T2FD LOW-NOISE SHORTWAVE RECEIVING ANTENNA

Features:
* Frequency range 3 - 35 MHz (- 3 dB points)
* Can be used as monitor antenna from 1.8 - 40 MHz
* Low-noise design, reduced sensitivity to man-made noise and atmospheric statics.
* Constant sensitivity over the entire frequency range without an antenna tuner.
* Coaxial cable between antenna and receiver.
* Length just 15 metres (45 feet)
* Passive, therefore no intermodulation
* Antenna is complete, ready to hang.
* Heavy duty construction in plastic and stainless steel, completely weatherproofed for trouble free outdoor use.

Advantages of the T2FD antenna
The T2FD (Tilted Terminated Folded Dipole), originally developed by the US Navy, is an antenna still in common use by military and government receiving establishments. There are good reasons for this choice by the professionals. The antenna is terminated internally with its characteristic impedance. This terminated loop principle means that the antenna is not as sensitive to annoying man-made interference sources, such as fluorescent lights, dimmers, televisions etc. The antenna is also less prone to noise from natural sources, such as statics. **The T2FD is really a "low-noise" antenna!** By ensuring a constant impedance throughout the length of the antenna, (a T2FD is a "travelling-wave" antenna), the T2FD is also less prone to distortion due to multipath fading. Independent tests have shown that when compared to dipole or long-wire antennas, the background noise with a T2FD antenna is not only much lower, but weak (DX) signals suffer from reduced distortion. Sometimes this can make the difference between being able to understand a weak station or not. In the case of data reception, lower distortion reduces the number of errors.

Wide natural bandwidth, equal sensitivity on every frequency
The T2FD has a wide natural bandwidth. Dipoles, trap-dipoles, and similar types of antenna work well on one, or a number of frequency bands in the shortwave spectrum. But outside and between these bands, reception is much worse. The T2FD does not suffer from "dead zones" since the specifications for the antenna are the same for the entire frequency range. This is not only a useful feature for military monitoring stations (who often need to change frequency quickly), but it is also ideal for the shortwave listener who likes to listen to both the broadcast and utility sections of the spectrum.

No need for height
The ends of a dipole, trap-dipole, and longwire antennas have a high impedance. This is a problem when the wire runs in the vicinity of conductors such as metal roofs, wet trees, and the like. The T2FD has less trouble because of its constant impedance at any point of the antenna. The conductivity of the ground under the antenna has little influence on the performance. The height of the lower end of the T2FD does not have to be more than 1.5 - 2 metres above the ground surface. If you hang the T2FD with an angle of 30 degrees, then the antenna pattern shows so many lobes, you can regard the antenna as sensitive to signals from all directions (i.e. omni-directional). This 30 degree angle ensures also that the antenna is sensitive for horizontal- as well as vertical polarised signals, leading to reduced polarisation fading.

Why hams don’t like the T2FD
If there are so many positive aspects to the T2FD, there must be a reason why the antenna doesn't have the popularity it deserves. One reason is that radio amateurs think that much of their transmitting power is lost in the terminating resistor. For some is this a reason, not to use the T2FD. This is just partly correct. A good designed T2FD radiates the power over the whole length of the antenna wire. At the termination point nearly all power is already radiated. Extensive tests with a caloric meter on the terminating resistor show that with a good designed T2FD, in practice about 85% is radiated and 15% is converted into heat, although amateur antenna books (all copying from each other) say that it is 35%. The T2FD is therefore classified by amateurs as a low efficiency antenna. Some think that the power loss is a problem, but in fact you can loose 75% of your transmitter power before the counter station sees one S-point signal drop! This is a small price paid for the wideband, no tuning behaviour of the T2FD.

For reception the T2FD is un-beaten
For receiving purposes the T2FD has an extra advantage. Reason is man-made and atmospheric noise. On shortwave, up to at least 15 MHz, this noise is so high, that it determines the signal to noise ratio, and thus the intelligibility of the received station. Do not forget that you can only hear a station, when it is stronger than the received atmospheric noise! With an antenna with reduced efficiency, not only the signal strength of the received station becomes a little lower, but also the received noise is lowered with the same amount. This means that the signal to noise ratio (and thus the intelligibility of the speech) remains the same! This can be compared with the insertion of a 3 dB attenuator in the antenna line. The S-meter deflects a half S-point

lower, but the noise is also a half S-point lower, so the signal to noise ratio doesn't change. The advantage of the T2FD however, is that due to the terminated loop design, the atmospheric- and man-made noise becomes MUCH lower. It can be compared with the low noise behaviour of the so-called magnetic loop antennas. This means in practice, that the T2FD gives a little lower S- meter reading, but a much better signal to noise ratio than a dipole, longwire or vertical!

Feeding problems of home-built T2FD antennas
Another reason that not every shortwave listener knows that the T2FD is one of the best receiving antennas, is because the original T2FD uses a symmetrical open ladder feeder directly to the receiver. This is not only difficult to install, but it is also not easy to effectively couple a 500 Ohm symmetrical feeder onto the 50 Ohm asymmetrical antenna input of most modern communication receivers. It is tried to solve this problem with the use of a 10:1 matching transformer (a so-called "balun"), but is extremely difficult to design a transformer which maintains its electrical AND phase characteristics over the required frequency range. Such a transformer is nearly impossible to build for the home constructor if no RF network analyser is available. Ready available 10 : 1 balun transformers do not show either a constant 500 ohms impedance, are not balanced in voltage as well as current, or show un-equal phase shift over the frequency range. The often used 1 : 4 baluns (50 to 200 Ohms) have the same problem. Besides that, 200 Ohms as source impedance is much to low for the characteristic impedance of the wire loop. Even with a 200 Ohms terminating resistor, the bandwidth of such a 200 Ohms T2FD is limited. Reasons why home-built T2FD antennas with coax lead-in cable show often moderate results.

The RF Systems T2FD Antenna
RF Systems has experimented with the T2FD for several years, continually improving on the design. By analysing the problems from different angles, and trying various materials, the good points of the original design could be improved upon. The new design means that common coaxial cable (RG 58/u) can be used as a lead-in to the receiver, eliminating picked-up interference from equipment such as computers, dimmers and fluorescent lights. To start with, the characteristic impedance of the RF Systems T2FD has been raised to 550 Ohms. Thanks to the development of a special frequency-compensated 11:1 transformer, the antenna is perfectly matched to the 50 Ohm coaxial cable and the input impedance of most communications receivers. By using frequency compensating technology, the bandwidth of the antenna (at the -3 dB points) works out to be 3 - 35 MHz even though the length is just 15 metres. This special transformer not only ensures a perfect symmetry in the antenna across the frequency range, but also isolates the coaxial cable (from a high-frequency point of view) from the antenna. In that way, interference signals that are picked up by the outer braid of the coaxial cable do not interfere with signals picked up by the antenna, nor do they influence the reception pattern.

Static discharge protection
In addition, the transformer ensures that the antenna-wire on the T2FD is grounded, so that any static build-up that may occur due to nearby thunderstorms, is safely discharged to earth. This not only protects the sensitive input circuitry of the receiver, it reduces the atmospheric noise which is generated as a result, especially in the region between 3 and 7 MHz, provided that a good interference free ground is used and not the safety ground of the mains.

Construction
The RF Systems T2FD is designed to withstand the worst weather conditions and has survived gale’s with wind speeds over 200 km/h. All sensitive components are in the centre piece, which has been filled with polyurethane foam. The antenna is therefore completely waterproof. The antenna wire it selves is made from oxigene free, pre-stretched copper, covered with clear, UV-light and air-pollution resistant poly-urethane. The connection between the antenna and coaxial cable is sealed off with an included plastic sleeve which slides over the PL 259 connector. The antenna is made of UV-light resistant plastics and stainless steel fasteners. The antenna is delivered complete, and only needs to be hung. The coaxial cable between the antenna and receiver is not included because the length (up to 30 mtrs) is different in each location.

PLEASE NOTE THAT THE RF SYSTEMS T2FD ANTENNA IS DESIGNED FOR RECEPTION ONLY.

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