TRD Country of origin: England

DATA SUMMARY

Organisation: Auxiliary Units.

Design/Manufacturer: Auxunits (Signals) workshops, Bachelor's Hall, Hundon. (Coleshill after 1942).

Year of Introduction: 1941.

Purpose: Auxiliary Units Wireless Network. (Special Duties Branch).

Receiver:
Circuit features: Untuned buffer, superreg. detector, AF amplifier.
Frequency coverage: 48-65MHz.
Valves: EF50, EF39, 6C5.

Transmitter:
Circuit features: Power oscillator, Heising modulator, microphone amplifier. Amplitude modulation.
Frequency coverage: 48-65MHz.
Valves: TV03-10, 6V6 or 6F6, 6C7.

Aerial: Dipole. Belling & Lee 80Ω flat twin feeder embedded in walls or trees.

Power Supply: Powerpack, made by Masteradio, Watford. HT rectifier OZ4A (in some cases a synchro-nous vibrator) providing 250V HT. Powered by a 6V 85Ah accumulator.

Size (cm): Height 23.5, Length 24, Width 38.

Accessories: Telephone handset or RAF plotters head-phone and chest microphone assembly, aerial.

The Savage sets had a conventional design with a VHF Power Oscil-lator using a TV-03-10 double-triode valve in the transmitter RF sec-tion. Heising modulation was employed using a 6L6G tetrode and a L63 triode valve as speech amplifier. The carbon microphone input was fed to this stage via a transformer.
The receiver had a self-quenched super-regenerative detector and an AF output stage. both using an L63 valve. The AF output was trans-former coupled to the handset earpiece. The set was in two boxes: the transmitter-receiver unit and power supply unit. The 'Savage' sets appeared not to be well received in field due to frequent breakdowns.

This Supplement chapter is a follow up replacing the 'TRD' section in the *'Great Britain'* chapter of WftW Volume 4.

REMARKS

In view of new information which came available after the publica-tion of WftW Volume 4 in 2004, it was felt that a full revision of the TRD chapter would be in place, particularly rectifying the in-correct repeated information on the assumed 'secure' communica-tion feature of the TRD. I am very grateful to Malcolm Atkin who very kindly amended and enhanced the original text!

Auxiliary Units.

The Auxiliary Units were formed amidst the threat of a German inva-sion in mid-1940 and were essentially a coastal stay-behind organisa-tion of the War Office, with fighting patrols of the operational wing based on the Home Guard. The civilian intelligence wing SDB (Spe-cial Duties Branch) was stood-down in July 1944, with the operational wing continuing until November 1944. When first founded, the Spe-cial Duties Branch had no wireless capability, relying instead on a 'grapevine telegraph' of runners inherited from the Home Defense Scheme of SIS. It needed a wireless set of relatively short range that could be used by operators with only minimal training and therefore looked towards a system that used voice transmission rather than Morse code.

The Bryan Savage set.

The first set was designed by Captain (later Major) John Hills G2AW, on the basis of research carried out pre-war at Cambridge University by Professor Wilfrid Lewis, by Stanley Lewer (G6LJ), for his WS17 set, and by Section D of the Secret Intelligence Service (SIS aka MI6). It was manufactured from November 1940 by W Bryan Savage Ltd and is therefore known today as the 'Savage set'. Forty to fifty of these 'Savage' sets were reportedly produced.

References:

- Photograph of TRD replica and excellent reworked, corrected, and enhanced text of WftW Vol.4 by Malcolm Atkin, UK.

Savage rebuilt to TRD.

In early 1941, the Savage set was rebuilt into a single metal box as the 'TRD' (probably standing for 'Transmitter-Receiver-Dabbs'). Later variants were named the TRF and TRM. The box contained three chassis bolted together to the front panel: transmitter, vibrator HT unit and receiver. Like the 'Savage' sets a standard GPO telephone handset, or a RAF Plotters headphone and chest microphone was used. Sometimes AF output was via a loudspeaker.
The TRD was designed under the lead of Captain Ken Ward but the technical work was undertaken by a number of former amateur radio hams. Jack Millie (GM8MQ) and Bill Bartholomew (G8CK) designed the transmitter; Tom Higgins and Ron Dabbs (G2RD) designed the receiver; Les Parnell (G8PP), Jimmy McNab (GM2CQ) and John Mackie designed the power supply. It was powered from a 6V accumulator battery and operated at 48 – 65 MHz. Some sources mention that the controls on sets used by Out Stations were minimal with the transmitter pre-set for a fixed frequency.

TRD circuit design was not revolutionary.

The modern legend that the TRD wireless was revolutionary in design and undetectable is not supported by the accounts of those involved. Ken Ward clearly stated in a 1999 interview that the design was essentially that of Hills's Savage set.
The impetus for change had come from the need to rebuild the Savage set so that it was easier for the operators to use and for the technicians to service, rather than from any requirement from higher authority to add new security features. One improvement isolated the receiver from the radiation that it caused (and thereby likely to give away its position to the enemy) by the simple means of using an untuned RF amplifier acting as buffer. Other circuit changes were the use of different valves. Security was based not upon any radical new design but more simply upon the short range of the set, and the relatively rare use of the VHF frequencies employed which might therefore escape enemy attention. (Only two types of German DF sets were capable to operate on the TRD frequencies, available in a very limited quantity). By June 1944 the frequencies had been rationalised to 60 or 65 MHz and with an inner circle of IN Stations (control stations) using 48MHz or 52MHz. The normal range was up to 30-60 miles, fully depending by line of sight but the signal could, on occasion under extreme conditions, be picked up at up to 500 miles. A duplex set functioning as a repeater station, (also known as 'relay' or 'talk-through'), was developed for use where the distance of a coastal Out Station and IN (Control) Station at an Area Headquarters was too great or high hills intervened. Approximately 250 TRD, 28 TRM and 36 TRF sets were ultimately produced.

Its effectiveness as a clandestine set was limited by its reliance on fixed frequencies and a dipole aerial which could not be re-located without the specialist assistance of Royal Signals technicians. If the Control Station (usually sited at, or near, an army HQ), had to relocate then communication might be lost to one or more Out Stations mostly because the loss of line of sight. The War Office had no experience of organising secret stay behind organisations (this being the responsibility of SIS) and the network was not likely to survive more than a few days following any invasion.

No. 17 Sets.

From 1943, 200 now-obsolete Wireless Sets No. 17 were issued to the Special Duties Branch. They were likely used for training and for communications to army HQs. The Wireless Set No. 17, designed by Stanley Lewer (G6LJ) in 1939, was originally developed for short range communication of up to 15 miles between Searchlight and Anti-Aircraft batteries. It operated in the frequency band 44-61MHz on AM R/T. The set was powered by a 2V accumulator and a 120V HT battery. Due to its simple transceiver design, lacking a receiver buffer and with a self-quenched circuit, the set could be intercepted (even on receive!) at a considerable distance and might interfere with the navigation systems of low-flying aircraft. It must be noted that no TRD sets or technical documentation have survived, and all examples of this interesting set were apparently destroyed the end of World War II by SIS.

Wireless Set No. 17.

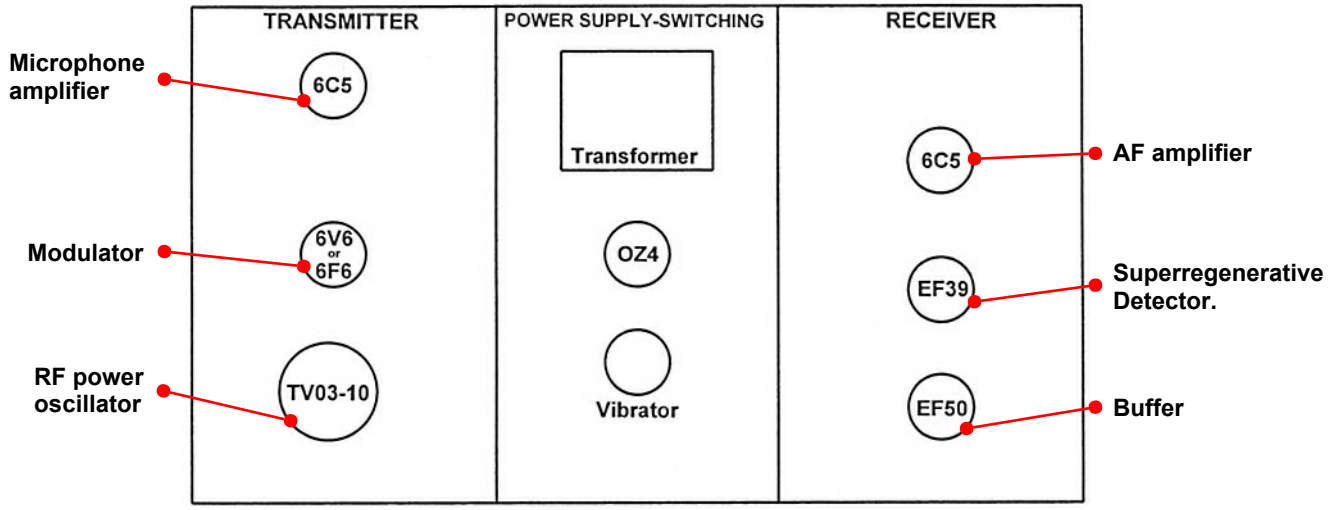
This was not to suppress any supposed unique quality of the TRD but was part of the general recall of all clandestine sets by SIS for their destruction. Being located within the UK, they were easier to destroy on a comprehensive basis than the other sets of SIS or SOE that were scattered across Europe. Technical information for this section is based on memories of members of the Auxunits Special Duties Branch and designers of the set. The limitation of memories of so long ago may lead to some inaccuracies, showing how quickly our history can be lost!
The inherent unsuitability of the TRD and No. 17 Sets for clandestine warfare begs the question of the purpose of the SDB network. It's rigid organisation reflects the inexperience of the War Office and the SDB would have been of only limited usefulness during an invasion. The network was liable to be broken as soon as the IN (control) stations were destroyed or had to move location. Until early 1942 they were located in surface Nissen huts and just 15 miles from the coast, based at, or near, army HQs. Any relocation would require a relocation of the aerials at the Out Stations of the civilian cells - then presumed to be behind enemy lines and inaccessible. There was also no means of communication with the fighting patrols of the Operational wing of the Auxiliary Units. This may have been a failed experiment in using short range VHF and voice transmission, but the wireless stations would at least have provided a diversion to the existence of the true resistance organisation organized by SIS and was cheap to maintain. The main purpose of the SDB may well have been unconnected to the wireless network in providing a core of civilian intelligence agents who could monitor the activities of their communities and any 'loose talk' emanating from local military bases.

The Museum of the British Resistance Organisation (BRO) located on the Parham Aifield Museum, Parham, Woodbridge, Suffolk, IP13 9AF, UK, would like to invite anyone finding more details of the TRD to contact them.

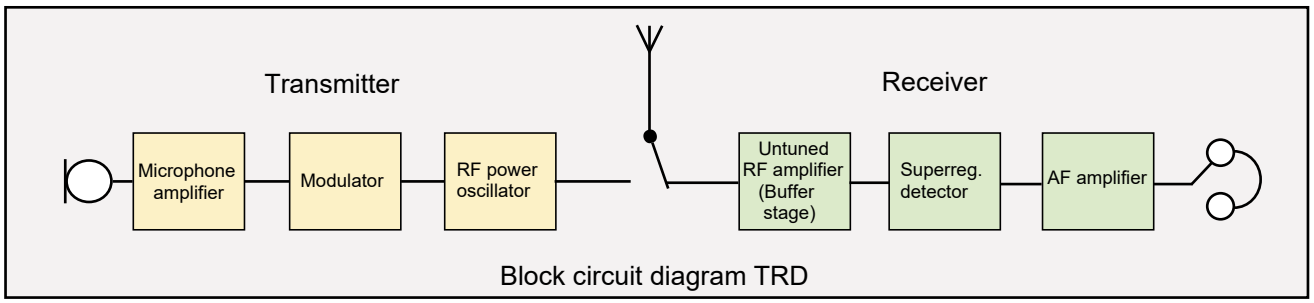
Highly recommended for further reading on all aspects of the Auxiliary Units (including interesting chapters on the Signal Sections) are '*Churchill's Underground Army'*, by J. Warwicker (2008) and '*Fighting Nazi Occupation'* by Malcolm Atkin (2015).

Associated Publications:

- *'With Britain in Mortal Danger, Britain's Most Secret Army of WWII'*, J. Warwicker, 2002, Cerberus Publishing Limited. ISBN 1 84145 112 6.
- *'Churchill's Underground Army: A History of the Auxiliary Units in World War II'*, J. Warwicker, 2008, Frontline Books, London. ISBN 978 1 84832 515 9.
- '*Auxiliary Units Signals*', Arthur Gabbitas, published in David Weller's website 'AUXUNIT NEWS' (Personal Stories - *Radio Hams*) at URL http://www.auxunit.org.uk
- '*Royal Signals in the British Resistance'*, Richard Aixill, *Mercury*, No. 11, July 1995, pp.40-41.
- '*A Portable Duplex Radio-Telephone*', W. B. Lewis and J. Milner. *The Wireless Engineer*, Sep. 1936, pp.475-482.
- *'Fighting Nazi Occupation'*, M. Atkin, 2015, Pen & Sword Limited, Barnsley. ISBN 978 1 47383 377 7.
- '*Die deutschen Funkpeil-und Horch-Verfahren bis 1945',* Fritz Trenkle, 1982, AEG-Telefunken Aktiengeselschaft, Ulm.



Top chassis view of a TRD built late 1941, sketched by J.Millie, a member of the design team.



Block circuit diagram TRD