

How to Prevent Oscillation in Signal Booster Systems

Oscillation occurs in any electronic or informational system where a positive loop exists between the system's output and input. You probably know it by its common name – “feedback”.

So, What exactly Is Oscillation, or Feedback?

The most well-known example is audio feedback in a system with a microphone and loudspeaker. The microphone registers the input, and transmits it to the speaker for amplification.

However, when the speaker broadcasts the sound, the microphone picks up some of this emitted sound, and it gets passed back through the system. This results in the high-pitched howl that we're all familiar with - which gets worse if the microphone user inadvertently walks towards the speaker.

Oscillation in Cellular Signal Boosting Systems

Unfortunately, cellular signal booster systems are not immune to feedback. Although the consequences are different, the root cause is the same as with the microphone/speaker: it's the positive feedback loop between the output and the input.

A cellular signal boosting system consists of a receiving external antenna and a transmitting internal antenna. It's purpose is to improve reception inside a building with otherwise weak signal strength.

The system works like this: the external antenna receives a signal outside the building, then transmits it inside to the internal antenna, via an amplifier if necessary. The internal antenna then broadcasts the signal inside, resulting in stronger signal where it's needed.

How Oscillation Creeps In

Oscillation occurs when the broadcasted signal from the *internal antenna* gets picked up by the *external antenna*, and passed through the system again - just like the microphone and loudspeaker.

The result is a background “noise” across a wide range of radio frequencies, which is the equivalent of the howl of the microphone in the audio feedback situation. This feedback causes interference, which leads to poor reception on the phone or device being used.

A signal boosting system suffering from oscillation can actually interfere with the reception of any phone in the vicinity, regardless of the phone's assigned network. This is because the oscillation actually causes “noise” on a wide range of frequencies, even if the system is tuned to receive signal from just one network.

Car cellphone booster systems can make this problem mobile. if they aren't configured correctly, they may produce oscillation that interferes with the reception on other phones in the vicinity of the car as it moves!

Eliminating Oscillation In Your Booster System

Increase the distance between antennae, and you'll reduce oscillation. As mentioned, the problem arises when emitted signal from the internal antenna reaches the external antenna and gets passed back through the system.

If you can set the antennae far enough apart to ensure that the external antenna receives negligible signal from the internal antenna, then you can greatly reduce or eliminate oscillation.

How Far Apart is Enough?

The answer depends on the system, and the signal in and around your location.

In short, the "loss" of the feedback signal over the distance between the antennae needs to be smaller than the "gain" of the system – i.e. how much the signal is boosted by. The difference between system gain and feedback loss should be at least 20 decibels to allow for fluctuations in the environment (I.e. from passing cars).

Practically, this simply boils down to finding a good location for the external antenna. Trial and error works well here - place the external antenna, then test for oscillation. You may need to try a few locations to find the sweet spot of desirable boost with acceptable feedback. Quality external antennae may well have an oscillation meter built in to let you know when oscillation is too high.

Your choice of external antenna will also affect the oscillation in the system. Directional antennas are less prone to oscillation since they primarily receive signal from one direction. As long as they're not facing the internal antenna, they will contribute much less to systemic oscillation.

Reducing Oscillation When More Distance isn't an Option

If you've already fixed your booster system in place and are experiencing oscillation - or if you simply don't have the option to move the external antenna further out -you may still be able to reduce the feedback.

Firstly, make sure that the antennae are not pointed at each other.

Beyond that, you can get creative - try placing a metal baking tin or oven pan behind the external antenna. This should only affect the boosted signal strength slightly, if at all, and has the advantage of blocking much of the feedback signal from the internal antenna. Users have reported surprising reductions in oscillation from homemade solutions like this. In theory, any sort of metal plate or foiled board should suffice – the only challenge is to affix it firmly behind the external antenna.

Now you have an understanding of what oscillation is, why it occurs, and how to avoid it from scuppering your signal boosting efforts.