

Networks of boosters could transform mobile phone signal in rural blackspots

4 April 2016, by Tim Brown, University Of Surrey



Spot the mobile phone mast. Credit: Nicolas Nova, CC BY-NC

There is exponential growth in 5G mobile communication technology, which will deliver terabits of data to mobile smartphones and tablet computers every second. For users, this will mean faster file download speeds on the move, and clear uninterrupted Skype video conversations from anywhere.

We already know, however, that as soon as a mobile device is taken out of town and into green pastures, 4G, 3G and even sometimes 2G services become patchy, even non-existent. This is because masts need to be deployed typically every 20-30km, and sometimes even more frequently, and this becomes difficult in [rural areas](#).

Historically, erecting mobile phone masts in rural areas was fraught with difficulty, especially in places of outstanding natural beauty. Nowadays, the situation has changed – people need to be connected and the demand for more masts has risen.

A compromise has been reached in many cases by creating masts that are camouflaged as trees to fit in with the surroundings, particularly where other trees are present. This is all very well but the [trees themselves obstruct the air waves](#) that are transmitted and received by the base station and prevent them from propagating as far as possible. This fundamentally is a problem because the base station mast is not normally allowed to be higher than the height of the trees or it will be too conspicuous.



All manner of disguises... Credit: George Rex, CC BY-SA

Large [base stations](#) in rural areas do not often make a lot of sense from a cost point of view – as one mast serves only a few users. So is there an alternate for rural villages, hamlets and even farms?

Boosting the signal

An analogy can be used here in which we compare a ceiling light to a desk lamp. We need the ceiling light to see the furniture and other obstacles in a home or office, but it is sensible to use a desk lamp to provide additional light to read or write at the desk. We could also have brighter ceiling lights, so that they illuminate the desk well, but that may waste more energy than is necessary.



The ol' desk lamp analogy. Credit: Shutterstock

This is like the mobile technology situation in rural villages and hamlets, where smaller base stations – so small they often go unnoticed (they could be just a small box on top of a building) – can be deployed, like desk lamps, to provide coverage where it is most needed. The possibility to do this in recent times has only come about due to the increased broadband connectivity to rural villages.

Additionally, they can be placed on top of high buildings, such as towers or church spires, in such a way that they go unnoticed. Farm houses would struggle to get coverage this way, but there do exist "booster" devices that can be used to extend coverage into the farmhouse from a far away base station. In some cases, even satellites are used. Such devices are normally attached to the exterior of a building and are wired to a further device inside that will re-transmit the signal, thus boosting the interior signal.

Small base stations and boosters may solve the coverage problems in homes, but how do they help someone who is taking a country walk in the remotest parts of Cornwall? And more seriously, someone who has a broken leg in a deep valley and needs to dial for help?

5G services also aim to connect billions of devices wirelessly using the Internet of Things, where many "things", usually electronic devices that could even be attached to living animals, are linked in some way to the internet. This could mean, for example, that farmers will not lose any sheep as each one will wear a wireless device which can be tracked on the internet.

Some low frequencies and very high transmitter masts used to broadcast television already reach most areas of the country, but they are beginning to be used [for mobile services as well](#). I think this will be the answer for 5G services in rural areas because they will have the capability to reach as far as television broadcast transmitters do at present. However, more work will be necessary to extend them to operate for mobile services.

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