## About the T2FD antenna type

**T2FD** is folded dipole, terminated with a 600-900 ohms resistor. Feed impedance is coupled with balun; this prototype used 50/600 ohms voltage balun 1:12.

T2FD is a wide band antenna with rather low SWR over the full designed frequency range: antenna tuner is seldom needed.

Antenna length is not critical: it works well beyond the designed frequency range, with less radiation however while transmitting.

Free space gain is typically 3-6 dB below fixed frequency half-wave dipole. Radiation pattern is similar to dipole with the similar dimensions. Efficiency varies from 15% to 50%, typically 30%. Some people say that T2FD is a sophisticated dummy load...

T2FD is a non-resonant, traveling wave antenna, which is rather immune to local wide band noise sources and statics. T2FD is a extremely quiet RX antenna with high S/N ratio... worth to try!

T2FD is an ideal construction for wide band reference antennas and for Slow Frequency Hop systems. It is also used as a high-quality wide band receiving antenna (low power terminator). Antenna type is widely used by military and commercial services since late 1940s. Antenna type is mostly used as NVIS short to medium range portable tactical HF wire antennas for 0 to 2000 km range, using frequencies 2 to 15 MHz. With NVIS operations the low inverted-V configuration gives the best results.

## T2FD proto

This proto was built for tests as amateur radio stations HF antenna. This antenna was assembled as inverted-V at 3/8/3 m height. Input power range is up to 50W/carrier and up to 100W/SSB with the 50W terminator. SWR is from 1.1 to 2.3 full range: optional use with antenna tuner. 1.8 MHz QSO's were tested with tuner... poor signal reports.

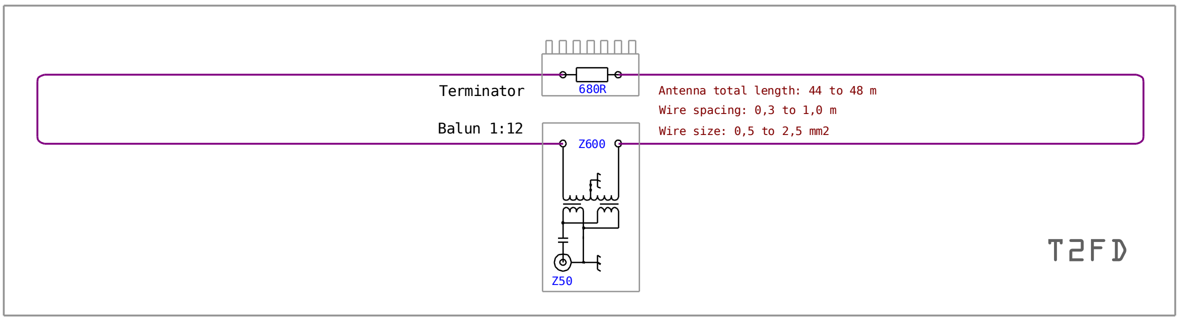
Antenna full length is 44 m for frequencies from 3.5MHz to 30MHz. Wire length was tuned to optimal SWR on 7 MHz, so the SWR is below 2.0 on all amateur bands. See the SWR chart below.
Prototype antenna's wire spacing was 450 mm, suitable range is 300 to 1000 mm. 5/500 mm glass fiber spacers were used between the wires, distance between spacers was about 3 m. Spacers were fitted with gable ties. 1.5 $mm^2$ PVC insulated stranded equipment copper wire was used as the antenna wire; suitable wire size ranges from 0.5 to 2.5 $mm^2$.

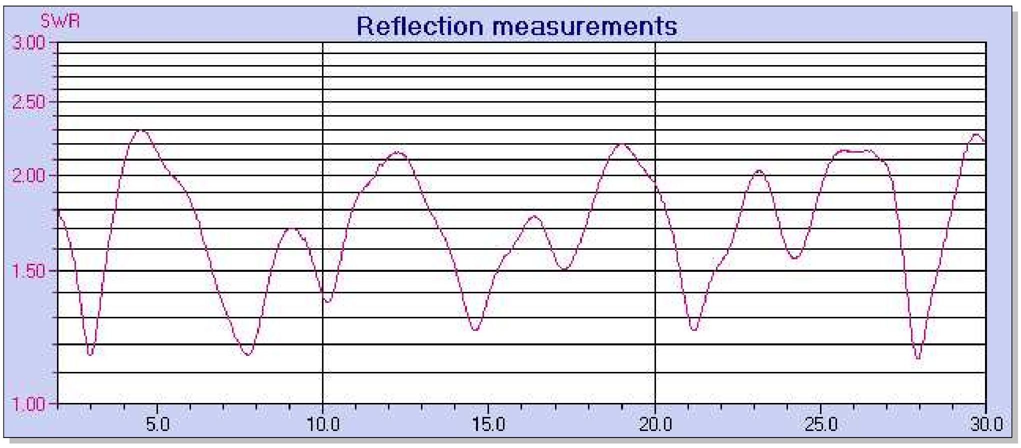
This antenna uses horizontal wire loop and low inverted-V position; with NVIS antennas we try to get the main radiation pattern up... the cloud warmer effect. Optional counterpoise wire below the antenna (buried 5cm) was tested, wire length about 45m. Only minor changes were seen on simulations with average ground.

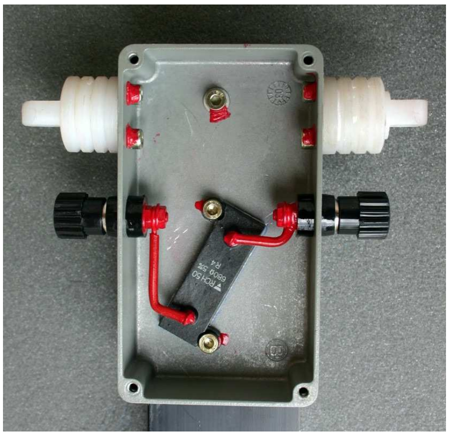
The antenna would work as well with vertical wire loop. Some DX listeners use T2FD as sloper configuration with good results.
If you use vertical wire loop and a flat top dipole assembly with high altitude (15-20m) you get direction pattern similar to half wave dipole with lower angle radiation. Some QSO's to P4/PY gave fair signal reports. However, the T2FD is not the best DX antenna...

NEC2 pattern simulations of this proto antenna at the appendix.
Also the total efficiency was simulated as follows:

| MHz | Eff % |
|---|---|
| 4 | 28% |
| 7 | 14% |
| 14 | 24% |
| 21 | 27% |
| 28 | 31% |



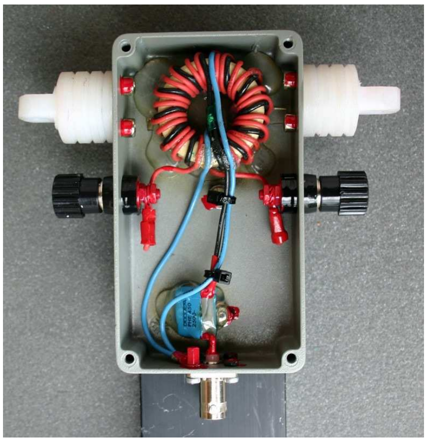


## Terminator Box

680 Ohms low-inductance resistor is fitted into Al die-cast box.

Resistor type is **RCH50 680R 50W**, Vishay (Elfa).
Optional type **FPA100 680R 200W**, Arcol (Elfa).
Optional type **MHP140 680R 140W**, BI (Farnell).

Both boxes are fitted into an aluminum profile heatsink.
Nylon insulators and 4mm wire-terminals are for connecting the antenna wires. The box was finally potted with beeswax.



## Balun Box

Transformer type: 50 ohms to 600 ohms (1:12) voltage balun.
***Balun details are on separate document at the appendix.***
Components were fitted with hot-glue into the Al die-cast box.
Nylon insulators and 4mm wire-terminals are for antenna wires.
Grounded BNC (or UHF) connector for 50 ohms coaxial feed gable.
The box was finally potted with beeswax.

## Current Balun

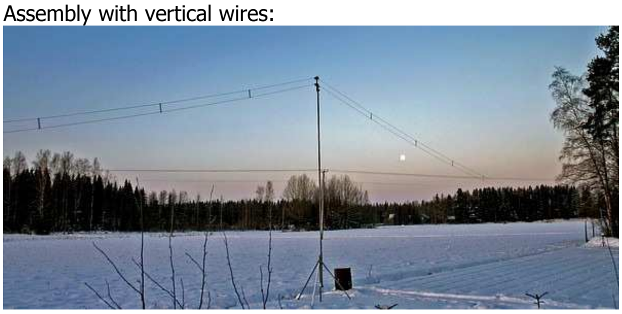
In this case we got the antenna assembled into rather free space, so we did not use extra choke balun. If the antenna would not be in perfect balance, due the obstacles around, then it is wise to add an external 1:1 current/choke balun into the coaxial feed line, near this balun box. The balun prevents coaxial mantle radiation. Normal 'dirty balun' or ferrite tubes over feed line work well.

## Support bar for horizontal wire loop

Terminal & balun boxes are fitted for 450 mm horizontal wire-spacing. It is also possible to use the wire loop at vertical position. The antenna works like dipole: it is possible to use the antenna as inverted-V or as a sloper to get omnidirectional direction pattern. Optimal center-point height is about 9 meters. Minimal wire height from ground is over 2 meters, due the high RF voltage on wires.

Assembly with horizontal wires:

Assembly with vertical wires:



## Terminator cooling

This antenna type moves about 40 to 90% of the full carrier power into the terminator. This varies by the antenna length and frequency. With CW/SSB the average dissipation is 15 to 30%.
If you use thick-film based resistor, enclosed into a transistor case or similar, it is important to cool the resistor properly. Normally you fit the resistor tight into a heatsink, using heat transfer silicone. Some heatsinks for solid state relays are compact and efficient. Typically the thick-film resistors can handle 20 to 40% of the nominal power at the 125C device temperature. As an example:

Take BI's MHP140W resistor in TO-245 case. It can handle 30 W with 125C case temperature. Using 100W transmitter with normally compressed SSB, you dissipate average 30W into the resistor. If you use heatsink of 2K/W, then the heatsink temperature rise is about 60C, which means about 85C device temperature at 25C ambient temperature. It works, but heatsink of 4K/W produces device temperature of 145C, which is too high.

Heatsinks are easiest to fit into the center support pole of the antenna. Air cooled silicone carbide resistors are light and are easier to fit directly into wires without further support.

T2FD proto 02.07.2011