

Understanding Digital Television Reception Problems

Carl Sundberg – KMTR TV Engineer

Without question, it's easier to receive the old analog TV channels than the new DTV channels. The reason is very easy to understand. If you are listening to drum beat where there is a very loud echo, you can count the beats easily as long as the beat is very slow. As the drum beats speed up, it gets harder and harder to tell if you are hearing the primary beat or the echo and at some point, that echo makes it impossible to be able to count the actual beats.

Analog TV had one primary signal that locked up the entire receiver. That signal pulsed at 60 times a second. The new digital signal has 8 beats that pulse at a total rate of over 19 million times a second. Because television signals can't be heard by our ears, we don't realize that television signals can have echoes just like sound. With an old television signal, we could see those echoes. They appeared as a secondary image that made the picture look like there were ghosts in the background of all images. Because the main signal that caused the receiver to work was at a rate of only 60 times a second, most TV receivers could lock up to that slow rate signal even when there was an echo present. Like you, listening to a slowly beating drum, the receiver could readily properly figure out what was the main beat it needed to use.

Since TV signals can literally bounce off of everything, signal echoes are every where. You can not eliminate them completely. Like a person listening to a drum beat where echoes can be heard, you can reduce the number of echoes by making your ears more directional by cupping the palm of your hand over your ear. If you use a funnel to listen through, you can really make your hearing very directional. We utilize this concept to make microphones more directional. Microphones used to record orchestras are usually very long tubes with the pick up element in the end of the tube.

Since your new digital TV or converter box is trying to receive multiple pulses that are cycling at an extremely fast rate, it gets very important for your antenna to be like the orchestra tube microphone. It needs to be pointed at the strongest signal and it needs to eliminate as much echo as possible. The traditional rabbit ear and loop antenna is a little more like a human ear. They pick up signals that come from all directions. If you use one of these devices with an amplifier, you not only amplify the signal, but the echoes as well. So, amplified antennas of this design can actually make it harder for your digital TV to work in cities where there are strong signals.

Below are some pictures of set top antennas that are more directional than rabbit ear type antennas. Both of these antenna types not only pick up the signals better in one direction, they also block some of the echoes that are coming from behind it.



Both of the two antennas shown above are designed to work with UHF channels 14 through 65. When the digital channels everyone is using switch to some VHF (channel 2 through 13) and some UHF, these channels will require a different type of antenna. The antenna on the right has traditional dipoles (rabbit ears) folded into the case. Directional antennas will be important for the VHF channels, but they suffer less from echoes than the higher UHF channels because their wave length is longer and it takes bigger objects for their signals to bounce and make an echo.

Signals can be blocked by anything. Some objects block signals better than others. Metal objects and hills block signals very well, but you can even see a change in signal when a person walks by an antenna. For this reason, to get the best and most steady signal, an outside antenna, at least 15 feet from the ground is the best kind of antenna. By being at least 15 feet above the ground, you will be reducing echoes that come from passing cars and trucks. Another reason outside antenna's work best is because they have more room to be larger. To make an antenna very directional, the pick up elements need proper spacing. This spacing takes length. The antennas above have many elements, but it would be even more directional if they were longer for better element spacing.

Don't be surprised if an outside antenna works best when you point it in a direction away from a station. Many antenna installers will tell you they have pointed antennas at metal roof tops or water towers to get the best signal. If you have a hill in the way, sometimes you can find a metal roof top on a hilltop house that will make a good signal reflector for that hard to find, clean, echo free signal. Below is a picture that shows how multiple signals can cause a receiver to have pick-up problems.



Good luck with this new technology. And always remember, echoes are what cause a signal to be difficult to receive. Very directional antennas work the best.