



Antennas for Emerging Technologies

TGI Structured PhD Module

Dublin Institute of Technology, Kevin St, Room 403

Monday 2nd September to Friday 6th September

Monday 2nd September 09.00 – 17.00

08.50 Registration

09.00 Introduction Professor Max Ammann

09.00-12.30 Channel Characterisation and Modelling for Body Centric Communications
Professor William Scanlon

Overview of Body centric communications

Rationale for channel characterization

Narrowband channel measurement examples:

- 2.45 GHz on-body
- 868 MHz off-body
- Body centric diversity
- Effect on applications – localisation examples

12.45 Lunch

14.00-17.00 Channel Measurement Practical Professor William Scanlon

- Experimental design
- Fixed link measurements
- Wearable measurements
- Statistical Characterisation using Matlab

Tuesday 3rd September 09.00 – 17.00

09.00-12.30 Body to Body Communications Professor William Scanlon

- Context
- Early experimental investigations @ 2.45 GHz
- A numerical mm-wave body to body study
- Context aware body area networks (CABAN)
- Coping with body effects: an ad-hoc sports tracking example

12.30 Lunch

14.00-15.00 Electrically Small Antennas: Introduction to Fundamental Concepts Dr Steve Best

- Fundamental antenna properties
- Fundamental performance limits
- Small antenna design challenges and approaches

15.00-17.00 Electrically Small Antennas: – State-of-the-Art

Dr Steve Best

- Fundamental antenna designs
- Antenna designs meeting fundamental limits
- Wireless device antennas
- New antenna concepts – Fact or Science Fiction?
 - Fractal antennas
 - E-H antennas/Cross-Field antennas
 - Metamaterial antennas
 - Non-Foster matching

Wednesday 4th September 09.00 – 17.00

09.00-11.00 Design of RFID Antennas Dr Steve Best

- RFID concepts and applications
- RFID antenna design challenges and approaches
- Commercial RFID antennas
- Detailed design procedure and example for a 915 MHz RFID antenna

11:30 - 12:30 Design of Implantable/Medical Device Antennas Dr Steve Best

- MICS specifications and requirements
- Electrical properties of the human body and antenna design considerations
- Human body and internal antenna interactions

12.30 Lunch

13.30- 14.45 Design of Implantable/Medical Device Antennas Dr Steve Best

- Interface issues between antenna and MICS band transceiver (system design considerations: TX power, RX sensitivity, etc.)
- Detailed design procedure and example for an internal antenna at MICS band
- System design consideration and optimizing the performance of the communication link (antenna impedance and circuit considerations between the antenna and MICS band transceiver)

14:45 - 16:00 MIMO Antennas Dr Steve Best

- Understanding MIMO (link budgets, channel capacity, multiple antenna systems)
- MIMO antenna design challenges (mutual coupling, ground plane interactions, antenna correlation coefficient)
- MIMO antenna designs

16:00 - 17:00 EBG Ground Plane Antenna Dr Steve Best

- Antenna and ground plane interactions
- EBG ground planes
- Design of EBG antenna systems

Thursday 5th September 09.00 - 17.00

09.00-11.00 Efficient EM Simulation of modern applications Dr Winfried Simon

- Time domain simulation using FDTD
- Efficient simulation model setup (ports, mesh, memory usage, ...)
- Considering losses for broad band and high frequency applications

11.15-12.15 RF MEMS switches for agile antenna front ends Dr Winfried Simon

- MEMS technology
- RF MEMS switch & phase shifter design
- integrated antenna front endtime domain simulation using FDTD

12.15-12.45 EM simulation using EMPIRE Xccel Dr Winfried Simon

- Introduction to EMPIRE xccel
- Challenging antenna applications

12.45 Lunch

- 14.00-17.00 RF MEMS switch design (simulation tutorial) Dr Winfried Simon**
- Layout import challenging antenna applications
 - RF MEMS switch optimization for broad frequency range (DC – 50 GHz)

Friday 6TH September 09.00 - 16.00

- 09.00-10.00 Introduction to LTCC Technology Dr Winfried Simon**
- LTCC process
 - RF applications on LTCC

- 10:00 - 11:00 Array antenna design Dr Winfried Simon**
- 24 GHz automotive radar array antenna on Rogers PCB
 - 60 GHz WPAN dielectric waveguide antenna on LTCC
 -

- 11:30 – 12:30 KA Band LTCC front end module design**
- Patch antenna, 90° hybrid, calibration network, LO network
 - Active component integration
 - Realization & measurement
 -

12:30 - 13:30 Lunch

- 13.30 - 15:00 Optimizing multilayer transitions for high frequency usage (EM simulation tutorial) Dr Winfried Simon**
- Transition design & optimization
 - RF load design

- 15:15 - 16.00 60 GHz WPAN antenna design (EM simulation tutorial)**
- Layout import & simulation, waveguide modes & coupling
 - Array design

16.00 Close



Biographies:

William G. Scanlon received the B.Eng. degree in electrical engineering (first-class honours) and the Ph.D. degree in electronics from the University of Ulster, UK in 1994 and 1997, respectively. He was appointed as Lecturer at the University of Ulster in 1998, Senior Lecturer and Full Professor at Queen's University of Belfast (UK) in 2002 and 2008, respectively. He is currently Director of Research for the Digital Communications Cluster and Chair of Wireless Communications at Queen's and he holds a part-time Chair in Short Range Radio at the University of Twente, The Netherlands. Prior to starting his academic career he had 10 years of industrial experience, having worked for Nortel Networks, Siemens and GEC-Osram. His current research interests include personal and body-centric communications, wearable antennas, RF and microwave propagation, channel modelling and characterization, wireless networking and protocols and wireless networked control systems. He has published over 200 technical papers in major IEEE/IET journals and in refereed international conferences. He served as keynote speaker for the NATO Military Communications and Information Systems Conf. (2010), the Intl. Conf. on Bodynets (2010) and the European Workshop on Conformal Antennas (2007). He Co-Chaired the International Workshop on Advances in Wireless Physical Layer Communications for Emerging Healthcare Applications at MobiHealth 2012 and the 2009 Loughborough Antennas and Propagation Conference and he has acted as invited speaker and session chair at numerous other international conferences. Prof. Scanlon received a Young Scientist award from URSI in 1999, and he

was a recipient of the 2010 IEEE H. A. Wheeler Prize Paper Award and he is also an Associate Editor for the IEEE Journal of Translational Engineering in Health and Medicine.



Steven R. Best is a Principal Sensor Systems Engineer with the MITRE Corporation in Bedford, MA. He received the B.Sc.Eng and the Ph.D. degrees in Electrical Engineering in 1983 and 1988 from the University of New Brunswick in Canada. Dr. Best has over 25 years of experience in business management and antenna design engineering in both military and commercial markets. Prior to joining MITRE, Dr. Best was with the Air Force Research Laboratory (AFRL) at Hanscom AFB, where his research interests included electrically small antennas, wideband radiating elements, conformal antennas, antenna arrays and communications antennas. Prior to joining AFRL, he was President of Cushcraft Corporation in Manchester, NH from 1997 to 2002. He was Director of Engineering at Cushcraft from 1996 to 1997. Prior to joining Cushcraft, he was co-founder and Vice

President and General Manager of Parisi Antenna Systems from 1993 through 1996. He was Vice President and General Manager of D&M/Chu Technology, Inc (formerly Chu Associates) from 1990 – 1993. He joined Chu Associates as a Senior Electrical Engineer in 1987.

Dr. Best is the author or co-author of 3 book chapters and over 100 papers in various journal, conference and industry publications. He frequently presents a three-day short course for the wireless industry titled “Antennas and Propagation for Wireless Communication”, he is the author of a CD-ROM series on antenna theory and design, and he has presented several Webinars on antenna topics. He has also authored an IEEE Expert Now module on electrically small antennas. Dr. Best is a former Distinguished Lecturer for IEEE Antennas and Propagation Society (AP-S), a former member of the AP-S AdCom, a former Associate Editor for the IEEE Transactions on Antennas and Propagation, and Senior Past Chair of the IEEE Boston Section. He is currently the AP-S Electronic Communications Editor-in-Chief. Dr Best is a Fellow of the IEEE and the immediate Past-President of the IEEE Antennas and Propagation Society.

Winfried Simon was born in Aachen, Germany in 1970. He studied Electrical Engineering at the Duisburg University and received his Diploma Degree in 1997. He joined the IMST GmbH in Kamp-Lintfort in 1996, and is working as senior engineer in the department of Antennas & EM Modelling. His main fields of activities are 3D electromagnetic simulations and the design of antennas, multilayer LTCC circuits, waveguide components and MEMS devices. He is author and co-author of more than 60 scientific publications and board member of the European School of Antennas (ESoA).