The R2FX APT Receiver for Weather Satellites

Les Hamilton

New APT weather satellite receivers do not appear on the scene very often these days so, when I heard about the *R2FX* model manufactured by Holger Eckardt of Hohenbrunn, Germany, I just had to try one out.

This receiver has beautifully clean lines and is provided in an attractive aluminium case measuring just 113 x 85 x 31 mm. The front panel supports just a single 'select' button and 12 variously coloured LEDs (figure 1) while the rear panel boasts twin 50 Ω BNC antenna sockets, a power supply socket, audio-out jack socket and RS232 serial interface (figure 2).

Manufacturer's Specifications

The *R2FX* receiver is designed for the reception of polar orbiting weather satellites which transmit in the 137 MHz band. Matched IF filters and a highly linear demodulator provide optimum image quality, even with weak signals. An AFC circuit compensates for Doppler frequency shifts. A novel feature is the ability of the *R2FX* to utilise two antennas simultaneously: the receiver polls the antennas constantly and always selects the stronger signal to provide the cleanest possible image.

The *R2FX* Package

The *R2FX* comes complete with a power supply unit. Unfortunately it is of the continental '*Shuko*' 2-pin design so you will require a suitable adaptor if you plan to use it. I used a standard plug-top PSU designed for use in the UK without experiencing any problems. Also supplied was an audio lead to connect the *R2FX* to the soundcard of your computer and a CD bearing a copy of the *R2FX* manual, Craig Anderson's *WXtoImg* decoding software and some sample images and WAV files.

Power Supply for the *R2FX*

Without doubt the single most important aspect of preparing the *R2FX* for use is attaching the power supply. This receiver works well with an input of between 5 volts and 12 volts d.c. but you must take care with the supply's polarity.

The power jack feeding the *R2FX* must have a centre-positive supply (the jack tip must be positive) as the receiver is not protected against reverse polarity.

The lower limit of 5 volts permits the unit to be powered from a USB port on your PC. And although it would have been perfectly feasible to include polarity protection circuitry, this would raise the minimum voltage to 6 V and prevent USB operation.

The supplied PSU comes ready to use but UK members who substitute one their own must note the above carefully, specially as the *R2FX* does not possess a power switch: once the PSU is connected, the device is switched on. Check the voltage of the PSU—exceeding 15 V for even a short period can lead to damage. Personally, I always use a 6-volt supply and this has proved entirely satisfactory at all times. On the subject of PSU, I have found that a set of four rechargeable 2300 mAh NiMH 'AA' batteries also performs beautifully, providing a minimum of 36 hours supply—useful for trips to the countryside with a laptop.

Setting up the *R2FX*

Connecting up the *R2FX* could hardly be simpler. The PSU plugs into the rear of the unit, the audio lead connects between the audio-out socket and the line-in (or mic-in) of your PC soundcard while the antenna attaches to the 'Antenna 1' BNC position.

Should you require to adjust the audio output level of the *R2FX* there is a small trimming potentiometer inside the unit, close to the RS232 D-connector, labelled 'V' in figure 3. Turning this counter-clockwise decreases the output. But be careful, as the device does not have a 'stop' and rotates a full 360°—so you can inadvertently set the output back to 'high' by turning too far.

To switch on the *R2FX* you simply supply power—it does not have an on/off switch. The entire display of LEDs lights up for about two seconds, then all extinguish except for the the amber antenna LEDs and the red 137.50 MHz channel LED. You will probably notice the amber LEDs alternating on and off as the receiver polls between the two antenna BNC connectors.

Repeatedly pressing the 'Select' switch briefly steps the receiver through the six frequency channels. Holding this switch down for two seconds or more sets the receiver into scan mode and the six red LEDs start to flick on and off in turn as each channel is activated. The *R2FX* comes with the two new polar satellite frequencies already installed, and you can program new frequencies later should the need ever arise through the RS232 port, using your computer.

Frequencies currently provided are:

137.10 MHz -	Metop / NOAA 19 (future)
137.40 MHz -	Okean/Sich
137.50 MHz -	NOAA 12, 15
137.62 MHz -	NOAA 17
137.91 MHz -	NOAA 18
134.00 MHz -	WEFAX downconverter

Using the *R2FX*

Once set up the *R2FX* performed almost flawlessly and images and WAV files were produced using both *Wxsat* and *WxToImg* software packages. I found the audio output somewhat high for my notebook PC, so reduced this as explained above. My first image is reproduced in figure 5.

I was initially disappointed to note a stepped pattern of short, dark, horizontal lines marching diagonally across the image. As I was simultaneously decoding the same image with my *Proscan* receiver (which did not produce this effect), I initially feared that

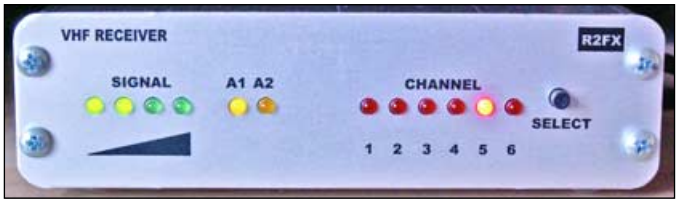


Figure 1
The front panel of the R2FX showing the various LEDs

Figure 2
The back panel of the R2FX, showing connectors

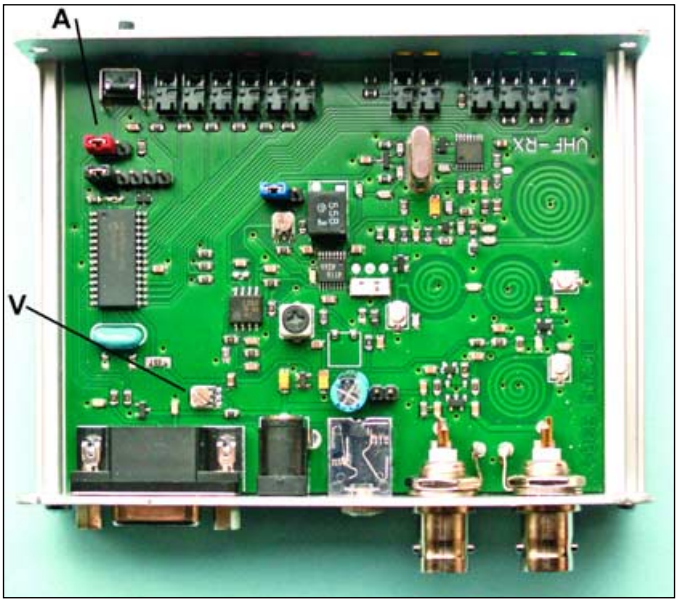


Figure 3
The interior of the R2FX showing the audio output adjust potentiometer (V) and the jumper switch (A) used to set/unset the dual antenna facility

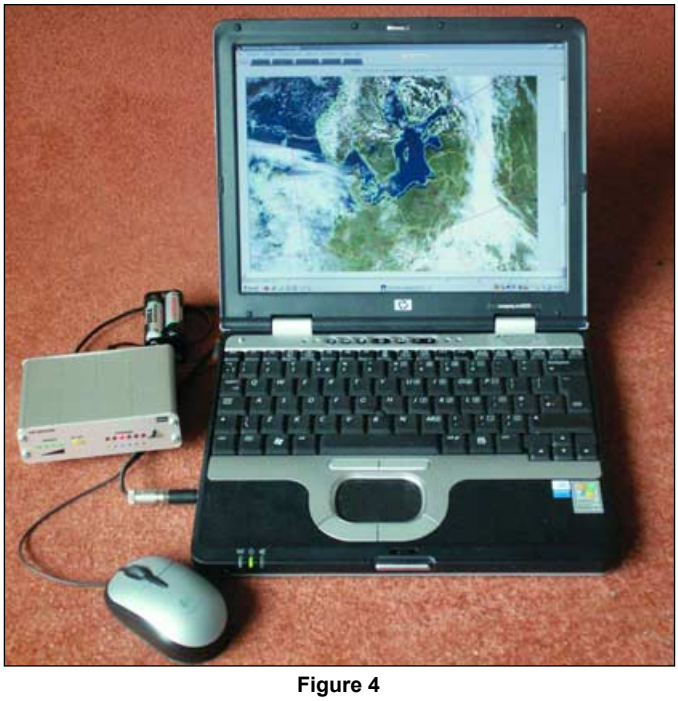


Figure 4
My mobile weather satellite ground station, consisting of the R2FX receiver with 4 x AA battery pack and notebook PC.

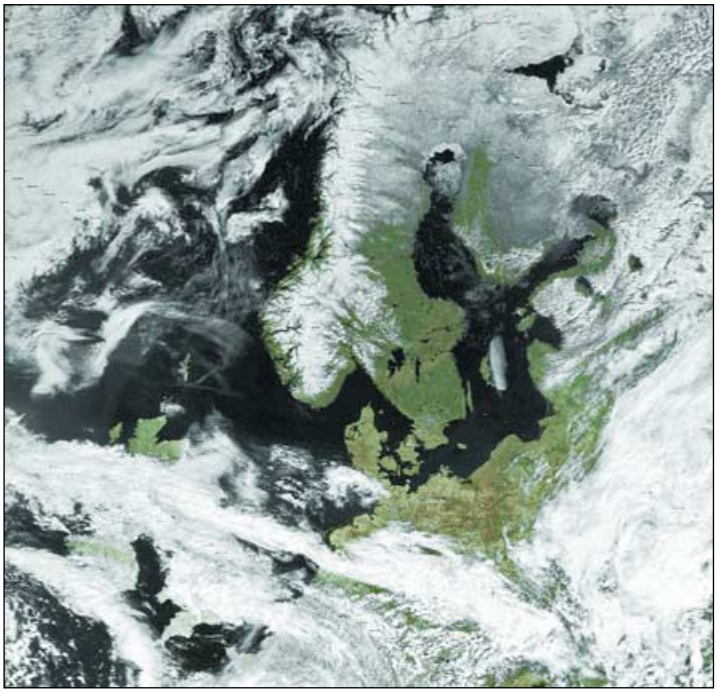


Figure 5
My first NOAA 17 image received at 10:34 UT on April 26, 2005 using the R2FX. A stepped pattern of short, dark, horizontal lines mars the image. The effect is most clearly evident over northern Scandinavia and over the mass of cloud at upper left. This effect is easily addressed by converting the R2FX from 'antenna diversity' to single-antenna mode.

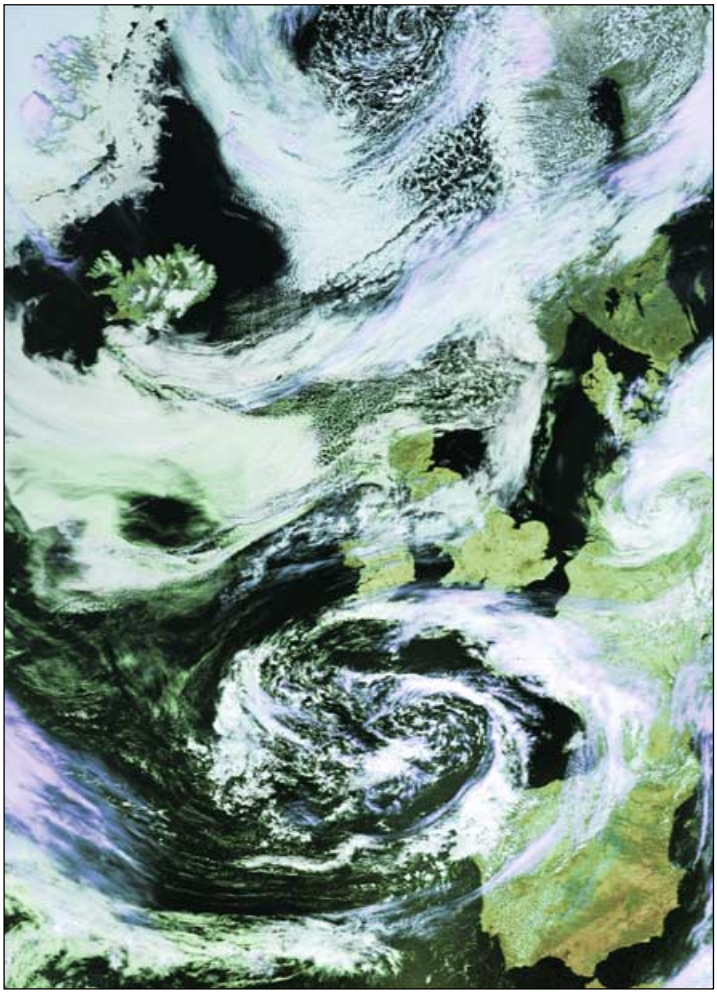


Figure 6
This image from NOAA 17 was acquired at 11:40 UT on May 15, 2005 after the R2FX had been adjusted for single-antenna operation.

Processing: both the above images were produced using Satsignal

my *R2FX* might be faulty. However, an e-mail to Holger Eckardt soon solved this. The unit ships in twin-antenna mode ('*antenna diversity*' as the manual describes it) ... but I only had a single antenna connected. It turns out that, in this situation, the total lack of signal when the receiver attempts to access the second antenna results in a brief loss of signal, which places black pixels in the image. Switching the *R2FX* to single antenna mode removed the problem completely (figure 6).

Using Two Antennas

The idea of using twin antennas intrigued me, so I ran a test with two QFH antennas, deliberately positioned to the north and south of my house in such a manner that the structure prevented me obtaining a complete horizon to horizon pass from either (neither QFH was capable of receiving a complete pass because of the obstruction from my house). Nevertheless, results were superb: you would not have been able to guess that there was a problem as the *R2FX* seamlessly switched antennas at the appropriate point to maintain the strongest possible signal. For users who cannot position a single antenna in a location clear of obstructions this provides a novel way of extending the imaging range.

Changing to Single Antenna Mode

As my situation does not require me to make use of twin antennas I decided to switch modes. On opening the case of the *R2FX* you will see a red jumper next to the push-button on the front panel (labelled 'A' in figure 3). By default this is in the right-hand position (twin antenna mode). Just move the jumper to the left-hand position and the receiver is converted for single-antenna operation. You will find that only the amber antenna LED labelled 'antenna 1' now illuminates. Of course, the antenna must be connected to the 'Antenna 1' BNC connector otherwise you will not now receive any signal at all.

Performance

I received my *R2FX* in mid-April. Once the antenna 'problem' was understood, I ran a series of tests comparing the *R2FX* with my commercial *Proscan* and *Martelec MSR 50* receivers. The *R2FX* was tested simultaneously with either the *Proscan* or *MSR 50*, both test receivers being fed from QFH antennas in the loft; signals were decoded on laptop PCs using *WXtoImg* software.

Results were identical. Images were all well-nigh perfect, and any imperfections resulting from local interference showed identically on both. I had initially feared that the *R2FX*, being manufactured in Germany, might not possess sufficient filtering to eliminate pager intrusions but I need not have worried. There were absolutely no problems in this respect.

NOAA 18 Problems

However, the arrival of NOAA 18 in mid May, transmitting on the new frequency of 137.9125 MHz, did produce severe problems. Certainly, at my location in northeast Scotland, the *R2FX* was badly affected by pagers (some transmitting on 137.975 MHz), and images were simply awash with horizontal pager intrusions. But the same was true for the *MSR 50* (I cannot comment on the *Proscan* here, as mine is not upgraded for NOAA 18, although members elsewhere in Great Britain have found it impossible to image from NOAA 18 on the *Proscan* also)

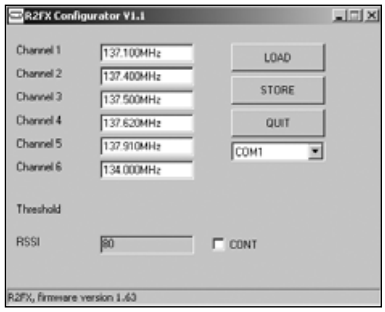
The NOAA 18 situation does, however, vary a great deal across Great Britain. From some districts I have received reports that imaging is 'impossible' or 'hopeless' using both the *Proscan* and *R2FX;* from others, both receivers are performing perfectly. As expected, most members in the London area (a notorious pager hot-spot) cannot obtain NOAA 18 images—though even there, some readers have reported good reception using the *R2FX*. One final associated problem can arise when pager activity is particularly severe: if the R2FX is in scanning mode, it can lock on to 137.91 MHz for 30 minutes or more at a time, which means that passes of other satellites can be missed.

Satellite Imaging 'On Location'

One of the delights of holidaying in remoter parts of Britain is taking along a mobile satellite ground station in order to check up on impending weather. This is something I do several times a year when visiting the Isle of Skye off the west coast of Scotland. The *R2FX* adds a new dimension to this pursuit because it can be operated with a power supply as low as 5 volts—you can even power it directly from a USB port on a laptop PC. It is the simplest task to purchase a set of four rechargeable AA batteries, a cell-holder and a 6 mm plug to fit the *R2FX*. Figure 4 shows my station shortly after decoding a satellite pass. The battery pack can be seen just behind the *R2FX* and the entire setup can be used 'in the field' without the need for mains electricity.

Reprogramming the R2FX Frequencies

If you purchased your R2FX earlier than May 2005 it will be set up with with the old Russian APT frequencies rather than the two new NOAA ones. This is easily rectified by downloading a simple program called *R2FX-config* from Holger Eckardt's website (see below). All you require to do is connect the *R2FX* to the 9-pin serial port on your computer then run this program.



First select the correct port (normally COM1) and click 'LOAD'. This recovers the frequencies held in the *R2FX* and displays them as illustrated. Just retype any of these then click 'STORE' and the new value will be programmed back into the receiver.

Conclusions

The *R2FX* is a modern, highly effective APT weather satellite receiver that performs well even in the UK with its notorious 'pager' problems. The only significant criticism concerned imaging from NOAA-18, but in fairness, the *R2FX* fared no worse than most other receivers.

I have received numerous reports from GEO members indicating that APT receivers of all types are being affected by pagers at the NOAA-18 frequency of 137.91 MHz. In some parts of the country the problem is so severe that imaging is impossible: yet there are locations where excellent images are being obtained with the R2FX.

The bottom line is this: if you are looking for a high quality receiver for APT then the *R2FX* is as good as any you will get. And its price of 179 euros (which includes post and packing) equates to just a shade over £120. When you consider that the UK-designed *RX2* receiver now costs £90 in kit form, this ready-built receiver from Germany, which works 'straight out of the box', becomes a very attractive proposition. As far as I can ascertain, it is the cheapest ready-built receiver currently on the market, as well as being one of the best.