

A parallel unbalanced digitization architecture to reduce the dynamic range of multiple signals

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The technologies employed in urban sensor networks are permanently evolving, and thus the gateways of these networks have to be regularly upgraded. The existing method to do so is to stack-up receivers dedicated to one communication protocol. However, this implies to have to replace the gateway every time a new protocol is added to the network. A more practical way to do this is to perform a digitization of the full band and to perform digitally the signal processing, as done in Software-Defined Radio (SDR).

The main hard point in doing this is the dynamic range of the signals: indeed the signals are emitted with very different features because of the various propagation conditions. It has been proved that the difference of power between two signals can be so important that no existing Analog-to-Digital Converter (ADC) is able to properly digitize the signals. This paper proposes a solution to reduce the dynamic range of signals before digital conversion. In the paper, the assumption is made that there is one strong signal, and several weak signals. This assumption is made from the existing urban sensor networks topology.

A receiver architecture with two branches is proposed with a “Coarse Digitization Path” (CDP) and a “Fine Digitization Path” (FDP). The CDP allows to digitize the strong signal and to get data on it that is used to reconfigure the FDP. The FDP then uses a notch filter to attenuate the strong signal (and then to reduce the dynamic range of the signals) and digitizes the rest of the band.

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