New Capabilities for PCL System: 3D Measurement for Receiver in Multidonors Configuration

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***Abstract*— For more than 15 years, the interest for PCL (Passive Coherent Location) system has been growing. It began with the analog waveforms like TV [1] and FM [2,3]; now the interest for digital waveform has increased [2, 4] and especially for DVB-T (Digital Video Broadcasting-Terrestrial).**

Despite all these interesting progress, some new requirements mentioned by several potential users [5] of such PCL systems have appeared like an altitude estimation and especially for low altitude targets. Some works have began in this area especially for tracking consideration [6].

In order to illustrate the PCL capabilities, we'll present some elevation measurements using a 2D array with DVB transmitters in a SFN (Single Frequency Network) configuration. The corresponding 3D tracking results will also be presented. These measurements will be analysed according to the "GPS" reference plots.

In a second part, after a short description of the main differences between the three main kinds of illuminators (FM, DAB, DVB-T), we'll consider the complementarities of these potential donors in order to outline some elementary rules for choosing the most appropriate waveforms according to our final requirements.

Keywords: **PCL, Digital waveform (DAB, DVB), 3D measurement, sparse antenna design.**

I. INTRODUCTION

Most of the digital broadcasters considered in this paper are using COFDM (Coded Orthogonal Frequency Division Multiplex) waveform in a Single Frequency Network, nevertheless; only the cancellation filter is specific to that waveform [2,4]. The other results are achievable with similar waveforms (according to their band as well as to their useful bandwidth). In order to detect mobiles targets and reach these interesting range resolutions, it is necessary to develop specific zero-Doppler path cancellation filters and especially in the SFN (Single Frequency Network) mode for which all the transmitters in a given area are transmitting the same waveform. These main constraints could find a solution with a specific filter used for zero-Doppler path cancellation [4] in a SFN network using COFDM modulation. This knowledge of this signal algorithm step allows to go more in use of a passive receiver for the 3D measurement.

So we will present the main characteristics of the 2D array considered in order to:

- Efficiently cancel the main direct paths,
- Efficiently estimate the target elevation angle,
- Limit the number of antenna elements in a 2D array.

Then we will illustrate some of the experimental results obtained. The focusing point will deal with the elevation estimation as the filter efficiency has already been described [2].

In a second part, considering the main constraints of the different waveforms (FM, DAB, DVB), we will outline the complementarities of these potential donors in order to give some elementary rules for choosing the most appropriate waveforms according to our final requirements.

We will conclude by some of the remaining studies required for defining a complete PCL system that could provide an air traffic surveillance with 3D capabilities for low altitude targets.

II. MAIN ELEMENTS OF THE DVB-3D SYSTEM

As in any PCL system, the most important step of the signal processing is the zero-Doppler cancellation filter. The main requirements for such a filter are:

- The efficiency, especially in SFN mode,
- The "limited" losses for the target paths,
- The "reasonable" hardware architecture.

The filter already described [2,4] allows an efficient cancellation of the main direct paths (including their corresponding multipaths), even in a SFN mode using a limited array system. Typically 4 or 8 antenna elements are required for implementing this filter. Furthermore, it doesn't require any additional antenna like some reference antenna in order to estimate the reference channel (for correlation) and/or to eliminate this reference signal from the "target" antenna. The