April 25, 1960

THE INSTITUTE OF RADIO ENGINEERS, INC.
1 East 79th Street, New York 21, New York

TO: Members of the Standards Committee and Chairmen of All Measurements Subcommittees

FROM: J. G. Kreer, Jr., Measurements Coordinator

SUBJECT: Proposed IRE Standards on Radio Interference: Methods of Measurement of Conducted Interference Output of FM and Television Broadcast Receivers in the Range of 300 kc to 25 mc.

The enclosed Proposed IRE Standards on Radio Interference: Methods of Measurement of Conducted Interference Output of FM and Television Broadcast Receivers in the Range of 300 kc to 25 mc. is forwarded to you for comment. Additional copies are available for Committee and Subcommittee members, upon request to the Technical Secretary, IRE, L. G. Cumming, 1 East 79th Street, New York 21, N.Y.

It is urgently requested that this Proposed Standard be given careful consideration by the Measurements Subcommittees and that written comments be forwarded not later than May 31, 1960.

Comments should be sent to the following:

Mr. Richard J. Farber
Hazeltine Research Corporation
Little Neck, New York

with a copy to:

Mr. J. G. Kreer, Jr.
Bell Telephone Laboratories, Inc.
Whippany, New Jersey

If no comments are received by May 31, 1960, it will be assumed that the Proposed Standard is satisfactory and it will be submitted for approval by the IRE Standards Committee.

J. G. Kreer, Jr.
Measurements Coordinator

Enclosure

cc: Radio Frequency Interference Committee

THE INSTITUTE OF RADIO ENGINEERS, INC.
1 East 79th Street, New York 21, New York

60 IRE 27. PS1
February 1960

PROPOSED IRE STANDARDS ON RADIO INTERFERENCE: METHODS OF MEASUREMENT OF CONDUCTED INTERFERENCE OUTPUT OF FM AND TELEVISION BROADCAST RECEIVERS IN THE RANGE OF 300 KC TO 25 MC

1. INTRODUCTION

1.1

FM and television broadcast receivers are frequently potential sources of interference to other FM and television broadcast receivers as well as to receivers in other services. In the range of 300 KC to 25 MC this interference can arise from high level receiver signals such as the IF, and in television receivers, the horizontal deflection system. This standard defines a method for obtaining a measure of these various interference sources in the frequency range of 300 KC to 25 MC. It supersedes and replaces the three standards, "IRE Standards on Receivers: Methods of Measurement of Interference Output of Television Receivers in the Range of 300 to 10,000 KC, 1954" (54 IRE 17. S1), "IRE Standards on Methods of Measurement of the Conducted Interference Output of Broadcast and Television Receivers in the Range of 300 KC to 25 MC, 1956" (56 IRE 27. S1), and Supplement to "IRE Standards on Receivers: Methods of Measurement of Interference Output of Television Receivers in the Range of 300 to 10,000 KC, 1954" (54 IRE 17. S1) (58 IRE 27. S1).

This standard describes standard input signals, the equipment set-up and measurement techniques.

2. EQUIPMENT REQUIRED AND METHOD OF INSTALLATION

2.1

To perform the measurements described in this standard, the following equipment is required:

2.1.1 A screen room of minimum inside dimensions of 7' H x 7' W x 10' L with adequate shielding and filtering to eliminate external interference. For large receivers the requirements of Section 2.2.1 may dictate a room larger than this minimum size.

2.1.2 A power line impedance network. The purpose of this network is to present a standard value of power line impedance to the receiver under test regardless of the local power line conditions.

2.1.2.1 The line impedance network is schematically illustrated in Fig. 1. The purpose of the one ohm (non-reactive) resistor is to minimize any possible resonance effects of the series circuit of the 5 microhenry inductor and the 1.0 microfarad capacitor. The purpose of the 1000 ohm resistors is to limit the line voltage that may appear at the coaxial connectors.

2.1.2.2 The impedances of the line network measured from each side of the receiver receptacle to chassis must conform within ± 5 per cent to the characteristic shown in Fig. 2. (For this requirement the power plug is open-circuited and both measurement outlets terminated).

2.1.2.3 A suitable method of measuring these impedances is shown in Fig. 3. This measurement technique is a substitution method. The reference resistor is chosen so that the voltage drop across this resistor is equal to the voltage across the line-impedance network at each frequency of measurement. The value of the resistor is then taken as the absolute value of the impedance. Since the impedance of the line network is considerably less than that of the 470 ohm resistor, the generator impedance has a negligible effect on the measurements. The accuracy of the voltmeter is unimportant since it is only used to hold the voltage constant when the switch is changed. It is important to keep the lead lengths as short as possible.

2.1.2.4 To minimize variations which might occur among different line impedance networks and to permit more uniformity in test facilities, detailed construction drawings of a suitable network, of which assembly drawings are shown in Fig. 4 (a) and (b), have been prepared.[1] Any network constructed according to these drawings should be tested in order to insure that it meets the requirement of Section 2.1.2.2.

2.1.3 A source of a Standard RF input signal.

2.1.3.1 The RF signal shall be coupled to the receiver under test by means of a 20 db 300 ohm resistive attenuator pad. This network, details of which are shown in Fig. 5, is designed to have an impedance of 300 ohms balanced, and 300 ohms unbalanced (impedance between the two output terminals connected together and ground). If the signal generator is not located within the screen room adequate filters should be installed at the signal input to the screen room to exclude undesired signals in the frequency band of interest.

If the receiver has a built-in antenna, it shall be disconnected from the antenna terminals during these tests. If the signal generator does not have a nominal 300-ohm center-tapped output impedance, a suitable matching network shall be provided between the signal generator and the attenuator pad.

If the receiver is designed for use with an unbalanced shielded transmission line, a line having the characteristics recommended by the receiver manufacturer shall be used in place of the twin-lead in Figs. 5 and 7. The input terminals of the transmission line are connected to the output terminals of the resistive pad. In addition, a resistor is connected in shunt with the output

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1. These drawings may be purchased from the Institute of Radio Engineers, Inc. 1 East 79th Street, New York 21, N.Y. at a cost of $2.00 per copy.

terminals of the pad so that the combination of pad and resistor matches the nominal input impedance of the receiver.

2.1.3.2 For a television receiver, the input signal shall consist of simulated sound and picture signals on a standard television channel. The use of a low band VHF channel will be generally satisfactory, but the measurement can be made using any VHF or UHF channel.

2.1.3.2.1 The modulation of the picture signal shall consist of the mixture of the following signals as shown in Fig. 6: (observed on a double-sideband detector or equivalent, with a video frequency response up to 15 MC).

A. Pulses of 5 μs width at a repetition rate of 15750 pulses per second to represent horizontal synchronizing pulses. The pulse amplitude shall be sufficient to modulate the picture carrier so that the level between pulses is 37.5% of the peak level during the pulses.

B. A sine wave of 2.0 MC to represent video modulation. The amplitude of this modulation shall be sufficient to produce 1% peak-to-peak modulation during the time interval between the synchronizing pulses. This sine wave may be allowed to run through the synchronizing pulse period. (A method of obtaining 1% modulation is to adjust the modulation level for 10% to permit observation of an oscilloscope and then to reduce the modulating 2.0 MC signal by 20 db).

C. A sine wave of 3.58 MC to represent color signal modulation. The amplitude of this modulation shall be sufficient to produce 10% peak-to-peak modulation between the synchronizing pulses. This sine wave may be allowed to run through the synchronizing pulse period.

2.1.3.2.2 No modulation of the sound signal is employed.

2.1.3.2.3 The peak level of the picture carrier delivered at the output terminals of the 300 ohm resistive attenuator shall be 3200μv (50 db below one volt) open circuit. The sound carrier level shall be 3 db below the maximum level of the modulated picture signal.

2.1.3.3 For an FM broadcast receiver, the input signal shall be delivered from the 300 ohm resistive pad at an open circuit level of 1000μv (60 db below one volt) at a frequency of 98 MC. No modulation shall be employed.

2.1.4 A suitable tuned voltmeter (field strength meter). This instrument shall have a 50-ohm input impedance and be tunable over at least the frequency range of interest. The nominal bandwidth of the voltmeter shall not exceed 10 kc. Means shall be provided for either internal or external calibration. The instrument shall be adequately shielded and the power leads filtered to prevent spurious pick-up.

2.1.5 A regulated source of primary input power. Unless otherwise specified, the voltage at the receiver receptacle shall be maintained at 117 volts ± 2 per cent. Voltage regulators with high harmonic content should be avoided.

2.2

The equipment shall be installed in the following manner:

2.2.1 All portions of the receiver under test shall be at least 30 inches from the wall of the shielded enclosure. Floor model receivers shall be placed on a non-metallic platform 18 inches above the metallic floor of the shielded enclosure and table models placed on a non-metallic platform 30 inches above the floor. If the receiver is equipped with remote cables, these should be connected to the receiver and terminated either with the normal equipment or with a dummy load. They should be coiled up and located on top of the receiver.

2.2.2 The power line impedance network shall be located directly below the back of the cabinet of the receiver under test. The center line of the power line impedance unit shall be coincident with the center line of the receiver back. Similarly, the RF signal coupling pad shall be mounted at the ceiling of the screen room directly above the power line impedance network. The standard arrangement is shown in Fig. 7.

2.2.3 The line impedance network shall be on the floor of the shielded enclosure and shall be connected to the metallic floor by means of four solid copper straps as shown in Fig. 8. The width to length ratio of each strap shall be at least 1 to 5 and the thickness of the strap shall be at least 0.025 inches. In the unit shown in Fig. 4, four holes have been provided for this purpose. The connection from the line impedance network to the power source should be kept close to the walls or floor of the shielded room when inside the enclosure.

2.2.4 A 50-ohm resistive load shall be connected to each of the two coaxial connectors of the line impedance network at all times. The voltages developed across these loads represent the conducted interference output of the receiver. A 50-ohm nonreactive resistor or a 50-ohm input impedance field-strength meter or any combination of field-strength meter and external resistor to equal 50 ohms can be used as the resistive load. The field strength meter shall measure the average of the detected voltage. This measurement position is normally designated as "Field Intensity" or "Carrier".

2.2.5 The power line cord from the receiver under test shall be dressed to the power line impedance network through the shortest possible path. The excess cord length shall be taken up by wrapping the cord in a figure eight pattern around the two posts provided on the top of the unit. The receiver power line cord shall be plugged into the receptacle provided in the power line impedance network. This is shown in Fig. 9.

The disposition and length of the RF transmission line between the antenna attenuator pad and receiver is also important. As shown in Fig. 7, the length of transmission line shall be just sufficient to connect the receiver antenna terminals to the antenna attenuator pad.

3. MEASUREMENT PROCEDURE

3.1

The equipment is assembled in the prescribed manner, and the receiver under test is tuned to the appropriate input signals.

3.1.1 For a television receiver, the correct tuning is determined by injecting a signal at the nominal intermediate picture carrier frequency and tuning the receiver local oscillator for a zero beat with the converted input picture carrier. If the receiver employs automatic local oscillator tuning means, the frequency of the converted IF picture carrier shall be recorded. If both manual and automatic tuning are provided, measurements shall be recorded for both conditions.

3.1.2 For an FM receiver the tuning is adjusted for maximum measured interference.

3.2

With the tuned voltmeter connected to one 50-ohm output of the power line impedance network, the voltage between this side of the power line and ground is measured at the frequencies of interest. The measurement is repeated with the voltmeter connected to the other 50-ohm terminal of the power line impedance.

3.3

The customer-operated controls of the receiver, with the exception of the tuning adjustments, can be placed at any setting. In general, the range of these controls should be searched to determine the setting that produces the maximum interference value at each frequency of interest.

3.4

The interference voltage is recorded at each frequency of interest separately for each side of the power line.

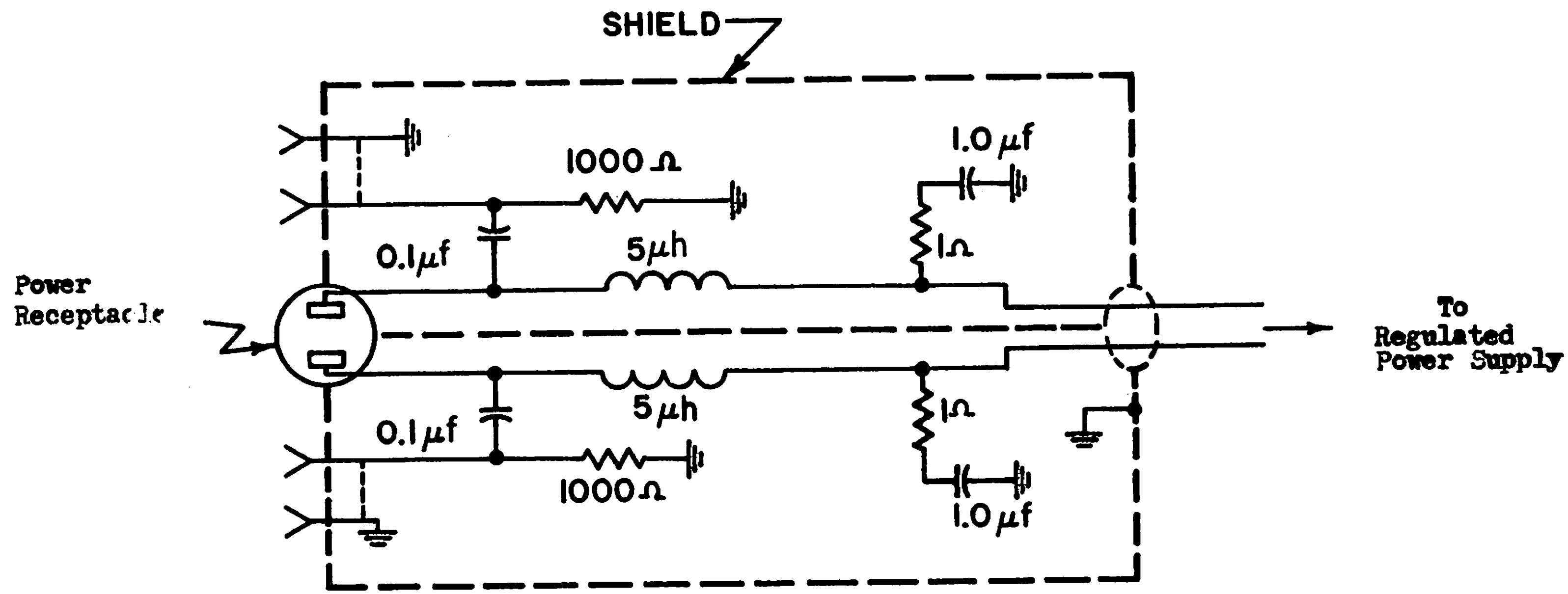


FIG. 1 POWER LINE IMPEDANCE SCHEMATIC

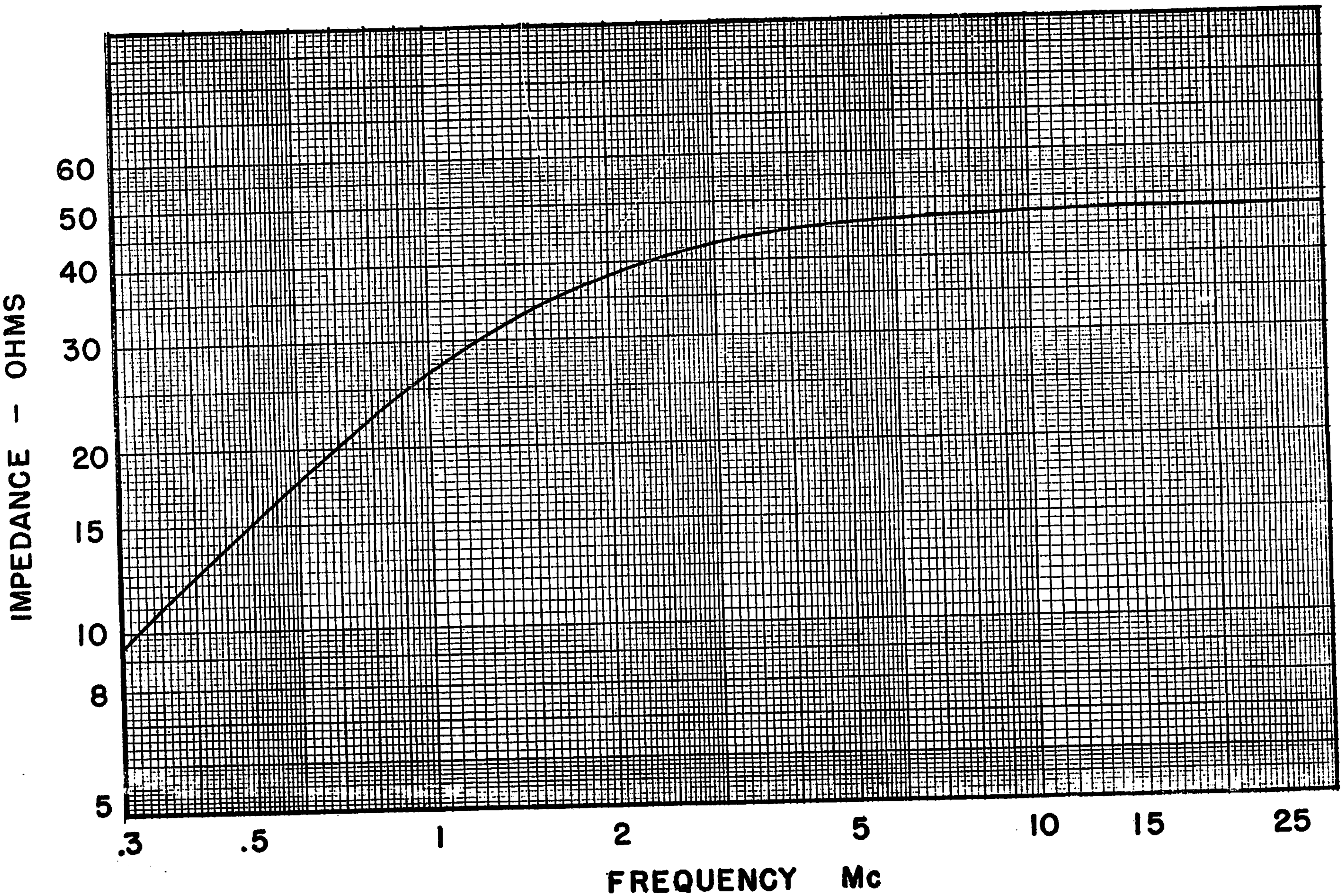


FIG. 2 - Impedance Characteristic of Line Measured from Either Side of the Receiver Receptacle to Chassis

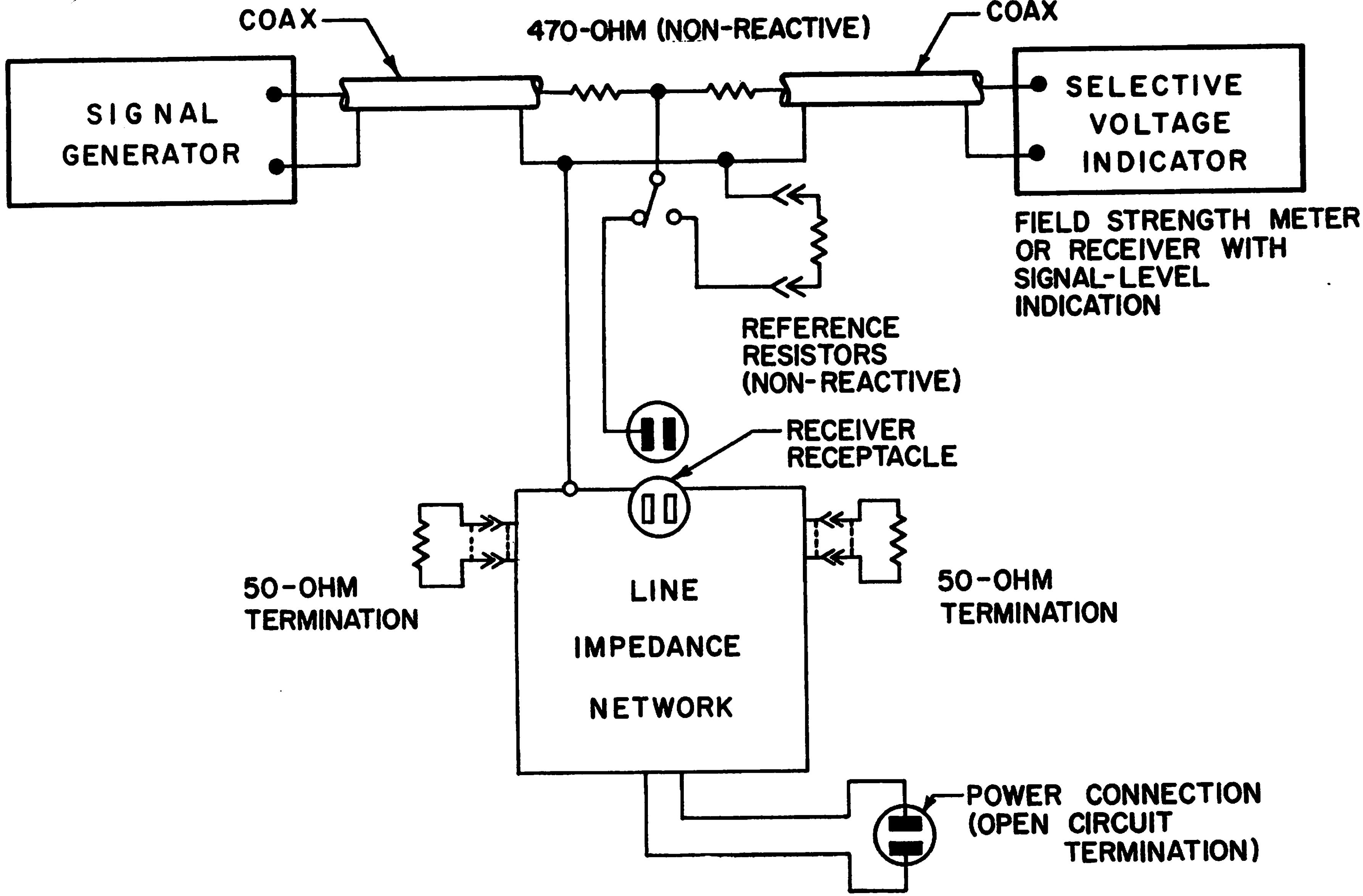
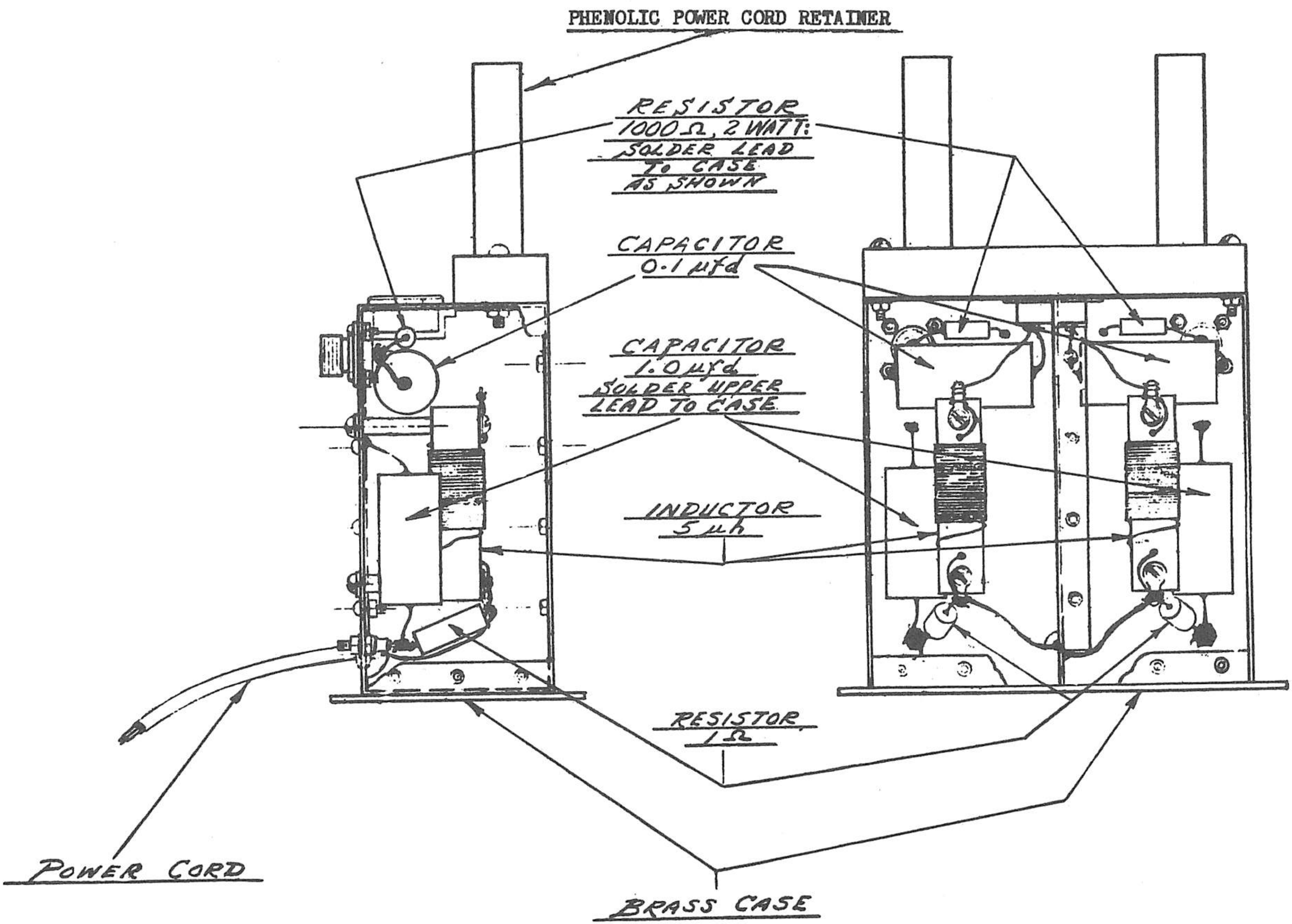


FIG. 3 METHOD OF MEASUREMENT OF IMPEDANCE CHARACTERISTIC SHOWN IN FIG. 2



PHENOLIC POWER CORD RETAINER
RESISTOR
1000 Ω, 2 WATT:
SOLDER LEAD
TO CASE
AS SHOWN
CAPACITOR
0.1 μfd
CAPACITOR
1.0 μfd
SOLDER UPPER
LEAD TO CASE
INDUCTOR
5 μh
RESISTOR
1 Ω
POWER CORD
BRASS CASE

FIGURE 4a

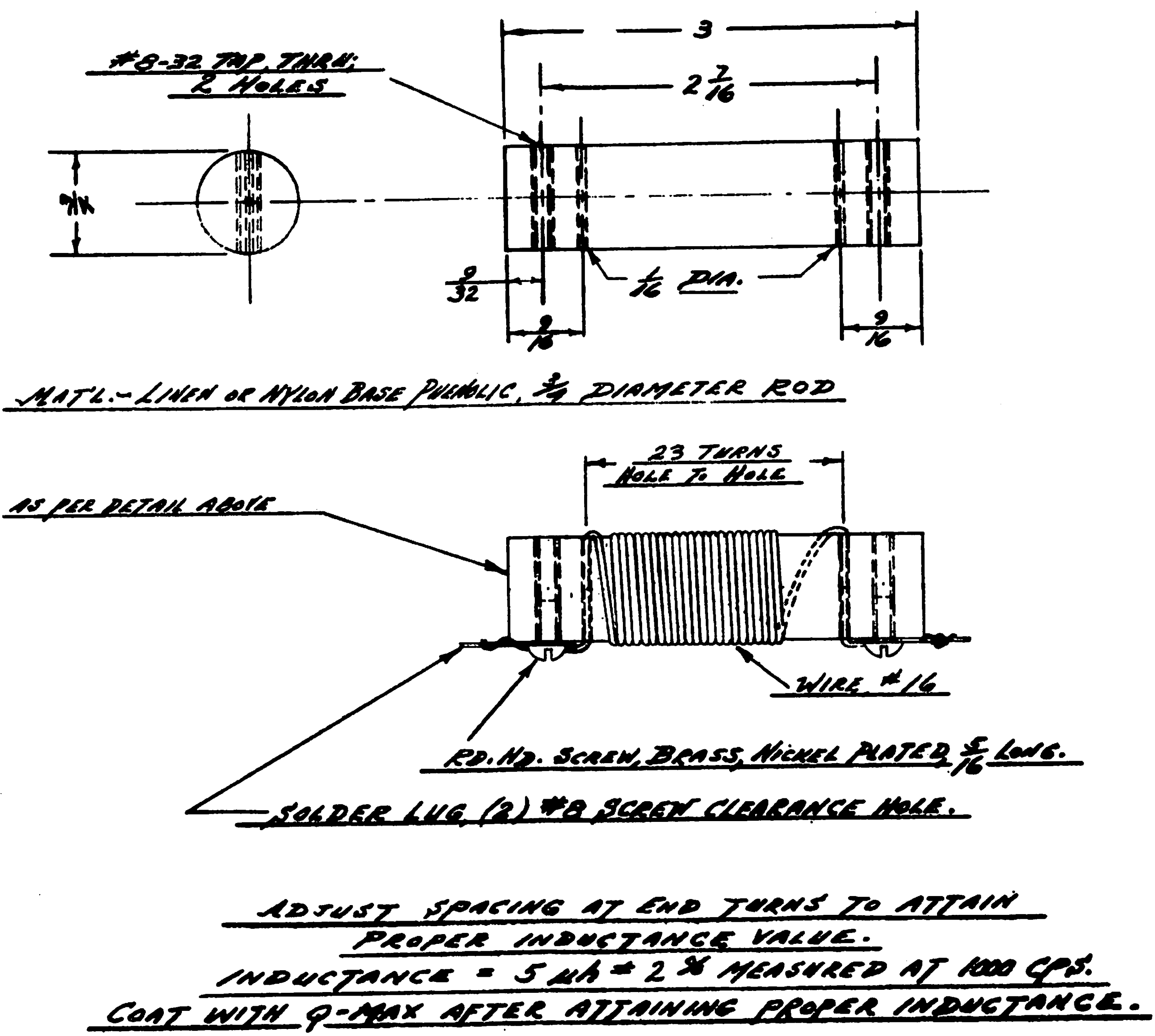
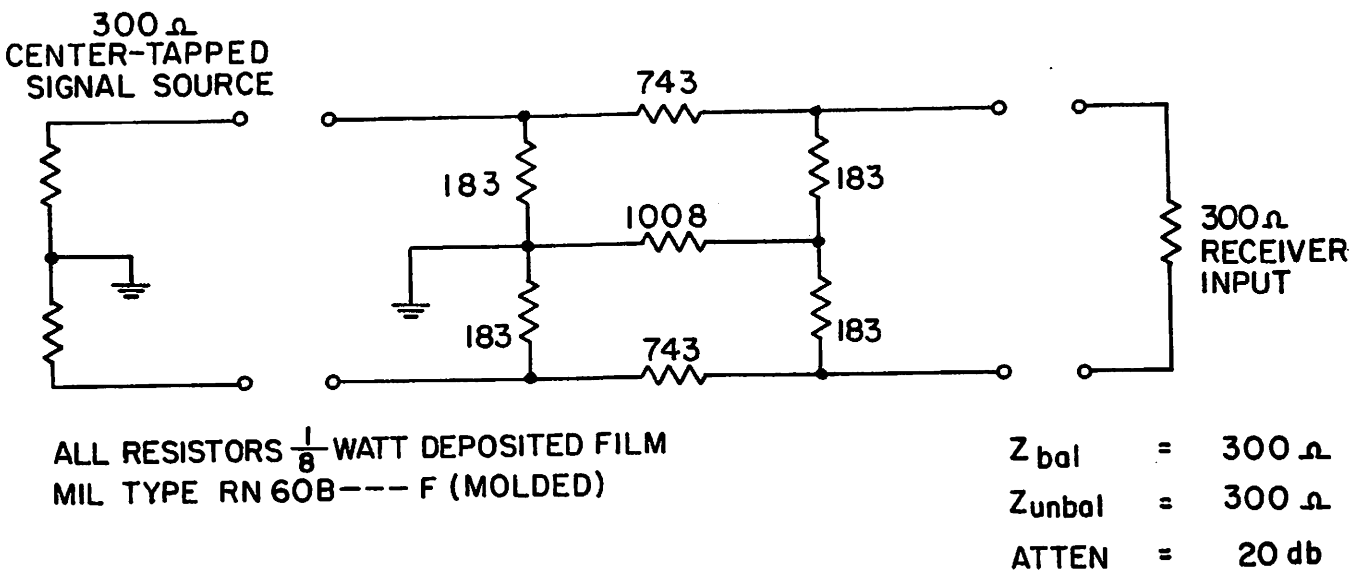
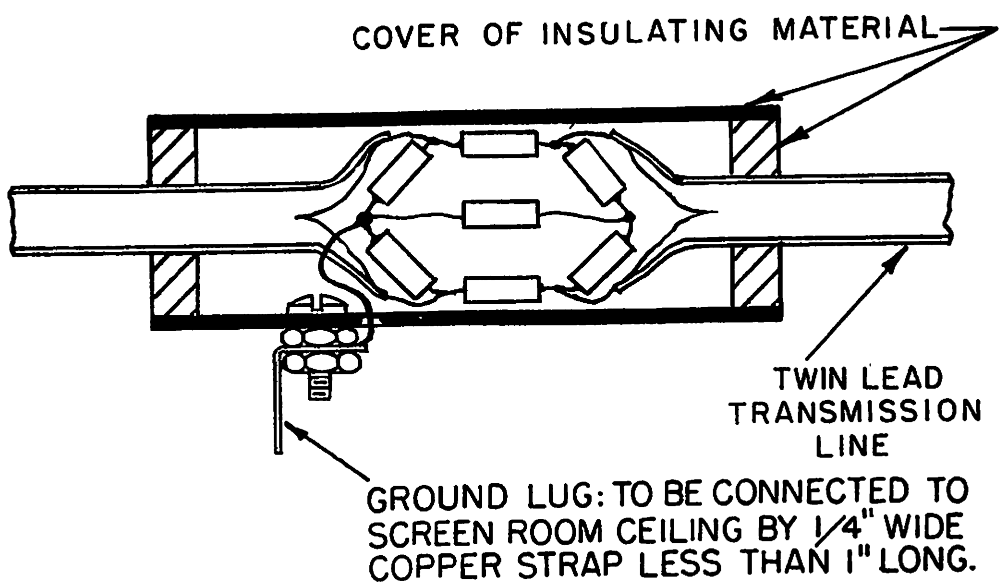


FIGURE 4b

Fig. 4 (a) Line Impedance Assembly. (b) Inductor 5µh.



(a) SCHEMATIC DIAGRAM OF RESISTIVE PAD



(b) DRAWING OF TYPICAL CONSTRUCTION

ANTENNA COUPLING PAD

FIG. 5

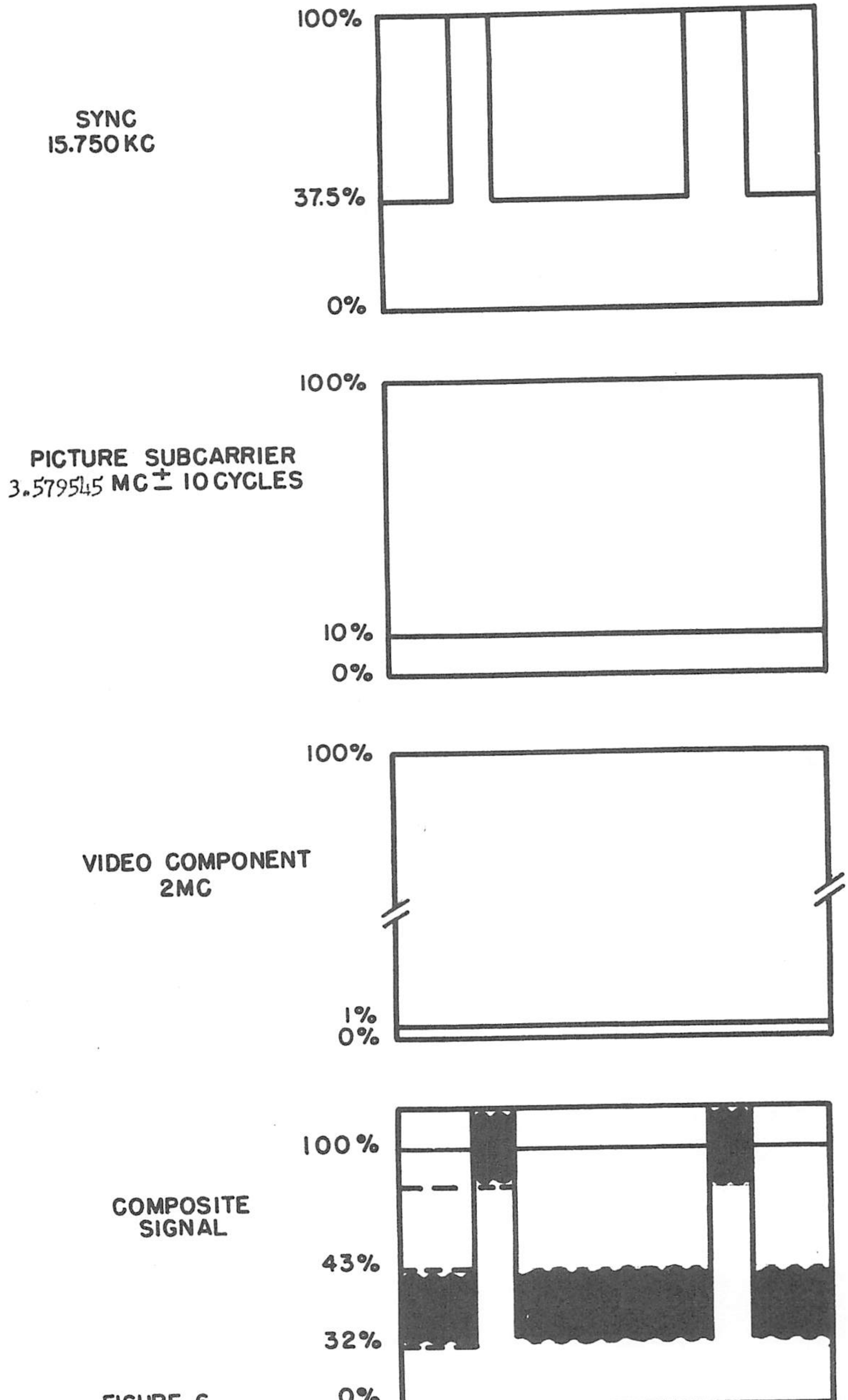

SYNC
15.750 KC
100%
37.5%
0%
PICTURE SUBCARRIER
3.579545 MC ± 10 CYCLES
100%
10%
0%
VIDEO COMPONENT
2MC
100%
1%
0%
COMPOSITE
SIGNAL
100%
43%
32%
0%

FIGURE 6

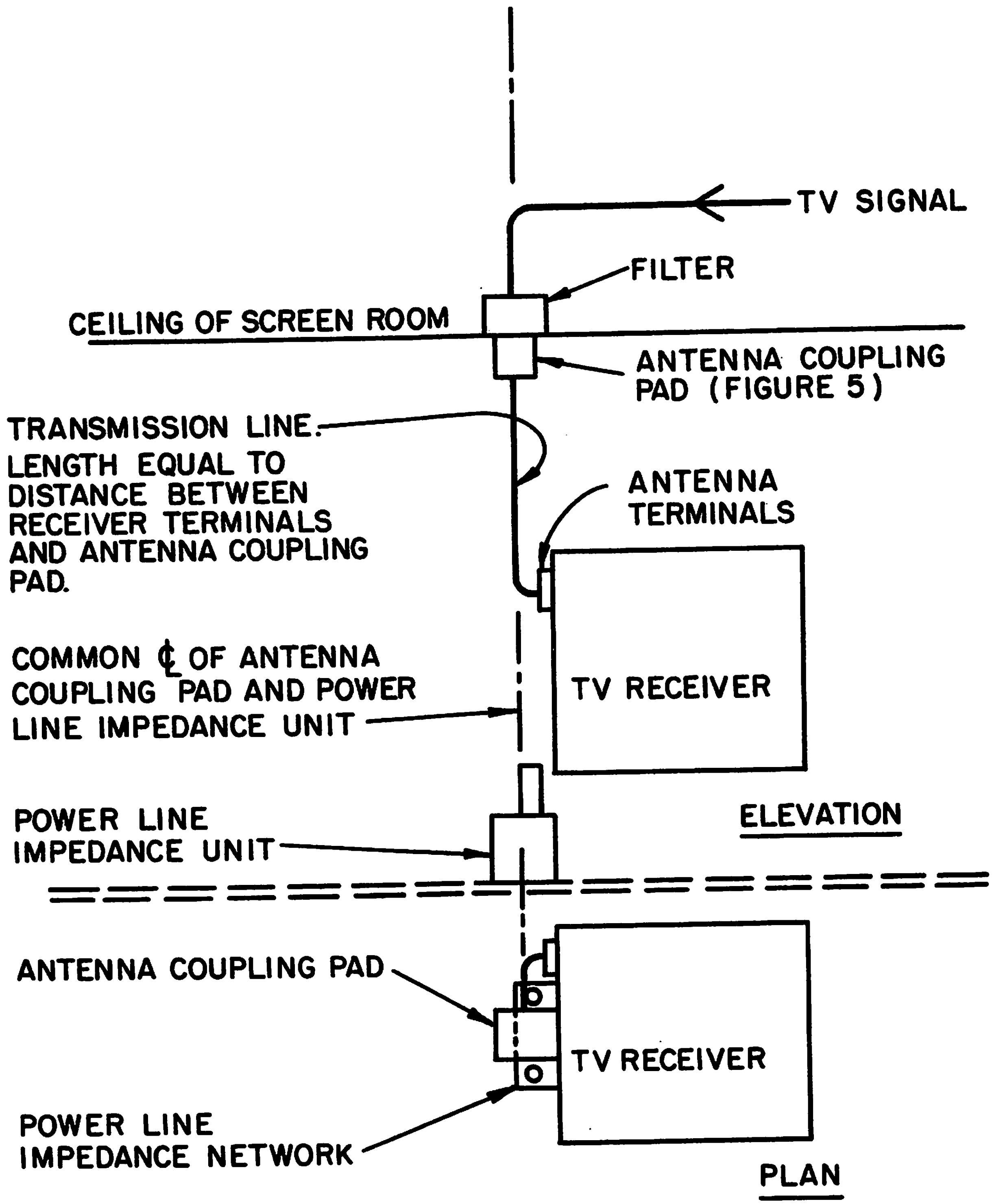
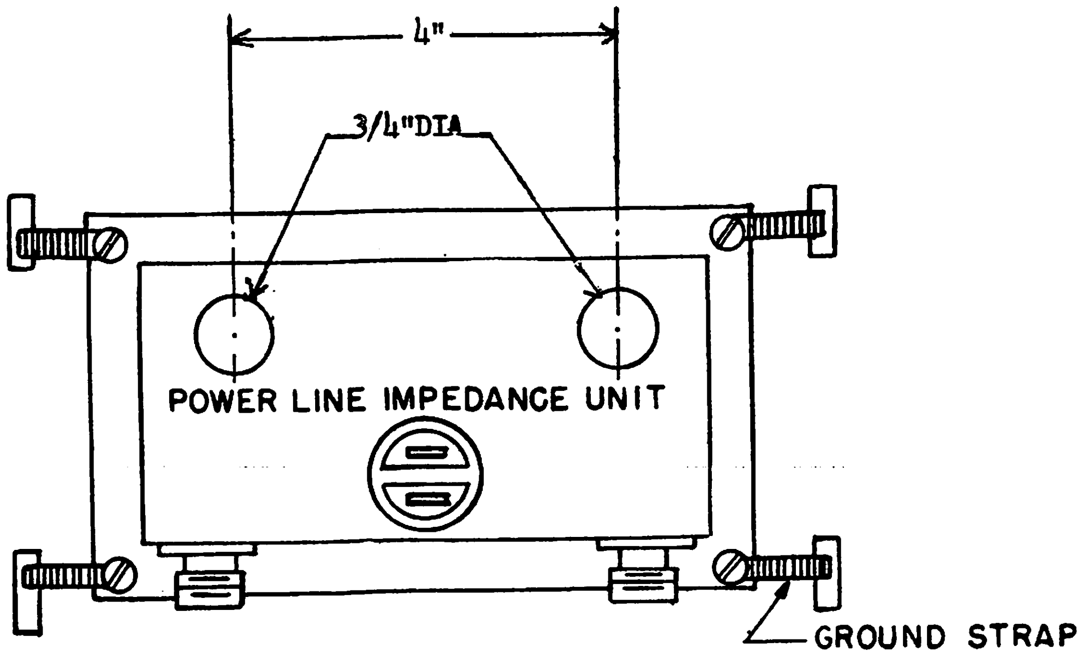
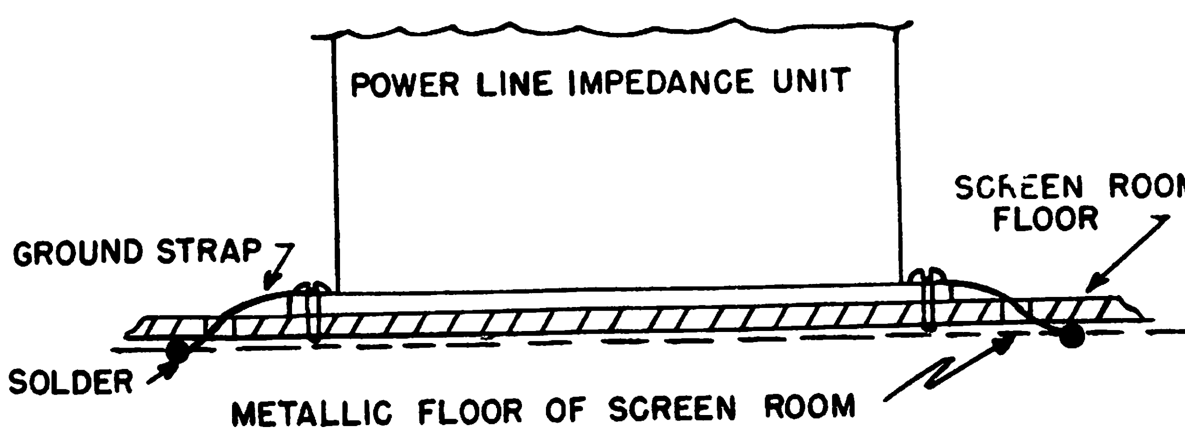


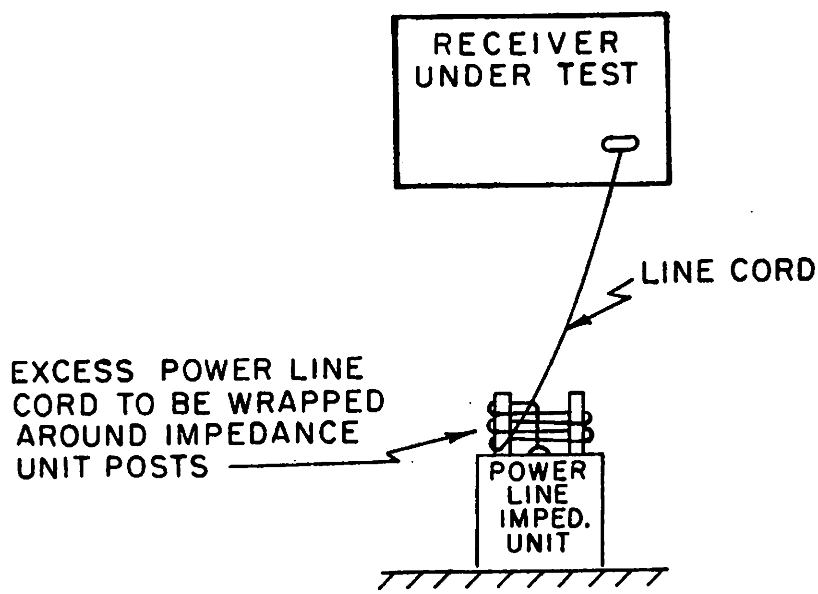
FIG.7 SIGNAL INPUT SYSTEM





SUGGESTED METHOD FOR GROUNDING THE LINE IMPEDANCE UNIT TO THE SCREEN ROOM

FIGURE 8



METHOD OF DRESSING THE RECEIVER POWER LINE CORD

FIG. 9

2.1.3.2 Specify AM signal for video and FM for aural. Suggest method of modulating AM signal and what generators are useable. Suggest method of coupling AM and FM generators to antenna to prevent cross coupling.

2.1.3.2.1 A. Specify rise time of pulse

3.2 Allow use of coaxial switch with open line terminated.

3.3. Have contrast and brightness controls at max. Disable or set a.g.c. controll to min. This makes circuits at max. gain.