



ELT –Topics & Trends

Collaboration Proposal for:



**UNIVERSITÀ
DEGLI STUDI
DI PALERMO**

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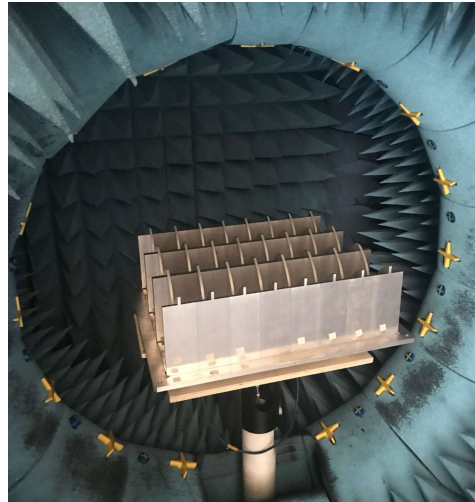
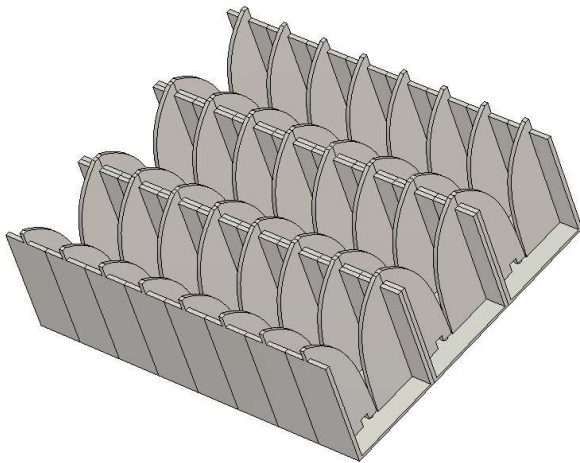
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Summary

- **Connected Array**
- **Tightly Coupled Antennas**
- **Sparse array optimization**
- **UWB Antenna Miniaturization**
- **UWB planar balun**
- **Wideband DRA antenna**
- **UWB Metamaterials**
- **Metalenses / Metasurfaces**
- **Antenna planarization**
- **Multi-Beam planar antenna**
- **Power combiner**
- **Vircator**
- **Tunable filters miniaturization**
- **Photonic integrated circuits**



Connected Array for M-AESA applications



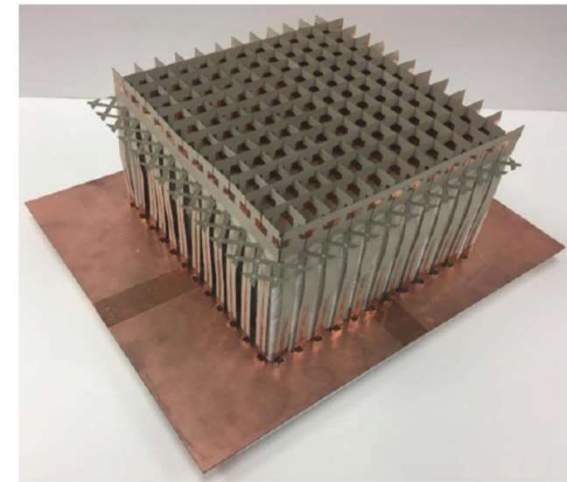
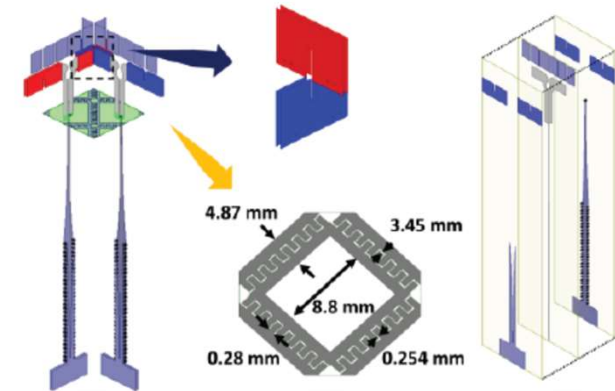
Key info:

- Variable number of elements
- Extremely high total efficiency
- Simplified feeding structure

Tightly Coupled Antennas

A new way to design antenna array:

Controlling the coupling between antenna is possible to have a larger bandwidth reducing the overall size.



Sparse array optimization

- Grating Lobes Reduction
- Higher Beam Steering
- Reduced Number Of Radiating Elements
- DoA Estimation Enhancement
- Null Steering
- Beamforming

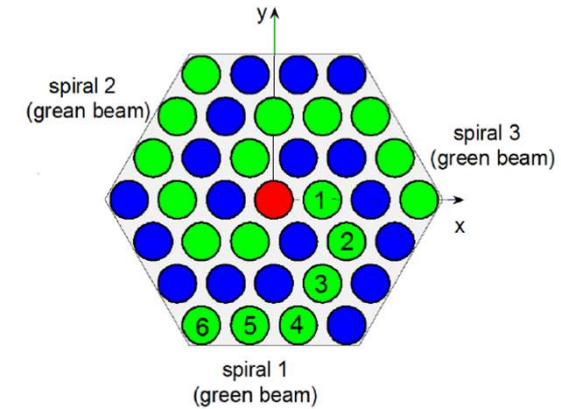


Fig. 2. $2 \times 18 + 1$ element hexagonal trifilar array geometry

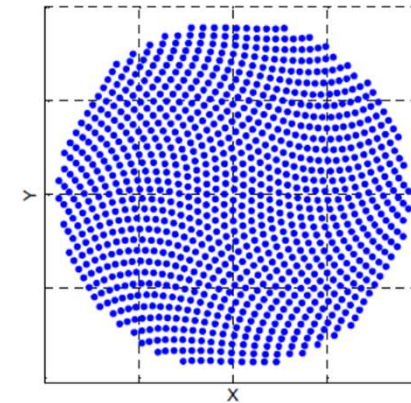


Fig. 2. 1024-element array, Vertigo lattice.



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UWB Antenna Miniaturization (Sinuous Antenna)

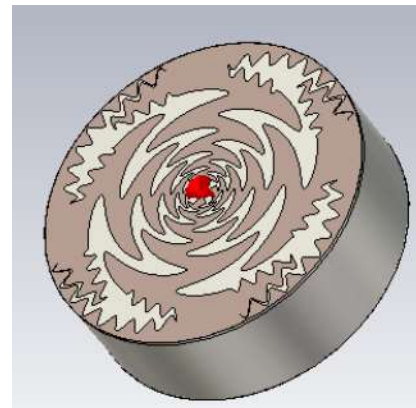
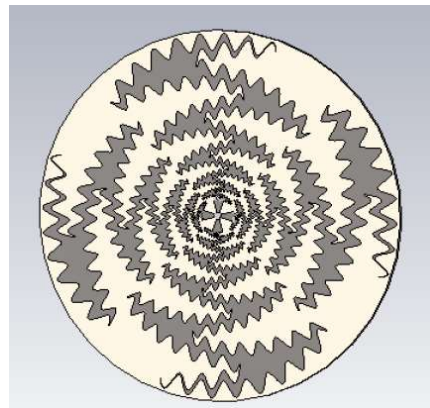
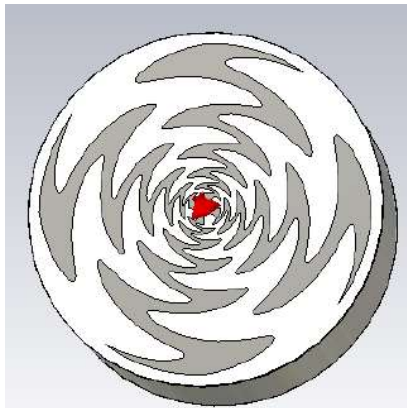
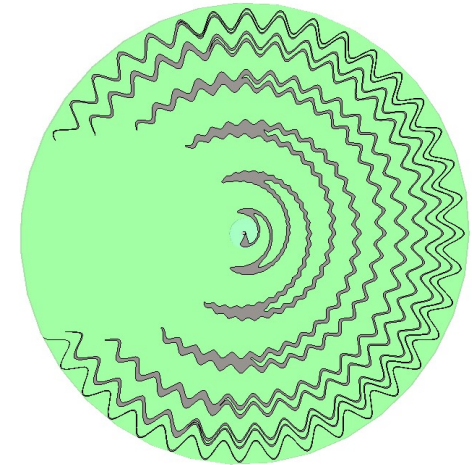
Key info example:

- Max Diameter dim. 60mm
- working frequency starting from 1 GHz

In collaboration with:
Prof. Luciano Mescia
Politecnico di Bari



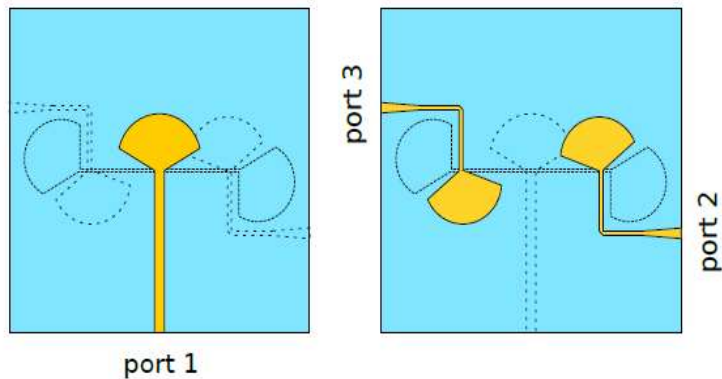
Unconventional
sinuous



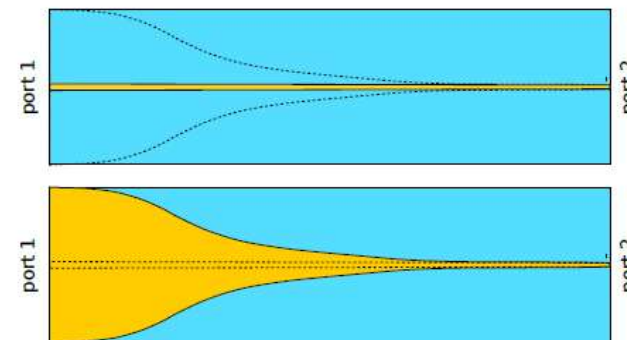
UWB planar balun

Working frequency band (0.5-18) GHz to feed the sinuous antenna

Balun with stubs



Klopfenstein balun

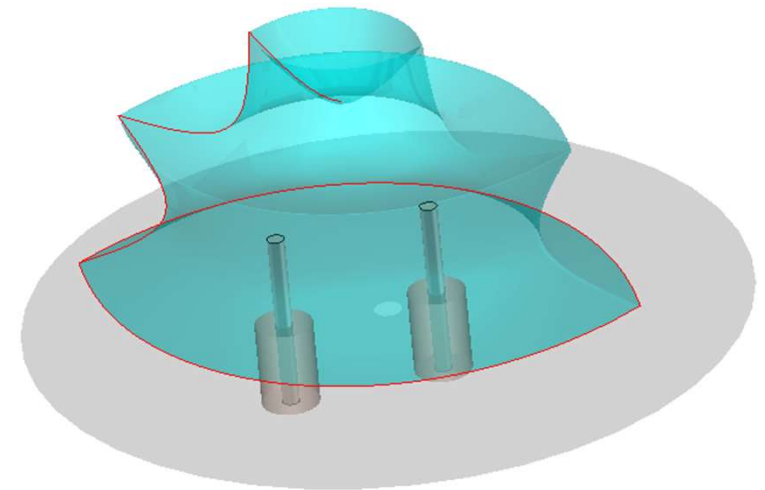


Wideband circular polarized DRA antenna

Overall frequency range of interest: from 5GHz to 10GHz

Desired performances:

- Circular polarization
- Small dimension
- High HPBW (Directivity $\cong 3$ dBi)
- Simplified feeding



In collaboration with: Prof. Luciano Mescia -Politecnico di Bari



Prof. Diego Caratelli – TU/e

TU/e



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UWB Metamaterials (1/3) – Cavity Backed Antennas

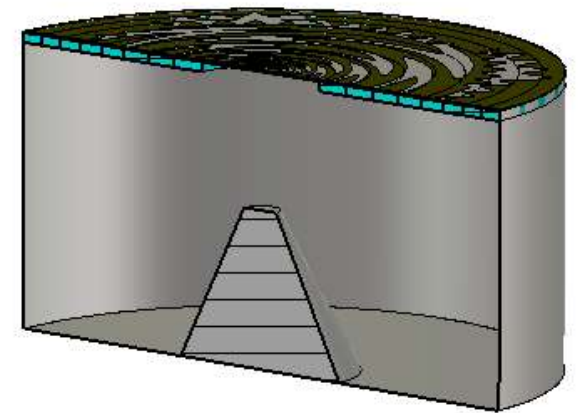
Overall frequency range of interest: from 0.5GHz to 40GHz

From 0.5 GHz to 18 GHz and/or from 18 GHz to 40 GHz

Desired performances:

- Controlled Patterns (HPBW/ripple/squint)
- Extended Impedance matching
- Polarization Purity
- Max Dim. (diameter) : $\lambda_{max}/2$

* MTM lens/metamaterial on the top and/or inside the cavity of the antenna



UWB Metamaterials (2/3) – RCS Reduction

Overall frequency range of interest: from 0.5GHz to 40GHz

From 0.5 GHz to 18 GHz and/or from 18 GHz to 40 GHz

Desired performances:

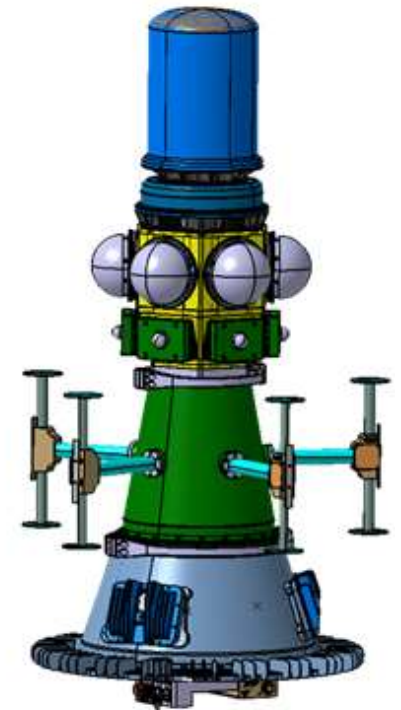
- RCS Reduction



UWB Metamaterials (3/3) – Cloacking

Overall frequency range of interest: from 0.5GHz to 6GHz

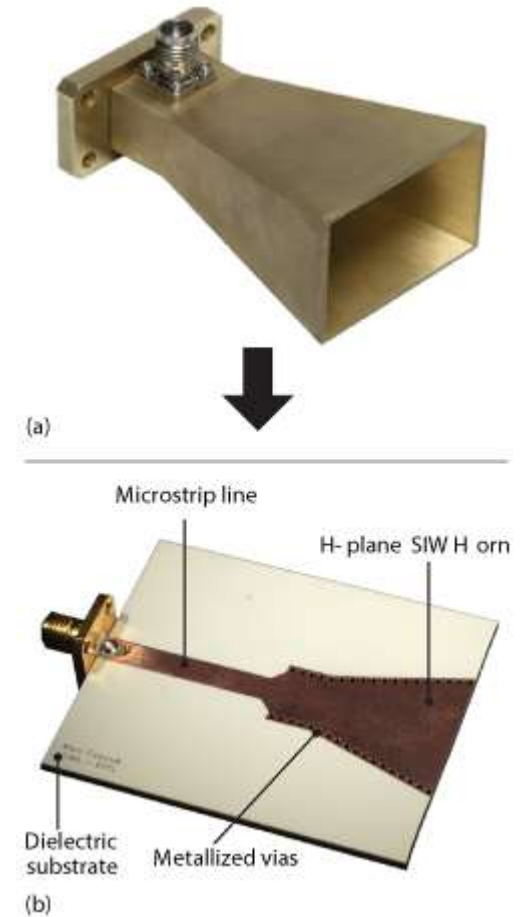
The idea is to reduce pattern perturbation related to the central must of the platform.



Antenna planarization

Overall frequency range of interest: from 0.5GHz to 40GHz

Design a planar antenna characterized by the same performance of a given 3D antenna



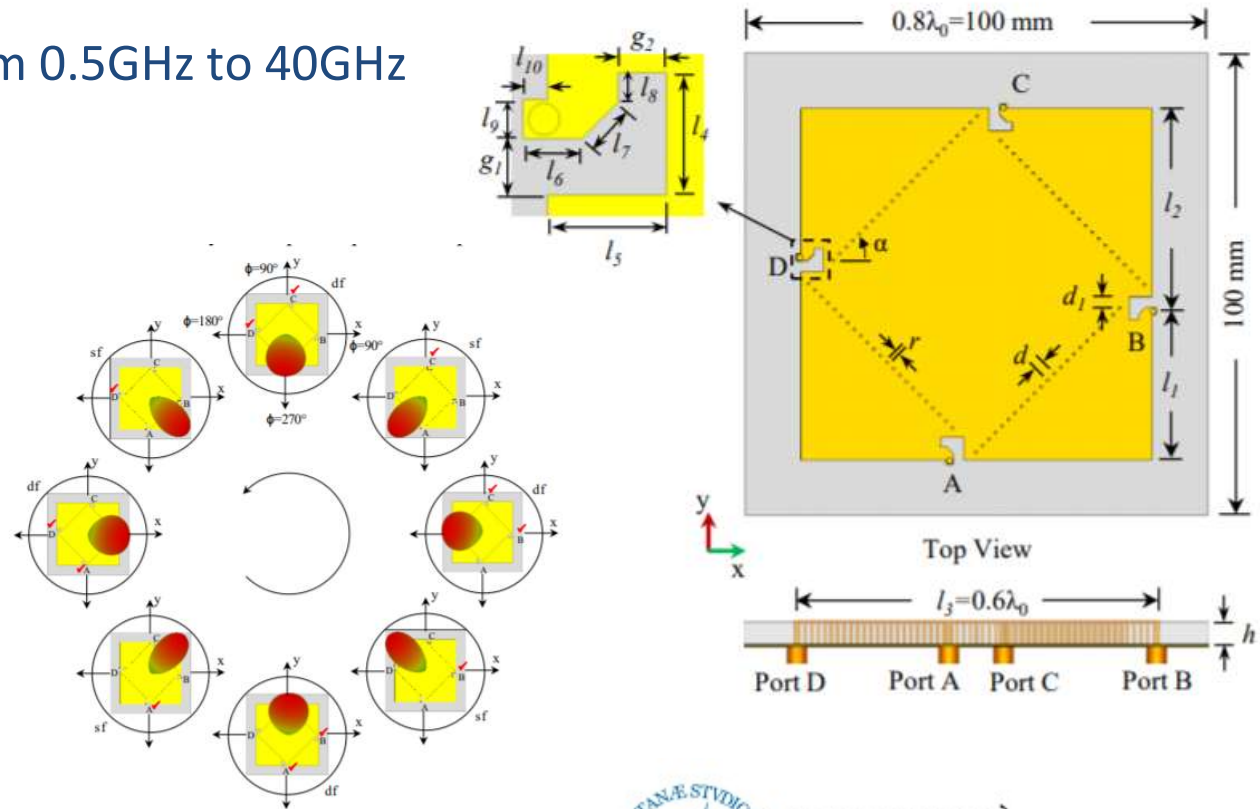
Multi-Beam planar antenna

Overall frequency range of interest: from 0.5GHz to 40GHz

UWB Multi beam generation.

Examples of interest:

- Direct DoA estimation in Az-EI



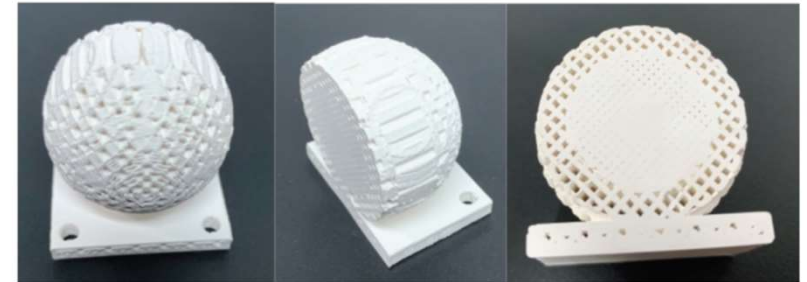
Metalenses / Metasurfaces (1/2)

Overall frequency range of interest: from 0.5GHz to 40GHz

From 0.5 GHz to 18 GHz and/or from 18 GHz to 40 GHz

Desired performances:

- Controlled Patterns (HPBW/ripple/squint)
- Extended Impedance matching
- Polarization Purity



Examples of interest:

- Aperture antennas (i.e. horn antennas)
- Cavity backed antennas

Metalenses / Metasurfaces (2/2)

Overall frequency range of interest: from 0.5GHz to 40GHz

From 0.5 GHz to 18 GHz and/or from 18 GHz to 40 GHz

Desired performances:

- Controlled Patterns (HPBW/ripple/squint)
- Extended Impedance matching
- Polarization Purity

Examples of interest:

- Antenna Arrays:
 - Improve the scanning capabilities (WAIM/meta-radome)
 - Management of mutual coupling in dense arrays



Power combiner

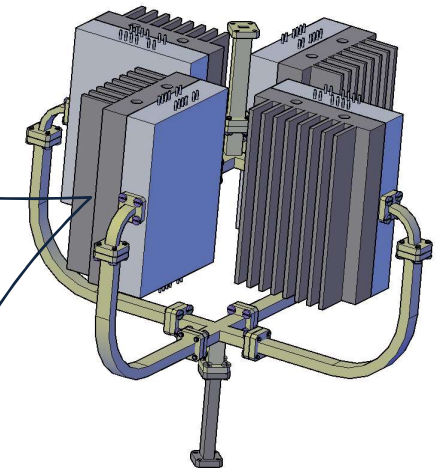
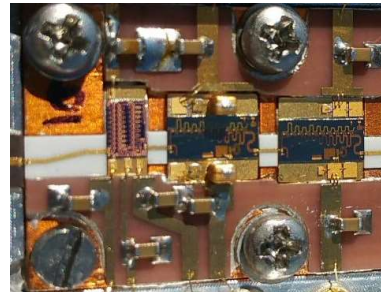
Overall frequency range of interest: from 0.5GHz to 18GHz desired up to 40GHz

Desired performances:

- Total output power 100 W @40GHz

Example of interest:

- EW Jammer



In collaboration with: **Prof. Franco Di Paolo**



Università degli Studi di Roma "Tor Vergata"
Oggi, l'Ateneo del domani

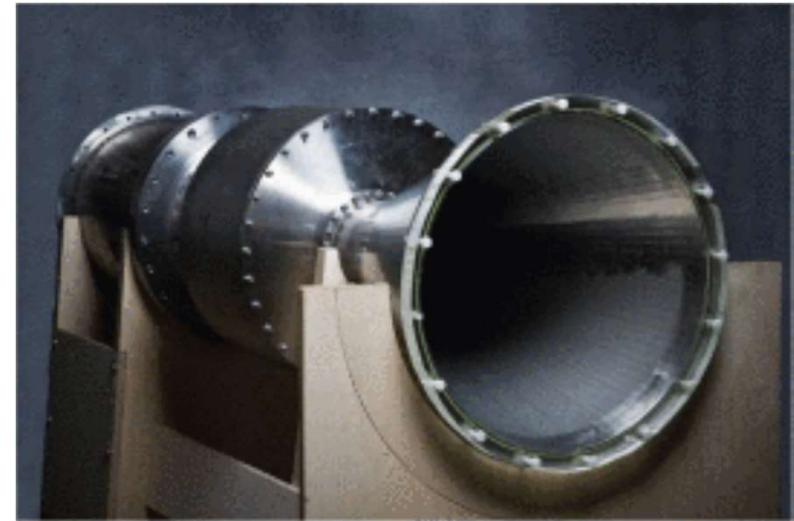
Vircator

Desired performances:

- Output beam width $\cong 10^\circ$
- EIRP up to 90 dBW

Example of interest:

- Anti drone and UAVs



In collaboration with: Prof. Franco Di Paolo

Desired performances:
• Output beam width $\cong 10^\circ$
• EIRP up to 90 dBW

Example of interest:
• Anti drone and UAVs

Tunable Filters miniaturization

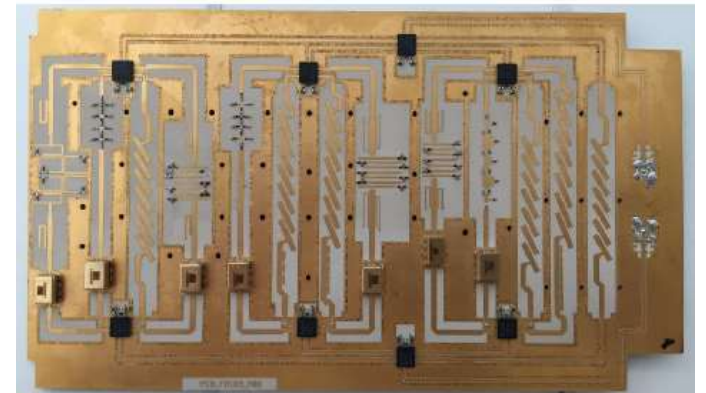
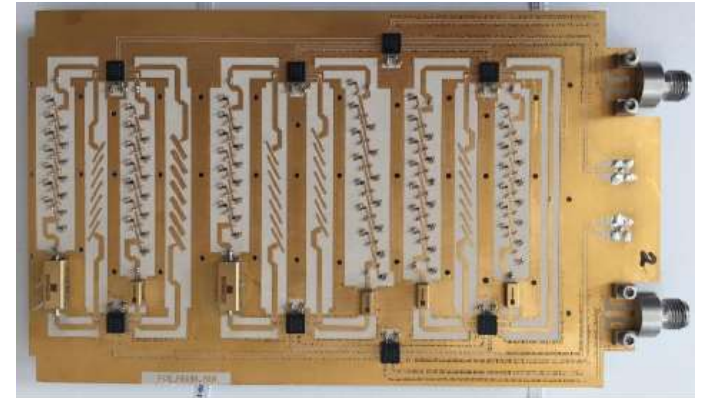
Overall frequency range of interest: from 0.5GHz to 40GHz

Desired performances:

- Out of band rejection ($>40\text{dB}/\text{GHz}$)
- Power Consumption 3W
- Switching speed $< 10\mu\text{s}$
- Reduced in band ripple ($<1\text{dB}$)
- Size 3U
- Insertion loss ($<15\text{ dB}$)

Example of interest:

- UWB receiver



Photonic integrated circuits

Microwave-photonic integrated packages microsystems for high performance SWaP EW system.

The package shall host RF inputs/outputs up to 40 GHz and input/output optical fiber with heterogeneous microwave and photonics chiplets (GaN, GaAs, SiGe, SOI, Si, SiN, InP, LiNbO₃).

Miniaturization of Mach-Zehnder modulator, optical oscillator, optical filter...

Design of high precision tunable lasers....

