shows the compression ratios of the SBI and the re-ordering time. It is observed that the compression ratios have just ~1.4% loss (Table 1) comparable with the CALIC coder while the sorting speed was nearly 98% reduced compared with the BWT. During the prediction process, the correlation of the image is not completely removed; it still contains some structures of the image. The SBI technique can bring the similar pixels together. Once the pixels are grouped together, there is a high chance that the final re-ordered sequence will contain long runs of the same pixel and this can let the final entropy coder compress more easily. Furthermore, Table 2 summarises the computational complexity of the context modelling in the CALIC and the SBI. It is obvious that the proposed method introduces very little computational process while the CALIC requires heavy mathematical operations [3] for each image pixel.

Table 2: Computational complexity of CALIC (modelling stage) and SBI

Method	ADD/MINUS	MUL/DIV	Shift	ABS	Comparison
CALIC	4	1	3	1	11
SBI	1	0	0	0	0

Conclusion: We have proposed an efficient data re-ordering technique, the subblock interchange (SBI) technique, which is a better alternative for the context modelling part in a normal image compression system, while sacrificing a few per cent of compression ratios (<1.5%) compared with the state-of-the-art CALIC coder over ISO/IEC 10918-1 and JPEG2000 test image but with a substantial gain in the computational operations since it saves nearly 98% sorting speed compared with the BWT and 20 times of mathematical operations (Table 2) over the CALIC coder. Thus, SBI provides a better performance gain in terms of complexity against compression ratio.

22 April 2003
Electronics Letters Online No: 20030700
DOI: 10.1049/el:20030700

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Non-contact high resolution microwave scanning measurement technology

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For non-contact inspection of microwave integrated and hybrid circuits a technical concept and realisation of a high resolution scanning technique for the detection of the electric field distribution has been developed. The near-field signal is measured in magnitude and phase allowing the calculation of the signal flow in the device under test.

Introduction: To increase the functionality, flexibility and reliability of microwave measurements for the inspection of integrated and hybrid circuits, a non-contact scanning technology is needed. In contrast to [1] where only the signal level is modulated and monitored with high resolution, here the electric field distribution is sampled in magnitude and phase extremely close to the surface of the device under test (DUT) with high spatial resolution but less field disturbance as compared to other (contact based) techniques. Measurements of three field components are usually required for a numerical evaluation aiming at increasing the resolution and at calculating the signal flow on the surface of the DUT. The results should help in locating the possible sources of circuit failure. The closer the near field is sampled the higher the resolution and the numerical evaluation becomes less necessary and less complicated.

Definition of requirements: The main application of the new measurement technique consists in the localisation of circuit failure during the prototyping process of radio frequency high power amplifier (RF-HPA) components. Miniaturised S-band or C-band microchips shall be sampled with a spatial resolution of 5 μm, which is better than (wavelength) $\lambda/5000$. The microchips have dimensions up to 4×4 mm^2 and a surface roughness within the range of ~100 μm (Fig. 1).

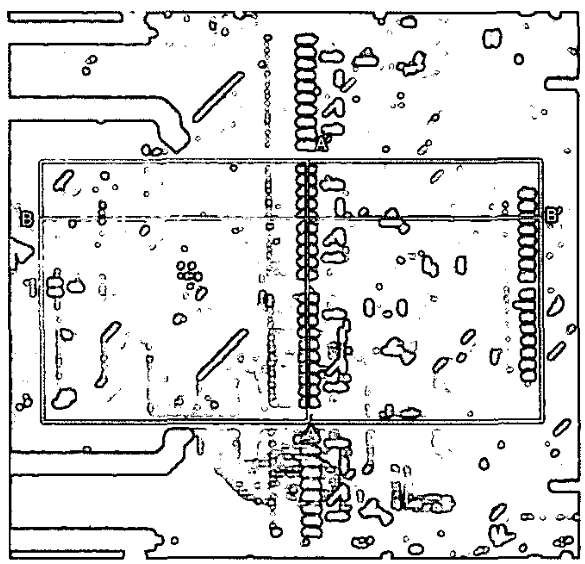

Fig. 1 *Microscope image of microchip under test with measurement area*

Topography scanning: Owing to the fine sampling grid and small measurement height (in relation to the surface roughness) the topography of the DUT has to be considered. A shear-force setup (see [2]) is utilised to scan the topography of the circuit using a mechanically oscillating tip and controlling its distance by the damping of this oscillation. A precise motorised 3D stage-table is needed and used to move the different kinds of tips and antennas to their required positions.

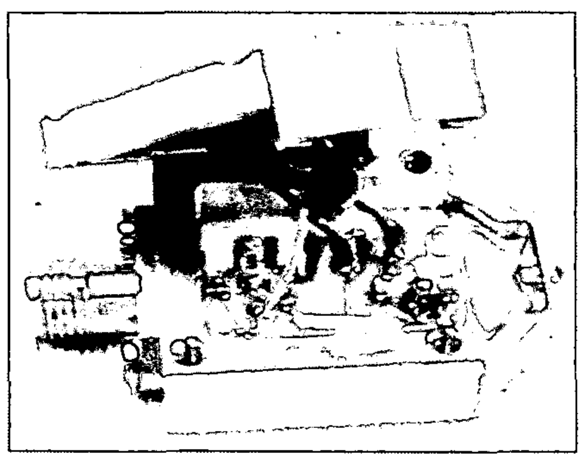

Fig. 2 *Image of opened antenna amplifier box with connected magnetic field antenna*

Miniaturised active near-field antennas: The normal component of the electric field and two tangential electric or magnetic field components are usually chosen to be sampled with a miniaturised coaxial monopole and a miniaturised dipole or loop type antenna with 10–20 μm in size to enable the resolution desired. Antenna amplifiers were designed and fabricated to match the antenna impedance and to increase the signal level for the frequency band chosen (see Fig. 2 for loop type antenna). A calibration is needed to quantify the antenna sensitivity and frequency response.

Field measurement: After checking the topography of the DUT by means of a precise shear-force tip, the latter is exchanged with a micro-antenna and identical paths are followed. The field distributions can now be measured within a height of $z = 10, \ldots, 25$ μm above the circuit.

Calculation of signal flow: Assuming that the measurement height is very small the resolution achieved with one field scan is so good that usually no further focusing is required. The latter can be achieved with help of the Green's function and an inverse field transform.

Results: Measurement results of the field strength distribution within a large area above the output stage of an RF-HPA are given. The area consists of some metal semiconductor field effect transistors (MESFETs), a number of microstrip transmission lines, a coil and power splitters and combiners. Fig. 1 shows the microscope top view of the measurement area. For this area with $2700 \times 1400\ \mu m^2$ in size the topography and the E-field distribution at $f = 3.025$ GHz (Fig. 3) 25 μm above the DUT are sampled with 10 μm spatial resolution. Only structures carrying an RF-signal are visible. Owing to its dynamic range, which can be taken from Fig. 4, the E-field-measurement resolution (see Fig. 5) suffices to check the function of the circuit and to locate possible circuit failure sources.

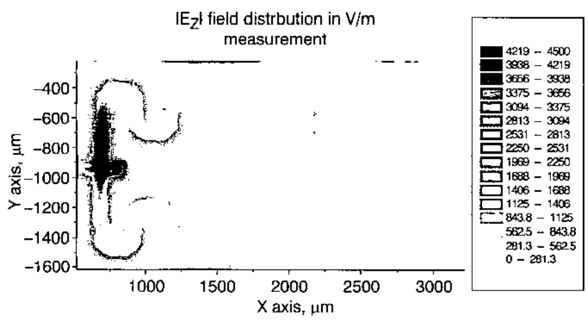

Fig. 3 *Measured electric field 25 μm above MMIC at f = 3.025 GHz*

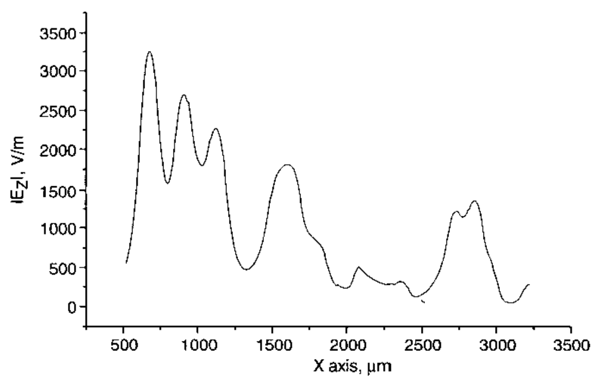

Fig. 4 *Cut B-B′ of measured electric field 25 μm above MMIC at f = 3.025 GHz*

Outlook: The measured field strength data of three (preferable electric) field components can be transformed numerically (although at high computational expense) into signal flow data with some increased spatial resolution.

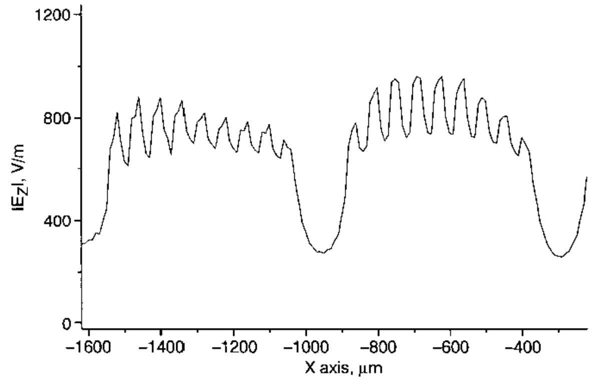

Fig. 5 *Cut A-A′ of measured electric field 25 μm above MMIC at f = 3.025 GHz*

Conclusion: A high resolution scanning technique for the inspection of the near-field distribution close to the surface of a DUT in magnitude and phase has been developed. A prototype setup has been produced and tested. The test bench consists of miniaturised near-field antennas, their amplifiers, a 3D precision stage-table and a topography sampling technique. First measurements show a spatial resolution of at least 25 μm of the E-field distribution which is better than $\lambda/5000$ and a dynamic range of up to 35 dB is achieved.

Acknowledgment: This work was funded by the European Commission within the 'μ-antenna'-project SMT4-CT97-2189.

31 March 2003

Electronics Letters Online No: 20030705

DOI: 10.1049/el:20030705

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Photorefractive effect and high power transmission in $LiNbO_3$ channel waveguides

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The photorefractive index changes in singlemode annealed proton exchanged channel waveguides is measured for guided powers of more than 100 mW at 1064 nm. Wave guidance up to 2 W is demonstrated.

Introduction: New developments in optical communication between geostationary and low earth orbit satellites are based on gigahertz phase modulation of light with a wavelength of 1064 nm [1]. An optical power of ~250 mW in continuous operation is required.