



THE DUXFORD RADIO SOCIETY

The Radio Section of the Duxford Aviation Society

Imperial War Museum, Duxford, Cambridge

Equipment History File

Wireless Set No. 62 (British Army 1945)



1. Introduction

Wireless Set No. 62 (WS62) was a general purpose, low-power, semi-tropicalised, vehicle station transmitter & receiver designed for short-range use in the high-frequency (HF) radio bands by the British Army during the Second World War. The frequency range covered was 1.6 to 10.0 MHz in two switched bands. The total military service life was from 1945 until the late 1960s.

Although intended initially as interim equipment, WS62 had a long service life and was used in the Second World War by British Army infantry, the Parachute Regiment and the Special Air Service (SAS) in both European and Far East campaigns, and also in the Korean War during the 1950s. The equipment was also used in Auster and Beaver aeroplanes and the Skeeter helicopter. It was first trialled early in 1944 with war time production running from late 1944 to 1946, post-war military production resuming in the early 1950s, and production for commercial applications continuing until 1966.

WS62's original application was as a vehicle-mounted mobile station, with the option of quickly transferring the complete equipment in its carrier out of a vehicle, for use as a ground station or animal-pack station. The transceiver unit could also be carried on the back as a man-pack station.

Designed and manufactured by Pye Ltd in Cambridge, it was also manufactured by Pye Group affiliate companies in Australia and India.

2. Equipment History

WS62 was originally designated as Wireless Set No. 22 MKII, and intended as an interim replacement for the general-purpose, low-powered Wireless Set No. 22 MKI, (another Pye design), which had been in service with the British Army since 1942. The permanent replacement for WS22 MKI was planned to be a new design of equipment, Wireless Set No. 42. The design concepts for WS42 used the latest miniature valves and the equipment was to be hermetically sealed for use in all climates of the world. However, for various reasons, the WS42 project was eventually abandoned after fieldtrial and WS62 became the permanent replacement for WS22.

While the previous WS22 MKI functioned fairly satisfactorily in service, it was bulky with a separate power supply and being made from steel was heavy, with an all-up weight of 57.5lb for the two main units. Lighter, more robust and water-proof equipment was desirable for use by infantry, Airborne Forces and in various transportable applications. Experience in the Tropics had shown that electronic equipment quickly succumbed to the effects of moisture and high humidity, and became unreliable within a short space of time.

Starting in late 1943, WS62 was rapidly designed over a six month period. 50 prototypes were subject to fieldtrial in early 1944 and limited production began in late 1944. Pye Ltd was given an urgent order for 10,940 units and by the end of the war had produced 7,350. Early units were found to need internal strengthening when dropped by parachute, and the WS22 type man-pack carrying-attachments on the case made the equipment too bulky to fit into a parachutist's kit-bag. After initial experience in the field, the equipment design evolved from the original WS62 model through MK1 and MKII versions, with the MKII becoming the norm and earlier models being retrospectively modified to that standard. Later versions included the MK3, MK4, and MK5 sets for aircraft use, and the MK6 which operated from dry batteries used by the SAS.

At the time, Pye Ltd was a relatively small and enthusiastic company with characteristics which made it quick, flexible and innovative, and not afraid to contradict instructions from the Ministry of Aircraft Production or Ministry of Supply. During the War, Pye Ltd expressed great dissatisfaction with the Ministry procurement system, which led to other companies being given contracts to manufacture larger quantities of the Pye designs than Pye itself. Pye complained vociferously about Philips being given more orders for Wireless Set No. 22 and Communications Receiver Type PCR than themselves, as the original designers. They lobbied Westminster and questions were asked in the Houses of Parliament, resulting in a souring of relations between the Company and the Ministry. This led to an increasing reluctance by the Company to accept military design contracts (as opposed to military manufacturing contracts). As a result, the design of Wireless Set No. 62 was privately funded by Pye Ltd, and subsequently was only able to be manufactured by Pye Group companies (or its licensees) over its long production life. For use by the Australian Army, WS62 was manufactured by the Pye Group affiliate company Electronic Industries Limited (EIL) of Melbourne, Victoria.

The Pye Ltd team which designed WS62 was also responsible for Wireless Sets No. R10, 18, 19, 22, 68, the PCR Receiver series, early work on radar proximity fuses, the first hand-portable VHF radio and various other equipment. After the war ended this group was formed into a separate division which became known as Pye Telecommunications Ltd. WS62 remained in service with the British Army after the Second World War, and when the Korean War began in 1950, a shortage of equipment caused Pye Ltd once again to manufacture the set. Wartime production of WS62 was carried out at the original Pye Ltd Radio Works in Haig Road, Cambridge, but by the time the Korean War started Pye Telecommunications was established at its own factory (called Ditton Works) in Cambridge, and WS62 was produced there and later at Haverhill. WS62 was also supplied to the Indian Army and eventually manufactured under licence by Bharat Electronics Ltd, Bangalore, India. Pye Telecommunications also supplied India's rival, Pakistan, with WS62 via its direct sales force. The equipment was sold commercially world wide until the late 1960s.

3. Technical Description

Like WS22 before it, the frequency coverage of WS62 was intended to be similar to the WS19 used in armoured fighting vehicles (AFV), so that both armoured vehicles and non-armoured trucks and jeeps could all communicate with one another in the same frequency band.

Due to its mainly aluminium construction, WS62 weighed approximately 30lbs, much less than the WS22 which it replaced. It was also waterproof, would stand immersion for 5 minutes and would float. Waterproofing was achieved by means of clamping the edges of the front panel into a neoprene rubber gasket, which was mounted in a grease-filled groove inside the case front edge. All front panel controls were either sealed or had grease-filled rubber compression glands clamped around their control shafts. The case was constructed with a built-in carrying harness, and in the man-pack application required three men to carry the complete station; one to carry the set, one for the 22 Ampere-hour battery and one for the battery-charging pedal-generator. An aerial base was mounted on the end of the case for vertical or horizontal aerial rods to be connected directly which enabled the station to be operated while on the ground or on a man's back.

Wireless Set No 62 was a true transceiver, where the same master oscillator drove both the receiver and the transmitter, thus ensuring that the two sections of the equipment were aligned to the same frequency at all times. This process used subtractive mixing in the receiver to produce the receiver Intermediate Frequency (IF), and additive mixing in the transmitter to generate the transmitter drive signal, as described below. The equipment could send and receive both radiotelephony (RT) signals and continuous wave (CW) Morse code signals.

An interesting mixture of older and newer (for the time) thermionic valve technology was used in the circuit. ('Valves' are called 'tubes' in the USA). These ranged from 1930s British Mazda-Octal directly heated 2.0 Volt battery valves, indirectly heated 6.3 Volt International Octal valves, and two of the (then) latest high gain Philips/Mullard 6.3 Volt B9G all-glass units (an EF50 and a QV04-7). Some of the functions of the valves were shared between receiver and transmitter.

The receiver was a conventional supersonic-heterodyne type receiver (Superhet) with an IF of 460 KHz and consisted of an RF Amplifier, Mixer, separate Local Oscillator, two IF Amplifier stages, Signal and AVC Detectors, an Audio Frequency Amplifier to drive headphones, and a Beat Frequency Oscillator for the reception of CW signals. The transmitter aerial tuning circuits used to match the transmitter Power Amplifier to the aerial impedance also provided a small amount of front end selectivity ahead of the receiver RF Amplifier.

The transmitter radio frequency circuits consisted of a Master Oscillator (which was also the receiver Local Oscillator), a Transmit Mixer, a Transmit Oscillator (which was also the receiver Beat Frequency Oscillator), a Buffer Amplifier and the final transmitter Power Amplifier. On early sets, a two-stage Microphone Amplifier was used to amplitude modulate the Power Amplifier, but on later equipment only one valve stage was used for this function in order to improve modulation quality.

The transmitter RF power output was approximately 1 Watt into an 8 foot vertical rod or 100 foot sectional long-wire antenna. WS62 was powered from an external 12 Volt battery, and originally used a miniature rotary transformer mounted inside the case to generate the high voltage for the valves. In 1963, a transistor dc-dc converter was adopted to replace the rotary motor-generator.

A tuneable wave meter known as Crystal Calibrator No. 10 was supplied with WS62 as a frequency setting aid. A dedicated range of accessories enabled the equipment to be operated by remote control over telephone lines in a similar manner to WS19 and WS22 before it. For mounting in a vehicle or on a Mule, WS62 used the same series of equipment carriers as WS22 (Carriers Set No. 40 MK1 or MKII).

4. Brief Technical Specification

Frequency range:	1.6 - 4.00 MHz and 4.0 – 10.0 MHz in two switched ranges
Receiver sensitivity:	1.6 - 4.00 MHz; better than 3uV input, 4.0 - 10.00 MHz; better than 6uV to give 20dB signal-to-noise ratio when modulated 30% at 400 cycles
Receiver IF:	Receiver Intermediate Frequency (IF) 460 KHz
Receiver selectivity:	Between 5 and 8 KHz wide at -6dB points. Average slope between -6 and -60dB points not less than 5.8 dB/KHz
Receiver Audio output:	Not less than 200mW at 1 KHz
Transmitter RF output:	CW - 0.78 to 1.1 Watts depending on frequency R/T - 0.44 to 0.84 Watts depending on frequency (Note: TX terminated by 60pF capacitor in series with 10 Ohm non-reactive resistor)
Number of valves:	Total of 11 thermionic valves (termed ‘tubes’ in the USA) some shared between transmitter and receiver
Size/weight:	WS62 transceiver unit (excluding accessories) - 30 lb 20 ¼ inches wide, 10 ¼ inches high, 12 ¾ inches deep
Power Supply:	12 V DC at 3.0 to 5.0 Amps from external batteries, powering internal rotary transformer (motor-generator), or internal unit Power Supply Transistorised No. 36
Antenna System:	Mobile station: vertical rod aerials 4 ft, 8 ft or 14 ft high Fixed station: vertical ground mounted 32 ft mast Fixed station: horizontal 100 ft long end-fed wire (adjustable)
Accessories:	Headgear Assembly No. 10, Remote Control Units Type L No. 1 & 2, Crystal Calibrator No. 10, Charging Set Lightweight 80 Watts No. 1 Petrol Driven, Charging Set Pedal Driven 60 Watts

5. References & Sources of Further Information

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2. Pye Telecommunications Wireless Set 62 Technical Handbook Issue 1, part number 202462 circa 1958 (Note: this document contains errors, the document listed above is more consistent)
3. Wireless Set No. 62 Working Instructions, ZA27690, October 1945 and reprinted 1953
4. Frankland M. (2002) Radio Man, The Institute of Electrical Engineers, London.
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6. Duxford Radio Society www.duxfordradiosociety.org
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