

 EPIC

European Photonics  
Industry Consortium



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Media Partner

**Electro  
Optics**

# Integrating RF antennas with Photonic Integrated Circuits

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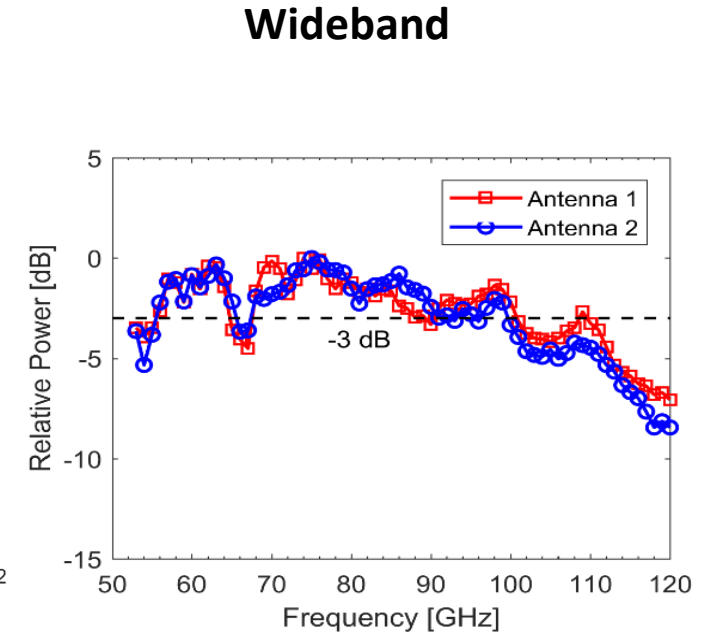
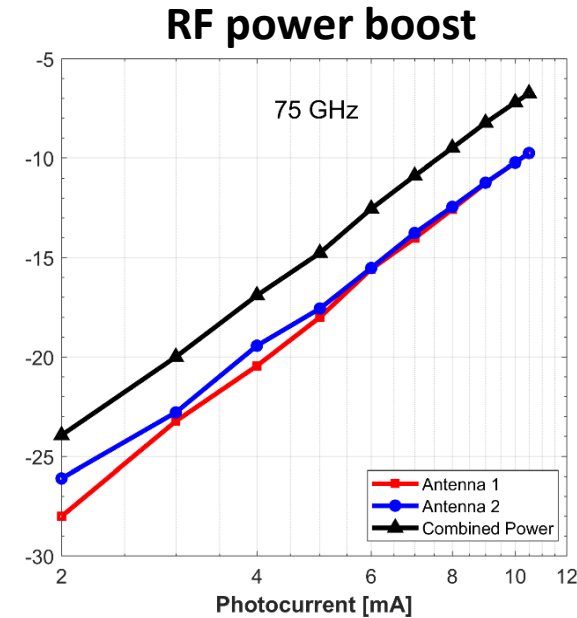
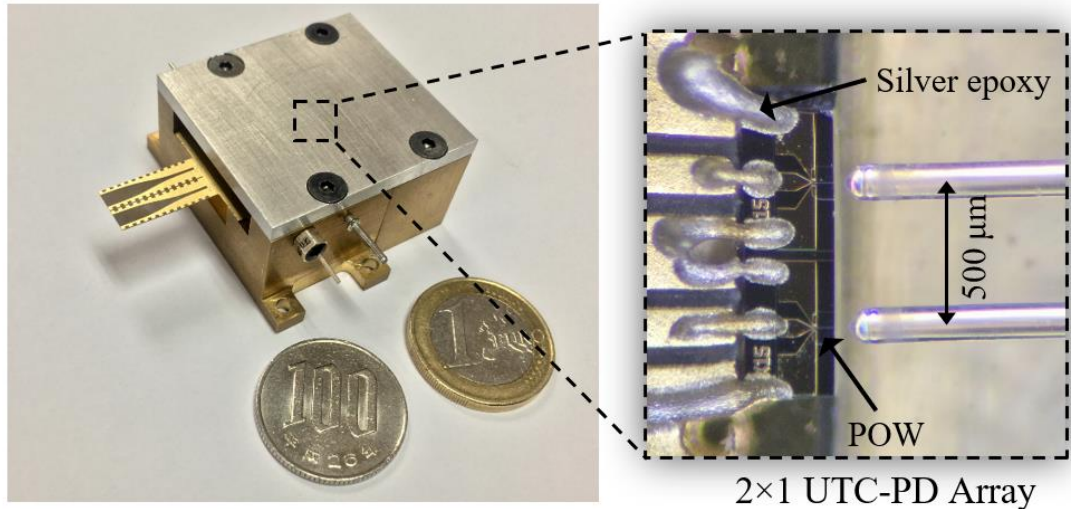
**Monday, 8 November 2021, 15:00 CET**

**EPIC Online Technology Meeting on New Developments  
for Microwave Photonics**

# Integrating RF antennas with Photonic Integrated Circuits

## Edge Coupling

## 1D phase array with wideband tapered slot antennas



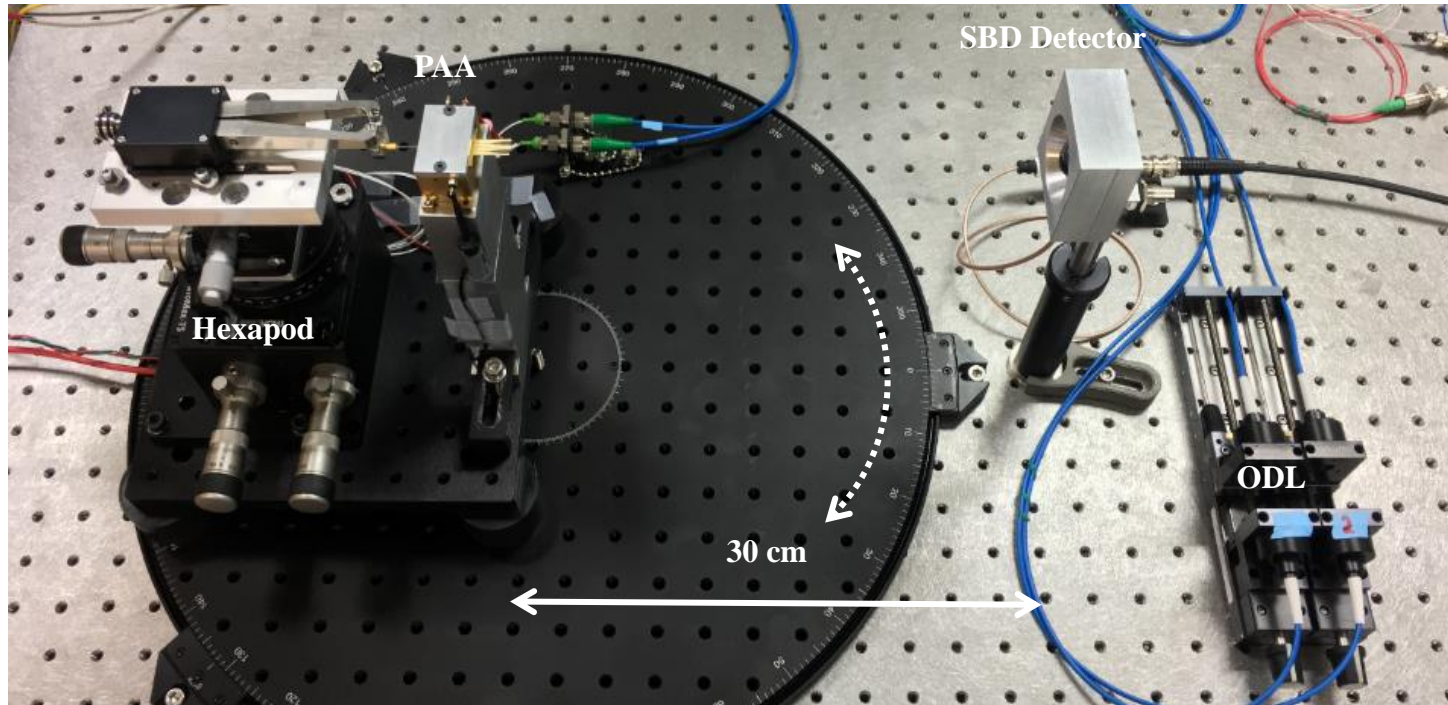
Antennas use standar RF pad connectors on high-frequency photodiodes  
Achieve boost in emitted RF power (+3 dB each time number of elements doubles)  
Use of wideband RF Tapered Slot Antennas

Requires high frequency interconnects

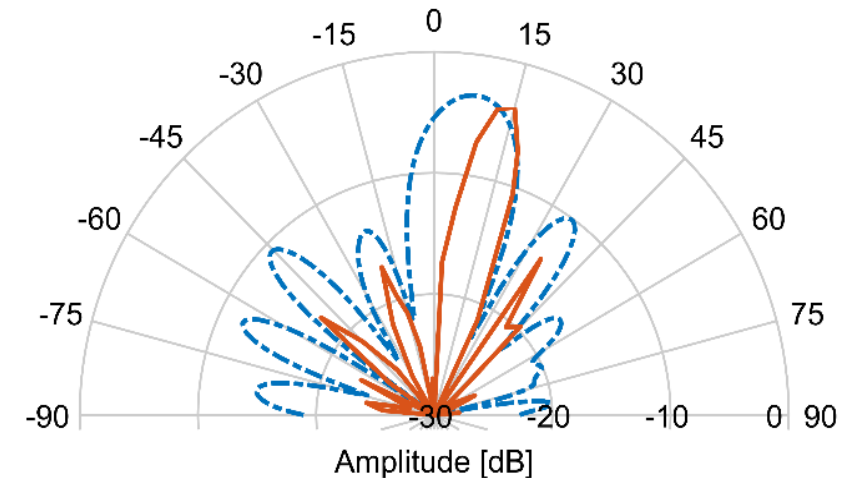
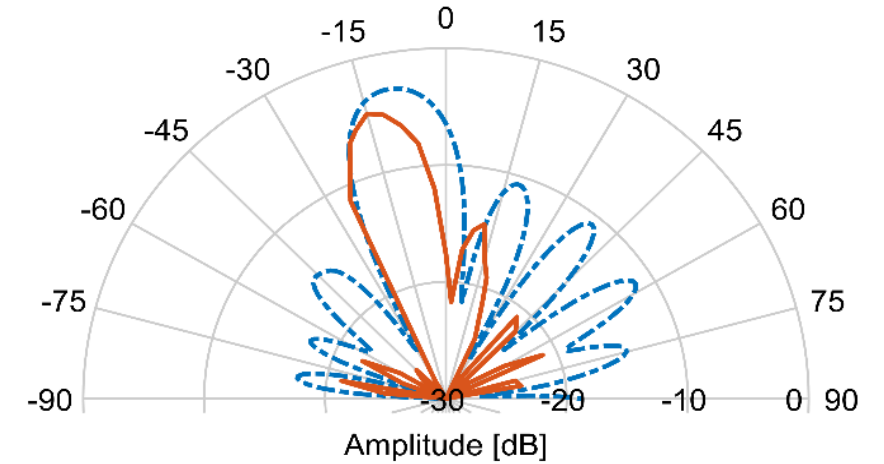
# Integrating RF antennas with Photonic Integrated Circuits

## Edge Coupling

1D phase array with wideband tapered slot antennas



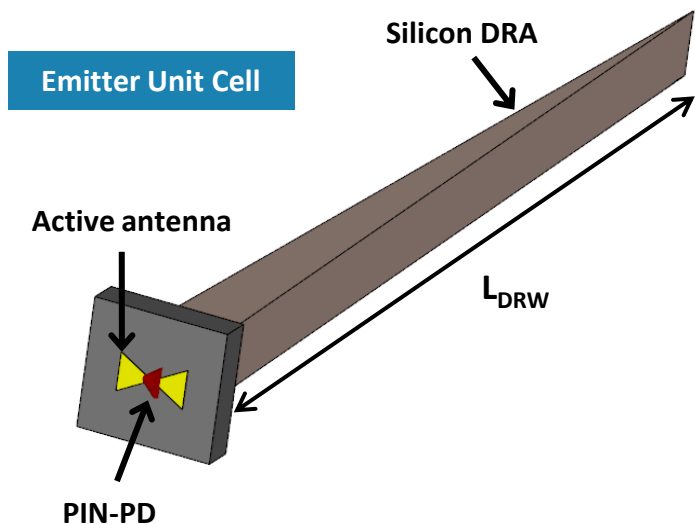
Beam-steering with Optical True-Time Delay  
No power penalty  
Wideband



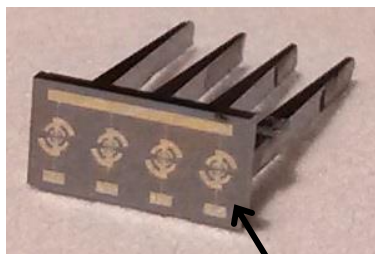
# Integrating RF antennas with Photonic Integrated Circuits

## Vertical Coupling

### Dielectric Rod Antenna (DRA)



### Prototype (1x4 DRA)



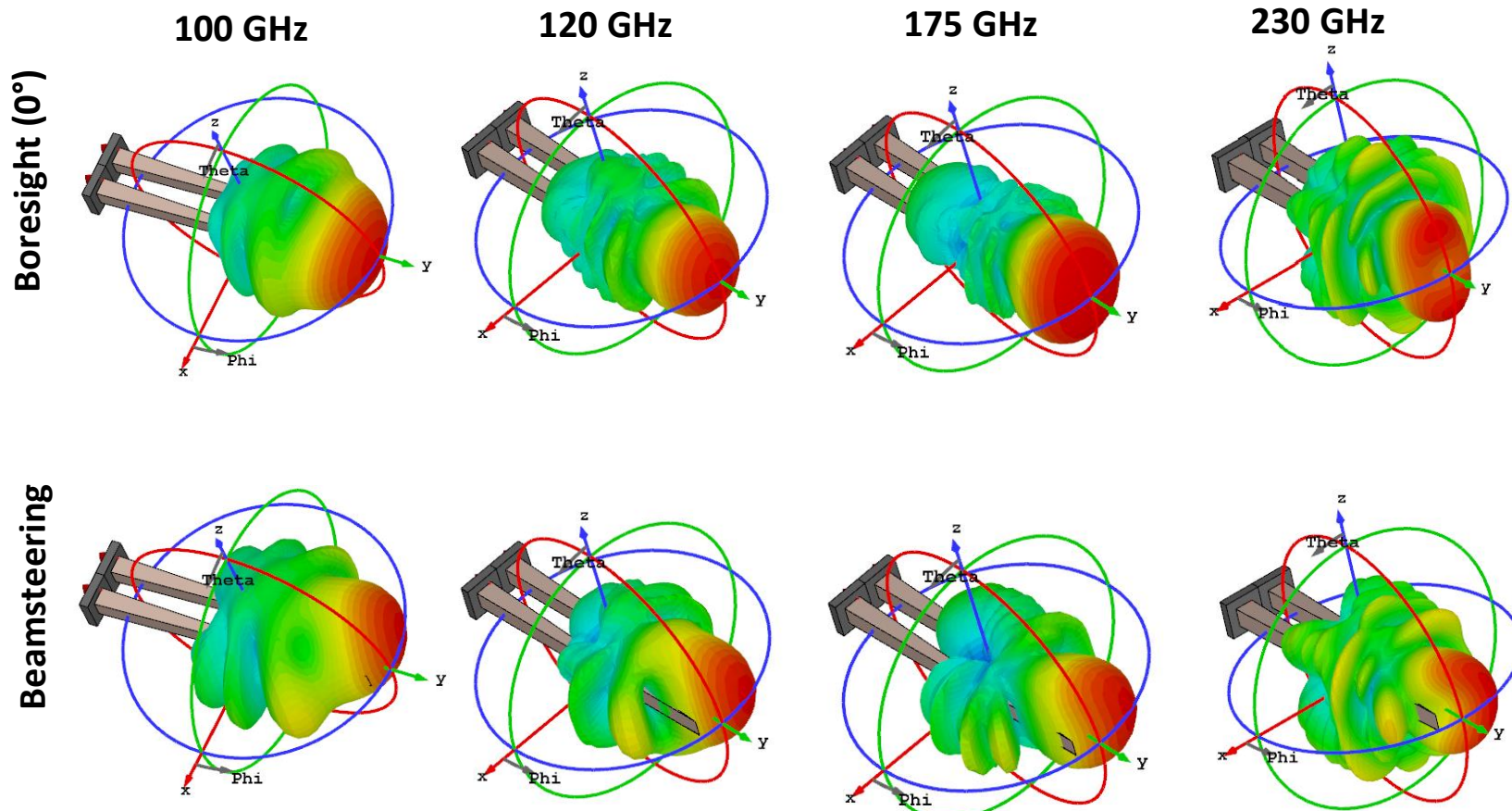
Photomixers



For 2D integrated phase array antennas

Target freq. range 90 – 320 GHz

### Radiation Patterns

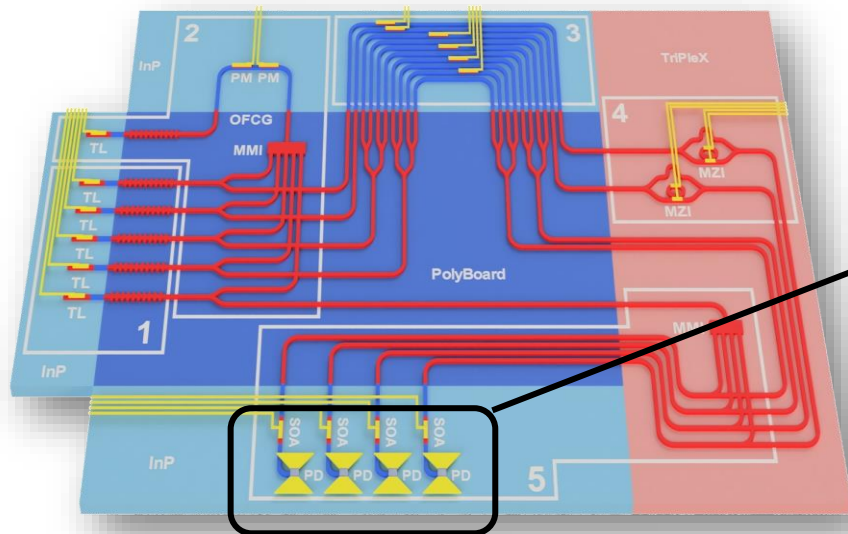


✓ Ultra-broadband radiation with beamsteering

# Integrating RF antennas with Photonic Integrated Circuits

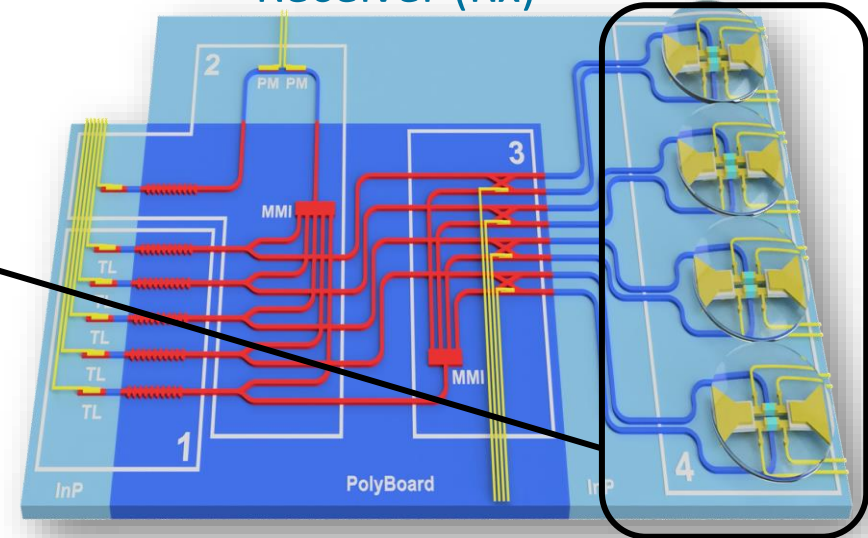
**TERAWAY** Hybrid photonics-based platform for ultra-wideband signal generation, emission and detection

Transmitter (Tx)



1. Optical carrier generation unit (InP + PolyBoard)
2. Optical phase locking unit (Optical Frequency comb)
3. Optical (data) modulation unit (InP)
4. Optical multi-beamforming unit (TriPlex –  $\text{Si}_3\text{N}_4$ )  
Independent steering of the transmitted wireless beam
5. Optical amplification, frequency up-conversion and wireless emission unit (InP + Si)

Receiver (Rx)



1. Optical carrier generation unit (InP + PolyBoard)
2. Optical frequency comb generator unit (InP + PolyBoard)
3. Optical phase shift unit (Photonic LO)
4. Wireless detection and optical IQ photonic mixing (PX) unit

# Integrating RF antennas with Photonic Integrated Circuits



PHOTONICS<sup>21</sup> 5G PPP

12 Partners

6 EU countries

3 Large Companies

4 SMEs

2 Industry-oriented  
Research Institutes

3 Academic Organizations

Topic: 5G Long Term Evolution

Type: RIA

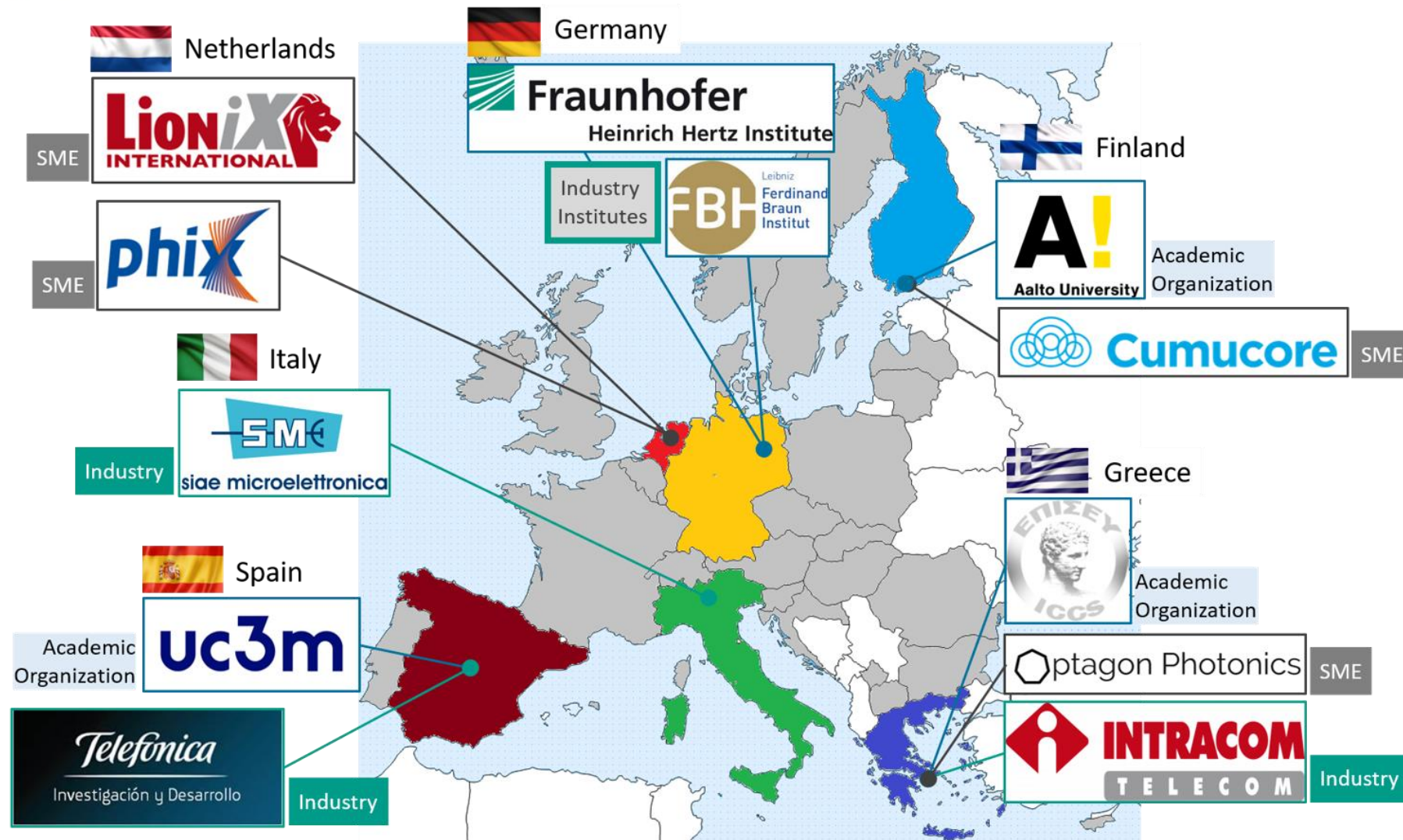
Call: H2020-ICT-2019-2

Contract No: 871668

Start date: 1 November 2019

Duration: 36 Months

EC contribution: € 5 999 498.75



TERAWAY project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under G.A No 871668 and it is an initiative of the Photonics Public Private Partnership.