Introduction: Projects of the topic

✔ TMCS: terahertz (THz) band for fast wireless communications

✔ Goal: demonstrate the use of ‘terahertz’ band for higher capacity (data-rate)
   Need developments at components AND system level

✔ Why?
- We all need to communicate, faster and faster
- If we take into account the user needs for bandwidth, actual systems can’t handle this (radio resources over crowded)
- this is driving the 5G implementation and beyond 5G research

✔ How? THz communications scenarios studied in TMCS:
- Long range, Fixed link (point to point), advanced technology (feed by fiber networks)
- Short range: adjustable link (mobile user), cheaper technology, steerable antenna
What is THz?

- There remains a lack of sources at the THz frequency range.
- Two possibilities:
Introduction of the domain

- Where we should do THz links?

Atmosphere is suitable for THz coms around 200-300 GHz

Frequencies not (yet) allocated beyond 275 GHz
**TERALINKS in a nutshell**

**TERALINKS: main goals**
- Achieve the first outdoor THz link, with 40 Gbps data-rate real-time
- Combine photonics, tube amplifier and smart antennas

**Distinctive features**
- Push and interconnect different technologies towards a real functionnal system for back-haul links

*Example: 1 km targeted system with 40 Gbps*

*Partners: Univ Lille [FR], Lancaster Univ [UK], Queen Mary College [UK], Univ. Nice [FR], Univ public of Navarra [SP]*
WISDOM: main goals

✓ Use 3D techniques for fast fabrication THz passive/active antennas
✓ Combine 3D and CMOS devices toward power combining/antenna arrays

Distinctive features

✓ Demonstration of beam-steerable links for device to device communications

Examples:
A novel high-gain resonant cavity antenna operating at 300 GHz
New unit cell design of the partially reflecting surface layer

Partners:
UniKent [UK], KU Leuven [BE], TU Graz [AT], Univ Warwick [UK]
Major achievements and output

- **TERALINKS**
  - THz sources achieved
  - Tube amplifier designed for 240 GHz
  - 3 types of antenna fabricated & characterized
  - 10 Gbps system in the lab demonstrated with silicon photodiodes
  - 100 Gbps system in the lab demonstrated with III-V photodiodes

Website for project dissemination (5 journal papers + 10 conferences (2 invited))
Major achievements and output

**WISDOM**

- 3 types of antennas fabricated and measured up to 300 GHz
- CMOS transceiver integrated with horn
- Novel design on metamaterial based lens

- Website for project dissemination (2 journal papers + 4 conferences (2 invited))
Upcoming challenges and needs

- **THz state of the art**

**Challenges:**

- Real capability of the system
- Cost reduction (examples):
  - 3D printed techniques
  - Use of 28 nm CMOS
  - Use of industrial silicon photonics
- III-V technologies
- Integration of the system
- Energy efficiency of the links

**Roadmap:**

- **TERALINKS:** towards km-range links
- **WISDOM:** towards indoor beam-steerable links
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Role of the CHIST-ERA support

- Helps to establish transnational/interdisciplinary relationships towards THz applications

- Fully in line with European strategy towards THz datacom beyond H2020 programs
  - Chistera will enable new EU proposals
  - Chistera helps Europe to contribute in this field (strategic due to recent new IEEE standard 802.15.3d)

- New topic suggestions:
  - Beyond 5G research / sustain the user connectivity
  - Next generation internet application
Questions