

Tokenblauser:

Receiving FT-8 at 10 GHz via the QO-100 satellite

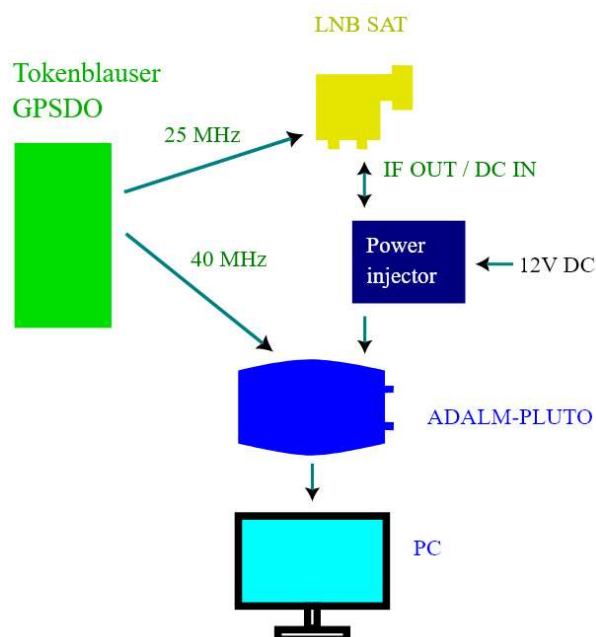
In this application note, we describe the usage of the Tokenblauser GPSDO as a signal generator to receive digital data from the QO-100 satellite.

QO-100 is a geostationary satellite, equipped with two linear transponders. FT-8 signals are re-transmitted in a narrow band, 10.489540 to 10.489543 GHz.

Key components

- 1) 10 GHz Satellite TV LNB (low-noise block, linear-polarized), modified for external 25 MHz reference;
- 2) Satellite dish – **you do not need it!**
- 3) DC injector to apply 12V to the LNB;
- 4) ADALM-PLUTO or any other SDR capable to receive at frequencies around 730 MHz; the SDR is configured/modified for external reference clock (40 MHz for ADALM-PLUTO, 28.8 MHz for RTL-SDR, etc);
- 5) RigExpert Tokenblauser as a source of reference frequencies;
- 6) SDR Console (<https://www.sdr-radio.com/console>) or other SDR computer software;
- 7) Virtual sound card, such as VAC (Virtual Audio Cable) or VSC, to redirect audio from the SDR software to the FT-8 decoding program (<https://vb-audio.com/Cable/>);
- 8) FT-8 decoding software, such as WSJT-X (<https://sourceforge.net/projects/wsjit/>).

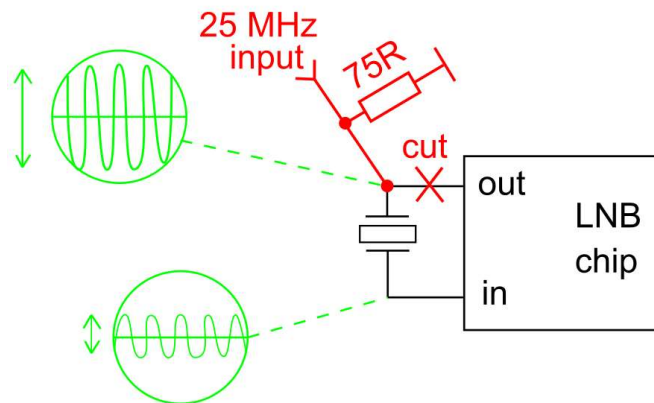
The structure diagram of the hardware is located below:



LNB modification

- 1) Carefully disassemble the LNB and find the 25 MHz crystal on the PCB;
- 2) By using an oscilloscope, check the swing of the 25 MHz signal on both pads of the crystal.
- 3) The pad with a larger swing is an output of the LNB chip. Cut the trace from this pad.
- 4) Wire the pad to an RF connector. Add a 75-Ohm resistor to ground. If the LNB has two outputs, use one of them to inject 25 MHz (do not forget to cut old traces to free up this output).
- 5) Assemble the LNB, using silicone glue for water protection.

The following diagram illustrates this modification:



Point the LNB to the QO-100 satellite

Calculate azimuth and elevation at the website: <https://eshail.batc.org.uk/point/> . You only need to guess an approximate location of the satellite, plus or minus 20 degrees, since the LNB itself has a wide beam.

(On the contrary, if the satellite dish is used, the beam is very narrow and you will need to adjust your dish to get maximum signal level.)

Fix the LNB steady, such as like on this photo. Please notice the orientation of the LNB for the vertical polarization.

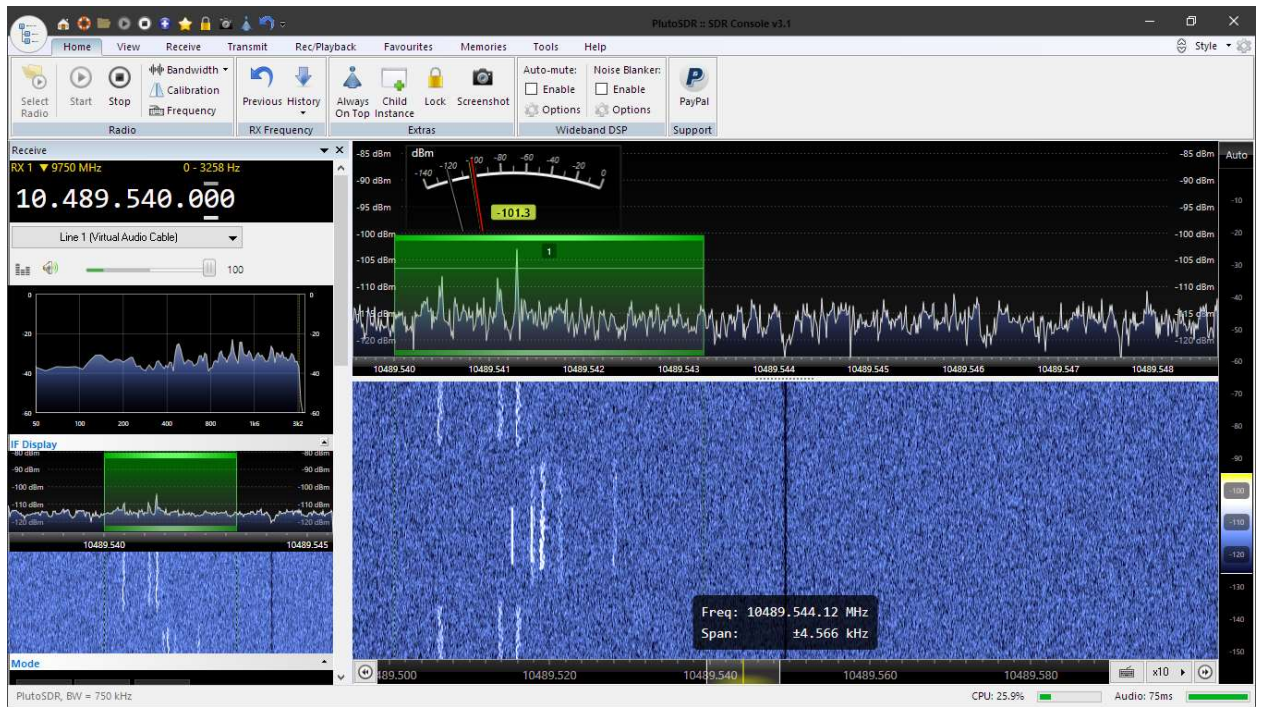


Set up the hardware

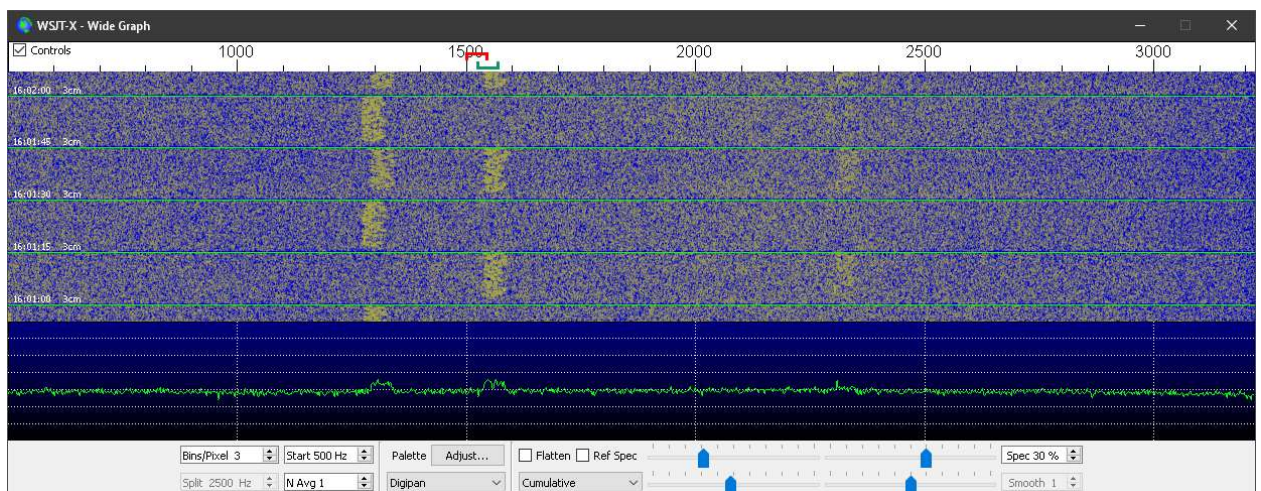
Make sure the Tokenblauer is locked to the GPS and the outputs are set up to generate 25 and 40 MHz. Connect the cables and apply power to the LNB.

Set up the software

Set up the SDR software according to it's User's manual. Taking into the account the LO frequency of the LNB (9.75 MHz), tune to 10.489540 GHz. FT8 traces should appear on the waterfall:



Now re-direct the output audio to your Virtual sound card. Run the WSJT-X software and set it up to receive from the same Virtual sound card. Now the FT-8 signals will be visible in the Wide Graph window:



The WSJT-X software is now able to decode the FT-8 signals:

Other signals

In addition, you may check the frequency stability of your Tokenblauser GPSDO by tuning to one of the satellite beacons, such as the one located at 11.703505 GHz:

