LINE-SWEEP GENERATOR GE4/535

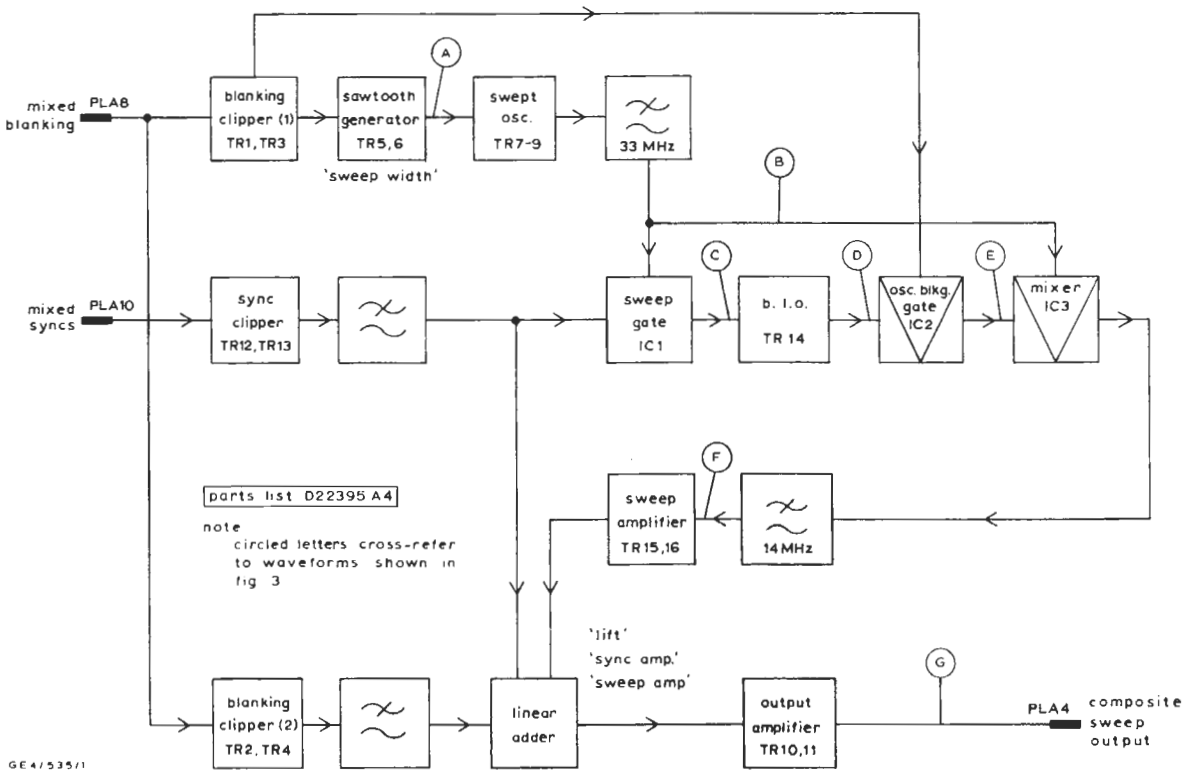


Fig. 1 Block Diagram of the Line-sweep Generator GE4/535

Introduction

The GE4/535 accepts mixed blanking and syncs and provides a composite video output consisting of a blanked frequency-sweep waveform phase-locked to line frequency. Sweep-waveform amplitude, lift and sync amplitude of the output waveform can be varied continuously by controls mounted on the front panel. The frequency of the output sweep waveform varies from zero to a maximum which can be adjusted from 3·5 MHz to 10 MHz by a pre-set control on the front panel.

The generator provides a sensitive method of investigating the frequency response of a video circuit where a composite test signal must be used.

The GE4/535 requires an external power supply and will operate on 525-line or 625-line standards. It is constructed on a CH1/12A chassis using index-peg positions 26 and 36.

General Specification

Pulse Inputs

Mixed Syncs	2 volts p-p across 5 kilohms
Mixed Blanking	2 volts p-p across 5 kilohms
Output (from 75 ohms)	fully blanked composite sweep waveform at standard level into 75 ohms
Minimum Instantaneous Frequency (at start of active line)	nominally zero
Maximum Instantaneous Frequency (at end of active line)	adjustable from 3·5 MHz to 10 MHz
Instantaneous Frequency Characteristic	linear with time
Amplitude Variation of Output Sweep	less than 0·25 dB from 0 to 10 MHz
Operating Standards	525-lines 625-lines
Power Requirements	+12 volts, 120 mA

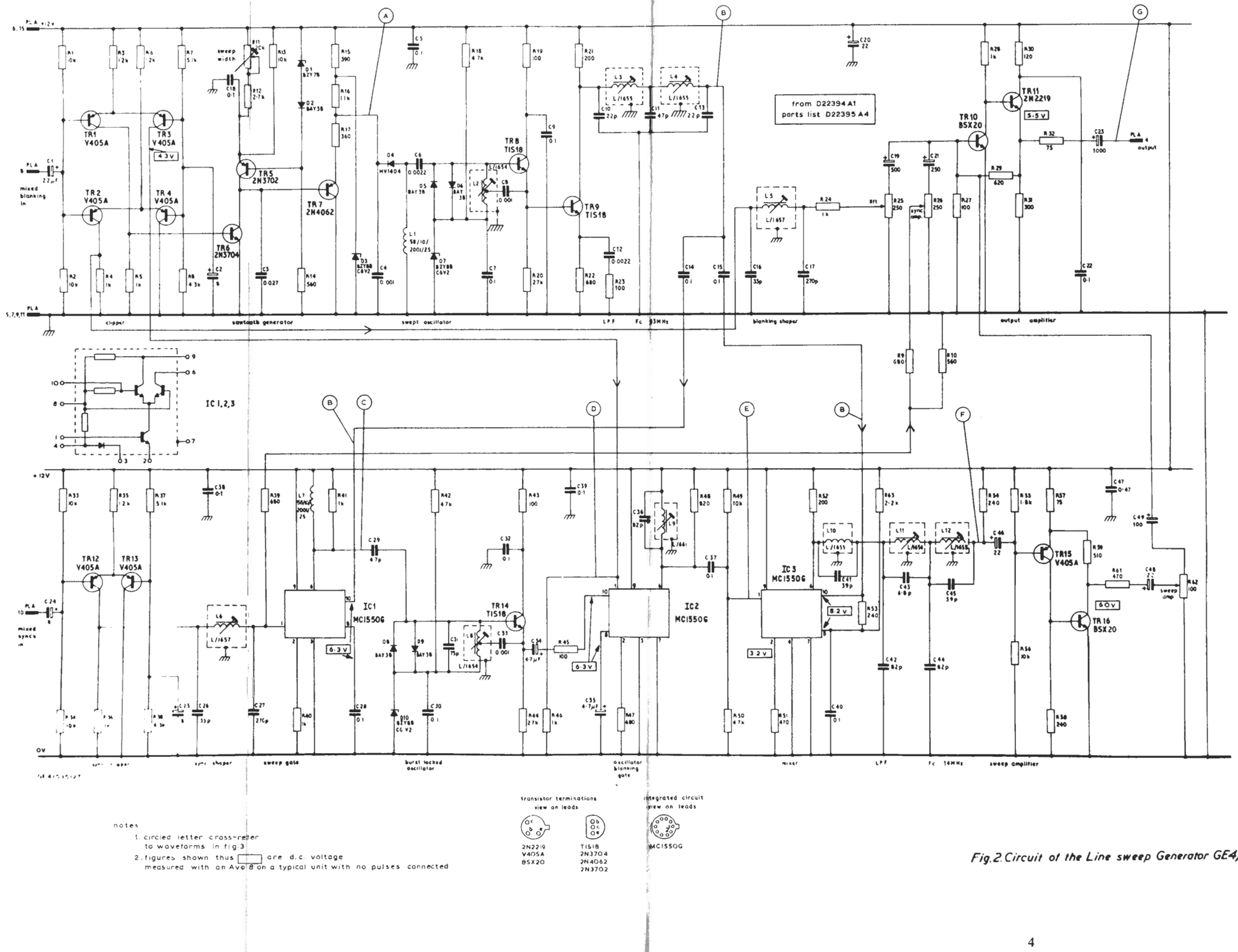
General Description

A block diagram of the GE4/535 is given in Fig. 1.

Blanking pulses are used to generate a sawtooth waveform which has a flat base (clamped to a fixed potential during the line-blanking period) and a ramp rising linearly with time during the active line period, This waveform is applied to a varactor diode, the capacitance of which determines the resonance frequency of an oscillator. The output frequency is 20 MHz during line blanking (stabilised by the clamped portion of the sawtooth) and rises to a maximum between 23·5 and 30 MHz depending on the sawtooth amplitude.

Two outputs are taken from the swept oscillator; one is applied directly to the first input of a mixer and the other is gated by syncs during the line-blanking period to produce a 20-MHz burst. An oscillator is synchronised by this burst to 20 MHz so that the resultant output waveform has a fixed phase relationship to the original 20-MHz signal. The burst-locked oscillator output is blanked before it is applied to the second input of the mixer. (Blanking is effected on the unit output at this stage to achieve a defined blanking-level with simple circuitry.) Modulation products at the mixer output include a frequency-difference signal (0 to 10 MHz, maximum) which is selected by a low-pass filter.

Syncs and lift are added to the 0 to 10-MHz sweep waveform at the input of a virtual-earth adder and the composite sweep output waveform passed to the output.



notes

1. circled letter cross-refer to waveforms in fig.3
2. figures shown thus [ ] are d.c. voltage measured with an AVO 8 on a typical unit with no pulses connected

transistor terminations view on leads

2N2219 V405A BSX20

TIS18 2N3704 2N4062 2N3702

integrated circuit view on leads

MC1550G

Fig.2. Circuit of the Line sweep Generator GE4/535

Circuit Description

The circuit diagram of the GE4/535 is given in Fig. 2 on page 4. Waveforms at points indicated are shown in Fig. 3.

Blanking pulses enter the unit on PLA8 and are processed in parallel by two clippers TR1, TR3 and TR2, TR4. One output from clipper 1 (TR1, TR3) triggers the sawtooth generator TR5 by bottoming TR6 during line blanking. The sawtooth waveform (Fig. 3 a) rises from a clamped potential (near 0 volts) at the start of the active line and finishes at the end of the active line. (The amplitude of the sawtooth determines the maximum frequency of the sweep waveform at the output of the unit, hence the *Sweep Width* control operates in this stage.) The sawtooth waveform is passed by emitter follower TR7 to a modified Hartley oscillator TR8 controlled by varactor diode D4. The oscillator delivers a constant-amplitude output (determined by amplitude-limiting diodes D5 and D6) while the frequency varies linearly with time from 20 MHz (during blanking) to between approximately 23·5 and 30 MHz (depending on the setting of *Sweep Width*) at the end of the active line. This waveform is shown in Fig. 3 b,

The swept oscillator output is taken via the common-emitter amplifier TR9 and 33-MHz low-pass filter to the sweep gate IC1. This stage also receives sync-pulses via the clipper TR12, TR13 and low-pass filter L6. The sweep gate IC1 allows the swept oscillator output to pass only during the sync-pulse period when the oscillator frequency is 20 MHz. This 20-MHz burst (Fig. 3 c) locks the output of the burst-locked oscillator in a fixed phase relationship to the burst for the duration of the active line.

The burst-locked oscillator output (Fig. 3 d) is applied to the blanking gate IC2 which also receives a feed of clipped blanking pulses from TR3. The blanked 20-MHz signal (Fig. 3 e) is taken from IC2 and applied together with the swept-oscillator output to the mixer IC3. The frequency-difference signal (0 to 10 MHz, maximum) shown in Fig. 3 f at the output of IC3 is selected by the 14-MHz low-pass filter L10–12 and amplified by TR15, TR16 before it passes to the linear adder.

The adding function is performed by the virtual-earth input of the final amplifier TR10, TR11. To this point are passed the 0 to 10-MHz sweep waveform with syncs and blanking via *Sweep Amp*, *Sync Amp* and *Lift* controls which allow the signals to be combined in adjustable proportions. The amplifier is capable of delivering the signal shown in Fig. 3 g at standard level into 75 ohms via PLA 4.

Integrated Circuit

The IC type MC1550G used in this unit both as a mixer and as a gate is basically a long-tailed-pair with a current-control transistor in the emitter circuit.

When the device is used as a gate the pulse input is applied to pin 1 and the h.f. input to pin 10. The output is taken from pin 6.

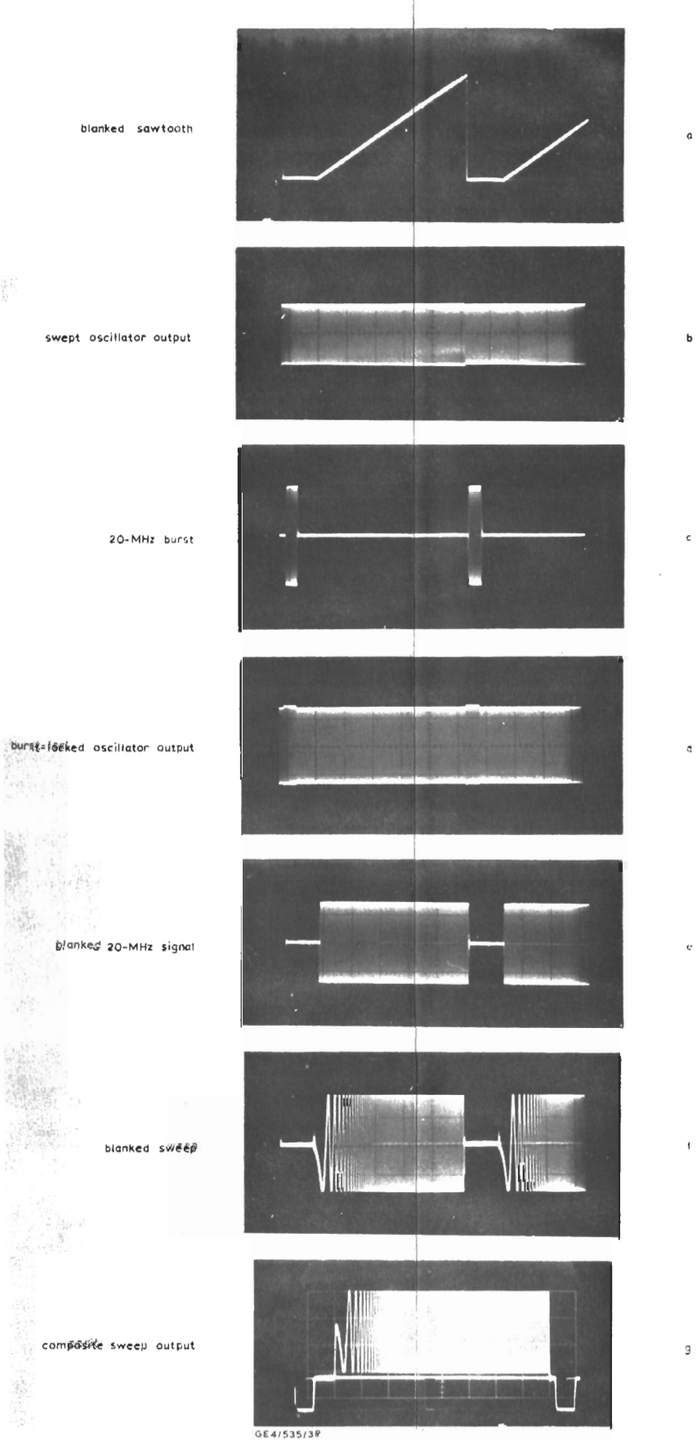


Fig. 3 Waveforms in the Line-sweep Generator GE4/535

Operation

The continuously-varying fequency-swept waveform generated by this unit shows up irregularities, such as amplitude notches in the frequency response of a network, which cannot necessarily be identified with multi-burst or pulse-and-bar waveforms. However, the high sweep-rate causes envelope distortion of the true amplitude characteristic when sweeping circuits in which the amplitude response varies rapidly with frequency. In Fig. 4 some typical responses of networks swept with the GE4/535 waveform are compared with characteristics obtained from steady-state measurements.

Maximum-frequency Adjustment

The maximum instantaneous frequency of the sweep waveform at the unit output is readily set to any required value by terminating the signal at an oscilloscope with an open-circuited cable $\lambda/4$ long at the required frequency. A sharply defined null occurs in the display at that frequency. The *Sweep Width* control is used to set that null to the end of the active line.

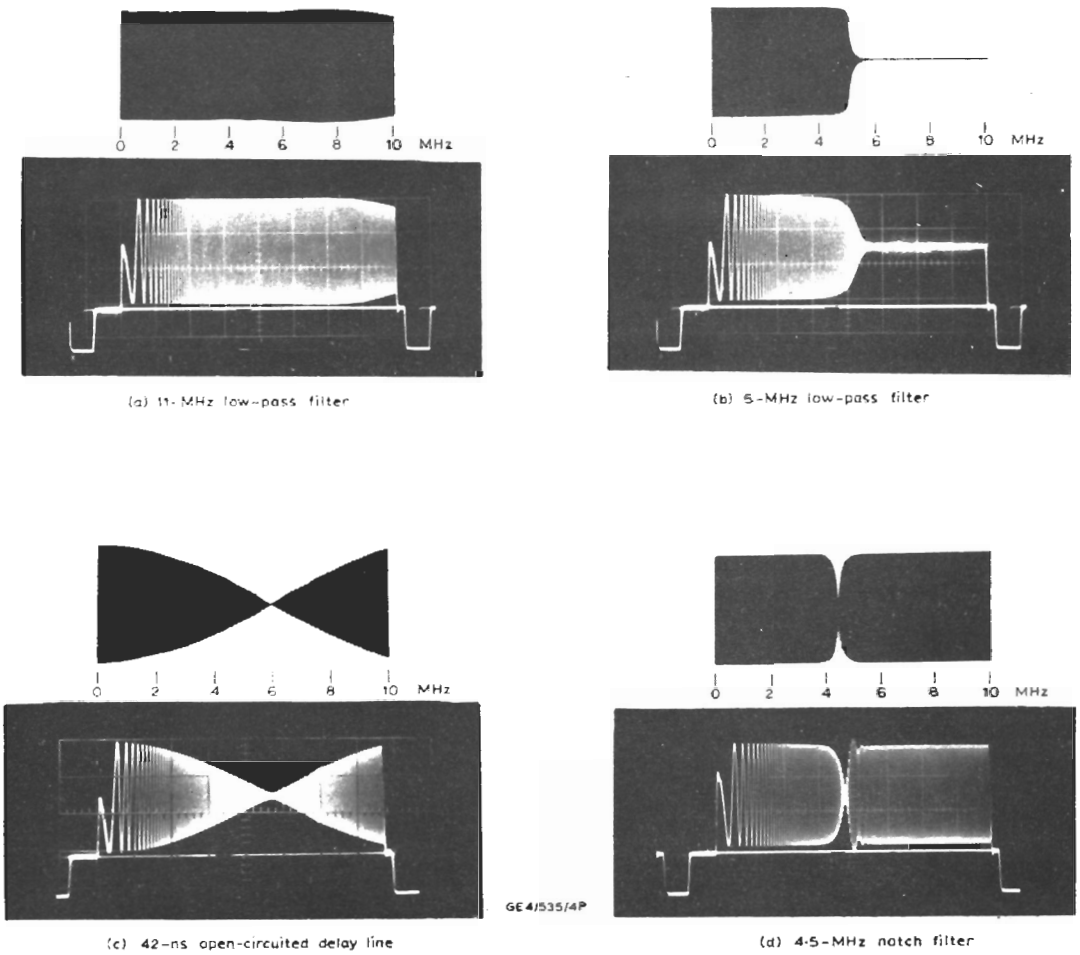


Fig. 4 Typical Responses Obtained with the GE4/535
Silhouettes show responses obtained from steady-state measurements

Alignment

Routine alignment of the generator is not necessary. If frequency-sensitive components are replaced the procedure given may be followed in part or whole as required.

Equipment Required

Oscilloscope with bandwidth greater than 10 MHz
Receiver to cover 20 MHz
+12 volts power supply
Feed of 625-line mixed blanking pulses
Feed of 625-line mixed sync-pulses
16-foot length of PSF1/2 or PSF1/3 coaxial cable ($\lambda/4$ at 10 MHz) with connector at one end and open-circuited at the other.

Burst-locked Oscillator

Connect the power supply to the unit. Do not connect the pulses.
Check that the d.c. consumption is approximately 120 mA.
Use the receiver with a small loop aerial near L8 to adjust L8 for an oscillator output of 20 MHz.

14-MHz Low-pass Filter

Set *Lift* and *Sync Amp* controls fully anticlockwise and *Sweep Amp* fully clockwise.
Connect a link across L10, remove one lead of C15 from the printed wiring board and observe the terminated output of the unit on the oscilloscope. Trim L12 for minimum 20-MHz component at the output.
Transfer the link to L12 and trim L10 similarly. Remove the link and reconnect C15.

Zero-frequency Setting

Connect the mixed blanking feed to PLA8 and terminate it in 75 ohms.
The unit should deliver a composite output similar to Fig. 3 g but with the frequency-sweep signal unlocked from line-frequency.
Adjust L9 for maximum signal amplitude,
Adjust L2 so that a zero-frequency beat occurs in the signal at the start of the active line.
Connect the mixed sync feed to PLA10 and check that the frequency-sweep signal is phase-locked to line frequency.
Retrim L2 so that the first half-cycle of the frequency-sweep signal is negative-going from blanking level. The amplitude of the signal should be 1 volt p-p $\pm$10%.

Maximum-frequency Check

Check that 0·5 volt of lift and 0·3 volt p-p of syncs are available at the unit output.
Set *Sweep Amp* to give 0·7 volt p-p signal during the active line and adjust *Lift* and *Sync Amp* to give a composite output (Fig. 3.g) of 1 volt p-p.
Replace the 75-ohm oscilloscope termination with the open-circuited cable.
Turn *Sweep Amp* fully clockwise and check for a null in the display towards the end of the active line, as described under **Operation**.
Remove the cable and replace the 75-ohm termination.
Turn *Sweep Width* fully anticlockwise and check on the oscilloscope that the maximum instantaneous frequency of the signal during the active line is less than 3·5 MHz.

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