P5

The newsletter of the
Severnside Television Group

September 2003

ATV by Satellite

Just a reminder that the amateur television broadcast via satellite are back on again from Sweden on Sirius 2 at 5 degrees east of south on a Saturday or Sunday morning.
Further details are on the Parabolic web site www.parbolic.se

International Television Contest

From Sat 13th September at 7pm until Sunday at 1pm, please do your best to come on the air. Ken, Ivor and myself will be in the usual location on top of the Mendips. We hope to be able to work 10GHz 2.3GHZ and 1.3GHZ. Even Brian GW6BWX & Pat are threatening to go out portable on one of the mountains near Snowdonia National Park - weather permitting!

GB3ZZ

During the recent hot spell of weather a problem occurred at Filton due to excessive heat which was investigated, additional cooling was installed to keep the TX & amplifiers cool, hopefully in October the engineering team will restore GB3ZZ back to it's former power, with all the problems other groups are experiencing once a repeater go off air we are reluctant to close it down for it's annual overhaul so the plan is to sort out any problem's while still maintaining a service even if this means reducing the power for a short time.

Aerials

Aerials are still in stock for those of you who wish to purchase any.
Please remember it's the sale of aerials, which enables us to keep the repeater going

Sad News

John Ashton G4NTS passed away after a long illness. Ivor and I attended John's cremation at Torquay on behalf of our group. Members of the Torbay Television group also attended the cremation.
John will be remembered in the south west for all the hard work and effort he put into amateur television, constructing a repeater in Weymouth before moving to Devon.
He also helped with the TV repeater on Dartmoor and finally with the Torbay television repeater.
John also took over the manufacture of the 23cms preamps which most of us use today.
His wife Sue, his relatives and friends will all miss him. His involvement in our hobby will keep our memory of him alive

Viv, G1IXE

LATE NEWS - *** WEST OF ENGLAND RALLY ***

Longleat may be history – but watch out for an announcement about a new rally soon!

Infra-Red Remote Control Systems. By Brian Kelly, GW6BWX

Just about every piece of domestic hi-fi or video unit comes with a remote control handset these days. Despite being so commonplace, when trying to find out how to emulate one for a project I'm working on, I found surprisingly little information on how they actually operate. Obviously, they flash one or more LEDs in some kind of meaningful sequence but how they prevent interaction between different units and are oblivious to bright room lights was something of a mystery until I worked out their secrets.

The Dark Ages.

First, a brief history lesson, taking us back all of 25 years. Before then the only remote controls were 'wired', they extended the front panel knobs and switches of the equipment to a duplicate set at the far end of the cable. These worked well but left a fairly hefty multi-core cable trailing across the room which was unsightly, and possibly dangerous as it had to carry mains power to the remote on/off switch. The first 'wireless' remote units were quite primitive and only had one function, to change TV channel. These only had one 'command' which was to move to the next higher channel number. It wasn't a problem back then because there were only three channels so it didn't take long to go full circle back to a lower number. They used an ultrasonic principle, the receiver was a microphone feeding a narrow band filter and the presence of a tone initiated the channel jump. The transmitter end, inside the handset was, quite incredibly, a tuning fork! A spring-loaded hammer hit the metal fork when the button was pressed and a tone was produced. The frequency was quite low, usually about 20Khz, just above hearing range. The problems with this system were two fold; only one 'command' was available and anything else making a similar noise would activate the receiver. One of my favourite tricks when working in the TV trade back then was to simultaneously change channel on all the TVs in the showroom by shaking my bunch of keys!

The Light Ages.

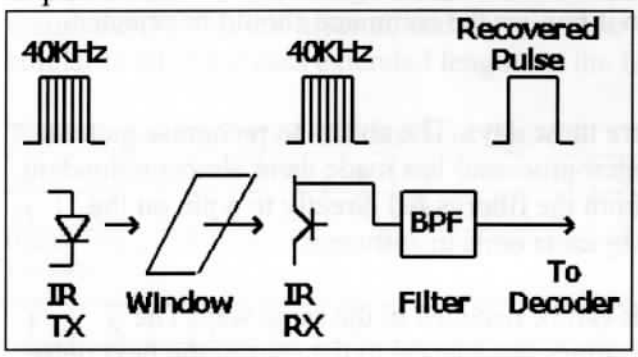
The first infra-red controls appeared about 20 years ago, its worth remembering that quality LEDs were not commercially available until the late 1970s and even then it took a while for bright ones to be developed. Infra-red opened a whole realm of possibilities because for the first time it was feasible to send coded commands and control more than one function. In the UK, Plessey and Philips were quick off the mark at making transmitter and receiver chip pairs. Unfortunately, and rather short sightedly, their first attempts assumed that only one receiver would be in range of a handset so they made no attempt to add coding to distinguish one receiver from another. I remember well how a close friend used to tear his hair out when he bought a very early 'DNT' satellite receiver and found it responded to his TV remote control as well as its own. No matter how hard he tried, he couldn't keep the TV on channel 6 to watch the satellite receivers UHF signal while trying to watch Sky TV. The simple task of changing satellite program involved placing his hands in various places on the TV to obscure the light beam while waving the remote around with his other hand! What made it all the more infuriating was that neither the TV or satellite box had manual controls yet he had to go right up to them to use the 'remote'!

I've digressed from technical matters. The fix to stop the wrong receiver responding was simply to add a special sequence of flashes, called the address field, to the flashes

conveying the command. Any receiver picks up the flashes but only the one recognising its particular address code would respond. This principle is still used right up to the present day. The problem of activating the wrong unit hasn't been completely eliminated, as there doesn't seem to be anyone controlling which addresses get allocated, at least for all but the RC5 and RC6 systems, which are licensed and controlled by Philips. However, the problem has diminished to a very few cases these days.

Filtering.

Before going in to the details of how the address and commands are represented by light flashes, lets take a look at the steps taken to make receivers immune to ambient light. If you think of the relatively low light output of a remote control handset and the need for it to be seen with bright sunlight shining directly at the receiver, you get some idea of why some sort of filtering is essential. There are three protection systems to allow the wanted light to be seen through the ambient light 'noise'. The first is a physical barrier to all but infra-red wavelengths. Usually, this is a plastic window on the outside of the equipment, dark coloured in visible light but transparent at the longer wavelengths of IR. Combined with a similar plastic window in the actual detector device, most of the spectrum is blocked from ever reaching the detector element. The second level of protection comes from an AGC circuit. This tracks the average light level, letting only instantaneous increases, such as the extra light flashes from the transmitter through. This has to be done because there are other sources of infra-red light around and the receiver must adapt to regard them as 'normal'. The final stage of protection is to use a carrier rather than continuous light pulse. Instead of simply turning on and off in the pattern of the bytes being sent, the zeroes are sent as no light, the LED is off, and ones are sent as rapid pulses. It is rather like 100% amplitude modulation on a carrier at around 40KHz, figure 1 explains all. The exact frequency varies from one manufacturer to another but generally lies within the range 35 to 45KHz. By using a carrier it is possible to electronically filter the signal from the detector, further lessening the chance of random pick-up being recognised. In recent times a new problem with filtering has arisen; that of low-energy compact fluorescent lamps. These lamps are becoming more and more popular but the light from them is actually rapidly pulsed, usually at around 50KHz and at such high brightness this can still produce signals than can squeeze through an electronic filter. The process of decoding the data should eliminate misinterpreted signals though.



Sending the bits.

There are three types of modulation and of each of these, a multitude of protocols. I will explain the common protocols later but for now, lets look at how the binary bits of the command are actually converted to meaningful light flashes. The first common system is called "space width modulation" and is shown in figure 2. In this system, the 'on' periods are constant and the gap 'off' periods are either short (typically 400uS) or long (typically 1200uS). A pulse followed by a short gap is deemed to be a 'one' and a pulse followed by a long gap is a 'zero'. The 'on' period itself is usually

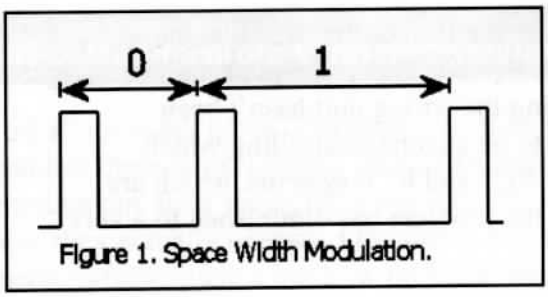


Figure 1. Space Width Modulation.

about 300uS long. Because the final gap is impossible to measure, an additional 'on' must be added to mark its end. This type of transmission is economical on battery life because only brief bursts of current are needed, as all 'on' periods are short.

Very similar to space width modulation is pulse width modulation, see figure 3. The same principle applies but this time the gaps are of constant length and the duration of the 'on' period is changed. It is slightly less economical on battery power to do this but it offers slightly better rejection of repetitive interference such as that from electronic lamps.

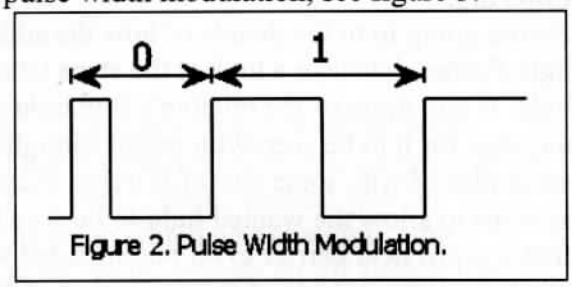


Figure 2. Pulse Width Modulation.

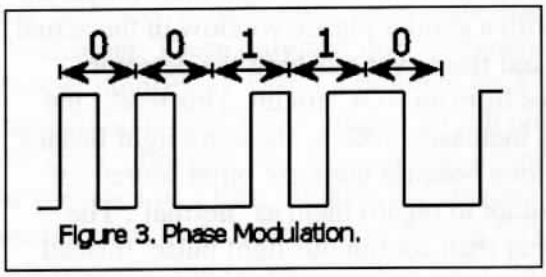


Figure 3. Phase Modulation.

The third common system is phase modulation, see figure 4. Timing is everything in this method as ones and zeroes contain both 'on' and 'off' periods. A 'one' is represented as an 'on' followed by an 'off'. A 'zero' is represented by an 'off' followed by an 'on'. In other words, the on and off are reversed between one and zero bits. This is a little more complicated than using straight forward timing differences but it has the advantage of better error rejection. Certain combinations of bits are not possible so if they are seen it implies the command should be rejected.

Receiving the bits

Command decoding chips are quite rare these days. The ability to recognise patterns and measure timing intervals with a microprocessor has made them almost redundant. In modern receivers, the one or zero from the filter is fed directly to a pin on the processor and the assembly back into bytes is done in software.

Both of the width modulation methods can be decoded in the same way. The processor waits for the start of a pulse, times the interval to the start of the next pulse and decides whether it lies between acceptable duration to be a one or zero. If it doesn't fit the expected times, the command is rejected and has to be resent.

Phase modulation can be decoded in one of two methods. The most obvious way is to rely on the known duration of one bit period. Usually, this is 1.778mS so if the sampling rate is twice that speed it is possible to detect the first and second halves of the bit separately. From this it is easy to decide whether the 'on' or 'off' came first and hence what the bit was. A second method is conceptually a little more complicated but easier to work with in software. It relies on the fact that the time between rising edges is always one, two or three bit lengths. One bit length implies no change in the bit polarity, two bit lengths means it must be inverted three implies a change and back again. As phase modulation protocols always start with a 'one', the

byte can be reconstructed by selectively inverting the following bits until all have been received.

The Protocol.

By protocol, I mean the way in which the combination and timing of flashes is made to convey information to the receiver. This is where each manufacturer takes their own route. In order to do something useful with the recovered bits it is necessary to treat them as a long word of ones and zeroes. Within the word is the address field and the command field. According to the manufacturers specification, the word is split into these two fields and the address is compared with one hard coded into the unit. When a match occurs, the unit knows it is seeing data intended for it and it then decodes the command field to see what action has been requested. The number of bits in each field is up to the manufacturer but is typically 5 bits for the address and 8 bits for the command.

Most of the width modulation systems use an additional protection method; the data is sent twice, first in normal polarity then with the bits inverted. Note that this isn't the same as inverting the signal to the LED, it means that the pattern of gaps and pulses is reversed. The unit's software inverts the second half and compares it to the first half. If they match, the command is deemed to be valid, if they don't, it is rejected.

Phase modulation usually follows the Philips RC5 or RC6 protocols. In RC5, the first bit is always a 'one'. The second bit is normally a zero but can be a one to signify an extended command is being sent. The third bit is called the 'toggle' bit and it has a special meaning. If a new key on the remote control is pressed, it is set to a one, if the same key is pressed again, or the key is held down so it automatically repeats, the bit is set to zero. The following five bits are the address field and the next six bits are the command. RC5 is not inverted and repeated like the other protocols. RC6 is very similar to RC5 but uses extended lengths in the fields.

The two protocol types are shown in figure 5.

1	0	0	0	1	1	1	0	0	0	0	1	1	0	1	0	...
A	A	A	A	A	A	A	A	D	D	D	D	D	D	D	D	...

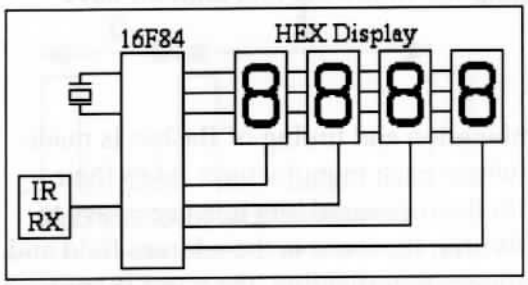
Here the address is 10001110 and the command is 00011010 and the whole sequence is repeated with ones turned to zero and vice versa.

1	X	0	0	0	1	1	0	0	1	1	0	0	1
1	E	T	A	A	A	A	A	D	D	D	D	D	D

In RC5 the first bit is always 1. the second bit is usually 0, the 'T' is only a 1 if a new key is pressed. The address here is 00110 and the command data is 011001.

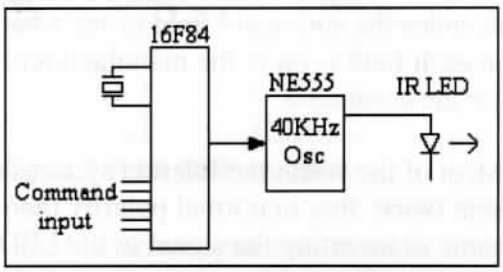
Home experiments.

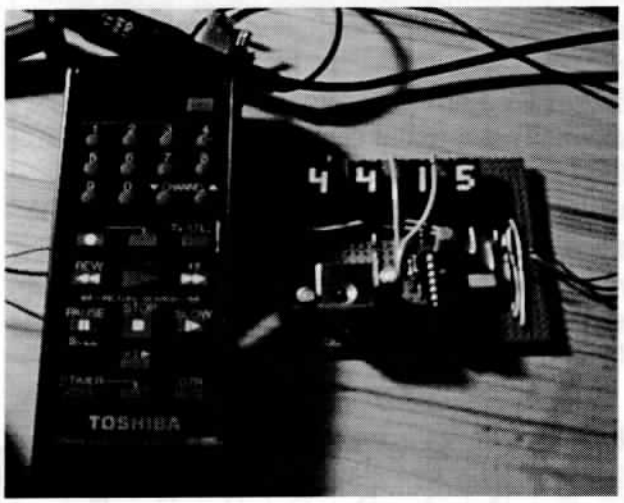
My interest in remote control comes about because I have a project that involves a need to control a VCR. I could wire directly to the electronics of the VCR but I decided to use a non-invasive approach instead. All the functions of the unit I need to use could be controlled from the hand-held remote unit so I decided to emulate it in software and aim an LED at the VCR instead. After a few attempts I managed to decode the pulses from the original remote and display the address and commands on a hexadecimal display.



The decoder block diagram is in figure 6 and the photographs shows the constructed board. The encoder was made next, my design will be driven from computer data bus but for testing purposes the command field input was hard-wired. I decided not to try to create the carrier in software because it made the timing rather difficult so I used an NE555 instead. This chip can also source enough current to operate the LED directly.

The encoder block diagram is in figure 7. The photograph shows that I'm not in the least bit neat when I prototype things!





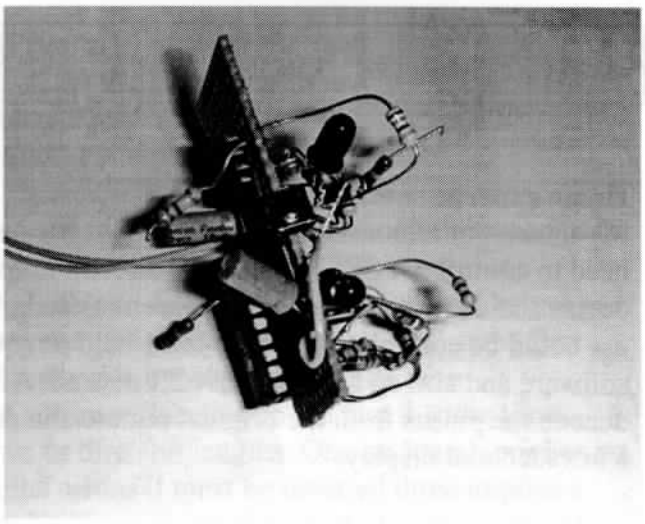
The decoder showing GB3ZZ's video recorder address code of 44 and the PLAY command of 15.

These were picked up by pressing the PLAY key on the remote control in the photograph.

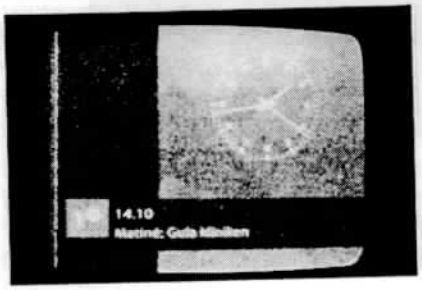
The Encoder.

The black LED is the Infra-red emitter diode.

Proof that even I can make a mess if I really try. It does work though!



TV-DX News *from Stephen Michie, G7KXD*



Photographs (top to bottom)

1. Anglia TV weather forecast. From the Sandy Heath Transmitter on UHF channel 24.
2. TVE 1 from Guardacanal Spain on channel E4
3. Graphics caption on BT-1 from Belarus on channel R2
4. SVT 1 from Sweden on channel E3

Reception Logs.

6th May: RAI Uno and Italian private TX below E2

13th May: Slovenia E3 Icum TX showing Oglasi news

19th May: E3 RTP 1 Portugal with C1 logo top right. 1931 R2 YT-1 Ukraine weather.

27th May: NRK 1 E2/3/4 Norway, subtitled progs. SVT1 E2/3/4 clock – see pics.

6th June: TVE 1 Spain E2/3/4 Nova Czech R1/R2. RAI Uno 1A/1B. RTC Klub PECS Hungary R2.

17th June: Large all day SpE opening. R1 MTV1 Hungary. R1/R2 Nova Czech. 1407 R2 TVR1 Romania childrens.R2 BT-1 Belarus – see pics. 1541 R2 G704 testcard Russian type. R2 L1 Lithuania new box logo top right. 1753 R3 YT-1 Ukraine.

20th June: Large opening. YT-2 Ukraine pop show. 0909 R1/R2 Nova Czech. Norway/Sweden E2/3/4 Highlight. Lassivas TV2 Latvia PM5544 1325. 1756 E4 RUV Iceland showing trivia text pages.

26th June: HRT1 Croatia E4 showing visesti news 1744. E4 TVE1 see pics. With message rolling at top saying E4 Guardacanal TX to close retune to UHF ch E43.

28th June: 0449 R2 G204 Russian type TC.

7th July: R2 1+1 ads 1919. This station uses yt-2 Ukraine TX?

8th July: SLO1 E3 Slovenia E4 Hari Croatia 1830. R1/R2 Nova Czech clock Telcvizni noviny news.

9th July: SVT1 Sweden E2 showing PM5534 TC. SpE also on 9th, 10th, 13th.

14th July: Dutch regional TXs. Tropospheric reception. TV Flevoland E25, TV Frysan E28, RTV Noord E36, Text.

15th July: as 14th + NED2 E27 text, NED3 E30 Zender Lopik FUBK then widescreen PM5544.

16th July: ETV R2 Estonia showing AK news. DR1 E3/4 E3 FYN Copannagane4 showing Tvansioion news. SpE also in 17th, 18th,19th Spain , Italy, Portugal, Nova Czch RTL Klub, PGCS Hungary.

20th July: Spain E2/3/4 cartoon R2 L1 Lituania 0922. R2 YT-1 medical documentary.

21st July 1036 E2/3/4 SVC1 PM3354 Norway, Sweden in most of day.

22nd July: Sweden, Norway, Denmark E3 schedules/text.1729 YLE TV1 Finland subtitled 1801. UT1 Ukraine football.

23rd July: 0748 unid R2 sloping 1 logo bottom right. 0802 R2 YF2 documentary. 0836 R2 YT1 cartoons Ukraine both signals. 0856 R2 unid ballet dark logo bottom left. 0901 unid carrier with some pic information below eu R2 faulty TX? This has been seen by myself and various other DXs in SWM etc.

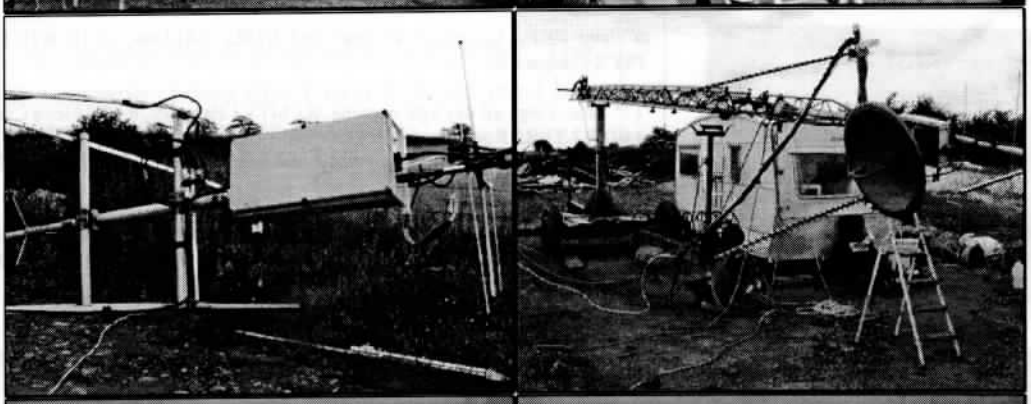
Small opening occurred on 25th, 26th 1019 R1 BT1 Belarus. 1037 E3 DK Denmark subtitled. 1049 R2 ETV Estonia subtitled. 1159 SVT1 E2/E3/E4 clock.

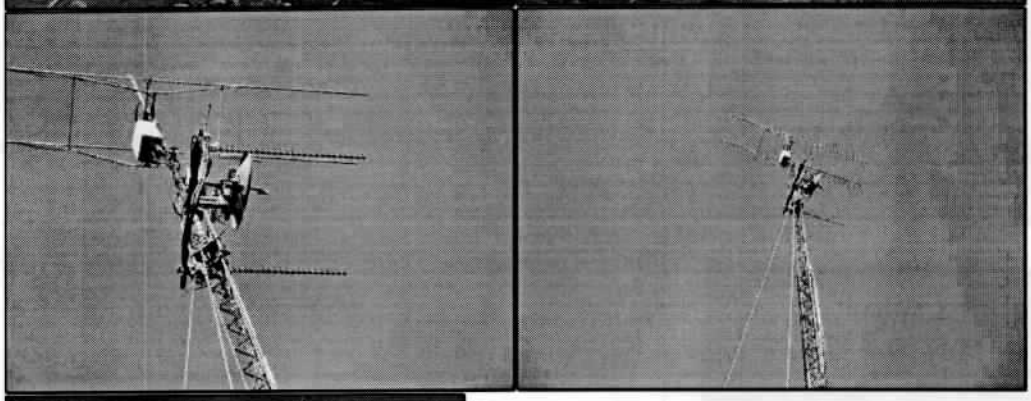
27th July: RAIUno E2. RTP1 Portugal.

28th July: SLO1 E3 Slovenia 1244. 1909 RAIUno 1A/1B TG1 news.

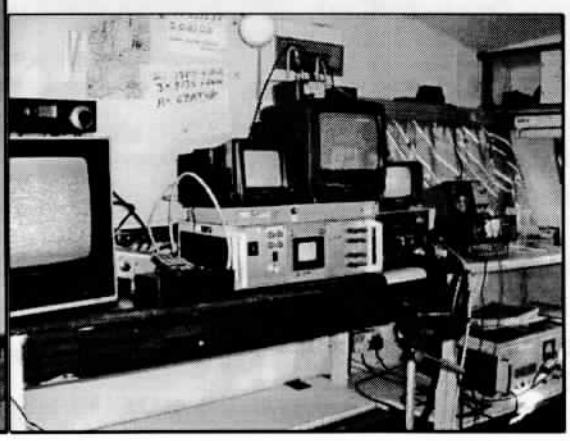
A good season so far.

Pictures from the ATV activity weekend.

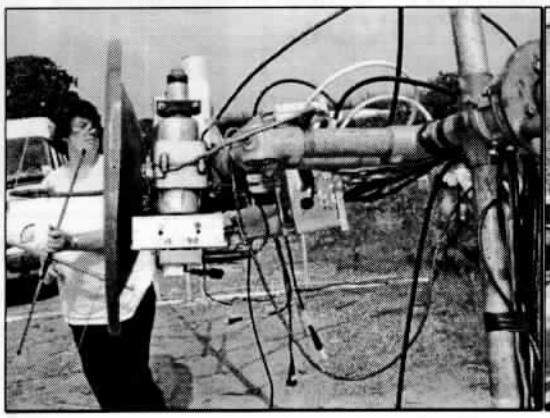




Photographs from Ken, G4BVK.



More Activity Day photographs.



Silent Key Sale. These are items from the late John Ashton's shack.

Phillips & Commodore monitors	Qty 3	£20
Stand alone cd drive for Amiga		£offers
Amiga 600		" "
Amiga 1200		" "
Amiga 500		" "
Amiga 500 stand alone hard disk		" "
Brother HL1030 laser printer		£50
Brother HL1040 laser printer		£50
Yaesu G450C rotator (new)		£280
Yaesu FT736R Quad Band Base Station 6m,2m,70cm,23cm		£1000
Yaesu MD1 Base Station Microphone		£40
Various 70cms atv rx/tx pcbs assembled		£offers
Welz antenna change over coaxial switch		£20
Yupiteru MVT7100 scanner		£149
Tas Payroll Manager accounting software unused		£50
Tas Books accounting software unused		£50
EME UHF/SHF 430MHz - 2.4GHz swr/power meter (cost £500)		£350
Welz swr/pwr meter HF thru 23cms		£50
Calscope hobby oscilloscope		£30
Camlink Vision 1000 Digital Vision Mixer		£50
Echostar SR50		£30
ACT a/v special effects generator		£40
Worthing 23cms tx boxed with antenna change over relay		£100
Yaesu YC 500E Frequency Counter		£30
Optoelectronics 100MHz - 2.4GHz handie frequency counter		£40
Cropredy atv test card generator		£25
SSB Electronics DCW15B Preamp and Sequencer (cost >£200)		£120
Dove atv rx, boxed		£30
Yaesu FT4700R Dual Band Mobile (panel lights not working, but very easy fix)		£175

TFT video monitor intended for professsional cctv installation engineer new unused £150
other minor items available, sep list to follow

Contact Kris G1BJN
077 888 26530 or 01626 854113

Don't forget!

The International ATV Contest is on **September 13th and 14th.**

Please support the Club by contacting our station, G7ATV. Every contact helps to boost our score so please blow the cobwebs out of your station and give us a call.

A chance meeting at the Telford Rally on August 31st. Shaun, Viv, Pat and Ivor after bumping into each other while browsing at Cosford Air Museum. The rally was very well attended and the weather was warm and dry, just as well as there were many outside traders. As well as being a radio rally, Cosford has a very impressive display of aircraft, missiles and vintage cars.

Your editor is hiding behind the camera!

Submitting articles for P5.
If you have any news, photographs or articles for P5, please send them to:
P5 Editor.
The Villa
Plas Panteidal
Aberdyfi
Gwynedd.
LL35 0RF

or you can email them to:
betwixtbbs@aol.com