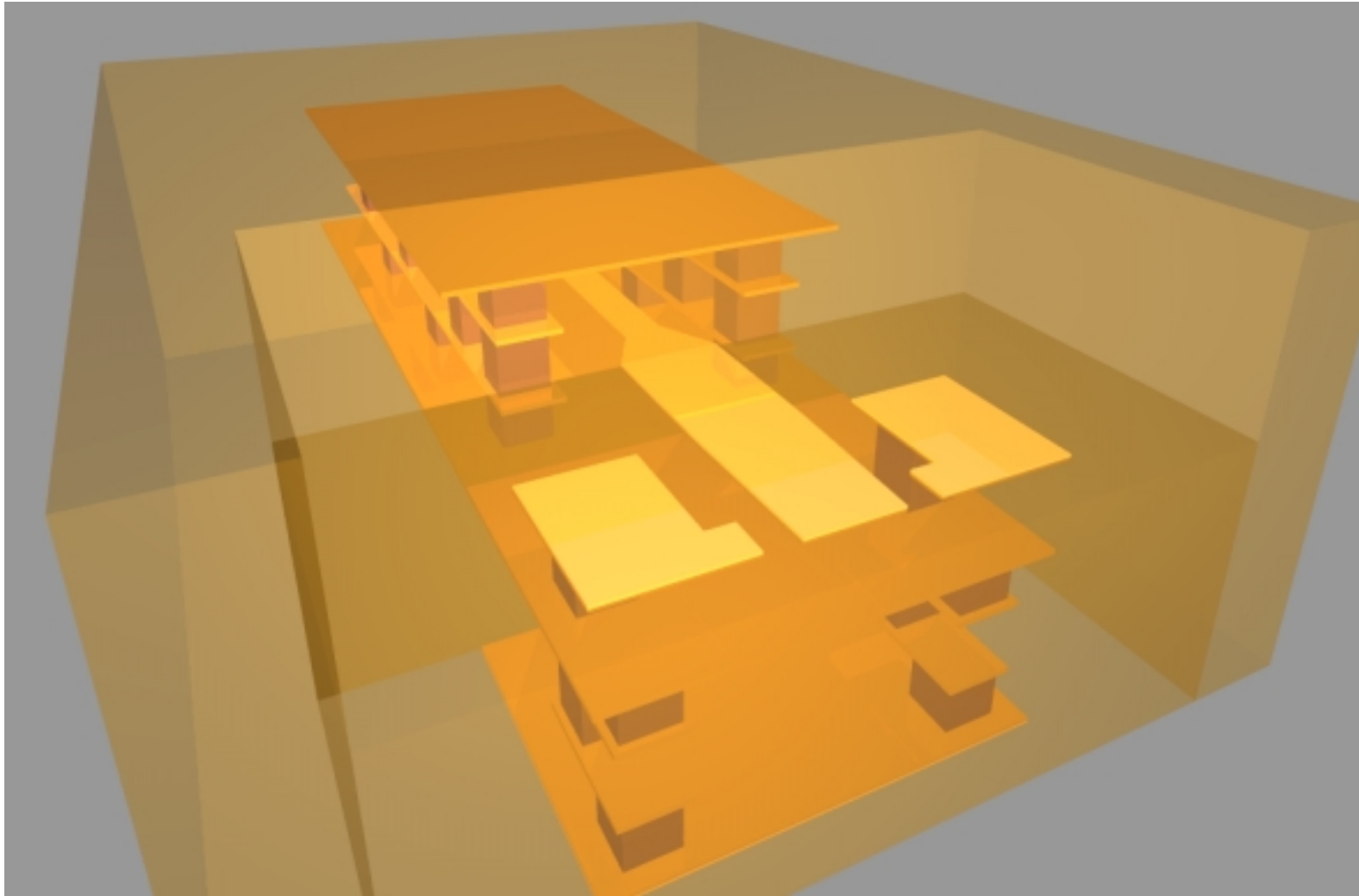


Cross Section of the μ W-Port

Top-View



Transition: Probe Pad 50Ω Stripline



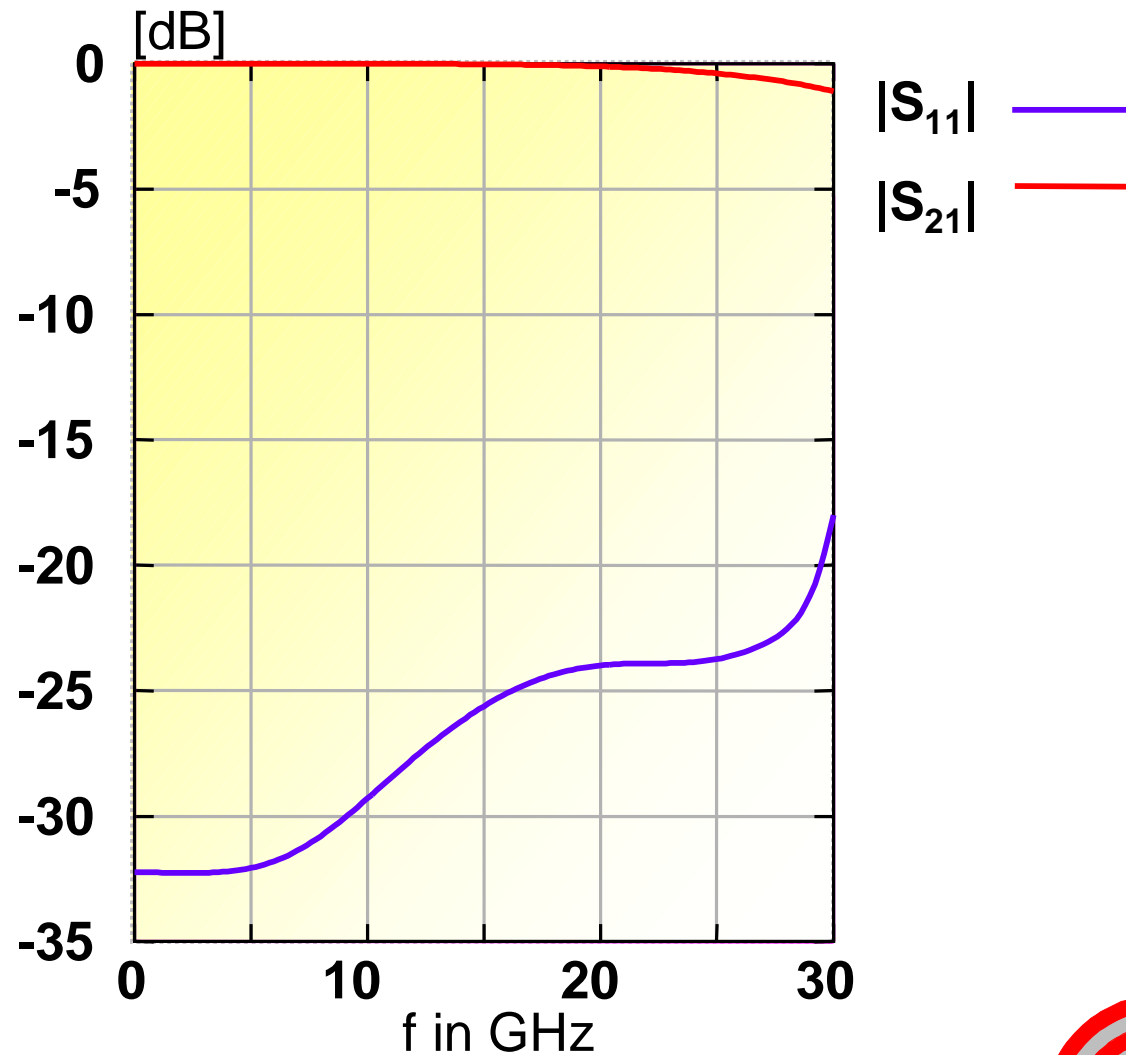
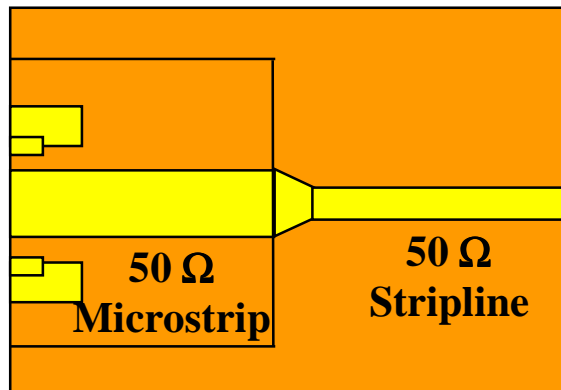
3D View of Simulation model

Transition: Probe Pad

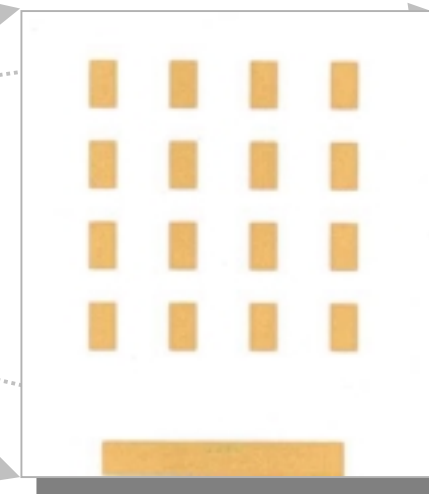
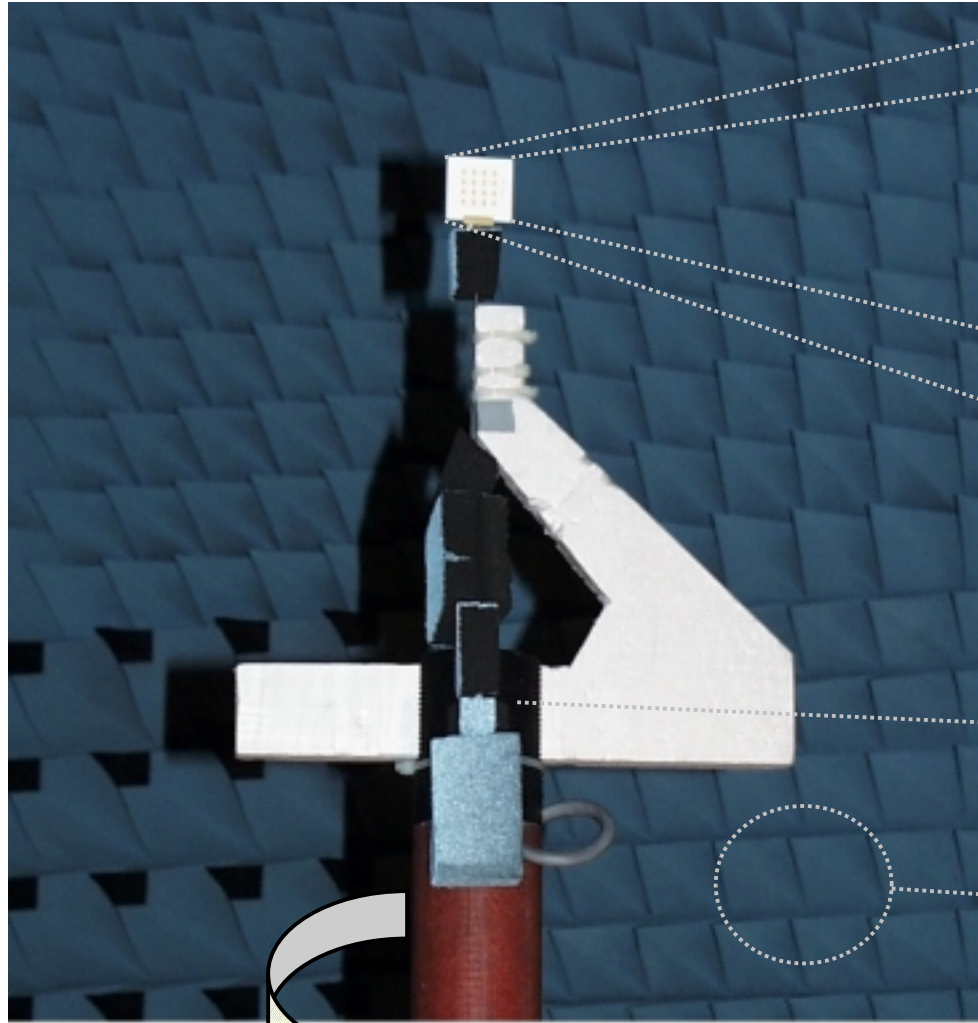
50Ω Stripline

Simulation Results:

Top View:



Antenna Measurement in Anechoic Chamber



Patch Antenna

Positioner

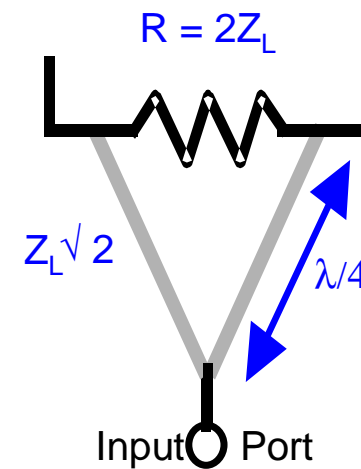
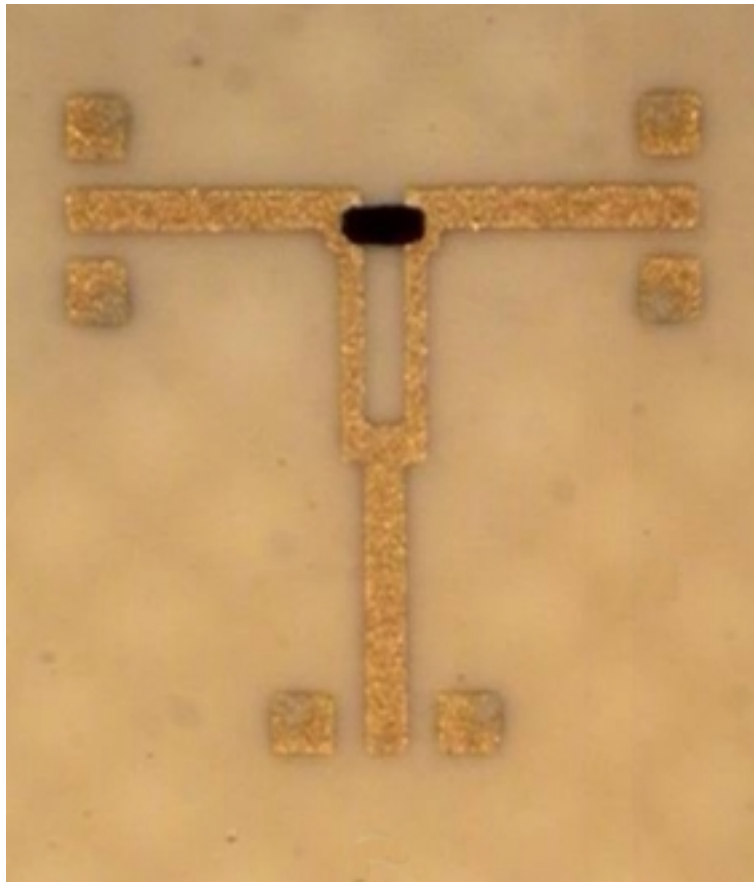
Absorbers



Components

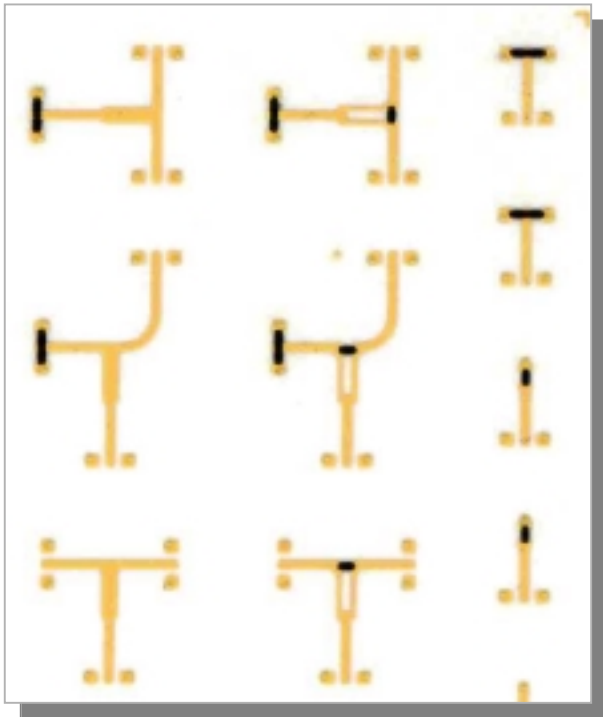
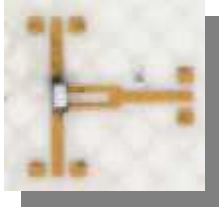
- Wilkinson Power Divider
 - Transmission lines
 - Microstrip
 - Triplate
 - Resistor
- Patch Antenna
- Active Devices

Wilkinson Power Divider



Power Dividers on LTCC

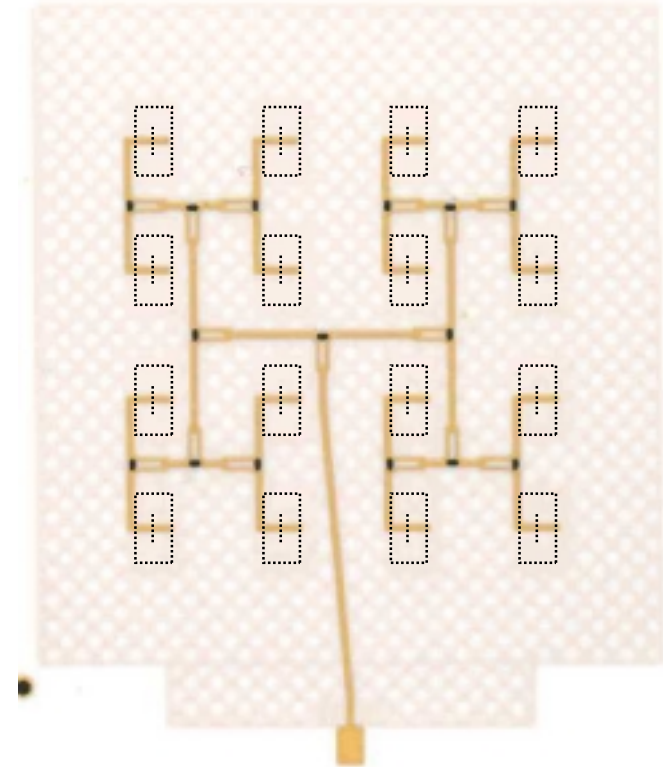
Wilkinson Power Dividers and T-Junctions



Test Structures

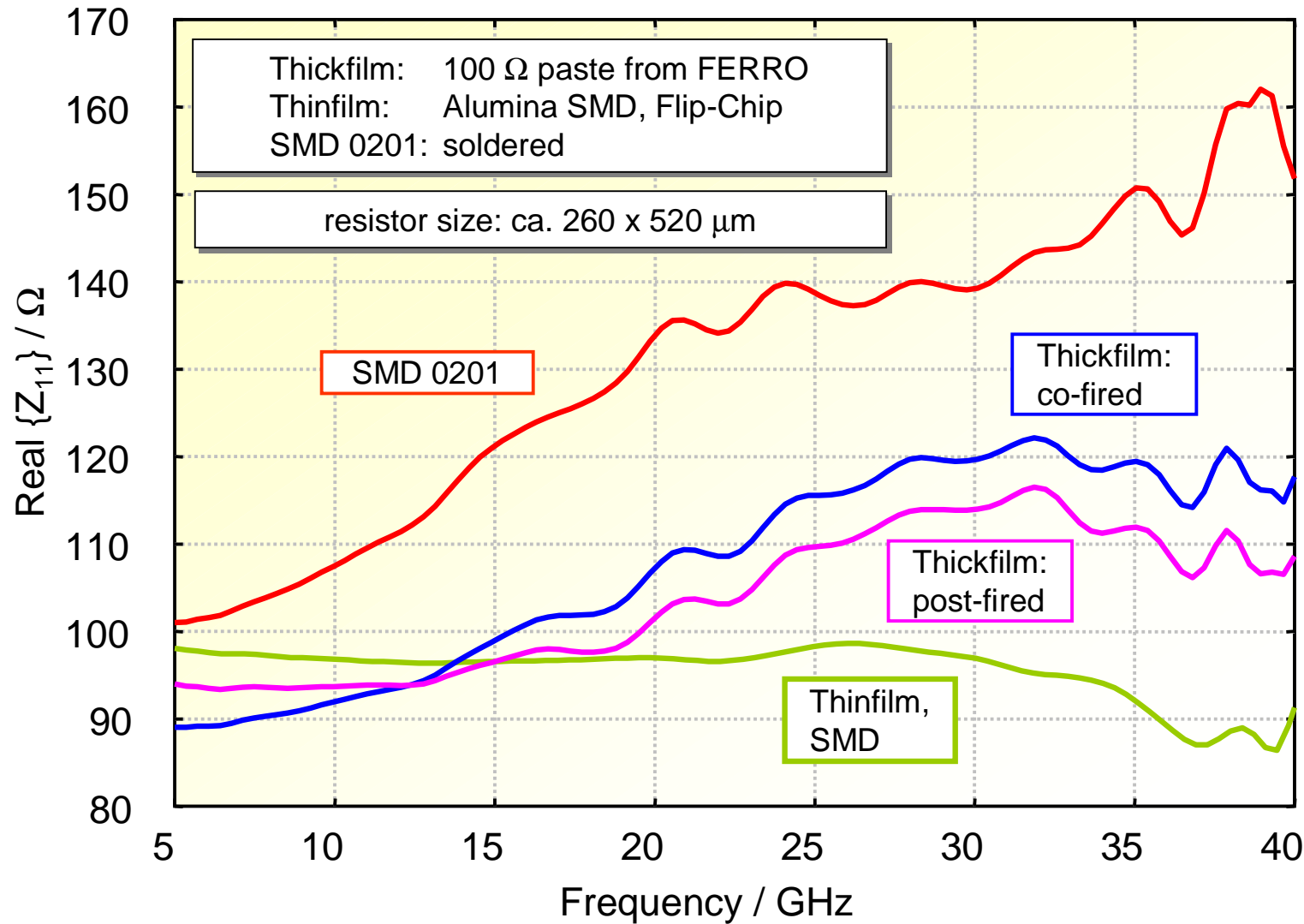


2x2 Patch Antenna

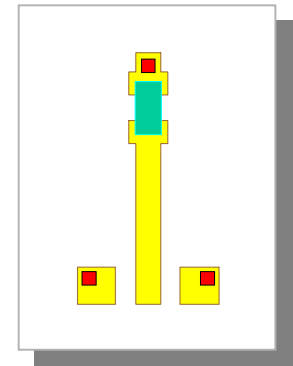


4x4 Patch Antenna

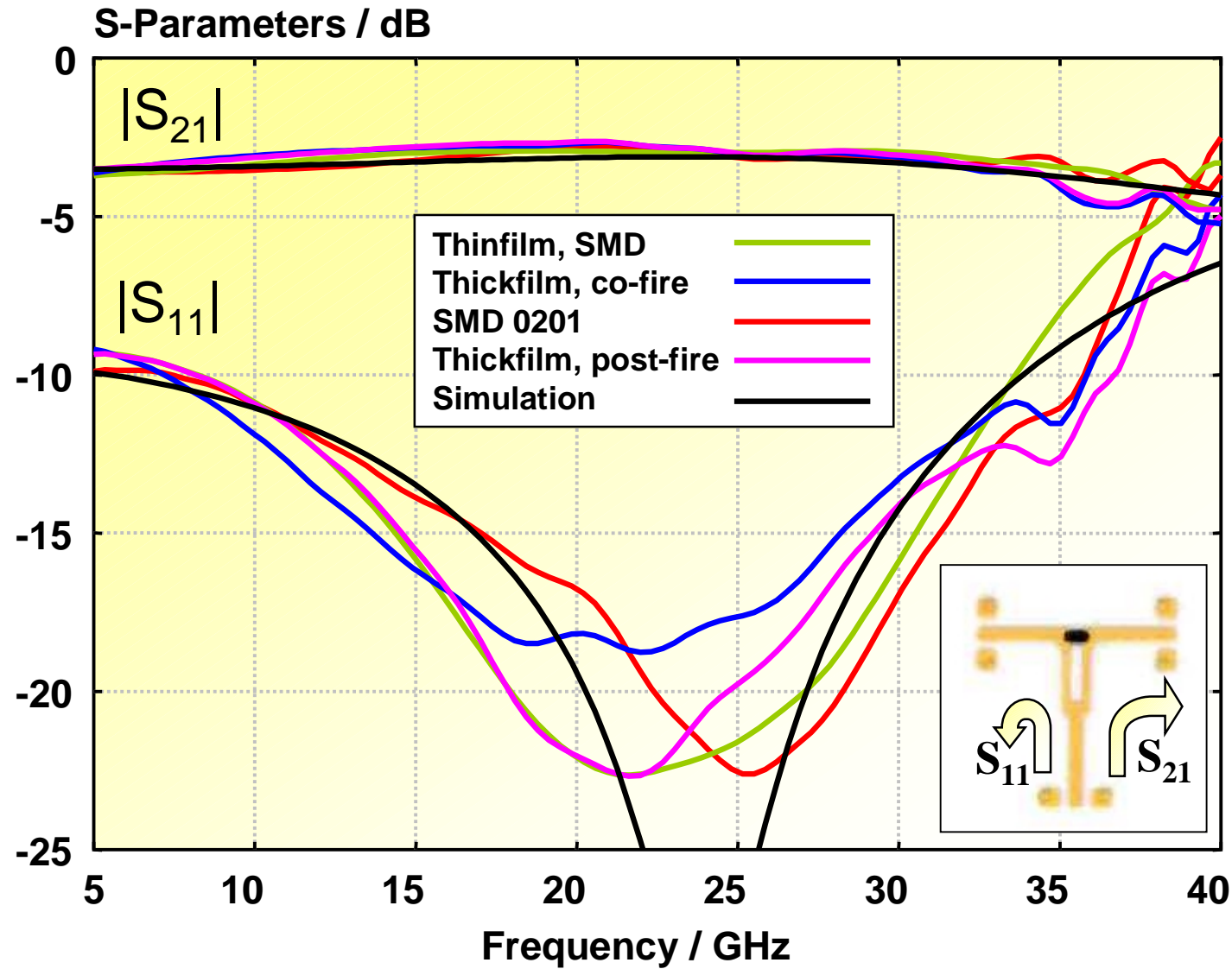
100Ω Resistor on LTCC



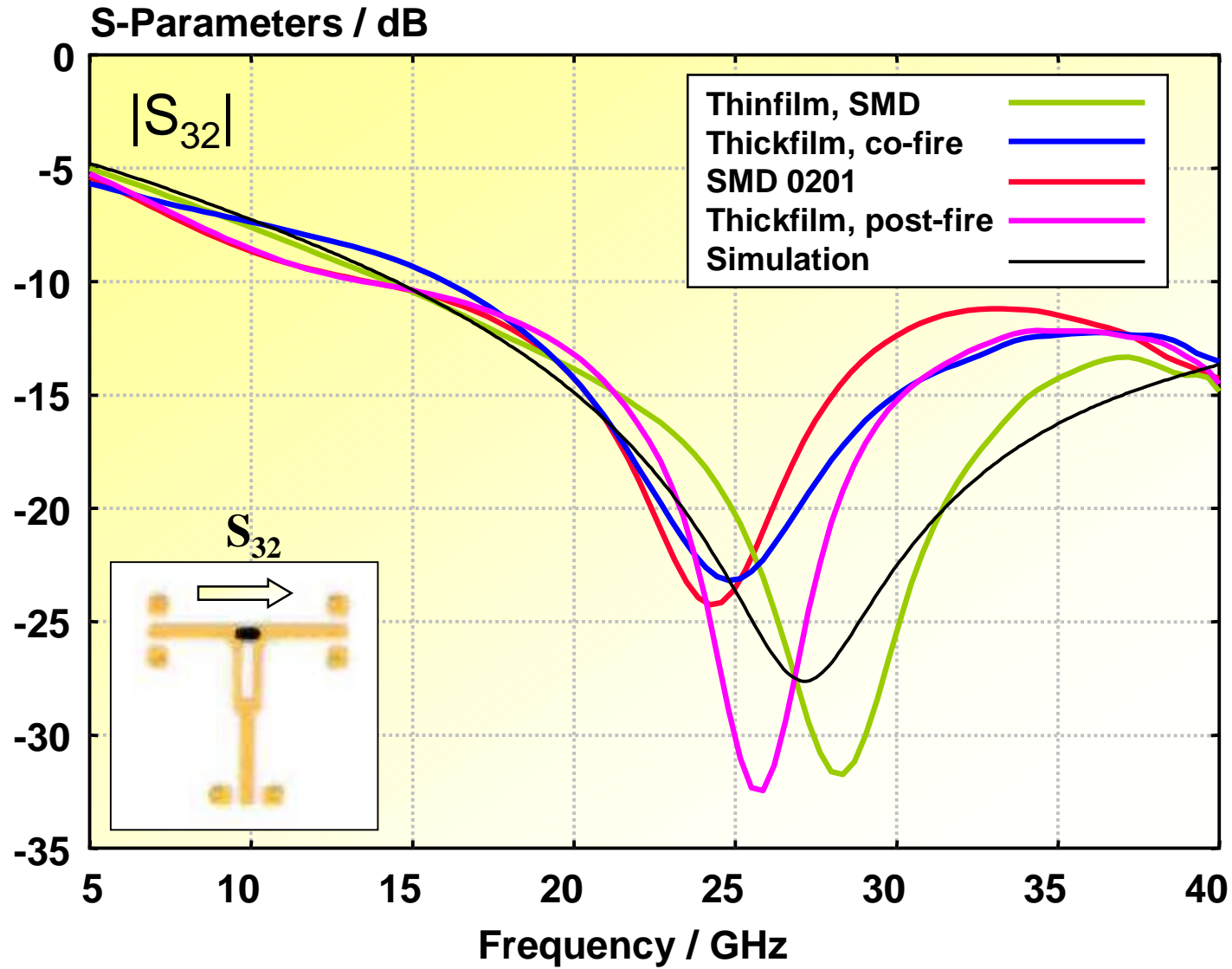
test structure:
1 x 100 Ω
with via



Wilkinson Divider on LTCC



Wilkinson Divider: Isolation



1:8 Divider LTCC vs. PTFE

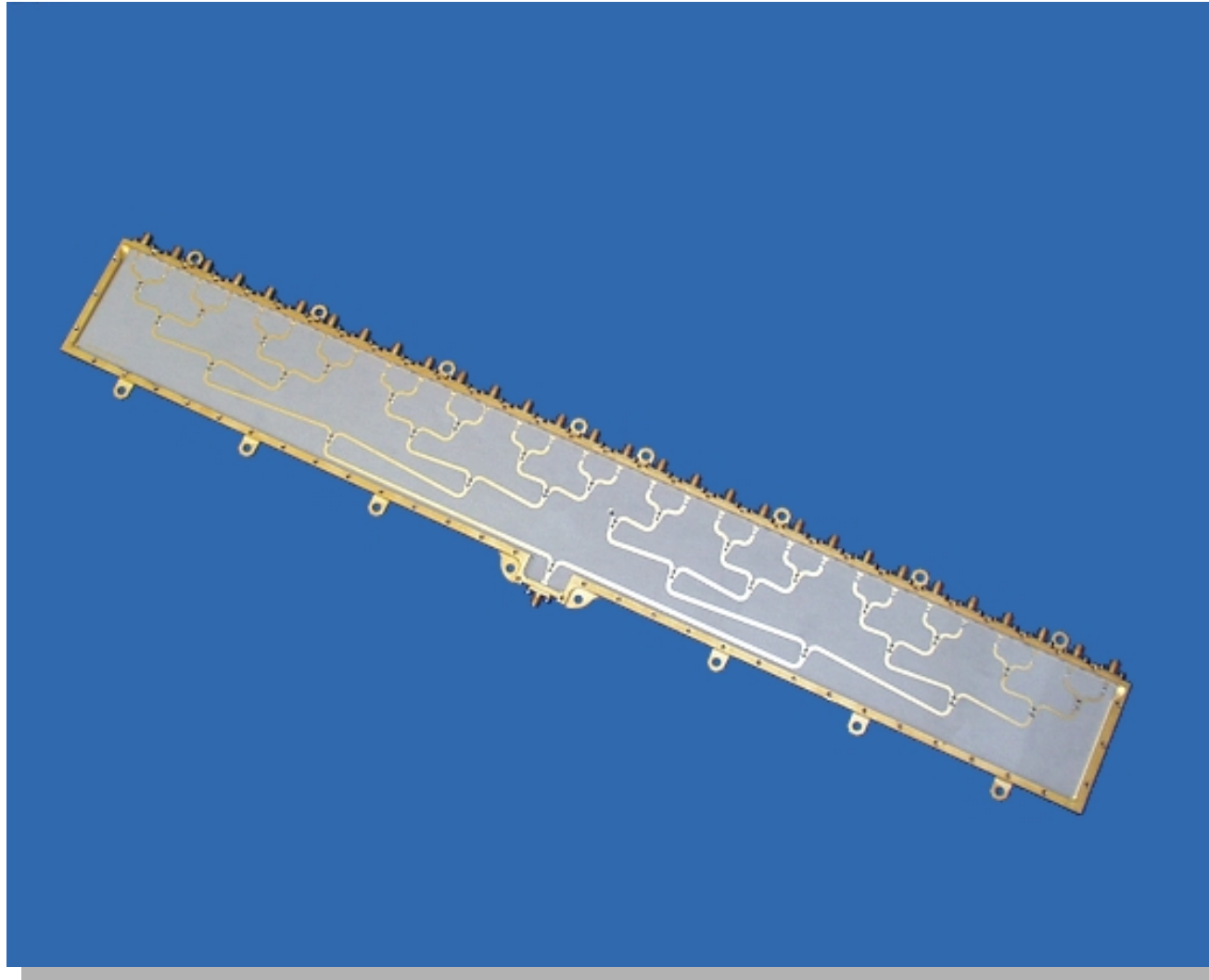
	LTCC: DuPont 951	PTFE Composite: RT/Duroid 6002
waveguide	triplate: thickfilm Au	Microstrip line: Cu
permittivity	7.8	2.94
sheet resistance of conductor	5 mΩ (Au) 3 mΩ (Ag)	1.1 mΩ (½ oz. Cu)
50Ω-line width	425 μm	1950 μm
line loss factor	0.24 dB/cm	0.038 dB/cm
line length	46 mm	144 mm
total line losses	1.1 dB	0.55 dB
outer dimensions ⁺ [mm]	58 x 24 x 0.7	176 x 67 x 0.8* 200x 90 x 14**
weight ⁺	3.2 g	≈ 215 g
TCE [ppm/K]	5.8	16* 24**

⁺ no connectors
* PTFE substrate
** Al housing

Comparison of 1:8-divider networks in LTCC and PTFE technology for 10GHz



1:30 Divider on PTFE



Length
650 mm
25,6"

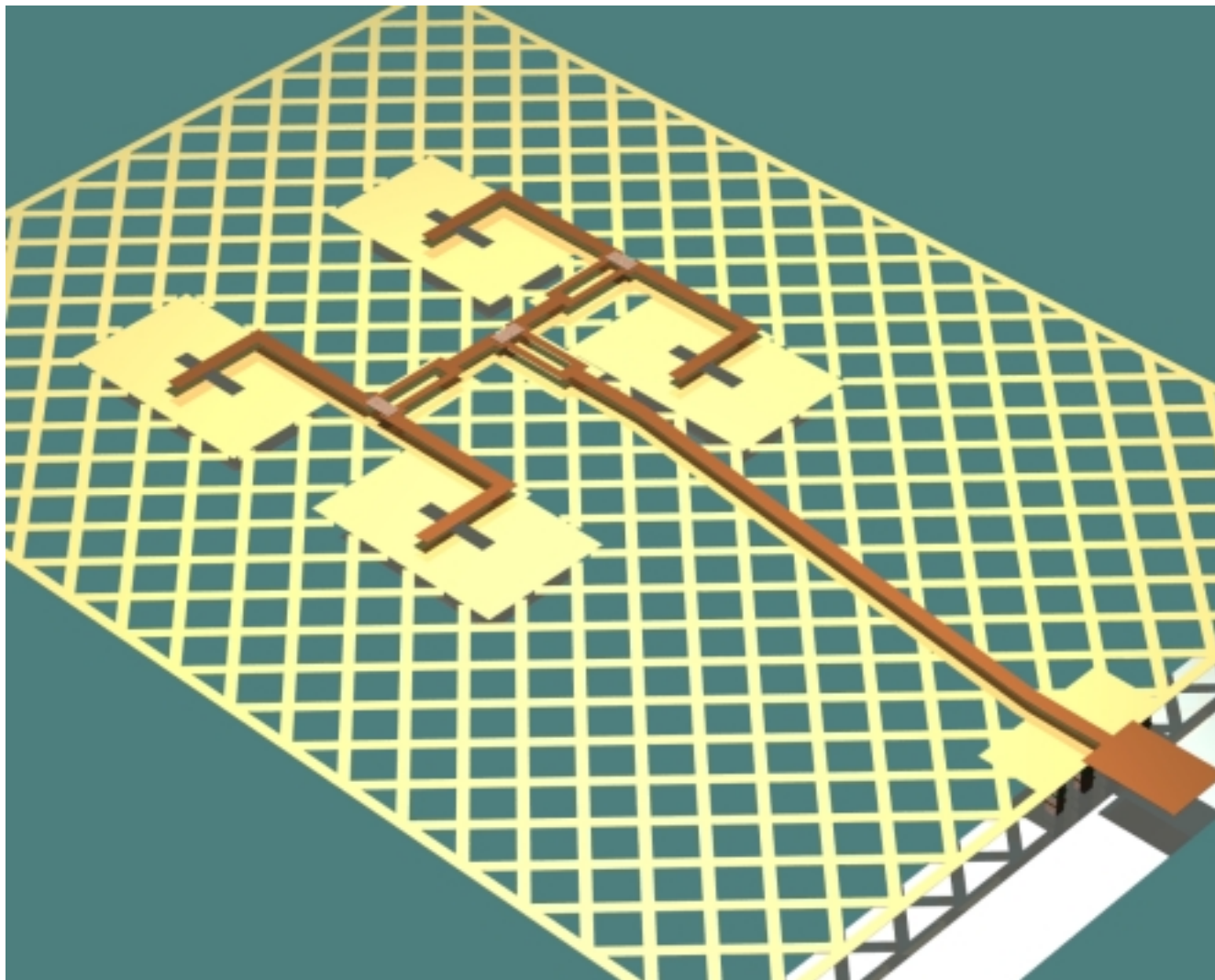
Patch Antenna

- 2x2 and 4x4 patch antenna with
- different feeding networks
 - T power divider
 - Wilkinson power divider with
 - thick film resistors
 - thin film resistors
 - SMD resistors
- measured gain: 14.5 dBi (4x4 patches)
8.2 dBi (2x2 patches)
- measured matching about 15 dB
- measured efficiency about 65 %

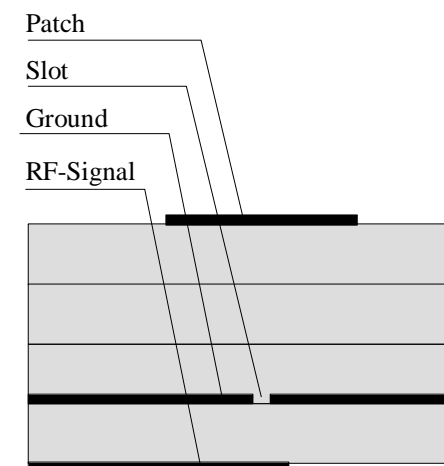
**ISM-Band:
24.125 GHz**



2x2 Patch Antenna

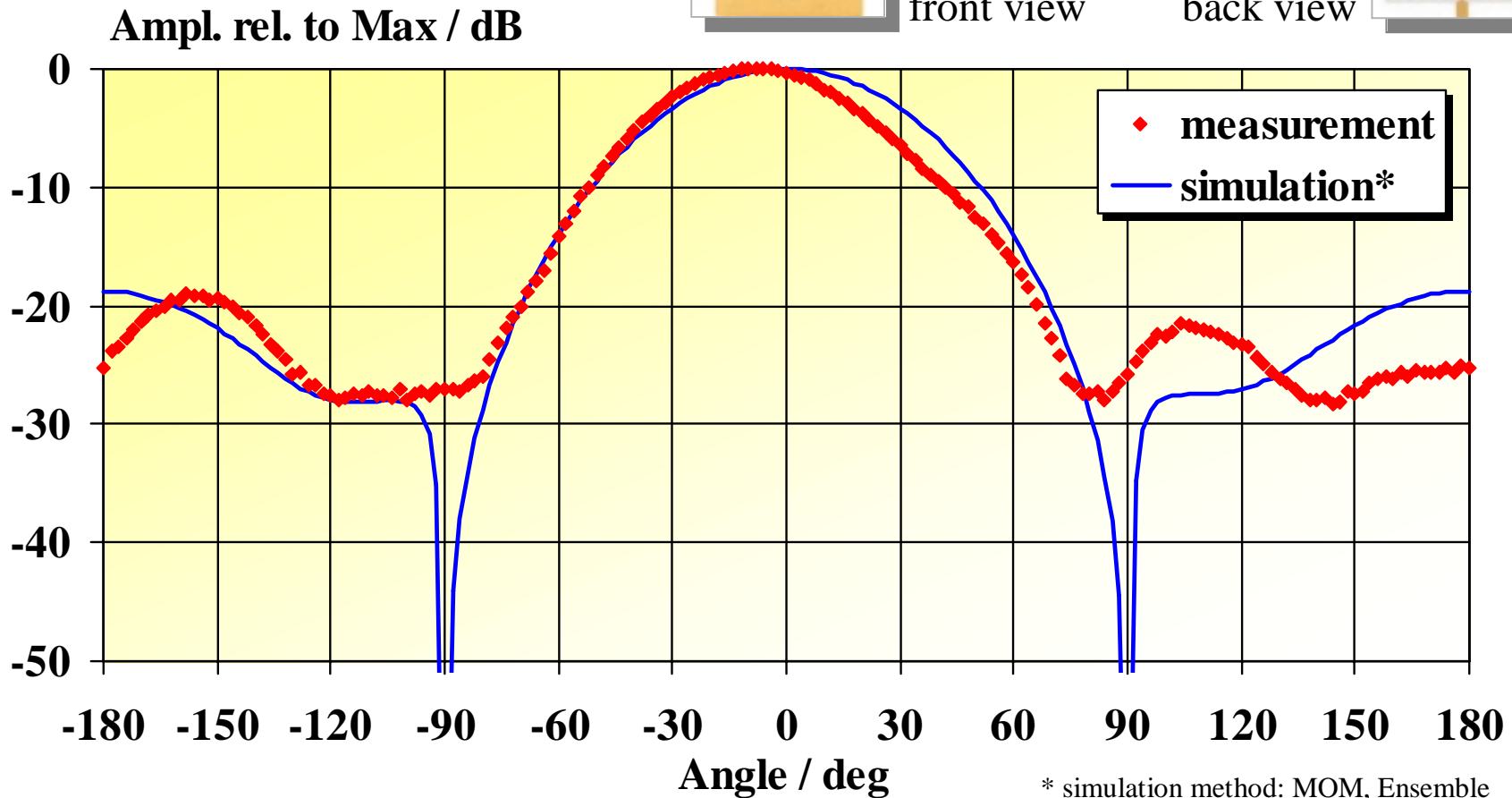
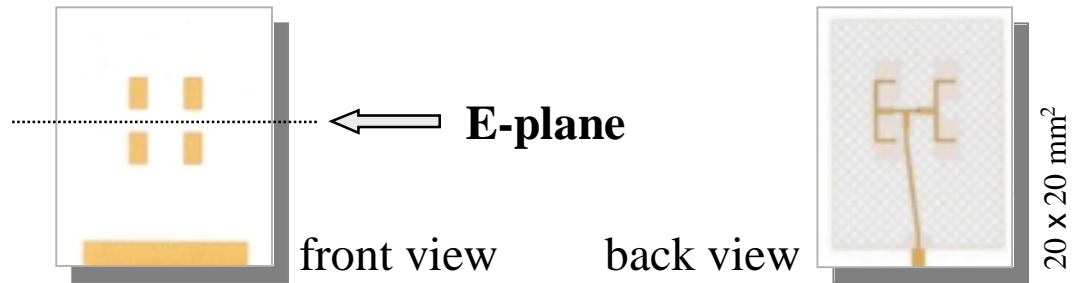


- 2 x 2 Patches
- aperture coupling
- microstriplines
- ground mesh
- Wilkinson-dividers



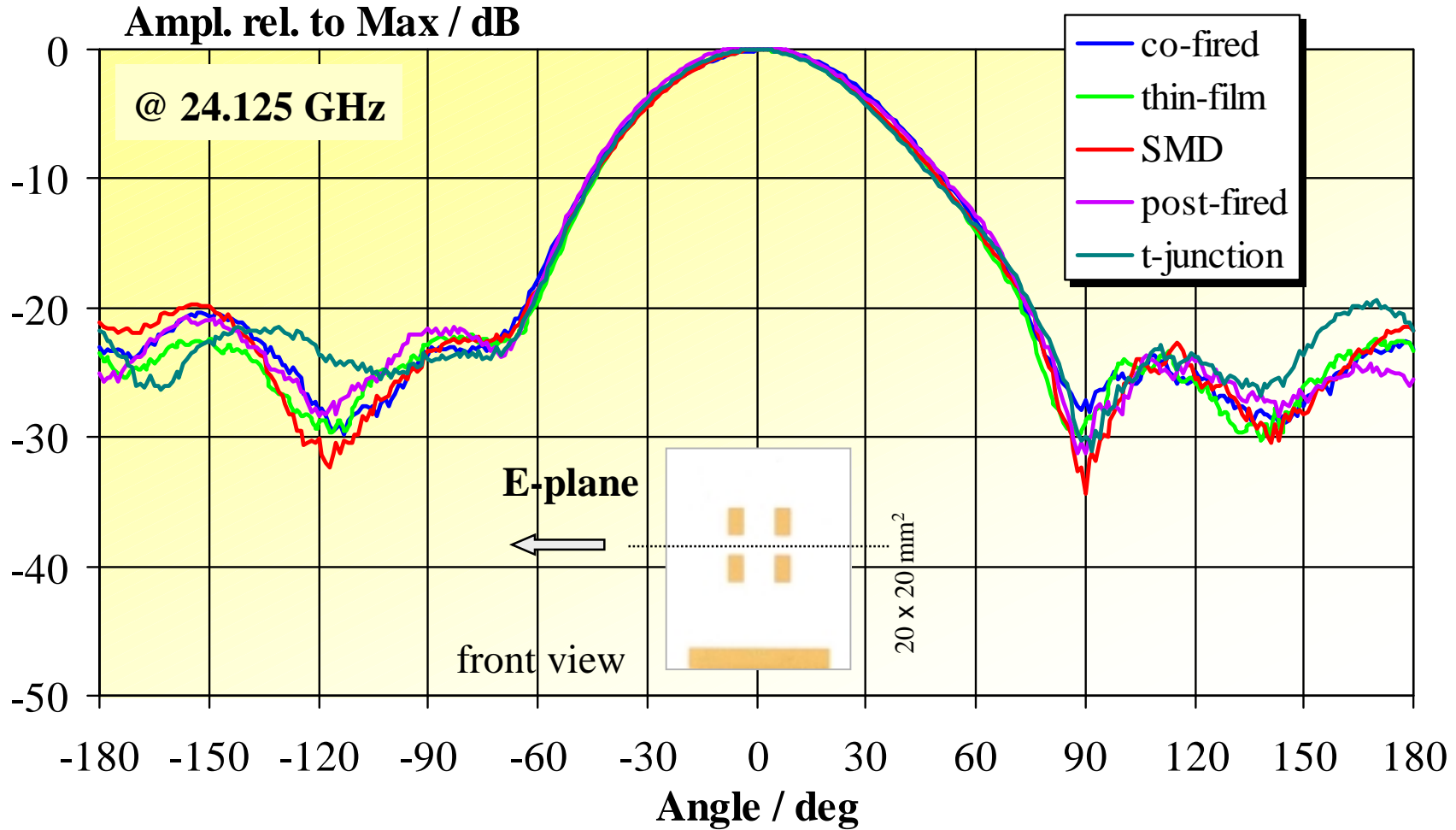
2x2 Patches, E-Plane

with T-Divider
@ 24.125 GHz



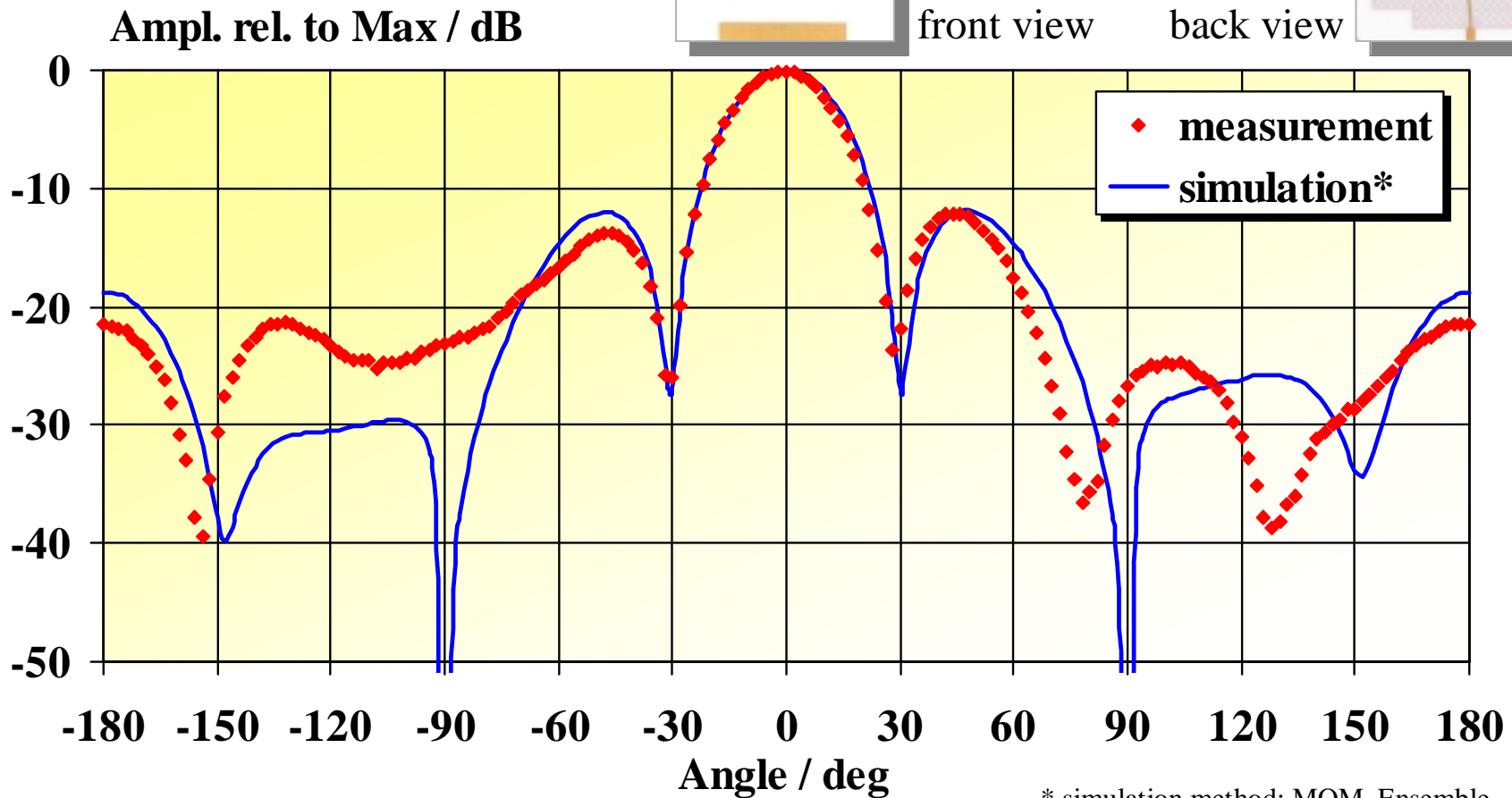
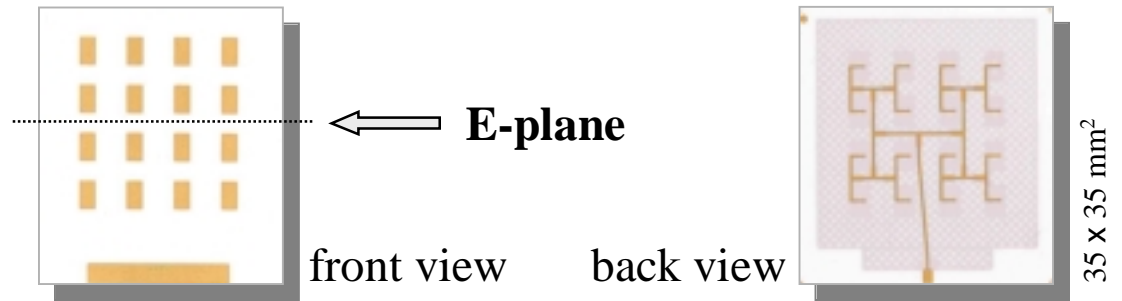
* simulation method: MOM, Ensemble

2x2 Patches, E-Plane



4x4 Patches, E-Plane

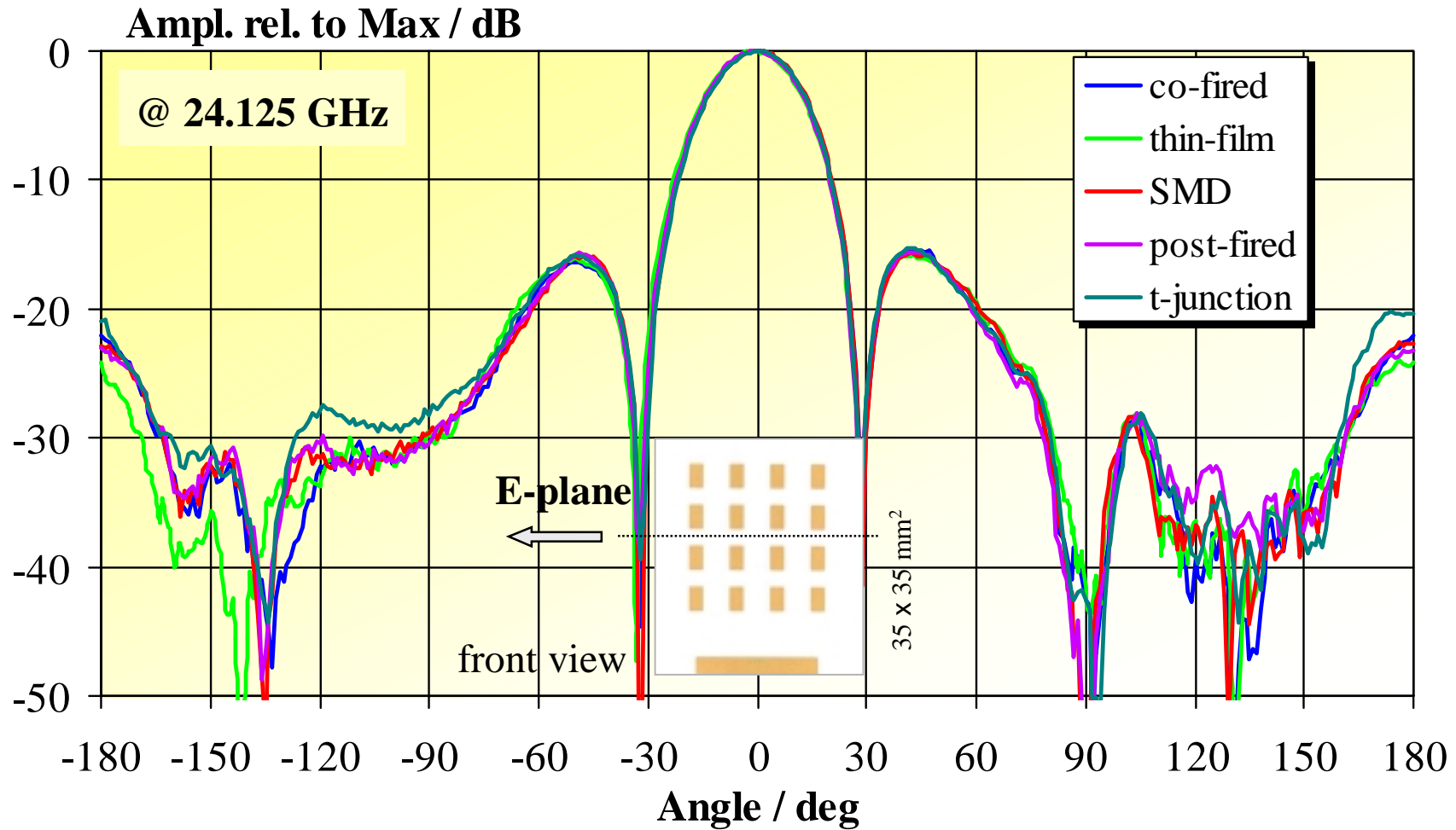
with T-Divider
@ 24.125 GHz



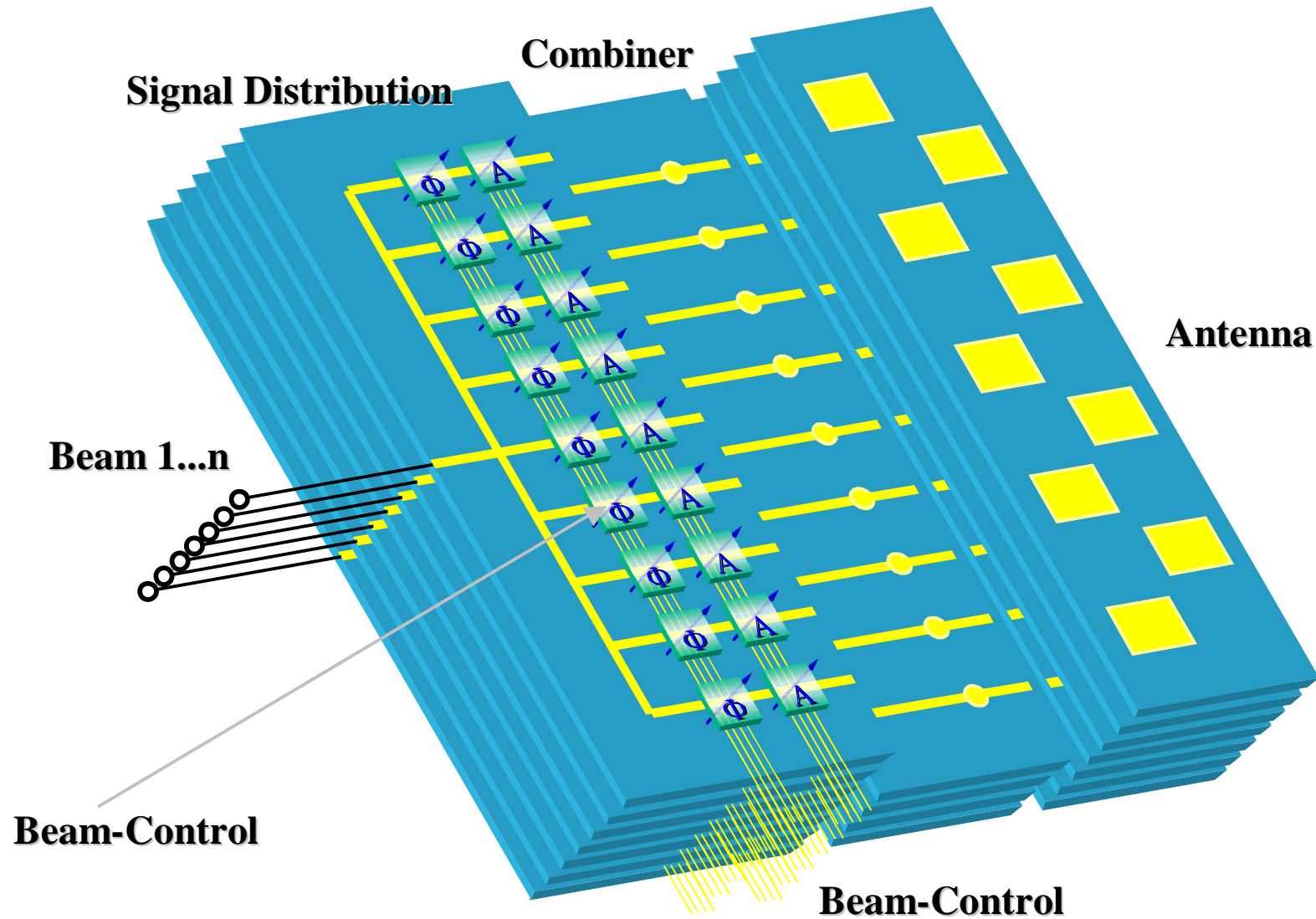
* simulation method: MOM, Ensemble



4x4 Patches, E- Plane



System Integration on LTCC





Summary

Thickfilm resistors and conductors can be used
in microwave feeding networks

High degree of integration

Economic

<http://www.ltcc.de>

