

DATV reception – a practical guide

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More and more amateurs are starting to transmit digital ATV signals on 23cms and 70cms for simplex / DX operation and most repeaters also have a digital output capability. This article gives a quick introduction to the various technologies and modes in use and looks at some practical ways to receive these digital ATV signals.

MPEG-2 video encoding and DVB-S QPSK modulation has been adopted as the current standard in the UK for DATV on 23cms and 70cms. This means we are using the same technology as standard definition satellite TV services such as the FreeSat service in the UK and the signals can be received on a standard consumer Free To Air Set Top Box (FTA STB).

DVB-S uses a variable bandwidth modulation scheme, depending on the video and audio bit rates transmitted and the amount of Forward Error Correction (FEC) applied. As a variable bandwidth system, it is ideally suited to 70cms where we are now able to run full colour video and 2 audio channels in 2 MHz. On 23cms, where bandwidth is not at such a premium, we can run 4 Msymbols, thereby achieving better picture quality within a slightly increased bandwidth of 4 MHz.

Note that the DVB-T (OFDM) modulation scheme as used by FreeView has not been adopted by amateurs in the UK and a FreeView box will not receive UK DATV signals. This is primarily due to the fixed 6/7/8 MHz bandwidth of the system, which gives a lower power / bandwidth ratio than 2 or 4 MHz QPSK and requires highly linear PAs and group delay correction over the full 8 MHz spectrum.

DATV activity in the UK

70cms – ATV activity on this band, which has the potential for real DX working, has been revitalised by the use of DVB-S QPSK modulation. Several stations in the South of England have recently worked French DATV stations and MODTS worked G8GTZ and G8LES at a distance of over 350 Kms. With a bandwidth of only 2MHz centred on 437 MHz (the DATV operating frequency), we can achieve reasonable power levels and linearity from amplifiers designed for narrow band operation and there are some surplus amplifiers from the Freeview re-engineering project appearing on ebay at the moment.

23 cms – Once again DVB-S is being adopted, using a slightly higher symbol rate of 4 Msymbols, which typically occupies 4 MHz and good results are being achieved by stations using DATV for simplex contacts. A noise free digital picture with 2 audio channels can normally be locked when a P2 noisy analogue ATV signal is received.

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.

In the future, it is likely we will come under pressure from OFCOM and the primary users on 23cms to be more spectrum efficient and go digital only on repeater outputs. Whilst this is reasonable approach and the BATC is looking to support repeater groups during such a transition, I do believe we should resist being forced to adopt digital only inputs on ATV repeaters for as long as possible.

This situation may change as projects such Digilite and DATV Express are developed further to make live low cost digital transmission without the use of a PC possible.

Higher bands – Tests have been carried out on 2.3 and 3.4GHz with good results and there are a couple of repeaters running digital 10GHz outputs.

Receiving DATV - Mast head pre-amplifiers

In order to achieve reasonable results on any band above 50 MHz 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, does a kit of parts for a pre-amplifier based on the SPF5043 which, despite its small size, has extremely good performance at 70cms, 23cms and even 2.3 GHz at a cost of only £12. See <http://www.g4ddk.com/SPFAMP.pdf>



G4DDK SPF5043 pre-amp

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 DATV – 23cms

Receiving 23cms DATV is easy! A basic Free to Air (FTA) Digital STB from ebay or Maplin (a lot of people use the Comag range of receivers from Maplin) will tune 23cms without any modification, although most require additional gain in the shack for optimum performance. A satellite L band line amplifier (also 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.

Even the cheapest satellite receivers seem to have a “pass through” L Band output and your existing 23cms FM ATV receiver can be fed directly from this output without the need for a separate splitter.

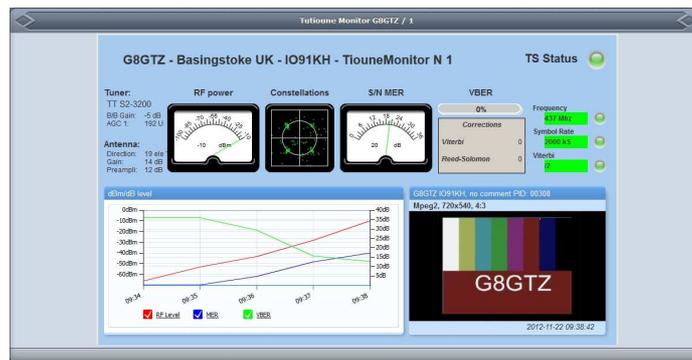
To be able to receive a DVB-S signal you will need to know the symbol rate (effectively the bit rate) and possibly the FEC to set your receiver up with the correct parameters along with the frequency of the transmission. Typical parameters for 23cms are 4.000 Msymbols at ½ or ¾ FEC - exactly how these parameters are entered and the receivers is tuned depends on the make and model of STB.

Note, the box MUST be able to receive FTA 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.

F6DZP has developed the Tutioune PC software specifically for DATV – this runs on the Technotrend S-2300 tuner card and gives very detailed analysis of the signal and also enables web based monitoring of the received signal – see the link below for an example from my DATV station:

http://www.vivadatv.org/tutioune.php?om_id=G8GTZ&station_id=1



G8GTZ Tutioune monitor page

Receiving DATV – 70cms

The reason why it is easy to receive 23cms DATV is that the satellite boxes tune L Band (950 – 2150 MHz) which of course 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.



SUP-2400

In order to help promote the use of 70cms DATV and to compliment the Digilite 70cms project, the BATC shop now has stock of these units either in un modified form or modified as described in the accompanying article in CQTV. See the BATC on line shop for more details.

To receive 70cms DATV, the modified SUP2400 is put in line between your 70cms mast head pre-amp and the digital STB. As the upconverters are very wide band it is possible a band pass filter will be required between the mast head pre-amp output and SUP-2400 input.

The digital STB is tuned to the up converted 70cms frequency – the SUP-2400 has a high side 2400 MHz LO and so 437 MHz is tuned at 1963 MHz. The DVB-S parameters are entered as normal which for 70cms operation are 2 Msymbols with $\frac{1}{2}$ or $\frac{3}{4}$ FEC.

Receiving DATV – the higher bands

Narrow band QPSK operation is possible on the higher bands and reception is relative easy on 3.4 GHz and 10 GHz.

As well as the problems caused the pollution from wi fi and other ISM services, there are no consumer devices to enable easy reception of 2.3GHz DATV signals although home brew converters down to L band are relative easy to make.

We do have a fairly large spectrum allocation at 3.4 GHz in the UK and it is relatively unused. It is also easy to receive DATV signals at 3.4 GHz as C band LNBs, available on ebay in the USA for less than \$10, cover the band and down convert signals to L band, thereby enabling the use of a standard FTA STB. The band is potentially very interesting for DATV and I have applied for a repeater NoV, GB3BA, on 3407MHz using 2 Msymbols QPSK to provide coverage of the Thames Valley and surrounding areas.

Similarly, the use of modified standard satellite LNBs to cover the 10 GHz amateur band which are readily available on ebay, make for easy reception of DATV signals on that band.