New Low Cost Lock-In Thermographic-Based Technique for Quantitative Monitoring of Electronic Wireless Systems

Researchers from the Spanish National Research Council at the Institute of Microelectronics of Barcelona (IMB-CNM) have recently developed a lock-in thermography-based technique for functional analysis and quantitative power consumption monitoring in wirelessly powered and pad-free electronic systems. This approach is fast (imaging-based), spatially-resolved, noninvasive, nondestructive, and of easy implementation in Quality Control systems for industrial processes.

Industrial partners are being sought to exploit the existing know-how through a licence agreement.

Easily Implemented and Fast Method to Monitor Electronic Wireless Systems

Nowadays the use of wirelessly powered systems is being extended to more and more applications, such as product tracking, identifications, asset management, logistics, payment, etc., making that their design has become also far more demanding from the point of view of their constituting functional parts and powering system robustness. Besides, their fabrication process requires reliable monitoring techniques to detect, localize and quantitatively analyze electrical dysfunctions related with their functional behavior or powering system.

The developed technique can be easily implemented into most of commercial infrared thermographic cameras and used as a quality control system for wireless electronic devices not only due to its noninvasive, nondestructive and spatial resolved characteristics, but also the quantitative nature of the measurement. Through the proposed modulations, the analysis of the individual parts of the system or integrated circuit (IC) and their possible electrical interactions can be performed. Additionally, it can be applied to other imaging temperature sensing systems.

Fig.1) Above- *Applications of Radio Frequency Identification Device (RFID).* ***Bottom-*** *Temperature Amplitude ($|S_{\Delta T}|$) images of a RFID Device. From left to right the activation of different Integrated Circuit parts is assessed and quantified with a real time lock-in detection.*

Main Advantages and Applications

- Diagnostic imaging technique (6 microns spatial resolution with the used IR camera) oriented to wirelessly powered integrated systems under real operation.
- Locally permits quantitative consumption and functional analyses.
- As non-invasive and non-destructive technique allows fast control in integrated systems, even applicable in wire bonding-free chips.
- Can be easily implemented in any other imaging temperature sensing system.
- Lower cost and faster (sample preparation, processing, etc.) than other mainstream techniques like SQUID-based systems, EBIC, OBIC, OBIRCH.
- Integrated approach in industrial processes suitable as quality control system for any integrated systems debugging (at powering and functional level), functional and quantitative consumption analysis, figures of merit extraction in frequency, etc...

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