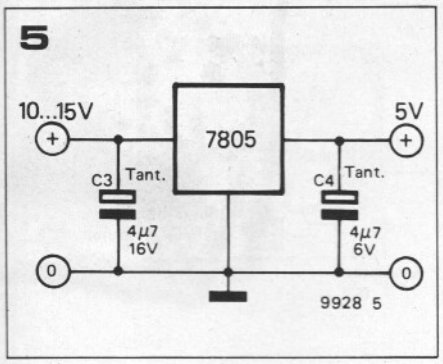


Figure 3. The address circuitry for the two highest address bits of the RAMs. This arrangement enables the available memory capacity to be divided into four separate blocks.

Figure 4. The wiring diagram for the connections between the call generator and the add-on circuit.

Figure 5. A suggested power supply for the add-on circuit, whereby the required voltage is derived from the existing supply voltage of the call generator.

the points marked B_{ROM} and C_{ROM} are joined to the diode matrix. Outputs B and C in figure 2 are taken to the corresponding inputs of the call generator, whilst input A is taken to point A of the call generator. Points F and G and address bits A8 and A9 in this figure refer to the diagram of figure 3.

Points D and E in figure 3 are connected to the corresponding points in the call generator. In the case of point E a small modification affecting the reset switch, S2, in the call generator is required. Originally this switch was connected in parallel with capacitor C3. For use with the add-on circuit however, the contact of S2 which was joined to point E should be disconnected and joined to earth. This step ensures that the reset facility is preserved.

The complete add-on circuit is fed from a 5 V supply, this being the voltage required by the two RAMs. Since the original call generator operated at a supply voltage of between 10 and 15 V, an extra supply stage is required. Figure 5 shows a suitable circuit which derives the necessary 5 V from the existing supply voltage of the call generator.

Literature:
Elektor 10, February 1976, Automatic call-sign generator.

TV sound modulator

When used in conjunction with the UHF modulator described in the December 1977 issue of Elektor, or other UHF modulators, this sound modulator will allow audio signals to be fed to the antenna input of a domestic TV set and reproduced via the audio circuits of the receiver.

A video signal can be fed into the antenna socket of a domestic TV receiver by amplitude modulating the signal onto a UHF carrier. This is the function of the UHF modulator described in the December 1977 issue of Elektor. However, if it is also necessary to feed a sound signal into the receiver, this cannot be modulated directly onto the UHF carrier, since an audio signal lies within the spectrum of the video signal, and the two would interact. It is first necessary to place the sound signal outside the video signal band by modulating it onto a subcarrier, using frequency modulation for better sound quality. The frequency-modulated subcarrier is then modulated onto the UHF carrier together with the video signal.

Since the sound subcarrier is itself not usually amplitude modulated (see table 1) it does not produce amplitude modulation of the UHF carrier, but causes the appearance of a second carrier (frequency-modulated) whose centre frequency differs from the video carrier by 6 MHz. This is illustrated in figure 1 and clarified in table 1.

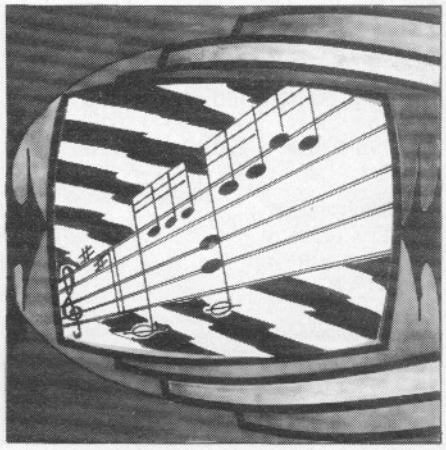
In a broadcast TV system most of the lower sideband (LSB) is suppressed. This suppression generally starts at about 1 MHz from the carrier, leaving only a small part of the video sideband and none of the sound. However, for a modulator which is to be used in the home, no suppression is necessary.

Block diagram

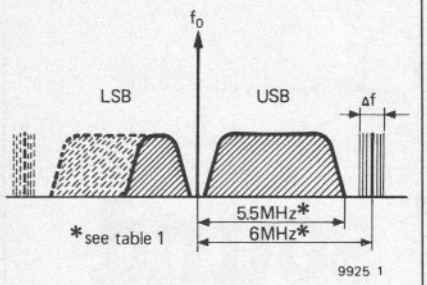
Figure 2 shows a block diagram of a sound modulator. The first stage of the modulator is a high-frequency pre-emphasis network, which boosts the high end of the audio spectrum to improve the signal-to-noise ratio. A

Specifications

The specifications given below are based on measurements made on the prototype at a supply voltage of 15 V.
Frequency deviation: 25 kHz/V. Maximum ± 75 kHz for 6 V p-p input.
Output level: 3 V p-p from 1 k.



1



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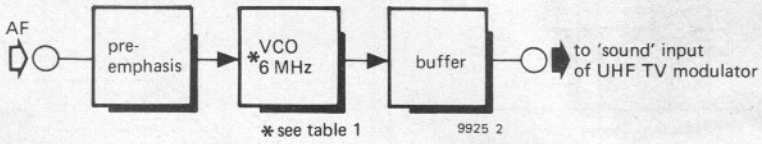


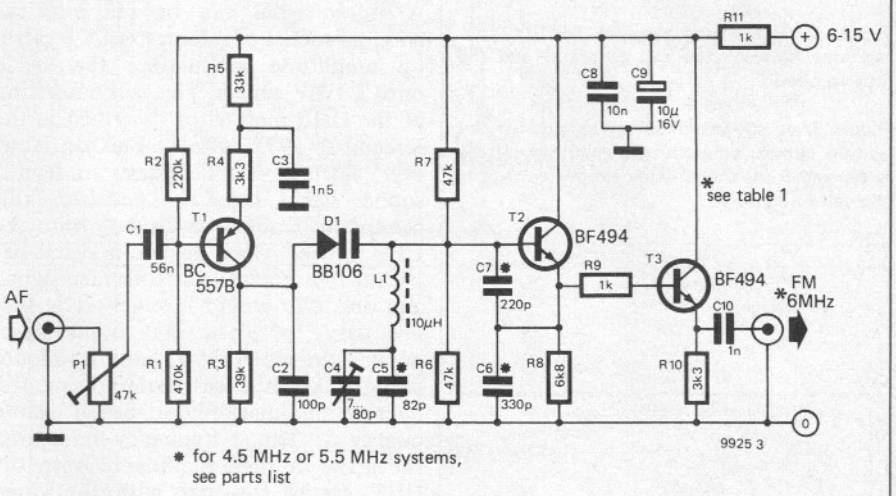
Figure 1. Showing the relationship of the FM sound carrier to the AM vision carrier and its sidebands.

Figure 2. Block diagram of a sound modulator.

Figure 3. Complete circuit of the 6 MHz TV sound modulator.

Figure 4. Printed circuit board and component layout for the modulator (EPS 9925).

3



Parts list

Resistors:
R1 = 470 k
R2 = 220 k
R3 = 39 k
R4,R10 = 3k3
R5 = 33 k
R6,R7 = 47 k
R8 = 6k8
R9,R11 = 1 k

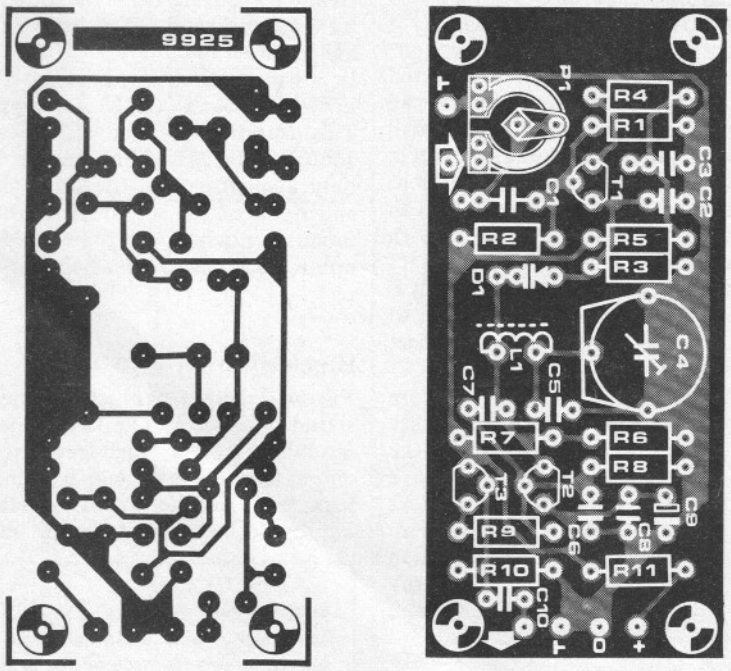
Capacitors:
C1 = 56 n
C2 = 100 p ceramic
C3 = 1n5
C4 = 7 . . . 80 p trimmer
C8 = 10 n ceramic
C9 = 10 µ/16 V
C10 = 1 n ceramic

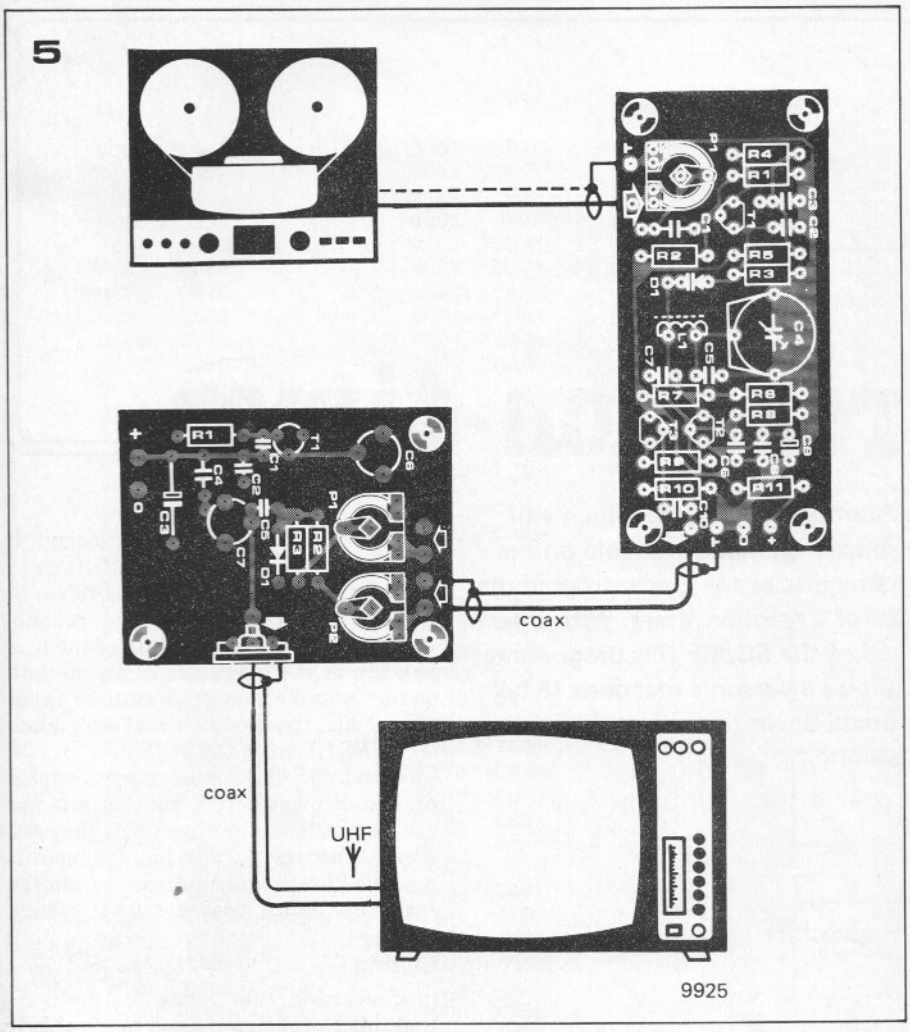
	6.0 MHz	5.5 MHz	4.5 MHz
C5	82 p	100 p	180 p
C6	330 p	390 p	680 p
C7	220 p	270 p	390 p

Semiconductors:
T1 = BC 557B
T2,T3 = BF 494
D1 = BB 106

Miscellaneous:
P1 = preset potentiometer 47 k
L1 = r.f. choke 10 µH

4





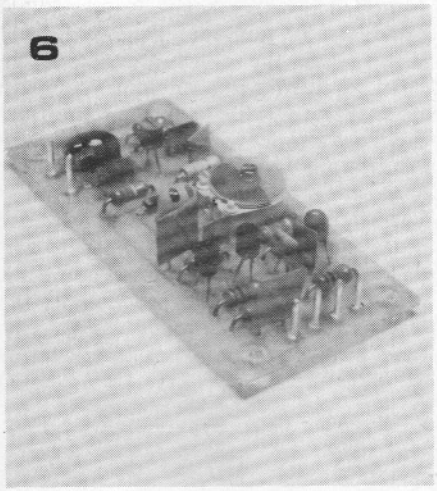


Figure 5. Connection from the output of the sound modulator to the input of the UHF modulator should be by coaxial cable.

Figure 6. Photograph of the completed board.

Table 1. A list of the various sound intermediate frequencies used by different countries. Also listed is the mode and deviation which is used. Note that the unit described here is not suitable for use in France, Luxembourg and Monaco.

Table 1.

sound IF	mode and deviation (Δf)	country or region
4.5 MHz	FM, 25 kHz	North and South America, Japan
5.5 MHz	FM, 50 kHz	Most of Western Europe, East Germany, Yugoslavia, most of north Africa
6.0 MHz	FM, 50 kHz	UK, Northern Ireland, most of the southern part of Africa.
6.5 MHz	FM, 50 kHz	USSR, and most east European countries.
6.5 MHz	AM	France, Luxembourg, Monaco

Note: this table is only valid for audio systems, not video!

complementary de-emphasis network in the TV set cancels this boost to give a flat frequency response.

The heart of the sound modulator is a 6 MHz voltage-controlled oscillator, whose frequency varies in sympathy with the amplitude of the audio input signal.

The final stage of the modulator is an output buffer which allows the 6 MHz output to be fed direct to the second input of the UHF modulator.

Complete circuit

The full circuit of the TV sound modulator is given in figure 3. The input stage around transistor T1 functions as an input buffer and pre-emphasis filter. This has unity gain at low frequencies, rising to 10 at the high end of the audio spectrum. The pre-emphasis is determined by the time constant R5/C3, and corresponds to the European standard of 50 μs.

The oscillator section 'T2' is a standard Clapp circuit, chosen for its exceptional stability. The frequency of this oscillator is modulated by using the audio signal from T1 to alter the capacitance of a varicap diode, D1.

The circuit is completed by an output buffer, emitter follower T3.

Construction

Construction of the sound modulator is extremely straightforward using the printed circuit layout of figure 4. To minimise stray radiation and frequency drift the circuit board should be built into a screened, i.e. metal, box. Connection from the output of the sound modulator to the input of the UHF modulator should be by coaxial cable as shown in figure 5. The current consumption of the circuit is extremely low (1 mA) so power can be taken from the existing supply to the UHF modulator.

Adjustment

Setting up the modulator is extremely simple, since incorrect adjustment is immediately apparent. Firstly, a suitable video signal is fed into the TV set via the UHF modulator and the set is correctly tuned to this.

The sound signal is then fed in and C4 is adjusted to tune the centre frequency of the modulator. Incorrect tuning will manifest itself as distortion, intercarrier buzz or no sound at all being present. Distortion may also occur if the audio input level is too high, but this can be adjusted using P1 on the sound modulator board.

The sound carrier level may be set by adjusting P2 on the UHF modulator board.