The UM1233-E36 UHF modulator

The stage to be presented (hereinafter UHF modulator) fulfills the same function in both Spectrum and ZX 81 (as well as Enterprise) type computers. Namely: it makes our small machine suitable for enjoying the joys of computer technology on an ordinary television. After describing the construction of the modulator, we provide some useful advice for retrofitters. The modulator can of course be used to display the signal of home-made computers or video cameras on a TV screen.

First, let's get acquainted with the mechanical structure of the UHF modulator.
The circuit is located in a box bent from a 40x27x16 mm sheet metal. which is closed by a shading cover along its two largest sheets. Through the hole in the lower right corner of the upper shielding cover, the tuning iron core of the **L1** coil protrudes, with which we can tune our device to a small extent around UHF channel 39. This is necessary if the reception conditions at the place of residence are such that the signal of a large-field TV transmitter filters into our system and causes interference images on the screen.
On the right edge of the UHF modulator, we see two wire outlets. Here, the modulator receives the 5 Volt supply voltage through a pass-through capacitor.
The video signal is introduced into the circuit via the other wire. The UHF connector speaks for itself.

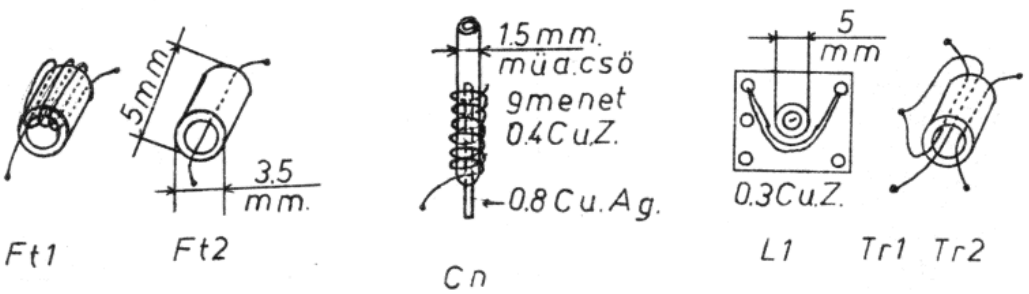

Figure 1: coil data

After that, let's see what's inside the box shall we? Carefully remove the closing cover, do not cause any damage. It is immediately noticeable that the inside of the box is divided into two parts by a curved shading plate. The carrier oscillator is located in the small part, and the modulator itself in the larger part.
It seems obvious that the designers attempted the impossible; to create a professional, reliable circuit from cheap, commercial components. They did it! Above the 300 MHz range, ordinary coils can no longer be used, but special cavity and ribbon feed line filter circuits are used. However, in our circuit, a simple coil body found in every hobbyist's drawer and ferrite cores with a hole in the middle were used to make the resonators. The oscillator is built with transistor **T1** , coil **L1** and several smaller components. The circuit itself is a simple grounded-base capacitive three-point-switched Colpits oscillator. The **L1** coil is actually not a coil, but rather a half turn consisting of two joined fibers located on a coil body with a diameter of 5 mm. The cold point above the supply voltage of the coil **L1** is cooled by the 5 nF capacitor marked **C3** . There is no capacitor parallel to the coil **L1** , because the tuning capacity of the vibrating circuit is given by the self-capacitance of the coil. **R4** and **R5** set the working point of the base, while **C4** cools the base of **T1 at high frequency. Filter elements FT1** , **C5** and **FT2** prevent the coupling of the two shielded stages through the supply voltage. We can reduce the frequency of the oscillator by including the iron core placed in the **L1** coil. If you want to increase the frequency, take out the iron core and replace it with a 4 mm diameter aluminum or copper core with a similar thread pitch. A useful signal from our oscillator is led through the voltage divider consisting of resistors **R1** and **R2** in the emitter circuit and the separating resistor **R3 to the coupling transformer TR1** , the primary side of which is designed as a resonator with the help of the tuning capacitor **C6** . The secondary side of the coupling transformer **TR1** consists of two identical coil parts, which provide counter-pulse drive to the transistors **T2** and **T3** .
These two transistors are identical to **T1** in terms of type . The emitter of the transistors is common and **R7 is connected here**by interposing a resistor, the low internal resistance video signal source.
The UHF modulator works satisfactorily when the quiescent level of the video signal is approx. 2 Volts, while in the controlled state (measured at the peaks of the sync signal) it is 3 Volts.
Capacitor **C8** more or less prevents high-frequency energy from escaping through the video connector. A high-capacity feed-through capacitor cannot be used here, because this would cut off the high-frequency components of the video signal. For example: dense vertical lines would merge. If the video output of our home-made computer is heavily loaded by the modulator, then insert an emitter follower stage.
The working point of the modulator transistors is set with a voltage connected to the central terminal of the coupling transformer **TR1** , which is produced by a divider made up of resistors R6 and R8. The operating point voltage is cooled by the high frequency of filter capacitor **C7** . Transistors
T1 and **T2 must be neutralized from a high- frequency** point of view. **Cn** neutralizing trimmer capacitors serve this purpose . (In the case of retrofitting, we must prepare these ourselves based on Figure 1.)

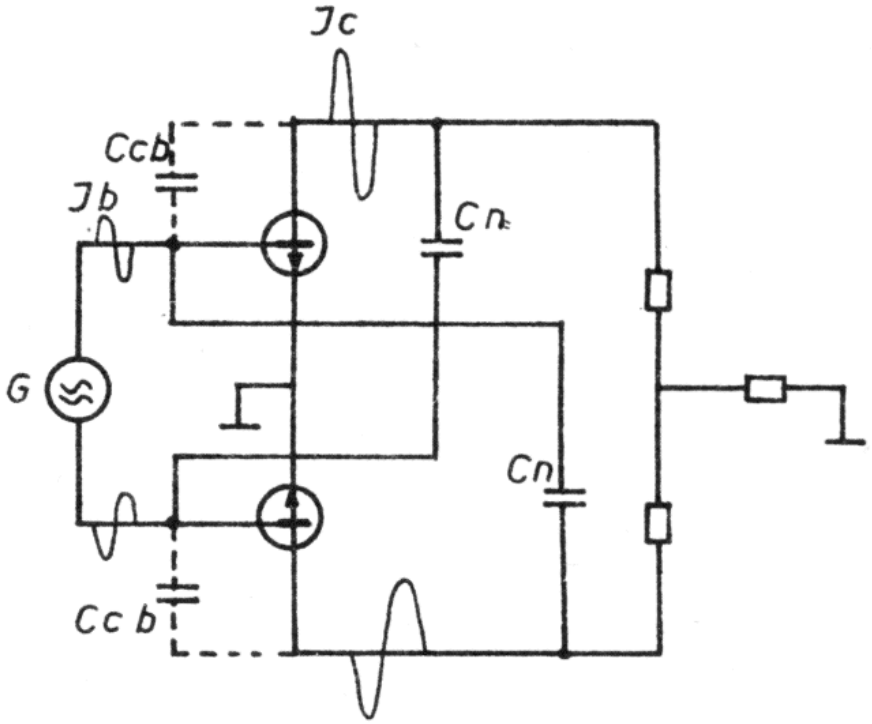

Figure 2: High-frequency replacement diagram of the modulator

Figure 2 illustrates the high-frequency replacement switching of the modulator. This shows the two **Ccb** capacities. (We have drawn the connections with dashed lines, because in reality they are located inside the transistors' casing). Through the collector-base capacitance **Ccb,** the transistors are positively fed back and energized. We can prevent this by passing a current of opposite phase to the base of the given transistor, with the help of the neutralizing capacitors Cn.
It follows that the two **Cn** create negative feedback in the circuit, and thus the symmetry of the modulator transistors can be set with them in terms of amplification. The collector of the modulator transistors **T2** and **T3** is connected to the coupling transformer **TR2** . The central terminal of the primary winding of the transformer is connected to the +5 Volt supply voltage with resistor **R9** . (By the way, **TR2** is the same as **TR1** , only it is connected in reverse in terms of signal progress.)
The secondary side of **TR2** is designed as a resonator with the help of tuning capacitor **C11** . The output impedance is approx. 20 Ohm, so the **R10** resistor is connected in series with the secondary coil . This is how the 75 Ohm output impedance used in television technology is created on the output RF connector of the UHF modulator.
Capacitor C9 cools the power line inside the box, while feed-through capacitor C10 prevents RF from escaping through the power line.

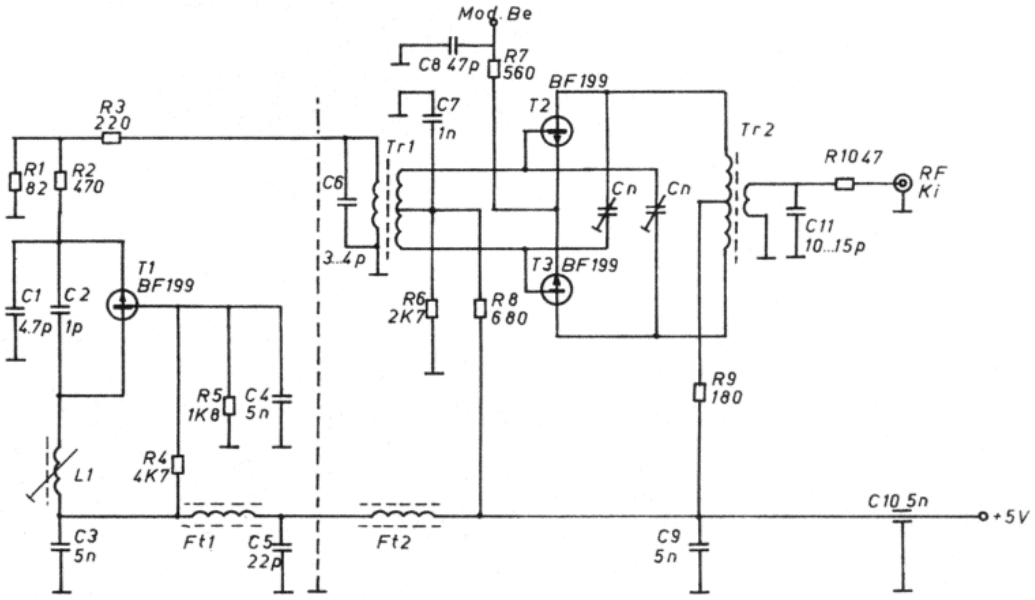

Figure 3: circuit diagram of the VM 123-E36 modulator

After the explanation of the switching principle, let's see how to build the UHF modulator!
The NY.Á.K. minimally different from the original.
The construction of the small device does not require special instruments or extensive device construction experience. It usually works the first time you turn it on.
It doesn't hurt to follow a rule or two! Only use high-quality metal film resistors. Color-coded resistors salvaged from bad Japanese

radios are best. The resistors must be inserted into the panel adjusted. The capacitors should also be as small as possible and only of the ceramic type.

Anti-excitation ferrite beads or ferrite tuning cores with a hole in the middle are suitable for coupling transformers. The coil body of **L1** can be any plastic tube with a diameter of 5 mm, you just have to make sure that the leg distribution matches the holes on the panel. The type of transistors should be **BF 199** . Do not experiment with another type, because it is not certain that the circuit will work. Try to solder the components with as short a leg as possible in accordance with the URH assembly rules. After installing the components, the panel must be placed in a shielding box and the inner shielding plate must be installed. This should also be soldered to the center of the panel with a short piece of wire.

We also need to make a cover for both sides of the box, which is in stable contact with the edge of the box. We start with the oscillator circuit. (**R8** and **R9** are not built in.) Bring the end of the antenna connector of our television closer to the switched-on oscillator.

Somewhere between 26...36. around the channel, the empty grid darkens. This means that the oscillator emits the empty carrier wave. With L1 iron or copper core, we can control its position on the scale of the television. If things have gone well so far, then solder in resistors **R8** and **R9** , then enter the modulating signal and carefully shield the device with the closing covers. Play the best possible image quality by slightly adjusting

the **Cn**

neutralizing capacitors. If there is little light, **C6** and **C11**we can improve it by changing the value of capacitors. If the modulation is too much or too little, but we get a visible image, we can improve it by changing the supply voltage +/-1, 1.5 Volts. Of course, after every change, put the shielding covers on and test the device! Also, make sure that the external shielding part of the outgoing RF connector is well soldered to the shielding box. Inside the box, the panel must be soldered to the plate. We have to produce the neutralizing trimmers ourselves, but luckily they are easy to make.

Figure 1 illustrates the structure of **Cn** . The wire is easily wound onto the plastic tube so that during adjustment, holding the protruding plastic tube with tweezers, we can easily pull the whole thing along the inner guide. To make **FT1** , thread three threads into the ferrite bead. The wire diameter is not critical, the only thing is that we can pull it into the iron core without damage.

If the oscillator frequency is very low, then the half-turn of the **L1** coil can be built from three or four joined fibers instead of two. This is important when we are close to Budapest II. to transmitter (channel 24).

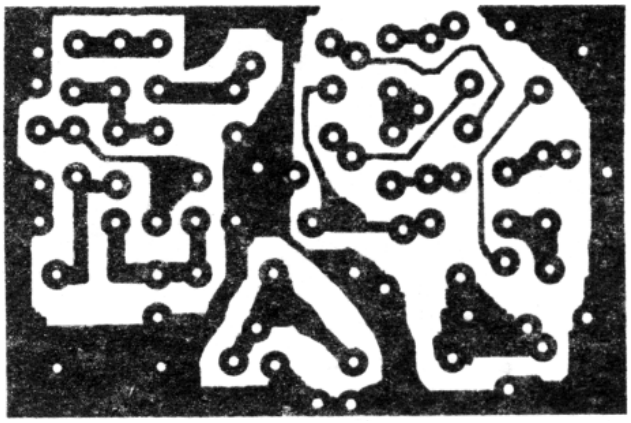

Figure 4: drawing of the printed circuit (foil on top)

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