

an a.r. special

The Belcom Liner 2 SSB Transceiver

The **Belcom Liner 2** is a fully solid state SSB transceiver which, although designed and styled for use in a mobile configuration is also a very useful home station transceiver.

Covering any 240kHz segment of the 144MHz band, this unit is rated at 20 watts PEP input on SSB. The actual power output measured on a wattmeter is of the order of 6 to 7 watts, varying considerably with supply volts in the manner typical of solid state power stages. This power level is quite suitable as input to a high power amplifier.

The standard frequency range is 144.1 to 144.33MHz, but this is altered simply by

inserting a different crystal in the 38MHz oscillator. Optional crystals supplied with the unit gave 240kHz bands starting at 144.0, 144.24, and 145.8MHz. This last band is one which covers the Oscar 6 up-link band 145.9 to 146.0MHz.

The main electrical feature of the unit is the method used to obtain continuous coverage over the 240kHz range, using switched crystals and a VXO.

Instead of using a VFO, two crystal oscillators are used in what the handbook calls a **synthesiser** circuit to produce a variable injection signal at around 20.21 MHz. One oscillator has a choice of 4 crystals separated by 10kHz and the other

has a choice of 6 crystals separated by 40kHz. The 24 different combinations of these 10 crystals thus are able to provide 24 channels spaced 10kHz apart. The outputs of the two oscillators are mixed and the sum frequency is selected as the **synthesiser** output.

The synthesised 20MHz VFO and the SSB on 7.8MHz are then mixed to produce 28MHz SSB; this is then mixed with 115 MHz energy from a VXO on 38.5MHz to produce the final output on 144MHz. The VXO is capable of providing a shift of about 6kHz about each **channel** frequency, so effectively continuous coverage is possible.

Using the 39.1MHz crystal supplied as an option to give an operating band of 145.8 to 146.03MHz, a demonstration of Oscar 6 was arranged by the author for meeting of the ACT Division of the WIA. Using this set **barefoot** and a 5 element beam it was easy to show that this power level is adequate to work through the satellite. Stations worked were in VK2, 3, 5 and 7 and ZL1. Later it was found that even using a simple quarter wave antenna it was quite easy to have contacts through Oscar 6 with this set.

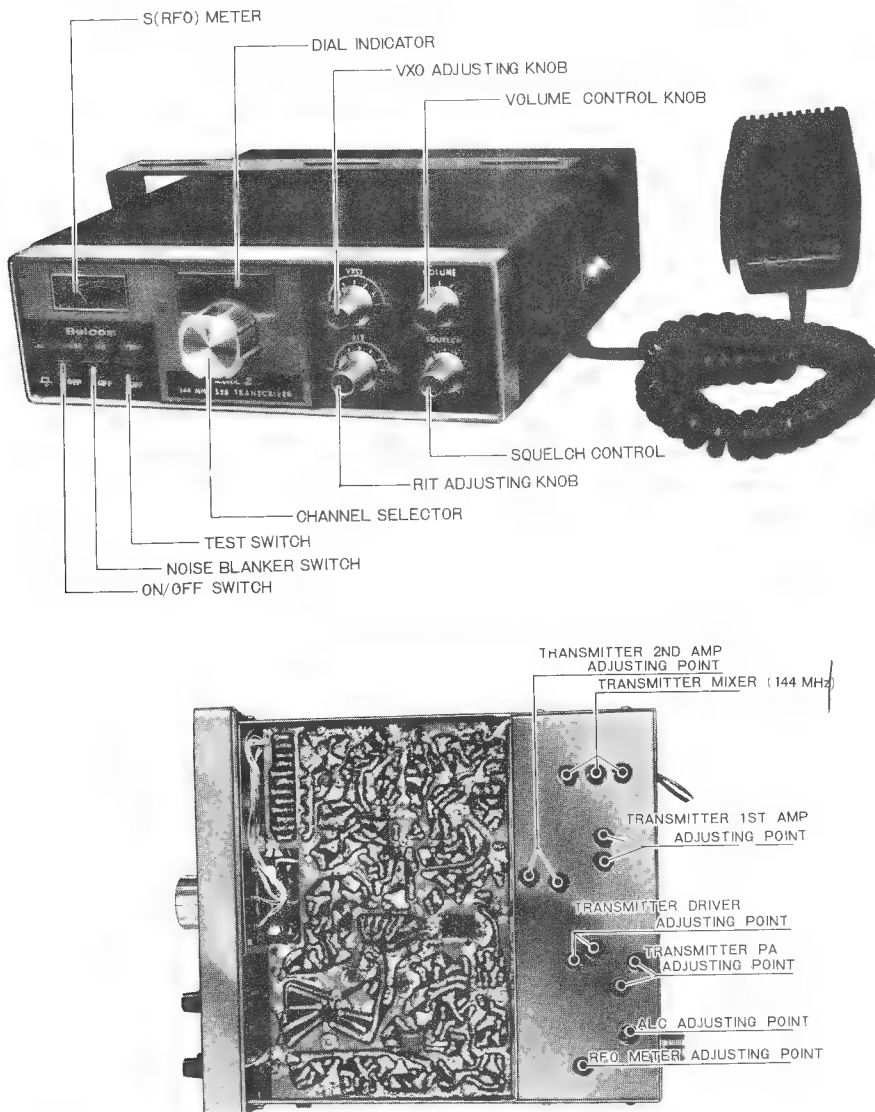
Several VK1 stations have been worked using this set in the transceive mode. In addition, reports have been received from stations further afield. The receiver performance was found to be lacking in sensitivity, as the specification of 0.5 microvolt for 10 db S/N would indicate. (At this level most FM receivers are providing some 20 db of quieting). Lab tests indicate that the receiver has an overall noise figure of 12 db; in short—a good case for a **good** pre-amplifier.

The reason for the disappointing receiver performance specification is not obvious, but it may well be linked with the fact that this set is intended to be used a mobile situation, where noise is probably the limiting factor. Whereas a noise blanker can be expected to effectively wipe out all noise from one main noise source, it is quite hopeless to try to remove a virtually constant background of the electrical noises that are present when operating mobile on VHF. Thus this receiver sensitivity may have been allowed to stay low deliberately.

OTHER FEATURES AND TEST RESULTS IN BRIEF

Meter provides S units on receive and output power on transmit. S meter readings are believable, as it takes 75 microvolts to make it read S9 and you cannot make it reach full scale deflection (marked **S9 plus 30**).

Noise Blanker is selected by a push button on the front panel: this was found to



be very effective, even in a location at a traffic-lights intersection (lots of ignition noise).

Full carrier output for test purposes is provided by one of the push buttons on the front panel (used by the author to obtain CW with the mike button!).

Receiver Incremental Tuning which provides several kHz of offset from transmit frequency for the receiver only. Works well.

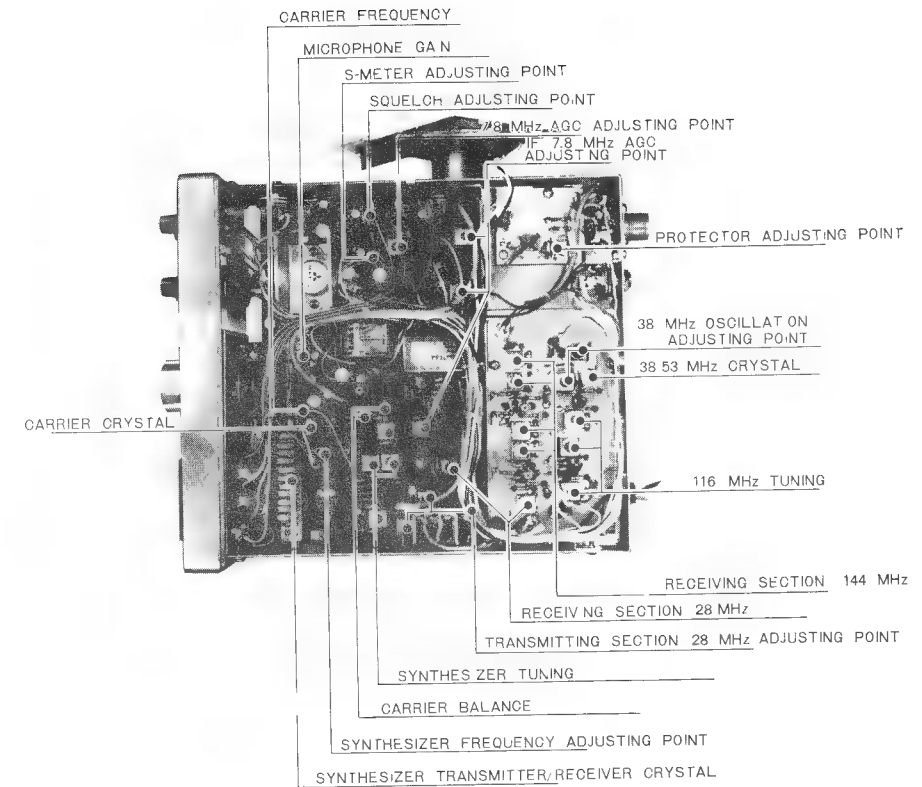
Squelch for fixed channel operation. Quite sensitive.

Calibration accuracy. The absolute frequency depends on the setting of the VXO control, but the frequency difference between channels was found to be within about 150Hz of the specified 10kHz.

Weight 3 kg, dimensions (WxHxD) 220 x 70 x 250 mm (8 1/4" x 2 3/4" x 10").

The Belcom Liner 2 uses 27 transistors, 6 FETs, 1 IC and 44 diodes. The input DC supply connector is polarised, and the line is fused, so that if the supply is wrongly connected for polarity, the reversed diode in the set will blow the fuse, protecting the active devices from damage. All controls were found to be easy to use and sensibly placed. For example, the (receiver audio) VOLUME control is the top right control, so that it falls easily to hand. Some mental gymnastics are needed to calculate the final frequency when first using a non-standard VXO crystal, but that is not too serious.

Examination of the circuit diagram reveals liberal use of double and even triple tuned circuits in mixer outputs. By all the indications, the claimed spurious suppression of 60 db is probably met. Certainly there were no outputs in the 144MHz band, other than the expected one, when testing the transmitter. The receiver was found to be a little worse, with a threshold effect occurring at about 1 millivolt: past this level there were several **birdies** in the band. As not too many signals are that strong, that might not give any trouble. This problem may be caused by one of the switching diodes (over 30 of them) causing distort-



ion or harmonics, and is one point to watch when installing a pre-amplifier. This problem is rarely, if ever, investigated when a pre-amplifier is installed in an FM **Carphone**. How many sets suddenly develop **birdies** when the pre-amp is added?

While evaluating this set, the costs of the various methods of getting onto the 144MHz band on SSB were compared. Assuming that one is keen enough to want permanent facilities on the band, the usual method used, namely an HF transceiver with a transverter to 144MHz would involve

an outlay of at least the cost of the HF set, or between about \$350 and \$600. Compared to that is this set which provides instant 144MHz SSB at reasonable power level, and uses considerably less space in your shack; you also get mobile operation (fox hunts, field days, etc) as a bonus. With the popularity of VHF **tunable** operation on the increase, sets such as this one will become more widely used.

The set comes complete with 2 power leads, PTT mike, mike clip, mobile mounting bracket, English manual (very clear and informative) and spare fuses and dial lamps. The crystals needed for coverage outside the standard frequency range are also readily available from the dealer, Sideband Electronics Engineering, who supplied the set for this review. The price of the Belcom Liner 2 is \$250.

SUMMARY

An excellent mobile SSB set, and ideal for the keen VHF operator to use as a driver for a high power amplifier; an easy way of getting onto the 2 metre satellite band with SSB. Pricewise, quite comparable to the **other method** of transceiving on 2m SSB on a dedicated equipment basis.

ACKNOWLEDGMENT

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