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My Return to OTA

A broadcast engineer goes 'back to the future'

by Dane Erickson, *7.09.2008*

Editor's Note: Dane Ericksen, a senior engineer with Hammett & Edison in the San Francisco area and longtime SBE National Director, relates his experiences in setting up a terrestrial DTV system in his Sonoma County home.

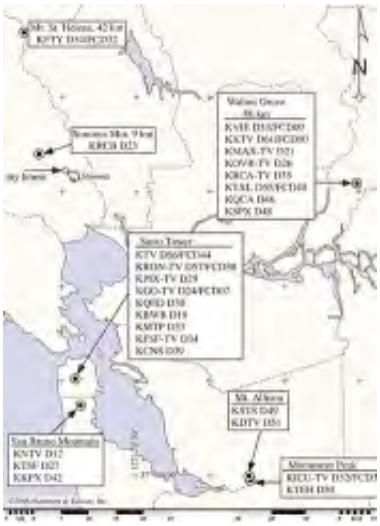

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Fig. 1: Bay Area DTV sites, based on Lambert conformal conic map projection. Map data taken from Sectional Aeronautical Charts, published by National Oceanic Survey. Geographic coordinate marks shown at 15-minute increments. City limits shown taken from U.S. Census Bureau TIGER/Line 2000 data.

SONOMA, CALIF.
After almost 20 years of cable TV, I decided that it was finally time to return to over the air.

Since my house is more than 60 km north of the Sutro Tower in San Francisco, and almost 70 km from San Bruno Mountain, another multi-DTV station transmitting site, this meant installing a rooftop antenna (Fig. 1). That, in turn, meant adding a support mast, bringing in a down lead cable, and routing the cable through existing walls so the feed could be accessed by my living room TV. Not impossible tasks, but not trivial tasks, either.

My house is a single-story residence in Sonoma County, just outside the Sonoma city limits. As shown by the satellite photo in Fig. 2, it's a nice quiet neighborhood with a fair number of trees. I was a little apprehensive that after taking all the antenna-installation steps I might not have useable DTV reception. This is because as shown by Supplemental **Figure S1** my house lacks line-of-sight to Sutro Tower and to the San Bruno Mountain antenna farm just south of San Francisco (for interested readers, all of the supplemental figures are available for viewing on the H&E Web site, **www.h-e.com**). However, the Terrain Integrated Rough Earth Model (TIREM) predicted service from both San Bruno Mountain (Fig. 3) and from the Sutro Tower (**Fig. S2**). So, I decided to make the hardware investment that would allow for OTA.

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THE INSTALLATION

My first discovery was that no manufacturer makes a VHF high-band/UHF-only rooftop antenna; since there are no VHF low-band DTV assignments in the San Francisco Bay Area, I didn't want to deal with the greater element and boom lengths of a conventional VHF-UHF rooftop antenna.

So as shown by Fig. 4, I combined an Antennas Direct Model DB4 two-bay UHF bow-tie antenna having 14 dBd gain with an AntennaCraft Model Y5-7-13 VHF high band antenna having 7 dBd gain. I then used a 3 dB combiner to feed a 16 dB gain Channel Master Model Titan 2 mast-mounted preamplifier. Since I wanted the ability to experiment with DTV reception from several sites, I also installed an AntennaCraft Model TDP-2 rotator.

(click thumbnail)

*Fig. 2: Satellite photo and topographic map of the author's house. Geographic coordinates are 38-18-19N, 122-29-23 W, NAD83; site elevation is 31.4 m (103 ft.) AMSL. Satellite image and map courtesy of Acme Mapper 2 (**mapper.acme.com/about.html**)*

As shown by **Fig. S3**, an existing gable above my garage made a convenient mounting for an 8-foot mast, which gets the antennas just above a beautiful cherry tree that occupies my front yard. Plus, from the street, you have to look hard to even spot the antennas (**Fig. S4**). The coax and rotor control cables were brought into my attic using a RadioShack wall feed-through tube, part number 15-1200A.

There is pass-DC 3 dB splitter in my attic, with one leg going to my living room, where a power supply inserts its DC voltage up to the coax to power the preamplifier. The other leg goes to a guest bedroom. As shown by **Fig. S5**, an F-fitting antenna discharge unit (ground block) was installed at my roof gable, and a ground wire was connected to an existing utilities ground wire next to the side of my house. While lightning is rare in Sonoma, prudence and Section 810 of the National Electrical Code require that a rooftop antenna be grounded. Since I had one mast mounting bracket left over, I used that as a pipe clamp. I was going to trim off the unneeded legs, but decided that the clamp looked sort of neat as installed, and so left the legs on.

A NEW DTV WORLD REVEALED

I purchased a Samsung Model DBTH260F 8-VSB tuner,

I purchased a Samsung Model DTVT2000 S-VSB tuner, which has a fifth-generation chip set (**Fig. S6**). Programming the tuner was straightforward, and the initial channel search returned 16 DTV signals with 46 program streams—impressive. The Sutro Tower UHF DTV stations showed 8 out of 10 bars in the signal strength display mode. The KNTV D12 signal from San Bruno Mountain was weaker, at only 3 bars, but that has proven sufficient to give only rare (and momentary) freeze frames.

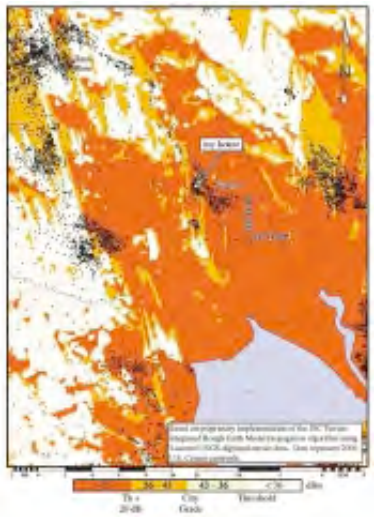

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Fig. 3: Terrain Integrated Rough Earth Model (TIREM) for KNTV-DT, D12; 103.1 kW ERP (DA) at 376.6 m HAAT. Based on the proprietary implementation of the JSC TIREM propagation algorithm using 3-second USGS digitized terrain data. Dots represent 2000 U.S. Census centroids.

As shown by Fig. 5, taken using a Rhode & Schwarz Model FSL6 spectrum analyzer, the receive carrier levels for the UHF signals are around Ð60 to Ð70 dBm. As shown by **Fig. S7**, D12 from San Bruno Mountain was significantly weaker, at Ð98 dBm. Note the DTV pilot feed through from KCBA-DT, D13, Salinas, transmitting from Fremont Peak, 193 km to the south, and feed-through of the KOVR-TV, N13, Stockton, visual carrier. KOVR-TV transmits from a 610-meter tower near Walnut Grove, 86 km east of Sonoma.

Fig. S8 shows two mountain ridges between my house and the Walnut Grove antennas, so it's surprising that any N13 signal is seen. Plus, the Figure S7 spectrograph was taken with my rooftop receiving antennas aimed south, not east.

As an unexpected bonus, I found that not only could I also receive the Monument Peak/Mt. Allison DTV stations, but that the long over-the-bay paths shown in **Fig. S9** didn't seem to bother my reception. And, the antenna orientation for all four sites was the same from my location. The only disappointment was no signal from KFTY-DT at Mt. St. Helena, 42 km to the north. That path has only one relatively minor blockage, so knife-edge refraction should provide plenty of signal. But, nothing. A check of the CDBS shows an out-of-core D54 license for 30 kW ERP and an in-core FCD32 CP for 19.9 kW ERP. Given this relatively modest D54 ERP, and the presence of a co-channel NTSC station, KTEH, at Monument Peak, I suspect that no KFTY reception will be possible until that station shifts from D54 to FCD32.

Fig: 4: Author's hybrid VHF high-band/UHF antenna combination is lightweight and wasn't too difficult to install. The pre-amp is mounted between the two antennas.

CECBs

I ordered a Sansonic Model FT-300A coupon eligible converter box (CECB) and a RCA Model

DTA800B CECB. The Sansonic CECB worked great, and has the same excellent sensitivity as my Samsung tuner. Like the Samsung, setup of the Sansonic CECB was easy (**Fig. S10**).

The RCA CECB (**Fig. S11**) was a disappointment; it had markedly less sensitivity, and had difficulty holding lock on the weaker KNTV D12 signal. Indeed, the RCA CECB was right in the nether region between a perfect DTV signal and no DTV signal. The RCA CECB remote control was also much worse, requiring a kluge approach of entering your TV receiver's remote control code for audio control.

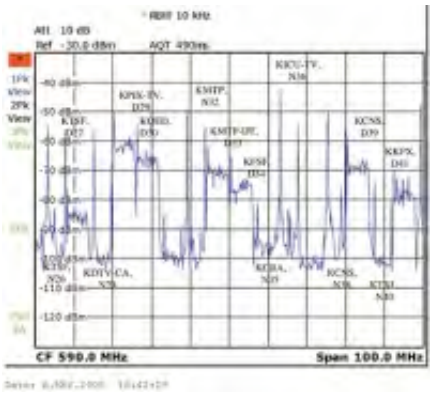

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Fig. 5: The middle of the UHF band as received at the author's house.

Because of its excellent performance, the Sansonic CECB is now doing service in my guest bedroom, where a second antenna outlet was installed. The RCA CECB should be suitable for use at my daughter's San Francisco apartment; even using an indoor, back-of-set low-gain antenna should provide sufficient signal for this sensitivity-challenged CECB.

SUMMARY

So, to paraphrase the famous MasterCard commercial: UHF antenna, $59.99; VHF high band antenna, $19.99; pre-amplifier, $56.99; antenna rotor, $64.99; mast and mounting hardware, $60; coax and rotor cables, $30; handyman charge to install antennas, $200 (I am recovering from a motorcycle accident broken leg, so ladder climbing is a no-no for now); Sonoma Phone Man charge to route cables through existing walls and add coax outlets, $234; Samsung HDTV tuner, $179.99; Sansonic CECB, $19.99 (after coupon); RCA CECB, $19.99 (after coupon); total, $946. The ability to not worry about my local cable company telling me that it will be turning off the analog signals on my cable service and that I will have to start renting digital cable set-top boxes: Priceless.

Mr. Ericksen is a senior engineer with Hammett & Edison, Inc. Consulting Engineers, near San Francisco. He is a registered professional engineer (P.E.), and holds SBE CSRTE, 8-VSB and CBNT certifications. Mr. Ericksen is Chairman of the ATSC TSG S3 Specialist Group on Digital ENG and serves on the SBE Certification Committee. He is in his sixth term as a SBE National Director and is currently the SBE Chapter 40, San Francisco, Secretary.