Technicalities

A spectrum analyser for five pounds!

By Frank Ogden G4JST, Editor

Regular readers of this column might get the impression that we have permanent access to thousands of pounds worth of test gear. Well, that is certainly true when it comes to the testing of review equipment although all my design work is carried out with much more modest facilities.

I am a very firm believer in the philosophy that if your hobby costs you a sizeable proportion of your income, then it is not a hobby worth having. In short, I do things on the cheap and I'm proud of it. Half decent RF test equipment comes with a prohibitive price tag. A synthesised signal generator weighs in at around £2000, a 100MHz scope around £1000, frequency counters £250 and a spectrum analyser breaks the bank at £8000+.

One might think that £12000 is the minimum investment needed to produce a synthesised transceiver design. Not true. I've produced *fully working* transverter systems, three synthesisers, several crystallised VHF boxes, numerous PAs of all kinds, any number of receivers with: one ex-WD AVO signal generator (£35 from GWM in Worthing) one D52 double beam scope (£50 from GWM) one Pullen 10kΩ/V multimeter (donated by a kindly uncle) and not much else. I do not say this to brag, but to make the point that you don't need to spend a fortune on test equipment. However I must state that my meagre core of test gear has been used to build a range of add-on bits and pieces to make it tell me infinitely more than it otherwise would. In a word, it's not what you have, it's the way that you use it. Expensive equipment offers absolute accuracy and convenience (hopefully) but these two extra assets can only be realised if the gear is used correctly and the results interpreted sensibly.

Absorption wavemeter

When amateurs lapse into reverie about test gear, the piece they tend to dream about most often is a spectrum analyser. I propose to show how an oscilloscope and signal generator can be persuaded to perform most of the functions of this extortionately priced piece of tackle.

A box that can resolve both the amplitude and frequency content of an RF signal is invaluable, especially when looking for parasitic oscillations on a transistor PA stage or lining up a transverter. In both these cases there are a number of signals present. Some will be harmonically related to a fundamental tone, others will represent mixing products, unwanted oscillations, etc. It is easy to find harmonic problems of a known fundamental because you know where to look. Things which are unrelated pose much more of a problem, especially if they come and go with some tuning adjustment further down the line.

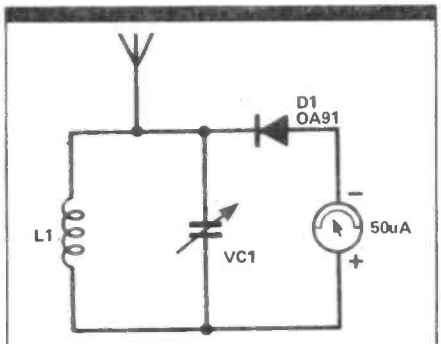

Fig. 1 Simple absorption wavemeter

The simple absorption wavemeter, beloved of the Home Office licence regulations and the City and Guilds examiners can tell quite a lot about a circuit provided that it is used with caution. **Fig. 1** represents a typical example. Provided that the coupling into the instrument is kept fairly light, then it will reliably sort out unwanted harmonic products from the fundamental but that is about all. For instance, if a parasitic product falls within about 10 per cent of an expected harmonic, then you don't stand any chance of detecting it with such a simple instrument. The calibration accuracy won't be much better, especially if the coupling detunes the tank circuit. The instrument's resolution can be improved substantially by tapping the diode detector and the input coupling right down towards the cold end of the coil. It is possible to achieve around 5 per cent resolution although the sensitivity does suffer.

Absorption spectrum analyser

The rather unpromising idea behind the absorption wavemeter ie. checking a sample RF signal for

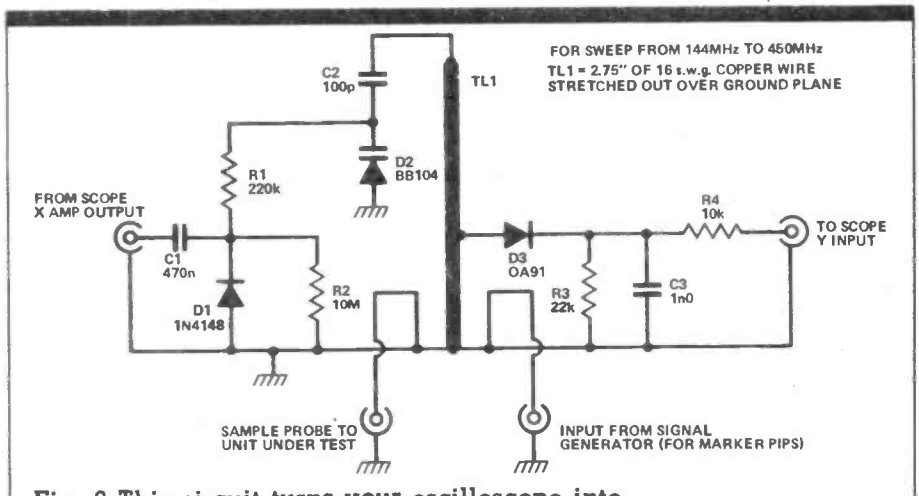

Fig. 2 This circuit turns your oscilloscope into an absorption spectrum analyser