MOTOROLA INC.
Communications Sector

INTERMEDIATE POWER AMPLIFIER (IPA) AND 9.6 V REGULATOR

MODELS: TLD2641A (132–158 MHz)
TLD2642A (146–174 MHz)

1. INTRODUCTION

The IPA assembly consists of four section: the 9.6 volt regulator circuit, a series pass power control circuit, an rf switch, and a two stage power amplifier (OMNI).

The 9.6 volt regulator is independent from the other three sections and provides the 9.6 voltage to the rest of the station. The rf switch precedes the OMNI amplifier in the transmit line while the series pass circuit acts as the dc feed to the first stage of the OMNI amplifier.

2. IPA THEORY OF OPERATION

During station transmit, the rf output generated by the transmit synthesizer (at least 12 dBm) is applied to the IPA. The rf switch is in the "on" state (CR454 forward biased and CR455 reverse biased) and passes the power to the OMNI amplifier module (a two stage class C amplifier with its second stage collector voltage at A + and its first stage collector voltage controlled by the series pass circuit). This module amplifies the rf power to a varying level between 0 and 8 watts depending on the control loop feedback voltage at the input to the series pass circuit (J452 pin 1). By varying this voltage, the power output of the IPA, and consequently the power out of the station, can be varied smoothly to any desired level within its rated limits.

During standby (receive) mode, a specified minimum rf power is allowed to be conducted to the output of the station. Since the transmit synthesizer is in continuous operation, the station switches the rf switch to an "off " state (CR454 reverse biased and CR455 forward biased) by pulling the TX-ENABLE line (J452 pin 2) to ground.

3. 9.6 V REGULATOR THEORY OF OPERATION

The 9.6 volt output is obtained from a series regulator circuit on the IPA DC Distribution board. The 9.6 volt regulator uses the A+ output from the ferro-resonant power supply as a source voltage. Filtering of the 9.6 volt regulator's output is done on the uniboard.

4. MAINTENANCE

4.1 IPA REMOVAL

The IPA assembly can be removed as follows, after removal of the rf tray cover.

Step 1. Disconnect the IPA input cable connector P451.

Step 2. Disconnect the IPA output cable connector P453 from straight adapter. Remove cable restraint(s) holding the IPA output cable to the station chassis.

Step 3. Disconnect the IPA dc interconnect cable connector P452.

Step 4. Loosen four (corner) captivated IPA mounting screws. The IPA assembly can now be lifted from the rf tray.

Step 5. Disconnect the rf output cable from J455.

4.2 IPA REPLACEMENT

Replacement of the IPA assembly is the reverse of IPA removal.

5. IPA TROUBLESHOOTING PROCEDURE

Refer to the IPA troubleshooting flow chart in this section while performing the following procedures. Before troubleshooting the IPA, place the station in the service mode. This is accomplished by moving station control module jumper JU1 into the "Service" position on CLB station models. On CXB station models, with the display cursor inactive, depress and hold the "Set" switch. While holding "Set", depress and hold the "Xmit" switch; when "tSt" appears in the "Status" display, release first the "Set" switch, then the "Xmit" switch. Connect the IPA output cable to a watt meter terminated in a 50 ohm load (watt meter element and load should be rated for 20 watts, 132–174 MHz operation.).

Step 1. Check the IPA power output. If the IPA power is greater than 10 watts, IPA is okay; otherwise , go to Step 2.

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Step 2. Check dc voltages at the OMNI module. V_{OMNI} (pin 2 of OMNI module) should be between 8 and 12 volts due to first stage current limiting circuit on interconnect board. If V_{OMNI} is low (an Indication of control voltage problems) then go to Step 4. If V_{OMNI} is greater than 11 volts (an indication that no rf power is present at input to OMNI module) then to to Step 3. Verify that A + is present at pin 3 of OMNI module: if not, then check J452–3 for A +. If A+ is not entering IPA module, check the power supply or power supply fuse.

Step 3. Check functionality of the rf switch. While in transmit mode, verify that CR454 is forward biased and CR455 is reverse biased. While in standby mode verify that CR454 is reverse biased and CR455 is forward biased. If switch is operating incorrectly, then go to Step 5; otherwise, check and verify that VCO buffer output is at least 12 dBm (~ 16mW). If buffer amp or VCO are operating incorrectly, refer to Synthesizer Troubleshooting Charts in this manual. If buffer output is okay, replace IPA.

Step 4. Check $V_{CONTROL}$, control loop feedback voltage (J452–1). If $V_{CONTROL}$ is greater than 3 volts, then check power control circuitry (Q403). If $V_{CONTROL}$ is between 0 and 3 volts, then check Q451 for open circuit. If Q451 is defective, then replace it; otherwise, replace IPA.

6. 9.6 V REGULATOR TROUBLESHOOTING PROCEDURE

Step 1. Check that A + is available at the emitter of Q456.

Step 2. Check that the regulator output is not shorted. Regulator output is shorted if CR453 is forward biased. If the regulator is shorted, investigate and repair.

Step 3. Check the voltage across VR451. If regulator output is above 9 volts, the voltage across VR451 should be approximately 8.2 volts. If regulator voltage is below 9 volts, the regulator output and diode voltage should be identical. If not, replace VR451.

Step 4. If the voltage is above 10.5 volts, check the voltage on the base of Q457. It should be under 4 volts. If it is under 4 volts, replace Q456. If it is above 4 volts, replace Q458 or Q457.

Step 5. If the output voltage is too low (less than 8.5 volts), check the voltage on the base of Q457. It should be above 4 volts. If it is above 4 volts, replace Q458 or Q457.

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CIRCUIT BOARD DETAIL & PARTS LIST
MODELS: TLD2641A (132–158 MHz)
TLD2642A (146–174 MHz)

parts list

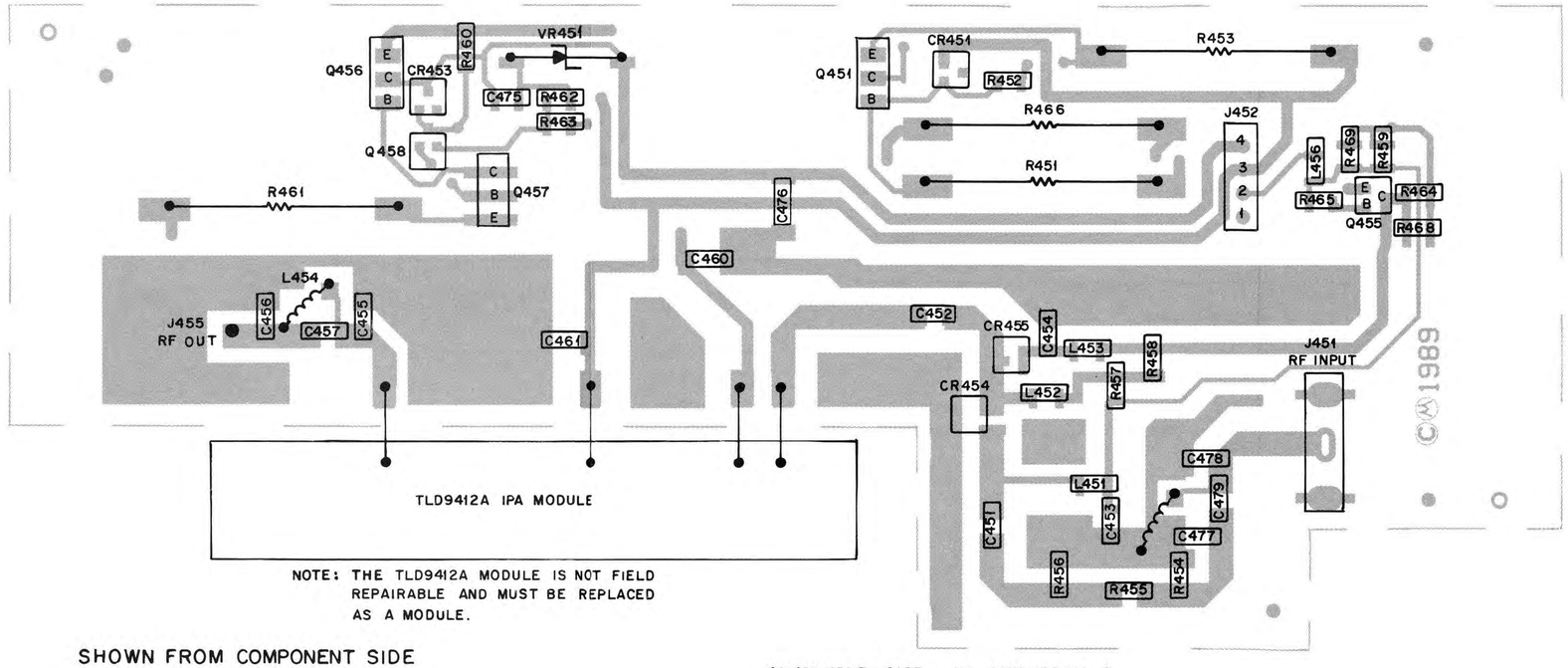
TLD9420A IPA Board — PL–11696–O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ±5% 50V: unless otherwise stated
C451 thru 454	2113740B73	1000
C455,456	2113740B25	10
C457	2113740B29	15
C460,461	2311049A21	22uF ±10%; 20V
C475	2113740B32	20
C476	2311049A21	22uF ±10%; 20V
C479	2113740B73	1000
		diode (see note):
CR451	4805119G04	silicon
CR453	4811058A11	silicon
CR454,455	4884622E02	silicon
		connector:
J452	2883143M05	plug; 4–contact
		coil:
L451 thru 453	2411087A29	1.8uH
L454	2484331M02	5 turns
L456	2411087A51	120uH
		transistor (see note):
Q451	4882022N74	PNP
Q455	4811056A09	NPN
Q456	4882022N74	PNP
Q457	4882367T02	NPN
Q458	4811056A09	NPN
		resistor, fixed: ±5%; 1/8 W unless otherwise stated
R451	0611086C39	150; 2W
R452	0611077A66	470
R453	0611086C07	3.9; 2W
R454	0611077A65	430
R455	0611077A27	11
R456	0611077A65	430
R457,458	0611077A74	1000
R459	0611072A45	680; 1/4W
R460	0611077A82	2200
R461	0611086C39	150; 2W
R462,463	0611077D60	41.2 ±1%
R464	0611072A45	680; 1/4W
R465	0611077A98	10K
R466	0611086C39	150; 2W
		zener diode (see note):
VR451	4883461E32	Zener; 8.2V

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN9930A IPA Hardware Kit — PL–10892–C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		non–referenced items
	0310943J11	SCREW, tapping: TT3 x 0.5 x 10mm; 2 used
	0310943J16	SCREW, tapping: TT3.5 x 0.6 x 10mm; 3 used
	0310943M04	SCREW, tapping: TT2.5 x 0.45 x 8mm; 2 used
	0383677N02	SCREW, captive: M3.5 x 0.6 x 18mm; 4 used
	0987439C02	CONNECTOR, female: 1–contact
	1110022A55	COMPOUND, thermal joint
	2684873R01	HEATSINK



SHOWN FROM COMPONENT SIDE

COMPONENT SIDE — BD–CEPS–47563–O
OL–CEPS–47564–O

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SCHEMATIC DIAGRAM
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