POLARIZATION-INDEPENDENT FREQUENCY SELECTIVE SURFACES FOR ATMOSPHERIC REMOTE SENSING

IITM Technology Available for Licensing

Problem Statement

- Existing FSS designs are sensitive to the polarization and angle of incidence of EM waves, limiting their effectiveness in diverse remote sensing applications.
- Current FSS configurations, including waveguide and substrate-backed types, face challenges with insertion and reflection losses, affecting performance in ultra-low-power applications.
- There is a need for FSS structures that offer wide operational bandwidth and effective spatial filtering for modern radiometers, addressing the limitations of existing narrowband or multi-band designs.

Intellectual Property

- IITM IDF Ref. **2214**
- **IN 531494 - Patent Granted**

Technology

The technology introduces a miniaturized Frequency Selective Surface (FSS) unit cell with a metal ring and dipole structure, designed to reflect specific millimeter wave frequencies while transmitting others with minimal loss.

The FSS can de-multiplex multiple frequency bands (e.g., 50-60 GHz, 170-195 GHz) for advanced remote sensing applications, with tailored reflection and transmission properties to handle different wavebands effectively.

The unit cell features a dielectric substrate and metal layer with precise dimensions and materials (e.g., gold, copper), optimizing performance for low-loss operation and wideband frequency separation in millimeter-wave remote sensing.

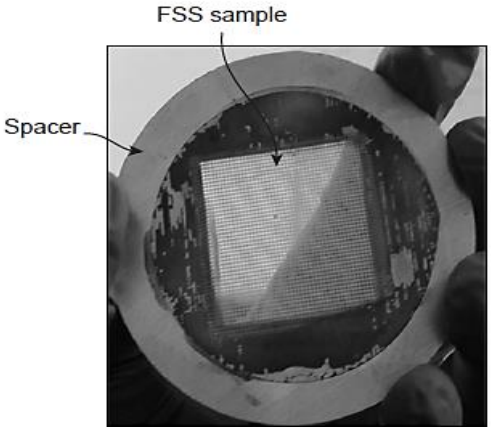

FIG. 1. Shows the Cascaded two-layer FSS on 875µm thick metal spacer.

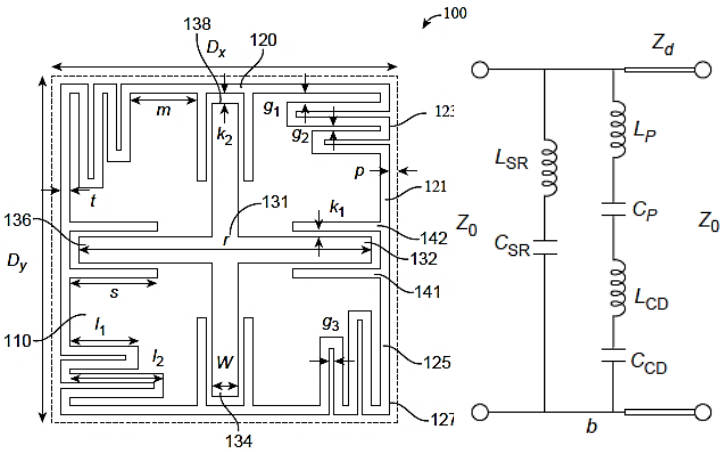

FIG. 2A. illustrates the unit cell geometry of the miniaturized resonant FSS.
FIG.2B. illustrates the equivalent circuit representation of the transmission line model.

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

Research Lab

Prof. Kavitha Arunachalam,
Dept. of Engineering Design
Prof. C.V. Krishnamurthy,
Department Of Physics

CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

Technology Category/ Market

Category - Atmospheric Remote Sensing
Applications- Radiometers, Spatial filters, phase and control metasurfaces, Satellite based weather forecasting and monitoring
Industry- Remote Sensing, Radar Systems, Satellite Communication

Market - The global remote sensing technology market size and is expected to hit around USD 55.36 billion by 2032, representing a **CAGR of 11.79%** from 2023 - 2032.

Key Features / Value Proposition

1. Tri-band Frequency Filtering

- Provides selective filtering for three distinct frequency bands (50-60 GHz, 87-91 GHz, and 170-195 GHz) with high precision.

2. High Insertion Loss

- Achieves significant attenuation (≥10 dB) in the reflected bands, enhancing signal clarity and reducing interference.

3. Low Insertion Loss in Pass Band:

- Ensures minimal signal loss (≤0.9 dB) in the pass band, optimizing transmission efficiency.

4. Compact and Miniaturized Design:

- Utilizes miniaturized unit cells (λ0/7 × λ0/7) for space-efficient integration into various systems.

5. Polarization-Insensitive Performance:

- Maintains consistent performance across different polarizations and angles of incidence, ensuring reliable operation in diverse conditions.

6. Enhanced Remote Sensing Capability

- Suitable for atmospheric remote sensing applications, including temperature profiling and humidity sensing, with high mechanical strength and low fabrication complexity.

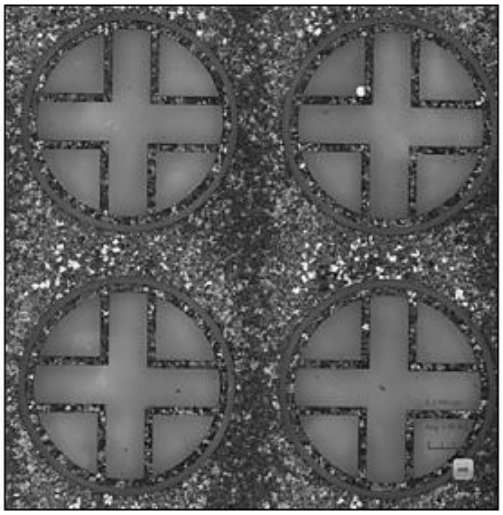

FIG. 3 illustrates the unit cell geometry of quad-band millimetre wave frequency selective surface.

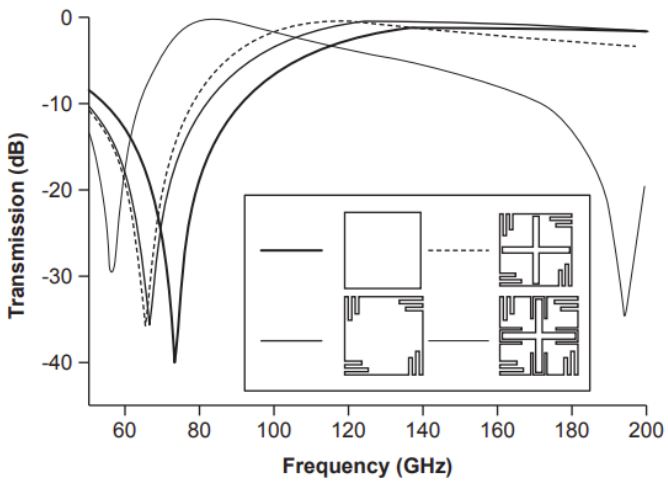

FIG. 4 illustrates the computed transmission response showing the evolution of the miniaturised unit cell for normal incidence.

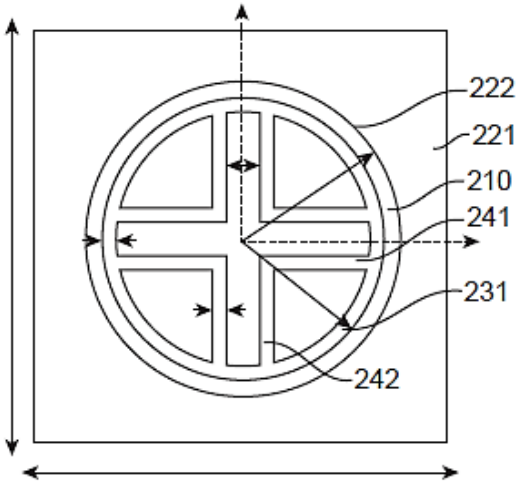

FIG. 5. illustrates the microscopic image of the fabricated unit cells.

CONTACT US
Dr. Dara Ajay, Head TTO
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: headtto-icsr@icsrpis.iitm.ac.in
tto-mktg@icsrpis.iitm.ac.in
Phone: +91-44-2257 9756/ 9719