



## Summary

Business femtocells promise a new era of low-cost high-performance indoor mobile for organisations of any size.

This introductory paper is concerned with the practical distinctions of business femtocells:

- Modular “Lego bricks” of coverage that suit any business space and which can be easily expanded or remodelled.
- Self-organising capabilities that eliminate the need for radio planning expertise, removing cost, complexity and engineering bottlenecks from indoor solutions.
- Self-installed and administered by regular IT staff, with the mobile operator providing remote management.
- Simple enough to be sold through an operator’s existing indirect channel to reach companies of all sizes.

The paper also considers technical challenges such as interference, and compares business femtocells with traditional business solutions such as picocells, which have existed for a decade, yet suffer from low market penetration due to high total cost of ownership.

## Indoor service quality: the challenge for mobile operators

Business customers expect coverage everywhere and all the time. These expectations arose from the way that mobile was sold to consumers, where 95%+ levels of population coverage are regularly quoted. But indoor coverage levels, especially in business premises, fall far short of these levels. Poor coverage is one of two central reasons for business customer churn.

There are bespoke solutions that can provide coverage but the cost cannot be justified for smaller organisations or for contracts with low numbers of subscribers - in other words, most customers. And value for money is the second central reason for customer churn.

Existing coverage solutions such as picocells require specialist engineers to install them. Besides the cost element, these engineers are a limited resource, and do not fit well with the SKU-based indirect channel often employed for business customers.

But is more than just about coverage: major productivity gains can be achieved by harnessing mobile applications using high speed 3G mobile broadband. Advanced messaging, video calling and collaboration applications are rarely used today because despite the widespread use of 3G handsets, data speeds inside buildings are just not fast enough.

Mobile operators ignore the twin drivers of coverage and value for money at their peril. The inevitable consequences are uncomfortably high churn rates, reduced growth competitiveness, and even a damaging negative image.

## The business femtocell opportunity

Femtocells meet the fundamental needs of business customers:

- They provide enhanced coverage indoors, transforming call quality without having to change handsets.
- They are a low cost solution suitable for the smallest business, and offer the potential for lower voice and data tariffs when employees are in the office.
- The solution can be bought through their existing channel relationship, and self-installed even more easily than a WiFi access point.

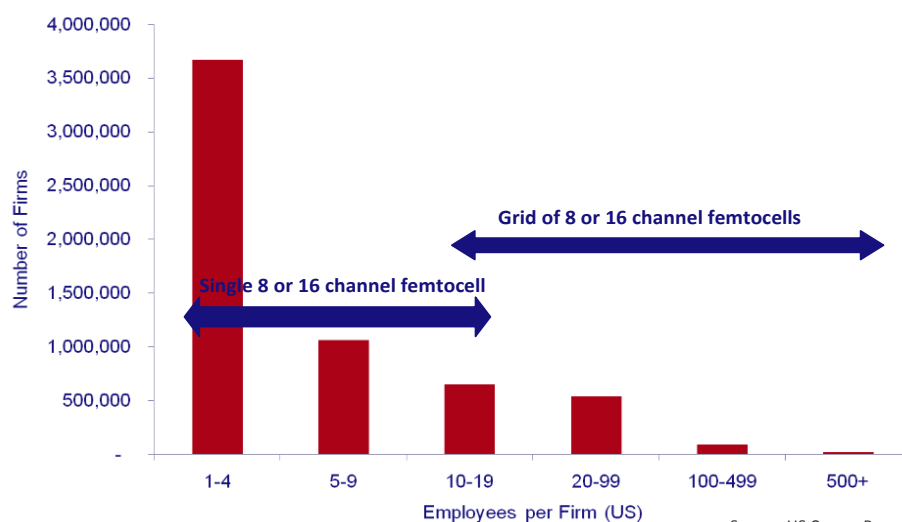
Femtocells also provide clear business benefits for operators.

- By providing great coverage and great value for money, business customer churn will be reduced, growth can be increased and the company's image improved.
- There are substantial cost savings to be made by reducing macro voice traffic and offloading data traffic direct to the internet.
- Operators can stimulate 3G usage and 3G based services by offering them at reduced rates and combined with optimal performance in the office.
- Opportunity to sell broader packages that include more than 3G, such as wired broadband.
- Femtocells provide a better, simpler and cost-competitive alternative to emerging VoIP over WiFi services.

## Where's the market for business femtocells?

Because it is smaller organisations that have been excluded by the price of today's coverage solutions, it is easy to assume that the primary market for business femtocells will be small enterprises. There are certainly plenty of them:

Figure 1 Distribution of companies by number of employees



But coverage solutions are not really about the size of a business, they are about the size of the business space. For example, most medium and large organisations operate out of a diverse range of premises: large HQ spaces, shared-occupancy branch offices, home workspaces. In order to acquire or retain a contract with a large enterprise, every type of space must be covered. Femtocells offer a single cost effective solution for all of these premises, one which can be adjusted at any time to suit the needs of the business. Picocells, repeaters

and DAS based solutions, which have been available for many years, just have not been able to provide a cost effective solution for mobile operators, which is why femtocells are such a major opportunity.

## What is a business femtocell?

The Femto Forum summarises a typical femtocell as follows<sup>1</sup>:

- A low-power access point
- Using mobile technology
- In licensed spectrum
- Generating coverage and capacity
- Over internet-grade backhaul
- At low prices
- With full operator management
- Self organising / self managing.

A business femtocell is simply a femtocell that is used in a business context, serving employees at an office as small as a home office or as large as an enterprise with more than 250 employees. The enterprise is just an application of femtocells, rather than definition of a type of device.

The key characteristic that distinguishes femtocells from other solutions (like picocells and VoIP over WiFi services, discussed later in the document) is the ability to self-organise. The femtocell constantly scans its radio environment and autonomously adjusts its configuration according to the operator's policies.

This means that femtocells can be self-installed incrementally, as a self-organising grid, which can cover large areas, grow and adapt with the business. The self-organising femtocell grid can be used to effectively meet the needs of the whole spectrum of business premises in a cost effective, scalable and practical way.

In addition to the features of a consumer grade femtocell, a business femtocell has additional capabilities such as mobility between femtocells and dynamic load balancing of calls, making it suitable for business use. There is also potential for integrating business femtocells with enterprise based telephony devices such as IP-PBXs, thus strengthening their proposition for the office environment.

Business femtocells typically support 8 to 16 active voice calls and data rates of between 7.2 and 21Mbps. Power outputs requirements are lower than that of picocells typically being between 10dBm and 20dBm depending on the number of calls that need to be support. This reduction in power compared to a typical 24dBm picocell has a significant impact on the cost as well as reducing the peak exposure to RF (V/m).

There are several advantages to this modular or grid approach.

- Users are closer to each cell, providing a better quality signal and higher throughput. And being closer, the signal has to penetrate fewer walls, further improving the service quality.
- A modular approach also means that the signal is efficiently contained within the outer walls of the building; even in irregular-shaped buildings (most business spaces are irregular).
- The modular approach provides an optimum mobile data experience, because every femtocell provides full HSPA, and that capacity is shared between fewer users.

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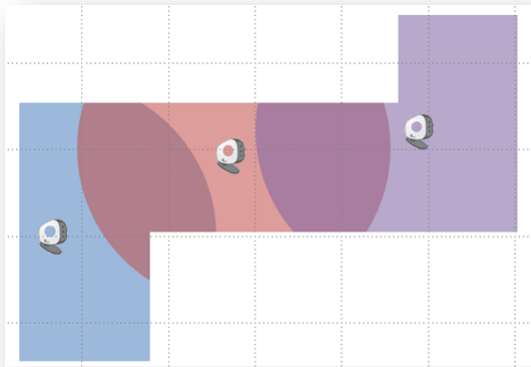
<sup>1</sup> Femto Forum Glossary, Version2.8

## How business femtocells work

### Decision making:

The first question that any business considering femtocells would ask is: How many femtocells would I need? A simple “coffee cup” diagram or online tool, similar to the one below, is used by the customer to work out how many femtocells will be needed and roughly where to put them.

Figure 2 Results from an access point calculator on a 50m grid

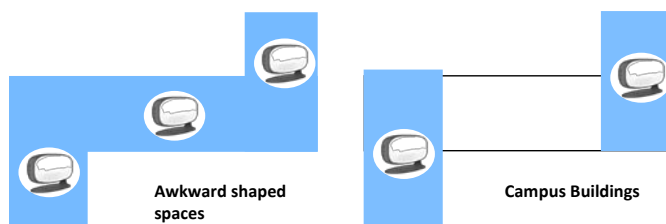


Each floor of each building can be planned for in advance including awkward shapes and sizes that plague the real world. But does the type and shape of the office space matter? In the real world, business spaces are rarely large square boxes with no neighbours. And even when they are, they invariably have a central elevator/stairway surrounded by thick fire-proofed walls.

Femtocells are particularly well-suited to real business spaces large and small, because they can be dropped-in like Lego blocks to precisely match the shape of coverage required, and new blocks can be simply be added as the business grows. Consider the examples below.

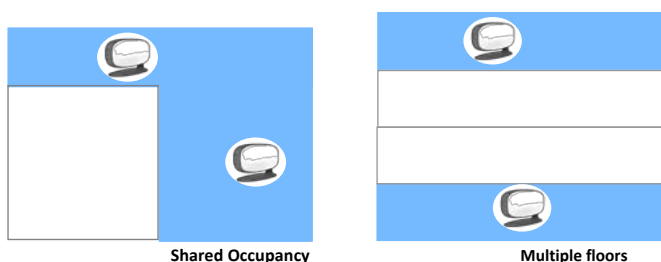
Figure 3 Typical business space configurations

### Awkward shapes, Campus buildings:



The normal office shape is designed to maximise window area, so awkward elongated designs are commonplace. Also, many organisations are split between several buildings on the same campus site or along the same street. The femtocell grid solution suits both formations equally well.

### Shared Occupancy:



Most small and medium businesses share their office space with other organisations. Others have grown by moving into new non-adjacent floors of the same building. The femtocell's low power and self-organising capabilities mean that each company can organise its own indoor coverage solution.











