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Analyses and Measures of GPR Signal with Superimposed Noise

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The influence of EM noises and environmental hard conditions on the GPR surveys has been examined analytically [1]. In the case of pulse radar GPR, many unwanted signals as stationary clutter, non-stationary clutter, random noise, and time jitter, influence the measurement signal. When GPR is motionless, stationary clutter is the most dominant signal component due to the reflections of static objects different from the investigated target, and to the direct antenna coupling. Moving objects like e.g. persons and vehicles, and the swaying of tree crown, produce non-stationary clutter. Device internal noise and narrowband jamming are e.g. two potential sources of random noises. Finally, trigger instabilities generate random jitter. In order to estimate the effective influence of these noise signal components, we organized some experimental setup of measurement. At first, we evaluated for the case of a GPR basic detection, simpler image processing of radargram. In the future, we foresee experimental measurements for detection of the Doppler frequency changes induced by movements of targets (like physiological movements of survivors under debris). We obtain image processing of radargram by using of GSSI SIR® 2000 GPR system together with the UWB UHF GPR-antenna (SUB-ECHO HBD 300, a model manufactured by Radarteam company). Our work includes both characterization of GPR signal without (or almost without) a superimposed noise, and the effect of jamming originated from the coexistence of a different radio signal. For characterizing GPR signal, we organized a measurement setup that includes the following instruments: mod. FSP 30 spectrum analyser by Rohde & Schwarz which operates in the frequency range 9 KHz – 30 GHz, mod. Sucoflex 104 cable by Huber Suhner (10 MHz – 18 GHz), and HL050 antenna by Rohde & Schwarz (bandwidth: from 850 MHz to 26.5 GHz). The next analysis of superimposed jamming will examine two different signal sources: by a cellular phone and by a transmitter operating in the Instrumental Scientific Medical (ISM) band (around 2.4 GHz). In the first case, signal of cellular phone is considered as an actual noise, and the measure should provide guidance on its electromagnetic compatibility, in the sense of operating limits of the GPR conditioning from the presence of signal transmitted by a cellular phone. Whereas, the analysis of superimposed signals in the ISM band is oriented to the implementation of a mobile GPR system that includes a transceiver, such as XBee, for transmitting results of localization (e.g. of buried people) to a remote station.

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1. J. Sachs, M. Helbig, R. Herrmann, M. Kmec, K. Schilling, E. Zaikov, and P. Rauschenbach, "Trapped victim detection by pseudo-noise radar," in Proc. ACWR '11 1st International Conference on Wireless Technologies for Humanitarian Relief, Amritapuri, Kollam, Kerala, India, 2011, pp. 265-272