Cognitive Radio Experimentation World

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SNE-ESHTER: A low-cost, compact receiver for advanced spectrum sensing in TV White Spaces

Advancing CREW Experimentation Facilities

Problem: How to enable experimentation with advanced spectrum sensing in TV White Spaces in diverse outdoor testbeds? Outdoor testbeds favor robust, compact hardware. Distributed sensing favors low cost and a large number of sensors.

Solution: Embedded Sensing Hardware for TVWS Experimental Radio (ESHTER) sensor node expansion deployed in CREW.
- VHF and UHF signal reception (40 – 900 MHz) including the TV broadcast band, 5 ms channel settle time.
- Baseband sampling with 500 kHz or 1 MHz bandwidth. Log-response energy detection up to 8 MHz bandwidth.
- Simultaneous synchronous sensing on two channels and/or two antennas on a single sensor node.
- Programmable hardware trigger for low-latency applications (e.g. CS-MAC protocols)

Deployment: Observing the Ofcom TVWS pilot

The UK regulator Ofcom is running trials for secondary devices using white space technology. CREW project, in cooperation with FP7 ACROPOLIS, has deployed two sensors in London to monitor the ongoing tests and their effect on the spectrum occupancy.

1. Receivers are mounted on VESNA sensor node cores, which provide an embedded 72 MHz CPU for signal processing.
2. An Ethernet interface allows simple distributed deployment of individual sensors with remote control over Internet.
3. Sensors deployed on roof-tops at King’s College London and Queen Mary University of London record long-term statistical data on spectrum occupancy during TVWS pilot.

Experiment: Channel occupancy decision

In this application, the sensor decides whether an 8 MHz UHF channel is occupied by an existing radio transmission, like a wireless microphone, or is vacant for secondary use. To make the sensor resistant to noise level changes, a covariance-based detector is used. Radio continuously sweeps available channels, calculates a test statistic based on the sample covariance vector and provides an up-to-date channel occupancy table.

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\gamma = \frac{\sum_{n=0}^{N-1} x_n \cdot x_{n-L}}{|\sigma_0|}
\]

weak signals cannot be reliably detected based on RSSI alone

PROJECT DATA
Start Date: 01/09/2010; Duration: 60 M
EU Funding: 4.885 M€
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