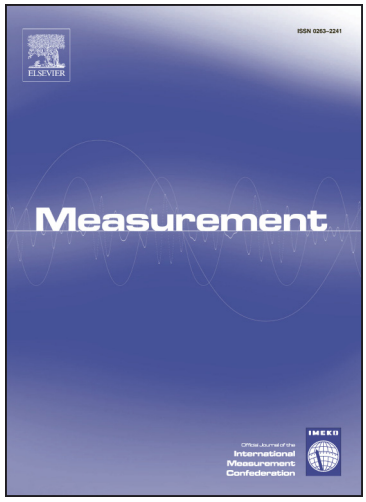

Use of Radar for illegal connections prospecting in buried or embedded cables

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Use of Radar for illegal connections prospecting in buried or embedded cables

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Abstract — **The purpose of this paper is to present a proposal to locate illegal connections underground using a technique to inject radar signals and collect their measurements. In special analyses, the reflection on the ground in the case of electrical conductors forms a hyperbola. Utilizing the radius of curvature variations of the hyperbola, the texture and tonal intensity of colors, it is possible to identify and differentiate between water pipes, gas pipes, tree roots, and others materials grounded. A testing area was built in a substation, where types of cables, containing branches, simulating clandestine links were buried in ditches. To support the analysis, a computational tool was developed to identify objects through statistical analysis of the radar grams, pixels, colors, and intensity.**

Keywords— **Ground Penetrating Radar - GPR; Measurement; Buried Cable; Pattern Recognition**

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1. Introduction

The detection of illegal connections mainly in condominiums is a difficult activity because of the impossibility of accessing individual meters or cables buried in the ground at these localities. It is known by comparative measures that there is fraud in cable connections, but it is difficult to prove; condominiums in general, however, do not allow prospecting.

Other illegal connections embedded in walls or underground extensions are impossible to identify in a visual inspection, but it can be detected by radar images. These images, under the legal point of view, serve as evidence of fraud and assist in carrying out the expert's investigation. A common technique already used for fraud detection is utilizing shunts that enable comparison between consumption readings as described by Parra and Calderon [1].

There are specific studies that model the electromagnetic fields in shield cables as shown in Feliziane [2] and others like Nikolajevic [3] that present a modeling for terminals cable. A methodology for identify buried cables faults can be checked in [4] and a full review of the methods used in market equipment are brought in Neier [5], including techniques of : Impulse