ADVANTEST®

ADVANTEST CORPORATION

INSTRUCTION MANUAL

TR1720N

Antenna Tuner

(75Ω)

MANUAL NUMBER 0797 EA 909

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Printed in Japan

CONTENTS

1. GENERAL

1.1 GENERAL DESCRIPTION

The TR 1720N antenna tuner when connected to the TR 4132N spectrum analyzer measures the field strength of various radio waves in the 100kHz to 30 MHz frequency range using loop and vertical type antennas. Using this tuner as an I/O tuning circuit can also reject pulse noise below a measured frequency as the selective tuner.

1.2 BASIC PRINCIPLES

The spectrum analyzer determines a field strength by measuring the tuning frequency electromotive force in antennas.

2. SPECIFICATIONS AND COMPOSITION

2.1 ELECTRICAL PERFORMANCES

(1) Frequency range:

Band 1	0.1 MHz to 0.2 MHz
Band 2	0.15 MHz to 0.3 MHz
Band 3	0.3 MHz to 0.6 MHz
Band 4	0.6 MHz to 1.4 MHz
Band 5	1.4 MHz to 3.5 MHz
Band 6	3.5 MHz to 10 MHz
Band 7	10 MHz to 30 MHz

(2) Field strength measurement range:
Depends on the TR 4132N measurement range and calibration coefficients. For details refer to other pages.

(3) Calibration coefficient accuracy:
K_ℓ; within ± 1 dB

2.2 DIMENSIONS AND WEIGHT

(1) Antenna tuning section:
Approx. 210 (width) x 140 (height) x 110 (depth) mm
Approx. 2.0 kg

(2) Container:
Approx. 495 (width) x 295 (height) x 155 (depth)
Approx. 2.3 kg

2.3 COMPOSITION

The tuner consists of the following components:

(1) Antenna tuning section 1

(2) Loop antennas (the serial numbers of these antennas are the same as those for the antenna tuning section) 7

(3)	Vertical antenna	1
(4)	Coaxial connection cable provided with 2 meters BNC-BNC connectors (MC-64-04)	1
(5)	Operating manual	1
(6)	Container	1

3.OPERATING INSTTUCTION

3.1 CHECK

Check that the tuner has not been damaged during the transportation.

Check that all components shown in Section 2.3 are provided.

3.2 HOW TO ASSEMBLE THE TUNER

(1) Loop antenna and antenna tuner

Mount the loop antenna so that its name plate side is the front and tighten the loop antenna with screws.

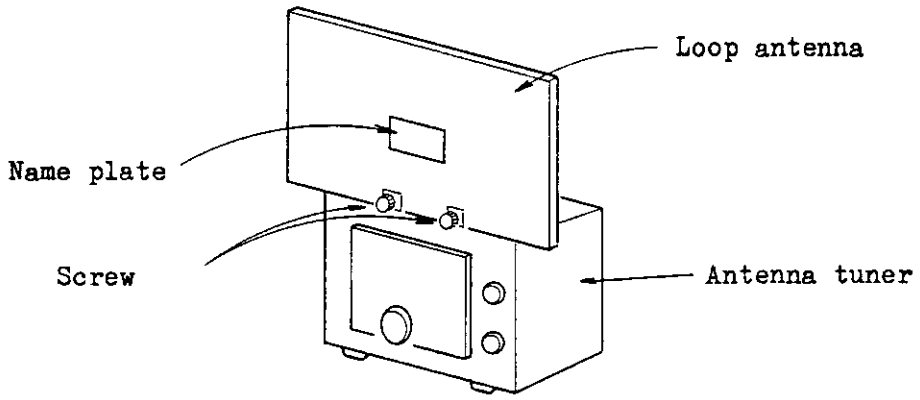


Fig. 3-1 How to assemble the loop antenna and antenna tuner

(2) The vertical antenna and antenna tuner are assembled as shown below.
Fix the vertical antenna to the top of the antenna tuner.

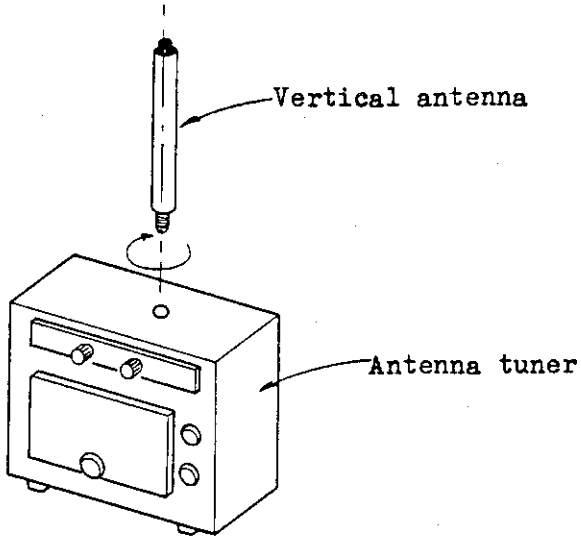


Fig. 3-2 How to assemble the vertical antenna and antenna tuner

3.3 HOW TO CONNECT THE ANTENNA TUNER AND TR 4132N SPECTRUM ANALYZER

Connect the OUTPUT connector on the left side of the tuner to TR 4132N spectrum analyzer INPUT connector with a coaxial cable. Provide the INPUT connector with the TR 1613 N-BNC adapter.

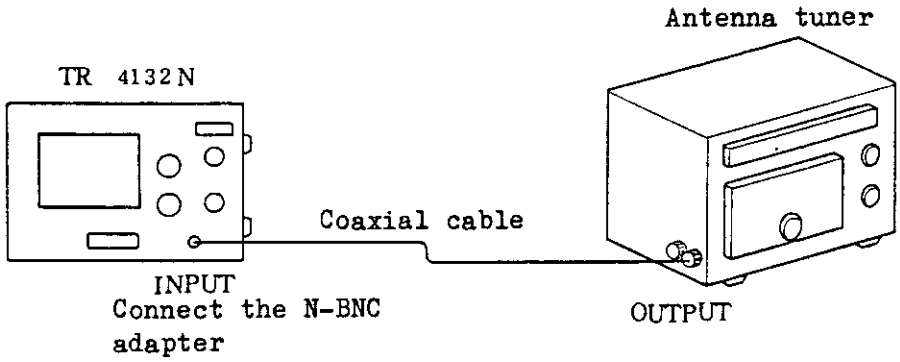


Fig. 3-2 How to connect the antenna tuner to the TR 4132N spectrum analyzer

3.4 HOW TO MEASURE THE FIELD STRENGTH

(1) The field strength is measured by the loop antenna as shown below.

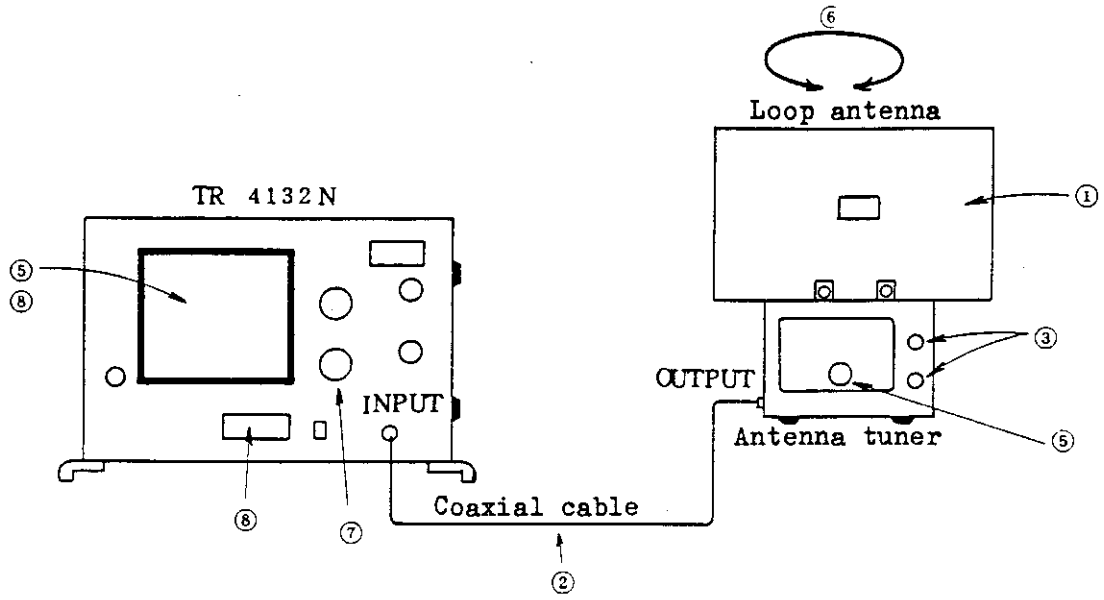


Fig. 3-3 How to measure the field strength using the loop antenna

1 Mount the antenna tuner with the specified frequency band loop antenna according to Section 3.2.

2 Connect the antenna tuner and TR 4132N spectrum analyzer with a coaxial cable as shown in Section 3.3. Also provide the TR 4132N INPUT connector with the N-BNC adapter.

3 Adjust the LOOP-VERT switch to LOOP.
The BAND switch can be set to any position when using the loop antenna.

4 Set the TR 4132N switches shown as follows:

Set the RF ATT. switch to 0 dB.

Set the BAND WIDTH switch to AUTO.

Set the DISPERSION/DIV switch to 0.1 MHz to 2 MHz according to the loop antenna bands.

Set the TUNING switch to the frequency to be measured.

Set the ANTENNA switch to INPUT LEVEL.

Set the 10 dB/DIV./5dB/DIV./LINEAR switch to 10 dB/DIV..

For details on the TR 4132N switches, refer to the TR 4132/4132N Instruction Manual.

5 Adjust the FREQUENCY dial on the antenna tuner so the TR 4132N CRT display spectrum becomes the maximum level.

6 Turn the antenna tuner so the TR 4132N CRT display spectrum becomes the maximum level.

7 Rotate the IF GAIN switch clockwise if the TR 4132N CRT display spectrum is too small. For details, refer to the TR 4132/4132N Instruction Manual.

8 The spectrum level to be measured is displayed.
The spectrum level can be obtained by deducting the CRT display spectrum level from the REFERENCE level.

9 Measure the field strength with the following formula.
Measured field strength = (TR 4132N level) + K_ℓ dB
(1 μV/m = 0 dB).
K_ℓ indicates the loop antenna calibration coefficient for the measured frequency, and can be determined by the calibration coefficient table shown at the end of this manual.

(2) The field strength is measurd by the vertical antenna as shown below.

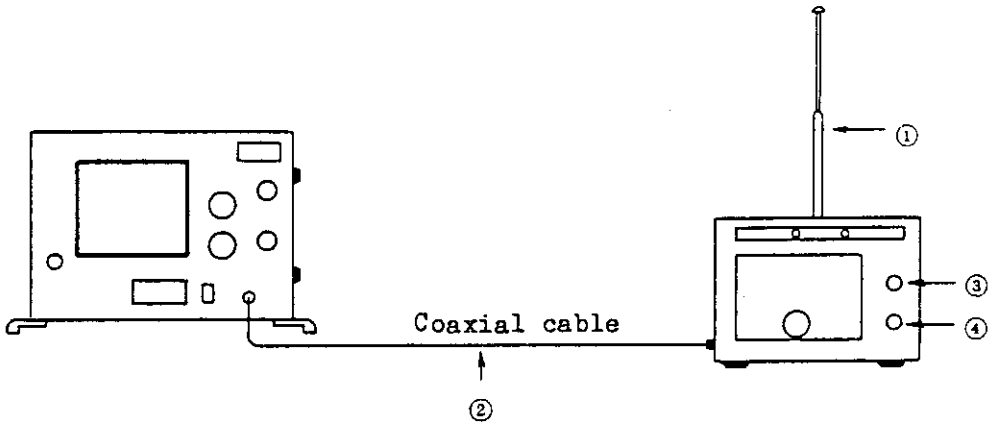


Fig. 3-4 How to measure the field strength using the vertical antenna

1 Connect the vertical antenna to the antenna tuner according to Section 3.2.
This antenna can be extended up to 2 meter.

2 Connect the antenna tuner and TR 4132N spectrum analyzer with a coaxial cable according to Section 3.3.

3 Set the LOOP-VERT switch to VERT.

4 Set the BAND switch to the frequency band to be measured.

5 Set the TR 4132N switches shown as follows:

Set the RF ATT. switch to 0 dB.

Set the BAND WIDTH switch to AUTO.

Set the DISPERSION/DIV. switch to 0.1 MHz to 2 MHz according to the frequency to be measured.

Set the TUNING control to the frequency to be measured.

Set the ANTENNA switch to INPUT LEVEL.

Set the 10 dB/DIV./5dB/DIV./LINEAR switch to 10 dB/DIV..

For further details on the TR 4132N switches, refer to the TR 4132/4132N Instruction Manual.

6 Adjust the FREQUENCY dial so that the TR 4132N CRT display spectrum becomes the maximum level.

7 Turn the IF GAIN switch clockwise if the TR 4132N CRT display spectrum is too small. For further details, refer to the TR 4132/4132N Instruction manual.

8 The spectrum level to be measured is displayed.
The spectrum level can be obtained by deducting the CRT display spectrum level from the REFERENCE level.

9 Measure the field strength with to the following formula.
Measured field strength = (TR 4132N level) + K_V dB
(1 μV/m = 0 dB). K_V indicates the vertical antenna calibration coefficient for the measured frequency, and can be determined by the vertical antenna calibration table shown at the end of this manual.

4. PRINCIPLES OF OPERATION

4.1 When the field strength is measured by the loop antenna.

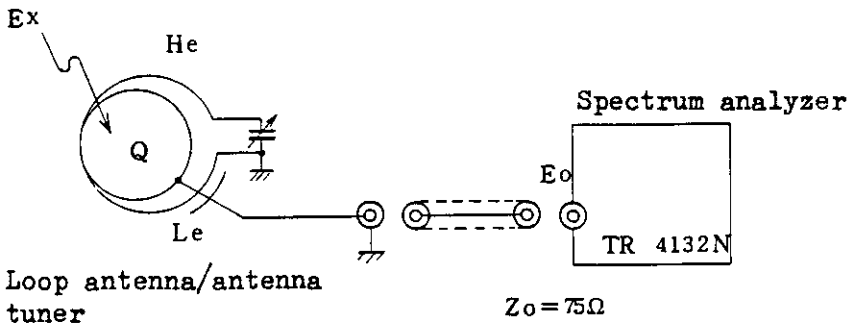


Fig. 4-1 How to measure the field strength using the loop antenna

The "Eo" voltage is generated in the loop antenna by the received radio wave and applied to the TR 4132N input terminal. The "Eo" formula is as follows:

$$Eo = Ex + He + Q - Le \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where, "Ex" indicates the unknown field strength and its field strength is expressed by dB (0 dB equals 1 μV/m). "Eo" indicates the TR 4132N input terminal voltage and its voltage is expressed by dB (0 dBμ equals 1 μV). "He" indicates the loop antenna effective height and its height is expressed by dB.
"Q" indicates the effective Q of the antenna tuning circuit and its Q is expressed by dB.
"Le" indicates the output division ratio of the antenna tuning circuit and its ratio is expressed by dB (Zo termination to the output terminal).

Therefore, the following formula can be obtained:

$$Ex = Eo - (He + Q - Le) \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

"He", "Q" and "Le" values vary according to the material, dimensions turn number of the loop antennas and frequency. If -(He + Q - Le) in formula (2) is replaced by $K\ell$, the following formula can be obtained:
$K\ell$ is usually called the calibration coefficient and can be obtained from a table or curve as a frequency function.

$$Ex = Eo + K\ell \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Therefore, the field strength can be obtained by adding $K\ell$ to Eo as shown in formula (3).

4.2 When the filed strength is measured by the vertical antenna.

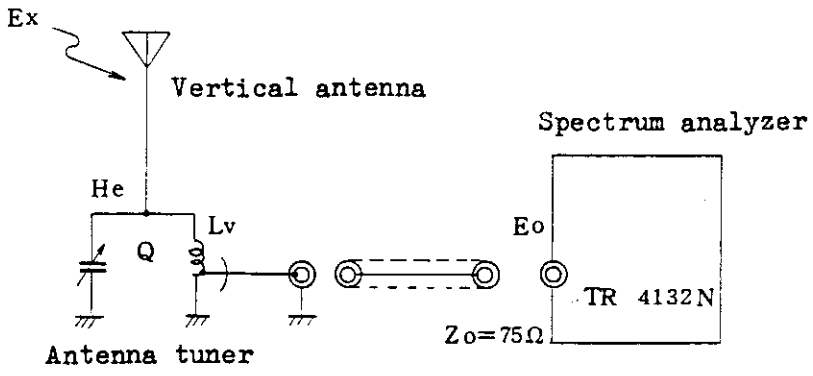


Fig. 4-2 How to measure the field strength using the vertical antenna

The "Eo" voltage is generated in the vertical antenna by the received radio wave and applied to the TR 4132N input terminal. The "Eo" formula is as follows:

$$Eo = Ex + He + Q - L_{\upsilon} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where, "Ex" indicates the unknown field strength and its field strength is expressed by dB (0 dB equals 1 μV/m).
"Eo" indicates the TR-4132N input terminal voltage and its field strength is expressed by dBμ (0 dBμ equals 1 μV).
"He" indicates the vertical antenna effective height and its height is expressed by dB.
"Q" indicates the effective Q of the antenna tuning circuit.
"L_{υ}" indicates the output division ratio of the antenna tuning circuit and its ration is expressed by dB (Zo termination to the output terminal).
Therefore, the following formula can be obtained:

$$Ex = Eo - (He + Q - L_{\upsilon}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

"He", "Q" and "L_{υ}" values vary according to the material dimensions, turn number of the vartical antenna and frequency.
If $-(He + Q - L_{\upsilon})$ in formula (5) is replaced by K_{υ}, the following formula
can be obtained:

$$Ex = Eo + K_{\upsilon} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

K_{υ} is called the calibration coefficient as K_{ℓ} mentioned in Section 4.1 and the K_{υ} field strength can also be obtained in the same way as K_{ℓ}.

5. MAINTENANCE

5.1 CLEANING

Always keep the loop antenna clean and free from statins and rust. A dirty loop antenna contact may cause measurement error. When the loop antenna is not in use, wrap it in vinyl and keep it in a moisture is not use place.

5.2 HOW TO CALIBRATE THE CALIBRATION COEFFICIENT BY MEASURING THE FIELD STRENGTH

(1) The calibration coefficient (Kℓ) meets with JIS C 6102 (radio receiver test method) and is calibrated by measuring the standard **field strength.**

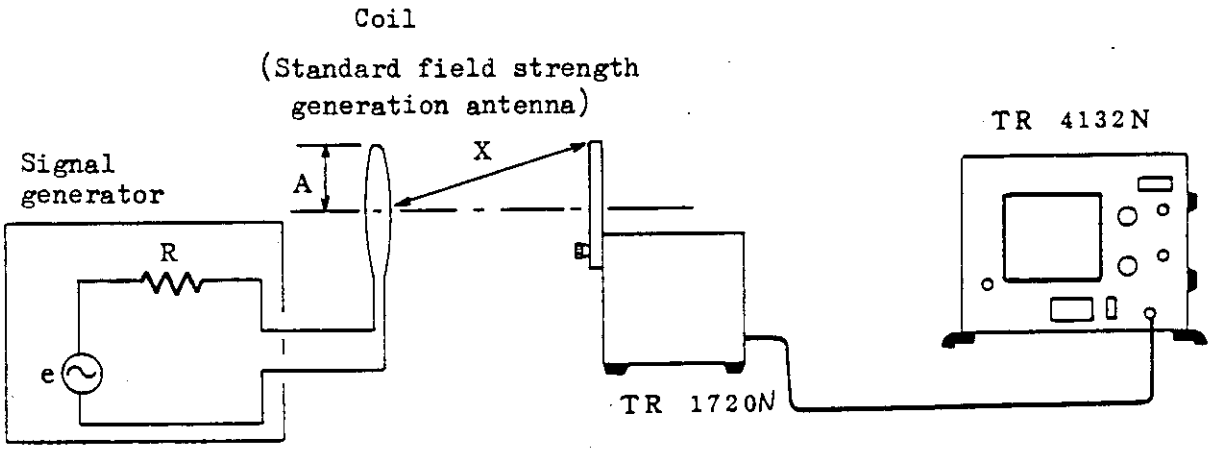


Fig. 5-1 How to calibrate the calibration coefficient

The equivalent field strength can be obtained as follows:

$$E = \frac{60\pi NA^2 I}{X^3} \quad X \quad 10^6$$

Where, "E" indicates the equivalent field strength of the TR 1720N loop antenna and its field strength is expressed by $\mu V/m$.

"N" indicates the turn number of the coil.

"A" indicates the coil radius and is expressed by meter.

"I" indicates the coil current and is expressed by A.

"X" indicates the distance between the center of the coil and loop antenna and is expressed by meter.

(2) How to calibrate the calibration coefficient by measureing the vertical antenna field strength. The calibration coefficient is calibrated using the standard signal generator.

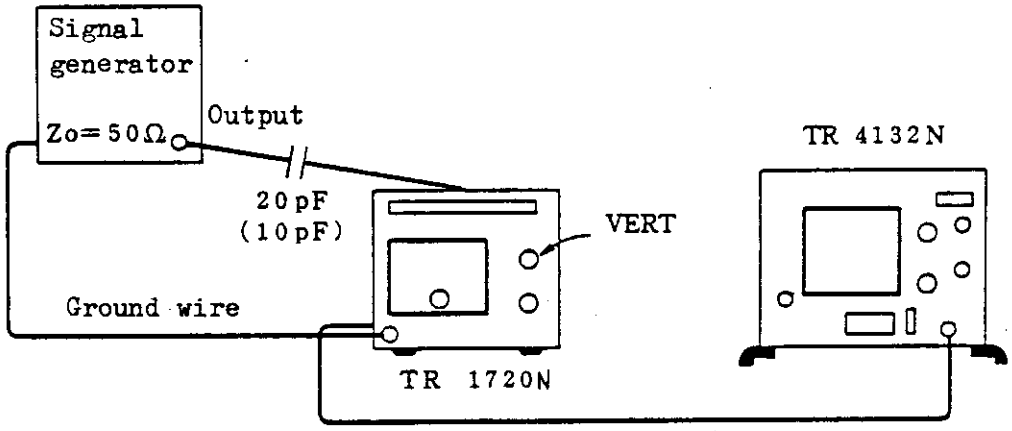


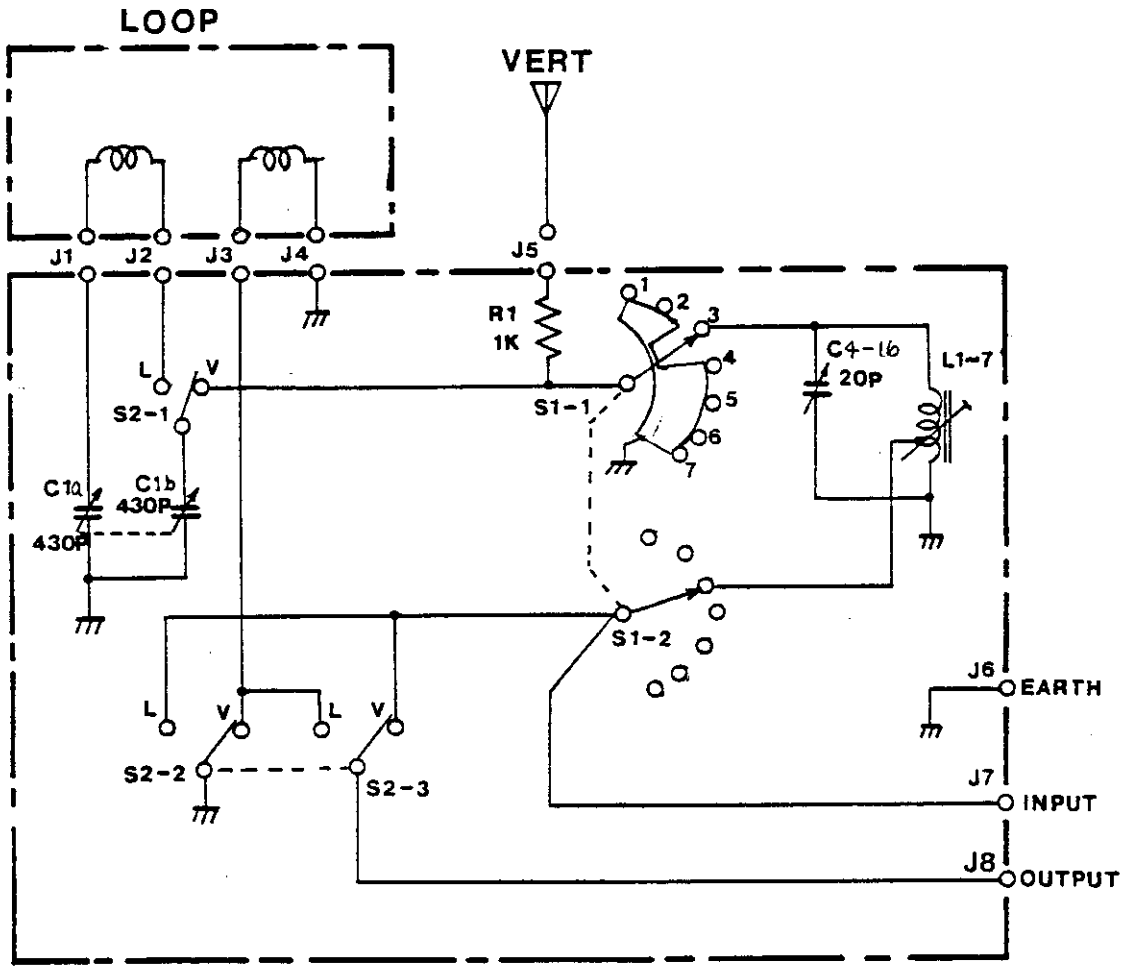
Fig. 5-2 How to calibrate the calibration coefficient

As shown in Fig. 5-2, a dummy antenna is connected between the output terminal of the signal generator (output impedance is 50) and the vertical antenna terminal of the TR-1720N antenna tuner. Use a 20 pF capacitor per the 2-meter vertical antenna and a 10 pF capacitor per the 1-meter vertical antenna.
When band 7 (10 MHz to 30 MHz) is calibrated, adjust the capacitor lead length to 5 cm or less.
Also adjust the ground wire between the signal generator and TR-1720N antenna tuner to 5 cm or less.

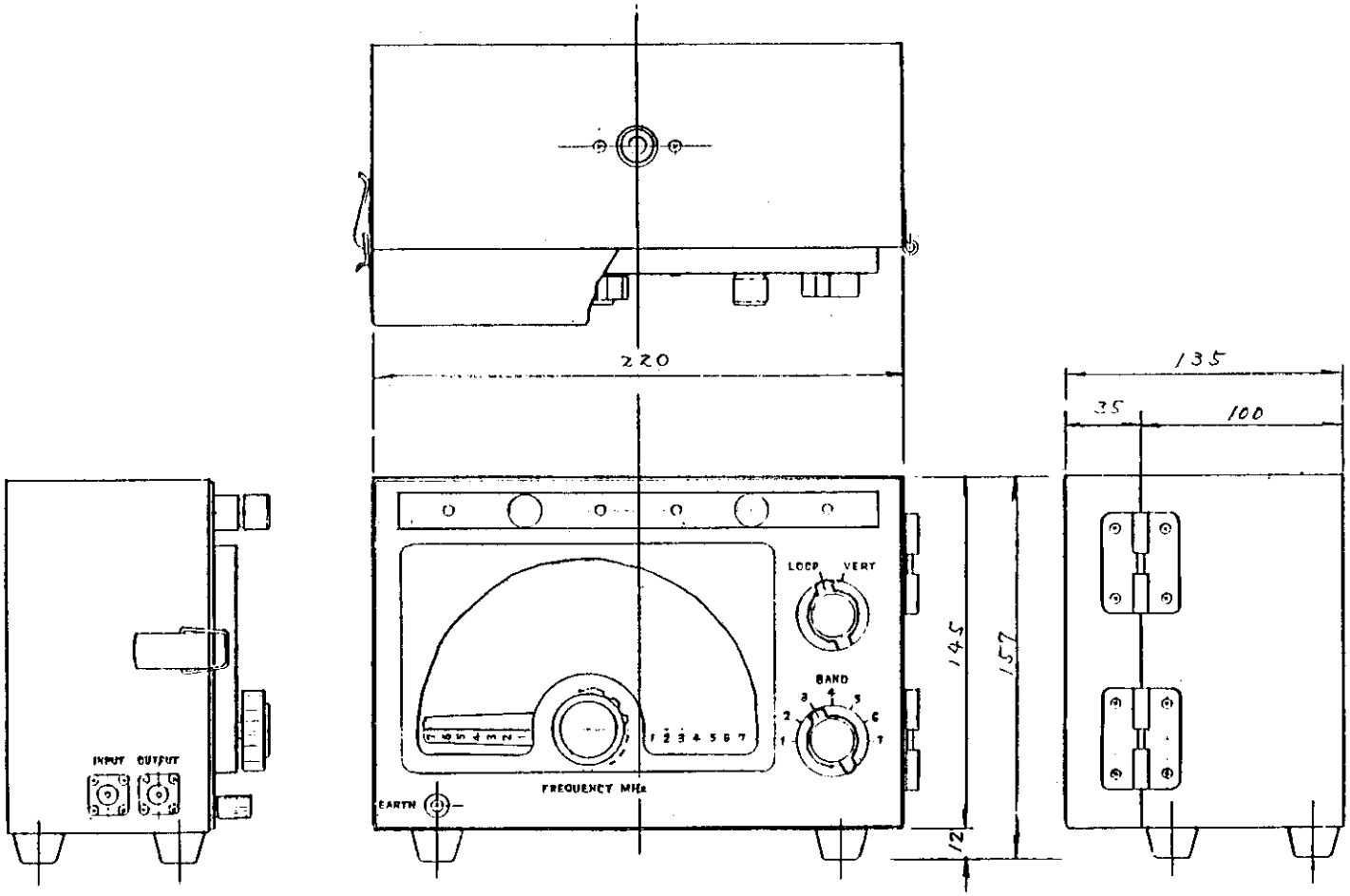
The level displayed by the TR 4132N CRT is then measured. In this case, the following formula can be obtained:

K_{υ} (dB) = (signal generator open terminal voltage)
- (TR 4132N spectrum level)

For details on how to calibrate the calibration coefficient contact the CE section of our head office or our nearest branch office.

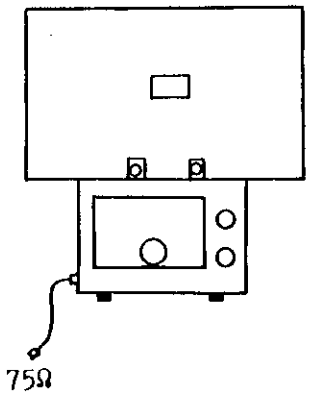


ANTENNA TUNER
CIRCUIT DIAGRAM

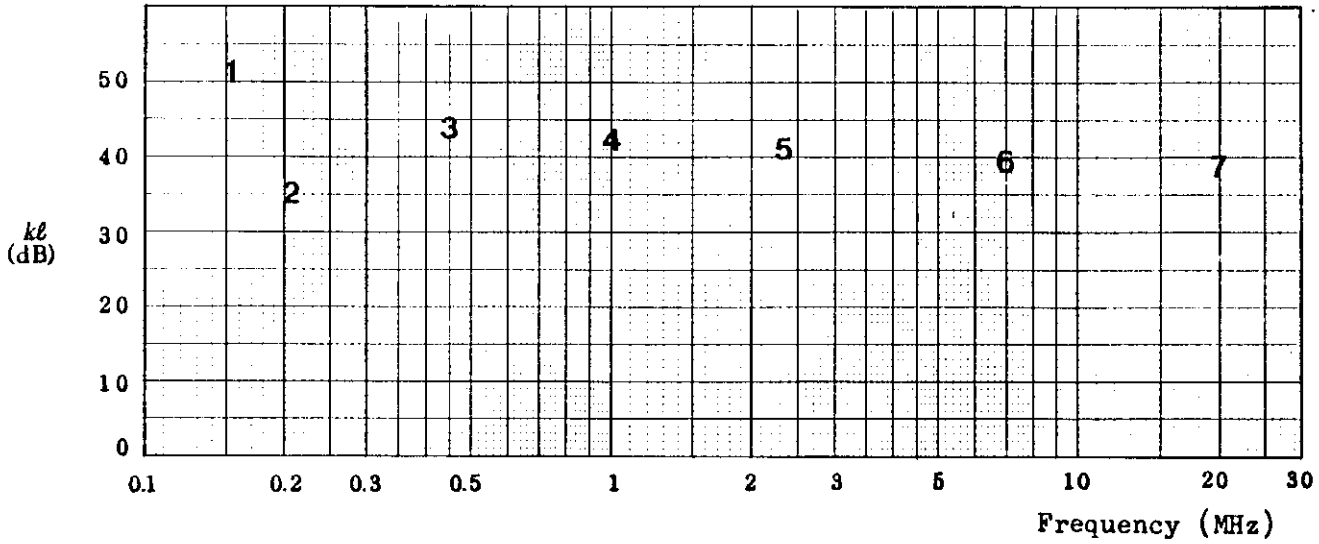


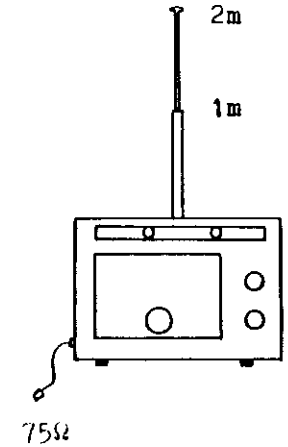
TR 1720N
EXTERNAL VIEW

TR1720N Antenna Tuner (7 5 Ω) Serial No. _____

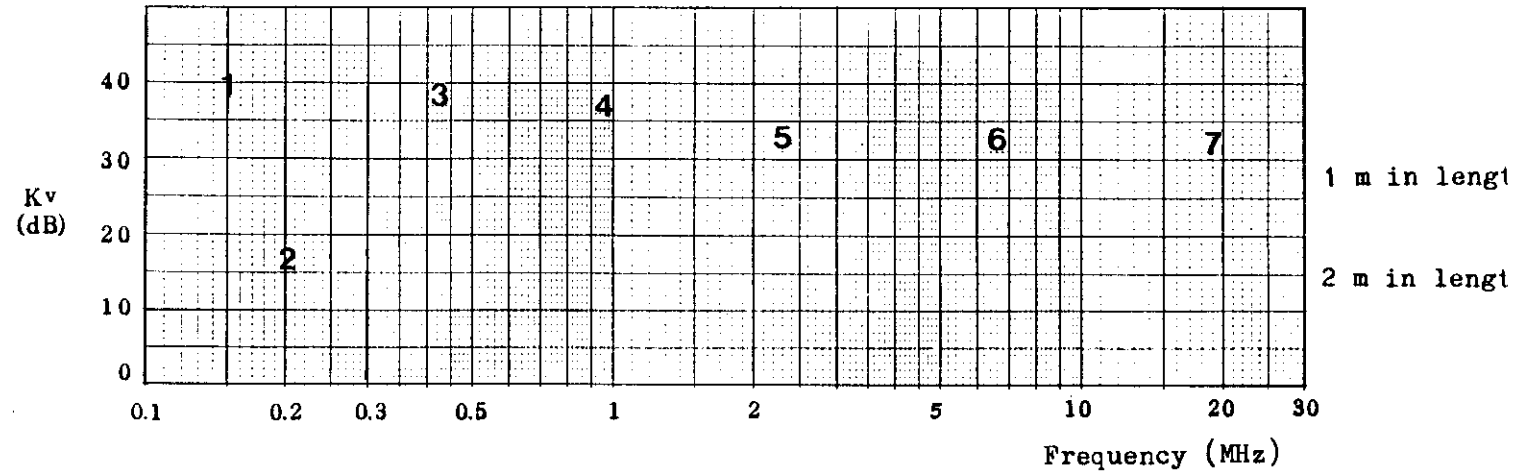


Loop antenna compensation coefficient($k\ell$)





Vertical antenna compensation coefficient (Kv)



Field strength = (Reading of TR4132N: dB μ) + K K : $k\ell$ or Kv
(dB)

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4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

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   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

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In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

SALES & SUPPORT OFFICES

Advantest Korea Co., Ltd.
22BF, Kyobo KangNam Tower,
1303-22, Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071
Fax: +82-2-532-7132

Advantest (Suzhou) Co., Ltd.
Shanghai Branch Office:
Bldg. 6D, NO.1188 Gumei Road, Shanghai, China 201102 P.R.C.
Phone: +86-21-6485-2725
Fax: +86-21-6485-2726

Shanghai Branch Office:
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing,
China 100083
Phone: +86-10-8235-3377
Fax: +86-10-8235-6717

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100
Fax: +65-6274-4055

Advantest America, Inc.
3201 Scott Boulevard, Suite, Santa Clara, CA 95054, U.S.A
Phone: +1-408-988-7700
Fax: +1-408-987-0691

ROHDE & SCHWARZ Europe GmbH
Mühldorfstraße 15 D-81671 München, Germany
(P.O.B. 80 14 60 D-81614 München, Germany)
Phone: +49-89-4129-13711
Fax: +49-89-4129-13723

ADVANTEST®

http://www.advantest.co.jp

ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan
Phone: +81-3-3214-7500