A Modular, High-Performance 23-cm ATV Transceiver

Here's an easy-to-build design by GM4PLM using low-cost, readily built ATV modules.

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Amateur Fast Scan television has been a part of the hobby that has fascinated me since my early days in amateur radio. I can still remember the thrill of watching those early 70-cm black-and-white transmissions using a modified domestic TV set I acquired from a trunk sale. My first real introduction to Amateur Television (ATV) was as a young man through a local ham, Barry White, G8YGT. He proudly showed me his beautifully kept Pye Image Orthicon camera and home-brewed 70-cm transceiver in his small, home-built studio at the back of his house. Barry kept my imagination flowing with stories of his days as a cameraman for prestigious, and now historic, TV programs such as Sunday Night at the London Palladium.

Those stories and visits to his studio gave me an interest that has never left me, and over the years I have enjoyed numerous bouts of ATV activity on 70 cm and 23 cm using both home-brewed and commercial equipment. In recent years my ATV activities were curtailed because of antenna problems at my small QTH, but a recent move to a new QTH and access to wide-open space brought me back to ATV with a renewed enthusiasm to "get going again."

I was quite shocked, however, when I picked up a copy of the British Amateur Television Club (BATC) magazine, CQ-TV. Technology certainly had moved on during the few years I was away from it, and the pages were now packed with readily available equipment for 23 cm, 13 cm, and even 10 GHz. The impact of the SATTV (satellite TV) market was also readily visible, with some of the vendors offering a variety of modules and surplus equipment from the market for use on the amateur bands. The introduction of other technologies, such as Wireless PC networking, also seemed to be having an effect, with readily available equipment that was only dreamed of a few years before. Things certainly had moved on very quickly, but all to the ham's benefit, that's for certain!

I decided that a good start would be to build a new station using some of the available modern components rather than try to resurrect some old equipment I had, which definitely was in need of some TLC to get it going again. Finally I decided I would build a new transceiver for the 23-cm ATV band using some of the ready-made modules available on the pages of CQ-TV. This course of action would allow me to construct a new transceiver that would perform well with the minimum amount of construction and alignment time. These modules certainly seemed to be able to offer quick access to the band with the minimum amount of fuss, a far cry from a few years ago.

After some deliberation I finally decided to buy some of the products from Giles Read, G1MFG. Giles runs a small, but busy internet and magazine mail-order business that specializes in ATV products (see <http://tvham.com>). He also has a great customer approach and a keen interest in home construction. I was pleased...
that he could answer all my queries quickly, and a set of mod-
ules was soon on its way to Scotland. Incidentally, Giles has a
U.S.-based presence as well and has been featured in the
American ATV magazine *ATVQ*. He has become quite well
known on the other side of the pond for his ATV activities.

The modules were delivered quickly and came safely pack-
aged, including detailed instructions for each of the modules in
the form of a small booklet.

Figure 1 shows a block diagram of the transceiver that forms
the basis of the transceiver I constructed. It is based on four
modules from Giles—a receiver, a transmitter, a controller, and
a solid-state power amplifier. The only module not supplied by
Giles was the DC power supply, which is an external 13.8 VDC
supply. I decided from the outset that the modules would be
built into a small desktop case so that it could reside on one of
the shelves where I house a lot of my equipment. Of course,
you don’t have to follow this construction pattern, and you can
house the modules in any suitable enclosure that meets your
needs. It really does not need to be anything spectacular, but I
would advise using a metal enclosure, as it is an RF

Before describing how the whole unit fits together, it’s worth
looking at some of the features of each of the modules, as they
will work as standalone units if required.

**Module 1: Synthesized Transmitter**

This module comes built and working. Its size is just amazing!
It’s simply a case of mounting the unit into the chosen
enclosure. As the transmitter only runs low power, at this point
I decided not to enclose the unit in a smaller screened housing.
I mounted it directly in the main chassis. The board measures
125 × 60 × 18 mm, and I was amazed at the very low compo-
nent count. There really is hardly anything on this board!

The biggest component is a screened tinplate unit that hous-
es all the RF components. Other than input sockets for
audio/video and DC power, there is not a great deal else on the
board to talk about! RF out is fed via a small microwave-type
SMA socket, which is a good choice. They are easily available
at low cost, perform well at these frequencies, and nicely fit
miniature low-loss PTFE coax.

Frequency selection is made via an 8-way miniature PCB-
mounting, DIL-style switch, which in a standalone unit selects
the operating frequency from a PIC microprocessor. Frequency
steps are selectable in 500-kHz steps and will cover the whole
of the 23-cm amateur band. The board requires 12–18 VDC and
produces between 50 and 100 mW RF output.

**Module 2: Receiver**

The receiver module looks similar in style to the transmitter
module but is slightly larger, measuring 150 × 60 × 18 mm.
Again, the board looks sparsely populated, although it has a few
more components than the previously described transmitter.
It is also dominated by the metal-screened RF module at one end
of the PCB. RF input is again via a microwave-style SMA sock-
et. Audio and video outputs are via phono-style sockets, with
sockets for 6- and 6.5-MHz sound outputs. The DC connector
is also a 2.1-mm DC-style item (tip positive).

As in the previously described transmitter, this unit requires
12–18 VDC. Frequency control is selectable in 500-kHz steps
in exactly the same manner as the transmitter, using an 8-way
DIL PCB switch and a PIC microprocessor. A small onboard
LED shows the PLL is locked. This version of the receiver range
is the Platinum model, which includes a video de-emphasis fil-
ter on the PCB.

**Module 3: LCD Transceiver Controller**

Although both transmitter and receiver units can act
autonomously, in a transceiver it would be rather unwieldy to
keep adjusting the internal DIL switches every time a frequency
change is necessary. To overcome this problem, a companion
controller PCB has been introduced. This module contains a
PIC microprocessor, which provides the frequency control sig-
nals directly to the transmitter and receiver synthesizers instead
of the onboard PICs (that are removed) and DIL switches.

There are a number of benefits, other than simply allowing
easy control of both transmit and receiver modules, to be
derived from using the controller module. Because frequency
control is no longer restrained by the limits of an 8-digit bina-
ry number programmed by the DIL switches, the frequency-
control step resolution can be increased to 125-kHz steps. This
can also be used to extend the receiver range, although the
rear panel to be switched between transmit and receiver modules. This connector is switched using the transmit/receive control line. Make sure the relay you choose is capable of carrying the power you are running through it, and that it is also rated at 23 cm. Otherwise you will find that it becomes lossy and could turn out to be an unwitting dummy load.

RF interconnections between the modules were made using miniature PTFE coax and small SMA connectors. These connectors are an excellent choice at these frequencies. They allow good, reliable, and (more important at microwave frequencies) low-loss connections to be made between the modules. This is particularly important where (a) low-power connections are made and poor connections would lose that power, or (b) high-power microwave transmissions in the wrong type of connector can cause heating because of high losses and potential damage to RF modules and connectors alike. Choosing the right connector and cables at these frequencies is very important. SMAs are readily available these days and are quite cheap as well.

Connecting the units is a quite simply matter of wiring together the DC control lines and RF, audio, and video connectors.