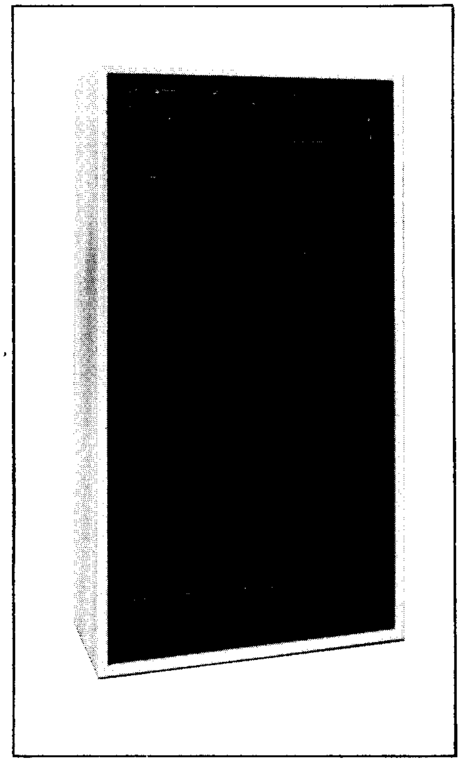
MOTOROLA

"MICOR"®

Base and Repeater Stations

406-420 MHz 12 W/45 W/75 W
450-470 MHz 2 W/12 W/20 W/45 W/75 W
470-512 MHz 12 W/20 W/40 W/60 W



This Manual Must be Used With
Control and Applications Manual 68P81025E60

THIS MANUAL HAS BEEN
DISCONTINUED

68P81025E50-H

BASE AND REPEATER STATIONS

406-420 MHz 12 W/45 W/75 W
450-470 MHz 2 W/12 W/20 W/45 W/75 W
470-512 MHz 12 W/20 W/40 W/60 W

CONTENTS

SECTION	NUMBER
Specifications	Page iv
2-Watt RPTR (RT) Station Model Chart ("AT" Suffix Models)	Page vii
12-Watt Base & RPTR (RT) Station Model Chart ("A" & "AT" Suffix Models)	Page viii
12-Watt Base & RPTR (RT) Station Model Chart ("B" & "BT" Suffix Models)	Page ix
20-Watt Base & RPTR (RT) Station Model Chart ("B" & "BT" Suffix Models)	Page x
20-Watt Base & RPTR (RT) Station Model Chart ("A" & "AT" Suffix Models)	Page xi
40/45-Watt Base & RPTR (RT) Station Model Chart ("A" & "AT" Suffix Models)	Page xii
60/75-Watt Base & RPTR (RT) Station Model Chart ("A" & "AT" Suffix Models)	Page xiii
Model Series Breakdown Chart	Page xiv
Factory Installed Options	Page xv
Foreword	Page xvi
General Safety Information	FPS-28750

STATION DATA

DESCRIPTION	68P81025E89
Manual Usage	Page 1
Equipment Description Introduction	Page 1
Transmitter	Page 2
Receiver	Page 2
Station Block Diagram	Page 3
Power Supply	Page 5
Volume & Squelch Controls	Page 5
"Private-Line" Tone-Coded Squelch Operation	Page 5
"Digital Private-Line" Binary-Coded Squelch Operation	Page 5
Accessories	Page 5
INSTALLATION	68P81025E91
Inspection	Page 1
Planning the Installation	Page 1
Ventilation	Page 1
Installation of 30-, 41-, & 60-Inch Indoor "Compa-Station" Cabinets	Page 1
Installation of 70-Inch Indoor Upright Station Cabinet	Page 2
Installation of 46- & 75-Inch "Outdoor" Cabinets	Page 2
Antenna Connections	Page 3
AC Input Power Connections	Page 5

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68P81025E50-H
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SECTION	NUMBER
Optional Mode Jumpering	Page 6
Control Line Connections	Page 7
Control Line Level Adjustment	Page 9
Typical Station Layout (rear) Racking, Cabling, and Parts List	Page 13
Station Cabinets Dimensional Details and Parts List	Page 16, 17
UPRIGHT OUTDOOR CABINET	68P81033E42
"COMPA-STATION" OUTDOOR CABINET	68P81033E46
"COMPA-STATION METERING & INTERCOM (EARLIER VERSION)	68P81042E33
UPRIGHT STATION METERING AND INTERCOM	68P81042E57
"COMPA-STATION" METERING AND INTERCOM (LATER VERSION)	68P81033E28
STATION ALIGNMENT	68P81042E53
Introduction	Page 1
Transmitter Alignment	Page 1
Receiver Alignment	Page 5
STATION MAINTENANCE	68P81025E92
Introduction	Page 1
Local Operation for Testing & Maintenance	Page 1
Maintenance Techniques	Page 3
Routine Maintenance	Page 3
Recommended Test Equipment	Page 4
Transmitter Maintenance	Page 4
Receiver Maintenance	Page 27
Maintenance Log Sheet	Page 39

TRANSMITTER

TRANSMITTER INTRODUCTION	68P81042E32
TRANSMITTER INTERCONNECT BOARD (TLN5645A, TLN5647A, TRN6195A)	68P81042E26
EXCITER/1ST BANDPASS FILTER (TLE1720B SERIES) TRIPLER/LOW LEVEL AMPLIFIER (TLE1600B SERIES)	68P81042E13
Introduction	Page 1
Functional Operation	Page 1
Schematic Diagram, Circuit Board Detail, and Parts List	PEPS-18716
POWER AMPLIFIERS	68P81042E14
Introduction	Page 1
12-WATT POWER AMPLIFIER (TLE1680A SERIES)	68P81042E16
20-WATT POWER AMPLIFIER (TLE1690A SERIES)	68P81042E17
40/45-WATT POWER AMPLIFIER, 450-512 MHz (TLE1703A)	68P81042E18
45-WATT POWER AMPLIFIER, 406-420 MHz (TLE1701A)	68P81042E39
60/75-WATT POWER AMPLIFIER 450-512 MHz (TLE1713A, TLE1714A)	68P81042E19
75-WATT POWER AMPLIFIER, 406-420 MHz (TLE1711A)	68P81042E38

SECTION | NUMBER

POWER CONTROL BOARD (TLN4926A/AV) 68P81034E14
Introduction . . . . . Page 1
Functional Description . . . . . Page 1
Schematic Diagram, Circuit Board Detail, and Parts List PEPS-27686

ANTENNA NETWORK, TLE1893B (RPTR STA'S) 68P81044E57

ANTENNA NETWORK, TLE1660B SERIES 68P81044F58

ANTENNA NETWORK, TLE1670B SERIES (RPTR STA'S) 68P81044E37

"PRIVATE-LINE" ENCODER (TLN5731A) 68P81026E71

SIMPLEX "DIGITAL PRIVATE-LINE" ENCODER (TTN6003A) 68P81028E63

DUPLEX "DIGITAL PRIVATE-LINE" ENCODER (TLN5725A) 68P81028E64

RECEIVER

RECEIVER INTRODUCTION 68P81042E36
Introduction . . . . . Page 1

RECEIVER INTERCONNECT BOARD 68P81034E07
Description . . . . . Page 1
"AND-Squelch" Operation. . . . . . Page 1
Schematic Diagram, Circuit Board Detail, and Parts List PEPS-28297

RF & I-F (BOARD: TLE8030A/B SERIES & RF DECK TLE8020A SERIES) 68P81042E37
Introduction . . . . . Page 1
Functional Description . . . . . Page 2
Schematic Diagram, Circuit Board Detail, and Parts List PEPS-17752

AUDIO & SQUELCH BOARD (TRN6006A, 7A) 68P81025E79
Description . . . . . Page 1
Functional Operation . . . . . Page 1
Schematic Diagram, Circuit Board Detail, and Parts List PEPS-16952

AUDIO POWER AMPLIFIER (TLN4290B) 68P81014E97
Description . . . . . Page 1
Schematic Diagram, Circuit Board Detail & Parts List PEPS-28290

TONE "PRIVATE-LINE" DECODER (TRN6002A) 68P81026E73

"DIGITAL PRIVATE-LINE" DECODER (TLN5729A) 68P81026E13

POWER SUPPLIES

POWER SUPPLY (TPN1151A, 52A) 68P81033E41

POWER SUPPLY (TPN1110A, B) 68P81020E44

PERFORMANCE SPECIFICATIONS

GENERAL

Frequency Range 406-420 MHz, 450-512 MHz
No. of Frequencies: Up to 4 frequencies

406-420 MHz 450-470 MHz MODEL SERIES	CONTINUOUS MINIMUM RF POWER OUTPUT	POWER INPUT REQUIREMENTS		DC POWER	
		STANDBY 121 V, 60 Hz	TRANSMIT 121 V, 60 Hz	STANDBY 13.6 V DC	TRANSMIT 13.6 V DC
C24RCB B/C34RCB B/C44RCB (Note 2) B/C54RCB B/C64RCB	2 W 12 W 20 W 45 W 75 W	.85 amp	2.1 amp 2.1 amp 2.6 amp 3.8 amp 6.1 amp	1.5 amp	10.0 amp 10.0 amp 11.0 amp 17.9 amp 27.0 amp
470-512 MHz MODEL SERIES					
B/C34RCB B/C44RCB B/C54RCB B/C64RCB	12 W 20 W 40 W 60 W	.85 amp	NOTE 1	1.5 amp	NOTE 1

NOTES:
1. Value same as comparable model above except as reduced to meet E.R.P. requirements.
2. Not available in 406-420 MHz range.

CABINET	DIMENSION (INCHES)	APPROXIMATE SHIPPING WEIGHT (LBS)
31-Inch "Compa-Station" Indoor Cabinet	22 W x 30-1/4 H x 10 D	150
41-Inch "Compa-Station" Indoor Cabinet	22 W x 41 H x 10 D	190
46-Inch "Compa-Station" Outdoor Cabinet	22 W x 46 H x 20 D (including Rain Shields)	180
60-Inch "Compa-Station" Indoor Cabinet	22 W x 60 H x 20 D	220
70-Inch Upright Indoor Cabinet	21-3/4 W x 70 H x 19-1/4 D	280
75-Inch Upright Cabinet	23-3/4 W x 74-5/8 H x 25-1/4 D (including Rain Shields)	365
Metering	Optional internal mounted meter used to measure all essential circuits for tuning and checking.	
	A single scale, 0-50 microampere meter with 2,000 ohms equivalent series resistance or Motorola portable test set can be used to measure all circuits essential to tuning and checking.	
	"B" models include DC metering and intercom as standard equipment.	

PERFORMANCE SPECIFICATIONS (Cont'd.)

TRANSMITTER

RF POWER OUTPUT	406-420 MHz 450-470 MHz 470-512 MHz	12 W 2W/12W 12 W	NOTE 2 20 W 20 W	45 W 45 W 40 W	75 W 75 W 60 W
OUTPUT IMPEDANCE			50 ohms		
OSCILLATOR FREQUENCY STABILITY			Channel element maintains oscillator frequency within ±0.0002% from -30°C to +60°C ambient (+25°C reference)		
TRANSMITTER SIDE BAND NOISE			85 dB @ ±25 kHz 100 dB @ ±1 MHz		
SPURIOUS & HARMONICS (CONDUCTED)			More than 85 dB below carrier		
MODULATION			15F2 and 16F3: ±5 kHz for 100% at 1000 Hz		
AUDIO SENSITIVITY			Local: 0.120 volt ±3 dB for 60% maximum deviation at 1000 Hz. Remote Telephone Line: -20 dBm max. for 60% maximum deviation at 1000 Hz		
FM NOISE			55 dB below 60% system deviation at 1000 Hz		
AUDIO RESPONSE			+1, -3 dB from 6dB/octave pre-emphasis, 300-3000 Hz, referenced to 1000 Hz		
AUDIO DISTORTION			Less than 2% at 1000 Hz; 60% system deviation		

"SENSITRON" RECEIVER

CHANNEL SPACING		25 kHz	
EIA MODULATION ACCEPTANCE		±7 kHz minimum	
FREQUENCY STABILITY		AFC channel element maintains receiver frequency within ±0.0002% of reference frequency from -30°C to +60°C ambient temperature (+25°C reference).	
INPUT IMPEDANCE		50 ohms	
		NO PREAMPLIFIER	WITH PREAMPLIFIER
SENSITIVITY	20 dB QUIETING	0.5 uV	0.25 uV
	EIA SINAD	0.35 uV	0.175 uV
SELECTIVITY (EIA SINAD)		-90 dB @±25 kHz	
EIA SINAD INTERMODULATION		-85 dB	-80 dB
SPURIOUS AND IMAGE REJECTION		100 dB minimum	
SQUELCH SENSITIVITY CARRIER SQUELCH (adjustable)		.25 uV or less at threshold	.125 uV or less at threshold
TONE-CODED SQUELCH		.25 uV or less	.125 uV or less
DIGITAL-CODED SQUELCH		.25 uV or less	.125 uV or less

PERFORMANCE SPECIFICATIONS (Cont'd.)

AUDIO (TELEPHONE LINE)	OUTPUT	+18 dBm at 600 ohms
	RESPONSE	+1, -3 dB
	DISTORTION	3% at 1000 Hz
	HUM & NOISE	-55 dB
	LOCAL SPEAKER	10 watts at 8 ohms output available

FCC LICENSE DESIGNATION

	Transmitter		
MODEL	450-470 MHz	470-494 MHz	494-512 MHz
B/C 64 Series			
75 Watt	CC4224C	---	---
60 Watt	---	CC4224C-1	CC4224C-2
B/C 54 Series			
45 Watt	CC4223C	---	---
40 Watt	---	CC4223C-1	CC4223C-2
B/C 44 Series			
20 Watt	CC4222C	CC4222C-1	CC4222C-2
B/C 34 Series			
12 Watt	CC4221C	CC4221C-1	CC4221C-2
C 24 Series			
2 Watt	CC4262C	---	---
	Receiver		
Non-Shifted IF w/o Preampl	RC0080		
Non-Shifted IF w Preampl	RC0081		
Shifted IF w/o Preampl	RC0082		
Shifted IF w Preampl	RC0083		

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

EPS-17817-B

2-W MODELS

MOTOROLA

STATION MODEL CHART

FOR

"MICOR" "COMPA-STATION" AND UPRIGHT

450-470 MHz

CODE:

[X] = QUANTITY OF ONE SUPPLIED

[*] = INDICATES A MODEL SERIES.
REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

C24RCB-1105AT

- A=BASE STATIONS
  AT=RPTR (RT) STATION
- 5=DC CONTROL
  6=TONE CONTROL
- 0=T1-R1 (ONE XMIT CHANNEL-ONE RECEIVE CHANNEL)
  2=T2-R2
  4=T2-2R1 (TWO XMIT CHANNELS-(2) ONE CHANNEL RECEIVERS)
  9=T4-R4 (FOUR XMIT CHANNELS-FOUR RECEIVE CHANNELS)
- 1=CARRIER SQUELCH
  3="PL" TONE CODED SQUELCH
  6="PL" DIGITAL CODED SQUELCH
- RF OUTPUT POWER 2 WATTS
- B OR C
  B=UPRIGHT STATION
  C="COMPA-STATION" RADIO

STATION MODEL	DESCRIPTION: TYPE OF SQUELCH	TYPE OF CONTROL	OPERATING CHANNELS
REPEATER (RT) STATIONS			
C24RCB1105AT	CARRIER	DC	T1-R1
C24RCB1106AT	CARRIER	TONE	T1-R1
C24RCB3105AT	"PRIVATE-LINE"	DC	T1-R1
C24RCB3106AT	"PRIVATE-LINE"	TONE	T1-R1
C24RCB6105AT	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C24RCB6106AT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1

STATION MODEL	CHANNEL ELEMENT (RCVR) KXN1024A	CHANNEL ELEMENT (XMTR) KXN1052A	"VIBRASENDER" RESONANT REED KLN6210A	*EXCITER/1ST BANDPASS FILTER (450-470 MHz) TLE1723B	*TRIPLER/LOW LEVEL AMPLIFIER (450-470 MHz) TLE1603A	*12-WATT POWER AMPLIFIER TLE1683A	* ANTENNA NETWORK (2 W) TLE1893B	*CONTROL CHASSIS TCN1187A	AUDIO POWER AMPLIFIER TLN4290B	GUARD TONE MODULE TLN1245B	STATION CONTROL MODULE TLN4635B	TIME OUT TIMER MODULE TLN4636A
C24RCB1105AT	X	X		X	X	X	X	X	X		X	X
C24RCB1106AT	X	X		X	X	X	X	X	X	X	X	X
C24RCB3105AT	X	X	X	X	X	X	X	X	X		X	X
C24RCB3106AT	X	X	X	X	X	X	X	X	X	X	X	X
C24RCB6105AT	X	X		X	X	X	X	X	X		X	X
C24RCB6106AT	X	X		X	X	X	X	X	X	X	X	X

STATION MODEL	DC TRANSFER MODULE ("PL") TLN4659A	DC TRANSFER MODULE (CS) TLN4661A	SQUELCH GATE MODULE TLN4662A	F1-TONE CONTROL MODULE TLN4658A	F1-"PL" TONE CONTROL MODULE TLN4638A	LINE DRIVER MODULE TLN4669B	POWER CONTROL BOARD TLN4926A	CARD PULLER TRN8686A	"PL" DECODER HARDWARE KIT TLN5654A	HARDWARE KIT TRN6197A	"VIBRASPONDER" RESONANT REED TLN8381A	"PL" STANDARD ENCODER TLN5731A
C24RCB1105AT		X	X			X	X	X		X		
C24RCB1106AT			X	X		X	X	X		X		
C24RCB3105AT	X		X			X	X	X	X	X	X	X
C24RCB3106AT			X		X	X	X	X	X	X	X	X
C24RCB6105AT	X		X			X	X	X	X	X		
C24RCB6106AT			X		X	X	X	X	X	X		

STATION MODEL	DUPLEX ENCODER TLN5725A	DECODER BOARD TLN5729A	"PL" DECODER HARDWARE KIT TLN5654A	*RECEIVER RF & IF BOARD TRE1203BA	AUDIO & SQUELCH BOARD TRN6006A	"PL" SQUELCH DECODER TRN6002A	CODE PLUG TRN6005A	"PL" ENCODER HARDWARE KIT TRN6188A	POWER SUPPLY TPN1110B	CABLE KIT (12 W) TKN6803A	CABINET KIT THN6141A
C24RCB1105AT				X				X	X	X	
C24RCB1106AT				X				X	X	X	
C24RCB3105AT				X	X	X		X	X	X	X
C24RCB3106AT				X	X	X		X	X	X	X
C24RCB6105AT	X	X		X	X		X	X	X	X	X
C24RCB6106AT	X	X		X	X		X	X	X	X	X

EPS-25407-B

12-W EARLIER VERSION MODELS

MOTOROLA

STATION MODEL CHART
FOR
"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS
406-420 MHz and 450-512 MHz

CODE:

- [X] = ONE SUPPLIED
- [2] = TWO SUPPLIED
- [4] = FOUR SUPPLIED
- [0] = TWO KXN1024A RCVR ELEMENTS SUPPLIED UNLESS RCVR CARRIER FREQUENCIES ARE SEPARATED BY 11.7 MHz ±25 kHz (OR A SUB-MULTIPLE THEREOF). IN THIS CASE, A KXN1024A CHANNEL ELEMENT IS USED IN THE FIRST RCVR AND A KXN1049A CHANNEL ELEMENT IS USED IN THE SECOND RCVR. THE IF OF THE SECOND RCVR IS SHIFTED USING A TLE8610A SHIFTED IF KIT.

* INDICATES A MODEL SERIES.
REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

C34RCB-1105A

- A = BASE STATION
- AT = RPTR (RT) STATION
- 5 = DC CONTROL
- 6 = TONE CONTROL
- 0 = T1-R1 (ONE XMIT CHANNEL -ONE RECEIVE CHANNEL)
- 2 = T2-R2
- 4 = T2-2R1 (TWO TRANSMIT CHANNELS-(2) ONE CHANNEL RECEIVERS)
- 9 = T4-R4 (FOUR TRANSMIT CHANNELS -FOUR RECEIVE CHANNELS)
- 1 = CARRIER SQUELCH
- 3 = "PL" TONE-CODED SQUELCH
- 6 = "PL" DIGITAL-CODED SQUELCH
- RF OUTPUT POWER
- B OR C
  - B = UPRIGHT STATION
  - C = "COMPA-STATION" RADIO

STATION MODEL (SEE NOTE)	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS	TCN1148A * UNIFIED CONTROL CHASSIS (BASE)	TCN1187A * UNIFIED CONTROL CHASSIS (RPTR)	TLE1600A SERIES * TRIPLER/LOW LEVEL AMPLIFIER	TLE1660B SERIES * ANTENNA NETWORK (BASE)	TLE1670B SERIES * ANTENNA NETWORK (RPTR)	TLE1720B SERIES * EXCITER & 1ST BANDPASS FILTER	TLN4926A POWER CONTROL BOARD	TLN5731A TONE "PRIVATE-LINE" ENCODER	TTN6003A "PL" DIGITAL-CODED SQUELCH ENCODER (SIMPLEX)	TLN5725A "PL" DIGITAL-CODED SQUELCH ENCODER (DUPLEX)	TRN6005A CODE PLUG (DIGITAL-CODED "PL")	KXN1052A CHANNEL ELEMENT (XMIT)	TLN6824A "VIBRASENDER" RESONANT REED	TRN6188A "PL" ENCODER HARDWARE KIT	TLN5654A "PL" DECODER HARDWARE KIT	TLN4635B STATION CONTROL MODULE	TLN4669B LINE DRIVER MODULE (1REC-2-WIRE)	TLN4670B LINE DRIVER MODULE (2 REC)	TLN4661A DC TRANSFER MODULE (F-CS-F1)	TLN4663A DC TRANSFER MODULE (C2-R2)	TLN4659A DC TRANSFER MODULE (F1-"PL")	TLN4660A DC TRANSFER MODULE (F2-R2 MUTE)	TLN1245B GUARD TONE MODULE	TLN4658A F1 TONE CONTROL MODULE
BASE STATIONS																											
C34RCB1105A	CARRIER	DC	T1-R1	X		X	X		X	X					X				X	X		X					
C34RCB1106A	CARRIER	TONE	T1-R1	X		X	X		X	X					X				X	X						X	X
C34RCB1125A	CARRIER	DC	T2-R2	X		X	X		X	X					2				X	X			X				
C34RCB1126A	CARRIER	TONE	T2-R2	X		X	X		X	X					2				X	X						X	X
C34RCB1145A	CARRIER	DC	T2-2R1	X		X	X		X	X					2				X		X				X		
C34RCB1146A	CARRIER	TONE	T2-2R1	X		X	X		X	X					2				X		X					X	X
C34RCB1196A	CARRIER	DC	T4-R4	X		X	X		X	X					4				X	X						X	
C34RCB3105A	"PL" TONE-CODED	DC	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X				X			
C34RCB3106A	"PL" TONE-CODED	TONE	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X						X	
C34RCB3125A	"PL" TONE-CODED	DC	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X			X				
C34RCB3126A	"PL" TONE-CODED	TONE	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X						X	
C34RCB3145A	"PL" TONE-CODED	DC	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X				X		
C34RCB3146A	"PL" TONE-CODED	TONE	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X					X	
C34RCB3196A	"PL" TONE-CODED	TONE	T4-R4	X		X	X		X	X	X				4	X	X	X	X	X						X	
C34RCB6105A	"DIGITAL PRIVATE-LINE"	DC	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X				X			
C34RCB6106A	"DIGITAL PRIVATE-LINE"	TONE	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X						X	
C34RCB6125A	"DIGITAL PRIVATE-LINE"	DC	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X			X				
C34RCB6126A	"DIGITAL PRIVATE-LINE"	TONE	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X						X	
C34RCB6145A	"DIGITAL PRIVATE-LINE"	DC	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X				X		
C34RCB6146A	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X					X	
C34RCB6196A	"DIGITAL PRIVATE-LINE"	TONE	T4-R4	X		X	X		X	X		X		X	4		X	X	X	X						X	
REPEATER (RT) STATIONS																											
C34RCB1105AT	CARRIER	DC	T1-R1		X	X		X	X	X					X				X	X		X					
C34RCB1106AT	CARRIER	TONE	T1-R1		X	X		X	X	X					X				X	X						X	X
C34RCB3105AT	"PL" TONE-CODED	DC	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X				X			
C34RCB3106AT	"PL" TONE-CODED	TONE	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X						X	
C34RCB6105AT	"DIGITAL PRIVATE-LINE"	DC	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X				X			
C34RCB6106AT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X						X	

STATION MODEL (SEE NOTE)	TLN4638A F1-"PL" TONE CONTROL MODULE	TLN4665A F2 TONE CONTROL MODULE	TLN1248A C2-R2 TONE CONTROL MODULE	TLN4636A TIME-OUT TIMER MODULE	TLN5292A 4-FREQUENCY CONTROL MODULE	TLN5293A F1 CONTROL MODULE (4F-CS)	TLN5294A F1-"PL" CONTROL MODULE (4F-"PL")	TLN8799A SERVICE BOARD	TRN6338A 5-VOLT REGULATOR KIT	TLN4662A SQUELCH GATE MODULE	TRE1200BA SERIES * RCVR RF & IF	TRN6006A RCVR AUDIO & SQUELCH BOARD	TLN4290B RCVR AUDIO POWER AMPLIFIER	TRN6002A "PL" TONE-CODED SQUELCH DECODER	TLN5729A "PL" DIGITAL-CODED SQUELCH DECODER	TLN8381A "VIBRASPONDER" RESONANT REED	KXN1024A CHANNEL ELEMENT (RCVR)	TKN6802A RECEIVER CABLE KIT (BETWEEN RECEIVER & ANTENNA NETWORK)	TLE8340A 2-RCVR COUPLER	TLN1738A 2ND RCVR CHASSIS NOTE	TPN1151A POWER SUPPLY (FORMERLY TPN1110B)	TRN6197A HARDWARE KIT	TRN6198A CABINET HARDWARE KIT (2-RECEIVER MODELS ONLY)	TRN6193A TRANSMITTER SHIELD KIT	TLE1680A SERIES * 12-WATT POWER AMPLIFIER	TKN6803A 12-WATT CABLE KIT		TRN6194A RECEIVER SHIELD KIT	THN6141A 31-INCH "COMPA-STATION" CABINET
BASE STATIONS																													
C34RCB1105A								X			X	X	X				X	X			X	X			X	X	X		X
C34RCB1106A								X			X	X	X				X	X			X	X			X	X	X		X
C34RCB1125A								X			X	X	X				2	X			X	X			X	X			X
C34RCB1126A			X					X			X	X	X				2	X			X	X			X	X			X
C34RCB1145A								X			2	2	2				0	X	X	X	X		X	X	X	X		X	
C34RCB1146A		X						X			2	2	2				0	X	X	X	X		X	X	X	X		X	
C34RCB1196A					X	X		X	X		X	X	X				4	X			X	X			X	X			X
C34RCB3105A								X			X	X	X	X		X	X	X			X	X			X	X			X
C34RCB3106A	X							X			X	X	X	X		X	X	X			X	X			X	X			X
C34RCB3125A								X			X	X	X	X		X	2	X			X	X			X	X			X
C34RCB3126A	X		X					X			X	X	X	X		X	2	X			X	X			X	X			X
C34RCB3145A								X			2	2	2	2		2	0	X	X	X	X		X	X	X	X		X	
C34RCB3146A	X	X						X			2	2	2	2		2	0	X	X	X	X		X	X	X	X		X	
C34RCB3196A					X		X	X	X		X	X	X	X		X	4	X			X	X			X	X			X
C34RCB6105A								X			X	X	X		X		X	X			X	X			X	X			X
C34RCB6106A	X							X			X	X	X		X		X	X			X	X			X	X			X
C34RCB6125A								X			X	X	X		X		2	X			X	X			X	X			X
C34RCB6126A	X		X					X			X	X	X		X		2	X			X	X			X	X			X
C34RCB6145A								X			2	2	2		2		0	X	X	X	X		X	X	X	X		X	
C34RCB6146A	X	X						X			2	2	2		2		0	X	X	X	X		X	X	X	X		X	
C34RCB6196A					X		X	X	X		X	X	X		X		4	X			X	X			X	X			X
REPEATER (RT) STATIONS																													
C34RCB1105AT				X				X		X	X	X	X				X				X	X			X	X			X
C34RCB1106AT				X				X		X	X	X	X				X				X	X			X	X			X
C34RCB3105AT				X				X		X	X	X	X	X		X	X				X	X			X	X			X
C34RCB3106AT	X			X				X		X	X	X	X	X		X	X				X	X			X	X			X
C34RCB6105AT				X				X		X	X	X	X		X		X				X	X			X	X			X
C34RCB6106AT	X			X				X		X	X	X	X		X		X				X	X			X	X			X

EPS-24551-B

NOTE

THE "B" UPRIGHT STATION MODELS ARE THE SAME AS THE "C" "COMPA-STATION" MODELS WITH OPTION C40 CHANGES AS FOLLOWS:

OMIT -	THN6141A	31-INCH CABINET
ADD -	THN6194B	70-INCH CABINET
	TLN1739A	METERING CHASSIS
	TLN5134A	METER PANEL
	TRN6190A	CABINET HARDWARE KIT
	TLN5264A	POWER JUNCTION BOX

12-W LATER VERSION MODELS

MOTOROLA

STATION MODEL CHART
FOR
"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS
406-420 MHz and 450-512 MHz

CODE:

- X = ONE SUPPLIED
- 2 = TWO SUPPLIED
- 4 = FOUR SUPPLIED
- 0 = TWO KXN1024A RCVR ELEMENTS SUPPLIED UNLESS RCVR CARRIER FREQUENCIES ARE SEPARATED BY 11.7 MHz ±25 kHz (OR A SUB-MULTIPLE THEREOF). IN THIS CASE, A KXN1024A CHANNEL ELEMENT IS USED IN THE FIRST RCVR AND A KXN1049A CHANNEL ELEMENT IS USED IN THE SECOND RCVR. THE IF OF THE SECOND RCVR IS SHIFTED USING A TLE8610A SHIFTED IF KIT.
- ☆ INDICATES A MODEL SERIES. REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

C34RCB-1105B

- B = BASE STATION
- BT = RPTR (RT) STATION
- 5 = DC CONTROL
- 6 = TONE CONTROL
- 0 = T1-R1 (ONE XMIT CHANNEL -ONE RECEIVE CHANNEL)
- 2 = T2-R2
- 4 = T2-2R1 (TWO TRANSMIT CHANNELS-(2) ONE CHANNEL RECEIVERS)
- 9 = T4-R4 (FOUR TRANSMIT CHANNELS -FOUR RECEIVE CHANNELS)
- 1 = CARRIER SQUELCH
- 3 = "PL" TONE-CODED SQUELCH
- 6 = "PL" DIGITAL-CODED SQUELCH
- RF OUTPUT POWER
- B OR C: B = UPRIGHT STATION; C = "COMPA-STATION" RADIO

STATION MODEL (SEE NOTE)	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS
BASE STATIONS			
C34RCB1105B	CARRIER	DC	T1-R1
C34RCB1106B	CARRIER	TONE	T1-R1
C34RCB1125B	CARRIER	DC	T2-R2
C34RCB1126B	CARRIER	TONE	T2-R2
C34RCB1145B	CARRIER	DC	T2-2R1
C34RCB1146B	CARRIER	TONE	T2-2R1
C34RCB1196B	CARRIER	DC	T4-R4
C34RCB3105B	"PL" TONE-CODED	DC	T1-R1
C34RCB3106B	"PL" TONE-CODED	TONE	T1-R1
C34RCB3125B	"PL" TONE-CODED	DC	T2-R2
C34RCB3126B	"PL" TONE-CODED	TONE	T2-R2
C34RCB3145B	"PL" TONE-CODED	DC	T2-2R1
C34RCB3146B	"PL" TONE-CODED	TONE	T2-2R1
C34RCB3196B	"PL" TONE-CODED	TONE	T4-R4
C34RCB6105B	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C34RCB6106B	"DIGITAL PRIVATE-LINE"	TONE	T1-R1
C34RCB6125B	"DIGITAL PRIVATE-LINE"	DC	T2-R2
C34RCB6126B	"DIGITAL PRIVATE-LINE"	TONE	T2-R2
C34RCB6145B	"DIGITAL PRIVATE-LINE"	DC	T2-2R1
C34RCB6146B	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1
C34RCB6196B	"DIGITAL PRIVATE-LINE"	TONE	T4-R4
REPEATER (RT) STATIONS			
C34RCB1105BT	CARRIER	DC	T1-R1
C34RCB1106BT	CARRIER	TONE	T1-R1
C34RCB3105BT	"PL" TONE-CODED	DC	T1-R1
C34RCB3106BT	"PL" TONE-CODED	TONE	T1-R1
C34RCB6105BT	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C34RCB6106BT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1

STATION MODEL	TCN1148A UNIFIED CONTROL CHASSIS (BASE)	TCN1187A UNIFIED CONTROL CHASSIS (RPTR)	TLE1600B SERIES TRIPLER/LOW LEVEL AMPLIFIER	TLE1660B SERIES ANTENNA NETWORK (BASE)	TLE1670B SERIES ANTENNA NETWORK (RPTR)	TLE1720B SERIES EXCITER & 1ST BANDPASS FILTER	TLN4926A POWER CONTROL BOARD	TLN5731A TONE "PRIVATE-LINE" ENCODER	TTN6003A "PL" DIGITAL-CODED SQUELCH ENCODER (SIMPLEX)	TLN5725A "PL" DIGITAL-CODED SQUELCH ENCODER (DUPLEX)	TRN6005A CODE PLUG (DIGITAL-CODED "PL")	KXN1052A CHANNEL ELEMENT (XMIT)	TLN6824A "VIBRASENDER" RESONANT REED	TRN6188A "PL" ENCODER HARDWARE KIT	TLN5654A "PL" DECODER HARDWARE KIT	TLN4635B STATION CONTROL MODULE	TLN4669B LINE DRIVER MODULE (1REC-2-WIRE)	TLN4670B LINE DRIVER MODULE (2 REC)
BASE STATIONS																		
C34RCB1105B	X		X	X		X	X					X				X	X	
C34RCB1106B	X		X	X		X	X					X				X	X	
C34RCB1125B	X		X	X		X	X					2				X	X	
C34RCB1126B	X		X	X		X	X					2				X	X	
C34RCB1145B	X		X	X		X	X					2				X		X
C34RCB1146B	X		X	X		X	X					2				X		X
C34RCB1196B	X		X	X		X	X					4				X	X	
C34RCB3105B	X		X	X		X	X	X				X	X	X	X	X	X	
C34RCB3106B	X		X	X		X	X	X				X	X	X	X	X	X	
C34RCB3125B	X		X	X		X	X	X				2	X	X	X	X	X	
C34RCB3126B	X		X	X		X	X	X				2	X	X	X	X	X	
C34RCB3145B	X		X	X		X	X	X				2	X	X	2	X		X
C34RCB3146B	X		X	X		X	X	X				2	X	X	2	X		X
C34RCB3196B	X		X	X		X	X	X				4	X	X	X	X	X	
C34RCB6105B	X		X	X		X	X		X		X	X		X	X	X	X	
C34RCB6106B	X		X	X		X	X		X		X	X		X	X	X	X	
C34RCB6125B	X		X	X		X	X		X		X	2		X	X	X	X	
C34RCB6126B	X		X	X		X	X		X		X	2		X	X	X	X	
C34RCB6145B	X		X	X		X	X		X		2	2		X	2	X		X
C34RCB6146B	X		X	X		X	X		X		2	2		X	2	X		X
C34RCB6196B	X		X	X		X	X		X		X	4		X	X	X	X	
REPEATER (RT) STATIONS																		
C34RCB1105BT		X	X		X	X	X					X				X	X	
C34RCB1106BT		X	X		X	X	X					X				X	X	
C34RCB3105BT		X	X		X	X	X	X				X	X	X	X	X	X	
C34RCB3106BT		X	X		X	X	X	X				X	X	X	X	X	X	
C34RCB6105BT		X	X		X	X	X			X	2	X		X	X	X	X	
C34RCB6106BT		X	X		X	X	X			X	2	X		X	X	X	X	

STATION MODEL	TLN4661A DC TRANSFER MODULE (1F-CS-F1)	TLN4663A DC TRANSFER MODULE (C2-R2)	TLN4659A DC TRANSFER MODULE (F1-"PL")	TLN4660A DC TRANSFER MODULE (F2-R2 MUTE)	TLN1245B GUARD TONE MODULE	TLN4658A F1 TONE CONTROL MODULE	TLN4638A F1-"PL" TONE CONTROL MODULE	TLN4665A F2 TONE CONTROL MODULE	TLN1248A C2-R2 TONE CONTROL MODULE	TLN4636A TIME-OUT TIMER MODULE	TLN5292A 4-FREQUENCY CONTROL MODULE	TLN5293A F1 CONTROL MODULE (4F-CS)	TLN5294A F1-"PL" CONTROL MODULE (4F-"PL")	TRN8686A CARD PULLER	TRN6338A 5-VOLT REGULATOR KIT	TLN4662A SQUELCH GATE MODULE	TRE1200BA SERIES RCVR RF & IF
BASE STATIONS																	
C34RCB1105B	X													X			X
C34RCB1106B					X	X								X			X
C34RCB1125B		X												X			X
C34RCB1126B					X	X			X					X			X
C34RCB1145B				X										X			2
C34RCB1146B					X	X		X						X			2
C34RCB1196B					X						X	X		X	X		X
C34RCB3105B			X											X			X
C34RCB3106B					X		X							X			X
C34RCB3125B		X												X			X
C34RCB3126B					X		X		X					X			X
C34RCB3145B				X										X			2
C34RCB3146B					X		X	X						X			2
C34RCB3196B					X						X		X	X	X		X
C34RCB6105B			X											X			X
C34RCB6106B					X		X							X			X
C34RCB6125B		X												X			X
C34RCB6126B					X		X		X					X			X
C34RCB6145B				X										X			2
C34RCB6146B					X		X	X						X			2
C34RCB6196B					X						X		X	X	X		X
REPEATER (RT) STATIONS																	
C34RCB1105BT	X									X				X		X	X
C34RCB1106BT					X	X				X				X		X	X
C34RCB3105BT			X							X				X		X	X
C34RCB3106BT					X		X			X				X		X	X
C34RCB6105BT			X							X				X		X	X
C34RCB6106BT					X		X			X				X		X	X

STATION MODEL	TRN6006A RCVR AUDIO & SQUELCH BOARD	TLN4290B RCVR AUDIO POWER AMPLIFIER	TRN6002A "PL" TONE-CODED SQUELCH DECODER	TLN5729A "PL" DIGITAL-CODED SQUELCH DECODER	TLN8381A "VIBRASPONDER" RESONANT REED	KXN1024A CHANNEL ELEMENT (RCVR)	TKN6802A RECEIVER CABLE KIT (BETWEEN RECEIVER & ANTENNA NETWORK)	TLE8340A 2-RCVR COUPLER	TLN1738A 2ND RCVR CHASSIS NOTE	TPN1151A POWER SUPPLY (FORMERLY TPN1110B)	TRN6197A HARDWARE KIT	TRN6198A CABINET HARDWARE KIT (2-RECEIVER MODELS ONLY)	TRN6193A TRANSMITTER SHIELD KIT	TLE1680A SERIES 12-WATT POWER AMPLIFIER	TKN6803A 12-WATT CABLE KIT	TRN6194A RECEIVER SHIELD KIT	THN6141A 31-INCH "COMPA-STATION" CABINET
BASE STATIONS																	
C34RCB1105B	X	X				X	X			X	X			X	X		X
C34RCB1106B	X	X				X	X			X	X			X	X		X
C34RCB1125B	X	X				2	X			X	X			X	X		X
C34RCB1126B	X	X				2	X			X	X			X	X		X
C34RCB1145B	2	2				0	X	X	X	X		X	X	X	X	X	
C34RCB1146B	2	2				0	X	X	X	X		X	X	X	X	X	
C34RCB1196B	X	X				4	X			X	X			X	X		X
C34RCB3105B	X	X	X		X	X	X			X	X			X	X		X
C34RCB3106B	X	X	X		X	X	X			X	X			X	X		X
C34RCB3125B	X	X	X		X	2	X			X	X			X	X		X
C34RCB3126B	X	X	X		X	2	X			X	X			X	X		X
C34RCB3145B	2	2	2		2	0	X	X	X	X		X	X	X	X	X	
C34RCB3146B	2	2	2		2	0	X	X	X	X		X	X	X	X	X	
C34RCB3196B	X	X	X		X	4	X			X	X			X	X		X
C34RCB6105B	X	X		X		X	X			X	X			X	X		X
C34RCB6106B	X	X		X		X	X			X	X			X	X		X
C34RCB6125B	X	X		X		2	X			X	X			X	X		X
C34RCB6126B	X	X		X		2	X			X	X			X	X		X
C34RCB6145B	2	2		2		0	X	X	X	X		X	X	X	X	X	
C34RCB6146B	2	2		2		0	X	X	X	X		X	X	X	X	X	
C34RCB6196B	X	X		X		4	X			X	X			X	X		X
REPEATER (RT) STATIONS																	
C34RCB1105BT	X	X				X				X	X			X	X		X
C34RCB1106BT	X	X				X				X	X			X	X		X
C34RCB3105BT	X	X	X		X	X				X	X			X	X		X
C34RCB3106BT	X	X	X		X	X				X	X			X	X		X
C34RCB6105BT	X	X		X		X				X	X			X	X		X
C34RCB6106BT	X	X		X		X				X	X			X	X		X

EPS-28370-A

20 W LATER VERSION MODELS

MOTOROLA

STATION MODEL CHART
FOR
"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS
450-512 MHz

CODE:

[X] = ONE SUPPLIED
[2] = TWO SUPPLIED
[4] = FOUR SUPPLIED
[0] = TWO KXN1024A RCVR ELEMENTS SUPPLIED UNLESS RCVR CARRIER FREQUENCIES ARE SEPARATED BY 11.7 MHz ±25 kHz (OR A SUB-MULTIPLE THEREOF). IN THIS CASE, A KXN1024A CHANNEL ELEMENT IS USED IN THE FIRST RCVR AND A KXN1049A CHANNEL ELEMENT IS USED IN THE SECOND RCVR. THE IF OF THE SECOND RCVR IS SHIFTED USING A TLE8610A SHIFTED IF KIT.

* INDICATES A MODEL SERIES.
REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

B/C44RCB-1105B

- B = BASE STATION
- BT = RPTR (RT) STATION
- 5 = DC CONTROL
- 6 = TONE CONTROL
- 0 = T1-R1 (ONE XMIT CHANNEL -ONE RECEIVE CHANNEL)
- 2 = T2-R2
- 4 = T2-2R1 (TWO TRANSMIT CHANNELS-(2) ONE CHANNEL RECEIVERS)
- 9 = T4-R4 (FOUR TRANSMIT CHANNELS -FOUR RECEIVE CHANNELS)
- 1 = CARRIER SQUELCH
- 3 = "PL" TONE-CODED SQUELCH
- 6 = "PL" DIGITAL-CODED SQUELCH
- RF OUTPUT POWER
- B OR C
  - B = UPRIGHT STATION
  - C = "COMPA-STATION" RADIO

NOTE

THE "B" UPRIGHT STATION MODELS ARE THE SAME AS THE "C" "COMPA-STATION" MODELS WITH OPTION C40 CHANGES AS FOLLOWS:

OMIT - THN6142A 41-INCH CABINET
ADD - THN6194B 70-INCH CABINET
TLN1739A METERING CHASSIS
TLN5134A METER PANEL
TRN6190A CABINET HARDWARE KIT
TLN5264A POWER JUNCTION BOX

STATION MODEL (SEE NOTE)	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS	TCN1148A	TCN1187A	TLE1600B SERIES	TLE1660B SERIES	TLE1670B SERIES	TLE1720B SERIES	TLN4926A	TLN5731A	TTN6003A	TLN5725A	TRN6005A	KXN1052A	TLN6824A	TRN6188A	TLN5654A	TLN4635B	TLN4669B	TLN4670B	TLN4661A	TLN4663A	TLN4659A	TLN4660A	TLN1245B	TLN4658A	TLN4638A	TLN4665A	TLN1248A
DESCRIPTION				UNIFIED CONTROL CHASSIS (BASE)	UNIFIED CONTROL CHASSIS (RPTR)	* TRIPLER/LOW LEVEL AMPLIFIER	* ANTENNA NETWORK (BASE)	* ANTENNA NETWORK (RPTR)	* EXCITER & 1ST BANDPASS FILTER	POWER CONTROL BOARD	TONE "PRIVATE-LINE" ENCODER	"PL" DIGITAL-CODED SQUELCH ENCODER (SIMPLEX)	"PL" DIGITAL-CODED SQUELCH ENCODER (DUPLEX)	CODE PLUG (DIGITAL-CODED "PL")	CHANNEL ELEMENT (XMIT)	"VIBRASENDER" RESONANT REED	"PL" ENCODER HARDWARE KIT	"PL" DECODER HARDWARE KIT	STATION CONTROL MODULE	LINE DRIVER MODULE (1REC-2-WIRE)	LINE DRIVER MODULE (2 REC)	DC TRANSFER MODULE (1F-CS-F1)	DC TRANSFER MODULE (C2-R2)	DC TRANSFER MODULE (F1-"PL")	DC TRANSFER MODULE (F2-R2 MUTE)	GUARD TONE MODULE	F1 TONE CONTROL MODULE	F1-"PL" TONE CONTROL MODULE	F2 TONE CONTROL MODULE	C2-R2 TONE CONTROL MODULE
BASE STATIONS																														
C44RCB1105B	CARRIER	DC	T1-R1	X		X	X		X	X					X				X	X		X								
C44RCB1106B	CARRIER	TONE	T1-R1	X		X	X		X	X					X				X	X						X	X			
C44RCB1125B	CARRIER	DC	T2-R2	X		X	X		X	X					2				X	X			X							
C44RCB1126B	CARRIER	TONE	T2-R2	X		X	X		X	X					2				X	X						X	X			X
C44RCB1145B	CARRIER	DC	T2-2R1	X		X	X		X	X					2				X		X				X					
C44RCB1146B	CARRIER	TONE	T2-2R1	X		X	X		X	X					2				X		X					X	X		X	
C44RCB1196B	CARRIER	DC	T4-R4	X		X	X		X	X					4				X	X						X				
C44RCB3105B	"PL" TONE-CODED	DC	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X				X						
C44RCB3106B	"PL" TONE-CODED	TONE	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X						X		X		
C44RCB3125B	"PL" TONE-CODED	DC	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X			X							
C44RCB3126B	"PL" TONE-CODED	TONE	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X						X		X		X
C44RCB3145B	"PL" TONE-CODED	DC	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X				X					
C44RCB3146B	"PL" TONE-CODED	TONE	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X					X		X	X	
C44RCB3196B	"PL" TONE-CODED	TONE	T4-R4	X		X	X		X	X	X				4	X	X	X	X	X						X				
C44RCB6105B	"DIGITAL PRIVATE-LINE"	DC	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X				X						
C44RCB6106B	"DIGITAL PRIVATE-LINE"	TONE	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X						X		X		
C44RCB6125B	"DIGITAL PRIVATE-LINE"	DC	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X			X							
C44RCB6126B	"DIGITAL PRIVATE-LINE"	TONE	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X						X		X		X
C44RCB6145B	"DIGITAL PRIVATE-LINE"	DC	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X				X					
C44RCB6146B	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X					X		X	X	
C44RCB6196B	"DIGITAL PRIVATE-LINE"	TONE	T4-R4	X		X	X		X	X		X		X	4		X	X	X	X						X				
REPEATER (RT) STATIONS																														
C44RCB1105BT	CARRIER	DC	T1-R1		X	X		X	X	X					X				X	X		X								
C44RCB1106BT	CARRIER	TONE	T1-R1		X	X		X	X	X					X				X	X						X	X			
C44RCB3105BT	"PL" TONE-CODED	DC	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X				X						
C44RCB3106BT	"PL" TONE-CODED	TONE	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X						X		X		
C44RCB6105BT	"DIGITAL PRIVATE-LINE"	DC	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X				X						
C44RCB6106BT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X						X		X		

STATION MODEL (SEE NOTE)	TLN4636A	TLN5292A	TLN5293A	TLN5294A	TRN8686A	TRN6338A	TLN4662A	TRE1200BA SERIES	TRN6006A	TLN4290B	TRN6002A	TLN5729A	TLN8381A	KXN1024A	TKN6802A	TLE8340A	TLN1738A	TPN1151A	TRN6199A	TRN6200A	TRN6193A	TRN6194A	TLE1690A SERIES	TKN6804A	THN6142A
DESCRIPTION	TIME-OUT TIMER MODULE	4-FREQUENCY CONTROL MODULE	F1 CONTROL MODULE (4F-CS)	F1-"PL" CONTROL MODULE (4F-"PL")	CARD PULLER	5-VOLT REGULATOR KIT	SQUELCH GATE MODULE	* RCVR RF & IF	RCVR AUDIO & SQUELCH BOARD	RCVR AUDIO POWER AMPLIFIER	"PL" TONE-CODED SQUELCH DECODER	"PL" DIGITAL-CODED SQUELCH DECODER	"VIBRASPONDER" RESONANT REED	CHANNEL ELEMENT (RCVR)	RECEIVER CABLE KIT (BETWEEN RECEIVER & ANTENNA NETWORK)	2-RCVR COUPLER	2ND RCVR CHASSIS	POWER SUPPLY	HARDWARE KIT	HARDWARE KIT	TRANSMITTER SHIELD KIT	RECEIVER SHIELD KIT	* 20-WATT POWER AMPLIFIER	75-WATT CABLE KIT	41-INCH "COMPA-STATION" CABINET
BASE STATIONS																									
C44RCB1105B					X			X	X	X				X	X			X	X				X	X	X
C44RCB1106B					X			X	X	X				X	X			X	X				X	X	X
C44RCB1125B					X			X	X	X				2	X			X	X				X	X	X
C44RCB1126B					X			X	X	X				2	X			X	X				X	X	X
C44RCB1145B					X			2	2	2				0	X	X	X	X		X	X	X	X	X	X
C44RCB1146B					X			2	2	2				0	X	X	X	X		X	X	X	X	X	X
C44RCB1196B		X	X		X	X		X	X	X				4	X			X	X				X	X	X
C44RCB3105B					X			X	X	X	X		X	X	X			X	X				X	X	X
C44RCB3106B					X			X	X	X	X		X	X	X			X	X				X	X	X
C44RCB3125B					X			X	X	X	X		X	2	X			X	X				X	X	X
C44RCB3126B					X			X	X	X	X		X	2	X			X	X				X	X	X
C44RCB3145B					X			2	2	2	2		2	0	X	X	X	X		X	X	X	X	X	X
C44RCB3146B					X			2	2	2	2		2	0	X	X	X	X		X	X	X	X	X	X
C44RCB3196B		X		X	X	X		X	X	X	X		X	4	X			X	X				X	X	X
C44RCB6105B					X			X	X	X		X		X	X			X	X				X	X	X
C44RCB6106B					X			X	X	X		X		X	X			X	X				X	X	X
C44RCB6125B					X			X	X	X		X		2	X			X	X				X	X	X
C44RCB6126B					X			X	X	X		X		2	X			X	X				X	X	X
C44RCB6145B					X			2	2	2		2		0	X	X	X	X		X	X	X	X	X	X
C44RCB6146B					X			2	2	2		2		0	X	X	X	X		X	X	X	X	X	X
C44RCB6196B		X		X	X	X		X	X	X		X		4	X			X	X				X	X	X
REPEATER (RT) STATIONS																									
C44RCB1105BT	X				X		X	X	X	X				X				X	X				X	X	X
C44RCB1106BT	X				X		X	X	X	X				X				X	X				X	X	X
C44RCB3105BT	X				X		X	X	X	X	X		X	X				X	X				X	X	X
C44RCB3106BT	X				X		X	X	X	X	X		X	X				X	X				X	X	X
C44RCB6105BT	X				X		X	X	X	X		X		X				X	X				X	X	X
C44RCB6106BT	X				X		X	X	X	X		X		X				X	X				X	X	X

EPS-24543-B

NOTE

THE "B" UPRIGHT STATION MODELS ARE THE SAME AS THE "C" "COMPA-STATION" MODELS WITH OPTION C40 CHANGES AS FOLLOWS:

OMIT - THN6142A 41-INCH CABINET
ADD - THN6194B 70-INCH CABINET
TLN1739A METERING CHASSIS
TLN5134A METER PANEL
TRN6190A CABINET HARDWARE KIT
TLN5264A POWER JUNCTION BOX

20 W EARLIER VERSION MODELS

MOTOROLA

STATION MODEL CHART
FOR
"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS

CODE:

- [X] = ONE SUPPLIED
- [2] = TWO SUPPLIED
- [4] = FOUR SUPPLIED
- [0] = TWO KXN1024A RCVR ELEMENTS SUPPLIED UNLESS RCVR CARRIER FREQUENCIES ARE SEPARATED BY 11.7 MHz ±25 kHz (OR A SUB-MULTIPLE THEREOF). IN THIS CASE, A KXN1024A CHANNEL ELEMENT IS USED IN THE FIRST RCVR AND A KXN1049A CHANNEL ELEMENT IS USED IN THE SECOND RCVR. THE IF OF THE SECOND RCVR IS SHIFTED USING A TLE8610A SHIFTED IF KIT.
- * INDICATES A MODEL SERIES. REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

C44RCB-1105A

- A = BASE STATION; AT = RPTR (RT) STATION
- 5 = DC CONTROL; 6 = TONE CONTROL
- 0 = T1-R1 (ONE XMIT CHANNEL -ONE RECEIVE CHANNEL); 2 = T2-R2; 4 = T2-2R1 (TWO TRANSMIT CHANNELS-(2) ONE CHANNEL RECEIVERS); 9 = T4-R4 (FOUR TRANSMIT CHANNELS -FOUR RECEIVE CHANNELS)
- 1 = CARRIER SQUELCH; 3 = "PL" TONE-CODED SQUELCH; 6 = "PL" DIGITAL-CODED SQUELCH
- RF OUTPUT POWER
- B OR C: B = UPRIGHT STATION; C = "COMPA-STATION" RADIO

STATION MODEL	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS	TCN1148A * UNIFIED CONTROL CHASSIS (BASE)	TCN1187A * UNIFIED CONTROL CHASSIS (RPTR)	TLE1600A SERIES * TRIPLER/LOW LEVEL AMPLIFIER	TLE1660B SERIES * ANTENNA NETWORK (BASE)	TLE1670B SERIES * ANTENNA NETWORK (RPTR)	TLE1720B SERIES * EXCITER & 1ST BANDPASS FILTER	TLN4926A POWER CONTROL BOARD	TLN5731A TONE "PRIVATE-LINE" ENCODER	TTN6003A "PL" DIGITAL-CODED SQUELCH ENCODER (SIMPLEX)	TLN5725A "PL" DIGITAL-CODED SQUELCH ENCODER (DUPLEX)	TRN6005A CODE PLUG (DIGITAL-CODED "PL")	KXN1052A CHANNEL ELEMENT (XMIT)	TLN6824A "VIBRASENDER" RESONANT REED	TRN6188A "PL" ENCODER HARDWARE KIT	TLN5654A "PL" DECODER HARDWARE KIT	TLN4635B STATION CONTROL MODULE	TLN4669B LINE DRIVER MODULE (1REC-2-WIRE)	TLN4670B LINE DRIVER MODULE (2 REC)	TLN4661A DC TRANSFER MODULE (1F-CS-F1)	TLN4663A DC TRANSFER MODULE (C2-R2)	TLN4659A DC TRANSFER MODULE (F1-"PL")	TLN4660A DC TRANSFER MODULE (F2-R2 MUTE)	TLN1245B GUARD TONE MODULE	TLN4658A F1 TONE CONTROL MODULE	TLN4638A F1-"PL" TONE CONTROL MODULE	TLN4665A F2 TONE CONTROL MODULE
BASE STATIONS																													
* C44RCB1105A	CARRIER	DC	T1-R1	X		X	X		X	X					X				X	X		X							
C44RCB1106A	CARRIER	TONE	T1-R1	X		X	X		X	X					X				X	X						X	X		
C44RCB1125A	CARRIER	DC	T2-R2	X		X	X		X	X					2				X	X			X						
C44RCB1126A	CARRIER	TONE	T2-R2	X		X	X		X	X					2				X	X						X	X		
C44RCB1145A	CARRIER	DC	T2-2R1	X		X	X		X	X					2				X		X				X				
C44RCB1146A	CARRIER	TONE	T2-2R1	X		X	X		X	X					2				X		X					X	X		X
C44RCB1196A	CARRIER	DC	T4-R4	X		X	X		X	X					4				X	X						X			
C44RCB3105A	"PL" TONE-CODED	DC	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X				X					
C44RCB3106A	"PL" TONE-CODED	TONE	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X						X		X	
C44RCB3125A	"PL" TONE-CODED	DC	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X			X						
C44RCB3126A	"PL" TONE-CODED	TONE	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X						X		X	
C44RCB3145A	"PL" TONE-CODED	DC	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X				X				
C44RCB3146A	"PL" TONE-CODED	TONE	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X					X		X	X
C44RCB3196A	"PL" TONE-CODED	TONE	T4-R4	X		X	X		X	X	X				4	X	X	X	X	X						X			
C44RCB6105A	"DIGITAL PRIVATE-LINE"	DC	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X				X					
C44RCB6106A	"DIGITAL PRIVATE-LINE"	TONE	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X						X		X	
C44RCB6125A	"DIGITAL PRIVATE-LINE"	DC	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X			X						
C44RCB6126A	"DIGITAL PRIVATE-LINE"	TONE	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X						X		X	
C44RCB6145A	"DIGITAL PRIVATE-LINE"	DC	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X				X				
C44RCB6146A	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X					X		X	X
C44RCB6196A	"DIGITAL PRIVATE-LINE"	TONE	T4-R4	X		X	X		X	X		X		X	4		X	X	X	X						X			
REPEATER (RT) STATIONS																													
C44RCB1105AT	CARRIER	DC	T1-R1		X	X		X	X	X					X				X	X		X							
C44RCB1106AT	CARRIER	TONE	T1-R1		X	X		X	X	X					X				X	X						X	X		
C44RCB3105AT	"PL" TONE-CODED	DC	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X				X					
C44RCB3106AT	"PL" TONE-CODED	TONE	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X						X		X	
C44RCB6105AT	"DIGITAL PRIVATE-LINE"	DC	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X				X					
C44RCB6106AT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X						X		X	

STATION MODEL	TLN1248A C2-R2 TONE CONTROL MODULE	TLN4636A TIME-OUT TIMER MODULE	TLN5292A 4-FREQUENCY CONTROL MODULE	TLN5293A F1 CONTROL MODULE (4F-CS)	TLN5294A F1-"PL" CONTROL MODULE (4F-"PL")	TRN8686A CARD PULLER	TRN6338A 5-VOLT REGULATOR KIT	TLN4662A SQUELCH GATE MODULE	TRE1200BA SERIES * RCVR RF & IF	TRN6006A RCVR AUDIO & SQUELCH BOARD	TLN4290B RCVR AUDIO POWER AMPLIFIER	TRN6002A "PL" TONE-CODED SQUELCH DECODER	TLN5729A "PL" DIGITAL-CODED SQUELCH DECODER	TLN8381A "VIBRASPONDER" RESONANT REED	KXN1024A CHANNEL ELEMENT (RCVR)	TKN6802A RECEIVER CABLE KIT (BETWEEN RECEIVER & ANTENNA NETWORK)	TLE8340A 2-RCVR COUPLER	TLN1738A 2ND RCVR CHASSIS NOTE	TPN1110B POWER SUPPLY	TRN6199A HARDWARE KIT	TRN6200A CABINET HARDWARE KIT (2-RECEIVER MODELS ONLY)	TRN6193A TRANSMITTER SHIELD KIT	TRN6194A RECEIVER SHIELD KIT	TLE1690A SERIES * 20-WATT POWER AMPLIFIER	TKN6804A 75-WATT CABLE KIT	THN6142A 41-INCH "COMPA-STATION" CABINET
BASE STATIONS																										
* C44RCB1105A						X			X	X	X				X	X			X	X				X	X	X
C44RCB1106A						X			X	X	X				X	X			X	X				X	X	X
C44RCB1125A						X			X	X	X				2	X			X	X				X	X	X
C44RCB1126A	X					X			X	X	X				2	X			X	X				X	X	X
C44RCB1145A						X			2	2	2				0	X	X	X	X		X	X	X	X	X	X
C44RCB1146A						X			2	2	2				0	X	X	X	X		X	X	X	X	X	X
C44RCB1196A			X	X		X	X		X	X	X				4	X			X	X				X	X	X
C44RCB3105A						X			X	X	X	X		X	X	X			X	X				X	X	X
C44RCB3106A						X			X	X	X	X		X	X	X			X	X				X	X	X
C44RCB3125A						X			X	X	X	X		X	2	X			X	X				X	X	X
C44RCB3126A	X					X			X	X	X	X		X	2	X			X	X				X	X	X
C44RCB3145A						X			2	2	2	2		2	0	X	X	X	X		X	X	X	X	X	X
C44RCB3146A						X			2	2	2	2		2	0	X	X	X	X		X	X	X	X	X	X
C44RCB3196A			X		X	X	X		X	X	X	X		X	4	X			X	X				X	X	X
C44RCB6105A						X			X	X	X		X		X	X			X	X				X	X	X
C44RCB6106A						X			X	X	X		X		X	X			X	X				X	X	X
C44RCB6125A						X			X	X	X		X		2	X			X	X				X	X	X
C44RCB6126A	X					X			X	X	X		X		2	X			X	X				X	X	X
C44RCB6145A						X			2	2	2		2		0	X	X	X	X		X	X	X	X	X	X
C44RCB6146A						X			2	2	2		2		0	X	X	X	X		X	X	X	X	X	X
C44RCB6196A			X		X	X	X		X	X	X		X		4	X			X	X				X	X	X
REPEATER (RT) STATIONS																										
C44RCB1105AT		X				X		X	X	X	X				X				X	X				X	X	X
C44RCB1106AT		X				X		X	X	X	X				X				X	X				X	X	X
C44RCB3105AT		X				X		X	X	X	X	X		X	X				X	X				X	X	X
C44RCB3106AT		X				X		X	X	X	X	X		X	X				X	X				X	X	X
C44RCB6105AT		X				X		X	X	X	X		X		X				X	X				X	X	X
C44RCB6106AT		X				X		X	X	X	X		X		X				X	X				X	X	X

EPS-24552-B

45/40 W MODELS

MOTOROLA

STATION MODEL CHART
FOR
"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS
406-420 MHz and 450-512 MHz

CODE:

- [X] = ONE SUPPLIED
- [2] = TWO SUPPLIED
- [4] = FOUR SUPPLIED
- [0] = TWO KXN1024A RCVR ELEMENTS SUPPLIED UNLESS RCVR CARRIER FREQUENCIES ARE SEPARATED BY 11.7 MHz ±25 kHz (OR A SUB-MULTIPLE THEREOF). IN THIS CASE, A KXN1024A CHANNEL ELEMENT IS USED IN THE FIRST RCVR AND A KXN1049A CHANNEL ELEMENT IS USED IN THE SECOND RCVR. THE IF OF THE SECOND RCVR IS SHIFTED USING A TLE8610A SHIFTED IF KIT.

* INDICATES A MODEL SERIES.
REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

C44RCB-1105A

- A = BASE STATION
- AT = RPTR (RT) STATION
- 5 = DC CONTROL
- 6 = TONE CONTROL
- 0 = T1-R1 (ONE XMIT CHANNEL -ONE RECEIVE CHANNEL)
- 2 = T2-R2
- 4 = T2-2R1 (TWO TRANSMIT CHANNELS-(2) ONE CHANNEL RECEIVERS)
- 9 = T4-R4 (FOUR TRANSMIT CHANNELS -FOUR RECEIVE CHANNELS)
- 1 = CARRIER SQUELCH
- 3 = "PL" TONE-CODED SQUELCH
- 6 = "PL" DIGITAL-CODED SQUELCH

RF OUTPUT POWER

FREQUENCY RANGE (MHz)	406-420	450-470	470-512
RF OUTPUT POWER	5 = 45 W	45 W	40 W

- B OR C
- B = UPRIGHT STATION
- C = "COMPA-STATION" RADIO

STATION MODEL (SEE NOTE)	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS	TCN1148A * UNIFIED CONTROL CHASSIS (BASE)	TCN1187A * UNIFIED CONTROL CHASSIS (RPTR)	TLE1600B SERIES * TRIPLER/LOW LEVEL AMPLIFIER	TLE1660B SERIES * ANTENNA NETWORK (BASE)	TLE1670B SERIES * ANTENNA NETWORK (RPTR)	TLE1720B SERIES * EXCITER & 1ST BANDPASS FILTER	TLN4926A POWER CONTROL BOARD	TLN5731A TONE "PRIVATE-LINE" ENCODER	TTN6003A "PL" DIGITAL-CODED SQUELCH ENCODER (SIMPLEX)	TLN5725A "PL" DIGITAL-CODED SQUELCH ENCODER (DUPLEX)	TRN6005A CODE PLUG (DIGITAL-CODED "PL")	KXN1052A CHANNEL ELEMENT (XMIT)	TLN6824A "VIBRASENDER" RESONANT REED	TRN6188A "PL" ENCODER HARDWARE KIT	TLN5654A "PL" DECODER HARDWARE KIT	TLN4635B STATION CONTROL MODULE	TLN4669B LINE DRIVER MODULE (1REC-2-WIRE)	TLN4670B LINE DRIVER MODULE (2 REC)	TLN4661A DC TRANSFER MODULE (1F-CS-F1)	TLN4663A DC TRANSFER MODULE (C2-R2)	TLN4659A DC TRANSFER MODULE (F1-"PL")	TLN4660A DC TRANSFER MODULE (F2-R2 MUTE)	TLN1245B GUARD TONE MODULE	TLN4658A F1 TONE CONTROL MODULE	TLN4638A F1-"PL" TONE CONTROL MODULE	TLN4665A F2 TONE CONTROL MODULE	TLN1248A C2-R2 TONE CONTROL MODULE
BASE STATIONS																														
C54RCB1105A	CARRIER	DC	T1-R1	X		X	X		X	X					X				X	X		X								
C54RCB1106A	CARRIER	TONE	T1-R1	X		X	X		X	X					X				X	X						X	X			
C54RCB1125A	CARRIER	DC	T2-R2	X		X	X		X	X					2				X	X			X							
C54RCB1126A	CARRIER	TONE	T2-R2	X		X	X		X	X					2				X	X						X	X			X
C54RCB1145A	CARRIER	DC	T2-2R1	X		X	X		X	X					2				X		X				X					
C54RCB1146A	CARRIER	TONE	T2-2R1	X		X	X		X	X					2				X		X					X	X		X	
C54RCB1196A	CARRIER	DC	T4-R4	X		X	X		X	X					4				X	X						X				
C54RCB3105A	"PL" TONE-CODED	DC	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X				X						
C54RCB3106A	"PL" TONE-CODED	TONE	T1-R1	X		X	X		X	X	X				X	X	X	X	X	X						X		X		
C54RCB3125A	"PL" TONE-CODED	DC	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X			X							
C54RCB3126A	"PL" TONE-CODED	TONE	T2-R2	X		X	X		X	X	X				2	X	X	X	X	X						X		X		X
C54RCB3145A	"PL" TONE-CODED	DC	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X				X					
C54RCB3146A	"PL" TONE-CODED	TONE	T2-2R1	X		X	X		X	X	X				2	X	X	2	X		X					X		X	X	
C54RCB3196A	"PL" TONE-CODED	TONE	T4-R4	X		X	X		X	X	X				4	X	X	X	X	X						X				
C54RCB6105A	"DIGITAL PRIVATE-LINE"	DC	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X				X						
C54RCB6106A	"DIGITAL PRIVATE-LINE"	TONE	T1-R1	X		X	X		X	X		X		X	X		X	X	X	X						X		X		
C54RCB6125A	"DIGITAL PRIVATE-LINE"	DC	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X			X							
C54RCB6126A	"DIGITAL PRIVATE-LINE"	TONE	T2-R2	X		X	X		X	X		X		X	2		X	X	X	X						X		X		X
C54RCB6145A	"DIGITAL PRIVATE-LINE"	DC	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X				X					
C54RCB6146A	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1	X		X	X		X	X		X		2	2		X	2	X		X					X		X	X	
C54RCB6196A	"DIGITAL PRIVATE-LINE"	TONE	T4-R4	X		X	X		X	X		X		X	4		X	X	X	X						X				
REPEATER (RT) STATIONS																														
C54RCB1105AT	CARRIER	DC	T1-R1		X	X		X	X	X					X				X	X		X								
C54RCB1106AT	CARRIER	TONE	T1-R1		X	X		X	X	X					X				X	X						X	X			
C54RCB3105AT	"PL" TONE-CODED	DC	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X				X						
C54RCB3106AT	"PL" TONE-CODED	TONE	T1-R1		X	X		X	X	X	X				X	X	X	X	X	X						X		X		
C54RCB6105AT	"DIGITAL PRIVATE-LINE"	DC	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X				X						
C54RCB6106AT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1		X	X		X	X	X			X	2	X		X	X	X	X						X		X		

STATION MODEL (SEE NOTE)	TLN4636A TIME-OUT TIMER MODULE	TLN5292A 4-FREQUENCY CONTROL MODULE	TLN5293A F1 CONTROL MODULE (4F-CS)	TLN5294A F1-"PL" CONTROL MODULE (4F-"PL")	TRN8686A CARD PULLER	TRN6338A 5-VOLT REGULATOR KIT	TLN4662A SQUELCH GATE MODULE	TRE1200BA SERIES * RCVR RF & IF	TRN6006A RCVR AUDIO & SQUELCH BOARD	TLN4290B RCVR AUDIO POWER AMPLIFIER	TRN6002A "PL" TONE-CODED SQUELCH DECODER	TLN5729A "PL" DIGITAL-CODED SQUELCH DECODER	TLN8381A "VIBRASPONDER" RESONANT REED	KXN1024A CHANNEL ELEMENT (RCVR)	TKN6802A RECEIVER CABLE KIT (BETWEEN RECEIVER & ANTENNA NETWORK)	TLE8340A 2-RCVR COUPLER	TLN1738A 2ND RCVR CHASSIS NOTE	TPN1110B POWER SUPPLY	TRN6199A HARDWARE KIT	TRN6200A CABINET HARDWARE KIT (2-RECEIVER MODELS ONLY)	TRN6193A TRANSMITTER SHIELD KIT	TRN6194A RECEIVER SHIELD KIT	TLE1700A SERIES * 45-WATT POWER AMPLIFIER	TKN6804A 75-WATT CABLE KIT	THN6142A 41-INCH "COMPA-STATION" CABINET
BASE STATIONS																									
C54RCB1105A					X			X	X	X				X	X			X	X				X	X	X
C54RCB1106A					X			X	X	X				X	X			X	X				X	X	X
C54RCB1125A					X			X	X	X				2	X			X	X				X	X	X
C54RCB1126A					X			X	X	X				2	X			X	X				X	X	X
C54RCB1145A					X			2	2	2				0	X	X	X	X		X	X	X	X	X	X
C54RCB1146A					X			2	2	2				0	X	X	X	X		X	X	X	X	X	X
C54RCB1196A		X	X		X	X		X	X	X				4	X			X	X				X	X	X
C54RCB3105A					X			X	X	X	X		X	X	X			X	X				X	X	X
C54RCB3106A					X			X	X	X	X		X	X	X			X	X				X	X	X
C54RCB3125A					X			X	X	X	X		X	2	X			X	X				X	X	X
C54RCB3126A					X			X	X	X	X		X	2	X			X	X				X	X	X
C54RCB3145A					X			2	2	2	2		2	0	X	X	X	X		X	X	X	X	X	X
C54RCB3146A					X			2	2	2	2		2	0	X	X	X	X		X	X	X	X	X	X
C54RCB3196A		X		X	X	X		X	X	X	X		X	4	X			X	X				X	X	X
C54RCB6105A					X			X	X	X		X		X	X			X	X				X	X	X
C54RCB6106A					X			X	X	X		X		X	X			X	X				X	X	X
C54RCB6125A					X			X	X	X		X		2	X			X	X				X	X	X
C54RCB6126A					X			X	X	X		X		2	X			X	X				X	X	X
C54RCB6145A					X			2	2	2		2		0	X	X	X	X		X	X	X	X	X	X
C54RCB6146A					X			2	2	2		2		0	X	X	X	X		X	X	X	X	X	X
C54RCB6196A		X		X	X	X		X	X	X		X		4	X			X	X				X	X	X
REPEATER (RT) STATIONS																									
C54RCB1105AT	X				X		X	X	X	X				X				X	X				X	X	X
C54RCB1106AT	X				X		X	X	X	X				X				X	X				X	X	X
C54RCB3105AT	X				X		X	X	X	X	X		X	X				X	X				X	X	X
C54RCB3106AT	X				X		X	X	X	X	X		X	X				X	X				X	X	X
C54RCB6105AT	X				X		X	X	X	X		X		X				X	X				X	X	X
C54RCB6106AT	X				X		X	X	X	X		X		X				X	X				X	X	X

EPS-24553-B

NOTE

THE "B" UPRIGHT STATION MODELS ARE THE SAME AS THE "C" "COMPA-STATION" MODELS WITH OPTION C40 CHANGES AS FOLLOWS:

OMIT -	THN6142A	41-INCH CABINET
ADD -	THN6194B	70-INCH CABINET
	TLN1739A	METERING CHASSIS
	TLN5134A	METER PANEL
	TRN6190A	CABINET HARDWARE KIT
	TLN5264A	POWER JUNCTION BOX

NOTE

THE "B" UPRIGHT STATION MODELS ARE THE SAME AS THE "C" "COMPA-STATION" MODELS WITH OPTION C40 CHANGES AS FOLLOWS:

OMIT - THN6142A 41-INCH CABINET
ADD - THN6194B 70-INCH CABINET
TLN1739A METERING CHASSIS
TLN5134A METER PANEL
TRN6190A CABINET HARDWARE KIT
TLN5264A POWER JUNCTION BOX

75/60 W MODELS

MOTOROLA

STATION MODEL CHART
FOR
"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS
406-420 MHz and 450-512 MHz

CODE:

X = ONE SUPPLIED
2 = TWO SUPPLIED
4 = FOUR SUPPLIED
0 = TWO KXN1024A RCVR ELEMENTS SUPPLIED UNLESS RCVR CARRIER FREQUENCIES ARE SEPARATED BY 11.7 MHz ±25 kHz (OR A SUBMULTIPLE THEREOF). IN THIS CASE, A KXN1024A CHANNEL ELEMENT IS USED IN THE FIRST RCVR AND A KXN1049A CHANNEL ELEMENT IS USED IN THE SECOND RCVR. THE IF OF THE SECOND RCVR IS SHIFTED USING A TLE8610A SHIFTED IF KIT.

* INDICATES A MODEL SERIES. REFER TO MODEL SERIES BREAKDOWN CHART

STATION MODEL VARIATIONS

C64RCB-1105A

- A = BASE STATION; AT = RPTR (RT) STATION
- 5 = DC CONTROL; 6 = TONE CONTROL
- 0 = T1-R1 (ONE XMIT CHANNEL -ONE RECEIVE CHANNEL); 2 = T2-R2; 4 = T2-2R1 (TWO TRANSMIT CHANNELS-(2) ONE CHANNEL RECEIVERS); 9 = T4-R4 (FOUR TRANSMIT CHANNELS -FOUR RECEIVE CHANNELS)
- 1 = CARRIER SQUELCH; 3 = "PL" TONE-CODED SQUELCH; 6 = "PL" DIGITAL-CODED SQUELCH
- RF OUTPUT POWER (FREQUENCY RANGE (MHz)):

	406-420	450-470	470-512
RF OUTPUT POWER	6 = 75 W	75 W	60 W

- B OR C: B = UPRIGHT STATION; C = "COMPA-STATION" RADIO

STATION MODEL (SEE NOTE)	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS
BASE STATIONS			
C64RCB1105A	CARRIER	DC	T1-R1
C64RCB1106A	CARRIER	TONE	T1-R1
C64RCB1125A	CARRIER	DC	T2-R2
C64RCB1126A	CARRIER	TONE	T2-R2
C64RCB1145A	CARRIER	DC	T2-2R1
C64RCB1146A	CARRIER	TONE	T2-2R1
C64RCB1196A	CARRIER	DC	T4-R4
C64RCB3105A	"PL" TONE-CODED	DC	T1-R1
C64RCB3106A	"PL" TONE-CODED	TONE	T1-R1
C64RCB3125A	"PL" TONE-CODED	DC	T2-R2
C64RCB3126A	"PL" TONE-CODED	TONE	T2-R2
C64RCB3145A	"PL" TONE-CODED	DC	T2-2R1
C64RCB3146A	"PL" TONE-CODED	TONE	T2-2R1
C64RCB3196A	"PL" TONE-CODED	TONE	T4-R4
C64RCB6105A	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C64RCB6106A	"DIGITAL PRIVATE-LINE"	TONE	T1-R1
C64RCB6125A	"DIGITAL PRIVATE-LINE"	DC	T2-R2
C64RCB6126A	"DIGITAL PRIVATE-LINE"	TONE	T2-R2
C64RCB6145A	"DIGITAL PRIVATE-LINE"	DC	T2-2R1
C64RCB6146A	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1
C64RCB6196A	"DIGITAL PRIVATE-LINE"	TONE	T4-R4
REPEATER (RT) STATIONS			
C64RCB1105AT	CARRIER	DC	T1-R1
C64RCB1106AT	CARRIER	TONE	T1-R1
C64RCB3105AT	"PL" TONE-CODED	DC	T1-R1
C64RCB3106AT	"PL" TONE-CODED	TONE	T1-R1
C64RCB6105AT	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C64RCB6106AT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1

STATION MODEL	TCN1148A * UNIFIED CONTROL CHASSIS (BASE)	TCN1187A * UNIFIED CONTROL CHASSIS (RPTR)	TLE1600B SERIES * TRIPLER/LOW LEVEL AMPLIFIER	TLE1660B SERIES * ANTENNA NETWORK (BASE)	TLE1670B SERIES * ANTENNA NETWORK (RPTR)	TLE1720B SERIES * EXCITER & 1ST BANDPASS FILTER
C64RCB1105A	X		X	X		X
C64RCB1106A	X		X	X		X
C64RCB1125A	X		X	X		X
C64RCB1126A	X		X	X		X
C64RCB1145A	X		X	X		X
C64RCB1146A	X		X	X		X
C64RCB1196A	X		X	X		X
C64RCB3105A	X		X	X		X
C64RCB3106A	X		X	X		X
C64RCB3125A	X		X	X		X
C64RCB3126A	X		X	X		X
C64RCB3145A	X		X	X		X
C64RCB3146A	X		X	X		X
C64RCB3196A	X		X	X		X
C64RCB6105A	X		X	X		X
C64RCB6106A	X		X	X		X
C64RCB6125A	X		X	X		X
C64RCB6126A	X		X	X		X
C64RCB6145A	X		X	X		X
C64RCB6146A	X		X	X		X
C64RCB6196A	X		X	X		X
C64RCB1105AT		X	X		X	X
C64RCB1106AT		X	X		X	X
C64RCB3105AT		X	X		X	X
C64RCB3106AT		X	X		X	X
C64RCB6105AT		X	X		X	X
C64RCB6106AT		X	X		X	X

STATION MODEL	TLN4926A POWER CONTROL BOARD	TLN5731A TONE "PRIVATE-LINE" ENCODER	TTN6003A "PL" DIGITAL-CODED SQUELCH ENCODER (SIMPLEX)	TLN5725A "PL" DIGITAL-CODED SQUELCH ENCODER (DUPLEX)	TRN6005A CODE PLUG (DIGITAL-CODED "PL")	KXN1052A CHANNEL ELEMENT (XMIT)	TLN6824A "VIBRASENDER" RESONANT REED	TRN6188A "PL" ENCODER HARDWARE KIT	TLN5654A "PL" DECODER HARDWARE KIT
C64RCB1105A	X					X			
C64RCB1106A	X					X			
C64RCB1125A	X					2			
C64RCB1126A	X					2			
C64RCB1145A	X					2			
C64RCB1146A	X					2			
C64RCB1196A	X					4			
C64RCB3105A	X	X				X	X	X	X
C64RCB3106A	X	X				X	X	X	X
C64RCB3125A	X	X				2	X	X	X
C64RCB3126A	X	X				2	X	X	X
C64RCB3145A	X	X				2	X	X	2
C64RCB3146A	X	X				2	X	X	2
C64RCB3196A	X	X				4	X	X	X
C64RCB6105A	X		X		X	X		X	X
C64RCB6106A	X		X		X	X		X	X
C64RCB6125A	X		X		X	2		X	X
C64RCB6126A	X		X		X	2		X	X
C64RCB6145A	X		X		2	2		X	2
C64RCB6146A	X		X		2	2		X	2
C64RCB6196A	X		X		X	4		X	X
C64RCB1105AT	X					X			
C64RCB1106AT	X					X			
C64RCB3105AT	X	X				X	X	X	X
C64RCB3106AT	X	X				X	X	X	X
C64RCB6105AT	X			X	2	X		X	X
C64RCB6106AT	X			X	2	X		X	X

STATION MODEL	TLN4635B STATION CONTROL MODULE	TLN4669B LINE DRIVER MODULE (1 REC-2-WIRE)	TLN4670B LINE DRIVER MODULE (2 REC)	TLN4661A DC TRANSFER MODULE (4F-CS-F1)	TLN4663A DC TRANSFER MODULE (C2-R2)	TLN4659A DC TRANSFER MODULE (F1-"PL")	TLN4660A DC TRANSFER MODULE (F2-R2 MUTE)	TLN1245B GUARD TONE MODULE	TLN4658A F1 TONE CONTROL MODULE
C64RCB1105A	X	X		X					
C64RCB1106A	X	X						X	X
C64RCB1125A	X	X			X				
C64RCB1126A	X	X						X	X
C64RCB1145A	X		X				X		
C64RCB1146A	X		X					X	X
C64RCB1196A	X	X						X	
C64RCB3105A	X	X				X			
C64RCB3106A	X	X						X	
C64RCB3125A	X	X			X				
C64RCB3126A	X	X						X	
C64RCB3145A	X		X				X		
C64RCB3146A	X		X					X	
C64RCB3196A	X	X						X	
C64RCB6105A	X	X				X			
C64RCB6106A	X	X						X	
C64RCB6125A	X	X			X				
C64RCB6126A	X	X						X	
C64RCB6145A	X		X				X		
C64RCB6146A	X		X					X	
C64RCB6196A	X	X						X	
C64RCB1105AT	X	X		X					
C64RCB1106AT	X	X						X	X
C64RCB3105AT	X	X				X			
C64RCB3106AT	X	X						X	
C64RCB6105AT	X	X				X			
C64RCB6106AT	X	X						X	

STATION MODEL	TLN4638A F1-"PL" TONE CONTROL MODULE	TLN4665A F2 TONE CONTROL MODULE	TLN1248A C2-R2 TONE CONTROL MODULE	TLN4636A TIME-OUT TIMER MODULE	TLN5292A 4-FREQUENCY CONTROL MODULE	TLN5293A F1 CONTROL MODULE (4F-CS)	TLN5294A F1-"PL" CONTROL MODULE (4F-"PL")	TRN8686A CARD PULLER	TRN6338A 5-VOLT REGULATOR KIT	TLN4662A SQUELCH GATE MODULE
C64RCB1105A								X		
C64RCB1106A								X		
C64RCB1125A								X		
C64RCB1126A			X					X		
C64RCB1145A								X		
C64RCB1146A		X						X		
C64RCB1196A					X	X		X	X	
C64RCB3105A								X		
C64RCB3106A	X							X		
C64RCB3125A								X		
C64RCB3126A	X		X					X		
C64RCB3145A								X		
C64RCB3146A	X	X						X		
C64RCB3196A					X		X	X	X	
C64RCB6105A								X		
C64RCB6106A	X							X		
C64RCB6125A								X		
C64RCB6126A	X		X					X		
C64RCB6145A								X		
C64RCB6146A	X	X						X		
C64RCB6196A					X		X	X	X	
C64RCB1105AT				X				X		X
C64RCB1106AT				X				X		X
C64RCB3105AT				X				X		X
C64RCB3106AT	X			X				X		X
C64RCB6105AT				X				X		X
C64RCB6106AT	X			X				X		X

STATION MODEL	TRE1200BA SERIES * RCVR RF & IF	TRN6006A RCVR AUDIO & SQUELCH BOARD	TLN4290B RCVR AUDIO POWER AMPLIFIER	TRN6002A "PL" TONE-CODED SQUELCH DECODER	TLN5729A "PL" DIGITAL-CODED SQUELCH DECODER	TLN8381A "VIBRASPONDER" RESONANT REED	KXN1024A CHANNEL ELEMENT (RCVR)	TKN6802A RECEIVER CABLE KIT (BETWEEN RECEIVER & ANTENNA NETWORK)
C64RCB1105A	X	X	X				X	X
C64RCB1106A	X	X	X				X	X
C64RCB1125A	X	X	X				2	X
C64RCB1126A	X	X	X				2	X
C64RCB1145A	2	2	2				0	X
C64RCB1146A	2	2	2				0	X
C64RCB1196A	X	X	X				4	X
C64RCB3105A	X	X	X	X		X	X	X
C64RCB3106A	X	X	X	X		X	X	X
C64RCB3125A	X	X	X	X		X	2	X
C64RCB3126A	X	X	X	X		X	2	X
C64RCB3145A	2	2	2	2		2	0	X
C64RCB3146A	2	2	2	2		2	0	X
C64RCB3196A	X	X	X	X		X	4	X
C64RCB6105A	X	X	X		X		X	X
C64RCB6106A	X	X	X		X		X	X
C64RCB6125A	X	X	X		X		2	X
C64RCB6126A	X	X	X		X		2	X
C64RCB6145A	2	2	2		2		0	X
C64RCB6146A	2	2	2		2		0	X
C64RCB6196A	X	X	X		X		4	X
C64RCB1105AT	X	X	X				X	
C64RCB1106AT	X	X	X				X	
C64RCB3105AT	X	X	X	X		X	X	
C64RCB3106AT	X	X	X	X		X	X	
C64RCB6105AT	X	X	X		X		X	
C64RCB6106AT	X	X	X		X		X	

STATION MODEL	TLE8340A 2-RCVR COUPLER	TLN1738A 2ND RCVR CHASSIS NOTE	TPN1110B POWER SUPPLY	TRN6199A HARDWARE KIT	TRN6200A CABINET HARDWARE KIT (2-RECEIVER MODELS ONLY)	TRN6193A TRANSMITTER SHIELD KIT	TRN6194A RECEIVER SHIELD KIT	TLE1710A SERIES * 75-WATT POWER AMPLIFIER	TKN6804A 75-WATT CABLE KIT	THN6142A 41-INCH "COMPA-STATION" CABINET
C64RCB1105A			X	X				X	X	X
C64RCB1106A			X	X				X	X	X
C64RCB1125A			X	X				X	X	X
C64RCB1126A			X	X				X	X	X
C64RCB1145A	X	X	X		X	X	X	X	X	X
C64RCB1146A	X	X	X		X	X	X	X	X	X
C64RCB1196A			X	X				X	X	X
C64RCB3105A			X	X				X	X	X
C64RCB3106A			X	X				X	X	X
C64RCB3125A			X	X				X	X	X
C64RCB3126A			X	X				X	X	X
C64RCB3145A	X	X	X		X	X	X	X	X	X
C64RCB3146A	X	X	X		X	X	X	X	X	X
C64RCB3196A			X	X				X	X	X
C64RCB6105A			X	X				X	X	X
C64RCB6106A			X	X				X	X	X
C64RCB6125A			X	X				X	X	X
C64RCB6126A			X	X				X	X	X
C64RCB6145A	X	X	X		X	X	X	X	X	X
C64RCB6146A	X	X	X		X	X	X	X	X	X
C64RCB6196A			X	X				X	X	X
C64RCB1105AT			X	X				X	X	X
C64RCB1106AT			X	X				X	X	X
C64RCB3105AT			X	X				X	X	X
C64RCB3106AT			X	X				X	X	X
C64RCB6105AT			X	X				X	X	X
C64RCB6106AT			X	X				X	X	X

EPS-24554-B

MOTOROLA

MODEL SERIES BREAKDOWN CHART

FOR

"MICOR" "COMPA-STATION" AND

UPRIGHT STATIONS

406-420 AND 450-512 MHz

MODEL	ITEM DESCRIPTION
	EXCITER/1ST BANDPASS FILTER
TLE1721B	EXCITER/1ST BANDPASS FILTER (406-420 MHz)
TLE1723B	EXCITER/1ST BANDPASS FILTER (450-470 MHz)
TLE1724B	EXCITER/1ST BANDPASS FILTER (470-494 MHz)
TLE1725B	EXCITER/1ST BANDPASS FILTER (494-512 MHz)
	TRIPLER/LOW LEVEL AMPLIFIER
TLE1601A	TRIPLER/LOW LEVEL AMPLIFIER (406-420 MHz)
TLE1603A	TRIPLER/LOW LEVEL AMPLIFIER (450-470 MHz)
TLE1604A	TRIPLER/LOW LEVEL AMPLIFIER (470-494 MHz)
TLE1605A	TRIPLER/LOW LEVEL AMPLIFIER (494-512 MHz)
	ANTENNA NETWORK
TLE1661A	Base Stations, 406-420 MHz
TLE1663A	Base Stations, 450-470 MHz
TLE1664A	Base Stations, 470-494 MHz
TLE1665A	Base Stations, 494-512 MHz
TLE1671A	RPTR Stations, 406-420 MHz
TLE1673A	RPTR Stations, 450-470 MHz
TLE1674A	RPTR Stations, 470-494 MHz
TLE1675A	RPTR Stations, 494-512 MHz
	POWER AMPLIFIER
TLE1681A	12-WATT POWER AMPLIFIER (406-420 MHz)
TLE1683A	12-WATT POWER AMPLIFIER (450-470 MHz)
TLE1684A	12-WATT POWER AMPLIFIER (470-512 MHz)
TLE1693A	20-WATT POWER AMPLIFIER (450-470 MHz)
TLE1694A	20-WATT POWER AMPLIFIER (470-512 MHz)
TLE1701A	45-WATT POWER AMPLIFIER (406-420 MHz)
TLE1703A	45-WATT POWER AMPLIFIER (450-470 MHz)
TLE1704A	45-WATT POWER AMPLIFIER (470-512 MHz)
TLE1711A	75-WATT POWER AMPLIFIER (406-420 MHz)
TLE1713A	75-WATT POWER AMPLIFIER (450-470 MHz)
TLE1714A	75-WATT POWER AMPLIFIER (470-512 MHz)
	RECEIVER RF & IF
TRE1201BA	RCVR RF & IF (406-420 MHz)
TRE1203BA	RCVR RF & IF (450-470 MHz)
TRE1204BA	RCVR RF & IF (470-494 MHz)
TRE1205BA	RCVR RF & IF (494-512 MHz)
	2ND RECEIVER
TLN1738A	2nd RECEIVER CHASSIS
	UNIFIED CONTROL CHASSIS
TCN1187A	UNIFIED CONTROL CHASSIS (RPTR STATIONS)
TCN1148A	UNIFIED CONTROL CHASSIS (BASE STATIONS)

MODEL	ITEM DESCRIPTION
	EXCITER/1ST BANDPASS FILTER
TLD5491A	EXCITER BOARD (135.3-140 MHz)
TLD5492A	EXCITER BOARD (150-170.6 MHz)
TFD6371A	1ST BANDPASS FILTER (135.3-140 MHz)
TFD6373A	1ST BANDPASS FILTER (150.0-156.6 MHz)
TFD6374A	1ST BANDPASS FILTER (156.6-164.6 MHz)
TFD6375A	1ST BANDPASS FILTER (164.6-170.6 MHz)
	TRIPLER/LOW LEVEL AMPLIFIER
TLN5650	CHASSIS AND HARDWARE KIT
TLE8391A	TRIPLER/AMPLIFIER (406-420 MHz)
TLE8393A	TRIPLER/AMPLIFIER (450-470 MHz)
TLE8394A	TRIPLER/AMPLIFIER (470-494 MHz)
TLE8395A	TRIPLER/AMPLIFIER (494-512 MHz)
TFE6151A	2ND BANDPASS FILTER (406-420 MHz)
TFE6153A	2ND BANDPASS FILTER (450-470 MHz)
TFE6154A	2ND BANDPASS FILTER (470-494 MHz)
TFE6155A	2ND BANDPASS FILTER (494-512 MHz)
	ANTENNA NETWORK
TLE5251A	CHASSIS AND HARDWARE KIT (406-420 MHz) BASE
TLE5253A	CHASSIS AND HARDWARE KIT (450-470 MHz) BASE
TLE5254A	CHASSIS AND HARDWARE KIT (470-494 MHz) BASE
TLE5255A	CHASSIS AND HARDWARE KIT (494-512 MHz) BASE
TLN5651A	REED SWITCH
TLE5221A	CHASSIS AND HARDWARE KIT (406-420 MHz) RPTR
TLE5223A	CHASSIS AND HARDWARE KIT (450-470 MHz) RPTR
TLE5224A	CHASSIS AND HARDWARE KIT (470-494 MHz) RPTR
TLE5225A	CHASSIS AND HARDWARE KIT (494-512 MHz) RPTR
TRN4161A	ANTENNA NETWORK BOARD
TRN4348A	ANTENNA NETWORK BOARD
TFE6361A	HARMONIC FILTER (406-420 MHz)
TFE6363A	HARMONIC FILTER (450-512 MHz)
	UNIFIED CONTROL CHASSIS
TLN5649A	CHASSIS
TLN5644A	UNIFIED CHASSIS INTERCONNECT BOARD
TLN5645A	TRANSMITTER INTERCONNECT BOARD (RPTR)
TLN5646A	RECEIVER INTERCONNECT BOARD (RPTR)
TLN5647A	TRANSMITTER INTERCONNECT BOARD (BASE)
TLN5648A	RECEIVER INTERCONNECT BOARD (BASE)
	POWER AMPLIFIER
TLE8301A	12-WATT PA (406-420 MHz)
TLE8303A	12-WATT PA (450-470 MHz)
TLE8304A	12-WATT PA (470-512 MHz)
TKN6766A	CABLE KIT
TLE8313A	20-WATT PA (450-512 MHz)
TKN6767A	CABLE KIT
TLE8321A	45-WATT PA (406-420 MHz)
TLE8323A	45-WATT PA (450-512 MHz)
TLE8331A	75-WATT PA (406-420 MHz)
TLE8333A	75-WATT PA (450-470 MHz)
TLE8334A	75-WATT PA (470-512 MHz)
TKN6768A	CABLE KIT
	RECEIVER RF & IF
TLE8021A	RF DECK (406-420 MHz)
TLE8023A	RF DECK (450-470 MHz)
TLE8024A	RF DECK (470-494 MHz)
TLE8025A	RF DECK (494-512 MHz)
TLE8031B	RF & IF BOARD (406-420 MHz)
TLE8032B	RF & IF BOARD (450-494 MHz)
TLE8033B	RF & IF BOARD (494-512 MHz)
	2ND RECEIVER
TLN5653A	CHASSIS AND HARDWARE
TLN5655A	INTERCONNECT BOARD

EPS-17818-A

FACTORY-INSTALLED OPTIONS

OPTION PLAN NUMBER OR OPTIONAL KIT NUMBER	DESCRIPTION	PUBLICATION REFERENCE: APPLICABLE SECTION WITHIN THIS MANUAL	PUBLICATION REFERENCE: PART NUMBER OF SEPARATE PUBLICATION
DC REMOTE CONTROL STATION OPTIONS			
C63	TLN4637A Paging Module	None	68P81025E60
C143	TLN4664A Repeater Control Module	None	68P81025E60
TONE REMOTE CONTROL STATION OPTIONS			
C56 OR C63	TLN4667A F2-R2 Mute Control Module	None	68P81025E60
	TLN1253A Paging Control Module	None	68P81025E60
TLN1249A OR TLN1250A OR TLN1251A	Squelch Control Module	None	68P81025E60
	Repeater Control Module	None	68P81025E60
	"PL" Control Module	None	68P81025E60
TLN1252A	"Wild Card" Module (See Note 3)	None	68P81025E60
C170	Guard Tone Keying	None	68P81025E60
OPTIONS APPLICABLE TO BOTH DC AND TONE REMOTE CONTROL STATIONS			
C12	TLE8191A/2A RF Preamplifier	Receiver RF & IF	None
C31	Transmit Only Station (Delete Receiver)	None	None
C140	AND Squelch Control	Receiver Interconnect Unit	None
C144 OR C144AB	TLN4668A 4-Wire Audio (1-Rcvr)	None	68P81025E60
	TLN4668A 4-Wire Audio (2-Rcvr)	None	68P81025E60
C145	TLN1460A TAC Encoder (See Note 5)	None	68P81104E73
C150	Base (RA) Operation	None	68P81105E08
C158	Multiple PL Transmit	None	68P81106E30
C261	Multiple PL Receive	None	68P81106E30
C262	Multiple PL Repeat	None	68P81106E30
C263	Multiple PL Transmit & Receive	None	68P81106E30
TLN1181A	Single-Tone Decoder Module	None	68P81025E60
TLN4636A	Time-Out Timer Module (See Note 6)	None	68P81025E60
TLN1740A	DC Metering W/Monitor Intercom (Note 7)	None	None
TLN1745A	Service Intercom W/Speaker (Notes 7 and 8)	None	None
C160	Repeater (RA) Operation	None	68P81105E08
C27	46-inch Outdoor Cabinet	Installation	None
C180	60-inch Indoor Cabinet	Installation	None
C36	75-inch Outdoor Cabinet	Installation	None
C38	120/220/240-Volt AC 50/60 Hz Power Supply	None	68P81104E92
C28	120-Volt AC/12-Volt DC Power Supply	None	68P81104E92
C29	Battery Saver/Alarm	None	68P81104E92
C181, 182, 183	Duplexer	None	68P81102E96
C75	Omit Time-Out Timer Module	None	None
TLN4151A	Relay Kit	None	68P81025E60

NOTES:

1. The options listed are not necessarily compatible with each other or with each type of station. Consult your Motorola representative for compatibility details.
2. Other options may become available after the printing of this instruction manual. Consult your Motorola representative for a complete listing of the current options available for your station.
3. One to four TLN4151A Relay Kits may be used with this option to provide one to four form "C" contact closures for operation of external equipment.
4. One TLN4151A Relay Kit may be used with this option to provide a form "C" contact closure for operation of external equipment.
5. This option also replaces the TLN4669A 2-Wire Audio with the TLN4668A 4-Wire Audio.
6. Option to base stations; supplied with repeater stations.
7. Option to "Compa-Station" Radios only.
8. TLN1745A Service Intercom Kit is identical to TLN1740A DC Metering W/Monitor Intercom Kit but less dc metering feature.

FACTORY-INSTALLED OPTIONS

OPTION PLAN NUMBER OF OPTIONAL KIT NUMBER	DESCRIPTION	PUBLICATION REFERENCE	
		APPLICABLE SECTION WITHIN THIS MANUAL	PART NUMBER OF SEPARATE PUBLICATION
DC REMOTE CONTROL STATION OPTIONS			
C63	TLN4637A Paging Module	None	68P81025E60
C143	TLN4664A Repeater Control Module	None	68P81025E60
TONE REMOTE CONTROL STATION OPTIONS			
C56 OR	TLN4667A F2-R2 Mute Control Module	None	68P81025E60
C63	TLN1253A Paging Control Module	None	68P81025E60
TLN1249A OR	Squelch Control Module	None	68P81025E60
TLN1250A OR	Repeater Control Module	None	68P81025E60
TLN1251A	PL Control Module	None	68P81025E60
TLN1252A	"Wild Card" Module (See Note 3)	None	68P81025E60
C170	Guard Tone Keying	None	68P81025E60
OPTIONS APPLICABLE TO BOTH DC AND TONE REMOTE CONTROL STATIONS			
C12	TLE8191A/2A RF Preamplifier	Receiver RF & IF	None
C31	Transmit Only Station (Delete Receiver)	None	None
C140	AND Squelch Control	Receiver Interconnect Unit	None
C144 OR	TLN4668A 4-Wire Audio (1-Rcvr)	None	68P81025E60
C144AB	TLN4668A 4-Wire Audio (2-Rcvr)	None	68P81025E60
C145	TLN1460A TAC Encoder (See Note 5)	None	68P81104E73
C150	Base (RA) Operation	None	68P81105E08
C158	Multiple PL Transmit	None	68P81106E30
C261	Multiple PL Receive	None	68P81106E30
C262	Multiple PL Repeat	None	68P81106E30
C263	Multiple PL Transmit & Receive	None	68P81106E30
TLN1181A	Single-Tone Decoder Module	None	68P81025E60
TLN4636A	Time-Out Timer Module (See Note 6)	None	68P81025E60
C149	DC Metering W/Monitor Intercom (Note 7)	Station Data	None
C226	Service Intercom W/Speaker (Notes 7 and 8)	None	None
C160	Repeater (RA) Operation	None	68P81105E08
C27	46-Inch Outdoor Cabinet	Installation	None
C180	60-Inch Indoor Cabinet	Installation	None
C36	75-Inch Outdoor Cabinet	Installation	None
C38	120/220/240-Volt AC 50/60 Hz Power Supply	None	68P81104E92
C28	120-Volt AC/12-Volt DC Power Supply	None	68P81104E92
C29	Battery Saver/Alarm	None	68P81104E92
C181, 182, 183	Duplexer	None	68P81102E96
C75	Omit Time-Out Timer Module	None	None
TLN4151A	Relay Kit	None	68P81025E60
C269	SPECTRA TAC (See Notes 9 & 10)	None	68P81107E40
C40	Indoor Upright Cabinet includes Metering and Intercom	Station Data	None

NOTES:

1. The options listed are not necessarily compatible with each other or with each type of station. Consult your Motorola representative for compatibility details.
2. Other options may become available after the printing of this instruction manual. Consult your Motorola representative for a complete listing of the currentoptions available for your station.
3. One to four TLN4151A Relay Kits may be used with this option to provide one to four form "C" contact closures for operation of external equipment.
4. One TLN4151A Relay Kit may be used with this option to provide a form "C" contact closure for operation of external equipment.
5. This option also replaces the TLN4669A 2-Wire Audio with the TLN4668A 4-Wire Audio.
6. Option to base stations; supplied with repeater stations.
7. Option to "Compa-Station" Radios only.
8. C226 Service Intercom Kit is identical to C149 DC Metering W/Monitor Intercom Kit but less dc metering feature.
9. Applicable on single receiver models only.
10. This option replaces the TLN4669B Line Driver with a TRN6552A Line Driver, and adds a TRN6085A Encoder Module and TRN6103A Miscellaneous Hardware Kit. On RT repeater models, the Squelch Gate Module TLN4662A is replaced with a TRN6689A Squelch Gate Module.

STATION DATA

Description 68P81025E89
Installation 68P81025E91
Upright Outdoor Cabinet 68P81033E42
"Compa-Station" Outdoor Cabinet 68P81033E46
"Comps-Station" Metering and Intercom (Early Version) 68P81042E33
Upright-Station 68P81042E57
"Compa-Station" Metering and Intercom (Later Version) 68P81033E28
Station Alignment 68P81042E53
Station Maintenance 68P81025E92

TRANSMITTER

Transmitter Introduction 68P81042E32
Transmitter Interconnect Board 68P81042E26
Exciter/1st Bandpass Filter Tripler/Low Level Amplifier 68P81042E13
Power Amplifiers (Introduction) 68P81042E14
12-Watt Power Amplifier 68P81042E16
20-Watt Power Amplifier 68P81042E17
40/45 Watt Power Amplifier (450-512 MHz) 68P81042E18
45-Watt Power Amplifier (406-420 MHz) 68P81042E39
60/75 Watt Power Amplifier (450-512 MHz) 68P81042E19
75-Watt Power Amplifier 68P81042E38
Power Control Board 68P81034E14
Antenna Network 68P81042E27
"PRIVATE-LINE" Encoder 68P81026E71
Simplex "DITITAL PRIVATE-LINE" Encoder 68P81028E63
Duplex "DIGITAL PRIVATE-LINE" Encoder 68P81028E64

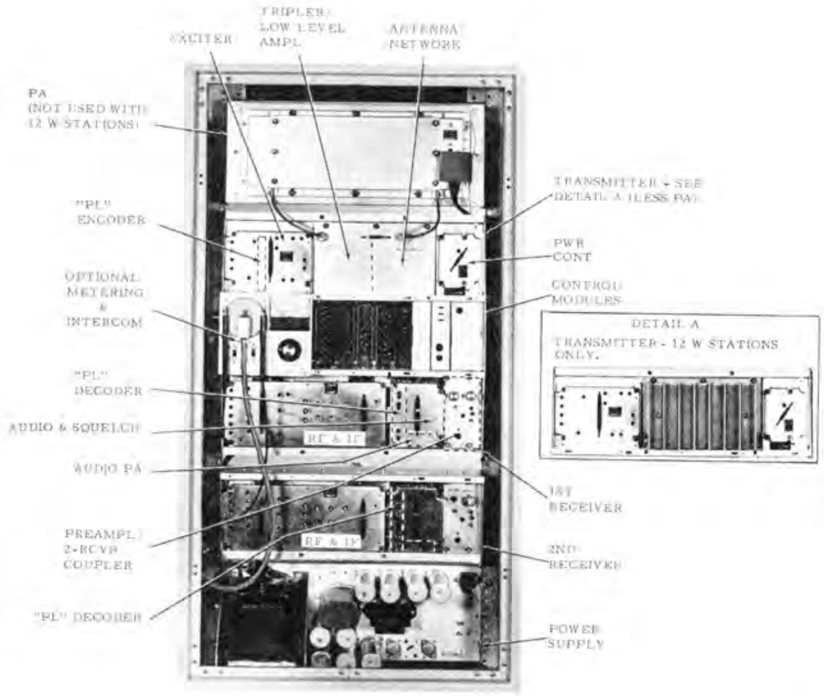
RECEIVER

Receiver Introduction 68P81042E36
Receiver Interconnect Board 68P81034E07
Receiver RF & I-F Board 68P81042E37
Receiver Audio & Squelch Board 68P81025E79
Audio Power Amplifier 68P81014E97
"PRIVATE-LINE" Decoder 68P81026E73
"DIGITAL PRIVATE-LINE" Decoder 68P81026E13

POWER SUPPLIES

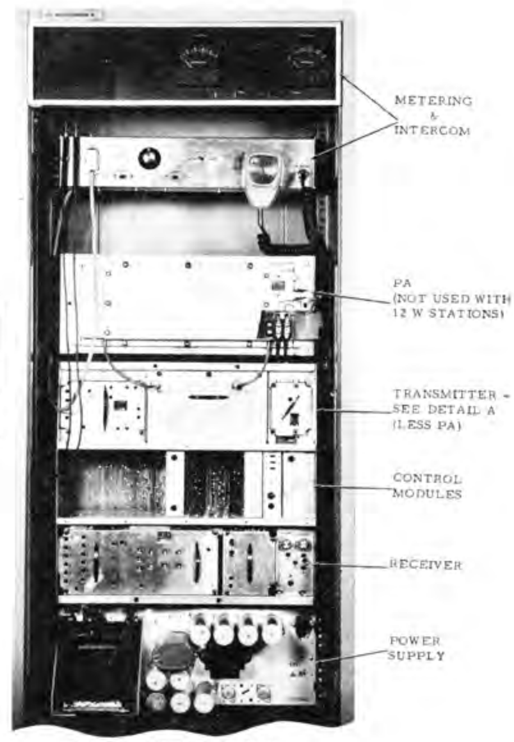
Power Supply 68P81033E41
Power Supply 68P81020E44

DESCRIPTION



TYPICAL "COMPA-STATION" RADIO

FBEPS-17735-A



TYPICAL UPRIGHT STATION

1. MANUAL USAGE

This manual describes all aspects of 406-420 MHz and 450-470 MHz "Micor" type Upright and "Compa-Station" radios except remote control and station applications. Separate CONTROL and APPLICATIONS manual 68P81025E60 describes how these stations are remotely controlled and outlines the various types of base and repeater stations and their applications.

2. EQUIPMENT DESCRIPTION INTRODUCTION

2.1 These Motorola "Micor" type base and repeater (RT) stations operate in the 406-420 MHz and 450-512 MHz range and are available in two basic model configurations -- "Compa-Station" models and Upright models. Basic electrical characteristics of both are identical; the primary differences being that the upright models include a larger cabinet with hinged doors (front and back) and built-in metering with monitor intercom. "Compa-Station" models are shorter, incorporate non-hinged doors, and built-in metering with monitor intercom is available as an option. ("Compa-Station" metering is unique from upright station metering.)

2.2 Many models are available as shown in the station model chart at the front of this manual which designates equipment operational differences. These differences include transmitter rf power output level, type of receiver squelch, number of operating frequencies, type of remote control, etc.

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3. TRANSMITTER

The transmitter generates a frequency modulated rf carrier signal of various power output levels depending upon the model. Refer to the following station block diagram for functional operation. The transmitter consists of the following items:

NOTE

Stations in the 470-512 MHz band are FCC-licensed to operate at or below a specified effective radiated power (ERP). The ERP of the station is related to the rf power output of the transmitter, antenna transmission line loss, antenna height and antenna gain. The maximum rf power output of the transmitter that will be permitted, without violating the licensed ERP for each specific station, must be determined by a communications specialist. This rf power figure may be equal to or below the maximum capability of the station. Record the figure for reference in future servicing and alignment of the station.

--Channel Element - An unheated, temperature-compensated crystal oscillator plug-in module (channel element) provides a stable fundamental rf frequency for the transmitter. One channel element is used for each transmitter frequency.

--Exciter - The exciter provides the low power excitation signal for the transmitter. An "IDC" (Instantaneous Deviation Control) circuit amplifies and limits audio signals from the microphone (or line) to prevent over deviation. Amplified audio is applied to the channel element to produce direct fm modulation. Multipliers in the exciter multiply the channel element frequency 12 times to generate an output frequency signal(s) in the 135 to 171 MHz band.

--First Bandpass Filter - The first bandpass filter couples 135-171 MHz signals from the exciter to the tripler/low level amplifier and attenuates any harmonics outside this band.

--Tripler/Low Level Amplifier - Exciter output frequency is tripled in this stage and amplified to drive the following power amplifier.

--Second Bandpass Filter - This filter is located electrically between the tripler and low level amplifier. This filter couples 406-512 MHz signals from the tripler to the low level amplifier and attenuates any harmonics outside this band.

--Power Amplifier - The low power output of the tripler/ low level amplifier is amplified to the rated power output of the transmitter in this solid-state power amplifier. Class C amplifiers are used which are cut off until signal drive is applied. A controlled amplifier stage regulates the amount of signal drive to prevent over-dissipation in the final amplifier stages. An input from the power control board controls the amount of gain.

--Power Control Board - The power control board automatically and instantaneously regulates the transmitter output power. It maintains output power should source voltage vary, and progressively reduces power when VSWR increase. The output of the board is applied to the controlled amplifier stage in the power amplifier to regulate the amount of gain.

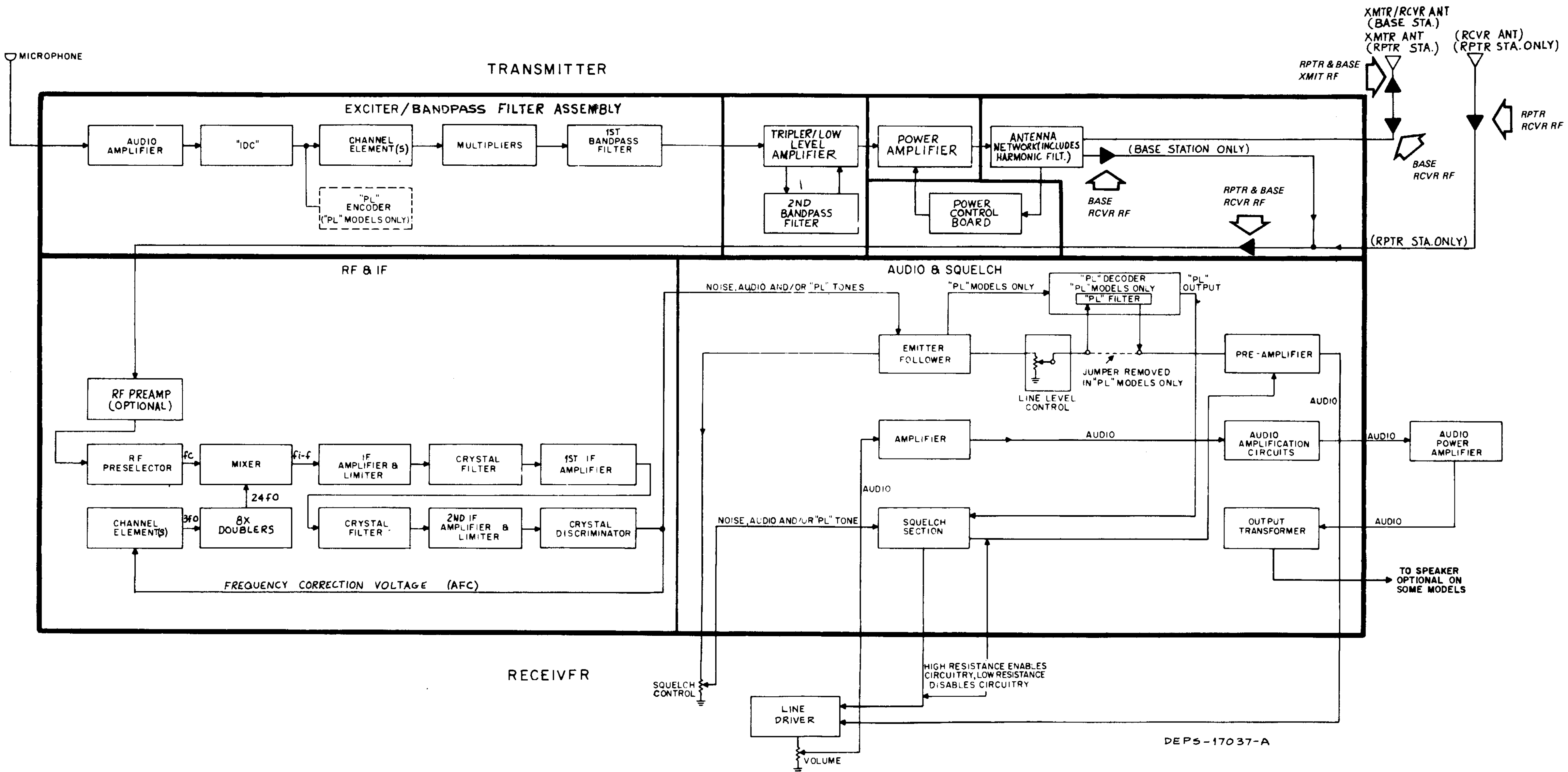
4. RECEIVER

4.1 The receiver accepts rf carrier signals on a specific channel in the 406-512 MHz range and provides voice audio in the 300-3000 Hz range. Refer to the station block diagram for functional operation. The receiver consists of the following items:

--Channel Element - A plug-in crystal oscillator module (channel element) provides stable frequency control for each frequency of operation. One channel element is required for each receiver frequency.

--Receiver RF & IF Board - The single-conversion superheterodyne FM receiver includes a preselector (comprised of six cavities) and two crystal filters for excellent selectivity. Two integrated circuit i-f amplifiers and limiters give high sensitivity. A crystal discriminator demodulates the audio directly from an 11.7 MHz i-f signal. (Some 2-receiver stations may have a "shifted i-f" to 11.8 MHz when required.) An AFC voltage is derived from the discriminator circuit which is used to correct the channel element frequency to provide an overall receiver stability of ±0.0002%.

--Audio & Squelch and Audio Power Amplifier Boards - Up to 10 watts of audio power at less than 5% distortion is provided by this circuit. When no messages are being received, the squelch circuit turns off the audio amplifiers to eliminate annoying noise in the speaker. A squelch tail eliminator circuit prevents the noise burst at the end of a message for strong signals. For weak signals, the circuit is automatically inhibited to prevent loss of portions of messages. The audio power amplifier transistors are mounted on a separate circuit board and aluminum heat sink for good heat dissipation.



MICROPHONE
TRANSMITTER
EXCITER/BANDPASS FILTER ASSEMBLY
AUDIO AMPLIFIER
"IDC"
CHANNEL ELEMENT(S)
MULTIPLIERS
1ST BANDPASS FILTER
"PL" ENCODER ("PL" MODELS ONLY)
TRIPLER/LOW LEVEL AMPLIFIER
2ND BANDPASS FILTER
POWER AMPLIFIER
POWER CONTROL BOARD
ANTENNA NETWORK(INCLUDES HARMONIC FILT.)
(BASE STATION ONLY)
BASE RCVR RF
RPTR & BASE RCVR RF
(RPTR STA.ONLY)
XMTR/RCVR ANT (BASE STA.)
XMTR ANT (RPTR STA.)
(RCVR ANT) (RPTR STA.ONLY)
RPTR & BASE XMIT RF
BASE RCVR RF
RPTR RCVR RF
RF & IF
RF PREAMP (OPTIONAL)
RF PRESELECTOR
fc
MIXER
fi-f
IF AMPLIFIER & LIMITER
CRYSTAL FILTER
1ST IF AMPLIFIER
24fo
CHANNEL ELEMENT(S)
3fo
8X DOUBLERS
CRYSTAL FILTER
2ND IF AMPLIFIER & LIMITER
CRYSTAL DISCRIMINATOR
FREQUENCY CORRECTION VOLTAGE (AFC)
AUDIO & SQUELCH
NOISE, AUDIO AND/OR "PL" TONES
"PL" MODELS ONLY
"PL" DECODER "PL" MODELS ONLY
"PL" FILTER
"PL" OUTPUT
EMITTER FOLLOWER
LINE LEVEL CONTROL
JUMPER REMOVED IN "PL" MODELS ONLY
PRE-AMPLIFIER
AUDIO
AMPLIFIER
AUDIO
AUDIO AMPLIFICATION CIRCUITS
AUDIO
AUDIO POWER AMPLIFIER
AUDIO
NOISE, AUDIO AND/OR "PL" TONE
SQUELCH SECTION
OUTPUT TRANSFORMER
AUDIO
TO SPEAKER OPTIONAL ON SOME MODELS
RECEIVER
SQUELCH CONTROL
HIGH RESISTANCE ENABLES CIRCUITRY, LOW RESISTANCE DISABLES CIRCUITRY
LINE DRIVER
VOLUME
DEPS-17037-A

4.2 With 2-receiver stations, a 2-receiver coupler is used. This unit permits two receivers to operate from the same antenna. The coupler has a maximum insertion loss of 4 dB to each receiver.

4.3 An optional receiver rf preamplifier is also available to improve receiver sensitivity (SINAD) by 6 dB to .175 microvolt. When used with 2-receiver stations, this more than makes up for the half power loss in each "leg" of the 2-receiver coupler.

5. POWER SUPPLY

The power supply utilizes a ferro-resonant (constant voltage) transformer and provides all the voltages necessary for operating the station. It automatically corrects for changes in load and input voltage thus maintaining a constant voltage output.

6. VOLUME AND SQUELCH CONTROLS

Receiver VOLUME and SQUELCH controls are located on the receiver chassis (all other operational circuit and their controls are on plug-in modules inserted into the unified control chassis). The RECEIVER VOLUME control only affects local speaker operation (when used).

NOTE

The SQUELCH control affects local and remote operation.

7. "PRIVATE-LINE" TONE-CODED SQUELCH OPERATION

7.1 This type of operation permits private communications on crowded radio communication channels. Several "Private-Line" (PL) networks can use the same rf carrier frequency in the same area if each network uses a different PL tone frequency. The PL tones are in the 67-210 Hz range, which is below the 300-3000 Hz voice frequency range used in radio communication equipment.

7.2 The transmitters are modulated by a continuous sub-audible PL tone in addition to the voice modulation. The tone is generated by a PL encoder, which is a plug-in circuit board in the transmitter. The receivers accept only signals that are modulated with the specific PL tone frequency. Signals without the tone or with a different tone are not heard. Thus, only messages from your own PL network are heard. A PL decoder, which is also a plug-in circuit board in the receiver, disables the audio circuits of the receiver until the proper tone is received. A filter blocks the tone from the speaker so that it will not be heard.

7.3 In PL radio systems, the operator will not hear all on-frequency signals until he PL disables the receiver. The PL decoder is bypassed and the receiver reverts to carrier noise type squelch control. It is necessary to monitor the channel before transmitting to avoid interfering with other users.

NOTE

The Motorola Order Processing Group assigns the PL tone frequencies to prevent duplicate or interfering tones from being used in the same area. Consult them before changing tones or adding new ones.

8. "DIGITAL PRIVATE-LINE" BINARY-CODED SQUELCH OPERATION

This type of operation is similar to "Private-Line" tone-coded squelch operation but with greatly expanded code capability. Refer to separate Instruction Section 68P81106E83 for complete details.

9. ACCESSORIES

In addition to the base and repeater stations described in this manual, some additional items are needed to complete the installation as follows:

9.1 ANTENNA AND TRANSMISSION LINE

An antenna and transmission line kit is available from Motorola on separate order. The type used should be determined by a qualified radio communications engineer and will depend upon local operating conditions.

9.2 REMOTE CONTROL CONSOLE

A remote control console is required at the control location for this station. It must be compatible with the station; that is, it must supply the audio and control commands of the type that will be accepted by the station.

9.3 OPTIONAL ACCESSORIES

Many optional accessories are available as factory installed items in new stations, and as "add-to" items for field installation. Many of those optional accessories are described in this manual. Other accessories may become available after the printing of this manual. Also, other accessories are available which have more special application than those listed herein. See your local Motorola representative and the following Factory-Installed Options list for complete details.

IMPORTANT

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.

2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and local conditions.

3. Frequency, deviation and power of a base station transmitter must be checked before it is placed in service and rechecked every year thereafter.

REMEMBER

The efficiency of the equipment depends upon a good installation.

1. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

2. PLANNING THE INSTALLATION

Since a good installation is so important to obtain the best possible performance of the communications system, carefully plan the installation before actual work is started. Location of the station in relation to power, control lines, the antenna, convenience and access for servicing should be considered. The cabinet dimensional detail diagrams show the size of the various cabinets for planning the space requirements. Read the entire procedure and the many suggestions offered to help you plan your installation. Make sure all tools, equipment and facilities are available when the installation is begun.

3. VENTILATION

The radio equipment is operated without forced ventilation. The cabinets have vents which allow outside air to be drawn in through an opening in the bottom of the doors and expelled through an opening in the top of the doors. The heated air rising in the cabinet causes a natural draft. Therefore, it is essential that the openings be kept free of obstructions so the air flow will not be restricted. The vents on outdoor type cabinets provide necessary station ventilation and in addition prevent rain, snow, etc. from entering the cabinet.

4. INSTALLATION OF 30-, 41-, AND 60-INCH INDOOR "COMPA-STATION" CABINETS

4.1 Refer to cabinet drawings at the end of this section for cabinet dimensional details.

4.2 The cabinet should be located on a solid, level surface convenient to the power source and the transmission line. The transmission line should be kept as short as possible to minimize line losses.

4.3 All antenna, power and control lines may be brought through the notch at the bottom of the rear door. Any or all of these lines may be brought out through the bottom, side or top of the cabinet, if desired, by drilling a hole in the cabinet at the desired position.

CAUTION

Before drilling, check location of proposed hole and verify that equipment will not be damaged by the drilling.

5. INSTALLATION OF 70-INCH INDOOR UPRIGHT STATION CABINET

5.1 GENERAL

Refer to cabinet drawings at the end of this section for the cabinet dimensional detail. The cabinet should be located on a solid, level surface convenient to the power source and the transmission line. The transmission line should be kept as short as possible to minimize line loss.

5.1 REMOVAL AND REVERSING OF DOORS

Both front and rear doors are removable by simply unhooking the arm of the door stop from the door and pulling down on the upper hinge pin. If desired, both front and rear doors may be reversed from right hand opening to left hand opening as follows:

Step 1. Remove the door and unbolt the hinge brackets from the cabinet.

Step 2. Remount these hinge brackets on the opposite side of the cabinet.

Step 3. Turn the door upside down and reinsert the hinge pins in the brackets.

Step 4. Remove the latch bar from the rear of the door lock and reinstall it 180° from its original position.

5.3 REMOVAL OF SIDE PANELS

The sides of the cabinet may be easily removed to aid in the installation or maintenance of the unit. Proceed as follows:

Step 1. Using a nut driver tool, remove the sheet metal screw located in the middle or the lower edge of the side panel, as viewed from inside the cabinet.

Step 2. Insert a large screwdriver between the lower edge of the side panel and the bright trim strip on the outside of the cabinet and pry up slightly to release the friction grips.

Step 3. Grasp the side panel at the edges with both hands and lift up several inches to remove it.

5..4 REPLACEMENT OF SIDE PANELS

Step 1. When replacing the side panel, position it over the frame with the top several inches above the top of the cabinet.

Step 2. Slowly slide the side panel down into position. When the top of the side panel is flush with the top of the cabinet, the panel is positioned properly.

Step 3. The locking screw should be replaced for security reasons.

6. INSTALLATION OF 46- AND 75-INCH "OUTDOOR" CABINETS

6.1 GENERAL

6.1.1 Refer to cabinet drawings at the end of this section for cabinet dimensional details.

6.1.2 The outdoor station may be installed in any convenient location (indoors or outdoors) which provides space to open the front and rear doors. If it is installed outdoors, the rain shield kit (which is packed with the cabinet) should be installed as described in this section. With these installed, the station is protected against all normally encountered elements such as rain, snow or sleet.

6.1.3 The station is not intended to withstand submersion in water. If pools of water could gather around the cabinet base, it is recommended that the cabinet be elevated on a suitable supporter platform.

6.1.4 Although the cabinet is built to be installed outdoors, it should be realized that maintenance of the station is not easily accomplished in inclement weather. It is therefore recommended that the station be installed inside of an enclosure which would provide protection for the serviceman and the test equipment he may be using. One such enclosure would be an elevator penthouse or a small building no less than six feet square and eight feet tall as measured on the inside.

6.1.5 The cabinet should be located on a solid, level surface convenient to the power source and the transmission line. The transmission line should be kept as short as possible to minimize line losses.

6.2 46-INCH CABINET RAIN SHIELD INSTALLATION

6.2.1 General

The rain shield kit is provided to cover the air vent openings at the top and bottom of both cabinet doors.

6.2.2 Procedure

The complete rain shield installation procedure is given in step form on the 46-inch outdoor cabinet dimensional detail at the end of this section.

6.3 75-INCH CABINET RAIN HOOD AND VENT SHIELD INSTALLATION

6.3.1 General

The rain hood is provided to cover the air vent in the top of the cabinet and the vent shield to cover the opening in the rear door.

6.3.2 Installation of Rain Hood

Step 1. Install the main section (largest fabricated assembly) over the opening in the top of the cabinet using the rectangular shaped gasket and 1/2-inch sheet metal screws provided.

Step 2. Mount the small rectangular cover inside the main section using the machine screws provided.

Step 3. Similarly, mount the larger cover on top of the whole assembly.

6.3.3 Installation of Vent Shield

Mount the awning-shaped vent shield over the opening in the rear door using the "U" shaped gasket and 3/8-inch sheet metal screws. Place the acorn nuts over the screws to cover exposed threads.

7. ANTENNA CONNECTIONS

7.1 INTRODUCTION

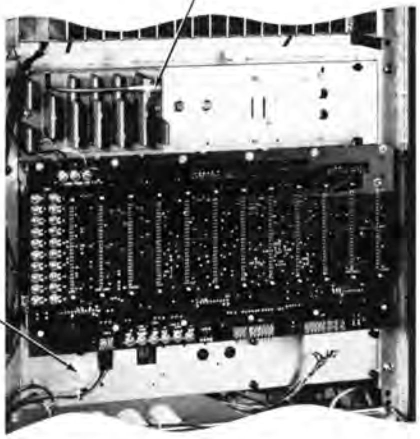
7.1.1 The antennas and transmission lines are not part of the station. Therefore, antenna installation instructions are not included in this section. Follow the instructions shipped with the antennas for applicable information.

7.1.2 In its primary application, the station is used for communications with mobile radios. Thus antennas having omni-directional characteristics are desirable. However, if the station is located at the outer perimeter of a communications area, or if it is to be used for communications with fixed stations, antennas with specific directional characteristics may be more suitable. FCC requirements may also dictate the type of antenna to be used.

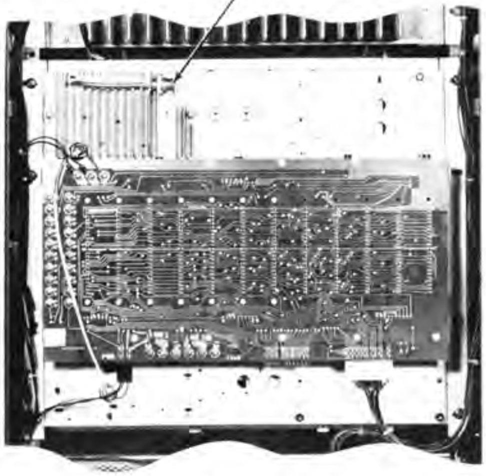
7.1.3 For base stations, the antenna's coaxial cable connects to the antenna network output with a type N connector. For repeater stations without an optional duplexer, two antennas are required, one for the transmitter and one for the receiver. The antenna coaxial cables connect directly to the transmitter and receiver. The transmitter output requires a type N connector at the antenna network output--the receiver input requires a type BNC connector. For repeater stations with an optional factory installed duplexer, the antenna's coaxial cable connects to the duplexer with a type UHF connector. (Refer to Figure 1.)

7.2 31-, 41-, AND 60-INCH INDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

Step 1. The antenna coaxial cable(s) may be brought through the notch at the bottom of the



REPEATER STATIONS



BASE STATIONS

FAEPS-17625-O

Figure 1.
Antenna Connection Locations

rear door. Cable(s) may be brought out through the bottom, side or top of the cabinet, if desired, by drilling a hole in the cabinet at the desired position.

CAUTION

> Be careful to determine internal clearance before drilling access holes. A 3/4-inch diameter hole allows conduit to be installed for cable runs. If conduit is not used, install rubber grommets in the holes to protect the cable(s).

Step 2. Connect the antenna cable(s) as shown in Figure 1 and discussed in paragraph 7.1.3.

7.3 46-INCH OUTDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

This outdoor cabinet antenna cable routing and connection procedure is the same as described for indoor type cabinets except the entrance must be sealed and made as weatherproof as possible.

7.4 70-INCH INDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

7.4.1 General

Six knockouts in three sizes are provided on the cabinet top for ease of installation. Refer to Figure 2 Cabinet Knockout Detail for proper hole usage and to Figure 3 Indoor Cabinet Antenna Cable Installation Diagram for typical installation details. Determine the type of cable entry or entries required as described in paragraph 7.1.3 and select the most convenient knockout(s). The coaxial output lead must be kept as short as possible to keep power loss to a minimum.

7.4.2 Transmission Lines Terminated in Female Connector

Step 1. Secure the transmission line (through the appropriate knockout) directly to the cabinet top with the nut supplied.

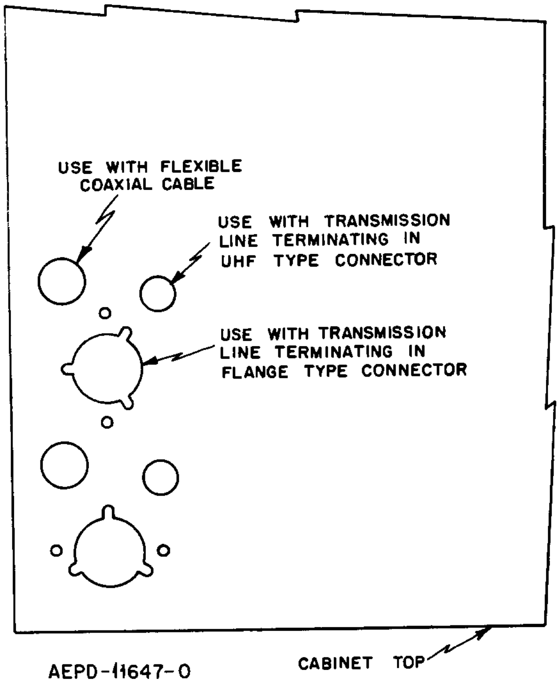


Figure 2.
Cabinet Knockout Detail

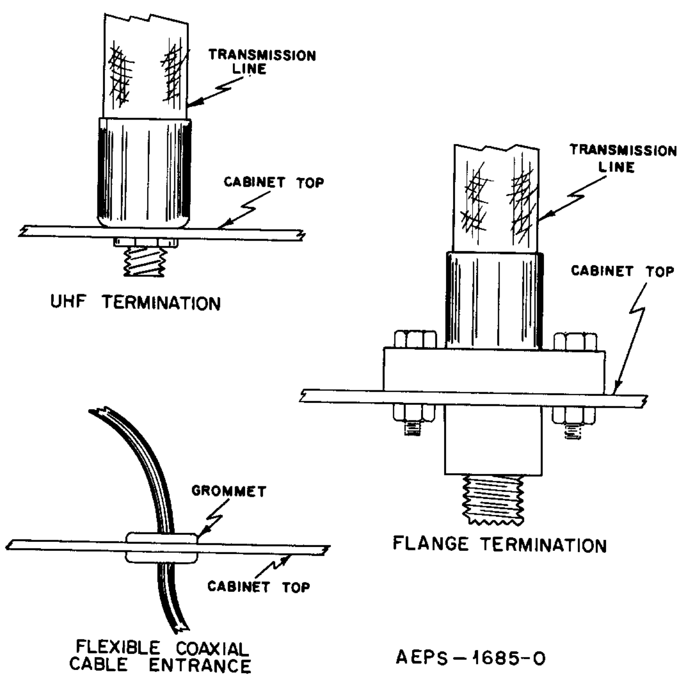


Figure 3.
Indoor Cabinet Antenna Cable Installation

Step 2. Measure and cut a piece of coaxial cable so that it will reach between the station output connector and the transmission line connector in the cabinet top.

Step 3. Install connectors as required.

7.4.3 Transmission Lines Terminated in Flange Type Connector

Step 1. Install the flange type connector in the cabinet top using the appropriate knockout.

Step 2. Measure and cut a piece of coaxial cable so that it will reach between the station output connector and the flange type connector in the cabinet top without any sharp bends.

Step 3. Install connectors as required.

7.4.4 Externally Terminated Transmission Line

The transmission line may be terminated adjacent to the cabinet, but must be within reach of the coaxial cable that connects to the radio equipment.

Step 1. Punch out the 7/8-inch knockout in the cabinet top.

Step 2. Install the rubber grommet (supplied) in the hole.

Step 3. Install a coaxial jumper cable of sufficient length to provide proper connection.

7.5 75-INCH OUTDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

Step 1. A flange-type bulkhead fitting should be used to make a weatherproof entry for the antenna transmission line(s). The recommended location for the fitting is on the right side of the cabinet (as viewed from the front) with its center 21 inches from the top and 7 inches from the rear. Any alternate location must be selected with caution to insure that the area is clear of chassis, framework, etc.

Step 2. Install connectors as required.

8. AC INPUT POWER CONNECTIONS

8.1 INTRODUCTION

8.1.1 All stations should have a separate power circuit from a 10-ampere (minimum), 120-volt ac, 60 Hz power source. The power lines should be installed in accordance with local electrical codes.

8.1.2 The primary ac power line may be installed prior to installation of the cabinet and terminated near the location chosen for the station.

8.2 31-, 41-, 60-INCH INDOOR/46-INCH OUTDOOR CABINETS POWER CONNECTION

8.2.1 Indoor and outdoor power connections are identical except that outdoor station requires additional weatherproofing.

WARNING

If a three wire grounded primary ac power source is not available the radio equipment must be grounded separately to prevent electrical shock hazards and provide lightning protection.

8.2.2 Connect the three-wire ac line cord to the ac outlet. A power on-off switch is not provided in the equipment, therefore, with power applied, the equipment is in an operative condition.

8.2.3 The station fuse controls all power to the station except ac power to the outlet in the power supply.

8.3 70-INCH INDOOR CABINET POWER CONNECTION

8.3.1 If the station is located in a room with a utility trough in the floor, the station may be installed over the trough and the power and control leads brought up through the bottom of the cabinet into the station. Do not punch out the knockouts for such an installation.

8.3.2 Two knockouts are also provided on the rear panel of the cabinet base for rear entrance of the power and control lines. When facing the rear of the cabinet, the right hand knockout is intended for the entrance of ac power. Punch out the knockout. Install a 7/8-inch rubber grommet (supplied) in the hole to protect the cable.

8.4 75-INCH OUTDOOR CABINET POWER CONNECTIONS

8.4.1 For bottom cable entry, power and control cables may be brought in at almost any desired point through the bottom of the cabinet. Measure and center punch the desired cable entry locations. Using the center punch marks as the center of the holes, drill 3/4-inch holes with a hold saw. Install rubber grommets in the holes to protect the cables. Seal the entry to make the opening as weatherproof as possible.

8.4.2 For rear cable entry, two punch marks are located on the rear panel of the cabinet base. Using these as centers, drill holes in the cabinet with a 3/4-inch hole saw. When facing the rear, the right-hand hole is intended for the entrance of ac power and the left-hand hole is intended for the entrance of control lines. Install rubber grommets in the holes to protect the cables. Seal the entry to make the opening as weatherproof as possible.

9. OPTIONAL MODE JUMPERING

9.1 GENERAL

9.1.1 Many station modes of operation are determined by jumper connections at the time of installation and are described in the following paragraphs.

9.1.2 Additional jumpers used with the station are identified and described in applicable sections elsewhere within this instruction manual.

9.2 TIME-OUT TIMER MODULE

Base stations or repeaters equipped with a time-out-timer module prevent unintentional continuous transmission. The timing jumpers on the module may be connected for 1/2, 1, 2, 4 or 8 minute operation. In repeaters, the time-out-timer will reset each time a new input signal arrives at the station, whether or not the dropout delay generator has shut off the transmitter. Repeater time-out time and line transmit time periods may be selected independently with the repeater select jumper and the line select jumper.

9.3 SQUELCH GATE

In repeater stations, the dropout delay generator in the squelch gate module prevents the transmitter from shutting off during loss or excessive fade of input signal for the length of time preset. The jumper can be set for 0, 1, 2, 4 or 8 second operation.

9.4 TWO-RECEIVER STATIONS

9.4.1 Stations equipped with two receivers can be connected for receiver #1 priority or receiver #2 priority if desired. A signal received on the priority receiver automatically mutes the other receiver. These jumpers are located on the line driver module.

Receiver #1 priority - JU18 OUT
JU24 IN
Receiver #2 priority - JU18 IN
JU24 OUT

9.4.2 Jumpers in the line driver module also allow receiver #2 to be partially muted (audio attenuation) if desired, rather than the full muting as shipped from the factory. Attenuation of 10 dB, 20 dB or 30 dB in respect to the unmuted condition are possible by jumper connections as follows.

30 dB attenuation - JU25, 26 IN
JU27 OUT
20 dB attenuation - JU25 IN
JU26, 27 OUT
10 dB attenuation - JU25, 26 & 27 OUT

9.4.3 Receiver #2 mute attenuation is a standard feature of dc controlled stations and optional on tone control.

10. CONTROL LINE CONNECTIONS

10.1 INTRODUCTION

10.1.1 The station can be controlled from a remote point over wire line circuits. Simplex audio is used, meaning that the remote point can send audio to the station or receive audio from the station, but not both at the same time. Therefore, a single audio pair will suffice. For dc remote control operation, the wire line must provide dc continuity for carrying the dc control currents. This must be the same pair that carries the transmit audio. For tone remote control operation the audio pair also carries the audio control tones.

10.1.2 Four-wire audio operation, wherein transmitter audio and receiver audio are carried on separate wire pairs, is possible with the optional Line Driver/4-wire, 2-receiver Audio Module (this module is also used in 4-wire, single receiver application). In such operation, line 1 is the transmit pair and line 2 is the receive pair.

10.1.3 In stations with two receivers and four-wire audio, jumpers can be arranged to use line 2 to carry the audio from receiver #2 only if desired.

10.2 LINE SPECIFICATIONS

The audio wire line(s) must meet the following specifications for acceptable radio communications. Verify the characteristics of leased telephone lines with the company providing the service before installation.

10.2.1 <u>DC Remote Control Operation</u>

<u>AUDIO LINE REQUIREMENTS</u>
1. FREQUENCY RESPONSE:
500 TO 2500 Hz
2. IMPEDANCE:
600-OHM BALANCED LINE

<u>DC LINE REQUIREMENTS</u>
1. DC RESISTANCE 0 TO 8000 OHMS.
2. MUST HAVE DC CONTINUITY.

10.2.2 <u>Tone Remote Control Operation</u>

FREQUENCY RESPONSE: 500 to 2500 Hz
FREQUENCY TRANSLATION ERROR: ±10 Hz MAX.
IMPEDANCE: 600-OHM BALANCED LINE
SIGNAL-TO-NOISE: 35 dB MIN.

Chart of Maximum Input and Loss

PHONE-COMPANY SPECIFIED MAXIMUM INPUT	MAXIMUM PHONE LINE LOSS USABLE WITH REMOTELY-CONTROLLED RADIO
+8 vu (14 dBm)	32 dB
0 vu (6 dBm)	24 dB
-8 vu (-2 dBm)	16 dB

10.3 INSTALLATION

10.3.1 <u>General</u>

The control line may be installed prior to installation of the cabinet and terminated near the location chosen for the station. Conduit or two-wire cable can be used from this termination to the station cabinet.

10.3.2 <u>Specific Connection Information</u>

Connect the 600-ohm lines to the screw terminals on the rear of the unified chassis interconnect board as shown in Figure 4. (In 2-wire applications, use line 1 connections.)

10.3.3 DC Control Line Levels

When the dc control line is initially connected, it must be tested to assure that its loop resistance is low enough to allow sufficient current for remote operation. Use the following test procedure.

Step 1. Connect a dc milliameter in series with the dc control line.

Step 2. Have the operator press the push-to-talk switch at the remote control console.

Step 3. The current must be at least +5.5 mA to key the transmitter and at least +10 mA for two-frequency transmitters. Check to see that the current is positive and not negative and that the station is actually keyed. Adjust the remote control console for F1 line current until +5.5 mA is achieved. For a two-frequency transmitter, adjust the remote control console for F2 line current of 10 to 12 mA.

If the line loop resistance is too high, the maximum line current from the console will not key the transmitter. There are two alternatives to correct this problem.

--Use a pair of lines having lower resistance while maintaining proper audio response, or

--Use an alternate pair of lines with lower resistance to carry dc current only. This pair need not have good audio loss or response characteristics.

Adjust the line current for "Private-Line" disable at the remote control console for -2.5 mA, if a "Private-Line" model is being adjusted.

10.3.4 Tone Control Line Levels

The control tone levels for the remotely controlled functions are adjusted at the remote control console. No additional adjustments are required.

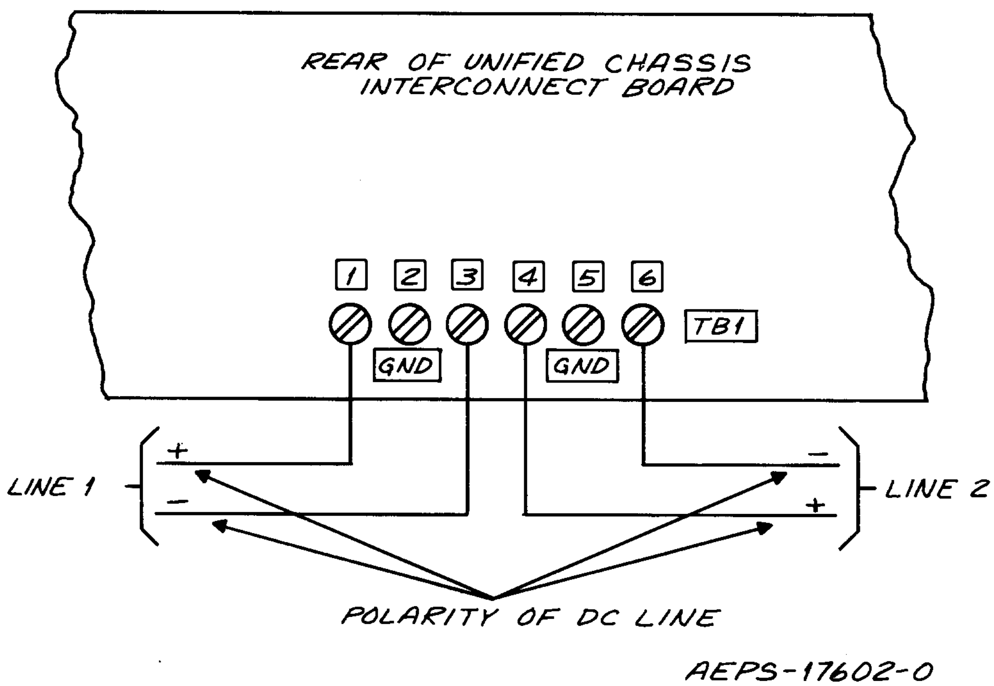


Figure 4.
Control Line Connections

11. CONTROL LINE LEVEL ADJUSTMENT

11.1 GENERAL INFORMATION

11.1.1 Most telephone companies limit the maximum signal amplitude which they will allow on their lines. The most common maximum level is 0 vu (volume units); check the telephone company for the maximum level to be used on your lines. Adjust the audio levels to the maximum permissible level which will give the best signal-to-noise ratio. For lines not subject to telephone company restrictions adjust speech levels to +8 vu.

11.1.2 The vu is the measurement for speech and can be measured only with a vu meter. This meter has special ballistics to control the rise and fall time and the overshoot of speech signal voltage. Since speech signals fluctuate so rapidly, special metering techniques are required. The meter point of a vu meter responds is a series of "kicks" or deflections of varying amplitude. Over a period of time, a majority of peaks will reach approximately the same level. There will be a few very strong peaks which will exceed this level and a few peaks of lower level. These are ignored and the measured speech level equals the majority of the "kicks" or peaks reached. Measurements show that the instantaneous peaks of a speech signal are about 10 dB higher than the vu value (the instantaneous peaks of a 0 vu speech signal will equal the peaks of a sine wave signal of ±10 dBm magnitude). Of course, a sine wave signal of ±10 dBm would produce a much greater volume because every cycle of the signal goes to peak amplitude.

11.1.3 Adjustment of the audio line levels is very difficult using actual speech signals which fluctuate so greatly. A sine wave signal (1000 Hz continuous tone, for example) is much easier to use for adjustments. However, sine wave signals are measured in dBm and the telephone company specifies the maximum signal level in vu. THERE IS NO CONVERSION FROM VU TO DBM OR VICE VERSA when measuring speech. Speech cannot be measured in dBm or converted into dBm. The dBm is a unit to measure the sine wave power as referenced to 1 milliwatt of power. The power of a speech signal of a particular vu is not defined and is different for different speakers. IT IS POSSIBLE TO CALIBRATE A VU METER BY USING A SINE WAVE SIGNAL ON THE 600-OHM LINE, THEN MEASURING THE SAME SIGNAL IN DBM WITH A VOLTMETER. On a 600-ohm line, a sine wave signal that will produce a 0 vu reading will measure 0 dBm on a voltmeter. This does not mean that 0 vu is equal to 0 dBm. Remember, the peaks of an actual 0 vu speech signal will have instantaneous peaks of +10 dBm amplitude.

11.1.4 We would normally conclude that sine wave signal levels would be adjusted 10 dB higher than the vu level specified for the line. EXPERIMENTAL MEASUREMENTS HAVE PROVEN THAT SINE WAVE SIGNAL LINE LEVELS SHOULD BE 6 DB HIGHER THAN THE VU LEVEL SPECIFIED FOR THE LINE (+8 vu speech level should be adjusted for +14 dBm tone level; 0 vu speech level should be adjusted for +6 dBm tone level).

600-OHM LINE VU, DBM, AND VOLTAGE EQUIVALENCY CHART

If Maximum Speech Level For Line Is	Adjust Tone Line Level For (1 mW ref)	Voltage Equivalent
+14 vu	+20 dBm	7.74 V
+12 vu	+18 dBm	6.15 V
+10 vu	+16 dBm	4.88 V
+8 vu	+14 dBm	3.88 V
+6 vu	+12 dBm	3.08 V
+4 vu	+10 dBm	2.44 V
+2 vu	+8 dBm	1.94 V
0 vu	+6 dBm	1.54 V
-2 vu	+4 dBm	1.22 V
-4 vu	+2 dBm	0.97 V
-6 vu	0 dBm	0.77 V
-8 vu	-2 dBm	0.61 V
-10 vu	-4 dBm	0.48 V
-12 vu	-6 dBm	0.38 V
-14 vu	-8 dBm	0.30 V
-16 vu	-10 dBm	0.24 V
-18 vu	-12 dBm	0.19 V
-20 vu	-14 dBm	0.15 V
-22 vu	-16 dBm	0.12 V
-24 vu	-18 dBm	0.09 V
-26 vu	-20 dBm	0.07 V

11.2.1 General

11.2.1.1 A local speaker at the station may be used for testing and level settings. If the station is equipped with built-in metering, it includes a local speaker. If not, the speaker in a Motorola portable test set may be used by connecting the test set with "Micor" adapter to the control receptacle (J3) on the unified chassis interconnect board. Otherwise, a "Micor" mobile speaker can be connected to the local speaker pins (J4-1 and -12 of unified chassis interconnect board). The receiver VOLUME control sets the audio level at the local speaker only.

11.2.1.2 Exciter audio should be measured at the input to the exciter and adjusted for the sensitivity value stamped on the exciter. This level should be measured at pins 12 and 19 of Exciter Board Plug P902.

11.2.1.3 "Private-Line" receivers must be PL disabled during adjustments with the PL DISABLE switch on the station control module. In "Private-Line" repeaters, the squelch gate must also be set for carrier squelch operation during adjustments by connecting jumper JU14 to the active pin and JU15 to the dummy pin. Be sure to return the jumpers to the PL condition after adjustments are complete.

11.2.1.4 If the station is equipped with a single-tone decoder module for repeater access unplug the single-tone decoder during adjustments.

11.2.2 Repeater Level Setting

Step 1. Set the receiver SQUELCH control at squelch threshold.

Step 2. Inject an on-frequency carrier signal into the receiver antenna input. Adjust the signal level to 20 dB quieting.

Step 3. Adjust the REPEATER SQUELCH KEY control (squelch gate module) so the transmitter just keys.

Step 4. Modulate the receiver input with a 1000-Hz tone at ±5 kHz deviation. Adjust the REPEATER LEVEL control (squelch gate module) so the exciter audio input (measured at pins 12 and 19 of Exciter Board Plug P902) is the value stamped on the exciter (modulator sensitivity +6 dB or approximately ±5 kHz transmitter deviation).

Step 5. On "PL" repeaters, return jumpers JU14 and JU15 to the "PL" condition.

11.2.3 Wire Line Controlled Base Stations and Repeater Stations

11.2.3.1 Determine the maximum allowable audio level permitted on the lines (use +8 vu for non-regulated lines) and set line audio levels to this amplitude. Refer to the 600-OHM, VU, DBM AND VOLTAGE EQUIVALENCY CHART for tone levels to be used.

NOTE

The following procedures assume the +8 vu speech level (+14 dBm tone level). For other speech levels, use a tone level 6 dB higher than the vu level (for 0 vu use +6 dBm); refer to the equivalency chart. On some lines, tone levels are not permitted to exceed the speech levels, even for short test tones (for example, maximum speech level of 0 vu and maximum tone level of 0 dBm). When such regulations apply, use the special procedures for low level test tone.

11.2.3.2 As mentioned previously, the lines used to carry audio have an ac impedance of 600 ohms. The amplitude of signals is most conveniently measured in dBm. Zero dBm is equal to 1 milliwatt across 600 ohms. Most audio voltmeter, such as the Motorola Transistorized AC Voltmeter, are calibrated to read directly in dBm when measuring across a 600-ohm impedance. Never use a volt-ohm meter or a multimeter.

Step 1. Apply a 1000-Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression. Adjust the output of the remote control console for +14 dBm (or maximum allowable audio level) at its output terminals. If the level at the station is above 0 dBm, remove JU1 on the station control module.

Step 2. Adjust the XCTR LEVEL control (station control module) so the exciter audio input (measured at pins 12 and 19 of Exciter Board Plug P902) equals the value stamped on the exciter. (Modulator sensitivity plus 3 dB or approximately ±5 kHz transmitter deviation.)

Step 3. Remove the 1000 Hz audio tone.

Step 4. Set the receiver SQUELCH control for squelch threshold.

Step 5. Inject a 1000 uV carrier frequency signal into the antenna input of the receiver. Modulate the signal with a 1000-Hz tone at ±5 kHz deviation.

Step 6. Adjust the LINE 1 OUTPUT (line driver module) for +14 dBm (3.9 V) or maximum allowable audio level as measured with an audio voltmeter across the line 1 terminals. If four-wire audio operation is used, with the receiver output applied to line 2, adjust the LINE 2 OUTPUT control while measuring across the line 2 terminals.

Step 7. If the station has two receivers, both feeding to line 1, set the LINE 1 OUTPUT control as specified with a ±5 kHz modulated carrier signal injected into receiver 1. Next, inject a ±5 kHz modulated carrier into receiver 2. If the line output on the voltmeter changes by more than 2 dBm, readjust the potentiometer on the receiver 2 audio and squelch board to match the receiver 1 reading.

Step 8. If the station has two receivers, each on a different line, adjust LINE 1 OUTPUT with a modulated carrier injected into receiver 1, and adjust LINE 2 OUTPUT with a modulated carrier injected into receiver 2.

11.2.4 Special Procedure for Low Level Test Tone

NOTE

The following procedure is written for the 0 vu speech level and 0 dBm test tone level, but other levels may be used by substituting appropriate levels (levels across the 600-ohm load should be 6 dB higher than the specified line level).

Step 1. Terminate the remote control console in a 600-ohm load resistor rather than the line.

Step 2. Apply a 1000-Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression.

Step 3. Connect an audio voltmeter across the 600-ohm load resistor and adjust the line output for +6 dBm.

Step 4. Reduce the 1000 Hz audio tone input until the voltmeter reads 0 dBm.

Step 5. Remove the 600-ohm load resistor and reconnect the line. Readjust the line output for 0 dBm across the line. Do not change the 1000 Hz tone level.

Step 6. Connect the audio voltmeter to the exciter audio input at the station and adjust the XCTR LEVEL control for 6 dB less than the value stamped on the exciter.

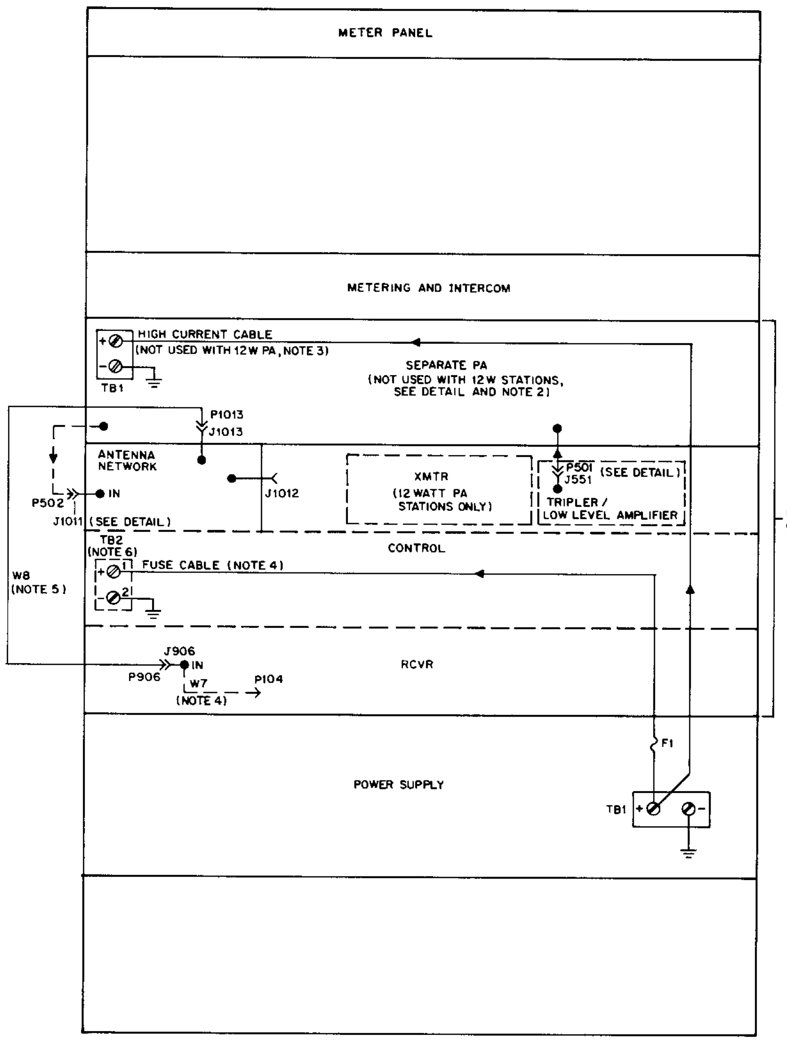
Step 7. Disconnect the line at the station and connect a 600-ohm load resistor in its place.

Step 8. Apply a 1000 uV carrier signal to the receiver antenna terminal from an FM signal generator. Modulate the carrier signal with a 1000 Hz tone at ±5 kHz deviation.

Step 9. Connect an audio voltmeter across the 600-ohm load resistor and adjust the LINE 1 OUTPUT control for +6 dBm.

Step 10. Reduce the deviation until the voltmeter reads 0 dBm.

Step 11. Remove the 600-ohm load resistor and reconnect the line. Readjust the LINE 1 OUTPUT for 0 dBm as measured across the line.



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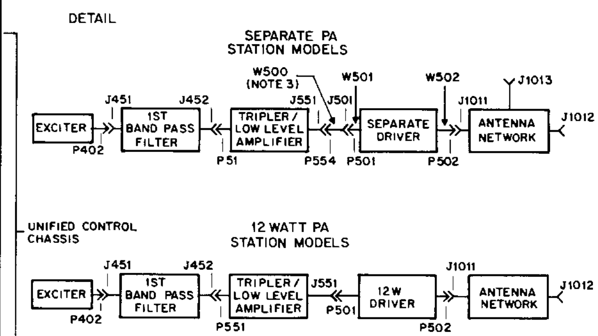

NOTES:

1. ALL CABLES ARE COAXIAL, EXCEPT FUSE, AND HIGH CURRENT CABLES.
2. ON 12-WATT STATION MODELS, THE SEPARATE PA IS REPLACED BY A 12-WATT PA, WHICH MOUNTS IN THE XMTR SECTION OF THE UNI-CHASSIS, AS SHOWN.
3. P/O TKN6804A CABLE KIT.
4. P/O TKN6803, 4A CABLE KIT.
5. P/O TKN6802A CABLE KIT, BASE STATIONS ONLY.
6. P/O TLN5644A INTERCONNECT BOARD.

PARTS LISTS SHOWN ON BACK

Typical Station Layout-Rear View: Racking & Cabling and Parts List
Motorola No. PEPS-28413-O
5/1/79- PHI

PARTS LIST

TKN6802A Receiver Input Cable Kit PL-6460-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P906, 1013	28-84967D01	CONNECTOR, plug: male, type "BNC"
W8	1-80775B85	CABLE ASSEMBLY: includes: ref. items P906, 1013 and 30-84173E01 CABLE, coaxial; 23" used

PARTS LIST

TKN6803A 12-Watt Cable Kit PL-6461-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F1	65-86099	FUSE: 7.5 A, 32 V
J906	9-83589A01	CONNECTOR, receptacle: female; type "BNC", bulkhead
P104 P1004	28-82331G02	CONNECTOR, plug: male; type "phono" consists of: 15-83498F06 HOUSING, connector; 6-contact and 29-83499F01 TERMINAL, pin; 6 used
W7	1-80775B09	CABLE ASSEMBLY: includes: ref. items J906, P104 and 30-84173E01 CABLE, coaxial; 11" used (Receiver Input Adapter Cable)
W601	1-80775B84	includes: ref. item P1004 and 9-83012H01 RECEPTACLE, female, wire crimp; 6 used: 42-10217A02 STRAP, tie; 3 used (Power Control Board Interconnect Cable)
NON-REFERENCED ITEMS		
	1-80775B82	CABLE, fuse, assembly includes: ref. item F1 and
	14-82882A01	INSULATOR, fuse holder body
	14-82883A01	INSULATOR, fuse holder cap
	29-847854	LUG, slotted tongue; 4 used
	41-82885A01	SPRING, fuse compressor
	42-10217A02	STRAP, tie; 5 used
	42-82884A01	CLIP, fuse; 2 used

PARTS LIST

TKN6804A 75-Watt Cable Kit PL-6462-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F1	65-86099	FUSE: 7.5 A; 32 V
J501 J906	9-84968D01 9-83589A01	CONNECTOR, receptacle: female; type "BNC", bulkhead female; type "BNC", bulkhead
P104 P554 P1004	28-82331G02 9-84886E01	CONNECTOR, plug: male; type "phono" female; type "BNC", light angle miniature consists of 15-83498F06 HOUSING, connector; 6-contact and 29-83499F01 TERMINAL, pin; 6 used
W7	1-80775B09	CABLE ASSEMBLY: includes: ref. items J906, P104 and 30-84173E01 CABLE, coaxial; 11" used (Receiver Input Adapter Cable)
W500	1-80775B83	includes: ref. items J501, P554 and 30-83794C01 CABLE, coaxial; 6" used Tripler/Low Level Amplifier Output Adapter Cable)
W601	1-80775B84	includes: ref item P1004 and 9-83012H01 RECEPTACLE, female wire crimp; 6 used: 42-10217A02 STRAP, tie; 3 used (Power Control Board Interconnect Cable)
NON-REFERENCED ITEMS		
	1-80775B81	CABLE, hi-current, assembly includes:
	29-82008L02	TERMINAL; 4 used
	30-812505	CABLE, battery: red; 42" used
	30-851875	CABLE, battery: blk; 42" used
	42-10217A02	STRAP, tie; 8 used
	1-80775B82	CABLE, fuse, assembly includes: ref. item F1 and
	14-82882A01	INSULATOR, fuseholder body
	14-82883A01	INSULATOR, fuseholder cap
	29-847854	LUG, slotted tongue; 4 used
	41-82885A01	SPRING, fuse compressor
	42-10217A02	STRAP, tie; 5 used
	42-82884A01	CLIP, fuse; 2 used

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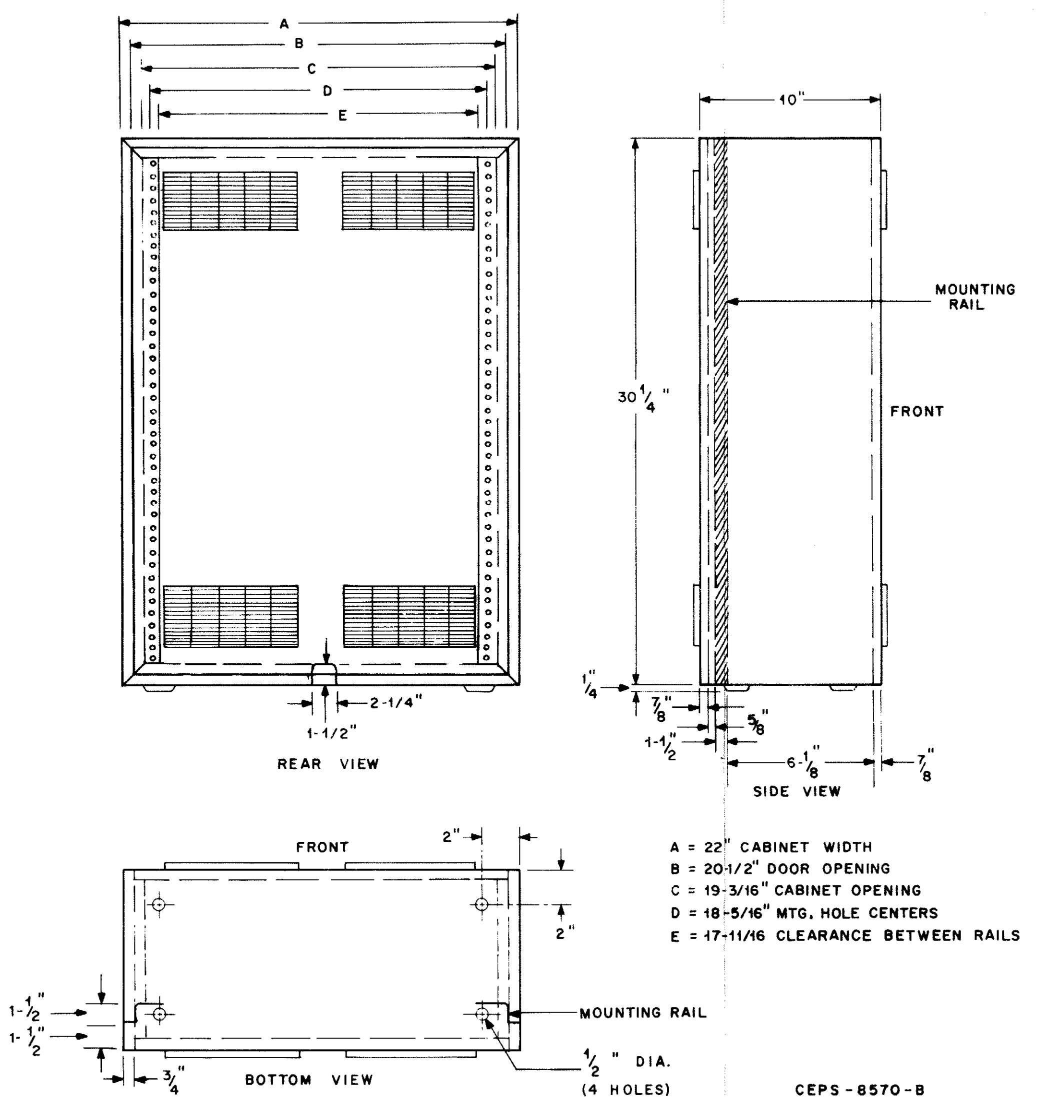
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

THN6141A Cabinet Kit (30 inch) PL-1787-D

NON-REFERENCED ITEMS		
	15E84107D25	CABINET (30")
	13C84430D01	DOOR VENT (8 required)
	2S10101A55	SPEED NUT (48 required)

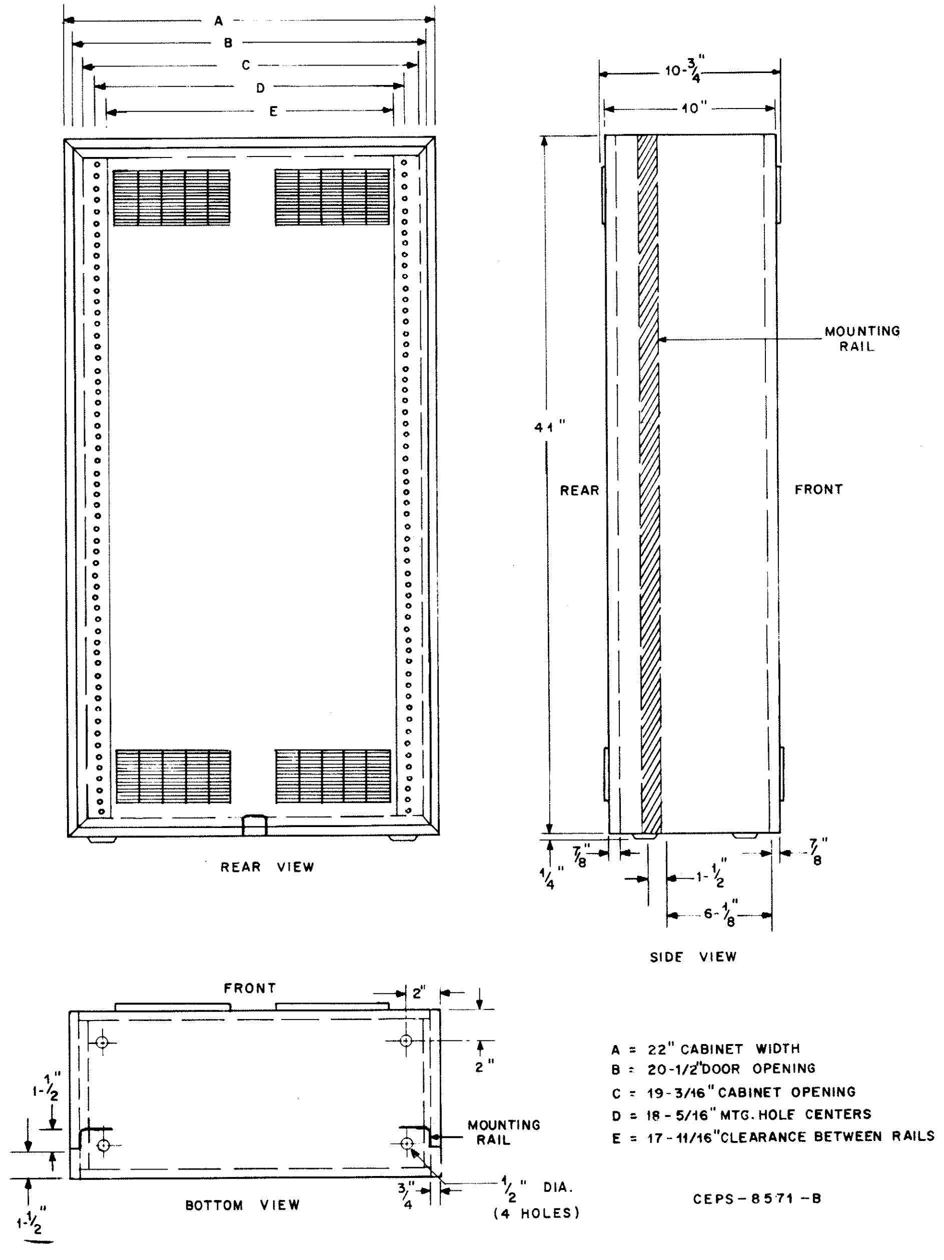


CEPS-8570-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

THN6142A Cabinet Kit (41-Inch) PL-1790-B

NON-REFERENCED ITEMS		
	15E84143D24	CABINET (41")
	13C84430D01	DOOR VENT (8 required)
	2S10101A55	SPEED NUT (48 required)



CEPS-8571-B

STATION HARDWARE KITS

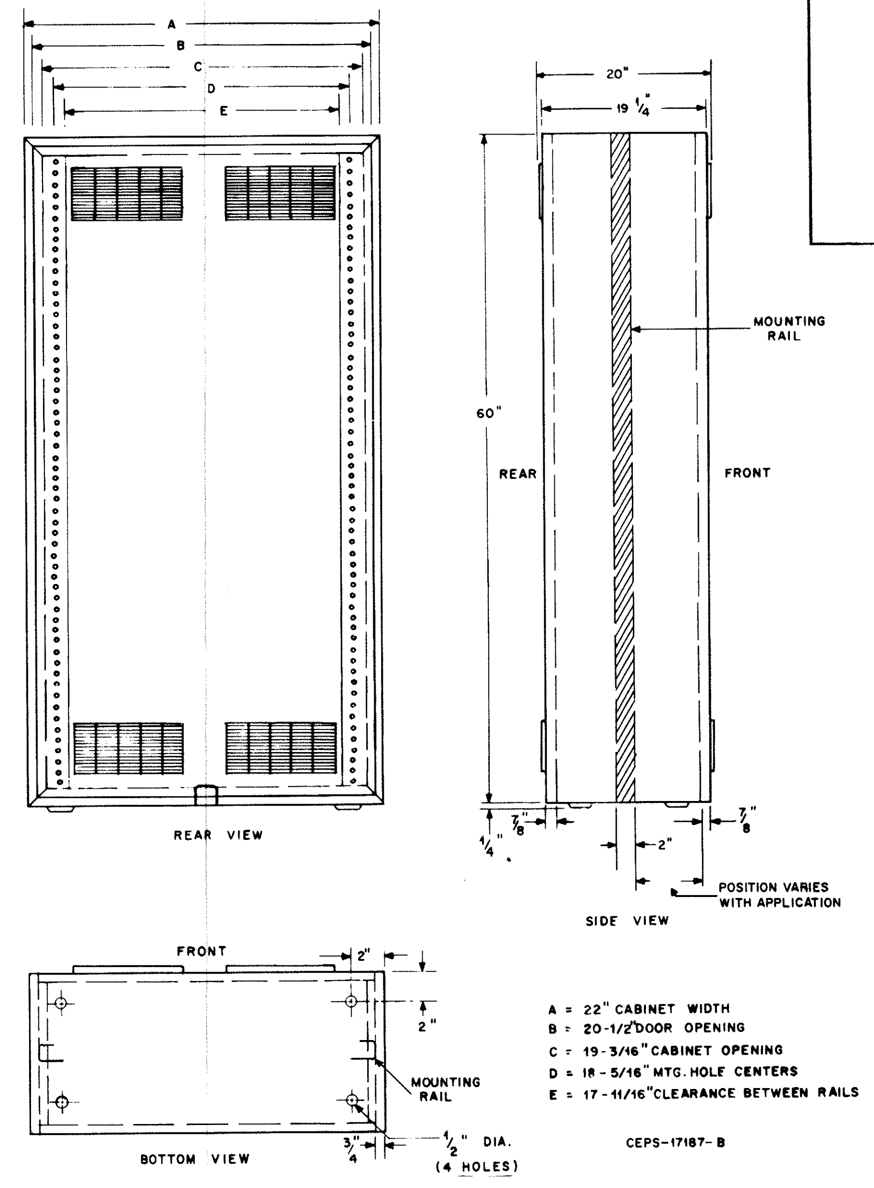
TRN6197A (12-Watt, 1-Receiver)
TRN6198A (12-Watt, 2-Receiver)
TRN6199A (Hi-Power, 1-Receiver)
TRN6200A (Hi-Power, 2-Receiver) PL-3397-O

	1V80731B73	SHIELD, exciter board
	1V80734B45	SHIELD, power control board
	1V80734B44	SHIELD, receiver rf-if board
	1V80728B57	SHIELD, audio board
	1V80775B76	COVER PLATE ASSY., includes 64-82623K01 COVER, plate (used in hi-power stations)
	1V80775B78	BRACKET ASSY., includes 7-82785K01 BRACKET (used in 12-watt stations)
	1V80775B77	BRACKET ASSY., includes 7-82898K01 BRACKET (used in hi-power stations)
	55-84300B01	HANDLE, plastic
	55-84300B02	HANDLE, plastic

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

THN6243A Cabinet Kit (60-inch) PL-3401-A

	15-83445K04	CABINET (60-inch)
	13-84430D01	DOOR VENT (8 required)
	2-10101A55	SPEED NUT (48 required)



CEPS-17187-B

	2-82360B07	SPEEDNUT, special
	3-135038	SCREW, tapping: 1/4"-14x3/4"
	42-83629G01	PIN, accordion
	2-10101A53	NUT, spring
	46-84090C01	STUD, retainer
	3-138162	SCREW, machine; 4-40 x 3/8"
	42-84284B01	RETAINER (BLK)
	33-83051K01	NAMEPLATE
	5-83885G01	RIVET, "Pop"
	13-813618	LABEL (patent)
	54-842366	LABEL (replacement parts)
	54-850440	LABEL (FCC license designation)
	54-83040C01	LABEL (exciter audio)
	66-84387C01	TOOL, tuning
	66-84690C01	TOOL, contact removal
	66-106515	WRENCH, "Allen"
	42-10217A10	"Tywrap"

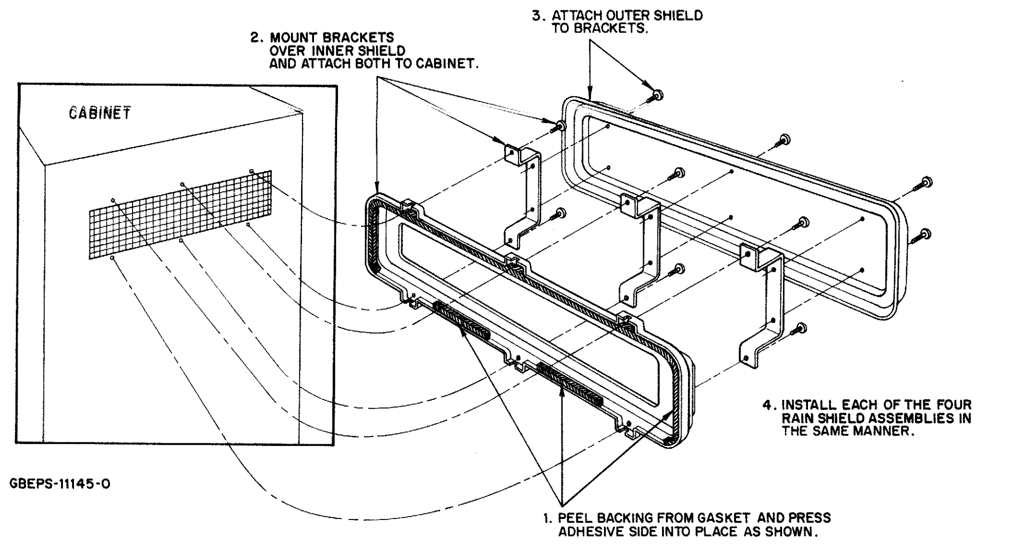
NOTE:
Except where noted, differences in models are in quantity of parts only.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

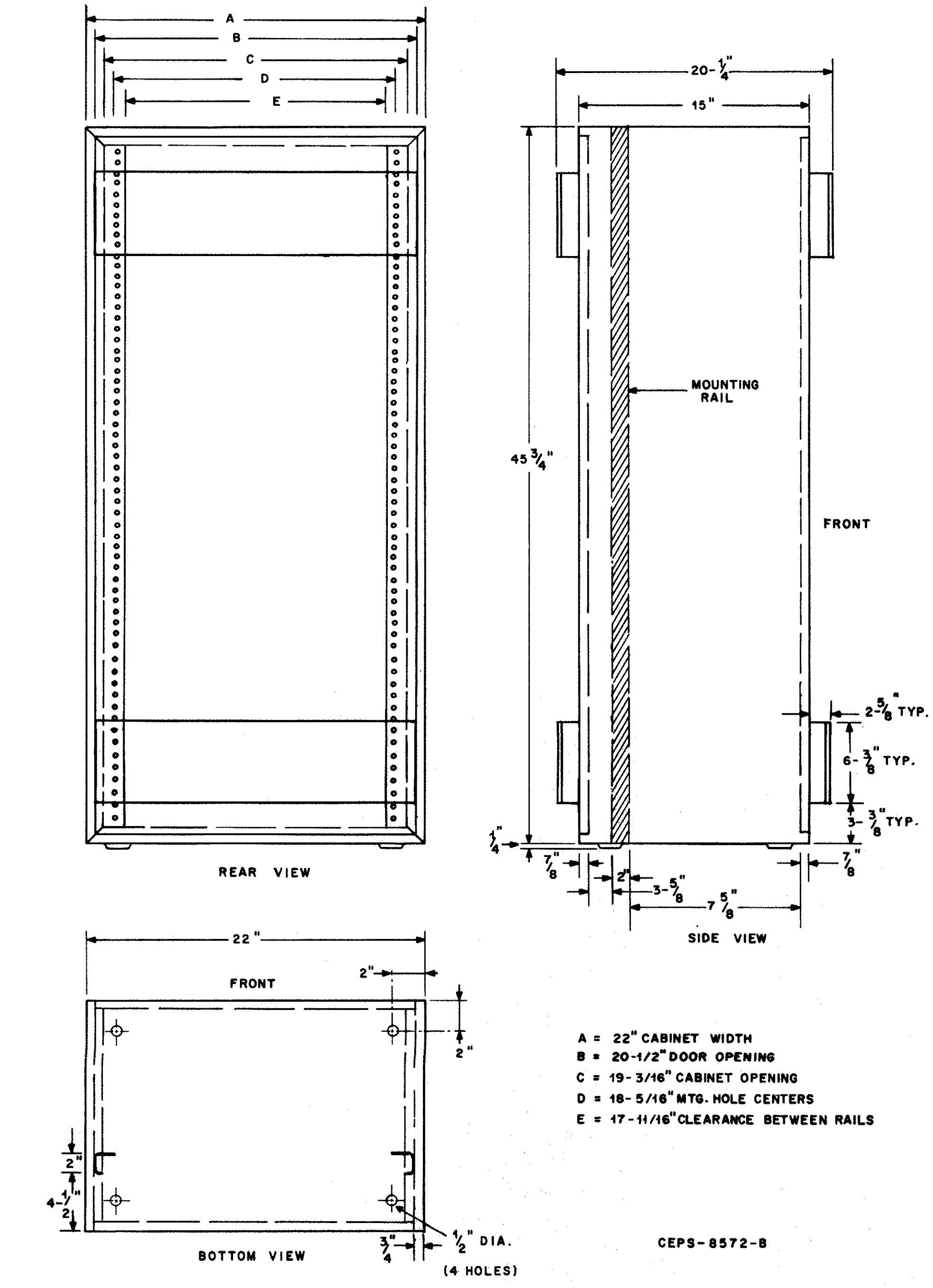
TLN4862A Outdoor Vent Kit PL-1797-A

	15-84188D01	COVER, outdoor vent (No. 1); 4 req'd
	15-84189D01	COVER, outdoor vent (No. 2) 4 req'd
	32-84452D01	GASKET: 4 req'd
	32-84452D02	GASKET: 8 req'd
	7-84187D01	BRACKET, vent cover: 12 req'd
	4-490775	FLATWASHER: 24 req'd
	4-9795	LOCKWASHER: 24 req'd
	3-138674	SCREW, machine: 6-32 x 11/16" 24 req'd
	3-138209	SCREW, tapping: 6-32 x 3/8" 24 req'd
	2-7005	NUT, hex: 6-32 x 1/4"; 24 req'd



GBEPS-11145-O

THN6143A Cabinet (46-Inch) Outdoor



CEPS-8572-B

Station Cabinets
Dimensional Details and Parts Lists
Motorola No. PEPS-17767-C
(Sheet 1 of 2)
5/1/79-PHI

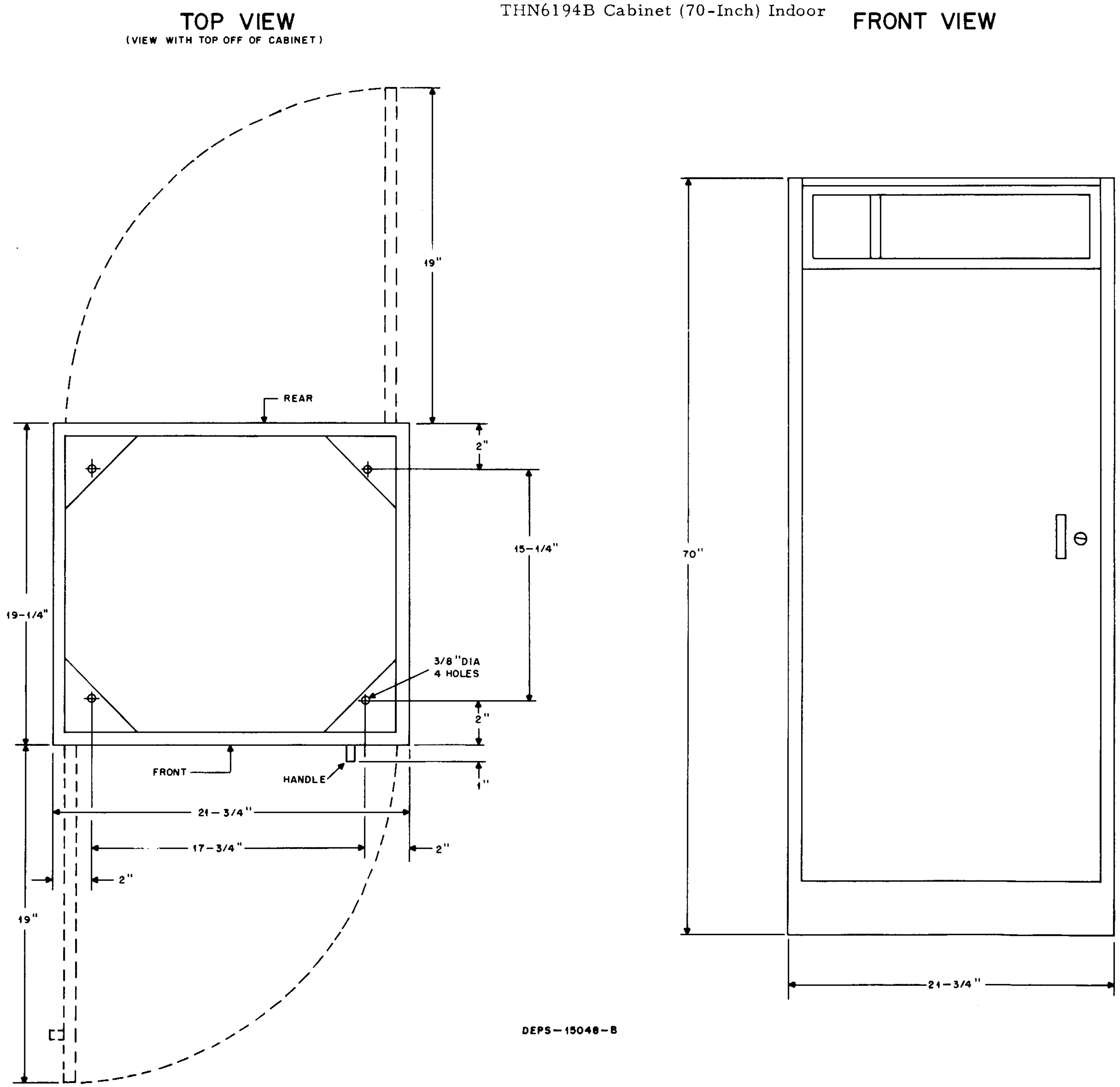
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TRN6190A Cabinet Hardware Kit (70" and 75") PL-3396-O

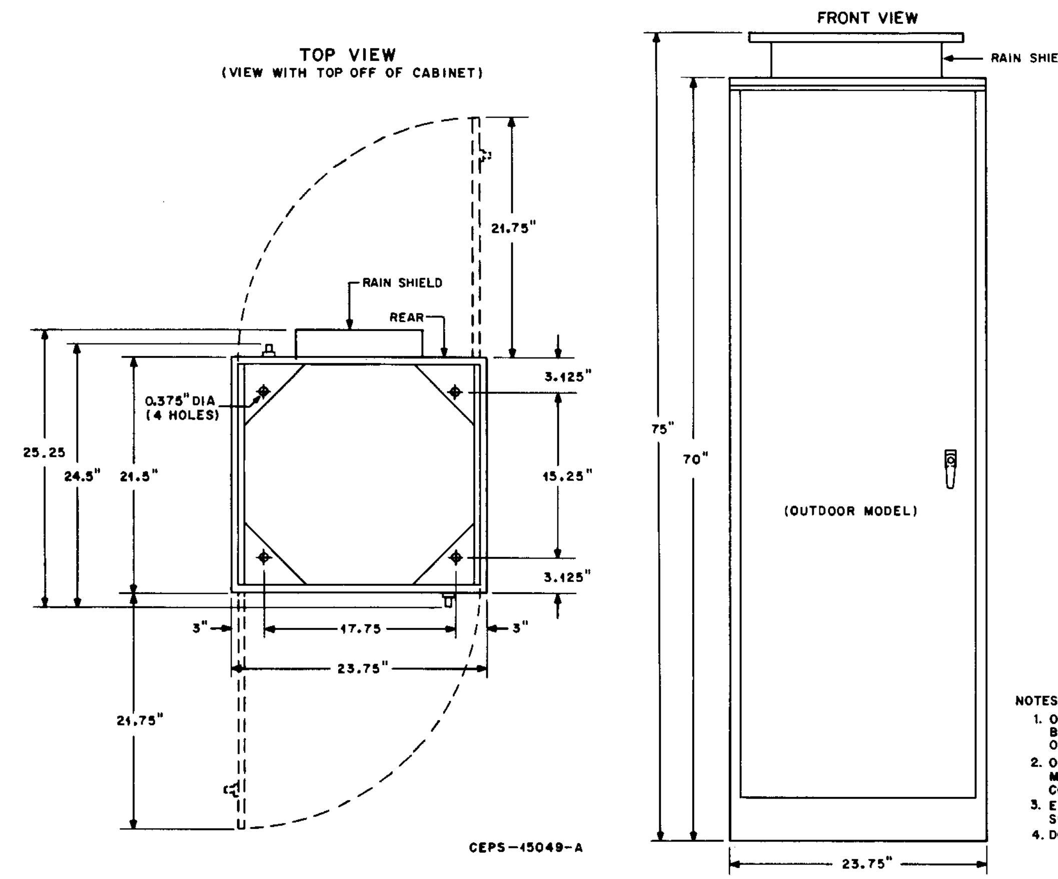
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	2-836540	NUT, speed: 2 req'd.
	3-839590	SCREW, special (washer-head) 2 req'd.
	2-82360B07	NUT, speed: 1/4"-14; 4 req'd.
	3-135038	SCREW, tapping: 1/4"-14 x 3/4"; 4 req'd.
	3-115727	SCREW, machine: 10-32x1/2"; 2 req'd.
	4-7652	LOCKWASHER: No. 10; 2 req'd.
	37-107997	GROMMET: 2 req'd.
	33-82830H02	LOGO ("MOTOROLA")

THN6194B Cabinet (70-Inch) Indoor



DEPS-15048-B

THN6203A Cabinet (75-Inch) Outdoor



CEPS-15049-A

NOTES:
1. ON INDOOR CABINETS, FRONT AND REAR DOORS CAN BE REVERSED FROM RIGHT OPENING TO LEFT HAND OPENING.
2. ON REAR DOOR, OPENING OPPOSITE AIR DUCT MUST BE UNCOVERED AND UNUSED OPENING COVERED (INDOOR CABINETS ONLY).
3. ELEVATE CABINET IF DANGER OF WATER SUBMERSION EXISTS.
4. DOORS ON OUTDOOR CABINETS ARE NOT REMOVABLE.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TLN6892A Rain Shield Kit PL-3402-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	26-82929H01	SHIELD, rain (top)
	26-84084F01	SHIELD, cover (top)
	15-82926H01	COVER, rain shield
	26-82930H01	SHIELD, rain (door)
	32-82930H01	GASKET, rain shield
	32-82932H02	GASKET, rain shield
	32-84180G01	GASKET: 2 req'd.
	32-84180G02	GASKET: 2 req'd.
	2-10080A03	NUT, spring: No. 8; 4 req'd.
	3-9661	SCREW, machine: 8-32 x 3/8"; 8 req'd.
	3-132823	SCREW, tapping: 8-18 x 3/8"; 4 req'd.
	3-135014	SCREW, tapping: 8-18 x 1/2"; 6 req'd.

UPRIGHT OUTDOOR CABINET

OPTION U27 (FOR UPRIGHT STATIONS)
OPTION C36 (FOR "COMPA-STATION" BASE RADIOS)

MODEL	SUFFIX	DESCRIPTION
THN6203A		75" Cabinet
TRN6720A		Rain Hood Vent Kit (for stations over 110 W only)
TRN6721A		Vent Seal Kit (for stations under 110 W only)

FEATURES

- -- Water drainage holes
- -- Thick door gaskets
- -- Vent seal for stations with less than 110 W output
- -- Vent kit for stations with greater than 110 W output

CABINET INSTALLATION

- -- Mount on elevated support or platform
- -- Shady or cool area if possible
- -- Minimum of eight inches for all obstructions

INSTALLATION OF TRN6720A RAIN HOOD VENT KIT

- -- Mount main section (largest assembly) over opening in top of cabinet using rectangular shaped gasket and 1/2-inch sheet metal screws provided.
- -- Install small rectangular cover inside main section using machine screws provided.
- -- Similarly, mount larger cover on top of entire assembly.
- -- Mount awning-shaped vent shield over rear door opening using "U" shaped gasket and 3/8-inch sheet metal screws. Place acorn nuts over screws to cover exposed threads.

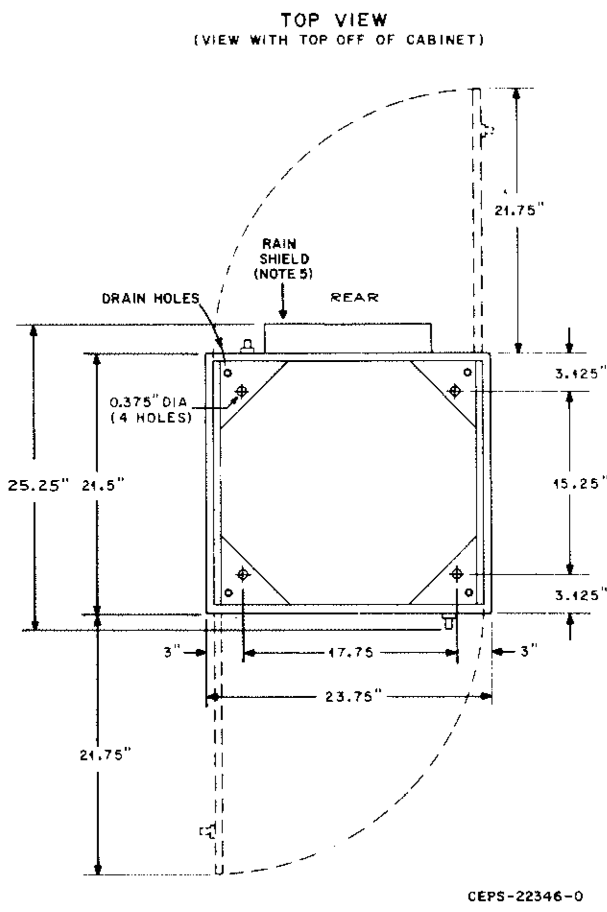
PERIODIC MAINTENANCE

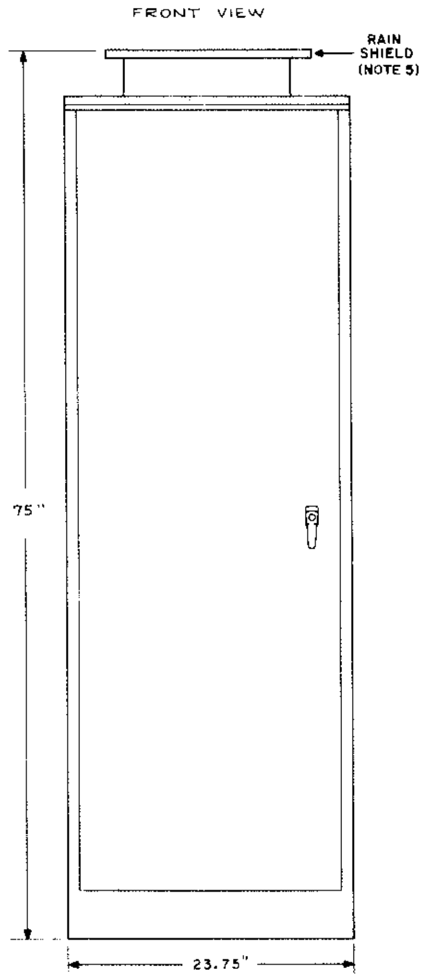
- -- Use a paint scraper or putty knife to remove all loose paint and paint blisters from the cabinet. Use a wire brush or steel wool to remove remaining rust from the area. The surface must be cleaned to bare metal and free of all rust.
- -- Wipe cleared surface with a clean cloth
- -- Apply a thin even coat of primer, Part No. 11S1003A42, to all exposed metal. This coat should dry to the touch in minutes. Apply an even smooth coat of paint, Part No. 11S10026A33 (haze beige).

NOTE
Be sure water drainage holes are cleared of all paint and primer.

- -- The above primer and paint are available from Communications Division Parts Department. Spray paint (Part No. 11-82716A05) and spray primer (Part No. ST-4330) are also available from Parts Department. However, spraying paint inside cabinet is not recommended.

- -- The above kits and paint can be obtained from Motorola Communications Division Parts Department, 1313 East Algonquin Road, Schaumburg, Illinois 60196





NOTES:

1. THE INDOOR CABINET FRONT AND REAR DOORS CAN BE CHANGED TO ALLOW LEFT--HAND OPENING INSTEAD OF RIGHT--HAND OPENING.
2. IF THE DOOR OPENING CHANGE MENTIONED IN NOTE 1 IS MADE, BE SURE TO RELOCATE THE VENT COVER TO THE UNUSED OPENING.
3. ELEVATE OUTDOOR CABINETS IF DANGER OF WATER SUBMERSION EXISTS.
4. DOORS ON OUTDOOR CABINET ARE NOT REMOVABLE.
5. STATIONS OVER 110 WATTS OUTPUT USE TRN6720A VENT KIT. STATIONS BELOW 110 WATT OUTPUT USE TRN6721A VENT SEAL KIT.

PARTS LIST

THN6203A Cabinet (75-Inch) PL-5198-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	15-82123H05	CABINET, outdoor

TRN6721A Vent Seal Kit PL-5106-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	2-10080A03	NUT, spring; #8; 6 used
	3-132823	SCREW, tapping; #8-18 x 3/8" 4 used
	3-135014	SCREW, tapping; #8-18 x 1/2; 6 used
	26-83956H01	SHIELD (2 hole)
	26-83956H03	SHIELD (1 hole)
	32-82499L01	GASKET; 13.0 x 4.5"
	32-82499L02	GASKET; 13.0 x 7.25"

TRN6720A Rain Hood Vent Kit PL-5107-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	2-10080A03	NUT, spring, #8; 6 used
	3-9661	SCREW, machine; 8-32 x 3/8"; 8 used
	3-132823	SCREW, tapping; 8-18 x 3/8; 4 used
	3-135014	SCREW, tapping; 8-18 x 1/2; 8 used
	15-82433L01	HOOD, door vent
	15-82926H01	COVER, rain shield
	26-82929H01	SHIELD, rain top
	26-84084F01	SHIELD, cover top
	32-82499L01	GASKET; 13.0 x 4.5"
	32-82499L02	GASKET; 13.0 x 7.25"
	32-84180G01	GASKET; 6-hole; 2 used
	32-84180G02	GASKET; 4-hole; 2 used

"COMPA-STATION" OUTDOOR CABINET

OPTION C27 (FOR "COMPA-STATION" BASE RADIOS)

MODEL	SUFFIX	DESCRIPTION
THN6143A		46" Cabinet (vented for continuous duty
THN6303A		46" Cabinet (sealed for intermittent duty only)
TLN4862A		Outdoor Vent Kit
TRN6448A		Cabinet Hardware Kit

FEATURES

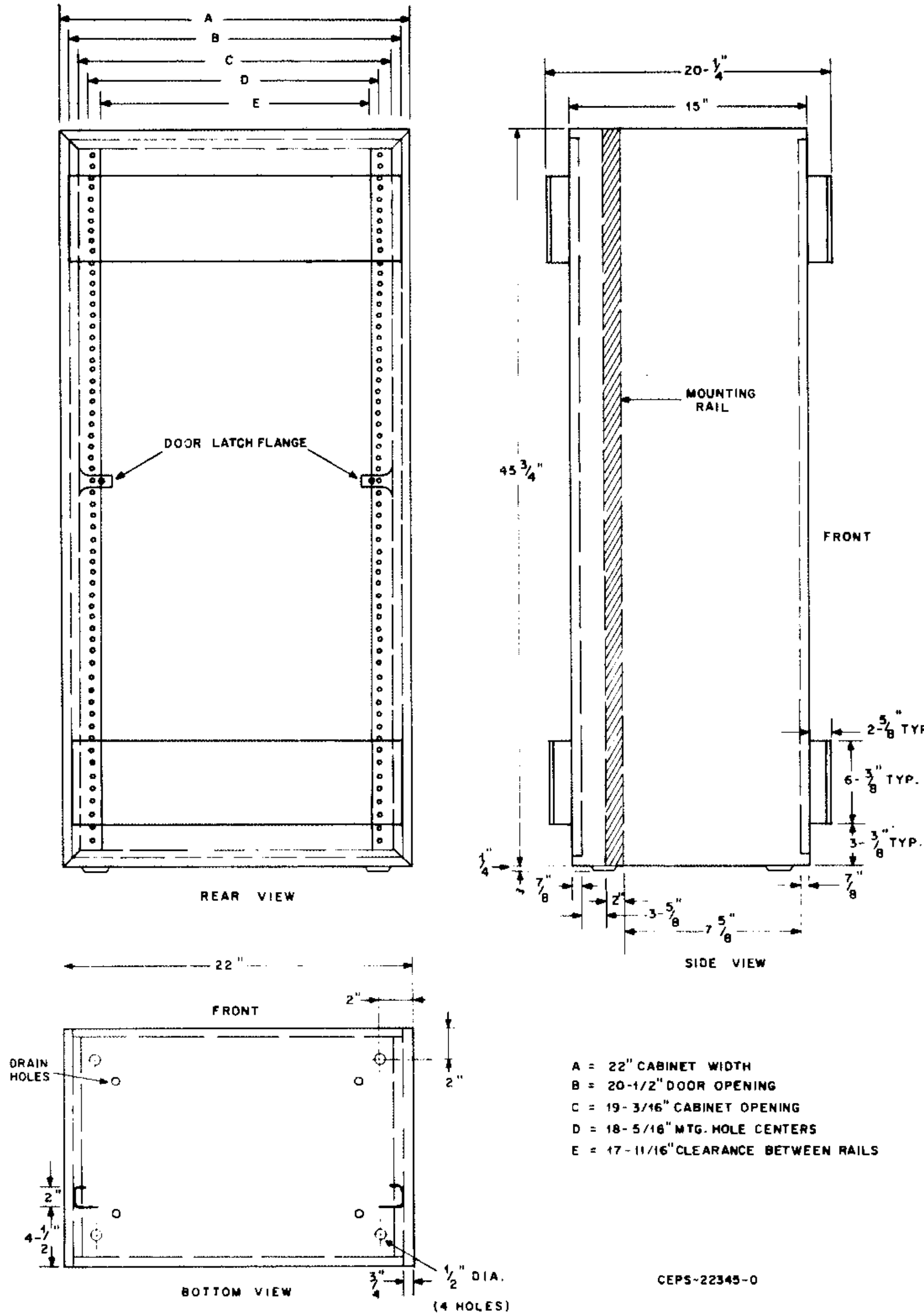
- -- Water drainage holes
- -- Rust resistant equipment mounting rails
- -- Thick door gaskets
- -- Screw and flange type door latches
- -- Vent seal for intermittent duty stations
- -- Vent kit for continuous duty stations
- -- Sealed cabinet corner joints

CABINET INSTALLATION

- -- Mount on elevated support or platform
- -- Shady or cool are if possible
- -- Minimum of eight inches for all obstructions

CAUTION

LOOSEN *BOTH* DOOR LATCHES BEFORE OPENING CABINET OR DAMAGE TO THE DOOR MAY RESULT.



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TRN6448A Cabinet Hardware Kit PL-3626-O

	2-836540	SPEED NUT (4 req'd.)
	3-135499	SCREW, tapping; 1/4 - 14 x 5/8" (4 req'd.)

THN6143A Vented 46-Inch Cabinet (For Continuous Duty Stations) PL-5104-O

	15-84144D08	CABINET, outdoor

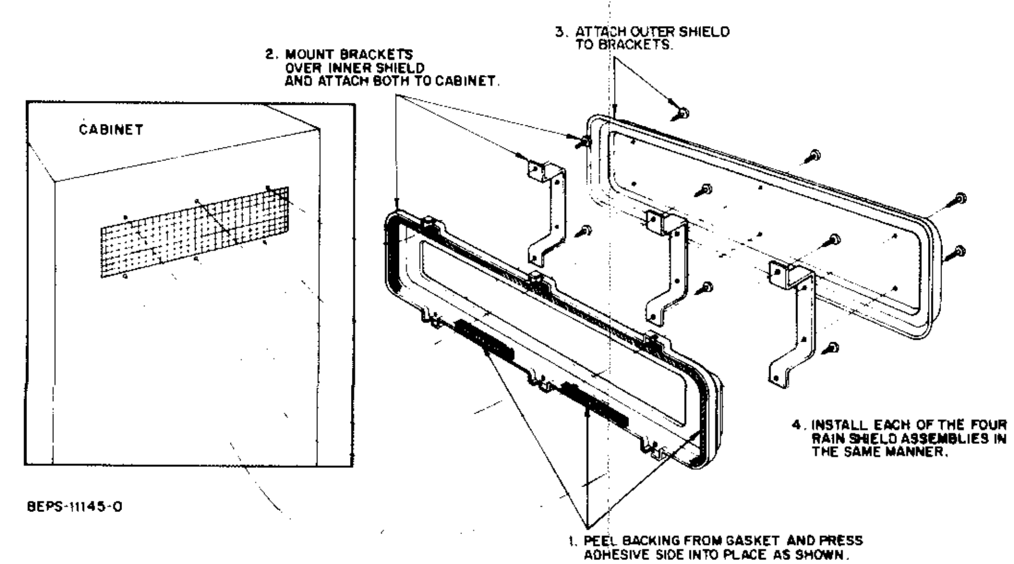
THN6303A Sealed 46-Inch Cabinet (For Intermittent Duty Station) PL-5105-O

	15-84144D11	CABINET, outdoor

TLN4862A Outdoor Vent Kit PL-1797-A

	15-84188D01	COVER, outdoor vent (No. 1); 4 req'd
	15-84189D01	COVER, outdoor vent (No. 2), 4 req'd
	32-84452D01	GASKET: 4 req'd
	32-84452D02	GASKET: 8 req'd
	7-84187D01	BRACKET, vent cover: 12 req'd
	4-490775	FLATWASHER: 24 req'd
	4-9795	LOCKWASHER: 24 req'd
	3-138674	SCREW, machine: 6-32 x 11/16" 24 req'd
	3-138209	SCREW, tapping: 6-32 x 3/8" 24 req'd
	2-7005	NUT, hex: 6-32 x 1/4"; 24 req'd

Outdoor Vent Kit

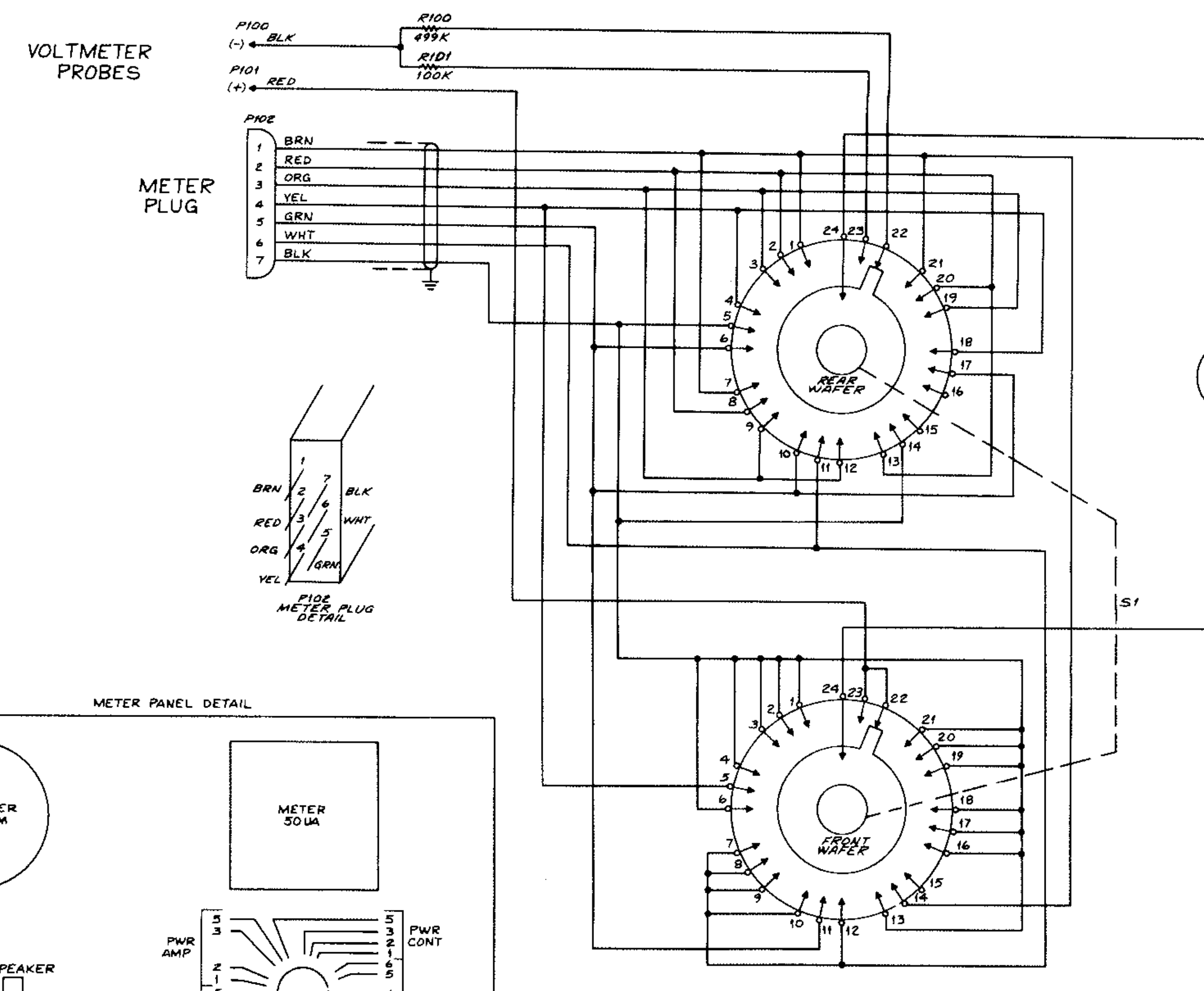


"COMPA-STATION" METERING & INTERCOM

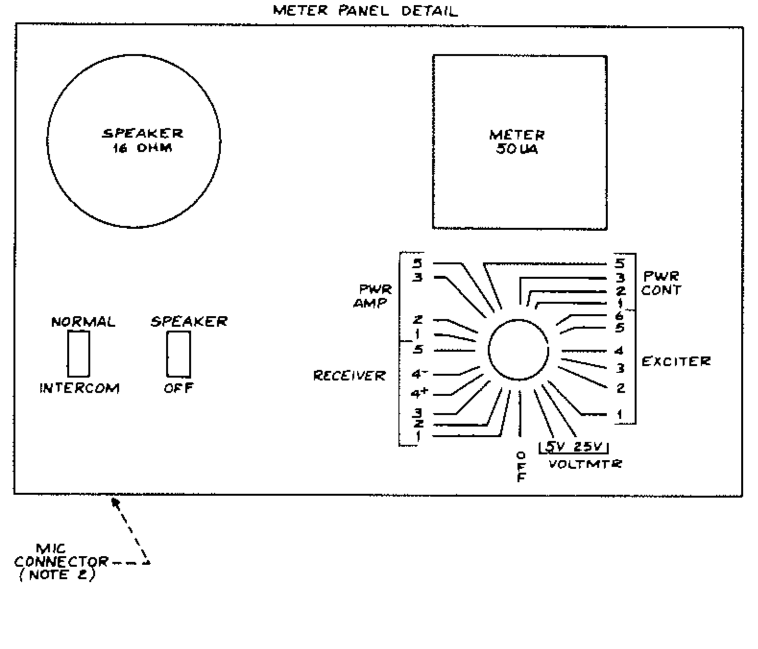
MODEL TLN1740A

INTERCOM

MODEL TLN1745A

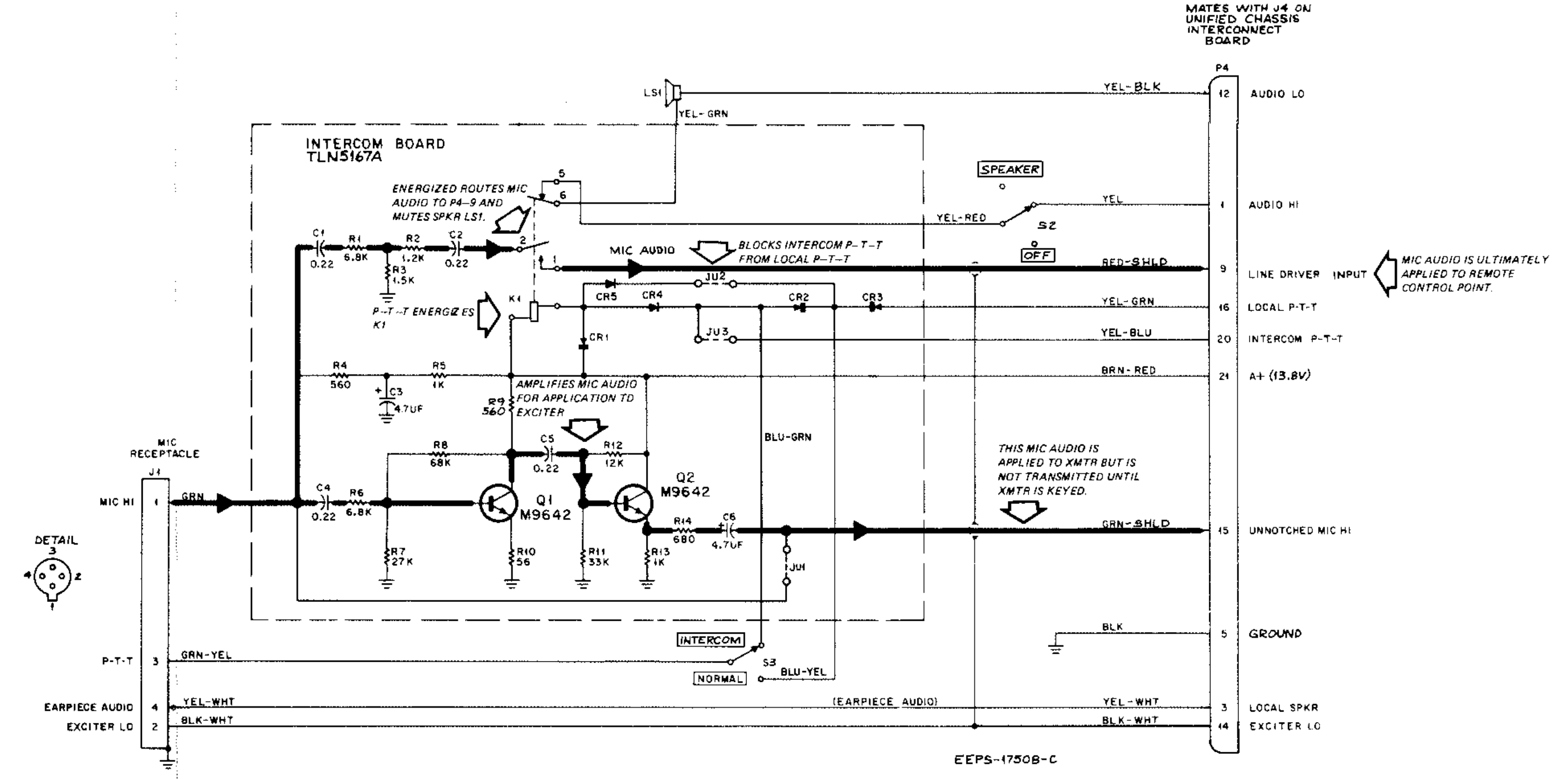


METER PANEL DETAIL



MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF	
TLN1740A METERING & INTERCOM KIT	TLN5657A – 1	METER KIT (CHASSIS)
	TLN5167A – 1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1745A INTERCOM KIT	TRN6189A	INTERCOM KIT (CHASSIS)
	TLN5167A - 1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT



OPERATING INSTRUCTIONS

1. METERING

Step 1. Select the function to be metered with the METER switch.

Step 2. Select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board or the power amplifier.

NOTE

Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used.

Step 3. For receiver discriminator adjustment, use both 4 (+) and 4 (-) and adjust for meter zero.

Step 4. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 5. To measure miscellaneous station voltages, use the voltmeter probes (P100 and P101) on either the 5 V or 25 V positions. Divide the 5 V full scale reading by 10 to obtain actual voltage and divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER-OFF switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the NORMAL position.

Step 4. The unit is now ready for "ON-THE-AIR" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER-OFF switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER-OFF switch in the SPEAKER position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

METER SELECT TABLE

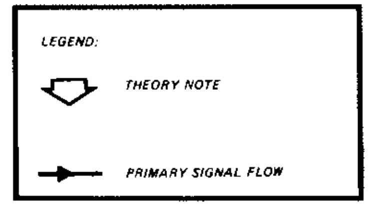
P102 METERING PLUG CONNECTED TO	METER SELECTOR SW. MTR NO.		POSITION	FUNCTION METERED
RCVR RF & I-F BOARD	RECEIVER	1	1	CHANNEL ELEMENT OUTPUT (3RD HARMONIC)
		2	2	1ST DOUBLER OUTPUT
		3	3	2ND DOUBLER OUTPUT
		4 (+)	4	DISCRIMINATOR OUTPUT
		4 (–)	5	DISCRIMINATOR OUTPUT
		5	6	LIMITER OUTPUT
POWER AMPLIFIER	POWER AMP (NOTE 2)	1	7	PRE DRIVER CURRENT
		2	8	25 W DRIVER CURRENT (75 W MODELS ONLY)
		3	9	FINAL AMPLIFIER CURRENT (EXCEPT 12 W STATIONS)
		5	10	CONTROLLED (ADL) STAGE VOLTAGE
POWER CONTROL BOARD	PWR CONT (NOTE 2)	5	11	FINAL AMPLIFIER CURRENT (12 W STATIONS ONLY)
		3	12	ADL VOLTAGE
		2	13	REFLECTED POWER
		1	14	FORWARD POWER
— —	— —	—	15	UNUSED
EXCITER	EXCITER	6	16	UNUSED
		5	17	EXCITER OUTPUT
		4	18	DOUBLER INPUT
		3	19	TRIPLER INPUT
		2	20	CHANNEL ELEMENT OUTPUT
		1	21	"IDC" AUDIO OUTPUT
— —	— —	–	22	25 VOLTS FULL SCALE (NOTE: METER IS LABELED 0–50)
— —	— —	–	23	5 VOLTS FULL SCALE
— —	— —	–	24	OFF

NOTES:

1. THIS OPTION REQUIRES THE USE OF A MOTOROLA MODEL TMN6071A MICROPHONE, OR EQUIVALENT.
2. WITH 12 W STATIONS, FINAL PA CURRENT IS METERED AT PWR CONT MTR 5. WITH ALL OTHER STATIONS, FINAL PA CURRENT IS METERED AT PA MTR 3.

JUMPER TABLE

JUMPER	NORMAL	WHEN "SPECTRA TAC" IS ADDED (CUT CR2)
JU1	OUT	OUT
JU2	OUT	IN
JU3	OUT	IN



FUNCTION

- Model TLN1740A provides built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.
- Model TLN1745A provides intercom between the station and the remote control point.

CIRCUIT BOARD DETAIL AND PARTS LIST SHOWN ON BACK

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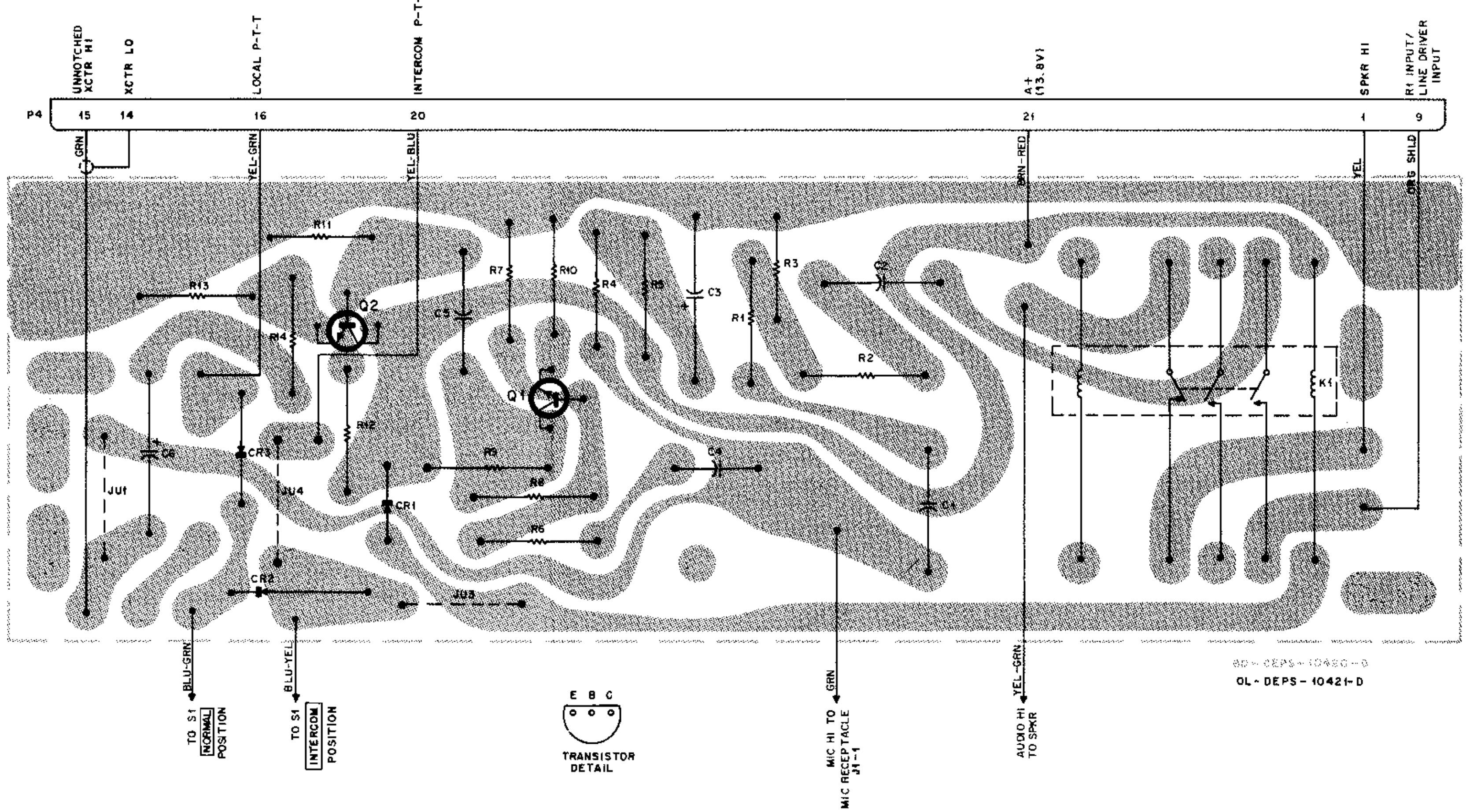
TLN5167A INTERCOM BOARD



SHOWN FROM SOLDER SIDE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN1552A Meter Chassis & Intercom Kit
TLN5167A Intercom Board PL-2156-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF:
C1,2	8-82905G11	0.22 ±10%; 50 V
C3	23-865137	4.7 ±20%; 25 V
C4,5	8-82905G11	0.22 ±10%; 50 V
C6	23-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1 thru 5	48-83654H01	silicon
		SWITCH, magnetic reed: 13.4 V dc
K1	80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1,2	48-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W;
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

TRN6189A Intercom Chassis Kit PL-3452-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		SPEAKER
LS1	50-84710G01	3"; 16 ohm
		SWITCH, slide:
S2, 3	40-11589	SPST
	NON-REFERENCED ITEMS	
	1-80775B59	CHASSIS (riveted) incl. ref. item S2 and S3
	1-80775B51	COVER ASSEMBLY
	2-132616	LOCKNUT, speaker (No. 6-32) 4 req'd.
	2-83896G01	NUT, hex (used with J1)
	4-7699	LOCKWASHER (used with J1)
	5-483208	GROMMET, rubber
	35-84530G01	GRILLE, speaker
	42-82143C02	CLAMP, cable (1/4")
	42-10217A02	TY-WRAP, cable: 4 req'd.
	3-134169	SCREW, machine: No. 4-40 x 1/4"; 7 req'd.
	3-129498	SCREW, machine: No. 6-32 x 5/16"; 4 req'd.
	29-115147	LUG, solder (No. 5)

PARTS LIST

TLN5657A Meter Kit PL-3415-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C100	21-82428B24	.01 uF +80-20%; 500 V
		DIODE: (SEE NOTE)
CR100, 101	48-82420C03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		LOUDSPEAKER; permanent:
LS1	50-84710G01	dynamic type; 3"; square 16 ohms voice coil impedance
		METER, dc:
M100	72-83120C02	scale: 0-50 microamperes
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contacts
		RESISTOR, fixed:
R100	6-84640C61	499k ±0.5%; 1/4 W
R101	6-13756D88	100k ±1%; 1/2 W
R102	6-124A33	220 ohm ±5%; 1/4 W
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	5-483208	GROMMET
	35-84530G01	GRILLE, speaker
	36-84556C01	KNOB, control
	42-10217A02	STRAP, cable; 4 req'd.
	42-82143C02	CLAMP, cable
	15-83947K01	COVER; 2 req'd. (used with P102)
	30-83678K01	CABLE, 7-conductor; 42" long (used with P102)
	42-83948K01	CLIP; 2 req'd. (used with P102)
	27-83008K01	CHASSIS, meter
	31-490181	TERMINAL STRIP, 1-lug
	42-871184	CLIP, probe; 3 req'd.
	15-83009K01	COVER, meter
	42-83123F01	RETAINER, nylon; 2 req'd.
	75-838826	BUMPER, rubber; 4 req'd.

NOTE:
For optimum performance, replacement diodes must be ordered by Motorola part number.

TKN6780A Cable Kit PL-3418-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR:
P4	-	includes:
	9-84151B03	CONTACT, receptacle; 10 req'd
	14-84556B02	HOUSING
	NON-REFERENCED ITEM	
	42-10217A02	STRAP, cable harness; 7 used

PARTS LIST

TLN5656A Metering Kit — PL-3416-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W unless otherwise stated
R1		NOT USED
R2	17-82177B04	5; 5 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
NON-REFERENCED ITEMS		
	42-890499	CLAMP, cable; 1/2"
	36-82630H01	KNOB, control
	31-490181	TERMINAL STRIP, 1-lug; 2 req'd.
	42-871184	CLIP, probe; 3 req'd.
	30-83678K01	CABLE, 7-conductor; 57" long (used with P102)
	15-83947K01	COVER; 2 req'd. (used with P102)
	42-83948K01	CLAMP, cable; 2 req'd.
	31-835961	TERMINAL BOARD, 18-lug
	27-83400K01	CHASSIS

NOTE:
For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

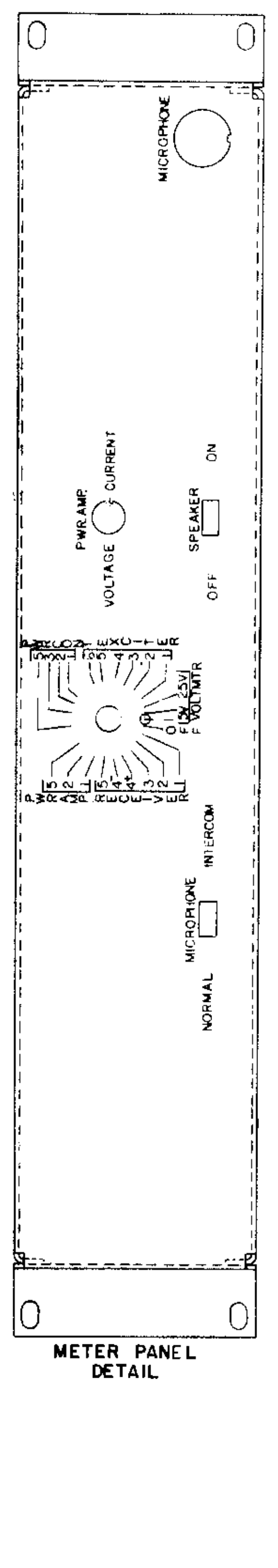
PARTS LIST

TKN6782A Cable Kit — PL-3417-O

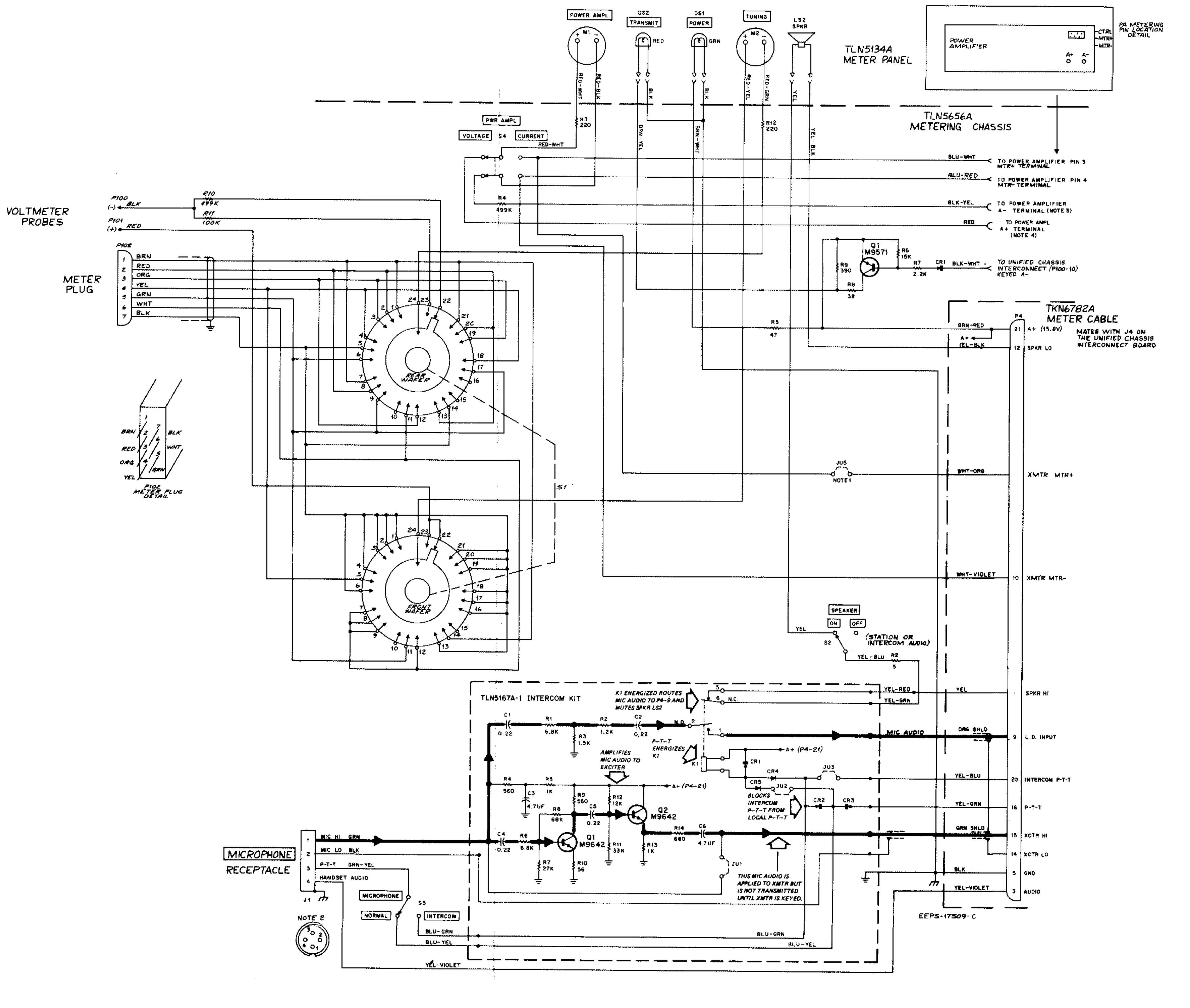
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P4	-	CONNECTOR: includes
	9-84151B03	CONTACT, receptacle; 12 req'd.
	14-84556B02	HOUSING

TLN5134A Meter Panel — PL-2233-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LIGHT, indicator:
DS1	65-83183G02	includes lamp and GRN lens
DS2	65-83183G04	includes lamp and RED lens
		LOUDSPEAKER, permanent magnet:
LS1	50-83562A01	dynamic type; 4"; square; 4 ohms voice coil impedance
		METER, electrical: 50 uA movements:
M1	72-84864B10	scale: 0-25 volts/amps
M2	72-84864B09	scale: 0-50 microamperes
NON-REFERENCED ITEMS		
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining; 2 used
	2-7009	NUT, hex: 10-32 x 3/8 x 1/8"; 4 used
	3-119916	SCREW, machine: 10-32 x 7/16"; 4 used
	3-131964	SCREW, tapping: 6-32 x 3/8; 12 used
	4-7658	WASHER, lock: #10 (split); 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter



METER PANEL DETAIL



METER SELECT TABLE

P102 METERING PLUG CONNECTED TO	METER SELECTOR SW. MTR NO.		POSITION	FUNCTION METERED	
RCVR RF & I-F BOARD	RECEIVER	1	1	CHANNEL ELEMENT OUTPUT (3RD HARMONIC)	
		2	2	1ST DOUBLER OUTPUT	
		3	3	2ND DOUBLER OUTPUT	
		4 (+)	4	DISCRIMINATOR OUTPUT	
		4 (–)	5	DISCRIMINATOR OUTPUT	
		5	6	LIMITER OUTPUT	
POWER AMPLIFIER	PA	1	7	PREDRIVER CURRENT	
		2	8	25 W DRIVER CURRENT (75 W MODEL ONLY)	
		6	9	CONTROLLED (ADL) STAGE VOLTAGE	
		–	10	– –	
POWER CONTROL BOARD	PWR CONT	5	11	FINAL AMPLIFIER CURRENT (12 W STATIONS ONLY)	
		3	12	ADL VOLTAGE	
		2	13	REFLECTED POWER	
		1	14	FORWARD POWER	
– –	– –	–	15	UNUSED	
EXCITER	XCTR	6	16	UNUSED	
		5	17	EXCITER OUTPUT	
		4	18	DOUBLER INPUT	
		3	19	TRIPLER INPUT	
		2	20	CHANNEL ELEMENT OUTPUT	
		1	21	"IDC" AUDIO OUTPUT	
– –	– –	–	22	25 VOLTS FULL SCALE	METER IS LABELED 0–50
– –	– –	–	23	5 VOLTS FULL SCALE	
– –	– –	–	24	OFF	

NOTES:

1. JU5—IN FOR 12 W MODELS; OUT FOR ALL OTHER MODELS.
2. INTERCOM REQUIRES THE USE OF A MOTOROLA MODEL TMN6071A MICROPHONE, OR EQUIVALENT.
3. ON 12—WATT STATIONS, BLK—YEL A(–) LEAD IS CONNECTED TO TB2—2 (–) ON UNIFIED CHASSIS INTERCONNECT BOARD.
4. ON 12—WATT STATIONS, RED A(+) LEAD IS CONNECTED TO TB2—1 (+) ON UNIFIED CHASSIS INTERCONNECT BOARD.

MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF
TLN1739A METERING CHASSIS	TLN5656A METERING CHASSIS TLN5167A INTERCOM BOARD KIT TKN6782A CABLE KIT
TLN5134A METER PANEL	– –

LEGEND:

THEORY NOTE

PRIMARY SIGNAL FLOW

UPRIGHT STATION METERING & INTERCOM

MODELS TLN1739A AND TLN5134A

OPERATING INSTRUCTIONS

1. METERING

Step 1. Tuning Meter Usage--Select the function to be metered with the meter switch. Next, select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board, or the power amplifier. NOTE: Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used. For receiver discriminator adjustment, use both 4 (+) and 4 (-) and adjust for meter zero.

Step 2. PWR AMP Meter Usage--Select PA current/voltage monitoring by placing the VOLTAGE/CURRENT switch in the applicable position.

Step 3. Refer to the Transmitter and Recevier sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 4. Voltmeter Usage--Use either the 5 V or 25 V scales as applicable. Divide the 5 V full scale reading by 10 to obtain actual voltage. Divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM positon.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the micrphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER switch to the OFF position before leaving the station unattended.

FUNCTION

Provides built-in metering of over 20 major test points in the transmitter and receiver(s). Plus intercom between the station and the remote control point.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM in the NORMAL positon.

Step 4. The unit is now ready for "on-the-air" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER switch in the ON position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

UPRIGHT STATION METERING & INTERCOM

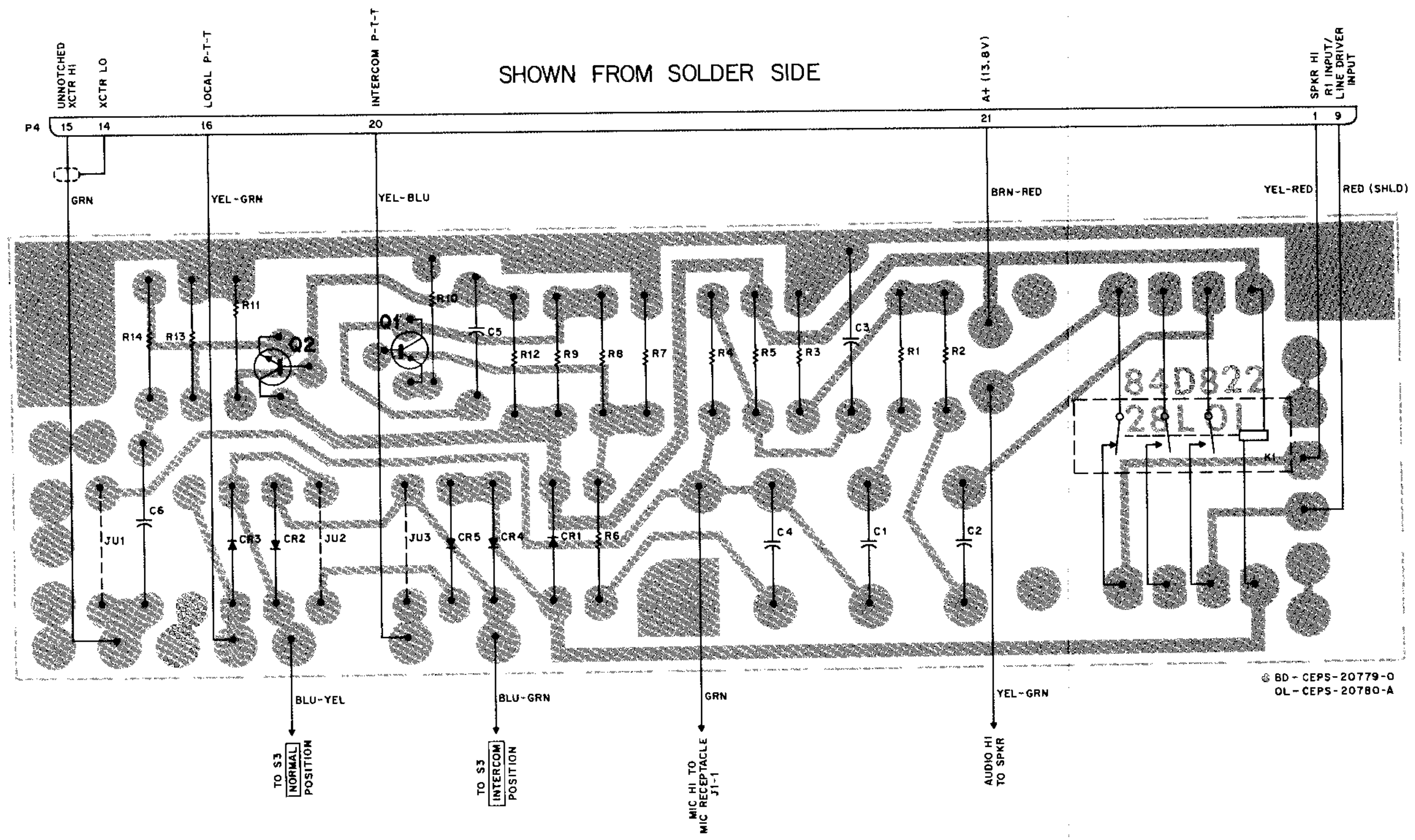
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN5167A Intercom Board PL-5076-O

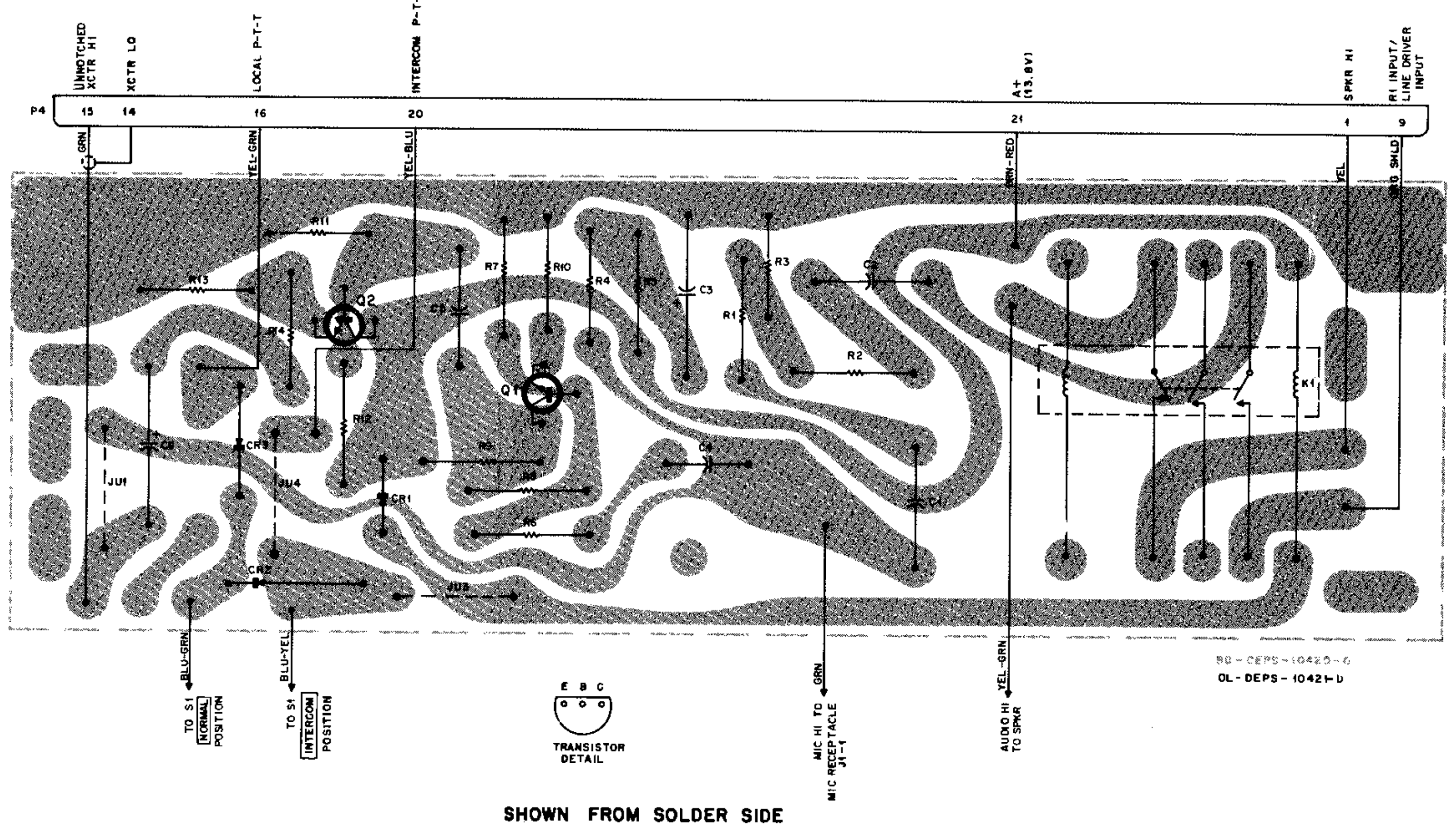
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF:
C1, 2	8-82905G11	0.22 ±10%; 50 V
C3	23-865137	4.7 ±20%; 25 V
C4, 5	8-82905G11	0.22 ±10%; 50 V
C6	23-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1 thru 5	48-83654H01	silicon
		SWITCH, magnetic reed: 13.4 V DC:
K1	80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1, 2	48-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W:
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

CURRENT VERSION



EARLIER VERSION

TLN5167A INTERCOM BOARD



"COMPA-STATION" METERING & INTERCOM

MODELS TLN1857A AND TLN1886A
INTERCOM
MODEL TLN1745A

PARTS LIST

TLN5900A Meter Kit
TLN5993A Meter Kit

NOTE
This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

PL-5077-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C100	21-82428B24	.01 uF +80-20%; 500 V
		DIODE: (SEE NOTE)
CR100, 101	48-82420C03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		LOUDSPEAKER; permanent:
LS1	50-84710G01	dynamic type; 3"; square 16 ohms voice coil impedance
		METER, dc:
M100	72-83120C02	scale; 0-50 microamperes
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe: RED
P102	28-84208B01	7-contacts
		RESISTOR, fixed:
R100	6-84640C61	499k ±0.5%; 1/4 W
R101	6-13756D88	100k ±1%; 1/2 W
R102	6-124A33	220 ohm ±5%; 1/4 W
R103	17-82177B55	8 ±10%; 7 W
R104	17-82177B44	13 ±10%; 15 W
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775R56	DIODE & CAPACITOR ASSEMBLY includes: DIODES CR100 & CR101 CAPACITOR C100
	1-80775B58	CABLE ASSEMBLY includes;
	3-129674	SCREW, machine; 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4"; 2 used
	15-83947K01	COVER, connector; 2 used
	30-83678K01	CABLE, 7-conductor; 42" lg.
	42-83948K01	CLAMP, cable; 2 used
	1-80775B61	VOLTMETER PROBES includes: CONNECTORS P100 & P101
	1-80792B23	SWITCH ASSEMBLY, wired (TLN5900A) includes: SWITCH S1
	1-80795B11	SWITCH ASSEMBLY, wired (TLN5993A) includes: SWITCH S1
	1-80792B24	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat: .128 x .250 x .033"; 2 used
	27-83008K03	CHASSIS, metering
	31-490181	TERMINAL STRIP: 2-terminal; 2 used
	31-823389	TERMINAL STRIP; 2 used
	42-871184	CLIP, mounting; 2 used SWITCHES S2, S3, & S4
	1-80793B04	COVER ASSEMBLY includes:
	1-80793B05	COVER SUBASSEMBLY includes:
	15-82734L01	COVER
	3-136138	SCREW, tapping: 6-32 x 3/8"; 2 used
	42-83123F01	RETAINER, screws; 2 used
	75-838826	BUMPER, rubber; 4 used
	2-7005	NUT, hex: 6-32 x 1/4 x 3/32"
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32"
	2-132616	NUT, hex: 6-32 x 1/4 x 3/32"; 4 used
	2-83896G01	NUT, special: 13/16-27 x .905 x .110"

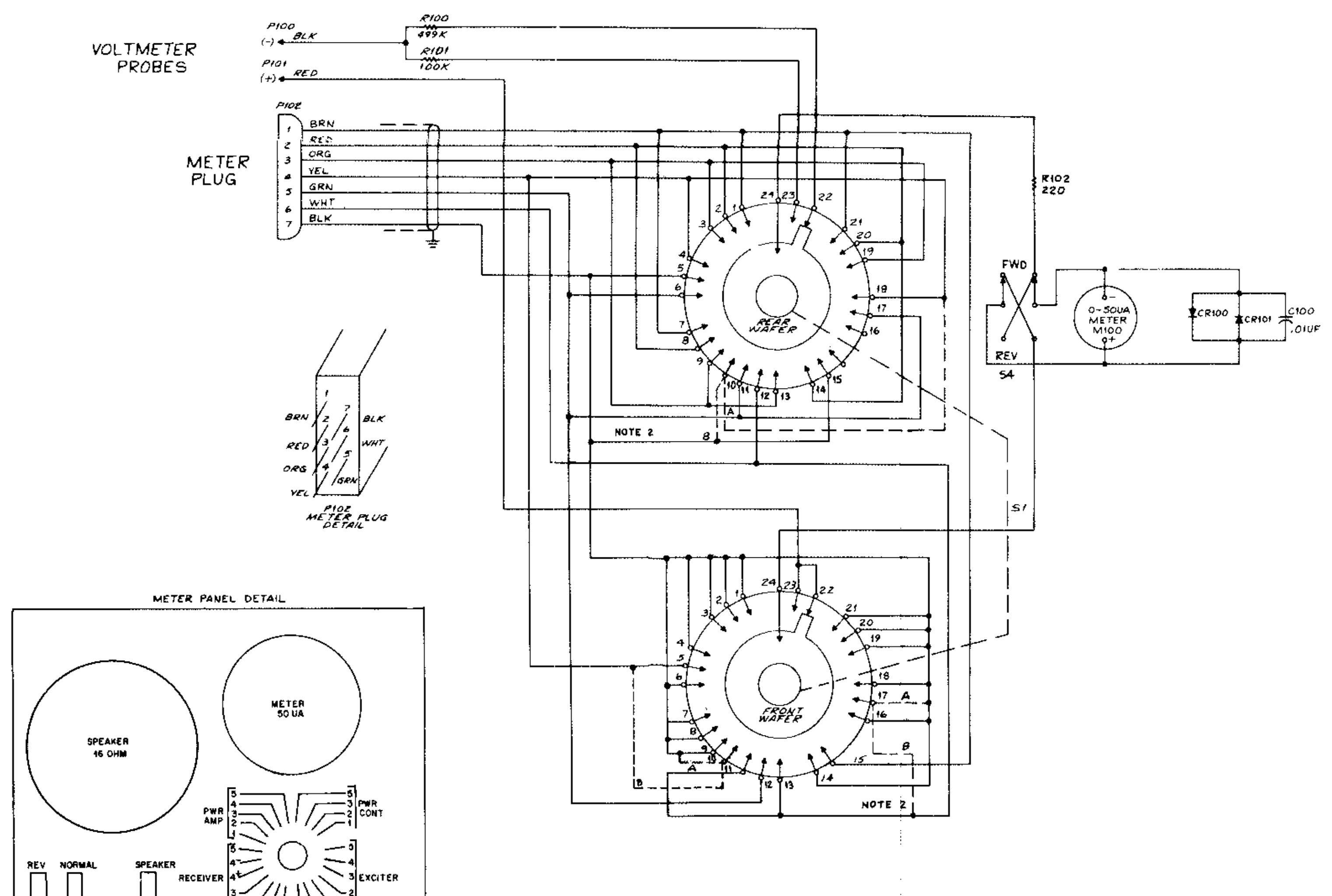
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-7331	SCREW, machine: 6-32 x 3/8
	3-129498	SCREW, machine: 6-32 x 5/16; 4 used
	3-134169	SCREW, tapping: 4-40 x 1/4; 6 used
	3-135111	SCREW, tapping; 4-40 x 3/8
	4-7568	WASHER, flat: .378 x .562 x .067"
	4-7650	WASHER, lock: #6 (internal tooth)
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)
	4-114057	WASHER, flat: .125 x .312 x .032"
	4-858060	WASHER, insulating: .125 x 7/32 x .060"; 3 used
	5-483208	GROMMET, rubber: 1/2" ID
	7-83198K01	BRACKET, meter
	14-84717F01	INSULATOR: .68 x .40"
	29-5247	LUG, soldering: #1/4 L; 2 used
	29-115147	LUG, soldering: #5
	35-84530G01	GRILLE, speaker
	36-84356C01	KNOB, pointer
	42-859067	CLAMP, cable: 1/2" OD (black)
	42-10217A02	STRAP, cable harness; 4 used
	42-82143C02	CLAMP, cable: 1/4" OD (black)
	54-83147L01	LABEL, caution

TKN6780A Cable Kit PL-3418-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR:
P4	-	includes:
	9-84151B03	CONTACT, receptacle; 10 req'd
	14-84556B02	HOUSING
	NON-REFERENCED ITEM	
	42-10217A02	STRAP, cable harness; 7 used

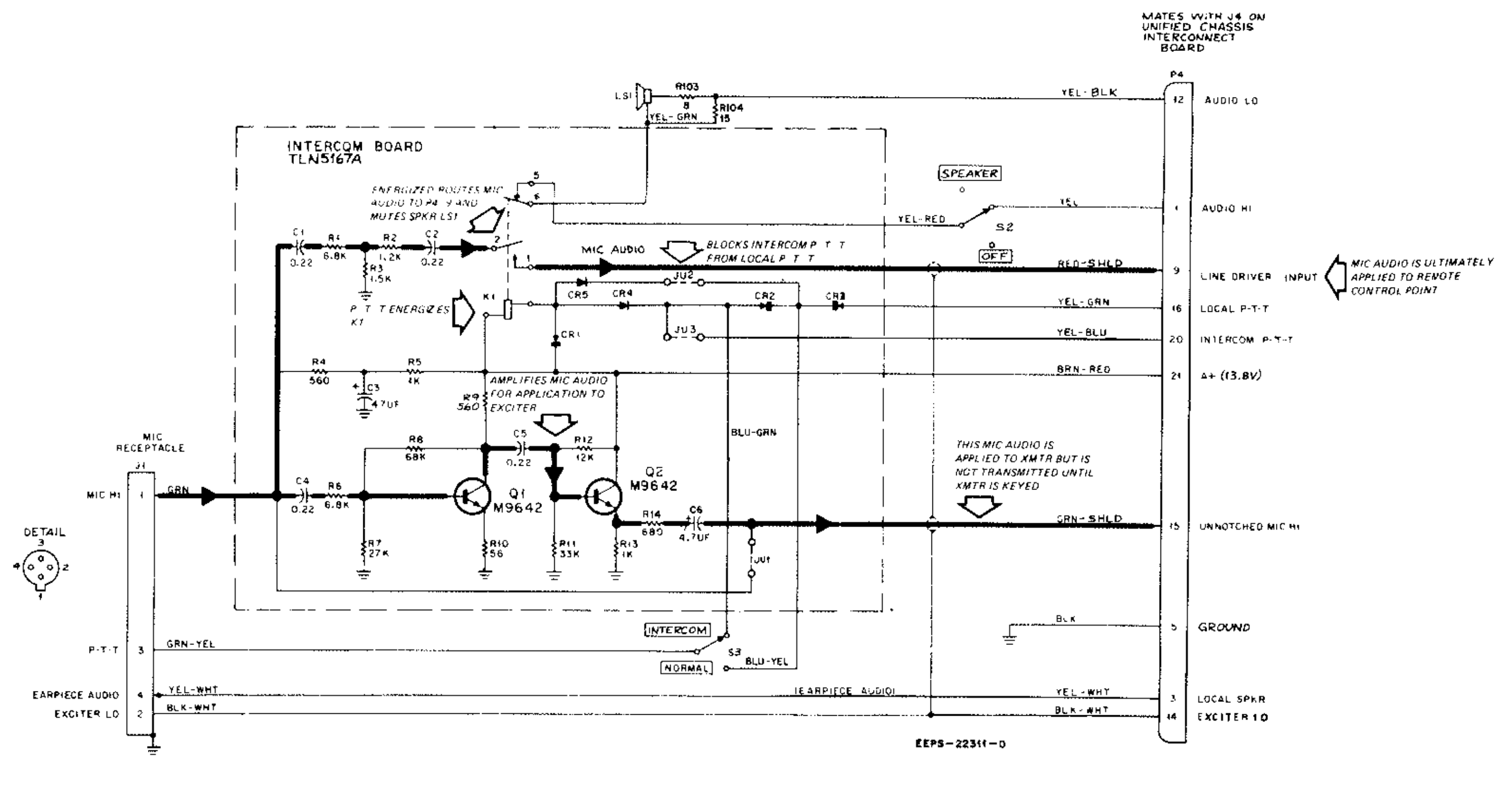
TRN6189A Intercom Chassis Kit PL-3452-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		SPEAKER
LS1	50-84710G01	3 ; 16 ohm
		RESISTOR, fixed; ±10%:
R103	17-82177B55	8; 7 W
R104	17-82177B44	13; 15 W
		SWITCH, slide:
S2, 3	40-11589	spst
	NON-REFERENCED ITEMS	
	1-80775B59	CHASSIS (riveted) incl. ref. item S2 and S3
	1-80775B51	COVER ASSEMBLY
	2-132616	LOCKNUT, speaker (No. 6-32) 4 req'd.
	2-83896G01	NUT, hex (used with J1)
	4-7699	LOCKWASHER (used with J1)
	5-483208	GROMMET, rubber
	35-84530G01	GRILLE, speaker
	42-82143C02	CLAMP, cable (1/4")
	42-10217A02	TY-WRAP, cable; 4 req'd.
	3-134169	SCREW, machine: No. 4-40 x 1/4"; 7 req'd.
	3-129498	SCREW, machine: No. 6-32 x 5/16"; 4 req'd.
	29-115147	LUG, solder (No. 5)
	31-823389	TERMINAL, strip; 2 used



MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF	
TLN1857A METERING & INTERCOM KIT	TLN5900A	METER KIT (CHASSIS)
	TLN5167A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1886A METERING INTERCOM KIT	TLN5993A	METER KIT (CHASSIS)
	TLN6167A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1745A INTERCOM KIT	TRN6189A	INTERCOM KIT (CHASSIS)
	TLN6167A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT



NOTE
W...I 12 W STATIONS, FINAL PA CURRENT IS METERED AT PWR CONT MTR 5. WITH ALL OTHER STATIONS, FINAL PA CURRENT IS METERED AT PA MTR 8.

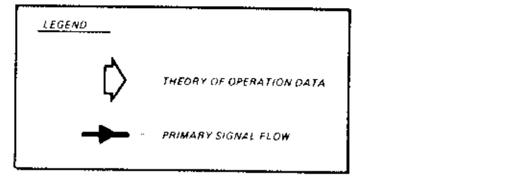
NOTE:

1. THIS OPTION REQUIRES THE USE OF A MOTOROLA MODEL TMN6071A MICROPHONE, OR EQUIVALENT.

JUMPER TABLE

JUMPER	NORMAL	WHEN "SPECTRA TAC" IS ADDED (CUT CR2)
JU1	OUT	OUT
JU2	OUT	IN
JU3	OUT	IN

2. LEADS A CONNECTED FOR TLN5900A. LEADS B CONNECTED FOR TLN5993A.



OPERATING INSTRUCTIONS

1. METERING

Step 1. Select the function to be metered with the METER switch.

Step 2. Select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board or the power amplifier.

NOTE

Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used.

Step 3. For receiver discriminator adjustment, use both 4(+) and 4(-) and adjust for meter zero.

Step 4. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 5. To measure miscellaneous station voltages, use the voltmeter probes (P100 and P101) on either the 5 V or 25 V positions. Divide the 5 V full scale reading by 10 to obtain actual voltage and divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speaker into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER-OFF switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the NORMAL position.

Step 4. The unit is now ready for "ON-THE-AIR" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER-OFF switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER-OFF switch in the SPEAKER position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

FUNCTION

--Models TLN1857A and TLN1886A provide built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.

METER SELECT TABLE

P102 METER PLUG CONNECTED TO	METER SELECTOR SWITCH MTR.	NO.	POS.	LOW BAND--MID BAND TLN1886A/TLN1887A POL.	FUNCTION METERED	HIGH BAND TLN1857/TLN1859A PCL.	FUNCTION METERED	820 MHz/UHF TLN1857A/TLN1859A POL.	FUNCTION METERED
RCVR AND IF BOARD	RCVR	1	1	REV	EXTENDER CHANNEL ELEMENT	REV	–	FWD	CHANNEL ELEMENT OUTPUT
		2	2	REV	–	REV	–	FWD	FIRST DOUBLER OUTPUT
		3	3	REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
		4+	4	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		4-	5	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		5	6	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
POWER AMP	PWR AMP	1	7	FWD	P.A. INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
		2	8	FWD	-	REV	CONTROLLED AMP OUTPUT	FWD	25 W DRIVER CURRENT (75 W)
		3	9	FWD	-	REV	INPUT FINAL AMP 90/100 W/60 W PREDRIVER	FWD	FINAL AMP CURRENT (EXCEPT 12 W MODELS)
		4	10	FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP.	FWD	–
		5	11	FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED (ADL) STAGE VOLTAGE FINAL AMPLIFIER CURRENT (12 W ONLY)
POWER CONTROL BOARD	POWER CONT.	5	12	FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADL VOLTAGE (ALL OTHERS)
		3	13	FWD	--		–	FWD	ADL VOLTAGE NOT USED (800 MHz ONLY)
		2	14	FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
		1	15	FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
	-	–	16		UNUSED		UNUSED		UNUSED
EXCITER	EXCTR	5	17	FWD	SECOND AMPLIFIER -- (LB) DRIVER INPUT -- (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
		4	18	FWD	FIRST AMPLIFIER (LB) DOUBLER INPUT -- (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
		3	19	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
		2	20	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
		1	21	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
	VOLT-METER	25 V	22	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
		5 V	23	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0--50	FWD	5 VOLTS FULL SCALE NOTE. METER IS LABELLED 0--50	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0--50
	OFF		24		OFF		OFF		OFF

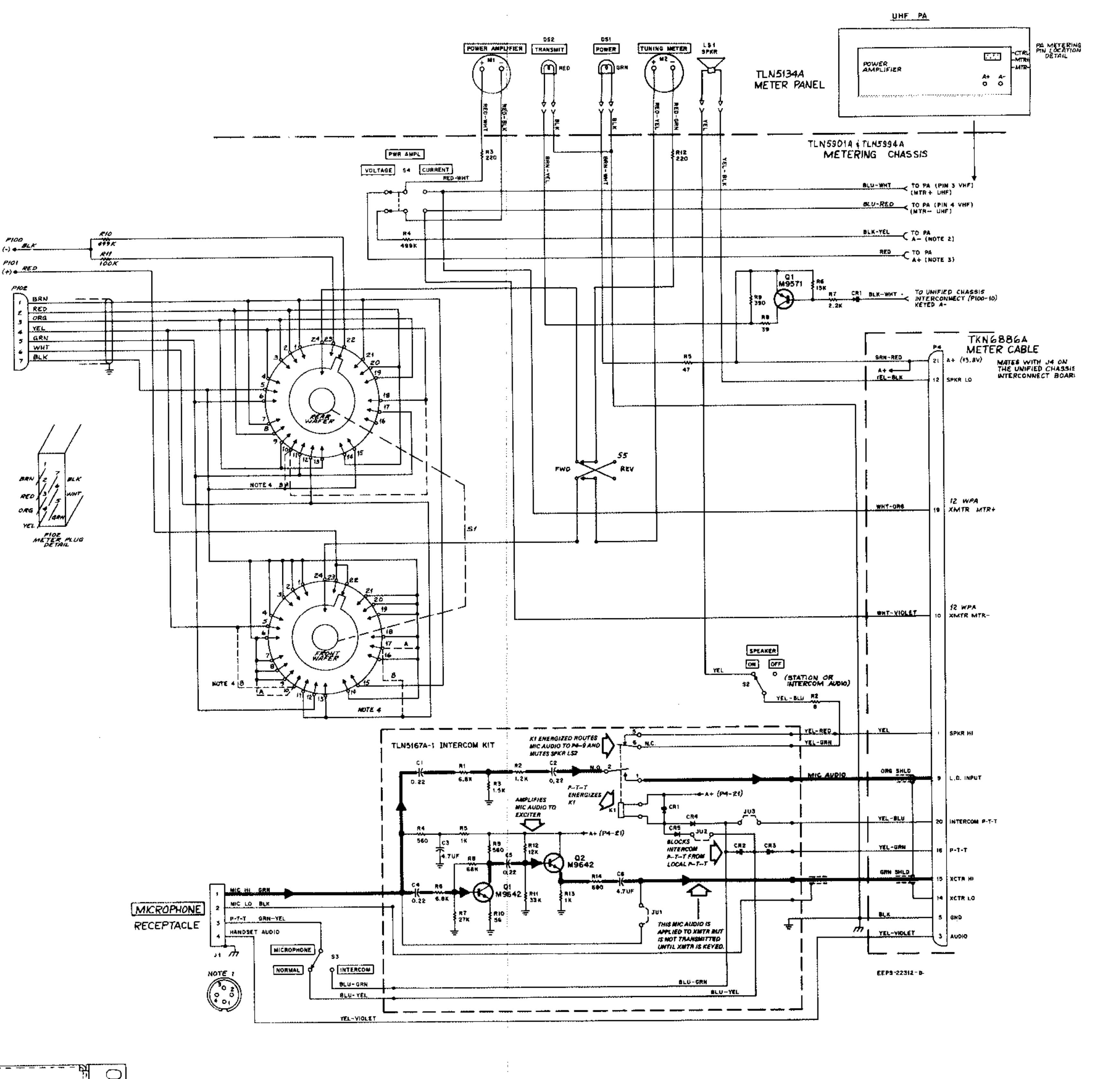
EPS-23014-A

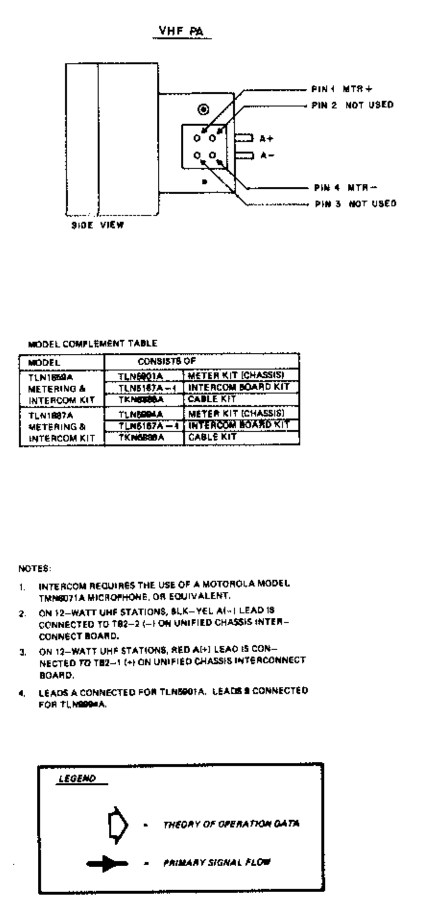
UPRIGHT STATION METERING & INTERCOM

MODELS TLN1859A AND TLN1887A

FUNCTION

Provides built-in metering of over 20 major test points in the transmitter and receiver(s). Plus intercom between the station and the remote control point.





METER SELECT TABLE

P102 METER PLUG CONNECTED TO	METER SELECTOR SWITCH MTR. NO.		POS.	LOW BAND—MID BAND TLN1886A/TLN1887A POL.	FUNCTION METERED	HIGH BAND TLN1857/TLN1858A POL.	FUNCTION METERED	820 MHz/UHF TLN1857A/TLN1859A POL.	FUNCTION METERED
RCVR AND IF BOARD	RCVR	1	1	REV	EXTENDER CHANNEL ELEMENT	REV	–	FWD	CHANNEL ELEMENT OUTPUT
		2	2	REV	–	REV	–	FWD	FIRST DOUBLER OUTPUT
		3	3	REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
		4+	4	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		4–	5	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		5	6	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
POWER AMP	PWR AMP	1	7	FWD	P.A. INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
		2	8	FWD	–	REV	CONTROLLED AMP OUTPUT	FWD	25 W DRIVER CURRENT (75 W)
		3	9	FWD	–	REV	INPUT FINAL AMP 90/100 W/60 W PREDRIVER	FWD	FINAL AMP CURRENT (EXCEPT 12 W MODELS)
		4	10	FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP.	FWD	–
		5	11	FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED (ADL) STAGE VOLTAGE FINAL AMPLIFIER CURRENT (12 W ONLY)
POWER CONTROL BOARD	POWER CONT.	5	12	FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADL VOLTAGE (ALL OTHERS)
		3	13	FWD	–		–	FWD	ADL VOLTAGE NOT USED (800 MHz ONLY)
		2	14	FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
		1	15	FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
–	–	–	16		UNUSED		UNUSED		UNUSED
EXCITER	EXCTR	5	17	FWD	SECOND AMPLIFIER – (LB) DRIVER INPUT – (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
		4	18	FWD	FIRST AMPLIFIER – (LB) DOUBLER INPUT – (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
		3	19	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
		2	20	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
		1	21	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
	VOLT-METER	25 V	22	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
		5 V	23	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50
	OFF	–	24		OFF		OFF		OFF

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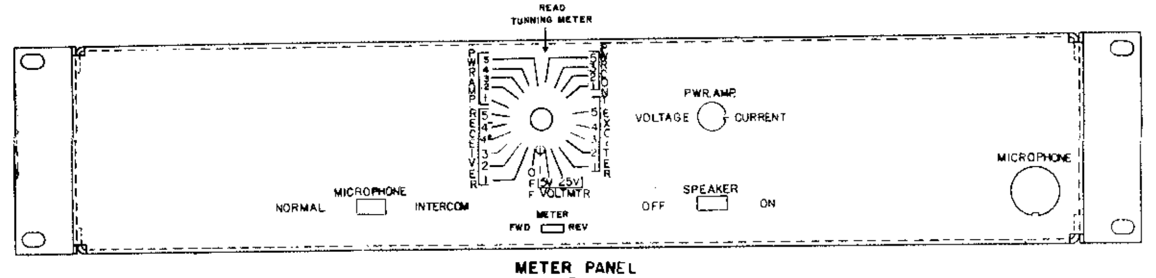


METER PANEL DETAIL

OPERATING INSTRUCTIONS

1. METERING

Step 1. Tuning Meter Usage -- Select the function to be metered with the meter switch. Next, select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board, or the power amplifier. NOTE: Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used. For receiver discriminator adjustment, use both 4(+) and 4(-) and adjust for meter zero.

Step 2. PWR AMP Meter Usage -- Select PA current/voltage monitoring by placing the VOLTAGE/CURRENT switch in the applicable position.

Step 3. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 4. Voltmeter Usage -- Use either the 5 V or 25 V scales as applicable. Divide the 5 V full scale reading by 10 to obtain actual voltage. Divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM in the NORMAL position.

Step 4. The unit is now ready for "on-the-air" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER switch in the ON position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

PARTS LIST

TLN5901A Meter Kit
TLN5994A Meter Kit

NOTE

This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

PL-5078-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W: unless otherwise stated
R1		NOT USED
R2	17-82177B55	8; 7 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
S5	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775B55	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine: 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4" 2 used
	15-83947K01	COVER, connector: 2 used
	30-83678K01	CLAMP, cable; 2 used
		CONNECTOR P102
	1-80775B60	VOLTMETER PROBES includes:
		CONNECTORS P100 & P101
	1-80792B39	SWITCH ASSEMBLY, wired (TLN5901A)
	1-80795B12	SWITCH ASSEMBLY, wired (TLN5994A) includes:
		SWITCH S1
	1-80793B03	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat: .128 x .250 x .033"; 3 used
	27-83400K02	CHASSIS, metering
	29-115147	LUG, soldering: #5
	31-490101	TERMINAL STRIP: 2-terminal; 2 used
	42-871184	CLIP, mounting; 3 used
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32
	2-115190	NUT, hex: 15/32-32 x 9/16 x 5/64"
	2-121841	NUT, hex: 6-32 x 5/16 x 7/64"
	2-83896G01	NUT, special: 13/16-27 x .905 x .110"
	3-134185	SCREW, tapping: 6-32 x 1/4: 2 used
	3-134212	SCREW, tapping: 4-40 x 5/16; 3 used
	3-136934	SCREW, tapping: 6-32 x 3/8"
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)
	4-8324	WASHER, lock: #15/32 (split)
	14-84717F01	INSULATOR: .68 x .40"
	29-5279	LUG, soldering: #7/8
	31-835961	TERMINAL STRIP, 18-terminal
	36-82630H01	KNOB, control
	42-890499	CLAMP, cable: 3.18 x .62"
	42-10217A02	STRAP, cable harness

TKN6886A Cable Kit — PL-5207-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR: includes:
P4	-	
	9-84151B03	CONTACT, receptacle: 12 used
	14-84556B02	HOUSING, connector
	NON-REFERENCED ITEMS	
	14-859051	INSULATOR, lug: .315 x .945"; 6 used
	29-5247	LUG, soldering: #1/4 L; 4 used
	29-824456	LUG, ring tongue: 2 used
	29-859118	LUG, receptacle: .295 x .750"; 6 used
	37-82603D60	SLEEVE, numbered; blank
	39-10184A24	CONTACT, female
	42-10217A02	STRAP, cable harness; 3.62" lg.; 28 used
	42-10217A10	STRAP, cable harness; 7.78" lg.; 4 used
	9-84234E10	JACK, test; white; 3 used

TLN5134A Meter Panel — PL-2233-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		LIGHT, indicator:
DS1	65-83183G02	includes lamp and GRN lens
DS2	65-83183G04	includes lamp and RED lens
		LOUDSPEAKER, permanent magnet:
LS1	50-83562A01	dynamic type; 4"; square; 4 ohms voice coil impedance
		METER, electrical: 50 uA movements:
M1	72-84864B10	scale: 0-25 volts/amps
M2	72-84864B09	scale: 0-50 microamperes
	NON-REFERENCED ITEMS	
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining; 2 used
	2-7009	NUT, hex: 10-32 x 3/8 x 1/8"; 4 used
	3-119916	SCREW, machine: 10-32 x 7/16" 4 used
	3-131964	SCREW, tapping: 6-32 x 3/8; 12 used
	4-7658	WASHER, lock: #10 (split); 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

STATION ALIGNMENT

1. INTRODUCTION

This section of the manual contains the station alignment procedures. The station alignment is separated into two major procedures -- Transmitter Alignment and Receiver Alignment. For a complete alignment of the station, perform all the alignment procedures in sequence for each section as follows:

— Transmitter: Exciter, PA;
— Receiver: RF & I-F.

When performing a touchup or check, only the particular step-by-step procedures is required.

NOTE

Before performing transmitter or receiver alignment, assure that the control line and audio line levels are set as described in the installation section of this manual.

In Upright station radios, metering is performed using the built-in metering capability. In "Compa- Station" radios, metering may be performed by using either optional built-in metering (if so equipped), or by using a Motorola Model S1056B through S1059B Series Portable Test Set. All meter readings are based on a 2000-ohm equivalent series resistance in the meter. Therefore, meters *not* having a 2000-ohm series resistance must have their readings corrected.

2. TRANSMITTER ALIGNMENT

2.1 EXCITER ALIGNMENT

Throughout the following Exciter Alignment Procedure, the metering plug will be inserted into the Exciter Metering Receptacle. If a PORTABLE TEST SET IS USED, SET THE OSCILLATOR & METER REVERSING switch to the OFF position, and set the REFERENCE A/B switch (on the metering cable plug) to A.

Perform the Exciter Alignment Procedure as given in Table 1. Figure 1 illustrates the physical locations of the Exciter coils and controls. Figure 2 is a graph giving the number of turns necessary to preset coils L407 and L408.

STATION ALIGNMENT

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

IMPORTANT

If the POWER SET control ONLY is used to adjust the rf power output, for any non-rf power alignment or trouble-shooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

Table 1. Exciter Alignment Procedure

STEP	ADJUST	SELECTOR SWITCH POSITION	PROCEDURE
1. Set-Up	—	—	Key transmitter (with the XMTR ON pushbutton on portable test set).
2. Power Output	POWER SET control	—	Turn fully CCW (counterclockwise) - minimum power output. Unkey transmitter.
3. Channel Element	FREQUENCY SELECT switch	2	Select desired frequency on multi-frequency stations. Key transmitter. Meter 2 should indicate at least 10 uA.
4. Pre-Alignment	All Exciter coils	5	If exciter is completely untuned and no readings are obtained on meter 5. 1. Set cores of tuning coils L401 thru L406 to the top of coil forms away from circuit board). 2. Set cores of tuning coils L407 and L408, away from circuit board end of coil forms, per Figure 2.
5. Buffer Output	L401	2	Adjust for minimum meter reading.
6. Buffer Output	L402, L401	3	Adjust (in order shown) for peak.
7. Tripler Output	L403	3	Adjust for minimum meter reading.
8. Tripler Output	L404, L403	4	Adjust (in order shown) for peak.
9. 1st Doubler Output	L405	4	Adjust for minimum meter reading.
10. 1st Doubler Output	L406, L405	5	Adjust (in order shown) for peak.
11. Exciter Output	L407	5	Adjust for peak.
12. Exciter Output	L408, L407	5	Adjust (in order shown) for peak.
13. —	—	—	Repeat Steps 6, 8 & 10.
14. Power Output	POWER SET control	—	Key transmitter. Adjust CW (clockwise) to desired power output level. Unkey transmitter. This completes the Exciter Alignment Procedure.

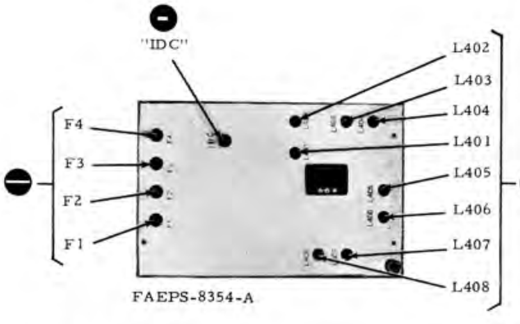
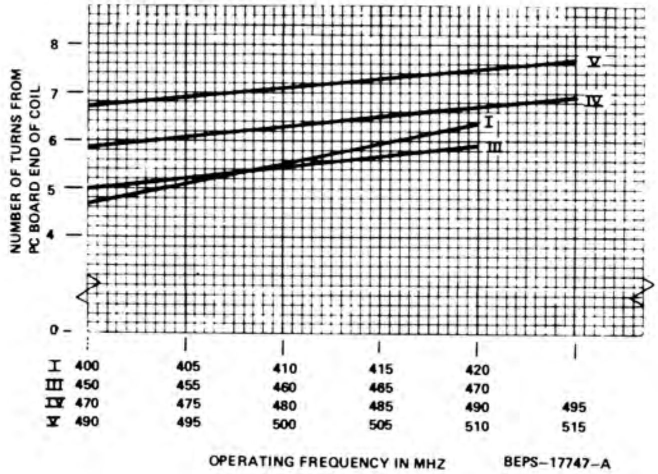


Figure 1. Exciter Adjustment Locations



NOTE: ACTUAL SETTING IS NOT CRITICAL. NEAREST 1/4 TURN IS ADEQUATE.

Figure 2. Exciter Tuning Coil L407 & L408 Preset

2.2 POWER AMPLIFIER ALIGNMENT

2.2.1 General

The transmitter power amplifier is broadband. Any channel may be used for initial PA power setting.

If a built-in wattmeter is used during the following procedure, a UHF-rated, non-reactive, 50-ohm dummy load must be connected to the transmitter's rf power output connector. The dummy load must be capable of dissapating more than the rated power output of the transmitter. Homemade dummy loads or radiating antennas are not adequate. If an external wattmeter is used, make sure that it is UHF-rated and that the dummy load connected to it meets the above requirements.

2.2.2 PA Power Setting Procedure

IMPORTANT

If the POWER SET control ONLY is used to adjust the rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

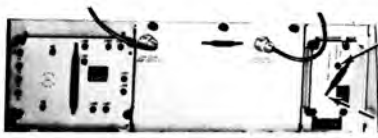


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Figure 3. Power Set and Drive Limit Control Locations

Step	Adjust	Metering Plug Location	Test Instrument	Stage and Procedure
1	POWER SET and DRIVE LIMIT	Power Control Board	Wattmeter	Pre-Setting of Controls: Connect the wattmeter to the transmitter rf power out put connector and remove the shield from over the Power Control board. Set the DRIVE LIMIT control fully clockwise (minimum power output). Set the POWER SET control fully clockwise (maximum power output).
2	DRIVE LIMIT Control	Power Control Board	Wattmeter	Choose the desired station power output from Table 2. Drive Limit: Key transmitter. Adjust the DRIVE LIMIT control counterclockwise (increasing the output power level), until the power output under the "Drive Limit" column in Table 2 is ob tained. If that power output is NOT ob tainable, turn the Drive Limit control fully counterclockwise (maximum power output). If the power output is already at, or above, the required "Drive Limit" level, leave the DRIVE LIMIT control set fully clockwise. **NOTE** For proper operation of the power leveling circuitry, the DRIVE LIMIT control must not be adjusted for any lower power output than that given in the "Drive Limit" column of Table 2. In transmitters where the drive limit power output level is NOT obtainable, the drive limit protection circuitry is not necessary and the DRIVE LIMIT control can be set for maximum power output.
3	POWER SET Control	Power Control Board	Wattmeter	Power Set: Key transmitter. Adjust the POWER SET control counterclockwise, un til the power output under the "Power Set" column in Table 2 is obtained. **CAUTION** Leaving the power output adjusted higher than specified can cause permanent damage to the power amplifier. On multi-frequency transmitters, check the power output on all channels. If necessary, re-adjust the POWER SET control so that the lowest power output channel is adjusted per Table 2, under the "Power Set" column. However, never allow the highest power out put channel to exceed the level specified under the "Drive Limit" column.

Unkey transmitter. Disconnect wattmeter and dummy load. Replace the Power Control board shield. This completes the PA Power Setting Procedure for 406-470 MHz stations. 470-512 MHz stations must be adjusted for system ERP. Refer to the graphs of Effective Radiated Power and Table 2.

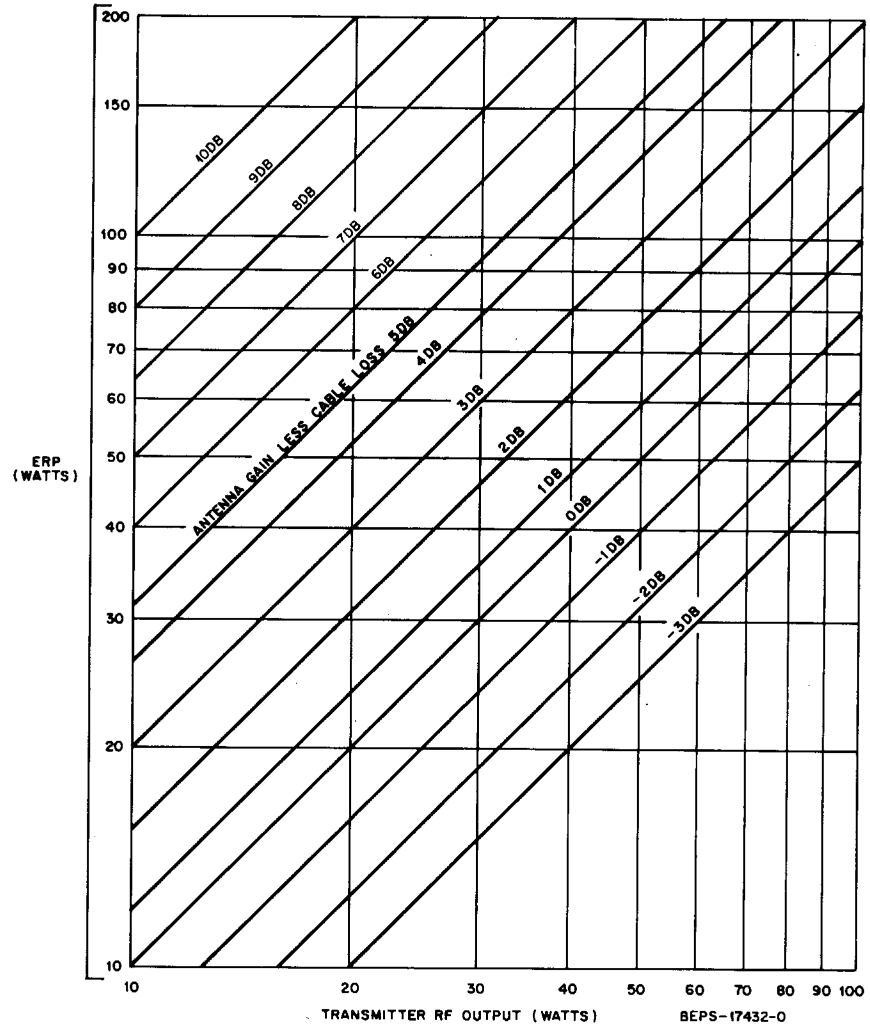

Figure 4. Graph of Effective Radiated Power

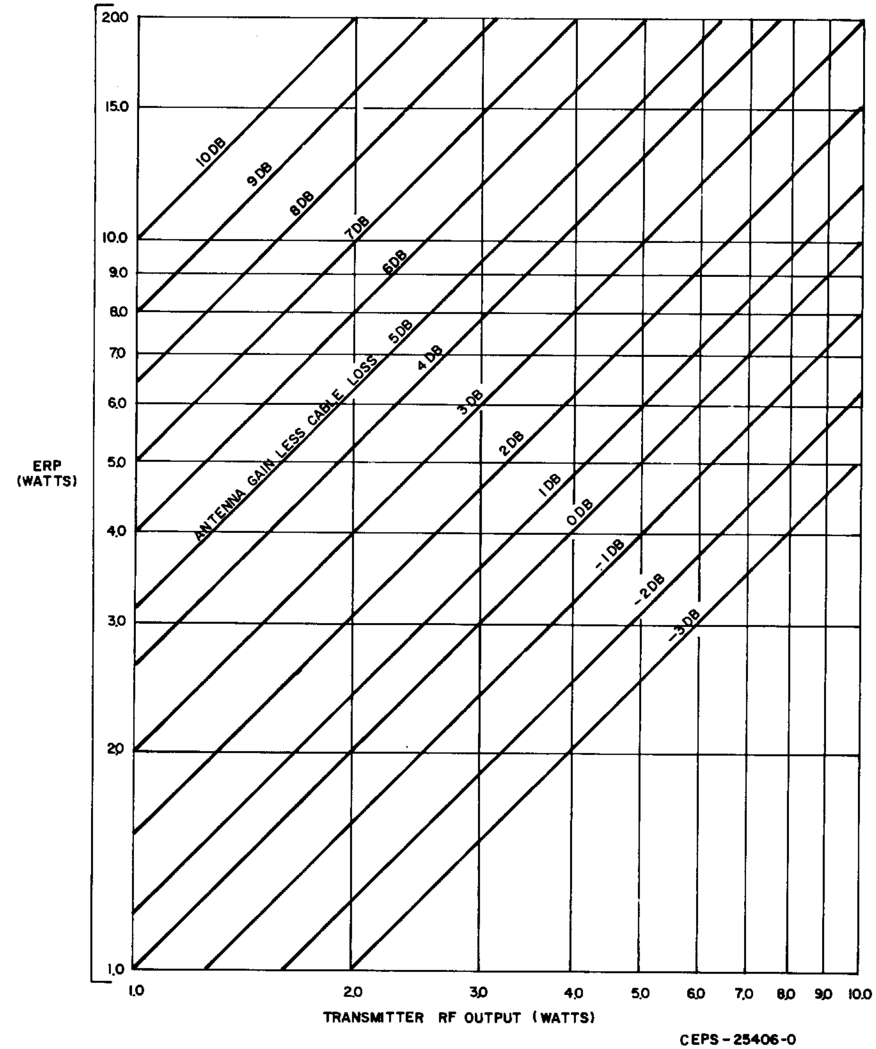

Figure 5. Graph of Effective Radiated Power (2 W Models)

Table 2. Power Levels

Model	Station Power Output	Drive Limit	Power Set
406-420 MHz			
B/C34	12	15	12
B/C54	45	55	45
B/C64	75	88	75
450-470 MHz			
C24	2	2.5	2
B/C34	12	15	12
B/C44	20	25	20
B/C54	45	55	45
B/C64	75	88	75
470-512 MHz			
B/C34	12*	15	12
B/C44	20*	25	20
B/C54	40*	50	40
B/C64	60*	70	60

*ERP - Adjust power output to power shown or per system to obtain EFFECTIVE RADIATED power per station license.

NOTE

Power output of 470-512 MHz stations is subject to FCC EFFECTIVE RADIATED POWER (ERP) licensing rules. Refer to the manufacturer's specification sheet for loss/gain factors involved in transmission lines, antennas, duplexers, etc. For example, the power loss in Teflon coaxial cable (Motorola Part No. 30-84173E01-RG400) is nominally 0.1 dB/foot.

2.3 OSCILLATOR FREQUENCY ADJUSTMENT

Step 1. Key the transmitter with no modulation (key the transmitter with the XMTR ON pushbutton on the portable test set rather than with the microphone). On tone-coded "Private-Line" stations, unplug the "Vibrasender" resonant reed from the "PL" tone generator. On digital-coded "Private-Line" stations, short the "PL" disable, J702, to ground J703. A Motorola Model TRN6332A Code Disable Plug is available for this purpose.

Step 2. Adjust the channel element warp capacitor, for the selected channel, to the exact desired frequency. In single-frequency models, adjust the F1 channel element warp capacitor. In multi-frequency models, adjust the warp capacitor that corresponds to the frequency selector switch setting; repeat for each frequency.

2.4 "IDC" ADJUSTMENT

Each channel element must be "warped" on frequency *before* setting "IDC".

Step 1. Connect an audio oscillator to the exciter's input -Audio Hi (pin 12) and, Ground (pin 1).

Step 2. Adjust the audio oscillator to 1000 Hz and 1 V rms. On "Private-Line" models, re-enable "PL".

Step 3. Key the transmitter, and adjust the "IDC" control for ± 5 kHz deviation.

Step 4. Reduce the audio oscillator output to 0.25 V rms. Essentially full deviation ± 5 kHz should still be indicated. Less than full deviation may indicate a weak audio stage.

3. RECEIVER ALIGNMENT

3.1 TWO-RECEIVER STATIONS

The two-receiver coupler (TLE8340A) used to connect both receivers to an antenna does not require alignment. Align both receivers while disconnected from the two-receiver coupler. Inject the rf signal generator output into each receiver at the rf preselector (or preamp) and align. Then reconnect the two-receiver coupler and check for proper operation. There will be a 3.5-4.0 dB loss in the coupler and a 6 dB gain through the preamplifier.

3.2 FREQUENCY CALCULATIONS

$f_c = 24 f_o + 11.7$ MHz or $f_c = 24 f_o + 11.8$ MHz

$f_o = \dfrac{f_c - 11.7 \text{ MHz}}{24}$ or $f_o = \dfrac{f_c - 11.8 \text{ MHz}}{24}$

Where: f_c = carrier frequency
f_o = channel element frequency
11.7 MHz = mixer output frequency (i-f)
11.8 MHz = mixer output frequency (shifted i-f)
24 = channel element harmonic

The receiver i-f is factory shifted from 11.7 MHz to 11.8 MHz when the difference between received carrier (channel spacing) frequencies is:

11.7 MHz ± 25 kHz
5.85 MHz ± 25 kHz
3.90 MHz ± 25 kHz
2.925 MHz ± 25 kHz

3.3 TUNE-UP FREQUENCY SELECTION FOR MULTI-FREQUENCY STATIONS

Maximum frequency separation up to 0.5 MHz -- Set the frequency selector switch to the frequency closest to the center of the range covered. For two- frequency radios select the higher frequency.

Maximum frequency separation between 0.5 MHz and 1.0 MHz-- Remove one channel element and insert a tune-up element whose frequency is midway between the two most widely separated frequencies. Set the frequency selector switch to select this element.

3.4 RECEIVER ALIGNMENT (RF & I-F BOARD) PROCEDURE

Perform the following Table 3.

Table 3. Receiver Alignment

NOTE:
This procedure includes optional rf preamplifier alignment details. If an optional rf preamplifier is not used, simply disregard preamplifier identified steps in the procedure.

STEP	ADJUSTMENT	METER POSITION	STAGE AND PROCEDURE
1	L101, L102, L103, L104, L105	—	Multiplier Coils - Adjust the cores of L101 through L105 to the end of the coil form away from the circuit board.
2	L106, L107, L108	—	Injection Filter - Adjust the tuning screws for L106 through L108 until the top of each tuning screw extends approximately one-eighth inch below the receiver shield.
3	L101, L102	1	Channel Element Output - Alternately tune L101 and L102 CCW two turns at a time until a peak indication on meter 1 is obtained.
4	L103, L104	2	First Doubler - Tune L103 CCW for a peak reading on meter 2. Tune L104 CCW for a dip on meter 2.
5	L105, L104	3	Second Doubler - Tune L105 CCW for a peak on meter 3. Tune L104 for a peak on meter 3. Repeak both coils until no further improvement can be obtained.
6	L101, L103	3	Detune L101 until meter 3 drops to 10 uA. Tune L103 for peak reading on meter 3, keeping this peak below 12 uA by further detuning of L101 if necessary.
7	L101, L102	1	Alternately tune L101 and L102 for peak reading on meter 1 until no further improvement can be obtained.
8	L106, L107, L108	3	Injection Filter - Tune L106 for a dip on meter 3. Tune L107 for a peak reading on meter 3. Tune L108 for a dip on meter 3. Do not repeat.
9	L109	4, 5	Discriminator - Insert 11.7 MHz injection probe of the test set into L110 hole on receiver shield. Be careful not to contact the circuit board. Set METER REV switch to position A or B for this step and be sure that the test set is equipped with an 11.7 MHz crystal in the corresponding A or B socket. Insert the injection probe far enough to obtain a saturated reading on meter 5. It should be possible to obtain readings on either side of zero (center) on meter 4 by tuning L109. Tune L109 for an EXACT zero reading on meter 4. This adjustment is critical.
10	L110, L111, L112, L113, L114, L115, L116	4, 5 **NOTE** In Steps 11 through 13, meter 11 is for portable test set only. Use an ac volt meter, across speak er terminals if no portable test set available.	RF Preselector and Mixer - Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. Disable the "PL" decoder by switching the "PL" monitor switch on the Station Control Module to the DISABLE position. Connect an rf signal generator to the receiver input connector and set the rf output of the generator to maximum. **NOTE** If the receiver frequency has been changed by more than 1 MHz, preset tuning screws L111 through L116 so that the screw end is in the space between the board and its shield, and approximately one-eighth inch from the shield. If the receiver is equipped with the optional preamplifier, disconnect and bypass the preamplifier. Set the generator to the carrier frequency by observing meters 4 and 5. **NOTE** If no indication is seen, unscrew the shell of the antenna cable connector, and pull the plug partially out of the jack so that the cable shield no longer makes contact with the station chassis. Set the generator to the carrier frequency as indicated by meter positions 4 and 5, then reconnect the cable shield to the radio. Adjust L111 through L116 clockwise one turn at a time, watching meter 5 for an increase in indication above noise level. Tune L111 through L116 for peak reading on meter 5, reducing generator output level as necessary to keep meter 5 out of saturation. Tune L110 for peak on meter 5. Repeat the adjust of L111 through L116. Turn L111 through L116 in or out as necessary until all screws are level. Repeat the adjustment of L111 through L116.

Table 3. Receiver Alignment (Cont'd)

STEP	ADJUSTMENT	METER POSITION	STAGE AND PROCEDURE
11	L106, L107, L108	11 (rcvr audio)	Tune L106, L107 and L108 for best noise quieting (minimum meter indication). Maximum meter 11 sensitivity may be obtained by placing the multiplier switch on the test set in the 0.2 V ac position.
12	L111, L112, L113, L114, L115, L116	11 (rcvr audio)	Tune L111 through L116 for best noise quieting. Repeat until no further improvement in quieting level can be obtained.
13	C1,C2, L111	5, 11	Premplifier - If the receiver is equipped with the optional preamplifier, reconnect the preamplifier. Tune C1 and C2 for maximum meter 5 reading. Then tune C1, C2, and L111 for best noise quieting on meter 11.
14			Perform 20 dB quieting sensitivity measurement as check of alignment. Refer to the Receiver Maintenance section of this manual for a description of how to check for 20 dB quieting sensitivity. The 20 dB quieting level should be lessthan 0.5 uV 0.25 uV with preamplifier).

STATION MAINTENANCE

1. INTRODUCTION

This section of the manual describes local operation techniques required to perform maintenance checks. Overall station maintenance is detailed in the front of this section while specific chassis maintenance (transmitter and receiver) is provided in the following paragraphs. Maintenance checks for control modules are given with the applicable module in separate Control and Applications Instruction Manual 68P81025E60.

2. LOCAL OPERATION FOR TESTING AND MAINTENANCE

Once power is applied and the station is properly adjusted, this base or repeater station is normally operated entirely unattended from a remote control point. However, the station may be locally operated utilizing controls on control modules in the unified chassis. This type of operation may be necessary to accomplish station maintenance and testing.

Local operation of the station is primarily accomplished utilizing controls on the station control module located in the unified chassis. The switch functions are listed in Table 1.

WARNING

The transmitter can be keyed remotely. To prevent unexpected transmitter keying while servicing the station, be sure the LINE DISABLE switch is actuated (direction of arrow). Also, the TLN4662A Squelch Gate Module must be temporarily removed from the remote control chassis if the station is equipped with any of the following dc transfer modules:

TLN4637A (no suffix)
TLN4659A (no suffix)
TLN4664A (no suffix)

The following are procedures pertaining to the local operation of a remotely controlled station or repeater station.

2.1 TRANSMITTER CONTROL

To prevent the transmitter from being keyed remotely, set station control module LINE DISABLE switch in the direction of the arrow. At conclusion of local operation, be sure that the LINE DISABLE switch is returned to its normal position (opposite direction of the arrow).

Table 1. Station Control Module Switch Functions

Switch	Position	Functions Possible
XMIT	Normal (not actuated)	Normal mode of operation
	Actuated (hold to right)	Turns transmitter on with no modulation. Use test microphone connected to Local Mic receptacle to modulate transmitter.
"PL" DISABLE* (functional only in "Private-Line" stations	Normal (left)	Only "PL" tone-coded on-frequency signals accepted by receiver.
	Actuated (right)	All on-frequency signals accepted by receiver.
LINE DISABLE*	Normal (left)	Transmitter can be operated by: 1. XMIT switch 2. Local microphone 3. Remote control console
	Actuated (right)	Transmitter can *not* be operated by remote control console over control line.

*The DISABLE LIGHT is illuminated when the LINE DISABLE or "PL" DISABLE switch is actuated.

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2.2 LOCAL MICROPHONE

2.2.1 Stations Without Built-In Metering

Connect a "Micor" microphone (Motorola Model TMN6054A or equivalent) to the microphone receptacle on the unified chassis interconnect board (part of J4, pins 3, 4, 5, 14, 15 and 16).

2.2.2 Stations With Built-In Metering

Connect a Motorola Model (TMN6071A) microphone, or equivalent to the MICROPHONE receptacle on the metering chassis.

2.3 LOCAL SPEAKER

2.3.1 Stations Without Built-In Metering

Connect an 8-ohm, 10-watt test speaker to J4, pins 1 and 12, on the unified chassis interconnect board. This speaker is used to monitor all received messages. A Motorola "Micor" speaker (Models TSN6016A, B or TSN6020A) plugs directly into these pins without requiring an adapter.

2.3.2 Stations With Built-In Metering

Place the SPEAKER ON-OFF switch to the ON position.

2.4 PORTABLE TEST SET (FOR STATIONS WITHOUT BUILT-IN METERING)

A Motorola S1056-S1059 Series Portable Test Set with TEK-37 or TEK-37A Adapter Cable can be used as a local control facility. Connect the red "control" plug of the adapter cable to the metering receptacle (J3) on the unified chassis interconnect board. The speaker in the test set can be used for monitoring received signals and a "Motrac" microphone (Model TMN6071A) connected to the microphone receptacle on the test set can be used for originating transmissions. The XMIT button on the test set can be used to key the transmitter without voice modulation.

2.5 FREQUENCY SELECTION

For stations with a two-frequency transmitter, the frequency can be locally selected by the F1-F2 switch on the dc transfer module or on the F2 tone decoder module. For stations with a two-frequency receiver, frequency selection is made by momentarily operating the REC F1 SELECT or REC F2 SELECT switch on the dc transfer module or on the F2 tone decoder module. For four-frequency stations, the frequency is selected by *momentary* operation of the desired frequency select switch on the four-frequency control module *after* the XMIT switch on the station control module is actuated.

2.6 SELECTION OF OTHER MODES

All other functions that can be activated by remote control can also be activated locally. Each module has test switches to activate any such functions, such as RPTR ON and RPTR OFF. Most of these switches are momentary action, which allows the station to continue operating in the selected mode until reset.

2.7 RECEIVED AUDIO

After the local speaker is turned on, or connected, the station is ready to receive audio. The receiver "PL" feature, if used, can be defeated by setting the station control module "PL" DISABLE switch in the direction of the arrow. (At the conclusion of local operation, be sure that the "PL" DISABLE switch is returned to its normal position.) If necessary, the receiver can be unsquelched utilizing the receiver SQUELCH control on the receiver chassis. The VOLUME control on the receiver chassis sets the audio output level of the local speaker.

2.8 TRANSMITTING

NOTE

Before initiating any local transmissions, monitor the channel to be sure that it is clear of other transmissions.

The transmitter is locally keyed by either activating the station control module XMIT switch or activating the push-to-talk microphone switch. Voice is transmitted using the local microphone.

2.9 CONCLUDING LOCAL OPERATION

At the conclusion of local operation, perform the following operations and checks to be sure that the station is ready for remote operation.

Step 1. Reset receiver squelch level per procedures in the Station Alignment Section (Audio & Squelch) of this manual.

Step 2. Be sure that station control module switches are positioned for normal operation (reference Table 1).

Step 3. Disconnect microphone and test speaker (if used).

Step 4. Set all external power switches ON.

Step 5. Be sure that station is operable from remote location.

Step 6. Turn local speaker OFF (if applicable).

Step 7. Disconnect or remove any metering plugs or test set.

Step 8. Be sure that cabinet doors are locked.

Step 9. Be sure that vents in cabinet are unobstructed.

3. MAINTENANCE TECHNIQUES

3.1 GENERAL

Specific Maintenance procedures for individual chassis, which comprise this station, are contained in the latter paragraphs of this section. Control module maintenance information is provided in the separate Control & Applications manual 68P81025E60. As an aid to isolating a malfunction to a specific chassis or module, a variety of general techniques are appropriate.

3.2 TRANSMITTER AND RECEIVER

Most troubles in the transmitter or receiver can be quickly isolated with metering checks. A log of normal meter readings *for this station* should be maintained. Each time maintenance is performed, the meter readings should be entered into the log. Variations from the previous readings can help to isolate a malfunction or may indicate an impending failure. If no previous meter readings are available, typical or minimum meter readings may be found with the receiver rf & i-f, exciter, power amplifier or power control board maintenance sections, as well as metering procedures. The maintenance log sheet is included at the end of this section.

3.3 POWER SUPPLY

A check of power supply voltages under load and no-load conditions (transmit and standby) should quickly isolate any malfunction.

3.4 REMOTE CONTROL UNIT

Isolation of a malfunction in the control portion of the unified chassis requires a functional understanding of the overall station operation and the inter- relationship between the various modules and chassis of the station. The "Functional Description" section along with the "Remote Control Chassis Modules" section of manual 68P81025E60 provide necessary information. With a basic understanding of station operation, troubles may be isolated by analyzing the following questions:

(1) Can the station be operated locally but not remotely? If so, this eliminates many circuits as possible sources of trouble.

(2) How many modes are inoperable? Concentrate testing on circuits that are common to the inoperable modes.

(3) Are adjustments properly set? This includes audio level adjustments at the station *and at the remote control point.*

(4) Are jumpers properly installed? The many jumpers in this station provide vast flexibility, but could be a source of trouble if improperly added, removed, or not removed, as the case may be.

4. ROUTINE MAINTENANCE

A check list for the performance of routine maintenance is given in Table 2.

Table 2. Routine Maintenance Check List

ITEM	CHECK
Receiver	Measure the signal level required to obtain 20 dB quieting.
	Compare meter readings with the minimum value and all previous readings taken. Realign the receiver, if necessary.
	For PL stations, check for proper operation of the PL decoder. Does the squelch open when the proper PL tone or binary code is detected?
Transmitter	Measure transmitter output power.
	Compare meter readings with the minimum value and all previous readings taken. Realign the transmitter, if necessary.
	Verify that each transmitter channel is on frequency and adjust if necessary.
	Tune and load the transmitter to the antenna.
	Measure transmitter frequency deviation for both voice and PL coded modulation. Adjust the "IDC" control, if necessary.
	Measure the exciter modulator sensitivity.
System Operation	Measure and adjust the audio input to the exciter.
	Measure and adjust the receiver(s) audio output to the control line.
	Check control line levels and functions for proper operation.
	Adjust receiver(s) on frequency with the distant transmitter(s) in the system.
	Check for proper repeater operation on repeater models.
	Check all accessory equiment for proper operation.
After Performing Maintenance	Check all items listed in the *Concluding Local Operation* paragraph of this section of the instruction manual.

5. RECOMMENDED TEST EQUIPMENT

A list of recommended test equipment for maintenance of this station is given in Table 3.

Table 3. Recommended Test Equipment

Type of Equipment or Type of Measurement	Equipment Characteristics	Recommended Type
Transmitter Frequency Measurement	Frequency — 406-512 MHz Accuracy — ± .00005% or better	Any of the following items of Motorola Test Equipment: Model R1200 Series Service Monitor Model S1344 Series Frequency Counter & Deviation Meter Model S1343 Series Frequency Counter
Transmitter Deviation Measurement (Note 1)	Peak reading type for voice or sinusoidal wave; scales for accurate reading of ± 5 kHz deviation (and ± 1 kHz deviation for "Private Line" models)	Any of the following items of Motorola Test Equipment: Model R1200 Series Service Monitor Model S1344 Series Frequency Counter & Deviation Meter Model R1007 Series Auto-Tune Deviation Meter
Transmitter Power Output Measurement	406-512 MHz; 50 ohms: at least 0-100 watts. 50 ohms dummy load: at least 100 watts.	Motorola S1350 Series Wattmeter with appropriate element Motorola Model S1013 Series RF Load Resistor
RF Signal Generator for receiver testing (Note 2)	406-512 MHz; FM; high-stability (± .0002% or better); adjustable output 0 to 1000 microvolts	Motorola Model R1200 Series Service Monitor Motorola Model R1201 Series AM-FM Signal Generator
Audio Voltage Measurements	High impedance (10 megohm); dBm scale	Motorola Model S1053 Series Solid State AC Voltmeter
Audio Signal Generator for audio circuit testing in receiver and transmitter	Variable amplitude 0 to 1 volt; 1 kHz tone (300 to 3000 Hz preferred); sinusoidal wave	Motorola Model S1067 Series Solid State Audio Oscillator Motorola Model TEK-1 Tone Oscillator Motorola Model R1200 Series Service Monitor
DC Voltage Measurements, Resistance Measurements, RF Voltage Measurements	High impedance (11 megohm) DC multimeter	Motorola S1063 Series Solid State DC Multimeter with SLN6055A RF Probe Motorola Model R1001 Series Digital Multimeter
Waveform Measurements	Oscilloscope: Audio Circuit Measurements RF Circuit Measurements	Motorola Model R1004 Series Oscilloscope A very high quality instrument is required (at least 50 MHz bandwidth)
Tone "Private-Line" injection for PL decoder circuit measurements	"Private-Line" tone generator using "Vibrasender" resonant reed for frequency accuracy; or audio oscillator with frequency counter for accurate setting of oscillator.	Motorola Model S1333 Series Audio Synthesizer Motorola Model SLN6221 Series "Private-Line" Tone Generator
"Digital Private-Line" Encoder and Decoder measurements	"Digital Private-Line" Encoder and Decoder. Also test digital code plugs.	Motorola Model SLN6413 Series "Digital Private-Line" Test Set
Tuning Tool	Used for adjusting all tunable components during equipment alignment.	Motorola part no. 66-84387C01
Contact Removal Tool	Used to remove female wire terminals from metering cable connector	Motorola part no. 66-84690C01

NOTES:

1. For "Digital Private-Line" stations, the Transmitter Deviation Monitor must have a low frequency response of less than 1 Hz. The Motorola R1200 Service Monitor, with deviation monitor and oscilloscope plug-in modules, requires modification to meet this requirement. No alternate test equipment is recommended.

2. For "Digital Private-Line" stations the RF signal generator must accept external modulation with a low frequency response of less than 1 Hz (essentially dc). The Motorola Model R1010 Series FM Signal Generator and the Motorola R1200 Service Monitor meet this requirement. Most other signal generators will probably not meet this specification.

6. TRANSMITTER MAINTENANCE

6.1 GENERAL

The following paragraphs provide maintenance shop type procedures for the individual transmitter circuits in the station. After preliminary tests have localized the trouble to the particular area, use these bench tests, which include measurements with built-in station metering or a Motorola portable test set, for testing and troubleshooting.

NOTE

Before troubleshooting a section of the transmitter, make certain all previous sections operate properly.

6.2 EXCITER MAINTENANCE

NOTE

The exciter board must be installed in the transmitter during testing to provide the necessary power, ground, control and signal connections. The circuit board should always be secured in place with all mounting screws for operation and testing to provide good rf ground to all stages of the exciter. The exciter should be tested while installed in the station -- usually the preferred method. However, if desired, it can be bench tested in a VHF (132-174 MHz) "Micor" mobile radio, except that the time-out-timer will be inoperative.

6.2.1 Metering

The exciter is equipped with a metering receptacle which allows five major test points to be measured. The output of the exciter is measured on meter position 5. With the portable test set connected to the metering receptacles, or by using the built-in station metering kit (if so equipped), readings may be made at each of the major test points in the circuit. A failure in almost any portion of the exciter will produce a low or zero meter reading for one or more of the test points. Improper alignment will also cause improper meter readings.

6.2.1.1 Using Built-In Station Metering

Step 1. The output of the exciter must be terminated into its normal point, the first bandpass filter. The output of the station, through the antenna network, must be terminated in a 50-ohm, non-reactive, dummy load or an antenna.

Step 2. Plug the metering plug into the exciter metering receptacle.

Step 3. Turn the station ON.

Step 4. Set the selector switch on the built-in station metering kit to position 1. Key the transmitter and whistle into the microphone long enough to observe the meter reading.

Step 5. Set the selector switch to positions 2, 3, 4 and 5 respectively, keying the transmitter and observing the meter readings for each position (whistling not required). On multi-frequency stations, repeat the readings for each exciter frequency. An analysis of the meter readings to determine whether each circuit is good or bad follows in the "Performance Tests" paragraph.

6.2.1.2 Using the Portable Test Set

To make the measurements using a portable test set, the portable test set must be connected to the station as listed in the following procedure.

Step 1. Connect the 20-pin plug of the test set adapter cable to the test set. When the test set is not in use, disconnect the 20-pin plug to conserve battery life. The plug acts as an ON-OFF switch, completing the battery circuit.

Step 2. Connect the red "control" plug of the adapter cable to the control receptacle on the unified chassis interconnect board. Connect the white "metering" plug of the adapter cable to the metering receptacle on the exciter circuit board.

Step 3. Set the FUNCTION SELECTOR switch of the portable test set to the XMTR position.

Step 4. Set the OSCILLATOR & METER REVERSING switch of the test set to the OFF position.

Step 5. Set the 1 V/100 mV switch on the adapter cable to the 100 mV position (TEK-37). On the later version adapter cable (TEK-37A), the switch is omitted and the unit always operates at 100 mV sensitivity.

Step 6. Set the REF A-B switch on the adapter cable to position A.

Step 7. The output of the exciter must be terminated into its normal point, the first bandpass filter. The output of the station, through the antenna network, must be terminated in a 50-ohm, non-reactive, dummy load or an antenna.

Step 8. Turn the station ON.

Step 9. Connect a microphone to the microphone receptacle on the portable test set or to the unified chassis interconnect board.

Step 10. Set the selector switch of the test set to position 1. Using the push-to-talk switch on the microphone, key the transmitter and whistle into the microphone long enough to observe the metering reading.

Step 11. Set the selector switch to positions 2, 3, 4, and 5 respectively, keying the transmitter with the XMTR ON pushbutton on the test set or the push-to-talk switch on the microphone and observing the meter reading for each position. On multi-frequency stations, repeat the readings for each exciter frequency. An analysis of the meter readings to determine whether each circuit is good or bad follows in the "Performance Tests" paragraph.

Each time maintenance is performed on the exciter, the readings should be compared with the previous set of readings. Any degradation of performance will quickly be noted. Often, a lower reading may indicate an impending failure and corrective action may be taken before the circuit fails entirely. The minimum values given in Table 4 may be used if no previous readings are available. However, these readings are an absolute minimum for normal operation and are no substitute for a log kept of meter readings. A typical exciter may have much higher readings and should not be allowed to drop to these minimum values before corrective action is taken. If a log is maintained, even small drops in meter readings will be noticed. This condition should be interpreted as abnormal operation and corrective action taken (such as realignment) to assure continued peak performance.

6.2.2 Performance Tests

The following performance tests may be used for troubleshooting to isolate the point of abnormal performance. They may also be used after repair and alignment to assure that the exciter meets all specifications before it is returned to service.

Step 1. Terminate the transmitter in an antenna and measure the radiated signal with a Motorola digital frequency meter and deviation monitor or other highly accurate frequency measuring device (± .00005% or better) when the transmitter is keyed in the following steps.

NOTE

Do not use the push-to-talk switch on the microphone as background noise will modulate the signal. Use the local XMIT switch on the Station Control Module.

Step 2. Key the transmitter to produce an unmodulated carrier signal. In tone-coded "Private-Line" stations disable the "Private-Line" encoder by unplugging the "Vibrasender" resonant reed. In digital-coded "Private-Line" stations, disable the "Private-Line" encoder by shorting the PL disable pin (J701) to ground (J702).

Table 4. Minimum Acceptable Exciter Meter Readings

SELECTOR SWITCH POSITION	REF A-B SWITCH POSITION (TEST SET ONLY)	READING	CIRCUIT METERED	IF LOW, THE DEFECTIVE CIRCUIT IS
1	A	2 uA (no mod) 10 uA (120 mV audio at Mic input)	Audio output of IDC circuit	IDC circuit
2	A	25 uA	Channel element output	Channel element
3	A	38 uA	Tripler input	Modulator or Tripler
4	A	15 uA	1st doubler input	Tripler or 1st doubler
5	A	20 uA	Exciter output	1st doubler, 2nd doubler or amplifier

6.2.2.1 Power Output Specification and Test Procedure

The exciter shall provide at least 400 milliwatts rf output on 1/3 of the assigned frequency. On multi-frequency stations with frequency separation of less than ± 850 kHz, at least 400 milliwatts output shall be provided on each channel.

Step 1. Connect the equipment as connected in "Metering" paragraph, except connect the test set "Metering" plug to the exciter metering receptacle.

Step 2. Set the selector switch to position 5. This checks the output of the exciter. Key the transmitter and observe the meter indication. A meter reading of at least 20 uA equals an rf signal level of 400 milliwatts.

Step 3. On multi-frequency stations, repeat the test for each exciter frequency. Select the frequency to be tested with the frequency selector switch associated with the station. The test set meter should indicate at least 20 uA for each frequency.

6.2.2.2 Frequency Specification and Test Procedure

The carrier frequency output of the transmitter shall be within .0002% of the assigned carrier frequency for each channel of operation.

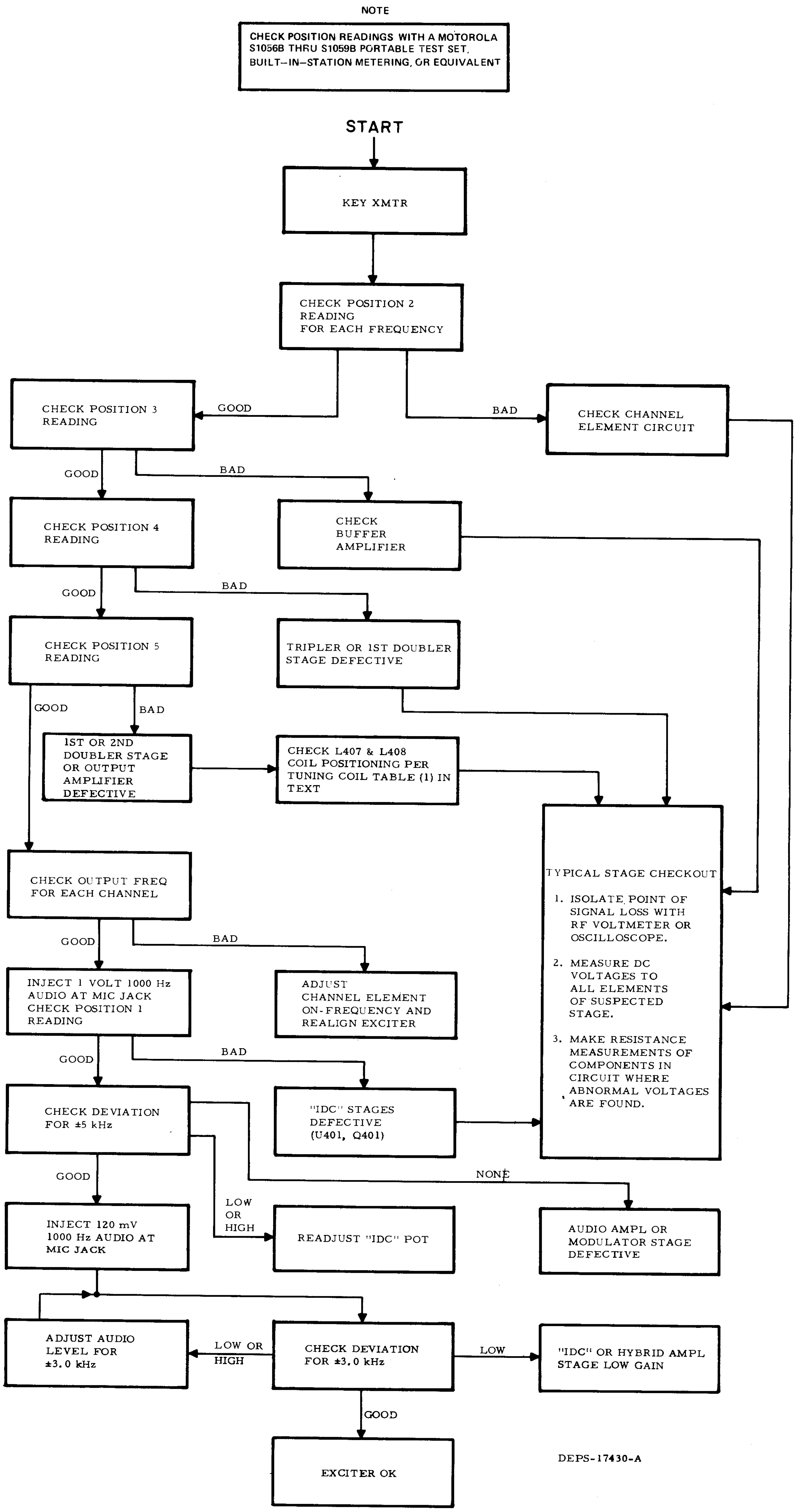
Step 3. Measure the transmitter carrier frequency output. On multi-frequency stations, repeat the test for each frequency.

Step 4. If adjustment is required, set the "warp" capacitor on the associated channel element for the assigned carrier frequency output. For best accuracy, the station should be brought to room temperature (+70° to 75°F) and the test equipment thoroughly warmed up. This brings the channel element to the center of its temperature compensation range. Once calibrated at this temperature, it can most accurately compensate for future temperature changes.

6.2.2.3 Deviation Specification and Test Procedure

The exciter output shall deviate ± 5 kHz with an audio input of 1 volt at 1000 Hz. In "Private-Line" stations, the exciter output shall deviate 0.5 to 1 kHz with "Private-Line" modulation applied.

Step 1. Terminate the transmitter output in an antenna and measure the radiated signal with a deviation meter.



EXCITER TROUBLESHOOTING CHART

Exciter Troubleshooting Chart
Motorola No. EEPS-17430-A
4/15/79- PHI

Step 2. In "Private-Line" stations, re-enable PL, which was disabled in the previous test. Key the transmitter with only "Private-Line" tone modulation. The deviation meter should indicate 0.5 to 1 kHz.

Step 3. Connect an audio oscillator output to pins 12 and 19 on the exciter board. Adjust the audio oscillator to 1000 Hz and 1 volt as measured on an ac voltmeter. The deviation meter should indicate ± 5 kHz deviation.

Step 4. Adjust the audio oscillator over the entire 300 to 3000 Hz range, keeping the audio level at approximately 1 volt. The deviation meter should never exceed ± 5 kHz, nor drop below ± 2.5 kHz.

6.2.2.4 Audio Sensitivity Specification and Test Procedure

An audio input of 120 mV at 1000 Hz shall produce approximately ± 3.0 kHz deviation.

Step 1. After completion of the deviation test, reduce the output of the audio oscillator to 120 mV at 1000 Hz.

Step 2. The deviation meter should indicate approximately ± 3.0 kHz. Meter reading 1 may be noted at this time for future reference. Future audio sensitivity checks may then be made by comparing the meter 1 reading with the noted value.

6.2.3 Troubleshooting

6.2.3.1 Check Input Voltages

If there are no meter indications at one or more of the metered points, check the dc input voltages to the exciter circuit board as given in Table 5.

Table 5. Exciter DC Input Voltages

P902-11 & 13	+ 9.6 volts with respect to chassis.
P902-6	Keyed A- (approximately -13.6 volts with respect to A+, pin 7) when keyed.

If meter indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

NOTE

In "Private-Line" stations, the transmitter cannot be keyed if the PL encoder is removed unless a jumper (JU401) is connected from pin 8 to pin 10 of the exciter to complete the keying circuit. This jumper is permanently connected in exciters for non-"Private-Line" operation.

6.2.3.2 Alignment as a Troubleshooting Technique

Low meter readings, low power output, and subnormal performance are very often corrected by realignment. Therefore, alignment should be the first troubleshooting step performed for these symptoms. Many technicians prefer to use alignment as the first troubleshooting step in all cases. During the alignment procedure, any trouble caused by a defective component will be discovered and corrected before alignment can be completed.

6.2.3.3 Isolating Defective Components

If meter readings are abnormal or tests indicated subnormal performance, a logical troubleshooting procedure is required to isolate the defective component efficiently. The meter readings and results of performance tests usually localize the malfunction to one or two specific stages. A zero meter reading indicates either (1) no drive from the preceding stages, or (2) a defective component in the metering circuit which includes the base-emitter junction of the following transistor which operates as a rectifier. The exciter troubleshooting chart summarizes these results in a logical sequence. A few voltage and resistance checks in the suspected circuit should readily isolate the defective component. Note that the final amplifier stage of the exciter is powered by A+ and keyed A-. Therefore, voltages should be checked with respect to keyed A- instead of chassis ground.

6.3 TRIPLER/LOW LEVEL AMPLIFIER MAINTENANCE

6.3.2 Tripler/Low Level Amplifier Removal and Reinstallation Procedure

NOTE

Field servicing of the tripler/low level amplifier should not be attempted. If the tripler/low level amplifier is defective, replace the entire unit. Removal and replacement is described following performance testing.

6.3.1 Performance Test

Step 1. Be sure the transmitter is not keyed. Turn the DRIVE LIMIT control fully counterclockwise (minimum drive limit).

Step 2. Check all PA transistors except for those in the controlled stage for proper collector operating voltages (+ 13.6 volts). The controlled stage collector voltage cannot be checked until later in this procedure.

Step 3. Turn the POWER SET control fully counterclockwise (minimum power output).

IMPORTANT
If the POWER SET control ONLY is used to reduce the rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

Step 4. Connect a UHF rated wattmeter to the transmitter output connector with an 8-inch or shorter length of coaxial cable. The wattmeter must be terminated in a 50-ohm, non-reactive, dummy load.

Step 5. Disconnect the transmitter output coax cable connector from the antenna network.

Step 6. Disconnect the rf connector from the output jack on the tripler/low level amplifier. Connect the tripler/low level amplifier output to the antenna network input using a short BNC-to-BNC adapter cable.

Step 7. Key the transmitter and check the tripler/low level amplifier output. The wattmeter reading should be at least 0.8 watt. If a minimum of 0.8 watt cannot be obtained, connect a short phono to BNC adapter cable between the tripler filter output port and the antenna network input connector. The wattmeter should read at least 0.08 watt.

Step 8. If the tripler/low level amplifier power output is low, check exciter meter position 5. With the REF A-B switch on the TEK-37A Test Set Adapter Cable set to B, the meter 5 reading should be at least 15 uA. If the meter 5 reading is low, the exciter is defective. If the meter 5 reading is 15 uA or greater, the tripler/low-level amplifier is bad. Also check all rf cable connectors and the bandpass filters.

6.3.2 Tripler/Low Level Amplifier Removal and Reinstallation Procedure

NOTE
All steps are performed from the front of the station.

6.3.2.1 All Models Except 2 & 12-Watt Models

Step 1. Disconnect the coaxial cables interconnecting the power amplifier to the LOW LEVEL AMP OUT and ANT NETWORK IN connectors on the unichassis.

Step 2. Loosen the three captivated shield cover screws and remove the shield cover.

Step 3. Loosen the captivated screw that holds the LOW LEVEL OUTPUT receptacle bracket and remove the receptacle from its mounting bracket.

Step 4. To reinstall the tripler/low level amplifier, reverse the procedure given in Steps 1-3.

6.3.2.2 2 & 12-Watt Models Only

Step 1. Loosen the two captivated power amplifier assembly screws on the PA heat sink.

Step 2. Pivot and lift the PA assembly up and off the pivot bushing and simultaneously disconnect the following connectors:

- -- power plug from 12 W PA receptacle on transmitter interconnect board.
- -- tripler plug from low level amplifier output receptacle on tripler/low level amplifier.
- -- PA output plug from antenna network.

The PA assembly is now completely disconnected from the unified chassis and can be placed to one side.

Step 3. Loosen the three captivated screws used to mount the 12-watt PA mounting bracket and remove the bracket.

Step 4. Disconnect the plug connected to TRPLR receptacle on the transmitter interconnect board.

Step 5. Loosen the four captivated screws that hold the tripler/low level amplifier in place.

Step 6. Carefully pull out the tripler/low level amplifier part way out and then disconnect the plug connected to the output of the first bandpass filter. The tripler/low level amplifier is now completely disconnected.

Step 7. To reinstall the tripler/low level amplifier, reverse the procedure given in Steps 1 to 6.

6.4 POWER AMPLIFIER MAINTENANCE

CAUTION
The power amplifier stages must be installed in the station for testing to provide the necessary power, ground, control, heat sinking and signal connections.

6.4.1 Performance Test

The only performance test needed for the power amplifier section of the transmitter is measurement of the rf power output at the transmitter output connector. Before performing the following test, be sure the exciter and tripler/low level amplifier are operating properly.

Step 1. Connect a UHF rated wattmeter to the transmitter output connector, using an 8-inch or shorter length of coaxial cable. The wattmeter must be terminated in a 50-ohm, non-reactive, dummy load.

Step 2. Key the transmitter and observe the power output reading on the wattmeter.

Step 3. If necessary, adjust the POWER SET control on the power control board until rated transmitter power output is obtained. If rated power output cannot be obtained, remove the shield from the power control board and set the DRIVE LIMIT control fully counterclockwise. Replace the power control board shield, key the transmitter, and again adjust the POWER SET control for rated transmitter power output.

IMPORTANT

If the POWER SET control ONLY is used to reduce the rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

Step 4. If it was necessary to change the DRIVE LIMIT control setting to obtain rated transmitter output power, refer to the TRANSMITTER ALIGNMENT section of this manual for the DRIVE LIMIT control adjustment procedure.

Step 5. If the performance test indicates that the power amplifier section of the radio set is not functioning properly, proceed with the following troubleshooting.

6.4.2 Troubleshooting

If a transmitter malfunction has been isolated to the power amplifier circuits, the cause of the malfunction can be found by using the following procedures. Visual checks and operating voltage checks should be made before more extensive troubleshooting is begun.

6.4.2.1 Visual Check

Step 1. Visually check for obvious physical defects, such as broken leads, broken or cracked microstrip substrates and broken or disconnected components. These defects should be corrected immediately. Then recheck the power amplifier performance. If the power amplifier fails the performance test, make voltage checks next.

Step 2. If the visual inspection reveals overheated components, do not replace the overheated parts until the cause of the overheating has been found and corrected. Otherwise, the new part may be damaged.

6.4.2.2 Voltage Check

Check for A+ and A- at the feedthrough connections and for proper voltages at the collectors of each transistor. Certain defects such as cracked microstrips, intermittent leads, etc., may not be obvious to a visual inspection.

NOTE

Cracked microstrips can often be found by sliding the tip of a modeling knife blade or some other sharp object along the surface of the ceramic substrate. Usually, a noticeable "bump" will be felt as the sharp object passes over the crack in the microstrip.

6.4.2.3 Isolating Defective Components

If visual and voltage checks do not reveal the cause of subnormal power amplifier performance, refer to the power amplifier troubleshooting chart, the interstage testing procedure, and the driver and final amplifier testing procedure. These sections provide systematic troubleshooting methods to help isolate the defective power amplifier stage and component.

6.4.3 Interstage Testing Procedure

During the troubleshooting procedure it is sometimes desirable to determine the power output of an individual transmitter stage with a given input level. The following procedure can be used to supplement a procedure using the meter readings given on the power amplifier troubleshooting chart.

If this procedure shows that a PA stage is malfunctioning and must be repaired, refer to the "Power Amplifier Repair Procedure" paragraph of this section.

NOTE

Due to the voltage requirements of NPN transistors, all "rf ground" plating is at A-. Therefore, caution should be used to prevent connection of "ground" plating on the power amplifier to chassis ground, either directly or by the use of test equipment ground leads. If ac powered test equipment is used, the ground lead must not be electrically connected to ac line ground.

CAUTION

DO NOT "SHORT CUT" THE FOLLOWING PROCEDURE. This procedure is designed to avoid situations in which excessive drive might be applied to the predriver or driver stages. Excessive drive could destroy the predriver or driver stages. It is possible to safely begin stage gain measurements at a stage with a *lower* power level than the predriver, if metering indicates that one of the lower power level stages is not operating properly. UNDER NO CIRCUMSTANCES, however, should attempts be made to "short-cut" the following procedure by checking the driver or final PA stage without first checking the output of the predriver stage.

Step 1. Be sure the transmitter is not keyed. Turn the DRIVE LIMIT control fully counterclockwise (minimum drive limit).

Step 2. Check all PA transistors, except for those in the controlled stage, for proper collector operating voltage (+13.6 volts). The controlled stage collector voltage cannot be checked until later in this procedure.

Step 3. Turn the POWER SET control fully counterclockwise (minimum power output).

IMPORTANT

If the POWER SET control ONLY is used to reduce the rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

Step 4. Connect a UHF rated rf wattmeter to the transmitter output connector with an 8 inch or shorter length of coaxial cable. The wattmeter must be terminated in a 50-ohm, non-reactive, dummy load.

Step 5. 2-W models -- bypass the antenna network built-in attenuator, as described in "Attenuator Bypassing (2-watt models only)" paragraph of the antenna network maintenance portion of this section, then proceed to Step 7a.

12-W models -- proceed to Step 7a.

20-, 40-, and 45 W models -- disconnect the predriver output from the final amplifier and proceed to Step 6.

60- and 75-W models -- disconnect the predriver output from the driver input stage and proceed to Step 6.

Step 6. Using an adapter cable, connect the predriver output to the antenna network. The shield of the adapter cable should be soldered to the microstrip ground plating as close as possible to the point where the cable center conductor is soldered. Use a 50-watt soldering iron and silver solder (1.4% silver, 36.1% lead, 62.5% tin), as recommended in the "Power Amplifier Repair Procedures" paragraph of this section. NEVER operate a PA stage without a proper 50-ohm termination.

NOTE

If the proper adapter cable is not available, the output of the predriver stage can be connected to the wattmeter with a short (less than 8") coaxial cable. Be sure the wattmeter is rated for use at UHF and is terminated in a 50-ohm, non-reactive, dummy load that is also rated for UHF. Home-made dummy loads or radiating antennas are not adequate for these tests.

If the predriver output is connected directly to the wattmeter, the accuracy of the measurement will be affected. Remember that since the antenna network is not connected between the output stage and the wattmeter, the wattmeter readings will be about 15% greater than those listed in Table 6 of this procedure.

Step 7. Defeat the "No Power" Protect circuit on the power control board as follows:

CAUTION

It is assumed that at this point in the procedure the interstage coupling to the transmitter final amplifier section has been disconnected to measure the power output of one of the earlier PA stages. In that case the following procedure is safe. IN NO CASE SHOULD THIS PROCEDURE BE USED WHEN DRIVE IS APPLIED TO THE TRANSMITTER FINAL AMPLIFIER STAGES.

Step 7a. Disconnect ac power from the station.

Step 7b. Remove the shield from over the power control board.

Step 7c. Refer to the power control board schematic diagram and circuit board detail. Locate capacitor C611.

Step 7d. Short the leads of C611 together, using a short piece of jumper wire soldered to the plating side of the circuit board. Be careful to avoid shorting any other plating.

Step 7e. Reconnect power to the station and proceed with the troubleshooting procedure.

Step 8. Key the transmitter. Slowly increase the predriver power output by turning the POWER SET control clockwise while watching the wattmeter. Set the predriver power output to the level specified in Table 6 of this procedure. If the proper predriver power output setting can be obtained, go directly to Step 3 of the "Driver and Final Amplifier Testing Procedure" paragraph of this section.

Step 9. If the proper predriver power output settings cannot be obtained; perform the following:

2 & 12 W models only-- Using an adapter cable, connect the controlled stage output to the antenna network (soldering techniques and requirements as described in Step 6).

All models except 2 & 12 W models -- Disconnect the test cable from the predriver output and connect it tó the controlled stage output.

Table 6. PA Stage Power Output for Interstage Troubleshooting (Minimum Values)

MODEL	POWER OUTPUT (NOTE 1) TRIPLER/ LOW LEVEL AMPL	CONTROLLED STAGE	PRE-DRIVER	DRIVER	FINAL AMPL
406-420 MHz					
B/C34		4W	16W	NOT USED	NOT USED
B/C54		4 W	16 W	NOT USED	50 W
B/C64	(NOTE 2)	4 W	16 W	40 W	80 W
450-470 MHz					
C24		4 W	16 W	NOT USED	NOT USED
B/C34		4 W	16 W	NOT USED	NOT USED
B/C44		4 W	16 W	NOT USED	27 W
B/C54		4 W	16 W	NOT USED	50 W
B/C64	(NOTE 2)	4 W	16 W	26 W	80 W
470-512 MHz					
B/C34		4 W	15 W	NOT USED	NOT USED
B/C44		4 W	15 W	NOT USED	24 W
B/C54		4 W	15 W	NOT USED	45 W
B/C64	(NOTE 2)	4 W	15 W	24 W	65 W

Note 1: These power levels take into account a 20% loss in the Antenna Network.
Note 2: Exciter meter 5 reading must be at least 20 uA. Tripler/low level amplifier should have an output of 1 watt.

Step 10. Key the transmitter and check the controlled stage output power reading on the wattmeter. If the controlled stage output power is at least the value given in Table 6, the predriver stage is defective.

Step 11. If the controlled stage power output is low, check the controlled stage transistor collector voltage with the POWER SET control set fully clockwise. If the drive level from the power control board is OK, the controlled stage transistor collector voltage will be within one volt of the dc supply voltage.

Step 12. If the controlled stage transistor voltage is normal, but the stage power output is low, the controlled stage is defective. It is assumed that the tripler/low level amplifier tests made earlier in the transmitter maintenance procedure have shown that the tripler/low level amplifier is operating properly.

Step 13. After all malfunctions have been discovered and corrected, and proper predriver power output is obtained, disconnect the test coaxial cable and make sure all rf interstage connections are restored.

Step 14. Re-enable the "No Power" Protect circuit on the power control board by removing the jumper that was connected across C611, earlier in this procedure. Be sure none of the power control board plating is shorted. Reinstall the power control board shield.

Step 15. Reconnect the transmitter output coax to the antenna network. Make sure a properly terminated wattmeter is connected to the transmitter output connector. The coaxial cable between the station and the wattmeter should be 8" or less in length.

Step 16. Key the transmitter. If adjusting the POWER SET control allows rated power to be obtained, do a complete POWER SET and DRIVE LIMIT control adjustment procedure. Refer to the TRANSMITTER ALIGNMENT section of this manual. If rated power output cannot be obtained, proceed to the "Drive and Final Amplifier Testing Procedure" paragraph of this section.

6.4.4 Driver and Final Amplifier Testing Procedure

It is assumed that before beginning the following procedure, it has been determined that the predriver, controlled stage, tripler/low level amplifier, and exciter are operating properly.

The driver and final amplifier stages may have one, two, or four transistors. These differing configurations require slightly different troubleshooting techniques. The procedure is therefore broken up according to the number of transistors used in the stage.

6.4.4.1 All Driver and Final Amplifier Stages

Step 1. Connect wattmeter to the transmitter output connector, using an 8-inch or shorter length of coaxial cable. Be sure the wattmeter is terminated in a 50-ohm, non-reactive, dummy load.

Step 2. Disconnect the predriver output connection from the following stage. Connect the predriver output to the input of the antenna network, using an adapter cable.

Step 3. Connect a Motorola test set to the Power Amplifier metering socket.

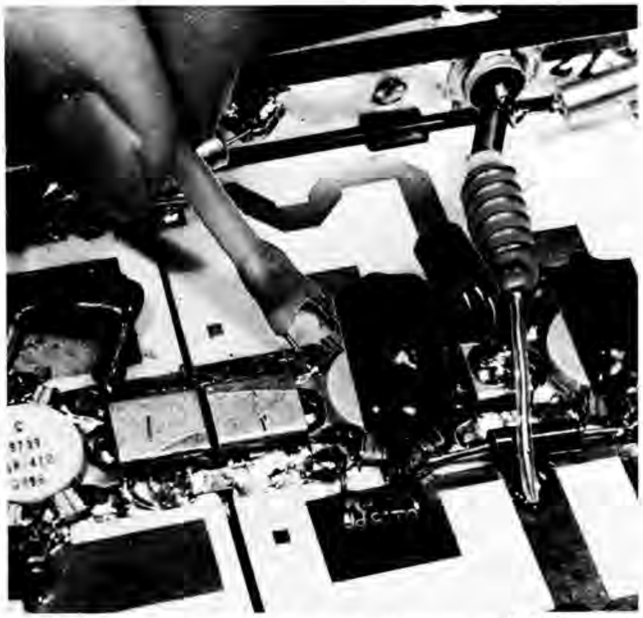


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Figure 1. Capacitor Bridging Method of Testing PA Transistors

Step 4. Key the transmitter. Adjust the POWER SET control on the power control board until the exact predriver output level listed in Table 6 is obtained. Observe the test set meter 5 reading. *Write down the reading for reference later in this procedure.* Turn the POWER SET control fully counterclockwise.

Step 5. Disconnect the adapter cable from the predriver output and reconnect the predriver output to the driver or PA input.

6.4.4.2 Single-Transistor Stages

Step 1. 20-watt power amplifier -- Connect the final amplifier output coaxial cable to the antenna network input.

60- and 75-watt PA drivers -- Disconnect the driver output from the final amplifier input. Connect the driver output to the antenna network input, using an adapter cable.

Step 2. Key the transmitter and adjust the POWER SET control for the same meter 5 reading recorded in Step 4, and observe the wattmeter. Compare the wattmeter reading with the value given in Table 6. If the stage power output is significantly less than the value given in Table 6, the stage is defective.

6.4.4.3 Two-Transistor Stages

Step 1. 40- and 45-watt power amplifiers -- Connect the final amplifier output cable to the antenna network input.

60- and 75-watt PA drivers -- Disconnect the driver output from the final amplifier input. Connect the driver output to the antenna network input, using an adapter cable.

Step 2. Key the transmitter, adjust the POWER SET control for the same meter 5 reading recorded in Step 4, and observe the wattmeter. Compare the wattmeter reading with the value given in Table 6. If the stage output is greater than 25% of the value given in Table 6, it is likely that both transistors are bad. If the stage output is greater than 25% of the value in Table 6, but still below rated power, it is probable that only one of the transistors is defective. The following procedure is a quick way to determine which transistor is bad: (Refer to Figure 1).

-- Trim the leads of a 10 pF, NPO, disc ceramic capacitor to within 1/4-inch of the capacitor body. As shown in Figure 1, a length of shrinkable tubing over the capacitor body will make handling easier.

-- One at a time, bridge each transistor base-emitter junction with the 10 pF capacitor, while the transmitter is keyed. If the transistor is good, the power output of the stage will drop significantly (greater than 20%). If the transistor is bad, the stage power output will drop only slightly.

6.4.4.4 Four-Transistor Stages

Step 1. 60- and 75-watt final amplifiers -- Be sure the final amplifier output coaxial cable is connected to the antenna network input.

Step 2. Key the transmitter, adjust the POWER SET control for the same meter 5 reading previously recorded in Step 4, and observe the wattmeter. Compare the wattmeter reading with the value given in Table 6. If the wattmeter reading is significantly below the value in Table 6, it is probable that one or more of the transistors is bad.

Step 3. To isolate the defective pair of transistors, alternately disconnect the chokes from each pair, key the transmitter, and observe the wattmeter. Disconnecting each choke should produce the same decrease in transmitter power output. The defective pair is the one that causes the least power output change, when it is disabled.

Step 4. After the pair that contains the defective transistor is identified, use the capacitor bridging method to determine which transistor of the pair is bad. The capacitor bridging technique is explained in the previous two-transistor stage testing section of this procedure.

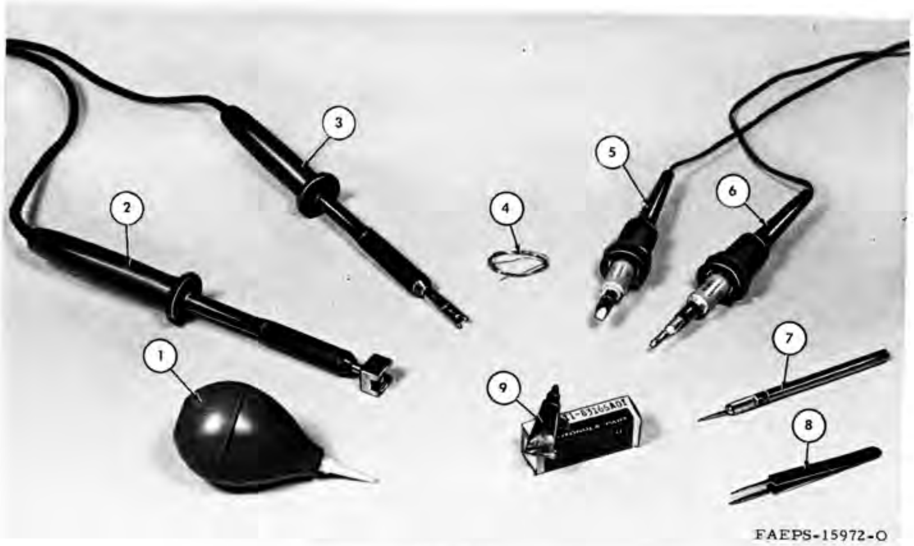


Figure 2.
Recommended Tools for Power Amplifier Repairs

6.4.5 Power Amplifier Repair Procedure

6.4.5.1 Recommended Tools for PA Servicing

Because of the unique power amplifier construction, it is recommended that the tools listed in Table 7 and shown in Figure 2 be used during the repair procedures in this section. Except for the silver solder (item 4) and the Wakefield thermal compound (item 9), which are supplied with replacement transistors, use of these tools is not mandatory. However, use of these tools will make quaility power amplifier repairs easier to perform.

The soldering iron tips listed in Table 8 and shown in Figure 3 are designed to make transistor removal, and chip capacitor removal and replacement easier.

Table 7. Recommended PA Servicing Tool

ITEM NUMBER	DESCRIPTION	MOTOROLA PART NUMBER
1	Solder remover	ST726
2	60-watt soldering iron	ST-1144
	Special tip for PA transistor removal	ST-1161
3	60-watt soldering iron	ST-1144
	Special tip for chip capacitor soldering	ST-1160
4	Silver solder; alloy content 1.4% silver, 36.1% lead, 62.5% tin	10-10041A61
5	50-watt soldering iron	ST-646
	1/4" chisel tip	ST-1174
6	50-watt soldering iron with 1/8" chisel tip	ST-648
7	Modeling knife	ST-1172
	5 extra modeling knife blades	ST-1173
8	Tweezers	ST-492
9	Wakefield thermal compound	11-83166A01

Figure 3.
Special Soldering Iron Tips for PA Servicing

Table 8. Special Soldering Iron Tips

ITEM NUMBER	MOTOROLA PART NO.	APPLICATION
1	ST-1160	Chip capacitor removal and replacement
2	ST-1161	PA transistor removal

6.4.5.2 Visual Inspection

After the malfunctioning stage has been identified, perform a thorough physical inspection before beginning repairs.

Check the ceramic substrate for hairline cracks. Hairline cracks can often be found by running a sharp instrument along the ceramic beside the microstrip conductors. Check in BOTH directions. A crack will usually "catch" the instrument, even when the crack is too small to be seen. Broken microstrip conductors can also be found through ohmmeter continuity checks.

Look for "leached" chip capacitors. Figure 4 shows examples of typical leaching of chip capacitor end metallization. Leaching is most often evidenced by failure of the chip capacitor end metallization to take solder. In severe cases the stacked plates inside the capacitor may be visible.

Figure 4.
Examples of Leached Chip Capacitors

If no defects are found, proceed with repairs to the defective stage.

6.4.5.3 Power Amplifier Transistor Removal

Step 1. As shown in Figure 5, unsolder all component connections at or near the points where the rf power transistor leads are soldered to the microstrip.

Step 2. Chip capacitors are connected between rf power transistor leads. Remove all four chip capacitors, using two soldering irons, as shown in Figure 6A, or the special soldering iron tip (Motorola Part No. ST-1160), as shown in Figure 6B.

CAUTION

Chip capacitors must not be re-used. Excessive heat applied during capacitor removal can cause leaching of the metallic contact area.

Step 3. Remove the two ground straps that cover the transistor mounting screws. See Figure 7.

Step 4. Remove excess solder from the transistor lead area with a vacuum bulb solder remover.

Step 5. Carefully lift each of the four rf power transistor emitter leads. Use a modeling knife blade or long-nosed pliers to lift each emitter lead while applying heat, as shown in Figure 8. Be sure the solder has melted before attempting to lift the lead, but avoid prolonged or excessive heating.

Step 6. Remove the transistor mounting screws.

Step 7. Alternately lift the base and the collector leads. Use a modeling knife blade or long-nosed pliers to lift a lead while applying heat, as shown in Figure 9. Be sure the solder has melted before you attempt to lift a lead, but avoid prolonged or excessive heating. All six power transistor leads can be desoldered simultaneously using a Motorola ST-1161 soldering iron tip on a 60- watt iron. See Figure 10. Grasp a transistor mouting lug with long-nosed pliers as shown, and as soon as the solder melts, remove the soldering iron and lift the transistor out.

NOTE

The ST-1161 soldering iron tip *should not* be used to install transistors.

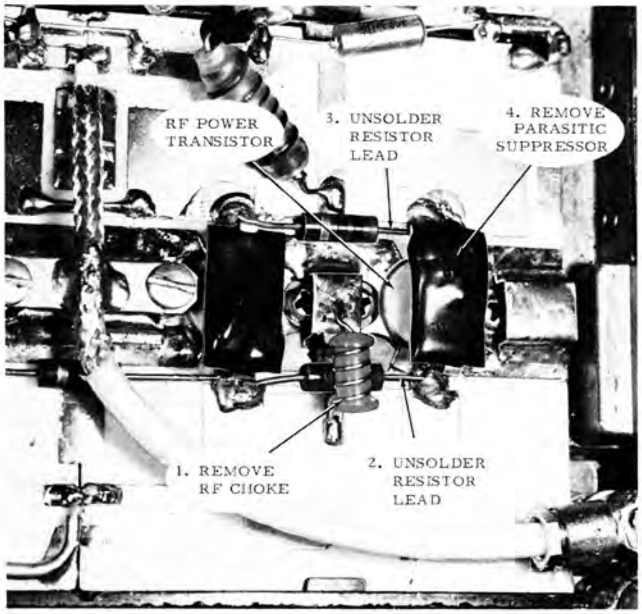
6.4.5.4 Power Transistor Replacement Procedure

Step 1. *Lightly* pre-tin the underside of each transistor lead. See Figure 11.

CAUTION

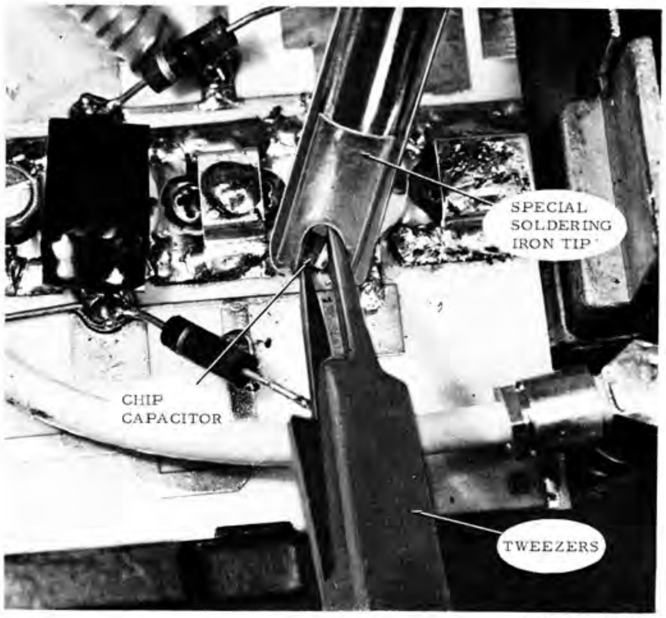
When pre-tinning the transistor leads do not allow thick build-ups of solder to occur. Such a build-up could cause the transistor to separate from its mounting base when the mounting screws are tightened. Avoid getting solder or flux on the transistor mounting base.

Step 2. Thoroughly clean the transistor mounting surface, using alcohol or another solvent that leaves no residue. Apply a light coat of Wakefield Thermal Compound (Motorola Part No. 11-83166A01) to the mounting surface (bottom side of the transistor). See Figure 12.



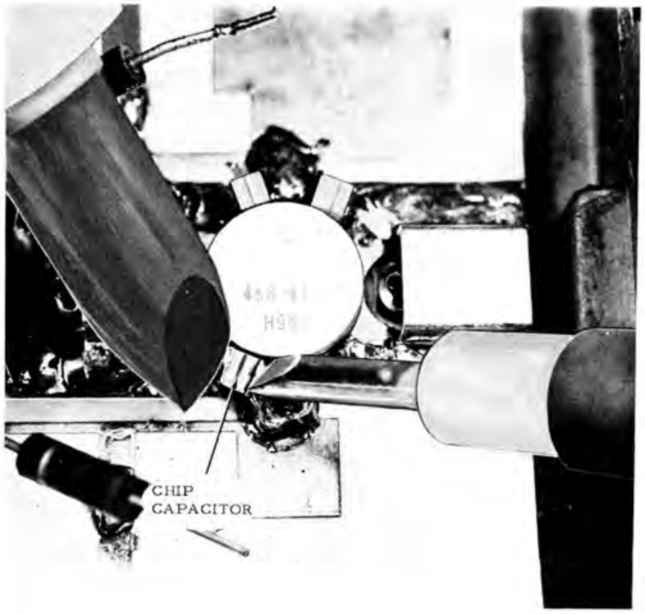
FAEPS-15967-O

Figure 5.
Component Removal Procedure (Typical)



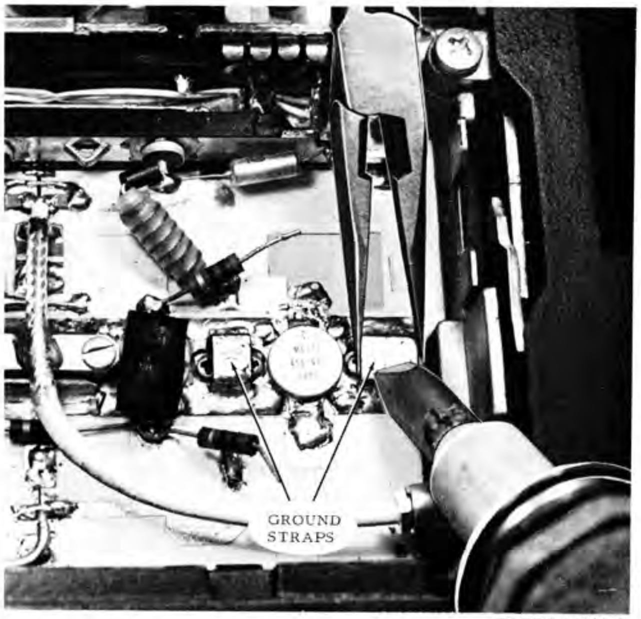
FAEPS-15966-O

Figure 6B.
Chip Capacitor Removal Using ST-1160 Soldering Iron Tip



FAEPS-15965-A

Figure 6A.
Chip Capacitor Removal Using Two Soldering Irons



FAEPS-15963-O

Figure 7.
Ground Strap Removal

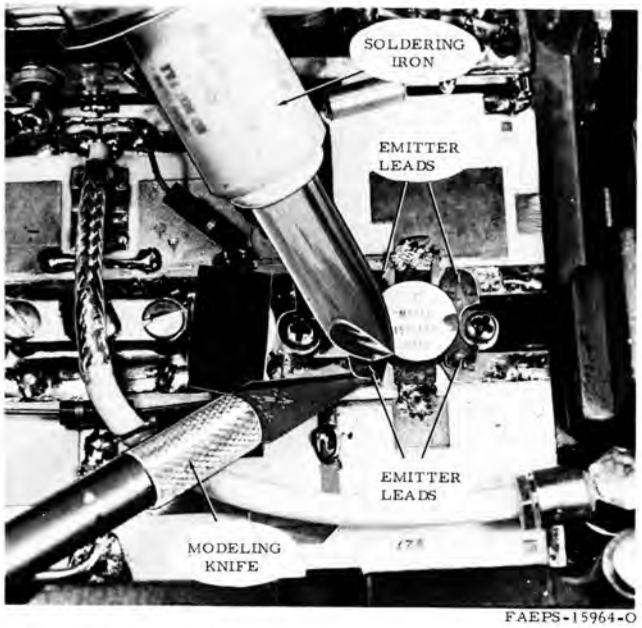


Figure 8.
Disconnecting Power Transistor Emitter Leads

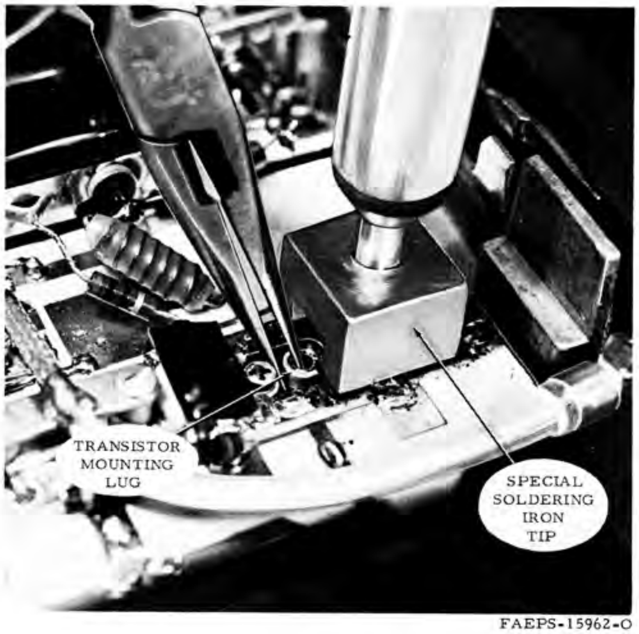


Figure 10.
Power Transistor Removal,
Using ST-1161 Soldering Iron Tip

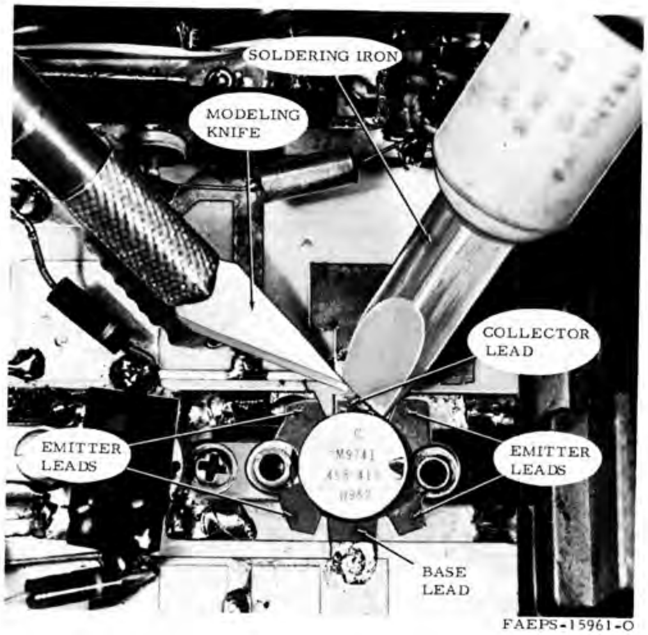


Figure 9.
Disconnecting the Power Transistor
Base and Collector Leads

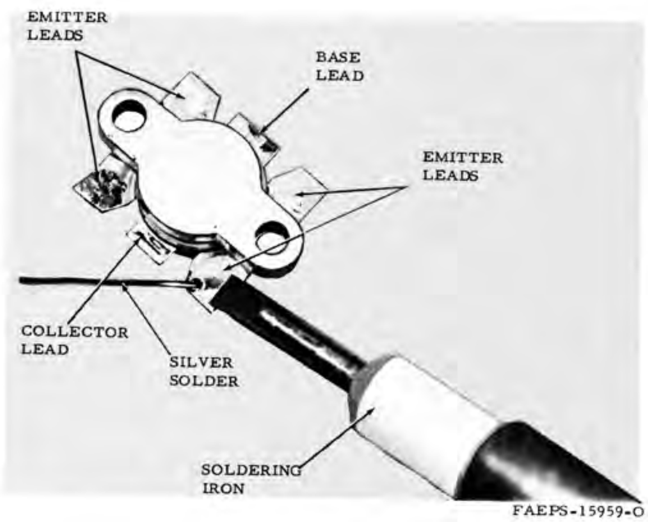


Figure 11. Pre-Tinning Power Transistor Leads

CAUTION

Thick coatings of thermal compound or foreign material on the transistor mounting surface will cause poor thermal contact and may result in early transistor failure.

Step 3. Mount the transistor. Be sure the collector lead, marked "C" on the transistor cap faces the proper direction. Refer to Figure 13. Refer to the Microstrip Location Diagram and Cross-Reference Table in the Power Amplifier Introduction section of this manual for the part numbers of the microstrip circuits according to location for various radio models.

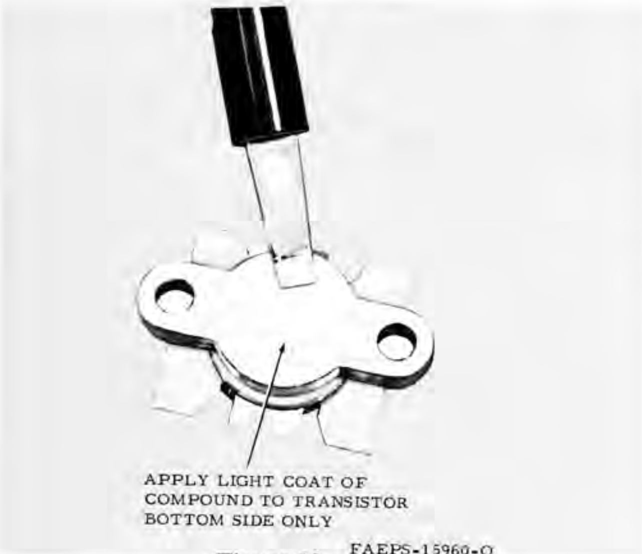
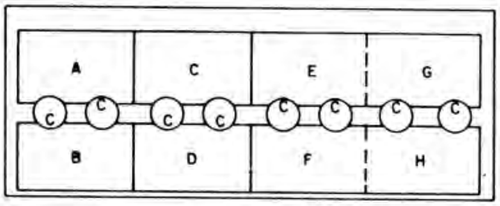


Figure 12.
Application of Wakefield Thermal Compound to Transistor Mounting Surface



NOTE:
"C" ON TRANSISTOR CAPS INDICATES PLACEMENT OF COLLECTOR LEAD.

Figure 13.
Power Transistor Placement Detail

Step 4. Carefully tighten the transistor mounting screws. Figure 14 shows proper transistor positioning before the leads are soldered to the microstrip.

CAUTION
To avoid damage to the transistor or the microstrip, the transistor mounting screws MUST be tightened before the transistor leads are soldered to the microstrip conductors. Do *not* tighten mounting screws too much or thread stripping in the heatsink will result.

Step 5. Solder each transistor lead, one at a time, to the microstrip. Use the silver solder (Motorola Part No. 10-10041A61) supplied with the replacement transistors. The use of a generous amount of the solder will insure a good contact over the entire area of the transistor tab and microstrip interface, and will assist in the reflow soldering of the chip capacitors. Use care that the solder does not bridge the leads or short either the base or collector leads to the microstrip ground. See Figure 15.

Step 6. Install the new chip capacitors supplied with the power transistor. Use a low-wattage soldering iron (50 watts or less) with a chisel tip (Figure 16A) or a 60 watt iron with a ST-1160 tip (Figure 16B). A reflow-type technique MUST be used and the soldering iron tip MUST NOT be allowed to touch the chip capacitor end termination. Make sure the chip capacitor is placed as close to the transistor cap as possible, as shown in Figures 16A and 16B.

CAUTION
Proper soldering technique and chip capacitor placement are essential to acceptable transmitter operation. Use extreme care when replacing chip capacitors.

Step 7. Check the chip capacitor solder connections. The solder should cover the entire capacitor end termination. If the solder adheres to only the lower portion of the end termination, as illustrated in Figures 17A and 17B, assume that the capacitor end termination metallization is leached. The capacitor must be replaced if the radio transmitter is to function properly. Remember that the leaching is probably the result of allowing the soldering iron to touch the chip capacitor end termination.

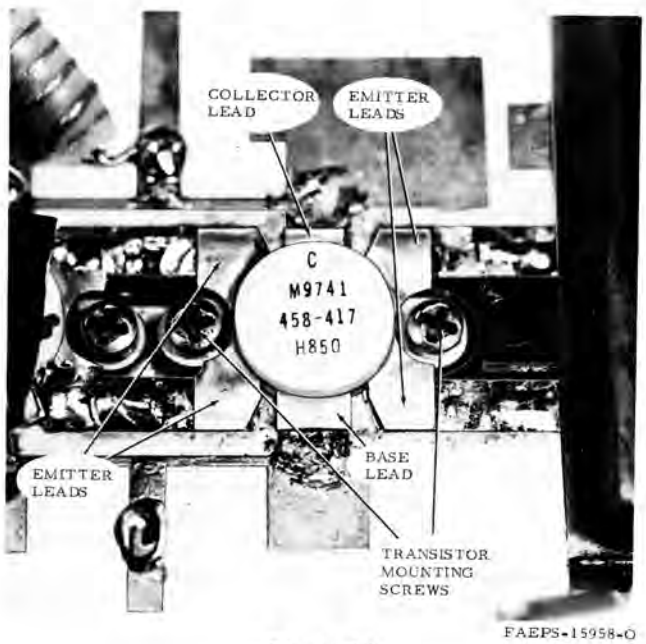


Figure 14.
Power Transistor Placement

6.4.5.5 Microstrip Removal and Replacement

Refer to the Power Amplifier section of this manual for location information for the eight possible microstrip boards. Each board is keyed with a letter identification. The letter is cross-referenced in a table to determine the microstrip board part number used for the various models of the radio.

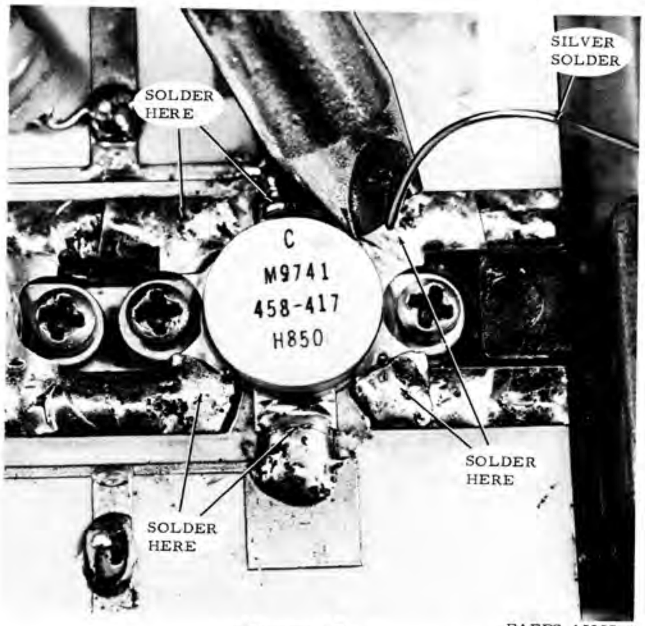


Figure 15.
Soldering Power Transistor Leads to the Microstrip

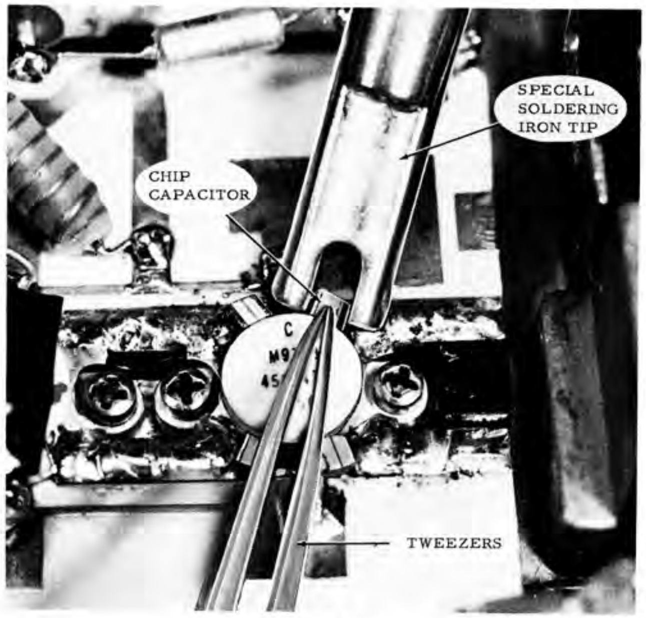


Figure 16B.
Chip Capacitor Installation, Using a 60-Watt Soldering Iron with ST-1160 Tip

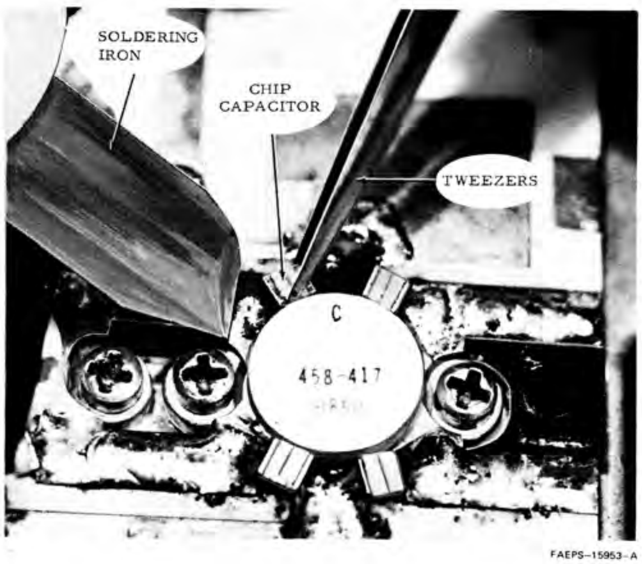


Figure 16A.
Chip Capacitor Installation, Using a 50-Watt Soldering Iron with a Chisel Tip

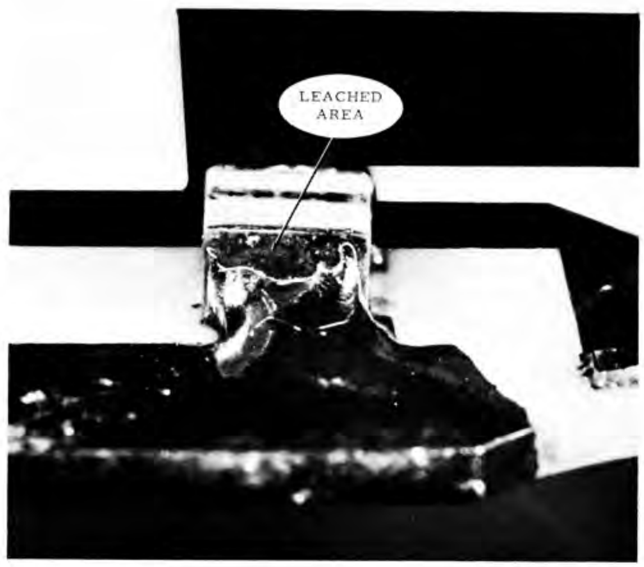


Figure 17A.
Appearance of Leached Chip Capacitor on Microstrip

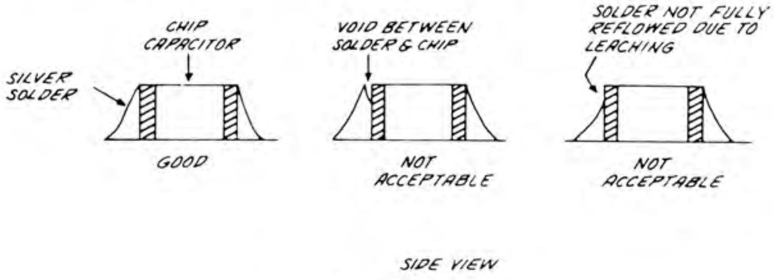


Figure 17B.
Chip Capacitor Soldering

TROUBLESHOOTING PREREQUISITES:

1. CONNECT THE RADIO ANTENNA CONNECTOR TO A WATTMETER THAT IS TERMINATED IN A 50-WATT DUMMY LOAD. BE SURE THE WATTMETER AND DUMMY LOAD ARE RATED FOR UHF USE.
2. USING A TEK-37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET TO THE RADIO AS FOLLOWS:
   A. CONNECT THE 20-PIN CONNECTOR OF THE ADAPTER CABLE TO THE RECEPTACLE ON THE FRONT OF THE PORTABLE TEST SET.
   B. CONNECT THE ADAPTER CABLE RED "CONTROL" PLUG TO THE CONTROL RECEPTACLE (J3) ON THE UNIFIED CHASSIS INTERCONNECT BOARD.
   C. CONNECT THE ADAPTER CABLE WHITE "METERING" PLUG TO THE PA METERING RECEPTACLE.
3. SET THE PORTABLE TEST SET SWITCHES AS FOLLOWS:
   A. SET THE FUNCTION SWITCH TO THE XMTR POSITION.
   B. SET THE METER SWITCH TO THE OFF POSITION.
   C. SET THE ADAPTER CABLE REF SWITCH TO POSITION A.
   D. SET THE ADAPTER CABLE 1 V-100 mV SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SUCH SWITCH, THE UNIT OPERATES AT 100 mV AT ALL TIMES.
   E. SET THE TEST SET SELECTOR SWITCH AS REQUIRED BY THE PROCEDURE.
4. USING BUILT-IN STATION METERING, CONNECT THE "CONTROL" PLUG TO THE CONTROL RECEPTACLE (J3) ON THE UNIFIED CHASSIS INTERCONNECT BOARD. ALSO, CONNECT THE METERING PLUG TO THE PA METERING RECEPTACLE.
5. REMOVE THE POWER CONTROL BOARD SHIELD AND TURN THE DRIVE LIMIT CONTROL TO MINIMUM (FULLY COUNTERCLOCKWISE).
6. BE SURE ALL AC-OPERATED TEST EQUIPMENT IS ISOLATED FROM AC LINE GROUND.
7. EACH TIME THE POWER SET CONTROL IS ADJUSTED, THE TRANSMITTER MUST BE DE-KEYED AND AGAIN KEYED SO THAT THE POWER CONTROL BOARD COMES OUT OF THE "SHUTBACK" CONDITION.

PA TROUBLESHOOTING CHART

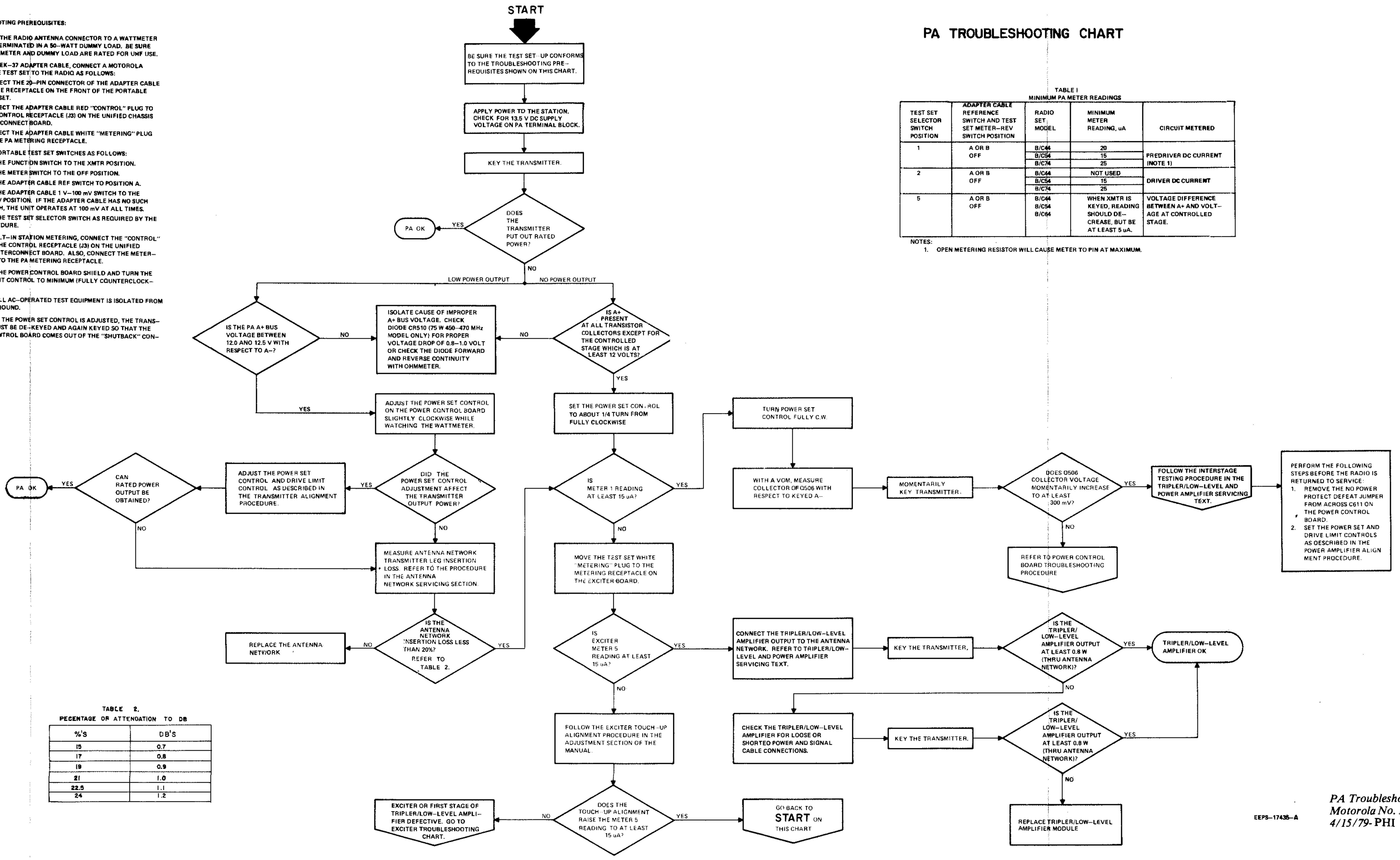


TABLE I
MINIMUM PA METER READINGS

TEST SET SELECTOR SWITCH POSITION	ADAPTER CABLE REFERENCE SWITCH AND TEST SET METER-REV SWITCH POSITION	RADIO SET MODEL	MINIMUM METER READING, uA	CIRCUIT METERED
1	A OR B OFF	B/C44	20	PREDRIVER DC CURRENT (NOTE 1)
		B/C54	15	
		B/C74	25	
2	A OR B OFF	B/C44	NOT USED	DRIVER DC CURRENT
		B/C54	15	
		B/C74	25	
5	A OR B OFF	B/C44 B/C54 B/C64	WHEN XMTR IS KEYED, READING SHOULD DECREASE, BUT BE AT LEAST 5 uA.	VOLTAGE DIFFERENCE BETWEEN A+ AND VOLTAGE AT CONTROLLED STAGE.

NOTES:
1. OPEN METERING RESISTOR WILL CAUSE METER TO PIN AT MAXIMUM.

TABLE 2.
PECENTAGE OF ATTENUATION TO DB

%'S	DB'S
15	0.7
17	0.8
19	0.9
21	1.0
22.5	1.1
24	1.2

EEPS-17435-A

PA Troubleshooting Chart
Motorola No. EEPS-17435-A
4/15/79- PHI

NOTES:

1. THE FIRST READING IS FOR THE 450–470 MHz BAND AND THE SECOND IS FOR 406–420 AND 470–512 MHz BAND.
2. THE POWER AMPLIFIER IS USED AS THE DRIVER AMPLIFIER WITH THE B84RCB MODEL SERIES.

POWER CONTROL BOARD METER READINGS

			READINGS	
SELECTOR SWITCH POSITION	REFERENCE AND METER SWITCH POSITIONS	CIRCUIT METERED	ALL MODELS EXCEPT B84RCB	B84RCB MODELS (NOTE 2)
1	A–REV	FORWARD POWER	SEE CALIBRATION LABEL	5–25 UA
2	A–OFF	REFLECTED POWER	MAXIMUM READINGS (WITH NORMAL REFLECTED POWER) 12–15 UA (C24 & B/C34) 14–17 UA (B/C44) 16–19 UA (B/C54) 18–22 UA (B/C64)	3–17 UA
3	B–OFF	CONTROL VOLTAGE	RANGE 30/25 UA NOTE 1	0–30 UA
5	B–REV	2/12 W PA CURRENT (USED IN 2 & 12 W STATIONS ONLY)	25/27 UA NOTE 1	FINAL DRIVER AMPLIFIER CURRENT (RANGE I ONLY) 27 UA TYPICAL

TROUBLESHOOTING PREREQUISITES

1. CONNECT THE RADIO ANTENNA CONNECTOR TO AN RF WATTMETER THAT IS TERMINATED IN A 50–OHM RESISTIVE DUMMY LOAD. BE SURE THE WATTMETER AND DUMMY LOAD ARE RATED FOR UHF USE.
2. THE POWER CONTROL BOARD MUST BE INSTALLED IN A COMPLETE RADIO FOR TESTING. TO PROVIDE THE NECESSARY POWER, GROUND, AND CONTROL CONNECTIONS. BE SURE THE CIRCUIT BOARD MOUNTING SCREWS ARE SECURE AND THAT ALL CONNECTIONS TO THE CIRCUIT BOARD ARE PROPERLY MADE.
3. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET TO THE RADIO AS FOLLOWS:
   A. CONNECT THE 20–PIN CONNECTOR OF THE ADAPTER CABLE TO THE RECEPTACLE ON THE FRONT OF THE TEST SET.
   B. CONNECT THE ADAPTER CABLE RED "CONTROL" PLUG TO THE RECEPTACLE ON THE CONTROL (INTERCONNECT) BOARD.
   C. CONNECT THE ADAPTER CABLE WHITE "METERING" PLUG AS NEEDED IN THE TROUBLESHOOTING PROCEDURE.
4. SET THE TEST SET SWITCHES AS FOLLOWS:
   A. SET THE TEST SET FUNCTION SWITCH TO THE XMTR POSITION.
   B. SET THE TEST SET METER SWITCH TO THE OFF POSITION.
   C. SET THE TEST SET METER SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
   D. SET THE ADAPTER CABLE REF SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
   E. SET THE ADAPTER CABLE 1 V–100 mV SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SUCH SWITCH THE UNIT OPERATES AT 100 mV AT ALL TIMES.
5. USING BUILT–IN STATION METERING, CONNECT THE "CONTROL" PLUG TO THE CONTROL RECEPTACLE (J3) ON THE UNIFIED CHASSIS INTER–CONNECT BOARD. ALSO, CONNECT THE METERING PLUG AS NEEDED IN THE TROUBLESHOOTING CHART.

Power Control Board Troubleshooting Chart
Motorola No. EEPS-17433-C
4/15/79- PHI

NOTE

Microstrips cannot be ordered as complete kits. Each part must be ordered by its individual part number. When ordering a new microstrip be sure to order new chip capacitors, including those that are associated with the rf power transistors; unless new rf power transistors are ordered (chip capacitors are included). Used chip capacitors must *not* be reused.

Step 1. Remove all transistors as described in the previous instructions.

Step 2. Remove all external component connections to the microstrip, including interface connections with other stages.

Step 3. Remove all remaining ground straps (if any).

Step 4. Lift the microstrip substrate out of the plastic holder.

Step 5. Place the new microstrip substrate into the plastic holder. Refer to the Power Amplifier section for location of the microstrip in the transmitter power amplifier assembly.

Step 6. Carefully clean all solder build-up off the transistor leads. Only a very thin layer of solder should remain. Check for solder-bridge shorts between transistor leads.

Step 7. Using silver solder (Motorola Part No. 10-10041A61), install the transistors and their associated chip capacitors as described in the "Power Transistor Replacement Procedure" paragraph of this section. BE SURE TO CAREFULLY TIGHTEN THE TRANSISTOR MOUNTING SCREWS BEFORE SOLDERING THE TRANSISTOR LEADS TO THE MICROSTRIP CONDUCTORS.

Step 8. Reconnect all external components to their proper locations on the microstrip.

6.5 POWER CONTROL BOARD MAINTENANCE

CAUTION

The power control board is incorporated in the transmitter to provide protection for the rf power transistors under environmental conditions such as voltage, load, or device variations. In order for the circuitry to operate properly and provide protection, it is necessary to have adjusted the power output controls (DRIVE LIMIT and POWER SET) in accordance with the Transmitter Alignment Procedure.

NOTE

The power control board must be installed in a transmitter for testing to provide the necessary power, ground, and control connections. For bench testing of a board that has been removed from the radio set and replaced by a spare, another radio set is required as a test fixture for troubleshooting.

6.5.1 Performance Tests

6.5.1.1 POWER SET Control Test

This control allows the power output of the transmitter to be varied from zero (0) power out with the control fully counterclockwise to greater than the rated output.

CAUTION

For proper operation of the protection circuitry, it is imperative that the POWER SET control never be left in a position that exceeds rated power output.

Refer to the PA Power Setting Procedure in the "Transmitter Alignment" portion of the Station Alignment section of this manual.

Step 1. Key the transmitter.

Step 2. Adjust the POWER SET control until the rated power output is reached.

IMPORTANT

If the POWER SET control ONLY is used to reduce the rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

Step 3. Unkey the transmitter.

6.5.1.2 Automatic Power Leveling Test

A separate variable dc power supply must be used to perform this test.

Step 1. Disconnect the 13.6 volt lead at the PA. Connect a 16 volt source in its place. Set the power supply output to +13.6 volts.

Step 2. Key the transmitter.

Step 3. Vary the supply voltage from +13.6 volts to +16 volts. The transmitter's power output variation should be between +10% and -5%.

Step 4. Unkey the transmitter and reconnect the PA to the station's power supply.

6.5.1.3 DRIVE LIMIT Control Test

This control allows the drive power to the power amplifier from the controlled stage to be limited to a level sufficient to provide rated performance. Its purpose is to set a limit on the drive power that can be called for by the automatic power leveling circuitry. This prevents earlier PA stages from being damaged by overdrive if later stages fail. Depending on the position of the DRIVE LIMIT control, the maximum collector voltage of the controlled stage can be limited to between 6.5 volts and 12.5 volts. The proper pocedure for setting the DRIVE LIMIT control is given in the Transmitter Alignment Procedure Portion of the Station Alignment section of this manual.

CAUTION

For proper operation of the power leveling circuitry, the DRIVE LIMIT control *must not* be set for any lower power output than that given in the Drive Limit column in Table 4 of the Transmitter Alignment section of this manual.

In stations with high gain driver and power amplifier stages, the power leveling POWER SET circuitry may operate the controlled stage at a collector voltage less than 6.5 volts. In such stations, little or no effect will be seen from the DRIVE LIMIT control. If it is not possible to lower power output, with the DRIVE LIMIT control, to the level called for in the transmitter alignment procedure, set the DRIVE LIMIT control to its maximum clockwise position (maximum drive limit.)

In some stations the rf drive reserve is not sufficient to require use of the DRIVE LIMIT control. In these stations, the power output level called for in the transmitter alignment procedure cannot be obtained. If such a situation is found, set the DRIVE LIMIT control fully counterclockwise (minimum drive limit).

6.5.1.4 "No-Power" Protect Circuit Test

The "no-power" protect circuit prevents the transmitter power amplifier from being operated without being connected to the antenna network. If the forward power detector in the antenna network does not sense more than approximately 7-watts, the "no-power" protect circuit will shut-off the drive to the power amplifier stages. This protect circuit can be made to operate to check its performance by turning the power output of the transmitter down below 7-watts using the POWER SET control. Once the "no-power" protect circuit operates, the transmitter must be re-keyed to return drive power, after the original "no-power" condition is corrected.

6.5.2 Troubleshooting

The power control board troubleshooting chart outlines a logical procedure for finding major functional failures. However, because of the complexity of the circuit operation, it is impossible to provide a troubleshooting chart that will be usable for some of the more subtle problems that may appear in the power control board performance tests. Efficient location of these "subtle" problems depends on a thorough knowledge of the power control board theory of operation. In any case, it is a good idea to review the power control board functional description in the Transmitter section of this manual before beginning troubleshooting.

Once you are familar with the circuit operation, a defective stage or component can be found by making voltage measurements and comparing them with those shown on the schematic diagram. Observe the voltage changes that occur when the POWER SET and DRIVE LIMIT controls are varied.

The transmitter power amplifier stages can be disabled to permit easier power control board troubleshooting. To disable the PA stages, remove the heavy RED lead from the barrier strip and cover with an insulator. On 12-watt (or 2-watt) units, remove the interconnect plug. If the PA stages are disabled, the "No-Power" protect circuits will go into operation. To disable the "No-Power" protect circuits, use the following procedure.

Step 1. Remove ac input power from the station.

Step 2. Remove the shield from over the power control board.

Step 3. Connect a jumper across C611 on the power control board.

Step 4. Reconnect ac power to the station and perform whatever troubleshooting is required.

CAUTION

Before the power amplifier stages are re-enabled, be sure to re-enable the "No-Power" protect circuit. DO NOT OPERATE THE POWER AMPLIFIER STAGES WITH THE "NO-POWER" PROTECT CIRCUIT DISABLED.

Table 9 lists some power control board malfunctions and their possible causes:

Table 9. Power Control Board Troubleshooting Hints

Symptom	Possible Cause -- Check the following:
POWER SET malfunctioning	a. Power detector diodes CR1001 and/or CR1002
	b. IU601 bias circuitry
	c. POWER SET pot
DRIVE LIMIT malfunctioning	a. CR603
	b. DRIVE LIMIT pot
"No-Power" protect malfunctioning	a. CR604
	b. CR611

6.6 ANTENNA NETWORK MAINTENANCE

NOTE
Field servicing of the antenna network is not recommended. If an antenna network is defective, it must be replaced as a unit.

6.6.1 Performance Tests

6.6.1.1 Transmitter Leg Insertion Loss Measurement (Repeater and Base Stations)

The transmitter leg insertion loss should be about 0.8 to 0.9 dB (15-20% power loss). Use the following procedure:

Step 1. Connect a thru-line rf wattmeter, a 50-ohm, non-reactive, dummy load, and adapter cables as shown in Figure 18.

NOTE
For accurate wattmeter readings, make sure low VSWR cable connections are made at all points. This means that all connectors must be properly installed and that a minimum number of adapters are used.

Step 2. Key the transmitter and write down the wattmeter reading.

Step 3. Insert the rf wattmeter between the power amplifier and the antenna network. Place an N type through connector in place of the wattmeter between the antenna network and the dummy load.

Step 4. Key the transmitter and write down the second wattmeter reading.

Step 5. If the difference between the two wattmeter readings is greater than 20% of the second wattmeter reading, replace the antenna network. Refer to the "Antenna Network Removal and Reinstallation Procedure" paragraph in this section.

6.6.1.2 Attenuator Bypassing (2-Watt Models Only)

For power amplifier and/or antenna network troubleshooting, bypass the attenuator (assembly within the antenna network). The following steps outline the necessary procedure.

Step 1. Unsolder the coaxial cable from port 2 on the circulator.

Step 2. Unsolder the coaxial cable from the output of the attenuator (this cable is also connected to the harmonic filter).

Step 3. Solder the coaxial cable from the harmonic filter to port 2 on the circulator. When soldering this coaxial cable, the shield must be soldered as close to the center conductor as permissible. Position the cable away from the circulator.

NOTE
The transmitter leg insertion loss should be about 1.0 to 1.1 dB (21-23% power loss). Use the following procedures.

Step 4. Repeat Steps 1 through 4 in the "Transmitter Log Insertion Loss Measurement" paragraph in this section.

Step 5. If the difference between the two wattmeter readings is greater than 23% of the second wattmeter reading, replace the antenna network. Refer to the Antenna Network Removal and Reinstallation Procedure in this section.

Step 6. To reassemble the antenna network after testing, reverse Steps 1 thru 3. Soldering to the attenuator is easier when the antenna network chassis is removed from heatsink. A layer of Wakefield Thermal Junction Compound (Motorola No. 11-83166A01) is required when the chassis is rejoined to the heatsink.

6.6.1.3 Receiver Leg Insertion Loss Measurement (Base Stations Only)

The antenna network receiver leg insertion loss should be about 1.2 to 1.3 dB (a voltage loss of

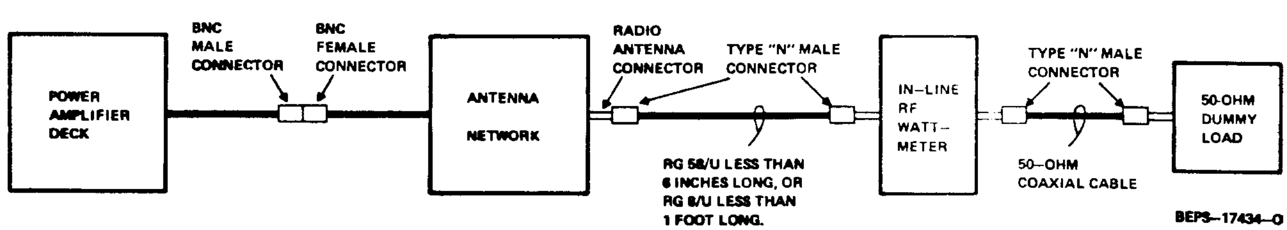


Figure 18.
Transmitter Leg Insertion Loss Test Set-Up

10-15%). Use the following procedure to measure the receiver leg insertion loss:

Step 1. Connect an rf signal generator to the antenna network output connector (J1012) through a 6 dB rf pad.

Step 2. Make a 20 dB quieting sensitivity measurement. Refer to the rf and i-f Board Maintenance paragraph in the Receiver Maintenance portion of this section for the test procedure. Write down the measured 20 dB quieting sensitivity.

Step 3. Connect the rf signal generator to the rf input of the receiver rf and i-f board (J104), at the bottom of the unified chassis.

Step 4. Make a second 20 dB quieting sensitivity check. Write down this second 20 dB quieting sensitivity figure.

Step 5. If the difference between the two 20 dB quieting sensitivity figures is greater than 15% of the second 20 dB quieting sensitivity figure, replace the antenna network. Refer to the "Antenna Network Removal and Reinstallation" procedure paragraph in this section.

6.6.1.4 Antenna/PA Isolation Measurement (Repeater & Base Stations)

The antenna network ensures that, should the antenna load open, the transmitter output power reflected back to the PA will be reduced by at least 20 dB. Lack of sufficient reflected power attenuation can damage the power amplifier.

Step 1. Disconnect the 7.5 ampere, in-line, high current, A+ fuse (between the power amplifier and the unified chassis) to prevent transmitter PA operation.

Step 2. Disconnect the transmitter output coaxial cable from the ANT NETWORK IN receptacle (J1011) on the antenna network.

Step 3. Disconnect the antenna network output cable from output receptacle J1012 on the antenna network.

Step 4. Connect an rf signal generator to the output receptacle, J1012, and an rf voltmeter to the ANT NETWORK IN receptacle, J1011.

Step 5. Set the signal generator to the transmitter carrier frequency and at maximum output level.

Step 6. Note the rf voltmeter reading. The reading should be at least 90% lower than the signal generator output level (20 dB).

Step 7. If the isolation isn't at least 20 dB, replace the antenna network. See the "Antenna Network Removal and Reinstallation" procedure paragraph in this section.

Step 8. Repeater stations -- proceed to following Step 9. Base stations -- skip Step 9, and proceed to "Transmitter Output/Receiver Input Isolation Measurement" paragraph in this section.

Step 9. Disconnect the test equipment and reconnect all previously removed station cables. Be sure to reconnect the fuse that was removed in Step 1.

6.6.1.5 Transmitter Output/Receiver Input Isolation Measurement (Base Stations Only)

The antenna network provides approximately 20 dB of isolation between the transmitter rf output connector and the receiver input cable (antenna network output to receiver) with the transmitter unkeyed and the station antenna connector terminated in a 50- ohm load. When the transmitter is keyed, switching action in the receiver leg of the network provides 40-to-50 dB of additional isolation. Perform the following procedure to ensure that proper switching action takes place.

NOTE

Lack of switching action in the receiver leg of the network can allow sufficient transmitter power into the receiver to damage the receiver mixer transistor.

Step 1. Be sure that the 7.5 ampere, A+ fuse (between the power supply and the unified chassis) is disconnected to prevent transmitter PA operation.

Step 2. Disconnect the transmitter output coaxial cable from the ANT NETWORK IN receptacle (J1011) on the antenna network.

Step 3. Connect an rf signal generator to the antenna receptacle (J1012) and an rf voltmeter to the antenna network receptacle (J1013) of the network. (If a voltmeter is not available, leave the cable connected to the receiver rf deck and use 20 dB quieting as a measuring reference.)

Step 4. Set the rf signal generator to the receiver frequency and at maximum output level. With the transmitter unkeyed, the presence of the injected signal from the signal generator should be noted on the rf voltmeter, with only slight attenuation (1.2 to 1.3 dB).

Step 5. Make sure the transmitter is disconnected from the network. Key the transmitter and check the rf voltmeter reading.

Step 6. The rf voltmeter reading should drop at least 60 dB (a voltage reduction of 1000 times). If receiver 20 dB quieting is used as a reference, the rf signal generator level would have to be 1000 times greater than the normal 20 dB quieting, or approximately 500 microvolts.

Step 7. If the isolation is less than 60 dB, replace the antenna network. See the removal and reinstallation procedure (paragraph 6.6.2).

Step 8. Disconnect the test equipment. Reconnect the transmitter output cable to the antenna network. Reconnect the fuse that was removed in Step 1.

6.6.2 Antenna Network Removal and Reinstallation Procedure

NOTE

Steps 1 and 2 are performed from the front of the station.

Step 1. All models, except 2 & 12-watt models:

-- Disconnect the LOW LEVEL AMP OUT and ANT NETWORK IN connectors from the unified chassis.

-- Loosen the three captivated shield cover screws and remove the cover.

-- Loosen the captivated screw that holds the ANT NETWORK IN receptacle bracket and remove the receptacle from its mounting bracket.

Step 2. 2 & 12-watt models only:

-- Loosen the two captivated power amplifier assembly screws on the PA heatsink.

-- Pivot and lift the PA assembly up and off the pivot bushing and simultaneously disconnect the following connectors:

- power plug from PA receptacle (J1001) on transmitter interconnect board.
- tripler plug from low-level amplifier output receptacle on tripler/low level amplifier.
- PA output plug from antenna network.

The PA assembly is now completely disconnected from the unified chassis and can be placed to one side while antenna network removal is completed.

NOTE

The following steps are performed from the rear of the station.

Step 3. Base stations only -- Disconnect the receiver output coaxial cable from the antenna network heatsink.

Step 4. Disconnect the antenna output coaxial cable from the antenna network heatsink.

Step 5. Loosen the two captivated antenna network mouinting screws (on heatsink).

Step 6. Carefully slide the antenna network out of the unified chassis.

Step 7. To reinstall the antenna network, reverse the procedure given in Steps 1-6.

7. RECEIVER MAINTENANCE

7.1 GENERAL

The following paragraphs provide maintenance shop type procedures for the individual receiver circuits in the station. After preliminary tests have localized the trouble to the particular area, use these bench tests, which include measurements with built-in station metering or a Motorola portable test set, for testing and troubleshooting.

IMPORTANT

If the POWER SET control ONLY is used to reduce the rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore the rf power to its rated level.

7.2 RF AND I-F BOARD MAINTENANCE

CAUTION

Do not remove the channel element by exerting force through the hole provided for access to the channel warp capacitor. Excessive pressure will damage the capacitor. A small access hole is provided adjacent to the one for channel warp adjustment. Use a tuning tool (Motorola Part No. 66-84387C01) to push out element.

The following paragraphs provide maintenance procedures for the receiver rf and i-f board. These procedures consist of tests which include metering measurements, testing, and troubleshooting procedures which include integrated circuit checks.

NOTE

The receiver rf and i-f board must be installed in a receiver for testing to provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stages of the receiver. The board may be installed in the station or a "Micor" mobile radio set for testing.

7.2.1 Performance Tests

Use the following tests to determine if the receiver rf and i-f board is operating properly. If either of the tests produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart in this section for a procedure to isolate the defective stage.

7.2.1.1 No-Signal Meter Reading Check

7.2.1.1.1 General

A failure in almost any part of the rf and i-f board will result in an improper meter reading in one or more of the test positions. Improper alignment will also cause improper meter readings.

Compare the current readings observed in positions 1 through 5 with those in Table 10. A low reading on meter position 1 indicates a defective channel element. A low reading on meter positions 2 or 3 indicates a defective multiplier circuit. Improper meter 4 or 5 readings indicate a malfunction elsewhere in the receiver; check rf and i-f voltages per the schematic diagram to isolate the malfunction.

Table 10. Minimum Receiver RF & I-F Meter Readings (No Input Signal Applied)

Selector Switch Position	Reading	Circuit Metered
1	15 uA	Channel element output
2	15 uA	First Doubler output
3	15 uA	Second Doubler output
4+, 4-	0 ± 2 uA	Discriminator output
5	10 uA	Second i-f amplifier and limiter

7.2.1.1.2 Input Voltages

If there are no test set indications at one or more of the metered points, check the dc input voltages to the receiver rf and i-f board per Table 11.

Table 11. RF & I-F Board DC Input Voltages

P904-9	A + continuous (+ 13.8 V dc with reference to chassis)
P904-11	9.6 ± 0.5 V dc continuous (with reference to chassis)
P904-8	9.6 ± 0.5 V dc continous (with reference to chassis)

If meter indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

7.2.1.1.3 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the station as follows:

-- Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.

-- Connect the adapter cable 7-pin red "control" plug to the control receptacle on the unified chassis (J3).

-- Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:

-- Set the function SELECTOR switch to the RCVR position.

-- Set the oscillator METER REVERSING switch to the OFF position.

-- Set the adapter cable SENS switch to the 100 mV position. If the adapter cable has no SENS switch, the unit operates at 100 mV sensitivity all of the time.

-- Set the adapter cable REF A-B switch to position A or position B.

Step 6. Refer to Table 10. Set the FUNCTION SELECTOR switch to the positions called for and observe the test set meter. Note that the meter readings given in Table 10 are minimums.

7.2.1.1.4 Using Built-In Station Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Connect the station metering kit "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Refer to Table 10. Set the FUNCTION SELECTOR switch to the positions called for and observe the meter. Note that the meter readings given in Table 10 are minimums.

7.2.1.2 20 dB Quieting Sensitivity Test

This performance test may be used after repair and alignment to be sure that the receiver meets all specifications before it is returned to service. The receiver shield must be in place while performing this test.

7.2.1.2.1 Using the Portable Test Set

Step 1. Set up the station and portable test set or meter panel as described in paragraphs 7.2.1.1.3 or 7.2.1.1.4.

Step 2. Set the portable test set MULT switch to the 2 V ac position.

Step 3. Set the portable test set FUNCTION SELECTOR switch to position 11 (AUDIO).

Step 4. Set the test set SPKR switch to the LOAD position and disconnect the station speaker to silence it during the test, if desired.

Step 5. On "Private-Line" stations, disable "PL" operation by setting the PL disable switch, (Station Control Module) to the disable position to the right.

Step 6. Adjust the receiver SQUELCH control fully counterclockwise (unsquelched).

Step 7. Adjust the receiver VOLUME control so the test set meter reads 2 V rms.

Step 8. Connect an rf signal generator to the receiver input connector.

Step 9. Adjust the rf signal generator controls as follows:

-- Adjust the rf signal generator to produce a CW or unmodulated signals.

-- Adjust the rf signal generator's output level to
-- maximum.

-- Adjust the rf signals generator's output frequency to the selected channel receive frequency. To adjust the signal generator to the proper frequency, without a frequency counter, adjust the generator frequency control until test set meter position 4 reads exactly zero.

Step 10. With the portable test set FUNCTION SELECTOR switch in meter position 11 (AUDIO), slowly decrease the rf signal generator output level until the test set meter reads 0.2 V rms (20 dB down from 2 V rms). Move the portable test set MULT switch to the 0.2 V ac position if necessary.

NOTE

The output frequency of some signal generators will be "pulled" when the output level is near maximum. It may be necessary to reset the generator frequency, to "zero" meter 4, as the generator output level is reduced.

Step 11. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV rms, or less, for a receiver without an rf preamplifier; or 0.25 uV rms or less, for a receiver with an rf preamplifier.

7.2.1.2.2 Using Built-In Station Metering

NOTE

This section substitutes a separate ac voltmeter for the portable test set FUNCTION SELECTOR switch position 11.

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the station.

Step 4. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. A "Private-Line" station must also be "PL" disabled.

Step 5. Set the range switch on an ac voltmeter to the 2 V ac position and connect the voltmeter across the speaker terminals of the built-in station meter kit. If desired, substitute an 8-ohm, 15-watt, non-inductive resistor for the speaker. Adjust the station VOLUME control for 2 volts as indicated on the voltmeter.

NOTE

The built-in station metering kit incorporates a dc voltmeter, not an ac voltmeter.

Step 6. Connect an rf signal generator to the receiver input connector.

Step 7. Adjust the rf signal generator controls as follows:

-- Adjust the rf signal generator to produce a CW or unmodulated signal.

-- Adjust the rf signal generator output level to maximum.

-- Adjust the rf signal generator output frequency to the selected channel receive frequency. To adjust the rf signal generator to the proper frequency, without a frequency counter, adjust the generator frequency control until meter position 4 reads exactly zero.

Step 8. Slowly decrease the signal generator output level until the ac voltmeter reads 0.2 V rms. Move the ac voltmeter range switch to the 0.2 V ac position if necessary.

NOTE

The output frequency of some rf signal generators will be "pulled" when the output level is near maximum. It may be necessary to readjust the generator frequency, to "zero" meter 4, as the generator output level is reduced.

Step 9. Note the signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV rms, or less, for a receiver without an rf preamplifier, or 0.25 uV rms or less, for a receiver with an rf preamplifier.

7.2.2 Troubleshooting

7.2.2.1 Visual Inspection

The first step in the troubleshooting procedure should be a thorough visual inspection of the receiver and, in particular, the receiver rf and i-f board. Corrosion, burned or damaged components are usually easily seen and may be the cause or a symptom of the receiver malfunction. Loose circuit board mounting screws, or a loose or improperly installed receiver shield are other easily found problems that can cause a considerable degradation in receiver performance.

After the "obvious" problems have been corrected, repeat the receiver rf and i-f board performance tests. If the tests still produce unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart in this section. The troubleshooting chart provides a systematic procedure for isolation of the defective stage and component.

As much information as possible has been included on the troubleshooting chart. However, it will be necessary to occassionally refer to the receiver rf and i-f schematic diagram and circuit board detail. Detailed procedures regarding alignment as a troubleshooting technique, integrated circuit and AFC troubleshooting, receiver gain measurements, and crystal dip tests follow in the remaining paragraphs of this section.

7.2.2.2 Alignment as a Troubleshooting Technique

Low meter readings, improper discriminator output, and otherwise abnormal performance of the receiver are very often corrected by realignment. Therefore, alignment should be one of the first troubleshooting steps performed for these symptoms.

7.2.2.3 Troubleshooting Integrated Circuits

Integrated circuits (IC) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

The IC on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in Table 12.

Table 12. Nominal Receiver Integrated Circuit DC Voltages

(All readings are in dc volts, measured with respect to chassis ground)

PIN NO	U101 VOLTAGE	U102 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: All voltages may vary ±10% from nominal readings shown.

7.2.2.4 Troubleshooting the AFC

To check AFC operation, perform the following procedure:

Step 1. Connect the Motorola test set (or use built-in metering if so equipped) to monitor discriminator output (meter position 4).

Step 2. Connect an rf signal generator to the receiver input connector. Set up the generator to provide about 100 uV rms of unmodulated signal at a selected receive channel frequency.

Step 3. Insert a screwdriver or other shorting device through the AFC OFF hole in the receiver shield, shorting the plating beneath the hole to the receiver shield. Simultaneously adjust the input signal frequency for a discriminator meter indication of approximately ±6 uA.

Step 4. Remove the short. The test set meter indication should return to within ±3 uA of zero. If it does not, the AFC is malfunctioning.

Step 5. If the AFC is malfunctioning, either components on the receiver rf and i-f board or the AFC circuitry in the channel element may be defective.

- The board may be checked by tracing the AFC error voltage from the discriminator output to the channel element. Performing Step 3 above, and then removing the short, should produce an error voltage of approximately 0.6 V dc (+ or — with respect to chassis ground) when measured with a dc voltmeter, with a minimum of 11 megohms in put impedance. Check for this error voltage at P904-15, P904-14, P904-7 and at the AFC OFF plating near the channel element.

-- The AFC circuitry in the channel element may be checked by substituting a known good channel element.

7.2.2.5 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every crystal filter has a good conductive path to ground. A continuity test should indicate less than 1 ohm between the crystal filter case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure portion of the Station Alignment. Perform a complete receiver rf and i-f alignment as given in the "Receiver Alignment" section of this manual. Leave the alignment test equipment connected to perform the following measurements.

Step 2. Refer to Table 13 for receiver gain measurements, the receiver rf and i-f schematic diagram, and the receiver rf and i-f circuit board detail diagram while performing this procedure.

NOTE

Receiver rf input voltages given in Table 13 are those at the receiver input connector. If a pad, or other attenuator, is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for losses in the pad.

Examples:

6 dB loss means: V out of the pad = 1/2 V into the pad.

20 dB loss means: V out of the pad = 1/10 V into the pad.

Step 3. Adjust the rf signal generator output frequency to the receive channel frequency ("0" reading on meter 4). Adjust the rf signal generator output to provide the required receiver input voltage for a particular test point as listed in Table 13. Then, using an rf ac voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. At every test point, the measured voltage should be within ±6 dB of the given value.

Table 13. Receiver Gain Measurements

TEST POINT (See RF & IF Circuit Board Detail)	RECEIVER INPUT VOLTAGE rms (preset)	TEST POINT VOLTAGE rms ±6 dB	REMARKS
A	16 mV	100 mV	
B	8 mV	50 mV	
C	10 mV	50 mV	
D	15 mV	50 mV	
E	12 mV	50 mV	
F	15 mV	50 mV	
G	10 mV	600 mV	U101 saturated output
H	6 mV	100 mV	
I	9 mV	100 mV	
J	12 mV	100 mV	
K	11 mV	100 mV	
L	20 mV	100 mV	
M	1 mV	750 mV	U102 saturated output

Step 4. A high or low test point voltage measurement *may* indicate that the crystal at, or ahead of, the test point is defective. However, it may also indicate that an associated circuit component is defective. The extremely high-Q crystals used in "Micor" "Compa-Station" and Upright radios are very sensitive to associated circuit component failure. For example, if L125 is defective, it might appear that Y102 is bad. To isolate the defective component, perform the crystal dip tests described in the following paragraph.

7.2.2.6 Crystal Dip Test

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

The monolithic crystals used in "Micor" receivers are made up of two separate resonators on a single quartz blank. Each crystal has a pair of characteristic operating frequencies. One way to find the characteristic frequencies of each crystal is to short the crystal output to chassis ground, then monitor the crystal input voltage with an rf ac voltmeter while varying the rf signal generator frequency, across the bandpass of the receiver. Low voltage points will occur at each of the crystal characteristic frequencies.

Figures 19 and 20 are plots of typical rf ac voltmeter readings obtained while testing good crystals. Note that the horizontal scales are calibrated in frequency, with f_o the channel frequency of the receiver. The vertical scales represent *relative* rf ac voltmeter readings. The bottom line is zero and the top line is maximum. Notice that each plot has one sharp minimum point above f_o and another below f_o. Table 14 lists the frequencies at which these dip points should appear. If the measured dips fall outside the tolerances listed in Table 14, the crystal *may* be defective.

Step 1. Leave the test equipment connected as was done for the receiver gain measurements.

Table 14. Crystal Dip Frequencies

CRYSTAL	TEST POINT GROUNDED	TEST POINT MONITORED	+ FREQUENCY DIP (kHz) ±2.5 kHz	− FREQUENCY DIP (kHz) ±2.5 kHz
Y101	C	B	6.0	7.0
Y102	E	D	6.5	6.5
Y103	I	H	6.0	7.0
Y104	K	J	6.5	6.5

Step 2. If the receiver uses AFC, disable the AFC by connecting a jumper between test point "N" (see receiver rf & i-f circuit board detail diagram) and chassis ground.

Step 3. Adjust the rf signal generator frequency to f_o, the receiver channel frequency ("0" reading on meter 4). Adjust the generator output control for at least 50 mV rms *at the receiver input connector.*

Step 4. Refer to Table 14. To test a particular crystal, find it in the table, ground the indicated test point, and connect an rf ac voltmeter between the monitored test point and a nearby chassis ground point.

Step 5. Starting at f_o, *slowly increase* the signal generator frequency, while watching for a dip in the rf ac voltmeter reading. This dip should be sharp, so increase the signal generator frequency very slowly and watch the rf ac voltmeter closely. When the dip is found, write down the frequency counter reading.

Step 6. Return the signal generator frequency to f_o. Then watch the rf ac voltmeter while *slowly decreasing* the signal generator frequency. When the dip is found, write down the frequency counter reading.

Step 7. Compare the test results with the frequencies and tolerances listed in Table 14 for the crystal tested. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective. Continue with this procedure to isolate the bad component.

Step 8. FOR TEST PURPOSES ONLY, exchange the suspected crystal with another of the same type (part number) from the receiver. Be sure to note the polarity of the crystal when making the change. Repeat the receiver gain measurements and crystal dip tests with the suspected crystal in the new location. If the suspected crystal tests bad again, consider it defective and replace it. If the crystal tests good, look for defective associated components at the original crystal location.

Step 9. When the tests are completed, be sure *all* jumpers connected during the test are removed and that any ***exchanged crystals are returned to their original locations.*** Refer to the parts list and circuit board detail diagram for correct parts location. Note the crystal polarity when replacing the crystals.

7.2.3 Field Conversion to Shifted I-F

A standard 11.7 MHz i-f receiver can be easily converted to operate at the shifted i-f of 11.8 MHz. Replace crystal filters Y101 through Y105 with the 11.8 MHz parts; refer to the receiver parts lists for the TLE8610A Shifted I-F Crystal Kit for the necessary part numbers. Finally, replace the channel element, using the 11.8 MHz i-f formula from the "Receiver" Alignment-portion of the Station Alignment section to calculate the new channel element frequency.

7.3 AUDIO AND SQUELCH BOARD MAINTENANCE

NOTE

The audio and squelch board must be installed in a radio set for testing to provide the necessary power and ground connections.

7.3.1 Performance Tests

The following performance tests may be used for troubleshooting to isolate the point of abnormal operation. They may also be used after repair to be sure that the board is operating properly, before it is returned to service.

7.3.1.1 Audio Amplification

The audio section of the audio and squelch board, combined with the separate audio power amplifier, will provide at least 10 watts audio output, into 8-ohms, with less than 5% overall distortion, from a 3.0 kHz deviated, 1 kHz modulated, on-frequency signal applied to the receiver input receptacle.

Step 1. Replace the speaker with an 8-ohm, 15-watt, non-inductive resistor.

Step 2. Set the SQUELCH control fully counterclockwise (unsquelched). "Private-Line" stations must also be PL disabled by placing the PL disable switch (Station Control Module) to the DISABLE position (to the right).

Step 3. Connect an rf signal generator to the receiver input receptacle and adjust it to the receive frequency.

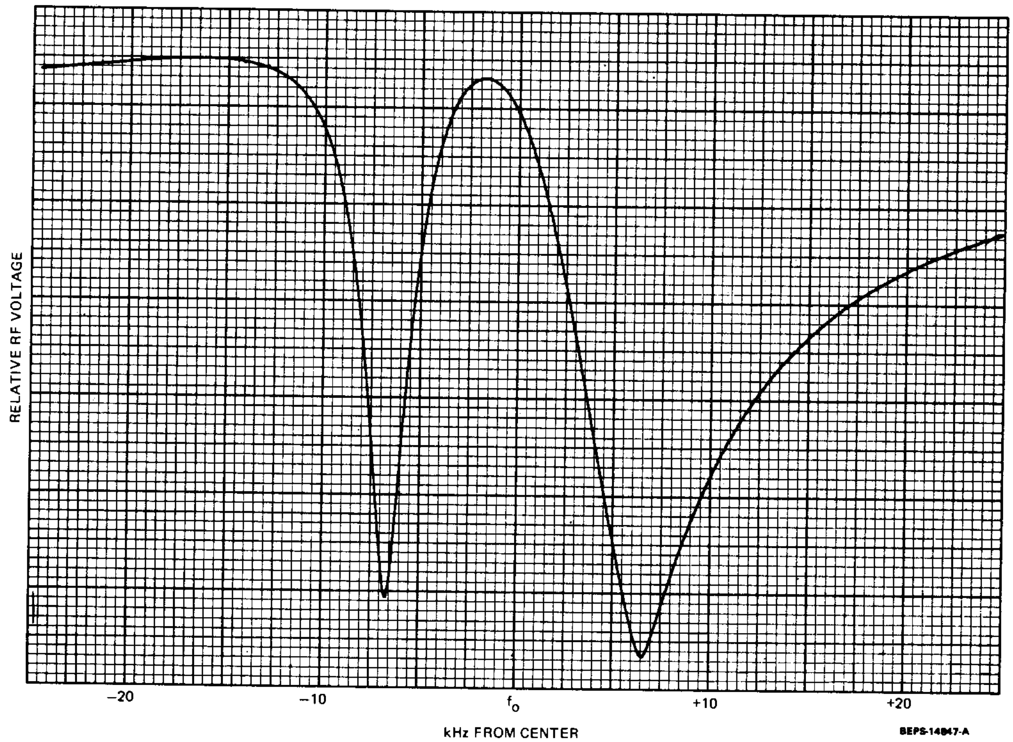


Figure 19.
Typical Plot of a Known Good Crystal in Position Y101 or Y103

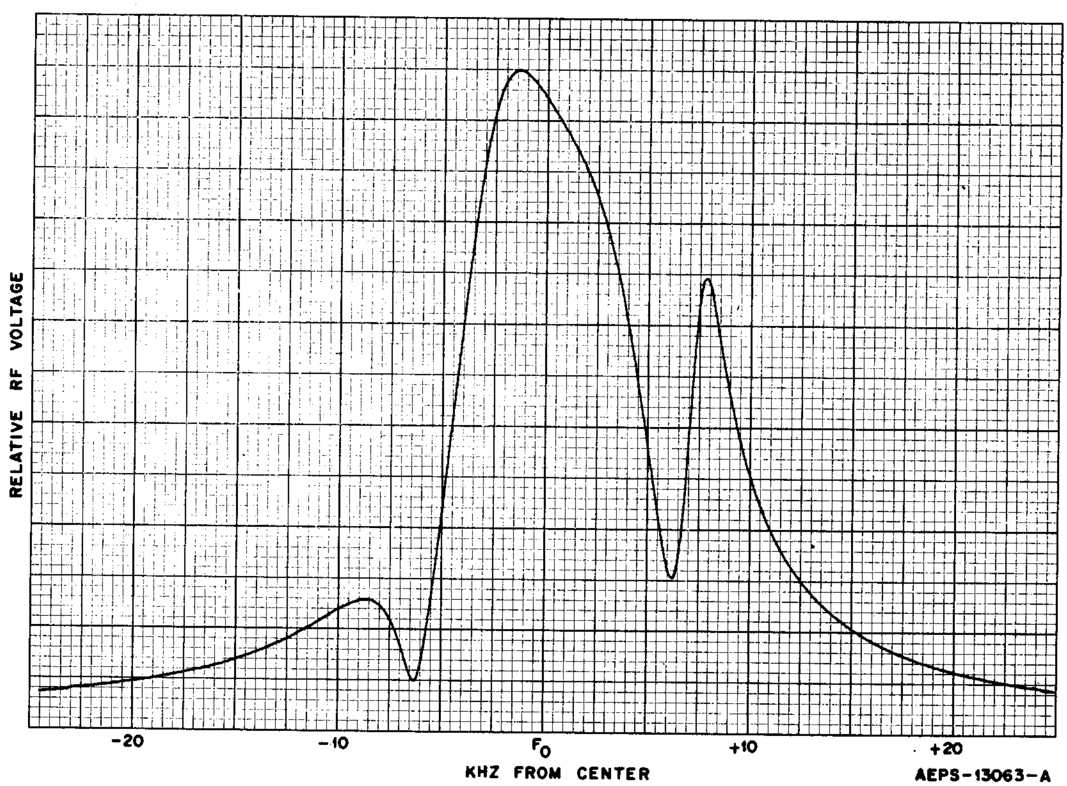


Figure 20.
Typical Dip Plot of a Known Good Crystal in Position Y102 or Y104

STATION MAINTENANCE

Step 4. Adjust the signal generator for 1.0 mV output, modulated with a 1000 Hz tone at ± 5.0 kHz deviation.

Step 5. Connect an ac voltmeter to pin J903-7 on the receiver interconnect board.

Step 6. Adjust LINE LEVEL control R203 for 150 mV rms.

Step 7. Reduce the deviation to ± 3.0 kHz.

Step 8. Connect an ac voltmeter across the 8-ohm load resistor.

Step 9. Adjust the VOLUME control until 9.0 V rms is read on the ac voltmeter (this represents 10 watts).

Step 10. Measure distortion at 10 watts audio power output. It should be less than 5%.

7.3.1.2 Squelch Control

7.3.1.2.1 Specifications

Spec 1. The squelch section of the receiver audio and squelch board shall enable the audio section when an rf signal level greater than 6 dB noise quieting (one-half the discriminator output level with no signal input) is applied to the receiver input, with the SQUELCH control set at threshold. When the signal is removed from the station, the audio channel shall become disabled after approximately 150 milliseconds. When an input signal greater than that required for approximately 20 dB noise quieting is removed from the receiver input, the audio channel shall become disabled immediately.

Spec 2. When the SQUELCH control is turned fully clockwise (tight squelch), an input signal that produces approximately 20 dB noise quieting shall be required to enable the audio channel.

Spec 3. The squelch section shall inhibit audio output when no input signal is received.

Spec 4. In "Private-Line" coded squelch stations, the squelch section of the receiver audio and squelch board shall perform as described in the preceding specification 1, while the radio station is "PL" disabled.

Spec 5. In "PL" operation, the squelch section shall inhibit audio output when the proper "PL" code is *not* received, regardless of input signal strength.

7.3.1.2.2 Procedure for Carrier Squelch Stations

Step 1. Turn the station ON and adjust the SQUELCH control clockwise, from the full counterclockwise position until the receiver *just* quiets (squelch threshold).

Step 2. Measure the resistance of U202-6 and -7 with reference to ground. Both pins should be less than 1000 ohms.

NOTE

Erroneous resistance measurements will be obtained if the voltage between the ohmmeter probes exceeds approximately 5.0 volts dc.

Step 3. Connect a rf signal generator to the receiver input receptacle and adjust it to the receive frequency. Modulate the generator output with a 1000 Hz tone at ± 3.0 kHz deviation.

Step 4. Slowly increase the rf signal generator output, until the receiver *just* unsquelches. Remove the modulation from the signal generator. Unsquelching should occur at a generator output that produces 6 dB noise quieting, or less.

Step 5. Measure the resistances of U202-6 and -7 with reference to ground. Pin 6 should be greater than 100k ohms and pin 7 should be greater than 45k ohms.

Step 6. Increase the rf signal generator output until approximately 12 dB noise quieting is obtained. Remove the rf signal from the receiver input, either by turning the generator OFF, or by using a relay in series with the generator output. A long "squelch tail" should occur. If a calibrated, triggered sweep oscilloscope is available for measurement, the duration of the "squelch tail" should be approximately 150 milliseconds, measured at the speaker terminals.

Step 7. Increase the rf signal generator output to produce 30 dB noise quieting. Turn the generator OFF, and note the "squelch tail" duration. It should be no more than a "click". The duration should be less than 10 milliseconds.

Step 8. Turn the SQUELCH control fully clockwise (tight squelch).

Step 9. Adjust the rf signal generator output level until the receiver *just* unsquelches. Unsquelching should occur at a generator output that produces approximately 20 dB noise quieting.

7.3.1.2.3 Procedure for "Private-Line" Tone-Coded Stations

Step 1. Disable the "PL" circuitry by placing the "PL" disable switch (Station Control Module) to the DISABLE position (to the right).

Step 2. Perform the previously described "Carrier Squelch Station Procedure".

Step 3. Return the station to "PL" operation. On stations using "AND" squelch operation, also turn the SQUELCH control fully counterclockwise during the following test.

TROUBLESHOOTING PREREQUISITIES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. TURN STATION ON.
3. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS:
   - A. CONNECT THE ADAPTER CABLE 20–PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   - B. CONNECT THE ADAPTER CABLE RED "CONTROL" PLUG TO THE RECEPTACLE J3 ON THE UNIFIED CHASSIS INTERCONNECT BOARD.
   - C. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
4. SET PORTABLE TEST SET SWITCHES AS FOLLOWS:
   - A. FUNCTION SWITCH TO THE RCVR POSITION
   - B. METER REVERSING SWITCH TO OFF POSITION
   - C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   - D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   - E. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
5. ON "PRIVATE–LINE" RADIOS, DISABLE THE PL DECODER BY SETTING THE PL SWITCH ON THE STATION CONTROL MODULE TO THE DISABLE POSITION.
6. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
7. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.

RECEIVER RF AND IF TROUBLESHOOTING CHART

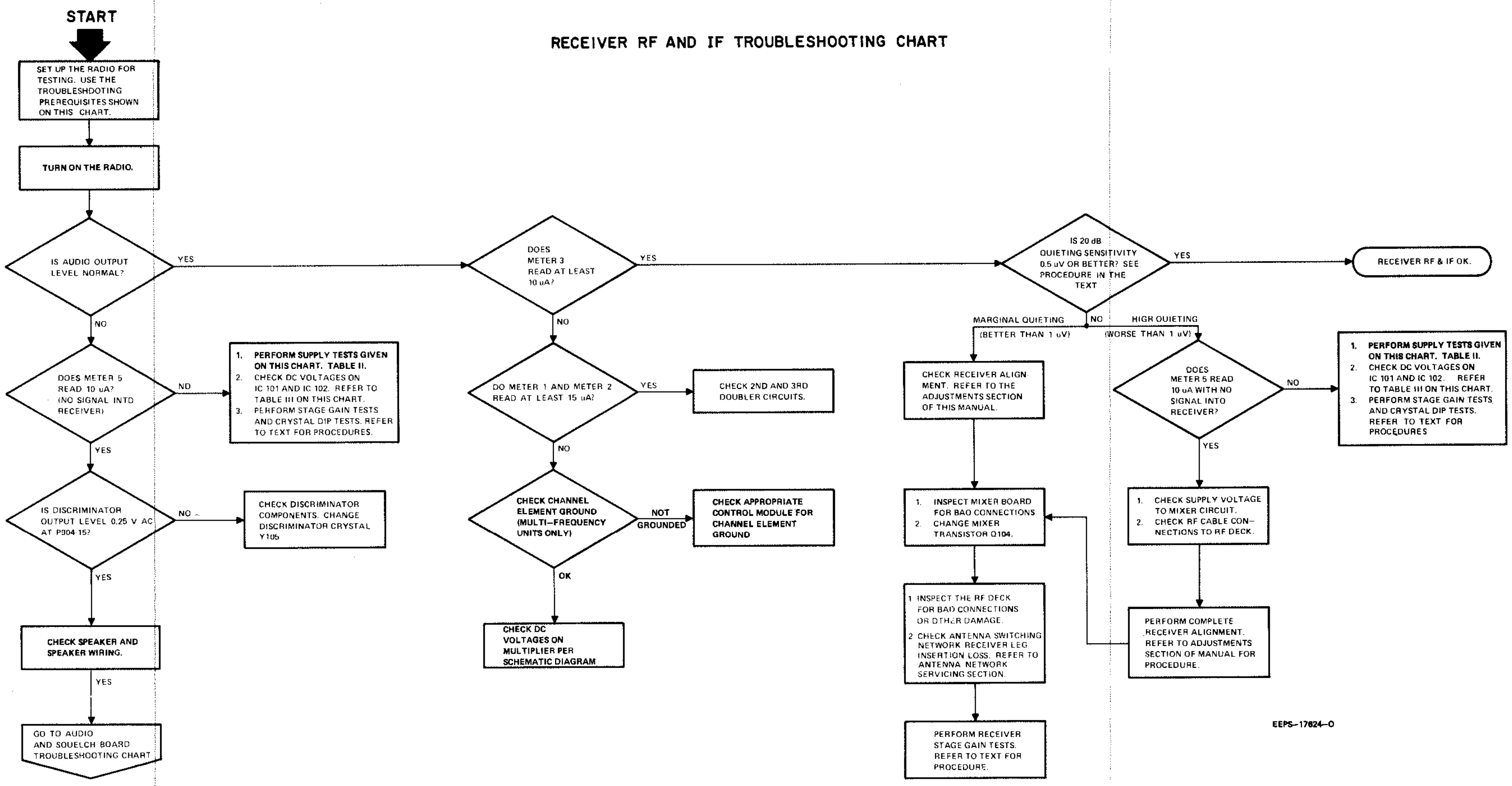


TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO-AMPS)	CIRCUIT METERED
1	15	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	15	SECOND DOUBLER OUTPUT
4	0±2	DISCRIMINATOR OUTPUT
5	10	SECOND I-F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

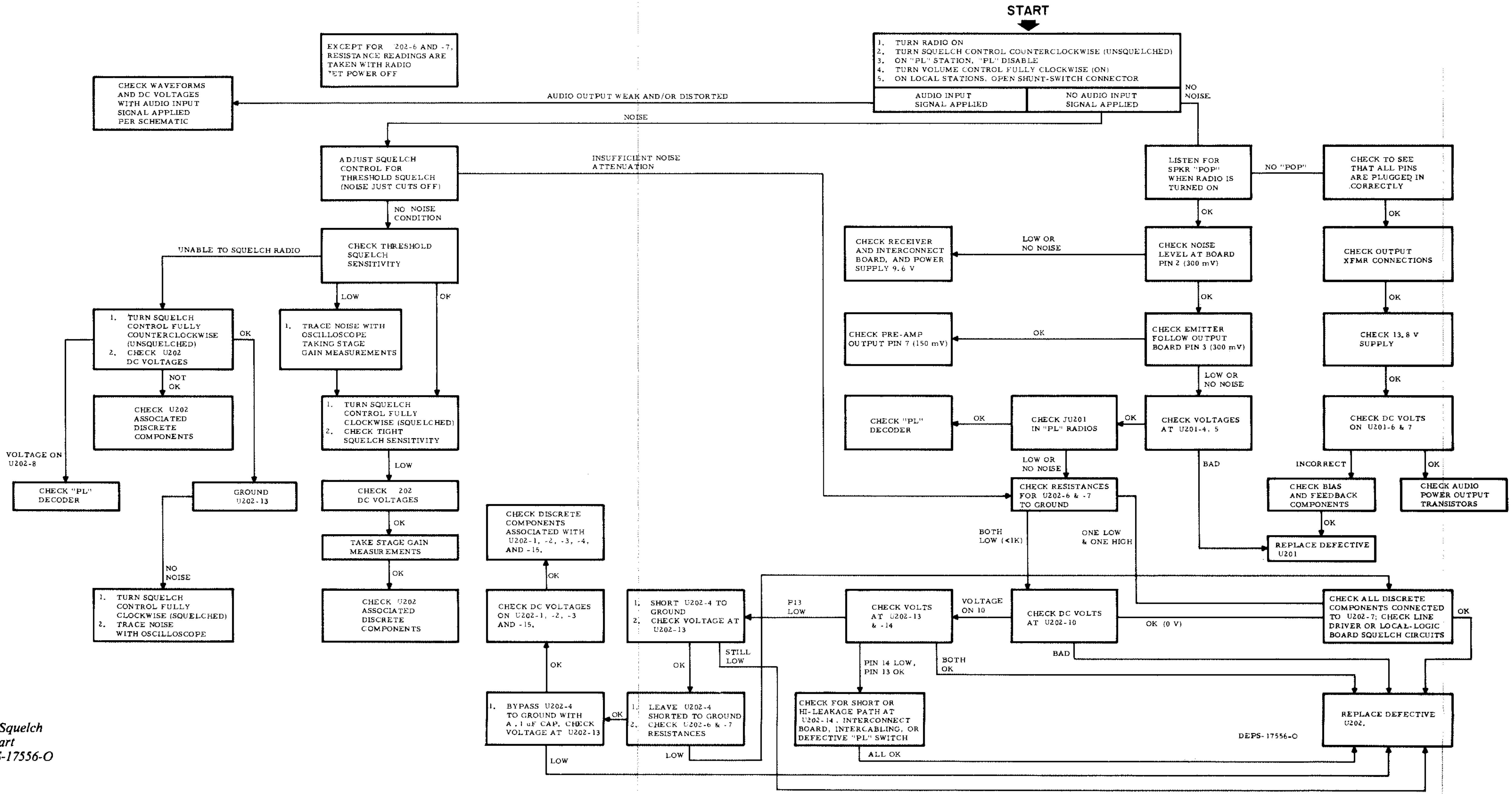
TEST POINT	DESCRIPTION
P904-9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904-11	**9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V).**
P904-8	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	IC101 VOLTAGE	IC102 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: ALL VOLTAGES MAY VARY ±10% FROM NOMINAL READINGS SHOWN.

Receiver RF & I-F Troubleshooting Chart
Motorola No. EEPS-17624-O
4/15/79- PHI



Receiver Audio and Squelch Troubleshooting Chart Motorola No. DEPS-17556-O 4/15/79- PHI

Step 4. Vary the rf generator output between minimum output and 1.0 mV, while checking the resistances of U202-6 and -7 with reference to ground. Both resistances should remain less than 1000 ohms.

Step 5. Modulate the on-frequency rf generator output with a "PL" tone for ±0.5 to ±1 kHz deviation, and a 1000 Hz tone for ±3.0 kHz overall deviation.

Step 6. Slowly increase the rf signal generator output until the receiver *just* unsquelches. Unsquelching should occur at a generator output that produces 6 dB quieting, or less.

7.3.2 Troubleshooting

7.3.2.1 Check Input Voltages

A malfunction in the audio and squelch board operation may be due to the loss of dc input voltages, which can be caused by the board or another section of the station. Since there are only two dc input voltages applied to the board, it is advantageous to verify their presence before beginning extensive troubleshooting, refer to Table 15.

Table 15. Audio & Squelch Board DC Input Voltages

P903-4	+ 9.6 V dc with respect to chassis gnd
P903-16	Audio A+ (approximately + 13.6 V dc with respect to A-)

NOTE

In a negative ground system, audio A- is chassis potential. In a positive ground system, audio A+ is chassis potential.

7.3.2.2 Isolating Defective Components

If tests indicate abnormal performance, a logical troubleshooting procedure should be followed to efficiently isolate the defective component. Results of performance tests usually localize the malfunction to one or two stages. The receiver audio & squelch troubleshooting chart summarizes these results in a logical sequence. A waveform analysis (with voltage and resistance checks) in the suspected circuit, should readily isolate the defective component, when compared with those on the schematic diagram.

7.3.2.3 Troubleshooting Integrated Circuits

Integrated circuits (IC) are very reliable components and should not be replaced until all checks have definitely proven that the IC is the defective component. Make sure that the external components in the circuit are normal. The IC on the audio and squelch board may be checked by dc voltage measurements, although signal tracing with an oscilloscope is preferred.

7.3.2.4 Squelch Circuitry Stage Gain Measurements

This troubleshooting procedure may be used to isolate a squelch malfunction, occurring before the detector, to a specific stage. The test is performed by injecting an ac signal at the input to the squelch circuitry and noting results obtained with an ac voltmeter. Most accurate results are obtained by taking dB gain and loss measurements between certain points, as illustrated in Figure 21. Individual point voltage checks may also be used to quickly verify proper squelch input circuitry operation, but this is not an adequate test to prove the circuitry is defective (refer to Table 16 and Figure 21). Tolerance addition *may* cause increasing variation from the typical readings in the table, as readings are taken further from the injected signal point.

The following procedure may be used for gain and loss (or signal level) measurements, while injecting a 3 kHz or 30 kHz signal. In "Private-Line" tone coded squelch stations, "PL" operation will not affect this test.

Step 1. Turn the VOLUME control fully counterclockwise (OFF), or to a comfortable listening level, if desired.

Step 2. Turn the SQUELCH control fully clockwise (squelched), and turn the station ON.

Step 3. Inject a 1.0 mV, on-channel signal, at the receiver input receptacle. This "quiets" the discriminator output and prevents erroneous test readings.

Step 4. Inject a 3 kHz, 10 mV rms signal into the receiver audio and squelch board, at P903-9.

Step 5. Take gain and loss (or signal level) measurements, as required (refer to Figure 21 and Table 16).

Step 6. Repeat the preceding test using a 30 kHz signal in place of the 3 kHz signal in Step 4.

7.3.2.5 Audio Circuitry Stage Gain Measurement

AC voltage measurements and waveforms are given, where applicable, on the schematic diagram. Refer to that diagram, and Figure 21 for pertinent information when making audio stage gain measurements.

7.4 AUDIO POWER AMPLIFIER MAINTENANCE

7.4.1 Performance Checks

Performance checks on this board consist of taking resistance measurements between the transistor elements. It should be noted, however, that some

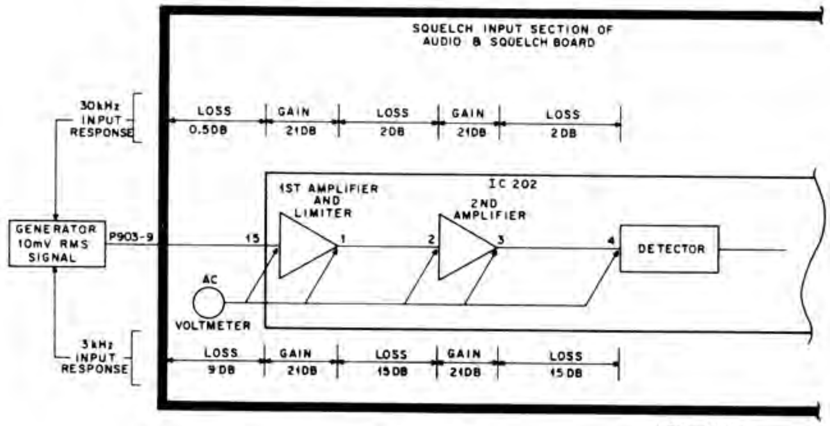


Figure 21.
Squelch Circuitry Stage Gain Measurements

Table 16. Squelch Integrated Circuit AC Measurements and Stage Gain

Connect AC Voltmeter to IC202-Pin	3 kHz Input Signal		30 kHz Input Signal	
	AC Voltage (mV rms)	Gain or Loss from Previous Reading	AC Voltage (mV rms)	Gain or Loss from Previous Reading
P903-9	10.0	——	10.0	——
15	3.5	9 dB loss	9.5	0.5 dB loss
1	40.0	21 dB gain	110.0	21 dB gain
2	7.0	15 dB loss	85.0	2 dB loss
3	80.0	21 dB gain	950.0	21 dB gain
4	14.0	15 dB loss	750.0	2 dB loss

Table 17. Transistor Resistance Measurement Chart
(Audio PA removed from station - Transistors mounted on board)

Ohmmeter Connections		Proper Resistance	
Positive Lead Connected To	Negative Lead Connected To	PNP Transistor	NPN Transistor
Base	Emitter, then Collector	Infinite	5-30 Ohms, Both Cases
Emitter, then Collector	Base	5-30 Ohms, Both Cases	Infinite
Collector	Emitter	Infinite	Infinite
Emitter	Collector	Infinite	Infinite

multimeters have insufficient voltage at the ohmmeter test probe tips to forward-bias a transistor junction and cannot be used. A volt-ohm-milliammeter (VOM) with 1000 to 20,000 ohms-per-volt sensitivity is required for these checks. Compare measured resistance readings with those in Table 17.

NOTE

Do not insert meter test probe tips into female connectors on the board. To do so could damage the connectors and result in poor electrical interconnection with the audio and squelch board.

7.4.2 Transistor Replacement

Care must be exercised to prevent damage (such as a scratch) to the mounting plate anodizing material at the transistor-mounting plate interface. Should the anodizing in this area become scratched, original performance can only be restored by the use of a new anodized plate. The plate can *not* be "repaired" by the use of any type of insulating washer without a loss in thermal conduction capability.

Factory replacement transistors are supplied with pre-formed leads to properly fit onto the anodized aluminum mounting plate and circuit board. A new nylon shoulder washer is included to insulate the transistor mounting screw from the transistor heatsink.

Step 1. Apply a thin, even coat of silicon grease to the metallic area of the transistor.

Step 2. Mount the transistor using the *new* nylon shoulder washer. Do not solder leads at this time. Tighten the transistor mounting screw.

NOTE

Do not damage the transistor by over tightening the mounting screw. Tighten the mounting screw until it just "touches" the nylon shoulder washer. Then turn the mounting screw 1/4 turn more.

Step 3. Solder transistor leads to printed circuit board.

STATION OPERATING PARAMETERS

ITEM	TYPICAL VALUE	FACTORY TEST (Note 1)	DATE WHEN PLACED IN SERVICE	1ST CHECK DATE	2ND CHECK DATE	3RD CHECK DATE	4TH CHECK DATE	5TH CHECK DATE	6TH CHECK DATE
Transmitter Output Power	See Table I								
Transmitter Deviation:									
With 1000 Hz @1 volt modulation	±5 kHz								
With PL tone-coded modulation	0.5 to 1 kHz								
Receiver 20 dB Quieting Level (less preampl or 2-wire coupler)	Less than 0.5 uV								
Frequency Measurement (Note 2):									
T1									
T2									
T3									
T4									
R1									
R2									
R3									
R4									
Exciter Audio Input Level (XCTR LEVEL):	Note 3								
Receiver Audio Output Line (LINE OUTPUT):	Note 3								
Repeater Level, if applicable	Note 3								
Control Line DC Current Levels and/or Function Tone Frequencies									
Transmit F1									
Transmit F2									
Transmit F3									
Transmit F4									
Disable Receiver PL									
Mute R2									
Unmute R2									

NOTES:
1. Enter data from factory test tickets provided with the station at time of shipment.
2. Transmitter frequency stability is ±0.0002%. Receiver frequency stability is ±0.0002% with AFC. Refer to receiver section for setting and measurement procedure.
3. Refer to the Installation & Adjustments section of this instruction manual for set up procedure and typical value.

STATION METER READINGS (Note 1)

CHASSIS METERED	METER SWITCH POSITION	FUNCTION	TYPICAL METER READING	FACTORY TEST (Note 2)	DATE WHEN PLACED IN SERVICE	1ST CHECK DATE	2ND CHECK DATE	3RD CHECK DATE	4TH CHECK DATE	5TH CHECK DATE	6TH CHECK DATE
RECEIVER	1	Channel Element Output	15 uA								
	2	1st Doubler Output	15 uA								
	3	2nd Doubler Output	15 uA								
	4 - and +	Discriminator Output	0±2 uA								
	5	Limiter Output	10 uA								
XCTR	1	"IDC" Audio Output	Note 4								
	2	Channel Element Output	25 uA								
	3	Tripler Input	38 uA								
	4	1st Doubler Input	22 uA								
	5	Exciter Output	25 uA								
POWER AMPL	1		15 uA (min)								
	2	Driver Current (75 Watt Only)	6-18 uA								
	3	PA Current	24-28								
	5	1st Stage Voltage	3-25								
POWER CONTROL	1	Forward Output Power	24-50 uA								
	2	Reflected Power	5-20 uA								
	5	Control Voltage	3-25 uA								

NOTES:
1. On multiple frequency stations, repeat test for each operational frequency.
2. Enter data from factory test tickets provided with station at time of shipment.
3. Reading should be 1 uA or less. If measurement is not readable, inject an on-channel signal @1.0 mV into the receiver input receptacle. A 20 uA typical reading should be obtained.
4. The "IDC" audio should be 2 uA without modulation and 10 uA with 120 mV @1000 Hz modulation applied to the microphone input.
5. See the complete transmitter alignment procedure included in this section of the manual for typical values.

MAINTENANCE LOG SHEET

TABLE 1

FREQUENCY RANGE/POWER OUTPUT LEVEL

MODEL SERIES	406-420 MHz	450-470 MHz	470-494 MHz (Note 1)	494-512 MHz (Note 1)
C24RCB	--	12 W	--	--
B/C34RCB	12 W	12 W	12 W	12 W
B/C44RCB	--	20 W	20 W	20 W
B/C54RCB	45 W	45 W	40 W	40 W
B/C64RCB	75 W	75 W	60 W	60 W

NOTES:
1. 470-512 MHz models should be set for indicated power output or less depending of system licensed ERP rating.
2. All frequency ranges - power output should be measured at the output of this antenna network using one foot or less of coaxial cable between the wattmeter and antenna network output connector.

SERVICING NOTES & HISTORICAL NOTES

DATE	ITEM (First maintenance problems encountered during servicing, addition of modification kits, and other items needed for historical purposes.)

EPS-17655-A

The station transmitter, illustrated in the following sections, is shown as a block diagram in Figure 1. The transmitter incorporates either an integral PA in the 2-, or 12-watt stations, or a separately racked PA in the 20-, 40/45-, 45-60/75-, or 75-Watt stations.

The transmitter operates in the UHF frequency band (406-512 MHz) on one of four FCC assigned frequency ranges:

— 406-420 MHz;
— 450-470 MHz;
— 470-494 MHz; and,
— 494-512 MHz.

Transmitter alignment and maintenance is detailed under the Station Data Tab, at the front of this manual. Transmitter cabling is detailed on the Typical Station Layout diagram (PEPS-28289) under the Station Data Tab. Transmitter electrical and/or mechanical parts lists, circuit board details, and parts location photographs accompany the applicable schematic diagram in the following sections.

Figure 2 shows connections between the power control board and other transmitter circuits. These connections are made via the transmitter interconnect board as indicated.

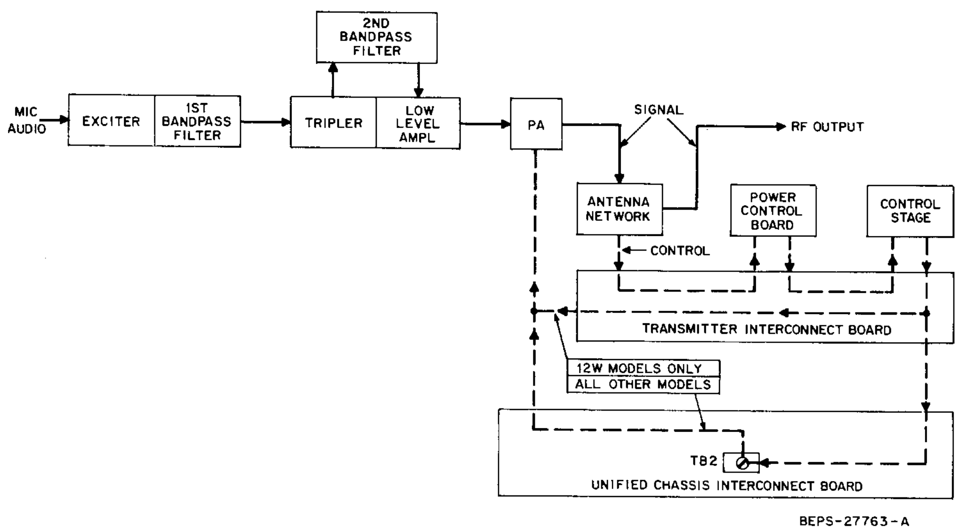


Figure 1. Transmitter Block Diagram

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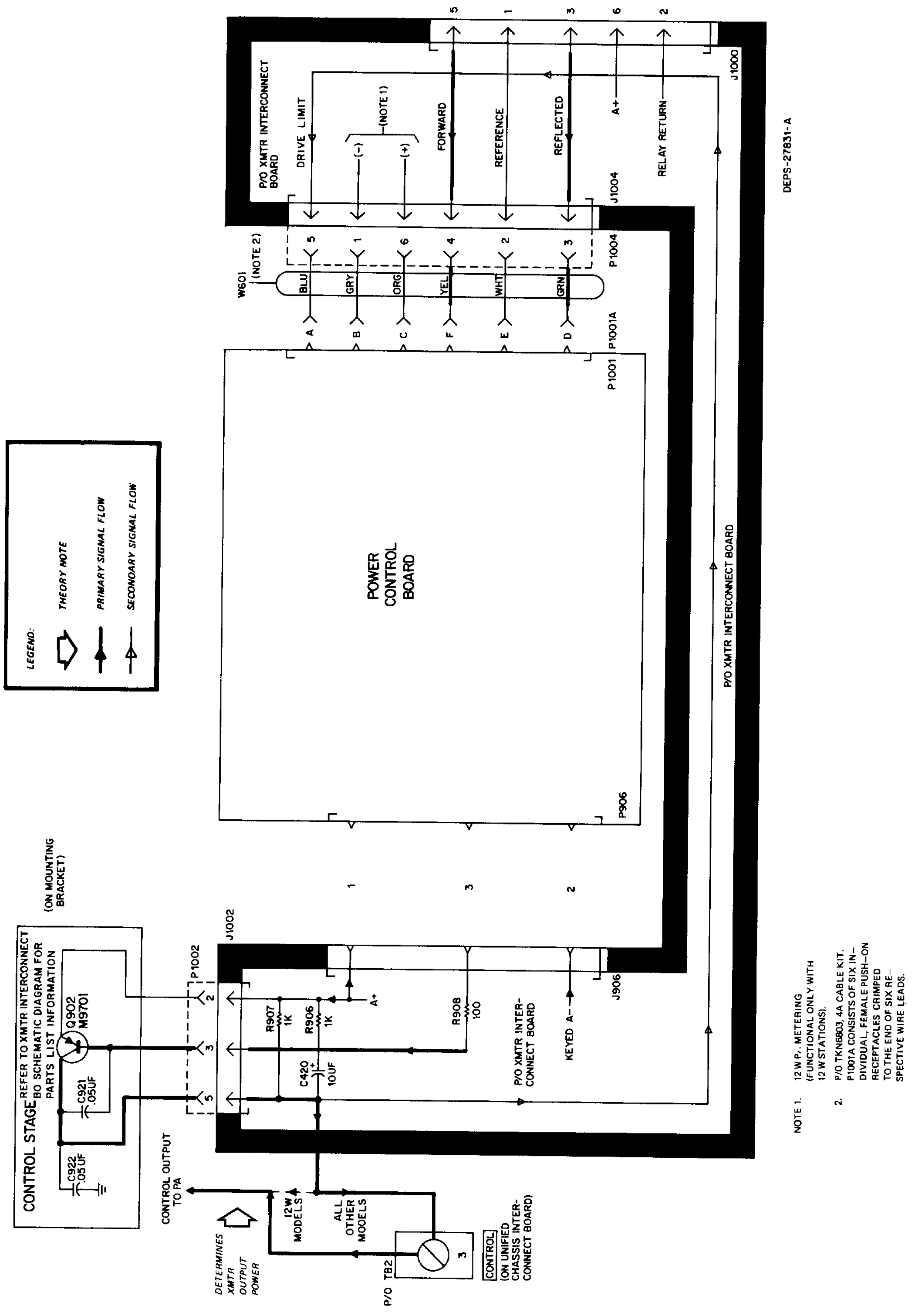
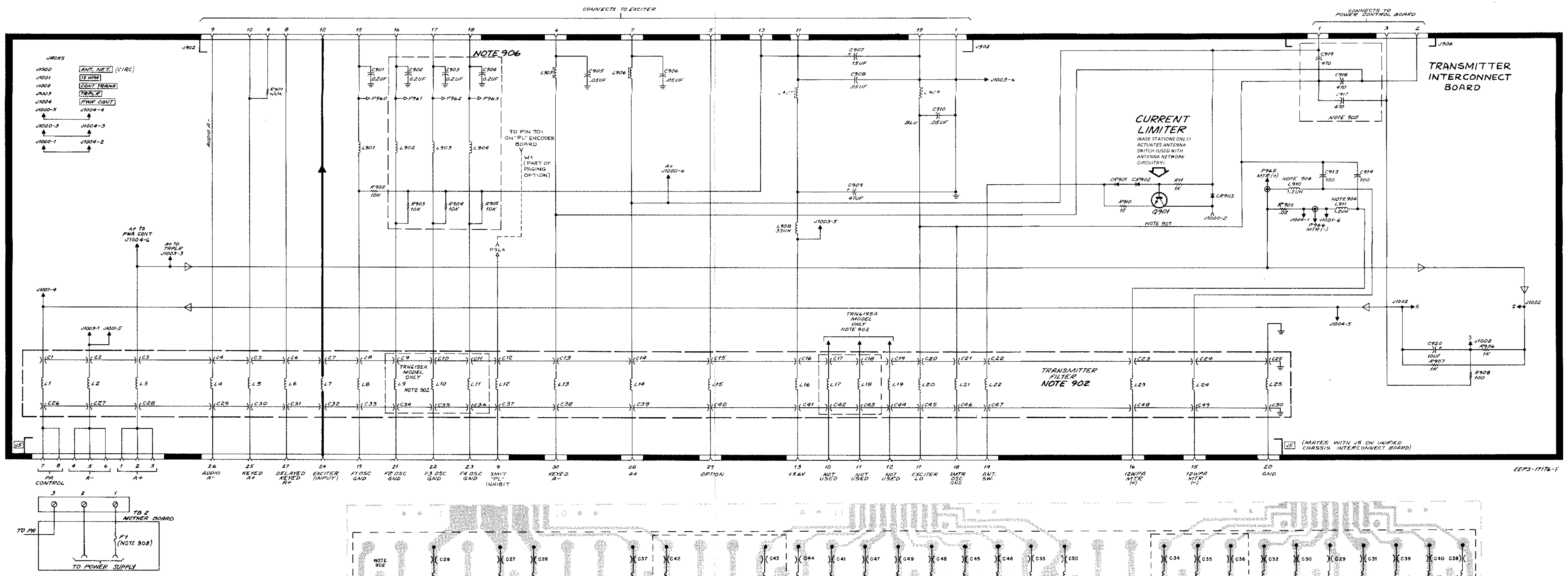


Figure 2. Power Control Board Connections to Transmitter Interconnect Board

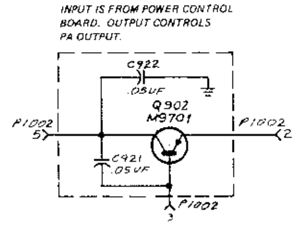


NOTES:

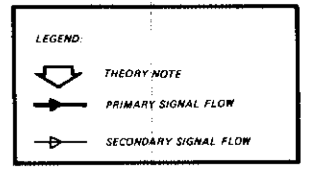
901. UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN PICOFARADS.
902. FILTERING COMPONENTS ARE USED ONLY WITH THE TRN6195A AND TLN5645A MODELS. THE TRN6195A MODEL USES ALL FILTERING COMPONENTS (C1--C50 AND L1--L25). THE TLN5645A MODEL USES ALL FILTERING COMPONENTS EXCEPT AS INDICATED ON THE SCHEMATIC DIAGRAM AND PARTS LIST. THE TLN5647A (BASE) MODEL DOES NOT USE ANY OF THESE FILTERING COMPONENTS BUT INCORPORATES "THRU" PLATING INSTEAD. (PLATING RUNS AND FILTERING COMPONENTS DO NOT EXIST SIMULTANEOUSLY.)
903. FILTERING CHOKES AND BYPASS CAPACITORS ARE USED ON VOLTAGE AND GROUND RUNS TO PREVENT RF RADIATION FROM BEING CON--DUCTED TO THE UNIFIED CHASSIS INTERCONNECT BOARD AND AFFECTING STATION OPERATION.
904. FILTER CHOKES L901 AND L911 PROVIDE A FILTERING FUNCTION FOR BUILT--IN STATION METERING ON 12--WATT STATIONS (AND RANGE I STATIONS OF THE B84RCB MODEL SERIES) ONLY. HOWEVER, THEY ARE PRESENT ON ALL STATIONS (ALL RANGES) OF THE B84RCB MODEL SERIES.
905. CAPACITORS C917, C918 AND C919 SHUNT RF ENERGY ON THE A+, KEYED A-, AND POWER CONTROL LEADS TO GROUND.
906. CAPACITORS C902--C904, CHOKES L902--L904 AND RESISTORS R903--R905 NOT USED ON TLN5645A (REPEATER) MODEL.
907. CURRENT LIMITER STAGE IS PRESENT ON THE TLN5647A (REPEATER) BOARDS, BUT IS NOT FUNCTIONAL IN THE B84RCB MODEL SERIES.
908. IN-LINE FUSE, P/O FUSE CABLE (TKN6004, 5, 6, 7A CABLE KITS – B84RCB MODEL SERIES, TKN6803, 4A – ALL OTHERS).

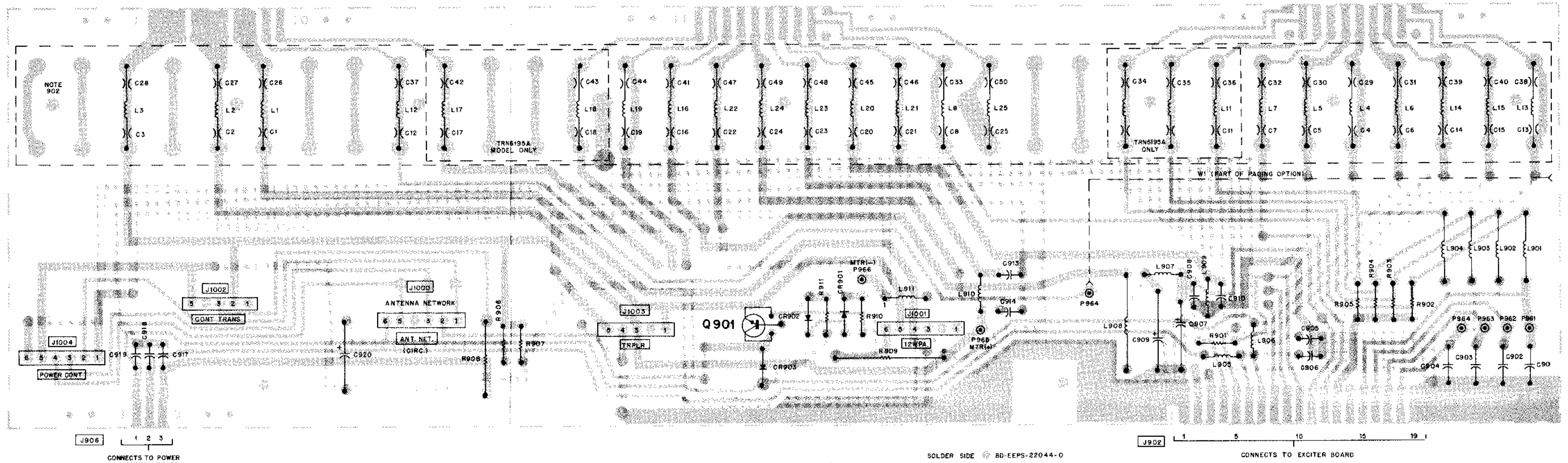
CONTROL STAGE

(ON REMOTE CONTROL CHASSIS) INPUT IS FROM POWER CONTROL BOARD. OUTPUT CONTROLS PA OUTPUT.



(PARTS LIST LOCATED IN REMOTE CONTROL CHASSIS SECTION OF CONTROL & APPLICATIONS MANUAL)





SHOWN FROM SOLDER SIDE

SOLDER SIDE 8D-EEPS-22044-O
COMPONENT SIDE 8D-EEPS-22045-O
OVERLAY OL-EEPS-22046-A

TRANSMITTER INTERCONNECT BOARD

MODEL TLN5645A (RPTR)
MODEL TLN5647A (BASE)
MODEL TRN6195A (FULL FILTERING OPTION)

FUNCTION

- Interconnects most transmitter circuit boards to each other, except the PA.
- Routes control functions from the unified chassis interconnect board to the transmitter.
- Repeater version includes unique transmitter filtering components.
- Includes partial control stage circuitry used to govern PA power output.
- Includes current limiter stage (base stations only) which is electrically functional with antenna network.

PARTS LIST

TRANSMITTER INTERCONNECT BOARD
TRN6195A (full filtering option)
TLN5645A (repeater station)
TLN5647A (base station)

PL-3407-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1 thru 18	21-861219	1000 pF +100-0%: 500 V (SEE NOTES 2, 3)
C19	21-82812H01	100 pF ±10%: 500 V
C20 thru 43	21-861219	1000 pF +100-0%: 500 V (SEE NOTES 2, 3)
C44 thru 50	21-82812H01	100 pF ±10%: 500 V
C901, 902, 903, 904	21-82372C02	0.2 uF +80-20%: 25 V (NOTE 2)
C905, 906, 908, 910	21-82372C04	0.05 uF +80-20%: 25 V
C907	23-83214C02	15 pF ±20%: 20 V
C909	23-82783B31	47 pF ±20%: 20 V
C911, 912		NOT USED
C913, 914	21-82204B06	100 pF ±10%: N1500
C915, 916		NOT USED
C917, 918,919	21-82187B07	470 pF ±10%: 500 V
C920	23-83214C20	10 uF ±20%: 20 V
		DIODE: (NOTE 1)
CR901, 902	48-82392B12	silicon
CR903	48-82466H13	silicon
		CONNECTOR, receptacle:
J1000, 1004	28-83441F07	male, 6 pin, white
J1001	28-83441F06	male, 6 pin, red
J1002	28-83441F04	male, 5 pin, red
J1003	28-83441F05	male, 5 pin, white
		COIL, rf:
L1, 2, 3, 4, 5, 6, 13, 14, 16, 19, 20, 22, 25	24-83977B01	1-1/2 turns (NOTE 3)
L7, 8, 9, 10, 11, 12, 15, 17, 18, 21, 23, 24, 905, 906, 907, 909	24-83961B01	3 turns (NOTES 2, 3)
L901, 902, 903, 904	24-80900A61	choke 0.62 uH (NOTE 2)
L908	24-854314	choke 33 uH
L910, 911	24-82723H01	choke 1.2 uH
		TRANSISTOR: (SEE NOTE 1)
Q901	48-869640	type M9640
		RESISTOR, fixed: ±10%: 1/4 W: unless otherwise stated
R901	6-124C97	100k
R902, 903, 904, 905	6-124C73	10k (NOTE 2)
R906, 907, 911	6-124C49	1k
R908	17-82291B21	100 ±5%: 3 W
R909	17-82620B03	0.02 ±5%: 3 W
R910	6-124A03	12 ±5%
		NON-REFERENCED ITEMS
	14-82621K01	INSULATOR
	3-134169	SCREW, tapping: 4-40 x 1/4" "Phillips", hex head
	3-139495	SCREW, tapping: 4-40 x 5/16" "Phillips"; 4 used
	5-84220B01	GROMMET
	14-83375K01	INSULATOR
	42-83629G01	FASTENER, driver; 2 used
	1-80775B71	FILTER BRACKET ASSY.
	1-80775B75	FILTER BRACKET COVER

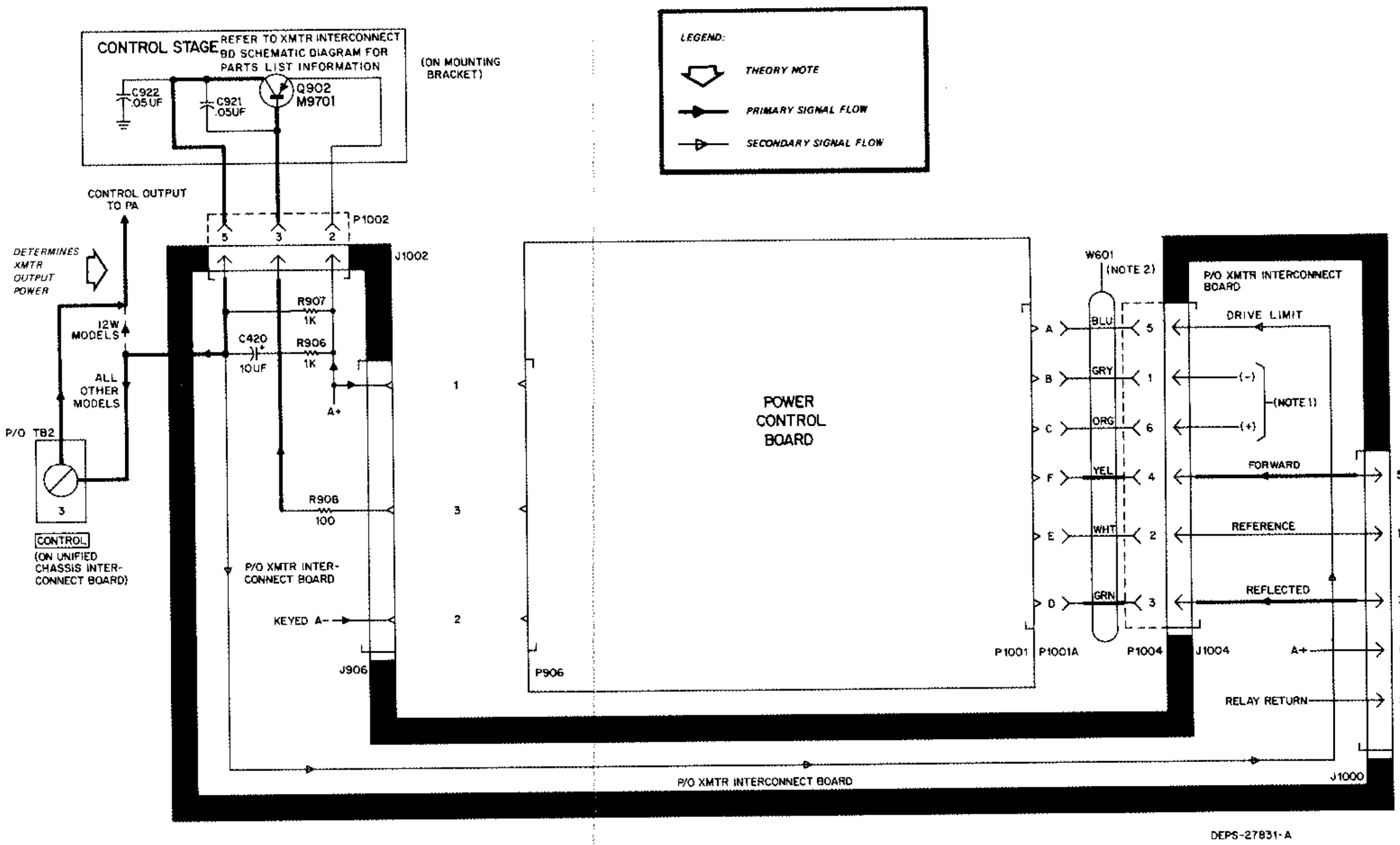
NOTES:

1. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.
2. The following items are not used with Model TLN5645A: Capacitors C9, 10, 11, 17, 18, 19, 34, 35, 36, 42, 43, 44, 902, 903, and 904; Coils L9, 10, 11, 23, 24, 25, 902, 903, and 904; Resistors R903, 904, and 905.
3. The following items are not used with Model TLN5647: Capacitors C1-50; Coils L1-25.

Transmitter Shield
(Repeater or Full Filtering)
TLE4181A (406-420 MHz)
TLE4183A (450-512 MHz)

PL-6435-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-139495	SCREW, tapping: 6-20 x 5/16"; 5 used
	26-82875K01	SHIELD; (TLE4183A)
	26-82832K01	SHIELD; housing (TLE4181A)



NOTE 1. 12 W P_o METERING (FUNCTIONAL ONLY WITH 12 W STATIONS).

2. P/O TKN6803, 4A CABLE KIT. P1001A CONSISTS OF SIX INDIVIDUAL, FEMALE PUSH-ON RECEPTACLES CRIMPED TO THE END OF SIX RESPECTIVE WIRE LEADS.

MOTOROLA INC.
Communications Group

EXCITER/1ST BANDPASS FILTER

MODEL TLE1720B SERIES

TRIPLER/LOW LEVEL AMPLIFIER

MODEL TLE1600B SERIES

1. INTRODUCTION

The Model TLE1720B series exciter/1st bandpass filter, and the Model TLE1600B series tripler/low level amplifier, provide low power excitation for an FM transmitter. Up to four plug-in channel elements, one for each transmitter operating frequency, are used to develop a direct FM carrier signal. Table 1 lists the models available per frequency range.

Table 1. Model Usage

Frequency Range	Exciter/1st Bandpass Filter	Tripler/Low Level Amplifier
406-420 MHz	TLE1721B	TLE1601B
450-470 MHz	TLE1723B	TLE1603B
470-494 MHz	TLE1724B	TLE1604B
494-512 MHz	TLE1725B	TLE1605B

The exciter is directly frequency-modulated (direct FM) for crystal-controlled frequency operation in the 132-174 MHz range. It consists of a symmetrical clipper and splatter filter, emitter follower, channel element(s) (voltage controlled crystal oscillator), buffer amplifier, tripler, first doubler, second doubler, and output amplifier. The fundamental crystal frequency is multiplied by twelve to provide an input to the tripler/low level amplifier, through the 1st bandpass filter, which develops the final output frequency and provides additional amplification of the rf signal. Table 2 gives the technical characteristics of the exciter/1st bandpass filter and tripler/low level amplifier.

When the exciter is used in "Private-Line" stations, a "Private-Line" encoder circuit board is plugged directly into the mating pins of the exciter; and one jumper (JU401) is removed from the exciter; no interconnecting wires are used. The exciter board also includes additional pins that permit the board to be used with certain types of optional equipment. These pins are designated P403 on the exciter schematic diagram.

2. FUNCTIONAL OPERATION

Refer to the exciter block diagram (Figure 1) and the exciter/1st bandpass filter and tripler/low level amplifier schematic diagrams at the end of this section.

2.1 DEVIATION LIMITING CIRCUIT

Microphone output audio is applied to the symmetrical clipper and splatter filter. This circuit, together with amplifier U401, provides pre-emphasis, amplification, and limiting of the microphone audio. Microphone audio is then applied to emitter follower Q401 (together with "PL" code), through IDC control to the channel element(s).

The output of the emitter follower is developed across IDC potentiometer R410. This audio signal can be monitored at pin 1 of the exciter metering receptacle. The potentiometer adjusts the maximum level of audio coupled to the oscillator-modulator, thus setting the amount of deviation.

In "Private-Line" radios, a low amplitude "Private-Line" code is continuously injected into the oscillator-modulator from the "Private-Line" encoder. This code range will produce 0.5 to 1.0 kHz deviation.

2.2 MODULATOR-OSCILLATOR STAGE (CHANNEL ELEMENT)

Channel elements are highly stable crystal-controlled oscillators. They use unheated crystals in an oscillator circuit that is temperature compensated over the entire temperature range of -30° to +60°C (-22° to +140°F). A variable warp capacitor in the base of each channel element is accessible through a hole in the exciter circuit board for fine frequency adjustment. Each channel element is a factory sealed, plug-in module which provides a train of frequency stable, positive going, pulses.

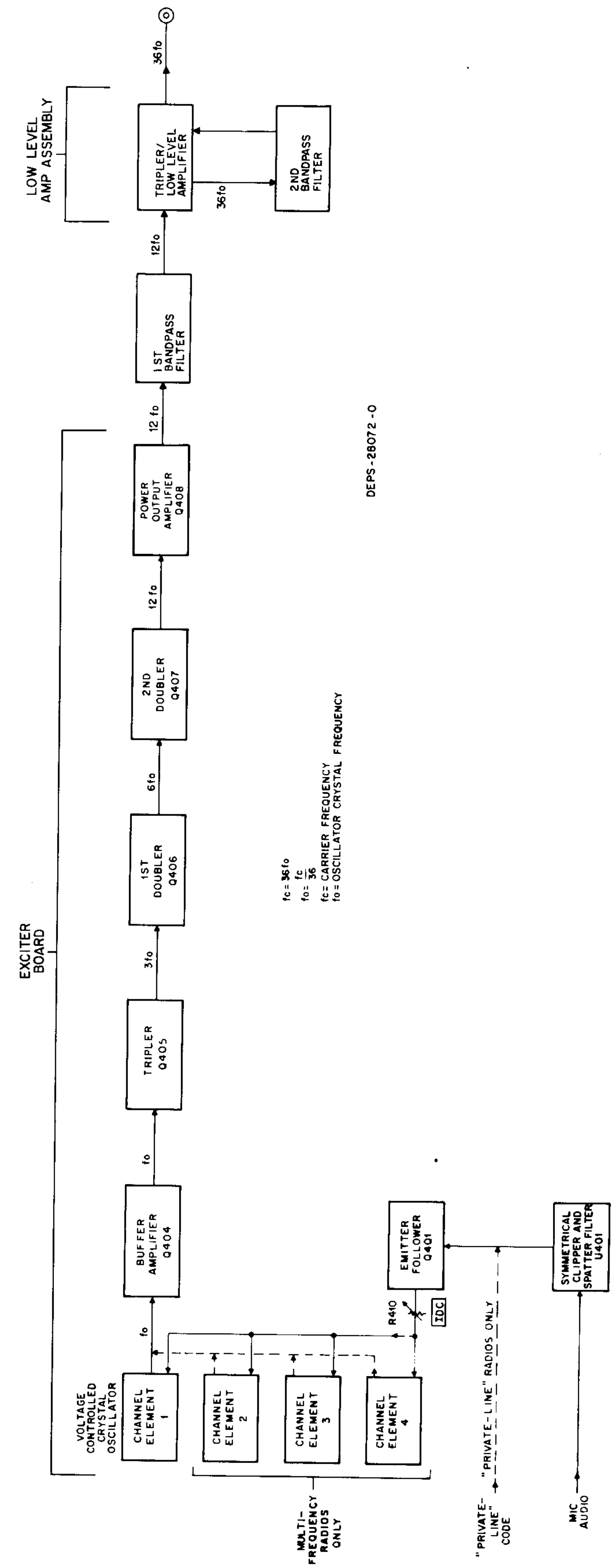


Figure 1. Exciter Block Diagram

The combination modulator-oscillator stage (channel element) consists of a parallel combination varactor and warping capacitor connected in series with a crystal. A change in capacitance seen at the crystal terminals will cause the crystal to vary its resonant frequency in proportion to the capacitance change. The audio voltage from the audio and IDC circuitry is applied to the varactor to cause a change in capacitance; this variation in turn causes the frequency to change at the same audio rate, creating a direct FM carrier.

This signal is multiplied twelve times and amplified in following stages to produce the input for the tripler/low level amplifier.

The exciter accepts up to four channel elements — one channel element is required for each frequency. Only one frequency may be selected at a time, but transmissions are possible on as many as four separate frequencies. A power input of +9.6 volts is applied to the channel element(s) continuously while the station is turned ON. Channel element output is developed only when a switched ground generated by the local or remote control unit is present. In multi-frequency transmitters, this switched ground is applied to a specific channel element as determined by the frequency selector switch associated with the station. An indication of the channel element output is available at pin 2 of the metering socket. This allows channel element operation to be easily checked with built-in station metering or with a Motorola portable test set.

NOTE

If station is equipped with a time-out timer module and the timer times-out, keyed A- is removed from the modulator-oscillator(s) and the entire transmitter is shut down.

2.3 BUFFER AMPLIFIER

The buffer amplifier, Q404, is biased to operate as a Class A amplifier and provides reserve gain which isolates the modulator-oscillator from the succeeding stages.

2.4 MULTIPLIERS AND EXCITER OUTPUT AMPLIFIER

On the exciter board the multipliers develop an output signal that is 12 times the channel element frequency and a final power amplifier gives power gain and matches the output impedance to 50 ohms.

The buffer amplifier output is developed across two parallel resonant tank circuits at the channel element frequency. Tripler Q405 operates as a Class C amplifier with its parallel resonant output tuned to the third harmonic of its input. Thus the output of the tripler is three times the channel element frequency. A meter connected at pin 3 of the metering receptacle measures the average dc base current which is proportional to input signal strength.

The first doubler circuit operates very similar to the tripler except its output is tuned to the second harmonic of its input and its drive is metered at pin 4. The output of the doubler is six times the channel element frequency.

The second doubler circuit also operates similar to the tripler with its output tuned to the second harmonic of its input. The drive to the second doubler is metered on pin 5 of the metering receptacle. The output signal is 12 times the channel element frequency and is the input to the tripler/low level amplifier.

Table 2. Exciter/1st Bandpass Filter & Tripler/Low Level Amplifier Technical Characteristics

Number of Channels	1 to 4
Maximum Frequency Separation	± 750 kHz
Oscillator Frequency	11-14.5 MHz
Frequency Multiplication	12 times (36 times with tripler/low level amplifier)
Output Power	400 milliwatts (nominally 1-2 watts out of low level amplifier)
Output Impedance	50 ohms
Modulator Type	Direct FM
Deviation	± 5 kHz, adjustable instantaneous deviation limiting
Audio Response	6 dB/octave pre-emphasis 300 to 3000 Hz
Audio Sensitivity	165 millivolts for ± 3.0 kHz deviation
Audio Distortion	Less than 3% at ± 3.0 kHz deviation from 300 to 3000 Hz
Power Requirements	Regulated +9.6 volts dc @ 150 mA +13.6 volts dc @ 100 mA
Construction	Fully solid-state
Metering	Five test points critical to operation and alignment are accessible at a metering receptacle which permits testing with built-in station metering, Motorola portable test set, or 0-50 uA microammeter, with 2000 ohms series resistance.

The exciter output amplifier also operates as a Class C power amplifier. This amplifier provides at least 400 milliwatts of frequency modulated signal as the input to the tripler/low level amplifier, through the 1st bandpass filter.

2.5 TRIPLER/LOW LEVEL AMPLIFIER

This sealed unit amplifies and triples the exciter output (135-171 MHz range) to produce an output in the 406-512 MHz range. The output power produced is nominally 1-2 watts; which drives the following power amplifier.

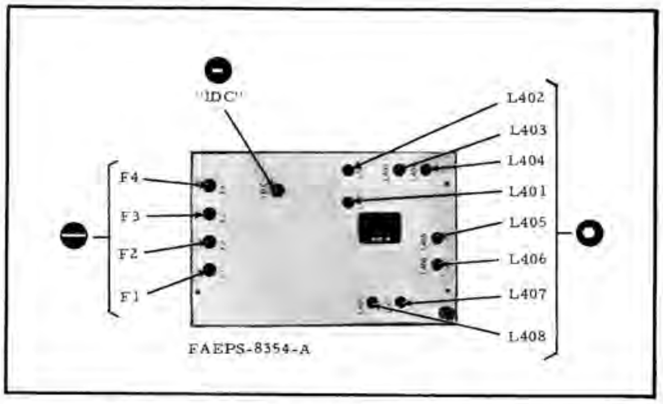


Figure 2. Exciter Adjustment Locations

3. EXCITER ALIGNMENT

If a portable test set is used during the following Exciter Alignment Procedure, the metering plug will be inserted into the Exciter Metering Receptacle. Set the OSCILLATOR & METER REVERSING switch to the OFF position, and set the REF A/B switch (on the metering adapter cable plug) to A. If using built-in station metering, turn the metering select switch to the EXCITER quadrant.

Perform the Exciter Alignment Procedure as given in Table 3. Figure 2 illustrates the physical locations of the exciter coils and controls. Figure 3 is a graph giving the number of turns necessary to preset coils L407 and L408.

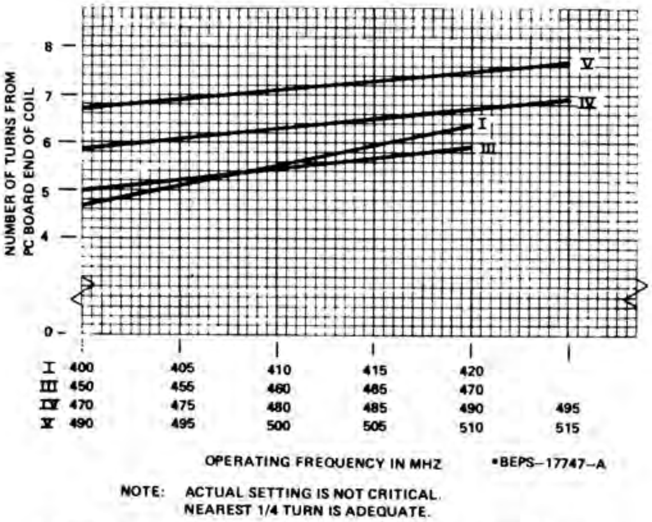


Figure 3. Exciter Tuning Coil L407 & L408 Preset

Table 3. Exciter Alignment Procedure

Step	Adjust	Selector Switch Position	Procedure
1. Set-Up	—	—	Key transmitter.
2. Power Output	POWER SET control	—	Turn fully CCW (counterclockwise) — minimum power output. Unkey transmitter.
3. Channel Element	—	2	Key transmitter. Meter 2 should indicate at least 10 uA.
4. Pre-Alignment	All Exciter coils	5	If exciter is completely untuned and no readings are obtained on meter 5. 1. Set cores of tuning coils L401 thru L406 to top of coil forms (away from circuit board). 2. Set cores of tuning coils L407 and L408, away from circuit board end of coil forms, per Figure 2.
5. Buffer Output	L401	2	Adjust for minimum meter reading.
6. Buffer Output	L402, L401	3	Adjust (in order shown) for peak.
7. Tripler Output	L403	3	Adjust for minimum meter reading.
8. Tripler Output	L404, L403	4	Adjust (in order shown) for peak.
9. 1st Doubler Output	L405	4	Adjust for minimum meter reading.
10. 1st Doubler Output	L406, L405	5	Adjust (in order shown) for peak.
11. Exciter Output	L407	5	Adjust for peak.
12. Exciter Output	L408, L407	5	Adjust (in order shown) for peak.
13. Repeat Steps 6, 8 & 10.			
14. Completion	POWER SET control	—	Key transmitter. Adjust CW (clockwise) to desired power output level. Unkey transmitter.
This completes the Exciter Alignment Procedure.			

4. EXCITER MAINTENANCE

NOTE

Exciter board must be installed in transmitter for testing to provide necessary power, ground, control and signal connections. Circuit board should always be secured in place with all mounting screws for operation and testing to provide good rf ground to all stages of exciter. Exciter should be tested while installed in the station--usually preferred method. However, if desired, it can be bench tested in VHF (132-174 MHz) "Micor" mobile radio, except that time-out timer is inoperative.

4.1 METERING

The exciter is equipped with a metering receptacle which allows five major test points to be measured. The output of the exciter is measured on meter position 5. With the built-in station metering, or by using the portable test set connected to the metering receptacles, readings may be made at each of the major test points in the circuit. A failure in almost any portion of the exciter will produce a low or zero meter reading for one or more of the test points. Improper alignment will also cause improper meter readings.

NOTE

An isolation network is an antenna network used to isolate "low level" power amplifier output from final power amplifier input.

4.1.1 Using the Built-In Station Metering

Step 1. The output of the exciter must be terminated into its normal point, the first bandpass filter. The output of the station, through the isolation network, must be terminated in a 50 ohm, non-reactive, dummy load or an antenna.

Step 2. Plug the metering plug into the exciter metering receptacle.

Step 3. Turn the station ON.

Step 4. Set the selector switch on the built-in station metering kit to the EXCITER quadrant, position 1. Key the transmitter and whistle into the microphone long enough to observe the meter reading.

Step 5. Set the selector switch to positions 2, 3, 4 and 5 respectively, keying the transmitter and observing the meter readings for each position (whistling not required). An analysis of the meter readings to determine whether each circuit is good or bad follows in the "Performance Tests" paragraph.

4.1.2 Using the Portable Test Set

To make the measurements using a portable test set, the portable test set must be connected to the station as listed in the following procedure.

Step 1. Connect the 20-pin plug of the test set adapter cable to the test set. When the test set is not in use, disconnect the 20-pin plug to conserve battery life. The plug acts as an ON-OFF switch, completing the battery circuit.

Step 2. Connect the red "control" plug of the adapter cable to the control receptacle on the unified chassis interconnect board. Connect the white "metering" plug of the adapter cable to the metering receptacle on the exciter circuit board.

Step 3. Set the FUNCTION SELECTOR switch of the portable test set to the XMTR position.

Step 4. Set the OSCILLATOR and METER REVERSING switch of the test set to the OFF position.

Step 5. Set the 1 V/100 mV switch on the adapter cable to the 100 mV position (TEK-37). On the later version adapter cable (TEK-37A), the switch is omitted and the unit always operates at 100 mV sensitivity.

Step 6. Set the REF A-B switch on the adapter cable to position A.

Step 7. The output of the exciter must be terminated into its normal point, the first bandpass filter. The output of the station, through the antenna isolation, must be terminated in a 50 ohm, non-reactive, dummy load or an antenna.

Step 8. Turn the station ON.

Step 9. Connect a microphone to the microphone receptacle on the portable test set or to the unified chassis interconnect board.

Step 10. Set the selector switch of the test set to position 1. Using the push-to-talk switch on the microphone, key the transmitter and whistle into the microphone long enough to observe the metering reading.

Step 11. Set the selector switch to positions 2, 3, 4, and 5 respectively, keying the transmitter with the XMTR ON pushbutton on the test set or the push-to-talk switch on the microphone and observing the meter reading for each position. An analysis of the meter readings to determine whether each circuit is good or bad follows in the "Performance Tests" paragraph.

Each time maintenance is performed on the exciter, the readings should be compared with the previous set of readings. Any degradation of performance will quickly be noted. Often, a lower reading may indicate an impending failure and corrective action may be taken before the circuit fails entirely. The minimum values given in Table 4 may be used if no previous readings are available. However, these readings are an absolute minimum for normal operation and are no substitute for a log kept of meter readings. A typical exciter may have much higher readings and should not be allowed to drop to these minimum values before corrective action is taken. If a log is maintained, even small drops in meter readings will be noticed. This condition should be interpreted as abnormal operation and corrective action taken (such as realignment) to assure continued peak performance.

4.2 PERFORMANCE TESTS

The following performance tests may be used for troubleshooting to isolate the point of abnormal performance. They may also be used after repair and alignment to assure that the exciter meets all specifications before it is returned to service.

4.2.1 Power Output Test

The exciter shall provide at least 400 milliwatts rf output on 1/3 of the assigned frequency.

Step 1. Configure the equipment as connected in the "Metering" paragraph, (connect the "metering" plug to the exciter metering receptacle).

Step 2. Set the selector switch to position 5. This checks the output of the exciter. Key the transmitter and observe the meter indication. A meter reading of at least 20 uA equals an rf signal level of 400 milliwatts.

4.2.2. Frequency Test

The carrier frequency output of the transmitter shall be within .0002% of the assigned carrier frequency.

Step 1. Terminate the isolation network in an antenna and measure the radiated signal with a Motorola digital frequency meter and deviation monitor or other highly accurate frequency measuring device (± .00005% or better) when the transmitter is keyed in the following steps.

NOTE

Do not use push-to-talk switch on microphone, as background noise will modulate signal. Use XMIT switch on Station Control Module.

Step 2. Key the transmitter to produce an unmodulated carrier signal. In tone-coded "Private-Line" stations disable the "Private-Line" encoder by unplugging the "Vibrasender" resonant reed. In digital-coded "Private-Line" stations, disable the "Private-Line" encoder by shorting the PL disable pin (J701) to ground (J702).

Step 3. Read the transmitter carrier frequency output.

Step 4. If adjustment is required, set the "warp" capacitor on the channel element for the assigned carrier frequency output. For best accuracy, the station should be brought to room temperature (+70° to 75°F) and the test equipment thoroughly warmed up. This brings the channel element to the center of its temperature compensation range. Once calibrated at this temperature, it can most accurately compensate for future temperature changes.

4.2.3 Deviation Test

The exciter output shall deviate ±5 kHz with an audio input of 1 V rms at 1 kHz. In "Private-Line" stations, the exciter output shall deviate 0.5 to 1 kHz with "Private-Line" modulation applied.

Step 1. Terminate the isolation network in an antenna and measure the radiated signal with a deviation meter.

Step 2. In "Private-Line" stations, re-enable PL, which was disabled in the previous test. Key the transmitter with only "Private-Line" tone modulation. The deviation meter should indicate 0.5 to 1 kHz.

Step 3. Connect an audio oscillator output to pins 12 and 19 on the exciter board. Adjust the audio oscillator to 1 kHz and 1 V rms (measured on an ac voltmeter). The deviation meter should indicate ±5 kHz deviation.

Table 4. Typical Exciter Meter Readings

Selector Switch Position	Reference Switch Position (Test Set Only)	Reading	Circuit Metered	If Low, The Defective Circuit Is
1	A	2 uA (no mod) 10 uA (120 mV audio at Mic input)	Audio output of IDC circuit	IDC circuit
2	A	25 uA	Channel element output	Channel element
3	A	38 uA	Tripler input	Modulator or Tripler
4	A	15 uA	1st doubler input	Tripler or 1st doubler
5	A	20 uA	Exciter output	1st doubler, 2nd doubler or amplifier

Step 4. Adjust the audio oscillator over the entire 300 to 3000 Hz range, keeping the audio level at approximately 1 V rms. The deviation meter should never exceed ± 5 kHz, nor drop below ± 2.5 kHz.

4.2.4 Audio Sensitivity Test

An audio input of 120 mV rms at 1 kHz shall produce approximately ± 3 kHz deviation.

Step 1. After completion of the deviation test, reduce the output of the audio oscillator to 120 mV rms at 1 kHz.

Step 2. The deviation meter should indicate approximately ± 3 kHz. Position 1 meter reading should be noted at this time for future reference. Future audio sensitivity checks may then be made by comparing the meter 1 reading with the noted value.

4.3 TROUBLESHOOTING

4.3.1 Check Input Voltages

If there are no meter indications at one or more of the metered points, check the dc input voltages to the exciter circuit board, which are given in Table 5.

Table 5. Exciter DC Input Voltages

P902-11 & 13	+ 9.6 volts with respect to chassis.
P902-6	Keyed A- (approximately -13.6 volts with respect to A +, pin 7) when keyed.

If meter indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

NOTE

In "Private-Line" stations, transmitter cannot be keyed if PL encoder is removed, unless jumper (JU401) is connected from pin 8 to pin 10 of the exciter to complete keying circuit. This jumper is permanently connected in exciters used in carrier squelch operation.

4.3.2 Alignment as a Troubleshooting Technique

Low meter readings, low power output, and subnormal performance are very often corrected by realignment. Therefore, alignment should be the first troubleshooting step performed for these symptoms. Many technicians prefer to use alignment as the first troubleshooting step in all cases. During the alignment procedure, any trouble caused by a defective component will be discovered and corrected before alignment can be completed.

4.3.3 Isolating Defective Components

If meter readings are abnormal or tests indicated subnormal performance, a logical troubleshooting procedure is required to isolate the defective component efficiently. The meter readings and results of performance tests usually localize the malfunction to one or two specific stages. A zero meter reading indicates either (1) no drive from the preceding stages, or (2) a defective component in the metering circuit which includes the base-emitter junction of the following transistor which operates as a rectifier. The accompanying troubleshooting chart summarizes these results in a logical sequence. A few voltage and resistance checks in the suspected circuit should readily isolate the defective component. Note that the final amplifier stage of the exciter is powered by A+ and keyed A-. Therefore, voltages should be checked with respect to keyed A-, instead of chassis ground.

5. TRIPLER/LOW LEVEL AMPLIFIER MAINTENANCE

5.1 PERFORMANCE TEST

NOTE

Field servicing of tripler/low level amplifier should not be attempted. If tripler/low level amplifier is defective, replace entire unit. Removal and replacement is described following performance testing.

Step 1. Disconnect PA input cable from Final PA input (J901) and isolation network output (J1012).

Step 2. Connect a UHF-rated wattmeter to J1012, with less than 6 inches of RG58/U cable or less than 1 foot of RG8/U cable. The jumper cable must have a type "N" male connector on each end. The wattmeter must be terminated in a 50 ohm, non-reactive, dummy load.

Step 3. Disconnect coaxial cable from tripler/low level amplifier output (J551). Disconnect "low level" PA output (P502) from isolation network input (J1011). Connect J551 to J1011 with a short BNC-to-BNC adapter cable.

Step 4. Key transmitter and measure tripler/low level amplifier power output. Wattmeter indication should be at least 0.8 watt. If a minimum of 0.8 watt cannot be obtained, connect a short phono-to-BNC adapter cable between the 2nd bandpass filter output (J553) and J1011. Key transmitter and measure power output. Wattmeter indication should be at least 0.08 watt.

Step 5. If a minimum of 0.08 watt cannot be obtained, measure EXCITER, meter position 5. Meter 5 indication should be at least 15 uA. (REF A/B switch on TEK-37A Portable Test Set Adapter Cable is set to B.)

If meter 5 indication is low, exciter is defective. If meter 5 indication is 15 uA or greater, tripler/low level amplifier is defective (low power output). Also, check all rf cable connectors and both bandpass filters.

5.2 TRIPLER/LOW LEVEL AMPLIFIER REMOVAL & REINSTALLATION

NOTE
All steps performed from front of station.

5.2.1 450-512 MHz Models Only

Step 1. Disconnect coaxial cables (W500, W501 & W502) connecting "low level" PA to tripler/low level amplifier output (J551) and isolation network input (J1011).

Step 2. Loosen three captivated shield cover screws and remove shield cover.

Step 3. Loosen captivated screw holding tripler/low level output receptacle bracket and remove bracket (with receptacle J551 mounted on bracket).

Step 4. Disconnect tripler/low level amplifier power plug from receptacle J1003 on transmitter interconnect board.

Step 5. Loosen four captivated screws holding tripler/low level amplifier in place.

Step 6. Carefully pull tripler/low level amplifier part way out and then disconnect its input (P551), connected to output of 1st bandpass filter (J452). Tripler/low level amplifier is now completely disconnected.

Step 7. To reinstall tripler/low level amplifier, reverse procedure given in Steps 1-6.

5.2.2 406-420 MHz Models Only

Step 1. Loosen two captivated assembly screws on "low level" PA heat sink.

Step 2. Pivot and lift "low level" PA assembly up and off pivot bushing and simultaneously disconnect following connectors:

- PA power plug from receptacle J1001 on transmitter interconnect board;
- "low level" PA input plug (P501) from tripler/low level amplifier output receptacle (J551);
- "low level" PA output plug (P502) from isolation network input (J1011).

"Low level" PA assembly is now completely disconnected from unified chassis. Place it aside.

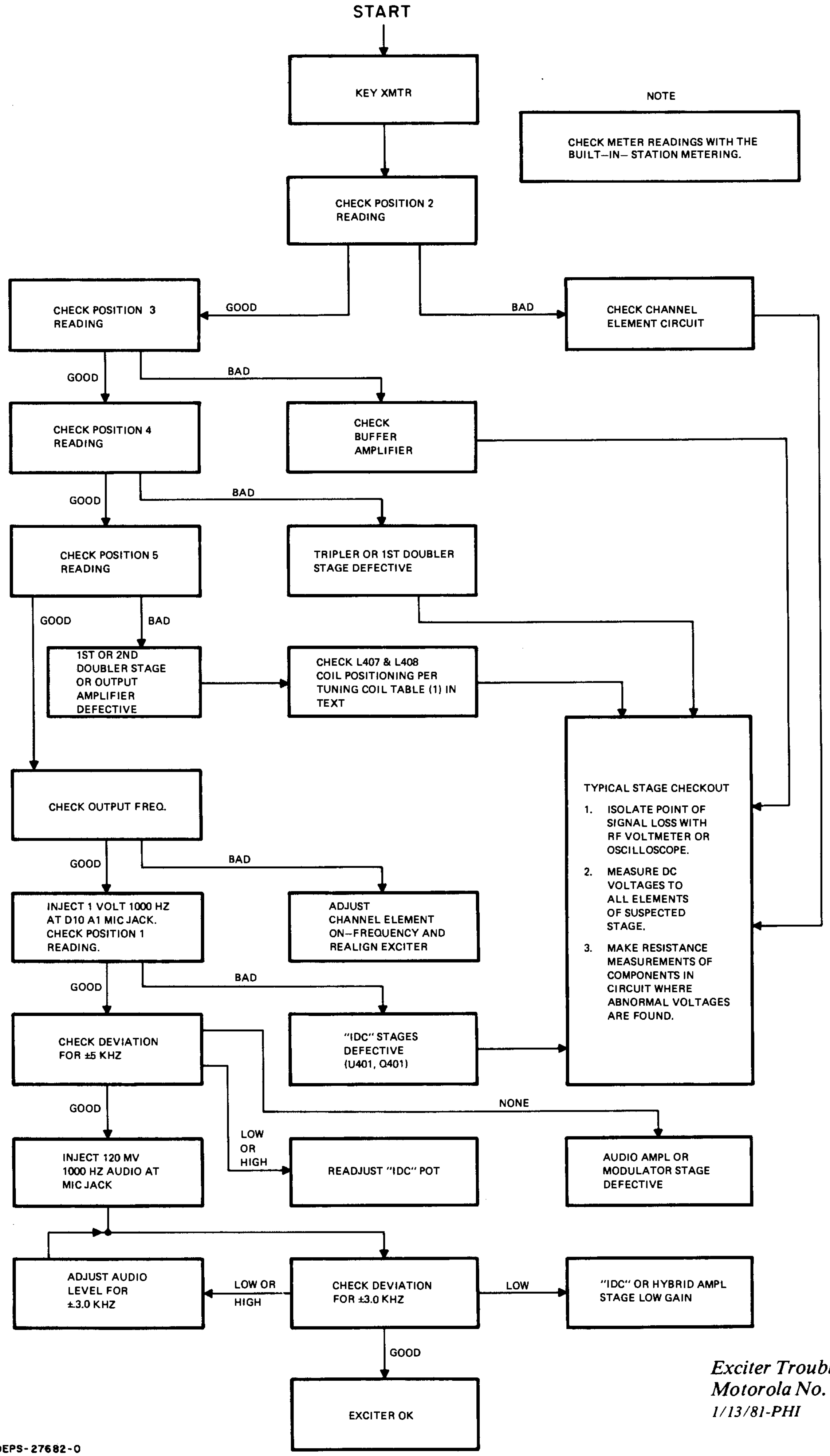
Step 3. Loosen three captivated screws used to mount "low level" PA mounting bracket and remove bracket.

Step 4. Disconnect tripler/low level amplifier power plug from receptacle J1003 on transmitter interconnect board.

Step 5. Loosen four captivated screws which hold tripler/low level amplifier in place.

Step 6. Carefully pull tripler/low level amplifier part way out and then disconnect its input (P551), connected to output of 1st bandpass filter (J452). Tripler/low level amplifier is now completely disconnected.

Step 7. To reinstall tripler/low level amplifier, reverse procedure given in Steps 1-6.



Exciter Troubleshooting Chart
Motorola No. DEPS-27682-O
1/13/81-PHI

DEPS-27682-O

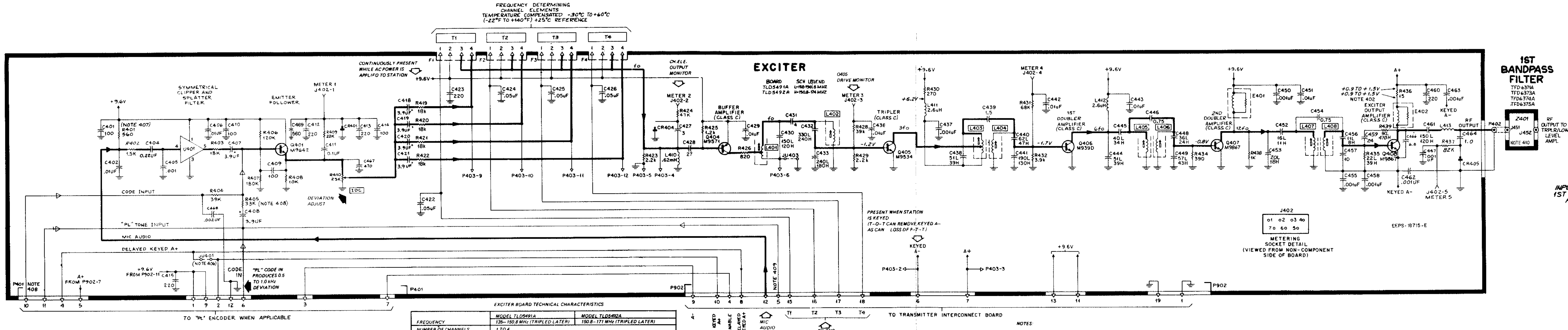
EXCITER TROUBLESHOOTING CHART

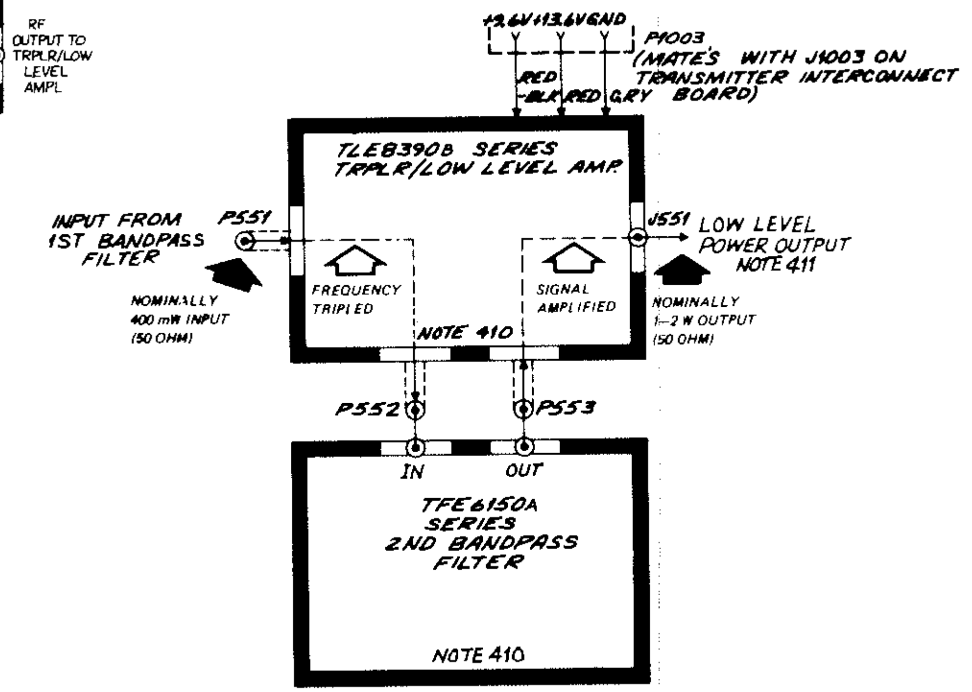
EXCITER/1ST BANDPASS FILTER

MODEL TLE1720B SERIES

TRIPLER/LOW LEVEL AMPLIFIER

MODEL TLE1600A SERIES





FUNCTION

Exciter — Produces modulated RF signal in 135-171 MHz range.

1st Bandpass Filter — Attenuates signals outside the bandpass range.

Tripler/Low Level Amp. — Triples exciter output frequency and amplifies that signal to drive the following PA.

EXCITER BOARD TECHNICAL CHARACTERISTICS

FREQUENCY	MODEL TLD5491A 135–150.8 MHz (TRIPLED LATER)	MODEL TLD5492A 150.8–171 MHz (TRIPLED LATER)
NUMBER OF CHANNELS	1 TO 4	
MAXIMUM FREQUENCY SEPARATION	±850 kHz	
OSCILLATOR FREQUENCY	11–14.5 MHz	
FREQUENCY MULTIPLICATION	12 TIMES	
OUTPUT POWER	400 MILLIWATTS (OUT OF 1ST BANDPASS FILTER)	
OUTPUT IMPEDANCE	50 OHMS	
MODULATION TYPE	DIRECT FM CHANNEL ELEMENTS	
DEVIATION	±5 kHz, ADJUSTABLE INSTANTANEOUS DEVIATION LIMITING	
AUDIO RESPONSE	6 dB/OCTAVE PRE–EMPHASIS 300 TO 3000 Hz	
AUDIO SENSITIVITY	120 MILLIVOLTS ±3dB FOR ±3.0 kHz DEVIATION	
AUDIO DISTORTION	LESS THAN 3% AT ±3.0 kHz DEVIATION FROM 300 TO 3000 Hz	
POWER REQUIREMENTS	REGULATED +9.6 VOLTS DC @ 150 mA +13.6 VOLTS DC @ 100 mA	
METERING	FIVE TEST POINTS CRITICAL TO OPERATION AND ALIGNMENT ARE ACCESSIBLE AT A METERING RECEPTACLE WHICH PERMITS TESTING WITH AN OPTIONAL BUILT–IN STATION METER, MOTOROLA PORTABLE TEST SET, OR 0–50 uA MICROAMMETER WITH 2,000 OHMS INTERNAL RESISTANCE. (USE THE BUILT-IN STATION METERING ON THE B8ARCB MODEL SERIES STATIONS.)	
FREQUENCY CALCULATION	$f_e = 12 f_o$ $f_c = 36 f_o$ $f_o = \frac{f_c}{36}$ or $\frac{f_e}{12}$ f_c = CARRIER FREQUENCY f_o = OSCILLATOR CRYSTAL FREQUENCY f_e = EXCITER OUTPUT FREQUENCY	

NOTES:

401. FREQUENCY CALCULATIONS GIVEN IN ACCOMPANYING TECHNICAL CHARACTERISTICS TABLE. NOTE THAT OUTPUT OF EXCITER IS 12 f_o AND NOT FINAL CARRIER FREQUENCY. A FOLLOWING TRIPLER STAGE MULTIPLIES EXCITER OUTPUT TO THE CARRIER FREQUENCY.
402. VOLTAGE MEASURED ACROSS R436.
403. HIGH IMPEDANCE TRANSISTORIZED VOLTMETERS (11 MEGOHM) NOT RECOMMENDED.
404. UNLESS OTHERWISE STATED, VOLTAGES MEASURED IN RESPECT TO CHASSIS GROUND.
405. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS.
406. JU401 REMOVED IN "PRIVATE–LINE" RADIOS.
407. R401 REMOVED IN REMOTE CONTROL STATIONS.
408. WHEN CODE INPUTS ARE APPLIED VIA P401–10, R405 MUST BE REMOVED FROM THE CIRCUIT.
409. IN "PRIVATE–LINE" RADIOS, P902–5 IS NOT CONNECTED TO THE TRANSMITTER INTERCONNECT BOARD.
410. THE TRIPLER/LOW LEVEL AMPLIFIER "BOX" IS NOT REPAIRABLE. IF DEFECTIVE, IT MUST BE REPLACED. THIS ALSO APPLIES TO THE 1ST AND 2ND BANDPASS FILTERS.

LEGEND

START = CIRCUIT THEORY MOST EASILY UNDERSTOOD BY BEGINNING AT THIS POINT AND FOLLOWING SIGNAL FLOW

= THEORY OF OPERATION DATA

= MAINTENANCE DATA

= PRIMARY SIGNAL FLOW

= SECONDARY SIGNAL FLOW

NOTES:

410. THE TRIPLER/LOW LEVEL AMPLIFIER "BOX" IS NOT REPAIRABLE. IF DEFECTIVE, IT MUST BE REPLACED. THIS ALSO APPLIES TO THE 1ST AND 2ND BANDPASS FILTERS.
411. APPLIED TO THE FOLLOWING PA STAGE (OR DRIVER AMPLIFIER OF THE B84RCB MODEL SERIES).

CEPS-17178-B

Model Complement

Assembly: Tripler/Low Level Amplifier	Chassis and Hardware Kit: TLN5650B	Chassis and Hardware Kit: TRN8728A	Tripler/Low Level Amplifier Note 410: TLE8391A	Tripler/Low Level Amplifier Note 410: TLE8393B	Tripler/Low Level Amplifier Note 410: TLE8394B	Tripler/Low Level Amplifier Note 410: TLE8395B	2nd Bandpass Filter Note 410: TFE6151A	2nd Bandpass Filter Note 410: TFE6153A	2nd Bandpass Filter Note 410: TFE6154A	2nd Bandpass Filter Note 410: TFE6155A
TLE1601B (406-420 MHZ)		X	X				X			
TLE1603B (450-470 MHZ)	X			X				X		
TLE1604B (470-494 MHZ)	X				X				X	
TLE1605B (494-512 MHZ)	X					X				X

Model Complement

Assembly: Exciter/1st Bandpass Filter	1st Bandpass Filter Note 410: TFD6371A	1st Bandpass Filter Note 410: TFD6373A	1st Bandpass Filter Note 410: TFD6374A	1st Bandpass Filter Note 410: TFD6375A	Exciter Board: TLD5491A	Exciter Board: TLD5492A
TLE1721B (406-420 MHZ)	X				X	
TLE1723B (450-470 MHZ)		X				X
TLE1724B (470-494 MHZ)			X			X
TLE1725B (494-512 MHZ)				X		X

EXCITER/1ST BANDPASS FILTER

EXCITER/1ST BANDPASS FILTER

MODEL TLE1720B SERIES

TRIPLER/LOW LEVEL AMPLIFIER

MODEL TLE1600A SERIES

PARTS LIST

LEGEND

L = 132-150.8 MHz
H = 150.8-174 MHz

TLD5491A, AV Exciter (132-150.8 MHz)
TLD5492A, AV Exciter (150.8-174 MHz) PL-4122-E

This parts list covers two models of the high band Exciter Board. Where differences exist a letter suffix L or H is added to the reference symbol to show the applicable unit.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF ±5%; 500 V: unless otherwise stated
C401	21-831125	100 ±10%; 300 V
C402	21-82428B59	.01 uF +80-20%; 200 V
C403		NOT USED
C404	8-82905G11	.22 uF ±10%; 50 V
C405	21-83596E13	.001 uF ±10%; 100 V
C406	21-82428B59	.01 uF +80-20%; 200 V
C407, 408	23-84762H08	3.9 uF ±20%; 15 V
C409, 410	21-831125	100 ±10%; 300 V
C411	21-82372C03	0.1 uF +80-20%; 25 V
C412, 413	21-83596E10	220 ±20%
C414	21-831125	100 ±10%; 300 V
C415	21-83596E10	220 ±20%
C416, 717		NOT USED
C418 thru 421	23-84762H08	3.9 uF ±20%; 15 V
C422	21-82372C04	.05 uF +80-20%; 25 V
C423	21-83596E10	220 ±20%
C424, 425, 426	21-82372C04	.05 uF +80-20%; 25 V
C427	21-83406D51	3 ±0.25 pF
C428	21-82133G06	27; 500 V
C429	21-82428B59	.01 uF +80-20%; 200 V
C430L	21-84494B07	150
C430H	21-84494B06	120
C431	21-83406D54	4 ±0.25 pF
C432L	21-84494B16	330
C432H	21-84494B13	240
C433L	21-84494B13	240
C433H	21-84494B46	180 ±3%
C434, 435		NOT USED
C436	21-82428B59	.01 uF +80-20%; 200 V
C437	21-83596E13	.001 uF ±10%; 100 V
C438L	21-84494B01	51
C438H	21-84494B24	39
C439L	21-861453	1.5 ±10%
C439H	21-864518	1 ±10%
C440L	21-852322	62
C440H	21-868681	47
C441L	21-84494B10	190
C441H	21-861601	130 ±3%
C442, 443	21-82428B59	.01 uF +80-20%; 200 V
C444L	21-84493B27	51; 200 V
C444H	21-84484B24	39
C445L	21-83406D91	40
C445H	21-84494B30	34
C446	21-82450B06	0.75 ±10%
C447	21-83596E13	.001 uF ±10%; 100 V
C448L	21-83406D92	36
C448H	21-83406D56	24
C449L	21-84493B31	57; 200 V
C449H	21-84494B28	43
C450	21-83596E13	.001 uF ±10%; 100 V
C451	21-82428B59	.01 uF +80-20%; 200 V
C452L	21-83406D93	16
C452H	21-83406D90	11
C453L	21-83406D81	20
C453H	21-83406D55	18
C454	21-82450B06	0.75 ±10%
C455	21-83596E13	.001 uF ±10%; 100 V
C456L	21-83406D90	11
C456H	21-83406D70	8 ±0.5 pF
C457	21-83406D89	10 ±0.5 pF
C458	21-83596E13	.001 uF ±10%; 100 V
C459	[illegible]	24; NPO
C460	21-83596E10	220 ±20%
C461L	21-84494B07	150
C461H	21-84494B06	120
C462, 463	21-83596E13	.001 uF ±10%; 100 V
C464	21-82355B62	1.0
C465	21-82428B59	.01 uF +80-20%; 200 V
C466	21-82610C23	6.8 ±.5%; 200 V
C467	21-82187B07	470 ±10%
C468	21-82428B28	.002 uF ±10%; 200 V
C469	21-82187B06	560
		DIODE: (SEE NOTE)
CR401	48-863030	germanium
CR402, 403		NOT USED
CR404, 405	48-82139G01	germanium
		COIL, rf:
E401	24-84392B06	40 turns on 820 ohm resistor
E402L	24-84392B13	15 turns on 560 ohm resistor
E402H	24-84392B05	9 turns on 560 ohm resistor
		CONNECTOR, receptacle:
J401		NOT USED
J402	9-84207B01	7 contacts
		COIL, rf:
L401	24-84389B02	18-2/3 turns; coded Black
L402	24-84389B01	18-1/2 turns; coded Yellow
L403	24-84389B06	8-2/3 turns; coded Green
L404	24-84389B05	8-1/2 turns; coded Red
L405, 406	24-84972A09	6-1/2 turns; coded Yellow
L407, 408	24-84972A11	3-1/2 turns; coded Green
L409		NOT USED
L410	24-80900A61	0.62 mH
L411, 412	24-82835G08	2.6 uH; coded Red-Blue-Gold
L413	24-84923C01	1-1/2 turns
		CONNECTOR, plug:
P401		part of printed circuit board
P402	28-84282D01	phono
P403, 902		part of printed circuit board
		TRANSISTOR: (SEE NOTE)
Q401	48-869642	NPN; type M9642
Q402, 403		NOT USED
Q404	48-869571	PNP; type M9571
Q405	48-869534	NPN; type M9534
Q406	48-869390	NPN; type M9390
Q407, 408	48-869867	NPN; type M9867
		RESISTOR, fixed: 5%; 1/4 W unless otherwise stated
R401	6-124A43	560 ohms
R402	6-124A53	1.5k
R403	6-124A79	18k
R404	6-124A87	39k
	or6-124A89	47k
R405	6-124A85	33k
	or6-124A89	47k
R406	6-124A99	120k
R407	6-124B04	180k
R408	6-124A73	10k
R409	6-124A81	22k
R410	18-83083G24	variable: 25k ±20%
R411 thru 418		NOT USED
R419 thru 422	6-124A79	18k
R423	6-124A57	2.2k
R424	6-124A85	33k
R425	6-124A51	1.2k
R426	6-124A47	820 ohms
R427		NOT USED
R428	6-124A87	39k
R429	6-124A57	2.2k
R430	6-124A35	270 ohms
R431	6-124A89	47k
R432	6-124A63	3.9k
R433		NOT USED
R434	6-124A39	390 ohms
R435L	6-124A09	22 ohms
R435H	6-124A15	39 ohms
R436	6-125A05	15; 1/2 W
R437	6-124A94	82k
R438	6-124A49	1k
R439L	6-124A49	1k
R439H	6-124A41	470 ohms
		SYMMETRICAL CLIPPER AND SPLATTER FILTER:
U401	1-80726D74	potted unit

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
NON-REFERENCED ITEMS		
	14-861196	INSULATOR, transistor; 2 req'd. (used with Q407 & Q408)
	26-83379H01	HEAT SINK (used with Q408)
	26-84598A01	SHIELD, coil; 4 req'd. (used with L405 thru L408)
	26-84598A02	SHIELD, coil; 4 req'd. (used with L401 thru L404)
	42-84284B01	RETAINER; 4 req'd.
	3-139506	SCREW, tapping: Phillips round hd., 4-40 x 5/16" 4 req'd. (used for muunting Retainers)
	55-84300B01	HANDLE
	30-83794C01	CABLE, coaxial; 6" req'd. (used with P402)
	29-84028H01	TERMINAL, pin; 19 req'd.
	29-84028H02	TERMINAL, pin; 12 req'd.
	29-855943	TERMINAL, pin; 16 req'd.
	39-10184A10	CONTACT, terminal; 10 req'd.

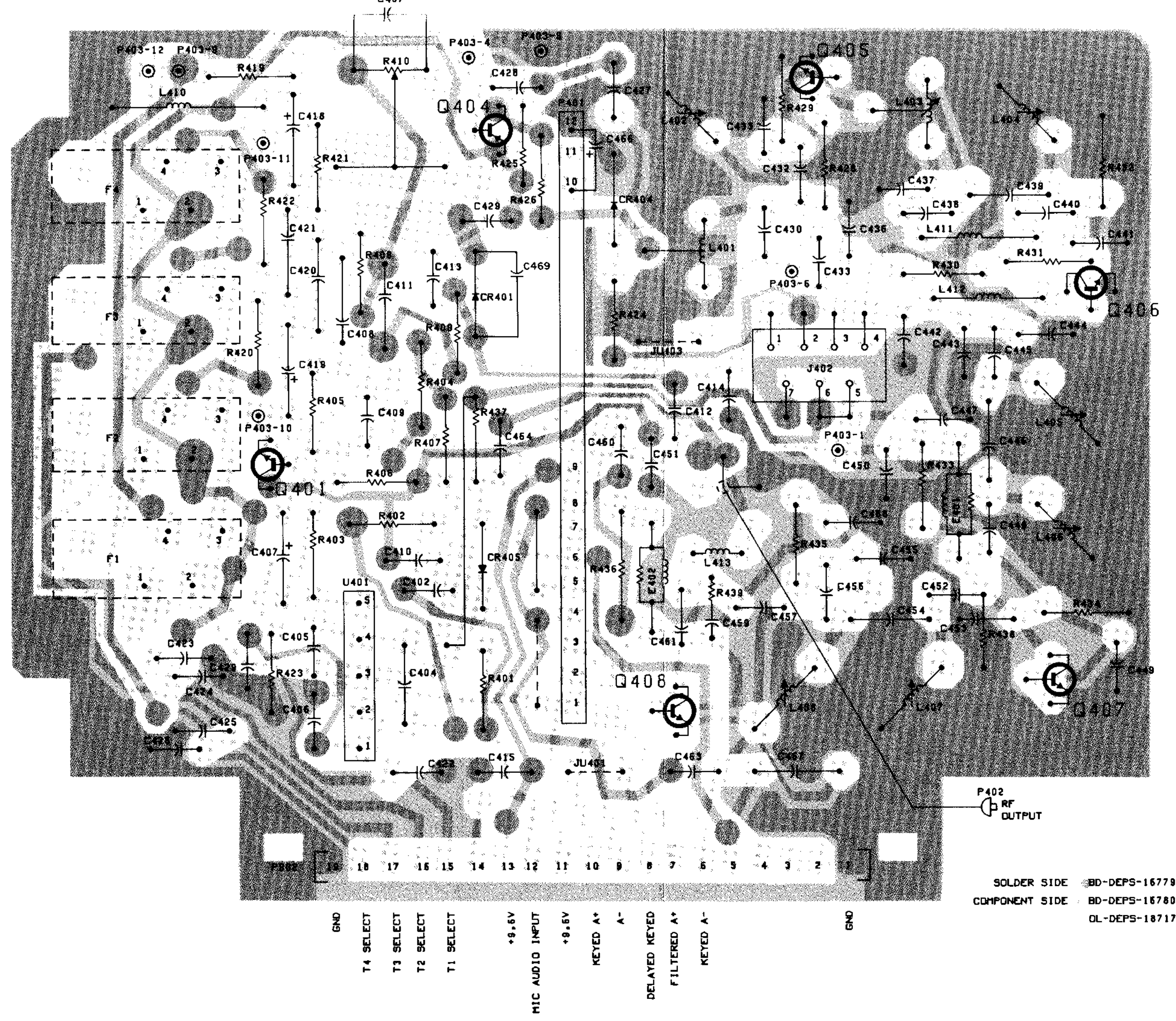
NOTE: For optimum performance, replacement diodes and transistors must be ordered by Motorola part numbers.

REVISIONS

PEPS-18716-E

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLD5491A TLD5492A	R428	FROM 6-124C85; 33k TO 6-124C87; 39k	PARTS LIST
	R437	FROM 6-124C97; 100k TO 6-124C94; 82k	
	C466	FROM 21-82428B28; .002 uF; ±10%; 500 V TO 21-82610C23; 6.8 pF; ±.5%; 200 V	
	R404, R405	ALTERNATE 6-124A89 47k ±5%; 1/4 W ADDED	PARTS LIST
	R409	FROM 6-124C88, 27k TO 6-124C81, 22k	Meter 1 J402-1
	R402	FROM 6-124A37; 330 ohms TO 6-124A53; 1.5k	PARTS LIST & SCHEMATIC
	U401	FROM 1-80763B05 TO 1-80726D74	
	R	FROM All 10% TO All 5%	PARTS LIST
	C469	ADD 21-82187B06	PARTS LIST & SCHEMATIC

SHOWN FROM SOLDER SIDE



SOLDER SIDE BD-DEPS-16779-O
COMPONENT SIDE BD-DEPS-16780-O
OL-DEPS-18717-B

Table 1. Model Usage

PA ASSEMBLY	POWER OUTPUT	FREQUENCY RANGE 406-420 MHz	450-470 MHz	470-512 MHz
TLE1681A	12 W	X		
TLE1683A	12 W		X	
TLE1684A	12 W			X
TLE1693A	20 W		X	
TLE1694A	20 W			X
TLE1701A	45 W	X		
TLE1703A (SEE NOTE)	40 W			X
	45 W		X	
TLE1711A	75 W	X		
TLE1713A	75 W		X	
TLE1714A	60 W			X

Note: This PA is "POWER SET" to either 40- or 45-watts, depending upon transmitter frequency desired.

1. INTRODUCTION

The "Micor" power amplifiers provide the needed output power requirements for base and repeater stations. Table 1 lists all the power amplifiers available. Refer to the station model charts, at the front of this manual, to identify the specific power amplifier covered in this manual. Alignment and Maintenance information is covered under the Station Data tab of this manual.

Transmitter Power Amplifier microstrip circuit location, according to radio models, is illustrated in Figure 1.

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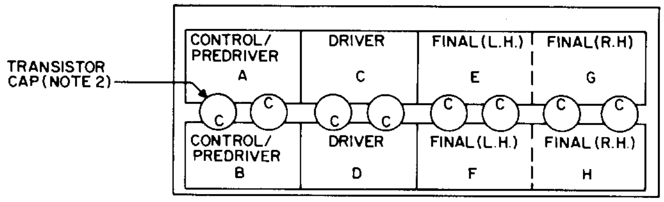


NOTES:

1. REFER TO CROSS–REFERENCE TABLE FOR PART NO. OF MICROSTRIP CIRCUITS ACCORDING TO LOCATION FOR VARIOUS RADIO MODELS.
2. "C" ON TRANSISTOR CAPS INDICATES PLACEMENT OF COLLECTOR LEAD.

POWER AMPLIFIER MICROSTRIP CROSS REFERENCE TABLE

LOCATION	RADIO MODEL	FREQUENCY RANGE (MHZ)	MICROSTRIP PART NO.
A	B/C34, B84	406–420	1V80709D52
	B/C54/64	406–420	1V80709D51
	C24	450–470	1V80709D53
	B/C34	450–470	1V80709D53
	B/C44, 54, 64, B84	450–512	1V80709D51
	B/C34	470–512	1V80709D52
B	B/C34, B84	406–420	1V80769B99
	B/C54, 64	406–420	1V80769B99
	C24	450–470	1V80775B62
	B/C34	450–470	1V80775B62
	B/C44, 54, 64, B84	450–512	1V80769B99
	B/C34	470–512	1V80769B99
C	B/C54, 64	406–420	1V80754B03
	B/C44, 64, B84	450–512	1V80739B15
	B/C54	450–512	1V80739B11
D	B/C54	406–420	1V80709D23
	B/C64	406–420	1V80709D26
	B/C44, B84	450–512	1V80709D22
	B/C54	450–512	1V80709D20
	B/C64	450–470	1V80709D19
	B/C64	470–512	1V80709D21
E	B/C64	406–420	1V80709D24
	B/C64	450–470	1V80709D17
	B/C64	470–512	1V80709D28
F	B/C64	406–420	1V80754B05
	B/C64	450–512	1V80739B28
G	B/C64	406–420	1V80709D25
	B/C64	450–470	1V80709D18
	B/C64	470–512	1V80709D27
H	B/C64	406–420	1V80754B07
	B/C64	450–512	1V80739B27

CEPS-17436-D

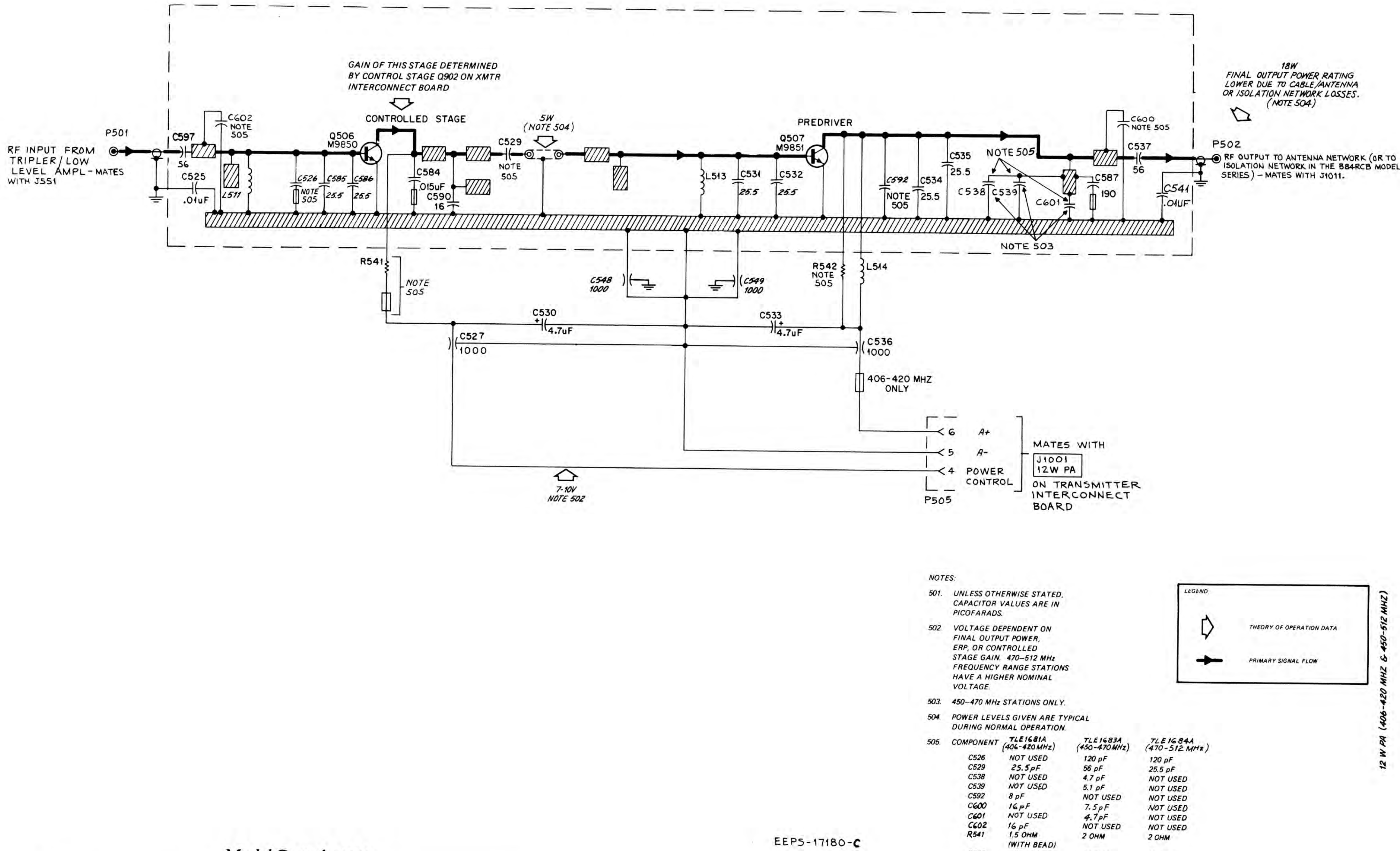
Figure 1. Microstrip Location Diagram & Cross Reference Table

12-WATT POWER AMPLIFIER

MODEL TLE1680A SERIES

FUNCTION

Provides final transmitter output power amplification.



NOTES:

501. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN PICOFARADS.

502. VOLTAGE DEPENDENT ON FINAL OUTPUT POWER, ERP, OR CONTROLLED STAGE GAIN. 470–512 MHz FREQUENCY RANGE STATIONS HAVE A HIGHER NOMINAL VOLTAGE.

503. 450–470 MHz STATIONS ONLY.

504. POWER LEVELS GIVEN ARE TYPICAL DURING NORMAL OPERATION.

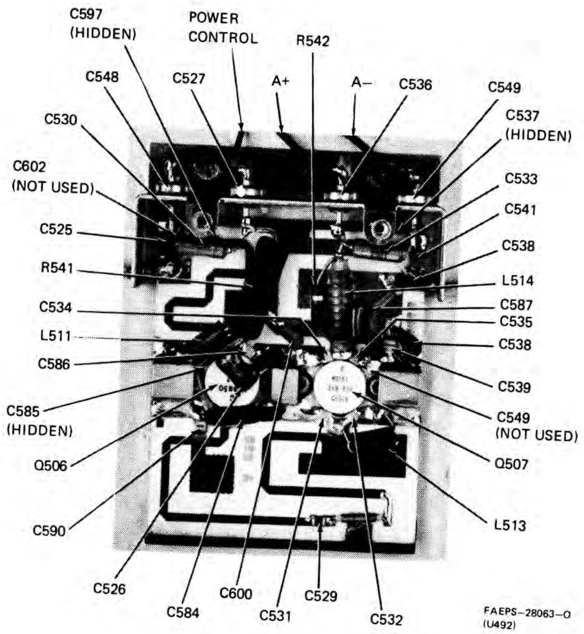
505.

COMPONENT	TLE1681A (406-420 MHz)	TLE1683A (450-470 MHz)	TLE1684A (470-512 MHz)
C526	NOT USED	120 pF	120 pF
C529	25.5 pF	56 pF	25.5 pF
C538	NOT USED	4.7 pF	NOT USED
C539	NOT USED	5.1 pF	NOT USED
C592	8 pF	NOT USED	NOT USED
C600	16 pF	7.5 pF	NOT USED
C601	NOT USED	4.7 pF	NOT USED
C602	16 pF	NOT USED	NOT USED
R541	1.5 OHM (WITH BEAD)	2 OHM	2 OHM
R542	NOT USED	10 OHM	10 OHM

Model Complement

Assembly	Consists of			
Power Amplifier	Microstrip and Heatsink Kit TLE8301A	TLE8303A	TLE8304A	Metering and Cable Kit TKN6766A
TLE1681A (406-420 MHz)	X			X
TLE1683A (450-470 MHz)		X		X
TLE1684A (470-512 MHz)			X	X

PARTS LIST SHOWN ON BACK



FAEPS-28063-O (U492)

PARTS LIST

MICROSTRIP AND HEATSINK KIT (12-WATT)
TLE8301A (406-420 MHz)
TLE8303A (450-470 MHz)
TLE8304A (470-512 MHz) PL-3433-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C525	21-84547A05	.01 uF ±20%; 50 V
C526	21-840713	120 pF ±5%; 500 V; 450-512 MHz
C529	21-84736E10	25.5 pF ±5%; 50 V; 406-420 MHz
	or 21-84873H26	56 pF ±10%; 50 V; 450-470 MHz
	or 21-84736E10	25.5 pF ±5%; 50 V; 470-512 MHz
C530	23-82783B11	4.7 uF ±20%; 35 V
C531, 532	21-84736E10	25.5 pF ±5%; 50 V
C533	23-82783B11	4.7 uF ±20%; 35 V
C534, 535	21-84736E10	25.5 pF ±5%; 50 V
C537	21-84736E31	56 pF ±10%; 50 V
C538		4.7 pF ±.5 pF; 500 V; 450-470 MHz
C539	21-84736E04	5.1 pF ±5%; 50 V; 450-470
C541	21-84547A05	.01 uF ±20%; 50 V
C584	8-82905G15	.015 uF ±10%; 100 V
C587	21-848978	190 pF ±3%; 500 V
C590	21-84736E05	16 pF ±0.25 pF; NP0
C592	21-851846	8 pF ±.025 pF; NP0; 406-420 MHz only
C597	21-84873H26	56 pF ±10%; 500 V; 406-512 MHz
C600	21-84736E08	16 pF ±5%; 50 V; 406-420 MHz
	or 21-857337	4.7 pF ±.5 pF; 500 V; 450-470 MHz
C601	21-857337	4.7 pF ±.5 pF; 500 V; 450-470 MHz
C602	21-84736E08	16 pF ±5%; 50 V 406-420 MHz only
		COIL, RF:
L511, 513	24-83977B02	choke; 2-1/2 turns
L514	24-84346A03	choke; .090 uH (sleeved)
		TRANSISTOR: (SEE NOTE)
Q506	48-869850	NPN; type M9850
Q507	48-869851	NPN; type M9851
		RESISTOR, fixed:
R541	17-82291B39	2 ±5%; 5 W (450-470 MHz)
	or 17-82291B40	1.5 ±10%; 5 W (406-420 MHz)
R542	6-125C01	10 ±10%; 1/2 W (450-512 MHz)
	NON-REFERENCED ITEMS	
	1-80775B31	COVER (driver amplifier)
	1-80709D52	MICROSTRIP (driver input) 406-420 MHz
	1-80709D53	MICROSTRIP (driver input) 450-470 MHz
	1-80709D52	MICROSTRIP (driver input) 470-512 MHz
	1-80775B62	MICROSTRIP (driver output) 450-470 MHz
	1-80769B99	MICROSTRIP (driver output) 470-512 MHz
	42-10128A10	RING, retaining: rubber; 2 req'd.
	42-84284B01	RETAINER: black; 8 req'd.
	42-82590M01	HOLDER, microstrip
	42-84473E02	STRAP, ground (large) 2 req'd.
	42-84473E03	STRAP, ground (small)
	43-82252H01	BUSHING: 2 req'd.
	76-84069B01	FERRITE BEAD: 4 req'd.
	3-114406	CAPSCREW: 4-40 x 5/16"; 4 req'd.
	3-118030	SCREW, machine: 10-32 x 1", 2 req'd.
	3-134186	SCREW, tapping: 6-32 x 5/16"; 2 req'd.
	3-135980	SCREW, tapping: 10-32 x 1/2"; 2 req'd.
	3-138162	SCREW, tapping: 4-40 x 3/8"; 8 req'd.

NOTE: **Replacement transistors must be ordered by Motorola part number for optimum performance.**

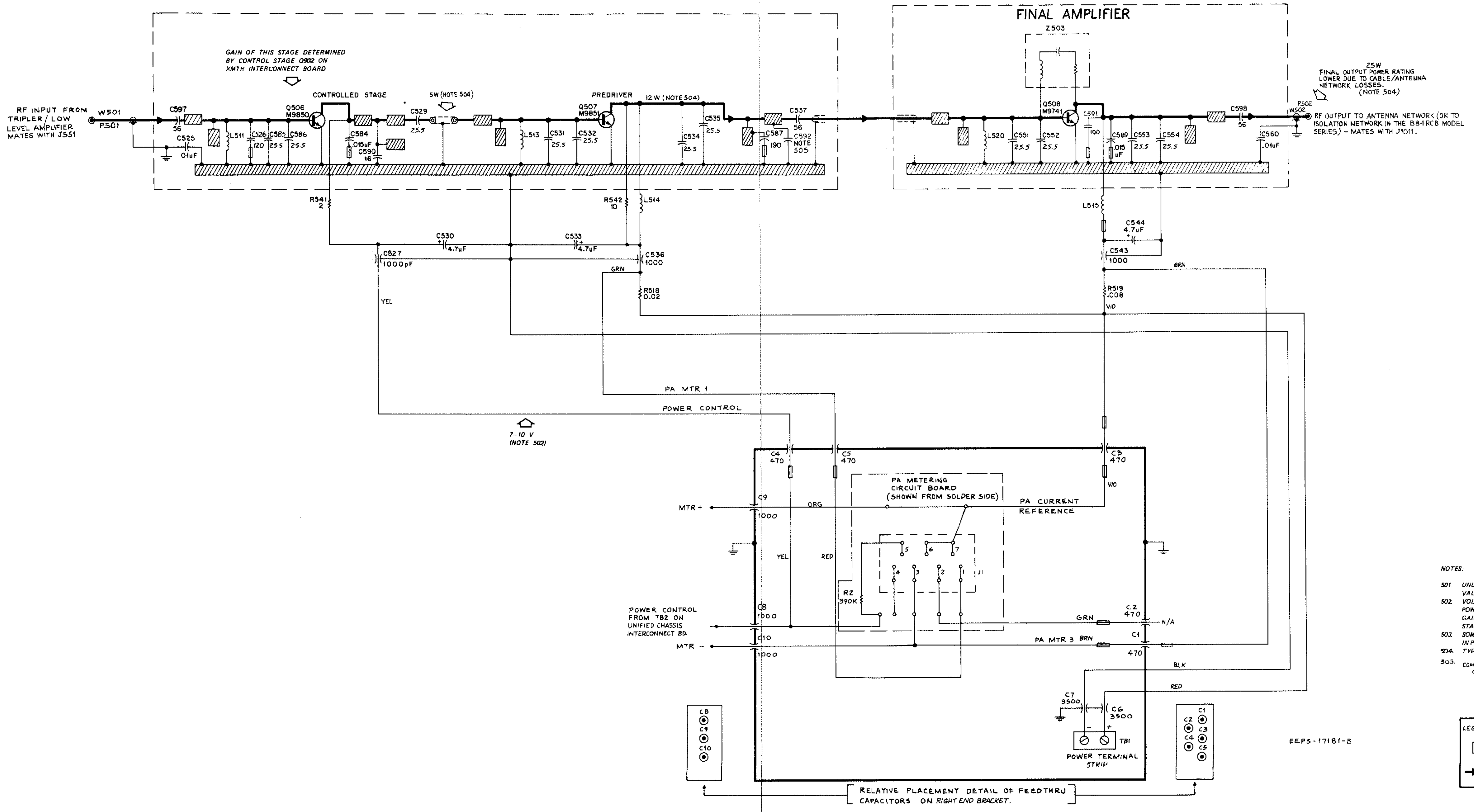
TKN6766A Metering and Cable Kit
15 W Driver Amplifier PL-3434-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, feed-thru:
C527, 536, 548, 549	21-861219	1000 pF; GMV; 500 V; coded RED
		CONNECTOR, plug:
P501	9-84886E01	female: right-angle
P502	28-83099K01	BNC type; imped. 50 ohms
P505		includes: 15-83498F07 INSULATOR, connector; 29-83499F01 CONTACT, terminal; 3 req'd. and 46-84549F01
	NON-REFERENCED ITEMS	
	1-80775B34	BRACKET & CAPACITOR ASSY., includes referenced items C527, C536, C548, C549 and 7-82648K01 BRACKET
	1-80775B33	CABLE & CONNECTOR ASSY., includes referenced item P505 and 42-10217A02 STRAP, cable harness; 2 req'd.
	1-80775B35	CABLE & CONNECTOR ASSY., includes referenced item P501 and 30-83794C01 CABLE, coaxial (7")
	1-80775B36	CABLE & CONNECTOR ASSY., includes referenced item P502 and 30-83794C01 CABLE, coaxial (9-1/4")

NOTE: **Replacement transistors must be ordered by Motorola part number for optimum performance.**

20-WATT POWER AMPLIFIER

MODEL TLE1690A SERIES



FUNCTION

Provides final transmitter output power amplification.

Model Complement

Assembly	Consists of	
Power Amplifier	Microstrip and Heatsink Kit [illegible]	Mounting and Cable Kit [illegible]
TLE1693A (450-470 MHz)	X	X
TLE1694A (470-512 MHz)	X	X

NOTES:

501. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN PICOFARADS.
502. VOLTAGE DEPENDENT ON FINAL OUTPUT POWER, ERP, OR CONTROLLED STAGE GAIN. 470–512 MHz FREQUENCY RANGE STATIONS HAVE A HIGHER NOMINAL VOLTAGE.
503. SOME COMPONENT VALUES VARY AS NOTED IN PARTS LIST.
504. TYPICAL POWER LEVELS DURING NORMAL OPERATION
505.

COMPONENT	TLE1693A (450-470MHZ)	TLE1694A (470-512MHZ)
C592	16 pF	NOT USED

LEGEND

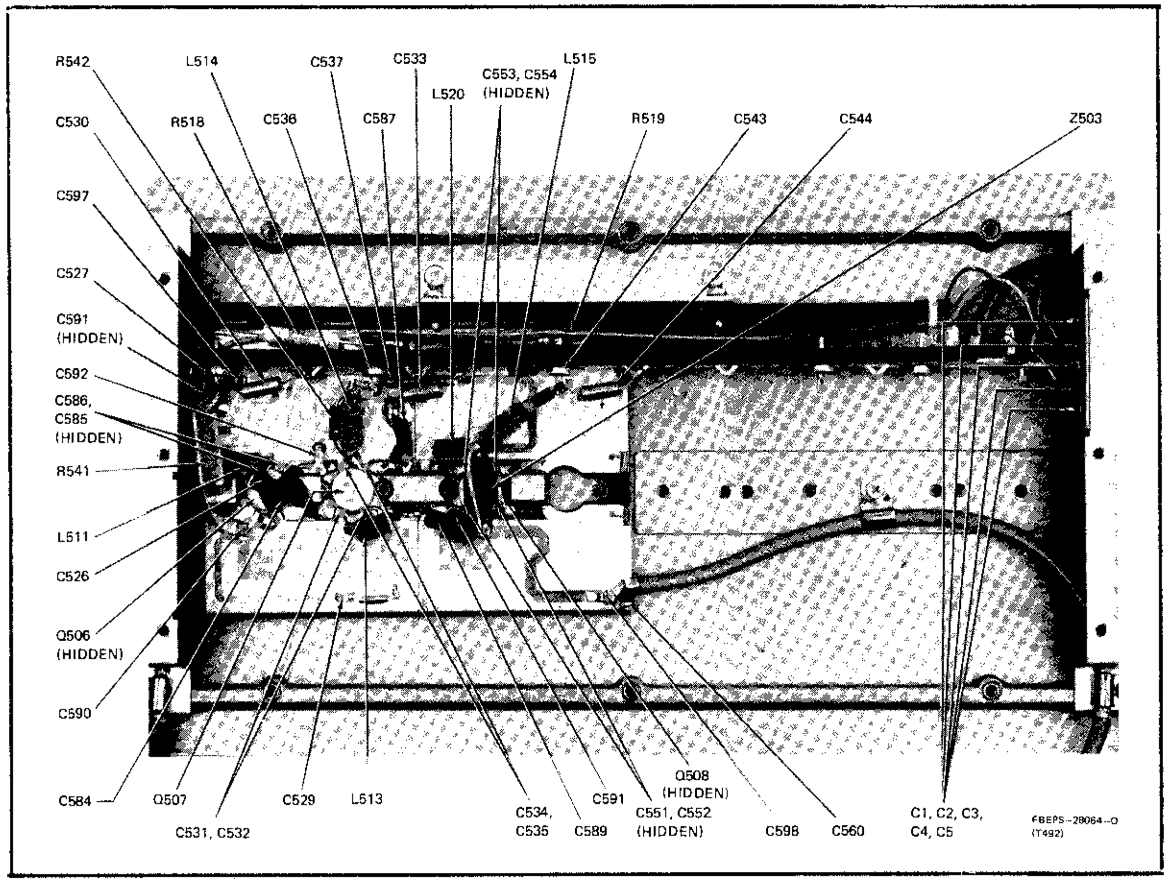
= THEORY OF OPERATION DATA.

= PRIMARY SIGNAL FLOW

PARTS LISTS SHOWN ON BACK

68P81042E17-A

1/13/81-PHI



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TLE8313A 20 W Microstrip and Heatsink Kit (450-512 MHz)		PL-3431-D
		CAPACITOR, fixed: pF ±20%; 50 V; unless otherwise stated
C525	21-84547A05	.01 uF
C526	21-840713	120; 500 V
C529, 531, 532, 534, 535, 551, 552, 553, 554, 585, 586	21-84736E10	25.5 ±5%
C530, 533, 544	23-82783B11	4.7 uF; 35 V
C537	21-84736E31	56 ±5%
C560	21-83422F01	.01 uF
C584, 589	8-82905G15	.015 uF ±10%; 100 V
C587, 591	21-848978	190 ±3%; 500 V
C590,	21-84736E08	16 ±5%
C592	21-84736E08	16 ±5%; (450-470 only)
C597	21-84873H26	56 ±10%
C598	21-84736E31	56 ±5%
		COIL, rf:
L511,513,520	24-83977B02	2-1/2 turns
L514,515	24-84346A03	.090 uH
		TRANSISTOR: (SEE NOTE)
Q506	48-869850	NPN; type M9850
Q507	48-869851	NPN; type M9851
Q508	48-869741	NPN; type M9741
		RESISTOR, fixed:
R541	17-82177B53	2 ±10%; 5 W
R542	6-125C01	10 ±10%; 1/2 W
		FILTER, parasitic suppressor:
Z503	1-80740B06	hybrid
NON-REFERENCED ITEMS		
		MICROSTRIPS:
	1-80739B15	25-37 W input
	1-80775B46	COVER(Driver Amplifier)
	1-80709D22	25 W output
	1-80709D51	driver input 22 W
	1-80769B99	driver output 22 W
	7-82796K01	BRACKET
	7-84406D01	BRACKET, mounting; 2 req'd.
	15-82737K02	COVER, end cap
	26-82653K01	HEATSINK
	30-83693F01	CABLE, coaxial; 1/2" long
	42-38764	CLAMP, cable
	42-83123F01	RETAINER; 12 req'd.
	42-82590M01	HOLDER, substrate; 2 req'd.
	42-84473E01	STRAP, ground (.775" wide)
	42-84473E02	STRAP, ground (.385" wide) 2 req'd.
	42-84473E03	STRAP, ground (.250" wide)
	76-84069B01	FERRITE BEAD; 6 req'd.
	64-84659E01	SUBSTRATE; 4 req'd.
	2-135435	NUT: 1/4 -20 x 7/16 x 5/36"; 6 req'd.
	3-114406	SCREW, captive: 4-40 x 5/16"; 6 req'd.
	3-125468	SCREW, captive: 1/4-20 x 1"; 6 req'd.
	3-134169	SCREW, tapping; 4-40 x 1/4"
	3-134186	SCREW, tapping: 6-32 x 5/16"; 10 req'd.
	3-138946	SCREW, tapping; 6-32 x 3/8"; 2 req'd.
	4-7666	LOCKWASHER, #6 external; 2 req'd.
	4-7678	LOCKWASHER; 1/4" external; 6 req'd.
	74-119952	FORM, coil

NOTE:
For optimum performance, replacement transistors must be ordered by Motorola part number.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TKN6767A Metering and Cable Kit		PL-3430-B
		CAPACITOR, fixed:
C1 thru 5	21-821474	470 pF ±20%; 500 V
C6, 7	21-84211B03	3500 pF; 250
C8, 9, 10, 527, 536, 543	21-861219	1000 pF; 500 V; coded RED
		CONNECTOR, receptacle:
J1	9-84207B01	female; 7 contact
		CONNECTOR, plug:
P501, 502	28-84967D01	male BNC type
		RESISTOR, fixed:
R2	6-124D12	390k ±10%; 1/4 W
R518	17-82620B03	.02 ±5%; 3 W
R519	6-84605E01	meter shunt; .008 ±1%
		TERMINAL BOARD
TB1	31-50378	2 screw barrier type
		CABLE, ASSEMBLY, RF:
W501	1-80775B41	includes: 30-84173E01 CABLE, coaxial, 12" long and P501
W502	1-80775B42	includes: 30-84173E01 CABLE coaxial, 15"long and P502
NON-REFERENCED ITEMS		
	76-83960B01	FERRITE CORE; 9 req'd.
	42-10217A02	STRAP, cable harness; 2 req'd.
	43-82253C07	BUSHING; 2 req'd.
	15-82737K01	COVER, end cap
	47-84475E01	BUS BAR; 3 used
	14-84548A01	INSULATOR, washer; 2 req'd.
	42-38764	CLAMP, cable; 2 used
	2-131865	NUT, 1/4-28 x 3/8 x 3/32"; 2 used
	3-129468	SCREW, tapping; 10-32 x 5/8"; 2 used
	3-184184	SCREW, tapping; 4-40 x 5/16"; 2 used
	4-7658	LOCKWASHER #10 internal; 2 used
	4-7670	LOCKWASHER #1/4 internal; 2 used
	29-5223	LUG, solder; 2 used
	29-847854	LUG, tongue
	14-84494E01	BUS BAR
	14-84937E01	INSULATOR, bus

revisions

MODEL AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TKN6767A	—	DELETE: 14-82975K01, INSULATOR	PARTS LIST

PARTS LIST

TLE8323A Microstrip and Heatsink Kit PL-3429-A

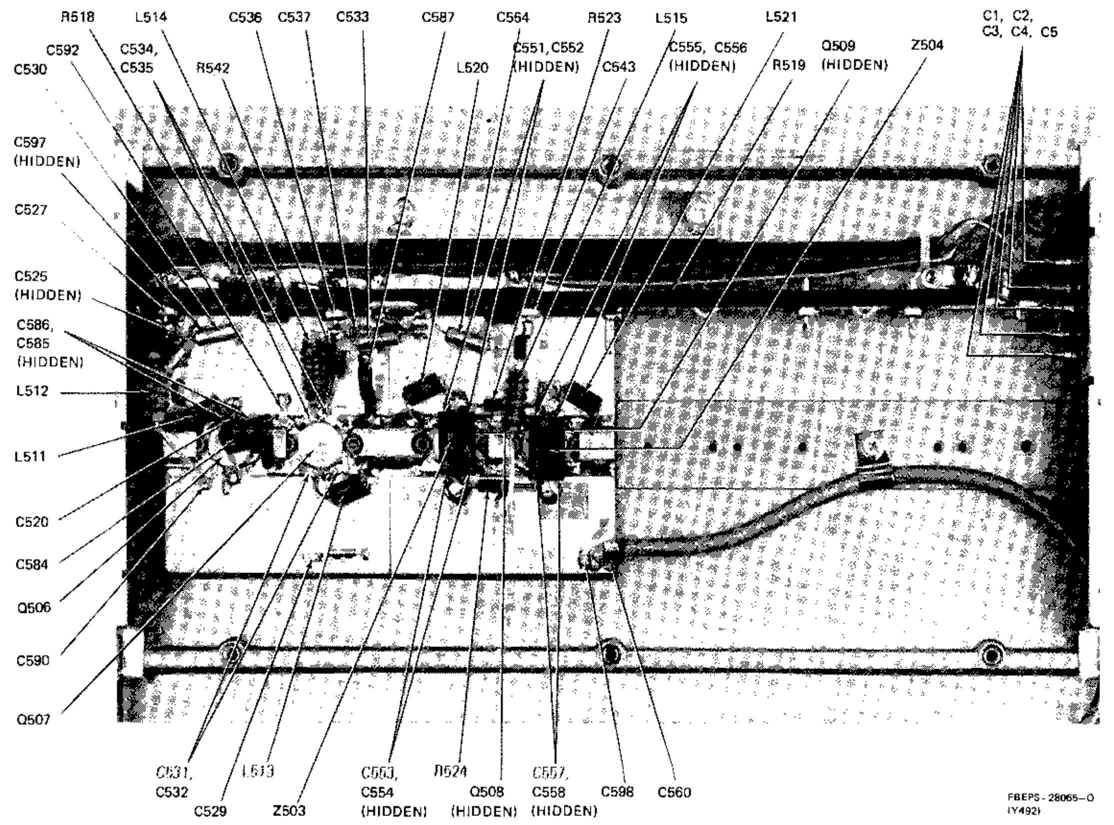
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C525	21-84547A05	.01 uF ±20%; 50 V
C526	21-840713	120 pF ±5%; 500 V
C529, 531, 532, 534, 535, 551, 552, 553, 554, 555, 556, 557, 558, 585, 586	21-84736E10	25.5 pF ±5%; 50 V
C530,533,544	23-82783B11	4.7 uF ±20%; 35 V
C537	21-84736E31	56 pF ±5%; 50 V
C560	21-83422F01	.01 uF ±20%; 50 V
C584	8-82905G15	.015 uF ±10%; 100 V
C587	21-848978	190 pF ±3%; 500 V
C590, 592	21-84736E08	16 pF ±5%; 50 V
C597	21-84873H26	56 ±10%; 50 V
C598	21-84736E31	56 ±5%; 50 V
		COIL, rf:
L511, 513, 520, 521	24-83977B02	choke: 2-1/2 turns
L512, 514, 515	24-84346A03	choke: .090 uH
		TRANSISTOR: (SEE NOTE)
Q506	48-869850	NPN; type M9850
Q507	48-869851	NPN; type M9851
Q508, 509	48-869755	NPN; type M9755
		RESISTOR, fixed:
R523,524,542	6-125C01	10 ±10%; 1/2 W
		FILTER, parasitic suppressor:
Z503, 504	1-80740B06	hybrid
NON-REFERENCED ITEMS		
	1-80739B11	MICROSTRIP; 45-52 Watt(input)
	1-80709D20	MICROSTRIP; 45 Watt(output)
	7-82796K01	BRACKET
	7-84406D01	BRACKET, mounting
	15-82737K02	COVER, end cap
	26-82653K01	HEATSINK
	42-38764	CLAMP, cable
	42-83123F01	RETAINER; 12 req'd.
	42-84470E01	HOLDER, substrate; 2 req'd.
	42-84473E01	STRAP, ground; 2 req'd.
	42-84473E02	STRAP, ground; 2 req'd.
	42-84473E03	STRAP, ground; 2 req'd.
	64-84659E01	SUBSTRATE; 2 req'd.

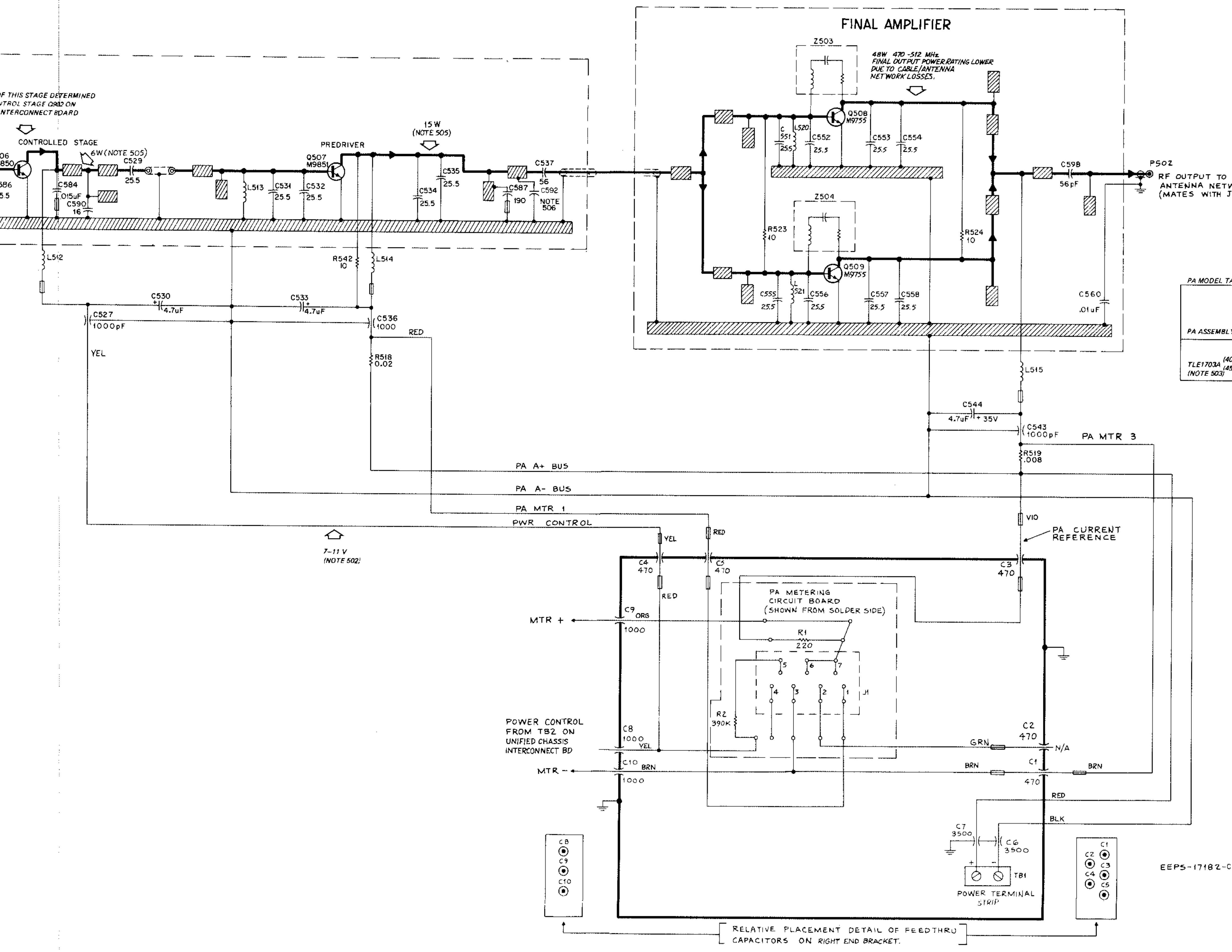
NOTE:
For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

PARTS LIST

TKN6767A Metering and Cable Kit PL-3430-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1 thru 5	21-821474	470 pF ±20%; 500 V
C6, 7	21-84211B03	3500 pF; 250
C8, 9, 10, 527, 536, 543	21-861219	1000 pF; 500 V; coded RED
		CONNECTOR, receptacle:
J1	9-84207B01	female; 7 contact
		CONNECTOR, plug:
P501, 502	28-84967D01	male BNC type
		RESISTOR, fixed:
R2	6-124D12	390k ±10%; 1/4 W
R518	17-82620B03	.02 ±5%; 3 W
R519	6-84605E01	meter shunt; .008 ±1%
		TERMINAL BOARD
TB1	31-50378	2 screw barrier type
		CABLE, ASSEMBLY, RF:
W501	1-80775B41	includes: 30-84173E01 CABLE, coaxial, 12" long and P501
W502	1-80775B42	includes: 30-84173E01 CABLE coaxial, 15" long and P502
NON-REFERENCED ITEMS		
	76-83960B01	FERRITE CORE; 9 req'd.
	42-10217A02	STRAP, cable harness; 2 req'd.
	43-82253C07	BUSHING; 2 req'd.
	15-82737K01	COVER, end cap
	47-84475E01	BUS BAR; 3 used
	14-84548A01	INSULATOR, washer; 2 req'd.
	14-82975K01	INSULATOR, terminal strip
	42-38764	CLAMP, cable; 2 used
	2-131865	NUT, 1/4-28 x 3/8 x 3/32"; 2 used
	3-129468	SCREW, tapping; 10-32 x 5/8"; 2 used
	3-184184	SCREW, tapping; 4-40 x 5/16"; 2 used
	4-7658	LOCKWASHER #10 internal; 2 used
	4-7670	LOCKWASHER #1/4 internal; 2 used
	29-5223	LUG, solder; 2 used
	29-847854	LUG, tongue
	14-84494E01	BUS BAR
	14-84937E01	INSULATOR, bus





PA MODEL TABLE

PA ASSEMBLY	TKN6767A METERING AND CABLE KIT	MICROSTRIP AND HEAT SINK KIT TLE8323A
TLE1703A (40W) (470–512 MHz) (45W) (450–470 MHz) (NOTE 503)	X	X

NOTES:

501. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN PICOFARADS.
502. VOLTAGE DEPENDENT ON FINAL OUTPUT POWER, ERP, OR CONTROLLED STAGE GAIN. 470–512 MHz STATIONS HAVE A HIGHER NOMINAL VOLTAGE.
503. ONE PA IS "POWER SET" TO 45 W; THE OTHER TO 40 W. REFER TO TRANSMITTER ALIGNMENT PROCEOURE FOR DETAILS.
504. N/A
505. RF POWER LEVELS ARE TYPICAL UNDER NORMAL CONDITIONS.
506.

COMPONENT	450-470 MHZ	470-512 MHZ
C592	16pF	NOT USED

40W PA (470–512MHz) 450W PA (450–470MHz)

40/45 WATT POWER AMPLIFIER

MODEL TLE1703A
(450-512 MHz)

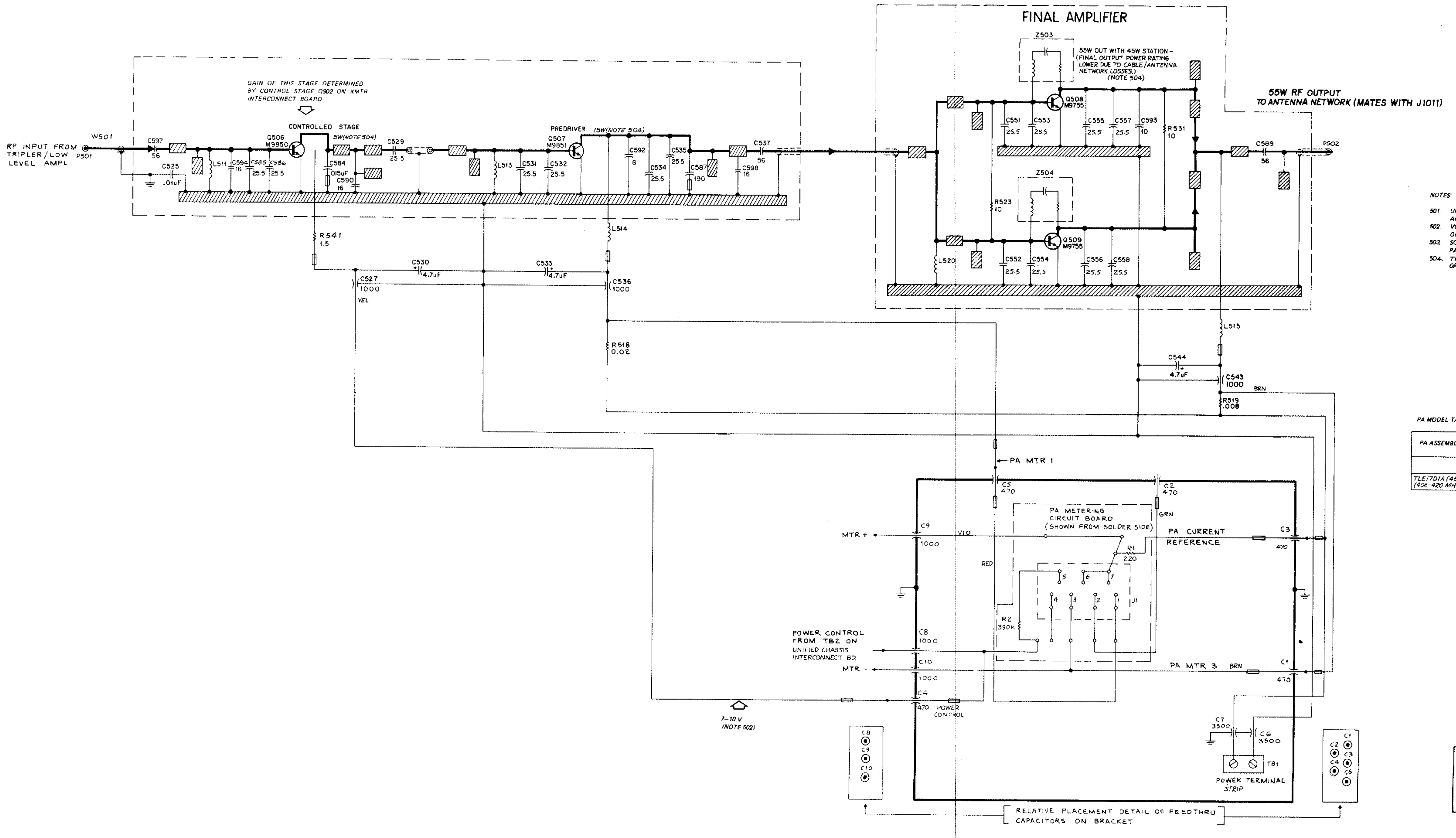
FUNCTION

Provides final transmitter output power amplification.

40/50 WATT POWER AMPLIFIER

45-WATT POWER AMPLIFIER

MODEL TLE1701A
(406-420 MHz)



NOTES:

501. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS.
502. VOLTAGE DEPENDENT ON FINAL OUTPUT POWER OR CONTROLLED STAGE GAIN.
503. SOME COMPONENT VALUES VARY AS NOTED IN PARTS LIST.
504. TYPICAL POWER LEVELS DURING NORMAL OPERATION.

PA MODEL TABLE

PA ASSEMBLY	METERING AND CABLE KIT	MICROSTRIP AND HEAT SINK KIT
TLE1701A (45W) (406-420 MHZ)	TKN6767A	TLE8321A

LEGEND

= THEORY OF OPERATION DATA

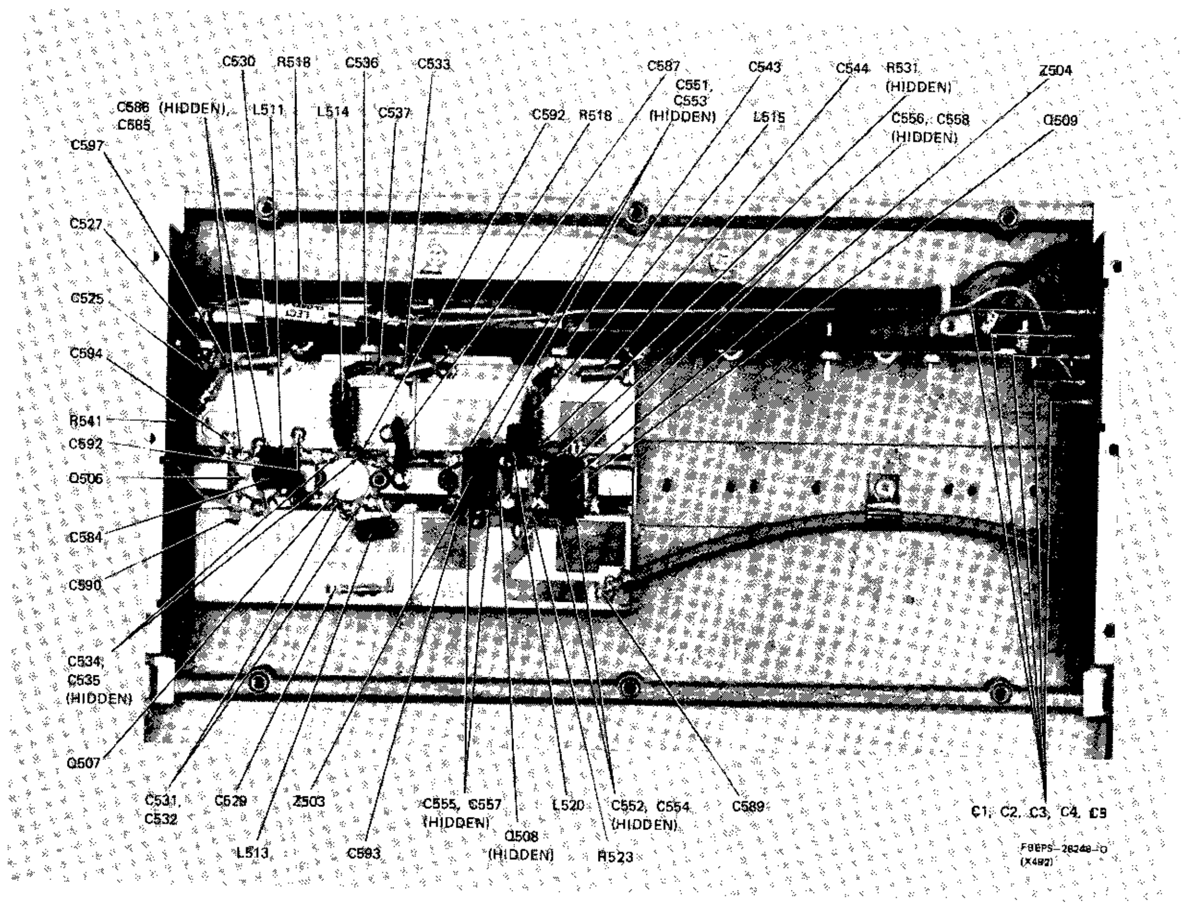
= PRIMARY SIGNAL FLOW

FUNCTION

Provides final transmitter output power amplification.

PARTS LISTS SHOWN ON BACK
68P81042E39-A
8/15/82- PHI

45 WATT POWER AMPLIFIER



REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLE8321A 45-Watt Microstrip and Heatsink PL-6465-O

		CAPACITOR, fixed:
C525	21-84547A05	.01 uF ±20%; 50 V
C529, 531, 532 534, 535, 551, 552, 553, 554, 555, 556, 557, 558, 585, 586	21-84736E10	25.5 pF ±5%; 50 V
C530, 533, 544	23-82783B11	4.7 uF ±20%; 35 V
C537	21-84736E31	56 pF ±5%; 50 V
C597	21-84736H26	56 pF ±10%; 500 V
C584	8-82905G15	.015 uF ±10%; 100 V
C587	21-848978	190 pF ±3%; 500 V
C589	21-84736E31	56 pF ±5%; 50 V
C590, 594, 598	21-84736E08	16 pF ±5%; 50 V
C592	21-851846	8 pF ±0.25 pF; 500 V
C593	21-847088	10 pF ±.5 pF; 300 V
		COIL, RF:
L511, 513, 520	24-83977B02	choke; 2-1/2 turns
L514, 515	24-84346A03	choke; .090 uH
		TRANSISTOR: (SEE NOTE)
Q506	48-869850	NPN; type M9850
Q507	48-869851	NPN; type M9851
Q508, 509	48-869755	NPN; type M9755
		RESISTOR, fixed: ±10%; 1/2 W; unless otherwise stated
R521		NOT USED
R523, 531	6-125C01	10
R541	17-82291B40	1.5 ±5%; 5 W
		FILTER, parasitic suppressor:
Z503, 504	1-80740B06	hybrid
	NON-REFERENCED ITEMS	
	1-80709D51	MICROSTRIP; 22 W input
	1-80769B99	MICROSTRIP; 22 W output
	1-80754B03	MICROSTRIP; 45 to 52 W
	1-80709D23	MICROSTRIP; 45 W
	2-135435	NUT, hex: 1/4-20 x 7/16 x 5/32"; 6 used
	3-114406	SCREW, captive: 4-40 x 5/16"; 8 used
	3-125468	SCREW, captive: 1/4-20x1"; 6 used
	3-134186	SCREW, tapping: 6-32 x 5/16"; 10 used
	3-136138	SCREW, tapping: 6-32 x 3/8"; 12 used
	3-138946	SCREW, tapping; 6-20 x 3/8"; 2 used
	4-7666	WASHER, lock: #6 ext.; 2 used
	4-7678	WASHER, lock: #1/4 ext.; 6 used
	7-82796K01	BRACKET
	7-84406D01	BRACKET, mounting; 2 req'd.
	15-82737K02	COVER, capacitor end
	30-83693F01	CABLE, coaxial; 2 used
	42-82590M01	RETAINER, substrate
	26-82653K01	HEATSINK, power ampl.
	42-83123F01	RETAINER; 12 req'd.
	42-84473E01	STRAP, ground; 3 req'd.
	42-84473E02	STRAP, ground; 2 req'd.
	42-84473E03	STRAP, ground; 4 req'd.
	76-84069B01	FERRITE BEAD; 6 req'd.
	15-82738K01	COVER

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

REVISIONS

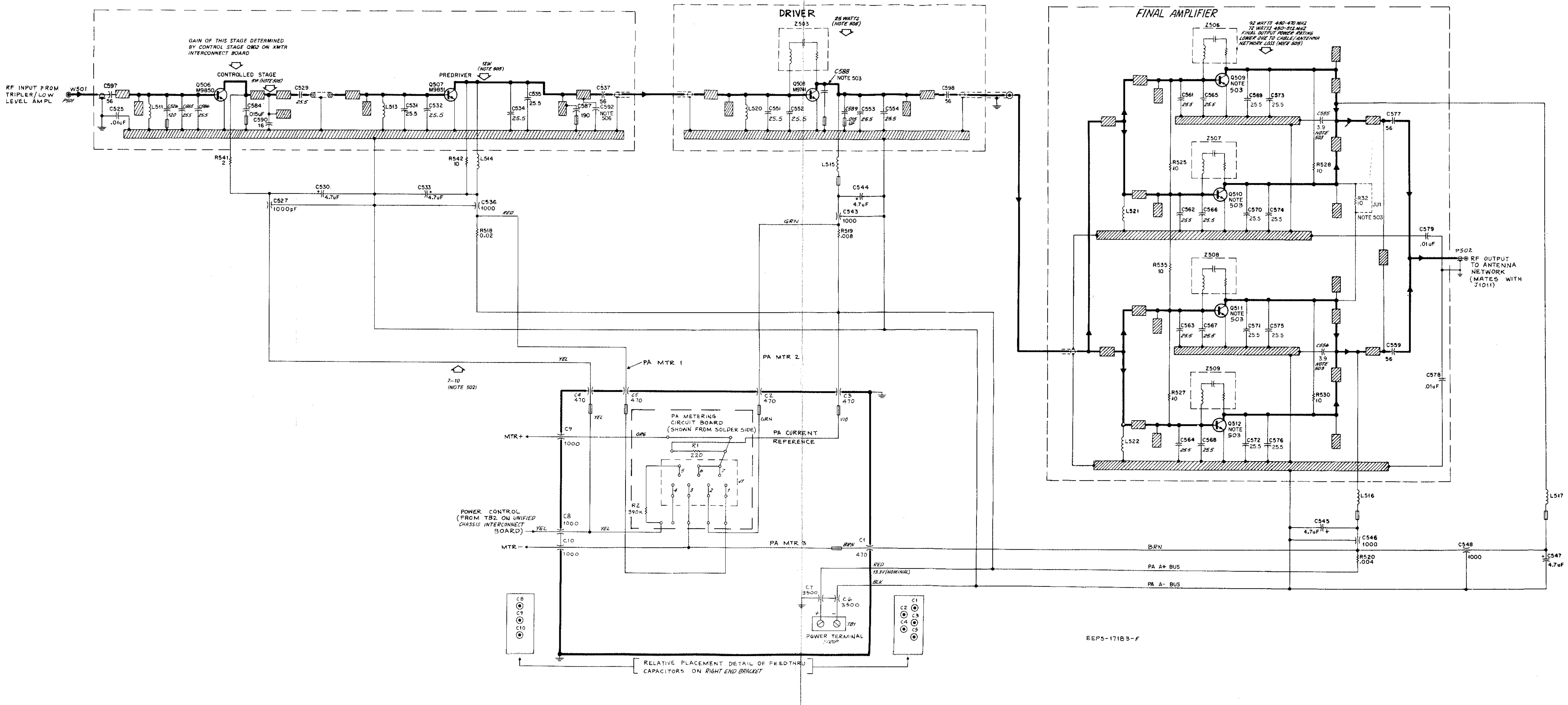
EEPS-28405-O

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE8321A-1	C529	FROM 21-84873H26 56 pF ±10%; 50 V TO 21-84736E10 25.5 pF ±5%; 50 V	Q506 COLLECTOR
	C537	FROM 21-84736E06 28 pF ±5%; 50 V TO 21-84547A05 56 pF ±10%; 50 V	Q507 COLLECTOR
	C587	FROM 8-82905G15 .015 uF ±10%; 100 V TO 21-848978	
	C592	FROM 21-832501 .01 uF +60-40%; 250 V TO 21-851846 8 pF ±0.25 pF; 500 V	
	C506	FROM 48-869738 TO 48-869850	CONTROLLED STAGE
	C507	FROM 48-869739 TO 48-869851	PREDRIVER
	R521	DELETED: WAS 6-125C27 120 ±10%; 1/2 W	Q506 BASE
	R541	FROM 17-82177B53 2 OHMS ±10%; 5 W TO 17-82291B40 1.5 OHMS ±5%; 5 W	Q506 COLLECTOR

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TKN6767A Metering and Cable Kit PL-3430-B

		CAPACITOR, fixed:
C1 thru 5	21-821474	470 pF ±20%; 500 V
C6, 7	21-84211B03	3500 pF; 250
C8, 9, 10, 527, 536, 543	21-861219	1000 pF; 500 V; coded RED
		CONNECTOR, receptacle:
J1	9-84207B01	female; 7 contact
		CONNECTOR, plug:
P501, 502	28-84967D01	male BNC type
		RESISTOR, fixed:
R2	6-124D12	390k ±10%; 1/4 W
R518	17-82620B03	.02 ±5%; 3 W
R519	6-84605E01	meter shunt; .008 ±1%
		TERMINAL BOARD
TB1	31-50378	2 screw barrier type
		CABLE, ASSEMBLY, RF:
W501	1-80775B41	includes: 30-84173E01 CABLE, coaxial, 12" long and P501
W502	1-80775B42	includes: 30-84173E01 CABLE coaxial, 15" long and P502
	NON-REFERENCED ITEMS	
	76-83960B01	FERRITE CORE; 9 req'd.
	42-10217A02	STRAP, cable harness; 2 req'd.
	43-82253C07	BUSHING; 2 req'd.
	15-82737K01	COVER, end cap
	47-84475E01	BUS BAR; 3 used
	14-84548A01	INSULATOR, washer; 2 req'd.
	42-38764	CLAMP, cable; 2 used
	2-131865	NUT, 1/4-28 x 3/8 x 3/32"; 2 used
	3-129468	SCREW, tapping; 10-32 x 5/8"; 2 used
	3-184184	SCREW, tapping; 4-40 x 5/16"; 2 used
	4-7658	LOCKWASHER #10 internal; 2 used
	4-7670	LOCKWASHER #1/4 internal; 2 used
	29-5223	LUG, solder; 2 used
	29-847854	LUG, tongue
	14-84494E01	BUS BAR
	14-84937E01	INSULATOR, bus



60/75-WATT POWER AMPLIFIER

MODELS TLE1713A & TLE1714A
(450-512 MHZ)

FUNCTION

Provides final transmitter output power amplification.

NOTES:

501. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS.
502. VOLTAGE DEPENDENT ON FINAL OUTPUT POWER, ERP, OR CONTROLLED STAGE GAIN. 470–512 MHz STATIONS HAVE A HIGHER NOMINAL VOLTAGE.
503.

COMPONENT	450–470 MHz	470–512 MHz
C555, C556	3.9 pF	NOT USED
R532	USED	NOT USED
Q509, Q510 Q511, Q512	M9995	M9755
C588	NOT USED	190pF
C592	16pF	NOT USED
R32	10Ω	JU1 (RESISTOR REMOVED)

504. N/A
505. RF POWER LEVELS ON EACH STAGE REPRESENT TYPICAL VALUES DURING NORMAL OPERATION.

PA MODEL TABLE

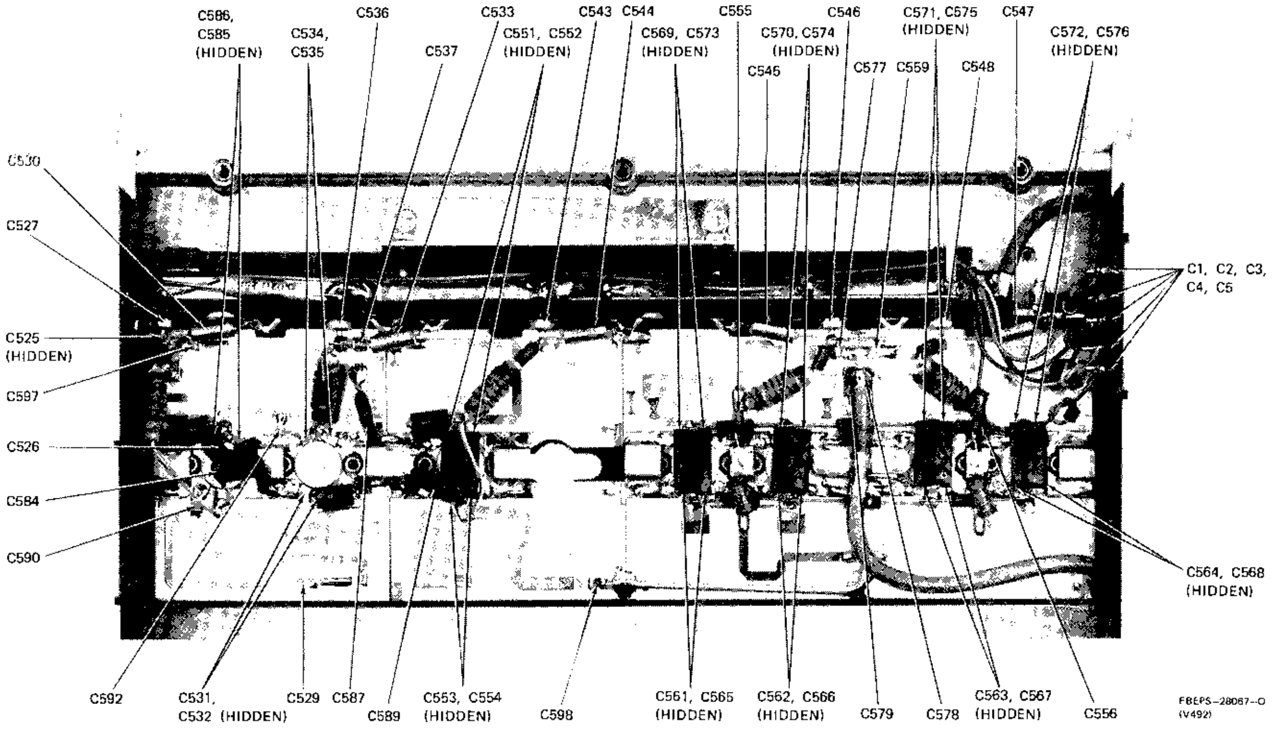
PA ASSEMBLY	TKN6768A METERING AND CABLE KIT	MICROSTRIP AND HEATSINK KIT	
		TLE8333A-2	TLE8334A
TLE1713A (75 W) (450–470 MHz)	X	X	
TLE1714A (60 W) (470–512 MHz)	X		X

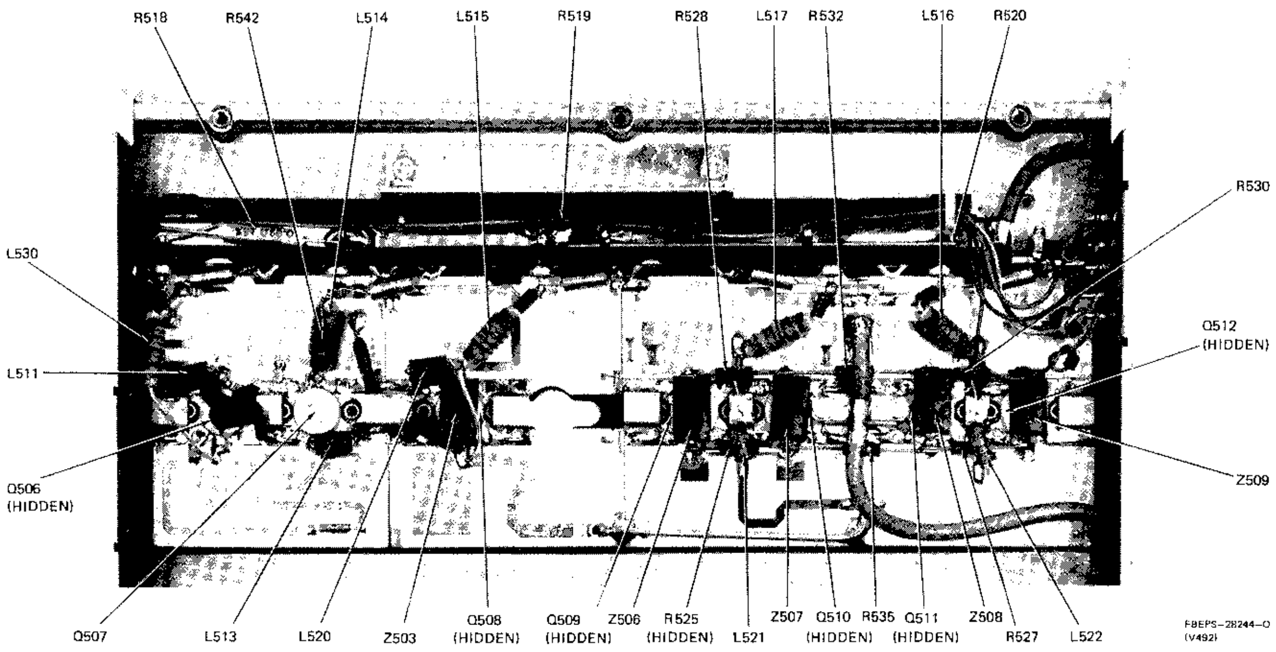
LEGEND:

THEORY OF OPERATION DATA

PRIMARY SIGNAL FLOW

PARTS LIST SHOWN ON BACK
68P81042E19-A
7/15/81-PHI





This parts list covers two models of the Microstrip and Heatsink Kit. Where differences exist the model number of the applicable unit is given in the description column.

TLE8333A 75 W Microstrip and Heatsink Kit (450-470 MHz)
TLE8334A 60 W Microstrip and Heatsink Kit (470-512 MHz) PL-3427-E

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF ±20%; 50 V; unless otherwise stated
C525	21-84547A05	.01 uF
C526	21-840713	120 ±5%; 500 V
C529, 531, 532, 534, 535, 551, 552, 553, 554, 561, 562, 563, 564, 565, 566, 567, 568, 585, 586	21-84736E10	25.5 ±5%
C530, 533, 544, 545, 547	23-82783B11	4.7 uF; 35 V
C555, 556	23-82133G40	3.9 uF; 50 V (TLE8333A only)
C537	21-84736E31	56 ± 5%
C569, 570, 571, 572, 573, 574, 575, 576	21-84636E10	25.5 ±5%
C578, 579	21-83422F01	.01 uF
C584	8-82905G15	.015 uF ±10%; 100 V
C587, 588	21-848978	190 ±3% 500 V
C589	8-82905G15	.015 uF ±10%; 100 V
C590	21-84736E08	16 ±5%
C559, 577, 598	21-84736E31	56 ±5%
C592	21-84736E08	16 ±5%
C597	21-84873H26	56 ±10%
		COIL, rf:
L511, 513	24-83977B02	2-1/2 turns
L520	24-83977B02	2-1/2 turns (TLE8333A only)
L514, 515, 516, 517	24-84346A03	.090 uH
L521, 522	24-83884G01	3-1/2 turns; coded RED
		TRANSISTOR: (SEE NOTE)
Q506	48-869850	NPN; type M9850
Q507	48-869851	NPN; type M9851
Q508	48-869741	NPN; type M9741
Q509, 510, 511, 512	48-869995	NPN; type M9995 (TLE8333A)
Q509, 510, 511, 512	48-869755	NPN; type M9755 (TLE8334A)
		RESISTOR, fixed: ±10%; 1/2 W: unless otherwise stated
R525, 527, 528, 530, 532, 535	6-125C01	10
R541	17-82177B53	2; 5 W
R542	6-125C01	10
		FILTER, parasitic suppressor:
Z503, 506-509	1-80740B06	hybrid
	NON-REFERENCED ITEMS	
		MICROSTRIPS
	1-80739B15	25-37 W input
	1-80709D17	37 W output
	1-80709D18	100 W output (TLE8333A only)
	1-80709D19	100 W output (TLE8333A only)
	1-80739B27	75-100 W input
	1-80739B28	75-100 W input
	1-80709D27	100 W output (TLE8334A only)
	1-80709D28	100 W output (TLE8334A only)
	1-80709D51	driver input 22 W
	1-80769B99	driver output 22 W
	26-82653K01	HEATSINK
	30-83693F01	CABLE, coaxial; 1/2" long
	30-83694F01	CABLE, coaxial; 3" long
	42-82590M03	HOLDER, substrate
	76-84069B01	FERRITE BEAD; 7 req'd.
	7-82796K01	BRACKET
	7-84406D01	BRACKET, mounting; 2 req'd.
	15-82737K02	COVER, end cap
	42-83123F01	RETAINER; 12 req'd.
	42-84473E01	STRAP, ground (.775" wide) 2 req'd.
	42-84473E02	STRAP, ground (.385" wide) 4 req'd.
	42-84473E03	STRAP, ground (.250" wide) 3 req'd.
	42-38764	CLAMP, cable

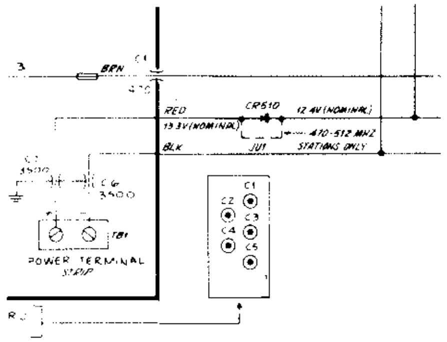
TKN6768A Metering and Cable Kit PL-3428-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF ±20%; 500 V; unless otherwise stated
C1 thru 5	21-821474	470
C6, 7	21-84211B03	3500; 250 V
C8, 9, 10, 527, 536, 543, 546, 548	21-861219	1000 +100-0%
		CONNECTOR, receptacle:
J1	9-84207B01	7 contacts
		CONNECTOR, plug:
P501, 502	28-84967D01	BNC type
		RESISTOR, fixed:
R1	6-124A33	220 ±5%; 1/4 W
R2	6-124D12	390k ±10%; 1/4 W
R518	17-82620B03	.02 ±5%; 3 W
R519	6-84605E01	meter shunt; .008 ±1%
R520	6-84606E01	meter shunt; .004 ±1%
		TERMINAL BOARD:
TB1	31-50378	2 screw barrier type
		CABLE ASSEMBLY, rf:
W501	1-80775B41	includes: 30-84173F01 CABLE, coaxial, 12" long and P501
	NON-REFERENCED ITEMS	
	76-83960B01	FERRITE BEAD; 5 req'd.
	1-80775B44	BUS BAR, 75 W
	30-84173F01	CABLE, coaxial (used with P501 & P502)
	42-10217A02	STRAP, cable; 2 req'd.
	43-82253C07	BUSHING, threaded; 2 req'd.
	15-82737K01	COVER, end cap
	14-84548A01	INSULATOR, washer; 2 req'd.
	42-38764	CLAMP, cable

NOTE: For optimum performance, replacement diodes, and transistors must be ordered by Motorola part numbers.

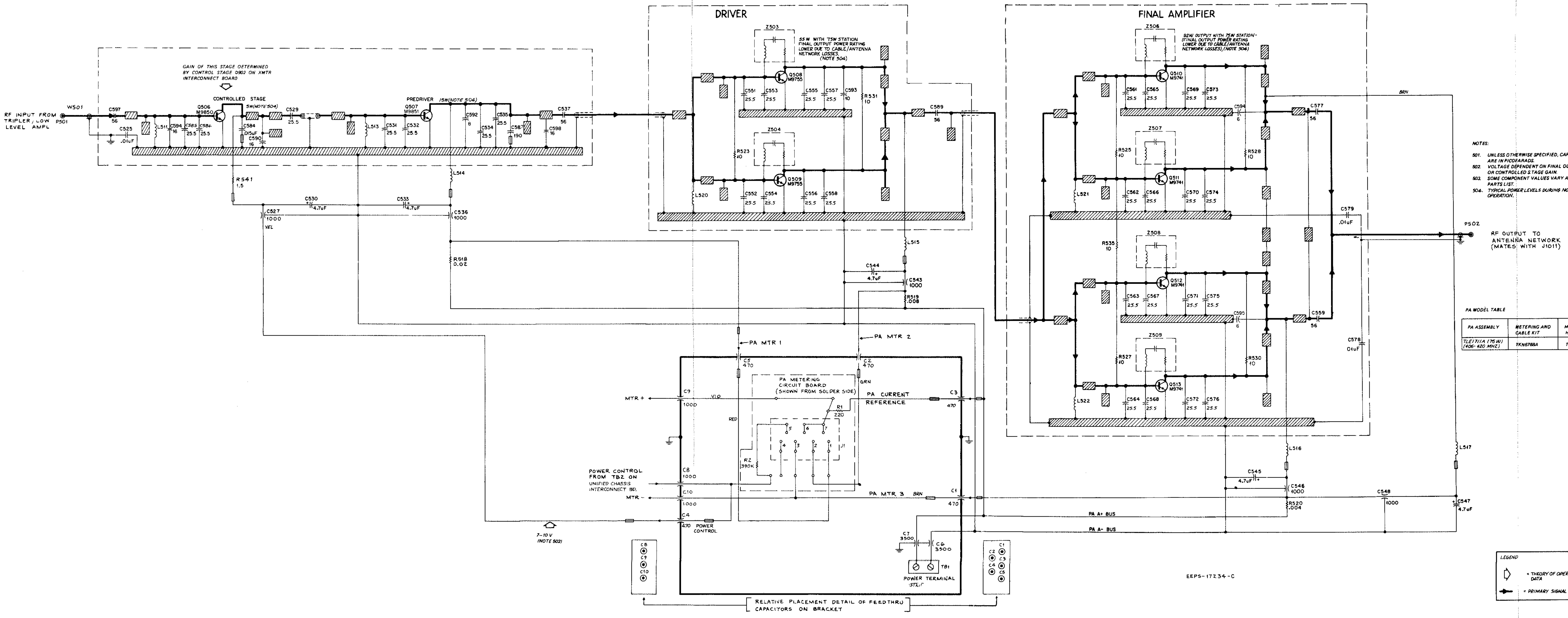
REVISIONS EEPS-17183-D

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLE1713A (TLE8333A-1)	CR510	DELETED 48-82732C07, CIRCUIT WAS AS SHOWN BELOW	PA A+ BUS



75-WATT POWER AMPLIFIER

MODEL TLE1711A
(406-420 MHz)



NOTES:

501. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN PICOFARADS.
502. VOLTAGE DEPENDENT ON FINAL OUTPUT POWER OR CONTROLLED STAGE GAIN.
503. SOME COMPONENT VALUES VARY AS NOTED IN PARTS LIST.
504. TYPICAL POWER LEVELS DURING NORMAL OPERATION.

PA MODEL TABLE

PA ASSEMBLY	METERING AND CABLE KIT	MICROSTRIP AND HEAT SINK KIT
TLE1711A (75 W) (406-420 MHZ)	TKN6768A	TLE8331A-1

LEGEND

⇨ = THEORY OF OPERATION DATA

→ = PRIMARY SIGNAL FLOW

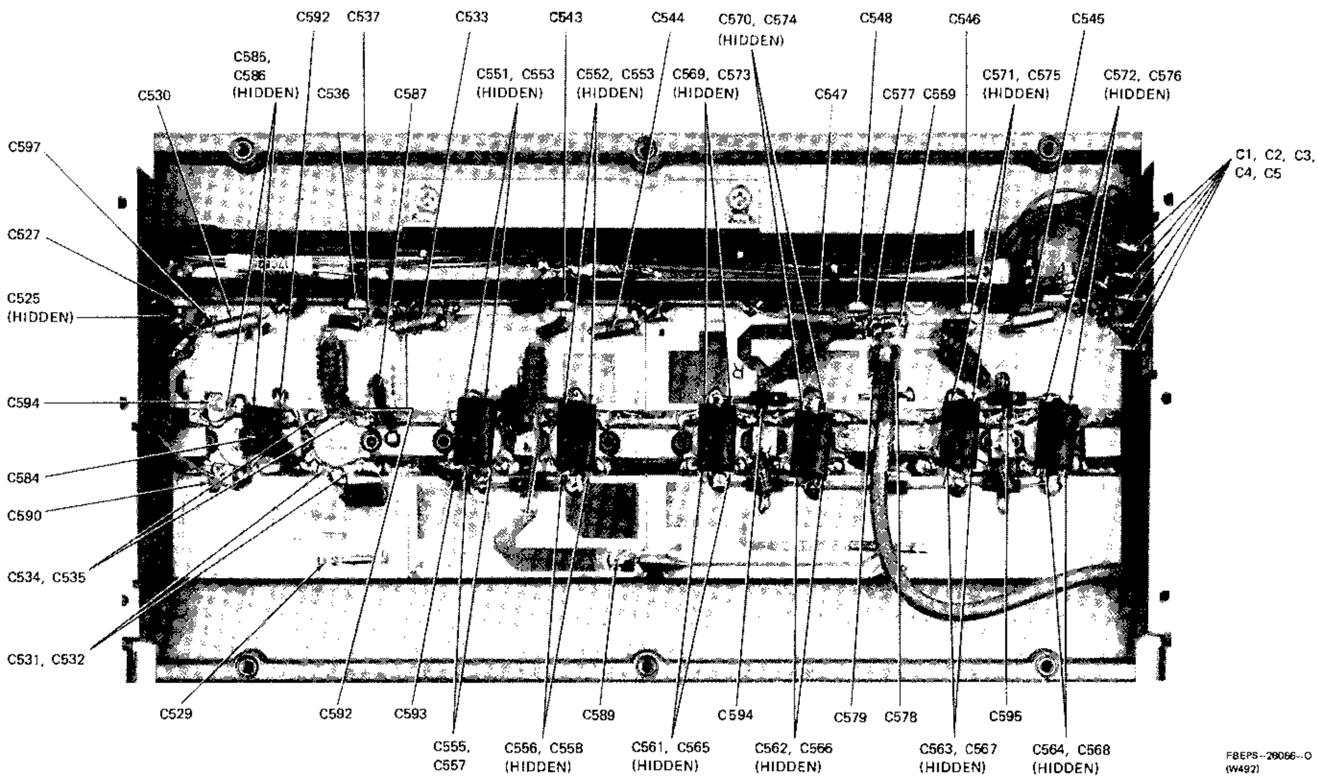
45 B 75W PA's (406-420 MHz)

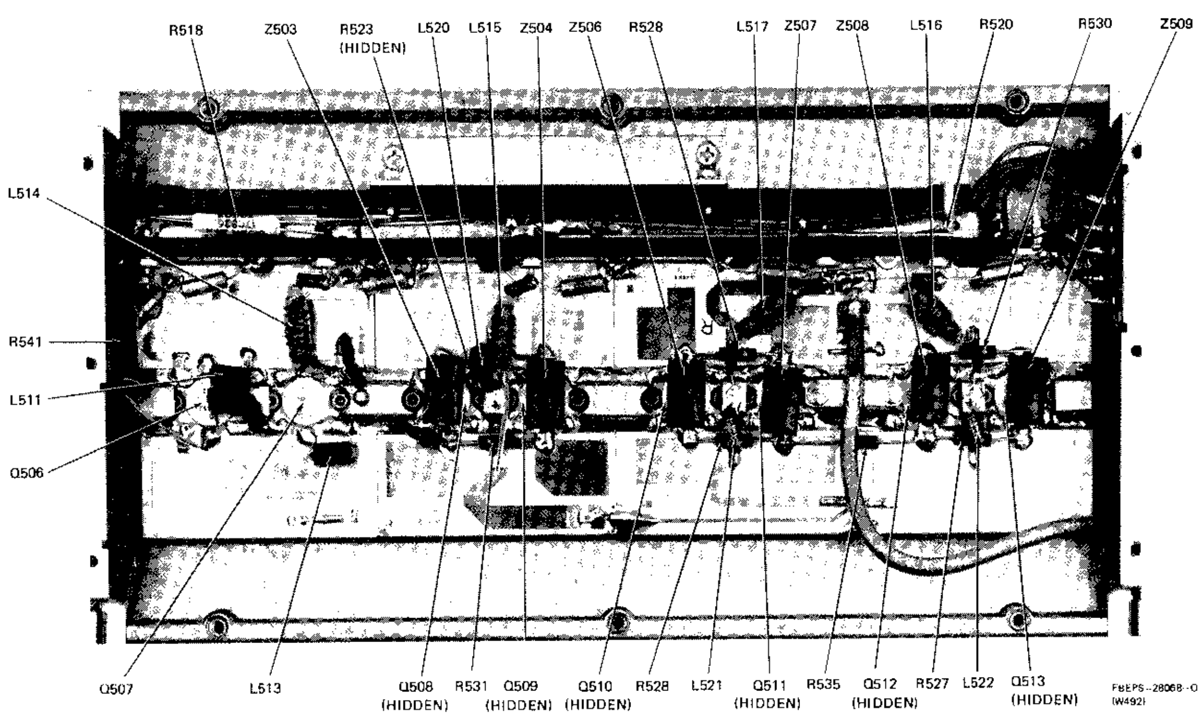
FUNCTION

Provides final transmitter output power amplification.

PARTS LIST SHOWN ON BACK
68P81042E38-A

7/15/81- PHI





REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TLE8331A 75-Watt Microstrip and Heatsink Kit		PL-3509-E
		CAPACITOR, fixed:
C525	21-84547A05	.01 uF ±20%; 50 V
C529, 531, 532, 534, 535, 551, 552, 553, 554, 555, 556, 557, 558, 585, 586	21-84736E10	25.5 pF ±5%; 50 V
C530, 533, 544, 547	23-82783B11	4.7 uF ±20%; 35 V
C545	23-82783B11	4.7 uF ±20%; 35 V
C537	21-84736E31	56 pF ±5%; 50 V
C559, 577	21-84736E31	56 pF ±5%; 50 V
C597	21-84736H26	56 pF ±10%; 500 V
C561 thru 576	21-84736E10	25.5 pF ±5%; 50 V
C584	8-82905G15	.015 uF ±10%; 100 V
C587	21-848978	190 pF ±3%; 500 V
C589	21-84736E31	56 pF ±5%; 50 V
C590, 594, 598	21-84736E08	16 pF ±5%; 50 V
C592	21-851846	8 pF ±0.25 pF; 500 V
C593	21-847088	10 pF ±.5 pF 300 V
C594, 595	21-82204B03	6 pF ±.5%; 500 V
		COIL, RF:
L511, 513, 520	24-83977B02	choke; 2-1/2 turns
L514, 515	24-84346A03	choke; .090 uH
L516, 517	24-84346A03	choke, .090 uH
L521, 522	24-83884G01	choke; 3-1/2 turns; coded RED; (TLE8331A only)
		TRANSISTOR: (SEE NOTE)
Q506	48-869850	NPN; type M9850
Q507	48-869851	NPN; type M9851
Q508, 509	48-869755	NPN; type M9755
Q510 thru 513	48-869741	NPN; type M9741
		RESISTOR, fixed: ±10%; 1/2 W: unless otherwise stated
R521		NOT USED
R523, 525, 527, 528, 530, 531, 535	6-125C01	10
R541	17-82291B40	1.5 ±5%; 5 W
		FILTER, parasitic suppressor:
Z503, 504	1-80740B06	hybrid
Z506, 507, 508, 509	1-80740B06	hybrid
NON-REFERENCED ITEMS		
	1-80709D51	MICROSTRIP; 22 W input
	1-80769B99	MICROSTRIP; 22 W output
	1-80754B03	MICROSTRIP; 45 to 52 W
	1-80754B05	MICROSTRIP; 100 W input;
	1-80709D24	MICROSTRIP; 100 W output;
	1-80754B07	MICROSTRIP; 100 W input
	1-80709D25	MICROSTRIP; 100 W output
	1-80709D26	MICROSTRIP; 52 W output
	2-135435	NUT, hex: 1/4-20 x 7/16 x 5/32"; 6 used
	3-1437	SCREW, machine: 4-40 x 5/8"; 2 used
	3-114406	SCREW, captive: 4-40 x 5/16"; 14 used
	3-125468	SCREW, captive: 1/4-20 x 1"; 6 used
	3-134186	SCREW, tapping: 6-32 x 5/16"; 10 used
	3-136138	SCREW, tapping: 6-32 x 3/8"; 12 used
	3-138946	SCREW, tapping: 6-20 x 3/8"; 2 used
	4-7666	WASHER, lock: #6 ext.; 2 used
	4-7678	WASHER, lock: #1/4 ext; 6 used
	7-82796K01	BRACKET
	7-84406D01	BRACKET, mounting; 2 req'd.
	7-84631E01	BRACKET, strain relief
	15-82737K02	COVER, capacitor end

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	30-83693F01	CABLE, coaxial
	42-82590M02	RETAINER, substrate
	26-82653K01	HEATSINK, power ampl.
	42-83123F01	RETAINER; 12 req'd.
	42-84473E01	STRAP, ground; 3 req'd.
	42-84473E02	STRAP, ground; 2 req'd.
	42-84473E03	STRAP, ground; 4 req'd.
	43-84804E01	SPACER, insulator; 2 req'd.
	76-84069B01	FERRITE BEAD; 6 req'd.
	15-82738K01	COVER

NOTE:
For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

POWER CONTROL BOARD

MODELS TLN4926A/AV

1. INTRODUCTION

The power control board operates as a control loop, which continually monitors the final stages of the transmitter (via the antenna network) and controls that output by regulating the A+ applied to collector of the first stage of the power amplifier. The A+ is controlled by control stage Q902, Q601, U601 and associated circuitry.

2. FUNCTIONAL DESCRIPTION
(Refer to the schematic diagram)

The output of the differential amplifier U601 is determined by the potentials present on the non-inverting (+) and inverting (-) inputs. These potentials are developed by the power control board circuitry in the following manner.

When the load impedance of the antenna circuitry provides a good match (low VSWR) to the power amplifier, a bias voltage is produced by the dc reference bias circuitry. The bias voltage produced is placed on the inverting input, pin 1 (also called the reference input), of the differential amplifier.

When the transmitter is keyed, the forward (output) power from the final stages of the power amplifier is fed through the antenna network to the antenna circuit. This flow of power is sampled by the forward power sampling circuitry and places a bias, proportional to the forward power in the antenna network, on the non- inverting input (pin 5) of the differential amplifier. The power set potentiometer is then adjusted,changing the potential on the non-inverting input. As this voltage changes, relative to the reference input voltage, the output of the differential amplifier changes, in turn changing the control transistor collector voltage and therefore the output of the power amplifier.

Once the power has been set to the proper level, any change in the output power will be instantly corrected by the circuitry. If the power increases, the increase causes the differential amplifier output voltage to increase, decreasing the output from the dc amplifier, increasing the output from the control stage, which decreases the gain of the power amplifier until the output returns to the preset level. A decrease in transmitter power amplifier output causes the reverse action.

Any power reflected back from the antenna circuit is detected by the reverse power sampling circuit. Reverse power causes a bias in the antenna network which decreases the potential on the reference input of the differential amplifier. Therefore, increasing levels of reflected power will cause the transmitter power output to be decreased to a safe level.

3. MAINTENANCE

Before beginning maintenance of the power control board, disconnect the cable between the isolation network output (J1012) and the PA input (J901). Connect a UHF-rated wattmeter between the isolation network output connector J1012, with a 50 ohm, non-reactive, dummy load capable of dissipating at least 50 watts.

CAUTION
Failure to observe maintenance philosophy can result in damage to station and/or associated test equipment.

The power control board is incorporated in the transmitter to provide protection for the rf power transistors under environmental conditions such as voltage, load variation, and device variations. In order for the circuitry to operate properly and provide protection, it is necessary to have adjusted the "low level" power amplifier controls (DRIVE LIMIT and POWER SET) in accordance with the alignment portion of the "Low Level" Power Amplifiers section (68P81042E28).

NOTE
Power control board must be installed in transmitter for testing to provide

necessary power, ground, and control connections. For bench testing of a board, which has been removed from radio set and replaced by spare, another radio set is required as troubleshooting test fixture.

3.1 PERFORMANCE TESTS

3.1.1 POWER SET Control Test

This control allows the power output of the transmitter to be varied from zero (0) power out (with the control fully counterclockwise) to greater than the rated output (with the control fully clockwise). Refer to the power amplifier power set procedure in the alignment portion of the "Low Level" Power Amplifiers section (68P81042E28).

CAUTION
For proper operation of the protection circuitry, it is imperative that the POWER SET control never be left in a position that exceeds rated power output.

Step 1. Key transmitter.

Step 2. Adjust POWER SET control until rated power output is reached.

IMPORTANT
If POWER SET control ONLY is used to adjust rf power output, for any non-rf power alignment or troubleshooting procedure, ONLY the POWER SET control requires adjustment to restore rf power to rated level.

Step 3. Unkey transmitter.

3.1.2 Automatic Power Leveling Test

A separate, variable dc power supply must be used to perform this test.

Step 1. Disconnect 13.6 volt lead at PA. Connect a 16 volt source in its place. Set power supply output to + 13.6 volts.

Step 2. Key transmitter.

Step 3. Vary the supply voltage from + 13.6 volts to + 16 volts. The transmitter power output variation should be between + 10% and -5%.

Step 4. Unkey transmitter and reconnect "low level" PA to the station power supply.

3.1.3 DRIVE LIMIT Control Test

This control allows the drive power to the "low level" PA from the controlled stage to be limited to a level sufficient to provide rated performance. Its purpose is to set a limit on the drive power that can be called for by the automatic power leveling circuitry. This prevents earlier "low level" PA stages from being damaged by overdrive if later stages fail. Depending on the position of the DRIVE LIMIT control, the maximum collector voltage of the controlled stage can be limited to between 6.5 volts and 12.5 volts. The proper procedure for setting the DRIVE LIMIT control is given in the alignment portion of the "Low Level" Power Amplifiers section (68P81042E28).

CAUTION
For proper operation of power leveling circuitry, the DRIVE LIMIT control *must not* be set for any lower power output than that given in DRIVE LIMIT column in Table 3 of the alignment portion of the "Low Level" Power Amplifiers section (68P81042E28).

In stations with high gain driver and power amplifier stages, the power leveling power set circuitry may operate the controlled stage at a collector voltage less than 6.5 volts. In such stations, little or no effect will be seen from the DRIVE LIMIT control. If it is not possible to lower power output with the DRIVE LIMIT control to the level called for in the alignment procedure, set the DRIVE LIMIT control fully clockwise, maximum drive limit (minimum power output).

In some stations the rf drive reserve is not sufficient to require use of the DRIVE LIMIT control. In these stations, the power output level called for in the "low level" PA alignment procedure cannot be obtained. If such a situation is found, set the DRIVE LIMIT control fully counterclockwise, minimum drive limit (maximum power output).

3.1.4 "No-Power" Protect Circuit Test

The "no-power" protect circuit prevents the transmitter "low level" power amplifier from being operated without being connected to the isolation network. If the forward power detector in the isolation network does not sense more than approximately 7 watts, the "no-power" protect circuit will shut-off the drive to the "low level" power amplifier stages. This protection circuit can be made to operate to check its performance by turning the power output down below 7 watts, using the POWER SET control. Once the "no-power" protect circuit operates, the transmitter must be re-keyed to return drive power, after the original "no-power" condition is corrected.

3.2 TROUBLESHOOTING

The power control board troubleshooting chart outlines a logical procedure for finding major functional failures. However, because of the complexity of the circuit operation, it is impossible to provide a troubleshooting chart that will be usable for some of the more subtle problems that may appear in the power control board performance tests. Efficient location of these "subtle" problems depends on a thorough knowledge of the power control board theory of operation. In any case, it is a good idea to review the power control board functional description, in this section, before beginning troubleshooting.

Once familiar with the circuit operation, a defective stage or component can be found by making voltage measurements and comparing them with those shown on the schematic diagram. Observe the voltage changes that occur when the POWER SET and DRIVE LIMIT controls are varied.

The "low level" power amplifier stages can be disabled to permit easier power control board troubleshooting. To disable the stages, remove the heavy RED lead from the barrier strip and cover with an insulator. On 406-420 MHz models, remove the interconnect plug. When the stages are disabled, the "No-Power" protect circuits will go into operation. To disable the "No-Power" protect circuits, use the following procedure.

Step 1. Remove ac input power from the station.

Step 2. Remove the shield from over power control board.

Step 3. Connect jumper across C611 on power control board.

Step 4. Reconnect ac power to station and perform whatever troubleshooting is required.

CAUTION

Before "low level" power amplifier stages are re-enabled, be sure to re-enable "No-Power" protect circuit. DO NOT OPERATE "LOW LEVEL" POWER AMPLIFIER STAGES WITH "NO-POWER" PROTECT CIRCUITS DISABLED.

Table 1 lists some power control board malfunctions and their possible causes.

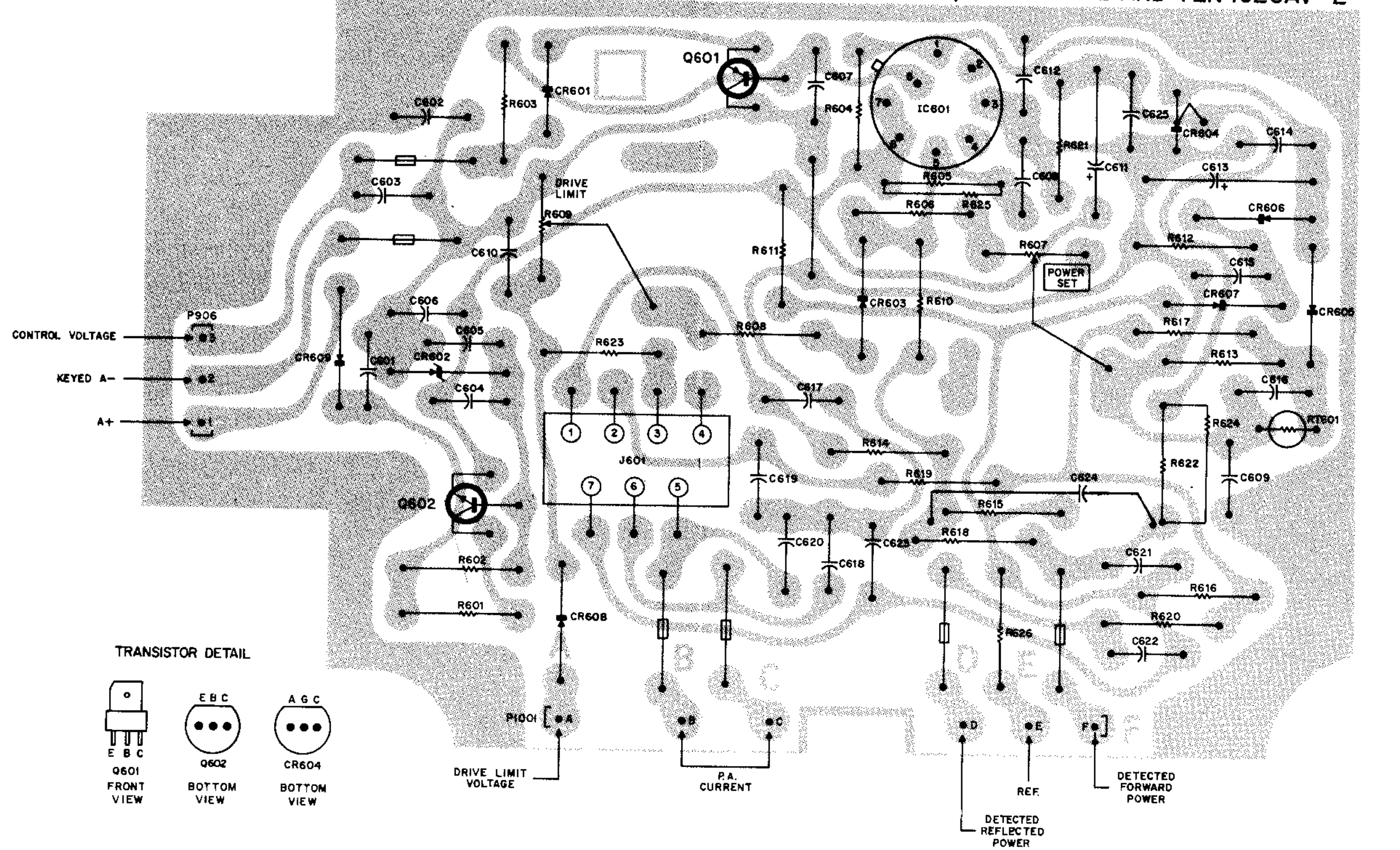
Table 1. Power Control Board Troubleshooting Hints

Symptom	Possible Cause -- Check the following:
POWER SET malfunctioning	a. Power detector diodes CR1001 and/or CR1002
	b. IC601 bias circuitry
	c. POWER SET pot
DRIVE LIMIT malfunctioning	a. CR603
	b. DRIVE LIMIT pot
"No-Power" protect malfunctioning	a. CR604
	b. CR611

POWER CONTROL BOARD

MODELS TLN4926A/AV

POWER CONTROL, TLN4926A-2 AND TLN4926AV-2



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SOLDER SIDE

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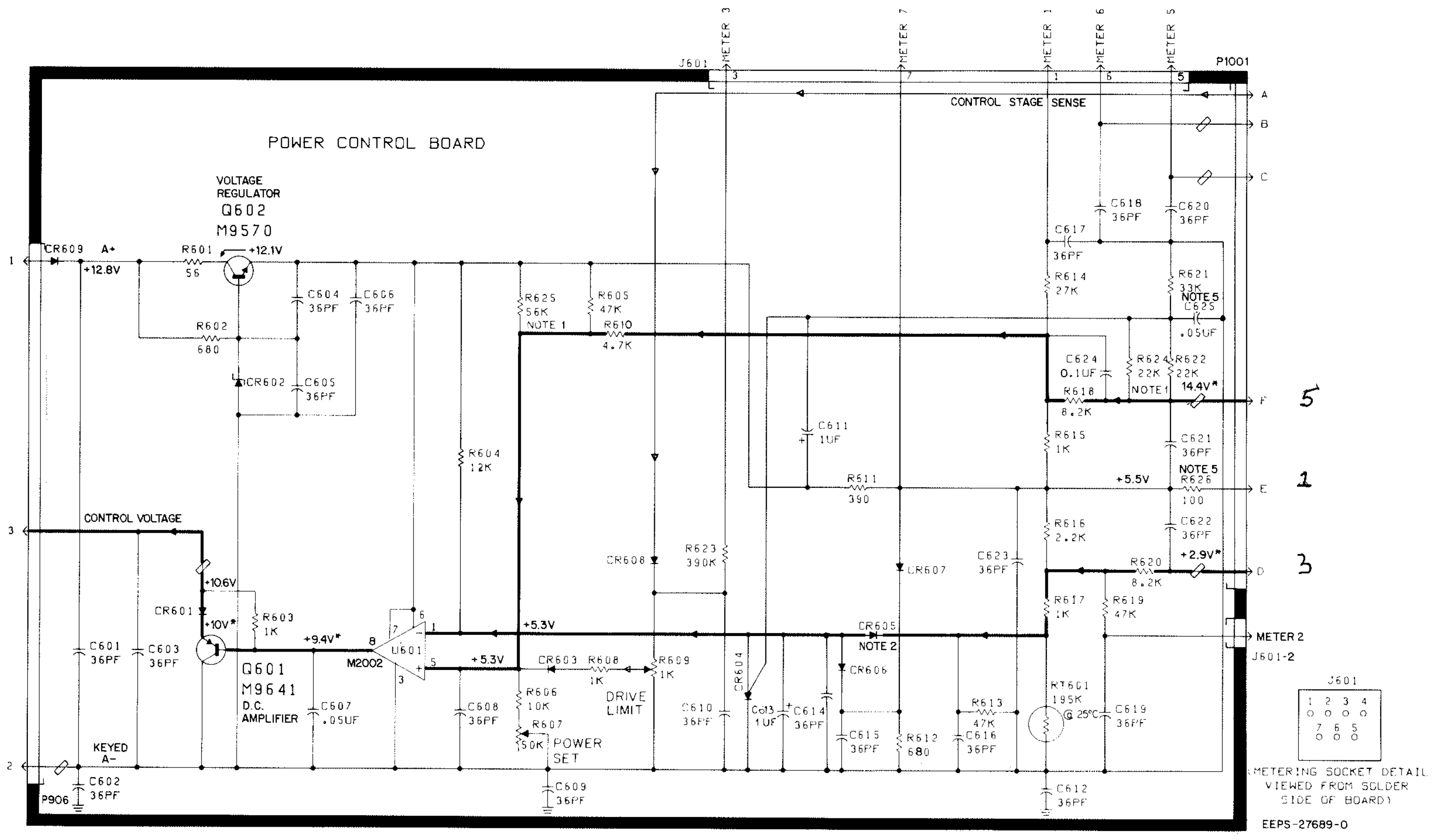
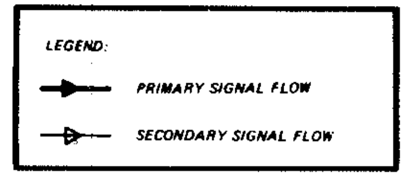


NOTES:

1. MOUNTED ON PLATING SIDE OF PRINTED CIRCUIT BOARD.
2. CR605 REMOVED IN B84RCB MODEL SERIES STATIONS.
3. ALL MEASUREMENTS TAKEN WITH AN 11 MEGOHM VTVM.
4. VOLTAGES MARKED WITH AN ASTERISK (*) VARY WITH POWER SET, DRIVE LIMIT AND GAIN OF POWER AMPLIFIER. NOMINAL VALUES ARE SHOWN.
5. THE FOLLOWING CHART DENOTES MODEL DIFFERENCES:

COMPONENT	TLN4926AV	TLN4926A
C625	.05 UF	NOT USED
R626	100 OHM	REPLACED WITH WIRE JUMPER AND FERRITE BEAD



FUNCTION

This board provides regulation of the output power by monitoring the forward output power and heatsink temperature by controlling the A+ supply voltage to the driver, low level amplifier and doubler. Protection is also provided by a no power protection circuit should the final be destroyed.

Motorola No. PEPS-27686-B
8/15/82-UP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

parts list

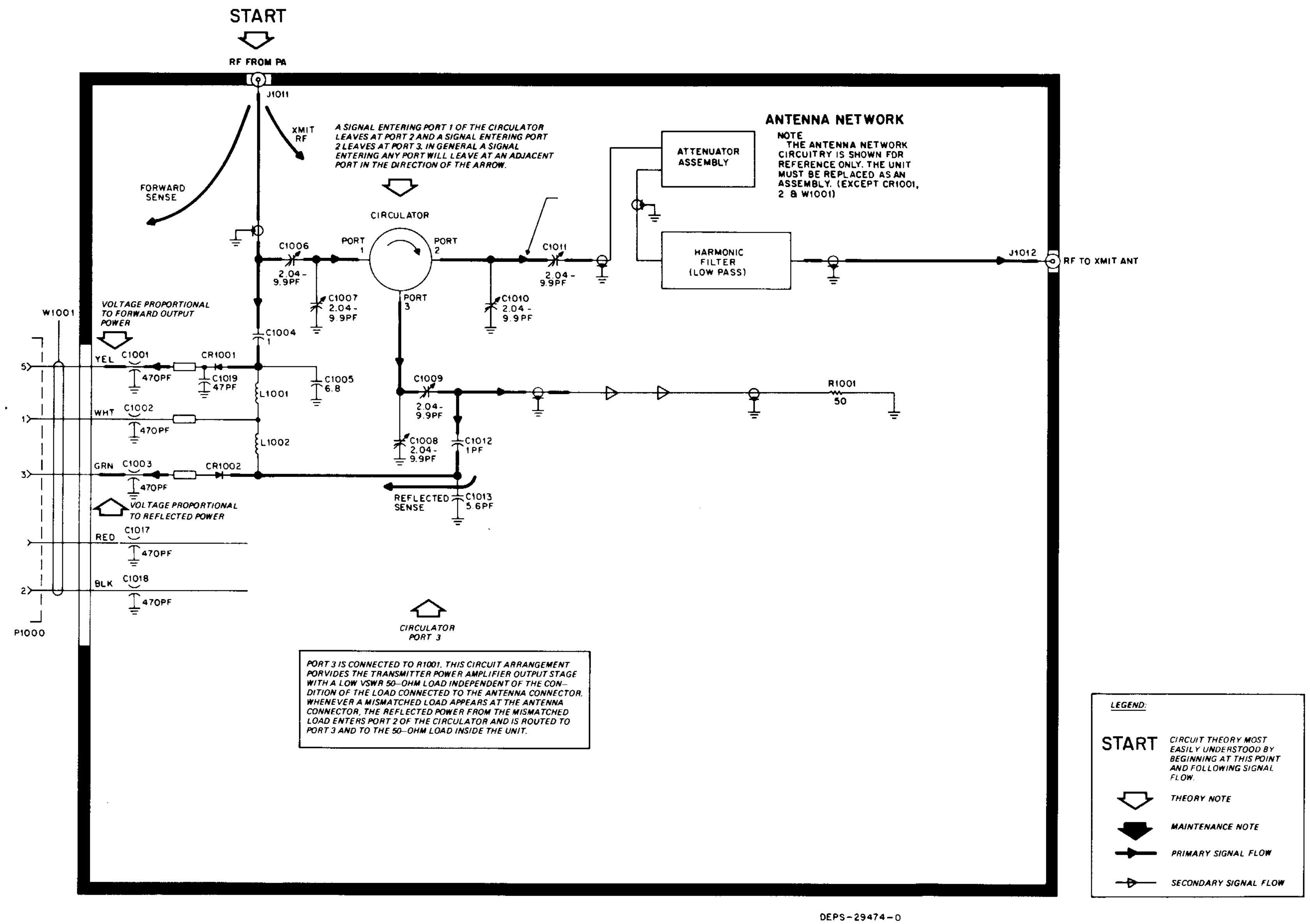
TLN4926A/AV Power Control Board PL-5254-C

		CAPACITOR, fixed:
C601 thru 606	21-82610C04	36 pF ±5%; 200 V
C607	21-82372C04	.05 uF +80-20%; 25 V
C608, 609, 610	21-82610C04	36 pF ±5%; 200 V
C611	23-82783B10	1 uF ±20%; 50 V
C612	21-82610C04	36 pF ±5%; 200 V
C613	23-83214C04	1 uF ±20%; 15 V
C614 thru 623	21-82610C04	36 pF ±5%; 200 V
C624	8-82905G30	0.1 uF ±10%; 50 V
C625	21-82372C04	.05 uF +80-20%; 25 V (TLN4926AV only)
		DIODE: (SEE NOTE)
CR601	48-83654H01	silicon
CR602	48-83696E04	Zener type; 9.1 V
CR603	48-84616A01	hot-carrier
CR604	48-869777	silicon controlled type M9777
CR605 thru 607	48-82392B16	silicon
CR608	48-82392B03	silicon
CR609	48-82466H18	silicon
		CONNECTOR, receptacle:
J601	9-84207B01	female; 7 contact
		TRANSISTOR: (SEE NOTE)
Q601	48-869641	PNP; type M9641
Q602	48-869570	NPN; type M9570
		RESISTOR, fixed: ±10%; 1/4 W; unless otherwise stated
R601	6-124C19	56
R602	6-124A45	680 ±5%
R603	6-124C49	1k
R604	6-124C75	12k
R605	6-124C89	47k
R606	6-124C73	10k
R607	18-83083G20	var: 50k ±30%
R608	6-124C49	1k
R609	18-83083G14	var: 1k ±30%
R610	6-124C65	4.7k
R611	6-124A39	390 ±5%
R612	6-124A45	680 ±5%
R613	6-124C89	47k
R614	6-124A83	27k ±5%
R615	6-124C49	1k
R616	6-124C57	2.2k
R617	6-124C49	1k
R618	6-124C71	8.2k
R619	6-124A89	47k ±5%
R620	6-124C71	8.2k
R621	6-124C85	33k
R622	6-124C81	22k
R623	6-124D12	390k
R624	6-124C81	22k
R625	6-124C91	56k
R626	6-124C25	100 (TLN4926AV only)
		THERMISTOR:
RT601	6-867628	195k ±10% @ 25°C
		INTEGRATED CIRCUIT: (SEE NOTE)
U601	51-83629M12	type; M2002
	MECHANICAL PARTS	
	55-84300B03	HANDLE; long
	54-84973E01	HANDLE; short
	76-84069B01	FERRITE BEAD; 6 used
	42-84284B01	RETAINER; 4 used
	3-139506	SCREW, tapping; 4-40 x 5/16"; 4 req'd.
	3-134169	SCREW, tapping; 4-40 x 1/4"
	5-84220B01	GROMMET
	29-84028H01	TERMINAL, male; 9 used

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

ANTENNA NETWORK

MODEL TLE1893B (RPTR STA'S)



FUNCTION

The antenna network provides the power amplifier stage with a constant, low VSWR, 50-ohm load which is independent of the transmit antenna. This load is provided by the circulator.

The antenna network develops dc voltages, which are proportional to the forward output power of the PA and the power reflected back into the PA (reverse power). These voltages are then routed to the power control board where they are applied to the input of a differential amplifier which determines the amount of drive supplied to the control stage. The control stage then sets the gain of the first stage of the power amplifier.

Another function of the antenna network is to attenuate transmitter carrier harmonics to a level at least 85 dB below the carrier. This is accomplished by a low pass harmonic filter incorporated as part of the antenna network.

PARTS LIST SHOWN ON BACK

PARTS LIST

TLE1893B Antenna Network
450-470 MHz (Repeater [RT] Station) PL-6808-O

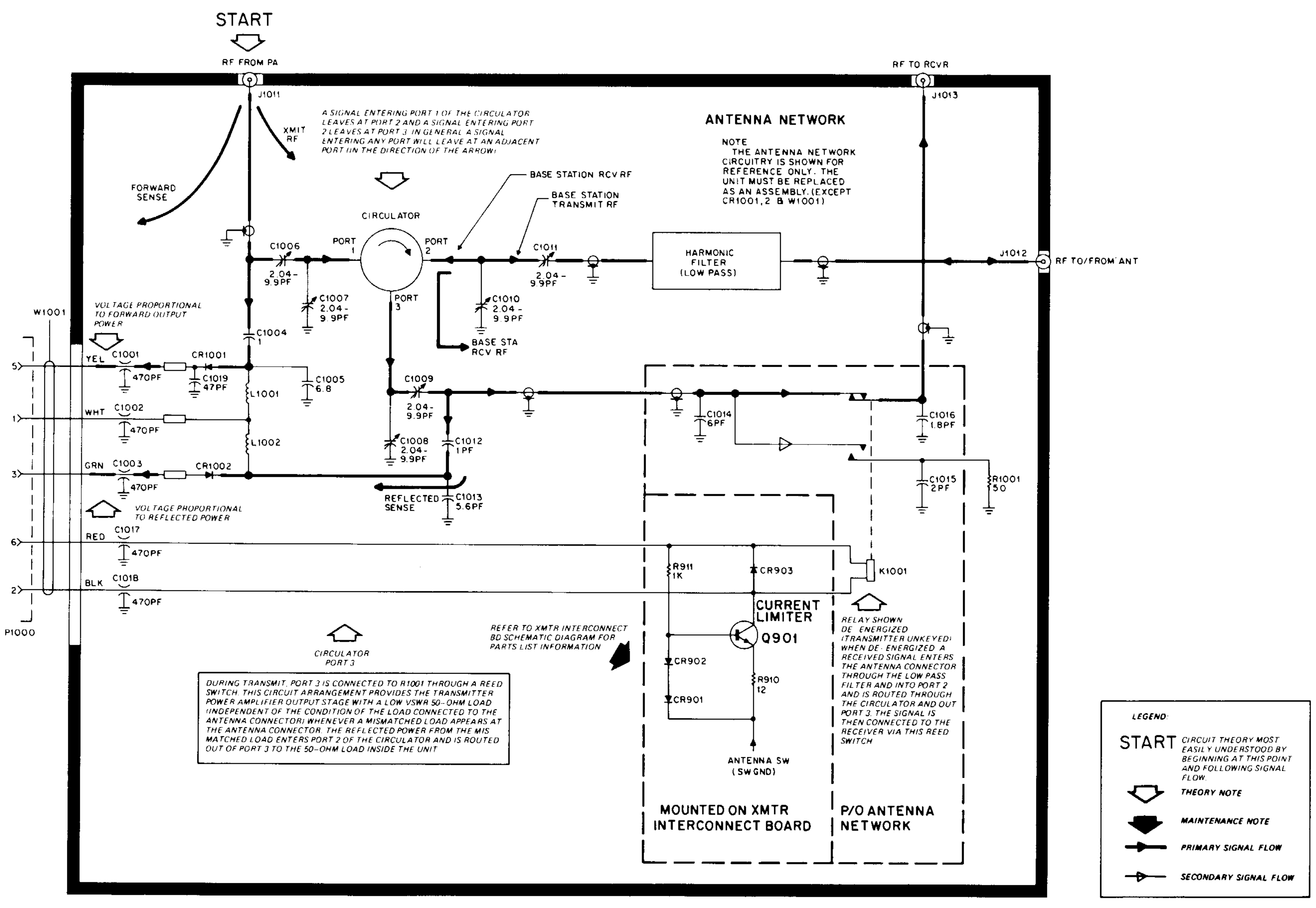
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NOTE: Field replacement of component parts of this unit is not recommended (except for those listed below). For replacement, order the entire unit. Specify kit number and frequency range.
CR1001, 1002	48-84616A01	DIODE, hot carrier

TKN6764A Antenna Network Cable PL-6434-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P1000	- -	CONNECTOR, plug: includes: 15-83498F06 HOUSING, connector, 29-83499F01 CONTACT connector; 5 used and 46-84549F11 PLUG, polarizing
W1001	1-80775B22	CABLE ASSEMBLY: includes: reference items P1000 and P1012: 42-10217A02 STRAP, cable; 4 used and miscellaneous wire leads.

ANTENNA NETWORK

MODEL TLE1660B SERIES (BASE STA'S)



FUNCTION

The antenna network provides the power amplifier stage with a constant, low VSWR, 50-ohm load which is independent of the transmit antenna. This load is provided by the circulator.

The antenna network develops dc voltages, which are proportional to the forward output power of the PA and the power reflected back into the PA (reverse power). These voltages are then routed to the power control board where they are applied to the input of a differential amplifier which determines the amount of drive supplied to the control stage. The control stage then sets the gain of the first stage of the power amplifier.

Another function of the antenna network is to attenuate transmitter carrier harmonics to a level at least 85 dB below the carrier. This is accomplished by a low pass harmonic filter incorporated as part of the antenna network.

PARTS LIST SHOWN ON BACK

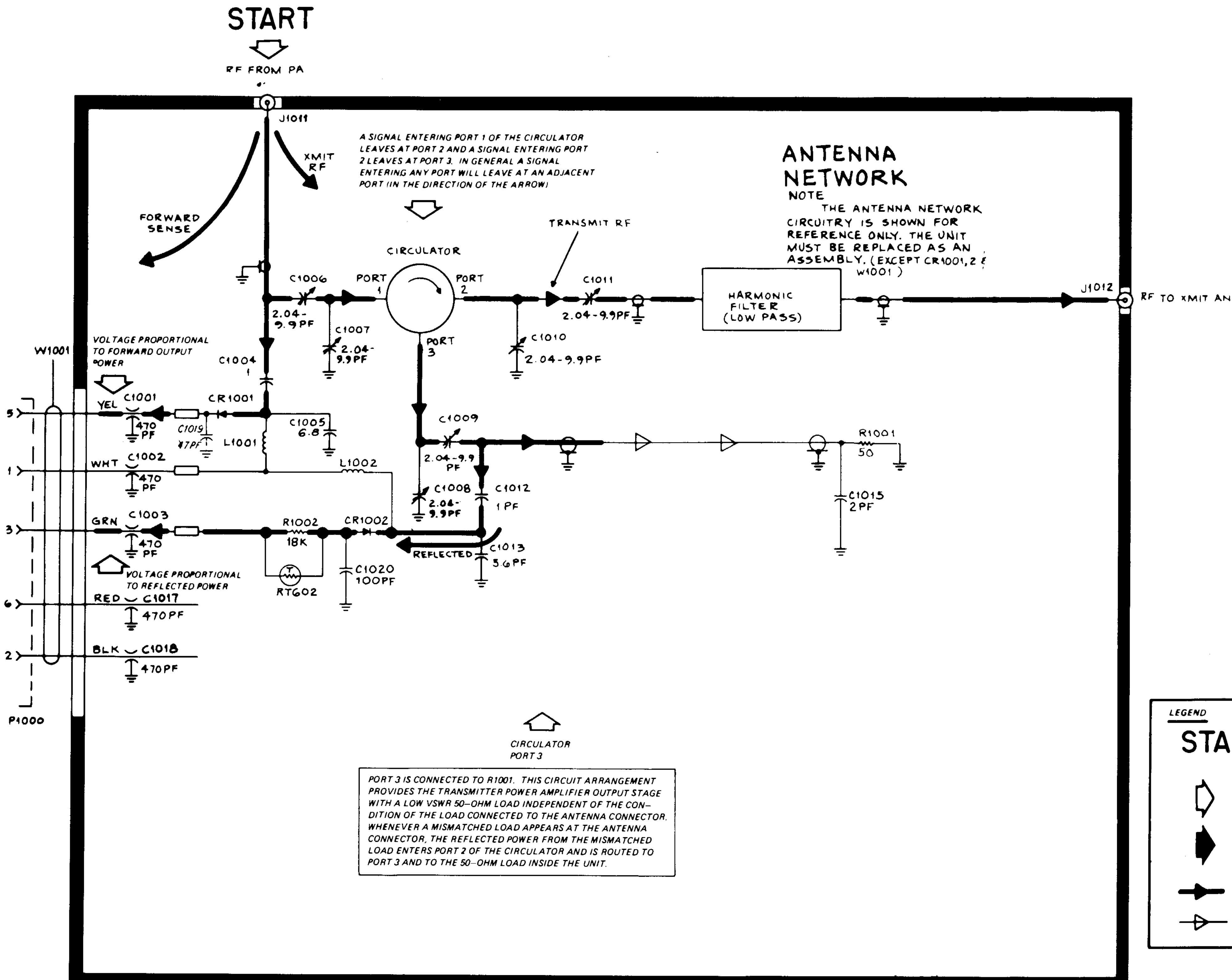
PARTS LIST

TLE1660B Series Antenna Network PL-6809-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	TLE1661B TLE1663B TLE1664B TLE1665B	406-420 MHz (Base Station) 450-470 MHz (Base Station) 470-494 MHz (Base Station) 494-512 MHz (Base Station)
		NOTE Field replacement of component parts of these units are not recommended (except those listed below). For replacement, order the entire unit. Specify kit numbers and frequency range quired.
CR1001, 1002	48-84616P01	DIODE, hot carrier

TKN6764A Antenna Network Cable PL-6434-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P1000	- -	CONNECTOR, plug: includes: 15-83498F06 HOUSING, connector, 29-83499F01 CONTACT connector; 5 used and 46-84549F11 PLUG, polarizing
W1001	1-80775B22	CABLE ASSEMBLY: includes: reference items P1000 and P1012: 42-10217A02 STRAP, cable; 4 used and miscellaneous wire leads.

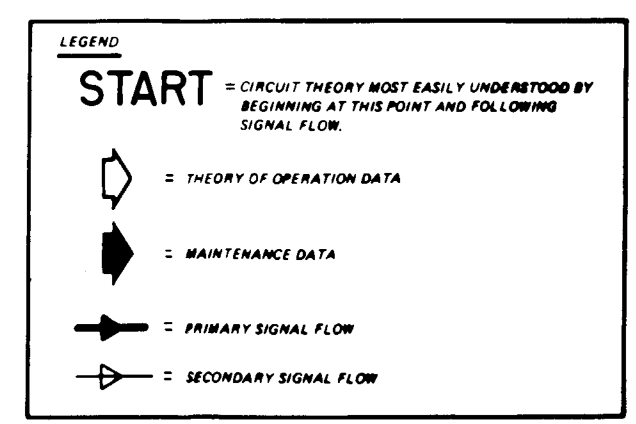


FUNCTION

The antenna network provides the power amplifier stage with a constant, low VSWR, 50-ohm load which is independent of the transmit antenna. This load is provided by the circulator.

The antenna network develops dc voltages, which are proportional to the forward output power of the PA and the power reflected back into the PA (reverse power). These voltages are then routed to the power control board where they are applied to the input of a differential amplifier which determines the amount of drive supplied to the control stage. The control stage then sets the gain of the first stage of the power amplifier.

Another function of the antenna network is to attenuate transmitter carrier harmonics to a level at least 85 dB below the carrier. This is accomplished by a low pass harmonic filter incorporated as part of the antenna network.



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PARTS LIST SHOWN ON BACK

parts list

TLE1670B Series Antenna Network PL-6746-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	TLE1671B	406-420 MHz (Repeater (RT Station)
	◄ TLE1673B	450-470 MHz (Repeater (RT Station)
	TLE1674B	470-494 MHz (Repeater (RT Station)
	TLE1675B	494-512 MHz (Repeater (RT Station)
		NOTE Field replacement of component parts of these units are not recommended (except those listed below). For replacement, order the entire unit. Specify kit numbers and frequency range required.
CR1001, 1002	48-84616P01	DIODE, hot carrier

TKN6764A Antenna Network Cable PL-6434-O

P1000		CONNECTOR, plug: includes: 15-83498F06 HOUSING, connector, 29-83499F01 CONTACT connector; 5 used and 46-845 46-84549F11 PLUG, polarizing
W1001	1-80775B22	CABLE ASSEMBLY: includes: reference items P1000 and P1012: 42-10217A02 STRAP, cable; 4 used and miscellaneous wire leads.

TONE "PRIVATE-LINE" ENCODER

MODEL TLN5731A

TECHNICAL CHARACTERISTICS

"PL" TONE FREQUENCY	Selected from 67-210 Hz range
FREQUENCY DETERMINING DEVICE	"Vibrasender" Resonant Reed
STABILITY	±0.15%
LEVEL (nominal)	350 mV rms
OUTPUT IMPEDANCE	4.7k ohms
POWER REQUIREMENTS	+9.6 V dc @15 mA

1. DESCRIPTION

The "Private-Line" (PL) encoder generates a low-frequency audio tone for continuous modulation of the transmitted rf signal in "Private-Line" operation.

2. FUNCTIONAL OPERATION

2.1 GENERAL

The encoder may be divided into three major sections.

Tone Oscillator -- The tone oscillator generates two equal-amplitude tone signals 180° out-of-phase whenever power is applied to the radio. A feedback amplifier provides negative feedback to limit the level of oscillation. The "Vibrasender" resonant reed determines the frequency of operation.

Reverse Burst Timing Generator -- The reverse burst timing generator provides a transmitter turn-off delay of approximately 150 milliseconds after the transmitter is unkeyed. During this period, a shifted phase tone (reverse burst) is developed in the tone output circuit which dampens the oscillations of the "Vibrasponder" resonant reed in listening receivers to eliminate the "squelch tail" noise burst at the end of the message.

Tone Output Circuit -- The tone output circuit provides a fixed level tone output to the modulator of the transmitter and shifts the phase of the tone during the reverse burst period to rapidly dampen the "Vibrasponder" resonant reeds in listening receivers.

2.2 TONE OSCILLATOR

The tone oscillator operates continuously while the station is "on". The outputs of the differential amplifier, formed by Q701 and Q702, are identical but 180° out of phase. The amplitudes of these collector signals are independent of frequency. A positive feedback signal is coupled through C701 and R708 which biases Q710 on through R727. To quickly bring the tone output up to full output, Q710 acts as a shunt around R708, which increases the positive feedback. After approximately 1.5 seconds (voltage across C710 reaches 9.0 volts) Q710 turns off and has no further effect on circuit operation. The output of Q701 is applied to feedback amplifier Q708 through C704 and R712. When the signal level exceeds a fixed amount, Q708 is biased into operation. It provides a negative feedback signal which keeps the oscillator out of limiting, thus provided a sinusoidal wave output. The "Vibrasender" resonant reed is the frequency determining device of the oscillator. It acts as a very high Q, narrow bandpass transformer, coupling only its resonant frequency and blocking all others. At its resonant frequency, the reed vibrates to couple energy from the primary to the secondary winding.

2.3 REVERSE BURST TIMING CIRCUIT

In the unkeyed transmitter condition, delay generator, Q706, is forward biased through CR703 and R719 to A- placing A+ across R721. This voltage is coupled to the base of the delayed turn-off switch (Q707) by R722, and Q707 is biased "off".

When the PTT button is closed, keyed filtered A+ is applied to R716 and turns on the keying switch, Q705. With Q705 acting as a short circuit:

--Q707 is biased "on" through R723, CR702 and Q705 to A-.

--Keyed, filter A+ is applied through Q707 to turn on the transmitter.

--C708 charges from the filtered A+ line through Q706 base-emitter junction, CR730 and R718.

--The PL switch gate, Q709, is turned on by bias current through R726 and Q705. This action turns off PL tone gate, Q703.

Note that Q706 has not changed states and is still turned on by bias current through R719.

When the PTT button is released, the keyed, filter A+ bias is removed from Q705 and it turns off. The transmitter continues to receive A+ from Q707 during the following sequence of events; with Q705 turned off:

--The PL switch gate, Q709, is turned off, activating the PL tone gate, Q703, which passes the reverse burst tone signal.

--C708 discharges through R718, R719, R721, R722 and R723, back biasing CR703 and turning off Q706.

--With Q706 off, Q707 remains on by receiving base bias through R722 and R721.

--After approximately 150 milliseconds, the voltage across C708 decreases to the point where Q706 turns on again and applies A+ across R721.

--The A+ across R721 turns off Q707 which removes the delayed keyed filter A+ from the transmitter.

2.4 TONE OUTPUT CIRCUIT

When the transmitter is keyed, PL gate switch Q709 is turned on. Q709, in turn, gates 9.6 volts to PL tone gate Q703, turning it off. When Q703 is turned off, only the output of Q701 is coupled to emitter follower Q704. When the transmitter is unkeyed, Q709 is turned off and Q703 is turned on which completes the tone path from Q702 to C703. The two tone signals 180° out of phase, combine through the phase shift capacitors to produce a signal to the emitter follower that is 240° out of phase with the original tone. Emitter follower Q704 provides impedance matching in a low impedance ouput and isolates the tone oscillator from the external circuit to which the tone output is applied.

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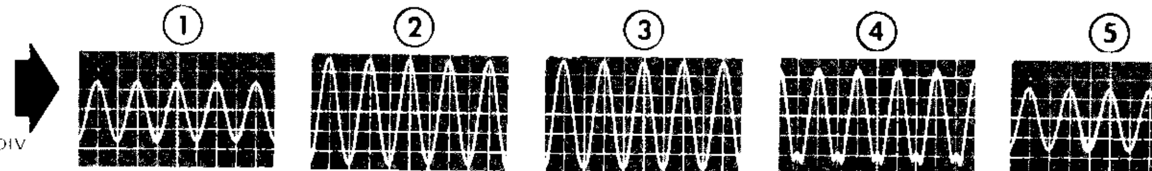
TONE "PL" ENCODER WAVEFORMS

OSCILLOSCOPE WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS

1. WAVEFORMS SHOWN USING 100 Hz "VIBRASENDER" RESONANT REED
2. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
3. HORIZONTAL DEFLECTION 5 msec DIV
4. ALL WAVEFORMS MEASURED IN RESPECT TO CHASSIS GROUND



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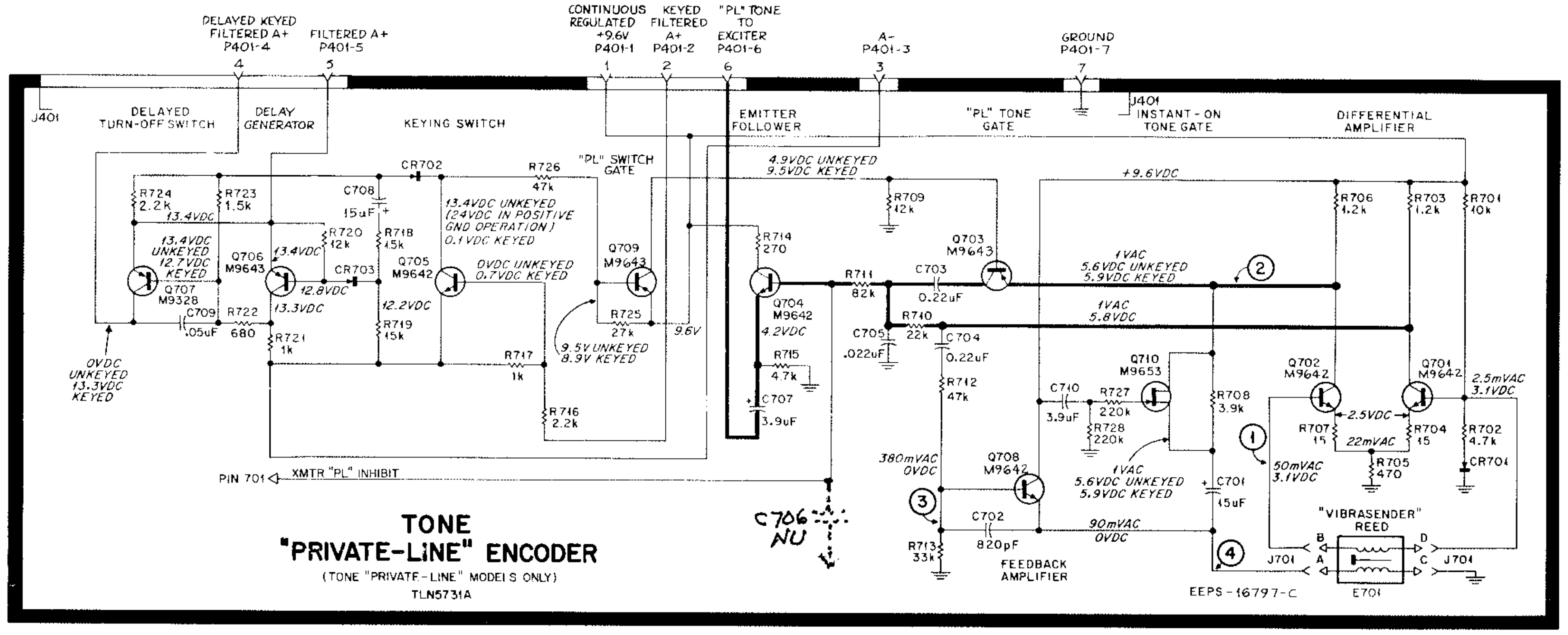

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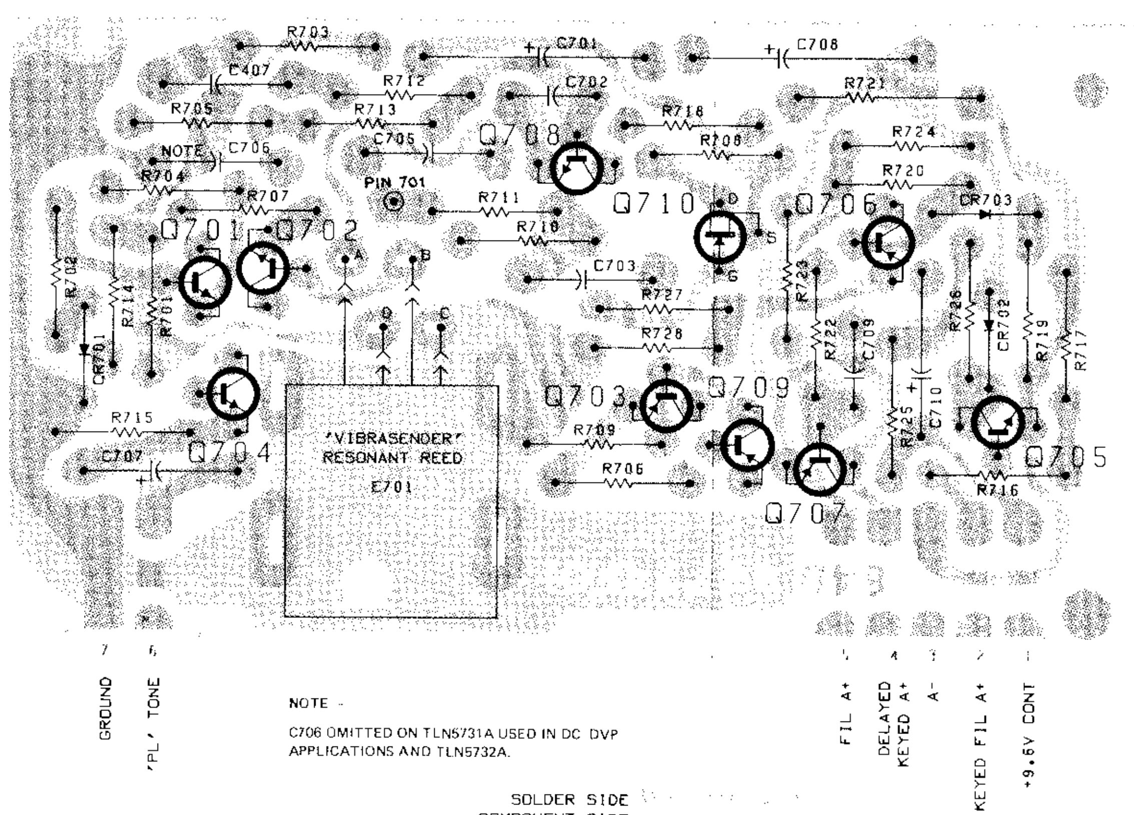

NOTE -
C706 OMITTED ON TLN5731A USED IN DC DVP APPLICATIONS AND TLN5732A.

SOLDER SIDE
COMPONENT SIDE

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"PL" ENCODER

701. ALL AC VOLTAGE MEASUREMENTS ARE RMS VALUES. ALL AC VOLTAGES ARE SINUSOIDAL EXCEPT Q708 EMITTER. METER READING DEPENDENT UPON METER RESPONSE TO NON-SINUSOIDAL WAVE.

702. DC VOLTAGE MEASUREMENTS IN Q705, Q706 AND Q707 STAGES TAKEN WITH RESPECT TO A-. VOLTAGES FOR ALL OTHER STAGES TAKEN WITH RESPECT TO CHASSIS GROUND. ALL DC VOLTAGES MAY BE MEASURED WITH 20,000 OHM-PER-VOLTMETER OR HIGH IMPEDANCE DC VOLTMETER (11 MEGOHM) EXCEPT BASE OF Q704 WHICH CAN ONLY BE MEASURED WITH A HIGH IMPEDANCE METER.

703. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS. RESISTOR VALUES ARE IN OHMS.

704. PIN 701 IS USED ONLY FOR CERTAIN OPTIONAL EQUIPMENT.

705. PINS J401-6 AND -7 ON THE PL ENCODER MATE WITH PINS P401-11 AND -12 ON THE EXCITER.

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(Sheet 1 of 2)
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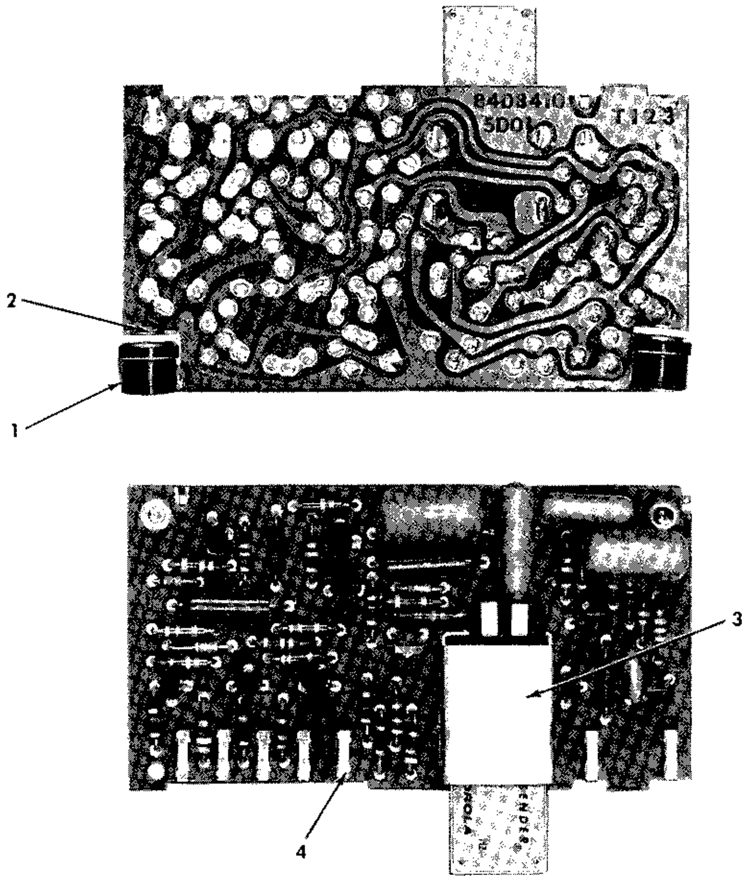
TONE "PRIVATE-LINE" ENCODER

MODEL TLN5731A



AEPS-6945-O

MECHANICAL PARTS LIST

TLN5731A and TLN4293B
"Private-Line" Encoder PL-1308-D

CODE	MOTOROLA PART NO.	DESCRIPTION
1	42-84284B01	RETAINER, screw: 2 req'd
2	3-138162	LOCKSCREW, tapping: No 4 x 3/8" Phillips hex head; 2 req'd
3	42-84116B02	SOCKET & BRACKET ASSEMBLY: for "Vibrasender" Resonant Reed
4	9-83011H01	TERMINAL, pin: female 7 req'd

68P81026E71-H
(Sheet 2 of 2)
5/10/79-PHI

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

ELECTRICAL PARTS LIST

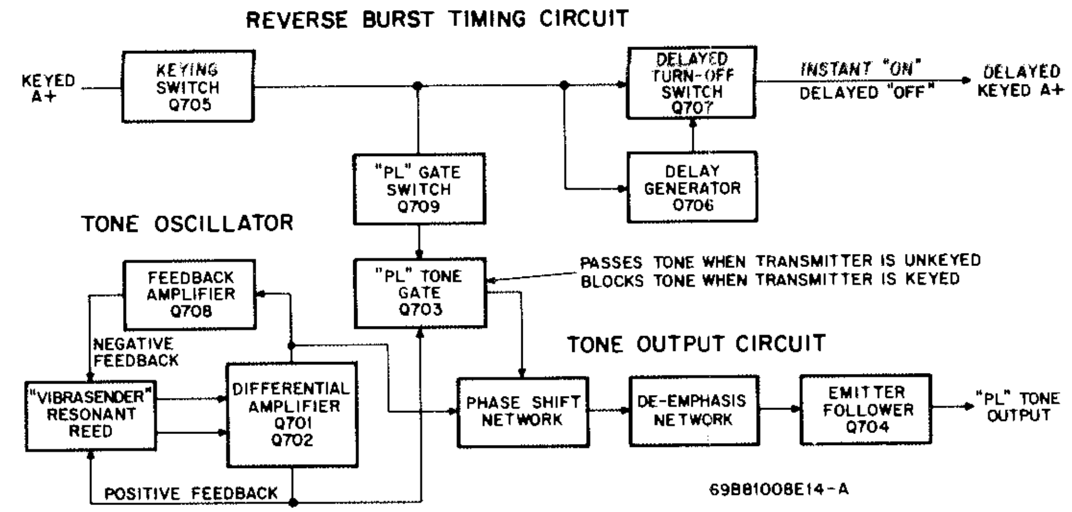
TLN5731A Tone "Private-Line" Encoder PL-3260-D

		CAPACITOR, fixed: uF; ±10%; 50 V; unless otherwise stated
C701	23-84762H09	15 ±20%; 20 V
C702	21-82187B23	820 pF; 500 V
C703, 704	8-82905G32	0.22
C705	8-83813H08	.022
C706		NOT USED
C707	23-84762H08	3.9 uF ±20%; 15 V
C708	23-83214C26	15; 25 V
C709	21-82372C04	.05; +80-20%; 25 V
C710	23-84762H08	3.9 uF ±20%; 15 V
		DIODE: (SEE NOTE I)
CR701, 702, 703	48-83654H01	silicon
		CONNECTOR, receptacle:
J401		consists of 7 female contact terminals (Part No. 9-83011H01) mounted on edge of circuit board
		"VIBRASENDER" RESONANT REED: (SEE NOTE II)
E701	KLN6210A	"plug-in" unit
		TRANSISTOR: (SEE NOTE I)
Q701, 702	48-869570	NPN; type M9570
	or 48-869642	NPN; type M9642
Q703	48-869571	PNP; type M9571
	or 48-869643	PNP; type M9643
Q704, 705	48-869570	NPN; type M9570
	or 48-869642	NPN; type M9642
Q706	48-869571	PNP; type M9571
	or 48-869643	PNP; type M9643
Q707	48-869328	PNP; type M9328
Q708	48-869570	NPN; type M9570
	or 48-869642	NPN; type M9642
Q709	48-869571	PNP; type M9571
	or 48-869643	PNP; type M9643
Q710	48-869653	FET; type M9653
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R701	6-124A73	10k
R702	6-124A65	4.7k
R703, 706	6-124A51	1.2k
R704	6-124A05	15
R705	6-124A41	470
R707	6-124A05	15
R708	6-124A63	3.9k
R709	6-124C75	12k ±10%
R710	6-124A81	22k
R711	6-124A95	82k
R712	6-124A89	47k
R713	6-124A85	33k
R714	6-124C35	270 ±10%
R715	6-124A65	4.7k
R716	6-124C57	2.2k ±10%
R717	6-124C49	1k ±10%
R718	6-124A53	1.5k
R719	6-124A77	15k
R720	6-124A75	12k
R721	6-125A49	1k;1/2 W
R722	6-124A45	680
R723	6-124A53	1.5k
R724	6-124C57	2.2k ±10%
R725	6-124C83	27k ±10%
R726	6-124C89	47k ±10%
R727, 728	6-124D06	220k ±10%

NOTES:

I. For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

II. The "Vibrasender" Resonant Reed (Model KLN6210A) is not a part of the encoder board. When ordering a complete board, the reed must be ordered separately.



MAINTENANCE

a. Recommended Test Equipment

(1) Motorola SLN6221A "Private-Line" Tone Generator -- used for testing "Vibrasender" resonant reeds.

(2) Motorola Solid-State AC Voltmeter -- used for tone level measurement.

(3) General purpose oscilloscope -- valuable for signal tracing and locating sources of distortion.

(4) Motorola Solid-State DC Multimeter -- used for dc voltage measurement.

(5) Motorola S1343 Series Frequency Counter or S1344 Series Frequency Counter/Deviation Meter -- used for measuring PL tone frequency.

b. Performance Test

Measure frequency deviation of the transmitter in which the PL encoder is installed. With the transmitter keyed and PL tone modulation (only), deviation should read ±0.5 to ±1.0 kHz.

c. Troubleshooting

(1) If no deviation is measured the trouble may lie in the tone oscillator or tone output circuit. The trouble may be isolated by the following steps.

(a) Check 9.6-volt input to encoder.

(b) Check ac signal voltage at collector of Q701.

(c) If signal is present, check Q704.

(d) If no signal is present any component in the oscillator loop could cause the trouble. Check the "Vibrasender" resonant reed in the SLN6221A "Private-Line" Tone Generator.

(e) If the tone generator does not produce an output signal the reed is defective.

(f) If the reed is good, replace it in the encoder and make dc voltage measurement in the tone oscillator circuit to locate the defective components.

(2) If low deviation is measured, check ac signal voltages and compare them with the chart readings to find the source of trouble.

(3) If deviation is normal, but calls are not being received, check the frequency of the PL encoder tone. If off-frequency, replace the "Vibrasender" resonant reed.

(4) If squelch tail noise bursts are heard by all listening receivers, check dc voltages of Q703 and Q706 is keyed and unkeyed conditions.

(5) If the transmitter cannot be keyed, and the trouble has been isolated to the PL encoder board, measure dc voltages in Q705 and Q707 stages.

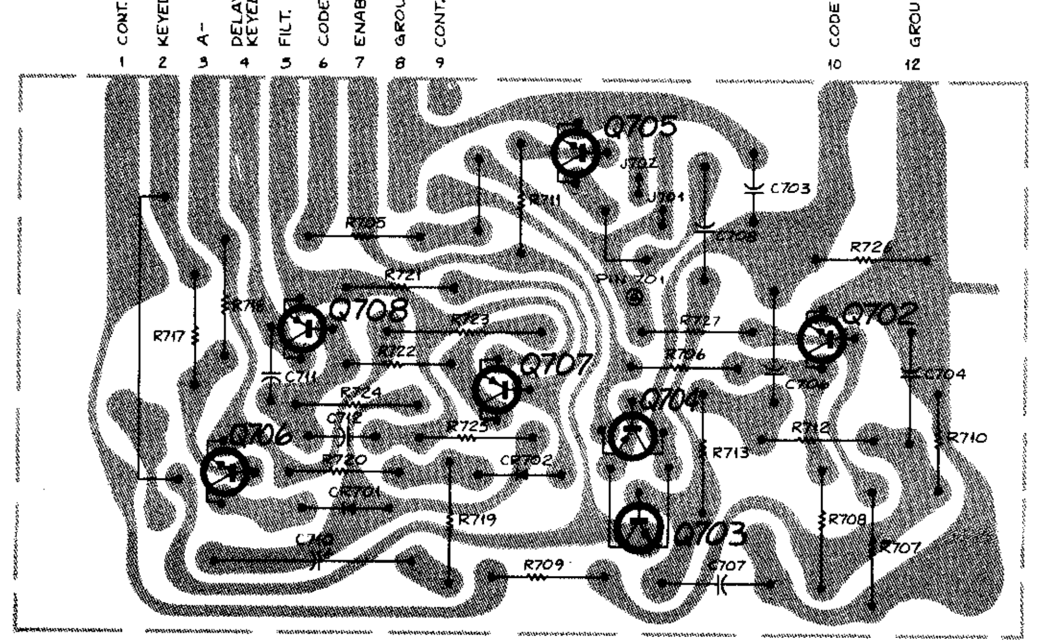
(6) If too much tone deviation is measured, check feedback amplifier Q708.

PARTS LIST

TTN6003A Encoder Board PL-3298-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF:
C703	21-831125	100 pF ±10%; 300 V
C704	8-83813H14	.043 pF ±5%; 50 V
C706	8-83813H24	.036 ±5%; 50 V
C707	8-83813H27	.0033 ±5%; 50 V
C708	8-83813H26	.0056
C710	23-82783B24	15 ±10%; 25 V
C711	21-82372C04	.05 +80-20%; 25 V
C712	21-83596E13	.001 ±10%; 100 V
		DIODE: (SEE NOTE)
CR701, 702	48-83654H01	silicon
		TRANSISTOR: (SEE NOTE)
Q702, 703	48-869642	NPN; type M9642
Q704	48-869643	PNP; type M9643
Q705, 706	48-869642	NPN; type M9642
Q707	48-869643	PNP; type M9643
Q708	48-869328	PNP; type M9328
		RESISTOR, fixed: ±5%; 1/4 W: unless otherwise stated
R705	6-124A75	12k
R706	6-124A81	22k
R707, 708	6-124A97	100k
R709	6-124A93	68k
R710	6-124A96	91k
R711	6-124A73	10k
R712, 713	6-124A97	100k
R717	6-124C57	2.2k ±10%
R718	6-124A49	1k
R719	6-124A53	1.5k
R720	6-124A79	18k
R721	6-124A75	12k
R722	6-124A45	680
R723	6-125A49	1k
R724	6-124A53	1.5k
R725	6-124C57	2.2k ±10%
R726	6-124A73	10k
R727	6-124A91	56k
	MECHANICAL PART	
	3-139506	SCREW, tapping; 4-40 x 5/16"; 2 used

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



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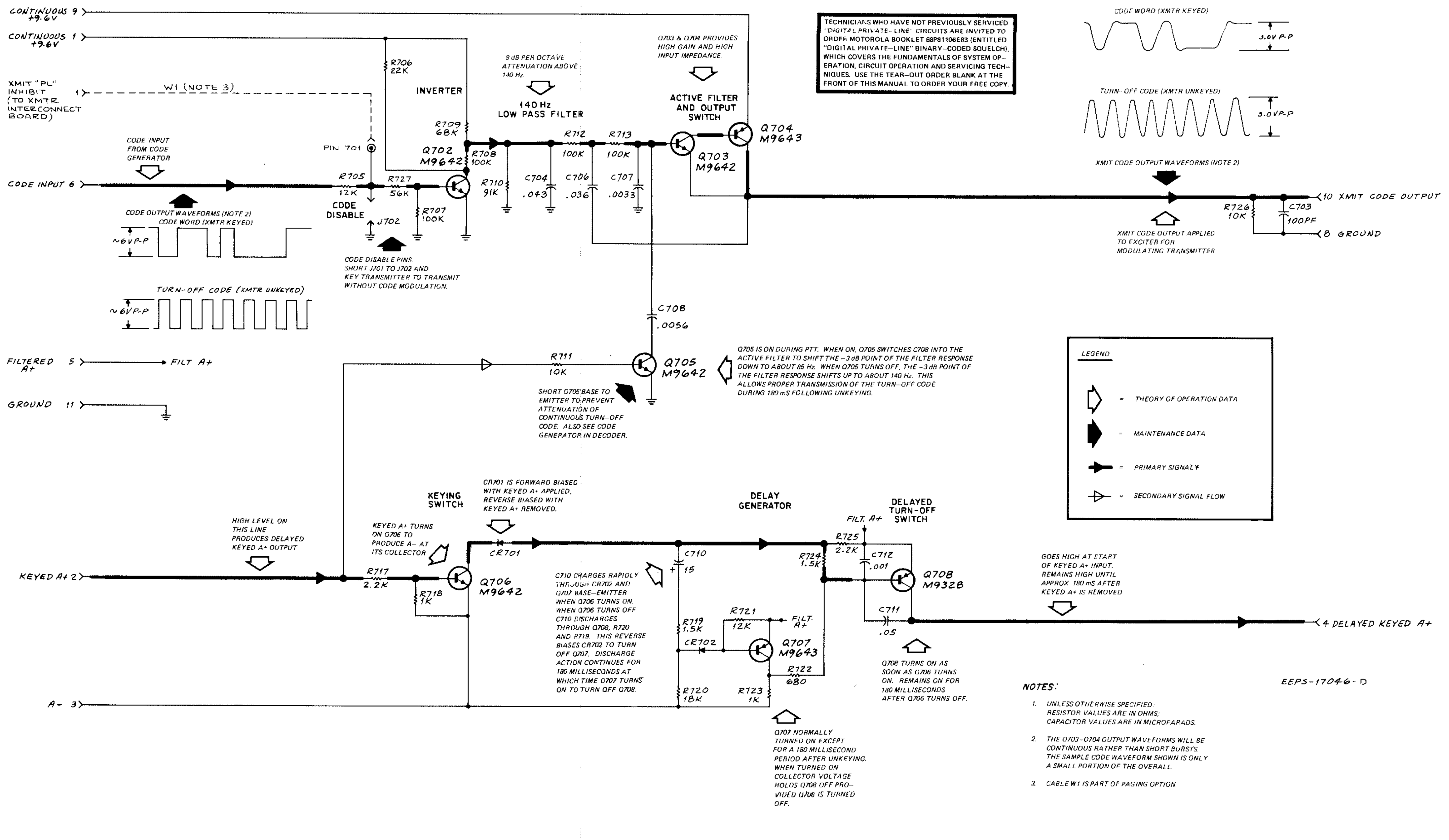


SIMPLEX "DIGITAL PRIVATE-LINE" ENCODER

MODEL TTN6003A

APPLICATION --

"Micor" Base Stations with Simplex "Digital Private-Line" Binary-Coded Squelch.

FUNCTION --

1. Interfaces code word generator (located on "Digital Private-Line" Decoder Board) to the exciter, provides low pass active filter for 23-bit binary code word.
2. Generates delayed keyed A+ (180 millisecond transmitter turn-off delay.

"DIGITAL PRIVATE-LINE" ENCODER BOARD TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSES	ACTION
No delayed keyed A+ to exciter board.	1. No keyed A+ to encoder board (pin 2).	Check keyed A+ at pin 10 of P902 on exciter board
	2. Malfunction in delayed keyed A+ generation circuitry.	Check delayed turn-off switch, delay generator and keying switch operation on encoder board.
Delayed keyed A+ remains high less than 160 msec or longer than 220 msec after unkeying.	Malfunction in delayed keyed A+ circuits.	Check C710. Then check delay generator circuit.
No Output on Xmit code out (pin 10), keyed or unkeyed.	1. No input to encoder board pin 6 from decoder board.	On decoder board, check U801-5 for code signal. Check for 6.0 V dc at U801-24. If 6.0 V dc is present, check 50 kHz clock for proper operation (U801-4). If clock is ok, replace U801.
	2. Faulty inverter (Q702)	Check inverter operation.
	3. Active filter malfunction	Check Q703, Q704 operation.
Code (not turn-off code) is on encoder board pin 10 when the radio is unkeyed.	U801 code generator on decoder board is not switching.	On decoder board, ground U801-9. If code is still present at U801-5, check 50 kHz clock output (U801-4). If clock is ok, replace U801.
Turn-off code (not code) is on encoder board pin 10 when the radio is keyed.	U801 code generator on decoder board is not switching.	Apply +9.6 V at J805 on decoder board. If turn-off code is still present at U801-5, replace U801.
Excessive "code sound" heard at the speaker of radio listening to this transmitter.	1. Code deviation is greater than ±1 kHz	Check for proper waveform amplitude at encoder board pin 10 (Xmit code out).
	2. Low pass active filter is not switching from 140 Hz to 85 Hz.	Replace Q705.
Squelch tails are heard at the speaker of a radio listening to this transmitter.	1. No turn-off code is being transmitted.	Check the delayed keyed A+ duration (170-250 msec). Then check U801-5 on decoder board for presence of the turn-off code.
	2. Low pass active filter is always switched low (85 Hz).	Replace Q705.
No other radios in the system are enabled by this transmitter; code is being transmitted.	Wrong code is being transmitted.	Feed U801-5 from decoder board into a Motorola Model SLN6413A "Digital Private-Line" test set. Check for proper decode. If proper decode is not obtained. Check for an intermittent or bad code plug (TRN6005A) or resistor network (Z801) on the decoder board. Check U801-15 thru U801-23 for a proper octal code.

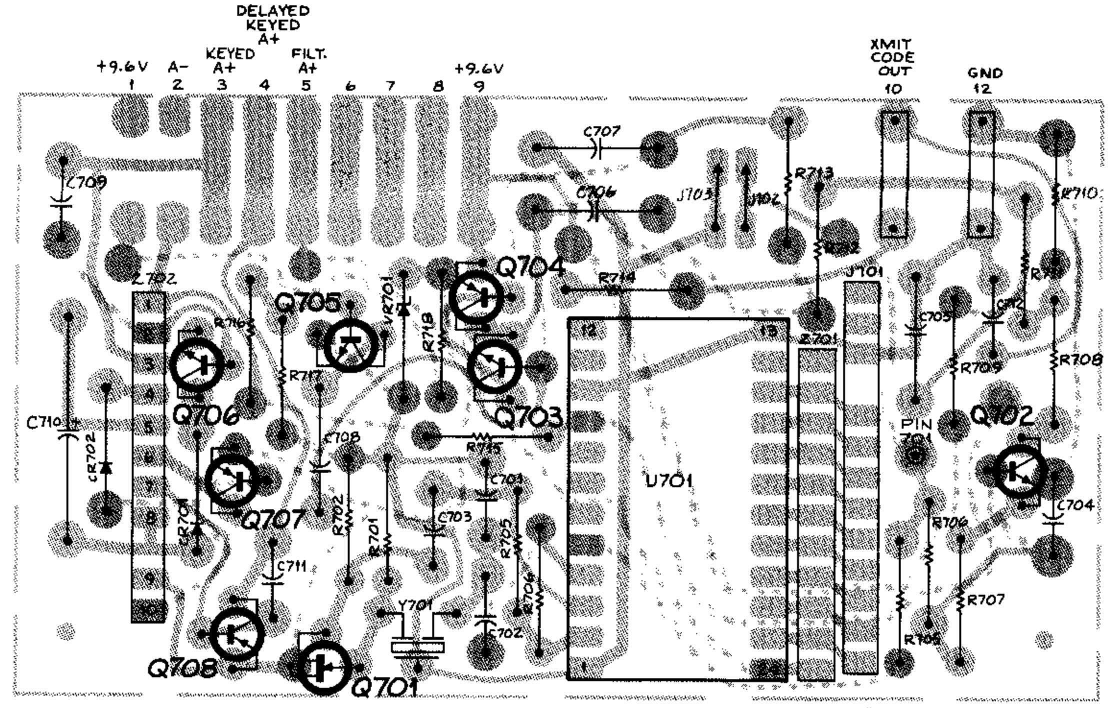
DUPLEX "DIGITAL PRIVATE-LINE" ENCODER

MODEL TLN5725A

APPLICATION --
"Micor" Base Stations & Repeaters

FUNCTION

Generates "Digital Private-Line" Code for transmitter in duplex applications (where decoder and encoder may be on simultaneously). Develops 180 mS transmitter turn-off delay (delayed keyed A+).



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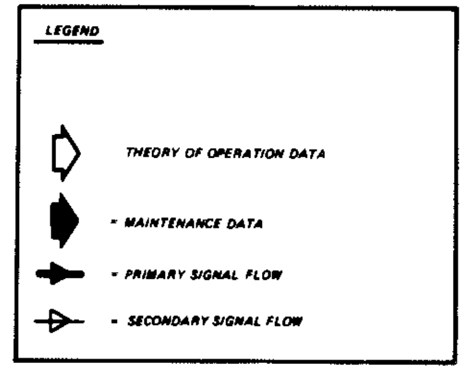
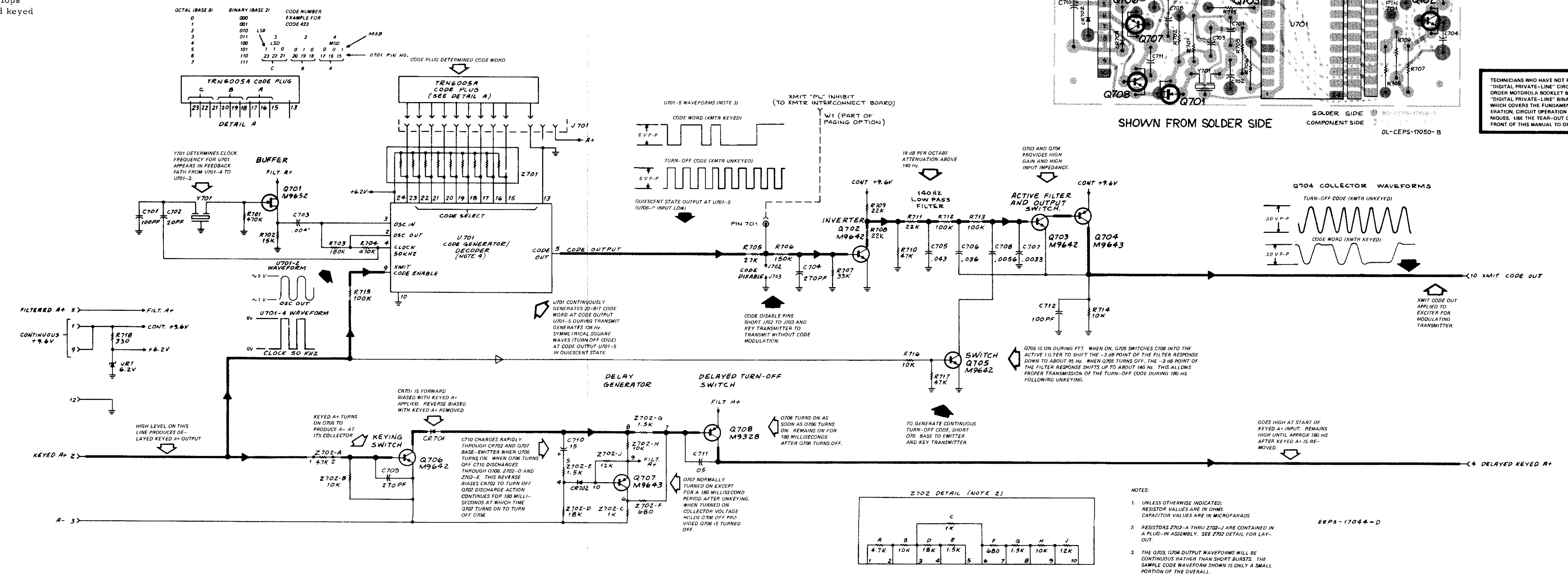
SOLDER SIDE
COMPONENT SIDE

OL-CEPS-17050-B

TECHNICIANS WHO HAVE NOT PREVIOUSLY SERVICED "DIGITAL PRIVATE-LINE" CIRCUITS ARE INVITED TO ORDER MOTOROLA BOOKLET 68P81106E83 (ENTITLED "DIGITAL PRIVATE-LINE" BINARY-CODED SQUELCH), WHICH COVERS THE FUNDAMENTALS OF SYSTEM OPERATION, CIRCUIT OPERATION AND SERVICING TECHNIQUES. USE THE TEAR-OUT ORDER BLANK AT THE FRONT OF THIS MANUAL TO ORDER YOUR FREE COPY.





NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTOR VALUES ARE IN OHMS CAPACITOR VALUES ARE IN MICROFARADS.
2. RESISTORS Z702-A THRU Z702-J ARE CONTAINED IN A PLUG-IN ASSEMBLY. SEE Z702 DETAIL FOR LAYOUT.
3. THE Q703, Q704 OUTPUT WAVEFORMS WILL BE CONTINUOUS RATHER THAN SHORT BURSTS. THE SAMPLE CODE WAVEFORM SHOWN IS ONLY A SMALL PORTION OF THE OVERALL.
4. U701 IS A CMOS DEVICE. OBSERVE CMOS HANDLING PRECAUTIONS.

EEPS-17044-D

PARTS LIST

TLN5725A Encoder Board — PL-3300-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF;
C701	21-82610C58	100 pF ±10%; 100 V
C702	21-82133G24	20 pF ±5%; 500 V
C703	21-82428B09	.0047 ±10%; 100 V
C704, 709	21-82187B22	270 pF ±10%; 200 V
C705	8-83813H14	.043 ±5%; 50 V
C706	8-83813H24	.036 ±5%; 50 V
C707	8-83813H27	.0033 ±5%; 50 V
C710	23-82783B24	15 ±10%; 25 V
C711	21-82372C04	.05 ±10%; 25 V
		DIODE: (SEE NOTE)
CR701, 702	48-83654H01	silicon
		TRANSISTOR: (SEE NOTE)
Q701	48-869652	field-effect; M9652
Q702, 703, 705, 706	48-869642	NPN; type M9642
Q704, 707	48-869643	PNP; type M9643
Q708	48-869328	PNP; type M9328
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R701, 704	6-124D14	470k ±10%
R702	6-124C77	15k ±10%
R703	6-124D04	180k ±10%
R705	6-124A83	27k
R706	6-124B02	150k
R707	6-124C85	33k ±10%
R708, 709, 711	6-124A81	22k
R710, 717	6-124A89	47k
R712, 713	6-124A97	100k
R714	6-124A73	10k
R715	6-124C97	100k ±10%
R716	6-124C73	10k ±10%
R718	6-124C37	330 ±10%
		INTEGRATED CIRCUIT: (SEE NOTE)
U701	51-84267A82	type M6782
		VOLTAGE REGULATOR:
VR701	48-83696F07	Zener; 6.2 V
		CRYSTAL:
Y701	48-82003K01	resonator; 50.000 KC
		RESISTOR NETWORK:
Z701	1-80772B36 or 51-82142K02	pull-up, 10-pin
Z702	1-80772B35 or 51-82142K01	push-to-talk, 10-pin
		MECHANICAL PARTS
	3-138162	SCREW, tapping; 4-40 x 3/8"; 2 used
	9-82071K01	SOCKET
	14-83878G01	PAD, transistor mounting
	42-82480K01	CLIP, edge; 10 used

RECEIVER INTRODUCTION

1. INTRODUCTION

The Model TRE1200BA Series "Micor" "Sensitron" UHF Receiver is illustrated in the following sections. Some stations include two receivers and, in a few of these stations, one of the receivers may have a shifted i-f. This occurs when the separation between the two operating carrier frequencies is mathematically related to the i-f. The Receiver RF & I-F section (68P81042E37) of this manual gives specific conditions when this occurs. All two receiver stations include a Model TLN8340A 2-Receiver Coupler. Table 1 lists the receiver models available per frequency.

Table 1. Model Usage

MODEL	FREQUENCY RANGE (MHz)
TRE1201BA	406-420
TRE1203BA	450-470
TRE1204BA	470-494
TRE1205BA	494-512

An optional Model TLE8190A Series RF Preamplifier is available for this receiver. The preamplifier increases the sensitivity of the receiver and is particularly useful in two receiver stations. The preamplifier more than makes up for the half signal strength loss in each leg of the two-receiver coupler. The optional rf preamplifier is illustrated in the Receiver RF & I-F section (68P81042E37) of this manual.

Receiver Alignment and Maintenance are detailed under the Station Data tab, at the front of this manual. Receiver cabling is detailed on the typical station layout diagram (PEPS-28289), under the Station Data tab. Receiver electrical and/or mechanical parts lists, circuit board details, and parts location photographs accompany the applicable schematic diagram in the following sections.

RECEIVER INTRODUCTION

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

UNIFIED CHASSIS RECEIVER INTERCONNECT BOARD

1. DESCRIPTION

The receiver interconnect board connects the receiver rf and i-f board and the receiver audio and squelch board to the station unified chassis interconnect board.

A number of jumpers are provided to allow use of the board in single and two-receiver stations, with "Digital PL" operation and for modified squelch operations. Jumper connections for these modes of operation are shown in the jumper chart on the receiver interconnect board schematic diagram.

2. "AND SQUELCH" OPERATION

An optional mode of receiver operation, known as "AND SQUELCH", can be added when desired. This feature provides "variable PL sensitivity" (coded squelch plus adjustable noise-activated carrier squelch.)

In this mode, the receiver audio channel is activated when a PL tone is received and the carrier squelch threshold level is exceeded. Since the carrier (noise-activated) squelch circuit sensitivity is adjustable, and since it is one of the controlling factors in the squelching of receiver audio, the operation can be aptly described as "variable PL sensitivity". Thus, "AND SQUELCH" denotes both coded squelch and carrier squelch operating simultaneously.

Conversion of the receiver to the "AND SQUELCH" mode of operation requires the addition of certain components to the receiver interconnect board, and the omission of certain jumpers on both the receiver interconnect board and the audio & squelch board.

The parts required to convert the receiver to "AND SQUELCH" operation are listed with the receiver interconnect board schematic diagram.

Refer to the Audio & Squelch Board section (68P81025E79) of this manual for further details relating to "AND SQUELCH" operation.

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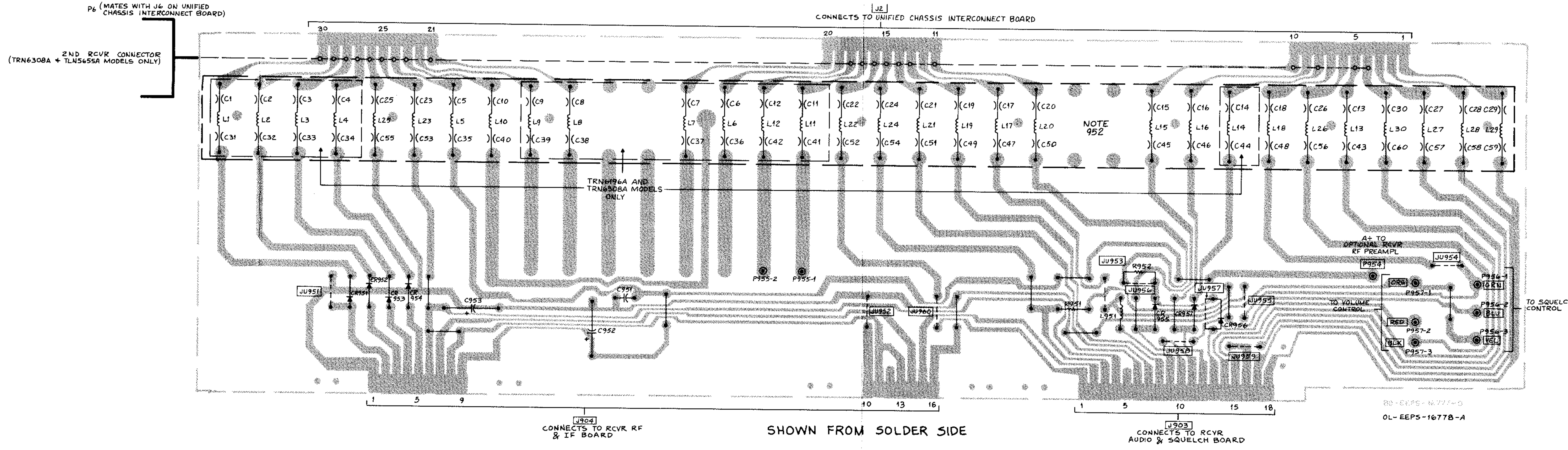
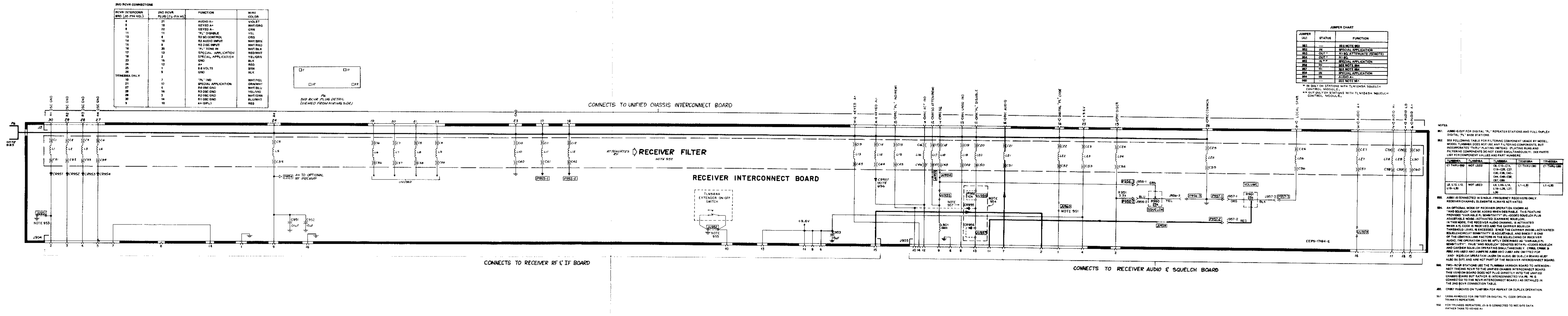
RECEIVER INTERCONNECT BOARD





FUNCTION

— Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

MODEL	APPLICATION
TLN5646A	With Repeater Stations
TLN5648A	With Base Stations (1st RCVR only)
TLN5655A	With Base Stations (2nd RCVR only)
TRN6196A (optional)	In place of TLN5646A or TLN5648A (provides additional filtering)
TRN6308A (optional)	In place of TLN5655A (provides additional filtering)

PARTS LIST SHOWN ON BACK
Motorola No. PEPS-28297-O
4/15/79-PHI

PARTS LIST

NOTE

This parts list covers five models of the Receiver Interconnect Board. Where differences exist, the model number of the applicable unit is given in the Description column.

TLN5646A/TLN5648A/TLN5655A/TRN6196A/TRN6308A
Receiver Interconnect Board PL-3435-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1 thru 60	21-861219	1000 pF +100-0%; 500 V (TRN6196A & TRN6308A)
C951	21-82428B59	.01 uF +80-20%; 200 V
C952, 953	23-84762H09	15 uF ±20%; 20 V
		DIODE: (SEE NOTE)
CR951 thru 954, 957	23-84762H09	silicon
		COIL, rf:
L1 thru 4, 6 thru 9, 11, 12, 14, 15 thru 21, 24, 25, 26	24-83961B01	3 turns; coded brown
L5, 10, 13, 22, 23, 27 thru 30	24-83977B01	1-1/2 turns
L901	24-82549D03	1000 uH
		CONNECTOR, plug:
P6	--	(TLN5655A) includes:
	14-84556B01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 14 req'd.
P6	--	(TRN6308A) includes:
	14-84556B01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 20 req'd.
		RESISTOR, fixed:
R951	6-124C61	3.3k ±10%; 1/4 W
		NON-REFERENCED ITEMS
	7-82626K01	BRACKET, filter
	14-82621K01	INSULATOR (TLN5648A & TLN5655)
	1-80775B75	COVER ASSEMBLY, filter (TLN5646A, TLN5655A, TRN6196A & TRN6308A) includes:
	15-82173K01	COVER, filter
	3-138162	SCREW, tapping: 4-40 x 3/8"; 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 4 used (TLN5646A, TLN5648A, TRN6196A & TRN6308A)
	42-84284B01	RETAINER, screw: 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 7 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID; 2 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID (TRN6308A)
	42-82143C03	CLAMP, cable: 1/8" ID (TLN5655A & TRN6308A)

NOTE:
For optimum performance, replacement diodes must be ordered by Motorola part number.

TLN5912A Hardware Kit, 2nd Rcvr PL-5080-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		RESISTOR, variable:
R960	18-82515B50	25k ±30%; 1/4 W

NOTE:
Hardware for TLN5912A is listed in the Receiver Hardware Kits Section.

TLN5184A "Extender" On-Off Switch Kit PL-5081-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH, toggle:
S1	40-82085J03	spdt
		NON-REFERENCED ITEMS
	4-1725	WASHER, flat: .266 x .562 x .040; 2 used
	54-84861G01	LABEL: Extender On-Off

TLN5892A Chassis & Hardware Kit PL-5086-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		RESISTOR, variable:
R951, 961	18-82515B50	25k ±30%; 1/4 W (shown on Receiver Interconnect Board Schematic)

NOTE:
Hardware for TLN5892A is listed in the Control and Application Manual.

TLN5060A Optional "And Squelch" Parts PL-2573-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR955	48-82392B03	silicon
CR956	48-82392B03	silicon
		RESISTOR, fixed:
R952	6-129668	10k ±10%; 1/4 W

"MICOR" "SENSITRON"

UHF RECEIVER RF & I-F

1. INTRODUCTION

This section contains functional description and operation of the receiver rf and i-f. Maintenance and troubleshooting information is covered under the Station Data tab of this manual. Table 1 lists receiver rf & i-f model usage per frequency. Table 2 gives the technical characteristics for the receiver rf & i-f.

Table 1. Model Usage

Frequency Range	RF Deck	RF & I-F Board	Preamplifier
406-420 MHz	TLE8021A	TLE8031A/B	TLE8191A
450-470 MHz	TLE8023A	TLE8032A/B	TLE8192A
470-494 MHz	TLE8024A		
494-512 MHz	TLE8025A	TLE8033A/B	

Table 2. Technical Characteristics

CHANNEL SPACING		25 kHz			
EIA MODULATION ACCEPTANCE		± 7 kHz minimum			
FREQUENCY STABILITY		AFC circuitry and channel element maintain receiver frequency within ± 0.0002% of reference frequency from -30°C to + 60°C ambient temperature (+ 25°C reference).			
INPUT IMPEDANCE		50 ohms			
		WITHOUT PREAMPLIFIER		WITH PREAMPLIFIER	
SENSITIVITY	20 dB QUIETING	0.5 uV		0.25 uV	
	EIA SINAD	0.35 uV		0.175 uV	
SELECTIVITY (EIA SINAD)		-90 dB @ ± 25 kHz			
EIA SINAD INTERMODULATION		-85 dB		-80 dB	
SPURIOUS AND IMAGE REJECTION		100 dB minimum			
SQUELCH SENSITIVITY		THRESHOLD AT 6 dB MAX QUIETING	TIGHT AT 14 dB MIN QUIETING	THRESHOLD AT 6dB MAX QUIETING	TIGHT AT 14 dB MIN QUIETING
CARRIER (adjustable), CODED (Tone or Digital)		0.25 uV MAX	1.2 uV MAX	0.125 uV MAX	0.6 uV MAX
METERING		All essential circuits for tuning and check are measurable with a single scale, 0-50 microampere meter, with 2000 ohms equivalent series resistance, or Motorola portable test set can be used.			
POWER REQUIREMENTS		Regulated: 9.6 volts @100 mA 13.8 volts @9.6 mA			

2. FUNCTIONAL DESCRIPTION

2.1 OSCILLATOR (CHANNEL ELEMENT)

Channel elements are highly stable crystal-controlled oscillators (TCXO). They use unheated crystals in an oscillator circuit that is temperature compensated over the entire temperature range of -30° to +60°C (-22° to +140°F). A variable warp capacitor in the base of each channel element is accessible through a hole in the base of the oscillator for fine frequency adjustment. Each channel element is a factory sealed, plug-in module which provides a train of stable frequency positive pulses, and is not field serviceable.

2.2 MULTIPLIERS

The third harmonic of the channel element frequency is selected by a two cell LC tuned circuit. The signal is then multiplied 8 times by three doubler circuits, routed to the rf deck and applied, through an injection filter, to the mixer to be heterodyned with the received carrier signal.

2.3 RF PRESELECTOR

The selectivity of the rf preselector prevents receiver degradation from mixer image frequency and spurious harmonics. It consists of six low loss, highly selective, helical resonant cavities. The bandpass of the preselector is characterized by a flat acceptance bandwidth and a steep skirt response. Carrier signals received at the antenna are routed to the rf deck and applied, through the preselector cavities, to the mixer to be heterodyned with the rf injection signal.

2.4 FIRST MIXER

The mixer uses a field-effect transistor, with low noise characteristics, to heterodyne the rf injection signal with the received carrier signal from the preselector, producing an i-f of 11.7 MHz. Frequency relationships are as follows:

$f_c = 24f_o + 11.7\,\text{MHz}$

Where f_c = carrier frequency
f_o = channel element fundamental

2.5 FIRST FOUR-POLE CRYSTAL FILTER

This filter and the second four-pole crystal filter are the major factors determining final receiver bandwidth and selectivity.

The first four-pole crystal filter consists of two monolithic crystals and associated impedance matching circuitry. The output of the mixer is coupled to the input of the filter by an adjustable matching network.

Each crystal produces mechanical vibrations at the crystal input when the electrical i-f signal is applied. Due to the inherent piezoelectric property of quartz crystals, these vibrations are propagated throughout the crystal and reconverted to electrical signals at the output electrodes. The high "Q" of the crystals creates a narrow bandpass, resulting in excellent off-channel signal rejection.

2.6 FIRST I-F AMPLIFIER

The first i-f amplifier couples signals between the first and second four-pole crystal filters and provides approximately 70 dB gain. The integrated circuit (IC) U101 contains three differential amplifier stages that are internally voltage regulated and temperature compensated. Isolation between the three stages is also provided internally.

2.7 SECOND FOUR-POLE CRYSTAL FILTER

The second four-pole crystal filter establishes the final receiver selectivity and operates identically to the previously described first four-pole crystal filter. The filtered signal is applied to the second i-f amplifier.

2.8 SECOND I-F AMPLIFIER AND LIMITER

The second i-f amplifier and limiter consists of an IC (U102) with associated discrete components and performs amplification and limiting functions.

Four internal differential amplifiers, with internal voltage regulation and temperature compensation, are employed. The first two differential amplifiers provide approximately 55 dB gain. The second stage output provides metering and is applied to the third stage. The third stage, along with the fourth stage, are overdriven to provide excellent symmetrical limiting characteristics. Full limiting occurs regardless of signal strength. The limited output of the second i-f amplifier is applied to the discriminator with a constant amplitude.

2.9 CRYSTAL DISCRIMINATOR

The crystal discriminator consists of a monolithic, dual-resonant crystal, the operation of which is similar to a double-tuned, inductively coupled transformer, and associated impedance matching circuitry.

The output of the dual-resonant crystal is applied to a phase discriminator. Since amplitude is constnat, the discriminator will produce true frequency demodulation.

The discriminator low level audio output is applied to the audio & squelch board via the receiver interconnect board.

3. ALIGNMENT

3.1 FREQUENCY CALCULATIONS

$$f_c = 24f_o + 11.7\text{ MHz}$$

$$f_o = \frac{f_c - 11.7\text{ MHz}}{24}$$

Where: f_c = carrier frequency
f_o = channel element frequency
11.7 MHz = mixer output frequency (i-f)
24 = channel element harmonic

3.2 PROCEDURE

Throughout the following receiver alignment (rf & i-f board) procedure, the metering plug will be inserted into the receiver metering receptacle. The procedure includes alignment details for the optional rf preamplifier. If the optional rf preamplifier is not used, disregard any preamplifier adjustments given in the procedure.

The receiver alignment (rf & i-f board) procedure is given in Table 3. The physical locations of the receiver coils and controls are illustrated in Figure 1.

NOTE

In Steps 11 thru 13 of the procedure, terminate local receiver audio in an 8 ohm resistive load capable of dissipating at least 10 watts.

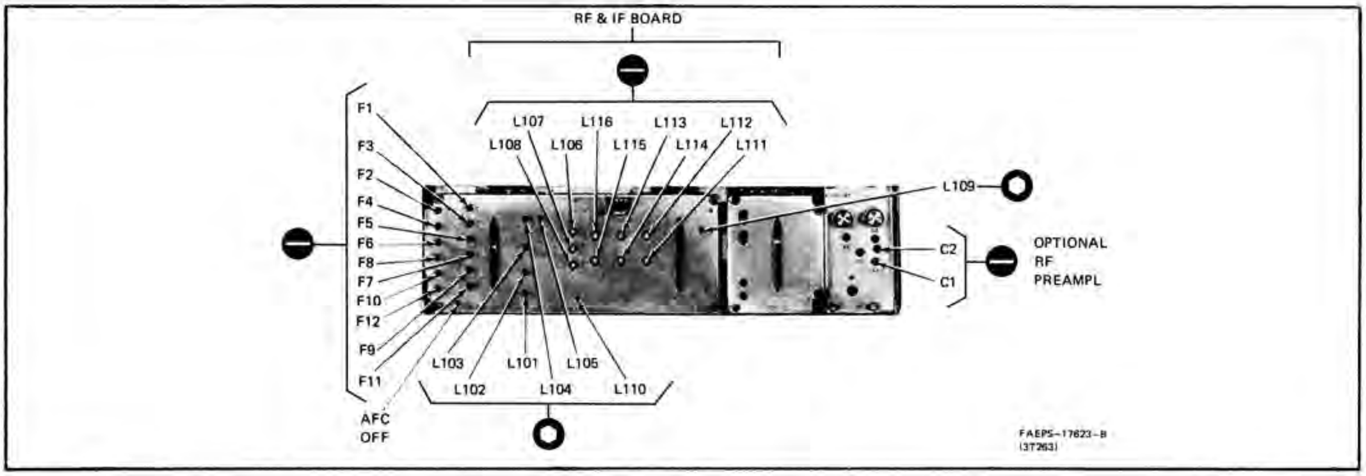


Figure 1. Receiver Adjustment Locations

Table 3. Receiver Alignment (RF & I-F Board) Procedure

Step	Selector Switch Position	Adjust	Procedure
1. Transmitter	—	LINE DISABLE switch	Set to disable position (to the right).
2. Pre-Alignment	—	All multiplier coils	Set cores of L101 thru L105 to top of coil form (away from circuit board).
		All injection filter cavities	Set tuning screws of L106 thru L108 so that screw end is approximately one-eighth inch behind receiver shield.
		All rf preselector cavities	Set tuning screws of L111 thru L116 so that screw end is approximately one-eighth inch behind receiver shield.
3. Line Power	—	—	Apply ac line power to station.
4. Channel Element Output	1	L101, L102	Alternately adjust CCW (counterclockwise), in order shown, two turns at a time, for peak.
5. First Doubler	2	 L103 L104	Adjust CCW as follows: Peak; Dip.
6. Second Doubler	3	 L105 L104	1. Adjust as follows (in order shown): CCW for peak, Tune for peak. 2. Repeat both until no further improvement is obtained.
7. Detuning	3	L101 L103	1. Adjust for drop to 10 uA. 2. Adjust for peak below 12 uA. Keep peak below 12 uA by further adjustment of L101, if necessary.

Table 3. Receiver Alignment (RF & I-F Board) Procedure (Cont'd.)

Step	Selector Switch Position	Adjust	Procedure
8. Channel Element Output Fine Tuning	1	L101, L102	Alternately adjust (in order shown) for peak, until no further improvement is obtained.
9. Injection Filter Cavities	3	L106 L107 L108	Adjust as follows (in order shown): Dip, Peak, Dip, Do not repeat.
10. Discriminator	5	—	1. Insert signal generator probe thru L110 hole on receiver shield. DO NOT touch circuit board. 2. Inject 11.7 MHz (11.8 MHz shifted i-f). 3. Adjust insertion of probe for saturated reading.
	4	L109	Adjust for EXACTLY zero. This adjustment is critical.
11. RF Preselector & Mixer		SQUELCH control	Set fully CCW (unsquelch receiver).
		PL DISABLE switch	Set to disable position (to the right)
	4		1. Connect rf signal generator to receiver input connector. 2. Set rf output of generator to maximum. 3. Disconnect and bypass optional preamplifier (if so equipped). 4. Adjust generator to carrier frequency. Obtain EXACTLY zero. This adjustment is critical. **NOTE** If no indication: a. Unscrew grounding shell of rf generator cable connector. b. Pull plug partially out of jack (until cable ground is isolated from chassis). c. Adjust generator to carrier frequency as indicated above. d. Reconnect grounding shell of cable connector.
	5	All rf preselector cavities	5. Adjust L111 thru L116 CW, one turn at a time, for peak. Reduce generator output level, as necessary, to keep meter out of saturation.
		L110	6. Adjust for peak. 7. Repeat from Step 5.
		All rf preselector cavities	8. Examine relative heights of screw ends of L111 thru L116. They should be relatively level, with respect to one another. If not, adjust as necessary to make them level. Then, repeat from Step 5.
12. Receiver Audio	Use ac voltmeter across local audio load, or selector switch position 11 of portable test set.	All injection filter cavities	1. Adjust L106 thru L108 for minimum indication (best noise quieting). Use 0.2 V ac range.
		All rf preselector cavities	2. Adjust L111 thru L116 for minimum indication (best noise quieting). 3. Repeat Step 2 until no further improvement can be obtained.
13. Preamplifier (if so equipped)	5	C1 C2	1. Reconnect preamplifier. 2. Adjust as follows (in order shown): Max, Max.
	Use ac voltmeter across local audio load, or selector switch position 11 of portable test set.	C1 C2 L111	Adjust as follows for best noise quieting (in order shown): Min, Min, Min.
14. Channel Element On-Frequency Adjustment	4	F1, F2, F3, F4	1. Insert screwdriver through AFC OFF hole in RCVR shield, and ground point "N" to shield while performing the following adjustments. 2. Check meter 4 reading, zero indicates on-frequency condition. 3. Adjust F1 warp capacitor, through hole in RCVR shield, for exact zero reading. DO NOT READJUST L101 OR L102 AFTER THESE ADJUSTMENTS ARE MADE. 4. Repeat Steps 1 thru 4 for F2, F3, and F4, if present.
15. Alignment Check			Perform 20 dB quieting sensitivity measurement as described in Maintenance paragraphs of this section. Obtain .5 uV reading (.25 uV with preamplifier).

Table 3. Receiver Alignment (RF & I-F Board) Procedure (Cont'd.)

Step	Selector Switch Position	Adjust	Procedure
16. Conclusion		All test equipment	Disconnect from station.
		PL DISABLE switch	Set to enable position (to the left).
		SQUELCH control	Adjust as required.
		LINE DISABLE switch	Set to enable position (to the left).
	This completes the receiver alignment procedure.		

4. MAINTENANCE

4.1 GENERAL

The following paragraphs provide maintenance shop type procedures for the individual receiver circuits in the station. After preliminary tests have localized the trouble to the particular area, use these bench tests, which include measurements with built-in station metering (or a Motorola portable test set), for testing and troubleshooting.

IMPORTANT

If POWER SET control ONLY is used to adjust rf power output, for any non-rf power alignment or troubleshooting procedure, then ONLY the POWER SET control requires adjustment to restore rf power to rated level.

CAUTION

Do not remove the channel element by exerting force through the hole provided for access to the channel warp capacitor. Excessive pressure will damage capacitor. A small access hole is provided adjacent to the one used for channel warp plug. Use a tuning tool (Motorola Part No. 66-84387C01) to push out element.

4.2 PERFORMANCE TESTS

The following paragraphs provide maintenance procedures for the receiver rf and i-f board. These procedures consist of tests which include metering measurements, testing, and troubleshooting procedures which include integrated circuit checks.

NOTE

The receiver rf and i-f board must be installed in receiver for testing to provide necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws during operation and testing to provide a good rf ground to all stages of the receiver. The board may be installed in the station or a "Micor" mobile radio set for testing.

Use the following tests to determine if the receiver rf and i-f board is operating properly. If either test produces unsatisfactory results, refer to the following receiver rf and i-f troubleshooting chart for a procedure to isolate the defective stage.

4.2.1 No-Signal Meter Reading Check

4.2.1.1 General

A failure in almost any part of the rf and i-f board will result in an improper meter reading in one or more of the test positions. Improper alignment will also cause improper meter readings.

Compare the current readings observed in RECEIVER quadrant positions 1 through 5 with those in Table 4. A low reading on meter position 1 indicates a defective channel element. A low reading on meter positions 2 or 3 indicates a defective multiplier circuit. Improper meter 4 or 5 readings indicate a malfunction elsewhere in the receiver. Check rf and i-f voltages per the schematic diagram to isolate the malfunction.

Table 4. Minimum Receiver RF & I-F Meter Readings (No Input Signal Applied)

Selector Switch Position	Reading	Circuit Metered
1	15 uA	Channel element output
2	15 uA	First Doubler output
3	15 uA	Second Doubler output
4+, 4-	0 ± 2 uA	Discriminator output
5	10 uA	Second i-f amplifier and limiter

4.2.1.2 Input Voltages

If there are no test set indications at one or more of the metered points, check the dc input voltages to the receiver rf and i-f board per Table 5.

Table 5. RF & I-F Board DC Input Voltages

P904-9	A+ continuous (+13.8 V dc with reference to chassis)
P904-11	9.6 V dc continuous (with reference to chassis) (±0.5 V)
P904-8	9.6 V dc continous (with reference to chassis) (±0.5 V)

"MICOR" "SENSITRON"

If meter indications localize the trouble to a specific stage or two, measure the dc input voltages to the suspected stages. Refer to the schematic diagram for the normal voltages.

4.2.1.3 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f boards mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure receiver shield is in place.

Step 3. Apply ac input power to station.

Step 4. Using a TEK-37 Adapter Cable, connect Motorola portable test set or meter panel to station as follows:

- Connect adapter cable 20-pin connector to receptacle on front of test set or meter panel.
- Connect adapter cable 7-pin red "control" plug to control receptacle on unified chassis (J3).
- Connect adapter cable 7-pin white "metering" plug to metering receptacle on receiver rf and i-f board.

Step 5. Set portable test set switches as follows:

- Set FUNCTION switch to RCVR position.
- Set OSCILLATOR & METER REVERSING switch to OFF position.
- Set adapter cable SENS switch to the 100 mV position. If adapter cable has no SENS switch, unit operates at 100 mV sensitivity all of the time.
- Set adapter cable REF A-B switch to position A or position B.

Step 6. Refer to Table 4. Set test set position SELECTOR switch to positions called for in Table 4 and observe test set meter. Note that the meter readings given are minimums.

4.2.1.4 Using Built-In Station Metering

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f circuit board mounting screws are secured and that all connections to the board are properly made.

Step 2. Be sure receiver shield is in place.

Step 3. Apply ac input power to station.

Step 4. Connect station metering kit "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Refer to Table 4. Set meter selector switch to the positions called for in Table 4 and observe meter. Note that the meter readings given are minimums.

4.2.2 20 dB Quieting Sensitivity Test

This performance test may be used after repair and alignment to assure that the receiver meets all specifications before it is returned to service. The receiver shield must be in place while performing this test.

4.2.2.1 Using the Portable Test Set

Step 1. Set up station and portable test set as described in Steps 1 through 5 of paragraph 4.2.1.3.

Step 2. Set portable test set MULT switch to 2 V ac position.

Step 3. Set portable test set position SELECTOR switch to position 11 (audio).

Step 4. Set test set SPKR switch to LOAD position and disconnect station speaker to silence it during test, if desired.

Step 5. On "Private-Line" stations, disable "PL" operation by setting PL switch, (Station Control Module) to DISABLE postion (to the right).

Step 6. Adjust receiver SQUELCH control fully counterclockwise (unsquelched).

Step 7. Adjust receiver VOLUME control for 2 volts rms on test set meter.

Step 8. Connect an rf signal generator to the receiver input connector (J906).

Step 9. Adjust rf signal generator controls as follows:

- Set signal generator to produce CW (or unmodulated) signals.
- Adjust output level to maximum.
- Adjust the output frequency to the selected channel receive frequency. To adjust generator to the proper frequency, without a frequency counter, adjust generator frequency control until test set meter position 4 reads exactly "zero".

Step 10. With portable test set selector switch in meter position 11 (audio), slowly decrease the signal generator output level until the test set meter reads 0.2 V rms (20 dB down from 2 V rms). Move portable test set MULT switch to 0.2 V ac position if necessary.

NOTE

The output frequency of some signal

generators will be "pulled" when the output level is near maximum. It may be necessary to reset generator frequency, to "zero" meter 4, as the generator output level is reduced.

Step 11. Note signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV rms, or less, for a receiver without an rf preamplifier; or 0.25 uV rms or less, for a receiver with an rf preamplifier.

4.2.2.2 Using Built-In Station Metering

NOTE

This section substitutes a separate ac voltmeter for the portable test set meter 11 position.

Step 1. The receiver rf and i-f board must be installed in a complete receiver for testing. Make sure the rf and i-f board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure receiver shield is in place.

Step 3. Apply ac input power to station.

Step 4. Unsquelch receiver by turning SQUELCH control fully counterclockwise. A "Private-Line" station must also be "PL" disabled.

Step 5. Set the range switch on ac voltmeter to the 2 V ac position and connect the voltmeter across speaker terminals of the station speaker. If desired, substitute an 8 ohm, 15 watt, non-inductive resistor for the speaker. Adjust the station VOLUME control for 2 V rms as indicated on the voltmeter.

NOTE

The built-in station metering kit incorporates a dc voltmeter, not an ac voltmeter.

Step 6. Connect rf signal generator to receiver input connector (J906).

Step 7. Adjust signal generator controls as follows:

- Set the signal generator to produce a CW (or unmodulated) signal.
- Adjust output level to maximum.
- Adjust output frequency to the selected channel receive frequency. To adjust the rf signal generator to the proper frequency, without a frequency counter, adjust the generator frequency control until meter position 4 reads exactly "zero".

Step 8. Slowly decrease the generator output level until the ac voltmeter reads 0.2 V rms. Move ac voltmeter range switch to 0.2 V ac position if necessary.

NOTE

The output frequency of some rf signal generators will be "pulled" when the output level is near maximum. It may be necessary to readjust the generator frequency, to "zero" on meter 4, as the generator output level is reduced.

Step 9. Note signal generator output level. If the receiver rf and i-f board is functioning properly, this level should be 0.5 uV rms, or less, for a receiver without an rf preamplifier; or 0.25 uV rms or less, for a receiver with an rf preamplifier.

4.3 TROUBLESHOOTING

4.3.1 Visual Inspection

The first step in the troubleshooting procedure should be a thorough visual inspection of the receiver and, in particular, the receiver rf and i-f board. Corrosion, burned or damaged components are usually easily seen and may be the cause or a symptom of the receiver malfunction. Loose circuit board mounting screws, or a loose or improperly installed receiver shield are other easily found problems that can cause a considerable degradation in receiver performance.

After the "obvious" problems have been corrected, repeat the receiver rf and i-f board performance tests. If the tests still produce unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart in this section. The troubleshooting chart provides a systematic procedure for isolation of the defective stage and component.

As much information as possible has been included on the troubleshooting chart. However, it will be necessary to occassionally refer to the receiver rf and i-f schematic diagram and circuit board detail. Detailed procedures regarding alignment as a troubleshooting technique, integrated circuit and AFC troubleshooting, receiver gain measurements, and crystal dip tests follow in the remaining paragraphs of this section.

4.3.2 Alignment as a Troubleshooting Technique

Low meter readings, improper discriminator output, and otherwise abnormal performance of the receiver are very often corrected by realignment. Therefore, alignment should be one of the first troubleshooting steps performed for these symptoms.

4.3.3 Troubleshooting Integrated Circuits

Integrated circuits (IC) are very reliable components and should not be replaced unless it is definitely indicated that the IC is the defective component. Before replacing an IC, make sure that the external components in the circuit are normal.

The IC's on the receiver rf and i-f board may be checked by dc voltage measurements. Proper voltages are shown in Table 6.

Table 6.
Nominal Receiver Integrated Circuit DC Voltages
(All readings are in dc volts, measured with respect to chassis ground)

Pin No.	U101 Voltage	U102 Voltage
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: All voltages may vary ± 10% from nominal readings shown.

4.3.4 Troubleshooting the AFC

To check AFC operation, perform the following test:

Step 1. Use built-in station metering (or connect a Motorola test set if so desired) to monitor discriminator output (RECEIVER quadrant, meter position 4).

Step 2. Connect an rf signal generator to the receiver input connector (J906). Set up generator to provide about 100 uV rms of unmodulated signal at the receive channel frequency.

Step 3. Insert a screwdriver or other shorting device through the AFC OFF hole in the receiver shield, shorting the plating beneath the hole to the receiver shield. Simultaneously adjust the input signal frequency for a discriminator meter 4 indication of approximately +6 uA.

Step 4. Remove the short. The meter indication should return to within 3 uA of zero. If it does not, the AFC is malfunctioning.

Step 5. If the AFC is malfunctioning, either components on the receiver rf and i-f board or the AFC circuitry in the channel element may be defective.

- The board may be checked by tracing the AFC error voltage from the discriminator output to the channel element. Performing Step 3 above, and then removing the short, should produce an error voltage of approximately 0.6 V dc (+ or — with respect to chassis ground) when measured with a dc voltmeter, with a minimum of 11 megohms input impedance. Check for this error voltage at P904-15, P904-14, P904-7 and at the AFC OFF plating near the channel element.
- The channel element AFC circuitry may be checked by substituting a known good channel element.

4.3.5 Receiver Gain Measurements

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

NOTE

Before making any receiver gain measurements, make sure the case of every crystal filter has a good conductive path to ground. A continuity test should indicate less than 1 ohm between the crystal case and the receiver circuit board ground plating. A bad ground connection may cause errors in gain measurements.

Step 1. Proper receiver alignment is essential to this procedure. Perform complete receiver rf and i-f alignment, as given in the Receiver Alignment portion of Station Alignment section of this manual. Leave the alignment test equipment connected to perform the following measurements.

Step 2. Refer to Table 7 for receiver gain measurements, the receiver rf and i-f schematic diagram, and the receiver rf and i-f circuit board detail diagram while performing this procedure.

NOTE

Receiver rf input voltages given in Table 7 are those at receiver input connector J906. If a pad, or other attenuator, is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

Examples:
6 dB loss means: V out of pad = 1/2 V into pad.

20 dB loss means: V out of pad = 1/10 V into pad.

Table 7. Receiver Gain Measurements

Test Point (See RF & I-F Circuit Board Detail)	Receiver Input Voltage (preset)	Test Point Voltage ± 6 dB	Remarks
A	16 mV	100 mV	
B	8 mV	50 mV	
C	10 mV	50 mV	
D	15 mV	50 mV	
E	12 mV	50 mV	
F	15 mV	50 mV	
G	10 mV	600 mV	U101 max output
H	6 mV	100 mV	
I	9 mV	100 mV	
J	12 mV	100 mV	
K	11 mV	100 mV	
L	20 mV	100 mV	
M	1 mV	750 mV	U102 max output

Step 3. Adjust rf signal generator output frequency to receive frequency ("0" reading on meter 4). Adjust rf signal generator output level to provide required receiver input voltage for a particular test point as listed in Table 7. Then, using an rf voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. At every test point, the measured voltage should be within ± 6 dB of the given value.

Step 4. A high or low test point voltage measurement *may* indicate that the crystal at, or ahead of, the test point is defective. However, it may also indicate that an associated circuit component is defective. Extremely high-Q crystals used in "Micor" radios are very sensitive to associated circuit component failure. For example, if L125 is defective, it might appear that Y102 is bad. To isolate defective component, perform crystal dip tests as described in crystal dip test paragraph.

4.3.6 Crystal Dip Test

A defective crystal in the i-f selectivity portion of the receiver can be located by measuring receiver gain voltages and performing crystal dip tests.

The monolithic crystals used in "Micor" receivers are made up of two separate resonators on a single quartz blank. Each crystal has a pair of characteristic operating frequencies. One way to find the characteristic frequencies of each crystal is to short the crystal output to chassis ground, then monitor the crystal input voltage with an rf voltmeter while varying the rf signal generator frequency, across the bandpass of the receiver. Low voltage points will occur at each of the crystal characteristic frequencies.

Figures 2 and 3 are plots of typical rf voltmeter readings obtained while testing good crystals. Note that the horizontal scales are calibrated in frequency, with F_o the channel frequency of the receiver. The vertical scales represent *relative* rf voltmeter readings. The bottom line is zero and the top line is maximum. Notice that each plot has one sharp minimum point above F_o and another below F_o. Table 8 lists the frequencies at which these dip points should appear. If the measured dips fall outside the tolerances listed in the table, the crystal *may* be defective.

Step 1. Leave test equipment connected as was done for receiver gain measurements.

Step 2. If receiver uses AFC, disable AFC by connecting a jumper between test point "N" (see receiver rf & i-f circuit board detail diagram) and chassis ground.

Step 3. Adjust the rf signal generator frequency to F_o, the receiver frequency ("0" on meter 4). Adjust generator output control for at least 50 mV rms *at receiver input connector J906.*

Step 4. Refer to Table 8. To test a particular crystal, find it in Table 8, ground the indicated test point, and connect an rf voltmeter between the monitored test point and a nearby chassis ground point.

Step 5. Starting at F_o, *slowly* **increase** the signal generator frequency, while watching for a dip in the rf ac voltmeter reading. This dip should be sharp, so increase the signal generator frequency very slowly and watch the rf voltmeter closely. When the dip is found, record the frequency counter reading.

Step 6. Return the signal generator frequency to F_o. Then watch the rf voltmeter while *slowly* **decreasing** the signal generator frequency. When the dip is found, record the frequency counter reading.

Step 7. Compare test results with the frequencies and tolerances listed in Table 8 for the crystal tested. If the measured dips fall outside the tolerances listed in Table 8, the crystal *may* be defective. Continue with this procedure to isolate the bad component.

Step 8. FOR TEST PURPOSES ONLY, exchange the suspected crystal with another of the same type part number) from the receiver. Be sure to note the polarity of the crystal when making the swap. Repeat receiver gain measurements and crystal dip tests with suspected crystal in new location. If the suspected crystal tests bad again, consider it defective and replace it. If the crystal tests good, look for defective associated components at the original crystal location.

Step 9. When the tests are completed, be sure *all* jumpers connected during the test are removed and that any **exchanged crystals are returned to their original locations.** Refer to the parts list and circuit board detail diagram for correct parts location. Note the crystal polarity when replacing the crystals.

Table 8. Crystal Dip Frequencies

Crystal	Test Point Grounded	Test Point Monitored	+ Frequency Dip (kHz) ± 2.5 kHz	—Frequency Dip (kHz) ± 2.5 kHz
Y101	C	B	6.0	7.0
Y102	E	D	6.5	6.5
Y103	I	H	6.0	7.0
Y104	K	J	6.5	6.5

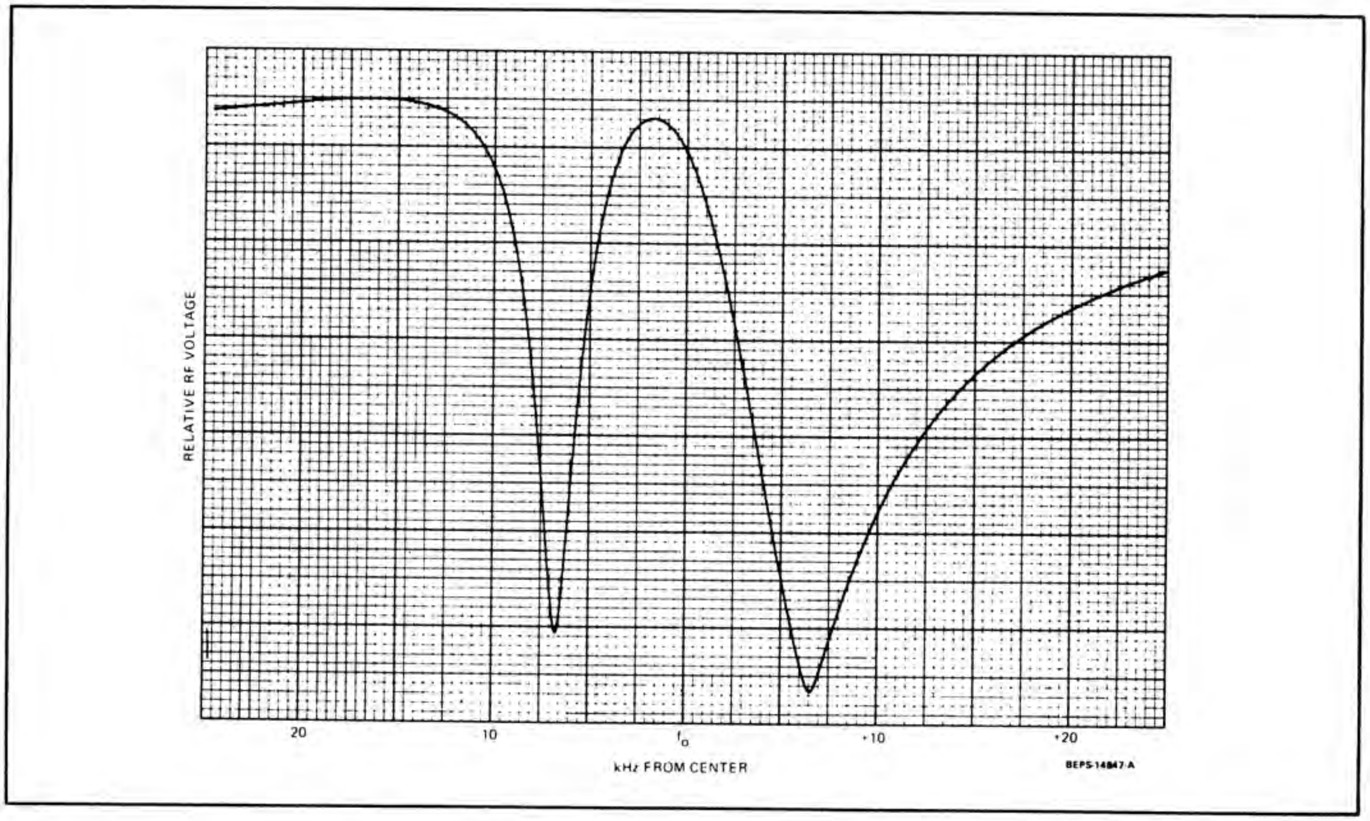


Figure 2. Typical Plot of a Known Good Crystal in Position Y101 or Y103

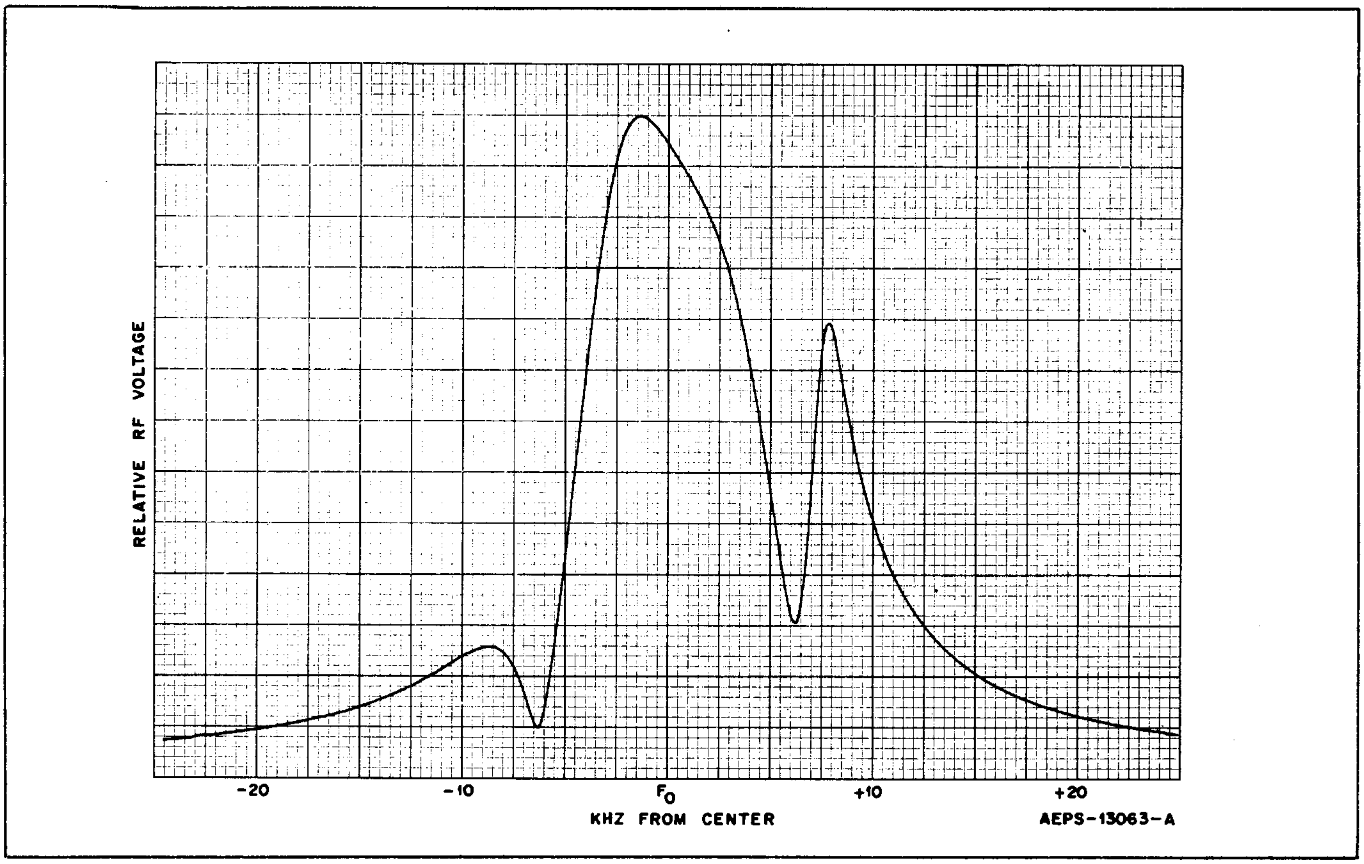
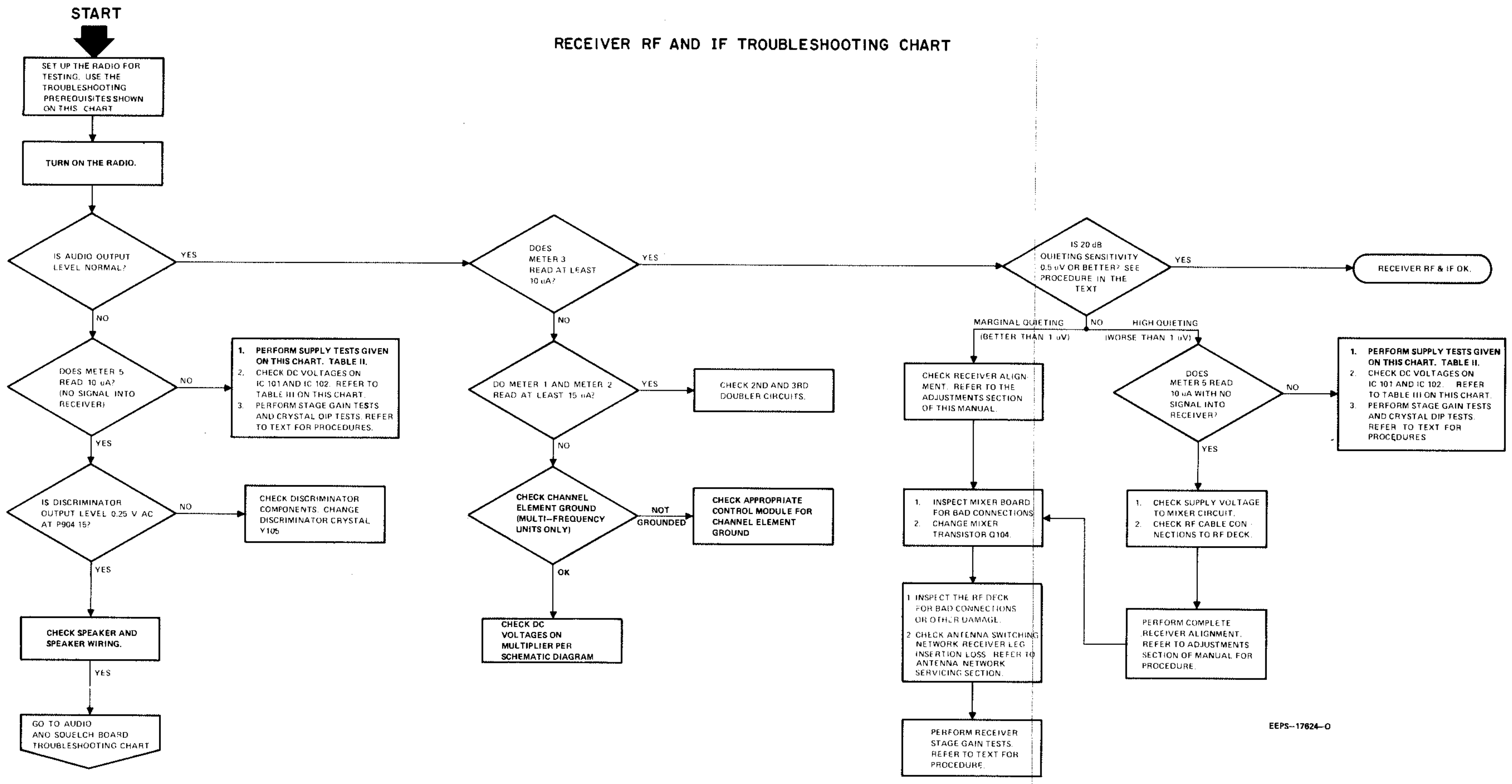


Figure 3. Typical Dip Plot of a Known Good Crystal in Position Y102 or Y104

TROUBLESHOOTING PREREQUISITIES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. TURN STATION ON.
3. USING A TEK–37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS:
   A. CONNECT THE ADAPTER CABLE 20–PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   B. CONNECT THE ADAPTER CABLE RED "CONTROL" PLUG TO THE RECEPTACLE J3 ON THE UNIFIED CHASSIS INTERCONNECT BOARD.
   C. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
4. SET PORTABLE TEST SET SWITCHES AS FOLLOWS:
   A. FUNCTION SWITCH TO THE RCVR POSITION
   B. METER REVERSING SWITCH TO OFF POSITION
   C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   E. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE.
5. ON "PRIVATE–LINE" RADIOS, DISABLE THE PL DECODER BY SETTING THE PL SWITCH ON THE STATION CONTROL MODULE TO THE DISABLE POSITION.
6. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
7. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.

RECEIVER RF AND IF TROUBLESHOOTING CHART



EEPS–17624–O

TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO AMPS)	CIRCUIT METERED
1	15	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	15	SECOND DOUBLER OUTPUT
4	0+2	DISCRIMINATOR OUTPUT
5	10	SECOND I F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

TEST POINT	DESCRIPTION
P904 9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904 11	**9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V).**
P904 8	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

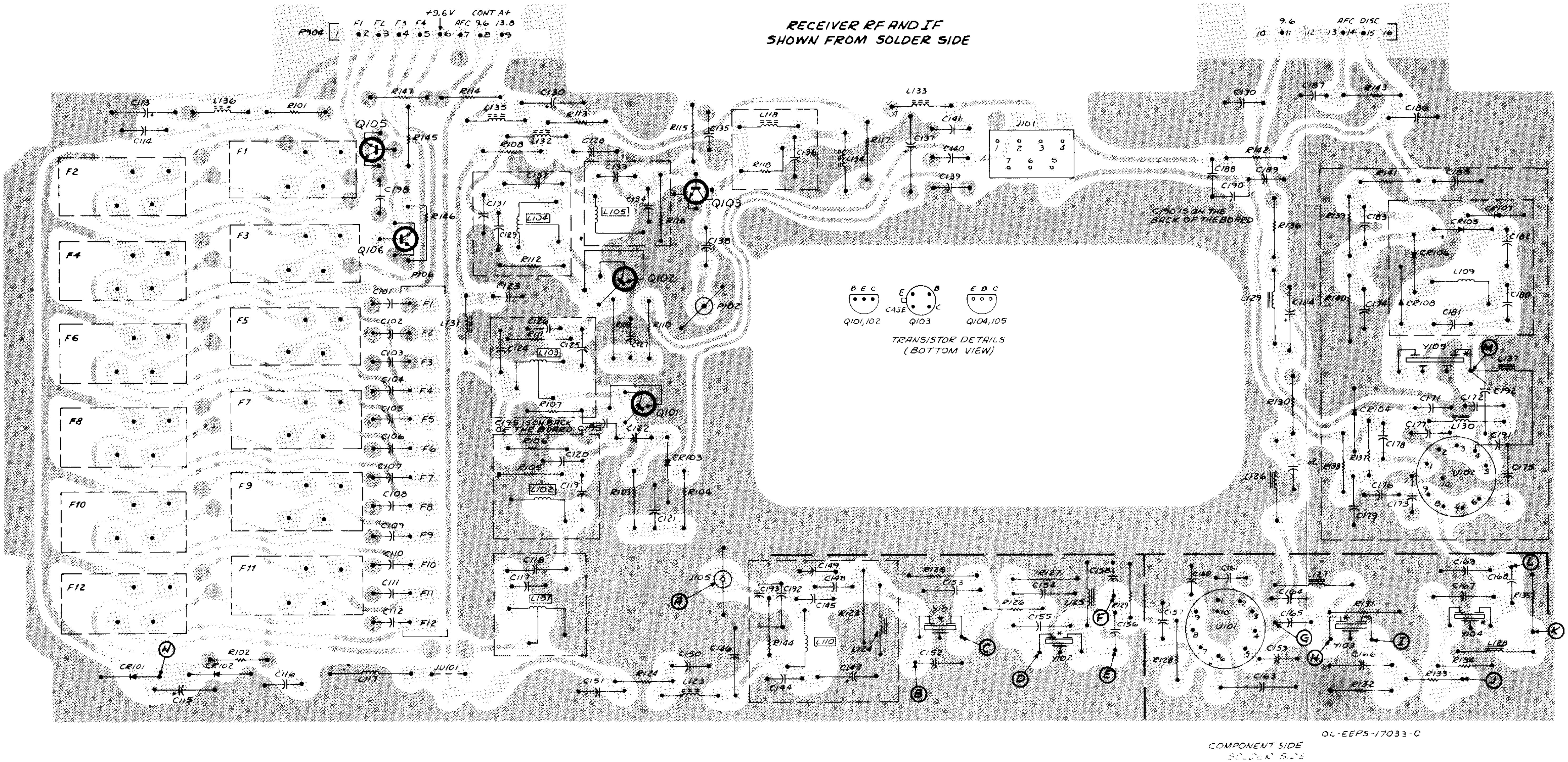
TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	IC101 VOLTAGE	IC102 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

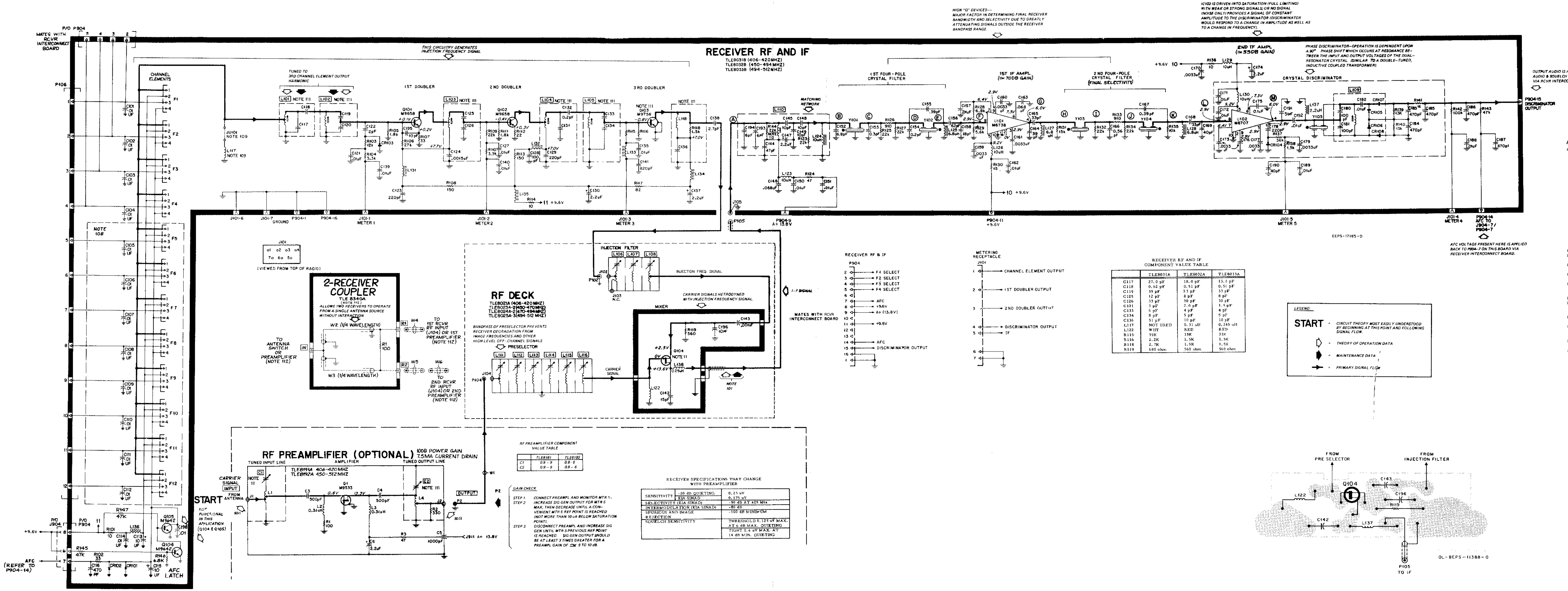
NOTE: ALL VOLTAGES MAY VARY ±10% FROM NOMINAL READINGS SHOWN.

Receiver RF & I-F Troubleshooting Chart
Motorola No. EEPS-17624-O
4/18/79-PHI

"MICOR" "SENSITRON"
UHF RECEIVER
RF & I-F



"MICOR" "SENSITRON"
UHF RECEIVER
RF & I-F



RECEIVER RF & IF NOTES

101. FREQUENCY CALCULATION:

$f_c = 24 f_o + 11.7$ MHz or $f_c = 24 f_o + 11.8$ MHz

$f_o = \frac{f_c - 11.7 \text{ MHz}}{24}$ or $f_o = \frac{f_c - 11.8 \text{ MHz}}{24}$

WHERE: f_c = CARRIER FREQUENCY
f_o = CHANNEL ELEMENT FREQUENCY
11.7 MHz = MIXER OUTPUT FREQUENCY (I–F)
11.8 MHz = MIXER OUTPUT FREQUENCY (I–F SHIFTED)
24 = CHANNEL ELEMENT HARMONIC

THE RECEIVER I–F IS FACTORY SHIFTED FROM 11.7 MHz TO 11.8 MHz WHEN THE DIFFERENCE BETWEEN RECEIVED CARRIER (CHANNEL SPACING) FREQUENCIES IS:

11.7 MHz ± 25 kHz
5.85 MHz ± 25 kHz
3.90 MHz ± 25 kHz
2.925 MHz ± 25 kHz

102. DASHED LINES REPRESENT SHIELDING.
103. INDEX DOT ON Y105 CRYSTAL CAN INDICATES PHYSICAL ORIENTATION REQUIRED.
104. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS. RESISTOR VALUES ARE IN OHMS.
105. RF VOLTAGES TAKEN WITH MOTOROLA SOLID–STATE DC MULTIMETER WITH PLUG–IN RF PROBE.
106. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND.
107. DC VOLTAGE IS FUNCTION OF SIGNAL LEVEL.
108. CIRCUITRY ASSOCIATED WITH CHANNEL ELEMENTS F5–F12 (CAPACITORS AND CHANNEL ELEMENT SOCKETS) ARE PRESENT ON THIS BOARD BUT NOT FUNCTIONAL.
109. JU101 IS ALWAYS CUT. L117 IS PRESENT ON THE CIRCUIT BOARD BUT NOT FUNCTIONAL IN THIS APPLICATION.
110. R144 MUST BE USED WITH RF DECK MODELS TLE8023A, TLE8024A AND TLE8025A SUFFIX –1 OR LATER, AND WITH TLE8021A (NO SUFFIX).
111. VALUE DEPENDS ON FREQUENCY RANGE OF RADIO SET. SEE COMPONENT VALUE TABLE ON THIS PAGE.
112. THE TWO–RECEIVER COUPLER MOUNTS IN THE RECEIVER SECTION OF THE UNIFIED CHASSIS AND MAY OR MAY NOT BE USED WITH OPTIONAL RF PREAMPLIFIERS. WITH NO PREAMPLIFIER, THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH RECEIVERS. WITH ONE PREAMPLIFIER, THE COUPLER CONNECTS BETWEEN THE PREAMPLIFIER AND BOTH RECEIVERS. WITH TWO PREAMPLIFIERS, THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH PREAMPLIFIERS. THE TWO-RECEIVER IS NOT USED IN TAC APPLICATIONS.

FUNCTION

— Produce low level audio output from received modulated rf signal.

Model Complement

MODEL X = required O = optional	TRE1201BA	TRE1203BA	TRE1204BA	TRE1205BA
RF DECK				
TLE8021A	X			
TLE8023A		X		
TLE8024A			X	
TLE8025A				X
RF & I-F BOARD				
TLE8031A/B	X			
TLE8032AB		X	X	
TLE8033A/B				X
PREAMPLIFIER				
TLE8191A	O			
TLE8192A		O	O	O
2-RCVR COUPLER				
TLE8340A	O	O	O	O

Receiver Gain Measurements

TEST POINT (See rf & i-f circuit board detail)	RECEIVER INPUT VOLTAGE (preset)	TEST POINT VOLTAGE ± 6 dB	REMARKS
A	16 mV	100 mV	
B	8 mV	50 mV	
C	10 mV	50 mV	
D	15 mV	50 mV	
E	12 mV	50 mV	
F	15 mV	50 mV	
G	10 mV	600 mV	U101 saturated output
H	6 uV	100 mV	
I	9 uV	100 mV	
J	12 uV	100 mV	
K	11 uV	100 mV	
L	20 uV	100 mV	
M	1 uV	750 mV	U102 saturated output

PARTS LIST SHOWN ON BACK
Motorola No. PEPS-17752-D
(Sheet 2 of 2)
4/15/79- PHI

UHF RECEIVER RF & I–F

RF DECK

TLE8021A (406-420 MHz
TLE8023A (450-470 MHz)
TLE8024A (470-494 MHz)
TLE8025A (494-512 MHz)

LEGEND:
L = 406-420 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz

PL-1878-G

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C142	21-840846	15 pF ±5%; 500 V; NP0
C143	21-83880G01	.001 uF ±10%; 100 V
C196	21-82355B26	10 pF ±0.25 pF; 500 V; NP0
		CONNECTOR, receptacle:
J102, 103, 104	9-84135B02	female; coaxial; miniature type
		COIL, RF:
L106L	24-84769E12	(coded RED, RED); 6-5/8 turns, tapped
L106M, H	24-84769E14	(coded YEL, YEL); 6-1/8 turns, tapped
L106HH	1-80752B34	(coded VIOLET-VIOLET): 5-7/8 turns; tapped
L107L	24-84769E15	(coded GRN, GRN); 6-5/8 turns
L107M, H, HH	24-84769E16	(coded BLU, BLU); 6-1/8 turns
L108L	24-84769E12	(coded RED, RED); 6-5/8 turns, tapped
L108M, H, HH	24-84734E01	(coded YEL, YEL); 6-1/8 turns, tapped
L111L	24-84731E09	4-1/2 turns
L111M	24-84731E01	4 turns, tapped
L111H	24-84731E04	3-3/4 turns, tapped
L111HH	24-84731E07	3-9/16 turns, tapped
L112L-112L	24-84731E10	4-1/2 turns
L112M-115M	24-84731E02	4 turns
L112H thru 115H	24-84731E05	3-3/4 turns
L112HH thru 115HH	24-84731E08	3-9/16 turns
L116L	24-84731E09	4-1/2 turns
L116M	24-84734E03	4 turns, tapped
L116H	24-84734E06	3-3/4 turns, tapped
L116HH	24-84734E07	3-9/16 turns, tapped
L122L	24-83884G06	YEL; 4-1/2 turns
L122M, H, HH	24-83884G03	BRN; 1-1/2 turns
L138	24-82723H04	choke; 0.29 uH
		RESISTOR, fixed:
R119 L	6-10401C45	680 ±10%; 1/4 W
R119M, H, HH		560 ±10%; 1/4 W
		CONNECTOR, plug:
P105	28-84282D01	male; coaxial; miniature type
		TRANSISTOR: (SEE NOTE)
Q104L, M, H, HH	48-869839	field-effect; N-channel M9839
		NON-REFERENCED ITEMS
	1-80745B84	MIXER BOARD: includes reference parts C142, C143, C196, L122, Q104, R119
	3-138841	SCREW, tuning: used with L106, L107, L108
	2-84773E01	NUT, tensioning: "star" type; used with L106, L107, L108
	3-139002	SCREW, tuning: used with L111 thru 116
	2-84773E03	NUT, tensioning: "star" type; used with L111 thru 116

RECEIVER RF & IF BOARD

TLE8031A/B(406-420 MHz)
TLE8032A/B(450-494 MHz)
TLE8033A/B(494-512 MHz)

LEGEND:
L = 406-420 MHz
M = 450-470 MHz
H = 470-494 MHz
HH = 494-512 MHz
* = For B Suffix boards only

PL-1879-I

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF; ±5%; 500 V; unless otherwise stated
C101 thru 112	21-82428B59	.01 uF +80-20%; 200 V
C113	23-84762H03	10 uF ±10%; 20 V
C114	21-82428B59	.01 uF +80-20%; 200 V
C115	8-83813H11	0.22 uF ±10%; 75 V
*C115	23-84762H03	10 uF ±10%; 20 V
C116	21-82187B39	470 +10%
C117L	21-840895	27; N330
C117M, H	21-82133G44	18; N330
C117HH	21-83406D01	13; N330
C118L	21-82450B46	0.62; coded BLU-RED-GRAY-GOLD
C118M, H, HH	21-82450B29	0.51; coded GRN-BRN-GRAY-GOLD
C119L	21-83406D06	39; N220
C119M, MO, H, HH	21-84493B44	33; 250 V; N150
C120	21-82610C44	100; 100 V; N220
C121	21-82428B59	.01 uF +80-20%; 200 V
C122	21-857336	2 ±0.25 pF; NP0
C123	21-82187B08	220 ±10%
C124	21-82187B11	.0015 uF ±10%; 100 V
C125L	21-82133G73	12; N150
C125M, H, HH	21-838912	8 +0.25 pF; N150
C126L	21-84493B44	33; N150
C126M, MO, H, HH	21-82610C14	30; 200 V; N150
C127	21-82428B59	.01 uF +80-20%; 200 V
C128	21-831125	100 ±10%; 300 V; N750
C129	21-82187B08	220 ±10%
C130	23-84762H04	2.2 uF ±20%; 25 V
C131L	21-83406D51	3 ±0.25 pF; NP0
C131M, H	21-857336	2.0 ±.25 pF; NP0
C131HH	21-868487	1.5 ±0.25 pF; NP0
C132	21-82450B35	0.2 ±10%; coded RED-BLK-GRAY-SILVER
C133L	21-82133G18	6 ±0.25 pF; N470
C133M, H, HH	21-849320	4 +0.25 pF; N470
C134L	21-84493B43	8 ±0.25 pF; N470
C134M, H, HH	21-82204B33	5 ±0.25 pF; N470
C135	21-82428B59	.01 uF +80-20%; 200 V
C136L	21-82610C07	51; 200 V; N150
C136M, H, HH	21-847056	10; 250 V; N150
C137	23-84762H04	2.2 uF ±20%; 25 V
C138	21-82355B30	2.7 ±0.1 pF; NP0 (450-512 MHz)
	or 21-82355B39	4.7 ±0.1 pF; NPO (406-420 MHz)
C139, 140	21-82428B59	.01 uF +80-20%; 200 V
C141	21-82187B17	820 ±10%
C144	21-82610C03	47; 200 V; N220
C145	21-82133G01	10; NP0
C146	8-82905G04	.068 uF +10%; 50 V
C147	23-84762H04	2.2 uF +20%; 25 V
C148, 149	21-82133G01	10; NP0
C150, 151	21-82428B59	.01 uF +80-20%; 200 V
C152	21-82133G33	6.8 +0.5 pF; NP0
C153	21-82450B04	0.3 +10%; coded ORG-BLK-GRAY-SILVER
C154	21-82450B35	0.2 +10%; coded RED-BLK-GRAY-SILVER
C155	21-82450B07	0.39; coded ORG-WHT-GRAY-GOLD
C156	21-82610C43	62; 100 V; NP0
C157	21-82428B59	.01 uF +80-20%; 200 V
C158	21-82133G29	18; NP0
C159, 160, 161	21-82428B57	.0033 uF +10%; 200 V
C162	21-82428B59	.01 uF +80-20%; 200 V
C163	8-83813H05	.068 uF +10%; 100 V
C164	21-82610C84	39; 450 V; NP0
C165	21-82355B09	33; NP0
C166	21-82450B33	0.56; coded GRN-BLU-GRAY-GOLD
C167	21-82450B07	0.39; coded ORG-WHT-GRAY-GOLD
C168	21-82355B09	33; NP0
C169	21-82610C45	40; 100 V; NP0
C170	21-82428B57	.0033 uF +10%; 200 V
C171, 172	21-82428B59	.01 uF +80-20%; 200 V

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C173	21-82428B57	.0033 uF +10%; 200 V
C174	23-84762H04	2.2 uF +20%; 25 V
C175	8-83813H06	0.1 uF +10%; 100 V
C176, 177	21-82428B57	.0033 uF +10%; 200 V
C178	21-82187B08	220 +10%
C179	21-82428B57	.0033 uF +10%; 200 V
C180, 181	21-83798B01	100; 200 V; NP0
C182	21-82428B59	.01 uF +80-20%; 200 V
C183, 184	21-82187B07	470 +10%
C185, 186, 187	21-82187B39	470 +10%
C188	21-82428B59	.01 uF +80-20%; 200 V
C189	21-82428B57	.0033 uF +10%; 200 V
C190	21-84493B24	40; N150
C191	21-82610C07	51: N150
C192	21-861443	.01 uF +100-20%; 75 V
C193, 194	21-840848	6 +.5 pF; NP0
C195	21-82355B26	10 ±0.25 pF; NP0
C197	21-82355B26	10 ±0.25 pF; NP0
*C198	21-82428B59	0.01 uF +80-20%; 200 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE I)
CR101, 102	48-82392B13	silicon
CR103, 104	48-82139G01	germanium
CR105 thru 108	48-84616A01	silicon; hot carrier type
		INTEGRATED CIRCUIT:
U101	51-84267A38	type M6738
U102	51-84267A07	type M6707
		CONNECTOR, receptacle:
J101	9-84207B01	metering; 7-contact
J105	9-84231B02	female; coaxial; miniature type
		COIL, RF:
L101	24-84972A15	BRN; 8-1/2 turns, tapped at 2-1/8 turns; includes tuning core
L102	24-84972A16	RED; 8-1/2 turns; includes tuning core
L103	24-84972A17	ORG; 6-1/2 turns, tapped at 1-7/8 turns; includes tuning core
L104	24-83857G07	YEL; 3-1/2 turns, tapped at 1-5/8 turns; includes tuning core
L105	24-83856G05	GRN; 3-1/2 turns; includes tuning core
L109	24-83879G04	YEL; 20 turns; includes tuning core
L110	24-84258B06	BLU; 16 -2/3 turns; includes tuning core
L117L		NOT USED
L117M, H	24-82542E01	.31 uH; choke
L117HH	24-82542E11	.245 uH; choke
L118	24-82723H02	choke; .039 uH
*L118	24-82723H03	3 turns
L120, 121		NOT USED
L123	24-82723H07	choke; 10 uH; coded VIO
L124	24-82549D25	choke; 10 uH; shielded; coded (SILVER) -BRN-BLK-BLK-GOLD
L125	24-84250D02	choke; 6.8 uH; shielded; coded WHT-BLU-GOLD-GRAY-GOLD
L126	24-82723H07	choke; 10 uH; coded VIO
L127, 128	24-84250D02	choke; 6.8 uH; shielded; coded WHT-BLU-GOLD-GRAY-GOLD
L129, 130	24-82723H07	choke; 10 uH; coded VIO
L131 thru 136	24-83961B01	3 turns over ferrite bead; coded BRN
L137	24-84250D03	choke; 2.2 uH (shld.) coded WHT-RED-GOLD-RED-GOLD
		CONNECTOR, plug:
P102	28-84227B01	male; coaxial; miniature type
		TRANSISTOR: (SEE NOTE I)
Q101	48-869658	NPN: type M9658 (450-512 MHz)
	or 48-869570	NPN: type M9570 (406-420 MHz)
Q102	48-869658	NPN: type M9658
Q103	48-869756	NPN: type M9756
*Q104, 105	48-869642	NPN: type M9642
		CONNECTOR, plug:
P106		(for reference only)
		RESISTOR, fixed: ±10%; 1/4 W: unless otherwise stated
R101	6-129755	10
R102	6-127807	33k
R103	6-129230	12k
R104	6-129231	3.3k
R105	6-129269	1.8k
R106	6-127806	27k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R107	6-10401A13	33 +5%
R108	6-129862	150
R109	6-128685	22k
R110	6-129231	3.3k
R111	6-129269	1.8k
R112	6-124A09	22 +5%
R113	6-129862	150
R114	6-129755	10
R115L	6-10401C87	39k
R115M, H, HH	6-127807	33k
R116L	6-10401C57	2.2k
R116M, H, HH	6-127803	1.5k
R117	6-129224	82
R118L	6-10401C59	2.7k
R118M, H, HH	6-127803	1.5k
R120, 121		NOT USED
R123	6-129667	22k ±5%
R124	6-129233	47
R125	6-129667	22k ±5%
R126	6-131289	910 ±5%
R127	6-129667	22k ±5%
R128	6-129237	6.8k ±5%
R129	6-129982	5.6k +5%
R130	6-131377	15
R131	6-129236	15k +5%
R132	6-129667	22k +5%
R133	6-131289	910 +5%
R134	6-129667	22k +5%
R135	6-129668	10k +5%
R136	6-129755	10
R137	6-124C86	36k
R138	6-127803	1.5k
R139	6-10401A76	13k ±5%
R140	6S124A76	13k ±5%
R141	6-127802	1k
R142	6-129226	100k
R143	6-128902	47k
R144	6-10401C81	22k
*R145	6-124C89	47k
R146	6-124C69	6.8k
R147	6-124C89	47k
		CRYSTAL UNIT, quartz 11.7 MHz
Y101	48-84755E01	i-f filter
*Y102	48-84755E01	i-f filter
	or 48-84755E02	i-f filter
*Y103, 104	48-84755E01	i-f filter
	or 48-84755E03	i-f filter
Y105	48-84754E01	discriminator
		*When replacing Y102, Y103 or Y104, order Part No. 48-84755E01 only.
		NON-REFERENCED ITEMS
	3-138804	SCREW, machine: 4-40 x 5/16" includes lockwasher; 5 used
	3-138891	SCREW, tapping: 6-32 x 7/16" includes lockwasher; 9 used
	3-139506	SCREW, tapping: 4-40 x 5/16" includes lockwasher; 8 used
	4-49854	WASHER, spacer; 2 used
	5-84500B03	EYELET, special; 8 used
	14-84560B01	INSULATOR, dual: 0.55" long x 0.22" wide; 4 used
	14-84583B01	INSULATOR, dual: 0.74" long x 0.37" wide
	26-83838F01	SHIELD, coil
	26-84250B01	SHIELD, coil: 0.750" inside dimension
	26-84250B03	SHIELD, coil: 0.625" outside dimension
	26-84250B08	SHIELD, coil: 1" outside dimension
	26-84250B12	SHIELD, coil: 0.750" inside dimension; 1.25" high
	26-84250B13	SHIELD, coil: 1" outside diam.; 1.30" high
	26-84253B01	SHIELD, can: 1.56" wide x 2.625" long
	26-84614G01	SHIELD, coil: 0.625" outside dimension
	26-84639E01	SHIELD, barrier
	26-84641E01	SHIELD, bottom
	26-84642E01	SHIELD, bottom

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	26-84861E01	SHIELD, barrier
	28-84227B01	CONNECTOR, phono
	42-84284B01	RETAINER; 8 used
	55-84300B02	HANDLE (long) 2 used
	55-84300B03	HANDLE (short)

TLE8340A 2-Receiver Coupler Kit PL-3432-O

		RESISTOR, fixed:
R1	6-124A25	100 ±5%; 1/4 W
		CABLE, RF:
W2, 3	30-83233K01	coaxial (solid)
W4	1-80737B77	includes; 30-83794C01 CABLE, coaxial (4"); 9-84968D01 JACK, bulkhead; 28-82331G01 CONNECTOR, phone type
W5	1-80775B69	includes; 30-84173E01 CABLE, coaxial (12") and (2) 28-82331G02 CONNECTOR, phono type
W6	1-80775B70	includes; 30-84173E01 CABLE, coaxial (11") and (2) 28-84967D01 CONNECTOR, BNC type
		NON-REFERENCED ITEM
	1-80775B68	BRACKET ASSEMBLY: includes 7-84131G01 BRACKET and (3) 9-83663C01 CONNECTOR, phono type

TLE8610A 11-8 MHz Shifted I-F Crystal Kit PL-6469-O

		CRYSTAL, unit:
Y101 thru 104	48-84755E04	I-F filters
Y105	48-84755E02	discriminator

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PREAMPLIFIER

TLE8191A Preamplifier (406-450 MHz)
TLE8192A Preamplifier (450-512 MHz)

PL-2693-O

		CAPACITOR, variable: (includes standard tuning "piston");
C1, 2	20-83693H03	0.9 - 9.0 pF (406-450 MHz)
	or 20-83693H01	0.8 - 6.0 pF (450-512 MHz) (NOTE: Also order 76-84425B01 PISTON, tuning;)(special; SEE NOTE II)
		CAPACITOR, fixed:
C3, 4	21-861441	500 pF ±10%; 75 V; N4700
C5	21-861219	.001 uF +100-0%; 500 V; coded RED
C6	23-84762H04	2.2 uF ±20%; 25 V
		CONNECTOR, receptacle:
J1, 2	9-84135B01	female; coaxial; miniature type
		COIL, RF:
L1	47-84330B01	(straight rod; 1.75" long)
L2, 3	24-800484	choke; 0.31 uH
L4	47-84330B03	(straight rod; 2.19" long)
		CONNECTOR, plug:
P2, 104	28-84282D01	male; coaxial; miniature type
		TRANSISTOR: (SEE NOTE I)
Q1	48-869533	field-effect "N Channel"; type M9533; does not include 42-83660C01 CLIP, transistor retaining
		RESISTOR, fixed:
R1	6-10401C25	100 ±10%; 1/4 W
R2	6-185B73	330 ±10%; 1/8 W
R3	6-10401C17	47 ±10%; 1/4 W
		LINE, RF transmission:
W1	1-80739B37	includes P2, P104 and 30-83794C01 CABLE, RF: coaxial; 6-1/2" length required

MOTOROLA INC.
Communications
Group

"MICOR" "SENSITRON" RECEIVER AUDIO & SQUELCH BOARD

MODEL TRN6006A, AV, 7A

1. DESCRIPTION

The audio and squelch board performs two basic functions -- audio amplification and audio squelching. The first two stages in the audio circuitry amplify the signal from the discriminator and provide the proper frequency response. This signal is routed to the line driver module in remote control stations and to the local logic board in local control models. The audio returns through a VOLUME control. The remaining stages in the audio circuitry take the signal returning from the line driver and VOLUME control and provide the necessary frequency response at the speaker. These latter stages also provide the drive required by the final audio amplifiers (located on a separate board) for rated power output. An integrated circuit and one transistor perform all of these functions.

The squelch circuitry disables the audio path during intervals between received messages. One integrated circuit performs the necessary detection and squelching functions. Also, in conjunction with the PL decoder and filter board in a PL station, this integrated circuit provides unsquelching when PL signals are received.

2. FUNCTIONAL OPERATION

2.1 GENERAL

The audio signal from the receiver discriminator is routed to the emitter follower (refer to Figure 1). The emitter follower output is coupled to the SQUELCH control mounted on the receiver chassis or local front panel and also to the line level potentiometer mounted on the audio & squelch board. The signal from this control is next applied to the preamplifier. If JU201 is cut, the signal is first sent through the PL filter for attenuation of the PL tone. The preamplifier output is coupled off the board to the line driver or local logic board. Audio returning from the line driver or local logic board is coupled through the appropriate VOLUME control to amplifier Q203. After amplification, the signal is applied to the audio amplification circuits. Here, the signal is raised to a level sufficient to drive the audio power amplifiers. These are mounted on a separate board which is secured to the chassis to provide "heat-sinking" capability. The output of the audio power amplifiers is applied to an output transformer which drives a speaker or speaker desk set transformer (local control stations only).

The signal returned from the SQUELCH control is applied to the squelch section for noise squelch control. Squelch action is achieved by utilizing the inherent characteristics of a discriminator known as "noise quieting". An input signal will cause more quieting of noise as the signal level is increased. When a desired level of noise quieting is reached, as determined by the squelch circuitry and the setting of the SQUELCH control, the audio portion of the board and line driver are enabled to allow a message to be heard. In a remote control station, the squelch circuit disables the audio circuitry by shunting a point in the audio signal path to ground and also operating a series switch in the audio signal path of the line driver.

In a local control station, the series path is broken on the local logic board. In addition, an *extra* shunt switch is activated on this board and its low resistance is directed back to the audio amplification circuits. This provides extremely quiet operation during periods of no signal.

Upon completion of a received message, audio shut-off is either immediate or automatically delayed 150 milliseconds, depending upon the signal level of the previously received rf carrier. A strong signal produces the immediate shut-off and prevents an annoying, loud "squelch tail" burst from being heard. Weak signals (signals that produce less than 20 dB noise quieting) produce the long shut-off delay and prevent a message from being chopped under "flutter" conditions. Since the

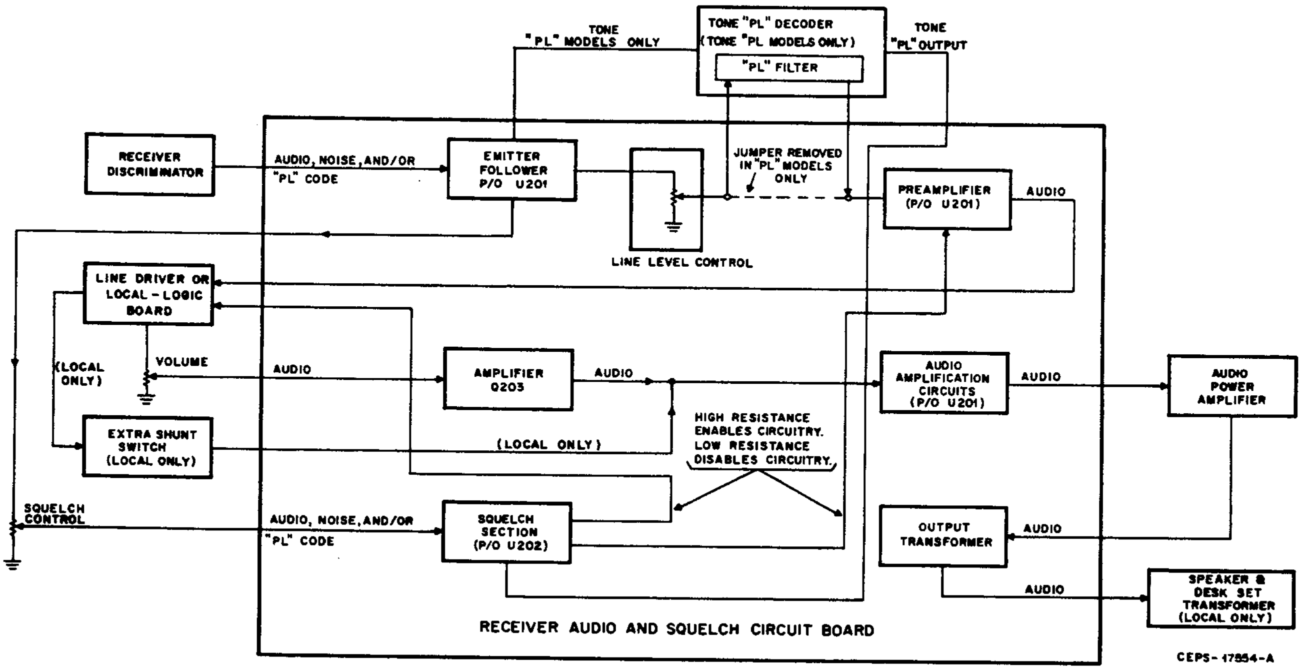


Figure 1. Audio and Squelch Block Diagram

received signal level must be low for the long turn-off delay to occur and the "squelch tail" level is comparable to that of the received signal, the "squelch tail" is not annoying.

2.2 EMITTER FOLLOWER CIRCUIT

The emitter follower circuit provides a low impedance output which isolates the high impedance discriminator output from the following squelch and audio circuitry.

The output of the discriminator is capacitively coupled to the emitter follower input at U201-1 and may consist of noise and audio signals. The output of the emitter follower at U201-2 is routed through C207 to the SQUELCH control and also to the line level control.

2.3 PREAMPLIFIER CIRCUIT

This circuit amplifies the low-level audio signal to provide the drive necessary for proper line driver operation. In addition, a negative feedback network (C208 and C209) provides the necessary frequency response characteristics for phone line operation. In PL stations, jumper JU202 is cut and the negative feedback is provided by C209 only. The network of R210 and C210 provides additional frequency response shaping.

2.4 AMPLIFIER CIRCUIT

Transistor Q203 increases the signal level from the line driver or local logic board to the level required by the audio amplification circuits. Jumper JU203 is out when the equipment leaves the factory. The gain of Q203 is sufficient to drive the audio amplification circuits if the signal strength from the line driver or squelch gate exceeds -10 dBm. With a signal strength below this level, it is advisable to put in JU203 which increases the gain of Q203. The RC network at the input to this stage provides additional frequency response shaping required at the speaker.

2.5 AUDIO AMPLIFICATION CIRCUIT

The signal from amplifier Q203 is applied to the differential amplifier thorugh capacitors C211 and C213. In a local station, the extra shunt switch on the local logic board is connected to the junction of C211 and C213.

The differential amplifier output provides the drive for the complementary amplifier. Resistors R221 and R220 form a voltage divider, biasing the differential amplifier at one-half of the supply voltage. Undesirable transient voltages are eliminated by capacitor C212.

Final audio amplification, on the audio and squelch board, occurs in the complementary amplifier. These stages provide the drive for the audio power amplifiers which are mounted on a separate board. The complementary amplifier emitter resistors (R218 and R219) are not included in U201 because of their high heat dissipation requirements.

Audio returned to the audio and squelch board (from the audio power amplifiers) is applied to the output transformer primary windings. This transformer consists of four windings -- two input primaries, an output secondary, and a feedback secondary. The output secondary winding couples audio power to an external 8-ohm speaker which can be driven with up to 10 watts at less than 5% distortion. Negative feedback from the output transformer winding through C216 and across R211 gives 6 dB per octave de-emphasis (roll-off) to the audio which has been pre-emphasized 6 dB per octave in the transmitter. Below 300 Hz, feedback from R213 and across C215 increases, giving low frequency de-emphasis. Capacitor C238 rolls off the high frequency gain of the amplifier to prevent high frequency oscillation. Capacitors C223 and C224, C240, C241, and C242 are rf bypass capacitors that shunt stray rf on the audio A+ and audio A- lines to ground. In local operation, the output secondary winding couples audio power to a 16-ohm speaker and an autotransformer. This transformer will drive up to six local desk sets.

2.6 NOISE ACTIVATED SQUELCH CIRCUIT

2.6.1 Squelch Input Circuit

The input signal from the SQUELCH control may consist of audio and noise. An input shaping network precedes U202 and passes high frequencies while attenuating low frequencies. Allowing the high frequencies to pass eliminates the effect of voice and results in more sensitive threshold squelch action.

The first amplifier and limiter is driven into limit by its input signal and prevents audio from squelching (disabling) the audio channel on voice signals. Amplified, limited noise is then passed through a coupling network to the second amplifier. This coupling network is also a high pass filter which further attenuates voice and tone signals to the second amplifier.

The second amplifier amplifies the noise signal and applies it through an RC coupling network to the detector. Capacitor C233 and C234 form another high pass filter that further attenuates the low frequencies. Capacitor C234 is used to produce a peak-to-peak detector action from the noise detector, and thus, generate twice the output voltage of a peak detector. This capacitor does not affect frequency response.

2.6.2 Detector and Switching Circuits

The detector output level is a function of received signal strength and the setting of the SQUELCH control. The detector develops the dc output voltage across filter capacitor C235. The lowest dc output voltage corresponds to a no signal input (maximum noise) condition. The output voltage increases as the received rf carrier signal level increases (noise decreases).

The primary function of the detector output, however, is the control of shunt switching. This is done by applying the detector output to three squelch control circuits simultaneously:

-- long "squelch tail" circuit,
-- long "squelch tail" defeat switch,
-- carrier squelch switching logic.

With no received rf carrier signal (maximum noise condition), the long "squelch tail" circuit and long "squelch tail" defeat switch are off and the carrier squelch switching logic is on. The audio channel is subsequently disabled, unless the squelch control logic is overridden by other circuitry.

As the input signal level increases (noise decreases), the detector output voltage increases. A detector output voltage above 2.8 volts dc results in enabling of the long "squelch tail" circuit. The long "squelch tail" circuit produces a voltage at U202-12 of 5.5 volts dc; this voltage causes the carrier squelch switching logic circuit to turn off and thereby enabling the audio channel. Capacitor C236 and resistor R235 provide a rapid-rise, slow-decay time constant to the voltage applied to the carrier squelch switching logic circuit. This permits a weak signal to immediately enable the audio channel, yet delays the audio channel shut-off if the signal is in a "flutter" condition. The voltage necessary to enable the carrier squelch switching logic is approximately 3.8 volts dc.

A voltage greater than 5 volts dc at the detector output (rf carrier signal level that produces 20 dB quieting or better with the SQUELCH control set at threshold), turns the long "squelch tail" defeat switch on. This disables the long "squelch tail" circuit and the 150 millisecond delay function. Audio channel disabling now occurs immediately after the rf carrier disappears.

2.6.3 Squelch Output Circuit

The squelch control logic circuit directly controls the shunt switches.

The output of the squelch control logic circuit depends upon the output of the preceding carrier squelch switching logic circuit. With the carrier squelch switch logic circuit off, the squelch control logic circuit will turn the shunt switches off, allowing a message to be heard. If the carrier squelch switch logic is on, the squelch control logic circuit will turn the shunt switches on, disabling the audio channel, and activating the series switches in the line driver or local logic board. Capacitor C237, connected to U202-10, slows the turn-off of the shunt switches to "soften" what would otherwise be any annoyingly abrupt turn-on of the audio. This same point (U202-10) supplies a digital output voltage that can be used as an indicator that the receiver is unsquelched (audio channel enabled).

Two additional functions that may affect the squelch control logic ouput are associated with "Private-Line" operation. PL disable (U202-14) may be either shorted to ground or open. When an open is present at U202-14 (PL disabled), a received signal with or without a PL code will be heard from the speaker. When at ground potential (PL enabled), the output of the carrier squelch switching logic circuit is inhibited. When the proper PL code is received, a +9.5 volts dc from the PL decoder board to U202-8 turns the squelch control logic circuit off which turns the shunt switches off and allows a message to be heard. Jumper JU204 is normally in the circuit and is only cut when a field modification is made. The cutting of this jumper *and associated modifications on the receiver interconnect board* will provide "AND SQUELCH" operation, changing the PL squelch circuitry from fixed sensitivity operation to variable sensitivity operation. Under this mode of operation, the SQUELCH control will affect the squelch sensitivity.

Audio disabling is performed by shunting the audio circuit to ground through a low impedance path and also by the operation of a series switch in the line driver or local logic board. When the solid state shunt switch is turned on (U202-7), signals developed across R236 are shunted to ground. This prevents any signals from being heard at the speaker. Acting in tandem with the first shunt switch, the second shunt switch output is routed to the line driver or local logic board and enables a set of switches on either of the boards. In a remote control system, this breaks the audio path and prevents audio from appearing on the 600-ohm line. In a local control system, these series switches also break the audio path, thus preventing any audio or hum and noise from reaching the speaker.

3. MAINTENANCE

3.1 GENERAL

This section of the manual provides maintenance shop type procedures for the audio and squelch board. It assumes that preliminary tests have already localized the trouble to this board. These bench tests include procedures for testing and troubleshooting, including integrated circuit check-out.

NOTE

The audio and squelch board must be installed in a station for testing to provide the necessary power and ground connections.

3.2 PERFORMANCE TESTS

The performance test may be used for troubleshooting to isolate the point of abnormal operation. They may also be used after repair to assure that the board is operating properly before it is returned to service.

3.2.1 Audio Amplification

3.2.1.1 Specifications

The audio section of the audio and squelch board combined with the separate audio power amplifier transistors will provide at least 10 watts (5 wattts local) audio output at less than 5 per cent distortion from a 3.0 kHz deviated, 1 kHz modulated on-frequency signal applied to the station antenna receptacle.

3.2.1.2 Procedure

Step 1. Replace the speaker with an 8 ohm, 15 watt non-inductive resistor. In local control stations, disconnect the autotransformer.

Step 2. Set the SQUELCH control fully counterclockwise (unsquelched). "Private-Line" stations must also be PL disabled.

Step 3. Connect an rf signal generator to the station antenna receptacle and adjust it to the receiver frequency.

Step 4. Adjust the signal generator for 1000 microvolt output, modulated with 1000 Hz tone at ±5.0 kHz deviation.

Step 5. Connect an AC voltmeter to pin J903-7 at the receiver interconnect board.

Step 6. Adjust the line level control R203 for 175 mV ac rms.

Step 7. Reduce the deviation to ±3.0 kHz.

Step 8. Connect an AC voltmeter across the 8 ohm resistor.

Step 9. Adjust the VOLUME control until 9.0 volts ac rms is read on the ac voltmeter (this represents 10 watts).

Step 10. Measure distortion at 10 watts audio power output. It should be less than 5%

3.2.2 Squelch Control

3.2.2.1 Specifications

3.2.2.1.1 The squelch section of the receiver audio and squelch board shall enable the audio section when an rf signal level greater than 6 dB noise quieting (one-half the discriminator output level with no signal input) is applied to the receiver with the SQUELCH control set at threshold. When the signal is removed from the station, the audio channel shall become disabled after approximately 150 milliseconds. When an input signal greater than that required for approximately 20 dB noise quieting is removed from the station, the audio channel shall become disabled immediately.

3.2.2.1.2 When the SQUELCH control is turned fully clockwise (tight squelch) an input signal that produces about 20 dB noise quieting shall be required to enable the audio channel.

3.2.2.1.3 The squelch section shall inhibit audio output when no input signal is received.

3.2.2.1.4 In "Private-Line" stations, the squelch section of the receiver's audio and squelch board shall perform as described in paragraphs 3.2.2.1.1, .2, and .3 while the radio set is PL disabled.

3.2.2.1.5 In PL operation, the squelch section shall inhibit audio output when the proper PL code is not received, regardless of the input signal strength.

3.2.2.2 Procedure

3.2.2.2.1 Carrier Squelch Stations

Step 1. Turn the station on and adjust the SQUELCH control clockwise from the full counterclockwise position until the receiver just quiets (threshold squelch).

Step 2. Measure the resistance of U202-6 and -7 with reference to ground. Both pins should be less than 1000 ohms.

NOTE

Erroneous readings will be obtained in resistance measurements if the voltage between the ohmmeter probes exceeds approximately 5.0 volts dc.

Step 3. Connect a signal generator to the station antenna receptacle and adjust it to the receiver frequency. Modulate the generator output with a 1000 Hz tone at ± 3.0 kHz deviation.

Step 4. Increase the signal generator output slowly until the receiver just unsquelches. Remove the modulation from the signal generator. Unsquelching should occur at a generator output that produces 6 dB noise quieting, or less.

Step .5 Measure the resistances of U202-6 and -7 with reference to ground. Both pins should be greater than 200,000 ohms.

Step 6. Increase the signal generator output until approximately 12 dB noise quieting is obtained. Remove the rf signal from the station input either by turning off the signal generator or by using a relay in series with the signal generator output. A long "squelch tail" should occur. If a calibrated, triggered sweep oscilloscope is available for measurement, the duration of the "squelch tail" should be approximately 150 milliseconds as measured at the speaker.

Step 7. Increase the signal generator output to produce 30 dB noise quieting. Turn off the rf signal and note the "squelch tail" duration. It should be no more than a "click". The duration should be less than 10 milliseconds.

Step 8. Turn the SQUELCH control fully clockwise (tight squelch).

Step 9. Adjust the signal generator output level until the station just unsquelches. Unsquelching should occur at a generator output that produces approximately 20 dB noise quieting.

3.2.2.2.2 "Private-Line" Stations

Step 1. Disabled the PL circuitry.

Step 2. Perform previously described carrier squelch station procedure.

Step 3. Return the station to PL operation. On stations using "AND" squelch operation, also turn the SQUELCH control fully counterclockwise during this test.

Step 4. Vary generator output between minimum output and 1000 microvolt output while checking the resistances of U202-6 and -7 with reference to ground. Both resistances should remain at less than 1000 ohms.

Step 5. Modulate the on-frequency generator output with a PL code for ± 0.5 to ± 1 kHz deviation and 1000 Hz tone for ± 3.0 kHz overall deviation.

Step 6. Increase the signal generator output slowly until the receiver just unsquelches. Unsquelching should occur at a generator output that produces 6 dB quieting, or less.

3.3 TROUBLESHOOTING

3.3.1 Check Input Voltages

A malfunction in the audio and squelch operation may be due to the loss of dc input voltages which can be caused by this board or another section of the station. Since there are only two input voltages applied to this board, it is advantageous to verify their presence before beginning extensive troubleshooting.

P903-1, -4	+ 9.6 V dc with respect to chassis
P903-16	Audio A + (approximately + 13.6 V dc with respect to A-)

In a negative ground system audio A- is at chassis potential. In a positive ground system, audio A+ is at chassis potential.

3.3.2 Isolating Defective Components

If tests indicate abnormal performance, a logical troubleshooting procedure should be followed to isolate the defective component efficiently. Results of performance test usually localize the malfunction to one or two stages. The accompanying troubleshooting chart summaryizes these results in a logical sequence. A few waveforms, voltage and resistance checks in the suspected circuit should readily isolate the defective component when compared with those on the schematic diagram.

3.3.3 Troubleshooting Integrated Circuits

Integrated circuits (IC's) are very reliable components and should not be replaced until all checks have proven definitely that the IC is the defective component. Make sure that the external components in the circuit are normal. The IC's on the audio and squelch board may be checked by dc voltage measurements although signal tracing with an oscilloscope is preferred.

3.3.4 Stage Gain Measurements

3.3.4.1 Squelch Circuitry

3.3.4.1.1 This troubleshooting procedure may be used to isolate a squelch malfunction occuring before the detector to a specific state. The test is performed by injecting an ac signal at the input to the squelch circuitry and noting results obtained with an ac voltmeter. Most accurate results are obtained by taking dB gain and loss measurements between points as illustrated in Figure 2. Individual point voltage checks may also be used to quickly verify proper squelch input circuitry operation but this is not an adequate test to prove the circuitry is defective (refer to the following table and Figure 2). Tolerance addition *may* cause increasing variation from the typical readings in the table as readings are taken further from the injected signal point.

3.3.4.1.2 The following procedure may be used for loss and gain or signal level measurements while injecting a 3 kHz or 30 kHz signal. In "Private-Line" radios, PL operation will not affect this test.

Step 1. Turn the VOLUME control fully counterclockwise (off), or to a comfortable listening level, if desired.

Step 2. Turn the SQUELCH control fully clockwise (squelched) and turn the station on.

Step 3. Inject a 1000 microvolt, on-channel signal at the station antenna receptacle. This "quiets" the discriminator output and prevents erroneous test readings.

Step 4. Inject a 3 kHz, 10 millivolt rms signal at the receiver audio & squelch board at P903-9.

Step 5. Take loss and gain measurements or signal level measurements as required.

Step 6. Repeat the preceding test using a 30 kHz signal in place of the 3 kHz signal in Step 4.

3.3.4.2 Audio Circuitry

AC voltage measurements and waveforms are given where applicable on the schematic diagram. Refer to this diagram for pertinent information when taking audio stage gain measurements.

AC Voltmeter Connected to U202-Pin	AC Voltmeter Reading with 3 kHz Signal Input (mV)	AC Voltmeter Reading with 30 kHz Signal Input (mV)
15	3.5	9.5
1	40	110
2	7	85
3	80	950
4	24	750

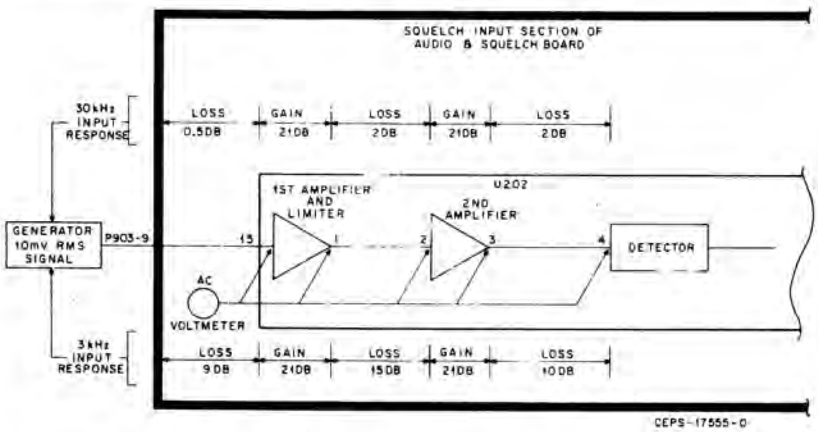
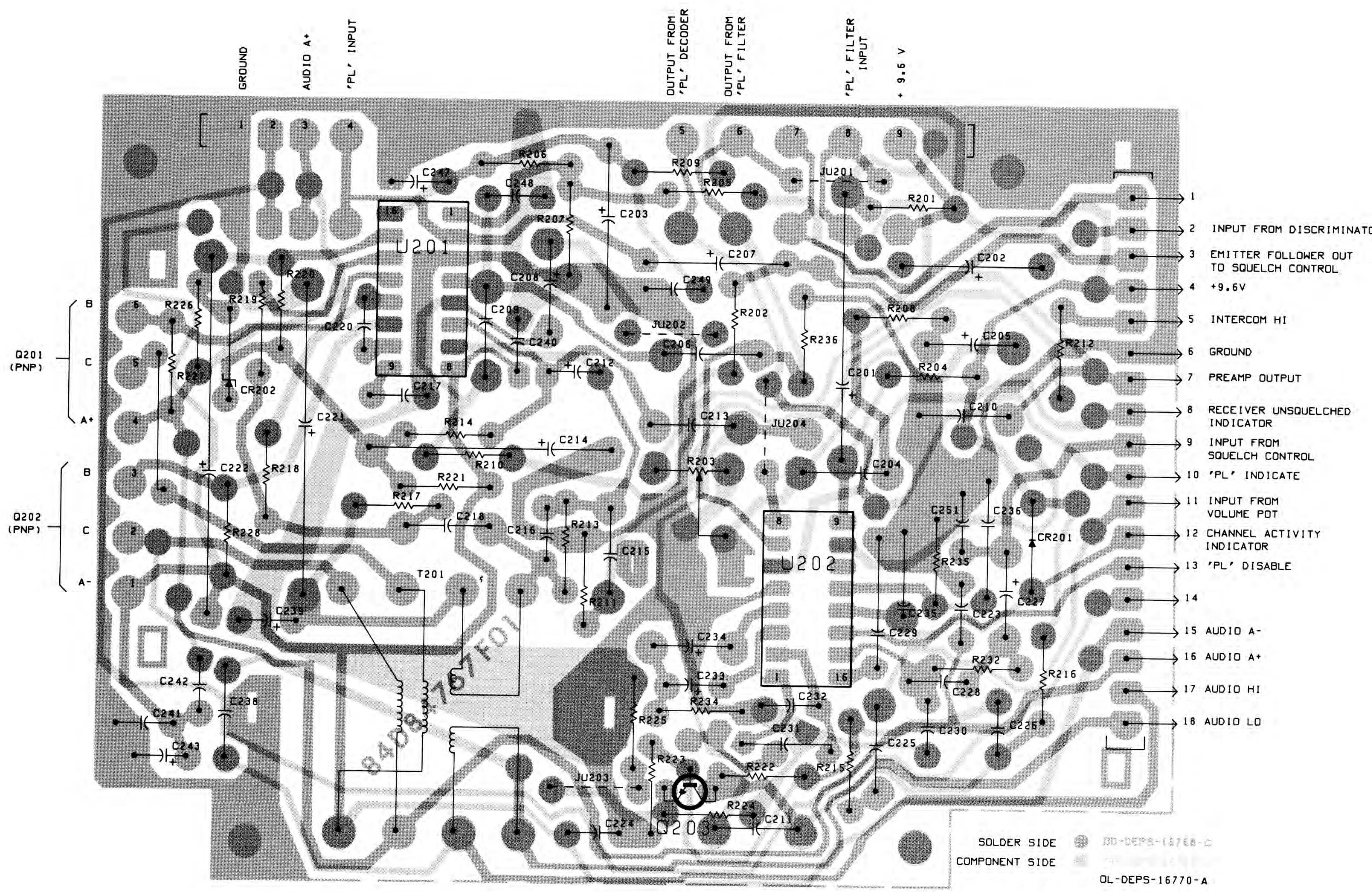


Figure 2. Squelch Circuitry Stage Gain Measurements

"MICOR" "SENSITRON"
UHF RECEIVER
AUDIO & SQUELCH BOARD

MODEL TRN6006A, AV, 7A

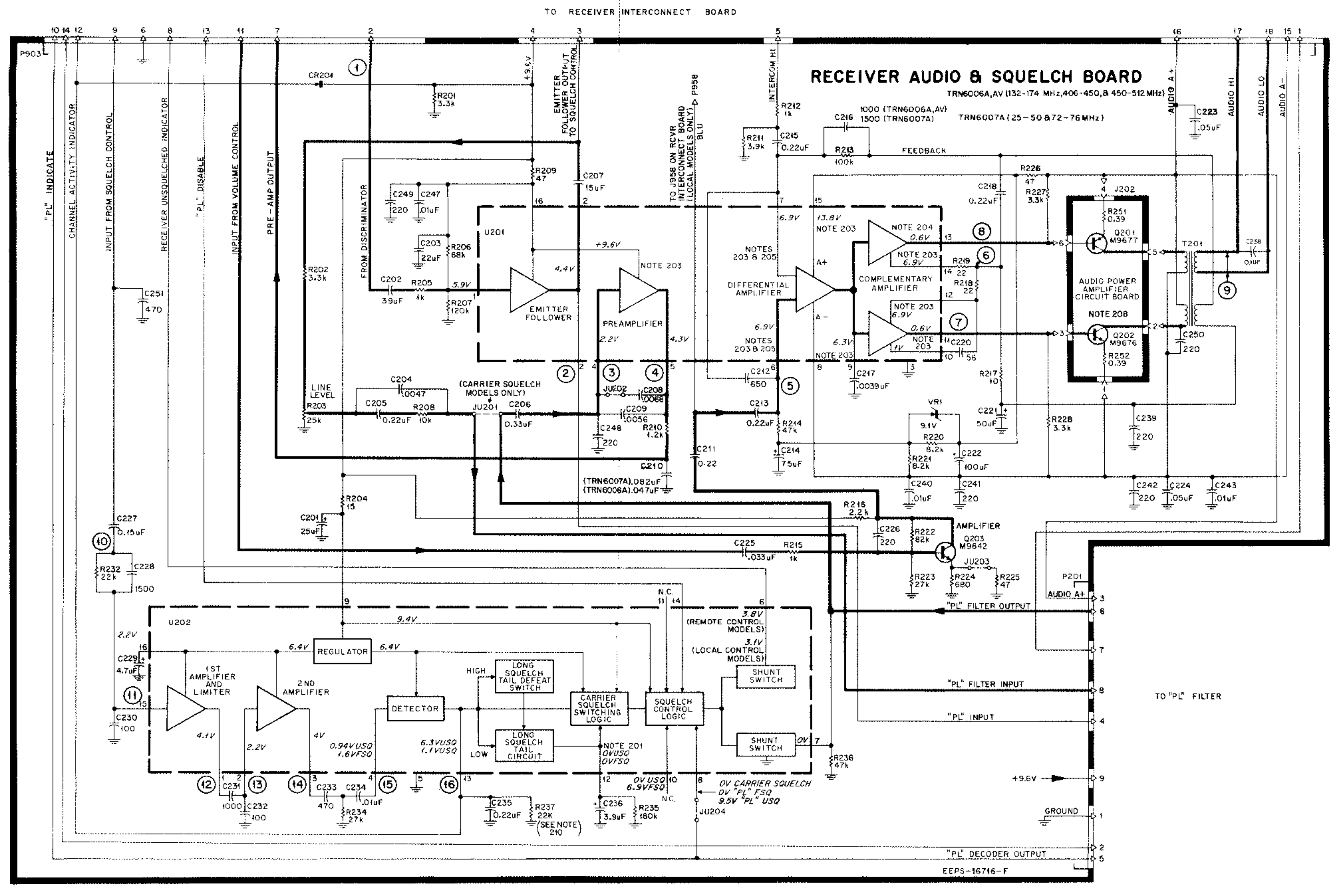


SHOWN FROM SOLDER SIDE

TRN6006A, AV, 7A Audio and Squelch Board
Circuit Board Detail, Schematic Diagram,
and Parts List
Motorola No. ***PEPS-16952-H***
(Sheet 1 of 2)
7/15/81-PHI

"MICOR" "SENSITRON" UHF RECEIVER AUDIO & SQUELCH BOARD

MODEL TRN6006A, AV, 7A



NOTES:

201. +5.6 VOLTS WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH (I.E., APPROXIMATELY 6 dB QUIETING SIGNAL WITH SQUELCH CONTROL AT THRESHOLD).
202. WHERE MORE THAN ONE VOLTAGE READING APPEARS:
  USQ = RECEIVER UNSQUELCHED
  FSQ = RECEIVER FULLY SQUELCHED
203. VOLTAGE MEASURED WITH RESPECT TO A–.
204. VOLTAGE MEASURED WITH RESPECT TO A+.
205. VOLTAGES AT U201-6 AND -7 MUST BE THE SAME VALUE.
206. UNLESS OTHERWISE STATED:
  CAPACITOR VALUES ARE IN PICOFARADS.
207. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES ± 10% MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND.
208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD.
209. JUMPER JU204 MUST BE REMOVED FOR "AND SQUELCH" OPERATION. (SEE "RECEIVER INTERCONNECT UNIT" SECTION). SEE JUMPER TABLE FOR JUMPER USE.

JUMPER TABLE

JUMPER	USE
JU201	CONNECTED IN CARRIER SQUELCH STATIONS.
JU202	CONNECTED IN CARRIER SQUELCH STATIONS.
JU203	CONNECTED TO PROVIDE 10 WATTS AUDIO AT SPEAKER WITH LINE LEVELS OF -10 dBM OR LESS (REMOTE CONTROL STATIONS ONLY).
JU204	CUT FOR "AND SQUELCH"

210. R237 USED ONLY IN IMTS APPLICATIONS (TRN6006AV)

FUNCTION

— Provides amplification of the low level audio output signal from the receiver rf and i-f.

— Provides audio squelch action

Model Usage

Receiver Frequency Range	TRN6006A	TRN6007A
25-50 MHz		X
72-76 MHz		X
132-174 MHz	X	
406-512 MHz	X	

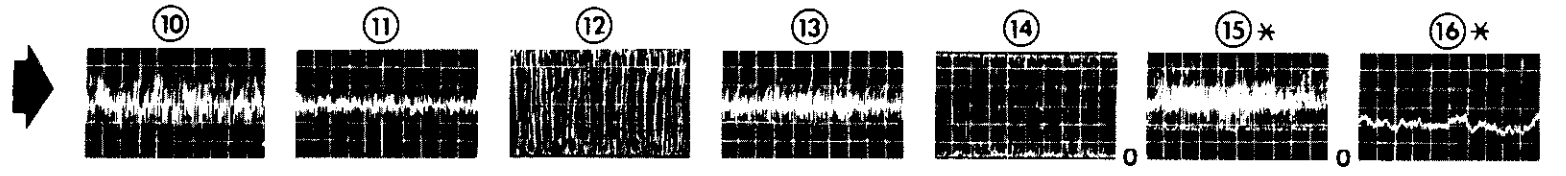
ALL SQUELCH CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY = 0.5 V/DIV.
2. HORIZONTAL DEFLECTION = 2 msec/DIV.
3. *SQUELCH CONTROL FULLY CLOCKWISE (ON). NO EXTERNAL* SIGNAL APPLIED.

*4. WAVEFORMS 15 AND 16 ARE DC COUPLED WITH ZERO AT BOTTOM, OTHERS AC COUPLED.

EPS-6534-O

SQUELCH CIRCUIT WAVEFORMS

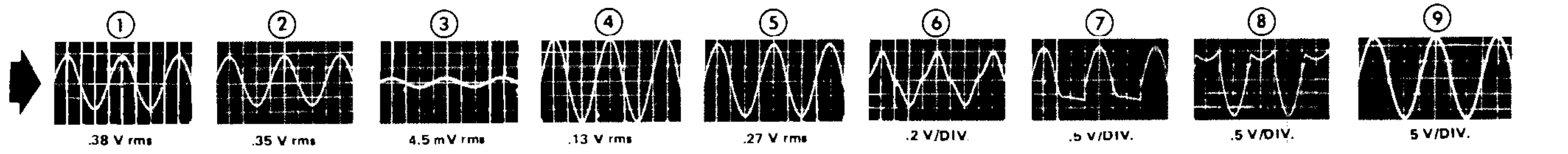


ALL AUDIO CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER THE FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM.
2. HORIZONTAL DEFLECTION = .25 msec/DIV.
3. SQUELCH CONTROL FULLY COUNTERCLOCKWISE (OFF). 1000 uV RF SIGNAL INPUT MODULATED WITH 1000 Hz TONE WITH +3.0 kHz DEVIATION.
4. VOLUME CONTROL SET FOR 9.0 V rms AT LOAD.
5. OUTPUT TERMINATED IN 8 OHM LOAD.
6. R203 SET FOR 175 mV AT PIN 7 WITH +5 kHz DEVIATION (1 kHz TONE).

EPS-8804-O

AUDIO CIRCUIT WAVEFORMS



PARTS LIST SHOWN ON BACK

TRN6006A, AV, 7A Audio and Squelch Board Circuit Board Detail, Schematic Diagram, and Parts List
Motorola No. PEPS-16952-H
(Sheet 2 of 2)
7/15/81-PHI

AUDIO & SQUELCH BOARD

PARTS LIST

LEGEND

L = 25-50 & 72-76 MHz
H = 132-174 MHz, 406-450 MHz, 450-512 MHz

TRN6007A Receiver Audio & Squelch Board
(25-50 & 72-76 MHz)
TRN6006A Receiver Audio & Squelch Board
(132-174 MHz, 406-450 MHz, 450-512 MHz,

PL-3269-F

This parts list covers two models of the Receiver Audio & Squelch Board. Where differences exist a letter suffix L or H is added to the reference symbol to show the applicable unit.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; uF; ±10%; 100 V; unl. stated
C201	23-83210A01	25 +150-10%; 25 V
C202	23-82783B36	39; 10 V
C203	23-84762H10	22 ±20%; 15 V
C204	8-83813H12	.0047
C205	8-83813H11	0.22; 75 V
C206	8-83813H29	0.33; 50 V
C207	23-82783B24	15; 25 V
C208	8-83813H01	.0068
C209	8-83813H26	.0056 ±5%; 50 V
C210L	8-82905G45	.082; 50 V
C210H	8-82905G03	.047; 50 V
C211	8-83813H11	0.22; 75 V
C212	21-848236	650 pF ±5%; 500 V
C213	8-83813H11	0.22; 75 V
C214	23-84081B03	75 +150-10%; 15 V
C215	8-83813H11	0.22; 75 V
C216L	21-82187B20	1000 pF
C216H	21-82187B31	1500 pF
C217	21-82187B43	.0039; 200 V
C218	8-83813H11	0.22; 75 V
C219		NOT USED
C220	21-83406D46	56 pF ±5%; 500 V; N150
C221	23-84081B01	50 +100-10%; 25 V
C222	23-83210A08	100 +150-10%; 25 V
C223, 224	21-82372C04	.05 +80-20%; 25 V
C225	8-82905G16	.033
C226	21-859942	220 pF ±5%; 500 V
C227	8-83813H07	0.15; 75 V
C228	21-84426B63	1500 pF ±5%
C229	23-84762H07	4.7 ±20%; 10 V
C230	21-84426B06	100 pF ±5%; 500 V
C231	21-84493B05	1000 pF; 200 V; N2200
C232	21-82133G03	100 pF ±5%; 500 V; N750
C233	21-84426B11	470 pF ±5%; 500 V
C234	8-83813H31	.01; 100 V
C235	8-83813H11	0.22; 75 V
C236	23-84762H08	3.9 ±20%; 15 V
C237		NOT USED
C238	21-82372C01	0.1 +80-20%; 25 V
C239	21-83596E10	220 pF ±20%; 500 V
C240	21-832501	.01 +60-40%; 250 V
C241, 242	21-83596E10	220 pF ±20%; 500 V
C243	21-832501	.01 +60-40%; 250 V
C244	21-82133G03	100 pF ±5%; 500 V
C245, 246		NOT USED
C247	21-832501	.01 +60-40%; 250 V
C248 thru 250	21-83596E10	220 pF ±20%; 500 V
C251	21-84426B11	470 pF ±5%; 500 V
		DIODE: (SEE NOTE)
CR201	48-83654H01	silicon
		CONNECTOR, plug:
P201		consists of contact pins mounted on circuit board
		TRANSISTOR: (SEE NOTE)
Q203	48-869642	NPN: type M9642
		RESISTOR, fixed: ±5%; 1/4 W; unl. stated
R201, 202	6-124A61	3.3k
R203	18-83083G24	variable: 25k ±30%
R204	6-124C05	15 ±10%

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R205	6-124A49	1k
R206	6-124A93	68k
R207	6-124A99	120k
R208	6-124A73	10k
R209	6-124C17	47 ±10%
R210	6-124A51	1.2k
R211	6-124A63	3.9k
R212	6-124A49	1k
R213	6-124C97	100k ±10%
R214	6-124A89	47k
R215	6-124A49	1k
R216	6-124A57	2.2k
R217	6-124C01	10 ±10%
R218, 219	6-124A09	22
R220, 221	6-124A71	8.2k
R222	6-124A95	82k
R223	6-124A83	27k
R224	6-124A45	680
R225, 226	6-124C17	47 ±10%
R227, 228	6-124A61	3.3k
R229 thru 231		NOT USED
R232	6-124A81	22k
R233		NOT USED
R234	6-124A83	27k
R235	6-124D04	180k ±10%
R236	6-124C89	47k ±10%
R237	6-124A81	22k
		TRANSFORMER, AF:
T201	25-84083B02	pri: split winding; total res 0.5 Ohms max sec: res 0.8 Ohms max feedback: res 2 Ohms max
		INTEGRATED CIRCUIT: (SEE NOTE)
U201	51-82848M70	type M4870
U202	51-84561L79	type M6179
		DIODE: (SEE NOTE)
VR1	48-82256C38	Zener; 9.1 V; 400 mW
	NON-REFERENCED ITEMS	
	42-84284B01	RETAINER; 4 req'd.
	3-138162	SCREW, tapping: Phillips rd. hd., 4-40 x 3/8"; 4 req'd. (used for mounting Retainers)
	55-84300B01	HANDLE (long)
	55-84300B02	HANDLE (short)
	29-84028H01	TERMINAL, contact; 18 req'd. (long)
	29-84028H02	TERMINAL, contact; 24 req'd. (short)

NOTE: Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MOTOROLA INC.
Communications
Group

AUDIO POWER AMPLIFIER

MODEL TLN4290B

1. DESCRIPTION

The audio power amplifier provides the required power to drive an 8-ohm speaker with 10 watts of audio power, or a 16-ohm speaker with 5 watts of audio power, with less than 5% overall distortion. Two complementary power transistors (NPN and PNP types), operating class AB, with two current limiting resistors, develop this power. The audio drive from the audio and squelch board is routed to this board, amplified, and then returned to the audio and squelch board, where it is applied to the audio output transformer.

The aluminum transistor mounting plate is anodized with a thin, very tough material. This mounting plate provides excellent electrical insulation and thermal conduction properties between the transistors and the heatsink.

2. SERVICING

a. Performance Checks

Performance checks on this board consists of taking resistance readings as is done for any transistor or resistor. It should be noted, however, that many VTVM's and solid-state multimeters do not have sufficient voltage at the test probes to forward bias a transistor junction into conduction and, therefore, should not be used. An inexpensive volt-ohm meter of 1,000 to 20,000 ohms-per-volt sensitivity is sufficient for performing these checks.

NOTE

Do not insert meter test probe tips into female connectors on the board. To do so could cause damage to the connectors and result in poor electrical interconnection with the audio and squelch board.

b. Transistor Replacement

Care must be exercised to prevent damage (such as a scratch) to the mounting plate anodizing at the transistor-mounting plate interface. Should the anodizing in this area become scratched, original performance can only be restored by the use of a new anodized plate. The plate can *not* be "repaired" by the use of any type of insulating washer without a loss in thermal conduction capability.

Factory replacement transistors are supplied with pre-formed leads to properly fit onto the aluminum mounting plate and circuit board. A new nylon shoulder washer is also included.

Step 1. Apply a thin, even coat of silicon grease to the metallic area of the transistor.

Step 2. Mount the transistor using the *new* nylon shoulder washer. Do not solder leads at this time. Tighten the transistor mounting screw.

Step 3. Solder transistor leads to printed circuit board.

TRANSISTOR RESISTANCE MEASUREMENT CHECK
(BOARD REMOVED FROM RADIO — TRANSISTORS MOUNTED ON BOARD)

Ohmmeter Connections		**Proper Resistance**	
Positive Lead Connected to	**Negative Lead Connected to**	**P-N-P Transistor**	**N-P-N Transistor**
Base	Emmitter, then Collector	Infinite	5-30 Ohms, Both Cases
Emmitter, then Collector	Base	5-30 Ohms, Both Cases	Infinite
Collector	Emitter	Infinite	Infinite
Emitter	Collector	Infinite	Infinite

Failure to obtain these results indicates a defective transistor which must be replaced.

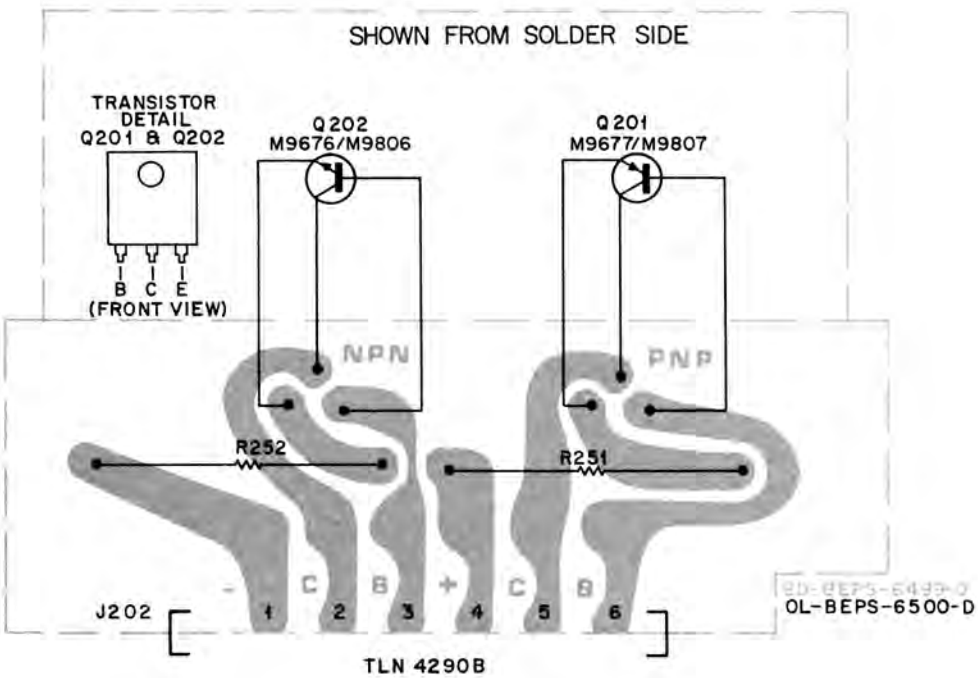
AUDIO POWER AMPLIFIER

AUDIO POWER AMPLIFIER

MODEL TLN4290B

FUNCTION

-- Provides up to 10 watts audio output

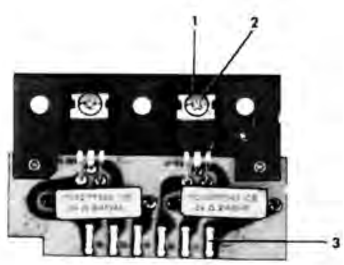


REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

AUDIO POWER AMPLIFIER

TLN4290B Audio Power Amplifier PL-1061-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J202		CONNECTOR, receptacle: c/o; 9B83011H01 PIN, female; 6 req'd
		TRANSISTOR: (SEE NOTE)
Q201	48R869807	PNP; type M9807
	or48R869677	PNP; type M9677
Q202	48R869806	NPN; type M9806
	or48R869676	NPN type M9676
		RESISTOR, fixed: ±10%; 3 W:
R251	17D82177B49	0.39
R252	17D82177B49	0.39
MECHANICAL PARTS		
1	4B84180C01	WASHER, shoulder
2	3S129841	SCREW, machine: No. 4-40 x 1/4"; incl. lockwasher
3	9B83011H01	PIN, female



FAEPS-6502-O

AUDIO POWER AMPLIFIER

Motorola No. PEPS-28290-O
4/15/79- PHI

TECHNICAL CHARACTERISTICS

FREQUENCY DETERMINING DEVICE	"Vibrasponder" resonant reed
"PL" TONE FREQUENCY	Selected from 67-210 Hz range
TONE ACCURACY	±0.15%
TONE BANDWIDTH	Approximately 1 Hz
TONE SENSITIVITY	0.25 volt ac rms reed drive
OUTPUT	9.5 volts dc switched
POWER REQUIREMENT	9.6 volts dc @15 milliamperes

1. DESCRIPTION

This decoder provides a dc output voltage to unsquelch the receiver's audio section only when the proper PL tone is received. The decoder will respond only to a specific, continuous low-frequency tone from a transmitter in the same "Private-Line" network.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 "PL" Tone Present

2.1.1.1 The PL filter passes low frequency PL tones and attenuates signals above 300 Hz. The noise switch shorts out high frequency noise signals. The tone from the PL filter is limited to a fixed level by the amplifier/clipper and then applied to the "Vibrasponder" resonant reed which vibrates when the tone is the same frequency as the reed's resonant frequency. When the reed is vibrating, the tone is applied to a detector which develops a dc output which activates the output switch. When the output switch is activated, 9.5 volts is present at its output to enable the audio circuits. The output also activates the noise switch.

2.1.1.2 A separate high pass audio filter is located on the PL decoder board which allows voice signals above 300 Hz to pass but blocks PL tones. This filter is connected in series with the audio signal path to prevent the PL tone from being heard in the speaker.

2.1.2 "PL" Tone Absent

When no PL tone is present, the output switch is off. The output voltage is 0 volts at this time which inhibits the squelch circuit to prevent an audio output to the speaker. The noise switch is off at this time which allows high frequency noise to bypass the PL filter. The presence of high frequency noise desensitizes the amplifiers and acts as an "anti-falsing" feature to prevent a random low-frequency noise signal from activating the resonant reed.

2.2 DECODER INPUT CIRCUITS

2.2.1 The receiver discriminator output signal consists of noise only when no carrier signal is being received. With a carrier signal input to the receiver, the noise is reduced and voice audio or voice audio and PL tone added.

2.2.2 These input signals are routed through the low pass filter and noise gate circuit. A receiver input signal that is modulated ±0.5 kHz with PL tone produces a nominal 60 millivolts rms signal at the input to the decoder. The low pass filter consisting of L801, C802, C803 and C805 attenuates sharply all signals above 300 Hz. Thus, voice and noise signals above 3000 Hz are blocked but PL tones are passed. High pass filter C801, R803, and C807 presents a parallel path for high frequency noise whenever the decoder is not activated. This condition is desirable so that low frequency noise (only) will not falsely activate the decoder. When the proper tone has been received and the decoder is activated, noise switch Q807 acts as a short and grounds all high frequency signals before they reach amplifier Q801.

2.3 INPUT AMPLIFIER CIRCUITS

Amplifier Q801 amplifies noise and PL tone signals which are coupled to amplifier/clipper Q802. Diode CR801 and the base emitter junction of Q802 limit both the positive and negative swing of the signal to a maximum amplitude. The amplified output of Q802 provides a constant amount of drive even though the amount of PL tone deviation from various transmitters is not constant. It also limits the noise signals to prevent oversensitivity to noise signals which could falsely operate the "Vibrasponder" resonant reed. "Vibrasponder" driver Q803 operates as an emitter follower to provide current drive to the low impedance "Vibrasponder" resonant reed.

2.4 "VIBRASPONDER" RESONANT REED

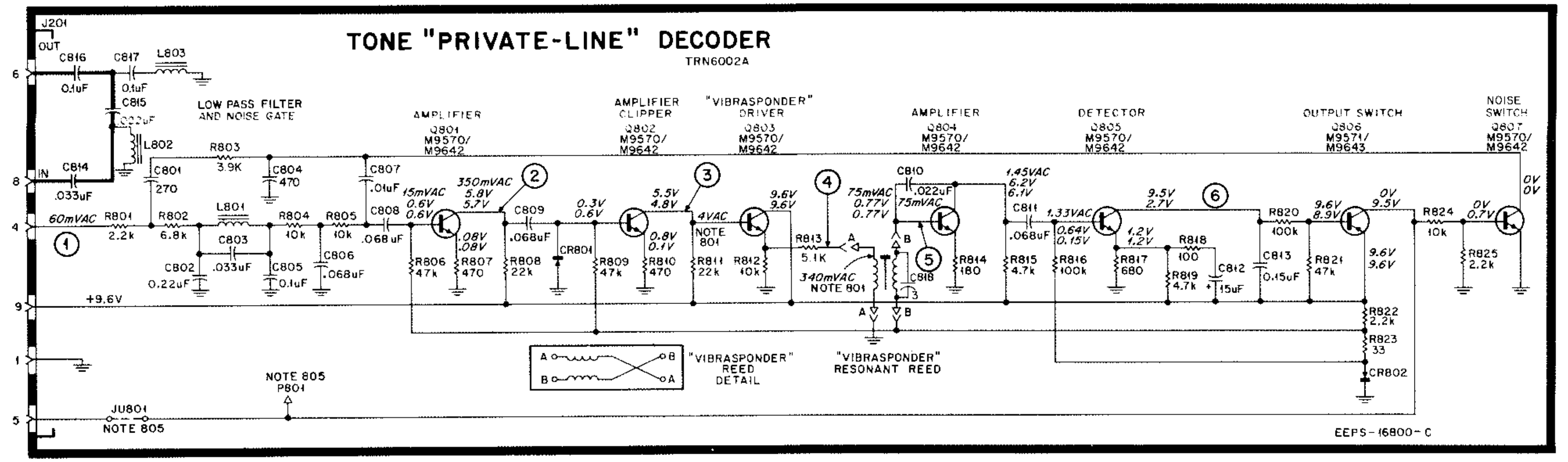
At resonance, the reed acts as a high Q transformer coupling energy from the primary to the secondary winding. At all other frequencies, the reed will not vibrate and no energy is coupled to the secondary winding.

2.5 OUTPUT CIRCUIT

When the proper PL tone is applied to the reeds, it develops a sinusoidal wave output at its resonant frequency. This sinusoidal wave is amplified by Q804. Negative feedback through C810 maintains the sinusoidal waveform. The amplified signal is coupled to detector Q805 which converts the signal to a dc potential. Q805 is cut off with its collector voltage of 9.6 volts until the tone is applied. With tone applied, the positive most portion of the sinusoidal wave is clamped at approximately .6 volt. The positive swing of each cycle causes momentary conduction of Q805 and the collector voltage drops to near zero volts. C813 charges during the conduction period and discharges through R820 and R821 to develop a filtered dc potential which forward biases output switch Q806. With Q806 activated, 9.6 volts is gated to the output which unsquelches the receiver. Noise switch Q807 is also activated which places a short across the noise gate as explained in paragraph (b).

2.6 AUDIO FILTER

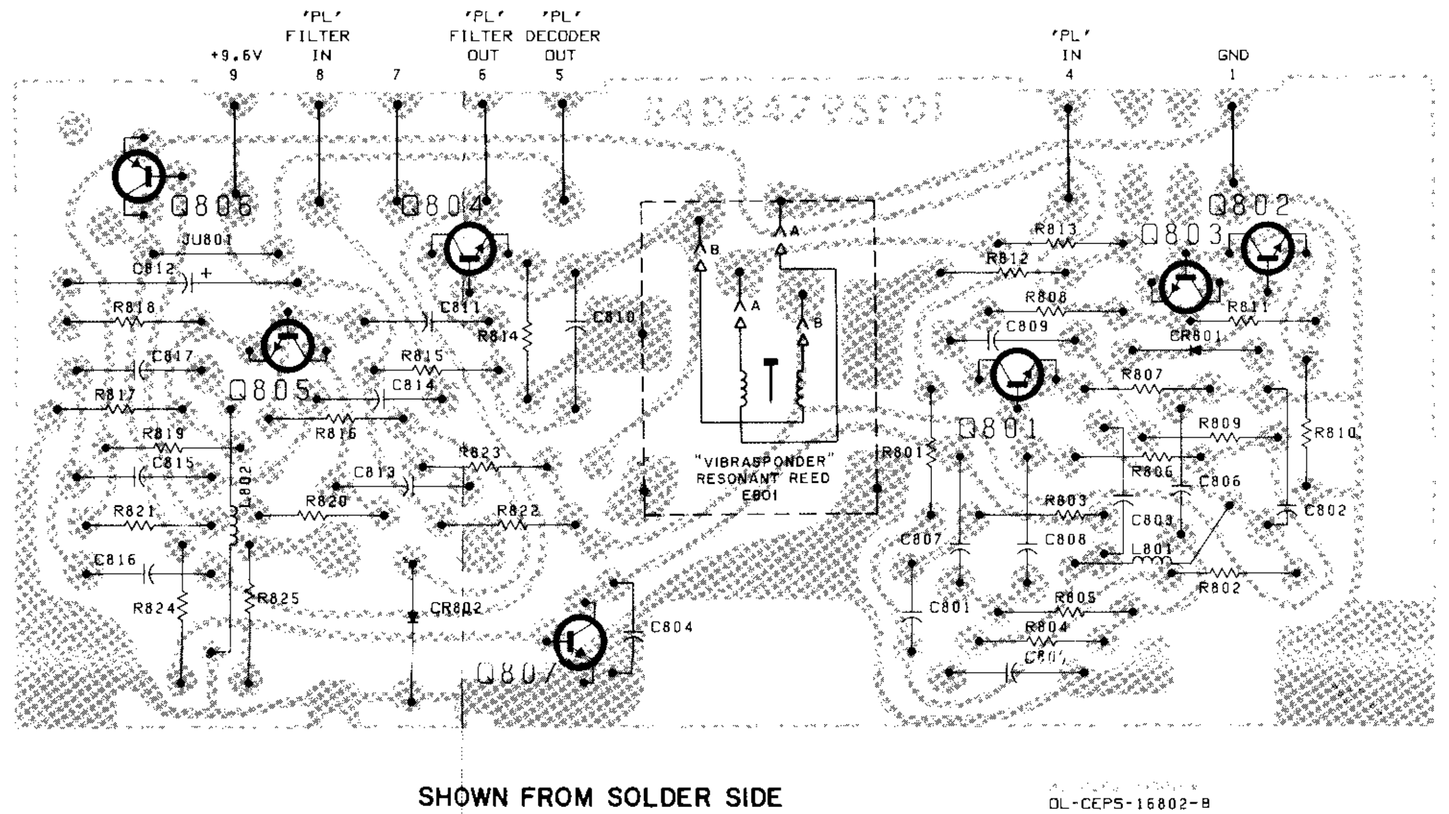
Audio and PL tone from the VOLUME control are routed through an audio filter consisting of C814-C817 and L802 and L803. The filter is electrically separate from the decoder but physically mounted on the same board. This filter is high-pass type which blocks the PL tone and passes the audio to the audio & squelch board.



NOTES:

801. DUE TO SQUARE WAVE CHARACTERISTIC SOME METERS RESPOND DIFFERENTLY. VOLTAGE SHOULD BE MEASURED WITH AN OSCILLOSCOPE.
802. AC VOLTAGE READINGS ARE RMS VALUES WITH 60 MILLIVOLTS "PL" TONE INPUT. USE HIGH IMPEDANCE (10 MEGOHM) AC VOLTMETER. MEASUREMENT MADE WITH RESPECT TO CHASSIS GROUND.
803. DC VOLTAGE READINGS TAKEN WITH HIGH IMPEDANCE (11 MEGOHM) DC VOLTMETER. TOP VALUE IS MEASURED WITHOUT "PL" TONE. BOTTOM VALUE IS MEASURED WITH 60 MILLIVOLTS "PL" TONE INPUT. MEASUREMENT MADE WITH RESPECT TO CHASSIS GROUND.
804. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS; CAPACITOR VALUES ARE IN PICOFARADS.
805. JUMPER JU801 AND P801 ARE INCORPORATED IN MODEL TRN6002A ONLY. JU801 IS REMOVED AND P801 IS USED ONLY FOR CERTAIN OPTIONAL EQUIPMENT.

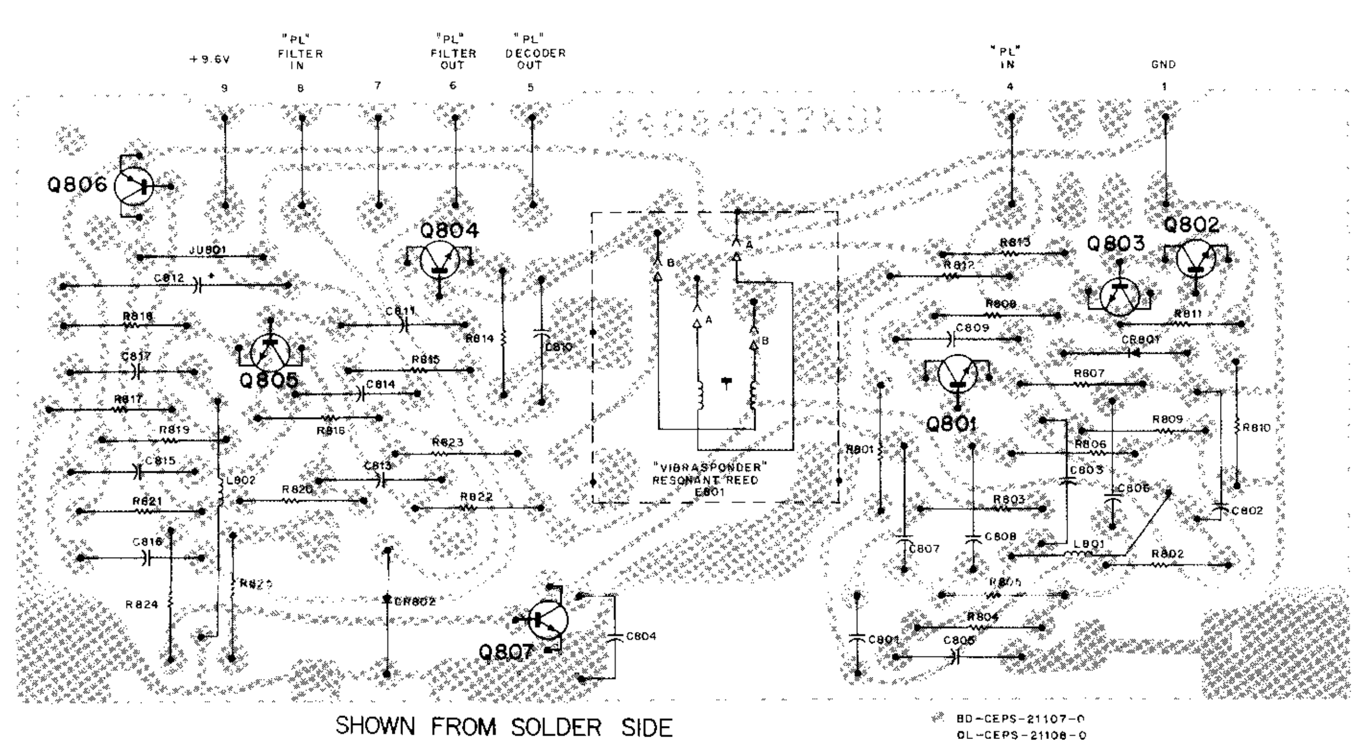
EARLIER VERSION



SHOWN FROM SOLDER SIDE

DL-CEPS-16802-B

LATER VERSION



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BD-CEPS-21107-O
DL-CEPS-21108-O

TONE "PRIVATE-LINE" DECODER

MODEL TRN6002A

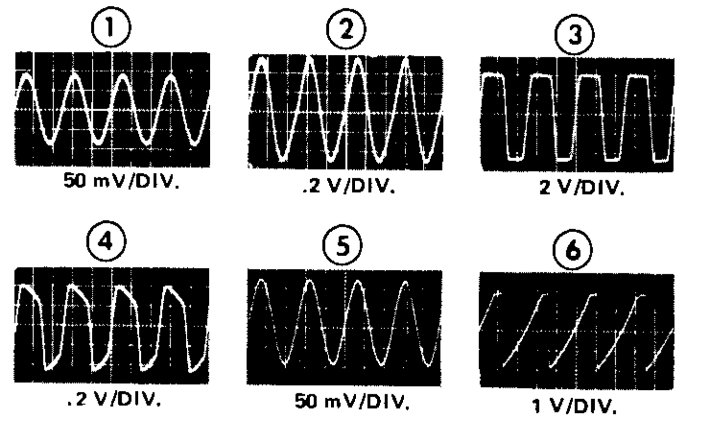
FUNCTION

Unsquelches receiver upon receipt of proper "Private-Line" tone

WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM.
2. HORIZONTAL DEFLECTION = 5 msec/DIV.
3. WITH RECEIVER OPERATING PROPERLY:
   A. INJECT 1000 uV RF CARRIER AT ANTENNA CONNECTOR.
   B. MODULATE CARRIER WITH "PL" TONE. ADJUST MODULATION FOR WAVEFORM (1); I.E. 60 mV rms (170 mV P-P) AT J201-2.
4. RECEIVER NOT USED:
   A. INJECT "PL" TONE AT J201-2.
   B. ADJUST TONE LEVEL FOR WAVEFORM (1).
5. OSCILLOSCOPE VERTICAL INPUT – AC.
6. OSCILLOSCOPE SYNC – INTERNAL.
7. MEASUREMENTS MADE WITH RESPECT TO CHASSIS GROUND.

"PL" DECODER WAVEFORMS



EPS-6182-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

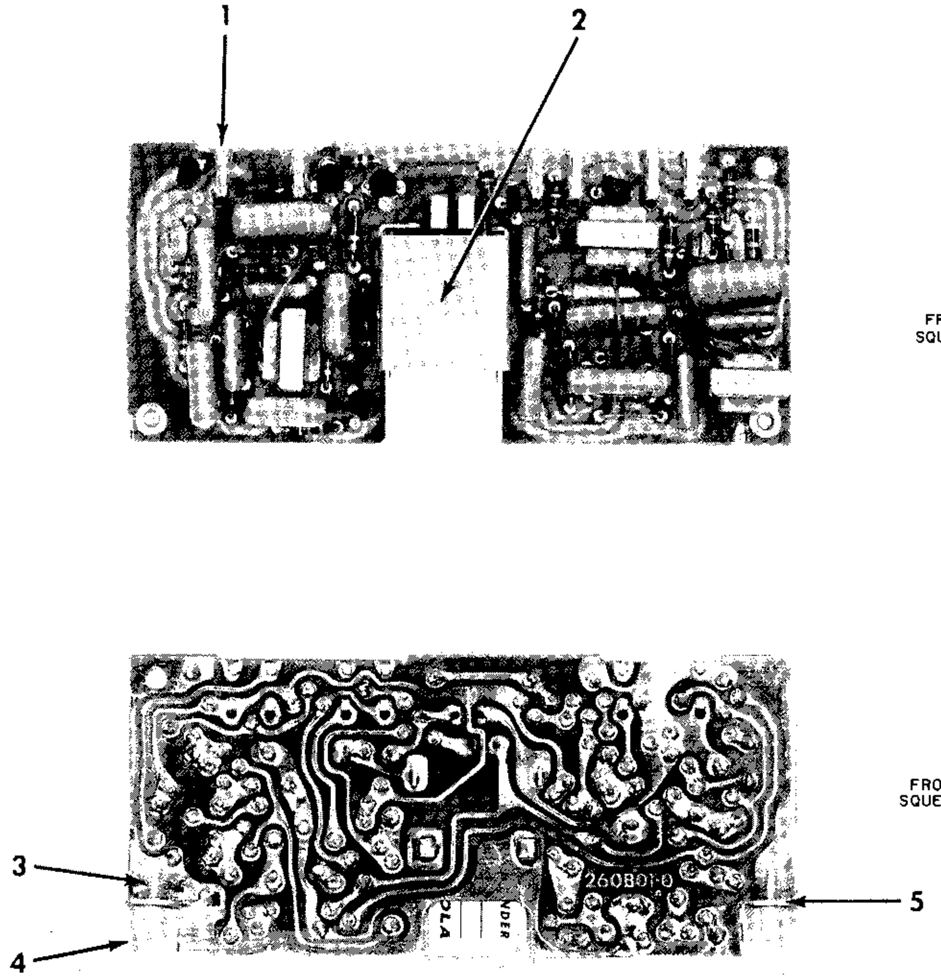
ELECTRICAL PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TRN6002A Tone "Private-Line" Decoder PL-3259-D

		CAPACITOR, fixed: uF ±10%; 50 V; unless otherwise stated
C801	21-82187B38	270 pF
C802	8-82905G32	0.22
C803	8-82905G08	.033; 100 V
C804	21-82187B39	470pF; 500 V
C805	8-83813H06	0.1; 100 V
C806	8-82905G04	.068; 100 V
C807	8-82905G01	.01
C808, 809	8-82905G04	.068; 100 V
C810	8-82905G02	.022
C811	8-82905G04	.068; 100 V
C812	23-83214C02	15 ±20%; 25 V
C813	8-82905G31	0.15
C814	8-83293B10	.033; ±5%
C815	8-83813H16	.022 ±5%
C816	8-82905G30	0.1
C817	8-82095G14	0.1 ±5%; 200 V
C818	21-83406D51	3 pF ±0.25 pF; 500 V
		DIODE: (SEE NOTE I)
CR801, 802	48-83654H01	silicon
		"VIBRASPONDER" RESONANT REED: (SEE NOTE II)
E801	TLN8381A	plug-in unit
		COIL, RF: choke
L801, 802,803	24-84003A01	6 H
		TRANSISTOR: (SEE NOTE I)
Q801 thru	48-869642	NPN; M9642
805	or 48-869570	NPN; M9570
Q806	48-869643	PNP; M9643
	or 48-869571	PNP; M9571
Q807	48-869642	NPN; M9642
	or 48-869570	NPN; M9570
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R801	6-11009C57	2.2k ±10%
R802	6-11009C69	6.8k ±10%
R803	6-11009C63	3.9k
804, 805	6-11009C73	10k ±10%
R806	6-11009C89	47k
R807	6-11009C41	470
R808	6-11009C81	22k
R809	6-11009C89	47k
R810	6-11009C41	470
R811	6-11009C81	22k
R812	6-11009C73	10k ±10%
R813	6-11009C66	5.1k
R814	6-11009C31	180
R815	6-11009C65	4.7k
R816	6-11009C97	100k
R817	6-11009C45	680
R818	6-11009C25	100 ±10%
R819	6-11009C65	4.7k
R820	6-11009C97	100k
R821	6-11009C89	47k
R822	6-11009C57	2.2k
R823	6-11009C13	33
R824	6-11009C73	10k ±10%
R825	6-11009C57	2.2k ±10%



AEPS-6105-O

MECHANICAL PARTS LIST

TRN6002A Tone "Private-Line" Decoder PL-3261-A

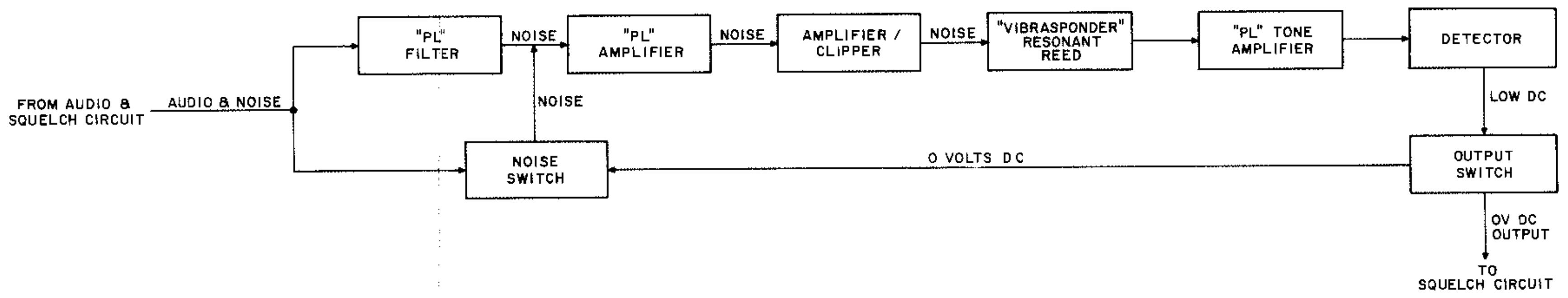
ITEM	MOTOROLA PART NO.	DESCRIPTION
1	9-83011H01	TERMINAL, pin: female; 6 req'd.
2	42-84116B01	SOCKET & CLAMP ASSY
3	3-136905	SCREW, lock: No. 4 x 5/16"; 2 req'd.
4	42-84284B01	RETAINER, Nylon: 2 req'd.
5	7-84223B01	BRACKET, retainer

NOTES:

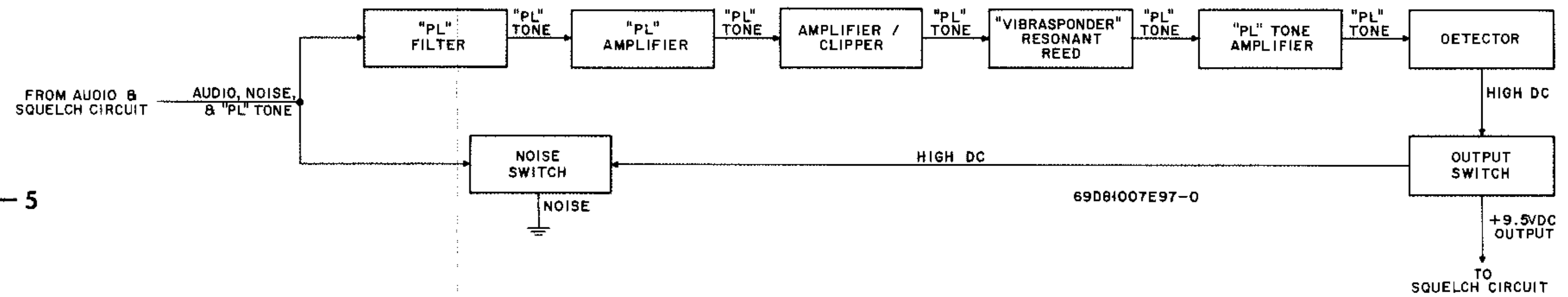
I. For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

II. The "Vibrasponder" Resonant Reed (Model TLN8381A) is not part of the decoder board. When ordering the complete board, the reed must be ordered separately.

"PL" TONE ABSENT



"PL" TONE PRESENT



REVISIONS 68P81026E73-E

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TRN6002A	C804	FROM 21-82187B26 .003 uF ±10%; 100 V TO 21-82187B39 470 pF ±10%; 500 V	Q801 BASE
	R803	FROM 6-124C73 10k ±10%; 1/4 W TO 6-124A63 3.9k ±5%; 1/4 W	
	R813	FROM 6-124A65 4.7k ±5%; 1/4 W TO 6-124A66 5.1k ±5%; 1/4 W	Q803 EMITTER

MAINTENANCE

a. Recommended Test Equipment

(1) Motorola R1010 Series RF Signal Generator. This solid-state unit provides receiver rf carrier signals.

(2) Motorola SLN6221A "PL" Tone Generator and "Vibrasender" resonant reed on the same frequency as the "Vibrasponder" resonant reed of the decoder. An audio signal generator may be used if it is accurately set to the decoder frequency. However, to obtain the accuracy necessary, the frequency should be adjusted while the signal is measured on a frequency counter.

(3) Motorola Solid-State Oscilloscope for tone signal measurement. Some measurements may be taken with a high impedance ac voltmeter.

(4) Motorola Solid-State DC Multimeter for dc voltage measurements.

b. Performance Tests

A 0.25 microvolt rf carrier signal modulated ±0.5 kHz with PL tone should unsquelch the receiver. This can be checked as follows:

(1) Connect the rf signal generator to the receiver rf input receptacle. Set the signal generator to the receiver carrier frequency, then set the output to minimum.

(2) Modulate the signal generator output ±0.5 kHz with a PL tone of the frequency stamped on the "Vibrasponder" resonant reed. The tone can be generated with a Motorola SLN6221A "PL" Tone Generator and a "Vibrasponder" resonant reed. The "Vibrasender" reed from the PL encoder may be used if it is the proper frequency.

(3) Also modulate the signal generator with an audio tone in the 300 to 3000 Hz range at ±3.3 kHz.

(4) Increase the output of the signal generator until the receiver unsquelches and the audio tone is heard on the speaker. No more than 0.25 microvolt should be required to unsquelch the receiver.

c. Troubleshooting

If the PL decoder does not operate, or operates improperly, the following hints may be helpful in locating the malfunction.

(1) Testing the "Vibrasponder" Resonant Reed

One of the first tests should be a check of the "Vibrasponder" resonant reed. Inject a 340 millivolt rms PL tone of the proper frequency directly to the primary of the reed. Use an oscilloscope or ac voltmeter to check the output across the secondary of the reed. Approximately 75 millivolts rms should be measured. If the reed is good, continue with other decoder tests.

(2) Decoder Testing

To test the decoder, inject a 1000 microvolt carrier signal into the receiver. Adjust PL modulation for 60 millivolts rms tone signal at the input to the decoder (test point 1 on the schematic diagram and circuit board detail). If the PL tone is injected directly into the decoder for testing, an rf carrier signal should be injected into the receiver to quiet the receiver noise. Otherwise, noise and PL tone will both be present and will produce erroneous readings.

With 60 millivolts PL tone input, measure signal and dc voltages at various points in the decoder to isolate the trouble. Typical values for a normally operating decoder are given on the schematic diagram. Some waveforms are not sinusoidal and should be measured with an oscilloscope. Most ac voltmeters are calibrated to read accurately only for sinusoidal signals.

If under normal operating conditions, the PL tones are heard with the speaker audio, the high pass filter on the decoder board should be checked.

NOTE

The "PL" decoder can be removed from its normal position in the receiver chassis and plugged on the front or circuitry side of the audio board. Parallel-connected pins have been provided for ease of servicing. Remove the audio board shield for access to these pins.

"DIGITAL PRIVATE-LINE" DECODER

MODEL TLN5729A

FUNCTION

1. Decodes A 23-bit binary code word to unsquelch the receiver.
2. In radios with simplex "Digital Private-Line" operation, generates a 23-bit binary code word when the transmitter is keyed.

TECHNICAL CHARACTERISTICS

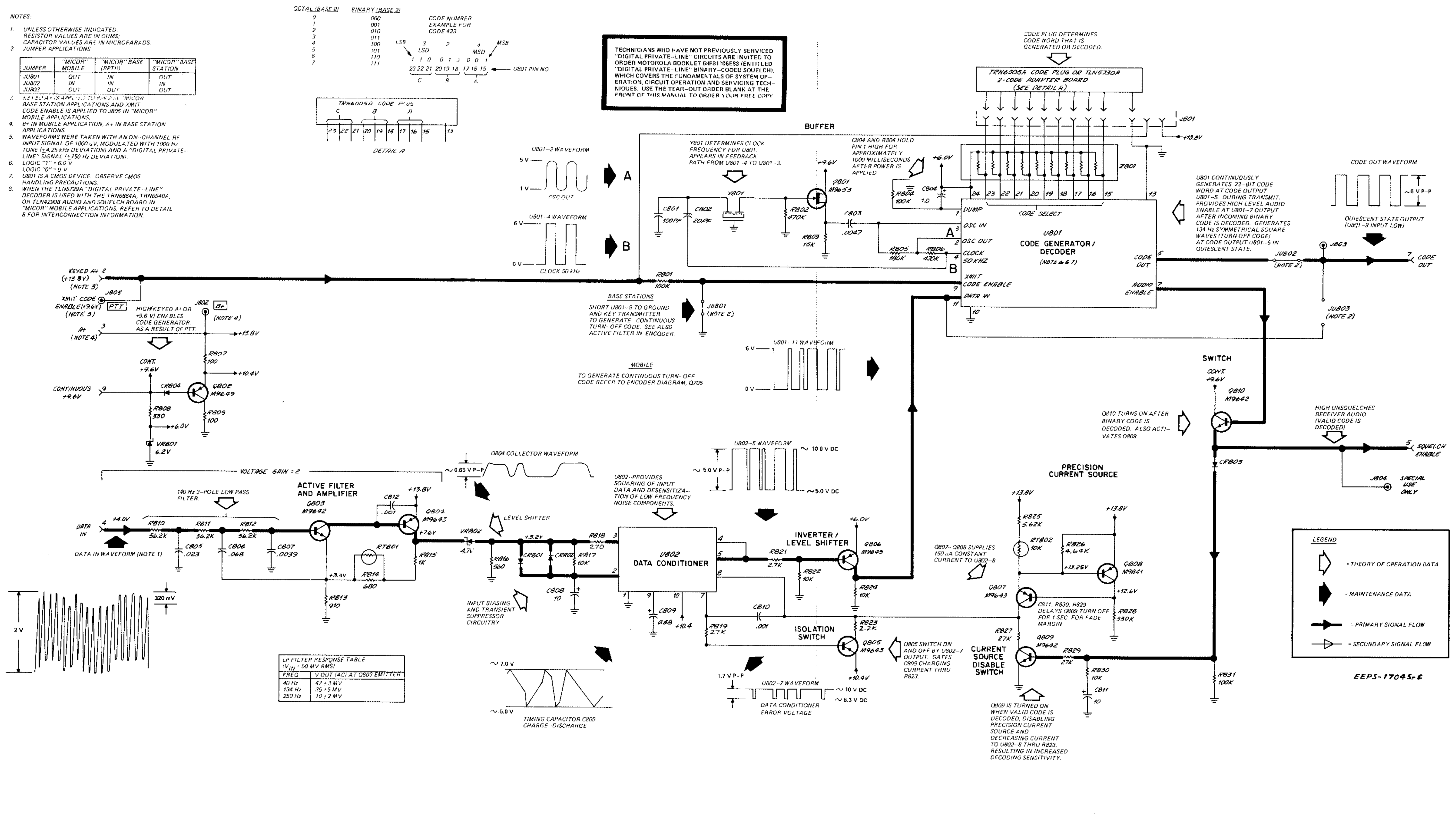
CODE DETERMINING DEVICE	TRN6005A CODE PLUG
CODE FORMAT	23-BIT WORD
CODE FREQUENCY SPECTRUM	11-67 Hz
OUTPUT	SWITCHED 5.3 V DC

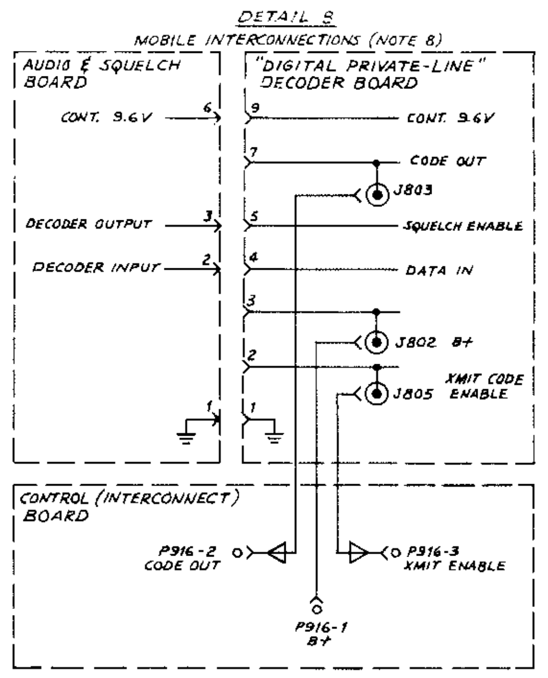
PARTS LIST

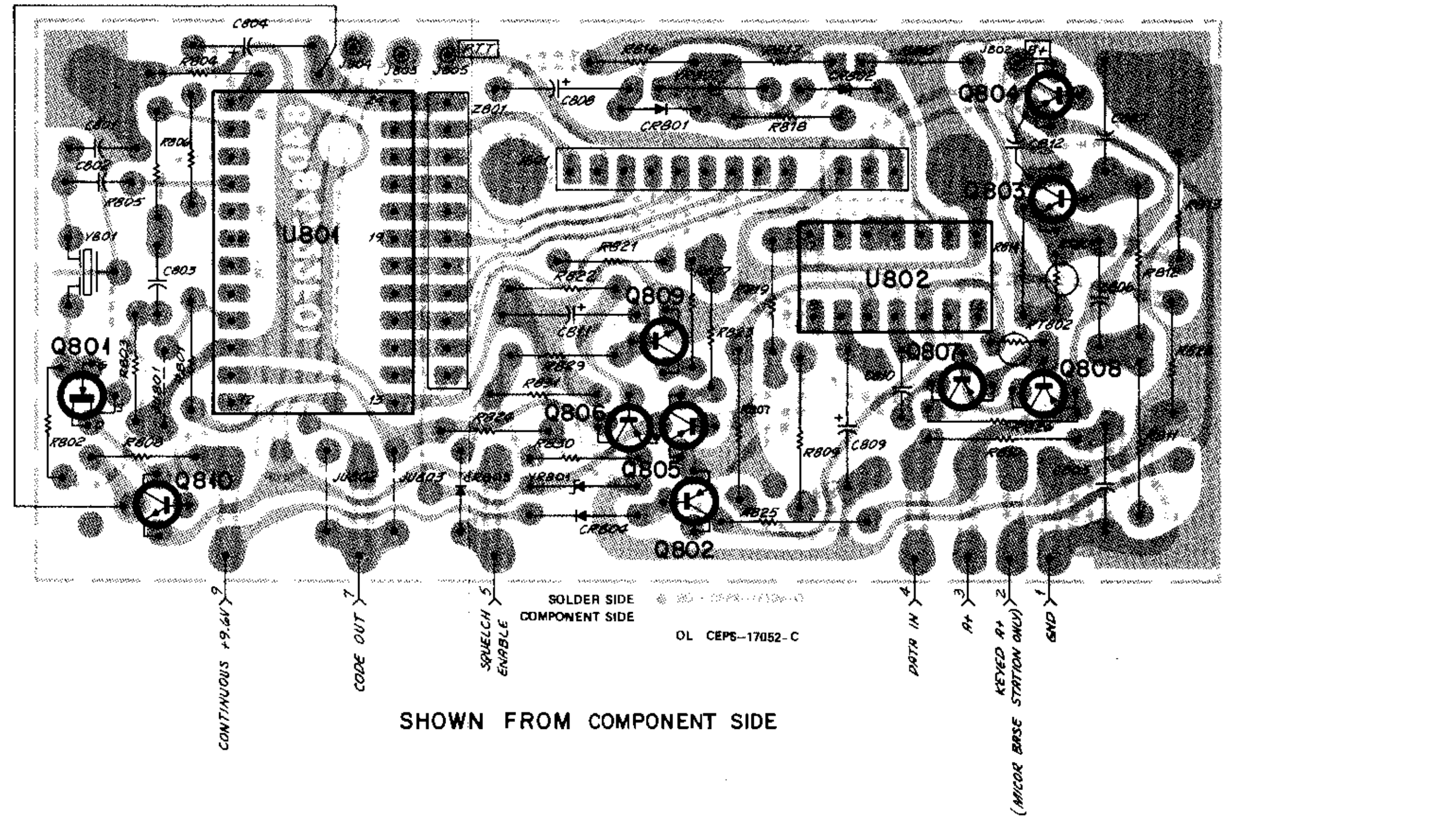
TLN5729A Decoder Circuit Board PL-3299-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF;
C801	21-83798B01	100 pF ±5%; 200 V
C802	21-82610C22	20 pF ±5%; 200 V
C803	21-82428B56	.0047 ±10%; 100 V
C804	23-82783B08	1.0 ±20%; 35 V
C805	8-82905G39	.023 ±5%; 50 V
C806	8-83813H23	.068 ±5%; 50 V
C807	8-83813H19	.0039 ±5%; 50 V
C808, 811	23-84762H03	10 ±10%; 20 V
C809	23-82783B48	0.68 ±5%; 35 V
C810	21-82187B20	1000 pF ±10%; 100 V
		DIODE: (SEE NOTE)
CR801, 802	48-84616A01	hot carrier
CR803	48-83654H01	silicon
CR804	48-82139G01	germanium
		TRANSISTOR: (SEE NOTE)
Q801	48-869653	field-effect; type M9653
Q802	48-869649	PNP; type M9649
Q803, 809, 810	48-869642	NPN; type M9642
Q804, 805, 806, 807	48-869643	PNP; type M9643
Q808	48-869841	PNP; type M9841
		RESISTOR, fixed: ±10%; 1/4 W; unless otherwise stated
R801, 804, 831	6-124C97	100k
R802, 806	6-124D14	470k
R803	6-124C77	15k
R805	6-124D04	180k
R807, 809	6-125C25	100 ;1/2 W
R808	6-124C37	330
R810, 811, 812	6-13755C64	56.2k ±1%
R813	6-124A48	910 ±5%
R814	6-124A45	680 ±5%
R815	6-124A49	1k ±5%
R816	6-124C43	560
R817, 822, 824, 830	6-124C73	10k
R818	6-124C35	270
R819	6-124C83	27k
R821	6-124A59	2.7k
R823	6-124A57	2.2k ±5%
R825	6-13755C67	5620 ±1%
R826	6-10621C59	4640 ±1%
R827, 829	6-124C83	27k
R828	6-124B10	330k ±5%
		THERMISTOR:
RT801	6-865641	300 ohm @ 25°C
RT802	6-82696B01	10k ohms @ 25°C
		INTEGRATED CIRCUIT: (SEE NOTE)
U801	51-84267A82	M6782
U802	51-84320A55	M2055
		VOLTAGE REGULATOR:
VR801	48-83696E07	Zener type; 6.2 V
VR802	48-82256C03	Zener type; 4.70 V
		CRYSTAL:
Y801	48-82003K01	resonator; 50.00000 KC
		RESISTOR NETWORK:
Z801	1-80772B36 or 51-82142K02	pull-up, 10-pin

NOTE: For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.







SHOWN FROM COMPONENT SIDE

"DIGITAL PRIVATE-LINE" DECODER

HANDLING PRECAUTIONS FOR CMOS INTEGRATED CIRCUITS

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, *CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping,* and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules even in a system.

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions:

(1) Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch hoth hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

(2) Whenever possible avoid touching any electrically conductive parts of the circuit module with your hands.

(3) Normally, circuit modules can be inserted or removed with power applied to the unit. However, check the INSTALLATION and MAINTENANCE sections of the manual as well as the module schematic diagram to insure there are no objections to this practice.

(4) When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

(5) All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

(6) If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through a resistance of approximately 100k.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

(7) When soldering, be sure the soldering iron is grounded.

(8) Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

(9) When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

(10) All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

(11) Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). NEVER USE NONCONDUCTIVE MATERIAL for packaging these modules.

EPS-18293-O

"DIGITAL PRIVATE-LINE" DECODER BOARD TROUBLESHOOTING CHART

NOTES:

1. To obtain a test code for the following procedure apply a carrier frequency signal to the receiver rf input from an rf signal generator modulated by the code output of a Motorola SLN6413A "Digital Private-Line" Test Set. Be sure the signal generator is able to accept very low frequency modulation (less than ±5 Hz).

2. Before you replace U801, use the following procedure to verify that U801 is malfunctioning:
   a. Connect U801-11 to the code input of a Motorola SLN6413A "Digital Private-Line" Test Set.
   b. Apply a carrier-frequency signal to the receiver rf input from a signal generator that is modulated by the code output of the test set.
   If proper decode is indicated, U801 must be replaced. If U801 must be replaced, refer to the CMOS handling precautions.

SYMPTOM	PROBABLE CAUSE	ACTION
No decode, but received audio is good when PL is disabled.	1. Audio squelch is malfunctioning.	Remove the decoder board. Apply +9.6 V at P201-3 on audio & squelch board. If audio is not enabled, troubleshoot audio & squelch circuits.
	2. No 50 kHz clock	Check U801-4 for 50 kHz clock pulses. Rise time must be ≤750 n sec.
	3. Audio enable switch is malfunctioning.	If U801-7 is high, but circuit board pin 5 is low when receiving code, replace Q810.
	4. Dump pin U801-1 is always high.	Check U801-1 should always be 0 V.
	5. Wrong or bad code plug.	Replace with a known good code plug. Check U801-15 through U801-23 for proper octal code.
	6. No data into U801.	Check U801-11 for 0 - 6 V pulses. If pulses are not present, check Q806 and U802 operation.
	7. Transmit code enable input is high.	Ground U801-9. If a received code is properly decoded, check for a malfunction in the delayed transmit enable circuit on the encoder board.
	8. U801 has an internal malfunction.	If, after checking causes 1 through 7, the cause of the problem has not been isolated, replace U801. CAUTION: U801 is a CMOS device and may be damaged by improper handling. Refer to the CMOS handling precautions in this instruction section.
Excessive decoder falsing when monitoring an inactive channel (noise falsing).	1. Precision current source is low or inoperative.	Measure the dc voltages in the precision current source circuits. Current to U801-8 = (V_{BE} of Q808) (R825 + R826 +RT802)/ R826 (R825 + RT802)
	2. Current source disable switch is always on.	Check for 8 - 10 V at Q809 collector. If Q809 collector is 0 V, replace Q809.
	3. Improper 140 Hz low pass filter response.	Check dc voltages in filter circuit. Check the filter frequency response. Measured at Q803 emitter, the filter response should be -1.0 to -4.0 dB at 134 Hz and -12 to -15 dB at 250 Hz with 50 mV rms signal at decoder input.
	4. U802 supply voltage is too high.	Check U802-10 for +10.4 V ±0.2 V dc. If voltage is high, troubleshoot the +10.4 V regulator on the decoder board.
Excessive squelch tails (approx. 500 msec noise burst) at ends of received transmissions	1. Turn-off code not being transmitted by other radio unit.	Monitor circuit board pin 4 (DATA IN) for presence of turn-off code at ends of transmissions.
	2. U802 lock-in malfunction	Ground Q809 collector. With a 300 mV p-p signal at circuit board pin 4 (DATA IN), the waveform at U802-4 should be locked in to the input signal up to at least 175 Hz. If proper lock-in does not occur, replace C809, then check lock-in again. If lock-in is still bad, replace U802.
	3. U801 turn-off code detector is malfunctioning.	Check U801 (Note 2).
Poor detector sensitivity in poor quieting conditions	1. Improper 140 Hz low pass filter response response.	Check dc voltages in filter circuit. Check the filter frequency response; measured at Q803 emitter, the filter response should be -1.0 to -4.0 dB at 134 Hz and -12 to -15 dB at 250 Hz with 50 mV rms signal at decoder input.
	2. Precision current source supplying too much current to U802-8.	Measure the dc voltages in the current source circuits. Current to U802-8 = (V_{BE} of Q808) (R825 + R826 + RT802) R826 (R825 + RT802)
	3. Current source disable switch inoperative.	While detecting a valid code, check Q809 collector for 0 V dc. If 8-10 V is present, replace Q809.
Occassional squelch tail about 1 second after the end of a transmission from another radio	Current source disable switch is staying on too long.	Check Q809 collector. Q809 collector should go from 0 V dc to 8-10 V within 1.5 seconds after loss of audio squelch disable.

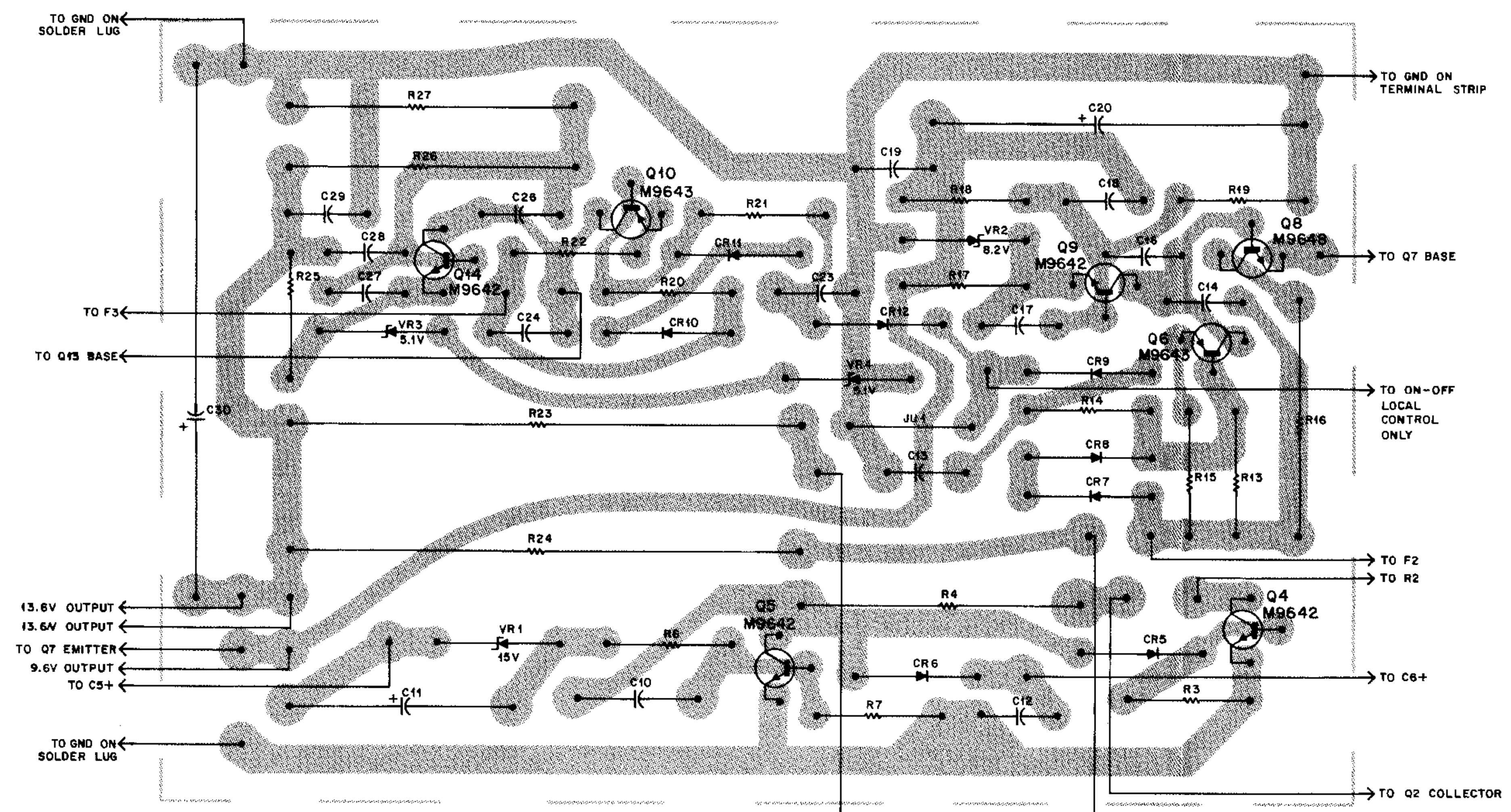
EPS-17705-C

POWER SUPPLY

MODELS TPN1151A AND TPN1152A

FUNCTION-

Provides regulated 9.6 V dc and two 13.6 V dc outputs from a 120 V, 60 Hz (TPN1151A), or 120, 220, 240 V, 50/60 Hz (TPN1152A) power input. All outputs are automatically adjusted for changes in load or input voltage.



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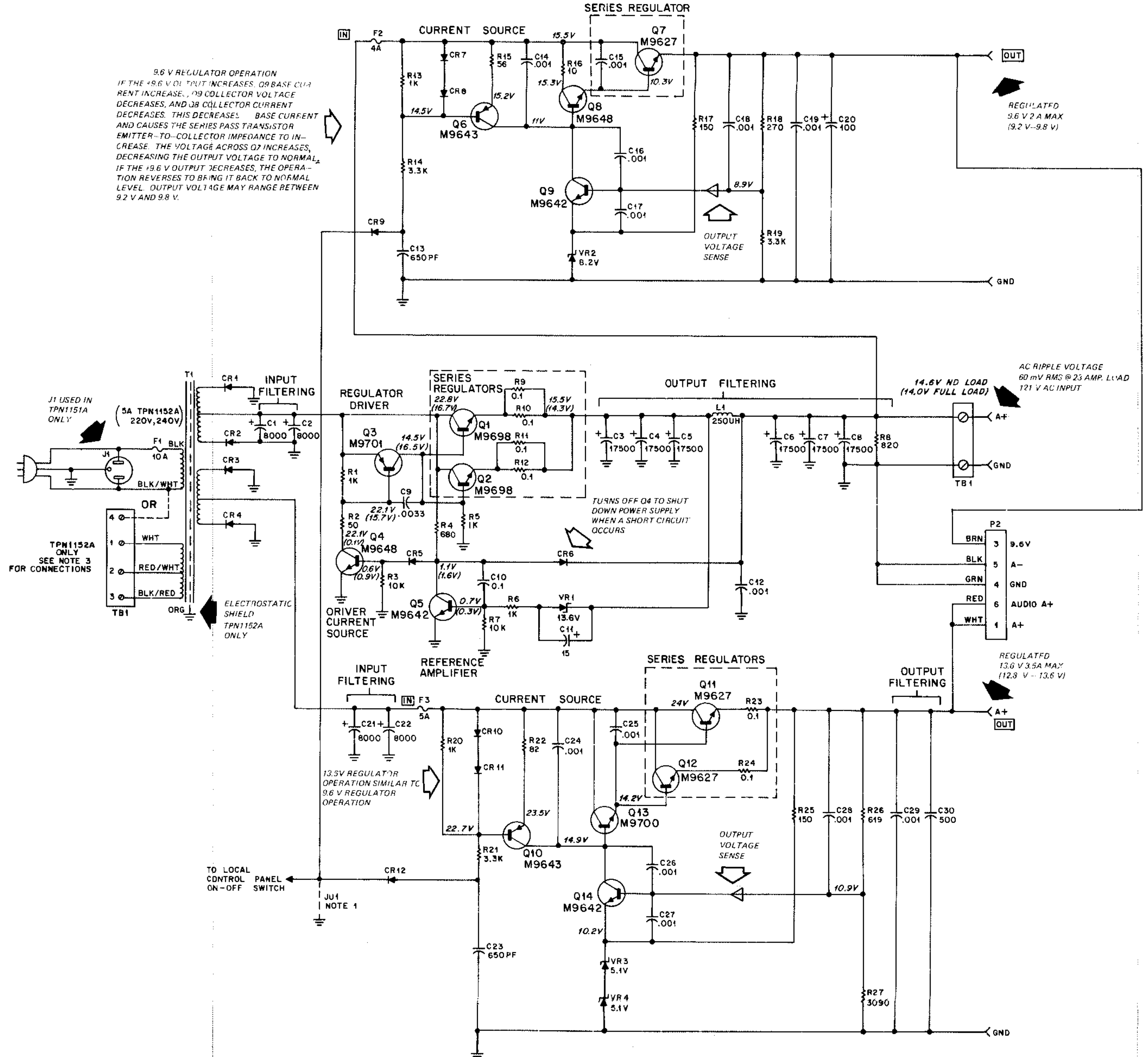
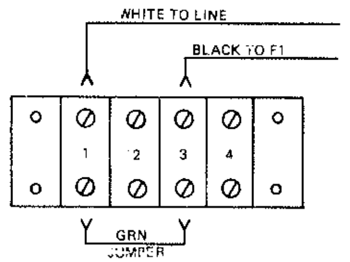


DEPS-22350-E

NOTES:

1. JU–1 IS IN ON REMOTE CONTROL MODELS, OUT ON LOCAL CONTROL MODELS.
2. UNLESS OTHERWISE STATED, CAPACITOR VALUES ARE IN MICROFARADS, RESISTOR VALUES ARE IN OHMS.
3. TPN1151A – 60 Hz 120 V AC SHOWN)
TPN1152A – 50/60 Hz 120, 220, 240 V AC (CONNECTIONS AS FOLLOWS).

TB1



CONNECTIONS FOR 120 V AC: GRN JUMPER FROM TB1–1 TO TB1–4
WHITE LEAD TO TB1–4
BLACK LEAD TO TB1–3

220 V AC: GREEN JUMPER FROM TB1–3 TO TB1–4
WHITE LEAD TO TB1–2
BLACK LEAD NOT USED, REMOVE

240 V AC: GREEN JUMPER FROM TB1–3 TO TB1–4
WHITE TO TB1–1
BLACK NOT USED, REMOVE

PARTS LIST SHOWN ON BACK OF THIS PAGE
68P81033E41-E
6/20/80-PHI

TRN6717A Power Supply Board — PL-5033-C

		CAPACITORS, fixed, uf unless otherwise stated
C10	8-82905G30	0.1; ±10%; 50 V
C11	23-83214C02	15; ±20%; 20 V
C12	21-82187B14	.001; ±10%; 100 V
C13	21-848236	650 pF; ±5%; 300 V
C14 thru 19	21-82187B14	.001; ±10%; 100 V
C20	23-82601A25	100; -10+150%; 100 V
C23	21-848236	650; ±5%; 300 V
C24	21-82187B14	.001; ±10%; 100 V
C26 thru 29	21-82187B14	.001; ±10%; 100 V
C30	23-83210A23	500 +150 -10%; 25 V
		DIODES: (SEE NOTE)
CR5 thru 12	48-83654H01	silicon
		TRANSISTORS: (SEE NOTE)
Q4	48-869648	NPN; type M9648
Q5	48-869642	NPN; type M9642
Q6	48-869643	PNP; type M9643
Q8	48-869648	NPN; type M9648
Q9	48-869642	NPN; type M9642
Q10	48-869643	PNP; type M9643
		RESISTORS, fixed; ±10%, 1/4 W; unless otherwise stated
R3	6-124C73	10k
R4	6-127C45	680; 2 W
R5, 6	6-124C49	1k
R7	6-124C73	10k
R13	6-124C49	1k
R14	6-124C61	3.3k
R15	6-124C19	56
R16	6-126C01	10
R17	6-124C29	150
R18	6-124A35	270 ±5%
R19	6-124C61	3.3k
R21	6-124A61	3.3k ±5%
R22	6-124C23	82k
R23, 24	17-82177B50	.1; 7 W
R25	6-124C29	150
R27	6-82672B36	3090 ±1%
		VOLTAGE REGULATORS: (SEE NOTE)
VR1	48-82256C65	zener, 13.6 V
VR2	48-83461E32	zener, 8.2 V
VR3, 4	48-83461E23	zener, 5.1 V
	MECHANICAL PARTS	
	1-80791B25	CIRCUIT BOARD, eyeleted includes:
	43-84594G01	STANDOFF

NOTE:

For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN6718A Power Supply Chassis (60 Hz)
TRN6731A Power Supply Chassis (50 Hz) — PL-5034-B

		CAPACITORS: fixed; uF unless otherwise stated
C1, 2	23-83093G13	8000; +150-10%; 35 V
C3 thru 8	23-83093G20	17500; +150-10%; 20 V
C9	21-82428B10	.0033; ±10%; 100 V
C21, 22	23-83093G13	8000; +150-10%; 35 V
C25	21-82187B14	.001; ±10%; 100 V
		DIODES: (SEE NOTE)
CR1, 2	01-80739B59	silicon
CR3, 4	48-82525G13	silicon
		FUSES:
F1	65-135105	10A
F2	65-61688	4A
F3	65-52293	5A
		COIL:
L1	25-84514G01	250 uH
		TRANSISTORS: (SEE NOTE)
Q1, 2	48-869698	NPN; type M9698
Q3	48-869701	PNP; type M9701
Q7, 11, 12	48-869627	NPN; type M9627
Q13	48-869700	NPN; type M9700
		RESISTORS: fixed; ±10%, unless otherwise stated
R1	6-125C49	1k; 1/2 W
R2	17-82177B20	50; 7 W
R8	6-124C47	820; 1/2 W
R9 thru 12	17-82177B50	.1; 7 W
R20	6-124C49	1k
		TRANSFORMER, power
T1	25-82623L01	120 V AC; 60 Hz (TRN1151 only) primary: BLK-BLK (WHT = .377 ohms) secondary: RED-RED = .031 ohms, GRN-RED = .138 ohms
	or	
	25-82623L02	120 V AC; 50 Hz (TRN1152 only) primary: WHT-BLK = 1.7 ohms secondary: RED-RED = .033 ohms, GRN-GRN = .152 ohms
	MECHANICAL PARTS	
	1-80793B96	COVER ASSEMBLY includes:
	1-80790B99	COVER, riveted includes:
	15-82683L01	COVER, power supply
	3-136138	SCREW, tapping; #6-32 x 3/8"; 4 used
	42-83123F01	RETAINER; 4 used
	1-80791B24	HEAT SINK ASSEMBLY includes:
	2-7005	NUT, hex; 6-32 x 1/4" x 3/32"; 4 used
	3-3398	SCREW, tapping; #6-20 x 3/8"
	3-488100	SCREW, machine; 6-32
	4-7569	WASHER, flat; .145-.312-.027"; 4 used
	4-7650	WASHER, lock; #6 internal; 2 used
	4-7666	WASHER, lock; #6 external
	4-474216	WASHER, insulated; 4 used
	4-84496C01	WASHER, shoulder; 4 used
	14-865854	INSULATOR, transistor; 2 used
	26-84923B01	HEAT SINK
	29-5207	LUG, solder; #6; 2 used
	29-84489B01	LUG, transistor; 4 used
	42-10217A01	STRAP, cable harness
	1-80791B23	CHASSIS, power supply, riveted includes:
	4-8242	WASHER, flat; .094-.250-.027"; 4 used
	9-84935D01	SOCKET, transistor; 3 used
	9-83662A01	SOCKET, transistor; 2 used
	31-121701	TERMINAL, strip; 5 pin
	27-82682L01	CHASSIS, power supply
	2-7005	NUT, hex; 6-32 x 1/4 x 3/32"; 4 used (TRN6731A only)
	3-135664	SCREW, tapping; #6-32 x 9/16"; 4 used (TRN6731A only)
	4-7669	WASHER, lock; #6 split; 4 used (TRN6731A only)
	29-812979	LUG, solderless; 4 used (TRN6731A only)
	29-847854	LUG, slotted tongue; (TRN6718A) 5 used (TRN6731A only)
	2-115123	NUT, hex; 10-32 x 3/8 x 1/8"; 4 used
	2-119913	NUT, hex; 8-32 x 11/32 x 1/8"; 2 used
	3-2957	SCREW, machine; 8-32 x 1/2"; 2 used
	3-3360	SCREW, tapping; #6-20 x 1/2"; 10 used
	3-7184	SCREW, machine; 6-32 x 1/2"; 4 used
	3-134214	SCREW, tapping; #6-32 x 5/8"
	3-7257	SCREW, machine; 8-32 x 5/8"; 4 used
	3-134214	SCREW, tapping; #6-32 x 5/8"
	3-136138	SCREW, tapping; #6-32 x 3/8"; 2 used
	3-136140	SCREW, tapping; #8-32 x 5/8"; 2 used
	3-138216	SCREW, tapping; #10-32 x 3/8"; 4 used
	7-82737L01	BRACKET
	9-82083C01	RECEPTACLE, fuse; 3 used
	29-5321	LUG, soldering; #10
	30-858552	CABLE, battery; #12 black; 11 used
	30-858553	CABLE, battery; #12 red; 11 used
	30-83211C01	AC CORD and PLUG
	9-83238C02	OUTLET, AC; 3 prong (TRN6718A only)
	31-50378	TERMINAL, board
	31-82272B05	TERMINAL, board; 4 pin (TRN6731A only)
	54-83532H01	LABEL, caution

NOTE:

For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

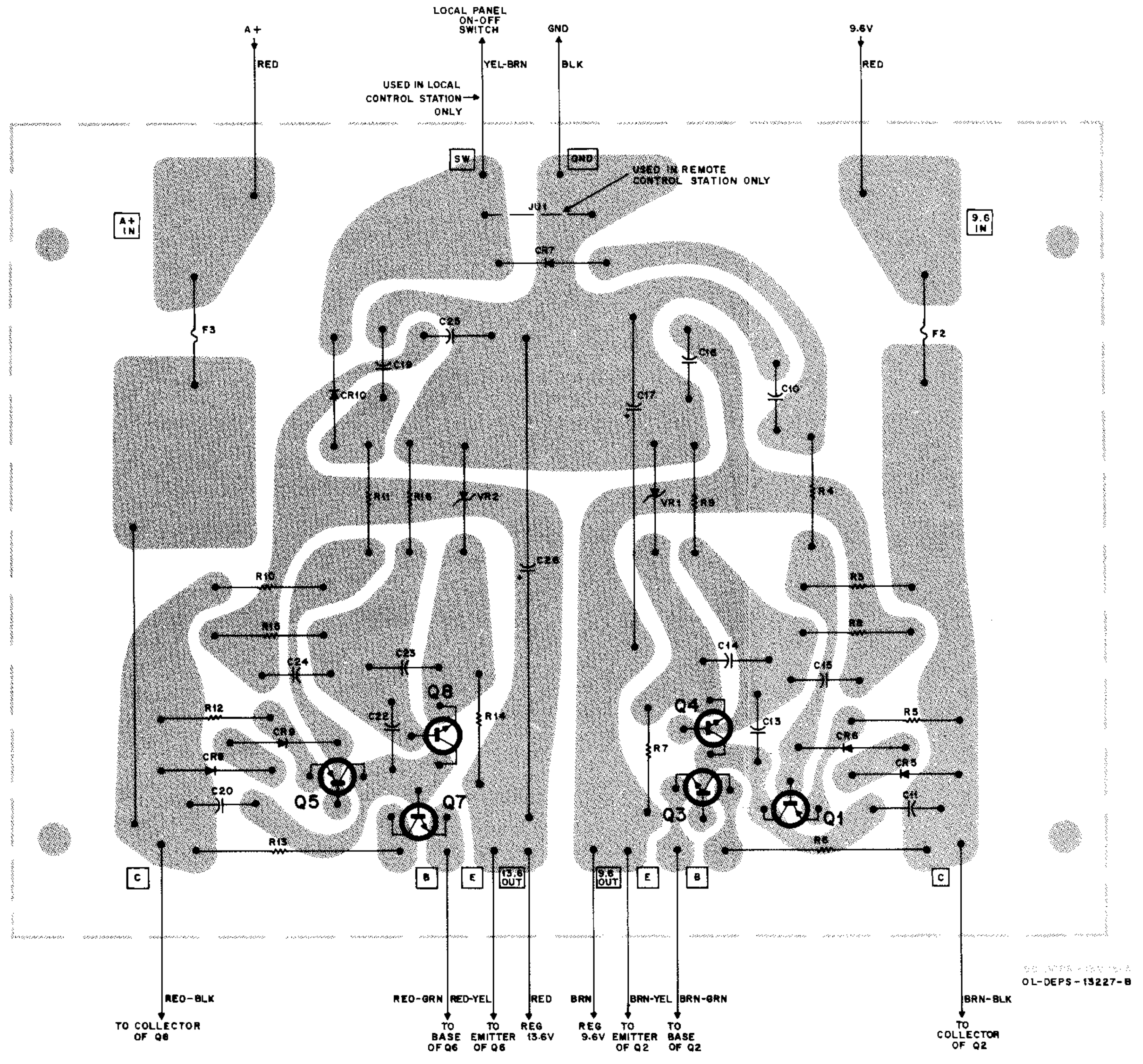
REVISIONS

68P81033E41-E

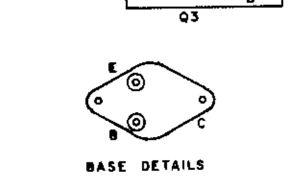
CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TRN6717A-1	R18	FROM 6-124A31, 180 TO 6-124A35, 270	Q9 BASE

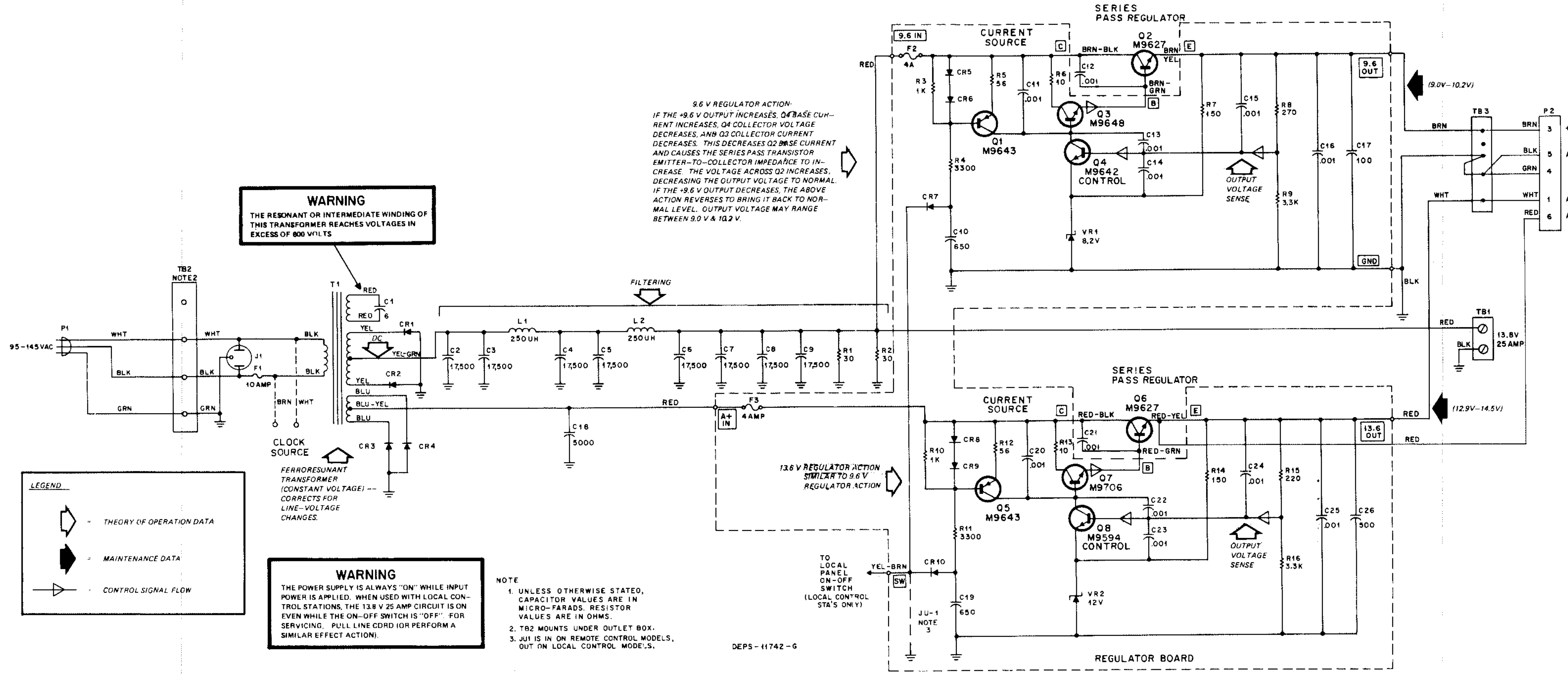
POWER SUPPLY

MODELS TPN1110A
TPN1110B



SHOWN FROM COMPONENT SIDE
9.6V AND 13.6V REGULATOR BOARD





FUNCTION

Provides regulated 9.6 V dc and 13.6 V dc outputs and a 13.8 V dc unregulated output from a 121 V 60 Hz ac power input. 9.6 V and 13.6 V outputs are automatically adjusted for changes in load or input voltage.

MODEL COMPLEMENT

Model	Version	Chassis & Hardware	Version	Regulator Board	Version	Cable
TPN1110A		TLN5123A		TLN5122A	1	TKN6658A
TPN1110B		TLN5123B		TLN5122A	1	TKN6658A

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

PARTS LIST

TLN5122A Power Supply Board PL-2420-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 100 V unless otherwise stated
C10	21-848236	650 pF ±5%; 300 V
C11	21-82187B29	.001
C13 thru 16	21-82187B29	.001
C17	23-82601A25	100 -10+150%; 20 V
C19	21-848236	650 pF ±5%; 300 V
C20	21-82187B29	.001
C22 thru 25	21-82187B29	.001
C26	23-83210A19	500 -10+100%; 20 V
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR5 thru 10	48-83654H01	Silicon
		TRANSISTOR: (SEE NOTE)
Q1	48-869643	PNP; type M9643
Q3	48-869648	NPN; type M9648
Q4	48-869642	NPN; type M9642
Q5	48-869643	PNP; type M9643
Q7	48-869706	NPN; type M9706
Q8	48-869594	NPN; type M9594
		RESISTOR, fixed: ±10%; 1/4 W unless otherwise stated
R3	6-10401C49	1k
R4	6-10401C61	3.3k
R5	6-10401C19	56
R6	6-488022	10; 1 W
R7	6-10401C29	150
R8	6-10401A35	270 ±5%
R9	6-10401A61	3.3k ±5%
R10	6-10401C49	1k
R11	6-10401C61	3.3k
R12	6-10401C19	56
R13	6-488022	10; 1 W
R14	6-10401C29	150
R15	6-10401A33	220 ±5%
R16	6-10401A61	3.3k ±5%
		SEMICONDUCTOR DEVICE, (SEE NOTE)
VR1	48-82256C08	Zener, 8.2 V
VR2	48-82256C25	Zener, 12 V
		NON-REFERENCED ITEM
	42-82690A01	CLIP, fuse; 4 req'd.

TKN6658A Cable Kit PL-2421-A

P2	9-84151B01	CONTACT, receptacle; 5 req'd.
	14-84590B01	INSULATOR, connector
	42-10217A02	STRAP, cable; 6 req'd.

NOTE:
For optimum performance, diode and transistor replacement parts must be ordered by Motorola part number only.

TLN5123B Chassis and Hardware Kit (P/O TPN1110B)
TLN5123A Chassis and Hardware Kit (P/O TPN1110A) PL-2417-H

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF ±10%; 100 V unless otherwise stated
C1	8-82705M01	6; 660 V
C2 thru 9	23-83093G20	17,500 +150-10%; 20 V
C12	21-82187B14	.001
C18	23-82304B16	5000 -10+150%; 35 V
C21	21-82187B14	.001
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2	1-80739B57	Assembly, silicon
CR3, 4	48-82525G13	silicon
		FUSE, cartridge:
F1	65-138179	10 A, 125 V
F2, 3	65-61688	4A, 250 V
		CONNECTOR, receptacle:
J1	9-83238C01	3 prong
		CHOKE, filter:
L1, 2	25-84514G01	250 uh
		TRANSISTOR: (SEE NOTE)
Q2	48-869627	NPN; type M9627
Q6	48-869627	NPN; type M9627
		RESISTOR, fixed:
R1, 2	17-83389G02	30 ±5%; 20 W
		TRANSFORMER, power:
T1	25-84516G01	primary windings 1 & 2; 3 secondary windings 3 & 5 with 4 center top, 6 & 8 with 7 center top, and 9 & 10
		NON-REFERENCED ITEMS
	14-865854	INSULATOR, transistor; 2 req'd
	5-84512G01	GROMMET; 4 req'd.
	9-82083C01	FUSEHOLDER, extractor post type
	14-84548A01	INSULATOR, diode; 2 req'd.
	37-107234	GROMMET, rubber
	9-84935D01	SOCKET, transistor; 2 req'd.
	64-83562D01	HEAT SINK; 2 req'd.
	30-83211C01	AC LINE CORD; includes molded plug (P1)
	43-10392A07	INSERT; 2 used

REVISIONS

68P81020E44-N

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN5122A-1	Q7	FROM 48-869648, M9648 TO 48-869706, M9706	13.6 V SERIES REGULATOR
	Q8	FROM 48-869642, M9642 TO 48-869594, M9594	
	C11, 13 THRU 16, 20, 22 THRU 25	FROM: 21-82187B20; .001 UF TO: 21-82187B29; .001 UF	PARTS LIST
TLN5123A, B	C1	FROM 8-84717G01 TO 8-82705M01	T1 RESONANT WINDING