IN BUILDING COVERAGE FOR MOBILE COMMUNICATIONS

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The IBC Concept

A dedicated cellular network in building (indoor) Coverage system consists of micro cellular base station equipment and a distributed antenna system (DAS). The DAS typically consists of small antennas (similar in size to vehicle mounted cellular antennas) interconnected using normal and antenna type coaxial cable distributed throughout the areas to be covered.

The underlying concept is to distribute a low power signal as evenly as possible throughout the area to be covered and to contain the signal within the building.

The main benefits for the people in the building are:

Provision of good quality mobile coverage throughout the building - this good coverage (typically results in the power output of mobile phones being reduced to 1% of the full power setting)
Greater mobile battery life due to low power operation

The main benefits for the overall network:

Provide a more complete continuity within the desired area of coverage
Relieve the rest of the network external to the building of the potential traffic of a highly densely populated area.

Conclusion

1. Antennas/radiating devices (leaky coaxial cable)
2. The backbone of the Distributed Antenna System (DAS)
3. The link from the IBC base station (BTS) to the switch
4. The IBC coverage & performance
5. The layout of the DAS to produce optimum coverage and performance
6. A frequency study, which frequencies work best indoor – utilisation of the frequency spectrum

Definition

This topic is a joint venture between UNSW and the company Telstra. The motivation for this project stems from an interest by Telstra in improving the way it produces designs and implementation of IBC's. The network system being looked at is to cover all the technologies including GSM (900-1800MHz), CDMA (800MHz) and 3rd Generation (2GHz+).

The research undertaken in this thesis focuses on:

1. Antennas/radiating devices (leaky coaxial cable)
2. The backbone of the Distributed Antenna System (DAS)
3. The link from the IBC base station (BTS) to the switch
4. The IBC coverage & performance
5. The layout of the DAS to produce optimum coverage and performance
6. A frequency study, which frequencies work best indoor – utilisation of the frequency spectrum

The Microcellular Strategy

Experimental Work

Three buildings were chosen for close analysis of their IBC operating performances, King, George and Sussex. The expected results and the measured results for George is presented in graphical form below. All three buildings provided adequate to very good coverage and signal quality. In order to provide a good service to the mobile users in the system, received signal strength in the range –35dBm -> -.75dBm has to be achieved.

CBD Sydney traffic (GSM) carried by the IBC systems is also presented as well as the associated CDMA traffic.

Future Work

Future work that can be undertaken on this topic would be related to developing a software tool for predicting the operating performance of the IBC system. Numerous researchers have attempted to design these tools using predictive models. The focus of future work could be on using one as a tool to predict the next generation of IBC systems following the recommendations could be as much as 35% or $100,000.

6. Frequency Usage

There is GSM900 MHz and now the GSM1800 MHz, these two both work well together and there doesn’t seem to be any advantage in using one as preference to the other. CDMA uses 800MHz and this operates successfully, this access scheme for mobile networks is the best for the indoor environment and should appear in more IBC designs in the near future. The third generation (2GHz+) of frequencies will operate better in the indoor environment than the lower frequencies.