

AERO EASY WITH MULTIPSK (Version 4.32)

Introduction

In this document (revision A), it will be found a small guide about :

- the hardware to use for monitoring AERO transmissions,
- the way to decode the AERO transmissions, this with snapshots of the Multipsk screen.

Notes about the help in Multipsk:

- for the contextual help, click on the right button of the mouse, with the focus over the « AERO » button,
- use also the button hints. For this, wait a fraction of second with the mouse focus over the button.

Contents

- AERO mode presentation
- Necessary hardware to monitor AERO transmissions
- How to decode AERO transmissions with Multipsk (V. 4.32)

AERO mode presentation

The Inmarsat "ClassicAero" channel P service consists of the transmission of downlink messages from geostationary satellites (Inmarsat 3F1, 3F2, 3F3, 3F4, 4F1 and 4AF4) to airliners in transcontinental flight. These messages are transmitted from ground stations (GES) to planes (AES) (but not AES to GES), according to the "Satcom ACARS" system protocol.

The frequencies used are 1545.0 to 1545.2 MHz for 600 and 1200 bauds transmissions and 1546.0 to 1546.11 MHz for 10500 bauds transmissions.

The Inmarsat AERO satellites transmit a great number of management frames relative to transmission and satellites link. They are decoded but encrypted. Reversely, several messages are text relative to weather reports (decoded by Multipsk), flight plans, etc.. These are the only messages really interesting.

Necessary hardware to monitor AERO transmissions

For these UHF frequencies, a stable receiver not having too much shift is advised, as, for example, the "RTL-SDR.COM V3" key which permits, moreover, to directly supply the LNA in 4.5 V.

Note : if your receiver is neither a RTL/SDR key nor a FUNcube, you will need to install a VAC link (48 KHz, IQ signal 16 bits, in baseband) between the SDR program associated to your receiver and Multipsk (in SdR interface).

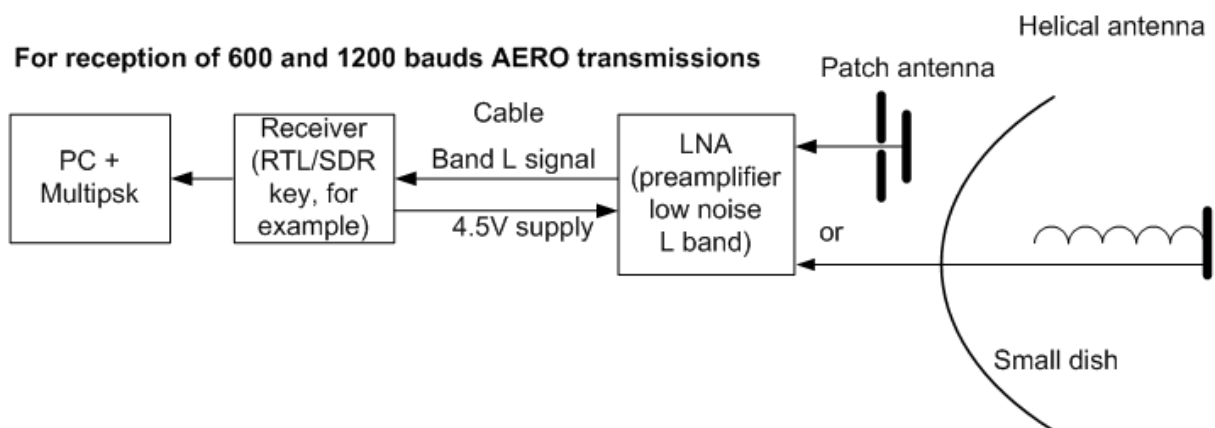
It is necessary to have at one's disposal a LNA ("Low Noise Amplifier") as, for

example, the « Outernet/Inmarsat L-band Amplifier – LNA » which can be supplied by the "RTL-SDR.COM V3" key. The LNA must be placed at the antenna output. A LNA specific to band L is advised.

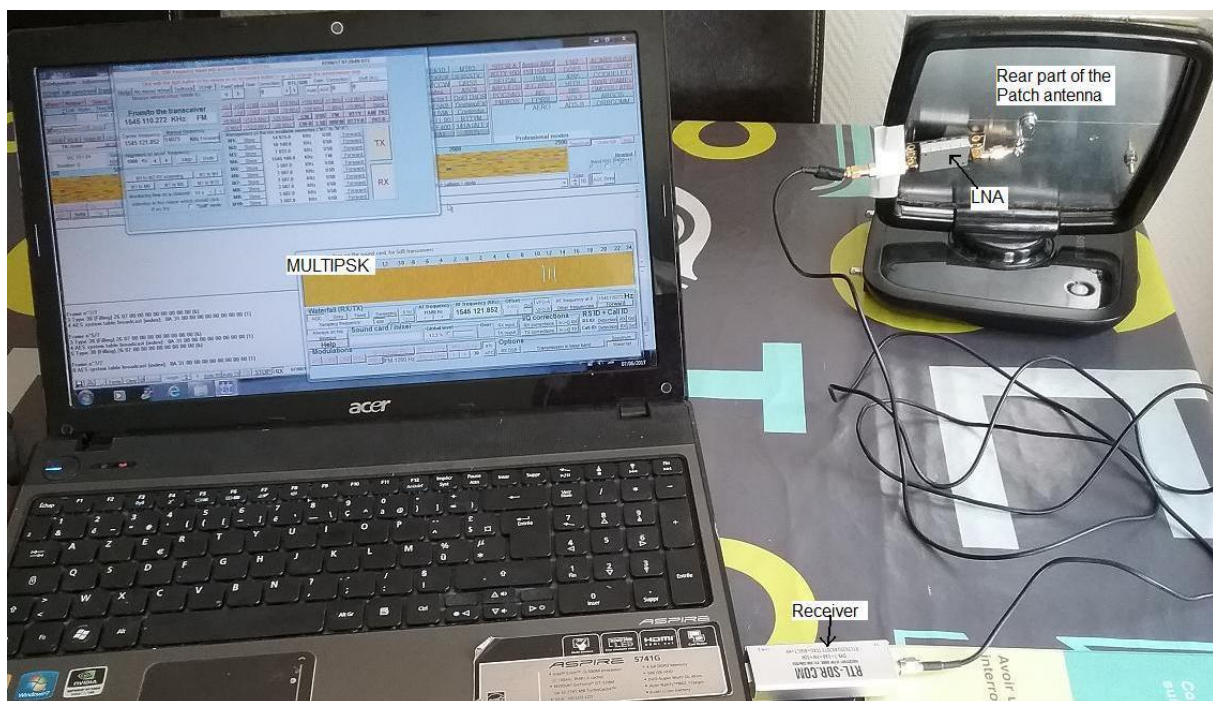
The cable between the LNA and the receiver must not introduce too many losses, so either use a cable with weak losses or a short cable.

600 and 1200 bauds transmissions

Now, if you plan to only receive and decode 600 and 1200 bauds transmissions, the antenna can be either a Patch antenna or a helical one installed on a small dish (60 cm diameter, for example).



Necessary hardware with a Patch antenna:



About these antennas :

- The Patch one : not very directional but quick to install.
- To build a Patch antenna, see : <http://www.rtl-sdr.com/building-and-testing-an->

[l-band-patch-antenna-for-inmarsat-c-reception/](#)

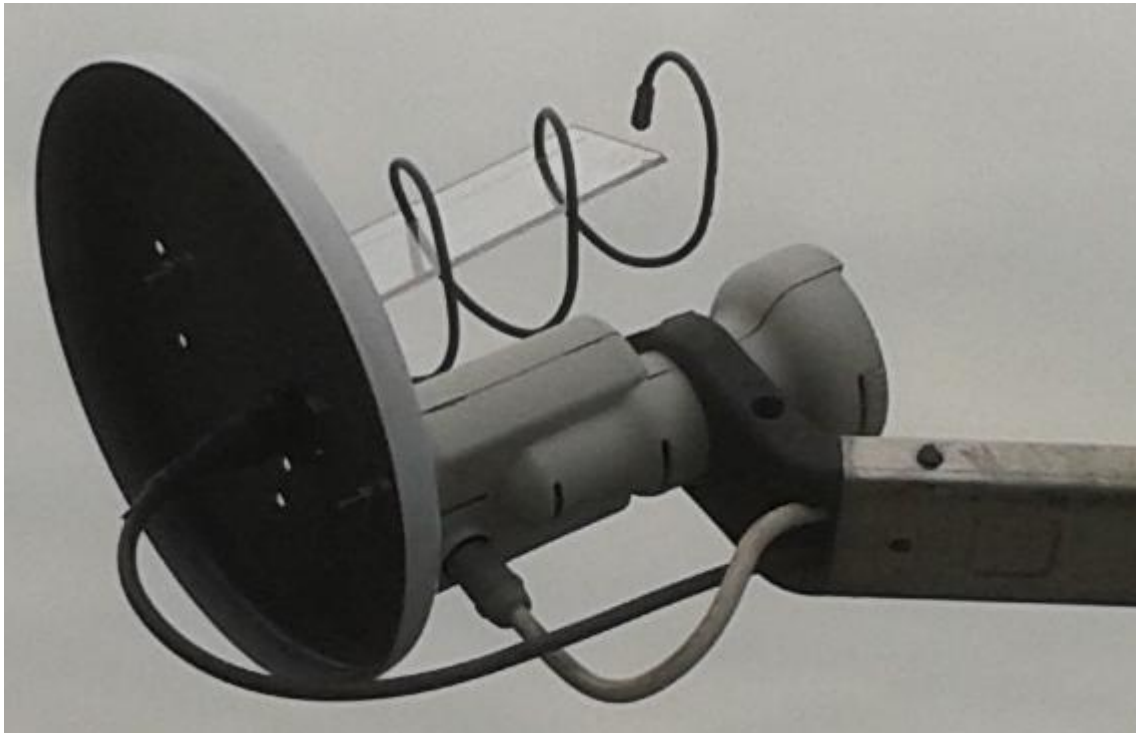
- The helical one installed on a small dish : more directional but more complicated to install.

For the helical antenna, see an example here : <http://www.uhf-satcom.com/lband/>

To calculate a helical antenna :

http://www.f1afz.fr/montages/calcul_helice/calcul_helice.html

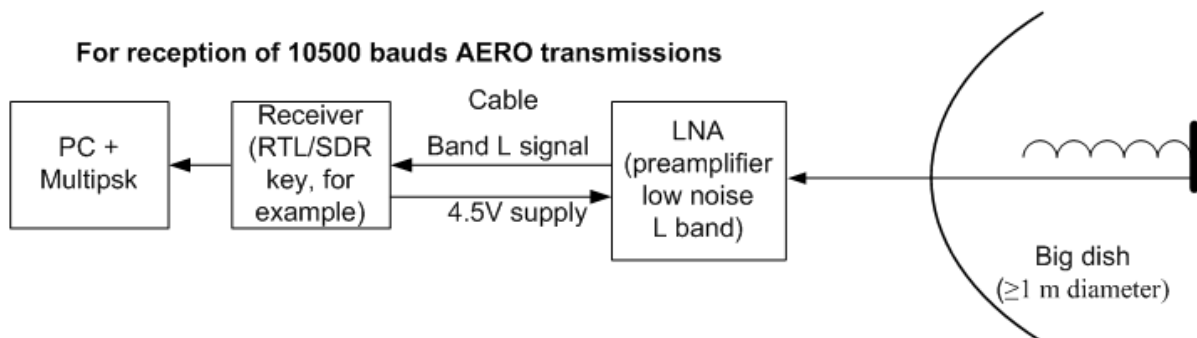
Attention, the AERO polarization is right-hand circular, but the « dish » reversing the polarization, antenna turns must be wound to the left, as shown below:



10500 bauds transmissions

To receive and decode 10500 bauds transmissions (the most interesting), a helical antenna installed on a 1 m diameter minimum dish is indispensable (but 1.2 m diameter or more would be ideal).

The polarization is the same as for the 600 and 1200 bauds transmissions, so the same helical antenna can be used for all AERO transmissions (600, 1200 and 10500 bauds). Note: the 10500 bauds transmissions decoding requests a fast PC.



Below, it is shown a 1.2 m diameter antenna :



How to decode AERO transmissions with Multipsk (V. 4.32)

It will be found, below, several snapshots which will show you how to configure Multipsk for the AERO mode, successively for:

- the 600 et 1200 bauds transmissions,
- the 10500 bauds transmissions.

One finishes with a snapshot of the « Satellites » window to help for antenna pointing.

The AERO frequencies can be found on this document : <http://jontio.zapto.org/hda1/AERO-March-2016-Europe.pdf> and also there: <http://www.uhf-satcom.com/lband/>

Several WEB sites manages this subject, as for example :

- <http://coolsdrstuff.blogspot.fr/2016/05/inmarsat-antenna-comparison.html>
- <http://jontio.zapto.org/hda1/jaero.html>

The Multipsk users can also ask their technical questions to the Multipsk Yahoo group (in English).

Reception of 600 and 1200 bauds AERO transmissions

The « Transceiver » window permits to control the RTL/SDR key frequency.

The screenshot displays the MULTIPSK V. 4.32 software interface. The main window is titled "MULTIPSK - THE MULTIMODE DIGITAL TRANSCEIVER * Version 4.32". It features a menu bar (Configuration, Adjustments, Options, Tools, PSKReporter, Satellites, Panoramic, Help) and a toolbar with various function buttons.

The "Transceiver" window is open, showing the following details:

- RTL-SDR frequency taken into account:** 1545110272 Hz
- Carrier frequency:** 1545 121.892 KHz
- Manual frequency:** 14075 KHz
- Alignment on an AF frequency:** 1000 Hz
- Monitoring time on a channel:** 60 s
- Attention to the relays which should click:** If so, try: ☐ "Split" mode

The "Waterfall (RX/TX)" window is also visible, showing a frequency spectrum plot. The plot has a horizontal axis from -24 to 24 KHz and a vertical axis from 0 to 2500 KHz. The plot shows a strong signal at 1545 121.892 KHz.

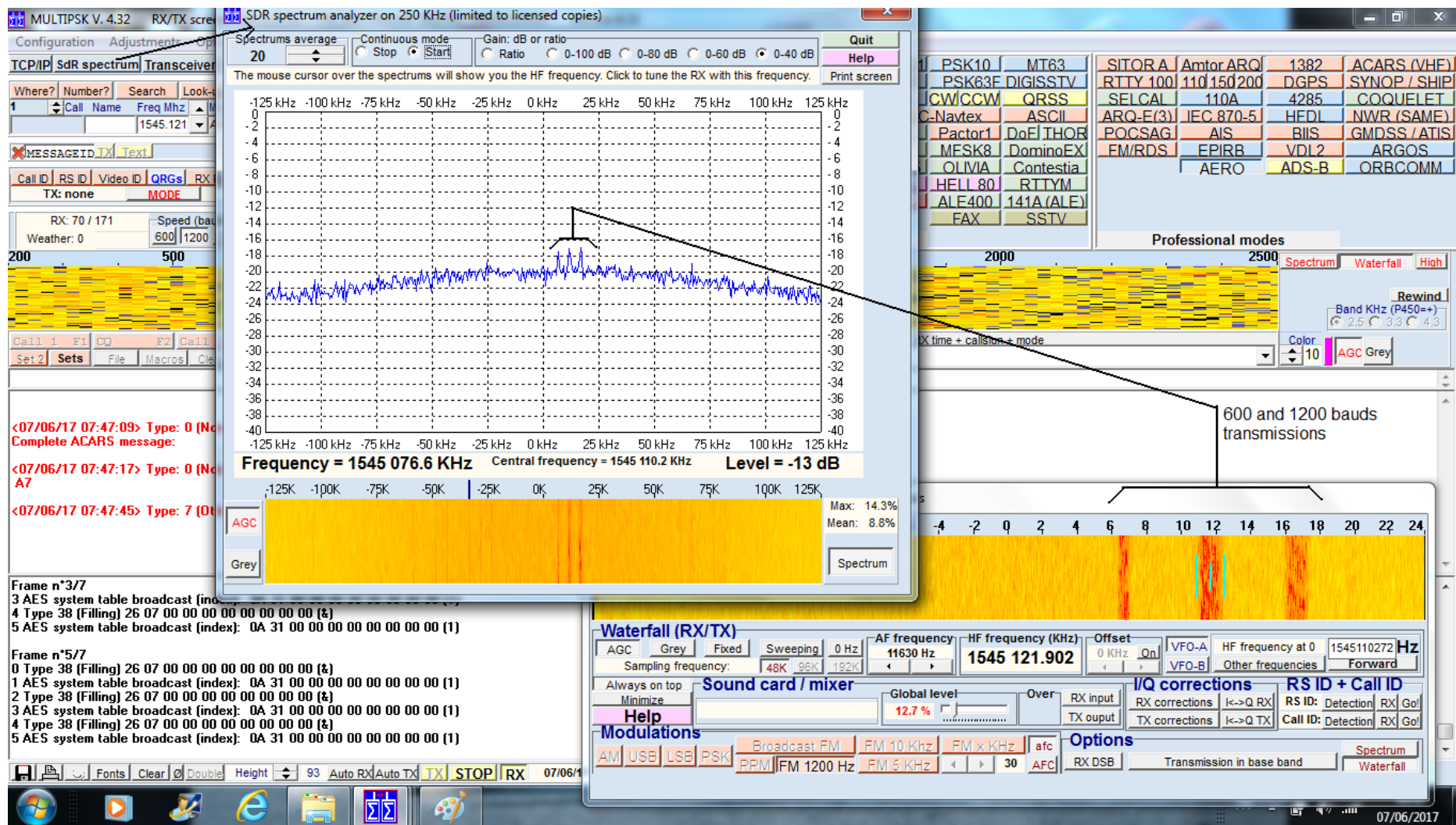
The "Options" window is open, showing the following settings:

- AGC:** Grey
- Fixed:** Sweeping
- Offset:** 0 KHz
- HF frequency:** 1545 121.892 KHz
- HF frequency at 0:** 1545110272 Hz
- Sampling frequency:** 48K, 96K, 192K
- Global level:** 13.6 %
- Over:** RX input, TX output
- I/Q corrections:** RX corrections, TX corrections
- RS ID + Call ID:** RS ID: Detection, Call ID: Detection
- Modulations:** AM, USB, LSB, PSK, Broadcast FM, FM 10 KHz, FM x KHz, PPM, FM 1200 Hz, FM 6 KHz
- Options:** RX DSX, Transmission in base band, Spectrum, Waterfall

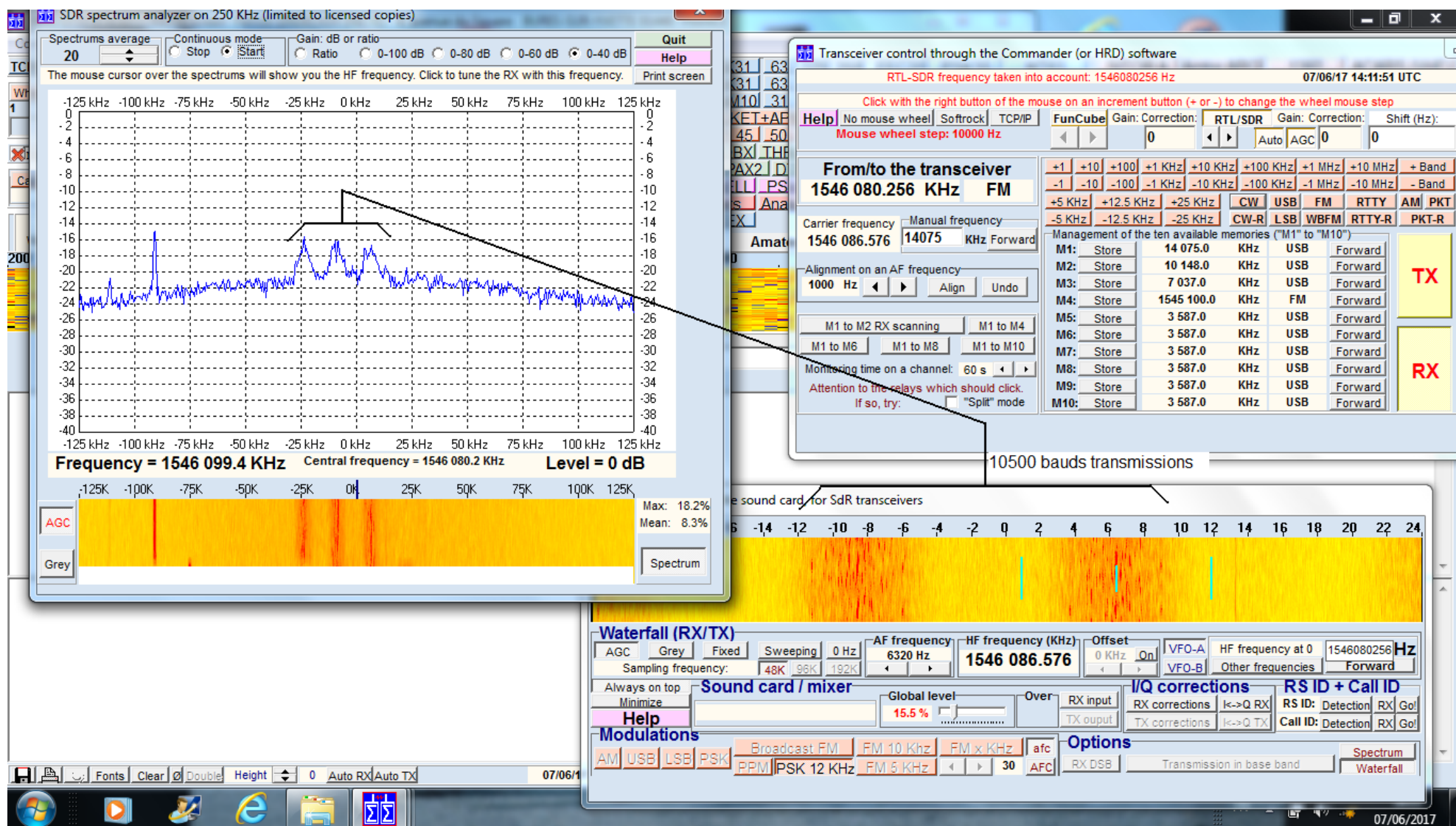
The bottom of the screen shows the Windows taskbar with the Start button and several application icons. The system clock in the bottom right corner indicates the date 07/06/2017.

Reception of 600 and 1200 bauds AERO transmissions

The « SdR spectrum » window permits to display a 250 KHz bandwidth and to control the RTL/SDR key frequency.
The peaks height on the SdR spectrum makes easier the antenna pointing.



Reception of 10500 bauds AERO transmissions (with the « Transceiver » and « SdR spectrum » windows open)



For the antenna pointing (azimuth and elevation), use the "Satellites" function.

32 RX/TX screen * MULTIPSK - THE MULTIMODE DIGITAL TRANSCEIVER * Version 4.32

Adjustments Options Tools PSKReporter Satellites Panoramic Help

Transceiver Country/Loc World QSO Mail Tune Beacon ID

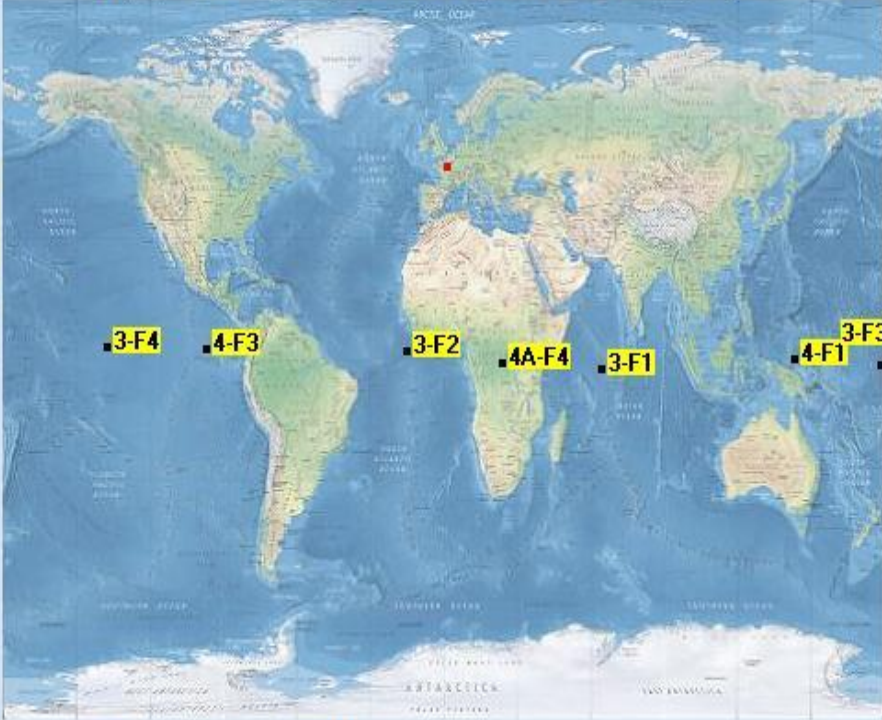
Search Look-up DXK DXView Pathfinder Where? --> PSKReporter

ne Freq Mhz Mode Ur RST My RST R S Locator QTH Notes Clear Logbook QSO->Log

Click on "Satellites" to make appear this window

Satellites tracking (positions and frequencies)

Automatic determination of the satellite position and its frequency taking into account the Doppler shift
Multipsk, with this frequency, will automatically control the receiver (configured in "Transceiver")



Help

Maps

- World
- Europe
- North America
- South America
- Asia
- Oceania
- Africa

23:54:53: 3-F2 1545.029990 MHz Map: World_physical_small.jpg

Options

Your position is known Personal Ring

Export of the sole frequency proposed when the satellite appears Fr. control Minimum elevation

HF AF No

Controls

File

Frequencies 3-F2

1545.0300 1545.1900 1546.0700

Satellites

Orbcomm Argos 3 / EPIRB

Aero Fax APT ISS Amateur

Your choice

Only one track

Satellite name-nom

Tracked

Reset

Offset

0 Hz 0 Hz

7 satellites Oldest prediction: 88.4 days It's time to download new data

List of the satellites positions (from the closest to the farrest)

Stop display

3-F2	36162 Km Az=203° El=35° 01.80°N 014.74°W F=1545.0300 M D=-10 Hz
4A-F4	36259 Km Az=152° El=30° 01.03°S 024.17°E F=1545.1200 M D=-8 Hz
3-F1	36710 Km Az=112° El= 7° 02.57°S 064.91°E F=1545.0050 M D=-21 Hz

Pass predictions

Save/Open

3-F2	is currently visible
4A-F4	is currently visible
3-F3	will not pass over your QTH before 12 hours

Note : in fact, 3-F3 does not cover Europe and is not more mobile (relatively to us) than the other geostationary satellites...