

# Mizuho SB-2X review

Regular readers of *Ham Radio Today* will have seen in the May issue a review of the Mizuho *MX-2* written by Frank Ogden, who concluded his review by saying that, although he liked the *MX-2* he would have preferred it to have been in a larger case and with extra crystals to cover a wider frequency range, including the beacon band. Well, in fact, such a rig exists, and it forms the subject of this article.

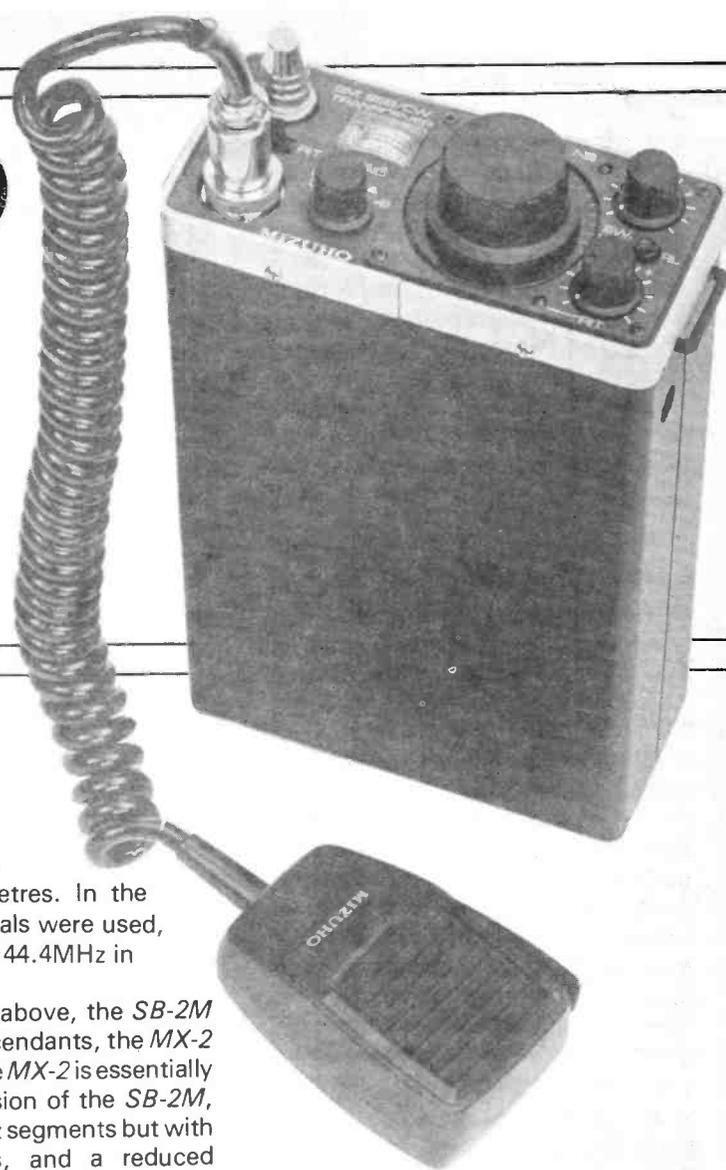
It's not strictly true to say that the *SB-2X* is an improved version of the *MX-2*, since both are derived from the Mizuho *SB-2M*, which was in production a few years ago and is still available on the second-hand market. The *SB-2M* was the same size as the *SB-2X*, ie. somewhere between the sizes of the *TR2300* and the *FT290*, and covered the frequency range 144.2 to 144.4MHz, producing one watt of SSB or CW output. The tuning system used was not a synthesiser, but a variable crystal oscillator (VXO), which is simply a crystal oscillator whose frequency is varied over a small range by a tuned circuit connected in series with the crystal. The advantages of this system for VHF use are that the stability obtained is better than all but the very best free-running VFOs, and the circuitry is much simpler (and hence cheaper) than either a VFO or a synthesiser. The disadvantage is that the tuning range is limited, since a crystal can only be pulled by a small amount, of the order of 10kHz, before the stability and crystal output become unacceptably low. For VHF this can be overcome to a certain extent by running the oscillator at a low frequency and multiplying up, but the tuning range is

still only about 50-100kHz in practice, and so it is necessary to use several crystals to cover even the SSB section of two metres. In the *SB-2M*, four crystals were used, covering 144.2 to 144.4MHz in 50kHz segments.

As mentioned above, the *SB-2M* produced two descendants, the *MX-2* and the *SB-2X*. The *MX-2* is essentially a miniaturised version of the *SB-2M*, still tuning in 50kHz segments but with only two crystals, and a reduced output of 200mW. The *SB-2X*, on the other hand, is an improved version of the *SB-2M*. Whilst it is the same size, the tuning range has been quadrupled by increasing the tuning segments to 200kHz each, so the coverage is now 144.0 - 144.6MHz and 144.8 - 145MHz in four ranges. In addition, a slow motion drive is now fitted, which makes tuning much easier. The tuning dial now has a pilot light, fitted with a ten-second timer; press a button on the front panel and the light comes on for about ten seconds and then goes out again! In addition, the *SB-2X* now has a noise blanker, RIT and a built-in mains operated nicad charger.

## Circuit description

A block diagram of the *MX-2* is shown in Fig. 1. On receive, the signal is amplified by a dual-gate MOSFET RF amplifier, and is then converted to the IF of 9 MHz by a junction FET mixer (why a junction FET?). It then passes through the SSB filter and is amplified by three IF stages using dual-gate MOSFETs before being fed



to the product detector, an SN76514 dual balanced mixer. From here the demodulated audio is fed to an IC AF amplifier and then to the loudspeaker. AGC is derived from the output of the third IF stage; it also operates the S-meter.

On transmit, the signal from the microphone is amplified by a two stage mic amp and then fed to the balanced modulator, the same double balanced mixer as is used for the receive product detector. The output of the balanced modulator passes through the SSB filter, the first receive IF amplifier and a junction FET source follower before being fed to the transmit mixer, another SN76514. Following this are two stages of amplification using dual-gate MOSFETs and then the bipolar PA. ALC is derived from the base circuit of the PA and fed back to control the IF amplifier.

In the VXO local oscillator circuit, one of four 15MHz crystals is pulled in frequency by a tuned circuit connected in series with its earthy end. RIT is provided by a varicap diode