INSTRUCTION MANUAL

6

EMPIRE*

NOISE AND FIELD INTENSITY METER

MODEL NF-105

Gertsch*

EMPIRE*

Sensitive Research*

Panoramic*

SINGER

Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

WARRANTY

THE SINGER COMPANY, METRICS DIVISION, warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

*Commander** Instruments: Potentiometers, Bridges,
Volt Ratio Boxes and Standard Resistors..................5 years
*Sensitive Research** Electrical Indicating Instruments............2 years
Other Electrical and Electronic Measuring Instruments..........1 year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuzes, lamps, thermoelements, and *RatioTran** potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

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THE SINGER COMPANY • METRICS DIVISION
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Instruments should be returned only on prior written authorization from the Singer Representative or the factory(1). Warranty repair will be made upon written request. Please provide the following information in order to expedite our processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, Bridgeport, Connecticut for *Commander**, *Empire**, *Panoramic**, and *Sensitive Research** instruments. Contact Metrics Division, Los Angeles, California for *Gertsch** instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.

ADDENDUM

for

MODEL NF-105 and NF-105 (M-126)

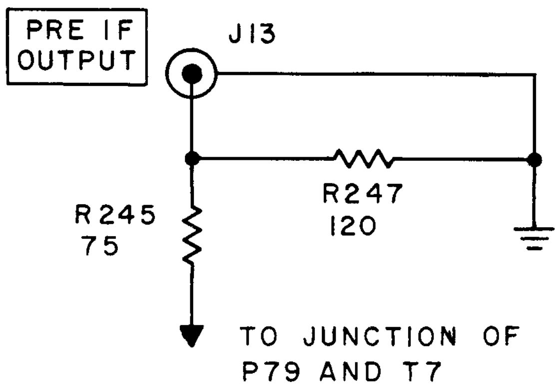
TYPE T1, T2, and T3 TUNING UNITS

I. PURPOSE.

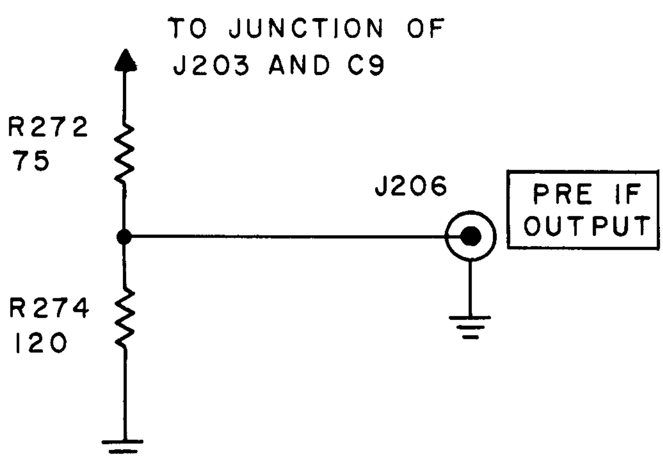
To update schematic diagrams of T1, T2, and T3 tuning units to include the PRE IF OUTPUT circuitry.

II. ADDENDUM.

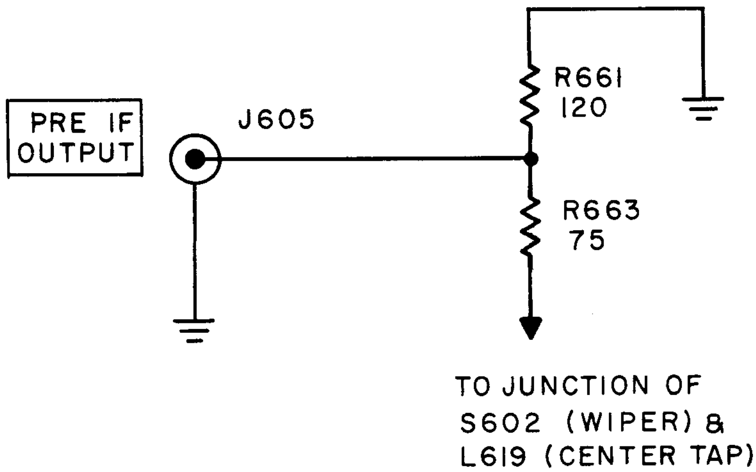
A. Add the following circuitry to the T1 tuning unit schematic:



B. Add the following circuitry to the T2 tuning unit schematic:



C. Add the following circuitry to the T3 tuning unit schematic:



III. DESCRIPTION.

The PRE IF OUTPUT circuitry provides an i-f signal whose bandwidth is greater than the i-f signal obtained from the tuning unit i-f amplifier. The output of the PRE IF OUTPUT circuitry is used for spectrum signature analysis.

MODELS TA/NF-105

TA/NF-205, TA/NF-105X-M-126

TA/NF-105-F and TA/NF-105-FX

I. PURPOSE.

To improve scan specifications from 10 db to 4 db.

II. DESCRIPTION.

On Parts Lists and Schematic Diagrams, change capacitor C717 from 200 uuf to 100 uuf

Addendum No. E12

ADDENDUM

for

MODEL T3/NF-105

The following components are to be deleted from List of Replaceable Parts for Model T3/NF-105.

R633, R654

The values of components noted below appear incorrectly in the List of Replaceable Parts for the Model T3/NF-105. Make changes as indicated.

Reference Symbol	Description	Part of
R624	220 ohms, 10%, 1/2 W carbon	42 MC I. F. Amplifier, T3
R630	220 ohms, 10%, 1/2 W carbon	42 MC I. F. Amplifier, T3

Change the schematic as follows:

1. Delete R633; connect C657 directly to the plate of V607.

2. Delete R654; connect C661 directly to the control grid of V609.

Addendum No. E14

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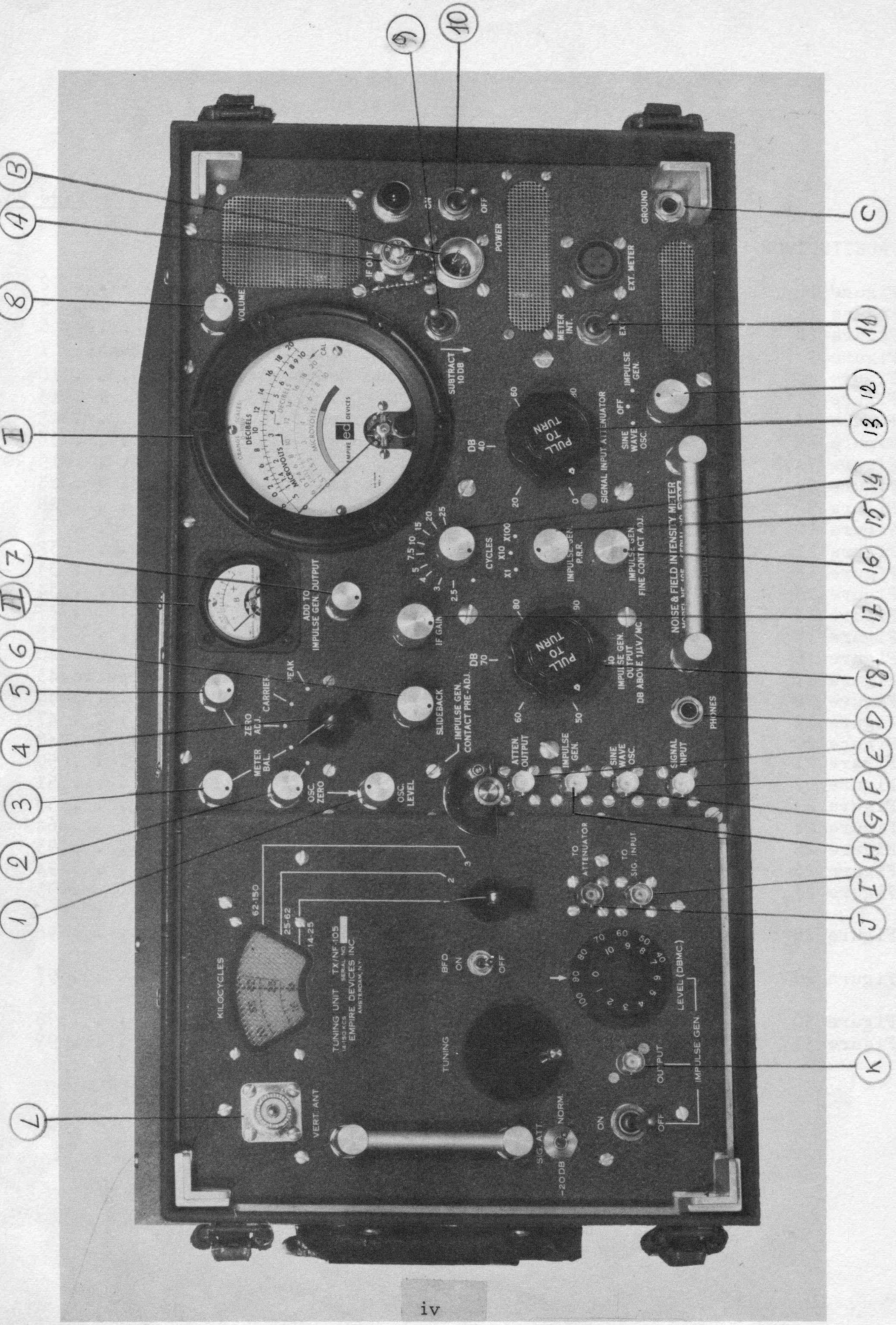
LIST OF ILLUSTRATIONS


NOISE & FIELD INTENSITY METER
TUNING UNIT TX/NF-105
EMPIRE DEVICES INC.
AMSTERDAM, N.Y.
KILOCYCLES
62-150
25-62
14-25
VERT. ANT
TUNING
BFO
ON
OFF
SIG. ATT.
NORM.
-20DB
LEVEL (DBMC)
IMPULSE GEN
OUTPUT
TO ATTENUATOR
TO SIG. INPUT
OSC. ZERO
OSC. LEVEL
METER BAL.
ZERO ADJ.
CARRIER
PEAK
SLIDEBACK
IMPULSE GEN. CONTACT PRE-ADJ.
ADD TO IMPULSE GEN. OUTPUT
IF GAIN
CYCLES
IMPULSE GEN. P.R.R.
IMPULSE GEN. FINE CONTACT ADJ.
PULL TO TURN
IMPULSE GEN. OUTPUT DB ABOVE 1µV/MC
SIGNAL INPUT ATTENUATOR
ATTEN. OUTPUT
IMPULSE GEN.
SINE WAVE OSC.
SIGNAL INPUT
PHONES
VOLUME
IF OUT
POWER
SUBTRACT 10 DB
METER INT.
EXT.
EXT. METER
GROUND
DECIBELS
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PART ONE - INTRODUCTION

SECTION I

Description of Noise and Field Intensity Meter Model NF-105

1. General

Noise and Field Intensity Meter Model NF-105 is intended for use in the frequency range from 150 KC to 1000 MC. This frequency range is covered by means of four plug-in heads which house the R. F. and I. F. circuits. The Basic Measuring Unit contains detectors and audio circuits, calibrating standards, attenuators and indicating circuits as well as a voltage regulated power supply. The 150 KC to 20 MC portion of this equipment is treated in a separate book and therefore this book concerns itself with the 20 MC to 1000 MC range. In addition, dipole antennas, magnetic, electric and line probes, injection blocks, cables and carrying cases are available. Inverters for DC operation of the equipment, a broad band antenna set and a remote indicating meter may be had as optional equipment.

2. Application

Model NF-105 provides a compact, lightweight, portable noise and field strength meter for measurements of noise originating in electrical and electronic equipment and of electrical field strength. Built-in impulse noise and sine wave generators are used as calibrating standards for noise and carrier measurements. Readings may be taken using a visual indicator (meter) or aural means (slide-back method). Figure 1 illustrates a typical application of the instrument.

3. Technical Characteristics

POWER REQUIREMENTS:	115 volts, 50 to 400 cycles (100 VA) or 12 or 24 Volts, DC (190 Watts)
VOLTAGE REGULATION:	"A" and "B" supply regulated for operation from 105 to 125 volts AC or 11.5 to 15 volts DC (23 to 30 volts DC respectively).
FREQUENCY RANGE:	150 KC to 1000 MC in four plug-in heads. Tuning Unit T-A/NF-105 treated in a separate book, covers the range from 150 KC to 30 MC in six bands; Tuning Unit T-1/NF-105 covers the range from 20 to 200 MC in two bands; Tuning Unit T-2/NF-105 covers the range from 200 to 400 MC in one band; Tuning Unit T-3/NF-105 covers the range from 400 to 1000 MC in two bands.

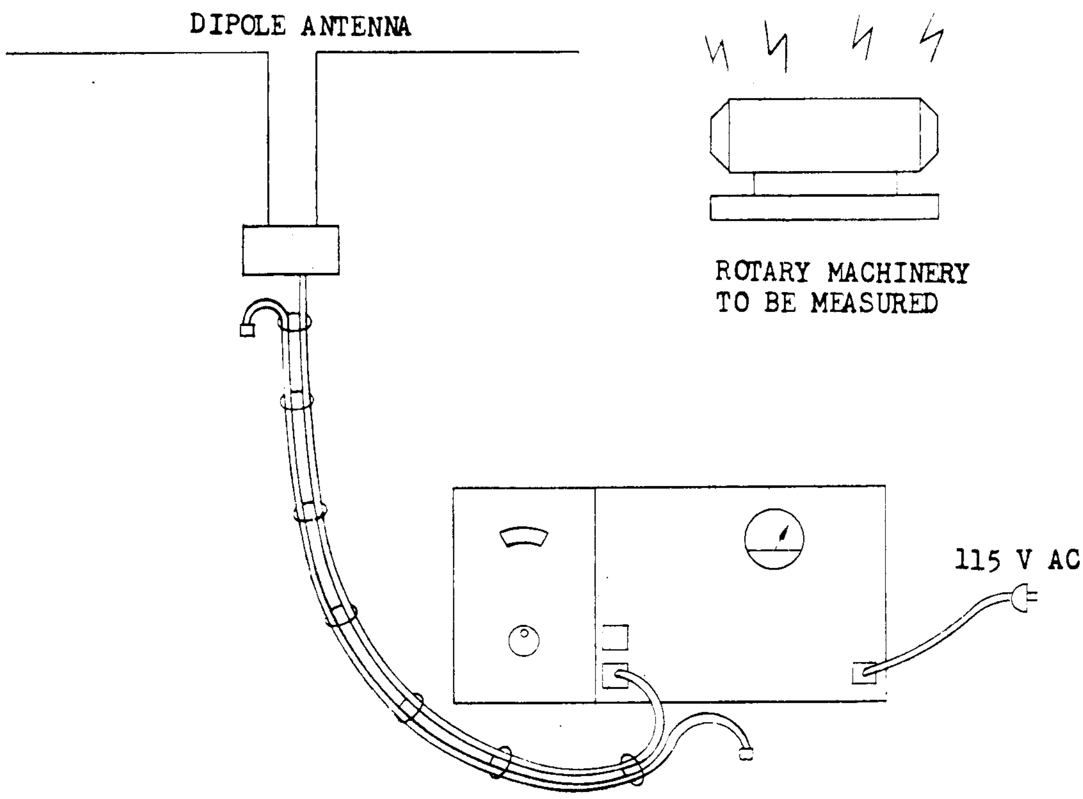


FIGURE 1 - TYPICAL APPLICATION OF NF-105

VOLTAGE RANGE AS A TWO-TERMINAL R. F. VOLTMETER:

Interference measurements: $\frac{1}{BW(MC)}$ to $\frac{100,000}{BW(MC)}$ microvolts/MC

Carrier intensity measurements: 1 to 100,000 microvolts

INPUT IMPEDANCE: 50 ohms

CALIBRATING IMPULSE NOISE SOURCE:

Pulse repetition rate: 2.5 to 2,500 cycles
Pulse spectrum: Flat to 1000 MC within $\pm$1/2 DB
Pulse amplitude: variable from 37 to 97 DB above 1 microvolt per megacycle bandwidth.

INDICATING METER: $4\frac{1}{2}$" logarithmic movement calibrated in microvolts (0.5 to 10) and decibels (-6 to +20).

WEIGHT: Basic Measuring Unit with a Tuning Unit - 71 lbs.

SIZE: Basic Measuring Unit - 18-3/4" wide X $9\frac{1}{2}$" high X 14-5/8" deep.

4. List of Components

Noise and Field Intensity Meter Model NF-105 consists of the components listed below.

Quantity	Name of Component	Catalog No.	Dimensions (in.) Height	Width	Depth
1	Basic Measuring Unit (Main Unit)	BA-105	9-1/2	18-3/4	14-5/8
1	Tuning Unit, 150 KC - 30 MC	T-A/NF-105	8-1/2	6-1/4	11-3/4
1	Tuning Unit, 20 MC - 200 MC	T-1/NF-105	8-1/2	6-1/4	11-3/4
1	Tuning Unit, 200 MC - 400 MC	T-2/NF-105	8-1/2	6-1/4	11-3/4
1	Tuning Unit, 400 MC - 1000 MC	T-3/NF-105	8-1/2	6-1/4	11-3/4
1	R. F. Patch Cord (6 inch)				
1	R. F. Patch Cord (18 inch)				
1	AC Line Cord				
1	Standard Accessory Kit, 20-1000 MC consisting of the following items	KT-105-D	14-1/4	23-3/4	7
1	Accessory Carrying Case	AC-105-C	14-1/4	23-3/4	7
1	Dipole Antenna Set (20-200 MC)	DM-105-T1	4-1/2	21-1/2	3-1/2
1	Dipole Antenna Set (200-400 MC)	DM-105-T2	4-1/2	21-1/2	3-1/2
1	Dipole Antenna Set (400-1000 MC)	DM-105-T3	4-1/2	21-1/2	3-1/2
1	Tripod (collapsed)	TP-105-A	21-5/8	4	3-1/4
1	Line Probe (50 ohms)	LL-105	3	2-1/2	2-1/2
1	Magnetic Field Probe	MP-105	10	3-1/2	1
1	Electric Field Probe	EP-105-A	7-5/8	5/8	5/8
2	30 ft. R. F. Cables	CB-105			
1	Earphones	EA-105	6	6	1
1	Alignment Harness	AH-105	2-1/2	3-1/2	3-1/2
1	Grounding Strap (3 ft.)	GR-105			
3	Antenna Masts	MA-105	20	1	1
1	Mast Socket	MS-105-A	1-3/4	1-1/2	1-1/2
1	Megacycle Rule (20-400 MC)				
1	Megacycle Rule (400-1000MC)				
1	Broad Band Antenna Cone	BB-105	9-1/2	8	8
1	Broad Band Antenna Plane	BB-105	1/2	24	24
1	Injection Block	UN-105	2	2-1/2	1
6	Broad Band Antenna Rods (2 ft.)	BB-105			
1	Inverter for 12 V DC Operation	MO12-105	6-3/4	9-7/8	5-5/8
1	Inverter for 24 V DC Operation	MO24-105	6-3/4	9-7/8	5-5/8
1	DC Supply Cord (6 ft.)	DC-105			
1	Remote Indicator	RE-105	4-1/2	4-5/8	4-1/2
1	Remote Indicator Cable (25 ft.)	RC-105			
1	Line Probe (500 ohms)	LH-105	3	2-1/2	2-1/2
1	Carrying Case for Optional Equipment	OC-105	25-1/2	28-1/4	11-3/4
1	Carrying Case for a Tuning Unit	TC-105	15-1/2	7-3/4	10-1/2
1	Antenna Equipment for T-A/NF-105	LM-105	14	15-1/2	6
1	Switching Unit	SU-105	3-3/8	5-3/8	4-1/8
1	Clamp-On Probe	CP-105	4-3/8	2-1/2	1-1/4
1	Filter, 150 KC to 30 MC	F-A/NF-105	4-1/8	3-3/8	5-3/8
1	Filter, 20 MC to 65 MC	F-IA/NF-105	4-1/8	3-3/8	5-3/8
1	Filter, 65 MC to 200 MC	F-IB/NF-105	4-1/8	3-3/8	5-3/8
1	Filter, 200 MC to 400 MC	F-2/NF-105	4-1/8	3-3/8	5-3/8
1	Tripod Bag	BG-105	30	4	5

LIST OF EQUIPMENT AND ACCESSORIES

Item	Description	Cat.#
1	Basic Measuring Unit	BA-105
	Tuning Unit (20-200MC)	T-1/NF-105
2	Switching Unit	SU-105
3	Tuning Unit (200-400MC)	T-2/NF-105
4	Tuning Unit (400-1000MC)	T-3/NF-105
5	Tuning Unit (15-30MC)	T-A/NF-105
6	Filters (20-65 MC)	F1A/NF-105
	Filters (60-200 MC)	F1B/NF-105
	Filters (200-400 MC)	F2/NF-105
7	30' RF Cables	CB-105
8	Power Cord, AC	
9	Grounding Strap	GR-105
10	6" RF Cable	
11	18" RF Cables	
12	Line Probe	LL-105

Item	Description	Cat.#
13	Dipole Antenna Set	DM-105-T1
	(20-200MC)	
14	Dipole Antenna Set	DM-105-T2
	(200-400MC)	
15	Dipole Antenna Set	DM-105-T3
	(400-1000MC)	
16	Megacycle Rulers	
17	Earphones	EA-105
18	Allen Wrenches	
19	Magnetic Field Probe	MP-105
20	Electric Field Probe	EP-105-A
21	Clamp-on Probe	CP-105
22	Block Clamp	
23	Magnetic Line Probe	LO-105
24	Line Probe (500-ohms)	LF-105

Item	Description	Cat.#
25	Line Probe (50-ohms)	LA-105
26	High Impedance Binding	PA-105
	Post	
27	Tripod	TP-105-A
28	Antenna Masts	MA-105
29	Mast Socket	MS-105-A
30	Loop Antenna	LP-105
31	Vertical Antenna	VA-105

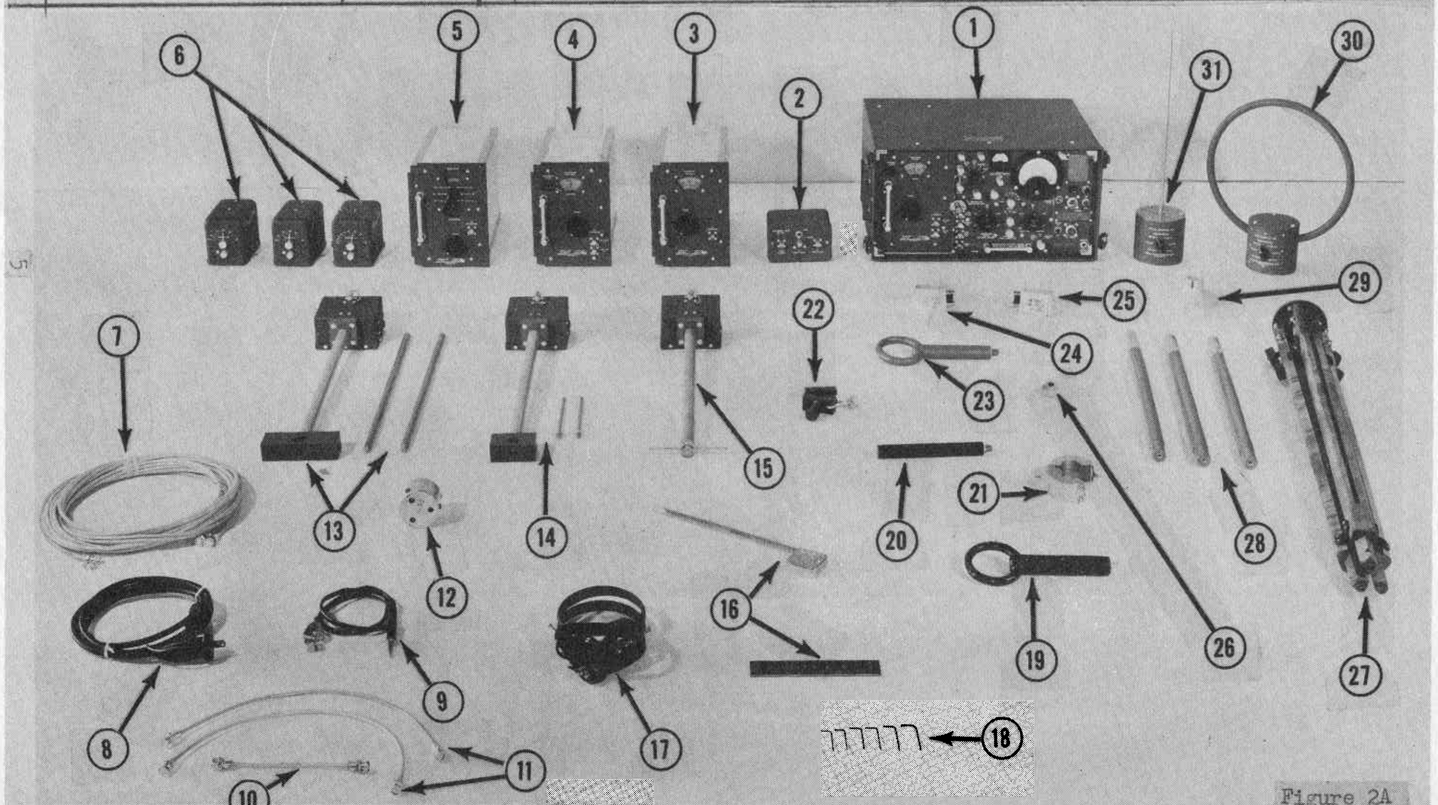


Figure 2A

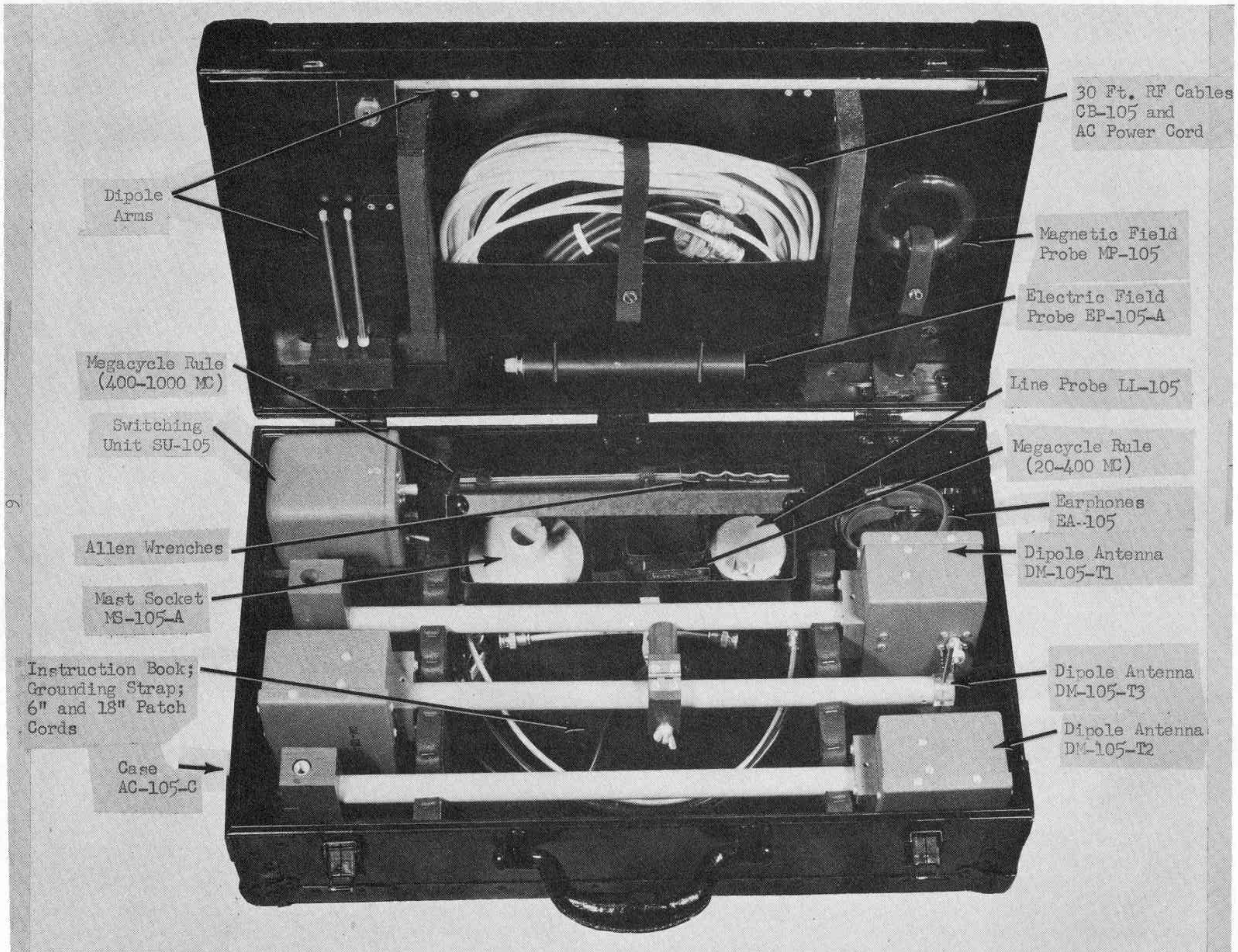


Figure 2B
Arrangement of Parts in Accessory Transit Chest

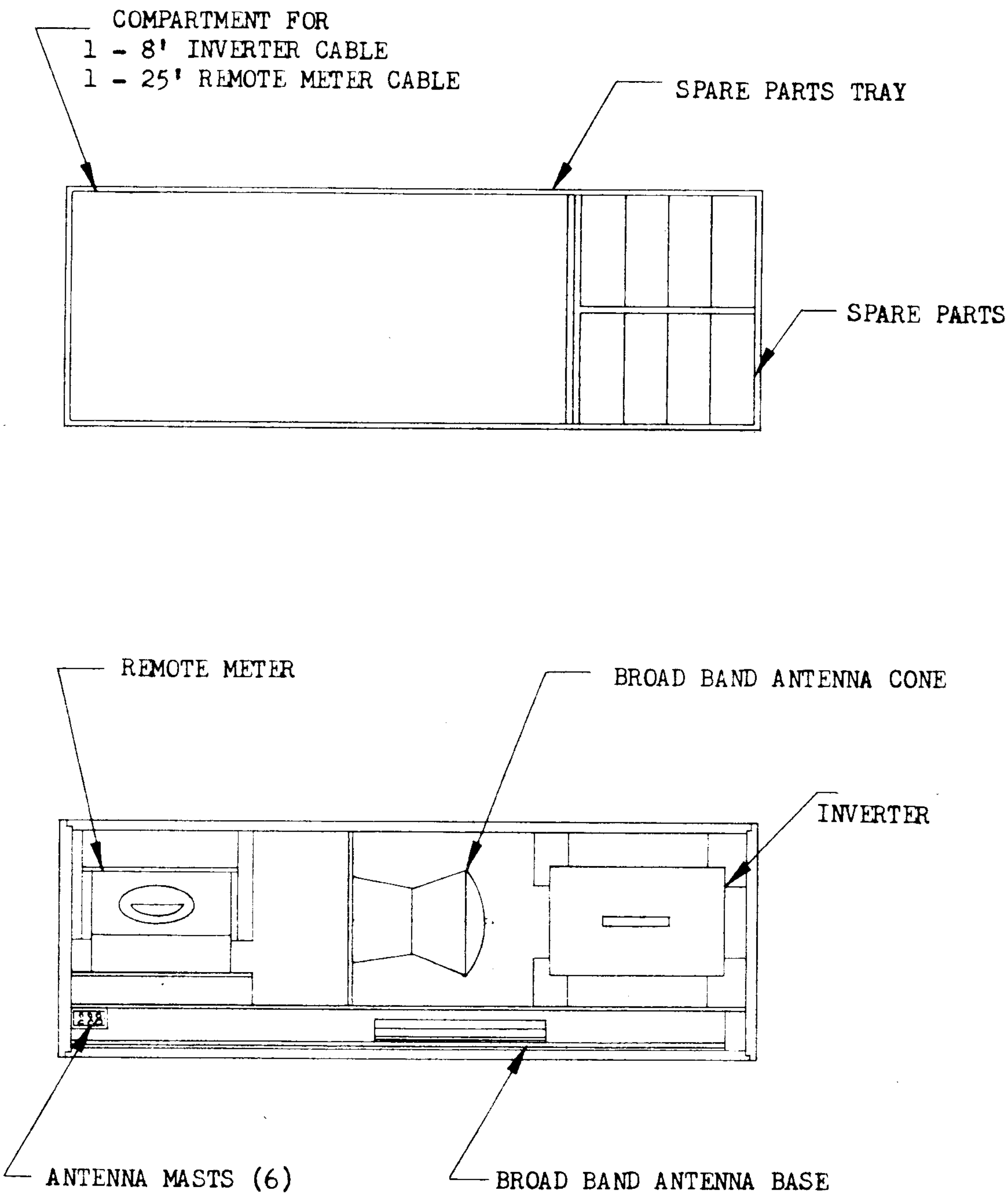


FIGURE 3 - ARRANGEMENT OF PARTS IN OPTIONAL EQUIPMENT
TRANSIT CHEST

5. Description of Major Components

The Basic Measuring Unit of Noise and Field Intensity Meter Model NF-105, in conjunction with the R. F. plug-in heads, contains all tubes and associated circuits. It is housed in an aluminum case provided with a gasketed front cover.

Of the four R. F. plug-in heads available, one is normally carried plugged into the main unit. The other three R. F. plug-in heads may be individually stored in carrying cases for tuning unit (TC-105).

For three of the tuning heads (T-1/NF-105, T-2/NF-105 and T-3/NF-105), there is a corresponding dipole antenna set consisting of a balun transformer and dipole arms. A mounting base and three extension mast rods are provided to mount any of the dipole antennas on the tripod.

Antennas for Tuning Unit T-A/NF-105 are covered in a separate section.

The broad band antenna consists of a cone equipped with fittings for extension rods, 6 extension rods and a ground plane.

All antennas may be mounted on an adjustable wooden tripod.

The magnetic field probe consists of a three-inch electrostatically shielded pick-up loop attached to a handle. In order to minimize shock hazard, the probe is insulated.

The electric field probe consists of a pick-up rod housed in a container. Like the magnetic field probe, this probe is insulated.

Four filters are available as optional items to provide a means of rejecting any single frequency desired from 150 KC to 400 MC.

The two line probes differ in that one is a 50 ohm and the other a 500 ohm pick-up device. Each probe is housed in a shield and is equipped with binding posts for easy attachment to the line to be evaluated. The probe is capacitively coupled to the line. A clamp-on probe is also available for taking conductive measurements.

The remote indicator contains a meter duplicating that on the main instrument panel. An earphone jack is provided to facilitate aural monitoring.

The DC inverters are of the rotary type furnishing the 115 volts 60 cycle power needed to operate the equipment.

The headset is designed for 600 ohms impedance.

An injection block is provided for use with the broad band antenna.

A grounding strap serves to protect the operator from electrical shock when touching the equipment.

An alignment harness is provided for R. F. and I. F. alignment of the plug-in heads. It consists of two small metal containers housing the appropriate circuits, connectors and connecting leads.

Switching unit SU-105 enables the operator to feed either the calibrating signal from the Impulse Generator or the interference signal from the antenna to the SIGNAL INPUT jack on the front panel by means of a toggle switch rather than by changing cables. This unit is available as an accessory.

SECTION II

Installation and Aseembly

6. Selection of Site

When setting up the equipment for interference measurements, it should be so located that the appropriate antenna or probe can reach the interference source when connected through the 30-foot length of R. F. cable. When using the equipment for field intensity measurements, a site must be chosen which is free from trees, electrical power and telephone lines, metal fences, buildings and other projections that might interfere with the field strength pattern.

7. Assembly and Interconnections

Ascertain that the plug-in head covering the desired frequency range is inserted in the main unit. If not, loosen the head latch located near the left edge of the main panel (see Figure 4). Holding back or locking the latch to clear the panel of the plug-in head, pull the handle located near the left edge of the plug-in head. Insert the head covering the desired frequency range in the main unit, again holding the latch of the locking mechanism. After fully inserting the head, release the latch which will then rest against the front of the plug-in head panel. Tighten the locking screw. Remove from the accessory carrying case such additional components as may be required, including the following:

a. R. F. patch cord - 6 inches. Connect this cord between the ATTEN. OUTPUT connector near the left edge of the equipment panel and the connector on the plug-in head; if the head used has more than one frequency range the cord must be attached to the connector corresponding to the frequency range desired.

b. R. F. patch cord - 18 inches. This cord is used with shunt calibration to connect the IMPULSE GEN. or SINE WAVE GEN. to the SIGNAL INPUT receptacle.

c. AC line cord. This cord leads from the AN connector located on the right side of the equipment panel (beneath the fuse post) to the 115 volts, 50 to 400 cycles power source.

d. Inverter. If the equipment is to be operated from a battery, the inverter corresponding to the available DC voltage (12 or 24 V) is used. Connect the free end of the AC power cord to the outlet on the side of the inverter.

e. DC power cord. By means of the DC power cord, connect the inverter to the battery. If the battery is part of a grounded system, always connect the black lead of the DC power cord to the grounded terminal of the battery, regardless of the battery polarity.

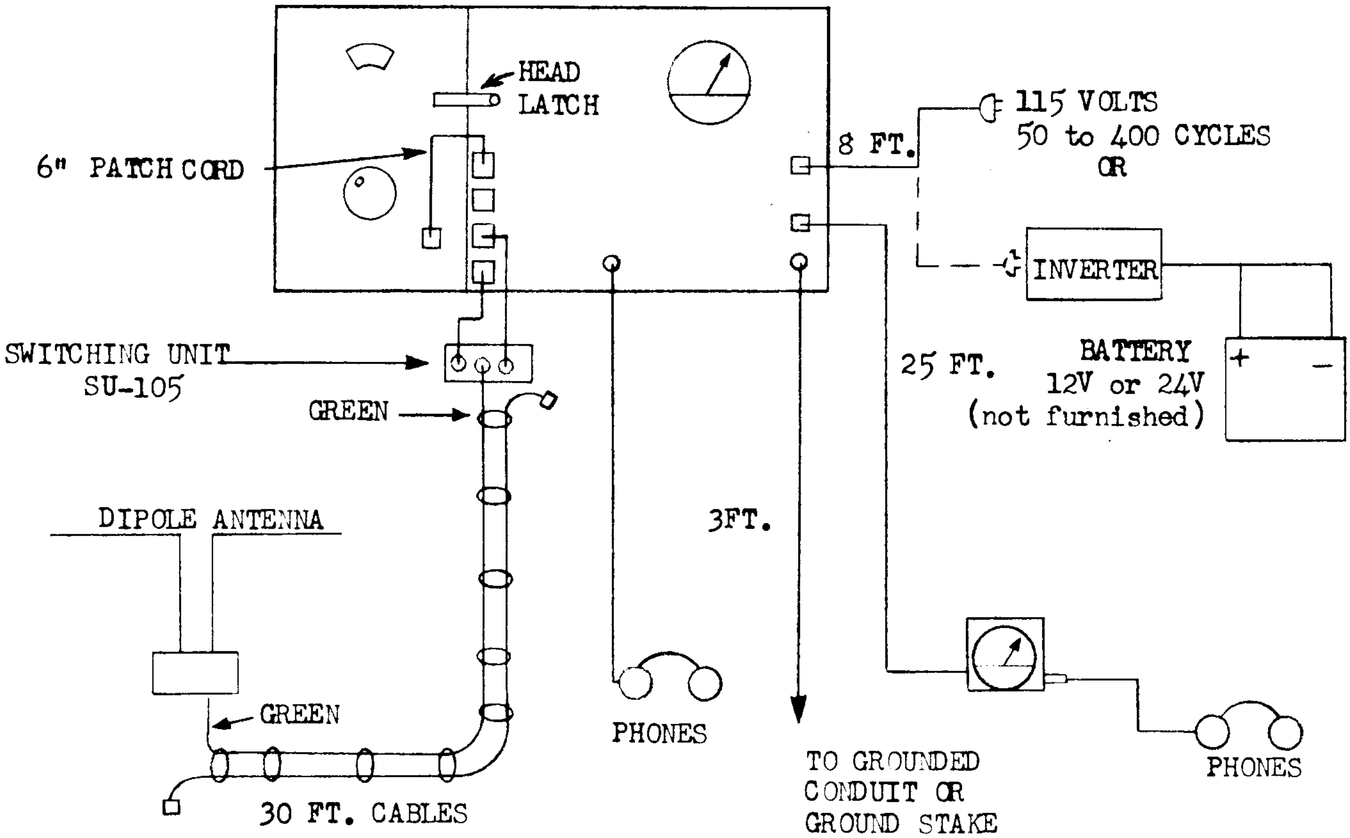


FIGURE 4 - INTERCONNECTION BETWEEN VARIOUS COMPONENTS

f. Remote indicator. In certain instances, it may be desirable to use the remote indicator in order to observe readings and have an aural monitor some distance from the location of the main unit.

g. Remote indicator cable. When the remote indicator is to be used, it is connected to the main unit by means of this 25-foot cable. The cable is attached to the main unit by means of an AN connector, located near the lower right hand corner of the front panel.

h. Headset. The headset is plugged into the PHONES jack located near the lower left hand corner of the main equipment panel, or may be inserted into the jack on the remote indicator unit.

i. Grounding strap. The plug-end of the grounding strap is inserted in the jack marked GROUND located in the lower right hand corner of the front panel; the other end of this cord may be connected to any suitable ground.

j. R. F. cables. The two 30-foot R.F. cables are taped together at fixed intervals in order to prevent shifting in their relative position. These cables must be used for all measurements since substitution of other cables of different types or having different lengths will disturb the measuring accuracy. When connecting the cables, the color coding must be observed. Attach one of the green plugs of the cable to the SIGNAL INPUT connector, also carrying the green marking and located in the lower left hand corner of the panel. The companion cable marked red is used only with the series method of calibration described in par. 10.4.

k. Injection block. The injection block is used only in conjunction with the broad band antenna.

l. Magnetic field probe. In order to pick up the magnetic field component of R.F. interference (for relative readings only), the magnetic field probe is used.

m. Electric field probe. For the electric field component of R. F. interference, the electric field probe is used. Attach its connector to the 30-foot cable with the green marking.

n. Line probes. If conducted interference is to be measured, select either the 50 or 500 ohm line probe, depending upon the impedance with which it is desired to load the line. Attach its connector to the 30-foot R.F. cable, with the green connector. If an unbalanced circuit is to be measured, connect the side which is grounded or is electrically closest to ground to the binding post marked by one dot. The "high" side is fed to the binding post marked by two dots. If a balanced circuit is to be evaluated, connect its center tap to the post marked by one dot, ground this post if no center tap is available. Connect the two "high" sides of the two remaining binding posts. The unmarked binding post is merely connected so that the probe provides a balanced load for the line. Therefore, the connections to the two "high" sides must be reversed, in order to obtain noise measurements for both sides of the balanced line.

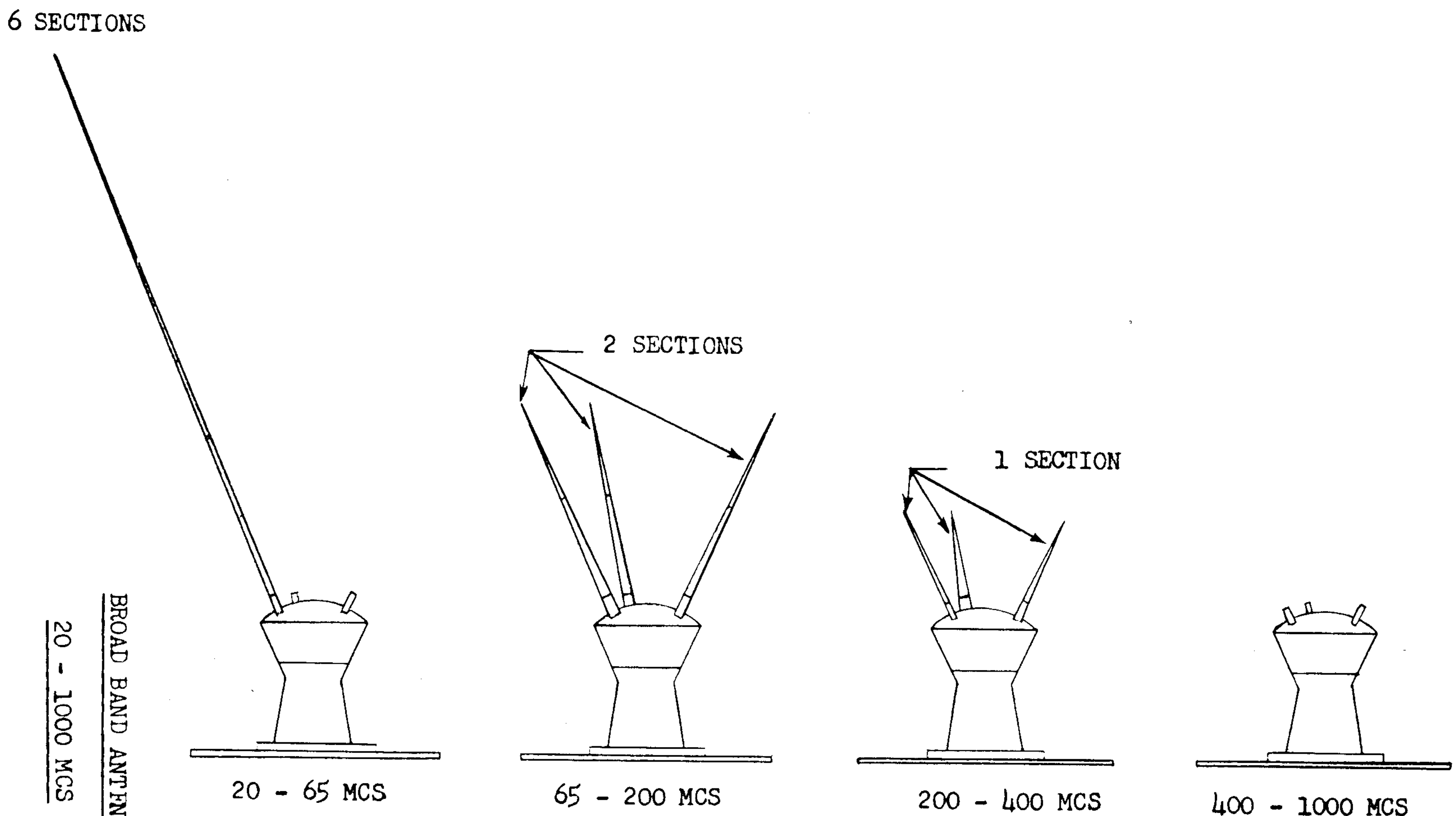
o. Tripod. If the dipole or the broad antenna is to be used, the tripod is employed as a supporting base. Extend the legs to the desired height and tighten the leg locking screws securely.

p. Broad Band antenna. In order to operate the broad band antenna, its plane, cone and extension rods are needed. Remove the rods on the tilt plate (near the center of the base) from their support clips, and insert them into the stud holes. This will permit angular adjustment of the antenna. Attach the antenna base to the tripod by securely fastening the two thumbscrews located in the tripod crown to the corresponding holes in the tilt plate. By means of the three fasteners in the cone flange, attach the cone to the ground plane. The cone extension rods are inserted into the holes on top of the cone, in order to obtain maximum operating efficiency of the antenna in the frequency range desired. Proceed in accordance with Figure 5. After the antenna is completely assembled on the tripod, connect the injection block to the connector from underneath the antenna base.

q. Dipole antenna. There are three dipole antenna sets covering the range of 20 - 1000 MC as follows:

20 - 200 MC	(DM-105-T1)
200-- 400 MC	(DM-105-T2)
400 -1000 MC	(DM-105-T3)

Each set consists of a bakelite tube having a dipole block on one end and a matching transformer on the other. On the 20 - 200 MC and 200-400 MC sets, the dipole arms are separate and are attached to threaded inserts on the opposite sides of the dipole block. There are two loose (unattached) pairs of adjustable dipole arms; one pair covering the frequency range of 27 to 140 MC, the other pair from 140 MC to 400 MC. Because of physical size, the maximum extended length of the low frequency dipole arms was limited to correspond to 27 MC. For frequencies from 20-27 MC, the dipole is extended to its maximum length. The chart of Figure 9 allows for the reduced effective height in this range. On the 400-1000 MC set, the dipole arms are permanently attached to the block. To use any of the dipole antennas, attach the bakelite tube to the tripod mast by means of the clamp. Place the mast base on the tripod crown, insert the mast into the socket on top of the base, and tighten the centrally located thumbscrew on the tripod crown thus locking the mast and the base to the tripod. If desired one or two additional mast sections may be inserted. The dipole may be rotated about a horizontal axis by loosening the bakelite clamp thumbscrew. When the desired position is obtained, tighten this thumbscrew.



BROAD BAND ANTENNA

20 - 1000 MCS

FIG. 5

r. Megacycle ruler. The megacycle rules are used to extend the dipole arms to the proper length for the desired operating frequency. To cover the range of 20-400 MC, use the steel tape rule. For the range of 400-1000 MC, the engraved bakelite rule is employed. When using the steel tape measure from the exact center of the dipole to the extreme tip of one dipole arm. Repeat procedure on the other arm. When using the bakelite rule measure from the plastic block which supports the dipole arm.

s. Switching Unit. Switching Unit SU-105 provides a coaxial switch to select either the IMPULSE GENERATOR output or antenna cable for connection to the SIGNAL INPUT receptical. Figure 6B shows switching unit connected for operation.

FIGURE 6A APPLICATIONS AND METHODS OF MEASUREMENT

APPLICATION	UNIT OF MEASUREMENT	PICK UP DEVICE	COUPLING DEVICE	CALIBRATION METHOD	CALIBRATOR	METHOD OF MEASUREMENT	INDICATION
Noise Measurement (Peak)	Microvolts per MC bandwidth or Microvolts per KC bandwidth	Dipole Probes a.Line-50 ohms b.Line-500 ohms c.Magnetic* d.Electric*	None	Shunt	Impulse Generator	Substitution	Meter or Slideback
						Direct Reading	Meter
		Broad band antenna	Injection Block	Series	Impulse Generator	Substitution	Meter or Slideback
						Direct Reading	Meter
Noise Field Intensity (Peak)	Microvolts per MC bandwidth per meter or Microvolts per KC bandwidth per meter	Dipole	None	Shunt	Impulse Generator	Substitution	Meter or Slideback
						Direct Reading	Meter
Two-Terminal RF Voltmeter (Carrier)	Microvolts	Any	None	Shunt	20-400 MC Sine Wave Gen. 400-1000 MC Impulse Gen.	Direct Reading	Meter
Carrier Field Intensity	Microvolts per meter	Dipole	None	Shunt	20-400 MC Sine Wave Gen. 400-1000 MC Impulse Gen.	Direct Reading	Meter

* Comparative Measurements Only

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	FUNCTION SWITCH	7	POWER SWITCH	13	30' CABLE
2	IMPULSE GEN. OUTPUT	8	SLIDEBACK CONTROL	14	METER BAL. CONTROL
3	SIGNAL INPUT ATTENUATOR	9	I.F. GAIN CONTROL	15	ZERO ADJ. CONTROL
4	IMPULSE GEN. P.R.R.	10	VOLUME CONTROL	16	FINE CONTACT ADJ. CONTROL
5	CYCLES CONTROL	11	6" PATCH CORD	17	POWER CABLE
6	SINE WAVE OSC.-IMPULSE GEN. SW.	12	18" PATCH CORD	18	IMPULSE GEN. OUTPUT CONTROL

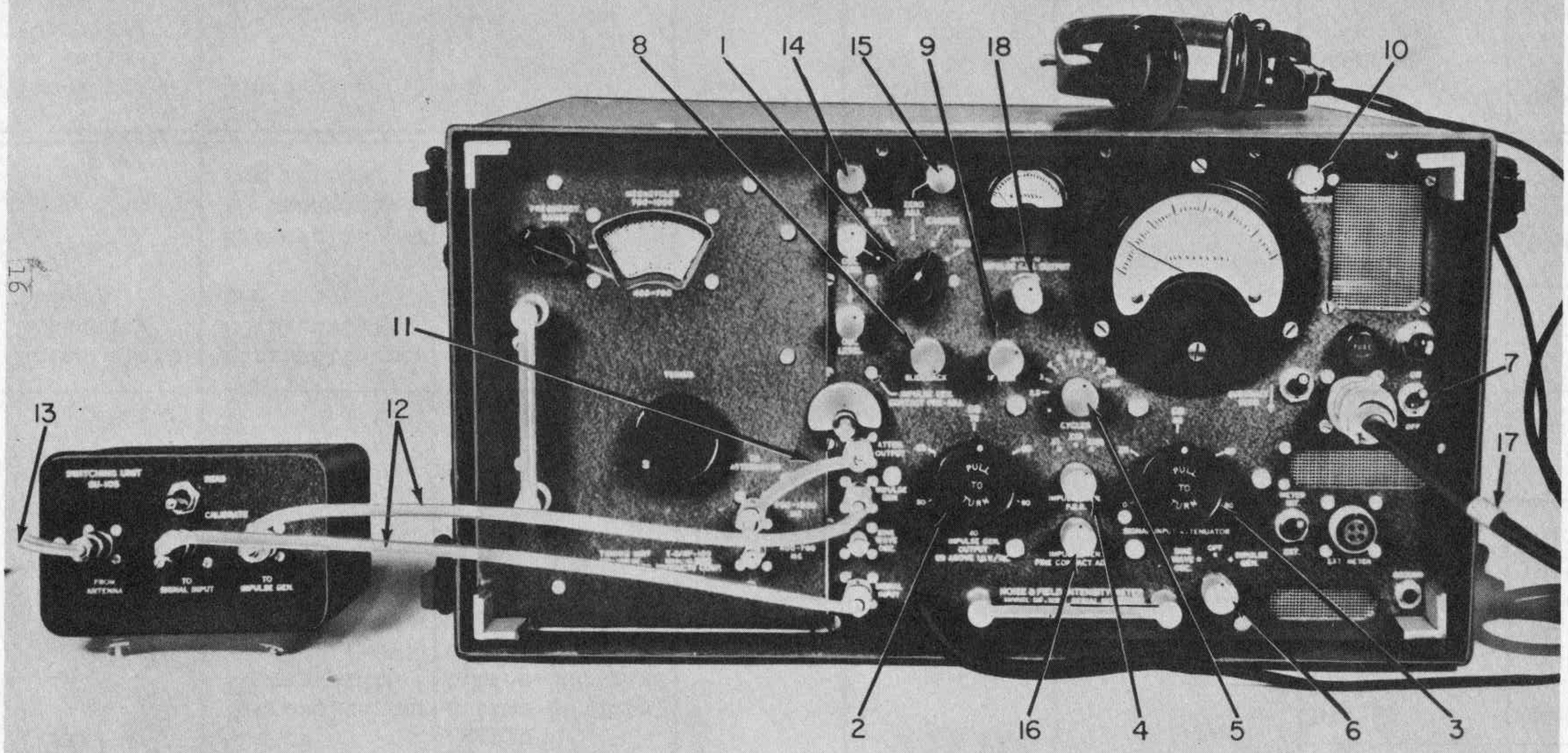


Figure 6B
SET-UP FOR PRELIMINARY ADJUSTMENTS

PART TWO - OPERATING INSTRUCTIONS

SECTION III

Operation

8. Applications and Methods of Measurement

Figure 6A tabulates the applications together with data required to calibrate and operate the instrument.

There are four major types of application as follows:

1. Noise Measurements (Peak)
2. Noise Field Intensity
3. Two-Terminal R.F. Voltmeter (Carrier)
4. Carrier Field Intensity

8.1. For noise measurements the output of the internal impulse generator is directly compared to the level of the unknown signal. Indication may be visual (meter) or aural (slideback).

The slideback method offers two advantages over the visual method. It makes it possible to differentiate between two or more types of interference simultaneously present; also it may be used at very low repetition rates, even for single impulses. Thus the slideback method should be used when the repetition rate is below 50 cycles.

In an **alternate** method, the internal impulse generator is used to **calibrate** the instrument which then becomes direct reading in terms of **microvolts** per megacycle bandwidth applied at the input receptacle.

In **both** cases, **shunt** calibration is employed, i.e. the calibrating voltage is applied at the same input receptacle which is to be used for the unknown voltage.

When the **broadband** antenna is used, series calibration is employed. In this case, the calibrating voltage is injected at the antenna in series with the unknown voltage.

8.2. Noise Field Intensity Measurements are performed in the identical manner as noise measurements using the dipole, except that the effective height of the dipole antenna is taken into account.

8.3. Two-Terminal R.F. Voltmeter. For T-1/NF-105 and T-2/NF-105 the Sine Wave generator is used to calibrate the instrument so that it is direct reading in terms of microvolts applied at the input receptacle.

For T-3/NF-105, the Impulse Generator is used as the calibrating standard.

8.4. Carrier Field Intensity measurements are performed by first calibrating as a two-terminal R.F. voltmeter. Then the effective height factor is applied to produce readings in microvolts per meter.

NOTE: The methods of 8.3 and 8.4, although stated as indicating carrier values, may be utilized to show peak values of modulating carriers. For the sake of simplicity, this variation of 8.3 and 8.4 has not been listed in Figure 6.

9. Control Settings

Before attempting to operate this equipment, make certain that the controls are set to the positions indicated.

CONTROL	POSITION
Function Switch	METER BAL
IMPULSE GEN. OUTPUT	90 DB above 1 μv/MC

NOTE: The IMPULSE GEN. OUTPUT and SIGNAL INPUT ATTENUATOR control knobs must be pulled out before being turned. Turning without first pulling forward may damage these attenuators. Upon lining up the dot on the control knob with the desired position, push knob all the way in.

SIGNAL INPUT ATTENUATOR	20 DB

NOTE: When the SIGNAL INPUT ATTENUATOR is in the 0 DB position use the orange scales on the large meter. For all other positions, read the black scales.

The conversion charts Figure 7 are provided for convenience in converting from "DB above one microvolt" to "microvolts" and from "DB above one microvolt per megacycle" to "microvolts per kilocycle".

IMPULSE GEN. P.R.R.	X100
CYCLES	10
SINE WAVE OSC. - IMPULSE GEN.	OFF
METER	INT.
POWER	OFF
POWER (on inverter, when used)	OFF (down)
SLIDEBACK	Max. clockwise

DB ABOVE 1 MICROVOLT
TO
MICROVOLTS

OR

DB ABOVE 1 MICROVOLT PER MEGACYCLE BANDWIDTH (DBMC)
TO
MICROVOLTS PER MEGACYCLE BANDWIDTH

Total DB OR DBMC	20	30	40	50	60	70	80	90
0	10.0	31.6	100	316	1000	3160	10000	31600
1	11.2	35.5	112	355	1120	3550	11200	35500
2	12.6	39.8	126	398	1260	3980	12600	39800
3	14.1	44.7	141	447	1410	4470	14100	44700
4	15.8	50.1	158	501	1580	5010	15800	50100
5	17.8	56.2	178	562	1780	5620	17800	56200
6	20.0	63.1	200	631	2000	6310	20000	63100
7	22.4	70.8	224	708	2240	7080	22400	70800
8	25.1	79.4	251	794	2510	7940	25100	79400
9	28.2	89.1	282	891	2820	8910	28200	89100
10	31.6	100.0	316	1000	3160	10000	31600	100000

MICROVOLTS

OR

MICROVOLTS PER MEGACYCLE BANDWIDTH

FIGURE 7A - CONVERSION CHART

DB ABOVE 1 MICROVOLT PER MEGACYCLE (DBMC)
TO
MICROVOLTS PER KILOCYCLE BANDWIDTH

TOTAL DBMC	20	30	40	50	60	70	80	90
0	.010	.031	.10	.31	1.0	3.1	10.0	31
1	.011	.035	.11	.35	1.1	3.5	11.0	35
2	.012	.040	.12	.40	1.2	4.0	12.0	40
3	.014	.044	.14	.44	1.4	4.4	12.0	44
4	.015	.050	.15	.50	1.5	5.0	15.0	50
5	.017	.056	.17	.56	1.7	5.6	17.0	56
6	.020	.063	.20	.63	2.0	6.3	20.0	63
7	.022	.070	.22	.70	2.2	7.0	22.0	70
8	.025	.079	.25	.79	2.5	7.9	25.0	79
9	.028	.089	.28	.89	2.8	8.9	28.0	89
10	.031	.100	.31	1.00	3.1	10.0	31.0	100

MICROVOLTS PER KILOCYCLE BANDWIDTH

FIGURE 7B - CONVERSION CHART

I.F. GAIN	Max. clockwise
VOLUME	Max. clockwise

9.1. Initial Adjustment

Turn POWER switch on and, when using the inverter, also turn on the toggle switch located next to its DC connector, thereby powering the equipment. Allow a five minute warm-up period before attempting to calibrate.

Adjust the METER BAL. control, located in the upper left hand corner, for zero reading on the large meter. Set function switch to ZERO ADJ. and turn the ZERO ADJ. control until the meter again reads zero. Repeat as required.

10. Noise Measurements

10.1. Visual Substitution (meter)

Turn the function switch to PEAK and leave it in this position for all peak measurements.

Connect the desired pick-up device to the SIGNAL INPUT receptacle by means of the 30 foot cable.

If the dipole antenna is to be used, adjust the dipole arms to the proper length for the frequency at which the measurement is to be taken. The megacycle rules are provided for this adjustment. Placement of the dipole antenna relative to the source of R.F. noise should be in accordance with the applicable specification or requirement.

Tune to the desired frequency. Adjust SIGNAL INPUT ATTENUATOR and IF GAIN to produce a reference reading. Use as much signal input attenuation as is consistent with good signal to noise ratio. After the reference reading has been obtained, disconnect the 30 foot cable from the SIGNAL INPUT receptacle and connect the 18 inch cable from the IMPULSE GEN. receptacle to the SIGNAL INPUT receptacle*. Turn on the impulse generator by rotating the SINE WAVE OSC. IMPULSE GEN. switch to the IMPULSE GEN. position. This switch is located below the SIGNAL INPUT ATTENUATOR.

NOTE: If no impulse generator signal is audible in the headset, slowly turn the IMPULSE GEN. FINE CONTACT ADJ. over its entire range. Should this fail to produce a signal in the headset, set the IMPULSE GEN. CONTACT PRE-ADJ. control as described in Section V, Par. 26.

*This step may be accomplished more conveniently by means of switching unit SU-105, available as an accessory item.

After adjusting the impulse generator, its repetition rate may be lowered to any value. However, for visual indication greatest accuracy is obtained with repetition rates above 100 per second.

By means of the step and variable controls, adjust the IMPULSE GEN. OUTPUT to match the reference reading previously obtained. (The impulse generator output in DB above 1 microvolt per megacycle is the sum of the readings of the IMPULSE GEN. OUTPUT and of the small meter.) This is the level of the unknown signal in DB above one microvolt per megacycle bandwidth at the input receptacle.

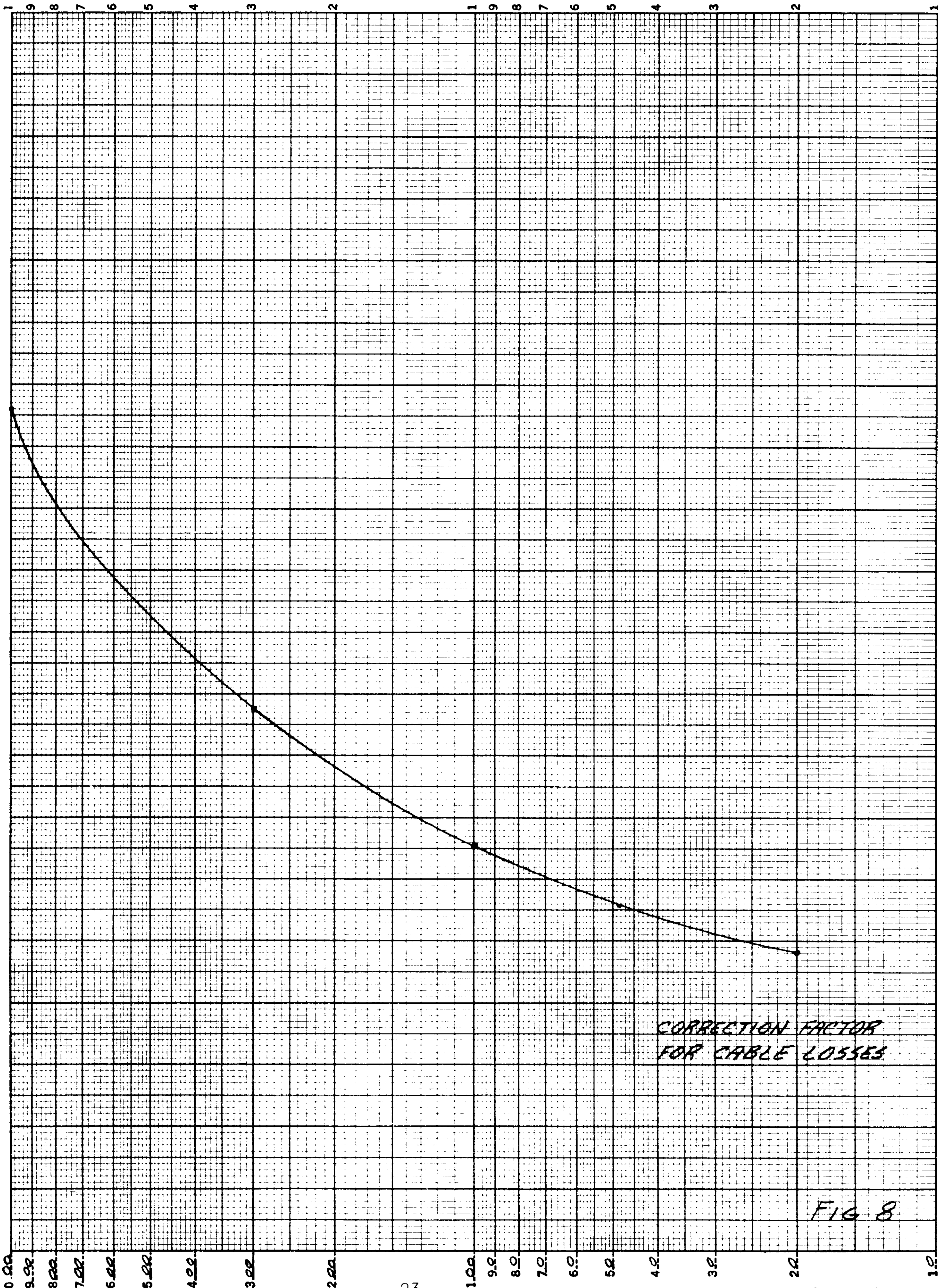
If the level of the unknown signal fluctuates, the measurement should be made at the highest reading unless otherwise stipulated in the applicable specification.

Since the insertion loss of the SIGNAL INPUT attenuator is the same for both unknown and calibrating signals, its reading need not be condidered. If, however, the level of the unknown signal is higher than the maximum output of the impulse generator, it will be necessary to reduce the insertion loss of the SIGNAL INPUT attenuator when applying the calibrating signal. In this case, the change in SIGNAL INPUT attenuator setting in DB must be added to the impulse generator reading. Conversely, if the level of the unknown signal is lower than the lowest output of the impulse generator, it will be necessary to increase the insertion loss of the SIGNAL INPUT attenuator when applying the calibrating signal. In this latter case, the change in SIGNAL INPUT attenuator setting in DB must be subtracted from the impulse generator reading.

Since there is a slight signal attenuation in the 30 foot cable, it is necessary for full accuracy to add a correction factor for this cable loss, which factor is obtained from Figure 8.

If the measurement was made with the dipole antenna a mismatch occured since the theoretical 72 ohm impedance of the dipole was terminated in the 50 ohm input impedance of the receiver. In order to compensate for this mismatch add 1.7 DB to the indicated reading. If, as required by some specifications, open circuit voltage (antenna induced voltage) is desired, an additional factor of 6 DB must be added.

When changing frequency ranges on T-1/NF-105 (20-200 MC) or T-3/NF-105 (400-1000 MC), turn the knob located to the left of the dial window to the desired range. In addition, change the connection of the patch cable on the head to correspond with the frequency range in use. Recalibrate the new frequency by following the procedure outlined above. When changing to a new frequency plug-in head, calibrate in a like manner.


CORRECTION FACTOR
FOR CABLE LOSSES
FIG 8
FREQUENCY MC
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
+1
+2
+3
+4
+5

10.2. Aural Substitution (slideback)

Another method of indication for the substitution method is by aural means using slideback. This latter method, in fact has several advantages over visual substitution (see Par. 8.1.).

If the slideback method of indication is to be employed, proceed as follows:

Choose the probe or antenna to be used and connect it to the main unit. Set the TUNING control to the desired frequency. Set the SIGNAL INPUT ATTENUATOR to the highest insertion loss which will still permit listening to the unknown noise. Set the IF GAIN control to about 60 or 70% of maximum clockwise position and scan by keeping the slideback control at the point at which the peaks of the unknown signal are barely audible in the phones. Alternately, set the slideback control at 50% rotation and follow with just sufficient gain to maintain this level in the phones.

NOTE: Setting the IF GAIN control near its minimum gain position may result in receiver overload causing erroneous readings.

Adjust the SLIDEBACK control until the noise is at the threshold of audibility.

Disconnect the 30 foot cable from the SIGNAL INPUT receptacle and connect the 18 inch cable from the IMPULSE GEN. receptacle to the SIGNAL INPUT receptacle.* Do not change the SLIDEBACK or the IF GAIN control settings until the measurement is completed. Turn on the impulse generator and vary its output until it is audible in the earphones. Adjust the IMPULSE GEN. P.R.R. control and the CYCLES switch until the P.R.R. agrees with that of the unknown signal if possible. (This is a convenience and not a condition to obtaining accurate results). Adjust the amplitude of the internal noise calibrator by varying the IMPULSE GEN. OUTPUT attenuator and the ADD TO IMPULSE GEN. OUTPUT control until the output produced in the earphones is at the threshold of audibility as was the unknown. Add the IMPULSE GEN. OUTPUT reading and that of the ADD TO IMPULSE GEN. OUTPUT meter. Note the sum of the two readings. This is the level of the unknown signal. For full accuracy apply the correction factor for cable loss (Figure 8).

If the measurement was made with the dipole antenna, the indicated signal level must be corrected by adding 1.7 DB to obtain the dipole voltage (see Par. 10.1). If open circuit voltage is desired add an additional factor of 6 DB.

If the level of the unknown signal is higher than the maximum output of the impulse generator or lower than its minimum output, the measurement may be made by operating the signal input attenuator as explained in Par. 10.1.

*This step may be accomplished more conveniently by means of switching unit SU-105, available as an accessory item.

10.3. <u>Noise Measurements - Direct Reading</u> (Two-terminal R.F. voltmeter-noise.)

As an alternate method, the instrument may be calibrated as a two-terminal R.F. voltmeter.

This method is essentially the reverse of the methods described in Par. 10.1 and 10.2 in that the instrument is calibrated prior to taking readings of the unknown voltage and thus becomes direct reading in terms of microvolts per megacycle at the input receptacle.

Adjust METER BAL. and ZERO ADJ. controls. Set function switch to PEAK. Tune to the desired frequency (approximately). Connect the 18 inch cable between IMPULSE GEN. and SIGNAL INPUT receptacles. Turn on the impulse generator. Set SIGNAL INPUT ATTENUATOR to 40 DB, IMPULSE GEN. OUTPUT (The impulse generator output in DB above one microvolt per megacycle is the sum of the readings of the IMP. GEN. ATT. and of the small meter) to 80 DB above one microvolt per megacycle. Adjust IF GAIN for full scale reading on the meter. Turn off the impulse generator. The instrument is now calibrated for a full scale sensitivity of 80 DB above one microvolt per megacycle bandwidth. (/) The sensitivity may be increased or decreased in 20 DB steps by changing the setting of the SIGNAL INPUT ATTENUATOR.

Full scale readings in the various SIGNAL INPUT ATTENUATOR positions will be as follows based upon the above calibration procedure.

SIGNAL INPUT ATTENUATOR SETTING DB	FULL SCALE SENSITIVITY DB ABOVE 1 uv/MC
0	40
20	60
40	80
60	100
80	120

(/) It must be noted that the sum of the readings in DB of the SIGNAL INPUT ATTENUATOR and of the large meter add up to 60 DB which differs by 20 DB from the full scale sensitivity mentioned above. This difference is due to the fact that the bandwidth of the instrument is considerably less than one megacycle.

When changing to a new frequency the IF GAIN control may require readjustment in order to maintain full scale reading of the calibrating voltage.

After the instrument has been calibrated, remove the 18 inch cable from the SIGNAL INPUT receptacle and connect the 30 foot cable with the green connectors between this receptacle and the desired pick-up device.*

The calibration procedure outlined above utilizes the full sensitivity of T-1/NF-105. However, the higher frequency heads T-2/NF-105 and T-3/NF-105 have wider bandwidths and therefore they are capable of more noise sensitivity. To fully realize this extra sensitivity, the instrument may be calibrated at a lower level of impulse generator voltage by using more IF gain. In this case, the indicated readings must be increased by a factor equal to the amount by which the sensitivity was increased. The sensitivity should not be increased beyond the point where the receiver noise level becomes excessive.

For measurements in the presence of a high noise background, it is recommended that the substitution method (Par. 10.1 or 10.2) be used in preference to the direct reading method.

10.4. Noise Measurements - Broad Band Antenna

As indicated in the previous paragraphs, the shunt calibration method (calibration at input terminals of instrument) is applied when dipole antennas or line probes are used as pick-up devices. For the broad-band antenna, series calibration (calibration signal in series with unknown) is used. The series calibration method has the advantage not to require a change of connections; however, an extra factor of 20 DB must be applied since the injection block attenuates the calibrating signal by this amount.

To use this method, connect the unbalanced injection block to the broad band antenna. Attach both of the 30 ft. cables to the correspondingly color-coded receptacles on the injection block. The other ends of the cables are connected to the SIGNAL INPUT receptacles (green) and to the IMPULSE GEN. receptacle (red). Turn IMPULSE GEN. switch OFF.

Tune to the desired frequency. Adjust SIGNAL INPUT ATTENUATOR and IF GAIN to produce a reference reading on the large meter. Shut off the external noise source. Turn on the impulse generator. Adjust IMPULSE GEN. output to obtain thereference reading. Note the reading of the IMPULSE GEN. OUTPUT controls. The unknown voltage is 20 DB less than this amount due to the attenuation of the calibrating voltage in the injection block. The reading so obtained is the open circuit voltage.

*This step may be accomplished more conveniently by means of switching unit SU-105, available as an accessory item.

For full accuracy, apply the cable loss correction factor. Note that the polarity of the cable loss correction factor depends upon the method of calibration. In the shunt calibration method, the instrument is calibrated to read voltage at its input terminals. The cable loss reduces the voltage between the signal source and the input terminals; therefore, the correction factor is positive. In the series calibration method, the calibrating voltage is injected at the pick-up device. This voltage is attenuated by the 30 foot cable so that the unknown signal is greater than the indicated value. Therefore, the correction factor is negative.

In the calibration procedure outlined above, meter indication was described. Slideback may also be used in a manner similar to that described in par. 10.2. In addition, the instrument may be calibrated to be direct reading, as outlined in par. 10.3.

11. Noise Field Intensity

Use the dipole antenna and calibrate by substitution or for direct reading as described in par. 10.1, 10.2 or 10.3. In order to take a reading, turn the antenna about a vertical axis until a maximum indication is accomplished. If the reading is either off scale or too low, change the setting of the SIGNAL INPUT ATTENUATOR until a reading is obtained within the central portion of the meter scale. The voltage picked up by the dipole is of the maximum value when the axis of the dipole arms is perpendicular to the direction in which the signal source is located. The dipole should also be rotated about a horizontal axis to give maximum response. It may be turned to any angle from horizontal to vertical. For accurate measurements, it is desirable to take three different readings, with the dipole antenna moved to different locations which are not in a straight line. The average of the three readings should then be used as the significant measurement. To obtain field strength readings in microvolts per megacycle per meter, add the dipole factor (Figure 9). This factor is composed of two frequency dependant variables namely:

Effective Height of the Dipole Antenna
Loss in the 30 foot Cable

and two constants, namely:

Mismatch from 72 ohm antenna to 50 ohm cable (1.7 DB)
Conversion to open circuit voltage (6 DB)

The reading thus obtained is the open circuit voltage picked up by the dipole. If loaded circuit voltage is desired it is necessary to subtract 6 DB.

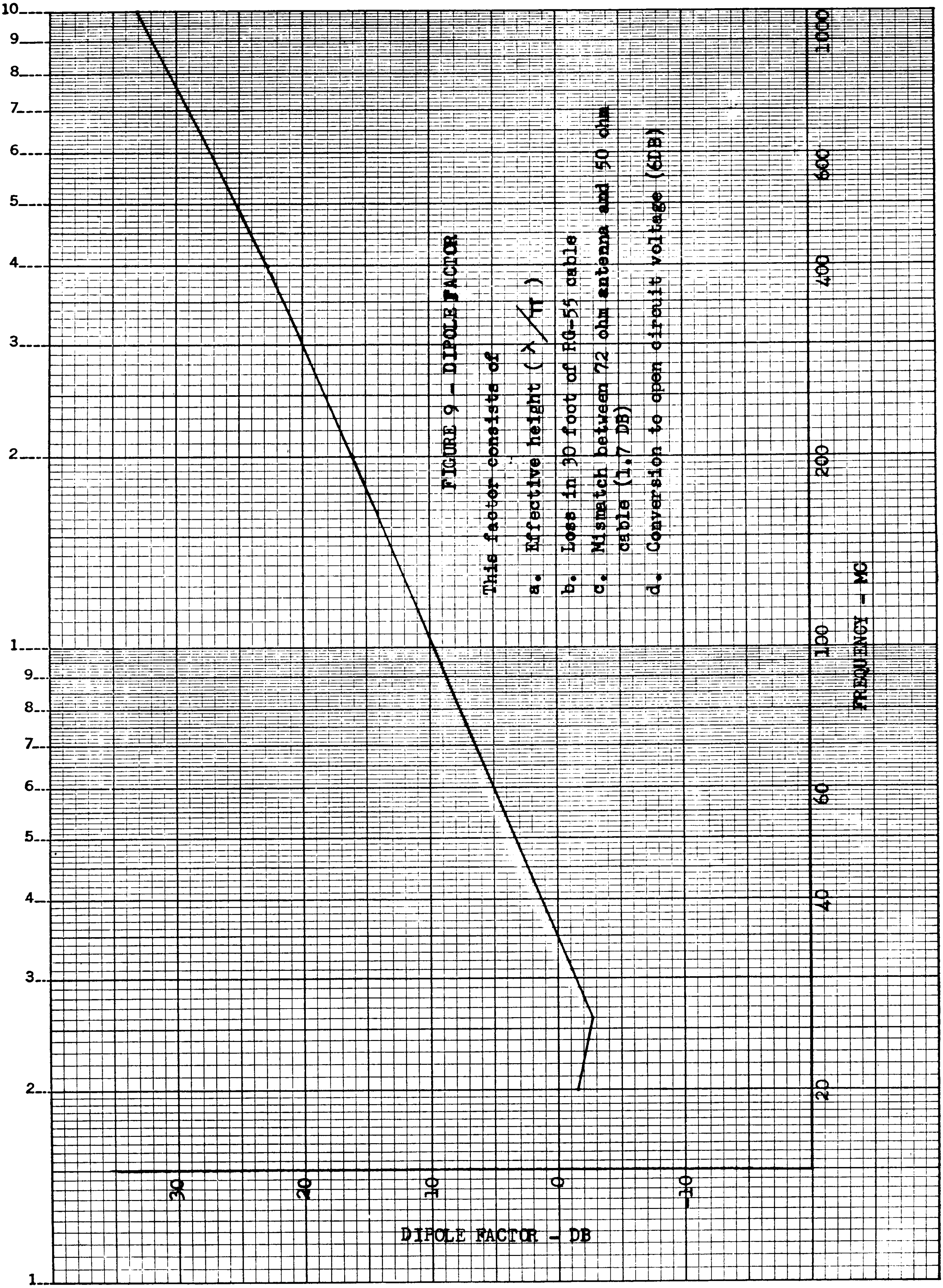


FIGURE 9 - DIPOLE FACTOR

This factor consists of

a. Effective height (λ / π)

b. Loss in 30 foot of RG-55 cable

c. Mismatch between 72 ohm antenna and 50 ohm cable (1.7 DB)

d. Conversion to open circuit voltage (6DB)

12. Two Terminal R.F. Voltmeter - Carrier Measurement

12.1. Calibration Procedure for T-1/NF-105 (20-200 MC) and T-2/NF-105 (200-400 MC)

Connect the 18 inch cable between the SINE WAVE OSC. and the SIGNAL INPUT receptacles. Set the SIGNAL INPUT attenuator to 80 DB.

Turn the function switch to its extreme counter-clockwise position, in order to adjust the sine wave oscillator. With the SINE WAVE OSC.-IMPULSE GEN. switdh in its OFF position, adjust the OSC. ZERO control (next to function switch) for zero reading on the main indicating meter. Set the SINE WAVE OSC. - IMPULSE GEN. switch to SINE WAVE OSC. Adjust the OSC. LEVEL control (beneath the OSC. ZERO control) for full scale reading (CAL mark) on the main indicating meter. The sine wave oscillator must again be adjusted as stated above, if the R.F. plug-in head is changed.

Set the TUNING control on the R.F. head to "CAL" (approximately 63 MC on either band of the 20 to 200 MC head or 220 on the 200 to 400 MC Head).

Set the function switch to CARRIER position. Tune the receiver about its "CAL" marking on the dial until the signal from the sine wave oscillator causes maximum deflection. Adjust the IF GAIN control for full scale meter reading. The instrument is now calibrated as a two terminal vacuum tube voltmeter at this frequency with a full scale sensitivity of 100 DB above one microvolt (80 DB on SIGNAL INPUT ATTENUATOR plus 20 DB on meter).

The sensitivity may be increased, in 20 DB steps, to a full scale value of 20 DB above one microvolt by operating the SIGNAL INPUT ATTENUATOR. The value of an unknown voltage is the sum of the DB readings of the meter and of the SIGNAL INPUT ATTENUATOR.

In order to calibrate at other frequencies, substitute the impulse generator for the sine wave oscillator. The impulse generator in this case is used as a transfer standard. Remove the 18 inch cable from the SINE WAVE OSC. receptacle and connect it to the IMPULSE GEN. receptacle. Turn the function switch to PEAK. Set the SIGNAL INPUT ATTENUATOR to 40 DB. Adjust the impulse generator output by means of the IMPULSE GEN. OUTPUT attenuator and the ADD TO IMPULSE GEN. OUTPUT control until a full scale reading or any other convenient reference is obtained on the large meter.

Tune to the desired frequency. Without changing the impulse generator output level, readjust the I.F. GAIN control for the previously established reference reading on the large meter. Set function switch to CARRIER. The instrument is now calibrated at the new frequency.

Inasmuch as the accuracy of carrier measurements is somewhat affected by the slight bandwidth variations of the receiver for different frequencies, the bandwidth factors in DB, Figs. 10, 11 and 12, should be added to the reading in DB above one microvolt if full accuracy is desired. To convert from "DB above one microvolt" to "microvolt" use the conversion chart Figure 7.

When changing frequency ranges on T-1/NF-105 (20-200 MC) turn the knob located on the left of the dial window to the desired range. In addition, change the connection of the patch cable on the head to correspond with the frequency range in use. Recalibrate the new frequency by following the procedure outlined above. When changing to the new frequency plug-in head, calibrate in a like manner.

In the presence of high ambient interference or high hiss level of the equipment, an accurate carrier measurement may be performed in the following manner.

Note the meter reading in microvolts produced by the combined noise and carrier levels. Detune the equipment sufficiently to lose the carrier signal.

Note the reading produced by noise level alone. The following formula applies:

$S = \sqrt{A^2 - N^2}$ in which S is the unknown carrier level, A the combined noise and carrier level and N the noise level (all in microvolts). For example, if the combined noise and signal level is 50 microvolts and the noise level 30 microvolts, the true signal level would be $S = \sqrt{50^2 - 30^2}$ or 40 microvolts.

12.2. Calibration Procedure for T-3/NF-105

The method of calibration for T-3/NF-105 differs from T-1/NF-105 and T-2/NF-105 in that, the impulse noise generator is used for carrier calibration. This is permissible since both the level of the impulse generator and the bandwidth of the receiver are known. The bandwidth of the receiver is a consideration since the impulse noise sensitivity of the receiver is a function of its bandwidth. Thus, if the receiver had a bandwidth of one megacycle, its CW sensitivity in microvolts would equal its impulse sensitivity expressed in microvolts per megacycle bandwidth. If the

BANDWIDTH DATA AND CALIBRATION CHART FOR
TUNING UNIT, T-1/NF-105

SERIAL NO. 3525

FREQ. MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
20	.141	0	59.0
30	.141	0	59.0
40	.141	0	59.0
50	.141	0	59.0
60	.141	0	59.0
65	.141	0	59.0

FIG. 10

62	.126	0	58.0
80	.126	0	58.0
100	.126	0	58.0
120	.126	0	58.0
140	.126	0	58.0
160	.126	0	58.0
180	.126	0	58.0
200	.126	0	58.0

FIG. 11

BANDWIDTH DATA AND CALIBRATION CHART FOR
TUNING UNIT, T-2/NF-105

SERIAL NO. 3525

FREQ. MC	BANDWIDTH IN MC	BANDWIDTH FACTOR IN DB	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
190			
200	.237	0	52.5
210	.237	0	52.5
220	.237	0	52.5
240	.237	0	52.5
260	.251	+ .5	52.0
280	.251	+ .5	52.0
300	.251	+ .5	52.0
320	.251	+ .5	52.0
340	.251	+ .5	52.0
360	.251	+ .5	52.0
380	.251	+ .5	52.0
400	.251	+ .5	52.0

FIGURE 12

receiver bandwidth were only 0.1 megacycle, the impulse noise calibrating voltage required for the previous CW sensitivity adjustment of the receiver would have to be increased by a factor of 10.

The calibration procedure is as follows. By means of the 18 inch cable, connect the impulse generator receptacle to the signal input receptacle and turn on the impulse generator. In view of the fact that the magnitude of cable losses is appreciable in this tuning range, the impulse noise source must always be applied through the 18 inch cable in order to avoid calibration errors.

Set the SIGNAL INPUT ATTENUATOR to 20 DB, IF GAIN control 3/4 full and the function switch to PEAK. By means of the impulse generator output controls, adjust the impulse generator output to the value indicated in the chart (Figure 13). Tune to the desired frequency and adjust the IF GAIN control for a full scale meter indication.

Set the SIGNAL INPUT ATTENUATOR to 20 DB and the function switch to PEAK. Tune to the desired frequency. By means of the impulse generator output controls, adjust the impulse generator output to the value indicated in the chart (Figure 13).

The instrument now has a full scale sensitivity of 40 DB above one microvolt as a two-terminal vacuum tube voltmeter. By changing the signal input attenuator setting the sensitivity may be changed in 20 DB steps. To convert these readings to microvolts see the conversion chart Figure 7. Calibration by means of the impulse noise signal must at all times be made with the function switch in the PEAK position, although the instrument is being calibrated to be used for carrier measurements. After calibration has been performed, carrier measurements are taken with the function switch in the CARRIER position. Readings must be taken in the PEAK position, however, if the peak value of a modulated carrier is to be measured.

In the presence of high ambient interference or high hiss level of the equipment, an accurate carrier measurement may be made, by taking readings of signal plus noise and then noise alone as outlined in par. 12.1.

13. Carrier Field Intensity

Calibrate as a two-terminal R.F. voltmeter in accordance with the methods described in par. 12.1 or 12.2.

Use the dipole antenna. In order to take a reading, turn the antenna about a vertical axis until a maximum indication is accomplished. If the reading is either off scale or too low, change the setting of the SIGNAL INPUT ATTENUATOR until a reading is obtained within the central portion of the meter scale. The voltage picked up by the dipole is the maximum value when the axis of the dipole arms is perpendicular to the direction in which the signal source is located. The dipole should also be rotated about the horizontal axis to give maximum response. For accurate measurements, it is desirable to take three different readings, with the dipole antenna moved to different locations which are not in a straight line. The average of the three readings should then be used as the significant measurement. To obtain field strength readings in microvolts per meter, add the dipole factor (Figure 9).

This factor is composed of two frequency dependant variables namely:

Effective Height of the Dipole Antenna
Loss in the 30 foot cable

and two constants, namely:

Mismatch from 72 ohm antenna to 50 ohm cable (1.7 DB)
Conversion to open circuit voltage (6 DB)

The reading thus obtained is the open circuit voltage picked up by the dipole. If loaded circuit voltage is desired it is necessary to subtract 6 DB.

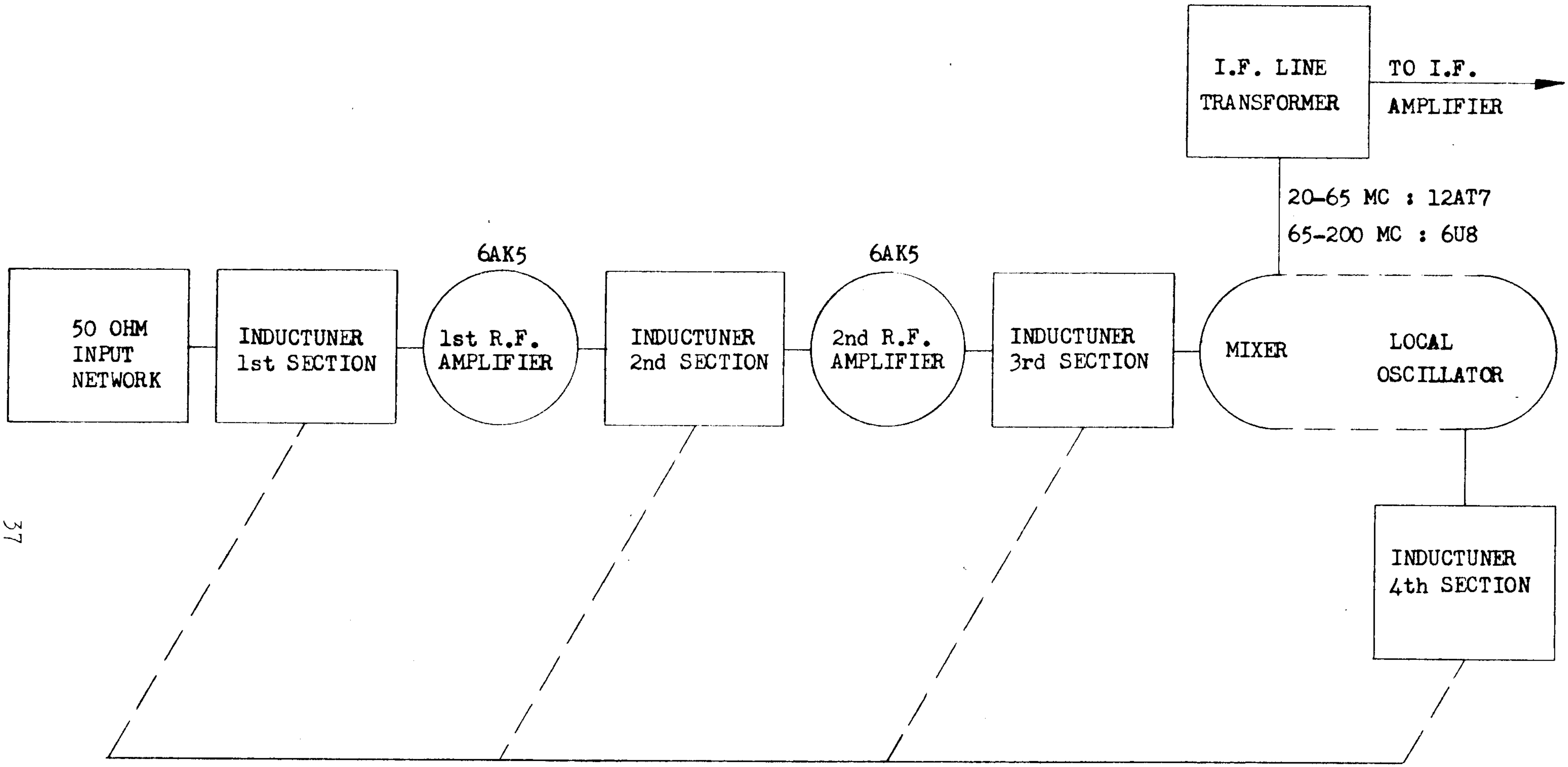


FIGURE 14 - BLOCK DIAGRAM OF R.F. AMPLIFIERS (20-200 MC)

PART THREE - REPAIR INSTRUCTIONS

SECTION IV

Theory of Operation

14. Tuning Unit T-1/NF-105

Tuning unit T-1/NF-105 covers the frequency range from 20 to 200 MC in two bands. There are two separate R.F. amplifiers, one covering the frequency range from 20 to 65 MC, and the other from 65 to 200 MC.

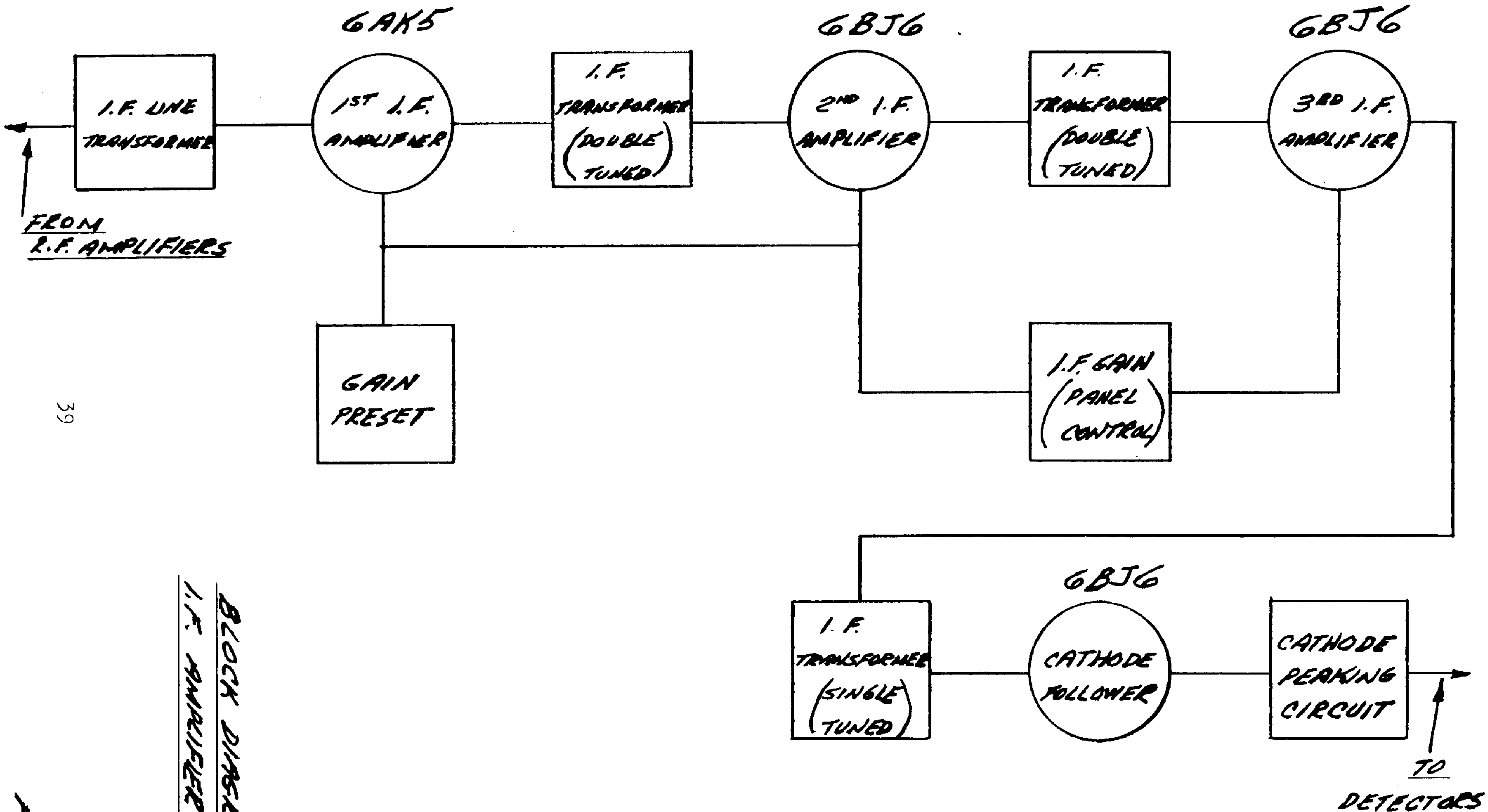
Each R.F. amplifier uses a four-section "Inductuner" as its variable tuning element. Each section of the Inductuner consists of a continuously variable inductor which in conjunction with the proper capacitor, end inductor and, in some instances, shunt inductor, covers the desired frequency range.

A block diagram of the R.F. amplifiers is shown in Figure 14, detail schematic illustration in Figure 27.

In order to keep the input voltage standing wave ratio (VSWR) to a low value, thus obtaining high measuring accuracy, the input circuit is made to appear as a 50 ohm load at the input terminal. Although this results in a deterioration in noise figure, this compromise between VSWR and noise figure is necessary for the sake of measuring accuracy. From the input, the signal is fed through the first tuned circuit to the grid of the first R.F. amplifier (6AK5). The plate of this stage is directly fed into the second tuned circuit, which in turn is capacitively coupled into the grid circuit of the second R. F. amplifier (6AK5). The signal obtained in the plate circuit of this stage is applied to the third tuned circuit, which is coupled to the grid of the mixer stage (half of a 12AT7 in the 20 to 65 MC range, half of a 6U8 in the 65 to 200 MC range). The other section of the mixer tube serves as the local oscillator. Inasmuch as a 10.7 MC I.F. frequency is employed, the oscillator generates a frequency which is, for all tuning positions, 10.7 MC higher than the corresponding R.F. frequency. The resultant difference frequency of 10.7 MC is applied from the plate circuit of the mixer into the I.F. line transformer.

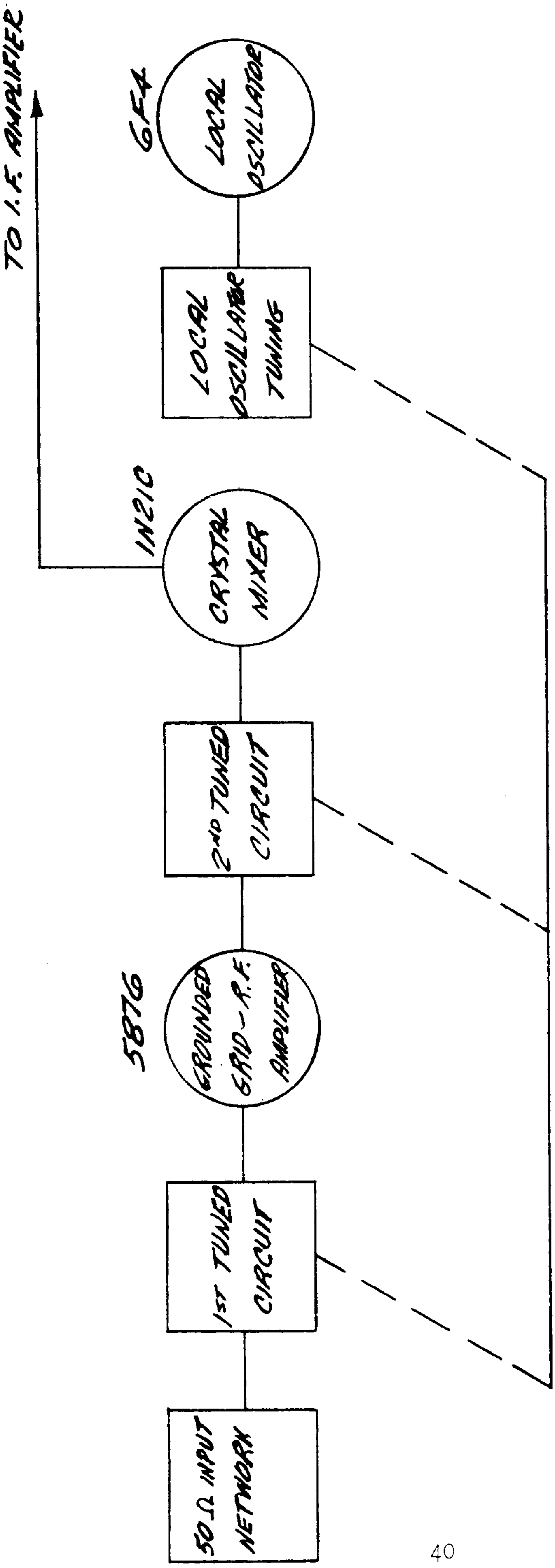
Local oscillator injection in the 20 to 65 MC range is accomplished by means of a 5 mmf capacitor (C78); in the 65 to 200 MC range, a 2 mmf injection capacitor is employed (C105).

Change-over of the two frequency ranges here discussed is accomplished by means of a band selector switch (S1) which switches the following functions:



BLOCK DIAGRAM OF
I.F. AMPLIFIER (10.7 MC).

FIG. 15



BLOCK DIAGRAM OF
R.F. AMPLIFIER
(200 – 400 MC)

FIG. 16

"B" Supply Voltage

Frequency Dial Illumination

I.F. Output

Gain

Since the 20 to 65 MC range has a high gain reserve, a potentiometer (R50) is provided in the cathode circuit of the first I.F. amplifier stage. This permits setting the gain to a value roughly corresponding to that of the 65 to 200 MC range.

The 10.7 MC I.F. amplifier (Block diagram Figure 15) consists of three amplifying stages and a cathode follower output stage. The output signal of the R.F. amplifier is switched into a low impedance line which feeds into the low impedance side of a line transformer. The high impedance circuit of this transformer is fed into the grid circuit of the first I.F. amplifier stage (6AK5). Its output, through a double tuned I.F. transformer, is applied to the grid circuit of the second I.F. amplifier (6BJ6). This stage is similarly coupled to the third I.F. amplifier (6BJ6). The third I.F. amplifier, through a single tuned I.F. output transformer, is fed to the grid of a triode connected 6BJ6 which is used as a cathode follower. This is done in order to feed the meter detector from a low impedance source to obtain good pulse response (see Par. 17). In order to obtain a high output voltage from the cathode follower stage, its cathode is tuned by means of L47.

The I.F. gain control R105, located on the main panel, varied the grid bias applied to the 1st, 2nd and 3rd I.F. amplifier stages.

15. <u>Tuning Unit T-2/NF-105</u>

Tuning Unit T-2/NF-105 covers the frequency range from 200 to 400 MC in one continuously tunable band.

The R.F. amplifier consists of a grounded grid R.F. amplifier stage, a local oscillator and a crystal mixer. A block diagram is shown in Fig. 16, detailed schematic illustration in Fig. 28.

The input signal is fed through a 50 ohm network, which, in conjunction with a tightly-coupled first tuned circuit keeps the input VSWR to a low value. The signal is inductively coupled to the tuned circuit which is fed into the cathode of a type 5876 pencil tube. The variable tuning elements used in this tuner are three individual tuning capacitors ganged together by means of a worm drive shaft. The R.F. stage operates as a grounded grid amplifier. Its plate circuit is tuned and inductively coupled to an untuned pick-up coil which feeds the signal to the 1N21B crystal mixer. The local oscillator operates at a frequency 30 MC higher than the corresponding R.F. frequency. Its energy is fed inductively into the crystal pick-up coil. In the mixer, it is combined with the R.F. signal producing a difference frequency of 30 MC, which is the I.F. frequency. Since the crystal mixer produces an output signal at a low impedance, this signal is fed directly into a low impedance line.

The 30 MC I.F. amplifier consists of 4 amplifying stages and one cathode follower output stage. Its theory of operation follows closely that of the 10.7 MC I.F. amplifier (Par. 14) and is, therefore, not discussed in detail.

In order to avoid interference in reception by microphonics produced in the local oscillator, the entire R.F. amplifier chassis and its dial and tuning mechanism are shock mounted.

16. Tuning Unit T-3/NF-105

The frequency range of 400-1000 MC is divided into two bands, 400-700 MC and 700-1000 MC. The circuitry used in the two ranges is essentially identical except that the constants are adjusted to correspond to the proper frequencies. (A block diagram is shown in Figure 18, detail schematic illustration in Figure 29.) The tuned circuits used are capacity loaded quarter-wave coaxial lines in the R.F. circuits and capacity loaded half-wave parallel lines in the oscillator circuit. Frequency tuning is accomplished by varying the amount of capacity loading of the lines.

The input signal is applied to a coupled pair of tuned circuits preceding a grounded grid triode type 5876. The plate of the 5876 is tuned by means of a single tuned circuit which is inductively coupled to a crystal, type 1N21B. The local oscillator is also inductively coupled to this crystal mixer. In the 400-700 MC range a 6T4 is used as the local oscillator tube, while in the 700-1000 MC range a 6F4 tube is used. The local oscillator operates 42 megacycles above the fundamental frequency. The mixer output therefore produces an IF frequency of 42 MC.

The frequency range switch applies the mixer output of either the 400-700 MC or the 700-1000 MC tuner to the input of the IF amplifier. At the same time, it switches the "B" voltage and dial lights. The first stage of the IF amplifier uses a cascode circuit in order to provide a low noise figure. A 6BQ7A double triode is employed in this stage. It is followed by four stages of synchronously tuned pentodes type 6AK5 and a 6BJ6 in a cathode follower circuit.

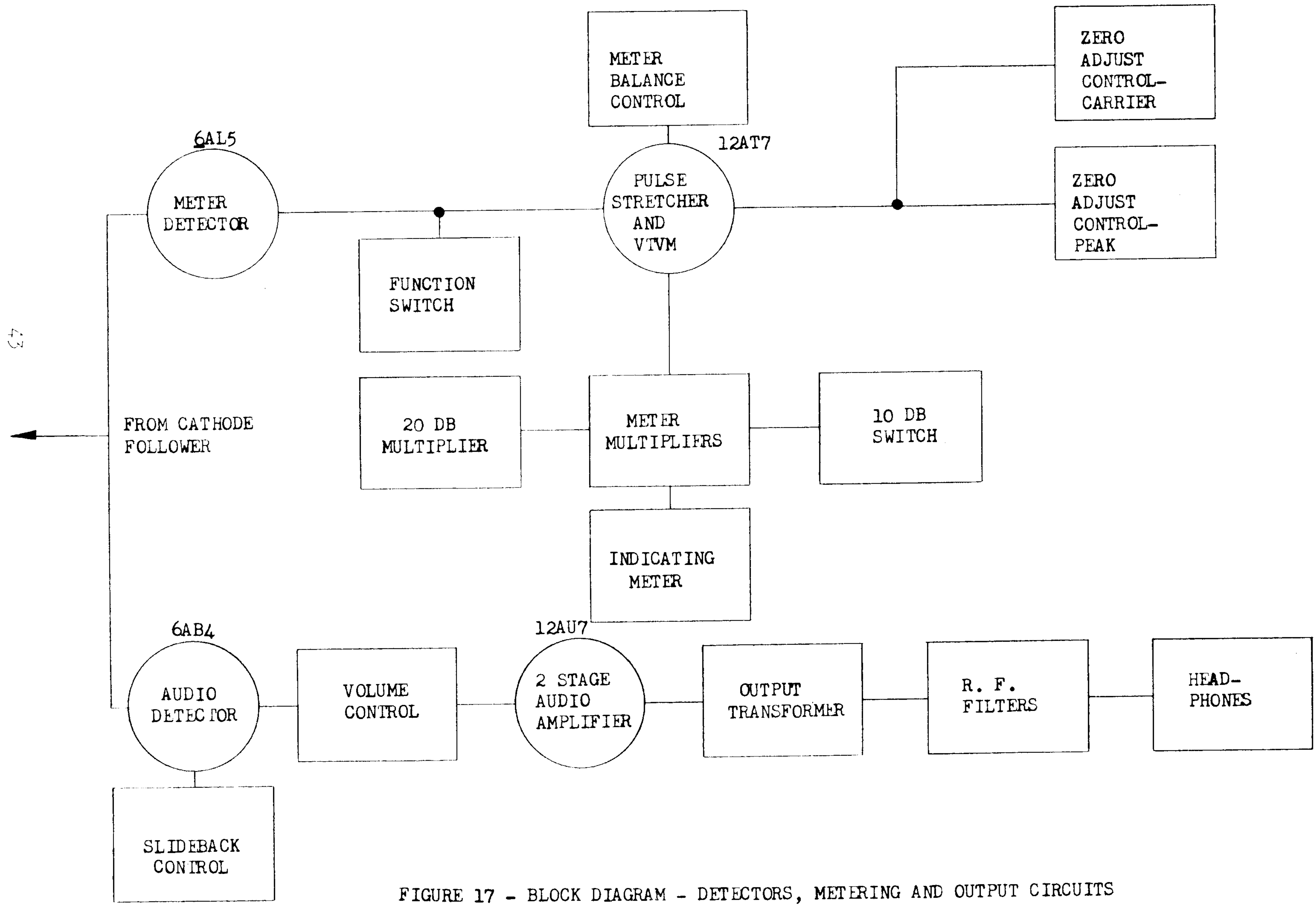


FIGURE 17 - BLOCK DIAGRAM - DETECTORS, METERING AND OUTPUT CIRCUITS

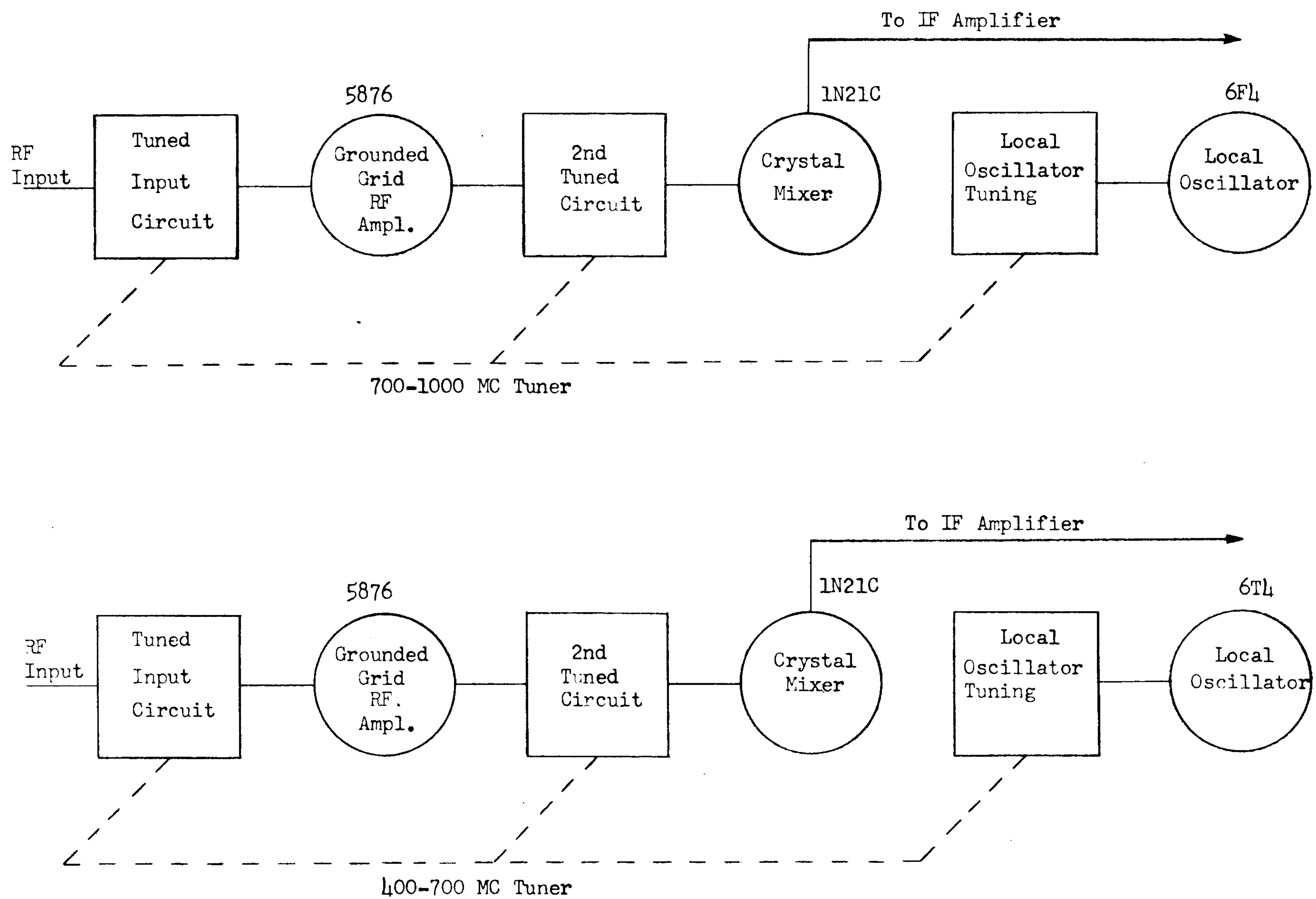


Figure 18
Block Diagram of RF Amplifiers
(400 to 1000 MC)

17. Detectors, Metering and Output Circuits

The output of the cathode followers (V7, V17 or V610) is applied to two detectors, V18 and V19, a 6AL5 and a 6AB4 respectively. The 6AL5, with both sections in parallel, supplies the voltage for the operation of the indicating meter; the 6AB4 operates as the audio detector. See Figure 17 for a block diagram, Figure 30 for a schematic diagram.

A function switch (S2) permits preliminary adjustment of the instrument and operates the meter circuits in two different manners. In the peak position, peak values of pulses or carriers are indicated; in the carrier position, peak of unmodulated carriers and average of modulated ones are read. Since it is difficult to show true peak values of pulses, especially at low repetition rates, special circuits are employee to accomplish satisfactory visual peak indication.

The output impedance of the cathode followers feeding the detectors is very low. Since the impedance of the two sections of the 6AL5 is also low, the resulting charge time is extremely short. The discharge time is made long by using a discharge resistor (R86) of 50 megohms. The discharge time is further increased by applying the 50 megohm resistor in the grid circuit of one-half of a double triode (V21) with negative feed back so that it operates as a resistance "magnifier" or a pulse stretcher, V21 simultaneously serves in the bridge type vacuum tube voltmeter circuit, which operates meter M1.

For carrier measurements, the 50 megohm resistor (R86) is shunted by R71 and R73 to a value of approximately 150,000 ohms. Thus, the discharge time is sufficiently shortened to permit indication of average rather than peak values.

For the 0 to 10 microvolt range, the voltage applied to the vacuum tube voltmeter for full scale reading is 2.5 volts. The corresponding voltage for the higher ranges is 25 volts. In both instances the R.F. and I.F. amplifiers are operated at the same gain level. The residual noise indication on the meter is thus reduced by a factor of 10 when operating on the higher ranges. The sensitivity of the instrument is switched by means of a wafer switch (S3) attached to the rear of the signal input attenuator. A momentary switch S4, located on the front panel, when operated shorts out part of the meter multiplier resistance, thus increasing the meter sensitivity by 10 DB. This feature effectively produces a 10 DB scale overlap and functions on all sensitivity ranges except the 0 to 10 microvolt range.

The indicating meter M1 is a 100 microampere logarithmic movement with one calibration serving the 0 to 10 microvolt range and a second one for all higher ranges. This distinction is necessary because of lack of linearity in the diode detector (V18) for voltages below 2.5 volts. The meter movement is protected from overload by means of a 1N34 crystal (X2) when switched to the more sensitive range. The dynamic range of the I.F. amplifier limits the diode voltage to a safe value for the less sensitive range.

Certain preliminary adjustments are necessary in the vacuum tube voltmeter circuit in order to allow for variations in tubes, aging and warm-up. The function switch disables those circuits which would interfere with these adjustments.

The anode of the audio detector, with the function switch in the peak position, may be biased to any desired value from 0 to approximately -20 volts by means of the slideback control (R80). This permits clearer aural pulse reception and measurement of pulse amplitude by the slideback method. (See Par. 10.2) The audio detector is followed by a two stage audio amplifier using a dual triode type 12AU7 (V20). Its output is fed through transformer T10 and an RF filter network F3 to the phone jack on the front panel and to an AN connector for remote phone operation. The use of the RF filter network is necessary in order to filter out RF interference that may be picked up by the headset and to prevent any RF currents in the phone leads from coupling back to the input circuit.

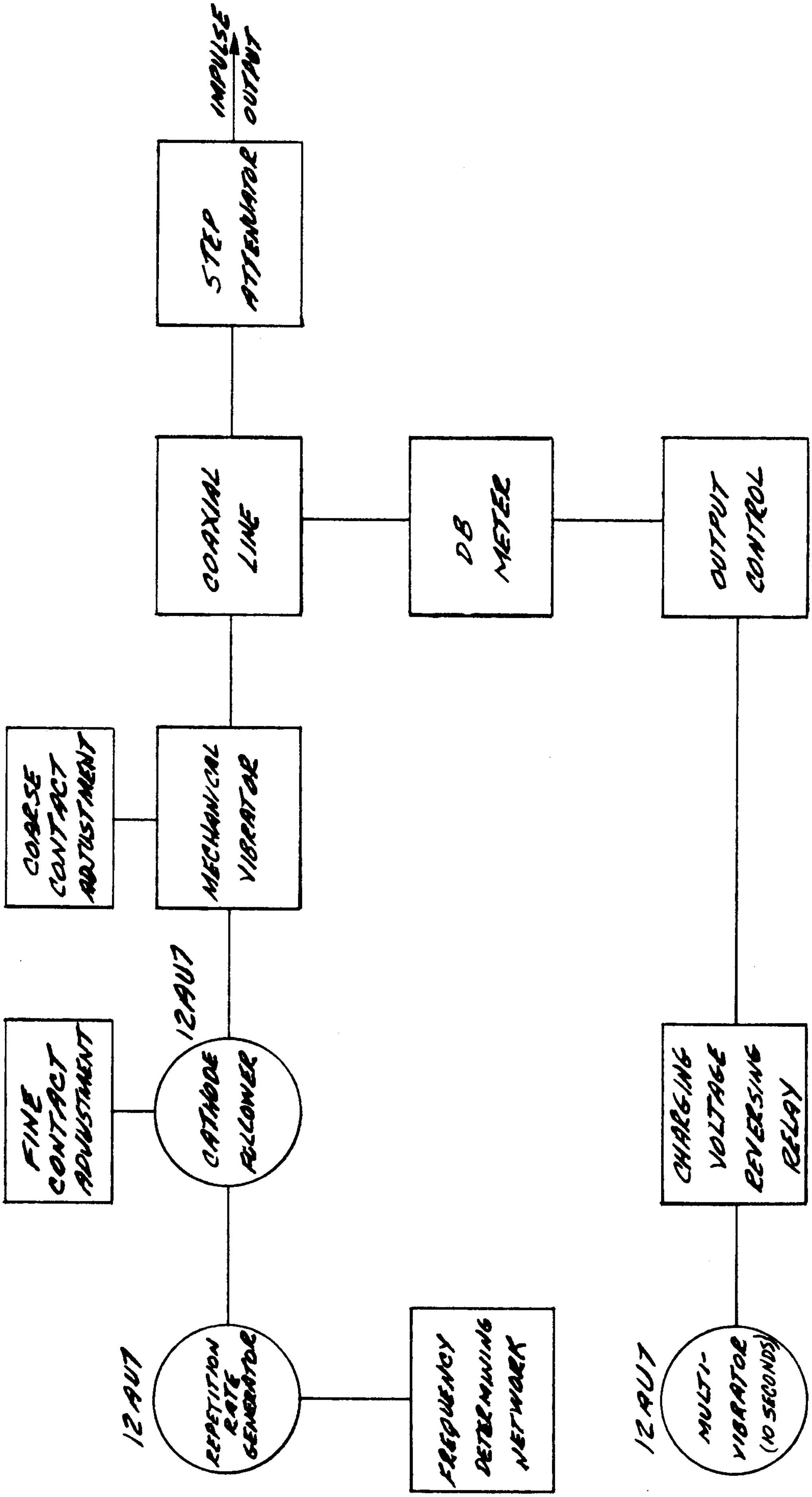
In the "Meter Balance" position of the function switch, the grids of the two sections of V21 are grounded. The meter balance control (R90) may, therefore, be operated to compensate for differences in the two tube sections.

In the "Zero Adjust" position, the IF amplifier is disabled by being biased to cut-off; any voltage reaching the grid circuit of the vacuum tube voltmeter is generated in the meter detector (V18) as contact potential and may be balanced out by biasing the other section of the VTVM tube by an equivalent amount of voltage of like polarity. This is accomplished by zero adjust control R99 located on the front panel. This control balances out the contact potential appearing for the high diode load resistance in peak position.

In the carrier position, the amount of contact potential is somewhat lowered because of the lower load resistance. This potential is balanced out by the carrier zero potentiometer R101 located inside the equipment to the rear of the plug-in head.

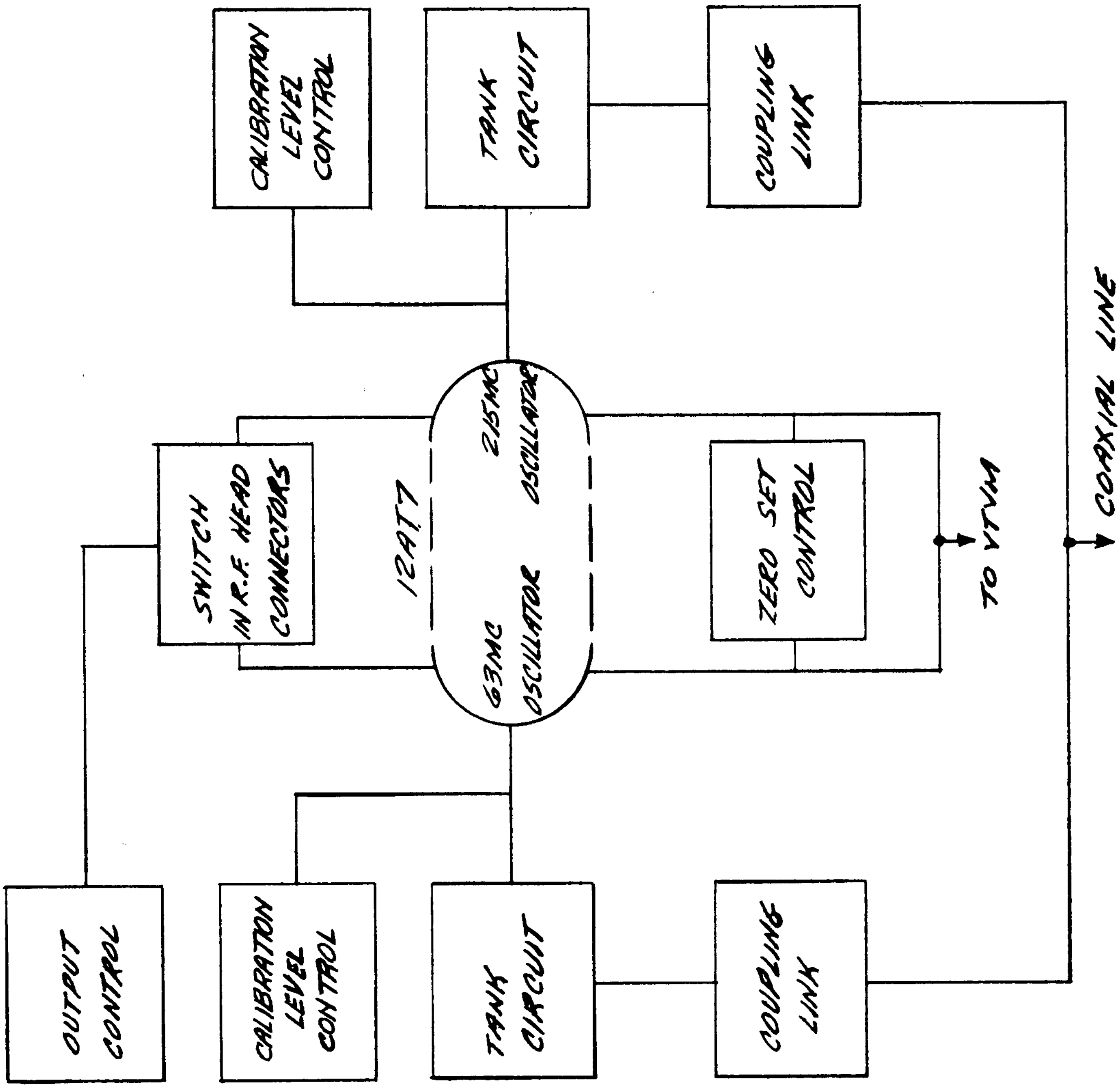
18. Impulse Generator

The impulse generator serves as a standard impulse noise source producing extremely short pulses of variable repetition rate. Because of the short pulse duration (approximately 0.0005 microseconds) an impulse noise spectrum flat from 0.01 MC to 1000 MC is obtained.



BLOCK DIAGRAM OF IMPULSE GENERATOR.

FIG. 19



BLOCK DIAGRAM OF
SINE WAVE OSCILLATOR

FIG. 20

The impulse generator consists of an electronic repetition rate generator (V23), a pulse shaper (V25), a magnetic driver, a coaxial line, a metering system and a step attenuator. See block diagram Figure 19, schematic diagram Figure 30.

The repetition rate generator uses a 12AU7 (V23) in a multivibrator circuit. Its frequency of operation is adjustable from 2.5 cycles to 2500 cycles by means of switch S5 and dual potentiometer R122A and R122B. The signal is fed to another 12AU7 (V25), arranged as a cathode follower, which holds to a constant width the pulses used to operate the magnetic driver.

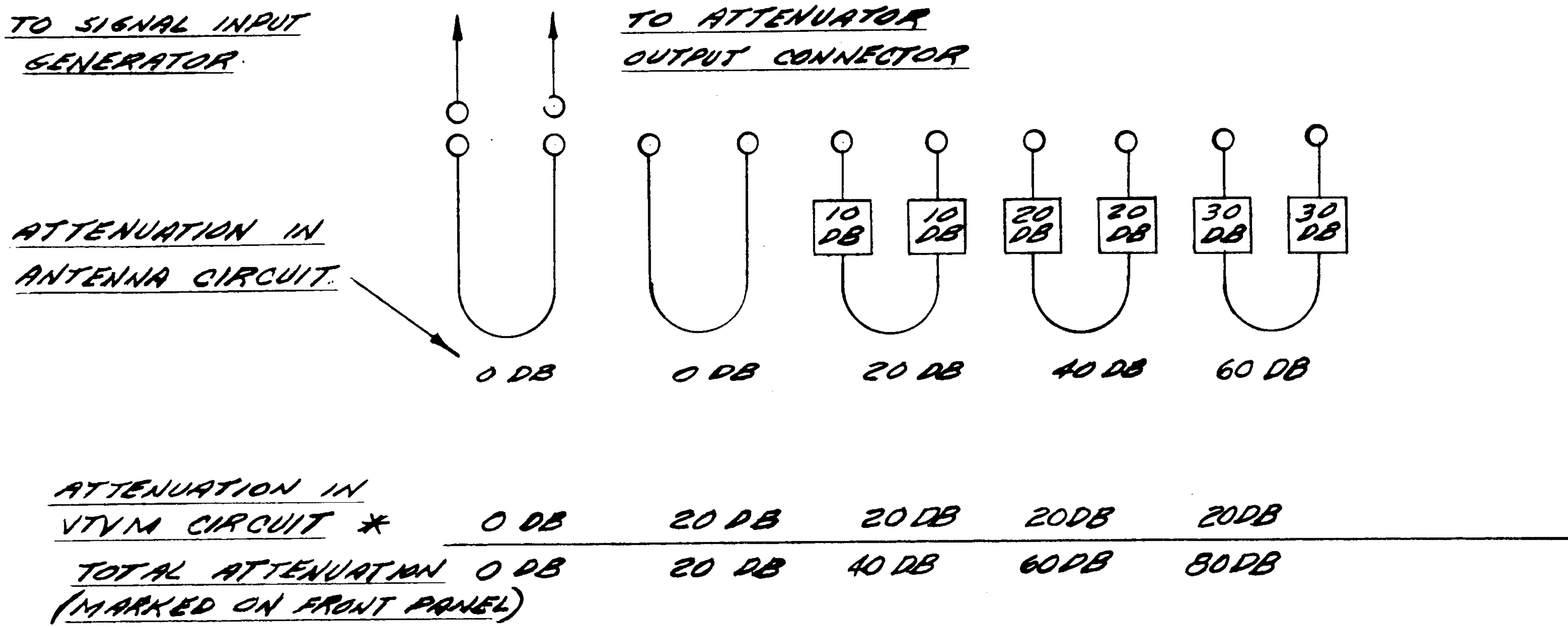
The device is coupled to a contact which discharges, at the desired pulse repetition rate, a charged coaxial line. The duration of the resultant pulse is determined by the length of the coaxial line. The polarity of the line charging voltage is reversed at 10 second intervals in order to minimize contact migration. Polarity reversal is accomplished by means of a 12AU7 (V24) multivibrator operating a relay (RE1).

Since the amplitude of the pulse generated in the coaxial line is, within the operating limits of the equipment, directly proportional to the charging voltage, the relative pulse amplitude in DB is shown by DC meter M3 as a function of the line charging voltage. The line charging voltage is varied over a 10 DB range by means of R163. Thus, a continuous 10 DB impulse output variation is achieved. The output may also be varied in steps of 10 DB by the impulse generator attenuator located on the front panel (see Par. 20). The total output in DB above one microvolt per megacycle of bandwidth is the sum of the indications of this meter and of the step attenuator.

The step attenuator is treated in Par. 20.

19. Sine Wave Oscillator

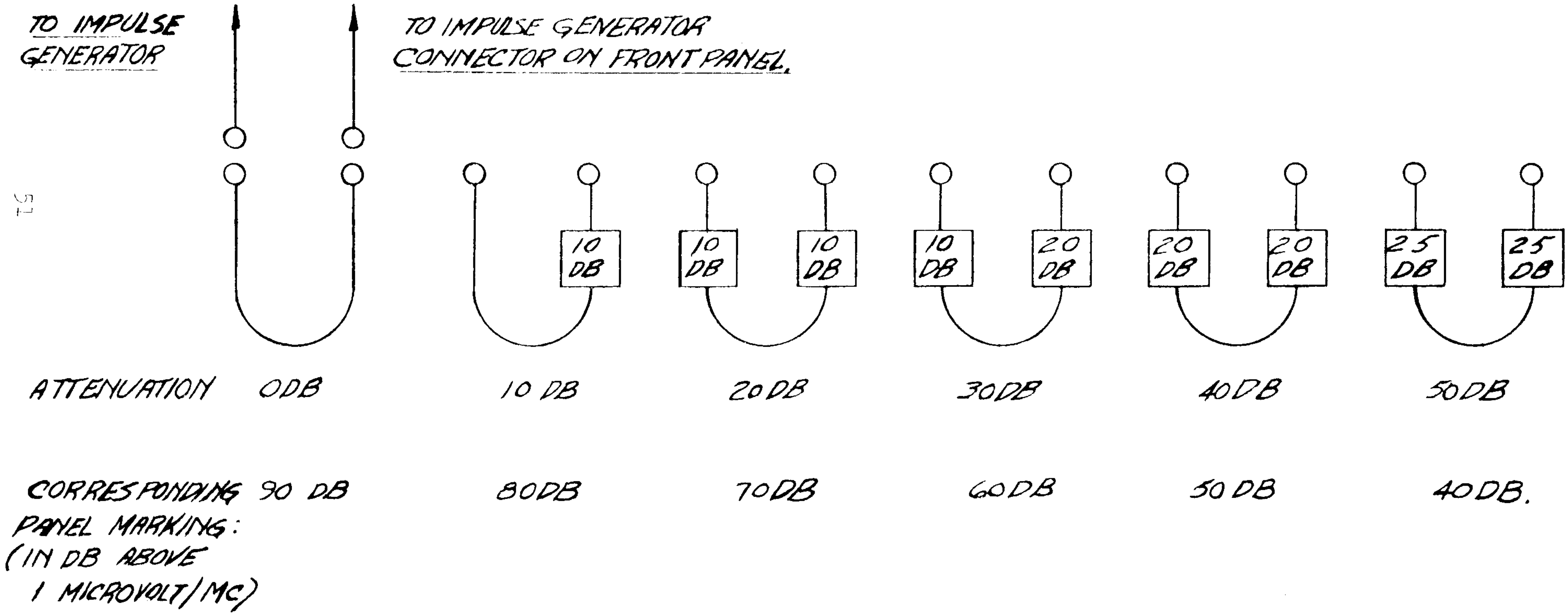
The sine wave oscillator (Figure 20) serves as a continuous wave calibrating standard delivering an output of 100,000 microvolts into a 50 ohm load. It operates at approximately 63 MC for calibration of the 20 to 200 MC R.F. plug-in head and at 215 MC for calibration of the 200 to 400 MC head. Frequency change is accomplished automatically by the head connector as plug-in heads are changed. The 63 MC oscillator uses one triode section of 12AT7 (V22), the 215 MC oscillator employing the other section. The output voltages of the 63 MC and the 215 MC oscillators are fed into low impedance links which, in turn, operate into a low impedance line. The oscillator level is preadjusted by varying the spacing between the tank coil and the coupling link. Fine adjustment is achieved by controlling the plate voltage of the oscillator



* THIS ATTENUATOR IS OPERATED BY A WAFER SWITCH, MOUNTED IN REAR OF THE ANTENNA INPUT ATTENUATOR

BLOCK DIAGRAM OF SIGNAL INPUT ATTENUATOR.

FIG. 21



BLOCK DIAGRAM OF IMPULSE GENERATOR ATTENUATOR

FIG 22

tube by means of R118. The output of the sine wave oscillator is metered by the VTVM (see Par. 17). The contact potential is balanced by means of the oscillator zero control (R100). The oscillator unit employs double shielding and is thoroughly filtered in order to avoid radiation. The sine wave oscillator is shown in detailed schematic form in Figure 30.

20. Step Attenuators

The instrument utilizes two step attenuators, one of which is used in the signal input, the other in the impulse generator output circuit. In view of the high frequencies involved, the attenuators are coaxial networks, so designed that the resulting VSWR is kept to a low value. Each attenuator section is a resistive "T" pad in which the series elements consist of rod resistors, the shunt element being a disc type resistor. The diameter of the outer conductor is so calculated that with the rod resistors acting as inner conductors, a perfect 50 ohm line results at the beginning and the end of each network.

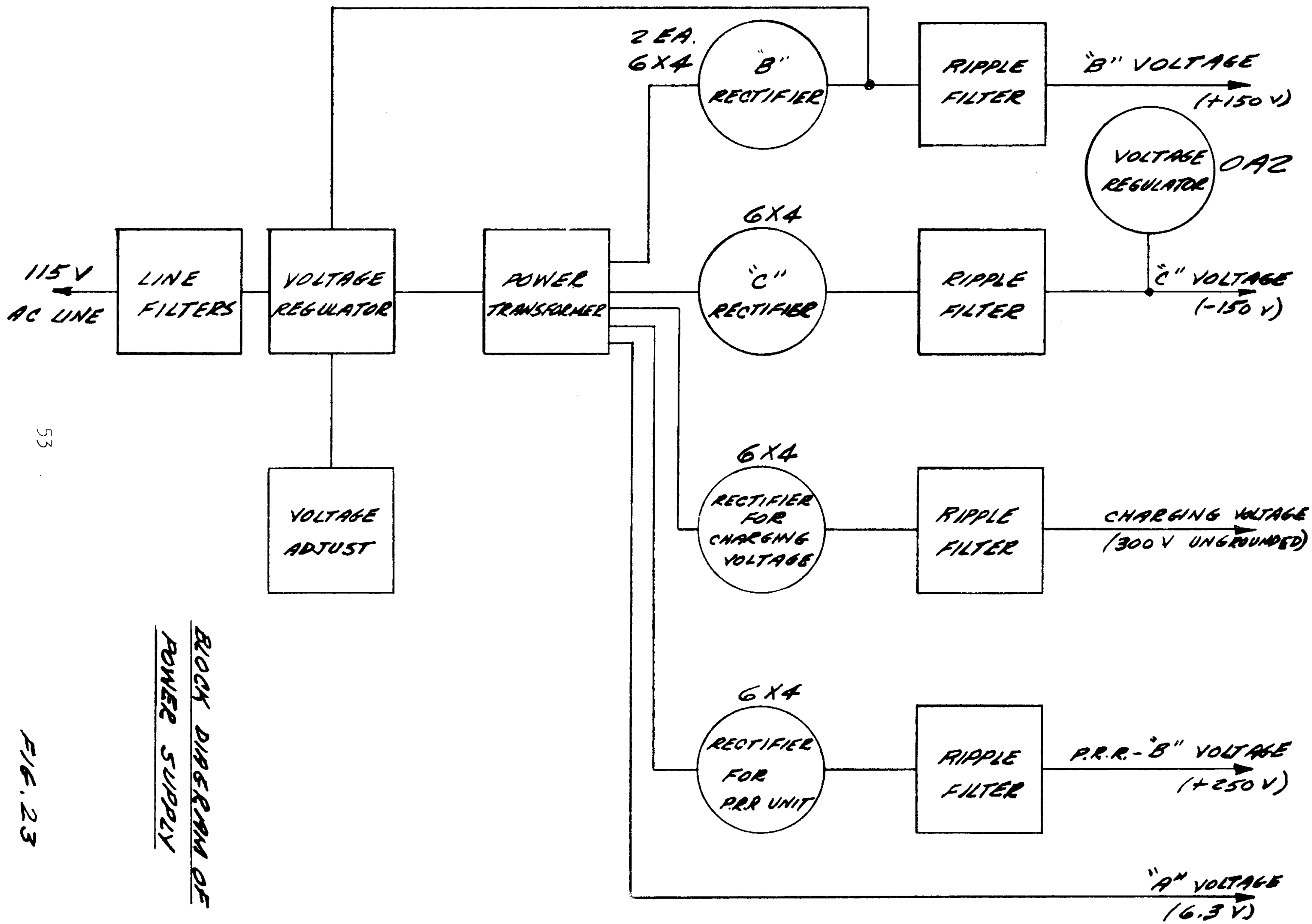
Block diagrams of the signal input and impulse generator attenuators are shown in Figures 21 and 22 respectively, a schematic diagram in Figure 30.

21. Power Supply

The power supply furnishes 150 volts "B" voltage, -150 volts "C" voltage, 300 volts charging voltage for the impulse generator, 250 volts for the P.R.R. generator and 6.3 volts "A" voltage. These voltages are regulated to make them independent of changes in either the primary supply voltage or in current drain in the various circuits due to changes in functional requirements.

Voltage regulation is accomplished by means of a vibrating finger regulator (RE2) which, using the 150 volts "B" voltage as reference, applies varying resistance values in series with the primary of the power transformer. The vibrating finger regulator and corresponding resistors are enclosed in a shield can in order to prevent relay contact noise from interfering with reception. All leads to this part of the circuit are well filtered.

The 150 volts "B" voltage is rectified by two 6X4 tubes (V29) and (V30) in a full wave circuit. The "C" voltage is derived from a 6X4 (V28) operating in a half wave circuit. Voltage regulation for the "C" circuit over and above that accomplished by the vibrating finger regulator is achieved by an OA2 (V31) gas tube regulator. The charging voltage



BLOCK DIAGRAM OF POWER SUPPLY

FIG. 23

for the impulse generator is obtained from a 6X4 rectifier (V27) and the 250 volts "B" branch is rectified by another 6X4 (V26).

A block diagram of the power supply is shown in Figure 23, the schematic diagram in Figure 30.

22. Alignment Harness

In order to gain access to the various circuits and adjustments of the RF plug-in head during operation, an alignment harness is used.

The function of the harness is twofold. It powers the RF head and, at the same time, connects the IF output to the main unit. Since the IF amplifier would regenerate if a long output lead were employed for this connection, a germanium diode in conjunction with a load resistor and by-pass capacitor is built into that end of the harness which is closer to the plug-in head.

Since the alignment harness employs a simplified detector, it is intended for alignment purposes only. Therefore, quantitative measurements should not be taken when using this harness.

SECTION V

Alignment Procedures

NOTE: Before attempting to make any of the following adjustments, the equipment should be permitted to warm up for a period of not less than 15 minutes.

23. Tuning Unit T-1/NF-105

Remove the dust cover of the plug-in head and the shield cover of the R.F. chassis. In order to gain access to the adjustments for the I.F. and R.F. circuits, the use of alignment harness AH-105 is required. Connect the plug-in head to the main chassis by means of the harness.

23.1. I.F. Amplifier, 10.7 MC

Set the function switch to carrier position and the band switch on the plug-in head to the 20 to 65 MC range. The signal input attenuator must be kept in the 20 DB position for all of the following alignment procedures, unless otherwise specified. Feed a 10.7 MC signal from a signal generator to the mixer grid (pin 2 of V10) of the 20 to 65 MC range. Keep the signal generator and the I.F. gain control so adjusted that no overload occurs. Peak transformers T5, T7, T8 and T9 and coil L46 for maximum output, gradually decreasing the signal generator voltage to prevent overload.

Set the band switch on the plug-in head to the 65 to 200 MC range. Feed a 10.7 MC signal to pin 2 of V13. Peak T6, without disturbing the other adjustments made in the previous step.

Cathode coil L47 in the output stage of the I.F. amplifier is not to be adjusted during this operation.

23.2. R.F. Tuner, 20 - 65 MC

All R.F. adjustments must be made using an insulated screw driver with as small a metal tip as possible.

Set the band switch to 20 to 65 MC range. Feed an R.F. signal from the signal generator to antenna connector P7, which is the lower of the two connectors on the head panel. A 50 ohm unterminated line is to be used between the signal generator and the receiver. Connect the plug-in head to the main unit by means of the alignment harness.

With tuning control and signal generator set to 21 MC adjust oscillator trimmer C84 for maximum output and peak R.F. trimmers C60, C67 and C79. Set tuning control and signal generator to 62 MC. Do not attempt any alignment at this frequency if calibration and sensitivity appear to be satisfactory. If alignment is required, change inductance of oscillator end inductor L26, by squeezing or spreading turns. Follow by adjusting the R.F. end inductors L20, L22 and L24. Alternately repeat adjustments at 21 and 62 MC as required. Do not change the adjustment of oscillator shunt inductor L27 which governs the tracking across the band.

After the low frequency band has been completely aligned, check the available gain reserve at the weakest point in the calibrated band. With the signal input attenuator set to 20 DB and the I.F. gain control in its maximum clockwise position, approximately 50 microvolts should be required for full scale meter deflection. If the required input differs greatly from 50 microvolts, R50 located on the rear of the R.F. chassis, is adjusted until this requirement is fulfilled.

23.3. <u>R.F. Tuner, 65 - 200 MC</u>

Set the band switch to the 65 to 200 MC range. Feed an R.F. signal into the upper antenna connector (P10) on the panel of the plug-in head. Set tuning control and signal generator to 65 MC. Peak oscillator trimmer C117 and adjust R.F. trimmers C96, C101 and C109 for maximum output. Set tuning control and signal generator to 200 MC. If alignment is required, change the inductance of the oscillator end inductor L42 by squeezing or spreading turns. Follow by adjusting R.F. end inductors L33, L36 and L39.

Do not disturb shunt inductors L31, L34, L37 and L40 which govern the tracking across the band. Replace the entire unit in its dust cover.

Do not attempt to make the following adjustments using the alignment harness.

Remove the main unit from its dust cover, plug Tuning Unit T-1 into the main chassis and allow approximately 1 hour warm-up. Set the tuning control and signal generator to 20 MC, turn the SIGNAL INPUT ATTENUATOR to 20 DB and set the function switch to CARRIER. Adjust the IF GAIN control for a full-scale deflection of 100 microvolts CW. Place a 500 ohm resistor across the terminals of the main indicating meter in order to extend its range. Increase the signal generator output until the receiver overload point is reached (use approximately 0.1 volt input). Adjust coil L-47, the cathode follower coil, on the IF chassis for maximum output. Remove the signal generator and the 500 ohm resistor. No further adjustment of this coil is necessary.

24. Tuning Unit T-2/NF-105

24.1. I.F. Amplifier, 30 MC

The procedures outlined in Par. 23.1 for the alignment of the 10.7 MC I.F. amplifier basically apply to the 30 MC I.F. amplifier as well.

Disconnect I.F. input connector P4 from the R.F. chassis adjacent to the worm gear drive. Feed a 30 MC signal into this connector. Align transformers T1, T2, T3 and coils L11, L62, carefully avoiding overload.

Cathode coil L16 is not be adjusted during this operation.

Reconnect the I.F. input plug to the R.F. unit and feed an R.F. signal of 200 MC into the antenna connector located on the front panel. Carefully tune the receiver for maximum meter deflection resulting from this signal. Peak C8 located beneath the R.F. chassis. Realign the I.F. input transformer T1 for maximum output with disturbing any of the other adjustments.

24.2. R.F. Tuner - 200 - 400 MC

Connect the 200 to 400 MC tuning unit to the main unit by means of the alignment harness. Feed the signal generator output, through the unterminated 50 ohm line into the antenna connector (P1) on the panel of the plug-in head. Set tuning control and signal generator to 395 MC. Adjust oscillator trimmer C12 for maximum output. Tune trimmer C20 while "rocking" the signal generator tuning until optimum alignment is obtained. Peak trimmers C1 and C2.

Set tuning control and signal generator to 210 MC. Adjust oscillator inductor L5 for maximum output.

NOTE: Great care must be exercised when adjusting oscillator or R.F. inductors for this frequency range, since very small changes in effective inductor length cause relatively large frequency changes.

Loosen the nut holding the oscillator inductor to the tuning capacitor (do not unsolder the other end of the inductor) and carefully slide the inductor until maximum output results. Retighten the nut. Repeat procedure until satisfactory alignment is obtained.

Adjust R.F. plate coil L3 by loosening both nuts holding it to the tuning capacitor and slide it until best alignment results. Retighten the nuts. At the same time note that L3 and L4 must be spaced approximately 1/8". The crystal mixer assembly is moved by sliding it after loosening its two mounting screws underneath the chassis. After proper coupling is obtained, retighten these screws. After changing the spacing, again check for proper inductance setting of L3.

In a similar manner, adjust L2. In this instance, a spacing of approximately 1/16" must exist between L1 and L2. This can be accomplished by bending L1 or sliding it after loosening its mounting screws.

If required, alternately repeat alignment at 395 MC and at 210 MC until optimum alignment results.

Remove the main unit from its dust cover, plug Tuning Unit T-2 into the main chassis and allow approximately one hour warm-up. Set the tuning control and signal generator to 200 MC, turn the SIGNAL INPUT ATTENUATOR to 20 DB and set the function switch to CARRIER. Adjust the IF GAIN control for a full-scale deflection of 100 microvolts CW. Place a 500 ohm resistor across the terminals of the main indicating meter in order to extend its range. Increase the signal generator output until the receiver overload point is reached (use approximately 0.1 volt input). Adjust coil L-16, the cathods follower coil, on the IF chassis for maximum output. Remove the signal generator and the 500 ohm resistor. No further alignment of this coil is necessary.

25. Tuning Unit T-3/NF-105

25.1. I.F. Amplifier, 42 MC

The procedures outlined in par. 23.1 for the alignment of the 10.7 MC I.F. amplifier apply, basically, to the 42 MC I.F. amplifier as well.

Disconnect the I.F. connector J-601. This is located on the I.F. chassis and band-switch, 400-700 MC range. Feed a 42 MC signal into J-601 on this chassis. Align coils L-619, L-621, L-627, L-626, L-623, and L-625 being careful to avoid overload.

Reconnect I.F. connector J-601. Feed an R.F. signal of 400 MC into the 400-700 MC input connector on the front panel. Turn the band-switch to the 400-700 MC position and adjust the TUNING control about the 400 MC mark for maximum output. Then readjust L-619 for maximum output without disturbing any of the other adjustments.

25.2. R.F. Tuner, 400-700 MC

It must be kept in mind that the circuits in this tuning unit are very critical so that small changes in inductance or capacity will produce large changes in tuning, and thus in tracking and sensitivity. Therefore, it is important that no adjustments be made until it is determined that they are absolutely necessary and then these adjustments must be madé with the utmost care.

Set the band switch to 400-700 MC. Feed an RF signal to input connector J605 which is the lower of the two connectors on the head panel. The signal generator should be isolated by a 50 ohm pad of at least 6 DB attenuation. Connect the plug-in head to the main unit by means of the alignment harness. With the signal input attenuator in the 20 DB position, and the IF GAIN control at maximum clockwise, set signal generator output to 100 microvolts. Tune receiver and generator to check points at approximately 50 MC intervals. If the meter indication is full scale or off scale at all check frequencies, the system gain is satisfactory.

Set signal input attenuator to 0 DB and signal generator output to 10 microvolts. At several check frequencies reduce IF GAIN until the signal generator output produces a full scale reading. Shut off the signal generator. The residual noise as indicated by the meter should not be in excess of 4 microvolts.

If the tuner so tested does not comply with the limits specified above proceed as follows. With the signal generator set at 420 MC adjust tuning control for maximum output. To align the RF and mixer circuits, bend their condenser plates for maximum signal indication.

After the low frequency end is aligned, set the signal generator at 670 MC and adjust tuning control for maximum output. The RF and mixer circuits may be peaked by adjusting the trimmer strips located under the tuning lines. Since this operation may disturb the low frequency adjustment, it is necessary to check both ends of the band several times to insure optimum performance.

After completing this alignment procedure, select the weakest point in the frequency range. Adjust L618 for maximum output.

25.3. R.F. Tuner, 700-1000 MC

This tuner is adjusted in the same manner as outlined in par. 25.2 for the 400-700 MC band. Use alignment frequencies of 730 and960 MC. Also adjust L640 for maximum output.

Remove the main unit from its dust cover, plug Tuning Unit T-3 into the main chassis and allow approximately one hour warm-up. Set the tuning control and signal generator to 400 MC, turn the SIGNAL INPUT ATTENUATOR to 20 DB and set the function switch to CARRIER. Adjust the IF GAIN control for a full-scale deflection of 100 microvolts CW. Place a 500 ohm resistor across the terminals of the main indicating meter in order to extend its range. Increase the signal generator output until the receiver overload point is reached (use approximately 0.1 volt input). Adjust coil L-628, the cathode follower coil, on the IF chassis for maximum output. Remove the signal generator and the 500 ohm resistor. No further alignment of this coil is necessary.

26. Impulse Generator

If an impulse signal cannot be heard in the headset after the impulse generator has been adjusted, as outlined in Section III, Par. 10, proceed as follows:

a. Set IMPULSE GEN. FINE CONTACT ADJ. to the center of its range.

b. Turn IMPULSE GEN. CONTACT PRE-ADJ. clockwise as far as it will go. (The IMPULSE GEN. CONTACT PRE-ADJ. is a screw driver adjustment located above the coaxial connectors on the main front panel.) This increases the contact spacing to a maximum.

c. While listening to the receiver, with the aid of a screw driver slowly rotate the IMPULSE GEN. CONTACT PRE-ADJ. in a counter-clockwise direction until a signal is heard in the headset. Adjust this control for a clear tone.

d. For any further adjustment, rotate the IMPULSE GEN. FINE CONTACT ADJ. in either direction. For large changes in repetition rate, it may be necessary to retouch this adjustment for a clear tone in the receiver.

When not using the impulse generator, set the SINE WAVE OSC.-IMPULSE GEN. switch OFF. This will increase the contact life.

The accuracy of the impulse generator can be checked in the following manner:

1. Set the impulse generator attenuator to the 90DB position. By means of a DC resistance bridge, measure the resistance from the center conductor to the shell of the impulse generator output connector on the front panel. This resistance should be 10 ohms ± 5%.

2. By means of a DC voltmeter, measure the charging voltage between C-207 on the impulse generator housing and ground. This voltage should be 300 volts ± 10% when the indication on the small meter is + 7 DB. Capacitor C-207 is of the feed-through type located at the end of a pipe rising from the impulse generator line at an angle of approximately 45 degrees.

If the resistance as measured in Step 1, and the voltage as measured in Step 2 are correct, the spectral width and intensity of the generator will be proper.

27. <u>Repetition Rate Generator</u>

Connect the output of the P.R.R. generator, accessible at the driving coil terminals of the impulse generator, to the vertical plates of an oscilloscope, whose horizontal plates are connected to a frequency calibrated audio generator. Set the impulse generator P.R.R. switch to its X100 position, the cycles control to 25. The frequency should now be 2500 cycles as checked by the audio generator. If an adjustment is required, set C187, accessible from the top of the P.R.R. driving unit, until the proper frequency output is obtained.

28. <u>Sine Wave Oscillator</u>

In order to check the sine wave oscillator output, proceed as follows. Plug the 20 to 200 MC Tuning Unit into the Basic Measuring Unit. Turn the sine wave oscillator on and use it as a source in accordance with instructions given in Section III, Operation. If the oscillator frequency should greatly vary from 63 MC, adjust trimmer capacitor C177 until this frequency is reached. C177 is accessible from the left side of the oscillator unit, as viewed from the front.

Connect the sine wave oscillator connector to the signal input connector on the main panel, <u>through the 18" cable</u>. Set the signal input attenuator to 80 DB, connect the attenuator output to the R.F. connector on the plug-in head by means of the six inch cable. With the function switch in the extreme counter-clockwise position, adjust the oscillator zero control for a zero reading on the meter (this adjustment must be made with the sine wave oscillator-impulse gen. switch in the off position). Turn on the sine wave oscillator, adjust the oscillator level control for full scale meter reading. Set the function switch to carrier position. Tune the receiver about its "CAL" marking on the dial until the signal from the sine wave oscillator causes maximum deflection. Disconnect the 18" cable from the signal input connector. Feed to the signal input connector <u>through a cable not to exceed two feet in length</u> the output of an external standard signal generator tuned to the receiver frequency. Adjust the signal generator output to exactly 100,000 microvolts. Set the I.F. gain to produce full scale reading on the meter, carefully retuning the signal generator to ascertain that it is peaked to the receiver frequency. Do not change the setting of the I.F. gain control until the completion of the gain calibration. Disconnect the signal generator cable from the signal input connector and substitute the 18 inch cable which is still attached to the sine wave oscillator connector. Carefully peak the receiver to the sine wave oscillator frequency. The reading produced by the sine wave oscillator should be full scale. If it departs appreciably from full scale, adjust the oscillator level control for full scale reading while retuning the receiver to maximum meter deflection. Turn the function switch to its extreme counter-clockwise position. By means of control R247 (located on the main chassis behind the step attenuator controlling the impulse generator output) adjust the meter indication to full scale. Turn off the sine wave oscillator and readjust the oscillator zero control. Turn on the sine wave oscillator and readjust R247 for full scale reading. For greater accuracy alternately readjust the oscillator zero (oscillator off) and R247 (oscillator on).

Similarly adjust the high frequency sine wave oscillator at 215 MC using the 200 to 400 MC plug-in head. If the frequency should depart greatly from 215 MC, the inductance of L52 must be adjusted by squeezing or spreading turns. (No trimmer is available for this frequency). In order to gain access to L52, remove the outer shield of the sine wave oscillator unit as well as its rear plate. After all shields have been replaced, check and adjust the amplitude of the sine wave oscillator output as described for the 63 MC unit, adjusting R248 instead of R247.

The sine wave calibrator may be checked in the following manner:

Adjust the sine wave generator level as shown above for either 62 or 215 megacycles. After the level has been set properly, disconnect the sine wave generator from the signal input connector and replace this with a signal from an accurately calibrated signal generator of the proper frequency. It should require 100,000 microvolts ± 1 DB to match the level produced by the sine wave generator.

The receiver portion of the instrument is a tuned vacuum tube voltmeter with the following basic sensitivities:

Signal Input Attenuator Setting DB	Full Scale Microvolts
0	10
20	100
40	1,000
60	10,000
80	100,000

The receiver portion itself should be capable of attaining the above sensitivity for any frequency from 20 MC to 1000 MC. In order to provide a safety factor for aging the instrument it is capable of sensitivities in excess of those shown.

Tuning Unit T-A/NF-105 (150 KC to 30 MC) is capable ot the following minimum sensitivities:

Signal Input Attenuator Setting DB	Full Scale Microvolts
0	1
20	10
40	100
60	1,000
80	10,000

For sine wave measurements the function switch must be placed in the carrier position.

29. **Carrier Zero Adjustment**

The meter zero adjustment for peak operation is accomplished by setting the zero adjust control as required in the instructions for operation. Should the zero adjust point in the carrier position (with I.F. gain control in extreme counter-clockwise position) differ from that on peak, proceed as follows:

After allowing the equipment to warm up, set the function switch to meter balance and adjust the meter balance control for meter zero. Turn the function switch to zero adjust and set the corresponding control for meter zero. Turn function switch to carrier and I.F. gain to extreme counter-clockwise position. Set R101, located next to the audio output transformer, for meter zero.

30. **Voltage Regulator**

When changing the voltage regulator, it may be necessary to reset R170, located above the power transformer. With the line voltage adjusted to 115 volts, change the setting of R170 until the voltage on the filtered side of the main "B" supply circuit measures 150 volts.

31. **Filament Voltage**

The filament voltage for tubes V21 and V22 is dropped to 5.8 volts by means of semi-adjustable resistor, R149. R149 is located on the right side of the main chassis, near the front.

In order to adjust the filament voltage for V21 and V22, operate the equipment at a line voltage of 115 volts. Vary the position of the adjustable contact on the resistor, until the filament voltage becomes 5.8 volts.

SECTION VI

Repair Instructions

32. General

The procedures employed in repairing this equipment are largely conventional as far as the electronic circuits are concerned. It is the purpose of these instructions to point out unusual procedures that might be helpful in making repairs. Such instructions are considered desirable for maintenance of the following units.

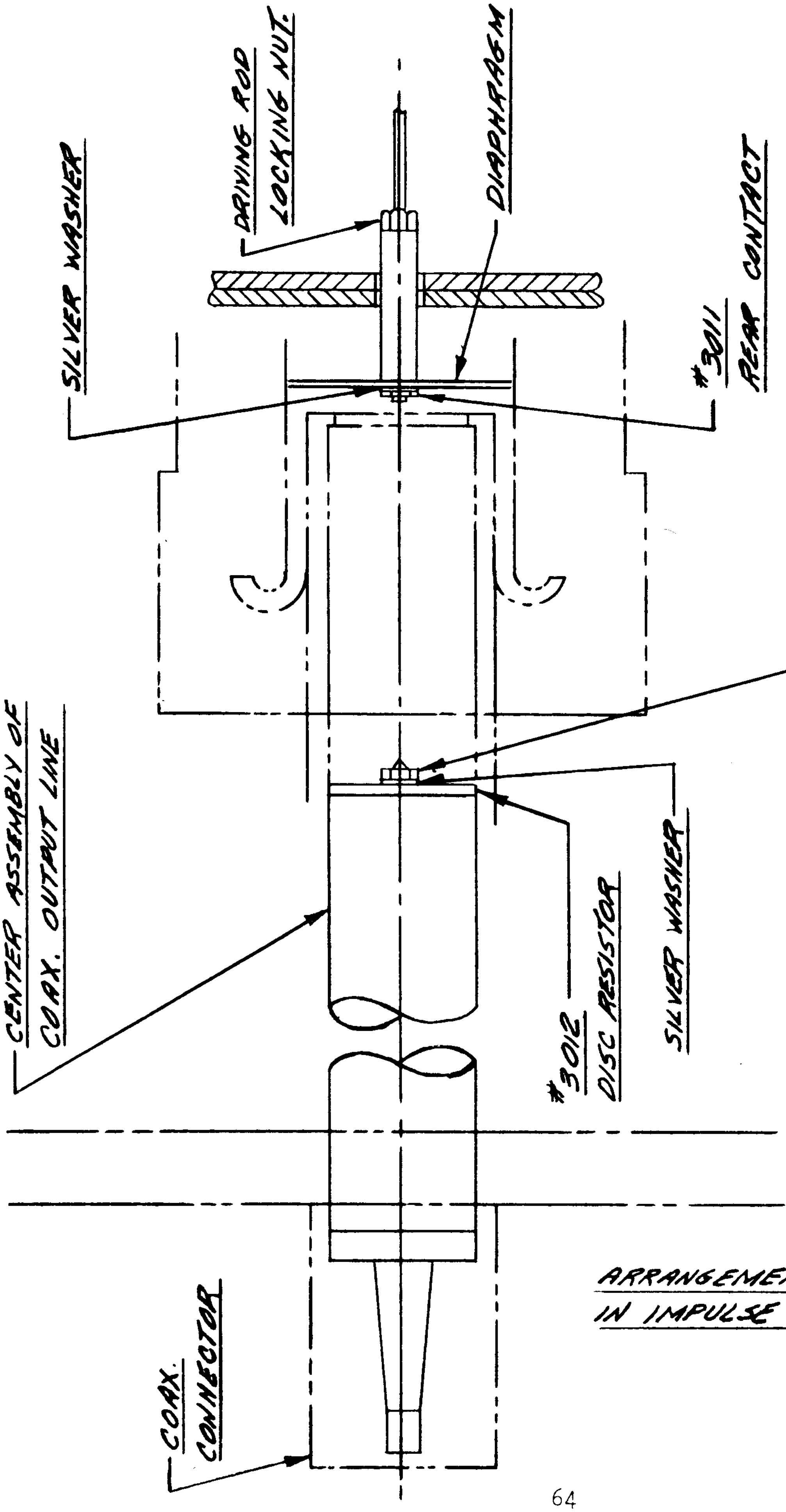
a. Impulse Generator
b. Step Attenuators
c. Gear Trains
d. Relays
e. Pencil Tubes

33. Impulse Generator

The only parts in the impulse generator that may need replacement are contact #3010, contact #3011 and disc resistor #3012. If it is found that it is no longer possible to adjust the contacts, as outlined in Section V, 26, the following steps should be taken, always referring to Figure 24:

a. Remove the coaxial cable from the generator unit.
b. Disconnect the three wires at the rear of the generator.
c. Remove the four mounting screws and lift out the generator.
d. With wrench #3013 remove the center assembly of the coaxial output line.
e. With wrench #3014 remove the front contact from the inner end of the center conductor.
NOTE: This also removes the disc resistor #3012 and a silver washer.
f. Examine the contact through a magnifying glass and, if it appears heavily pitted, replace it. If, however, it is only dirty, it may be cleaned with crocus cloth. Place the silver washer on the contact and screw it to the center conductor assembly.
NOTE: Space contacts are furnished with each unit.
g. While holding drive rod locking nut with light pliers, remove the rear contact with wrench #3014, taking care not to distort the driving assembly.

h. In order to examine and clean or replace the rear contact, proceed as outlined for the front contact under step f.



ARRANGEMENT OF PARTS
IN IMPULSE GENERATOR

FIG. 24

i. Replace center conductor assembly.
j. Connect the three leads and coaxial cable to the generator unit.
k. Adjust contacts, as outlined in Section V, 26.

If there is reason to believe that the output level has changed, the disc resistor #3012 should be checked. It should be 10 ohms ±5% and should be replaced, if it has exceeded these tolerances.

In order to check this resistor, set the impulse generator output attenuator to 90 DB above 1 microvolt/MC and connect an ohmmeter between the center conductor and the shell of the impulse generator front panel connector. If the resistor must be replaced, proceed as shown in steps a. to f. above.

34. Step Attenuators

After it has been established that the attenuation value of one of the steps of either step attenuator varies from the nominal value (see Figures 21 and 22), the attenuator must be removed from the front panel, in order to be repaired.

The impulse generator output attenuator may be removed without loosening the main front panel. In order to remove the signal input attenuator, it is necessary to drop the front panel.

a. To take an attenuator apart, remove the three number 10 nuts attached to the rear of the three tie rods. Pull out the rear plate. The barrel is now loose; therefore care must be taken not to drop it or its associated spring and washers.
b. Remove the barrel assembly.
c. Check the center pins for positioning. The point of each pin should be about flush with the face of its connector housing.
d. Loosen the number 6 nuts on the opposing end plate which lock the Allen set screws. Loosen each Allen set screw by approximately one turn.
e. Hold the barrel upright such that the plate in which the Allen set screws are located faces up. Remove the six number 6 screws used to fasten this plate. Remove the plate and the pressure slugs which are held down by the Allen set screws.
f. Identify the attenuator positions by referring to Figures 21 and 22 for the signal input and the impulse generator attenuator respectively. The 0 DB positions are the ones that have a coaxial line between the two connectors. Looking at the now opened end, the other positions are arranged clockwise for increasing attenuator for the impulse generator attenuator and counter-clockwise for the signal input attenuator.
g. In order to check the doubtful section, lift it out of the barrel. This is easily accomplished by pushing up on its

associated connectors. To remove a 10 DB section, first unsolder its connection to the coaxial cable, and swing the cable out of the way by pushing on its connector. If removing several sections at one time, note the location of each section so that it will be returned to its original position.

h. Check the resistance values of the suspected section(s) by referring to the following chart. The attenuator values are composed of 0, 10, 20, 25 or 30 DB sections or combinations thereof.

Attenuator Section	Series Resistors (rod)	Shunt Resistors (disc)
0 DB	-----	-----
10 DB	25.97	35.14
20 DB	40.91	10.10
25 DB	44.68	5.64
30 DB	46.93	3.17

The measured values must be within 2% of these nominal values.

i. After locating the defective resistor, make replacement.

j. Reassemble the attenuator in reverse order. Make certain of good alignment by checking connector fits. If binding should result,do not force. Instead, again go over the assembly operation.

35. Gear Trains

The gear trains, used in the tuning units, incorporate a clutch in order to prevent damage to the inductuners or the tuning capacitors respectively, should the tuning control inadvertently be turned past its end settings.

In the course of operation, this clutch may loosen up. It is to be reset as follows:

Remove the tuning head from its dust cover. Looking in from the side of the unit, a spring washer will be seen on the drive shaft. A collar controls the tension of this spring and thus the clutch action. If it becomes necessary to reset the clutch, loosen the two Allen set screws holding the collar to the shaft. With a screw driver move the collar toward the spring; gently pressing with the screw driver will increase the clutch tension. After the desired tension has been obtained, retighten the two Allen set screws.

36. Relays

a. There are two relays in Noise and Field Intensity Meter Model NF-105. One serves as a voltage regulator and is located in the voltage regulator box in the upper right hand corner of the equipment. Removing the cover of the voltage regulator box, pull out the relay and remove its dust cover. See that the small contact fingers are clean and are not bent out of shape. If one or several of these fingers have an oxidized surface, the relay was overloaded and should be replaced in order to assure continued satisfactory operation of the equipment. The other relay is used in the polarity reversing circuit of the impulse generator. It becomes accessible by removing the shield cover next to the three 12AU7 tubes on the P.R.R. unit.

b. Both relays should be carefully cleaned. Extreme care is required, especially in the case of the voltage regulator relay, because of its delicate contacts. The relays may be blown out with an air hose; however, the nozzle must be sufficiently far removed from the relay not to harm the mechanism. The contact located beneath the relay coil on the voltage regulator relay may be cleaned by means of sandpaper (0000), a crocus cloth, a small file or a relay burnishing tool. Whichever of the above tools is used, it must be gently applied in order not to mar the contact surface. Remove all loose dirt or metallic residue after cleaning relay contacts. The ten small finger contacts on the opposite side of the relay are too delicate for this type of cleaning and must not be touched. The polarity reversing relay must be cleaned in the same manner as the rear contact of the voltage regulator relay.

37. Pencil Tubes

Extreme care is required in removing and replacing the pencil tubes, type 5876 in T-2/NF-105 or T-3/NF-105. In order to remove this tube, from the T-2/NF-105 Tuning Unit, first remove the top of the vertical tube shield extending beyond the grid disc by pulling the shield straight up. Next, disconnect the two filament wires in the small compartment. Limit the heat which can reach the pencil tube by placing the jaws of a pair of long nose pliers between the solder connection and the tube and holding them there for at least 15 seconds after removing soldering iron. Remove the tube by gently pulling the grid disc straight up. Reverse procedure when replacing this tube.

To remove the 5876 pencil tube from either of the tuners in the T-3/NF-105 head, first remove the grid disc clamp. Disconnect the filament wires observing the precautions outlined in the previous paragraph. Lift the tube out of the clamps and then through the slotted hole in the shield plate. Reverse the procedure when replacing the tube.

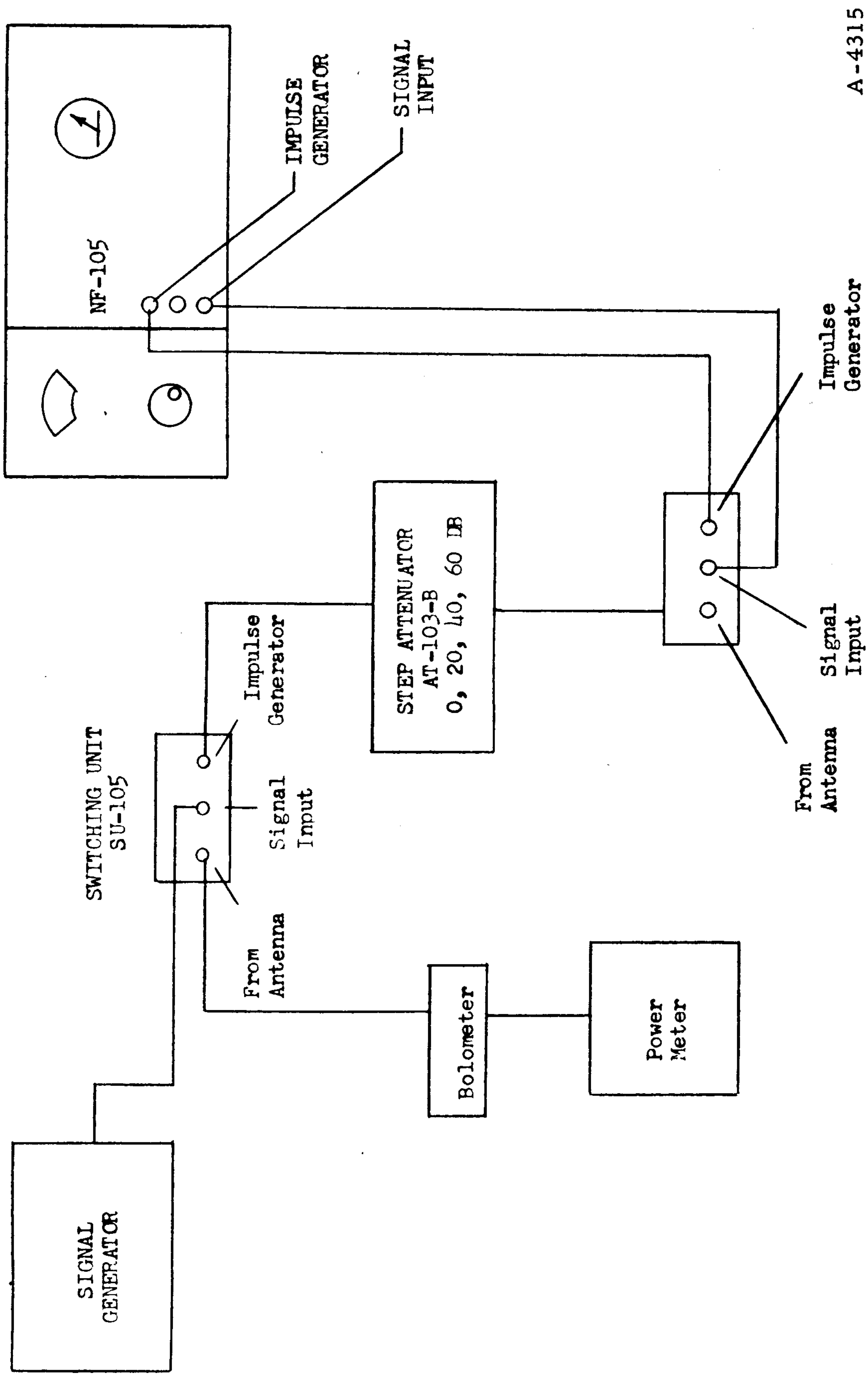
33. Calibration Procedure

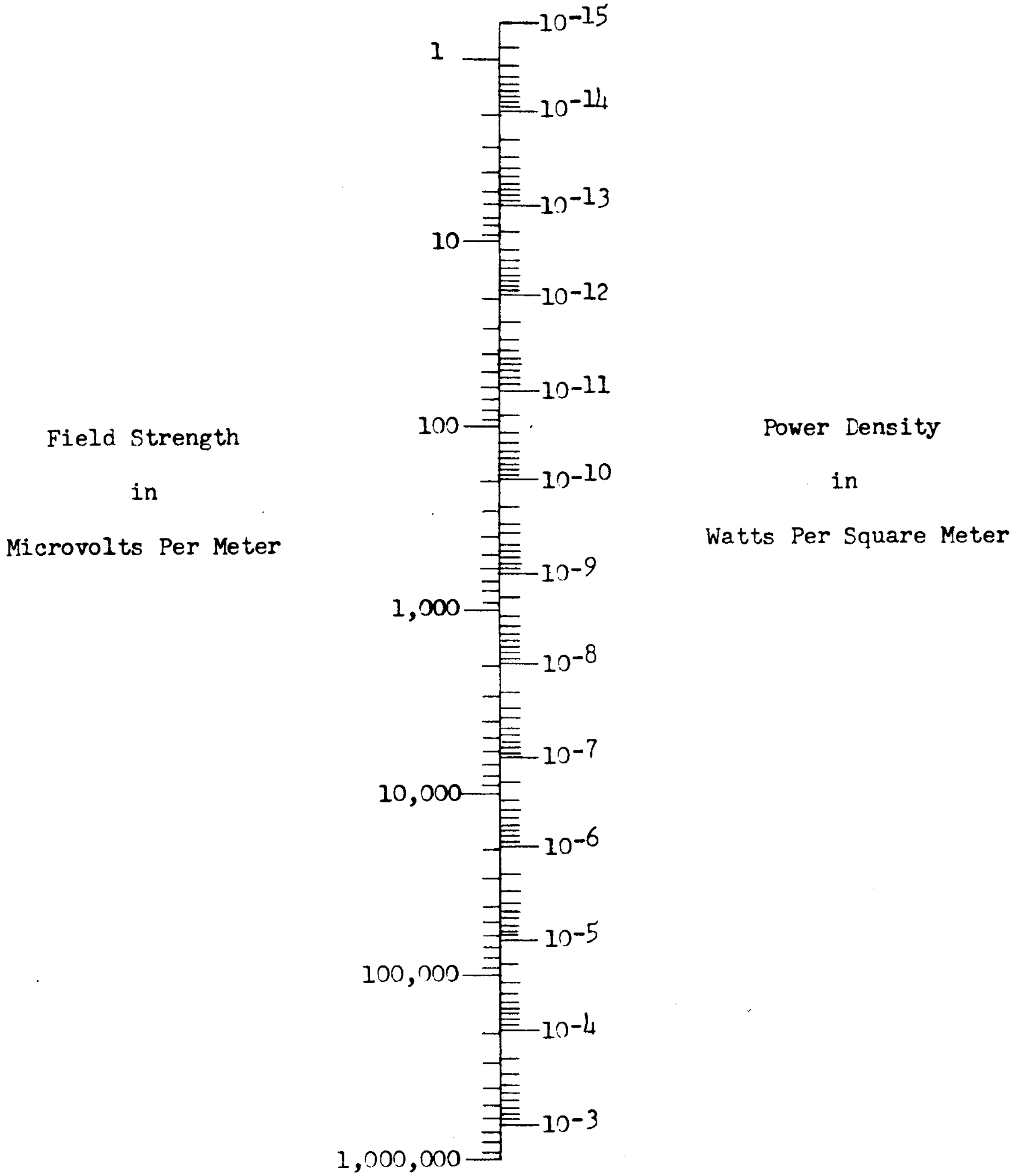
The calibration procedure described below is that which is employed by the factory. The equipment required is shown in block diagram form on page 68a.

All narrow band calibration is performed at the input terminals of the instrument at a level of 100 microvolts CW. The calibration is performed at all the frequencies indicated in the calibration charts furnished with the instrument. In the calibration charts the number in DBMC indicated in the right hand column is that which is equivalent to 100 microvolts CW when the signal input attenuator is in the 20 DB position. The IF gain control is adjusted to provide a full-scale indication with an input of 100 microvolts CW, the inpulse generator is then substituted for the CW signal and the impulse generator level required to produce the same full-scale indication is recorded in the right hand column. The function switch must be in the "Carrier" position when the CW generator is connected to the instrument and in the "Peak" position when the impulse generator is connected.

After the instrument is calibrated, the signal input attenuator accuracy can be checked by means of the step attenuator shown in the test set-up. Starting with a CW signal of .1 volts, the signal input attenuator in the 80 DB position, and the IF gain control adjusted for full-scale indication, insert 20 DB attenuation at a time by means of the step attenuator and remove 20 DB at a time by means of the signal input attenuator. This should return the meter to full-scale within 1 DB. The accuracy of the signal input attenuator will show up by means of this test.

The calibration of this instrument by the method described will be traceable to the Bureau of Standards if the step attenuator, the bolometer, and power meter are certified by the Bureau. For low frequencies, a VT voltmeter calibrated by the Bureau of Standards should be substituted for the bolometer and the power meter.


A-4315
IMPULSE GENERATOR
SIGNAL INPUT
NF-105
STEP ATTENUATOR
AT-103-B
0, 20, 40, 60 DB
Impulse Generator
Signal Input
From Antenna
SWITCHING UNIT
SU-105
Impulse Generator
Signal Input
From Antenna
Bolometer
Power Meter
SIGNAL GENERATOR



CONVERSION CHART

FIELD STRENGTH to POWER DENSITY

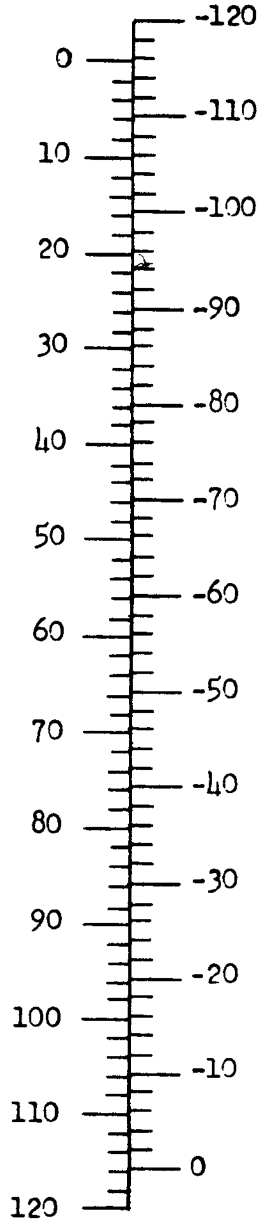
-- Microvolts Per Meter to Watts Per Square Meter

Field Strength

in

DB Above 1 Microvolt

Per Meter



Power Density

in

DBM Per Square Meter

CONVERSION CHART

FIELD STRENGTH to POWER DENSITY

-- DB Above 1 Microvolt Per Meter to DBM Per Square Meter

462-A

PARTS LIST FOR

NOISE AND FIELD INTENSITY METER MODEL NF-105

For simplicity the designation of the main components in the following list is shown in abbreviated form; thus BA-105 is BA, T-1/NF-105 is T1, etc., see List of Components, Par. 4.

I. CAPACITORS

Ref. Symbol	Description	Part of
C2	1.5-7 mmf, ceramic trimmer	R.F. Tuner, T2
C3	3-30 mmf, Hammarlund VU-30	"
C4	.5 mmf, 10%, 300 V, ceramic	"
C5	3-30 mmf,	"
C6	.47 mf, 20%, 400 V, metal tubular	Power Supply, BA
C7	180 mmf, 10%, 300 V, button mica	R.F. Tuner, T2
C8	3-12 mmf, ceramic trimmer	"
C9	100 mmf, 10%, 300 V, mica	"
C10	100 mmf, 10%, 300 V, button mica	"
C11	3-30 mmf,	"
C12	3-12 mmf, ceramic trimmer	"
C13	500 mmf, 10%, 300 V, button mica	"
C14	500 mmf, 10%, 300 V, button mica	"
C15	500 mmf, 10%, 300 V, button mica	"
C16	1000 mmf, 10%, 300 V, button mica	"
C17	500 mmf, 10%, 300 V, button mica	"
C18	500 mmf, 10%, 300 V, button mica	"
C19	1000 mmf, 10%, 300 V, ceramic	30 MC I.F. Amplifier, T2
C20	1.5-7 mmf, ceramic trimmer	R.F. Tuner, T2
C24	1000 mmf, 20%, 300 V, ceramic	30 MC I.F. Amplifier, T2
C25	5000 mmf, 20%, 300 V, ceramic	"
C26	1000 mmf, 20%, 300 V, ceramic	"
C27	1000 mmf, 20%, 300 V, mica	R. F. Tuner, T1
C28	500 mmf, 10%, 300 V, button ceramic	30 MC I.F. Amplifier, T2
C29	50 mmf, 10%, 300 V, ceramic feed-thru	"
C30	50 mmf, 10%, 300 V, ceramic feed-thru	"
C31	1000 mmf, 20%, 300 V, ceramic	"
C32	1000 mmf, 20%, 300 V, ceramic	"
C33	1000 mmf, 20%, 300 V, ceramic	"
C34	500 mmf, 10%, 300 V, button ceramic	"
C35	500 mmf, 10%, 300 V, button ceramic	"
C38	5000 mmf, 20%, 300 V, ceramic	"
C39	1000 mmf, 20%, 300 V, ceramic	"
C40	500 mmf, 10%, 300 V, button ceramic	"
C41	500 mmf, 10%, 300 V, button ceramic	"
C43	1000 mmf, 20%, 300 V, ceramic	"
C44	5000 mmf, 20%, 300 V, ceramic	"
C45	1000 mmf, 20%, 300 V, ceramic	"
C46	500 mmf, 300 V, 10%, button mica	"
C47	500 mmf, 10%, 300 V, button ceramic	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C48	1000 mmf, 20%, 300 V, ceramic	30 MC I.F. Amplifier, T2
C49	2000 mmf, 10%, 300 V, button mica	"
C50	500 mmf, 10%, 300 V, button ceramic	"
C51	1000 mmf, 20%, 300 V, ceramic	"
C52	500 mmf, 10%, 300 V, button ceramic	"
C53	500 mmf, 10%, 300 V, button ceramic	"
C54	500 mmf, 10%, 300 V, button ceramic	"
C55	500 mmf, 10%, 300 V, button ceramic	"
C57	5 mmf, 10%, 300 V, ceramic	R.F. Tuner, T1
C58	33 mmf, 5%, 300 V, ceramic	"
C59	33 mmf, 5%, 300 V, ceramic	"
C60	3-12 mmf, ceramic trimmer	"
C61	1000 mmf, 20%, 300 V, ceramic	"
C62	1000 mmf, 20%, 300 V, ceramic	"
C63	1000 mmf, 20%, 300 V, ceramic	"
C64	10,000 mmf, 20%, 300 V, ceramic	"
C65	33 mmf, 5%, 300 V, ceramic	"
C66	33 mmf, 5%, 300 V, ceramic	"
C67	3-12 mmf, ceramic trimmer	"
C68	82 mmf, 5%, silver mica	"
C69	1000 mmf, 20%, 300 V, ceramic	"
C70	1000 mmf, 20%, 300 V, ceramic	"
C71	1000 mmf, 20%, 300 V, ceramic	"
C72	10,000 mmf, 20%, 300 V, ceramic	"
C73	33 mmf, 5%, 300 V, ceramic	"
C74	33 mmf, 5%, 300 V, ceramic	"
C75	82 mmf, 5%, 300 V, silver mica	"
C76	500 mmf, 10%, 300 V, button mica	"
C77	100 mmf, 20%, 300 V, ceramic	"
C78	5 mmf, 10%, 300 V, ceramic	"
C79	3-12 mmf, ceramic trimmer	"
C80	1000 mmf, 20%, 300 V, ceramic	"
C81	22 mmf, 10%, 300 V, ceramic	"
C82	33 mmf, 5%, 300 V, ceramic	"
C83	15 mmf, 5%, 300 V, ceramic	"
C84	3-12 mmf, ceramic trimmer	"
C85	100 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C86	500 mmf, 10%, 300 V, button mica	R.F. Tuner, T1
C87	1000 mmf, 20%, 300 V, ceramic	"
C88	1000 mmf, 20%, 300 V, ceramic	"
C89	1000 mmf, 20%, 300 V, ceramic	"
C90	500 mmf, 10%, 300 V, button mica	"
C91	500 mmf, 10%, 300 V, button mica	"
C92	1000 mmf, 20%, 300 V, mica	"
C93	1000 mmf, 20%, 300 V, mica	"
C94	1000 mmf, 20%, 300 V, ceramic	"
C95	3 mmf, 10%, 300 V, ceramic	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C96	1.5-7 mmf, ceramic trimmer	R.F. Tuner, T1
C97	1000 mmf, 20%, 300 V, mica	"
C98	1000 mmf, 20%, 300 V, mica	"
C99	1000 mmf, 20%, 300 V, mica	"
C100	1000 mmf, 10%, 300 V, button mica	"
C101	1.5-7 mmf, ceramic trimmer	"
C102	5 mmf, 10%, 300 V, ceramic	"
C104	100 mmf, 20%, 300 V, ceramic	10.7 MC, I.F. Amplifier, T1
C105	2 mmf, 20%, 300 V, ceramic	R.F. Tuner, T1
C106	1000 mmf, 20%, 300 V, mica	"
C107	1000 mmf, 20%, 300 V, mica	"
C108	1000 mmf, 10%, 300 V, button mica	"
C109	1.5-7 mmf, ceramic trimmer	"
C110	500 mmf, 10%, 300 V, button mica	"
C111	2 mmf, 5%, 300 V, ceramic	"
C113	1000 mmf, 20%, 300 V, ceramic	"
C114	1000 mmf, 10%, 300 V, button mica	"
C115	15 mmf, 5%, 300 V, ceramic	"
C116	5 mmf, 10%, 300 V, ceramic	"
C117	1.5-7 mmf, ceramic trimmer	"
C120	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C121	1000 mmf, 20%, 300 V, ceramic	"
C123	1000 mmf, 20%, 300 V, ceramic	"
C124	500 mmf, 10%, 300 V, ceramic feed-thru	"
C125	500 mmf, 300 V, 10%, ceramic	"
C127	1000 mmf, 20%, 300 V, ceramic	"
C128	500 mmf, 10%, 300 V, ceramic feed-thru	"
C129	1000 mmf, 20%, 300 V, ceramic	"
C130	1000 mmf, 20%, 300 V, ceramic	"
C131	500 mmf, 10%, 300 V, button mica	R.F. Tuner, T1
C132	500 mmf, 10%, 300 V, button mica	"
C133	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C134	500 mmf, 10%, 300 V, button ceramic	"
C135	500 mmf, 10%, 300 V, button ceramic	"
C136	500 mmf, 10%, 300 V, button ceramic	"
C137	1000 mmf, 20%, 300 V, ceramic	"
C138	10,000 mmf, 20%, 300 V, ceramic	"
C139	10,000 mmf, 20%, 300 V, ceramic	R.F. Tuner, T1
C140	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C141	2000 mmf, 10%, 300 V, button mica	"
C142	1000 mmf, 20%, 300 V, ceramic	"
C143	500 mmf, 10%, 300 V, button ceramic	"
C144	500 mmf, 10%, 300 V, button ceramic	"
C145	10,000 mmf, 20%, 300 V, ceramic	"
C146	500 mmf, 10%, 300 V, button ceramic	"
C147	500 mmf, 10%, 300 V, button ceramic	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C148	500 mmf, 10%, 300 V, button ceramic	10.7 MC I.F. Amplifier, T1
C149	200 mmf, 5%, 300 V, silver mica	2nd Detector, BA
C150	200 mmf, 5%, 300 V, silver mica	"
C151	1000 mmf, 5%, 300 V, silver mica	"
C152	100 mmf, 5%, 300 V, silver mica	"
C153	100 mmf, 5%, 300 V, silver mica	"
C154	1000 mmf, 20%, 300 V, ceramic	VTVM, BA
C155	1000 mmf, 20%, 300 V, ceramic	"
C156	1000 mmf, 20%, 300 V, ceramic, stand off	2nd Detector, BA
C157	100 mmf, 20%, 300 V, ceramic, stand off	"
C158	0.5 mf, 20%, 600 V, oil filled	"
C159	10,000 mmf, 20%, 300 V, ceramic	"
C160	1000 mmf, 20%, 300 V, ceramic	Audio Amplifier, BA
C161	10,000 mmf, 20%, 300 V, ceramic	"
C162	250 mmf, 10%, 300 V, mica	"
C163	50 mf, 25 V, electrolytic	"
C164	10,000 mmf, 20%, 300 V, ceramic	"C" Bias, BA
C165	500 mmf, 10%, 300 V, button mica	Sine Wave Oscillator, BA
C166	500 mmf, 10%, 300 V, button mica	"
C167	2000 mmf, 10%, 300 V, button mica	"
C168	500 mmf, 10%, 300 V, button mica	"
C169	500 mmf, 10%, 300 V, button mica	"
C170	500 mmf, 10%, 300 V, button mica	"
C171	500 mmf, 10%, 300 V, button mica	"
C173	500 mmf, 10%, 300 V, button mica	"
C174	500 mmf, 10%, 300 V, button mica	"
C175	500 mmf, 10%, 300 V, button mica	"
C176	500 mmf, 10%, 300 V, button mica	"
C177	3-12 mmf, ceramic trimmer	"
C178	50 mmf, 5%, 300 V, ceramic	"
C179	25 mmf, 5%, 300 V, ceramic	"
C180	15 mmf, 5%, 300 V, ceramic	"
C181	10 mmf, 5%, 300 V, ceramic	"
C182	15 mmf, 5%, 300 V, ceramic	"
C183	10,000 mmf, 300 V, mica } matched to	Impulse Generator, P.R.R.,BA
C184	10,000 mmf, 300 V, mica } 20,000 mmf, 2%	"
C185	2000 mmf, 2%, 300 V, silver mica	"
C186	180 mmf, 2%, 300 V, silver mica	"
C187	4-30 mmf, ceramic trimmer	"
C188	10,000 mmf, 300 V, mica } matched to	"
C189	10,000 mmf, 300 V, mica } 20,000 mmf, 2%	"
C190	2000 mmf, 2%, 300 V, silver mica	"
C191	180 mmf, 2%, 300 V, silver mica	"
C192	10,000 mmf, 20%, GMV, ceramic	Power Supply, BA
C193	10,000 mmf, 20%, GMV, ceramic	"
C194	50 mf, 250 V, electrolytic	"

I. CAPACITORS continued

Ref. Symbol	Description	Part of
C195	35 mf, 400 V, electrolytic	Power Supply, BA
C196	35 mf, 400 V, electrolytic	"
C197	35 mf, 400 V, electrolytic	"
C198	35 mf, 400 V, electrolytic	"
C199	50 mf, 250 V, electrolytic	"
C200	50 mf, 250 V, electrolytic	"
C201	35 mf, 400 V, electrolytic	"
C202	35 mf, 400 V, electrolytic	"
C203	2 mf, 20%, 600 V, oil filled	Impulse Generator P.R.R., BA
C204	2 mf, 20%, 600 V, oil filled	"
C206	100 mmf, 5%, 300 V, silver mica	Audio Detector, BA
C207	55 mmf, 10%, 300 V, ceramic	Impulse Generator, BA
C208	50 mmf, 10%, 300 V, ceramic	Audio Detector, BA
C210	1000 mmf, 20%, 300 V, ceramic	Meter Detector Filament, BA
C211	1000 mmf, 20%, 300 V, ceramic	VTVM Filament, BA
C212	1000 mmf, 20%, 2500 V, ceramic	Line Probe, 500 ohms, LH
C213	1000 mmf, 20%, 2500 V, ceramic	"
C214	1000 mmf, 20%, 2500 V, ceramic	"
C215	1000 mmf, 20%, 2500 V, ceramic	Line Probe, 50 ohms, LL
C216	1000 mmf, 20%, 2500 V, ceramic	"
C217	1000 mmf, 20%, 2500 V, ceramic	"
C218	500 mmf, 10%, 300 V, button mica	R.F. Tuner, T2
C219	1000 mmf, 20%, 300 V, ceramic	Impulse generator P.R.R.,BA
C220	1000 mmf, 20%, 300 V, ceramic	"
C221	1000 mmf, 20%, 300 V, ceramic	10.7 MC I.F. Amplifier, T1
C222	500 mmf, 10%, 300 V, button mica	"
C223	5 mmf, 10%, 300 V, ceramic	Test Harness, AH
C224	1000 mmf, 20%, 300 V, ceramic	"
C225	1000 mmf, ceramic button	10.7 MC I.F. Amplifier, T1
C226	1000 mmf, ceramic button	"
C227	10,000 mmf, ceramic button	P.R.R. Impulse Generator, BA
C228	10,000 mmf, ceramic button	"
C229	5 mmf, ceramic button	30 MC I.F. Amplifier, T2
C601	2 mmf, 5%, 300 V, ceramic	R.F. Tuner, T3
C602	2 mmf, 5%, 300 V ceramic	"
C603	500 mmf, GMV, 300 V, feed-thru ceramic	"
C604	500 mmf, GMV, 300 V, feed-thru ceramic	"
C605A	Tuning, Air	"
C605B	Tuning, Air	"
C605C	Tuning, Air	"
C605D	Tuning, Air	"
C606	20 mmf, 5%, 300 V, ceramic	"
C607	500 mmf, GMV, 300 V, feed-thru ceramic	"
C608	500 mmf, GMV, 300 V, feed-thru ceramic	"

1. CAPACITORS continued

Ref. Symbol	Description	Part of
C609	1 mmf, 500 V, ceramic	R.F. Tuner, T3
C610	500 mmf, GMV, 300 V, feed-thru ceramic	"
C611	500 mmf, GMV, 300 V, feed-thru ceramic	"
C612	2 mmf, 5%, 300 V, ceramic	"
C613	2 mmf, 5%, 300 V, ceramic	"
C614	500 mmf, GMV, 300 V, button mica	"
C615	500 mmf, GMV, 300 V, button mica	"
C616	500 mmf, GMV, 300 V, button mica	"
C617	500 mmf, GMV, 300 V, feed-thru ceramic	"
C618	20 mmf, 5%, 300 V, ceramic	"
C619	.68 mmf, 500 V, ceramic	"
C620	500 mmf, GMV, 300 V, ceramic feed-thru	"
C621	500 mmf, GMV, 300 V, feed-thru ceramic	"
C622	5 mmf, 20%, 300 V, ceramic	42 MC Cascode, T3
C623	1000 mmf, 5%, 300 V, ceramic	"
C624	1000 mmf, 20% 300 V, ceramic	"
C625	1000 mmf, 20%, 300 V, ceramic button	"
C626	500 mmf, 10%, 300 V, ceramic	"
C627	22 mmf, 20%, 300 V, ceramic	"
C628	1000 mmf, 20%, 300V, ceramic feed-thru	R.F. Tuner, T3
C629	1000 mmf, 20%, 300 V, ceramic feed-thru	"
C630	3 mmf, 0.5%, 300 V, ceramic N750	42 MC I.F.Amplifier,T3
C633	1000 mmf, 20%, 300 V, ceramic button	42 MC Cascode, T3
C635	500 mmf, 10%, 300 V, button ceramic	"
C636	500 mmf, 10%, 300 V, button ceramic	"
C637	500 mmf, 10%, 300 V, ceramic feed-thru	"
C648	1000 mmf, 20%, 300 V, ceramic	42 MC I.F.Amplifier,T3
C649	1000 mmf, 10%, 300 V, button mica	"
C650	1000 mmf, 20%, 300 V, ceramic	"
C651	22 mmf, 20%, 300 V, ceramic	"
C652	1000 mmf, 10%, 300 V, ceramic	"
C654	1000 mmf, 20%, 300 V, ceramic	"
C655	1000 mmf, 10%, 300 V, ceramic	"
C656	22 mmf, 10%, 300 V, ceramic	"
C657	1000 mmf, 20%, 300 V, ceramic	"
C658	1000 mmf, 20%, 300 V, ceramic	"
C659	1000 mmf, 20%, 300 V, ceramic	"
C660	1000 mmf, 10%, 300 V, ceramic	"
C661	1000 mmf, 20%, 300 V, ceramic	"
C662	22 mmf, 20%, 300 V, ceramic	"
C663	1000 mmf, 10%, 300 V, ceramic	"
C664	1000 mmf, 20%, 300 V, ceramic	"
C665	1000 mmf, 10%, 300 V, ceramic	"
C666	1000 mmf, 20%, 300 V, ceramic	"
C668	1000 mmf, 10%, 300 V, ceramic	"
C669	15 mmf, 20%, 300 V, ceramic	"
C670	1000 mmf, 20%, 300 V, ceramic	"
C672	1000 mmf, 20%, 300 V, ceramic feed-thru	"

I. CAPACITORS continued

Ref. Symbol	DESCRIPTION	Part of
C673	1000 mmf, 10%, 300 V, ceramic	42 MC I.F.Amplifier,T3
C674	500 mmf, 20%, 300 V, ceramic button	"
C675	1000 mmf, 20%, 300 V, ceramic feed-thru	"
C676	500 mmf, 10%, 300 V, ceramic feed-thru	"
C677	500 mmf, 20%, 300 V, ceramic	"
C678	500 mmf, 10%, 300 V, ceramic	"
C679	500 mmf, 20%, 300 V, ceramic button	"
C680	1000 mmf, 10%, 300 V, ceramic	"
C681	1000 mmf, 300 V, ceramic feed-thru	"
C682	1000 mmf, 300 V, ceramic	"
C683	1000 mmf, 20%, 300 V, ceramic	"
C684	1000 mmf, 20%, 300 V, ceramic feed-thru	"
C685	1000 mmf, 300 V, ceramic	"
C686	1000 mmf, 10%, 300 V, ceramic feed-thru	"
C687	1000 mmf, 10%, 300 V, ceramic	"
C688	1000 mmf, 300 V, ceramic	"
C689	1000 mmf, 300 V, ceramic	"
C696	2000 mmf, 20%, 300 V, button mica	"
C697	500 mmf, GMV, 300 V, feed-thru ceramic	R.F. Tuner, T3
C698	500 mmf, GMV, 300 V, feed-thru ceramic	"
C699A	Tuning, Air	"
C699B	Tuning, Air	"
C699C	Tuning, Air	"
C699D	Tuning, Air	"

II. FILTERS

Ref. Symbol	Description	Part of
F1	Filter, Ext. meter; B-4465	External meter circuit
F2	Filter, phones; B-4464	Audio output, BA
F3	Filter cartridge consisting of an iron core choke of #22 P.E. wire by-passed by two .002 MFD, 300 V capacitors	VR cage, BA
F4	Filter, line; B-4186	Power supply, BA
F5	Filter cartridge consisting of an iron core choke of #22 P.E. wire by-passed by two .002 MFD, 300 V capacitors	VR cage, BA
F6	Same as F5	"
F7	Filter, cartridge; B-6933-1	Inverter, MO
F8	Filter, cartridge; B-6933-2	"

III. JACKS

Ref. Symbol	Description	Part of
J1	Phone Jack	Front Panel, BA
J2	Phone Jack	External Meter, BA
J7	UG-291/U	R.F. Tuner, T1
J8	UG-291/U	"
J10	UG-291/U	"
J11	UG-291/U	"
J79	IF Connector	"
J201	UG-291/U	R.F. Tuner, T2
J202	UG-291/U	"
J203	UG-291/U	"
J204	MX-1684/U	"
J205	MX-1684/U	"
J601	CBSN 1-310-1	R.F. Tuner, T3
J602	MX-1684/U	"
J603	MX-1684/U	"
J604	UG-291/U	"
J605	Connector, 15 Pin, Female	"
J606	CBSN 1-310-1	"
J607	UG535/U	"
J608	UG535/U	"

IV. INDUCTORS

Ref. Symbol	Description	Part of
L1	Antenna coupling	R.F. Tuner, T2
L2	Input tuning	"
L3	R.F. Plate	"
L4	Mixer pick-up	"
L5	Oscillator tank	"
L6A,B	Bifilar filament choke	"
L8	Filter choke	"
L9	Filter choke	"
L10	Filter choke	"
L11	Plate tuning	30 MC I.F. Amplifier, T2
L12	Filament choke	"
L13	Filament choke	"
L14	Filament choke	"
L15	Filament choke	"
L16	Cathode follower tuning	"
L17	Filament choke	R.F. Tuner, T2
L18	Filament choke	"
L19	Inductuner section	R.F. Tuner, T1
L20	End inductor	"
L21	Inductuner section	"
L22	End inductor	"
L23	Inductuner section	"
L24	End inductor	"
L25	Inductuner section	"
L26	End inductor	"
L27	Shunt inductor	"
L28	Filament choke	"
L30	Filament choke	"
L31	Shunt inductor	"
L32	Inductuner section	"
L33	End inductor	"
L34	Shunt inductor	"
L35	Inductuner section	"
L36	End inductor	"
L37	Shunt inductor	"
L38	Inductuner section	"
L39	End inductor	"
L40	Shunt inductor	"
L41	Inductuner section	"
L42	End inductor	"
L43	Filament choke	"
L45	Filament choke	"
L46	I.F. Plate tuning inductor	10.7 MC I.F. Amplifier, T1
L47	Cathode tuning inductor	"
L48	Filament choke	"
L49	Filament choke	"
L50	Filament choke	"

IV. INDUCTORS continued

Ref. Symbol	Description	Part of
L51	63 MC oscillator tank	Sine wave oscillator, BA
L52	215 MC oscillator tank	"
L53	63 MC pick-up coil	"
L54	215 MC pick-up coil	"
L55	Filament choke	"
L56	Filament choke	"
L57	Filament choke	"
L58	Driving coil assembly	Impulse Generator, BA
L59A,B	Dual filter choke	Power Supply, BA
L60	Choke, 3T, $\frac{1}{4}$ Dia.	R.F. Tuner, T2
L61	Filament choke	"
L62	Plate tuning	30 MC I.F. Amplifier, T2
L63	Filament choke	"
L64	Filament choke	Sine Wave Oscillator, BA
L65	Filament choke	"
L66	Iron core choke of #22 P.E. wire	"
L601	Cathode choke	R.F. Tuner, T3
L602	Plate choke	"
L603	Plate choke	"
L604	Filament choke	"
L605	Filament choke	"
L606	Filament choke	"
L608	Cathode choke	"
L609	Cathode choke	"
L610	Plate choke	"
L611	Plate choke	"
L612	Filament choke	"
L613	Filament choke	"
L614	Filament choke	"
L615	Filament choke	"
L617	Cathode choke	"
L618	Mixer coil	"
L619	Cascode input coil	42 MC Cascode, T3
L620	Neutralizing coil	"
L621A	Cathode choke	"
L622	Filament choke	"
L623	Plate coil	"
L624	Plate coil	42 MC I.F. Amplifier, T3
L625	Plate coil	"
L626	Plate coil	"
L627	Plate coil	"

IV. INDUCTORS continued

Ref. Symbol	Description	Part of
L628	Cathode Follower coil	42 MC I.F. Amplifier, T3
L629	Filament choke	"
L630	Filament choke	"
L632	Filament choke	"
L633	Filament choke	"
L634	Filament choke	R.F. Tuner, T3
L635	Cathode coil	42 MC I.F. Amplifier, T3
L637	Filament choke	"
L638	Filament choke	"
L640	Mixer coil	R.F. Tuner, T3
L643	Filament choke	"

V. PILOT LIGHTS

Ref. Symbol	Description	Part of
LP1	Lamp No. 47	R.F. Tuner, T2
LP2	Lamp No. 47	R.F. Tuner, T1
LP3	Lamp No. 47	"
LP4	Lamp No. 47	Pilot Light, BA
LP601	Lamp No. 47	R.F. Tuner, T3
LP602	Lamp No. 47	"

VI. METERS

Ref. Symbol	Description	Part of
M1	4.5" meter, 100 uA movement	Internal Meter, BA
M2	4.5" meter, 100 uA movement	External Meter, RE
M3	1.5" meter, 1 ma movement	DB Meter, BA

VII. INVERTER

Ref. Symbol	Description	Part of
MO1	DC Inverter, 115 V, 60 cycles output MO12-105 - 12 V DC input or MO24-105 - 24 V DC input	Inverter Unit, MO

VIII. CONNECTORS

Ref. Symbol	Description	Part of
P5	Connector, female; coaxial plug-in	30 MC I.F. Amplifier, T2
P6	Connector; 15 pin, female	R.F. Tuner, T2
P8	UG-88/U	R.F. Tuner, T1
P11	UG-88/U	"
P13	Connector, female; coaxial plug-in	"
P14	Connector; 15 pin, female	"
P15	Connector coaxial	2nd Detectors, BA
P16	Connector; 15 pin, male	R.F. Head Power Conn.,BA
P17	AN-3102-14S-2S (external meter)	Front Panel, BA
P18	AN-3106-14S-2P	Meter Cable, BA
P19	AN-3106-14S-2S	"
P20	AN-3102-14S-2P	External Meter, RE
P21	AN-3102-14S-1P	Power Supply, BA
P22	AN-3106-14S-1S	AC Power Cable, BA
P23	Plug; AC, Parallel blades	"
P24	2 pole universal receptacle	Inverter Unit, MO
P25	AN-3102-16-11P	"
P26	AN-3106-16-11S	DC Power Cable, DC
P27	UG-290/U	Sine Wave Oscillator, BA
P28	UG-88/U	"
P29	UG-291/U	"
P30	Special, Type N	Impulse Gen. Attenuator,BA
P31	MS-2012	"
P32	UG-291/U	"

VIII.CONNECTORS continued

Ref. Symbol	Description	Part of
P33	UG-90/U mod. Part #2031	Impulse Gen. Attenuator, BA
P34	UG-90/U mod.fPart #2031	"
P35	Part #2021	"
P36	Part #2021	"
P37	Part #2021	"
P38	Part #6722	"
P39	Part #6722	"
P40	Part #6722	"
P41	Part #6722	"
P42	Part #6722	"
P43	Part #6722	"
P44	Part #6722	"
P45	UG-291/U	Signal Attenuator, BA
P46	UG-90/U mod. Part #2031	"
P47	UG-291/U	"
P48	UG-90/U mod. Part #2031	"
P49	UG-88/U	R.F. Patch Cord, BA
P50	UG-88/U	"
P51	Part #2021	Signal Attenuator, BA
P52	Part #2021	"
P53	Part #2021	"
P54	Part #2021	"
P55	Part #6722	"
P56	Part #6722	"
P57	Part #6722	"
P58	Part #6722	"
P59	Part #6722	"
P60	Part #6722	"
P64	UG-536A/U	Injection Block, UN
P65	UG-291/U Modified	"
P66	8139	"
P67	UG-23/U	Broad Band Antenna, BB
P68	UG-625/U	Magnetic Probe, MP
P69	UG-290/U	50 ohm Line Probe, LL
P70	UG-290/U	500 ohm Line Probe, LH
P71	UG-625/U	Electric Field Probe, EF
P72	UG-625/U	Dipole Antenna, DM
P73	UG-291/U	R.F. Tuner. T2
P74	UG-88/U	R.F. Cable, CB
P75	UG-88/U	R.F. Cable, CB
P76	UG-88/U	"
P77	UG-88/U	"
P79	Connector, Female	R.F. Tuner, T1
P80	Connector, female; coaxial plug-in	Test Harness, AH

VIII. CONNECTORS continued

Ref. Symbol	Description	Part of
P81	Connector; 15 pin, female	Test Harness, AH
P82	Connector- COAX	"
P83	Connector; 15 pin, male	"
P84	Part#6722	Impulse Gen.Attenautor,BA
P85	Part#6722	"
P202	UG-88/U	R.F. Tuner, T2
P203	UG-88/U	30 MC I.F. Amplifier, T2
P204	UG-88/U	R.F. Tuner, T2
P205	UG-88/U	"
P601	CBSN 5276-1	R.F. Tuner, T3
P602	CBSN 5276-1	"
P605	Connector, female; coaxial plug-in	42 MC I.F. Amplifier,T3
P607	UG-88/U	R.F. Tuner, T3
P608	UG-88/U	"

IX. RESISTORS

Ref. Symbol	Description	Part of
R4	47 ohms, 10%, ½W, carbon	R.F. Tuner, T2
R6	470 ohms, 10%, ½W, carbon	"
R7	100K ohms, 10%, ½W, carbon	30 MC I.F. Amplifier, T2
R8	47 ohms, 10%, ½W, carbon	"
R9	100 ohms, 10%, ½W, carbon	R.F. Tuner, T2
R10	47 ohms, 10%, ½W, carbon	"
R11	20K ohms, 10%, 10W, wire wound	"
R12	10K ohms, 10%, ½W, carbon	"
R13	220 ohms, 10%, ½W, carbon	30 MC I.F. Amplifier, T2
R14	2.7K ohms, 10%, ½W, carbon	"
R15	330K ohms, 10%, ½W, carbon	"
R16	100 ohms, 10%, ½W, carbon	"
R17	150 ohms, 10%, ½W, carbon	"
R19	47K ohms, 10%, ½W, carbon	"
R20	330K ohms, 10%, ½W, carbon	"
R21	220 ohms, 10%, ½W, carbon	"
R22	150 ohms, 10%, ½W, carbon	"
R23	2.7K ohms, 10%, ½W, carbon	"
R24	150 ohms, 10%, ½W, carbon	"
R25	220 ohms, 10%, ½W, carbon	"
R26	150 ohms, 10%, ½W, carbon	"
R27	270 ohms, 10%, ½W, carbon	"
R28	100K ohms, 10%, ½W, carbon	"
R29	220 ohms, 10%, ½W, carbon	"
R31	150 ohms, 10%, ½W, carbon	"
R32	220 ohms, 10%, ½W, carbon	R.F. Tuner, T1
R33	47 ohms, 5%, ½W, carbon	"
R34	27K ohms, 10%, ½W, carbon	"
R35	220 ohms, 10%, ½W, carbon	"
R36	2.7K ohms, 10%, ½W, carbon	"
R37	27K ohms, 10%, ½W, carbon	"
R38	390 ohms, 10%, ½W, carbon	"
R39	27K ohms, 10%, ½W, carbon	"
R40	100 ohms, 10%, ½W, carbon	"
R41	2.7K ohms, 10%, ½W, carbon	"
R42	100 ohms, 10%, ½W, carbon	"
R43	27K ohms, 10%, ½W, carbon	"
R44	150 ohms, 10%, ½W, carbon	"
R45	47 ohms, 10%, ½W, carbon	"
R46	1K ohms, 10%, ½W, carbon	"
R47	10K ohms, 10%, ½W, carbon	"
R48	5.6K ohms, 10%, 2W, carbon	"
R50	5K ohms, potentiometer	"
R51	220 ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R52	50 ohms, 5%, ½W, disc-type D343	R.F. Tuner, T1
R53	47K ohms, 10%, ½W, carbon	"
R54	220 ohms, 10%, ½W, carbon	"
R55	100 ohms, 10%, ½W, carbon	"
R57	100 ohms, 10%, ½W, carbon	"
R58	27K ohms, 10%, ½W, carbon	"
R59	220 ohms, 10%, ½W, carbon	"
R60	22K ohms, 10%, ½W, carbon	"
R61	10 ohms, 10%, ½W, carbon	"
R62	47 ohms, 10%, ½W, carbon	"
R63	100 ohms, 10%, ½W, carbon	"
R64	27K ohms, 10%, ½W, carbon	"
R65	10K ohms, 10%, ½W, carbon	"
R66	22K ohms, 10%, ½W, carbon	"
R67	10K ohms, 10%, ½W, carbon	"
R69	5.6K ohms, 10%, 2W, carbon	"
R70	150 ohms, 10%, ½W, carbon	"
R71	100K ohms, 10%, ½W, carbon	Meter Detector, BA
R72	220K ohms, 10%, ½W, carbon	"
R73	47K ohms, 10%, ½W, carbon	"
R74	220K ohms, 10%, ½W, carbon	"
R75	2.2M ohms, 10%, ½W, carbon	Sine Wave Oscillator, BA
R76	220K ohms, 10%, ½W, carbon	Audio Detector, BA
R77	22K ohms, 10%, ½W, carbon	"
R78	47K ohms, 10%, ½W, carbon	"
R79	22K ohms, 10%, ½W, carbon	"
R80	50K ohms, potentiometer	Slideback, BA
R81	25K ohms, potentiometer	Volume, BA
R82	100K ohms, 10%, ½W, carbon	Audio Amplifier, BA
R83	1K ohms, 10%, ½W, carbon	"
R84	470K ohms, 10%, ½W, carbon	"
R85	270 ohms, 10%, ½W, carbon	"
R86	50M ohms, 1%, 1W, precision	VTVM, BA
R87	1K ohms, 10%, ½W, carbon	"
R88	390 ohms, 10%, ½W, carbon	"
R89	47K ohms, 10%, 2W, carbon	"
R90	10K ohms, potentiometer	Meter Balance, BA
R91	1K ohms, 10%, ½W, carbon	VTVM, BA
R92	47K ohms, 10%, 2W, carbon	"
R93	1K ohms, 10%, ½W, carbon	"
R94	4.2K ohms, 1%, ½W, precision	"
R95	20.5K ohms, 1%, ½W, precision	"
R95A	1.8K ohms, 1%, ½W, precision	"
R96	54K ohms, 1%, ½W, precision	"
R97	166K ohms, 1%, ½W, precision	"
R98	150K ohms, 10%, ½W, carbon	"
R99	2.5K ohms, potentiometer	Zero Adjust, BA

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R100	10K ohms, potentiometer	Oscillator Zero, BA
R101	10K ohms, potentiometer	Carrier Zero, BA
R102	47K ohms, 10%, 2W, carbon	Sine Wave Oscillator, BA
R103	330K ohms, 10%, ½W, carbon	VTVM, BA
R104	220K ohms, 10%, ½W, carbon	Gain Control Circuit, BA
R105	25K ohms, potentiometer	"
R106	100K ohms, 10%, ½W, carbon	"
R107	220K ohms, 10%, ½W, carbon	Sine Wave Oscillator, BA
R108	220K ohms, 10%, ½W, carbon	"
R109	680 ohms, 10%, ½W, carbon	"
R110	2.7K ohms, 10%, 2W, carbon	"
R111	680 ohms, 10%, ½W, carbon	"
R112	2.7K ohms, 2W, carbon, 10%	"
R113	220K ohms, 10%, ½W, carbon	"
R114	220K ohms, 10%, ½W, carbon	"
R115	2.2M ohms, 10%, ½W, carbon	"
R116	10K ohms, 10%, ½W, carbon	"
R117	22K ohms, 10%, ½W, carbon	"
R118	10K ohms, potentiometer	Oscillator Level, BA
R119	47K ohms, 10%, 2W, carbon	Sine Wave Oscillator, BA
R120	47K ohms, 10%, 2W, carbon	"
R121	430K ohms, 5%, ½W, carbon	Impulse Generator P.R.R.,BA
R122A,B	5M ohms, dual potentiometer	"
R123	47K ohms, 10%, ½W, carbon	"
R124	47K ohms, 10%, ½W, carbon	"
R125	430K ohms, 5%, ½W, carbon	"
R127	10K ohms, 10%, 1W, carbon	"
R128	4.7M ohms, 10%, ½W, carbon	"
R129	3.3K ohms, 10%, 1W, carbon	"
R130	4.7M ohms, 10%, ½W, carbon	"
R132	2.2M ohms, 10%, ½W, carbon	"
R133	1M ohms, 10%, ½W, carbon	"
R135	470 ohms, 10%, ½W, carbon	"
R136	10K ohms, 10%, 2W, carbon	"
R137	10K ohms, 10%, 2W, carbon	"
R138	20K ohms, potentiometer	Fine Contact Adjustment, BA
R139	10K ohms, 10%, 2W, carbon	Impulse Generator P.R.R.,BA
R140	10K ohms, 10%, 2W, carbon	"
R143	1M ohms, 10%, ½W, carbon	"
R144	2.2M ohms, 10%, ½W, carbon	"
R145	470 ohms, 10%, ½W, carbon	"
R146	10 ohms, 10%, ½W, disc - type D490	Impulse Generator, BA
R147	4.7M ohms, 10%, ½W, carbon	"
R149	2 ohms, 10%, WW, semi-variable, 10W	Power Supply, BA
R150	1.2K ohms, 10%, 1W, carbon	"
R152	1K ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R153	100 ohms, 10%, ½W, carbon	Power Supply, BA
R154	47 ohms, 10%, ½W, carbon	Audio Amplifier, BA
R155	2.2K ohms, 10%, 2W, Carbon (2 ea.in par.)	Power Supply, BA
R156	1.2K ohms, 10%, 1W, carbon	"
R157	2.2K ohms, 10%, 2W, carbon	"
R158	100 ohms, 10%, ½W, carbon	"
R159	4.7K ohms, 10%, ½W, carbon	"
R160	10K ohms, 10%, 25W, wire wound	"
R161	390K ohms, 10%, 1W, carbon	"
R162	10K ohms, 10%, ½W, carbon	Impulse Generator, BA
R163	100K ohms, potentiometer	Add to Imp.Gen.Output, BA
R164	300K ohms, 1%, 1W, Prec. resistor	Impulse Generator, BA
R168	15K ohms, 5%, compensating	Voltage Regulator, BA
R169	7.5Kohms, 10%, 2W, carbon	"
R170	5K ohms, potentiometer	VR Adjust, BA
R171	150 ohms, 10%, ½W, carbon	30 MC I.F. Amplifier, T2
R172	1K ohms, 10%, ½W, carbon	R.F. Tuner, T1
R173	100 ohms, 10%, ½W, carbon	10.7 MC I.F. Amplifier, T1
R174	2.7K ohms, 10%, ½W, carbon	"
R175	150 ohms, 10%, ½W, carbon	"
R176	330K ohms, 10%, ½W, carbon	"
R177	47K ohms, 10%, ½W, carbon	"
R178	100 ohms, 10%, ½W, carbon	"
R179	2.7K ohms, 10%, ½W, carbon	"
R180	330K ohms, 10%, ½W, carbon	"
R181	150 ohms, 10%, ½W, carbon	"
R182	100 ohms, 10%, ½W, carbon	"
R183	2.7K ohms, 10%, ½W, carbon	"
R184	100K ohms, 10%, ½W, carbon	"
R185	220 ohms, 10%, ½W, carbon	"
R186	150 ohms, 10%, ½W, carbon	"
R187	150 ohms, 10%, ½W, carbon	"
R188	150 ohms, 10%, ½W, carbon	"
R189	25.96 ohms, 2%, ½W, Rod	Signal Attenuator, BA
R190	35.14 ohms, 1%, ½W, disc	"
R191	25.96 ohms, 2%, ½W, Rod	"
R192	25.96 ohms, 2%, ½W, Rod	"
R193	35.14 ohms, 1%, ½W, disc	"
R194	25.96 ohms, 2%, ½W, Rod	"
R195	40.91 ohms, 2%, ½W, Rod	"
R196	10.1 ohms, 1%, ½W, disc	"
R197	40.91 ohms, 2%, ½W, Rod	"
R198	40.91 ohms, 2%, ½W, Rod	"
R199	10.1 ohms, 1%, ½W, disc	"
R200	40.91 ohms, 2%, ½W, Rod	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R201	46.93 ohms, 2%, ½W, Rod	Signal Attenuator, BA
R202	3.17 ohms, 1%, ½W, disc	"
R203	46.93 ohms, 2%, ½W, Rod	"
R204	46.93 ohms, 2%, ½W, Rod	"
R205	3.17 ohms, 1%, ½W, disc	"
R206	46.93 ohms, 2%, ½W, Rod	"
R207	25.96 ohms, 2%, ½W, Rod	Impulse Gen. Attenuator, BA
R208	35.14 ohms, 1%, ½W, disc	"
R209	25.96 ohms, 2%, ½W, Rod	"
R210	25.96 ohms, 2%, ½W, Rod	"
R211	35.14 ohms, 1%, ½W, disc	"
R212	25.96 ohms, 2%, ½W, Rod	"
R213	25.96 ohms, 2%, ½W, Rod	"
R214	35.14 ohms, 1%, ½W, disc	"
R215	25.96 ohms, 2%, ½W, Rod	"
R216	25.96 ohms, 2%, ½W, Rod	"
R217	35.14 ohms, 1%, ½W, disc	"
R218	25.96 ohms, 2%, ½W, Rod	"
R219	40.91 ohms, 2%, ½W, Rod	"
R220	10.1 ohms, 1%, ½W, disc	"
R221	40.91 ohms, 2%, ½W, Rod	"
R223	10.1 ohms, 1%, ½W, disc	"
R224	40.91 ohms, 2%, ½W, Rod	"
R225	40.91 ohms, 2%, ½W, Rod	"
R226	10.1 ohms, 1%, ½W, disc	"
R227	40.91 ohms, 2%, ½W, Rod	"
R228	50 ohms, 5%, ½W, carbon	Line Probe, LH
R229	450 ohms, 5%, ½W, carbon	"
R230	500 ohms, 5%, ½W, carbon	"
R231	45.0 ohms, 2%, ½W, Rod	Injection Block, UN
R232	5 ohms, 1%, ½W, disc	"
R233	45.0 ohms, 2%, ½W, Rod	"
R234	45.0 ohms, 2%, ½W, Rod	"
R235	5 ohms, 1%, ½W, disc	"
R236	44.68 ohms, 2%, ½W, Rod	Impulse Gen. Attenuator, BA
R237	5.64 ohms, 1%, ½W, disc	"
R238	44.68 ohms, 2%, ½W, Rod	"
R239	56 ohms, 10%, 2W, carbon	Power Supply, BA
R240	1M ohms, 10%, ½W, carbon	10.7 MC I.F. Amplifier, T1
R241	220K ohms, 10%, ½W, carbon	"
R242	100K ohms, 10%, ½W, carbon	"
R243	100K ohms, 10%, ½W, carbon	"
R244	2700 ohms, 10%, ½W, carbon	R.F. Tuner, T1
R245	2700 ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R246	100K ohms, 10%, ½W, carbon	Test Harness, AH
R247	2.5 Megohms, potentiometer	Sine Wave Oscillator, BA
R248	2.5 Megohms, potentiometer	"
R249	44.68 ohms, 2%, ½W, Rod	Impulse Gen. Attenuator, BA
R250	5.64 ohms, 1%, disc	"
R251	44.68 ohms, 2%, ½W, Rod	"
R252	40.91 ohms, 2%, ½W, Rod	"
R253	15K ohms, 10%, ½W, carbon	Impulse Generator P.R.R.,BA
R254	15K ohms, 10%, ½W, carbon	"
R255	10 ohms, 10%, ½W, A.B.	30 MC I.F. Amplifier, T2
R256	47K ohms, 10%, ½W, A.B.	"
R257	5 ohms, 5%, 10W, WW	Power Supply, BA
R258	20 ohms, 5%, 10W, WW	"
R259	50 ohms, 5%, 10W, WW	"
R260	75 ohms, 5%, 10W, WW	"
R261	125 ohms, 5%, 10W WW	"
R262	200 ohms,5%, 10W, WW	"
R263	225 ohms, 5%, 10W WW	"
R264	250 ohms, 5%, 10W,WW	"
R265	300 ohms, 5%, 10W,WW	"
R266	54 ohms, 5%, 10W, WW	"
R267	47 ohms, 10%, 1/2 W, Carbon	30 MC I.F.Amplifier, T2
R268	100K ohms, 10%, 1/2 W, Carbon	"
R269	2.7K ohms, 10%, 1/2 W, Carbon	"
R270	47 ohms, 10%, 1/2 W, carbon	R.F. Tuner, T2
R271	15K ohms, 10%, 1/2 W, carbon	Power supply, BA
R601	47 ohms, 10%, ½W, carbon	R.F. Tuner, T3
R602	1K ohms, 10%, ½W, carbon	"
R603	10K ohms, 10%, ½W, carbon	"
R604	2.2K ohms, 10%, 2W, carbon	"
R605	47 ohms, 10%, ½W, carbon	"
R606	1K ohms, 10%, ½W, carbon	"
R607	6.8K ohms, 10%, ½W, carbon	"
R609	10K ohms, 10%, 2W, carbon	"
R610	100 ohms, 10%, ½W, carbon	42 MQ Cascode, T3
R611	10 ohms, 10%, 1W, carbon	"
R612	270 ohms, 10%, ½W, carbon	"
R613	4.7K ohms, 10%, ½W, carbon	"
R620	4.7K ohms, 10%, ½W, carbon	"
R621	2.7K ohms, 10%, ½W, carbon	"
R623	4.7K ohms, 10%, ½W, carbon	42 MC I.F. Amplifier, T3
R624	390 ohms, 10%, ½W, carbon	"
R625	100K ohms, 10%, ½W, carbon	"
R628	4.7K ohms, 10%, ½W, carbon	"
R629	150 ohms, 10%, ½W, carbon	"

IX. RESISTORS continued

Ref. Symbol	Description	Part of
R630	390 ohms, 10%, ½ W, carbon	42 MC I.F. Amplifier, T3
R631	1K ohms, 10%, ½W, carbon	"
R633	10 ohms, 10%, ½ W, carbon	"
R634	150 ohms, 10%, ½W, carbon	"
R635	47K ohms, 10%, ½W, carbon	"
R637	4.7K ohms, 10%, ½W, carbon	"
R639	390 ohms, 10%, ½W, carbon	"
R640	4.7K ohms, 10%, ½W, carbon	"
R641	150 ohms, 10%, ½W, carbon	"
R642	390 ohms, 10%, ½W, carbon	"
R643	47 ohms, 10%, ½W, carbon	"
R644	10K ohms, 10%, ½W, carbon	"
R645	150 ohms, 10%, ½W, carbon	"
R646	47K ohms, 10% ½W, carbon	"
R647	220 ohms, 10%, ½W, carbon	"
R648	150 ohms, 10%, ½W, carbon	"
R649	47 ohms, 10%, ½W, carbon	"
R651	4.1K ohms, 10%, 2W, carbon	R.F. Tuner, T3
R653	150 ohms, 10%, ½W, carbon	42 MC I.F. Amplifier, T3
R654	10 ohms, 10%, ½W, carbon	"
R656	2.2K ohms, 10%, ½W, carbon	R.F. Tuner, T3
R657	1.3K ohms, 10%, ½W, carbon	"
R658	47 ohms, 10%, ½W, carbon	42 MC I.F. Amplifier, T3
R659	47 ohms, 10%, ½W, carbon	"

X. RELAYS

Ref. Symbol	Description	Part of
RE1	DPDT relay, 8800 ohm coil	Impulse Generator P.R.R., BA
RE2	Voltage Regulator	Power Supply, BA

XI. FUSES

Ref. Symbol	Description	Part of
RG1	1.6A "Slo-Blo" type 3AG	Power Supply, BA
RG2	15A type 3AG for 24 Volt	Inverter, MO
RG3	15A type 3AG for 24 volt	"
RG2	20A MDL for 12 Volt	"
RG3	20A MDL for 12 Volt	"

XII. SWITCHES

Ref. Symbol	Description	Part of
S1	Wafer switch, 4 PDT - band change	R.F. Tuner, T1
S2	Wafer switch, multiple-function	VTVM Circuit, BA
S3	Wafer switch, meter multiplier	"
S4	Toggle switch OFF-momentary ON ST42C	"
S5	Wafer switch, DP3T - P.R.R.	Impulse Gen. P.R.R., BA
S6	Wafer switch 3P3T	Imp.Gen.-Sine Wave Osc., BA
S7	Toggle switch, SPDT ST 42 D	Meter Circuit, BA
S8	Toggle switch, SPST ST 42 A	Power Supply, BA
S9	Toggle switch, DPST ST 52 K	Inverter, MO
S601	Wafer switch, DPDT - band change	R.F. Tuner, T3
S602		42 MC I.F. Amplifier, T3

XIII. TRANSFORMERS

Ref. Symbol	Description	Part of
T1	Line transformer	30 MC I.F. Amplifier, T2
T2	I.F. transformer	"
T3	I.F. transformer	"
T5	Line transformer	R.F. Tuner, T1
T6	Line transformer	"
T7	Line transformer	10.7 MC I.F. Amplifier, T1
T8	I.F. transformer	"
T9	I.F. transformer	"
T10	Audio output transformer	Audio Amplifier, BA
T11	Power transformer	Power Supply, BA

XIV. TUBES

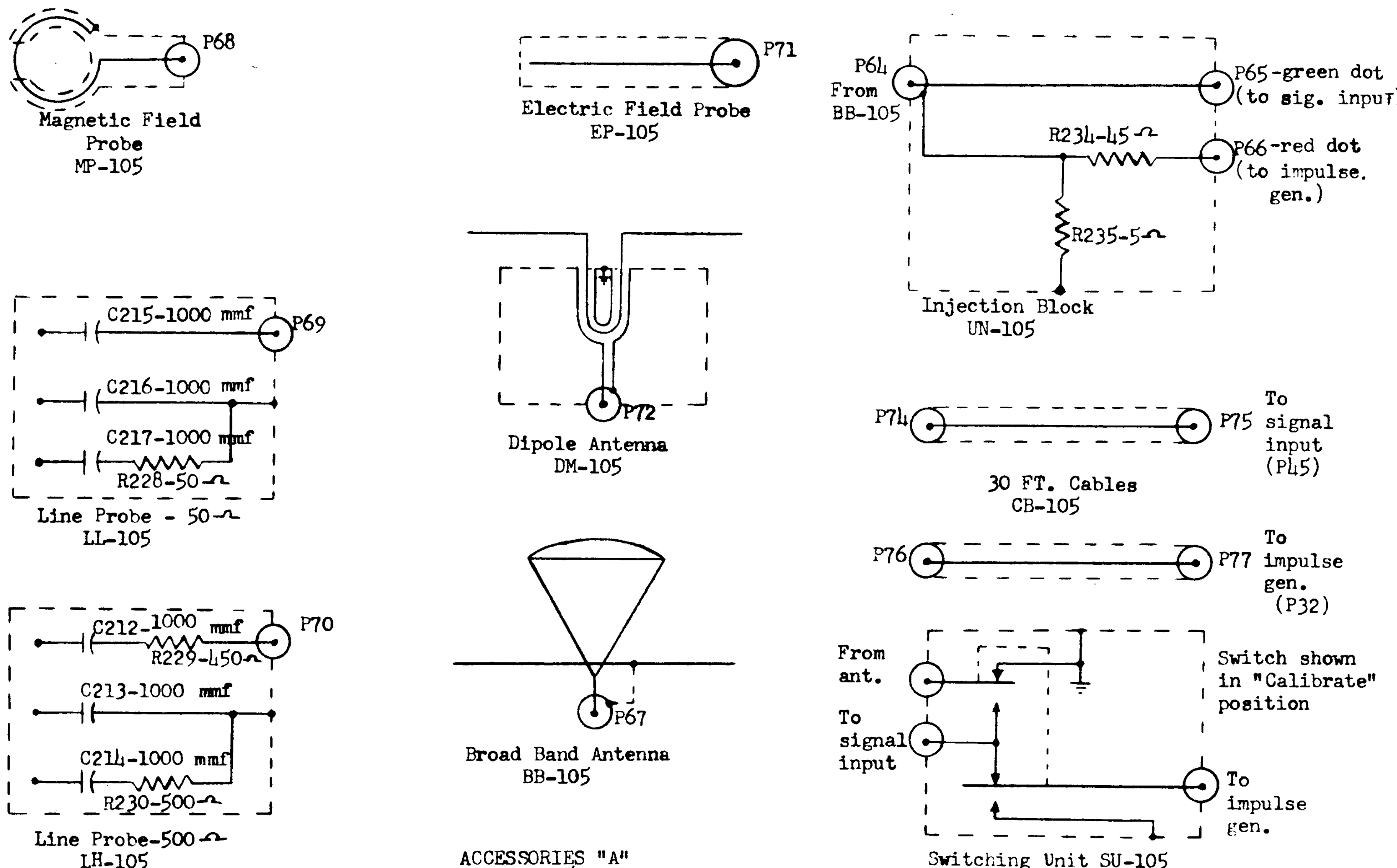
Ref. Symbol	Description	Part of
V1	5876	R.F. Tuner, T2
V2	6F4	"
V3	6BJ6	30 MC I.F. Amplifier, T2
V4	6BJ6	"
V5	6BJ6	"
V6	6BJ6	"
V7	6BJ6	"
V8	6AK5	R.F. Tuner, T1
V9	6AK5	"
V10	12AT7	"
V11	6AK5	"
V12	6AK5	"
V13	6U8	"
V14	6AK5	10.7 MC I.F. Amplifier, T1
V15	6BJ6	"
V16	6BJ6	"
V17	6BJ6	"

XIV. TUBES continued

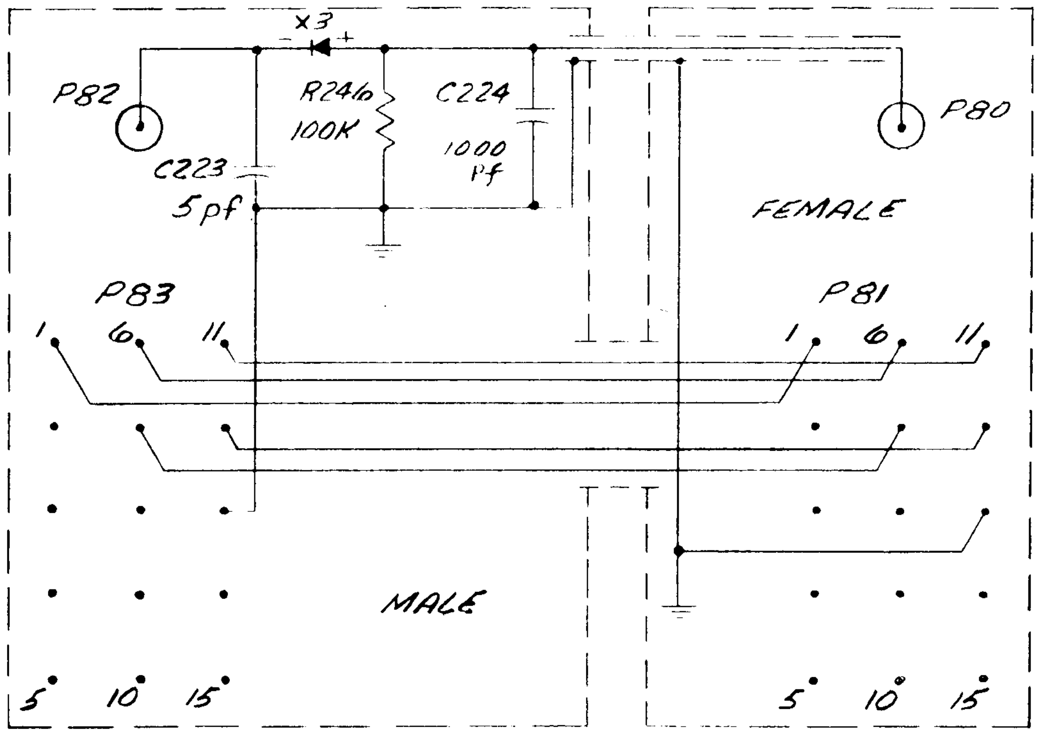
Ref. Symbol	Description	Part of
V18	6AL5	Meter Detector, BA
V19	6AB4	Audio Detector, BA
V20	12AU7	Audio Amplifier, BA
V21	12AT7	VTVM, BA
V22	12AT7	Sine Wave Oscillator, BA
V23	12AU7	Impulse Generator P.R.R., BA
V24	12AU7	"
V25	12AU7	"
V26	6X4	Power Supply, BA
V27	6X4	"
V28	6X4	"
V29	6X4	"
V30	6X4	"
V31	OA2	"
V601	5876	R.F. Tuner, T3
V602	6F4	"
V603	5876	"
V604	6T4	"
V605	6BQ7A	42 MC Cascode, T3
V606	6AK5	42 MC I.F. Amplifier, T3
V607	6AK5	"
V608	6AK5	"
V609	6BJ6	"
V610	6BJ6	"

XV. CRYSTALS

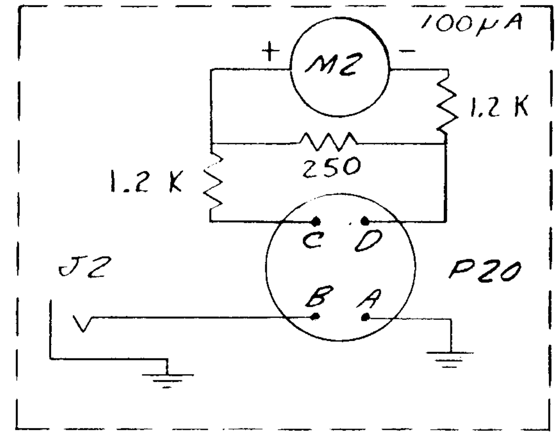
Ref. Symbol	Description	Part of
X1	1N21C	R.F. Tuner, T2
X2	1N34A	VTVM, BA
X3	1N34A	Test Harness, AH
X601	1N21C	R. F. Tuner, T3
X602	1N21C	"



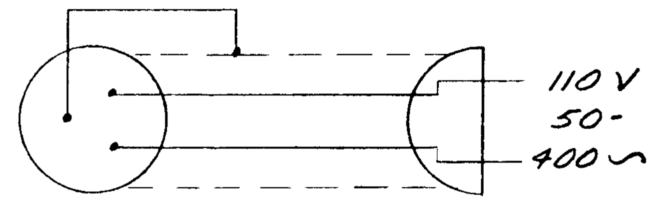
ACCESSORIES "A"
Fig. 25



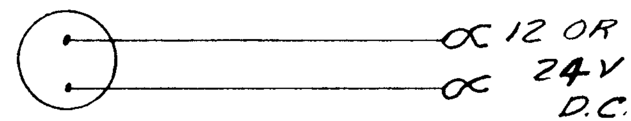
TEST HARNESS
AH-105



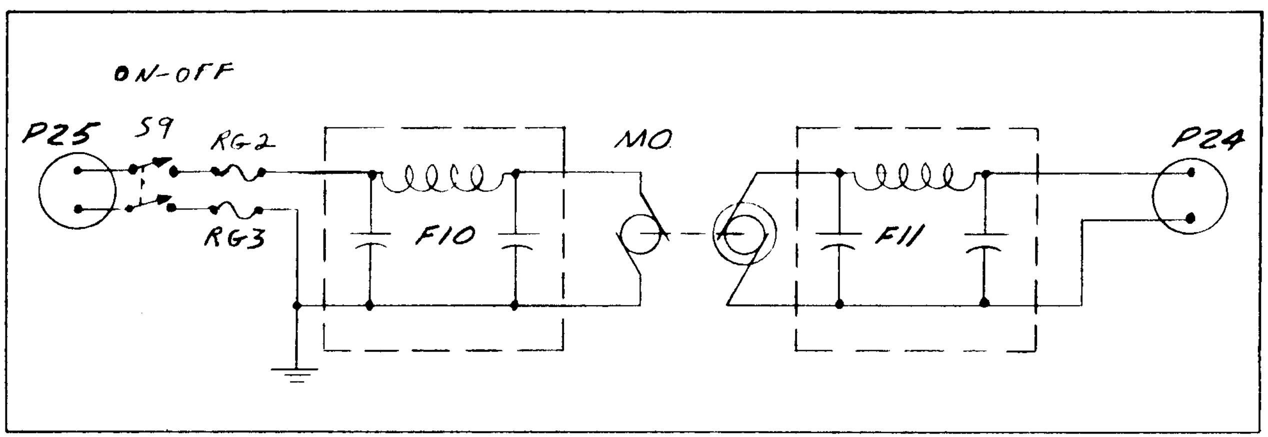
EXTERNAL METER
RE-105



A.C. POWER CABLE



DC POWER CABLE
DC-105



INVERTER
MO-$\binom{12}{24}$-105

ACCESSORIES "B"

FIG. 26

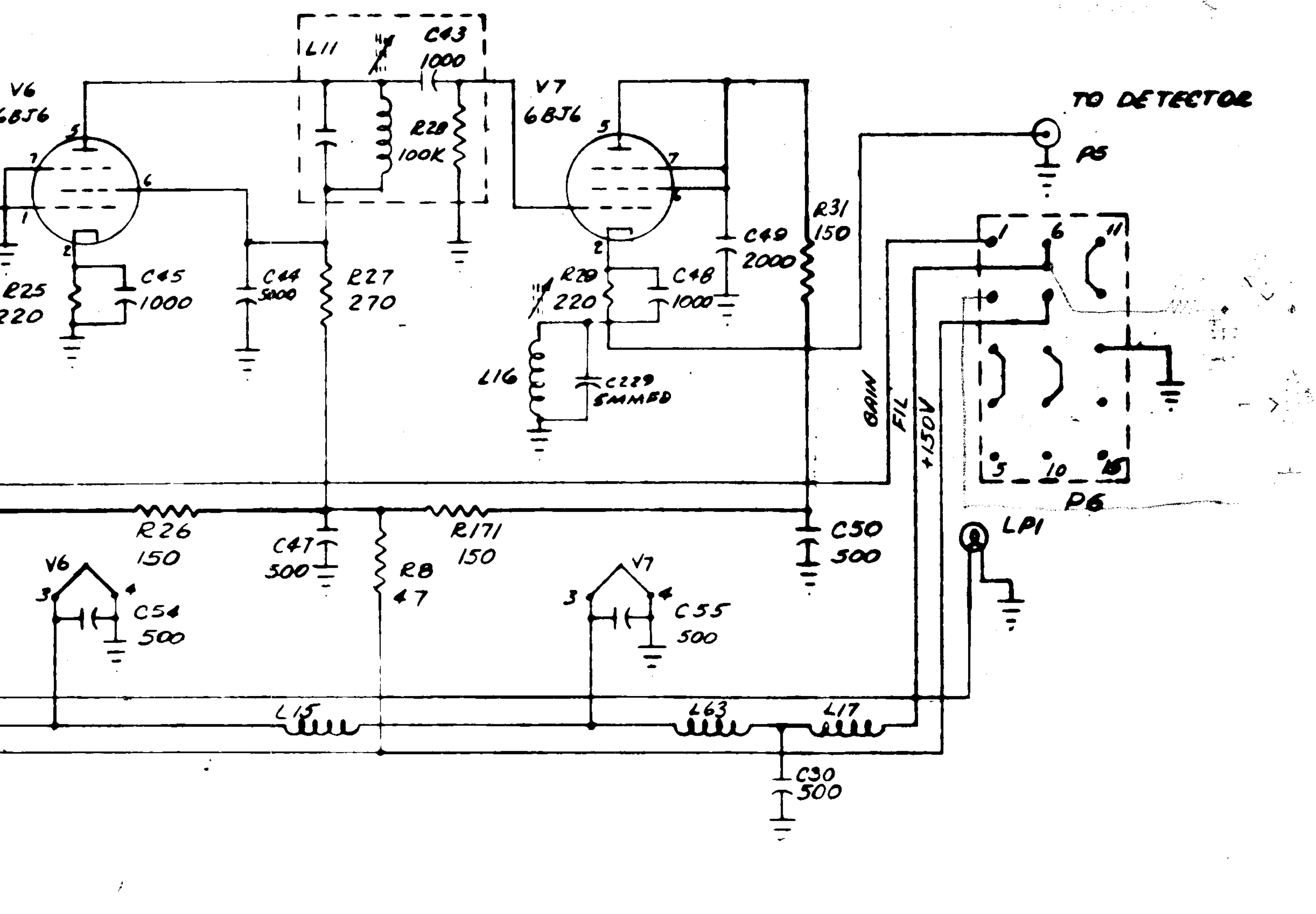
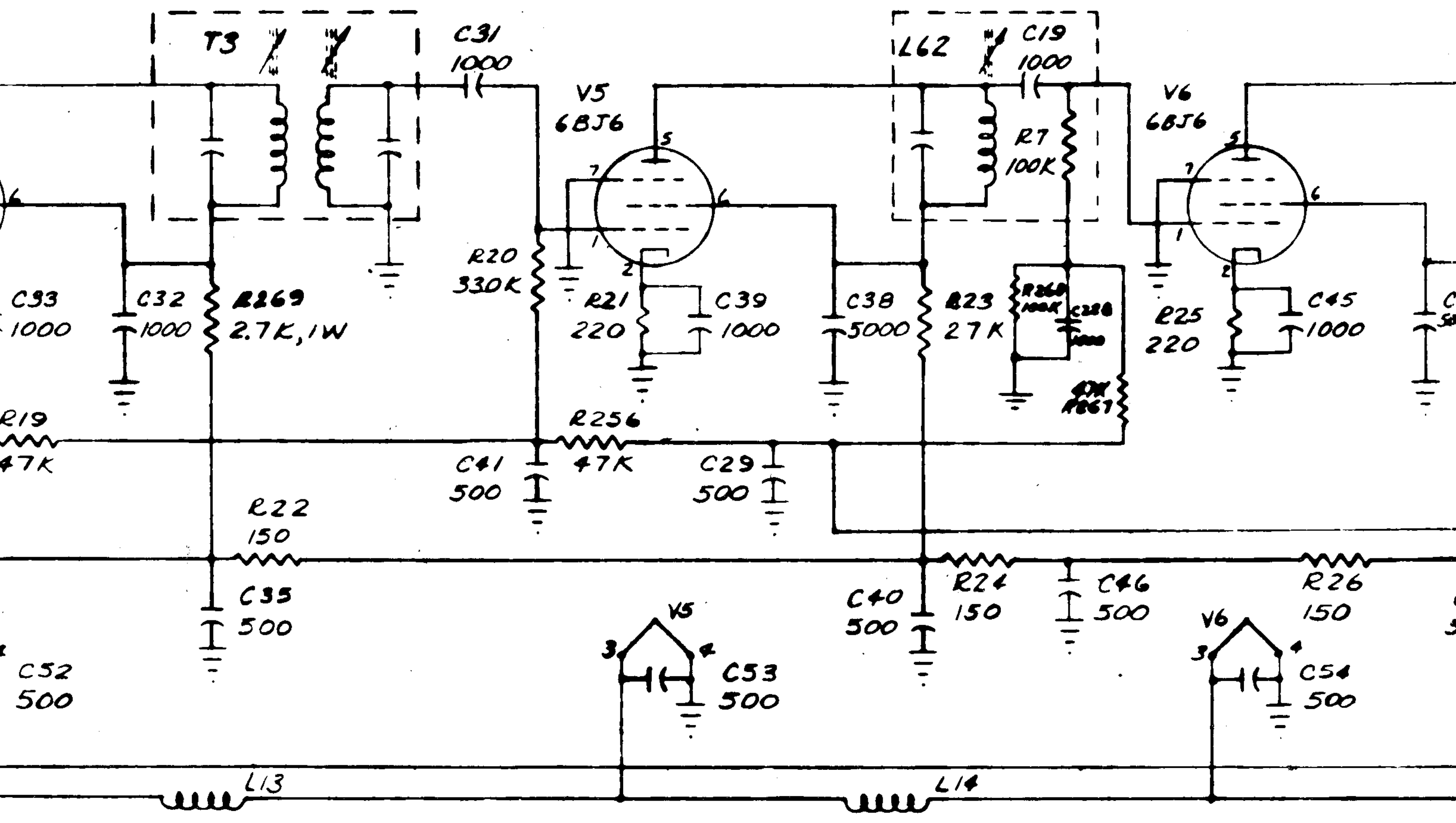
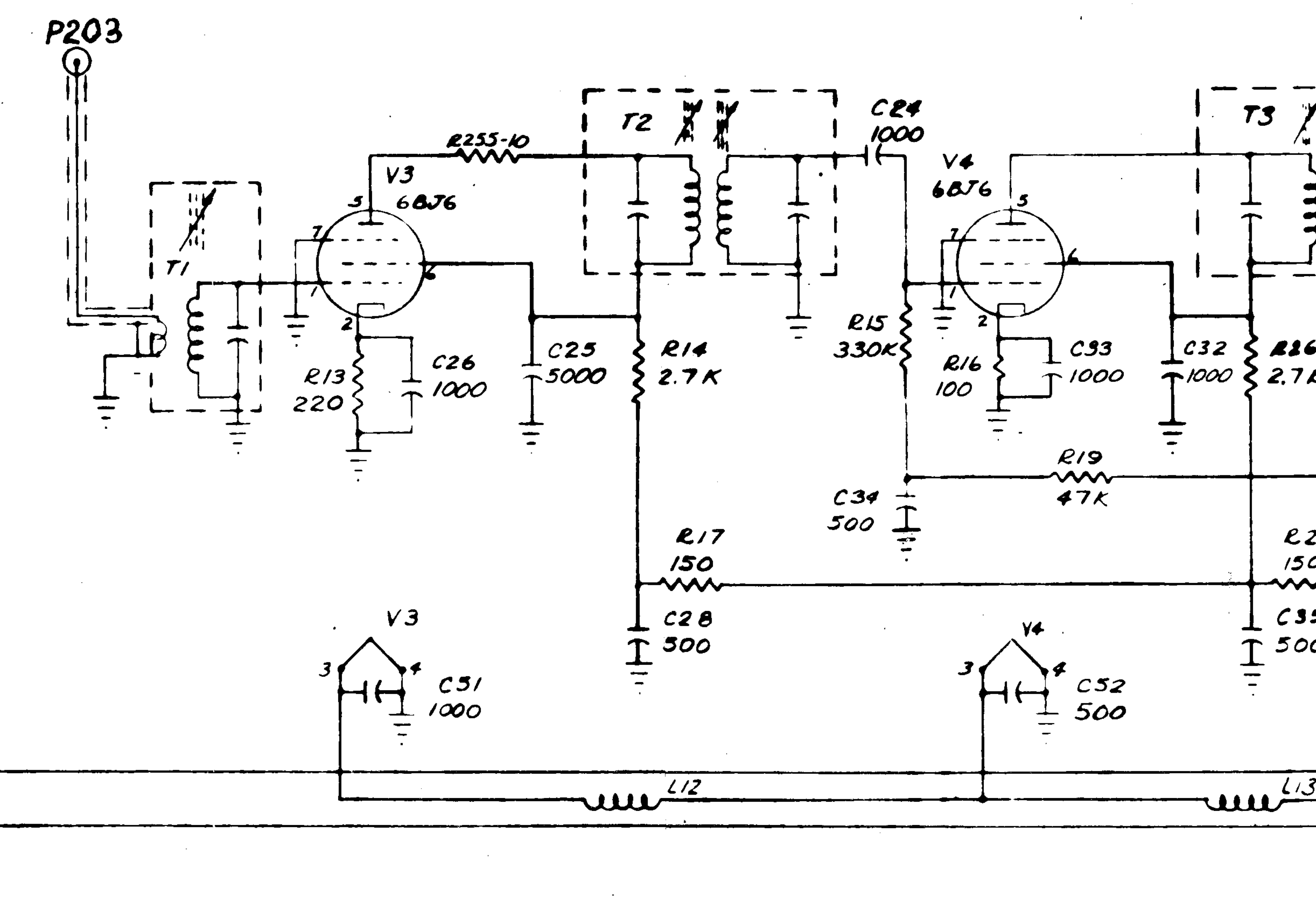


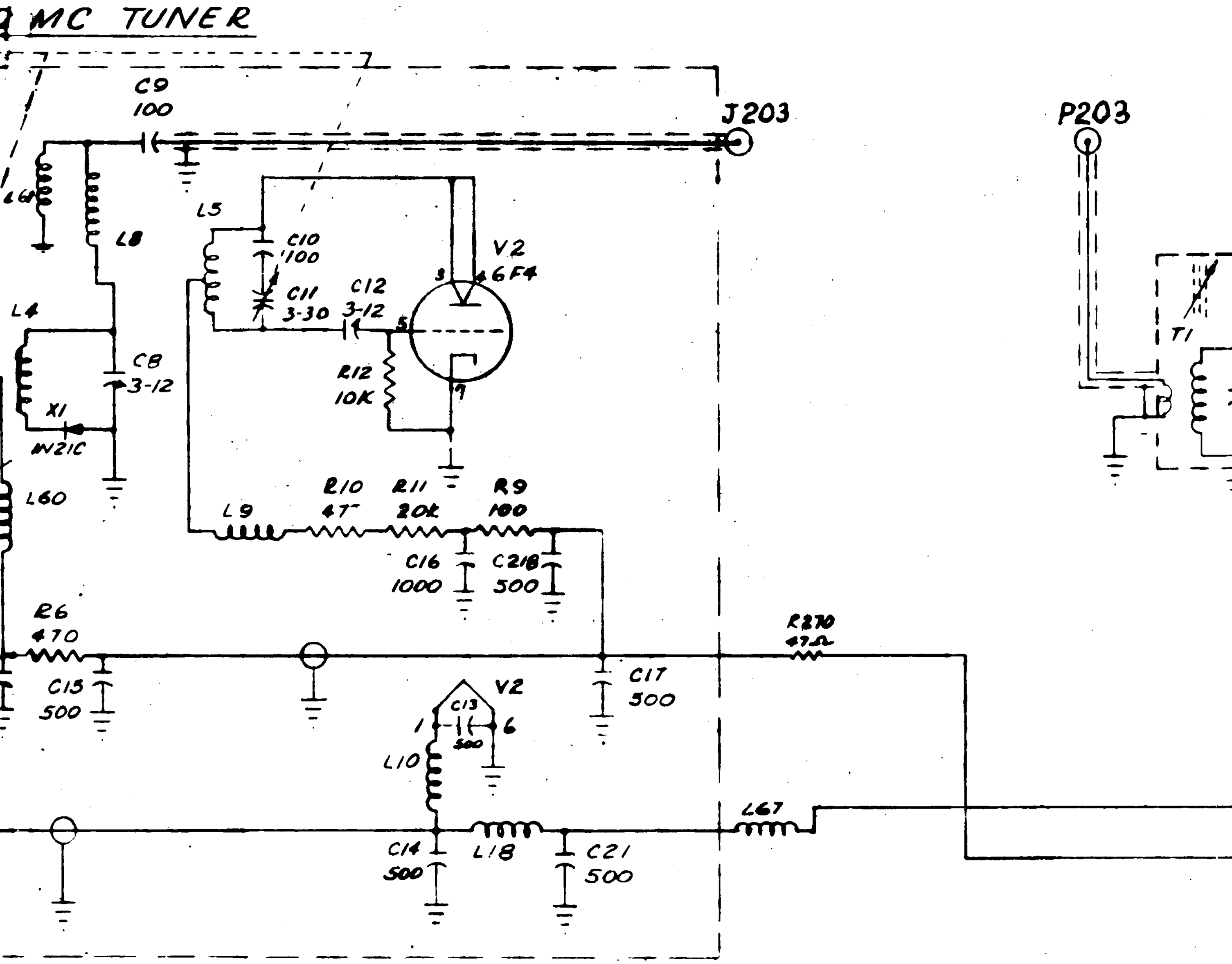
Figure 28. Schematic Diagram,
T2/NF-105, 200-400MC

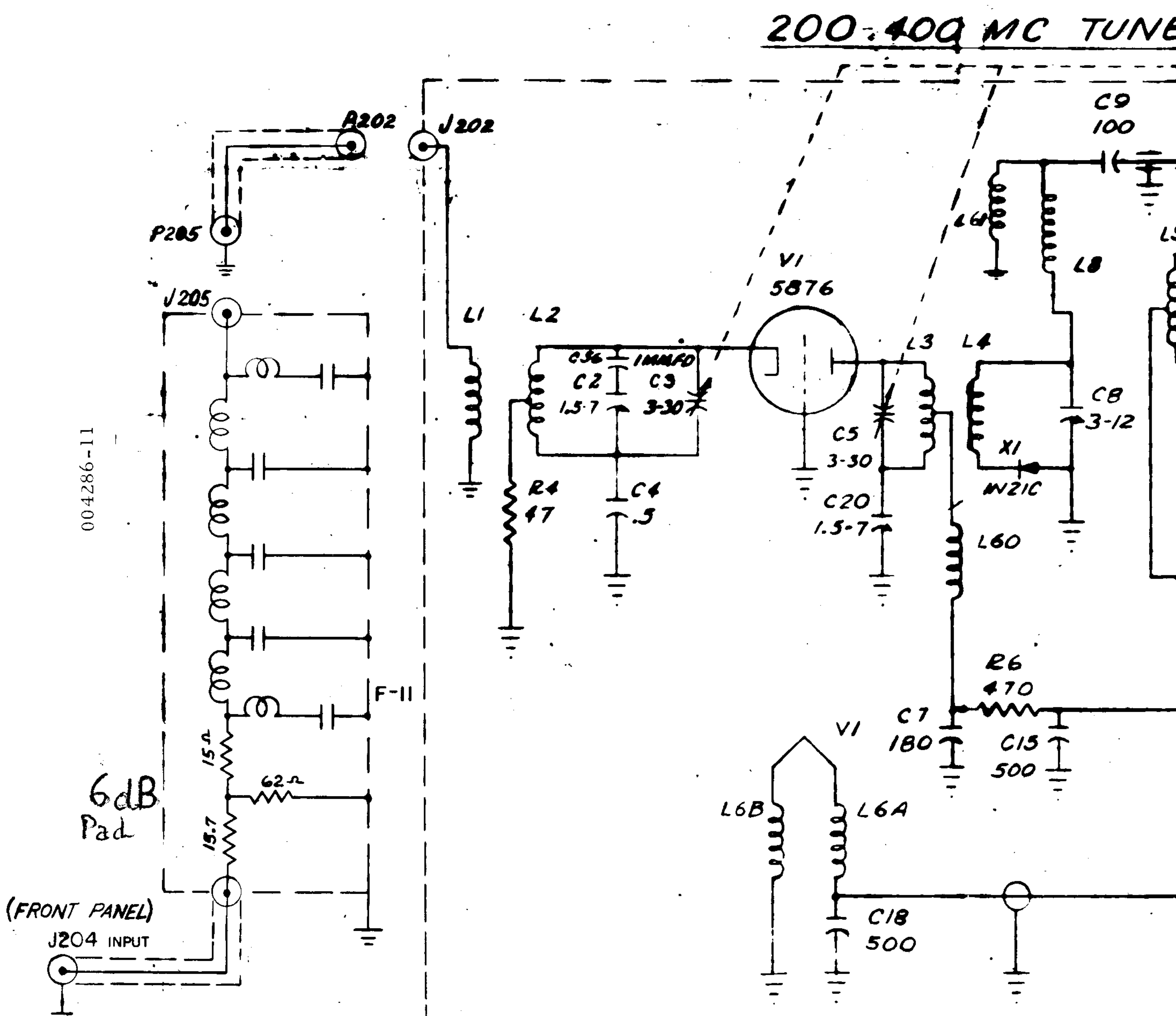
30 MC I.F. AMPLIFIER





P203
T1
V3
6BJ6
R13
220
C26
1000
C25
5000
R14
2.7K
R255-10
T2
C24
1000
V4
6BJ6
R15
330K
R16
100
C33
1000
C32
1000
T3
2.7K
R19
47K
C34
500
R17
150
C28
500
V3
C51
1000
V4
C52
500
L12


MC TUNER
C9
100
J203
P203
L61
L8
L5
C10
100
C11
3-30
C12
3-12
V2
6F4
L4
C8
3-12
R12
10K
X1
IN21C
T1
L60
L9
R10
47
R11
20K
R9
100
C16
1000
C218
500
R6
470
C15
500
R270
47Ω
C17
500
C13
500
L10
L67
C14
500
L18
C21
500


200-400 MC TUNE
C9
100
L6
L8
V1
5876
J202
P202
P205
J205
L1
L2
C36
1MMFD
C2
1.5-7
C3
3-30
L3
L4
C8
3-12
X1
IN21C
C5
3-30
C20
1.5-7
L60
R4
47
C4
.5
R6
470
C7
180
C15
500
L6B
L6A
C18
500
F-11
15Ω
62Ω
15.7
6dB
Pad
(FRONT PANEL)
J204 INPUT
004286-11

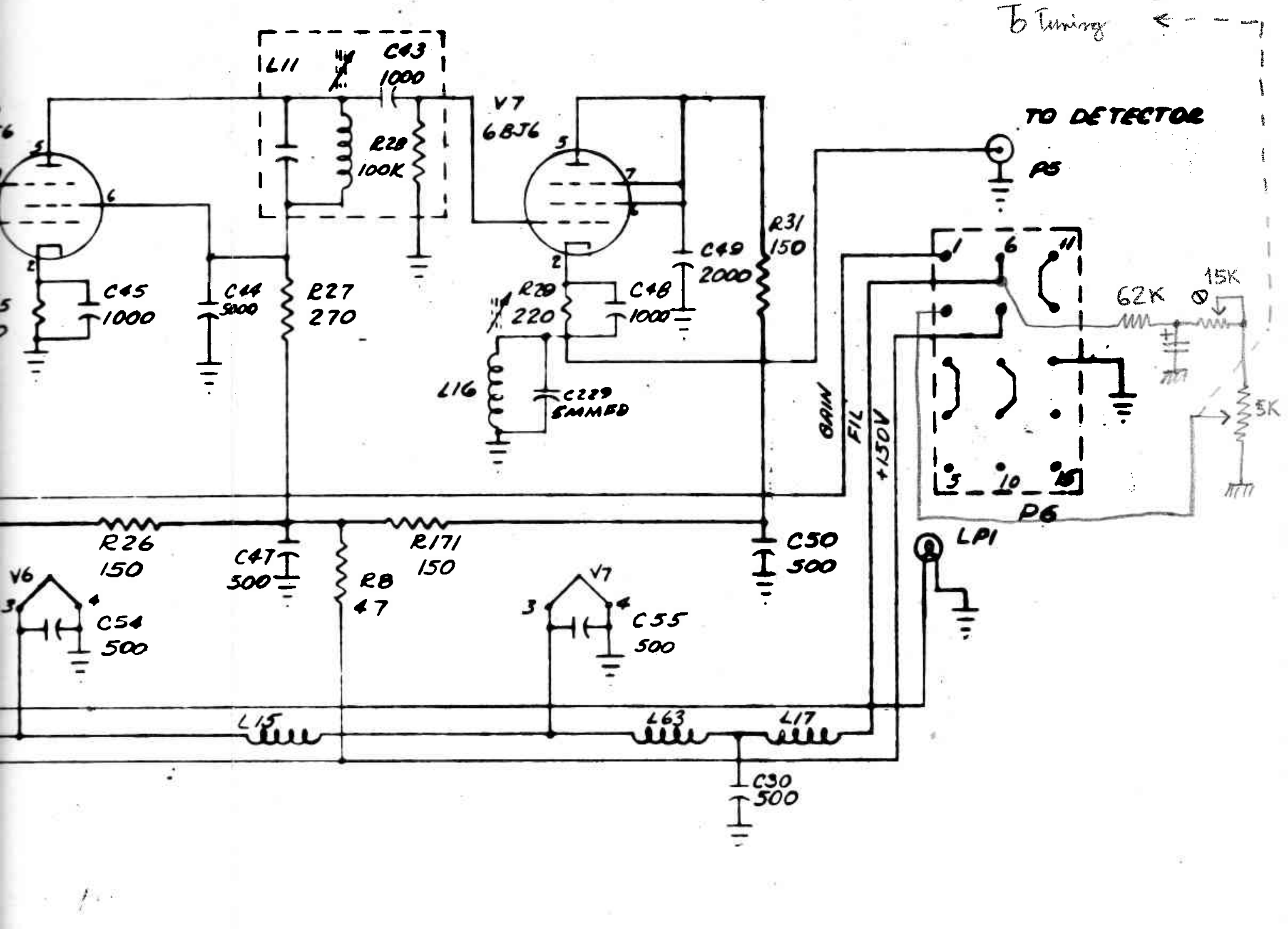
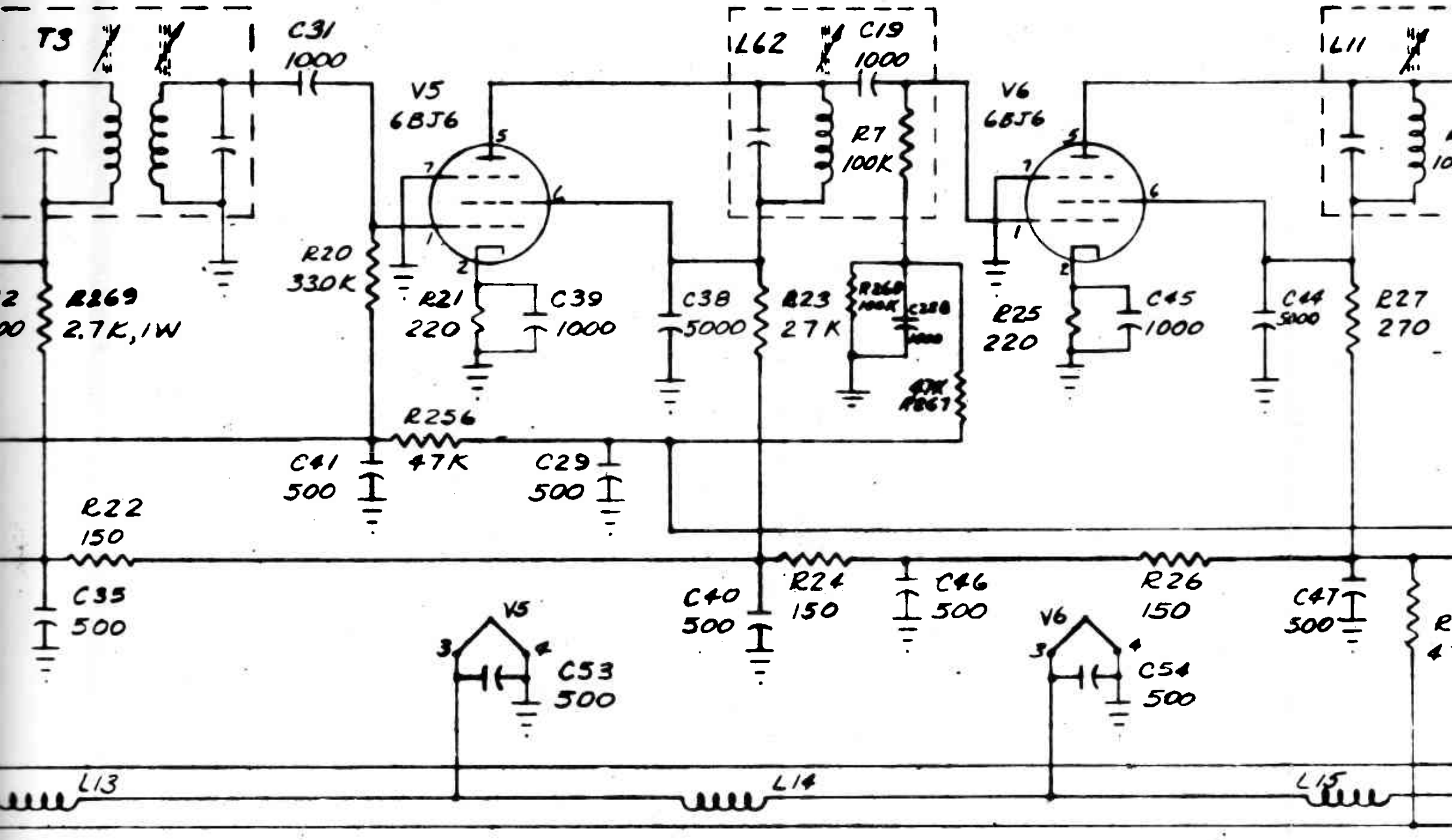
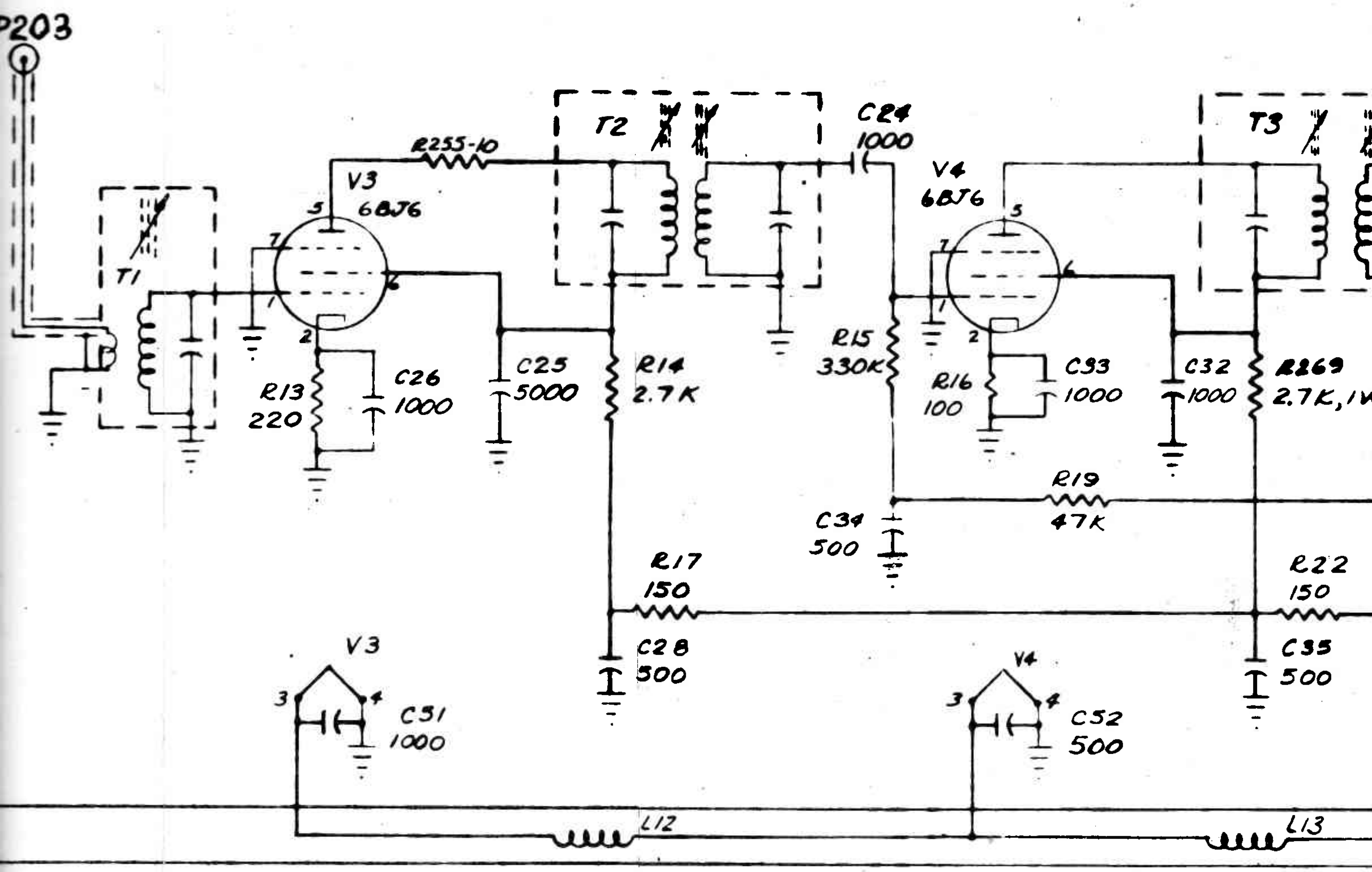
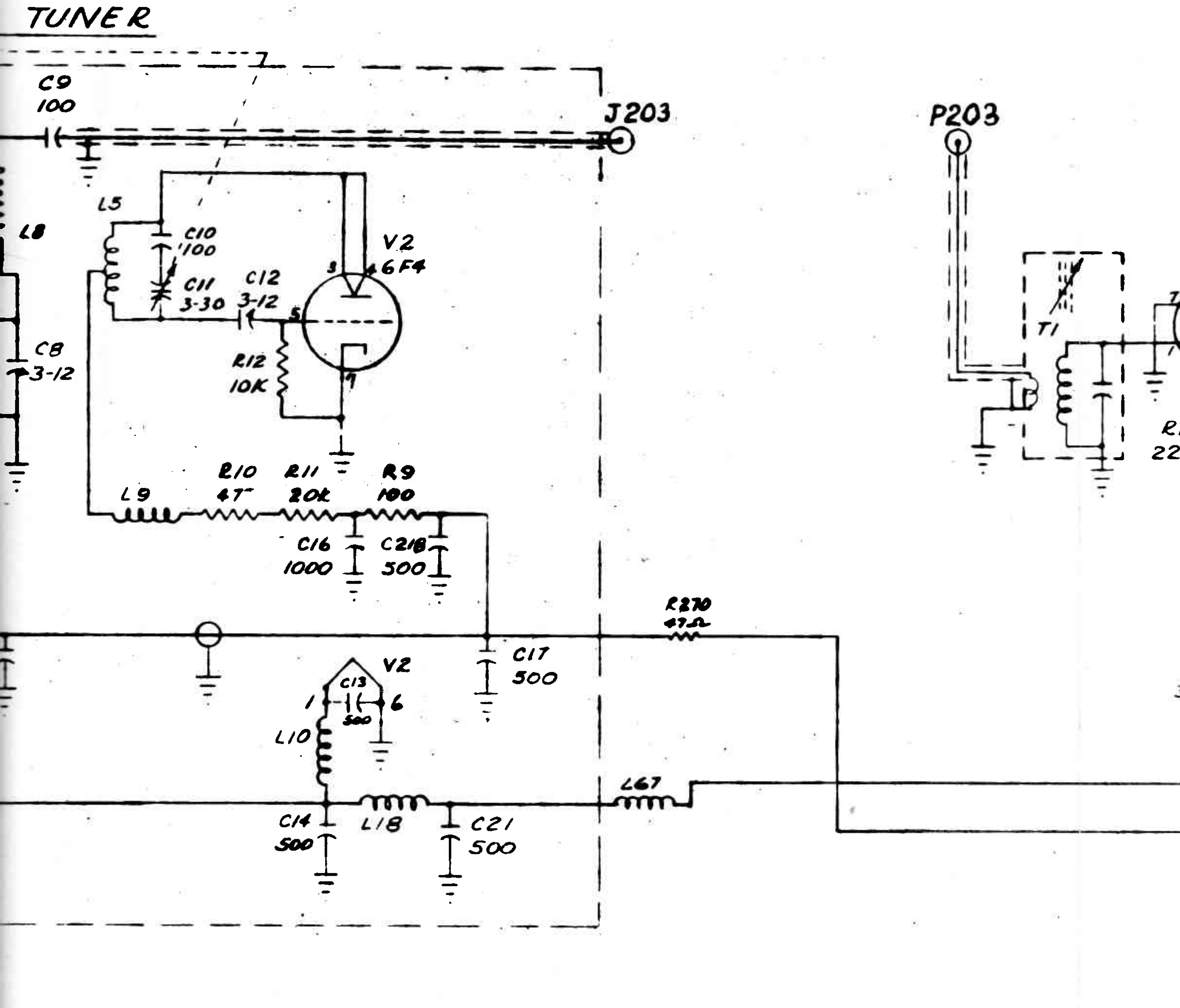


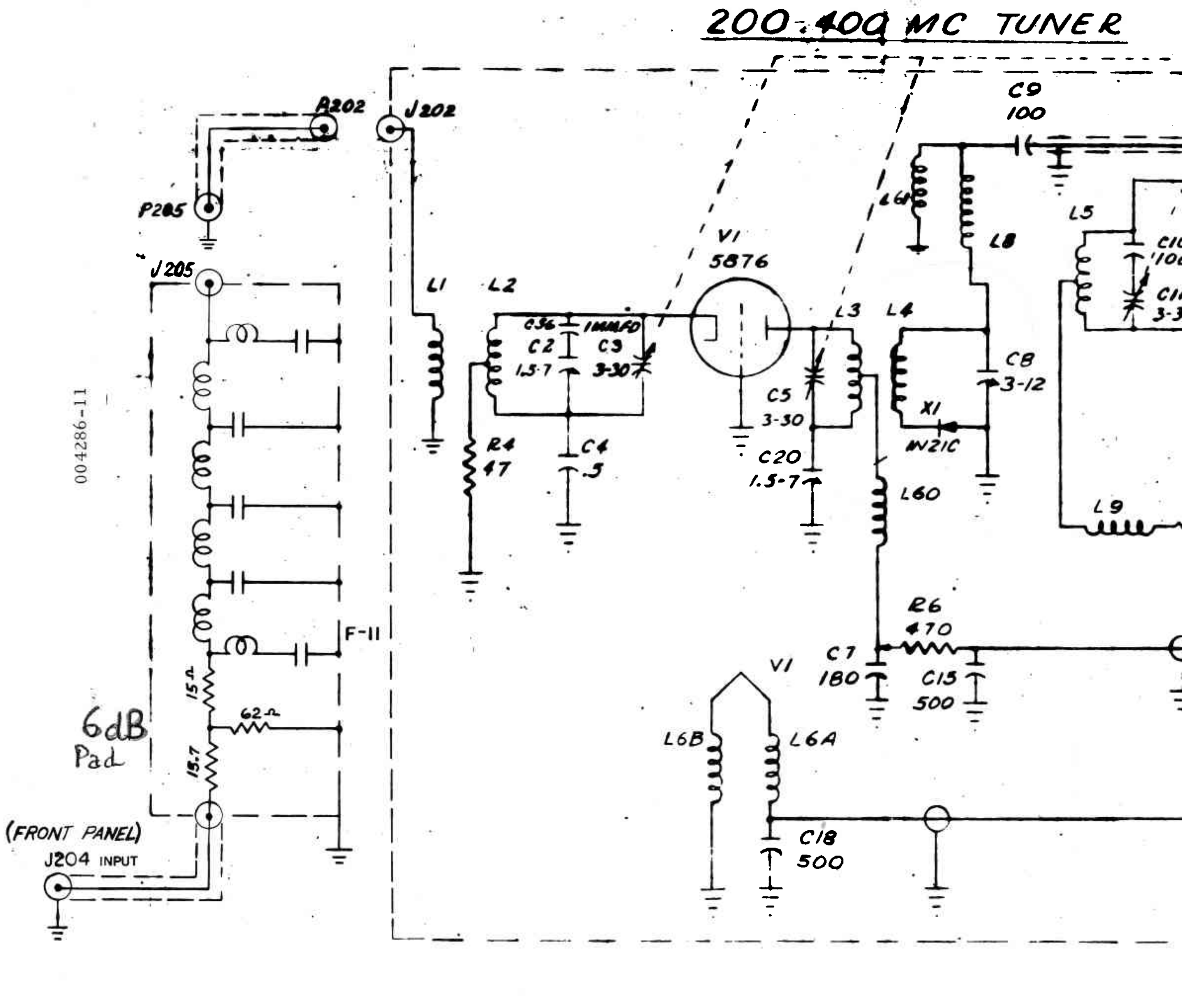
Figure 28. Schematic Diagram,
T2/NF-105, 200-400MC

30 MC I.F. AMPLIFIER




P203
T1
V3
6BJ6
R255-10
T2
C24
1000
V4
6BJ6
T3
R13
220
C26
1000
C25
5000
R14
2.7K
R15
330K
R16
100
C33
1000
C32
1000
R269
2.7K,1W
R19
47K
C34
500
R17
150
C28
500
R22
150
C35
500
V3
C51
1000
V4
C52
500
L12
L13


TUNER
C9
100
J203
P203
L5
L8
C10
100
C11
3-30
C12
3-12
V2
6F4
C8
3-12
R12
10K
T1
R10
47
R11
20k
R9
100
L9
C16
1000
C21B
500
R270
47Ω
C17
500
V2
C13
500
L10
C14
500
L18
C21
500
L67



200-400 MC TUNER
P202
J202
P205
J205
F-11
15Ω
62Ω
15.7
6dB Pad
(FRONT PANEL)
J204 INPUT
L1
L2
C36 1MMFD
C2 1.5-7
C3 3-30
R4 47
C4 .5
V1 5876
C5 3-30
C20 1.5-7
L3
L4
L61
L8
CB 3-12
X1 1N21C
L60
C9 100
L5
L9
R6 470
C7 180
C15 500
V1
L6B
L6A
C18 500
004286-11

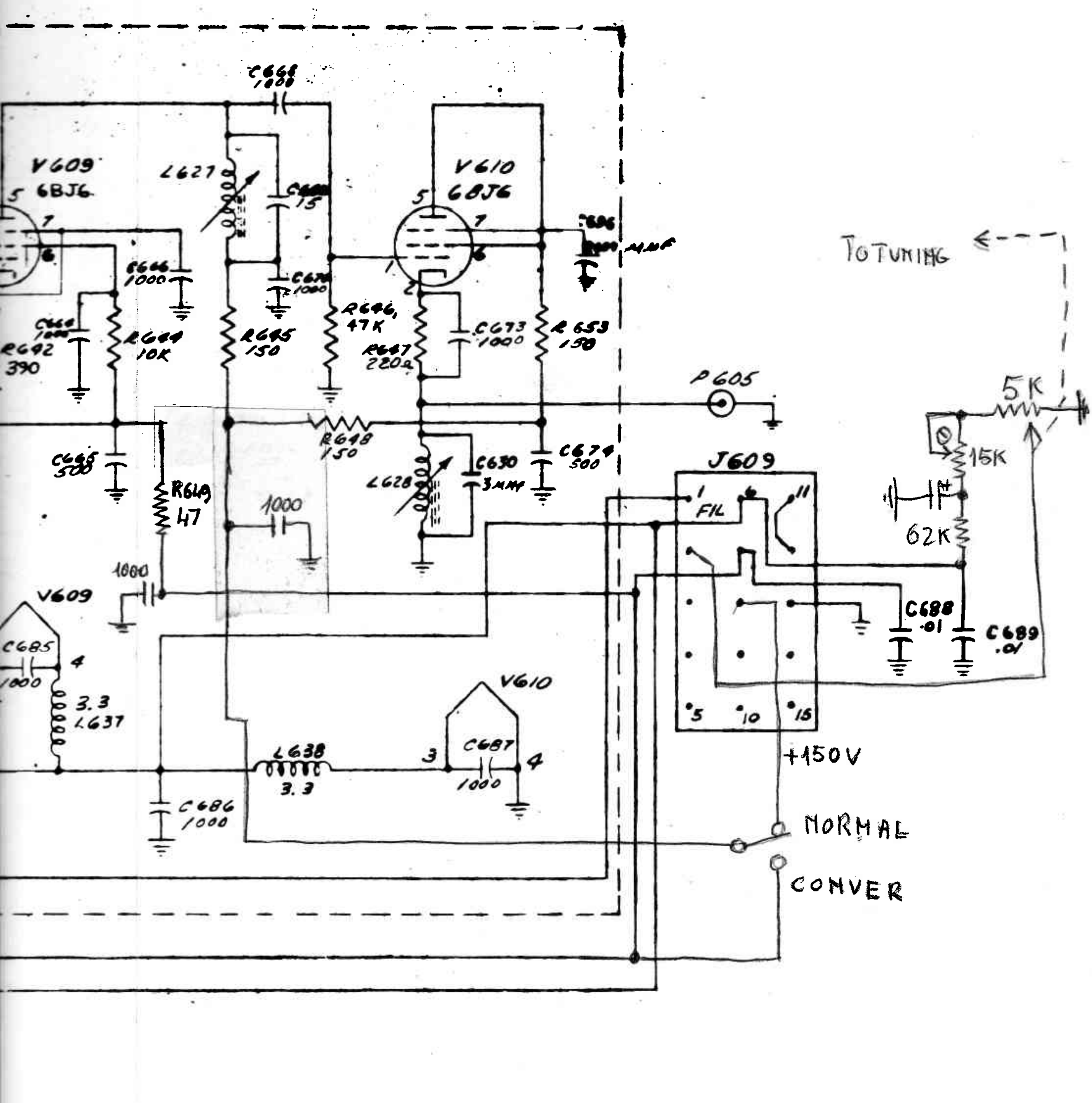
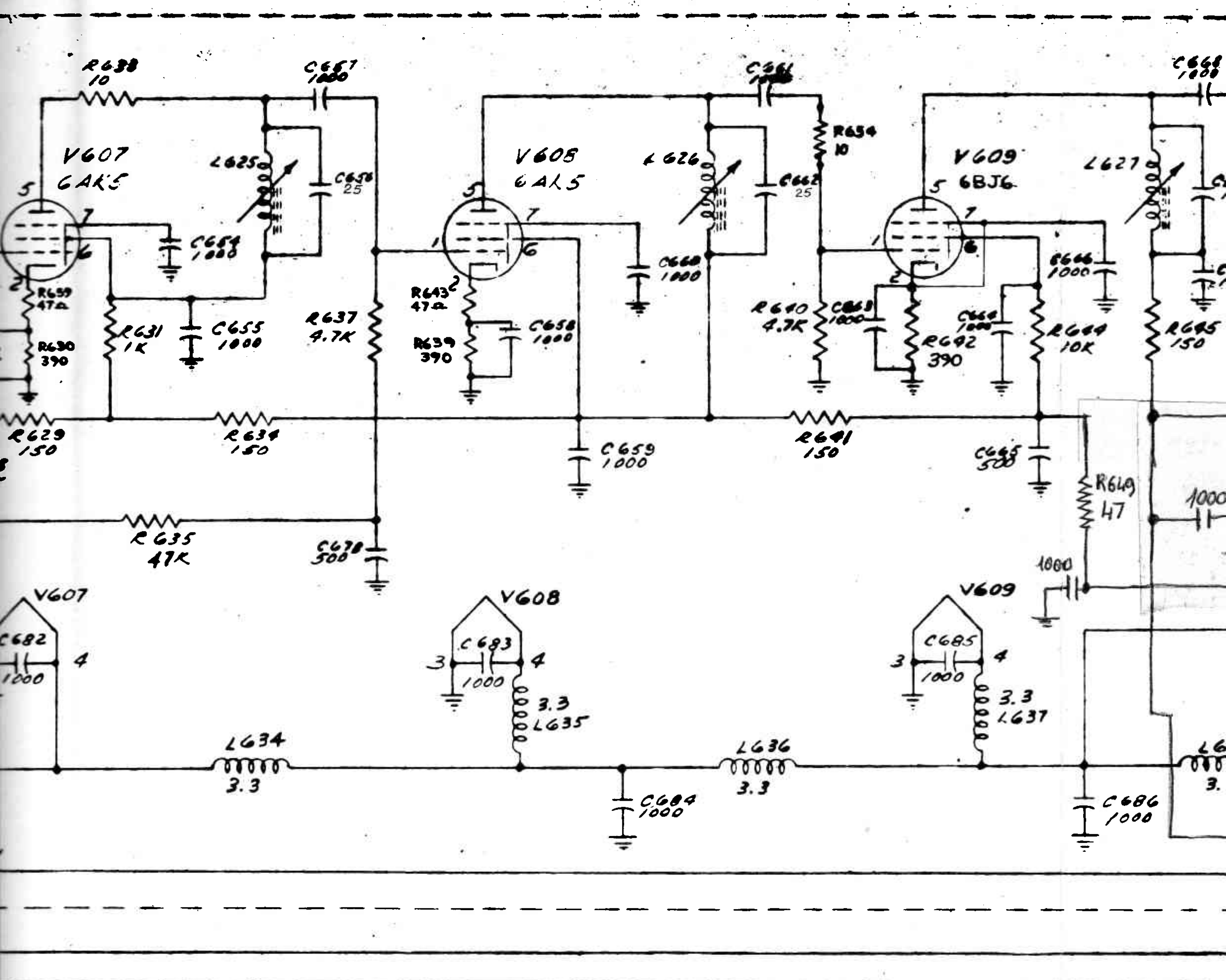


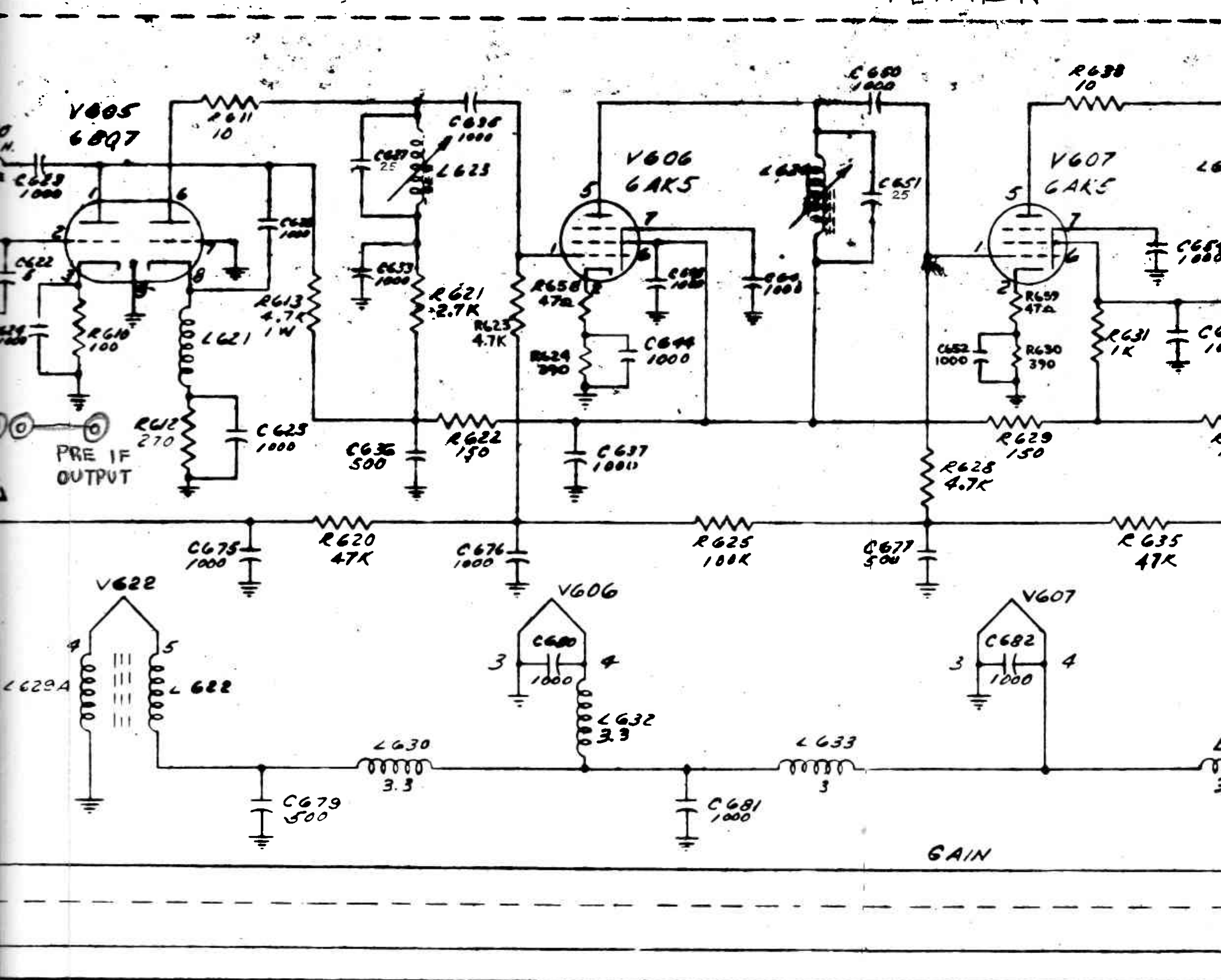
Figure 29. Schematic Diagram,
T3/NF-105, 400-1000MC

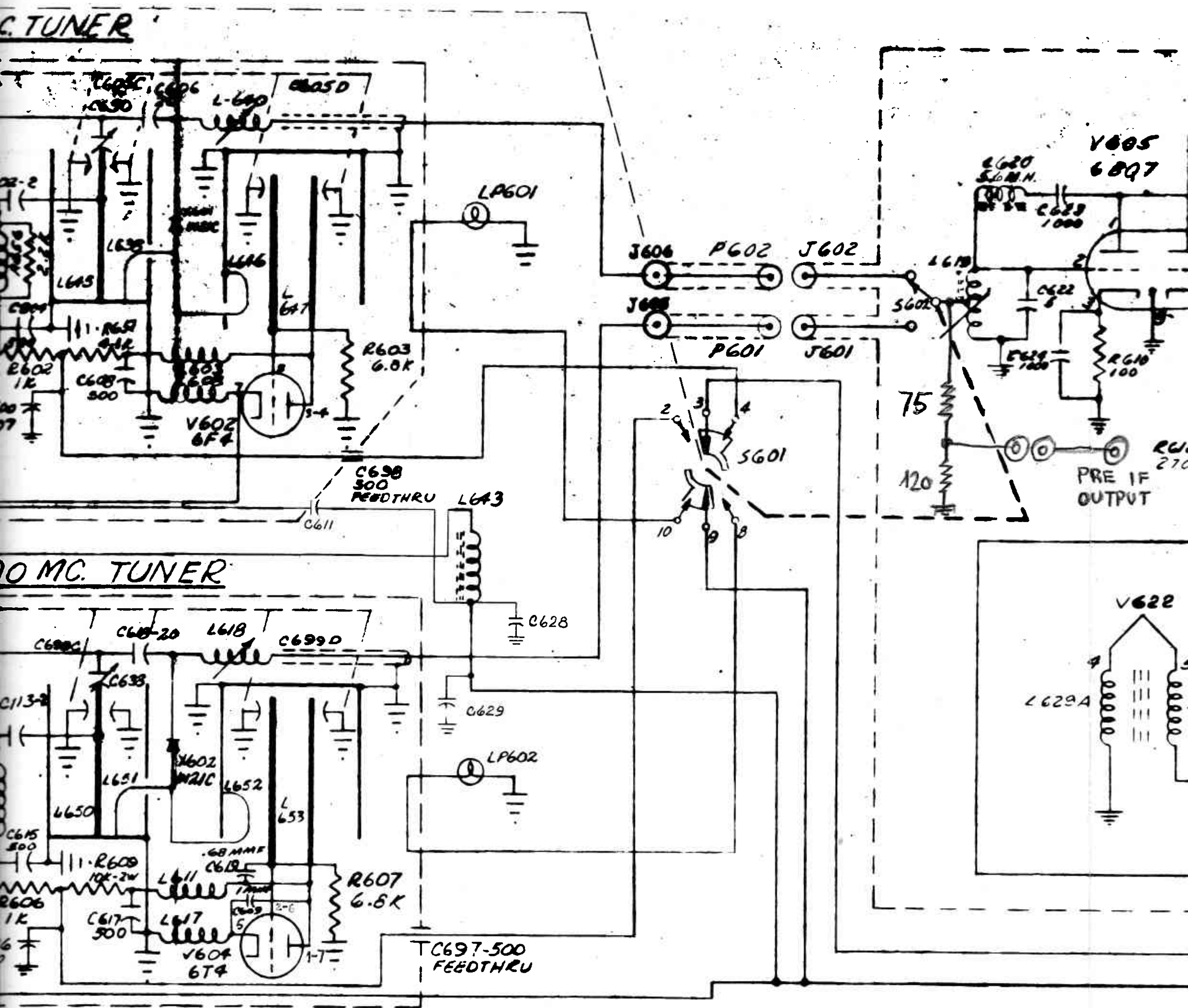
ER



R638 10
C657 1000
C661
C668 1000
V607 6AK5
L625
C656 25
C654 1000
R659 47Ω
R630 390
R631 1K
C655 1000
R637 4.7K
V608 6AK5
L626
C662 25
R654 10
C660 1000
R643 47Ω
R639 390
C658 1000
V609 6BJ6
L627
C666 1000
R640 4.7K
C663 1000
R642 390
C664 1000
R644 10K
R645 150
R629 150
R634 150
C659 1000
R641 150
C665 500
R649 47
1000
R635 47K
C678 500
V607
C682 1000
V608
C683 1000
3.3 L635
V609
C685 1000
3.3 L637
L634 3.3
L636 3.3
C684 1000
C686 1000

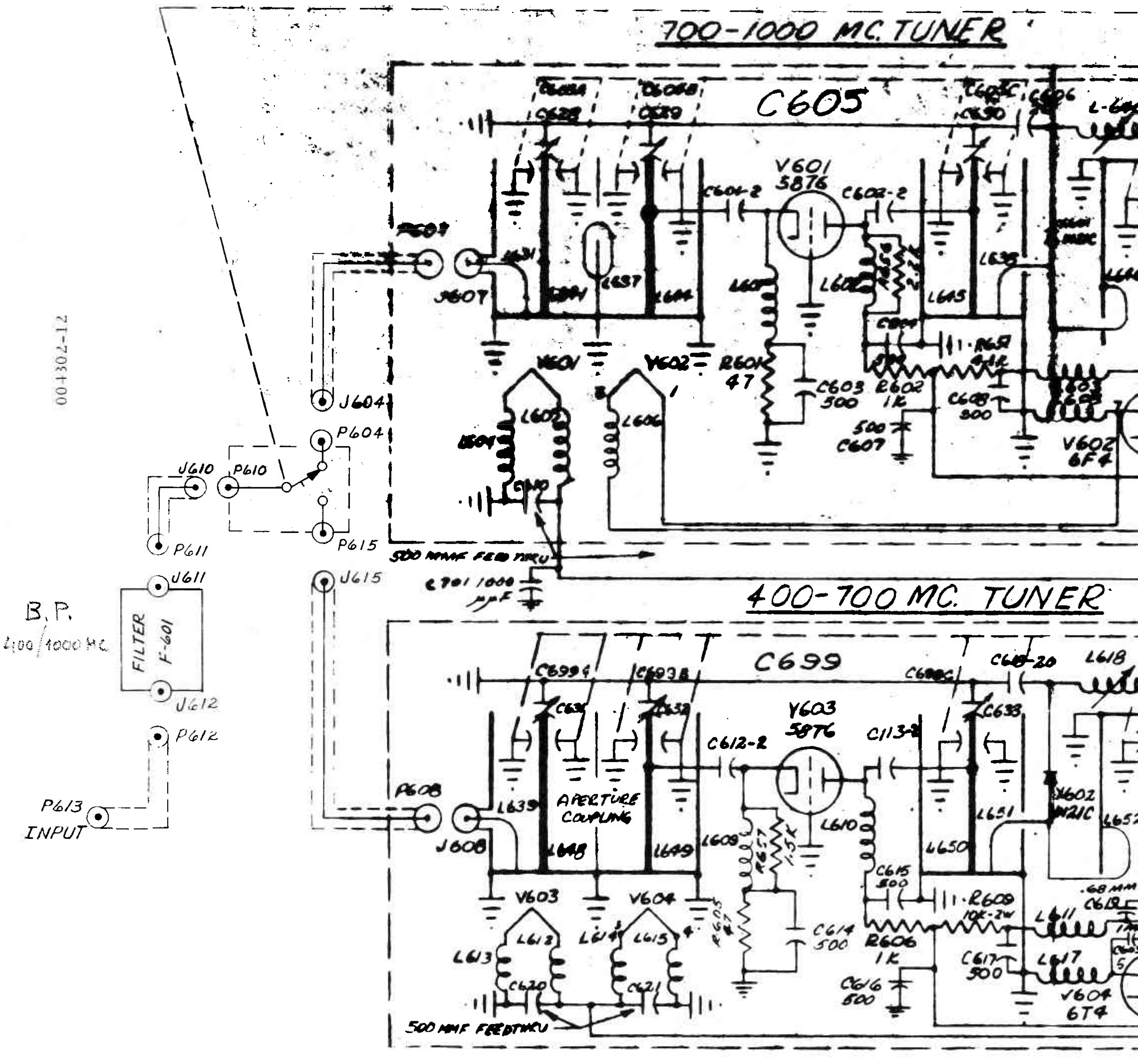
42 MC IF AMPLIFIER





C. TUNER
V605
6BQ7
LP601
J606
P602
J602
P601
J601
S602
R603
6.8K
V602
6F4
S601
75
120
PRE IF
OUTPUT
C698
300
FEEDTHRU
L643
C611
C628
C629
00 MC. TUNER
V622
L618
L629A
LP602
R607
6.8K
V604
6T4
C697-500
FEEDTHRU

004302-12



700-1000 MC. TUNER
C605
V601
5876
V602
6F4
J607
J604
P604
P610
J610
P611
P615
J615
J611
J612
P612
P613
INPUT
B.P.
400/1000 MC
FILTER
F-601
500 MMF FEED THRU
C701 1000 MMF
400-700 MC. TUNER
C699
V603
5876
V604
6T4
P608
J608
APERTURE COUPLING
R601 47
C603 500
R602 1K
C608 500
C607 500
R606 1K
C614 500
C615 500
C617 500
C616 500
R609 10K-2W
500 MMF FEEDTHRU

REVISIONS			
SYM	DESCRIPTION	[illegible]	APR
N	ADDED R51 ECN [illegible]	[illegible]	[illegible]

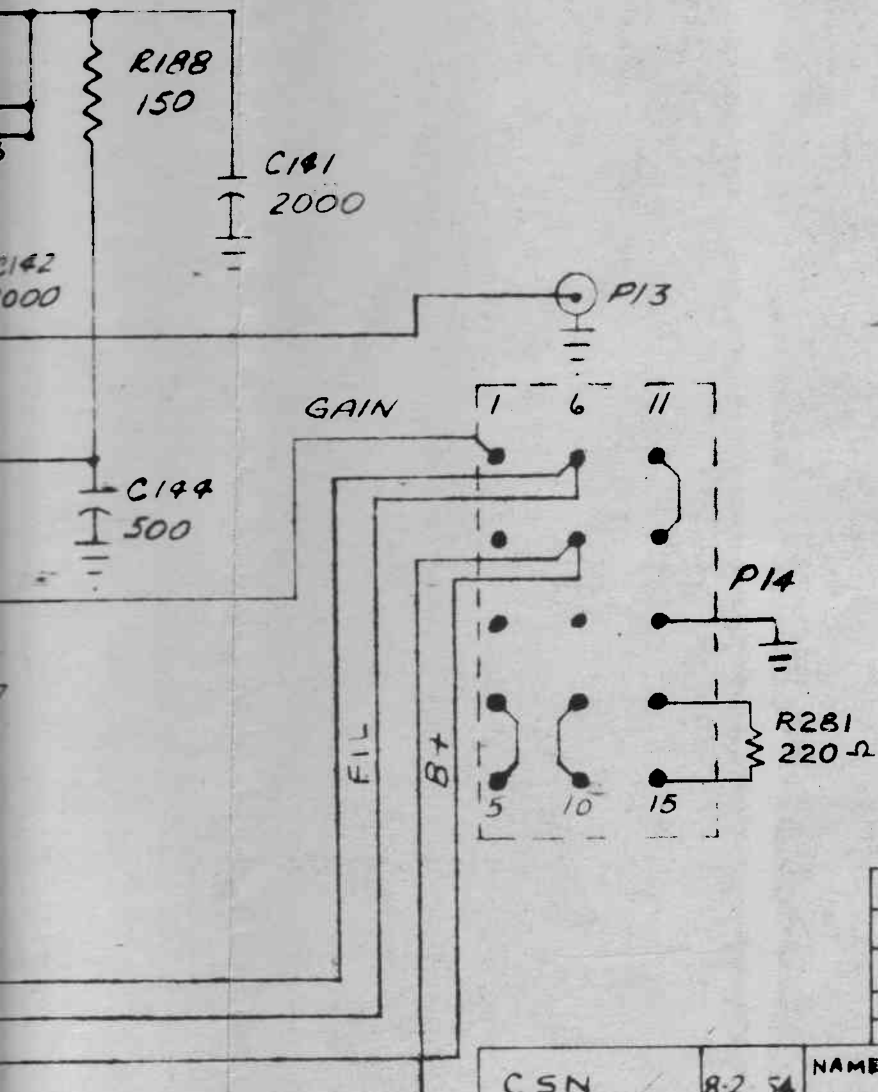


FIG. 27

	T1/NF-105	

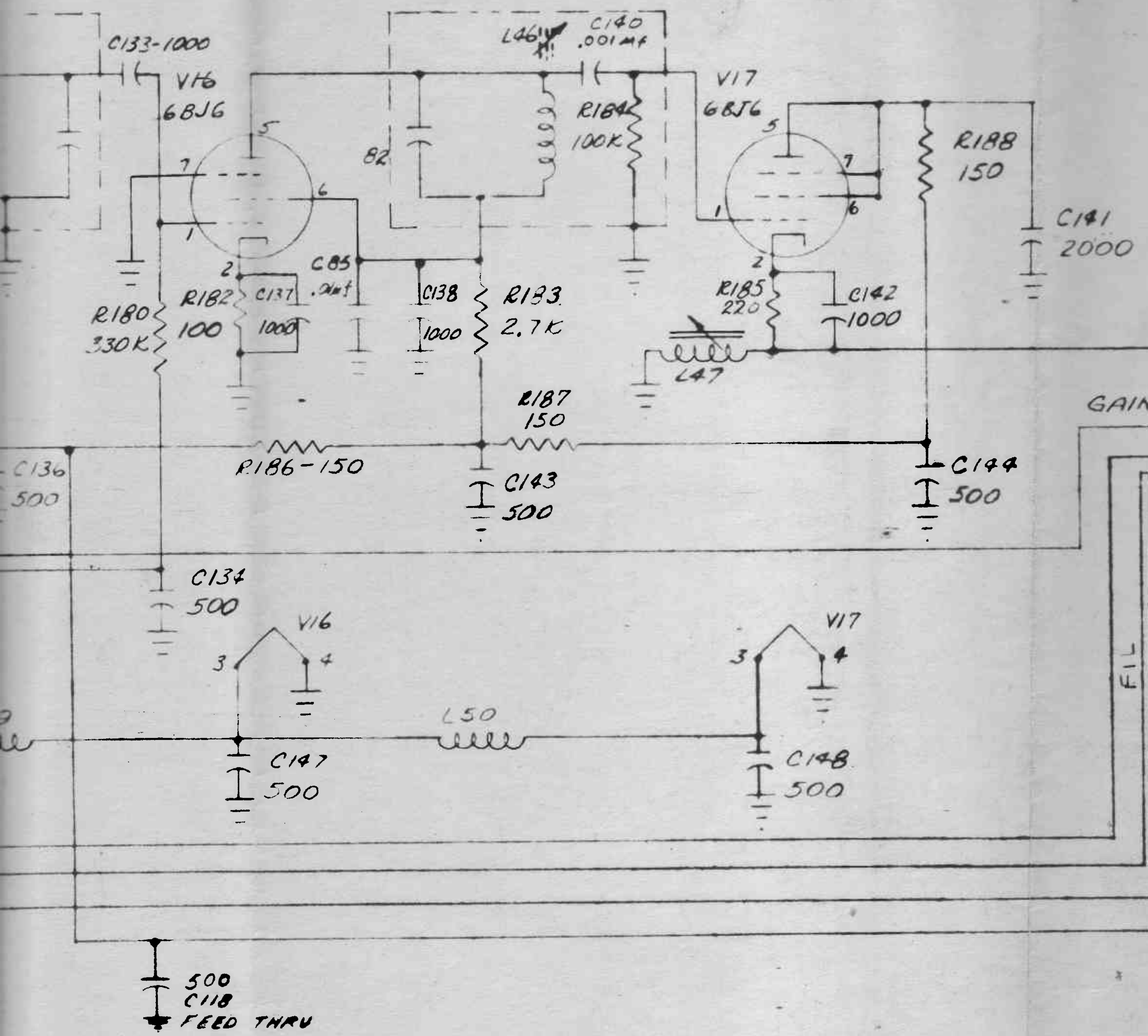
CSN	8-2-54	NAME TUNING UNIT 20 TO 200 MC NF-105

THE SINGER COMPANY
METRICS DIVISION
BRIDGEPORT, CONN., U.S.A.

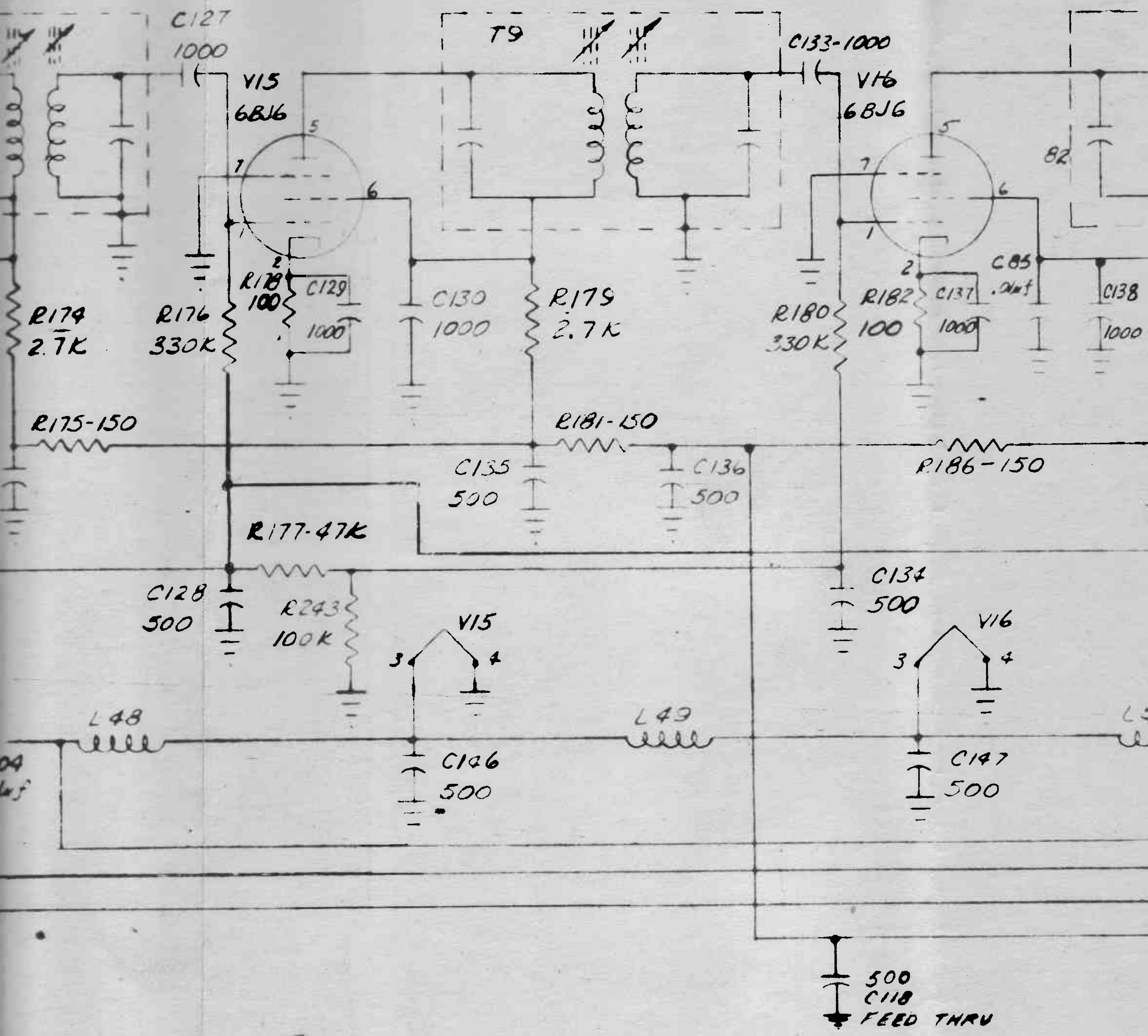
R 004285 N

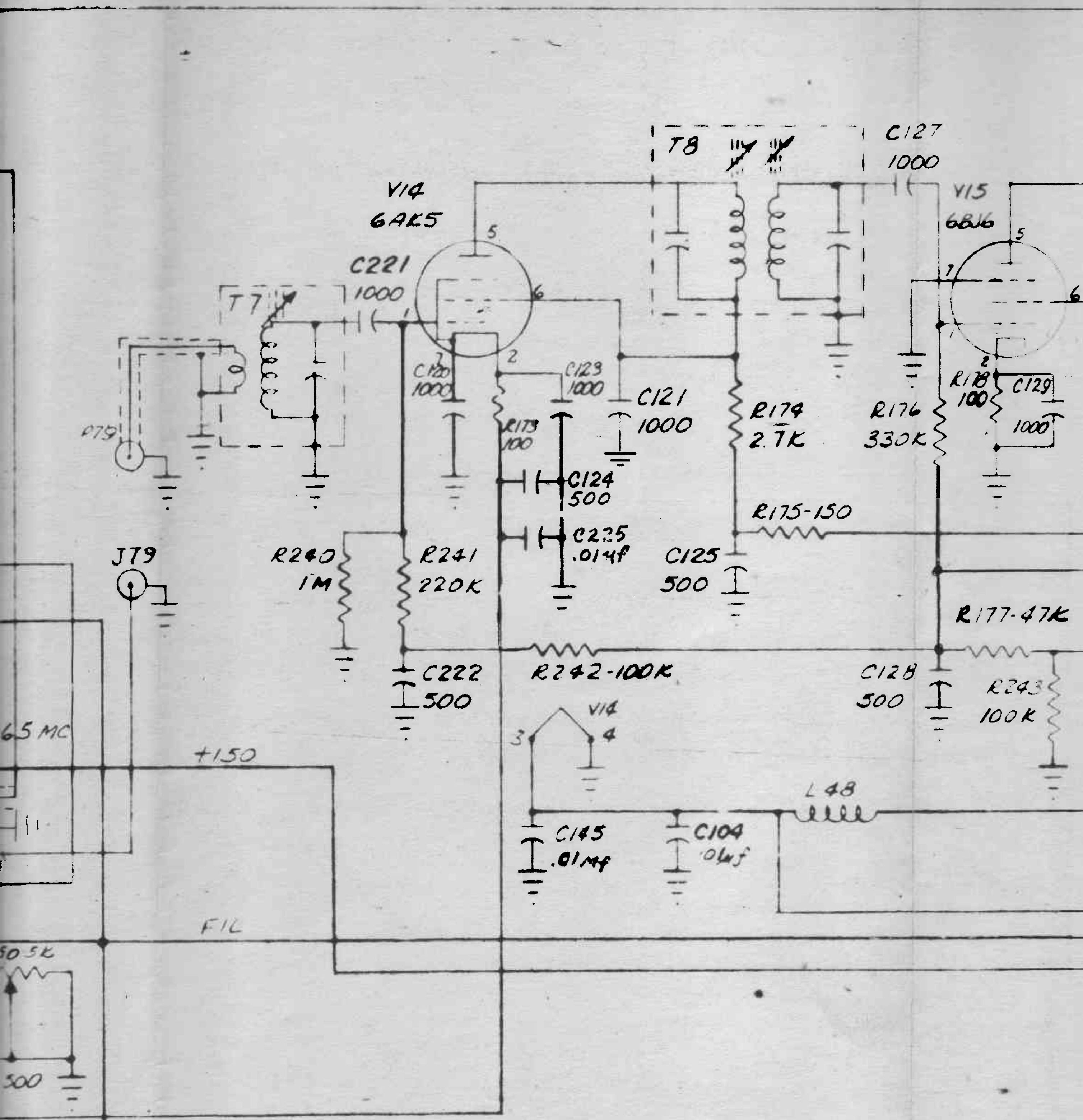
REF. R4285

.F. AMPLIFIER

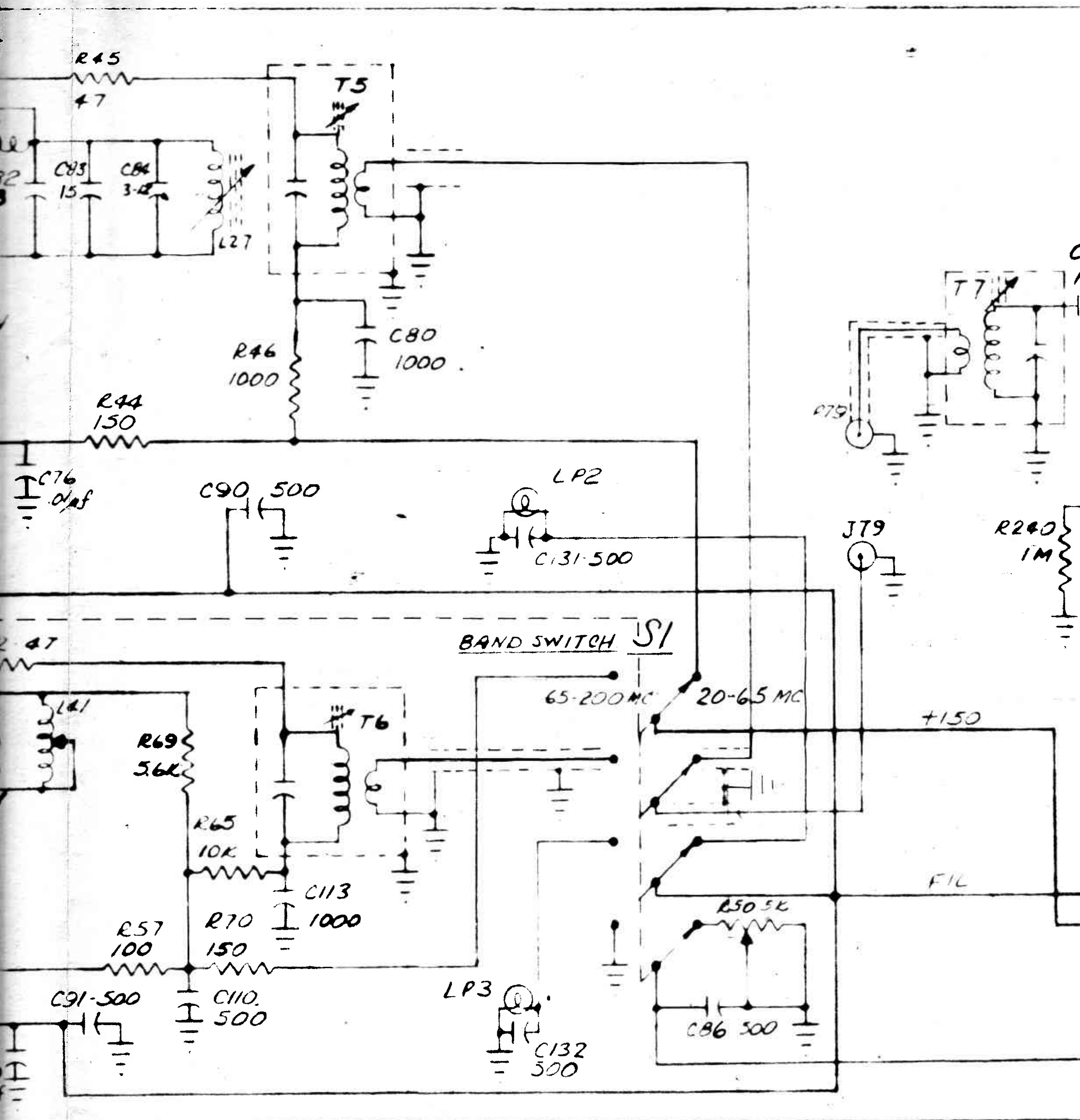

C133-1000
V16
6BJ6
L46
C140
.001 mf
R184
100K
V17
6BJ6
R188
150
82
C141
2000
R180
330K
R182
100
C137
1000
C85
.01mf
C138
1000
R183
2.7K
R185
220
C142
1000
L47
R187
150
GAIN
R186-150
C136
500
C143
500
C144
500
C134
500
V16
3
4
V17
3
4
FIL
L50
C147
500
C148
500
500
C118
FEED THRU

10.7 MC I.F. AMPLIFIER





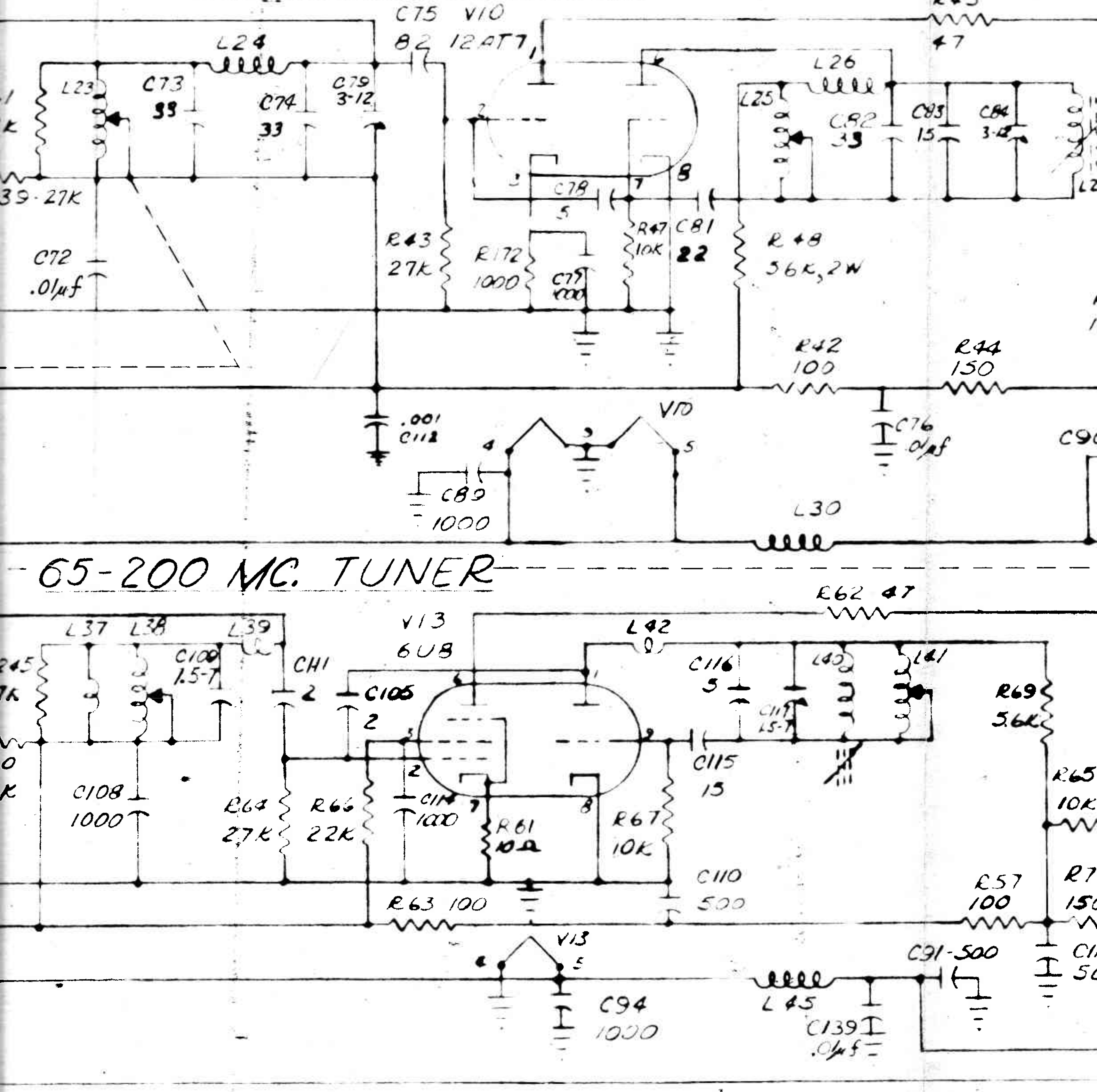
T8
C127
1000
V14
6AK5
V15
6BJ6
C221
1000
T7
P79
C120
1000
C123
1000
C121
1000
R174
2.7K
R176
330K
R178
100
C129
1000
R173
100
C124
500
C225
.01uf
R175-150
C125
500
J79
R240
1M
R241
220K
R177-47K
C222
500
R242-100K
C128
500
R243
100K
V14
3
4
6.5 MC
+150
L48
C145
.01mf
C104
.01uf
FIL
500

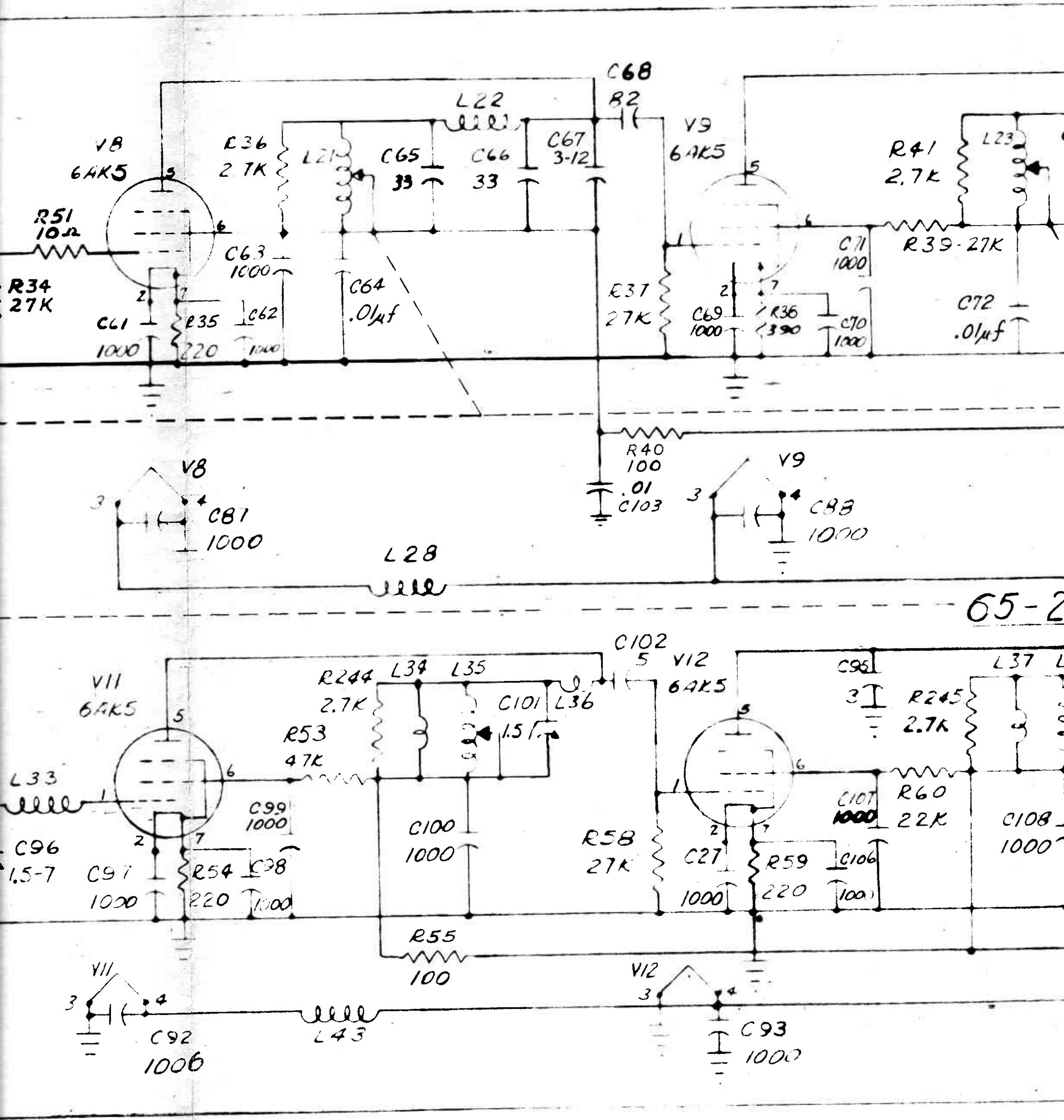


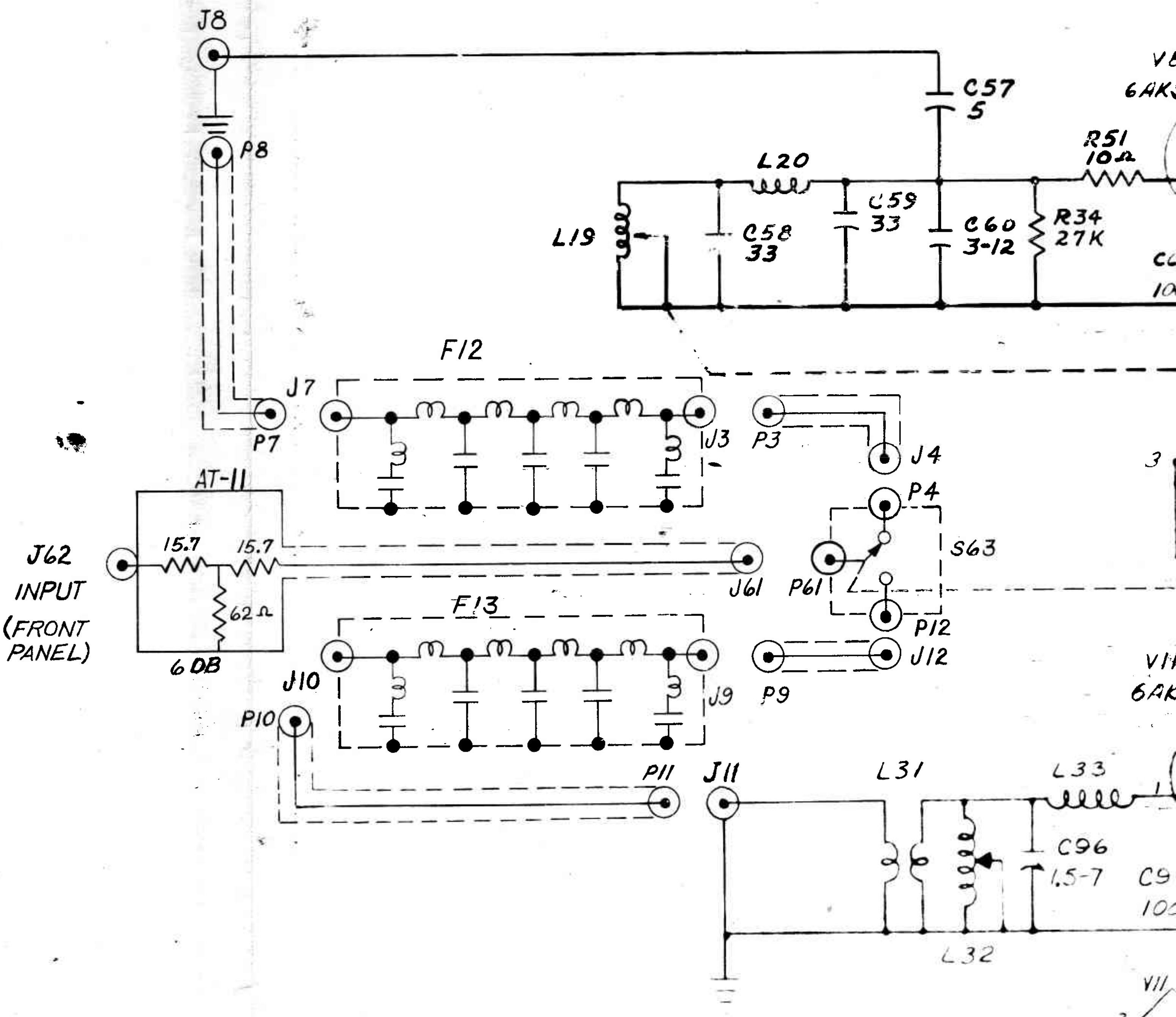
R45
47
T5
C83
15
C84
3-12
L27
C80
1000
R46
1000
R44
150
C76
.01µf
C90 500
LP2
C131-500
J79
T7
R240
1M
BAND SWITCH S1
47
L21
R69
5.6K
T6
65-200 MC
20-65 MC
+150
R65
10K
C113
1000
FIL
R57
100
R70
150
R50 5K
C91-500
C110
500
LP3
C132
500
C86 500

20-65 MC. TUNER

65-200 MC. TUNER




C68
82
L22
V8
6AK5
R36
2.7K
L21
C65
33
C66
33
C67
3-12
V9
6AK5
R41
2.7K
L23
R51
10Ω
R34
27K
C63
1000
C64
.01μf
C71
1000
R39-27K
C61
1000
R35
220
C62
1000
R37
27K
C69
1000
R36
390
C70
1000
C72
.01μf
R40
100
.01
C103
V8
C87
1000
V9
C88
1000
L28
65-2
C102
V12
6AK5
V11
6AK5
R244
2.7K
L34
L35
C101
1.5
L36
C95
3
L37
R245
2.7K
R53
47K
L33
C99
1000
C100
1000
R58
27K
C107
1000
R60
22K
C108
1000
C96
1.5-7
C97
1000
R54
220
C98
1000
C27
1000
R59
220
C106
1000
R55
100
V11
V12
C92
1006
L43
C93
1000



J8
P8
C57
5
V8
6AK
R51
10Ω
L20
C59
33
L19
C58
33
C60
3-12
R34
27K
F12
J7
P7
J3
P3
J4
P4
AT-11
J62
INPUT
(FRONT
PANEL)
15.7
15.7
62Ω
6 DB
J61
P61
S63
F13
P12
J12
J10
P10
J9
P9
P11
J11
L31
L33
C96
1.5-7
L32

SWITCH LEGENDS:

S2: FUNCTION SWITCH

POS. 1- METER BAL.
2- ZERO ADJ.
3- CARRIER ZERO
4- CARRIER
5- PEAK

S3: METER ATTEN.

S4: SUBTRACT 10 DB.

S5: CYCLES x1 x10 x100

S6: IMPULSE GENERATOR ON-OFF

S7: INT. EXT. METER SWITCH

S8: POWER ON-OFF

S9: MICROSWITCH - ACTIVATED BY TUNING UNITS T1, T2, & T3.

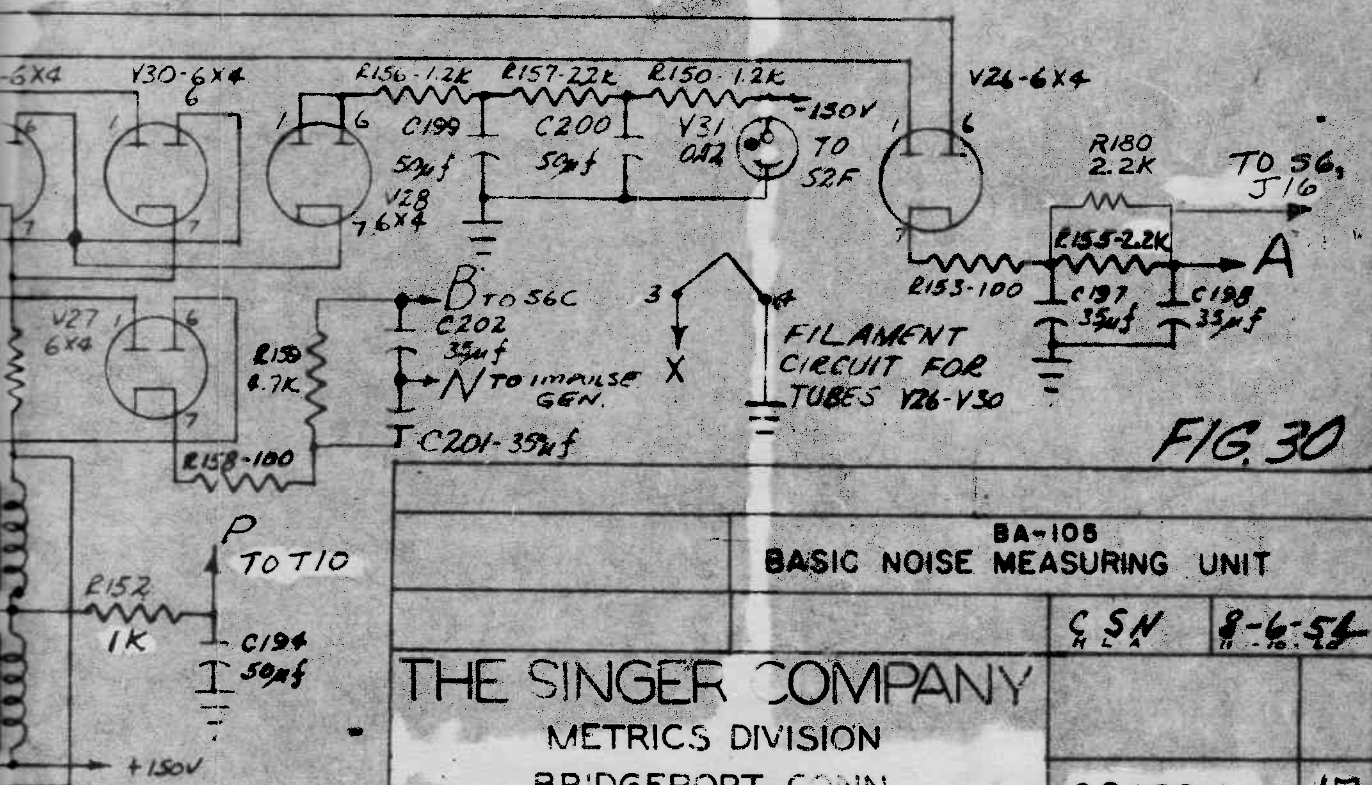


FIG. 30

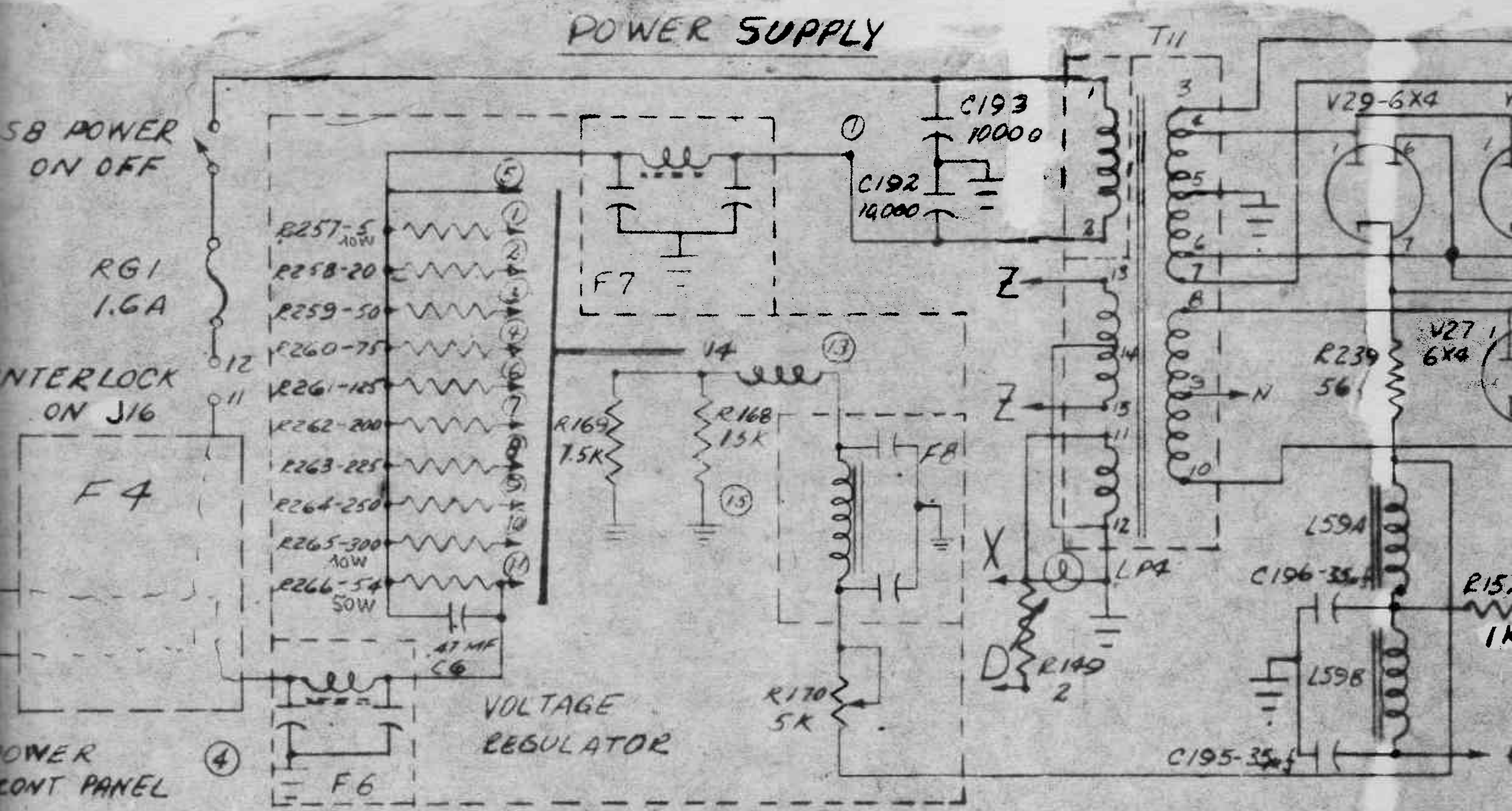
BA-105
BASIC NOISE MEASURING UNIT

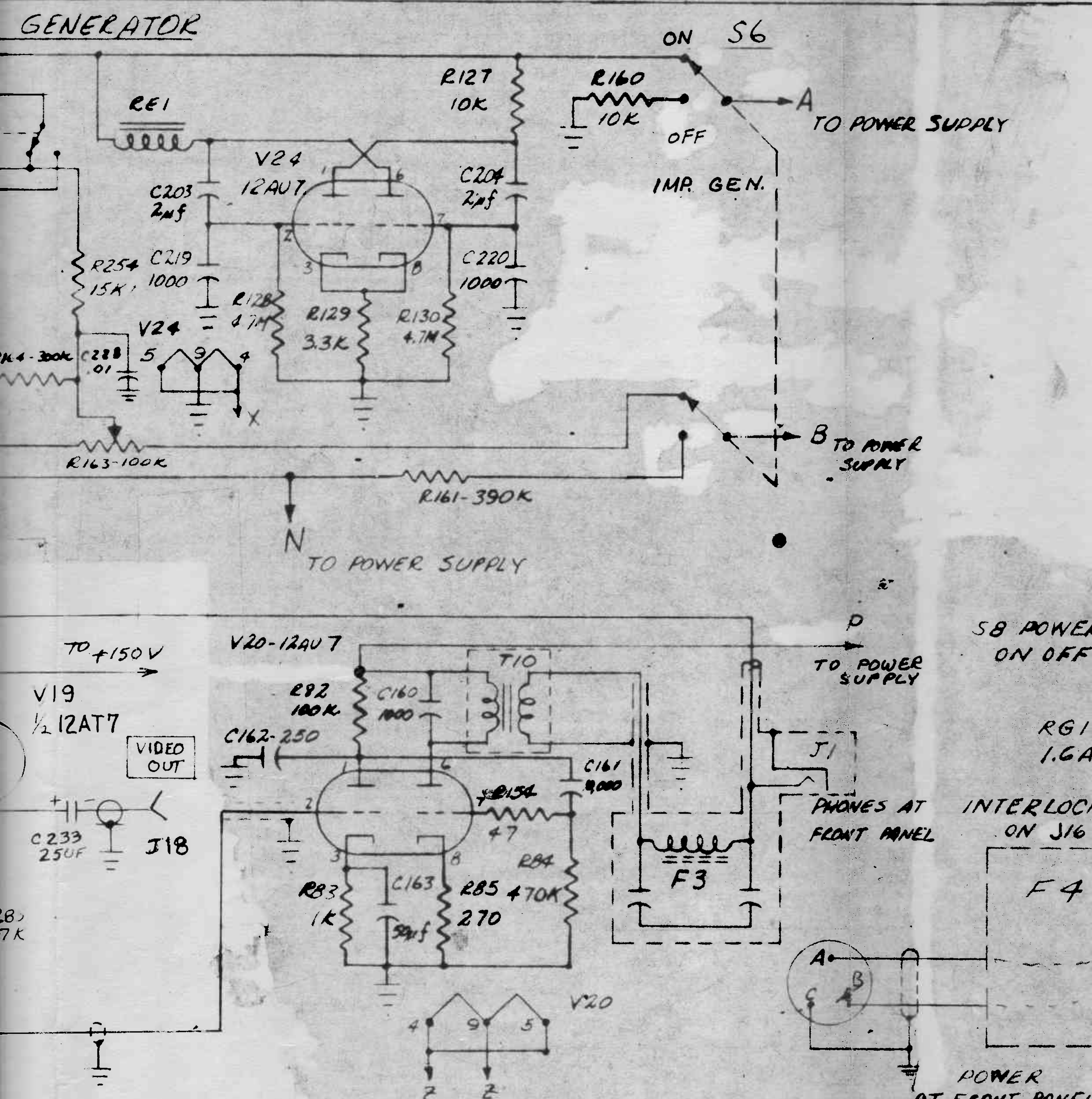
C SN 8-6-54

THE SINGER COMPANY
METRICS DIVISION
BRIDGEPORT, CONN.

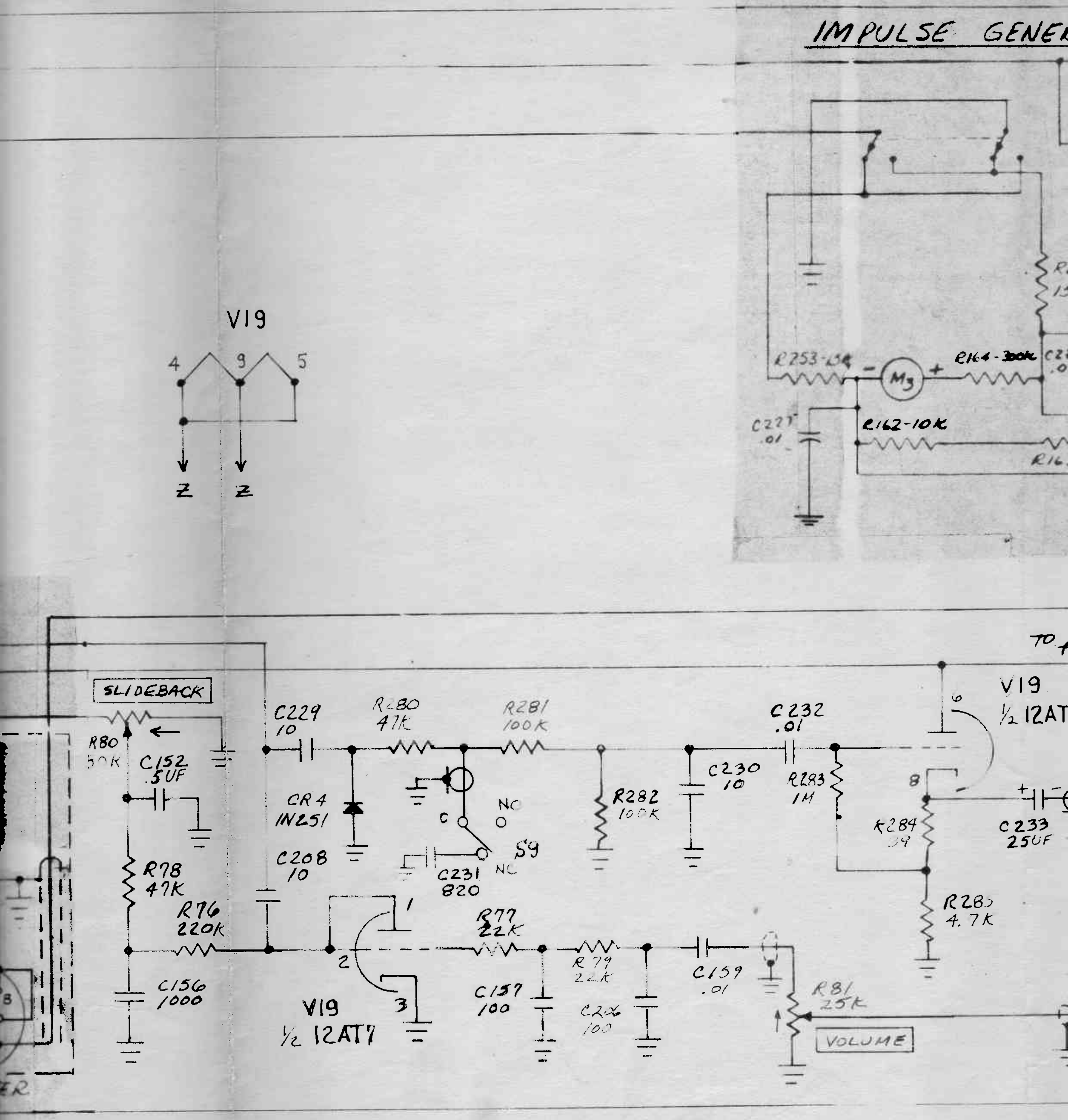
004284 17

PLY

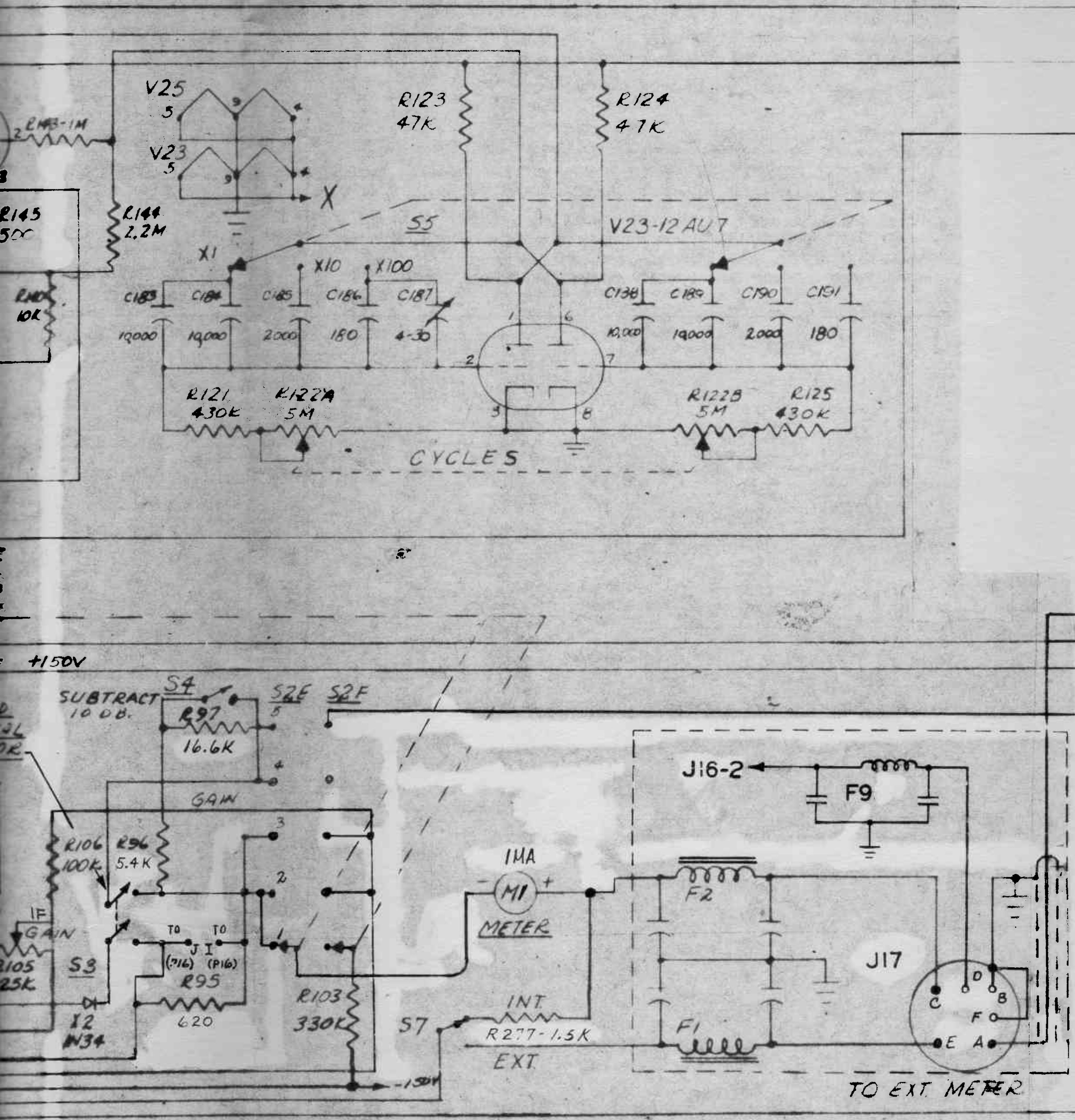

POWER SUPPLY
S8 POWER
ON OFF
RG1
1.6A
INTERLOCK
ON J16
F4
R257-5 10W
R258-20
R259-50
R260-75
R261-125
R262-200
R263-225
R264-250
R265-300 10W
R266-54 50W
.47 MF
C6
F6
F7
C193
10000
C192
10,000
T11
R169
7.5K
R168
1.5K
F8
R170
5K
VOLTAGE
REGULATOR
POWER
FRONT PANEL
LP4
R149
2
V29-6X4
V27
6X4
R239
56
L59A
L59B
C196-35
C195-35
N



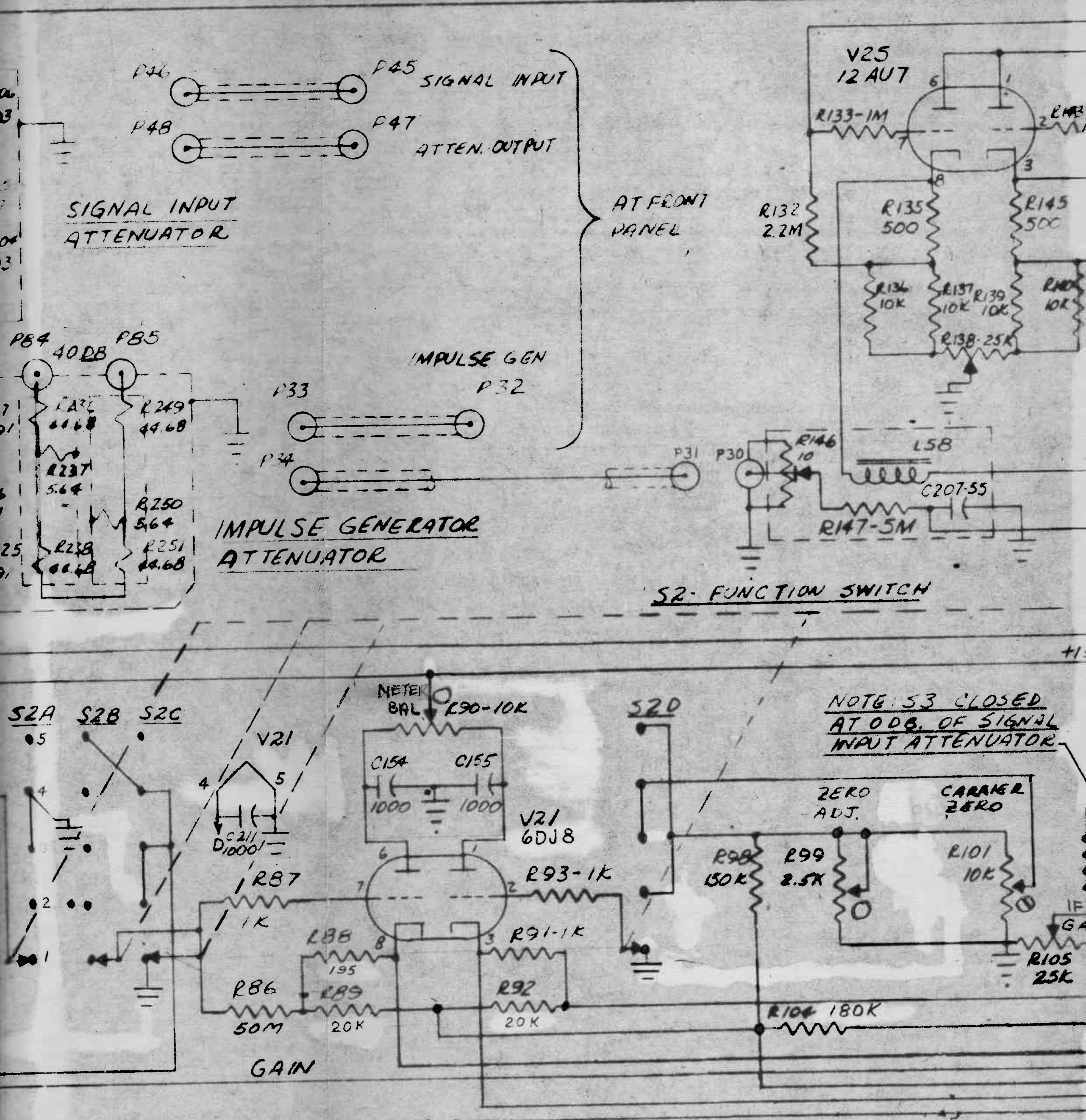
GENERATOR
ON
S6
OFF
IMP. GEN.
R127
10K
R160
10K
A
TO POWER SUPPLY
RE1
V24
12AU7
C203
2μf
C204
2μf
C219
1000
C220
1000
R254
15K
R128
4.7M
R129
3.3K
R130
4.7M
V24
C228
.01
X
B
TO POWER SUPPLY
R163-100K
R161-390K
N
TO POWER SUPPLY
P
TO POWER SUPPLY
TO +150V
V19
½ 12AT7
VIDEO OUT
C233
25UF
J18
V20-12AU7
T10
R82
100K
C160
1000
C162-250
C161
1000
R154
47
R84
470K
R83
1K
C163
50μf
R85
270
F3
J1
PHONES AT FRONT PANEL
V20
Z
Z
S8 POWER
ON OFF
INTERLOCK
ON J16
F4
POWER
AT FRONT PANEL



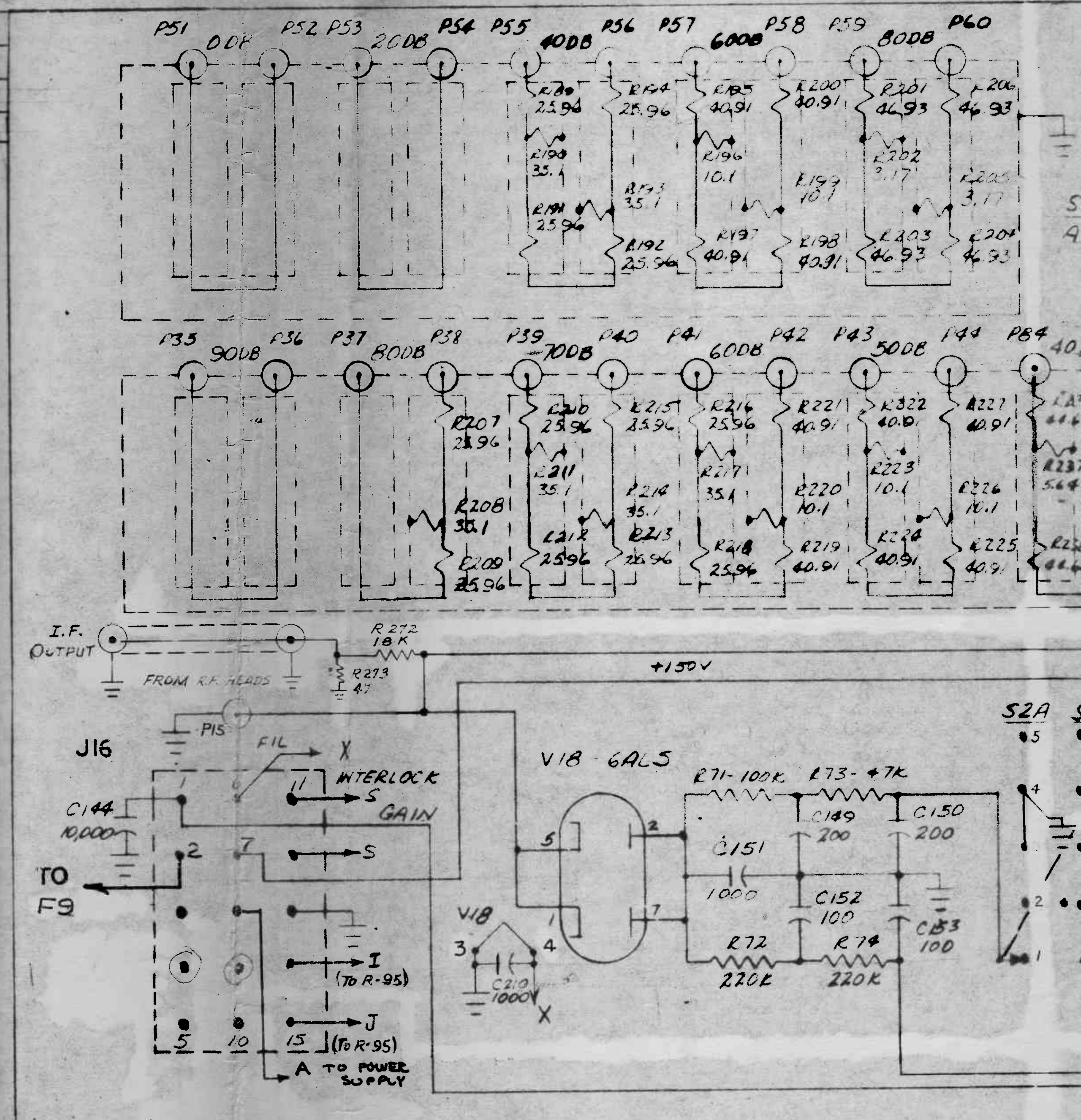
IMPULSE GENE
V19
4
9
5
Z
Z
R253-15K
M3
R164-300K
C227
.01
R162-10K
SLIDEBACK
R80
50K
C152
.5UF
R78
47K
R76
220K
C156
1000
C229
10
CR4
1N251
C208
10
R280
47K
R281
100K
C
NC
NC
S9
C231
820
R282
100K
C230
10
C232
.01
R283
1M
V19
1/2 12AT
6
8
R284
39
C233
25UF
R285
4.7K
1
2
3
V19
1/2 12AT7
R77
22K
R79
22K
C157
100
C226
100
C159
.01
R81
25K
VOLUME
TO



V25
V23
R143-1M
R145
R144
2.2M
R140
10K
X
X1
X10
X100
S5
V23-12AU7
R123
47K
R124
47K
C183
C184
C185
C186
C187
10,000
10,000
2000
180
4-30
C188
C189
C190
C191
10,000
10,000
2000
180
R121
430K
R122A
5M
R122B
5M
R125
430K
CYCLES
+150V
SUBTRACT
10 DB.
S4
R97
16.6K
S2E
S2F
GAIN
R106
100K
R96
5.4K
IF
GAIN
R105
25K
S3
J1
(J16)
(P16)
R95
620
X2
1N34
R103
330K
1MA
M1
METER
S7
INT
R277-1.5K
EXT
-150V
J16-2
F9
F2
F1
J17
TO EXT METER



P46
P45
SIGNAL INPUT
P48
P47
ATTEN. OUTPUT
SIGNAL INPUT ATTENUATOR
AT FRONT PANEL
P84
40DB
P85
R249 44.68
R237 5.64
R250 5.64
R238
R251 44.68
IMPULSE GEN
P33
P32
P34
IMPULSE GENERATOR ATTENUATOR
P31
P30
R146 10
L58
C207-55
R147-5M
V25 12AU7
R133-1M
R132 2.2M
R135 500
R145 500
R136 10K
R137 10K
R139 10K
R138-25K
S2- FUNCTION SWITCH
S2A
S2B
S2C
V21
C211 1000
METER BAL
R90-10K
C154 1000
C155 1000
V21 6DJ8
R87 1K
R93-1K
R88 195
R91-1K
R86 50M
R89 20K
R92 20K
GAIN
S2D
NOTE: S3 CLOSED AT 0DB. OF SIGNAL INPUT ATTENUATOR
ZERO ADJ.
CARRIER ZERO
R98 150K
R99 2.5K
R101 10K
R105 25K
R104 180K


P51
0 DB
P52
P53
20 DB
P54
P55
40DB
P56
P57
60DB
P58
P59
80DB
P60
R194 25.96
R195 40.91
R200 40.91
R201 46.93
R206 46.93
R196 10.1
R202 3.17
R193 35.1
R199 10.1
R205 3.17
R192 25.96
R197 40.91
R198 40.91
R203 46.93
R204 46.93
P35
90DB
P36
P37
80DB
P38
P39
70DB
P40
P41
60DB
P42
P43
50DB
P44
P84
R207 25.96
R215 25.96
R216 25.96
R221 40.91
R222 40.91
R227 40.91
R211 35.1
R217 35.1
R223 10.1
R208 35.1
R214 35.1
R220 10.1
R226 10.1
R212 25.96
R213 25.96
R218 25.96
R224 40.91
R209 25.96
R219 40.91
R225 40.91
I.F. OUTPUT
FROM R.F. HEADS
R 272 18 K
R 273 47
+150V
P15
J16
FIL
X
INTERLOCK
S
GAIN
S
C144 10,000
TO F9
I
(To R-95)
J
(To R-95)
A TO POWER SUPPLY
V18 6AL5
V18
C210 1000
X
R71- 100K
R73- 47K
C149 200
C150 200
C151 1000
C152 100
C153 100
R72 220K
R74 220K
S2A

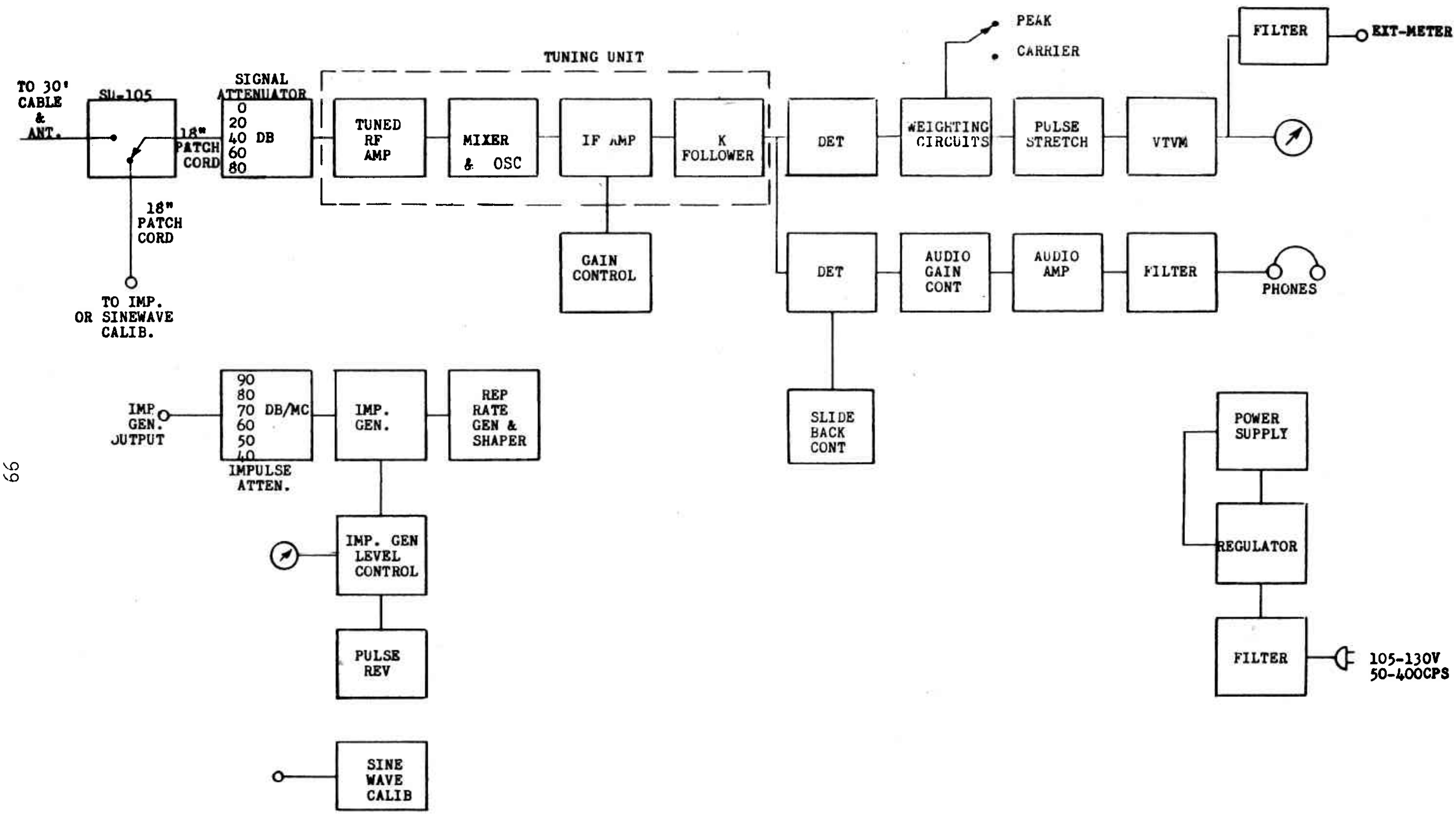


Figure 31

BLOCK DIAGRAM
NF-105

B-6742

INSTRUCTION MANUAL

EMPIRE*

TUNING UNIT

150 KC TO 30 MC

MODEL TA/NF-105

SERIAL NO.

Gertsch* EMPIRE* Sensitive Research* Panoramic*

SINGER

Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

1. General

Tuning Unit T-A/NF-105 covers the frequency range from 150 KC to 30 MC by means of six bands.

Its calibration method differs from T-1/NF-105 and T-2/NF-105, the 20-400 MC ranges, in that, in addition to the peak calibration, the carrier calibration also is performed by means of the impulse noise generator.

The procedure for peak calibration is identical to that used for the 20-1000 MC ranges, and is described in detail in the instruction manual for the NF-105. Carrier (CW) calibration is performed by means of the impulse generator. This procedure is possible since both the level of the impulse generator and the bandwidth of the receiver are known. The bandwidth of the receiver must be considered because the impulse noise sensitivity of the receiver is a function of the receiver bandwidth. If, for instance, the receiver had a bandwidth of one megacycle, its CW sensitivity in microvolts would equal its impulse sensitivity expressed in microvolts per megacycle bandwidth. If the receiver bandwidth were only 0.1 megacycle, the impulse noise calibrating voltage required for the previous CW sensitivity adjustment of the receiver, would have to be increased by a factor of 10. The Calibration chart (Figure 1) indicates the equivalent impulse level required to produce a full scale deflection of 100 microvolts of carrier (CW) voltage.

The noise bandwidth of Tuning Unit Model T-A/NF-105 is approximately 10 KC. The exact value of bandwidth (in Megacycles) for any frequency may be determined by referring to the calibration chart shown in Figure 1 and dividing the carrier sensitivity (100 uv) by the equivalent impulse level.

For example: $\frac{100 \text{ uv}}{80 \text{ DBMc}} - \frac{100 \text{ uv}}{10{,}000 \text{ uv}} = 0.01 \text{ Mc} = 10 \text{ KC}$

2. Accessories

a. Switching Unit SU-105

b. Antenna Equipment LM-105- Including the following items:

Carrying Case	LC-105
Loop Antenna	LP-105
Vertical Antenna	VA-105
Magnetic Probe	LO-105
Line Probe (50 ohms)	LA-105
Line Probe(500 ohms)	LF-105
High Impedance Binding Post	PA-105

Switching Unit SU-105 enables the operator to feed either the calibrating signal from Impulse Generator or the interference signal from the antenna to the SIGNAL INPUT jack on the front panel by means of a toggle switch rather than by changing cables. This unit is available as an accessory.

The input impedance of the NF-105 for all frequency ranges is 50 ohms. In order to achieve efficient energy transfer from the vertical and the loop antennas, couplers (impedance matching devices) are furnished as part of these antennas. Since the impedance of the antennas is a function of frequency, matching transformers are used for each frequency range of tuning Unit T-A/NF-105.

The vertical antenna VA-105 consists of a 41" collapsible rod mounted on top of its coupler. The coupler contains six autotransformers, whose 50 ohm output, by means of a six position switch, is connected to the antenna receptacle located on the coupler.

Similarly, the loop antenna LP-105 is mounted on a coupler containing the appropriate matching networks. They are also selected for the proper frequency range by means of a six position switch.

Magnetic Field Probe Model LO-105 is similar to Magnetic Field Probe Model MP-105 except that is has more inductance than the latter so as to provide effective low frequency pickup. Since Model LO-105 and MP-105 are of the same physical appearance Magnetic Field Probe Model LO-105 has half its loop painted red to provide a simple means of identification.

Line Probes Model LA-105 and LF-105 are designed for 50 ohms and 500 ohms impedance respectively. They are used in the same manner as Line Probes LL-105 and LH-105, as described in the instruction manual for the higher frequencies.

3. Conducted Measurements (Two Terminal VTVM)

Connect the impulse generator output to the signal input receptacle (located on the Basic Measuring Unit) by means of the 18" cable. In addition, connect the attenuator output to the corresponding receptacle on the tuning unit by means of the 6" cable. Connect the signal input receptacle to the equipment to be measured as shown in Figure 2 **after calibration has been performed.**
Turn the equipment on and after it has warmed up, adjust the meter balance and zero adjust controls for meter zero. Turn the impulse generator on and adjust its pulse repetition rate to approximately 1,000 cycles per second.

For CW measurement adjust the Impulse Generator output controls to the value indicated for the desired frequency (see Figure 1).

Set the signal input attenuator to 20 DB. Turn the bandswitch on the tuning unit to the proper frequency range and tune to the desired frequency. Turn the function switch to its peak setting and adjust the gain control for full scale indication on the large meter.

The instrument now has a full scale sensitivity of 100 microvolts (CW) as a two-terminal vacuum tube voltmeter. By changing the attenuator setting 0, 40, 60 or 80 DB the sensitivity is changed to 10, 1,000, 10,000 or 100,000 microvolts full scale, respectively, as shown in the table below. Calibration by means of the impulse noise signal must at all times be made with the function switch in the PEAK position, even though the instrument is being calibrated to be used for carrier measurements.

SIGNAL INPUT ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	10 Microvolts
20 DB	100 Microvolts
40 DB	1000 Microvolts
60 DB	10,000 Microvolts
80 DB	100,000 Microvolts

After the calibration has been performed carrier measurements are normally taken with the function switch in the CARRIER position. Readings must be taken in the PEAK position, however, it the peak value of a modulated carrier is to be measured.

If sensitivity in excess of that produced by the above described calibration procedure is desired, the sensitivity may be increased by 20 DB as follows: Set signal input attenuator to 40 DB instead of 20 DB while calibrating. This procedure increases the full scale sensitivity of the instrumentto 1, 10, 100, 1,000, and 10,000 microvolts respectively depending upon the setting of the signal input attenuator. Therefore, when following this alternate calibration procedure, deduct 20 DB from the indicated reading. In the one microvolt full scale position, correction for residual noise may be applied as indicated in the instruction manual for the NF 105.

For PEAK measurements of broadband noise the substitution method (visual or aural) is used as described in detail in the instruction manual for the NF-105. The readings of broadband noise are always in terms of DB above 1 microvolt per megacycle bandwidth.

Radiated Measurements

In order to make radiated measurements, vertical antenna Model VA-105 or loop antenna Model LP-105 are used as pick-up devices. If measurements are conducted in a shielded room, vertical antenna Model VA-105 is commonly employed. Extend the vertical antenna to its full length (41 inches). The base of the coupler must be mounted on a metal plate about 12" square (not furnished), which is bonded to the metal bench top by means of a copper bond strap 12" wide. A typical set-up is shown in Figure 3.

Connect the impulse generator output to the signal input receptacle (located on the Basic Measuring Unit) by means of the 18" cable. In addition, connect the attenuator output to the corresponding receptacle on the tuning unit by means of the 6" cable.

Turn the equipment on and after it has warmed up, adjust the meter balance and meter zero control. Turn the impulse generator on and adjust its pulse repetition rate to approximately 1000 cycles per second.

For CW measurements proceed as follows:
Adjust the impulse generator output controls to the value indicated for the desired frequency (see Figure 1).

Set the signal input attenuator to 40 DB. Turn the bandswitch on the tuning unit to the proper frequency range and tune to the desired frequency. Turn the function switch to its peak setting and adjust the gain control for full scale indication on the large meter. The two terminal sensitivity now becomes as follows:

SIGNAL INPUT ATTEN.	FULL SCALE SENSITIVITY
0DB	1 microvolt
20DB	10 microvolts
40DB	100 microvolts
60DB	1000 microvolts
80DB	10,000 microvolts

The actual level impressed across the input terminals of the instrument will now be 20 DB less than the sum of the signal input attenuator and meter reading.

Disconnect the 18" cable from the signal input receptacle and in its place connect the pick-up device (VA-105) by means of the 30 ft. cable.* Set the bandswitch of the coupler to the desired frequency range.

In order to read narrow band CW radiated signals the antenna factors as shown in Figures 4 or 5 must be applied to the instrument reading. These antenna factors indicate the voltage transformation ratio in the matching transformers necessary to convert the antenna impedance to 50 ohms as required by the input impedance of the instrument. The actual transformation ratio shown in Fig. 4 and 5 is 20 DB greater than the number shown. However, since the instrument was sensitized by 20 DB, 20 DB was removed from the antenna published factor. This will now provide the correct radiated reading as the sum of the vertical antenna factor, the signal input attenuator and the meter indication.

Check by means of the tuning adjustment on the tuning unit that the desired signal produces maximum meter deflection. It may be necessary to change the input attenuator setting in order to achieve an "on scale" meter reading. If in tuning to the signal to be measured an appreciable departure from the original calibrating frequency was required, consult the calibration chart (Figure 1) and, if necessary, calibrate at the new frequency. Add to the sum of the meter and signal input attenuator readings(in DB) the antenna factor of Figure 4. The reading thus obtained in DB above one microvolt constitutes the antenna induced voltage.

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*This step may be accomplished more conveniently by means of switching unit SU-105, available as an accessory item.

For measurement of broadband noise the substitution method (visual or aural) is used as described in the instruction manual for the NF-105. The readings of broadband noise are always in terms of DB above one microvolt per megacycle bandwidth. Add to the result of the substitution measurement the antenna factor in Figure 4, plus a constant of 20 DB.

When making broadband radiated measurements the substitution method must be employed. In this method the indication obtained from the unknown radiated signal is matched by the built-in impulse generator. The unknown radiated signal is picked up by the antenna then fed to the instrument through the antenna matching networks necessary to convert the antenna impedance. The substitution impulse generator signal however is fed directly to the input terminals of the instrument. The result of this is that the full transformation ratio of the antenna matching networks must be added to the impulse generator level in order to indicate the true radiated signal appearing at the antenna. It is for this reason that substitution measurements taken with Tuning Unit T-A/NF-105 require the addition of 20 DB to the antenna factor.

If for either CW or broadband noise measurements the loop antenna (LP-105) is to be employed, refer to Figure 5 for the proper antenna factor wherever Figure 4 is mentioned above.

For measurement of field strength in microvolts per meter refer to the next section.

5. Field strength measurements may be conducted by means of either the loop or the vertical antenna. Results obtained when using the loop antenna will be more accurate since they are essentially independent of ground consistency and height above ground. On the other hand a disadvantage of the loop antenna, especially at the lower frequencies, is its small effective height compared to that of the vertical antenna. For these reasons, use the loop antenna for field strength measurements whenever the signal level is sufficient to produce an adequate indication. Since the loop antenna is a directive device, it must be rotated for maximum pickup as indicated by the meter.

If a low signal level makes the use of the vertical antenna necessary, it is recommended that the antenna be located over the center of a network of wires placed on the ground and covering an area of approximately 800 square feet. The base of the antenna coupler must be connected to the ground network by a side bonding strap.

In spite of the precaution of spreading a ground wire network it is recommended that for greater accuracy, the vertical antenna be calibrated by means of the loop antenna at or near the frequency to be measured.

The calibration procedure is the same as that described in the previous section on radiated measurements. In order to obtain field strength in DB above one microvolt per meter, refer to Figure 4 for the vertical antenna and Figure 5 for the loop antenna. Add 6 DB (the effective height of a 41" rod) to the readings obtained using Figure 4.

6. Circuit Description

The frequency range of 0.150 MC to 30 MC is divided into six turret switched bands using IF frequencies of 0.455 and 1.600 MC. The proper intermediate frequency is chosen automatically by the bandswitching turret.

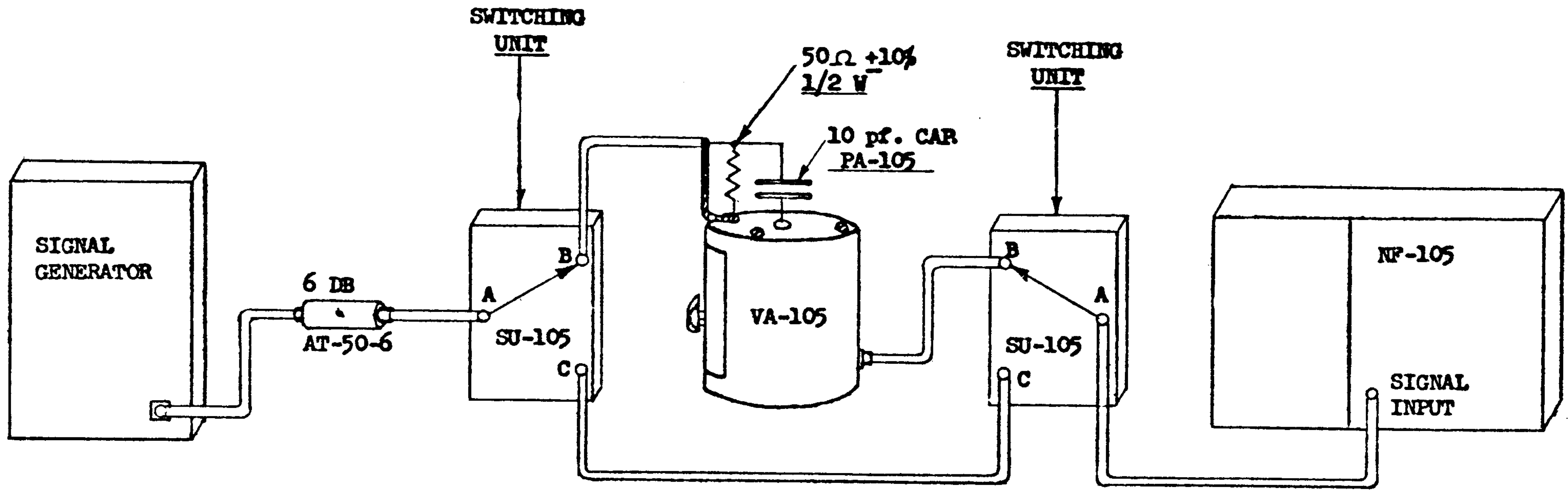
BAND	FREQUENCY	IF
1	0.150 to 0.360 MC	0.455 MC
2	0.360 to 0.870 MC	1.600 MC
3	0.870 to 2.1 MC	0.455 MC
4	2.1 to 5.2 MC	1.600 MC
5	5.2 to 12.5 MC	1.600 MC
6	12.5 to 30 MC	1.600 MC

The input signal, after passing through the signal input attenuator in the Basic Measuring Unit, is applied to a tuned circuit proceeding an RF Amplifier, using a type 5702 pentode. The signal is then fed to the tuned mixer stage employing a 5875 tube where it is mixed with the local oscillator voltage. The local oscillator employes a 5702 and operates above the signal frequency by an amount equal to the IF frequency. The resulting IF signal is amplified by the corresponding IF amplifier. Each IF amplifier consists of 4 double tubed stages using 6BJ6 tubes. A schematic diagram of Tuning Unit T-A/NF-105 is shown in Figure 6.

CALIBRATION SET-UP FOR VERTICAL ANTENNA VA-105

The test procedure used to determine the vertical antenna factor is shown on drawing #A9400.

The calibration charts furnished with our vertical antenna indicates the voltage transformation ratios vs. frequency of the antenna coupler. When the switching units are placed in position "C", the NF-105 reads the signal directly from a standard signal generator. When the switching units are placed in position "B", the NF-105 reads the signal after the transformation of the vertical antenna coupler. The difference between the reading obtained with the switches in positions "B" and "C" is the vertical antenna factor. The number thus obtained is the number shown on the vertical antenna charts + 20 DB. For instance, at 150 KC, the reading after the coupler will appear approximately 39 DB below that of the straight through setting.



ON SU-105:

A - CENTER CONNECTOR
B - LEFT CONNECTOR
C - RIGHT CONNECTOR

A 9400

CALIBRATION SET-UP FOR VERTICAL ANTENNA VA-105

PARTS LIST FOR TUNING UNIT
MODEL T-A/NF-105

I. CAPACITORS

Ref. Symbol	Description	Part Of
C700	5 - 25 mmf, ceramic trimmer	Tuned ckt.
C701	15 mmf, ceramic	"
C702	5 - 25 mmf, ceramic trimmer	"
C703	15 mmf, ceramic	"
C704	5 - 25 mmf, ceramic trimmer	"
C705	15 mmf, ceramic	"
C706	5 - 25 mmf ceramic trimmer	"
C707	15 mmf, ceramic	"
C708	5 - 25 mmf, ceramic trimmer	"
C709	15 mmf, ceramic	"
C710	5 - 25 mmf, ceramic trimmer	"
C711	15 mmf, ceramic	"
C712A	10-290 mmf, variable air	R.F.Tuner
C712B	10-290 mmf, variable air	"
C712C	10-290 mmf, variable air	"
C713	.01 mmf, 300V ceramic disc	"
C714	1470 mmf, 2%, ceramic	"
C715	.01 mmf, 300V, ceramic disc	"
C716	.01 mmf, 300V, ceramic disc	"
C717	200 mmf, 5%, 500V dura mica	Tuned ckt.
C718	200 mmf, 5%, 500V, dura mica	"
C719	5 mmf, ceramic	"
C720	2 mmf, ceramic	"
C721	2 mmf, ceramic	"
C722	5-25 mmf, ceramic trimmer	"
C723	15 mmf, ceramic	"
C724	5-25 mmf, ceramic trimmer	"
C725	5 mmf, ceramic	"
C726	5-25 mmf, ceramic trimmer	"
C727	5 mmf, ceramic	"
C728	5-25 mmf, ceramic trimmer	"
C729	15 mmf, ceramic	"
C730	5-25 mmf, ceramic trimmer	"
C731	15 mmf, ceramic	"
C732	5-25 mmf, ceramic trimmer	"
C733	15 mmf, ceramic	"
C734	.01 mmf, 300V ceramic disc	R.F.Tuner
C735	.01 mmf, 300V, ceramic disc	"
C736	.01 mmf, 300V, ceramic disc	"
C737	.01 mmf, 300V, ceramic disc	"
C738	5-25 mmf, ceramic trimmer	Tuned ckt.
C739	33 mmf, 5%, ceramic	"
C740	5-25 mmf, ceramic trimmer	"
C741	43 mmf, 2%, 500V, dura mica	"
C742	5-25 mmf, ceramic trimmer	"

I. CAPACITORS (continued)

Ref. Symbol	Description	Part of
C743	15 mmf, 5%, ceramic	"
C744	5-25 mmf, ceramic trimmer	"
C745	15 mmf, ceramic	"
C750	5-25 mmf, ceramic trimmer	"
C751	15 mmf, ceramic	"
C752	5-25 mmf, ceramic trimmer	"
C753	5 mmf, ceramic	"
C754	25 mmf, 500V, ceramic	R.F.Tuner
C755	25 mmf, 500V, ceramic	"
C756	118 mmf, 2%, 500V dura mica	Tuned ckt.
C757	80 mmf, 2%, 500V, dura mica	"
C758	540 mmf, 2%, 500V dura mica	"
C759	480 mmf, 2%, 500V, dura mica	"
C760	960 mmf, 2%, 500V, dura mica	"
C761	2020 mmf,2%, 500V dura mica	"
C762	.01 mmf, 300V, ceramic disc	R.F.Tuner
C763	.01 mmf, 300V, ceramic disc	"
C764	.47 mmf, 100V, electrolytic	"
C765	.47 mmf, 200V, electrolytic	"
C766	500 mmf, ceramic feed-thru	1.6 MC IF Amp.
C767	.001 mmf, 300V, ceramic disc	"
C768	250 mmf, 500V, dura mica	"
C769	.01 mmf, 300V, ceramic disc	"
C770	500 mmf, 500V, ceramic feed-thru	"
C771	.001 mmf, 300V, ceramic disc	"
C772	.01 mmf, 300V, ceramic disc	"
C773	.01 mmf, 300V, ceramic disc	"
C774	500 mmf, 500V, ceramic feed-thru	"
C775	250 mmf 500V, dura mica	"
C776	250 mmf, 500V, dura mica	"
C777	.001mmf, 300V, ceramic disc	"
C778	.01 mmf, 300V, ceramic disc	"
C779	.001mmf, 300V ceramic disc	"
C780	.01 mmf, 300V, ceramic disc	"
C781	.01 mmf, 300V, ceramic disc	"
C782	500 mmf, 500V, ceramic feed-thru	"
C783	250 mmf, 500V, dura mica	"
C784	250 mmf, 500V, dura mica	"
C785	.001mmf, 300V ceramic disc	"
C786	.001mmf, 300V, ceramic disc	"
C787	.01 mmf, 300V, ceramic disc	"
C788	500 mmf, 500V ceramic feed-thru	"
C789	250 mmf, 500V dura mica	1.6 MC IF Amp.
C790	250 mmf, 500V, dura mica	"
C791	.001mmf, 300V, ceramic disc	"
C792	.01 mmf, 300V, ceramic disc	"
C793	.01 mmf, 300V, ceramic disc	"
C794	500 mmf, 500V ceramic feed-thru	"

I. CAPACITORS (continued)

Ref. Symbol	Description	Part of
C795	.01 mmf, 300V ceramic disc	"
C796	200 mmf, 500V, dura mica	"
C797	500 mmf, 500V, ceramic feed thru	455 KC IF Amp.
C798	820 mmf, 500V, dura mica	"
C799	.001mmf, 300V, ceramic disc	"
C800	.01 mmf, 300V, ceramic disc	"
C801	500 mmf, 500V, ceramic feed-thru	"
C802	.001mmf, 300V, ceramic disc	"
C803	.01 mmf, 300V, ceramic disc	"
C804	.01 mmf, 300V, ceramic disc	"
C805	500 mmf, 500V ceramic feed-thru	"
C806	510 mmf, 500V, dura mica	"
C807	510 mmf, 500V, dura mica	
C808	.01 mmf, 300V, ceramic disc	"
C809	.001mmf, 300V, ceramic disc	"
C810	.001mmf, 300V, ceramic disc	"
C811	.01 mmf, 300V, ceramic disc	"
C812	.01 mmf, 300V, ceramic disc	"
C813	500 mmf, 500V, ceramic feed-thru	"
C814	510 mmf, 500V dura mica	"
C815	510 mmf, 500V, dura mica	"
C816	.001mmf, 300V, ceramic disc	"
C817	.01 mmf, 300V ceramic disc	"
C818	.01 mmf 300V, ceramic disc	"
C819	500 mmf, 500V, ceramic feed-thru	"
C820	.01 mmf, 300V, ceramic disc	"
C821	510 mmf, 500V, dura mica	"
C822	510 mmf, 500V, dura mica	"
C823	.001mmf, 300V, ceramic disc	"
C824	.01 mmf, 300V, ceramic disc	"
C825	.01 mmf, 300V ceramic disc	"
C826	500 mmf, 500V, ceramic feed-thru	"
C827	.01 mmf, 300V, ceramic disc	"
C828	510 mmf, 500V dura mica	"
C829	.01 mmf, 300V ceramic	"
C830	.01 mmf, 300V, ceramic	1.6 MC IF Amp.
C831	.01 mmf, 300V ceramic	455 KC IF Amp.
C832	500 mmf, 500V, ceramic feed-thru	"
C833	500 mmf, 500V, ceramic feed-thru	1.6 MC IF Amp.

II. JACKS

Ref. Symbol	Description	Part of
J700	UG-291/U	Ant. Conn.
J701	Connector, Coaxial; Type MB	455 KC IF
J702	Connector, Coaxial; Type MB	1.6 MC IF
J703	Connector, Coaxial; Type MB	R.F. Input
J704	Connector, Coaxial; Type MB	Switching Box IF
J705	Connector, Female; Coaxial Plug-In	IF Output
J706	Connector, Coaxial; Type MB	455 KC IF
J707	Connector, Coaxial; Type MB	1.6 MC IF

III. INDUCTORS

Ref. Symbol	Description	Part of
L700	Input choke	1.6 MC IF
L701	Input choke	455 KC IF
L702	Cathode coil	R.F. Tuner
L703	Filament choke	"
L704	Filament choke	"
L705	Filament choke	"
L706	Filament choke	1.6 MC IF
L707	Filament choke	"
L708	Filament choke	"
L709	Filament choke	455 KC IF
L710	Filament choke	"
L711	Filament choke	"

IV. PILOT LAMPS

Ref. Symbol	Description	Part of
LP700	Lamp No. 47	R.F. Tuner
LP701	Lamp No. 47	"

V. CONNECTORS

Ref. Symbol	Description	Part of
P701	Plug, Coaxial; Type MB	455 KC IF
P702	Plug, Coaxial; Type MB	1.6 MC IF
P703	Plug, Coaxial; Type MB	R.F. Input
P704	Plug, Coaxial; Type MB	IF Output
P706	Plug, Coaxial; Type MB	455 KC IF
P707	Plug, Coaxial; Type MB	1.6 MC IF
P708	Connector; Pin, Female	Main unit plug

VI. RESISTORS

Ref. Symbol	Description	Part of
R700	36 ohms, 1/2 w, 5% carbon	Tuned Ckt.
R701	150 ohms, 1/2 w,10% carbon	"
R702	150 ohms, 1/2 w,10% carbon	"
R703	150 ohms, 10%, ½w, carbon	R.F.Tuner
R704	10K ohms, 10%, ½w, carbon	"
R705	1K ohms, 10%, ½w, carbon	"
R706	220 ohms, 10%, ½w, carbon	"
R707	220 ohms, 10%, ½w, carbon	"
R708	10K ohms, 10%, ½w, carbon	"
R709	220K ohms, 10% ½w, carbon	"
R710	470 ohms, 10%, ½w, carbon	"
R711	22K ohms, 10%, ½w, carbon	"
R712	1K ohms, 10%, ½w, carbon	Tuned ckt.
R713	1.5K ohms, 10% ½w carbon	"
R714	1.5K ohms, 10%, ½w, carbon	"
R715	1.5K ohms, 10%, ½w, carbon	"
R716	1.2K ohms, 10%, ½w, carbon	"
R718	150 ohms, 10%, ½w, carbon	R.F.Tuner
R719	4.7K ohms, 10%, 2w, carbon	"
R720	150 ohms, 10% 2w, carbon	"
R721	1M ohms, 10%, ½w, carbon	1.6 MC IF
R722	100K ohms, 10%, ½w, carbon	"
R723	1K ohms, 10%, ½w, carbon	"
R724	390 ohms, 10%, ½w, carbon	"
R725	1M ohms, 10%, ½w, carbon	"
R726	47K ohms, 10%, ½w, carbon	"
R727	1K ohms, 10%, ½w, carbon	"
R728	390 ohms, 10%, ½w, carbon	"
R729	47K ohms, 10%, ½w, carbon	"
R730	1M ohms, 10%, ½w, carbon	"
R731	220K ohms, 10%, ½w, carbon	"
R732	470 ohms, 10%, ½w, carbon	"
R733	390 ohms, 10%, ½w, carbon	"
R734	47K ohms, 10%, ½w, carbon	"
R735	470 ohms, 10%, 1w, carbon	"
R736	680 ohms, 10%, ½w, carbon	"

VI. RESISTORS (continued)

Ref. Symbol	Description	Part Of
R737	15K ohms, 10%, $\frac{1}{2}$w, carbon	1.6 MC IF
R738	150 ohms, 10% $\frac{1}{2}$w, carbon	+150 V line
R739	7.5K ohms, 10 w, wire wound	"
R740	100K ohms, 10%, $\frac{1}{2}$w, carbon	455 KC IF
R741	1M ohms, 10%, $\frac{1}{2}$w, carbon	455 KC IF
R742	1K ohms, 10%, $\frac{1}{2}$w, carbon	"
R743	100 ohms, 10%, $\frac{1}{2}$w, carbon	"
R744	22K ohms, 10%, $\frac{1}{2}$w, carbon	"
R745	1M ohms, 10%, $\frac{1}{2}$w, carbon	"
R746	15K ohms, 10%, $\frac{1}{2}$w, carbon	"
R747	15K ohms, 10%, $\frac{1}{2}$w, carbon	"
R748	1K ohms, 10%, $\frac{1}{2}$w, carbon	"
R749	100 ohms, 10%, $\frac{1}{2}$w, carbon	"
R750	22K ohms, 10%, $\frac{1}{2}$w, carbon	"
R751	15K ohms, 10%, $\frac{1}{2}$w, carbon	"
R752	470 ohms, 10%, $\frac{1}{2}$w, carbon	"
R753	15k ohms, 10%, $\frac{1}{2}$w, carbon	"
R754	100 ohms, 10%, $\frac{1}{2}$w, carbon	"
R755	22K ohms, 10%, $\frac{1}{2}$w, carbon	"
R756	15K ohms, 10%, $\frac{1}{2}$w, carbon	"
R757	15K ohms, 10%, $\frac{1}{2}$w, carbon	"
R758	470 ohms, 10%, 1w, carbon	"
R759	680 ohms, 10%, $\frac{1}{2}$w, carbon	"
R760	15K ohms, 10%, $\frac{1}{2}$w, carbon	"
R761	470 ohms, 10%, $\frac{1}{2}$w, carbon	"
R762	100K ohms, 10%, $\frac{1}{2}$w, carbon	"
R763	100K ohms, 10%, $\frac{1}{2}$w, carbon	1.6 MC IF
R764	100K ohms, 10%, $\frac{1}{2}$w, carbon	"
R765	100K ohms, 10%, $\frac{1}{2}$w, carbon	"
R766	100K ohms, 10%, $\frac{1}{2}$w, carbon	"
R767	100K ohms, 10%, $\frac{1}{2}$w, carbon	"
R768	100K ohms, 10%, $\frac{1}{2}$w, carbon	"
R769	4.7K ohms, 10%, $\frac{1}{2}$w, carbon	Tuned ckt.
R770	47 ohms, 10% $\frac{1}{2}$w, carbon	R.F.Tuner
R771	1.5K ohms, 10%, $\frac{1}{2}$w, carbon	Tuned ckt.
R772	47K ohms, 10%, $\frac{1}{2}$w, carbon	455 KC IF
R773	47K ohms, 10%, $\frac{1}{2}$w, carbon	"
R774	47K ohms, 10%, $\frac{1}{2}$ w, carbon	"

VII. SWITCHES

Ref. Symbol	Description	Part of
S701	SPDT	R.F. Tuner
S702	Wafer Switch, 3PDT, 2 Section, #A6387	IF Amplifier

VII. TRANSFORMERS

Ref. Symbol	Description	Part of
T700	IF transformer, A6078	1.6 MC IF
T701	IF transformer, A6078	"
T702	IF transformer, A6078	"
T703	IF transformer, A6076	"
T704	IF transformer, A6077	455 KC IF
T705	IF transformer, A6077	"
T706	IF transformer, A6077	"
T707	IF transformer, A6075	"
T708	Input transformer	Tuned ckt.
T709	Input transformer	"
T710	Input transformer	"
T711	Input transformer	"
T712	Input transformer	"
T713	Input transformer	"
T714	Input transformer	"
T715	Input transformer	"
T716	Input transformer	"
T717	Input transformer	"
T718	Input transformer	"
T719	Input transformer	"
T720	Input transformer	"
T721	Input transformer	"
T722	Input transformer	"
T723	Input transformer	"
T724	Input transformer	"
T725	Input transformer	"

IX. TUBES

Ref. Symbol	Description	Part of
V700	5702	R.F. ckt.
V701	5784	"
V702	5702	"
V703	6BJ6	1.6 MC IF
V704	6BJ6	"
V705	6BJ6	"
V706	6BJ6	"
V707	6BJ6	455 KC IF
V708	6BJ6	"
V709	6BJ6	"
V710	6BJ6	"

CALIBRATION CHART FOR TUNING UNIT T-A/NF-105

SERIAL NO. 3525

FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC	FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC	FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
.150	85.0	.870	81.0	5.2	76.0
.174	84.5	.900	81.0	6.0	76.0
.200	84.0	1.0	80.0	7.0	75.5
.225	83.0	1.1	80.0	8.0	75.5
.250	83.0	1.3	79.5	9.0	75.5
.275	83.0	1.5	79.5	10.0	75.5
.300	83.0	1.7	79.0	11.0	75.5
.325	83.5	1.9	79.0	12.0	75.5
.360	84.0	2.1	80.0	12.7	75.5
.360	80.0	2.1	76.0	12.7	75.5
.400	79.0	2.4	75.0	15.0	75.5
.450	78.5	2.7	75.0	19.0	75.5
.500	78.0	3.0	75.0	21.0	75.5
.560	78.0	3.4	75.0	24.0	75.5
.620	78.0	3.7	75.0	27.0	75.5
.700	77.0	4.0	75.0	30.0	75.5
.760	77.0	4.4	75.0		
.820	76.0	4.7	75.0		
.870	76.0	5.2	75.0		

FIGURE 1

CALIBRATION CHART FOR TUNING UNIT T-A/NF-105

SERIAL NO.

FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC	FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC	FREQ. (MC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
.150		.870		5.2	
.174		.900		6.0	
.200		1.0		7.0	
.225		1.1		8.0	
.250		1.3		9.0	
.275		1.5		10.0	
.300		1.7		11.0	
.325		1.9		12.0	
.360		2.1		12.7	
.360		2.1		12.7	
.400		2.4		15.0	
.450		2.7		19.0	
.500		3.0		21.0	
.560		3.4		24.0	
.620		3.7		27.0	
.700		4.0		30.0	
.760		4.4			
.820		4.7			
.870		5.2			

VOID

FIGURE I

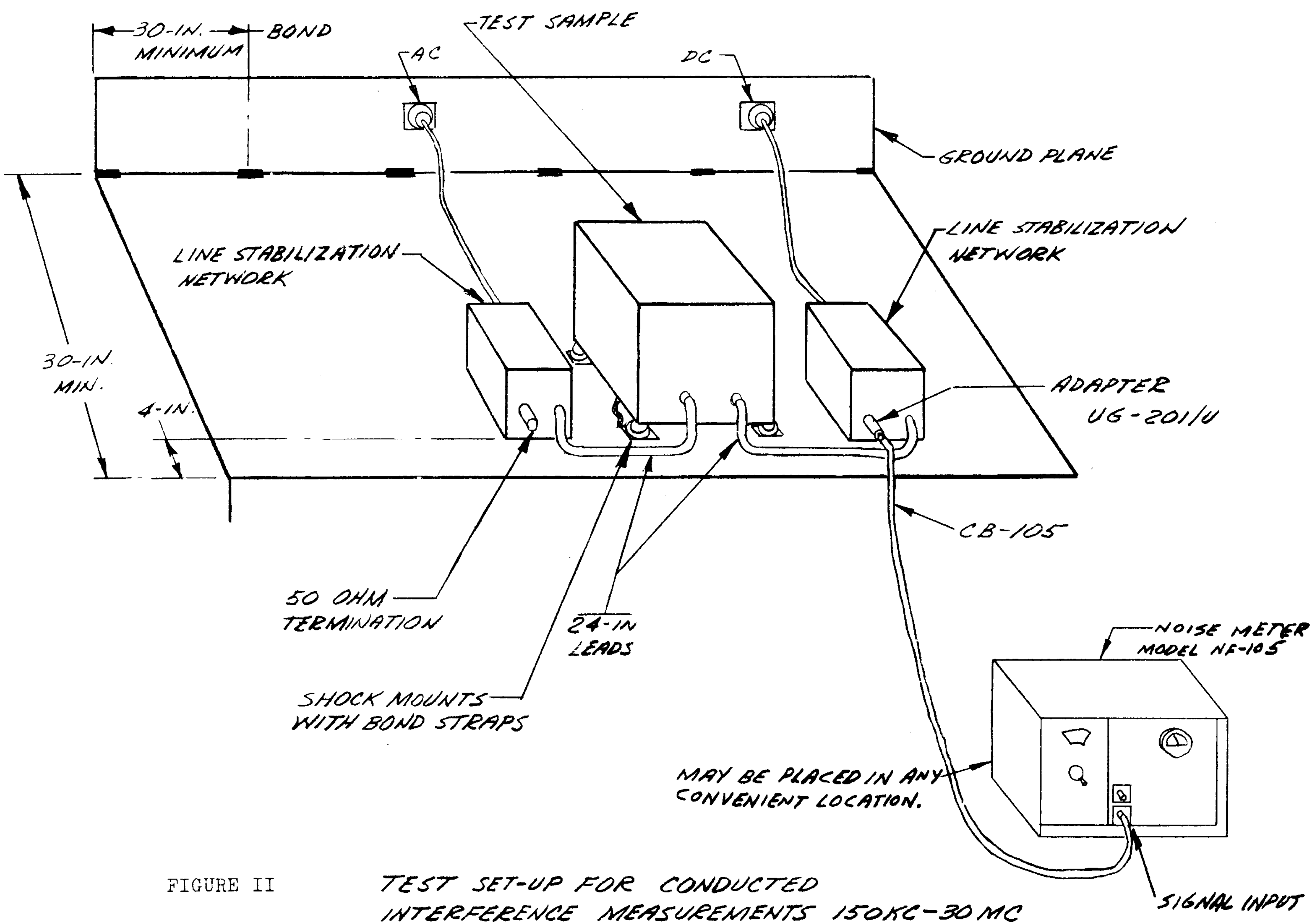


FIGURE II TEST SET-UP FOR CONDUCTED INTERFERENCE MEASUREMENTS 150KC-30MC

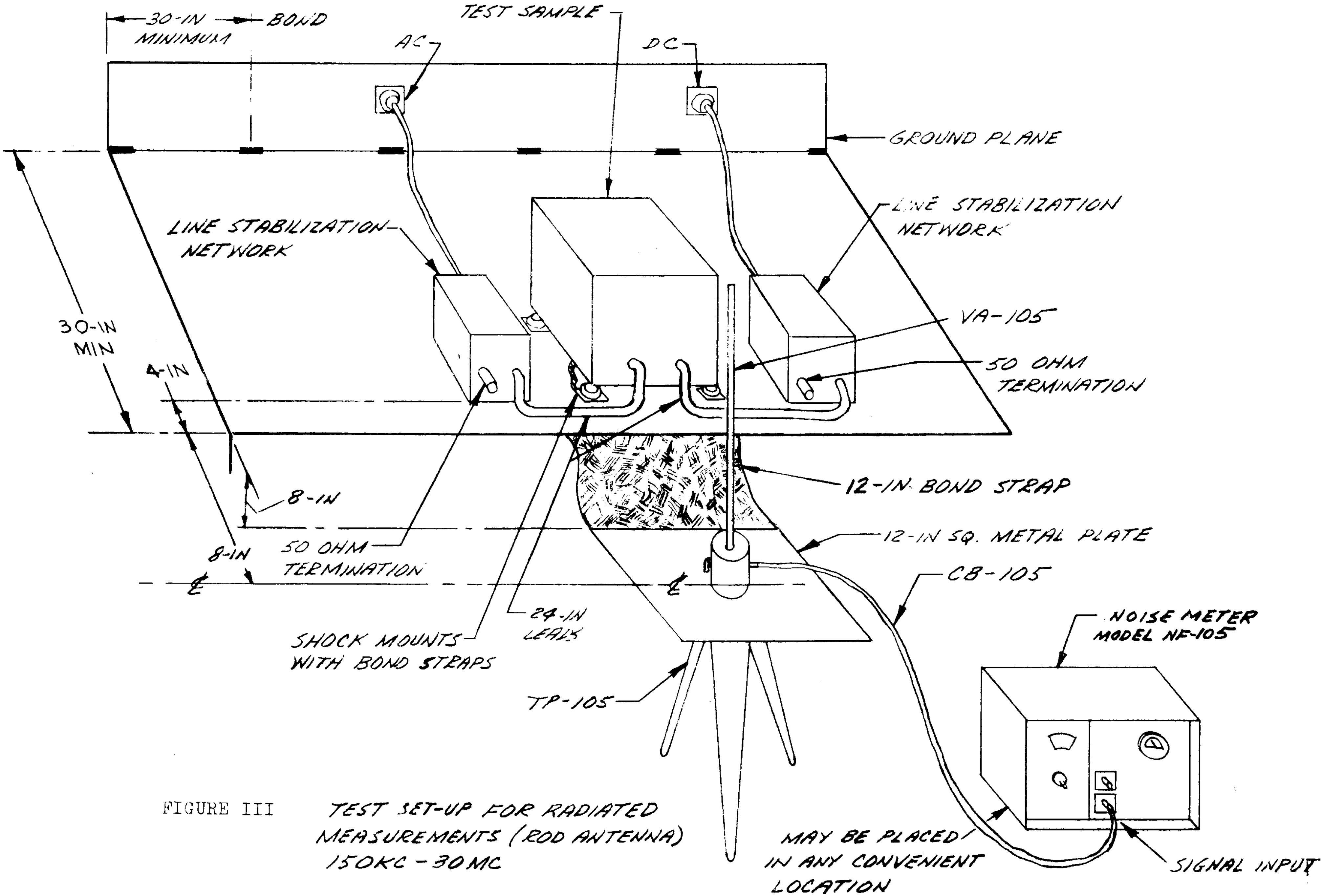


FIGURE III TEST SET-UP FOR RADIATED MEASUREMENTS (ROD ANTENNA) 150KC - 30MC

UNIT #

SERIAL NO.

ANTENNA FACTOR FOR VERTICAL ANTENNA VA-105

BAND	FREQUENCY MC	DB
1	.150	
	.230	
	.260	
	.300	
	.330	
	.360	
2	.360	
	.400	
	.500	
	.600	
	.700	
	.800	
	.870	
3	.870	
	1.0	
	1.2	
	1.4	
	1.6	
	1.8	
	2.1	

BAND	FREQUENCY MC	DB
4	2.1	
	2.7	
	3.4	
	4.0	
	4.6	
	5.2	
5	5.2	
	6.0	
	7.0	
	8.0	
	9.0	
	10.0	
	11.0	
	12.7	
6	12.7	
	14.0	
	17.0	
	20.0	
	23.0	
	26.0	
	28.0	
	30.0	

FOR SUBSTITUTION MEASUREMENTS ADD 20 DB TO THE ABOVE FACTORS

FIGURE IV

ANTENNA "FACTOR" FOR

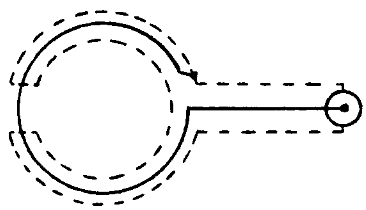
LOOP ANTENNA LP - 105

FREQUENCY	DB	FREQUENCY	DB
150 KC	41.0	2.4 MC	27.8
175 KC	40.0	2.7 MC	27.3
200 KC	39.5	3.0 MC	27.0
225 KC	38.8	3,4 MC	26.6
250 KC	38.3	3.7 MC	26.1
275 KC	37.8	4.0 MC	25.9
300 KC	37.3	4.4 MC	25.5
325 KC	36.9	4.7 MC	25.3
360 KC	36.5	5.2 MC	25.1
400 KC	36.5	6.0 MC	24.0
450 KC	36.0	7.0 MC	23.0
500 KC	35.5	8.0 MC	22.0
560 KC	35.0	9.0 MC	21.2
620 KC	34.4	10.0 MC	20.8
700 KC	34.0	11.0 MC	20.3
760 KC	33.5	12.0 MC	20.0
820 KC	33.0		
870 KC	32.8	12.7 MC	19.8
		15.0 MC	19.3
900 KC	32.5	19.0 MC	19.0
1000 KC	31.8	21.0 MC	18.6
1.1 MC	31.0	24.0 MC	18.4
1.3 MC	30.2	27.0 MC	18.2
1.5 MC	29.8	30.0 MC	18.0
1.7 MC	29.3		
1.9 MC	29.2		
2.1 MC	29.0		

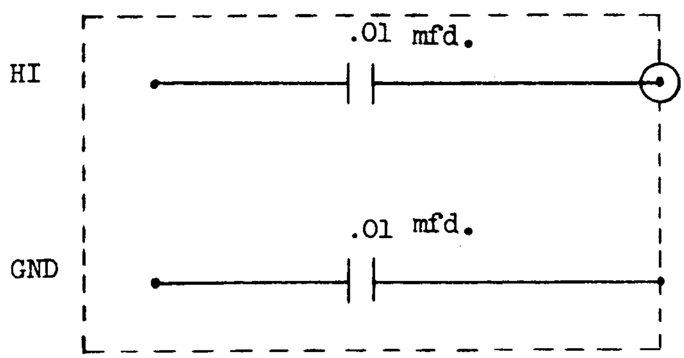
FOR SUBSTITUTION MEASUREMENTS ADD 20 DB TO THE ABOVE FACTORS

REVISED DATE
JANUARY 6, 1964

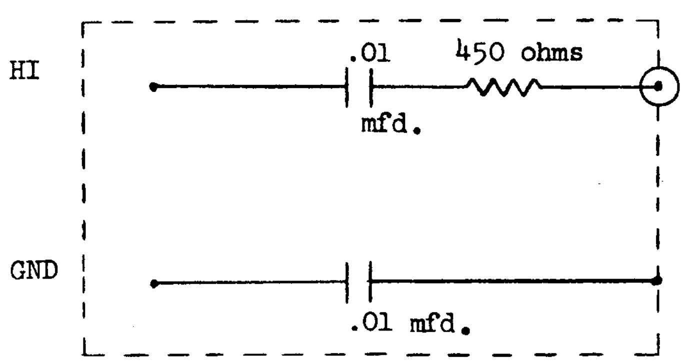
FIGURE V



Magnetic Field Probe (Red)
LO-105



Line Probe - 50 ohms
LA-105



Line Probe - 500 ohms
LF-105

Figure VI
Schematic Diagram
150 KC - 30 MC Probes
(Part of Antenna
Equipment LM-105)

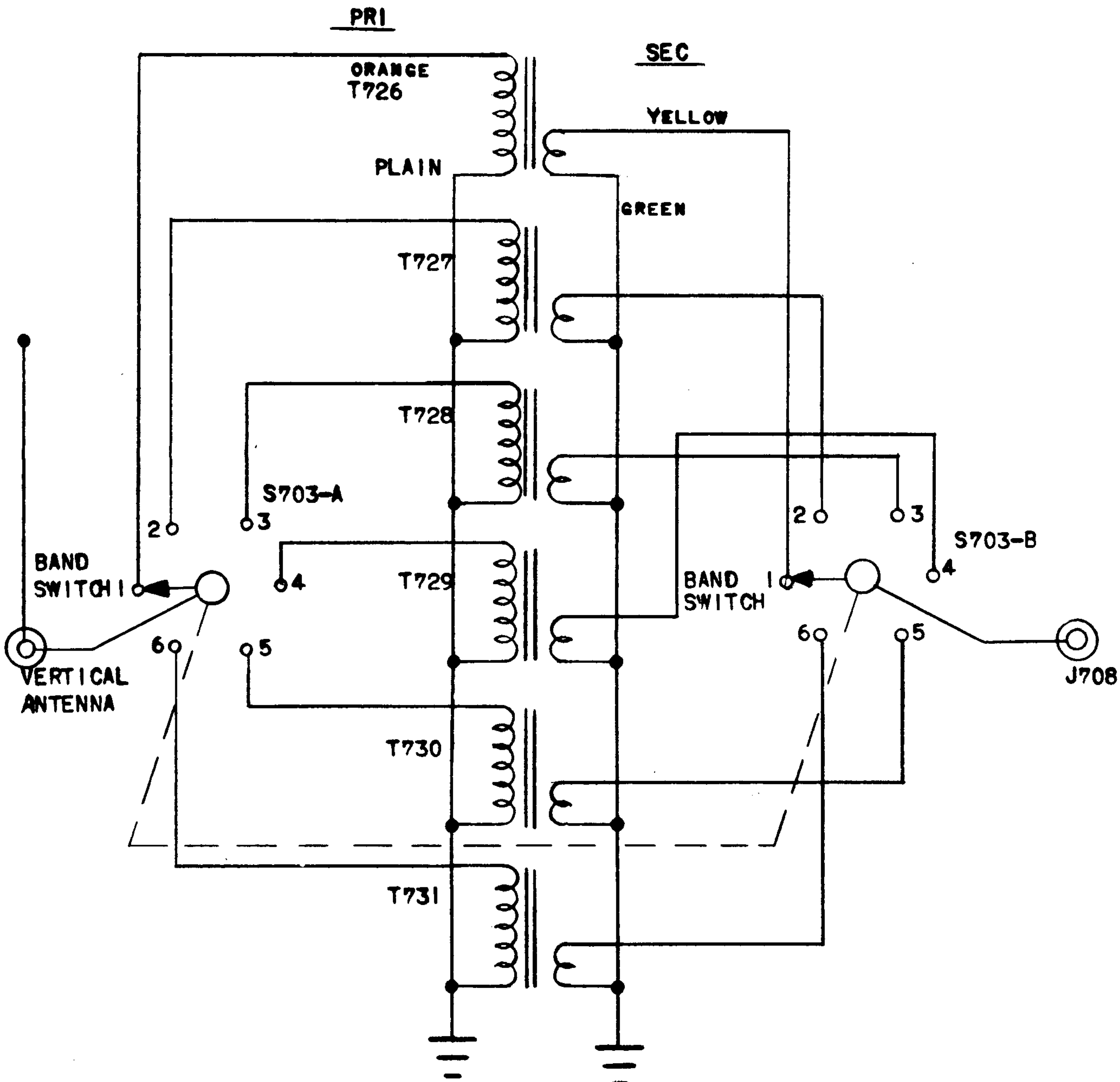


FIGURE VII
SCHEMATIC - VERTICAL ANTENNA
VA- 105

A-6467

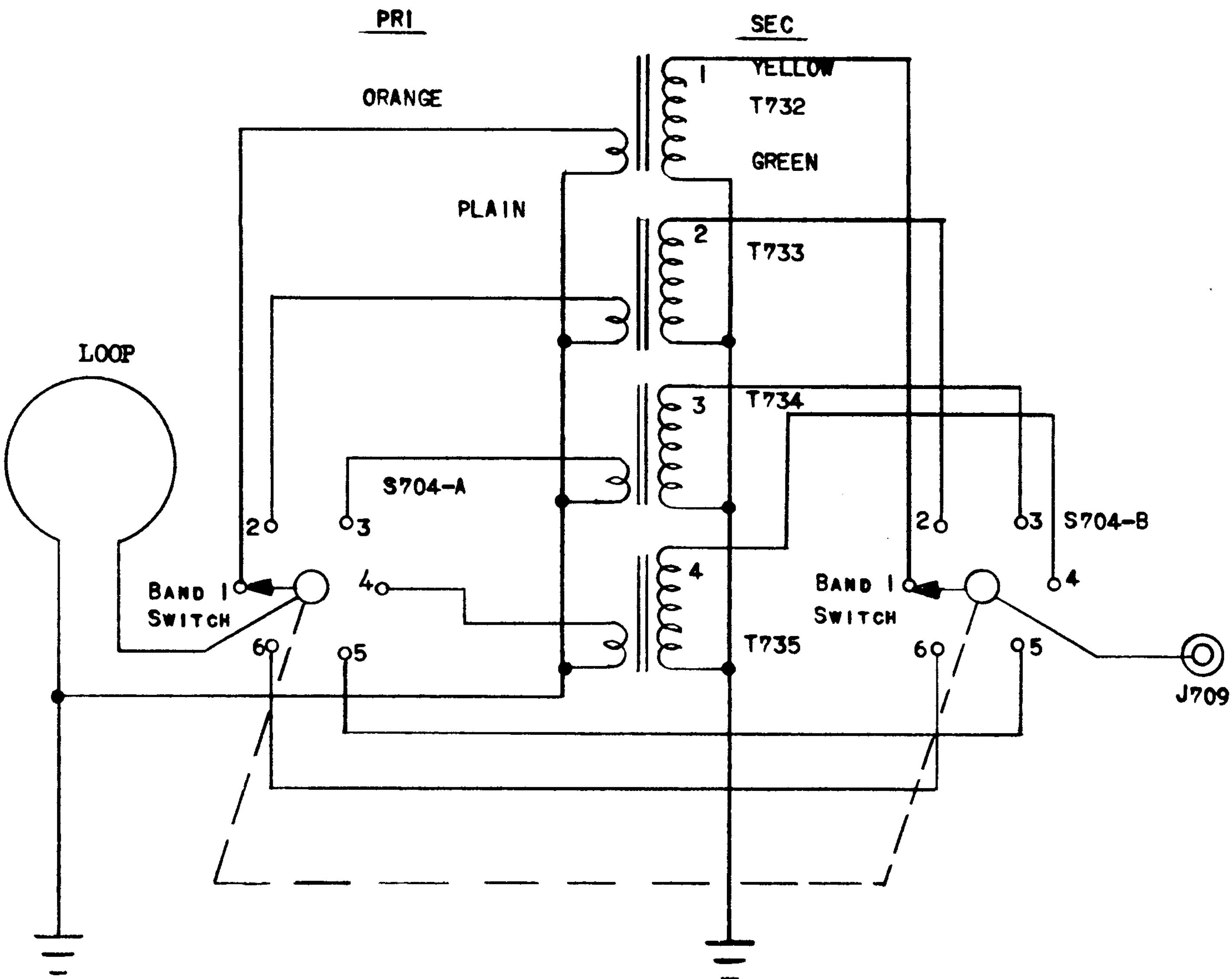


FIGURE VIII
SCHEMATIC - LOOP ANTENNA
LP - 105

A-6466

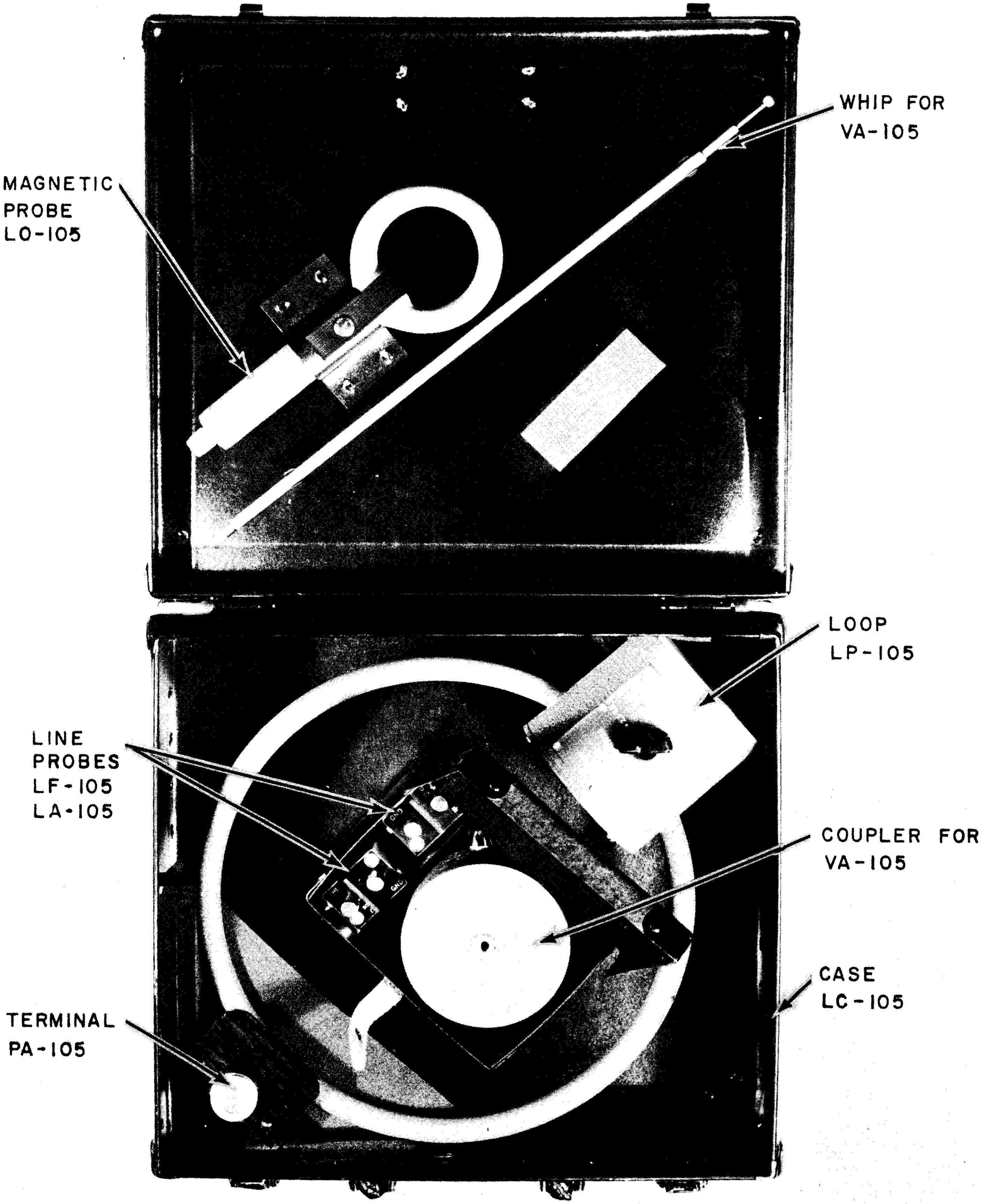
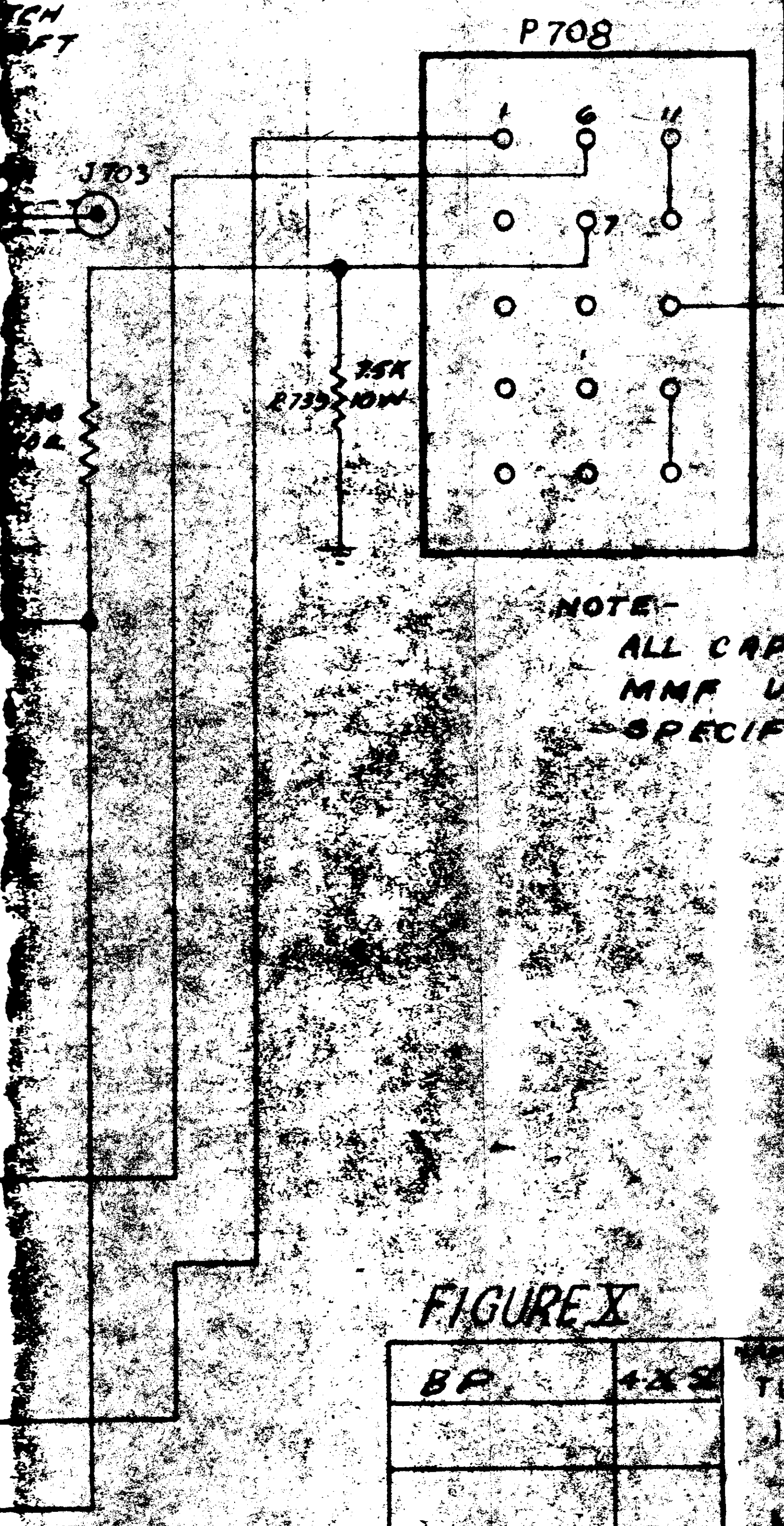


FIGURE IX. ARRANGEMENT OF COMPONENTS IN LM-105

SYM.	REVISIONS	DATE	APPRO.
W	ADDED R772 R773 & R774	[illegible]	[illegible]
X	C714 - 1000 WAS C714 - 1470. ECN 1130	[illegible]	[illegible]
22	FL-701 WAS F-701 PER PCN 1673 R.W.	[illegible]-64	
23	R731 WAS 220K PER PCN 3221 11-12-65 GND	11/18/[illegible]	[illegible]
24	C717 WAS 200UUF PER PCN 3451 2-11-66 GND	[illegible]	[illegible]
25	ADDED RESISTOR R778; C719 WAS 5PF; C759 WAS 480PF PER PCN 3691 5-4-66 GND	[illegible]	[illegible]



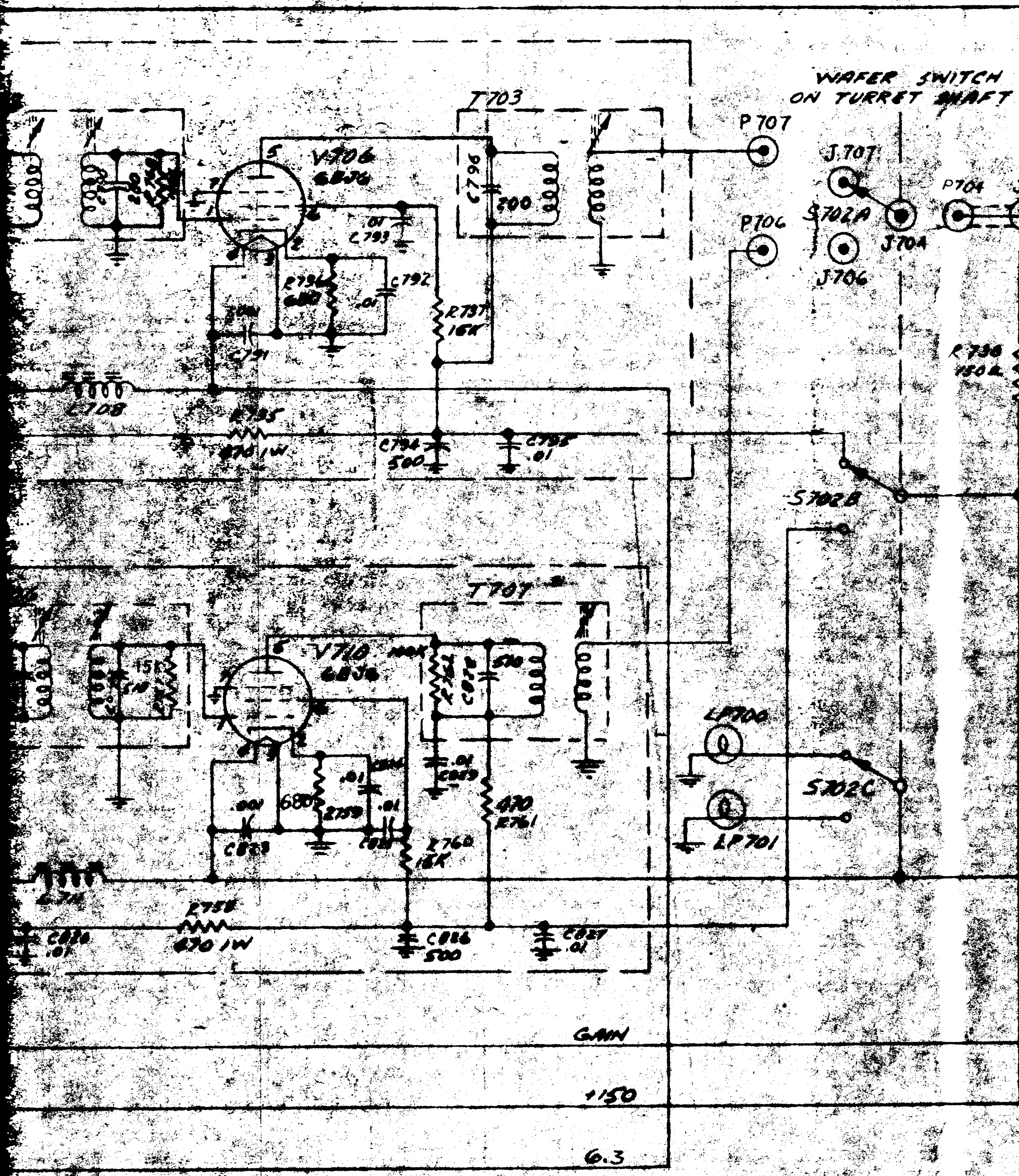
NOTE-
ALL CAPACITOR VALUES IN MMF UNLESS OTHERWISE SPECIFIED.

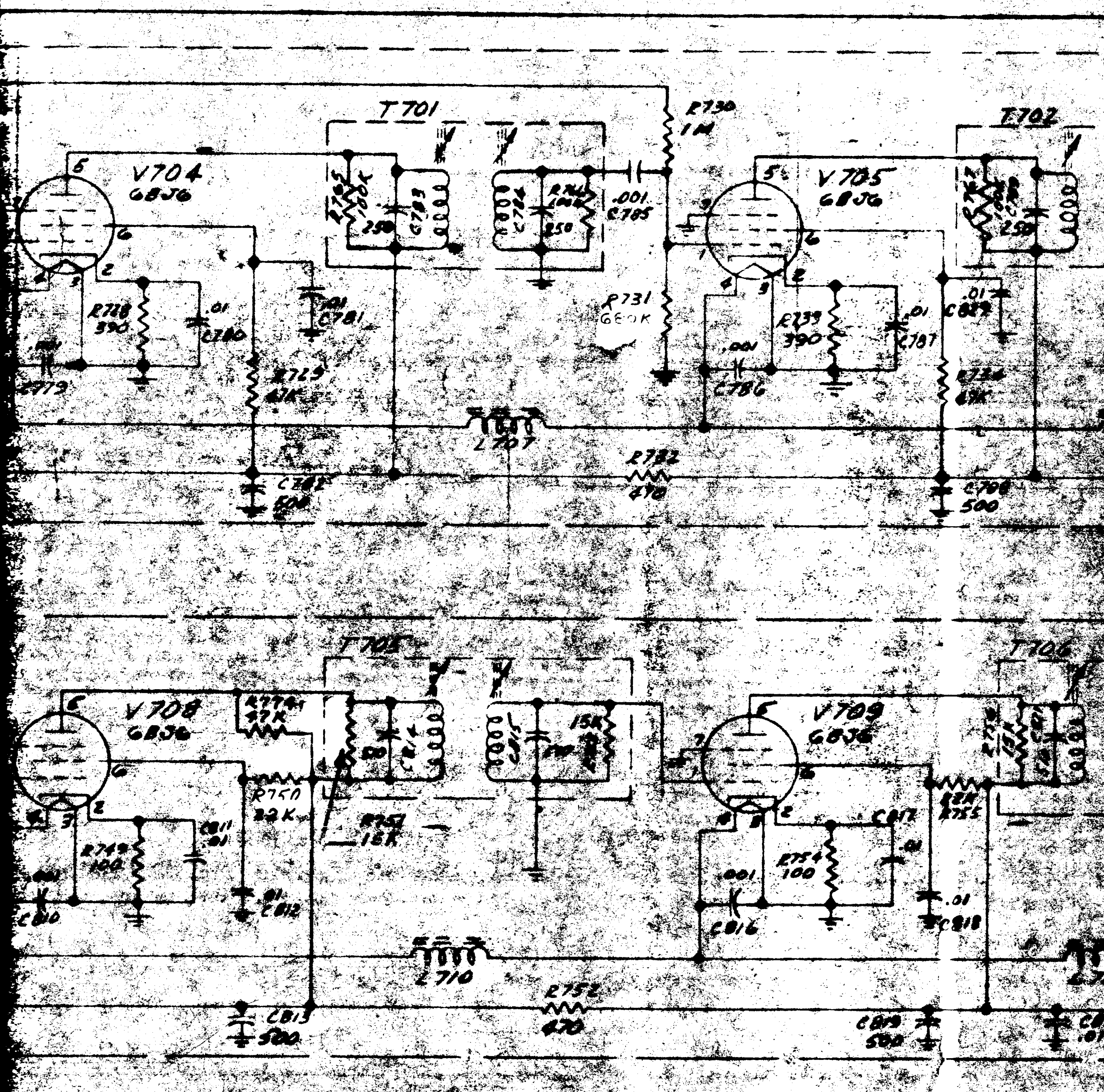
FIGURE X

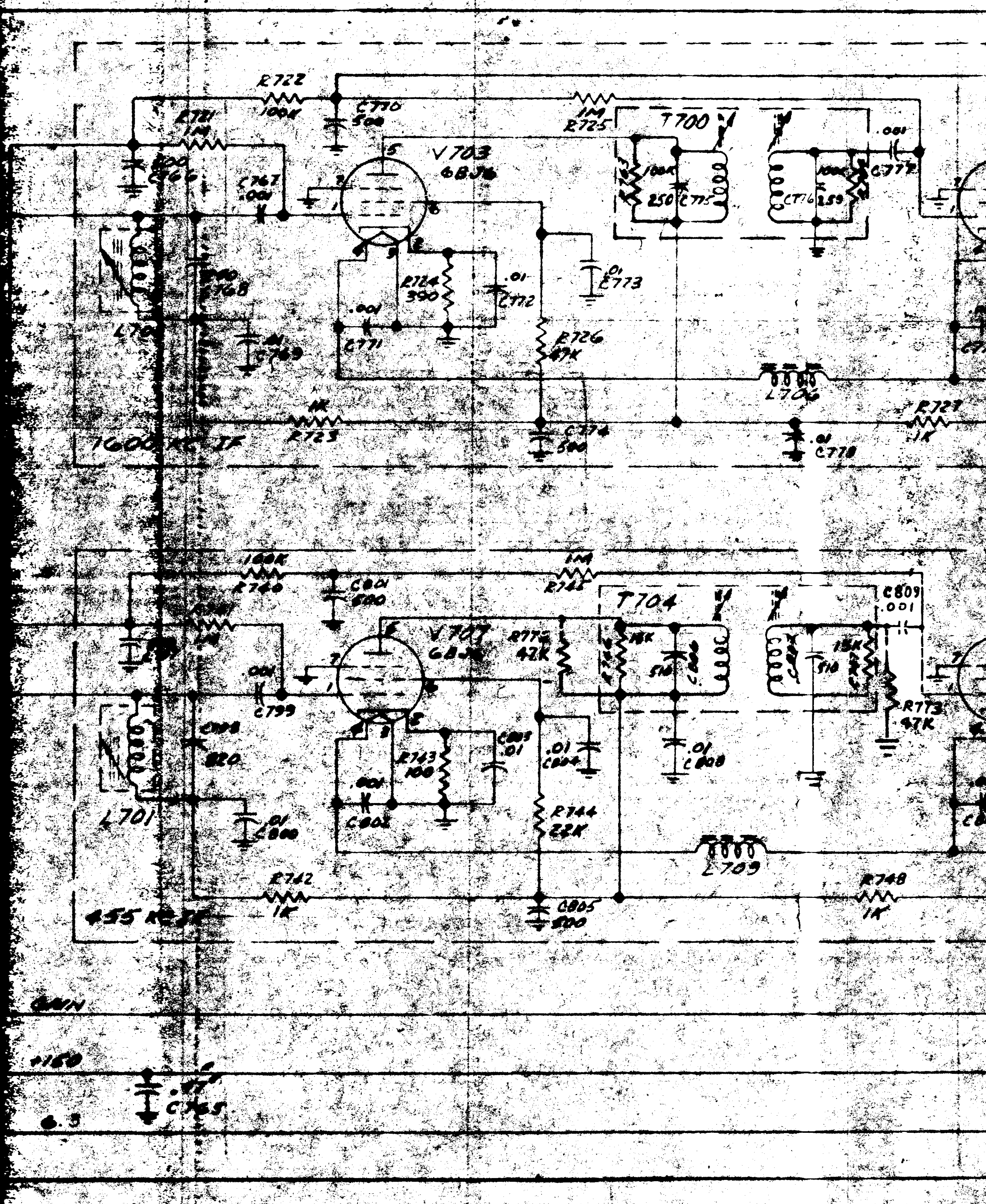
	TA-NF-105		

BP	4X2	TUNING UNIT 15-30 MC	THE SINGER COMPANY METRICS DIVISION BRIDGEPORT, CONN., U.S.A.
		NF-105	R 004371

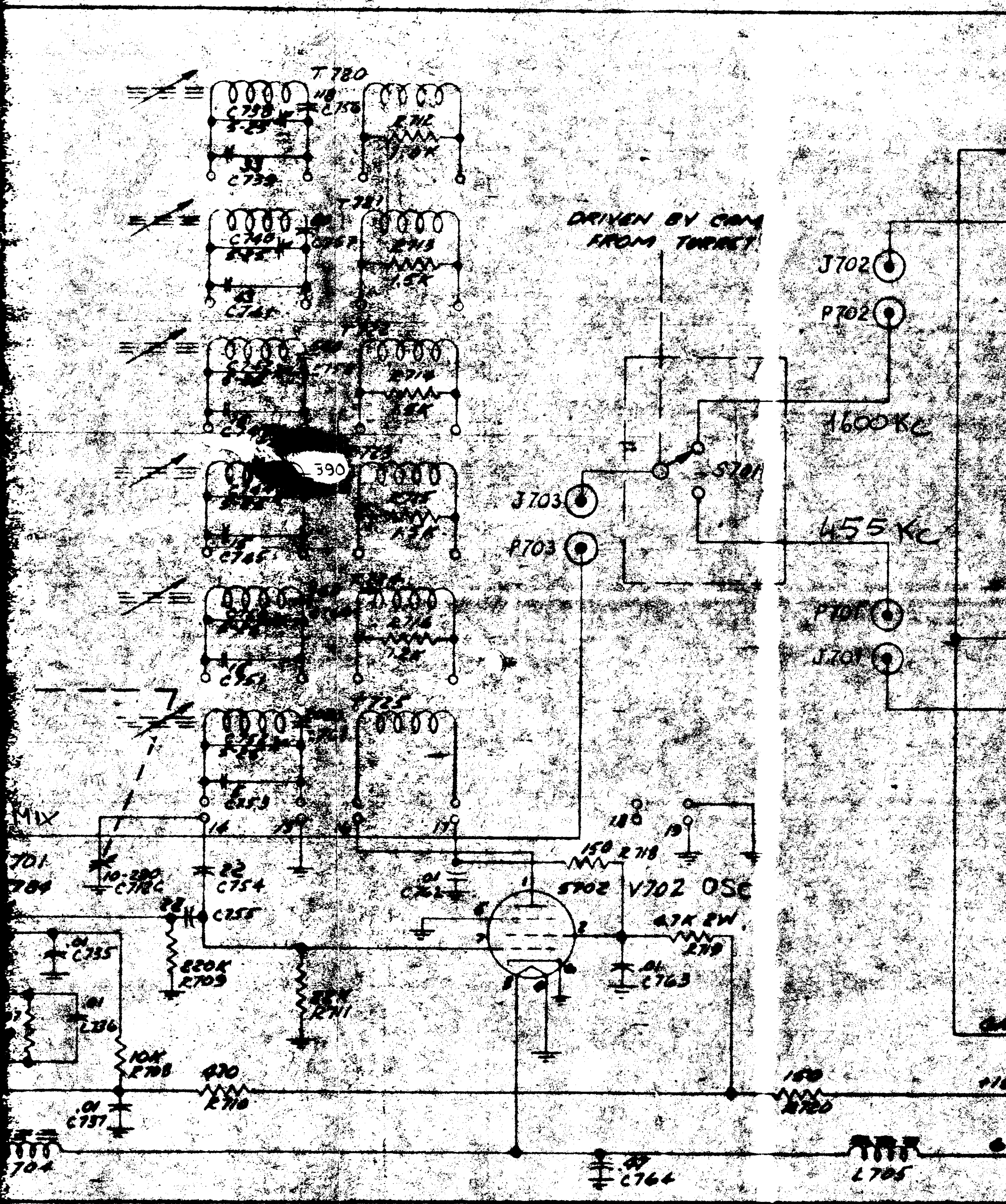
REF R-31[illegible]


WAFER SWITCH
ON TURRET SHAFT
T703
P707
P706
J707
J706
S702A
S702B
S702C
V706
6BJ6
C796
200
C793
.01
C792
R737
15K
C791
L708
R735
470 1W
C794
500
C795
.01
T707
V710
6BJ6
LP700
LP701
680
R759
C823
C825
R760
15K
470
R761
C829
.01
R758
470 1W
C826
500
C827
.01
C820
.01
GAIN
+150
6.3

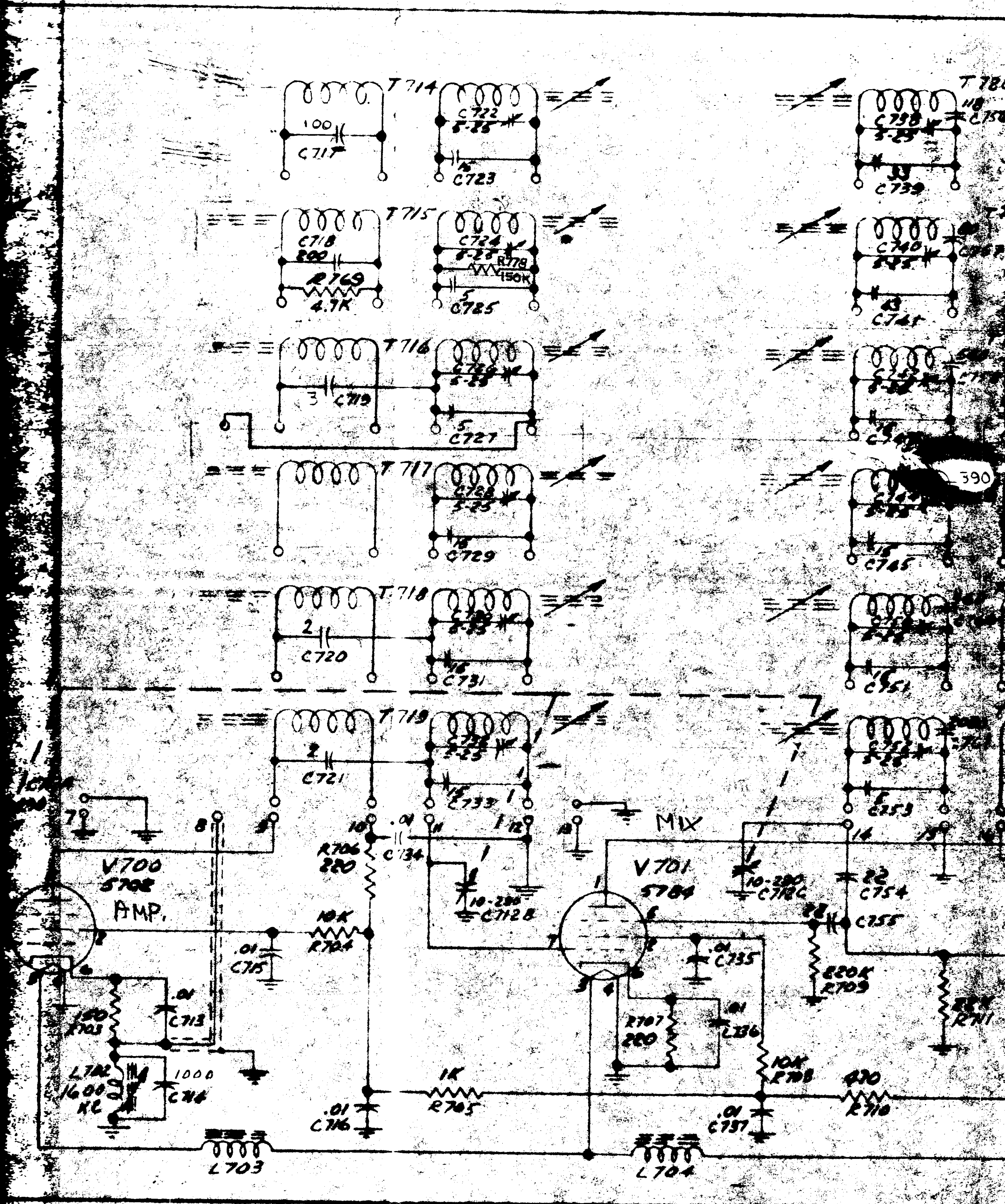

T701
V704
6BJ6
R730
1M
.001
C785
T702
V705
6BJ6
R728
390
.01
C780
C781
R729
47K
C782
500
L707
R732
470
R731
680K
R739
390
.01
C787
.001
C786
R734
47K
C789
500
T705
V708
6BJ6
R750
22K
R751
15K
R749
100
.01
C812
C811
C810
L710
R752
470
C813
500
V709
6BJ6
T706
R754
100
.001
C816
C817
.01
C818
C819
500
R755
22K



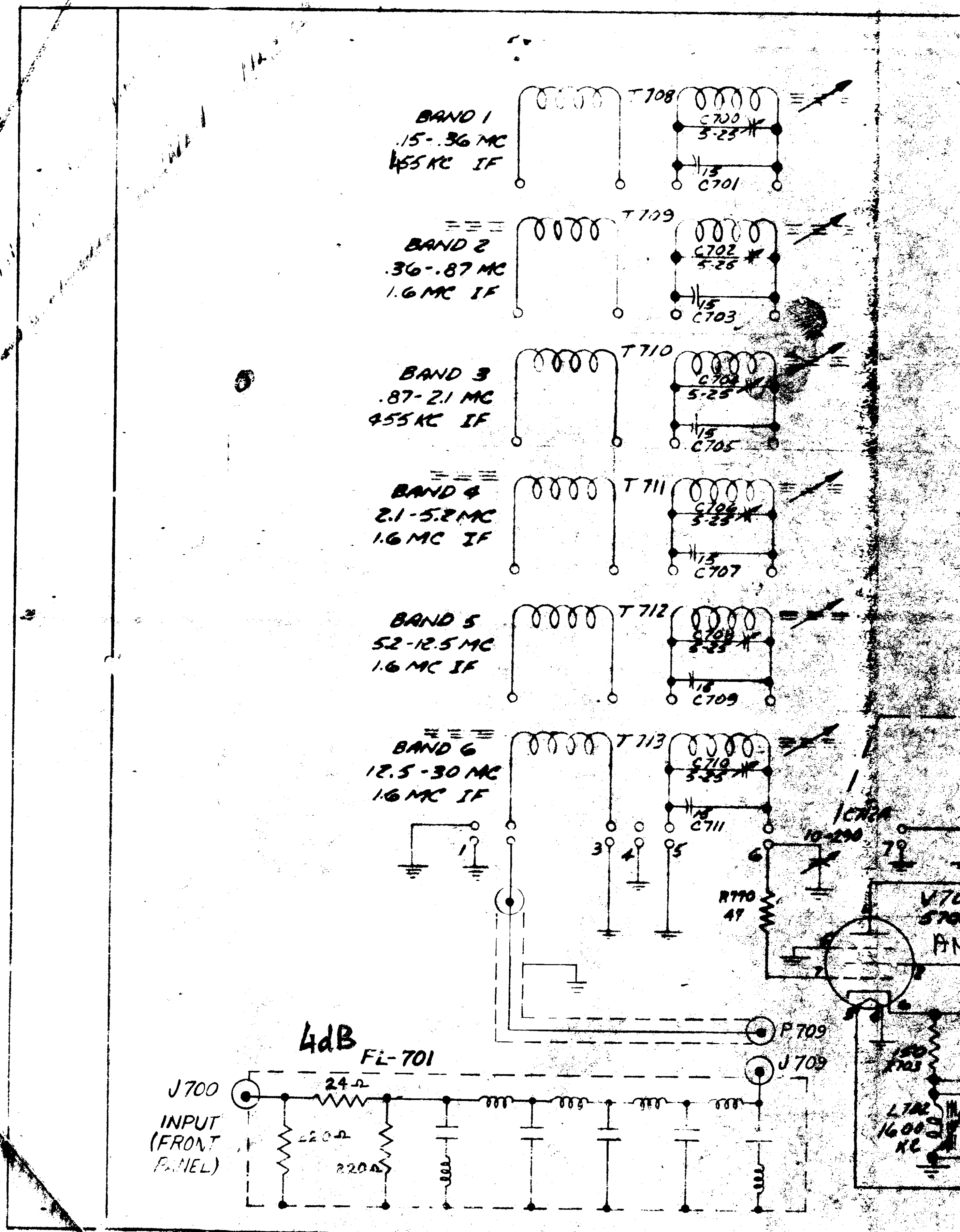
R722
100K
C770
500
R721
1M
C767
.001
V703
6BJ6
1M
R725
T700
.001
C777
100K
250
C775
C776
R724
390
.01
C772
.001
C771
.01
C773
R726
47K
L706
R727
1K
C774
500
.01
C778
R723
C768
C769
1600 KC IF
100K
R740
1M
R746
C801
500
T704
V707
R772
47K
C809
.001
15K
510
C799
C798
820
R743
100
C803
C804
C808
R773
C802
R744
22K
L709
R742
R748
C805
C800
L701
455 KC IF
GAIN
+160
6.3



DRIVEN BY CAM FROM TURRET
J702
P702
1600 KC
455 KC
S701
J703
P703
P701
J701
MIX
V702 OSC
150 R718
4.7K 2W R719
.01 C762
.01 C763
22 C754
C755
820K R709
.01 C735
.01 C736
10K R708
.01 C737
470 R710
150 R720
C764
L705
10-280 C716C
390



T714
100
C717
C722
5-25
C723
T715
C718
200
R769
4.7K
C724
R778
150K
5
C725
T716
3
C719
5
C727
T717
C729
T718
2
C720
C731
T719
2
C721
C733
V700
AMP.
.01
C715
10K
R704
R706
220
C734
10-280
C712B
.01
C713
1000
C714
1K
R705
.01
C716
L703
MIX
V701
5784
10-280
C712C
22
C754
C755
.01
C735
220K
R709
R707
220
C736
10K
R708
.01
C737
470
R710
L704
T720
C738
C739
C740
C741
C745
C751
C753
390



BAND 1
.15-.36 MC
455 KC IF
T 708
C700
5-25
15
C701
BAND 2
.36-.87 MC
1.6 MC IF
T 709
C702
5-26
15
C703
BAND 3
.87-2.1 MC
455 KC IF
T 710
5-25
15
C705
BAND 4
2.1-5.2 MC
1.6 MC IF
T 711
C707
BAND 5
5.2-12.5 MC
1.6 MC IF
T 712
C709
BAND 6
12.5-30 MC
1.6 MC IF
T 713
C711
R770
47
P 709
J 709
4dB
FL-701
J700
INPUT
(FRONT PANEL)
24Ω
220Ω
220Ω

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