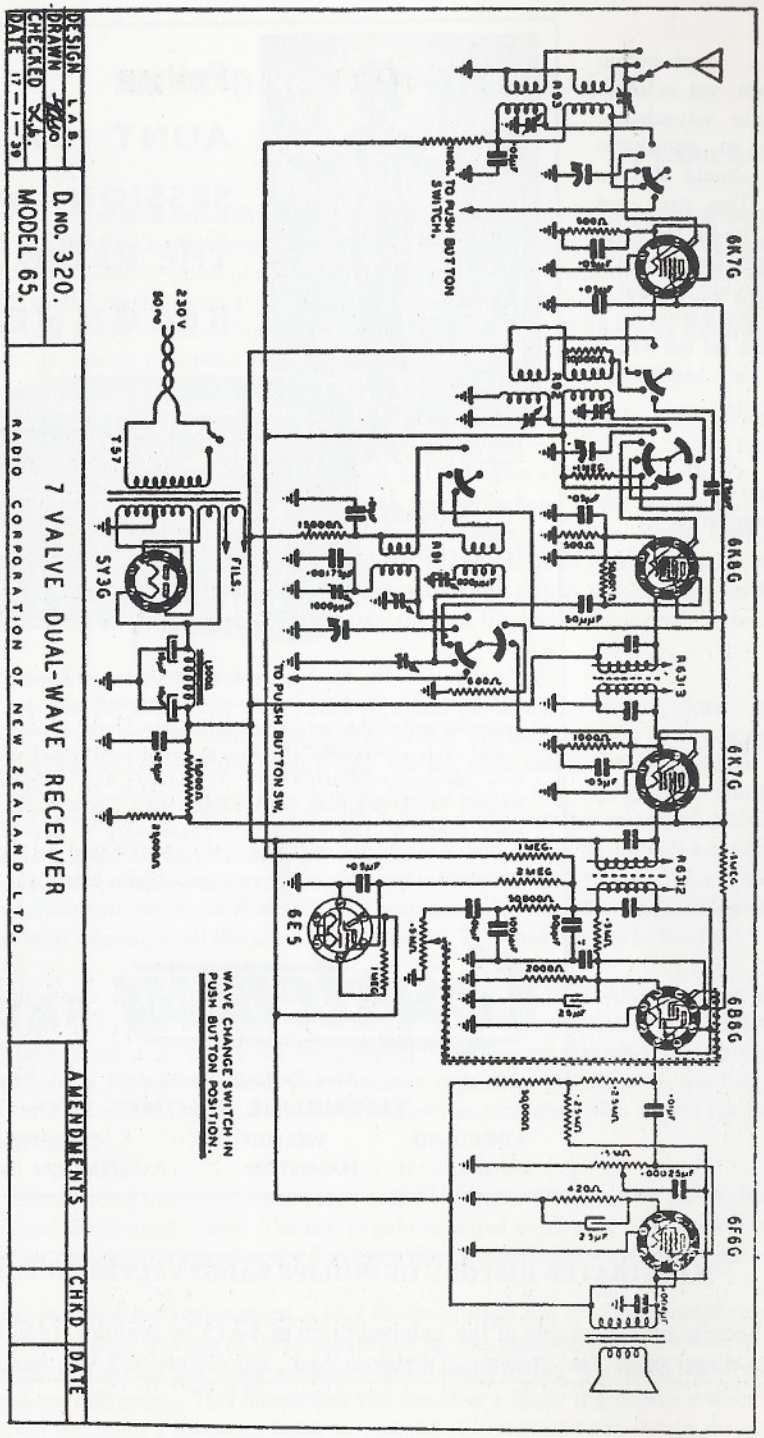


THE NZ HRO RECEIVER

Phil McGechie

The name may be a little misleading but the New Zealand made type 941SWB series of communication receivers is often referred to as such, and with good reason. It uses some components and mechanical arrangements that give it the appearance of its "National" counterpart and, within the limitations of its reduced specification it has a comparable performance.

The 941SWB receiver which was designed and manufactured by Collier and Beale Ltd, Ghuznee St, Wellington to Post and Telegraph Dept., Radio Section orders over the period 1941 through World War II has been considered by many to have been the first of the type produced by C&B. The type number allocated by the P&T indicates that the design was first produced in 1941 (see later paragraph). However, the design and manufacture by Collier and Beale of this type of set goes back further than 1941. Recently a type 938SWB came to light and it is possible that earlier versions existed before 1938.

It is not known how many of these receivers were produced but the number would possibly be as high as 200. My research indicates some 50 to 60 units but there are production runs that I have no data on. Each set was allocated an individual serial number by the P&T Dept at the time of order but these serial numbers came from a register which included many other types of radio equipment thus are not unique to the type 941. Serial numbers for the 938 and 941 receivers examined range from 95 to 1047.

With regard to the type numbering, P&T (later NZ Post Office) Radio Section used a code for receivers and some other equipment where the first digits denoted the number of valves and the last two digits indicated the year of first manufacture. Thus type 941 was a nine valve receiver of 1941 design. The equipment title , ie. Receiver, defined the use with a frequency band indicator added at the end where applicable - SWB was short wave band. Transmitting equipment used a different code giving year of manufacture and power output level. This type numbering system ceased in the 1960's.

Now before anyone tells me that they have found a receiver type 940 or perhaps 943 I should point out that the type numbering was not only applied to equipment of NZ manufacture. Imported items purchased by Radio Section of the P&T were allocated a P&T type number on their first arrival in New Zealand. Take the National HRO, a number of which Radio Section imported in 1940. These became

type 940SWB3. The number 3 in this case denoted coverage of three bands, ie. LF, MF & HF.

I have parts lists and circuits for the 941 receivers dated 7/1/42 and 15/9/42 covering serial numbers 333-338, 469-495 and 594-605. A type 941SWB2 was produced which covered MF as well as HF bands and this had serial numbers 606-609. There were obviously other production runs as I have serial number 986 and know of units with serial numbers above 1000.

The circuit shown with this article applies to serial numbers 333-338 and 469-495 but with minor changes discussed later it applies to all type 941 receivers. Some of the receivers which have survived to date have their name plates missing but luckily the type and serial numbers are shown on each coil box. I have not seen a circuit for type 938SWB.

The 941SWB was supplied with three coil boxes covering 2.5 to 5, 5 to 10, and 10 to 20 Mhz. The 941SWB2 was equipped with an additional coil unit covering 1.4 to 2.5 Mhz. The 2 after SWB denotes coverage (or partial coverage) of two frequency bands , MF and HF.

Now, lets have a look at the equipment itself. These receivers were supplied for 19" (475mm) rack mounting. They used a National type PW4 gang capacitor and dial. On the front of the coil boxes were full length calibration charts which were much easier to use than the smaller HRO charts.

Type 938 differs mainly from type 941 in that it uses a quite different physical design for the coil box assembly which is patterned closely on the National HRO with each coil and trimmer in its own neatly made sheet metal box secured to a 5mm aluminium panel. The overall length of the 938 coil box is 25mm shorter than the later 941. A second variation between these two receivers is in the front panels: the 938 has a 5mm aluminium panel whereas the 941 panel is of sheet steel reinforced by folded edge at the top and bottom. Panels were supplied in black wrinkle paint finish.

A four section cast aluminium coil box is used in the type 941 with a sheet steel coil box panel. Probably the changes in coil box and panel design were the result of a wartime shortage of suitable aluminium plate.

The circuit used is generally conventional with two RF and two IF amplifier stages. A separate 6C5 oscillator feeds a 6L7 mixer valve. Since this receiver was required primarily for CW operation AGC was not fitted. The gain of the second RF stage was manually controlled from the front panel: a separate similar control changed the gain of the IF stages.

A two stage audio amplifier using low power triodes (6C5s) providing a maximum of 50 milliwatts into headphones and/or into a 600 ohm audio line.

Metal octal valves were used throughout. Operation was off a common battery station supply of 6V and 180V to give reliable no-break service consequently there is no designated AC power supply unit. Filter units are fitted to the rear of most 941s to prevent RF interference being introduced through the common battery systems. Type 938 does not appear to have had these filters fitted.

There were a number of variations in manufacture from batch to batch. The following list of known changes may help restorers. Note that this list may not be complete.

1. Type 938 has a variable capacitor as BFO pitch control.

2. The type 938 examined has been heavily modified but does not appears to have originally been fitted with an interstage audio transformer.

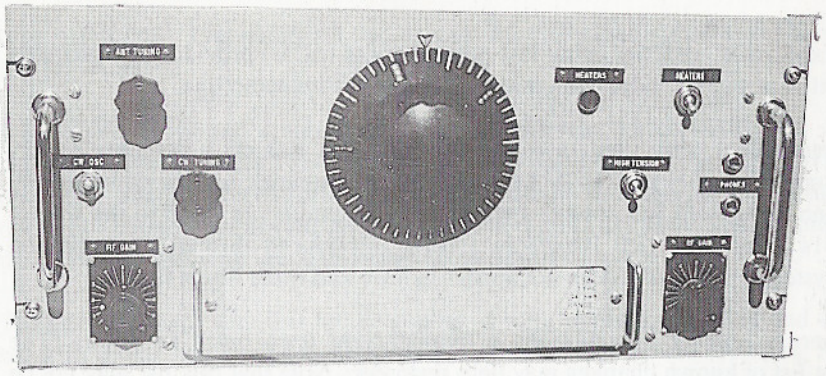
3. Type 938 has rotary switches for BFO and HT control while all 941s noted have toggle switches. It is not possible to tell whether the 938 had a LT switch as the space is now occupied by an 'S' meter.

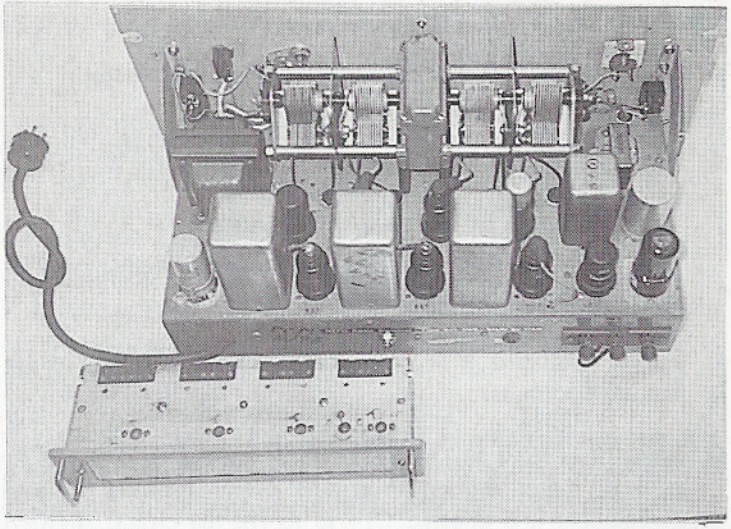
4. Earlier sets used a full wave audio detector circuit while later ones had halfwave circuits.

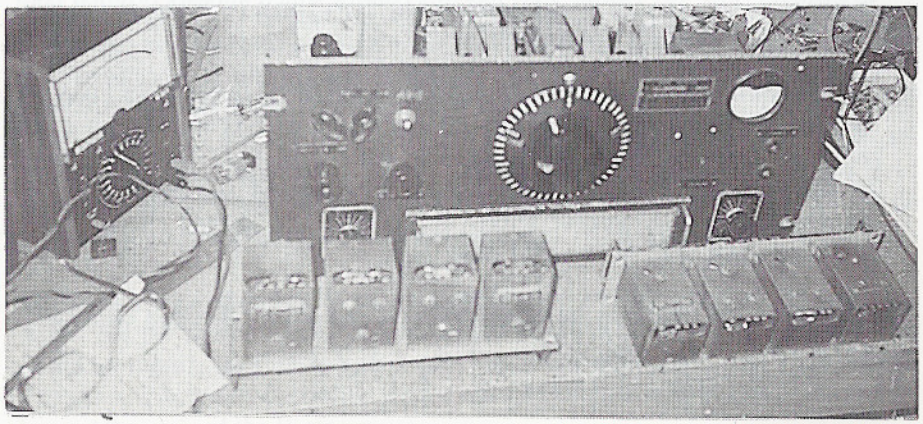
5. Some units have an 'ANT TUNING' control to peak the first RF circuit. I have not found this on an original circuit printing but some show it as an amendment and allocate C14 to it. (in the circuit shown C14 is allocated elsewhere). My 941 (serial 986) has this control which appears original both from its wiring and its engraved label.

6. Some receivers have a form of variable selectivity whereby the coupling between the primary and secondary coils of the first IF is varied by a small variable capacitor. Type 938 and some batches of 941s had this; others replace IFT1 and IFT2 with a single inductively coupled unit and delete C14. As I remember the variable selectivity control had limited effect. Later circuits showed IFT2 & 3 as IFT3 & 4.

7. Some 941 receivers may have the BFO coil and wiring mounted on a small subchassis.







8. In one of the parts lists that I have, the first IF amplifier is shown as type 6L7 but invariably the circuits show type 6K7.

The reader should be aware that all these receivers were ordered by the P&T regardless of who was the end user, this being Government wartime policy.

The design is attributed largely to the late Gordon Pike with Percy Collier overseeing the operation. I am told that two special version of these receivers were constructed for New Zealand Broadcasting use in their Overseas Receiving station at Makara.

It was policy within P&T Radio Section that where an item of equipment was significantly modified a new serial number and documentation would be issued. I have a circuit diagram of 941SWB serial 1000 showing a modified AF output stage using a 6V6 together with a new output transformer for speaker operation. Further modifications included fitting AGC and a 6K8 mixer with the triode section of that valve being crystal controlled for fixed frequency operation, the normal 6C5 tunable oscillator being retained for general coverage .

During the 1950's the five type 941's at Auckland Radio were repainted grey as part of a station refurbishment programme. At around this time these receivers were fitted with AGC , RF and IF gain controls were commoned and an audio gain control fitted. I don't recall an AGC on/off control being fitted. What, if any changes were made to sets at other stations is not known.

Many and varied will be the modifications subsequently made by owners after NZPO released them. My own 941 arrived with a grey panel sporting a large 'S' meter . That panel has since been replaced. AGC had been fitted together with a 6V6 output stage. Both the AGC and the modified output stage have been retained and it has an excellent performance.

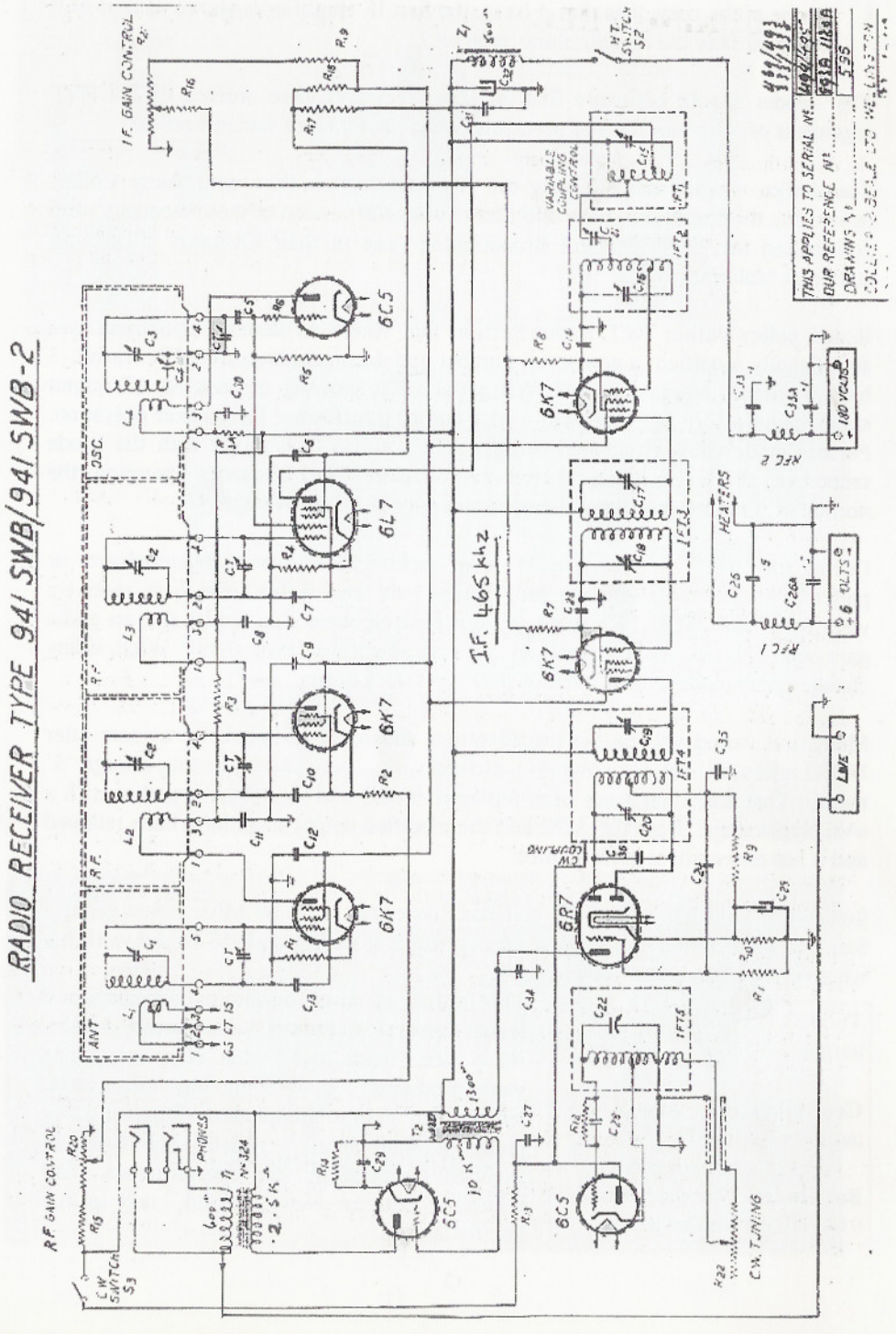
Somewhere out there may be a coil box covering 14 to 30 Mhz. I was given a blank coil box and told to make it up as a training project in 1957. It did work but where it ended up is not known.

Top left. Front panel of the author's 941SWB

Centre left. Rear view of the author's 941SWB

Bottom left. The modified 938SWB on the test bench.

This article is based on limited research and leaves several questions unanswered. How many were made and what other variations were produced? I welcome any information which may help to complete the story of a key piece of equipment which established an excellent reputation for performance and reliability both in New Zealand and in the Pacific Islands.



MEASURING FREQUENCY - THE WAVEMETER

Reg Motion

At the birth of radio, interference between users was negligible but as interest in this novel means of communication quickened problems arose and there was a general call to regulate usage by specifying powers, frequencies, times and other relevant criteria. Radio transmissions do not recognise country boundaries thus the International Telecommunication Union (ITU) was asked to consider the problems and makes recommendation to countries in accordance with its findings.

Suitable and stable frequencies of transmission are one essential factor in avoiding mutual interference. Here the ITU recommends to countries the bands which should be used for types of transmissions and the relevant authority in each country allocates the bands for use in that country then assigns frequencies to users and monitors such usage.

Thus there is a requirement for both the user and the monitoring authority to measure frequency with sufficient accuracy. This has led to a continuing development of the means for such measurement.

The earliest common method of frequency measurement was the simple wavemeter. A coil of known inductance resonates with a capacitor of known size at a frequency which can be calculated. The inductance of simple coils can be quite accurately calculated from their physical makeup (number of turns, length, diameter and wire size). More complicated coils can be measured by comparison (eg. bridge methods) with other precalculated inductances or capacitances used as standards. Similarly capacitance can be determined by calculation or measured by comparison. Thus the frequency of resonance may be determined.

When coupled inductively to a source of RF power such as the output of a transmitter a current flows in the coil/capacitor combination. At resonance this current is at a maximum as also is the voltage across the capacitor/inductor terminals thus providing a means of indicating resonance. Resonance can also be judged from the maxima in power absorbed from the transmitter as indicated by a slight rise in the plate current of the output stage.

Actually, while such a device is called a "wavemeter" the name is a misnomer as it really measures frequency. This comes about because in early days it was almost universal practice to deal with wavelength rather than frequency consequently such instruments were calibrated in the equivalent freespace wavelength and the name given in early times has stuck with this type of instrument.

Up until about 1924 wavemeters were the principal frequency determining instruments. An accuracy of 1% could be expected for the commonly available types while precision devices gave 0.1% with temperature correction. The variable capacitors and inductors in these precision instruments are examples of some of the finest mechanical work with a great amount of thought going into maintaining the accuracy of calibration over long periods of time.