

# Simple HF ATU on Lengths of Coaxial Cable

Igor Grigorov, va3znw

The ATU was made by me in far 80s. It was may be a simplest ATU what I made ever. It contains only one rotary switch and rolls of a coaxial cable. But the ATU works very well. The ATU has only one lack- sizes. Sizes of the ATU are not small. Below there are several words to the theoretical base of the ATU.

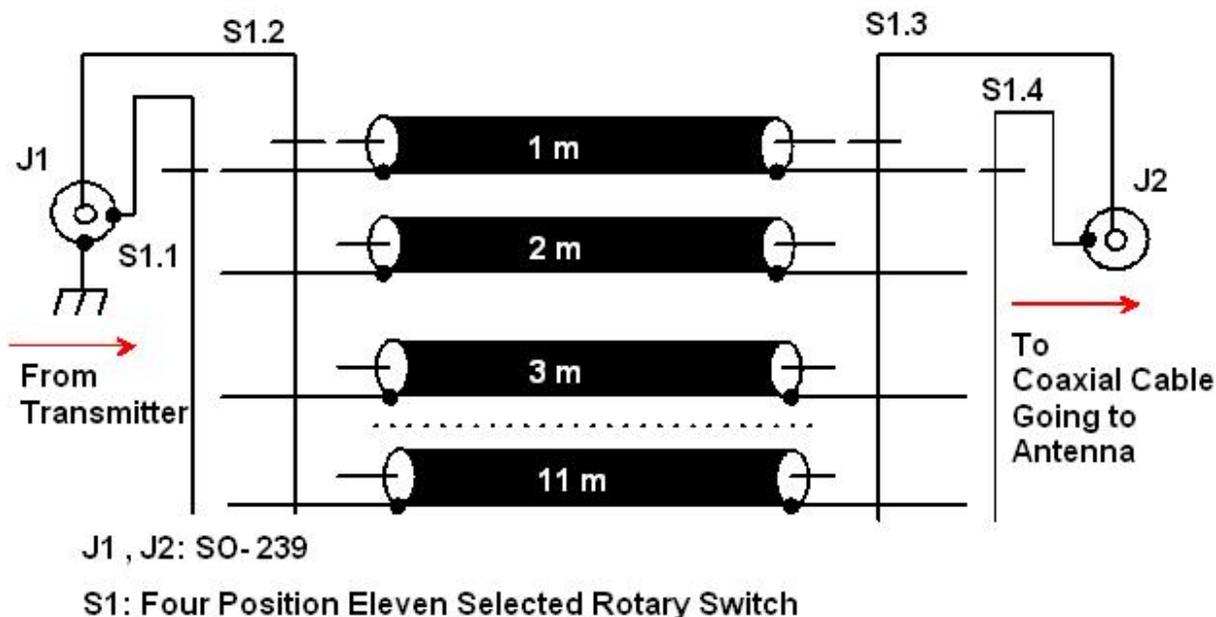
For those who know the Smith Chart the principle of operation of the ATU is not a secret. Using Smith Chart we can find how impedance of antenna system is changed along a transmission line. Based on this we can find optimal length of the transmission line and place(s) on transmission line where we can install stub(s) to eliminate the reactance in the line. Of course, the description is too simple and GOOGLE helps those who want to know more about Smith Chart and how we could match antenna impedance with our transmitter using only transmission line of definitely length with stubs.

For described here matching unit it means: let's turn on our antenna through line with variable length and find when SWR at our transmitter would be best. It is easy. It is simple. It works in most cases.

Yes, at some cases the ATU does not work or work not good but only in some cases... **Figure 1** shows schematic of the ATU.

The ATU contains 11 lengths of 50-Ohm coaxial cable. First length is 1 meter long, second one is 2 meter long, third one is 3 meter long, and so on, next one has length in 1 meter longer the previously one. The lengths of coaxial cable are connected to a four-pole 11-position rotary switch S1. So with help of the S1 you may choose the length of the transmission line from transmitter to antenna system. And if you are lucky (you will be lucky!) match the transmitter with existing antenna system. The matching device works fine at HF- Range 3.5- 30.0- MHz.

If you wish use the device only at 7.0- 30.0- MHz the lengths of the coaxial cable should have step 0.5- m. First one should have 0.5- m length, the second 1.0- meter length, the third one 1.5- meter length and so on. **Figure 2** shows the design of the ATU.

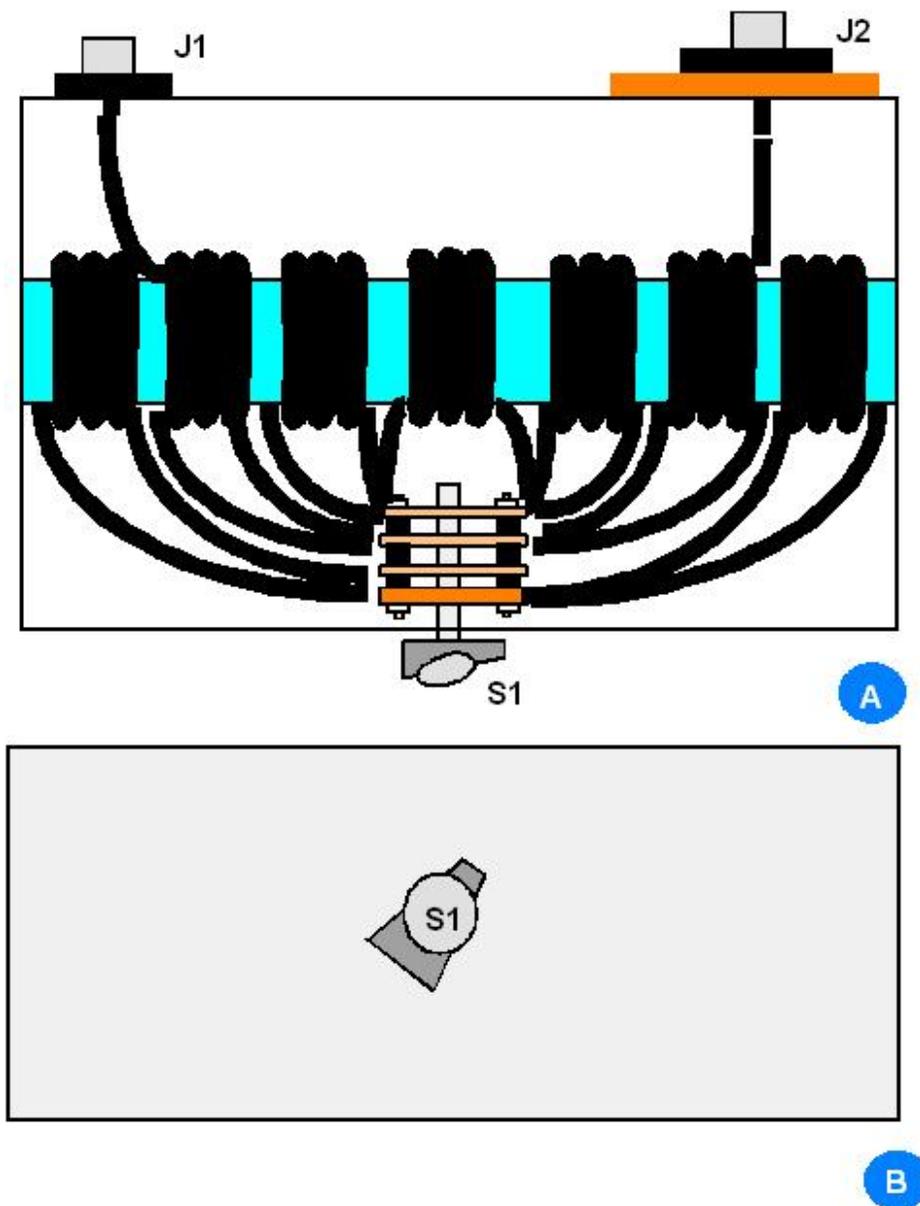


**Figure 1** Simple HF ATU on lengths of Coaxial Cable

**Note:** Pay attention that “ground” of the socket J2 is not connected to the ATU case. The socket is placed on a dielectric plate (it was used a piece of PCB without foil).

The design was very simple. A big metal box from unknown surplus device was used for the ATU. Lengths of the coaxial cable was coiled and then dressed on to a plastic tube. It was used plastic water pipe (something like 1... 2-inch OD).

The ATU is very simple to use. Just connect the ATU between transmitter and antenna system. Then rotate S1 on to minimum SWR. **Figure 3** shows connection of the ATU. It is possible to use the transceiver’s internal SWR-meter or an external one. Do not rotate the S1 when transceiver is in transmission mode. S1 breaks the transmission line so it may cause high SWR. Go to receiving mode, switch the length of the coaxial cable, go to transmission mode and check SWR.



**Figure 2** Design of the Simple HF ATU on lengths of Coaxial Cable

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However, you may rotate the S1 in receiving mode and tune on to maxima reception. You need begin the tuning from the lowest length of the length of the coaxial cable. Then turn on the next length of the coaxial cable and check SWR.

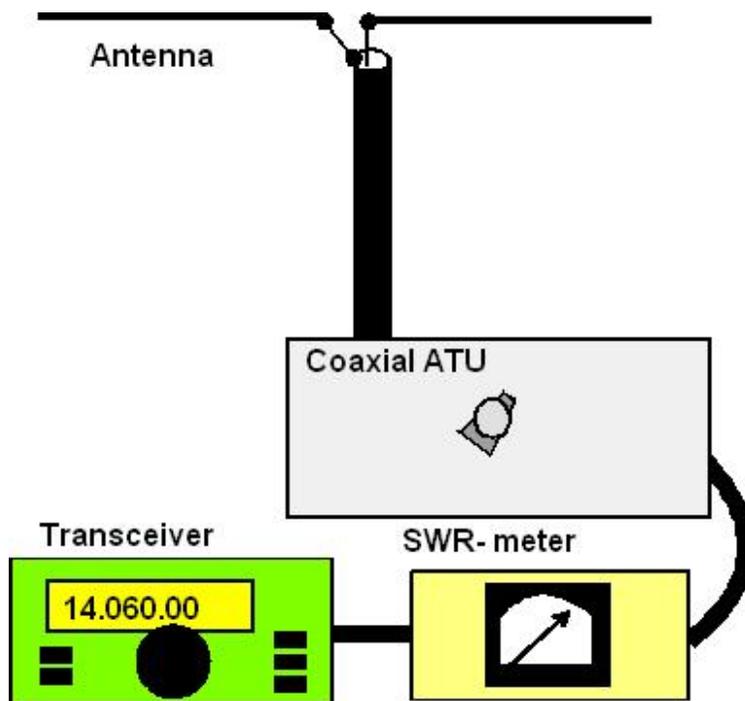
On my memory it was very effectively ATU that could match lots of my experimental antennas (be truth – antenna system- antenna plus coaxial cable going to my transmitter) that I just connected to the coaxial cable placed on the roof. One of the days I decided to rework the ATU to get more efficiency. Any lover of the Smith Chart and matching of the antenna by length of the transmission line straight away could understand how the next ATU works. For those, who do not care about the theory I include some simple explanation. **Figure 4** illustrates the explanation.

For example, there is an antenna with impedance, let's say, 500 Ohm and Reactance minus 100 Ohm. Line L3 transform the impedance, let's say, to 200 Ohm and Reactance Plus 300-Ohm. Stub L2 kills the reactance. The stub, depends on the length, may be opened or closed. Then line L1 transform the pure 200- Ohm to 50- Ohm at the transmitter terminal.

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Of course, it is very simple explanation, in the real life, is required work with the Smith Chart to find the gold length of the L1, L2 and L3. I have a doubt that in real life somebody will do the theoretical simulation at amateur station. But we may try it in practical way. May be we would be lucky and maybe we can do it with our ATU.

At the design of our ATU we have all components that are at **Figure 4**. Line L3- it is coaxial going from the antenna to the ATU. Line L1- it is variable length of the coaxial cable that we connect between transmitter and antenna system. Line L2- it is row of length of not used coaxial cables that are sitting inside ATU. What can we do- just connect the unused cable in to terminal ATU- antenna system. Then play! Chose length from transmitter to antenna system, then connect the stub and check SWR, and again try another connection to find the low SWR at transmitter terminal. At first sight is hard to do but having some experience (and maybe some theoretical base- GOOGLE helps you) it is not so hard. **Figure 5** shows schematic of the modified ATU. Pay attention that Switch S2 has one empty position (physically I removed stopper from the switch) when no one stub does not connected to the ATU. Switch S2 was placed under switch S1.



**Figure 3** Connection of the Simple HF ATU on lengths of Coaxial Cable

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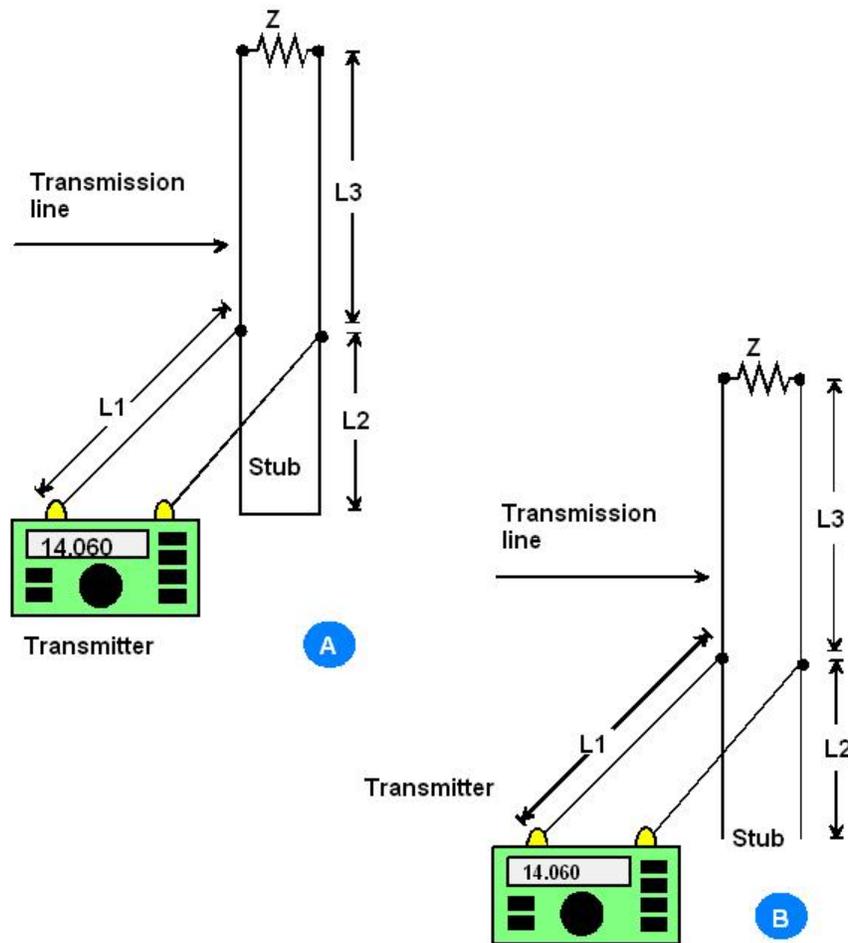
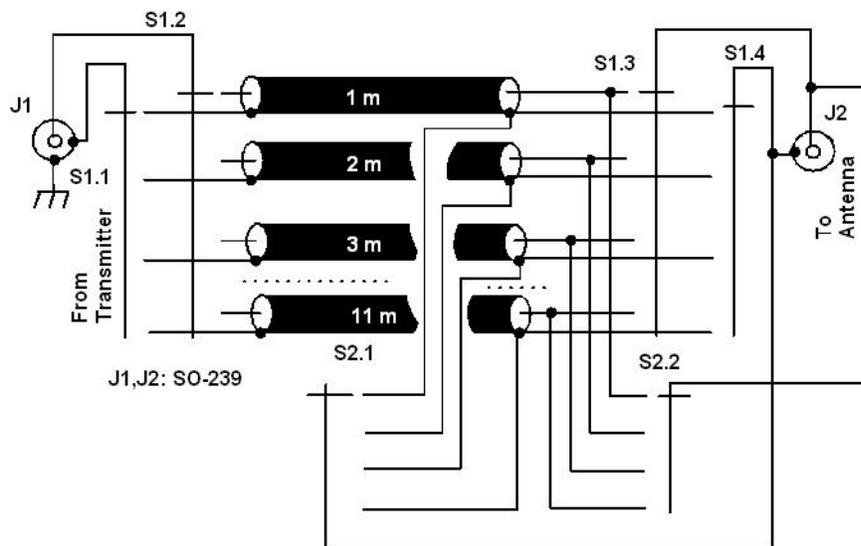


Figure 4 Method of Matching Antenna with help of the Length of the Transmission Line with Stub



S1: Four Position Eleven Selected Rotary Switch

S2: Two Position Eleven Selected Rotary Switch.

The switch has zero selected position, hen no one length does not connected to the antenna jack .

Figure 5 Modified Simple HF ATU on lengths of Coaxial Cable