

#5G CHECK THE FACTS

Macro and Small Cells

A mobile network involves several different pieces of equipment to broadcast a mobile signal. Mobile signals are broadcast from an antenna attached to supporting structures such as masts or poles. The antennas are often known as cells, and within a mobile network, there will be a mixed ecology of macro cells and small cells. Macro cells broadcast across a wide area, while small cells help to complement the macro network.



Figure 1: Examples of three macro sites (a base station, a rooftop site, and a monopole) and a small cell (top middle).

What are macro cells (or macro sites)

Mobile signals are broadcast between the phone and mast. A macro site is a cellular base station, or more commonly known as a mobile mast, or tower that sends and receives radio signals between the phone and mast.

The antennas for macro cells are mounted on ground-based masts, rooftops and other existing structures at a height that provides a clear view over the surrounding buildings and terrain. Macro cell base stations have power outputs of typically tens of watts.

Examples of macro cells equipment

Street works phone mast (monopoles)

These are deployed on the public highway (e.g. pavements). They are often disguised to match the existing street furniture, and often the only visible difference can be the equipment cabinets at ground level.

Monopoles are often more discreet and less visibly obtrusive, but often limited by the amount of equipment and number of mast operators that can be placed on the mast.

The average height can range from 15m - 20m.



Existing structures (rooftop site)

These phone masts are usually deployed on existing buildings and structures like blocks of flats, commercial property. The advantage is that rooftops provide the height so that a ground-based mast is not required. Local authority planners generally prefer to see existing structures being utilised, as opposed to giving planning consent for new ground-based phone masts. Rooftop phone masts can include some or all of the following: stub masts, pole-mounted antennas, surface-mounted antennas and flagpoles.

Standalone (ground based site)

The most common form of standalone masts is a lattice tower. Lattice towers are normally larger pylon-type structures and are more visibly obtrusive, but these towers can generally accommodate more equipment and are easier to upgrade and redevelop and can house numerous operators. They are more commonly found in rural areas where there are no existing buildings and a requirement to broadcast over a much larger area.



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What are small cells (or micro cells)



Small cells (also known as micro cells or pico cells) are smaller antenna systems designed to work over a very short range, perhaps only a hundred metres. They complement the existing macro network by providing a signal to areas where macro cells might find it difficult to reach or where additional capacity is needed, such as high-usage urban areas to ease congestion (e.g train stations, stadiums etc.).

Because they only need to cover a short range, the power output is typically much lower than a larger macro base station. Small cells are generally either wall-mounted, or pole-mounted.

- ▶ Wall-mounted small cells. A wall-mounted antenna is normally located externally. The antenna is enclosed within a plastic case, similar in appearance to a security alarm box.
- ▶ Pole-mounted small cells can also be mounted on existing street furniture - typically a CCTV camera pole or lighting column.

Macro network vs. small cells

	Macro cell site	Small cell
Range	300m to 16km	10m to 100m
Height	Average height from 15-20 metres (urban monopoles) or up to 30 metres (base station).	Typically attached to existing street furniture such as lamppost or to the side of a building.

Figures here are based on a typical site. Specific sites may vary based on locational needs.

How are network deployments designed and considered?

When designing and building their networks, mobile network operators' primary consideration is to consider their customers' coverage, capacity needs, and demands. While cost, aesthetics and minimising the environmental impact are always considerations, the radio engineering requirement is the priority, ensuring that there is continuous coverage, a strong signal and enough capacity. The customer must get the best possible coverage/capacity through an operator's well-designed radio access network. Mobile operators are subject to strict planning laws, which set out rules and guidance as to how mobile network infrastructure can be situated and to ensure it fits in with existing landscapes as much as possible.

Infrastructure sharing

Mobile operators often share passive infrastructure, that is the poles and the masts, to reduce the need to duplicate costs and minimise the impact on the landscape. This is further promoted by the telecom's regulator, Ofcom, which states that it "encourages mobile network operators to share masts and/or sites where possible".¹

Neutral host solutions

Neutral host solutions can also be used to provide multi-network operator coverage to further complement the wider network. These are particularly suitable indoors, where duplicate equipment is difficult to install. This solution could also assist outdoors in dense locations where site availability is difficult.

Guidelines on radio frequency exposures

All UK mobile phone operators design, build and operate their installations, both macro cells and small cells, to comply with the guidelines set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Independent surveys by the UK regulator have shown that radiofrequency exposure from UK mobile phone installations is hundreds of times below these guideline levels.

¹ Ofcom - <https://web.archive.org/web/20150220114723/http://licensing.ofcom.org.uk/radiocommunication-licences/mobile-wireless-broadband/cellular-wireless-broadband/policy-and-background/site-sharing/>