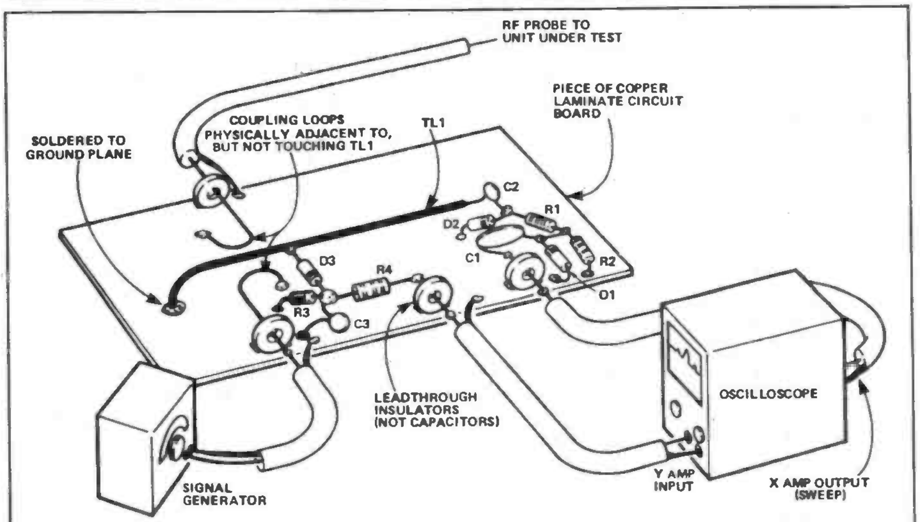

Fig. 3 The physical layout shown actual size. A line of this length enables a frequency sweep from around 140 to 450MHz. Precise lengths are not important because the signal generator accurately calibrates the response of the unit

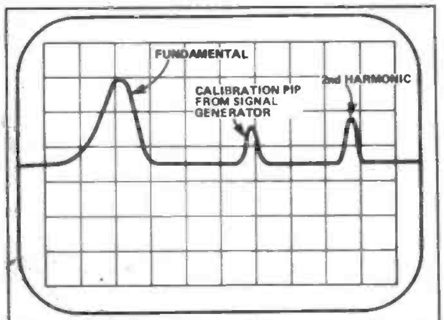

Fig. 4 Typical oscilloscope trace derived from absorption spectrum analyser

resonance in an external tuned circuit can be turned completely on its head to very good effect. If the coil of the wavemeter is replaced by a high Q stripline, and the variable capacitor by a varicap diode (a device that exhibits a capacitance inversely proportion to an applied DC voltage) then you have all the makings of a spectrum analyser. If you replace the classic meter movement by the input to an oscilloscope and drive the varicap from the timebase sweep voltage, then the stripline circuit will tune in step with the sweep voltage at any given moment; as the spot progresses from left to right, the trace will be deflected by incident RF signals as the stripline tuning passes through them. The result is the typical spectrum analyser display.

Fig. 2 shows the circuit of an absorption spectrum analyser suitable for looking at the rubbish from two metre boxes. The dimensions, tuning arrangements and component values can be scaled for any other frequency. There is no reason why the basic circuit cannot be adapted for anything between HF to SHF. C1, D1 and R2 ensure that the sweep voltage takes the varicap diode over the full tuning range without going into conduction. Note that the sweep voltage should be around 30V peak-to-peak: any more and it will have to be attenuated with a resistive divider and any less will demand external amplification. As shown, the circuit responds to a 3:1 frequency range. It is interesting to observe that the drive voltage need not be a linear ramp. Almost anything, including a mains derived sine wave will do provided that it has the necessary amplitude, that it is applied to both the unit and the scope X input, and that it should be slow enough so that the LF circuits can have sufficient time to respond.

Limitations

Fig. 3 shows the component layout, actual size, and the interconnections with the external test instruments. **Fig. 4** is a redrawing of a typical display. (Sorry, I don't have a scope camera.) Note the role of the signal generator. By injecting the generator signal onto the line along with the sample, a realtime calibration of the complete system can be arranged. The generator inserts a pip which can be moved up and down the trace to calibrate received signals. When the generator and incident signals precisely coincide, the combined pip develops a beat ripple. The frequency is simply recorded from the signal generator and the trace blip thus identified.

The complete system is as useful as it is simple although there are some limitations. But considering that you would receive £7995 change out of the price of a proper spectrum analyser, the drawbacks can be lived with. In essence they are lack of linearity in the frequency sweep, and lack of logarithmic response on the display. You also have to watch that incident RF signals don't overload the unit which then cause the whole trace to 'tilt'.

The first problem, non-linearity of frequency sweep, is largely offset by direct calibration using the sig gen. For absolute accuracy, the generator can run in tandem with a frequency counter. The amplitude response is a difficult one to get over. As the circuit stands the display range is around 30dB in the traditional sense. Turning up the Y amp gain on the scope doesn't really help because all diodes have varying degrees of band gap voltages which the input RF has to exceed before any response occurs. The basic circuit will usefully display signals down to the 50mV level. If the signal generator has an accurate attenuator, it can be used for amplitude calibration as well but a relative response is generally all that is needed.

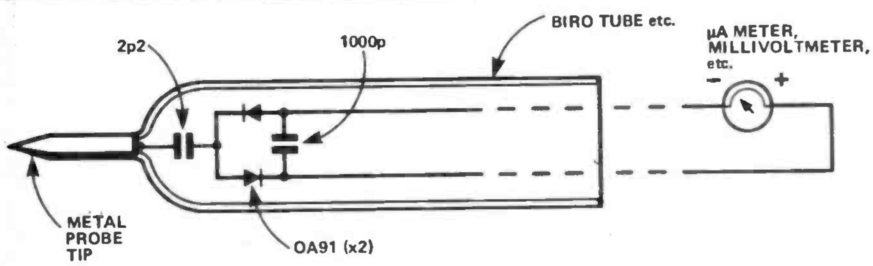

Fig. 5 Improved RF probe for detecting and making relative measurements of signal levels in conjunction with a millivoltmeter or DC multimeter