The Multipath to Clarity
Receiving HDTV over the air takes luck and lots of patience

By Philip Yam

Keep the antenna level. Rotate it 90 degrees. Move it a few inches to the left. Stand to the right. Hold it a bit higher ... there--nope. Try again.

That has been my high-definition television (HDTV) experience. I plunged into the alphabet-soup world of digital television (DTV) in 2003, shortly after I replaced my electron-gun boob tube with a 42-inch plasma flat panel. I hoped to enjoy beautifully crisp images--only to see what a lousy picture my Manhattan cable company was piping in. The larger screen amplified flaws in the analog signals, which not only produced images muted in detail and color but also added faint lines and speckles, not to mention scratchy audio. I was too cheap to fork over the $15 monthly fee for digital cable, which included only a few HDTV channels anyway. So I decided to snag the signals over the air, just like the old days.

Local stations around the country are making the change to digital, thanks to a 1997 Federal Communications Commission mandate (see www.dtv.gov). To smooth the transition, the FCC allows broadcasters to deliver both analog and digital signals over the TV spectrum (channels 2 to 69). If you can get standard over-the-air television, the mantra goes, then you can get digital.

So I spent some $300 for a set-top box, the Samsung SIR-T351 HDTV receiver, and then rooted around in one of my storage bins for the right antenna. Broadcasters in my area beam DTV on the UHF band (channels 14 to 69), so I grabbed the outline bow-tie antenna. (Rabbit ears work for the VHF channels 2 to 13.) I laid the bow tie against my west-facing window, trying to catch the signals originating from transmitters atop the Empire State Building a mile to the north. I turned on the receiver and watched my TV screen flash to life--with a "No Signal" message.

Actually the problem was too many signals. Reception in cities is notoriously bad, because the broadcast bounces around as it strikes the tall buildings. As a result, signals arrive at an antenna along many paths and at different times. The receiver has to sort through this mess and figure out which signal to lock on to. It's like trying to identify the real lightbulb in a hall of mirrors.

In analog TV, such multipath distortion shows up as ghosts. As a kid, I used to tweak the antenna continually and maybe even pound the top of our TV's wood cabinet. Reception did not have to be perfect: I could still follow Get Smart through the multiply warped images.

No such luck with digital, which is all-or-nothing: if the multipath problem is severe, the tuner will not produce any image or sound whatsoever. The only recourse I had was fiddling with the antenna (plasma TVs are too thin to pound). I managed to pull in digital broadcasts of WPIX (channel 33) and WABC (channel 45) and only sporadically at that.

I had stumbled headlong into the problem identified in the late 1990s by the Sinclair Broadcast Group, based near Baltimore. The company conducted field tests suggesting that indoor reception may not be possible. The U.S. transmission format is called 8-VSB (for 8-level vestigial sideband), which is more susceptible to multipath distortion than the European system, called coded orthogonal frequency division multiplexing, or COFDM. The 8-VSB format requires less power to broadcast and packs in more data each second (19.4 megabits compared with 18.66 for COFDM)--useful for "datacasting" services. But 8-VSB did so poorly in multipath environments that Sinclair urged the FCC to switch.

Although my experiences echoed Sinclair's findings, I figured I should give 8-VSB an honest shot with a better antenna.
Based on posts on the AVS Forum (www.avsforum.com), a consumer electronics board, I tried the Gemini Silver Sensor. Looking like a miniature rooftop Christmas-tree antenna, this indoor model is supposed to be a ghost buster.

I also sought help from www.antennaweb.org, which recommends an antenna based on street address. The site shows the channels that you can receive and the direction to point your antenna. It told me to aim at the Empire State Building, which I knew could not work--too many intervening buildings. The only way I could receive HDTV was to capture a strong reflected signal.

In the antenna world, bigger is often better, so I also tried something more radical and not particularly aesthetic: an outdoor UHF antenna, used indoors. Called a four-bay bow-tie antenna, it spans about two feet by three feet--among the more compact types of roof antenna. (Even so, you had better have an exceptionally understanding family.) Sure enough, it enabled me to pick up WNBC.

Still, reception was sporadic. I would stand in the corner of the room, moving the cumbersome antenna slightly this way and that as the receiver teased me with moments of signal lock. At other times, I located a sweet spot and left the antenna in place, only to lose the channel when the weather changed.

In January I suddenly picked up WCBS with my Silver Sensor pointed south. Then came WWOR, followed by WNYW after I put the antenna on top of a couple of boxes stacked on a speaker. Finally, I could pick up all the channels being transmitted from the Empire State, albeit with some effort. Something had changed. I looked down the avenue and saw an apartment tower going up a few blocks south. New York City's ever changing skyline had redirected HDTV toward me, at least for the moment.

I live on the 11th floor, and I cannot imagine that those closer to street level will be able to pick up local stations reliably, a fact that could be important once broadcasters cease analog transmissions. At that time they will give up channels 52 to 69. Four of those will go to public safety; the others will be auctioned off for wireless services. The target turn-off date is December 31, 2006, on the condition that 85 percent of the market served by the broadcasters can get digital (2009 or 2010, realistically). Unfortunately, the 85 percent figure counts those who have the equipment even if they cannot receive DTV because of multipath distortion. In sticking with 8-VSB, the FCC gambled that improving technology would save the day.

It is shaping up to be a smart bet, as receivers get better: first-generation models handled ghosts that lagged the main signal by no more than 10 microseconds and were no stronger than half the main signal. New circuitry made by LG Zenith can cope with time differences of 90 microseconds and multipath signals as strong as the main one, the company claims. Its performance convinced Sinclair to drop its objections to 8-VSB. As of this past March, however, LG had not offered these units for sale.

New antennas may also help. Dotcast, based in Kent, Wash., designed an active E-field antenna, which is being marketed by Winegard Company and Terk Technologies. It looks like a mini version of the radar antenna on vintage aircraft carriers. A special amplifier inside boosts only the electric field signal picked up by the antenna, Dotcast says, while ignoring other radio-frequency waves. The narrow, 27-inch-long Dotcast antenna, which should be available this year for about $120, is supposed to function as well as a five-foot-long roof antenna.

HDTV does not transform the viewing experience the way TiVo and DVDs do. And there are growing pains. On WCBS football games, some on-screen graphics did not show up. A space shuttle launch momentarily appeared during a high-def broadcast of ABC's Desperate Housewives (it was not a lame sex joke). But once you see the clarity and color and hear the digital 5.1 sound, there's no turning back. I want my HDTV. I just wish it were easier to get.

Further Reading
- How Do Eclipse Photographs Get Made?
- Phoning It In: Software Turns Mobile Phone into Personal Newscam
- News Bytes of the Week--Second coming: The new iPhone is here
- Musicophobia: When Your Favorite Song Gives You Seizures
- Microsoft, Google Fighting for Unused Spectrum between TV Channels
- Antigravity: Catalogue Gizmos of Questionable Efficacy
- The Switch Is On: Compact Fluorescents
- Video: CES: Day Three Coverage