

Manual for the Weather Satellite Receiver **R2FX**



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2m Receiver for APT Mode Satellites

Introduction

Read the manual carefully before beginning of operation.

With the R2Fx you get a receiver which is designed for the reception of APT signals from low-orbit weather satellites on the 137MHz band. This are e.g. those of the American NOAA series or the Russian METEOR and SICH satellites. In addition it is possible with a suitable converter to receive the geo-stationary satellites like Meteosat which transmit on 1.7GHz.

Matched IF filters and a highly linear demodulator provide optimal picture quality even with weak signals. The excellent receiver noise figure makes an additional pre-amplifier in most cases obsolete.

Thanks to the implemented scan mode it is easy to find the satellites even without a satellite tracking software.

An AFC circuit compensates the frequency shift of the satellite caused by the Doppler effect or the temperature related frequency drift of an Meteosat converter.

A novelty which no other low-cost sat-receiver can provide is the antenna diversity capability. This gives pictures without any signal drops during the whole pass even with simple antennas.

Safety precautions

The receiver complies to the national and European requirements for electromagnetic compatibility. The reception of weather transmissions in the EC is free for everybody.

Technical modifications of the receiver by the user causes loss of guarantee. There is no liability against damage of the receiver which is due to disregard of this manual. Also there is no liability for incidental or indirect damages arising from that.

Please supply the receiver only with well filtered DC voltage between 5 and 12 Volts. Voltages which exceed this value even for a short period of time can damage the device seriously. Find below further information for power supply.

Included items

- 2m-receiver R2FX
- AC Mains adapter (not all country versions)
- 3,5mm connector cable
- Manual

Preparing for use

Supply the receiver only from the enclosed AC adapter or from a regulated 5 ..12V DC supply. The power supply cable shall be plugged into the receptacle which is labeled with **DC**.

Watch the polarity if you use another cable than that of the original AC adapter. The receiver does not have any protection against wrong polarity. Mixing up plus and minus will damage the device.

The AC adapter has selectable voltage and polarity. The position of the voltage selector shall be 6V and the polarity switch adjacent to the LED. The plus-mark at the small adapter at the end of the DC cable shall be located so that it is beside the letters "TIP" on the receptacle.

The R2Fx does not have a power switch. The receiver is on if you attach the power. Once in operation at least one of the red LEDs on the front is on.

Connection to a PC or hardware demodulator

The receiver provides an audio signal of approximately $800\text{mV}_{\text{RMS}}$. To get a picture out of this signal it must be processed. In general this is done by the PC. The receiver is either connected to the sound card or to an external hardware demodulator which is connected to the serial interface of the PC if the computer itself does not have an audio interface. Suitable external demodulators are e.g. Harifax 3 or the HamCom interface.

With a build-in audio interface things becomes really easy. You connect the 3.5mm connector of the receiver to the line input of the sound card. You can use mono or stereo connectors. In the latter case the signal comes out only at the center pin (right channel). The sound card of the PC in most cases has the same connector so that a one-to-one cable fits best.

The receiver output is compatible to all yet know sound cards or hardware demodulators. For further information how to connect any particular device refer to it's manual.

Meanwhile there is plenty of public domain and shareware software available which supports APT reception. See the appendix for more information.

Connection of an antenna

The receiver has two 50Ω BNC connectors for the antenna. Since the satellites are working in the 2m-band in general all 2m-antennas are suitable. The satellites uses relatively low orbits therefore they normally have more or less strong signals. This means that you don't need a directional antenna. The best solution is an omni-directional antenna. This makes tracking superfluous.

However due to multi path propagation of the satellite signals (e.g. reflections from walls or hills) there often can be noticed drop outs on the signal which you can see as noisy stripes on the picture. With the diversity circuit the receiver selects automatically which of both antenna inputs provides the better signal quality. So if you connect two antennas e.g. a vertical and a horizontal dipole it is very likely that you don't get any signal drop-out during the whole pass. The two LEDs marked with A1 and A2 indicate which of the antennas is currently in use.

Certain attention should be spend on the feed line of the antenna. The cable shall not be too thin and too long. For distances up to 20m R58 is fine. Up to 60m RG213 can be used. For longer distances an additional pre-amplifier directly mounted at the antenna could be necessary. DC supply of a remote amplifier is supported by the receiver (see below).

How to select the frequency

The receiver includes 6 memory channels. Channels 1 to 5 are pre-programmed with the currently used satellite frequencies. Channel 6 is provided for operation with a 1.7GHz converter for geo-stationary satellites. Please see the table for the channel allocation. The same data you find on a sticker on the bottom of the receiver.

- | | |
|--------------------------|----------------|
| - Channel 1: 137,300 MHz | NOAA18 |
| - Channel 2: 137,400 MHz | SICH1M |
| - Channel 3: 137,500 MHz | NOAA12, NOAA15 |
| - Channel 4: 137,620 MHz | NOAA17 |
| - Channel 5: 137,850 MHz | NOAA18 |
| - Channel 6: 134,000 MHz | |

By pressing the key labeled **SELECT** you can proceed cyclically from one channel to the next. For each channel there is a corresponding LED on the front.

If you press the key for more than 2 seconds the receiver starts to scan the channels 1 to 5. If there is a sufficiently strong signal it remains on that channel. If the signal vanishes the scan mode is resumed after a latency time of 5 seconds.

Pressing the key again for a short time the scan mode resumes.

Display of the signal strength

On the front cover you see four green LEDs which indicate the strength of the received signal. The table shows the relation between RF input power and the numbers of active LEDs. As soon as the first LED is on the scanning stops. This signal strength is sufficient then for the most decoders to provide pictures in good quality. As soon if the signal is strong enough to activate the second LED the picture is virtually free of noise.

LEDs	RF input power	RF input voltage
1	-120 dBm	0,22 μ V
2	-110 dBm	0,71 μ V
3	-100 dBm	2,2 μ V
4	-90 dBm	7,1 μ V

Power supply from the PC

Sometimes it is inconvenient to supply the receiver from the AC adapter. In this cases it is possible to obtain the DC supply from the PC provided that it has a game port or a Midi interface. This is the case at nearly all sound cards. You need a two wire cable which on one side has a 2.1mm DC plug and on the other a 15-pin Sub-D connector. See the table how to connect the wires:

Polarity	DC connector	Midi/Game-Port
Plus	Center conductor	Pin 1
Minus	Outer conductor	Pin 4, 5 and 8

Caution, the receiver does not have any protection against wrong polarity. Mixing up plus and minus will damage the device.

Serial interface

The receiver has a serial RS232 interface. Through that it is possible to re-program the memory channels, control the receive frequency or read a RSSI value. There is no particular software necessary for communication. Just use any terminal software like e.g. *HYPERTERM*® which is included with Microsoft *Windows*®. The baudrate is 1200 bps, 8 data bits, 1 stop bit, no parity, no flow control. Each character you type on the keyboard will be echoed to the monitor. You need a 9 pin Sub-D cable for the connection between receiver and PC.

The syntax for controlling the frequency is easy. You have to type in the sequence Cxyyy. Here C means the capital C on the keyboard (ASCII code 43h). x is the channel number and runs from 0 to 6. The numbers 1 to 6 corresponds to the memory channels 1 to 6. Entering a frequency on channel 0 causes the receiver to jump to that frequency immediately without saving it to any memory location. This is a way e.g. to make a fast programmed scan by the PC.

yyy is the 3-digit frequency value starting with the 1MHz digit and having 10kHz resolution. I.e. 750 means 137.500MHz or 782 is the code for 137.820 MHz. 999 is the highest value and sets the receiver to

139,990MHz. However it is not guaranteed that the PLL still locks on that channel. The lower limit is 400 which means 134.000 MHz.

Entering a *M* will respond with the frequency allocation table.

With *R* the receiver returns the current RSSI value. This value is a measure for the received signal strength. It runs from 40 with no signal to an upper limit of approximately 130. The absolute value does not mean much however the slope is well defined and is related accurately to the logarithm of the input voltage.

The entry of *Txx* determines the threshold value where the scanner stops. *xx* is an integer number between 00 and 99 and corresponds to the value you get with the *R* command. Reasonable values lay between 50 and 80. The initial value is 61. This function is useful if you operate the receiver in environments where RF noise exists which otherwise would render the scanner to stop.

RESET

If you want the receiver to restore all initial settings you must switch on the device and during the first two seconds while all lamps are on press the *SELECT*-key. Keep the key pressed until the red lamps extinguish. During reset no antenna must be connected as the RSSI circuit is calibrated at the same time.

Inside the receiver

Remote supply

If you want to connect a Meteosat convert to the R2FX or if you need a pre-amplifier due to a very long antenna cable you can supply those devices through the coax cable itself. To use that option you have to open the cover by removing the two upper screws on the front and the two on the rear side.

If you pull up the cover you see directly below the audio connector a two-pin receptacle marked with *JP1*. If you connect both pins with a jumper the DC input voltage is applied to the *ANTENNA 1* BNC connector. A maximum current of 100mA is allowed.

Caution, there is not protection against short on that port.

Disabling the antenna diversity

In case you are using a Meteosat converter or you only have a single antenna you can disable the antenna diversity circuit. Close to the *SELECT*-key you see a 3-pin receptacle marked with *JP3*. Originally there is a jumper between the middle and the right pin (seen from the front side) which means that the diversity is active. If the jumper is connected between middle and left position *ANTENNA 1* is the only active antenna.

Technical data

Frequency range	134 ... 138 MHz
Channel spacing	10kHz
IF bandwidth	30kHz
Number of channels	total 6, 5 of them scanable
Sensitivity	0,28µV at 20dB S/S+N (SINAD/CCITT)
Distortion at 1kHz AF	1%
AFC-pulling range	±7kHz
Supply voltage	5 – 12V, 100mA max.
Size	113x85x31mm

User interface	Key for channel selection LEDs for signal strength LEDs for channel display LEDs for antenna switch
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Connectors

Antenna (2x 50 Ω ,BNC)
AF-Output (800mV_{rms}, 600 Ω)
Power supply
Serial interface

Appendix

Hardware-Decoder:

- Harifax 4. Universal decoder for APT signal as well as for Fax transmissions on short-wave or SSTV. Works together with e.g. JVCOMM. URL: <http://www.diethiems.de/index1.htm>

Software for decoding satellite transmissions:

- JVCOMM, universal program for APT satellites, SSTV and short-wave Fax. For Sound card and hardware decoder. Free demo: <http://www.jvcomm.de/>
- WXSAT, easy to use program for APT decoding, enables coloured pictures by combination of visible and infrared image of NOAA. Free download: http://www.hffax.de/WX_Satellite/WXSat/wxsat.html
- SATSIGNAL, Offline-decoder, i.e. you store the satellite pass as WAV-file and the decoding follows later. Excellent picture quality. Free download: <http://www.satsignal.net/>
- WXtoImg, excellent weather satellite signal to image converter for Windows, Linux and MacOS www.wxtoimg.com

Satellite tracking software:

- OSXSAT, Free download: <http://www.fengers.de/0sxsat.htm>
- Plenty of tracking software for each flavour from AMSAT. <http://www.amsat-dl.org/vertrieb/index.html>

Kepler elements:

- The latest Kepler elements for the tracking software: <http://www.space-track.org>

General:

- Good sites for everything concerning picture transmission: www.hffax.de, www.geo-web.org.uk, www.rig.org.uk

E-mail address: df2fq@amsat.org , internet page: www.df2fq.de

