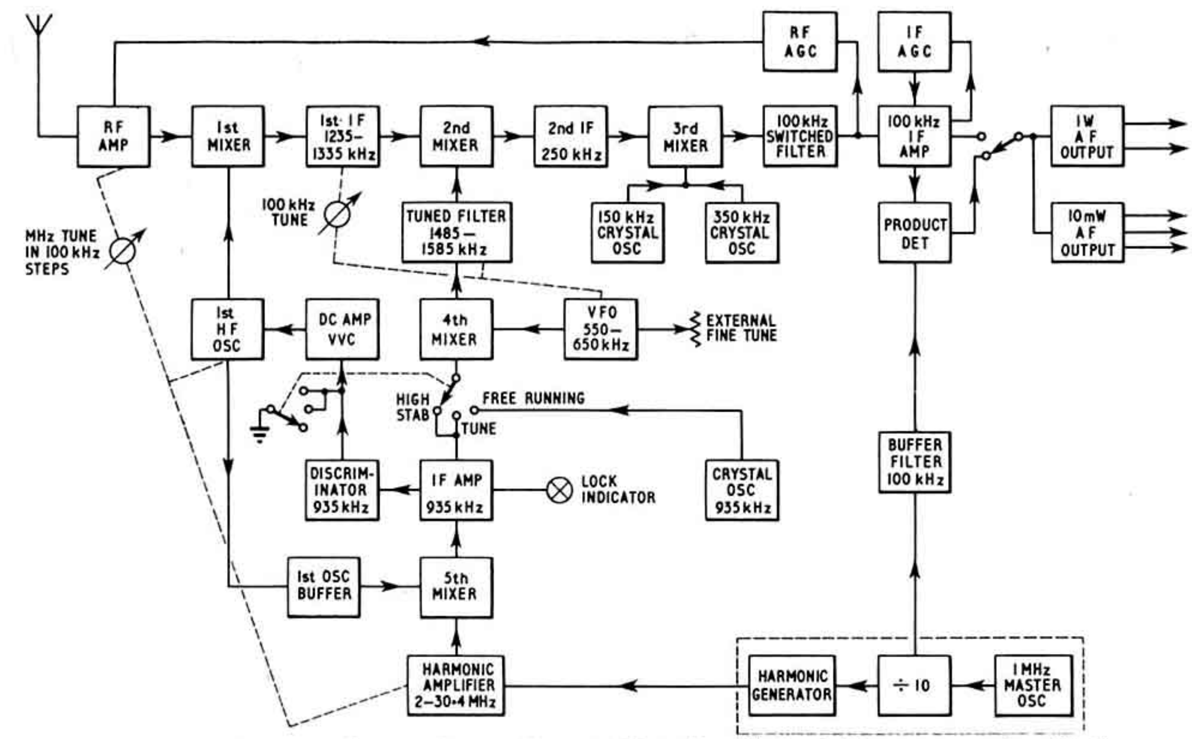


Fig 2. Simplified block diagram of new Eddystone 958 receiver (lf/mf switching arrangements omitted).

low-value capacitors can be fabricated simply by marking out the required area of copper. The outer " box " for the filter can be formed from similar board, with both outer and inner surfaces bonded together to form a double screen. For transmitter powers of under 300 watts pep, the vhf idling load can comprise a pair of 2 watt 100 ohm resistors in parallel, assuming a reasonably flat line.

Attenuation of a 6-pole filter is given as better than 40 dB throughout the vhf stop band, and mostly of the order 45-50 dB. Filters using printed-board capacitors are stated to be effective well up into the uhf region, whereas similar filters based on mica capacitors may give little attenuation at uhf.

One final point emerges vividly from this article: no low-pass filter can be fully effective unless the basic transmitter is adequately shielded, with all emerging leads adequately filtered. It is reported that, in a Channel 2 fringe area, transceivers of four different makes were operated—none had adequate shielding/filtering, as they stood originally, to allow the absorptive low-pass filter to do its job properly.

In other words, not even an absorptive filter can hope to cure TVI if the harmonics can leak out along paths other than the aerial feeder.

New Eddystone Solid-state Receiver

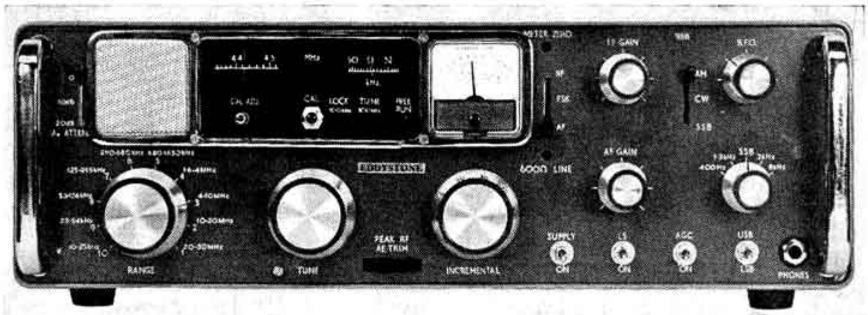
Last month *TT* reported on work by Eddystone on new receivers for marine ssb. *Point-to-point Telecommunications* (January, 1969) contained preliminary details of a new advanced all-semiconductor general purpose receiver from the same stable: the Eddystone 958. This is a wide range (10 kHz to 30 MHz) receiver aimed at the commercial market and designed for ssb or fsk reception and in much the same category as the comparable Racal, GEC, Plessey and Redifon high-grade units to which previous reference has been made. While it is unlikely that many of the Eddystone 958 receivers will grace amateur shacks, there is no reason why some useful tips on modern receiver design should pass unnoticed.

Basically, the set is triple-conversion on hf with first tunable if of 1235 to 1335 kHz, and fixed if of 250 and 100 kHz. On the lower frequency bands, double or single conversion is used. For high-stability ssb mode, tuning is in 100 kHz bands with a narrow-bandwidth drift-cancelling loop, and a stable interpolating oscillator tuning 550 to 650 kHz in conjunction with a phase-locked hf oscillator. The use of a 100 kHz rather than the more usual 1 MHz band is noteworthy.

A simplified outline of the complex front-end arrangement is shown in Fig 2 and a fairly detailed explanation is given in the *Point-to-point* article, together with other design points of general interest.

FETs rather than bipolar devices are used in all signal-handling circuits. The rf stage is a triple-tuned cascode amplifier using a junction-FET in the grounded-source section and a MOS FET in the top section. The reason for this unusual mixture is that the JFET has a relatively high gate-breakdown of 25 volts; in addition the rf gate is protected against very large off-tune signals by the bandpass high-Q input circuit which gives some 40 dB attenuation at 10 per cent off tune.

Signals from nearby transmitters are reduced to 2·4 volts peak-to-peak by using four high-current silicon diodes connected directly across the aerial input. A peak rf/aerial



The Eddystone 958 is a solid-state receiver with a frequency coverage of 10 kHz to 30 MHz capable of high-stability operation on the hf bands. The frequency setting accuracy is within 200 Hz.

trimmer uses variable voltage capacitance diodes; a subsidiary benefit is that these diodes conduct and damp the tuned circuits when rf voltages exceed about 5 volts.

Another interesting feature is the use of a microcircuit (SIC) wideband amplifier between the first oscillator and the harmonic mixer. This buffer is needed to stop 100 kHz harmonics from the harmonic generator from being coupled, via the first oscillator, into the first mixer and so causing spurii. It was found very difficult to achieve 80 dB isolation with conventional circuitry because of stray coupling between components and printed circuit leads. The microcircuit amplifier has an output impedance of only 1·5 ohms, with little stray radiation from the tiny chip, so that " the far superior performance justifies the extra cost."

The tuning arrangements include the use of a finely-printed film-disc of 10 inches circumference optically projected and magnified to form a 50-inch tuning scale; it is suggested that this avoids the inherent mechanical loading problems of the more usual film strip for this purpose. A 0·5-inch of scale length thus represents each 1 kHz, and the tuning knob acts at 2 kHz per complete revolution, or 9° rotation per 50 Hz.

General construction is based on a diecast aluminium front panel 5·25-inch high, and the chassis includes nine removable circuit modules. The rf assembly has six double-sided printed-circuit discs, which carry all inductors, trimmers, trackers, etc and form a complete printed-circuit turret switch, with gold plated edge contact areas. Any disc can be removed and replaced.

The basic 958 receiver, described by D. W. Ford, is the first of a number of versions based on this general constructional technique. The article does not provide final performance specifications, and it is uncertain whether the receiver is yet in quantity production. But clearly this advanced receiver is likely to represent a further notable British contribution to high-performance solid-state hf receiver design.

FET Oscillators

The interpolation oscillator (i.e. the variable frequency oscillator of the heterodyne pre-mixer or partial synthesis system) of the Eddystone 958 adopts the relatively low-frequency of 550 to 650 kHz. But it is interesting also in that it is based on an FET which, because of its high input impedance, loads only very lightly the high Q inductor. A large tuning capacitor is used together with a variable reactor circuit to permit remote fine tuning. The entire circuitry for this stage is constructed on a double-sided fibre-glass board, mounted integrally with the capacitor and the whole circuit accurately temperature compensated.

The more general question of whether to use FETs rather than bipolar devices for oscillators has perhaps not received the detailed attention it deserves, although the subject has cropped up a number of times in *TT*. Evidence collated from a number of sources all seems to favour the use of FETs provided that only low output from the oscillator stage is required.

For example, some comparisons between the stability of LC oscillators at 100 MHz for FETs and bipolars appear in the book *FET Applications Handbook* (although two different curves presented in different chapters do not correlate too well!). It is suggested that over the temperature range 30–100° C, a bipolar unit drifted about 50 kHz whereas the drift with the FET was only about 5 kHz (for this test the temperature of the other components was held steady). The second comparison does not give quite such a sweeping advantage to the FET but still shows a useful improvement; it also indicates that the FET has a steady drift lower with rising temperature whereas the bipolar starts off with a positive drift and then turns over, possibly making accurate temperature compensation more difficult for the bipolar.

This question also receives careful attention by A. Lorona, W6WQC in an informative article " A zero-temperature-compensated JFET VFO " (*73 Magazine*, December 1968). This shows how the temperature coefficient of a JFET oscillator can be adjusted by varying the operating point, and can be set up to provide virtually zero temperature coefficient over a limited temperature range, or possibly even adjusted to provide equal and opposite drift characteristic to that of the tuned circuit. Alternatively a thermistor or other temperature sensitive resistor might be inserted in the source lead to provide a precise temperature correction.

Because of the spread of FET characteristics, it is necessary

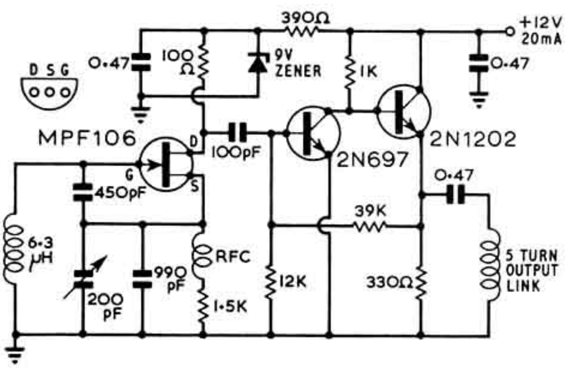


Fig. 3 The W6WQC 3·5 MHz JFET vfo designed for zero temperature coefficient operation.