"Project Phoenix"

Software for DX Reception of 32-line NBTV Test Cards

Abstract:

A proposal for a software program to pull Narrow-bandwidth Television images of still pictures out of the noise and give Amateur TV a new lease on life.

Background:

NBTV is an acronym for Narrow-band Television, which is a low-definition mode for sending and receiving moving or still images. It was most popularly used in the mid-1920s to send TV pictures over long distances via radio transmissions in the HF spectrum. Mechanical scanning equipment was used on both the transmit and receive functions. Although there was considerable interest in NBTV when it was first introduced, problems with synchronizing the images, along with the greatly improved definition of all-electronic 525-line television systems, made NBTV a historical relic by the end of the 1930s.

Toward the end of the Twentieth Century, interest in NBTV was renewed to the point that several workers and organizations began experimenting with the medium. Peter Yanczer, K0IWX, in the USA; and the members of the Narrow-bandwidth Television Association ("NBTVA") in Britain have been actively refurbishing and recreating historic mechanical television sets. Several mutually exclusive formats are used. In the USA, various configurations of 24, 48 and 60 horizontal scanning lines, some employing interlacing, are being resurrected. By contrast, the UK generally prefers either 30-line or 32-line vertically scanned formats that have a history going back to John Logie Baird's pioneering work.

More Recent Developments:

The proliferation of personal computers allows for software that can convert video signals from webcams or camcorders into any desired NBTV format. Prerecorded material of both a historic and a contemporary nature can be played on an audio Compact Disc and displayed on a computer screen using such software. The UK operators have taken the lead here, and their NBTVA standard of 32 vertically scanned lines has pretty much become the modern standard. The majority of this activity is off the air, but there is at least one NBTV net taking place on Saturday mornings in the UK on the 40 Meter band.

NBTV and the Future of Amateur Television:

Amateur Television ("ATV") is at a crossroads, at least here in the USA. With digital HDTV supplanting 525-line NTSC analog TV, the long-term outlook for obtaining analog hardware is dim. Not only that, but in an environment where electromagnetic spectrum space is getting harder to protect, can we continue to justify a 4.5 MHz chunk of territory for each ham TV channel? Couldn't all that bandwidth be used more efficiently?

Some of us believe that digital ATV ("DATV") is the way of the future. They point out that it has the potential to provide better video resolution with a narrower bandwidth. But DATV is expensive, complicated, and has the annoying characteristic of displaying a blue screen when the received signal strength falls below a critical level (which always seems to occur when something of vital interest is being transmitted). And do we really need a high-definition picture? Speaking personally, I've reached an age where I'd rather prefer a lower definition likeness of myself being sent over the air. Many of my Amateur Radio colleagues are in the same boat, whether or not they'd care to admit it.

All of this brings us back to NBTV. Depending upon the number of scanning lines and frames-per-second, an NBTV picture can occupy between a single sideband's worth of spectrum up to 100 kHz or so. That's a tremendous savings of bandwidth compared to analog television.

It's a more efficient mode of operation in another way, too. The narrower bandwidth will reach out much farther before it blends into the noise. Let's assume that our 4.5 MHz analog TV signal can span a radius of ten miles. Let's further assume that our VHF or UHF NBTV signal can span a radius of fifty miles, which ought to be safely conservative. The 525-line analog signal covers an area of 314 square miles. The NBTV signal covers 7,850 square miles. Isn't it obvious that the latter scenario provides many more potential hams to contact? And isn't the lack of a critical mass of participants the biggest problem with ATV at present? Is it reasonable to expect operators interested in moving-image communication to invest big money in DATV if it permits no greater participation than the present analog TV?

NBTV as a VHF/UHF DX Mode:

My investigation of NBTV has shown me nothing about the mode's potential for working new grid squares on VHF or UHF. Therefore, here is a scenario for a way of exploiting that potential:

We know that NBTV can send and receive moving pictures, but imagine that you're transmitting a continuous still picture of your callsign test pattern (or test card, as I understand it's called there). Just so we can start out gradually, we'll generally follow the NBTVA format of 32-lines vertically scanned, with an aspect radio of 3:2 vertical to horizontal, giving us a minimum image that is 32x48 pixels, or 48 columns of 32 rows. The vertical sync consists of two consecutive rows of black, one comprising the end of one frame and the other beginning the next. Just to make it easier for the software, we'll make it a rule that only the vertical sync can be all black across all 32 columns. The program reads in a frame of video, unravels the sync bars and displays a real time picture. It also reads the frame into memory and displays the memory alongside the real time picture. It does the same thing with each successive frame, only each time, all the frames in memory are averaged, and the average value of each pixel is displayed. So, assuming we limit our picture to solid black and solid white only (no halftones), and we assign an arbitrary value of 100 to black and 0 to white, any pixel with a value averaged over time to be less than 50 will be displayed as white, and greater than 50 as black.

It won't take many frames until the software is statistically confident of what each pixel was intended to be. I would not be surprised to find that only a couple of second's worth of transmission at 12.5 frames-per-second will provide a good image regardless of noise. Someone with better mathematical skills than me can figure out how degraded the receive image can be and still allow adequate deciphering.

I would call this software program "Phoenix" after the mythical bird that rose from its own ashes. It has yet to be written. I'm still determining the best way to begin, but anybody has my permission to beat me to it!

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The original document can be found at:
http://www.qsl.net/nb4tv/Project Phoenix.pdf