• E-mail: ian.g4jqt@googlemail.com

The Simple Sixty

Ian Liston-Smith G4JQT shows how you can get on the air with a simple two-transistor design.

After a minor modification one afternoon to make a Pixie transceiver operate on 60m, I made some CW QSOs with it almost immediately. This spurred me on to design a really simple transmitter to see what could be worked with significantly more output on 5262kHz – the UK CW QRP centre of activity for the 60m band. Incidentally, if you're not familiar with the G-QRP Club Pixie design, do a Google search or follow the link below.
www.gqrp.com/The_Sprat_Pixie_File.pdf

This two-transistor circuit, **Fig. 1**, is what I eventually came up with. The circuit is quite conventional and, to keep it simple, I have left out some of the enhancements usually seen in similar circuits. For example, there is no Tx/Rx changeover switch or relay and the keying is in the emitter of Tr1 rather than indirectly keying its supply via a PNP keying transistor. Neither have I included any components to pull the crystal for a little frequency agility. Nevertheless, there's no reason why all these additions and more can't be added. The only embellishments I have included are an LED to give an indication of RF output and a power-on LED.

Circuit Description

The crystal oscillator circuit is a Pierce type. The Colpitts oscillator is probably more familiar and has some advantages but the Pierce design enables the oscillator to drive the PA directly. The minor disadvantage of this design is the possibility of slight chirp if the antenna load is incorrect or the supply voltage is much higher than, say, 14V.

The PA device is the ubiquitous IRF510 power MOSFET. They tend to run out of steam beyond 10 to 15MHz but are more than happy at 5MHz. As with most transmitters, it's not recommended that it is keyed for more than 15 to 20 seconds during tune-up, particularly without any RF load!

The circuit easily produces 5W of RF output but with careful selection of RF chokes, transformers and inductors I have managed over 15W output.

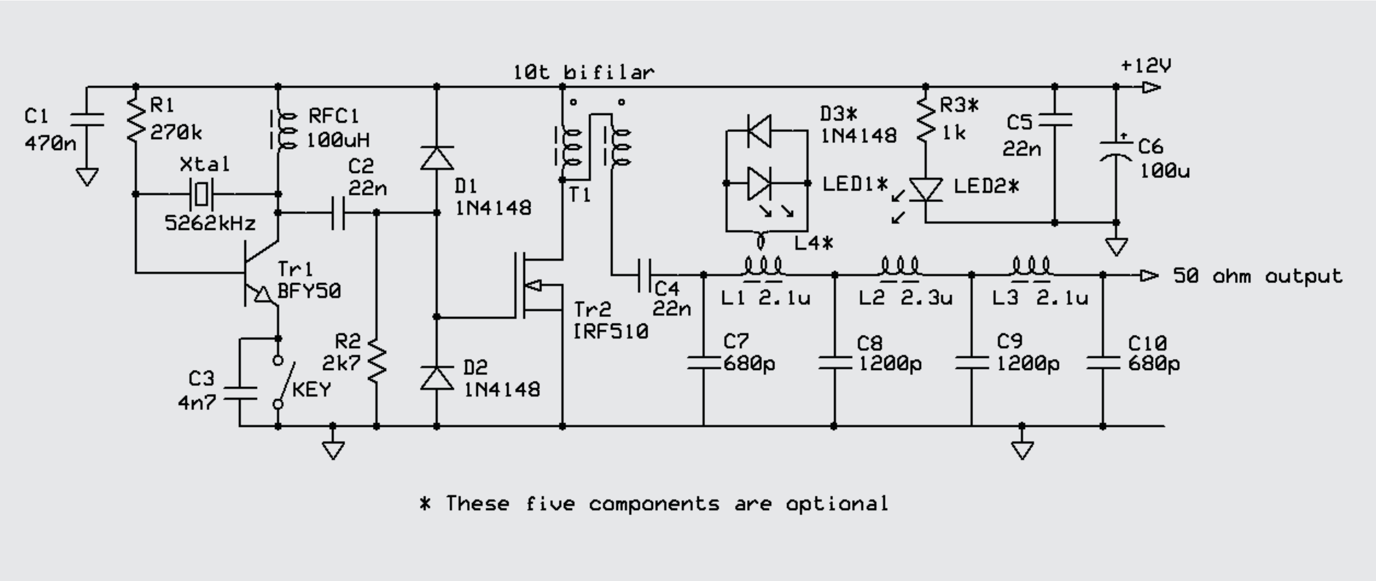
I've had plenty of QSOs with this little rig and 60m is ideal for daytime inter-G working, even with a modest antenna. The 60m band is available to full licence holders but unlike the other bands it is split into sub-bands so if you're unfamiliar with this part of the spectrum it's worth checking the link below.
http://rsgb.org/main/operating/band-plans/hf/5mhz

Construction

I didn't bother making a PCB layout so the photo, **Fig. 2**, shows my prototype using 'ugly construction'. Most of the components are not particularly critical but the transistors are driven pretty hard so do require heat-sinks, particularly Tr2.

L1 is about 10 to 15 turns around a large ferrite bead but again it's not critical. If a ready-made choke is used, it must be able to easily withstand a current of 25mA and have a value of 100μH to 500μH.

T1 is not critical either. I wound eight bifilar turns through a small 15mm square pig-nose ferrite block but an FT50-10 core or even a short piece of ferrite rod works nearly as well. Wire type is not critical but I'd suggest something between 24 and 34SWG enamelled copper wire.



Twist the two wires for T1 together fairly tightly and wind the transformer on whatever ferrite you use, then separate the four ends. The start of one end joins the finish of the other and these are connected to Tr2 drain. One of the spare ends goes to the 12V line and the other to C4. (The dots shown on T1 in the circuit diagram represent wires at the same end so it's clear how they are connected.)

The lowpass filter components are more critical than the other parts. Toroids L1 and L3 consist of 20 turns and L2 has 21 turns – all wound on T50-2 (red) cores.

It's always worth pushing the turns closer together or wider apart to get maximum output. The calculated inductance sometimes does not quite coincide with an exact number of turns and this is a way of slightly adjusting the inductance of the toroid.

Good low-loss ceramic capacitors should be used in the lowpass filter. I found that the wrong type of capacitors used here can get warm and significantly reduce the output power.

If you decide to include the LED RF indicator, just wind two or three turns over L1. Diode D3 is wired in the opposite direction to the LED and protects it against reverse voltage, although it probably isn't necessary at these power levels.

There are plenty of more complex CW transmitters out there but I wanted to see

Above: Circuit of the Simple Sixty. Right: An inside view of the 'ugly' style construction.

PARTS LIST

C1	470nF
C2	22nF
C3	4.7nF
C4	22nF
C5	22nF
C6	100µF
C7	680pF ceramic or mica
C8	1200pF ceramic or mica
C9	1200pF ceramic or mica
C10	680pF ceramic or mica
D1	1N4148
D2	1N4148
D3	1N4148 (optional)
L1	2.1µH 20 turns on FT50-2
L2	2.3µH 21 turns on FT50-2
L3	2.1µH 20 turns on FT50-2
L4	2 or 3 turns over L1 (optional)
LED1	(optional)
LED2	(optional)
R1	270kΩ
R2	2.7kΩ
R3	1kΩ (optional)
RFC1	100µH (see text)
T1	10 turns bifilar on FT50-10 (see text)
Tr1	BFY50 with heatsink
Tr2	IRF510 with heatsink
Xtal	5262kHz (I can supply the crystal @ 60p each plus 70p post)