

TechTalk 87
DATV Testing Report
- Part 4 (Field Testing)
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This is the fourth OCARC TechTalk article describing the testing of the Digital-ATV station that we had planned.

TechTalk77 describes the initial exciter bench tests.

TechTalk78 describes 1 mW field test in a RACES drill.

TechTalk83 describes bench testing the entire station.

This month we report on the results we obtained in field testing of a Digital-ATV portable unit in the City of Orange, here in Southern California.

Some Background

The authors are both members of the OCARC, but they are also members of the RACES emergency communications group for the City of Orange, called COAR (City of Orange Amateur Radio). For years, the COAR group had equipped itself with analog-ATV equipment intended to send field pictures to the city Emergency Operation Center (EOC) located inside the Orange Police Department building. But for years, COAR has been frustrated by the quality of the ATV pictures being received by the EOC. The 440 MHz analog-ATV quality was degraded because the signal path typically included elevated-freeways, 2-story residential homes, 1-to-3-story commercial buildings and a "forest" of backyard trees and tree-lined streets. The only good transmissions occurred if we parked the portable ATV transmitter on a hilltop with a clear signal path back to the Orange PD building.

Members of the COAR team had speculated that perhaps Digital-ATV might provide the solution to improving the quality of our field video transmissions.

The DATV Equipment

Fig 1 is a block diagram of the set-up used during the recently completed field tests of DATV. The transmitter, and power amplifiers and SetTopBox (STB) receiver have all been described in more detail in the early TechTalk testing reports.

Another ViewSat VS2000 DVB-S STB was purchased on eBay for installation inside the EOC Radio Room for the purpose of conducting these DATV field Tests. The eBay cost of this FTA STB unit was less than \$60 including shipping. Fig 2 shows the new STB (bottom unit) being tested side-by-side to Ken W6HHC personal STB receiver before the field tests began.

The frequency used for the field tests was 1.292 GHz. Ken W6HHC had planned to set up the test frequency on 1.2915 GHz, but discovered that the STB menu would NOT allow him to enter 0.5 MHz digits. The Symbol-Rate was set to 2.2 MS/sec...producing an DVB-S RF BWallocated of 3 MHz. The Forward Error Correction (FEC) was configured to 1/2.



Figure 2 – Bench testing the ViewSat STB for OPD

The receiving 1.2 GHz antenna (Fig 3) was a 24-element loop-Yagi antenna mounted 3-stories high on top of the Orange PD building. The loop-Yagi antenna is made by Directive Systems (in Maine US). A Down East Microwave LNA for 1.2 GHz was installed for the field tests to drive the received DATV signal down 250+ feet of coax to the EOC Radio Room receiver.

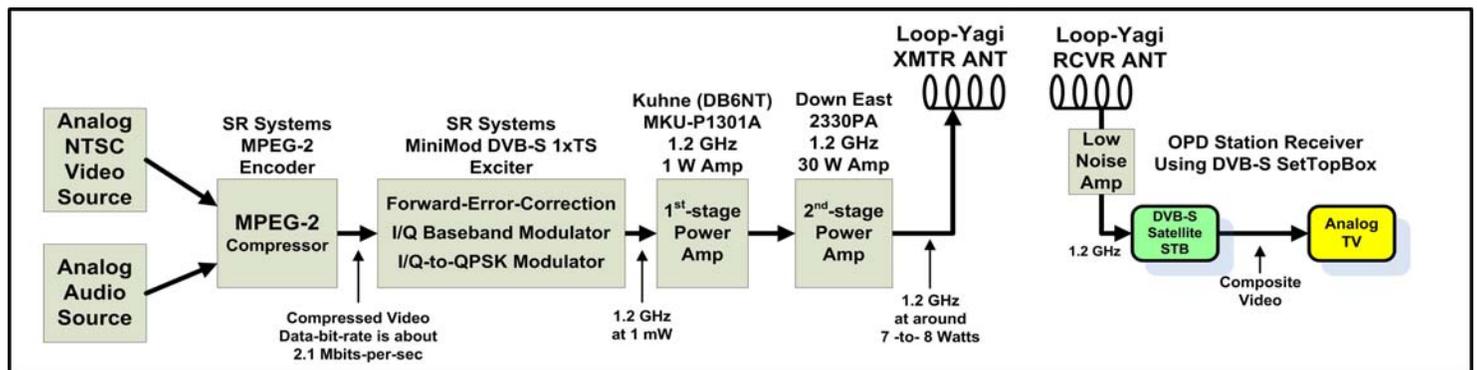


Figure 1 – Block Diagram of DVB-S Transmitter and Receiver for DATV Field Tests

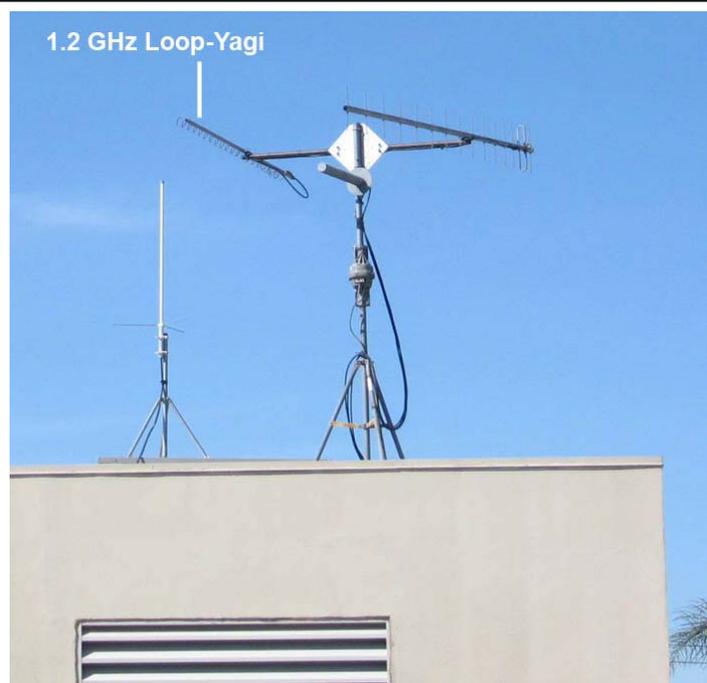


Figure 3 – 1.2 GHz Loop-Yagi on roof of OPD

The field transmitting antenna is also a 24-ele loop-Yagi from Directive Systems that Robbie KB6CJZ keeps in his closet of spare antennas. **Fig 4** shows a typical set up of the portable antenna during the field tests. The loop-Yagi is mounted on 25-feet of Radio Shack stacking masts.



Figure 4 – Bruce KC6DLA adjusts direction for the Field set-up of the 1.2 GHz Loop-Yagi

COAR member, Bruce KC6DLA, provided the field masts and a clever mast-support system that mounts to the roof-rack of a station wagon or mini-van....see the mast support details in **Fig 5** and **Fig 6**.



Figure 5 – Mast-brace attaches to roof-rack



Figure 6 – The car tire secures the support base and prevents mast from slipping.

First Field Test – El Modena High School

The first DATV test site we chose, the parking lot of the El Modena High School, was picked because COAR RACES had tried analog-ATV tests on 440 MHz from this location two years earlier with extremely poor video quality...P1 or P2 at best. But P1 or P2 was not the video quality that COAR RACES wanted to show to the Police or Fire Chiefs or to the Mayor of the city in the EOC room. The test distance is only 3.2 miles, but includes one elevated freeway, three-story apartment buildings, homes, 2-and-3-story commercial buildings, and plenty of trees.

While Robbie KB6CJZ and Steve KI6DDE manned the OPD receiving station, Ken W6HHC set up the DATV transmitting station in the back of his mini-van...see **Fig 7**. Just to be prepared, Ken also set up a STB receiver with a “sniffer” antenna and a notebook computer display to confirm that a video picture was actually being transmitted...if there was a lack of picture at the OPD. You can see the Notebook display in the center of the **Fig 7**.

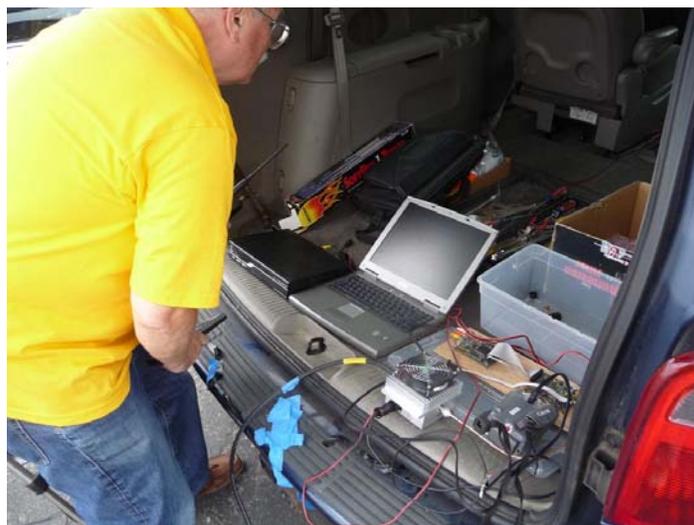


Figure 7 – Field DATV transmitting station in back of MiniVan (sniffer receiver display in center)

Steve KI6DDE reported seeing a picture at the Police station from El Modena High School, even before Ken could finish setting up his "sniffer" receiver. The picture was perfect! Robbie KB6CJZ reported that the QUALITY monitor on the STB menu displayed 100%.

Fig 8 and **Fig 9** show the quality of the DATV signal that was received in the EOC Radio Room.



Figure 8 – First received DATV Video at OPD

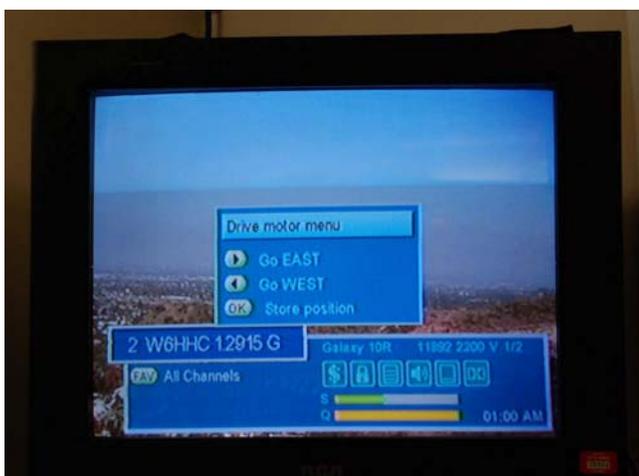


Figure 9 – The SetTopBox QUALITY meter said 100%

The only testing problem we had was that we could not get any of three video cameras working correctly. Later we discovered one camera had the power unit set to CHARGE instead of VIDEO, a second camera that was producing out-of-focus pictures had been set to manual focus, and a third camera could deliver tape video, but not camera video. The field team was amazed at their diminished trouble-shooting skills under the pressures of field testing!

Luckily we had a previously-recorded ATV tape in the one camera...and played back the tape into the DATV transmitter. We felt we had accomplished "proof of concept" for DATV quality by evaluating the tape transmission.

Second Field Test – AMTRAK Train Station

The second DATV test site we chose, the parking lot of the AMTRAK train station, was picked for two reasons. First, COAR RACES had also tried analog-ATV tests on 440 MHz from this location two years earlier with extremely poor video quality...just P1. Second, COAR had been asked to test DATV at an upcoming RACES drill for the city. We knew that we would be asked once again to supply video from the AMTRAK station during the RACES drill. The test distance is only 1.8 miles, but includes, 2-story commercial buildings, 3-story University buildings, homes, and plenty of trees. We had to aim the 1.2 GHz antenna right into a pair of large leafy trees, about 75 feet away.

A picture was reported at the EOC Radio Room as soon as the transmitter switch was turned on. Again Robbie reported the DATV picture was perfect and the SetTopBox QUALITY meter read 100%.



Figure 11 – Robbie KB6CJZ views received DATV Video inside EOC Radio Room



Figure 12 – First live Camera video from AMTRAK Train Station is received as DATV at OPD.



Figure 13 – Ken W6HHC keeps an eye on the DATV transmitter at the AMTRAK Field Testing Site



Fig 15 – At DATV Field Site during Drill are (L-R): COAR Members Dave KG6RWU, Bruce KC6DLA, and OPD Volunteer Dan Claypool (Antenna is aimed straight into two trees on left)

Third Field Test – City “Mock EOC Drill”

The Police Department conducted the planned “mock EOC” drill for the City of Orange in order to test the abilities and training of Police Department volunteers, including COAR RACES communications volunteers to provide support for city EOC officials and staff and to provide communications from the field in a simulated train wreck incident. As expected, COAR was directed to provide DATV video from the simulated medical triage area in the parking lot of the Amtrak train station. A perfect DATV picture was being received at the EOC with only 10 minutes of travel time and 10 minutes to set-up the portable DATV equipment.

The received DATV signal was first displayed in the EOC Radio Room. The video was then distributed to large-screen LCD many displays inside the EOC room itself, as shown in **Fig 16**.



Figure 14 – Live video as received in EOC Radio Room during the RACES Drill (analog TV display)



Figure 16 – Live video as received in EOC RACES Drill is distributed to large-screen displays

Fig 14 shows the quality of the received video as seen on an analog CRT TV display. **Fig 17** shows the crisp clarity and quality of the DATV video distributed onto a large-screen digital display. Robbie KB6CJZ has commented that sweep-speeds and camera shutter speeds prevent these JPEG photos from really capturing the great quality he was actually seeing with his eyes on the CRT TV display.



Figure 17 – This close-up of a large-screen display in EOC Room show the clarity of received DATV.

Robbie did notice that some pixilation occurred on the DATV video when a fast moving bus passed quickly down the street within our field of vision.

Conclusions and Plans

In overview, the authors and other COAR members were very pleased with the DATV video they had obtained from our initial set of field tests. It was very encouraging to see DATV overcome the analog-ATV problems of multi-path reflections and weak signals. From the same locations that had been previously tried with 440 MHz analog-ATV with extremely poor results, COAR was now receiving 1.2 GHz Digital-ATV with really great video quality.



Figure 18 – Members of COAR RACES and other OPD Volunteers gathered in the EOC room after the drill to begin a debrief session

Digital-ATV really does produce higher-quality video than analog-ATV under adverse conditions!!

The authors have plans to do more field testing to eliminate the slight pixilation situations seen in these first field tests. Perhaps a slightly higher Symbol-Rate...or an FEC setting with slightly less-redundancy might make a difference to reduce the observed pixilation. We used D1 video resolution in these tests. It will be interesting to compare the quality of HD1 video resolution with D1 in an attempt to reduce the NDBR (payload) we need to support for a chosen Symbol-Rate.

It has been a really fascinating journey for the authors to see DATV progress from a study...to planning a station...to testing the station. Our DATV field testing has really confirmed the robustness of the DVB-S Digital-ATV signals.

Interesting DATV Links

- ARRL-TAPR DCC 2009 paper on "Planning a DATV Station on DVB-S" – www.TAPR.org/pub_dcc28.html
- TAPR PSR Quarterly Journal Issue 111 on DVB-S Modulation Overview – see www.TAPR.org/psr.html
- Amateur Television of Central Ohio WR8ATV (First US DATV Repeater) – see www.ATCO.TV
- British ATV Club - Digital Forum – see www.BATC.org.UK/forum/
- British ATV Club - select from about 25 streaming repeaters – see www.BATC.TV/
- German portal for DATV streaming repeaters and downloads – see www.D-ATV.net (in German)
- AGAF D-ATV components (Boards) – see www.datv-agaf.de and www.AGAF.de
- Lechner DATV Boards - <http://lechner-cctv.de/d-atv-dvb.151.de.html?mwdSID=9agn7phuiu46fvm2ok3aueltf3>
- Complete ready-to-go DATV transmitters – see www.d-atv.org/D-ATV-Modulator.pdf
- SR-Systems D-ATV components (Boards) – see www.SR-systems.de
- DGØVE microwave amps, up-converters, down-converters – see www.DGØVE.de
- Kuhne Electronics (DB6NT) RF Amplifiers – see www.Kuhne-Electronic.de
- MiniKits (SMT kits for RF amplifiers) – see www.MiniKits.com.au
- Melbourne DATV Repeater VK3RTV – see www.VK3RTV.com/latest.html
- Orange County ARC newsletter entire series of DATV articles – see www.W6ZE.org/DATV/