A NOVEL PLANAR TRAVELING WAVE ANTENNA WITH OMNIDIRECTIONAL RADIATION CHARACTERISTICS

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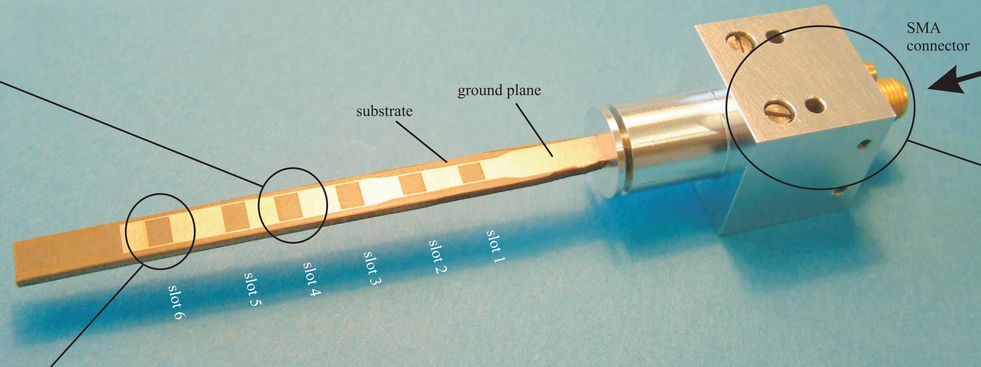
Point-to-Multipoint Antenna

- design frequency 24 GHz
- setup can also be used to design antennas for frequencies up to 60 GHz and more
- excellent omnidirectional azimuth coverage
- narrow beam width in elevation
- potentially low cost
- vertical polarization

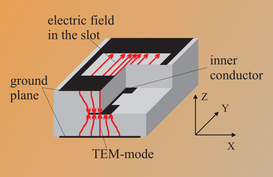
Antenna Design

- triplate waveguide with fundamental TEM-mode
- symmetrical setup to minimize excitation of parallel-plate-modes
- symmetrical setup to guarantee symmetrical radiation pattern
- radiation through slots in upper and lower ground planes
- simple tube radome

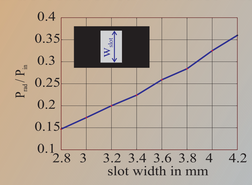


Single Radiating Element

- symmetric slot in upper and lower ground plane
- matching structure with inner conductor to reduce reflections
- radiation-transmission-ratio can be controlled with slot width



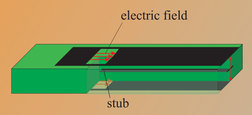
Structure of a single slot pair

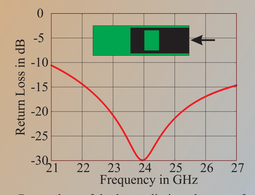


Radiation efficiency of a matched single slot pair over slot width (ε,=2.33, h=0.79 mm, w_{metal}=w_{slot}+200µm, w_{inner}=0.5 mm, l_{slot}=3 mm)

Terminating Radiating Element (100%-Radiator)

- center conductor stub
- matching only with stub length
- good bandwidth

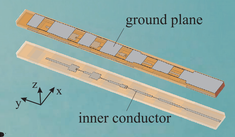


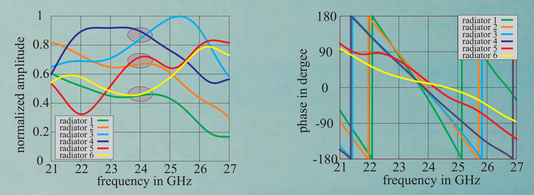


Return loss of the last radiating element of the antenna array over the frequency.

Radiation Pattern

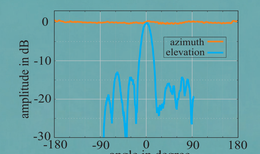
- side lobes lower than -13 dB @ 24 GHz
- 16.5° 3dB-beam-width in elevation
- less than 1 dB rippel in the azimut (!)
- 6°/GHz beam panning
- crosspolarization level better than -20 dB



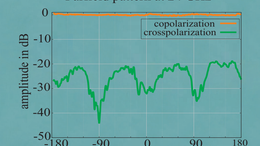


Amplitude of the six-element-array (amplitude taper with max. at center slots)

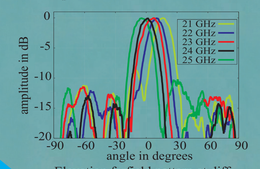
Phase of the six-element-array (slots nearly in phase at 24 GHz)



Farfield pattern at 24 GHz

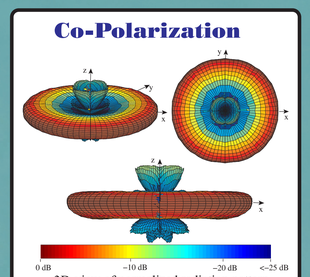


Crosspolarization in azimut at 24GHz



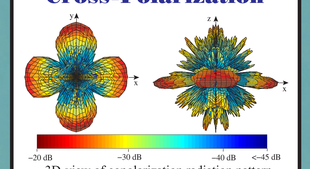
Elevation farfield pattern at diff. frequencies

Co-Polarization



3D-view of normalized radiation pattern

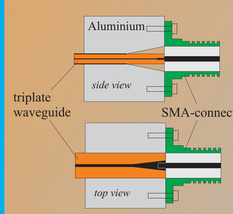
Cross-Polarization

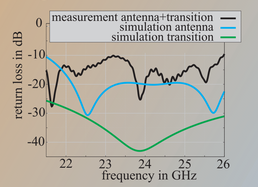


3D-view of copolarization radiation pattern normalized to maximum of the copolarization.

Coaxial-to-Triplate-Transition

- standard sma-coaxial-connector
- simple contactless mounting possible (capacitive coupling)
- improved return loss with galvanic contact

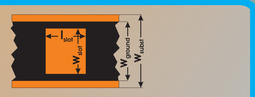


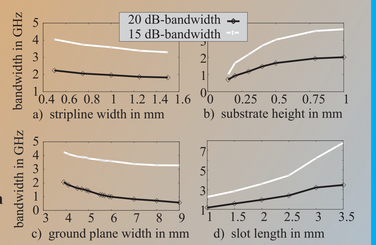


Measured return loss of the antenna-transition-combination and simulated results for the return loss of the antenna and the coaxial-triplate-transition.

Effects of Geometry on Bandwidth (return loss)

- width of the center conductor has low effect on bandwidth
- increasing bandwidth with increasing substrate height
- smaller ground plane width increases bandwidth
- significant increase of bandwidth with inreasing slot length





Effects of Geometry on Radiation Pattern

low ripple in azimuth for

- small ground plane width w_{ground}
- small substrate height h_{subst}
- small substrate width w_{subst}