KW E-Z MATCH

Most modern day transceivers need a proper termination of 50ohms in order to function satisfactorily. The KW E-Z MATCH is designed to transform a high impedance or mismatched transmission line to 50ohms resistive. The circuitry and components used allow this to be done with a minimum loss. Modern transmitters and transceivers will meet their spurious and intermod specifications only if worked into a proper load. A Low Pass Filter is almost useless for harmonic reduction if it is not terminated in a proper impedance. The KW E-Z Match will match 30-2500 ohms on 20, 15 and 10 metres and 30-1000ohms on 80 and 40 metres. Impedances outside these limits can also be matched depending on the magnitude of the reactive component. Transmitters with power inputs as high as 1 KW PEP can be used if the natural SWR is less than 2:1 on a 50ohm line. For high impedance and end fed antennas the safe maximum transmitter input power is 350 watts PEP. The limitation is basically one of peak RF voltage and is dependent on the reactive component of the load. Tuning is simple and straightforward. For best results the transmitter should first be tuned into a dummy load. Preliminary tuning of the KW E-Z Match is done by adjusting the controls for maximum signal on receive. Then using the lowest power (for minimum interference) final adjustments are made to bring the SWR to as near unity as possible. The dial readings of the KW E-Z Match are then logged for easy reference. Connections are provided for balanced feeders to the antenna and a UHF coaxial connector (SO239) for input. There is also provision for mounting an additional coax connector when the antenna feedline is coaxial.

K. W. EEZ-ZEE MATCH

ANTENNA TUNING UNIT

The K.W. E-Z Match is designed to provide an improved system of matching between a Transmitter output or Receiver input and an antenna system. The unit covers bands 10-80 metres inclusive and enables resistive loads from 15 ohms to 5000 ohms to be matched. Re-active components in an antenna system can be considerably reduced and the standing-wave-ratio (S.W.R.) improved. This will also tend to improve results when dealing with television interference (TVI). Maximum power should not exceed 400 watts p.e.p. (SSB), 100 watts power output A.M. with 100% modulation.

TRANSMITTER OPERATION

Connect the low impedance output of a transmitter to the RF input of a standing-wave-ratio bridge (e.g. The K.W. Match) and the RF "output" of the SWR Bridge to the R.F. input co-axial socket on the KW E-Z Match. Connect the antenna to the appropriate terminals at the rear of the E-Z Match. (See instructions below). With the SWR Bridge switched to "reflected" power, tune the two controls at the front of the E?Z Match for minimum SWR indication. NOTE: It may be necessary to re-adjust the sensitivity of the SWR Indicator, with the switch in the "forward" power position, to obtain optimum SWR indication.

WARNING During the tuning process, always ensure that the P.A. stage is not pulled off-resonance. Slight re-adjustment to maintain resonance may be necessary.

When the correct match has been found, log the dial readings of E-Z Match for easy reference after a frequency change.

RECEIVER OPERATION.

The same principals apply when using the E-Z Match with a Receiver only. Adjustment should be made for optimum signal strength. An SWR Indicator is not required. From experience, it may be found, that a quick approximate method of tuning the E-Z Match for transmission is to adjust on a received signal at the required transmission frequency. Final adjustment of the E-Z Match should be done using the SWR Indicator method.

ANTENNA CONNECTIONS to the E-Z Match. At the rear of the unit are two pairs of terminals - Black and Red - each will accept a 'Banana' Plug or screw down on to wire or to a 'spade' tag. A fifth terminal, black in colour, situated below the two pairs of terminals is provided for an earth connection and for a connection link to one of the terminal pairs when using a single-wire-feed-antenna. The BLACK pair of terminals are for use on 40 and 80 metres. The RED pair of terminals are for use on 10, 15 and 20 metres. A pair of terminals should always be used when the antenna is fed with co-axial cable, twin cable or open wire feeder. For single-wire feed use only one terminal of the paid (Black 40/80 - Red 10/15/20) for the antenna connection and link the other terminal of the pair to the earth terminal. Try reversing the connections to antenna and earth terminal pairs for best SWR. ALWAYS connect an earth wire to the E-Z Match. It is desirable that this be made as short as possible to a ground-post and not to the earth of the domestic mains supply.

TVI - Proofing. A 52 or 75 ohm Low-Pass-Filter should be connected in the co-ax line between the transmitter and the E-Z Match. When using an SWR indicator, place this in the co-ax line between the transmitter and the Low Pass Filter.

NOTE: K.W. Products to assist in the reduction of television interference.

K.W. Match SWR Indicator. Dual impedance 52 and 75 ohms. Measure for best standing wave ratio on the antenna system.
Price...£8.10.0d.
P/P..... 3.6d.

K.W. Balun, converts co-ax input to balanced output (e.g. fit at top of co-ax feeder to dipole or beam)
Price...£1.15.0d.
P/P..... 1.6d.

K.W. Low Pass Filter. When ordering state whether for 52 or 75 ohm impedance, also channel number of local BBC/TV Station.
Price...£4.14.0d.
P/P..... 2.6d.

K.W. High Pass Filter. Fitted at the T.V. set to reduce the effect of 'Shock excitation'.
Price...£1. 6.6d.
P/P..... 1.0d.

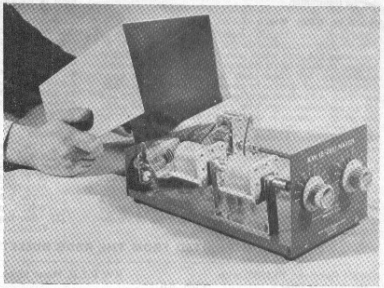
K.W. T.V. Balun. Fitted at the T.V. Antenna feed point to match the 'balanced' antenna to co-ax feeder. Reduces effect of 'shock excitation'.
Price... 12.6d.
P/P..... 1.0d.

K.W. E-Z Match, as described above.
Price..£12.10.0d.
P/P.... 6.0d.

K.W. ELECTRONICS LIMITED,
Vanguard Works,
1, Heath Street,
Dartford,
Kent.

Insurance for Your Final

By R. F. STEVENS, G2BVN*



The KW E-Zee Match, the dimensions of which are 6 in. wide, 5 in. high and 12 in. deep.

THE present trend in the design of power amplifier stage of transmitters operating on the h.f. bands, both home built and commercial products, is that the output circuit shall be of the " pi " configuration. In most cases this is designed to work into an impedance of 52 or 75 ohms in order to match the types of coaxial cable commonly used as feeders in amateur stations. Further, the designer or manufacturer usually states that the v.s.w.r. on the feeder should be kept as low as possible and certainly not greater than 3 : 1, otherwise performance of the amplifier will be degraded. Unfortunately, however, an aerial is rarely resonant at exactly 52 or 75 ohms, and then often at one frequency only. Therefore the impedance at the feed point will usually be a figure other than that for which the output circuit was designed.

Apart from the unproductive exercise involved in generating r.f. power only for it to be dissipated before it reaches the radiating portion of the aerial installation, a high v.s.w.r. brings other disadvantages. The voltage across the loading capacitor in the pi output circuit may reach a value large enough to cause arcing and there will certainly be an excessive circulating current in the tank coil. Where a final amplifier employs television deflection valves this current will bring additional and unwanted heat into a circuit whose heat dissipating properties are already being pushed towards the limit.

What then can be done to ease this situation? The answer is neither difficult nor expensive and can be supplied by the addition of an aerial matching unit. This device has been in use since the beginnings of Amateur Radio and is known by many names including aerial coupler, aerial tuning unit, and more recently, transmatch. The earlier units used band-switched circuits and one probable reason for their fall from favour was the time required in adjusting a further tuned circuit when changing bands. However the "Z Match" aerial coupler [1] provided switchless operation over the frequency range 3·5 to 30 Mc/s by the use of a multiband tank circuit, the basic details of which are shown in Fig. 1. Around this original design a number of commercial units have been fashioned, some of them including in the same cabinet a reflectometer to facilitate setting up.

Unfortunately the aerial matching unit has been credited with properties, none of which it possesses. Firstly, it *cannot* under any circumstances improve the v.s.w.r. of an aerial installation. If a mismatch exists between the aerial and the feeder then correction can only be applied at one place and it is necessary to adjust the aerial to bring the feed point impedance to a figure corresponding to the impedance of the feeder. Also, the addition of a matching unit will not affect the radiation pattern of an aerial in any way and most certainly it will not narrow the main lobe of a beam.

What useful function will the matching unit perform? Functioning as an r.f. transformer it will present to the output circuit of the transmitter a load for which this was designed and into which it will work with maximum efficiency, thus protecting the components in the final amplifier. The matching unit can be adjusted so that the feeder between it and the output of the transmitter will have almost a 1 : 1 v.s.w.r. and into which low pass filters may be inserted in the knowledge that their performance is not being degraded and components possibly damaged by the effects of a high v.s.w.r. Further, there will be available the attenuation afforded by the additional tuned circuit of the matching unit and harmonics may be reduced by up to 12dB. This property is particularly valuable where interference to television receivers poses a problem. With the Z-match type of unit using a multiband circuit the additional time necessary when changing bands is reduced to a minimum.

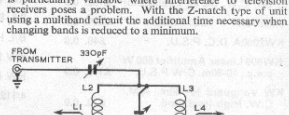


Fig. 1. The basic circuit of the aerial matching unit using a multiband tank without switching. Coil values are L1, 2·4 μH; L2 3·5 μH; L3 1·7 μ H; L4 1·8 μH.

A bonus obtained from the use of a matching unit is that where the same aerial is used for transmitting and receiving, the strength of the received signals in many cases will be increased. This is due to the existence of an impedance match between the receiver input circuit and the feeder. To

* Chairman, RSGB Technical Committee.

make use of this further advantage, send-receive switching must obviously be carried out in the cable between the unit and the transmitter.

The K.W. E-Zee Match

The only commercially manufactured match unit at present readily available in the UK is that produced by K.W. Electronics Ltd., and which is shown in the photo. This is designed to cover bands between 3·5 and 30 Mc/s without switching and will enable loads varying in impedance up to several thousand ohms to be matched to the transmitter output circuit. A combination of terminals on the rear of the unit will accommodate single wire, twin feeder or coaxial cable. One set of terminals is used on 3·5 and 7 Mc/s with the remainder being used on the three higher frequency bands.

An approximate adjustment of the tuning controls can be made on a received signal on or near the transmitting frequency, but the preferred method of setting up is to use a standing wave indicator, and an instrument of the "Monimatch" type [2] is entirely suitable as it is not desired to measure accurately the value of the s.w.r., but rather to obtain dial settings where the reflected power is at a minimum. Once dial settings have been obtained for the various bands they can be marked with Letraset or similar material to facilitate rapid retuning.

Where coaxial cable feeder is used it is considered essential that this should have a high density braid covering, which most of the cables designed for entertainment use do not have, and that the fitting of suitable terminations should be carefully carried out. The quality of the cable should be such that there can be no doubt that it does conform to the stated impedance. Impedance changes can often be accounted for by alterations in the position of the centre conductor relative to the braid and this has frequently been noted in cheap cable. The writer is firmly of the opinion that time spent on the station aerial system is a good investment and the use of an aerial matching unit will in many cases enable your transmitter to more efficiently carry out the job for which it was designed.

References

[1] "The Z-match Aerial Matching Unit," page 276, RSGB BULLETIN, December 1956.
"The ZS1CK Transmatch," "Technical Topics" (J. P. Hawker, G3VA), page 304, RSGB BULLETIN, May 1966.
"The Z-Match Antenna Coupler," by A. W. King, W1CJL, page 11, *QST*, May 1955.
[2] "Standing Wave Ratio Meters," by P. Harris, G3GFN; page 297, RSGB BULLETIN, May 1964.

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A switched "Z"-match aerial unit

by R. A. Butterworth, G8BI*

IT could be said without much fear of argument that the "aerial match", "Z"-match, call it what you will, together with an swr bridge, has done a great deal to help radio amateurs to get a more efficient transfer of rf from their transmitters into the odd bits of wire they throw up and call aerials. The extra tuned circuit is, of course, a fringe benefit to help to keep those nasty harmonics down.

The following refers to a commercially built unit but there may be something of interest for those who have built their own. As supplied, it is a one-aerial-at-a-time unit. It has to be "un-parked" from wherever it is stored, and feeders juggled with, and it becomes tedious if one only wants to check the activity or compare one aerial against another. By the addition of a low-loss switch and two coaxial sockets, these snags can be averted and the following advantages obtained:

(*a*) both aerials are permanently connected;
(*b*) any type of feeder or long wire can be used, and
(*c*) change-over from one to the other aerial is just a click of a switch.

Modification of the E–Z-match

The following components are required:
one low-capacitance low-loss ceramic, four-pole, three-way switch;
four ceramic miniature stand-off insulators;
a length of ¼in diameter rod;
a small universal coupler;
two insulated Belling coaxial sockets, and
2ft of 14 swg tinned copper wire.

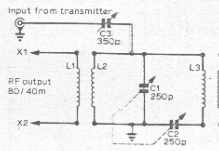
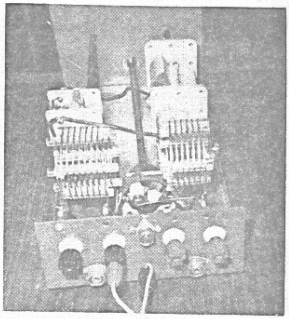
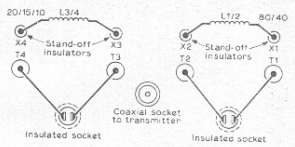


Fig 1. Basic circuit of "Z"-match unit



Rear view of unit showing back pane arrangement



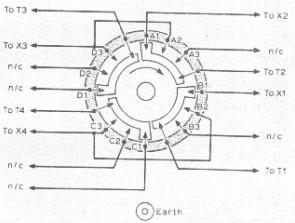


Fig 2. Back panel layout, above, and switch wafer connections

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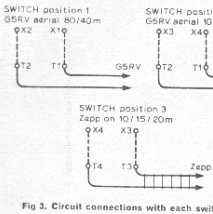

Fig 3. Circuit connections with each switch position

It is suggested that the following procedure is used:

(1) Mount the ceramic stand-offs on the back panel, adjacent to the two coil assemblies, so that the coils can be mounted on them instead of on the screw terminals.

(2) Drill the back panel with clearance holes so that the two insulated type coaxial sockets can be mounted below and central to each pair of screw terminals.

(3) Carefully unsolder the coil assemblies from the screw terminals (L1 and L4) and re-connect to the stand-offs so that the original position of the coils is maintained.

(4) Make up a simple "L" bracket of $\frac{1}{16}$in aluminium to mount the switch as near as possible to the back panel and central to the coils so as to get the shortest possible leads between coils, switch and stand-offs. Use the "L" bracket as a template to mark out the position of the hole in the front panel before mounting the switch assembly on the chassis.

(5) Reference to Fig 2 should make the wiring-up clear. The two coaxial sockets are, of course, wired in parallel to the screw-type terminals which, incidentally, are combined 4mm sockets. Good solder joints are essential, so use a medium soldering iron.

(6) The final operation is the fitting of the extension shaft, flexible coupler and front panel knob. Because of the length of the extension shaft it is essential to fit a $\frac{1}{16}$in panel bush to the front panel for good support.

The switch has three positions marked HIGH, LOW and X which with the two aerials used by the author gives:

"L": 80 and 40 on the 5RV.

"H": 20, 15 and 10 on the 5RV.

"X": 20, 15 and 10 on a double extended Zepp.

Obviously any type of aerial can be used and selected at the simple turn of the switch. The addition of the coaxial sockets simplifies connection of the cable by means of the usual plug instead of inefficient splayed-out ends. The author's unit has been in use now for two years and such tests that have been made show that there is little or no insertion loss.

A scaffold tilt-over

by A. M. FRASER, GM3AXX*

WITH the almost universal acceptance of the commercial 180W transceiver, one of the few constructional pleasures left to the average amateur lies in the field of aerials. At the author's previous location, a 35ft telegraph pole, plus a 12ft dural extension, supported the rotary beam and the end of a long-wire aerial. Though outside aerials were forbidden, the author got away with it—no doubt due to the presence of some 20 similar poles scattered about the immediate vicinity.

However, at his new location in a small village the telephone lines are in underground ducts, so that a lone telegraph pole would doubtless arouse considerable curiosity. It was essential to design and build a slim inconspicuous mast which could be raised or lowered by one person in approximately 30 seconds with little effort. Furthermore, for the first four or five months, the author planned to do just that at each operating period, thus bewildering and baffling any village official who might stray near "Chez 3AXX".

Photo 1. The base-section assembly

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