Getting ready to receive Es'hail-2

Noel Matthews G8GTZ

Whilst the BATC web SDR at Goonhilly will provide a means to listen to the narrow band segment, it will only provide a spectrum monitor for the wideband DATV segment and if you want to decode any of the signals, you will need to set up a system at home.

The expectation is that the wide band DATV transponder will be able to be received in most of the UK on a 1 meter dish and it may even be possible use a smaller 80cms offset dish. This article primarily describes setting up a dish and equipment to receive the wideband transponder but the techniques can be used to set up a dish to receive the narrow band transponder, where a smaller dish will be adequate for most areas of the UK.

Equipment required – a dish

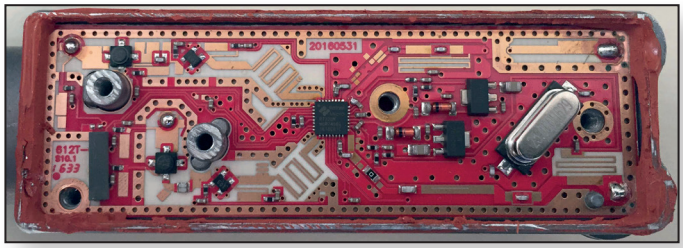
As mentioned above, to receive the wide band transponder, ideally you will use a 1 metre or larger dish to receive Es'hail-2 although it may be possible to use a smaller 80cms dish. Larger dishes are available on ebay and a number of members have recently purchased brand new 1.2 metre dishes for £20. Your local domestic recycling facility (AKA the tip!) can also be a useful source of dishes and second hand 80cms and 1 metre dishes are often available on Gumtree.

Even an 80cms dish will have 30 dB plus gain at Ku band with a very small beam width of approximately 2.5 degrees making mounting and aligning the dish very critical.

Equipment required – Low Noise Block (LNB)

Just like any consumer satellite system, you will need an LNB at the dish to convert the 10 – 12GHz Ku band signals down to L Band which can then be decoded by the satellite receiver. Whilst any modern Ku band satellite LNB will receive the BADR4 signals, it is recommended that you use a Phase Lock Loop LNB to receive the Es'hail-2 amateur signals. This is because the frequency stability of a standard DRO unit will make it difficult to receive the Narrow Band transponder SSB signals and Reduced Bandwidth DATV (RB-TV) signals on the wide band transponder.

The most common unit is the Octagon Optima PLL OTLSO LNB (Beware there are a number



of other Octagon units available which are standard DRO LNBs – ensure you buy the OTLSO PLL unit).

These are a very good example of modern microwave integrated design – as the picture shows it contains very little silicon and uses the Rafael RT320M at its heart, which is a dual synthesizer, dual mixer, RF switch and logic chip with a 25MHz reference crystal. You will see some frequency drift when resolving SSB signals with this LNB and it is possible to improve the frequency stability by locking to an external source but that is beyond the scope of this article.

Other units PLL LNBs are available such as the Goobay unit are also currently available on ebay.

Narrow band Receive equipment

Using one of the above LNBs means that the IF frequency fed down the co-ax to your receiver will be in the range of 739.55Mhz to 739.80MHz for the narrow band transponder and 741.0MHz to 749.0MHz for the wideband or DATV transponder.

To receive the narrow band transponder you can simply use an SDR receiver such as FUNcube dongle, Lime SDR or the cheap RTL dongle which will cover the IF frequencies from the LNB. Alternatively, if you wish to use an amateur band receiver on HF, 144 or 432 MHz you will need an additional unit to covert the IF frequencies to your amateur band of choice.

You will also need to arrange to feed 12 volts DC up the co-ax to power the LNB – this can either be done internally in your receiver or by an external bias tee. (Note: 12v and not 18v will be required to receive the vertically polarised Es'hail-2 narrow band transponder.)

Wide band Receive equipment

To receive the wide band, horizontally polarised DATV transponder you will need a DATV receiver capable of receiving 741 MHz to 749MHz. Unfortunately this is outside the normal tuning range of a consumer digital TV Set Top Box (STB) and you will need an additional up converter to shift the IF frequency up to be in the tuning range of the STB at L-band between 950 – 2150MHz.

Such converters are available, however there is a USB tuner designed specifically for Amateur TV use which covers down to 143MHz and is suitable to receive Es'hail-2 with no modifications or additional up-converter.

These units are called MiniTiouner and are available from the BATC and other sources and are used with the MiniTiouner software developed by F6DZP to receive and decode the signals. See ***https://wiki.batc.org.uk/MiniTioune*** for more details. The other reason why MiniTioune is the preferred solution to receive the DATV transponder is that most amateur TV transmissions are expected to use Reduced Bandwidth DATV (RB-TV) with a bandwidth below 1 MHz. Unfortunately standard consumer STB will not receive these RB-TV signals but MiniTiouner has been designed to receive RB-TV signals with less than 100 KHz bandwidth. Note - there will initially be a DATV beacon transmission running at 2.4Ms (3MHz bandwidth) which can be received using a standard DVB-S2 receiver and appropriate up converter.

Note that the DATV receiver will need to be capable of providing 18v DC to the LNB to select horizontal polarisation required for the wide band transponder.

Aligning the dish

Whilst the actual launch date for Es'hail-2 has not yet been released it is already possible to set up and align your dish and test your decoder using an existing broadcast satellite called BADR4. BADR4 is in the same orbital slot that Es'hail-2 will occupy and has a European wide spot beam carrying a number of free to air TV services including the BBC Arabic service which can be received throughout Europe.

The first step is to check that you are going to mount your dish in a position in a position where it can see the satellite – as a rough guide Es'hail 2 is only 2 degrees to the south of where the Astra satellite transmitting Sky and Freeview is positioned at 28 degrees east of south. (Note the bearings are referenced to the South and therefore Sky is further round to the east (or left!) than Es'hail 2.

▶ *Footprint of BADR4 downloaded from Lyngsat.com*

http://www.dishpointer.com/ is a very useful site to check if you have clear take off in the required direction – simply enter your QTH postcode and select BADR4 as the satellite and it will overlay the direction to the satellite on a Google satellite view so you can see which neighbours house to aim for! The panel below the map gives you azimuth and elevation from your QTH and LNB skew angle.

Another useful site is ***https://www.suncalc.org*** which tells you exactly where the sun is in the sky at your QTH at any particular time – using this information you can tell when during the day the sun is on the same Azimuth as BADR4 and use this to align your dish.

Also, near every equinox, the sun passes through the same position in the sky as a given satellite – using this website ***https://www.satellite-calculations.com/Satellite/suninterference.php*** you can calculate when the sun will be in the same position as BADR4 – this happens for a few days around the 10th of October 2018 for the UK and as long as it is sunny, you will be able to see where to place your dish by seeing where there is direct sunlight.

Aligning the dish with a DATV receiver

Once you have the dish mounted securely and pointing in roughly the right direction, you need to set up your LNB and receiver – note a Sky STB is not suitable and you must use a Free To Air STB.

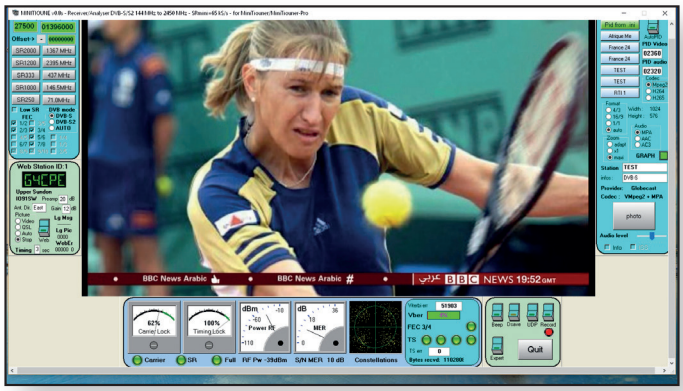
Whilst MiniTiouner is the recommended system to decode DATV signals on the Es'hailsat wide band transponder, it is recommended that you use a standard free to air satellite box or satellite finder to align the dish on BADR4. This is because you will need to configure the LNB to run the correct local oscillator for the channel you want to receive plus you need to ensure you are using the correct polarity.

Next you need to know what parameters to set in your STB – this will depend on what channel you want to receive and for a full list of channels available on BADR4 see this Lyngsat page. ***https://www.lyngsat.com/Badr-4-5-6.html***

Most people have used BBC Arabic as the test signal – Lyngsat gives the following parameters:

- Frequency = 11,996MHz which means you need to select the LNB LO frequency to be "high" or 10.600MHz and then set your receive frequency to 11,996MHz.
- Horizontal polarity means you will need 18 volts on the LNB feed
- Symbol rate 27,500 and ¾ FEC will need to be selected in the satellite set up menu

If you have an SDR or spectrum analyser these will be useful during the alignment process and should be connected in to the LNB feed via a splitter with the STB on the other leg providing volts and 22KHz tone. A DC block should be used to ensure no damage to the analyser and also to ensure no incorrect voltage is fed in to the LNB.



If you do not have a set top box and need to use a standard MiniTiouner, which does not produce 18v or 22KHz on the LNB feed, you can use the following method for setting up your dish:

Rotate the LNB on the dish mount through 90 degrees so the satellite cable comes out of the LNB at 90 degrees to vertical – this will mean that you can use a 12v feed to receive horizontal signals.

Because you are not sending 22KHz up the co-ax, the LNB will not switch in the higher frequency Local Oscillator and will use the 9,750MHz oscillator and you will need to enter 02246000 in the MiniTiouner frequency panel (11996 – 9750 = 2246MHz). Note that you can only do this in MiniTiouner as a standard STB will not tune above 2150MHz.

The easiest way to find the strong satellite from Astra (Sky) at 28 degrees East and use the SDR, sat finder or analyser and watch for several 27MHz wide signals to appear. Once you have peaked on the signal you need to decode a program to try and identify which satellite you are actually receiving. Do a satellite or transponder scan with 27,500 SR, H and V polarity and auto FEC and see what appears – these are very common parameters and almost all European satellites have signals which will decode using them. Now refer back to Lyngsat to try and identify which transponder you are actually viewing by looking at the various satellite program lists.

Once you know which satellite you are receiving, work out which way the dish needs to be rotated and set your receiver for the BADR4 BBC Arabic service (11996MHz, 3/4 FEC and 27500 SR) and tweak the dish round until you see it start to decode. If you are looking on an analyser or SDR, BADR4 is much weaker than Astra at 28 degrees or Eutelsat at 13 degrees and if you are starting to see another set of very strong signals, you have probably gone too far! Note – there is a 2nd BBC Arabic channel on Eutelsat at 13 degrees.

Once you are sure you are receiving BADR4, tweak the horizontal and vertical mounting and LNB skew using either the STB quality meter or MiniTiouner for best MER / SNR / signal quality.

Results

Dish size	MER or SNR
1.3 metre	12 dB
1.2 metre	11 dB
1.0 metre	10 dB
.8 metre	7.5 dB

Based on results posted on BATC forum you should see the following results on BBC Arabic channel on BADR4

For more details see ***https://forum.batc.org.uk/viewforum.php?f=101***

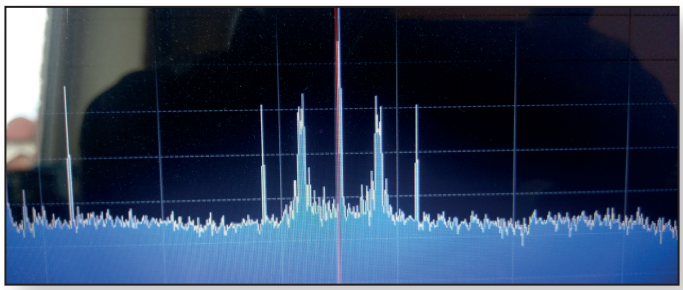
Aligning the dish with an SDR

If you do not have a Digital satellite receiver and want to just receive the narrow band transponder, almost every geostationary satellite runs a narrow band telemetry beacon which can be used to align your dish using just a simple SDR such as FUNcube or RTLdongle.

The beacons are on different frequencies so can be used to easily identify which satellite you are receiving - unfortunately the BADR4 beacon is in the higher frequency band above 12GHz and requires the LNB to be fed with a 22KHz tone to switch in the higher local oscillator which is not easy to do using a standard SDR. However, the BADR 7 satellite is in the same orbital slot and has a telemetry beacon which is receivable throughout Europe on 11,200.5MHz which gives an IF signal on 1450.5MHz – you may have to tune +/- 100KHz depending on the stability of your LNB.

Use the same dish alignment procedure described above but monitor 1450.5MHz on your SDR waterfall – you will see a high level of wideband noise from other satellite signals such as Astra at 28 degrees but should clearly see the beacons carriers when aligned on BADR7 at 28 degrees.

Note the BADR7 beacon is horizontally polarised so you will either need to feed the LNB with 18v or physically rotate the LNB by 90' as described above if you only have 12v available. And don't forget that Es'hail-2 Narrow band is vertically polarised so when alignment is complete on BADR7 you will need to switch back to vertical polarisation.



▶ *BADR7 beacon received by G7JTT on an RTL dongle*

For more information on other satellite beacons check out this site: ***http://frequencyplansatellites.altervista.org/Beacon-Telemetry_Europe-Africa-MiddleEast.html***

Conclusions

Whilst no actual launch date has been announced for Es'hail-2, it is scheduled for launch before the end of 2018. Using the BADR4 signals or the BADR7 beacon to align and test your system means that once the Es'hail-2 amateur transponders are commissioned, all you will need to do is tune down to 739.55Mhz to 739.80MHz for the narrow band transponder and 741.0MHz to 749.0MHz for the wideband or DATV transponder.

BATC Awards Presentations at CAT18

In addition to the contest winners published in the CAT18 report, the BATC awarded certificates to those amateurs who succeeded in the BATC Activity Contests. All those in first place received certificates to celebrate the fact; congratulations to the winners and thanks to those who took part.

BATC Prizes:

1 A £50 Amazon Voucher to the winner of the BATC 146 MHz Contest. Won by a Committee member (**G8GKQ**) with the (then) Chairman second. So not awarded.

2 A £50 Amazon Voucher to each station in the Best DX 2-way 5.6 GHz Contact. **G3NWR (G4EWJ) and G4CBW** achieved the best DX 2-way 5.6 GHz Contact at 154 km. They are awarded a £50 Amazon Voucher each.

3 A £50 Amazon Voucher to the transmitting station using a Portsdown system received at the furthest distance (any band). The best Portsdown DX by a non-Committee Member was **G4LDR** for a contact with G8GTZ at 64 km on 24 GHz. Notably, this was Neil's fist contest and he also had a Portsdown contact on 76 GHz.

Band	First	Second	Third
Overall IARU	M0DTS	G8GTZ	G8GKQ
70 cm	G8GKQ	G8GTZ	G4GUO
23 cm	G7AVU	M0DTS	G1LPS
13 cm	M0DTS	G8GTZ	G1LPS
9 cm	G4CBW */ G3NWR *	-	G1LPS
6 cm	M0DTS	G4CBW	G8AGN
3 cm	G4CBW/ G3NWR	-	G8GKQ/ G8GTZ
24 GHz	G8GTZ *	G8GKQ	G4LDR
76 GHz	G4LDR */ G8GTZ *	-	-
146	G8GKQ	G8GTZ	G4CBW/ G3NWR

* IARU Contest Band Winners