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Abstract: This document presents first results form a 300 GHz channel measurement campaign carried out in real data center within the EU Horizon 2020 project TERAPOD.

Purpose: Information of the Technical Advisory Group THz

300 GHz Channel Measurements in a Real Data Center - First Results

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Outline

- Introduction to H2020 TERAPOD
- Data Center Application Scenarios for 300 GHz wireless links
- Measurement Set-Up
- First Measurement Results
- Conclusion and Outlook

Horizon 2020 TERAPOD -Terahertz based Ultra High Bandwidth Wireless Access Networks

- TERAPOD is one of the six funded projects from the Horizon 2020 ICT-Call-09-2017 on „Networking Research beyond 5G“
- Project duration 2017-2020
- 11 Partners from Ireland, Spain, Portugal, Germany and the United Kingdom
- Web Page: www.terapod-project.eu

Vision and Objective of TERAPOD

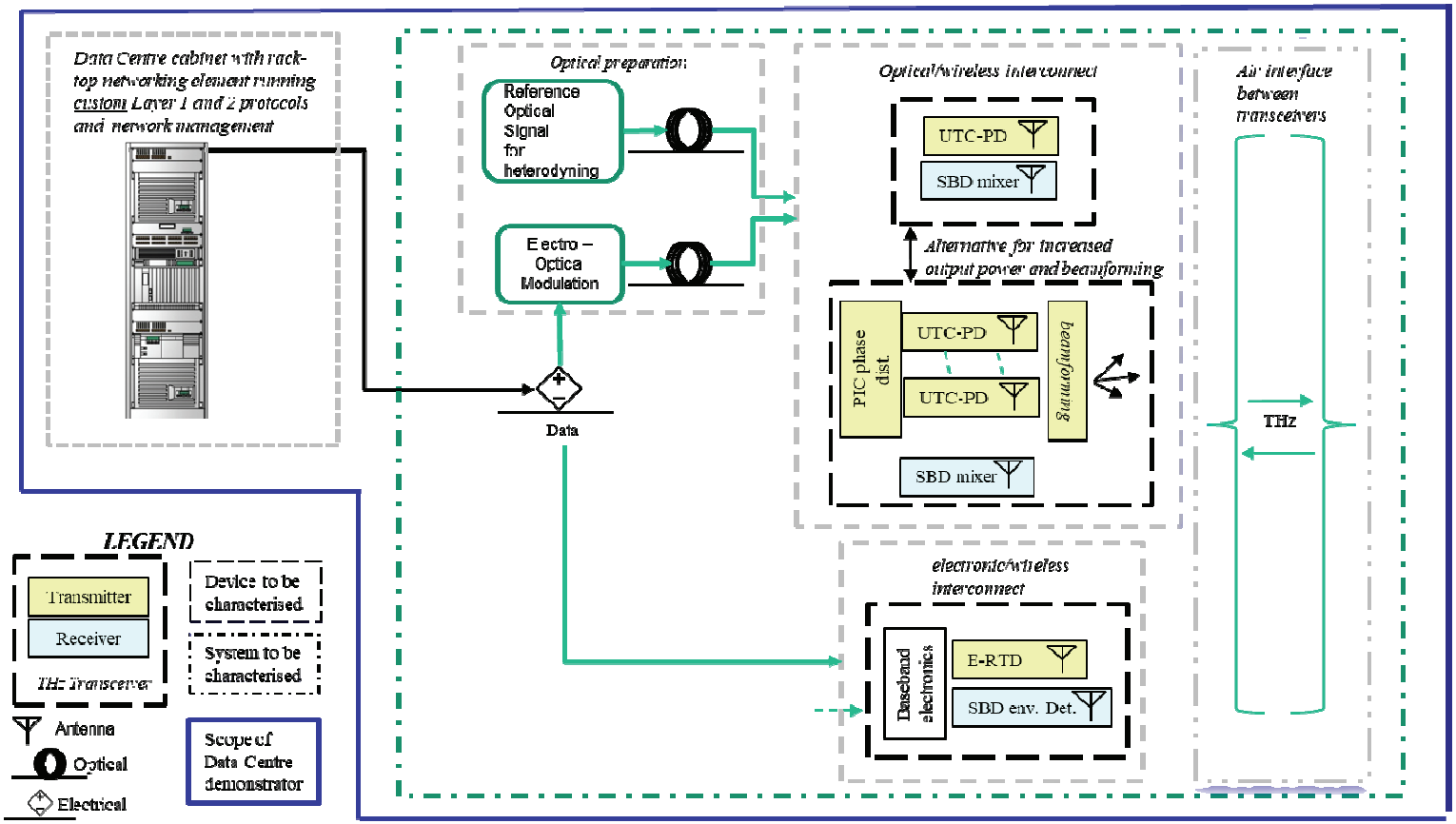
VISION: Push the boundaries of the THz communications, through the combination and integration of multiple THz technologies, paving the way towards future Tb/s wireless communications.

Objective: The overall TERAPOD **objective** to investigate and demonstrate the feasibility of ultra-high bandwidth wireless access networks operating in the Terahertz (THz) band.

Demonstrated within the operational setting (Dell EMC Data Centre) and will significantly progress innovations across the full communications protocol stack.

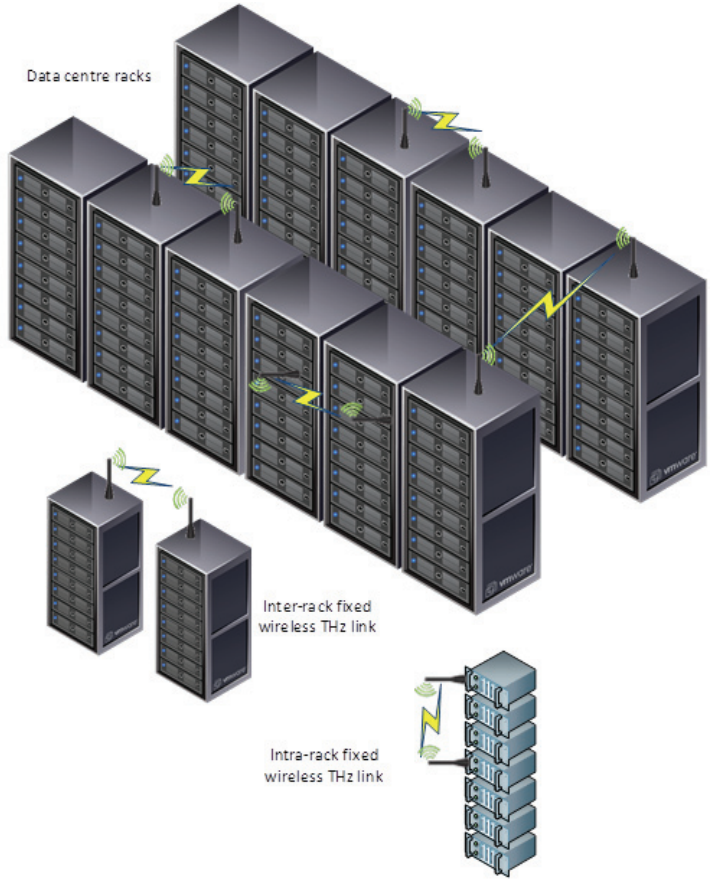
THz components and modules	THz devices and links	Characterization and modeling	Communication protocols and networking

TERAPOD Concept



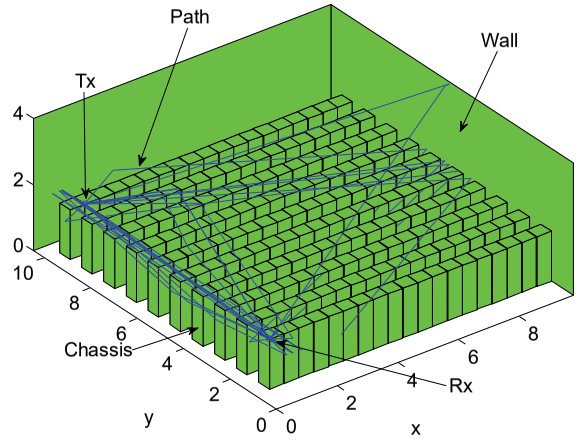
TERAPOD Target Scenario– Data Centre

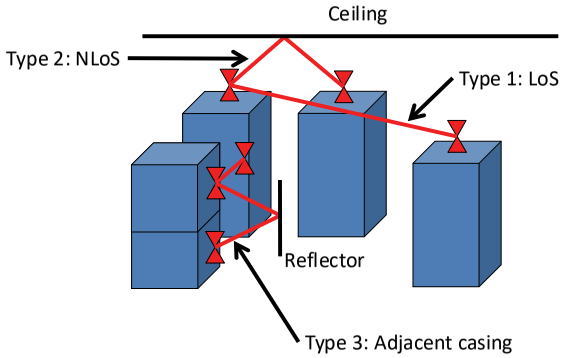
- Short range (1-10 m)
- High data rates (1-over 40 Gbps)
- Dense Topology
- Protocols/integration
- Low mobility
- Limited sensitivity to cost



Why 300 GHz Channel Measurements in a real Data Center?

- In the literature no channel measurement campaign at 300 GHz in a real data center are reported up to now,
- The TG3d Channel Model (Channel Modeling Document – CMD, doc. 15-14-0310-17-003d) is based on ray tracing simulation in an ideal data center only
- Different link types have been defined in the CMD
- The measurements presented in this document are covering these and other configurations

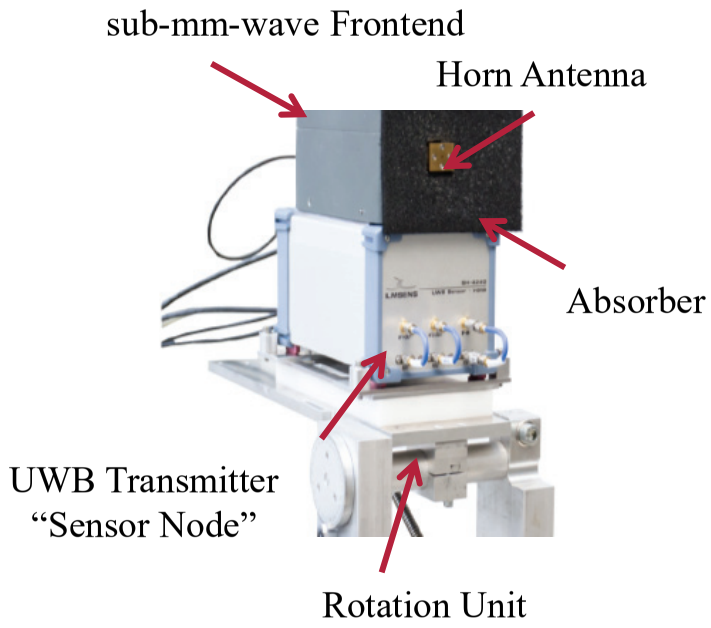




souce: 15-14-0310-17-003d

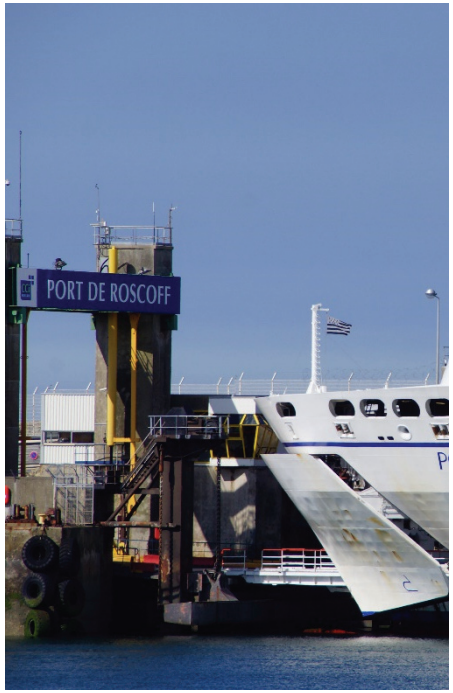
Measurement Equipment

- TUBS‘s time domain channel sounder has been used for the measurments
- Allows Measurement of the time-variant impulse response with a PRBS signals (sequence M= 12)
- Carrier frequency: 304,2 GHz
- Bandwidth: approx. 8 GHz
- Use of rotational units to measure spatial channel characteristics

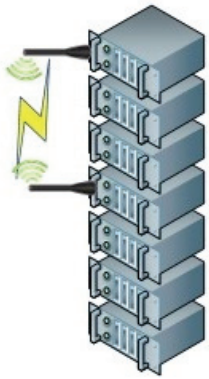


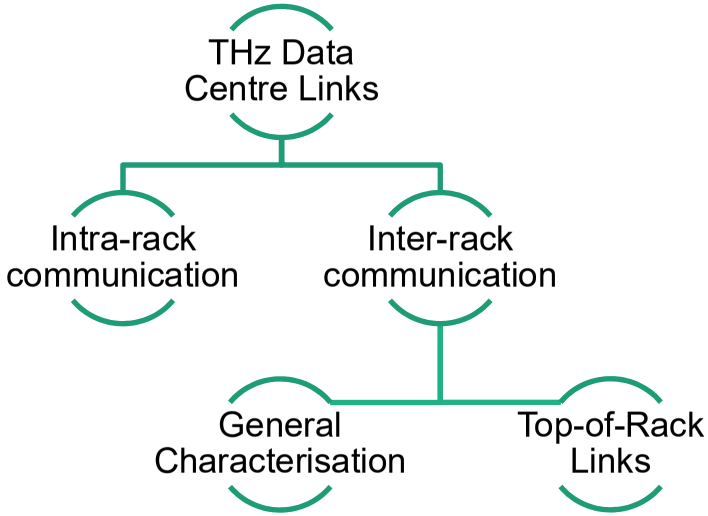
For more information on the measurement equipment see:
S. Rey, J. Eckhardt,. Peng, K. Guan, T. Kürner, Channel Sounding Techniques for Applications in THz Communications, 2nd Workshop on THz Communications (THZCOM) at the 9th International Congress on Ultra Modern Telecommunications and Control Systems, 8 November 17, 5 pages

Initial Measurement Campaign within the Research Data Centre of Dell/EMC, Cork Ireland




Categorisation of THz communication scenarios





Measurement campaign – Inter-rack scenarios
General characterisation

Rotational measurement

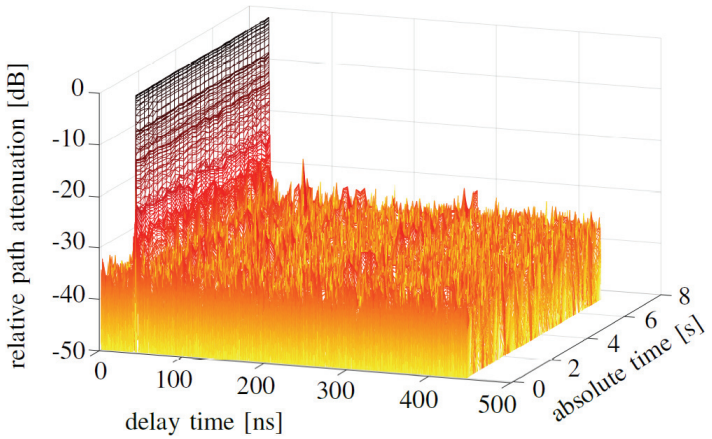
Point-to-point measurement

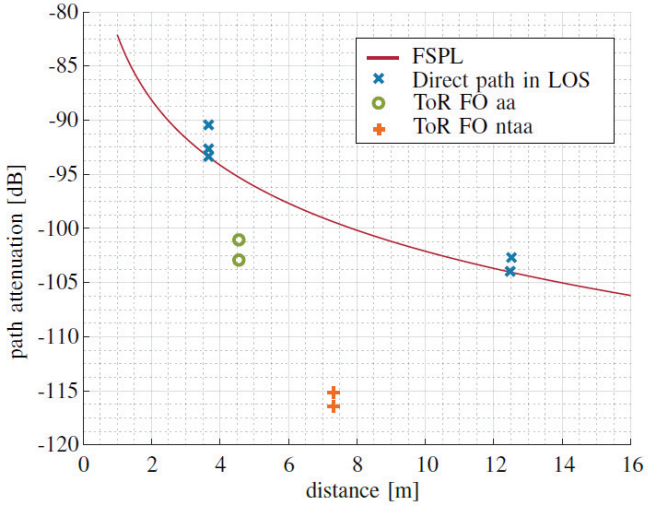
Measurement campaign – Inter-rack scenarios Top-of-Rack

Rotational measurement

Point-to-point measurement

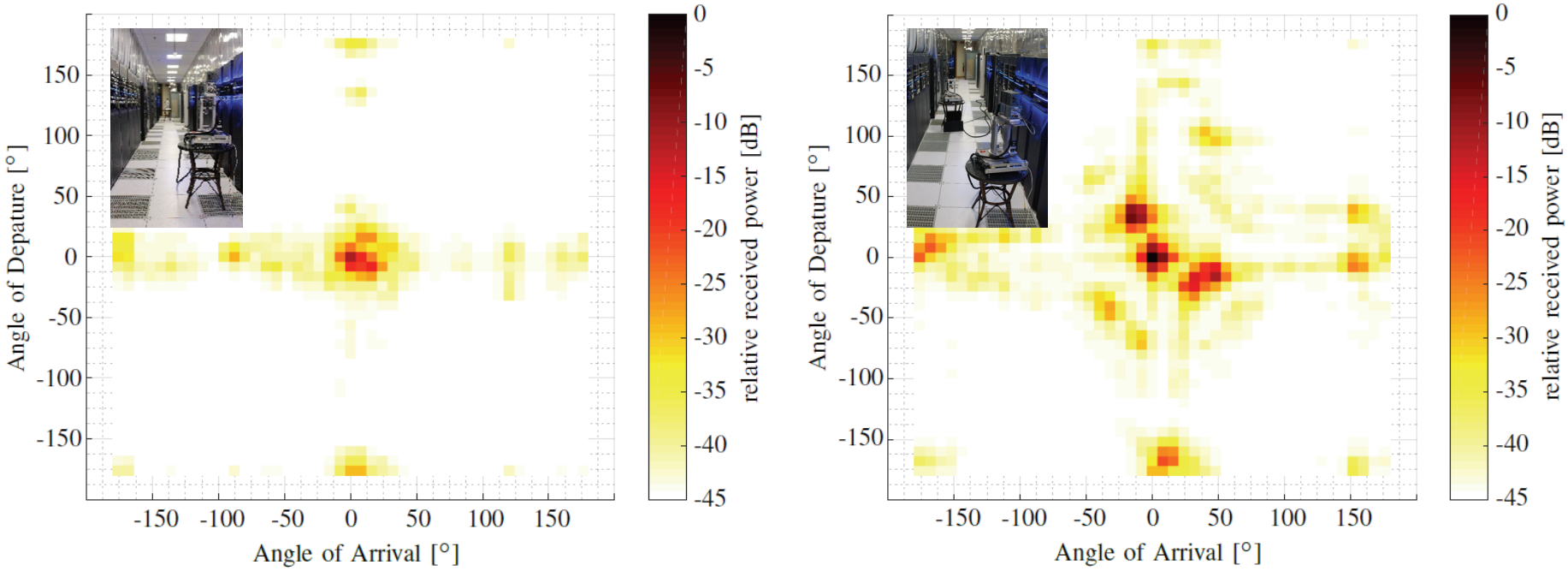
Measurement campaign – First Results





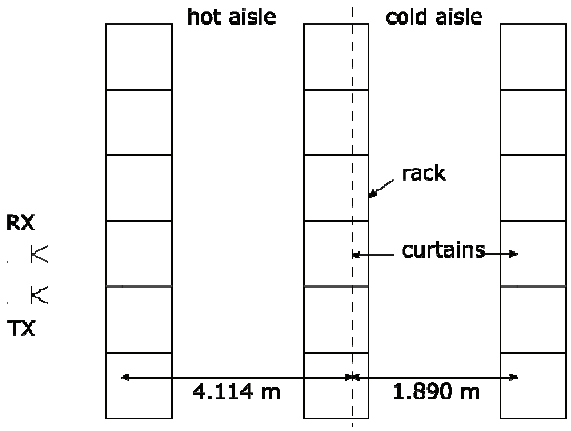
- Channel is time invariant
- Measurements agree with theoretical analysis

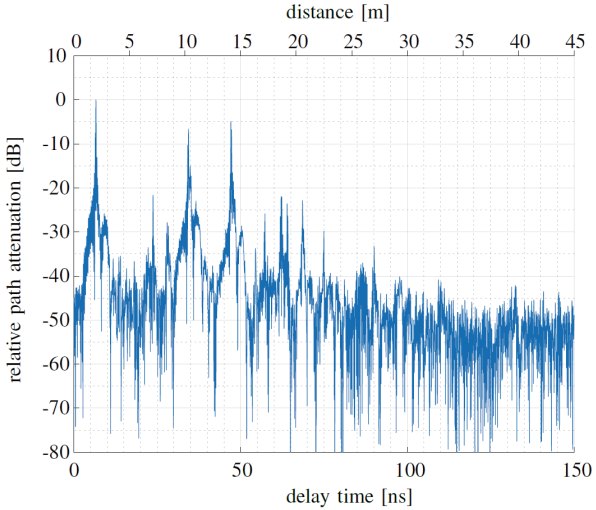
Measurement campaign – First Results



Power Angular Spectrum of General Characterisation Measurement;
left: long distance between Tx and Rx; 12,5 m
right: short distance between Tx and Rx: 3,6 m

Measurement campaign – First results





Reflection measurement agrees with the environment's geometry

Conclusion and Outlook

- First results from a 300 GHz channel measurement campaign in the Research Data Center of Dell/EMC has been presented.
- Results indicate, that measured propagation effects can be traced back to the geometry of the scenario
- Next steps:
  - Evaluation and assessment of the complete measurement campaign (including measurements in a second data center)
  - Calibration of ray tracing algorithm

- The TERAPOD project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 761579