Amateur Television "Getting Started"

Part 1 - An overview of UK ATV

Due to popular demand we're running a series of articles on getting started in Amateur Television, from first principles through to the latest techniques. These will appear in CQ-TV over coming editions and will also be available as booklets and leaflets for anyone interested in getting started. As always we're looking out for contributors - contact the Editor if you have an idea for an article or help guide please. To start here are the first two articles on ATV and RBTV

Whether it's watching live video from the International Space Station, helping produce programs for live streaming of the AMSAT colloquium 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.

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

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

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 where you can view most of the UK TV repeaters along with some 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 ***www.batc.org.uk*** – it only costs £6 a year for a cyber membership and gives you access to whole host of information.

What is the BATC?

Most ATV operators are members of the BATC which has approximately 950 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 the RSGB 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 normally

transmitted on the higher frequency bands and can be found on 70cms and above. In the UK we have adopted the DVB-S standard which uses QPSK modulation which has the benefit of variable bandwidth depending on the bit rate used for the video transmission.

However, in the UK we have recently been allocated 1 MHz of spectrum at 146 MHz for DATV experimentation. Due to the narrow bandwidth, this requires the use of new techniques which we have called Reduced Bandwidth TV (RB-TV). This is not covered by this article but is the subject of separate "Getting Started" articles and a special edition of CQ-TV available for free download at ***http://www.batc.org.uk/club_stuff/rbtv.pdf***

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 Amplitude Modulation 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 TV technology was becoming available which enabled analogue FM TV transmissions on

23cms and so interest in 70cms declined. However, 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 centered on 437 MHz and several stations in the South of England have worked French DATV stations and M0DTS/p regularly works stations at a distance of over 200 Kms on the BATC activity days.

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

For details of all UK TV repeaters see the ETCC web site which has a full and up to date list ***http://www.ukrepeater.net/repeaterlist5.htm*** 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.

13cms – This band was used by ATV operators, however the recent Ofcom changes means that several repeaters have had to move out of the band. There is still room for Digital ATV operation but it may be worth checking with other ATV operators and the BATC before committing too much time and effort to get on the band.

9cms – The 3.4 GHz band is the latest band for ATV activity and the UK band plan allows DATV operation between 3404 to 3410MHz. There are currently 3 repeaters in operation on 9cms and the tests done by these groups show very good coverage results and it 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 coverage on 10 GHz is surprisingly good - 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 two 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!

An Outside Broadcast Van being refubished by ATV enthusiasts

A number of ATV operators specialize in renovating old cameras and studio equipment and some even renovate complete Outside Broadcast vehicles!
http://projectvivat.co.uk/Vivat/Home.html

▶ *Noel G8GTZ and Peter G3PYB streaming an event live to the web via the BATC Streaming Server*

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.

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 and the BATConline YouTube channel.

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?

As well as being a fascinating hobby for operators and those with a technical interest, more and more amateurs are discovering how ATV can complement their own interests and make it accessible to more people.

Lincoln Shortwave radio club 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 meters

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

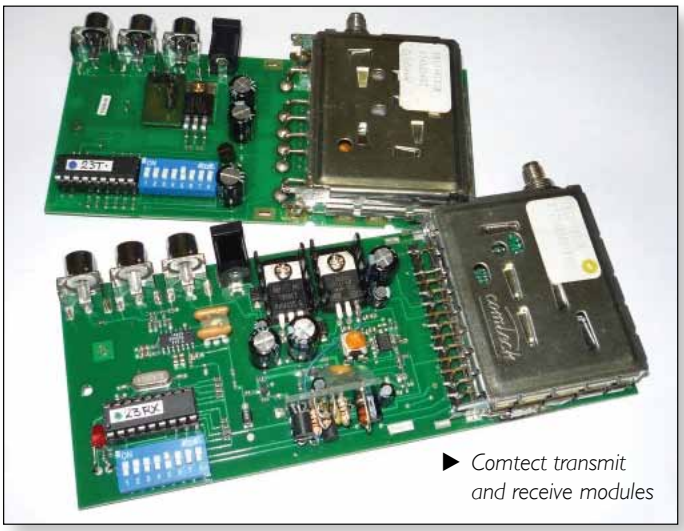
A long yagi or beam is needed to work any distance and in order to achieve reasonable results on any band it is essential to use a mast head pre-amplifier. The latest generation of MMICs mean that a sub 1dB noise figure and very good cross modulation performance can be achieved from very simple designs which are easy to build and at very low cost. A pre-amplifier based on the SPF5043 which has extremely good performance at 70cms, 23cms and even 2.3 GHz is available at a cost of only £13 ***http://www.g4ddk.com/SPFAMP.pdf*** .

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.



▶ *Comtect transmit and receive modules*

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 Roy G8CKN ***https://batc.org.uk/shop/3rdparty*** .

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 has documented the modifications and the BATC shop ***https://batc.org.uk/shop/hardware-and-kits*** 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.

Receiving 9 and 3cms

Receiving the higher frequency bands is actually easier than 23cms or 70cms as we can use commercial satellite downconverter units. These are readily available on eBay and other online sites and can be used with the Free-to-Air satellite receiver described above.

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.

Digital transmission is more complex and in order to reduce the cost a number of projects have been developed by the ATV community – these range from the low cost DIY approach of the Digilite project ***http://www.g8ajn.tv/dlindex.html*** up to the more complete approach of the DTX1 which is available from the BATC shop and provides a ready built digital transmit system to cover 70cms and 23cms.

Linear power amplifiers from DB6NT ***http://www.kuhne-electronic.de/en/home.html*** and Minikits in Australia ***http://www.minikits.com.au/*** 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***

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 activity days and 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. 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 small computer systems such as Raspberry Pi and ways of generating and transmitting 3D and HD video.

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 are plans in late 2016 to launch a geo-stationary satellite dedicated to Digital Amateur TV – this will enable ATV contacts between amateurs across continents.

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 ***http://www.batc.org.uk/forum/***

To find out more, contact your local repeater group, read the Bi-monthly ATV column in RadCom or join the BATC ***http://www.batc.org.uk/club_stuff/members.html***

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 at ***www.batc.tv*** – but be careful, you might just catch the bug!