UNIVERSITY OF BIRMINGHAM

MICROWAVE INTEGRATED SYSTEMS LABORATORY

ULTRAWIDEBAND SIGNATURE ANALYSIS FOR DETECTION OF DRUGS, WEAPONS AND EXPLOSIVES

EPSRC/DTI project in collaboration with THALES RESEARCH & TECHNOLOGY (UK) Ltd.

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Project overview

Project is dedicated to development of 'early warning' system for Concealed Weapons and Explosives (CW&E) detection based on the Late Time Response (LTR) signature analysis in UWB radar. The principal aim of the project is an investigation into the generic problems of UWB sensor technology and its use for CW&E detection at a 'stand-off distance'.

Aim and objectives

Our research primary goal is to investigate fundamental problems of target remote detection and identification via UWB sensors, based on LTR analysis of target return signal.

Research stages are defined by sequential research steps of generic system analysis shown in Fig. 1.

Applications of the technology

- Indoor security
- Outdoor security
- Vehicle mounted sensors

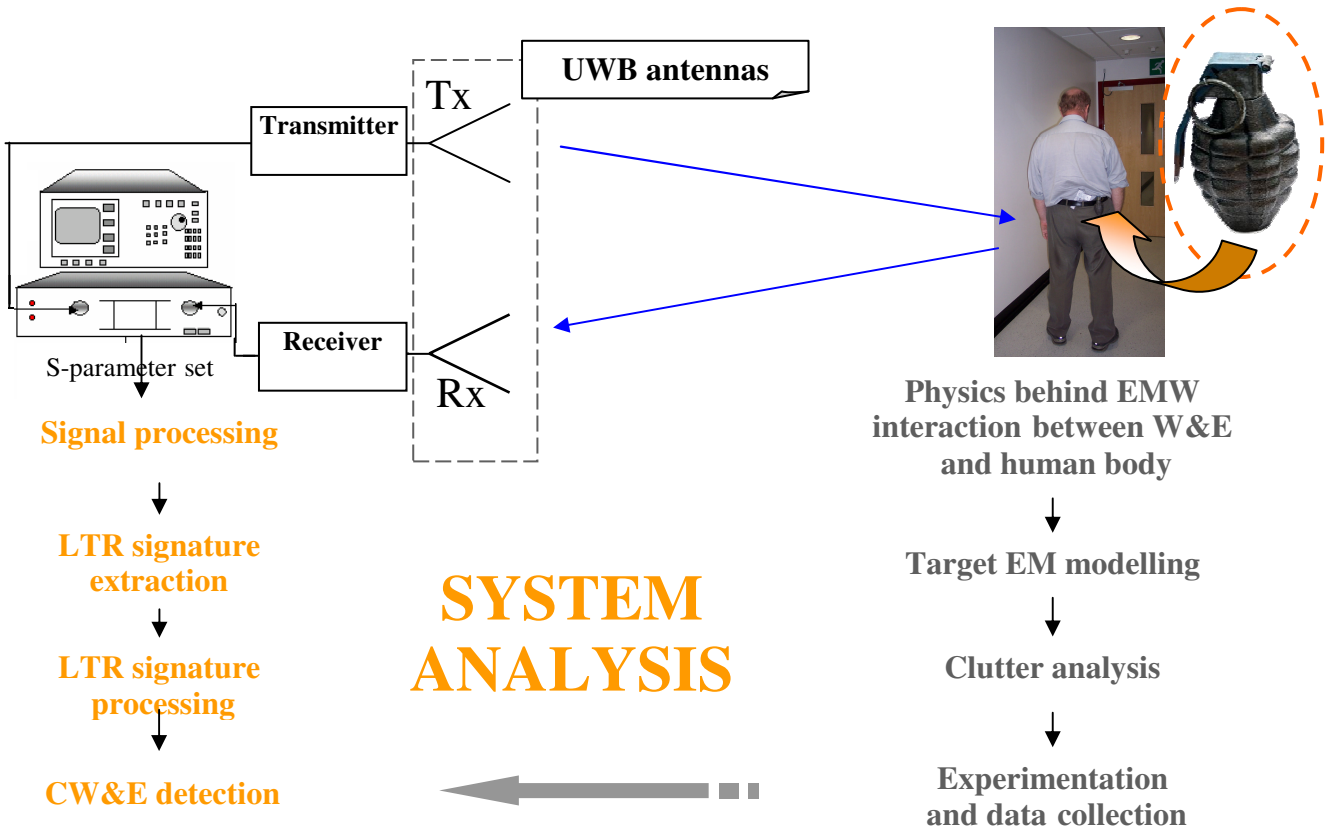


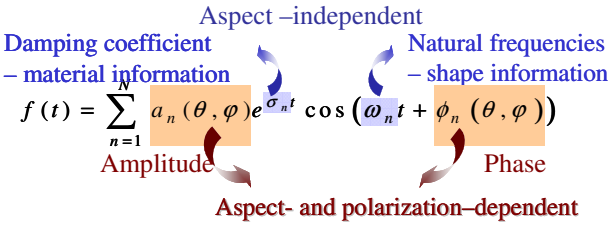
Fig. 1. General scheme of System approach for UWB sensor system development

- Automotive sensors
- Detection of buried victims under rubble
- Sensors for detection of significant backscattered energy from malignant tumour

Main concept of LTR based target identification

In order to identify the hidden target by backscattered energy UWB radar technology is exploited

High resolved UWB radar enables the target detection and identification by analysis of both specular (early-time - ETR) and resonance (late-time - LTR) parts of return signal in time-domain (TD). ETR carries information on scattering centers localization. In contrast, the substance of LTR is transient field oscillations when incident wave scatters on objects and resonates, corresponding to the bandwidth of the interrogating signal. LTR in TD can be presented as a sum of series with limited number of terms corresponding



lowest fundamental modes.

Then target can be identified if the extracted set of LTR parameters (resonance signature) is compared with the collection of known data of various targets.

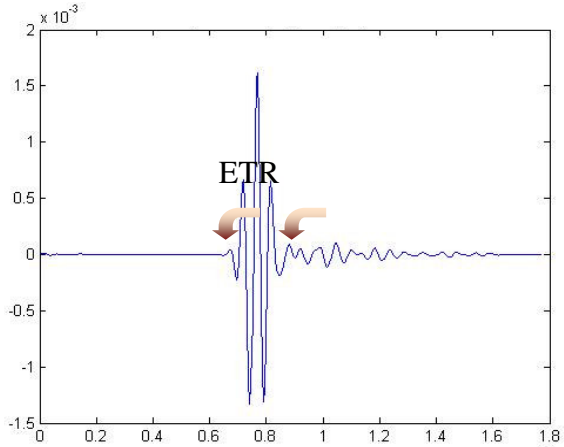
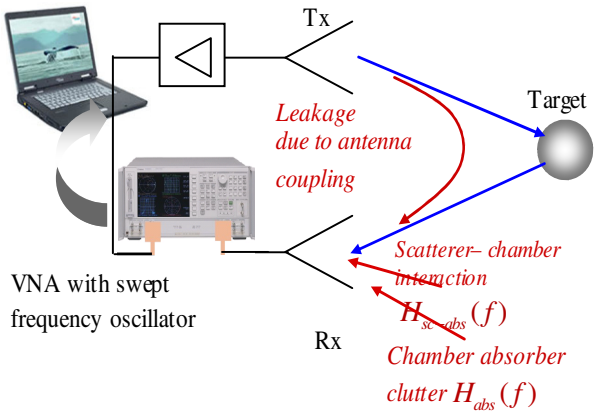


Fig. 2 Amplitude vs. time (ns) of response from conductive cylinder (75 mm diam)

FD Measurement and Processing Data

Below (Fig 3) the processing procedure of signal measured in the frequency domain is presented. As a stepped frequency generator VNA drives the transmitting antenna and collects the signal from the receiving antenna. In order to refine the object backscattered signal the leakage field and the



chamber absorber clutter field must be eliminated.

Signal preprocessing also includes equalization and filtering of informative signal. As UWB antennas we use Vivaldi antennas operating in range 0.5 -10 GHz

Fig. 3. Measurement system layout for controlled anechoic chamber measurements

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