Two-Metre Sideband with the K.W. "Viceroy"

USING THE TRANSVERTER PRINCIPLE

WHILE many AT station operators now run a K.W. "Viceroy" CW/SSB transmitter, in one or other of its three marks—and the two-metre conversion discussed here is being used with a Mk. II—the VHF transverter principle can also be applied in the same way with any transmitter capable of giving stable output on the 14 mc band. This output can be either CW or SSB, but in the case of AM phone the PA at the VHF end is directly modulated in the usual way.

In other words, when transverting, the station HF transmitter is used as the driver for a conversion circuit operating (in this case) into the two-metre band. Since for ordinary CW or AM phone operation separate VHF transmitting equipment may already be available, it follows that the transverter idea is applicable mainly where it is desired (given an SSB transmitter in use on the HF bands) to get on two metres with Sideband phone, the CW facility being a side-issue — which brings us back to the "Viceroy" and the object of the present exercise.

The block diagram at Fig. 1 illustrates the general circuit arrangement, and shows how CW and SSB can be radiated on two metres with the "Viceroy" on 20 metres. Note, however, that by adopting this principle a further unseen dividend is being paid by the system—that of VFO control on the 144 mc band. The inherent stability of the "Viceroy" on 14 mc is such that not only can excellent SSB results be obtained on two metres, but also the great advantage of easy frequency changing—but it is to be hoped, and is expected, that any VFO changes will be strictly within the applicable Zone area! (*see* p.96, April SHORT WAVE MAGAZINE).

Transverter Circuit

At Fig. 2 is shown the actual circuitry involved, in which the oscillator chain is made to serve two purposes: (*a*) For the transverter frequency change, and (*b*) As the oscillator section of the receiving converter. While this latter facility may not be required where a satisfactory 2m. Rx converter is already in use (in which case the Rx pick-up off L5 could be omitted), the point is that it is desirable to keep the oscillator running on "receive" anyway; this is because crystals in the overtone mode are liable to slight drifting on switching on, due to heating, and this is most undesirable when transmitting SSB phone.

In the model transverter built to this design, an 8750 kc crystal (Ch.388 in the FT-241A range) is multiplied to 131·25 mc through a 12AT7, the output being boosted by a 5763, V3 in the circuit; the 131·25 mc output is passed to another 5763 as an additive mixer (V1 in Fig. 2) with the 14 mc transmitter input, giving 145·25 mc at L3. An A.2521 in the cathode follower configuration is used as an isolating stage between mixer and output RF amplifier (not shown in Fig. 2)—which could be a QQV03-10 or similar, to drive a two-metre linear amplifier as a QRO PA, running CW or SSB to choice from the "Viceroy," or AM phone with a separate high-level modulator.

However, what we are concerned with here is getting the 14-144 mc conversion, using the arrangement of Fig. 2. If the circuit is built up carefully in unit form—crystal oscillator chain; 5763 amplifier; mixer; cathode follower—with proper screening between sections,

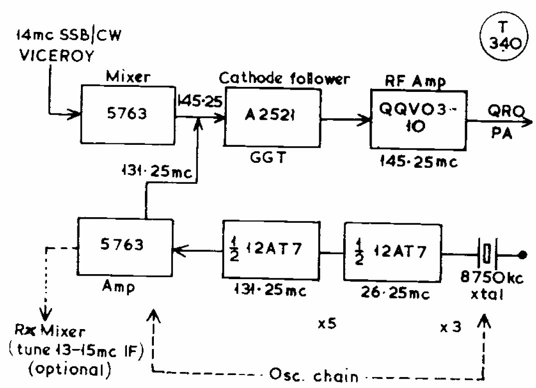


Fig. 1. Block diagram of the circuit sequence for obtaining two-metre Sideband phone using a K.W. "Viceroy" on the 14 mc band. From a conventional crystal-oscillator chain, an injection frequency of 131 mc is applied to the 5763 mixer which, from the 14 mc "Viceroy" input, produces a 145 mc SSB signal, passed on to a cathode follower (in this case an A.2521) as an isolating stage between mixer output and a 145 mc linear RF amplifier. As explained in the text, the 5763 oscillator-amplifier can also be used to give an injection frequency (at 131 mc) for the receiving converter, thus making the oscillator chain common to both Tx and Rx. In other words, the arrangement becomes a complete two-metre conversion unit, or transverter. The circuit is shown in Fig. 2, with values.

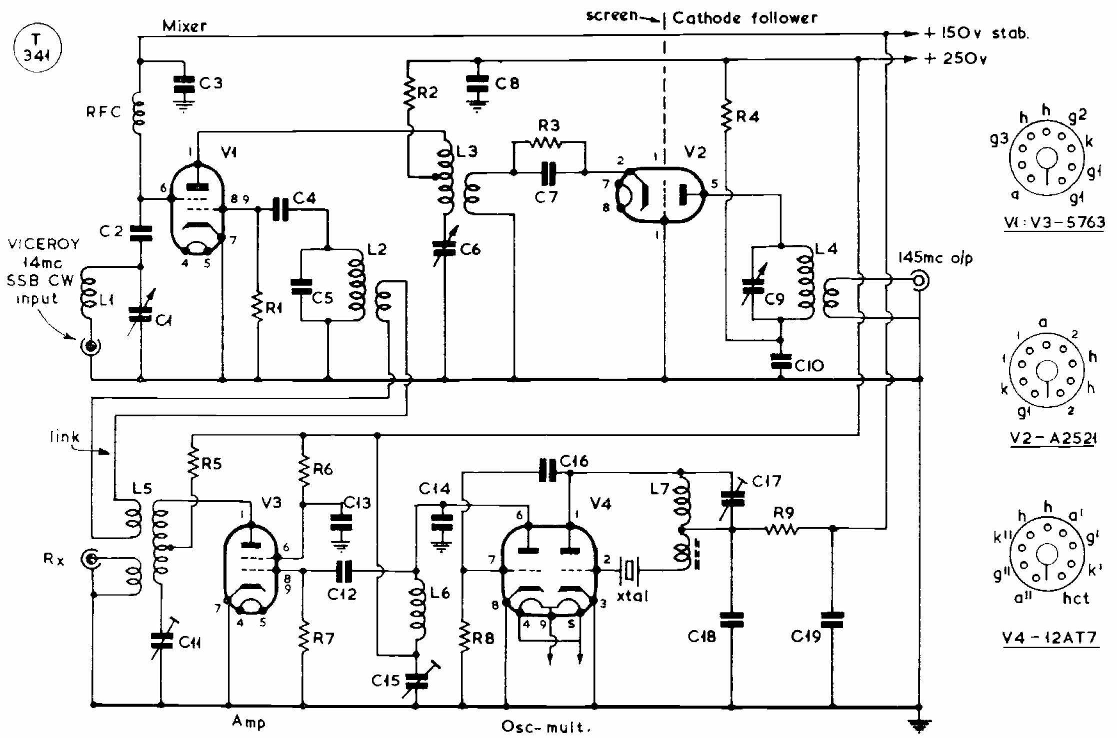


Fig. 2. Circuit evolved from the block diagram shown in Fig. 1, which makes it clear how the conversion is obtained. The 14-131 mc mixing stage V1, a 5763, is isolated from the 145 mc final output by the cathode-follower V2, in which an A.2521 is used. To obtain sufficient injection power, a 5763 amplifier V3 follows the conventional 12AT7 8.75-131 mc crystal oscillator V4. Since for reasons explained in the text it is desirable (but not essential) to keep the oscillator running on "receive," it follows that some of the V3 output can usefully be taken as the injection frequency for the receiving converter, giving a tunable IF of 13-15 mc in the main receiver. This makes a neat and economical arrangement of the whole transverter unit. While the CO and injection frequencies actually used need not be those shown for the general design, it is clear that they must be chosen to avoid beats that would fall in the receiver tuning range.

and a liberal use of ·001 μF ceramic feed-through's wherever applicable, there should be no trouble with unwanted beats. The frequency relationships chosen are such that provided the tuned circuits are made selective, with adequate isolation (given by the A.2521 stage) between mixer and output, no spurious emanations should appear.

In setting up, the output from the SSB driver-Tx should be adjusted to give no more than enough mixing in the V1 5763 stage. Obviously, careful checks must be made all through to ensure that the correct frequency appears at the cathode of V2 and, with a 145 mc RF amplifier running under drive from the A.2521, bench tests should be carried out to make sure that the SSB product is clean and free from " squiggers " in or around the two-metre band ; at the first going-off, the thing might well give the well-known Egyptian bag-pipe effect, and this would almost certainly be due to too much Tx drive. As already explained, in the interests of SSB stability the

Table of Values

Fig. 2. The 14-144 mc Transverter Circuit

C1	= 5-60 $\mu\mu$F
C2, C3, C8, C10, C13, C14, C19	= .001 μF, ceramic feed-thru, as applicable
C4, C16	= 50 $\mu\mu$F
C5	= 5 $\mu\mu$F
C6, C9	= 3-10 $\mu\mu$F, var.
C7	= 0.1 μF
C11, C15	= 2-10 $\mu\mu$F, preset trimmer
C12	= 25 $\mu\mu$F
C17	= 3-30 $\mu\mu$F, trimmer
C18	= .01 μF
R1	= 33,000 ohms
R2, R5	= 100 ohms, w/wound
R3	= 200 ohms
R4, R9	= 1,000 ohms
R6	= 10,000 ohms
R7	= 22,000 ohms
R8	= 100,000 ohms
RFC	= 2.5 mH RF choke
V1, V3	= 5763
V2	= A.2521
V4	= 12AT7
Xtal	= 8750 kc (Ch.388)
L1	= to tune 14 mc with C1
L2	= to tune 130 mc with C5
L3	= to tune 145 mc with C6, and centred link
L4	= to tune 145 mc with C9, and link o/p
L5	= to tune 130 mc with C11
L6	= to tune 130 mc with C15
L7	= to tune 26 mc with C17

CO section should not be switched off for " receive."

Having once set up the transverter and its associated RF amplifier, either CW or SSB phone is obtained by operating the " Viceroy " in the usual way for these two modes—and the probability is that once having got going on two metres with Sideband phone, AM will never be used, for it is an extraordinary fact that not only is SSB much easier to tune on VHF than might be supposed, but a good Sideband transmission sounds stronger than its associated CW signal. And if a QRO linear is eventually achieved at the VHF end, a lot of heavy audio equipment would be required for full control under AM conditions.

Those interested in VHF and circuit design will see immediately that the transverter principle can be applied in a variety of ways, from LF to UHF, with different frequency relationships and driver-transmitters—and we acknowledge the Midland Amateur Radio Society's *News Letter* for May 1962 as the source of the inspiration. Incidentally, if you want to hear a two-metre transverter system in operation, using a "Viceroy" as the Tx driver, listen to G3BA of Sutton Coldfield.

AERIAL TUNING FOR TOP BAND

EFFICIENT COUPLING SYSTEM

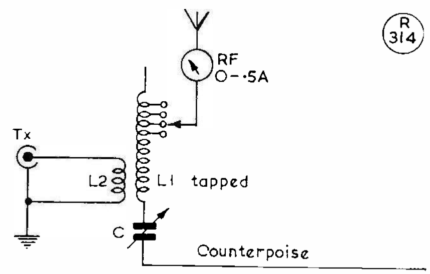
THOSE who until now have been content to transmit on 160 metres with a length of wire pushed into the Ae. socket of the transmitter, leaving it to the *pi*-tank network to take up the slack, would probably find a marked improvement in radiating efficiency by changing to the arrangement shown in the diagram.

A coil L1 of about 70 turns of 22g. enamelled, close-wound on a 1½-in. diameter former, should have taps taken out every two turns for about one-third of its winding length—this will give 11 or so tapping points. L2 is a 5-turn link winding over the earthy end of L1, and it is the coax lead to this link that is plugged into the Tx, or to the aerial send-receive switch. The condenser C is a 500 μμF BC-type variable.

Instead of a direct earth connection, a counterpoise is used on the lower side, and this is run in whatever way may be convenient. In theory, a counterpoise should exactly balance the aerial—in practice, it almost never can in an amateur installation, but experience has shown that a counterpoise run in almost any direction can often give much better results than a direct earth.

With an aerial of anything from 90-150 ft. in length, and a counterpoise of 50-90 ft., it should be possible to find the correct aerial tapping point to tune the system to resonance—this is the object of the taps, and the coil can be trimmed to the final size when the aerial tap has been established. The correct point is when maximum RF is shown in the ½-amp. aerial ammeter with resonance tune on the variable condenser and 10w. input to the transmitter, the *pi*-tank in the Tx, of course, being kept at resonance while the aerial tuning adjustments are made. Once they have been found for whatever area of Top Band the operator favours, the tune will hold over quite wide changes of frequency.

When the system is right on tune in this way, not only will radiating efficiency be found to have improved (compared with any system tuned only on



Showing the circuit arrangement discussed in the text. By using a counterpoise, radiating efficiency on 160 metres can often be considerably improved compared with a direct earth. In amateur practice, the counterpoise need not be directly underneath the aerial, nor must it be of the same electrical length. The coil size suggested, with the taps taken, will accommodate wide variations in aerial and counterpoise dimensions.

the Tx tank against ground), but there will be an additional bonus on the receiving side, in that signals will come up considerably. Hence, the station change-over should be arranged to swing the aerial link between Tx and Rx.

A rather simpler version of this circuit (with L1 untapped) has given G3PLB (London, N.22) much improved results on Top Band, and was suggested by him in a recent issue of the Southgate & Finchley group *Newsletter*.

AMENDMENTS AND CORRECTIONS

In the circuit on p.188, June, R2 should have been shown as variable, as stated in the paragraph of values below the diagram. Going back to the May issue, we are informed by the M-O Valve Co., Ltd., that in the circuit on p.124, the "Voltage-Regulated Power Supply," it is advisable to use 150-ohm resistors in each cathode of the 6080, V3; this is in order to assist in the equal sharing of current when the triode sections are paralleled; failure to take this precaution can lead to unsatisfactory valve life.

Going further back still, to the February issue, and the circuit on p.658, G3BAK explains that following some correspondence on the subject of modulating the klystron, it should be made clear that the square wave must be of sufficient amplitude to sweep from the operating point to the peak of the mode.