H.F. Communications Receiver | RA.17

- **FREQUENCY RANGE 500 KHz TO 30 MHz**
- **CONTINUOUS TUNING WITH ELECTRONIC BANDSWITCHING**
- **OUTSTANDING STABILITY AND TUNING ACCURACY**
- **SOLID CAST ALUMINIUM CONSTRUCTION**

Although designed more than ten years ago, when it represented such a revolutionary advance in radio reception, the Racal RA.17 Receiver continues to provide the outstanding performance which has made it justly famous.

Approved and used by the Armed Services and by major communications and broadcasting authorities in nearly every country in the world, over 15,000 models of the RA.17 and its derivatives have now been produced. Development has continued unceasingly to improve this receiver still further and the design has been advanced to include modern technical refinements and to meet the needs of the latest reception techniques. The latest version, the RA.17L Receiver, is now the standard model.

A revolutionary frequency-changing circuit eliminates switches and complex wiring in the r.f. circuits, providing dependable electronic bandswitching from 1 to 30 MHz. The superlative setting accuracy, stability and sensitivity may be judged from examination of the specification included in this leaflet. To obtain full advantage from the advanced electrical design, the highest quality engineering and workmanship have been employed at all stages of development and manufacture. All components have been selected for dependable performance in all climates and are types approved for use by the Armed Forces.

The North American version of this receiver, the RA.17C-12, is built to American standards. Plugs, sockets, valves, panel engravings, screw threads and a number of components are all of American design.

The RA.17 Receiver acquires increased usefulness with the addition of the specially designed adaptors and converters shown on the final page of this leaflet. These units add versatility without affecting the superb performance of the receiver in any way.

RACAL

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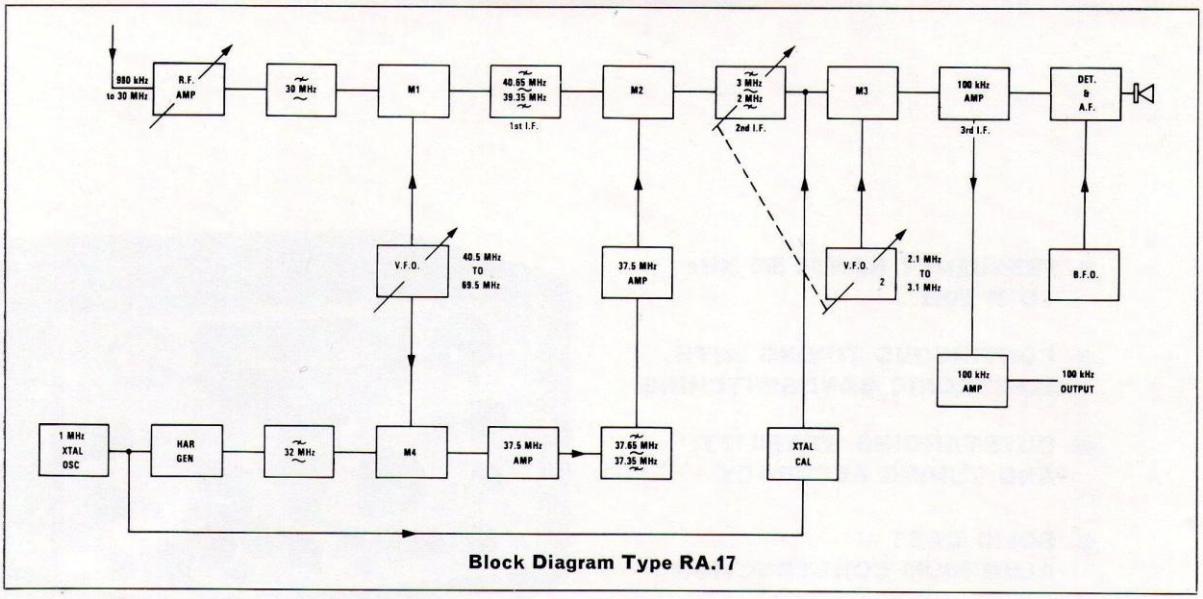
H.F. Communications Receiver
Type RA.17

TECHNICAL DESCRIPTION



Block Diagram Type RA.17

The r.f. stage of the RA.17 is preceded by an attenuator network and has switched choice of wideband input or double-tuned pre-selection. The amplified input signal is subsequently mixed in M1 with a variable frequency oscillator (VFO1) to produce a wideband 1st i.f. output centred on 40 MHz.

The output of VFO1 is also mixed in M4 with harmonics (up to 32nd) generated from a 1 MHz crystal oscillator The output circuit of M4 limits the useful settings of VFO1 to intervals of 1 MHz, that is when VFO1 minus a harmonic of 1 MHz gives a product of 37.5 MHz from M4. The output from the 37.5 MHz filter and amplifier circuits is mixed with the 1st i.f. in M2 to produce a wideband 2nd i.f. from 2 to 3 MHz.

This ingenious arrangement ensures that, if VFO1 drifts and so creates a change in the 1st i.f., an equal change is caused in the 37.5 MHz output and the drift is cancelled in M2. The stability of this frequency changing system is therefore that of the 1 MHz crystal. VFO1 is set by the megahertz dial of the receiver and acts as an electronic bandswitch.

The signal is then accepted by a conventional superheterodyne receiver tuned over the range 2 to 3 MHz by VFO2. This interpolation receiver employs a film scale 5 ft. long, calibrated at each kilocycle, coupled to VFO2 and a tunable band-pass filter. VFO2 includes a special coupling circuit to simplify dual diversity operation.

The complete absence of mechanical bandswitching and multiple wiring in both VFO circuits together with well-designed temperature compensating circuits ensures very high re-setting accuracy and stability

The final i.f. chain operates at 100 kHz and incorporates filters giving a choice of six bandwidths. A built-in calibrator is provided for setting the film scale cursor exactly to each 100 kHz point. Additional facilities include a buffer amplifier giving an i.f. output at 100 kHz and an a.f. amplifier supplying an independent output for 600-ohm line circuits.

NORTH AMERICAN VERSION

A special version of the RA.17 has been developed for use in North America and in territories where American standards are current. This receiver the RA.17C-12, has a performance generally identical with that of the British version. Certain valve changes have been made to ensure that all are obtainable as standard North American types. Silicon diodes replace the vacuum type power rectifier The r.f./a.f. level meter includes calibration as an S-meter The a.f. output valve is replaced by one of higher rating to give a maximum output of 1 watt.

To ease maintenance problems 'Unified' screw threads, readily obtainable from American sources, are employed throughout. Coaxial plugs and sockets are 83 and BNC types. A' gauge telephone jacks with a loudspeaker cut-off circuit are provided for headphone reception.

A proportion of the components including crystals, loudspeaker meter and transformers are of North American manufacture. Wherever possible other components are directly interchangeable with equivalents available in the North American market. Details of suitable replacement components can be supplied.

VALVE TYPES

RA.17L : ECC.189 (1) –EF91 (10) –6F33 (1) –E180F (2) –EK90 (2) –EF93 (4) –EB91 (2) –GZ34 (1).

RA.17C-12 : 6ES8 (1) –6AU6 (8) –6AS6 (1) –6688 (2) –6BE6 (2) –6BA6 (4) –6AL5 (2) –6AQ5 (1) 12AT7 (1) –5704 (1).

RA.17

TECHNICAL SPECIFICATION

Frequency Range
1 to 30 MHz, range extends to 0.5 MHz with slight degradation of performance.

Stability
After warm-up, drift in output frequency less than 50 Hz per hour under conditions of constant supply voltage and ambient temperature.

Input Impedance
75 ohms unbalanced.

Tuning
Effective scale length of approximately 145 feet, i.e. about 6 in. of scale length corresponds to 100 kHz. Frequency increments remain substantially constant over the entire band.

Calibration
A 100 kHz signal derived from a 1 MHz crystal oscillator, having an accuracy of 5 parts in 10^6 provides check points at 100 kHz intervals.

Aerial Input
(a) Wideband.
(b) Double-tuned in six bands:
(i) 0.5 to 1.0 MHz. (iv) 4 to 8 MHz.
(ii) 1 to 2 MHz. (v) 8 to 16 MHz.
(iii) 2 to 4 MHz. (vi) 16 to 30 MHz.

Sensitivity
A1 reception, bandwidth 3 kHz:
1 µV for 18 dB signal/noise ratio.
A2 reception, 30% modulated, bandwidth 3 kHz:
3 µV for 18 dB signal/noise ratio.

Cross Modulation
For levels of wanted signal between 3 µV and 1 mV, an interfering signal 10 kHz off-tune and modulated 30%, must be at a level greater than 50 dB above that of the wanted signal to produce a cross modulation of 3%. The ratio of wanted to unwanted signal is improved at the rate of 3 dB/% up to 10% off-tune.

Intermodulation
Better than 100 dB down for interfering signals at least 10% removed from the wanted signal.

Blocking
With similar conditions to those for cross modulation, the unwanted signal level must be 60 dB above that of the wanted signal to reduce the audio output by 3 dB.

Selectivity
Six alternative bandwidths are obtained by means of a selector switch. Filter details (nominal) are:

	—6 dB	—66 dB	Detected Output
1	13 kHz	35 kHz	28 kHz
2.	6.5 kHz	22 kHz	20 kHz
3.	3.0 kHz	15 kHz	15 kHz
4.	1.2 kHz	8 kHz	8 kHz
5.	0.30 kHz	Less than 2 kHz	Less than 2 kHz
6.	0.10 kHz	Less than 1.5 kHz	Less than 1.5 kHz

Bandwidths 5 and 6 are obtained with crystal-lattice filters; differences in centre frequencies of these bandwidth settings do not exceed 50 Hz.

I.F. Output
100 kHz at 75 ohms impedance. Level approximately 0.2V with a.g.c. in operation. Two outlets in parallel are provided.

Image and Spurious Response
With wideband or tuned input, external image signals are at least 60 dB down. Internally generated spurious responses are below noise level in all cases.

Noise Factor
Less than 7 dB throughout the entire frequency range.

B.F.O. Range
±8 kHz.

B.F.O. Stability
With constant ambient temperature and supply voltage, after warm-up time of 1 to 2 hours, drift does not exceed 50 Hz. For input level variations of 10 µV to 1 mV b.f.o. drift is negligible.

Automatic Gain Control
A.G.C. is applied to the r.f. and the first 100 kHz i.f. stages only. An increase in signal level of 20 dB above 1 µV improves the signal/noise ratio by 18 dB.

An increase in signal level of 100 dB above 1 µV increases the a.f. output by less than 7 dB.

A.G.C. Time Constants
Short: *Charge:* 25 milliseconds
Discharge: 200 milliseconds
Long: *Charge:* 200 milliseconds
Discharge: 1 second

A.F. Response
With 13 kHz bandwidth, response remains within ±4 dB from 250 Hz to 6000 Hz.

A.F. Output
1. 50 mW from a switched 2½ in. loudspeaker on the front panel (1 W, North American version).
2. Two headphone sockets in parallel on front panel.
3. Three independent outputs of 3 mW at 600 ohms at rear of chassis.
4. One output of 10 mW at 600 ohms. Pre-set level is independent of the a.f. gain control setting.
5. One output of 50 mW (1 W North American version) at 3 ohms.

Note: Two headphone sockets are connected across the loudspeaker on the British version and across one of the 600 ohms, 3 mW outlets on the North American version of the receiver.

Distortion
Not greater than 5% at 50 mW output.

Hum Level
With A.F. GAIN control at maximum, the hum level is never less than 40 dB below rated output 50 mW or 1W respectively).

Noise Limiter
A series noise limiter circuit can be switched into operation to provide limiting at modulation levels exceeding 30%.

Meter Indication
Alternative switching for indication of signal carrier level or a.f. output level. Additional 'S' Meter indication on North American version.

Controls

Megahertz Tuning	Kilohertz Tuning
Aerial Band Switch	Aerial Tuning
Aerial Attenuator	Tuning Lock
I.F. Gain	I.F. Bandwidth
System Switch	A.G.C. Time Constant
B.F.O. on/off	B.F.O. Note
A.F. Volume	Line Output Level
Limiter on/off	Loudspeaker on/off
Power on/off	Meter Switch

External Connections
Power Input
Aerial Input
2 to 3 MHz I.F. Input (for RA.137 L.F. Converter)
1 MHz Oscillator Output
100 kHz I.F. Output
VFO2 Output (for diversity coupling)
A.G.C. Line
A.F. Outputs

Power Supply
100–125 and 200–250V 45–65 Hz a.c.
Power consumption 120VA approximately.

Dimensions
For rack mounting: *Height:* 10½ in. (26.7 cm). *Width:* 19 in. (48.3 cm). *Depth:* 20⅛ in. (51 cm), (with fitted dust cover).
Fitted cabinet: *Height:* 12 in. (30.5 cm). *Width:* 20½ in. (52 cm). *Depth:* 21⅞ in. (55.6 cm).
Weight: Rack mounted 67 lb. (30.5 kg.)
In cabinet 97 lb. (44 kg.)

Construction
Cast chassis with ⅛ in. aluminium front panel, finished to highest durability and climatic specification.

Notes
(i) 2nd V.F.O. output lead is normally coupled to the oscillator cathode. For panoramic reception with the RA.66, this is moved to the oscillator anode.
(ii) For panoramic reception, alterations are made in the a.g.c. circuits. These cause minor changes in performance.

CONVERTERS AND ADAPTORS

Low Frequency Converter Type RA.137

The RA.137 extends the lower frequency limit of the RA.17 to 10 kHz. The converter input circuit can be switched for either wideband or double-tuned operation. The output is fed to the 2 3 MHz section of the RA.17 where the same highly accurate film scale is used for tuning indication.

Single Sideband Adaptor Type RA.63

This adaptor, which operates from a 100 kHz i.f. output of the RA.17 Receiver, enables s.s.b. signals in the upper or lower sideband to be received. Vernier tuning of the local oscillator is provided for distortion-free reception. The unit can be used for suppressed or pilot carrier s.s.b. and for s.s.b. reception of d.s.b. signals over a pass-band from 500 to 3,000 Hz.

Independent Sideband Adaptors Type RA.98 and RA.121

These adaptors are designed to simplify reception of independent sideband signals. The RA.98 includes a motor-driven automatic tuning device to maintain correct alignment even during long periods of fading. With the RA.121, after accurate tuning has been effected using a cathode ray tube, a locking device holds the local oscillator exactly to the incoming pilot carrier The passband of both adaptors is 300 to 6,000 Hz.

Diversity Switching Unit Type MA.168

This switching unit operates from the 100 kHz i.f. outputs of two RA.17 Receivers operating in diversity. The unit electronically selects the better signal which is passed either to a built-in detector and b.f.o. in the case of a.m., m.c.w. and c.w signals, or to external adaptors in the case of f.s.k. or s.s.b. signals. The unit is fully transistorized.

SPECIAL RECEIVERS

Panoramic Receiver Type RA.81

Using the RA.66 Panoramic Adaptor, the RA.17 Receiver will provide panoramic reception of band-widths up to 1 MHz. A first-class visual display of radio transmissions throughout the h.f. spectrum is obtained making the receiver ideal for search, monitoring or bandwatching activities. Simple modifications to the RA.17L Receiver are necessary, altering the a.g.c. characteristics, the performance of the receiver is otherwise unchanged.

Panoramic Recording Receiver Type RA.166A

The RA.166A is a further development of the Panoramic Receiver Type RA.81. In addition to providing visual panoramic presentation, a permanent record of the spectrum scanned is marked on a chart recorder.

Radio Teleprinter Receiving Terminals Type RA.103 and RA.129

The RA.103 Dual Diversity and RA.129 Single Channel terminals employ the RA.70 Frequency Converter and PV 78 F.S.K. Converter to exploit the high stability and setting accuracy of the RA.17 for accurate radio teleprinter reception. Tuning is extremely simple and channel changing is a matter of a few seconds. These versatile terminals are ideal for aviation, meteorological and similar services.

ANCILLARY UNITS

I.F. Converter Unit Type RA.73

This small crystal-controlled frequency converter unit enables auxiliary equipment with a 400–500 kHz input to be used with the RA.17 Receiver A crystal-controlled oscillator is employed to convert the 100 kHz output of the RA.17 to the required frequency

Receiver Protection Unit Type MA.107

This unit is designed for insertion in the aerial input circuit of the RA.17 Receiver to afford complete protection against excess voltage due to nearby transmitters.

Decade Frequency Generator Type MA.1350A

This synthesizer phase-locks the second v.f.o. of the RA.17 Receiver, providing exceptionally stable and accurate frequency selection in discrete steps of 100 Hz, using four decadic controls. In addition, an interpolation oscillator enables the receiver to be continuously tuned over a range of 100 Hz, 1 kHz or 10 kHz. The MA.1350A incorporates a reference frequency generator with a stability of ± 2 parts in 10^9 per day.

RACAL

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