



instruction book

KWS-1 Transmitter

©Collins Radio Company 1955, 1956, 1957, 1958, 1963

Collins Amateur Equipment Guarantee

The Collins Amateur Equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to workmanship or materials and which are returned to Collins at its factory or its designated Service Agency, transportation prepaid, provided:

- (a) Buyer presents properly executed Warranty Verification Certificate.
- (b) Notice of the claimed defect is given Collins or an authorized Service Agency, or an authorized Distributor, in writing, within 180 days from the date of purchase and goods are returned in accordance with Collins instructions.
- (c) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins designs are subject to only such adjustments as Collins may obtain from the supplier thereof.
- (d) Any failure due to use of equipment for purposes other than those contemplated in normal amateur operations or in violation of Collins applicable Instruction Book shall not be deemed a defect within the meaning of these provisions.

This Warranty is void with respect to equipment which is altered, modified or repaired by other than Collins or Collins Authorized Service Agencies. However, alteration or modification in accordance with Collins Service Bulletins shall not affect this Warranty.

Collins reserves the right to make any change in design or to make additions to, or improvements in, Collins products without imposing any obligations upon Collins to install them in previously manufactured Collins products.

No other warranties, expressed or implied, shall be applicable to said equipment, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements contained in these paragraphs. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

NOTICE: With each equipment or set of equipments purchased, the distributor should furnish a Warranty Verification Certificate. It is necessary that this certificate accompany the equipment when it is returned for warranty repairs. Be sure that you get it from your distributor.

Warranty Repairs

On the opposite page are listed the Service Agencies authorized to perform warranty repair on Collins Amateur Equipments.

If you should wish to return material or equipment direct to Collins under the guarantee, you should notify Collins, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Amateur Product Office
Cedar Rapids, Iowa

INFORMATION NEEDED:

- (A) Type number, name and serial number of equipment
- (B) Date of delivery of equipment
- (C) Date placed in service
- (D) Number of hours of service
- (E) Nature of trouble
- (F) Cause of trouble if known
- (G) Name of distributor from whom the equipment was purchased.

Equipment returned to the Service Agency or Collins for warranty repair must be accompanied with the Warranty Verification Certificate.

Out-of-warranty Repair, Modifications, Addition of Accessories, Alignment, etc.:

For information on service of this type write to the address shown below. If you wish to return your equipment for repairs, etc., without prior correspondence, be sure to include the following information attached to the equipment inside the packing carton:

- (1) Complete instructions detailing work to be performed.
- (2) Your return address.
- (3) Method of shipment by which the equipment should be returned.
- (4) Special instructions.

DIRECT YOUR CORRESPONDENCE TO:

Collins Radio Company
Service Repair Department
Third Street Building
Cedar Rapids, Iowa

HOW TO ORDER REPLACEMENT PARTS:

When ordering replacement parts, you should direct your order to one of the listed Collins distributors.

Please furnish the following information insofar as applicable:

INFORMATION NEEDED:

- (A) Quantity required
- (B) Collins part number (9 or 10 digit number) and description
- (C) Item or symbol number obtained from parts list or schematic
- (D) Collins type number, name and serial number of principal equipment
- (E) Unit subassembly number (where applicable)

NOTE: See Distributor List.

COLLINS AUTHORIZED AMATEUR DISTRIBUTORS AND SERVICE AGENCIES

ALABAMA

Ack Radio Supply Company
3101 4th Avenue South
Birmingham 5
Phone: FAirfax 2-0588
Attn: E. C. Atkerson

*Beddo Engineering Services
2424 Tenth Avenue South
Birmingham
Phone: ALpine 1-7582
Attn: Dr. C. P. Beddow
SEE ALSO: Atlanta, Georgia (Ack)

ALASKA

Yukon Radio Supply, Inc.
(P. O. Box 406)
645 1 Street
Anchorage
Attn: A. E. Peterson

ARIZONA

Elliott Electronics, Inc.
418 N. 4th Avenue
Tucson
Phone: MAIn 4-2473
Attn: Jerry Flewelling

**Southwest Electronic Devices
(P. O. Box 3647)
140 S. 2nd Street
Phoenix
Phone: ALpine 2-1743
Attn: Herman A. Middleton

ARKANSAS

Lavender Supply Company
(P. O. Box 1168)
518-520 E. 4th Street
Texarkana
Phone: 2-4195
Attn: Joe M. Lavender

Ed Moory's Radio & Appliance
12th & Jefferson
DeWitt
Phone: WHitney 6-2820
Attn: Ed Moory

CALIFORNIA

**Amrad Supply, Inc.
999 Howard Avenue
Burlingame
Phone: DIamond 2-5757
Attn: Dan Rodriguez

Amrad Supply, Inc.
3425 Balboa Street
San Francisco
Phone: SKYline 1-4661
Attn: J. Steventon

*Communication Receiver Service
5016 Maplewood
Los Angeles 4
Phone: HOllywood 2-2429
Attn: Charles C. Messman

Elmar Electronics
140 11th Street at Madison
Oakland 7
Phone: TE 4-3311
(TXW-OA73)
Attn: Elvin Feige/M. L. Chirone

**Henry Radio Company, Inc.
(P. O. Box 64398)
11240 W. Olympic Blvd.
Los Angeles 64
Phone: GRanite 7-8701
Attn: Ted Henry

Mission Ham Supplies
5474 Mission Blvd.
Riverside
Phone: OV-30523
Attn: Wm. P. Hullquist

Quement Industrial Electronics
(P. O. Box 527)
161 San Fernando
San Jose
Phone: CYpress 4-0464
Attn: Frank Quement

Radio Products Sales, Inc.
1501 S. Hill Street
Los Angeles 15
Phone: RIchmond 8-1271
Attn: Ken Rausin

Scott Radio Supply, Inc.
266 Alamitos Avenue
Long Beach
Phone: HEmlock 6-1452/7-8629
Attn: Evelyn E. Scott

Valley Electronic Supply Company
1302 W. Magnolia Blvd.
Burbank
Phone: VICTORIA 9-3944
Attn: Frank Eckert/Bud Rand

Western Radio & TV Supply Company
(P. O. Box 1728)
1415 India Street
San Diego 1
Phone: BElmont 9-0361
Attn: A. W. Prather/Art Stewart

COLORADO

Radio Products Sales Co.
16th Street
Denver 2
Phone: CHERRY 4-6591
Attn: Walter Nettles/Willard Wright

CONNECTICUT

Hatry of Hartford, Inc.
100 High Street
Hartford
Phone: JACKson 7-1881
Attn: Edward C. Gedney

Radio Shack Corp. of Connecticut
230 Crown Street
New Haven 10
Phone: SPRuce 7-6871
Attn: E. G. Alberino
SEE ALSO: Boston, Massachusetts

DELAWARE

Willard S. Wilson, Inc.
403-405 Delaware Avenue
Wilmington 1
Phone: OLYmpia 5-4321
Attn: Willard S. Wilson

DISTRICT OF COLUMBIA

Electronic Wholesalers, Inc.
2345 Sherman Ave. NW
Washington 1
Phone: HUDson 3-5200
Attn: Ray Avey

FLORIDA

**Amateur Radio Center, Inc.
2805-7 N. E. 2nd Avenue
Miami
Phone: FRanklin 4-4101
Attn: Wiley Gilkison

**Broad Radio
7231 Central Avenue
St. Petersburg 10
Phone: 72314
Attn: H. G. Palin

**Electronic Wholesalers, Inc.
9390 NW 27th Avenue
Miami 47
Phone: OXFord 6-1620
Attn: Philip Konter

Grice Electronics, Inc.
(P. O. Box 1911)
300 E. Wright St.
Pensacola
Phone: HEmlock 3-4616
Attn: F. R. Grice, Jr.

**Kinkade Radio Supply, Inc.
1719 Grand Central Avenue
Tampa
Phone: 8-6043
Attn: E. T. Kinkade

GEORGIA

Ack Radio Supply Co.
331 Luckie Street NW
Atlanta 13
Phone: JA 4-8477
Attn: T. E. Atkerson

Specialty Distributing Co., Inc.
763 Juniper St. N.E.
Atlanta 8
Phone: TRinity 3-2521
Attn: J. E. Eaton

HAWAII

**Honolulu Electronics
819 Keeaumoku Street
Honolulu 14
Phone: 995-466
Attn: Thomas Teruya

IDAHO

Robbie's Radio & TV, Inc.
(P. O. Box 5021)
3715 State Street
Boise
Phone: 28892
Attn: W. A. Robinson, Jr.

ILLINOIS

Allied Radio Corp.
100 N. Western Avenue,
Chicago 80
Phone: HAYmarket 1-6800
Attn: Jim Summerfield/Jason Thomas

Klaus Radio & Electric Company
403 E. Lake Street
Peoria
Phone: RH 8-3401
Attn: Clifford Morris

Newark Electronics Corporation
223 W. Madison Street
Chicago 6
Phone: STate 2-2944
Attn: Les Wilkins/A. L. Poncher

INDIANA

Brown Electronics, Inc.
1032 Broadway
Fort Wayne
Phone: ANThony 3382
Attn: A. A. Brown

Graham Electronics Supply, Inc.
122 S. Senate St.
Indianapolis 4
Phone: MELrose 4-8487
Attn: G. M. Graham/D. A. Hilts/
J. F. Simpson

Radio Distributing Co., Inc.
(P. O. Box 14999)
1212 High St.
South Bend 15
Phone: ATLantic 8-4665
Attn: William A. Davidson

IOWA

Bob and Jack's, Inc.
4507 Forest Avenue
Des Moines 11
Phone: Blackburn 5-0873
Attn: Robert M. Evans/Jack Laudis

Radio Trade Supply Co.
1224 Grand Avenue
Des Moines 9
Phone: ATLantic 8-7237
Attn: Leo Vince Davis/Larry Woolis

World Radio Laboratories, Inc.
(P. O. Box 919)
3415 W. Broadway
Council Bluffs
Phone: 32-81851
Attn: Alan McMillan/Leo Meyerson/
C. H. Williams

KANSAS

The Overton Electric Co., Inc.
522 Jackson Street
Topeka
Phone: CEntral 3-1367
Attn: S. D. Thacher/Frank Thacher

LOUISIANA

**Radio Parts Inc.
1112 Magazine Street
New Orleans 13
Phone: 522-0217
Attn: Irvine J. Levi

MARYLAND

Uncle George's Radio Ham Shack Division
Electronics Distributors, Inc.
11324 Fern Street
Wheaton
Phone: LOKwood 5-2262
Attn: George J. Pasquale

MASSACHUSETTS

DeMambro Radio Supply, Inc.
1095 Commonwealth Avenue
Boston 15
Phone: ALgonquin 4-9000
Attn: Frank DeMambro

Graham Radio, Inc.
505 Main Street
Reading
Phone: 944-4000
Attn: Robert T. Graham, Sr.

Radio Shack Corp.
730 Commonwealth Avenue
Boston 17
Phone: REgency 4-1000
Attn: A. E. Coe

*Two-Way Radio Engineers, Inc.
109-115 Ward Street
Boston
Phone: GARRison 7-3511
Attn: Sherman M. Wolf

MICHIGAN

*Communication Service Company
201 South Lincoln
Charlotte
Phone: 1770-W
Attn: Bart Rypstra

M. N. Duffy & Co.
2040 Grand Avenue W.
Detroit 26
Phone: WOODward 3-2270
Attn: M. N. Duffy/Bill Mains

Purchase Radio Supply
327 E. Hoover Avenue
Ann Arbor
Phone: NORmandy 8-8696/8-8262
Attn: Roy J. Purchase

Radio Supply & Engineering
90 Selden Avenue
Detroit 1
Phone: TEMple 1-3175
Attn: C. N. Houser

Warren Radio Company
1710 South Westnedge
Kalamazoo
Phone: FIREside 2-5720/2-7127
Attn: Frank Smith

MINNESOTA

Lew Bonn Company
1211 LaSalle Avenue
Minneapolis 3
Phone: FEderal 9-6351
Attn: Joe Hotch

**Electronic Center, Inc.
107 3rd Avenue North
Minneapolis 1
Phone: FEderal 8-8678
Attn: Ward Jensen

MISSOURI

Walter Ashe Radio Company
1125 Pine Street
St. Louis 1
Phone: CHEstnut 1-1125
Attn: Joe Novak

Burstein-Applebee Co.
1012-1014 McGee Street
Kansas City 6
Phone: BALtimore 1-1155
Attn: R. H. Friesz/Clyde Fritz

Henry Radio Company
211 North Main
Butler
Phone: ORchard 9-3127
Attn: Bob Henry, Helen DeArmond

NEW HAMPSHIRE

**Evans Radio
(P. O. Box 312)
Bow Junction, Route 3A
Concord
Phone: CApital 5-3358
Attn: Roger Britton

NEW JERSEY

Federated Purchaser, Inc.
1021 U. S. Rt. 22
Mountainside
Phone: ADams 2-8200
Attn: Hal Thorn

12/1/61

**ALSO AUTHORIZED DISTRIBUTOR
*SERVICE AGENCY ONLY

Hudson Radio & Television Corp.
of New Jersey
35 Williams Street
Newark 2
Phone: Market 4-5154
Attn: Joseph Prestia

*Warner Engineering Co., Inc.
239 Lorraine Avenue
Upper Montclair
Phone: Pioneer 6-7900
Attn: Charles K. Atwater

NEW MEXICO

*Simms Communications, Inc.
217 Camino Encantado
Santa Fe
Phone: YUcca 2-9502
Attn: Preston W. Simms

NEW YORK

Adirondack Radio Supply
(P. O. Box 88)
185-191 W. Main St.
Amsterdam
Phone: VICTOR 2-8350
Attn: Ward Hinkle

Ft. Orange Radio Distributing Co., Inc.
904-16 Broadway
Albany 7
Phone: HEMlock 6-8411
Attn: Harry Miller

Genesee Radio & Parts Co., Inc.
2550 Deleware Avenue
Buffalo 16
Phone: DE 9661
Attn: Martin Feigenbaum

Harrison Radio Corporation
225 Greenwich Street
New York 7
Phone: BARclay 7-7777
Attn: W. E. Harrison/Ben Snyder

Harvey Radio, Inc.
103 W. 43rd Street
New York 18
Phone: JUdson 2-1500
Attn: Harvey Sampson/George Zarrin

NORTH CAROLINA

Dalton-Hege Radio Supply Co., Inc.
938 Burke Street
Winston-Salem
Phone: PARK 5-8711
Attn: Wayne Yelverton

**Freck Radio & Supply Co.
38 Biltmore Avenue
Asheville
Phone: ALpine 3-3631
Attn: T. T. Freck

OHIO

Custom Electronics, Inc.
1918 South Brown Street
Dayton 9
Phone: BALdwin 3-3157
Attn: Richard Sauer/Jim Shupe

Pioneer Electronic Supply Co.
5403 Prospect Avenue
Cleveland 3
Phone: 432-0010
Attn: J. Fred Ohman/Herb Farr

Selectronic Supplies, Inc.
3185 Bellevue Road
Toledo 6
Phone: GREENwood 4-5477
Attn: Glenn Ingersoll

Steinberg's Inc.
633 Walnut Street
Cincinnati 2
Phone: CHerry 1-1880
Attn: Jule Burnett

**Universal Service
114 N. Third Street
Columbus 15
Phone: CAPitol 1-2335
Attn: Francis R. Gibb

OKLAHOMA

Radio, Inc.
1000 South Main Street
Tulsa 19
Phone: LU 7-9124
Attn: E. R. Durham

OREGON

Portland Radio Supply Co.
1234 S. W. Stark Street
Portland 5
Phone: CAPitol 8-8647
Attn: C. B. Lucas

PENNSYLVANIA

Cameradio Company
1121 Penn Avenue
Pittsburgh 22
Phone: EXpress 1-4000
Attn: Harry Kaplin

Radio Electric Service Company
of Pa., Inc.
N. W. cor. 75th & Arch Sts.
Philadelphia 6
Phone: WALnut 5-5840
Attn: Edward Miller

RHODE ISLAND

W. H. Edwards Company
116 Hartford Avenue
Providence 9
Phone: GASpee 1-6158
Attn: Sal Infantolino

SOUTH CAROLINA

Dixie Radio Supply
1900 Barnwell Street
Columbia
Phone: ALpine 3-5333
Attn: B. W. Krell

Wholesale Radio Supply Co.
(P. O. Box 2223)
515 East Bay St.
Charleston
Phone: RA 22634
Attn: Irving Sonenshine

SOUTH DAKOTA

Burghardt Radio Supply
(P. O. Box 746)
621 4th Street S. E.
Watertown
Phone: TURner 6-5749
Attn: Stan Burghardt/Al Hodgkin

TENNESSEE

Electra Distributing Company
1914 West End Avenue
Nashville 4
Phone: ALpine 5-8444
Attn: Richard B. Harris

W. & W. Distributing Company
(P. O. Box 436)
644-646 Madison Avenue
Memphis
Phone: JACKson 7-4628
Attn: Mrs. S. D. Wooten, Jr.

TEXAS

All-State Electronics, Inc.
2411 Ross Avenue
Dallas 1
Phone: RI 1-3281
Attn: Walter Clayton/J. Howard Klein

Amateur Electronics, Inc.
2802 Ross Avenue
Dallas
Phone: RIVERSide 8-9198
Attn: Walter L. Jackson

**Busacker Electronic Equipment
Company, Inc.
(P. O. Box 13204)
1216 W. Clay Street
Houston 19
Phone: JACKson 6-2578
Attn: Garth L. Johnson

*Communications Service, Inc.
3209 Canton Street
Dallas 26
Phone: RIVERSide 7-1852
Attn: Cecil A. White, Jr.

Crabtree's Wholesale Radio
2608 Ross Avenue
Dallas
Phone: RIVERSide 8-5361
Attn: R. B. Bryan/Russell Manship

Electronic Equipment & Engineering Co.
(P. O. Box 3687)
805 South Staples Street
Corpus Christi
Phone: TULip 3-9271
Attn: R. N. Douglas

Hargis-Austin, Inc.
(P. O. Box 716)
410 Baylor Street
Austin
Phone: GREENwood 8-6618
Attn: Mrs. Paul Hargis Joe Fooche

**Howard Radio Company
1475 Pine Street
Abilene
Phone: ORchard 2-9501
Attn: R. L. Howard

McNicol, Inc.
811 North Estrella Street
El Paso
Phone: LO 6-2936
Attn: C. C. McNicol

Radio & Television Parts Co.
1828 N. Saint Mary's St.
San Antonio 12
Phone: CAPitol 6-5329
Attn: Charlie Hildebrand

WASHINGTON

*C & G Radio Electronics Co.
2502-6 Jefferson Avenue
Tacoma 2
Phone: BRoadway 2-3181
Attn: Lloyd Norberg

C & G Radio Electronics Co.
2221 Third Avenue
Seattle 1
Phone: MAin 4-4355
Attn: Dennis Ranier

Northwest Electronics Distributors
East 730 First Avenue
Spokane 3
Phone: KE 4-2644
Attn: J. P. McGoldrick

Pringle Radio Wholesale Company
2101 Colby
Everett
Phone: ALpine 2-6303
Attn: M. U. Baker

WISCONSIN

Amateur Electronic Supply
3832 West Lisbon Avenue
Milwaukee 8
Phone: WESt 3-3262
Attn: Steve Potyandy/Terry Sterman

Harris Radio Corporation
289 North Main Street
Fond du Lac
Phone: WALnut 2-4670
Attn: Terry Sterman/Harris E. Sterman

Satterfield Electronics, Inc.
1900 South Park Street
Madison 5
Phone: ALpine 7-4801
Attn: A. W. Satterfield/W. E. Uhalt

COLLINS AUTHORIZED SERVICE AGENCIES

ALABAMA

*Beddow Engineering Services
2424 Tenth Avenue South
Birmingham
Phone: ALpine 1-7582
Attn: Dr. C. P. Beddow

ARIZONA

**Southwest Electronic Devices
(P. O. Box 3647)
140 South 2nd St.
Phoenix
Phone: ALpine 2-1743
Attn: Herman A. Middleton

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999 Howard Avenue
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Phone: DIAMond 2-5757
Attn: Dan Rodriguez

*Communication Receiver Service
5016 Maplewood
Los Angeles 4
Phone: HOLlywood 2-2429
Attn: Charles C. Messman

**Henry Radio Co., Inc.
(P. O. Box 64398)
11240 W. Olympic Blvd.
Los Angeles 64
Phone: GRANite 7-6701
Attn: Ted Henry

FLORIDA

**Amateur Radio Center, Inc.
2805-7 N. E. 2nd Avenue
Miami
Phone: FRanklin 4-4101
Attn: Wiley Gilkison

**Broad Radio
7231 Central Avenue
St. Petersburg 10
Phone: 72314
Attn: H. G. Palin

**Electronic Wholesalers, Inc.
9290 N. W. 27th Avenue
Miami 47
Phone: OXFord 6-1620
Attn: Philip Konter

**Kinkade Radio Supply, Inc.
1719 Grand Central Avenue
Tampa
Phone: 8-6043
Attn: E. T. Kinkade

HAWAII

**Honolulu Electronics
819 Keaamoku Street
Honolulu 14
Phone: 995-466
Attn: Thomas Teruya

LOUISIANA

**Radio Parts, Inc.
1112 Magazine Street
New Orleans 13
Phone: 522-0217
Attn: Irvine J. Levi

MASSACHUSETTS

*Two-Way Radio Engineers, Inc.
109-115 Ward Street
Boston
Phone: GARRison 7-3511
Attn: Sherman M. Wolf

MICHIGAN

*Communication Service Company
201 South Lincoln
Charlotte
Phone: 1770-W
Attn: Bart Rypstra

MINNESOTA

**Electronic Center, Inc.
107 Third Avenue North
Minneapolis 1
Phone: FEderal 8-8678
Attn: Ward Jensen

NEW HAMPSHIRE

**Evans Radio
(P. O. Box 312)
Bow Junction, Route 3A
Concord
Phone: CAPitol 5-3358
Attn: Roger Britton

NEW JERSEY

*Warner Engineering Co., Inc.
239 Lorraine Avenue
Upper Montclair
Phone: PIONEER 6-7900
Attn: Charles K. Atwater

NEW MEXICO

*Simms Communication, Inc.
217 Camino Encantado
Santa Fe
Phone: YUcca 2-9502
Attn: Preston W. Simms

NORTH CAROLINA

**Freck Radio & Supply Co.
Biltmore Avenue
Asheville
Phone: ALpine 3-3631
Attn: T. T. Freck

OHIO

**Universal Service
114 North Third Street
Columbus 15
Phone: CAPitol 1-2335
Attn: Francis R. Gibb

TEXAS

**Busacker Electronic Equipment
Company, Inc.
(P. O. Box 13204)
1216 W. Clay Street
Houston 19
Phone: JACKson 6-2578
Attn: Garth L. Johnson

*Communications Service, Inc.
3209 Canton Street
Dallas 26
Phone: RIVERSide 7-1852
Attn: Cecil A. White, Jr.

**Howard Radio Company
1475 Pine Street
Abilene
Phone: ORchard 2-9501
Attn: R. L. Howard

WASHINGTON

*C & G Radio Electronics Co.
2502-6 Jefferson Avenue
Tacoma 2
Phone: BRoadway 2-3181
Attn: Lloyd Norberg

**ALSO AUTHORIZED DISTRIBUTOR
*SERVICE AGENCY ONLY



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TABLE OF CONTENTS

<u>Paragraph</u>		<u>Page</u>
SECTION I		
GENERAL DESCRIPTION		
1.1.	General	1-1
1.2.	Major Units	1-1
1.3.	General Characteristics and Description	1-1
	1.3.1. Exciter/Power Amplifier.	1-1
	1.3.2. Power Supplies	1-3
1.4.	Reference Data.	1-3
1.5.	Modification for Canada	1-3
1.6.	Tube Complement	1-4
1.7.	Accessories (Not Supplied)	1-4
SECTION II		
INSTALLATION AND INITIAL ADJUSTMENT		
2.1.	Installation	2-1
	2.1.1. Unpacking	2-1
	2.1.2. Placement of Units	2-1
2.2.	External Connections	2-1
SECTION III		
OPERATION		
3.1.	Initial Adjustments	3-0
3.2.	Tuning Procedure	3-0
	3.2.1. CW Operation	3-0
	3.2.2. SSB Operation	3-2
	3.2.3. AM. Operation	3-2
SECTION IV		
THEORY OF OPERATION		
4.1.	General Circuit Description	4-0
	4.1.1. Circuit Description, SSB Signals	4-1
	4.1.2. Circuit Description, AM. Signals	4-1
	4.1.3. Circuit Description, CW Signals	4-1
	4.1.4. Circuit Description, FSK Signals	4-1
4.2.	Detailed Circuit Description	4-1
	4.2.1. Exciter/Power Amplifier Circuits	4-1
	4.2.2. Power Supply Circuits	4-17
	4.2.3. Control Circuits	4-19
	4.2.4. Function of Operating Controls	4-20
	4.2.5. External Connections	4-22

TABLE OF CONTENTS (Cont.)

<u>Paragraph</u>		<u>Page</u>
SECTION V MAINTENANCE AND ALIGNMENT		
5.1.	Maintenance	5-1
	5.1.1. General	5-1
	5.1.2. Cleanliness	5-1
	5.1.3. Trouble Shooting	5-1
	5.1.4. Trouble Shooting Procedure	5-3
5.2.	Electrical Maintenance	5-6
	5.2.1. Test Conditions	5-6
	5.2.2. Exciter and Power Amplifier	5-7
	5.2.3. Alignment of KWS-1	5-8
5.3.	Mechanical Maintenance	5-13
	5.3.1. Dial Cord Replacement	5-13
SECTION VI PARTS LIST		
SECTION VII ILLUSTRATIONS		
SECTION VIII ANTENNAS WITH 52-OHM COAXIAL FEED LINES		
8.1.	General	8-1
8.2.	Antenna Details	8-1
8.3.	Transmission Line	8-2
8.4.	Test Information	8-2

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1-1	KWS-1 Transmitter.	1-0
1-2	Block Diagram of Single Sideband Development	1-2
2-1	Exciter/Power Amplifier Rear Panel	2-2
2-2	Installation of PA Tubes	2-2
2-3	KWS-1 Connections to Associated Apparatus.	2-3
3-1	Exciter Front Panel	3-1
3-2	Power Supply Front Panel.	3-1
4-1	Exciter/Power Amplifier, Block Diagram	4-0
4-2	VOX Circuits, Simplified Schematic Diagram	4-2
4-3	LFO, Balanced Modulator and FL101 Mechanical Filter, Simplified Schematic Diagram	4-3
4-4	Balanced Modulator and FL101 Mechanical Filter, Simplified Schematic Diagram	4-4
4-5	Balanced Modulator Output, Typical Oscilloscope Pattern.	4-5
4-6	FL101 Mechanical Filter, Functional Diagram	4-5
4-7	FL101 Mechanical Filter Output, Typical Oscilloscope Pattern	4-6
4-8	First Mixer V201, Simplified Schematic Diagram	4-7
4-9	6CL6 Driver Feedback and Grid-to-Cathode Neutralization Circuits, Simplified Schematic Diagram.	4-10
4-10	6CL6 Driver Grid-to-Cathode Neutralization Bridge Diagram	4-11
4-11	6CL6 Driver Grid-to-Plate Neutralization Circuits (80 Meters), Simplified Schematic Diagram.	4-11
4-12	6CL6 Driver Grid-to-Plate Neutralization Bridge Diagram (80 Meters)	4-12
4-13	6CL6 Driver Grid-to-Plate Neutralization Circuits, (40, 20, 15, 11 and 10 Meters), Simplified Schematic Diagram	4-12
4-14	6CL6 Driver Grid-to-Plate Neutralization Bridge Diagram (40, 20, 15, 11 and 10 Meters)	4-13
4-15	4X250B Final Amplifier Grid-to-Plate Neutralization Circuits, Simplified Schematic Diagram	4-13
4-16	4X250B Final Amplifier Grid-to-Plate Neutralization Bridge Diagram	4-14
4-17	Automatic Load Control Circuits, Simplified Schematic Diagram	4-15
4-18	Primary Circuits, Simplified Schematic Diagram	4-16
4-19	Control Circuits, Simplified Schematic Diagram	4-18
5-1	Exciter Test Jacks and Points of Tuned Circuit Adjustments	5-5
5-2	Dial Cord Replacement	5-14
6-1	Exciter/Power Amplifier, Rear Panel	6-31
6-2	Exciter/Power Amplifier, Top View, Top Cover Open	6-32
6-3	Exciter/Power Amplifier, Front Panel, Internal View	6-33
6-4	Exciter/Power Amplifier, Bottom View, Cover Removed	6-34
6-5	Exciter, Bottom View, Upper Right Quarter.	6-35
6-6	Exciter, Bottom View, Lower Right Quarter	6-36
6-7	Exciter, Bottom View, Upper Left Quarter, Including Power Amplifier	6-37
6-8	Exciter, Bottom View, Lower Left Quarter	6-38
6-9	Power Amplifier, Bottom-Rear-Left View.	6-39
6-10	Power Amplifier, Top View, Cover Removed	6-39
6-11	Power Amplifier, Front View, Cover Removed	6-40
6-12	Power Supply, Front Left Oblique View, Panel Removed	6-41
6-13	Power Supply, Front Vertical Oblique View, Panel Removed	6-42
6-14	Power Supply, Front Right Oblique View, Panel Removed	6-43
6-15	Power Supply, Rear View, Panel Removed	6-44
6-16	Power Supply, Rear Oblique View, Panel Removed	6-45

LIST OF ILLUSTRATIONS (Cont.)

<u>Figure</u>		<u>Page</u>
7-1	Exciter/Power Amplifier, Complete Schematic Diagram	7-3/7-4
7-2	Power Supply, Complete Schematic Diagram	7-5/7-6
7-3	Interconnecting Cable, Wiring Diagram	7-7
7-4	RG-8/U Cable Assembly to Connectors	7-8
7-5	RG-58/U Cable Assembly to Connectors	7-9
8-1	Balun With Balanced Open Wire Line for Reduction of Losses on Long Transmission Lines	8-3
8-2	10-Meter Beam With Shortened Unbalanced to Balanced Transformer (Balun) Feed System	8-4
8-3	20-Meter Beam With Shortened Unbalanced to Balanced Transformer (Balun) Feed System	8-5
8-4	Half-Wave Antenna With Quarter-Wave Unbalanced to Balanced Transformer (Balun) Feed System	8-6
8-5	Broadband Antenna With Quarter-Wave Unbalanced to Balanced Transformer (Balun) Feed System	8-7
8-6	Short Balun for 40 and 80 Meters	8-8

LIST OF TABLES

<u>Table</u>		<u>Page</u>
3-1	Approximate PA Tuning and Loading Dial Settings	3-3
4-1	Tuned Circuit Components	4-9
4-2	Typical Meter Readings	4-22
5-1	Fuse Table	5-7
5-2	Test Jacks	5-7
5-3	Driver Plate Alignment	5-11
5-4	Tube Pin Voltage to Ground	5-15
5-5	Tube Pin Resistances to Ground	5-16
8-1	Nominal Antenna Performance Specifications	8-1

1.3.2. POWER SUPPLIES.

The power supply portion of the KWS-1 includes a high and low voltage supply in the single cabinet. The high voltage Power Supply consists of two single phase, full wave rectifiers and filter networks for supplying voltages to the plates and screen grids of the Power Amplifier. Also included in the high voltage supply are suitable interlocks for safety purposes, a primary switch, overload fuses and a plate contactor. The low voltage Power Supply provides all operating voltages for the exciter portion.

On cw operation, the high voltage is ON and a grid-block system of bias is used to cut off the r-f excitation to the Power Amplifier. On phone operation, the push-to-talk switch on the microphone, or the voice operate (VOX) system, controls the application of operating voltages by the carrier control relay action. Thus, actual transmitting occurs only when the cw key is depressed on CW, when the operator is talking on SSB or when the push-to-talk switch is operated.

1.4. REFERENCE DATA.

Power Source: 115 or 230 volts ac, 50/60 cycles, single phase.

Power Input Requirements: The maximum overall input power requirement is 1500 watts.

PA Plate Power Input: The nominal rated power input is 1000 watts peak envelope power.

Distortion: Third order distortion is down more than 35 decibels with tone frequencies of 900 and 2500 cps.

Frequency Range:

Band (Meters)	Range (Mc)
80	3.0 to 4.0
40	7.0 to 7.3
20	14.0 to 15.0
15	20.5 to 21.5
11	26.4 to 27.4
10	28.0 to 29.0
10	29.0 to 30.0

Calibration: Direct reading in kilocycles on linear scale.

Dial Accuracy: Within 200 cps.

Frequency Stability:

Warmup: 5 minutes, not more than 1000 cps.
10 minutes, not more than 500 cps.

Normal Operation: After 20 minutes, within 300 cps of starting frequency.
After 30 minutes, within 100 cps over 10-minute period.

Audio Frequency Response: Within plus or minus three decibels from 200 to 2900 cps.

Carrier Suppression: Not less than fifty decibels.

Undesired Sideband Suppression: Not less than fifty decibels.

Spurious Radiation: At least 35 decibels down.

Impedance of Microphone Input: High impedance.

Impedance of Antenna Connection: 52 ohms.
(See section VIII of this book for suggested antennas.)

Impedance of Phone Patch Connection: 600 ohms

Signal Level of Phone Patch: 0.1 volt.

Finish: St James grey wrinkle.

1-5. MODIFICATION FOR CANADA.

Equipments sold in Canada are modified to meet Canadian Department of Transport Power Regulations as follows: Final plate voltage reduced to 1500-V; Final screen voltage reduced to 300-V. This allows the transmitter to be operated at 700 watts input. This modification must not be changed.

1-6. TUBE COMPLEMENT.

Quantity	Tube Type	Reference	Function
1	5749	V001	VFO
1	12AT7	V101	Audio Amplifier
1	12AT7	V102	Audio Output/Squelch Amplifier
1	12AT7	V103	VOX Amplifier/Relay Amplifier
1	12AT7	V104	Low Freq. (250 kc) Oscillator/Amplifier
2	OB2	V105, 106	Voltage Regulators
1	6AL5	V107	VOX and Squelch Rectifiers
1	3TF4A	RT101	Filament Regulator
1	12AT7	V201	First Mixer
4	6BA6	V202, 203, 209	1st, 2nd and 3rd Amplifiers
1	12AT7	V204	Second Mixer
2	6CL6	V206, 207	Drivers
1	6AU6	V208	Crystal Oscillator
2	4X250B	V401, 402	Final Amplifiers
1	6AL5	V403	Automatic Load Control Rectifier
1	6AN5	V205	4th Amplifier
2	866A	V501, 502	Rectifiers, PA plate voltage
1	5Y3-GT	V503	Rectifier, PA screen voltage
1	6AS7-G	V504	Voltage Regulator, PA screen voltage
1	12AX7	V505	Voltage Regulator, PA screen voltage
1	OB2	V506	Voltage Regulator, PA screen voltage
1	5U4-GB	V508	Voltage Rectifier, low voltage
1	6AL5	V509	Bias Rectifier
1	2D21	V507	PA Screen Protect

1-7. ACCESSORIES (Not Supplied).

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>312A-1 Speaker Control. Provides space for mounting beam direction indicator, clock, etc., and includes a 10-inch speaker for receiver output.</p> <p>020 0186 00 Microphone assembly with push-to-talk stand.</p> | <p>020 0187 00 Microphone assembly with plain stand.</p> <p>522 0649 00 Model 302C-1 Directional Wattmeter</p> <p>522 0475 00 Model SC-101 Station Control System</p> <p>Telegraph Key</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

SECTION II

INSTALLATION AND INITIAL ADJUSTMENT

2.1. INSTALLATION.

2.1.1. UNPACKING.

The KWS-1 Transmitter is packed in two separate cases. The smaller case contains the Exciter/Power Amplifier. The larger case is the cabinet containing the Power Supply. Remove the two cabinets from the packing cases, using care to prevent damage to the units. Retain the packing material, for if shipping damage is evident, the units should be returned to their cases and the transportation company notified immediately.

The oscillator ballast tube, Type 3TF4A, the 4X250B tubes, the lamp chimneys, the plate connectors, and the antenna relay kit parts are all packed separately and placed in the power supply crate. These items must be unpacked and installed. The order of installation of the 4X250B tubes, the lamp chimney and connectors is shown in figure 2-2. Be sure the chimney is installed correct side up.

Make a thorough visual inspection of the outside and inside of each unit. Do not make adjustments or external connections at this time, but look for broken parts and connections, or any other evidence of shipping damage. Reference to figure 1-1 and to the photographs in section VI will be helpful in making the visual check.

2.1.2. PLACEMENT OF UNITS.

The Exciter/Power Amplifier is designed for table mounting or may be mounted on top the power supply cabinet alongside the operator's table. This choice and the accessibility of the local power outlet will determine the actual placement of units.

Allow enough space at the rear of the units for making external connections, replacement of fuses and to provide adequate circulation of air.

2.2. EXTERNAL CONNECTIONS.

Assembling the KWS-1 into an operating station is quite simple and consists briefly as follows:

- a. Plug microphone into the MIC jack (J101) located at lower right-hand corner of front panel. (See figure 3-1.)
- b. Plug the high voltage cable plug into the 2000 V dc jack J402 at rear of the PA. (See figure 6-1.)
- c. Plug the power supply interconnecting cable plug into the rear of the transmitter. See figure 2-1.
- d. Plug the pendent cable plug into CONTROL CIRCUITS at the rear of the transmitter. See figure 2-1.
- e. Connect the pendent cable to the receiver circuits, key line, antenna relay, etc. (See figure 2-3.)
- f. Install blower hose. Be sure clamps are tight. (See figure 6-1.)
- g. Plug antenna coax line into J401 on rear of PA unit. It is recommended that either an r-f ammeter or a power indicating device be used between the KWS-1 and the antenna. It is also recommended that a coaxial antenna change-over relay be used. This relay must have an extra set of normally open contacts for use in grounding the key line interlock. A source of 115 V dc, switched by the break-in relay is provided by the Power Supply for operating the 115 V dc antenna relay coil. (See figure 2-3.)
- h. Calibrate signal for the receiver can be secured by running a coax line from the receiver antenna post to the 6CL6 PLATE test point (J201). Run coax through large hole in rear of transmitter. (See figure 2-3.)

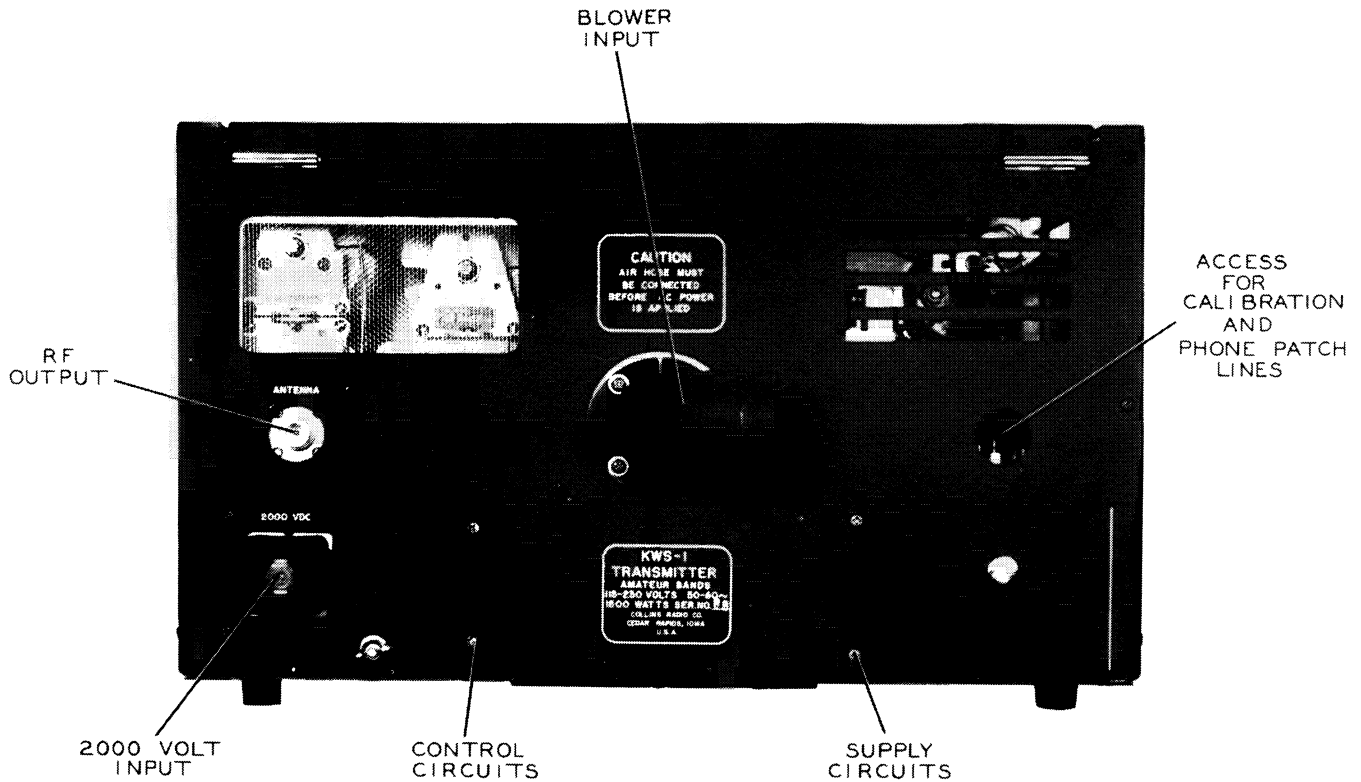


Figure 2-1. Exciter/Power Amplifier Rear Panel

i. Connect the Power Supply to a-c source by means of cable supplied.

The power supply is shipped ready for 230 volts ac operation. Connect power cord as follows: White wire = neutral; white and red = 230 V; white and black = 230 V.

NOTES

1. If 115 V operation is desired, consult figure 7-2.
2. If further information on external connections is desired, read paragraph 4.2.5. of section IV of this book.

j. Tune up the transmitter as outlined in section III of this book.

k. Check the value of power amplifier screen voltage as outlined in paragraph 4.2.4.6.f. This value must be 350 V (300 V Canada). The KWS-1 is now ready for operation.

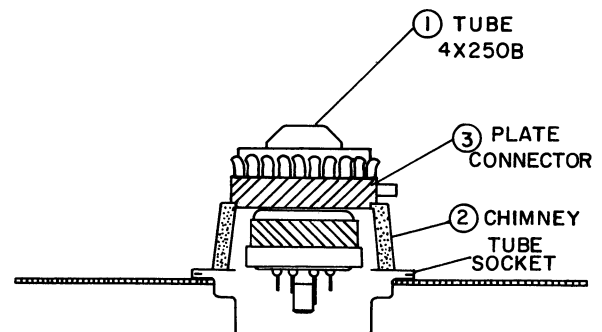


Figure 2-2. Installation of PA Tubes

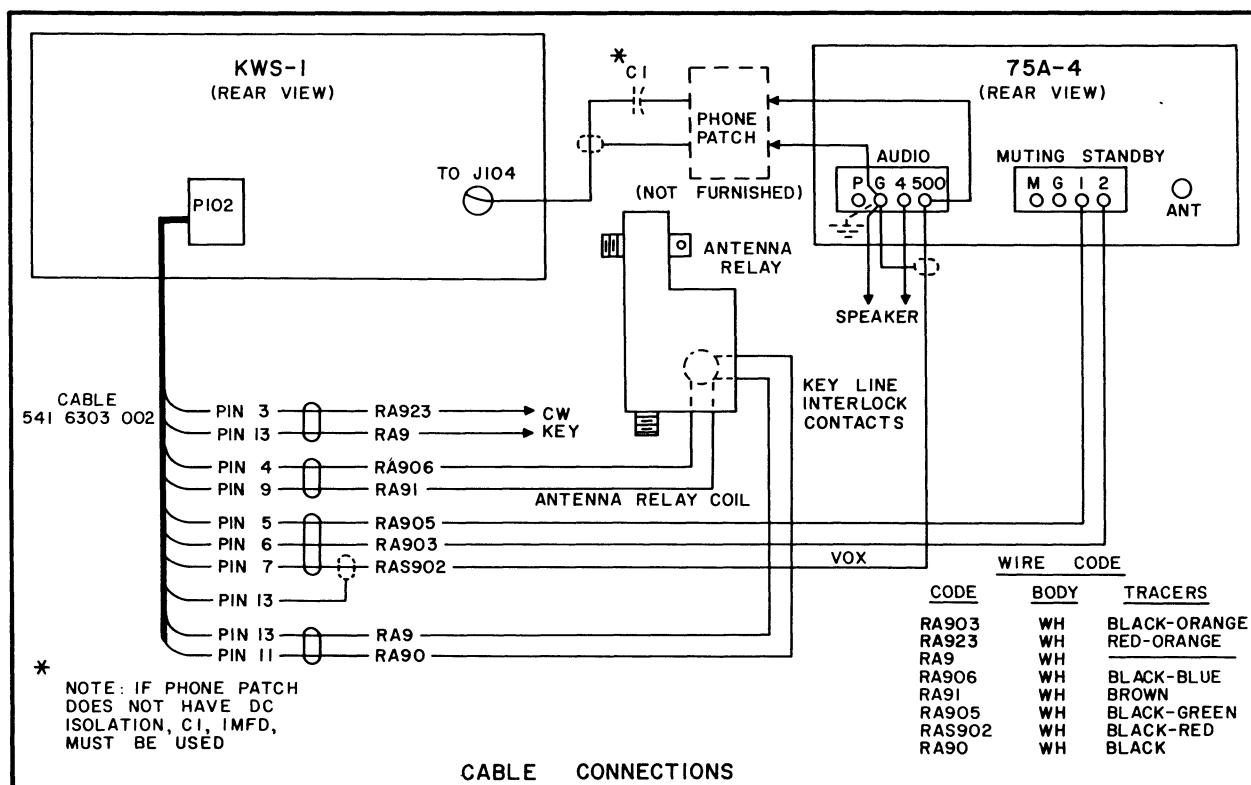
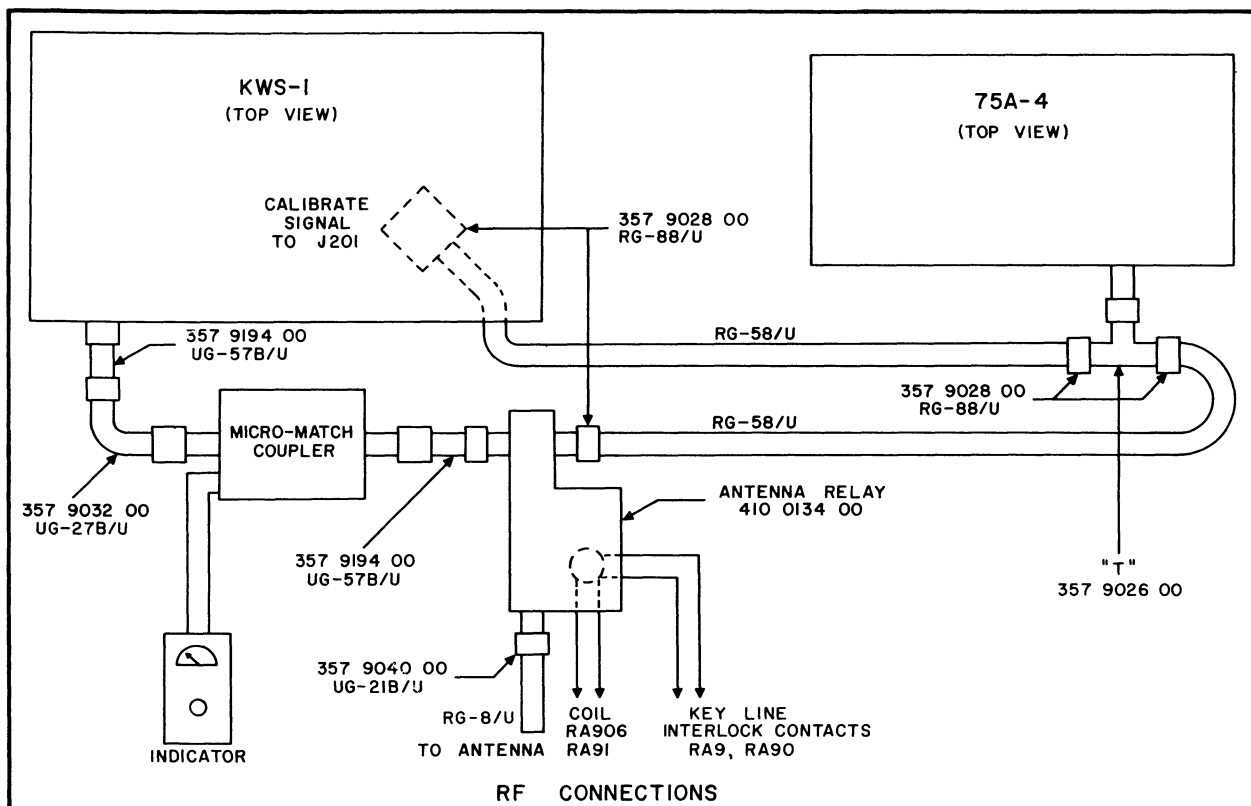


Figure 2-3. KWS-1 Connections to Associated Apparatus

SECTION III OPERATION

3. 1. INITIAL ADJUSTMENTS.

a. Turn FILAMENT switch ON. Blower should start. Adjust PA FILAMENT control on Power Supply for 6 volts on MULTIMETER.

CAUTION

Do not attempt to operate with blower in-operative or air hose disconnected as serious damage will result to the PA tubes.

b. Set EMISSION switch to CW, CARRIER LEVEL to zero, TUNE-OPERATE to OPERATE and BIAS control (on power supply) to "O".

c. Turn PA PLATE voltage ON. Advance PA BIAS ADJUST control until PA idling current is 100 ma.

d. Turn PA PLATE voltage OFF.

NOTE

A complete description of the functions of the operating controls appears in paragraph 4.2.4. of section IV.

3. 2. TUNING PROCEDURE.

3.2.1. CW OPERATION.

a. Turn the FILAMENT switch ON.

b. Select the desired band and set the main tuning dial to the frequency desired. (See paragraph 5.1.3.3. of section V for dial calibration procedure). Turn CARRIER LEVEL control full off (CCW).

c. Select CW on the EMISSION switch.

d. Place the TUNE-OPERATE switch in TUNE position.

e. Set the PA TUNING and LOADING controls several turns counterclockwise from the settings indicated in table 3-1.

f. Turn PA PLATE voltage switch ON.

g. Close TEST KEY. Advance the CARRIER LEVEL control until grid meter reads about midscale.

h. IMMEDIATELY RESONATE THE PA TUNING CONTROL for a dip in plate current.

i. Rotate the LOADING control clockwise to increase loading.

j. Load and resonate simultaneously (use both hands) until the transmitter is loaded to about 150 milliamperes in TUNE position.

k. During the loading and tuning process, the grid drive will tend to increase. This effect is caused by the action of the PA inverse feedback. Keep reducing the CARRIER LEVEL control so that grid current stays at near midscale.

l. Switch the TUNE-OPERATE switch to OPERATE. Again adjust grid current for midscale.

m. Continue loading to about 400 ma. Note antenna current or power output.

n. Continue loading to 500 ma (465 ma Canada) at resonance while watching both output and PA current. However, if the output ceases to rise as loading is increased, back off the LOADING control slightly and do not try to load beyond this point.

o. The transmitter is now ready to use on cw. Reduced input can be had by simply backing off the CARRIER LEVEL control until the desired plate input is reached. No grid current will show under these conditions as the PA will be operating class AB₁. If full output is desired, run the grid current to about 1/2 to 3/4 meter scale.

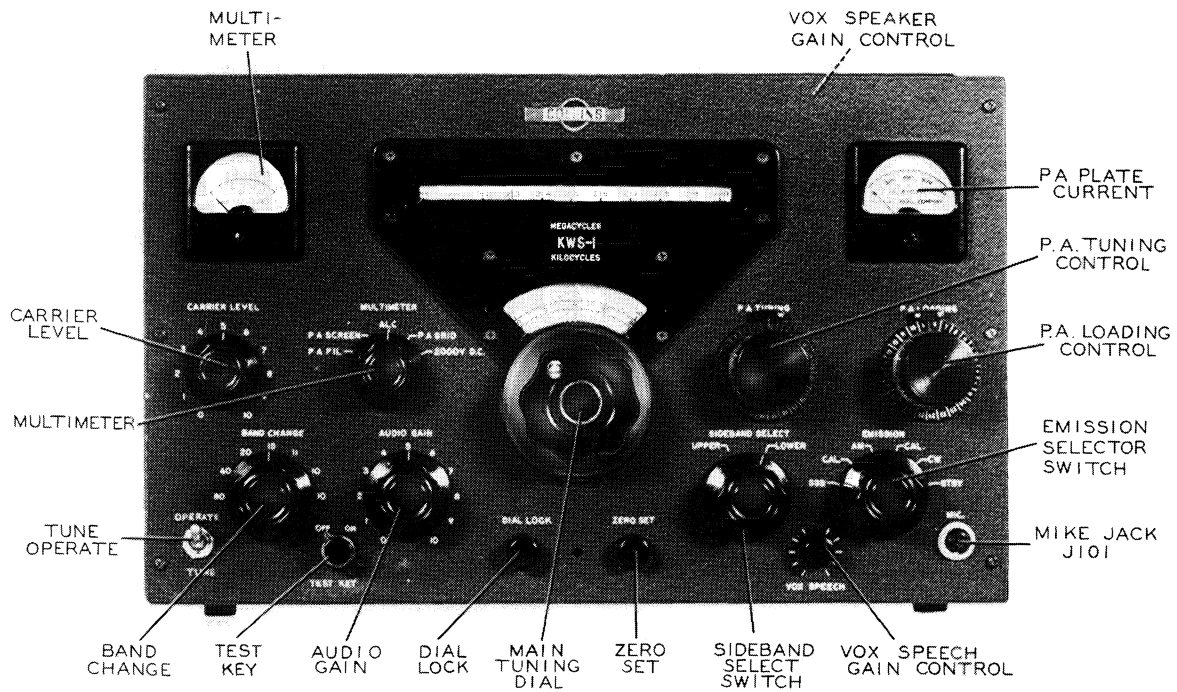


Figure 3-1. Exciter Front Panel

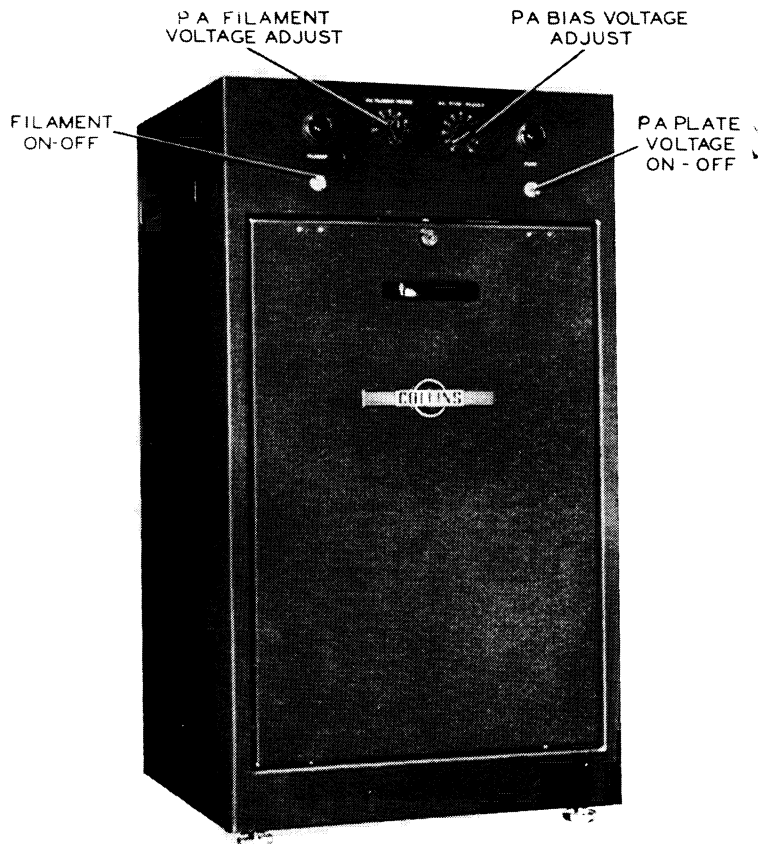


Figure 3-2. Power Supply Front Panel

Section III

Paragraphs 3.2.1. - 3.2.3.

p. Switch to STANDBY during reception because receiver is disabled when switch is in CW position.

3.2.2. SSB OPERATION.

a. Tune the transmitter exactly as for cw ("a" through "n" above).

b. Switch to SSB.

c. Set AUDIO GAIN at zero and speaker quieting control (inside unit above PA plate meter) to counterclockwise stop.

d. Speak into microphone while advancing the VOX SPEECH control. Set control for a pleasing action of the carrier control relay.

e. Advance AUDIO GAIN until ALC meter kicks to about midscale on voice peaks.

CAUTION

Under no circumstances should PA GRID current show during SSB operation or distortion will be generated.

f. Advance speaker quieting control for minimum feedback.

g. The transmitter is now ready to use on SSB. Choice of sidebands is available at the SIDEBAND SELECT switch. If there appears to be an objectionable amount of carrier present, the balanced modulator can be checked. Refer to paragraph 5.1.4.3. b.(10) of section V.

3.2.3. AM OPERATION.

a. Tune the transmitter exactly as for cw ("a" through "n" of paragraph 3.2.1.). Note antenna current or power output at threshold of grid current. (Use auxiliary r-f current meter or power output indicator.)

b. Switch to AM. operation.

c. Back OFF CARRIER LEVEL control until the power drops to 1/4 the cw value (1/2 antenna current). This corresponds to a plate current of about 275 ma (255 ma Canada).

d. Advance AUDIO GAIN control until voice peaks just start to show a trace of ALC. This trace of ALC indicates 100% modulation and should not be exceeded or distortion will result.

TABLE 3-1

APPROXIMATE PA TUNING AND LOADING DIAL SETTING
(With 52-ohm Load)

BAND	FREQUENCY IN KILOCYCLES	PA TUNE		PA LOAD	
		APPROX. SETTINGS	ACTUAL SETTINGS	APPROX. SETTINGS	ACTUAL SETTINGS
80M	3,500	262		237	
	3,750	390		353	
75M	4,000	505		435	
40M	7,000	1282		1080	
	7,150	1300		1095	
	7,300	1325		1100	
20M	14,000	1795		1545	
	14,150	1800		1570	
	14,300	1810		1595	
15M	21,000	2000		1765	
	21,450	2015		1767	
11M	27,000	2080		1875	
10M	28,000	2094		1880	
	29,000	2108		1895	
	29,700	2121		1907	

SECTION IV THEORY OF OPERATION

4.1. GENERAL CIRCUIT DESCRIPTION.

Owners of the KWS-1 Transmitter should become thoroughly familiar with operational theory before attempting to solve service or maintenance problems. This section outlines the operational theory in relation first, to the signal path through the Exciter/Power Amplifier and second, by a detailed description of all circuits in the signal path, especially those unique to single sideband, suppressed carrier transmission. Reference should be made to the block diagram in figure

4-1, the overall schematic diagram in figure 7-1, to the photographs in section VI, and to illustrations supplementing the text.

Throughout the text, reference will be made to various jack, tube, plug and switch terminals. In many instances, this reference is made by following the component symbol by a dash and the terminal number. For instance, J102-7 refers to jack J102, terminal seven, and S101C-3 refers to switch S101C, terminal three.

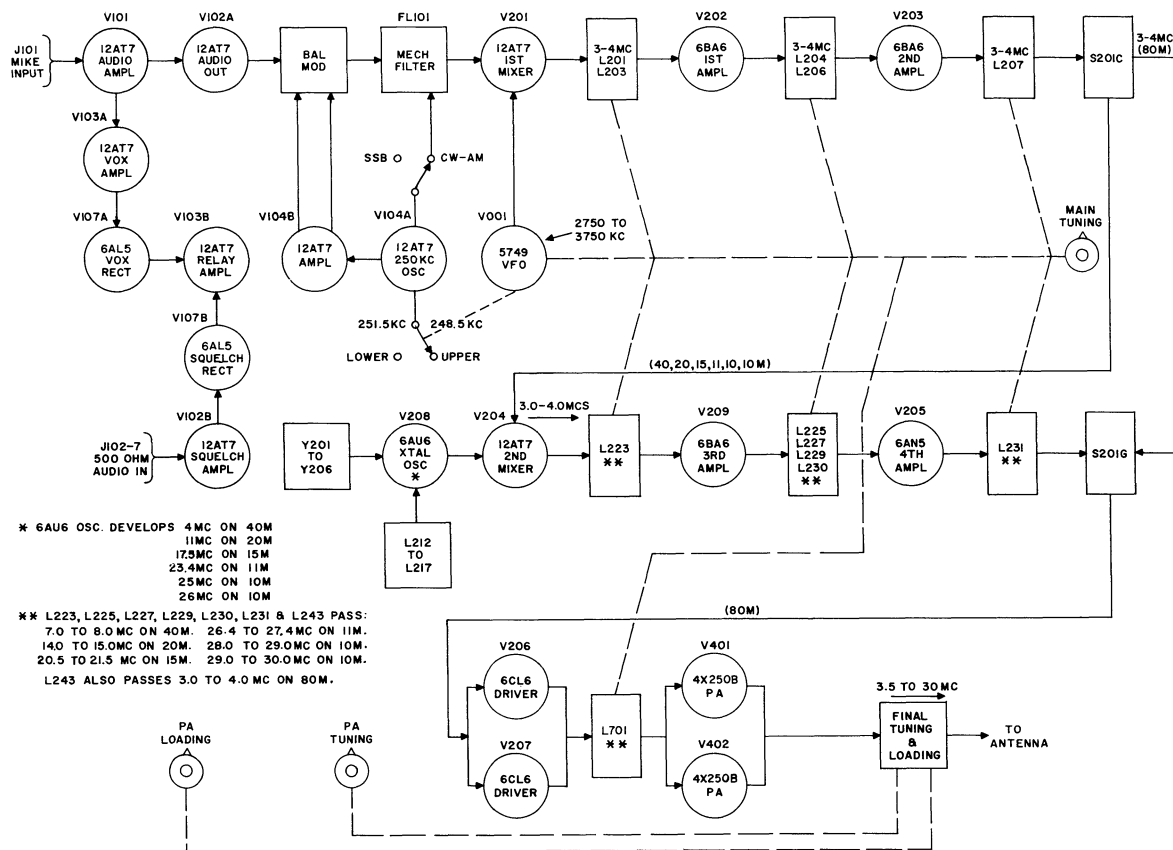


Figure 4-1. Exciter/Power Amplifier, Block Diagram

4.1.1. CIRCUIT DESCRIPTION, SSB SIGNALS.

The audio signal is fed from the microphone jack J101 on the front panel through a two-stage amplifier into a cathode follower audio output stage. The cathode follower matches the audio signal to the 1N67A diode balanced ring modulator. The output of a 250-kc oscillator is amplified and fed into the balanced modulator. The output of the modulator contains both upper and lower sidebands, but the carrier is attenuated by more than 50 decibels. The signal is fed through a mechanical filter, the input of which is series tuned to match the low impedance of the balanced modulator. The FL101 Mechanical Filter has an output containing either the upper or lower sideband, depending upon the selection of the operator. The carrier and undesired sideband are greatly suppressed, or, for all purposes of signal consideration, are eliminated.

The output of the FL101 Mechanical Filter is parallel tuned to match the high impedance of the first mixer grid. In addition to accepting output signals from the FL101 filter, the first mixer also accepts signals from the vfo. The mixer plate circuit contains a special feedback network which provides an additional 20 decibels of attenuation to undesired vfo signals appearing in the plate circuit. The desired output of the mixer is passed through two stages of linear amplification, including five high "Q" tuned circuits. The tuned circuits provide sufficient gain and selectivity to produce essentially spurious-free signals in the 80-meter band.

At this point, the 80-meter signals are fed directly into the paralleled driver stages, while the frequencies of the 40, 20, 15, 11, and 10-meter bands require further conversion. These signals are fed into a second mixer, which also receives an input from a crystal oscillator. The oscillator signal is selected by the BAND CHANGE control to provide correct output frequencies for the desired band. The conversion frequency output of the second mixer is fed through two stages of r-f amplification, including three high "Q" tuned circuits to produce a signal which is again, essentially spurious-free. The amplified signal is then fed into the 6CL6 driver stages. The output of the drivers is fed directly into the Power Amplifier.

The Power Amplifier is designed for linear class AB₁ operation with individual tuning and loading controls in the final amplifier output circuit. Grid-plate neutralization is included to provide improved stability of operation. An r-f feedback system is used to permit operation with lower distortion.

An Automatic Load Control circuit is also included in the Power Amplifier, however, a complete analysis of this circuit is included in the detailed circuit description.

4.1.2. CIRCUIT DESCRIPTION, AM SIGNALS.

For AM signals, the output of the 250-kc oscillator is reinserted at the output of the mechanical filter to provide operation with carrier and one sideband. By adjustment of the CARRIER LEVEL control, it is possible to vary the amount of carrier reinserted and produce the proper relationship between the sideband and the carrier.

4.1.3. CIRCUIT DESCRIPTION CW SIGNALS.

Cw operation is produced by reinserting the 250-kc oscillator signal at the output of the mechanical filter, as in AM. operation, and by grid-block keying of the first mixer and the driver stages. The EMISSION control eliminates exciter circuits unnecessary for cw signals. A wave shaping network is included to reduce transients in the cw output.

4.1.4. CIRCUIT DESCRIPTION, FSK SIGNALS.

Although a 600-ohm audio input circuit is available for use with an external phone patch circuit, it is also possible to feed an external audio FSK oscillator into this circuit to provide for carrier shift FSK operation. With the EMISSION switch in the SSB position, the mark and space frequencies of the audio oscillator produce two r-f voltages in the exciter output, spaced by the correct amount for all bands.

4.2. DETAILED CIRCUIT DESCRIPTION.

4.2.1. EXCITER/POWER AMPLIFIER CIRCUITS.

4.2.1.1. AUDIO CIRCUITS.

a. SPEECH AMPLIFIER CIRCUITS. The audio input signals into the KWS-1 Transmitter are first amplified by a two-stage preamplifier consisting of a duotriode 12AT7; V101. These are conventional audio amplifiers, the output of which is coupled through condenser C132 to the control grid of audio output stage V102A.

The purpose of squelch amplifier V102B and rectifier V107B is to prevent the audio signals of the receiver from operating K101 relay by feedback of the audio signals through the transmitter microphone and audio circuits. A connection is made to the receiver output transformer, which feeds the speaker audio signals into the transmitter through J102-7, through the VOX SPEAKER gain control R122, to the grid of V102B. At the same time, the same speaker signals are feeding through the transmitter microphone into the VOX amplifier V103A to produce a plus voltage on the V103B grid, to operate relay K101. However, the voltage applied to the V102B squelch circuit is amplified and fed through C115 to the cathode of rectifier V107B. This rectifier circuit is identical to V107A, except V107B is connected in reverse, such that a negative voltage is produced and applied through R126 to the grid of relay amplifier V103B. This occurs at the same time the plus voltage is being applied from V107A, at point (A) in figure 4-2. The plus and minus voltages are adjusted by potentiometers R113 and R122 to a point at which they balance out, preventing the receiver speaker signals from operating the transmitter relay K101.

The lead from V103B grid to switch S101C-3 grounds the grid during calibration procedures, to prevent audio signals from operating relay K101 during calibration.

The lead from the V103B cathode to the PTT input on J101-2 or J102-2, permits use of an external, manual push-to-talk control, instead of the voice operate circuits built into the exciter circuits.

4.2.1.2. LFO, BALANCED MODULATOR AND FL101 MECHANICAL FILTER CIRCUITS. Development of the 250-kc carrier frequency in the KWS-1 Transmitting System is accomplished by a crystal controlled oscillator stage, V104. Figure 4-3 is a simplified schematic diagram to show only oscillator V104, the balanced modulator, FL101 Mechanical Filter, and the audio output cathode follower stage. This diagram may be used to study the KWS-1 methods of carrier development, modulation and filtering relative to single sideband transmission.

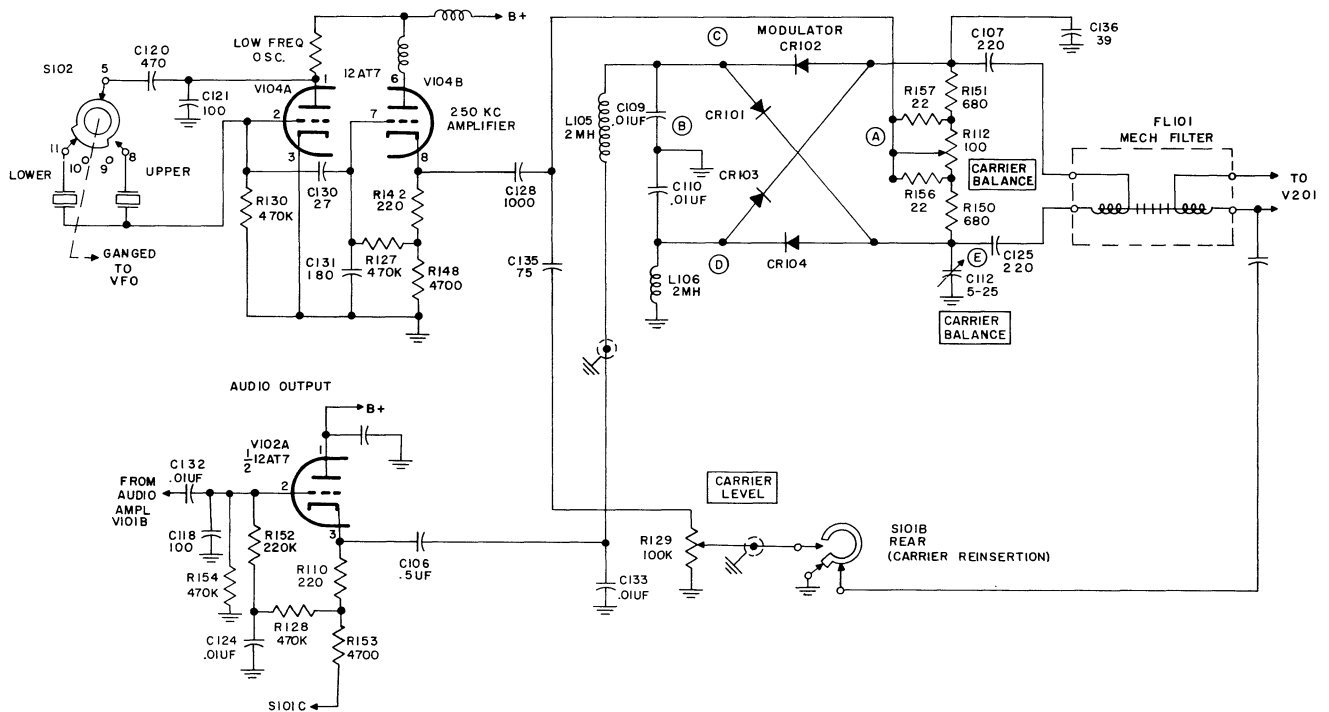


Figure 4-3. LFO, Balanced Modulator and FL101 Mechanical Filter, Simplified Schematic Diagram

a. SINGLE SIDEBAND SIGNALS.

(1) LFO. For the development of single sideband signals, the 250-kc output of V104A is coupled through condenser C130 into the grid of the 250-kc amplifier, V104B. The output of V104B is coupled from the cathode through C128 to point (A), and from the ground to point (B) of the balanced modulator, to provide an r-f input to the modulator. (See figure 4-4.)

(2) BALANCED MODULATOR. The balanced modulator is a "ring type" modulator. It receives two signal inputs, the 250-kc carrier signal at points (A) and (B) in figure 4-4, and the audio signal at points (C) and (D). The purpose of the modulator is to suppress the carrier frequency, and to pass only the upper and lower sideband frequencies resulting from modulation by the impressed audio. As shown by the component values, the modulator is a low impedance unit with two points of "balance" adjustment at points (A) and (E) in figure 4-4. R112 is adjusted for voltage balance, and C112 for capacity balance of the 250-kc r-f voltages applied.

The 250-kc carrier frequency, because of equal inputs at (A) and (B), and because of the equal component values in the ring, is balanced out, or

suppressed. As stated above, R112 and C112 provide vernier adjustments for the balance circuits to take care of component inherent value variations. The diode rectifiers are made up in matched sets at the factory. The adjustment procedure will be discussed in the chapter covering Maintenance and Alignment.

Although the ring is balanced insofar as the r-f carrier voltage is concerned, the audio input essentially "modulates" the carrier by causing unbalance of the ring voltages at an audio rate, relative to the positive and negative alternations of the audio cycles. Thus, on one audio alternation, for example, the CR101 plate is biased positive, causing its impedance to be lowered, while the CR102 cathode is biased positive, causing its impedance to be increased. On the following alternation, the impedance unbalance is the opposite. Thus, the carrier is "modulated" to produce two sidebands, but the carrier is suppressed by the ring balancing action. Assuming a 1000 cps audio note, the modulator output at the input of FL101 would be sideband frequencies of 249 kc and 251 kc, with the 250 kc carrier suppressed. (See figure 4-4.) R112 is adjusted to balance the inherent variations in R150 and R151.

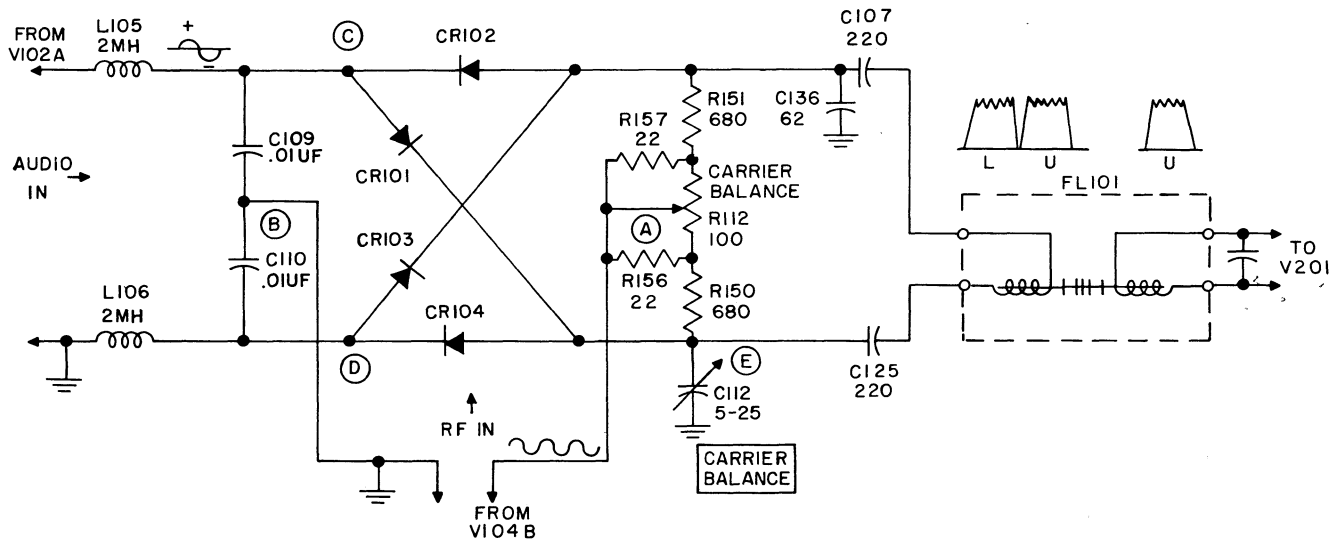


Figure 4-4. Balanced Modulator and FL101 Mechanical Filter, Simplified Schematic Diagram

Although figure 4-4 shows the modulator output in a practical "U and L" manner, the actual output waveform, when viewed on an oscilloscope, would be similar to figure 4-5, representing the 249-kc and 251-kc sideband signal plus the audio of the example stated in the preceding paragraph.

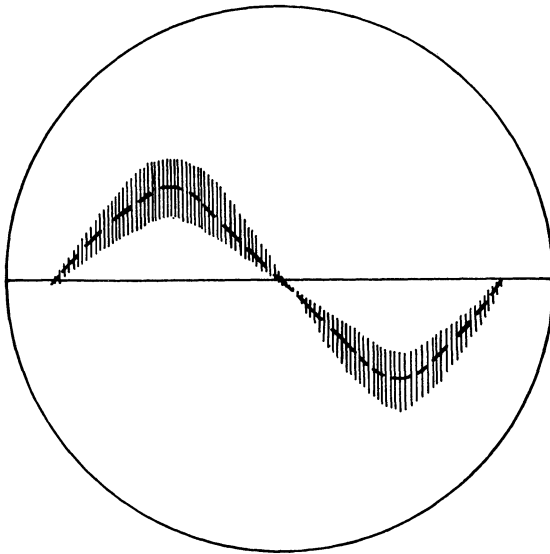


Figure 4-5. Balanced Modulator Output, Typical Oscilloscope Pattern

(3) FL101 MECHANICAL FILTER. A functional diagram of the Collins FL101 Mechanical Filter is shown in figure 4-6.

Mechanical Filter FL101 operates on the principle of magnetostriction to convert oscillating magnetic energy into mechanical vibrations and back to magnetic energy. In mechanical filter design,

the magnetostriction transducer input coil is designed to resonate at a particular frequency or band of frequencies, contingent upon the desired purpose of the filter. For KWS-1 Transmitters, the FL101 Mechanical Filter input circuit contains a fixed value, series-tuned resonant circuit composed of C107, C125 and the transducer input coil. C107 and C125 are chosen to match the filter, and is a series resonant circuit for low impedance input to accept the low impedance output of the balanced modulator. Low impedance input characteristics are desired to attain stability of operation in the development of the low level, single sideband transmission signals.

Within the filter, a nickel wire in the input transducer coil vibrates mechanically and transmits this energy to the first of a series of nickel alloy discs. The mechanical vibration of the first disc is coupled to succeeding discs by means of nickel-wire coupling elements. Biasing magnets at either end of the filter polarize the filter elements to prevent frequency doubling in much the same manner as biasing magnets in a headphone prevent the phone diaphragm from bending the same direction for both alternations of an a-c cycle. The mechanical vibration of the last disc is coupled to a magnetostriction transducer element identical to the one used at the input of the filter. By a reverse principle of magnetostriction, the mechanical vibrations of the nickel-wire transducer core is converted to electrical impulses. Each of the discs used has a mechanically resonant "Q" exceeding 2000. Six of the discs are overcoupled to produce a mechanically-shaped response curve with a flat top and almost vertical sides. Thus the filter passes a band of frequencies very little wider than the flat top of the selectivity curve. In the case of FL101 Mechanical Filter, this band of frequencies is approximately 3 kc wide and centers on 250 kcs. Figure 4-4 shows a practical example of the FL101 Mechanical Filter output wave containing all the USB frequencies however, on an oscilloscope, the

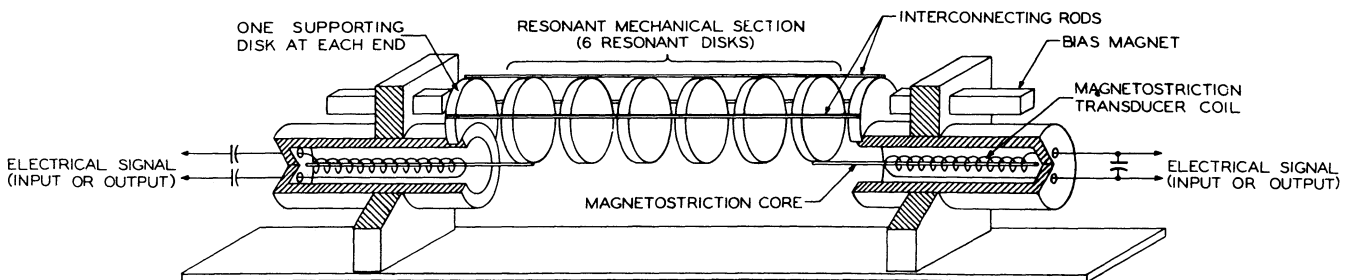


Figure 4-6. FL101 Mechanical Filter, Functional Diagram

Section IV

Paragraphs 4.2.1.2. - 4.2.1.3.

wave shape would be that of figure 4-7, with a single r-f frequency when a single audio tone is applied to the balanced modulator, but actually contains the upper or lower sideband output of the modulator.

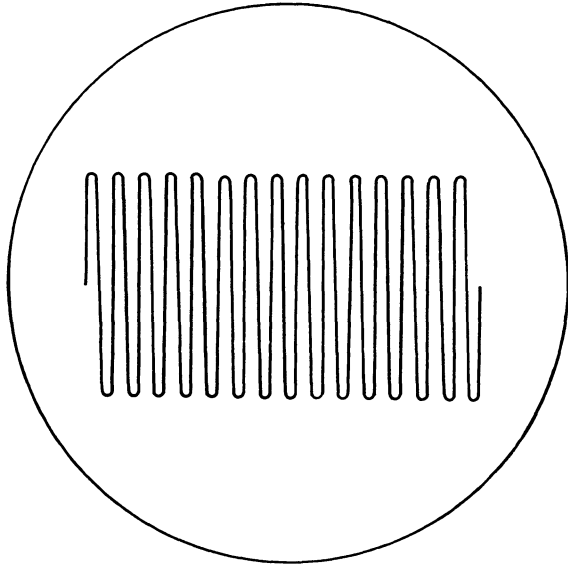


Figure 4-7. FL101 Mechanical Filter Output, Typical Oscilloscope Pattern

(4) **SIDEBAND SELECTION.** The operator has the choice of transmitting on either the upper or lower sideband. The selection is accomplished by switch S102 (see figure 4-3). The KWS-1 normally operates on the lower sideband, however, if S102 is switched to the U, or upper, position, the action selects the "UPPER" sideband crystal for the V104 250-kc oscillator, to change the output frequency of V104 by 3 kc. This is the same bandwidth as the FL101 Mechanical Filter output. In order to maintain the proper frequency relationships between the vfo and the 250 kc lfo, S102 is mechanically ganged to the vfo can. Adjustment of S102 to either sideband automatically adjusts the vfo output 3 kc in the opposite direction from the lfo adjustment. Thus if the lfo is adjusted down, the vfo is adjusted up 3 kc in their respective frequency ranges, to maintain proper output frequency in the overall KWS-1 Transmitter.

Vernier adjustments of S102 operation are accomplished on the switch itself. This adjustment will be discussed under Maintenance and Alignment.

b. **CW AND AM. SIGNALS.** Cw and AM. emission in relation to V104, V108A, the modulator and FL101 Mechanical Filter is somewhat different than single sideband.

For both cw and AM, a portion of the 250-kc carrier must be reinserted into the r-f circuits. This is accomplished by taking a part of the carrier frequency off the V104B cathode through condensers C128 and C135. (See figure 4-3.) This is fed through the CARRIER LEVEL control potentiometer R129, by which the operator may adjust the desired amount of reinserted carrier. The signal is then fed through switch S101B and C117 to the output side of Mechanical Filter FL101, through the filter output transducer coil to the V201 first mixer control grid.

On cw, the cathode circuit of audio output stage V102A is opened by switch S101-C, terminal eight, to prevent audio signals from interfering with cw operation. Thus, the modulator and filter are not used on cw, and the 250 kc carrier is essentially reinserted "around" the filter.

AM. operation is similar, except the audio output is present. The modulator and filter are utilized similar to SSB operation, but the carrier is reinserted into the FL101 filter output, and the total output then consists of AM. with the carrier and one sideband.

4.2.1.3. **VFO AND RF CIRCUITS.** The output of the FL101 Mechanical Filter is taken off condenser C108 which, with the filter output transducer coil, forms a parallel resonant circuit for high impedance. The output is fed through a coaxial cable and resistor R201, into the grid of the first mixer stage V201, pin number seven, in the r-f section of the exciter.

a. **VFO CIRCUITS.** (See figure 7-1.) The hermetically sealed, variable frequency oscillator is a permeability tuned, Hartley type circuit, tunable from 2750 kc to 3750 kc with control dial calibration of one kc per division. The tank circuit consists of condenser C001 and inductances L001 and L002. The remaining components designed and connected to promote stability of operation in the oscillator over-all action. L001 and L002 are slug tuned, with L002 ganged to the main tuning system.

Operational stability of the vfo is improved by regulating the plate and filament supply voltage and current. This is accomplished for the plate circuit by feeding B plus voltage into the OB2 regulator tubes V106 and V105, connected in series to ground. A 210-volt regulated supply is taken off the V106 plate

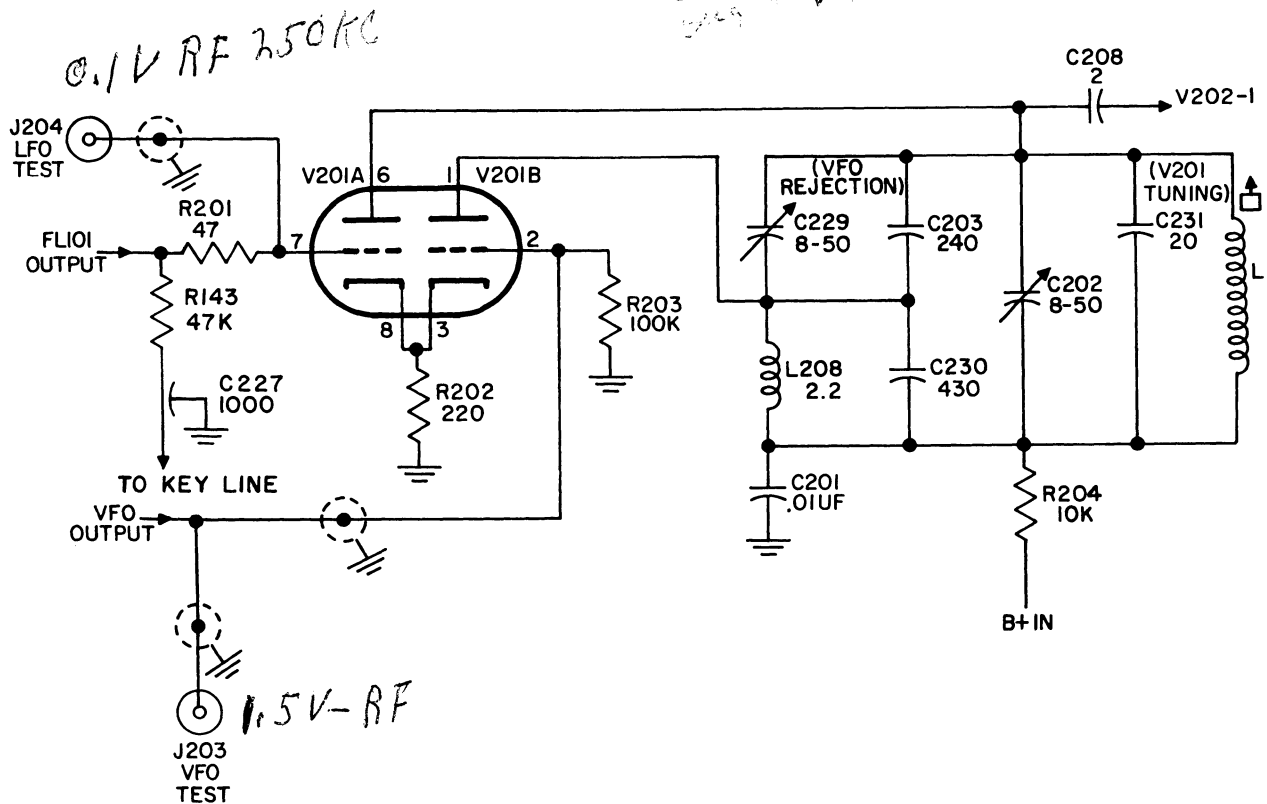


Figure 4-8. First Mixer V201, Simplified Schematic Diagram

and fed into the vfo plate circuit. Regulation for the filament supply is provided by RT101, which utilizes a 12.6-volt input to produce a 6.3-volt regulated output for the vfo filament.

The vfo generates frequencies from 2750 kc to 3750 kc. Vfo output is taken off the plate circuit and fed through a coaxial cable into the grid, pin number two, of the duotriode first mixer stage, V201.

b. RF CIRCUITS.

(1) V201 FIRST MIXER STAGE. A simplified schematic diagram of the first mixer stage appears in figure 4-8. This diagram will assist in understanding the theory involved in the first mixer design.

There are two test points available for each of the V201 grids. (See figures 5-1 and 7-1.) One is taken off pin number seven of V201A to jack J204, and the other off pin two of V201B to jack J203. J204 will provide a test voltage for signal input, and J203 for vfo input.

The ratio of voltage input on pin seven of V201A to that of pin two on V201B is approximately 0.1 volt to 1.5 volts. Thus, the vfo input is considerably stronger than the signal input. This is the reason for the rather complex tuned plate circuit consisting of L201, C231, C202, C203, C229 and C230. L208 is a choke in the V201B plate B plus supply circuit. The purpose of the tuned plate circuit is to reject a strong, undesired frequency component in the V201 output, which is a result of the strong vfo input signal at the V201B grid. The theoretical principle involved is selective feedback rejection. The actual tuned plate circuit consists of C202, C231 and L201, with C202 and L201 adjusted to resonate the circuit at the desired 3 to 4-mc output frequency. C203, C229 and C230 form a capacitive voltage divider. The selected values of C203 and C230 determine the amount of feedback for the undesired vfo frequency component. C229 is adjusted for null of the particular frequency to be rejected. Adjustment procedures will be discussed under Maintenance and Alignment.

Thus, by virtue of the heterodyne action in V201, and the selective feedback rejection in the

Section IV

Paragraph 4.2.1.3.

tuned plate circuit, the output frequency of V201 contains a very satisfactory degree of selective band pass and stability characteristics for the desired 3.0 to 4.0-mc i-f range.

L201 and L203 are top coupled through C208, which serves to couple the V201 output into amplifier V202.

(2) FIRST AND SECOND AMPLIFIERS.

The V202 and V203 amplifier stages are conventional, insofar as the signal amplification is concerned, but the associated circuitry contains several control and neutralization connections which are considered unique to the KWS-1 Transmitter.

Automatic Load Control d-c voltage from the power amplifier circuits is applied to the V202 and V203 control grids. (See figure 7-1.) The action here is similar to receiver avc circuits, and will be discussed in detail with power amplifier circuits. An ALC meter connection is made across the V202 cathode and a reference voltage at R209 to measure the amount of Automatic Load Control in decibels. The V202 cathode circuit also contains a potentiometer, R207, for an ALC meter zero adjustment. The ALC meter action is similar to the "S" meter of an amateur receiver.

Capacitors C268 and C322, off the bottom of the V203 plate tuned circuit inductance L207, are utilized in a circuit for neutralization of plate-to-grid and grid-to-cathode capacitance in the 6CL6 driver stages. These circuits will be discussed with the driver and power amplifier circuit description.

A d-c keying voltage is connected to the first mixer V201 control grid through R143 and FL101 Mechanical Filter output coil. The keying voltages are obtained through a wave shaping network for improvement of the cw keying characteristics.

Selectivity in the V202 and V203 amplifier stages is provided by grid and plate tuned circuits consisting of L203 - C206/C207, L204 - C211/C212, L206 - C216/C217 and L207 - C221/C222 inductance and capacitance combinations. Table 4-1 shows the inductance and capacitance combinations in all exciter circuits which provide selectivity for the respective amateur band frequencies. R210 and R211 form a voltage divider in the V202 screen grid plus supply circuit, while R215 and R216 perform the same purpose for V203.

The output of V202 is coupled by C218 into V203, while the V203 output is coupled by C293 into the C section of switch S201. From here, the 80-meter signals not requiring further frequency conversion, are passed directly into the driver stages. The signals for 40, 20, 15, 11 and 10 meters require further frequency conversion, thus are fed into the second mixer stage V204 through coupling condenser C232.

(3) CRYSTAL OSCILLATOR AND SECOND MIXER CIRCUITS.

(a) CRYSTAL OSCILLATOR. V208 oscillator stage is utilized to produce conversion frequencies for heterodyne action with the 40, 20, 15, 11 and 10-meter signals in mixer stage V204. Oscillation frequencies are selected by switches S201A and S201B from crystals Y201 to Y206, and inductances L212 to L217, respectively. V208 is shunt fed through L228 to keep B plus voltages off the tuned circuits. The output of V208 is fed through C224 to the second mixer V204B pin number two control grid.

(b) SECOND MIXER. V204 mixer stage is a conventional duotriode type, with the signal input frequencies fed into control grid pin number seven through condenser C232.

Similar to V201 mixer, there are two test points provided for V204. (See figure 5-1.) One is taken off pin number seven to jack J206 for measuring signal input levels. The other test point is taken off pin number two to jack J205 for measuring the V204 input level from crystal oscillator stage V208. Usage of all test points will be discussed in detail in the chapter on Maintenance and Alignment.

L220 and C249 form an eight-megacycle trap circuit to reduce the second harmonic of the crystal oscillator on the 40-meter range of frequencies. A similar trap is not needed for the higher frequency bands, because the harmonic frequencies would fall outside the KWS-1 selectivity circuits' band pass.

The main output tuning inductance is L223. By itself, this inductance is used for the 40-meter band. (See table 4-1.) When S201D is switched to the 20, 15, 11 or 10-meter bands, L218, L219 and L221 are placed in parallel to L223 to provide the proper tuned circuit inductance. Variable capacitors C248, C250, C252, C254, C255 and C256 are provided for high frequency trimming of the respective coils for the frequencies passed by the

second mixer. Each coil is inductively trimmed at the low frequency end by an iron slug.

(4) THIRD AND FOURTH AMPLIFIERS
V209 and V205 amplifier stages provide the final amplification and selectivity in the r-f section of the KWS-1 Transmitter.

The tuned output circuit of V209, which could also be considered the tuned input circuits of V205, consists of inductances L225, L227, L229, L230 and trimmers C257, C301, C302, C304, C306 and C308. Switch S201E governs the selection of these components for operation on the 40, 20, 15, 11 or 10-meter bands. (See table 4-1.)

The tuned plate circuit of V205, also considered the tuned grid input circuits for the 6CL6 drivers, consist of inductances L231, L234, L236 and L237, with capacitors C264, C265, C266, C267, C269 and C272 providing the high frequency trimming. Switching of the tuned circuits is accomplished by S201-F-2, while S201-F-1 opens the V205 cathode circuit when the KWS-1 Transmitter is operating on 80-meters. This prevents undesired signals from leaking into the 80-meter output. R237 thru R243 are loading resistors for all bands except 10 meters high.

C273 off the B plus supply input to V205 is in a capacitance neutralization circuit which will be discussed in relation to the driver and power amplifier stages.

The output of V205 is switched through S201-G into the driver stages V206 and V207.

4.2.1.4. DRIVERS AND POWER AMPLIFIER CIRCUITS.

a. SIGNAL CIRCUITS. Single sideband and AM. r-f input signals to the two, parallel connected 6CL6 driver stages passes directly through the E201 and E202 parasitic suppression components to the tube control grids.

Cw keying voltage to the driver stages is fed through R229, E201 and E202 to the 6CL6 control grids.

The 6CL6 plate circuits are shunt fed through L238 and the parasitic suppression components E203 and E204.

Two test points are provided for the 6CL6 driver stages. One, for the control grids, is taken off the R229-E202 Junction to jack J207. (See figures 5-1 and 7-1.) The other, for the cathode circuit, is taken directly off the 6CL6 cathode and fed into J208.

Driver stage output signals are coupled through C305 and switched over the amateur bands by S201-I to include the correct power amplifier tuned grid input circuits for the respective bands. The tuned circuit component combinations for each band are shown in table 4-1.

TABLE 4-1. TUNED CIRCUIT COMPONENTS

METER BAND	2ND MIXER OUTPUT (SWITCH S201D)			3RD AMPL. OUTPUT (SWITCH S201E)			4TH AMPL. OUTPUT (SWITCH S201F-2)			6CL6 DRIVER OUT. (SWITCH S201I)		
	IND.	TRIM.	PAD.	IND.	TRIM.	PAD.	IND.	TRIM.	PAD.	IND.	TRIM.	PAD.
80										L701	C710	C703
40	L223	C248	C247	L225	C308	C309	L231	C272	C271	L701 L703	C711	C704
20	L223 L218	C250	C329	L225 L230	C306	C330	L231 L237	C269		L701 L702	C712	
15	L223 L219	C252		L225 L229	C304		L231 L236	C267		L701 L704	C713	
11	L223 L221	C254		L225 L227	C302		L231 L234	C266		L701 L705	C707	C331
10 (LO)	L223 L221	C255		L225 L227	C301		L231 L234	C265		L701 L705	C708	
10 (HI)	L223 L221	C256		L225 L227	C257		L231 L234			L701 L705		

The 4X250B power amplifier tubes V401 and V402 are operated in parallel and as class AB₁ amplifiers. Output signals are coupled through C406 to the power amplifier tuning and loading circuits, and through J401/P401 to the antenna.

The power amplifier final tuning and loading circuits consists of a PI-L network, with C407, L406, L401, C408 and C409 forming the pi tuning circuit, and C408, C409 and L402 and the L-type loading circuit. For final stage tuning purposes, C407 and L401 are ganged together and brought out to the front panel. In the same manner, C408, C409 and L402 are ganged together and brought out to the front panel. The controls provide individual vernier tuning and loading adjustments of the output amplifiers over the entire frequency range of the KWS-1 Transmitter without the use of band switches.

Inductance L404 operates as a static drain to prevent dc voltages from building up on the antenna circuits.

The V401 and V402 screen grid circuits are series fed through L405, while the plate circuits

are shunt fed through L403. Control grid bias is received from circuits in the high voltage power supply and fed through TB501-6 and J103-2 to L239 and the respective grid tank inductance for which-ever band is selected.

b. NEGATIVE FEEDBACK AND NEUTRALIZATION CIRCUITS.

(1) NEGATIVE FEEDBACK. A portion of the power amplifier r-f output is fed back through C402 into the 6CL6 cathode circuit for the ultimate purpose of improving final amplifier stage linearity. (See figure 4-9.) At the 6CL6 cathodes, the feedback circuit consists of R708, L706 and C714. The choke, L706, provides a d-c return for the cathode. R708 loads the choke to lower the circuit "Q", preventing oscillations which could be caused by L706 resonating at the feedback frequencies. C714 forms a capacitive voltage divider with C402 off the 4X250B plate to provide the proper value of feedback voltage which produces approximately 12 db of feedback.

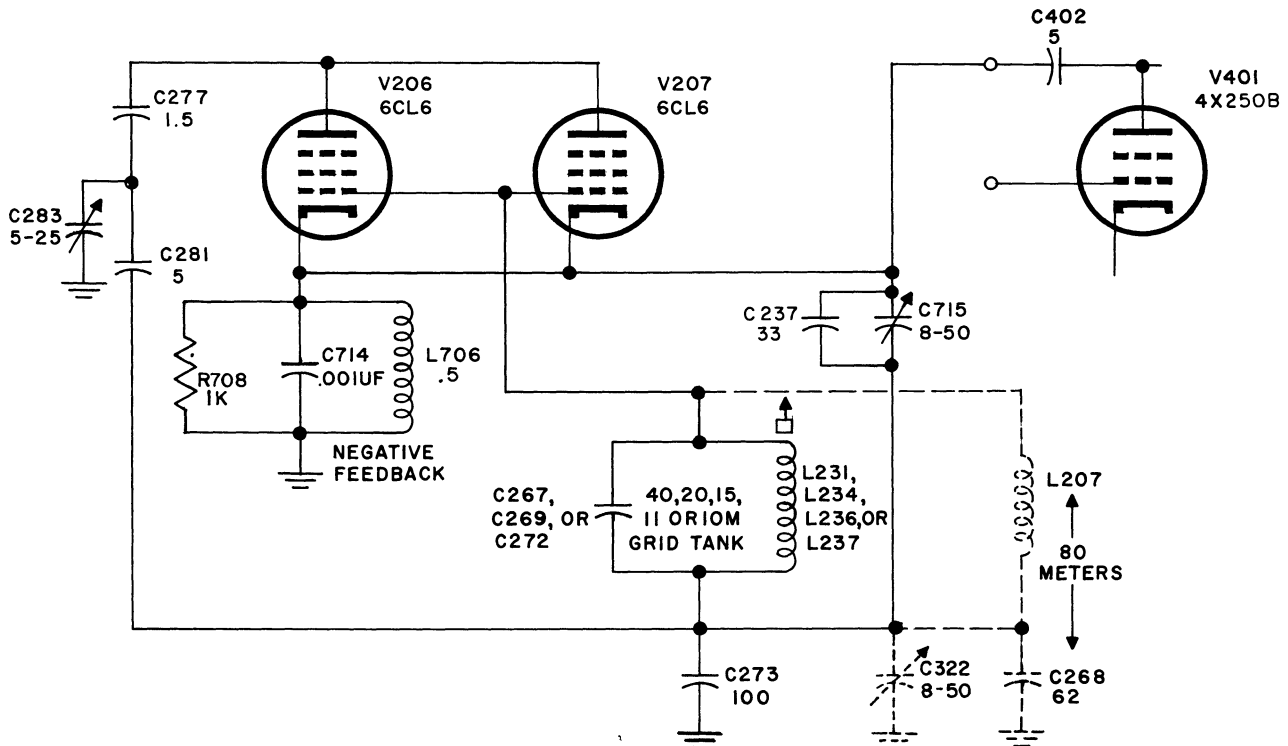


Figure 4-9. 6CL6 Driver Feedback and Grid-to-Cathode Neutralization Circuits, Simplified Schematic Diagram

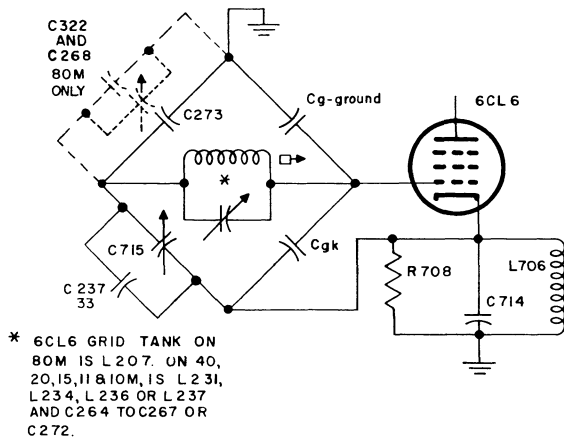


Figure 4-10. 6CL6 Driver Grid-to-Cathode Neutralization Bridge Diagram

(2) NEUTRALIZATION. Certain types of inherent feedback voltages in high level output amplifier stages produce undesirable oscillations which reduce the efficiency of operation. It is this type of feedback the neutralization circuits of the KWS-1 Transmitter eliminates, to improve the linearity and efficiency characteristics. There are four such neutralization circuits, which are discussed below.

(a) 6CL6 GRID TO CATHODE NEUTRALIZATION. (See figures 4-9 and 4-10.) The cathode feedback voltage in the 6CL6 stages will appear on the grid tank circuits to cause stage oscillation, unless the feedback is neutralized. On the bridge diagram of figure 4-10, the feedback voltage is carried over from cathode to grid by the tube's internal grid-to-cathode (Cgk) capacitance. This capacitance forms a voltage divider with the

tube's grid-to-ground (Cgg) capacitance. The two capacitances, in series, comprise one side of the neutralization bridge. Neutralization is provided on the 40, 20, 15, 11 and 10-meter bands by condenser C715 and C273, which are in series and form a voltage divider from the 6CL6 cathode to ground. In this position, these capacitors form the other side of the neutralization bridge to balance out the undesired feedback voltage impressed across the Cgk and Cgg arms of the bridge. With the grid tank circuit across the midpoint of both bridge arms, the feedback is balanced out to eliminate this source of stage oscillations. The components of the bridge are shown on the simplified practical diagram of figure 4-9. On 80 meters only, C268 and C322 are placed in parallel to C273 to provide sufficient divider capacitance for neutralization at the 80-meter frequencies.

(b) 6CL6 GRID TO PLATE NEUTRALIZATION (80 Meters). The neutralization of grid-to-plate feedback voltages in the 6CL6 stages when operating on 80 meters is accomplished by the use of condensers C277, C281 and C283 in combination with C268, C322 and C273. (See figures 4-11 and 4-12.) The combination of C277, C281 and C283 is necessary to provide the very small amount of capacitance required in the neutralization arm of the bridge. The feedback voltage is carried over from the tube plate to grid by the internal grid-to-plate (Cgp) capacitance, and from grid-to-ground by the Cgg capacitance, which, together, are in series to form one side of the bridge, with the top of the 6CL6 grid tank circuit connected to the midpoint of the bridge arm. Neutralization balance is provided by the bridge arm consisting of C277, which is in series to ground with the arm consisting of C322, C273, C268, C281 and C283. The bottom of the grid tank circuit is connected to the midpoint of this bridge

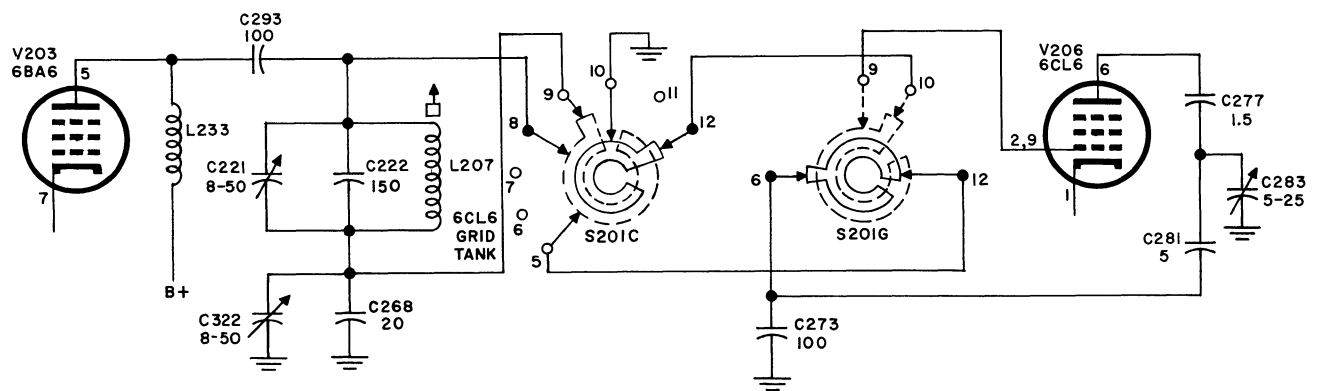


Figure 4-11. 6CL6 Driver Grid-to-Plate Neutralization Circuits (80 Meters), Simplified Schematic Diagram

Section IV

Paragraph 4.2.1.4.

arm, thus, the tank is across the bridge, and the balanced-out feedback voltage will not affect the stage.

(c) 6CL6 GRID-TO-PLATE NEUTRALIZATION (40, 20, 15, 11 and 10 Meters). There are only two differences between neutralization of grid-to-plate neutralization on 80 meters, and on the higher frequency bands. For the higher bands, C322 and C268 are not placed in parallel to C273 in the bridge circuit. Also, the grid tank components will be different for each band of operation. These differences are shown in the practical diagram of figure 4-13, and the bridge diagram of figure 4-14. Neutralization is accomplished in the same manner as described in subparagraphs (a) and (b) above.

(d) 4X250B GRID-TO-PLATE NEUTRALIZATION. (See figures 4-15 and 4-16.) In this instance, the internal tube capacitances from grid-to-plate (Cgp), and from grid-to-cathode, which is grounded (Cgk), form one side of the bridge. The other side of the neutralization bridge is composed of the Cn capacitance off the 4X250B plate, and C298 off the bottom of the grid tank. The balance of the feedback voltage is accomplished in the same manner as described in preceding subparagraphs (a), (b) and (c). Neutralization capacitor C/N (see figure 6-10) is an adjustable metal bracket mounted close to the plates of the power amplifier 4X250B.

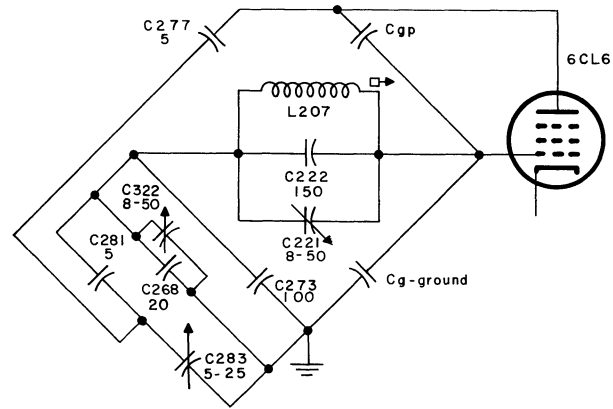


Figure 4-12. 6CL6 Driver Grid-to-Plate Neutralization Bridge Diagram (80 Meters)

c. RECEIVER INJECTION. (See figure 7-1). J201 is connected to the 6CL6 plate circuit to provide receiver injection during calibration procedures. The receiver can be connected to J201 through a "T" fitting in the coaxial line going to the receiving antenna. During calibration, all sections of the KWS-1 Transmitter are turned ON, except the power amplifier. Thus the calibration signal may be heard by the operator to assist in making the proper adjustments. During power amplifier neutralization adjustments, the receiver is connected to J201, and

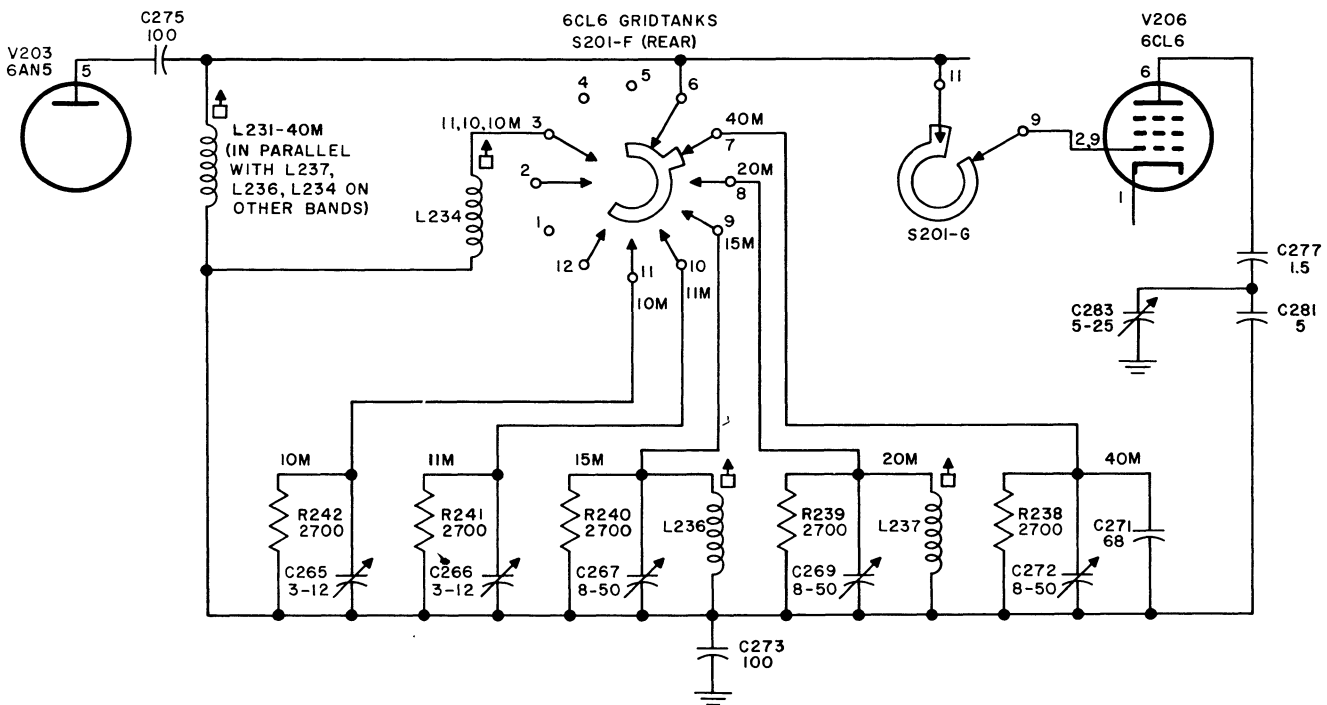


Figure 4-13. 6CL6 Driver Grid-to-Plate Neutralization Circuits, (40, 20, 15, 11 and 10 Meters), Simplified Schematic Diagram

the r-f signal is injected into output connector J401.

d. AUTOMATIC LOAD CONTROL (ALC). The power amplifier circuits include a 6AL5 (V403) duodiode tube used as a rectifier in the Automatic Load Control system. This system operates very similar to receiver avc circuits to provide a dc voltage on the higher peaks of the 4X250B input. The d-c control voltage is fed back into the Exciter, amplifier stages V202 and V203 to reduce the KWS-1 overall gain, preventing the higher excitation peaks from causing power amplifier grid current flow with resulting distortion in the power amplifier output.

The simplified schematic diagram of figure 4-17 will assist in understanding the circuitry and operational theory of ALC.

When PA grid current flows, it causes a rise in the PA DC grid voltage across the grid resistors R514 and R515 of the power supply cabinet. This change in voltage is coupled through C403 to the diode clamper and rectifier, V403. V403 gives a DC ALC output voltage whose attack and decay times

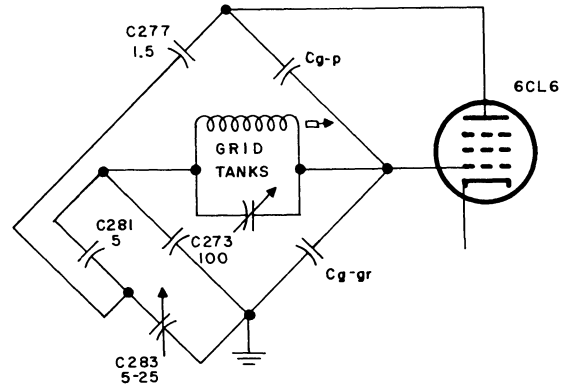


Figure 4-14. 6CL6 Driver Grid-to-Plate Neutralization Bridge Diagram (40, 20, 15, 11 and 10 Meters)

are controlled by C325, R248, and C324, R247. The action is automatic and actually very narrow pulses of PA grid current do flow. However, they are so short in duration that no ill effects are caused. The ALC voltage is fed out of the power amplifier

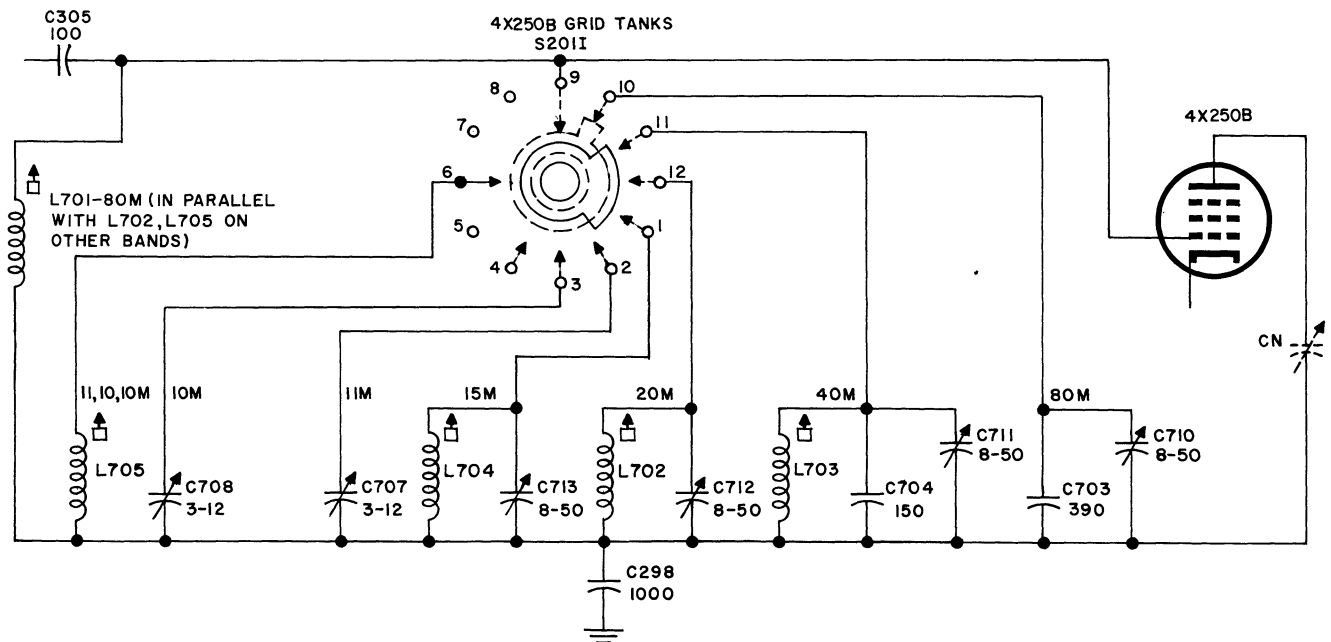


Figure 4-15. 4X250B Final Amplifier Grid-to-Plate Neutralization Circuits, Simplified Schematic Diagram

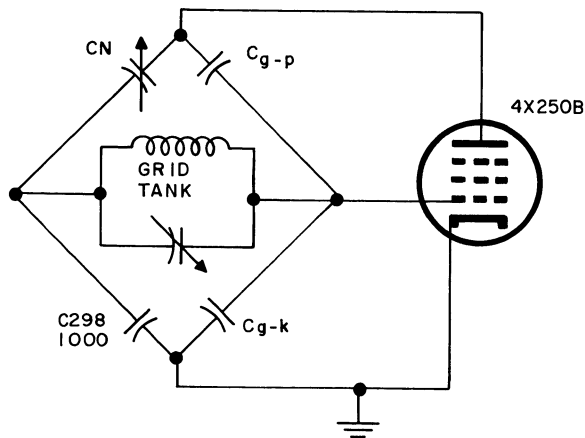


Figure 4-16. 4X250B Final Amplifier Grid-to-Plate Neutralization Bridge Diagram

section, through L247, R205 and the V202 amplifier grid tank circuit inductance L203 and through R213 and the V203 grid tank inductance L206. The additional d-c bias voltage on the V202 and V203 grids decrease the over-all KWS-1 gain, and the excitation peaks which were overdriving the output stages. The measurement of d-c ALC control voltage on amplifiers V202 and V203 is explained in paragraph 4.2.1.5.c. below, under MULTIMETER ALC position.

R406 and C413 are connected in series to ground from the V403 plates to prevent motorboating.

4.2.1.5. MULTIMETER CIRCUITS (See figure 7-1.) Paragraph 4.2.4.6. in this section lists the positions of the MULTIMETER switch (S701) on the Exciter unit front panel. The circuitry involved in each of the five switch positions is described below. Switch terminals 1 and 7 are long contacts connected to either side of meter M201, and are in constant contact with the switch rotor in all positions.

a. PA FIL POSITION. To measure the power amplifier filament voltage, S701 rotor tabs are on terminals 2 and 8. This connects the switch meter terminal 1 to ground through terminal 2, and connects meter terminal 7 to switch terminal 8, which goes through rectifiers CR701 and CR702, and resistor R707 to the 6.3-volt filament supply through jack J103-20 and the power supply TB502-17.

b. PA SCREEN POSITION. The power amplifier screen-grid current is measured when the switch S701 rotor tabs are on terminals 3 and 9. This shunts the one-ohm resistance R705 across meter terminals 1 and 7. Switch terminal 3 is connected to the power amplifier screen grid circuit through feedthrough condenser C415 and choke L405. Switch terminal 9 is connected to jack J103-8 through the K101 relay connections eight and nine. J103-8 is connected to TB501-7 in the Power Supply. This meter circuit is tied in with the TUNE-OPERATE switch S204, which is explained below in paragraph 4.2.1.7.

c. ALC POSITION. The ALC d-c control voltage is fed into amplifiers V202 and V203 through L247 to the control grids. (See figure 4-17.) The ALC meter is connected through MULTIMETER switch S701 across the V202 cathode to the screen grid through R210. The purpose of the meter connected in this manner is to measure the amount of Automatic Load Control voltage in decibels.

To understand how the meter can register decibels in this circuit, the following points should be considered:

a. The R210 screen-grid meter connection provides a reference voltage from the R210-R209 divider.

b. The S701-10 connection to R206 provides a method of measuring the change in V202 cathode voltage due to the ALC d-c control voltage applied to the control grid.

c. The remote cutoff characteristics of V202 produces a change in cathode voltage equivalent to decibels of ALC applied.

Under these conditions, if a curve was plotted for the change in cathode voltage due to the ALC applied, it would essentially duplicate a curve plotted for decibels of change in gain for V202 due to ALC voltage applied to the control grid. Therefore, the MULTIMETER ALC position is calibrated in decibels.

The principles of this circuit are equivalent to the "S" meter hookup in the Collins 75A amateur receivers.

d. PA GRID POSITION. Measurement of the power amplifier control grid current is accomplished when the S701 switch rotor tabs are on switch terminals 5 and 11. This position shunts the five-ohm resistance R706 across switch meter terminals 1

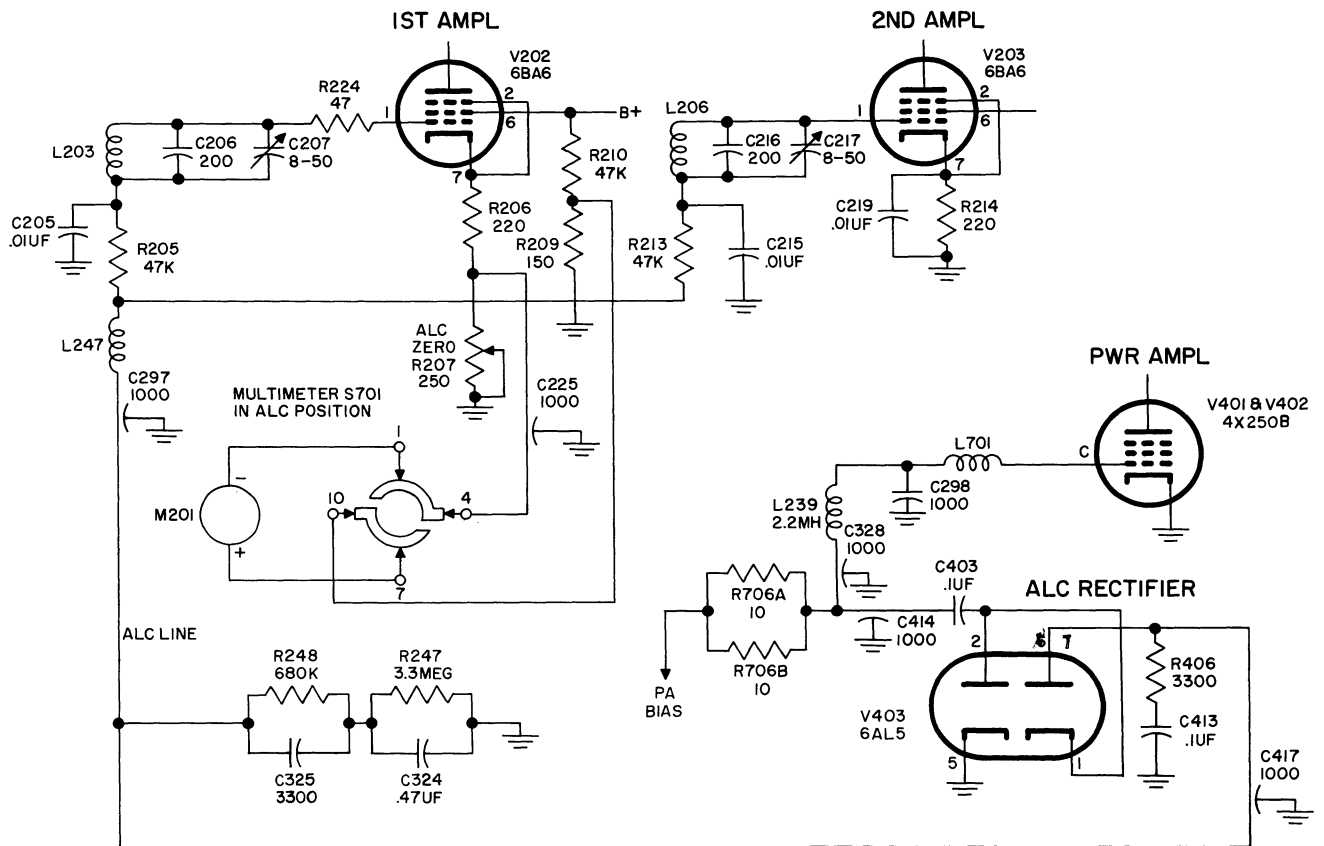


Figure 4-17. Automatic Load Control Circuits, Simplified Schematic Diagram

and 7. Terminal 5 is then connected to the V401 and V402 control grids through feedthrough condenser C328, inductance L239 and the respective grid tank circuits. Switch terminal number 11 is connected to jack J103-2, and to power supply TB501-6. In the Power Supply, the circuit goes to the PA BIAS voltage circuit consisting of R513, R514 and R515, and from here to TB502-19 on the low voltage power supply which is the -150 volt bias supply source.

e. 2000-VOLT POSITION. Adjustment of the MULTIMETER switch S701 to the 2000 VDC position places the switch rotor tabs in contact with terminals 12 and 6. Terminal six grounds one side of the M201 meter, while terminal 12 connects through jack J103-12 and the power supply TB501-9 to the high voltage meter circuit. This circuit in the Power

Supply connects to the high voltage source through the meter resistance divider consisting of R517 to R521.

4.2.1.6. PA PLATE CURRENT METER. Constant metering of the power amplifier plate current is registered on the meter in the upper right-hand corner of the front panel. The plus side of this meter, M701, is grounded, while the minus side is connected to J103-14. A connection is made from J103-14 through the interconnecting cable to the power supply TB501-4, and from that point to the ungrounded side of R516. This point is connected to the center tap on the high transformer T503 through the overload relay mounted on K502. R516 serves as safety resistance for the meter circuit.

Section IV

Paragraphs 4.2.1.7. - 4.2.1.8.

4.2.1.7. PA TUNE-OPERATE CIRCUIT. The normal 4X250B screen-grid voltage (350 volts) originates in the Power Supply off the cathode of V504, and is fed through TB501-1 and J103-3 to switch S204 on the exciter front panel, labeled TUNE-OPERATE. In its normal position, S204 is closed and the screen grid 350 volts is fed through the switch to terminal eight on K101 relay, and out of the relay through terminal nine to MULTIMETER switch terminal 9. From the switch terminal nine, the circuit passes through R705 to switch terminal 3 and from there to the 4X250B screen grid.

When the TUNE-OPERATE switch is placed in the TUNE position, the above circuit is altered at the source, in that the 350-volt supply passes through R524. The screen-grid voltage, reduced in value, is taken off the lower end of R524 and fed through TB501-7 and J103-8 directly to relay K101 terminal 8, completely bypassing switch S204 which is open.

4.2.1.8. CW WAVE SHAPING NETWORK. The resistive-capacitive network mounted on TB103 provides the necessary circuitry for accepting the -150 volt bias supply from the low voltage power supply, and reducing the supply to the proper value for cw keying of the V206 and V207 driver stages, and V201 first mixer.

The -150 volt supply is fed out of the low voltage supply through TB502-19 to J103-11 on the exciter rear panel. From here, the supply goes directly to TB103.

The cw key lead-in is connected to the Exciter through J102-3, and through S101C-12, S101A-7 to TB103. On TB103, the key is connected across R141 and C134 to improve the cw wave shape during keying operations.

The -150 volts for the cw key is fed through a divider on TB103, consisting of R139, R138 and R141. The key is connected at the junction of R138 and R141. Keying voltage for the driver stages is taken off the divider junction between R139 and R138. Condenser C129 provides additional wave shaping for this circuit. The driver keying voltage is fed out of TB103, through feedthrough C299 and the parasitic suppression components E201 and E202, into the 6CL6 control grids.

Another lead from the R139-R138 junction is connected to a divider consisting of R137 and R136. For the V201 first mixer, the circuit is through TB103-1, R143, the FL101 Mechanical Filter output coil and R201, into the V201 control grid. C127 provides additional wave shaping in this circuit.

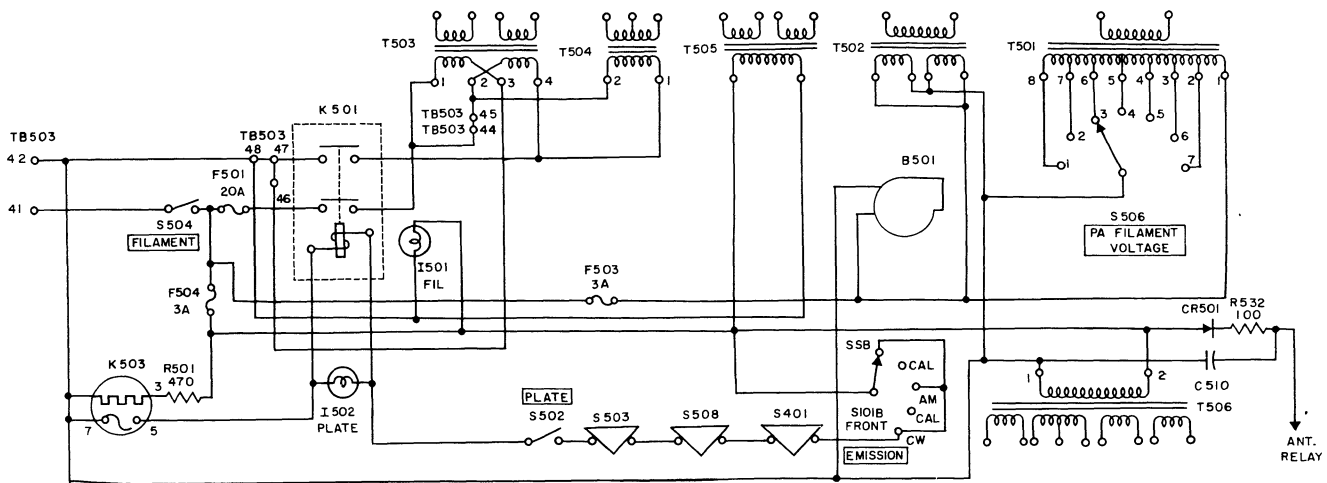


Figure 4-18. Primary Circuits, Simplified Schematic Diagram

The purpose of keying the drivers and the first mixer during keying operation is to bias these tubes past the cutoff point, eliminating "back wave" of the cw signal.

4.2.1.9 INTERCONNECTION OF THE EXCITER AND POWER AMPLIFIER WITH THE POWER SUPPLIES. (See figure 7-3.) Interconnecting between the two cabinets of the KWS-1 Transmitter is accomplished by connecting all signal circuits of the Exciter and Power Amplifier to J102 and all supply circuits to J103 on the exciter rear panel. From here, an interconnecting cable (W1) carries all power circuits to the power supply cabinet. The control and signal circuits emerge at J102 into a pendent cable that can be attached directly to the sources of control (key etc.) The supply circuits in the power supply cabinet connect to TB501 or TB502, according to whether the leads are for the high or low voltage Power Supplies. TB503 is for either a 230-volt or 115-volt a-c input to the cabinet from the external source.

The 2000-volt supply for the final amplifier plate circuits is fed from the high voltage Power Supply through a separate cable (W2) directly to jack J402 on the power amplifier chassis. J402 is mounted inside a metal "can" which is mounted on the power amplifier chassis, but protrudes through the exciter rear panel at the lower left-hand corner below antenna jack J401.

4.2.2. POWER SUPPLY CIRCUITS

4.2.2.1. GENERAL. The Power Supply of the KWS-1 Transmitter is designed for either a 230-volt or 115-volt a-c input. The schematic diagram in figure 7-2 shows alternate connections for either input value, whichever is available at the installation. Power supply primary circuits are shown in the simplified schematic diagram of figure 4-18.

The complete Power Supply is essentially divided into two sources, the low voltage Power Supply and the high voltage Power Supply. The circuitry for each is conventional, and the a-c input for both is brought into the cabinet on terminal board TB503. The input is fed through fuses F501 and F502 to HV transformer T503. Fuse F503 protects the filament transformers and the blower; fuse F504 protects filament transformers and the low voltage supply.

4.2.2.2. LOW VOLTAGE POWER SUPPLY. This Power Supply is constructed as a integral unit, to the high voltage supply cabinet with all leads brought out to terminal board TB502. (See figure 6-16.)

Two duodiode rectifier tubes, V508 and V509, operate from one transformer, T506, the primary of which is connected through fuse F504 to the a-c input on TB503-41 and 42.

A connection across the T506 transformer primary coil feeds 110 ac through a selenium rectifier, CR501, which is filtered by R532 and C510 to provide approximately 110 dc for operation of an antenna relay. This output is made available on TB502-14.

Transformer terminals 3, 4, 5, 6, and 7 are taken off the T506 high voltage secondary winding, with the full voltage taken from 3 and 7, and fed directly to the plates of full-wave rectifier V508. The 275-volt d-c output of V508 is filtered and fed to TB502-18 to provide plate and screen-grid supplies for the Exciter.

Transformer terminals 8 and 9 furnish 5 volts a-c for the V508 filaments, while 10 and 11 furnish 6.3 volts a-c to TB502-17 which is fed through the interconnecting cable into jack J103-20 for the exciter circuit tube filaments.

The cathode bias rectifier V509 receives an a-c input from transformer terminals 4 and 6. Connected in this manner, a -150-volt d-c output is available off the plates, which is fed through a filter network to TB502-19, and through the interconnecting cable to exciter jack J103-11 for use in the cw keying and wave shaping network. Another lead off TB502-19 is fed into the high voltage Power Supply, into a resistive voltage divider consisting of R513, R514 and R515. Off the movable arm of potentiometer R515, a negative bias supply voltage is fed through TB501-6 to J103-2 to supply the power amplifier 4X250B stages with the proper value of grid bias voltage.

Transformer terminals 12 and 13 of T506 provides a 12.6-volt a-c source through TB502-15 and 16, to exciter J103-4 and 5 for the RT101 filament regulation circuit of the vfo. The output of RT101 is 6.3 volts, regulated.

4.2.2.3. HIGH VOLTAGE POWER SUPPLY. The leads in the high voltage source feeding off the a-c input line through FILAMENT switch S504 are as follows:

a. Panel light I501, which is mounted on the power supply front panel above the FILAMENT switch. When ON, this light indicates that voltage is being supplied to the filaments of all tubes and the low voltage Power Supply is turned ON.

Section IV
Paragraph 4.2.2.3.

b. Transformer T502, which supplies the V501 and V502 with 2.5 volts.

c. Blower B501, connected to the a-c input line through TB505.

d. Thermal Relay circuit K503 and K501. This is the circuit which causes a thirty-second time delay for the high voltage transformer after switch S504 is turned ON, to prevent application of 2000 volts to the plates of V501 and V502 before the tubes have warmed up. Lamp I502 above the switch lights when the time delay period has expired with the PLATE switch S502 ON.

e. The low voltage Power Supply and antenna relay power source.

f. The 115 or 230-volt a-c input to the high voltage Power Supply is fed into two transformers, T503 and T505.

The T505 circuit includes rectifier V503, the output of which is filtered and fed through a voltage regulation circuit consisting of V504, V505 and V506 to provide a regulated 350-volt d-c supply at TB501-1 for the power amplifier screen grids. The PA TUNE-OPERATE circuit components are across the 350-volt supply to ground. This circuit description was given in paragraph 4.2.1.7. above.

V507, a 2D21 thyratron, is used in a screen protect circuit. (See figure 7-2.) Should the bias supply fail, the grid of V507 would lose its bias and allow a large amount of plate current to flow through V507. This plate current is enough to blow screen fuse F505, through which it is drawn, and cut off the PA screen supply. Likewise should a short occur between the plate and screen of the 4X250B tubes, the thyratron would strike and blow the screen fuse. (The plate fuse F506 would likely blow too.)

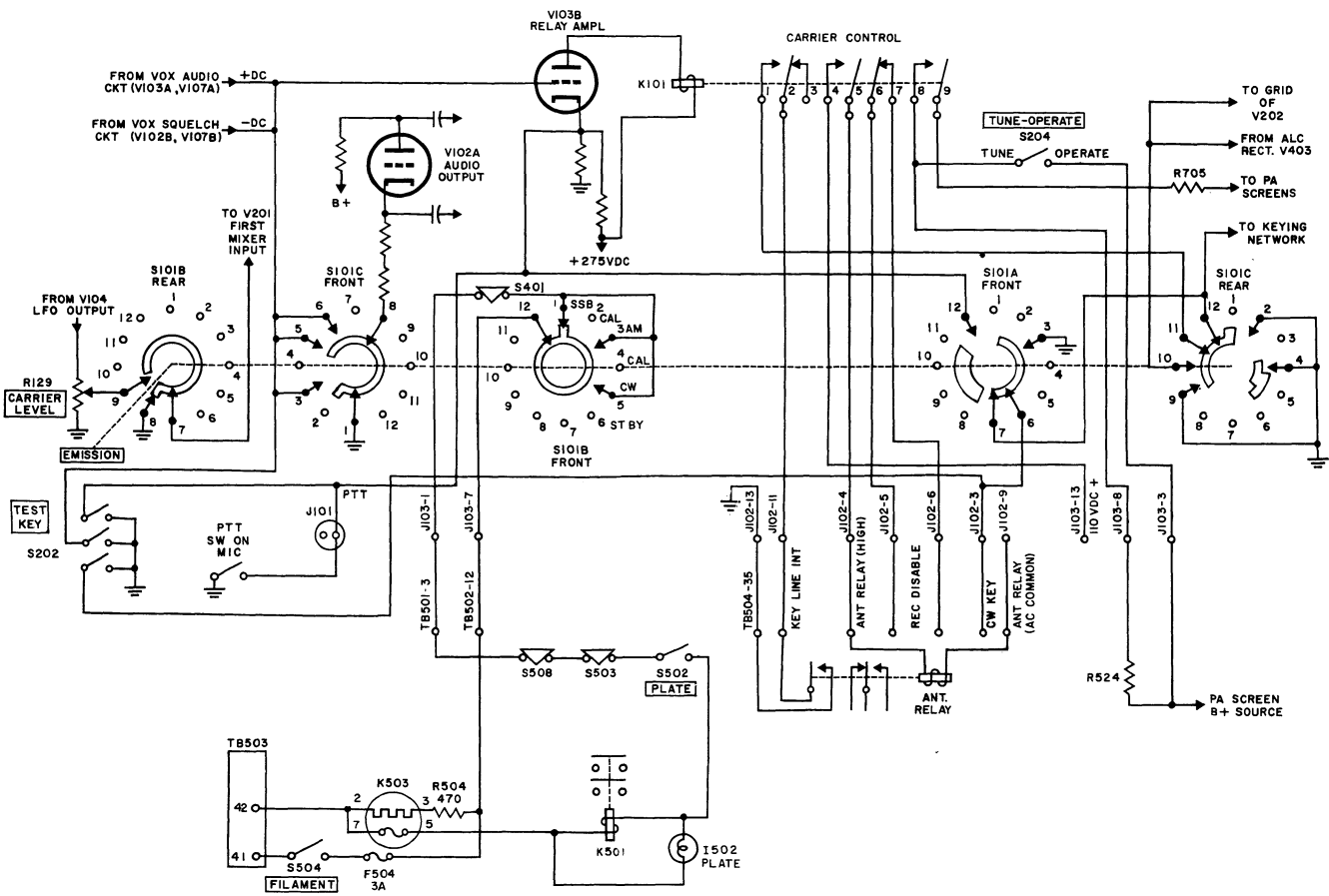


Figure 4-19. Control Circuits, Simplified Schematic Diagram

High voltage transformer circuit of T503 includes the rectifiers V501 and V502. This output is filtered and fed into a separate coaxial cable off an E501 standoff, directly to the Power Amplifier. Resistor R516 is in the power amplifier plate current meter circuit, and is connected from TB501-4 to J103-14. The PA plate current is measured in the negative side of the power supply 2000-volt output, to keep high voltages off the exciter terminals.

4.2.3. CONTROL CIRCUITS.

4.2.3.1. GENERAL. The carrier control circuits are shown in figure 4-19. All filaments and the entire low voltage supply are energized upon closing FILAMENT switch S504. Assuming that the contacts of time relay K503 are closed, the circuit to close plate contactor K501 is from S504 through S101B (front), S401, S508, S503, PLATE switch S502, the coil of plate contactor K501, K503 to TB503 terminal 42. Notice that EMISSION switch S101B (front) opens the circuit in CAL and STBY positions.

Refer to figure 4-19. The following control functions take place at the various positions of the EMISSION selector switch, S101.

4.2.3.2. SSB. S101A front, no action, except key circuit is fed through contacts 6 and 7; S101B front, contacts 1 and 12 are closed to allow PA plate current to be turned on; S101B rear, contacts 7 and 8 are closed to ground the lead going to V201 grid circuit to prevent rf from feeding around the balanced modulator; S101C front, contacts 1 and 3 are open so that the VOX circuits will operate, contacts 1 and 8 are closed so that the audio output tube V102A will operate; S101C rear, contacts 11 and 12 are closed so that the carrier can be turned on by the relay amplifier tube V103B by means of the VOX circuits.

4.2.3.3. CAL. S101A front, no action except key circuit is fed through contacts 6 and 7; S101B front, PA plate current relay circuit is opened at contacts 12 and 2; S101B rear, output of CARRIER LEVEL control is fed through contacts 9 and 7 to provide an r-f signal for calibration purposes; S101C front, VOX control circuit is grounded at contacts 1 and 3 to prevent VOX from interfering with calibration procedure; S101C rear, Exciter is keyed by grounding the key line through contacts 2 and 12.

4.2.3.4. AM. S101A front, no action except key circuit is fed through contacts 6 and 7; S101B front, PA plate current relay circuit is completed through

contacts 1 and 3; S101B rear, output of CARRIER LEVEL control is fed through contacts 9 and 7 to provide r-f signal unhindered by balanced modulator; S101C front, contacts 1 and 4 unground VOX circuit so that it may be used to control carrier; S101C rear, contacts 11 and 12 route keying circuit through K101.1 and 2 so that the VOX circuits control turning the carrier on and off.

4.2.3.5. CAL. This position is treated the same as the first CAL position - refer to paragraph 4.2.3.3. above.

4.2.3.6. CW. S101A front, contacts 3 and 12 ground the cathode of relay tube V103B to close Carrier Control Relay K101, the key circuit continues to feed through contacts 6 and 7; S101B front, PA plate current relay circuit is completed through contacts 12 and 5; S101B rear, output of CARRIER LEVEL control is fed through contacts 7 and 9 to provide excitation; S101C front, contacts 1 and 6 ground the VOX circuit to render the VOX inoperative; contacts 1 and 8 open to disconnect the cathode of audio output tube V102A; S101C rear, contacts 11 and 12 are open to make contacts 1 and 2 of K101 inoperative, contacts 9 and 10 are closed to render the ALC inoperative.

4.2.3.7. STBY. S101A, contacts 6 and 7 open to prevent operation of the key circuits, contacts 3 and 12 open to disable Carrier Control Relay K101; S101B front, contacts 12 and 6 are open to disable the PA plate relay circuit; S101B rear, no function; S101C front, contacts 1 and 8 are open to disable V102A; S101C rear, no function.

4.2.3.8. CARRIER CONTROL RELAY K101. The coil of Carrier Control Relay K101 is excited by the plate current of V103B when (a) the grid of V103B is positive with respect to cathode or (b) when the cathode of V103B is grounded to remove its fixed cathode bias. The first condition occurs when SSB or AM. is selected and the microphone is spoken into; the second condition occurs when CW is selected by the EMISSION switch or when a push-to-talk button circuit is used.

Contacts 1 and 2 of K101 perform the keying function in SSB and AM. emission through the NO key line interlock contacts of the antenna relay. Contacts 2 and 3 (NC contacts) are not used. Contacts 4 and 5 (NO contacts) are used to connect antenna relay coil voltage to J102-4. Contacts 6 and 7 (NC contacts) are used to disable a receiver. Contacts 8 and 9 connect the PA tubes' screen source when transmitting.

Section IV

Paragraphs 4.2.4. - 4.2.4.6.

4.2.4. FUNCTION OF OPERATING CONTROLS (See figures 3-1 and 3-2.)

4.2.4.1. **BAND CHANGE.** Selects the proper exciter tuning elements for the amateur band upon which operation is desired. The knob rotates 30° between adjacent bands. Clockwise rotation selects higher frequency bands. The band selected is indicated by the control knob and appears on the slide rule dial.

4.2.4.2. **KILOCYCLES TUNING KNOB.** Operates both the slide rule pointer and the vernier dial to select the exact frequency upon which operation is desired.

4.2.4.3. **EMISSION SWITCH.** Selects the type of emission desired. The different switch positions are explained below:

a. **STBY POSITION.** Adjusts transmitting operation to a standby status. The high voltage is OFF, the cathode circuit of the audio output (V102A) is open, the Automatic Load Control line is open, and the cw key line is open.

b. **CW POSITION.** Switches transmitting operation for the purpose of cw keying. The cw key is connected into the transmitting circuits and high voltage is ON. The carrier level control is activated, the audio output cathode circuit is open, and the relay amplifier (V103B) grid is grounded. The Automatic Load Control line is also grounded.

c. **CAL POSITION.** Adjusts the transmitter circuits for the purpose of frequency calibration. The high voltage is OFF and the carrier level control is activated. The grid of Relay Amplifier V103B is grounded. The cathode of Audio Output Amplifier V102A is closed to provide the operator the opportunity of calibration by "talking self on frequency". This position of the EMISSION control provides a signal for calibration procedures through switch S101A and S101C, which closes the cw key line to unblock the first mixer, second amplifier and driver control grids.

d. **AM POSITION.** Causes the transmitter to produce an AM. output utilizing the carrier and one sideband. The high voltage in ON, the carrier level circuit is connected, and the audio output amplifier cathode circuit is closed. Carrier Control Relay, K101, completes the cw key circuit when VOX or push-to-talk circuits are activated.

e. **CAL POSITION.** Same as the CAL position described under position c. above.

f. **SSB POSITION.** Adjusts the transmitter circuits for the purpose of single sideband, suppressed carrier operation. The high voltage is ON and the carrier level control circuit is open. The cathode circuit of the audio output stage is closed. The K101 relay completes the cw key circuit when VOX or push-to-talk circuits are activated.

4.2.4.4. **SIDEBAND SELECT.** Selects either the upper or lower sideband for transmission by altering the frequency of the low frequency (250 kc) oscillator V104. This control shifts the vfo frame to maintain proper dial calibration.

4.2.4.5. **CARRIER LEVEL.** Adjusts the amount of carrier reinserted for CW, CAL and AM. operations.

4.2.4.6. **MULTIMETER AND PA PLATE CURRENT METER.** The MULTIMETER switch on the exciter front panel selects the various circuits to be measured on the meter in the upper left-hand corner.

The PA plate current meter does not have a control knob associated with its operation, but constantly indicates the value of final stage plate current.

Each position of the MULTIMETER switch, and, the PA plate current meter, is functionally explained below. Table 4-2 gives full scale and typical readings for the MULTIMETER.

a. **PA FIL.** This position of the MULTIMETER switch causes the upper left-hand meter to indicate filament voltage values of the power amplifier final stage. Variations of line voltage will cause the filament voltage to vary, reducing the efficiency of overall operation. Adjustment of this voltage to the correct value (6 volts) should be made after the initial warmup period has expired. The adjustment is accomplished by the PA FILAMENT VOLTAGE control on the power supply front panel.

b. **PA SCREEN.** The MULTIMETER switch in this position gives the operator a reading of the final amplifier screen grid current. It is used during the operation adjustments of the PA LOADING control on the exciter front panel. (See paragraph 5.1.3.2.) When first switched to this position, the screen current indicated will appear rather high, but this value should fall to 17 ma when the proper level of PA loading is obtained.

c. **ALC.** This position of the MULTIMETER switch provides a reading in decibels for the amount of Automatic Load Control attenuation being applied to the exciter first and second amplifier stages.

The manner in which a decibel reading is obtained is explained in paragraph 4.2.1.5.c.

In this position, the meter may be adjusted to zero reading by operating the PLATE switch on the power supply front panel to the OFF position and adjusting the ALC ZERO control until the meter needle comes to rest at zero. The ALC ZERO control is a screwdriver adjustment inside the top of the exciter cabinet. (See figure 5-1 and paragraph 4.2.4.20.c. below).

The ALC position of the MULTIMETER switch is also used to monitor the KWS-1 output during actual transmitting operation. This is explained in the operation procedure of paragraph 5.1.3.2. below.

d. PA GRID. This position of the MULTIMETER switch is used in the operation procedure explained in paragraph 5.1.3.2. below, relative to the level of PA grid current necessary for proper operation of the KWS-1 Transmitter.

e. 2000 V DC. This MULTIMETER position is used for measuring the final stage plate supply voltage. The measurement procedure is explained in section V, paragraph 5.1.4.3.b.(8).

f. PA PLATE CURRENT METER. The power amplifier final stage plate circuit operates with an idling plate current, which means the plate current meter in the upper right-hand corner of the exciter front panel should register at least 100 milliamperes at all times during transmitter operation. Adjustment of the transmitter to this level of operation should be made after the initial warmup period has expired, and is accomplished as follows:

(1) The final stage idling plate current adjustment should be made with no r-f drive applied, therefore, the CARRIER LEVEL control should be operated to its zero position, TUNE-OPERATE in OPERATE and PA BIAS ADJUST in CCW position.

(2) To attain proper final stage plate current adjustment, the final stage screen grid voltage should be properly adjusted to 350 volts dc. To accomplish this, connect a voltmeter to M201 terminal with MULT switch in PA SCREEN position. The voltage adjustment is made with a screwdriver on the potentiometer R511 inside the power supply cabinet. (See paragraph 4.2.4.19a, below, and figure 6-12.) In order to make this

adjustment, the power supply cabinet front door panel will have to be removed, breaking the interlock connections. Therefore, the adjustment must be made, the door panel returned to position, and the new reading observed on the voltmeter. This procedure should be repeated until a 350-volt dc (300-V Canada) value is obtained on the voltmeter.

(3) After the PA screen-grid voltage is properly adjusted, operate the PA BIAS ADJUST control on the power supply front panel until the plate current meter on the exciter front panel reads 100 milliamperes.

4.2.4.7. PA TUNING. Tunes final amplifier (V401 and V402) plate circuit (continuous coverage from 80 through 10 meters).

4.2.4.8. PA LOADING. Adjusts amount of loading for final output circuit (continuous coverage from 80 through 10 meters).

4.2.4.9. TUNE-OPERATE. This is the toggle switch in the front panel lower left-hand corner. It lowers the power amplifier (V401 and V402) screen-grid voltage when the control is in the TUNE (down) position. Prevents plate current soar during initial tuning.

4.2.4.10. TEST KEY. Energizes the transmitter signal circuits for tune-up procedures.

4.2.4.11. DIAL DRAG. This control applies a braking action to the KILOCYCLES, vernier tuning control to prevent its turning when the SIDEBAND SELECT control is operated. The purpose of the DIAL DRAG is not to completely lock the vernier control dial, and should never be left in a tight adjustment.

4.2.4.12. ZERO SET. Operates the slide-rule pointer on the KILOCYCLES vernier scale during calibration adjustments. Once it has been set, further adjustments will be unnecessary over long periods of time.

4.2.4.13. VOX SPEECH. Adjusts the gain of the V103A voice operate circuits.

4.2.4.14. VOX SPEAKER. Adjusts the gain of the V102B speaker squelching circuit. This control is a potentiometer located inside the exciter cabinet. It is accessible by raising the top cover, and may be found at the inside top edge of the front panel, toward the right end. (See figures 3-1 and 6-2).

TABLE 4-2

TYPICAL METER READINGS

CONTROL POSITION	CIRCUIT METERED	FULL SCALE READING	TYPICAL READING
PA FIL	PA Filament Voltage	10 V, ac	6 Volts
PA SCREEN	PA Screen Current	50 ma, dc	Starts at approximately full scale, and decreases as PA is loaded, reaching about 17 ma when proper loading level is obtained.
ALC (Auto-matic Load Control)	Decibels of ALC attenuation	18 db	Typical reading depends upon final stage drive.
PA GRID	PA Grid Current	10 ma, dc	Typical reading depends upon amount of final stage drive. In AM. and SSB grid current is zero. In CW grid current can be as high as 7 ma.
2000 V DC	Final stage plate supply	5000 V, dc	Approximately 2000 volts, dc.

4.2.4.15. PA FIL ADJUST. Adjusts the 6-volt filament supply applied to V401 and V402.

4.2.4.16. PA BIAS VOLTAGE. Adjusts the grid bias voltage applied to V401 and V402. This is utilized for adjustment of final stage plate current to proper idling level. (See paragraph 4.2.4.6.f. above).

4.2.4.17. FILAMENT. Applies supply voltages to all filaments in the KWS-1 Transmitter, the blower, the low voltage power supply, and to the regulated final screen-grid supply circuit. To prevent damaging the power amplifier tubes, the screen grid supply is never applied to the tubes unless the high voltage is ON. When the FILAMENT switch is operated, a green light above the switch goes ON.

4.2.4.18. PLATE. Turns ON high voltage to tubes V401 and V402. In this circuit, there is a time delay of thirty seconds provided by Thermal Relay K501, after the filament circuits have been activated.

4.2.4.19. INTERNAL SCREWDRIVER ADJUSTMENTS.

a. PA SCREEN VOLTAGE. Adjusts amount of voltage applied to the power amplifier stage screen grids to 350 volts. This adjusting facility (R511) is located in the power supply cabinet. (See figure 6-12 and paragraph 4.2.4.6.f. (2) above.)

b. ALC ZERO. This adjustment is inside the exciter cabinet top side, to the left of center. Its purpose is to adjust the multimeter ALC action to zero, and is made only when the FILAMENT switch is ON and final amplifier supply is OFF. The EMISSION switch should be in the CAL position.

4.2.5. EXTERNAL CONNECTIONS.

4.2.5.1. EXCITER/POWER AMPLIFIER CABINET.

a. FRONT PANEL. (See figure 3-1.)

The only external connection to be made on the exciter front panel is to the J101 microphone jack. This jack is located in the lower right-hand corner of the front panel.

b. REAR PANEL. (See figure 2-1.)

There are five external connections to be made on the exciter and power amplifier rear panel.

(1) J102/P102. All signals and control circuits of the Exciter which require external connections are brought out to J102/P102 on the rear panel and fed through the interconnecting pendant cable.

(2) J103/P103. This connection provides an input from the high voltage Power Supply and low voltage Power Supply for all B plus and filament supplies necessary for the operation of the Exciter and Power Amplifier, except the 2000-volt supply to the final amplifier stages. All wiring to J103 is fed through the W1 interconnecting cable from terminal boards TB501 and TB502 in the power supply cabinet.

(3) J104. This receptacle is located on top of the exciter's audio chassis. It is a 600-ohm connection for phone patch. Use a 1 mf capacitor in series if the phone patch does not have dc isolation.

(4) J402/P402. The power amplifier 2000-volt supply is brought directly from the high voltage Power Supply output at E501, and through separate interconnecting cable (W2) to the power amplifier chassis. J402 is mounted on the power amplifier chassis, and protrudes through the exciter rear panel in a shielding "can" located at the lower left-hand corner below the antenna jack J401.

(5) J401/P401. This connection provides the r-f output for the KWS-1 Transmitter.

(6) BLOWER. The blower for the KWS-1 forced air cooling system is located in the power supply cabinet and is interconnected to the power amplifier chassis through a flexible hose. The connection is made to an elbow on the rear wall of the Power Amplifier, which protrudes through the center of the exciter rear panel wall.

(7) A good, external ground connection may be made to the ground stud adjacent to the terminal strips.

4.2.5.2. HIGH VOLTAGE AND LOW VOLTAGE POWER SUPPLIES.

a. FRONT PANEL. (See figure 3-2.)

There are no front panel connections to be made on this unit.

b. REAR PANEL. (See figure 6-15.)

The "rear panel" referred to is the horizontal plate, mounted about one third the distance up from the chassis bottom TB502 and TB501 terminal boards are the inner left and right-hand boards, respectively, on the horizontal plate, looking into the rear of the cabinet. (See figure 6-15.) TB503 is the black-colored terminal board (to which either a 230 or 115-volt a-c input connection is made). TB503-42 should be used for the a-c common connection. The control and signal circuits are brought out of pins in plug P102 at the rear of the exciter unit. The circuits are explained below.

(1) J102-2. Connects to the exciter V103B relay amplifier cathode, which operates Carrier Control Relay K101. Externally, J102-2 connects to the high side of the push-to-talk switch.

(2) J102-3. This lead is fed through to switch S101B (front) terminals 7 and 6, to the grid-block keying network. Externally, this line connects to the high side of the cw key.

(3) J102-4. Feeds through to the normally open contacts 5 and 4 of Carrier Control Relay K101. When these contacts close, the circuit is fed through J103-13 to the low voltage Power Supply TB502-14. This is a rectified 110 volts dc, 22 milliamperes supply for operating a 4000-ohm antenna relay coil mounted externally to the KWS-1 Transmitter. The low side of this circuit is furnished by J102-9.

(4) J102-5 and 6. These leads connect through to the normally closed contacts 6 and 7 of the Carrier Control Relay K101. Externally, the leads connect into a receiver's standby circuits.

(5) J102-7. Provides a 500-ohm audio frequency input through to the VOX SPEAKER gain

Section IV

Paragraph 4.2.5.2.

control potentiometer R122, and to the grid of amplifier V102B in the speaker signal squelch circuits. Externally, this lead connects to the high side of the 500-ohm VOX audio source.

(6) J102-9. This lead feeds directly out J103-6 to TB502-11 of the low voltage Power Supply a-c common connection. Externally, J102-9 connects to the low side of the antenna relay.

(7) J102-13. Provides a ground connection in the Exciter, and a ground for the externally connected cw key, push-to-talk VOX circuits and ant. interlock circuits.

(8) J102-11. This lead (along with the ground lead above) connects to a set of normally open contacts on the antenna relay. This prevents the carrier from coming on before the antenna is connected to the transmitter output.

SECTION V

MAINTENANCE AND ALIGNMENT

5.1. MAINTENANCE.

5.1.1. GENERAL. This section is written to provide the operator of this equipment with suggestions and procedures for properly maintaining the KWS-1 Transmitter in good operating condition.

Correlative to all electronic equipment, tube failure is the most common cause of trouble.

The maintenance procedures which follow are divided into two categories, electrical and mechanical. Frequent reference should be made to the photograph and diagrams included with the text of this section, and in sections VI and VII.

5.1.2. CLEANLINESS. A common cause of high voltage arcs, consequently of intermittent or permanent equipment failure, is dust and dirt between tuning condenser plates, switch contacts or relay contacts.

For those operators living in a high-humidity locality, or where there is a salt-laden atmosphere, it is possible to experience equipment failure for no apparent reason. Investigation will reveal corrosion of switch and relay contacts or other connections due to the type of climate.

Regardless of the reason, cleanliness in the equipment is essential for reliable operation. Dust may be removed with a small blower or a soft lintless cloth. Contacts may be cleaned with carbon tetrachloride or an equivalent nonabrasive cleaning fluid.

5.1.3. TROUBLE SHOOTING.

5.1.3.1. GENERAL. If the results obtained with the transmitter are in a gradual decline, use the following operational check to evaluate its condition. If a complete failure is experienced go to paragraph 5.1.4., Trouble Shooting Procedure, and follow the procedure there outlined.

5.1.3.2. OPERATIONAL CHECK, CW.

a. Turn FILAMENT switch ON. Blower should start. Be sure blower does start, otherwise the PA tubes may become damaged. Be sure air hose is connected.

b. Adjust PA FILAMENT VOLTAGE to 6 volts. If 6 volts are unobtainable, the a-c supply line may be inadequate or filament transformer T501 may be defective.

c. Set EMISSION switch to CW, CARRIER LEVEL to 0, TUNE-OPERATE to OPERATE, BIAS control to "O".

d. Turn PA PLATE voltage ON. Advance PA BIAS ADJUST control until PA idling current is 100 ma.

e. Turn PA PLATE voltage OFF.

f. Select high 10-meter band with BAND CHANGE switch.

g. Set up on 29 mc with main tuning dial.

h. Place the TUNE-OPERATE switch in the TUNE position.

i. Set the PA TUNING and PA LOADING controls several turns clockwise from the settings given in table 3-1 of section III.

j. Turn PA PLATE voltage ON.

k. Close the TEST KEY. Advance the CARRIER LEVEL control until the MULTIMETER in the PA GRID position shows about midscale.

m. Immediately resonate the PA TUNING control for a dip in plate current. If a dip is not obtainable, the PA LOADING may still be too high or a PA tube may be gassy or otherwise defective.

Section V

Paragraphs 5.1.3.2. - 5.1.3.5.

n. Rotate the PA LOADING control clockwise to increase loading.

o. Load and resonate simultaneously (use both hands) until the PA is loaded to about 150 ma in the TUNE position.

p. During the loading and tuning process, the grid current will tend to increase. This effect is caused by the action of the PA inverse feedback. Keep reducing the CARRIER LEVEL control so that grid current stays at near midscale.

q. Switch the TUNE-OPERATE switch to OPERATE. Again adjust the grid current for midscale.

r. Continue loading to about 400 ma. Note antenna current or power output.

s. Continue loading to 500 ma at resonance while watching both PA plate current and output. However, if output ceases to rise as PA plate current increases, back off PA LOADING control slightly and do not try to load beyond this point. If this point is reached much too soon, check the screen voltage on the PA tubes.

t. The transmitter should now be ready for use on cw.

5.1.3.3. OPERATIONAL CHECK, SSB.

a. Tune up the transmitter exactly as for cw (paragraph 5.1.3.2. above).

b. Set AUDIO GAIN at zero and speaker quieting control (inside exciter unit above PA plate meter) to counterclockwise.

c. Speak into microphone while advancing the VOX SPEECH control. Set the control for a positive action of the carrier control relay. If the vox circuit cannot be made to operate satisfactorily, check the condition of tubes V103 and V107.

d. Advance the AUDIO GAIN until the MULTIMETER in the ALC position kicks to about midscale on voice peaks.

NOTE

There must be no grid current showing on SSB operation or distortion will be generated.

e. Advance speaker quieting control for minimum feedback. If good action cannot be achieved, check V102, V103, and V107.

f. The transmitter should now operate satisfactorily on SSB. Choice of sidebands is available at the SIDEBAND SELECT switch. If there appears to be an objectionable amount of carrier present, the balanced modulator can be checked as in paragraph 5.1.4.3. (10).

5.1.3.4. OPERATIONAL CHECK, AM.

a. Tune the transmitter exactly as for cw (paragraph 5.1.3.2. above).

b. Switch to AM.

c. Back off the CARRIER LEVEL control until the output power drops to 1/4 the cw value (1/2 antenna current). This corresponds to a plate current of about 275 ma.

d. Advance the AUDIO GAIN control until the ALC current just starts to kick on audio peaks.

e. The transmitter is now ready to use on AM.

5.1.3.5. DIAL CALIBRATION. The following procedure is given to assist with dial calibration.

a. Turn the equipment ON as instructed in the OPERATIONAL CHECK, CW given in paragraph 5.1.3.2.

b. Tune a communications receiver to WWV at 15 mc. The bfo in the receiver should be OFF.

c. Rotate the KWS-1 Exciter BAND CHANGE control to the 20-meter band.

d. Rotate the MAIN TUNING dial to 15.0 mc.

e. Rotate the EMISSION switch to either CAL position.

f. Continue to rotate the MAIN TUNING dial about the 15.0 point until the calibration signal is zero beat with WWV.

g. Adjust the ZERO SET knob until the KILOCYCLES dial fiducial is exactly on 15.0 mc.

5.1.4. TROUBLE SHOOTING PROCEDURE.

With all external connections made, the following checks should be made on the KWS-1 equipment. For mechanical checks listed below, all power should be OFF.

5.1.4.1. TEST EQUIPMENT.

Test equipment for the electrical checks listed below consists of a 1000-ohm-per-volt ohmmeter and a VTVM.

5.1.4.2. MECHANICAL CHECKS.

a. TUNING MECHANISM. Release the DIAL DRAG on the exciter front panel. Rotate the MAIN TUNING dial (KILOCYCLES) and check the following:

(1) SLUG RACK. Raise the cabinet lid and observe the slug rack movement. The rack should move up and down freely when the dial is turned. If there is any tendency to stick or bind, check closely for a bent rack, or for foreign matter in the turning mechanism and travel-path of each tuning slug.

(2) SLIDE RULE DIAL FIDUCIAL. The fiducial should move back and forth freely as the MAIN TUNING (KILOCYCLES) dial is operated. The end limits of the fiducial travel should agree with the mechanical stops on the tuning dial. The stops are located on the tuning shaft adjacent to the backside of the front panel.

(3) GEAR TRAIN. The gear trains of the KILOCYCLES tuning dial and Power Amplifier should operate with no binding or unusual gear tooth noise. Backlash should be mechanically undetectable. The KILOCYCLES tuning dial gear train may be viewed in figure 6-3, and the power amplifier gear train in figure 6-11.

The exciter front panel may be taken off by removal of the BAND CHANGE, KILOCYCLES tuning, SIDEBAND SELECT, PA TUNING and PA LOADING control knobs and six recessed head screws, three on each end of the panel. The

loose panel should be lowered carefully to prevent breakage of the internal wiring interconnections.

If trouble is suspected in the power amplifier gear train, the entire unit should be removed from the exciter cabinet. The power amplifier front cover may then be removed by loosening the PA TUNING and PA LOADING tuning shaft couplers (see figure 6-2) and four recessed head screws on both sides of the front cover. The cover should be removed carefully to prevent disturbance of the gear positions on the gear train. Tip the Power Amplifier back to keep the gears intact as they are manually rotated.

The cause of any gear strain or binding should be determined and eliminated.

b. FRONT PANEL CONTROLS. The following front panel controls should particularly be checked for free movement and proper switch alignment, where applicable.

(1) DIAL LOCK. This knob should have right and left-hand turning limits, and should, in its tight position, hold the KILOCYCLES tuning dial in a secure, immovable position. This knob should never be permitted to remain in its tight position during normal tuning procedures.

(2) ZERO SET. This control will have right and left-hand turning limits, and should move the KILOCYCLES tuning pointer to the left or right for the purpose of zero-setting during calibration procedures. Once the KWS-1 Transmitter is calibrated, the ZERO SET should not require movement until a dial error is noticed.

(3) BAND CHANGE. The BAND CHANGE should move freely to each of its seven positions. If sticking or hesitation of movement is noticed, the exciter bottom plate should be removed to check the movement of all mechanically moving parts associated with the operation of this control.

(4) MULTIMETER SWITCH AND EMISSION SWITCH. These controls should also have free and definite movement through each of their positions. If not, the front panel of the Exciter should be lowered, and the reason for faulty movement determined and eliminated.

(5) SIDEBAND SELECT SWITCH. Operate this control, and, at the same time, raise the top panel to observe the vfo movement to be sure it moves freely and does not rub the chassis at any point. If it does, locate the point of contact and

Section V

Paragraphs 5.1.4.2. - 5.1.4.3.

perform mechanical adjustments to eliminate the cause.

5.1.4.3. ELECTRICAL CHECKS.

a. FUSES. Remove power line connection.

All fusing circuits are located in the power supply cabinet. (See figure 6-13.) The following checks should be made.

(1) HIGH VOLTAGE PRIMARY. The S504 FILAMENT switch on the power supply front panel should be OFF. Measure the resistance from TB503-41 to the output side of F501. Reference to the power supply schematic in figure 7-2 will be helpful in making this measurement. With the fuse out, there should be an open circuit, and with it in, a short circuit.

Repeat this procedure from TB503-43 to the output side of fuse F502. A fuse replacement table will be found in paragraph 5.2.1.3.

(2) LOW VOLTAGE POWER SUPPLY.

With S504 FILAMENT switch on the power supply front panel ON and the power line disconnected, measure the resistance between TB503-41 and T501-2. An open circuit should be measured when F501 is removed, and a short circuit with it in.

b. SUPPLY CIRCUITS. For these checks, remove high voltage rectifiers V501 and V502, the power amplifier screen grid supply rectifier V503, and the low voltage rectifier V508. These tubes may be found in the power supply cabinet. (See figure 6-13.) Operate the EMISSION switch on the exciter front panel to the STBY position.

(1) BLOWER AND FILAMENT CIRCUITS.

Plug in the external power line cord and operate the FILAMENT switch to the ON position. Make the following observations:

(a) The blower should come on.

WARNING

IF THE BLOWER DOES NOT COME ON WHEN THE FILAMENT SWITCH IS OPERATED, TURN OFF ALL POWER IMMEDIATELY. WITHOUT COOLING, THE 4X250B POWER AMPLIFIER TUBES COULD BE DAMAGED IN VERY SHORT TIME.

If the blower does not come on, and with all power OFF, run a continuity check on the blower circuits, using figure 7-2 as a guide. The blower hose must always be in place if the 4X150A tubes are in their sockets.

(b) Inspect all tubes and dial lights for filament operation. If any tubes do not light, they should be checked for replacement. If the tube checks good, the power should be shut OFF and the filament circuits subjected to continuity checks.

(c) Check the power amplifier filament voltage by operating the MULTIMETER switch to the PA FIL position. Operate the PA FILAMENT VOLTAGE control on the power supply front panel through its positions and observe the readings on the MULTIMETER in the upper left-hand corner of the exciter front panel. This voltage should vary from 5.0 volts to 6.3 volts. If it does not, check out the power amplifier filament circuits. (See figure 7-2.) Adjust the filament voltage for 6.0 volts.

(2) -150 BIAS SUPPLY. The d-c voltage between TB502-19 in the power supply cabinet and ground should measure -150 volts. A faulty measurement here would require a check of the V509 bias rectifier and associated circuitry.

(3) PA BIAS. Check the minus d-c voltage from one of the multimeter (M201) terminals (see figure 6-2) to ground. MULTIMETER switch must be on PA GRID. This measurement should vary from -53 volts to -125 volts when the PA BIAS ADJUST control on the power supply front panel is varied through its entire range. Maximum voltage should be obtained when this control is in its farthest counter-clockwise position. Adjust to -62 volts. A failure to obtain correct readings here would indicate faulty circuit wiring, or trouble involving R513, R514, and R515.

(4) DRIVER BIAS. Operate the EMISSION switch on the exciter front panel to the CW position. Remove the bottom cover from the exciter cabinet and measure the voltage on V206 pin two. This measurement to ground should be -30 volts dc with the cw key up, and -4 volts with the key down. If not, check the keying network mounted between the gear plate and front panel beneath the PA plate current meter, M701.

(5) V201 FIRST MIXER KEYING. The voltage from V201 pin 7 to ground should measure -26 volts with the cw key up and -.04 volts with the key down. If it does not, check the keying network mentioned in the preceding paragraph (4).

(6) LOW VOLTAGE SUPPLY. Return tube V508 to its socket, and measure the voltage from TB502-18 to ground. If this measurement is not 275 volts positive, either the tube is bad or there is component trouble in this circuit. If so, check T506, L502, L504, C509 or R531.

(7) REGULATED SCREEN SUPPLY. Return V503 to its socket and measure the voltage from one of the multimeter (M201) terminals to ground with the MULTIMETER set on PA SCREEN. By varying the PA SCREEN ADJUST control with a screwdriver inside the power supply cabinet (see figure 6-13) set this voltage to plus 350 volts dc (300-V Canada). PA screen-grid voltage adjustments are made with a

screwdriver on the R511 potentiometer located between V501 and V502 in the power supply cabinet. (See figure 6-12, and paragraph 4.2.4.6f. (2).) If it is impossible to make the 350-volt adjustment, check V503 and associated circuitry.

(8) HIGH VOLTAGE SUPPLY. To make this check, perform the following steps:

- (a) Return V501 and V502 to their sockets.
- (b) Replace the rear door to the power supply cabinet and see that the exciter lid is down.
- (c) Operate the PA BIAS ADJUST control on the front panel to a completely counter-clockwise position.
- (d) Operate the MULTIMETER switch on the exciter front panel to the 2000 V dc position.

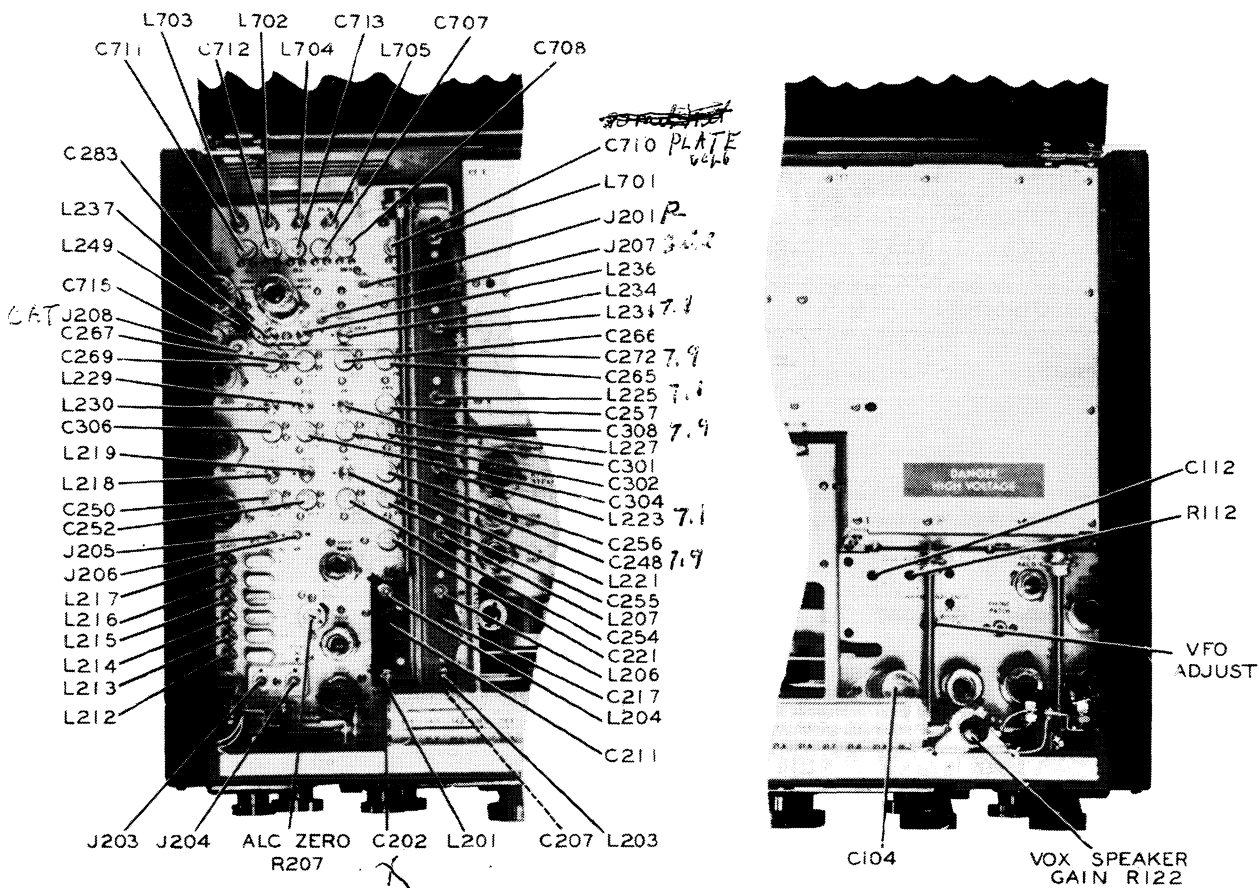


Figure 5-1. Exciter Test Jacks and Points of Tuned Circuit Adjustments

Section V

Paragraphs 5.1.4.3. - 5.2.1.1.

(e) Operate the EMISSION switch to the CW position. Key must be open.

(f) Operate the PLATE toggle switch on the power supply front panel to the ON position. The red light above the switch should go ON.

(g) The high voltage reading on the multimeter should read approximately 2000 volts.

(9) NEUTRALIZATION CHECK. The following procedure will show whether or not the KWS-1 r-f circuits are properly neutralized.

(a) Operate the EMISSION switch on the exciter front panel to the AM. position.

(b) Operate the MULTIMETER switch to PA GRID.

(c) Operate the CARRIER LEVEL control until grid current begins to show on the meter.

(d) Operate the PA TUNING control through resonance, and observe the meter reaction. If the circuits are neutralized properly, the grid current will dip exactly on resonance, and will rise symmetrically on either side of resonance.

(10) BALANCED MODULATOR CHECK. The following procedure will determine if the ring modulator is in balance.

(a) Operate the EMISSION switch to SSB.

(b) A receiver antenna connection should be made to J201 into the 6CL6 driver plate circuit.

(c) The carrier will be heard if the modulator is not in balance. Adjust R112, and C112 (see figure 5-1) for minimum sound of the carrier.

(11) COLLINS MODEL 35C-2 LOW-PASS FILTER. It is not likely the Collins KWS-1 Transmitter will require precautionary adjustments because of TVI. However, if this problem does arise, for some reason unique to a particular installation area, the 35C-2 Low-Pass Filter may be installed in the KWS-1 antenna lead. In rare cases of extreme difficulty, a high-pass filter may be installed in the TV receiver antenna lead in.

5.2. ELECTRICAL MAINTENANCE.

5.2.1. TEST CONDITIONS.

5.2.1.1. TEST EQUIPMENT REQUIRED. The following test equipment is required to perform the specified procedure.

EQUIPMENT	SPECIFICATIONS
a. Signal Generator	Output to 30 mc.
b. Voltmeter	Hewlett-Packard 400 C or equivalent. (Must have r-f probe).
c. Accurately Calibrated Receiver	75A-4 (or equivalent with "S" meter and Crystal Calibrator).
d. 1 kw, 50 ohm, resistive load	
e. Microphone with locking PTT switch	

5.2.1.2. POWER REQUIREMENTS.

at 60 cps, or a 230-volt a-c supply at 60 cps. The transmitter must be externally and internally connected to satisfy the power source.

For proper maintenance checks, the KWS-1 Transmitter must have either a 115-volt a-c supply

5.2.1.3. FUSES.

TABLE 5-1
FUSE TABLE

SYMBOL	LOCATION	RATING	TYPE
F501	HV PRI.	20 Amp.	Cartridge - 3AG
F502	HV PRI. and Screen (230-V)	10 Amp.	Cartridge - 3AG
F503	Filament and blower	3.2 Amp.	Cartridge - Slow Blow
F504	Filament and LV Supply	3.2 Amp.	Cartridge - Slow Blow
F505	Screen Voltage Output	1/4 Amp.	Cartridge - 3AG
F506	HV Supply Output	1 Amp.	Cartridge - High Voltage

5.2.1.4. TEST POINTS.

Table 5-2 below lists the typical voltage values for the KWS-1 test point jacks.

TABLE 5-2
TEST JACKS
(Refer to figure 5-1)

TEST JACK	VOLTAGE VALUE (RF VOLTS)
666 PLATE J 201	40-50 (with PA on)
VFO I NJ J 203	1.5
25000 I NJ J 204	0.1 (for full output)
X TAL I NJ J 205	1.5 (on bands 40 thru 10m)
VIF J 206	0.1 (for full output)
666 GRID J 207	8-10 (with PA on)
666 CAT J 208	5-6 (with PA on)

5.2.2. EXCITER AND POWER AMPLIFIER.

to perfect alignment before attempting to insert them into their sockets. Use a special tube pin straightener available for such purposes.

5.2.2.1. TUBE REPLACEMENT.

a. GENERAL. All tubes are removed by pulling straight up after first removing their shields, if they are so equipped. Special instructions apply to the 4X250B tubes. (See next paragraph.) Should the tube pins become bent, be sure they are straightened

b. PA TUBES. The top cover of the power amplifier enclosure must be removed to get at the PA tubes (as well as the ALC rectifier V403). Once the cover is off, check by means of a shorting tool to see that there is no charge in the hv filter capacitors.

WARNING

WHENEVER ANY ADJUSTMENTS INVOLVING THE HIGH VOLTAGE OR POWER AMPLIFIER CIRCUITS ARE CONTEMPLATED, DISCONNECT THE TRANSMITTER FROM THE POWER LINES AND SEE THAT ALL FILTER CAPACITORS ARE DISCHARGED.

Grasp the plate connector of the tube to be removed and pull straight up. (The plate connector consists of a large ring with metal fingers running radially in from the ring to provide a pressure fit to the tube plate and a connecting pin which snaps into an adjacent clip.)

Once the plate connector has been removed, the tube can be pulled from its socket.

When replacing the tube connector assembly, see that it is on straight and down as far on the tube as it will go. See figure 2-2.

When replacing the compartment cover, be sure that the cover screws are pulled fully down so that the interlock (S401) operates.

5.2.3. ALIGNMENT OF KWS-1. The following alignment procedure assumes that the KWS-1 is completely out of alignment. Use all of it or any part of it that is necessary to accomplish the desired results.

5.2.3.1. VFO ALIGNMENT.

NOTE

This assumes a vfo in good adjustment. If the vfo is out of frequency adjustment, refer to paragraph 5.2.3.9.

- a. Remove V104 from its socket.
- b. Connect the antenna of a communications receiver to J203. (See figure 5-1.)
- c. Set the KILOCYCLES tuning to 3.5 mc and the BAND CHANGE to 80.
- d. Place the EMISSION switch in the CAL position and turn up the CARRIER LEVEL control to half scale and turn the FILAMENT switch ON.

e. Set the receiver dial to 3250 kc (must be very accurately calibrated - use an external calibrator if necessary).

f. Turn the receiver bfo on and set it to center of i-f passband.

g. Loosen the coupler of the vfo shaft and rotate the shaft until zero beat is obtained in the receiver.

h. Replace V104 in its socket.

i. Calibrate and tune the receiver to 3.5 mc.

j. Leave the KWS-1 KILOCYCLES dial at 3.5 mc and the receiver at 3.5 mc.

k. Manually rotate the vfo shaft until zero beat is obtained.

m. Tighten the coupler.

5.2.3.2. SIDEBAND SELECT ADJUSTMENT.

a. With the KILOCYCLES dial accurately set on 3.5 mc, set up the DIAL DRAG.

b. Set SIDEBAND SELECT at LOWER.

c. Connect the communications receiver antenna input to J203.

d. Set the EMISSION switch to CAL and CARRIER LEVEL to half scale.

e. Tune the receiver for zero beat with the bfo on.

f. Operate the SIDEBAND SELECT switch to "UPPER".

g. Adjust the mechanical limit of the SIDEBAND SELECT switch (available through the top of the audio chassis) for zero beat.

h. Operate the SIDEBAND SELECT switch back and forth a few times to make sure that the zero beat stays.

5.2.3.3. CRYSTAL OSCILLATOR ADJUSTMENT.

a. Connect an r-f voltmeter (vacuum tube voltmeter) from J205 to ground. (Transmitter remains in CAL operation.)

b. Select bands 40 thru 10 and adjust associated crystal oscillator tuning slug for maximum. (See table below.) A value of about 1.5 volts should be obtained on each band. The 10 and 11-meter bands will run slightly lower because the oscillator is used as a doubler on these bands.

BAND	40	20	15	11	10 LO	10 HI
COIL	L217	L216	L215	L214	L213	L212

5.2.3.4. TRAP ADJUSTMENTS.

a. FIRST MIXER PLATE TRAP.

(1) Connect the communications receiver antenna input to J207.

(2) Set the BAND CHANGE switch to "80".

(3) Set the KILOCYCLES dial to 3.5 mc.

(4) Set EMISSION to CAL.

(5) Turn CARRIER LEVEL control fully counterclockwise.

(6) Tune the communications receiver until the transmitter VFO is heard near 3.25 mc.

(7) Adjust C229 for minimum signal at the receiver. (Use "S" meter and bfo off.)

b. 8 MC TRAP.

(1) Connect communications receiver as in 5.2.3.4. above.

(2) Set the KWS-1 BAND CHANGE switch to "40".

(3) Set the KILOCYCLES dial to 7.3 mc.

(4) Tune the communications receiver until the second harmonic of Y206 (8 mc) is heard.

(5) Adjust C249 for minimum signal at the receiver.

5.2.3.5. EXCITER TRACKING.

a. 80-METER TRACKING.

(1) Place the EMISSION switch in the CAL position.

(2) Use the CARRIER LEVEL control to adjust drive.

(3) Connect the communications receiver antenna to J207. BFO OFF.

(4) Short out L701 with a short jumper (put jumper across coil - not to ground), (see NOTE** below).

(5) Set BAND CHANGE switch to "80" position.

(6) Set the KILOCYCLES dial at 3.1 mc and adjust L201, L203, L204, L206 and L207 for maximum indication on the receiver "S" meter (receiver tuned to 3.1 mc).

(7) Tune transmitter and receiver to 3.9 mc and adjust C202, C207, C211, C217 and C221 for maximum indication on receiver "S" meter.

NOTE

It may be necessary to reduce gain in receiver as alignment proceeds to keep the "S" meter in range. Do this by loosening the coupling to the receiver.

(8) Repeat steps (6) and (7) until tracking is accomplished.

b. 40-METER TRACKING.

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above (80-meter tracking).

(2) Set the BAND CHANGE switch to "40" position.

(3) Set the transmitter and receiver tuning dial to 7.1 mc and adjust L223, L225 and L231 for maximum "S" meter readings.

(4) Set the transmitter and receiver dials to 7.9 mc and adjust C272, C308, and C248 for maximum "S" meter readings.

(5) Repeat steps (3) and (4) until tracking is accomplished.

c. 20-METER TRACKING.

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

Section V

Paragraphs 5.2.3.5. - 5.2.3.6.

(2) Set the BAND CHANGE switch to the 20 position.

(3) Set the transmitter and receiver dials to the 14-mc bands and adjust L218, L230 and L237 for maximum "S" meter readings.

(4) Set the receiver and transmitter dials to 14.3 mc and adjust C250, C306 and C269 for maximum "S" meter readings.

(5) Repeat steps (3) and (4) until tracking is accomplished.

d. 15-METER TRACKING.

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "15" position.

(3) Set the transmitter and receiver tuning dials to 21.0 mc and adjust L219, L229 and L236 for maximum "S" meter reading.

(4) Set the transmitter and receiver tuning dials to 21.4 mc and adjust C252, C304 and C267 for maximum "S" meter indication.

(5) Repeat steps (3) and (4) until tracking is accomplished.

e. HIGH 10-METER TRACKING. (See NOTE* below.)

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "10" high position.

(3) Set the transmitter and receiver tuning to 29.4 mc and adjust C256 and C257 for maximum "S" meter indication.

f. LOW 10-METER TRACKING (See NOTE* below.)

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "10" low position.

(3) Set the transmitter and receiver tuning dials to 28.1 mc and adjust L221, L227 and L234 for maximum "S" meter indication.

(4) Set the transmitter and receiver tuning dials to 28.9 mcs and adjust C255, C301 and C265 for maximum "S" meter readings.

(5) Repeat steps (3) and (4) until tracking is accomplished.

g. 11-METER TRACKING (See NOTE* below.)

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "11" position.

(3) Set the transmitter and receiver tuning dials to 27.1 mc and adjust C254, C302 and C266 for maximum "S" meter indications.

***NOTE**

The 10 high, 10 low, and 11 bands must be aligned in the order given above.

****NOTE**

The driver stage must be neutralized before tracking of the plate circuit is attempted or the stage will probably oscillate. The tracking procedure will be resumed at paragraph 5.2.3.7. below. If oscillation persists, check to see that screws in shields are tight and check bypass condensers for broken leads.

5.2.3.6. NEUTRALIZING.

a. GENERAL. If the shorting wire is still across L701 from the tracking procedure above, remove the wire. The driver (6CL6) grid-plate neutralizing, and the PA grid-plate neutralizing are done with all filaments energized, the driver plate on but the PA plate voltage off. The driver (6CL6) grid-cathode neutralizing is done with all filaments excited and the driver and PA plate voltage on.

b. DRIVER (6CL6) GRID-PLATE NEUTRALIZATION.

(1) Set the EMISSION to CAL and BAND CHANGE to 15M.

(2) Couple a receiver lightly to 6CL6 GRID test point, J207, and adjust CARRIER LEVEL for about midscale "S" meter reading.

(3) Swing 6CL6 plate tuning capacitor C713 thru resonance and note reaction on "S" meter.

(4) Adjust neutralization capacitor C283 for minimum meter reaction as the plate is tuned thru resonance.

c. PA GRID-PLATE NEUTRALIZATION.

(1) Set EMISSION to CAL and BAND CHANGE to 15M.

(2) Couple a receiver to antenna output jack, J401.

(3) With PA plate off, adjust CARRIER LEVEL until a signal is heard in receiver.

(4) Tune the PA TUNING and PA LOADING controls until the signal is strongest (see tuning chart in section III for approximate settings).

(5) Reduce the CARRIER LEVEL to 1/2 scale on receiver "S" meter.

(6) Loosen screws on PA neutralizing capacitor and slide it in slot until the signal is minimum.

(7) Tighten the neutralizing capacitor screws.

d. DRIVER (6CL6) GRID-CATHODE NEUTRALIZATION.

(1) Couple the PA into a dummy load and load the transmitter to 1 kw input on 15 meters.

(2) Lightly couple a receiver to the 6CL6 GRID test point, J207, and reduce the CARRIER LEVEL to about midscale on the receiver "S" meter.

(3) Rock the PA TUNING control C407 and note reaction on "S" meter.

(4) Adjust cathode neutralizing capacitor, C715, for minimum receiver "S" meter reaction as PA is tuned through resonance.

e. 80-METER NEUTRALIZATION.

(1) Set EMISSION to CAL and BAND CHANGE to 80M (at 3.5 mc).

(2) Lightly couple a receiver into the 6CL6 GRID test point, J207.

(3) Set CARRIER LEVEL for about 1/2 scale on "S" meter (PA PLATE OFF).

(4) Swing the 80-meter 6CL6 plate tuning capacitor, C710, through resonance and note reaction on "S" meter.

(5) Adjust C322, 80-meter neutralizing capacitor, for minimum reaction as the plate is tuned through resonance.

5.2.3.7. DRIVER (V206/V207) TRACKING.

NOTE

The preceding exciter stages should be tracked and all neutralizing procedures completed before the driver plates are tracked, otherwise some instability may be experienced.

a. Connect VTVM set up to read r-f volts to J201.

b. Set EMISSION switch in CAL position.

c. Adjust CARRIER LEVEL for one-fourth scale indication on VTVM.

d. Adjust the following trimmers at the frequencies indicated with the BAND CHANGE switch set at the bands indicated. Adjust for maximum indication on VTVM.

TABLE 5-3

DRIVER PLATE ALIGNMENT

BAND CHANGE (BAND)	COIL	FREQ. (MC)	CAPACITOR	FREQ.
80	L701	3.10	C710	3.90
40	L703	7.0	C711	7.3
20	L702	14.0	C712	14.3
15	L704	21.0	C713	21.4
*High 10	L705	29.5	--	--
*Low 10	--	--	C708	28.5
* 11	--	--	C707	27.5

*NOTE: The high 10, low 10, and 11 meter bands must be aligned in this order.

Section V

Paragraphs 5.2.3.8. - 5.2.3.9.

5.2.3.8. BALANCED MODULATOR ADJUSTMENT.

- a. Set the EMISSION selector switch to SSB.
- b. Connect the communications receiver to J201.
- c. Set the BAND CHANGE switch to 80.
- d. Set the KILOCYCLES dial to 3500 kc.
- e. Set SIDEBAND SELECT to LOWER.
- f. Tune the receiver until the carrier is heard, bfo off, and carrier showing on "S" meter.
- g. Adjust R112 and C112 for minimum indication on "S" meter.
- h. Repeat step g.

5.2.3.9. VFO ALIGNMENT.

a. GENERAL. The vfo is calibrated and sealed at the factory and should require adjustment only at widely separated intervals. If the calibration error becomes excessive for operation or beyond the point where the vernier dial corrector (ZERO SET control) cannot correct, the following procedure should be followed to make correcting adjustments.

b. TEST EQUIPMENT REQUIRED.

(1) Precision frequency measuring gear capable of measuring 2750 kc and 3750 kc (or harmonics thereof) or:

(2) A precisely calibrated receiver capable of receiving 2750 kc and 3750 kc (or harmonics thereof) or:

(3) A Collins 75A-2, 3 or 4 calibrated at 27.5 mc (11-meter band) and at 30 mc (10-meter band).

c. PROCEDURE.

(1) Connect the frequency measuring device to J203. Use loose coupling if listening to the fundamental or low harmonic of the oscillator.

(2) Turn the transmitter to CAL emission and turn on the frequency measuring equipment and allow them to warm up for about 1 hour.

(3) Very carefully calibrate the frequency measuring equipment using WWV as a frequency standard. (If 75A's are used, adjust calibration

oscillator against WWV then calibrate KILOCYCLES dial and bfo.)

(4) Select LOWER sideband with SIDEBAND SELECT control.

(5) Set BAND CHANGE control to 80.

(6) Turn KILOCYCLES dial to 3.0 mc (2750 kc vfo frequency). Tune for zero beat in frequency measuring equipment.

NOTE

If 75A is used, the 10th harmonic (27.5 mc) of 2750 kc should be used here and the 8th harmonic (30 mc) used at the 3750 kc point. (3 and 4 respectively on the transmitter KILOCYCLES dial.)

(7) Set the ZERO SET (fiducial) to 0 on KILOCYCLES dial (3000 kc). Note the dial reading if the fiducial cannot go to 0.

(8) Rotate the KILOCYCLES dial to 4.0 mc (3750 kc vfo frequency) and tune to exact zero beat on frequency measuring equipment (30.0 mc on 75A receivers).

NOTE

If the harmonic at 30 mc is used, it would be well to check on the 80-meter band at 3750 kc to see that a signal is actually there. This prevents the possibility of using the wrong harmonic.

Do not readjust ZERO SET control. The calibration error is then the number of dial divisions more or less than the 10 turns it should take to cover the range between the two test frequencies. Usually, the error tends to be toward more rotation of the KILOCYCLES dial than the 10 turns that should be required. To correct the error, proceed as follows:

(9) Rotate the KILOCYCLES dial towards and through dial zero (4000 kc) until a total of 2 times the dial division error has been counted.

(10) Engage the trimmer adjusting stud with a strong thin wire (such as a straightened-out paper clip) and turn until zero beat in the frequency measuring equipment is restored.

(11) The ZERO SET (fiducial) can now be adjusted until it is set at dial zero (4000 kc).

(12) This completes the procedure in most cases. To check, retune the KILOCYCLES dial and frequency measuring equipment to the 2750 kc end of the range and check the dial division error. If the adjustments have been done carefully, less than 1/2 division error will be found. The above procedure can be repeated until satisfactory results are obtained. This endpoint adjustment restores factory accuracy to the intermediate points, also.

(13) In most cases, the dial reading will again be centered in the window. If this is not so and it is desired to center the dial reading, set the KILOCYCLES dial to zero beat at 3 mc and carefully loosen the setscrews in the mechanical stop side of the flexible coupler and turn the dial so that 3 mc is straight up. Tighten the setscrews.

5.2.3.10 SYNCHRONIZING PA ROLLER COILS AND CAPACITORS.

- a. Set PA TUNING and PA LOADING controls to 0-0.
- b. Set capacitors to full mesh (C407, C408, C409).
- c. Set roller for PA TUNING coil one turn from maximum inductance. The end of the roller coils farthest from the panel is the maximum inductance end.
- d. Set the roller for PA LOADING coil four turns from maximum inductance.

5.3. MECHANICAL MAINTENANCE.

5.3.1. DIAL CORD REPLACEMENT.

a. GENERAL. Two dial cords are used in this equipment - one for the MEGACYCLES dial drum and one for the MEGACYCLES dial pointer. Refer to figure 5-2. In either case the front panel must be removed to gain access to the dial cords.

b. FRONT PANEL REMOVAL.

(1) Remove the following knobs: BAND CHANGE, KILOCYCLES tuning, PA TUNING, PA LOADING and SIDEBAND SELECT.

(2) Remove six panel screws (three on each side).

(3) Pull the panel forward and off the extended control shafts. Allow it to tip forward - being careful to prevent breakage of connecting wires.

c. POINTER CORD. (See figures 5-2 and 6-3.)

(1) Obtain a type 432 1018 00 Collins dial cord. This cord is cut to correct length and has securing loops already tied in the ends (as does the drum cord).

(2) Scribe a mark on the KILOCYCLES tuning shaft and the dial hub to mark their relative positions and remove the KILOCYCLES dial.

(3) See figure 5-2. Turn the KILOCYCLES tuning shaft to the clockwise stop.

(4) Start at point X in the drawing with the cord hooked to one end of the spring (Collins Part Number of this spring is 503 1240 001).

(5) Bring cord around pulley C to pulley B.

(6) Wrap around pulley B clockwise, through the deep slot, around the tab, and back through the shallow slot. Wrap around pulley B two times clockwise.

(7) Wrap cord around pulley A and loop the end on the free end of the spring.

(8) Fasten the pointer to the cord.

(9) Replace the KILOCYCLES dial and match the scribe marks (added in step (2)) and tighten the setscrews.

(10) Back the KILOCYCLES dial to where O is straight up.

(11) Slide the pointer to the first major mark at the right-hand edge of the drum.

(12) Check by turning the KILOCYCLES dial shaft through its entire range.

(13) Replace panel - be sure KILOCYCLES dial plate is in the correct position on its shaft so that there is no binding and so that the DIAL DRAG works correctly.

(14) Replace the knobs.

d. DRUM CORD. (See figures 5-2 and 6-3).

(1) Obtain a Collins Type 532 1020 00 dial cord.

(2) Turn the BAND CHANGE to the 3-4 mc band (80 meter).

(3) Turn pulley E approximately one turn and hold tension spring taut. (The front panel must have been removed as in paragraph b. above).

(4) Make approximately 3/4 turn around pulley D and hook cord to tab.

(5) Extend the cord around the inside of the idler pulley F and go around pulley E to the tab and hook the cord to it. Release the tension spring.

(6) Replace the panel and knobs.

(7) Loosen the setscrew in the drum hub opposite the coil tension spring and align the drum calibration to the 80-meter band then tighten the setscrew.

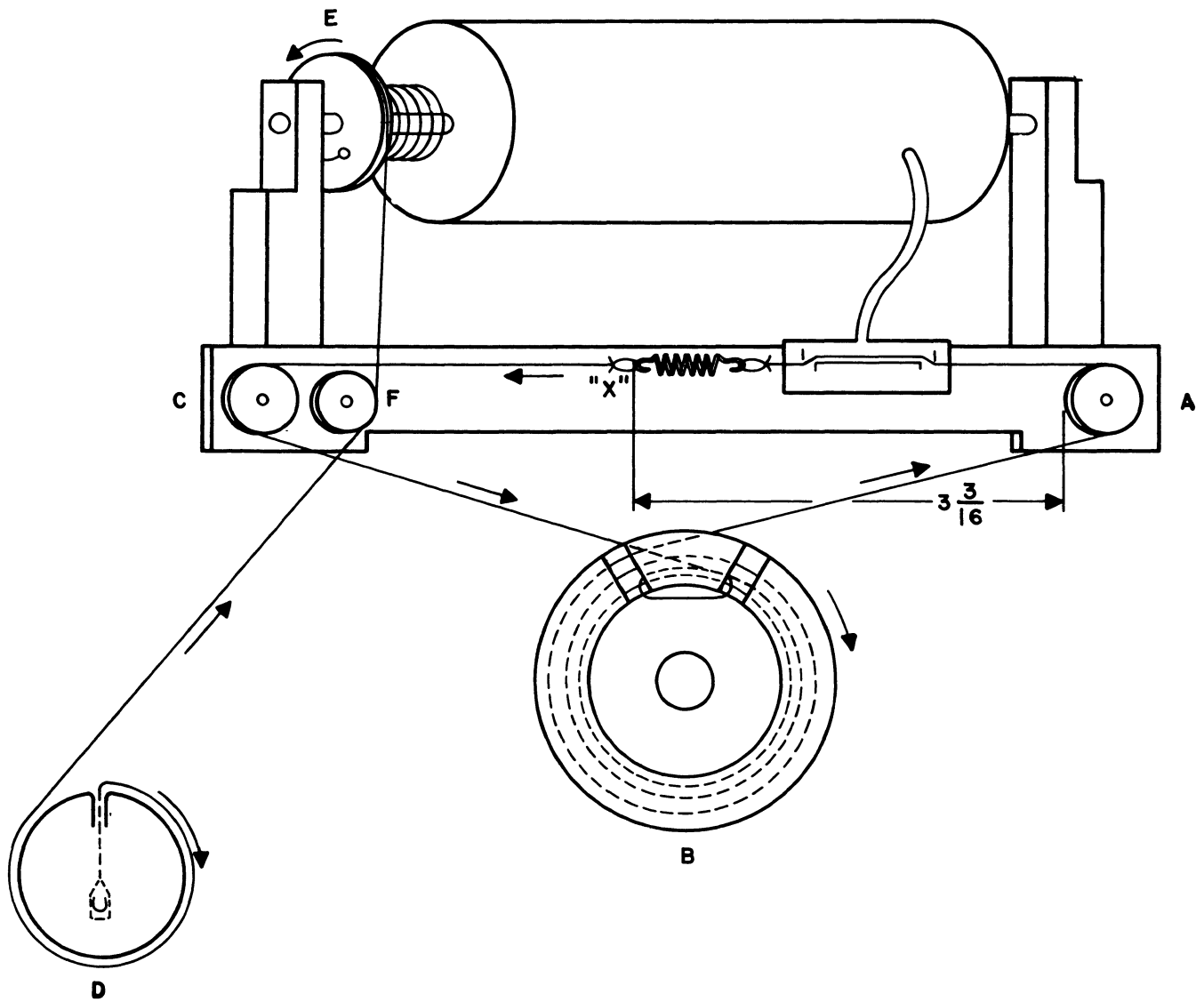


Figure 5-2. Dial Cord Replacement

TABLE 5-4

TUBE PIN VOLTAGE TO GROUND

Readings taken with VTVM
Set in CALIBRATE - No Carrier - 40 Meter Band

PIN TUBE	1	2	3	4	5	6	7	8	9
V001	-3.2	0	+36	+36	+200	+88	0	-	-
V101	+41	0	+0.6	0	0	+125	0	+1.7	6.3 AC
V102	+165	+16.5	+23	0	0	+75	0	+0.75	6.3 AC
V103	+90	-0.12	+0.8	0	0	+285	0	+9.3	6.3 AC
V104	+120	-13	0	0	0	+285	+11	+50	6.3 AC
V105	+108	0	IC	0	+108	IC	0	-	-
V106	+215	+108	IC	+108	+215	IC	+108	-	-
V107	0	0	0	6.3 AC	+0.53	NC	-0.6	-	-
RT101	NC	+36	+36	NC	NC	NC	+36	+36	NC
V201	+200 320	-0.1 -2.5	+2.1	0	0	+200 320	-0.4 -2.5	+2.1	6.3 AC
V202	0.01	2.8-3.3	0	6.3 AC	+270 320	+130 200	2.8-3.3	-	-
V203	0	+3.1	0	6.3 AC	+280	+140	+3.1	-	-
V204	+185 335	0	+2.15 0	0	0	+185 320	0	+2.15 0	6.3 AC
V205	0	+7.8 9.4	0	6.3 AC	+140 163	+140 163	+7.8 9.4	-	-
V206	+1.6	-3.8	+215 320	0	6.3 AC	+285 320	0	+215	-3.8 -2.8
V207	+1.6	-3.8	+215 295	0	6.3 AC	+285 300	0	+215 295	-3.8 -2.8
V208	-1.3	0	0	6.3 AC	+280	+47	0	-	-
V209	0	+5	0	6.3 AC	+280	+160	+5	-	-

TABLE 5-5

TUBE PIN RESISTANCES TO GROUND

Readings taken with VTVM
Set in CALIBRATE - No Carrier - 40 Meter Band

TUBE \ PIN	1	2	3	4	5	6	7	8	9
V001	82K	0	60K	60K	12.6K	62K	0.1 Ω	-	-
V101	240K	100K	680	0	0	85K	470K	1000	.05 Ω
V102	37K	720K	4500	0	0	115K	0-880K	330	.05 Ω
V103	100K	1M	330	0	0	23K	0	680	.05
V104	52K	470K	0	0	0	9K	500K	4900	.05
V105	∞	0	IC	0	∞	IC	0	-	-
V106	11K	∞	IC	∞	11K	IC	∞	-	-
V107	100K	100K	0	.05	860K	NC	860K	-	-
RT101	NC	58K	58K	NC	NC	NC	58K	58K	NC
V201	18.2K	100K	220	0	0	18.2K	60K	220	.05
V202	920K	220-320	0	.05	10K	19K	220-320	-	-
V203	930K	220	0	.05	9.8K	19.8K	220	-	-
V204	19K	100K	220	0	0	19K	100K	220	.05
V205	27	220	0	.05	13K	13K	220	-	-
V206	7.5	22K	13.5K	0	.05	9K	0	13.5K	22K
V207	7.5	22K	13.5K	0	.05	9K	0	13.5K	22K
V208	100K	0	0	.05	13.5K	480K	7.5	-	-
V209	0.3	390	0	.05	9.6K	19.5K	390	-	-

NOTES

SECTION VI PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
B501	Blower		541 2293 004
C101	RF filter for audio input	CAPACITOR: mica; 47 uuf p/m 10%; 500 wv	912 0471 00
C102	V101A plate equalizer	CAPACITOR: mica; 510 uuf p/m 10%; 300 wv	912 0546 00
C103	V101B grid coupling	CAPACITOR: ceramic; 0.0022 uuf ±10% 400 vdcw	931 0281 00
C104		CAPACITOR: electrolytic; 3 sect; 15, 15 and 10 uf minus 10% plus 50%; 450 v	183 1091 00
C104A	V101A plate decoupling	p/o C-104	
C104B	B plus bypass	p/o C-104	
C104C	V102A plate bypass	p/o C-104	
C105	V103A grid coupling	CAPACITOR: same as C103	931 0281 00
C106	V102A cathode output	CAPACITOR: paper; 0.5 uuf minus 10% plus 20%; 600 wv	931 0205 00
C107	Mechanical filter input tuning	CAPACITOR: mica; 220 uuf p/m 2%; 500 wv	912 0517 00
C108	Mechanical filter output tuning	CAPACITOR, fixed: mica; 91 uuf p/m 2%; 500 dc working v	912 0490 00
C109	Modulator divider	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C110	Modulator divider	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C111	V101B plate equalizer	CAPACITOR: mica; 510 uuf p/m 10%; 300 wv	912 0546 00
C112	Carrier balance	CAPACITOR, variable: ceramic; 5.0 to 37.5 uuf; 350 dc working v	917 1073 00
C113	V107A plate coupling	CAPACITOR: paper; 0.01 uf p/m 10%; 400 wv	931 0289 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C114	V107A cathode filter	CAPACITOR: paper; 0.2 uuf minus 10% plus 20%; 200 wv	931 0167 00
C115	V107B cathode coupling	CAPACITOR: paper; 0.01 uf p/m 10%; 400 wv	931 0289 00
C116	V107B plate filter	CAPACITOR: paper; 0.5 uuf minus 10% plus 20%; 200 wv	931 0169 00
C117	Carrier level output coupling	CAPACITOR: ceramic; 1,000 uuf; 500 wv	913 1186 00
C118	V102A grid filter	CAPACITOR: mica; 100 uuf p/m 10%; 500 wv	912 0495 00
C119	V104B plate bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C120	V104 plate feedback	CAPACITOR: mica; 470 uuf p/m 10%; 300 wv	912 0543 00
C121	V104 plate bypass	CAPACITOR: mica; 100 uuf p/m 10%; 500 wv	912 0495 00
C122	V102B plate filter	CAPACITOR: paper; 0.001 uf p/m 10%; 400 vdcw	931 0277 00
C123		Not used	
C124	V102A grid decoupler	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C125	Mechanical filter coupling	CAPACITOR: mica; 220 uuf p/m 2%; 500 wv	912 0517 00
C126		Not used	
C127	Keying filter network	CAPACITOR: paper, 0.1 uf p/m 10%; 150 wv	931 0333 00
C128	V104B cathode coupling	CAPACITOR, fixed: ceramic; 1000 uuf guaranteed min; 500 dc working v	913 1186 00
C129	Keying filter network	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C130	V104B grid coupling	CAPACITOR: ceramic; 27 uuf p/m 10%; 500 wv	912 0453 00
C131	V104B grid bypass	CAPACITOR: mica; 180 uuf p/m 10%; 500 wv	912 0513 00
C132	V102A grid coupling	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C133	V102A cathode divider	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00

Section VI
C-134 - C-214

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C134	Keying filter network	CAPACITOR: paper 0.1 uf ±10%; 150 wv	931 0333 00
C135	Carrier level coupler	CAPACITOR: mica; 75 uuf p/m 10%; 250 wv	912 0486 00
C136	Modulator loading	CAPACITOR, fixed: mica; 39 uuf ±2%; 500 dc working v	912 0463 00
C137	V104B plus bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C201	V201 plate decoupler	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C202	Trimmer for L201	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C203	V201 voltage divider	CAPACITOR: mica; 240 uuf p/m 2%; 500 wv	912 0520 00
C204		Not used	
C205	V202 grid decoupler	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C206	Padder for L203	CAPACITOR: mica; 200 uuf p/m 2%; 500 wv	912 0516 00
C207	Trimmer for L203	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C208	V202 grid coupling	CAPACITOR: ceramic; 2.0 uuf p/m 1/4 mmf; 500 wv	916 0075 00
C209	V202 cathode bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C210	V202 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C211	Trimmer for L204	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C212	Padder for L204	CAPACITOR, fixed: mica; 220 uuf p/m 2%; 500 dc working v	912 0517 00
C213	V202 plate decoupling	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C214	B plus bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C215	V203 grid decoupling	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C216	Padder for L206	CAPACITOR: mica; 200 uuf p/m 10%; 500 vdcw	912 0516 00
C217	Trimmer for L206	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C218	V203 grid coupling	CAPACITOR: ceramic; 2.0 uuf p/m 1/4 mmf; 500 wv	916 0075 00
C219	V203 cathode bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C220	V203 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C221	Trimmer for L207	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C222	Padder for L207	CAPACITOR: mica; 150 uuf; p/m 2%; 500 wv	912 0505 00
C223		Not used	
C224	B plus bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C225	ALC circuit filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C226	ALC circuit filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C227	Key line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C228	Filament line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C229	V201 plate trap	CAPACITOR: variable; 8.0 to 75.0 uuf 350 wv	917 1075 00
C230	V201 voltage divider	CAPACITOR: mica; 430 uuf p/m 2%; 300 wv	912 0538 00
C231	Padder for L201	CAPACITOR: mica; 39 uuf p/m 10%; 500 wv	912 0465 00
C232	V204 grid coupling	CAPACITOR, fixed: mica; 62 uuf p/m 2%; 500 dc working v	912 0478 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C233	V208 cathode	CAPACITOR: mica; 150 uuf p/m 2%; 500 wv	912 0505 00
C234	V208 feedback	CAPACITOR: mica; 15 uuf p/m 5%; 500 wv	912 0437 00
C235	V208 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C236	V204 grid filter	CAPACITOR: mica; 510 uuf p/m 10%; 300 wv	912 0546 00
C237	Neutralizer padder	CAPACITOR: mica; 33 uuf p/m 10%; 500 wv	912 0459 00
C238	Padder for L214	CAPACITOR: mica; 10 uuf p/m 5%; 500 wv	912 0431 00
C239	V209 grid coupling	CAPACITOR: mica; 10 uuf p/m 5%; 500 wv	912 0431 00
C240	Padder for L215	CAPACITOR: mica; 20 uuf p/m 5%; 500 wv	912 0443 00
C241	Padder for L216	CAPACITOR: mica; 75 uuf p/m 2%; 500 wv	912 0484 00
C242	Padder for L217	CAPACITOR: mica; 220 uuf p/m 2%; 500 wv	912 0517 00
C243	B plus bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C244	V204 grid coupling	CAPACITOR: ceramic; 5.0 uuf p/m 10%; 500 wv	916 0429 00
C245	V204 plate decoupling	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C246	B plus bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C247	40 M padder for L223	CAPACITOR: mica; 82 uuf p/m 10%; 500 wv	912 0489 00
C248	40 M trimmer for L223	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C249	8 MC trap tuning	CAPACITOR: variable; 5.0 to 37.5 uuf; 350 wv	917 1073 00
C250	20 M trimmer for L218	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C251	Padder for L213	CAPACITOR: mica; 5 uuf p/m 10%; 500 wv	912 0429 00
C252	15 M trimmer for L219	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C253	80 meter trap resonating	CAPACITOR: ceramic; 36 uuf p/m 2%; 500 wv	916 0460 00
C254	11 meter trimmer for L221	CAPACITOR: variable; 5.0 to 37.5 uuf; 350 wv	917 1073 00
C255	10 M trimmer for L221	CAPACITOR: variable; 3.0 to 18.0 uuf; 350 wv	917 1072 00
C256	10 M trimmer for L221	CAPACITOR: variable; 3.0 to 18.0 uuf; 350 wv	917 1072 00
C257	10 meter trimmer for L227	CAPACITOR: variable; 3.0 to 18.0 uuf; 350 wv	917 1072 00
C258	V205 grid coupling	CAPACITOR: mica; 470 uuf p/m 2%; 300 wv	912 0541 00
C259	V209 plate decoupling	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C260	V209 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C261	V209 cathode bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C262	V208 plate blocking	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C263	V203 screen decoupling	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C264		CAPACITOR: Not Used	
C265	10 M trimmer for L234	CAPACITOR: variable; 3.0 to 18.0 uuf; 350 wv	917 1072 00
C266	11 M trimmer for L234	CAPACITOR: variable; 5.0 to 37.5 uuf; 350 wv	917 1073 00
C267	15 M trimmer for L236	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C268	L207 bypass and voltage divider	CAPACITOR: mica; 20 uuf p/m 10%; 500 wv	912 0444 00

Section VI
C-269 - C-292

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C269	20 M trimmer for L237	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C270	V205 plate decoupler	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C271	40 meter padder for L231	CAPACITOR: mica; 68 uuf p/m 2%; 500 wv	912 0481 00
C272	40 meter trimmer for L231	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C273	V205 plate decoupling	CAPACITOR: mica; 100 uuf p/m 2%; 500 wv	912 0493 00
C274		Not used	
C275	V205 plate blocking	CAPACITOR: mica; 100 uuf p/m 2%; 500 wv	912 0493 00
C276		Not used	
C277	Driver neutralizer voltage divider	CAPACITOR: ceramic; 1.5 uuf p/m 1/4 mmf; 500 wv	916 0072 00
C278	Driver screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C279	B plus bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C280		Not used	
C281	Driver neutralizer voltage divider	CAPACITOR: mica; 5 uuf p/m 10%; 500 wv	912 0429 00
C282		Not used	
C283	Driver grid plate neutralizer	CAPACITOR: variable; 5.0 to 37.5 uuf; 350 wv	917 1073 00
C284 thru C289		Not used	
C290	B plus RF filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C291	Filament line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C292	Filament line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C293	V203 plate blocking	CAPACITOR: mica; 100 uuf p/m 2%; 500 wv	912 0493 00
C294	B plus RF filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C295	V205 cathode bypass	CAPACITOR: ceramic; 10,000 uuf 500 wv	913 1188 00
C296	V205 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C297	V202 ALC filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C298	PA neut voltage divider	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C299	Key line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C300	B plus RF filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C301	10 M trimmer for L227	CAPACITOR: variable; 3.0 to 18.0 uuf; 350 wv	917 1072 00
C302	11 meter trimmer for L227	CAPACITOR: variable; 5.0 to 37.5 uuf 350 wv	917 1073 00
C303	B plus bypass	CAPACITOR: paper; .033 uuf p/m 10%; 400 wv	931 0293 00
C304	15 M trimmer for L229	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C305	Driver plate blocking	CAPACITOR: mica; 510 uuf p/m 10%; 300 wv	912 0546 00
C306	20 M trimmer for L230	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C308	40 M trimmer for L225	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C309	40 M padder for L225	CAPACITOR: mica; 82 uuf p/m 10%; 500 wv	912 0489 00
C310	Driver grid load blocking	CAPACITOR: ceramic; 10,000 uuf 500 wv	913 1188 00
C312	V-208 plate decoupling	CAPACITOR: ceramic; 10,000 uuf 500 wv	913 1188 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C313	J102 RF filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C314	RF Bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C315		NOT USED	
C316		Not used	
C317	J201 blocking	CAPACITOR: mica; 5 uuf p/m 10%; 500 wv	912 0429 00
C318	J207 blocking	CAPACITOR: mica; 5 uuf p/m 10%; 500 wv	912 0429 00
C319	V-206 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C320	V-206 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C321	V-207 screen bypass	CAPACITOR: ceramic; 10,000 uuf; 500 wv	913 1188 00
C322	80 M neutralizing cap	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C323	V-201 grid return bypass	CAPACITOR: mica; 510 uuf p/m 10%: 300 wv	912 0546 00
C324	ALC time constant	CAPACITOR: .47 uf ±20%; 100 wv	931 0500 00
C325	ALC time constant	CAPACITOR: paper; .0033 uf ±10%; 400 wv	931 0283 00
C328	PA bias line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C329	Padder for L-218	CAPACITOR: mica; 15 uuf p/m 10%; 500 wv	912 0438 00
C330	Padder for L-230	CAPACITOR: mica; 15 uuf p/m 10%; 500 wv	912 0438 00
C331	Padder for C-707	CAPACITOR: mica; 15 uuf p/m 10%; 500 wv	912 0438 00
C332	J102 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C333	J102 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C334	J102 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C335	J102 rf filter	CAPACITOR: ceramic; 1000 uuf +80%, -20%, 500 wv	913 1292 00
C336	J102 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C337	J102 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C338	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C339	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C340	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C341	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C342	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C343	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C344	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C345	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C346	J103 rf filter	CAPACITOR: ceramic; 1000 uuf +80% -20%, 500 wv	913 1292 00
C347	J103 rf filter	SUPPRESSOR, electrical noise: 0.01 uf ±20%, 600 wv	241 0085 00
C348	J103 rf filter	SUPPRESSOR; electrical noise: 0.01 uf ±20%, 600 wv	241 0085 00
C349	J103 rf filter	SUPPRESSOR, electrical noise: 0.01 uf ±20%, 600 wv	241 0085 00
C350	J103 rf filter	SUPPRESSOR; electrical noise: 0.01 uf ±20%, 600 wv	241 0085 00
C351	J103 rf filter	SUPPRESSOR, electrical noise: 0.01 uf ±20%, 600 wv	241 0085 00
C402	Negative feedback capacitor	CAPACITOR: ceramic; 5 uuf p/m 10%; 5000 WV	913 0092 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C403	ALC coupling capacitor	CAPACITOR: paper; .1 uf $\pm 10\%$; 200 WV	931 0333 00
C404	V-401 screen bypass	p/o XV401A	
C405	V-402 screen bypass	p/o XV402A	
C406	PA plate blocking	CAPACITOR: ceramic; 1000 uuf p/m 20%; 5000 WV	913 0101 00
C407	PA tuning	CAPACITOR: variable, air; 23-235 uuf	540 5509 00
C408	PA loading	CAPACITOR: variable, air; 25.2-570 uuf	540 5515 00
C409	PA loading	CAPACITOR: variable air; 25.2-570 uuf	540 5515 00
C413	V403 plate stabilizing	CAPACITOR: paper; 0.1 uf p/m 10%; 150 WV	931 0333 00
C414	ALC bias line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 WV	913 1292 00
C415	PA screen line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 WV	913 1292 00
C416	PA plate line filter	CAPACITOR: paper; .01 uf minus 10% plus 30%; 2500 WV	241 0167 00
C417	ALC output line filter	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 WV	913 1292 00
C418	PA filament line filter	CAPACITOR: paper; 0.1 uf plus 20% minus 10%; 600 WV	241 0006 00
C419	PA filament line filter	CAPACITOR: ceramic; 10,000 uuf; 500 WV	913 1188 00
C501	L501 tuning	CAPACITOR: paper; 0.15 uf p/m 10%; 10,000 WV	930 0035 00
C502		Not used	
C503	HV filter	CAPACITOR: paper; 4 uf p/m 10%; 3000 WV	930 4340 00
C504	HV filter	CAPACITOR: paper; 4 uf p/m 10%; 3000 WV	930 4340 00
C505	Screen supply filter	CAPACITOR: electrolytic; 40 uf -15% +100%; 500 WV	183 1124 00
C506	Regulated supply stabilizer	CAPACITOR: paper; 0.022 uf p/m 10%; 400 WV	931 0291 00
C507	Bias supply filter	CAPACITOR: electrolytic; 10 uf +50% -10%; 450 WV	183 1085 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
C508	Bias supply filter	CAPACITOR: electrolytic; 10 uf +50% -10%; 450 wv	183 1085 00
C509	LV supply filter	CAPACITOR: dry electrolytic; dual section 40 mf each section, -15% +100%; 450 dc working v	183 1009 00
C510	Antenna relay supply filter	CAPACITOR: electrolytic; 10 uf +100% -10%; 150 wv	183 1040 00
C703	80 M padder for L701	CAPACITOR: mica; 390 uuf p/m 10%; 500 wv	912 0537 00
C704	40 M padder for L703	CAPACITOR: mica; 150 uuf p/m 2%; 500 wv	912 0505 00
C707	11 M trimmer for L705	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C708	10 M trimmer for L705	CAPACITOR: variable; 5.0 to 37.5 uuf; 350 wv	917 1073 00
C709		CAPACITOR: Not Used	
C710	80 M trimmer for L701	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C711	40 M trimmer for L703	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C712	30 M trimmer for L702	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C713	15 M trimmer for L704	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
C714	Driver cathode bypass	CAPACITOR: ceramic; 1000 uuf minus 20% plus 80%; 500 wv	913 1292 00
C715	Driver cathode neutralizer	CAPACITOR: variable; 8.0 to 75.0 uuf; 350 wv	917 1075 00
CR101	Part of balanced Mod.	CRYSTAL UNIT: rectifying; metallic; 75 peak inverse v; 1N67A	353 0147 00
CR102	Part of balanced Mod.	CRYSTAL UNIT: rectifying; metallic; 75 peak inverse v; 1N67A	353 0147 00
CR103	Part of balanced Mod.	CRYSTAL UNIT: rectifying; metallic; 75 peak inverse v; 1N67A	353 0147 00
CR104	Part of balanced Mod.	CRYSTAL UNIT: rectifying; metallic; 75 peak inverse v; 1N67A	353 0147 00
CR201	Spark Suppressor	RECTIFIER: metallic; selenium; input 130 v ac; output 50 ma	353 0153 00
CR501	Antenna relay supply rectifier	RECTIFIER: metallic; selenium; input 130 v ac, 60 cps; output 52 v dc min	353 0186 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
CR701	Filament meter rectifier	CRYSTAL UNIT: rectifying; metallic; 75 peak inverse v; 1N34A	353 0103 00
CR702	Filament meter rectifier	CRYSTAL UNIT: rectifying; metallic; 75 peak inverse v; 1N34A	353 0103 00
E201	V207 grid parasitic suppressor	SUPPRESSOR: parasitic; six turns #18 AWG wire wnd on 330 ohm 1 w resistor	540 5253 00
E202	V206 grid parasitic suppressor	SUPPRESSOR: parasitic; six turns #18 AWG wire wnd on 330 ohm 1 w resistor	540 5253 00
E203	V206 plate parasitic suppressor	SUPPRESSOR: parasitic; six turns #18 AWG wire wnd on 330 ohm 1 w resistor	540 5253 00
E204	V207 plate parasitic suppressor	SUPPRESSOR: parasitic; six turns #18 AWG wire wnd on 330 ohm 1 w resistor	540 5253 00
E403	V401 parasitic suppressor	SUPPRESSOR: parasitic; two turns #18 AWG wire wnd on 47 ohm 2 w resistor	540 5641 00
E404	V402 parasitic suppressor	SUPPRESSOR: parasitic; two turns #18 AWG wire wnd on 47 ohm 2 w resistor	540 5641 00
E501	HV output post	INSULATOR: standoff; round post shape; grade L-4 ceramic	190 0024 00
E501A	HV terminal	STUD: cadmium plate, 10-32 stud, 1" long	312 3040 00
E502	Ground terminal	STUD: cadmium plate, 10-32 stud, 1" long	312 3040 00
F501	Plate transformer fuse	FUSE: cartridge; 20 amp	264 4160 00
F502	Plate and screen transformer fuse	FUSE: cartridge; 10 amp, 25 v	264 4140 00
F503	Filament and blower fuse	FUSE: cartridge; 3.2 amp, 250 v, slow blow	264 0216 00
F504	Filament LV transformer fuse	FUSE: cartridge; 3.2 amp, 250 v, slow blow	264 0216 00
F505	Screen fuse	FUSE: cartridge; 1/4 amp	264 4020 00
F506	HV plate fuse	FUSE: HV; 1 amp	264 0252 00
FL101	Sideband filter	FILTER: mech; 250 kc	522 9080 002
I101	Kilocycle dial lamp	LAMP: incandescent; 6-8 v, 0.25 amp; bulb	262 0264 00
I102	Megacycle dial lamp	LAMP: incandescent; 6.3 v, 0.15 amp; bulb	262 3240 00
I103	Megacycle dial lamp	LAMP: incandescent; 6.3 v, 0.15 amp; bulb	262 3240 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
I104	Meter lamp	p/o M-201	
I501	Filament pilot lamp	BULB: LIGHT; candelabra base	262 3320 00
I502	Plate pilot lamp	BULB: LIGHT; candelabra base	262 3320 00
I701	Pilot lamp	p/o M-701	
J101	Microphone connector	CONNECTOR: receptacle; two round female contacts; straight	369 1004 00
J102	Control cable connector	CONNECTOR: receptacle; 15 round male cont; straight	372 1079 00
J103	Power cable connector	CONNECTOR: plug; 20 round male cont; straight	372 1069 00
J104	Phone patch input audio amplr V-101	JACK: phone; single round female cont	360 0088 00
J201	6CL6 plate test point	CONNECTOR: receptacle; single round female cont; straight	357 9100 00
J203	VFO injection test point	CONNECTOR: receptacle; single round female contact; straight	357 9100 00
J204	250 KC injection test point	CONNECTOR: receptacle; single round female contact; straight	357 9100 00
J205	Xtal injection test point	CONNECTOR: receptacle; single round female contact; straight	357 9100 00
J206	VIF test point	CONNECTOR: receptacle; single round female contact; straight	357 9100 00
J207	6CL6 grid test point	CONNECTOR: receptacle; single round female contact; straight	357 9100 00
J208	6CL6 cathode test point	CONNECTOR: receptacle; single round female contact; straight	357 9100 00
J401	Antenna connector jack	CONNECTOR: receptacle; single round female contact	357 9003 00
J402	PA plate voltage input jack	CONNECTOR: plug; single round male contact	372 1489 00
K101	Carrier control relay	RELAY: armature; cont arrangement, 1C, 2A, and 1B	972 1353 00
K501	Plate contactor	RELAY: power; contact rating 15 amp; noninductive at 115 v ac	401 1194 00
K502		Not Used	

Section VI
K503 - L214

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
K503	Time delay	RELAY: thermal; contact rating 3 amp 150 v dc, 3 amp 250 v ac	402 0211 00
L102	V104 B plus choke	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L103	V104 B plate choke	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L104	V104 B cathode series choke	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L105	Mod. input choke	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L106	Mod. input choke	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L201	V201 plate coil	COIL: 80 mh	540 5270 002
L202	B plus line filter	COIL: RADIO FREQUENCY: 139 turns of #36 AWG wire	240 0134 00
L203	V202 grid coil	COIL: 80 mh	540 5270 002
L204	V202 plate coil	COIL: 80 mh	540 5270 002
L205	B plus line filter	COIL: RADIO FREQUENCY: 139 turns of #36 AWG wire	240 0134 00
L206	V203 grid coil	COIL: 80 mh	540 5270 002
L207	V203 plate coil	COIL: 80 mh	540 5270 002
L208	V201 plate choke	COIL, RADIO FREQUENCY: 139 turns of #36 AWG wire	240 0134 00
L209	80 meter trap coil	COIL, RADIO FREQUENCY: choke; 47 uh; single layer wnd; #22 AWG enameled wire	240 0190 00
L210	B plus line filter	COIL, RADIO FREQUENCY: 139 turns of #36 AWG wire	240 0134 00
L211	V208 cathode choke	COIL, RADIO FREQUENCY: choke; 112 turns #36 nylon enameled wire	240 0073 00
L212	V208 26 mc tank	COIL, RADIO FREQUENCY: 10 turns #26 AWG enameled wire	540 5254 00
L213	V208 25 mc tank	COIL, RADIO FREQUENCY: 10 turns #26 AWG enameled wire	540 5254 00
L214	V208 23.4 mc tank	COIL, RADIO FREQUENCY: 10 turns #26 AWG enameled wire	540 5254 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
L215	V208 18 mc tank	COIL: tuning; 18 mc	540 5256 00
L216	V208 11 mc tank	COIL: tuning; 18 mc	540 5256 00
L217	V208 4 mc tank	COIL, RADIO FREQUENCY: 25 turns #32 AWG enameled wire	540 5257 00
L218	V204 20 M tank	COIL, RADIO FREQUENCY: 19 turns #30 AWG enameled wire	540 5258 00
L219	V204 15 M tank	COIL, RADIO FREQUENCY: 13 turns #26 AWG enameled wire	540 5259 00
L220	8 mc trap inductor	COIL, RADIO FREQUENCY: choke; 47 uh; single layer wnd; #22 AWG enameled wire	240 0190 00
L221	V204 11 and 10 M tank	COIL, RADIO FREQUENCY: 11 turns #26 AWG enameled wire	540 5260 00
L222	V204 plate choke	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L223	V204 40 M tank	COIL, RADIO FREQUENCY: 6.58 turns #30 AWG wire	540 5271 002
L224	V209 plate choke	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L225	V209 40 M tank	COIL, RADIO FREQUENCY: 6.58 turns #30 AWG wire	540 5271 002
L226		Not used	
L227	V209 11 and 10 M tank	COIL, RADIO FREQUENCY: 11 turns #26 AWG enameled wire	540 5260 00
L228	V208 plate choke	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L229	V209 15 M tank	COIL, RADIO FREQUENCY: 13 turns #26 AWG enameled wire	540 5259 00
L230	V209 20 M tank	COIL, RADIO FREQUENCY: 19 turns #30 AWG enameled wire	540 5258 00
L231	V205 40 M tank	COIL, RADIO FREQUENCY: 6.58 turns #30 AWG wire	540 5271 002
L232	B plus line filter	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L233	V203 plate choke	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00

Section VI
L234 - J256

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
L234	V205 11 and 10 M tank	COIL, RADIO FREQUENCY: 7 turns #26 AWG enameled wire	540 5325 00
L235	V205 plate choke	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L236	V205 15 M tank	COIL, RADIO FREQUENCY: 10 turns #26 AWG enameled wire	540 5254 00
L237	V205 20 M tank	COIL, RADIO FREQUENCY: 19 turns #30 AWG enameled wire	540 5258 00
L238	Driver plate chokes	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L239	PA Bias line filter	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L240 thru L245		Not used	
L246	B plus line filter	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L247	ALC line filter	COIL, RADIO FREQUENCY: 139 turns #36 AWG wire	240 0134 00
L248	V205, V206, V207 filament line filter	COIL, RADIO FREQUENCY: 20 turns #18 AWG wire	540 5252 00
L249	Driver Cathode Choke	COIL, RADIO FREQUENCY: choke, single wound, single layer wound; 0.22 uh \pm 20%, 2000 ma max dc	240 0067 00
L250	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L251	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L252	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L253	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L254	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
J255	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 000
J256	J103 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
L257	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns No. 18 wire	540 5252 00
L258	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns No. 18 wire	540 5252 00
L259	J103 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L260	J103 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L261	J103 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 uh p/m 10% at 350 kc	240 0084 00
L262	J103 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 mh p/m 10% at 350 kc	240 0084 00
L263		Not used	
L264	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns, #18 wire	540 5252 00
L265	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns, #18 wire	540 5252 00
L266	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns, #18 wire	540 5252 00
L267	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns, #18 wire	540 5252 00
L268	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns, #18 wire	540 5252 00
L269	J103 rf filter	COIL, RADIO FREQUENCY: choke, 20 turns, #18 wire	540 5252 00
L270	V204 plate loading	COIL, RADIO FREQUENCY: choke, single wound, 2.0 mh \pm 10% at 350 kc	240 0084 00
L271	J102 rf filter	COIL, RADIO FREQUENCY: choke, single wound, 2.0 mh \pm 10% at 350 kc	240 0084 00
L401	PA tuning coil	INDUCTOR: rotary; 15 uh, 24 turns #12 AWG tinned copper	980 0111 00
L402	PA loading coil	INDUCTOR: rotary: 10 uh, 17 turns #14 AWG tinned copper	980 0110 00
L403	PA plate choke	COIL, RADIO FREQUENCY: choke, 159 turns #27 chrome oxide wire	540 7979 00
L404	Static drain choke	COIL, RADIO FREQUENCY: 139 turns #36 AWG SNE wire	240 0134 00

Section VI
L405 - R101

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
L405	PA screen choke	COIL, RADIO FREQUENCY: choke, 500 uh; 112 turns #36 nylon enamel wire	240 0073 00
L406	PA 10 meter inductor	COIL: double ear soldering lug; brass	540 5486 002
L501	HV filter choke	REACTOR: filter; 55 ohms nominal; 120 cps	668 0153 00
L502	LV filter choke	REACTOR: filter choke; 4 hy, 230 ma, 100 ohm dc resistance; 1600 v rms tests; enclosed metal case	668 0147 00
L503	Screen filter choke	REACTOR: filter; 12 hy; 375 nominal ohm	668 0004 00
L504	LV filter choke	REACTOR: filter choke; 4 hy, 230 ma, 100 ohm dc resistance; 1600 v rms test; enclosed metal case	668 0147 00
L701	Driver 80 M tank	COIL: 80 mh	540 5673 002
L702	Driver 20 M tank	COIL, RADIO FREQUENCY: 10 turns #26 AWG enameled wire	540 5254 00
L703	Driver 40 M tank	COIL, RADIO FREQUENCY: 17 turns #28 AWG wire	540 5670 002
L704	Driver 15 M tank	COIL: 15 mh	540 5671 002
L705	Driver 11 and 10 M tank	COIL, RADIO FREQUENCY: 4 turns #26 AWG wire	540 5672 00
L706	Driver cathode choke	COIL, RADIO FREQUENCY: choke 112 turns #36 nylon enameled wire	240 0073 00
M201	Multimeter	METER: signal level; 0-1 ma dc; 50 ohm p/m 20%	458 0238 00
M701	PA plate current meter	METER: milliammeter; 0-800 mc dc	458 0293 00
P102	Control cable plug	CONNECTOR: receptacle; 15 female cont; straight COVER: for 15 cont plug connector	372 1081 00 372 1083 00
P103	Power cable plug	CONNECTOR, RECEPTACLE ELECTRICAL: 20 female cont; straight COVER: for 20 cont connector	372 1071 00 372 1073 00
P104	Phone patch input audio amplr V101	PLUG: phone; single round male cont	361 0045 00
P401	Antenna connection plug	CONNECTOR, PLUG ELECTRICAL: single round male contact	357 9040 00
P402	PA plate voltage plug	CONNECTOR, RECEPTACLE ELECTRICAL: single round female contact	372 1490 00
R101	Audio input rf filter	RESISTOR: comp; 4700 ohm p/m 10%; 1/2 w	745 1380 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
R102	V101A grid	RESISTOR: comp; 1 megohm p/m 10%; 1/2 w	745 1478 00
R103	V101A cathode	RESISTOR: comp; 680 ohm p/m 10%; 1/2 w	745 1345 00
R104	V101A plate	RESISTOR: comp; 0.22 megohm p/m 10%, 1/2 w	745 1450 00
R105	V101B grid	RESISTOR: comp; 470,000 ohm p/m 10%, 1/2 w	745 1464 00
R106	V101B cathode	RESISTOR: comp; 1000 ohm ±10%, 1/2 w	745 1352 00
R107	V101 plate decoupling	RESISTOR: comp; 27,000 ohm p/m 10%, 1/2 w	745 1412 00
R108	V101B plate	RESISTOR: comp; 56,000 ohm p/m 10%, 1/2 w	745 1426 00
R109	Audio gain control	RESISTOR: variable; 1 megohm p/m 20%; 1/2 w	376 3528 00
R110	V102A cathode	RESISTOR: comp; 220 ohm p/m 10%; 1/2 w	745 1324 00
R111	V102A plate dropping	RESISTOR: comp; 27,000 ohm p/m 10%, 1/2 w	745 1412 00
R112	Carrier balance	RESISTOR: variable; 100 ohm p/m 20%, 1/2 w	380 6271 00
R113	VOX speech gain control	RESISTOR: variable; 1 megohm p/m 20%, 1/2 w	376 3513 00
R114	V103A cathode	RESISTOR: comp; 330 ohm p/m 10%, 1/2 w	745 1331 00
R115	V103A plate	RESISTOR: comp; 100,000 ohm p/m 10%, 1/2 w	745 1436 00
R116	V107A plate	RESISTOR: comp; 100,000 ohm p/m 10%, 1/2 w	745 1436 00
R117	V103B grid	RESISTOR: comp; 2.2 megohm p/m 10%, 1/2 w	745 1492 00
R118	V103B cathode	RESISTOR: comp; 680 ohm p/m 10%, 1/2 w	745 1345 00
R119	V103 fixed bias series	RESISTOR: wire wound; 22,000 ohm p/m 10%; 10 w	710 0260 00
R120	Receiver muting divider	RESISTOR: comp; 68,000 ohm p/m 10%; 2 w	745 5729 00
R121	Receiver muting divider	RESISTOR: comp; 10,000 ohm p/m 10%; 1/2 w	745 1394 00
R122	VOX speaker gain	RESISTOR: variable; 1 megohm p/m 20%; 1/2 w	376 3528 00
R123	V102B cathode	RESISTOR: comp; 330 ohm p/m 5%; 1/2 w	745 1331 00
R124	V102B plate	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00
R125	V107B cathode	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00
R126	V103B grid	RESISTOR: comp; 2.2 megohm p/m 10%; 1/2 w	745 1492 00
R127	V104B grid	RESISTOR: comp; 0.47 megohm p/m 10%; 1/2 w	745 1464 00

Section VI
R128 - R148

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
R128	V102A grid decoupling	RESISTOR: comp; 0.47 megohm p/m 10%; 1/2 w	745 1464 00
R129	Carrier level control	RESISTOR: variable; 100,000 ohm $\pm 20\%$; 2 w	380 0631 00
R130	V104A grid	RESISTOR: comp; 0.47 megohm p/m 10%; 1/2 w	745 1464 00
R131	Voltage regulator dropping	RESISTOR: wire wound; 2500 ohm $\pm 5\%$; 11 w	746 6088 00
R132	Filament bias divider	RESISTOR: comp; 470,000 ohm p/m 10%; 1/2 w	745 1464 00
R133	Filament bias divider	RESISTOR: comp; 68,000 ohm p/m 10%; 1/2 w	745 1429 00
R134	V107A cathode	RESISTOR: comp; 1.5 megohm $\pm 10\%$; 1/2 w	745 1485 00
R135	V107B plate	RESISTOR: comp; 1.5 megohm $\pm 10\%$; 1/2 w	745 1485 00
R136	Keying filter	RESISTOR: comp; 10,000 ohm p/m 10%; 1/2 w	745 1394 00
R137	Keying filter	RESISTOR: comp; 1 megohm p/m 10%; 1/2 w	745 1478 00
R138	Keying filter	RESISTOR: comp; 2700 ohm p/m 10%; 1/2 w	745 1370 00
R139	Keying filter	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00
R140		Not used	
R141	Keying filter	RESISTOR: comp; 22,000 ohm p/m 10%; 1/2 w	745 1408 00
R142		Not used	
R143	V201 grid decoupling	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R144	Receiver muting divider	RESISTOR: comp; 68,000 ohm p/m 10%; 2 w	745 5729 00
R146	V104A plate load	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R147		Not used	
R148	V104B cathode	RESISTOR: comp; 4700 ohm p/m 10%; 1/2 w	745 1380 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
R149	V104B cathode	RESISTOR: comp; 220 ohm p/m 10%; 1/2 w	745 1324 00
R150	Balanced modulator bridge	RESISTOR: comp; 680 ohm p/m 10%; 1/2 w	745 1345 00
R151	Balanced modulator bridge	RESISTOR: comp; 680 ohm p/m 10%; 1/2 w	745 1345 00
R152	V102A grid	RESISTOR: comp; 0.22 megohm p/m 10%; 1/2 w	745 1450 00
R153	V102A cathode load	RESISTOR: comp; 4700 ohm p/m 10%; 1/2 w	745 1380 00
R154	V102A grid divider	RESISTOR: comp; 0.47 megohm ±10%, 1/2 w	745 1464 00
R155	V103A grid series	RESISTOR: comp; 0.33 megohm ±10%, 1/2 w	745 1457 00
R156	Shunt for R112	RESISTOR: comp; 22 ohm p/m 10%; 1/2 w	745 1282 00
R157	Shunt for R112	RESISTOR: comp; 22 ohm p/m 10%; 1/2 w	745 1282 00
R158	V102A output level adj.	RESISTOR: comp; 100 ohm ±10%; 1/2 w	745 1352 00
R201	V201 grid stabilizer	RESISTOR: comp; 47 ohm p/m 10%; 1/2 w	745 1296 00
R202	V201 cathode	RESISTOR: comp; 220 ohm p/m 10%; 1/2 w	745 1324 00
R203	V201 grid	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00
R204	V201 plate decoupling	RESISTOR: comp; 10,000 ohm p/m 10%; 2 w	745 5694 00
R205	V202 grid decoupling	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R206	V202 cathode	RESISTOR: comp; 220 ohm ±10%, 1/2 w	745 1324 00
R207	ALC zero control	RESISTOR: wire wound; 250 ohm ±10%; 2 w	750 0519 00
R208	80 M driver load	RESISTOR: comp; 8,200 ohms p/m 10%; 2 w	745 5691 00
R209	V202 screen divider	RESISTOR: comp; 150 ohm p/m 10%; 1/2 w	745 1317 00
R210	V202 screen divider	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R211	V202 screen	RESISTOR: comp; 22,000 ohm p/m 5%; 1 w	745 3407 00
R212	V202 plate decoupling	RESISTOR: comp; 1000 ohm p/m 10%; 1/2 w	745 1352 00
R213	V203 grid decoupling	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R214	V203 cathode	RESISTOR: comp; 220 ohm ±10%; 1/2 w	745 1324 00
R215	V203 screen bleeder	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R216	V203 screen	RESISTOR: comp; 22,000 ohm p/m 5%; 1 w	745 3407 00
R217	V203 plate decoupling	RESISTOR: comp; 1000 ohm p/m 10%; 1/2 w	745 1352 00
R218	V204 grid	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00

Section VI
R219 - R245

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
R219	V204 cathode	RESISTOR: comp; 220 ohm p/m 10%; 1/2 w	745 1324 00
R220	V204 grid	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00
R221	V208 screen	RESISTOR: comp; 470,000 ohm p/m 10%; 1/2 w	745 1464 00
R222	V208 plate decoupling	RESISTOR: comp; 4700 ohm p/m 10%; 1/2 w	745 1380 00
R223	V204 plate decoupling	RESISTOR: comp; 10,000 ohm p/m 10%; 2 w	745 5694 00
R224	V202 grid suppressor	RESISTOR: comp; 4700 ohm \pm 10%; 1/2 w	745 1296 00
R225	V205 cathode	RESISTOR: comp; 220 ohm p/m 10%; 1/2 w	745 1324 00
R226	V205 screen bleeder	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R227	V205 screen	RESISTOR: comp; 22,000 ohm p/m 5%; 1 w	745 3407 00
R228	V205 plate decoupling	RESISTOR: wire wound; 4000 ohm p/m 10%; 10 w	710 1442 00
R229	Driver grid	RESISTOR: comp; 18,000 ohm p/m 10%; 1/2 w	745 1405 00
R230	V209 plate decoupling	RESISTOR: comp; 1000 ohm p/m 10%; 1/2 w	745 1352 00
R231	Driver screen	RESISTOR: comp; 4700 ohm p/m 10%; 2 w	745 5680 00
R232	V209 screen	RESISTOR: comp; 22,000 ohm p/m 5%; 1 w	745 3407 00
R233	V208 grid	RESISTOR: comp; 100,000 ohm p/m 10%; 1/2 w	745 1436 00
R234	V209 screen bleeder	RESISTOR: comp; 47,000 ohm p/m 10%; 1/2 w	745 1422 00
R235	V209 cathode	RESISTOR: comp; 560 ohm p/m 10%; 1/2 w	745 1342 00
R236	Load for L230	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R237	Load for L229	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R238	40 M load for L231	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R239	Load for L237	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R240	Load for L236	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R241	11 M load for L234	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R242	10 M load for L234	RESISTOR: comp; 2700 ohm \pm 10%; 1/2 w	745 1370 00
R243	40 M load for L227	RESISTOR: comp; 27 ohm \pm 10%; 1/2 w	745 1384 00
R244	V205 parasitic suppressor	RESISTOR: comp; 27 ohm \pm 10%; 1/2 w	745 1286 00
R245	V204 grid loading	RESISTOR: comp; 4700 ohm \pm 10%; 1/2 w	745 1380 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
R246		NOT USED	
R247	ALC time constant	RESISTOR: comp; 3.3 megohm $\pm 10\%$; 1/2 w	745 1499 00
R248	ALC time constant	RESISTOR: comp; 680,000 ohm p/m 10%; 1/2 w	745 1471 00
R249	Parasitic suppressor	RESISTOR: comp; 47 ohms p/m 10%; 1/2 w	745 1296 00
R406	V403 plate stabilizing	RESISTOR: comp; 3300 ohm p/m 10%; 1/2 w	745 1373 00
R407	Parasitic suppressor	RESISTOR: comp; 470 ohms p/m 10%; 2 w	745 5638 00
R501	K503 heater series	RESISTOR: comp; 4700 ohm p/m 10%; 2 w	745 9083 00
R502	HV bleeder	RESISTOR: wire wound, 25,000 ohm p/m 10%; 160 w	710 6254 00
R503	HV bleeder	RESISTOR: wire wound, 25,000 ohm p/m 10%; 160 w	710 6254 00
R504	V504 plate	RESISTOR: comp; 470,000 ohm p/m 10%; 1/2 w	745 1464 00
R505	V504/V505 cathode series	RESISTOR: comp; 4700 ohm p/m 10%; 2 w	745 5680 00
R506	V504/V505 cathode series	RESISTOR: comp; 4700 ohm p/m 10%; 2 w	745 5680 00
R507	V504/V505 cathode series	RESISTOR: comp; 3900 ohm p/m 10%; 2 w	745 5677 00
R508	V504/V505 cathode series	RESISTOR: comp; 3900 ohm p/m 10%; 2 w	745 5677 00
R509	Screen adjust series	RESISTOR: comp; 560,000 ohm p/m 10%; 1/2 w	745 1468 00
R510	Screen adjust dropping	RESISTOR: comp; 47,000 ohm p/m 10%; 2 w	745 5722 00
R511	Screen adjust	RESISTOR: 25,000 ohm p/m 20%; 2 w	380 5765 00
R512	Screen adjust divider	RESISTOR: comp; 22,000 ohm p/m 10%; 1 w	745 3408 00
R513	PA bias dropping	RESISTOR: comp; 4700 ohm p/m 10%; 2 w	745 5680 00
R514	PA bias divider	RESISTOR: comp; 3300 ohm p/m 10%; 2 w	745 5673 00
R515	PA bias adjust	RESISTOR: variable; comp; 5000 ohm p/m 20%; 2 w	380 0614 00
R516	Plate meter shunt	RESISTOR: wire wound; 50 ohm p/m 10%; 25 w	710 3502 00
R517	Meter divider	RESISTOR: film; 1.0 megohm p/m 1%; 1/2 w	705 2203 00
R518	Meter divider	RESISTOR: film; 1.0 megohm p/m 1%; 1/2 w	705 2203 00
R519	Meter divider	RESISTOR: film; 1.0 megohm p/m 1%; 1/2 w	705 2203 00
R520	Meter divider	RESISTOR: film; 1.0 megohm 1/m 1%; 1/2 w	705 2203 00
R521	Meter divider	RESISTOR: film; 1.0 megohm p/m 1%; 1/2 w	705 2203 00
R522	Meter divider	RESISTOR: comp; 10,000 ohm p/m 10%; 1 w	745 3394 00

Section VI
R523 - S101C

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
R523	V507 grid divider	RESISTOR: comp; 15,000 ohm p/m 10%; 1 w	745 3401 00
R524	TUNE-OPERATE screen dropping	RESISTOR: comp; 27,000 ohm p/m 10%; 2 w	745 5712 00
R525	V507 grid divider	RESISTOR: comp; 47,000 ohm p/m 10%; 1 w	745 3422 00
R526	V507 grid divider	RESISTOR: comp; 1.0 megohm p/m 10%, 500 wv	745 5778 00
R527	V507 grid divider	RESISTOR: comp; 1.0 megohm p/m 10%; 500 wv	745 5778 00
R528	V507 grid series	RESISTOR: comp; 27,000 ohm p/m 10%; 1 w	745 3412 00
R529	Bias supply filter	RESISTOR: comp; 470 ohm p/m 10%; 1/2 w	745 1338 00
R530	Bias supply filter	RESISTOR: comp; 470 ohm p/m 10%; 1/2 w	745 1338 00
R531	LV supply bleeder	RESISTOR: comp; 68,000 ohm p/m 10%; 2 w	745 5729 00
R532	Ant. relay supply filter	RESISTOR: comp; 100 ohm p/m 10%; 1/2 w	745 1310 00
R533	V507 bias series	RESISTOR: comp; 0.10 megohm p/m 10%; 1 w	745 3436 00
R534	Surge damper	RESISTOR: wire wound, 50 ohms \pm 10%; 10 w	710 1502 00
R535	Heater to cathode leakage protection	RESISTOR; comp, 1.0 megohm \pm 10%; 1/2 w	745 1478 00
R705	Multimeter shunt	RESISTOR: wire wound; 1 ohm p/m 3%; 2 w	747 9296 00
R706	R706A and R706B	(incl)	
R706A	Multimeter shunt	RESISTOR: comp; 10 ohm p/m 10%; 1/2 w	745 1268 00
R706B	Multimeter shunt	RESISTOR: comp; 10 ohm p/m 10%; 1/2 w	745 1268 00
R707	Filament meter multiplier	RESISTOR: 4320 ohm p/m 1%; 1/2 w	705 2146 00
R708	Driver cathode	RESISTOR: comp; 1000 ohm p/m 10%; 1/2 w	745 1352 00
R709	PA screen bleeder	RESISTOR: wire wound; 20,000 ohm p/m 5%; 12 w	747 9246 00
RT101	Oscillator filament voltage regulator	TUBE: 3TF4A	734 0004 00
S101A	Part of emission selector switch	SWITCH: rotary; 6 circuit, 6 position; nonshorting	259 0659 00
S101B	Part of emission selector switch	SWITCH: rotary; 6 circuit, 6 position; nonshorting	259 0659 00
S101C	Part of emission selector switch	SWITCH: rotary; 6 circuit, 6 position; nonshorting	259 0659 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
S102	Sideband select switch	SWITCH: rotary; 1 circuit, 12 position; shorting	269 1680 00
S201A	Part of Band Change switch	SWITCH: rotary; 1 circuit, 12 position; nonshorting	269 1692 00
S201B	Part of Band Change switch	SWITCH: rotary; 1 circuit, 12 position; nonshorting	269 1692 00
S201C	Part of Band Change switch	SWITCH: rotary; 2 circuit, 12 position; nonshorting	269 1693 00
S201D	Part of Band Change switch	SWITCH: rotary; 1 circuit, 12 position; nonshorting	269 1694 00
S201E	Part of Band Change switch	SWITCH: rotary; 1 circuit, 12 position; nonshorting	269 1694 00
S201F	Part of Band Change switch	SWITCH: rotary; 2 circuit, 12 position; nonshorting	269 1696 00
S201G	Part of Band Change switch	SWITCH: rotary; 2 circuit, 12 position; nonshorting	269 1697 00
S201H		Not used	
S201I	Part of Band Change switch	SWITCH: rotary; 1 circuit, 12 position; nonshorting	269 1699 00
S202	TEST KEY	SWITCH	259 1020 00
S203		Not used	
S204	Tune-operate	SWITCH: toggle; spst	266 0015 00
S401	PA box lid interlock	SWITCH: sensitive; spdt; 15 amp, 115 vac	260 0839 00
S502	PLATE switch	SWITCH: toggle; spst	259 0837 00
S503	Door interlock	SWITCH: interlock	
S503A	p/o S503	SWITCH: interlock; 2 male contact	260 4040 00
S503B	p/o S503	SWITCH: interlock; 2 female contact	260 4050 00
S504	FILAMENT switch	SWITCH: dpst; toggle	266 3057 00
S505		Not used	
S506	FILAMENT VOLTAGE	SWITCH: rotary; 1 circuit, 7 position; nonshorting	259 0665 00
S507	S507A and S507B		
S507A	Part of HV grounding interlock	WASHER: contact; cad plate, brass 2" lg x 3/4" thk	504 9553 001

Section VI
S507B - V103

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
S507B	Part of HV grounding interlock	BRACKET: shorting; steel-cold rolled, bright cad plate	540 5441 002
S508	Rear-door interlock	SWITCH: interlock	
S508A	p/o S508	SWITCH: interlock; 2 male contact	260 4040 00
S508B	p/o S508	SWITCH: interlock; 2 female contact	260 4050 00
S701	Multimeter	SWITCH: rotary; 2 circuit, 5 position; nonshorting	259 0673 00
T501	PA filament	TRANSFORMER: filament; pri 115 v, secd 6.3 v, 6.6 amp; 1000 tv, 50/60 cps	662 0156 00
T502	HV rectifier filament	TRANSFORMER: power; fil type; input 115 v or 230 v; single output winding; output 2.5 v center tapped input 2500 v rms test	672 0399 00
T503	HV plate	TRANSFORMER: plate; input 115 v or 230 v rms, 50/60 cps, single phase; 5000 tv	662 0155 00
T504	Screen power	TRANSFORMER: power pri 115 v, secd 980 v ct; 1900 tv, 50/60 cps	662 0157 00
T505	Filament	TRANSFORMER: filament; pri 117 v ct at 107 v, secd #1: 5 v, 4.0 amp, secd #2: 6.3 v, 3.6 amp; 2500 tv; 50/60 cps	662 0158 00
T506	Low voltage supply	TRANSFORMER: power; filament and plate type, pri 115 v, secd #1: 860 v, 80 ma dc, ct; secd #2; 270 v 10 ma dc; secd #3: 5.0 v, 4.0 A p/m 3%, secd #4: 6.6 v, 9.0 A p/m 3%; secd #5: 12.6 v, 0.3 A, p/m 5%; 1600 rms test	662 0146 00
TB103	Keying network resistor board	BOARD: terminal; mtg strip for resistors	306 0296 00
TB501	Output connector	TERMINAL STRIP: 10 term	367 0438 00
TB502	Low voltage output connector	TERMINAL STRIP: 10 term	367 0438 00
TB503	Line input connector	TERMINAL STRIP: 3 term	367 0643 00
TB504		Not used	
TB505	Blower connector	TERMINAL STRIP: 2 term	367 0001 00
V001	VFO	TUBE: 5749	253 0005 00
V101	Audio amplifier	TUBE: 12AT7	255 0205 00
V102	Audio output/squelch amplr	TUBE: 12AT7	255 0205 00
V103	VOX/relay amplr	TUBE: 12AT7	255 0205 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
V104	Low freq. oscillator	TUBE: 12AT7	255 0205 00
V105	Voltage regulator	TUBE: OB2	257 0058 00
V106	Voltage regulator	TUBE: OB2	257 0058 00
V107	VOX/squelch rectifier	TUBE: 6AL5	257 0018 00
V201	1st Mixer	TUBE: 12AT7	255 0205 00
V202	1st Amplifier	TUBE: 6BA6	255 0185 00
V203	2nd Amplifier	TUBE: 6BA6	255 0185 00
V204	2nd Mixer	TUBE: 12AT7	255 0205 00
V205	4th Amplifier	TUBE: 6AN5	255 0235 00
V206	Driver	TUBE: 6CL6	255 0216 00
V207	Driver	TUBE: 6CL6	255 0216 00
V208	Crystal Oscillator	TUBE: 6AU6	255 0202 00
V209	3rd Amplifier	TUBE: 6BA6	255 0185 00
V401	Power amplifier	TUBE: 4X250B	256 0112 00
V402	Power amplifier	TUBE: 4X250B	256 0112 00
V403	ALC rectifier	TUBE: 6AL5	257 0018 00
V501	HV rectifier	TUBE: 866A/866	256 0049 00
V502	HF rectifier	TUBE: 866A/866	256 0049 00
V503	Screen rectifier	TUBE: 5Y3GT	255 0157 00
V504	Screen regulator	TUBE: 6AS7G	255 0203 00
V505	Screen regulator	TUBE: 12AX7	255 0201 00
V506	Screen regulator	TUBE: OB2	257 0058 00
V507	Screen protect	TUBE: 2D21	257 0065 00
V508	LV rectifier	TUBE: 5U4GB	257 0109 00
V509	Bias rectifier	TUBE: 6AL5	257 0018 00
XC509	For C505 and C509	WASHER: special type; phenolic used for mounting 1-3/8 in. dia electrolytic capacitor	310 0064 00
XF501	Holder for F501	HOLDER: fuse; extractor post type; for 3 AG fuse	265 1002 00

Section VI
 XF502 - XL237

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
XF502	Holder for F502	HOLDER: fuse: extractor post type; for 3AG fuse	265 1002 00
XF503	Holder for F503	HOLDER: fuse; extractor post type; for 3AG fuse	265 1002 00
XF504	Holder for F504	HOLDER: fuse; extractor post type; for 3AG fuse	265 1002 00
XF505	Holder for F505	HOLDER: fuse; extractor post type; for 3AG fuse	265 1002 00
XK503	Socket for K503	SOCKET: tube; octal	220 1005 00
XI101	Socket for I101	LAMPHOLDER: bracket for miniature bayonet base bulb	262 0150 00
XI102	Socket for I102	LAMPHOLDER: bracket for miniature bayonet base bulb	262 1210 00
XI103	Socket for I103	LAMPHOLDER: bracket for miniature bayonet base bulb	262 1210 00
XI501	Holder for I501	LAMPHOLDER: candelabra	262 0255 00
XI502	Holder for I502	LAMPHOLDER: candelabra	262 0255 00
XL212	Socket for L212	MOUNTING: coil and core holder	139 0184 00
XL213	Socket for L213	MOUNTING: coil and core holder	139 0184 00
XL214	Socket for L214	MOUNTING: coil and core holder	139 0184 00
XL215	Socket for L215	MOUNTING: coil and core holder	139 0184 00
XL216	Socket for L216	MOUNTING: coil and core holder	139 0184 00
XL217	Socket for L217	MOUNTING: coil and core holder	139 0184 00
XL218	Socket for L218	MOUNTING: coil and core holder	139 0184 00
XL219	Socket for L219	MOUNTING: coil and core holder	139 0184 00
XL221	Socket for L221	MOUNTING: coil and core holder	139 0184 00
XL227	Socket for L227	MOUNTING: coil and core holder	139 0184 00
XL229	Socket for L229	MOUNTING: coil and core holder	139 0184 00
XL230	Socket for L230	MOUNTING: coil and core holder	139 0184 00
XL234	Socket for L234	MOUNTING: coil and core holder	139 0184 00
XL236	Socket for L236	MOUNTING: coil and core holder	139 0184 00
XL237	Socket for L237	MOUNTING: coil and core holder	139 0184 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
XL702	Socket for L702	MOUNTING: coil and core holder	139 0184 00
XL703	Socket for L703	MOUNTING: coil and core holder	139 0184 00
XL704	Socket for L704	MOUNTING: coil and core holder	139 0184 00
XL705	Socket for L705	MOUNTING: coil and core holder	139 0184 00
XRT101	Socket for RT101	SOCKET: tube; 9 contact miniature; includes metal shield	220 1063 00
XV101	Socket for V101	SOCKET: tube; 9 contact miniature	220 1103 00
XV102	Socket for V102	SOCKET: tube; 9 contact miniature	220 1103 00
XV103	Socket for V103	SOCKET: tube; 9 contact miniature	220 1103 00
XV104	Socket for V104	SOCKET: tube; 9 contact miniature	220 1103 00
XV105	Socket for V105	SOCKET: tube; 7 contact miniature	220 1036 00
XV106	Socket for V106	SOCKET: tube; 7 contact miniature	220 1036 00
XV107	Socket for V107	SOCKET: tube; 7 contact miniature	220 1111 00
XV201	Socket for V201	SOCKET: tube; 9 contact miniature	220 1103 00
XV202	Socket for V202	SOCKET: tube; 7 contact miniature	220 1111 00
XV203	Socket for V203	SOCKET: tube; 7 contact miniature	220 1111 00
XV204	Socket for V204	SOCKET: tube; 9 contact miniature	220 1103 00
XV205	Socket for V205	SOCKET: tube; 7 contact miniature	220 1111 00
XV206	Socket for V206	SOCKET: tube; 9 contact miniature	220 1103 00
XV207	Socket for V207	SOCKET: tube; 9 contact miniature	220 1103 00
XV208	Socket for V208	SOCKET: tube; 7 contact miniature	220 1111 00
XV209	Socket for V209	SOCKET: tube; 7 contact miniature	220 1111 00
XV401A	Socket for V401	SOCKET: tube; 8 contact	220 1174 00
XV401B	Chimney for V401	CHIMNEY: for 8 contact tube	220 1150 00
XV402A	Socket for V02	SOCKET: tube; 8 contact	220 1174 00
XV402B	Chimney for V402	CHIMNEY: for 8 contact tube	220 1150 00
XV403	Socket for V403	SOCKET: tube; 7 contact	220 1203 00
XV501	Socket for V501	SOCKET: tube; 4 prong bayonet lock	220 1218 00
XV501B	Part of XV501	COVER: tube socket	220 1219 00

Section VI
XV502 - Z102

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NO.
XV502	Socket for V502	SOCKET: tube; 4 prong bayonet lock	220 1218 00
XV502B	Part of XV502	COVER: tube socket	220 1219 00
XV503	Socket for V503	SOCKET: tube; 8 prong octal	220 1005 00
XV504	Socket for V504	SOCKET: tube; 8 prong octal	220 1005 00
XV505	Socket for V505	SOCKET: tube; 9 contact miniature	220 1103 00
XV506	Socket for V506	SOCKET: tube; 7 contact miniature	220 1111 00
XV507	Socket for V507	SOCKET: tube; 7 contact miniature	220 1112 00
XV508	Socket for V508	SOCKET: tube; 8 prong octal	220 1005 00
XY201	Socket for Y201	SOCKET: crystal; for CR-7 type crystal	292 0023 00
XY202	Socket for Y202	SOCKET: crystal; for CR-7 type crystal	292 0023 00
XY203	Socket for Y203	SOCKET: crystal; for CR-7 type crystal	292 0023 00
XY204	Socket for Y204	SOCKET: crystal; for CR-7 type crystal	292 0023 00
XY205	Socket for Y205	SOCKET: crystal; for CR-7 type crystal	292 0023 00
XY206	Socket for Y206	SOCKET: crystal; for CR-7 type crystal	292 0023 00
Y101	Lower sideband crystal	CRYSTAL UNIT: quartz 251.65 kc $\pm 0.02\%$	290 4458 00
Y102	Upper sideband crystal	CRYSTAL UNIT: quartz 248.35 kc $\pm 0.02\%$	290 4457 00
Y201	Crystal of 10 M (hi) band	CRYSTAL UNIT: quartz 13,000.000 kc $\pm 0.005\%$	291 8102 00
Y202	Crystal of 10 M (lo) band	CRYSTAL UNIT: quartz; single crystal plate; holder HC-6/U; 12,500.000 kc	291 8141 00
Y203	Crystal for 11 M band	CRYSTAL UNIT: quartz; single crystal plate; holder HC-6/U; 11,700.000 kc	291 8165 00
Y204	Crystal for 15 M band	CRYSTAL UNIT: quartz; single crystal plate; holder HC-6/U; 8,750.000 kc	291 8088 00
Y205	Crystal for 20 M band	CRYSTAL UNIT: quartz; single crystal plate; holder HC-6/U; 11,000.000 kc	291 8114 00
Y206	Crystal for 40 M band	CRYSTAL UNIT: quartz; single crystal plate; holder HC-6/U; 4,000.000 kc	291 8131 00
Z102	Contains L101, C122, C123 and C124	TUNING UNIT: cement; top, rolled plate; retainer ring; 250 kc	540 4060 00

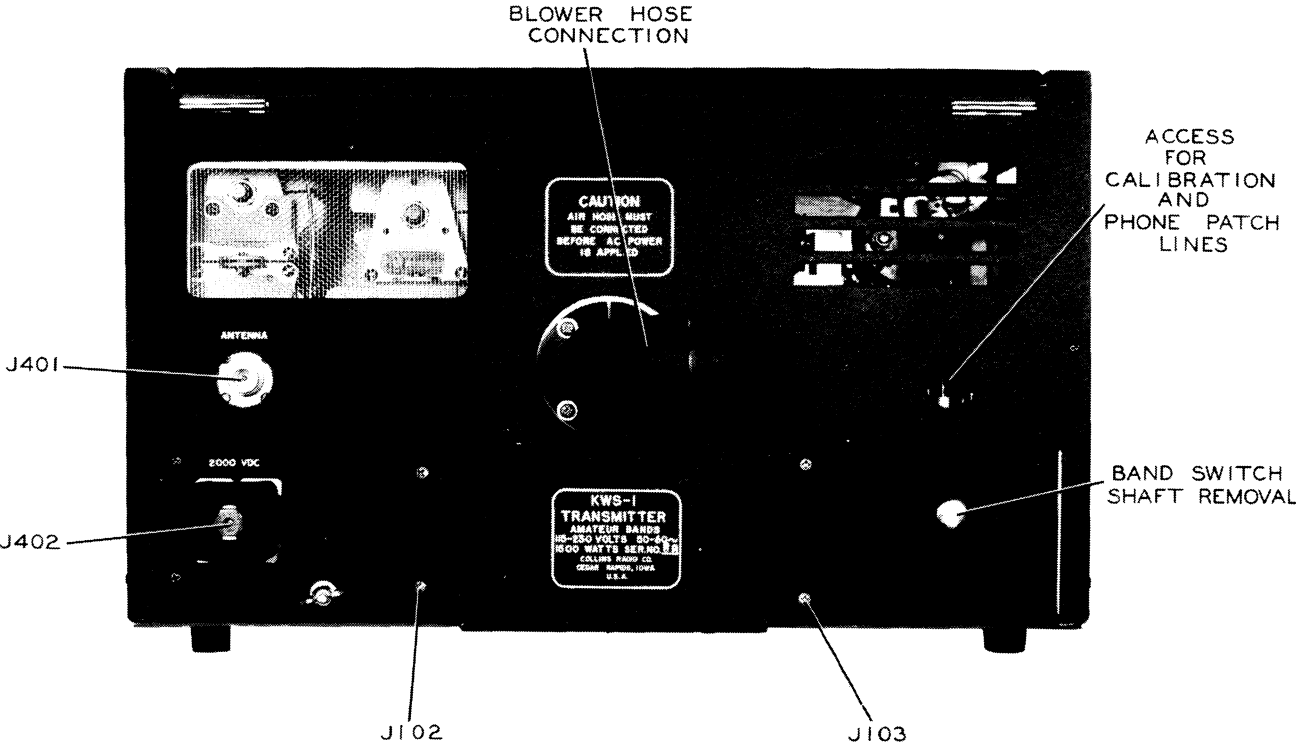


Figure 6-1. Exciter/Power Amplifier, Rear Panel

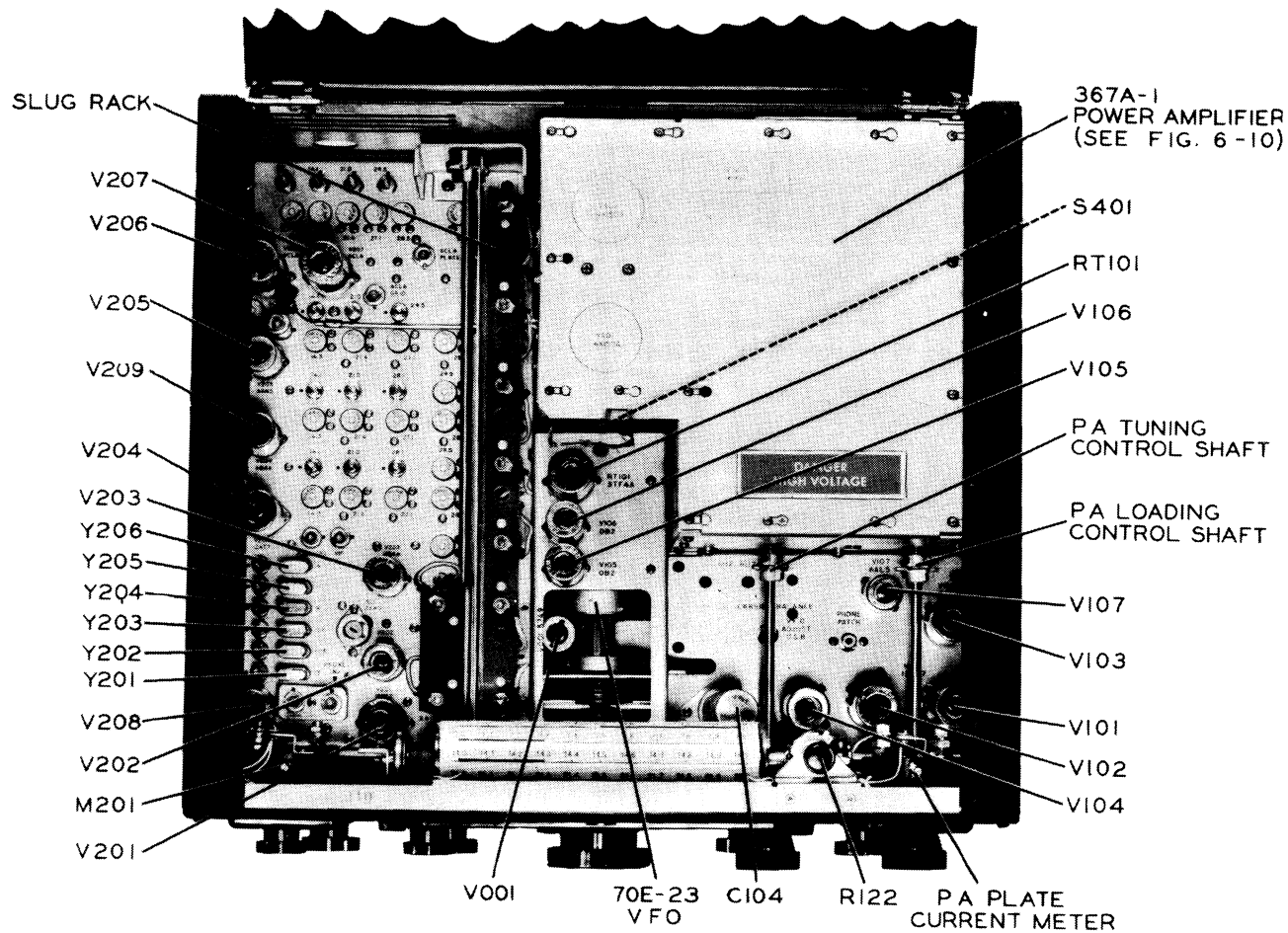


Figure 6-2. Exciter/Power Amplifier, Top View, Top Cover Open

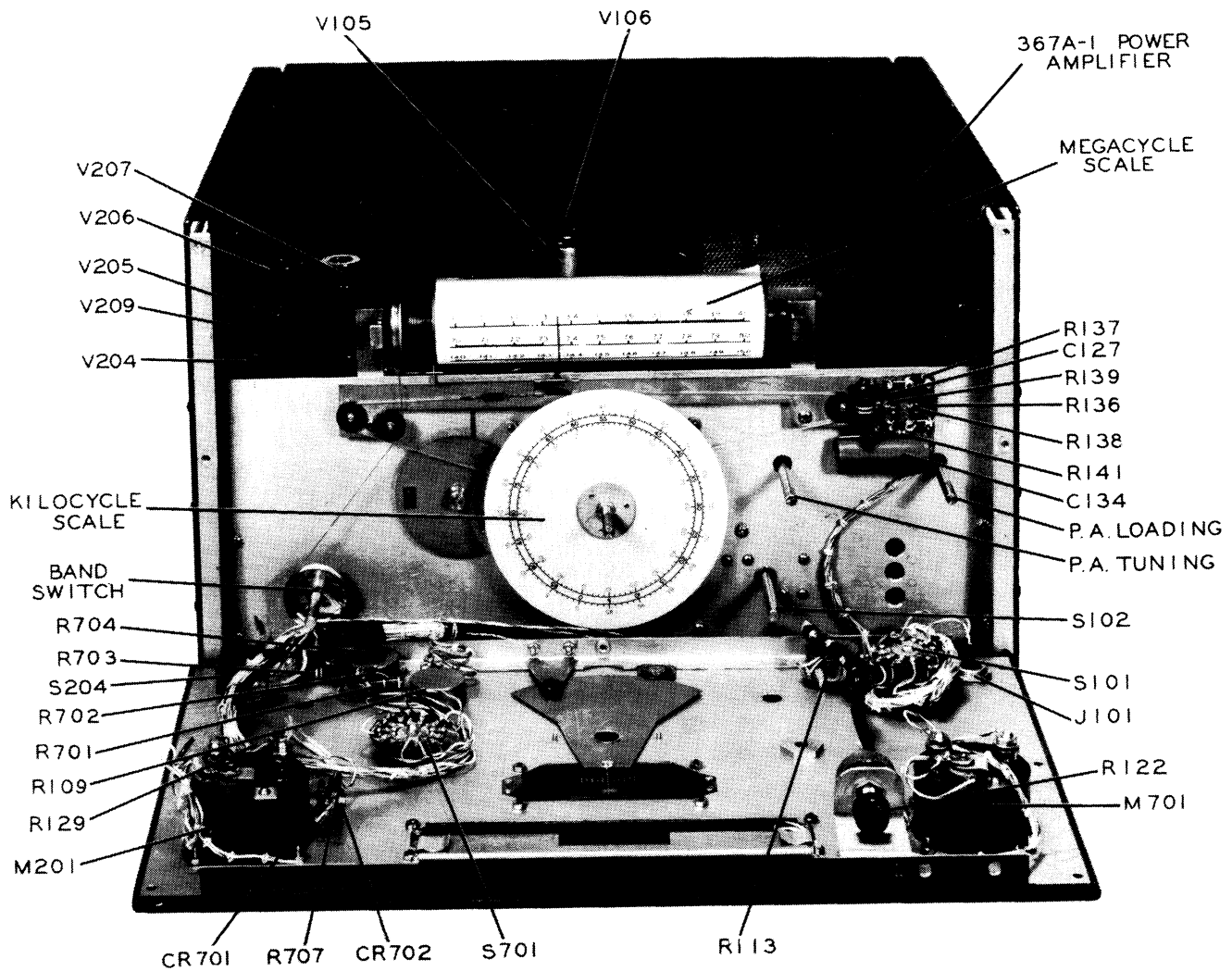


Figure 6-3. Exciter/Power Amplifier, Front Panel, Internal View

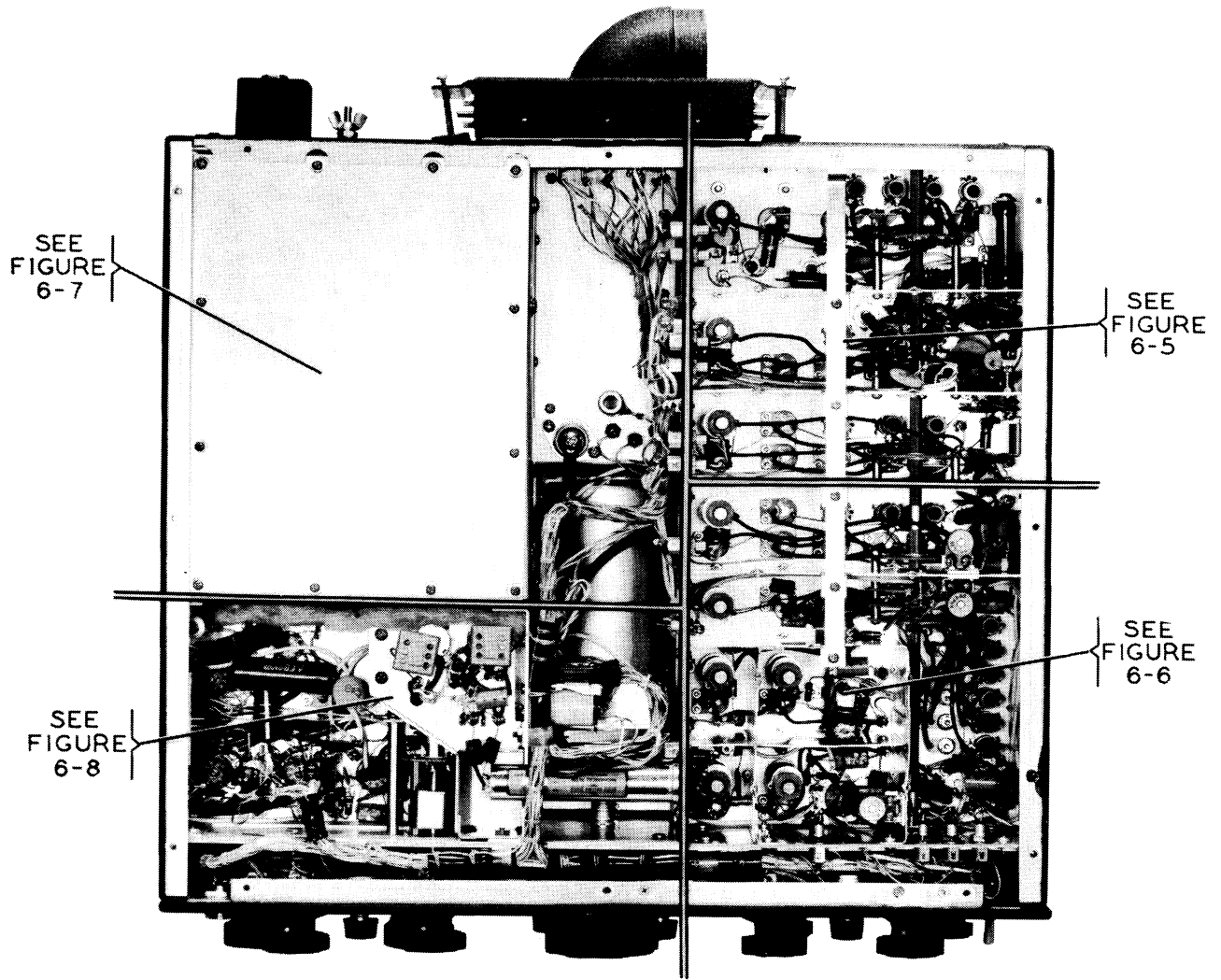


Figure 6-4. Exciter/Power Amplifier, Bottom View, Cover Removed

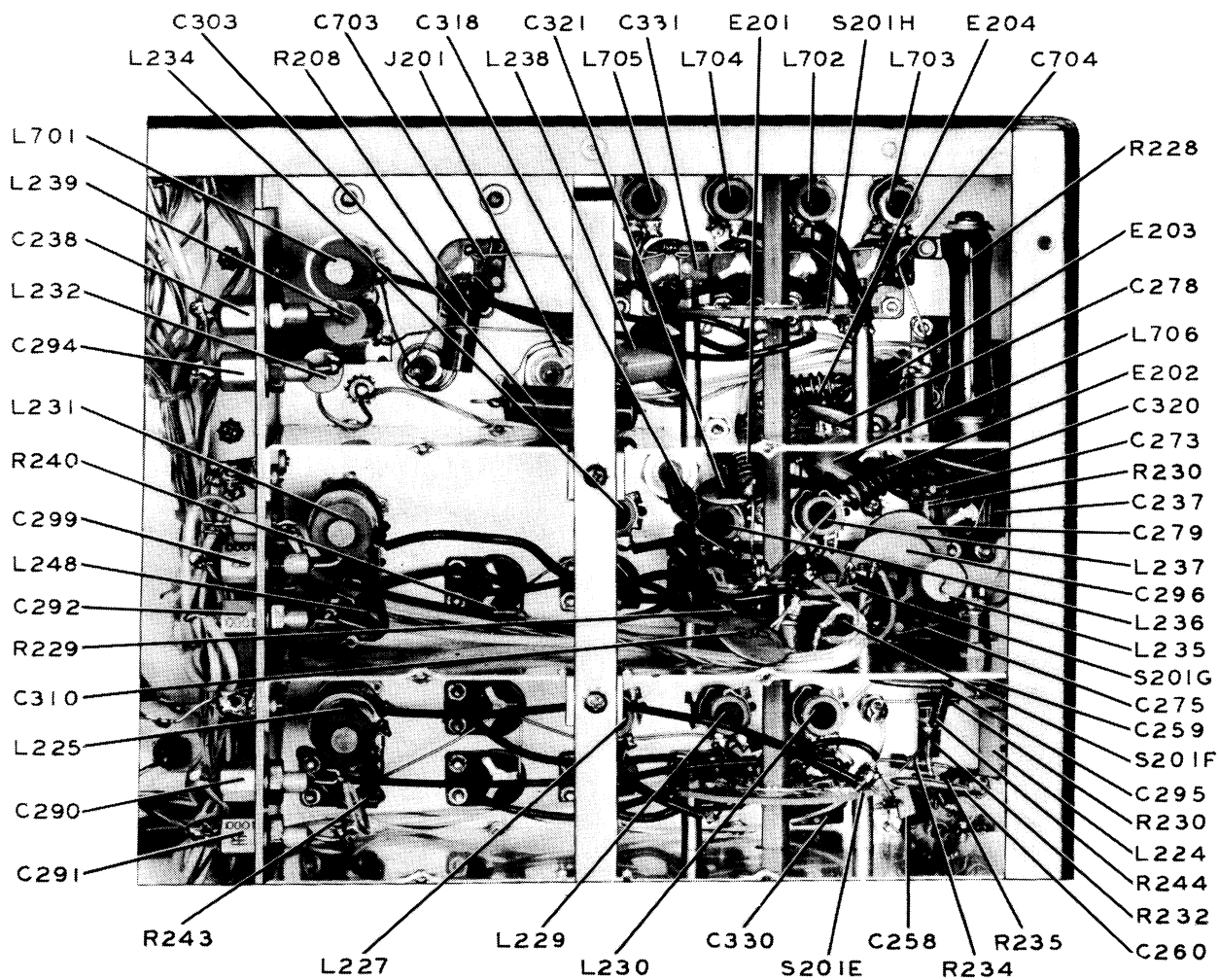


Figure 6-5. Exciter, Bottom View, Upper Right Quarter

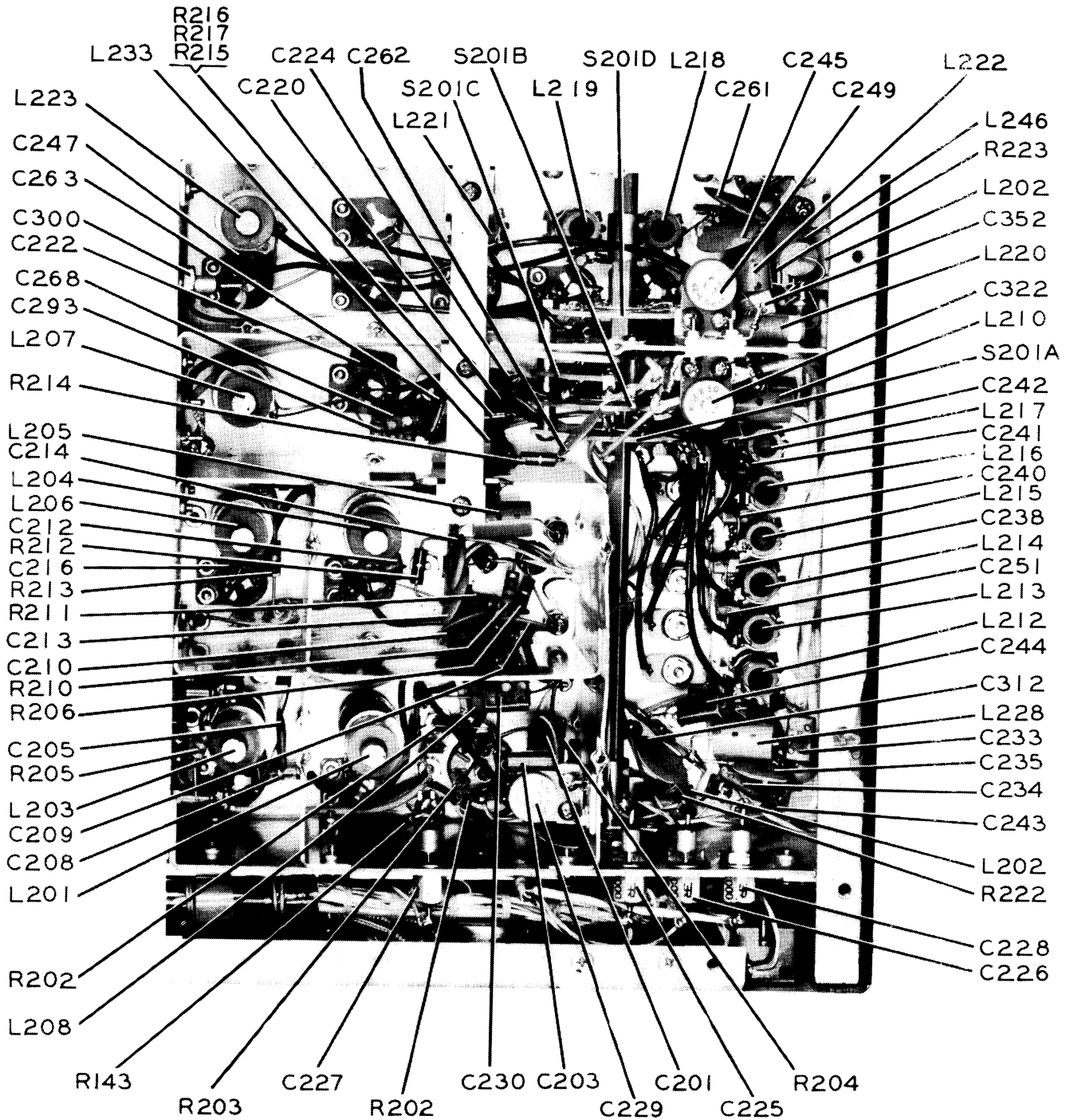


Figure 6-6. Exciter, Bottom View, Lower Right Quarter

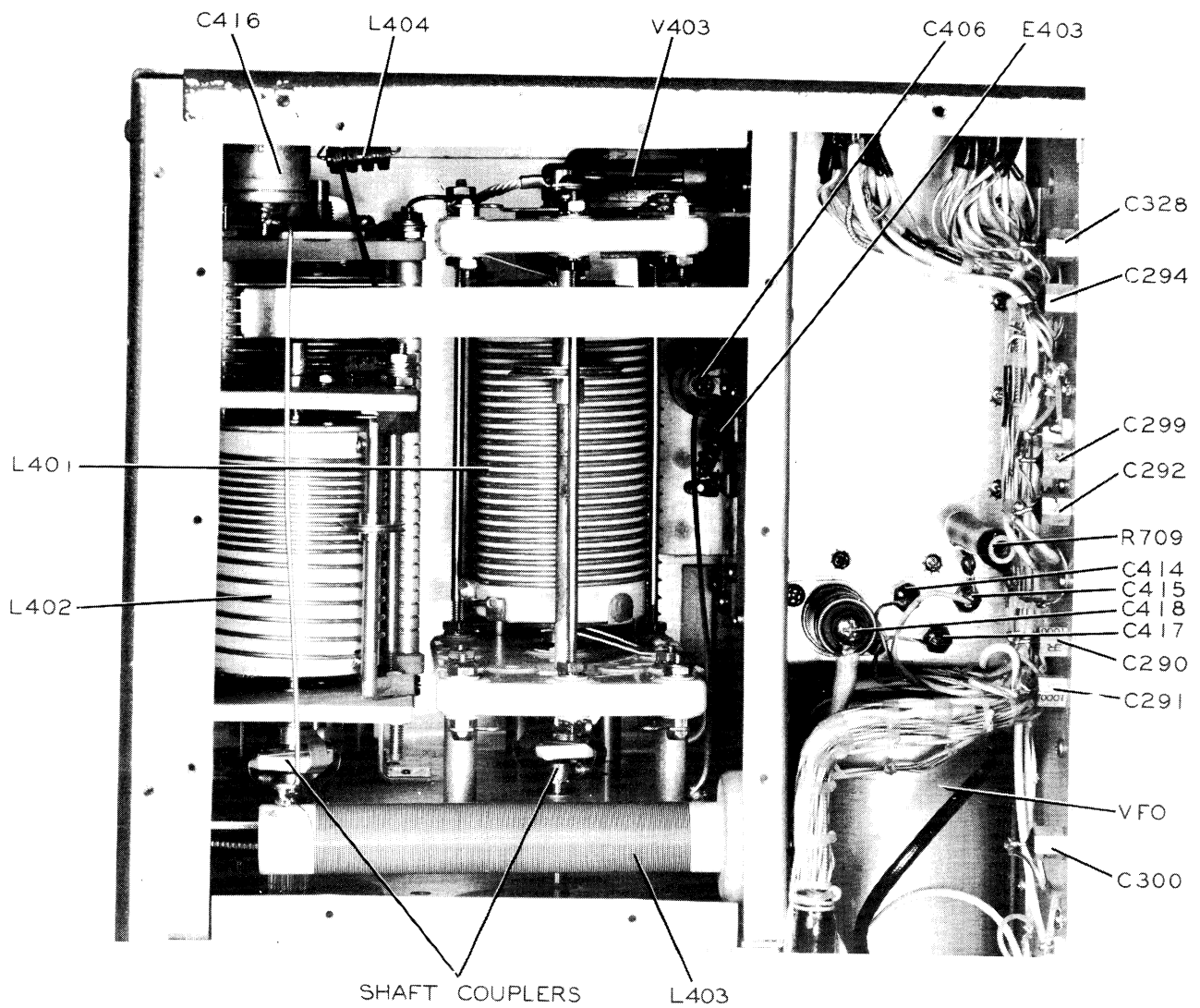


Figure 6-7. Exciter, Bottom View, Upper Left Quarter, Including Power Amplifier

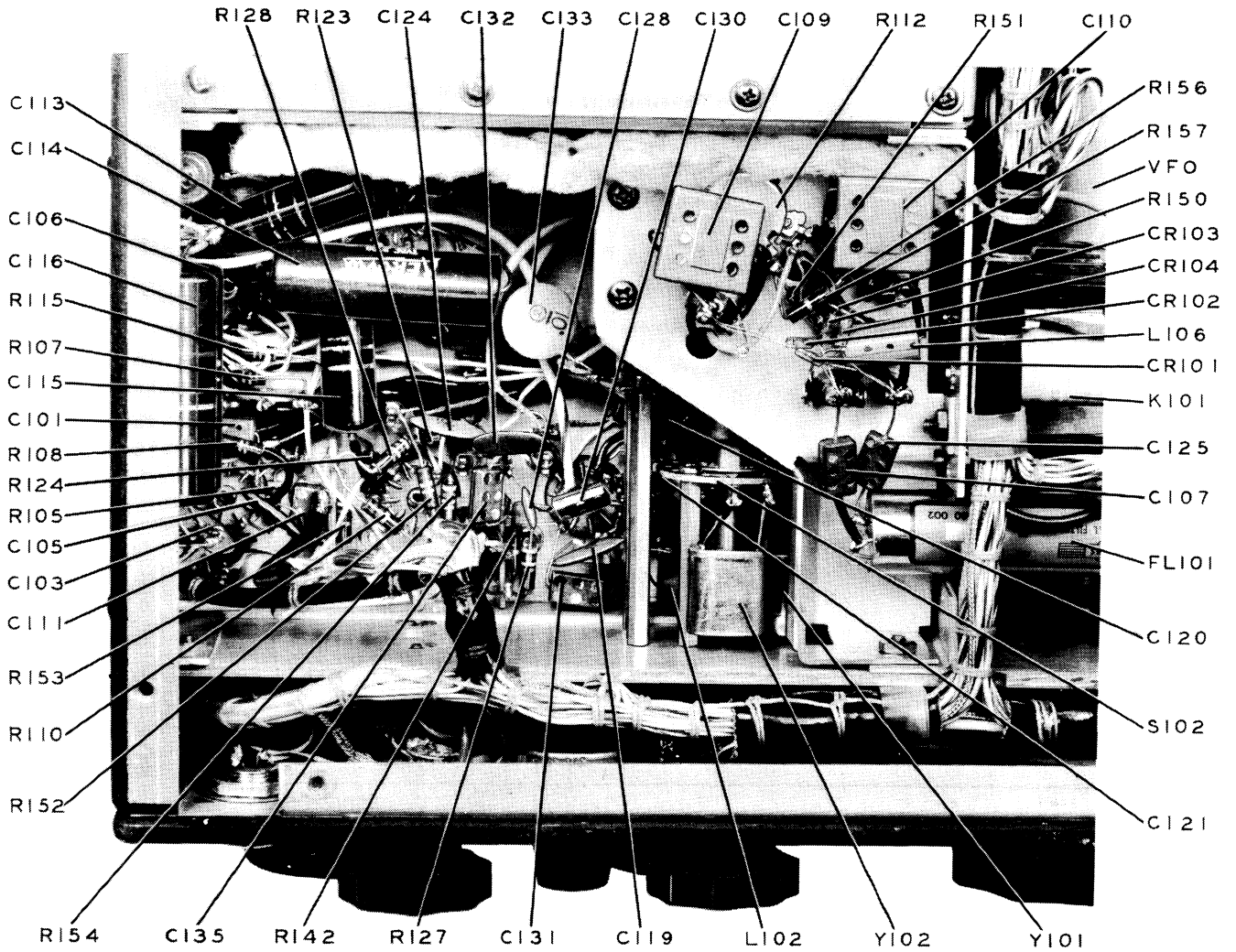


Figure 6-8. Exciter, Bottom View, Lower Left Quarter

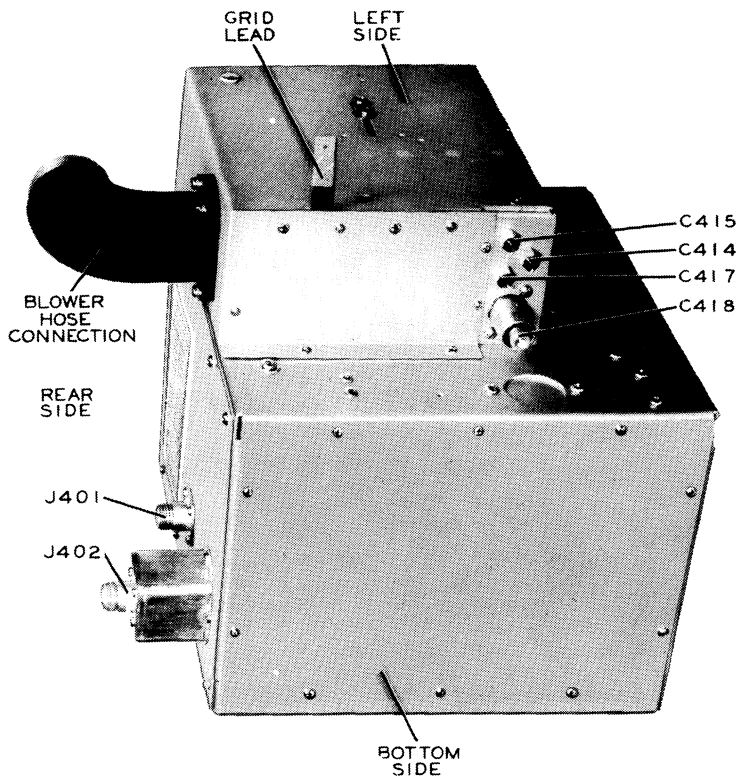


Figure 6-9. Power Amplifier, Bottom-Rear-Left View

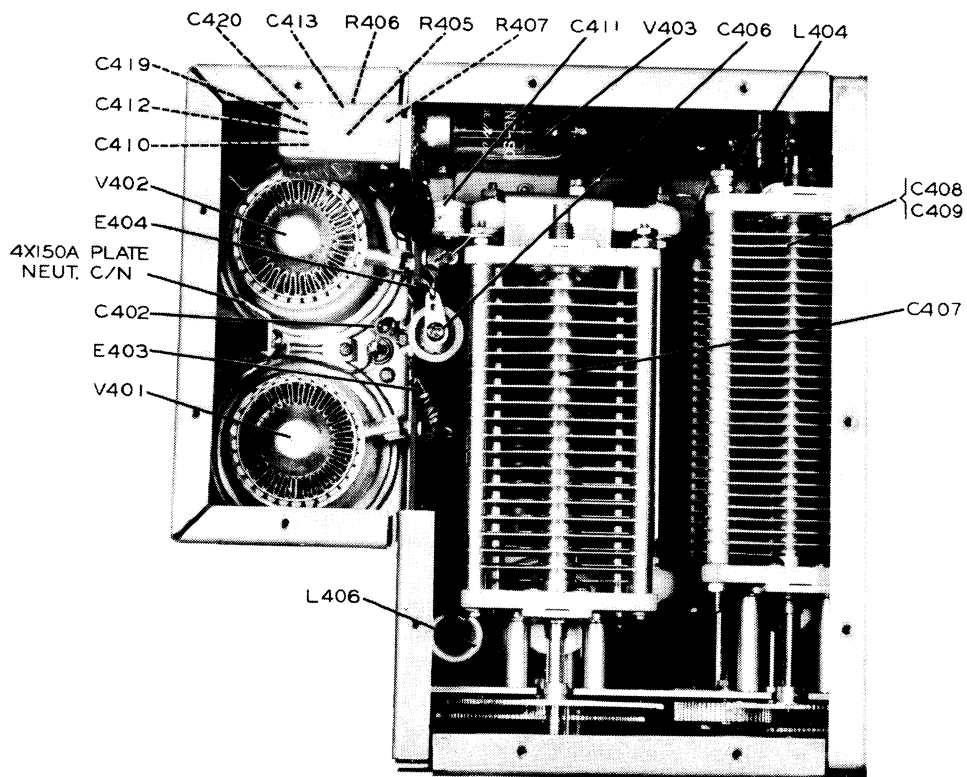


Figure 6-10. Power Amplifier, Top View, Cover Removed

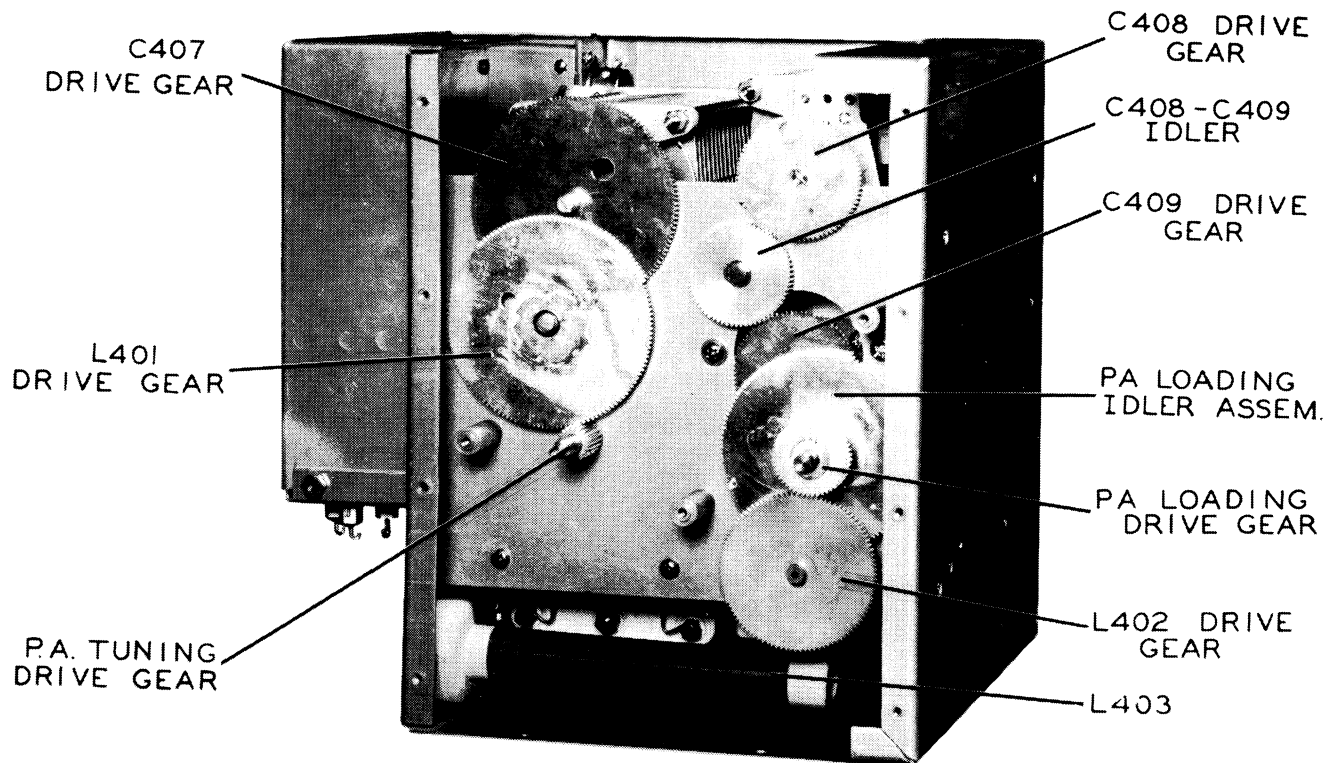


Figure 6-11. Power Amplifier, Front View, Cover Removed

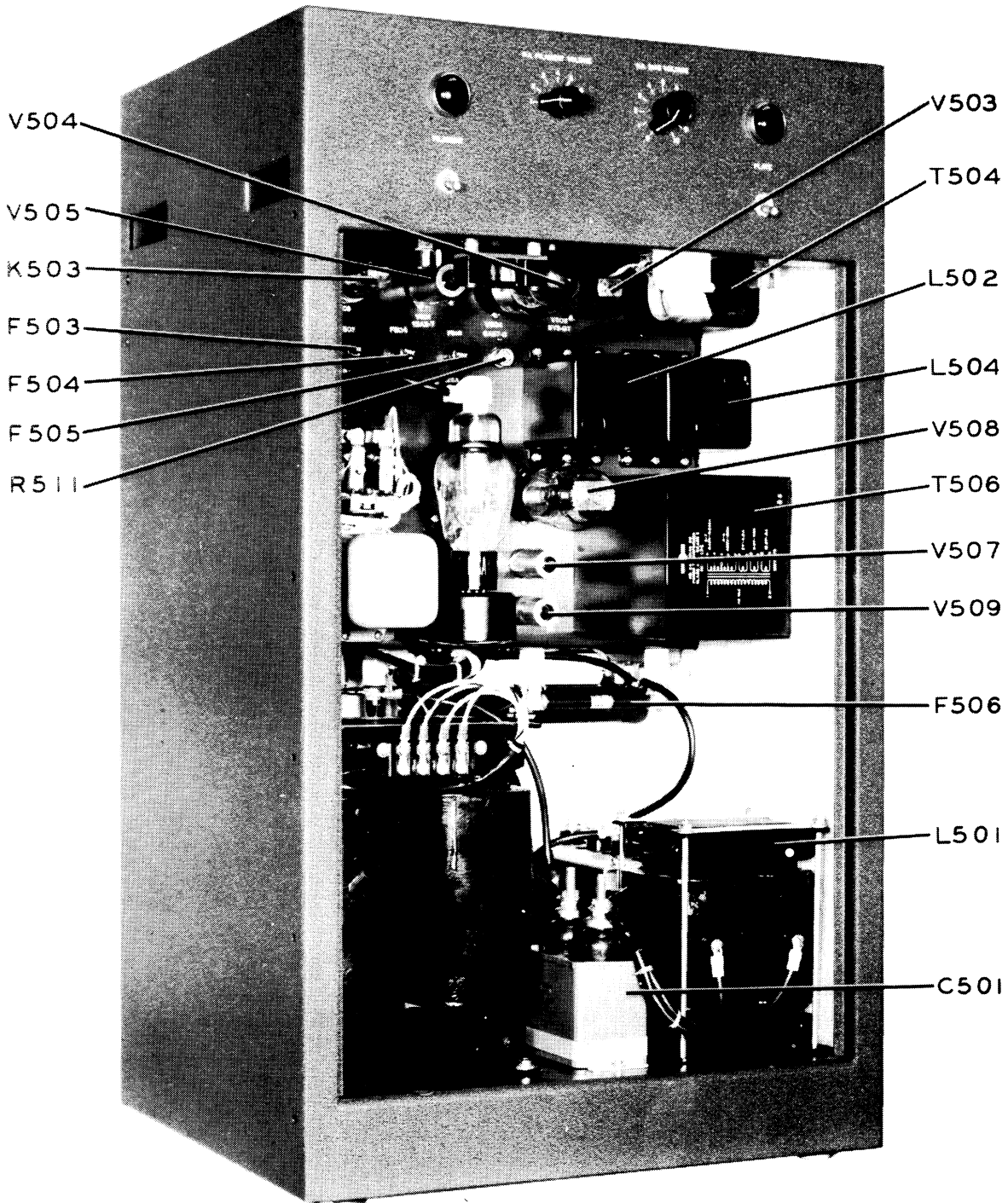


Figure 6-12. Power Supply, Front Left Oblique View, Panel Removed

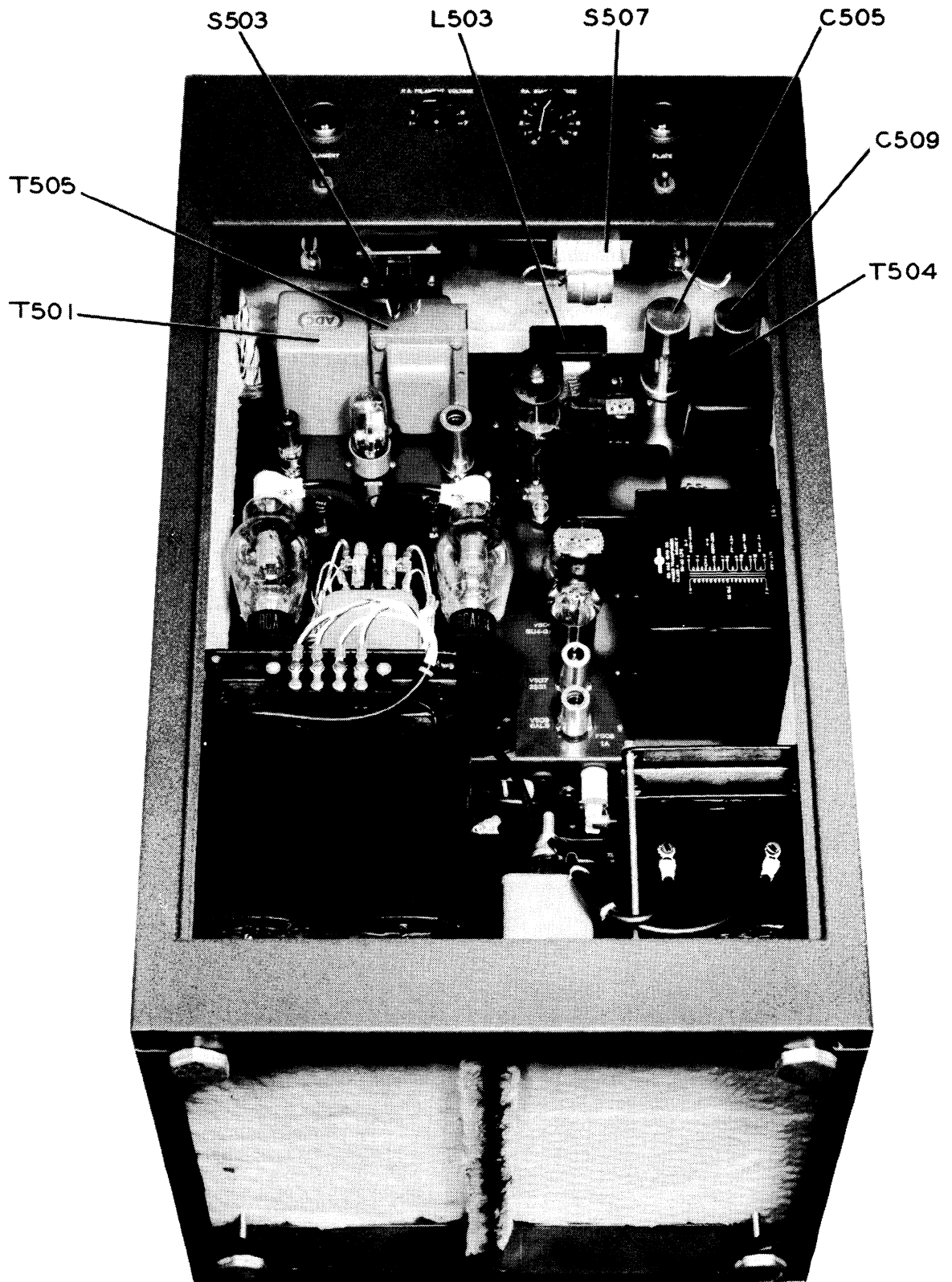


Figure 6-13. Power Supply, Front Vertical Oblique View, Panel Removed

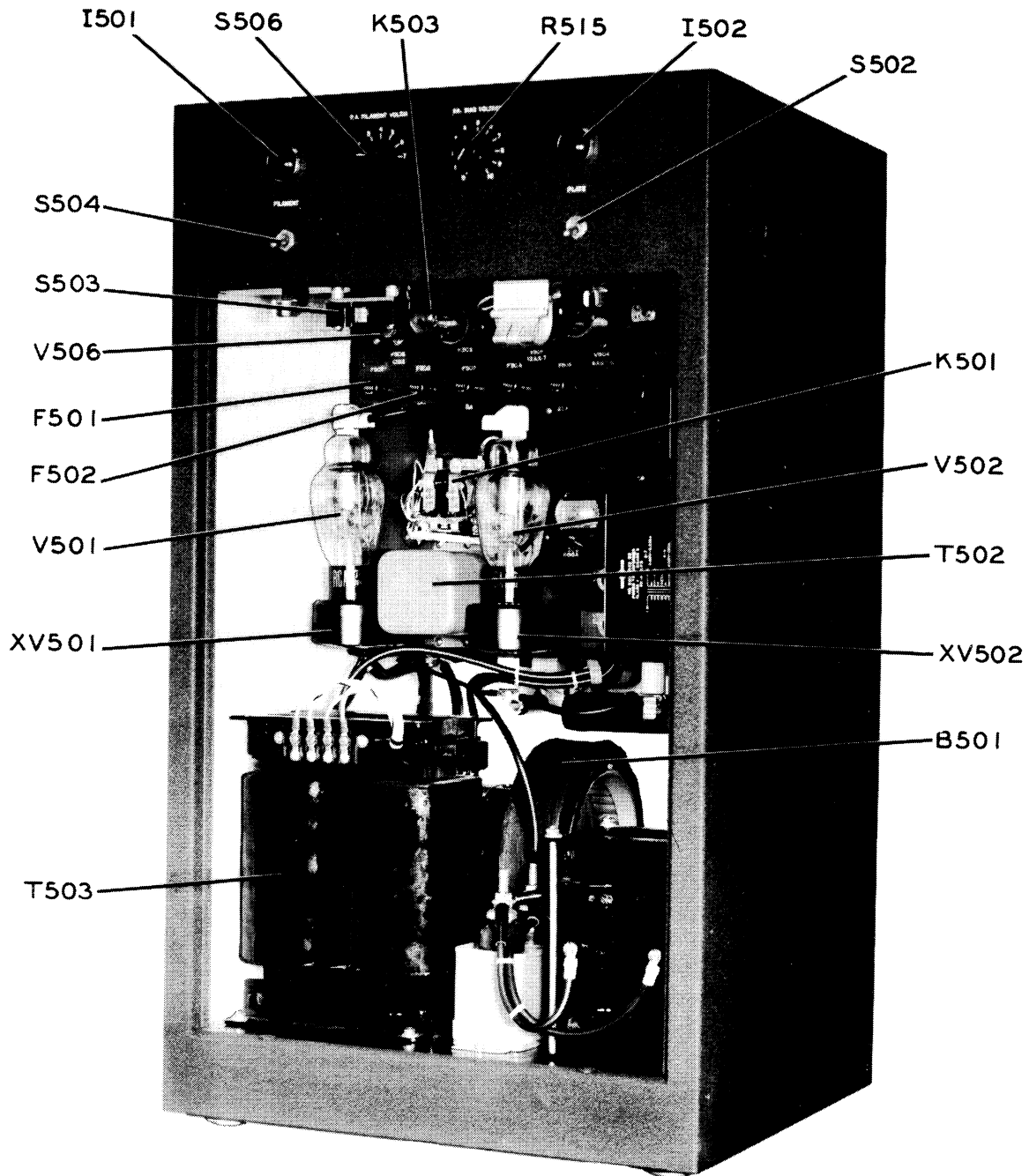


Figure 6-14. Power Supply, Front Right Oblique View, Panel Removed

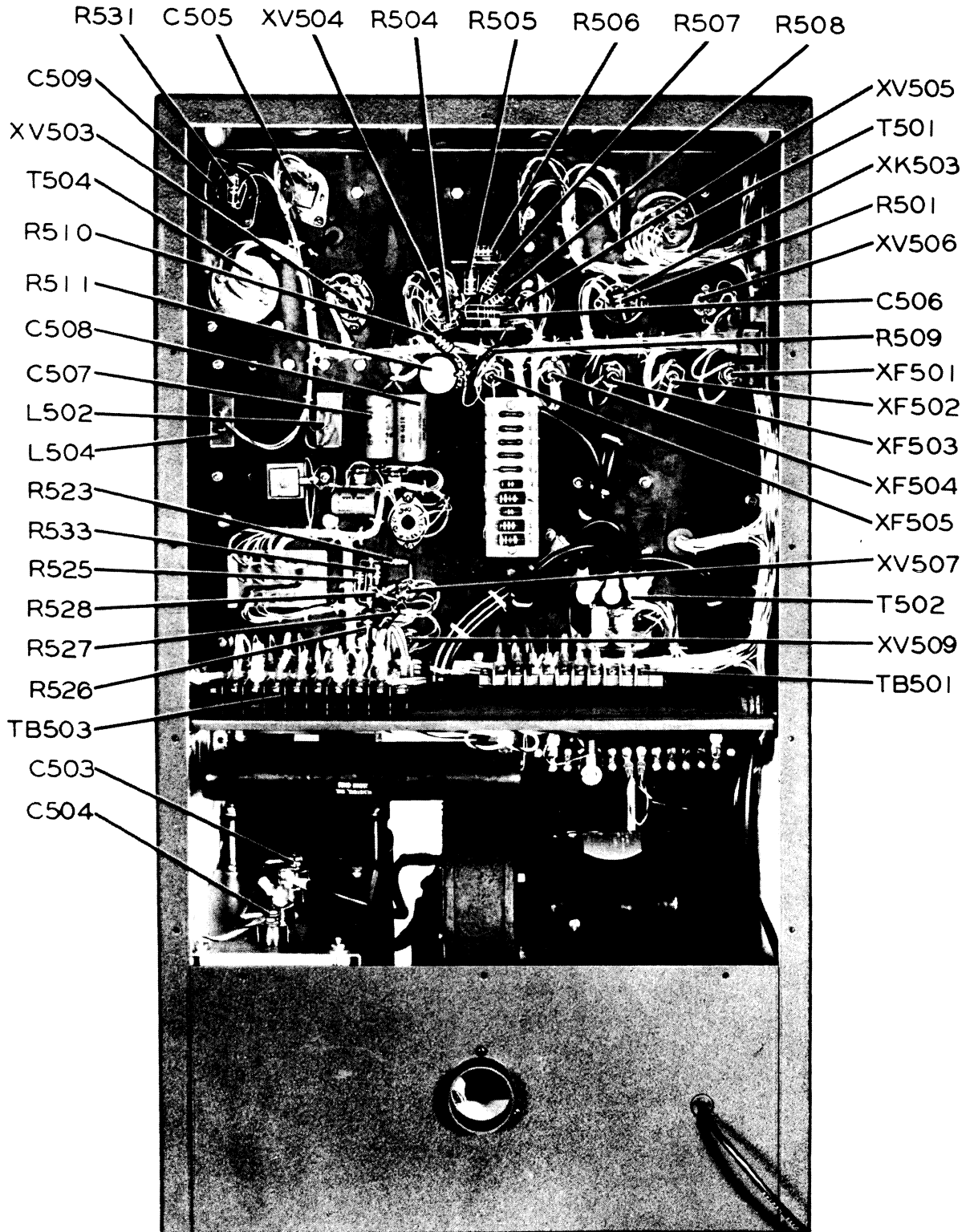


Figure 6-15. Power Supply, Rear View, Panel Removed

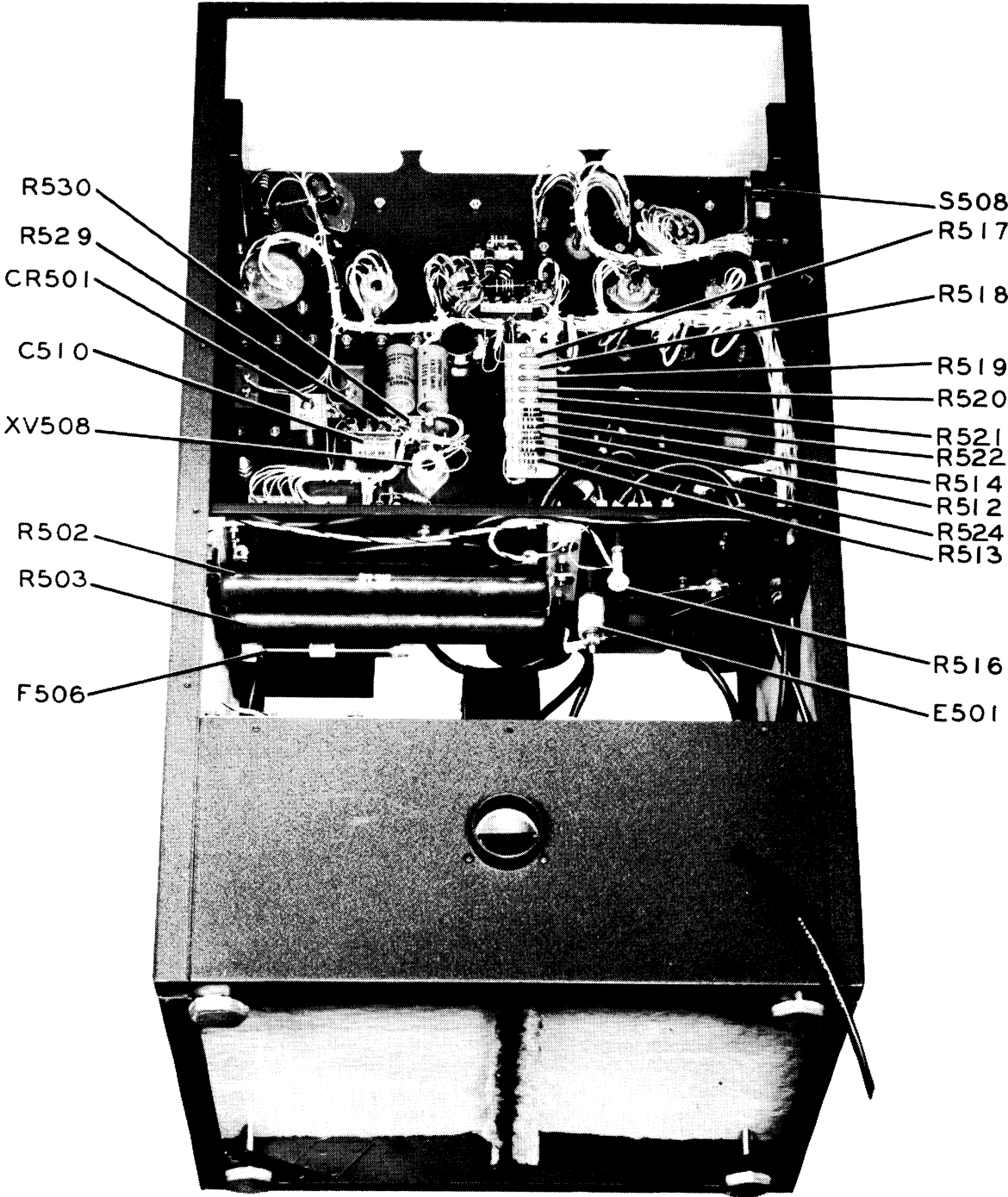


Figure 6-16. Power Supply, Rear Oblique View, Panel Removed

**SECTION VII
ILLUSTRATIONS**

HIGH VOLTAGE SUPPLY

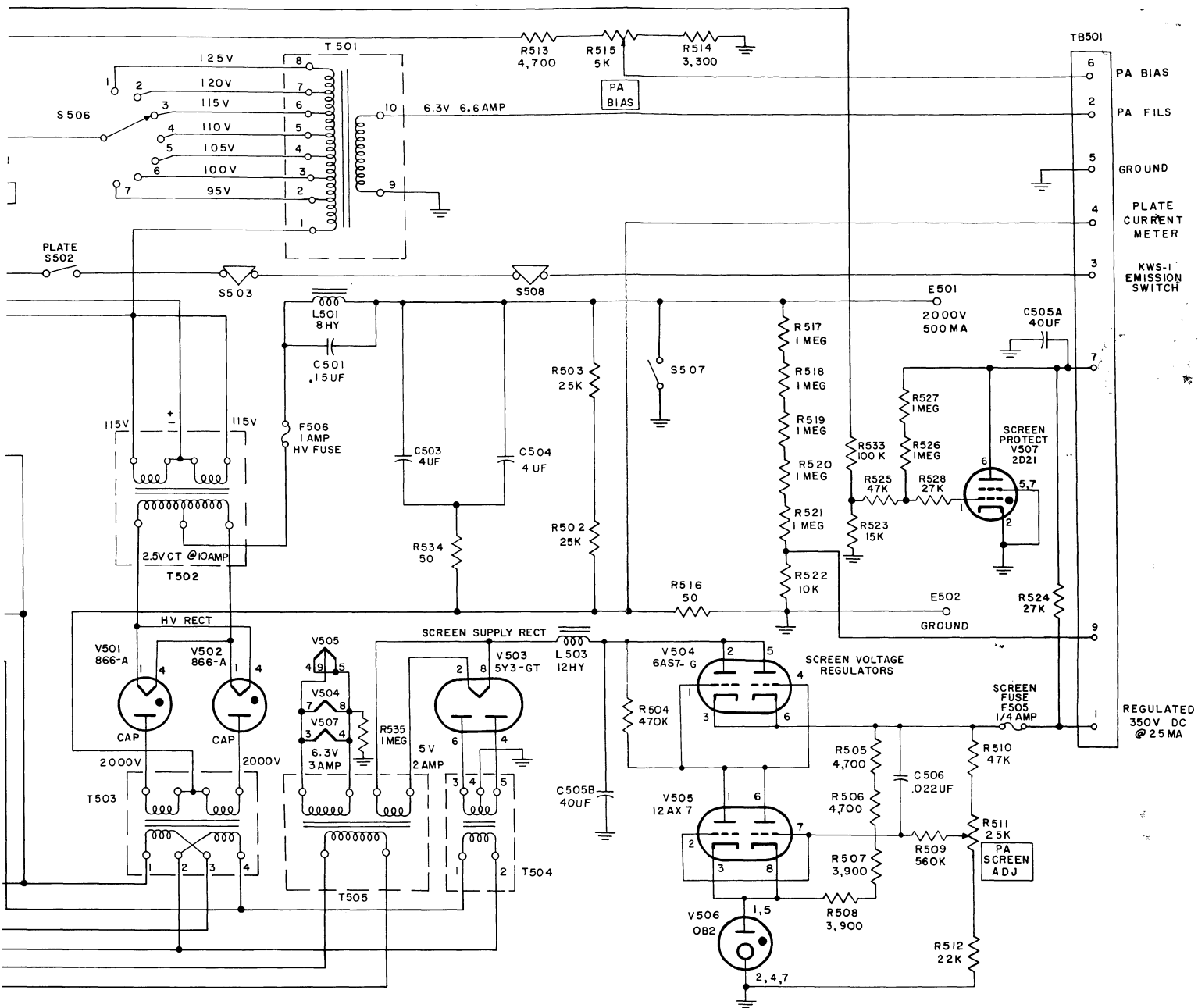
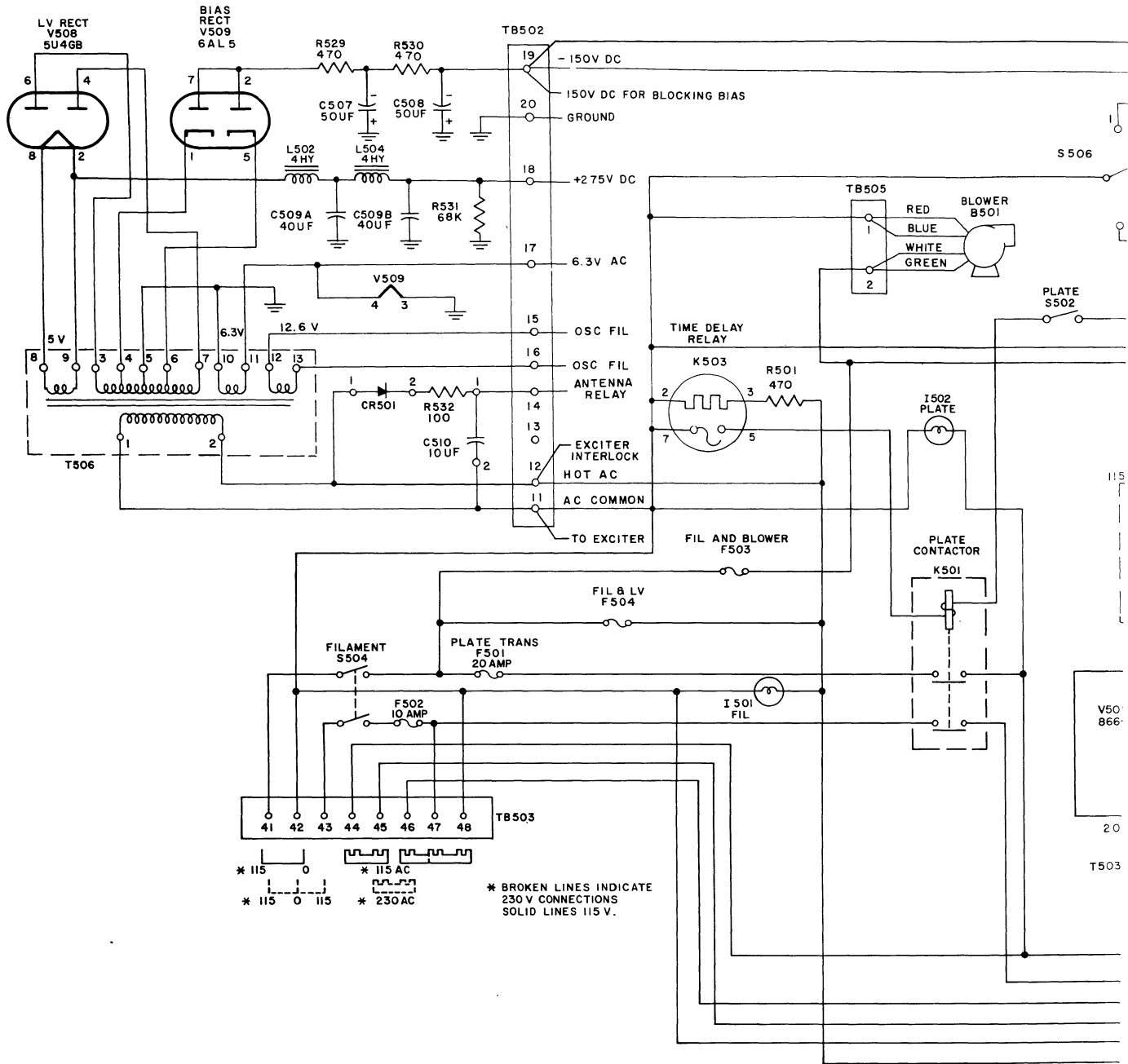


Figure 7-2. Power Supply, Complete Schematic Diagram

LOW VOLTAGE AND BIAS SUPPLY



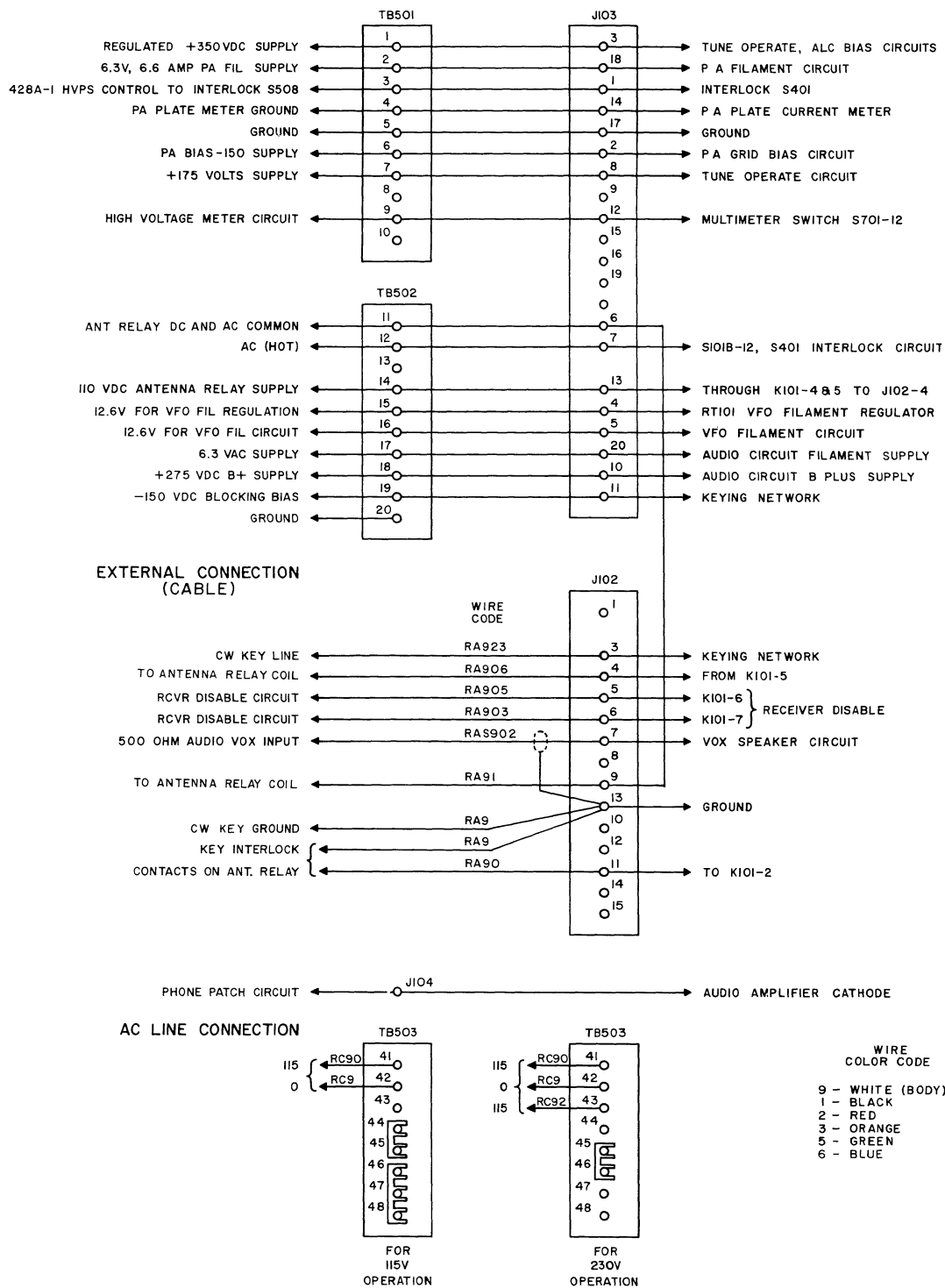
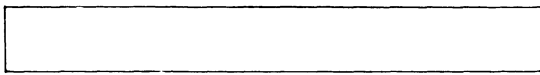
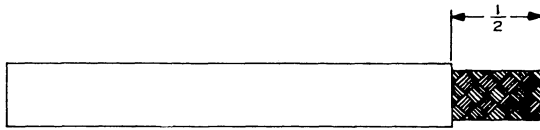


Figure 7-3. Interconnecting Cable Wiring Diagram

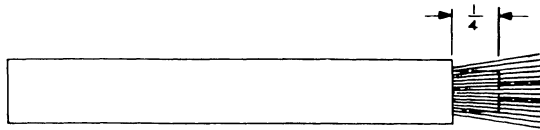
Section VII



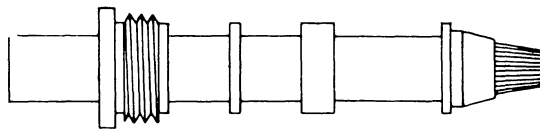
CUT END OF CABLE EVEN.



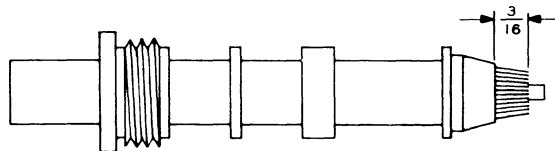
REMOVE VINYL JACKET $\frac{1}{2}$ INCH —
DON'T NICK BRAID.



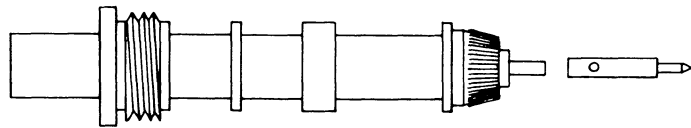
COMB OUT COPPER BRAID AS SHOWN.
BARE $\frac{1}{4}$ INCH OF CENTER CONDUCTOR—
DON'T NICK CONDUCTOR.



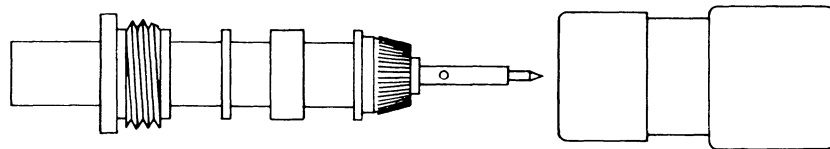
TAPER BRAID AS SHOWN. SLIDE NUT,
WASHER AND GASKET ON VINYL JACKET.
SLIDE CLAMP ON BRAID.



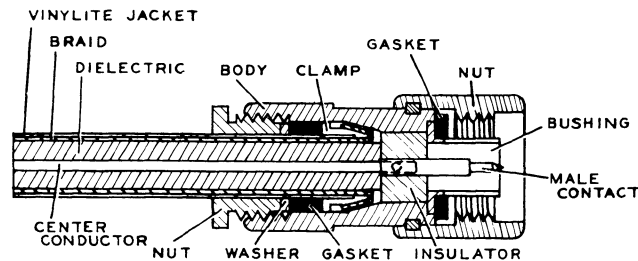
WITH CLAMP IN PLACE, TRIM BRAID
AS SHOWN.



FOLD COPPER BRAID BACK ON CLAMP.
TIN CENTER CONDUCTOR,
USING MINIMUM AMOUNT OF
HEAT.



HOLDING CONTACT WITH PLIERS,
SOFT SOLDER CONTACT TO
CENTER CONDUCTOR. IT IS
IMPERATIVE THAT BACK END
OF CONTACT BE FLUSH WITH
POLYETHYLENE DIELECTRIC. DO
NOT USE EXCESS SOLDER. WIPE
CLEAN—SEE THAT END OF
CABLE INSULATOR IS CLEAN
AND FREE OF SOLDER, ROSIN
AND FOREIGN MATERIAL.



SLIDE BODY INTO PLACE CAREFULLY SO
THAT CENTER CONDUCTOR ENTERS HOLE
IN INSULATOR. FACE OF CABLE DIE-
LECTRIC MUST FIT FLUSH AGAINST IN-
SULATOR. PROPERLY TIGHTEN BODY
AND NUT WITH WRENCHES.

NOTES: 1. THIS ASSEMBLY PROCEDURE APPLIES
TO TYPE N PLUGS. THE PROCEDURE
FOR JACKS IS THE SAME EXCEPT
FOR THE USE OF A FEMALE CONTACT
AND A JACK BODY.

Figure 7-4. RG-8/U Cable Assembly to Connectors

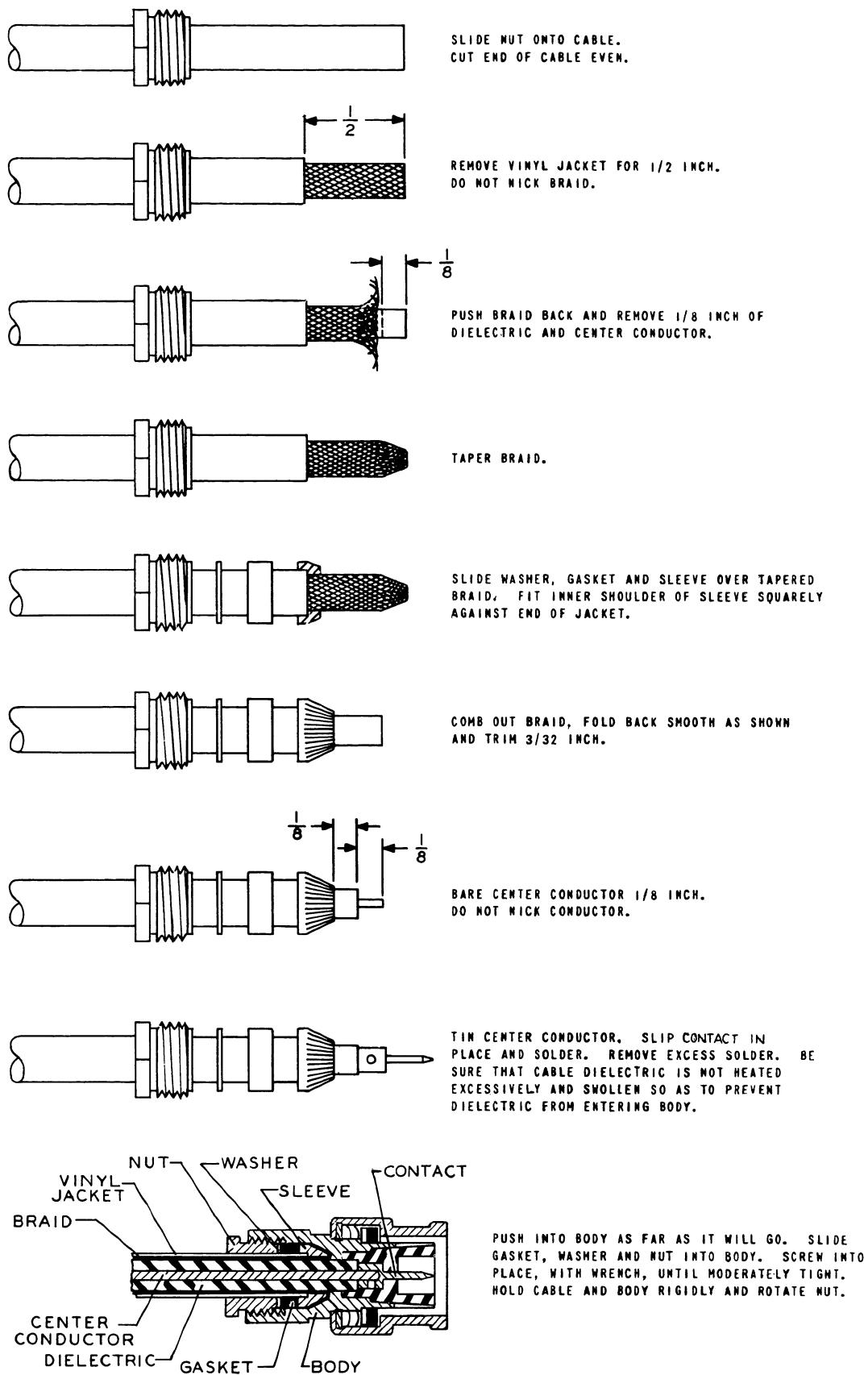


Figure 7-5. RG-58/U Cable Assembly to Connectors

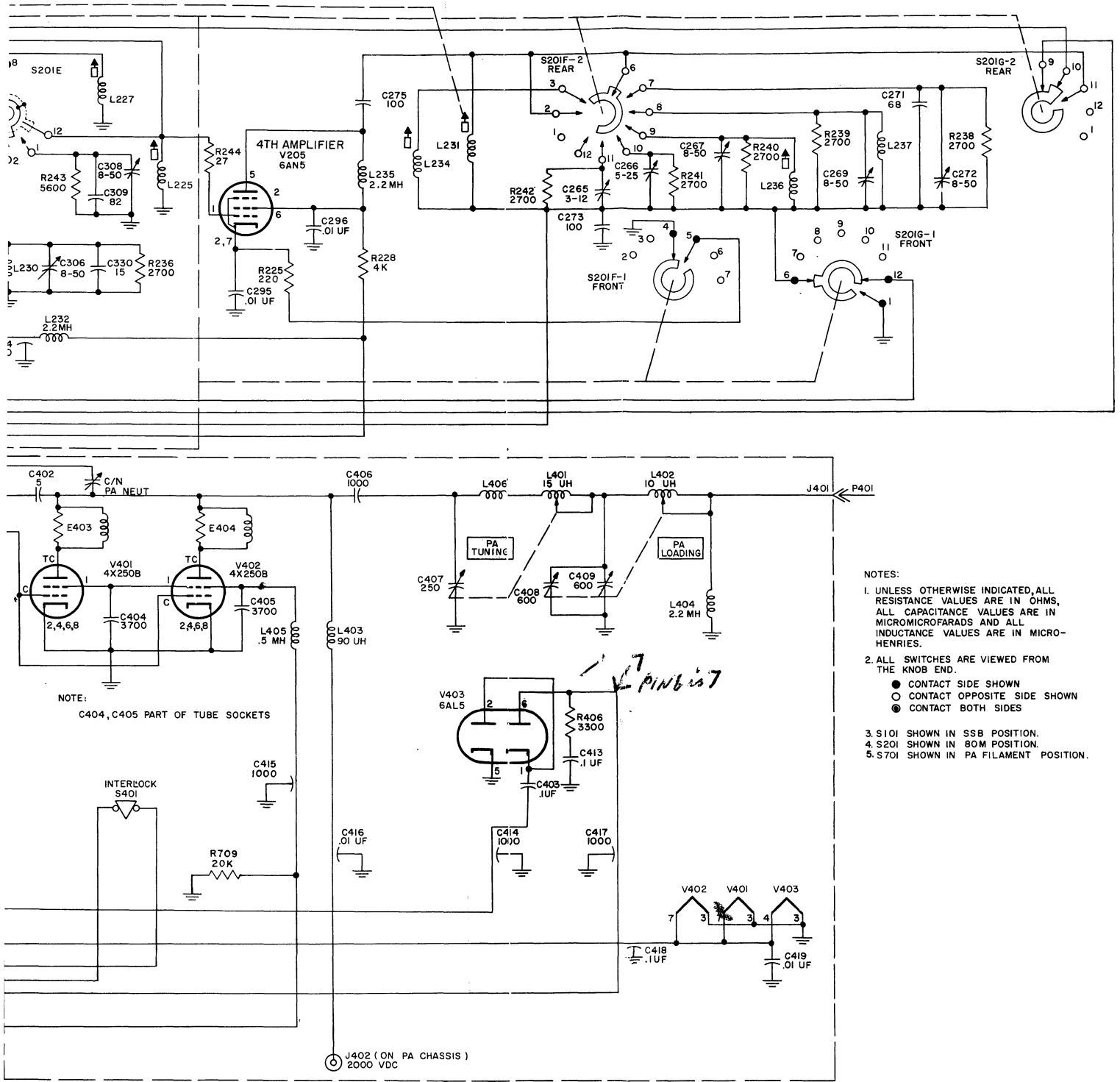
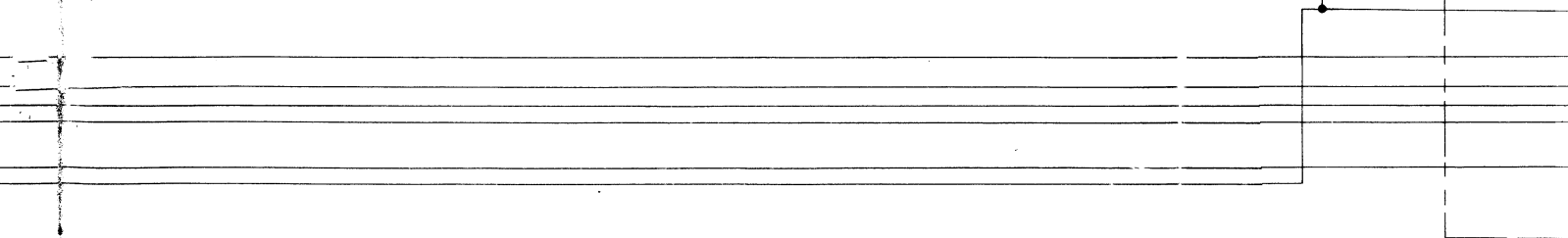
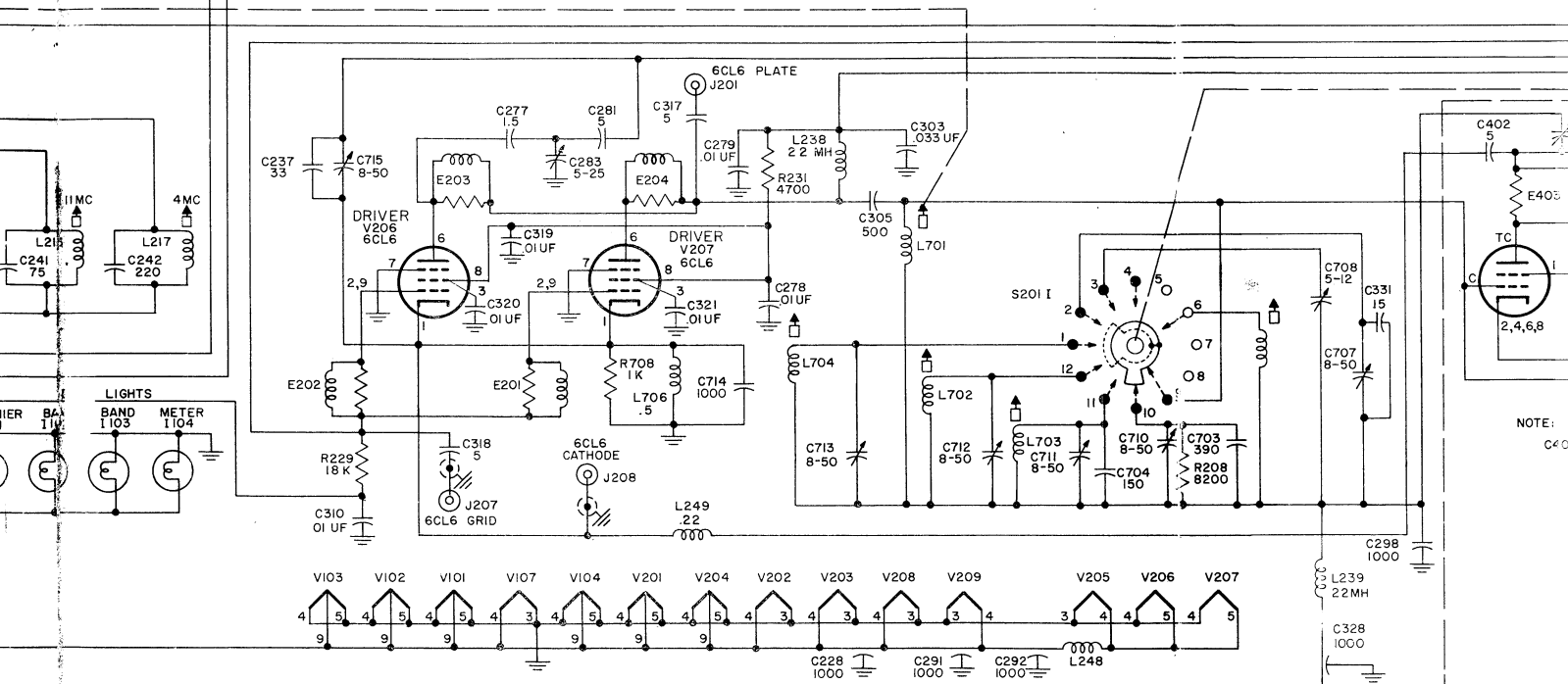
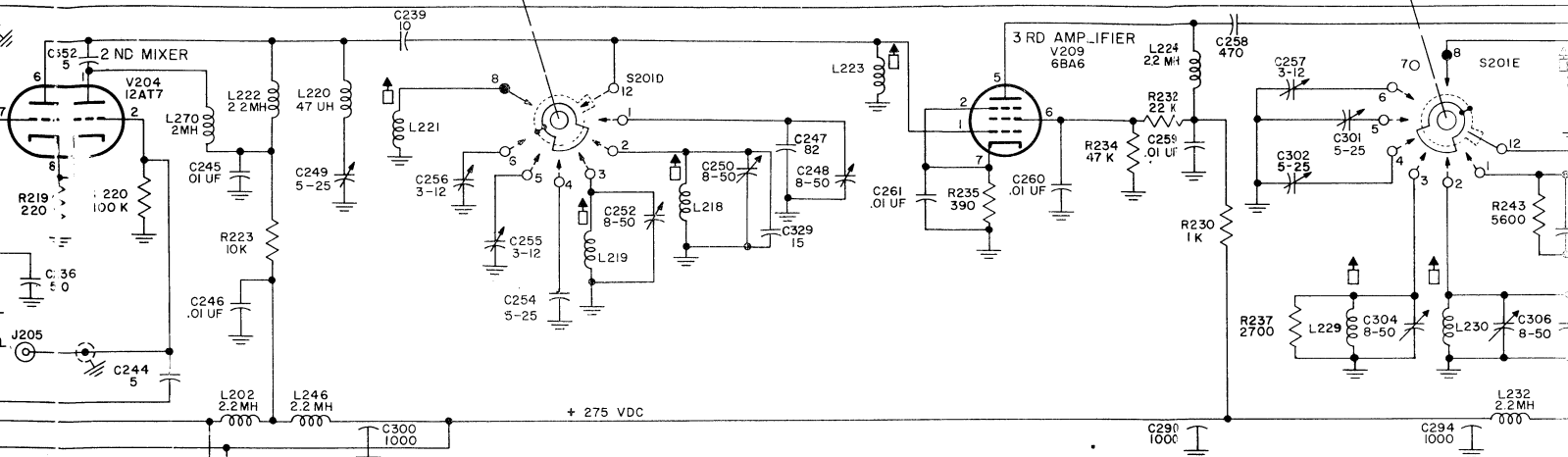


Figure 7-1. Exciter/Power Amplifier, Complete Schematic Diagram



NOTE: C40

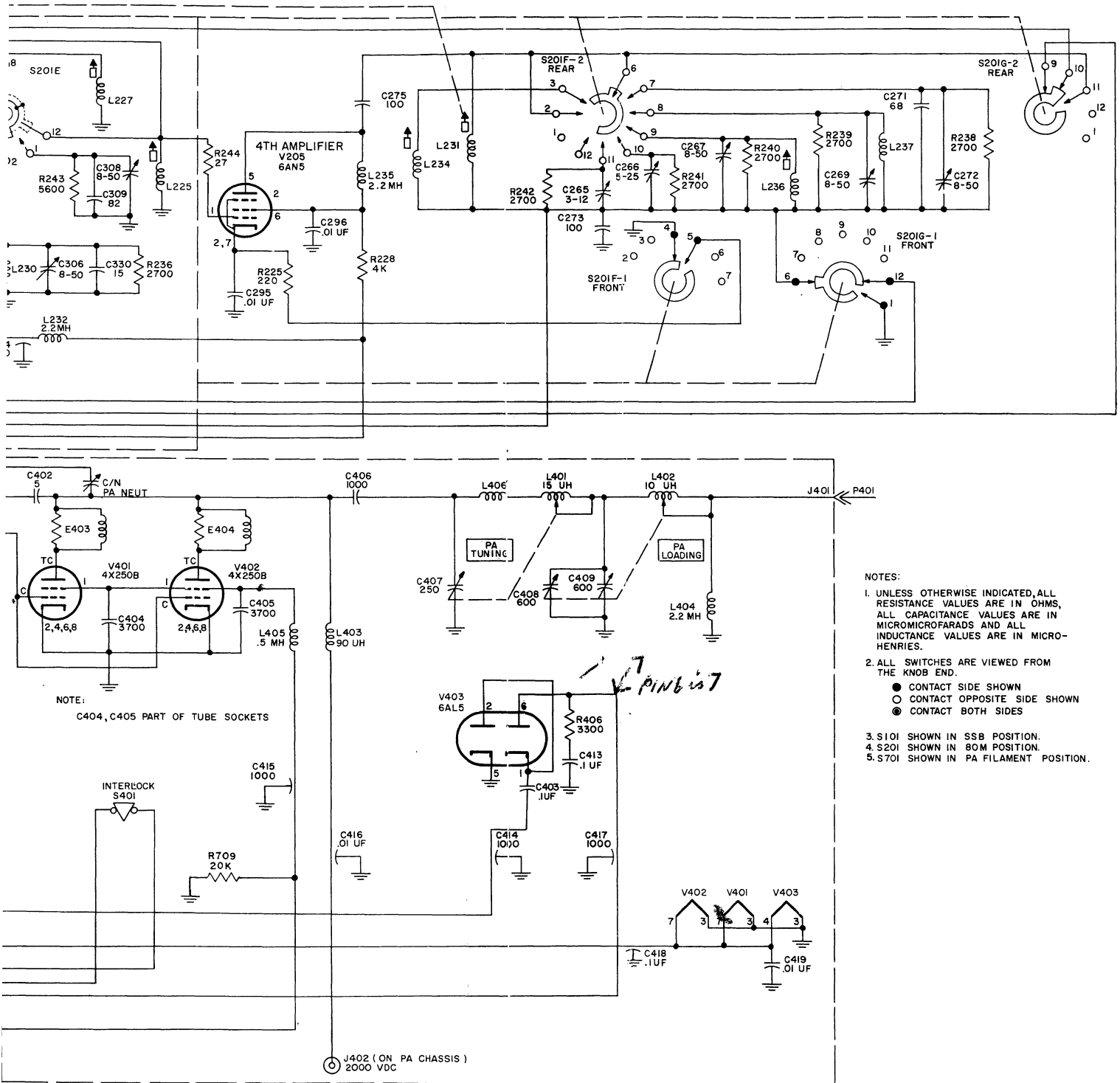
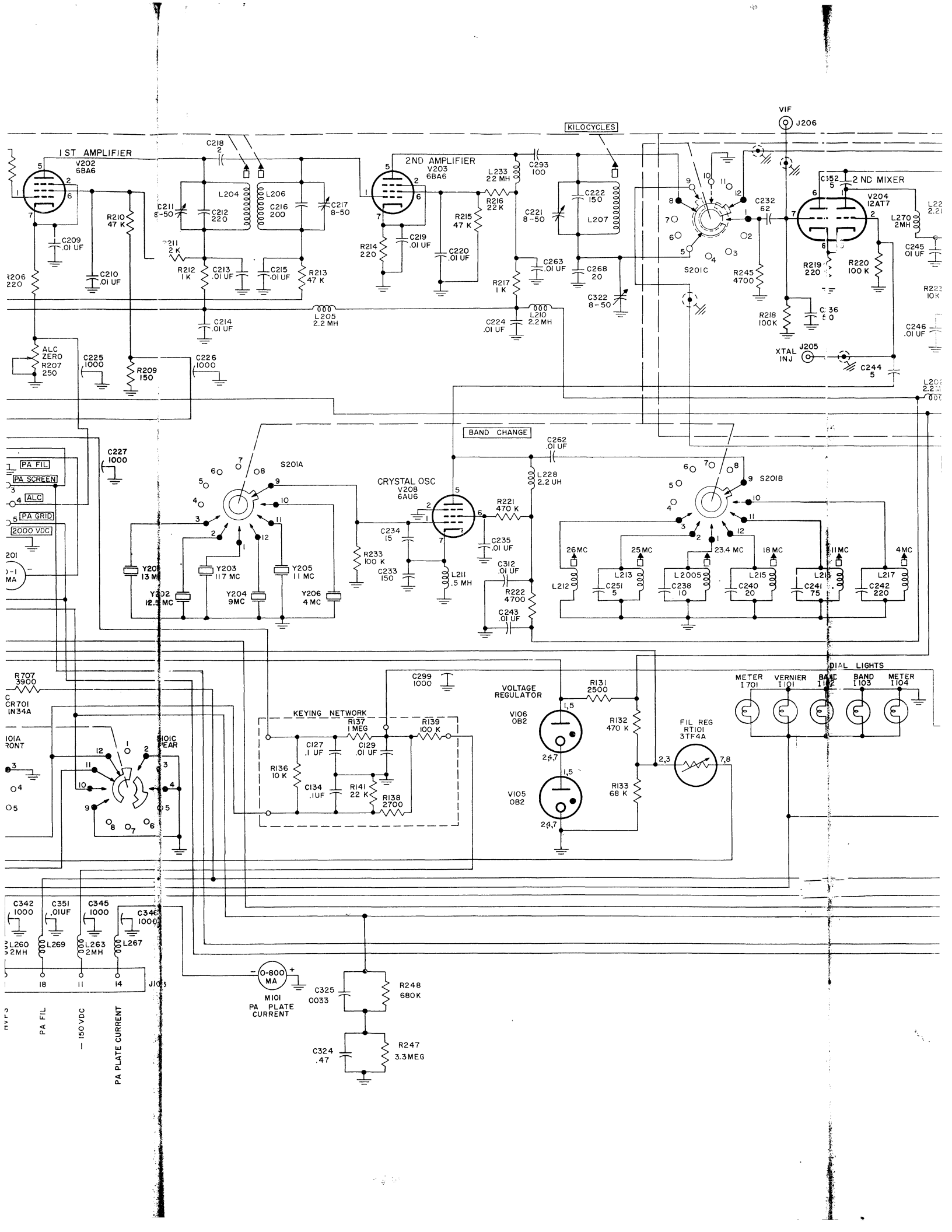
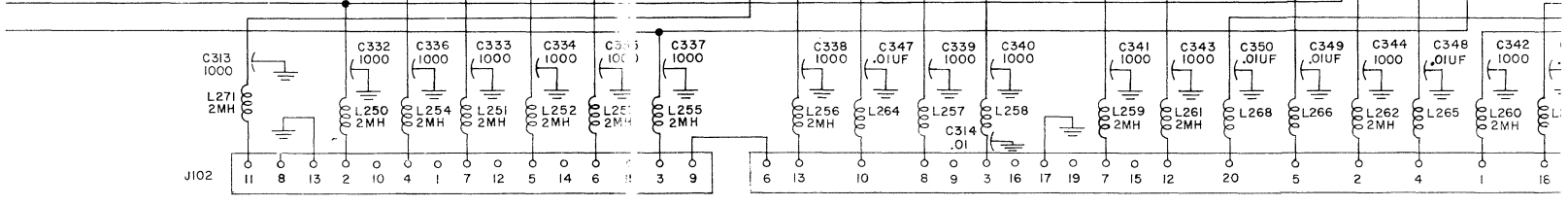
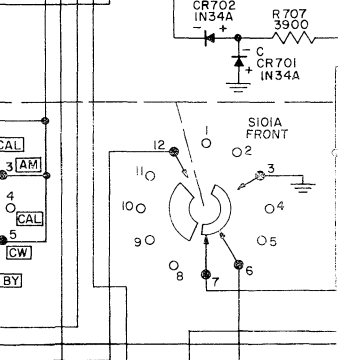
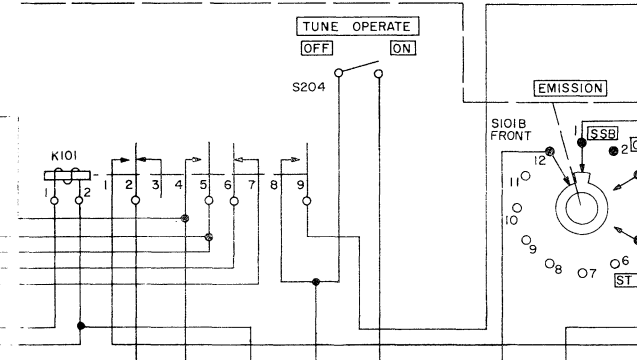
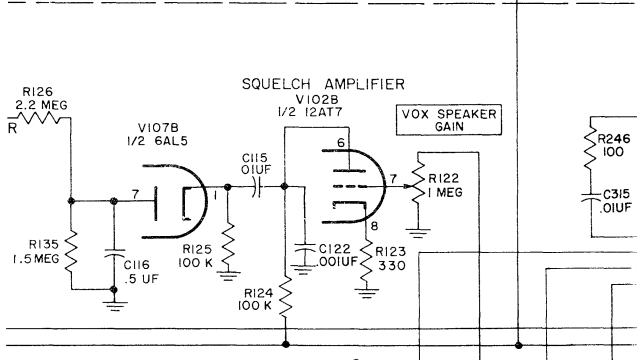
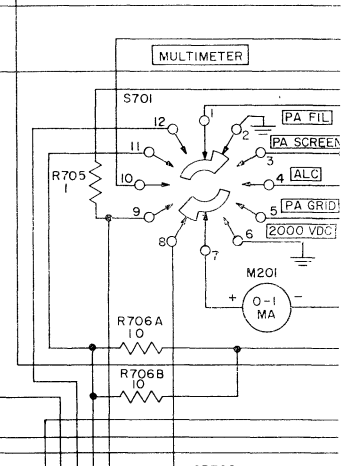
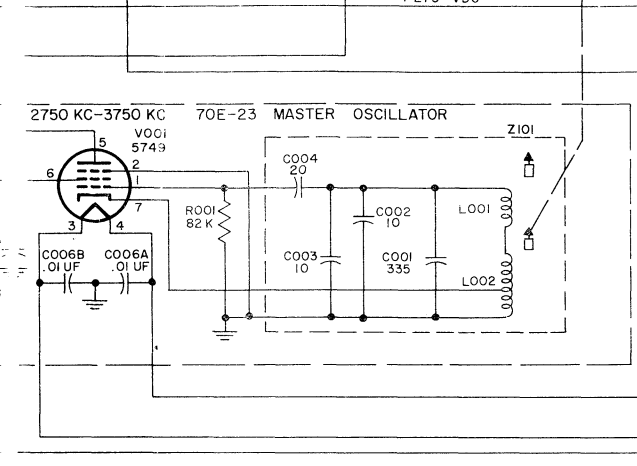
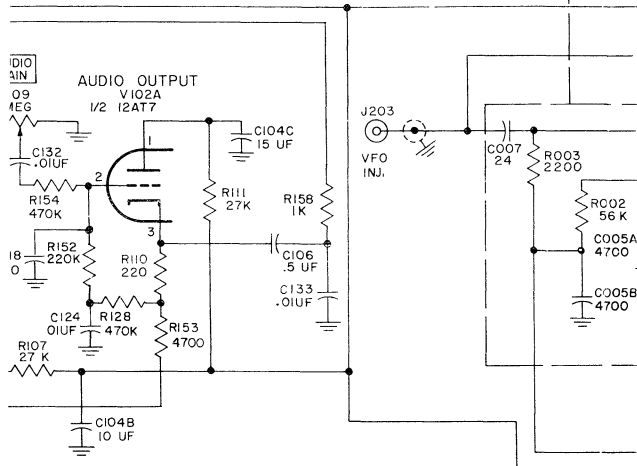
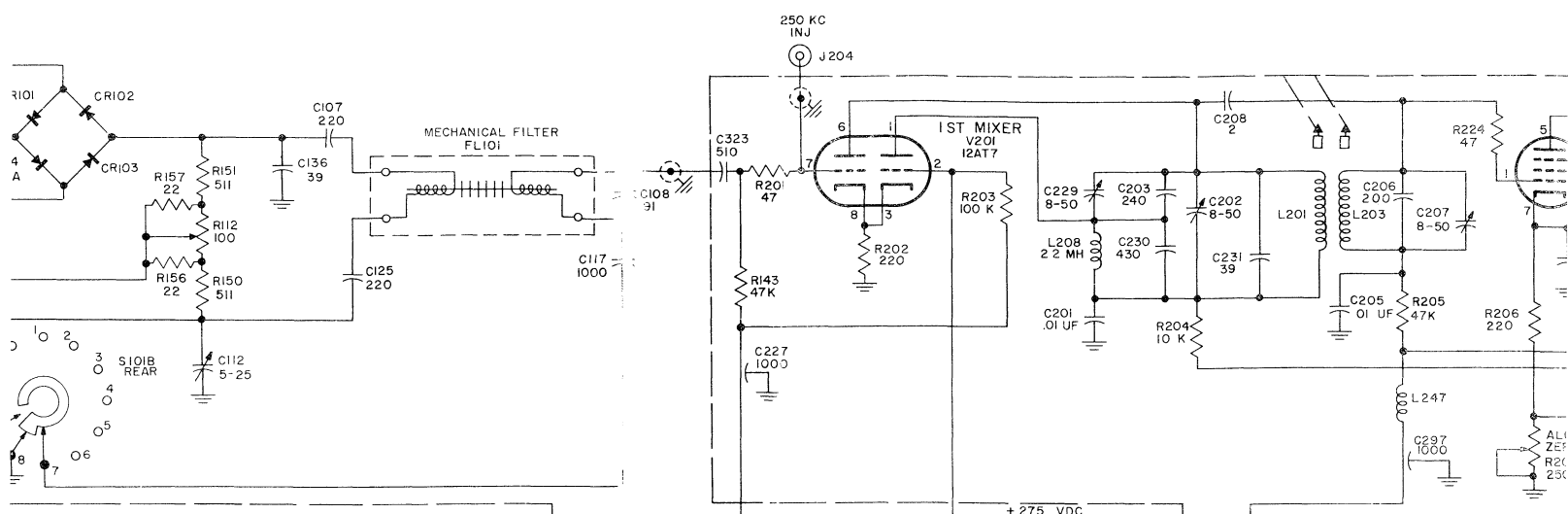
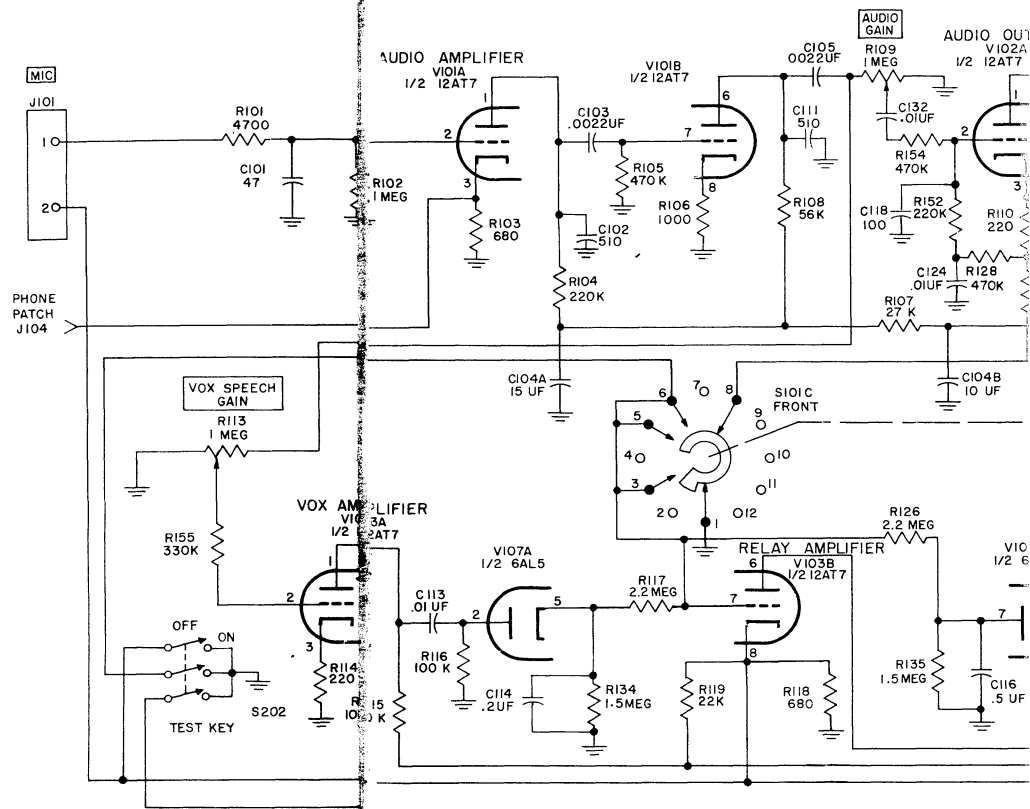
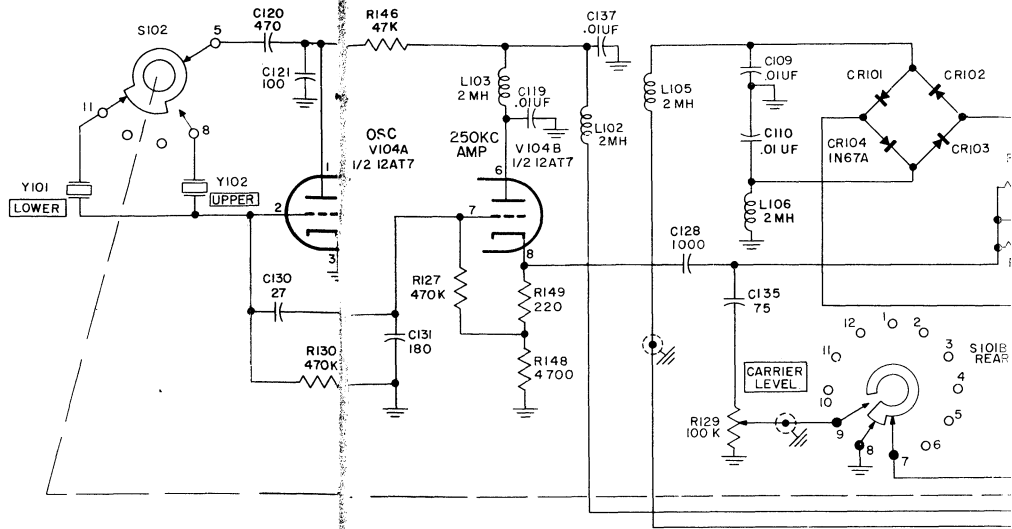


Figure 7-1. Exciter/Power Amplifier, Complete Schematic Diagram





- KEY LINE INTERLOCK
- GROUND
- PTT
- ANT. RELAY
- 500 OHM AUDIO
- RCVR DISABLE
- RCVR DISABLE
- CW KEY
- AC COMMON
- ANT. RELAY
- +275VDC
- TUNE OPERATE
- +350VDC
- GROUND
- HOT AC
- HV METER
- 6.3VAC
- OSC FIL
- PA BIAS
- OSC FIL
- HVPS
- PA FIL



SECTION VIII ANTENNAS WITH 52-OHM COAXIAL FEED LINES

8.1. GENERAL.

This section pertains to some antennas which may be used with the KWS-1 Transmitter.

The advantages of using these antennas are listed below:

- (a) Broadband.
- (b) Coaxial feed system provides shielding for better signal-to-noise ratio at the receiver input terminals.

(c) The half-wave dipole antennas attenuate spurious radiation and the half-wave dipole feed lines attenuate spurious radiation at TV frequencies.

(d) No added tuning controls are necessary.

(e) Coaxial connectors provide a convenient means of transferring antennas.

8.2. ANTENNA DETAILS.

The table following gives the nominal performance expected from the antennas described in this section.

TABLE 8-1

NOMINAL ANTENNA PERFORMANCE SPECIFICATIONS

	FIGURE 8-2	FIGURE 8-3	FIGURE 8-4	FIGURE 8-5
ANTENNA ITEM	10-Meter Beam	20-Meter Beam	40-Meter Dipole	80-Meter Dipole
Frequency range	29.96 to 29.7 mc	14.0 to 14.4 mc	7.0 to 7.3 mc	3.5 to 4.0 mc
Front to back ratio	4 to 1	10 to 1	----	----
Gain over half-wave dipole	6.75 db	5.1 db	----	----
SWR	1.1 at band ctr. 2.1 at band ends	1.8 at band ends	1.8 at band ends	2.5 at band ends

The KWS-1 Amateur Transmitter is designed with an unbalanced output to secure the advantages of pi and L networks.

The KWS-1 Amateur Transmitter antenna output circuits are designed to work into an unbalanced resistive load of 52 ohms with a maximum standing wave ratio of 2.5 to 1. Hence, the transmission line must incorporate a method of line balancing in order to match between the unbalanced output circuits and a balanced radiator. Figures 8-2 and 8-3 show

construction details of beams for use on 10 or 11 and 20 meters. Each beam is constructed with a balanced to unbalanced transformer (balun) to match the beams to a coaxial feed line. Figures 8-4 and 8-5 show construction details of horizontal dipoles for use on 40 and 80 meters. Each dipole is constructed with a balun to match the dipole to a coaxial feed line. If it is desired to use shorter length baluns than those shown for the 40 and 80-meter dipoles, refer to figure 8-6, Short Balun for 40 80 Meters.

Section VIII

Paragraphs 8.2. - 8.4.

The 100 mmf ceramic capacitor used in the 10 and 20-meter beams is described below. The r-f current flowing in this capacitor at 10 meters is 6 amperes; at 20 meters, 3 amperes.

CAPACITOR: Ceramic, 100 mmf $\pm 10\%$, 5000-vdcw. Collins part number 913 0821 00 or Centralab Type 850A.

8.3. TRANSMISSION LINE.

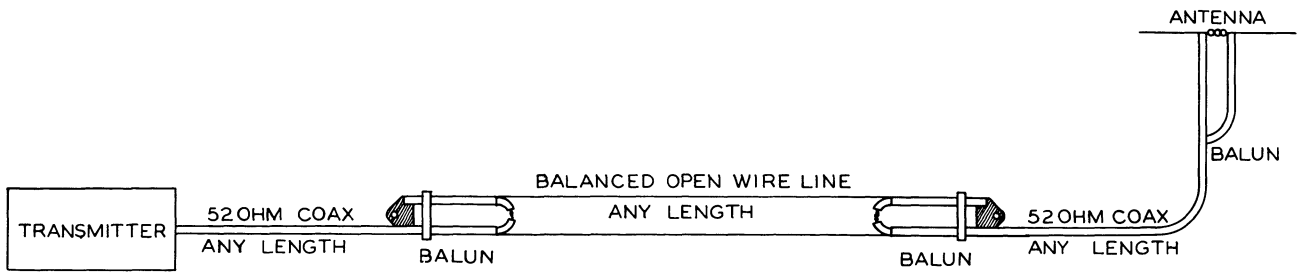
At some installations a long transmission line will be necessary. For lowest transmission line losses, a high impedance open wire balanced line is recommended. To secure the advantage of the low losses of an open wire line, it is necessary to use an unbalanced to balanced impedance matching transformer (balun) to transfer from the unbalanced low impedance output termination, provided on the transmitters to a high impedance open wire balanced

line. Figure 8-1 indicates the construction details of a balun for this purpose.

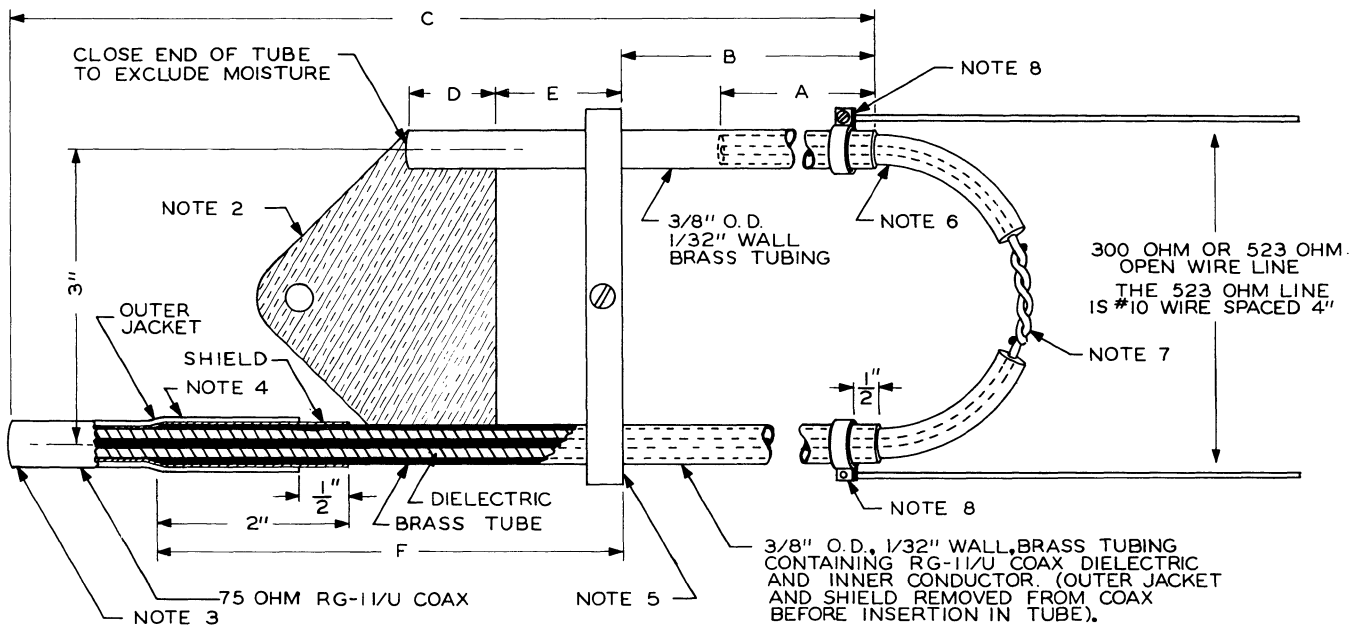
8.4. TEST INFORMATION.

All baluns mentioned in this discussion are resonant circuits. The baluns are cut to operate at the center frequency of the band specified.

If it is desired to check any balun, disconnect the antenna from the balun, and the center conductor of the feed cable from the shield of the opposite cable. Use a grid dip meter, or other means, to check for resonance. If the balun is off frequency, correction may be made by either changing the length of the balun or changing the value of the capacity used. The resonant frequency may also be varied by altering the spacing between cables. The length of the balun must not exceed one quarter wavelength, and baluns shorter than those given in figure 8-6 are not recommended.



THIS SYSTEM PERMITS USE OF A BALANCED OPEN WIRE LINE TO REDUCE LOSSES ON LONG TRANSMISSION LINES. CONSTRUCTION DETAILS OF THE UNBALANCED TO BALANCED IMPEDANCE MATCHING TRANSFORMER (BALUN) USED BETWEEN THE OPEN WIRE LINE AND THE 52 OHM RG-8/U COAXIAL CABLE ARE SHOWN BELOW.



NOTES:

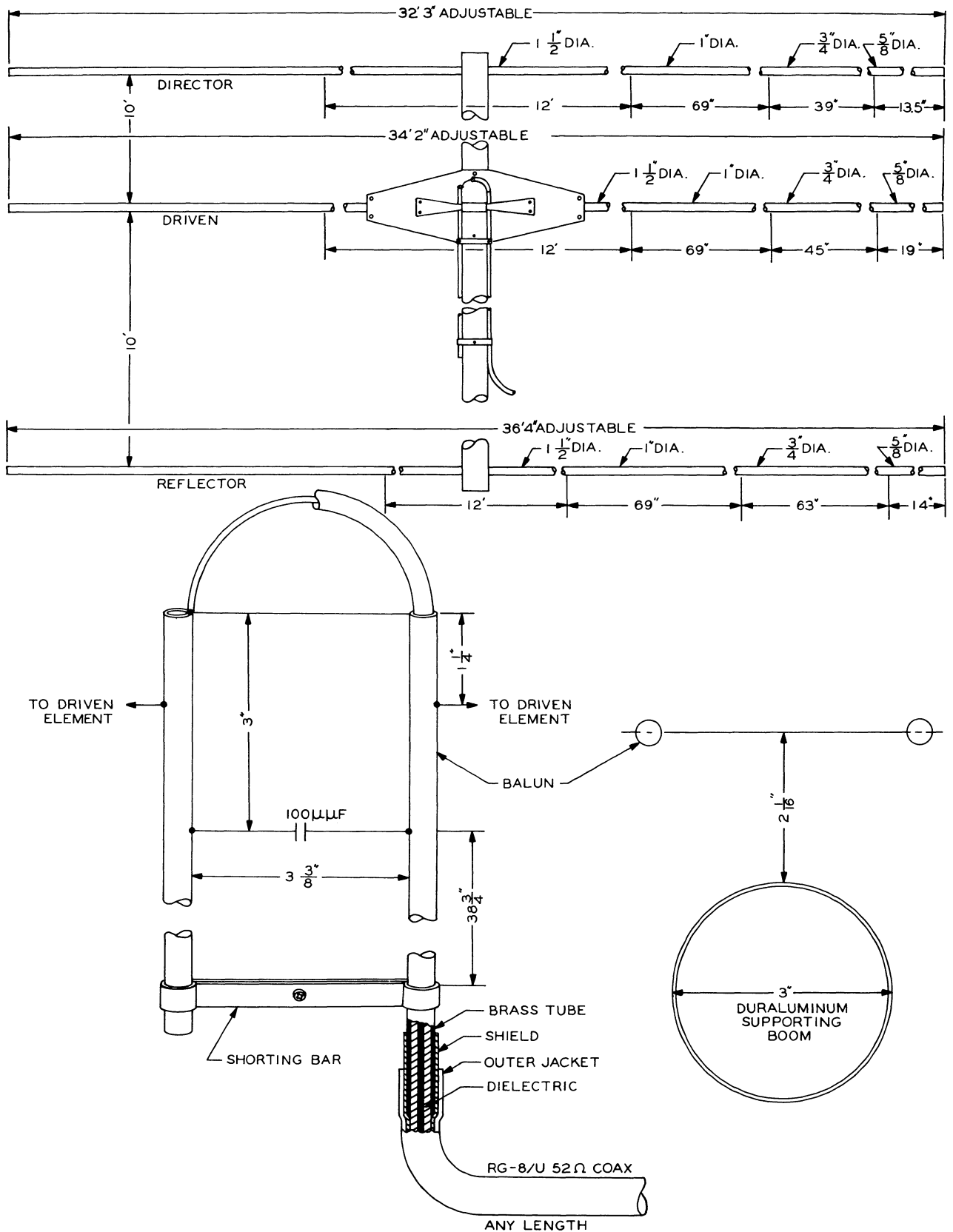
1.

FREQ. MC.	OPEN WIRE LINE IMPEDENCE	LENGTH - INCHES		
		A	B	C
27 TO 29.7	300 OHMS	15 3/8	38 1/4	69 5/8
27 TO 29.7	523 OHMS	10 5/8	44 1/2	69 5/8
14 TO 14.3	523 OHMS	21 1/4	92 1/4	139

DIMENSIONS D, E, AND F ARE NOT CRITICAL AND MAY BE ADAPTED TO THE INDIVIDUAL INSTALLATION. DIMENSION D SHOULD BE LONG ENOUGH TO PERMIT SILVER SOLDERING BRASS PLATE AND TUBES TOGETHER. DIMENSION E SHOULD BE LONG ENOUGH TO PERMIT ADJUSTMENT OF THE SHORTING BAR. DIMENSION F SHOULD BE LONG ENOUGH TO PROVIDE SUFFICIENT OVERHANG FOR CONNECTING THE RG-11/U CABLE.
2. BRASS PLATE OF CONVENIENT SIZE SILVER SOLDERED TO THE TWO BRASS TUBES. PLATE MAY BE GROUNDED OR UNGROUNDED AND IS DESIGNED TO SECURE THE BALUN TO AN END SUPPORT.
3. ATTACH A COAX CONNECTOR HERE TO PERMIT ATTACHING A LENGTH OF 52 OHM RG-8/U COAX.
4. REMOVE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-11/U 75 OHM COAXIAL CABLE. CUT THE OUTER JACKET 1/2 INCH SHORTER THAN THE SHIELD. BEVEL THE OUTER EDGE OF THE 3/8" O.D. BRASS TUBE. SLIDE THE DIELECTRIC INSIDE THE TUBE. FORCE THE BEVELED END OF THE BRASS TUBE BETWEEN THE DIELECTRIC AND THE SHIELD FOR A DISTANCE OF ABOUT 2 INCHES AS SHOWN. SOLDER THE SHIELD TO THE TUBE, USING A MINIMUM AMOUNT OF HEAT TO AVOID DAMAGING THE DIELECTRIC. COVER THE AREA WITH SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
5. THIS SHORTING BAR SHOULD BE MOVABLE TO PERMIT ADJUSTING THE BALUN TO REDUCE THE OVERALL STANDING WAVE RATIO OF THE SYSTEM.
6. REMOVE THE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-8/U 52 OHM COAX. INSERT THE PROPER LENGTH OF BARE DIELECTRIC INSIDE THE TUBE.
7. SOLDER INNER CONDUCTORS TOGETHER. COVER THE TUBE ENDS AND ALL OF THE CABLE BETWEEN WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
9. INSTALL A BRACKET FOR ATTACHING THE OPEN WIRE LINE. IF BRACKET IS SOLDERED, BE VERY CAREFUL TO AVOID OVERHEATING AND DAMAGING THE DIELECTRIC.

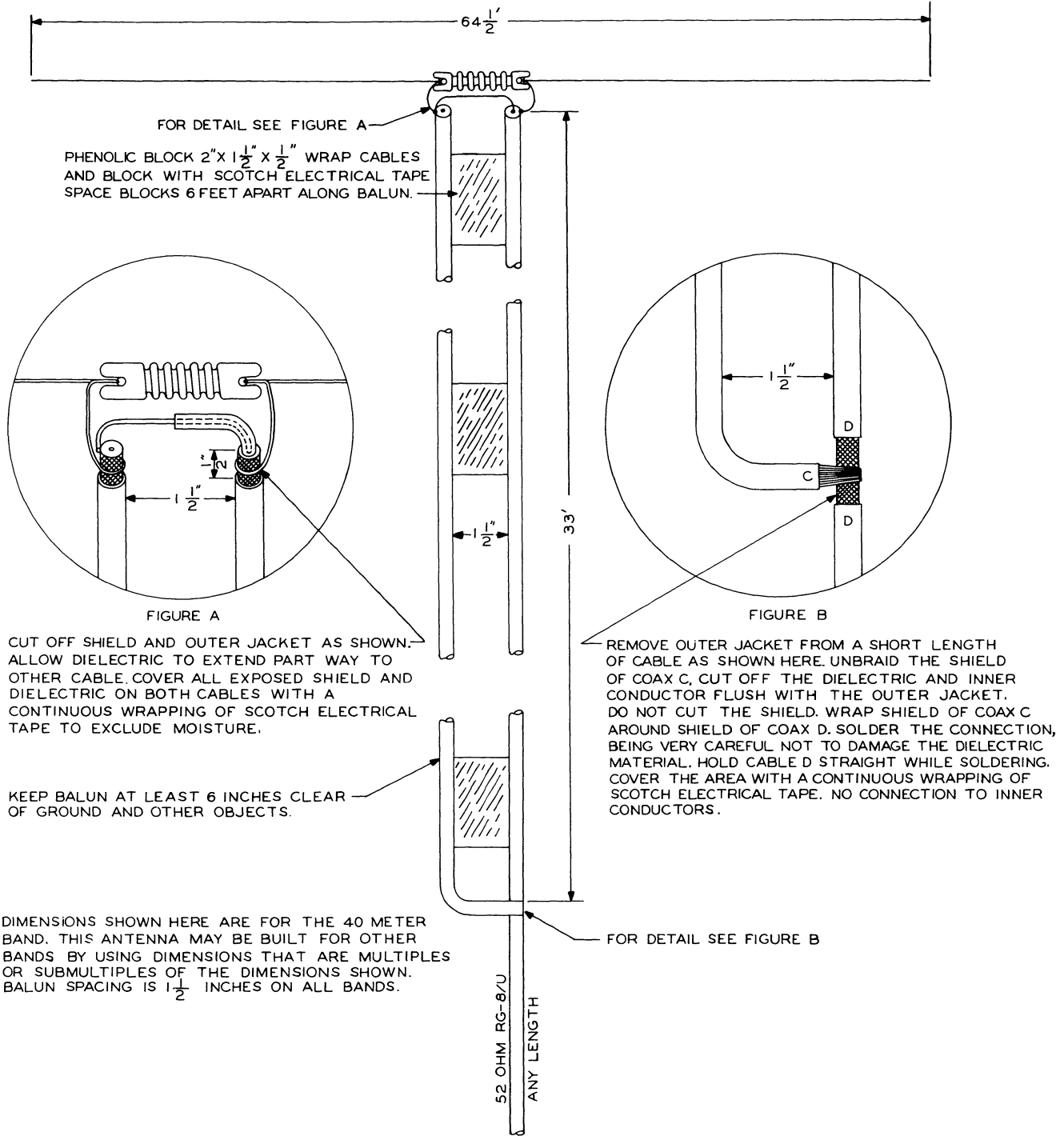
**BALUN WITH BALANCED OPEN WIRE LINE
FOR REDUCTION OF LOSSES ON LONG TRANSMISSION LINES.**

Figure 8-1. Balun With Balanced Open Wire Line for Reduction of Losses on Long Transmission Lines



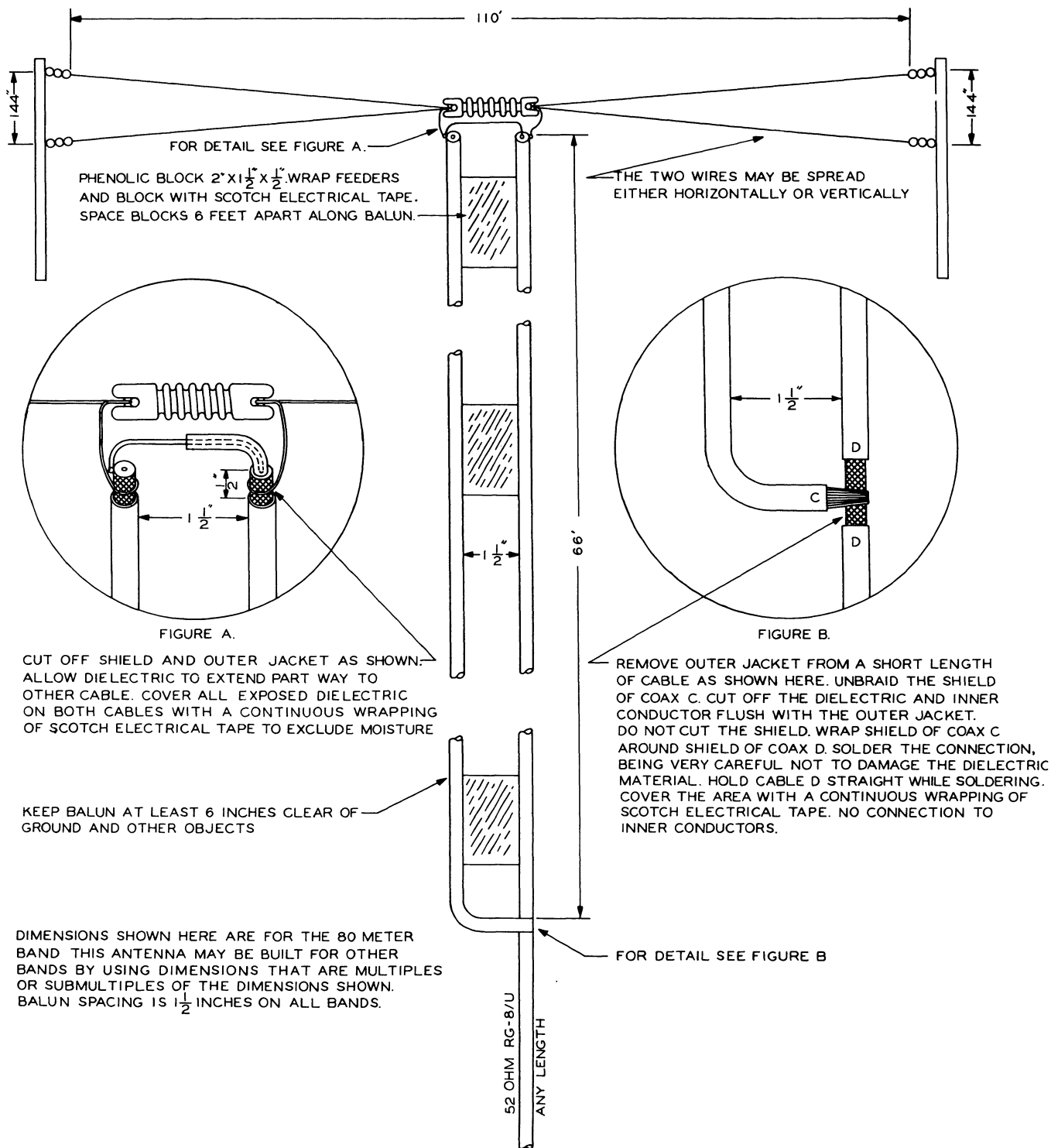
20 METER BEAM WITH SHORTENED UNBALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM. GENERAL CONSTRUCTION IS THE SAME AS THE TEN METER BEAM.

Figure 8-3. 20-Meter Beam With Shortened Unbalanced to Balanced Transformer (Balun) Feed System



HALF WAVE ANTENNA WITH QUARTER WAVE UNBALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM

Figure 8-4. Half-Wave Antenna With Quarter-Wave Unbalanced to Balanced Transformer (Balun) Feed System



BROADBAND ANTENNA WITH QUARTER WAVE UNBALANCED TO BALANCED TRANSFORMER (BALUN) FEED SYSTEM.

Figure 8-5. Broadband Antenna With Quarter-Wave Unbalanced to Balanced Transformer (Balun) Feed System

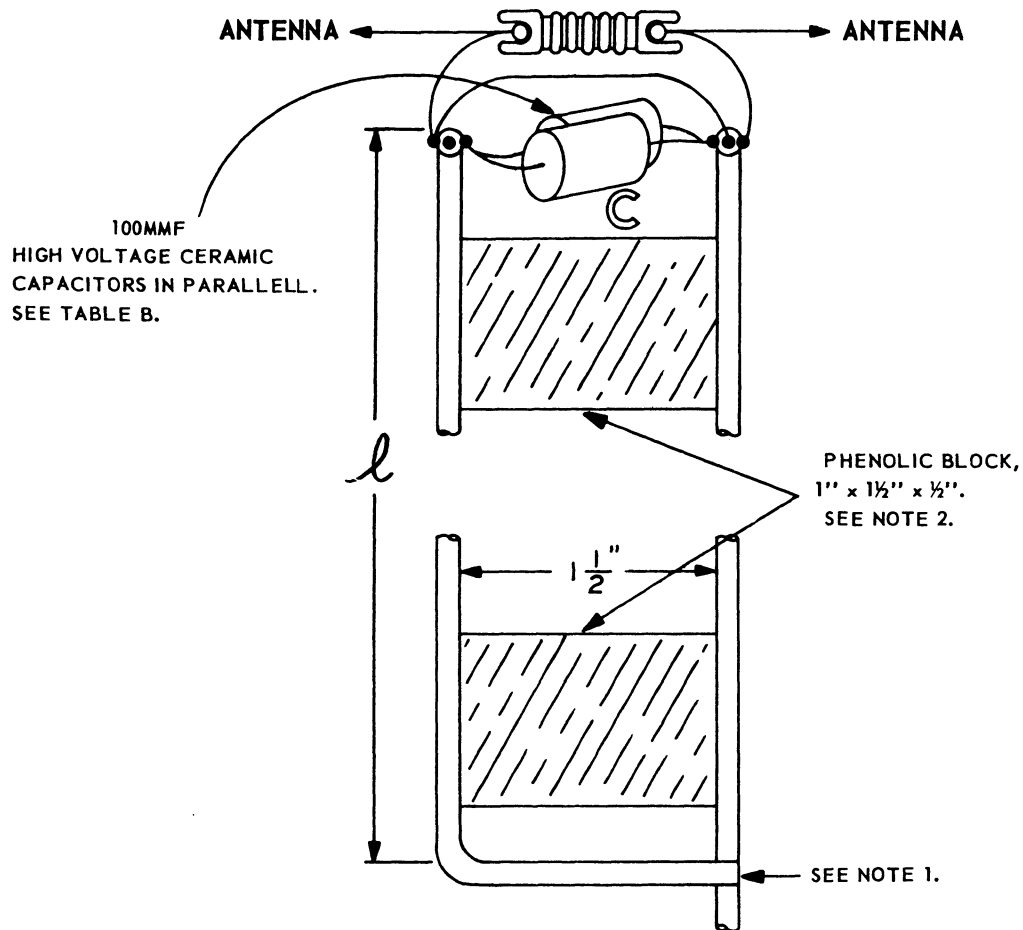


TABLE A

TABLE B- SUITABLE CAPACITORS

BAND	l	C	QUANTITY	TYPE	VALUE	COLLINS PART NO.
40 METERS	7'3"	200MMF	2	CENTRALAB TYPE 850	100MMF	913 0821 00
80 METERS	13'6"	400MMF	4	CENTRALAB TYPE 850	100MMF	913 0821 00

NOTE: 1. FOR PERTINENT CONSTRUCTION DETAILS, REFER TO FIGURES 8-4 AND 8-5.

2. CONSTRUCT BALUN FOR 40-METER BAND WITH THREE SPACERS. CONSTRUCT BALUN FOR 80-METER BAND WITH FOUR OR FIVE SPACERS.

3. THE TWO CABLES SHOULD BE VERY NEARLY PARALLEL.

Figure 8-6. Short Balun for 40 and 80 Meters