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The BITX 40

Colin Redwood G6MXL looks at a handy (and budget priced) 40m SSB QRP Transceiver Kit.

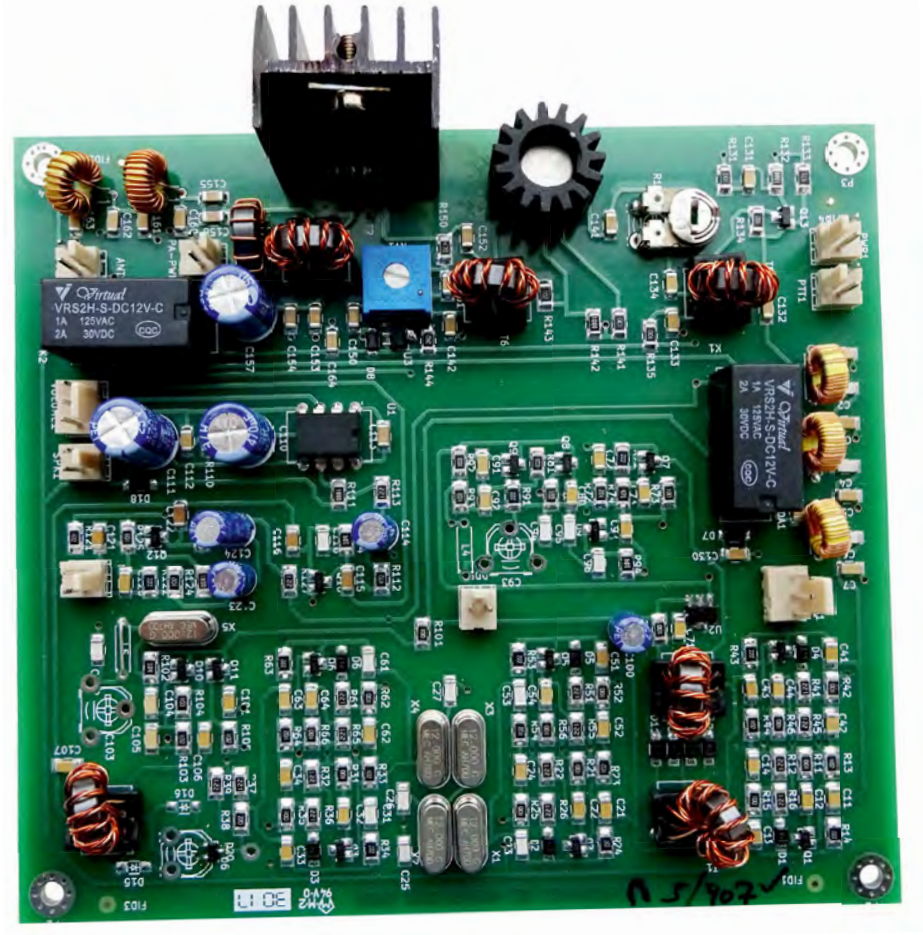

Fig. 1: The main board is supplied fully populated.

Welcome to the March *What Next*. This month I am looking at a small 40m SSB transceiver kit that can provide about 7W RF output. It is available as an un-boxed kit from HF Signals in India: **www.hfsignals.com**

The main board uses surface mount devices and is already assembled, **Fig. 1**. The transceiver also uses two additional boards, one for the display and the other for an Arduino device mounted behind the display board. In case this might put you off, again the Arduino is already assembled and pre-programmed and can easily be considered as just another component. At no point is any soldering required on any of the boards.

All that is left for the constructor to do is to provide a box to put it in, make a square hole for the display, drill the holes for all the controls, inputs and outputs, and connect all of these. So you might think of this as more of a kit for a mechanical engineer than an electrical engineer.

As I'll describe later, a pre-drilled and painted box is available in a choice of colours from another Indian supplier. You'll still need to fix the controls and sockets to the box and connect them to the main board. Unlike a 'black box' from the main Japanese suppliers, with this kit there are numerous ways you can tailor the basic transceiver, not least with the choice of connectors.

Obtaining the Kit

The kit can be ordered online from India. It costs US$59 or for an extra US$10 you get delivery in just under a week by DHL (so approximately £50 in total). I was prompted to pay the additional £21 import duty through the DHL website by an automated telephone message a day or two after the kit had been despatched. You can track the shipment on the DHL website using the waybill number that is e-mailed to you when the kit is shipped. This gave me confidence that the automated telephone request was genuine.

The kit is delivered well packed with bubble wrap around the main printed circuit board (PCB) and the Arduino and display boards. There's a small resealable plastic bag with all the hardware, connectors and connecting wires and so on and also a list of parts supplied that I used to check everything was present. The whole kit is supplied in what looks like a small plastic lunch box.

Box, etc.

You'll need to provide a suitable box for the kit. You can make a box, use a box that you might already have or buy a suitably sized box. It doesn't need to be anything special – I've even seen people use a plastic food container! You'll need to provide your own tools to drill suitable holes to mount the controls, the input and output connections and what I think is the most difficult task, that of making a square hole for the display. You'll also need to provide your own loudspeaker and/or headphones. While a very basic electret microphone is provided, I suspect many readers will prefer to use an existing microphone and provide a suitable microphone connector. I would be tempted to use the same microphone as my main transceiver with a suitable connector on the BITX40, wired to suit.

Commercial Box

As an alternative to making a box, pre-drilled and painted boxes intended specifically for the BITX are available in a choice of colours (black, blue, red or Siemens grey) from another Indian source, Inkits, also known as Amateur Radio Kits. I opted for this approach. I found the

painted box to be of high quality with all the holes pre-drilled for all the controls, sockets and so on, clearly labelled giving an excellent finish (**Figs. 2** and **3)**. At US$ 24.99 + US$ 15.00 postage (approx. £30), this seemed to me a simple way to achieve a good finish.
https://amateurradiokits.in

I needed to slightly enlarge a few holes and there was also a hole for a microphone gain control, which is not mentioned anywhere in the documentation. The box I received was supplied in a different colour to the one I ordered but I am not complaining because I actually prefer the Siemens grey! Delivery by tracked post was in about ten days. I suspect that the box might also suit other homebrew transceiver projects.

RF Connector

The kit comes with a BNC socket, which would be a good choice for those planning to use it out in the field with feeder terminated in a BNC plug (many of the SOTAbeams antennas have their feeders terminated in BNC plugs, for example). If you prefer a different socket, then feel free to supply your own. The box from Amateur Radio Kits comes pre-drilled to take the supplied SO-239 socket.

Antenna

You'll need a suitable antenna. The antenna will need to resonant on 40m or you'll need to use an ATU, which is not supplied. I opted to use my 40m dipole.

Arduino

I don't pretend to have any skills whatsoever in programing Arduinos. Fortunately, the Arduino is supplied pre-programmed. Those who wish to add functionality will find that all manner of enhancements are well documented at:
https://tinyurl.com/yb2cyhyr

Assembly

I'd recommend reading and following the instructions, which unfortunately are not always as clear as they could be. It should be noted that the wiring colours do not follow what I would consider 'normal' wiring colour convention, with brown rather than the usual red being used for positive in many places. Before ordering the kit, I would suggest prospective buyers read through the assembly instructions to satisfy themselves that they are comfortable with what is involved in the assembly:

Fig. 2: The front panel as delivered.

Fig. 3: The rear panel with the connectors and fuse installed. The hole labelled Power is for an alternative power supply for the PA stage (see text).

www.hfsignals.com/index.php/2017/11/23/wiring-up-the-bitx40

I found that I had to be careful when soldering the lead to the loudspeaker because the magnet in the loudspeaker attracted the soldering iron bit away from the solder joint and towards my fingers!

Installing the display and Arduino boards was quite fiddly. Not only do you have to get the display and Arduino boards onto the threaded spacers, you have to get the 16 pins from the display board to mate with their counterpart socket on the Arduino board at the same time. The arrangement using threaded spacers is not clearly described. I found that slackening off the spacers while carefully sliding (not forcing) the PCBs onto the threads worked for me.

The instructions didn't explain which way round to mount the display and Arduino boards. Once I had examined them carefully, I came to the erroneous conclusion that there was only one way that would fit the box and not leave the 7805 IC regulator overhanging the side of the box. This had to be with the regulator on the right-hand end. During initial testing, it soon became all too apparent that the display was upside down. As a result, I had to bend the regulator's leads by 90° to get it to fit in the left-hand side of the box, **Fig. 4**.

The instructions that describe the wiring of the volume and tuning controls refer to the left, and right tags as seen from the front panel.

Tools

You'll need a soldering iron and solder, a No.1 size cross-point screwdriver, a spanner for the potentiometers, a spanner for the threaded spacers, and wire stripper/cutters. In most cases the assembly involves mounting the various sockets and controls onto the case and then soldering one end of the lead to the socket or control and pushing the plug at the other end into the relevant connector on the main PCB.

As I mentioned earlier, I encountered a few instances where the hole in the commercial case that I bought separately was just slightly too small for the socket or control provided. Perhaps this was due to the paint? It was quite easy to use a drill to enlarge the hole. If using a normal 8-pin microphone connector (not supplied), then you'll also need to make a suitable hole for the size of your socket.

There are a number of YouTube videos that readers needing a little encourage-

ment with the assembly might like to look at. I found the ones from **David Casler KE0OG** very helpful: **www.youtube.com/watch?v=0Qe7bcoKvM8**

Power Supply

The BITX40 transceiver requires a stable 12 to 13.8V DC supply capable of delivering 2A. Increasing the supply voltage to the power amplifier stage only (a separate socket on the PCB is provided for this) will enable a higher transmit output power. If you take this option, you'll need to replace the supplied heatsink with a larger one (which must be kept electrically isolated from the case). I suspect many people will opt for either batteries for portable operation or a shack PSU. I chose to keep to the standard supply voltage.

The kit comes with a standard barrel plug and chassis socket with the centre positive. The diameter of the centre pin is bigger than that used on my Yaesu FT-817 so I cannot use the various leads I'm already using with my FT-817 for the BITX. Again, being a kit, there is no reason why constructors could not replace the chassis socket with one that is compatible with a smaller diameter centre-pin barrel plug.

Testing

The main board is tested in India for both receive and transmit before despatch, so testing is essentially limited to the assembly and the connections you make. When I first applied power, everything seemed totally dead so I deduced that most likely there was a problem with the DC supply. I started to check connections and quickly discovered that I had connected the barrel power socket incorrectly with the negative lead connected to the side that is disconnected when the plug is inserted (which would usefully isolate an internal battery if an external power supply was plugged in). With this error corrected, the receiver sprung into life and by turning the tuning control, I could tune in to various CW and SSB signals.

The other problem I encountered during initial tests was that although the display was lit, it wasn't actually displaying anything. This was easily cured when I added the power supply lead to the Power Amplifier connection. Only the top line of the display is used.

Enhancements

One of the joys of this kit is that it enables the builder to tailor the transceiver to their particular needs – something that you can't do with your typical Japanese black box! Examples of this include the box, the type of antenna socket (BNC is supplied with the basic kit, while a SO-239 socket is supplied with the case I bought), replacing the 10kΩ tuning potentiometer with the multiturn variety to assist fine tuning, the type, colour and size of the knobs, choosing a more appropriate microphone that incorporates a push-to-talk (PTT) with a suitable connector front-panel connection, increasing the voltage supplied to the PA stage to increase the output power (you'll need a second input socket for this approach) and changing the DC supply socket. If you are relatively new to construction, I'd suggest starting with the standard offering and then swapping based on experience.

Support Group

There is a very active support group on the internet. In the archives there is a wealth of useful advice for those wanting to enhance their BITX40 transceiver. I'm currently receiving upwards of 20 e-mails each day from the group, mostly focusing on a new multiband transceiver from the same Indian source: **https://groups.io/g/BITX20/attachment/21606/1/BITX40**

Initial Impressions

It's still very early days but I thought readers would appreciate my initial impressions of using the BITX40, **Fig. 5**. As supplied, it operates with lower sideband (LSB). This is great for phone use or using it for RTTY with Audio Frequency Shift Keying (AFSK). I've yet to investigate the feasibility of upper sideband (USB) operation for AFSK for other data modes such as PSK31/63, JT65 and FT8.

The tuning arrangements take some getting used to. The central part of the range of the tuning control operates as might be expected, giving a 50kHz tuning range. If you go to the bottom or top of the tuning control's range, then the frequency jumps down or up in 10kHz steps for as long it remains at the end, giving full coverage of the 40m band. As you can imagine, this approach really takes some getting used to but makes an effective tuning arrangement if you tend to stay on or around a particular frequency.

I'll report back to readers in a future *What Next* on my experiences of using the BITX40 on the air. Suffice to say that I am hearing plenty of LSB signals on 40m against a quiet background.

Fig. 4: The correct orientation of the display and Arduino boards.

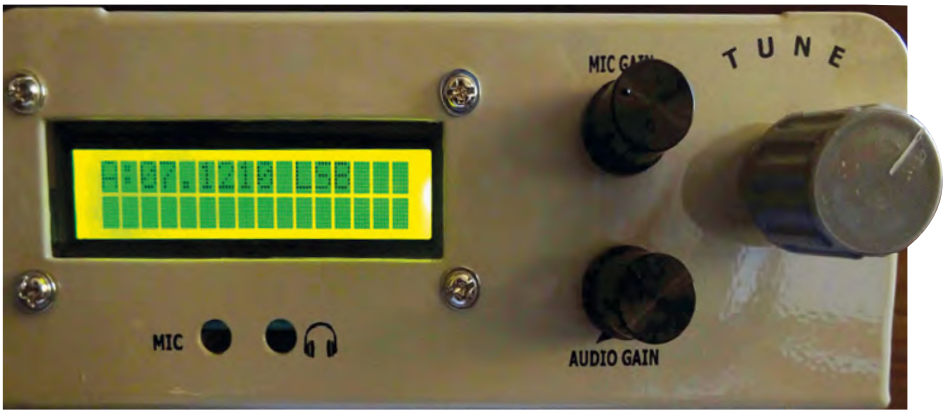

Fig. 5: The almost finished project.