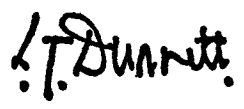
AIR PUBLICATION

116E - 1719 - 1

ANTENNA TUNING UNIT RACAL TYPE MA.144

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL



Ministry of Defence

FOR USE IN THE

ROYAL AIR FORCE

MA. 144
AERIAL TUNING UNIT

TECHNICAL MANUAL

RACAL COMMUNICATIONS LIMITED
BRACKNELL
BERKSHIRE
ENGLAND

Ref. 79

Printed in England

Issue 2 — 1 . 67 . 125

Antenna Tuning Unit Type MA.144 and MA.144C

CONTENTS

ILLUSTRATIONS

TABLES

◀ Antenna Tuning Unit Type MA.144 & MA.144C ▶

GENERAL DESCRIPTION

◀ The Antenna Tuning Unit Type MA.144 and MA.144C are T-section networks designed to match a whip type antenna to the 50-ohm impedance of a Racal Linear Amplifier Type TA.99. Satisfactory matching is obtained with antennas ranging in length from one-fourteenth wavelength (a few ohms) at the lowest frequency to one wavelength (several thousand ohms) at the highest frequency.

The unit is robustly constructed and is completely enclosed in a rectangular case.▶

◀ Antenna Tuning Unit Type MA.144 & MA.144C ▶

TECHNICAL SPECIFICATION

Frequency range	◀ MA.144 1.5 to 25MHz MA.144C 1.5 to 30MHz ▶
Power rating	1kW r.m.s.
Antenna impedance range	3 ohms to several thousand ohms with positive and negative phase angles.
Standing-wave ratio due to the unit	Less than 1.5 : 1
Tuning	Continuous. ◀ Approximate calibration charts are supplied ▶

Dimensions (approx)	Height	Width	Depth	
	10	18	14.5	in
	25,7	46	37	cm

Weight (approx.)	40lb (88kg.)

Antenna Tuning Unit Type MA.144 and MA.144C

OPERATING INSTRUCTIONS

CONTROLS (fig. 1)

1. The antenna tuning unit has four controls which are mounted on the front panel of the unit, and are described below.

(1)	TRANSFORMER TAP	An eight position switch which changes the input transformer tapping.
(2)	L1	A continuously variable control associated with a graduated scale to vary the inductance of coil L1.
(3)	C1	A continuously variable control associated with a graduated scale to vary the capacitance of capacitor C1.
(4)	L2	A continuously variable control similar to the L1 control to vary the inductance of coil L2.

TUNING PROCEDURES

WARNING...

VERY HIGH VOLTAGE EXISTS AT THE ANTENNA TERMINAL.

2. Set the transmitter to low power and transmit. Adjust L1, C1, L2 and T1 controls as described in the following paragraphs.

Antenna less than quarter wavelength at operating frequency

3. Set C1 close to minimum and adjust L1, L2 and T1 controls in sequence for a minimum reading on the VSWR meter (e.g. Standing-wave Ratio Indicator type MA.152).

Note...

At low frequencies, L1 should be set near to its maximum value. It may be necessary to adjust the C1 control slightly to obtain a minimum value of reflected power on the VSWR meter.

Antenna between a quarter and half wavelength

4. Set control L2 to zero and adjust L1, C1 and T1 controls in sequence for a minimum reading on the VSWR meter.

Antenna between a half and three-quarter wavelength

5. Set control L1 to zero and adjust L2, C1 and T1 controls in sequence for a minimum reading on the VSWR meter.

Antenna between three-quarter and full wavelength

6. Set control L2 to zero and adjust L1, C1 and T1 in sequence for a minimum reading on the VSWR meter.

Note...

At frequencies above 24MHz, it may be necessary to shorten the length of the antenna to less than one wavelength in order to obtain a satisfactory match and avoid a power loss within the unit.

TUNING CHARTS

7. Tables 1 to 5 give the approximate settings of the controls for whole MHz frequencies; this information is intended only as a guide. Operators should log settings obtained for frequencies used to enable antenna tuning to be effected as swiftly as possible.

◀ Antenna Tuning Unit Type MA.144 & MA.144C ▶

CIRCUIT DESCRIPTION

◀ The circuit diagrams for the MA.144 and the MA.144C are shown in Figures 2 and 3 respectively.

The r.f. signal from the transmitter is applied to the auto-transformer T1, which performs an impedance transformation between the T-section network and the output of the transmitter. Switch SA selects the ratio of impedance transformation, and the T-network L1, L2 and C1 provides variable matching to the antenna.

At low frequencies, L1 and L2 (C1 at minimum) resonate with the antenna capacitance. This presents a low resistive impedance to T1, which matches this impedance to the 50 ohm output circuit of the transmitter.

At high frequencies, the antenna impedance increases, and matching is achieved by adjustments to L1, C1 and C2.

For the MA.144, C1 is protected against voltages in excess of 15kV by a spark gap; further protection is provided by a potentiometer action of the antenna voltage by L1 and L2. In the MA.144C, protection is by means of L1 and L2 only. ▶

PARTS LIST

Cct. Ref.	Value	Description	Manufacturer and Type or Drawing No.
C1	12-500pF	Variable Air Capacitor	Jennings UCSF
◀ L1		Tuning Coil	Racal DA.16940/B (MA.144) Racal DA.16940/F (MA.144C)
L2		Tuning Coil	Racal DA.16940/A (MA.144) Racal DA.16940/E (MA.144C)
T1		Transformer	Racal CA.16931 (MA.144) Racal CA.39520 (MA.144C) ▶
SA		8-position switch	Aviation & Electronic Equipments Ltd. ES-1-8-EAAD
SKT1		Free Socket	◀ P.E.T. 201/LA/UR67/DEM/P.T.F.E.▶
PL1		Fixed Plug	P.E.T. 222

TABLE 1

Tuning chart - 36 ft whip antenna (MA.144)

Transmitter frequency, MHz	Approximate settings			
	L1	C	Transformer tap	L2
2	22.92	0	3	30.33
3	2.14	1.15	3	21.72
4	2.02	1.20	4	11.33
5	2.02	8.14	4	5.01
6	2.02	22.75	6	3.73
7	2.07	13.95	7	2.08
8	4.05	9.81	7	0.01
9	4.51	8.41	7	0.05
10	4.58	7.08	7	0.12
11	5.37	6.35	6	0.1
12	5.12	4.38	6	0.08
13	4.24	0.73	6	3.17
14	1.77	8.48	6	6.26
15	1.78	9.37	6	6.35
16	1.78	9.84	6	5.06
17	0.98	10.70	6	3.78
18	0.16	10.12	6	2.61
19	0.20	8.63	6	2.08
20	0.17	8.35	6	1.03
21	0.82	7.61	6	0.03
22	1.07	5.55	6	0.18
23	0.87	4.27	6	0.33
24	1.12	1.20	6	0.33

TABLE 2

Tuning chart - 20 ft whip antenna (MA.144)

Transmitter frequency, MHz	Approximate settings			
	L1	C	Transformer tap	L2
9	0.17	17.86	6	4.50
10	0.76	14.40	6	3.0
11	1.23	14.34	6	2.51
12	1.50	11.92	6	0.53
13	2.17	10.55	6	0.38
14	2.66	6.99	7	0
15	2.65	6.08	7	0
16	2.65	5.45	7	0
17	2.65	0.92	7	0
18	2.52	4.92	6	1.77
19	2.53	3.20	6	1.75
20	2.24	3.55	6	2.91
21	1.97	1.68	6	3.09
22	1.71	0.57	6	3.24
23	2.43	0.20	7	4.22
24	2.50	0.20	7	3.46
25	2.50	0.20	7	2.81

TABLE 3

Tuning chart - 120 ft slant-wire antenna (MA.144)

Transmitter frequency, MHz	Approximate settings			
	L1	C	Transformer tap	L2
1.5	6.50	5.79	3	19.54
2	29.07	24.93	5	25.74
3	27.62	9.71	4	29.53
4	10.04	7.20	6	24.33
5	23.72	7.68	8	26.29
6	20.55	6.73	7	17.63
7	11.42	5.78	7	30.33

TABLE 4

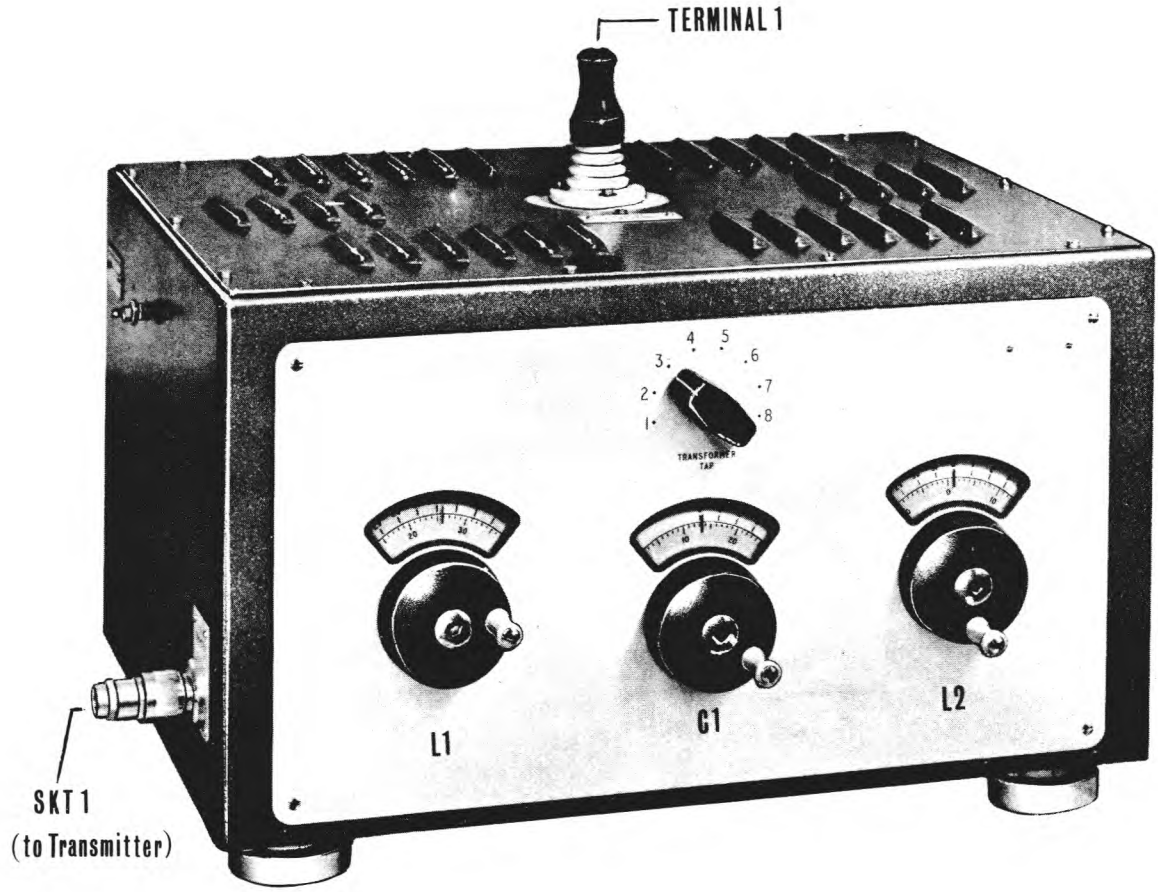
Tuning chart - 32 ft whip antenna (MA. 144C)

Transmitter frequency, MHz	Approximate settings /			
	L1	C	Transformer tap	L2
2	19.5	0	3	27.2
4	20.0	10.8	4	27.0
6	19.5	6.5	5	20.6
8	10.5	6.3	6	13.7
10	5.0	6.8	6	10.7
12	3.8	8.3	6	10.6
14	0.0	12.3	6	6.1
16	0.0	14.2	6	4.3
18	0.6	12.5	6	3.0
19	1.3	9.1	6	2.7
20	1.4	7.5	6	1.9
21	1.7	5.9	6	1.0
22	2.0	4.6	6	2.2
23	1.9	0	6	1.8
24	0	0	6	3.1

TABLE 5

Tuning chart - 18 ft whip antenna (MA.144C)

Transmitter frequency, MHz	Approximate settings			
	L1	C	Transformer tap	L2
18	0	0	6	4.1
20	0	9.6	5	4.3
22	1.8	9.9	5	3.4
24	0	8.8	5	2.5
26	1.7	7.0	6	1.6
28	1.6	6.5	6	1.6
30	1.2	9.0	6	1.7
30.2	1.3	8.5	6	1.8



6611/A

Antenna Tuning Unit
Types MA.144/MA.144C

Fig.1

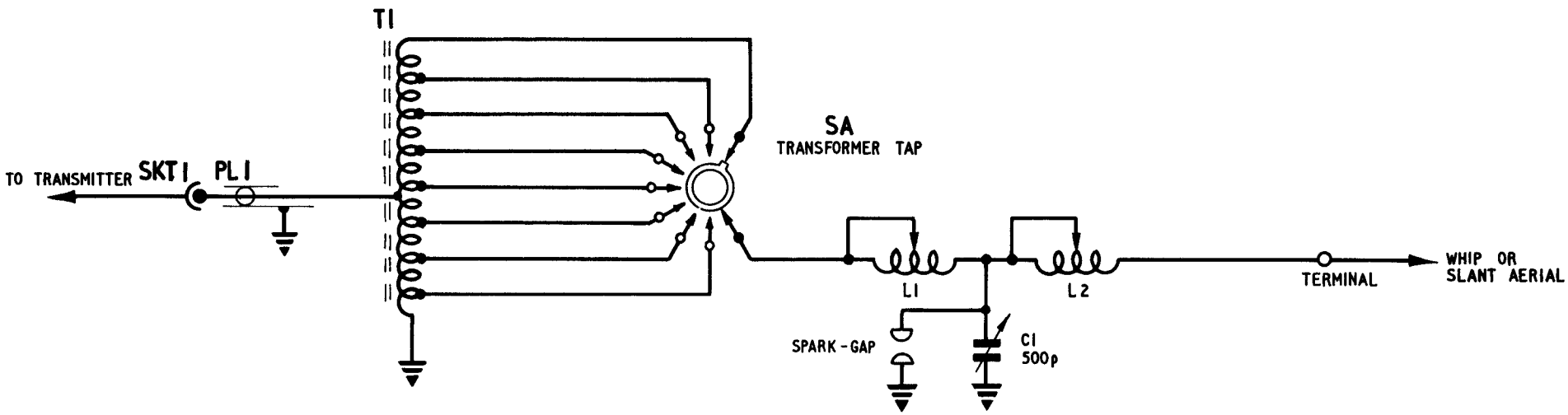


Fig.2

Circuit: Aerial Tuning Unit Type MA.144

12615/A

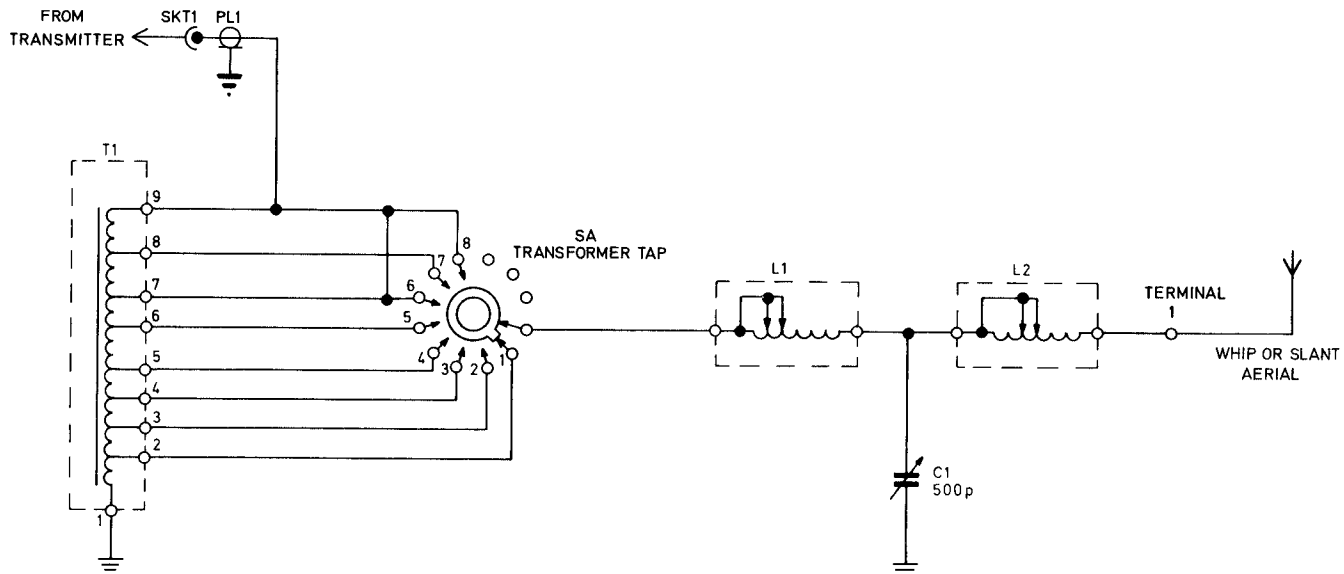


Fig. 3

12615/C

Circuit: Aerial Tuning Unit Type MA.144C