

## VOLTAGE CONTROLLED OSCILLATOR AND MULTIPLIER OS2/523

### Introduction

The OS2/523 is designed for use in the u.h.f. rebroadcast television receiver RC5M/502. It uses a voltage-controlled crystal which operates in the range 9 MHz to 13 MHz, with multipliers having a ratio of 48 or 72. The unit requires inputs of gating pulses and error signals from associated equipment.

Two printed circuit boards are used and these are mounted on a special chassis based on the CH1/12B format with index pegs 47 and 67. The U.H.F. output connection is made through a BNC socket mounted on the front panel. The d.c. supplies, the gating pulse input and the error signal input are made through a rear mounted 15-way Painton plug.

The unit is not continuously tuned but is preset to the channel on which it is required to work.

### General Specification

<i>Output Level</i>	1 V r.m.s. across 50 ohms
<i>Output Frequency</i>	Any one channel in Bands IV or V.
<i>Output Level Stability with Temperature</i>	$\pm 1.5$ dB from $0^{\circ}\text{C}$ to $55^{\circ}\text{C}$ ambient
<i>Power Requirements</i>	50 mA at +24 V 90 mA at +12 V up to 500 mA at 12 V for oven
<i>Weight</i>	4 lb 12 oz

### Circuit Description

The circuit diagram is given in Fig. 1. The crystal oscillator is an HDC Research type 35BBC operating at a single frequency in the range 9 MHz to 13 MHz. (For a complete list of channels, crystal frequencies and unit output frequencies, see Appendix 1 in the Designs Department Specification.<sup>1</sup>) The crystal is housed in a proportional oven which provides continuous control and maintains the temperature to within narrow limits. The voltage control to the oscillator is supplied by the 4-diode bridge which provides a path, during the gating pulse period, for the error signals at PLA13.

The output from the crystal oscillator is fed via a common-emitter amplifier to a common-base amplifier tuned to the oscillator frequency. Transistors TR9 and TR10 are frequency multipliers with factors of 2 and 3 respectively. TR11 is an amplifier with the collector tuned to six times the crystal oscillator frequency. Multiplier TR2 doubles for Band IV and triples for Band V. TR4 acts as an adjustable impedance in the emitter circuit of TR2 and gives some degree of gain control. It also provides temperature compensation for TR2, offsetting the decrease in output as temperature increases; the effect is due to increasing leakage current in TR4 which establishes a forward bias across R19. The output from the TR2 multiplier stage is about 1 volt across 50 ohms in the range 125 MHz to 225 MHz.

TR3 is a common-emitter tuned amplifier for driving the varactor quadrupler stage; it provides an output of about 2.5 volts across 50 ohms. There is a test point for monitoring purposes.

The varactor diode D3, has a highly non-linear current-voltage relationship. The input drive at frequency  $f$  is matched into the diode by means of L13, C25 and C38 with some temperature compensation by C26. L14 and C27 form a parallel-resonant circuit at the output frequency  $4f$  to prevent the input circuit from shunting the diode at the output frequency. Similarly L15, C28 and C43 prevent shunting of the diode by the output circuit at

the input frequency. C29, L16 and D3 are series-resonant at  $2f$ . The output circuit C30, L17, C31 and C32, matches the diode to 50 ohms at  $4f$ . The output of the varactor stage is about 1.2 volts r.m.s. across 50 ohms. A monitoring point is provided.

The output band-pass filter has a loss of about 1 dB; thus the output of the unit is normally about 1.1 volts r.m.s. across 50 ohms.

### Maintenance

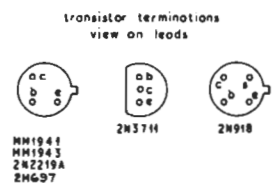
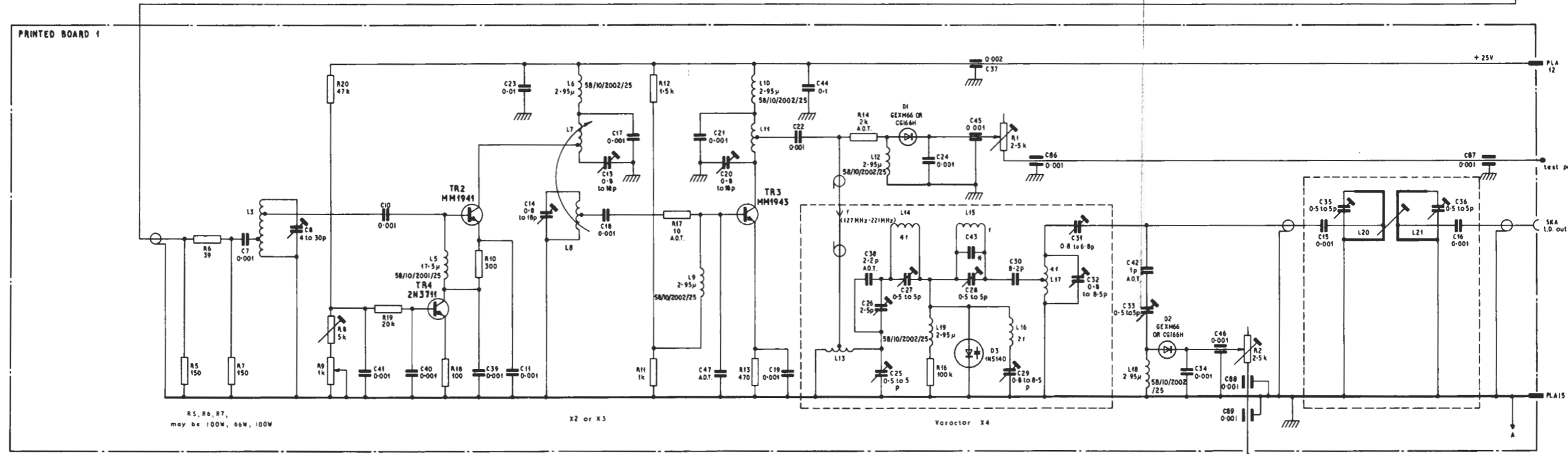
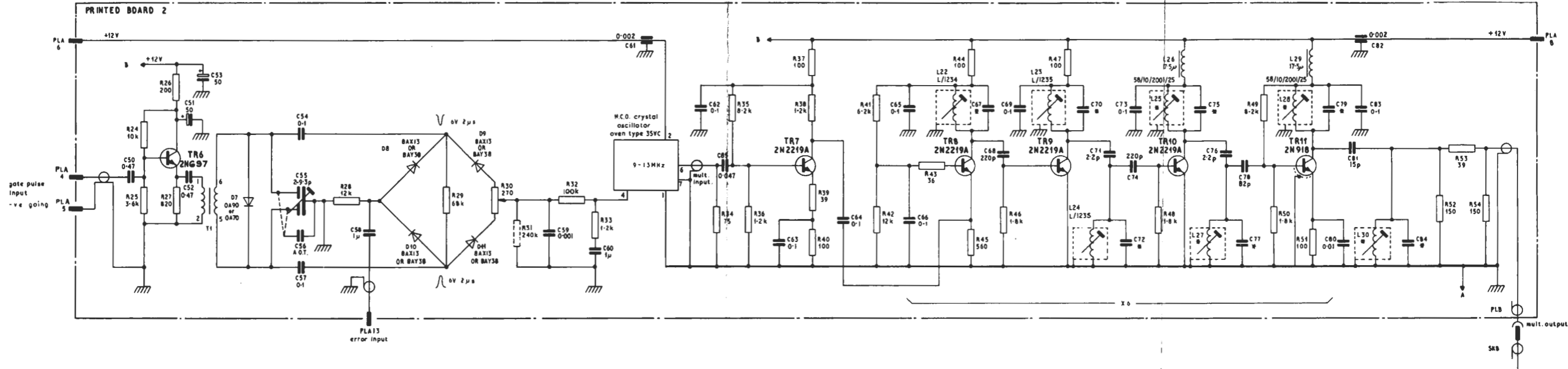
Routine maintenance is not required; the unit is tested as part of its parent unit. The following points can, however, be noted. For complete line-up tests reference should be made to the Designs Department Specification.<sup>1</sup>

1. The potential on C37, C61 and C82 should be 24 V  $\pm 100$  mV, 12 V  $\pm 100$  mV and 12 V  $\pm 100$  mV respectively.
2. The gating pulses at the junction of D8 and D9 should be negative-going and at the junction of D10 and D11 they should be positive-going. The duration of the pulses should be 2  $\mu\text{s}$  and the amplitude should be 6 V. Capacitors C55 and C56 provide adjustment for equalising the amplitudes.
3. R30 is set for minimum gating-pulse amplitude across R31.
4. The output frequency of the oscillator, measured at SKA, is initially adjusted to be within 72 Hz of its nominal value but this close tolerance will probably not be maintained in use and may increase to 200 to 300 Hz. If adjustment of the frequency becomes necessary, the adjuster is accessible through the front panel. (A counter, fed through a 20-dB 50-ohm attenuator, is required for this test and the burst signal must be removed.)
5. The output signal level at SKA is set to 1.1 V r.m.s. by R9.
6. To set the output from TP1 connect an Avometer Model 8 on its 250- $\mu\text{A}$  range between the test point and earth. Adjust R1 so that the meter reads 50  $\mu\text{A}$ .
7. The output from TP2 is set similarly except that R2 is put to its centre point and C33 adjusted to give the 50- $\mu\text{A}$  reading.

N.B. For tests 6 and 7 above, the output of the unit at SKA should be normal, i.e. 1.1 V r.m.s. across 50 ohms.

### Reference

1. Designs Department Specification No.6.54(70)



OS2/523/17

from D27322 A1 iss. 2

Note: For values of components marked thus # see table.  
X For channels 21-43 inc. C45 = 33p  
For channels 44-68 inc. C43 not fitted

component	channel				
	21 to 25 51 to 60	26 to 31 61 to 68	32 to 34	39 to 44	45 to 50
C67	390p	330p	300p	390p	390p
C70	180p	130p	110p	220p	200p
C72	180p	130p	110p	220p	200p
C75	68p	36p	47p	56p	47p
C77	56p	47p	39p	47p	39p
C79	56p	39p	33p	39p	39p
C84	68p	39p	27p	47p	47p
L25, L27, L28, L30	L/1236	L/1236	L/1235	L/1237	L/1237

Channels 35-38 incl. are not used for TV