# NON-CONTACT MONITORIG OF CARDIORESPIRATORY THORACIC ACTIVITY BY USING MICROWAVE DOPPLER TECHNOLOGY

**Desar Shahu[1], Algenti Lala[2], Elson Agastra[3], Klodian Xheka[4]**

[1,2,3]Polytechnic University of Tirana, Albania. Email: dshahu@fti.edu.al
[4]Metropolitan University of Tirana, Albania. Email: kxheka@umt.edu.al

## Abstract

Clinical practice often requires the continuous monitoring of some important physiological parameters of the patient vital signs. Among vital signs, the monitoring of cardiorespiration activity is particularly important in evaluating different pathologies and preventing diseases such as the sudden infant death syndrome or the obstructive sleep apnea. The use of contact devices can be quite cumbersome, interfering with the usual patients actions and behavior, that's why non-contact measurement of cardiorespiratory activity, using Doppler or ultra wideband radar techniques, is getting an important task in different medical applications and ambient assisted living. The possibility to monitor the cardiorespiratory activity in a non-invasive way, by measuring thoracic displacement using cost-effective microwave Doppler technology, has been studied. Several laboratory tests were performed in order to demonstrate the feasibility of the proposed electromagnetic measurement method. A vector network analyzer connected to a double ridge horn antenna, aiming to the subject under observation, has been used as a measurement setup. The broadband antenna, which is well matched on the frequency range from 700MHz to 18GHz, was excited by a single frequency signal having a 1mW of input power. In order to have a higher sensitivity the phase of the total reflection coefficient, modulated by the subject thorax displacement due to respiration activity, has been measured. Different healthy subjects were asked to breath normally or to stay in apnea for a few seconds in order to monitor the heartbeat activity. Measurements up to 2.5m has been held for the monitoring of the cardiorespiratory activity and an appropriate design of the antenna would further improve the signal to noise ratio and the vital detection range. Time domain signal processing techniques have been used in order to valuate the main frequency and rate variability of the heartbeat and respiration signals. They have shown a very good correlation coefficient with the electrocardiogram and spirometer results, used as reference instruments. On the other hand, a simple electromagnetic model was developed in order to analyze the scattering problem, using appropriate analytical and numerical techniques. This feature will be important for the design stage of the electromagnetic system.

***Keywords:*** *non-contact measurement, cardiorespiratory activity, thorax displacement, respiration rate variability, electromagnetic model.*