Planar Arrays Covered by Metamaterial Surfaces for Micro-wave and Millimeter-wave Applications

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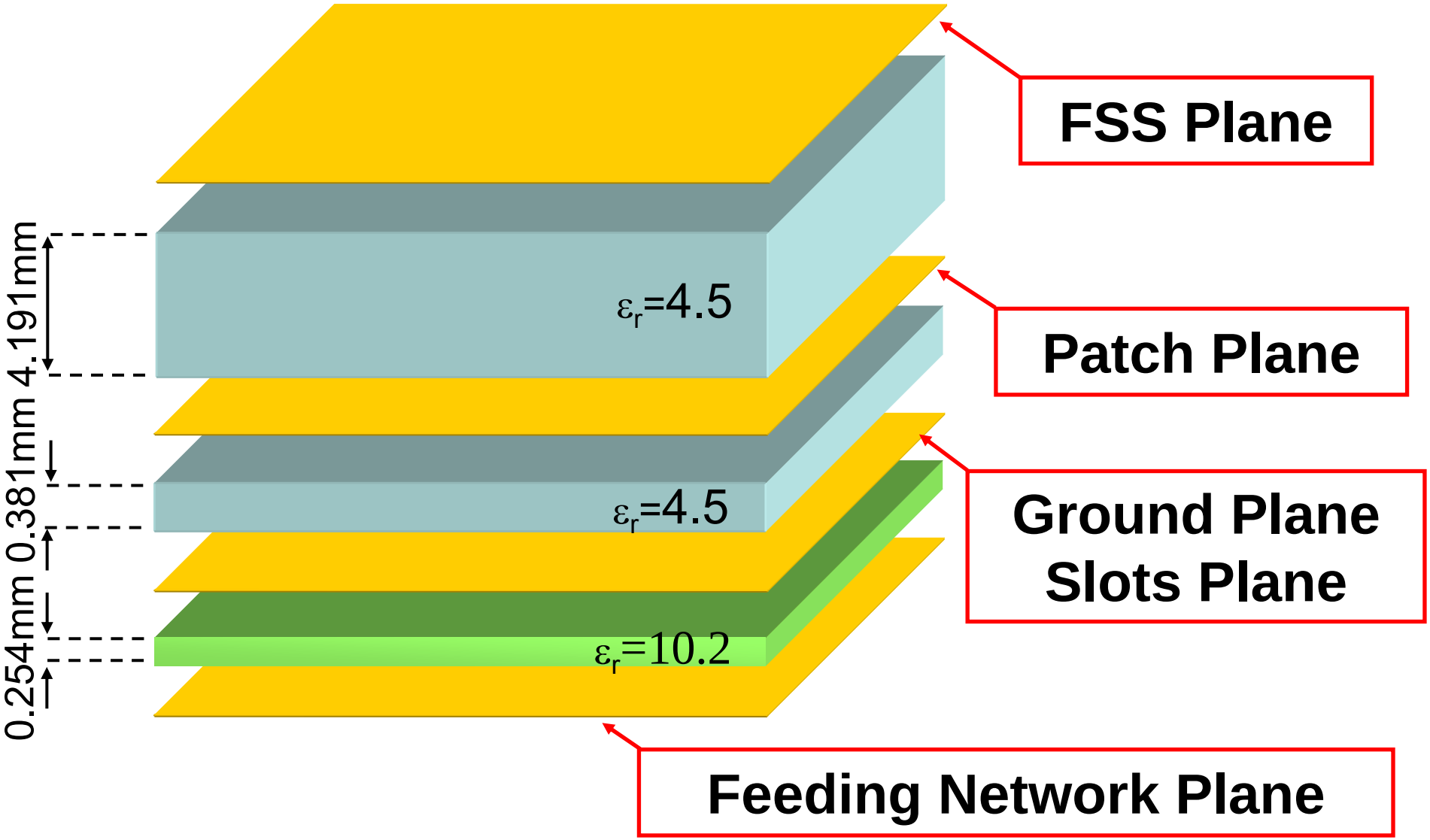
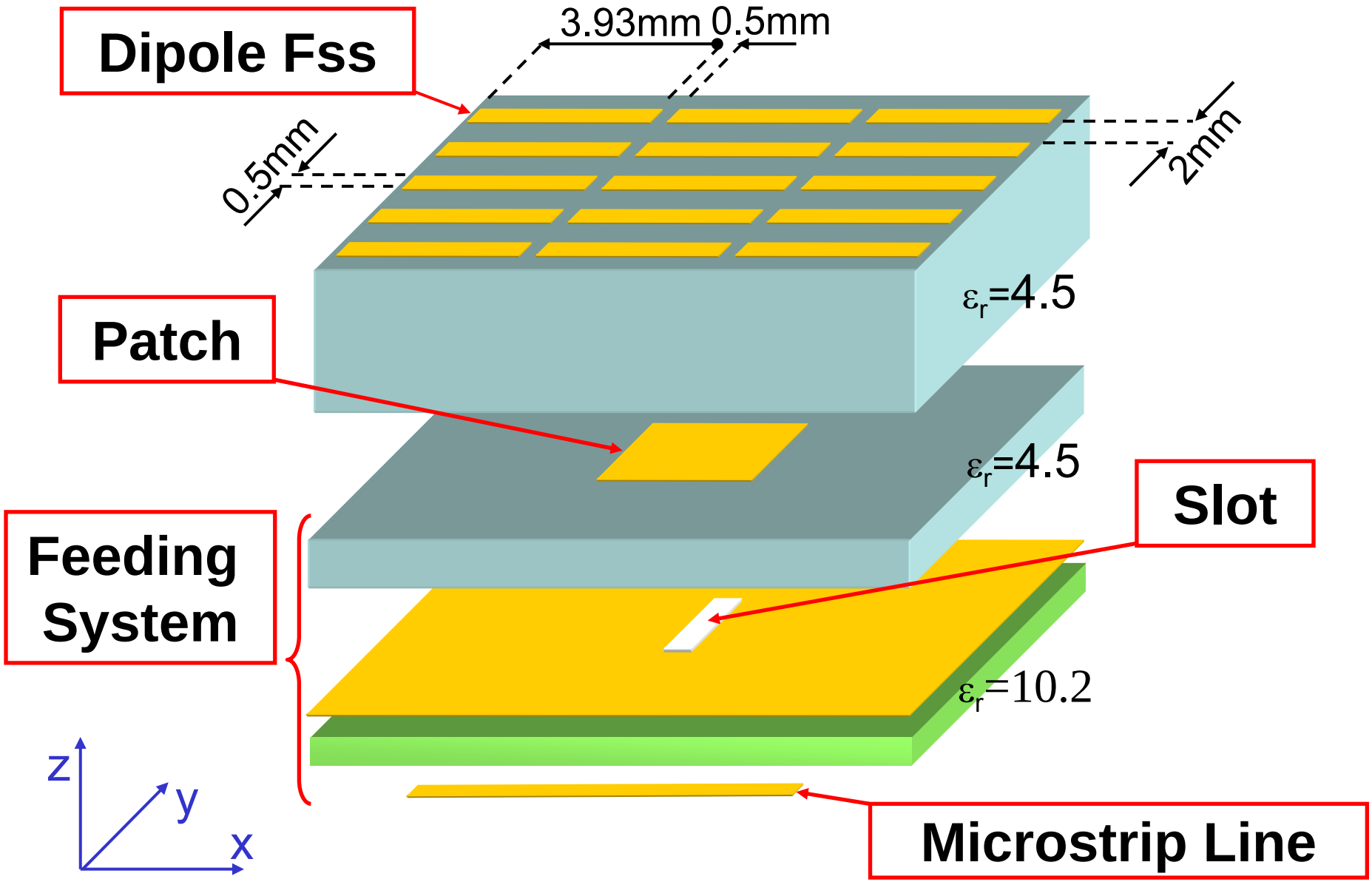
Geometry: Stackup



Geometry


Dipole Fss
3.93mm
0.5mm
0.5mm
2mm
Patch
ε_r=4.5
ε_r=4.5
Slot
Feeding System
ε_r=10.2
z
y
x
Microstrip Line

Motivation and Applications

- **Planar Printed Antenna:**
  - **Easy to fabricate**

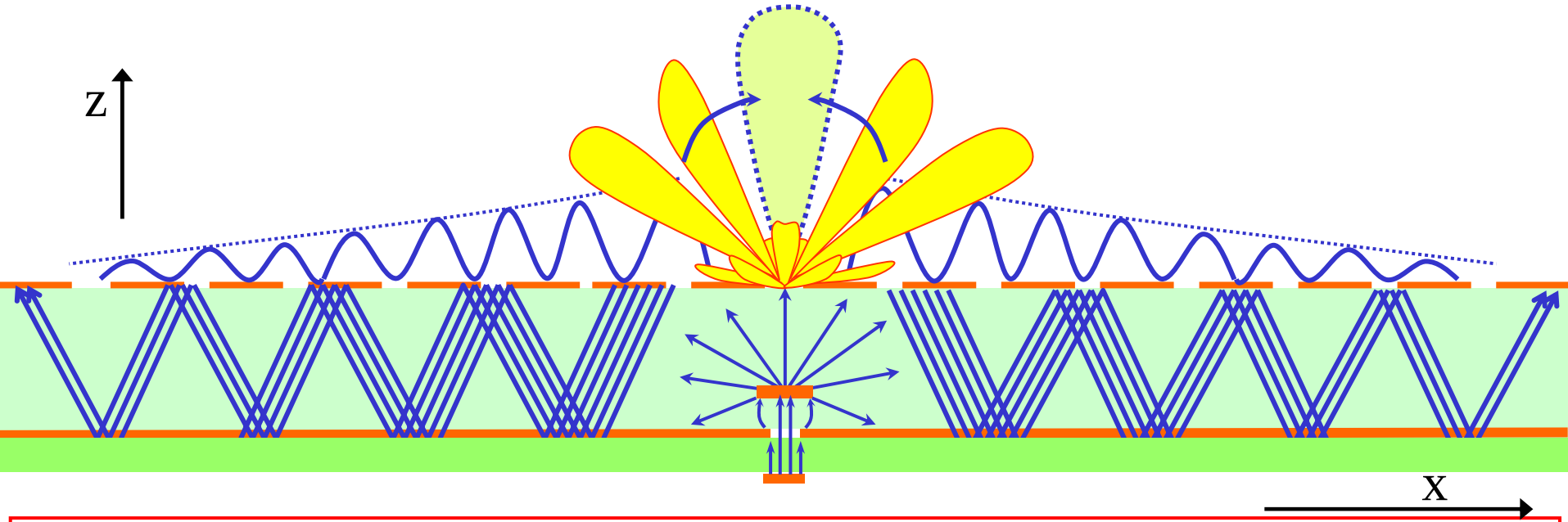
- **Leaky Wave Antenna:**
  - **High Gain Enhancement**
  - **Lens Behavior**

- **Frequency-Scanning Antenna**

- **Point-to-Point High Gain Antenna**

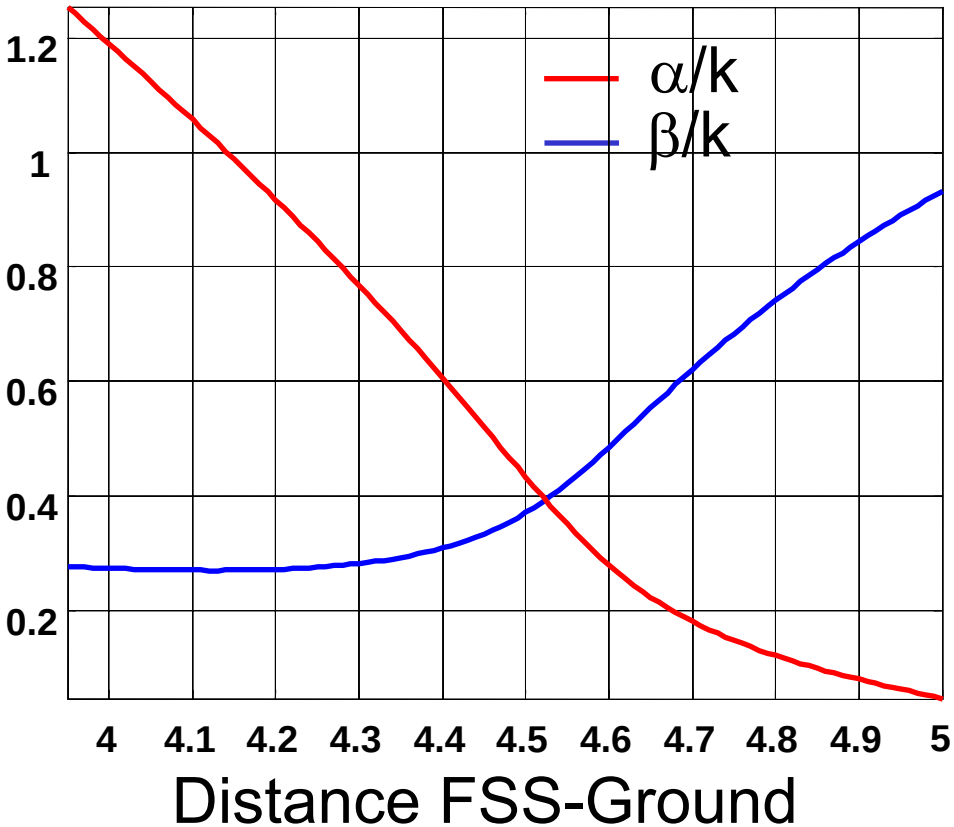
- **Wireless and Remote Sensing Applications**

Operation

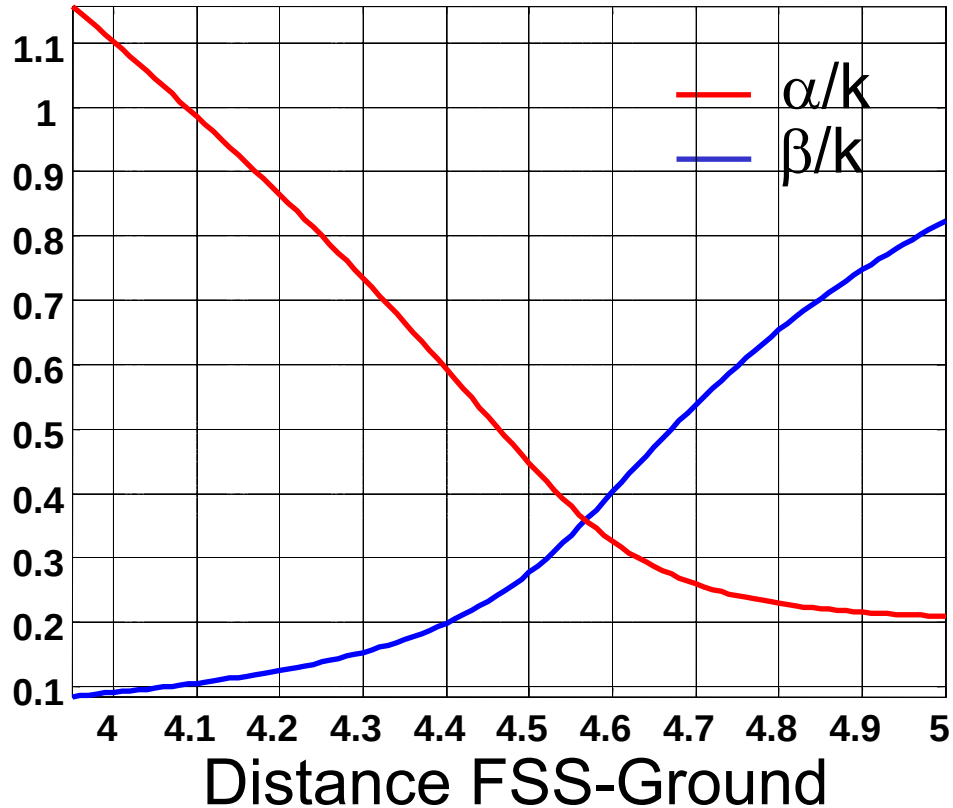


- **The FSS behaves as a Partially Reflecting Surface**
- **The FSS+Ground behave as Weakly Transparent Parallel-plate Waveguide**
- **The Sources excite a Cylindrical Weakly Attenuated Leaky Wave :** $k_t = \beta - j\alpha$

Operation

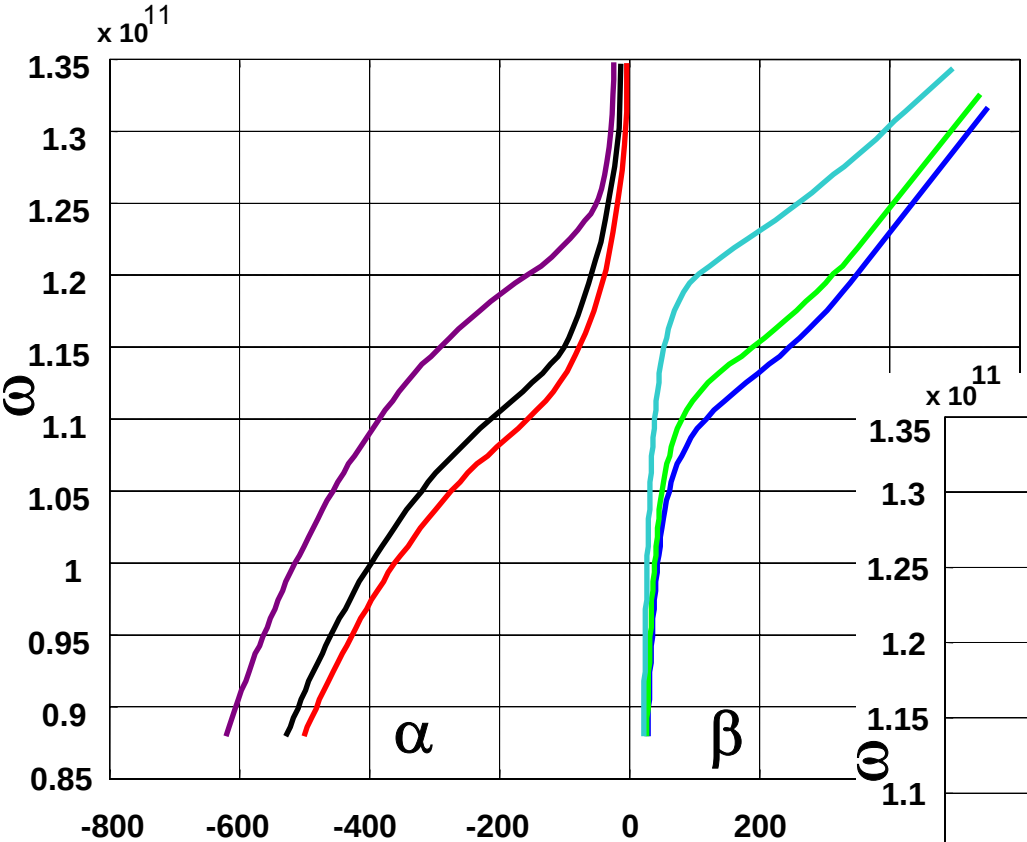


TE_z Leaky Mode



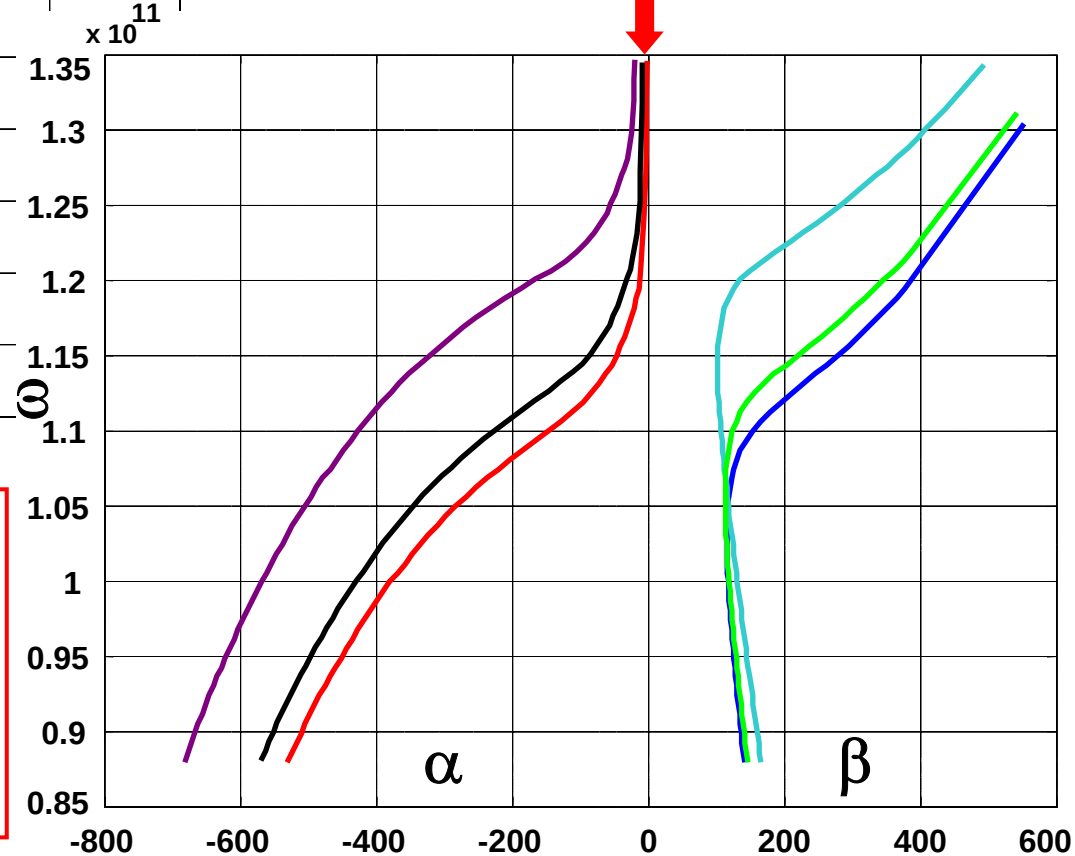
TM_z Leaky Mode

Dispersion Diagram



TM_z Leaky Mode

TE_z Leaky Mode

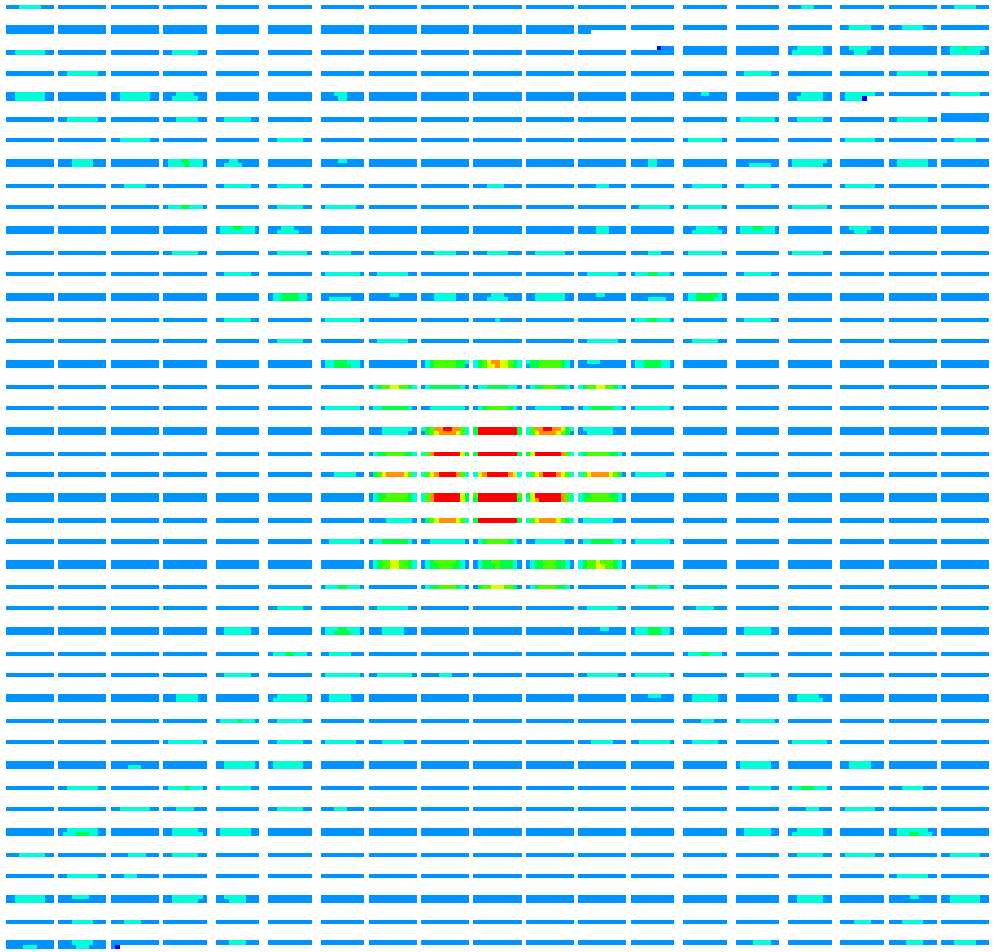


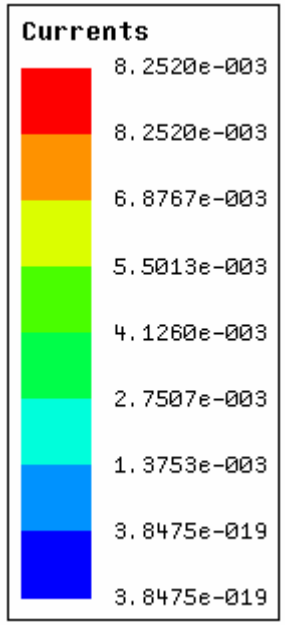
Distance FSS-Ground

- 4.191mm
- 4.562mm
- 4.69mm

Current Distribution

FSS Plane

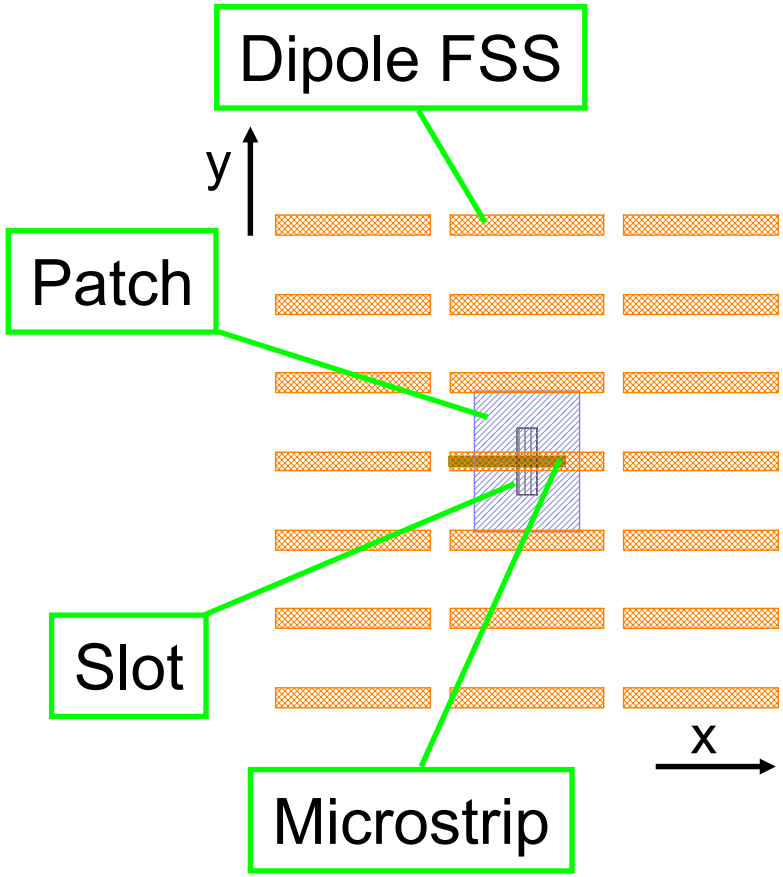




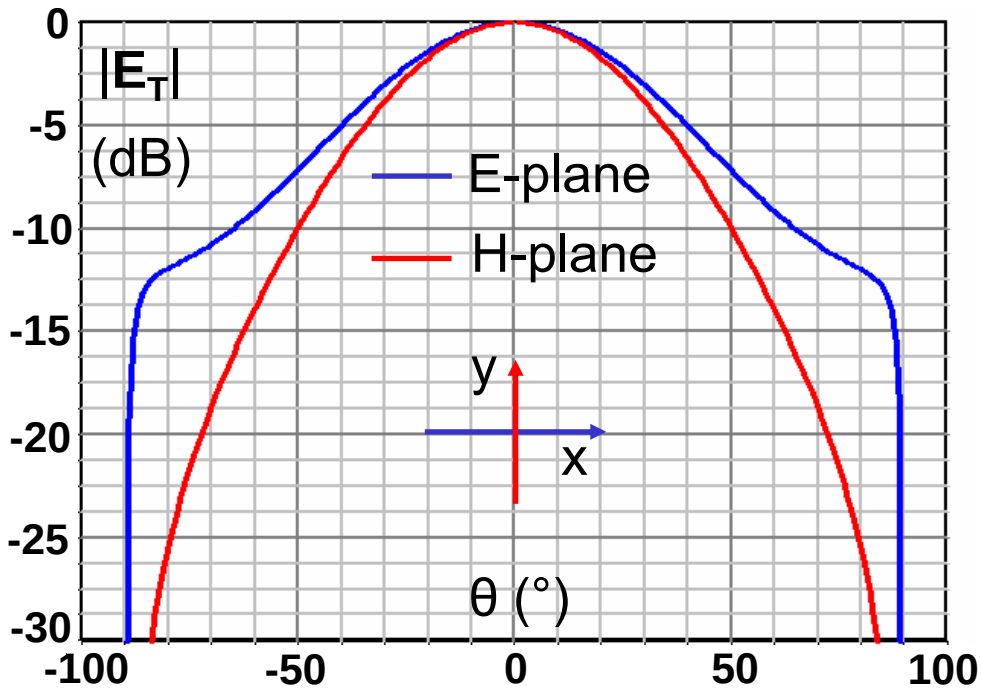
Only one patch is feeding the whole FSS

Simulation performed by Ansoft Designer version 2.0

Operation: Single Element



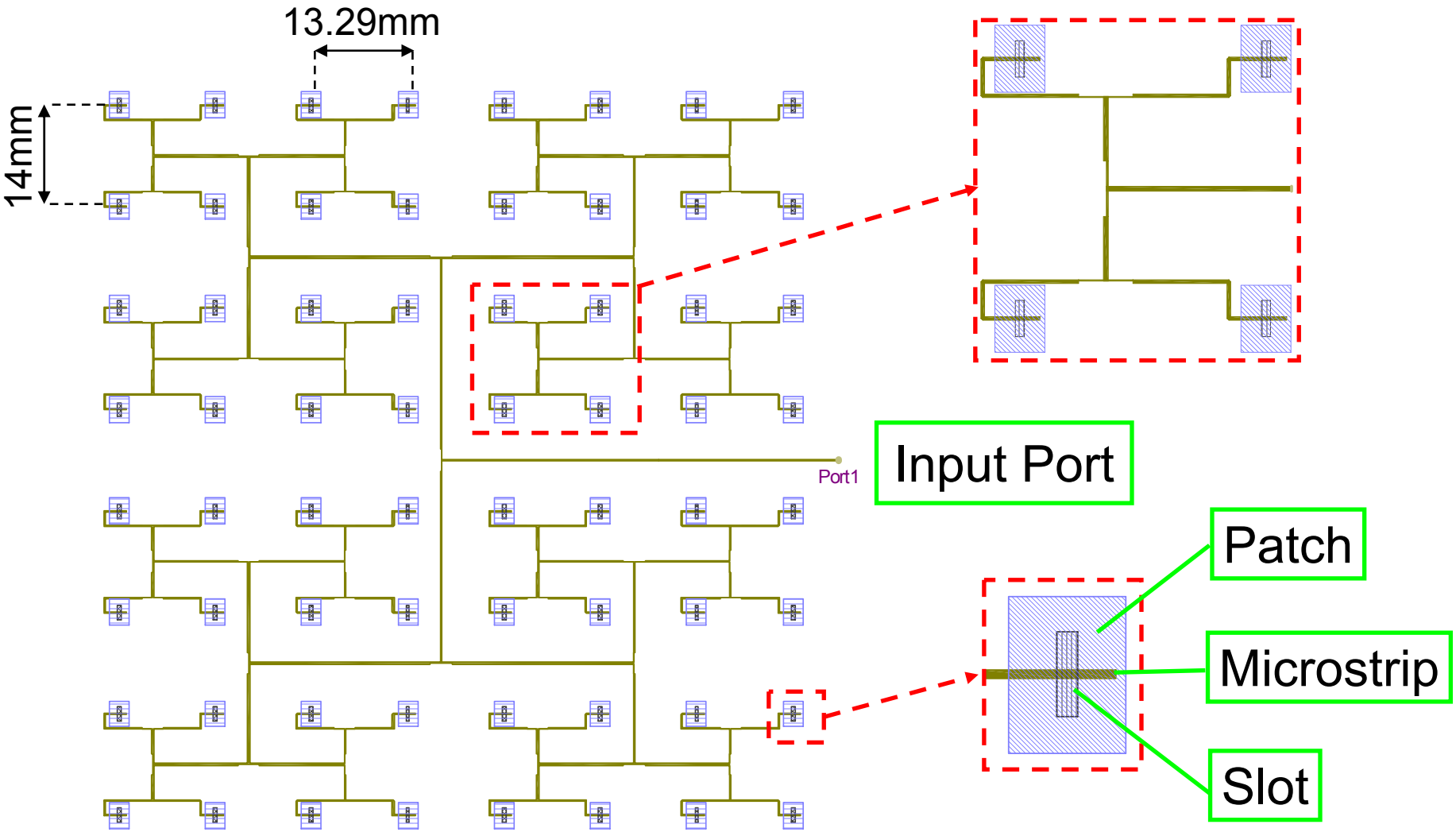
Far Field: Total Field



Linearly Polarized
Very Low Cross-Components

Simulation performed by
Ansoft Designer version 2.0

Array 8x8: Feeding System



Operating Frequency: F_0= 18 GHz

Antenna size: 106x110 mm

Return Loss

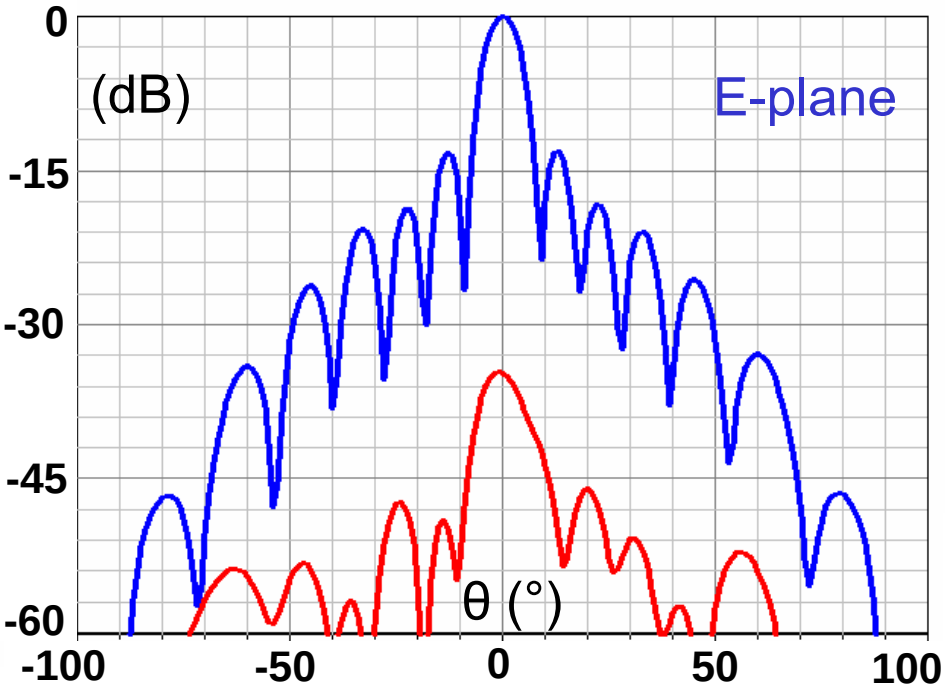
Operating Frequency: F_0= 18 GHz

Bandwidth: B_{-15dB}= 600 MHz

Input impedance : Z ≈ 50 Ohm

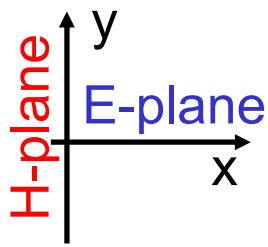
Simulation performed by Ansoft Designer version 2.0

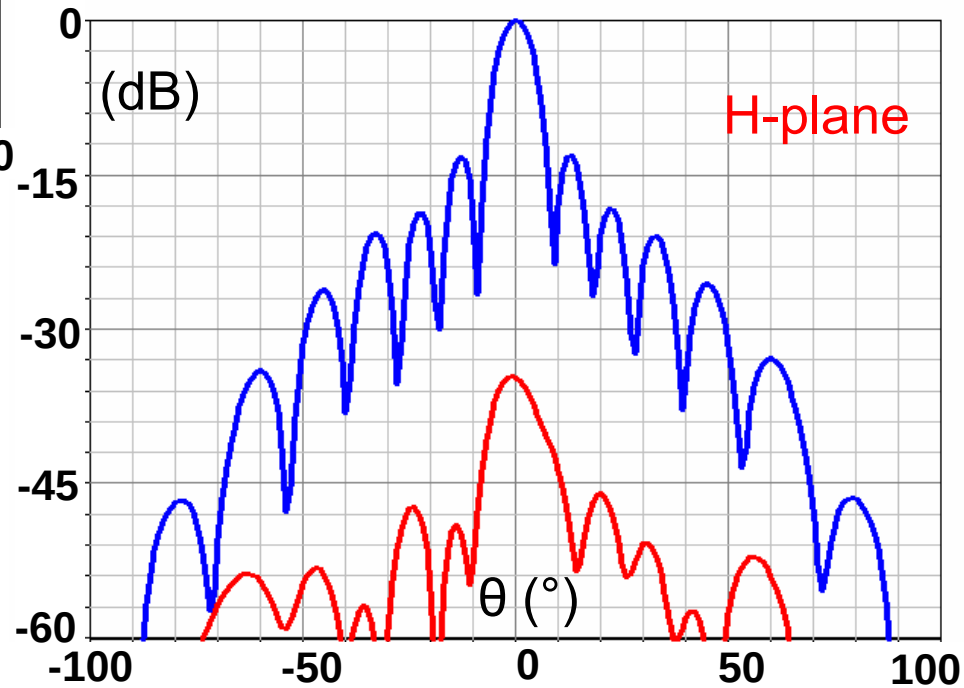
Far Field



Far Field

|Ex| |Ey|

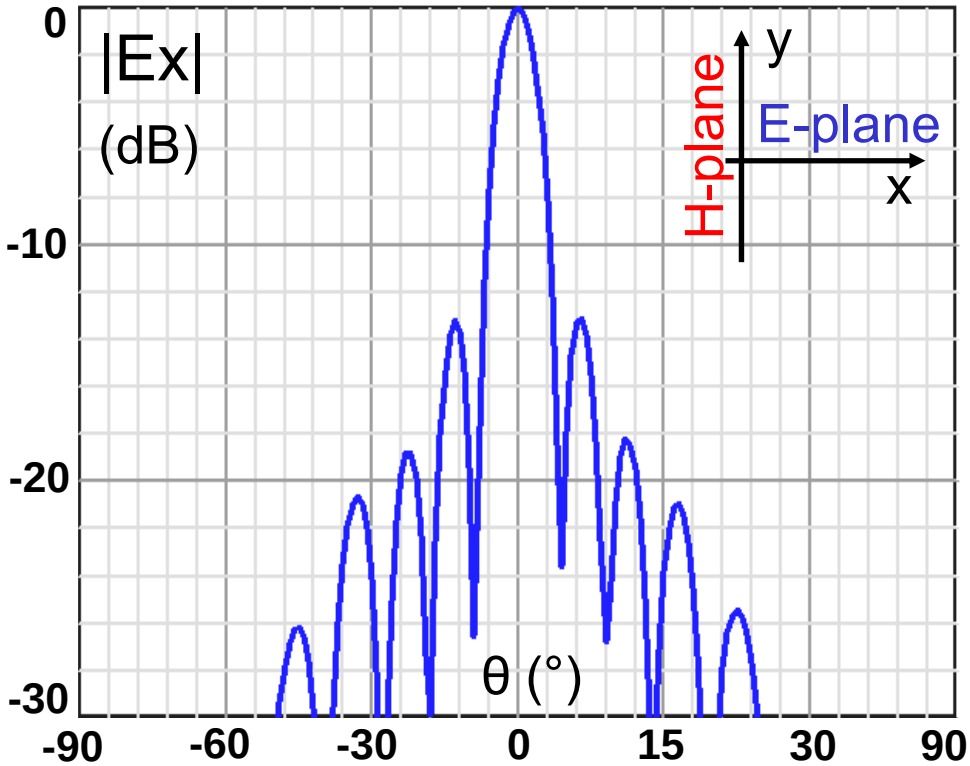




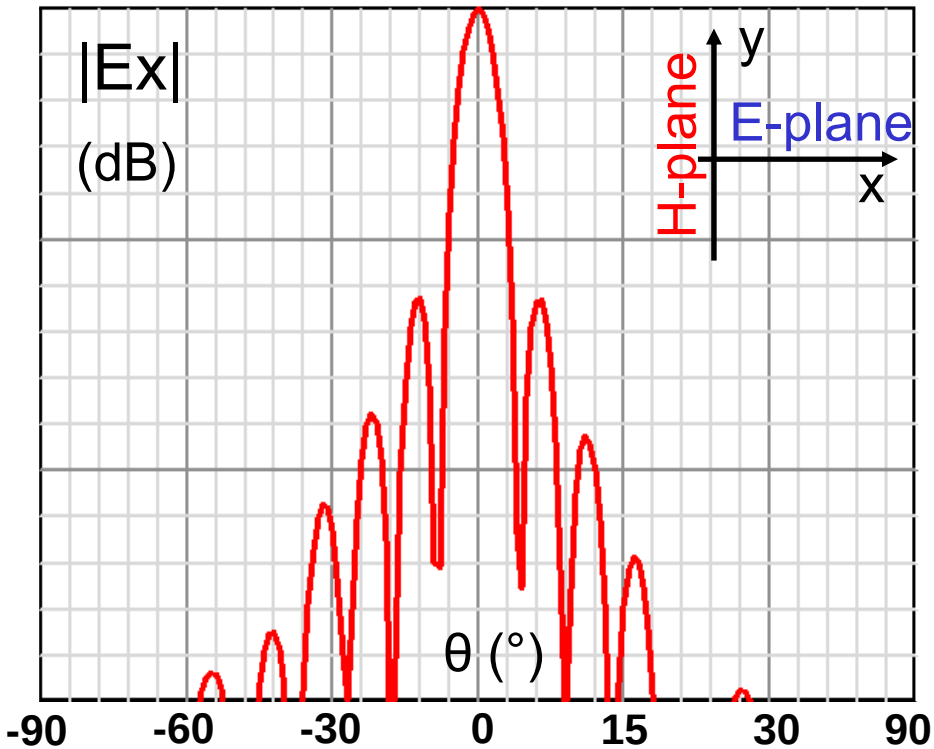
Linearly Polarized: x-polarized

Low Cross-Polarized Component

Far Field

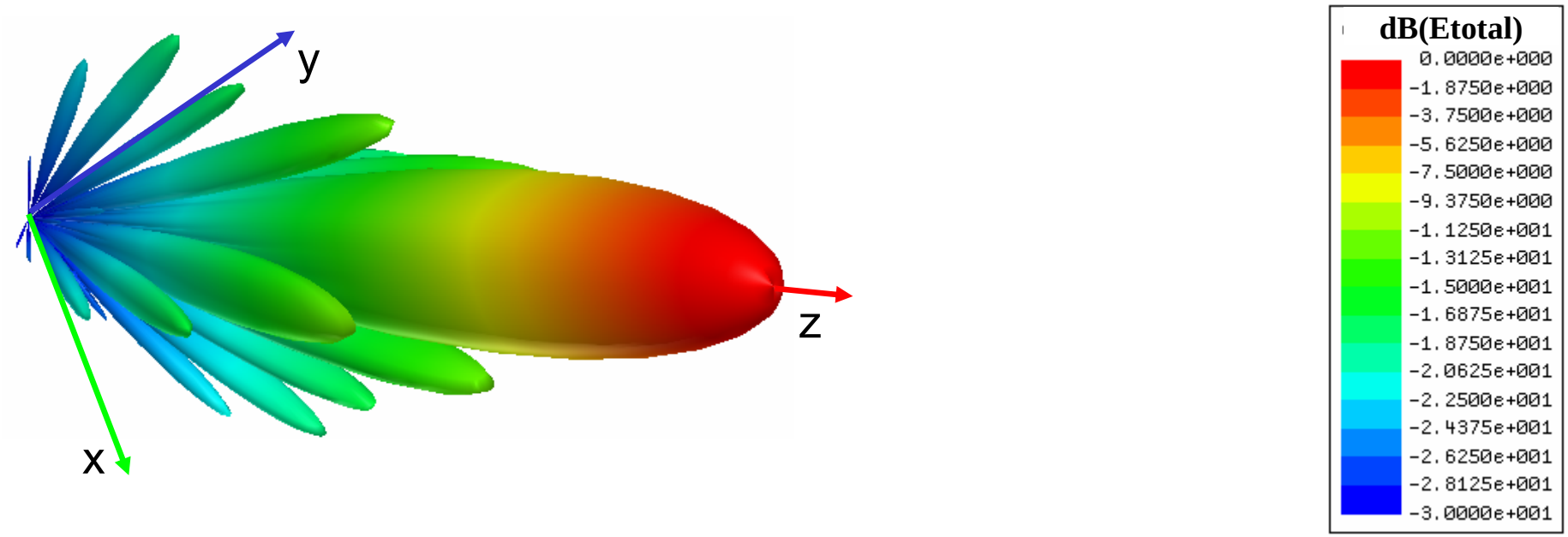
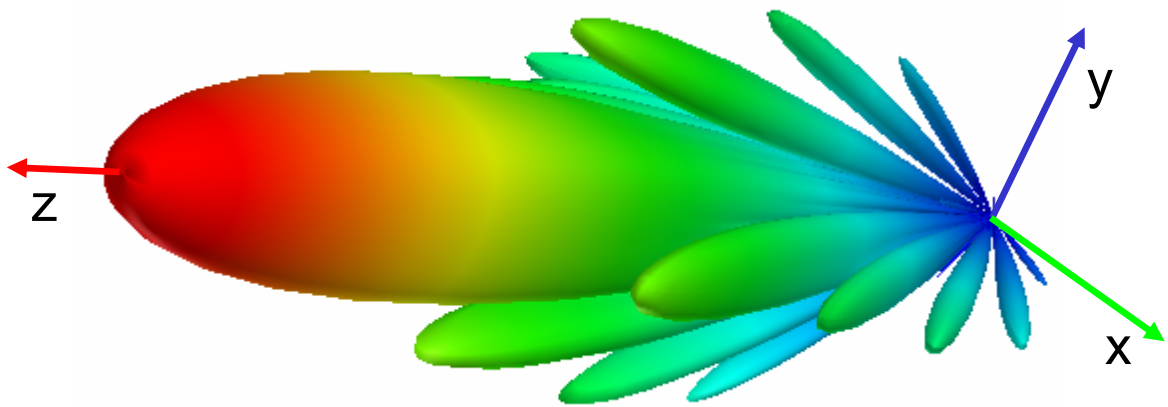


SLL = -12.64 dB
Beamwidth ≈ 7°



SLL = -13.08 dB
Beamwidth ≈ 7°

Far Field



3D Radiation Pattern