Microwave ATV – A New Approach!

This article was originally presented as a paper at the 2006 Microwave Update in Dayton, Ohio and published in the *Proceedings*. In it W3HMS challenges the reader to consider other frequencies, such as 3480 MHz and 10 GHz, as possible alternatives for ATV use.

By John Jaminet,* W3HMS

Amateur Television (ATV) has, since its inception in the 1950s, used the 420–450 MHz band for both simplex and in- band AM repeaters. This was necessary in the early days as little equipment operated well above 2 meters and reception was often accomplished using converted UHF TV tuners with poor sensitivity. The pictures were often marginal, with rolling, without color, and without sub-carrier sound. Those close to repeaters will argue differently, but in the fringe area where I found myself, the best pictures were rather pathetic by the commercial color and sound standards of the day. Sound was often transmitted on 2 meters, which did offer two-way discussion of the picture on the screen. Sub-carrier sound as the broadcasters did it was the exception rather than the rule, and sound-on-carrier required an additional receiver. The transmitters classically used crystal signals doubled and tripled to the output frequency, often 439.25 MHz, using cathode AM modulation.

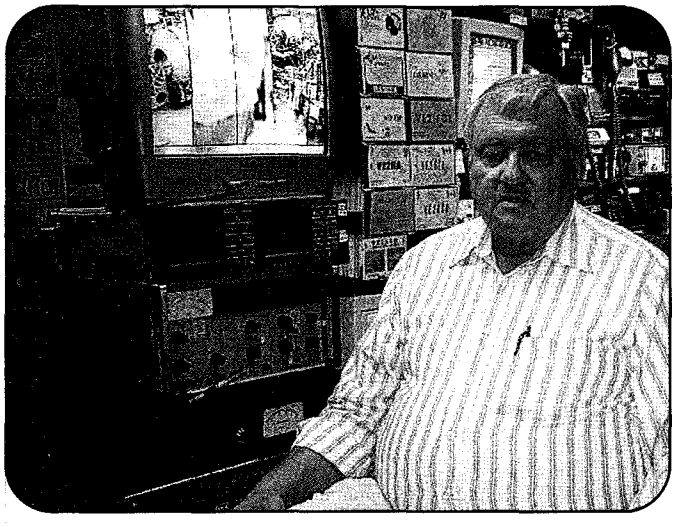
ATV picture at the author's QTH.

A Visit to Switzerland

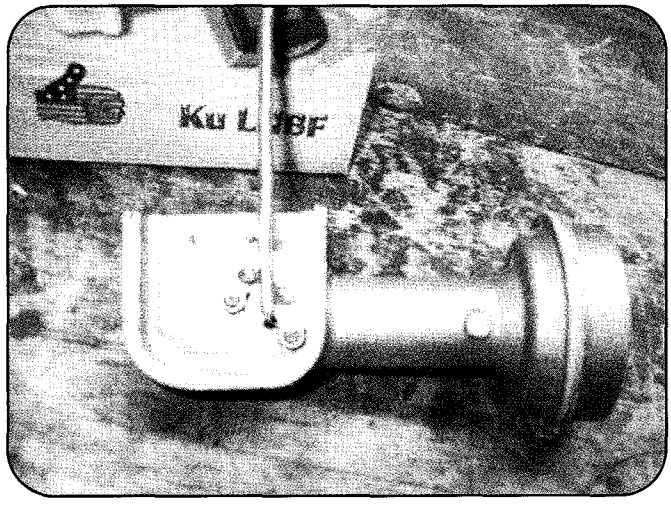
In the fall of 1997 I found myself at the QTH of Michel, HB9AFO, near Lausanne. During one evening in his shack I had the pleasure of seeing a rock-solid 1255-MHz FM ATV picture at 18 miles between Switzerland and France. It was great—like a painting on the wall—except for the plume of smoke from his pipe coming across Lake Geneva in France! This was the day that I knew there must be a better way . . . and there is! It is FM and the microwave bands.

Another reason why I visited HB9AFO was to see his world-class 10-GHz ATV equipment. He and his partner then held the

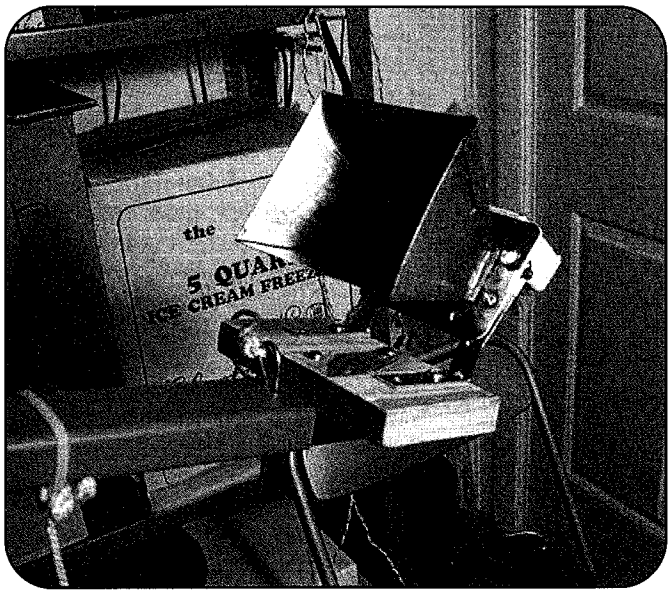
*912 Robert St., Mechanicsburg, PA 17055
e-mail: <W3HMS@aol.com>



The author in front of his ATV ham station.



The KU-band LNB (low noise block) for 10 GHz ready to be resealed.

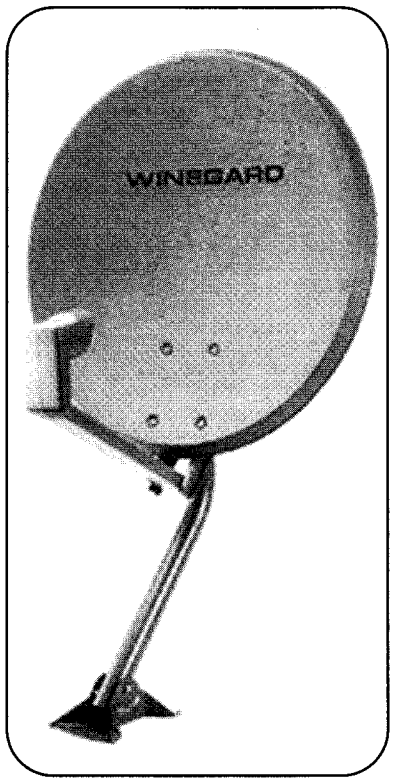


A 3.4-GHz offset dish feed.

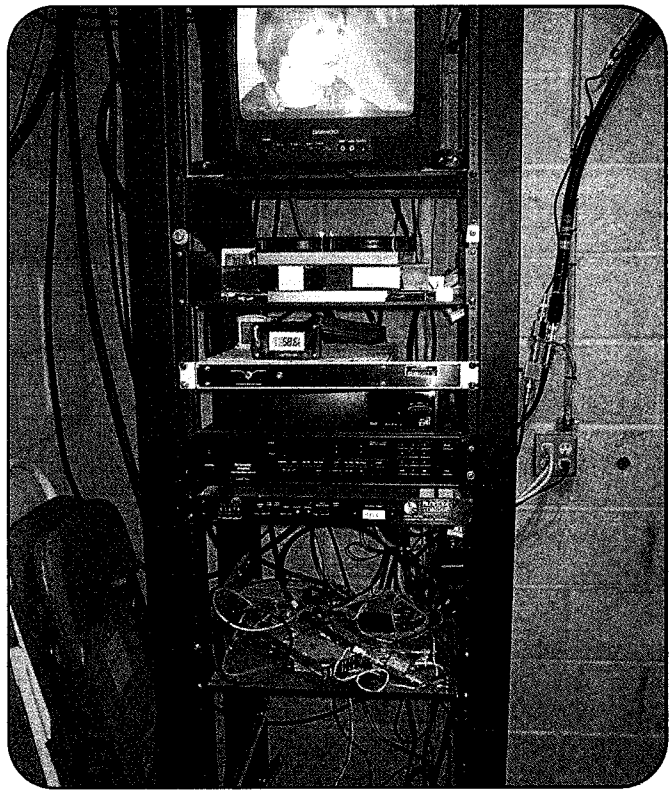
world DX record at about 410 miles. I was impressed by the use he and colleagues made of Ku-band satellite components such as LNBs and antennas. Indeed, F6IWF had developed a modification for a popular LNB that brought all the power of engineering and production for a mass-produced item and gave hams a super-performing LNB for relatively low cost. The same was true for 60 cm and larger offset dishes.

My 10-GHz Work

I had always wanted to work 10 GHz with a Gunnplexor in sound and in video. Therefore, I obtained an LNA from F6IWF and two LNAs with 9-GHz oscillators from the U.K. These were put into service with ham-fest-grade U.S.-style satellite receivers which tune 950–1450 MHz and 18-inch offset dishes using feeds designed from the W1GHZ HDL.ant PC program. For video transmitted on 10,300 MHz, the IF is 1300 MHz. I ran periodic tests with Joe, WA3PTV, and we gradually extended our personal DX records in ATV to 51.6 miles using only 10 milliwatts on one leg of the QSO. The other leg used just 250 mw and a 24-inch dish. In both cases we had



A 24-inch offset dish. →



The White Rock ATV repeater as of January 31, 2006.

P5—that is, broadcast-level pictures—in full color. Our 10-GHz efforts then turned to CW/SSB and contesting.

FM vs. AM Video Modulation

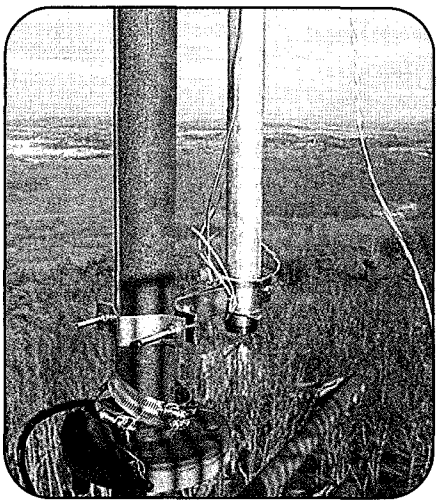
With respect to modulation, FM offers considerable advantages over AM with respect to picture quality, just as it does for audio quality when compared to AM, particularly in a fine music environment. To me this is clearly evident in the snow-free pictures received with a signal level of AM P3, which appears as P5+ in FM.

Microwave ATV

For an ATV repeater, the 9-cm band at 3300–3500 MHz offers the possibility of using modern, high-quality components designed for the mass market without modification for transmitting commercial-grade pictures in FM. Additionally, to the best of our knowledge this band has no competition from data communication or other unlicensed devices. With an input on another band, the user can see his own pictures at the same quality level as other viewers see it. In addition, the use of 2200-MHz separation permits the LNB and the transmitting antenna to be close on the same station tower without QRM, and it eliminates filters at the repeater and at QTH stations. Hams have found that filters are always costly, bulky, and difficult to tune and, it seems, become untuned from time to time. Thus the absence of filters is a real plus.

SMRA Microwave ATV Repeater

In the Carlisle/Harrisburg, Pennsylvania area the South Mountain Repeater Association is now operating a dual-band repeater using 1280-MHz FM input and 3480-MHz FM out-



The White Rock 3480-MHz repeater site view at 100 feet.

Gary Blacksmith, WA3CPO, holding the 23-cm omni antenna. It is designed to be well protected from intruding insects.

put. We are currently repeating NASA shuttle audio and video when no signals are in the 1280-MHz receiver. Local reception provides an outstanding, full-color, snow-free picture. In fact, our DX record is 63 miles with this kind of picture. It is perfectly legal to rebroadcast NASA video, which most viewers receive with a 24-inch dish, Dishnet type LNB, and a Free to Air MPEG-2 Traxis DBS-2800 receiver purchased on the internet. The beacon/repeater is on full time—that is, 24 hours per day 7 days per week—for months at a time between shutdowns!

The project leader for this most ambitious project is Gary Blacksmith, MD, WA3CPO, who has obtained an excellent site with a 100-foot tower and 7/8-inch hardline cable from the transmitter to the antenna. Our transmitting antenna is a vertically polarized omni on 3480 MHz with a gain of 11 dBd made by Stella-Dorus in Ireland.

We are using a commercial-grade exciter with 1 milliwatt output to the Toshiba 40-watt amplifier. This exciter is very small, about the size of a commemorative postage stamp, but its performance characteristics are superb. The amplifiers, which need only 1 mw of drive, are often used by 9-cm weak-signal operators, of which I am one. The transmission antenna is either a panel antenna with about 135-degree coverage or a commercially made omni with 11 dBd gain. We use vertical polarization on both reception and transmission, as omnidirectional antennas for this polarization are more readily available than horizontal antennas. To improve the picture quality of all input signals, we use a Time Base Corrector, a model ATV-8710. The video/audio controller is the model ATVC-4 Plus by Intuitive Circuits.

Sound

The sound subcarrier input to the repeater on 1280 MHz is 5.5 MHz. The sound subcarrier output on 3480 MHz is 6.8 MHz. Both frequencies are quite common in the world of satellite TV.

Toshiba 40-watt Amplifiers

We have found that the Toshiba 40-watt amplifiers get *very hot* in the summer months with 24/7 use, and they require a *large* heat sink with the fins pointing up. By large, we mean about 2.5 times the surface area of the amp. This large heat sink is cooled by two 5 inches across blowers in parallel, so if one fails the other will continue. In addition, we have installed thermometers designed for indoor and outdoor use on the amps with the outside probe mounted on the hottest part of the heat sink. The summer temperature difference between chassis and the hottest part of the heat sink is often 20–30° F. Since this rework, we have had excellent service for the primary White Rock repeater and the new 3420-MHz