

# WIRELESS HACKS

*100 Industrial-Strength Tips & Tools*



O'REILLY®

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## Aligning Antennas at Long Distances

By working methodically and communicating well, you can easily bring up wireless links several miles apart.

The farther apart your points are, the harder it is to aim your antennas. At distances up to five miles or so, this is rarely a problem. Just so long as you have enough total gain to overcome the path loss, which you should have calculated by now [Hack #81]. At greater distances, getting the antennas pointed directly at each other can be quite tricky. Here is a list of techniques that might help you get your dishes pointed where they need to be:

- Use mobile phones or FRS/GMRS radios [Hack #9] to maintain communications between the two points while you're aiming the antennas. It helps to have at least two people at each end (one to manipulate the antenna, and another to coordinate with the other end). Radios often work much better in areas where mobile phone coverage is spotty.
- Set up all of your network settings ahead of time, so there aren't any variables once you get to the remote site. Check all gear, ping each box, and even transfer a file or two to be sure that your equipment works at close range. You don't want to question it later if you have problems getting the link going.
- Use a tool like the Wavemon [Hack #33] or Kismet [Hack #31], or a good built-in client [Hack #20] to show the signal strength and noise readings in real time. This kind of tool is your best friend, short of an actual spectrum analyzer.
- Work on one end of the link at a time, slowly changing one variable at a time, until you see the maximum signal strength and lowest noise at each end of the link.
- If you have one handy (and your link budget permits it), first try an omni or sector antenna on one end of the link. Once you find the other end of the link, replace it with your dish or yagi and tune it in. Typically, the higher gain the antenna, the shorter the beam width, and therefore, the harder it is to aim.
- Sweep slowly, and don't be afraid to go beyond the best perceived signal. Most antennas have smaller side lobes that appear as false positives. Keep moving until you find the main lobe. It should stand out significantly from the others, once you find it.
- Many times, particularly with offset dish antennas and yagi antennas, the antenna appears to be aimed too low or far to the left or right of the other end of the link. This is normal. Don't worry about how it looks, worry about finding the greatest possible signal.

- Do *NOT* touch the actual antenna while taking a reading. Resting your hand on the antenna interferes with the radiation pattern, and drains your signal very quickly. Take your readings with all hands clear of the equipment.
- Don't forget to compare horizontal and vertical polarization. Try the antennas in both positions, and use the one that shows the lowest noise.
- Once your link is in place, consider using WEP to discourage others from attempting to connect to it. If you want to provide wireless access at either endpoint, set up another gateway, preferably with caching services (such as caching DNS and a transparent web proxy, like Squid). This helps reduce the amount of traffic that goes over the long link, cuts down on network collisions, and generally makes more efficient use of the link.

It can take all day to properly align antennas at a great distance, but it can also be fun, with the right group of people. Just take your time, think about what you're doing, and be sure to leave time at the end of the day to celebrate!