Antenna Switching Units

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Oh, it was very good times long ago. I had one antenna on the roof and one home-made transceiver in the shack. My antenna was connected to transmitter without even using an RF-connector. Coaxial cable from the antenna just was soldered to transmitter's PA. These are the times that every radio amateur remembers as being the best in one's radio amateur life.

But in due course, new antennas were installed, to first home made transceiver was added a commercial made second one then an old military third... Antenna connectors on these transceivers were differed from each other. That situation caused to use RF adapters and special coaxial cables to alter the arrangement of rigs and antennas.

There came a time when I entangled in antennas, receivers, transceivers, and the methods of switching to alternate antennas and change from one rig to another.

Solution was clear- it should be used clear marked an Antenna Switching Unit (ASU).
So to make life easy I made several experimental Antenna Switching Units that some of them are described below.

Universal ASU

A schematic diagram for universal ASU is shown in **Figure 1**. The unit provides connection of 3 transceivers and two receivers (or transceivers) to one of four antennas or to a dummy load 50 or 75 Ohm (in the USSR some commercial made transmitters have 75-Ohm output). It is useful to connect a small bulb in series with the dummy load that allows estimate power level of the used transceiver.

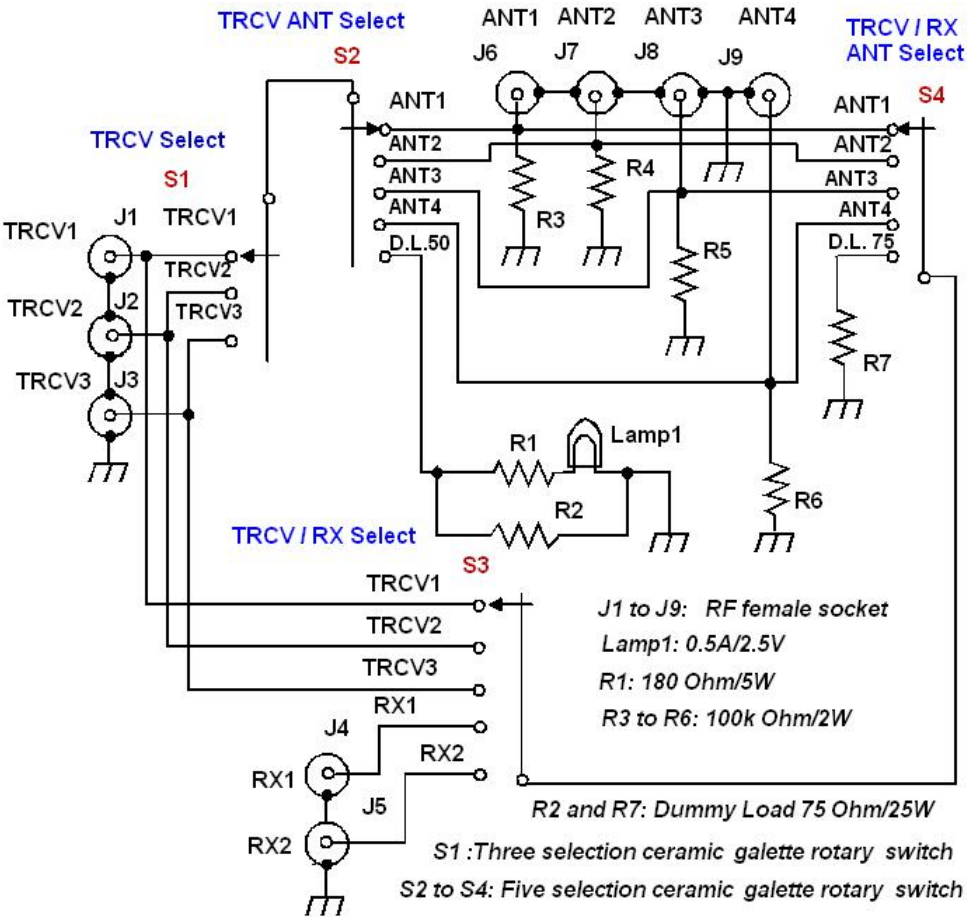

Figure 1 Universal ASU

To prevent connection of a receiver antenna to a transmitter output or to simultaneously switch two transmitters to one antenna, switches S2 and S4 should be independent of each other (however it need pay attention when switching).

How it works: Switch S1 selects operational transceiver. Switch S2 selects an antenna for use with this transceiver. Other auxiliary transceivers or receivers may be connected to other antennas with help of switches S3 and S4. All antennas connected to ASU are permanently grounded with help of R3, R4, R5 and R6 (100 K/2W) for electro-static bleed-off. Resistors R2 and R7 were old commercial made 75 Ohm/25W dummy load. To one of the dummy load was connected to bridge resistor 180 Ohm/5W that created new 50 Ohm dummy load. **Figure 2** shows the views of the front panel (**Figure 2A**) and inside design (**Figure 2B**) of the universal ASU.

There were used usual ceramic galette rotary switches that work well for power levels up to 200W. For higher power levels it is necessary to use special powerful ceramic galette rotary switches intended for operation in high-current, high voltage circuits. Montage and component mounting should meet RF guidelines.

ASU for RF-Bridge/ATU

If in the shack there are several separately units such as an ATU, transceiver, and RF-bridge it is possible to hook up the equipment with help of special ASU. In this case it is possible tune the system ATU plus Antenna with the RF-bridge. Even though a transceiver or the ATU may have an SWR-meter built-in it, it would be useful to use an RF-bridge for antenna tuning. RF-bridge gives the real impedance of the system Antenna plus ATU. **Figure 3** shows schematic for such unit.

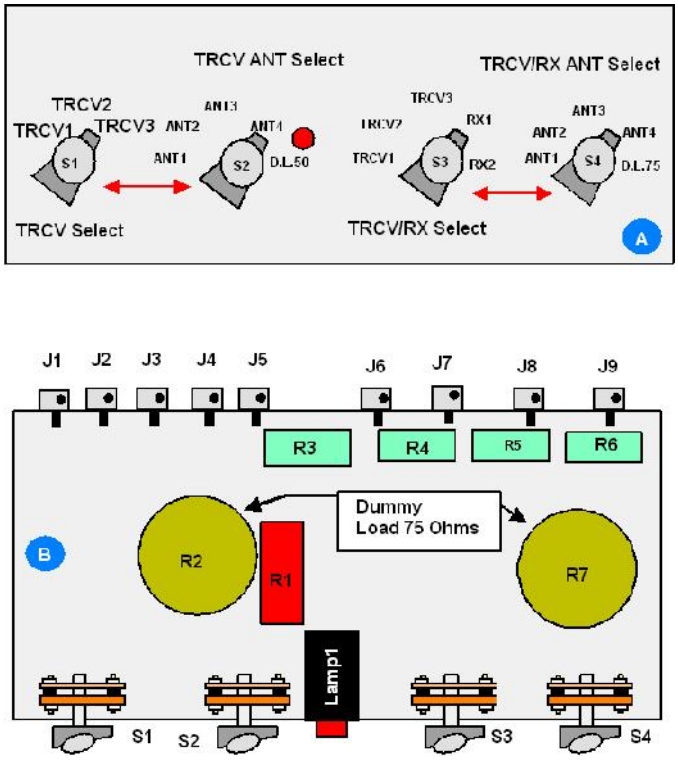

Figure 2
Front Panel (A) and Inside Design (B) of the Universal ASU

When S1 switched to the Control position, RF power from transceiver goes to the RF-bridge and ATU with antenna as well connected to the Bridge. In tuning mode it should be used level of RF power that intended for operation of the RF- bridge. My RF-bridge required near 0.5 W of RF power. When the system is tuned, S1 should be switched to Operation position and RF power may be increased. **Figure 4** shows the system Transceiver- ASU- ATU- RF-bridge.

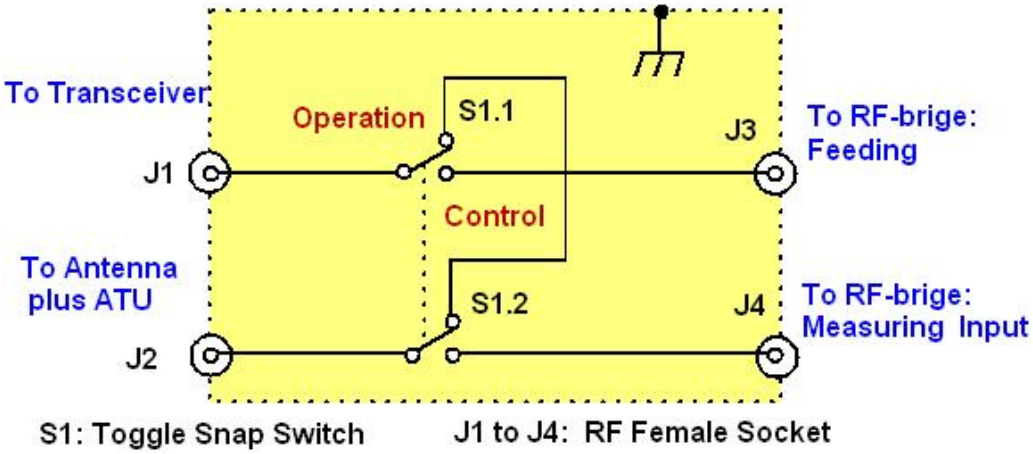

Figure 3 ASU for RF-bridge

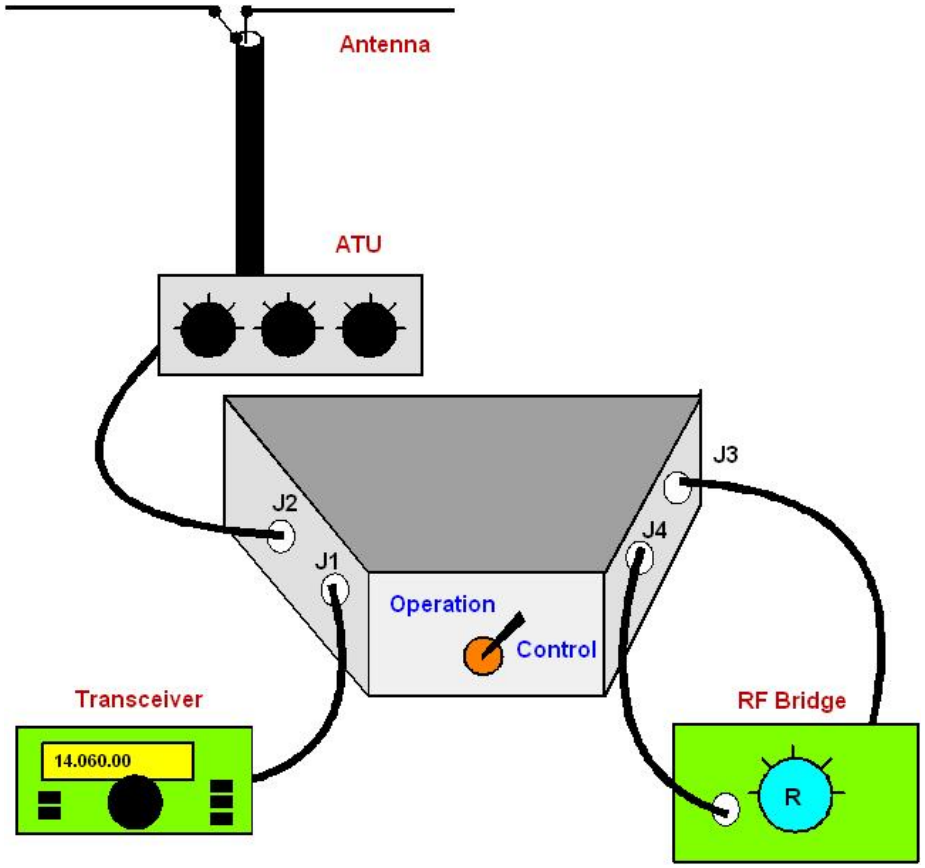

Figure 4 System Transceiver- ASU- ATU- RF-bridge

Unusual ASU

In the far 80s at one of Russian transmitting centers I saw an unusual ASU that was made from usual electrical light switches. It was ceramic- based light switches intended for 220V AC main. Schematic of the device is shown in **Figure 5**. Independent two-position light switches were used in the design. The ASU worked with HF transmitters on frequencies 2-25 MHz, one of the transmitters had 5 KW of output power.

Figure 6 shows the unusual ASU with connections to transmitters and antennas. With the help of light switches it is convenient to switch symmetrical antenna that fed through two-wire ladder line.

ASU on a Roof

ASU installed on a roof allows use one coaxial cable to feed several antennas. Antennas in this case switched on by RF relays. Sometimes it is possible to use high quality industrial or electro- technical relays instead of RF relays. Differs from the way how the control (switch on/off) on the relay exists there are two sophisticated types of the remote ASU

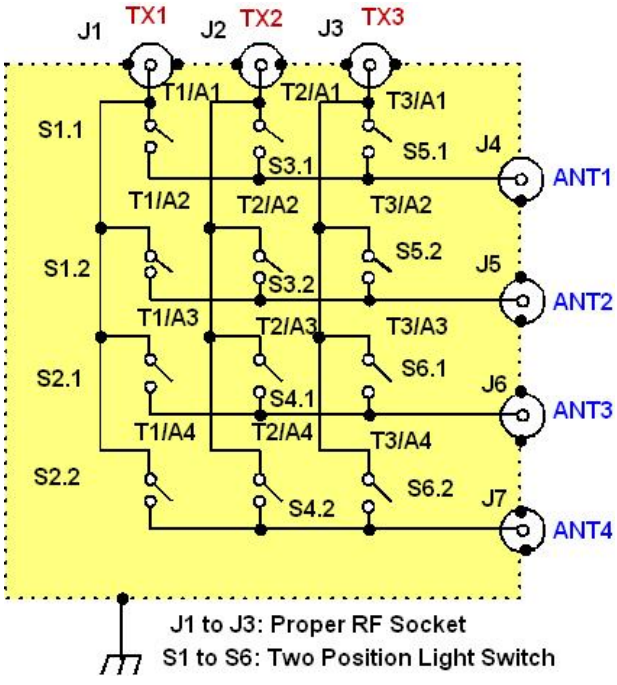

Figure 5 Unusual ASU

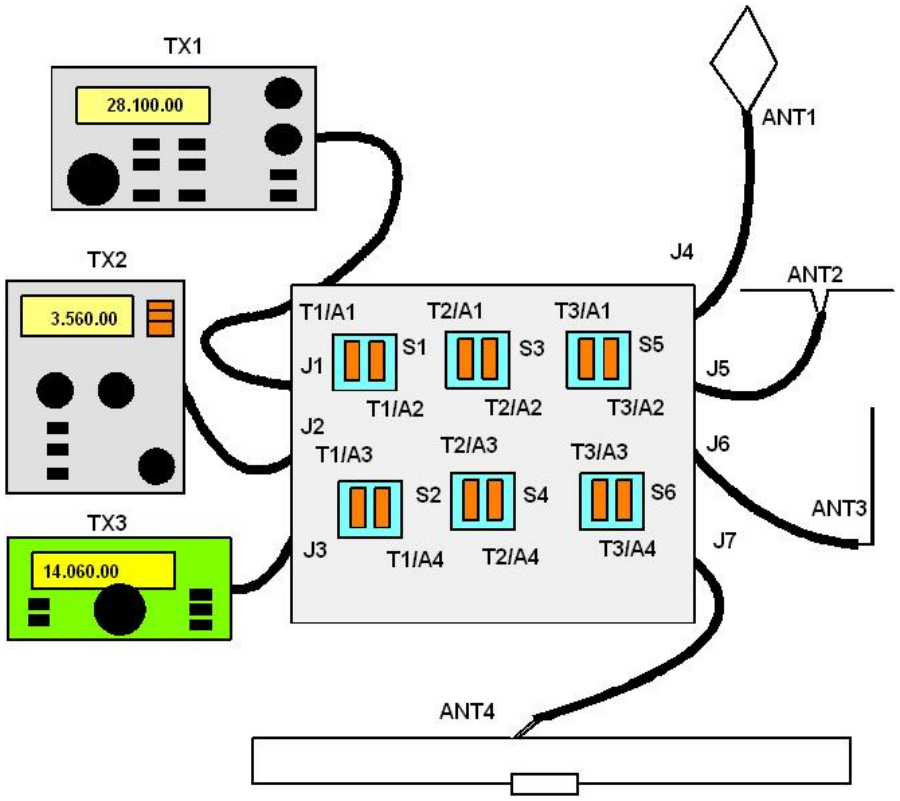

Figure 6 Unusual ASU with connections to transmitters and antennas

Most simple and reliable ASU is device where the controls on the antenna-switching RF relays coming through a separate multi-wire cable that usual attached to the feeding coaxial cable.

Another type ASU is device that controls antenna-switching RF relays through the central core and braid of the antenna coaxial cable. The ASU required special code/decode circuits to select the necessary RF-relay. Below there are schematic for those both types of the roof ASU.

ASU with Separate multi- wire cable

An ASU that controls antenna-switching RF relays by a separate multi-wire cable is very reliable and simple in design. **Figure 7** shows sketch of the system with ASU that controls of the antenna-switching RF relays by a separate multi-wire cable. The ASU includes two units. Switching unit A1, that sends control voltage to the RF-relays, is in the shack. Switching unit A2, that is contained the RF relays, is on the antenna installation site - on the roof. **Figure 8** shows schematic of the unit A1. **Figure 9** shows schematic of the unit A2.

How it works: If there is no coming DC voltage to RF relays (unit A2), then antenna # 1 is switched on. When DC voltage is coming to unit A2 and RF relay K1 is powered up in this case antenna # 5 is switched on, in turn RF relay K2 is powered up- antenna # 4 is switched on, RF relay K3 is powered up - antenna # 3 is switched on, RF relay K4 is powered up - antenna # 2 is switched on. The logical schematic allows use only N- 1 relays to switch on N antennas. In this case four RF relays allow hook up five separate antennas. Design of unit A1 is shown in **Figure 10** (inside- **10A**, front **11B**). Design of unit A2 is shown in **Figure 11** (inside- **11A**, front **11B**).

Unit that placed on the roof should be protected from atmospheric influence- from direct contact with rain, wind, and snow. In perfect deal the unit should be hermetically sealed. It is very good if the unit may be installed in dry place, for example, in a loft or attic of the house.

ACU with Control to the RF Relays through Coaxial Cable

ACU with control of the antenna-switching RF relays through the central core and braid of antenna coaxial cable should have code circuit in the shack and decode circuit on the roof. The code/decode circuits work instead of the multi- wire cable that is present in discussed above wired ASU.

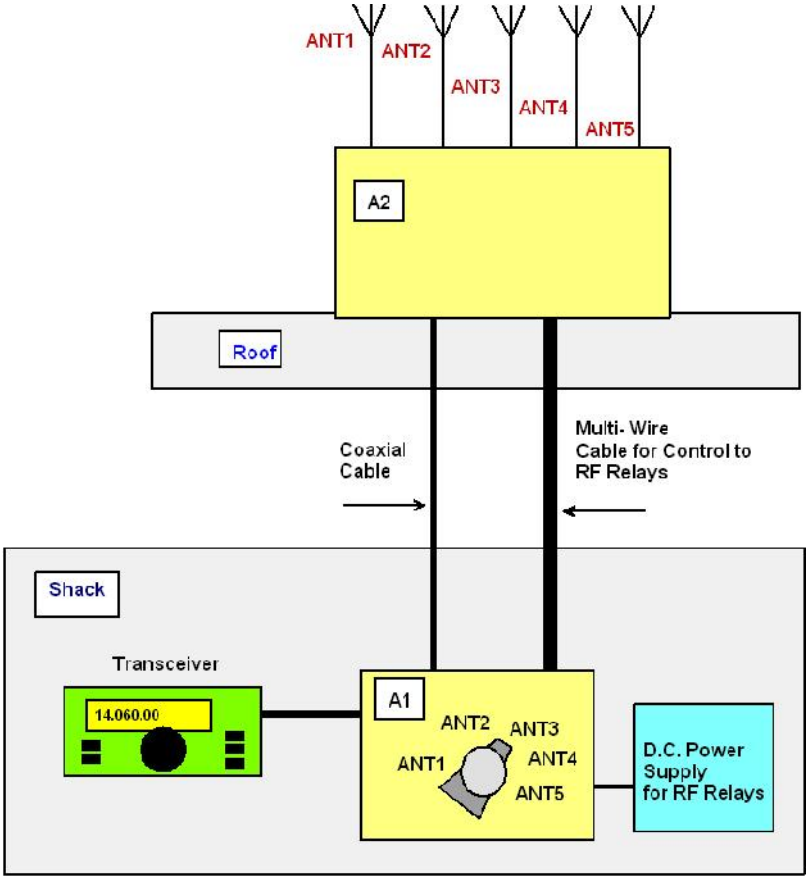

Figure 7 Sketch of the Roof ASU

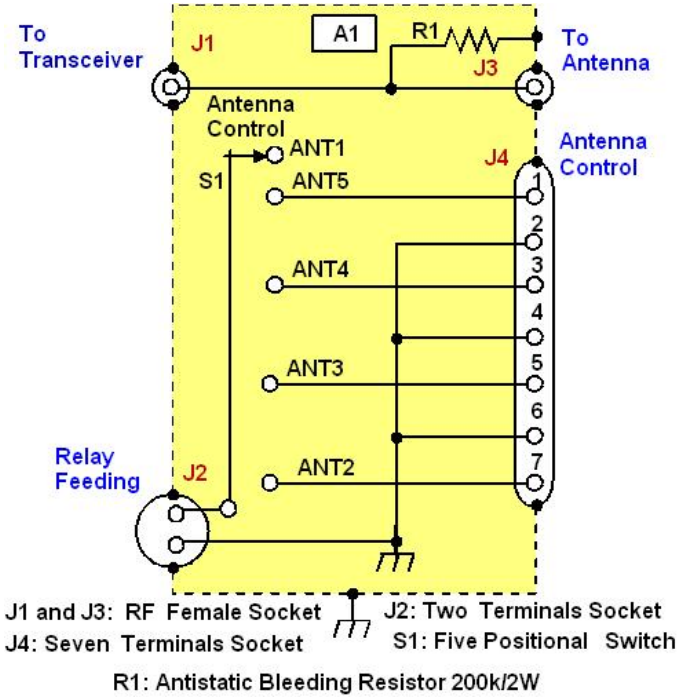

Figure 8 Schematic Diagram of Unit A1

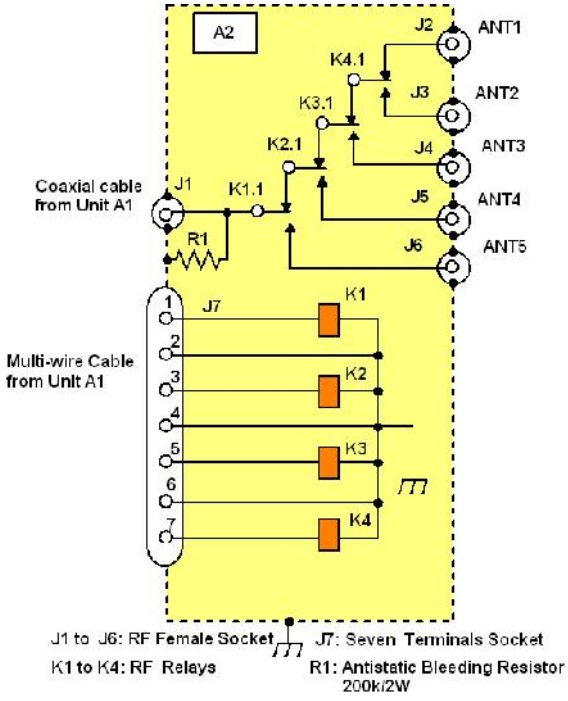

Figure 9 Schematic Diagram of Unit A2

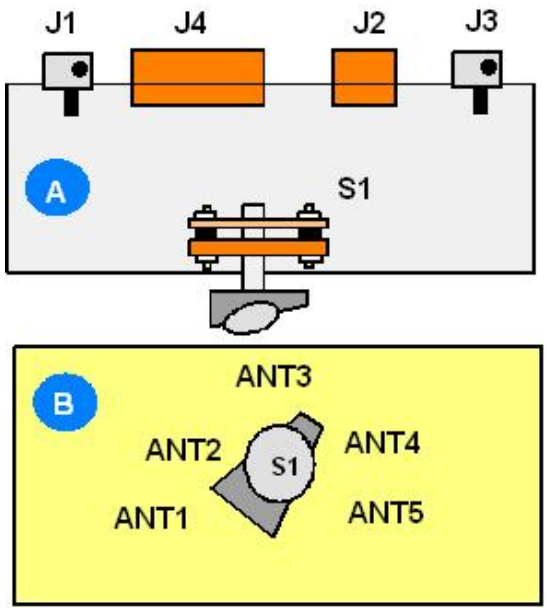

Figure 10 Design of unit A1

The switching unit A1 with code circuit is installed in the shack. The switching unit A2 (with decode circuit and RF relays) is installed on the antenna installation site - on a roof.

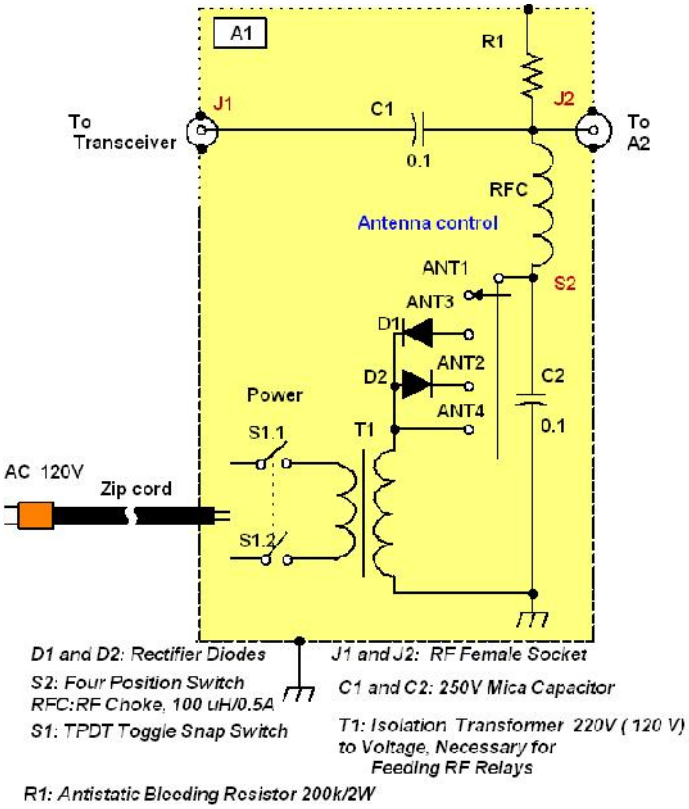

Figure 12 Schematic Diagram of Unit A1

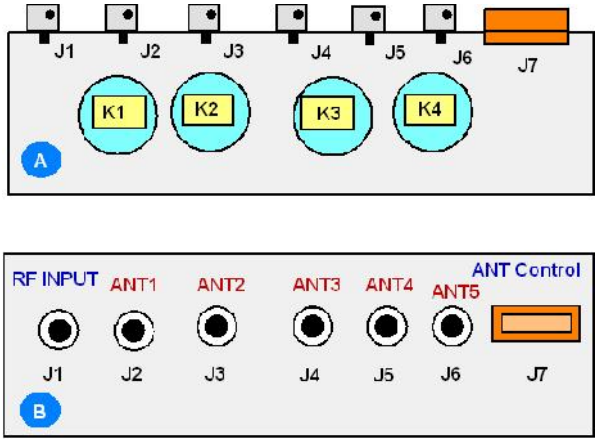

Figure 11 Design of unit A2

Schematic diagram for the unit A1 is shown in **Figure 12**. Schematic diagram for the unit A2 is shown in **Figure 13**.

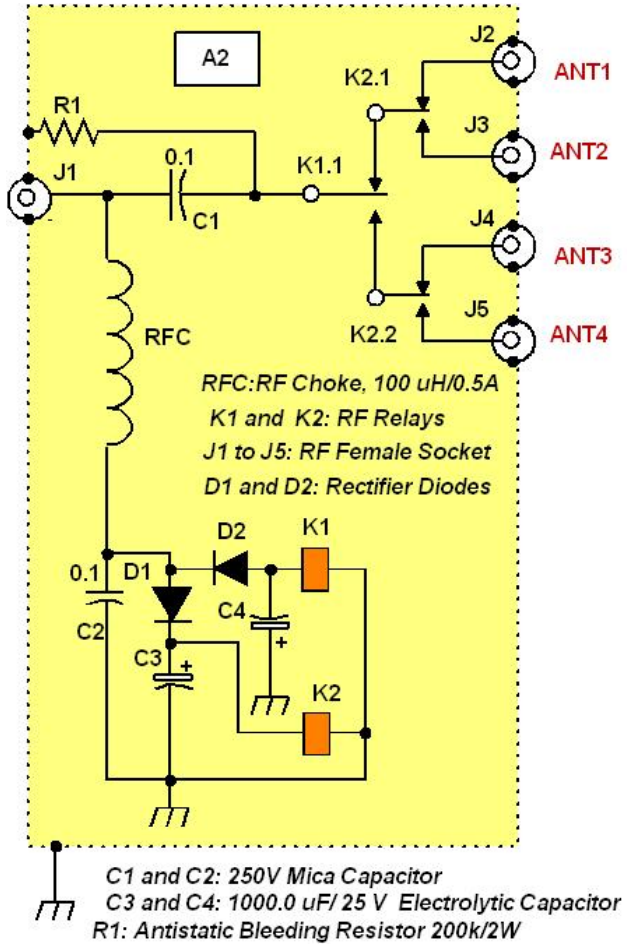

Figure 13 Schematic Diagram of Unit A2

How it works: RF voltage for antenna and control voltage for RF relays are going through one coaxial cable. The RF and Control voltages are separated at input and output of the coaxial cable with help of RF chokes. Inside the unit A1 installed main transformer that provides supply voltage for RF-relays. Logical for the code/decode circuit is very simple. If supply voltage is not coming to the coaxial cable then antenna # 1 is switched on. If the voltage in negative polarity (relative to the braid of the coaxial cable) is going to the coaxial cable then relay K1 powered up and it is switched on antenna # 3. If the voltage in positive polarity (relative to the braid of the coaxial cable) is going to the cable then relay K2 powered up and it is switched on antenna # 2. If the AC is going to the cable then both relay K1 and K2 powered up and there is switched on antenna # 4.

The RF relays used in the unit A2 should all use the same switching on voltage. Relay K2 is DPDT Relay. There is possible by such relay on e- bay or at some other places (MOUSER, DIGI-KEY). Anyway the relay may be substituted by common use SPDT Relay. Inner core of the coaxial cable should withstand both the antenna RF current and the switching on RF relay current.

Design of the unit A1 is shown in **Figure 14** (inside- **14A**, front **14B**). Design of the unit A2 is shown in **Figure 15** (inside: **15A** - front: **15B**).

Unit A2 that placed on the roof should be protected from atmospheric influence- from direct contact with rain, wind, and snow. In perfect deal the unit should be hermetically sealed. It is very good if the unit may be installed in dry place, for example, in a loft or attic of the house.

73! VA3ZNW

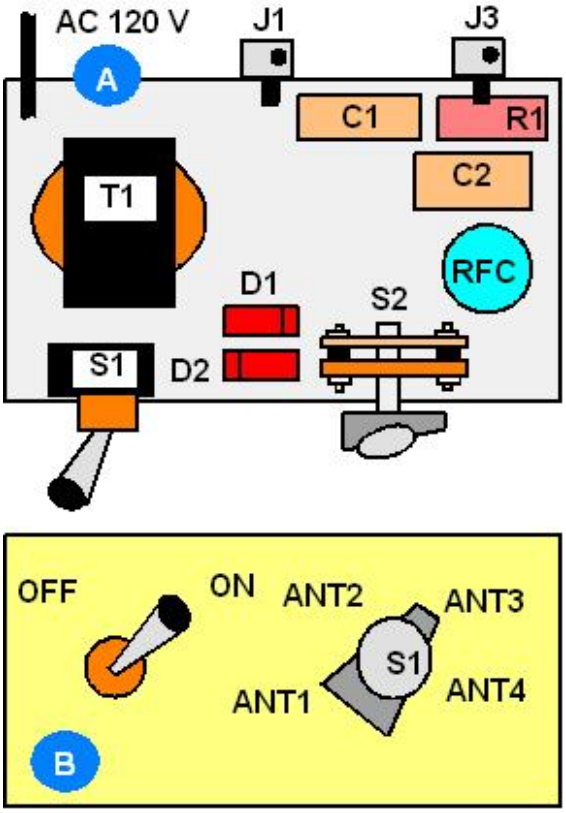

Figure 14 Design of Unit A1

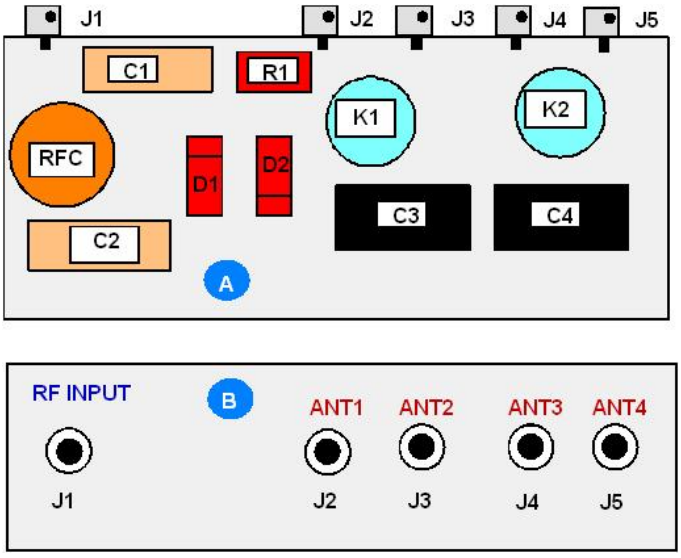

Figure 15 Design of Unit A2