Managing Board Meeting
Scientific Advisory Board Meeting

Brno University of Technology
Technicka 12, Brno, Room SE6.121

The 13th of January, 2015
Time: 10:00 to 12:00

Managing Board

Prof. Jarmila **Dědková**, the dean, FEEC BUT

Prof. Lubomír **Grmela**, vice-rector, BUT

Otto **Vodvářka**, Rohde & Schwarz

Leoš **Dvořák**, Honeywell

Prof. Markus **Rupp**, Vienna Univ. Technol.

Prof. Zbyněk **Škvor**, Czech Technical Univ.

Scientific Advisory Board

Prof. Erich **Leitgeb**, Graz Univ. Technol.
Prof. Hans **Hartnagel**, Darmstadt Univ. Technol.
Prof. Juraj **Bartolić**, Univ. of Zagreb

Prof. Vladimír **Aubrecht**, CVVOZE Centre
Prof. Petr **Stehlík**, NETME Centre
Prof. Petr **Štěpánek**, ADMAS Centre

Roman **Tkadlec**, CommScope
Ladislav **Pospíchal**, MeGA
Karol **Molnár**, Honeywell

INWITE

- Sensor systems
  [prof. Ulrich Schmid, doc. Jaromír Hubálek]
- Signal processing
  [prof. Franz Hlawatsch, prof. Zdeněk Smékal]
- Radiofrequency applications
  [prof. Christoph Mecklenbräuker, prof. Aleš Prokeš]
- Mobile communications
  [prof. Markus Rupp, Dr. Roman Maršálek]
- Cyber-security
  [prof. Tanja Zseby, Dr. Jan Hajný]

Distributed working group

- Antennas and high frequency circuits
  [prof. Holger Arthaber, doc. Jaroslav Láčík]

ADWICE

- Project **ADWICE**
  [ADvanced WIreless technologies for Clever Engineering]
- International consortium
  [Vienna University of Technology / SIX Research Center]
- Financing
  [Horizon 2020 / Czech state budget]
- Initial phase
  [06/2015 to 05/2016]
- Research phase
  [01/2017 to 12/2022]

Quantitative Evaluation

Researchers: headcount

	Program	Employees
1	Microwave Technologies	21
2	Wireless Technologies	41
3	Converged Systems	50
4	Multimedia Systems	22
5	Sensor Systems	79
-	Management	13
	Total	236

Sampling date: 12/2014

Researchers: categories

Position	Empl.	FTE	Average load
Ph.D. student	77	31.4	41%
Junior scientist	71	50.5	71%
Senior scientist	54	26.7	49%
Support staff	21	1.9	9%
Total	223	110.5	50%

Sampling date: 12/2014

Management

Position	Empl.	FTE	Average load
Director	1	0.5	50%
Vice-director	2	1.0	50%
Department head	5	1.0	20%
Department vice-head	5	1.0	20%
Total	13	3.5	27%

Sampling date: 12/2014

Master-degree graduates

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	10	11	13
2	Wireless Technologies	18	7	24
3	Converged Systems	5	26	37
4	Multimedia Systems	1	3	23
5	Sensor Systems	9	22	38
	Total	43	69	135

PhD-degree graduates

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	3	2	6
2	Wireless Technologies	4	1	2
3	Converged Systems	4	5	2
4	Multimedia Systems	2	1	8
5	Sensor Systems	3	4	5
	Total	16	13	23

Explanation: Dr. Mišurec

Students involved

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	26	15	26
2	Wireless Technologies	26	10	12
3	Converged Systems	23	38	83
4	Multimedia Systems	12	3	37
5	Sensor Systems	8	22	43
	Total	95	88	201

Publications

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	23.0	20.1	12.0
2	Wireless Technologies	25.0	13.8	31.0
3	Converged Systems	15.0	50.6	23.0
4	Multimedia Systems	22.0	6.3	22.0
5	Sensor Systems	22.5	41.2	15.0
	Total	107.5	132.0	103.0

Explanation: Prof. Kasal, Dr. Mišurec, Prof. Vrba

Selected Publications

P1 KADLEC, P.; RAIDA, Z. Multi-objective self- organizing migrating algorithm applied for design of electromagnetic components. *IEEE Antennas & Propagation Magazine*, 2014, vol. 24, no. 3. **IF: 1.152**

P2 HRUBOS, Z.; GOTTHANS, T. Analysis and synthesis of chaotic circuits using memristor properties. *Journal of Electrical Engg.*, 2014, vol. 65, no. 3. **IF: 0.420**

P3 YUCE, E.; MINAEI, S.; HERENCSÁR, N. Grounded voltage controlled positive resistor with ultra low power consumption. *Elektronika Ir Elektrotechnika*, 2014, vol. 20, no. 7. **IF: 0.445**

P4 ONCHIS, D.; RAJMIC, P. Generalized Goertzel algorithm for computing the natural frequencies of cantilever beams. *Signal Processing*, 2014, no. 96, p. 45-50. **IF: 2.238**

P5 CHUDOBOVA, D. et al. Effect of ampicillin, streptomycin, penicillin and tetracycline on metal resistant and non-resistant Staphylococcus aureus. *International Journal of Environmental Research and Public Health*, 2014, vol. 11, no. 3. **IF: 1.993**

Prototypes, software

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	3	5.2	3.0
2	Wireless Technologies	6	3.6	6.0
3	Converged Systems	5	13.0	20.0
4	Multimedia Systems	2	1.6	5.0
5	Sensor Systems	22	10.6	18.0
	Total	38	34.0	52.0

Explanation: Prof. Kasal

Selected prototypes, software

P1 Planar H-plane horn antenna for experimental wireless link 76/86 GHz; Puskely

P2 Electronically tunable oscillators with fractal elements; **patent**; Petrzela, Gotthans

P3 Smart multi-purpose home gateway - SYMPHONY 1.0; Hosek, Masek, Kovac

P4 Software analyser of the text meaning (SW); Masek

P5 Bulk-driven quasi-floating-gate differential difference; Khateb, Fujcik, Pavlík, Prokop, Kledrowetz

Research contracts

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	1 894	1 166	3 183
2	Wireless Technologies	1 319	808	934
3	Converged Systems	466	2 958	1 454
4	Multimedia Systems	0	372	132
5	Sensor Systems	1 561	2 407	1 599
	Total	5 240	5 790	7 302

In thousands of CZK; 1 EUR ≈ 28 CZK

Explanation: Dr. Mišurec, Prof. Smékal, Prof. Vrba

Selected research contracts

P1 Volkswagen; In-car time-domain electromagnet fields and effects on passengers; Raida

P2 VF; Research and development of FD-11 and FD-17; Kubicek

P3 Telekom Austria; Universal smart home gateway demonstrator for different home automation services; Hosek

P5 Honeywell; Development of software for electronic equipment; R. Vrba

Grant projects

	Program	12/2013	plan 2014	12/2014
1	Microwave Technologies	3 134	3 899	8 022
2	Wireless Technologies	11 274	2 678	11 496
3	Converged Systems	10 472	9 807	13 472
4	Multimedia Systems	2 438	1 234	3 153
5	Sensor Systems	4 251	7 982	10 608
	Total	31 569	25 600	46 751

In thousands of CZK; 1 EUR ≈ 28 CZK

Grant projects

P1 GACR; Research of artificial electromagnetic materials and meta-materials with usage numerical and visualization methods; Fiala

P2 GACR; Research of wireless channels for communication and positioning in vehicles; Prokes

P4 MH; Speech, its impairment and cognitive performance in Parkinson's disease; Smekal

P5 GACR; Generalized higher-order elements; Biolek

Summary

	Indicator	Plan	12/2014
1	Publications	132	103
2	Prototypes, SW	34	52
3	Research contracts	5.79 MCZK	7.30 MCZK
4	Grant projects	25.6 MCZK	46.7 MCZK
5	Master-degree graduates	69	135
6	PhD-degree graduates	13	23
7	Joint projects	3	12
8	Students involved	88	103
9	Full-time equivalent	85	110

Contacts

Director:

Prof. Zbynek Raida; raida@feec.vutbr.cz

Vice-directors:

Dr. Martin Slanina; slaninam@feec.vutbr.cz

Dr. Jiří Dřínovský; drino@feec.vutbr.cz

Research Targets

SIX departments (1)

Prof. Miroslav **Kasal**
Microwave Technologies

Research targets:

- Design methodology for passive and active structures operating up to 110 GHz
- Comparison of numerical and experimental studies of biological effects of EM fields

Presentation of Prof. Kasal

SIX research centre
sensor, information and communication systems

Faculty of Electrical Engineering
and Communication

Brno University of Technology
Technicka 12, CZ-61600 Brno, Czechia

http://www.six.feec.vutbr.cz

Department of Microwave Technologies

Prof. Miroslav Kasal
kasal@feec.vutbr.cz

Research targets

Research targets in 2014:

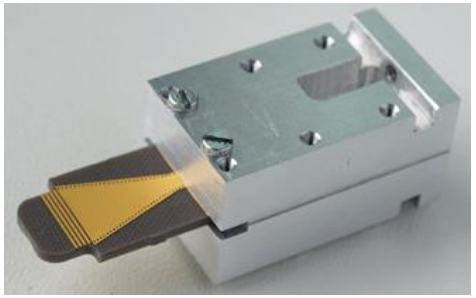
- Design methodology for passive and active structures operating up to 110 GHz
- Comparison of numerical and experimental studies of biological effects of EM fields
- Time domain (integral) methods

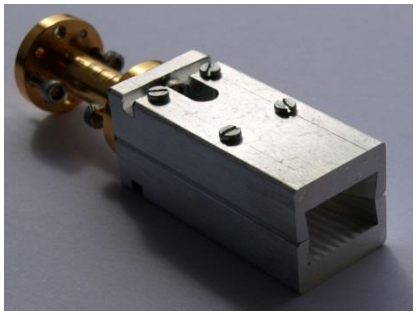
Application research in 2014

Research targets (1)

Design of experimental link 75 GHz / 85 GHz

Experimental link 75 GHz / 85 GHz





Horn antennas

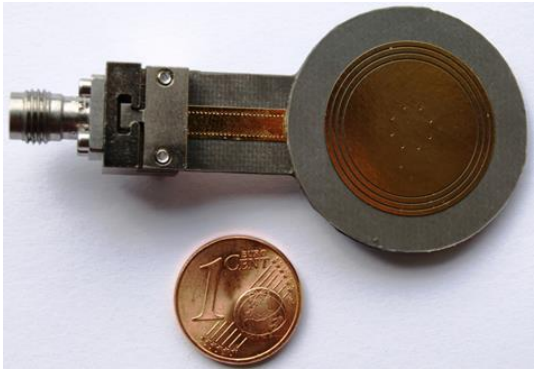
URBANEC, T.; MIKULÁŠEK, T.; PUSKELY, J.; WOLANSKÝ, D.; VŠETULA, P.; RAIDA, Z.; ŘEŘICHA, V.; BARTYZAL, J. 75/ 85 GHz experimental wireless link. In *ICECom 2013 Proceedings.* Dubrovnik: Korema, 2013. s. 1-4. ISBN: 978-953-6037-66- 7.

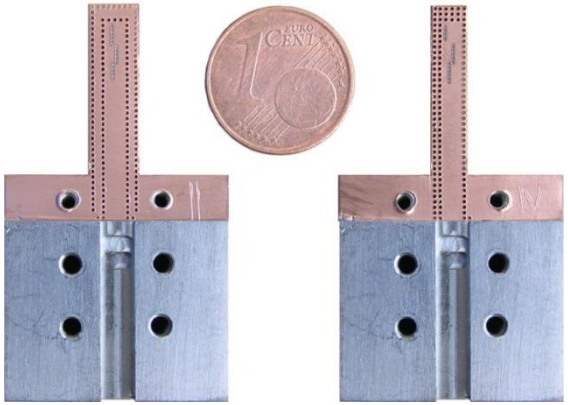
PUSKELY, J.; URBANEC, T.; MIKULÁŠEK, T.; WOLANSKÝ, D.; VŠETULA, P.; RAIDA, Z.; ŘEŘICHA, V.; BARTYZAL, J. Novel Planar Horn Antenna for 75/85 GHz Experimental Wireless Link. *Radioengineering.* Conditional accepted

Research targets (2)

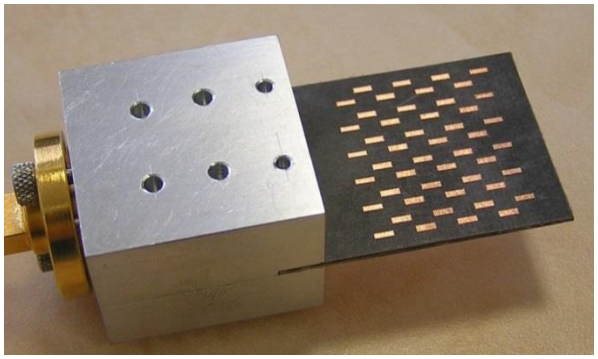
Body area networks BAN, Phantoms

SIW antennas 60 GHz
Propagation of creeping waves





Slot antennas utilized for channel characterization



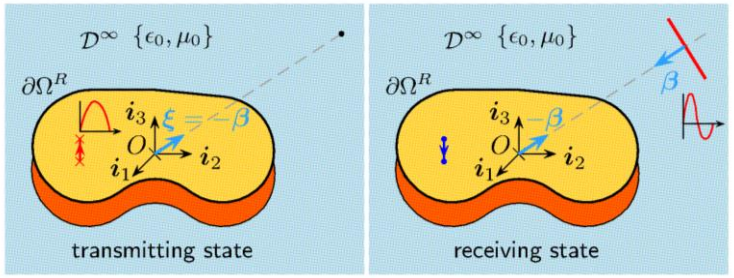
Patch array for point-to-point communication 60 GHz

LÁČÍK, J.; MIKULÁŠEK, T.; RAIDA, Z.; URBANEC, T. Substrate integrated waveguide monopolar ring- slot antenna. *Microwave and Optical Technology Letters,* 2014, roč. 56, č. 8, s. 1865-1869. ISSN: 0895- 2477.

MIKULÁŠEK, T.; LÁČÍK, J. Two feeding methods based on substrate integrated waveguide for microstrip patch antennas. *IET Microwaves Antennas & Propagation,* 2014, vol. 9, no. 14, ISSN: 1751- 8725.

PUSKELY, J.; POKORNÝ, M.; LÁČÍK, J.; RAIDA, Z. Wearable Disc- like Antenna for Body Centric Communications at 61 GHz. *IEEE Antennas and Wireless Propagation Letters,* 2014, roč. 13, č. 4, s. 158-161. ISSN: 1536- 1225.

Research targets (3)

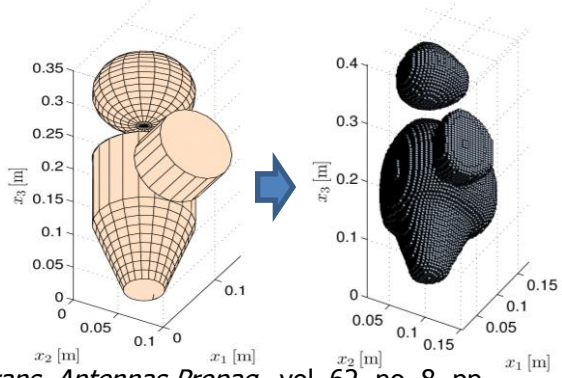


Time-domain (integral) methods

Time-domain reciprocity in antenna theory

Time-domain SI/PI analysis on PCBs (EMC)

Miscellaneous applications of EM pulses



M. Stumpf, `Pulsed EM field radiation, mutual coupling, and reciprocity of thin planar antennas,' *IEEE Trans. Antennas Propag.*, vol. 62, no. 8, pp. 3943-3950, August 2014.

A Finalist of `The Best SI/PI Paper Award' (the only one from Europe):
M. Stumpf, `Time-domain mutual coupling between power-ground structures,' in *Proc. 2014 IEEE Int. Symp. EMC*, Raleigh, NC, USA, August 2014, pp. 240-243.

M. Stumpf, `The time-domain contour integral method – an approach to the analysis of double-plane structures,' *IEEE Trans. Electromagnetic Compat.*, vol. 56, no. 2, pp. 367-374, April 2014.

M. Stumpf, `Time-domain analysis of rectangular power-ground structures with relaxation,' *IEEE Trans. Electromagnetic Compat.*, vol. 56, no. 5, pp. 1095-1102, October 2014.

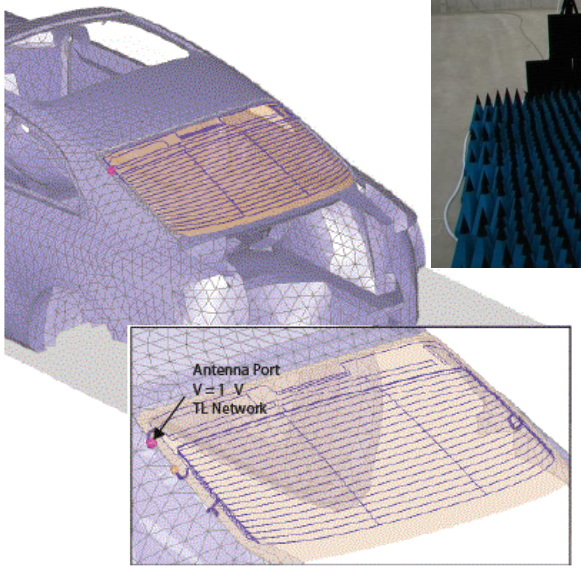
M. Stumpf, `Radar imaging of impenetrable and penetrable targets from finite-duration pulsed signatures,' *IEEE Trans. Antennas Propag.*, vol. 62, no. 6, pp. 3035-3042, June 2014.

M. Stumpf and G. A. E. Vandenbosch,`Impulsive electromagnetic response of thin plasmonic metal sheets,' *Radio Science*, vol. 49, no. 8, pp. 689-697, August 2014.

Application research (1)

In-car wireless communication
Volkswagen A.G.

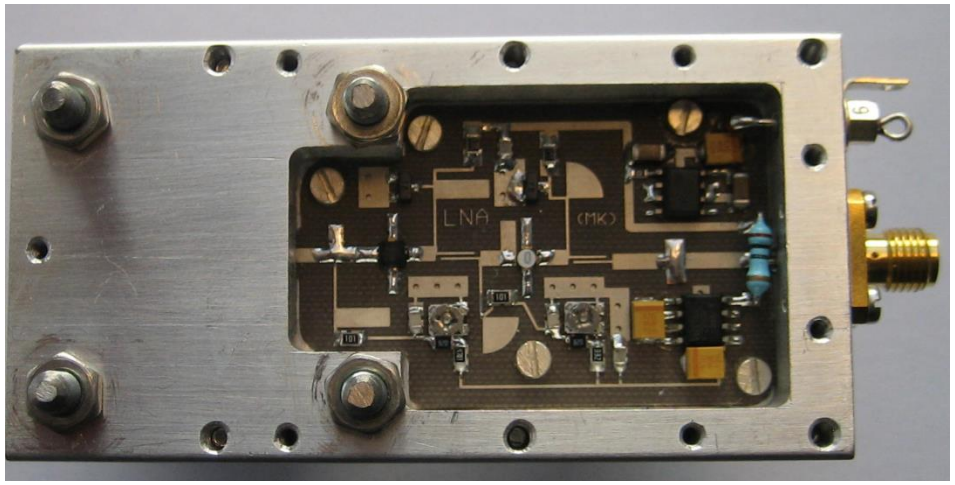
TV antennas
Škoda Auto a.s.

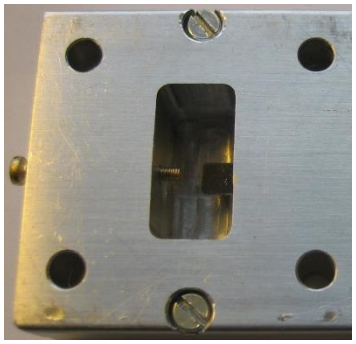


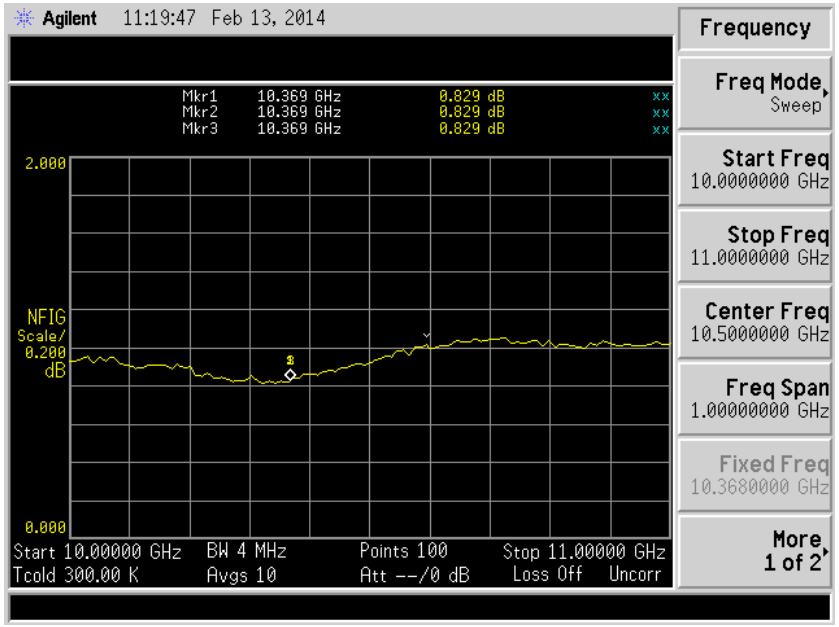
FMCW Radar Simulator for Vehicle Speed Measurement
RAMET a.s.

Application research (2)

Low Noise Microwave Amplifier with WG input







Application research (3)

IR heaters for neonatal bed

TSE, s.r.o.

Partial discharge localization in high-power transformers

TES Třebíč, s.r.o.

Localization of wood-destroying pets

Thermo Sanace, s.r.o.

Visions

- Woven antennas
- Antennas for future generations of mobile communication systems
- Millimeter-wave local links in mechanical engg.
- ???

Contact

Prof. Miroslav Kasal

kasal@feec.vutbr.cz

http://www.six.feec.vutbr.cz

SIX departments (2)

Prof. Stanislav **Hanus**
Wireless Technologies

Research targets:

- Suppression of atmospheric effects in free-space optical communication
- Methods of dynamic spectrum allocation in SW and cognitive radio; multi-carrier UWB comm.

Presentation of Prof. Hanus

SIX research centre
sensor, information and communication systems

Faculty of Electrical Engineering
and Communication

Brno University of Technology
Technicka 12, CZ-61600 Brno, Czechia

http://www.six.feec.vutbr.cz

Department of Wireless Technologies

Prof. Stanislav Hanus
hanus@feec.vutbr.cz

13.01.2015

1. Optical Wireless Communications (prof. Wilfert)

- Free-Space Optical (FSO) Link. Project: Hybrid Wireless Technology for Municipal Networks (prof. Kolka)
- The point-to-point Free-Space Optical link is designed to transmit data stream up to the speed of 1 Gbps over a distance of 1 km. The communication is carried out via a laser beam with a power of 100 mW at a wavelength of 1550 nm

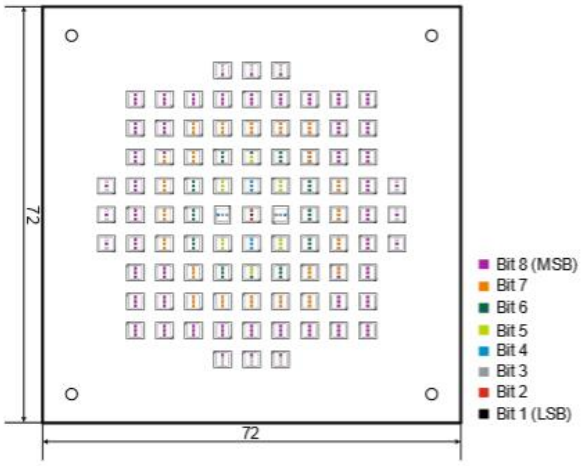
1. Optical Wireless Communications (prof. Wilfert)

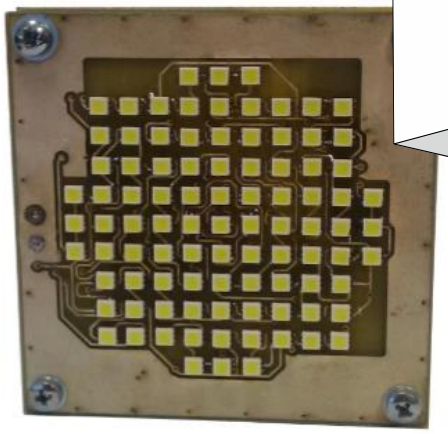
- Optical atmospheric propagation modelling (COST CZ LD12067 – CZK 1 750 000) – The research is focused on finding the optimal optical sources for the optical wireless communications and investigation of the optimal optical beam shape

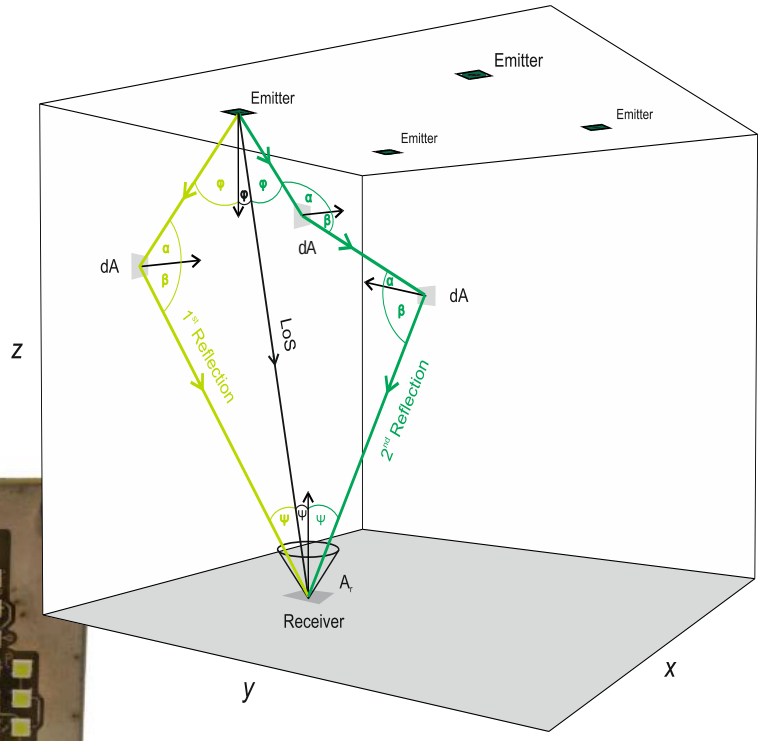
- Alignment procedure

1. Optical Wireless Communications (prof. Wilfert)

- The optical digital to analog conversion (ODAC) concept was introduced as a method able to cope with light emitting diode´s non-linear characteristic and dimming constraints

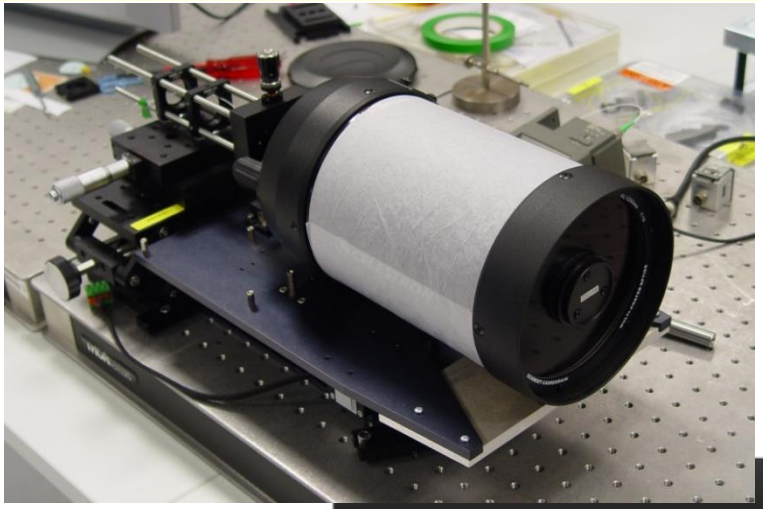




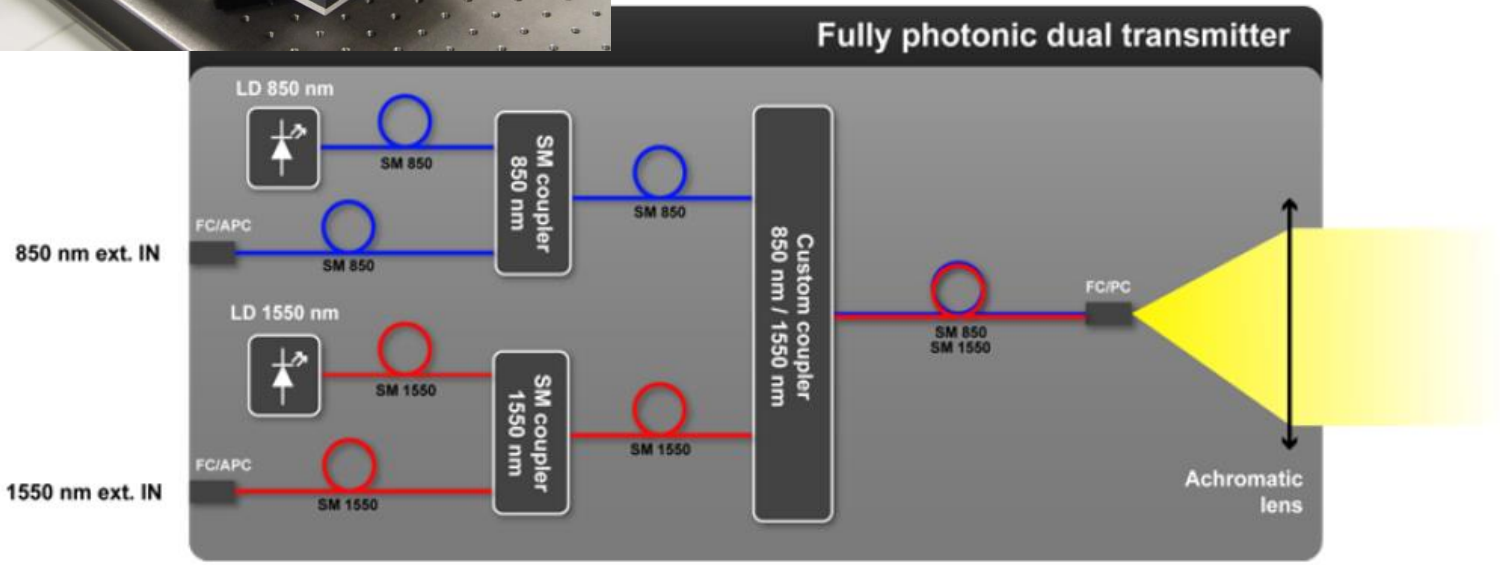


- System model for error analysis

1. Optical Wireless Communications (prof. Wilfert)

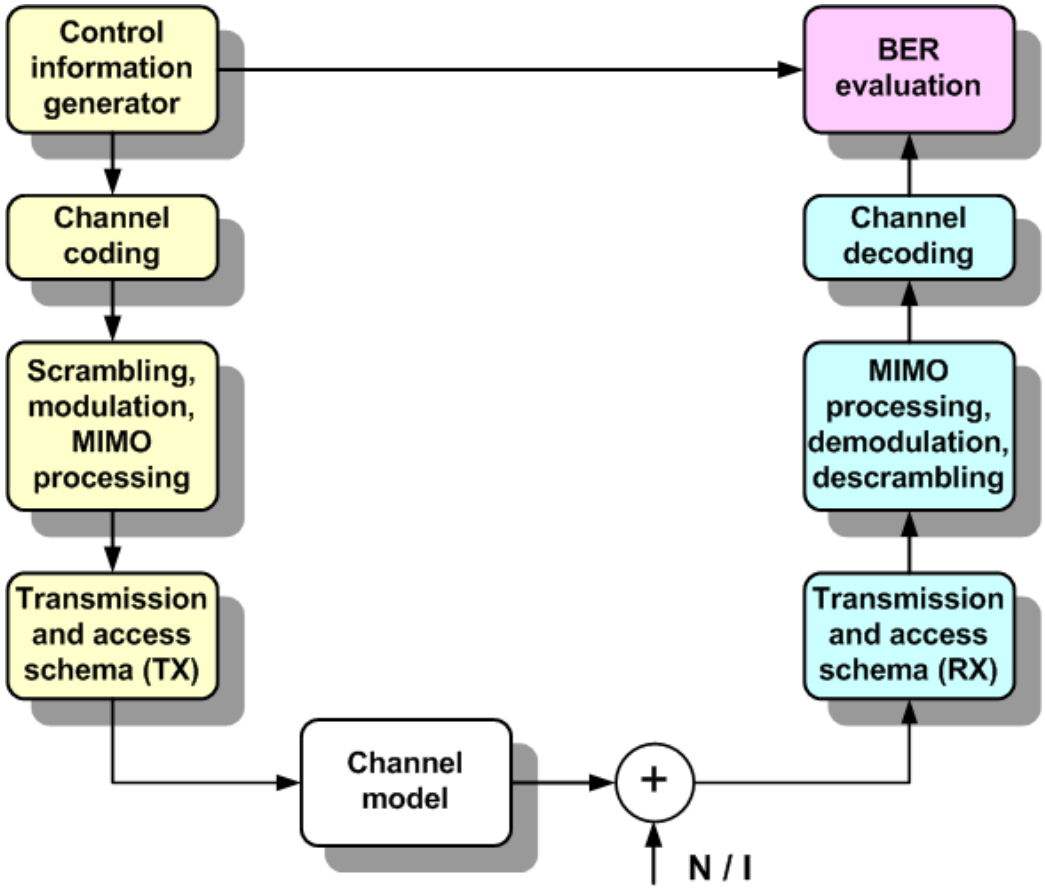


- Vision – The concept of all photonic transceiver using only optical fiber and passive optical fiber elements



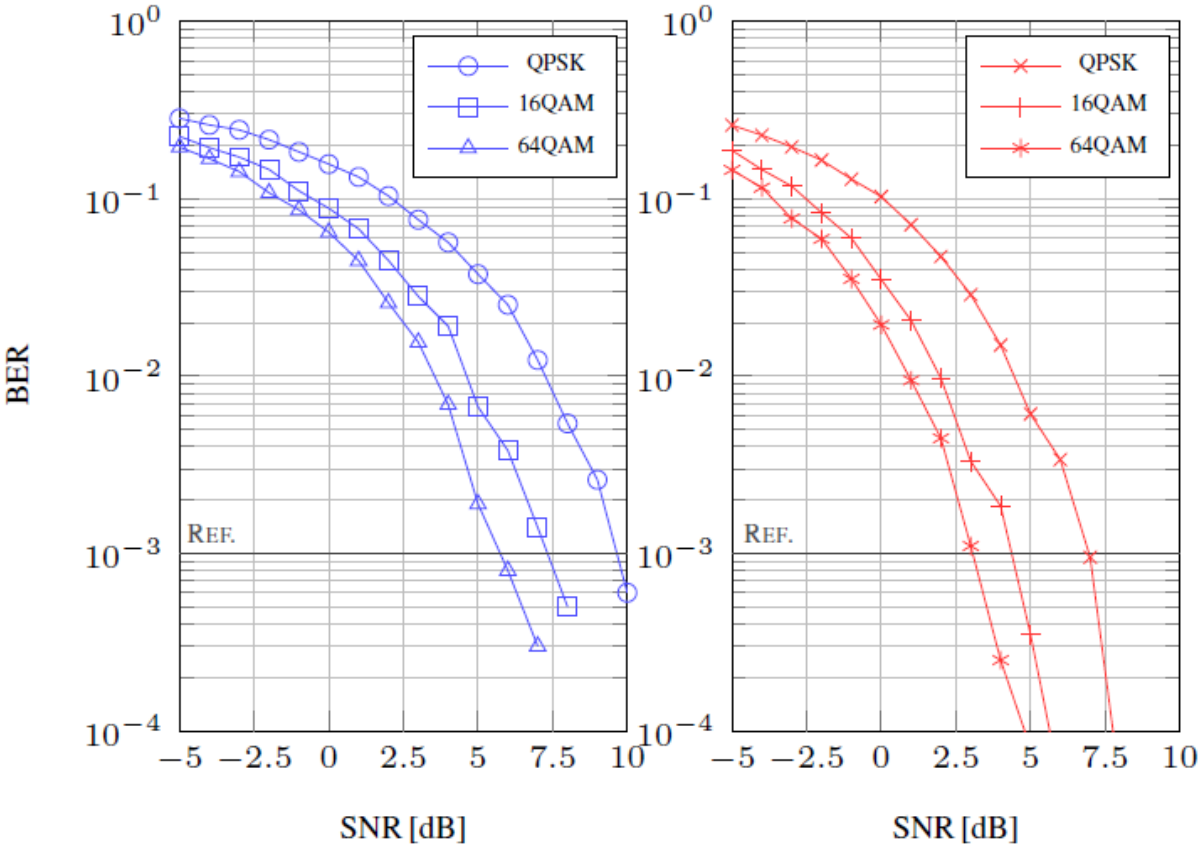
2. Mobile Communications (Dr. Polák)

- The research was concentrated on simulation of control signals transmission of LTE system, both uplink and downlink, in different radio environments



2. Mobile Communications (Dr. Polák)

- The example of the results achieved



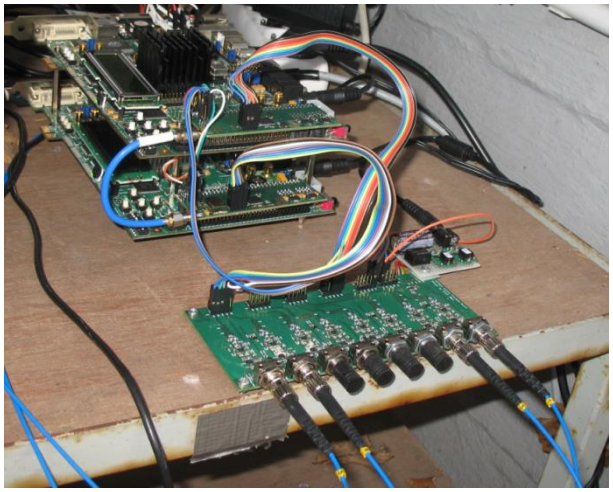
2. Mobile Communications (Dr. Polák)

- The designed models of LTE system were tested under laboratory conditions

- Thanks to Rohde & Schwarz – Prague, Ltd, for lending the necessary equipments

2. Mobile Communications (Dr. Polák)

- Optical measurements of explosions. Technology Agency of the Czech Republic, budget for 2014/total: 1 133 000 CZK / 3 918 000 CZK (Assoc. prof. Maršálek)

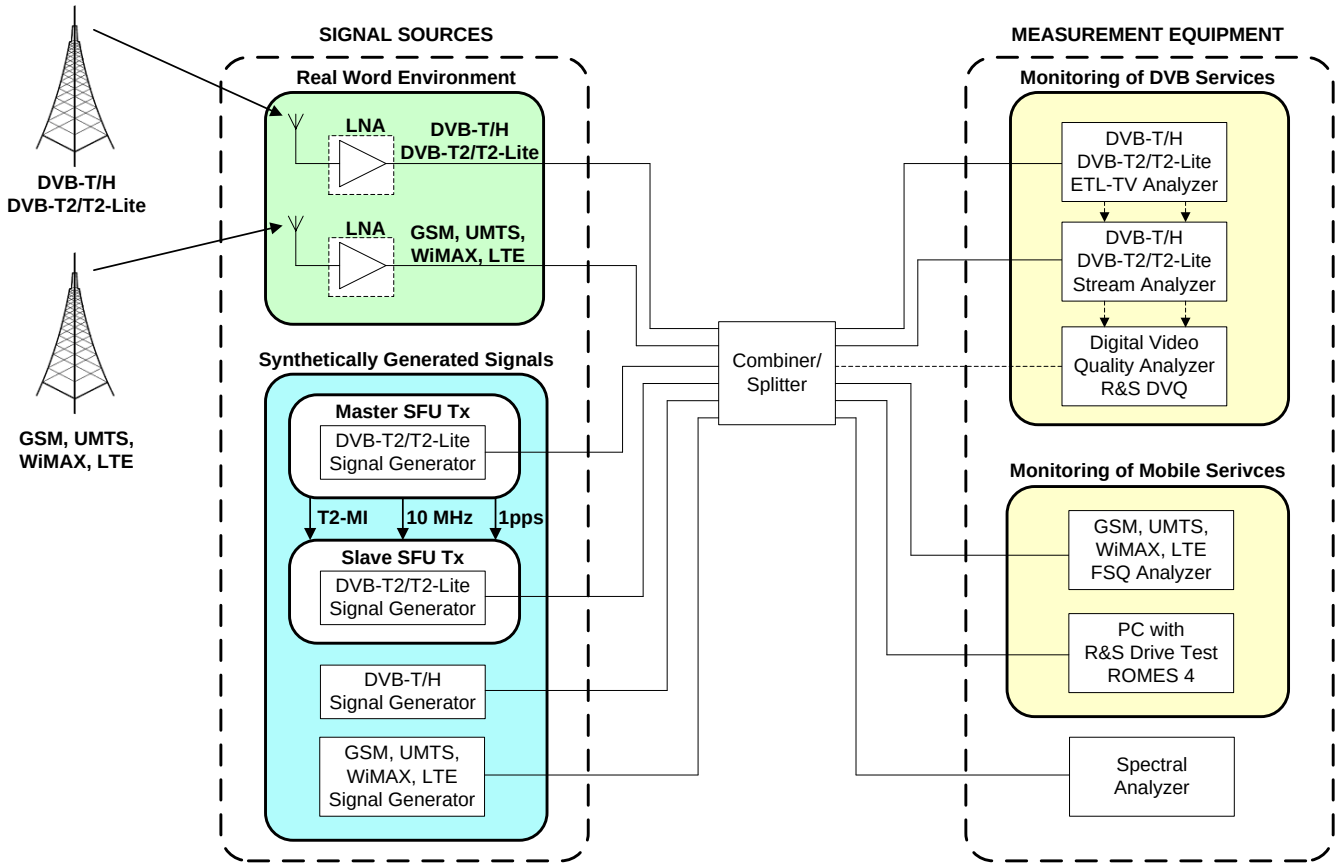


- Final prototype will be ready in 2015, then to commercialize by OZM research, Ltd.
- National patent application (data analysis and configuration) submitted in 2014

3. Television Technology (Assoc. prof. Kratochvíl)

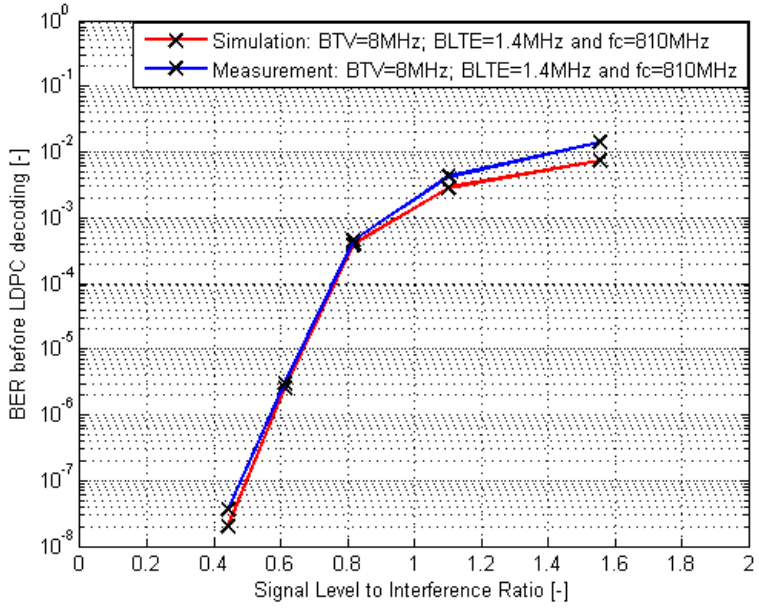
- Mobile communication networks and DVB systems in common frequency bands – advanced co-existence scenarios (ARTEMOS WP5)

- General block diagram of workplace for measuring the interaction between wireless mobile networks an DVB services and vice versa

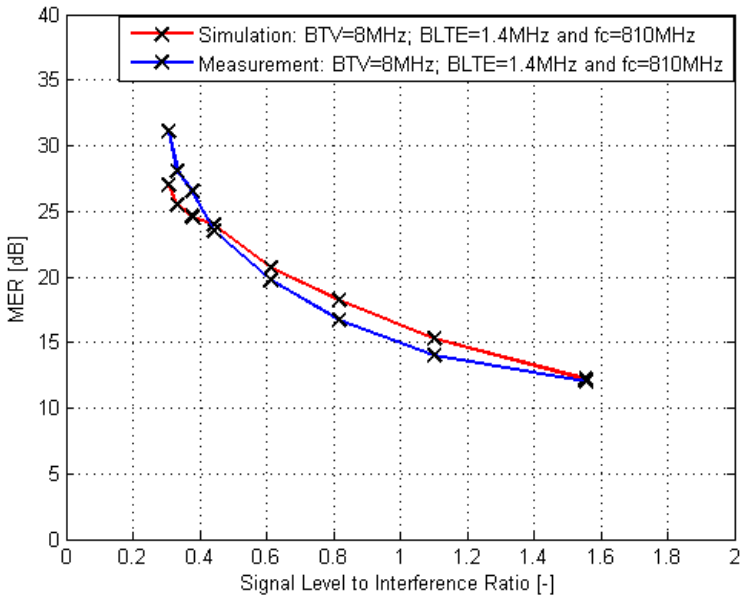


3. Television Technology (Assoc. prof. Kratochvíl)

- Dependences of BER before channel decoding (a) and MER (b) on the signal level to interference ratio, when bandwidth of DVB-T2 and LTE RF signals is 8 MHz and 1.4 MHz respectively and center frequencies of both services are 810 MHz



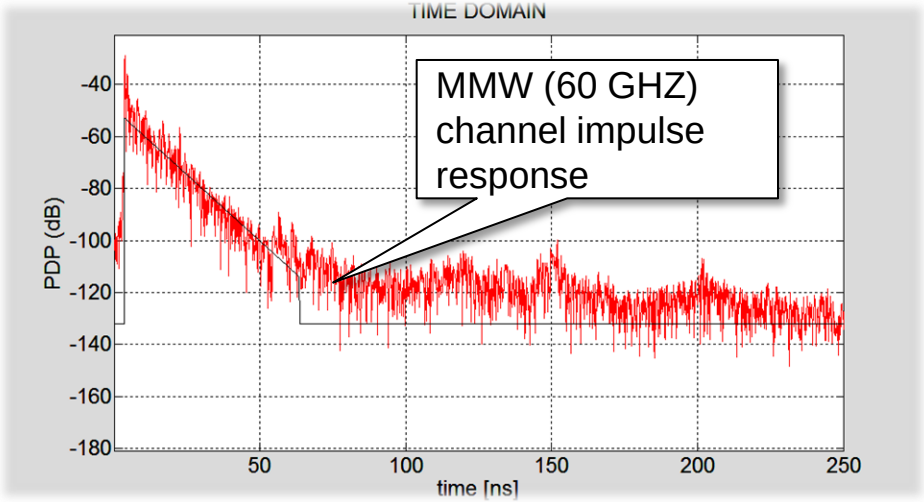
a) BER



a) MER

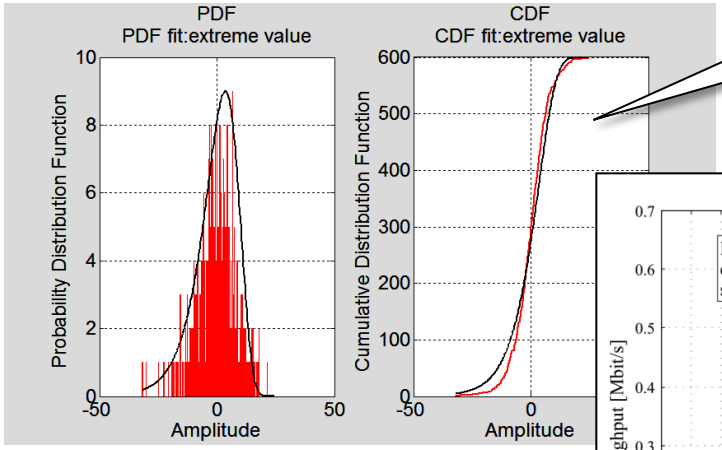
4. Radiocommunication Systems (prof. Prokeš)

- Research into wireless channels for intra-vehicle communication and positioning (Czech Science Foundation, CZK 8 765 000) – UWB, 60 GHz, infrared
- Intra-vehicle and V2X nonstationary channel analysis and localization

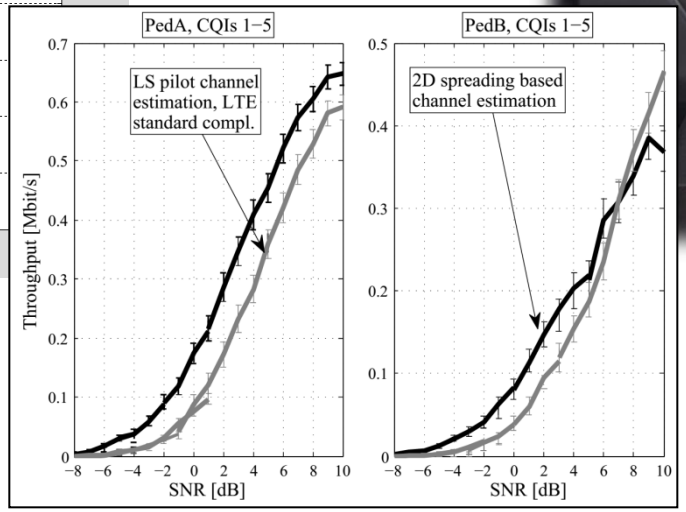


4. Radiocommunication Systems (prof. Prokeš)

- BLUMENSTEIN, J., MARSALEK, R., FEDRA, Z., PROKES, A., MECKLENBRÄUKER, CH. Channel estimation method for OFDM in low SNR based on two-dimensional spreading. Wireless Personal Communications, Springer International Publishing AG 2014, Vol. 78, Issue 1, p. 715-728, ISSN: 0929- 6212



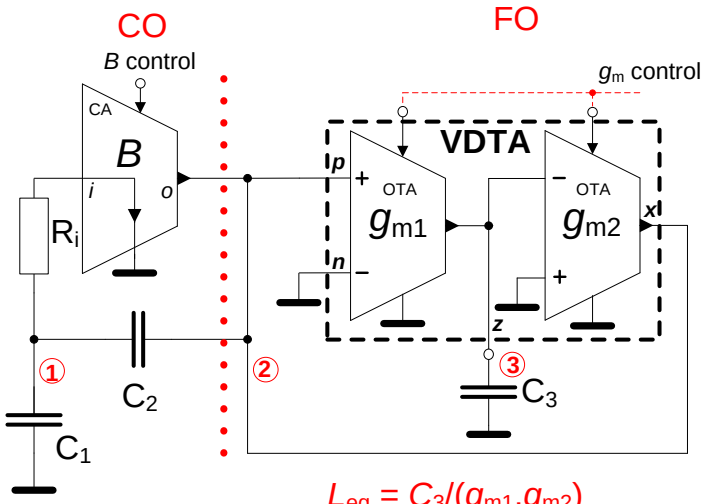
Power delay profile fit



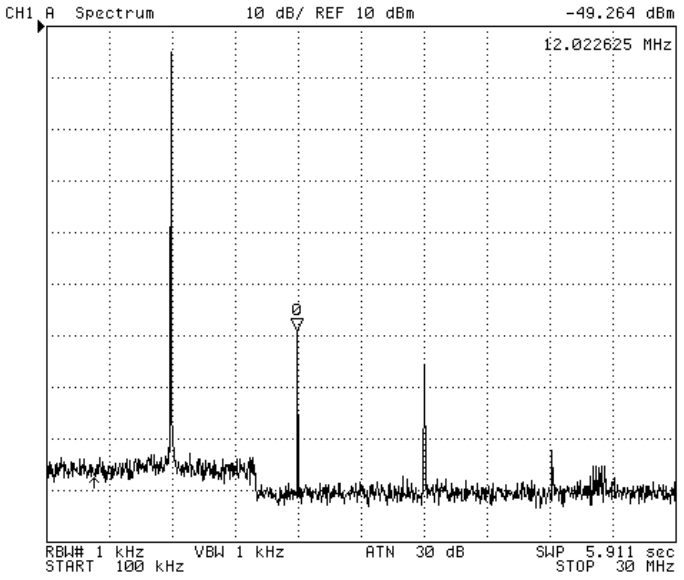
Frequency domain measurement in MMW band

5. Analog and Digital Systems (prof. Brančík)

- Research for electronically adjustable advanced active elements for circuit synthesis (Czech Science Foundation – Budget: 3 343 000 CZK, Dr. Šotner)
- This circuit operates without necessity of metal coil and offers two voltage outputs with phase shift 90 degrees and simple electronic control (linear) of frequency of oscillation by driving voltage in comparison to standard LC solution



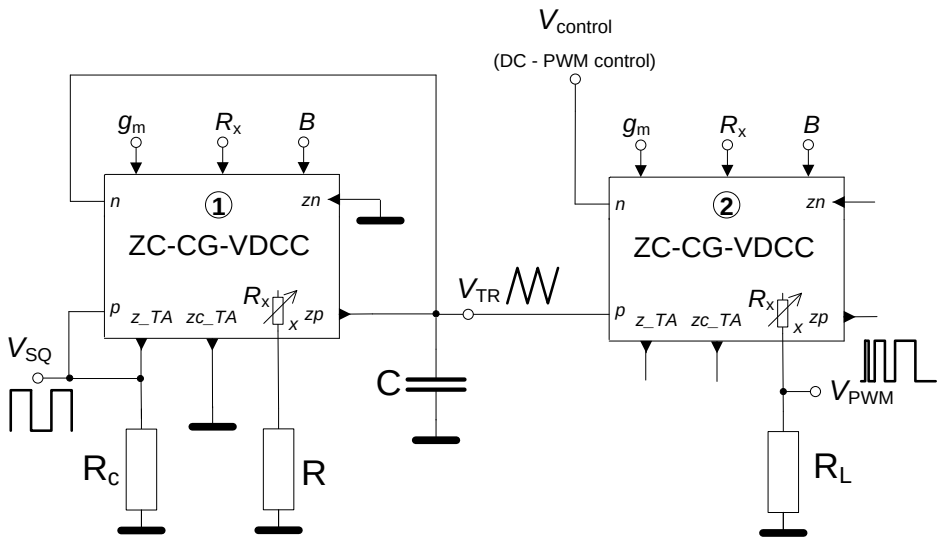
$L_{eq} = C_3/(g_{m1}.g_{m2})$

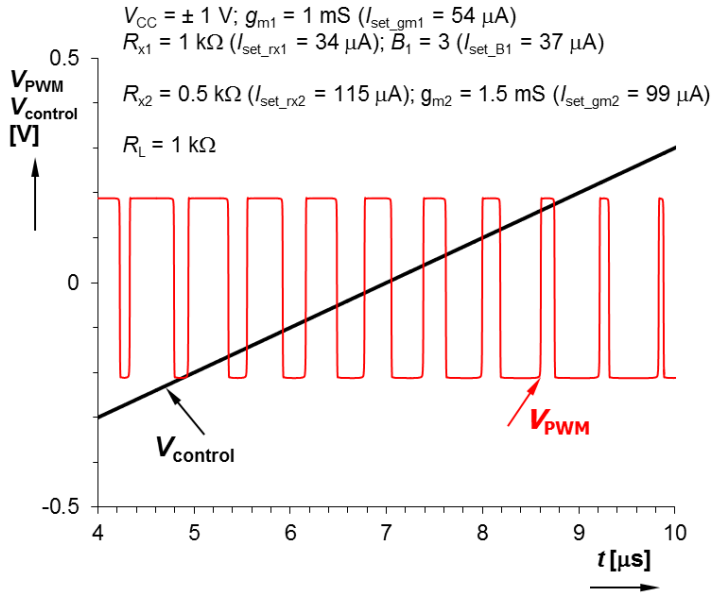


5. Analog and Digital Systems (prof. Brančík)

- Electronically tunable triangular and square wave generator employing advanced active devices with multi-parameter control

- Advanced active devices with availability of multi-parameter control and two internal subsections are applied for triangular wave, square wave and PWM generation





Contact

Prof. Stanislav Hanus

hanus@feec.vutbr.cz

http://www.six.feec.vutbr.cz

SIX departments (3)

Dr. Jiří **Mišurec**
Converged Systems

Research targets:

- Low-power, high-speed UWB circuits for advanced communication
- Control networks protocols for advanced communication; commercial exploitation

Presentation of Dr. Mišurec

SIX research centre
sensor, information and communication systems

Faculty of Electrical Engineering
and Communication

Brno University of Technology
Technicka 12, CZ-61600 Brno, Czechia

http://www.six.feec.vutbr.cz

Programme of Converged Systems

Assoc. Prof. Jiri Misurec, CSc.
misurec@feec.vutbr.cz

Vision

Devices and protocols development for fast and secure hypermedia data transmission

- data processing
- archiving methods
- novel services

[1] HAJNÝ, J.; MALINA, L.; MARTINÁSEK, Z.; TĚTHAL, O. Performance Evaluation of Primitives for Privacy-Enhancing Cryptography on Current Smart-cards and Smart-phones. In *Data Privacy Management and Autonomous Spontaneous Security*. Springer, 2014. pp. 17-33. ISBN: 978-3-642-54567-2.
[2] KOVÁČ, D.; MAŠEK, P.; HOŠEK, J.; PAVLOVA, M.; KRAJSA, O. Analysis of Network Parameters Influencing Performance of Hybrid Multimedia Networks. *Int. J. of Advances in Telecommunications, Electrotechnics, Signals and Systems*, 2014, vol. 2, no. 3, p. 122-128. ISSN: 1805- 5443.

Applications (1)

SMART MULTI-PURPOSE HOME GATEWAY - SYMPHONY 1.0

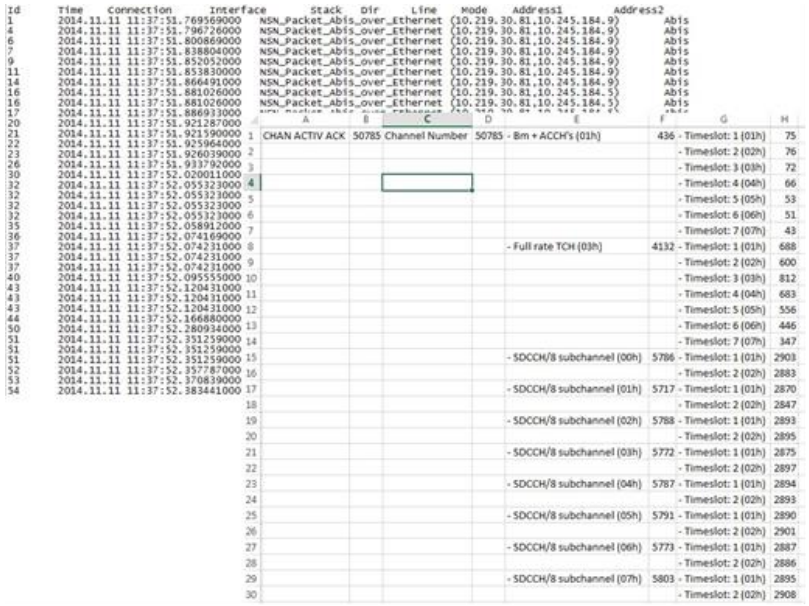
Telekom Austria Group [EUR 23 800.-]

- data-store platform for e.g. smart metering, sensors data
- graphical interpretation on a smart phone
- remote access to mobile smart devices
- device management
- utilization of complex visualization platform to provide graphical overview of the gateway and data from connected sensors

Applications (2)

BAGR - BTSM A-bis GPRS Radio Analyzer

TestEX s.r.o. & Darlan GmbH & Co. [CZK 329 000.-]



Id	Time	Connection	Interface	Stack	Dir	Line	Mode	Address1	Address2
1	2014.11.11 11:37:51.769569000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
4	2014.11.11 11:37:51.796726000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
6	2014.11.11 11:37:51.800869000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
7	2014.11.11 11:37:51.838804000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
9	2014.11.11 11:37:51.852052000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
11	2014.11.11 11:37:51.853830000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
14	2014.11.11 11:37:51.866491000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.9)	Abis
16	2014.11.11 11:37:51.881026000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.5)	Abis
16	2014.11.11 11:37:51.881026000			NSN_Packet_Abis_over_Ethernet				(10.219.30.81,10.245.184.5)	Abis
17	2014.11.11 11:37:51.886933000								
20	2014.11.11 11:37:51.921287000								
21	2014.11.11 11:37:51.921590000								
22	2014.11.11 11:37:51.925964000								
23	2014.11.11 11:37:51.926039000								
26	2014.11.11 11:37:51.933792000								
30	2014.11.11 11:37:52.020011000								
32	2014.11.11 11:37:52.055323000								
32	2014.11.11 11:37:52.055323000								
32	2014.11.11 11:37:52.055323000								
32	2014.11.11 11:37:52.055323000								
35	2014.11.11 11:37:52.058912000								
36	2014.11.11 11:37:52.074169000								
37	2014.11.11 11:37:52.074231000								
37	2014.11.11 11:37:52.074231000								
37	2014.11.11 11:37:52.074231000								
40	2014.11.11 11:37:52.095555000								
43	2014.11.11 11:37:52.120431000								
43	2014.11.11 11:37:52.120431000								
43	2014.11.11 11:37:52.120431000								
44	2014.11.11 11:37:52.166680000								
50	2014.11.11 11:37:52.280934000								
51	2014.11.11 11:37:52.351259000								
51	2014.11.11 11:37:52.351259000								
51	2014.11.11 11:37:52.351259000								
52	2014.11.11 11:37:52.357787000								
53	2014.11.11 11:37:52.370839000								
54	2014.11.11 11:37:52.383441000								

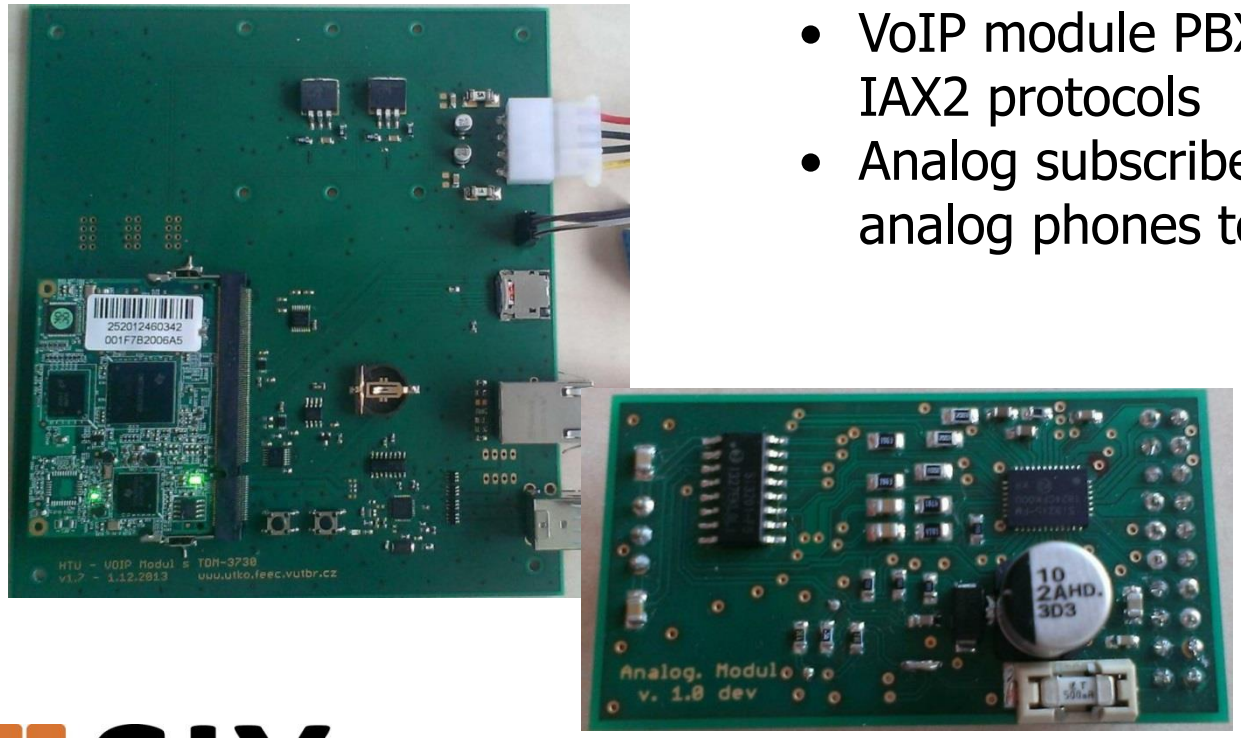
	A	B	C	D	E	F	G	H
1	CHAN ACTIV ACK	50785	Channel Number	50785	- Bm + ACCH's (01h)	436	- Timeslot: 1 (01h)	75
2							- Timeslot: 2 (02h)	76
3							- Timeslot: 3 (03h)	72
4							- Timeslot: 4 (04h)	66
5							- Timeslot: 5 (05h)	53
6							- Timeslot: 6 (06h)	51
7							- Timeslot: 7 (07h)	43
8					- Full rate TCH (03h)	4132	- Timeslot: 1 (01h)	688
9							- Timeslot: 2 (02h)	600
10							- Timeslot: 3 (03h)	812
11							- Timeslot: 4 (04h)	683
12							- Timeslot: 5 (05h)	556
13							- Timeslot: 6 (06h)	446
14							- Timeslot: 7 (07h)	347
15					- SDCCH/8 subchannel (00h)	5786	- Timeslot: 1 (01h)	2903
16							- Timeslot: 2 (02h)	2883
17					- SDCCH/8 subchannel (01h)	5717	- Timeslot: 1 (01h)	2870
18							- Timeslot: 2 (02h)	2847
19					- SDCCH/8 subchannel (02h)	5788	- Timeslot: 1 (01h)	2893
20							- Timeslot: 2 (02h)	2895
21					- SDCCH/8 subchannel (03h)	5772	- Timeslot: 1 (01h)	2875
22							- Timeslot: 2 (02h)	2897
23					- SDCCH/8 subchannel (04h)	5787	- Timeslot: 1 (01h)	2894
24							- Timeslot: 2 (02h)	2893
25					- SDCCH/8 subchannel (05h)	5791	- Timeslot: 1 (01h)	2890
26							- Timeslot: 2 (02h)	2901
27					- SDCCH/8 subchannel (06h)	5773	- Timeslot: 1 (01h)	2887
28							- Timeslot: 2 (02h)	2886
29					- SDCCH/8 subchannel (07h)	5803	- Timeslot: 1 (01h)	2895
30							- Timeslot: 2 (02h)	2908

- Automated evaluation of correlation between messages on A-bis interface
- Maps signaling procedure
- Evaluates success of procedures, quantifies errors
- Mainly for 2G GSM

Applications (3)

VoIP module and Analog subscriber card

OPTOKON, a.s. [CZK 18 629 000,-]



- VoIP module PBX supporting SIP and IAX2 protocols
- Analog subscriber card for connecting analog phones to the VoIP module

Key equipment

- Cisco Security MARS 25R
  - Monitoring, analysis of threats
- Cisco IPS-4240
  - Protection against attacks and threats
- Spirent TestCenter C1
  - Voice and video quality evaluation
- IXIA XM2-02
  - Load tester of network infrastructure
- 4G LTE-A Huawei

Interdisciplinary visions

- 5G PPP
  - 5G-MTC for Consumers and Professional Communications
  - Holistic 5G Network Architecture
  - Cognitive Network Management
  - Service Level Management & Metrics for QoS & QoE
- Security and Cryptography
  - Digital identity protection and privacy protection
  - Lightweight cryptography
  - Sidechannel attacks and protection

Contact

Assoc. Prof. Jiri Misurec

misurec@feec.vutbr.cz

http://www.six.feec.vutbr.cz

SIX departments (4)

Prof. Zdeněk **Smékal**
Multimedia Systems

Research targets:

- Algorithms for interactive gestural interface (wo)man-to-machine
- Signal- and image-processing algorithms for advanced communication systems

Presentation of Prof. Smékal

Faculty of Electrical Engineering
and Communication

Brno University of Technology
Technicka 12, CZ-61600 Brno, Czechia

http://www.six.feec.vutbr.cz

Department of Multimedia Systems

Prof. Zdeněk Smékal
smekal@feec.vutbr.cz

Vision

High-performance and accurate analysis of structured and unstructured signals

- Database data,
- Image, Audio, Video

[1] Onchis, D. M., Rajmic, P. Generalized Goertzel algorithm for computing the natural frequencies of cantilever beams. Signal Processing, Elsevier, 2014. *IF: 2,3*

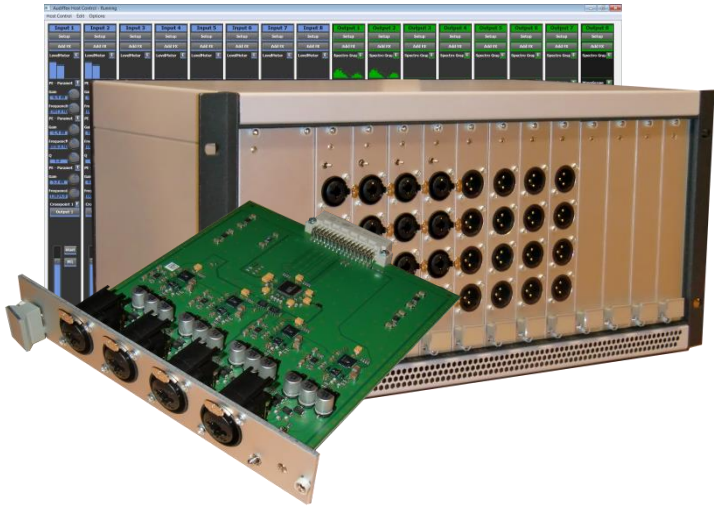
[2] Rajmic, P., Průša, Z. Discrete Wavelet Transform of Finite Signals: Detailed Study of the Algorithm. International Journal of Wavelets, Multiresolution and Information Processing, 1, 2014. *IF: 0,5*

[3] Rajmic, P., Hošek, J., Fusek, M., Andreev, S., Stecík, J. Simplified Probabilistic Modelling and Analysis of Enhanced Distributed Coordination Access in IEEE 802.11 The Computer Journal, 2014. IF: 1,3

Applications (1)

3D Sound Field Analysis and Rendering

Software Analyzer for Audio Systems
Universal System for Multichannel Digital Audio Signal Processing

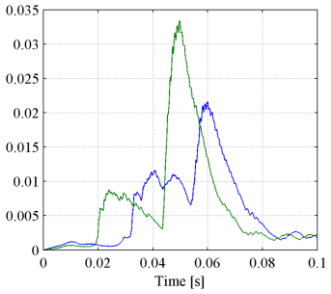


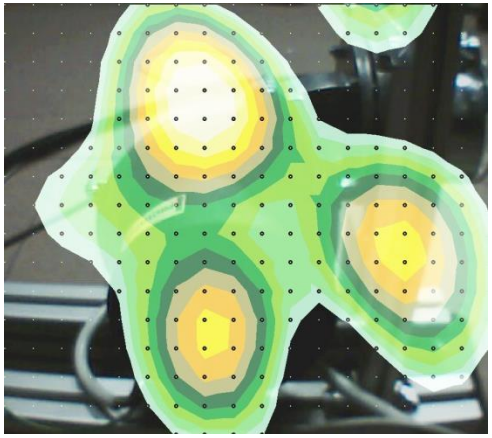
Noise Source Identification and Analysis

Honeywell, Schneider Electric
[CZK 160 000.-]

Honeywell

Schneider Electric





Applications (2)

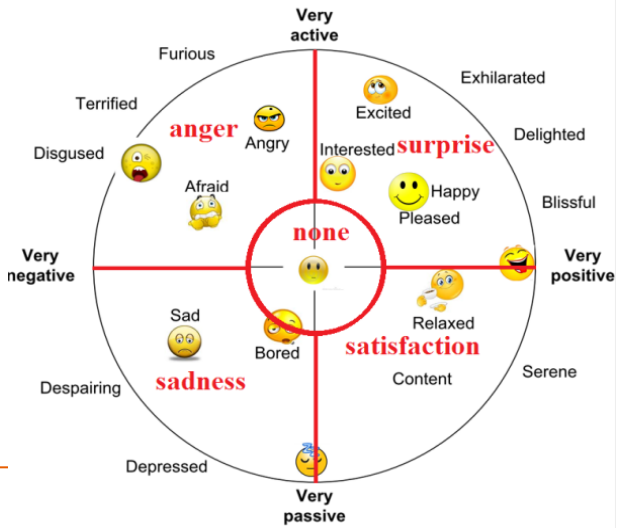
Software for pedestrian detection

FR-TI4/151, Research and development of technology for machine emotion detection in unstructured data (2012-2015, MPO/FR)

- Higher accuracy than state of the art: 96,7 %
  vs. (HOG: 88,6%, HOG+SVM: 86,7%, C4: 93,94%)
- Higher performance, real-time

Software for emotion recognition from short texts

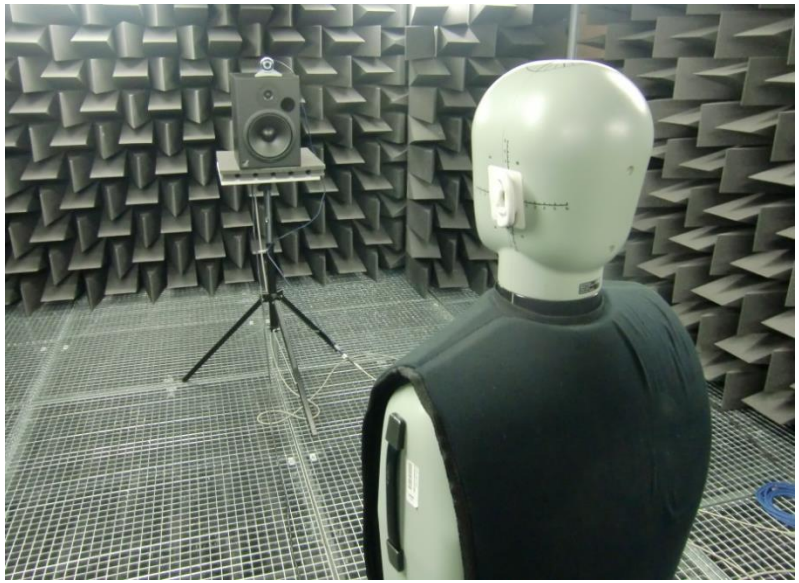
Human performance: 85,4 %
Machine performance: 80,5 %



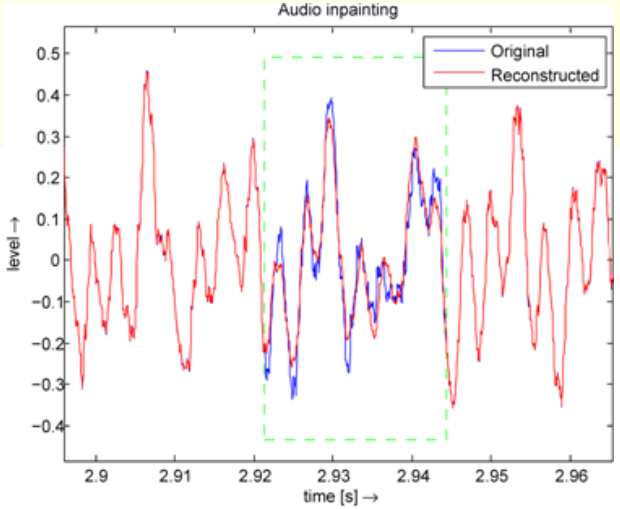
Neural disorder analysis from handwriting

Key equipment

- Anechoic chamber (RT_{60}=50 ms, f_C=100 Hz, L_N<10 dBA)
- Reference listening room (ITU-R BS.1116-1, ISO NR10)



New Projects (1)



- Modern methods for the restoration of digital audio signals, 2015-2017, 0,16 mil. CZK, MSMT

- Advanced Meteorological Information for Aviation, 2015-2016, 22 mil. CZK, TAČR

New Projects (2)

- Tool for collecting, analyzing and visualizing statistical data about product usage in order to increase development efficiency, TAČR, 14,4 mil CZK
- Primary and soft biometric and non-biometric traits in the de-identification process of audio-visual content in multimedia data (2014-2016, MSM/LD) 1,806 mil. CZK

Contact

Prof. Zdeněk Smékal

smekal@feec.vutbr.cz

http://www.six.feec.vutbr.cz

SIX departments (5)

Prof. Radimír **Vrba**
Sensor Systems

Research targets:

- Research of sensors with increased resolution for security and safety applications

Faculty of Electrical Engineering
and Communication

Brno University of Technology
Technicka 12, CZ-61600 Brno, Czechia

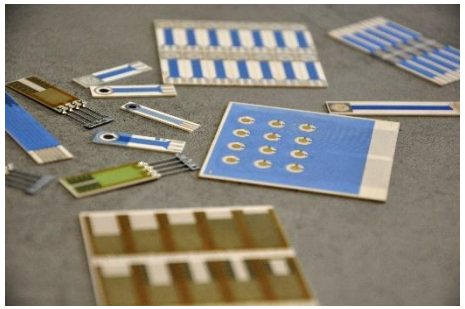
http://www.six.feec.vutbr.cz

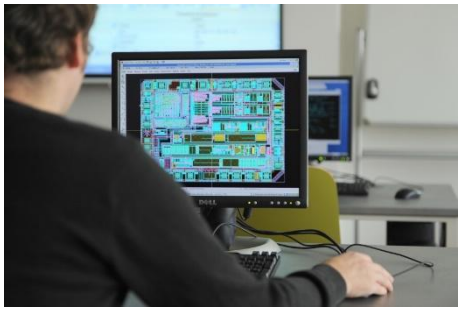
Department of Sensor Systems

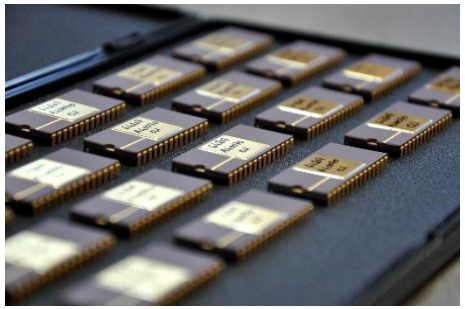
Prof. Radimír Vrba
vrbar@feec.vutbr.cz

Laboratories & Teams

- Noise and Dielectric Spectroscopy Lab
- Prof. Lubomír Grmela
- Nanometrology Lab
- Dr. Vladimír Holcman
- Lab of Microsensors and Nanotechnologies
- Ass. prof. Jaromír Hubálek
- Laboratory of Full Custom Integrated Circuit Design
- Ass. prof. Lukáš Fujcik
- Sensor Systems Lab
- Ass. prof. Dan Komosný







Publications in IF journals (Noise and Dielectric Spectroscopy Lab)

2014

- Noise fluctuation

ŠICNER, J.; ŠKARVADA, P.; MACKŮ, R.; KOKTAVÝ, P. Study of the Influence of Structural Defects on Properties of Silicon Solar Cells. Key Engineering Materials (print), 2014, roč. 592-593, č. 1, s. 449-452. ISSN: 1013-9826.

DALLAEVA, D.S. ;KARDASHOVA, G.D.; SAFARALIEV, G.K.; TOMÁNEK, P. High-density ceramic materials on the basis of silicon carbide. Key Engineering Materials (print), 2014, roč. 592- 593, č. 1, s. 397-400. ISSN: 1013-9826.

ŠIK, O.; ŠKARVADA, P.; GRMELA, L.; ELHADIDY, H.; VONDRA, M.; ŠIKULA, J.; FRANC, J. Contact Quality Analysis and Noise Sources Determination of CdZnTe- Based High Energy Photon Detectors. Physica Scripta, 2013,

Accepted for publication:

- Biological sensors

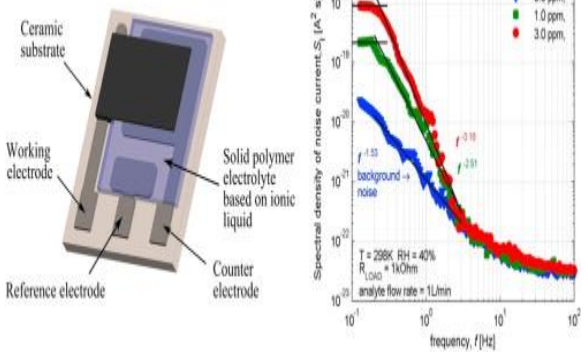
SITA, Z.; SEDLÁKOVÁ, V.; MAJZNER, J.; SEDLÁK, P.; ŠIKULA, J.; GRMELA, L. Analysis of noise and non-linearity of I- V characteristics of positive temperature coefficient chip thermistors. METROL MEAS SYST, 2013, roč. XX,

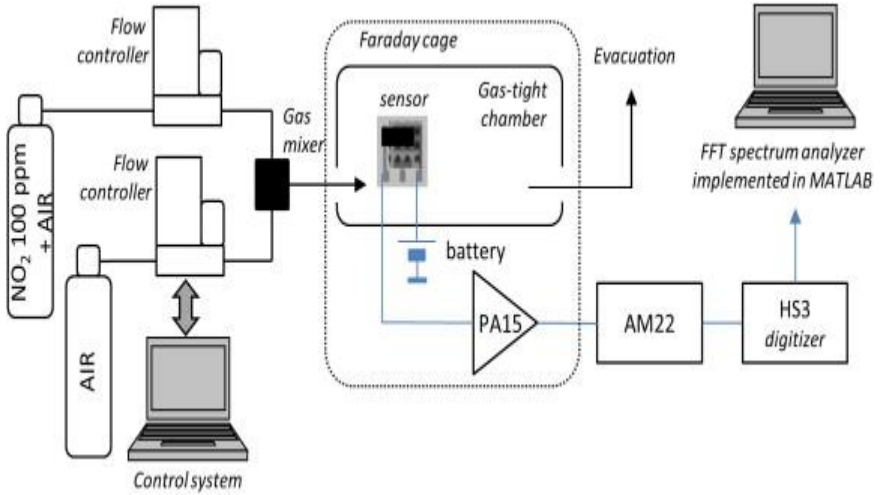
- Radiation transfer

BARTLOVÁ, M.; AUBRECHT, V.; BOGATYREVA, N.; HOLCMAN, V. Multigroup Approximation of Radiation Transfer in SF6 Arc Plasmas. Acta Polytechnica (on-line), 2015

Functional samples

Sensors of in amperometric NO_2





Experimental apparatus designed for the study of sensor parameters.

MAJZNER, J.; SEDLÁK, P.; TOFEL, P.; GRMELA, L.: medivik; Měřící systém pro diagnostiku vibrací krystalizátoru. ústav fyziky

Research grants (Noise and Dielectric Spectroscopy Lab)

TA ČR:

- Využití laserové triangulační metody s cílem optimalizace technologií pro zlepšení povrchové kvality ocelových polotovarů - TA04010312

Publications in IF journals (Nanometrology Lab)

2014

- SNOM microscopy

ŠKARVADA, P.; TOMÁNEK, P.; KOKTAVÝ, P.; MACKŮ, R.; ŠICNER, J.; VONDRA, M.; DALLAEVA, D.; SMITH, S.; GRMELA, L. A variety of microstructural defects in crystalline silicon solar cells. Applied Surface Science. 2014. 312(312). p. 50 - 56. ISSN 0169-4332.

ŠIK, O.; ŠKARVADA, P.; GRMELA, L.; ELHADIDY, H.; VONDRA, M.; ŠIKULA, J.; FRANC, J. Contact Quality Analysis and Noise Sources Determination of CdZnTe- Based High Energy Photon Detectors. Physica Scripta, 2013, roč. 85, č. 03,s. 1-5. ISSN: 0031- 8949.

ŠKARVADA, P.; TOMÁNEK, P.; ŠICNER, J. Influence of localized structural defects on the pn junction properties. Key Engineering Materials (print). 2014. 592-593(1). p. 441 - 444. ISSN 1013-9826.

Accepted for publication:

- Optical sensors

DALLAEVA, D.; RAMAZANOV, S.; PROKOPYEVA, E.; KASPAR, P.; TOMANEK, P. AFM Imaging of Natural Optical Structures. In Advances in Electrical and Electronic Engineering - intenetový časopis, (http://advances.utc.sk). http://advances.utc. sk: 2015

Functional samples (Nanometrology Lab)

HOLCMAN, V.; MACKŮ, R.; ŠKARVADA, P.; BOGATYREVA, N.; MAJZNER, J.; SEDLÁK, P.: Aut_ 02; Autoclave 2. 1. UFYZ VUT. URL: http://www.fyzika.fekt.vutbr. cz. (software).

HOLCMAN, V.; MACKŮ, R.; ŠKARVADA, P.; ŠICNER, J.; TOFEL, P.; TRČKA, T.: Par01; Systém řízení a sběru dat vyvíječe páry. UFYZ FEKT. URL: http://www.fyzika.feec.vutbr. cz. (software)

TOFEL, P.; HOLCMAN, V.: SofB; Software pro vyhodnocení EEG dat. http://www.fyzika.feec.vutbr. cz. URL: http://www.ufyz.feec.vutbr.cz/veda-a-vyzkum/produkty/software-pro-vyhodnocení-eeg- dat. (software)

Research grants (Nanometrology Lab)

TA ČR:

- Využití laserové triangulační metody s cílem optimalizace technologií pro zlepšení povrchové kvality ocelových polotovarů - TA04010312

Publications in IF journals (LabSensNano)

2014

- biosensing

Sochor, J.; Nejdl, L.; Ruttkay-nedecky, B.; Bezdekova, A.; Lukesova, K.; Zitka, O.; Cernei, N.; Mares, P.; Pohanka, M.; Adam, V.; Babula, P.; Beklova, M.; Zeman, L.; Kizek, R. Investigating the influence of taurine on thiol antioxidant status in Wistar rats with a multi-analytical approach. *J. Appl. Biomed.*, 2014

Chudobova, D.; Dostalova, S.; Blazkova, I.; Michalek, P.; Ruttkay-nedecky, B.; Sklenar, M.; Nejdl, L.; Kudr, J.; Gumulec, J.; Tmejova, K.; Konecna, M.; Vaculovicova, M.; Hynek, D.; Masarik, M.; Kynicky, J.; Kizek, R.; Adam, V. Effect of ampicillin, streptomycin, penicillin and tetracycline on metal resistant and non-resistant Staphylococcus aureus. *Int. J. Environ. Res. Pub. Health*, 2014

Chudobova, D., Cihalova, K., Dostalova, S., Ruttkay-nedecky, B., Merlos Rodrigo, M.A., Tmejova, K., Kopel, P., Nejdl, L., Kudr, J., Gumulec, J., Krizkova, S., Kynicky, J., Kizek, R., Adam, V. Comparison of the effects of silver phosphate and selenium nanoparticles on Staphylococcus aureus growth reveals potential for selenium particles to prevent infection. *FEMS Microbiology Letters*, 2014.

Accepted for publication:

- sensing properties of carbon nanotubes

Majzlíková, P.; Sedláček, J.; Prášek, J.; Pekárek, J.; Svatoš, V.; Bannov, A. G.; Jašek, O.; Synek, P.; Eliáš, M.; Zajíčková, L.; Hubálek, J. Sensing Properties of Multiwalled Carbon Nanotubes Grown in MW Plasma Torch: Electronic and Electrochemical Behavior, Gas Sensing, Field Emission, IR Absorption. *Sensors*, 2015.

- wireless sensor – activity and dehydration

Solovei, D.; Žák, J.; Majzlíková, P.; Sedláček, J.; Hubálek, J. Chemical Sensor Platform for Non-Invasive Monitoring of Activity and Dehydration. *Sensors*, 2015.

Functional samples (LabSensNano)

VALLEJOS VARGAS, S.; HUBÁLEK, J.; SEDLÁČEK, J.; PRÁŠEK, J.: Aerosol generator. LabSensNano, T10-N0.66.	GABLECH, I.; PRÁŠEK, J.: Semiconductive SnO2/MWCNTs sensor for the detection of Isobutane. LabSensNano, T10-N0.66.
VALLEJOS VARGAS, S.; HUBÁLEK, J.; PRÁŠEK, J.; PYTLÍČEK, Z.: AACVD reactor. LabSensNano, T10-N0.66.	MÁRIK, M.; SVATOŠ, V.; HUBÁLEK, J.: Platinum nanotips for electrical measuring cells. LabSensNano, T10-N0.66
VARGAS VALLEJOS, S.: Flexible gas sensor based on WO3 nanowires. LabSensNano, T10-N0.66.	PRÁŠEK, J.; MAJZLÍKOVÁ, P.: Screen-printed three-electrode system with carbon working electrode for detection in microvolumes. LabSensNano, T10-N0.66.
SEDLÁČEK, J.; SVATOŠ, V.; PEKÁREK, J.; NEUŽIL, P.; HUBÁLEK, J.: Workplace for bolometer calibration. LabSensNano, T10-N0.66.	PRÁŠEK, J.; MAJZLÍKOVÁ, P.: Screen-printed three-electrode system with gold working electrode for detection in microvolumes. LabSensNano, T10-N0.66.
CHMELA, O.; ŽÁK, J.; HUBÁLEK, J.: Test chamber for organic material in inert atmosphere. LabSensNano, T10-N4.28.	PRÁŠEK, J.; MAJZLÍKOVÁ, P.: Screen-printed three-electrode system with platinum working electrode for detection in microvolumes. LabSensNano, T10-N0.66.

Research grants (LabSensNano)

GA ČR:

- Značení proteinů kvantovými tečkami a jejich detekce v mikrofluidním systému (13-20303P)
- Nový nanostrukturovaný systém pro detekci infračerveného záření (NanoIR) (13-19947S)

Smluvní výzkum:

Seant technology s.r.o.	Výzkum v oblasti analýzy pomocí kontaktní profilometrie	HS18457047	1 000 Kč
TOKOZ a.s.	Vývoj mechatronické vložky TOKOZ PRO	HS18357021	365 000 Kč
SMTPlus.Cz s.r.o.	Výzkumné a vývojové práce	HS18257009	58 600 Kč
PROFIcomms s.r.o.	Depozice tenkých vrstev	HS18457116	35 000 Kč
Honeywell	Vývoj softwaru pro elektronická zařízení	HS18457005	1 163 863 Kč

Publications in IF journals (IC Design Team)

2014

- Integrated circuit design

VLASSIS, S.; KHATEB, F. Automatic tuning circuit for bulk-controlled sub-threshold MOS resistors. Electronics Letters. 2014. 2014 (50)(6, IF: 1.068). p. 432 - 433. ISSN 0013-5194.

KUMNGERN, M.; KHATEB, F.; PHASUKKIT, P.; TUNGJITKUSOLMUN, S.; JUNNAPIYA, S. ECCCII-Based Current-Mode Universal Filter with Orthogonal Control of Wo and Q. Radioengineering. 2014. 2014 (22)(2, IF: 0.796). p. 687 - 696. ISSN 1210-2512.

PROMMEE, P.; KHATEB, F. High-performance current-controlled CDCCC and its applications. INDIAN JOURNAL OF PURE & APPLIED PHYSICS. 2014. 2014 (52)(10, IF: 0.711). p. 708 - 716. ISSN 0019-5596.

KUMNGERN, M.; KHATEB, F. 0.8-V floating-gate differential difference current feedback operational amplifier. In 11th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology. Thailand, IEEE, 345 E 47TH ST, NEW YORK, NY 10017 USA. 2014. p. 1 - 5. ISBN 978-1-4799-2993-1.

DEMARTINOS, A.; PSYCHALINOS, C.; KHATEB, F. Ultra-Low Voltage CMOS Current-Mode Four-Quadrant Multiplier. INTERNATIONAL JOURNAL OF ELECTRONICS. 2014. 2014 (2)(4, IF: 0.751). p. 224 - 233. ISSN 0020-7217.

KHATEB, F.; KUMNGERN, M.; VLASSIS, S.; PSYCHALINOS, C. Differential difference current conveyor using bulk-driven technique for ultra-low-voltage applications. CIRCUITS SYSTEMS AND SIGNAL PROCESSING. 2014. 2014 (33)(1, IF: 1.264). p. 159 - 176. ISSN 0278-081X.

KHATEB, F. Bulk-driven floating-gate and bulk-driven quasi-floating-gate techniques for low-voltage low-power analog circuits design. AEU - International Journal of Electronics and Communications. 2014. 2014 (68)(1, IF: 0.696). p. 64 - 72. ISSN 1434-8411.

Functional samples (IC Design Team)

FUJCIK, L.; HAZE, J.; KLEDROWETZ, V.; PROKOP, R.: ASIC - Integrated circuit for electro-chemical measurement by potentiostat method , IC Design Team, T10-6.27.

KHATEB, F.; FUJCIK, L.; KLEDROWETZ, V.; PRISTACH, M.; PROKOP, R.; PAVLÍK, M.: ASIC - Low-voltage low-power BD-QFG DDA , IC Design Team, T10-6.27.

PROKOP, R.; FUJCIK, L.; NEUZIL, P.; PAVLÍK, M.: ASIC -Self-corrected Compensating Measurement of Bolometer Signal Using ΔΣ Modulation, IC Design Team, T10-6.27.

Research grants (IC Design Team)

GA ČR:

- Research of novel intelligent integrated conception for EMG signal processing (14-07724S)
- New Nanostructured Sensing System for Infrared detection (NanoIR) (13-19947S)
- Devices for Neurocontrol and Neurorehabilitation DeNeCoR (7H13014)

Publications in IF journals (Sensor Systems Team)

2014

- Wireless sensor networks

ČERVENKA, V.; MRÁZ, Ľ.; KOMOSNÝ, D. Comprehensive Performance Analysis of Lightweight Mesh and Its Comparison with ZigBee Pro Technology. WIRELESS PERSONAL COMMUNICATIONS, SPRINGER, 2014, vol. 78, no. 2, p. 1527-1538. ISSN: 0929- 6212.

Accepted for publication:

- IP networks

KOMOSNY, D.; VOZNAK, M.; KATHIRAVELU, G.; SATHU, H. Estimation of Internet Node Location by Latency Measurements - The Underestimation Problem. Information Technology And Control, 2015. ISSN: 2335-884X.

Functional samples (Sensor Systems Team)

ŠIMEK, M.; BOTTA, M.: SIP- Xively App; SIP Client for Cloud Services. Technická 12, SD 5. 74. URL: http://wislab.cz/our-work/smart-multi-purpose-home-gateway-symphony-10. (software)
KRAJSA, O.; DZURENDA, P.: HTU_ vrátník; Modul pro kontrolu přístupů pro HTU. 5. 73. (functional sample)
KRAJSA, O.; HANÁK, P.; SYSEL, P.: Analogová účastnická karta; Analogová účastnická karta. SD5. 73. (functional sample)
KRAJSA, O.; HANÁK, P.: VoIP modul; VoIP modul. SD5. 73. (functional sample)

Research grants (Sensor Systems Team)

International:

- TeleCalmPlus: The Smoke in the Chimney - An Intelligent Sensor-based Telecare Solution for Homes. No.21280013

Contact

Prof. Radimír Vrba

vrbar@feec.vutbr.cz

http://www.six.feec.vutbr.cz