MAIN EQUIPMENT USED AT 547 SIG TP
and
NVA/VC COMMUNICATIONS EQUIPMENT

SET ROOM

R5223 HF Receiver

The R5223 is an Australian made communications receiver, manufactured by TCA. (Telecommunication Company of Australia, a subsidiary of Philips). It was designed and made in Adelaide in 1961 for the Australian Army and called the Reception Set R5223. The receiver covers 1.5mcs to 30.5mcs in 29 bands, each band being 1mc wide and centered on the frequencies 2 to 30mcs. It is a 13 valve super heterodyne receiver using double conversion (the 2 lower bands are single conversion only), and is suitable for CW, MCW, and VOICE. It is in an aluminium watertight case, and even the speaker is waterproof. Flanges can be added to the side of the case to rack mount the unit. The power requirements can be selected to be 240VAC, 110VAC, or 12VDC.
The R5223 receiver was not suitable for operations with 547 Sig Tp. There were numerous failures and they were eventually replaced by the Collins R390.
Collins R390 HF Receiver

The Collins R390/391 Receiver replaced the R5223 and was used extensively by the Troop during the Vietnam deployment.

Figure 3: Collins R390

Figure 4: Collins R390
5. Technical Characteristics

Type of circuit

Triple-conversion superheterodyne on eight lowest frequency bands; double-conversion superheterodyne on all other bands.

Frequency range

0.5 to 32 mc.

Types of signals received

A1, cw; A2, mcw; A3, voice; A9, single sideband; F1, frequency-shift keying.

Type of tuning

Continuous; frequency read directly on counter-type indicator.

Method of calibration

Built-in crystal-controlled.

Calibration points

Every 100 kc.

Audio power output:

- 600-ohm unbalanced line: 500 mw, minimum.
- 600-ohm balanced line: 10 mw, minimum.
- Headphones: 1 mw, minimum.

If selectivity

100 cps to 15 kc bandwidth in six steps.

Intermediate frequencies:

- First variable if (used on eight lowest frequency bands): 17.5 to 25 mc.
- Second variable if (used on all bands): 2.5 to 2 mc on lowest band; 3 to 2 mc on all other bands.
- Third (fixed) if: 455 kc.

Power source

115/230 volts ac ±10%, 48 to 62 cps.

Power input:

115/230 volts ac: 225 watts total; 140 watts with OVENS switch turned to OFF.

Number of tubes

26 (including current-regulator tube RT510).

Antennas:

- Unbalanced: Straight-wire of random length or vehicular-mounted whip.
- Balanced: 125-ohm terminating impedance; matches 50- to 200-ohm balanced or unbalanced transmission lines by using adapters.

Temperature range

-40° C (-40° F) to 65° C (149° F).

Altitude

Up to 10,000 ft. above sea level.

Weight

75 lb.

Range of vfo

3.455 to 2.456 mc.
Racal RA217 HF Receiver

The RA217 were issued for the ARDF Kit, however, when additional spares became available some were installed in the Set Room.

![Racal RA217 HF Receiver](http://www.tuberadio.com/robinson/museum/RA217/)

**Figure 5: Racal RA217**

<table>
<thead>
<tr>
<th>Country: Great Britain (UK)</th>
<th>Manufacturer / Brand: Racal Engineering (Racal Instruments) Ltd., Bracknell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year: 1964</td>
<td>Type: Communication Receiver (also Amateur)</td>
</tr>
<tr>
<td>Semiconductors (the count is only for transistors)</td>
<td>Semiconductors present:</td>
</tr>
<tr>
<td>Principle: Superhet, double/triple conversion, ZF/IF 40000/2500 kHz</td>
<td></td>
</tr>
<tr>
<td>Wave bands: Broadcast plus more than 2 Short Wave bands.</td>
<td></td>
</tr>
<tr>
<td>Details:</td>
<td>Power type and voltage: Alternating Current supply (AC) / 100-125 / 200-250 Volt</td>
</tr>
<tr>
<td>Loudspeaker:</td>
<td>- For headphones or amp.</td>
</tr>
<tr>
<td>Power out:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>from Radiomuseum.org</td>
<td>Model: RA-217 - Racal Engineering Racal</td>
</tr>
<tr>
<td>Material: Metal case</td>
<td></td>
</tr>
<tr>
<td>Shape: Boatanchor (heavy military or commercial set).</td>
<td></td>
</tr>
<tr>
<td>Dimensions (WHD):</td>
<td>Dimensions: 330 x 160 x 330 mm / 13 x 7.1 x 13 inch</td>
</tr>
<tr>
<td></td>
<td>1000 - 3000 kHz, AM / USB/LSB, CW with BFO, mechanic digital readout (1 kHz and interpolation).</td>
</tr>
<tr>
<td>Notes:</td>
<td>Fully transistorized successor of the RA-17 using the &quot;Wodley-loop&quot; technique.</td>
</tr>
<tr>
<td></td>
<td>Standard bandwidths are 0.2 / 1 / 3 / 13 MHz.</td>
</tr>
<tr>
<td></td>
<td>IF outputs 1.6 MHz and 100 or 455 kHz.</td>
</tr>
<tr>
<td>Net weight (2.2 lb = 1 kg):</td>
<td>16 kg / 35 lb 3.9 oz (35.242 lb)</td>
</tr>
<tr>
<td>Mentioned in:</td>
<td>Racal Handbook, Rinus Jansen</td>
</tr>
<tr>
<td>Literature/Schematics (1):</td>
<td>Funkschau 1964, Heft 17, Seite 454</td>
</tr>
</tbody>
</table>

1 http://www.tuberadio.com/robinson/museum/RA217/
Receiver Radio RA-329

In 1968 the Troop also had two Receiver Radio RA-329 issued with the ARDF equipment².

The RA329 is an HF receiver covering the frequency range from 1 to 30 mhz. The receiver is a transistorised version of the RA17 receiver (which uses valves and shares the same architecture), being a triple conversion super heterodyne receiver, utilising the Wadley loop system. The RA329 has a mechanical digital frequency readout with 2 separate knobs for setting the frequency, one for kilohertz and another for megahertz. It receives AM, SSB, DSB, MCW, CW, and FSK pHM and FM. It has variable IF bandwidths of 13 khz, 3 khz, 1 khz, and 200 hz. It weighs 18 kg in the rack cabinet.

The receiver was made by RACAL Electronics, Bracknell, Berkshire, UK, between 1969 and 1972. This RA329 main unit consists of an RA217D receiver, an FSK and terminating unit called the MA323, and a 19" rack frame called the MA322.³

---

² AWM103 F38/71/22 Accounting Stocktakes Handover-Takeover 547 Sig Tp, 28 Aug 68.
³ http://www.tuberadio.com/robinson/museum/RA217/
⁴ Ibid.
R744A VHF Receiver (OA 1451/PRR)

The R744a was first noticed being used for VHF intercept in 1966. The July 1970 Stocktake listed the equipment as The Receiver Group OA 1451/PRR Qty 1. The OA1451 primarily consisted of R744A VHF Receiver.

![R744A VHF Receiver](http://www.radiomuseum.org/r/military_oa_1451prr_r744a.html)

**Figure 7: RA-7441A VHF Receiver**

### R-744A VHF Surveillance Receiver

**General Notes**

This small receiver was made by Arvin Industries for the US army during the early 1960s. Its dimensions are about 15 x 6 x 7 inches. Coverage is from 20 - 100MHz in one continuous range and it will receive AM, FM and CW modes. It uses sub miniature pentodes types 6611 x 7 and 6612 x 3. Each of the 3 x IF stages, the calibration and BFO oscillators, AM detector and audio stage are separately housed in 8 small cylindrical cans about 2” high and 3/4” in diameter with a 99A tube base. The set is operated either by internal batteries or an external 24V vehicle power supply. There is no internal speaker, necessitating the use of headphones.

A variation seen is the R744/(E3)-1 made by Mallory, which doesn’t have a bandspread knob. These sets were also used by the Australian Army, where the Contract Number under the makers name has been blacked out. There is also supposed to be a similar set covering 100 - 200 MHz. These sets were designed as surveillance receivers having continuously variable tuning to overcome the drawback that most field military sets were restricted to FM mode with only pre-set fixed frequencies at say 100kHz separation. The R744 was used in Vietnam and possibly other fields.

<table>
<thead>
<tr>
<th>Country: United States of America (USA)</th>
<th>Manufacturer / Brand: MILITARY U.S. (different makers for same model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year: ?</td>
<td>Type: Radio - or past WW2 tuner</td>
</tr>
<tr>
<td>Valves / Tubes: 13: 6612 6611 6611 6611 6612 6612 6611 6611 6611 6611 6611 6611 6611 6611</td>
<td></td>
</tr>
<tr>
<td>Principle: Superhet with RF-stage</td>
<td></td>
</tr>
<tr>
<td>Wave bands: VHF/UHF (see notes for details)</td>
<td></td>
</tr>
<tr>
<td>Details:</td>
<td></td>
</tr>
<tr>
<td>Power type and voltage: Batteries / addl. power jack / 1.45 &amp; 45 or 24 Volt</td>
<td></td>
</tr>
<tr>
<td>Loudspeaker: - For headphones or amp.</td>
<td></td>
</tr>
<tr>
<td>Power out:</td>
<td></td>
</tr>
<tr>
<td>from Radiomuseum.org: Model: OA-1451/PRR R744A - MILITARY U.S. different makers</td>
<td></td>
</tr>
<tr>
<td>Material: Metal case</td>
<td></td>
</tr>
<tr>
<td>Shape: Tabletop, Mantel/Midget/Compact up to 14” width, but not a Portable (See power data. Sometimes with handle but for mains only)</td>
<td></td>
</tr>
<tr>
<td>Dimensions (WHD): 14.5 x 6.5 x 5.5 inch / 368 x 165 x 140 mm</td>
<td></td>
</tr>
<tr>
<td>Notes: All mode (AM, FM, CW) military VHF surveillance receiver covering 20-100 MHz in one band. Designed by Mallory, but made under contract by others as well. Many valves are in sealed pull out modules and cannot be accessed directly.</td>
<td></td>
</tr>
<tr>
<td>Net weight (2.2 lb = 1 kg): 15 lb (15 lb 0 oz) / 6.810 kg</td>
<td></td>
</tr>
</tbody>
</table>

5 [http://www.radiomuseum.org/r/military_oa_1451prr_r744a.html](http://www.radiomuseum.org/r/military_oa_1451prr_r744a.html)
Reception Set R216

The unit had two Reception Sets R216 held in the Q store for intercept of Low Level (VHF) communications.⁶

Figure 8: Reception Set R216⁷

---

⁶ AWM103 F38/71/22 Accounting Stocktakes Handover-Takeover 547 Sig Tp, 28 Aug 68.
⁷ http://www.wftw.nl/rsets.html
Philips EL Tape Recorder


**Figure 9: Philips EL Tape Recorder**

<table>
<thead>
<tr>
<th>PRINCIPAL DATA (Subject to alteration without prior notice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operates on the four-track system.</td>
</tr>
<tr>
<td>All transistors: no warming-up time required.</td>
</tr>
<tr>
<td>Four speeds: 1/4&quot;, 1&quot;, 3/4&quot; and 7/8&quot; inches/sec.</td>
</tr>
<tr>
<td>Adjustable to mains voltages of 110, 127, 200-250 V, A.C. 50 c/s. (Can be adapted for 60 c/s by your dealer.)</td>
</tr>
<tr>
<td>The recorder is provided with a &quot;stereo&quot; output socket for the reproduction of pre-recorded stereo tapes, providing that a suitable pre-amplifier is connected to this socket. Also for &quot;dual-play&quot; and &quot;multiply&quot; purposes.</td>
</tr>
<tr>
<td>Mixing of microphone with Radio/Gramophone inputs.</td>
</tr>
<tr>
<td>Can be used as an amplifier for microphone and record player.</td>
</tr>
<tr>
<td>Suitable for long-play and double-play tape on 3 to 7 inch reels.</td>
</tr>
<tr>
<td>Maximum playing time: 4 x 8 hours.</td>
</tr>
<tr>
<td>Monitoring facilities during recording by means of headphones or via the built-in loudspeaker.</td>
</tr>
<tr>
<td>Tape pause button.</td>
</tr>
<tr>
<td>Connection for foot switch.</td>
</tr>
<tr>
<td>Meter type modulation level indicator.</td>
</tr>
<tr>
<td>Record safety interlock.</td>
</tr>
<tr>
<td>Frequency range at a speed of 17/8&quot; inch/sec.: 60-4,500 c/s ± 3 dB, 1 inch/sec.: 60-10,000 c/s ± 3 dB, 3/4&quot; inches/sec.: 60-13,000 c/s ± 3 dB, 7/8&quot; inches/sec.: 60-16,000 c/s ± 3 dB,</td>
</tr>
<tr>
<td>Built-in 2.5-W amplifier.</td>
</tr>
<tr>
<td>Automatic stopping at the end of the tape when in the record, playback, fast wind or fast rewind position.</td>
</tr>
<tr>
<td>Rapid winding in both directions: 1800 ft of tape in 180 seconds.</td>
</tr>
<tr>
<td>Power consumption: approx. 55 W.</td>
</tr>
<tr>
<td>Signal to noise ratio: better than 40 dB.</td>
</tr>
<tr>
<td>Three inputs: diode 0.02 megohm, 3 mV record player 0.5 megohm, 150 mV microphone 1000 ohms, 1 mV</td>
</tr>
<tr>
<td>Four outputs: diode 0.02 megohm, 1 V loudspeaker 3-7 ohms, 2.5 W headphones 1500 ohms, 200 mV stereo c. 300 ohms = c. 0.4 mV at 1 kς/</td>
</tr>
<tr>
<td>Dimensions: 16 1/2&quot; x 15 1/2&quot; x 8 1/4&quot;.</td>
</tr>
<tr>
<td>Weight: 28 lbs.</td>
</tr>
<tr>
<td>Tropicalized.</td>
</tr>
</tbody>
</table>

---

AN/PNH-4 Recorder Reproducer

The equipment list for 1968 shows Recorders AN/PNH-4 as being held.

Figure 10: Recorder, Reproducer Set AN/PNH-4 – Carry Case

Figure 11: Recorder, Reproducer Set AN/PNH-4


Ibid.


Ibid.
Nagra Tape Recorder

The Nagra was the main tape recorder used in the Set Room and Processing area.

Figure 12: Nagra tape recorder
Tape Speeds: 15, 7½ and 3⅛ ips, changed by easily accessible rotary switch. Reel Size: 7” dia. max. Equalization: Ampex and CCIR. Frequency Response: (Recording at level of −20 db): At 15 ips, ±1 db, 30–18,000 cps (±1.5 db, 30–16,000 cps). At 7½ ips, ±1 db, 40–15,000 cps (±1.5 db, 50–12,000 cps). 
Harmonic Distortion: 2% of 3rd harmonic; 0.5% of 2nd harmonic on record and playback. Signal-to-Noise Ratio: At least 70 db on playback at 15 and 7½ ips; mike preamp noise level, about −125 dbm. Wow and Flutter (DIN 45507 standard): ±0.08% or ±0.1% min. peak-to-peak at 15 ips; ±0.12% or ±0.15% min. peak-to-peak at 7½ ips. Absolute Speed Stability: ±0.1% at 15 and 7½ ips, factory adjusted. Speed Variation: ±0.1% or ±0.2% from beginning to end of 7” reel. Inputs: 50- or 200-ohm microphone; 100,000-ohm 0.5 to 10-volt line signal and 2,500-ohm 10 mV to 1-volt line signal for bridging. Output: Balanced line; 

with load not less than 600 ohms, 4.4 volts (±15 db). Monitoring output unbalanced, with load not less than 50 ohms (0.3 volt). Feeds balanced broadcast lines from normally recorded tape, or may be used as remote pickup amplifier to feed line. Controls: Record or Playback Mode Switch; Mike Level; Line Level and Playback combined. Size: Case, approx. 12 ½” w. x 8 ¾” d. x 4 ½” h; overall, approx. 14” w. x 9 ½” d. x 4 ½” h. Weight: Less batteries, 13 lbs. 13 oz.
ARDF

Racial RA217 HF Receiver

See Set Room above.

Akai X-V Tape Recorder

The Akai Tape Recorders were issued with the ARDF Kit.

![Akai X-V Tape Recorder](image)

**Figure 13: Akai X-V Tape Recorder**

**Description**

The Akai X-V features 4-track stereo/monaural recording/playback system, cross-field head, brushless motor, 7” reel capacity (with adaptor) and 8 hours HIFI recording with a 5” tape.

**Specifications**

- Tape speed: 15/16, 1-7/8, 3-3/4 and 7-1/2 lps
- Wow and flutter: less than 0.15% (7-1/2 lps)
- Frequency response: 40 to 20,000Hz (7-1/2 lps)
- Signal to noise ratio: 50dB (DC power), 45dB (AC power)
- Output power: 4 watts total
- Transistors: 30
- Dimensions: 280 x 130 x 300mm
- Weight: 5.5kg (without battery)
ARDF Communications - Ground

The RT-524s were contained in the ARDF Ground Control Console to communicate with all ARDF aircraft. The RT-524 was coupled with the Nestor KY-8 for voice security. The Collins 390 Receiver was used for target guidance.

**Figure 14: ARDF Ground Control Console**

RT-524 (AN/VRC46)

**Figure 15: RT-524**
Specifications

Receiver-transmitter, FM, 30-74.95MHz, 50 KHz spacing, 920 channels. Manual tuning version of RT-246/VRC with built-in loud-speaker. The RT-524/VRC is the major part of AN/VRC-12 vehicle radio station typically used in M151 Truck, Utility ¼-Ton, 4x4 Mutt Jeeps series of vehicles as well as in older Humvee's and tanks.

Operates from 24 VDC vehicle battery or power supply. Transmitter output power 8W (low) and 35W (high).

**RT-524/VRC Specifications:**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>30.00 to 75.95 MHz</td>
</tr>
<tr>
<td>Channel spacing</td>
<td>50 kHz</td>
</tr>
<tr>
<td>Number of Channels</td>
<td>920 Channels</td>
</tr>
<tr>
<td>Mode of Operation</td>
<td>Voice frequency modulated (FM)</td>
</tr>
<tr>
<td>Receiver stability</td>
<td>Crystal controlled, (+ 3.5 kHz of nominal frequency)</td>
</tr>
<tr>
<td>Receiver Sensitivity</td>
<td>0.5 V / for 10 dB (S+N+D)/(N+D) for 8.0 kHz deviation</td>
</tr>
<tr>
<td>Transmitter output power</td>
<td>35 W &quot;High Power&quot; and 8 Watts &quot;Low Power&quot;</td>
</tr>
<tr>
<td>Transmitter deviation</td>
<td>8.0 ? 2 kHz nominal</td>
</tr>
<tr>
<td>Circuit</td>
<td>Super-heterodyne single conversion</td>
</tr>
<tr>
<td>Image Rejection</td>
<td>Greater than 85 dB</td>
</tr>
<tr>
<td>IF Bandwidth</td>
<td>32 kHz minimum @ 6 dB, 85 kHz maximum @ 60 dB</td>
</tr>
<tr>
<td>Squelch</td>
<td>150 Hz tone-operated or noise-operated, with RF signal having 10 dB (S+N+D)/(N+D) ratio</td>
</tr>
<tr>
<td>Limiting</td>
<td>Less than 1 dB change in audio output for RF input from 1 ?V to 100,000 ?V</td>
</tr>
<tr>
<td>Distortion</td>
<td>Less than 8% from 500 to 3000 Hertz</td>
</tr>
<tr>
<td>Audio Output</td>
<td>500 mW into 600-Ohm speaker 150 mW into 600-Ohm headphone</td>
</tr>
<tr>
<td>Volume Control</td>
<td>Adjustable from less than 0.25 mW to 1.0 W maximum</td>
</tr>
<tr>
<td>Audio Pass-band</td>
<td>500Hz-3000Hz</td>
</tr>
<tr>
<td>X Mode</td>
<td>Provided</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C to +65°C (-40°F to +147°F)</td>
</tr>
<tr>
<td>Power Requirement</td>
<td>24-28 VDC @10.0A</td>
</tr>
<tr>
<td>Dimensions</td>
<td>6&quot;H x 15&quot;W x 13&quot;D. (15.2 cm x 38.1 cm x 33 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>58 lbs. (26.3 kg)</td>
</tr>
</tbody>
</table>
KY-8 Voice Security Device

The ARDF ground station communications were covered by KY-8 Speech Security Equipment.

*Figure 16: TSEC KY-8*
Aircraft Communications

The AN/PRC 77 Radio Set

The PRC-77 was used in the aircraft for air to ground communications by the ARDF operator. The set used an external antenna on the aircraft.

Normally the AN/PRC-77 was ‘coupled’ with a KY-38 for secure speech.

The AN/PRC-77 is a manpack, portable VHF FM combat-net radio transceiver manufactured by "Associated Industries" and used to provide short-range, two-way radiotelephone voice communication.

Freq range: 30-75.95 MHz (920 Channels using 50kHz steps)
Range: up to 8km
Power Output: 1.5-2.0W

---

AN/PRC translates to "Army/Navy, Portable Radio, Communication."
KY-38 Voice Security Device

The KY-38 is the backpack variant of the Nestor family of voice security devices. Used during the Vietnam War, this family included the KY-8 vehicular unit, the KY-28 aircraft unit, and the KY-28 backpack unit. These devices permitted secure voice communications over radio.

This particular unit has been disassembled; that is, all of the cryptographic hardware has been removed from the unit before it was released as surplus, leaving only the case, power supply, interface circuitry, and an interesting electromechanical keying device. The battery box is also missing.

The cryptographic key is entered with a KYE-38 keyfill device (which I do not have). Opening the small door on the front panel of the KY-38 reveals a collection of holes. Two large holes allow long pins on the KYE-38 keyfill device to act the spring-loaded mechanical keying mechanism inside the KY-36, and 64 smaller holes allow the keying switches to be set by corresponding pins on the KYE-36. Behind each of the small holes is a multi-position slide switch which can be set in any of a number of positions by inserting a metal pin into its hole to the correct depth. The switches are all reset to their initial positions (closest to the front panel) by the mechanical keying mechanism.

The keying mechanism's powerful springs are coiled while entering the desired key, and the mechanism is then armed once the front panel door is closed. The springs are released when the door is opened, the manual service knob is turned, or an electrical service signal is applied through a connector on the front panel. Once released, the springs return all of the keying switches to their initial positions, thus erasing the entered cryptographic key.
AN/PRC-64

Two AN/PRC-64 were issued to the Troop and they were primarily used as beacons for calibrating the ARDF equipment.

USA Spy Radio Set\(^{12}\)

The AN/PRC-64 was a true spy radio set, developed by Delco in the USA in the early 1960s as a possible successor to the AN/GRC-109 (RS-1). It was intended for use by Special Forces (SF) and for espionage activities. The design was based on the Delco 5300 that was used by the CIA. It was extremely popular with the Special Operations Group of the Australian Army in Vietnam.

During their operational life, most of the PRC-64 units were upgraded to PRC-64A, which allowed faster burst transmissions in combination with the AN/GRA-71 burst encoder that was connected to the 7-pin morse KEY socket.

The PRC-64 was an extremely compact unit for its time and measures only 25 x 13 x 12 cm. Even when packed together with the accessories in the canvas carrying bag, the set measures less than 35 x 14 x 14 cm and weighs less than 3.5 kg including the battery. The unit is powered by an internal battery and is switched on by opening the top lid. The small size however comes at a price, as the HF output power is no more than 5 Watt (CW morse) or 1.5 Watt (AM voice).

Frequency selection of the PRC-64 is crystal controlled, limiting its operation to 4 preset channels. Receiver and transmitter each have their own set of 4 crystals to allow split-frequency operation. The frequency range is from 2.2 to 6.0 MHz. RX and TX frequencies are usually written in a table inside the top lid. The crystals were stored in a compartment behind the table.

Figure 20: AN/PRC-64

Note

The troop was allocated three crystals:
Serial Nos 5752, 4490, 5185 that relate to frequencies

\(^{12}\) http://cryptomuseum.com/spy/prc64/index.htm
Antenna RC292

Antenna Equipment RC-292 is an elevated, wide-band, modified ground-plane antenna designed to increase the distance range of radio sets in 30 to 76 mHz range. The RC-292 is a VHF Low Band 1/4 wave vertical antenna with ground plane. RC stands for Radio Component and this antenna was the successor to the RC-291.

![Figure 21: Antenna RC292](http://radionerds.com/index.php/RC-292)

Antenna Dorne-Marglin AS-2236

The AS-2236 is a highly directional VHF Antenna that provides increased gain as opposed to other VHF antennas and can be used in vertical or horizontal mode.

![Figure 22: Antenna AS-2236](http://radionerds.com/index.php/AS-2236)

COMMUNICATIONS CENTRE

AN/GGC-3 Teleprinter

PURPOSE OF EQUIPMENT: Teletypewriter Sets AN/GGC-3(*) and AN/GGC-53(*) are lightweight, transportable units which can be used in either fixed or mobile teletypewriter stations. They provide facilities for manual transmission direct from keyboard and for tape transmission from transmitter-distributor. Received messages are printed and perforated on paper tape for later transmission.

Teletypewriter Reperforator-Transmitters TT-76(*)IGGC are used to send and receive over direct current (dc) wirelines carrier, or radio systems when used with Telegraph Terminal TH-5/TG, or similar line terminating devices.

Teletypewriter Reperforator-Transmitters TT-699(*)IGGC are used to send and receive over dc (6-volt polar) signal circuits only.
Figure 23: AN/GGC-3
Teleprinter TT-4c/TG

1-7. Purpose and Use

a. Purpose. Teletypewriter Sets AN/PGC-1 and AN/PGC-3, Teletypewriters TT-4(*)/TG, TT-335/TG, TT-698(*)/TG, and TT-722(*)/TG are used to transmit teletypewriter messages in the form of direct-current (dc) teletypewriter signals and to convert received dc signals into messages printed on a roll of recording paper. Teletypewriter TT-537/G is used primarily to receive low-voltage Baudot teletypewriter signals from a field artillery gun direction computer (FADAC) and to record the received messages on 8½-inch-wide recording paper.

Figure 24: Teleprinter TT-4C

---

MOD-19 TTY

Figure 25: MOD - 19 TTY
KW7 On Line Crypto System

The KW7 was used to encrypt all traffic over the Military and Sigint communications network.

Specifications

- Keying method: Cables, keylist.
- Service life: 1940’s - 1980’s.
- Input: Teletype
- Output: On-line encrypted teletype.
- Speed: 50+ wpm.
- Applications: Strategic and tactical environments.
- Note: Typically used to send encrypted teletype

*Figure 26: KW-7*
**Direction Finder Set AN/PRD-1**

The PRD-1 was used by 121 Signal Squadron (Singapore) on several exercises in Malaya in 1962. It was found to be very successful if you could see the target.

The US Army used the PRD-1 extensively in the early stages of the war. On several occasions 547 Sig Tp borrowed a set to assist in some of their operations.

**AN/PRD-1 Specifications**

The Direction Finding Set AN/PRD-1 is designed for use a mobile and portable radio direction finder. The basic equipment consists of a loop antenna, a superheterodyne-type receiver, and power supply unit. The equipment covers a frequency range of 100k kc (kilocycles) to 30 mc (megacycles) in seven overlapping bands. The set is capable of receiving cw (continuous wave), icw (interrupted continuous wave), and a-m (amplitude modulated) signals throughout the frequency range, and of receiving f-m (frequency modulated) signals in the range of 12.5 to 30 mc. The complete equipment consists of Antenna AS-536/PRD-1, Antenna AT-301/PRD-1, Radio Receiver R-395/PRD-1, Dynamotor Power Supply DY-79/PRD-1, Battery Box CY-947/PRD-1, Direction Finder Tripod MT-870/PRD-1 and a number of additional components. Direction Finder Set AN/PRD-1 is used to determine the direction of arrival of transmitted radio signals from friendly or enemy source. By orienting the antenna and operating the receiver, the direction can be determined easily by using a null method.

---

**Frequency coverage:** 100 kc - 30 mc in seven bands  
**Type of signals:** cw – icw – am – fm  
(15 – 30 mc)  
**IF:** 455 KHz  
**Tubes Rx:** 6 x 1U4, 1 x 3Q4, 2 x 1U5,  
2 x 6AK5, 1 x 1R5, 1 x 6C4  
**Tubes Dynamotor:** 1 x 6AK5, 2 x 12AU7  
**Dynamotor Power Supply:** DY-79/PRD-1  
**Battery Box:** CY-497/PRD-1  
**Power supply:** 24V 7A  
**Dimensions:** Case CS-80 16 5/32 x 12  
9/16 x 10 11/16 inc.  
**Weight:** 63.5 lb  
**Manual:** TM 11-677

---

15 See the story of DODO.  
16 Extract from: http://www.radiomilitari.com/prd1.html
ANNEX C To
The Story of 547 Sig Tp
In SVN 1966 - 1972

Figure 27: PRD-1 front panel
ANNEX C To
The Story of 547 Sig Tp
In SVN 1966 - 1972

Figure 28: PRD-1 setup

Figure 29: ASA’s Green Berets– Soldiers of the 403rd RR SOD (Abn) in Vietnam (Photo: INSCOM)\textsuperscript{17}

Extract from the book *Body of Secrets*[^18]:

On a typical mission, the PRD-1 would be transported by jeep to what was thought to be a good spot from which to locate Vietcong in the Delta. Once at the site, a tactical DF post would be established. A bunker made of double or triple sandbags would be set up, then encircled with rolls of barbed wire and concertina wire, perhaps fifteen feet across. A variety of antennas would be set up and warning signs would be posted. “Signs telling,” said Parks, “that this was a classified site and not to enter on pain of death and according to some regulation or another.” In the center, sitting on a tripod, would be the PRD-1, which was about eighteen inches square and crowned with a diamond-shaped antenna that could be rotated. At its base was an azimuth ring marked off in degrees. Once he was set up, the DF operator would put on his earphones and begin listening for enemy signals. “Timeto get on the knobs and kill a Commie for Mommy,” said Parks. In order to cover the operational area, a “net” of three DF sites would have to be set up. This would allow the operators to triangulate the enemy signals and get a fix on their exact locations. “‘Find them, fix them, and fuck ‘em over!’ was our unofficial motto,” said Parks. “‘Better Living Through Electronics’ was another one.” Once a DF station picked up an enemy transmission, the operator would take a bearing on it. The information would then be encrypted and sent up the chain of command and an attack order would frequently be given. Heavy artillery fire would then plaster the site, and the infantry would sweep in. Unfortunately, the Vietcong were wise to the game; they knew the United States was probably listening and they avoided transmitting as much as possible. Or they would place their transmitting antenna up to a mile from the actual transmitter, in order to avoid fire. “It was a great and intricate game of fox and hounds played silently between us,” said Parks. “Each side aware of the other though we never met. It was a life-or-death game for them, too. To place it bluntly, the DF teams were there to aid the 199th in its task of killing those Vietnamese radio ops and all of their buddies, if at all possible. We hounded them unmercifully. . . . Their radio ops became worse as time went by due to the better-trained ones having been killed.” But DF missions were a double-edged sword, as Specialist Davis had discovered. Since the range of the PRD-1 was only about five miles— on a very good day— the Sigint soldiers had to be almost in the enemy’s camp to locate them. “They were practically in our lap most of the time,” said Parks. “Once, we DF’d a transmission that was coming from a grass hut not three hundred yards from me— easy rifle shot if I could have caught him coming out of the hut.”

Telefunken PE-484 Miniature Direction Finder

The 547 Sig Tp 1 July 1970 Stocktake\(^{19}\) contained two Telefunken Equipment Portable\(^{20}\). It is believed that the PE-484 was only used once operationally by the Troop\(^{21}\).

Specifications\(^{22}\)

The PE-484 was a body-wearable miniature direction finder (Kleinstpeilempfänger) with a wide range of accessories, introduced around 1958 by Telefunken in Germany. It could be carried inconspicuously under the operator's clothing and was intended for tracking down clandestine radio stations. In some countries the PE-484 was used until the early 1980s.

The PE484 is a beautifully crafted receiver with a body made of Bakelite. It has a very ergonomic design with metal support pins at either side, allowing it to be strapped to the body with the supplied canvas belt. It is fully self-contained and is powered by three internal rechargeable batteries.

Special body-wearable antennas were supplied, allowing the entire setup to be hidden under the operator's clothing. A thin wire, hidden in the sleeve of the coat, connected to a field strength meter that was carried on the left wrist.

The PE-484 came with a lot of dedicated accessories, such as the much sought after wrist-watch field strength indicator, packed together in a leather briefcase. An extended version came with even more accessories, and was packed in a large leather suitcase (see below).

The receiver covered all frequencies between 0.057 and 20.6 MHz, with the exception of the 0.443 to 0.498 MHz section, divided over 10 frequency ranges. Each frequency range had its own tuning could that also acted as the frequency scale. It was inserted from the side of the receiver. When strapped to the body, the tuning scale could be observed by the user.

---

\(^{19}\) AWM103, R838/1/19 Accounts Stocktakes 547 Sig Tp.
\(^{20}\) It is not known when the equipment was first issued.
\(^{21}\) See May Tao SAS Excursion.
\(^{22}\) Extract from: http://www.cryptomuseum.com/df/telefunken/pe484/
Figure 30: Wearable Antenna

Figure 31: Transportation Case
Annex C: To
The Story of 547 Sig Tp
In SVN 1966 - 1972

Single Station Location System

Operators Console

The monitor receiver shown here is a Racal RA-1217.

![Figure 32: Part of the Operators Console](image)

**Double conversion**, I.F. 47,21 MHz, 455 kHz

**Digital frequency display**, mechanical, 1 kHz

AM, SSB, FM

960 kHz - 30 MHz

**Selectivity** -6 dB

13 / 6 / 3 / 1 / 0.2 kHz

**Sensitivity**
0.5 uV SSB

RF Gain, four step attenuator

![Figure 33: Racal RA-1217](image)

---

23 [http://www.shortwaveradio.ch/radio-e/racal-ra-1217-e.htm](http://www.shortwaveradio.ch/radio-e/racal-ra-1217-e.htm)
The twin-channel radio receiver shown has not been identified but in later correspondence (1971) a RA-153 was mentioned as being a receiver in use.

<table>
<thead>
<tr>
<th>Twin Channel Receiver RA-153</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country:</strong> Great Britain (UK)</td>
</tr>
<tr>
<td><strong>Manufacturer / Brand:</strong> Racal Engineering (Racal Instruments) Ltd., Bracknell</td>
</tr>
<tr>
<td><strong>Year:</strong> 1967–1969</td>
</tr>
<tr>
<td><strong>Semiconductors (the count is only for transistors):</strong> Semiconductors present.</td>
</tr>
<tr>
<td><strong>Principle:</strong> Superhet, double/triple conversion</td>
</tr>
<tr>
<td><strong>Wave bands:</strong> Broadcast plus more than 2 Short Wave bands.</td>
</tr>
<tr>
<td><strong>Power type and voltage:</strong> Alternating Current supply (AC) / 100-125 / 200-250 Volt</td>
</tr>
<tr>
<td><strong>Loudspeaker:</strong> - For headphones or amp.</td>
</tr>
<tr>
<td><strong>Power out from Radiomuseum.org:</strong> Model: Twin Channel Receiver RA-153 - Racal Engineering Racal</td>
</tr>
<tr>
<td><strong>Material:</strong> Metal case</td>
</tr>
<tr>
<td><strong>Shape:</strong> Rack</td>
</tr>
<tr>
<td><strong>Dimensions (WHD):</strong> 480 x 530 x 570 mm / 18.9 x 20.9 x 22.4 inch</td>
</tr>
<tr>
<td><strong>Coverage:</strong> 980 - 30000 kHz, AM/SSB with BFO, linear analog readout (ca. 1 kHz).</td>
</tr>
<tr>
<td><strong>Bandwidths:</strong> 0.1 / 0.3 / 0.75 / 1.2 / 3 / 8 kHz -6 dB.</td>
</tr>
<tr>
<td><strong>Notes:</strong> Professional twin channel receiver used for direction finding and radio propagation studies. The set consists of two RA-117 receivers with common VFO's, but separate signal paths. Variants: RA-153A with a single AF stage switchable two both receivers and RA-153B with twin AF stages, one for each channel. Options: MA-126 Phase and Amplitude Compensation Unit, MA-190 Indicator and Balancing Unit and a Direction Finding Unit.</td>
</tr>
<tr>
<td><strong>Net weight (2.2 lb – 1 kg):</strong> 59 kg / 129 lb 15.3 oz (129.956 lb)</td>
</tr>
</tbody>
</table>

---

24 http://www.radiomuseum.org/r/racal_twin_channel_receiver_ra.html
Several receivers were used in the SSL over the years.

**Receiver Racal RA17**

![Racal RA17](image)

**Figure 36: Racal RA17**

### DETAILS OF THE RECEIVER

**1.1 ELECTRICAL DETAILS**

**Frequency Range**
0·5 to 30 Mc/s covered in 30 bands 1 Mc/s wide. Frequencies below 1 Mc/s will be received with slight degradation of performance.

**Tuning**
An effective scale length of approximately 145 feet, with substantially constant frequency increments, provides excellent discrimination, i.e. 6 inches of scale corresponds to 100 kc/s, calibrated at 1 kc/s intervals.

**Calibration**
Scale checkpoints at 100 kc/s intervals

**Aerial Input**
75Ω unbalanced.

**L.F. Output**
100 kc/s 2½
(a) 75Ω approximately 180mV R.M.S.
(b) High impedance.
Audio Outputs

<table>
<thead>
<tr>
<th>Impedance</th>
<th>Level</th>
<th>Distortion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 3Ω</td>
<td>30mW</td>
<td>5% max.</td>
</tr>
<tr>
<td>(ii) 600Ω</td>
<td>3mW</td>
<td>&quot;</td>
</tr>
<tr>
<td>(iii) 600Ω</td>
<td>3mW</td>
<td>&quot;</td>
</tr>
<tr>
<td>(iv) 600Ω</td>
<td>3mW</td>
<td>&quot;</td>
</tr>
<tr>
<td>(b) 600Ω</td>
<td>10mW</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

The level of output (b) is not dependent on the setting of the audio gain control but may be separately adjusted.

Power Supplies
100-125 volts or 200-250 volts. 45-65 c/s.
Consumption—85 watts approximately.

1.2 MECHANICAL DETAILS
The receiver is designed for both table or rack mounting. The front panel, normally painted Light Admiralty Grey to British Standard Specification 381C colour 697, has been carefully designed to minimise operator fatigue and combines utility with pleasing appearance.

The dimensions of the 1-in. thick steel front panel conform with the requirements for mounting in a standard 19-in. rack.

For table mounting, the receiver is fitted in a robust steel cabinet which is slotted at the rear to enable the operator to gain easy access to the mains input socket and fuse, and the termination strips.

A dust cover is provided with both models, thereby keeping the dust intake to a minimum.

The chassis are of cast construction ensuring maximum rigidity and effective electrical screening.

1.3 DIMENSIONS AND WEIGHT

**Rack Model**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>19-in. (48·3 cm)</td>
</tr>
<tr>
<td>Height</td>
<td>10¼-in. (26·7 cm)</td>
</tr>
<tr>
<td>Depth overall</td>
<td>20½-in. (51 cm)</td>
</tr>
<tr>
<td>Depth behind panel</td>
<td>18¼-in. (47·6 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>67-lb. (30·5 kg)</td>
</tr>
</tbody>
</table>

**Table Model**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>20⅞-in. (52 cm)</td>
</tr>
<tr>
<td>Height</td>
<td>12-in. (30·5 cm)</td>
</tr>
<tr>
<td>Depth</td>
<td>21⅝-in. (55·6 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>97-lb. (44 kg)</td>
</tr>
</tbody>
</table>
Ionosonde

An ionosonde, or chirpsounder, is a special radar for the examination of the ionosphere. An ionosonde consists of:

- A high frequency (HF) transmitter, automatically tunable over a wide range. Typically the frequency coverage is 0.5–23 MHz or 1–40 MHz, though normally sweeps are confined to approximately 1.6–12 MHz.
- A tracking HF receiver which can automatically track the frequency of the transmitter.
- An antenna with a suitable radiation pattern, which transmits well vertically upwards and is efficient over the whole frequency range used.
- Digital control and data analysis circuits.

The transmitter sweeps all or part of the HF frequency range, transmitting short pulses. These pulses are reflected at various layers of the ionosphere, at heights of 100–400 km, and their echos are received by the receiver and analyzed by the control system. The result is displayed in the form of an ionogram, a graph of reflection height (actually time between transmission and reception of pulse) versus carrier frequency.\(^{25}\)

---

Figure 38: Ionosonde Transmitter and Amplifier

Figure 39: Ionosonde Antenna similar to this
Figure 40: Ionogram display example
**Olivetti Programma 101 Computer**

The Olivetti Programma 1101 Computer was the first used in the SSL.

![Figure 41; Olivetti Programma 101 Computer](image)

The Programma 101 was the first commercial "desktop computer" produced by Italian manufacturer Olivetti and invented by the Italian engineer Pier Giorgio Perotto. It was launched at the 1964 New York World's Fair, a futuristic design for its time.

The Programma 101 was able to calculate the basic four arithmetic functions (addition, subtraction, multiplication, and division), plus square root, absolute value, and fractional part. Also clear, transfer, exchange, and stop for input. There were 16 jump instructions and 16 conditional jump instructions. 32 label statements were available as destinations for the 32 jump instructions and/or the four start keys (V, W, Y, Z).

Each full register held a 22-digit number with sign and decimal point.

Its memory consisted of 10 registers: three for operations (M, A, R); two for storage (B, C); three for storage and/or program (assignable as needed: D, E, F); and two for program only (p1, p2). Five of the registers (B, C, D, E, F) could be subdivided into half-registers, containing an 11-digit number with sign and decimal point. When used for programming, each full register stored 24 instructions.

It printed programs and results onto a roll of paper tape, similar to calculator or cash register paper.²⁶

---

PDP-8 Computer

The PDP-8 computer replaced the Olivetti and was used to calculate all the SSL results.

Figure 42: PDP8 Computer and Printer

What is a PDP-8?\textsuperscript{28}

The PDP-8 family of minicomputers were built by Digital Equipment Corporation between 1965 and 1990, although it is worth noting that the term minicomputer first came into prominence after the machine was introduced. The first use of the term appears to have been made by the head of DEC's operations in England, John Leng. He sent back a sales report that started: "Here is the latest minicomputer activity in the land of miniskirts as I drive around in my [Austin] Mini Minor." The term quickly became part of DEC's internal jargon and spread from there; the first computer explicitly sold as a minicomputer, though, was made by by Interdata.

\textsuperscript{27} https://www.grc.com/pdp-8/pdp-8.htm
\textsuperscript{28} Ibid.
The primary tactical voice communications radio used by the VC/NVA at the battalion-to-regiment level was the Chicom Type 71 B transmitter, which had a range of approximately fifty kilometers. This radio was replaced in the mid-1960s by the improved Chicom Type 63 transmitter. For communications from regiment to higher echelons, the VC/NVA relied on the Chicom radio set, Model 102E, which had an estimated range of one hundred twenty-five kilometers. Soviet equivalents of these radios were also employed. Communications equipment captured or stolen from the Allies, particularly FM PRC 10s, 25s, and 77s, were also used. However, these U.S.-made radios were not frequency-compatible with the Chicom and Soviet models and were therefore limited in their use.

Telephone wire included U.S.-made WD-1, which was frequently left behind when Americans abandoned fixed positions and fire bases. A gray plastic-coated wire made in China was also used. The telephones themselves were U.S.-made TA-312s or similar sets of Soviet design—Stuchotsk Model TA 1-43 or Chicom models E0754 and Q-071.

The limited number of radios and telephones were backed up by the principal means of communication—couriers. In actual combat, virtually all messages by both main-force VC and the NVA were transmitted by this method. Runners carried verbal and written reports and requests from platoon to company and orders from company to platoon. Company messengers performed similar missions between their unit and battalion.

Some of the enemy equipment captured by Australian and US forces and presented to the Troop.

![Figure 44: Chicom Field Telephone (AKA 252B)](image-url)
Figure 45: Chicom Field Telephone (AKA 252B)

Figure 46: Plague
Chinese Type 102E / XD 6 Radio Station

One of the most often captured radios was the Chicom Model 102E which was man-packed or mounted in vehicles. This set was a copy of the U.S. AN/GRC 9 set with a few changes. The transmitter took up more space and the outer carrier, a metal chest housed the transmitter, receiver and a space for the D81 dry battery. The transmitter required a 6410 hand cranked generator or a 964IE Dynamotor. The hand-cranked generator looked just like the U.S. versions but had a built-in voltmeter, an idea first seen in WW II Japanese generators. The set was a 15 watt set with a range of 75 miles, and covered 2-12 MHz. The complete set with accessories weighed 105 lb. The receiver and transmitter alone weighed 38 lb. This set was being replaced by the XD 6 set which had the same technical characteristics.29

CHICOM 102E RADIO (aka 55B, 81, 103, 15-watt radio)

The ChiCom 102E is a low power (15 watts), tactical pack or vehicular, high frequency AM transmitter-receiver used by ground forces. It is an electronic copy of the US Army AN/GRC-9 radio with minor changes in the front panel controls and in the positions of the components.

CHARACTERISTICS:

Receiver Frequency Coverage: 2-12 mc (3 bands)
Type of Reception: Voice, Mwer, CW
Power Source: Battery—1.4, 90 volts

Transmitter Frequency Range: 2-12 mc (3 bands)
Type of Emission: Voice, CW
Frequency Control: Master oscillator or crystal
Power Source: 12-volt battery and dynamotor, hand cranked generator. (6.3, 425 volts)
Range: Voice—80 km, CW—200 km

Antennas: 64m long wire, 32m inverted "L", 4.8m whip (5 sections)
Dimensions: 38.1 x 20.95 x 33 cm
Weight: 18.38 kg (without battery)
Chinese Type 71B Radio

Figure 48: Chinese Type 71B Radio

Figure 49: Chinese Type 71B Radio
CHICOM 71B RADIO (aka 2-3 watt radio)

The ChiCom 71B is a low power (2-3 watts) AM transceiver, professionally designed and well constructed. It is primarily used by ground forces between battalion and regiment and between company and battalion.

CHARACTERISTICS:

Receiver Frequency Coverage: 1.9-7.2 mc (2 bands)
Type of Reception: Voice, ΜCW, CW
Power Source: Battery, D71—1.4, 90 volts

Transmitter Frequency Range: 1.9-7.3 mc (3 bands)
Type of Emission: Voice, CW
Frequency Control: Master oscillator or crystal
Power Source: Battery, D71—1.4, 7.5, 150 volts
Range (est.): 4.82-48.27 km

Antennas: 1.92m whip or 10.06m long wire
Dimensions: 29.21 x 15.54 x 18.72 cm
Weight: 15.44 kg (with battery)
Type K-63 Back Pack Radio

The Type 63 manpack set was the newest item supplied by China. This set was probably intended as a replacement for the Model 71 B radio. This set looked like a copy of the U.S. W.W.II Walkie-talkie but when the RT unit was removed from its case, it looked more like an AN/PRC 10. It weighed 35 lb, was 3 1/2" x 10" x 16" and was powered by a D-63 dry battery with taps at 3V, 27V, 90V and 178.5 volts. It was estimated to be a 2 watt transmitter and covered 1.5 to 6 MHz. Unlike the U.S. counterparts this set had a built-in key for CW operation.31

31 http://www.armyradio.com/publish/Articles/William_Howard/Pictures/Type_63-01.jpg
Unknown Types

Figure 51: Unidentified

Figure 52: Unidentified
Figure 53: Unidentified

Chicom Transceiver 702 D

Figure 54: Chicom Transceiver 702 D