

# LABORATORY REFERENCE SERIES

## 5T10

ACCUTOUCH CLL FM TUNER

LUX CORPORATION, JAPAN

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**WARNING:** TO PREVENT FIRE OR SHOCK HAZARD  
DO NOT EXPOSE THIS APPLIANCE TO  
RAIN OR MOISTURE.

## Thank you for purchasing the 5T10

With our C.L.L. circuitry total control is effected throughout all the stages, from the front end to the IF and detector circuits in accordance with the crystal controlled transmission frequency of a broadcasting station. Therefore, this may be called the ideal tuning system offering accurate and stable tuning condition even if the ambient condition such as temperature is fluctuated.

Generally speaking, in the case of quartz lock and synthesizer systems renowned for exact and stable tuning, only the local oscillation or front end is partially controlled. To obtain a more precise tuning, an extremely narrow capture range is set at the C.L.L. circuit of the 5T10, and it is hard for the conventional tuning method to obtain precise tuning point, since it requires to watch the center tuning meter. Therefore, we employed our original "ACCUTOUCH" system, which adjusts all the tuning circuits exactly to the desired tuning point. The "ACCUTOUCH" system detects the exact center tuning point, utilizing the control voltage at the C.L.L. circuit, which triggers a mechanical lock on the tuning knob.

The 5T10 proclaims an FM tuner of sonic excellence. The front end employs a distortion-free local oscillator and an RF amp stage consisting of the combination of a MOS FET and a 5-gang variable capacitor, which makes it possible to realize superb interference rejection and intermodulation characteristics. In the IF stage, a 2-step bandwidth selector is provided to make compatible both excellent distortion and selectivity. In the "wide" position, 2 pairs of LC block filters of good group-delay characteristics are employed to realize lower distortion, while conversely in the "narrow" position an additional ceramic filter is added to offer high selectivity. The IF stage is so designed as to be inherently low in distortion, but to make it perfect, a new quadrature IC and a special detector transformer are combined at the FM detector stage to offer low distortion and high signal-to-noise ratio plus wider bandwidth. In the audio output stage, DC amp configuration is adopted to realize excellent sonic quality.

In addition, the C.L.L. circuit incorporates a lock-retaining circuit, and no new locking is needed when power is turned off and on once the station has been tuned in.

We recommend that you choose your other Hi-Fi components with care for the optimum combination with this unit, and go through the contents of this owner's manual to make the most of the potential of this tuner.



# Switches & Terminals

## 1. Tuning Knob

Use this knob to tune to desired stations. Conventionally, tuning point has been obtained by signal strength meter and center meter, but for the quartz locked tuner like the 5T10 which is designed to realize unconditionally stable reception, the receiving frequency is locked and therefore it is hard to obtain the precise tune-in point center frequency of a broadcasting station by use of center meter. We adopted our original tuning lock function which mechanically locks the center point by electronic sensing. Thus all the circuits are adjusted to obtain the optimum tuning point.

Turn the Tuning Knob slowly, and it will be locked with a "responsive" feeling when the Tuning Lock Release Switch (2) is set at the protruded position. At this time the Center Indicator (5) lights up to show the accurate tuning point is seized even at the RF stage (radio frequency amplifying stage), IF stage (inter frequency amplifying stage), and FM detection stage. The mechanical lock is automatically released in about 1 second.

## 2. Tuning Lock Release Switch

This switch releases the Tuning Lock function. Press alternately for switch-on and off. The Tuning Lock function operates when the switch is in the protruded position, while it is released when depressed.

Normally, it is advisable to set the switch always at the protruded position.

The Tuning Lock system is designed not to respond to quick rotation of the Tuning Knob. Therefore it is advisable to rotate the tuning knob quickly first, and then slow down as the desired station is coming near.

## 3. Power Switch

The power switch is of an alternating push-on, push-off type. Press in this switch and AC power is supplied to the tuner and the dial scale is illuminated. A time delay muting circuit is integrated to eliminate unpleasant "thump noise" at the time of turning the unit on. Because of this circuit, the tuner is muted for approx. five seconds until all circuits are put into stable operational condition.

## 4. Signal Strength Indicator

This indicator shows the electric field strength of a broadcasting station. When a station is tuned in the electric field strength is displayed in five points. The greater the number of indicator light, the stronger the

electric field strength. Stereo broadcasting can be received satisfactorily when the indicator lights up in excess of the third point.

## 5. Center Tune Indicator

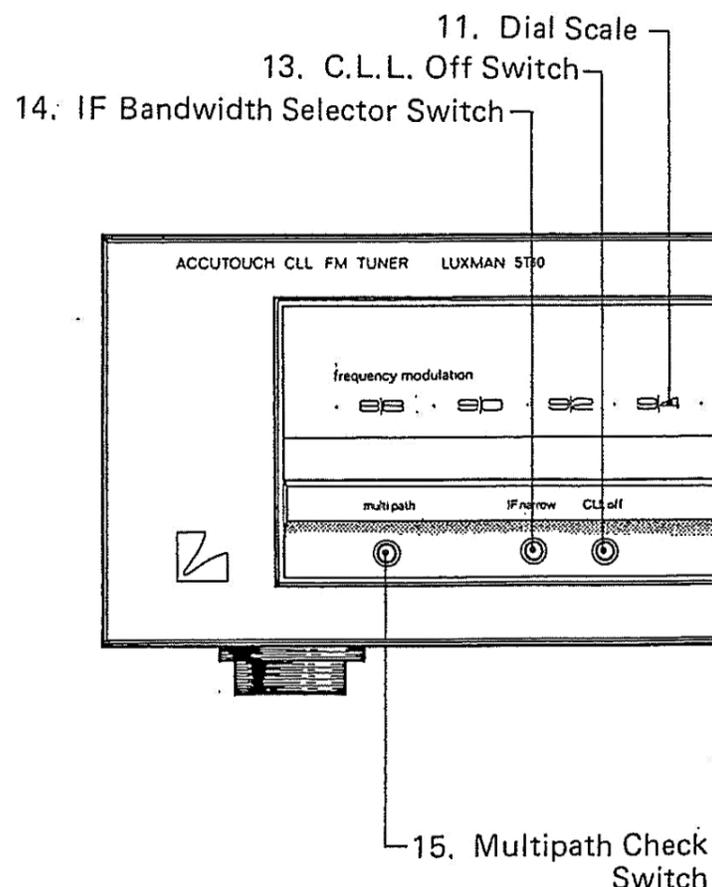
This indicator lights up only when the center frequency of a broadcasting station is tuned in.

## 6. Stereo Indicator

The indicator lights up to identify stereo FM reception. FM stereo broadcasting of impractically low level is automatically received in monaural mode and accordingly the indicator does not light. When the Mode Switch (7) is lifted up to the "mono" position, stereo broadcasting is received in monaural mode and the indicator does not light.

## 7. Mode Switch

Reception mode can be selected by this switch. For normal Reception of the program, set it to the center "normal" position. In this case, the tuner circuit automatically selects stereo or monaural broadcasting. FM broadcasting of impractically low level is automatically received in monaural mode to improve the signal-to-noise ratio.



When this lever switch is lifted up to the "mono" position, stereo broadcasting is received in monaural mode. For instance, when you wish to improve the signal-to-noise ratio of the broadcasting wave which exceeds the level point that stereo broadcasting is automatically changed to monaural, this position will provide better effect on the signal-to-noise ratio. When it is pressed down to the "test tone" position, the recording calibrator is operated. The calibrator produces a test tone of the level equivalent to 400Hz, 50% modulation at the output terminal. Therefore, adjust the recording level to obtain 0VU reading on the VU meter of the recording tape deck.

However, in the case of actual broadcasting, modulation ratio may possibly be higher, which may incidentally create an excessive level. In this case, it is necessary to reduce the recording level.

### 8. High-Blend Switch

This switch eliminates high frequency noises caused at the time of receiving stereo FM broadcasting. This circuit makes partial blending at high frequencies and provides a reduction only in high frequency noises without affecting the frequency characteristics.

In the center "normal" position, this circuit does not operate. In the "max." position, strong noises can be eliminated, while in the "moderate" position, slight noises can be eliminated. Therefore, select the position according to the noise level. In the case of receiving a broadcasting station of such strong electric field strength that all the indications of the Signal Strength Indicator (4) light up, it is advisable to set the switch to the center "normal" position.

### 9. Muting Level Adjuster

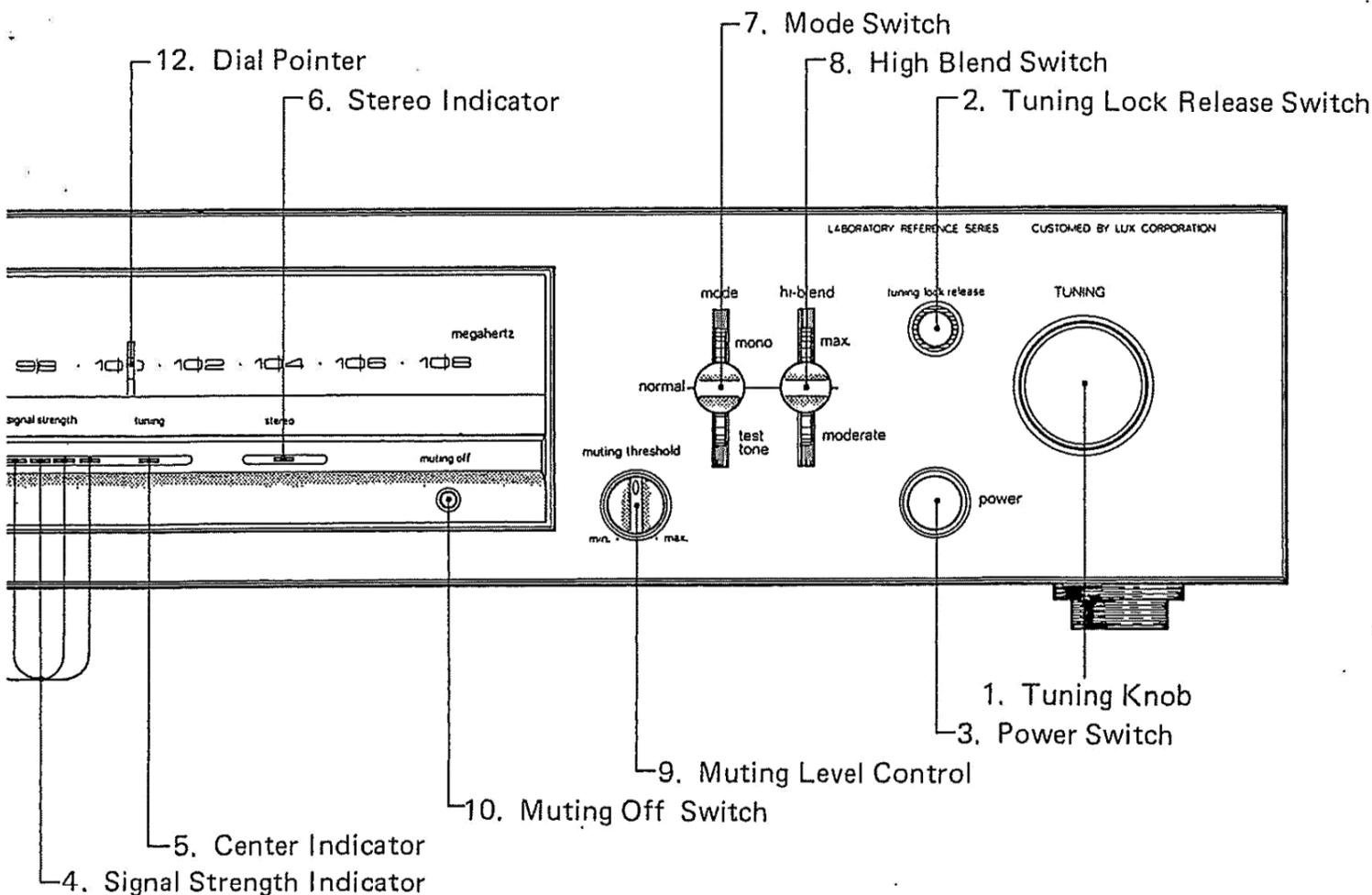
This adjuster is provided to determine the muting threshold level, and is operated when the Muting Off Switch is unpressed at the "protruded" position. At this time, the threshold range is variable from approx. 30 $\mu$ V to approx. 500 $\mu$ V.

However, it might be possible that the electric field fluctuates according to the transmission path of the broadcasting wave even at the time of receiving the broadcasting station of strong electric field strength. In this case, when the muting level is pre-fixed within the range of this fluctuation.

This phenomenon is caused because the muting level is pre-fixed a little high, therefore turn the Muting Level Adjuster knob counter-clockwise to realize stable reception.

#### About Muting Level

Such functions as mechanical brake, center tune indicator, and signal strength are controlled within the range. That is to say, when the threshold level is set to the maximum (500 $\mu$ V) position, all above functions become ineffective against such station whose electric field strength is 300 $\mu$ V.



## 10. Muting Off Switch

The muting circuit is provided to remove the interstation noise peculiar to FM broadcasting which occurs when tuning is shifted out of the correct tuning point. The Muting Off Switch is provided to make it feasible to receive broadcasting waves of weak electric field strength. The output circuit is turned on or off by means of a relay, therefore pleasant positive muting operation is feasible without switching thumps.

When this switch is kept unpressed, interstation noise possible at the time of some drift occur can be filtered. At this time the switch is coupled to the Muting Level Adjuster (9) and the range of muting threshold is variable from  $30\mu\text{V}$  to  $500\mu\text{V}$ . Both broadcast signals and interstation noises under the level fixed by the Adjuster are eliminated.

When the Muting Off Switch is depressed, the Tuning Lock function, the Center Indicator, and the Signal Strength Indicator etc., are automatically switched so that they are operated over  $2\mu\text{V}$ .

## 11. Dial Scale

The dial scale is calibrated for FM broadcast frequencies only (from 88MHz to 108MHz). Turn the Tuning Knob (1) and the dial pointer moves to indicate the receiving frequency.

## 12. Dial Pointer

The Dial Pointer is coupled to the Tuning Knob to indicate receiving frequency. Read the frequency on the dial scale that is indicated by the dial pointer.

## 13. C.L.L. Off Switch

The IF stage and the FM detection stage of the 5T10 is designed to be quite wide frequency range, since it proclaims a tuner of excellent tonal quality. Also the C.L.L. circuitry utilizes the broadcasting wave for the frequency control. Thus, in such area where many broadcasting stations are existing, it may be possible that the desired station is interfered by other stations, or that it is hard to judge to which station the tuning lock should be made. The C.L.L. can be released to prevent such inconvenience.

In the "protruded" position, the C.L.L. circuit operates, while in the "depressed" position, it is released.

## 14. IF Bandwidth Selector Switch

This switch is provided to realize either the low distortion characteristic which aims to improve sonic quality,

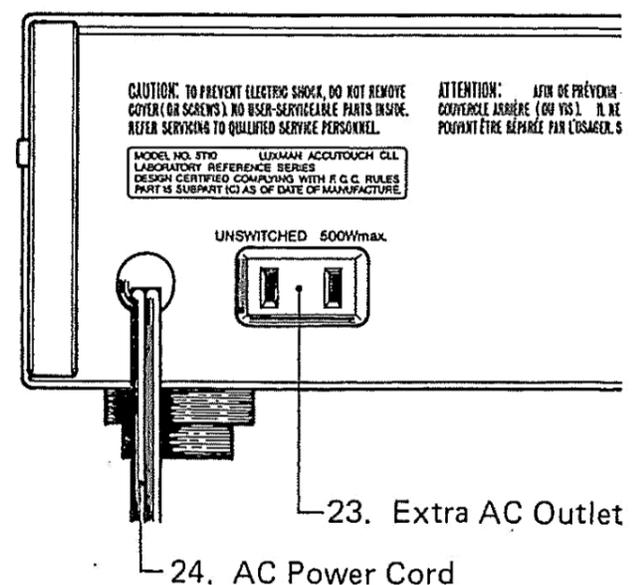
or the high selectivity characteristic (which aims) to ensure clear reception. The switch is of an alternate push-on, push-off type. In the "protruded" position, the IF bandwidth is "WIDE", and the selectivity at  $\pm 400\text{kHz}$  becomes 30dB to realize low distortion. When it is depressed, the bandwidth is "NARROW" to provide 90dB selectivity at  $\pm 400\text{kHz}$ , which is effective to eliminate interference by an adjacent station.

Normally, this switch should be in the "wide" position to receive the broadcasting of strong electric field strength. And only when interference of the adjacent station occurs, set the switch to the "narrow" position.

## 15. Multipath Check Switch

This switch is provided to check if the multipath phenomenon exists. The term "multipath" means that the antenna receives multiple paths of FM radio waves reflected by mountains, buildings etc. besides the waves direct from broadcast stations. This deteriorates stereo sound playback.

The best reception is obtained when the direction of antenna is fixed so that the reproduced sound is at a minimum with this switch depressed. Do not forget to release the switch to the "off" position after multipath check is finished.



Of course before checking the multipath it is necessary to tune in to the station to check its receiving condition.

### 16. Coaxial Connector (75 ohms)

Many FM antennas are provided with the 75-ohm terminal. Use 75-ohm coaxial cable to connect the FM antenna to this connector.

When this connector is used, an F-type connector provided should be fixed to the coaxial cable. The F-type connector makes it easy to connect the cable to the 5T10 without using solder.

As for the connection, refer to the section "about Coaxial Connector".

### 17. Antenna Terminal (75 ohms)

Function of the terminal is identical to that of the Coaxial Connector (16). Use this terminal for connection of an FM antenna with 75-ohm coaxial cable as lead-in wire.

Connect the inner conductor to the 75-ohm terminal (right) and the outer shield wires to the GND terminal (left).

### 18. Antenna Terminal (300 ohms)

Connect the attached Dipole Antenna or an FM antenna of 300 ohms to this terminal.

### 19. Earth Terminal (GND)

Connect the earth lead from other amplifier etc. Especially, it is effective to reduce noises triggered at the time of selecting equipments by use of input selector box etc. if the earth lead of all the equipments are made common.

### 20. Output Terminal-2

Normally, the output signals of the 5T10 can be taken out from this terminal. Connect the terminal to the "TUNER" terminal or to the "AUX" terminal of an audio amplifier.

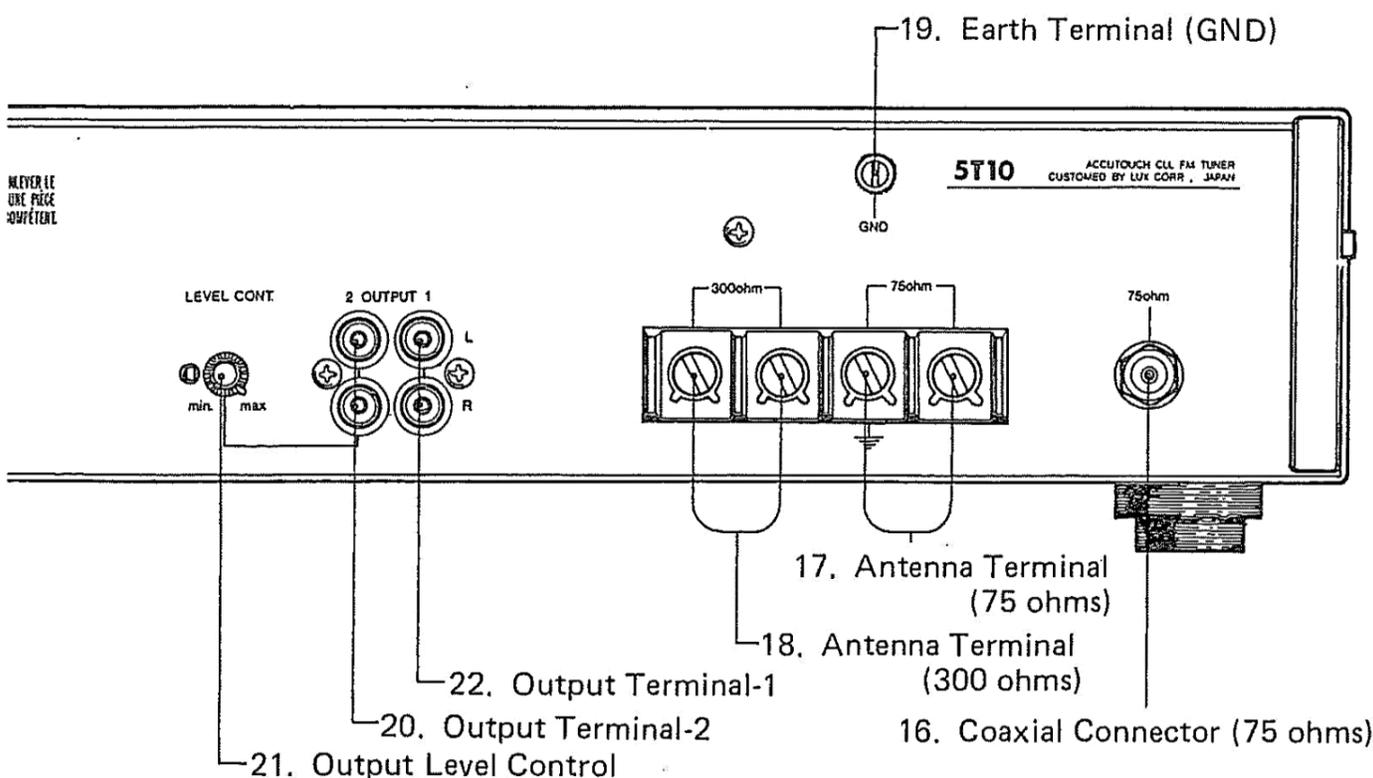
The Output Level Control is coupled to this terminal, and suitable reproduction level can be obtained to match that of other audio components.

### 21. Output Level Control

This control is provided for the Output Terminal-2 (20) to permit output level adjustment in the range of 0V to 1V. An extreme clockwise turn provides the maximum 1V output, while an extreme counter-clockwise turn reduces the output to 0V.

### 22. Output Terminal-1

Same use as the Output Terminal-2 (20), except that constant output (max. 1V) is always obtainable.



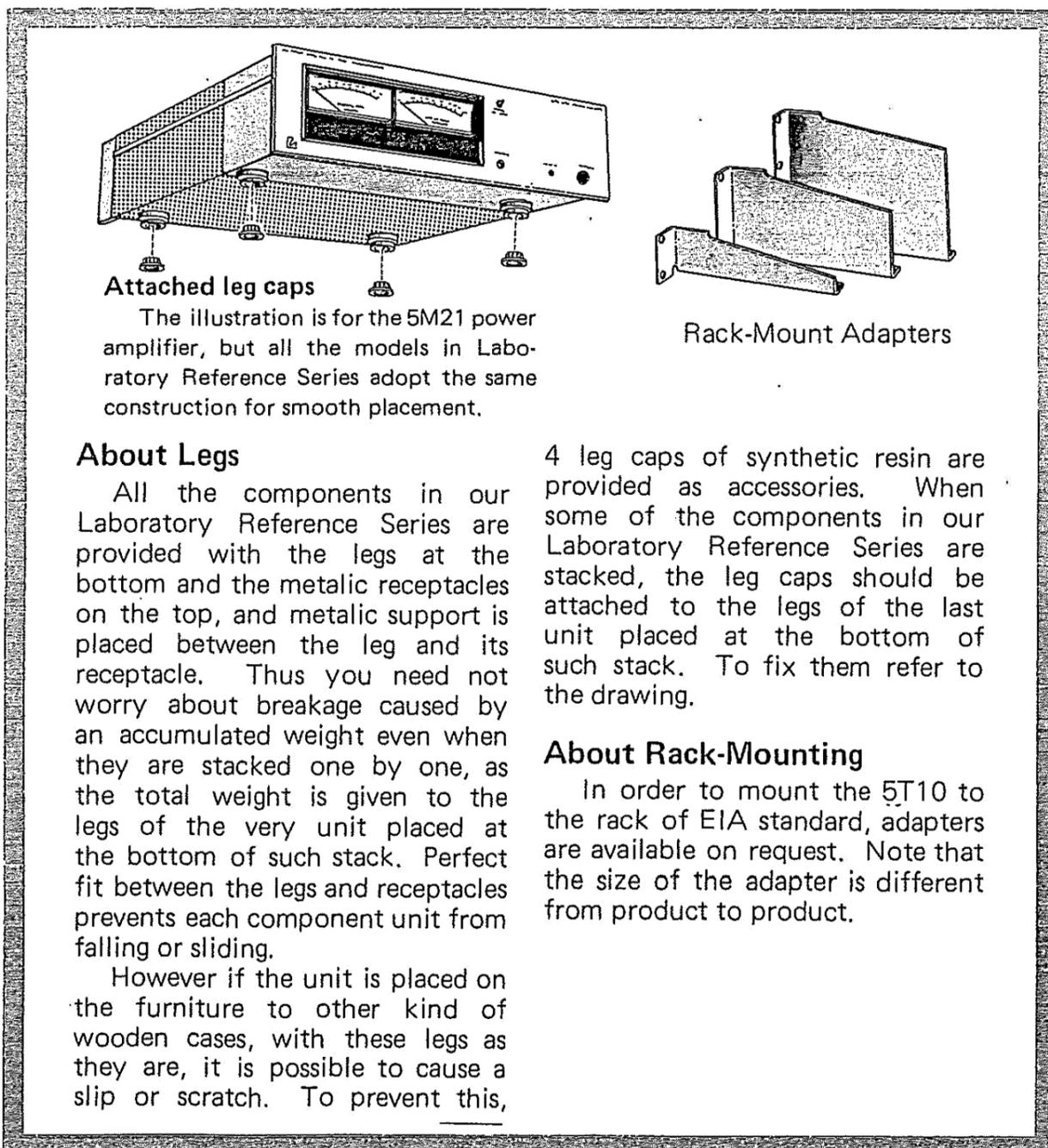
### 23. Extra AC Outlet

AC power supply to other audio equipment can be taken from this outlet. The maximum rating of the outlet is 500W. Note that this outlet is not coupled with the AC Power Switch (3) of the 5T10.

In some countries, this outlet is not provided since it is prohibited by law.

### 24. AC Power Cord

Plug the power cord into an appropriate AC outlet in your listening room, or into an extra AC Outlet (SWITCHED) of an amplifier. In the latter case, switching ON or OFF of the 5T10 can be made by the power switch of the amplifier. The power consumption of the 5T10 is 20W.



#### About Legs

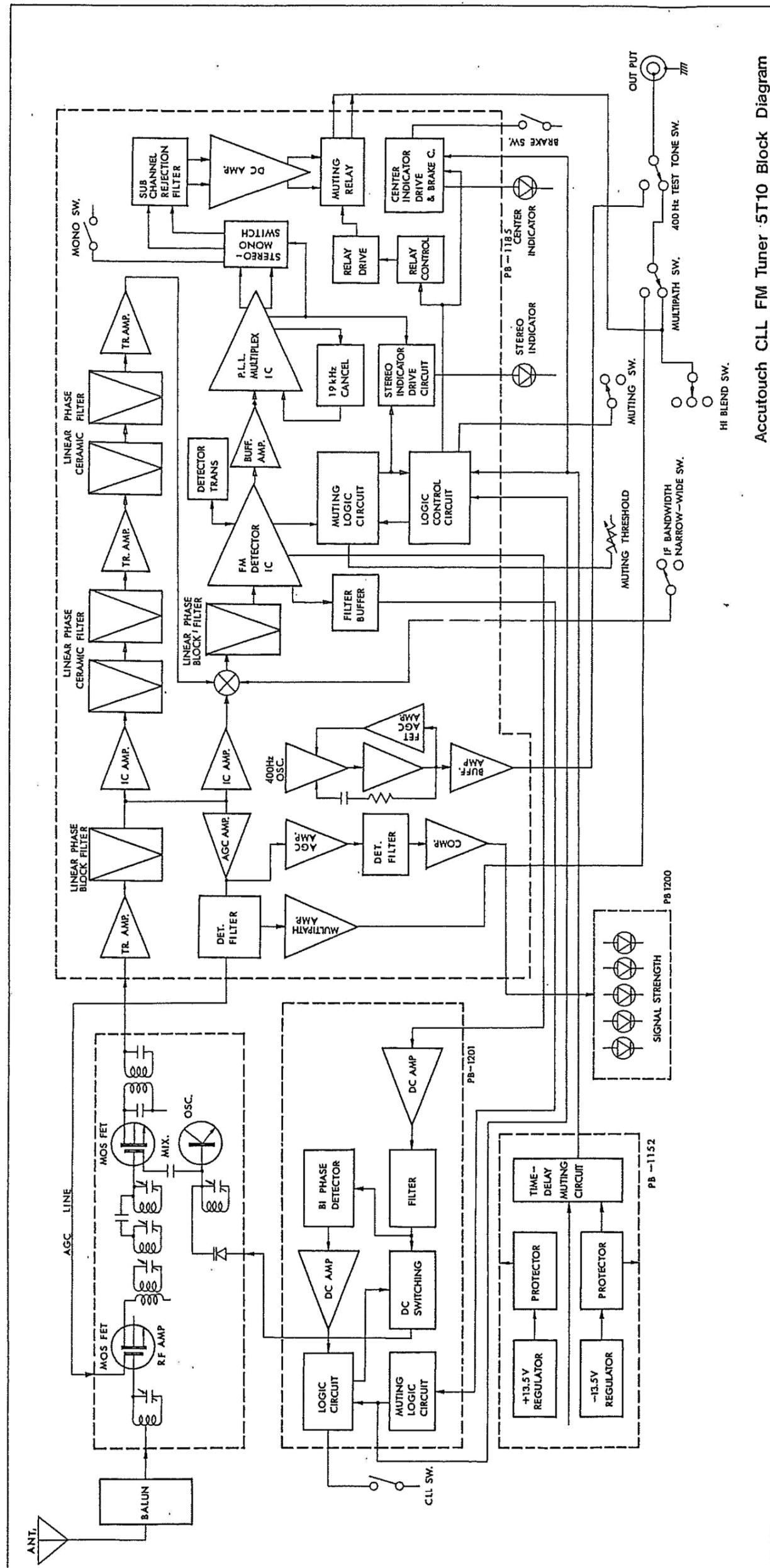
All the components in our Laboratory Reference Series are provided with the legs at the bottom and the metallic receptacles on the top, and metallic support is placed between the leg and its receptacle. Thus you need not worry about breakage caused by an accumulated weight even when they are stacked one by one, as the total weight is given to the legs of the very unit placed at the bottom of such stack. Perfect fit between the legs and receptacles prevents each component unit from falling or sliding.

However if the unit is placed on the furniture to other kind of wooden cases, with these legs as they are, it is possible to cause a slip or scratch. To prevent this,

4 leg caps of synthetic resin are provided as accessories. When some of the components in our Laboratory Reference Series are stacked, the leg caps should be attached to the legs of the last unit placed at the bottom of such stack. To fix them refer to the drawing.

#### About Rack-Mounting

In order to mount the 5T10 to the rack of EIA standard, adapters are available on request. Note that the size of the adapter is different from product to product.



Accutouch CLL FM Tuner 5T10 Block Diagram

Block  
Diagram

# Connection Procedure

## Connection of Antenna to Antenna Terminals

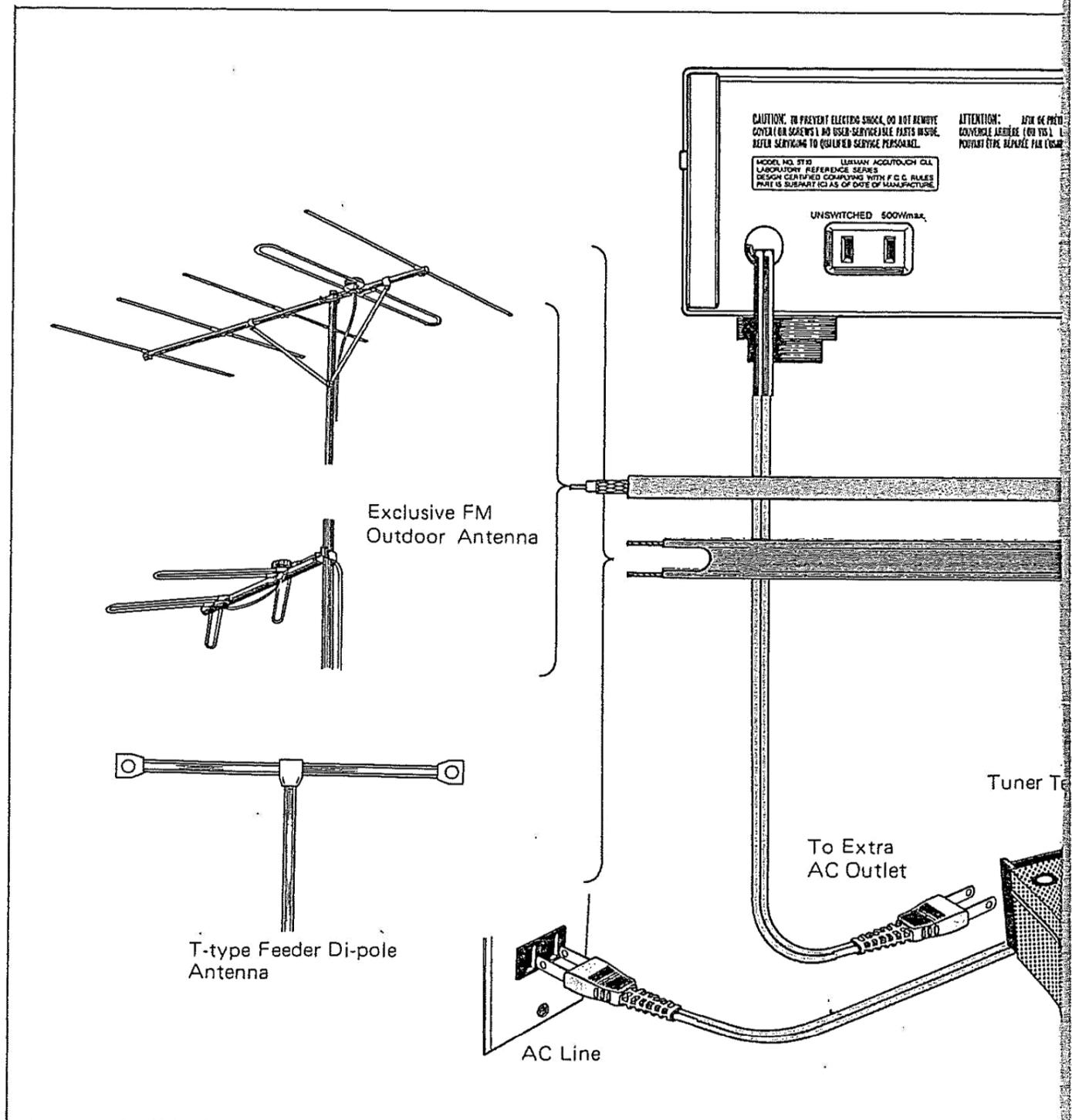
3 different Antenna Terminals are provided; the Coaxial Connector (75-ohm) (16), the Antenna Terminal (75-ohm) (17) and the Antenna Terminal (300-ohm) (18). Select an appropriate terminal, considering the impedance of the antenna connected and that of the lead-in cable. For the connection procedure, refer to the illustration.

## Connection of Outputs to Audio Amplifier

Connect the output terminals (20) or (22) to the TUNER or AUX terminals of an audio amplifier by means of pin jack cord. Left channel output must be connected to left channel input, and so with the right channel. Since the output terminal (20) is coupled with the Output Level Control (21), use of these terminals is normally recommended.

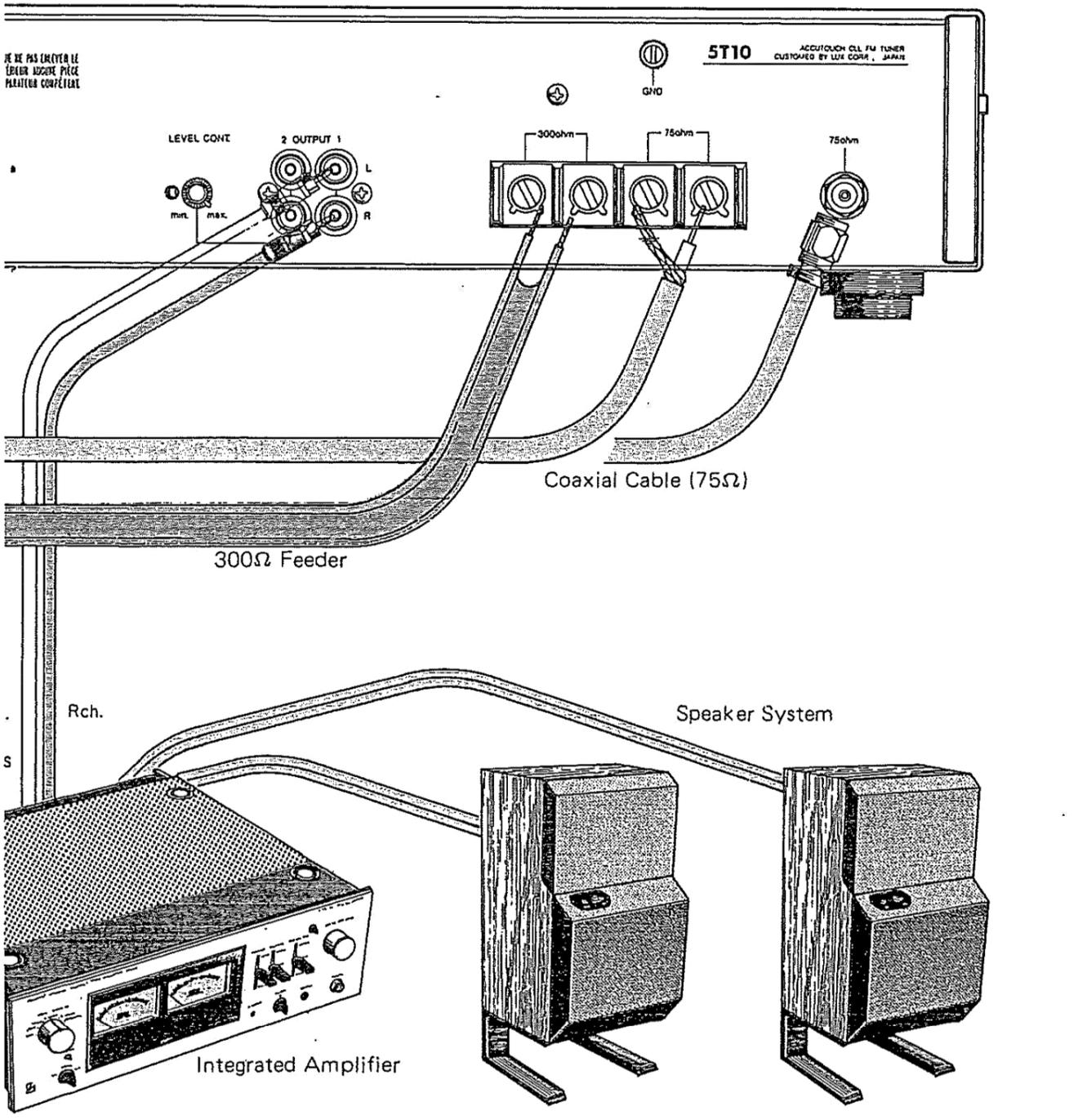
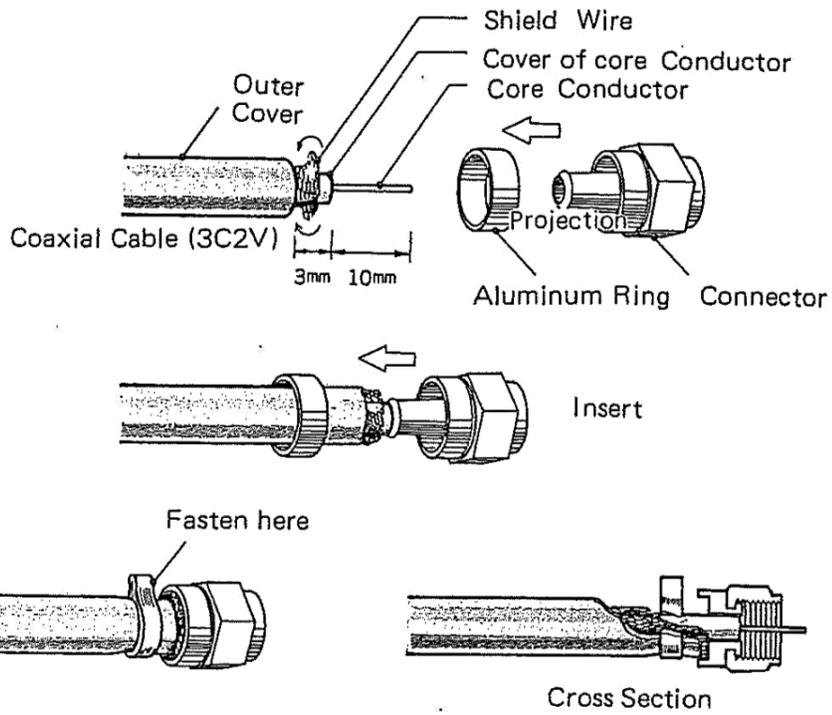
## AC Power Cord

Plug the AC Power Cord (24) into an appropriate AC wall socket, or the AC outlet of an audio amplifier. Switch on the AC Power Switch (3) and the dial scale lights up. Then in about 5 seconds, the 5T10 is put into the operational condition, since a time-delay muting circuit is provided to prevent the unwanted switching thumps.



# [ HOW TO USE COAXIAL CONNECTOR ]

As shown in the Figure 1, peel off the outer cover and insert the projected section of the connector in between the shield wire and the core conductor cover. Then firmly fasten the aluminum ring, as shown by the Figure 2, by means of plier.



# To Make the Most of This Tuner

## FM ANTENNA

The greatest advantage of FM broadcasting is that playback sound is superior to that of AM: However, because of the inherent characteristics of FM broadcast frequencies (VHF band), even when a high quality tuner is used, incorrect selection of antenna and its feeder cable may easily impair the advantage of FM. The FM antenna system must be set up taking into account the electric field strength, multi-path problems, noise sources, tuner location and so forth.

## SELECTION OF FM ANTENNA

### [ Field Strength ]

When receiving FM broadcasts from distant stations, it is necessary to use a highly sensitive tuner to improve S/N ratio. However, if the FM antenna was inadequately selected, a user cannot take the advantage of such high sensitive tuner. For instance, a comparison of the following tuner/antenna combination was made:

- (1) a tuner having IHF sensitivity of  $1.7\mu\text{V}$  plus a simple single feeder antenna (a type of whip antenna).
- (2) a tuner having IHF sensitivity of  $2.5\mu\text{V}$  plus an exclusive 3-element FM antenna.

Results showed that the latter combination gave better reception. This is because such a simple single feeder antenna has a negative gain while an exclusive FM antenna has a positive gain. The gain factors of such exclusive FM antenna are, 3-4dB with 2 elements, 4-5dB, 3 elements, 5-7dB 5 elements and 6-8dB, 7 elements.

As the antenna gain is increased in proportion to the number of antenna elements, selection of optimum FM antenna can be determined by consideration of field strength of FM wave where the tuner is installed. Needless to say, your audio shop will gladly assist you for optimum selection of the antenna.

In summary, where far from broadcast stations, high gain antennas are needed. If field strength is sufficiently strong, good reception is possible with the di-pole antenna (T-type) provided.

### [ Multipath Measures ]

The terms multi-path refers to the multiple paths of FM radio waves reflected by mountains, buildings, etc. that are received by an antenna besides the waves arriving directly from broadcast stations. This phenomenon is inevitable because of the inherent nature of VHF (very high frequency) transmission waves. In the case of a television receiver, presence of multipath is visibly recognized by so-called "ghost" phenomenon and every-

one is aware of the importance of proper setting of TV antenna. However in the case of FM reception, multipath problems may only be perceived as deteriorated playback of stereo sound. Very frequently, such deterioration is attributed to the program source. Correction of multipath problems can sometimes be made by use of an FM tuner having excellent limiter characteristics, but normally there would be no other measures than to provide an optimum FM receiving condition by selection of antenna, location, direction, height, etc. An effective way to filter harmful multipath waves coming from all conceivable directions by reflection, and to catch the direct wave only, is a use of directional FM antenna as explained in the "Field Strength" Section of this manual.

Since such antennas not only possesses gain but also directivity when it is directed to broadcast stations, it filters out waves coming from other directions. The directivity sharply increases as the number of antenna element increases. When sharp cut-off of multipath waves is desired, use of an antenna having more elements is necessary. The standard di-pole antenna (T-type) has such directivity as may be described by the numeral "8". This means when multipath waves come from the opposite direction of broadcast stations it is subjected to multipath influence. To the horizontal direction (parallel to antenna leads), since gain is lowered, multipath waves coming from that direction can be filtered. With this knowledge, the di-pole antenna may be very useful.

The whip antenna which is provided for portable transistor radios has no directivity. This means where multipath is present, it is completely subjected to its influence.

Measures against multipath trouble must be taken after verifying the cause of multipaths occurrence by which optimum measures can be known - - - use of directional antenna such as exclusive FM antenna, standard di-pole antenna, etc. and also its correct placement and setting up. If multipath problems are present at a place close to broadcast stations (sufficient field strength), it is suggested that you procure a 2 element compact FM antenna at an audio shop. This antenna has little or no gain but has very good directivity and is optimum for reducing multipath measures at a location having strong field strength. When using a standard di-pole antenna (provided as accessory), it is also recommended to set it outdoors in order to avoid possible influence of metallic accessories such as curtain

rods, etc., not to speak of steel used in ferro-concrete structure.

**[ How to Detect Multipath ]**

It has been rather difficult for conventional tuners to check multipath, since they required an Oscilloscope etc. We adopted the Multi-Path Check Switch on the front panel to make it easy to check for multipath problems to suppress to the minimum level the distortion thereby triggered.

The multipath check can be made by the following procedure. First, connect the respective output terminals to an amplifier and operate the 5T10 so that the reproduction of FM broadcasting can be made. Then tune in to the desired station.

Now, press in the Multipath Check Switch, and distorted sound may possibly be reproduced. This is caused by the multipath signals reaching the antenna. Therefore, re-set the antenna direction so that minimum sound level and the most clear sound can be ob-

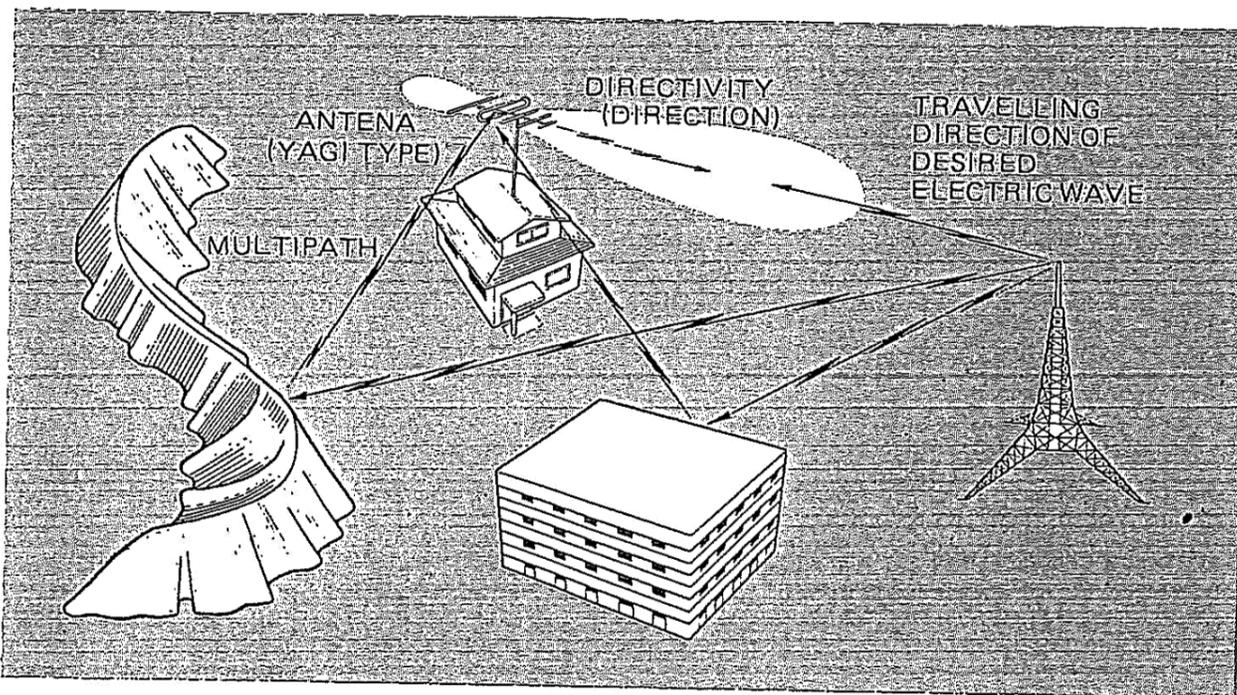
tained. In the area of good wave-condition, the reproduction of such multipath ingredients is reduced even to an inaudible level.

Thus, multipath is reduced down to the minimum. Do not forget to release the switch to the original "protruded" position, for normal listening.

**About Tuning Lock System**

The Tuning Lock System will not operate for weak-wave stations below the pre-fixed muting level, since it is operated by the control signal from the C.L.L. Circuitry and the Muting Circuitry.

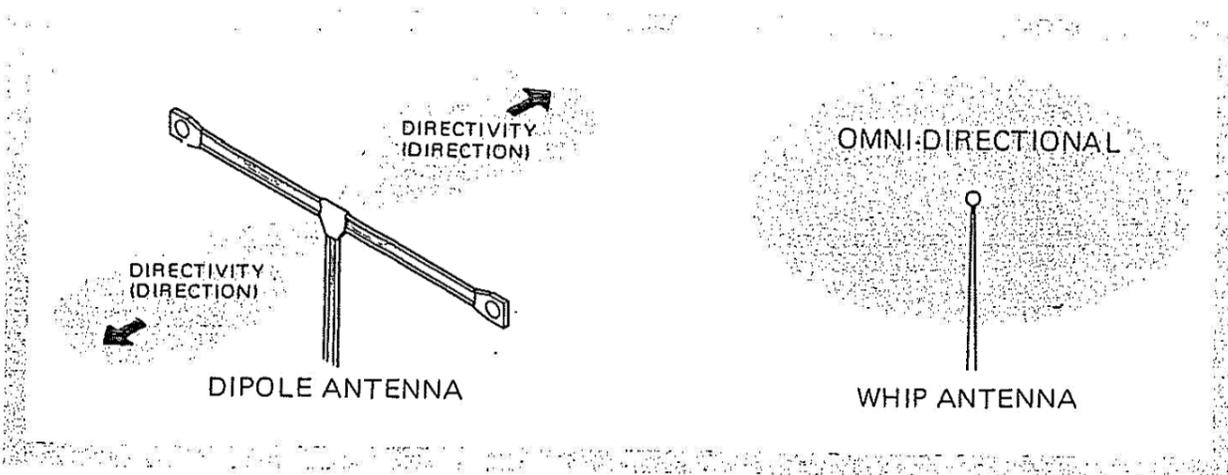
Therefore, when such station whose electric field is fluctuating around the muting level is tuned in to with the C.L.L. Off Switch turned on, the Tuning Lock starts or ceases to function in accordance with the fluctuation of electric field. In this case it is advisable to turn the muting level adjuster counter-clockwise.



**LOCATION OF FM ANTENNA**

Any good FM antenna cannot exhibit its designed performance if it is erected incorrectly - - - too low or hindered by surroundings. The FM antenna must be at least 4 meters (14 feet) high from the ground level and

clear of surrounding obstacles for 3 meters (10 feet) or more. To prevent possible pick-up of car ignition noise, or any other high frequency noises, the antenna must be set up as far as possible from such noise generating sources.



## ANTENNA CABLE

### [ Selection of Cable and Connection ]

Selection of cable and its connection is important as well. There are two types of FM antenna cables, one is the ribbon feeder antenna having 300-ohm impedance and other is the coaxial cable having 75-ohm impedance.

The 300-ohm ribbon feeder cable is identical to what is used for the standard di-pole antenna provided, and it can be used for extension of the di-pole antenna for connection to the 300-ohm FM antenna terminals.

In case 75-ohm coaxial cable is used, connect the exclusive terminal for coaxial cable of the FM antenna and the Coaxial Connector (16) or the Antenna Terminal (75-ohm) (17).

The 75-ohm coaxial cable is more stable than the 300-ohm ribbon feeder against environmental (weather) conditions. Also, it is less influenced by external electrical noise, and the impedance is quite stable even if it is located in the vicinity of metallic obstacles. Therefore, we recommend that you use this coaxial cable in case you think the ribbon feeder type is inadequate.

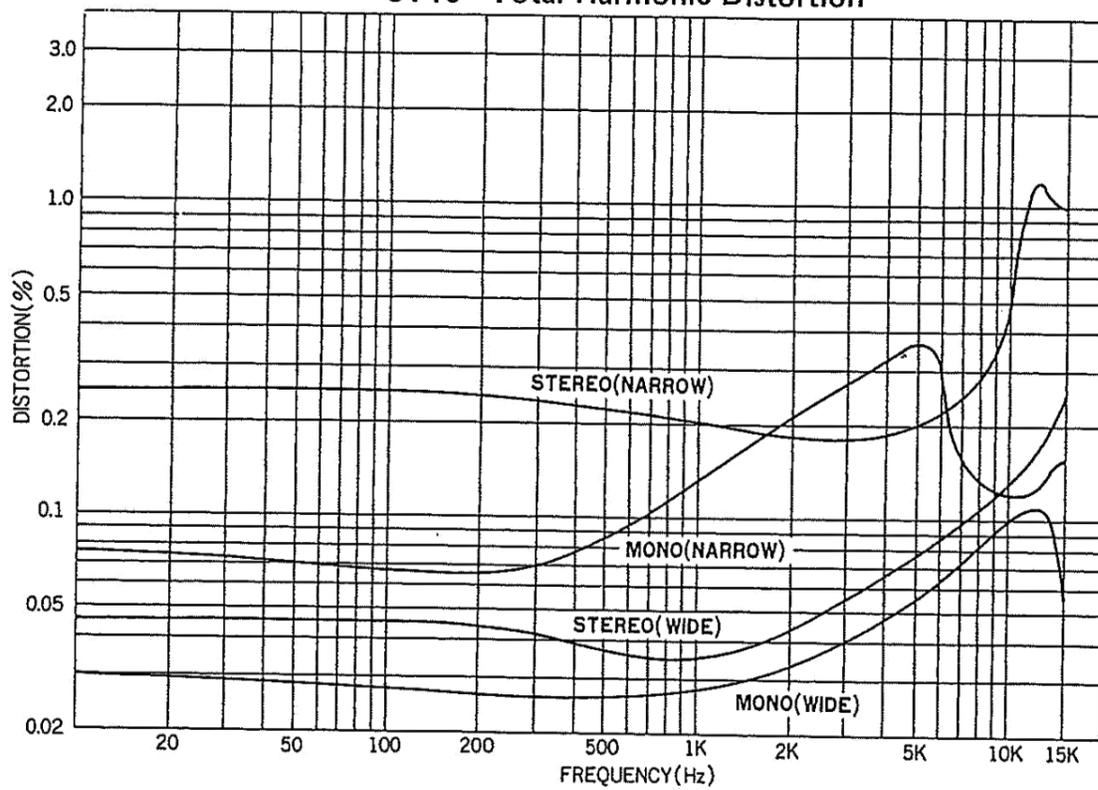
Coaxial cable is normally supplied in two different impedance types: 75-ohm and 50-ohm. For use with a 50-ohm cable, a special matching transformer is necessary. Impedance matching between the antenna, cable and antenna terminals is very important. When mismatched, it will cause generation of standing waves which presents similar problems as that of multipath, resulting in deterioration of sound.

### [ Cable Wiring ]

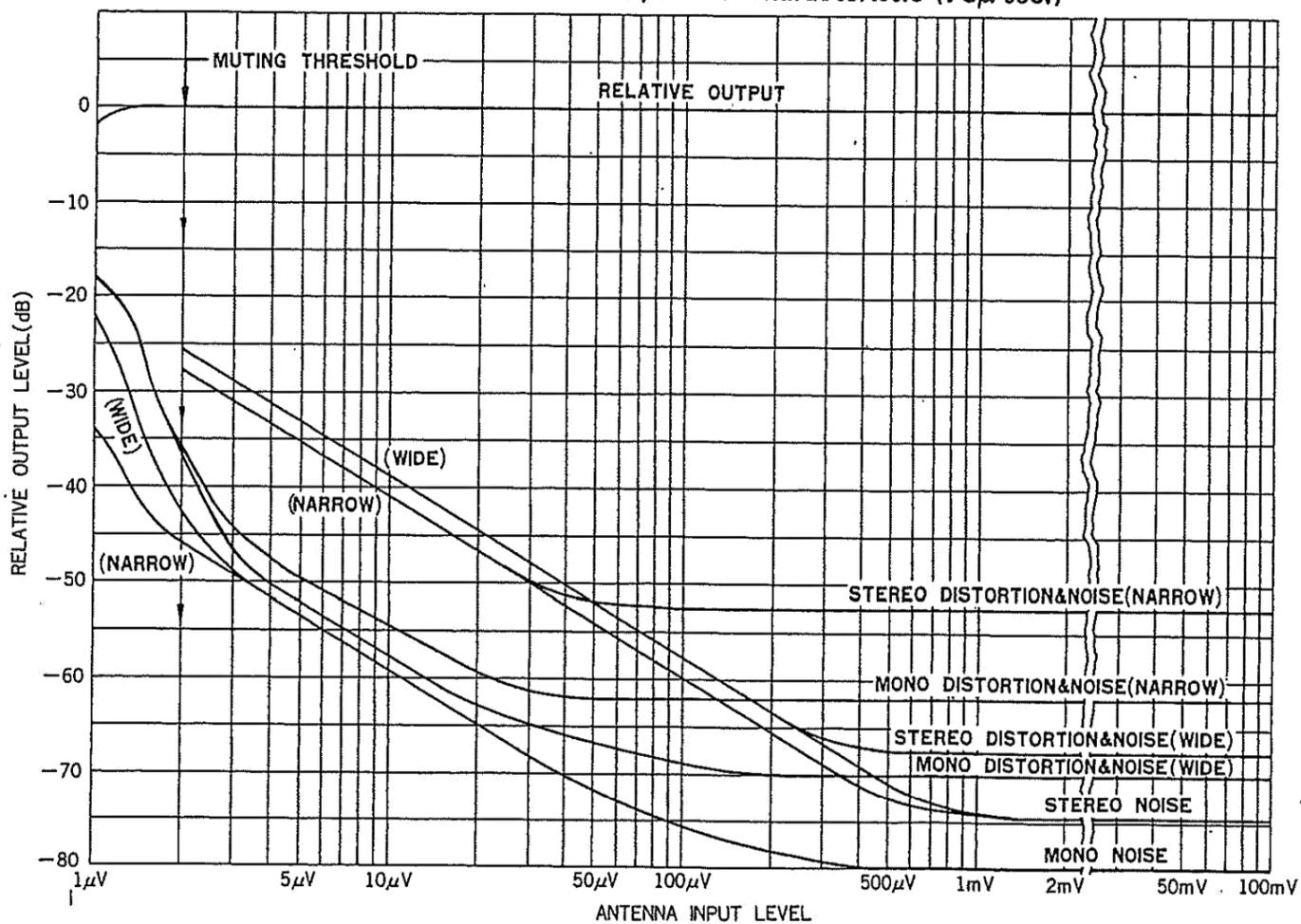
The antenna cable must be placed carefully. Avoid placing it near or in parallel to conductive substance as this causes the cable impedance to vary. Coaxial cable has more stable characteristics against various environmental conditions inclusive of weather and it is less influenced by external noise sources. The insertion loss of the ribbon feeder is 0.45dB per 10 meters (33 feet) for the FM band, while the coaxial cable, type 3C2V which is most commonly used, is 1.35dB. Therefore, the shorter the cable length, the better the result.

# Standard Curves

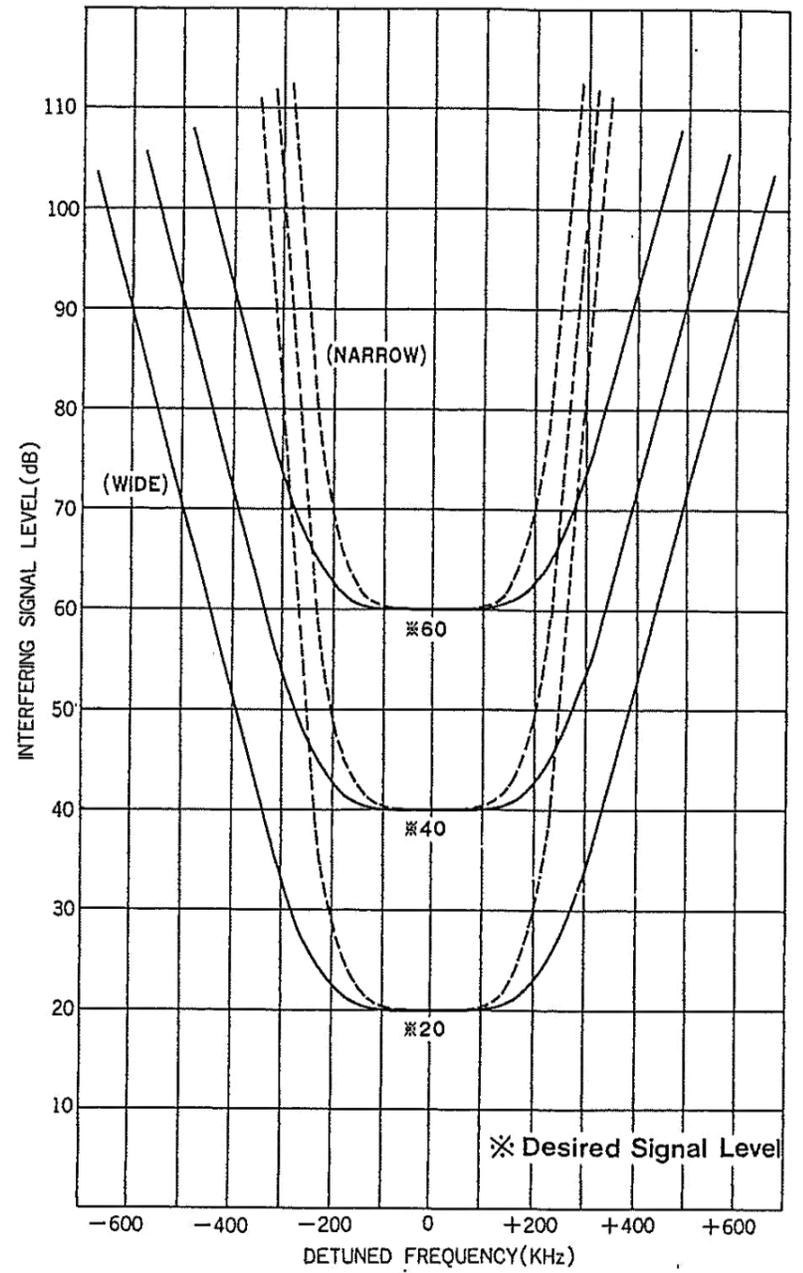
5T10 Total Harmonic Distortion



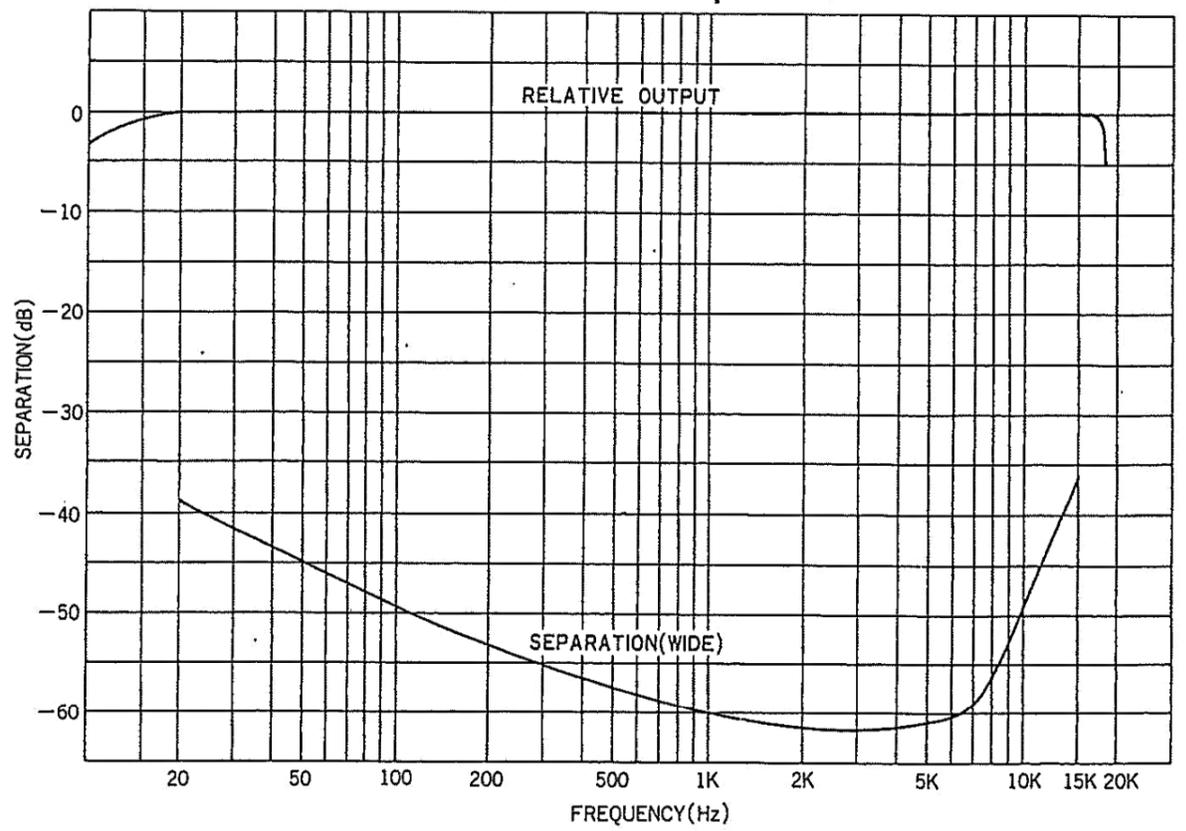
5T10 Distortion, Noise Characteristic-(75 $\mu$  sec.)



5T10 Signal Selectivity



5T10 Channel Separation



# Specifications

Receiving Frequency:	87.5MHz - 108MHz
50dB Quieting Sensitivity:	50 $\mu$ S 16.0dBf (3.3 $\mu$ V)
	75 $\mu$ S 14.2dBf (2.8 $\mu$ V)
IHF Usable Sensitivity:	10.7dBf (1.8 $\mu$ V)
Signal-to-Noise Ratio:	80dB
Frequency Response:	20Hz - 17,000Hz (within -0.5dB, mono & stereo)
Total Harmonic Distortion:	0.05% (wide, 100Hz, mono) 0.05% (wide, 1kHz, mono) 0.07% (wide, 6kHz, mono) 0.07% (wide, 100Hz, stereo) 0.06% (wide, 1kHz, stereo) 0.1% (wide, 6kHz, stereo) 0.2% (narrow, 1kHz, mono) 0.5% (narrow, 1kHz, stereo)
Capture Ratio:	0.8dB (wide), 2dB (narrow)
Adjacent Channel Selectivity:	12dB (narrow, $\pm$ 200kHz)
Alternate Channel Selectivity:	60dB (narrow, $\pm$ 300kHz) 30dB (wide, $\pm$ 400kHz) 90dB (narrow, $\pm$ 400kHz)
Spurious Response Ratio:	100dB
IF Response Ratio:	100dB
Image Response Ratio:	100dB
AM Suppression Ratio:	62dB
Stereo Separation:	45dB (wide, 100Hz) 50dB (wide, 1kHz) 45dB (wide, 10kHz) 30dB (narrow, 1kHz)
Output Voltage:	1V (fix) 0V - 1V (variable)
Output Impedance:	100 ohms (fix) 100 ohms - 1.25k ohms (variable)
Muting Threshold:	variable 30 $\mu$ V - 500 $\mu$ V
Additional Features:	Tuning Lock System, IF Bandwidth Selector, Multipath Check Switch, Recording Test Tone Circuit, Center Indicator, Signal Strength Indicator, FM Muting Switch, FM Muting Level Control, Time Delay Muting Circuit, Output Level Control etc.
Power Consumption:	20W
Dimensions:	442(W) x 400(D) 101(H) mm (17-3/8" x 15-3/4" x 4")
Weight:	Net 7.0kgs (15.4 lbs.) Gross 8.5kgs (18.7 lbs.)

\* Specifications and appearance design are subject to possible change without notice.

**LUX CORPORATION, JAPAN**

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