# **Radiocoverage Measurements of a Wireless Local Area Network**

EVANGELOS T. SAPOUNTZIS, JOHN T. SAPOUNTZIS and KONSTANTINOS VOUDOURIS

Technological Educational Institute (TEI) of Athens Department of Electronics, GR-12210, Athens, Greece, kvoud@ee.teiath.gr http://www.ee.teiath.gr

*Abstract:* Primary objective of this paper is the analysis and presentation of radiocoverage measurements of a WiFi installation, based at the TEI of Athens campus, aiming to develop a methodology for installing WiFi access points, in academic environment, within the consept6 of eServises, such as eCampus. COST 231 model is deployed for comparing theoretical and measured results.

Key-Words: Wireless communications, Wireless local area network, radiocoverage,

## **1. Introduction**

Implementing the fundamental guidelines of *e*Europe Action Plan [15], European Union member states turn their efforts inter alia, to technologies that rapidly deploy services such as *e*Goverment, *e*Health or *e*Learning. As a platform, the Wireless Local Access Network technology, based in 802.11x, constitutes a relatively new inquiring activity in wireless networks area [13,14]. This fact offers a large number of evolutionary extensions and future aspirations. The Wi-Fi model is the most expedient and modern provision offering innumerous possibilities in common and professional level [1-7].

Within the Microwaves laboratory of the Technological Educational Institute of Athens, Greece, a WiFi experimental set up was installed. Measurements of signal strength in various places inside the lab, as well as along corridors and other rooms of the building, were recorded.

To that end, COST 231 model is deployed for comparing theoretical and measured results [8-12].

## 2. Measurements campaign

The most common WLAN topology was considered. The base station consists of an access point and the measurements were recorded on a specific transceiver. In the following figure, the top-view of the microwaves lab room is shown, along with the position of the access point.



Fig. 1: Top View of the measurement set up

Lines AA', BB', CC', DD' and EE', depict the measured paths.

Access point and antennas used, are mainly the basic equipment for ISM band; the license free microwave frequency band used by the most wireless networking applications. More specifically, the equipments used during the measurement recording procedure were the following:

- Laptop PC Toshiba Satellite A80-12g including an Intel Wi-Fi Card.
- Proxim Access Point A.P 700.
- Network Stumbler software.

## **3. Results**

Measurements were recorded for three distinguished parts of the building. Firstly, measurements in the Microwaves Laboratory, were considered, then readings around 1<sup>st</sup> floor's perimeter corridor were taken and finally, a floor bellow the access point position, i.e. around ground floor's perimeter corridor.

A typical measured power level in the microwaves lab. room is shown in figure 2 below.



Fig. 2: Typical power level measurement along AA' path (see fig.1)

Selective fading in 1.7 and 3.5 meters may be observed, as obvious obstacles were disturbing the line of sight.

Furthermore, the radiocoverage in the lab room along CC' path, may be shown in next figure 3.



Fig. 3: Microwaves Lab room radiocoverage along CC' path

To this end,, measurements were taken along the corridors of  $1^{st}$  and ground floors of the Department of Electronics building. The particular corridors are of square type as shown in next figure.



Fig. 4: Top view of 1<sup>st</sup> floor building

The radiocoverage at the corridor of the fist floor of the building is shown in the next figure.



Fig. 4. 1<sup>st</sup> floor corridor radiocoverage

The effect of a crowdie by students corridor may be observed, after the fist 20 meters. Despite the fact that signal strength peak value increases, the system experiences string fading due to the dense human presence.

#### 4. Radiocoverage approximation

The approximation application is based on calculating the attenuation factor *n*, *through methods such as* the standard least square approximation [16], to the following equation of the COST-231 One-Slope Model [7-14]:

$$L_{osm} = L_0(d_0) + 10 \cdot n \cdot \log\left(\frac{d}{d_0}\right) \qquad (1)$$
$$L_0(d_0) = FSL(d_0) = 20\log\left(\frac{4\pi d_0}{\lambda}\right) \qquad (2)$$

For n=3.5, a comparison between theoretical and measured results may been observed in the next figure [16].



Theoretical predictions do not fit well to measurements. Nevertheless, the margin between theory and measurements of 10 dB, in favor of the experimental results, may be considered insignificant when planning a WiFi network as such.

## 5. Conclusions

Initial results yielded by this method seem to be very promising. In order to better solidify them, extensive measurements must take place in the future. Nevertheless, for purposes of planning an optimal wireless local area network, it seems that COST 231 one-slope model is able to estimate quite successfully the signal levels at the area of interest and in very little time.

Measured results alone, showed that in an academic environment, services such as eCampus are feasible using simple and inexpensive tools for planning and installing equipment, fulfilling therefore the aim for an information and knowledge societies for all.

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