

IND51 MORSE Final One day Workshop

Thursday 9th June 2016,

National Physical Laboratory, Hampton Road, Teddington, UK, TW11 0LW



Metrology for Optical and RF Communications

Background

High quality satellite, fibre and mobile communications are an essential part of modern life and vital to our wealth-creating industries, with increasing demand for telecommunications growing at 40% p.a. The EU “2020 Digital Agenda for Europe” acknowledges this and sets ambitious targets that will have an impact on all areas of the communication network and offers significant opportunities for European industry. Industries are addressing this challenge through unlocking the latent capacity of ground-based and satellite-based systems. However, the potential technologies are complex and reliable measurement is required to develop and test innovative solutions in appropriate timescales and costs.

This project aimed to support the R&D activities of industry by providing the underpinning metrology required by the wireless, optical and satellite communication parts of the network, covering all aspects from the network-edge to the network-core.

The specific objectives were:

- **Theme 1: Terrestrial Wireless Communications:** Adaptive wireless systems that optimise the transmission channel are difficult to fully characterise. This project addressed three areas: (1) Measurement of radiated RF power and (2) Over-The-Air testing for 4G (and above) systems such as LTE and LTE-advanced where the transmitters and handsets have several antennas; and (3) Low-cost reconfigurable antennas are needed for many applications, including small satellites, but these are expensive to measure because each possible state must be measured. We will develop robust, traceable test methods in collaboration with test-equipment manufacturers to reduce this problem and reduce costs.
- **Theme 2: Development of signal processing algorithms for the improvement of measurement performance:** Communication satellites are becoming more sophisticated and as a result, testing time and costs are becoming a serious problem. This project addressed the issue of measurement efficiency (time and accuracy) and verification through four tasks: (1) Verified algorithms that balance measurement, modelling and interpolation to reduce test-time (2) Develop a nearly non-invasive electric field sensor to test small antennas at high frequencies (> 60 GHz). (3) Improve the accuracy of the large testing facilities. The sensor developed in (2) will be used in this work. (4) The effect of environmental factors on measurement uncertainties - testing antennas under temperature stress.
- **Theme 3: Optical Communications:** A faster optical core network needs to carry more data per channel. The alternatives are the network crunch (no capacity) or the huge cost of laying more fibre. This project aimed to provide new terminal and test equipment will be developed in industry to achieve up to 1Tbit/s in a single channel. The project developed supporting metrology for the transmitters and receivers.

At this workshop you will hear results from this 3-year project, viewpoints from leading industry speakers and have the opportunity to speak with the project scientists.



IND51 MORSE Final One day Workshop DRAFT Agenda

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F16 Lecture theatre		
09:00-09:30	Registration	
09:30-09:40	Introduction	David Humphreys, NPL
	Theme: Terrestrial wireless communications	
09:40-10:10	WP1 overview & traceable measurements of LTE-base station power	Frederic Pythoud, METAS
10:10-10:35	Spatial domain analysis: OTA test for the 5G age	Moray Rumney, Keysight Technologies
10:35-11:00	Coffee break and networking	
11:00-11:25	Measurement of system embedded antennas	Marco Spirito, TU Delft
11:25-11:50	Development of MIMO OTA metrology at NPL	Tian Hong Loh/Chong Li, NPL
11:50-13:00	Lunch and posters	
	Theme: Development of signal processing algorithms for the improvement of measurement performance	
13:00-13:10	Signal processing techniques for antenna measurement improvement	Jean-Marie Lerat, LNE
13:10-13:35	Antenna measurement techniques improving measurement speed (draft title)	Stuart Gregson, Nearfield Systems Inc. (UK)
13:35-14:00	Using antenna modelling to speed up radiation pattern measurements	Phil Miller, NPL
14:00-14:25	Signal processing techniques for compensation of CATR effect on antenna measurement	Jean-Marie Lerat, LNE
14:25-14:50	Compressed sensing approach for reflect array diagnostic from far-field measurement	Laurent le Coq / Benjamin Fuchs, University of Rennes
14:50-15:20	Coffee break and posters	
	Theme: Optical communications	
15:20-15:30	WP3 overview	Irshaad Fatadin, NPL
15:30-15:55	High-speed photonic components and related optoelectronic test requirements	Andreas Umbach, Finisar
15:55-16:20	Characterization of high-speed optical transmitters using Error vector Magnitude	Martin Hudlicka, CMI
16:20-16:45	Characterization of fast photodiodes using a laser-based vector network analyzer	Mark Bieler, PTB
16:45-17:00	Concluding remarks and discussion	David Humphreys, NPL
17:00-17:30	Networking	
17:30	Close of meeting	



Poster titles

1. "LTE power measurements", Frederic Pythoud, (METAS)
2. "New modulation technique: constellation switching", Frederic Pythoud, (METAS)
3. "Measuring Smart Antenna" Tian Hong Loh and David Cheadle (NPL)
4. "Design and characterization of a reference mm-wave frequency scanning antenna", Marco Spirito (TU Delft)
5. "Near-field antenna measurements using electro-optic probes", Mark Bieler (PTB)
6. "Antenna measurement under a temperature grade", Michael Charles (LNE)
7. "Characterising Digital Oscilloscopes", David Humphreys (NPL)
8. "Measuring Differential-Photodiode Common-Mode Rejection-Ratio", David Humphreys (NPL)