Crossed Sector Automatic Detection In 4G Radio Access Networks

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The Long Term Evolution (LTE) is the latest step in the advancing series of mobile telecommunications systems, it is called the fourth Generation (4G). In order to boost performance and deal with the increasing complexity within the operating 3G/4G networks, the Self-Organizing Networks (SON) concept was introduced.

The main goal of SON is to incorporate auto-configuration and self-optimization capabilities in the LTE Radio Access Base Stations, called evolved NodeBs (eNBs). Inside SON, the network should auto-detect if the sectorized antennas are connected to the wrong transceivers, which can happen due to human implementation error. Hence, this paper focuses in the crossed sector detection, presenting an algorithm that identifies sectors which are crossed. This erroneous implementation degrades user performance, since radio resource planning and reuses strongly depend on antenna directivity and orientation.

The aim of this paper is to develop an enhanced crossed sector detection algorithm, taking into account the Received Signal Reference Power (RSRP) and the eNB's antenna radiation pattern. The concept is to compare the measured received signal strength from two sectors (using drive-test measurements), with a signal strength prediction based on network topology and antenna pattern knowledge.

In order to test and validate the developed methodology, the algorithm was applied to a real Portuguese 4G mobile operator, where drive-test measurements were used. The algorithm produced strong results, since, several real crossed sector situations were detected.

Figure 1 illustrates one of the cases, where a real crossed sector is highlighted. The triangles represent the sectors of the analyzed tri-sectorized base-station, each one with a distinct color. The small filled circles represent the drive DT measurements. The circles' colors are in accordance with the serving cell color. Hence, the crossed sector occurrence is visible.

The algorithm considers a statistical analysis, which supports the crossed sector identification with a certain degree of accuracy. For this obvious case, the accuracy was 98%. Nevertheless, situations exist where the detection is not so certain. The accuracy calculations and method will be presented in the full paper version.

Figure 1 - Detected crossed sectors.