

CHIST-ERA Projects Seminar

Cross Topics

Topic TMCS 2015

G. Ducournau, C. Del Rio Bocio, C. Gu

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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)



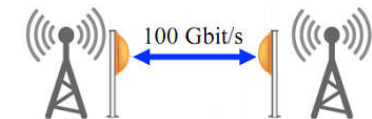
Need developments at components AND system level

❖ 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



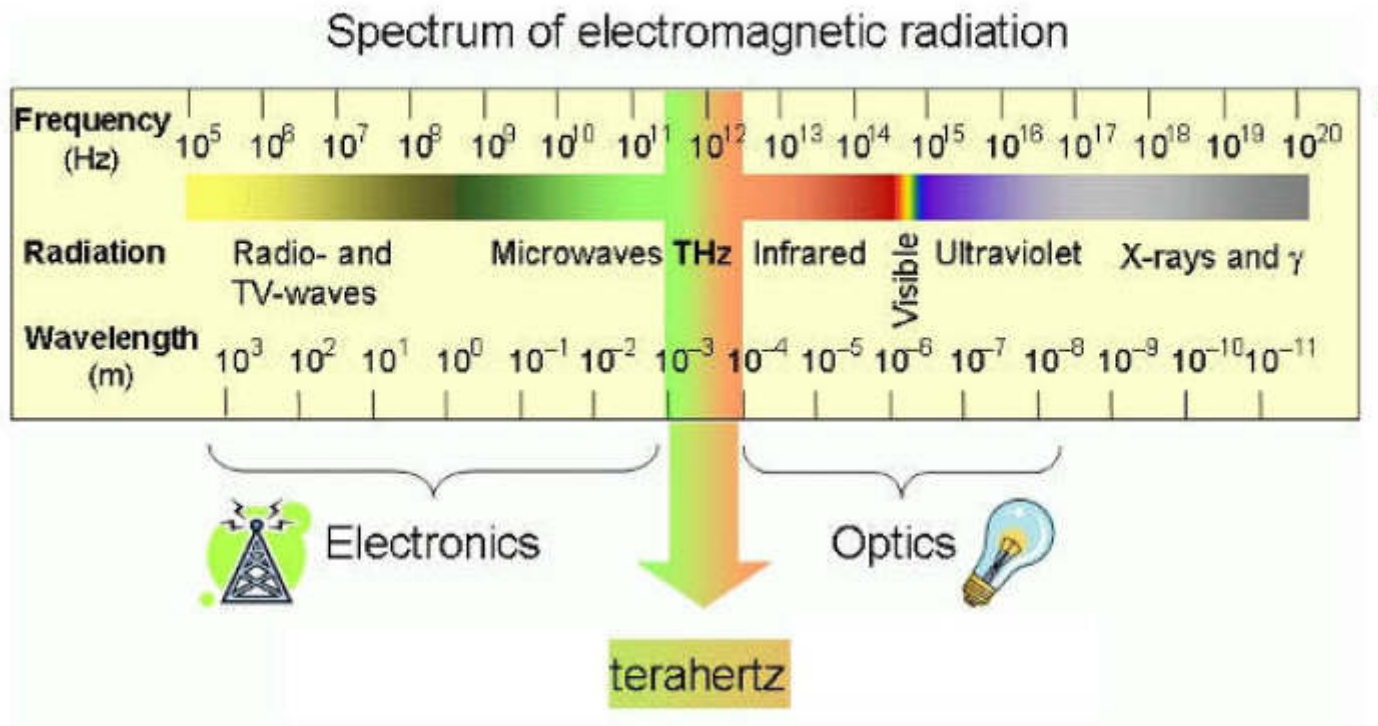
TERALINKS
WISDOM



Introduction of the domain

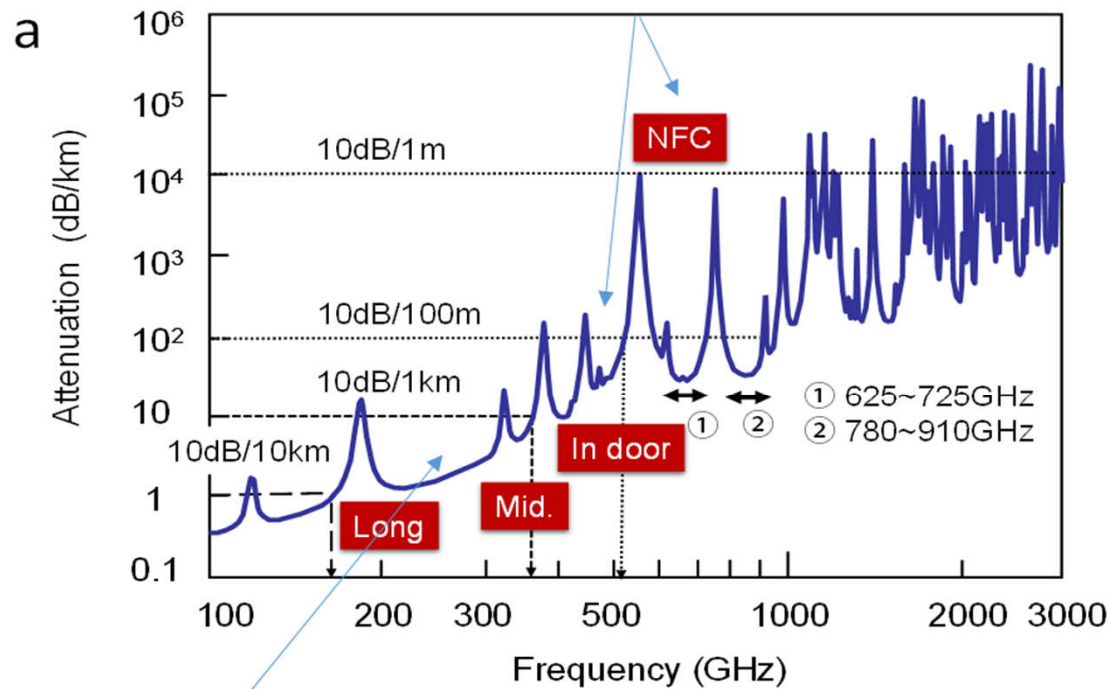
❖ What is THz?

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



Introduction of the domain

❖ Where we should do THz links?



Point to point

Atmosphere is suitable for THz coms around 200-300 GHz

Frequencies not (yet) allocated beyond 275 GHz

TERALINKS in a nutshell

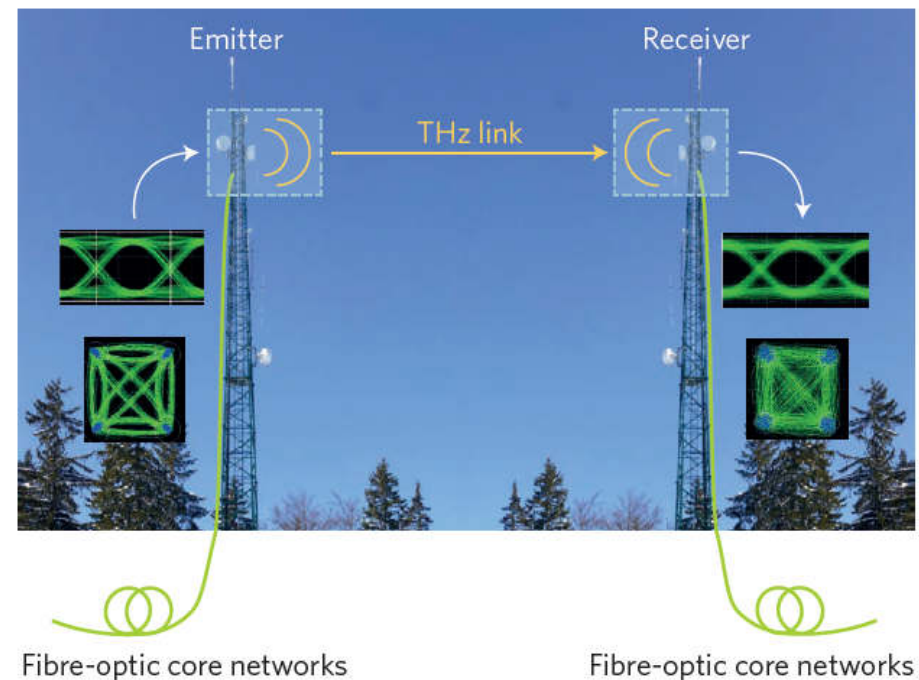
❖ TERALINKS: main goals

- ✓ 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 functional 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 in a nutshell

❖ 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

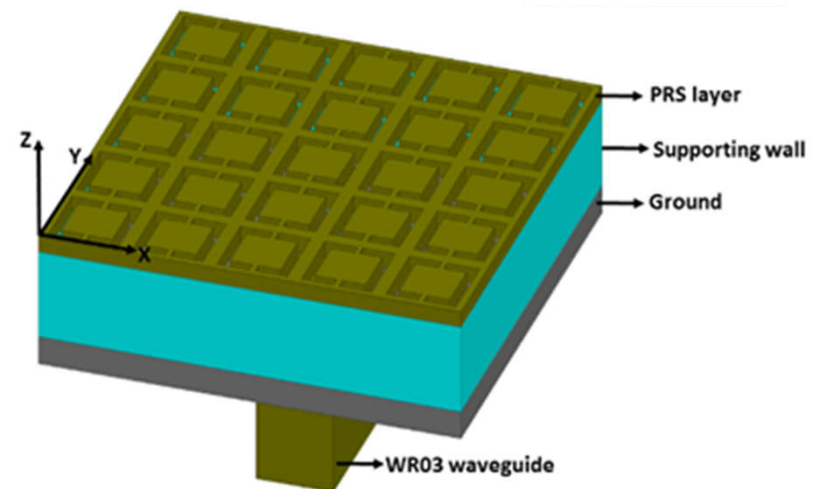
- ✓ Demonstration of beam-steerable links for device to device communications



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]

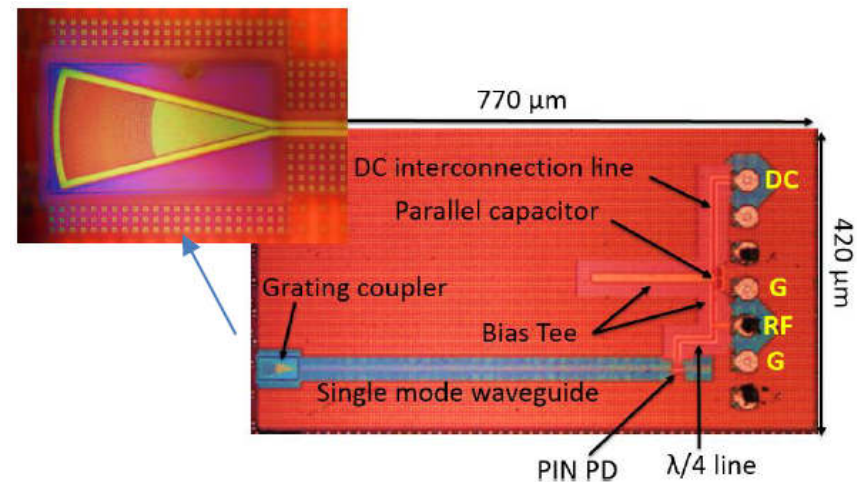
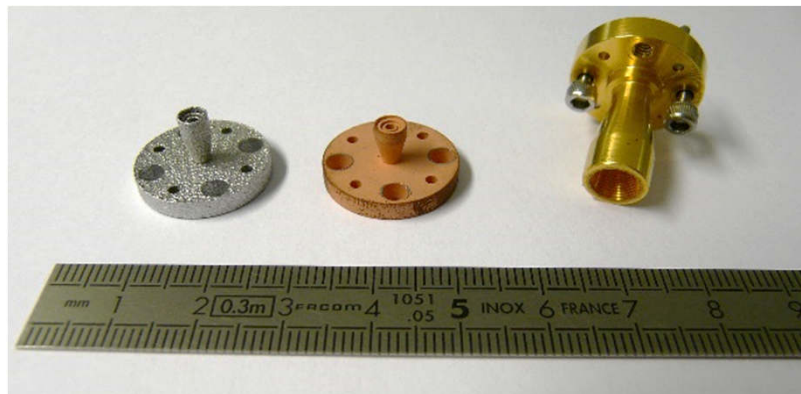
Major achievements and output

❖ TERALINKS

System Devices

- ✓ 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

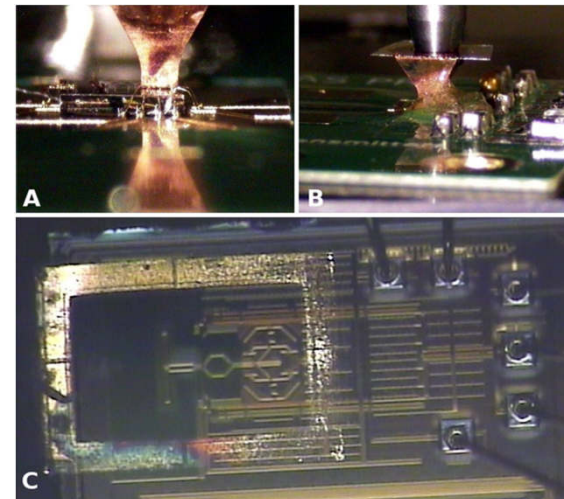
Website for project dissemination (5 journal papers + 10 conferences (2 invited))



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))



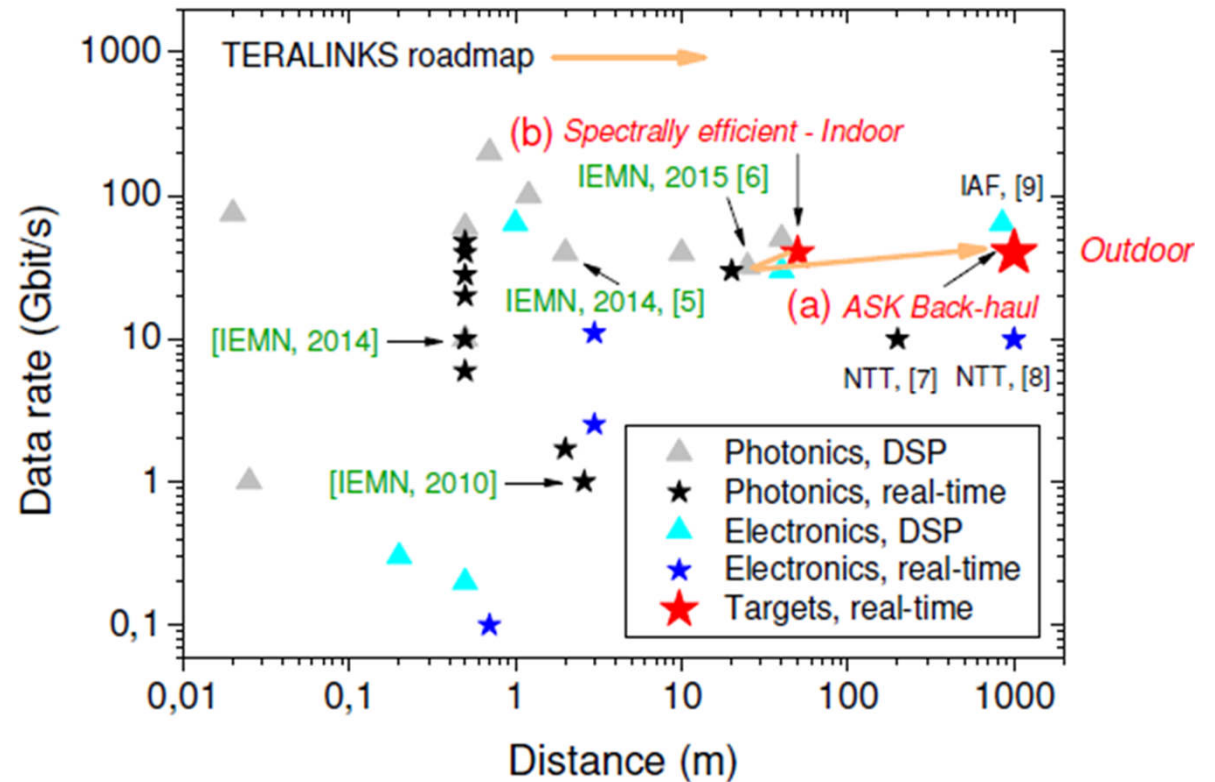


Upcoming challenges and needs

❖ THz state of the art

Challenges:

- Real capability of the system
- Cost reduction (exemples):
 - 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

Challenges focus

	Real-time capacity	Integration	Energy efficiency	3D tech.	CMOS tech.	Silicon-photonics based tech.	III-V tech.
TERALINKS	X	X	X	X		X	X
WISDOM		X	X	X	X		

- ❖ **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**



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Questions

Questions ?