NATLOCK REFERENCE SYNTHESISER C02/545

Introduction

The C02/545 accepts a stable frequency of 5MHz and derives from it stable frequencies of 4·5 MHz and 4·4296875 MHz (Natlock frequency). It is designed for use in any area having a stable frequency standard with a 5-MHz output.

The synthesiser is constructed on a CH1/12A chassis with index-peg numbers 47 and 49. Power for the synthesiser is provided by a PS2/22A Stabilised Power Supply adjusted to give a reduced output voltage (−5·25 volts). The PS2/22A is constructed on the same chassis as the rest of the synthesiser.

General Description

Fig. 1 shows a block diagram of the synthesiser. The 5-MHz input is divided down to 500 kHz by a ÷10 system and these two signals are applied to a modulator. The lower sideband (4·5 MHz) of the modulation process is selected by a crystal filter to provide the 4·5-MHz output of the synthesiser.

The 4·5-MHz signal is then divided down to 70·3125 kHz by a ÷64 system, and these two signals are applied to a second modulator. The lower sideband (4·4296875 MHz) of this modulation process is selected by a second crystal filter to provide the synthesised Natlock-frequency output.

General Specification

Input	5-MHz sinewave, 1 volt p-p ±6 dB.
Input Impedance	approximately 1 kilohm.
Outputs	4·5 MHz sinewave, 1 volt p-p across 75 ohms. 4·4296875 MHz sinewave, 1 volt p-p across 75 ohms.
Output Impedance	75 ohms.
Power Input	240 volts a.c. fused at 150 mA.
Internal PS2/22A Output	−5·25 volts ±0·3 volts.
Temperature Range	0°C to 40°C
Weight	1 kg (2 lb. 4 oz.)

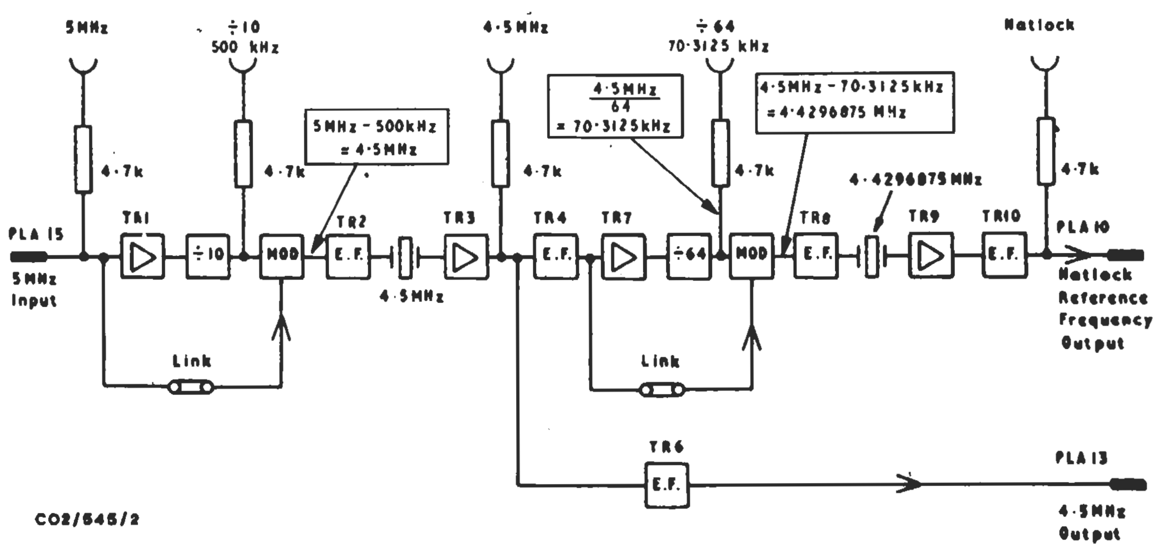

Fig. 1. Block Diagram of the C02/545

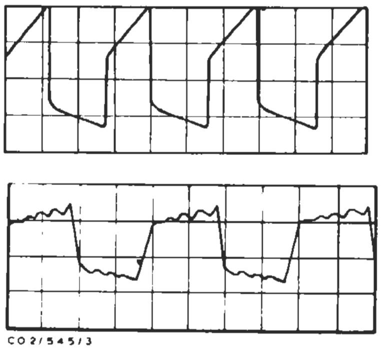

Fig. 2 *Waveforms at Test Points in the CO2/545*

Monitor Points	
5 MHz	5 MHz synthesiser input, 1 volt p-p ±6 dB, sinewave.
÷10	500 kHz, approximately 2 volts p-p, waveform as shown in Fig. 2 (a).
÷64	70·3125 kHz, approximately 3 volts p-p, waveform as shown in Fig. 2 (b).
4·5 MHz	4·5 MHz synthesiser output, approximately 1 volt p-p sinewave.
Natlock	4·4296875 MHz synthesiser output, approximately 1 volt p-p sinewave.

Circuit Description

The circuit of the synthesiser is shown in Fig. 3. The 5-MHz input is amplified by TR1 and applied to a digital ÷10 circuit IC1. The output of IC1 is at 0·5 MHz and is fed together with the 5-MHz input signal to MOD 1.

MOD1 output is applied to emitter follower TR2 which provides a low-impedance drive to the frequency-selective bridge formed by C5, C6, XL1 and T1 primary. Capacitor C6, XL1 and half of T1 primary form a series-resonant circuit at 4·5 MHz. Capacitor C5 balances the shunt capacitance of XL1 to provide neutralisation for the unwanted components of the modulator output.

The secondary of T1 drives a common-base amplifier TR3 which in turn drives two emitter followers, TR4 and TR6. The 4·5-MHz output of the synthesiser is taken from TR6.

The 4·5-MHz output of TR4 is amplified by TR7 and applied to a digital ÷64 system comprising IC2, IC3 and IC4, which are identical ÷4 circuits. IC4 output is at 70·3125 kHz and this is fed together with the 4·5-MHz signal to MOD 2.

MOD2 output passes via gain control R25 and emitter follower TR8 to the frequency selective bridge formed by C14, C15, XL2 and T2 primary. This bridge operates in the same way as that associated with T1 primary except that the required frequency is now the difference between 4·5 MHz and 70·3125 kHz i.e. 4·4296875 MHz.

T2 secondary drives a common-base amplifier TR9 which in turn drives the output emitter follower TR10.

Testing the CO2/545

Equipment Required

Oscilloscope and probe with level response up to 5 MHz.
Frequency counter to resolve 5 MHz ± 0·1 Hz.
Three 75-ohm terminations.
Switched attenuator 75-ohm, 12-dB.
Source of 5 MHz ± 0·1 Hz sinewave, at 2V p-p from 75-ohms.
AVO Model 8.
Test connector, e.g. PN3A/18 suitable wired with 75-ohm termination on pin 15.
EP1M/508 Remote Signal Analyser.
4·4296875-MHz parallel-resonant crystal for burst-locked oscillator in EP1M/508.
GE4L/520 Non-Linearity Test Signal Generator.

Test Procedure

1. Connect the AVO 8 across C3 on the PS2/22A Power Supplier board. Switch on the mains and adjust RV1 for –5·25 volts ± 0·3 volts.
2. Terminate the Natlock and 4·5-MHz outputs in 75 ohms.
3. Connect the 2-volt p-p 5-MHz source to the synthesiser input via the switched attenuator. Set the attenuator to 6 dB to give a synthesiser input level of 1 volt p-p. Use the Frequency Counter to check that the frequency is correct to within 0·1 Hz.
4. Disconnect one end of each of the two links on the board.
5. Connect the oscilloscope probe to the junction of C4 and R7. Trim MOD1 variable resistors for minimum spikes on the display.
6. Transfer the oscilloscope probe to the ÷10 monitor socket and check for a waveform similar to that shown in Fig. 2 (a).
7. Re-connect the link adjacent to IC1.
8. Transfer the oscilloscope probe to the emitter

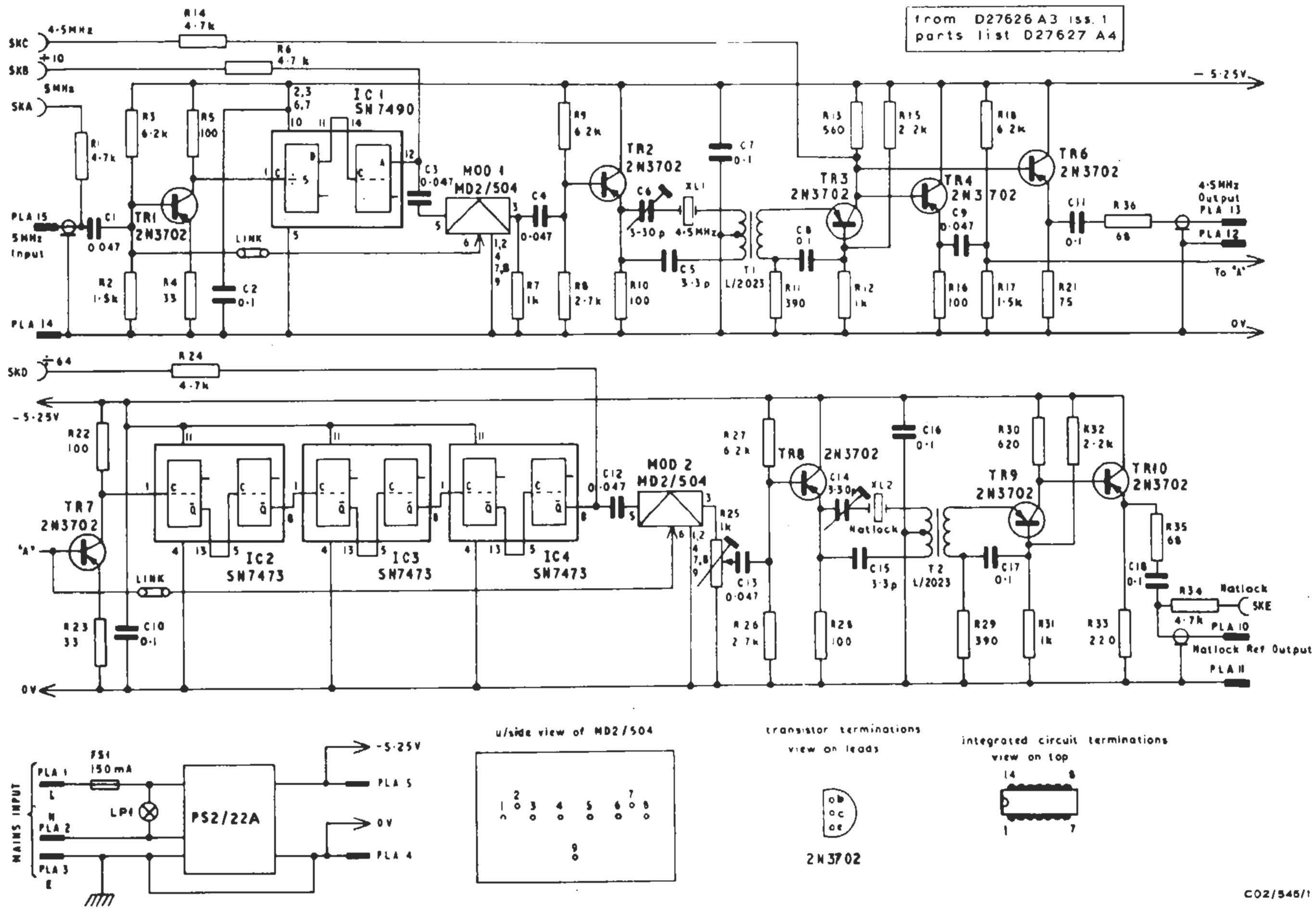

Fig. 3. Circuit of the Natlock Reference Synthesiser

of TR3 and adjust C6 for maximum sinewave output.

9. Transfer the oscilloscope probe to the juction of R25 and MOD2 pin 3. Trim MOD2 variable resistors for minimum spikes on the displayed trace.
10. Check at the ÷64 monitor socket for a waveform similar to that shown in Fig. 2 (b).
11. Re-connect the link adjacent to R25.
12. Connect the oscilloscope probe to the emitter of TR9 and adjust C14 for maximum sinewave output.
13. Transfer the oscilloscope probe to the junction of C18 and R34 and adjust R25 for a 1-volt p-p sinewave output.
14. Connect the Frequency Counter to the 4·5-MHz output and check that the indicated frequency is 4·500000 MHz ± 0·1 Hz.
15. Transfer the Counter to the Natlock output and check that the indicated frequency is 4·4296875 MHz ± 0·1 Hz.
16. Connect the oscilloscope probe to the junction of R36 and pin 13 on the Painton 15-pole plug. Check that the 4·5-MHz output is 1 volt p-p.
17. Use the input attenuator to vary the input level from +6 dB to –6 dB. Check that this does not cause a variation in the 4·5-MHz output level.

Phase Jitter Measurement

1. Remove the OS1/502 Burst Locked Oscillator from the EP1M/508 Remote Signal Analyser. Lift the spring clip which secures the oven and unplug the oven to reveal the crystal. Remove the crystal and replace it with one for 4·4296875 MHz.
2. Set up the GE4/525 Luminance Non-Linearity Test Signal Generator as below:
   - 625 free trigger mode
   - Test W/F to *Bump*
   - Bar Off
   - Pedestal Off
   - Auto Off
   - Slide switch to *Normal*
3. Switch the GE4/526 Chrominance Non-Linearity Test Signal Generator to give burst on all lines.
4. Switch the UN1/576 Waveform Processor Unit (part of the Remote Signal Analyser) to *Chroma.*
5. Connect the *Test Signal* output of the GE4L/520 to *Sig.In* on the EP1M/508.
6. Connect the Natlock output of the CO2/545 under test to the *Ext. Subcarrier* input of the GE4L/520.
7. Connect the oscilloscope to the *Demod. Out* of the EP1M/508 and check the display for jitter. This should be less than 0·5° p-p.
   Note that jitter very much greater than 0·5° could be caused by failure of the OS1/502 to lock to the burst on the GE4L/520 output. If this is suspected connect the oscilloscope probe to the OS1/502 phase comparator output at the junction of R11 and R12. A correctly locked oscillator will give a steady d.c. voltage at this point whereas an unlocked oscillator will give a low-frequency variation of at least 0·1 volt.

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