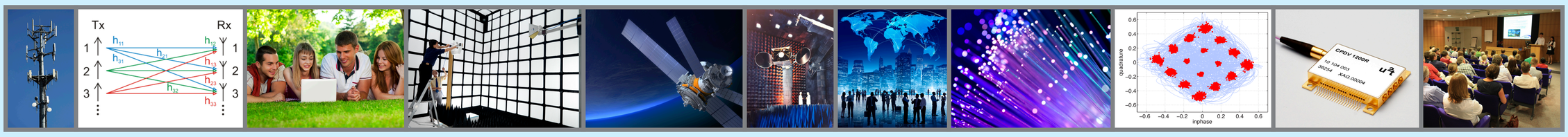
JRPi11 Metrology for Optical and RF Communication Systems (MORSE)

EURAMET
European Association of National Metrology Institutes



Motivation

We believe that a knowledge-based economy is critically dependent on the quality of its communication structure. This is also recognised by the Europe 2020 Digital Agenda, one of the Flagship Initiatives to promote economic growth.

Metrology underpins the R&D for each generation of communication technology. We believe that this JRP will support European NMIs, communication research and future Horizon 2020 projects. Keeping Europe involved in this technology development is important.

Communications capacity increases roughly in line with Moore's Law, doubling capacity every 2 years. While we are used to each successive generation of technology being faster, this masks the huge technology effort involved.

Stakeholder viewpoints

"The objectives of this project are highly aligned with ETSI objectives. The project is regarded as important pre-normative research for ongoing standardisation work in ETSI"

Dr Hermann Brand, Director Innovation, ETSI.

"Understanding performance and how to measure it are the vital first steps in driving new innovations in RF and optical system design. …The ICT KTN Wireless Technology and Spectrum Working Group has in particular placed on record the fact that the lack of such techniques is a limiting factor in the exploitation of MIMO technology"

Dr Philip Hargrave FREng, CEO and Network Director, ICTKTN.

Overview

The JRP includes four key industry unfunded partners, two University REG and five NMIs with a strong track record in communication metrology.

The three technical areas focus on high-value parts of the communications system: Terrestrial Wireless communications, Satellites, and the optical core.

- WP1: Metrology for dense wireless communications. More users per cell and better power efficiency achieved with Multiple Input and Multiple Output (MIMO) antennas but these systems are difficult to measure.

  The "Internet of Things", Smart Grids and machine-to-machine communications are expected to grow by x22 over 2011-2016. Smart antennas use less power and give better connections, but they need new metrology.
- WP2: New satellites are increasingly sophisticated but the available test time is fixed. This JRP develops new metrology to cut test times and accommodate the increased complexity improving EU industry competitiveness.
- WP3: Optical communications underpin the fast internet. This JRP provides the metrology infrastructure for the technology development for 1 Tbit/s communications per channel (2016).

Dissemination is key for successful Impact. The stakeholders include knowledge networks with strong links to industry and dissemination is through physical capability, training and publication at national and international levels. We are keen to cooperate with other EU NMIs to increase the impact of this work.

Scientific & Technical Excellence

Each successive generation of communications system extends the state of the art - supporting metrology must achieve similar improvements

WP1. Terrestrial wireless communication

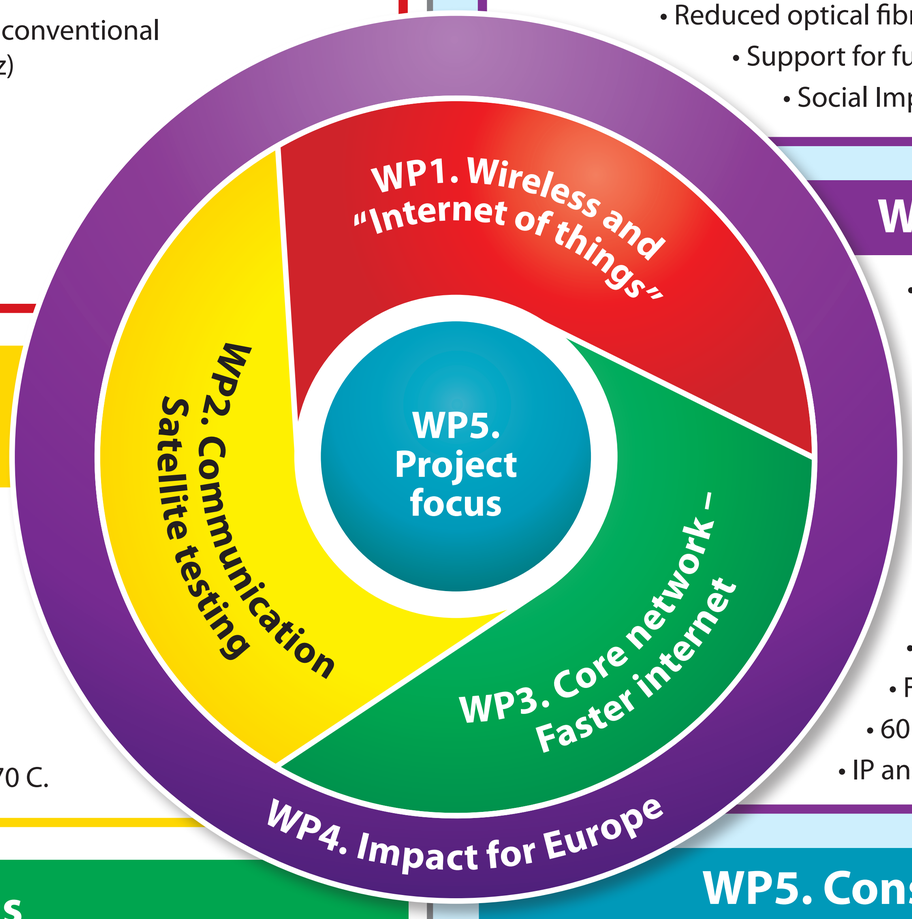
- Known MIMO uncertainties comparable with best conventional antenna measurement (±0.13 dB over 2.6,- 4.0 GHz)
- Support for higher order and massive MIMO
- Smart/reconfigurable antenna measurement – comparable accuracy to standard antenna, measurement growth rate less than number of states.

WP2. Improved antenna measurement techniques

- 75% measurement time reduction by Sub-Nyquist spatial sampling -strategies and EM modelling
- Develop 60 GHz optoelectronic RF field sensor
- Impact Compact Antenna range uncertainty (±0.32 dB and ±3.3º)
- Multi-physics antenna measurements over 0 C to 70 C.

WP3. Optical communications

- Photodiode complex frequency response 1 -100 GHz. Traceability for differential photodiode systems
- Full waveform metrology for optical transmitter with uncertainties over >28 GHz
- Uncertainties for optical Error Vector Magnitude (EVM).



WP4. Impact

- Support EU "2020 Digital Agenda for Europe" goals and EU Horizon 2020 research
- Keep focussed work within Europe
- Energy saved through improved measurements for MIMO systems
- 50%-75% test-time reduction for EU satellite industry through algorithms/ test methods
- Reduced optical fibre deployment needs – better use of assets
- Support for future radiated emission regulations
- Social Impact: Infrastructure benefits to EU citizens.

WP4. Dissemination

- Stakeholders have early access to results
- Focus groups - ICTKTN (UK)
- > 15 publications expected, >4 Best practice Guides
- Dissemination through Training and national language meetings (>12)
- Standards committees (ETSI, IEC, 3GPP)
- COST ACTION IC1004
- NMI Measurement Services
- Independently verified test methods
- Focal point through web page
- 60 GHz optical RF sensor technology
- IP and technology.

WP5. Consortium and Management

- Strong JRP team with complementary knowledge and facilities. Collaboration between team members within workpackages.
- Access to state of the art equipment through industrial partners
- Stakeholder advisory board will be formed for guidance
- Stakeholder's group include Knowledge Transfer routes to increase impact
- JRP Coordinator (NPL) will be supported by experienced project management team.

Supporting EMRP Objectives

- Work requires collaboration
- Meets the EMRP objective of accelerating innovation and competitiveness
- The work packages map directly on to the SRT technical objectives
- Algorithms developed in this JRP will support other European NMIs
- Increased knowledge base and capabilities for participating NMIs.

	Funded Partners					Unfunded Industrial Partners				REG	
	NPL	CMI	EJPD	LNE	PTB	Aeroflex	Agilent	Dassault	EXFO	TU Delft	Uni Rennes IETR
WP1	○		●	○		○				○	
WP2	○			●	○			○		○	○
WP3	●	○			○		○		○		
WP4	○	○	○	○	●	○	○	○	○	○	○
WP5	●	○	○	○	○					○	○

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