## Active Microwave Circuits and Antennas

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## Some Recent Achievements:

- SAT: Spin out company based on multiband and switched band antenna IP. One antenna for all functions in a 4G handset.
- NICs:
- Highest reported NIC frequency, ~2GHz.
- Successful strategy developed for stability.
- First reported non- linearity measurements.
- New single transistor higher frequency version subject to current patent action
- Young Engineer Prize for O.O. Tade at EuMC 2012
- Final Year Projects on RF power harvesting


## Negative Impedance Converters:

- Highest reported NIC frequency, $\sim 2 \mathrm{GHz}$.
- Successful strategy developed for stability.
, First reported non- linearity measurements.
- New single transistor higher frequency version subject to current patent action
- Young Engineer Prize for O.O. Tade at EuMC 2012
http:// www.birmingham.ac.uk/ university/ colleges/ eps/ epscommunity/ news/ student/ young- engineer.aspx


## EuMC Young Engineer Prize



Novel Fully-Planar Extended-Composite Right/Left Handed Transmission Line based on Substrate Integrated Waveguide for MultiBand Applications M. Durán-Sindreu ${ }^{1,2}$, J. Bonache ${ }^{1}$, F. Martín', T. Itoh ${ }^{2}$ ¹GEMMA/CIMITEC, Departament d'Enginyeria Electrònica, Universitat Autònoma de Barcelona, Spain
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Negative Impedance Converters for Broadband Antenna Matching O. O. Tade, P. Gardner, P. S. Hall School of Electronics, Electrical and Computer Engineering, University of Birmingham, United Kingdom

## NIC

- NIC - Negative Impedance Converter
- Two port active device
- Consists of two transistors
- It is reciprocal
- It is symmetric
- Stability Problems



## Antenna matched with negative components

- Chassis Antenna
- 100mm X 40 mm
- Radiation Element is $40 \mathrm{~mm} \times 5 \mathrm{~mm} \times 7 \mathrm{~mm}$
- Centre Fed



## Matching Antennas with NIC



## NIC Realisation



Substrate -
Taconic TLY - 5

$$
\begin{aligned}
& \epsilon_{\mathrm{r}}-2.2 \\
& \tan \delta-0.009 \\
& \mathrm{t}=1.57 \mathrm{~mm}
\end{aligned}
$$

Capacitor - AVX 3.9pF
Transistor - NXP BFS - 17 (SOT- 23) Biased at 5V, 20mA

## Results



## SAT: Smart Antenna Technology Ltd

- Spin out company based on multiband and switched band antenna IP.
, Prize winner at 2 competitions



## BEng FYP: RF Rectifier Module



## Relevant selected publications:

- Hall, P.S. ; Gardner, P. ; Faraone, A. "Antenna Requirements for Software Defined and Cognitive Radios." Proc IEEE. 100, 7. pp 2262-2270. 2012.
- Tade, O.O. ; Gardner, P. ; Hall, P.S. "Negative impedance converters for broadband antenna matching." 42nd EuMC, pp: 613-616. 2012
- Hu, Z.H. ; Hall, P.S. ; Gardner, P. "Reconfigurable dipole- chassis antennas for small terminal MIMO applications." Electronics Letters. 47, 17. pp: 953
- 955. 2011. 

