EPFL-TTO

EPFL Innovation Park J
CH-1015 Lausanne
Switzerland
+41 21 693 70 23
http://tto.epfl.ch/

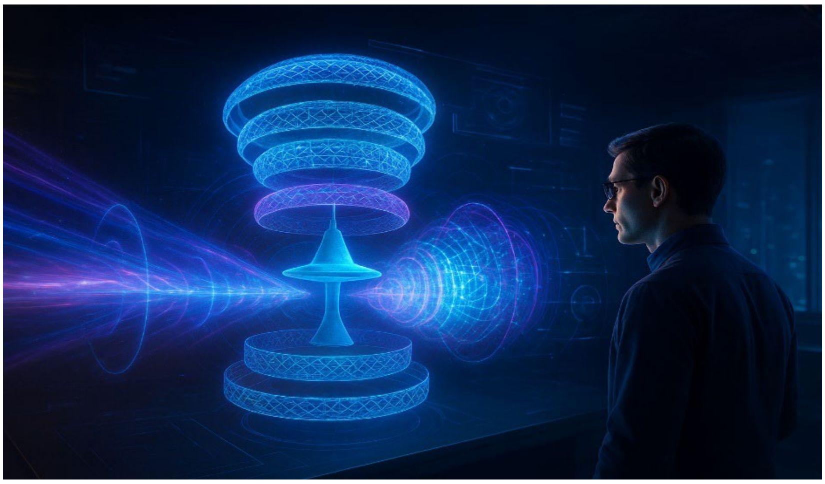
Research Contact

Romain Fleury
+41 21 693 56 88
romain.fleury@epfl.ch

TTO Contact

Mauro Lattuada
+41 21 693 35 63
mauro.lattuada@epfl.ch

GPS Interference cancellation using metamaterials



Ref. Nr

6.2566

Keywords

GPS antenna, Metamaterial layers, Phase-shift metasurface, Passive RF filtering

Intellectual Property

US Application 19/322,409

Publication

N/A

Date

17/12/2025

Description

Modern satellite navigation systems (GPS, GLONASS, Galileo, BeiDou) are increasingly vulnerable to intentional and unintentional interference originating from terrestrial sources.
Conventional countermeasures - signal-processing algorithms, choke-ring antennas, high-impedance surfaces, and adaptive CRPA arrays - suffer from one or more shortcomings, such as limited suppression capability (often <10 dB), high cost and large form factor, and long processing times and degraded robustness under blind interference conditions.
This technology introduces a radially loaded metamaterial (MTM) system surrounding a microstrip patch antenna to achieve large-scale cancellation of unwanted electromagnetic interference, especially RHCP signals arriving from low elevation angles.
The system integrates one or a combination of three MTM covers, each exploiting distinct physical mechanisms:

1. Magneto-Dielectric Metasurface (Artificial Magnetic Conductor)
2. Metasurface Polarizer (Chiral MTM)
3. Phase-Shift Cancellation Metasurface

Advantages

- High interference suppression (30–40+ dB) in azimuth-plane conditions
- Fully passive, low-cost structure without complex arrays or processors
- Compact and lightweight, compatible with commercial GPS form-factors
- Flexible MTM architecture: magnetic, chiral, and phase-engineered cells
- Scalable to other wireless systems across frequency bands
- PCB-compatible fabrication for both conductive tracks and unit-cell structures
- Enables future reconfigurable and conformal architectures for broader angular coverage

Applications

- Consumer GPS receivers (drones, smartphones, wearables)
- Automotive navigation and ADAS systems
- Marine and aviation positioning equipment
- IoT devices requiring robust GNSS performance
- High-precision timing & synchronization systems
- Defense and critical-infrastructure positioning resilience
- General RF systems requiring compact passive interference mitigation