

Volume 1 AMENDMENT No. 2

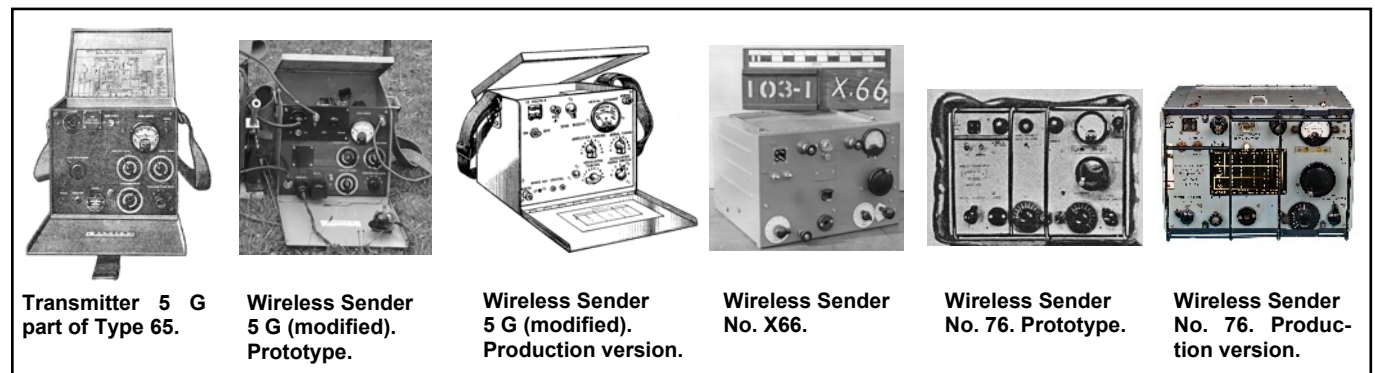
Date of issue: December 2022.

After the publication of 'Wireless for the Warrior' Volume 1 'Wireless Sets No. 1-88', a small number of minor (typing) errors and incorrect data was spotted. Corrections, additional photos and newly obtained information are published in 'Volume 1 Amendments'.

From Type 65 to Wireless Sender No. 76. A survey.

This amendment is a follow up with new information and illustrations which were obtained after the publication (in 1995) of the original chapter 'Wireless Sender No. 76' in WftW Volume 1, which should preferably be read along with these pages. Requirements for a powerful, yet small airborne forces rear link transmitter, led to the adoption of a Royal Navy transmitter 5 G. The development from the Transmitter 5 G to Wireless Sender No. 76 is described in some detail with illustrations and circuit diagrams. Basic information and a few illustrations were taken from WftW Volume 1 to provide a better background for those not having access to it.

In literature, particularly user manuals and technical documentation, names of various items may vary, though as much as possible the most common names were used. E.g. the modified Royal Navy 5 G was known as Sender Admiralty 5 G (Modified), Wireless Sender Type 5 G (Modified), Wireless Sender 5 G (Adm) and Wireless Sender Admiralty 5 G - Modified.



With the formation of British Airborne Forces in the early part of World War 2, the need arose to maintain direct contact over relatively long distances with the Airborne Division Headquarters, also known as 'Base', after landing to report the advance. Long range communication was also essential for maintaining contact with supporting armies, BBC war correspondents, Public Relations and Phantom. These long range links, known as 'Rear Link', were maintained by detachments of the Royal Corps of Signals, equipped with special wireless equipment. At the initial stages no existing Army wireless set would meet any of the requirements: lightweight yet robust, built to survive a drop by parachute, small, a long working range

and a wide frequency coverage yet low consumption from accumulators.

A Royal Navy transmitter 5 G, part of a transportable beach and port parties set Admiralty Type 65, was the most suitable for this purpose but only available in a small quantity. Modified by Signals Research Development Establishment, it was used as an interim substitute for operation on 12V DC, known as Wireless Sender 5 G (Adm), along with Reception Set R109A. This rear link station was unofficially known as 65 Set, with reference to the original Adm. Type 65. The first operational use of a 5 G (Modified)/R109A rear link was on the 12th of November 1942 at the taking of Bône airfield in Algeria by the 3rd Battalion, Airborne Bri-

gade. As the supplies of the original Royal Navy Transmitter 5 G made available for Army use were very limited, and stations became lost during active operations, a functionally similar transmitter was developed by SRDE in late 1942.

It is believed that the first development model was Wireless Sender X66 (the only reference to this are a few photos held in the Royal Signals Museum archives) evolving into Wireless Sender No. 76. Production of the No. 76 started early 1943, its first operational use was during landing operations in Sicily in July 1943.

The R109 companion receiver was always an A, B or C version which had an improved performance on CW.

Excerpts from the book 'Echoes From Arnhem' by Lewis Golden, OBE.

'...radio communication from brigade headquarters to parachute battalions hundreds of miles away was quite beyond the range of the sets which were already in use, namely No. 22 sets which were not very reliable over distances over more than two or three miles. The brigade signal section was therefore issued with No. 65 sets which consisted of a Royal Navy transmitter and a separate Army receiver. The old and the new had little in common. No. 22 sets used rod aerials and transmitted ground waves which followed the earth surface; but No. 65 sets used open wire aerials which transmitted sky waves up to the ionosphere for reflection back to earth. No. 22 sets had speech as well as Morse

facilities; No. 65 sets permitted Morse transmissions only, No. 22 sets could be tuned to a selected frequency; No. 65 sets were crystal controlled... it was a sudden and dramatic change of equipment, but it had to complement a sudden and a dramatic change in the brigade's role.'

'Escorted by Spitfires, the 3rd Battalion force flew to Bône on 12th of November 1942 and dropped at 0840 hours. There was no opposition. One of the two 65 sets was missing.

The surviving 65 set had suffered the disconnection of its loudspeaker...when communication was accomplished there was a great sense of relief. This comparatively untried radio was working effectively over 280

miles, a distance which had never been contemplated for a brigade to battalion link. It was signals history in the making; and although the link was seldom easy to maintain, particularly as a result of fading and interference during the hours of darkness, the brigade staff recorded with much satisfaction that the Brigade 65 wireless set was the only one in whole First Army to keep in contact with Bône.'

(Pages 34-35-37).

(This highly recommended book is sold out, but still available at second hand sources, e.g. at Amazon.)

Royal Navy Transmitter 5 G

Transmitter 5 G was part of a Royal Navy Type 65 transportable beach and port parties communication set comprising a 5 G transmitter and B28 (CR100) receiver. The station was powered from AC, either a 250W Blue Diamond generating set or available AC mains. The frequency coverage was 2.9 - 12MHz, covered in 6 oscillator ranges and 3 plug-in coils. The RF output was 4-6W. Transmitting on frequencies above 6MHz was by doubling the crystal frequency in the RF power amplifier. CW keying was done in the cathode of the 807 RF output valve. Considering the circuit diagram (below), the 6V6 oscillator valve was continuously on, radiating on the crystal frequency. We may surmise that these Royal Navy nets were always operating in full duplex, allowing fast break-in operation. Power was derived from a built-in AC power supply. A rotary switch fitted on the front panel allowed the transmitter to be used on voltages between 110 and 250V at 50Hz. [It is possible, but not yet confirmed, that in a later version of the 5 G this switch was replaced by an internally fitted AC voltage selector.]

DATA SUMMARY Transmitter 5 G

System: Morse CW only.

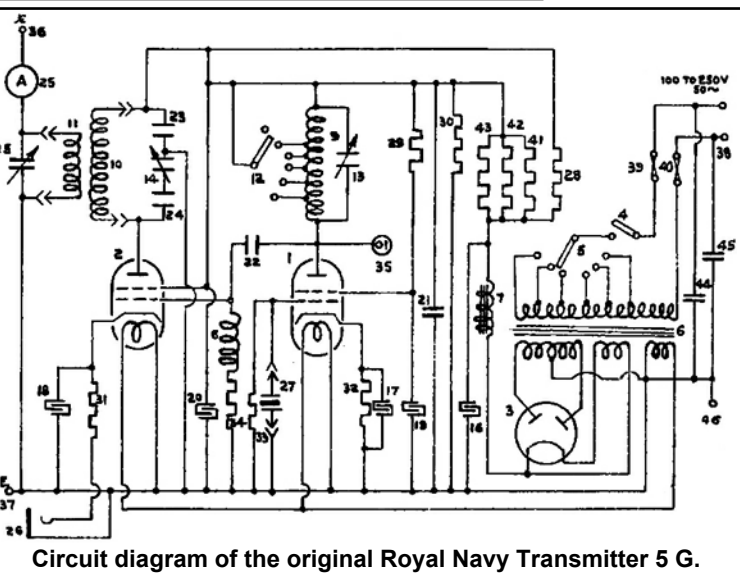
Frequency coverage: 2.9 -12 MHz

Power Supply: 110-250V AC 50Hz.

Weight: 21lb.

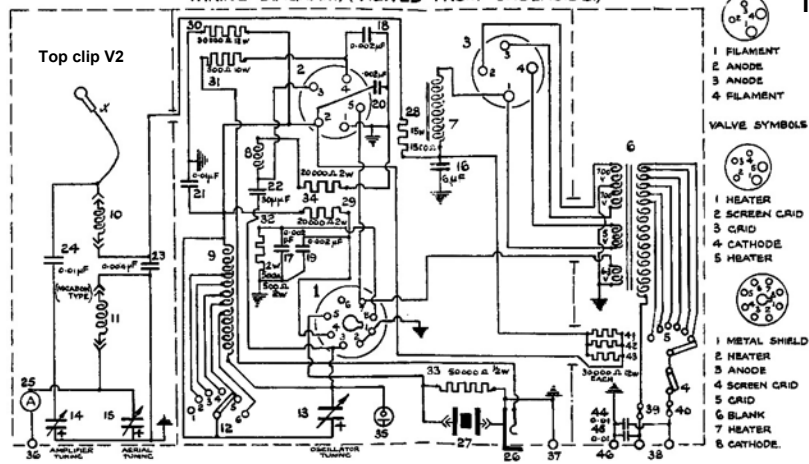
Size (inches): height 8 ¾, length 9 ½, width 11.

Valves: 6V6 crystal osc., ATS25 RF power amplifier.

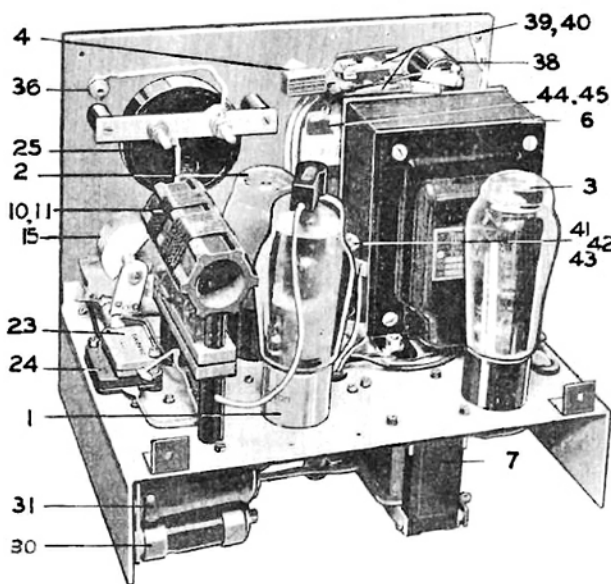
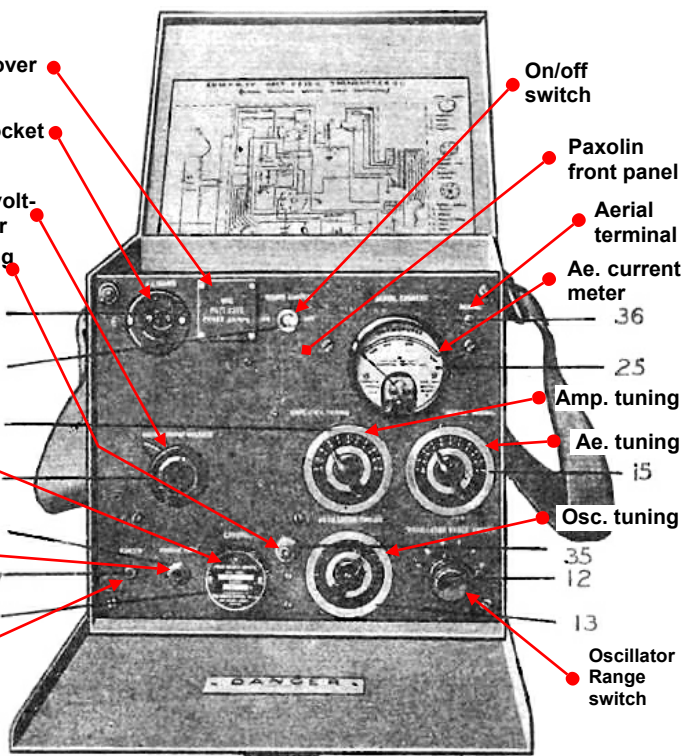


ADMIRALTY PATT. X2113A TRANSMITTER 5G

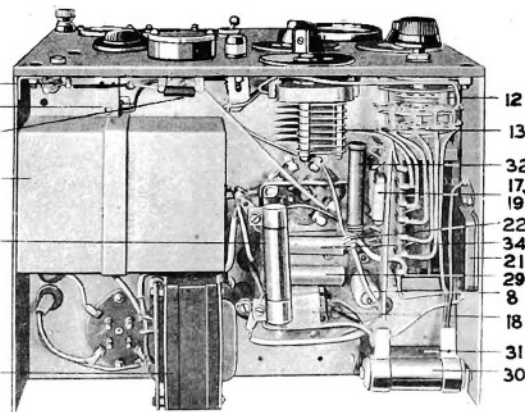
WIRING DIAGRAM, (VIEWED FROM UNDERSIDE.)



Wiring diagram of Transmitter 5 G.

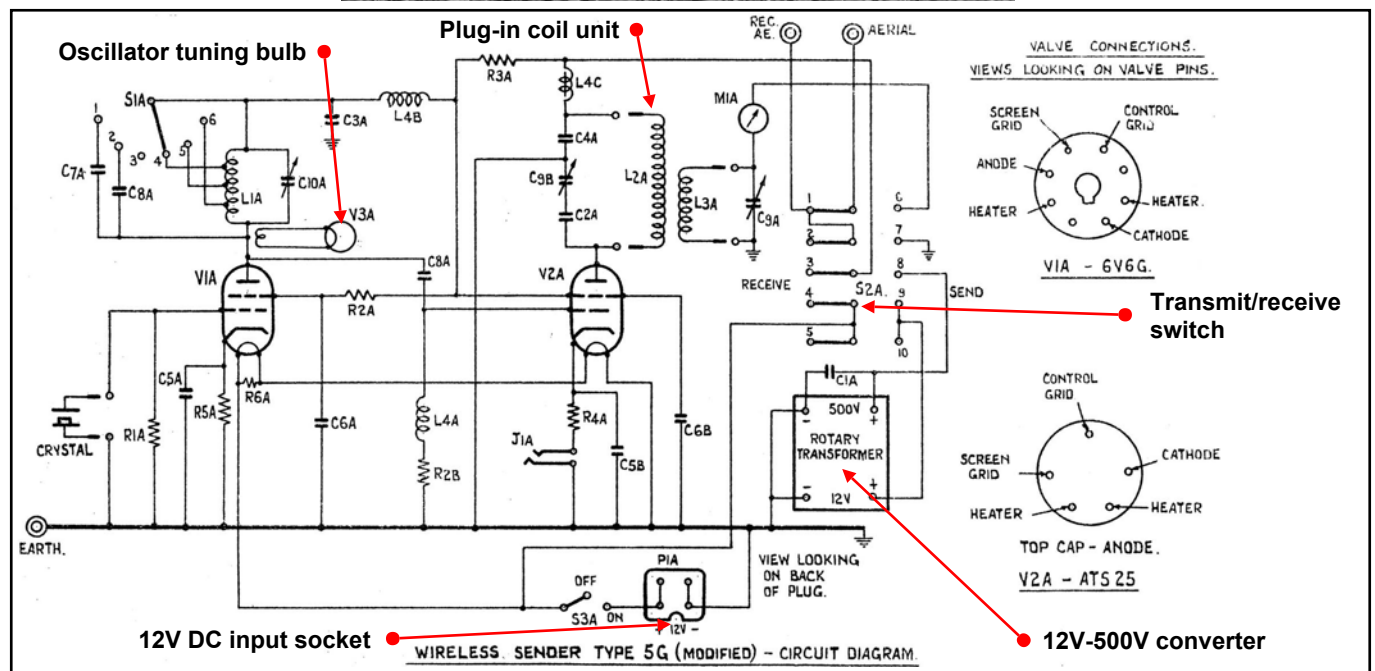
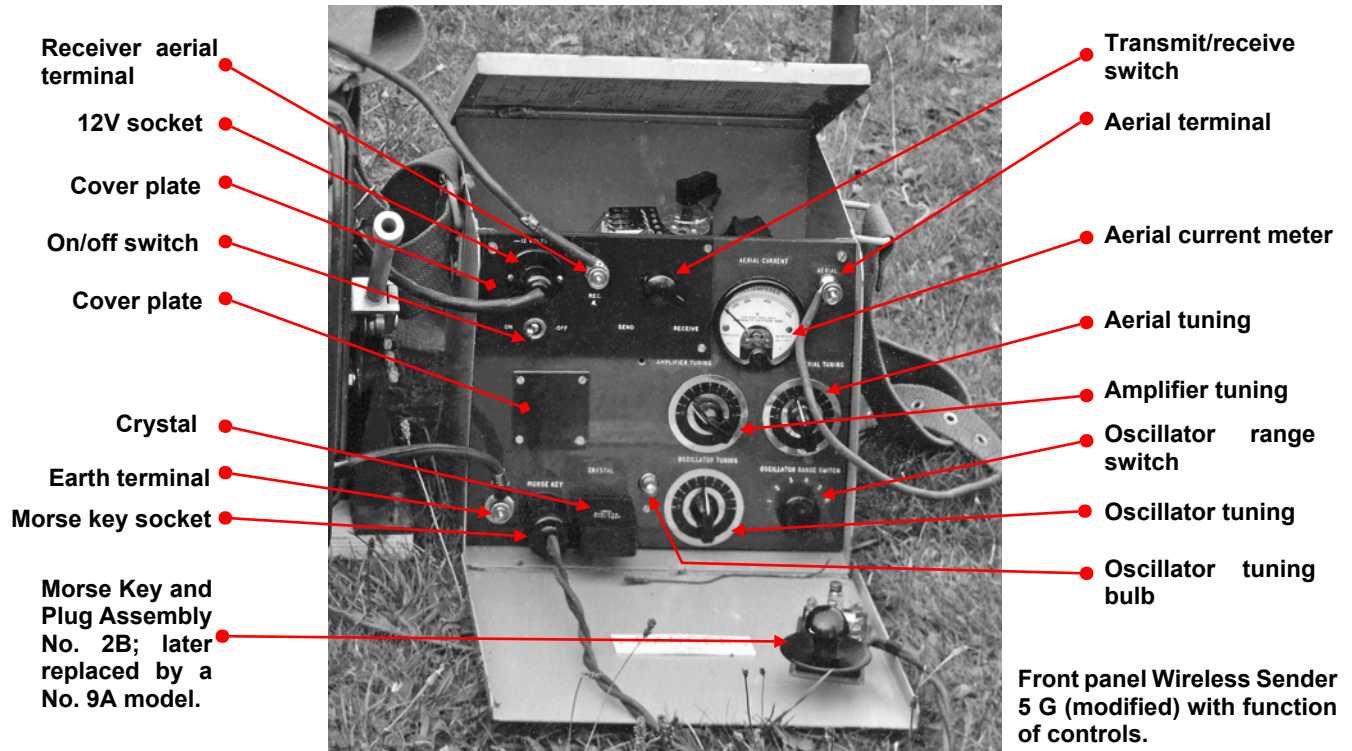


Internal view of Transmitter 5 G. Note plug-in coil.



Bottom view of Transmitter 5 G.

Wireless Sender 5 G (Modified)

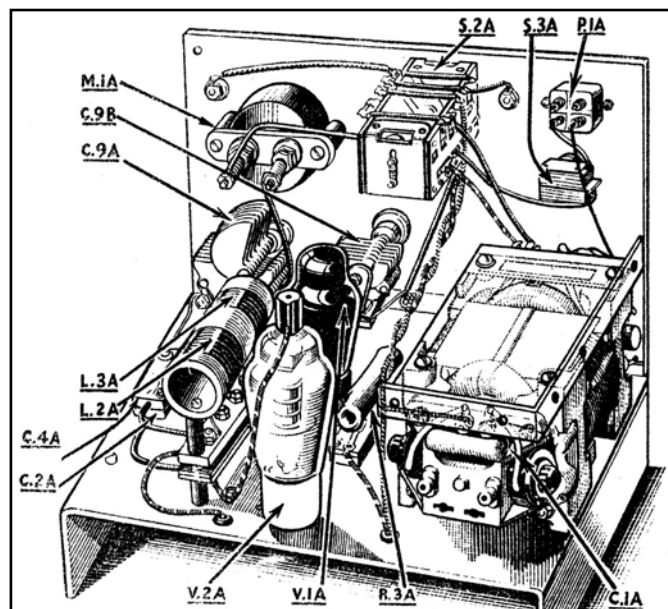


Component (1)	Symbol (2)	Value (4)	Remarks. (5)
Fixed.	C1A	0.1 uF	1,000 Volt, tubular.
	C2A	0.01 uF	Type 3691W
	C3A	0.01 uF	Type S 691W
	C4A	0.00 4 uF	2,200 Volt D. C. Mica.
	C5A	0.002 uF	Type M mica.
	C5B	0.00 2 uF	" " "
	C6A	0.002 uF	Type M2 mica.
	C6B	0.002 uF	" " "
	C7A	0.0001 uF	Mica.
	C8A	0.00005 uF	"
Variable	C9A	0.00016 uF	"
	C9B	0.00016 uF	"
	C10A	0.00005 uF	"
	C10A	0.00005 uF	"
Jack	J1A		Jack Microphone No. 2.
Inductances	L1A		Osc. anode tuning.
	L2A		Amplifier coil
	L3A		Aerial coil
	L4A		R. F. choke.
	L4B		" "

Component (1)	Symbol (2)	Value (4)	Remarks. (5)
Condensers.	M1A		500 mA
Meter	P1A		Plug 4-point No. 7.
Plug Resistances	R1A	50,000 ohms	1 watt.
	R2A	20,000 "	2 watt.
	R2B	" "	" "
	R3A	10,000 "	20 watt.
	R4A	500 "	5 watt.
	R5A	500 "	2 watt.
	R6A	15 "	3 watt.
Switches	S1A	Single pole 6-way	Rotary disc 2 position 5 way magnum On-off toggle
	S2A		
	S3A		
Valves	V1A		6V6G
	V2A		ATS 25
	V3A		Bulb 6VJ

List of main components Sender 5 G (Modified)

The modification of the original Admiralty 5 G transmitter by SRDE consisted principally of the removal of the AC power transformer and rectifier components, fitting a 12V/500V DC rotary converter, and a transmit/receive switch. Although in the trial models two Paxolin plates covered the holes of not required items on the front panel, in the production version new Paxolin front panel and chassis were made. The original 2-pt AC socket was replaced by a 4-pt socket and a receiver aerial terminal fitted. Most parts of the original RF components were retained including the use of three plug-in coils, variable capacitors, valves and RF ammeter. The frequency coverage was extended down to 2MHz and the oscillator tuning neon bulb replaced by a 6V bulb with a small loop over oscillator coil L1A.



Top chassis view of Wireless Sender 5 G (modified).

DATA SUMMARY Wireless Sender 5 G (modified)

Purpose: Transmitter for rear link communication.

System: Morse CW only.

Frequency coverage: 2-12 MHz in 6 oscillator ranges: 2-2.2, 2.2-2.6, 2.4-3.5, 3.5-4.8, 4.8-6.6 and 5.6-6.5MHz, and 3 RF PA plug-in coils: 2-2.9, 2.9-5 and 5-12MHz.

Crystal controlled: Plug-in socket fitted on the front panel.

Range: 250-300 miles, depending on conditions.

Aerial: 110ft wire aerial supported on two 12ft mast.

RF power output: 4-6W.

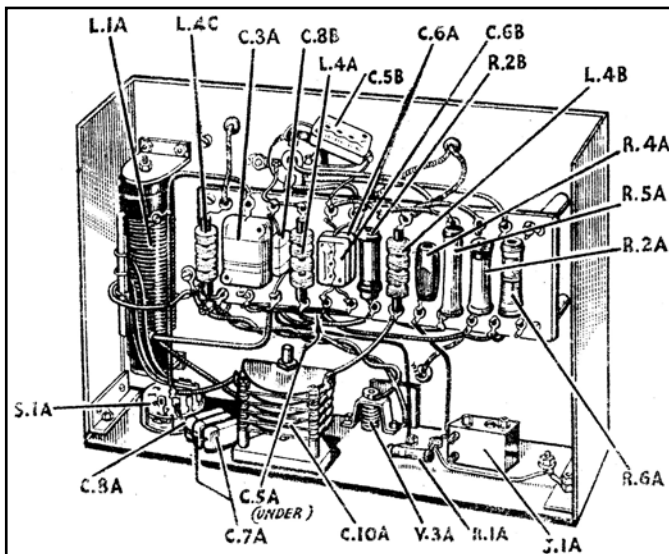
Power Supply: 12V accumulator providing 500V HT.

Consumption: Stand-by 1A, key-up 4.9A, key down 7.1A.

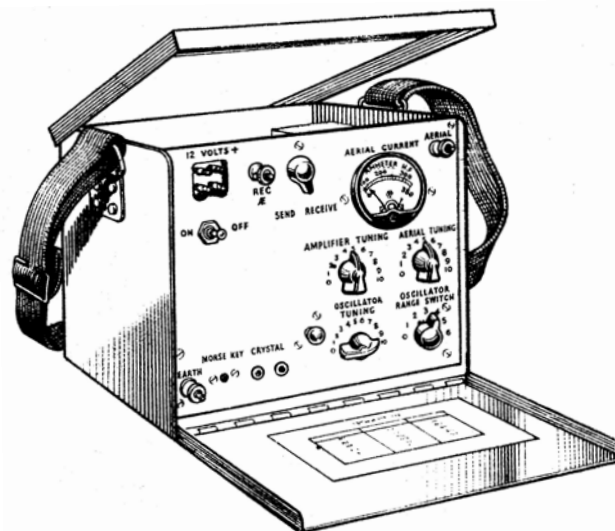
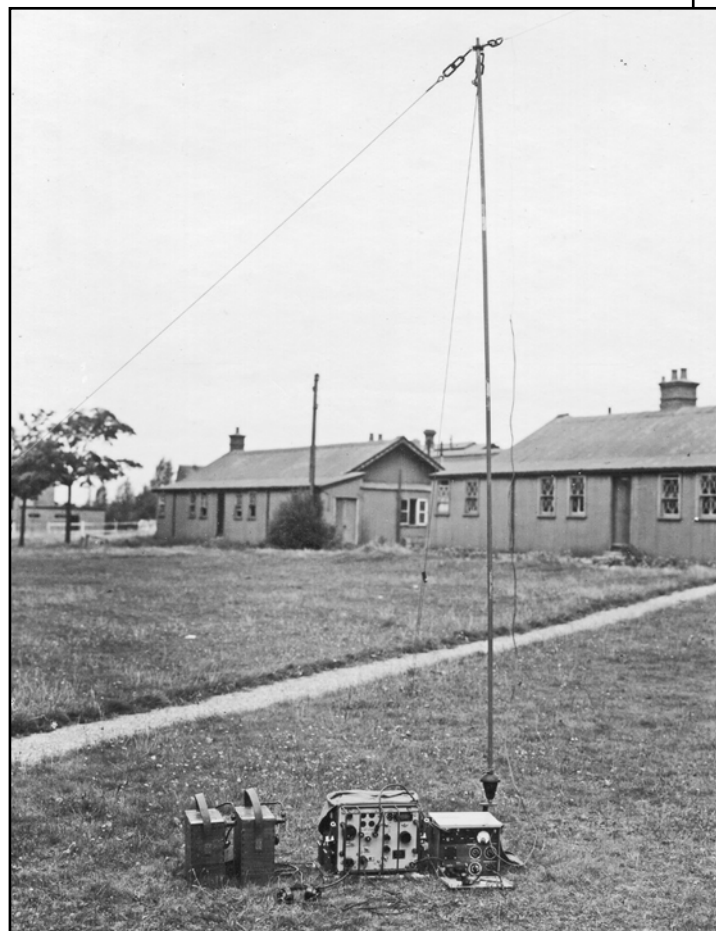
Weight: 23lb.

Size (inches): height 8 ¾, length 9 ½, width 11.

Valves: 6V6 crystal oscillator, ATS25 RF power amplifier, the latter operating as a frequency doubler above 6.5MHz..



Bottom chassis view of Sender 5 G (modified). Taking into account that there were no mounting holes of e.g. the former rectifier valve, a new chassis was made.



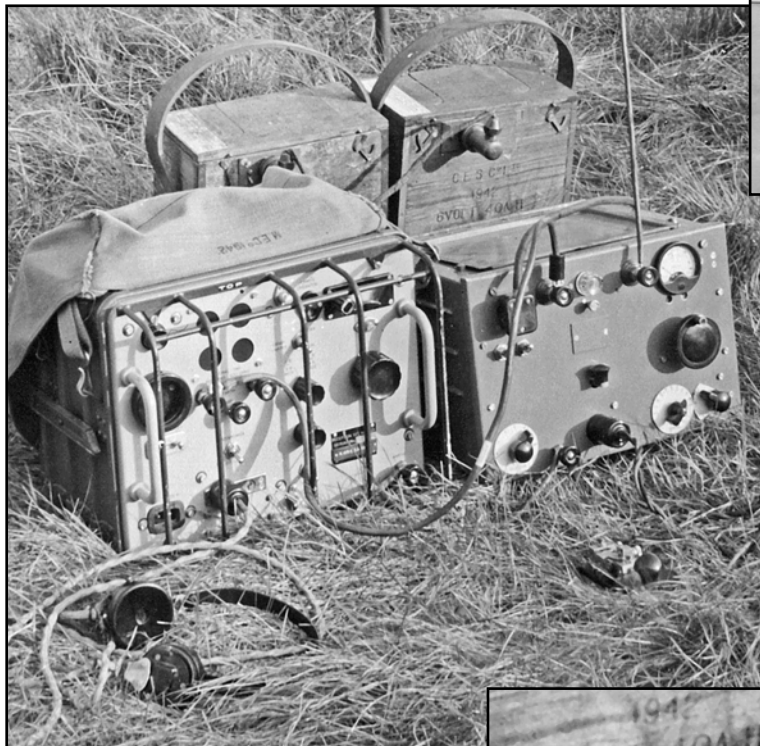
Line drawing showing of what is believed the production version of the Wireless Sender 5 G (modified). The original 2-pt socket was replaced by a standard Army 4-pt socket in addition to a new Paxolin front panel.

Ground station range trials with a Wireless Sender 5 G (modified) and a R109A (Experimental s/n 1). Note one of the 12ft support masts of the wire Aerial 110-ft No. 1 (left).

Wireless Sender X66

Even before the first operational use of the modified Royal Navy 5 G transmitter it was made clear that further supplies could no longer be relied upon. In late 1942 development commenced at SRDE for a set with similar features to meet the growing and urgent demand for rear link communication at prospective airborne forces operations. This eventually became Wireless Sender No. 76, via development model No. X66.

Photograph taken at SRDE of the development model Wireless Sender No. X 66 (right).

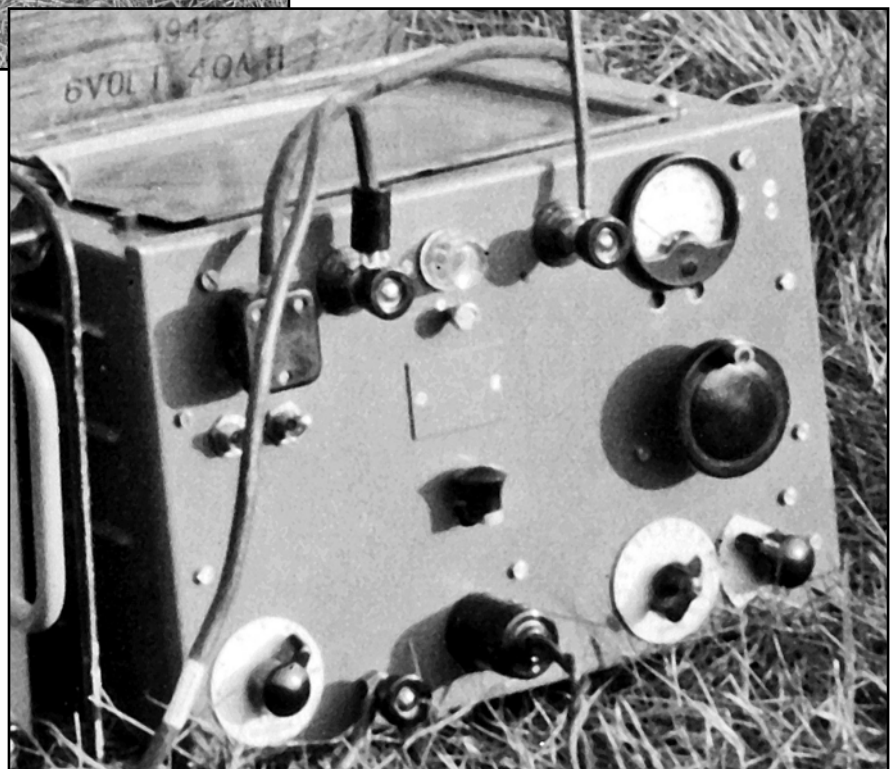


Rear link communication trials with an experimental Wireless Sender No. X66 and prototype Reception Set R109A. The latter embodied a modification replacing AVC with RF gain control for CW reception (left).

The Morse key (in front on the grass) was a Key and Plug Assembly No. 2B.

Close up view of Wireless Sender No. X66. The electrical and mechanical parts of this transmitter evolved into the Wireless Sender No. 76. This experimental trial model did not have the added protective frame (right).

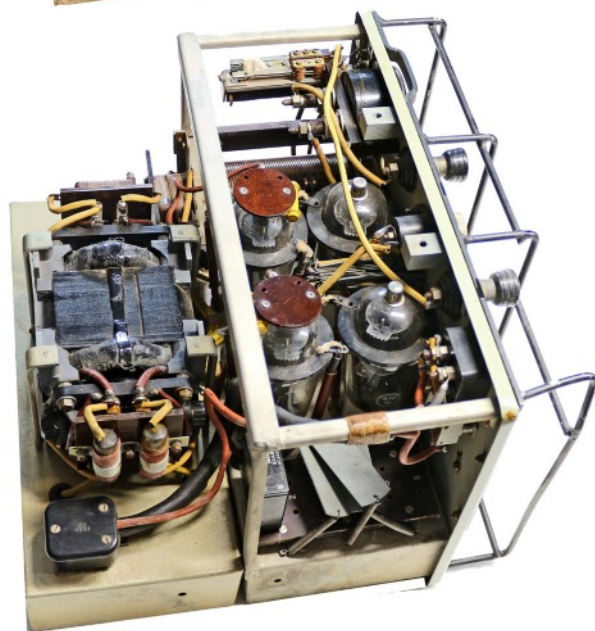
The built-in Morse key was omitted in the later production model of the No. 76 Set. An external Key and Plug Assembly No. 9A became standard issue (below).



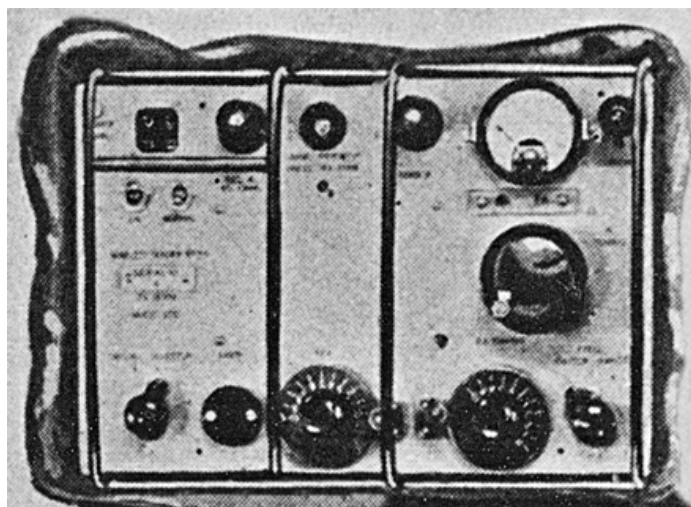
Wireless Sender No. 76



WS No. 76 in 'Case Carrying No. 16'.



Internal top chassis view of Wireless Sender No. 76 with its metal enclosure detached. The associated Power Supply No. 18 (left) was a separate unit which could be replaced by a Supply Unit Rectifier No. 14. There is no evidence that these AC powered units were ever used in operational service. Note two spare valves.



This was believed a prototype trial model of Wireless Sender No. 76 with serial No. 4. The Morse key socket replaced the earth terminal, here fitted top right. The function of the control at the left hand side of the P.A. tuning is unknown. The protective frame differs from the production version, though the holes for that can be spotted.



Production version of Wireless Sender No. 76. Comprehensive details can be found in WftW Volume 1.

DATA SUMMARY Wireless Sender No. 76

Purpose: Transmitter for rear link communication.

System: Morse CW only.

Frequency coverage: 2-12 MHz in 3 switched ranges: 2-3.5, 3.5-6 and 6-12MHz.

Crystal control: 6 crystals, selected by a switch.

Range: 250-300 miles, depending on conditions.

Aerial: 110ft wire aerial supported on two 12ft masts.

RF power output: 9W.

Power Supply: 12V accumulator providing 500V HT.

Consumption: Stand-by 1A, key-up 3.2A, key down 8.1A.

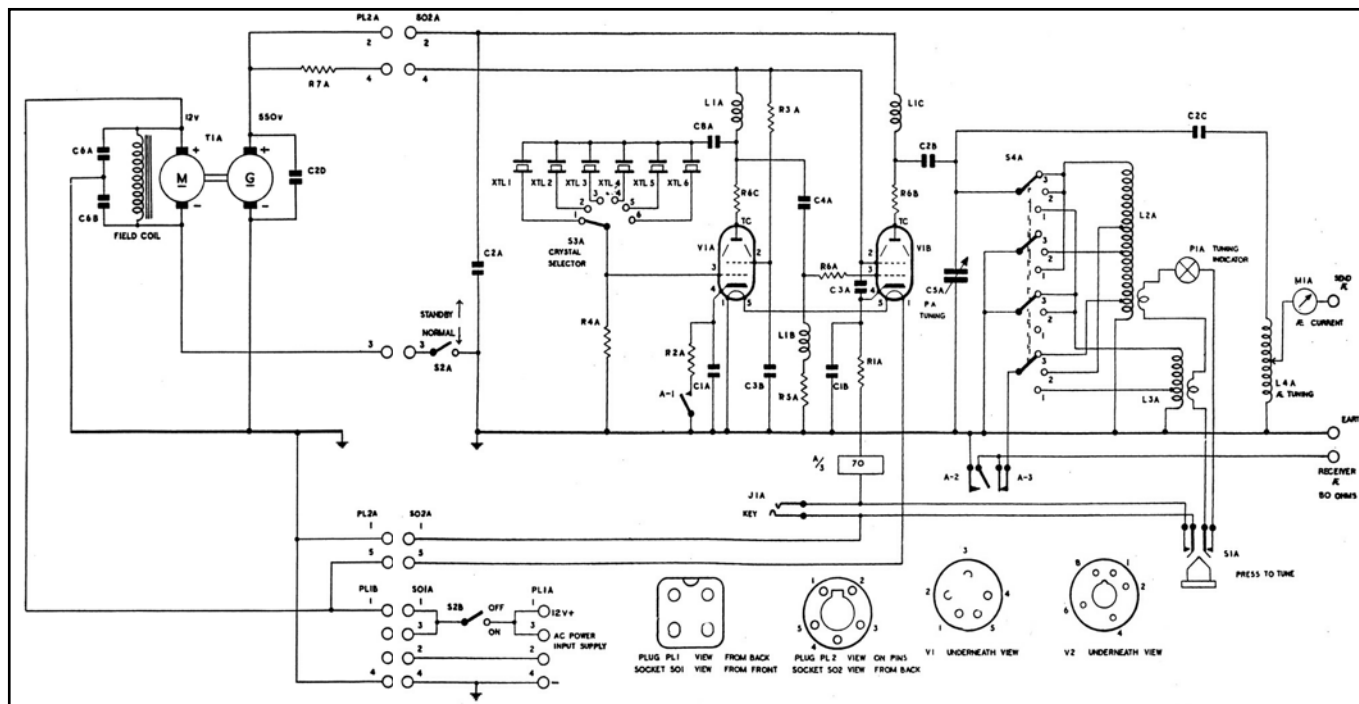
Weight: 30lb.

Size (inches): height 8 ¼, length 12, width 12 ¼.

Valves: ATS25 crystal oscillator, ATS25 RF power amplifier, the latter operating as frequency doubler above 6.5MHz.

References

- Photographs courtesy Royal Signals Museum, Blandford Forum, U.K.
- Echoes from Arnhem, Lewis Golden, 1984, William Kimber, isbn 9780718305215.
- Wireless for the Warrior, Vol. 1, Chapter WS 76, L.Meulstee, 1995, isbn 1898805 08 3.
- Wireless for the Warrior, Compendium 7, Key and Plug Assemblies, L.Meulstee, June 2014, isbn 9789081927161.
- Wireless Sender type 5 G (Modified), Working instructions, SRDE Pamphlet No. 366A, March 1943.
- Wireless Station Admiralty 5G in Hand-cart Wireless No. 1, SRDE Pamphlet No. 414A, June 1943.
- Rear link glider station - Jungle station. (Wireless Sender 5 G Modified and Reception Set R109 in truck 5 cwt, f.w.d. Airborne), SRDE Pamphlet 368A, n.d.
- Rear link parachute station, Wireless Sender 5 G modified & Reception Set R109C and Generator Pedal 70 watt. Packing Instructions Container Type F, SRDE Pamphlet 427A, n.d.
- Animal Pack Wireless Station No. 76/R109 and Wireless Station Adm 5G/R109, Fitting and loading instructions, ZA25010, WO 935, July 1944.
- Provisional packing instructions for Airborne Signal Equipment, SRDE Provisional Pamphlet No. 588A, Sep. 1945.
- Wireless Sender No. 76, Working instructions, ZA22702, WO Code Nr. 1049, Feb. 1944.
- EMER's Telecommunications D450-D459, Wireless Sender No. 76, Nov. 1944.
- EMER's Telecommunications D500-D504, Sender, Admiralty 5 G (Modified), Jul. 1944.

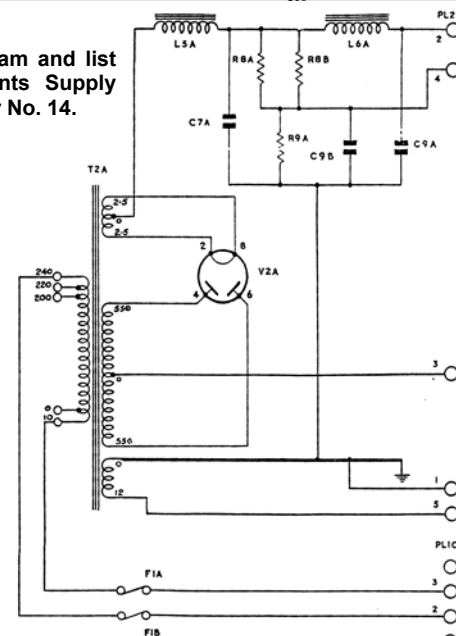


Circuit diagram of Wireless Sender No. 76 with associated 12V DC Power Supply No. 18.

Component	Symbol	Value and Rating	Function
Condensers	*C1A	0.05uF 600 V. D.C. working	V1A bias res. bypass.
	*C1B	0.05uF 600 V. D.C. working	V1B bias res. bypass.
	C2A	0.01uF 1000 V. D.C. working	V1B anode decoupling.
	C2B	0.01uF 1000 V. D.C. working	V1B anode coupling.
	C2C	0.01uF 1000 V. D.C. working	Output coupling.
	C3A	0.002uF 600 V. D.C. working	V1B screen decoupling.
	C3B	0.002uF 600 V. D.C. working	V1A screen decoupling.
	C4A	0.0002uF 600 V. D.C. working	V1A-V1B coupling.
	C5A	160uuF max.	Amp. tuning.
	C8A	0.002uF 600 V. D.C. working (mica)	Crystal coupling.
Var. Condenser			
Condenser			
Jack	J1A	Jacks Microphone No. 2	Key jack.
Inductances	L1A	1500 m H.	V1A anode choke.
	L1B	1500 m H.	V1B grid choke.
	L1C	1500 m H.	V1B anode choke.
	L2A		Amp. tuning, Range 2 and 3.
Meter	L3A		Amp. tuning, Range 1.
	L4A	65uH.	Aerial coupling.
	M1A	0-500 mA R.F.	Aerial current meter.
	P1A	6 V 0.06A (Bulb 6 V.J.)	Tuning indicator.
Plug	PL1A	4 Pt. No. 7	External power input.
Resistances	†R1A	220 ohms 2 watt	V1B cathode bias.
	†R2A	470 ohms 2 watt	V1A cathode bias.
	†R3A	47000 ohms 2 watt	V1A screen volts dropper.
	R4A	47000 ohms 1 watt	V1A grid leak.
Relay	R5A	22000 ohms 1 watt	V1B grid leak.
	R6A	47 ohms 1 watt	V1B grid stopper.
	R6B	47 ohms 1 watt	V1B anode stopper.
	R6C	47 ohms 1 watt	V1A anode stopper.
Relay	RELIA	75 ohm coil; 2 make, 1 break	Keying relay.
Switches	S1A	Key 228	Press to tune.
	S2A	S.p., on/off	Normal/standby.
	S2B	S.p., on/off	Power on/off.
	S3A	S.p., 6-way rotary	Crystal selector.
Sockets	S4A	4-pole, 3-way	Frequency range switch.
	S01A	4 pt. No. 7	Input to power unit.
Valves	S02A	5 pt.	Power input to sender.
	V1A	A.T.S. 25	Oscillator.
Crystals	V1B	A.T.S. 25	Amplifier.
	X1A-F		Frequency control.

List of components Wireless Sender No. 76 (above) and Power Supply Unit No. 18 (right).

Circuit diagram and list of components Supply Unit Rectifier No. 14.



Supply Unit Rectifier No. 14 (ZA 21774)

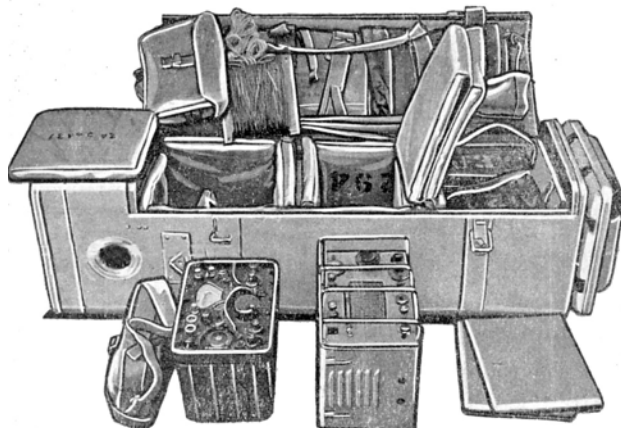
Component	Symbol	Value and Rating	Function
Condensers	C7A	2uF 800 V. D.C. working	H.T. smoothing.
Inductances	L5A	1 H 200 mA D.C.	H.T. smoothing.
Fuses	F1A	Slydlok 5A	A.C. input fuses.
	F1B	Slydlok 5A	
Plugs	PL1C	4 pt. No. 7	Input plug.
	PL2B	5 pt.	Output plug.
Resistances	R1B	220 ohms 2 watt	Additional bias.
	R8A	10,000 ohms 10 watt	Volts dropper.
	R9A	100,000 ohms 20 watt	Bleeder.
Transformer	T2A	550-0-550 V. 12 V. 2.5-0-2.5 V.	Power transformer.
Valve	V2A	5U4G	Rectifier.

Power Supply Unit No. 18 (ZA 21775)

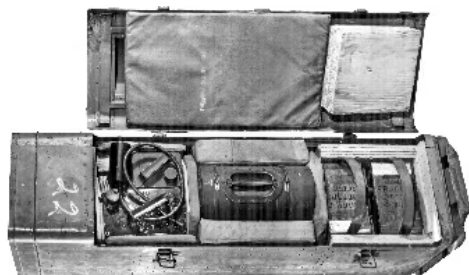
Component	Symbol	Value and Rating	Function
Condensers	C2D	0.01uF 1000 V. D.C. working	H.T. suppression rotary trans.
	†C6A	0.01uF 350 V. D.C. (or higher) working	L.T. suppression rotary trans.
	†C6B	0.01uF 350 V. D.C. (or higher) working	
Plugs	PL1B	4 pt. No. 7	Input.
	PL2A	5 pt.	Output.
Resistance	R7A	3000 ohms 10 watt	Volts dropper.
Rotary Transformer	T1A	12/500 V. D.C.	D.C. volts converter.

WS 76/R209 station in Type 'F' container and Parachutist Kitbag.

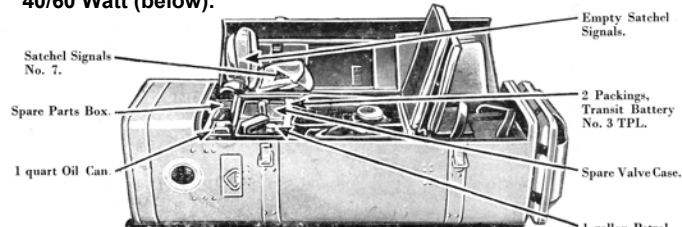
'Wireless Station No. 76/R209 Parachute' in Container Type 'F'. (1945). This rigid metal container was especially designed to house signal equipment; when packed the total weight should not have exceeded 250lbs. Shown below was a complete minimum working station with two 6V 40Ah batteries at the bottom, the WS 76 and R209 in two separate positions above, all thoroughly padded. Wireless sets were packed so that the initial impact tended to force the valves, vibrators, etc. into the holder.



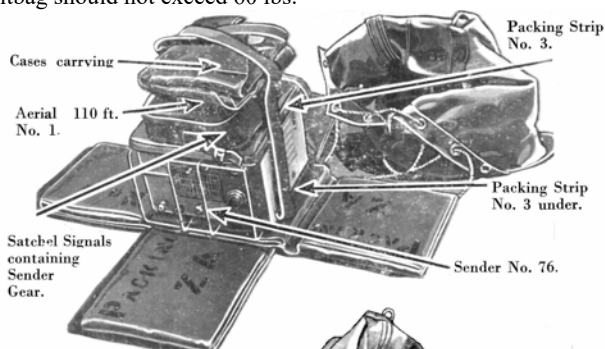
WS No. 76 and R209 plus two 6V 40Ah batteries and station accessories in the first container.



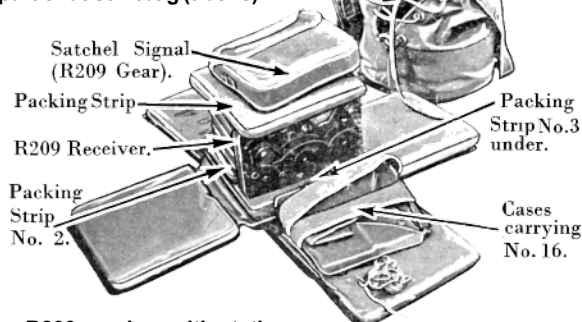
A second 'F' Type container was loaded with two 6V 40Ah batteries and a Charging Set Lightweight 80 Watt (above), or in the projected (but never materialised) Charging Set Lightweight 40/60 Watt (below).



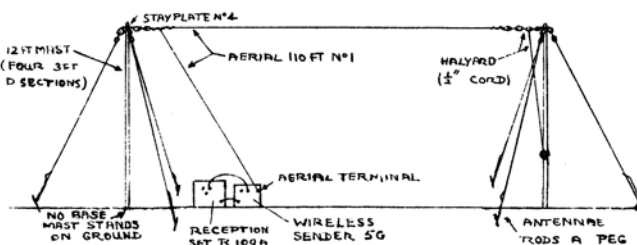
A WS 76/R209 rear link parachutist kitbag station was carried in four loads: Transmitter, receiver and two 6V 40Ah batteries, along with accessories. The Kitbag Parachutist (also known as leg bag) was similar to an enlarged Army kitbag, but had a laced side and provided with leg straps. The all-in weight of the packed kitbag should not exceed 60 lbs.



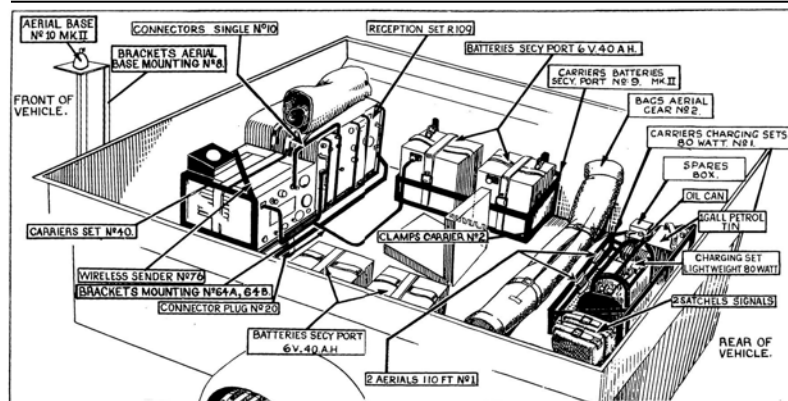
Wireless Sender No. 76 with 110ft wire aerial and folded Case Carrying No. 16 packed in parachutist kitbag (above).



R209 receiver with station accessories packed in parachutist kitbag (above).



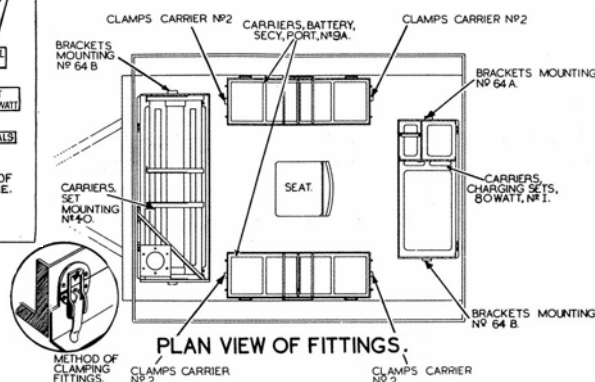
Wire Aerial 110-ft No. 1 was exclusively used with Adm 5 G transmitter and Wireless Sender No. 76 rear link station. It was erected between two 12-ft masts.



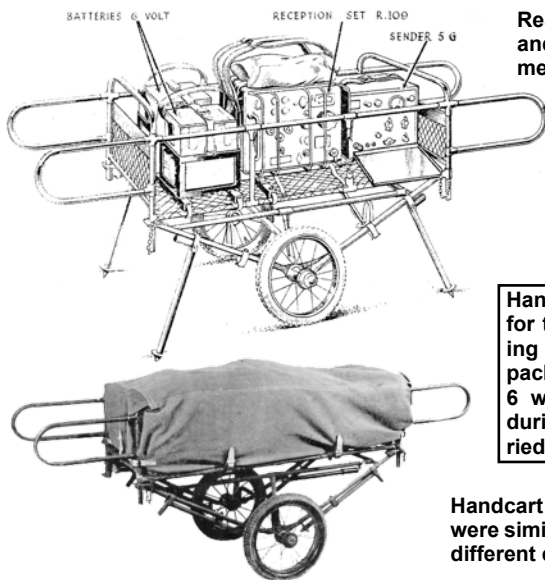
Fitted in an airborne glider trailer 10-cwt. was rear link station comprising Wireless Sender No. 76 and Reception Set R109 with Charging Set Lightweight 80 Watt.

WS 76/R109 station in Trailer 10-cwt.

Wireless Sender No. 76 and R109 were placed in a 'Carriers Set Mounting No. 40' (below).

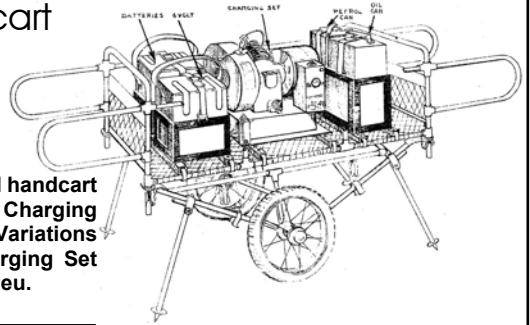


Wireless Station Adm 5 G (mod)/R109 in Handcart



Rear link Adm 5 G (modified) and R109A wireless equipment in the first handcart (left).

Rear link station second handcart with accumulators and Charging Set 300W Mk.I (right). Variations were noted with a Charging Set Lightweight 80 Watt in lieu.

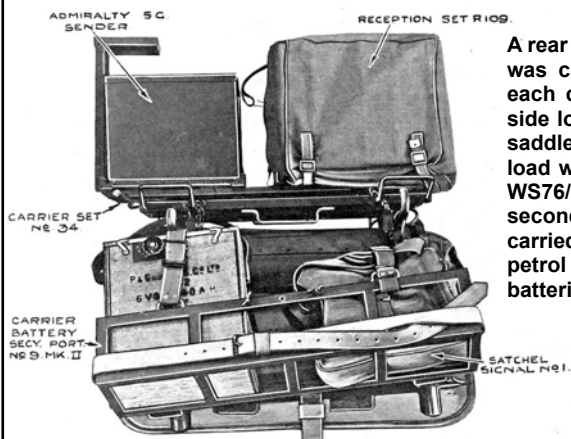


Handcart No. 1 was provided primarily for transport of wireless equipment during beach landings. The equipment was packed in waterproof bags No. 8 and No. 6 which rendered it immersion proof during the landing. The station was carried in two handcarts.



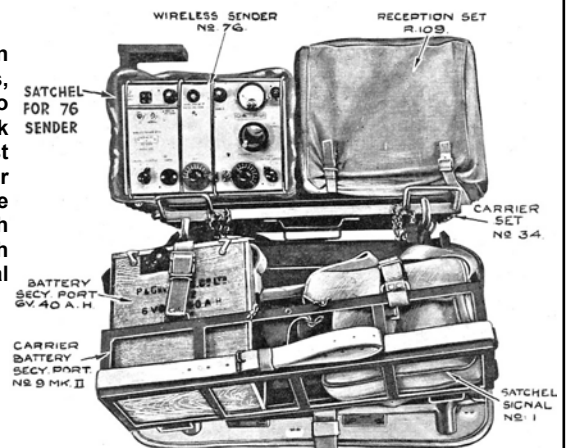
Handcart No. 1 Mk.IV and Mk. 5 (right) versions were similar to the Mk.III (left), apart from having different carrying handles, wheels and tyres.

Adm 5 G (mod)/R109 and WS 76/R109 animal pack stations.



Adm 5 G/R109 animal pack station.

A rear link animal pack station was carried by two animals, each carrying a top and two side loads on an animal pack saddle. Shown here is the first load with a 5G (mod)/R109 or WS76/R109. Not shown is the second animal pack which carried a charging set with petrol and oil, and additional batteries.



WS No. 76/R109 animal pack station.

Adm 5 G (mod)/R109 station in Truck 5-cwt.

The positions of equipment in a rear link glider and jungle station fitted in a Truck 5-cwt 4x4, airborne are shown left and below. Unnecessary fixtures to the vehicle were removed in order to reduce weight: the four lifting handles, two outer foot rests behind the front wings, the two rear bumpers and the front bumper was shortened to the width of the chassis supports.



The station could only be used at a halt or stationary for erecting the Aerial 110-ft No. 1. It had therefore no rod aerial base attached on the battery rack at the rear of the vehicle.

