EDDYSTONE

AMATEUR BAND COMMUNICATIONS RECEIVER

MODEL 888A

This particular model has been designed with one purpose in mind — to meet the highly specialised needs of the Amateur Radio operator. Accordingly, only the six commonly used bands are included in the coverage and several major benefits are immediately obtained. The most apparent, and also probably of most importance in the minds of many, is the greatly expanded tuning scale, resulting in a remarkable degree of bandspread, enabling the frequency in use to be read to very fine limits. Another advantage is the fact that the L/C ratio for each of the tuned circuits can be chosen for optimum performance. The principal features of the " 888A " are discussed in detail in the following pages. Here it is sufficient to state that, in the general opinion of well qualified experts, the " 888A " Amateur Communications Receiver is, on all counts, the ideal set for the enthusiast wishing to ensure that, on the receiving side at least, he is well equipped.

A number of active operators and technical specialists were consulted during various stages in the development of the " 888A." We are confident there is no receiver in existence to approach this model in general performance and in ease of handling. The " 888A " receiver is a highly specialised, craftsman-built British product.

EDDYSTONE

" 888A " RECEIVER

In the following paragraphs, electrical features of the " 888A " receiver are discussed in detail. But it must be emphasised that, allied to the excellent performance, is the first-class workmanship and robust construction embodied in the receiver. For example, the front panel and the coil box are strong aluminium diecastings, which form a very rigid foundation for the receiver as a whole. High reliability and long useful life are thus assured.

BANDSPREAD

Bandspread — the operative word which is almost bound to crop-up when an Amateur enthusiast critically examines a communications receiver. Almost always, there is not enough of it and the demand is for more, and more again.

In a general purpose receiver, it is not possible to provide a very large amount of bandspread and, in any case, professional operators generally do not like too much. Provided a really good drive mechanism with a high reduction ratio is fitted, tuning can be carried out satisfactorily right up to the highest frequency. In most cases, the actual bandspread, meaning kilocycles per division of scale, with frequency — for example, on the lower frequency bands (1·8 Mc/s. and 3·5 Mc/s.) tuning is relatively easy, but difficulty may be experienced on the 14 Mc/s. band, where only a small movement of the control knob results in the tuning changing by quite a number of kilocycles.

To give the finest possible control within the bands of frequencies allocated to Amateur communications, the only real answer is to leave out all frequencies outside these bands and spread each Amateur band right across the whole of the tuning scale. That is what has been done in the " 888A " receiver.

Bearing in mind each scale is twelve inches long, the reader will be able to appreciate the very high degree of bandspread thus obtained, whilst actual handling of the " 888A " will immediately emphasise the ease of tuning obtainable on a highly congested band.

The drive mechanism is geared and has a reduction ratio of 40 to 1, twenty revolutions of the tuning knob being required for the pointer to traverse the scale. In addition, there is a vernier scale which in effect gives a total of 1,000 divisions, each of which represent quite a small change in frequency, the approximate figures being shown below.

The main scale is marked off at close intervals and the frequency to which the receiver is tuned can be read off within acceptable limits.

Range	*Freq. limits (kc/s.)*		*kc/s. per division*
1	28000	30000	2
2	21000	21500	0·7
3	14000	14350	0·5
4	7000	7300	0·33
5	3500	4000	0·7
6	1800	2000	0·25

The above are mean average figures.

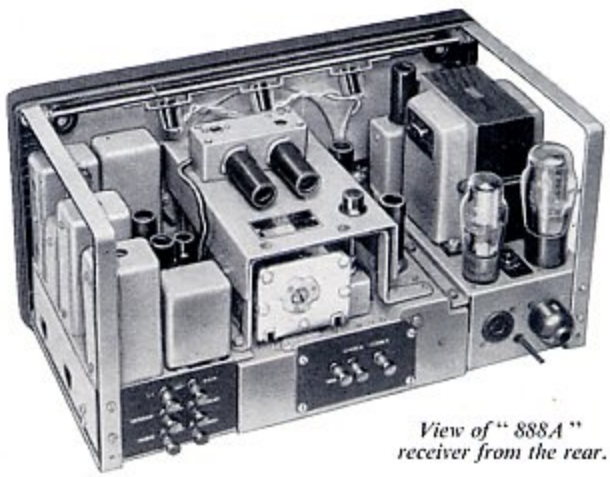
OSCILLATOR STABILITY

In the design of any receiver, oscillator stability is an important point which must be given careful consideration. It is necessary, however, to study the subject from more than one angle. To remove every trace of drift and produce a self running oscillator with absolute stability is an extremely difficult problem and entails expense out of all proportion, except perhaps in a few special isolated cases which may merit the inordinate cost. Experienced Amateurs will readily appreciate the amount of work and length of time involved in achieving a high degree of stability in a home constructed variable frequency oscillator, as used in transmitting equipment, and even in the most expensive frequency measuring apparatus it is normal to incorporate a control for correction of self-running oscillator frequency against a fixed crystal standard.

The design of the oscillator circuit in the " 888A " receiver is such that excellent overall frequency stability is an inherent feature. There is a brief short-term drift due to warming-up of the valve, and long-term drift is counteracted by the use of negative temperature coefficient condensers. Any remaining drift is very slight and of a random nature. In a receiver with wide coverage, the drift would not be noticed but, in the " 888A " it is of course magnified by the greatly expanded tuning scales, each of which covers only a very limited range of frequency. Therefore, to enable any slight variations to be corrected, and to ensure the pointer indicates the actual frequency with the minimum of error, two panel controls are provided. One is a knob, located in the centre of the control panel, which adjusts a small trimmer condenser in parallel with the oscillator tuned circuit. This by itself would be of little practical value and so a crystal-controlled calibration oscillator is fitted inside the receiver. It is brought into operation by a press switch on the panel and produces harmonic beats, 100 kc/s. apart, throughout the tuning range. Positive correction can thus be made at those major scale markings which are exact multiples of 100 kc/s. To avoid confusion, the calibrator switch, when pressed, mutes incoming signals.

Once set up and provided the stable temperature has been reached, no further oscillator adjustment will be required for some considerable time unless the band in use is changed.

A separate triode valve is employed in the oscillator position and the injection voltage is optimum. Hence maximum gain is secured from the frequency changer and noise is kept to the lowest possible figure. Stabilised high tension voltage is supplied to the oscillator valve and changes of frequency due to mains voltage variations or to operation of the gain controls are negligible.



View of " 888A " receiver from the rear.

RF AND IF STAGES

To overcome the poor noise factor which would otherwise result, a radio frequency amplifying stage before the frequency changer is essential and, provided high gain is contributed by this stage, most of the noise at the output will be derived from the aerial and not from the receiver. This is the case with the " 888A" receiver. All the components associated with the RF stages (meaning the signal and oscillator tuned circuits) are of the highest quality and as a consequence the " Q " values of the tuned circuits are maintained at particularly high values. The L to C ratios and inter-stage couplings on each range are set at optimum whilst the provision of air-dielectric trimmer condensers and moveable dust-iron cores in the coils allows very close alignment throughout.

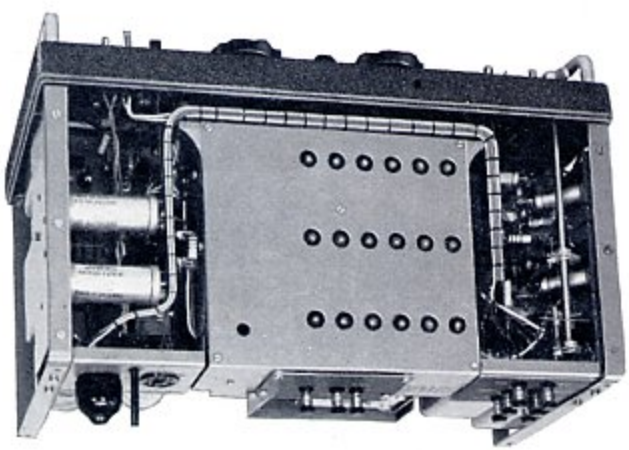
An aerial trimmer, accessible when the lid is lifted, can be used to bring the first tuned stage to exact resonance, thus making allowance for possible variations of load reflected on the circuit by different aerials. In some cases this feature may make all the difference in bringing a very weak signal up out of the noise and making it readable. The nominal input impedance is 75 ohms.

To secure a high degree of selectivity, the " 888A " utilises a double superheterodyne circuit, a further advantage being that image interference is to all intents and purposes eliminated.

After amplification, the incoming signal is changed to 1620 kc/s., a useful degree of amplification at this frequency being derived from the mixer valve. The signal is passed on to a second frequency-changer via a double-tuned high " Q " IF transformer, and is here converted to 85 kc/s. At this comparatively low frequency, both high gain and sharp selectivity can be achieved without difficulty and the single 6BA6 valve is amply sufficient — in fact, more gain would confer no benefit, and usually the IF gain has to be reduced when receiving A1 signals.

To cater for all types of signal, the selectivity is made variable, the system adopted being to move the coils inside the IF transformer cases, through a system of mechanical links. The bandwidth (at 6 db points) can be varied smoothly over the ranges 0·9 kc/s. to 5 kc/s. In addition, an extremely narrow bandwidth, usable only on stable A1 signals, is available when the audio filter is brought into circuit.

Due to the independent control of RF and IF gain, in conjunction with the fine frequency adjustment afforded by the bandspread system, single sideband telephony signals can be tuned in with ease.



Underside of the " 888A " receiver, showing the substantial coil-box casting.

OTHER SPECIAL FEATURES

Audio Filter. Mention has already been made of the audio filter, which is of very advanced design. It has a steep response curve and peaks at 1,000 cycles, with a bandwidth of only 100 cycles at 6 db points. Further, the insertion loss is extremely low — only 1 db at 1,000 cycles, which means that the filter can still be used even with a weak signal. With careful tuning, a signal can be made to stand out clearly with a considerable diminution of noise and interference, and the improvement in readability will delight the keen CW operator.

Monitoring. When the Standby Switch is in the " off " position, the receiver is de-sensitized but not completely muted. A signal from a local transmitter can therefore be monitored on either CW or telephony. As the degree of stray pick-up will vary in individual cases, a control is fitted whereby the standby sensitivity can be altered; the knob is readily accessible for adjustment when the lid is lifted.

Auxiliary Control. A pair of contacts on the Standby Switch are brought out to terminals at the rear and, by including externally a relay and energizing source, the switch can be used to control other equipment — for example, an associated transmitter.

Separate Controls. To obtain the best possible results under all conditions and with various types of signal, separate gain controls are fitted for the RF, IF and AF stages. These will be found of considerable value once skill in handling them has been acquired — for example, with a weak CW signal, it is often helpful to keep the RF gain fully advanced but to reduce IF gain when strong interference is present.

Battery Operation. Although primarily intended for operation from A.C. mains the " 888A " receiver also accepts independent L.T. and H.T. supplies.
Connections are made by interchangeable plugs fitting into sockets at the rear of the receiver.

Noise Limiter. The noise limiter, of the series diode type, is designed to reduce interference of a pulse nature — e.g. car ignition. It can be brought into use by a panel switch and is a valuable asset on occasions. It should be borne in mind that the action of a noise limiter is dependent on bandwidth, hence the one in the " 888A " is more effective with the selectivity control at minimum, as it should be for receiving telephony.

Audio Output. A low impedance loudspeaker (2·5 ohms) can be connected to the spring loaded terminals at the rear of the receiver. The Eddystone Cat. No. 688 speaker is recommended, as it matches the receiver electrically and physically. A jack on the panel takes high resistance telephones and then the speaker is automatically muted.

Signal Strength Meter. A socket at the rear takes the Eddystone Cat. No. 669 " S " Meter, which can be placed either on top or alongside the receiver. This instrument is finished to match and is useful for taking comparative readings of carrier levels.

Mounting Feet. Specially designed blocks (Cat. No. 774) can be supplied for raising the front panel to a convenient operating angle. They are of cast aluminium, finished to match the receiver and easily attached.

Aerials. The receiver will give excellent results with aerials of widely differing patterns. It is desirable to use an aerial (or aerials) designed to resonate within the particular bands in which most interest exists, and to match as closely as possible into the input impedance of the receiver (75 ohms).

SPECIFICATION OF THE EDDYSTONE "888A" RECEIVER

COVERAGE.
Complete coverage of the six major amateur bands.

Range 1	..	28,000 kc/s. to 30,000 kc/s.
Range 2	..	21,000 kc/s. to 21,500 kc/s.
Range 3	..	14,000 kc/s. to 14,350 kc/s.
Range 4	..	7,000 kc/s. to 7,300 kc/s.
Range 5	..	3,500 kc/s. to 4,000 kc/s.
Range 6	..	1,800 kc/s. to 2,000 kc/s.

VALVES

Valve Position	*Type*	*Function*
V1	6BA6	R.F. Amplifier.
V2	ECH81/6AJ8	Mixer (Signal frequency to 1620 kc/s).
V3	6C4/L77	Oscillator.
V4	ECH81/6AJ8	Frequency changer (1620 kc/s.) to 85 kc/s.
V5	6BA6	I.F. Amplifier (85 kc/s.).
V6	6AT6/DH77	Demodulator, A.G.C. and first stage audio.
V7	6AL5/D77	N.L. and "S" Meter diodes.
V8	6AQ5	Output stage.
V9	6BE6	CW/SSB Converter.
V10	5Z4G	Rectifier.
V11	VR150/30 (OD3)	Stabiliser.
V12	6AU6	Crystal Calibrator Oscillator.

All the valves, with the exception of the rectifier and stabiliser are of the miniature type.

TUNING MECHANISM AND SCALES
The gear-driven, flywheel-controlled mechanism has a reduction ratio of 40 to 1, is free from backlash and permits the most critical tuning on all ranges. The vernier scale is read against a seventh (lowest) line on the main dial and opens up each scale length to the equivalent of fourteen feet.
The scales proper are twelve inches long and directly calibrated.

CRYSTAL CALIBRATOR
The crystal calibrator provides marker points at 100 kc/s. intervals and is operated by a switch on the front panel. This switch, of the push-button type, mutes incoming signals whilst a calibration check is being made. A trimmer is provided on the crystal calibrator to permit accurate adjustment to an external sub-standard signal.

OSCILLATOR TRIMMER
A vernier control on the panel permits exact electrical adjustment of the oscillator frequency, to bring it into coincidence with the frequency indicated by the pointer and dial after checking against the crystal calibrator.

INTERMEDIATE FREQUENCY STAGES
The first I.F. is 1620 kc/s. and the second 85 kc/s. Transformers specially designed for the purpose are used and high gain with complete stability is achieved. A separate gain control is provided.

CW/SSB CONVERTER
This is built as a separate unit to ensure adequate screening and high stability. For reception of CW and SSB signals, the diode detector is cut out of circuit and the incoming signal (at IF) is mixed with the local BFO to produce directly a signal at audio frequency. Fine adjustment is afforded by the panel pitch control which gives a variation of ± 3 kc/s.

AUTOMATIC GAIN CONTROL
The delayed AGC system maintains the output level within 10 db for an 80 db change of input above 2 microvolts (measured at 1·9 Mc/s.). The time constant is generally suitable for the type of fading experienced on the Amateur bands.

NOISE LIMITER
The series diode noise limiter is effective on noise of a pulsative nature and is readily brought into operation by a front panel switch. Special care has been taken to avoid hum being introduced in this part of the circuit.

ELECTRICAL PERFORMANCE
SENSITIVITY throughout is better than 3 microvolts for a 20 db signal to noise ratio (50 milliwatts output, 30% modulation). Absolute sensitivity on C.W. is better than 0·5 microvolts.

SELECTIVITY is variable from 30 db to 60 db down, 5 kilocycles off resonance. With the audio filter in circuit, a signal 250 cycles off resonance is attenuated 32 db.

OUTPUT POWER exceeds 2·5 watts into a 2·5 ohm load.

IMAGE RATIO better than 35 db at 30 Mc/s. and higher on other bands.

AERIAL INPUT
Input impedance is approximately 75 ohms balanced or unbalanced. An aerial trimmer, accessible when the lid is lifted, permits optimum results to be obtained.

OUTPUT CIRCUITS
Terminals at the rear accept a speaker with an impedance of 2·5 ohms. A panel jack is provided for high resistance telephones, the speaker being automatically disconnected when these are in use.

OTHER FEATURES
A socket at the rear of the receiver takes the plug of standard Eddystone Cat. No. 669 "S" Meter. Another plug permits the use of auxiliary sources of power. On the front panel is the "Standby" switch, which desensitises the receiver, but does not remove HT from any of the valves. An internal adjustment is provided whereby the stand-by sensitivity can be altered.

CONTROLS
Large knobs for BAND SELECTOR and TUNING. Smaller knobs for independent control of RF, IF and AF gain; BFO Pitch: Oscillator Frequency. Butterfly knob for Variable Selectivity. Toggle switches for:— Mains on/off; AM/CW–SSB; Noise Limiter; Standby (long dolly); A.F. Filter; A.G.C. on/off Press switch for Crystal Calibrator. Internal controls:— small knobs for Aerial Trimmer and Standby Sensitivity; screwdriver adjustment of Crystal Calibrator frequency.

FINISH
All steel parts are rust-proofed. All internal parts are finished for tropical service, the external surfaces being enamelled an oyster grey hammer tone. The grey control knobs are mounted on an anodised finger plate, and the protective handles are chromium plated.

POWER SUPPLY
Standard mains transformer with primary tappings for 110 volts or 200/240 volts 40/60 cycles. A transformer for 110/125 volts 25/60 cycle mains can be fitted to special order. Power consumption approximately 80 watts.

WEIGHT AND DIMENSIONS
The weight (unpacked) is 44 lbs. (20 kilos). Dimensions are:— overall width 16¾" (42·5 cms.); depth 10" (25·4 cms.); height 8¾" (22·2 cms.).

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