Wide Band RF Transformers on Ferrite Tubes

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Ferrite transformer on ferrite tubes performs several functions at once: this one does match of the feeding coaxial cable to the antenna (or transform impedance of the antenna to impedance of the coaxial cable), balances RF current at feeding terminals of a symmetrical antenna and suppresses the common-mode current on to outer side of the coaxial cable braid.

It is possible to find on the sale in the internet lots different ferrite tubes. Some ferrite tubes may be saved from old CRT monitors where the ferrite is used as noise-suppressing chokes on communication cable. For the transformer it was used ferrite tubes marked as FRR-9.5.

The tube has dimensions (ID x OD x L) 9.5x17.5x35. When you will be looking for ferrite tubes in the internet keep in the mind that the best ones should have permeability 600. Figure 1 shows FRR-9.5 ferrite tubes.

Figure 1
Ferrite Tubes Marked as FRR-9.5

Four of these tubes, placed side by side, and two rows from the two tubes placed in bridge, form binocular ferrite core that could be used for making wide band RF transformer.

Table 1
Data of Transformers Made of on Ferrite Tubes

Number Turns of Primary Winding	Number Turns of Secondary Winding	Transformer Ratio U Primary/ U Secondary	Transformer Ratio R Primary/ R Secondary	Ratio at input R= 50 Ohm
1	1	1:1	1:1	50:50
1	1,5	1:1.5	1:2.25	50:112.5
1	2	1:2	1:4	50:200
1	2.5	1:2.5	1:6.25	50:312.5
1	3	1:3	1:9	50:450
1	3.5	1:3.5	1:12.5	50:625
2	1	1:0.5	1:0.25	50:12.5
2	1,5	1:0.75	1:0.56	50:28
2	2	1:1	1:1	50:50
2	2,5	1:1.25	1:1.56	50:78
2	3	1:1,5	1:2,25	50:112,5
2	3,5	1:1,75	1:3	50:150
2	4	1:2	1:4	50:200
2	4,5	1:2,25	1:5	50:250
2	5	1:2,5	1:6,25	50:312.5
2	5,5	1:2,75	1:7,56	50:378
2	6	1:3	1:9	50:450
2	6,5	1:3,25	1:10,56	50:528
2	7	1:3,5	1:12,5	50:625

The tubes are fixed by Scotch. One such transformer could cover all HF Band from 160 to 10 meter. The tubes have rounded edges. It eliminates damage to the insulation of the winding wire by the edges.

The article described simplest transformers on binocular ferrite core with separate primary and secondary winding. Table 1 shows data for the transformers. One turn is considered as a wire coming through the holes of both sides of the binocular core. Half of turn is considered as a wire coming through the hole of one side of the binocular core.

The table shows that is possible create a very wide range of the transformers for different resistance ratio. A simplest one, transformer with a 1: 1 ratio serves like a choke. This transformer balances the RF current in the antenna parts (for symmetrical antenna) and suppresses the common-mode current on the outer braid of the coaxial cable. Other transformers in addition to this job provide transformation of antenna impedance to impedance of the feeding coaxial cable.

What should be guided when choosing the number of turns for primary winding? With other things being equal, transformer with a single-turn primary winding, compare to the double-turn primary winding counterpoint, has about in four times higher lower frequency of the passband together with the higher upper frequency of the passband.

Therefore for transformer used at 160 and 80 meter it is better to use double-turn primary winding. For transformer used from 40 to 10 meter it is better to use single-turn primary winding.

The higher is the transformation ratio the more difficult is to obtain a wide bandwidth since the leakage inductance of the windings is increased. The leakage inductance could be compensated by switching on a capacitor in bridge to the primary winding. The capacity of the capacitor should be found at minimum SWR at higher working frequency of the transformer.

The ready transformer could be tested. For the test the transformer should be terminated to non- inductive resistor. Then SWR curve should be taken at working range of the transformer.

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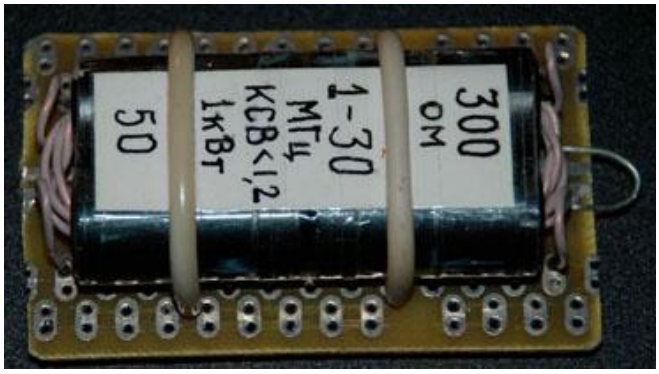

Practical Design of Wide Band Transformer 300/50-Ohm, 1- 30- MHz

Practical Design of Wide Band Transformer 200/50-Ohm, 1.8- 14.5- MHz with compensation capacitor