TECHNICAL PROGRAM

MONDAY, October 21, 2013

9:15-10:30 (75 min) - PLENARY SESSION **Salon A, B, C**

9:15-10:30 1A1: INVITED SPEAKERS

Chair: Ronen Alfia, Elta Systems

1A1-1: GaN Market Opportunities and Outlook
Dr. Asif Anwar, Strategy Analytics Inc., Milton Keynes, U.K.

Abstract: While military applications continue to drive the GaN device market, commercial applications are finally emerging and going into volume production. Both wireless infrastructure and CATV networks are becoming increasingly data-centric with an emphasis on technologies that can offer wider bandwidths and higher linearity coupled with high voltage operation thus opening the door for increased of GaN. As GaN technologies mature, similar performance requirements will come from markets that typically operate at higher frequencies with opportunities emerging in VSAT/satellite and point-to-point radio markets. GaN will also see increasing use in the military sector with radar and communications applications adding to early implementation in electronic warfare systems.

1A1-2: SiGe:C Devices and MMIC's for Microwave Links and Active Safety Systems
Dr. Franz Dielacher, Infineon Technologies Austria, Villach, Austria

Abstract: The millimetre-wave frequency range of the electromagnetic spectrum is increasingly used for high-data-rate communications and pro-active safety systems like car-radar, identification and e-safety. Steady progress in integrated circuit and packaging technology enable the integration of complete transceivers on a chip or in a package including even the antenna. After describing criteria and trade-offs for technologies and system partitioning, this talk addresses low-cost high performance technologies such as CMOS and SiGe-bipolar and low loss, low cost organic packaging materials. Efficient millimetre-wave radios and transceiver concepts will be presented with examples and measurements. In addition to the performance of electrical components, major criteria are high reliability, long lifetime and high yield fabrication. Advanced packaging technologies including MEMS, embedded passive components, 3D integration and package co-design will be addressed as well.

10:30 – 11:00 ***COFFEE BREAK AND VISITING THE EXHIBITION***

MONDAY, October 21, 2013

11:00-12:40 (100 min) - PLENARY SESSION **Salon A, B, C**

1A2: OPENING SESSION

Chair: Shmuel Auster, Conference Chair

1A2-1: Opening Remarks
Shmuel Auster, Conference Chair
Hila Oren, CEO, Tel-Aviv Global & Tourism - welcome address
Dr. Stephen Weinstein, Technical Program Chair
Prof. Madhu Gupta, MTTS President
Dr. Doug Zuckerman, ComSoc, IEEE Div. III Director
Prof. Moshe Kam, IEEE President 2011: "In memory of Roger Pollard"
Mr. Mark Pierpoint, Vice President & General Manager, Agilent Technologies

1A2-2: Keynote address
"Radio Challenges in the Connected World"
Shachar Rivel.Intel Israel

Abstract: In recent years we are presented with a verity of new devices – from ultrabooks, tablets, smartphones to wearable devices. In parallel there is an increasing demand for higher bandwidth from consumers, as well as being connected in numerous way (cellular, WiFi, BT, GPS, etc.). These developments present challenges to the radio industry – What new technologies should be adopted? What architecture should be selected? Which engineering skills are required in order to give excellent solutions for the new requirements? The presentation will cover the products and technology trends as well as possible future solutions.

1A2-3: Keynote address
"Spectrum Imperatives and Technology Challenges for Wireless Systems"
Dr. Adam Drobot, Chairman, OpenTechWorks Inc., Dallas, USA

Abstract: To accommodate the rapidly increasing consumer demand for broadband wireless communications, there are trends toward i) improved efficiency for currently assigned spectrum blocks; ii) capabilities for wide band spectrum sharing schemes; and iii) exploitation of higher frequencies for commercial use. These require significant investment in, development, and rethinking of the basic hardware architectures in common use today. The most challenging design aspects include antenna performance, miniaturization, adaptive multi-channel capabilities, spatial diversity, wide band operation, energy efficiency, and advanced signal processing, realized through advanced sub-systems and components. Manufacturing ultimately determines the competitiveness and economic viability of the designs and is one of the key questions. This talk surveys the high level requirements to meet the growth in demand and offers a view of possible approaches and outstanding challenges.

12:40 – 14:00 LUNCH (Jaffa Court and Royal Hall) AND VISITING THE EXHIBITION

MONDAY, October 21, 2013

14:00-15:40 (100 min) - PARALLEL SESSIONS 1A3, 1B3, 1C3, 1D3

14:00-15:40 1A3: RFICs **Salon A**

Chair: Dr. Eran Socher, Tel Aviv University
Co-Chair: Aleksey Dyskin, Technion - Israel Institute of Technology

1A3-1: On-Chip Transmitter with an EIRP of +2.8 dBm at 217 GHz in 90 nm CMOS
B. Khamaisi, S. Jameson, E. Socher, Tel-Aviv University , Tel-Aviv, Israel

Abstract: In this paper, we present a transmitter operating in the 210-227 GHz in 90nm CMOS, based on a Colpitts VCO. The third harmonic of the generated VCO fundamental signal is coupled to an on-chip dipole antenna. The silicon substrate of the CMOS chip is thinned from 280 μm to 80 μm in order to improve the performance of the transmitter in terms of effective isotropic radiated power (EIRP) and directivity. The transmitter achieves an EIRP of +2.8 dBm at 217 GHz and directivity of about +13.1 dBi with total power radiated of -10.3 dBm. The circuit consumes 134 mW of DC power and an area of 0.53 mm2.

1A3-2: CMOS Distributed Amplifiers Using High-Pass and Low-Pass Artificial Transmission Lines
I. Gertman, E. Socher, Tel-Aviv University, Tel-Aviv, Israel

Abstract: Two prototypes of a distributed amplifier (DA) were implemented in 65 nm CMOS based on a low-pass and high-pass artificial transmission lines (ATL). The characteristic impedance and the propagation factor of ATLs were analyzed by combining the lines with an approximate CMOS cascode model. The simulated gain for the low-pass ATL DA has a peak of 13 dB at 7 GHz, 3dB bandwidth is 14.6 GHz (from 4.3 to 18.9 GHz). The simulated Psat and PO1dB are better than 15 dBm and 10 dBm up to 30 GHz. The measured performance degraded due to oscillations at 3 GHz, the measured gain is 12 dB at 7.7 GHz and 3-dB bandwidth is 7 GHz from 4.7 to 11.7 GHz. The designed 3-stage high-pass ATL DA has a simulated peak gain of 17.7 dB at 50 GHz and 3dB bandwidth of 26.4 GHz from 44.1 to 70.5 GHz. The simulated Psat is better than 8 dBm from 43 to 71 GHz.The measured peak power gain is 10.1 dB at 61.5 GHz and 3-dB bandwidth is 10.3 GHz from 54.7 to 65 GHz. Peak Psat reduced to 6.8 dBm at 62 GHz.

1A3-3: A 6.6 mW Inductorless Static 2:1 Frequency Divider Operating up to 60 GHz in 28 nm CMOS
V. E. Issakov [1], B. Parvais [1], K. Vaesen[1], V. Vidojkovic [1], P. Wambacq [1,2], [1]IMEC, Leuven, Belgium, [2] Vrije Universiteit Brussel, Brussels, Belgium

Abstract: This paper presents an inductorless static 2:1 frequency divider operating up to 60 GHz. In order to save the chip area no peaking inductors are used in this design. Alternatively, to achieve the high operating frequency, the range has been extended by asymmetrical sizing of the data and latch transistors and by reducing the load of the following buffer stage. The load reduction is achieved by means of a gate-drain capacitance neutralization in the following differential buffer stage. The circuit has been realized in a 28 nm CMOS technology. Measurements show that the divider exhibits a maximum operating frequency of 60 GHz and features an input sensitivity below 0 dBm over a broad input frequency range of 34 GHz. The divider consumes 7.3 mA from a single 0.9 V supply.

1A3-4: Performance Evaluation of Broadband Drivers for Radio Frequency Applications
N. Joram, R. Wolf, F. Ellinger, Technische Universitaet Dresden, Dresden, Germany

Abstract: This paper presents enhanced versions of the two most common drivers used in radio frequency integrated circuits: the common-collector stage and the differential pair. The common-collector stage is extended to a totem pole stage and the differential pair to a multi-tanh structure. A key point is the direct comparison of small-signal and large signal measurement results between the standard architectures and enhanced versions in the range from 1 GHz to 10 GHz. An integrated circuit was manufactured in a 250 nm SiGe BiCMOS process with switchable versions of both drivers and their enhancements. Measurements prove the superior performance of the enhanced versions, showing an increase of dynamic range by 10 to 20 dB.

1A3-5: Broadband Receiver Frontend with High Dynamic Range for Multi-standard Digital Radio
B. Lindner, N. Joram, A. Strobel, U. Yodprasit, F. Ellinger, Dresden University of Technology, Dresden, Germany

Abstract: A receiver frontend consisting of a low noise amplifier (LNA) and a quadrature down-conversion mixer is presented which is optimized for large bandwidth and high input dynamic range. The input bandwidth covers several standards such as DAB, DRM+ and DVB-T. A minimum system noise figure of 5 dB is achieved. The 1 dB compression point reaches 7 dBm and the input-referred IP3 amounts to 15 dBm. A dynamic range of −99 dBm to 7 dBm and frequency range from 17MHz up to 2GHz e.g. for DAB is reached.

14:00-15:40 1B3: MILLIMETER WAVE AND TERAHERTZ TECHNOLOGIES AND SYSTEMS — Salon B

Chair: Dr. Solon Spiegel, Rio Systems
Co-Chair: Prof. Asher Yahalom, Ariel University

1B3-1: A Monolithic Analog to Digital converter in 32nm CMOS for broadband radar applications.
Roger Levinson, VP Strategy and Innovation Group, and Craig Hornbuckle, VP Systems Engineering , Kenneth Dyer, Director of Data Converter Development, Semtech Corporation

Abstract: There have been several architectural advancements in phased array radar systems over the past decades. Each advancement has required improved analog receiver channel performance and has been addressed by advancements in available technologies capable of supporting circuit implementation. With the scaling of CMOS technologies to 32nm and below, the ability to integrate extremely powerful DSP solutions at manageable power consumption has become a reality. In addition, we now have the ability to implement Analog to Digital Converters capable of digitizing the entire spectrum of interest while maintaining the required dynamic performance. These two factors combine to enable the implementation of monolithic, multi-channel receivers, thus decreasing board space and power constraints. In this presentation, we will show the fundamental architectural evolution of receive channels, the required circuit performance to achieve a broadband digitizing solution and an example of an 8-bit, 64GSPS ADC capable of achieving 6 ENOB up to 20GHz of input Bandwidth. We will also show the next steps to achieving higher levels of performance utilizing the next technology node, 14nm FinFET.

1B3-2: Millimeter- and Submillimeter-Wave Monolithic Integrated Circuits Based on Metamorphic HEMT Technology for Sensors and Communication
M. Schlechtweg [1], A. Tessmann [1], A. Leuther [1], H. Massler [1], S. Wagner [1], R. Aidam [1], J. Rosenzweig [1], O. Ambacher [1], I. Kallfass [2], U. Lewark [2], R. Sommer [3], A. Wahlen [3], S. Stanko [3], J. Ender [3]; [1] Fraunhofer IAF, Freiburg, Germany, [2] Karlsruhe Insttute of Technology, Karlsruhe, Germany, [3]Fraunhofer FHR, Wachtberg, Germany

Abstract: For the next generation of sensors and communication systems operating at frequencies up to 600 GHz and above, the Fraunhofer IAF is developing a broad variety of millimeter- and submillimeter-wave monolithic integrated circuits (MMICs and S-MMICs) and modules. The monolithic integrated circuits are realized using the advanced metamorphic high electron mobility transistor (mHEMT) technology in the InGaAs/InAlAs material system on 4” GaAs substrates. This paper presents a 600 GHz amplifier S-MMIC and a chip set of MMICs developed for a 300 GHz radar.

1B3-3: Uncooled and Passive 0.5-1.5 THz FPA Imager
E. Shumaker [1], D. Corcos [1], N. Kaminsky [1], D. Elad [1], T. Morf [2], B. Klein [2]; [1] IBM, Haifa, Israel, [2] IBM, Zurich, Switzerland

Abstract: Radiation in the "THz gap" holds great promise for numerous novel applications from navigation aids to medical imaging. An all-silicon antenna coupled MOSFET bolometer, realized in CMOS-SOI-MEMS process is intended to become a cornerstone of a novel focal-plane-array imager aimed at operation in the 0.5-1.5 THz range. The present article reports on the progress in design and characterization of this innovative sensor.

1B3-4: Transmission Line Modeling of Active Microwave Pulse Compression Systems
S. P. Savaidis[1], Z. C. Ioannidis [2],1, N. A. Stathopoulos [1], S. A. Mitilineos [1], C. Tsitouri [1]; [1] Technological Educational Institute of Piraeus, Athens, Greece, [2] National and Kapodistrian University of Athens, Athens, Greece

Abstract: Microwave pulse compression using a waveguide cavity composed by an inductive iris and an H-plane T-junction with the transverse arm shorted is studied using the individual components' equivalent circuits and transmission line theory. The equivalent circuit model of the device is studied in detail and key figures such as the length of the waveguide cavity, the iris width as well as the cavity gain and cavity leakage are calculated analytically. Furthermore, a design procedure based on transmission line theory is proposed. As a verification of the proposed method, a microwave pulse compressor working at 1.3GHz is studied and then compared with the results of a full-wave three dimensional commercial electromagnetic code as well as with literature-available experimental results.

1B3-5: Sheet Electron Beam Millimeter-Wave Amplifiers at the Naval Research Laboratory
B. Levush, D. K. Abe, Naval Research Laboratory, Washington, United States

Abstract: To meet the need to transmit increasingly massive volumes of data, both the defense and commercial sectors are turning to higher operational frequencies to take advantage of larger signal bandwidths while concurrently requiring increased amplifier power to achieve the necessary signal-to-noise ratios over large transmission distances. In response to these needs, the last decade has seen a leap in performance of a variety of millimeter-wave devices. The Naval Research Laboratory (NRL) is the principal U.S. Department of Defense R&D center focused on the development of the science and technology behind new millimeter-wave high power solid-state and vacuum electronic devices. Selected examples of NRLs research projects are described with an emphasis on high power millimeter-wave vacuum electronic devices.

14:00-15:40 1C3: SENSOR SYSTEMS AND APPLICATIONS — Salon C

Chair: Prof. Nadav Levanon, Tel Aviv University
Co-Chair: Prof. Yael Nemirovsky, Technion, Israel Institute of Technology

1C3-1: TECSAR – Program Status
U. Naftaly, O. Oron, ELTA Systems Ltd, Ashdod, Israel

Abstract: TECSAR is a space based Synthetic Aperture Radar (SAR) satellite. The satellite was launched on 21st January 2008, and the radar payload of the satellite was operated successfully after launch. The satellite performs excel-lently since its first activation. After an In Orbit Test (IOT) period, the system was delivered to the customers and is fully operational since then and provides a large number of high quality SAR images. A second generation TECSAR satellite is under development.

1C3-2: Feasibility of a Radar Altimeter for an Unmanned Aerial Vehicle Cruising in the Mars' Atmosphere
S. Yonemura [1,2], A. Tomiki [2], T. Toda [2], T. Kobayashi [1]; [1] Wireless Systems Laboratory, Adachi-ku, Japan, [2] Institute of Space and Astronautical Science, Sagamihara-shi, Japan

Abstract: The Japan Aerospace Exploration Agency has planned an unmanned aerial vehicle (UAV) ejected from a Mars orbiter for observing the residual magnetic fields near the surface and the exposed strata of Mars. An altimeter is indispensable to achieve this mission. It must be miniature and lightweight—less than 200 g—to be equipped on the airplane flying in the thin atmosphere of Mars. For this purpose, we have been developing an FM-CW radar for its accepted merits: easier signal processing and lower power consumption than a pulse radar. Tentative specifications and construction of the altimeter were examined. Normalized radar cross section of the Mars' surface, previously unknown, was estimated ranging between -20 and -5 dB from the past radar observation of the earth and the moon. Preliminary estimation revealed that the altitude can be measured in the worst case. A breadboard model is now under development and a series of outdoor experiments using an UAV were planned.

1C3-3: Komarov Crater Analysis:Its Origin & Classification to Floor-Fractured Craters
O. N. Calla, S. Mathur, M. Solanki, International Centre for Radio Science, Jodhpur, India

Abstract: The paper presents the study of Komarov Crater using Miniature-Radio Frequency (Mini-RF) and Lunar Orbiter Laser Altimeter data (LOLA). This combined study uses variations in crater morphology and regional distribution to explore the reason behind formation mechanisms. The distribution of crater features from m-Chi decomposition, differentiate materials within ejecta deposits and their relative thicknesses and helps in knowing the surface topography. Many lunar craters are classified under population of Floor-Fractured Craters (FFC) and mapped according to their distribution on the Moon. The population of FFCs was categorized according to the classes outlined by Schultz. This paper also points out the importance of SAR and LOLA data by relating Komarov Crater to one of the FFCs subclass. We propose this tendency to be supportive in knowing the mode of evolution, formation of features and also in classifying the crater classes.

1C3-4: A Self-Calibration Method for an Implantable Displacement Sensor
S. Hao, Michigan State University, East Lansing, United States

Abstract: This paper describes a hardware implementation of an automatic calibration process for an implantable sensor used for monitoring the postoperative stability of a hip or knee implant. The RL-Wheatstone bridge, which is the essential part of the sensor, is capable of being self calibrated in vivo by adjusting its electronic component values alternatively until it is balanced. This calibration method extends the measurement range of the sensor by separating the small, elastic movement from the gross, unrecoverable movement, which is suitable for long term in-vivo measurements. The subsystem for calibration is realized using 0.35 μm CMOS (Complementary Metal-Oxide Semiconductor) technology on two 2.8 mm2 chips, consisting of two voltage-controlled resistors, a ±90° phase detector and a preamplifier. The simulated and in vitro measured results validate its feasibility to calibrate the bridge, which will ensure a detectable range of ±150 μm in subsequent micromotion measurement.

1C3-5: Vehicle Proximity Map Formation in VANET
Y. Allouche, M. Segal; Ben-Gurion University of the Negev , Beer-Sheva, Israel

Abstract: In this paper we introduce the Cluster-Based Beacon Dissemination Process (CB-BDP) based on inter vehicle communication in highway scenarios. This process aims to provide vehicles with a local vehicle proximity map of their vicinity. The CB-BDP is designed under the two following objectives. First, we want the map to be detailed and as accurate as possible. Second, we want the map to be coordinated with nearby vehicles, thereby allowing synchronized and coordinated reactions of nearby vehicles to evolving hazardous situations. In [1] we have introduced a clustering scheme design to provide an optimized topology for an efficient and reliable beacon dissemination process. In this paper, we propose a cluster based aggregation-dissemination beaconing process that uses this optimized topology to distribute the vehicle proximity map. Our proposed scheme deals with the heavy load of beacon messages by integrating a contention-free MAC strategy for reliable communication.

1C3-6: Sink hole monitoring using SAR imagery
O. Oron, Elta Technologies, Ashdod, Israel

14:00-15:40 1D3: ADVANCES IN ELECTROMAGNETICS AND ANTENNAS (invited session) Royal H
Chair: Prof. Amir Boag, Tel Aviv University, Israel

The session will cover some recent advances in computational electromagnetics, and antenna development. Novel differential and integral equation based approaches for the numerically efficient solution of electromagnetic scattering and antenna problems will be presented. Two papers will describe carbon nanotube and plasmonic nano-antennas bridging the gap between electromagnetics and optics. Finally, advances in the design of reconfigurable antennas will be discussed.

1D3-1: Towards an infinitely thin PML
Rafi Kastner, Tel Aviv University, Tel-Aviv, Israel

1D3-2: Reconfigurable Slot Antenna for Cognitive Radio Applications
Lev Pazin, Yehuda Leviatan, Technion, Haifa, Israel

1D3-3: UWB Dual-Vivaldi nano-antennas
Zeev Iluz & Amir Boag, Tel Aviv University, Tel-Aviv, Israel

1D3-4: Antenna effects in the infrared and terahertz response of carbon nanotubes
Gregory Slepyan, Tel Aviv University

1D3-5: Analysis of Scattering by Essentially Convex Bodies Using the Directive Source Integral Equation
Arkadi Sharshevsky [1], Vitaliy Lomakin [2], & Amir Boag [1]; [1] Tel-Aviv University, Tel-Aviv, Israel; [2] University of California, San Diego, USA

15:40 – 16:00 COFFEE BREAK* AND *VISITING THE EXHIBITION

MONDAY, October 21, 2013

14:00 – 16:00 (120 min) - 1P1: POSTER SESSION* **Room 5**

1P1-1: Waveguide E-Plane Folded Cross-Coupled Filters
J. Meyler, K. Garb, R. Kastner, Tel Aviv university, Tel Aviv, Israel

Abstract: Folded E-plane cross-coupled waveguide filter topologies provide high selectivity by virtue of their transmission zeros. A design method for these topologies is presented below. The method is explained in physical terms and is validated by both simulations and experiments.

1P1-2: Fabrication and characterization of RF MEMS high isolation switch up to X-band
S. Dey, M. S. Parihar, S. K. Koul, Indian Institute of Technology, Delhi, New Delhi, India

Abstract: Design and development of a metal contact switch that employs micro electromechanical systems (MEMS) based on electrostatic actuation and implemented using a coplanar waveguide (CPW) with three switch cells is presented. The design is based on the series-shunt switch configuration. The main objective of the present design is to achieve high isolation up to 12GHz frequency (X-band). The dimensions of the MEMS switch have been optimized with finite element method based Coventor Ware software. The switch has been fabricated using gold based surface micromachining process. The mechanical response, electrical response, switching time, loss performance and Intermodulation distortions of the MEMS switch have been experimentally investigated. Return loss better than 15dB and isolation greater than 60dB have been experimentally obtained upto 12GHz from the fabricated switch.

1P1-3: A Class-F-1 GaN HEMT Power Amplifier Optimized for Envelope Tracking with Gain-Efficiency Trajectory Analysis and Comparison
Z. Wang, Nokia, Beijing, China

Abstract: In this paper, a high voltage class-F-1 GaN HEMT power amplifier (PA) was developed and optimized for envelope tracking (ET) over 920MHz to 960MHz. The design was facilitated by micro strip harmonic tuning. The PA achieved a high efficiency greater than 70% across the band by delivering over 25W average power. It was optimized for envelope tracking (ET), compared with class-A/AB power amplifiers based on 28V GaN HEMT and GaAs HV-HBT gain-efficiency trajectories, this work obtained superior ET system efficiency of back-off and pre-distortion linearization capability respectively with proposed three metrics for ET PA selection.

1P1-4: Analysis of a Switched Ultra-Low Power Bandgap Reference Source for Passive RFID Tags
J. G. Schulze [1], S. J. Spiegel [2]; [1]Technische Universität Dresden, Dresden, Germany, [2] Rio Systems, Givat Shmuel, Israel

Abstract: In this paper, a switched ultra-low power bandgap reference source is presented that consumes 185 nA and requires a minimum supply voltage of 1.2 V. Circuit details to achieve the low power dissipation are discussed and simulation results are demonstrated. Process variations are considered. The reference source is part of a passive RFID tag analog front-end that is com- pliant with the EPCglobal Class1 Gen2 standard. As technology, a TowerJazz 0.18um standard logic process is used. The bandgap reference provides a supply-independent PTAT current and a bandgap voltage of 1.05 V, which exhibit a minimum PSRR of 120 dBOhm and 40 dB, respectively. The start-up requires 750 us.

1P1-5: A Quad 1.25GSps 8 bit ADC with 3.2GHz input bandwidth and its use in communication systems.
A. Glascott-Jones, N. Chantier, M. Wingender, F. Bore, E. Bouin, E2v, St Egreve, France

Abstract: Interleaving multiple ADCs is a useful technique for increasing overall conversion sample rate, however precautions must be taken when using the technique. This paper discusses the issues and parameters that need to be accounted for in the employment of interleaved conversion systems. The paper then describes a new Quad data acquisition component for communication and instrumentation systems. The EV8AQ165 is a high bandwidth, high sample rate, 4 core converter. The converter can sample at 5GSps in interlaced mode and has an input bandwidth of 3.2GHz. Features of this component will be presented along with characterization results and its use in communication systems will be highlighted.

1P1-6: An X-band GaN HEMT Hybrid Power Amplifier with Low-loss Wilkinson Division on AlN Substrate
G. C. Barisich [1], S. Pavlidis [1], C. A. Donado Morcillo [1], O. L. Chlieh [1], E. Gebara [2], J. Papapolymerou [1]; [1] Georgia Institute of Technology, Atlanta, United States, [2] I2R Nanowave, Incorporated, Atlanta, United States

Abstract: The high-power operation of a modular and compact power amplifier (PA) is demonstrated using gallium nitride (GaN) transistors and power-combining networks implemented on an aluminum nitride (AlN) substrate. The power-combining network, tuned for X-Band operation, includes matching circuits and Wilkinson power dividers (WPDs) with tantalum nitride (TaN) thin-film resistors. PA efficiency is increased by minimizing network thermal loss with the AlN substrate, which is an excellent thermal conductor. All system components were mounted on a metal carrier, and were interconnected through gold wire bonds. Large-signal measurements showed power added efficiency (PAE) of 44 % and a peak output power of 6.5 W at 9.5 GHz with a 3 dB fractional bandwidth of 14 %.

1P1-7: Moving target Speed calibrator for Multanova 6F speed radar (34.3GHz)
U. Nissan(Nissanov), A. Yahalom, Ariel University of Samaria, Ariel, Israel

Abstract: We describe the design of a device intended to calibrate Multanova 6F Doppler speed radars. The speed calibrator modulates the transmitted signal from the speed radar with the Doppler frequency, which is generated by a signal generator. This frequency corresponds to the speed of the target vehicle being measured by the speed radar. The range of "speeds" generated by the Speed calibrator is 25–250km/h and for both directions of travel (receding and approaching).

1P1-8: The methods of the bandwidth enhancement of the flash ADC with the differential input
N. N. Prokopenko, A. I. Serebryakov, P. S. Budyakov, Don State Technical University, Rostov-on-Don, Russian Federation

Abstract: This paper presents the methods of the response speed increase of the flash ADCs with the differential input that allow reducing of the parasitic capacitances effect of the active and passive components in the analog sections, and also optimizing the amplitude frequency response irregularity.

1P1-9: Substrate Integrated Waveguide Fixed Phase Shifter for 90°-degree Directional Coupler
T. Castellano1, O. Losito [1], L. Mescia [1], M. Chiapperino [1], G. Venanzoni [1], D. Mencarelli [1], G. Angeloni 2], C. Renghini [2], F. Bigelli [2], P. Potenza [2], F. Prudenzano [1]; [1] Politecnico di Bari, Bari, Italy, [2] Somacis Spa, Castelfidardo, Italy.

Abstract: Substrate Integrated Waveguide (SIW) technology can be used in both microwave and millimeter wave integrated circuits. In this paper, a single-layer planar directional coupler based on SIW is designed and characterized. The coupler is obtained via a single-layer dielectric substrate with metallic vias, and fabricated by using a standard printed circuit board (PCB) process. The compact size and shape allow the integration of these planar SIW directional couplers in sophisticated planar circuits. The chosen substrate allows low cost implementation, fast prototyping and precise manufacturing. More precisely, the fabricated device is a – 3dB directional coupler exhibiting a large bandwidth (about 2GHz) and 90-degrees phase shift between the output and coupled ports. An accurate investigation is made using CST Microwave Studio©, and the simulation results are compared with the measurement. The coupler exhibits interesting performance for satellite and DVB applications.

*Note: Posters will be displayed from 8:00 till 17:00. Poster frontal presentations will take place between the indicated hours.

MONDAY, October 21, 2013

16:00-17:40 (100 min) - PARALLEL SESSIONS 1A4, 1B4, 1C4

16:00-17:40 1A4: SOLID-STATE DEVICES, RFICs, CIRCUITS AND MODELING — Salon A

Chair: Dr. Claudio Jakobson, Samsung Electronics
Co-Chair: Aleksey Dyskin, Technion - Israel Institute of Technology

1A4-1: TSV Multi-Signal Connection Compact Modeling
E. Mina [1], S. Shlafman [2], R. A. Gordin [2], B. Sheinman [2], D. Elad [2], [1] IBM, Burlington, United States, [2] IBM, Haifa, Israel

Abstract: The paper presents wideband circuit level compact models of through-silicon via (TSV) multi-signal connections within an array. The models were developed for time and frequency domain characterization of periodic TSV array patterns, including crosstalk evaluation. A frequency dependent silicon substrate induced dispersion and loss effects are considered, as well as the skin and proximity effects. The models were verified by EM simulations up to 30 GHz.

1A4-2: Process Effective Power Mosfet Integrated in 0.18um platform with Very Low Rdson
S. C. Levy, S. Levin, A. Heiman, N. Berkovitch, S. Shapira, TowerJazz, , Migdal Haemek, Israel

Abstract: A super Low Rdson Power transistor with high Break down voltage was developed, using double Resurf technique with low mask count.

1A4-3: Modeling of SAW Resonators Fabricated on GaN/Si
A. Stefanescu [1], V. Buiculescu [1], A. Dinescu [1], A. Cismaru [1], A. Muller [1], G. Konstantinidis [2], A. Stavrinidis [2], G. Stavrinidis [2], [1] I]MT-Bucharest, Bucharest, Romania, [2] Forth-Iesl-Mrg, Heraklion, Greece

Abstract: This paper presents new 2D and 3D numerical models for surface acoustic wave resonators (SAW) on GaN/Si substrate, working on frequencies above 5 GHz. The interdigital transducers (IDT) have fingers and interdigit spacings of 200nm wide. The simulations are compared with experimental results obtained for one port SAW resonators.

1A4-4: Efficient Electromagnetic Analysis of Spiral Inductor Patterned Ground Shields
J. C. Rautio, J. D. Merrill, M. J. Kobasa, Sonnet Software, North Syracuse, United States

Abstract: Patterned ground shields are widely used to increase the Q of spiral inductors on silicon. As RFIC (radio frequency integrated circuit) technology pushes toward deeper submicron nodes, the geometries of ground shields can become exceedingly complicated. This poses a huge challenge for numerical EM (electromagnetic) simulators. This paper explores several ground shield geometries and illustrates a new anisotropic conducting sheet model for efficient EM analysis of even the most complicated ground shield geometries by substitution of a continuous, but anisotropic conducting sheet. The technique is validated by comparison of EM analysis results using this new model to EM analysis results of actual ground shield geometries. We also explore visualization of the current induced in the silicon substrate by the inductor and (if present) the ground shield.

1A4-5: AlGaN/GaN HEMT Development Targeted for X-band Applications
W. Wohlmuth, M. Weng, C. Lin, J. Du, S. Ho, T. Chou, S. Li, C. Huang, W. Wang, W. Wang, WIN Semiconductors, Kuei Shan Hsiang, Taiwan

Abstract: This paper discusses a newly developed 0.25um GaN on SiC foundry process technology to support discrete and MMIC applications extending from L- through X-band. The GaN HEMT technology is based on high-throughput and low-cost i-line photolithographic tools and on large-diameter 100mm SiC substrates. The technology supports applications utilizing supply voltages up to 28V with power density of 4W/mm, PAE of 45%, and large signal linear gain of 15dB at 10GHz based on on-wafer measurements without harmonic terminations.

16:00-17:40 1B4: MICROWAVE AND TERAHERTZ SENSORS, IMAGING, DETECTING AND TOMOGRAPHY - II **Salon B**

Chair: Prof. Asher Yahalom, Ariel University
Co-Chair: Prof. Yosef Pinhasi, Ariel University

1B4-1: Passive non-imaging mm-wave sensor for detecting hidden objects
B. Kapilevich, B. Litvak, A. Shulzinger, Ariel University, Ariel, Israel

Abstract: The paper presents the results of design and testing non-imaging mm-wave sensor aimed for remote detecting contrabands hidden on a human body under cloth. It operates in passive direct receiver mode at the range 80-100GHz. The unimodality approximation has been suggested for applying in the algorithm of detection. The antenna system of the sensor is based on horn antenna integrated with focusing dielectric lens. The sensor has demonstrated detection probability up to 100% in laboratory environment for the tested samples both plastics and metals hidden under cloth at the distance up to 3m with spatial resolution about 5cm.

1B4-2: New Approach to Estimation of Chirp Signal with Unknown Parameters
I. Rusnak, L. Peled-Eitan, Rafael, Haifa, Israel

Abstract: The problem of estimation of chirp signal parameters - the frequency, frequency change rate, amplitude and phase is dealt with. The existing approaches for estimation of signals with unknown parameters are reviewed. The fact that a harmonic-chirp signal can be represented as a rotating two dimensional vector is exploited. This can be intuitively seen when harmonic signal is represented by I and Q components, i.e. it is a two dimensional signal that embodies a circle in the two dimensional plane as a rotating vector with varying rotating rate. A novel approach for estimation is presented. This approach is motivated by the problem of tracking and estimating a spiraling motion. The estimator is the state dependent differential Riccati equation (SDDRE) based estimator. It is based on the equations of motion of a rotating vector with varying rotating rate. The equivalence between the spiraling motion and chirp signal is elaborated. Simulation demonstrate the vitality of the approach.

1B4-3: Constrained-Beam Amplitude Monopulse Technique for Bearing Estimation in Passive Radar with Uniform Circular Dipole Array
J. Hwang, Y. Pang, J. Li, Y. Chiu, Yuan-Ze University, Chung-Li, Taiwan

Abstract: The paper presents an improved method for estimating the direction of arrival (DoA) of aircraft targets, based on a passive coherent location (PCL) equipped with uniform circular dipole array (UCDA). First, we use the dual-domain spatial-temporal processing (STP) for suppressing the direct path interference (DPI). Based on the STP, a constrained-beam amplitude monopulse (CBAM) technique is then developed. It is shown that the combined STP-CBAM technique has many merits, such as high bearing estimation accuracy, low complexity, and feasibility for hardware realization. Finally, the performance of the complete STP combined with CBAM bearing estimation scheme is validated using computer simulation.

1B4-4: 3D Millimeter wave imaging system using chirp radar and Glow Discharge Detector pixel
D. Rozban [1,2], A. Aharon (Akram) [2,1], A. Levanon [2], A. Abramovich [1], N. S. Kopeika [2]; [1] Ariel University , Ariel, Israel, [2] Ben Gurion University, Beer sheva, Israel

Abstract: Demonstration of Millimeter Wave (MMW) imaging system using chirp radar method and Glow Discharge Detector (GDD) Focal Plane Array (FPA) is presented. A unique quasi optical set up and advanced detection methods using the GDD are intended to build the 3D MMW imaging system. This quasi optical setup enables to detect the distance and reflection of each point in object in order to reconstruct a 3D MMW image.

1B4-5: Application of Super-Rayleigh Resolution in Radio Astronomy and Passive Radio Imaging
Y. A. Pirogov, A. I. Chulichkov, S. S. Batova, V. B. Khaikin, M.V. Lomonosov Moscow State University, Moscow, Russian Federation.

Abstract: Use of mathematical reduction method allows to achieve super-Rayleigh resolution of radio imaging with high enough S/N. It is demonstrated by processing of Sun and town building images obtained with help of microwave radiometric receivers.

16:00-17:40 1C4: MEDICAL TECHNOLOGIES & APPLICATIONS OF RF AND ULTRASOUND (invited session) **Salon C**

Chair: Ruth Rotman, Elta Technologies, Ashdod, Israel
Co-Chair: Stephen Weinstein, Commun. Theory & Technol. Consulting

Abstract: RF and ultrasound techniques and devices, and accompanying computational methods, are already widely deployed in medical practice and hold great potential for future benefits. This invited session describes several of those promising technologies, plus environmental cueing for patient support systems.

1C4-1: Multi-Cue Unit: An Independent Device and Actuator of a Wearable System for Gait-Support in Parkinson Patients
Y. Zhao [1], F. Anhalt [1], U. Fietzek [2], L. T. D'Angelo [1], [1] Technische Universitaet Muenchen, Munich, Germany, [2] Schoen Klinikum Muenchen Schwabing, Munich, Germany

Abstract: Impairment of gait and freezing are common symptoms in patients with Parkinson's disease (PD). In this paper, a device to improve these symptoms by delivering auditory and somatosensory external stimuli (so-called cues) is presented. The device can be not only used independently but also as actuator of a wearable system to offer situation-dependent cueing during Freezing-episodes. Furthermore, it is possible to individually choose from a variety of settings and wearing-positions. An experiment, where the Multi-Cue Unit (MuCU) was tested and evaluated with six Parkinson-patients was set up and carried out. According to the results of the self-assessment, the MuCU is light weight and also very easy to operate. Moreover, four out of all six patients experienced a shorter FOG - episode with the wearable device and preferred the situation-dependent cueing.

1C4-2: A Fingerprint for Cancer; Identification of the Proteome Cancer Fingerprint in Blood Plasma via Image Analyses of Subcellular Translocation in a Novel Cell Based Chip for Early Cancer Detection and Diagnostics
Liron Agiv [1], Stanley Rotman [2], Yoram Altchuler [3]; [1] Dept. Biomedical Engineering, Univ. Ben Gurion of the Negev; [2] Dept. Electrical Engineering, Univ. Ben Gurion of the Negev; [3] CSO, NovellusDx Ltd., Jerusalem Bio-Park, Hadasah Medical Center Campus, Jerusalem, Israel

1C4-3: Processing of Acceleration Signals for Physiological State Identification
Guy Tsror [1], Sharona Bistry [1] & Stanley Rotman [2]
[1] Dept. of Biomedical Engineering Univ. Ben Gurion of the Negev, [2] University of Ben Gurion of the Negev

1C4-4: The Advantages and Pitfalls of Sensor Fusion for Target Detection in Medical and Geophysical Applications
Ruth Rotman, Elta Electronics Industries, Ashdod Israel

Abstract: In the following paper, we will examine the implications of sensor fusion (or lack of it) for geophysical, military and medical applications. In many areas, the medical field is surpassing even the military in sophisticated integration of multiple sensors. However its implementation must be done carefully and correctly in both realms.

17:45 *WELCOME COCKTAIL* (Royal H). ***Sponsored by*** Agilent Technologies

TUESDAY, October 22, 2013

9:00-10:40 (100 min) - PARALLEL SESSIONS 2A1, 2B1, 2C1, 2D1, 2E1

9:00-10:40 2A1: POWER AMPLIFIER AND DEVICE MODELING **Salon A**

Chair: Dr. Danny Elad, IBM Research Lab, Haifa, Israel
Co-Chair: Dr. Solon Jose Spiegel, RIO Systems

2A1-1: Efficiency Study of a 2.2-kV, 1-ns, 1-MHz Pulsed Power Generator Based on a Drift-Step-Recovery Diode
L. M. Merensky [1], A. S. Kesar [1], A. F. Kardo-Sysoev [2]; [1]Soreq Nuclear Research Center, Yavne, Israel, [2] Ioffe Physical Technical Institute, St. Petersburg, Russian Federation

Abstract: Nanosecond pulsed-power generators featuring high peak and average power are attractive for ultra-wideband radars in applications such as through-wall detection and ground penetration. The efficiency of the pulse production scheme has a major importance in battery operated devices. This paper presents an efficiency study of a 2.2-kV, 1-ns pulsed power circuit. A peak voltage of 2.2-kV with a rise-time of less than 1-ns and a rise-rate of 3-kV/ns was obtained, where the efficiency was 24%. A higher efficiency of 52% was obtained when the circuit was optimized to an output peak voltage of 1.15 kV. The circuit was operated in single-shot mode, as well as in bursts of up to 100 pulses at a repetition rate of 1 MHz.

2A1-2: High Efficiency Ka-Band Gallium Nitride Power Amplifier MMICs
C. F. Campbell, Y. Liu, M. Kao, S. Nayak, TriQuint, Richardson, United States

Abstract: The design and performance of two high efficiency Ka-band power amplifier MMICs utilizing a 0.15um GaN HEMT process technology is presented. Measured in-fixture continuous wave (CW) results for the 3-stage balanced amplifier demonstrates up to 11W of output power and 30% power added efficiency (PAE) at 30GHz. The 3-stage single-ended design produced over 6W of output power with up to 34% PAE. The die sizes for the balanced and single-ended MMICs are 3.24x3.60mm^2 and 1.74x3.24mm^2 respectively.

2A1-3: Integrated 60V Vertical DMOS on 0.18um platform for Power over Ethernet IC
N. Berkovitch [1], T. Herman [2,1], S. Levin [1], S. Shapira [1], H. Jebory [3]; [1] TowerJazz, Migdal Haemek, Israel, [2] Consultant, LA, United States, [3] TowerJazz, Newport Beach, United States

Abstract: Power Management Integrated Circuits is one of the most growing markets in the semiconductor industry, with increasing demand for efficient electronic devices and dense integration schemes. Power over Ethernet designs are some of the most challenging, incorporating multiple channels of large High Voltage FET drivers, along with dense logic cores and high precision analog. The extreme amount of silicon area consumed by the HV drivers and the need for efficient low resistance switching has driven the need to go to area efficient vertical topologies. While vertical structures are widely common in discrete device manufacturing, it introduces many challenges in IC platforms. We present a 60V platform based on a 0.18um CMOS technology, integrated with a best in class 60V vertical DMOS, providing a high performance and cost effective platform for PoE designs.

2A1-4: 1kW GaN S Band Radar Transistor
J. L. Walker, G. Formicone, F. Boueri, B. Battaglia, Integra Technologies, Inc., El Segundo, United States

Abstract: This paper describes a GaN transistor with 1kW output power for S band radar and other applications. This is believed to be the highest power ever reported from a single-ended transistor at this frequency and is a threefold improvement on the previous best.

2A1-5: Tunable Pulse Generators Based on Drift-Step Recovery Effect in COTS Power Rectifier Diodes
D. Sostanovsky1,1, A. Boryssenko2,2, 1Ratio, Kiev, Ukraine, 2A&E Partnership, Belchertown, United States

Abstract: This study reports several design approaches and their experimental verification to create tunable pulse generator based on Commercial-Off-The-Shelf (COTS) power rectifier diodes driven for fast switching in Drift Step Recovery Mode (DSRD) mode. Two major pulse generation schemes are explored to charge/discharge the internal inductive-capacitive energy storage with single and dual (cascaded) DSRD switch circuits. Key research and design methodology behind both designs is discussed. Major simulated and measured results are in a good agreement to each other.

2A1-6: A 40 GHz Paramutually Coupled Oscillator
John Q Public, Mary D Doe, Technical University of North America Electrical Engineering, United States

Abstract: A novel design for a 40 GHz paramutually-coupled oscillator is described herein. Implementation of the design on a 23 nm SiGe WinFET process has yielded close agreement to predicted performance parameters. Such an oscillator can be readily integrated into RFIC upconvert / downconvert chains requiring paramutual RF coupling.

9:00-10:40 2B1: WIRELESS COMMUNICATION IN THE 21st CENTURY (invited session) Salon B

Chair: Irving Kalet, Azrieli College, Jerusalem, Israel and Columbia University, USA

This open panel session addresses the possible directions for wireless communications in the near future, beginning with the now almost "classic" wireless communications systems e.g., 4G-LTE and Wi-Fi. The topics to be discussed include 5G (fifth generation) cellular systems, and new very wideband systems operating in the millimeter microwave range (e.g., WiGig). We will also discuss new directions in the use of wireless communications in areas such as satellite communications and the bio-medical field. Members of the audience are invited to join members of the panel in suggesting new ideas for future directions in wireless communications.

2B1-1: Introduction to Panel Session
Irving Kalet, Azrieli College of Engineering, Jerusalem and Columbia University, New York, USA

Abstract: This talk will serve as an introduction to the panel session. We will try to present a picture of the present state of the radio or physical interface of wireless communications. Wireless communications covers many areas including cellular communications, broadband wireless access communications, satellite communications, deep-space communications and even “in-body” communications.
Most of these topics will be covered in the talks to be given in the session. However, we will try at the beginning of the session, to present a general picture of wireless communications today.

TUESDAY, October 22, 2013

2B1-2: The Future of Wireless Communications in the Twenty-First Century: Global and Regional Views
Haim Mazar, Ministry of Communications of Israel, Deputy Director, RF Spectrum and Licensing & Vice Chairman, ITU-R, Study Group I

Abstract: Wireless communications in the future will provide much more capacity than exists today perhaps reaching more than 40 Gbps for fixed service. Wi-Fi and similar systems will serve to offload, to improve cellular capacity. Due to the scarcity of usable RF spectrum, the transmissions will operate in higher frequency ranges, e.g., EHF -30 to 300 GHz, millimetric waves, and 300 to 3 000 GHz decimillimetric waves. Therefore, antennas will be smaller, transmitter and receiver hardware will be reduced in size, and processing power will increase. The attenuation, created by atmospheric gases (water vapour and oxygen) in those frequency ranges, may actually serve for secure communications.
Due to extensive propagation losses, less interference is assumed to occur at receivers and more unlicensed bands will open. The new wireless allocations will be globalized throughout the world. European standards will be introduced in Africa. Asian-Pacific standards, developed mainly by CJK (China, Japan and Korea) and Australia will penetrate into Latin America, and the US RF allocations and standards will expand mainly in North America. It appears that the cellular standards will be developed only by 3GPP, extending the GSM family of standards (e.g., GSM, UMTS, LTE).

2B1-3: Information Theory in Wireless Communications: Past, Present and Future
Shlomo Shamai, Technion, Haifa, Israel

Abstract: We start by demonstrating in a descriptive way the origin of information theory in Shannon's 1948 monumental work, and mention some direct implications on classical wireless technology. We discuss a change of paradigms in Information Theory from being a pure mathematical theory of communications to a theory with widescope direct practical implications and applications, emphasizing wireless systems. To demonstrate the rich aspects of the problems considered and their implications as well as some inter-disciplinary connections, we focus on a simple matrix based linear additive Gaussian model. Such a model plays a central role in numerous wireless communications channels and networks. We elaborate on the information-estimation intimate connection, mentioning its recent impact on theoretical analysis of wireless single and multi-terminal problems. A short outlook concludes the presentation.

2B1-4: Challenges and Future Directions in Next Generation Wi-Fi Networks
Matti Wax, CTO, Alvarion, Rosh Hayain, Israel

Abstract: In recent years, Wi-Fi has become a key element in mobile data communication, complementing the cellular network and enabling it to better cope with the exponential increase in mobile data demand. The success of Wi-Fi made it a victim of the "tragedy of the common". The rising number of Wi-Fi users and Wi-Fi networks in public venues, all competing on the same limited unlicensed spectrum resources, has created new challenges that need to be addressed to ensure the continuing success of Wi-Fi. In this talk we will describe the status of these high density networks and the sources of their problems, and will also point out potential directions to address these challenges.

2B1-5: IEEE802.11ad: 60 GHz Multi-Gigabit Wi-Fi and More
Gal Basson, VP, Wilocity, Caesarea, Israel

Abstract: IEEE802.11ad is a recently ratified standard, bringing Wi-Fi into the unlicensed 60 GHz band. In addition to bumping the speed up to 7 Gbps, this new standard enables ultra-low latency (virtually wired equivalent) operation, allowing for seamless, wireless docking as well as highly directional transmission, allowing for game changing capacity improvements in the network. Developing radio systems in 60 GHz introduces many implementation challenges as well, including mm-wave RF design in CMOS, low power design for mobile applications, and implementation of large antenna arrays. In this talk, we will first go through the market advantages IEEE802.11ad brings to the table, and then follow up with a technical discussion about addressing implementation challenges.

2B1-6: Satellite Internet for Consumer Market
Motti Chorev, Microwave System Engineer, Elta, Israel

Abstract: The first, unsuccessful efforts to provide broadband internet access began in 1999 during the period of the dot.com bubble. As time passed, several technologies matured, and today more than one million users, in the United States alone, are served by broadband internet access via satellite. There are two main players in the market, HNS and ViaSat. Each one owns and operates its own satellite, providing a commercially viable model. Both companies use the Ka frequency band as a cornerstone. We will discuss key enabling technologies for the future, e.g., spot-beam satellites, advanced modulation schemes and modern microwave components for ground segment.

9:00-10:40 2C1: MIMO AND MINIATURIZED ANTENNAS — Salon C

Chair: Eli Levin, The Open University of Israel
Co-Chair: Asaf Katz, Suron A.C.A Ltd, Israel

2C1-1: Design and Testing of a Miniaturized Dual Polarized VHF Array Element for AIS Space Application
L. J. Foged [1], A. Giacomini [1], F. Saccardi [1], L. M. Tancioni [1], A. Di Cintio [2], G. Della Pietra [2], A. Caliumi [2], G. Duchini [2], P. de Maagt [3], N. J. Fonseca [3], J. M. Baracco [4]; [1] MVG, Pomezia, Italy, [2] CGS Space, Milano, Italy, [3] Esa Estec, Nordwijk, Netherlands, [4] Mardel, Vence, United States

Abstract: The space-based Automatic Identification System is devised to provide identification and position information to vessels for maritime safety and security purposes. The system is intended to operate at VHF through mini-satellite platforms in Low Earth Orbit. Due to the in-orbit deployment of the antenna array and overall mass requirements for the satellite, the array element minimization and mass reduction are considered performance design drivers. The important size reduction properties of Artificial Magnetic Materials or Meta Materials made this approach a natural choice as baseline array element technology. The antenna and array verification represents a challenging task due to the low-gain and frequency. This paper presents the preliminary study of the array element including the manufacturing of an elegant bread-board and testing in a hemispherical near-field antenna test range together with post-processing issues involved.

2C1-2: A Dual-band Shorted Planar Monopole Antenna with slots for WLAN
H. Yang, R. Zhang, Y. Shen; Beijing University of Posts and Telecommunications, Beijing, China

Abstract: An improved dual-band shorted planar monopole antenna with a bevel is presented for WLAN（wireless local area network）. The parasitic element at the top of the antenna can reduce the height of antenna and can widen bandwidth. Compared with conventional planar monopole antenna, the antenna can work at dual band by adding rectangular-slots in vertical radiation elements. It can be concluded from the good results of return loss is less than -10dB within the frequency range of 2.15-2.53/5.05-5.49GHz, which could cover the WLAN dual-band of 2.4-2.484/5.15-5.35GHz. The acceptable agreement of measured and simulated results shows that this kind of antenna has perfect input impedance and pattern properties.

2C1-3: A Design-Algorithm for MIMO Radar Antenna Setups with Minimum Redundancy
A. Kirschner, U. Siart, J. Guetlein, J. Detlefsen, Technische Universitaet Muenchen, Munich, Germany

Abstract: Coherent MIMO radar systems with co-located antennas, form monostatic virtual arrays by discrete convolution of a bistatic setup of transmitters and receivers. Thereby, a trade-off between maximum array dimension, element spacing and hardware efforts exists. In terms of estimating the direction of arrival, the covariance matrix of the array element signals plays an important role. Here, minimum redundancy arrays aim at a hardware reduction with signal reconstruction by exploiting the Toeplitz characteristics of the covariance matrix. However, the discrete spatial convolution complicates the finding of an optimal antenna setup with minimum redundancy. Combinatorial effort is the consequence. This paper presents a possible simplified algorithm in order to find MIMO array setups of maximum dimension with minimum redundancy.

2C1-4: Basic Performances of Triple Band MIMO Antenna for WiMAX by using a Folded Monopole Antenna with a Parasitic Element

T. Ito [1], M. Nagatoshi [1], S. Tanaka [2], H. Morishita [1]; [1] National Defense Academy, Yokosuka, Japan, [2] Yazaki Corporation, Yokosuka, Japan

Abstract: A folded monopole antenna (FMA) which can cover 2.5/3.5 GHz bands of WiMAX is already reported. In this study, 2.5/3.5/5.5 GHz bands of WiMAX are covered by placing a parasitic element in the vicinity of FMA. Furthermore, two FMAs are used in order to investigate the basic performances of MIMO antenna for WiMAX. As a result, antenna efficiency is more than 75 %, and a very small envelope correlation of less than 0.01 between the two FMAs is observed in the three bands.

2C1-5: An Electrically Small Elliptic PIFA for RFID in Harsh Metallic Environments

J. Sidén, H. Nilsson, Mid Sweden University, Sundsvall, Sweden

Abstract: Remote identification of metallic objects with RFID tags require that the tag's antenna consists of more than one layer of conducting material, where one layer can comprise the metallic object itself, or alternatively the object itself can be used for to make a slot antenna. Tag antennas are also seldom smaller than about 1/4 of a wavelength. This paper presents a capacitively fed PIFA for passive UHF RFID where the radiating element has received elliptical geometry and is placed inside a circular metallic cup that constitutes the tag antenna's boundary conditions and is protected by a top layer of an extremely hard plastic material that also works as a superstrate. The elliptic radiating patch has length of only 0.068 wavelengths and with its cup it has total antenna diameter of 0.084 wavelengths and total antenna height 0.016 wavelengths. The RFID tag can be placed upon a metallic or non-metallic surface or immersed into the same to create an overall flat surface

9:00-10:40 2D1: MULTI-ANTENNA/PHASED ARRAY SYSTEM CALIBRATION AND TRAINING (invited session) **Royal H**

Chair: Prof. Caleb Fulton, University of Oklahoma, USA

Abstract: This session focuses on the calibration and training of phased array systems, highlighting the synergies in techniques and challenges between the successful implementation of various multi-antenna applications. A number of diverse topics are discussed, including channel estimation for array-based passive imaging, in-situ conformal array calibration for weather polarimetry, near-field equivalence techniques, and model-based feedback mechanisms for waveform optimization.

2D1-1: Calibration strategy for a TDM FMCW MIMO radar system

Johanna Guetlein, Andreas Kirchner & Juergen Detlefsen
Fachgebiet Hochfrequente Felder und Schaltungen, Technische Universitaet Muenchen, Germany

Abstract: A coherent multiple input multiple output (MIMO) radar system that uses the principles of a frequency modulated continuous wave (FMCW) radar and a time domain multiplexing technique can use a special modulation scheme to enable the unambiguous location estimation as well as a velocity estimation and compensation in a short measurement time. To use this modulation scheme a special calibration procedure is needed. This strategy shall be displayed here.

2D1-2: A 2D Synthetic Aperture Radiometry Demonstrator by Switching Strategy at X Band
Y. Aouial, S. Meric, O. Lafond, Mohamed Himdi, Institute of Electronic & Telecommunication of Rennes, France

Abstract: The broad topic of the presented paper consists in the research on novel methods in the field of microwave imaging, in particular the so-called passive microwave / millimeter-wave imaging, which is also referred to radiometric imaging. This study focuses on proximity range applications such as concealed objects detection, human body screening, etc. The aim is to design a low cost and compact fully electronic passive imaging system suitable for short-range 2D imaging applications, and study the necessary devices for the implementation of a complete demonstrator. In this study, a new approach based on the use of a switch sub-matrix strategy has been adapted into a complete antenna system at X band. The main objective of this prototype is to validate this approach experimentally. Image quality is examined by using the interferometric aperture synthesis technique and G-matrix calibration imaging algorithms. The spatial resolution is measured and is compared with theory.

2D1-3: Cylindrical polarimetric phased array radar: A multi-function demonstrator and its calibration
Caleb J. Fulton [1], G. Zhang [1], L. Lei, W. Cocangel [1], R. Kelley, M. McCord [2]; [1] Univ. of Oklahoma, Norman (Oklahoma) USA, [2] National Severe Storms Lab, Norman, USA

Abstract: This paper provides an overview of the calibration techniques, tools, and challenges surrounding the development of a Cylindrical Polarimetric Phased Array Radar (CPPAR) demonstrator for the US Multifunction Phased Array Radar (MPAR) effort. The calibration of this system is being carried out at multiple levels, using multiple techniques, in order to achieve the best possible sidelobe and polarimetric performance, and each of these techniques are discussed herein.

2D1-4: Equivalent current reconstruction technique for array and radar antenna diagnostic
Lars Jacob Foged [1], Francesco Saccardi [1], Lucia Scialacqua[1], Riccard Turrin [2], Russell Soerens [2], Roni Braun [2], Javier L. Araque Quijano [3], Giuseppe Vecchi [4]; [1] MV Italy, Italy, [2] OrbitFR, United States, [3] Univ. Nacional de Colombia, CMUN, Colombia, [4] LACE, Politecnico di Torino, Italy

Abstract: The equivalent radiating current technique is based on an integral equation formulation of the inverse source problem upon rigorous application of the equivalence principle. From the measured near or far field data it allows the accurate determination of the equivalent radiating sources on an arbitrary 3D surface enclosing the Antenna Under Test. The main advantage of the integral equation formulation with respect to wave expansion techniques is its true geometry-independence both for the radiator in examination and the measurement range. The equivalent current technique is highly applicable in the testing, validation and diagnostics of antenna arrays and radars. Indeed, the visualization of the equivalent radiating currents on a surface conformal to the physical shape of the antenna is particularly useful to understand multi element array functioning and facilitate design improvements. This communication discuss different applications of the technique in the testing of these antennas.

2D1-5: Phased array antenna model-in-the-loop radar waveform optimization
S.A. Seguin, J. Jakabosky, B.D. Cordill, S. Blunt, Univ. Kansas, Lawrence, USA

Abstract: Radar systems are being held to ever more strenuous spectral compliance standards. To meet these expectations innovative approaches that compensate for spectral spreading or other effects from the physical hardware need to be developed. Specifically, when considering phased array radar systems, it is important to consider the distortions introduced by their antennas. Radar waveforms that are optimized comprehensively for an entire radar system, including these antenna effects need to be explored. Ongoing work is exploring the optimization of radar waveforms that include the physical effects from transmitters and antennas. Here radar waveform performance is optimized for a radar system that includes the effects of a slotted waveguide phased array antenna using Continuous Phase Modulations (CPM) implemented waveforms.

2D1-6: Photonic beamforming system challenges and opportunities
Moshe Tur, Tel Aviv University, Israel

9:00-10:40 2E1: RELATING THE STATE OF THE ART IN HYPERSPECTRAL DATA ANALYSIS TO SYNTHETIC APERTURE RADAR IMAGE PROCESSING (TUTORIAL) **Royal I**

Presenter: Stanley Rotman, University of Ben Gurion of the Negev

Abstract: A large number of analysis techniques have been developed for the processing of multispectral and hyperspectral imagery. These techniques include Principal Component Analysis (PCA), Anomaly Detection (AD) and Matched Filter Target Detection (MFTD). On the surface this multi-dimensional data analysis should not be relevant to SAR images, which are traditionally single images taken of wide-scale imagery. However, with the advent of dual polarization imagery and multiple multi-look imagery, we can think of SAR imagery as having many of the characteristics of the hyperspectral imagery. In this lecture we will review several of the major methods of hyperspectral data analysis and relate this work to SAR imagery

10:40 – 11:00 ***COFFEE BREAK AND VISITING THE EXHIBITION***

TUESDAY, October 22, 2013

11:00-12:40 (100 minutes) - PARALLEL SESSIONS 2A2, 2B2, 2C2, 2D2, 2E2

11:00-12:40 2A2: MICROWAVE AND MM-WAVE CIRCUITS AND TECHNOLOGIES — Salon A

Chair: Dr. Michael Schlechtweg, Fraunhofer Institute IAF, Germany
Co-Chair: Dr. Solon Jose Spiegel, RIO Systems

2A2-1: An active up conversion mixer covering the entire 71-86GHz Eband range in SiGe Technology
B. Sheinman [1], R. Carmon [1], R. Ben-Yishay [1], O. Katz [1], N. Mazor [1], R. Levinger [1], A. Bruetbart [2], A. Golberg [2], D. Elad [1]; [1] IBM, Haifa, Israel, [2] Tadiad, Information Technologies & Services , M.P. Ashrat, Israel

Abstract: An IF to RF up-conversion mixer for the entire E-BAND 71-76GHz and 81-86GHz frequency range was designed and fabricated in IBM 0.12µm SiGe technology. The Mixer comprises of a double balanced Gilbert-cell with a degeneration inductor in the amplifying stage for increased linearity. The mixer exhibits conversion gain higher than -2dB, output compression point above -7dBm, and LO leakage less than -30dB. The core mixer area is 0.37mm2 and consumes 140mW from a 2.7V power supply

2A2-2: A V-band 8.5Gbps transmitter in 65nm CMOS
A. Rubin, E. Socher, Tel Aviv University, Tel Aviv, Israel

2A2-3: Performance Comparison for Millimeter-Wave Single-Pole Double Throw Switches
A. Dyskin [1], S. Wagner [2], D. Ritter [1], I. Kallfass [3]; [1] Technion - Israel Institute of Technology, Haifa, Israel, [2] Fraunhofer Institute of Applied Solid State Physics, Freiburg, Germany, [3] University of Stuttgart, Stuttgart, Germany

Abstract: In this paper we present the performance comparison of different single-pole double throw (SPDT) switch topologies realized in metamorphic high electron mobility transistor (mHEMT) technology. Conventional series-series and shunt-shunt topology switches designed for 60 GHz and 94 GHz are compared to the asymmetrical topology switch designed for broadband performance from 60 to 90 GHz. Parameters like insertion loss, isolation, power matching and linearity are considered in this paper.

2A2-4: Analysis of Cross-Coupled Common-Source Cores for W-Band LNA Design at 28nm CMOS
T. Heller [1,2], E. Cohen [1], E. Socher [2]; [1] Intel Corporation, Haifa, Israel, [2] Tel-Aviv University, Tel-Aviv, Israel

Abstract: This paper discusses the constraints set by device dimensions and cross-coupling capacitance on the power gain, bandwidth, and noise performance of millimeter-wave common-source pairs fabricated in CMOS processes. The analysis is backed by simulation of 28nm bulk-CMOS cores at W-band frequencies (70GHz-110GHz). The paper also proposes a new transformer geometry for improving the quality factor of very small transformers.

2A2-5: Broadband Design of RF MEMS SPDT switch
U. Sharma, M. Kumar, K. K. Jain, Solid State Physics Lab, Delhi, India

Abstract: This paper describes a broadband single pole double throw (SPDT) switch in the range of DC to 18 GHz. The switch consists of a cascade of a cantilever type ohmic series switch connected through bias lines. Electrodes below the cantilever are used to toggle the switch between open and closed position. Simulated electromechanical response of the single switch and RF performance of the SPDT switch are presented. The SPDT switch provides an insertion loss -0.4 dB, return loss -16dB and isolation better than -39 dB over the full frequency band. Electromechanical results of SPST switch indicate a pull down voltage of 11 volts and switching time of 13.5us.

11:00-12:40 2B2: COMMUNICATION ALGORITHMS AND STRATEGIES **Salon B**

Chair: Prof. Jay Weitzen, University of Massachusetts - Lowell, USA
Co-Chair: Dr. Stephen Weinstein, Commun. Theory & Technol. Consulting

2B2-1: Wireless Sensor Network Security: A Critical Literature Review
A. Betts, F. Meyer-Bodemann, F. Muller, S. Zhu, University of Derby, Derby, United Kingdom

Abstract: As technology advances the use and popularity of Wireless Sensor Networks (WSN) have been growing. However, the network protocols associated with WSNs have primarily been designed for energy efficiency. In this paper we investigate the security mechanisms designed for each, the data-link, network and application layers. Through the review of recently publish material, this paper investigates the security vulnerabilities associated with data aggregation, routing and user authentication in WSN environments. This paper finds that security is not properly implemented for any of these technologies, leaving WSNs open to a plethora of attacks.

2B2-2: Wireless Software Defined Networks: Challenges and Opportunities
C. Chaudet [1], Y. Haddad [2]; [1] Telecom ParisTech, Institut Telecom Paris, Paris, France, [2] Jerusalem College of Technology, Jerusalem, Israel

Abstract: Software Defined Networking (SDN) is a network paradigm that relies on the separation of the control and forwarding planes in IP networks. The interconnection devices take forwarding decisions solely based on a set of multi-criteria policy rules defined by external applications called controllers. It is possible to let multiple controllers manage each element of a given network, which allows to create independent networks on the same physical infrastructure. If the implementation of SDN in wired networks is relatively easy, it poses a lot of radio-specific problems in the wireless domain, related to link isolation or to channel estimation. Nevertheless, the wireless domain is also where SDN bears the highest potential, as it provides functions that could foster a better collaboration between access points to reduce interferences or to enhance security. This paper reviews some benefits of wireless SDN and exposes related challenges.

2B2-3: Gossip-based transmission algorithms performance in Wireless Sensor Networks (WSN)
M. Martinez Espinoza, M. Yarleque Medina, Pontificia Universidad Catolica del Peru, Lima, Peru

Abstract: Up-to-date, research in WSN has found a stalemate due to issues, such as energy consumption, scalability and terrain adaptation. This has motivated recent studies about algorithms and protocols that can help solving them in a way that consumption is reduced and the device's life span is maximized, as well as a reduction of data loss caused by collisions. To overcome these obstacles, gossip-based transmission techniques have shown some advantages in routing and data distribution. This paper presents simulation results and implementation regarding the efficiency in message transmission for different gossip-based algorithms (flooding, RGA, DRG, RGAM) and how the results in different topologies shows the DRG algorithm supremacy over the rest, since this can reduce up to half the amount of messages transmitted in different networks to complete a certain task. Likewise, an implementation of a short-scale WSN has been made to verify the previous results.

2B2-4: Managing and Measuring Performance of Large Femtocell Networks
J. A. Weitzen [2,1], R. Wakim [2]; [1] Airvana, Chelmsford, United States, [2] University of Massachusetts Lowell, Lowell, United States

Abstract: Large femtocell networks with upwards of one million units must be managed differently from macro cell networks with a few tens of thousands of base stations. This paper describes a network performance system that is helping to manage several large femtocell networks. It incorporates parallel processing, rule based artificial intelligence, large scale automated data analysis, and information theoretic data mining. The next generation of automatic femtocell network management system is also discussed.

2B2-5: Slotted Adaptive Frequency Hopping and Rolling Scheme for Multi-net Cognitive Radio with Experimental Result
J. Hwang, S. Li, J. Li, Y. Chiu, M. Chang, Yuan-Ze University, Chung-Li, Taiwan

Abstract: In this paper, we propose a slotted adaptive frequency hopping and rolling (SAFHR) scheme to realize the dynamic spectrum access for cognitive radio (CR). First, based on the CR spectrum sensing result and the quadratic prime code, an adaptive frequency hopping scheme is designed to avoid the frequency static interference due to primary user (PU). Secondly, adaptive frequency rolling scheme is incorporated to combat the frequency dynamic interference in the presence of multiple CR nets. As a whole, the SAFHR algorithm aims to maximize the frequency spectrum utilization and frequency diversity for each CR user, and to accommodate as many CR users as possible. By employing a so called Instruments-in-MATLAB software defined radio (IM-SDR) platform, experimental results of the SAFHR scheme is demonstrated under the scenario with two CR nets, five CR nodes, and one PU

11:00-12:40 2C2: METAMATERIAL AND THz ANTENNAS **Salon C**

Chair: Reuven Shavit, Ben-Gurion University Of the Negev
Co-Chair: Yehuda Leviatan, Technion−Israel Institute of Technology

2C2-1: Compact Tunable Printed Antennas for Medical and Commercial Applications
A. Sabban, Ort Braude, Kiryat Yam , Israel

Abstract: Communication and Biomedical industry is in continuous growth in the last decade. Compact tunable antennas are crucial in the development of Communication and wearable biomedical systems. The antenna resonant frequency may be tuned by using a varactor to compensate variations in antenna resonant frequency at different locations on the body. Design considerations, computed and measured results on the human body of wideband printed antennas with high efficiency at 434MHz are presented in this paper. The proposed antenna may be used in Communication and Medical systems.

2C2-2: Planar Ka band Antenna for Satellite Communication Based on Metamaterial Technology
R. Shavit, R. Joffe, E. Falek, Ben-Gurion Univ, Beer-Sheva, Israel

Abstract: In order to overcome the antenna problem associated with high conduction losses but remain with microstrip radiating elements it is proposed to use metamaterial technology [1] to obtain this goal. In the proposed antenna it is suggested to use a flat lens with effective zero index made of a multilayer and periodic structure of printed elements to enhance the patch gain from 6 dBi to 19 dBi with radiation efficiency close to 90%. This high radiation efficiency enables to reduce the antenna aperture size. The concept of a flat lens with zero index fed symmetrically by a balanced dipole operating at X band is described in [2]. In our study the feeding dipole was replaced by a patch backed by a ground plane and optimized at Ka band. To obtain a gain in excess of 30 dBi an array of 6x6 patch elements with a flat lens on top was designed and optimized for radiation efficiency, gain and radiation pattern.

2C2-3: Wideband planar skirt antenna and its application for the detection of terahertz radiation
N. Kaminski [1], D. Corcos [1], E. Shumaker [1], D. Elad [1], T. Morf [2], B. Klein [2], U. Drechsler [2], M. Despont [2]; [1] IBM research Haifa, Haifa, Israel, [2] IBM research Zurich, Rueschlikon, Switzerland

Abstract: A new type of traveling wave antenna is presented. Key features of the antenna are planar, low mass and wide bandwidth of operation. One such antenna was designed for terahertz radiation detection and realized in standard IBM CMOS-SOI process with subsequent MEMS post processing. Measurements performed at 655GHz showed very good agreement with the theoretical predictions based on full wave simulations. The present article describes the antenna physics, design, fabrication and measurement results.

2C2-4: Metamataerial Parfect Absorber for Millimeter wavelength region
Y. Azoulay, A. Abramovich, Ariel University , Ariel , Israel

Abstract: In this paper, we present a perfect absorber for Millimeter Wavelength (MMW) region based on metamaterial. This metamaterial perfect absorber is composed of split ring resonator (SSR) to absorb the electric field and cut wire to absorb the magnetic field. The realization of this metamaterial absorber will be carried out using metal patterns printed on FR4 substrate similar to well-known printed circuit boards (PCB's) technology for Electronic industry. This manufacturing process is very cheap and simple. This perfect absorber can be used for military applications such as camouflage and invisibility applications, perfect absorbers can be used to build absorptive interferometers, which could be used in detectors, transducers, and THz switches. Another potential application is in radiology, where the principle of the CPA might be used to precisely target electromagnetic radiation inside human tissues for therapeutic or imaging purposes.

2C2-5: Antenna packaging of a 32 element TX/RX phased array RFIC for 60 GHz Communications
E. Cohen, M. Ruberto, M. Cohen, H. K. Pan , S. Ravid, Intel, Haifa, Israel

Abstract: An integrated CMOS 60GHz phased array antenna module supporting symmetrical 32 elements TX/RX for wireless docking is described. The RFIC is packaged with a 6x6 patch antenna on LTCC creating a 25mm x 25mm LGA package having an antenna gain of 19dBi and ~2dB routing loss. The TX total EIRP is 29dBm with scanning of +/-30deg. The RFIC is also packaged with two 2x16 slot loop antenna on high density PCB with 17dBi peak gain and steering of up to +/-50deg.

11:00-12:40 2D2: AUTOMOTIVE APPLICATIONS - RADAR (invited session) Royal H

Chair: Dr. Igal Bilik, General Motors Advanced Technikcal Center, Herzliya, Israel
Co-Chair: Dr. Ran Gazit, General Motors Advanced Technical Center, Herzliya, Israel

Abstract: The session focuses on automotive radar technology, including system design and implementation challenges, directions for possible solutions and state-of-the-art developments in the area of automotive radar.
Topics included in the session are automotive radar system, challenges in automotive radars, technology trends of next generation automotive radar systems, advanced concepts and signal processing for automotive radars, and components of automotive radars enabling new applications.

2D2-1: Target classification in automotive radar
Igal Bilik, General Motors Advanced Technical Center, Herzliya, Israel

2D2-2: Computationally Efficient Ambiguity Mitigation in LFM Automotive Radars
Shamgar Gurevich [1], Alex Fish [2], Igal Bilikc[3] and Kobi Sheim [3], ""
Affiliations: [1] University of Sydney Australia; [2] University of Wisconsin, USA; [3] General Motors Advanced Technical Center, Herzliya, Israel

2D2-3: Global Routing with Energy Balancing in Intra-Vehicular Environment
G. R. Tsouri [1], M. Laifenfeld [2]; [1] Rochester Institute of Technology, Rochester, United States; [2] General Motors, Advanced Technical Center, Herzlia, Israel.
Presenter: Moshe Laifenfeld.

Abstract: Global routing in vehicular sensor networks is considered with the aim of balancing energy consumption across the nodes to achieve longer network lifetime. To this end, a routing protocol based on Dijkstra's routing algorithm with an augmented link cost function is used. Performance of the routing protocol is evaluated using a hardware experimental setup comprising 8 nodes positioned throughout the car and an access point placed near the dashboard. Real-time experiments implementing the routing algorithm are performed. Results demonstrate efficient balancing of energy consumption across all nodes in the network and a substantial increase in network lifetime.

2D2-4: Automotive Radar on Chip
Eran Soher, Tel Aviv University, Israel

2D2-6: Feature Selection for Classification of Human Micro-Doppler
S. Z. Gürbüz [1], B. Tekeli [1], M. Yükse [1], C. Karabacak [2], A. C. Gürbüz [1], M. B. Guldogan [3],
Affiliations: [1] TOBB University of Economics and Technology, Ankara, Turkey; [2] TUBITAK Space Technologies Research Institute, Ankara, Turkey; [3] Turgut Ozal University, Ankara, Turkey

Abstract: Dozens of features have been proposed for the use in human micro-Doppler classification problems. However, the issues of how many and which features should be selected has not yet been rigorously addressed in the context of human micro-Doppler analysis. Moreover, most classification results are present for the case when the human directly walks towards or away from the radar. As the aspect angle between target and antenna increases, the observed micro-Doppler spread diminishes, leading to increasingly poor feature estimates. Thus, there is also a question of how features should be selected by taking into consideration estimate quality. This work examines the application of information theory to shed light on these questions. Mutual information is used to compute the contribution of features as a function of physical relevance and estimate quality. An importance ranking of features is derived, with results shown for arm swing detection and discrimination of walking from running

2D2-7: LTCC Parasitic Patch Antenna for 77 GHz Automotive Applications
A. Bunea [1], D. Neculoiu [1], M. Lahti [2], T. Vaha-Haikkila [2]; [1] National Institute of R&D in Microtechnologies - IMT Bucharest, Bucharest, Romania; [2] VTT Technical Research Centre of Finland, Espoo, Finland

Abstract: A microstrip parasitic patch antenna consisting of four parasitic patches, fed by one active patch, with a stripline input, is presented in this paper. The antenna was designed for the Low Temperature Co-fired Ceramics (LTCC) technology and shows very good matching and radiation behavior in the 77 GHz band, with measured reflection losses lower than – 10 dB between 75.175 – 80.6 GHz and below – 40 dB at 77 GHz. Simulation results show a gain higher than 8 dBi in the 76 – 81 GHz frequency range, with a radiation efficiency higher than 80%. A separate structure, based on direct conversion (video) receiver was designed and fabricated for radiation pattern measurements. The E and H planes at 77 GHz were measured and show good agreement with simulation results, with a computed gain of 8.2 dBi for the direction normal to the patches.

11:00-12:40 2E2: DATA FUSION (TUTORIAL) Royal I

Presenter: Moshe Kam (Past President, IEEE), Drexel University, Philadelphia, USA

Abstract: Multi-Sensor data fusion is the process that integrates information from multiple data sources and sensors about the same physical object or phenomenon into a coherent, consistent and useful representation. The goal is to obtain from a suite of inputs related to the object/ phenomenon a better understanding of its features and characteristics than could be achieved by a single source or by simple averaging of all available inputs. Data Fusion techniques borrow from detection and estimation theory, statistical signal processing, and information theory, and have been applied to medical diagnostics, radar target detection and tracking, air traffic control, oil exploration, military command and control, electric power networks, robot navigation, weather prediction, remote sensing, and wireless sensor networks. This tutorial would provide an overview of the most popular fusion algorithms, topologies and methods, including those that emanate from Bayesian decision theory, sequential detection and Kalman iltering. We will also review hard/soft fusion techniques which address data and opinions generated by humans along with readings from automatic sensors and detectors. We will review specific results related to the theme of COMCAS 2013.

12:40 – 14:00 LUNCH (Jaffa Court) AND VISITING THE EXHIBITION

14:30-16:10 (100 min) - PARALLEL SESSIONS 2A3, 2B3, 2C3, 2D3, 2E3

14:30-16:10 2A3: NOVEL PASSIVE AND ACTIVE COMPONENTS AND MODELS — Salon A

Chair: Aleksey Dyskin, Technion, Haifa, Israel
Co-Chair: Dr. Claudio Jakobson, Samsung Electronics

2A3-1: A Compact Wideband Filter Based on a Grounded Transversal Resonator
N. Jankovic, V. Crnojevic-Bengin, University of Novi Sad, Novi Sad, Yugoslavia

Abstract: In this work, a grounded transversal resonator is presented which exhibits tri-mode behaviour and provides two transmission zeros. The proposed resonator is analyzed and used to design a very compact low-loss wideband bandpass filter with a central frequency of 4 GHz. The fabricated filter exhibits 3-dB fractional bandwidth of 83.5%, good in-band and out-of-band performances and a compact size of only 0.29λg x 0.19λg, where λg denotes the guided wavelength on the given substrate at the central frequency.

2A3-2: Scaling Quad-Flat No-Leads Package Performance to E-band Frequencies
S. S. Cahill [1], E. A. Sanjuan [1], D. Regev [2], [1] BridgeWave Communications, Santa Clara, United States, [2] Presto Engineering, Migdal Ha'emek, Israel

Abstract: This paper describes a low-cost plastic MicroCoax enabled Quad-flat no-leads (QFN) package to address increasing frequency needs. Package has excellent isolation between I/O signals, bias pins, and controls as well as low insertion and return loss for increased bandwidth. The package effectively maintains bare die performance at mm-wave (mmW) frequencies, and simplifies mmW chip design/integration with the PCB, eliminating package-PCB 3D EM interactions and thermal dissipation complications. The package leverages controlled impedance MicroCoax lines, replacing traditional wire bonds. QFN transitions to MicroCoax lines are optimized for low mmW discontinuities. Package performance results up to 65GHz and scaling steps to enhance package frequency to 90GHz and beyond is discussed along with related test strategies. Package structure is broadband, allowing a variety of mmW die and high speed analog chipsets to be assembled using the same process sequence and package configuration.

2A3-3: A Small Size Low Cost Electronically Tunable Bandpass Filter with Integrated Bias Control
P. Quednau, R. Trommer, L. Schmidt, Friedrich-Alexander-University Erlangen-Nuremberg, Erlangen, Germany

Abstract: This paper presents the development of a compact sized, low cost wide range tunable bandpass filter based on a novel RF structure. The proposed design offers a narrow passband with a relative bandwidth down to 3.9 %, a wide tuning range from 700 MHz to 1150 MHz and the ability to adapt bandwidth and insertion loss during operation. Tuning is achieved by reverse biased varactor diodes with a low supply voltage of 5 V max. Design of the novel bandpass structure, integration and miniaturization to reduce its size down to approx. 6 cm2 is discussed. Measurement results over the whole tuning range are presented and the design of a miniaturized multi channel bias controller for easy frequency setting and temperature compensation is shown.

2A3-4: Lossy Inverters and Their Influence on Coupled Resonator Filter Characteristics
M. Zukocinski, A. Abramowicz, Warsaw University of Technology, Warsaw, Poland

Abstract: Lossy inverters have been used recently to describe circuits with lossy couplings. The subject is important for microwave filters design as well as for coupled transmission lines analysis and measurements. In this paper it is shown that lossy inverters do not satisfy the passivity condition. They should be considered as active circuits. On the base of coupled dielectric resonators examples new models of lossy coupling have been developed that preserve the passivity condition. The influence of the coupling losses on filter characteristics has been shown. Moreover, the developed models can be easily used to design coupled resonator microwave filters employing the coupling matrix method.

2A3-5: Lumped Element Model for Arbitrarily Shaped Integrated Inductors - A Statistical Analysis
F. M. Passos [1], M. H. Fino [1], E. R. Moreno [2], R. G. Echevarría [2], F. F. Fernández [2]; [1] New University of Lisbon, Caparica, Portugal, [2] Institute of Microelectronics of Seville, CSIC and University of Seville, Seville, Spain

Abstract: In this paper a model based in lumped elements is presented for the characterization of integrated inductors. The model allows the modelling of integrated inductors for a wide range of frequencies and different inductor topologies, thus granting the evaluation of important design parameters such as inductance, quality factor and self-resonance frequency. The model will be explained in detail and compared against electromagnetic simulations for a 0.35- m and 0.13- m CMOS technologies. Results for square and octagonal geometries are presented. A statistic analysis is also presented for the octagonal topology in order to validate the model over a wide range of geometric variables in 0.35- m CMOS technology.

14:30-16:10 2B3: MICROWAVE AND TERAHERTZ SENSORS, IMAGING, DETECTING AND TOMOGRAPHY - I — Salon B

Chair: Prof. Yosef Pinhasi, Ariel University
Co-Chair: Prof. Boris Kapilevich, Ariel University

2B3-1: The detector array system for 3-mm wavelength video imaging
V. Shahkin [1], Y. Belov [2], P. Volkov [1], A. Goryunov [1], I. Illarionov [1], A. Serkine [2]; [1] The Institute for Physics of Microstructures RAS, Nizhni Novgorod, Russian Federation, [2] Radio Physics Research Institute of the Ministry of Education and Science, Nizhni Novgorod, Russian Federation

Abstract: We present the results of development of a 3-mm wavelength video imaging system. The external EM radiation is detected with an 8 x 8 detector array illuminated by an aspheric lens, which forms an image, and a digital control unit. Some measured characteristics of the array elements (antenna element patterns, sensitivity, etc.), optical characteristics of the imaging system (point spread function, resolution, field of view, etc), as well as parameters of the digital unit (data processing and transmission rates) are given. The developed system was used in the experiments for imaging of simple objects (one or several metal spheres of different diameters) by means of reflected monochromatic signal detection.

2B3-2: Heterodyne detection and polarization effects at 300 GHz using Ne Indicator Lamp Glow Discharge Detectors
A. Aharon (Akram) [1,2], D. Rozban [3,2], A. Abramovich [2], N. S. Kopeika [1,3]; [1] Ben-Gurion University of the Negev, Beer-Sheva, Israel, [2] Ariel University, Ariel, Israel, [3]Ben-Gurion University of the Negev, Beer-Sheva, Israel

Abstract: A miniature neon indicator lamp, also known as a Glow Discharge Detector (GDD), costing about 50 cents, was found to be an excellent room temperature THz radiation detector. A proof of concept of 300 GHz heterodyne detection using GDD is demonstrated in this paper. Furthermore, a comparison to direct detection was carried-out and polarization effects on heterodyne detection were investigated. Preliminary results at 300 GHz showed better sensitivity by a factor of 20 with only 56 microwatt local oscillator power using heterodyne compared to direct detection. Further improvement of the detection sensitivity can be achieved if the Local Oscillator (LO) power (Plo) is increased. Effects of orthogonal polarizations of signal and local oscillator powers on heterodyne sensitivity were found to be surprisingly weak.

2B3-3: Simulations of 2D Metamaterial Apertures for Coherent Computational Imaging
G. Lipworth, A. Mrozack, J. Hunt, D. Brady, D. R. Smith; Duke University, Durham, United States

Abstract: A metamaterial aperture operating as a leaky waveguide with resonating metamaterial irises can sweep its operation frequency to modify its complex field pattern with no moving parts. By randomly distributing the metamaterials' resonance frequencies, we show the aperture can generate random illumination patterns well suited for compressive sensing. In this way the aperture utilizes the physical layer to avoid redundant measurements in the image reconstruction process.

2B3-4: Solutions of Mutual Shadowing Effect between People Tracked by UWB Radar
J. Rovnakova, D. Kocur, Technical University of Kosice, Kosice, Slovak Republic

Abstract: Ultra wideband (UWB) radar allows us to track people in critical environments and situations. However, the results of application of single UWB radar have shown the reduced ability to detect the other persons if some person is located between the radar antennas and the rest of persons. The described negative phenomenon is consequence of the mutual shadowing between people. In the paper, we will outline three potential solutions of this effect. They are based on application of UWB radar network, weak signal enhancement and highup setting of radar antennas. The experimental results achieved with these approaches confirm the suppression of the mutual shadowing effect.

2B3-5: Usage of Amplitude, Phase and Polarization Readout for Sub-Pixel Resolution in RADAR Images
S. Cohen, Z. Zalevsky, Bar-Ilan Univ., Ramat-Gan, Israel

Abstract: A new technique for sub-pixel identification in Synthetic Aperture Radar (SAR) images is presented. First the sub-pixel combinations among we would like to distinguish are presented, and the theoretical basis of separation by using magnitude, polarization and phase of the return. The second part tests the separation ability by using SAR images of a sub-pixel shaped targets.

14:30-16:10 2C3: ANTENNA DESIGN AND MODELING — Salon C

Chair: Rafi Kastner, Tel Aviv University

2C3-1: Semi-Passive RFID tags with Double Loop Antennae Arranged as a Shifted Gate System for Stability Optimization Under Delayed Electromagnetic Interferences
O. Aluf, Tel-Aviv University, Tel Aviv, Israel

Abstract: In this article, we discuss the crucial subject of Semi-passive RFID TAGs system stability. Semi-passive TAGs with double loop antennae arranged as a shifted gate system for stability optimization under delayed electromagnetic interferences. The double loop antenna is employed due to the fact that it consists of two parallel loops—a primary one and secondary one. We define Vi1(t) and Vi2(t) as the voltages on double loop antennae as a function of time. Vi1(t) is the voltage as a function of time time on the primary loop and Vi2(t) is the voltage as a function of time on the secondary loop. The index (i) stands for the first gate (i=1) and second gate (i=2). Due to electromagnetic interference, there are differences in time delays with respect to gate antenna's first and second loop voltages and voltages derivatives. The delayed voltages are Vi1(t-τ1) and Vi2(t-τ2) respectively (τ1≠ τ2) and delayed voltages derivatives are dVi1(t-Δ1)/dt, dVi2(t-Δ2)/dt respectively.

2C3-2: Methods for Extending the Bandwidth of Field Compensation
M. Haridim, B. Levin, S. Revich, Holon Institute of Technology, Holon, Israel

Abstracts: A compensation method aiming to form a weak field area (a dark spot) in an antenna near region over a broad frequency band is considered. The need for broadband field compensation arises in cases when it is necessary to protect the human body against irradiation, for example, if a mobile transmitter is located in a vehicle in the vicinity of several users. It is shown that broadband field compensation can be achieved in structures, in which the needed anti-phase fields are created by antennas of identical type, by radiators located at equal distance from the compensation point, or by flat reflectors.

2C3-3: Transparent Antenna with Conical Feed
B. Levin, M. Haridim, S. Chulski, Holon Institute of Technology, Holon, Israel

Abstract: An equation for the current along a transparent radiator is written and solved. Based on this solution the current distribution along the radiator axis is analyzed. It is shown that the current decays abruptly along the radiator. For this reason the transmitted signal depends weakly on the radiator length. A concrete type of transparent antenna is offered and investigated. The feasibility of the proposed transparent antenna is experimentally verified. It is shown that the efficiency of the proposed transparent antenna is comparable to that of a monopole.

2C3-4: Analysis and Design of Antenna Radomes
J. Moreno [1], L. Lozano [1], F. Catedra [2], I. Gonzalez [2]; [1] University of Alcala, Alcala de Henares, Spain, [2] Newfasant, Guadalajara, Spain

Abstract: A new tool for the analysis and design of radomes using multicore processors is presented. The radomes can be defined by multilayer structures with embedded Frequency Selective Surfaces (FSS). Radome with metallic layers with arbitrarily shaped can be also analyzed. Four different approaches can be used for the analyses of the radomes: Iterative Physical Optics -Moment Method, (IPO-MoM); approach, iterative MoM (antenna)- MoM (radome), (MoM-MoM); full MoM approach using the thin layer approach, (MoM-TL); and full MoM with a full volumetric approach (MoM-VOL). The two full MoM approaches provide accurate and fast simulations of the radome behavior. Optimization features for the radome design are also included by imposing a mask in a bandwidth for the reflection or transmission coefficients. The tool has been cross validated using results obtained with a well checked 3D MoM code.

2C3-5: On the Impact of Edge Roughness to Narrowband and Wideband Flat Dipole Antennas
J. Sidén, J. Gao, H. Nilsson, Mid Sweden University, Sundsvall, Sweden

Abstract: Antennas are commonly designed as well-tuned devices with the intention that they will be produced with a high geometrical precision. Manufacturing technologies for high throughput at low cost such as additive printing and subtractive milling processes can however induce mechanical tolerances that were not accounted for by the antenna designer. This work investigates the specific impact that a significantly high level of edge roughness can have on flat dipole antennas. Two different antennas of dipole-type are compared for different degrees of edge roughness with the objective to identify the properties that make antenna designs vulnerable to the specific issue of edge roughness. Results show that dipoles with wideband characteristics are more susceptible to edge roughness than its narrowband counterpart. It is also observed that rough-edged antennas of finite conductivity show a significant increase in ohmic losses as compared to corresponding antennas with straight edges.

14:30-16:50 2D3: AUTOMOTIVE APPLICATIONS - COMMUNICATION (invited session) Royal H

Chair: Dr. Moshe Laifenfeld, General Motors Advanced Technical Center, Herzlia, Israel
Shmuel Auster, Elta Systems

The session focuses on automotive aspects in wireless and wired communications on a variety of automotive applications, from infotainment, through connectivity, to intra-vehicular communications. Both theoretical as well as practical aspects are of interest including design and implementation challenges, potential solutions and state-of-the-art technologies that can fit into the automotive space. Topics included in the session include automotive cellular (LTE, M2M, offload); infotainment; vehicle to vehicle and infrastructure communications; intra-vehicular networks and applications; distributed vehicular computing; wireless power and charging; autos in smart grid and power line communications (PLC); and sensing and energy harvesting.

2D3-1: Vehicle Proximity Map Formation in VANET
Y. Allouch & M. Segal; Ben-Gurion University of the Negev, Beer-Sheva, Israel

Abstract: In this paper we introduce the Cluster-Based Beacon Dissemination Process (CB-BDP) based on inter vehicle communication in highway scenarios. This process aims to provide vehicles with a local vehicle proximity map of their vicinity. Based on this map, safety applications can be used for accident prevention by informing drivers about evolving hazardous situations. The CB-BDP is designed under the two following objectives. First, since it is used for safety applications, we want the map to be detailed and as accurate as possible. Second, we want the map to be coordinated with nearby vehicles, thereby allowing synchronized and coordinated reactions of nearby vehicles to evolving hazardous situations. In [1] we have introduced a clustering scheme design to provide an optimized topology for an efficient and reliable beacon dissemination process. The topology is adaptive and robust in order to meet the challenging VANET conditions. In this paper, we propose a cluster based aggregation-dissemination beaconing process that uses this optimized topology to distribute the vehicle proximity map. An accurate and detailed map results in a heavy load of beacon messages. Our proposed scheme deals with this load by integrating a contention-free medium access control (MAC) strategy for reliable communication.

2D3-2: Vehicular Relay Nodes for Cellular Deployment: Downlink Channel Modeling and Analysis
J. Scheim, N. Lavi, General Motors, Herzliya, Israel. Presenter: Dr. Jacob (Kobi) Scheim.

Abstract: This paper proposes a novel cost-effective heterogeneous networks (HetNet) deployment approach based on nomadic vehicular relay nodes (VeRNs). VeRN downlink performance are analyzed in two deployment models, which focus on VeRN impact on the network as a function of its placement. The 2-hop relay link via a VeRN is analyzed compared to the cellular direct-link for the proposed deployment models investigating both link level and spectral efficiency (SE) aspects. The analysis is based on extensive simulations with an indicative proposed figure of merit. The results show significant improvement in link level as well as substantial increase in spectral efficiency when using VeRNs across a set of deployment parameters.

2D3-3: Comparative Characterization of Four Antennas for VANETs by On-Field Measurements
G. A. Gavilanes Castillo [1], M. Reineri [1], D. Brevi [1], R. Scopigno [1], M. Gallo [2], M. Pannozzo [2], S. Bruni [2], D. Zamberlan [2]; [1] Istituto Superiore; Mario Boella, Turin, Italy; [2] Calearo Antenne S.p.A., Isola Vicentina, Italy.

Abstract: Vehicular ad-hoc networks (VANETs) have been extensively studied by simulations and trials and are getting closer and closer to the practical deployment. Despite this, only few studies have investigated the issues of antenna placement, even if it is far from being negligible: depending on the antenna position, a stronger or a weaker signal may be received and the overall effectiveness of safety messages carried by VANETs may get affected. This paper aims at digging into the problem of antenna placement for VANETs by a field-test comparative analysis of four candidate antennas, differing in their design and, particularly, in their positions.

2D3-4: TeaCP: a Toolkit for Evaluation and Analysis of Collection Protocols in Wireless Sensor Networks
W. Si [1], M. Hashemi [1], I. Warsawski [1], M. Laifenfeld [2], D. Starobinski [1], A. Trachtenberg [1]; [1] Boston University, Boston, USA [2] GM Advanced Technical Center, Herzliya, Israel.
Presenter: Prof. Ari Trachtenberg

Abstract: Several collection protocols have been developed to achieve efficient gathering of data in Wireless Sensor Networks (WSN) including intra-car WSN. Though there exist WSN tools capable of controlling, monitoring, and displaying sensor data, there is still a need for a general benchmarking tool capable of visualizing, evaluating, and comparing the network layer performance of these protocols. In an effort to fill this gap, we present TeaCP, a prototype Toolkit for the evaluation and analysis of Collection Protocols in both simulation and experimental environments. Through simulation of an intra-car WSN and real lab experiments, we demonstrate the functionality of TeaCP for comparing the performance of two prominent collection protocols, the Collection Tree Protocol (CTP) and the Backpressure Collection Protocol (BCP).

2D3-5: Magnetic-resonant Wireless Power Transfer for an Automotive Environment
M. Chabalko and D. Ricketts; Carnegie Mellon University, Pittsburgh USA.

Abstract: Magnetic-resonant wireless power transfer (MR-WPT) has become a popular means to efficiently transfer power over near to mid-ranges. Many previous works have focused solely on the efficiency of the wireless link. In an automotive environment, however, several other significant constraints present themselves that must be considered when using MR-WPT. In this talk we will discuss three key parameters that must be considered: impedance detuning due to mobile loads, impedance detuning and parasitic loss due to neighboring metallic components and human safety and exposure to magnetoquasistatic fields. We will describe these challenges and how they affect the design of WPT systems for an automotive environment. Our conclusions show that these constraints do not limit the application of MR-WPT, but rather require different design techniques than many traditional MR-WPT systems

2D3-6: Experimenting With A Wireless Mesh Network Towards Sensing Inside a Vehicle's Transamission
M. Laifenfeld [1], K. Vaknin [1], L. Hardy [2], A. Goll [2]; [1] General Motors, Herzlia, Israel; [2] Virtual-Extension, Beit Dagan, Israel
Presenter: Leor Hardy

Abstract: In this paper we study experimentally Diversity Path Mesh (DPM), a proprietary cooperative mesh network technology that is based on superimposed radio signaling and flooding, for the purpose of real-time sensing inside a vehicle's transmission. The harsh, highly metallic environment, of the vehicle's transmission interior is a challenging environment for any wireless radio technology especially when footprint, throughput and cost are among the primary concerns. We find that DPM can potentially provide a robust and reliable solution with a low price tag. We further provide a theoretical intuition why DPM is optimal in terms of packet error probability among all re-transmission strategies for the in-transmission sensing application.

2D3-7: DC-BUS powerline communication for monitoring high voltage battery packs
Y. Maryanka [1], O. Amrani[2], [1] Yamar, Tel Aviv, Israel. [2] Tel Aviv University, Tel Aviv, Israel
Presenter: Yair Maryanka

Abstract: The presentation describes a Battery Management System (BMS) for electrical vehicles, using unique DC-BUS powerline communication that monitor and manage multiple-cell rechargeable Lithium-Ion battery packs over the powerline connecting these battery packs eliminating extra wires, providing simple galvanic isolation between the high voltage power battery and the vehicle's monitoring ECU. The communication based on a semiconductor device designed to operate effectively over the DC powerline with strong Inverter's switching noise is described.

14:30-16:10 2E3: MODERN METHODS FOR MICROWAVE FILTER NETWORK SYNTHESIS (TUTORIAL) **Royal I**

Presenter: Richard Cameron, COM DEV Europe, Aylesbury U.K..

Abstract: This tutorial lecture, minimizing mathematics and jargon, introduces the state-of-the-art coupling matrix filter synthesis method to microwave equipment designers, helping to meet the very stringent specifications that are demanded by modern telecommunication, radar and scientific/earth observation systems. One important advantage over classical synthesis methods is a one-to-one correspondence between the elements of the coupling matrix and the individual physical components of the filter. Another is the ability to reconfigure the coupling matrix through similarity transforms to arrive at a different coupling topology, corresponding to the available coupling elements of the particular microwave structure that has been selected for the application. The coupling matrix will naturally accommodate critical specifications such as asymmetric characteristics, transmission zeros and group delay equalization.

14:30-16:30 PARALLEL POSTER SESSIONS 2P2, 2P3, 2P4* Room 5

14:30-16:30 2P2: POSTER SESSION - RF AND MICROWAVE TECHNIQUES AND TECHNOLOGIES, RADAR

2P2-1: Millimeters wavelength imaging system based on Flat Parabolic Surface
G. G. Litmanovitch, Ariel University, Ariel, Israel

Abstract: In this study we will present ongoing research and development of Millimeters wavelength (MMW) imaging systems based on Flat Parabolic Surface (FLAPS). The conventional reflector antennas used for MMW imaging systems are mechanically cumbersome, complicated for manufacturing, and therefore are very expensive. In this study we propose to use FLAPS technology instead of the conventional reflectors in MMW imaging systems. FLAPS are composing of metal patterns printed on dielectric substrate. In this work we will use copper patterns printed on FR4 substrate much like the common printed circuits board (PCB) used in the electronics industry. This will make the manufacturing process of MMW large aperture mirrors for imaging systems very cheap and light weight. Theory, metal patterns and simulation results will be presented in this work.

2P2-2: Persistent Scatterers Detection In Open Area In High Resolution SAR Imagery - Case Study: Sendai, Japan
A. Shalev, A. Yagev, Y. August, D. G. Blumberg, S. R. Rotman; Ben Gurion University of the Negev, Beer-Sheva, Israel

Abstract: The PS-InSAR method results are highly depending on the Persistent Scatters Candidate (PSC) selection process. This study implements a new algorithm for detection of PSC in open fields and natural areas based on high resolution TerraSAR-X images. The main challenge in PSC detection in natural areas is the lack of strong reflected targets in these areas. This cause high number of diverted targets, or low number of true PS targets (depend on the thresholds). Conventional methods for PS detection are highly depending on the fine calibration, and on the scaling of the target within the resolution cell. Our method is more robust since it less depends on fine calibration, and not depends on the target gain. The method consists of two main steps. The first step is definition of a PSC target amplitude time signature (ATS). The second step is detection of pixels with the same (close enough) temporal signature cone, this way strong and weak reflectors get the same chance to be mark as a target.

2P2-3: Atmospheric effects ultra wide band Frequency-Modulated Continuous-Wave (FMCW) RADAR operating in the millimeter and sub-millimeter wavelengths
N. Balal, G. A. Pinhasi, Y. Pinhasi; Ariel University, Ariel, Israel

Abstract: The demand for high resolution directive RADARS the lack of wide frequency bands within the conventional spectrum causes one to seek bandwidth in the higher millimeter and sub- millimeter wave spectrum at Extremely High Frequencies (EHF) above 30GHz. Since the EHF band covers a relatively large spectrum which is free of users, enables the utilization of ultra wideband signals, resulting in better resolution in the longitudinal and transverse dimensions. One of the principal challenges in realizing ultra wide band RADARs in the EHF band is phenomenon occurring during electromagnetic wave propagation through the atmosphere. Characterization of the atmospheric medium is via its refractivity leading to a transfer function, which describes the changing response of the medium in the frequency domain. This description enables the consideration of broadband FMCW signals taking into account inhomogeneous absorptive and dispersive effects of the medium.

2P2-4: A Study on Novel Broadband Ku-band Spatial Power Divider/Combiner
Y. Zhang [1], K. Yang [1], S. Xie[1], X. Ren [1], Y. Liu [2]; [1] University of Electronic Science and Technology of China , Chengdu , China, [2] Beijing University of Posts and Telecommunications, Beijing, China

Abstract: A novel broadband traveling-wave power divider/combiner structure with waveguide ports and microstrip probes is presented at Ku-band for the first time. Design procedure was simplified by mathematical modeling and full-wave simulations. A design of Ku-band 2-way power divider/combiner was carried out to verify the approach. Some fabrication details of conventional machining were taken into account by setting up simulations. The measured results showed a minimum overall insertion loss of 0.42dB corresponding to a combining efficiency greater than 90%, and 1dB bandwidth of 36.2%.

2P2-5: Electromagnetic Heating Apparatus having Decoupled Excitations
I. Chaimov, S. R. Rogers, GOJI, Hod-Hasharon, Israel

Abstract: This paper demonstrates improved electromagnetic heating of a load by increasing the isolation (or decoupling) factor between two electromagnetic feed elements. The efficiency of the heating process is measured by the ratio of power absorbed by the heated load to total power delivered by the radio frequency or microwave sources. Intuitively, the use of multiple feeds increases the total power delivered to the load; however, coupling between sources tends to reduce the heating efficiency. The use of filtering techniques, applied between the source and feed elements in a two-port system, is shown to increase isolation between the ports and overall heating efficiency. Measurements with a Vector Network Analyzer (VNA) are presented to verify and quantify the improvement.

14:30-16:30 2P3: POSTER SESSION - ANTENNAS

Chair: Shmuel Auster, Elta Systems Ltd

2P3-6: Reflector Surface Diagnosis Using a Multilevel Non-Uniform Grid Algorithm
A. Gergel, A. Boag, Tel Aviv University School of Electrical Engineering, Israel

Abstract: The Rayleigh-Sommerfeld (RS) back-propagation method is accelerated by a modified version of the multilevel nonuniform grid algorithm (MLNG). The algorithm utilizes oblate spheroidal grids to be effective in terms of the number of sampling points that are required for correct reconstruction of the fields measured on quasi-planar surfaces. The method is demonstrated on the example of a parabolic reflector with a surface distortion. A good agreement between the results of the direct RS integration and the proposed method is demonstrated. Comparison between the field distributions reconstructed from the measurements and the desired ones can be used for the localization and correction of surface anomalies in large reflector antennas.

2P3-7: A Cheap Matching Component for Correcting Ill-matched Antennas
L. Sigawy, M. M. Mayost, H. Matzner, JCE – Jerusalem College of Engineering , Jerusalem, Israel

Abstract: A cheap matching component for correcting ill-matched antennas is proposed. The component is based on a parasitic longitudinal matching component. It is shown that this component can greatly correct input impedances which deviate from the designed value by -27j to +23j ohms.

2P3-8: Asymmetric Coplanar Strip Fed Zeroth Order Directional Antenna
D. Raghavan Nair, V. V K Thalakkatukalathil, J. Palassery, D. C. Mukund, M. Pezholil, Cochin University of Science and Technology, Cochin, India

Abstract: A novel via free, asymmetrical coplanar strip fed Zeroth order directional antenna suitable for 2.4GHz WLAN applications is presented. The Zeroth order resonance is achieved by realizing a Composite Right Left Handed transmission line, which is an interdigital capacitor inserted into the shorted asymmetric coplanar strip. Directivity is obtained by the structural asymmetry of the antenna. The antenna is made of low cost substrate of relative permittivity 3.7 and height 1.6mm with an overall dimension of 29X16.5X1.6mm3. The prototype offers a 2:1 VSWR impedance bandwidth (2.21GHz-2.49GHz) of 280MHz and exhibits directional radiation pattern with 3.7dBi peak gain over the entire band. The design and analysis of the antenna is discussed based upon dispersion diagram and surface current distributions. Experimental and simulation results of the antenna along with resonant mechanisms are discussed in this paper.

2P3-9: Planar Differential Antenna for UWB Pulse Radar Sensor
D. Pepe1, D. Zito2,1, 1Tyndall National Institute, Cork, Ireland, 2University College Cork, Cork, Ireland

Abstract: A novel planar differential ultra-wideband (UWB) antenna was designed and implemented on low-cost FR4 substrate and characterized experimentally. The design was used in the implementation of a complete UWB pulse radar sensor obtained by co-integrating a system-on-a-chip UWB pulse radar packaged in QFN32 package with the two proposed antennas, one for the transmitter and one for the receiver. The experimental results confirm the predictions obtained by simulations, and the effectiveness of the novel antenna design for the implementation of low-cost short-range pulse radar sensor was validated by field operational tests.

14:30-16:30 2P4: POSTER SESSION - SPECIAL APPLICATIONS

Chair: Doug Zuckerman, Applied Communication Sciences, USA
Co-Chair: Shmuel Auster, Elta Systems, Israel

2P4-10: Active-passive remote sensing of rains
A. Linkova, G. Khlopov, Usikov Institute of Radiophysics and Electronics of National Academy of Sciences of Ukraine, Kharkov, Ukraine

Abstract: Possibility of measurement of rain intensity by combination of double frequency radar and radiometer remote sensing is considered in the paper. Results of numerical simulation of active-passive sensing of uniform rain are presented for wavelengths 8 mm and 3.2 cm and for different rain intensity. It was shown that considered algorithm allows to reconstruct rain intensity with good accuracy.

2P4-11: Gun Muzzle flash detection using CMOS sensors
T. Merhav, V. Savuskan, Y. Nemirovsky, Technion-Israel Institute of Technology, Haifa, Israel

Abstract: This study focuses on the detection of muzzle flash detection of small arms using low cost silicon CMOS - based sensors and imagers. Two types of sensors are utilized: CMOS Image Sensors and CMOS-SPADs (Single Photon Avalanche Diodes). The detection approach is based on Near-Infrared (NIR) spectral features of muzzle flash originating from alkali metal flash suppressing additives in the gun powder. The spectral signature around wavelength of 760nm allows achieving adequate signal to noise ratio even in day light.

*Note: Posters will be displayed from 8:00 till 17:00. Poster frontal presentations will take place between the indicated hours.

TUESDAY, October 22, 2013

APPLICATIONS SEMINARS

11:00 – 12:00 APPLICATION SEMINAR – Sponsored by *ASCOTECH* **Royal J**

A Robust 80W, 48V, 100-1000 MHz Broadband GaN Amplifier
Ray Baker, Nitronex, LLC

Abstract: This work presents a 80W broadband power amplifier for use in the 100 to 1000 MHz frequency band. Through the combination of a custom 4:1 impedance transformer and a 48V GaN device we achieve 80W of CW output power over nearly a decade of bandwidth utilizing a single ended device. To the authors' knowledge, this work utilizes the first ever commercially available 48V GaN devices mounted in a plastic package. In addition to the bandwidth, this device exhibits state of the art robustness, surviving a 15:1 VSWR test with no observed degradation in linear RF performance.

12:00 – 13:00 APPLICATION SEMINAR – Sponsored by *EIM* **Royal J**

Power Sub-Miniature (PSM) Connectors for Space Applications
H. Karstensen [1], J. Fuchs [1], D. Raboso [2], E. Sorolla [3], M. Mattes [3], D. Schönherr [4], H. L. Hartnagel [4]
[1] HUBER+SUHNER AG, Herisau, Switzerland, [2] European RF High Power Laboratory (ESA), Universidad Politécnica de Valencia, Spain, [3] Ecole Polytechnique Federal Lausanne, Switzerland, [4] Institut für Hochfrequenztechnik, Fachgebiet Mikrowellenelektronik, TU Darmstadt,Germany

Abstract: This paper presents a newly developed SMA-like connector for High Power Space applications that can withstand more than 1500 Watts in the P- and L-Band for a pulsed signal of 2% duty-cycle. This implies an improvement of 50 per cent compared to other powerful connectors such as TNC while the mass is reduced by more than 60 per cent with respect to a TNC connector. In the L-band a 7th order PIM power of less than -140dBm has been measured for input powers of 47dBm per carrier. The frequency range is 0 – 18 GHz, the insertion loss <0.1 dB (typical <0.05 dB), and the VSWR <1.1 in the full range.

14:30 – 15:30 APPLICATION SEMINAR – Sponsored by *Freescale* **Royal J**

Rugged LDMOS
Yan Vainter - Freescale

Abstract: Traditional RF applications required power transistors that could withstand high mismatch conditions, but the ability of the latest generation of devices to handle even more severe mismatches has enabled new and emerging high-power RF applications, as well as dramatically improving reliability and simplifying more mature applications.

WEDNESDAY, October 23, 2013

09:00-10:40 (100 min) - PARALLEL SESSIONS 3A1, 3B1, 3C1

9:00-10:40 3A1: CMOS CIRCUIT DESIGN (TUTORIAL) Royal H

Presenter: Dr. Shraga Kraus, Technion, Israel

Abstract: Analog circuit design for baseband will be studied, with emphasis on the role of baseband circuits in receiving and transmitting chains. Guidelines for proper design of the building blocks will be provided, as well as considerations for putting the blocks together and embedding the whole baseband section in a communication system.

9:00-10:40 3B1: CAD, MEASUREMENTS AND POWER DIVIDING TECHNIQUES FOR MICROWAVE AND COMMUNICATIONS DEVICES Royal I

Chair: Dr. Michael Schlechtweg, Fraunhofer Institute IAF, Germany
Co-Chair: Prof. Boris Kapilevich, Ariel University, Israel

3B1-1: Monostatic Superscattering in Cylindrical Structures
V. Vulfin, R. Shavit; Ben-Gurion University of the Negev, Beer-Sheva, Israel

Abstract: Many studies have been done regarding the calculation of monostatic RCS (Radar Cross Section) of different objects for different applications. In this work, we study a cylindrical 2D structure, made of a PEC cylinder of radius a coated with a cylindrical shell of external radius b. An optimization procedure is launched and its goal is maximum monostatic RCS at normal incidence for a uniform plane wave. The radius b is a fixed parameter. The coating constitutive parameters (permittivity and permeability) and the radius a, are the parameters in the optimization process. In the optimization an analytical model of the cylinder scattering is used. The desired goal in this case is to obtain at normal incidence a monostatic RCS larger than that of the monostatic RCS of a PEC 2D plate with width equal to the cylinder diameter 2b. The optimization is executed for both polarizations of the incident plane wave: TM and TE. The possibility of a broadband solution has also been investigated.

3B1-2: Avoiding crosstalk in multiconductor TEM waveguides
R. Ianconescu, Shenkar College of Engineering and Design, Ramat Gan, Israel

Abstract: Guided TEM waves have been usually investigated between 2 conductors, but there are many cases which require the analysis of TEM waves guided by many conductors, like flat cables, high frequency polyphase transmission lines, etc. In a previous work I developed a methodology for multiconductor TEM waves, which is in many senses a generalization of the 2 conductors case, but also emphasizes new properties. This work uses the multiconductor TEM formalism to analyze the crosstalk in flat cables, and suggests a method to overcome this crosstalk. It is to be mentioned that by overcoming the crosstalk, one increases the transferred information rate.

3B1-3: CAD, measurements and power dividing techniques for microwave and communications devices. A CAD tool for the electromagnetic modeling of braided wire shields
Ruben Otin[1], Roger Isanta[1], Harmen Schippers[2], Jaco Verpoorte[2], [1] International Center for Numerical Methods in Engineering (CIMNE), Spain, [2] National Aerospace Laboratory (NLR), Netherlands

Abstract: In this work we present a computer aided design tool which can be useful for characterizing the shielding quality of braided wire shields. This numerical tool can be applied systematically to a wide variety of situations where complex geometries and materials may be present. Also, it can help in the validation and improvement of existent analytical models. These analytical models can be hard to compare directly against measurement because of uncertainties in the input data produced by manufacturing tolerances or changes in the properties caused by aging and handling.

3B1-4: Pulsed S-parameter measurements: on resolution, duration, and uncertainty
J. Martens, Anritsu, Morgan Hill, California, USA

Abstract: As the timing and uncertainty requirements continue to increase for pulsed S-parameter measurements, it may be worth revisiting the effects of time resolution, time duration (either in terms of number of pulses or period) and measurement architecture on uncertainties. The advent of highly linear, faster digitizers has enabled improved resolution for constant uncertainty, sometimes at the expense of duration or range of pulse periods allowed but data processing changes can get around a number of those issues. A newer structure will be presented allowing resolutions down to 2.5ns simultaneously with pulsed periods in the 100 ms range and transmission uncertainties on the scale of 0.1 dB/1 deg to 40 GHz and higher depending on the setup. The effects of a number of the structural options on uncertainty are discussed along with complications introduced by additional pulse parameter dependencies.

3B1-5: Comparison of Scattering from 2-D and 3-D Structures with Frequency-Dependent Materials in Time and Frequency Domains
D. I. Olcan [1], D. S. Petrovic [2], B. M. Kolundzija [1, 2]; [1] University of Belgrade, Belgrade, Yugoslavia, [2] WIPL-D d.o.o., Belgrade, Yugoslavia.

Abstract: We present results for comparison of scattered electromagnetic field obtained using numerical analysis of cylindrical and electrically long 3-D structures and 2-D structures of the same cross-section (considered infinite in the third dimension). The parameters of materials of which the structures are made are frequency-dependent. The comparison is done both in frequency-domain and in time-domain. The quantitative and qualitative relations between scattered near-field obtained using 2-D and 3-D structures is discussed.

9:00-10:40 3C1: TECHNOLOGIES FOR HIGHER PERFORMANCE COMMUNICATIONS Royal J

Chair: Stephen Weinstein, Communication Theory & Technol. Consulting, USA
Co-Chair: Doug Zuckerman, Applied Communication Sciences, USA

3C1-1: Optimal order estimation for modeling and predistortion of power amplifiers
T. Gotthans [1,2], G. Baudoin [1], A. Mbaye [1]; [1] Universite Paris-Est, Noisy Le Grand, France, [2] Brno University of Technology, Brno, Czech Republic

Abstract: Digital baseband predistortion is a cost effective approach to linearize a power amplifier. For a given type of model, two questions have to be solved: estimation of the model coefficients, and determination of the model structure, e.g. orders of nonlinearity, memory lengths. To choose proper orders of series is not evident in order to keep low complexity with acceptable results. In the article, we propose to use an integer genetic algorithm for the determination of orders of polynomial series for predistortion or power mamplifier modeling. The used fitness function aims to achieve a compromize between accuracy and complexity of the model. The method is evaluated on real measured power amplifier. The obtained results show that the proposed integer genetic algorithm is able to determine in a very small number of iterations a good model structure. Its complexity is quite low and it can be applied whether offline or online for adaptive determination of the structure.

3C1-2: On the Potential of Application Based Coordinated Multi-Point (CoMP)
R. Nossenson, Y. Bellaiche, D. Hababou, Jerusalem College of Technology, Jerusalem, Israel

Abstract: A Coordinated Multipoint (CoMP) refers to a system where several geographically distributed antenna nodes coordinate to improve performance of the served users in the coordination area and are connected to each other through dedicated links. One of the main issues that was identified in CoMP is the backhaul requirements - the type and amount of data to be exchanged among coordinating nodes. We propose and evaluate a new scheme for CoMP - the Application Based CoMP (ACoMP) target on improving application QoS parameters and reducing the communication among the coordinating nodes. In the ACoMP scheme, each node is responsible for a specific sub-set of applications that correspond to some classes of service. Users in the coordination area are served by nodes that support their active applications. Simulation results indicate that the communication between the nodes in this case is negligible and some improvements in the QoS parameters (throughput, packet-loss, etc.) are achieved.

3C1-3: DCSR: A Dynamic channel and resolution sampling for a Compressive Sensing Receiver to acquire GPS signals
A. Albu-Rghaif, I. A. Lami, University of Buckingham, Buckingham, United Kingdom

The use of CS technique to acquire GPS signals saves processing time when compared with software FFT based receivers. The computational complexity is reduced by up to 60%. Such CS solution uses a fixed size measurement matrix chosen to offer a compromise between the processing overhead and signals acquisition success level. This paper proposes a dynamic acquisition algorithm for GPS signals based on CS. Instead of using a fixed size sampling channels and fixed correlators in the measurement matrix, our DSCR dynamically changes the number and size of the required Channels/Correlators according to the received GPS signals power during acquisition. This adaptive solution offers better fix capability when the GPS receiver is located in harsh signal environment or it will save valuable processing/decoding time (battery power, especially for Smartphones) when the receiver outdoors. A feedback loop is devised to control the sampling channels number and resize the measurement matrix.

3C1-4: PAPR Reduced OFDM Visible Light Communication using Exponential Nonlinear Companding
K. Bandara, N. Pararajasingam, Y. Chung, Pukyong National University, Busan, Republic of Korea

Abstract: In visible light communication (VLC), LEDs are used to transmit data using intensity modulation. LEDs have a limited operating voltage range and the voltage-current characteristic shows a nonlinear behavior. When an orthogonal frequency division multiplexing (OFDM) signal is used to drive these transmitter LEDs (VLC-OFDM), LED chip overheating and nonlinear distortions occur, due to high peak-to-average power ratio (PAPR) of the OFDM signal. Unlike radio frequency baseband communication systems, the VLC-OFDM signal is a real-valued signal. This would lend itself to the PAPR reduction in VLC-OFDM. In this paper, we propose to use exponential nonlinear companding transformation techniques in VLC-OFDM to reduce the PAPR. Simulation results demonstrate that with the exponential companding function employed in VLC-OFDM, the PAPR of the VLC-OFDM is significantly reduced compared with previously considered methods.

3C1-5: Incoherent Compression of Complementary Code Pairs for Laser Ranging and Detection
D. Kravitz [1], D. Grodensky [1], N. Levanon [2], A. Zadok [1]; [1] Bar-Ilan University, Ramat Gan, Israel, [2] Tel-Aviv University, Tel-Aviv, Israel

Abstract: A scheme for the incoherent compression of complementary code pairs is proposed and demonstrated in a laser range-finding experiment. The off-peak aperiodic auto-correlations of complementary bipolar codes sum up to zero, hence they are attractive for radar and laser ranging systems. In incoherent compression, the two codes are converted to unipolar representations using a pulse position modulation algorithm prior to transmission. Following incoherent detection, the two received echoes are compressed through digital filtering, and added together to obtain strong sidelobe suppression. The scheme does not require the preservation of phase information in transmission or reception, and the length of the code pairs is scalable through simple procedures. Incoherent compression is particularly attractive for photonic implementations, in which direct detection is phase insensitive. A peak-to-sidelobe ratio of 42 dB is obtained in a laser range-finding experiment using 832 bits-long codes.

10:40 – 11:00 COFFEE BREAK (Foyer)

WEDNESDAY, October 23, 2013

11:00-12:40 (100 min) - PARALLEL SESSIONS 3A2, 3B2, 3C2

11:00-12:40 3A2: RECENT ADVANCES IN OPTICAL COMMUNICATIONS, INTRODUCING SPATIAL DIVISION MULTIPLEXING (TUTORIAL) **Royal H**

Presenter: Moshe Tur, Tel Aviv University, Israel

Abstract: This tutorial addresses new, promising technique to enhance both free space optical and fiber optic communication. Special emphasis is placed on orbital momentum techniques.

11:00-12:40 3B2: RECENT ADVANCES IN SOFTWARE DEFINED RADIO AND COGNITIVE RADIO (TUTORIAL) **Royal I**

Chairman Dr. Arie Reichman, Ariel University and Ruppin Academic Center

3B2-1: SDR and CR: Overview, standards and trends
Dr. Arie Reichman, Ariel University and Ruppin Academic Center

Abstract: Software Defined Radio (SDR) and Cognitive Radio (CR) techniques provide more efficient management of radio resources and improve re-usability of equipment. Standardization in these fields has great potential for spreading the use of SDR and CR. The challenges include design of energy-efficient SDR solutions for broadband standards, dynamic spectrum management, improving spectrum sharing efficiency.

3B2-2 The present status of standardization of SDR and CR and penetration of usage of these standards. Implementation tools for SDR and CR
Dr. Amir Abramovich, Ariel University

Abstract: Methods for design and implementation of SDR based on graphic programming tools will be presented. A demonstration of design will be shown.

11:00-12:40 3C2: MMWAVE INTEGRATION IN SILICON DRIVEN BY 60G SYSTEMS (TUTORIAL) **Royal J**

Presenter: Emanuel Cohen, Intel Israel, Haifa, Israel

Abstract: This tutorial presents recent progress of highly scaled Si-based technologies in the domain of millimeter-wave (MMW) applications traditionally dominated by the III-V technologies. It reviews recently developed architectures, circuit design and systems currently being investigated that benefit from the massive integration and sophisticated digital processing for RF assistance that CMOS process has to offer. The focus is on MMW applications for wireless high data rate communications especially at 60 GHz describing the building blocks for a full phased array system from the component design through the system testing and packing of a full solution in CMOS. A brief roadmap into the future of Sub-mm-wave and terahertz frequencies for imaging and communication applications will also be offered.

12:40 – 14:00 LUNCH (Jaffa Court)

14:00-15:00 (60 min) - SESSION 3A3

14:00-15:00 3A3: CLOSING SESSION **Royal H**

Closing remarks
Shmuel Auster, Conference Chair