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# OCF-Dipole-Calculator

OCF means "Out of Center Feeded".
The program shows the idealized current distributions of such a general dipole for a maximum of nine different frequencies, helps to select an optimal feed point for multiband operation and calculates the corresponding input impedances on the basis of integrals of antenna theory.

Of course, both symmetrical and resonant radiators are included in an OCF dipole as special cases. The results are suitable as a starting point for all amateur calculations where the input impedance of the radiator is required (e.g. for the cable calculator or the double-zepp calculator). Knowledge of the position of the current maxima (current bellies) also allows a rough estimate of the radiation pattern ("current radiates").

The operation is self-explanatory, only three special features have to be considered:

- If you want to change the color of a current curve, right-click with the mouse on the corresponding color entry (top row) helps.

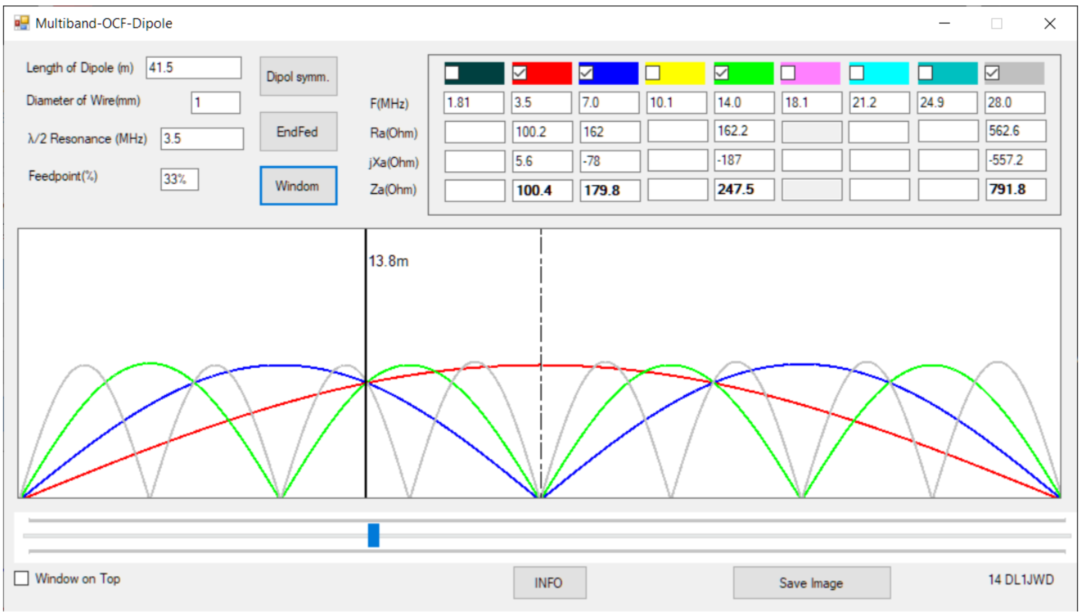
- A particularly sensitive shift of the feed point succeeds with the arrow keys of the keyboard or with the mouse wheel.

- The *OCF.cfg* configuration file ensures that the settings you have made are not lost again.

**Example 1**: **FD4-Antenna**

Among the off-center fed resonant dipoles, the so-called "current sum or windom antenna" has a special meaning. The aim was to find a feed-in point that would enable operation on several amateur radio bands.
The most common variant, the FD4 developed around 1970 by Kurt Fritzel, DJ2XH, with a length of 41.5 meters, we want to take a closer look.

Use the slider (below the diagram) to change the feed point.
A click on the button "Windom" saves this work:



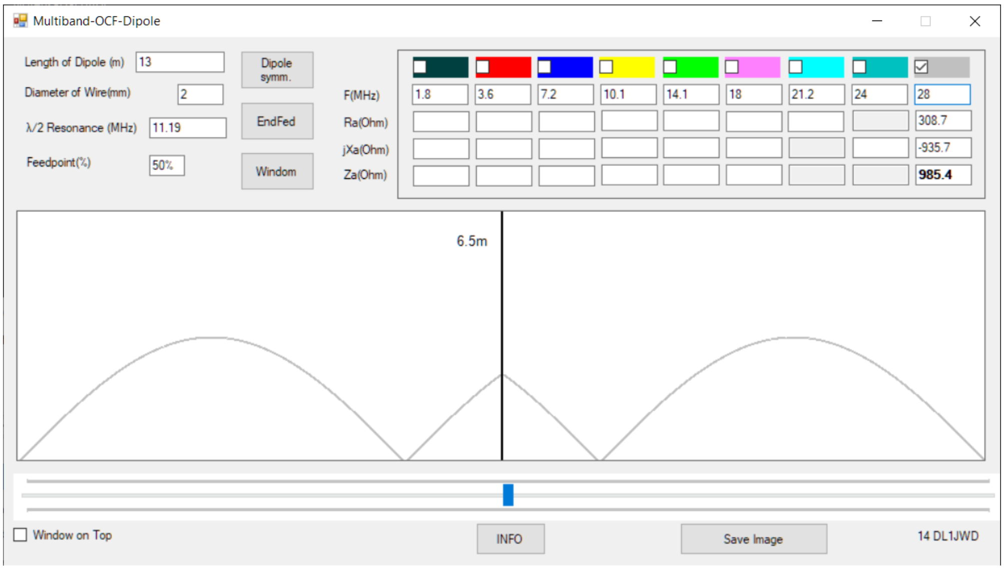
It can be seen that at a distance of 13.8m all four current curves overlap in one point.
However, this does not mean that the input impedances Za = Ra + jXa of the dipole are all the same size at this point, but the absolute value of Za is of the same order (a few hundred ohms), so that the adaptation to the 50Ohm PA should not be a problem.

In addition to 3.5/7/14/28 MHz, this antenna can also be used on 18.1 and 24.9MHz, but not on 21MHz (current node), just give it a try!

**Example 2: Nonresonant 13m-Dipole**

Every OM knows the mantra "electricity radiates". The OCF dipole calculator helps to determine the "valuable" current bellies on the antenna in order to gain at least a general idea of the expected radiation pattern.

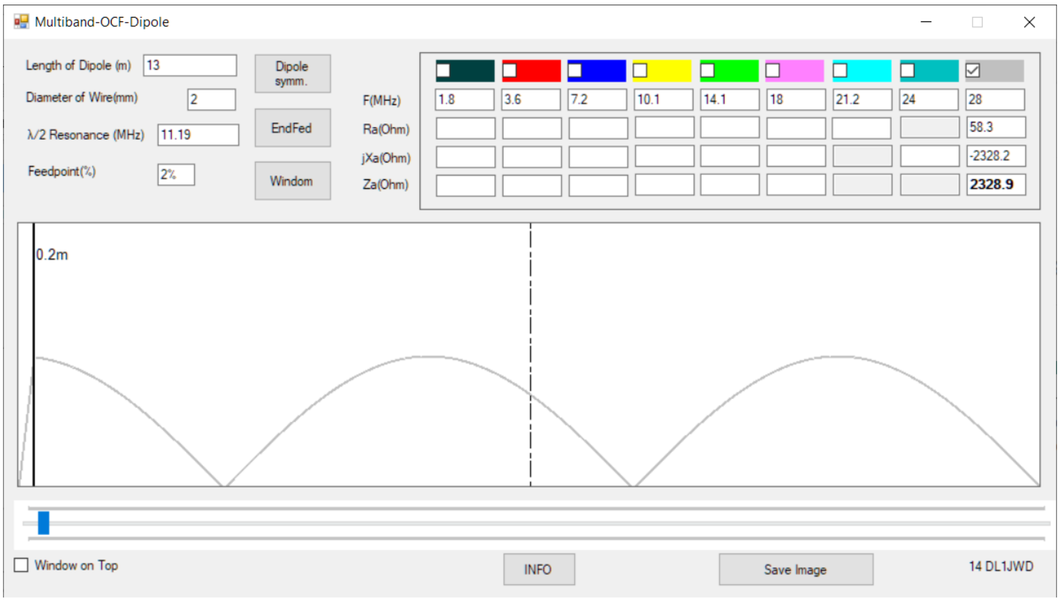
As an example, a non-resonant 2x6.5m dipole will be used, which is operated on 28MHz and which we first want to feed symmetrically.
To do this, we use the button "Dipole symm." to place the feeding point exactly in the middle:




We can see that the current distribution has two maxima (each lambda/4 distance from the beginning and end). At 28MHz, the input impedance is Ze(Ohm) = 308.7 - j935.7, which corresponds to an absolute value (amount) of about 1kOhm.

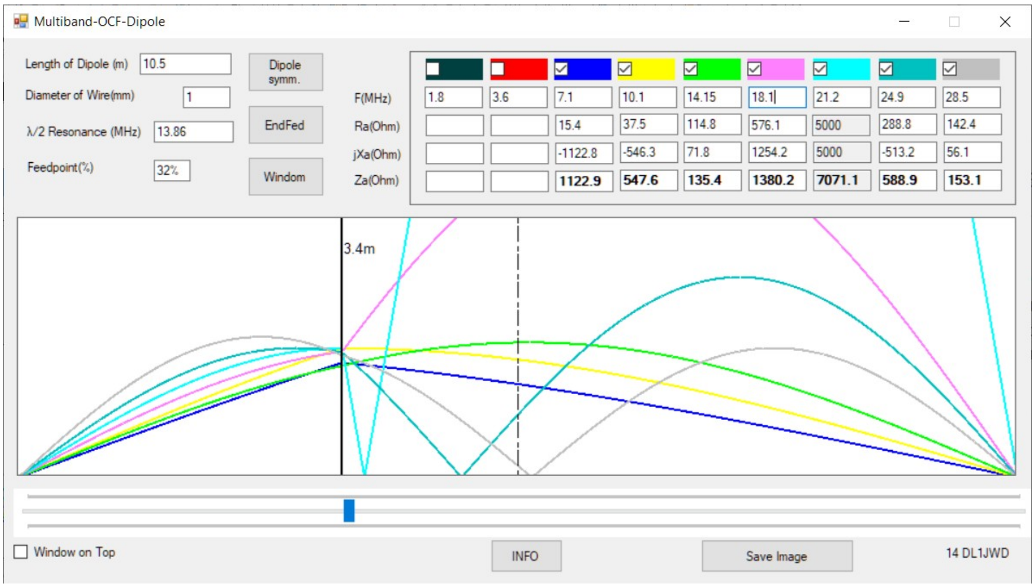
Comparatively, we now want to feed the spotlight at one of its two ends.
To do this, we either drag the slider all the way to the left or click the "EndFed" button.
Then we move the feed point about 20cm to the right, why?

The answer: Theoretically, an end-fed radiator cannot function due to the lack of counterweight.
In order to obtain reasonably real values, the slider must therefore be moved a little to the right (in the example this would correspond to a 20cm radial).




## Example 3: Short aperiodic antenna for 10m to 40m

The asymmetric dipole described in /7/ by DK7ZB is 10.5m long and has leg lengths of 3.4m and 7.1m.




OM Martin measured the impedances at the feeding point of his dipole and thus allowed me to make the following comparison:

| | measured (DK7ZB) | calculated (DL1JWD) |
|---|---|---|
| Frequency(MHz) | Impedance (Ohm) | Impedance (Ohm) |
| 28.50 | 139 + j38 | 142.4 + j56.1 |
| 24.90 | 174 - j537 | 288.8 - j513.2 |
| 21.20 | 2195 - j1930 | Za > 5000 |
| 18,10 | 581 + j 970 | 576.1 + j1254.2 |

| | | |
|---|---|---|
| 14,15 | 128 + j 34 | 114.8 + j71.8 |
| 10,10 | 52 - j548 | 37.5 - j546.3 |
| 7,10 | 25 - j1117 | 15.4 - j1122.8 |

With the exception of the 15m band, relatively good matches can be observed.
It should be noted that the formulas I implemented only apply to stretched asymmetric dipoles under the ideal conditions of free space /4/.
Installation height, suspension as inverted V and radiation coupling due to a non-rectangular feed line are not taken into account and are likely to be mainly responsible for the deviations.

**Hints**:

- The current curves of my program do not show the actual, but only the tendential absolute values (lower half folded upwards).

- Particularly difficult is the simulation of an extremely high-impedance feed into a current node (e.g. with end-fed antennas), you can see this by the disproportionately strong deflections of the current curve at these critical points, here the theory moves more and more away from practice.

- In order to ensure proximity to Praxix, I have limited the maximum impedance values to 5kOhm.

## Theory

There is already a comprehensive literature (/1/, /2/,/3/) for the amateur-oriented understanding of windome and current-sum antennas, what is missing are usable statements about the expected input impedances in the feeding point.
There is therefore no way around the exact knowledge of the real and reactive part of the base point impedance Za of the radiator, because only then can calculations be made for the optimal length of the feed line or for the elements of the matching circuit.
**The OCF Dipole Calculator is intended to close this gap.**

For the graphical representation of the current curves, I have implemented three conditions that (at least up to not extremely high-impedance impedances) represent reality in a fairly good approximation:

1. at both ends of the antenna the current is zero

2. at the feed point, the same current flows in and out (no current jumps)

3. all currents are sinusoidal

If you want to make the effort, you can convince yourself that the generated diagrams come quite close to the simulation results with EZNEC or MMANA-GAL (dipole in free space).

As a basis for the calculations of the input impedances I use the integral formulas of a thin linear antenna, as the mathematically interested OM can read e.g. in /4/ and as I have implemented them e.g. in the DZR and in the dipole GP computer.

From /5/ comes the idea that the input impedance of an asymmetrically fed antenna can be approximated as the sum of the input impedances of unequally long monopole antennas.

A comprehensive practice-oriented article on end-fed antennas and the optimal length of the (radiating) feed line and possibilities for current measurement on their outer screen can be found in /6/.

**Literature**


/1/ Warsow, K., DG0KW: Windom- und Stromsummen-Antennen und deren Erweiterung zur Allband-Antenne, http://www.dl0hst.de/dateien/technik/windom-stromsummen-antenne.pdf

/2/ Wippermann, W. DG0SA Probleme außer der Mitte gespeister Antennen, http://www.wolfgang-wippermann.de/aga.pdf

/3/ Karl H.Hille, DL1VU: Windom- und Stromsummen-Antennen, Funkamateur-Bibliothek 15

/4/ Kark, K.: Antennen und Strahlungsfelder. Friedr. Vieweg & Sohn Verlag, Wiesbaden 2004

/5/ Janzen, G., DF6SJ: Kurze Antennen. Franckh'sche Verlagshandlung Stuttgart 1986

/6/ Schnorrenberg, W., DC4KU: Optimaler Betrieb einer endgespeisten Halbwellenantenne. FUNKAMATEUR 4/19, S.341-345

/7/ Steyer, M., DK7ZB: Kurze aperiodische Antenne für 10 m bis 40 m.
FUNKAMATEUR 8/19, S.742-743