Horizon 2020 Grant Agreement no: 814523

Tera**h**ertz end-to-end wireless systems supp**o**rting ultra-high data **R**ate applications

ThoR

Deliverable D1.4

Deliverable

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Start date of project: 01-Jul-2018

Date of issue: 19-Dec-2018
Due date: 31-Dec-2018
ThoR Ref: ThoR_TUBS_181218_B_WP1 Initial DMP

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Project co-funded by the European Commission within the Horizon 2020 programme and the National Institute of Information and Communications Technology in Japan (NICT)		
Dissemination level		
PU	**Public**	**X**
PP	**Restricted to other programme participants (including the Commission Services)**	
RE	**Restricted to a group specified by the consortium (including the Commission Services)**	
CO	**Confidential, only for members of the consortium (including the Commission Services)**	

 Named Distribution Only

Contents

Change register

Version	Date	Author	Organisation	Changes
0	11-DEC-2018	Thomas Kürner	TUBS	Initial Version in DMP online
A	18-DEC-2018	Thomas Kürner	TUBS	Input from co-authors included
B	19-DEC-2018	Thomas Kürner	TUBS	Review comments from Tetsuya Kawanishi incorporated

Reviewed by Tetsuya Kawanishi Waseda University Version A, 19.12.18

1. Statement of independence

The work described in this document is genuinely a result of efforts pertaining to the ThoR project. Any external source is properly referenced.

Confirmation by Authors:	Thomas Kürner	TUBS
	Laurenz John	Fraunhofer IAF
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	Petr Jurcik	DTAG

2. Initial DMP

The following pages have been created with DMP online

ThoR: THz end-to-end wireless systems supporting ultra-high data Rate applications

A Data Management Plan created using DMPonline

Creator: Thomas Kürner

Affiliation: Other

Template: European Commission (Horizon 2020)

Grant number: 814523

Project abstract:

Data traffic densities of several Tbps/km2 are already predicted for 5G networks. To service a fully mobile and connected society networks beyond 5G must undergo tremendous growth in connectivity, data traffic density and volume as well as the required multi-level ultra-densification. The ThoR project will provide technical solutions for the backhauling/fronthauling of this traffic. The ThoR consortium brings together the leading Japanese and European players from industry, R&D and academia, whose prior work defines the state-of-the-art in high data rate long range point-to-point THz links. This team has been instrumental in defining and implementing the new IEEE 802.15.3d Standard “100 Gbps Wireless Switched Point-to-Point Physical Layer.” ThoR’s technical concept builds on this standard, in a striking and innovative combination using state-of-the-art chip sets and modems operating in the standardized 60 and 70 GHz bands, which are aggregated on a bit-transparent high performance 300 GHz RF wireless link offering >100 Gbps real-time data rate capacity. ThoR will apply European and Japanese state-of-the-art photonic and electronic technologies to build an ultra-high bandwidth, high dynamic range transceiver operating at 300 GHz combined with state-of-the-art digital signal processing units in two world-first demonstrations: - more than 100 Gbps P2P link over 1 km at 300 GHz using pseudo data in indoor and outdoor controlled environments - more than 40 Gbps P2P link over 1 km at 300 GHz using emulated real data in a live operational communication network. This will require an innovative combination of specific THz PHY technology advances: photonic millimeter-wave generation in E-band used to drive wideband up/down-conversion into THz bands, combined with solid-state and Travelling Wave Tube amplifiers to enable long range operation. Using this concept, ThoR will enable the required multi-frequency and channel aggregation towards the new IEEE 802.15.3d Standard. The success of ThoR will represent the first operational use of THz frequencies in ICT and this influential and powerful consortium will directly influence and shape the frequency regulation activities beyond 275 GHz through agenda item 1.15 of WRC 2019.

Last modified: 19-12-2018

ThoR: THz end-to-end wireless systems supporting ultra-high data Rate applications - Initial DMP

1. Data summary

Provide a summary of the data addressing the following issues:

- State the purpose of the data collection/generation
- Explain the relation to the objectives of the project
- Specify the types and formats of data generated/collected
- Specify if existing data is being re-used (if any)
- Specify the origin of the data
- State the expected size of the data (if known)
- Outline the data utility: to whom will it be useful

The following purposes of data collection have been identified (this list may be extended as the project progresses):

- Device characterisation data required for device specifications and for modelling of RF impairments in link level simulations.
- Characterization of single transistors and integrated circuits required for the design of solid-state RF front end receive and transmitt MMICs. Characterization of the packaged solid-state RF front end.
- Free-space propagation data required for link design.
- Measurements, modelling and simulation data are necessary inputs to model and verify components of the developed hardware as well as the wireless THz data transmission system.

The data will be used for device and circuit engineering, for modelling and simulations, and as a basis for designing wireless links.

Types of data produced:

- Measurement data: device and circuit characterisation, channel and antenna measurement.
- Scenario data: simulation data defined in WP2, typical/generic geometrical environments.
- Simulation data: simulation results from WP5 and WP6, physical and system layer simulations, open-source simulation software. Simulation results from WP4, RF front end design (EM/circuit simulation software: ADS, CST).

No data-re-use is foreseen at this point.

All data will be generated by the project except the 3D builing data required to set-up the simualtion scenrios

Size of the data.

- Measurement data originating from device characterisation will be low-volume; expected total size below 1 GB
- Modelling data will be medium-volume, of the order of 100 GB

The data will be utilised by project partners, and will be made available to third parties as open-source data if possible and adequate (see section 3.2)

2. FAIR data

2.1 Making data findable, including provisions for metadata:

- Outline the discoverability of data (metadata provision)
- Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers?
- Outline naming conventions used
- Outline the approach towards search keyword
- Outline the approach for clear versioning

- Specify standards for metadata creation (if any). If there are no standards in your discipline describe what metadata will be created and how

- Metadata provision:
    - Data will be sorted by category
    - A file will be provided and regularly updated, listing the type of data, its filename, and relevant information as to its nature.
    - A file will be provided listing all abbreviations in use.
    - For data originating from measurements, simulation, and device characterisation a table of contents will be provided, showing data structure.
    - Each category of data will have the same folder structure.
    - Each scenario will have its own identifier.

Data files will have standard identifiers. The details will be defined before D2.4 is submited.

2.2 Making data openly accessible:

- Specify which data will be made openly available? If some data is kept closed provide rationale for doing so
- Specify how the data will be made available
- Specify what methods or software tools are needed to access the data? Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)?
- Specify where the data and associated metadata, documentation and code are deposited
- Specify how access will be provided in case there are any restrictions

As far as possible the processed data will be openly available.

Types of data not available:

- Raw data.
- Data violating personal rights.
- Data violating company interests. Especiall confidential data (e.g. locations and parameters of macro/micro base stations) from real-life network deployment cannot be provided openly

Most of the processes data will be available as clear text files, importable into software packages such as Matlab, Excel, and Origin. Where necessary, software conversion script will be provided.

Data will be stored in Powerforlder hosted at the TUBS. On a case by case basis, links to data will be registered with appropriate Open Access Data Repositories hosted by TUBS with agreed access restrictions and procedures in place.

2.3 Making data interoperable:

- Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability.
- Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability? If not, will you provide mapping to more commonly used ontologies?

Processed measurement data from device characterisation and free-space propagation measurements will be stored as tabulated values in tab-separated columns with named column headings in ASCII plain-text files that can be read or imported into suitable software tools (e.g. MATLAB, EXCEL, Origin).

Processed channel measurement data will be provided as MATLAB data files that can be directly loaded into MATLAB.

Scenario data will be in the form of a generic data type containing the scenario data in an XML file, where every point in space is characterised by several properties.

Modelling data will be recorded as statistical parameters listed in an appropriate table format (e.g. EXCEL). The format of the stochastic channel models will be defined in the course of the project.

Simulation data will be produced by MATLAB or C#, with the exact format determined by the simulation software. If open-source simulation software is provided, the data can be directly imported and used.

Processed measurement and simulation results of integrated (packaged) circuits will be stored using ASCII text files (see above) as well as Touchstone files (usable in conventional RF circuit simulators).

2.4 Increase data re-use (through clarifying licenses):

- Specify how the data will be licenced to permit the widest reuse possible
- Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed
- Specify whether the data produced and/or used in the project is useable by third parties, in particular after the end of the project? If the re-use of some data is restricted, explain why
- Describe data quality assurance processes
- Specify the length of time for which the data will remain re-usable

A licensing policy will be introduced within the project.

Open source data will be made available at the conclusion of the project, where possible and adeqate. The project will have innovation cycles that will depend on confidentiality. Final analysed data will be published.

Re-using the data:

- Measurement data pertaining to devices and propagation will be re-usable.
- Simulation data will be re-usable or reproducible, because simulation software will be open-source.

Data will be maintained for use by other projects, researchers or development engineers, as recommended in the Guidelines on the Handling of Research Data by the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG).

3. Allocation of resources

Explain the allocation of resources, addressing the following issues:

- Estimate the costs for making your data FAIR. Describe how you intend to cover these costs
- Clearly identify responsibilities for data management in your project
- Describe costs and potential value of long term preservation

Costs for cloud service: to be decided

Responsibilities for data management: to be agreed by project partners.

Powerfolder is hosted by partner TUBS.

4. Data security

Address data recovery as well as secure storage and transfer of sensitive data

Data will be hosted on powerfolder by TUBS or on own repository. Data security will be provided by the host.

Raw data will be held in local repositories; with data security provided locally.

Data will be secured by TUBS backup policies, local as well as remote (off site).

5. Ethical aspects

To be covered in the context of the ethics review, ethics section of DoA and ethics deliverables. Include references and related technical aspects if not covered by the former

The project addresses aspects of data transmission in the THz domain. There will be no personal data acquired or revealed. All stored data will be "de-identified". Therefore no specific aspects have been put to the ethics section of the DoA (Description of Action)

6. Other

Refer to other national/funder/sectorial/departmental procedures for data management that you are using (if any)

Country-dependent issues:

- Germany: minimum of 10-year storage must be guaranteed for research data as recommended in the Guidelines on the Handling of Research Data by the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG).