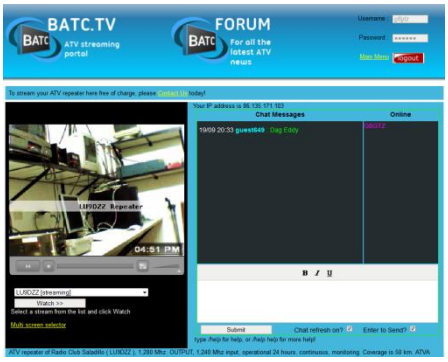
Getting started in Amateur Television

Whether it's watching live video from the International Space Station, helping produce programs for live streaming of the EME 2012 conference, building pre-amps and high power amplifiers for the microwave bands or developing high speed data links to carry digital TV signals, the world of ATV has something to interest everyone!

So what exactly is ATV? ATV is a fascinating area of our hobby which covers all aspects of video production, editing, transmission and reception. This article is about Fast Scan TV which means we transmit and receive pictures in the same quality as you receive from local and national TV stations such as BBC and Sky.



LU9DZZ TV repeater on www.batc.tv

Amateur Television has always been at the fore front of the technology revolution. Many stations are now transmitting Digital pictures (DATV) using the DVB broadcast standards and using video streaming technologies to exchange pictures with ATV operators around the world.

How do I get started? The first place to start is to go to www.batc.tv, the British Amateur Television Club's (BATC) video streaming portal[1] where you can view most of the UK TV repeaters along with those from Australia, USA and South America. These are streamed live along with a live interactive chat room so you can join in the discussion. Most repeater groups have regular net nights – see the table – and all welcome new comers to the interactive discussion.

Once you have caught the bug and want to know more, the next thing to do is to join the BATC [2] – it only costs £4 a year and gives you access to whole host of information.

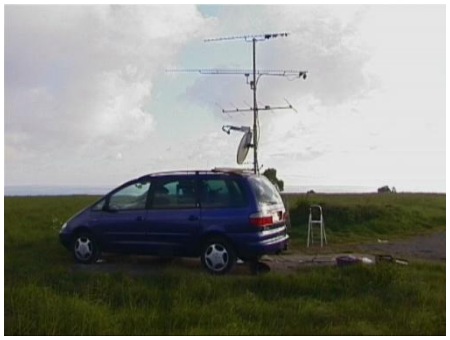
What is the BATC? Most ATV operators are members of the BATC which has approximately 800 members, 80% of whom are in the UK. The BATC publishes a quarterly magazine called CQ-TV, runs an on-line shop to support home constructors with difficult to obtain components and sub assemblies and runs a lively members forum where you can ask questions and learn more about the hobby. It also represents the ATV community on the RSGB ETCC (Emerging Technology Co-ordination Committee) and spectrum forum and generally represents the interests of the ATVers around the world.

Which band and where? Because of the bandwidth required to transmit live broadcast quality pictures, Fast scan TV is transmitted on the higher frequency bands and can be found on 70cms and above.

Repeater	Time of net (UK)
GB3SQ - Bournemouth	Sun – 8pm
GB3TM -	Sun - 8pm
VK2RTS - Sydney	Mon – 11am
GB3HV – Farnham	Tues – 9pm
W6ATN -	Wed – 3:30am
VK7OTC – Hobart	Wed – 10:30am
GB3NQ – St Austell	Wed – 8pm
GB3BH - Watford	Wed – 8pm
GB3VL - Lincoln	Fri – 7pm
GB3EN - Enfield	Fri – 8:30pm

Nets on batc.tv

70cms - The reduced bandwidth of digital transmissions compared to analogue signals means ATV on 70cms is going through a revival in interest. Analogue TV had previously used AM and occupied up to 6 MHz bandwidth. In the mid 1980s, as the 70cms band was reduced in size and became more occupied, using that amount of bandwidth became increasingly difficult to justify. Also analogue satellite technology was becoming available which enable analogue FM TV transmissions on 23cms and so interest in 70cms declined. However,



TV portable contest operation

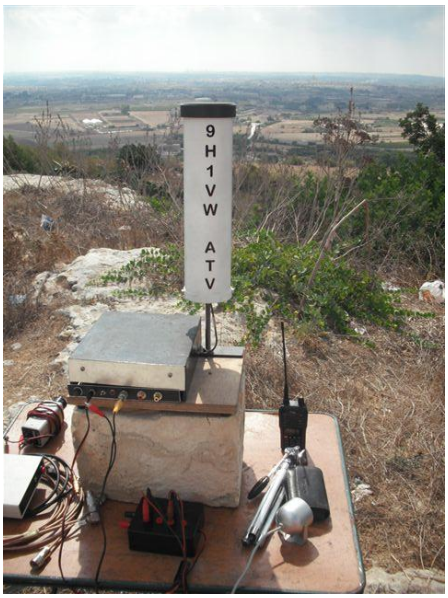
the recent introduction of Digital ATV (DATV) has enabled operators to transmit broadcast quality pictures in a 2 MHz bandwidth and we are once again taking advantage of the great propagation to be found on 70cm. Simplex activity is centred on 437 MHz and several stations in the South of England have recently worked several French DATV stations. In the last BATC contest M0DTS worked G8GTZ and G8LES at a distance of over 350 Kms.

23cms – This is the most widely used band for ATV operation and there are currently 23 licensed repeaters in the UK with a mixture of analogue and digital outputs between 1308 and 1318 MHz and inputs on 1248 MHz. For details of all UK TV repeaters see the ETCC web site which has a full and up to date list [3] along with links to repeater group websites. Most repeaters are now equipped with either DATV receive or transmit capability or both and noise free pictures can

be achieved when a digital input signal is relayed via a digital output.

Simplex operation takes place between 1255 and 1275 MHz and broadcast quality pictures using FM are regularly exchanged over distances in excess of 100 KM.

13cms – This band is currently home to 11 repeaters around the UK, one of which has a digital output. However, the recently announced Ofcom review of the band for amateur use means this may change, but we are hopeful that repeaters will still be present on 13cms, probably with digital outputs.



9H1VW ATV portable

9cms – The 3.4 GHz band has seen little ATV activity up to now, however with the recent band plan changes it has been agreed that 3404 to 3410MHz should be used for DATV. This has been confirmed with Ofcom issuing an NoV for GB3BA near Basingstoke on 3406 MHz. This will be the first UK ATV repeater on 9cms and with 3 other applications in for approval, 9cms looks like becoming an important band for ATV operation.

3cms – 10 GHz has always been used by ATVers as it is quite easy to make transmit and receive equipment for that band. There are currently 7 repeaters with outputs on 3cms and a new application for GB3FY, near Fleetwood, on 10,425 MHz has recently been received. Coverage on 10 GHz is surprisingly good and a high performance receive system is easy to achieve with just a mini satellite dish and modified LNB.

It's not all about radio! There's a lot more to ATV than transmitting and receiving – many ATVers are also members of the local video club and combine the 2 hobbies. A lot of amateurs also have an interest in railways or planes and these tend to be favourite topics for the videos transmitted on activity nights, alongside the latest technical achievements in the shack!

A number of ATV operators specialise in renovating old cameras and studio equipment and some even renovate complete Outside Broadcast vehicles[4]!

The BATC runs a live production desk which is used to stream live events such as the annual AMSAT-UK Colloquium, microwave roundtables and conferences. This gives our members an opportunity to "get behind the camera" and be involved in production of live TV for the batc.tv streaming video website.

The BATC team have been present at the AMSAT UK meetings for the last couple of years and provided live streaming of the lectures along with recordings which are made available for later viewing on the BATC streaming website.

Perhaps our biggest and most successful event to date has been the EME 2012 conference held in Cambridge. For this, the BATC team videoed and edited all the presentations, which were then made available to a worldwide audience on the BATC streaming site within 30 minutes of the talk finishing.

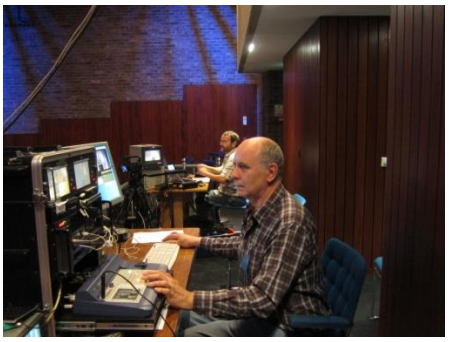


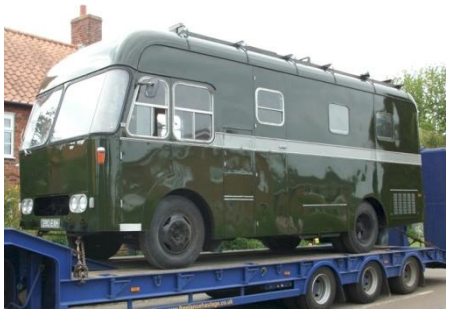
Figure 5: The BATC team at EME2012

RSGB news and video library Videos of all the events we have produced, including the EME 2012 conference and the BATC conventions are available in the film archive section of batc.tv. This is becoming a valuable reference source of major events and presentations.

A recording of the Sunday RSGB news broadcast by Roy, G8CKN, is available under the news desk section on batc.tv is and updated each week.

Why should I do ATV? More and more amateurs are discovering how ATV can complement their own interests and make it accessible to more people.

Lincoln Shortwave radio club recently transmitted live pictures into GB3VL, the Lincoln TV repeater, from the their special event station GB70DAM from RAF Scampton to commemorate the 70th anniversary of the Dambusters raid. GB3VL is streamed live on the BATC streaming site and so attracted a large number of viewers from around the world to see the station behind the voice on 40 mts.



***Project Vivat* TV OB Unit under restoration**

And the amateurs involved in the High Altitude Ballooning Community [5] are using Amateur Television to transmit pictures of balloon launches back to their local repeater which in turn is streamed live on batc.tv.

So how do I get on air? The first thing to say is that transmitting and receiving ATV need not be expensive or complicated.

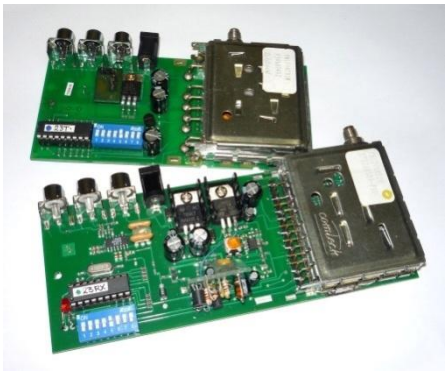
The first step is to decide which band you are going to focus on. If you already have a well equipped narrow band station with a beam you are half way there!

However, as the bandwidths of digital ATV signals are 100 times greater than a FM voice signal and 6 times wider still for analogue ATV signals, squeezing every last bit of system performance is important.

A long yagi or beam is needed to work any distance and in order to achieve reasonable results on any band it is essential to use a mast head pre-amplifier. The latest generation of MMICs mean that a sub 1dB noise figure and very good cross modulation performance can be achieved from very simple designs which are easy to build and at very low cost. Sam Jewell, G4DDK [6], does a kit of parts for a pre-amplifier based on the SPF5043 which has extremely good performance at 70cms, 23cms and even 2.3 GHz at a cost of only £12.

The pre-amp should be mounted in a waterproof box as close as possible to the antennae feed point, along with a change over relay if transmit operation is envisaged. As the system noise figure is already determined by the pre-amp, and as long as the cable run is not longer than 20 metres, good quality satellite TV co-ax can be used to connect the pre-amp to the receiver in the shack and also feed DC power up to the pre-amp and antennae change over relay.

Receiving 23cms Receiving 23cms ATV and DATV is easy! This is because 23cms lies in the middle of L-Band, which is the group of frequencies that domestic satellite systems use to send the signal down from the LNB, mounted on the dish, to the Set Top Box (STB) in your living room. Therefore any analogue satellite receiver or the very basic Free to Air (FTA) Digital STB from ebay or Maplin will tune 23cms without any modification.



Comtech Tx and RX modules (G8CKN)

Analogue satellite receivers are becoming hard to find, even at rallies. However, there is an alternative in the Comtech receive and transmit modules, which are actually more suited to ATV operation, due to their narrower bandwidth and are used by the majority of ATV operators. These are available, ready modified for use on ATV from a couple of suppliers [7].

Even with a mast head pre-amp most receivers will require additional gain in the shack for optimum performance. A satellite L-band line amplifier (available from many suppliers on ebay) will work in most circumstances and if you live in a noisy RF environment, you may need to provide some band pass filtering.

For FM ATV reception, all you need to know is the frequency of the other station or repeater. But to be able to receive a DVB-S signal you will need to know the symbol rate (effectively the bit rate) and possibly the FEC to set your receiver up with the correct parameters along with the frequency of the transmission. Typical parameters for 70 cms are 2Ms/s or for 23cms at 4Ms/s either at ½ or ¾ FEC. Exactly how these parameters are entered and the receiver is tuned depends on the make and model of STB.

Note, the box MUST be able to receive free to air broadcasts and a SKY or similar dedicated satellite service box will NOT tune to the DATV parameters.

It is also possible to receive DATV signals using a PC DVB-S or S2 satellite tuner card. Once again the set up of the card and software will differ between products but they provide surprisingly good results.

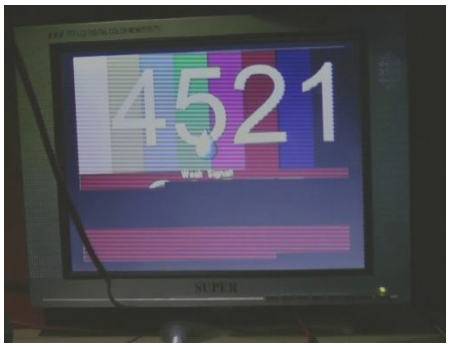
Receiving 70cms. The reason why it is easy to receive 23cms ATV and DATV signals is that the satellite boxes tune L Band (950 – 2150 MHz) which includes 23cms. However, in order to receive 437 MHz (70cms) DATV on a standard satellite STB, you need to up convert the signal to L band.

Luckily there is a consumer device available in the USA which is used on cable networks to up convert UHF signals to L Band where they are then received on a standard satellite box. These units are made by a company called Zinwell and known as SUP-2400. They are available on ebay, but only in the US and they do require modification, which involves SMD components, to work on DATV. M0DTS [8] has documented the modifications and the BATC shop [9] sells the unmodified units.

Once modified, they are placed in line between the mast head pre-amplifier and the standard digital STB and tuned to the up converted frequency. Note that the same digital satellite receiver can of course be used for 23cms and 70cms and just retuned depending on which band is being received.

Transmitting ATV Firstly, you need to generate some video signals - most ATV operators will start with a camcorder as the camera in the shack and a media card reader, available for around £10, to generate test cards and station information slides.

For analogue transmission on 23cms and 13cms most stations use the range of Comtech modules which are available for less than £50. These generate around 20 milliwatts but when fed in to a 2 stage power amplifier will provide around 10 watts after filtering.



70cms DATV over 350 KMs

Digital transmission is more complex and in order to reduce the cost of digital transmission, a number of amateurs have developed a low cost system called Digilite. The Digilite system is designed for homebrew construction, with the hard to get components and PCB available from the BATC shop, and uses a PC and video capture card to do the video coding. Many operators are using the system to transmit DATV on both 70 and 23cms – for more details see G8AJN's excellent website [10].

A more complete approach is available from SR Systems in Germany and provides a ready built digital transmit system to cover 70cms and 23cms. [11]

Linear power amplifiers from DB6NT[12] and Minikits in Australia [13] can be used for ATV operation although for digital use, the drive level must be reduced by up to 50% to ensure good linearity. After filtering, the

average ATV station will run around 10 – 15 watts in to a low loss feeder.

Operating Because of the weak nature of ATV signals, a lot of activity is centred on the TV repeaters and the best way to get started is to find your local repeater group. However, ATV operators do also work DX, particularly during lift conditions and distances up to 500 Km are easily achievable. As with all microwave activities, talkback is often the challenge and a new web based tool specifically for ATV DX working has recently been launched at www.dxspot.tv [14]

Most ATV stations operate from home with a modest outside antenna system, particularly if they are in the coverage area of a local repeater. However, the BATC also organises contests and a lot of operators go out to operate portable stations on the local high spots.

How technical is ATV? Having said that ATV need not be complex, it is also the one of the few areas of the hobby which still supports active experimentation and developments.

Whilst the BATC and other groups have made entry in to the hobby easy for newcomers, most people find that once they "catch the bug" they are very soon building small projects and soon are experimenting with pre-amps and other pieces of home built video and RF equipment.

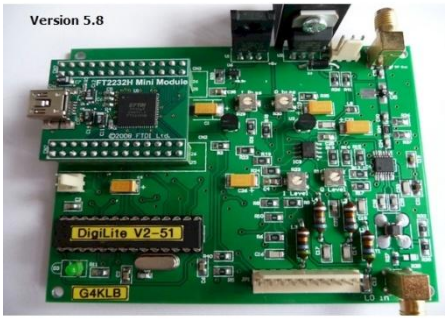


Figure: The Digilite PCB

For others, the big attraction is that there is limited commercial amateur radio equipment available and the hobby can be as technical as you choose with a large element of experimentation at frequencies above 1 GHz and high speed digital transmission techniques.

Areas currently under investigation by the ATV community include the use of SDR technologies, the potential of powerful OBC systems such as Raspberry Pi and ways of generating and transmitting 3D and HD video.

The BATC encourages such projects with low cost digital operation a major focus for the club and it has supported engineering projects by its members to produce a DATV transmission system within the reach of the average amateur.

The future? Two very exciting things are about to happen for the ATV community.

Firstly, the launch of live TV from the ISS - whilst it will be using standard DVB-S equipment in the 13cms amateur band, due to the potentially low power of the signals and the orbit of the ISS, receiving it will be pretty challenging but some ATV ops will be setting up equipment to receive it. For the rest of us, the live pictures from several large ground stations around the world will be available on the BATC streaming portal.

Secondly there is the potential release of some bandwidth for narrow band digital ATV operation below 70cms. A number of ATVers are already looking at the potential of very narrow band DATV (sub 1 MHz) operation using DVB-S2 modulation with MPEG4 or H265 HEVC codecs.

ATV – why not? ATV is very easy to get started in and yet has plenty for everyone – take a look at the BATC forums to see what people are talking about today [15]

To find out more, contact your local repeater group, read the Bi-monthly ATV column in RadCom or come along to CAT13, the BATC 2013 convention to be held in October at Finningley near Doncaster.

As well as being great fun, ATV can really compliment other areas of our hobby. ATV has instant appeal as it is "multi-media" and is a valuable tool to attract young people in to amateur radio

At the very least, go and have a look at the streaming video website – but be careful, you might catch the bug!

Websearch:

[1] http://www.batc.tv/index.php
[2] http://www.batc.org.uk/
[3] http://www.ukrepeater.net/repeaterlist5.htm
[4] http://projectvivat.co.uk/Vivat/Home.html
[5] http://ukhas.org.uk/
[6] http://www.g4ddk.com/
[7] https://www.batc.org.uk/shop/3rdparty
[8] http://www.m0dts.co.uk/
[9] https://www.batc.org.uk/shop/
[10] http://www.g8ajn.tv/dlindex.html
[11] http://sr-systems.de
[12]http://www.kuhne-electronic.de/en/home.html
[13] http://www.minikits.com.au/
[14] www.dxspot.tv
[15] http://www.batc.org.uk/forum/