Modifying The FRG-7

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Part 2

Switched selectivity filtering for the FRG-7 using a special 2kHz s.s.b. filter provides options for narrow/wide selectivity with options to use either the existing 6kHz filter or fitting a 4kHz type. No holes need be drilled in the front panel and optional switching arrangements are given.

The Problems

As was mentioned in the first part of this series, the FRG-7 does suffer rather badly from excessive i.f. bandwidth. The existing filter is a ceramic type, designated LFC6, and it has a 6kHz bandwidth. This may be fine for general listening but it is of little use to the DXer trying to winkle-out weak signals amongst the "megawatters" or narrow-band s.s.b. amongst the crowded amateur bands.

In the FRG-7, the selectivity is decided at the last i.f. of 455kHz and there is no attempt in any of the receiver's preceding stages to determine bandwidth characteristics. However, alternative filters for this i.f. frequency are fairly easy to obtain and so it is not too difficult to design a unit which will allow us to switch in different filters.

Why Two Filters?

If we are to solve the selectivity problem mentioned above then we need to look at an i.f. passband of about 2kHz, which is generally considered to be near the ideal for s.s.b. However, the same bandwidth will cause distorted reception of an a.m. signal, particularly music. Having made that point though it must be stressed that the 2kHz filter can provide exceptional a.m. performance in terms of trying to sort out weak signals from amongst adjacent strong ones. In fact, with the circuit suggested it is frequently possible to hear stations which cannot be heard at all with the 6kHz filter.

The system adopted here uses the existing filter in conjunction with a mechanical 2·1kHz filter, and in the author's view this presents a reasonable cost-effective solution. The circuit board will also accept alternatives to the LFC6, should a 4kHz filter be preferred and of course

The re-lettered front panel of the FRG-7

there is no reason why the circuitry should not be extended to a 4-filter system with even wider filters for high quality a.m. or 144MHz band converter use. If this is tried though some thought must be given as to where a 4-way switch can be fitted.

How it Works

When contemplating this project, the author was aware that several different methods had already been published. These fell into two categories, the first being to actually bring the i.f. signal out to the MODE switch, switch it to the appropriate filter, then switch it out of the filter and back to the circuit. This method was discounted on the grounds that it restricted the use of the 2kHz filter to s.s.b. and the author considered it dubious engineering practice to route i.f. signals out to the front panel and back.

The second method, which seems to have been far more popular, involves the use of switching diodes, using switched d.c., to block or pass the signals. The commercial unit from Cirkit (formerly Ambit International) uses such a method and the author's initial design work was along these lines. However, the method does suffer from drawbacks. There is signal attenuation through the switching diodes and this, coupled with the insertion loss through the 2kHz filter and its matching transformers, does make the set rather deaf to weak signals.

At this stage the author gratefully acknowledges the advice of Nigel Curzon at South Midlands Communications who not only provided background notes for this series but also suggested trying c.m.o.s. switching. This was done using a 4066 quad-bilateral switch and the results were very pleasing.

CMOS Quad Switches

Several versions of quad switches are available and at the cost of little more than a transistor, this is a remarkable device that has clearly been overlooked by many constructors if articles in the hobbyist magazines are anything to go by. It would seem appropriate at this point therefore to give a brief description of the device.

The i.c. chosen for this application is the 4066, which consists of four solid-state switches in a 14-pin d.i.l. package. Each switch has a control pin which when held low causes the switch to open. In effect it exhibits a resistance equal to $10T\Omega$ ($10^{13}\Omega$). When the same pin is pulled high the switch closes and, in the case of the 4066, exhibits only 120Ω when 10 volts are applied. In the case of the somewhat cheaper 4016, the "on" resistance is slightly higher. Crosstalk between switches is quoted at 50dB and the i.c.s will work with both single and dual