

The Swallow UHF Prescaler

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THE SWALLOW UHF Prescaler can extend the frequency range of a digital frequency meter DFM up to at least 575MHz (and typically 800MHz). It features a bipolar front end amplifier, divide by ten prescale ratio, LEDs to indicate POWER ON and prescaler CLOCKING and an integral power regulator capable of running from either a low voltage DC or AC source. This design is a marked improvement on my original UHF prescaler, which I designed in 1984 [1]

Construction and testing are straightforward requiring no special skills or equipment. There are no rare or esoteric components used in the design.

CIRCUIT DESCRIPTION

THE COMPLETE CIRCUIT diagram for the prescaler is shown in Fig 1.

FRONT END AND PRESCALER

The front end comprises amplifier TR1, which is capacitively coupled to the signal to be measured via C1. Transistor TR1 is biased in class B by resistors R1 and R2; Resistor R3 forms the collector load which is capacitively coupled via C2 to prescaler IC1 at pins 15 and 16. Prescaler IC1 can be set to divide by 10 or 11 and provides TTL and complementary ECL outputs. In this design the IC is set to divide by ten and the TTL at pin 11 is used. A pull up resistor at R5 at the output is included to ensure the correct TTL levels are obtained.

The output (1/10 the input frequency) is fed to the DFM in the normal manner and the DFM is simply multiplied by ten. What could be easier?

CLOCK DETECTOR

A small amount of the TTL output signal is tapped via C4 and fed to diodes D1, D2 which together with C5 form a half wave doubling circuit. When a UHF input signal has been prescaled and the output (now 1/10 of the input frequency) is present on IC1:11 the voltage doubler drives transistor TR2 via resistor R6 to saturation, illuminating LED D3 and hence indicating that the prescaler is 'clocking' the signal. The LED is unlit during no-signal-input conditions.

POWER SUPPLY

The power supply comprises a bridge rectifier BR1, reservoir capacitor C6 and a standard 1A 7805 regulator IC2, together with decoupling capacitors C7, C8 and C9. An LED, D4 and resistor R9 are included to indicate when power is on.

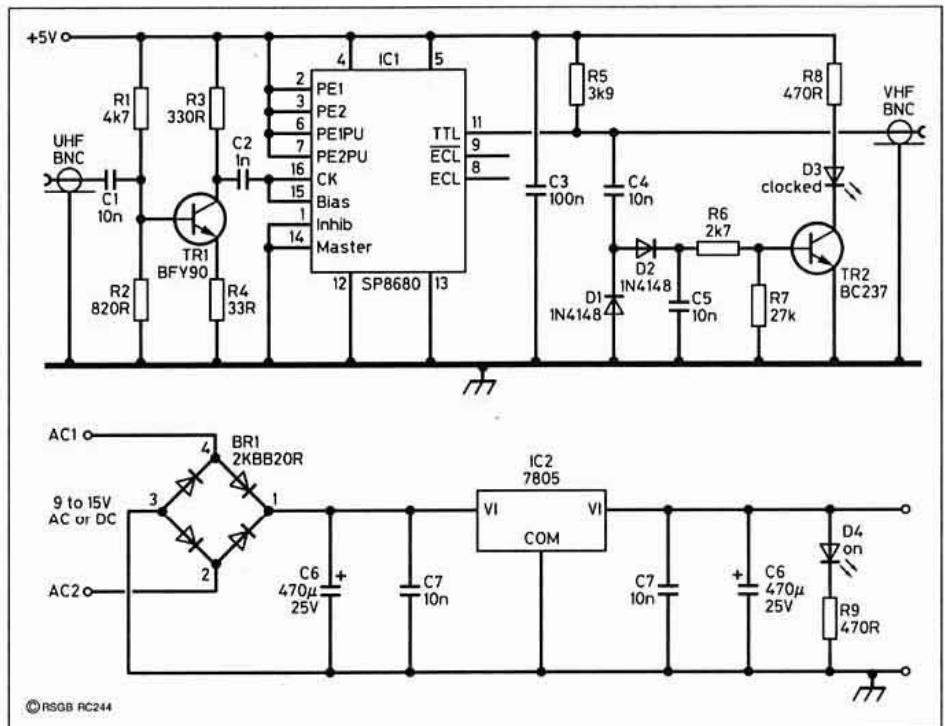


Fig 1: UHF prescaler circuit diagram.

CONSTRUCTION

A SINGLE SIDED PCB has been designed for the prescaler. The component layout and the foil pattern are shown in Fig 2(a) and Fig 2(b) respectively.

The unit is small enough to fit in some bench DFMs and it might be possible in some instances to take advantage of the secondary AC supply to power the unit. You would of course need to provide fuse protection, a new UHF socket on the front panel and switching between the normal input and your prescaler VHF output.

The switching can be done with a sub-miniature toggle switch at the prescaler output and normal HF input as the frequency is only up to a maximum of 80MHz here, as long as you keep the wires (ie inductance) to a minimum.

But be warned you might invalidate any warranty if you do this.

If you do not intend fitting the PCB inside an existing DFM case then it should be housed inside a metal

case with suitably protected AC/DC source, and a couple of BNC sockets for the input and output.

If you power the unit from a DC source then do not fit the bridge rectifier BR1 but do fit capacitor C6 and C7.

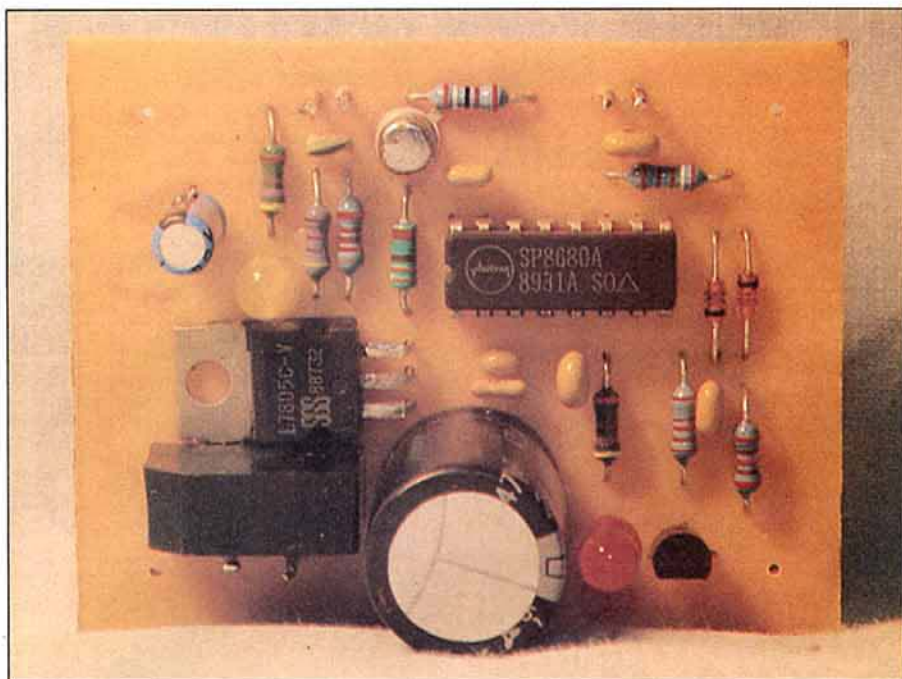
TESTING THE UNIT

THIS UNIT IS EASY to test. Connect a suitable supply and check that the current consumption is about 150mA; if it is wildly different from this value there is a fault on the unit. The IC prescaler normally runs quite warm to the touch; if it is running hot then there is a problem.

Feed in a VHF or UHF signal and check that the 'clocked' LED is lit when there is a

SPECIFICATION

Power Requirements	9 to 15V AC or DC @ <150mA
Indicators	Power ON and CLOCKED LEDs
Prescale Ratio	$F_{out} = F_{in}/10$
Sensitivity	350mVpp @ 650MHz, 600mVpp @ 40 MHz
Output	TTL Levels
Maximum input voltage	2.5Vpp
Minimum output frequency	40MHz (typically 10MHz)
Maximum input frequency	650MHz (typically 800MHz)



General view of the Swallow UHF prescaler.

signal present. Check that the output frequency is 1/10 of the input frequency. This can easily be done if you have, or you can borrow, a VHF/UHF signal generator.

Otherwise you can use a VHF or UHF handheld transceiver. The prototype unit triggered correctly with a quarter wavelength piece of wire connected to the input socket. This was placed 2.5m from a 7/8 wavelength antenna fed with 1.5 watts at 145MHz.

Finally, do note that at the upper limit of its range (800MHz) the clocked LED will light when the prescaler is counting incorrectly. This is because the prescaler is outputting a TTL pulse stream but the divide by ratio is not 10:1. What is more your frequency counter will sometimes 'tumble' randomly and sometimes show a steady frequency which is incorrect. This

does not cause any problems so long as you bear it in mind when trying to measure frequencies above 800MHz.

The prototype counted correctly up to a maximum frequency of 890MHz with 450mV RMS input.

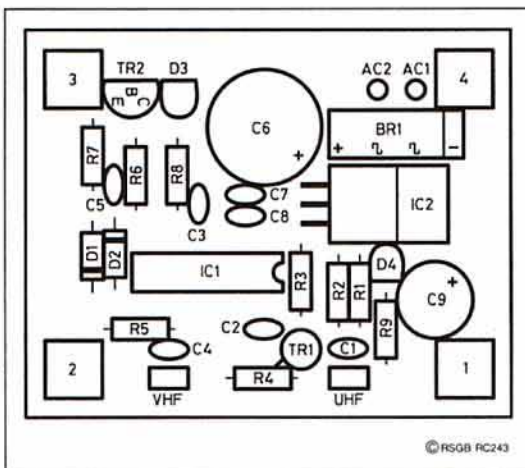


Fig 2(a): PCB, component side screen, actual size.

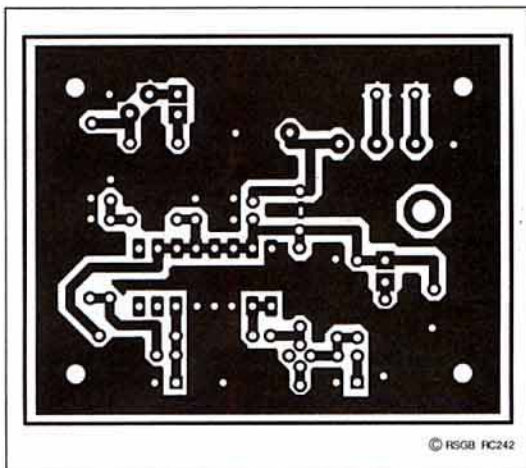


Fig 2(b): Solder side foil pattern, actual size.

COMPONENTS LIST

Resistors

- R1 4k7
- R2 820R
- R3 330R
- R4 33R
- R5 3k9
- R6 2k7
- R7 27k
- R2, R9 470R

Capacitors

All capacitors 16V sub-miniature plate ceramic unless otherwise noted.

- C1, C4, C5, C7,
- C8 10nF
- C2 1nF
- C3 100nF
- C6 470µF, 25V radial electrolytic
- C9 4µ7, 10V radial electrolytic

Semiconductors

- BR1 2KBB20R bridge rectifier diode
- D1, D2 1N4148 diode
- D3, D4 5mm LED one red, one green
- TR1 BFY90 NPN transistor
- TR2 BC237 NPN transistor
- IC1 SP8680 GEC Plessey UHF prescaler
- IC2 7805 1A5V regulator

REFERENCES

- [1] 'An Economy Prescaler', *Practical Wireless*, September 1985.

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