MILLIMETER-WAVE FOLDED LENS ANTENNAS

Ralf Leberer, Ezio Perrone and Wolfgang Menzel

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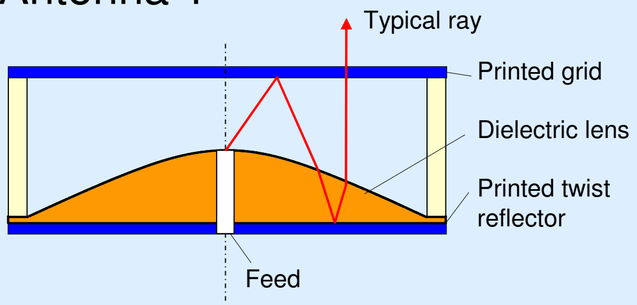
Part 1

Antenna 1



Folded lens antennas:

Folding and multiple use of the lens:

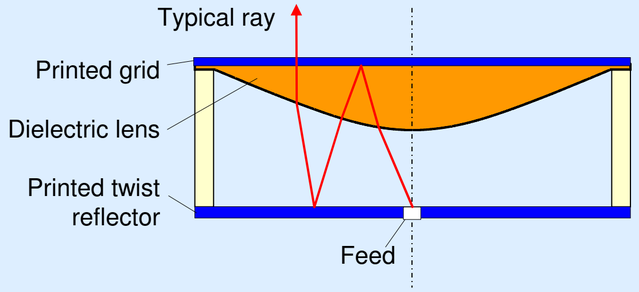
→ very compact arrangements

→ high gain, especially at mm-wave frequencies

→ potentially low loss

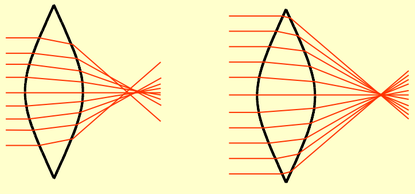
→ potentially low cost

Antenna 2

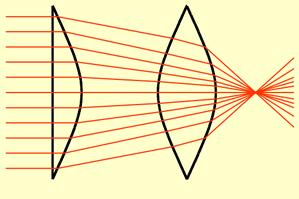


Design of the lens antennas

- Selection of a preliminary lens contour
- Approximation of the contour by a polynomial
- Ray tracing (unfolding the arrangement) and optimization of polynomial
- Grooves for surface matching



Rays for approximate (left) and optimized (right) lens contour for antenna 1



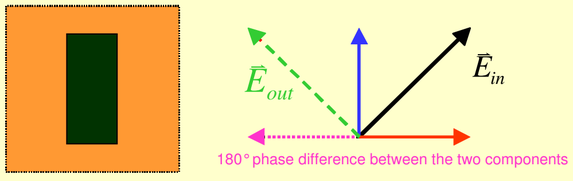
Rays for optimized lens contour for antenna 2

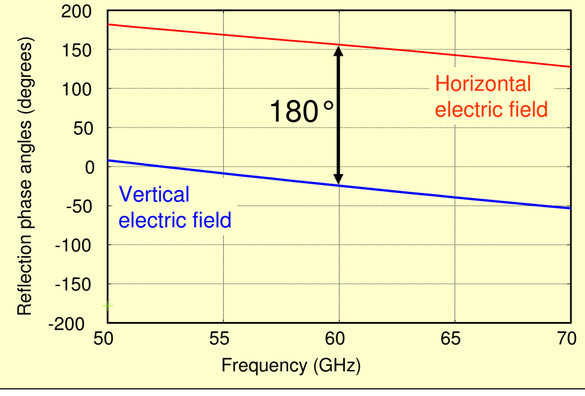
Aperture diameter of antennas investigated here: 100 mm

Design of the twist polarizer

a) Printed periodic patch array

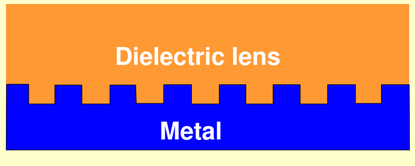
Selection of substrate and patch dimensions for optimal bandwidth. The design is done using a spectral domain method and Floquet's principle.





b) Metallized grooves at the antenna backside (antenna 1 only)

Grooves can be machined into the backside of the lens and electroplated, or the lens may even be fabricated by plastic injection molding
(then no microwave substrate is necessary)



(Design is done by a mode matching technique)

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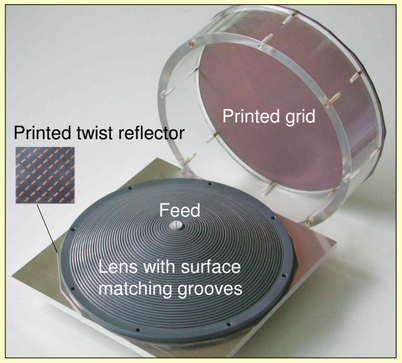
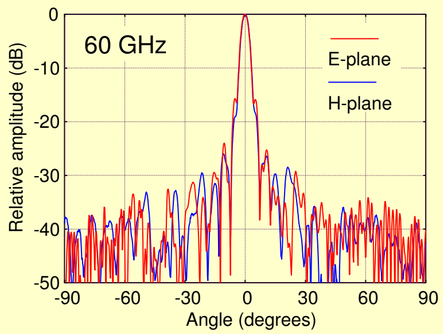
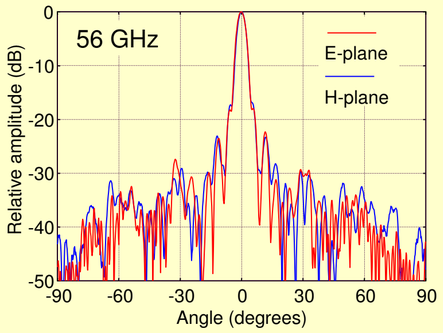
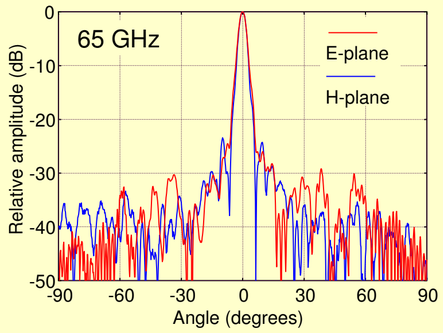
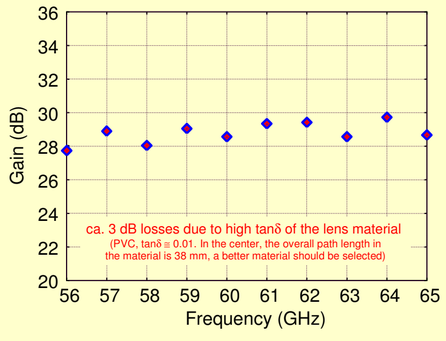
Antenna 1



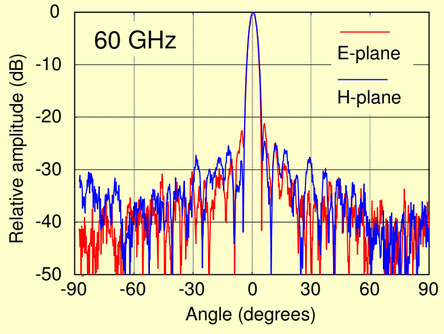


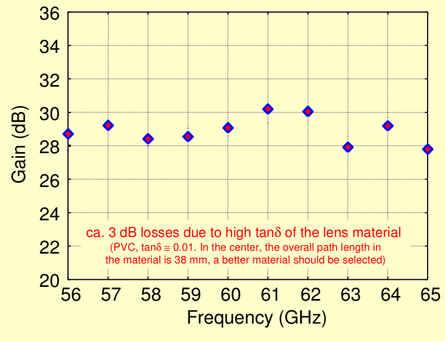






Antenna 1
with metal grooves





Antenna 2