

The Design of the R.1155

GENERAL CIRCUIT ARRANGEMENT AND AMATEUR BAND APPLICATIONS

THOUGH of vintage 1940, the R.1155 has remained one of the most popular "surplus" receivers for amateur-band operation, largely because it is still easy to buy. Intended originally for aircraft operation as the companion unit for the well-known T.1154 transmitter—discussed in some detail in the December, 1955, issue of *Short Wave Magazine*—the design of the R.1155 is basically very good. (It was prototyped by the Royal Aircraft Establishment, Farnborough, and manufactured under contract in large quantities by several well-known radio firms.) In Service use, the receiver was found to be easily adaptable for ground-station working.

A great many amateurs have since made the same discovery, and today there are few operators in this country who are not aware of the R.1155, even if they do not own one. It is also of interest to add that the design of the Radiovision "Hambander," in its time another very successful receiver, was largely inspired by the R.1155.

Circuit Arrangement

The diagram at Fig. 1 is a simplified version of the communication circuits of the R.1155—in the airborne application, it also provided direction finding and homing facilities by a direct-reading course meter, but those functions are not discussed here because they are of no practical interest from the Amateur Radio point of view.

To make it easy for those possessing an R.1155, and wishing to know more about its interior, the circuit nomenclature used in Fig. 1 follows that of the Service manual on the receiver.

The communication circuitry amounts to RF, FC and two IF stages into a detector-output valve, with separate valves for AVC operation combined with BFO, and a "magic eye" visual tuning indicator. (The latter is not shown in Fig. 1.) The audio output, while being adequate for headphones, is not sufficient for a speaker.

Since the R.1155 is a general-coverage re-

ceiver, it suffers (from the amateur viewpoint) by reason of having no band-spread. This means that the 7 and 14 mc bands cover only a few notches on the dial. Moreover, the 21 and 28 mc bands are not tuned at all, nor is 160 metres—a very severe disadvantage. The short-wave coverage is 3.0 to 18.5 mc, meaning that the R.1155 can be operated as it stands only on the 3.5, 7 and 14 mc amateur bands. It is very good on 80 metres.

Effective band-spread can be obtained by putting a small 10 or 15 μF variable capacity in parallel with the oscillator tuned circuit; as this capacity will only sweep a small proportion of any one HF tuning range, tracking will not be seriously affected, though of course calibration will be put out.

To get on to 15 and 10 metres a converter arrangement is necessary—see *Short Wave Magazine*, July, 1956—while for Top Band it is possible either to employ another converter, or to modify the MF tuning range 3 (600-1500 kc) to cover 1800-2000 kc, as explained in the September, 1956, issue of the *Magazine*.

The IF of the R.1155 is 560 kc, HF side of signal frequency, with adjustable dust-iron core IF transformers.

Valve Substitution

The original valve types were: VR100 for V3, V5, V6, equivalent to the CV1100, which is the old Osram KTW62, replaceable by the later G.E.C. W61 (KTW61). V4 used a VR99, also named CV1099 and actually a Z66, still in the current G.E.C. range; and for V7, V8 the type was a VR101 (CV1101) which is the original Osram MHL6, now obsolete, but replaceable by the G.E.C. DL63 double-diode triode. (The equivalents mentioned here are directly pluggable, without re-wiring of any sort being necessary.) The "magic-eye" is a VI103, which is the same as the G.E.C. Y63 in the current range.

Unless the receiver is bought as "brand new, unused, in original packing," one of the first things to do is to give it a new suit of valves.

AVC and BFO

When the master-switch is in the "omni" position, the gain of V3-V4-V5-V6, together, can be controlled by potentiometer R8(1), the resistor network being so arranged that (at 220v. HT) any negative voltage from about -4 up to -30 volts is given by the slider of R8(1).

With the master-switch at "AVC," the gain of stages V3-V6 inclusive is controlled automatically by the level of the incoming signal,

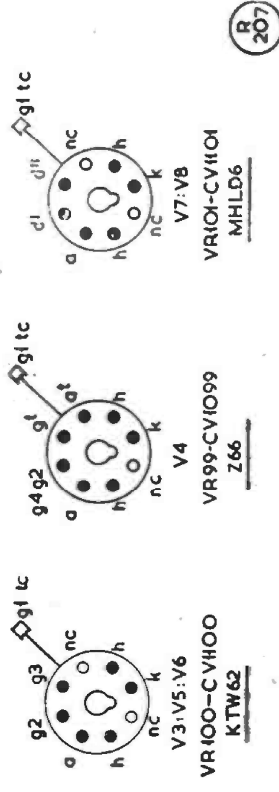
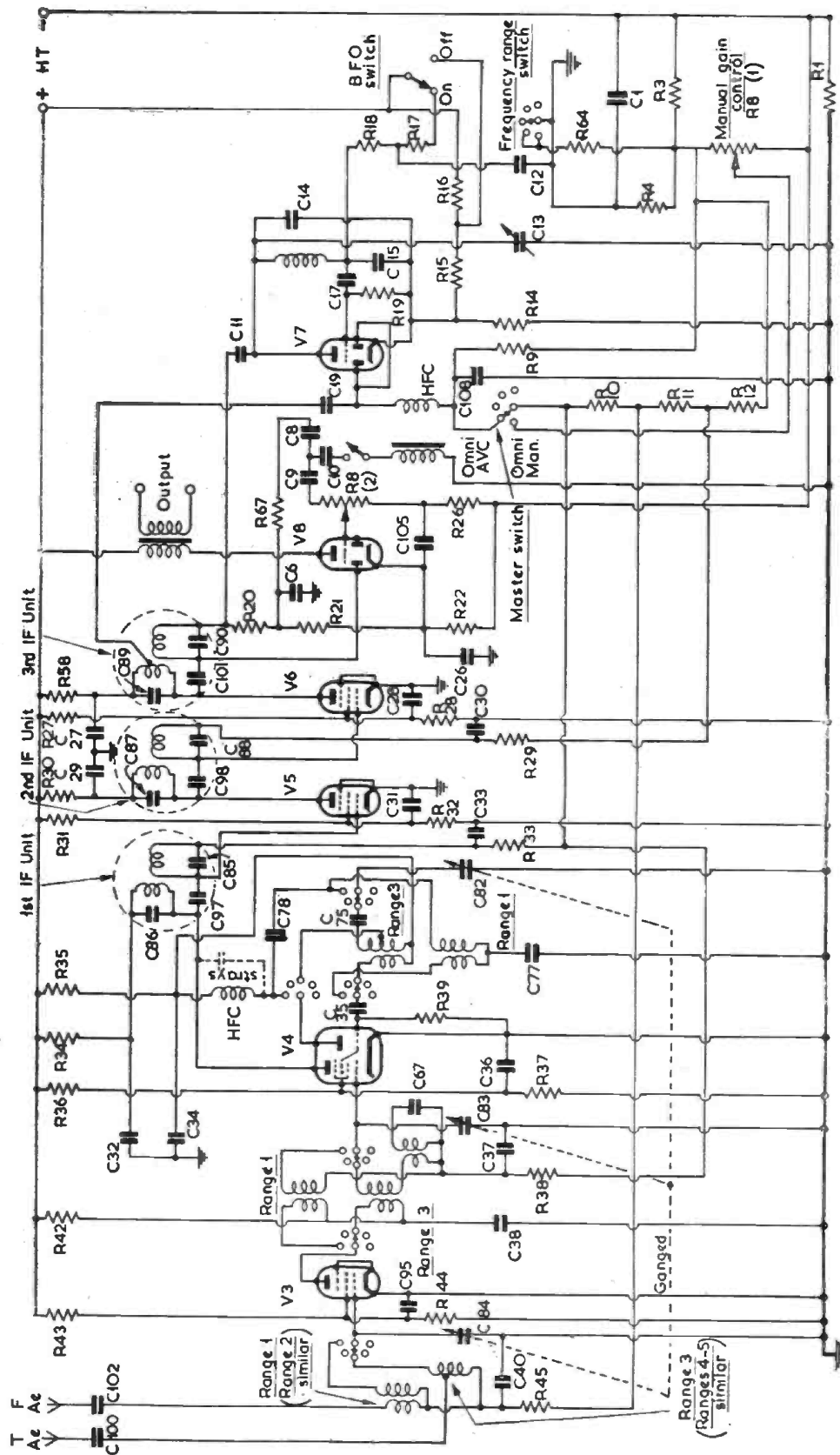


Fig. 1. Simplified diagram of the R.1155 communications circuits, discussed in the text. T, Ae is the "trailing" (long wire) aerial connection, which goes to Pin 2 of the Plug P1 (see Fig. 2) and F, Ae is the "fixed" aerial, corresponding to any short wire of 25-40 feet, going to Pin 1; in certain circumstances, better results will be obtained by trying either one of these. The KTW62 at V3, V5, V6 is now obsolete, as is the MHLD6 at V7, V8, but supplies are available from "surplus" sources. The Z66 at V4 is a current-production type (G.E.C.). Plugable equivalents of these valves in current production are the W61 (or earlier, KTW61) for V3, V5, V6, with the DL63 for V7, V8. The IF of the R.1155 is 560 kc, on the HF side of signal frequency, with a selectivity factor of 5 kc.

Table of Values

Fig. 1. Essential Circuitry, Receiver R.1155

C1 = 2.5 μ F	C97, C98 = 2 μ F
C6, C11, C17 = 100 μ F	C100 = 200 μ F
C8, C9, C19, C102 = .001 μ F	C101 = 4 μ F
C10 = .004 μ F	R1 = 2,000 ohms
C12, C26, C27, C28, C29, C30, C31, C32, C33, C34, C36, C37, C38, C40, C105 = 0.1 μ F	R3 = 1,200 ohms
C13 = 75 μ F, semi-variable (see text)	R4 = 120 ohms
C14 = .0016 μ F	R8(1), R8(2) = 50,000/500,000 ohm dual pot-meter (see text)
C15 = .00455 μ F	R9 = 2 megohms
C35, C108 = 200 μ F	R10, R11 = 150,000 ohms
C67 = .002 μ F	R12, R16, R27, R31, R36, R43 = 27,000 ohms
C75 = 537 μ F	R14, R22 = 1,000 ohms
C77 = .00617 μ F	R15 = 30,000 ohms
C78 = 15 μ F	R17 = 1,500 ohms
C82, C83, C84 = Main tuning gang assembly	R18 = 10,000 ohms
C85, C86, C87, C88, C90 = 300 μ F	R19, R20, R39 = 56,000 ohms
C89 = 600 μ F	R21 = 470,000 ohms
C95 = 0.5 μ F	R26, R29, R33, R38, R45 = 100,000 ohms
	R28, R32, R35, R37, R44, R67 = 22,000 ohms
	R30, R34, R42, R58 = 2,200 ohms
	R64 = 200 ohms

(NOTE: Circuit nomenclature as Service Manual).

with R8(2) as the manual audio gain control. Since in the actual design R8(1) and R8(2) are ganged together to the one knob marked "volume control," from a study of the circuit it is evident that with the master-switch at "omni," R8(1) only is operative—with R8(2) out of circuit—while with AVC on, audio gain R8(2) alone is available. This means that there is no manual control of audio gain, by itself, when AVC is off, the output being in effect controlled by R8(1), as a "manual AVC" knob.

It is for this reason that one of the modifications sometimes advocated is the physical separation of R8(1) and R8(2), so that they can be used independently; in fact, this modification is not really necessary.

In the AVC circuitry, the degree of bias is proportioned between V3-V6 in such a way as to give a sort of "graduated control," in the interests of good signal-noise ratio. That is to say, while V4, V5 take the full AVC bias volts, V3 gets half this voltage, and V6 only one-tenth. The AVC delay is about 13 volts, and the resulting AVC characteristic is such that a change in input signal of 80 dB only produces a variation in output level of 8 dB.

The triode section of V7 provides the BFO, the Colpitts oscillator being tuned to half-IF, i.e., 280 kc. What should be the variable pitch BFO control is C13 in the circuit diagram. In the R.1155 it is fitted not as an independent control, but for screwdriver ("fixed") adjustment. An obvious improvement here is to put

in a condenser which can be knob controlled.

Output End

The maximum attainable audio output is 100 mW which is ample for a headset, but, as already mentioned, means that an additional LF valve must be fitted for speaker operation—see under "Power Supply."

In the output side of the set there is incorporated an LF filter or noise limiter consisting of a choke with condensers C8, C9, C10, controlled by switch. The purpose of this is to suppress all audio frequencies below 300 cycles, which it does most effectively; it works

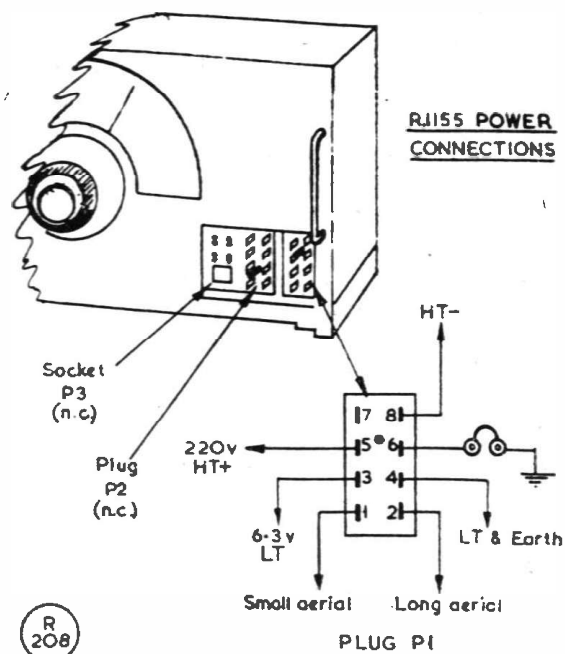


Fig. 2. This sketch is to locate the R.1155 power plug and its connections, looked at from the front (as the receiver is viewed). To operate the set as a normal communications receiver, socket P3 and plug P2 are ignored, connections as shown being made to P1. The headset can be connected across pins 6-4 or 6-8 if pin 4 is earthed, as shown here. Pin 7 connects HT+ to V1, V2 which are the D/F valves, not used at all in the communications application; these circuits are only brought in when the main (right-hand) panel switch is moved to the "balance," "visual" and "00" positions.

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Also on the output side there is a tuning indicator V10—not shown in the circuit of Fig. 1—which is driven off the AVC line; hence, it could easily be replaced by an S-meter unit operating on the principle of that described in the March, 1957, issue of *Short Wave Magazine*.

The Auxiliary Circuits

The circuitry of the R.1155 also incorporates three further valves (V1, V2 and V9, not

shown in Fig. 1) which are additional to the communications section of the receiver. These auxiliary circuits are there only to provide for direction finding and homing. In the sketch at Fig. 3, the circuit elements associated with the D/F functions are *unmarked*; they can, in fact, be removed altogether, to leave more space on the main chassis, since they play no part in the operation of the R.1155 as a communications receiver.

Power Supply

The R.1155 is not self-powered—in Service use, a complicated arrangement of HT and LT generators, driven off the aircraft main electrical line, was involved—so that another “modification” called for is the provision of a standard type of AC power pack. This should give about 60 mA at 220 volts HT, with 6.3 volts at 3 amps. or so for LT.

In some modifications a 6V6 (or G.E.C. KT63) as output audio amplifier is built on to the same chassis as the power pack, to form a complete unit operated externally to the main receiver. In this case, the grid connection for the output amplifier can be taken off pin 6 of the power plug P1—see Fig. 2.

The sketch at Fig. 2 locates the power inlet plug and its pin connections. The other two entries, plug P2 and socket P3, can be ignored ;

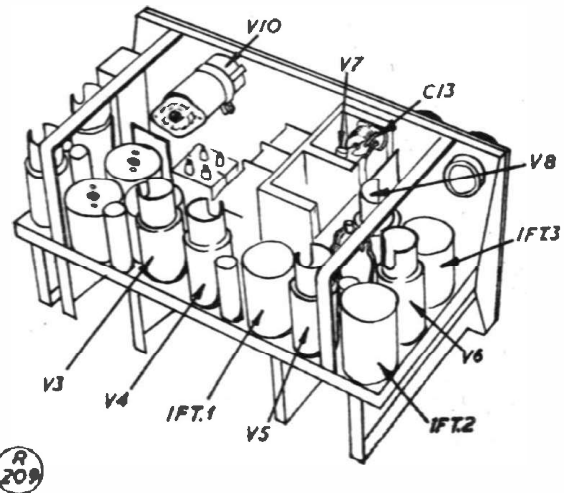


Fig. 3. Outline sketch of the R.1155 (chassis, near view) to locate main items shown in the circuit at Fig. 1. Valves and canned coils not marked here are for the D/F function of the receiver, and could well be removed, together with the connections to the “balance,” “visual” and “00” positions of the main panel switch. V10 is the magic-eye tuning indicator (not shown in the Fig. 1 circuitry) and is driven off the receiver AVC line, its grid being connected to the top end of R9 in Fig. 1. V10 could be replaced by the current G.E.C. type Y63, which is pluggable, or the magic-eye assembly removed altogether and replaced by an S-meter to the design in the March issue of “Short Wave Magazine.” All elements marked in this sketch correspond to the Fig. 1 nomenclature, and are as given in the Service manual on the R.1155.

they are the connection points for the D/F function of the receiver, including the remote reading visual course indicator.

Transistor DX on 40 Metres

AN HF CO-PA TRANSMITTER
RUNNING 120 mW

By Courtesy PHILCO (OVERSEAS), Ltd.

This very interesting description of a practical transistor transmitter — though the actual barrier-type transistors used are not yet generally available in this country—not only shows what can be done with such low power

THE transmitter shown here is a crystal controlled oscillator-amplifier running 120 milliwatts input on the 40-metre band and employing Philco type MADT and SB100 transistors, powered by two flashlight cells. The aerial system consists of two vertical ground planes with 40-foot radiators, spaced one quarter wave-length apart. One of these verticals is driven, the second element serving as a parasitic reflector. With this equipment W3FBL

on the DX bands, but also proves the practicability of QRPP operation with this particular type of HF transistor, which has such a high factor of conversion efficiency. The circuit arrangement is very similar to that originally devised by G3HMO and described in SHORT WAVE MAGAZINE some three years ago.—Editor.

of Laverock, Pennsylvania, has rolled up an impressive list of 40-metre contacts in six months' operation. His best DX so far is KH6KD and KH6BDV in Hawaii, with whom he keeps regular schedules at 2200 GMT on 7050 and 7073 kc. He has also made WAS and worked VE1, 2, 3 and 7.

The transmitter is shown in Fig. 1. Although the circuit appears to be without novelty, there are several features which make for efficiency and stability. Tank coils are large (4in. diameter in the amplifier) and of heavy wire ; in fact, this coil would be suitable for a kilowatt rig! This form of construction raises their unloaded Q, which is a very important factor in QRP operation. In fact, all connections are made as though a kilowatt were involved, to reduce losses.