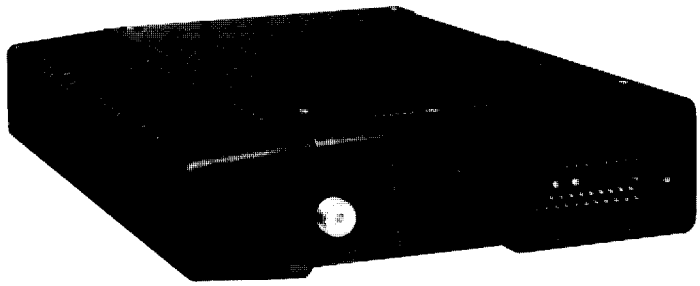
(Supersedes LBI-31620)

ERICSSON

Mobile Communications

RANGR™

136-174 MHz



INCLUDES

Maintenance Manual

TABLE OF CONTENTS

ILLUSTRATIONS

GE PART NUMBER	FCC FILING NUMBER	DESCRIPTION
19C852151P1	AXA9HHTR-164-A	136-153 MHz 40W 5 PPM
19C852151P2	-165-A	136-153 MHz 110W 5 PPM
19C852151P3	-164-B	150-174 MHz 40W 5 PPM
19C852151P4	-165-B	150-174 MHz 110W 5 PPM
19C852151P5	-164-A2	136-153 MHz 40W 2 PPM
19C852151P6	-165-A2	136-153 MHz 110W 2 PPM
19C852151P7	-164-B2	150-174 MHz 40W 2 PPM
19C852151P8	-165-B2	150-174 MHz 110W 2 PPM
19C852151P21	-NONE	136-153 MHz 40W 2 PPM
19C852151P22	-NONE	136-153 MHz 110W 2 PPM
19C852151P23	-NONE	150-174 MHz 40W 2 PPM
19C852151P24	-NONE	150-174 MHz 110W 2 PPM

WARNING

Although the highest DC voltage in Mobile Two-Way Radio equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits!

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

SYSTEM SPECIFICATIONS

FREQUENCY RANGE	136-153 MHz and 150-174 MHz
BATTERY DRAIN	
Receive	
Squelched	0.7 Amperes at 13.8 Volts
Unsquelched	2.2 Amperes at 13.8 Volts
Transmit	
40 Watts	14 Amperes at 13.6 Volts
110 Watts	29.5 Amperes at 13.4 Volts
FREQUENCY STABILITY	0.0005%/0.0002% depending on model.
TEMPERATURE RANGE	-30°C (-22°F) to +60°C (140°F)
DUTY CYCLE	100% Receive, 20% Transmit (EIA)
DIMENSIONS, LESS ACCESSORIES (H x W x D)	67 mm x 240 mm x 339 mm (2.6 x 9.5 x 13.3 inches)
WEIGHT, LESS ACCESSORIES	4.3 kg (9.5 pounds)

TRANSMITTER

TRANSMIT OUTPUT POWER	40W/110W
CONDUCTED SPURIOUS	-80 dB
MODULATION	±4.5 kHz
AUDIO SENSITIVITY	55 to 110 millivolts
AUDIO FREQUENCY CHARACTERISTICS	Within +1 dB to -4.5 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA
DISTORTION	Less than 2% (1000 Hz) Less than 5% (300 to 3000 Hz)
DEVIATION SYMMETRY	0.3 kHz maximum
MAXIMUM FREQUENCY SEPARATION	136-153 MHz ---- 17 MHz 150-174 MHz ---- 24 MHz
MICROPHONE LOAD IMPEDANCE	600 ohms
POWER ADJUST RANGE	100% to 50% of rated power
RF OUTPUT IMPEDANCE	50 ohms
FM NOISE	-60 dB
CARRIER ATTACK TIME	40 milliseconds
AUDIO ATTACK TIME	40 milliseconds

CHANNEL GUARD TX TONE DISTORTION	5%

RECEIVER

AUDIO OUTPUT (to 4.0 ohm speaker)	10 Watts with less than 3% distortion
SENSITIVITY 12 dB SINAD (EIA Method)	0.35 μV
SELECTIVITY EIA Two-Signal Method (30 kHz channels)	-90 dB
SPURIOUS RESPONSE	-85 dB
INTERMODULATION 30 kHz	-80 dB
MODULATION ACCEPTANCE	±7 kHz
MAXIMUM FREQUENCY SEPARATION	136-153 MHz --- 17 MHz 150-174 MHz --- 24 MHz
FREQUENCY RESPONSE	Within +2 and -8 dB of a standard 6 dB per octave de-emphasis curve from 300 to 3000 Hz (1000 Hz reference)
RF INPUT IMPEDANCE	50 ohms
HUM/NOISE RATIO UNSQUELCHED SQUELCHED	 -50 dB -70 dB
RECEIVER RECOVERY TIME	200 milliseconds
RECEIVER ATTACK TIME	150 milliseconds
CHANNEL SPACING	25/30 kHz

* These specifications are intended primarily for use of the serviceman. Refer to the appropriate Specifications Sheet for the complete specifications.

DESCRIPTION

General Electric synthesized RANGR mobile radio combinations are completely solidstate utilizing microcomputer technology and integrated circuits to provide high-quality, high-reliability radios. Standard combinations may be equipped with:

- Microcomputer Controlled Frequency Synthesizer
- Up to 16 channels
- .0005%/.0002% frequency stability
- Other structured options

The radio locks when the optional lock is installed but is not tamperproof. The cover can be removed in the locked or unlocked position.

The radio set is housed in a weather-resistant case only 6.7 centimeters high. The radio is secured to the vehicle by a bottom mounting plate. When unlocked, the radio may be pulled out of the mounting plate or the top cover removed for servicing.

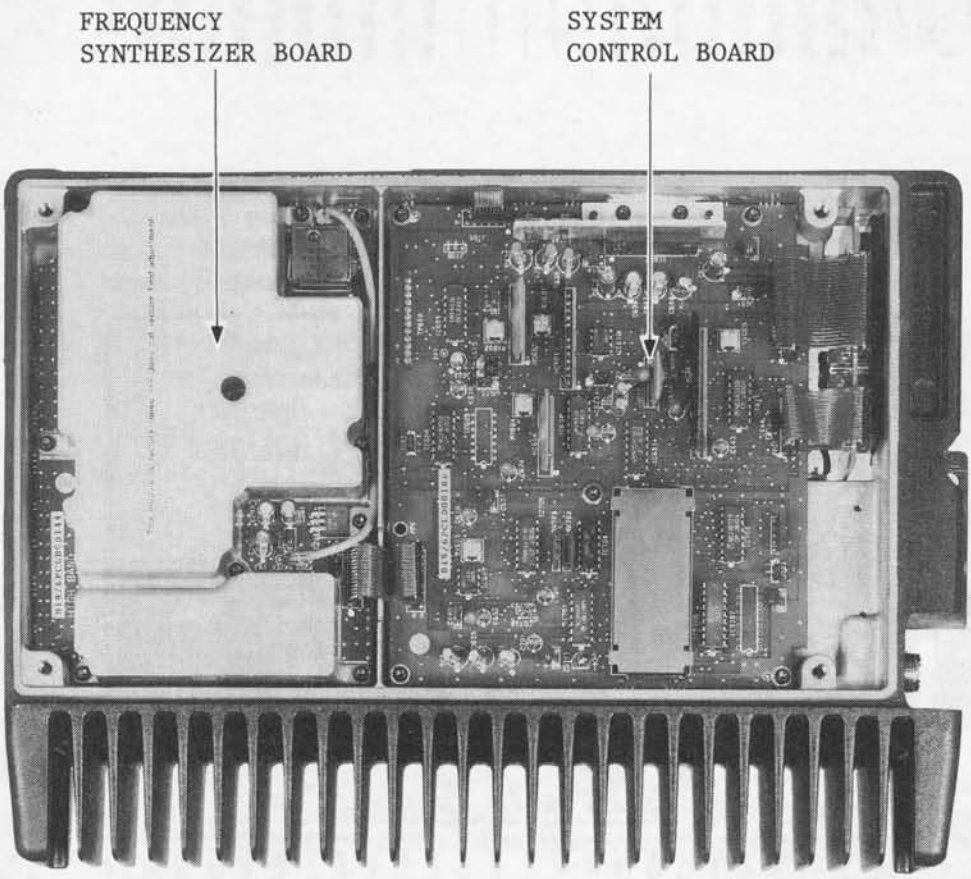
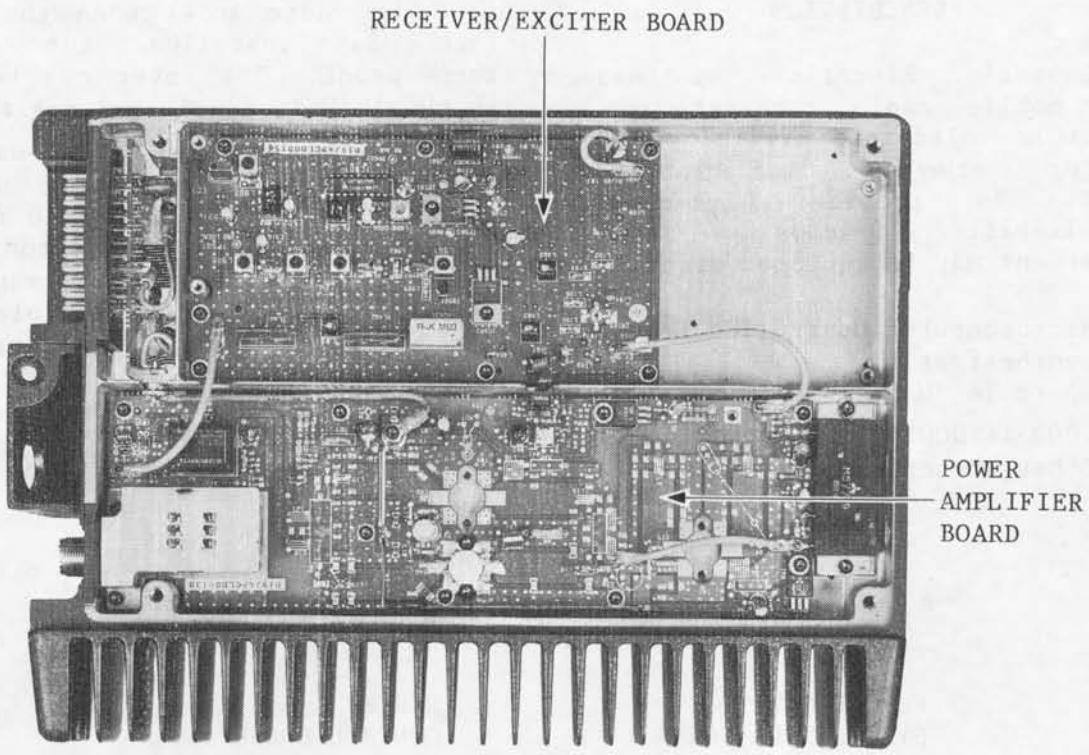
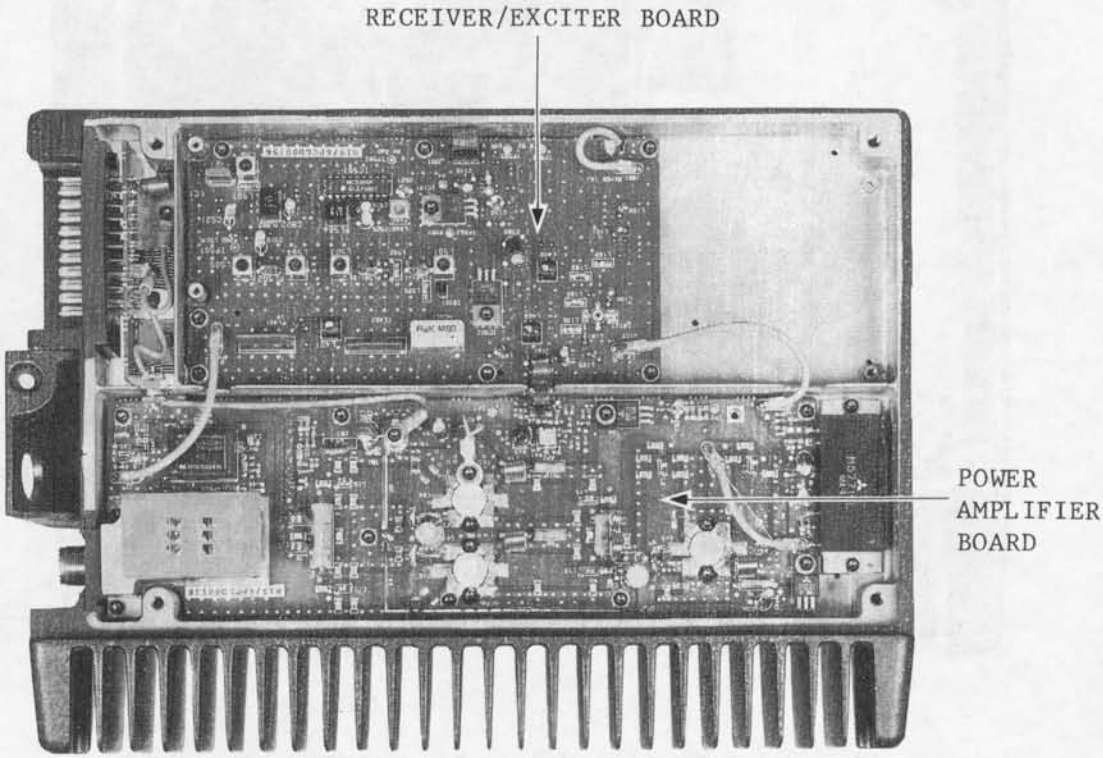


Figure 1 - Typical Module Layout (Top View)



- 40 W TYPE -



- 110 W TYPE -

Figure 2 - Typical Module Layout (Bottom View)

The basic radio consists of four printed wiring boards mounted in a cast aluminum frame. The four boards are the System Control board, the Frequency Synthesizer board, the Power Amplifier board, and the Receiver/ Exciter board.

The radio is of double-layer construction with tuning adjustments easily accessible from the top of the radio.

The System Control board and the Frequency Synthesizer board are located on the top of the radio, while the Power Amplifier board and the Receiver/Exciter board are located on the bottom.

Interconnections are provided by ribbon cable between the boards. A power bus connects A+ and A- from the front connector to the PA assembly.

SYNTHESIZER/INTERCONNECT

The synthesizer consists of a microcomputer, electrically-erasable PROM (EEPROM), a frequency synthesizer IC, transmit and receive VCO's and associated circuitry. The frequency synthesizer under control of the microcomputer generates all transmit and receive RF frequencies.

The EEPROM stores binary data for all RF frequencies, Channel Guard tones/digital codes, and the timing function of the carrier control timer(CCT). The microcomputer accesses the EEPROM and provides the correct WALSH bits to the Channel Guard circuitry to generate the correct Channel Guard tone or digital code on a per-channel basis.

PROGRAMMING

The EEPROM allows the radio to be programmed or reprogrammed as needed to adapt to changing system requirements. RF frequencies, Channel Guard tones and digital codes, and the CCT function can be reprogrammed.

The EEPROM can be reprogrammed through the radio front connector using the General Electric Universal PROM Programmer Model TQ2310. This programmer allows all information to be loaded simultaneously.

NOTE

When programming, remember that all RF frequencies must be divisible by 5 kHz or 6.25 kHz. Also insure that P707 is connected to J707-2 and 3 to enable programming.

Programming instructions are provided in the respective Programmer Maintenance Manuals.

TRANSMITTER

The transmitter consists of the exciter, frequency synthesizer, transmit VCO, and a power amplifier (PA) assembly. The PA assembly consists of a PA board mounted along the side of the radio next to the heat sink assembly. The PA board also contains an antenna relay and a low-pass filter.

Audio and Channel Guard circuitry for the transmitter is located on the System Control board.

RECEIVER

The receiver consists of the frequency synthesizer, RX VCO, injection amplifiers, front end, IF, and limiter detector. Audio, squelch and Channel Guard circuitry for the receiver is located on the System Control board.

SYSTEM CONTROL FUNCTION

A microprocessor on the System Control board controls the frequency synthesizer, the TX on/off, the decoding of CTCSS tones, the generation of CTCSS tones, etc. The audio processor circuitry for the transmitter and the receiver are located on the System Control board. Squelch circuitry and the digital Voice Guard circuit are also located on the System Control board.

CONTROL UNITS

S-series control units are available and may be used directly with RANGR radio combinations.

Refer to the applicable Maintenance Manual for detailed description of the Control Unit used with the RANGR radio combinations.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in the Operator's Manual for the control unit used.

MAINTENANCE

The service section of this manual contains the maintenance information to service this radio. The service section includes:

- System interconnections
- Mechanical layout
- Disassembly procedures
- Replacement of IC's, chip capacitors and resistors
- Alignment procedures for the transmitter and receiver
- Troubleshooting Procedure and waveforms

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ERICSSON

MAINTENANCE MANUAL

(Supersedes LBI-31718)

136-153 MHz & 150-174 MHz SYNTHESIZED RANGR

TWO-WAY FM RADIO

SERVICE SECTION

TABLE OF CONTENTS

DESCRIPTION

This section contains the information required to service the radio. Included are disassembly procedures, and procedures for replacing transistors, Integrated Circuits (IC's) and chip components. This section also includes alignment procedures and troubleshooting information (see Table of Contents).

INITIAL ADJUSTMENT

After the radio has been installed (as described in the Installation Manual), the following adjustments should be made by a certified electronics technician.

TRANSMITTER ADJUSTMENT

The adjustment for the transmitter includes measuring the forward and reflected power, and setting the transmitter to rated power output. Then, measure the frequency and modulation and record these measurements for future reference. For the complete transmitter adjustment, refer to the Alignment Procedure (see Table of Contents).

RECEIVER ADJUSTMENT

No adjustment for the input circuit is required. For complete receiver adjustment, refer to the Receiver Alignment Procedure (see Table of Contents).

MAINTENANCE

PREVENTIVE MAINTENANCE

To facilitate troubleshooting of problems on the printed circuit board assemblies, the following service accessories are available:

DESCRIPTION	PART NUMBER
EXTENSION CABLE 4 CONDUCTOR	B19/CFQ-3175
EXTENSION CABLE 10 CONDUCTOR	B19/CFQ-3177
EXTENSION CABLE 14 CONDUCTOR	B19/CFQ-3178
EXTENSION CABLE 24 CONDUCTOR	B19/CFQ-3179
COAXIAL CABLE	B19/CFQ-3180
COAXIAL CABLE	B19/CFQ-3234
TUNING TOOL	B19/MPTC00448

To ensure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This preventive maintenance should include the checks as listed in Table 1 Maintenance Checks.

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Ground connections and connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. When ground connections are not made directly to the battery, the connection from the battery to vehicle chassis must be checked for low impedance. A high impedance may cause excessive voltage drops and alternator noise problems.	X	
ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. Overvoltage is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. A weak battery will often cause excessive noise or faulty operation.		X
MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and parts to make sure that nothing is working loose. Be sure that all screws are properly torqued.	X	
ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.	X	
ALIGNMENT - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to applicable Alignment Procedure and troubleshooting sheet for typical voltage readings.		X
FREQUENCY CHECK - Check transmitter frequency and deviation, as required by FCC. Normally, these checks are made when the unit is first put into operation, after the first six months and once a year thereafter.		X

TABLE 1 - MAINTENANCE CHECKS

DISASSEMBLY PROCEDURE

To gain access to the unit for servicing:

1. Remove the lock screw on the front of the radio using No. 30 TORX® driver.
2. Pull the radio forward and remove from the mounting bracket.

To remove the printed wire boards:

1. Each of the boards may be removed after removing the radio cover, the cables and the retaining screws securing the board to the main frame.
2. The cables and the screws to be removed are listed in Table 2.

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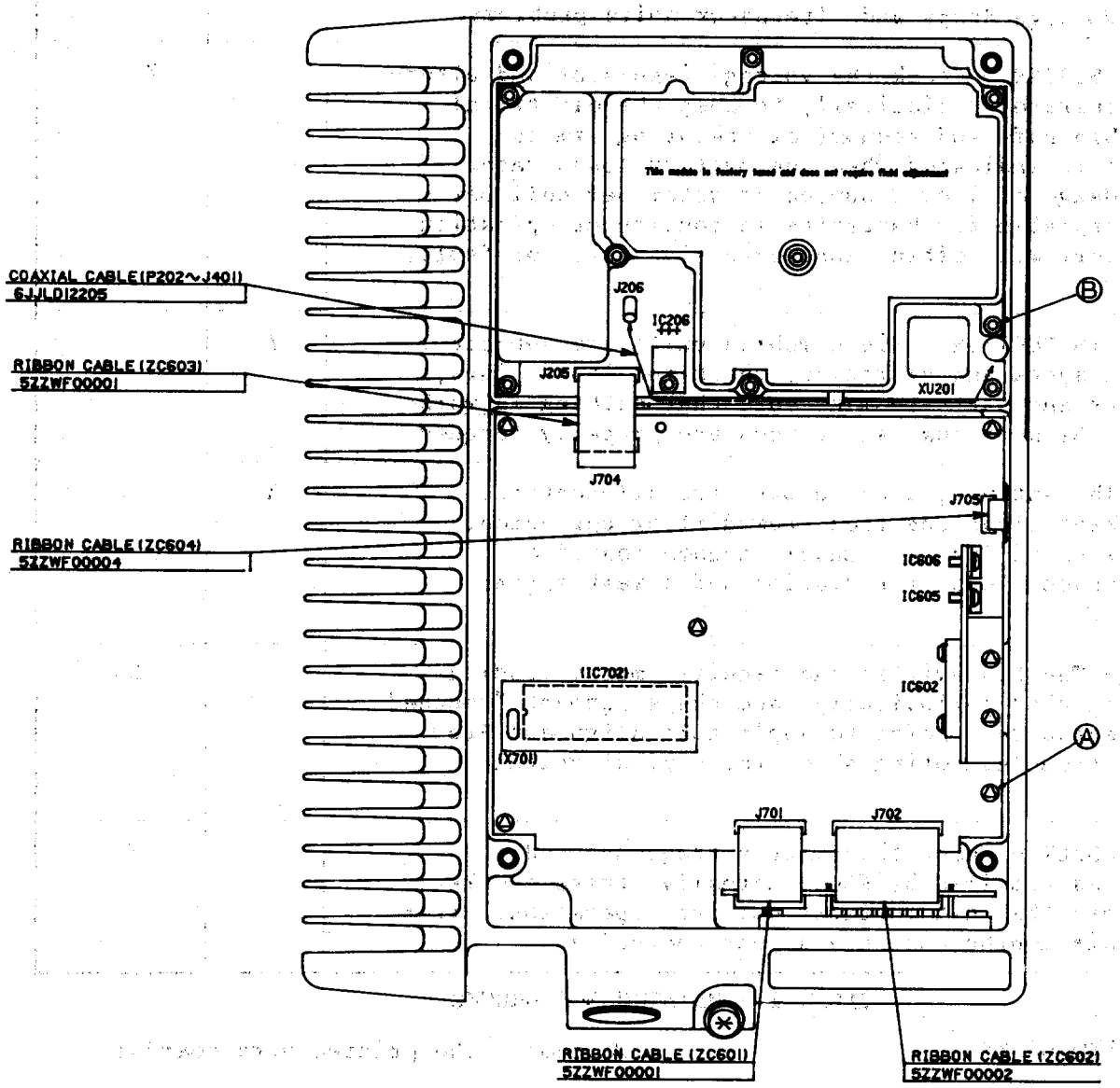
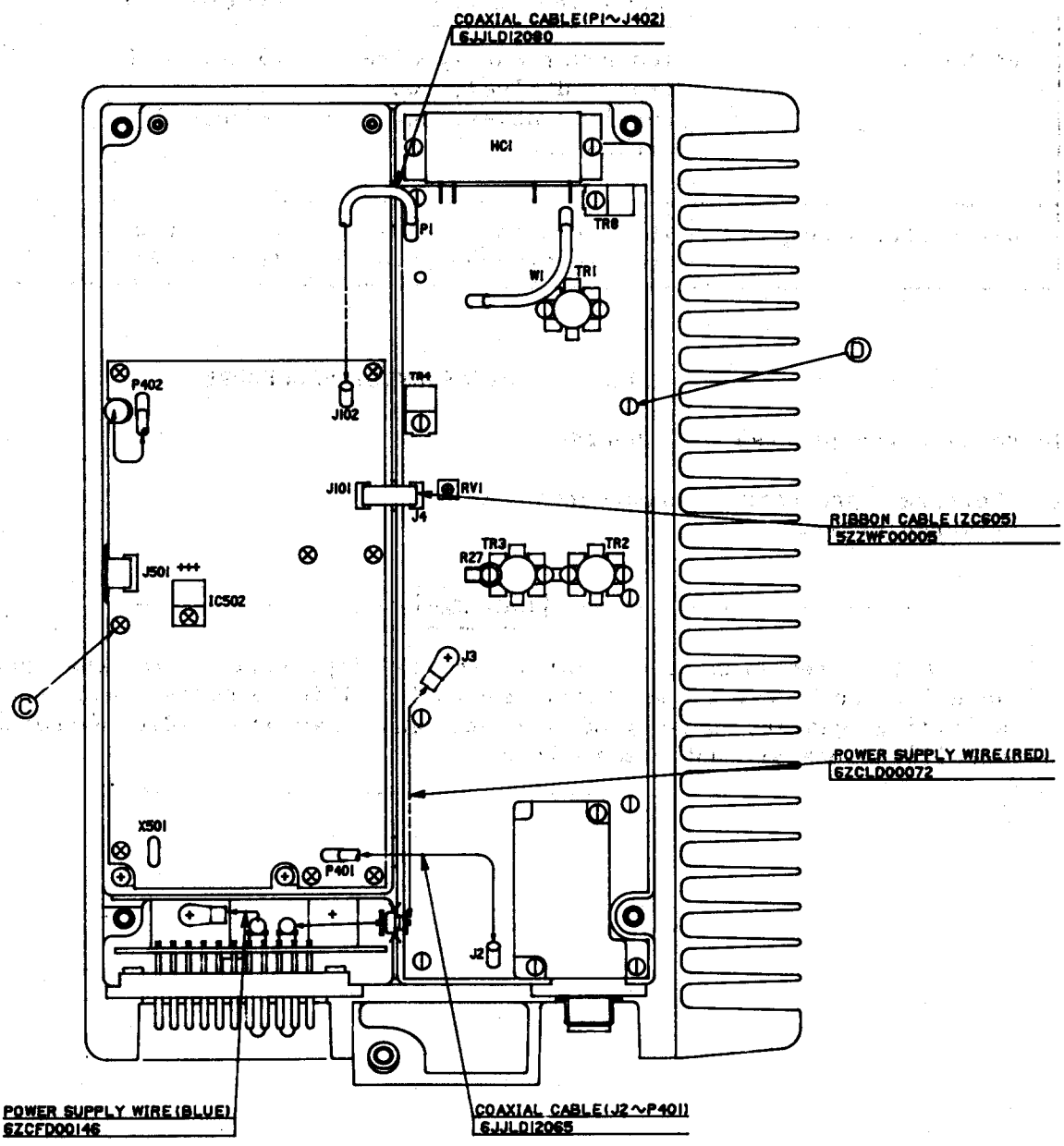


Disassembly-Top View

Figure 1



Disassembly–Bottom View

Figure 2

Board name	Cables to be removed	Screws to be removed
System Control board	Four ribbon cables	Seven screws A (Figure 1)
Synthesizer board	One coaxial cable and one ribbon cable	Ten screws B (Figure 1)
PA board	Two power supply wires (red and blue), two coaxial cables, one ribbon cable	19 screws D (Figure 2)
Rx/Exciter board	Three coaxial cables and two ribbon cables	Nine screws C (Figure 2)

TABLE 2 - DISASSEMBLY PROCEDURE

To replace the printed wire boards.

1. Perform preceding procedures in reverse order.

CAUTION

After securing the radio, it is important that the screws securing the covers be fully secured. This ensures that the RF shielding gaskets make good contact and that the radio performance specifications are not compromised.

PA TRANSISTOR REPLACEMENT

WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

To replace the PA RF transistors:

1. Unsolder one lead at a time with a 50 watt soldering iron. Use a scribe or X-acto® knife to hold the lead away from the printed circuit board until the solder cools. Remove the mounting screws.

2. Lift out the transistor. Remove any old solder from the printed circuit board with a vacuum desoldering tool. Special care should be taken to prevent damage to the printed circuit board runs because part of the matching network is included in the base and collector runs.

3. Trim the new transistor leads (if required) to the lead length of the removed transistor.

4. Apply a coat of silicone grease to the transistor mounting surface. Place the transistor in the mounting hole. Align the leads as shown on the Outline Diagram. Then replace the transistor mounting screws using moderate torque (9.4 kg.cm).

5. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Take care not to use excessive heat that causes the printed wire board runs to separate from the board. Check for shorts and solder bridges before applying power.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor or may cause low power output.

REMOVING IC's

Removing IC's (and most other soldered-in components) can be easily accomplished by using a vacuum desoldering tool such as SOLDA-PULLT® or equivalent. To remove an IC, heat each lead separately on the solder side and remove the old solder with the desoldering tool.

An alternate method is to heat all pins simultaneously using a special soldering tip.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the serviceman should discharge himself by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

REPLACING CHIP COMPONENTS

Replacement of chip components should always be done with a temperature-controlled soldering iron such as Weller EC2000 or EC1000, using a controlled temperature not exceeding 536°F (280°C). However, do not touch the black metal film of the resistors or the ceramic body of capacitors with the soldering iron.

★

NOTE

The metalized end terminations of the parts may be touched with the soldering iron without causing damage.

REMOVING CHIP COMPONENTS

1. Using two soldering irons heat both ends of the chip at the same time until solder flows, and then remove and discard the chip.
2. Remove excess solder with a vacuum solder extractor.
3. Carefully remove the epoxy adhesive and excess flux to prevent damage to the printed board.

REPLACING CHIP COMPONENTS

1. Using as little solder as possible, "tin" one end of the component and one of the pads on the printed wiring board.
2. Place the "tinned" end of the component on the "tinned" pad on the board and simultaneously touch the component and the pad with a well "tinned" soldering iron while pressing the component down on the board.
3. Place the "tinned" soldering iron on the other end of the component and the pad simultaneously. Apply solder to the top of the end of the component until the solder starts to flow. Use as little solder as possible while getting a good joint.
4. After the component has cooled, remove all flux from the component and printed wiring board area with alcohol.

TEST AND TROUBLESHOOTING PROCEDURES

Maintenance of the radio is facilitated by using the servicing techniques unique to this radio. Typical voltage readings are provided on the Schematic Diagram for reference when troubleshooting.

CAUTION

Before bench testing the radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed:	16.5 Volts
Transmitter keyed (50 ohms resistive load):	16.3 Volts
Transmitter keyed (no load or non-resistive load):	14 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limits shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 16.3 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes; 13.4 VDC for loads of 16 to 36 amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12 Volt automotive storage battery.

MICROPHONICS

Synthesized radios tend to be sensitive to shock and vibration, creating microphonics. The construction of the RANGR radio with its die-cast aluminum frame, cast shield, and multiple board-mounting screws, provides a high degree of immunity. When removing printed circuit boards or shields, note the location of all mounting hardware.

When servicing the radio be sure that no solder build-up has occurred on the chassis or shield.

To assure a high degree of resistance to microphonics be sure to replace exactly, all hardware removed. Be sure that all mounting screws are properly torqued and shields are in place. Refer to the Mechanical Layout Diagram.

NOTE

Loose or rubbing parts, especially in the VCO area are particularly sensitive and can cause microphonics. Again, be certain all hardware is properly installed and torqued.

TEST FREQUENCIES

If the EEPROM is not custom programmed to the customer specified personality, then a standard test program is provided. The EEPROM is programmed on several channels including tone and digital Channel Guard and carrier control timer. The test program is given in Table 3.

BAND	CH	TX (MHz)	RX (MHz)	CG (Hz)	CCT
136.00 to 153.00	1	144.500	144.025	71.9 023 71.9	0.30
	2	136.500	136.025		
	3	152.975	152.950		
	4	144.500	144.025		
150.00 to 174.00	1	159.975	159.950	71.9 023 71.9	0.30
	2	150.500	150.025		
	3	173.975	173.950		
	4	159.975	159.950		

BAND: frequency band

CH : channel number

TX : transmit frequency

RX : receive frequency

CG : channel guard

CCT : carrier control timer

Table 3 - Test Program

PA TROUBLESHOOTING PROCEDURE

DC VOLTAGE CHECK

First, Check the meter readings for power supply voltage and various stabilized DC voltages, at TP608.
The typical readings for the test points are given in the chart below.

TEST POINT	FUNCTION MEASURED	SCALE	TYPICAL READING
TP608-3	9V-RX	0-15V	9V
TP608-4	5V	0-15V	5V
TP608-8	EX9V	0-15V	9V
TP608-9	+8V	0-15V	8V
TP608-11	9V	0-15V	9V
TP608-12	A+	0-15V	13.6V

TABLE 4 - READINGS AT TP608

EXCITER QUICK CHECK

When troubleshooting the transmitter, check for typical readings for the DC voltages across Exciter resistor R116, the Synthesizer output (J206), and the Exciter output (J102) as listed in Table 5.

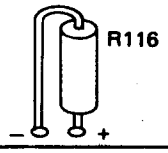
SYMPTOM	PROCEDURE	ANALYSIS
Little or No RF Output	Key transmitter and monitor Exciter DC voltages across R107 for 1.1 VDC or R116 1.0 VDC. Each voltage should increase. 	If voltage does not increase, check TR101, TR103 and associated components.
	Disconnect the coaxial cable plug P402 from the Synthesizer board and measure RX/EX INJECTION, J206. Should be +1 to +7 dBm.	If synthesizer output is low, check IC208 and associated circuitry.
	Disconnect the coaxial cable plug P1 from the Exciter board and measure EXCITER OUTPUT, J102. Should be 0.34 watts or more.	If EXCITER OUTPUT is low, check TR101, TR103 and associated components.

TABLE 5 - EXCITER QUICK CHECK

TYPICAL PERFORMANCE INFORMATION

SIGNAL LEVELS

SIGNAL	INDICATION	VOLTAGE LEVEL
CAS	High Level	9.0 VDC
	Low Level	0.15 VDC
RUS	High Level (Rx Un-sq)	9.0 VDC
	Low Level (Rx Squelched)	0.15 VDC
	Low Level (Rx Mute/PTT pulled low, Rx unsquelched)	0.6 VDC
$\overline{\text{SQ DSBL}}$, Input	Logic Low (Sq. Dis)	0 VDC
	Logic High(Sq)	2.4 VDC
	Rx Un-Sq	0.14 VDC
$\overline{\text{CCT PA ENBL}}$	Logic Low	0.35 VDC
	Logic High	5.5 VDC
$\overline{\text{TX ENB}}$	Logic Low	2.0 VDC
	Logic High	9.0 VDC
PTT, Input	Logic Low	0 VDC
	Logic High	13 VDC

TABLE 6 - SIGNAL LEVELS

Front Connector	J801
RX RF	P401
RX/EX INJ	P402
EX Output	J102

TABLE 7 RADIO CONNECTOR IDENTIFICATION

TRANSMITTER ALIGNMENT

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating, but not properly. Once a defect is pinpointed, refer to the Transmitter Troubleshooting Procedure. Before starting, be sure that transmitter is tuned and aligned properly.

CAUTION

Before bench testing the radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed:	16.5 Volts
Transmitter keyed (50 ohms resistive load):	16.3 Volts
Transmitter keyed (no load or non-resistive load):	14.0 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limits shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 16.3 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes; 13.4 VDC for loads of 16 to 36 amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12 Volt automotive storage battery.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST controls are adjusted to the proper setting before shipment and normally do not require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. Deviation Monitor

PROCEDURE FOR SETTING THE SYNTHESIZER TRANSMIT DEVIATION

NOTE

The transmit deviation has been properly set by the factory and should require no readjustement. Should it become necessary to adjust the deviation, please refer to the Maintenance Manual LBI-38184 and the section TX AUDIO PROCESSOR in SYSTEM CONTROL BOARD and MODULATION LEVEL CONTROL in FREQUENCY SYNTHESIZER BOARD. These will familiarize you with the modulation deviation and make the Alignment Procedure more understandable.

1. Select a center frequency channel. Remove P604
2. Rotate RV201 and RV604 fully counterclockwise.
3. Apply a 1 kHz tone at 1 Vrms through a 100μF capacitor to MIC HI at J701-6 (+ lead of capacitor).

   Connect the deviation monitor to the antenna connector J1 via a 30-dB coupler, whose output is terminated in a 50-ohm load. Key the radio.
4. Set VCO MOD ADJUST, RV202 for ±3.75 kHz deviation.
5. Adjust DEVIATION SYMMETRY ADJUST RV603 for a difference between plus and minus peak frequency deviation of less than ±0.1 kHz.
6. Repeat procedures 4 and 5 until the specified frequency deviation is obtained in both directions.
7. Set RV604 fully clockwise. Apply a 400 Hz tone to J604-2 and with the radio keyed, vary its amplitude until the Deviation Monitor reads 1 kHz. Note the level.
8. Change the signal generator frequency to 10 Hz at the same level and set LOOP MOD ADJUST, RV201 for a deviation of 1 kHz. Unkey the radio.
9. Disconnect the signal generator and replace P604 in position 1-2.
10. Select a frequency with Tone Channel Guard (preferably close to the center frequency).

    Key the radio and set CG DEVIATION ADJUST, RV604 for a deviation reading of ±0.75 kHz.

    NOTE: If channel Guard is not used on any frequency, the VCO MOD ADJUST RV202 may be set for a deviation of ±4.5 kHz instead of ±3.75 kHz.

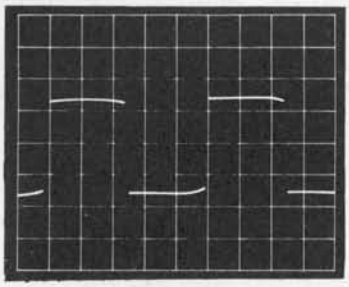
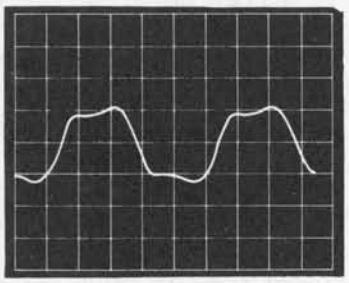
AUDIO CHECKS

TEST EQUIPMENT REQUIRED

- Audio Oscillator
- Voltmeter
- Oscilloscope
- Deviation Monitor

AUDIO AC VOLTAGE

1. Connect audio oscillator output across J701-6 (or J801-9) and J701-5 (or J801-5).

	IC607-1	IC607-7
SCOPE SETTING HORIZONTAL	200 µSEC/DIV	200 µSEC/DIV
VERTICAL	2 VOLTS/DIV	2 VOLTS/DIV
SET AUDIO OSCILLATOR at 1000 Hz WITH OUTPUT OF 1.0 VRMS. MODULATION ADJUSTED FOR 4.5 kHz DEVIATION. NOTE: AN RMS OR PEAK READING VOLTMETER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READINGS.		

AUDIO SENSITIVITY

1. Connect audio oscillator output across J701-6 (or J801-9) and J701-5 (or J801-5). Adjust output for 1000 Hz at 1.0 VRMS.

2. Reduce generator output until deviation falls to 3.0 kHz for radios without Channel Guard or to 2.25 kHz for radios with Channel Guard. Voltage should be less than 120 millivolts.

SYNTHESIZER AND TRANSMITTER ALIGNMENT

TEST EQUIPMENT REQUIRED

1. Wattmeter, 50 ohm (capable of measuring 150 Watts & 1 Watt)
2. DC Voltmeter, 20,000 ohms per volt
3. Digital Voltmeter
4. Power supply, 13.8 VDC regulated
5. An output meter or a VTVM

PRELIMINARY CHECKS AND ADJUSTMENTS

NOTE

Refer to Figure 3 for location of tuning and adjustment controls.

1. Apply DC power to radio.

NOTE

Before alignment or making any adjustments to the transmitter, be sure that power supply voltage (A+) and various stabilized DC voltages are proper. Refer to Table 4.

- SYNTHESIZER -

STEP	METERING POINT	TUNING CONTROL	METER READING	PROCEDURE
				NOTE The synthesizer is factory aligned and should not require further adjustment. Should it become necessary to adjust the synthesizer, please refer to the Maintenance Manual LBI-38184 and "Frequency Synthesizer" section. These will familiarize you with the operation of the VCO's and make the Alignment Procedure more understandable. **NOTE** The label on the cover of the Synthesizer must be removed, or holes made in it to gain access to the adjustable components, through the existing holes in the shield. These hole locations are shown in Figure 3. **NOTE** Should it become necessary to adjust the synthesizer, program a PROM to the highest frequency of the split for proper alignment, that is: 153 MHz for CMG-171A, 174 MHz for CMG-171B.
1.	TP201 (Control Voltage Monitor)	CV202	7.0 VDC	Select highest frequency transmit channel in the split metioned above. With a 50 ohm load on the antenna connector J1, key the radio. Adjust CV202 until the lock detector indicator, CD711, goes out. Monitor TP201 with a digital voltmeter and adjust CV202 for a reading of 7.0±0.1VDC. Check that CD711 remains out. Unkey the radio.
2.	TP201 (Control Voltage Monitor)	CV201	7.0 VDC	Select highest receive channel in the split as in Step 1 (release PTT switch). Adjust CV201 until lock detector indicator CD711 goes out. Monitor TP201 with a digital voltmeter and adjust CV201 for a reading of 7.0±0.1 VDC. Check that CD 711 remains out.
3.	TP201 (Control Voltage Monitor)		3.5 to 7.5VDC	Select each receive and transmit channel. Voltage at TP201 should be between 3.5 and 7.5 VDC.
4.	J206		+1 to +7 dBm	RX/TX injection level should be between +1 and +7 dBm.

STEP	METERING POINT	TUNING CONTROL	METER READING	PROCEDURE
5.	J206	FREQ TRIM Control on TCXO	Channel Operating Frequency	NOTE This step assumes the frequency is measured when the transmitter is first keyed. If delayed, the rapidly rising ambient temperature must be taken into consideration. The oscillator frequency should be set at 25°C ambient temperature. Press the PTT switch while monitoring the Rx/Ex injection frequency at J206. Adjust FREQ TRIM Control on TCXO for the assigned channel frequency within ±0.5 ppm. Note: The receiver injection frequency will automatically be correct.

STEP	METERING POINT	TUNING CONTROL	METER READING	PROCEDURE
				NOTE The Exciter requires no adjustment. If it becomes necessary to check the Exciter, proceed as follows.
6.				NOTE The Exciter can be isolated from the rest of the radio for checking purposes, if desired. To isolate and set up for alignment, remove coaxial cable connector P402. Connect a (0-1 watt) wattmeter to J102. Apply a +3 dBm on-frequency signal to P402 using adaptor coaxial cable B19/CFQ-3234.
			340 mW	Check output power on the wattmeter. It should be greater than 340 milliwatts.
7.				NOTE Disconnect wattmeter from J102. Reinstall P402, if removed. Connect a (0-150 watts) wattmeter and 50-ohm load to antenna jack J1.
	J1	RV1	Rated Output Power	110 WATT POWER AMPLIFIER Monitor the transmitter output power on each channel. Select the channel with the lowest output power and set RV1 for 110 watts output. 40 WATT POWER AMPLIFIER Monitor the transmitter output power on each channel. Select the channel with the lowest output power and set RV1 for 40 watts output.

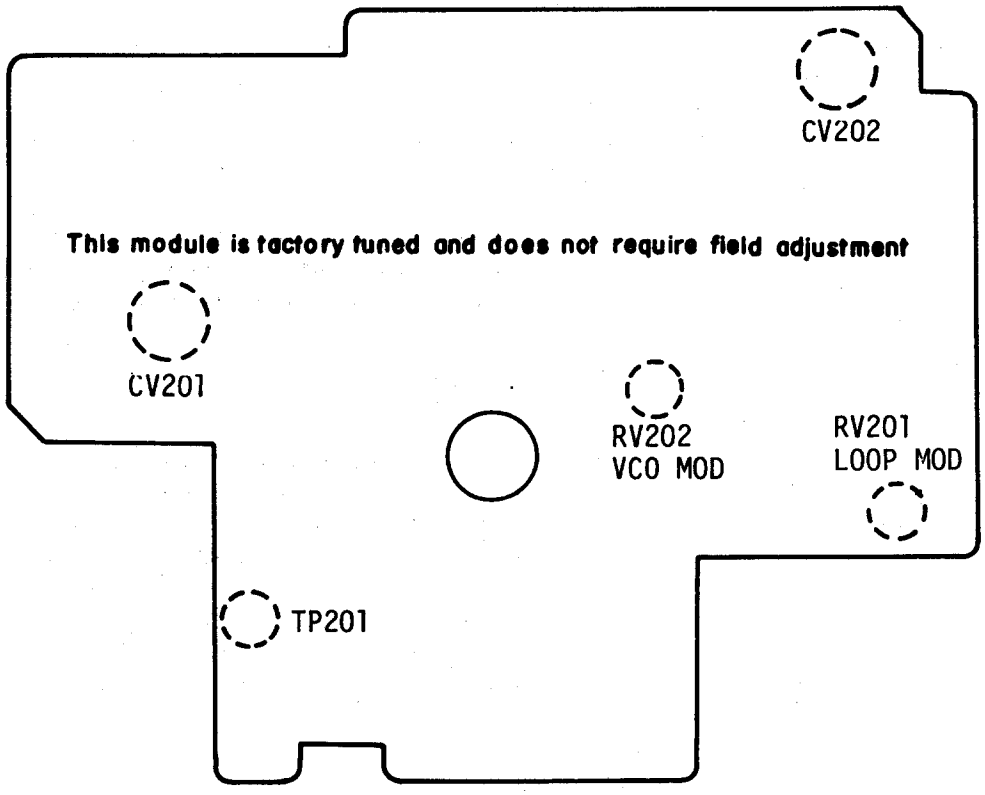


Figure 3 - Hole locations for synthesizer tuning and transmitter deviation adjustment

RECEIVER ALIGNMENT

Alignment of the Front-End and Local Injection circuits are not required because band-pass filters are employed in the RANGR wideband synthesized radio receiver.

TEST EQUIPMENT REQUIRED

- 20,000 ohms-per-volt multimeter.
- AC Voltmeter
- RF Signal Generator
- Frequency Counter (136 to 174 MHz)
- 4-ohm 15 watt resistor
- Audio Isolation Transformer (1:1) 19A116736P1 or equivalent

> **NOTE**
>
> Before aligning the receiver or making any adjustments to the radio be sure that the output of 9 Volt Regulator is 9.0 ±0.2 VDC

ADJUSTMENT PROCEDURES

RECEIVER FREQUENCY ADJUSTMENT

No receiver frequency adjustment is required.

2nd RECEIVER OSCILLATOR

Using a frequency counter monitor 2nd Local Terminal. Set L506 for a frequency of 81.745 MHz ±200 Hz.

IF/FM DETECTOR ALIGNMENT

Apply a 1000 microvolt, on-frequency test signal modulated by 1,000 Hz with ±3.0 kHz deviation to antenna jack J1.

Connect a 4-ohm, 15-watt resistor in place of the speaker. Connect the isolation transformer input across the resistor. Connect the isolation transformer output to the Distortion Analyzer (See Figure 5).

Adjust the VOLUME control for 5 Watts output (4.47 VRMS) using the Distortion Analyzer as a voltmeter.

Set the output signal level of the RF signal generator so as to obtain 12dB SINAD at audio output.

Adjust coils L501 and L503 to L505 to obtain minimum 12 dB SINAD.

Set the output signal level of the RF signal generator to 1000 microvolt.

Adjust L508 for maximum audio output.

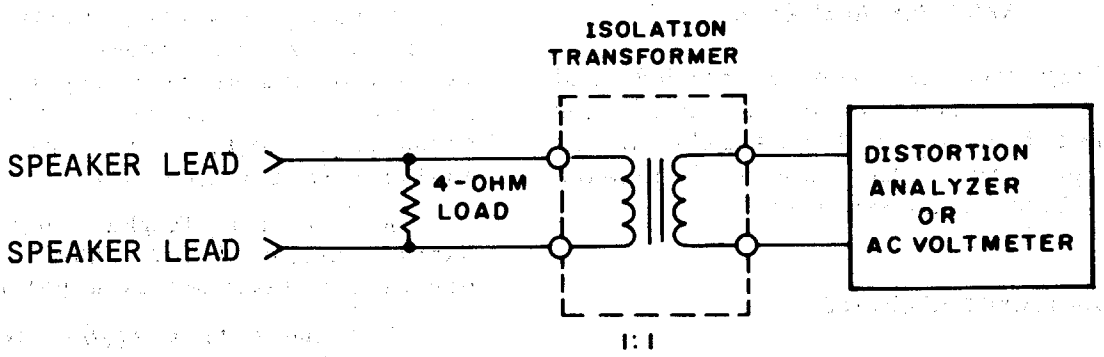


Figure 5 - Audio Isolation Transformer

RV601 ADJUSTMENT PROCEDURE

RV601 is used to set squelch amplifier gain to correct for noise variations between various bands of RANGR. This control does not require adjustment unless the squelch hybrid HC601 is changed or the systems board is exchanged between radios of different frequency bands.

1) Connect a signal generator to the antenna connector.

2) Set the squelch control on the Control Head fully clockwise.

3) Set RV601 on the System Control board fully clockwise.

4) Set the signal generator to the level to produce 20dB quieting.

5) Raise the generator level by 2dB.

6) Set the squelch control on the Control Head fully counterclockwise.

7) Adjust RV601 until the squelch just closes.

8) Set the modulation frequency to 1kHz with 3kHz deviation.

9) Check the signal generator level required to just open the squelch. It should be greater than the 20dB level and less than 1μV.

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RECEIVER AUDIO AND SQUELCH CHECKS

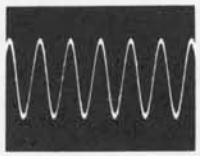
SQUELCH CIRCUIT TEST WITH 6kHz SIGNAL

PRELIMINARY STEPS

1. Set the squelch on the control head to close at 8 dB SINAD level.
2. Quiet receiver with 1000 uV modulated signal applied to antenna jack J1.
3. Set modulation frequency to 6 kHz.
4. Set deviation to 3 kHz.
5. Use 10 megohm probe.

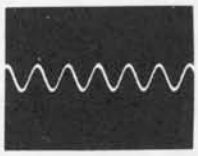
(A)

HOR .1 MSEC/DIV
VERT 0.1 V/DIV
(0.3 ∿ 0.6 V p-p)



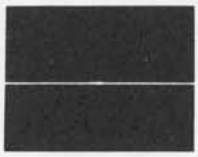
(B)

HOR .1 MSEC/DIV
VERT 0.1 V/DIV
(0.5 V p-p)



(C)

HOR .1 MSEC/DIV
VERT 2 V/DIV
(7.5 ∿8.0 VDC)
BASE LINE 0 VDC



SQUELCH CIRCUIT CHECKS WITH NOISE

PRELIMINARY STEPS

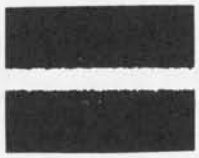
1. Set the squelch on the control head to close at 8 dB SINAD level.
2. Remove input signal.
3. Use 10 megohm probe.

(A)

HOR .5 MSEC/DIV
VERT 1 V/DIV
(3.5 ∿4.0V P-P)

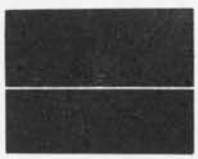
(B)

HOR .5 MSEC/DIV
VERT 1 V/DIV
(2 V P-P)



(C)

HOR .5 MSEC/DIV
VERT 2 V/DIV
(7.5 ∿8.0 VDC)



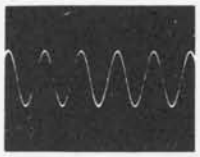
AUDIO CIRCUIT

PRELIMINARY STEPS

1. Apply 1000 uV on frequency signal with 1000 Hz modulation and 3 kHz deviation to antenna jack J1.
2. Output set to 10 Watts (6.3 VRMS) into 4-ohm load.
3. Use 1 megohm probe.

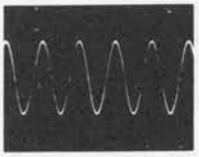
(D)

HOR .5 MSEC/DIV
VERT 50 mV/DIV
(160 mV P-P)



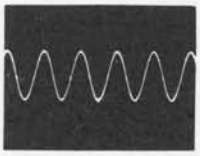
(E)

HOR .5 MSEC/DIV
VERT .2 V/DIV
(.84 V P-P)



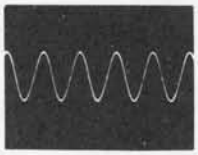
(F)

HOR .5 MSEC/DIV
VERT .1 V/DIV
(.28 V P-P)



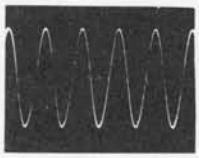
(G)

HOR .5 MSEC/DIV
VERT .1 V/DIV
(.28 V P-P)



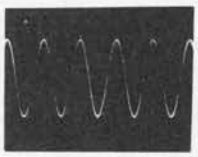
(H)

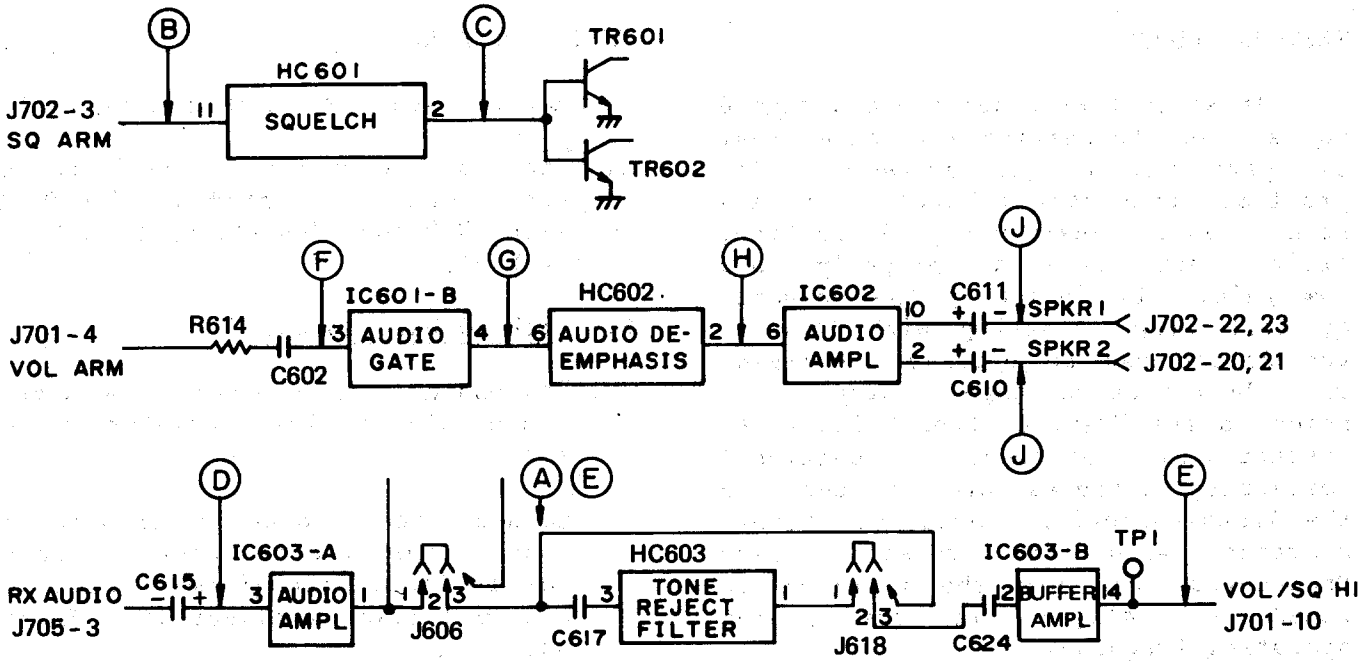
HOR .5 MSEC/DIV
VERT 50 mV/DIV
(280 mV P-P)



(J)

HOR .5 MSEC/DIV
VERT 2 V/DIV
(8.8 V P-P)




B
C
TR601
HC601
J702-3
SQ ARM
11
SQUELCH
2
TR602
J
F
G
H
IC601-B
HC602
IC602
C611
J701-4
VOL ARM
R614
C602
3
AUDIO
GATE
4
6
AUDIO DE-
EMPHASIS
2
6
AUDIO
AMPL
10
+
-
SPKR 1
J702-22, 23
2
SPKR 2
J702-20, 21
C610
D
A
E
IC603-A
HC603
IC603-B
TP1
RX AUDIO
J705-3
C615
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C617
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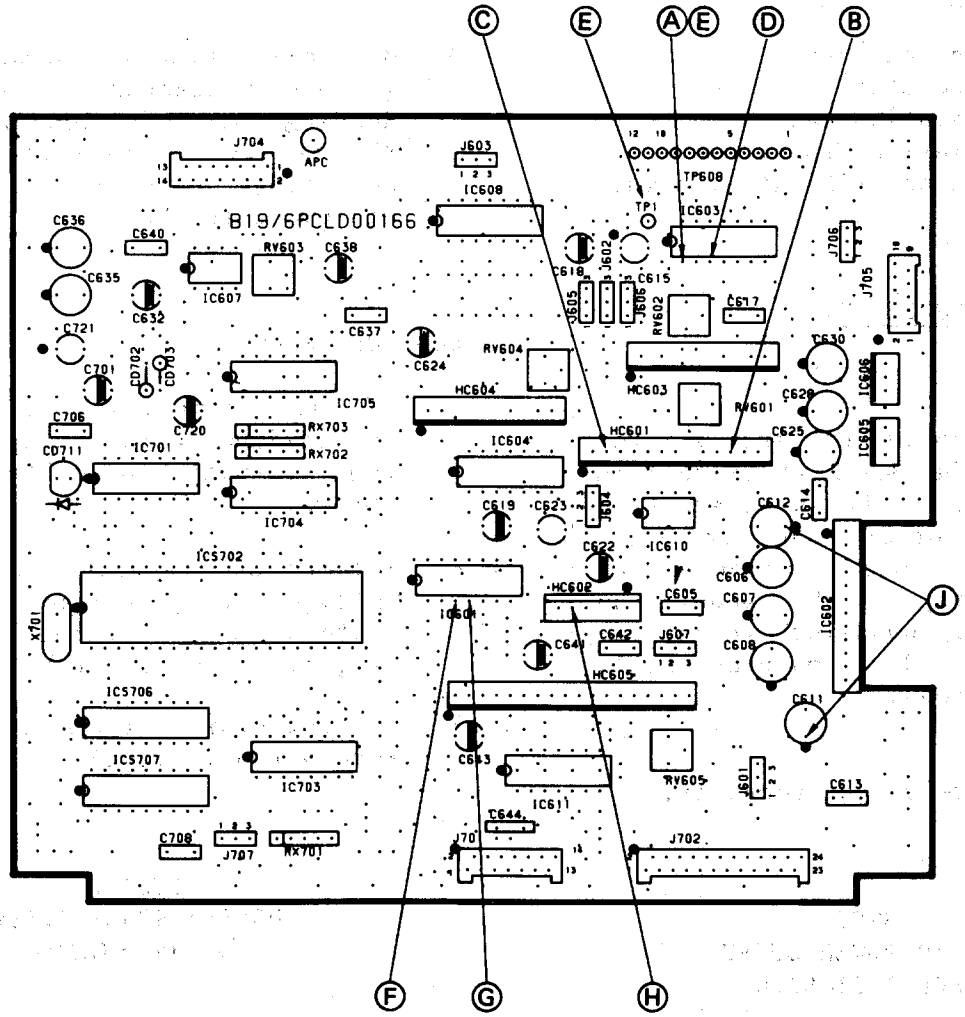
REJECT
FILTER
J618
C624
BUFFER
AMPL
VOL/SQ HI
J701-10


B19/6PCLD00166
C
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APC
J603
IC608
TP608
TP1
IC603
C636
C640
RV603
C638
C635
C632
IC607
C637
C721
C624
RV604
HC604
HC603
C630
C628
RV601
C625
C701
CD702
CD703
IC705
C706
C720
RX703
RX702
CD711
IC701
IC704
HC601
IC604
C619
C623
J604
C622
IC610
C612
C606
C607
C608
IC602
IC702
X701
HC602
C605
C642
J607
C641
HC605
IC706
IC707
IC703
C643
IC611
RV605
J601
C613
C644
C708
J707
RX701
J702

TEST PROCEDURE

These Test Procedures are designed to help you to service a receiver that is operating, but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pinpointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer
- Signal Generator
- 6 dB attenuation pad
- Audio Isolation Transformer
- 4-ohm resistor (15-watt minimum)

PRELIMINARY ADJUSTMENT

NOTE

These procedures are written around the Heathkit Distortion Analyzer. If a Distortion Analyzer other than the Heath IM-12 is used, measure the sensitivity and modulation acceptance bandwidth in accordance with manufacturer's instructions.

1. Unsquelch the receiver.

STEP 1
AUDIO POWER OUTPUT
AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1000 microvolt, on-frequency test signal modulated by 1,000 Hz with 3.0 kHz deviation to antenna jack J1.

B. With 10 Watt Speaker

Disconnect the speaker. Connect a 4-ohm, 15-watt load resistor in its place.

Connect the isolation transformer input across the resistor. Connect the isolation transformer output to the Distortion Analyzer (See Figure 5).

C. Adjust the VOLUME control for 10-watt output (6.32 VRMS) using the Distortion Analyzer as a voltmeter.

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 3%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 3%, or maximum audio output is less than 10-watt, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

F. FM Detector alignment (Refer to Receiver Alignment).

STEP 2
USABLE SENSITIVITY
(12 DB SINAD)

TEST PROCEDURE

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000 microvolt, on-frequency signal modulated by 1000 Hz with 3.0 kHz deviation to J1.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000 Hz distortion range position (1000 Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. Set signal generator output to 0.3 μV. Switch the RANGE control from SET LEVEL to the distortion range. Readjust Distortion Analyzer SET LEVEL as required until a 12 dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12 dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 5 Watts (4.47 Volts RMS across the 4.0 ohm receiver load using the Distortion Analyzer as a Voltmeter).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the IF stages as directed in the Alignment Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

TEST PROCEDURE

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Reduce audio output level to 10% of rated output.

B. Set the Signal Generator output for twice the microvolt reading obtained in the 12 dB SINAD measurement.

C. Set the RANGE control on the Distortion Analyzer to the SET LEVEL position (1000 Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

D. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12 dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

E. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than +7.0 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, check the synthesizer frequency and then refer to the alignment of IF stages.

ERICSSON

Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in Japan

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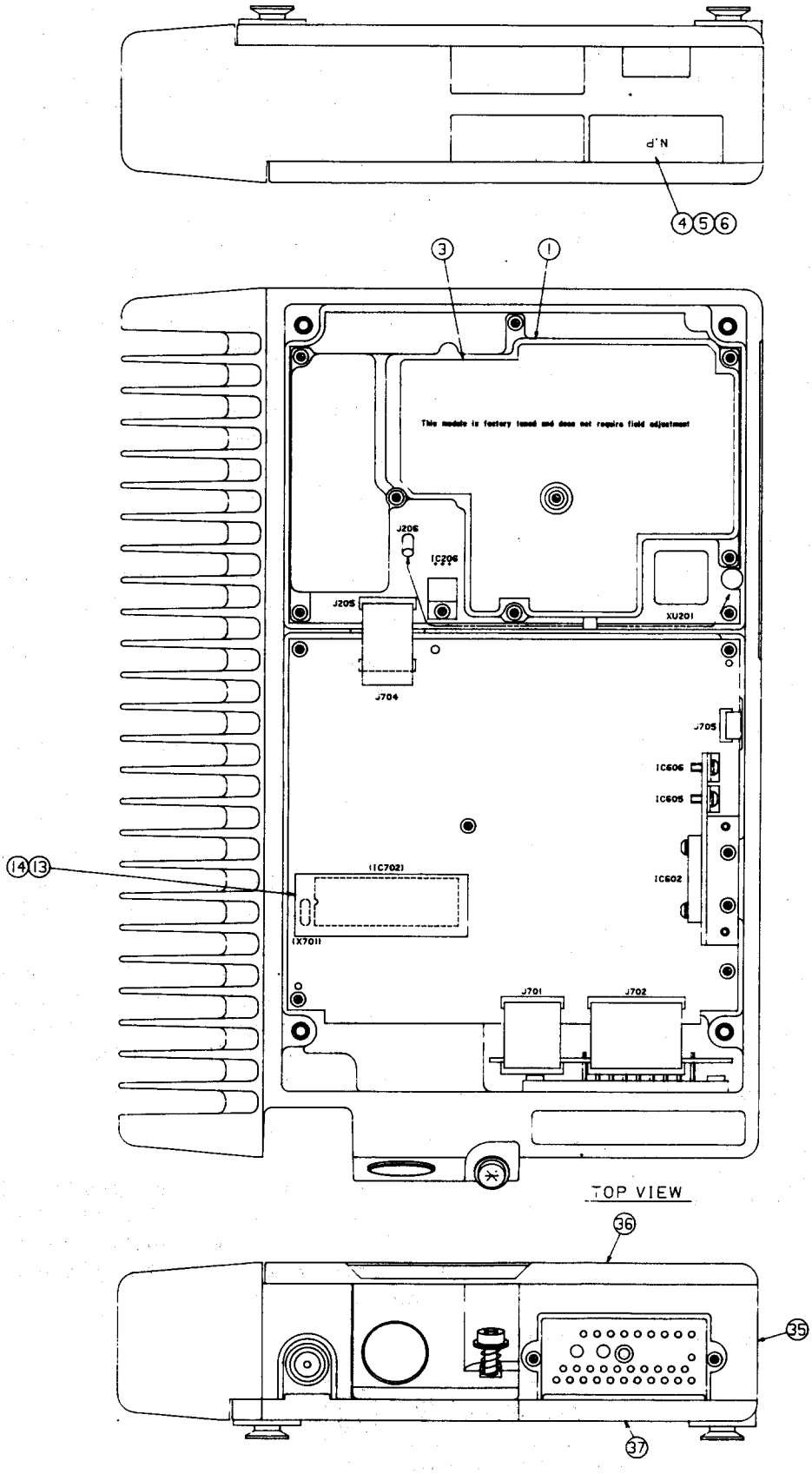
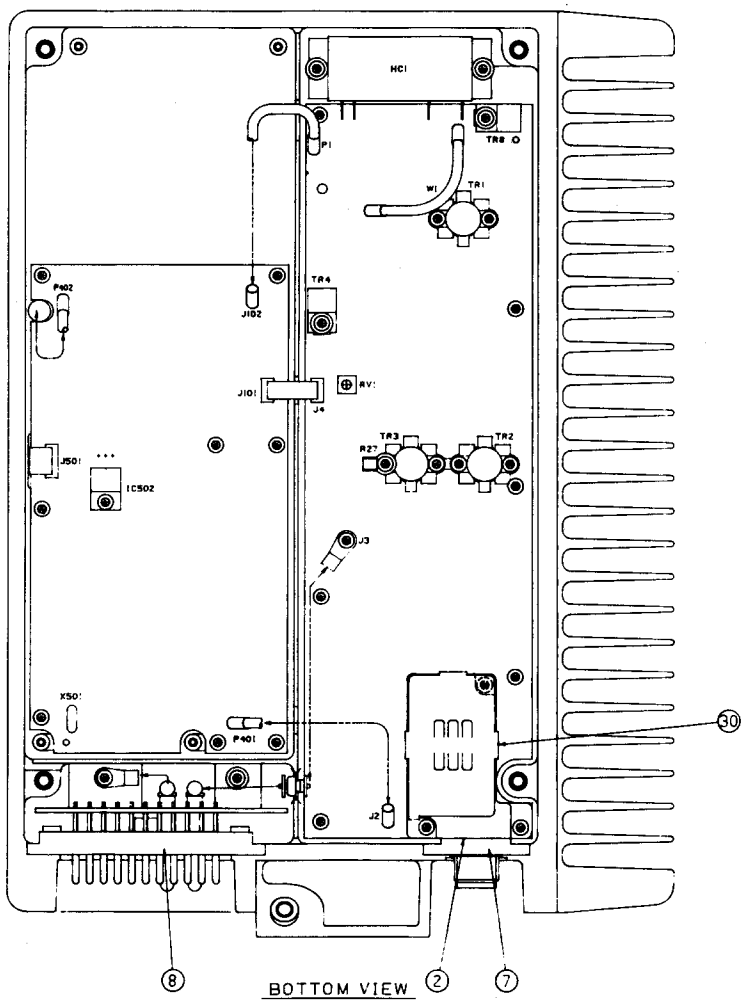
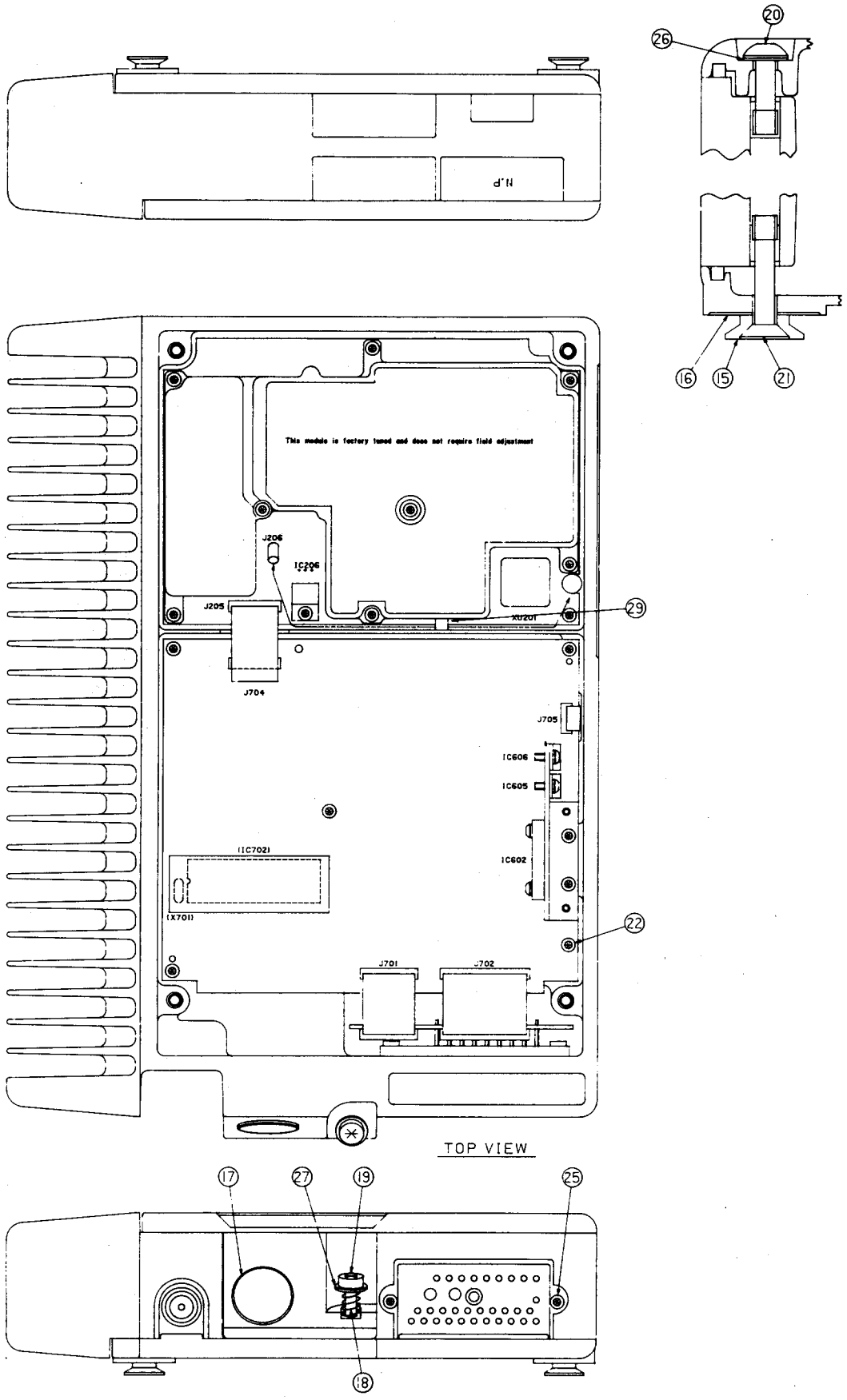


MECHANICAL LAYOUT DIAGRAM 1/2

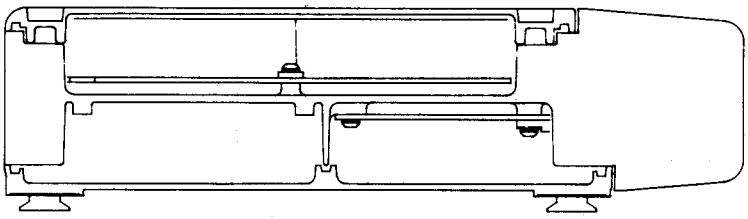


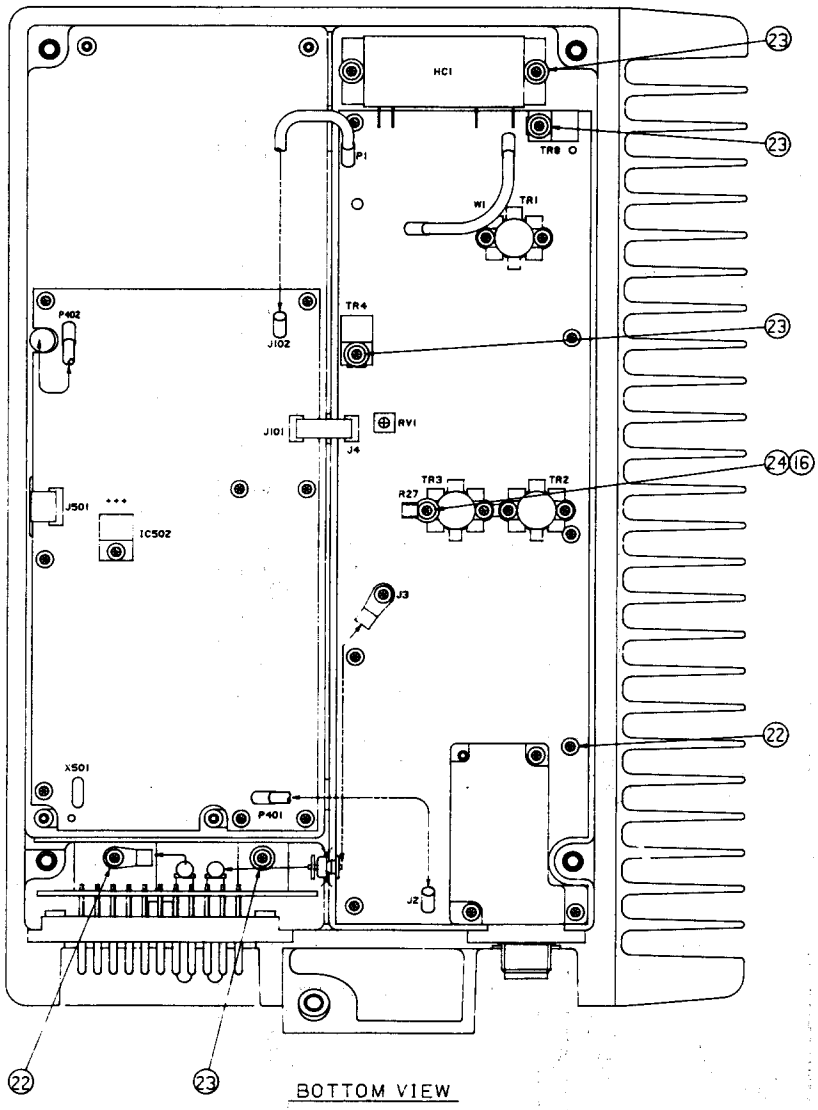
SYMBOL	GE PART NO.	NOMENCLATOR
1	B19/MTC002425B	CASE,SHIELD
2	B19/MTC002970	CASE,SHIELD
3	B19/MTT0211728	SEAL
4	B19/MPNN22095A	PLATE,SERIAL NO.
5	B19/MPNN19349	OVER LAY
6	B19/MTZ002812	ADHESIVE TAPE
7	B19/MPPK01415	GASKET,ANTENNA CONNECTOR
8	B19/MPPK01416	GASKET,INTERFASE CONNECTOR
10	B19/MPPK01286	GASKET,SHIELD
11	B19/MPPK01161	GASKET,SHIELD
12	B19/MPPK01163	GASKET,SHIELD
13	B19/MTB153924	CASE,SHIELD
14	B19/MTB153925A	COVER,SHIELD
30	B19/MTB160805	PLATE,GROUNDING
31	B19/MPPK01162	GASKET,SHIELD
35	B19/MPBC08459	FRAME ASM (COMPLETE ASM)
36	B19/MPBC08460	TOP COVER ASM (COMPLETE ASM)
37	B19/MPBC08461	BOTTOM COVER ASM (COMPLETE ASM)
38	B19/MPBX18126	MOUNTING BRACKET
39	B19/MPXP01744A	MOUNTING HARDWARE

MECHANICAL LAYOUT DIAGRAM 2/2



HARDWARE (SCREW) KIT
KIT CODE: B19/MPXP01954A 1/2

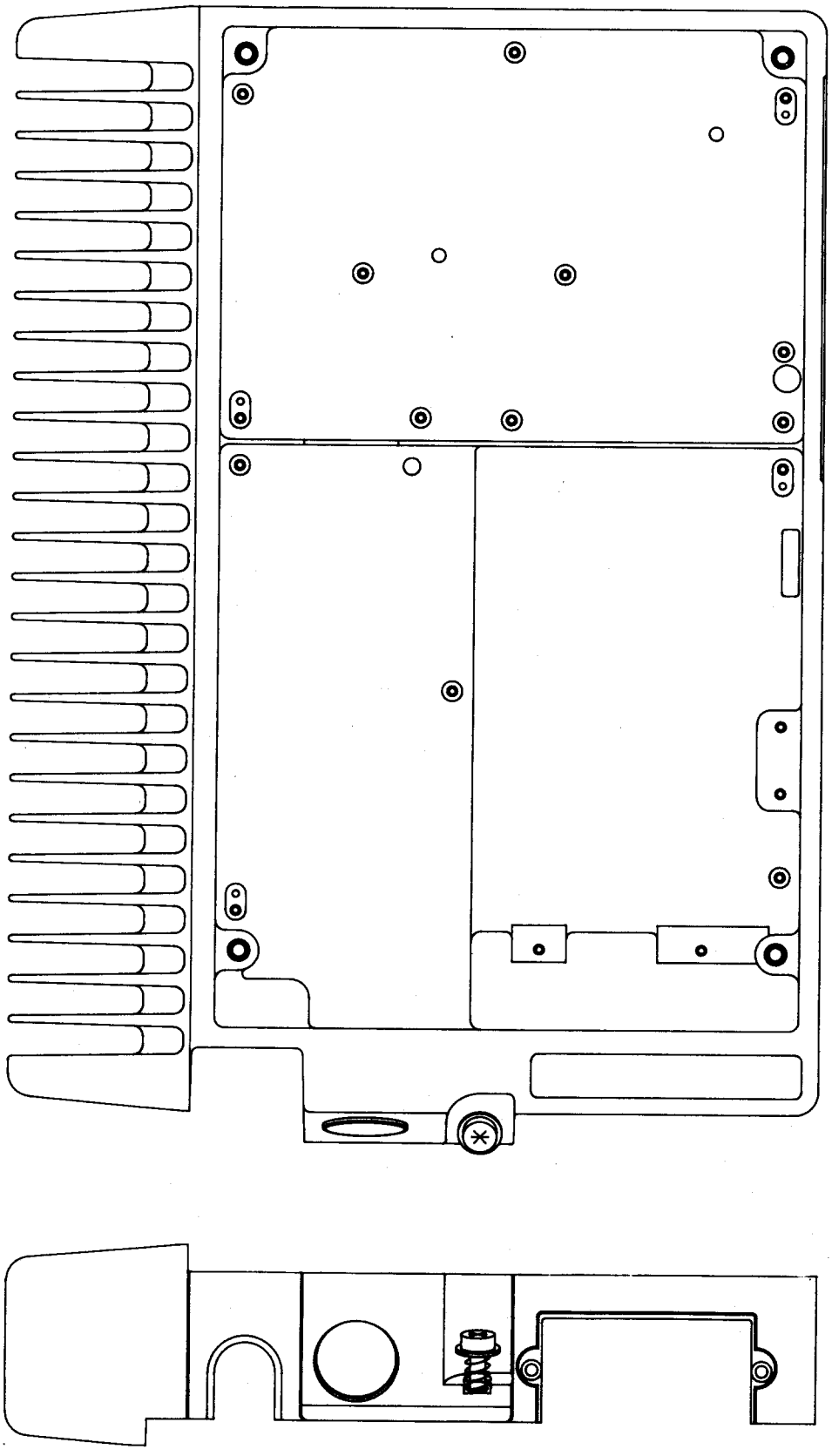




BOTTOM VIEW

ITEM NO.	GE PART NO.	DESCRIPTION	QTY PER KIT
15	B19/MTL032906B	FOOT	4
16	B19/MTT021134A	SPACER	4
17	B19/MTV002836	COVER	1
18	B19/MPSR02159B	SPRING	1
19	B19/MPTG02014A	SCREW	1
20	B19/MPTG02015	SCREW	4
21	B19/MPTG02016	SCREW	4
22	B19/BRTG03830	SCREW,PAN HEAD M3x8	56
23	B19/BRTG03942	SCREW,PAN HEAD M3x8	3
24	B19/BRTG03943	SCREW,PAN HEAD M3x12	3
25	B19.BRTG03293	SCREW,FLAT HEAD M3x10	6
26	B19/BRTG01781	WASHER,THRUST	4
27	B19/BRTG03301	WASHER	1
28	B19/MTL035255	SPACER	1
29	B19/MTT021147	CLAMP,CABLE	1

HARDWARE (SCREW) KIT
KIT CODE: B19/MPXP01954A 2/2



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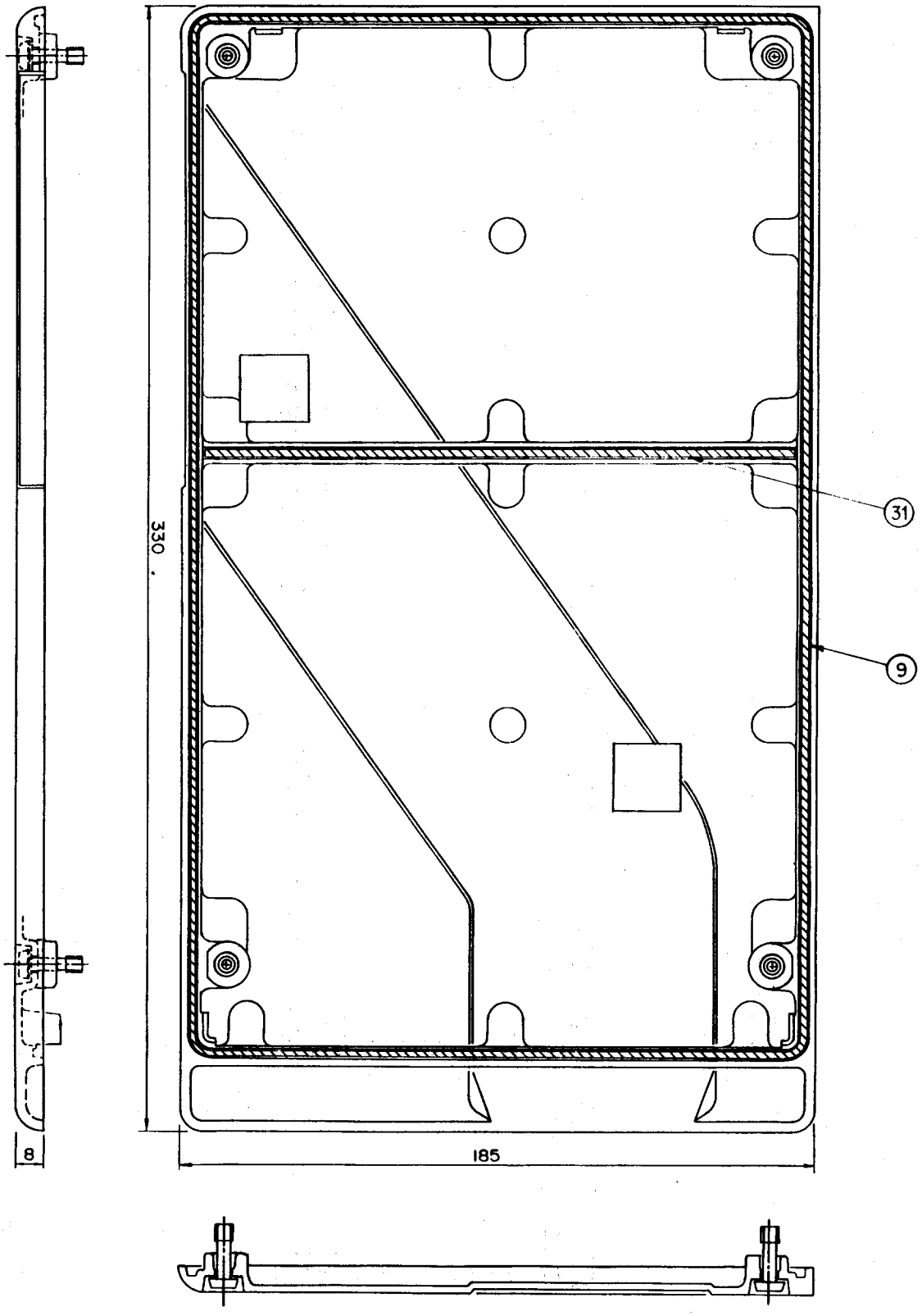

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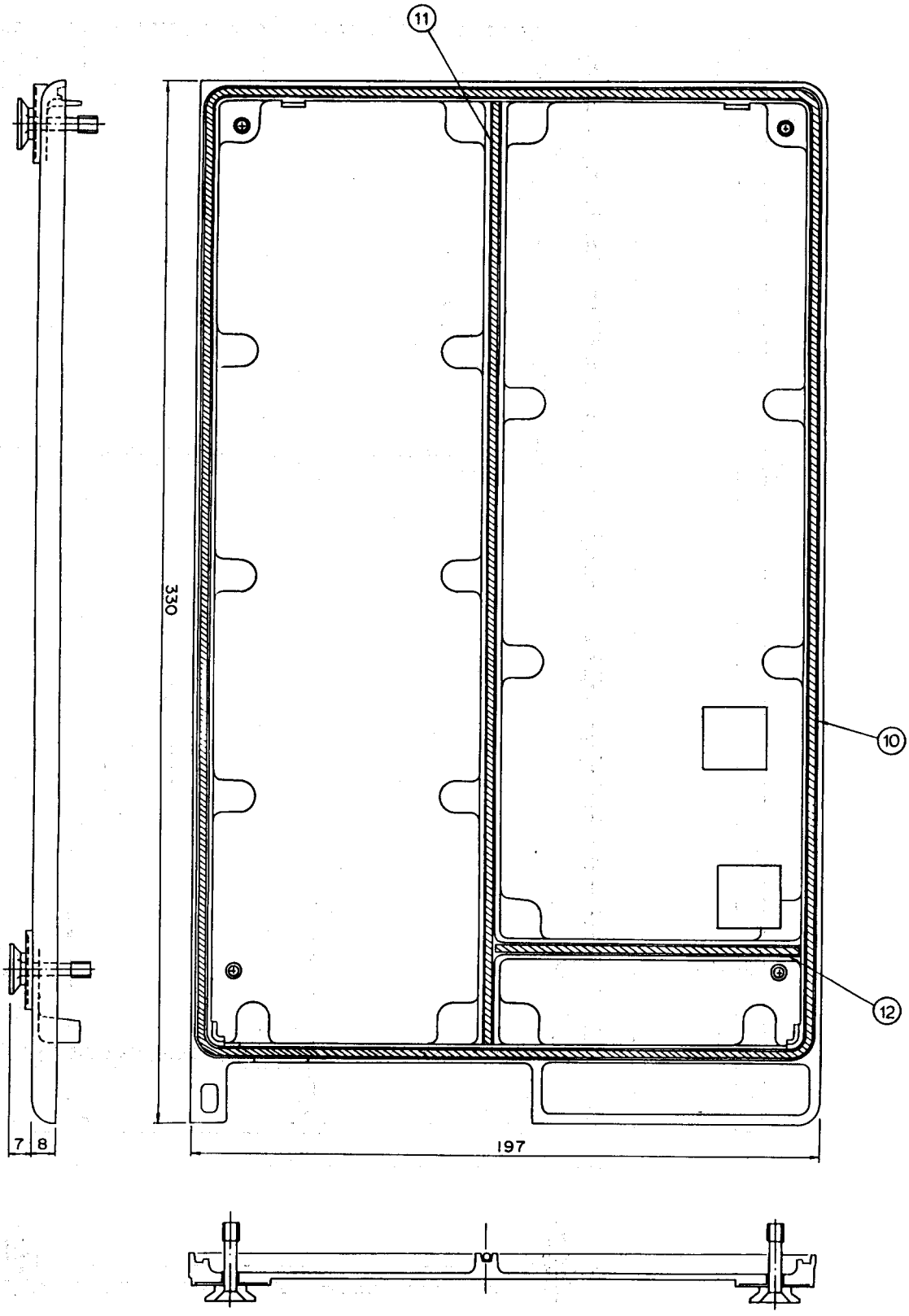

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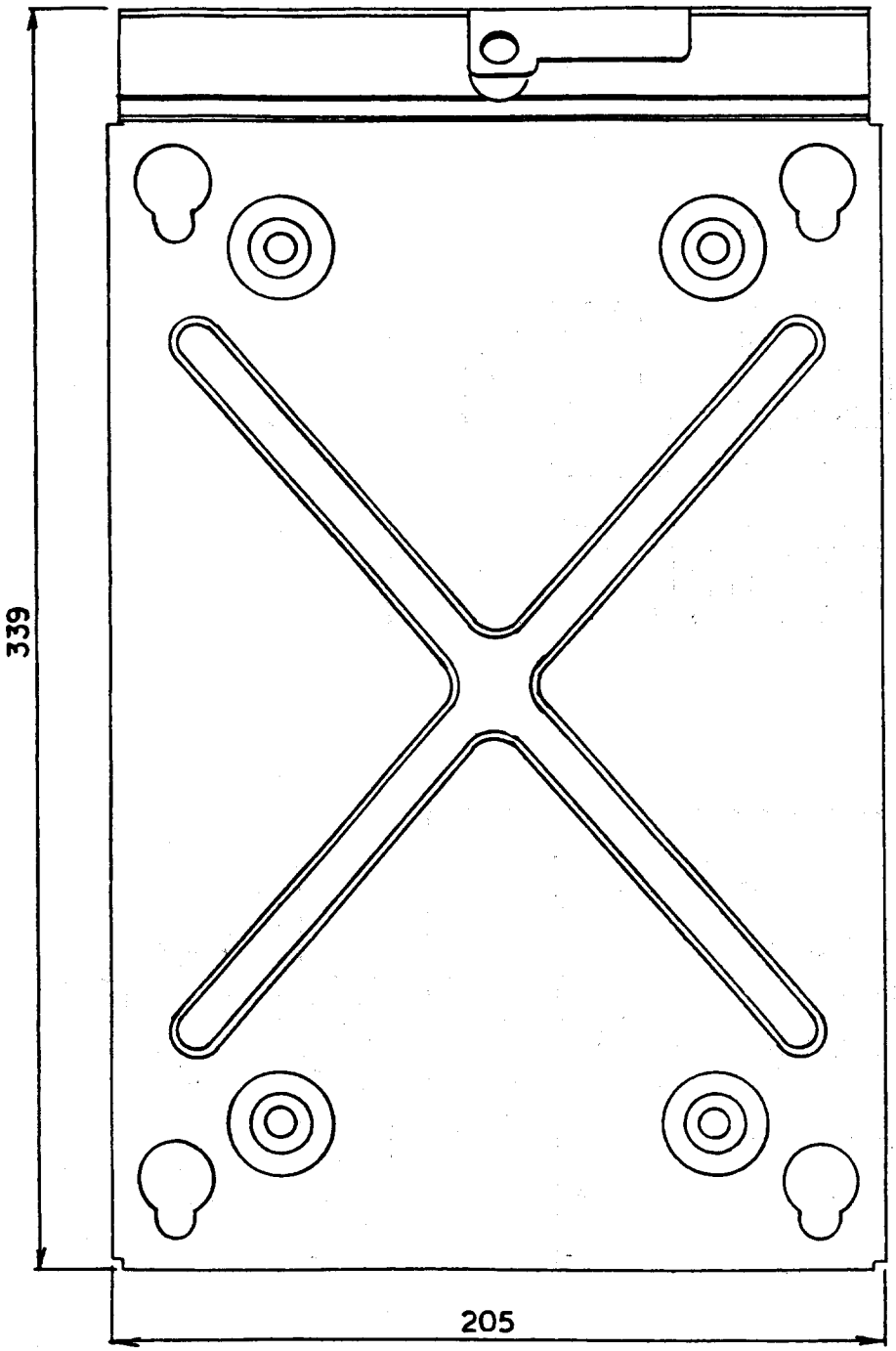

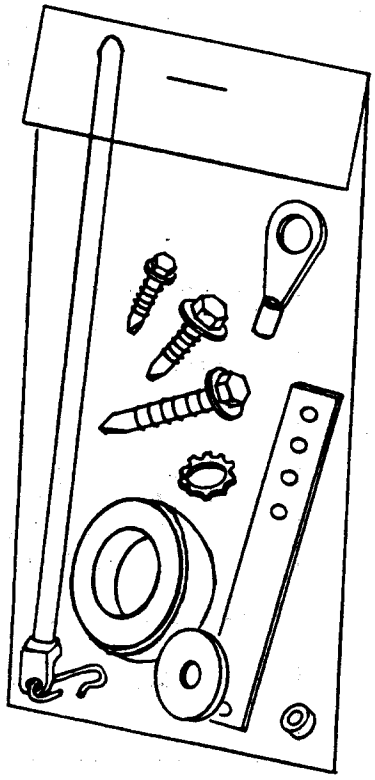

(38)
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CODE:B19/MPBX18126

(39)
MOUNTING HARDWARE KIT
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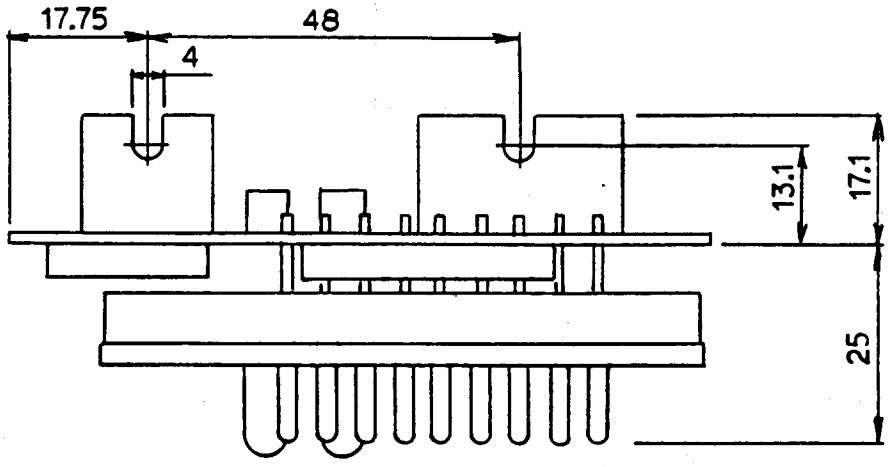

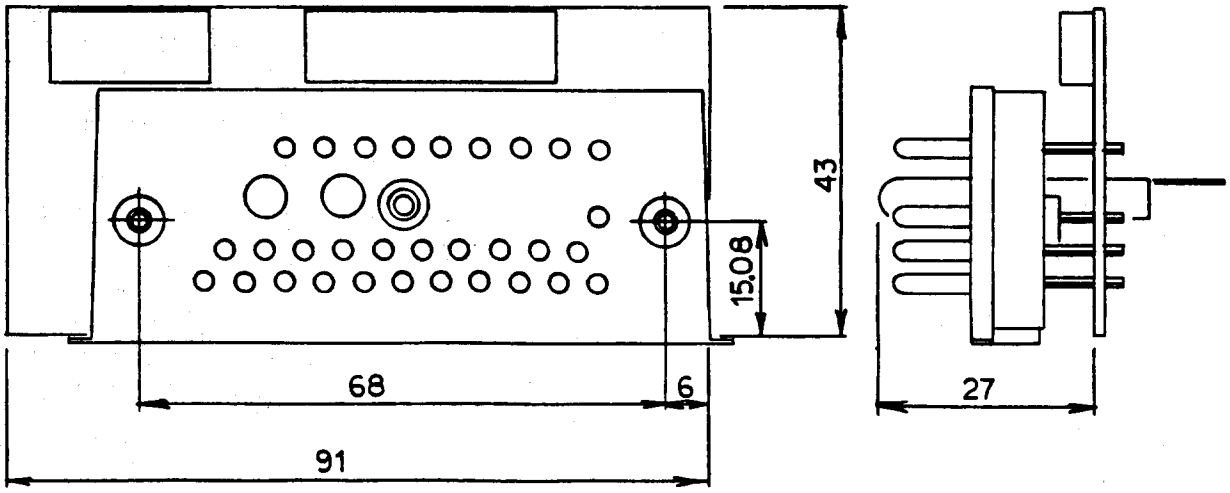

INTERFACE BOARD ASSEMBLY
ASM CODE:B19/CMH-813

ERICSSON

MAINTENANCE MANUAL

(Supersedes LBI-31719)

136-153 MHz
150-174 MHz BOARD ASSEMBLIES

TABLE OF CONTENTS

DESCRIPTION

The System Control board for RANGR provides all functions necessary for two-way communications. This board is controlled by the control unit.

The System Control board interconnects with the power/control cable from the control unit.

The System Control board contains the audio circuitry, microcomputer, EEPROM and voltage regulators. The micro-computer controls all system functions, supplies frequency data to the frequency synthesizer, and tone/code data to the Channel Guard.

In addition to the normal radio functions, the microcomputer contains self-diagnostic maintenance routines to aid in troubleshooting the radio. Included are an internal test of the microcomputer and input/output tests to assure proper operation of the data port and data bus. Details and procedures are included in the Service Section of this manual.

The system control and interface circuits consist of the microcomputer, electrically eraseable PROM, interface circuits for voltage shifting and protection, and a watchdog timer. The EEPROM gives the user the capability to program the radio's personality as desired. The EEPROM contains the receive and transmit frequency data, Channel Guard tone frequencies/digital codes and the CCT delay on a per-channel basis.

NOTE

The EEPROM may be programmed serially through the front connector using the General Electric Universal Radio Programmer Model TQ2310.

CIRCUIT ANALYSIS

SYSTEM CONTROL BOARD

MICROCOMPUTER AND CONTROL

The microcomputer interfaces with the control unit through J701/J702 and responds to all user commands and control functions originating from the control unit. It provides the transmit and receive data to the frequency synthesizer, switching information for tone and digital Channel Guard, and provides the carrier control timer (CCT) function when the radio is in the transmit mode.

When the microphone is keyed, the $\overline{\text{PTT}}$ line from the control unit goes low. This low is applied to the microcomputer through buffer TR702 and inverter TR703. TR702 is controlled by ignition switch A+. The ignition switch must be on and A+ applied to the base of TR702. TR702 must be turned on to permit keying of the transmitter. When Channel Guard is present, the release of the PTT signal is delayed by the microcomputer for approximately 160 milliseconds to eliminate any squelch tail.

The microcomputer immediately closes the antenna relay switch by applying a low level to $\overline{\text{DPTT}}$ at IC702-28. The microcomputer then delays 15 milliseconds before transmit 9V is switched on by applying a low level to $\overline{\text{TX ENB}}$ at IC702-32. This is done to guarantee that the antenna relay contacts are closed before the transmitter is energized. Once $\overline{\text{DPTT}}$ is low, the receive audio is muted. Buffers TR705 and TR704 provide $\overline{\text{DPTT}}$ to the audio control circuits, and antenna relay. IC704-B provides the DPTT signal to the Tx/Rx VCO's and the audio processor.

The $\overline{\text{TX ENB}}$ line is controlled by microcomputer port 1, bit 5 (IC702-32) through inverter TR712 and buffer TR711. A low level on IC702-32 turns TR712 off, allowing the base of TR711 to rise. TR711 turns on, and applies A- to the $\overline{\text{TX ENB}}$ line. Inverter TR710 is also turned on during this time to inhibit the alert tone PTT.

CHANNEL SELECTION

The microcomputer and EEPROM provide the radio with up to 16 independent transmit and receive frequencies. Each time the PTT switch is operated the microcomputer transfers channel data from the EEPROM and converts it to frequency data assigned to the selected channel. The frequency data is then loaded serially into the frequency synthesizer.

The microcomputer continually monitors the status of tri-state buffers IC703A-D. These buffers are periodically turned off by a positive 5 volt, one millisecond pulse from IC702-36. At the same time PROM power switch TR708 is turned on and applies +5 VDC to the EEPROM. When the buffers are turned on, channel select data is loaded into input/output ports of the microcomputer through ports P20-P23. Power is then applied to the EEPROM and the tri-state buffers are turned off. The microcomputer converts the channel select data into address information, accesses the EEPROM, and receives the frequency data stored in the addressed location. This data then passes through the I/O ports of the EEPROM and P20-P23 of the microcomputer. The conversion process is repeated eight times in rapid succession (eight locations are required for each channel) and the data loaded serially into the frequency synthesizer over the clock and data lines. This data also includes Channel Guard information, if present, and carrier control timer information on a per-channel basis. A 4-millisecond channel change pulse from port P16 of the microcomputer is also sent to the frequency synthesizer to speed up channel acquisition.

WATCHDOG TIMER

The watchdog timer, consisting of a digital counter IC701-A and TR701, monitors the operation of the microcomputer. IC701-A generates a reset pulse in the unlikely condition that the microcomputer goes awry and does not execute the software properly.

A 6 MHz crystal X701 steps the microcomputer through the software. As programmed in software a random pulse appears at IC702-35 and is applied to the base of inverter TR701 momentarily turning it on and inhibiting any reset pulse from timer IC701-A. A discharging circuit consisting of R710 and C705 forces the microcomputer to toggle IC702-A. If the timer does not receive any inputs for a specified period of time, TR701 turns off and IC701-A times out and applies a reset pulse to pin 4 of the microcomputer. The watchdog reset will normally restore the microcomputer to normal operation so that only one pulse will occur. In the event the microcomputer is not restored to normal operation, a 6 Hz square wave will appear on the reset line and the indicator CD711 (normally unlit) will turn on.

ADVANCE CHANGE PULSE

The advance change pulse is received from connector J702 and applied to the microcomputer interrupt port IC702-6 through inverter TR707. The advance change pulse is important in radios equipped with PSLM. When a call is received on a priority channel the advance change pulse interrupts the microcomputer, forcing it to service immediately the I/O circuits. The tri-state buffers are turned on and new channel select information read in.

CARRIER CONTROL TIMER

The carrier control timer function is executed by the microcomputer under software control on a per-channel basis. When the programmed time has elapsed an alert tone is generated from P13 (IC702-30) on the microcomputer, applied to the audio PA and heard on the speaker. The CCT may be programmed for 1 or 2 minutes or disabled (programmed for no CCT).

VOLTAGE TRANSLATION

Inverter buffers IC704D-G translate the 5 DVC levels required by the microcomputer to the +9 VDC level used by the frequency synthesizer. Inverter TR709 restores the proper polarity to the clock.

FREQUENCY SEGMENT CONTROL

To achieve rapid wideband VCO tuning extending over the 136-153 MHz range or the 150-174 MHz range, each Bandsplit is divided into four frequency segments.

By selecting one segment the operating frequency spread of the VCO is limited and frequency lock time reduced. Each segment is identified by two bits on a per-channel basis and programmed into the EEPROM. Capacitors are switched in and out of the VCO tank circuit to set the VCO tuning range to cover the correct frequency segment.

The frequency segment control circuit consists of a dual "D"-type flipflop operating under control of the microcomputer. The four frequency segment identification bits appear on the channel change and data lines and fed to dual "D" FF IC705. At the appropriate time the microcomputer applies the enable signal to clock the new segment data change through the FF. The output of the FF's is a binary expression identifying the frequency segment selected. Table 1 identifies the binary expression and the selected frequency segment.

The output of the frequency segment control circuit is applied to the modulation level control and the frequency segment selector circuits.

	SEGMENT	FREQUENCY SPLIT (MHz)	FF OUTPUT				GROUNDED MODULATION RESISTOR
			IC705-1 (INPUT TR216)	IC705-2 (INPUT TR217)	IC705-13 (INPUT TR218)	IC705-12 (INPUT TR219)	
136-153MHz	1	136-140	0	1	0	1	NONE
	2	140-144	0	1	1	0	R275
	3	144-148.5	1	0	0	1	R276, R296
	4	148.5-153	1	0	1	0	R275,R276 R296
150-174MHz	1	150-155.5	0	1	0	1	NONE
	2	155.5-161.5	0	1	1	0	R275
	3	161.5-167.5	1	0	0	1	R276, R296
	4	167.5-174	1	0	1	0	R275,R276 R296

TABLE 1 - Frequency Segment Selection

TX AUDIO PROCESSOR

The audio processor provides audio pre-emphasis with amplitude limiting and post limter filtering and a total gain of approximately 24 dB. Approximately 27 dB gain is provided by IC607A, 4 dB by IC607B and -7 dB by R666, R667.

The 9 Volt regulator IC606 powers the audio processor and applies regulated 9 volts to a voltage divider consisting of R665, R668 and symmetry control, RV603. The +4.5 V output from the voltage divider establishes the operating reference point for operational amplifiers IC607A and IC607B. C636 provides an AC ground at the summing input of both operational amplifiers.

When the input signal to IC607A-2 is of a magnitude such that the amplifier output at IC607A-1 does not exceed 5 volts P-P, the amplifier provides a nominal 27 dB gain. When the audio signal level at IC607A-1 exceeds 5 volts P-P, the amplifier gain is reduced to 1. This limits the audio amplitude at IC607A-1 to 6 volts P-P.

Resistors R662, R663 and C633 comprise the audio pre-emphasis network that enhances the signal-to-noise ratio. R663 and C633 control the pre-emphasis curve below limiting. R662 and C663 control the cut-off point for high frequency pre-emphasis. As high frequencies are attenuated, the gain of IC607 is increased.

Audio from the microphone is coupled to the audio processor through R662 and C633.

The amplified output of IC607A is coupled through R666, C633, R669, R670, R671 and bilateral switch IC608C to a second operational amplifier IC607B. The bilateral switch is controlled by the DPTT line so that Tx audio is transmitted only when the PTT switch is pressed. IC607B provides a signal gain of approximately 4 dB.

The Channel Guard tone input is applied to bilateral switch IC608C controlled by the DPTT line. The CG tone then modulates the reference oscillator and VCO on the synthesizer board.

A post-limiter filter consisting of IC607B, R669-R671, R687, C639 and C640 provides 12 dB per octave roll-off. R666 and C637 provide an additional 6 dB per octave roll-off for a total of 18 dB. The output of the post-limiter filter is coupled through the VG (Voice Guard) unit or directly to the synthesizer Tx MOD.

TX enable switch IC608-D shorts out operational amplifier IC607-B when the radio is in the receive mode. The TX ENABLE signal is generated by the microcomputer when the PTT switch is operated and is less than 2.7 VDC in the receive mode.

RX AUDIO

Received audio from the FM detector is applied to the input of audio pre-amplifier IC603-A. The audio output level of the audio preamplifier is adjusted by Volume/Squelch HI level control RV602 for 300 millivolts RMS. The audio of 300 millivolts RMS is applied to the audio preamplifier (IC603-B) through the Tone Reject filter (HC603). When VG is opptionally added, this audio is applied to VG (Voice Guard) circuit (IC611, HC605). Audio output from the VG circuit is applied to Tone Reject filter (HC603) through pins J606-2 & 3. The audio is then applied to the volume and squelch controls in the control unit through connector J701-10.

Audio is returned on the VOL ARM through J701-4 and applied to audio gate (bilateral switch) IC601-B. The audio gate is controlled by DPTT (delayed Push-To-Talk) and PA KEY/CCT PA ENB and is turned on when the control input (pin 5) exceeds 7 VDC. The gate is turned off when the control input is less than 2 volts. Receipt of an on-frequency signal (if present) with

sufficient signal-to-noise level and the correct Channel Guard frequency will cause the audio control circuit to apply +9 volts to IC601-B turning the audio gate on.

Audio from the audio gate is applied to the de-emphasis network consisting of a low-pass filter and a high-pass filter.

The low-pass filter provides a 6 dB per octave roll-off between 300 and 3000 Hz. The high-pass filter attenuates frequencies below 300 Hz.

The audio output from the de-emphasis network is applied to the non-inverting input of the audio power amplifier. The audio power amplifier consists of IC602, and associated circuitry, and provides 10-watts (6.3 VRMS across a 4 ohm load) of audio output power at terminals J702-20 and 22. The gain of IC602 is determined by the value of R622.

SQUELCH CIRCUITS

The squelch circuit(HC601)monitors noise on the SQ ARM output line and allows the receiver to be unmuted when an on-frequency signal reduces the noise level below the squelch threshold setting.

The 300 millivolt output of the audio preamplifier is applied to the squelch circuit through the variable squelch control in the control unit. The squelch control sets the noise threshold level required to operate the squelch circuit. When the noise falls below the threshold level, the receiver is unmuted.

The squelch circuit(HC601) consists of a high-pass filter, an averaging detector, DC amplifier, and a Schmitt trigger shown in Figure 1. The high-pass filter consisting of HC601-A, removes all voice signals from the SQ ARM output and couples noise to HC601-B.

Noise in the 6-8 kHz range is applied to the averaging detector consisting of HC601-B. The noise is rectified and filtered to provide an average DC output level proportional to the noise input. The DC output level is adjusted by RV601.

The average DC level is amplified by HC601-C to a level ranging from 0 to 6.0 VDC, and applied to the non-inverting input of the Schmitt trigger, HC601-D. The inverting input of HC601-D is referenced to 4.5 VDC. IC603-C provides the stable 4.5 VDC reference voltage.

When the DC level exceeds 4.5 VDC, Schmitt trigger HC601-D switches and provides a positive voltage to the CAS (Carrier Activity Sensor) and RUS (Receiver Unsquelched Sensor) control transistors in the audio control circuits. The Schmitt trigger will remain on until the threshold level falls below approximately 4.3 VDC. This difference in voltage between the firing point and turn-off point provides sufficient hysterisis to eliminate "bubbling" -- i.e., noise popping in the speaker. The "bubbling" would normally be caused by transitional changes in the DC level around the reference point which allows the receiver to be unmuted.

When an on-frequency signal is received, there will be little or no noise present at the squelch input. This results in an absence of voltage at the output of the squelch circuit Schmitt trigger, allowing the receiver to be unmuted.

AUDIO CONTROL

The audio control circuits shown by Figure 2 control the operation of the audio gate (IC601-B) and the final audio PA and consist of TR601-605, inverter IC601-A and associated circuitry. The audio control circuit inputs consist of $\overline{\text{DPTT}}$ (Delayed Push-To-Talk), $\overline{\text{RX MUTE}}$ (Receiver Mute), PA KEY/CCT PA ENB (Public Address Key/Carrier Control Timer Public Address Enable), and the output of the squelch circuit.

When an on-frequency signal with the correct Channel Guard Tone is received, CAS control transistor TR601 and RUS control transistor TR602 are turned off by the absence of a positive voltage at their bases. The CAS line from the collector of TR601 rises to +9 VDC and is supplied to J701-14.

The collector of RUS Transistor TR602 also rises to +9 VDC and turns on inverter IC601-A. A- is then applied to the base of inverter TR603, turning it off and allowing its collector to go high. The positive voltage on the collector is applied to audio gate IC601-B, turning it on. TR604 is biased on but has no effect on audio switches TR605. The base of the transistor is connected to the output of audio control switch IC601A-2 which is at A-. Therefore TR605 turns off, allowing input audio to the PA which feed audio power to the speaker.

When the microphone is keyed, the $\overline{\text{DPTT}}$ input is low. This low is applied to audio gate IC601-B through CD603B, turning IC601-B off. It is also applied to audio control switch IC601-A (through CD603A) turning it off. TR603 is also off and TR604, TR605 are on. TR605 shorts out the audio input to the audio PA IC602.

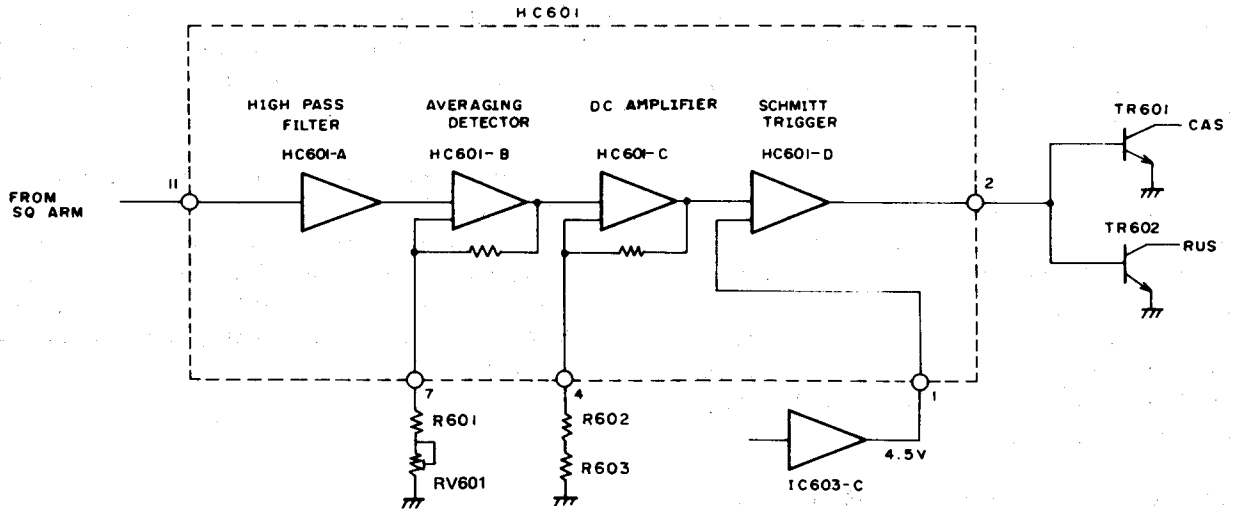

Figure 1 - Squelch circuits (HC601)

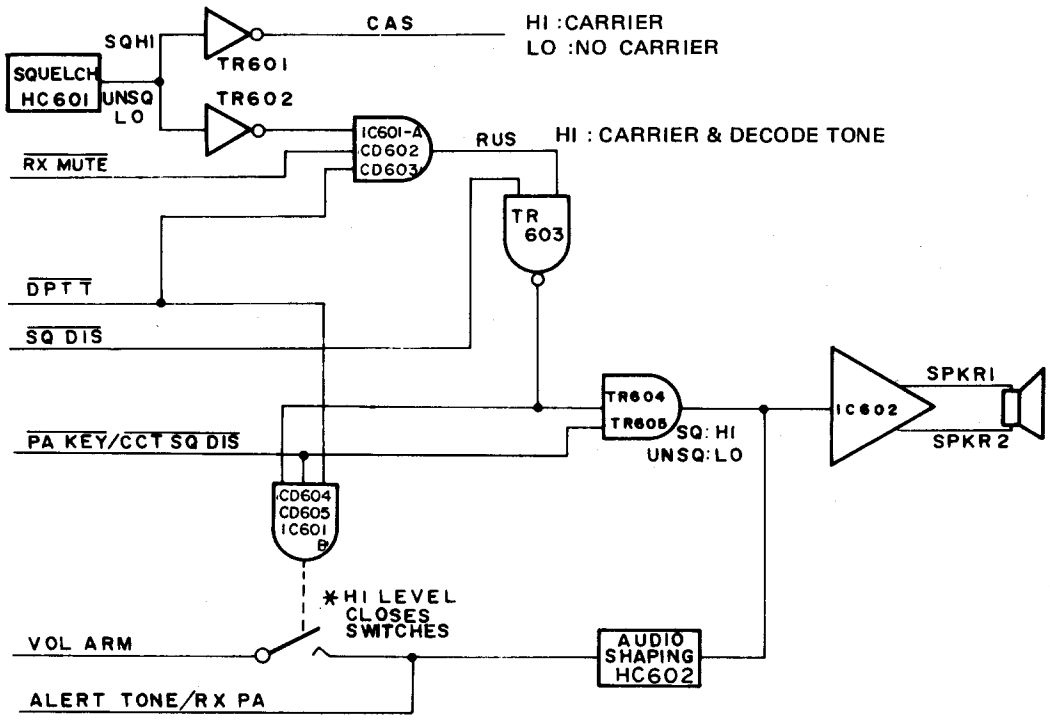

Figure 2 - Audio Control Circuit

POWER DISTRIBUTION

Battery supply A+ enters the radio through the front connector at J801-19. A- enters through J801. Figure 3 is a block diagram of the power distribution system. Two heavy connections are provided for transmit A+ and transmit A- and connect to two busses. The busses are connected to the PA through a special feedthrough arrangement. A second set of wires is routed through the control unit and supplies power to the audio amplifier and all other radio circuitry.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the serviceman should discharge himself by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

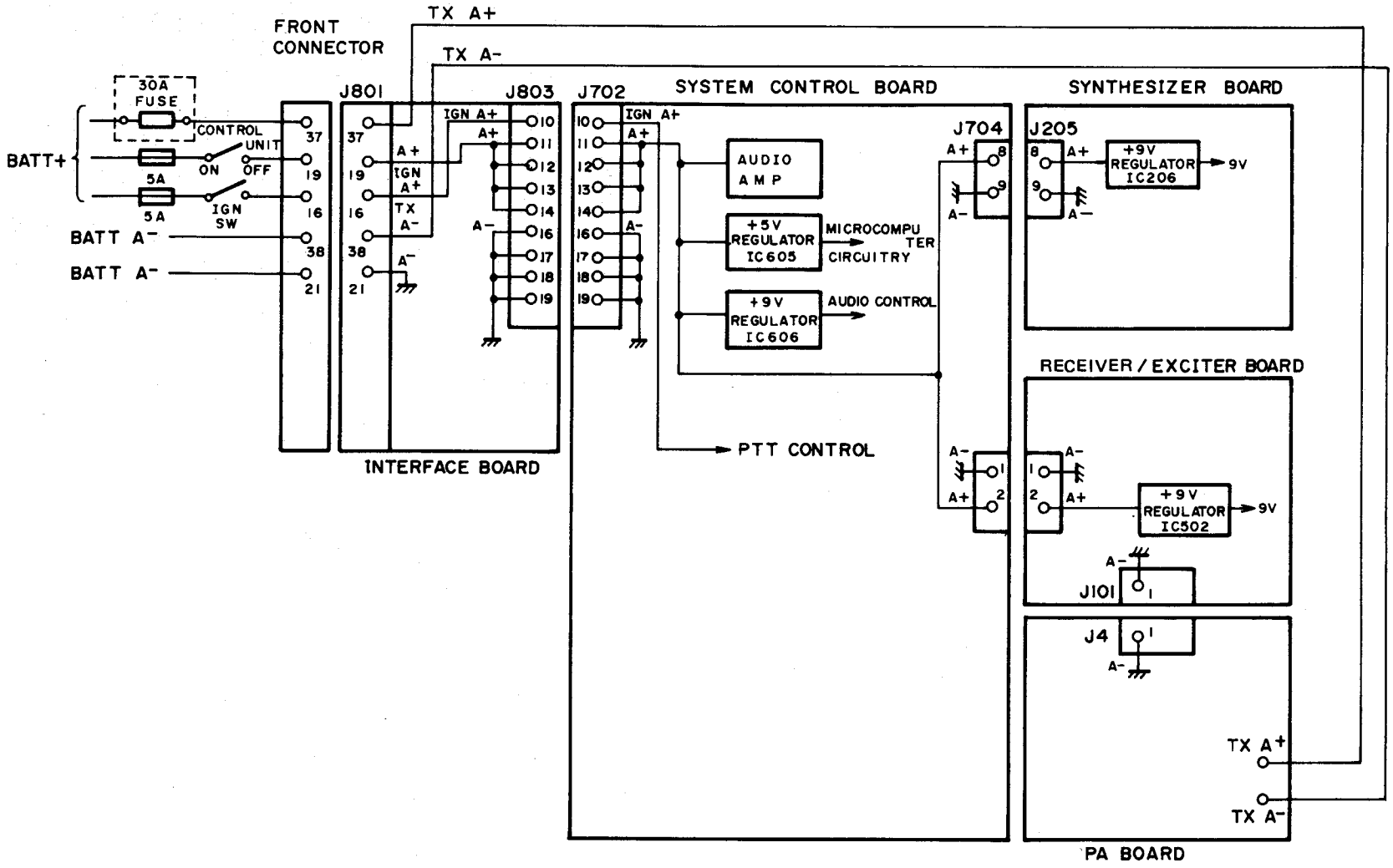

Figure 3- Power Distribution

CHANNEL GUARD

Channel Guard provides a means of restricting calls to specific radios through the use of a continuous-tone or digitally-coded squelch system (CTCSS or CDCSS). Tone frequencies range from 67 Hz to 210.7 Hz, 33 standard tones and 83 unique digital codes are available. These tones/codes are identified in Tables 2 and 3.

STANDARD TONE FREQUENCIES Hz				
67.0	88.5	107.2	131.8	167.9
71.9	91.5	110.9	136.5	173.8
74.4	94.8	114.8	141.3	179.9
77.0	97.4	118.8	146.2	186.2
79.7	100.0	123.0	151.4	192.8
82.5	103.5	127.3	156.7	203.5
85.4			162.2	210.7

TABLE 2 - Channel Guard Tone Frequencies

★

PRIMARY CODE	EQUIVALENT CODE	PRIMARY CODE	EQUIVALENT CODE	PRIMARY CODE	EQUIVALENT CODE
023	340, 766	205	135, 610	464	237,642, 772
025		223	350, 475, 750	465	056, 656
026	566	226	104, 557	466	144, 666
031	374, 643	243	267, 342	503	157, 312
032		244	176, 417	506	224, 313, 574
043	355	245	370, 554	516	067, 720
047	375, 707	251	236, 704, 742	532	161, 345
051	520, 771	261	227, 567	546	317, 614, 751
054	405, 675	263	213, 136	565	307, 362
065	301	265	171, 426	606	153, 630
071	603, 717, 746	271	427, 510, 762	612	254, 314, 706
072	470, 701	306	147, 303, 761	624	075, 501
073	640	311	330, 456, 561	627	037, 560
074	360, 721	315	321, 673	631 745	231, 504, 636
114	327, 615	331	372, 507	632	123, 657
115	534, 674	343	324, 570	654	163, 460, 607
116	060, 737	346	616, 635, 724	662 444	363, 436, 443,
125	172	351	353, 435	664	344, 471, 715
131	572, 702	364	130, 641	703	150, 256
132	605, 634, 714	365	107	712	136, 502
134	273	371	217, 453, 530	723	235, 611, 671
143	333	411	117, 756	731	447, 473, 474
152	366, 415	412	127, 411, 711		744
155	233, 660	413	133, 620	732	164, 207
156	517, 741	423 713	234, 563, 621	734	066
162	416, 553	431	262, 316, 730	743	312, 515, 663
165	354	432	276, 326	754	076, 203
172	057	445	222, 457, 575		
174	142, 270				

TABLE 3 - Primary and Equivalent Digital Codes (Octal)

The Channel Guard encode and decode functions are implemented in the microcomputer under software control. The microcomputer provides digital and/or tone Channel Guard with Squelch Tail Elimination (STE).

If the radio is in the receive mode, the Channel Guard tone/code is hard limited and fed to the microcomputer through IC702-29 (LIM CG Tone Decode). If the correct tone code is present, the receiver is opened by the RX MUTE line. If the radio is in the transmit mode, the microcomputer generates the Channel Guard tone using WALSH BIT 1 and WALSH BIT 2. Those outputs are summed together and filtered on the System Control board to generate a smooth sinewave for tone Channel Guard or a digital waveform for digital Channel Guard.

The Channel Guard contains a summing amplifier IC604-A, 8-pole active voice reject filter HC604, limiter IC604-C and tone/code reject filter HC603. A Channel Guard disable circuit TR606 allows the Channel Guard encode to be disabled. The Channel Guard decoder can be disabled at the microcomputer.

The microcomputer selects the assigned Channel Guard encode code/tone information from the EEPROM memory for each channel, transmit and receive, and generates the Channel Guard signal.

The output of audio preamplifier IC603-A is applied to the summing amplifier through bilateral switches IC601-C and D. In the encode mode DPTT is high applying A- from IC601-D to the control input of IC601-C turning it off and preventing any input from the output of audio preamplifier IC603-A from interfering with the encoding signal.

The output of summing amplifier IC604-A is applied to buffer/amplifier IC604-B through a two-pole active voice reject filter HC604, The active filter shunts all frequencies above 300 Hz to ground, thereby preventing those frequencies from interfering with the encoded signal. The output of IC604-B is the assigned CG tone or digital signal. This signal is applied to the TX MOD line through CG deviation control RV604, IC608C and IC607B. Channel Guard deviation is set for 0.75 kHz.

In the decode mode DPTT is low, turning bilateral switch IC601-D off, allowing the 9 V filtered supply to turn IC601-C on. The output of audio preamplifier IC603-A is then applied to the summing amplifier IC604-A through bilateral switch IC601-C. This signal is amplified and filtered by IC604A,B and HC604, so that only the CG signal (if present) is applied to hard limiter IC604-C. The CG signal is squared up for comparison by the microcomputer to determine if the CG signal is correct. If the microcomputer determines the CG signal to be correct, RX Mute transistor TR713, is turned off, applying +9 VDC to the RX MUTE line to open the receiver.

The Channel Guard Disable(CG DSBL) line has a double function. It can disable the encode or the decode CG function. The encode function is disabled by applying +19 V or more to J701-2. This will turn on TR606 and shunt the Channel Guard tone/code to ground while the decode function is disabled within the microcomputer software. To disable the decoder, ground the CG DSBL line at J701-2. The microcomputer will detect that the line is low, turn off TR713 and force the RX MUTE line high. The decode filter/limiter circuit is not affected, it continues to operate. The detection software also does not stop working. This allows the off-hook STE to function. When the CG DSBL line is pulled high (9.0 VDC) the microcomputer does not sense any changes. It is buffered by protection diode CD710. Channel Guard disable transistor TR606 will turn on when the CG DSBL line goes above 17 V and shorts the output of the filter to ground. This will prevent any signal from going out on CG HI and will also disable the

decoder since no limited CG tone will go to the microcomputer. The receiver will be muted since no CG is decoded. Disabling the decoder this way will never allow the audio to open up, while taking the radio off hook (pulling $\overline{\text{CG DSBL}}$ low) will always make the radio open up. Turning CG Disable transistor TR606 on causes the DC bias to change. It will take 2 or 3 seconds for the bias to restore itself after the encoder is disabled.

The Squelch Tail Elimination (STE) eliminates squelch tails when the radio is on-hook or off-hook. When Channel Guard is disabled (off-hook), the decoder is still looking at the received signal. The $\overline{\text{RX MUTE}}$ line is high, as would normally be expected. The Channel Guard decoder is looking for the STE burst (phase reversal in tone Channel Guard, STE tone in Digital Channel Guard). If an STE burst is detected, the $\overline{\text{RX MUTE}}$ line will go low for about 200 ms. This will prevent the squelch tail from being heard. After 200 ms, the $\overline{\text{RX MUTE}}$ line will go high again; by now the transmission has ended and the squelch will hold the audio closed. The off-hook STE does not affect the operation of the Channel Guard while on-hook. Another way of looking at it: the radio will go quiet for 200 ms any time STE is detected. If it was on-hook it will stay quiet after the 200 ms, if it was off-hook it will revert to noise squelch operation.

In some instances it is necesssary to invert the polarity of the digital Channel Guard signal to enhance system compatability. Inverted polarity normally results in a wrong code or one that cannot be used. When this occurs, move P603 connected between J603-1,2 to J603-2,3. The encode DCG codes may be inverted by reprogramming the EEPROM.

FREQUENCY SYNTHESIZER BOARD

The frequency synthesizer receives clock, data, and control information from the microcomputer and from this generates the Tx/Rx RF frequencies. It also provides frequency-lock status to the microcomputer. It consists of synthesizer chip IC201, low- and high-current buffers, loop filter, Tx & Rx voltage-controlled oscillators (VCO's), feedback amplifier, the dual-modulus prescaler, and the reference oscillator. The VCO's are locked to the reference oscillator by a single direct-divide synthesis loop consisting of the feedback buffer, prescaler, and synthesizer. The TX VCO operates over a frequency range of 136 MHz to 174 MHz. The RX VCO operates over the range 218.2 to 256.2 MHz.

REFERENCE OSCILLATOR

The reference oscillator consists of a 5-PPM* TCXO (Temperature Compensated Crystal Oscillator). The standard reference oscillator frequency is 13.2 MHz.

The TCXO is enclosed in an RF shielded can. Access to the oscillator trimmer is made through the hole in the top of the can. The TCXO is compensated by an internal temperature-compensated circuit for both low and high temperatures. With no additional compensation the oscillators will provide 5 PPM stability from -30°C to +60°C.

*2 ppm on some models.

SYNTHESIZER

Synthesizer IC201 contains a programmable reference oscillator divider (÷ R), phase detector, and programmable VCO dividers (÷N, A). The reference frequency, 13.2 MHz from the reference oscillator is divided by a fixed integer number to obtain a 5 kHz or 6.25 kHz channel reference for the synthesizer. This divide value can be changed by PROM programming. The internal phase detector compares the output of the reference divider with the output of the internal N, A counter. The N, A counter receives as its input the VCO frequency divided by the dual-modulus prescaler and programmed by the microcomputer. This comparison results in a ± error voltage when the phases differ and a constant output voltage when the phase-detector inputs compare in frequency and phase.

If a phase error is detected an error voltage is developed and applied to the VCO DC offset and high current buffers and loop-filter to reset the VCO frequency. The count of the ÷N, A counters is controlled by the frequency data received on the clock and data lines from the microcomputer. Thus, when a different channel is selected or when changing to the transmit or receive mode an error voltage is generated and appears at the phase-detector output, APD OUT causing the phase-locked loop to acquire the new frequency.

The enable pulse from the microcomputer enables the synthesizer and allows frequency data to be internally stored.

EQUALIZER

The equalizer consisting of IC209-A, R216, R219 and C2120 receives transmit audio from Loop Mod adjuster RV201. The output of the equalizer is summed with the output signal from the phase detector by adder IC209-B.

DC OFFSET AND HIGH CURRENT BUFFERS

DC offset buffer TR201, TR205 and diode CD202 receive the error voltage from the synthesizer and increase this level by 1.8 VDC to extend the operating range of the high-current buffers. When the PLL is off-frequency due to a channel change or frequency drift, the error voltage from the synthesizer(APD) rises or falls, turning TR201 either on or off. This transistor TR201 controls the DC offset buffer TR205. R207, CD202 and TR205 complete a high-current rapid-charge or -discharge path for C207-C209.

As the error voltage decreases, TR201, TR205 and CD202 turn on completing a discharge path for C207 to C209. When the error voltage goes positive TR201, TR205 and CD202 are turned off, allowing C207 to C209 to charge through R207. IC204 is turned on for four milliseconds when a channel is changed in receive. The time is 20 milliseconds when in transmit and when changing from transmit to receive.

LOOP FILTER

The loop-filter consists of R209-R211, and C207-209. This filter controls the bandwidth and stability of the synthesizer loop. Bilateral switch IC204 is controlled by the 4 millisecond, 9 volt channel-change pulse. When the channel-change pulse is present, the bilateral switch shorts out the low-pass filter, greatly increasing the loop bandwidth to achieve the 4-millisecond channel acquisition time required for dual priority scan. The low-pass filter removes noise and other extraneous signals internal to the synthesizer chip.

The output of the filter is applied to the varicaps in the transmit and receive VCO's to adjust and maintain the VCO frequency.

The use of two VCO's allows rapid independent selection of transmit and receive frequencies across the frequency split.

RECEIVER VOLTAGE CONTROLLED OSCILLATOR

The receiver VCO consists of a low-noise JFET oscillator, TR210, followed by high-gain buffer TR211. TR211 prevents external loading and provides power gain. The VCO is a Colpitts oscillator with the various varactors, capacitors and coil forming the tank circuit.

The VCO is switched on and off under control of the DPTT line. When the DPTT line is low, the Receiver VCO is turned on (TR213 is off, TR212 is on).
+10 dBm. The output is applied to the feedback buffer for VCO frequency control and as the RX/EX injection frequency to the receiver 1st mixer through L.O. buffers TR402, TR403 on the Rx board. The Rx VCO also uses a high-Q resonator coil to achieve superior noise performance. The VCO operates over a frequency range of 218.2-256.2 MHz. The VCO voltage need only be set once at the highest frequency of the band split, after which it will operate over the entire split with no more tuning.

TRANSMITTER VOLTAGE CONTROLLED OSCILLATOR

The transmit VCO is basically the same as the receiver VCO. The wideband VCO allows frequency separation of 17MHz or 24MHz as determined by the bandsplit the radio is operating on, 136-153 MHz or 150-174 MHz. The varactors in conjunction with the frequency segment selector circuitry (TR216-TR219, TR227, TR228, TR230 and pin diodes CD217, CD218 and CD221) provide a voltage-controlled adjustment range that extends across the entire frequency split. VCO control switch TR222 turns the Transmit VCO on when DPTT is high.

FEEDBACK BUFFER

The buffered output of the Rx VCO and Tx VCO, from TR211 and TR221 respectively, are supplied to the feedback buffer IC207. This, in turn, drives the dual-modulus prescaler IC202. The buffered VCO outputs also drive the synthesizer output buffer IC208, which provides the common Receiver/Exciter Injection drive.

DUAL-MODULUS PRESCALER

The dual-modulus prescaler completes the PLL feedback path from the synthesizer to loop-filter, to the VCO's and feedback buffers and then back to the synthesizer through the prescaler. The prescaler divides the VCO frequency by 64 or 65 under control of M CONT from the synthesizer. The output of the prescaler is applied to the synthesizer where it is divided down to 5 KHz or 6.25 kHz by an internal ÷ N, A counter and compared in frequency and phase with the divided-down frequency from the reference oscillator. The result of this comparison is the error voltage used to maintain frequency lock. The ÷ N, A counter is controlled by data received from the microcomputer. Depending on the operating frequency, the DC voltage at TP201 should be within the range 3.5 to 7.5 VDC when the PLL is locked.

LOCK DETECT

The lock-detect circuit consists of comparator IC203, diodes CD203 and CD204, and reference oscillator mute switch TR208, and TR209. It is used to quickly synchronize the phase relation of the divided-down VCO frequency and the reference oscillator if the loop loses lock. It also provides a fast lock-detect signal to the microcomputer to turn on the out-of-lock indicator. If a large change in frequency is required, the ramp capacitor output (C_R) of the synthesizer may increase

positive LD line from the synthesizer. Thus TR208 disables the reference oscillator and allows the PLL loop to be brought back to synchronization rapidly.

If a large frequency error exists, the LD positive lead from the synthesizer will carry negative spikes to the microcomputer through CD204 to activate the lock indicator circuit. Pulse shaper IC701 is a one-shot multivibrator which increases the pulse width to span 1 computer cycle. TR209 is turned on, keeping TR208 off thereby preventing TR208 from muting the reference oscillator.

MODULATION LEVEL CONTROL

The modulation level control circuit automatically sets the Tx audio level applied to the transmit VCO modulator CD212 through VCO deviation adjust control RV202. The modulation level control circuit consists of IC205, R274 - R282, varactor CD212, C245 and bypass capacitors C247 and C248. The modulation level is controlled by turning bilateral switches IC205 on or off (under control of IC705) to include attenuators R275, R276 and R281 in the circuit. R274, R275, R276 and R281 form an adjustable voltage divider to change the modulation level as required. Table 1 also identifies the resistor (if applicable) used for each frequency segment.

FREQUENCY SEGMENT SELECTOR

The frequency-segment selector switches capacitance in and out of the Tx and Rx VCO tank circuits to select the frequency segment containing the selected channel. The frequency segment selector consists of TR216 - TR219, TR227, TR228, TR230, CD209, CD210, CD217, CD218, CD220 and CD221 and operates under control of the microcomputer through FF's IC705A & B. Capacitors (C224, C227, C252, C255, C291 and C294) are selected or deselected for operation in a given segment. Table 4 identifies the circuit conditions existing for selection of each segment and the capacitors used.

Reverse bias to turn off the pin-diodes is provided by the +8 V filtered supply through R232, R234 and R286. Forward bias for the diodes and current for the switching transistors are provided by the +8 V supply though R231, R233 and R285. When segment 3 is selected, TR216, TR219 and TR227 are turned on. In the Tx VCO diodes CD217 and CD221 are reverse biased and CD218 is turned on. Capacitors C251 and C293 are effectively isolated from ground by L218 and L225 respectively and C254 is connected to ground via CD218 and TR219.

Similarly in the RX VCO C223 and C290 are isolated from ground, and C226 is grounded via CD210 and TR219.

Operation of the radio over the frequency ranges 136-153 MHz or 150-174 is determined by the group number of the synthesizer board. Each frequency split is divided into four operating segments varying from 4 to 6.5 MHz wide.

SEGMENT	TRANSISTOR SWITCH*							PIN DIOES						GROUNDED CAPACITORS
	TR216	TR217	TR218	TR219	TR227	TR228	TR230	CD209	CD210	CD217	CD218	CD220	CD221	
1	0	1	0	1	0	1	1	ON	ON	ON	ON	ON	ON	ALL
2	0	1	1	0	1	0	0	ON	OFF	ON	OFF	OFF	OFF	C223 C251
3	1	0	0	1	1	0	0	OFF	ON	OFF	ON	OFF	OFF	C226 C254
4	1	0	1	0	1	0	0	OFF	OFF	OFF	OFF	OFF	OFF	NONE

* '1' indicates transistor is turned on.

TABLE 4 - Capacitor Selection

PA BOARD

The PA assembly uses one power module and three RF power transistors to provide 110 watts of output power.

Supply voltage for the PA is connected from power leads on the System Interface Board to J3(A+) and G(A-) on the PA board. C92 and C93 prevent RF from getting on the power leads. Diode CD8 will cause the fuse to blow if the polarity of the power leads is reversed. CD7 is a surge protector to suppress pulses on the power leads.

TP1 through TP3 are the printed board terminals for control voltage and PA voltage measurement.

The Exciter output is coupled through J102 on the exciter unit to PA input jack P1.

The 340mW RF input at P1 is coupled to the power module through an attenuator pad (R1 - R5).

The power module amplifies the 200mW input to 8W.

The power module consists of a two stage RF amplifier. The first stage of the module is controlled by the voltage from the power control circuit.

The RF amplifier consists of a Class-C driver amplifier and two Class-C common-emitter amplifiers.

The 8-watt output is coupled to driver amplifier TR1 through the impedance matching components C9-C13, L3 and striplines Z1, Z2.

The output of TR1 is coupled to the power divider through the impedance matching components C14 to C20, L6 and striplines Z3 and Z4 via coupling capacitor C21.

TR1 amplifies the 8W input level to 32W. The power divider consists of L8, L9, C28 and C29. R7 absorbs any unbalance in the drive to TR2 and TR3.

The power amplifier stages are two identical paralleled Class-C power amplifiers (TR2 and TR3).

The output of the power divider is coupled to transistors TR2 and TR3 through the coupling capacitors C31, C53 and the impedance matching components C32-C36, L10, Z5, Z6 and C54-C58, L15, Z9 and Z10.

The output of transistors TR2 and TR3 is coupled to the power combiner through the impedance matching components C37, C38, C40-C44, L13, Z7, Z8 and C59-C61, C63-C66, L19, Z11, Z12 and the coupling capacitors C45, C67. The power combiner consists of L20, L21, C46, and C74. R9 absorbs the difference in the output power of TR2 and TR3. TR2 and TR3 each amplifies the input level from 16 to 64 W. The output of the combiner is coupled to antenna switch through 50-ohm stripline.

The antenna switch consists of K1 and the low-pass filter. The low-pass filter consists of C80-C87 and L24-L27. The filter output is coupled to the antenna through J1.

L29, C90 and C91 form a low-pass filter on the receiver input line. CD3 through CD6 limit the level of transmitted signal entering the receiver input.

In the Rx mode, signals from the antenna are coupled via K1 through this filter to the Receiver input.

POWER CONTROL CIRCUIT

The power control circuit provides power leveling as well as thermal protection for the PA.

When the transmitter is keyed, RF is rectified by CD1. The resulting DC turns on RF switch TR4-TR7. Turning on TR4 applies collector voltage to the 1st RF driver transistor in the PA module.

If the power output should start to increase above the level set by RV1, TR7 will start to conduct more. This causes TR4-TR5 to conduct less, reducing the collector voltage of TR4 to the 1st RF driver transistor in the PA module.

Thermal protection is provided only for the 110 watt power amplifier by temperature compensating resistor R27.
When the heat sink temperature rises above 90°C, the resistance of R27 increases and the power output is reduced to 55 W or more.

CAUTION

Do not operate the transmitter at levels higher than rated output. Operating at higher than rated output will shorten the life of the RF power transistors.

40 WATT POWER AMPLIFIER

The PA assembly uses one power module and an RF power transistor to provide 40 watts of output power.

The Exciter output is coupled through J102 on the Exciter unit to PA input jack P1.

The 340 mW RF input at P1 is coupled to the power module through an attenuator pad (R1 - R5).

The power module amplifies the 200 mW input to 12W.

The power module consists of a two-stage RF amplifier. The first stage power supply voltage is supplied by the power control circuit. The second stage power supply voltage is supplied by TR8.

The second RF amplifier operates in class-C.

The 12-Watt output is coupled to the amplifier TR2 through the 50-ohm coaxial cable, the coupling capacitor C31, the impedance matching components C32-36, L10 and striplines Z5 and Z6.

The output of TR2 is coupled via impedance-matching components, consisting of striplines Z7, Z8 and C37, C38, C40 through C47 and L13 to the antenna switch.

The antenna switch consists of K1 and the low-pass filter. The low-pass filter consists of C80-C87 and L24-L27. The filter output is coupled to the antenna through J1.

L29, C90 and C91 form a low-pass filter on the receiver input line. CD3 through CD6 limit the level of transmitted signal entering the receiver input.

In the Rx mode, signals from the antenna are coupled via K1 through this filter to the Receiver input.

RECEIVER/EXCITER BOARD

EXCITER CIRCUIT

The Exciter circuit is on the Receiver/Exciter board and consists of two wide-band amplifier stages operating over a frequency range of 135-174 MHz without any tuning. An attenuator pad (R101-R103) at the input of the Exciter provides a constant load for the VCO and attenuates the signal from the VCO to approximately 2 milliwatts.

The Exciter amplifies the 1 milliwatt signal from the VCO to provide 340 milliwatts drive to the power amplifier.

The 135-174 MHz Tx injection input from the Tx VCO is applied to the amplifier transistor TR101 through an attenuator pad from P402, the impedance matching components C105 and L101, and the low-pass filter consisting of C121 to C123 and L108. R104 and R105 set the bias voltage for TR101. Collector

voltage +9 V is applied through collector feed network R107 and L102. C103 is used to bypass the supply line. R108 provides negative feedback via C108.

The output of TR101 drives amplifier TR103 through the coupling capacitor C104, and impedance-matching components C110 and L104. R114, R115 and CD101 set the bias voltage for TR103.

Collector voltage +9V is applied through collector feed network R116, L106. C112 and C113 are bypass capacitors.

The output of TR103 is coupled to connector J102 through the impedance matching components L107 and capacitor C117.

R109 provides negative feedback via C111.

TR103 amplifies the 20 mW input level to 340 mW.

A+ supplied from the Frequency Synthesizer board is stabilized to 9V by IC101 (3-terminal regulator), and +9V is applied to TR101, TR103 through TR102, the Tx power switch.

When $\overline{\text{TX ENBL}}$ is High (receive mode), +9V is not applied.

Service Note

The output RF level can be measured by connecting a 50-ohm dummy load to J102, feeding a +3 dBm signal to P402 (135-174 MHz) and grounding the $\overline{\text{TX ENBL}}$ line.

The Exciter is energized by pressing the PTT switch. Regulated 9 volts is present on all exciter stages when the radio is turned on.

Typical emitter voltage of TR101 is 1.5 V.

RECEIVER CIRCUIT

The FM dual-conversion, super-heterodyne receiver is designed for operation in the 136-153/150-174 MHz frequency range. A regulated 9.0 volts is provided to all receiver stages except the audio PA IC, which operates from the switched A+ supply.

The receiver has intermediate frequencies of 82.2 MHz and 455 kHz. Adjacent channel selectivity is obtained by using two band-pass filters, an 82.2 MHz crystal filter and a 455 kHz ceramic filter.

All of the receiver circuitry except the synthesizer, audio preamp, audio PA, and squelch circuit is mounted on the Rx board. The receiver consists of:

- Front End and Mixer
- 82.2 MHz 1st IF, 455 kHz 2nd IF and FM Detctor
- Audio PA
- Squelch

RECEIVER FRONT END

An RF signal from the antenna is coupled through the low-pass filter, antenna relay, and band-pass filter (FL401) to the input of RF amplifier TR401. The output of TR401 is coupled through band-pass filter (FL402) to the input of 1st mixer HC401. Front-end selectivity is provided by these band-pass filters.

RECEIVER INJECTION

Receiver RF injection (218.2-235.2/232.2-256.2 MHz) from the synthesizer VCO is applied to amplifier TR402 through P402. The input level at P402 will be between 1.0 and 2.0 milliwatts. The output of amplifier TR402 is coupled to the input of amplifier TR403. The output of amplifier TR403 is filtered by a band pass filter consisting of C418 through C420 and L404. This filter is turned to pass frequencies in the 218.2-235.2/232.2-256.2 MHz passband.

1st MIXER

The first mixer is a double-balanced diode mixer (HC401) that converts a signal in 136-153/150-174 MHz range to the 82.2 MHz first IF frequency.

In the mixer stage, RF from the front-end RF filter is applied to one input of the mixer. Injection voltage from the amplifier stages is applied to the other input of the mixer. The 82.2 MHz 1st IF output signal is coupled from the output of HC401 through C501 to the source input of IF AMPL TR501. TR501 is a JFET amplifier/buffer stage. The output of the JFET buffer is coupled through L501 to a 4-pole XTAL bandpass filter (FL501).

1st IF

The highly-selective crystal filters FL501-1 and FL501-2 provide the first portion of the receiver IF selectivity. The output of the filters is coupled through the impedance-matching network L503, C505 and C506 to the 1st IF amplifier TR502.

The crystal filter output of FL501 is applied to the base of the 1st IF amplifier TR502, and the amplified signal is taken from the collector through an impedance-matching network, L504, C508 and R508 that matches the amplifier output to the input of FL502. The output of the filter is coupled through impedance-matching network L505, C509 and R509 to the 2nd mixer TR504.

2nd MIXER

The 82.2 MHz IF input is applied to TR504 and mixed with an 81.745 MHz frequency supplied by crystal oscillator X501. L506 sets the frequency of X501.

2nd IF AND DETECTOR

The output of the 2nd mixer is coupled to the 4-pole ceramic filter, which provides the 455 kHz selectivity. The output of the ceramic filter is coupled to the base of TR505. The transistor provides limiting for the 455 kHz IF signal (1.4Vp-p) to prevent high level overloading of IC501.

IC501 and associated circuitry function as the IF amplifier and FM detector.

The 455 kHz IF input is applied to pin 18.

The IF signal is amplified and applied to a 4-pole ceramic filter FL504 which provides the 455 kHz selectivity. The output of the 455 kHz filter is applied to IC501-5. The 2nd IF signal is amplified and limited. L508 shifts the IF signal by 90° and applies it to the internal FM detector. The FM detector compares the shifted IF signal to the internal IF signal to recover the audio modulation. The audio output of IC501 is applied to the system control unit.

ERICSSON

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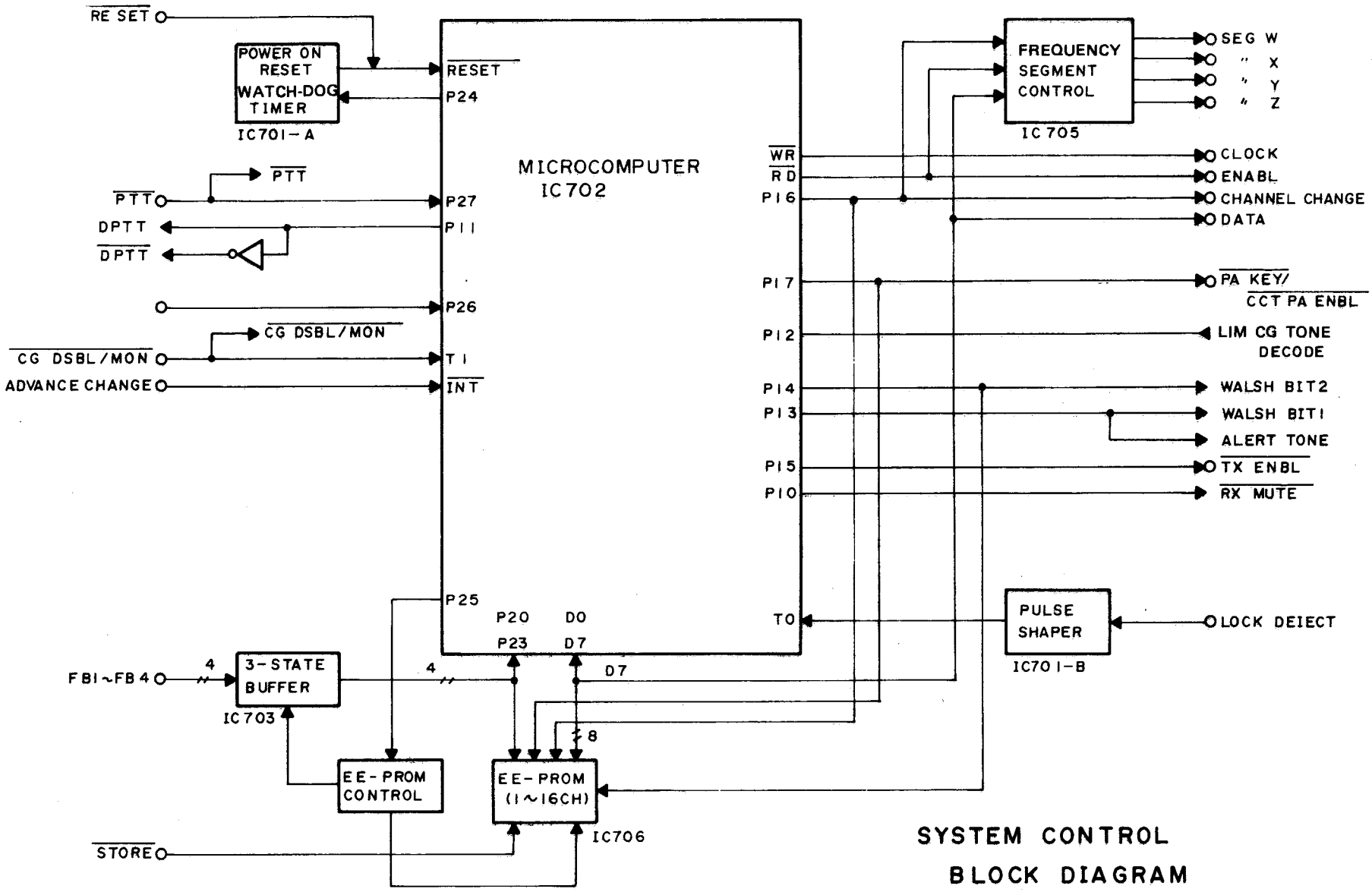
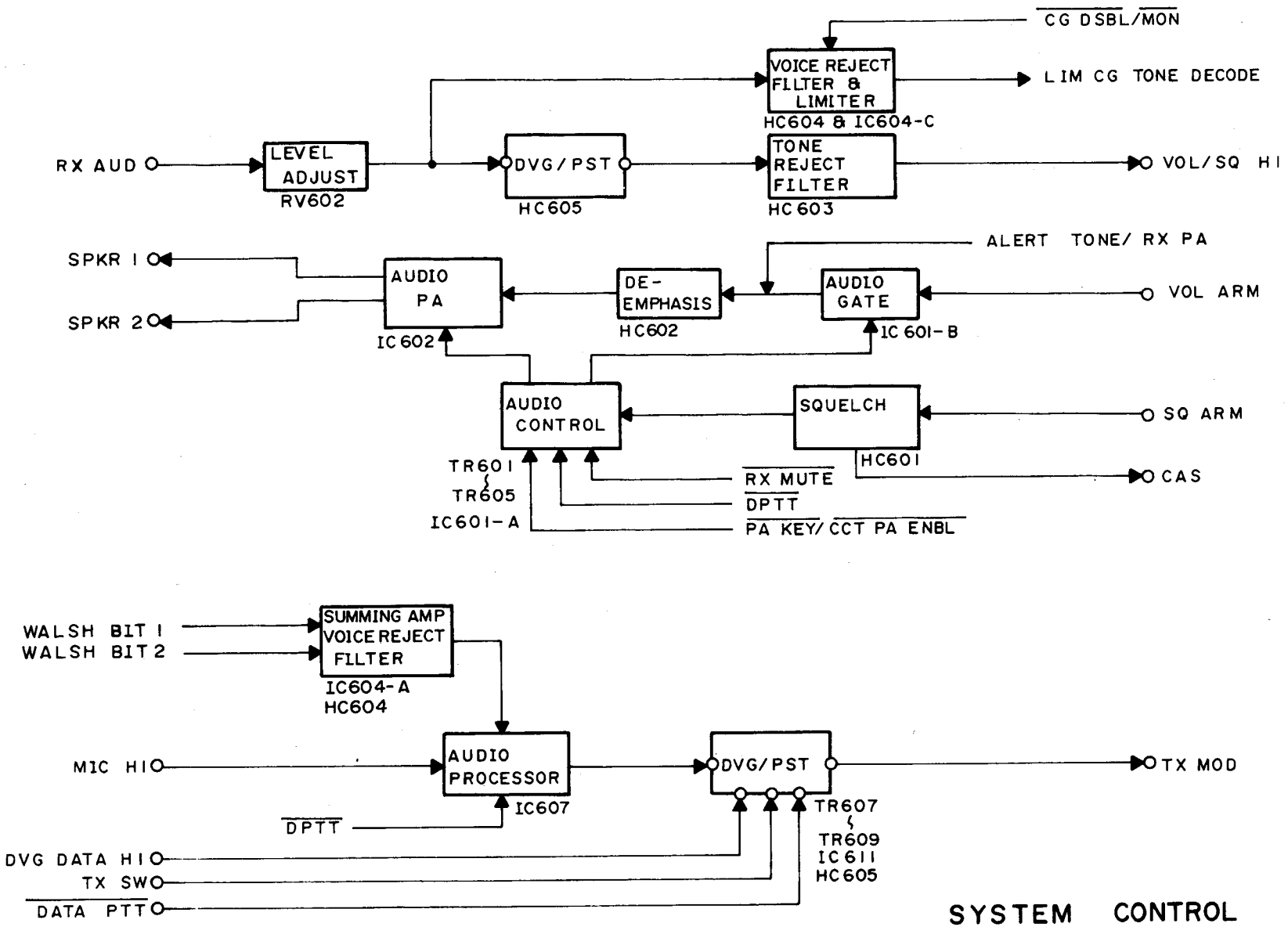
INTERCONNECTION	DD00–JHM–255

SECTION	SCHEMATIC DIAGRAM			
	A BAND 136–153 MHz		B BAND 150–174 MHz	
	40 W	110 W	40 W	110 W
SYSTEM CONTROL	DD00–CMC–486			
SYNTHESIZER	DD00–CMG–171			
POWER AMPLIFIER	DD00–CAH–715L	DD00–CAH–715H	DD00–CAH–715L	DD00–CAH–715H
RECEIVER/EXCITER	DD00–CMN–204			
INTERFACE	DD00–CMH–813			



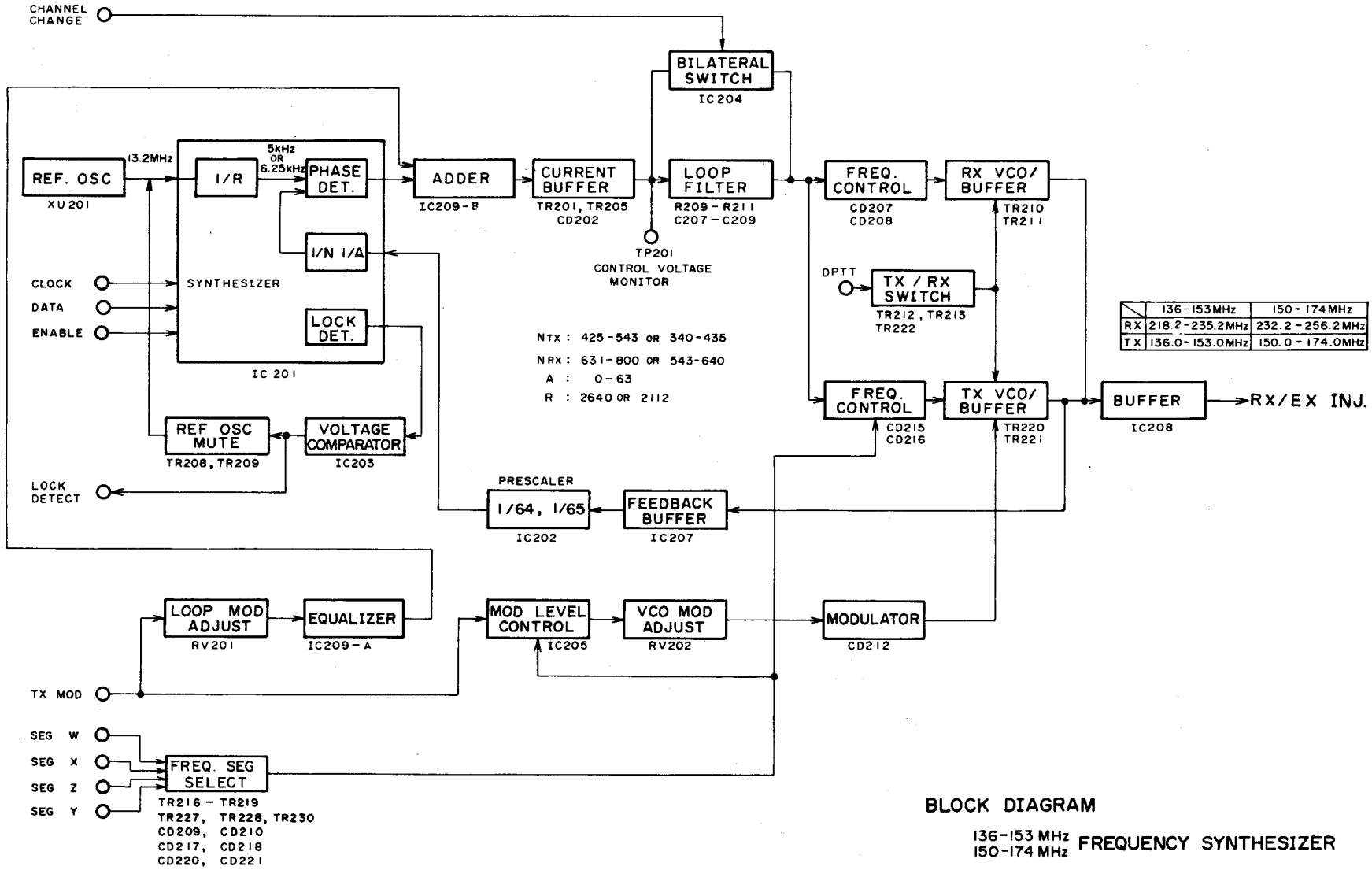
SYSTEM CONTROL
BLOCK DIAGRAM

DA00-CMC-486 1/2



SYSTEM CONTROL
BLOCK DIAGRAM

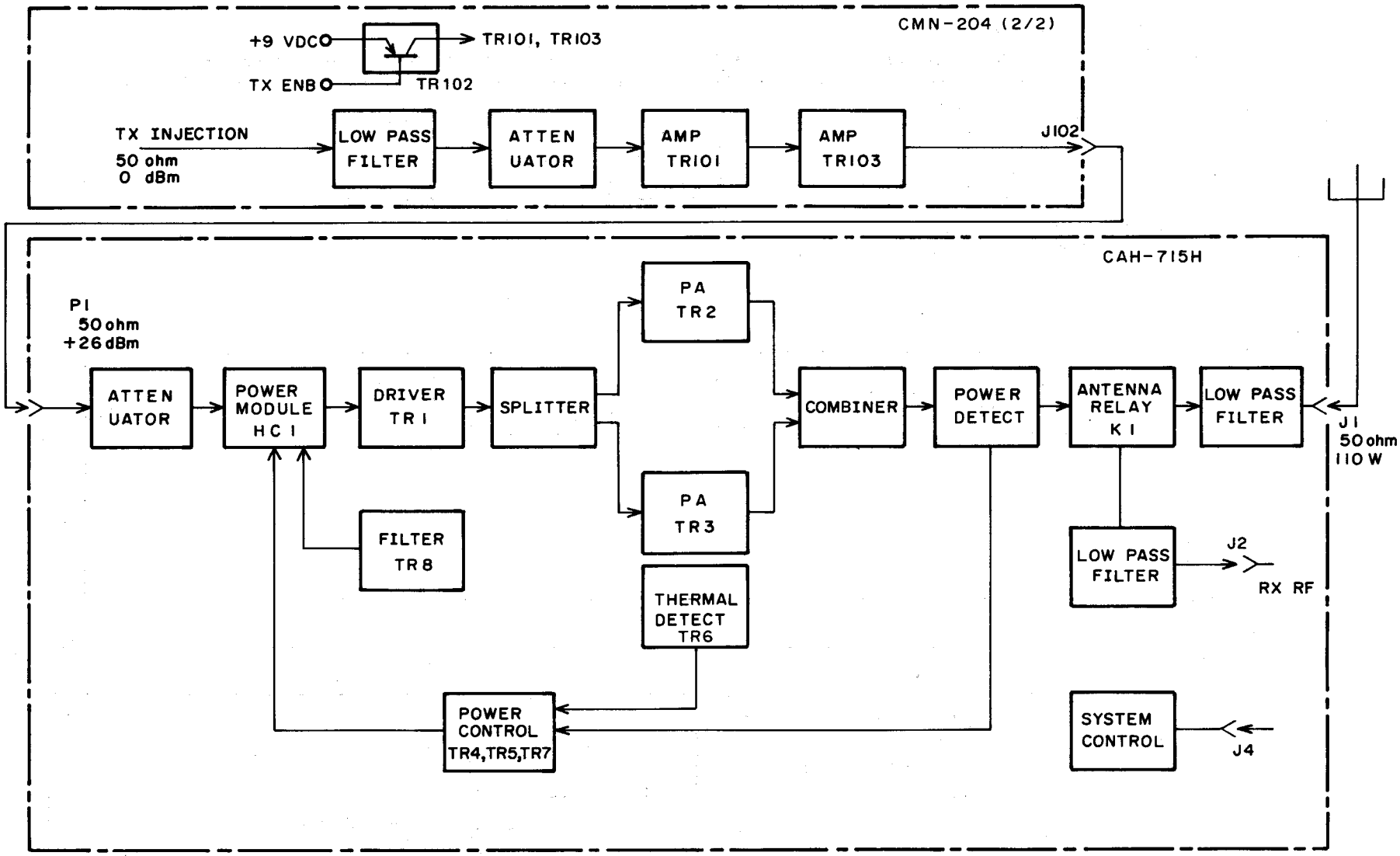
DA00-CMC-486 2/2



BLOCK DIAGRAM

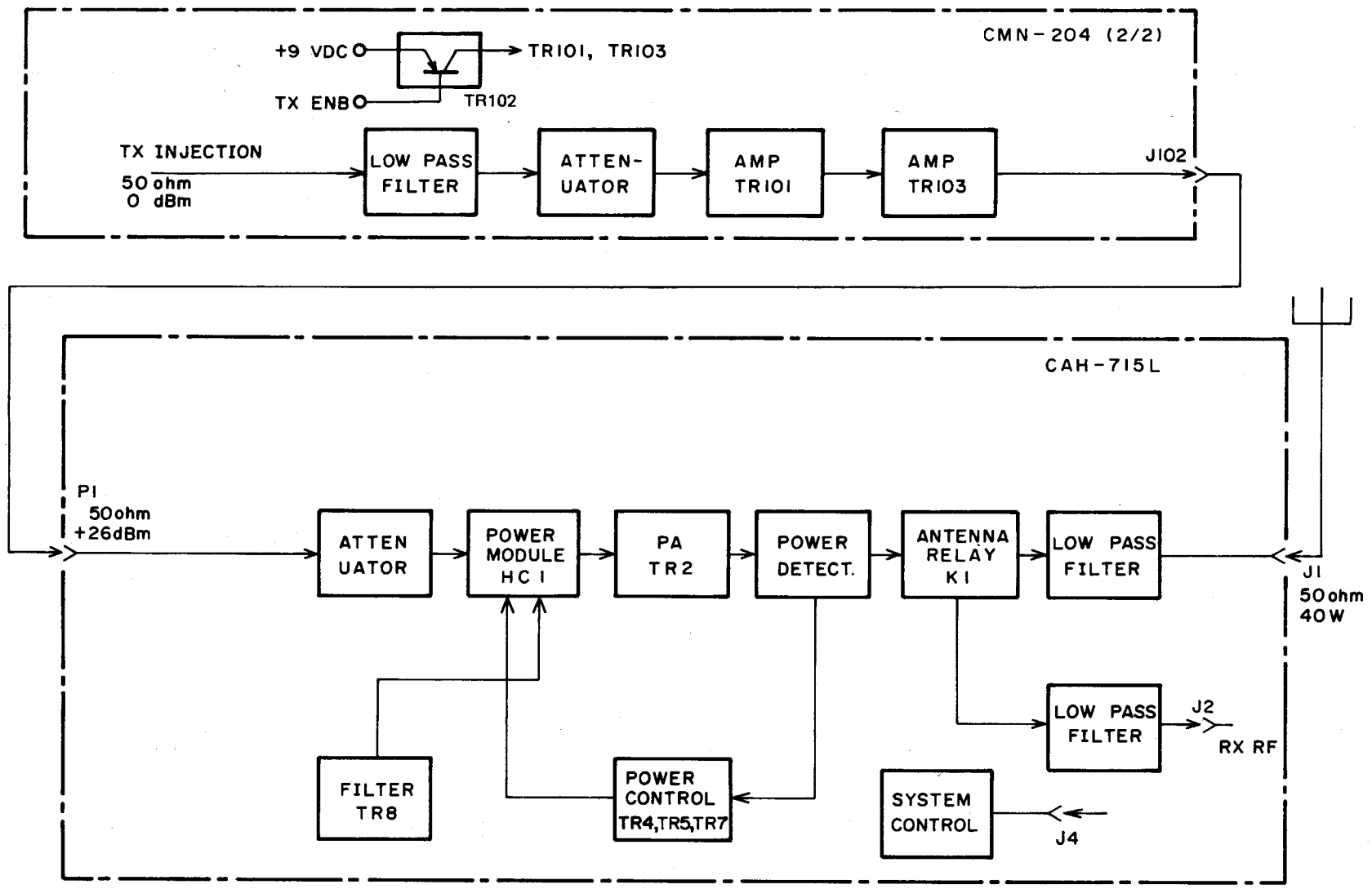
136-153 MHz
150-174 MHz FREQUENCY SYNTHESIZER

DA00-CMG-171



High Band Exciter and Power Amplifier Block Diagram

POWER AMPLIFIER CAH–715H
(including EXCITER CMN–204)
DA00–CAH–715 1/2



High Band Exciter and Power Amplifier Block Diagram

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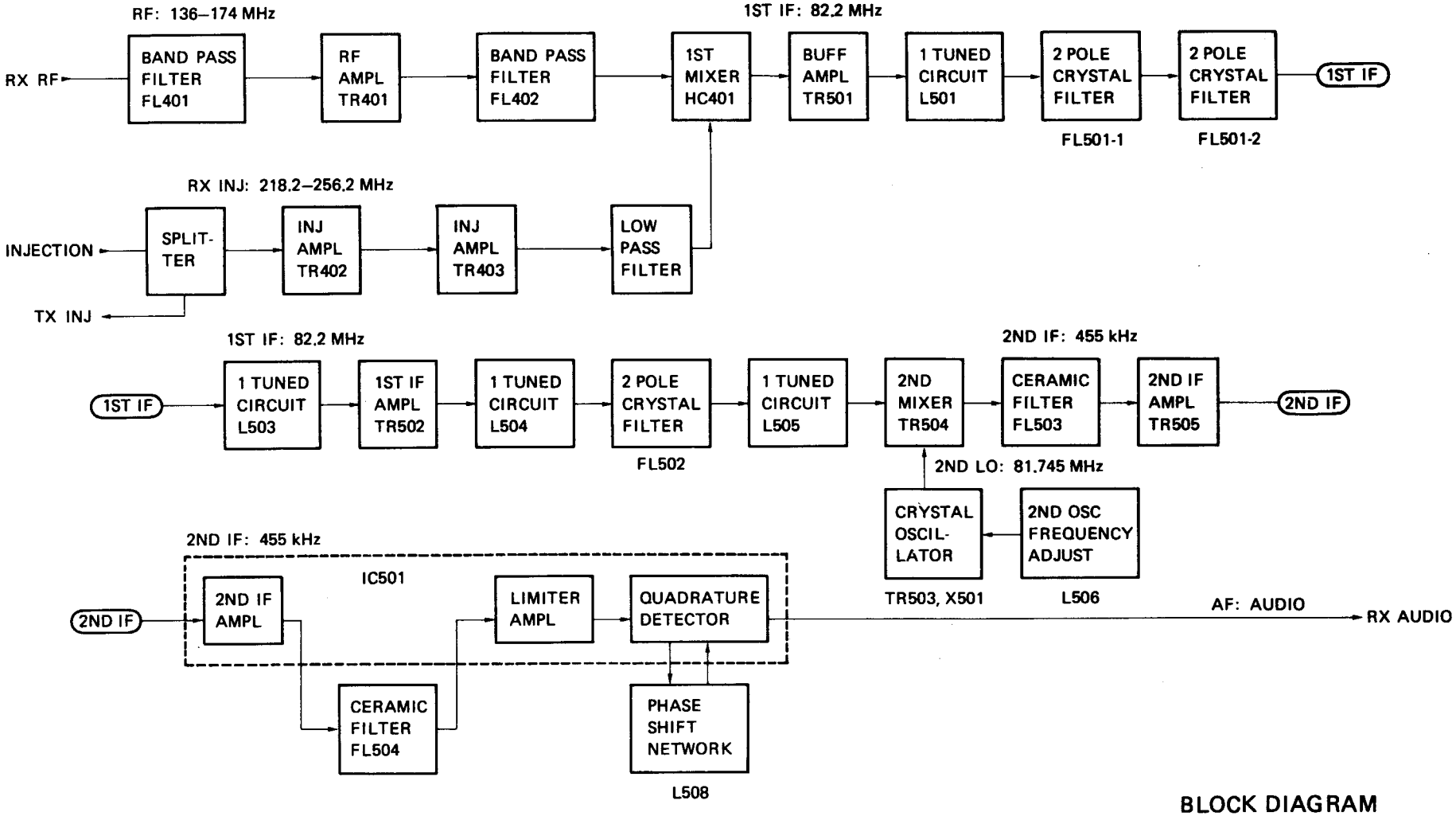
(including EXCITER CMN–204)
DA00–CAH–715 2/2



BLOCK DIAGRAM
136–174 MHz RECEIVER
DA00–CMN–204

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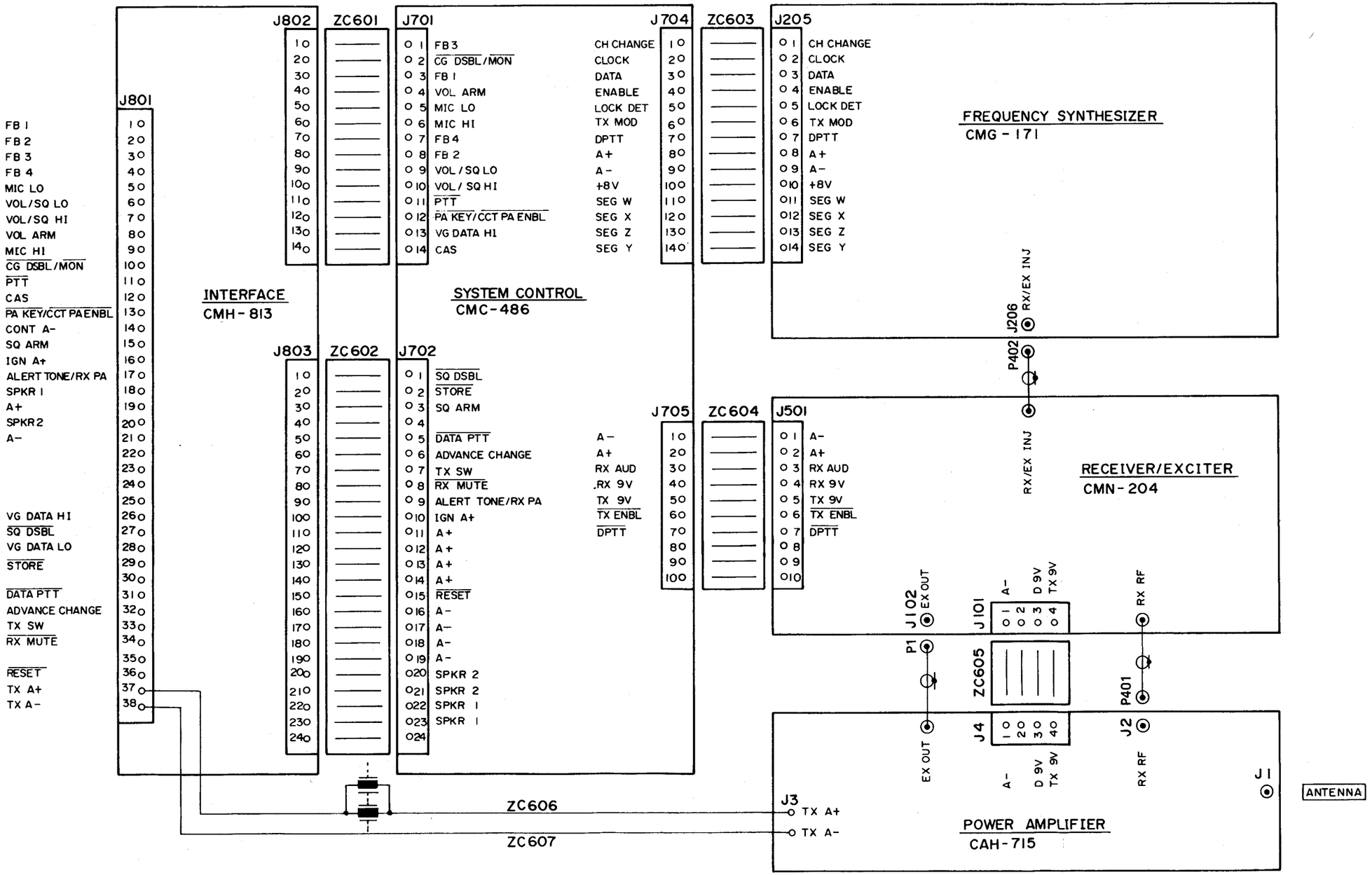
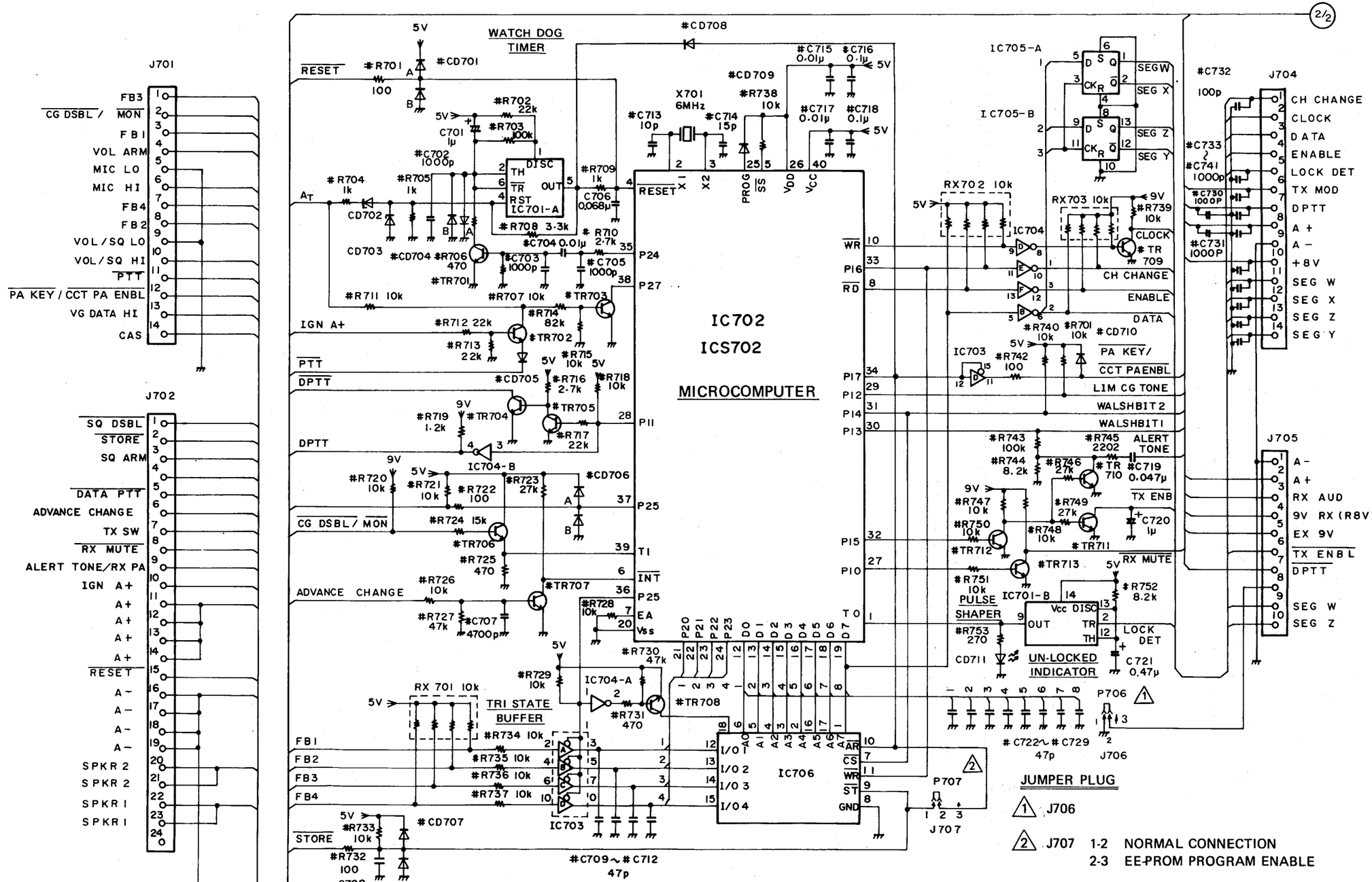


INTERCONNECTION DIAGRAM
DD00–JHM–255



POW		GND
5 V	9 V	
IC701-14	–	IC701-7
IC703-16	–	IC703-8
IC704-14	–	IC704-7
–	IC705-14	IC705-7

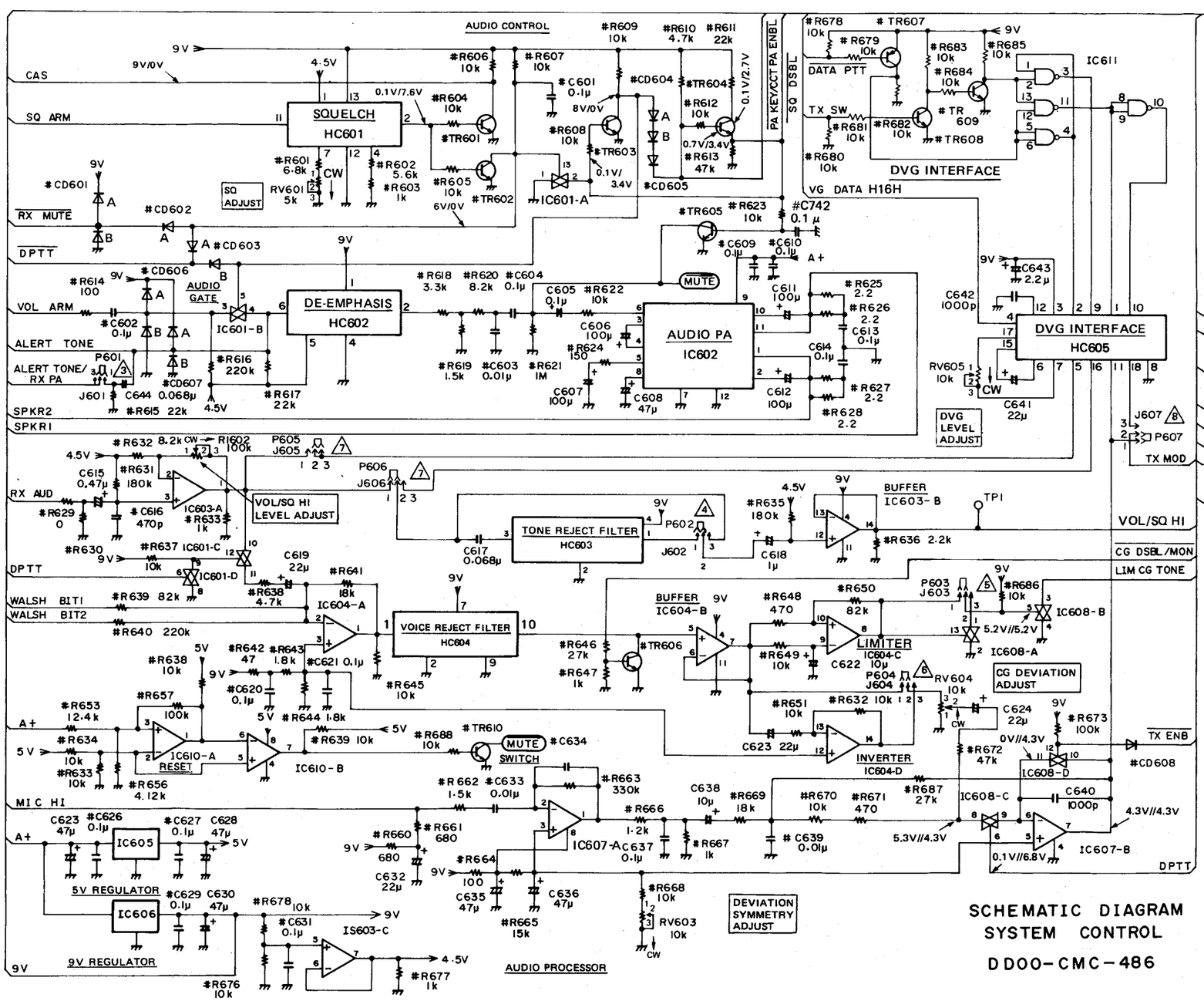
SPARE GATE		
DEVICE	INPUT	OUTPUT
IC703	14	13

JUMPER PLUG

1 J706

2 J707 1-2 NORMAL CONNECTION
2-3 EE-PROM PROGRAM ENABLE

SCHEMATIC DIAGRAM
SYSTEM CONTROL
DDOO-CMC-486 1/2



I9V	GND
IC601-14	IC601-7
IC603-4	IC603-11
IC604-4	IC604-11
–	IC607-4
IC608-14	IC608-7
IC609-14	IC609-7

SPARE GATE			
DEVICE	INPUT	OUTPUT	CONTROL
IC609	3	4	5
	8	9	6
	10	11	12

JUMPER PLUG

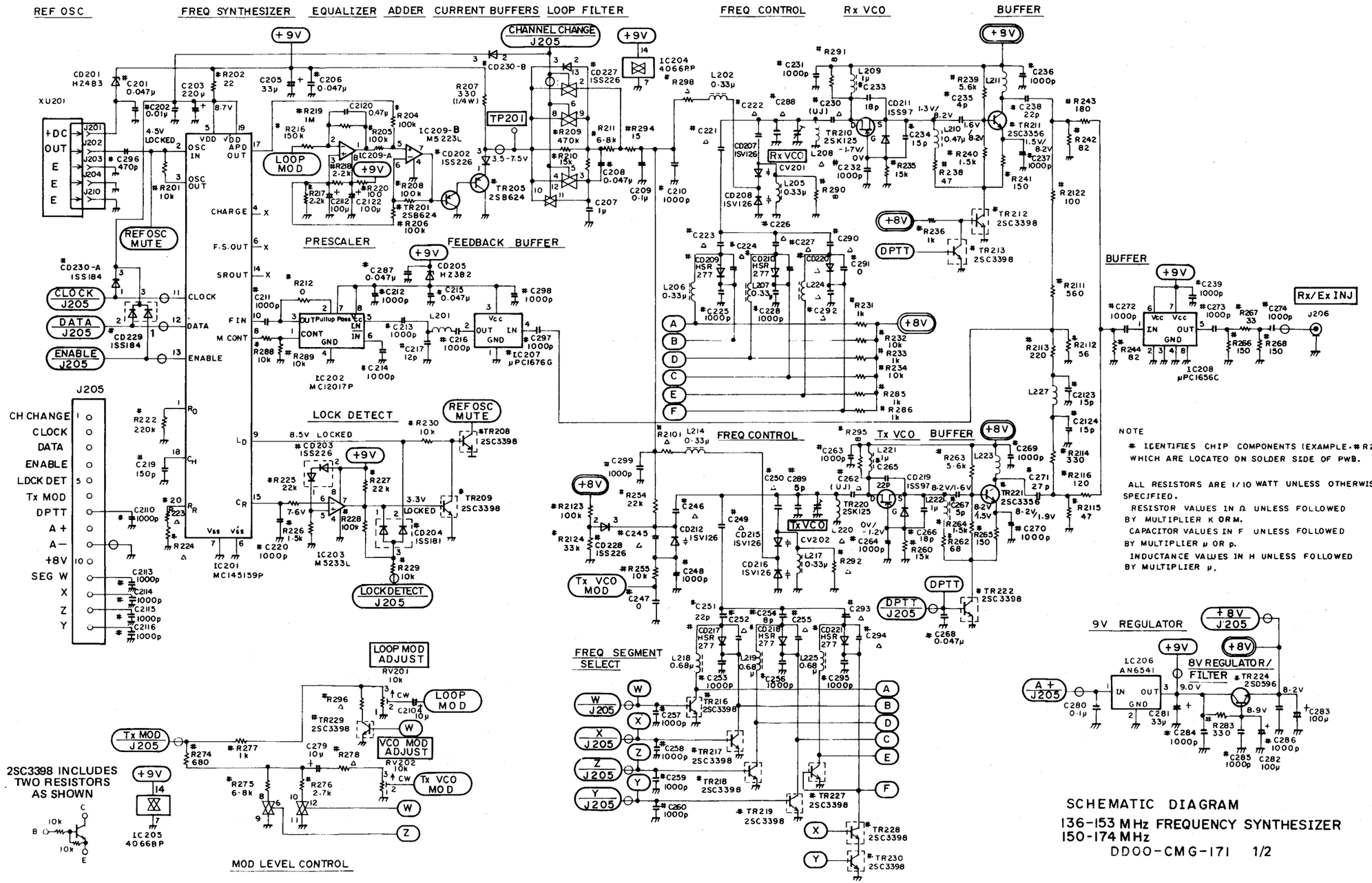
- △3 P601 1-2 NORMAL CONNECTION
  2-3 ALERT TONE/Rx PA DISABLE
- △4 P602 1-2 CG TONE REJECT FILTER USED
  2-3 CG TONE REJECT FILTER NOT USED
- △5 P603 1-2 RECEIVE CG POLARITY NORMAL
  2-3 RECEIVE CG POLARITY INVERTED
- △6 P604 1-2 TRANSMIT CG POLARITY NORMAL
  2-3 TRANSMIT CG POLARITY INVERTED
- P605 2-3 NORMAL
  1-2 WITH VOICE GUARD
- △7 P606 1-2 NORMAL
  2-3 WITH VOICE GUARD
- △8 P607 1-2 NORMAL
  2-3 WITH VOICE GUARD

DC VOLTAGE CHECK

SQUELCH CIRCUIT SHOWN FOR UNSQUELCHED/SQUELCHED
AUDIO PROCESSOR CIRCUIT SHOWN FOR DPTT LOW/DPTT HIGH

SCHEMATIC DIAGRAM
SYSTEM CONTROL
DDOO-CMC-486

2/2



SCHEMATIC DIAGRAM

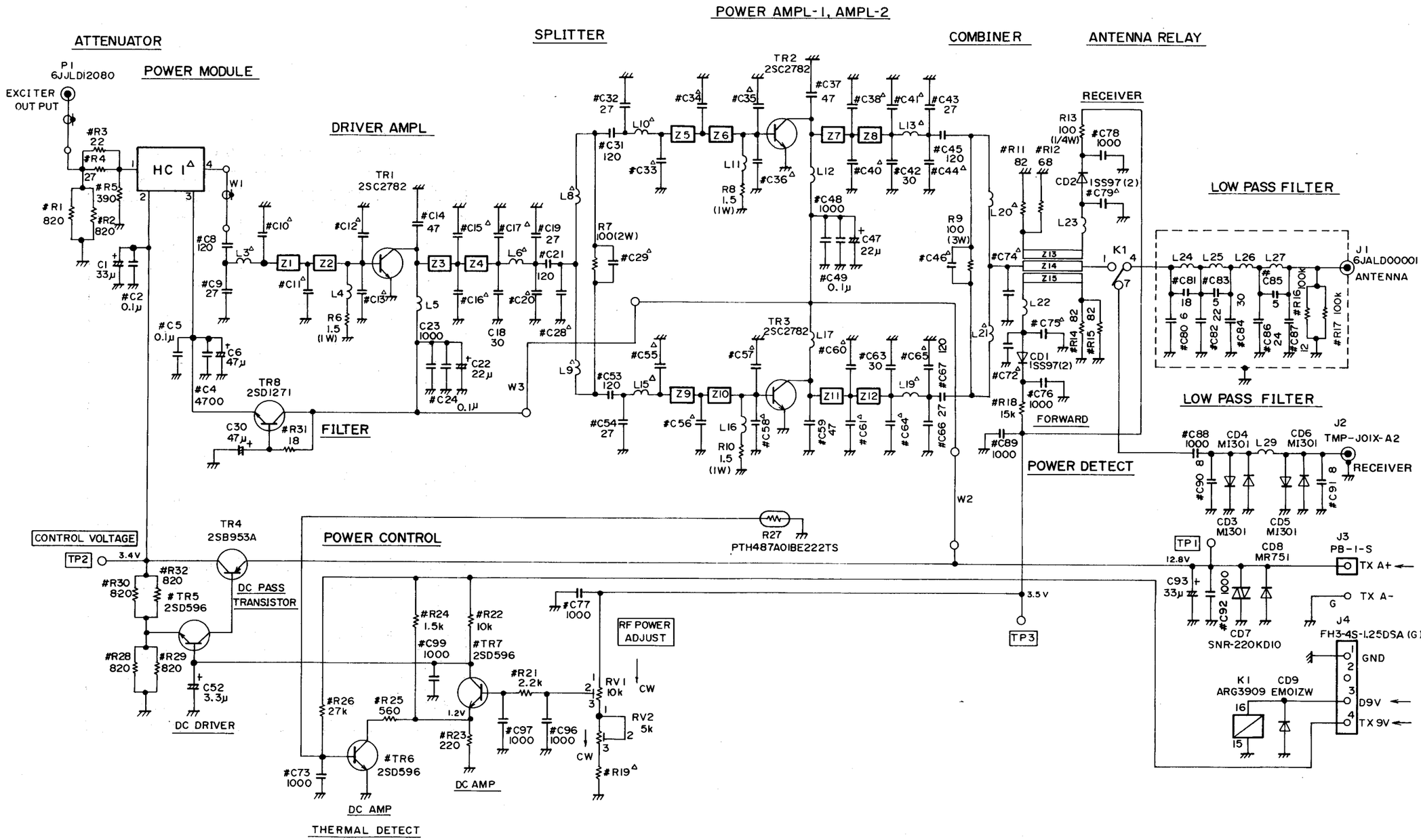
136-153 MHz FREQUENCY SYNTHESIZER
150-174 MHz

DDOO-CMG-171 1/2

△ COMPONENT IDENTIFICATION CHART

SYMBOL	CMG-171A (136-153MHz)	CMG-171B (150-174MHz)
C221	47pF	39pF
C222	15pF	22pF
C223	6pF	8pF
C224	1pF	2pF
C226	5pF	6pF
C227	4pF	2pF
C230	18pF	27pF
C245	18pF	22pF
C246	2pF	3pF
C249	22pF	22pF
C250	56pF	82pF
C252	2pF	0
C255	2pF	0
C262	33pF	39pF
C288	3pF	0
C290	0	4pF
C292	0	1000pF
C293	22pF	27pF
C294	2pF	0
CD220	——	HSR277
L208	JR-NB-8034	JR-NB-7967
L220	JR-NB-7966	JR-NB-9314
L224	∞	0.47μH
R223	39kΩ	47kΩ
R224	3.9kΩ	2.2kΩ
R278	10kΩ	33kΩ
R292	∞	10kΩ
R296	10kΩ	12kΩ
R298	47Ω	22Ω
R2101	47Ω	100Ω

SCHEMATIC DIAGRAM
136-153 MHz FREQUENCY SYNTHESIZER
150-174 MHz
DDOO-CMG-171 2/2



NOTES
1. " # " IDENTIFIES CHIP COMPONENTS (EXAMPLE #R12 OR R12#) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD
2. Z1-Z15, STRIPLINE PART OF PWB.
3. RV2 IS FACTORY TUNED AND DOES NOT REQUIRE FURTHER ADJUSTMENT.

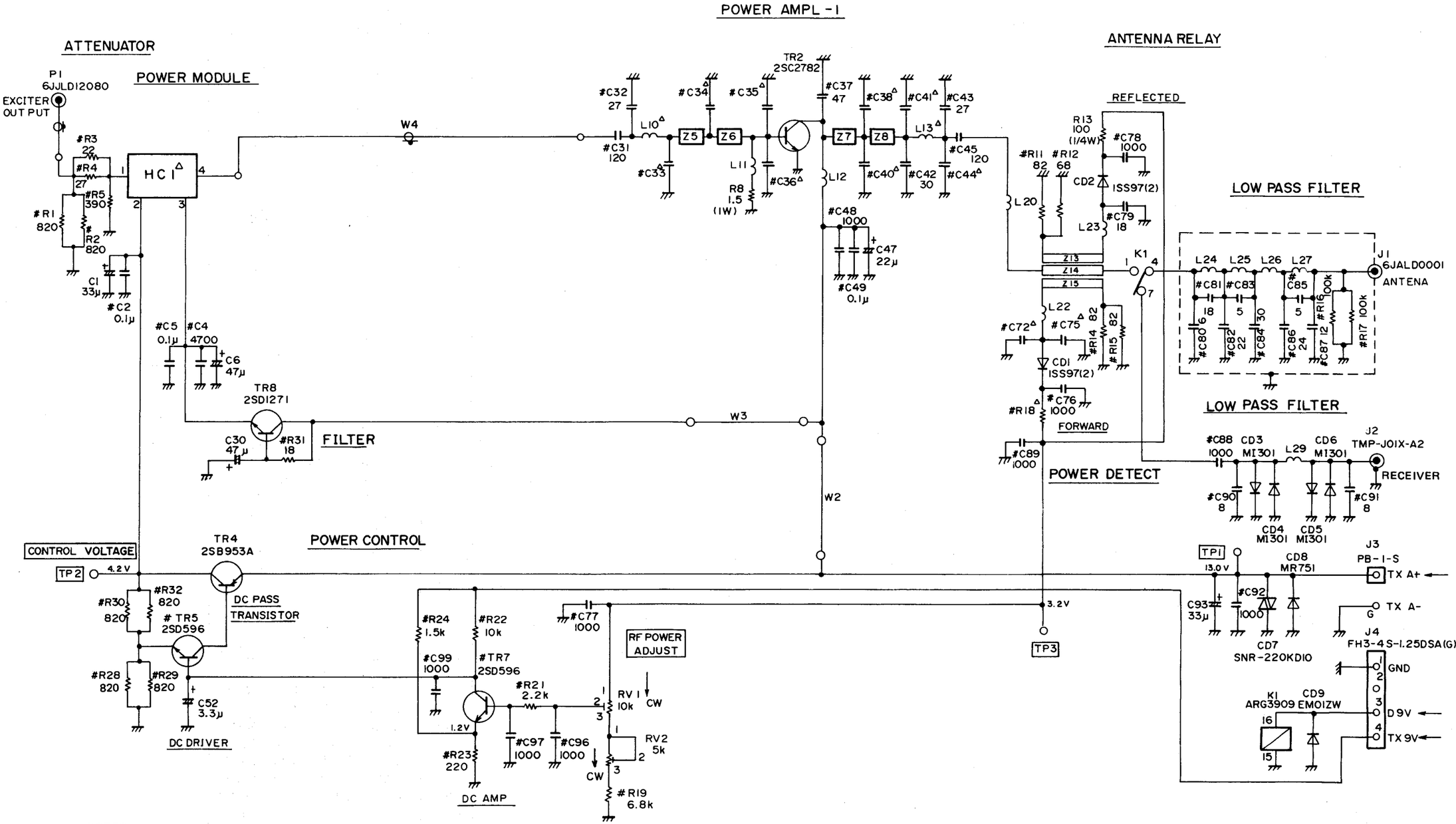
ALL RESISTORS ARE 1/10 OR 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN P UNLESS FOLLOWED BY MULTIPLIER μ.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

SCHEMATIC DIAGRAM
136-174 MHz 110W
POWER AMPLIFIER
DD00-CAH-715H 1/2

△COMPONENT
IDENTIFICATION CHART

	CAH-715AH 136 ~153MHz	CAH-715BH 150~174 MHz
HC1	M57719L-37	M57719-37
C10	68PF	56PF
C11	100PF	82PF
C12	270PF	220PF
C13	270PF	180PF
C15	180PF	150PF
C16	180PF	150PF
C17	24PF	39PF
C20	20PF	10PF
C28	20PF	15PF
C29	10PF	7PF
C33	68PF	56PF
C34	100PF	82PF
C35	270PF	180PF
C36	270PF	220PF
C38	180PF	150PF
C40	180PF	150PF
C41	24PF	39PF
C44	20PF	10PF
C46	10PF	8PF
C55	68PF	56PF
C56	100PF	82PF
C57	270PF	220PF
C58	270PF	180PF
C60	180PF	150PF
C61	180PF	150PF
C64	24PF	39PF
C65	20PF	10PF
C72	—	3PF
C74	18PF	15PF
C75	27PF	22PF
C79	27PF	22PF
L3	6LALD00017	6LALD00076
L6	6LALD00014	6LALD00075
L8	6LAFD01197A	6LALD00057
L9	6LAFD01197A	6LALD00057
L10	6LALD00017	6LALD00076
L13	6LALD00014	6LALD00075
L15	6LALD00017	6LALD00076
L19	6LALD00014	6LALD00075
L20	6LAFD01197A	6LALD00057
L21	6LAFD01197A	6LALD00057
R19	6.8kΩ	5.6 kΩ

SCHEMATIC DIAGRAM
136-174 MHz 110W
POWER AMPLIFIER
DD00-CAH-715H 2/2



NOTES

1. "#" IDENTIFIES CHIP COMPONENTS (EXAMPLE #R12 OR R12#) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD
2. $Z_5 - Z_8$ AND $Z_{13} - Z_{15}$, STRIPLINE PART OF PWB.
3. RV2 IS FACTORY SET AND DOES NOT REQUIRE FURTHER ADJUSTMENT.

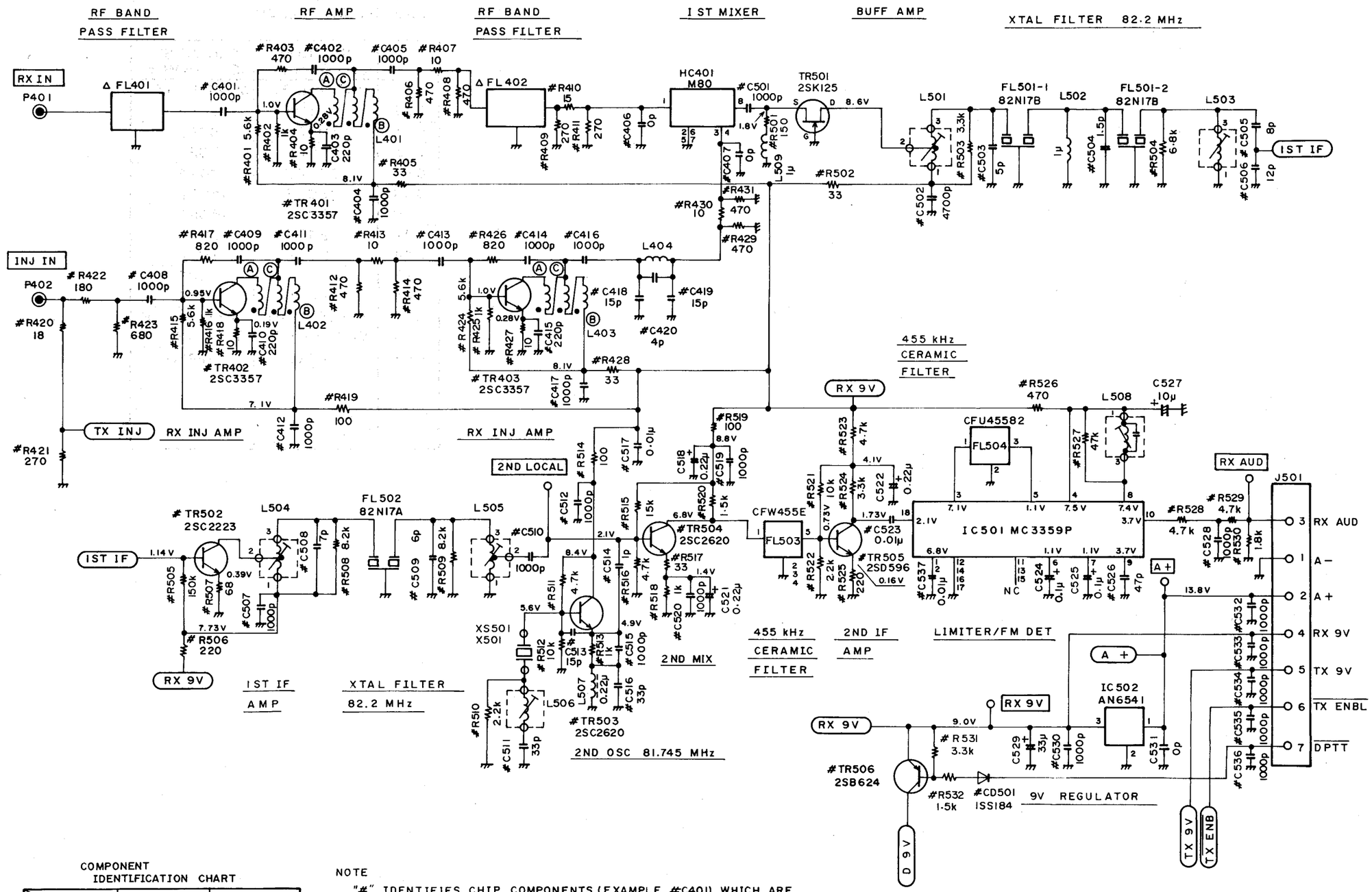
ALL RESISTORS ARE 1/10 OR 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN P UNLESS FOLLOWED BY MULTIPLIER μ.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

SCHEMATIC DIAGRAM
136-174MHz 40W
POWER AMPLIFIER
DD00-CAH-715L 1/2

△ COMPONENT
IDENTIFICATION CHART

	CAH-715AL 136~153MHz	CAH-715BL 150~174MHz
HC1	M57719L-37	M57719-37
C33	68PF	56PF
C34	100PF	82PF
C35	270PF	180PF
C36	270PF	220PF
C38	180PF	150PF
C40	180PF	150PF
C41	24PF	39PF
C44	20PF	10PF
C72	—	3PF
C75	27PF	22PF
L10	6LALD00017	6LALD00076
L13	6LALD00014	6LALD00075
R18	4.7kΩ	6.8kΩ

SCHEMATIC DIAGRAM
136-174MHz 40W
POWER AMPLIFIER
DD00-CAH-715L 2/2



COMPONENT IDENTIFICATION CHART

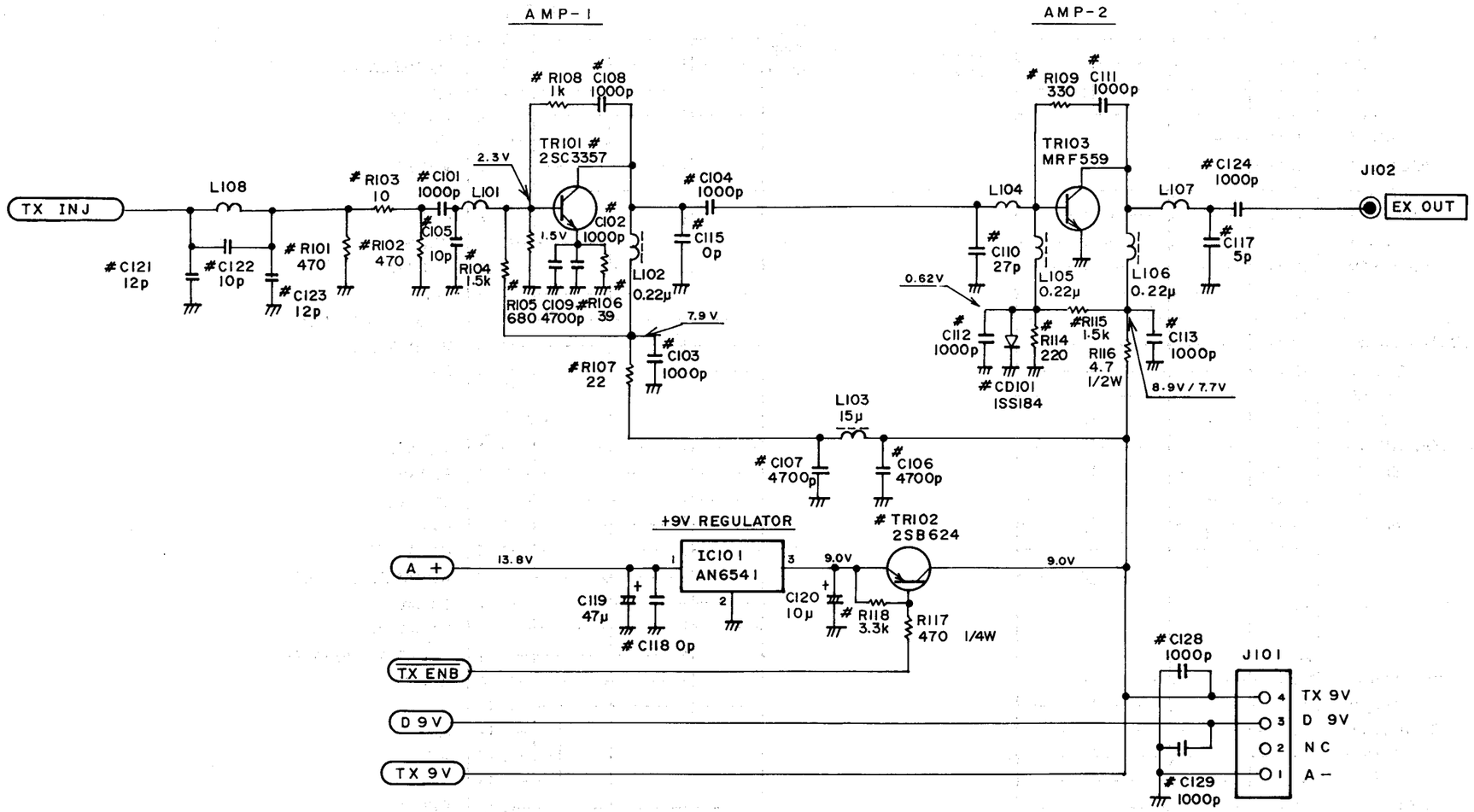
PART \ BAND	CMA-204A	CMA-204B
	136 - 153MHz	150-174MHz
FL401	BP136-153A4	BP150-174A4
FL402	BP136-153A4	BP150-174A4

NOTE

"#" IDENTIFIES CHIP COMPONENTS (EXAMPLE #C401) WHICH ARE LOCATED ON SOLDER SIDE OF PWB.

ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ, n OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

SCHEMATIC DIAGRAM
136-174 MHz RECEIVER
DD00-CMN-204
1/2

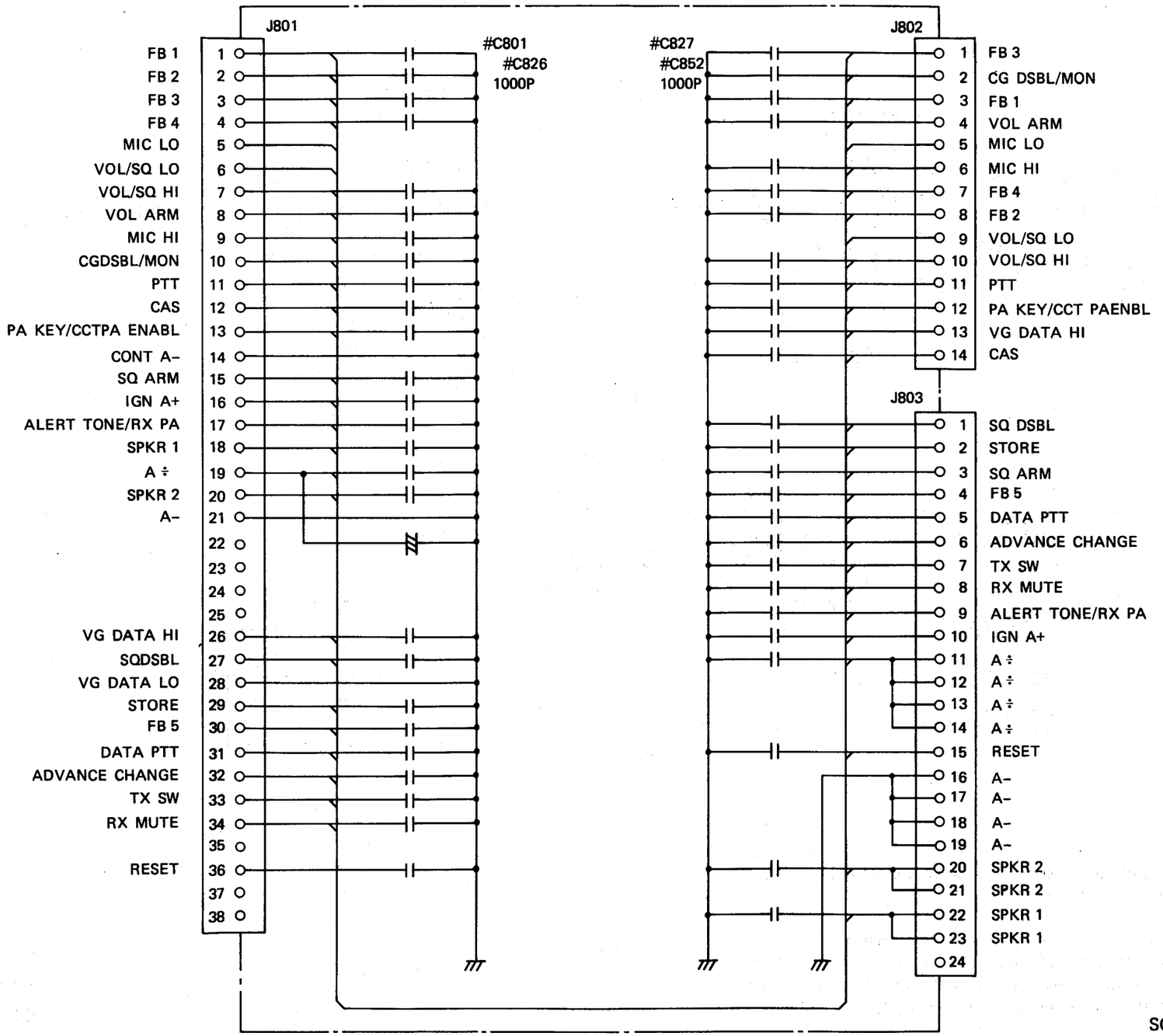


NOTE

"#" IDENTIFIES CHIP COMPONENTS (EXAMPLE #C171) WHICH ARE LOCATED ON SOLDER SIDE OF PWB.

ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ, n OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

SCHEMATIC DIAGRAM
136-174 MHz EXCITER
DD00-CMN-204
2/2



SCHEMATIC DIAGRAM
INTERFACE
DDOO-CMH-813

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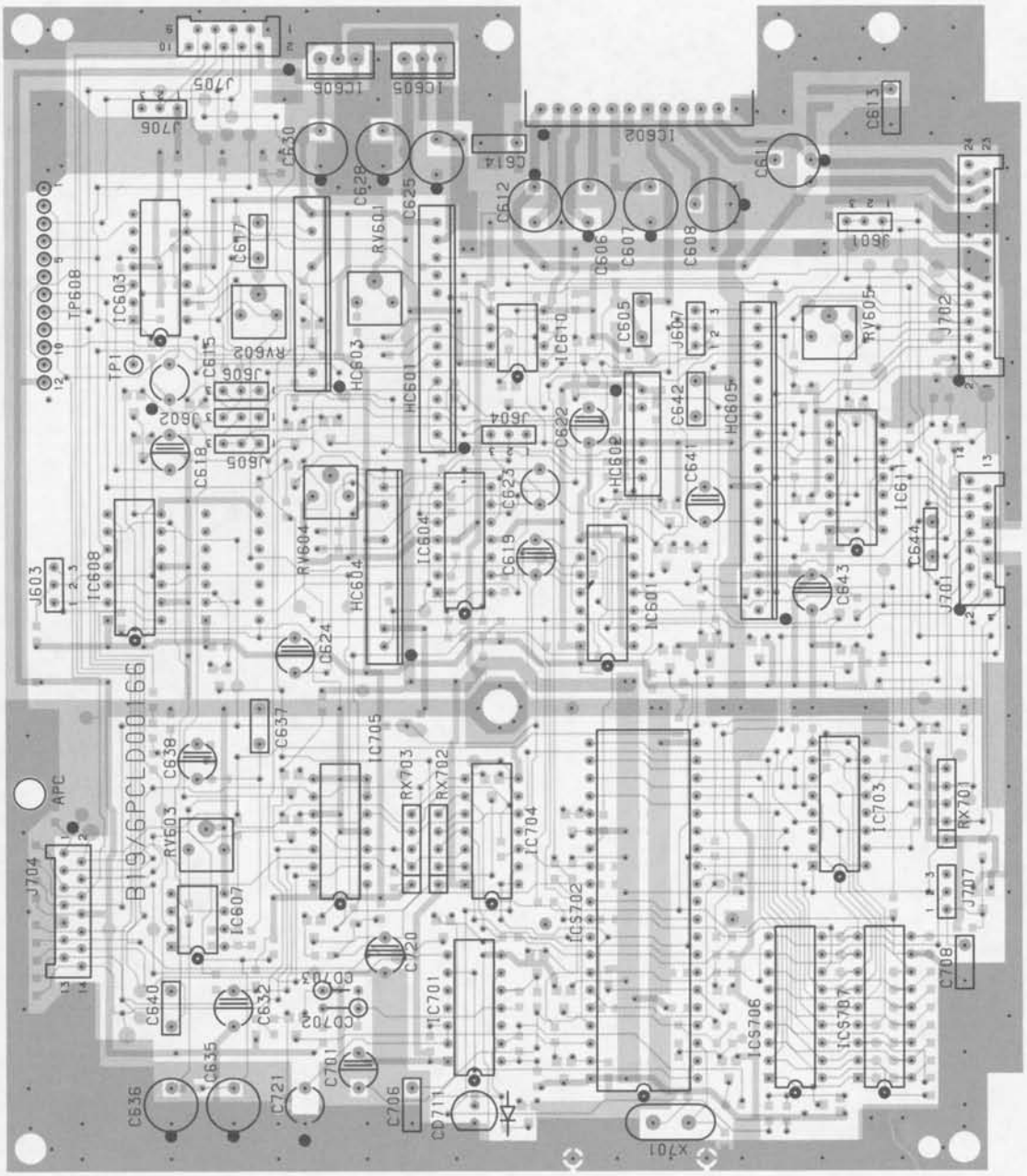
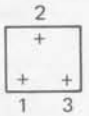
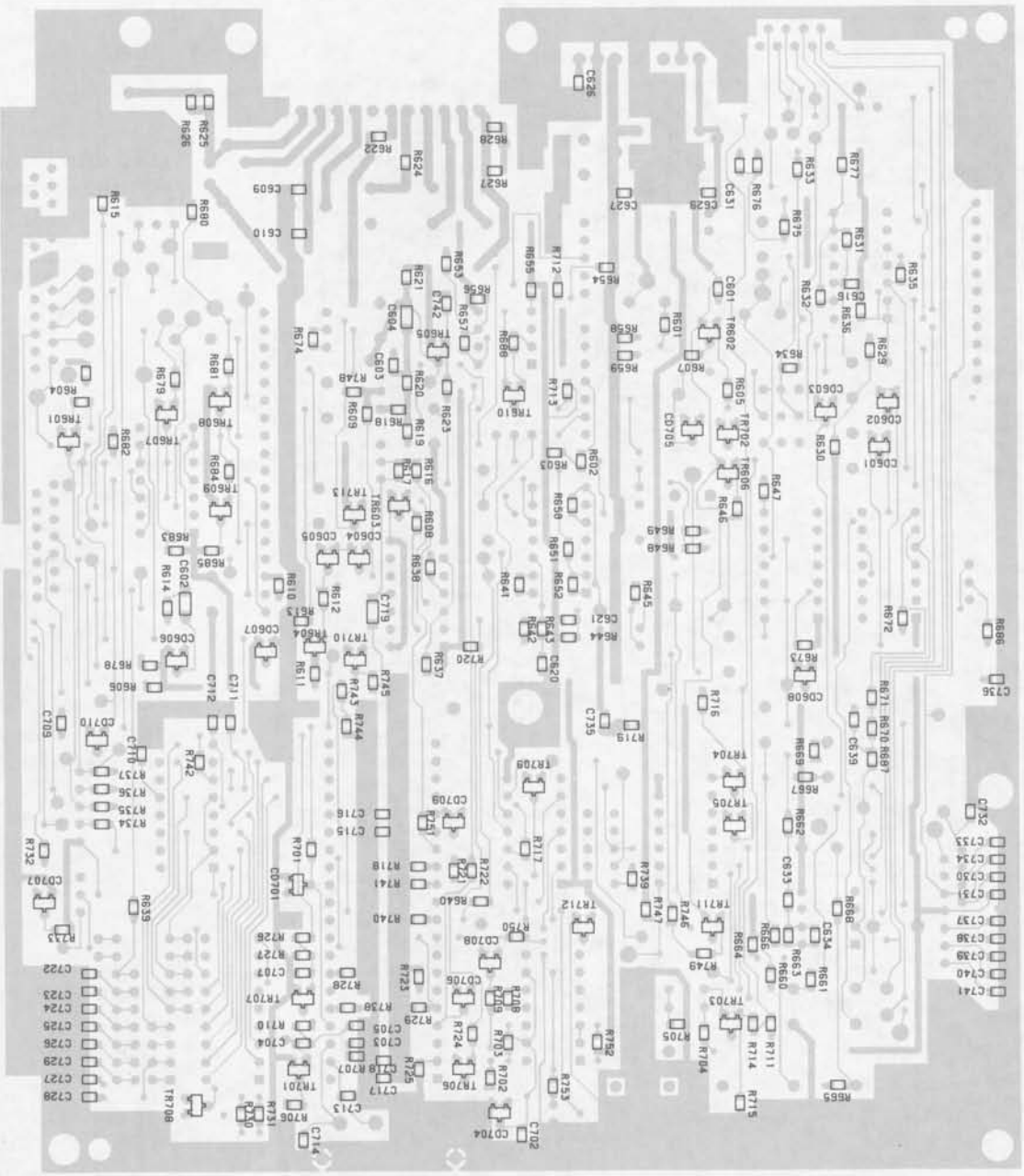


LEAD IDENTIFICATION
FOR VOLUME

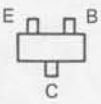


(TOP VIEW)

SYSTEM CONTROL BOARD
(COMPONENT SIDE)

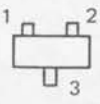


LEAD IDENTIFICATION
FOR TRANSISTORS



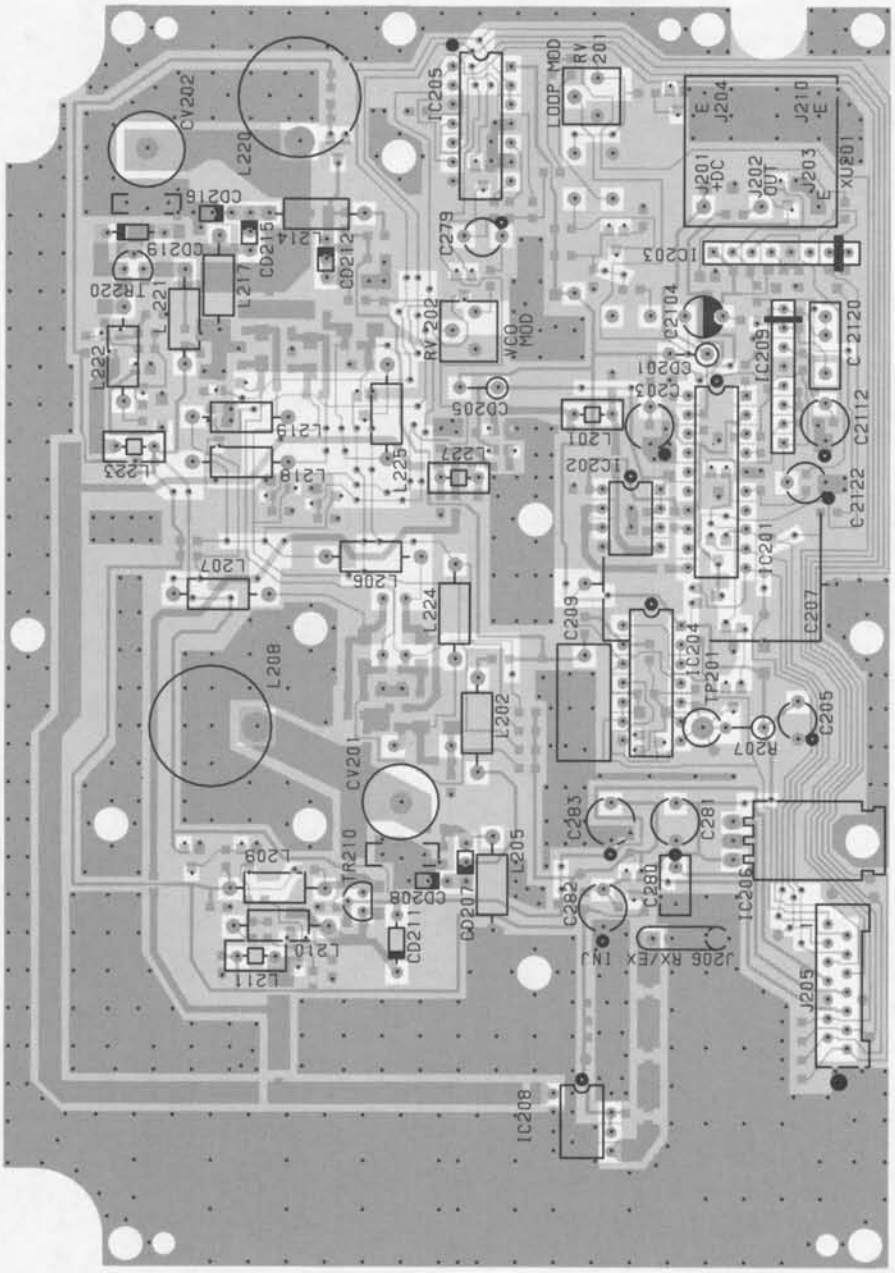
(TOP VIEW)

LEAD IDENTIFICATION
FOR DIODES



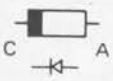
(TOP VIEW)

SYSTEM CONTROL BOARD
(SOLDER SIDE)

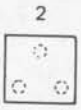


LEAD IDENTIFICATION
FOR TR210, TR220
(TOP VIEW)

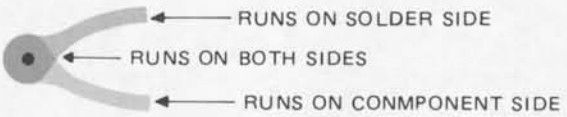
LEAD IDENTIFICATION
FOR DIODES
(TOP VIEW)



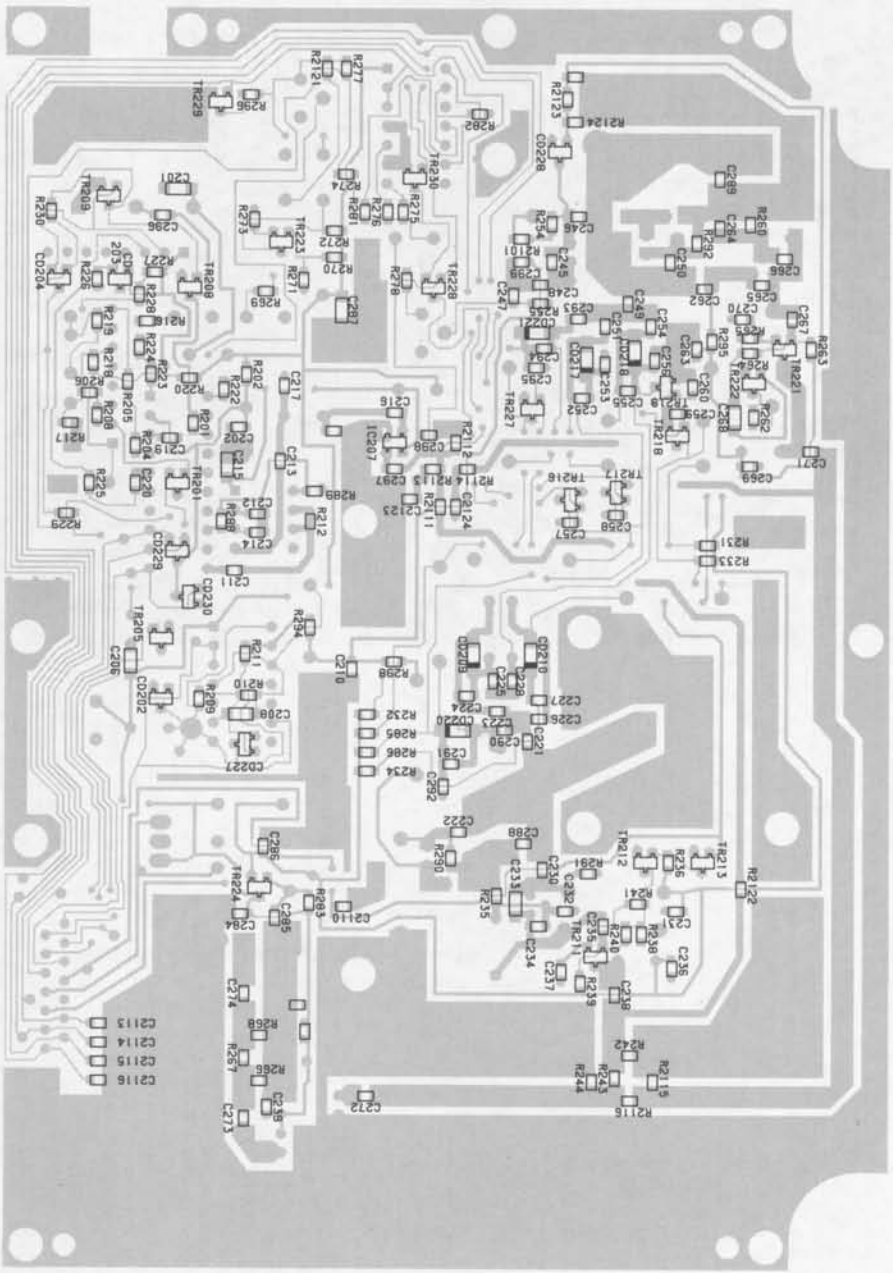
LEAD IDENTIFICATION
FOR RV201, RV202
(TOP VIEW)



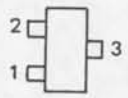
LEAD IDENTIFICATION
FOR IC206
(TOP VIEW)



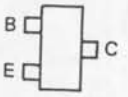
FREQUENCY SYNTHESIZER BOARD
(COMPONENT SIDE)



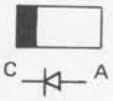
LEAD IDENTIFICATION
FOR DIODES
(TOP VIEW)



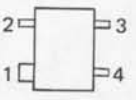
LEAD IDENTIFICATION
FOR TRANSISTORS
(TOP VIEW)



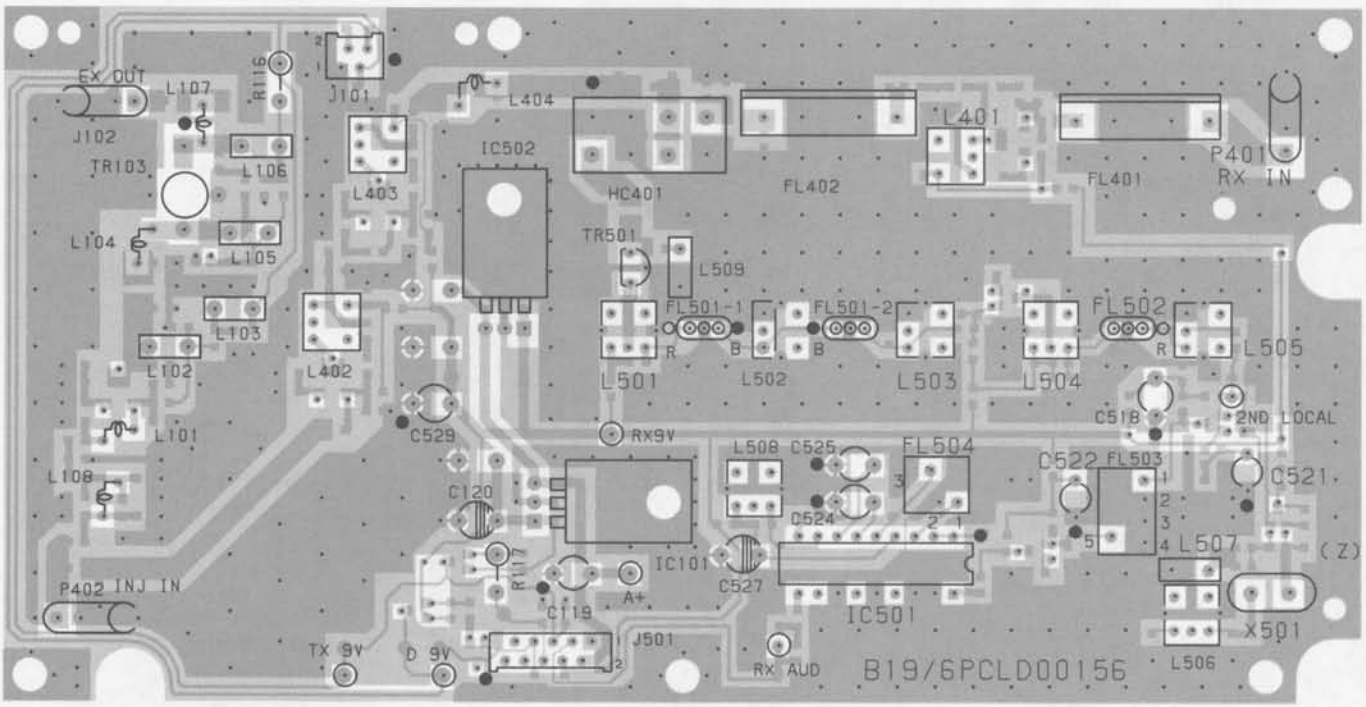
LEAD IDENTIFICATION
FOR DIODES
(TOP VIEW)

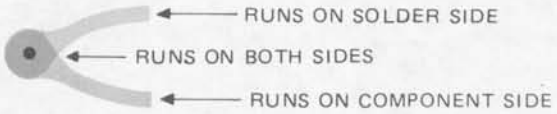


LEAD IDENTIFICATION
FOR IC207
(TOP VIEW)

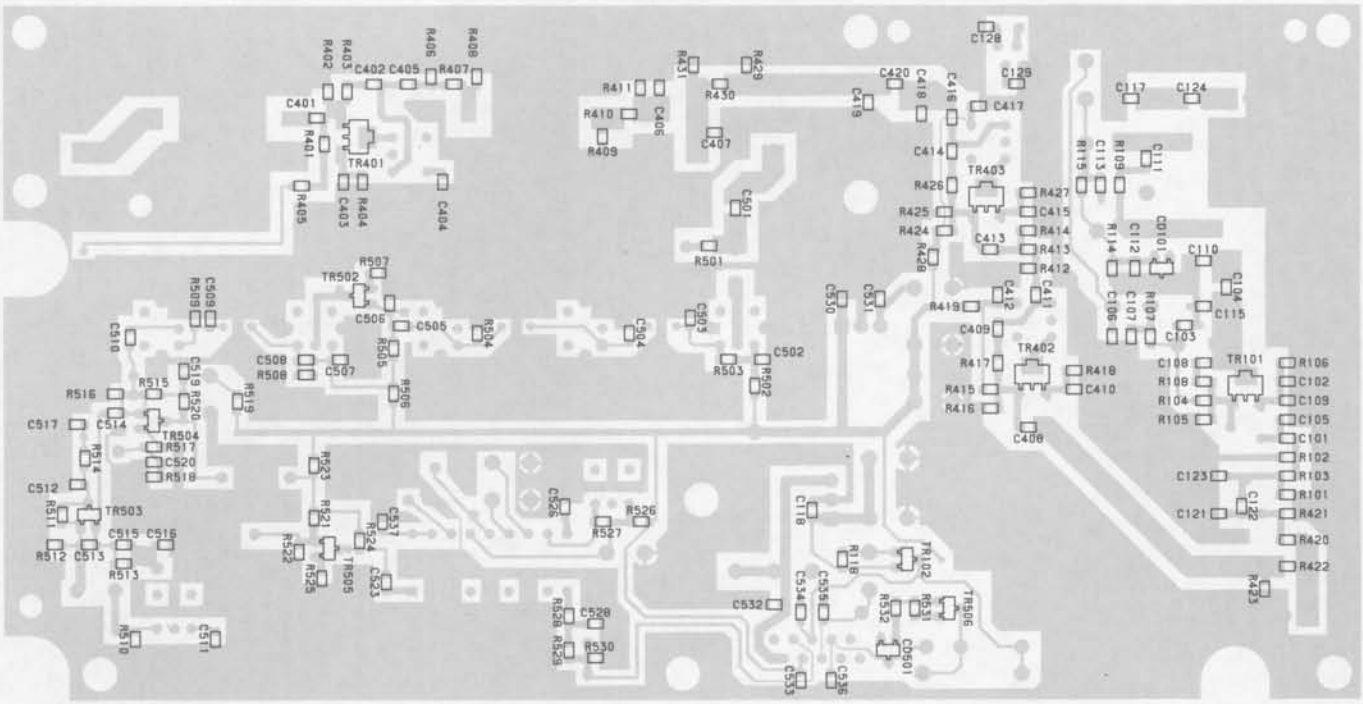


FREQUENCY SYNTHESIZER
(SOLDER SIDE)

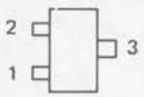




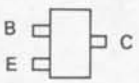
RECEIVER/EXCITER BOARD
(COMPONENT SIDE)



LEAD IDENTIFICATION
FOR CD501
(TOP VIEW)



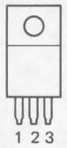
LEAD IDENTIFICATION
FOR TRANSISTORS
(TOP VIEW)



RECEIVER/EXCITER BOARD
(SOLDER SIDE)

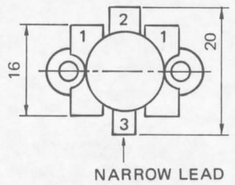
(Page D28 is blank)

LEAD IDENTIFICATION
FOR TR4 AND TR8
(TOP VIEW)



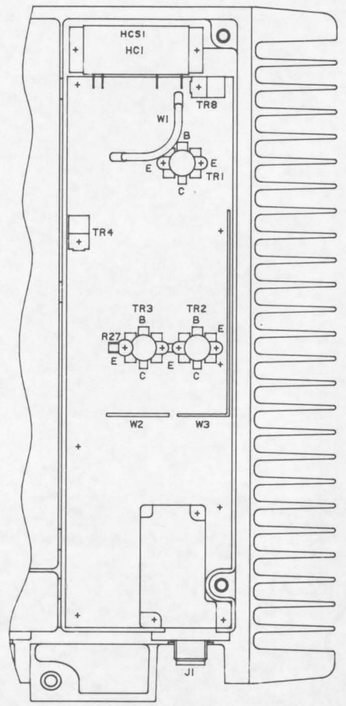
1: BASE
2: COLLECTOR
3: EMITTER

TYP LEAD TRIMMING
FOR TR1, TR2 AND TR3
(TOP VIEW)

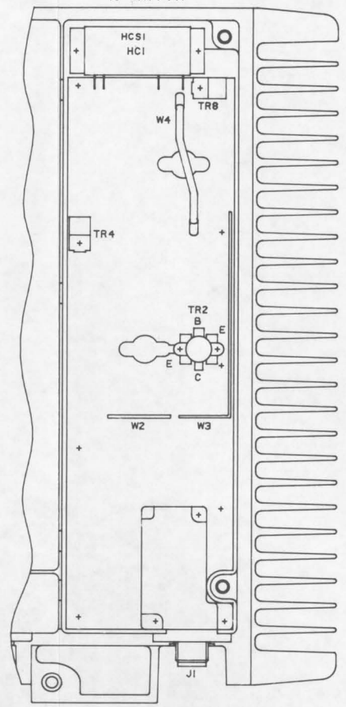


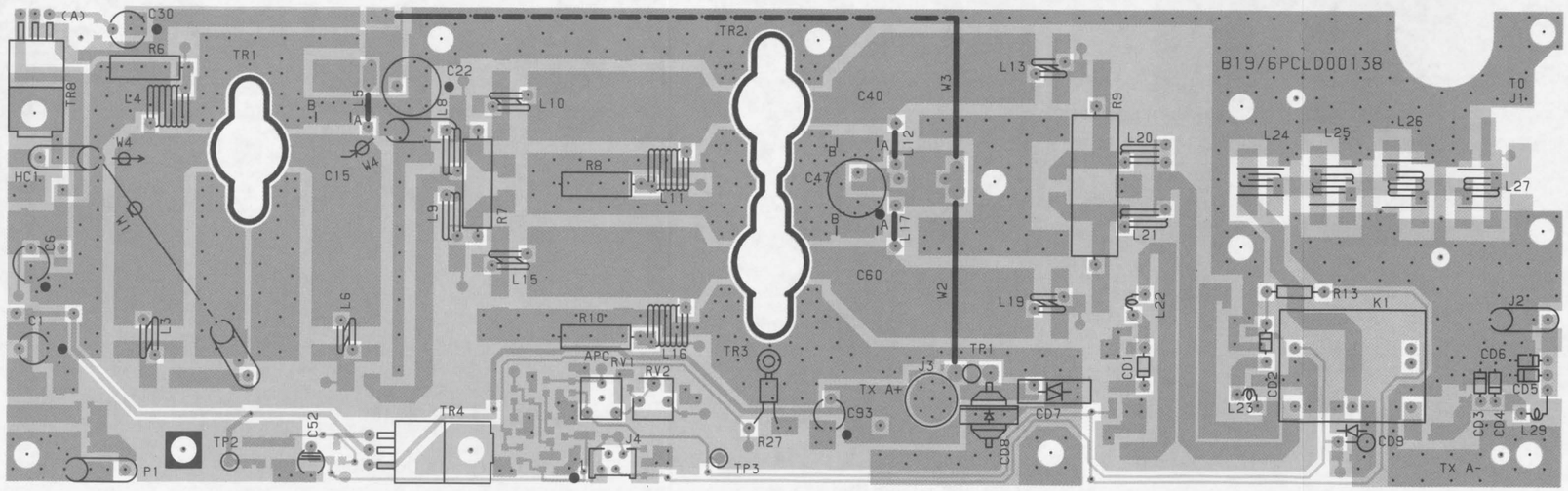
1: EMITTER
2: BASE
3: COLLECTOR

110-WATT PA

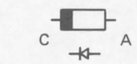


40-WATT PA



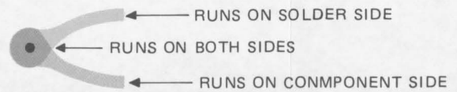


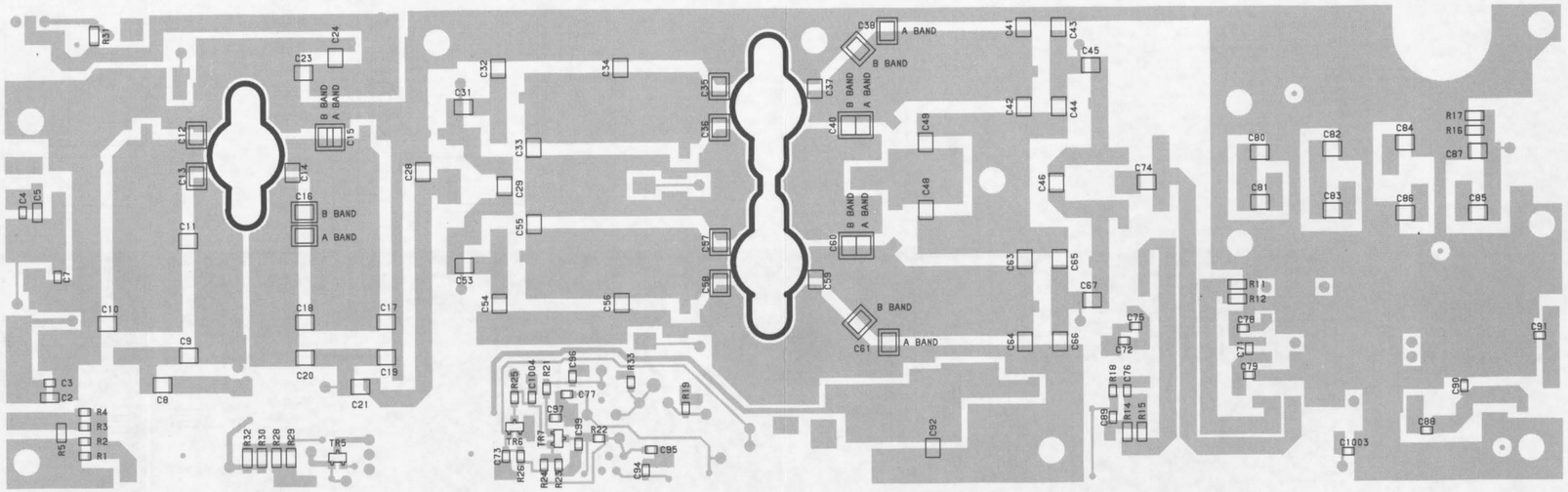
LEAD IDENTIFICATION
FOR DIODES
(TOP VIEW)



LEAD IDENTIFICATION
FOR RV1
(TOP VIEW)

POWER AMPLIFIER BOARD
(COMPONENT SIDE)

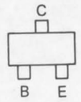


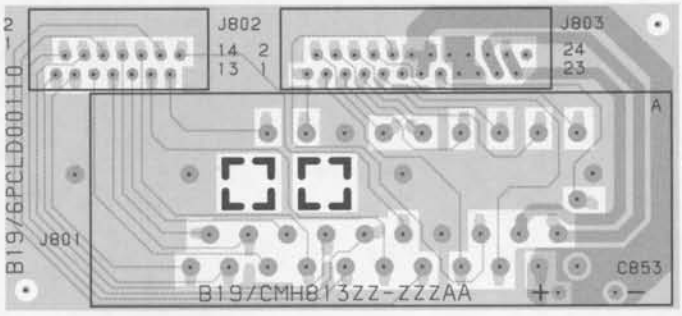


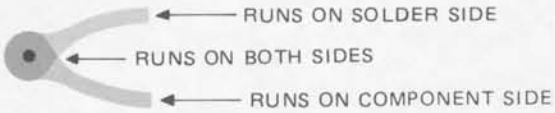
POWER AMPLIFIER BOARD

(CHIP COMPONENT ALLOCATION)

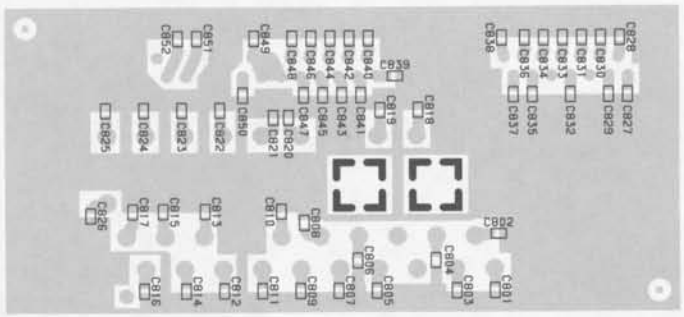
LEAD IDENTIFICATION
FOR TRANSISTORS
(TOP VIEW)





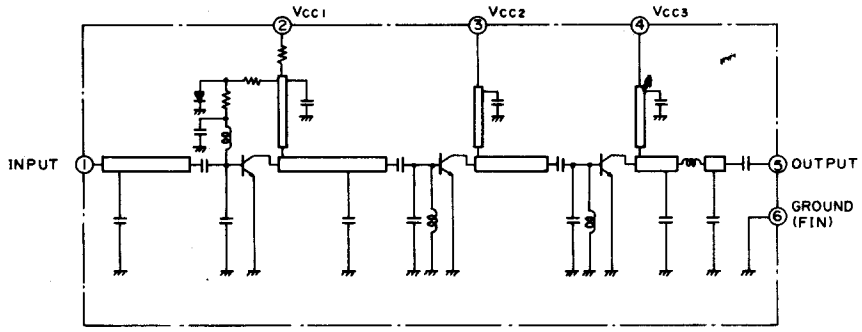
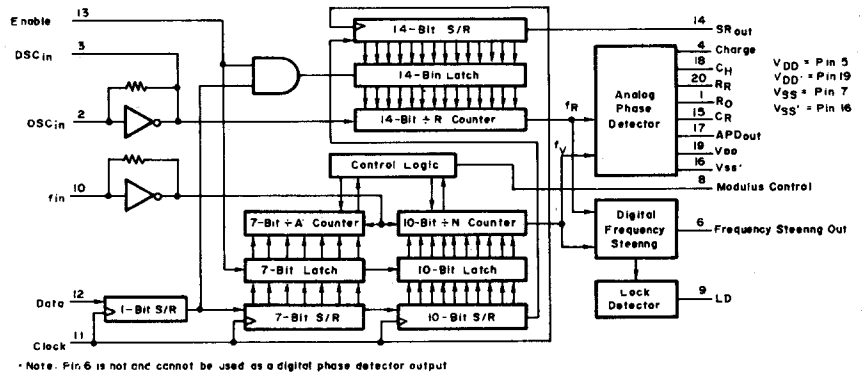
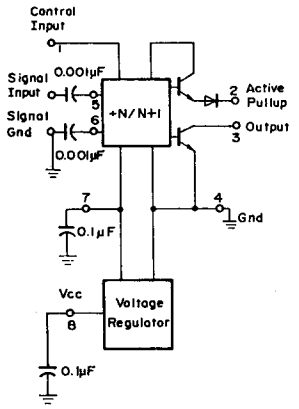
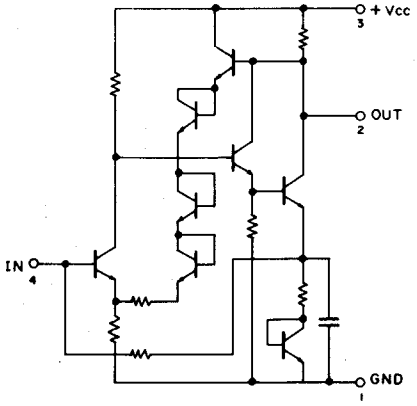


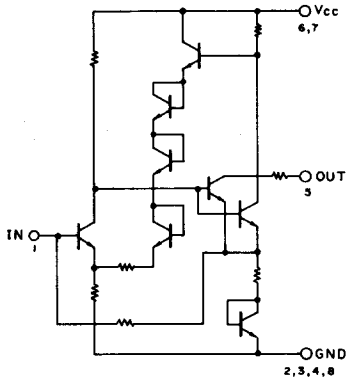
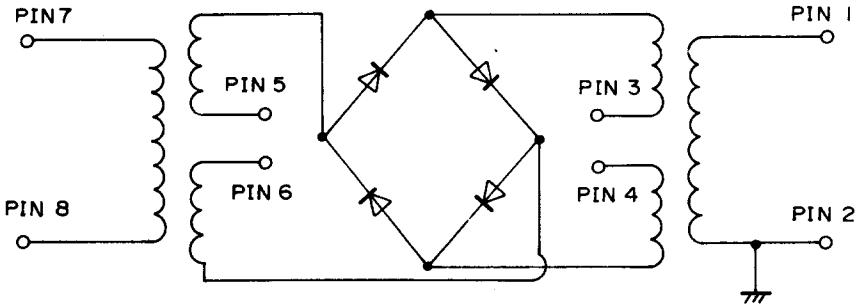
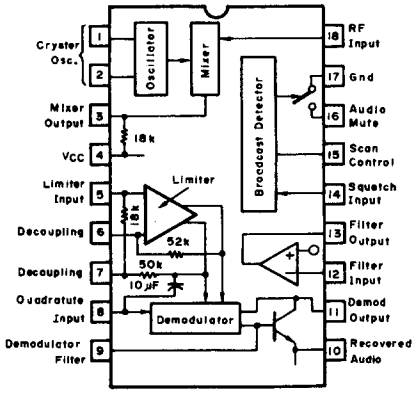
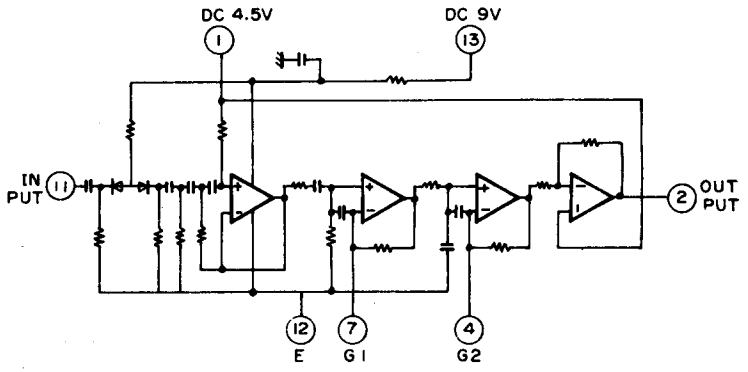
INTERFACE BOARD
(COMPONENT SIDE)

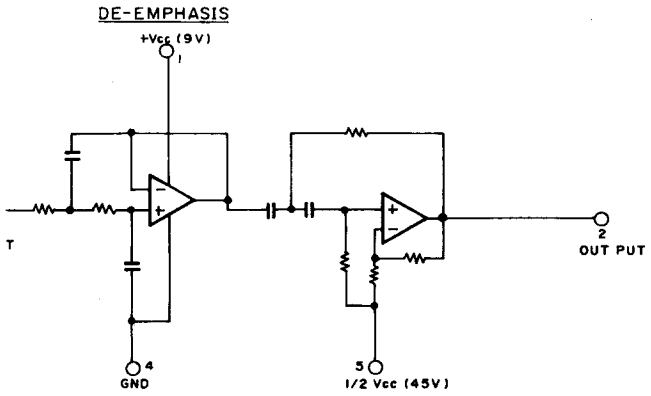
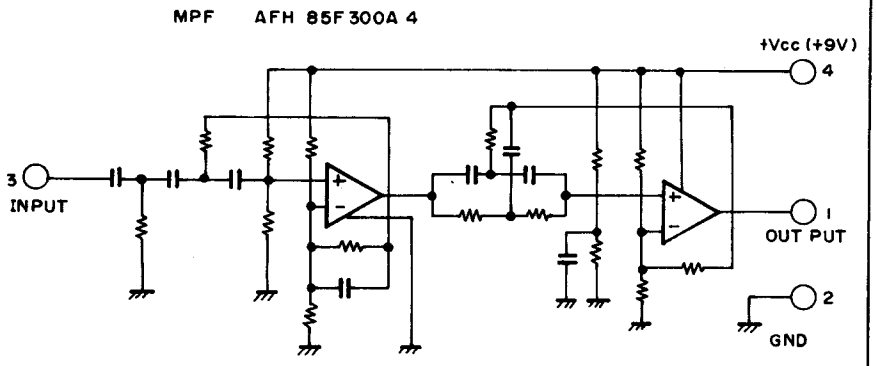
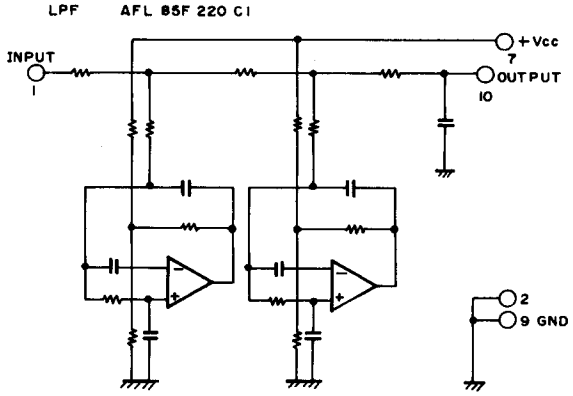
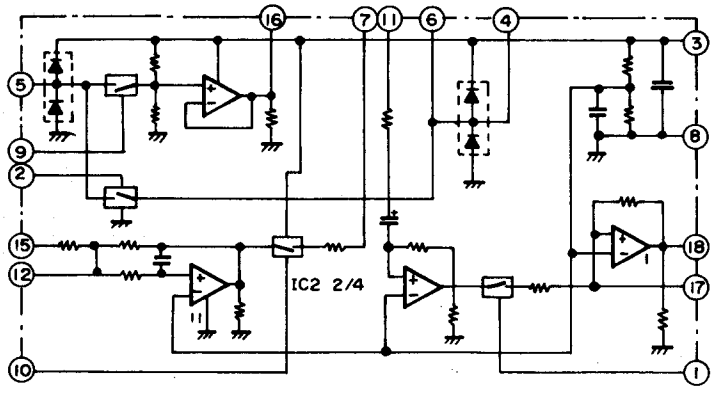


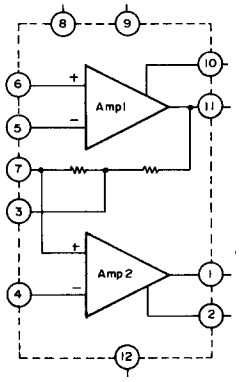
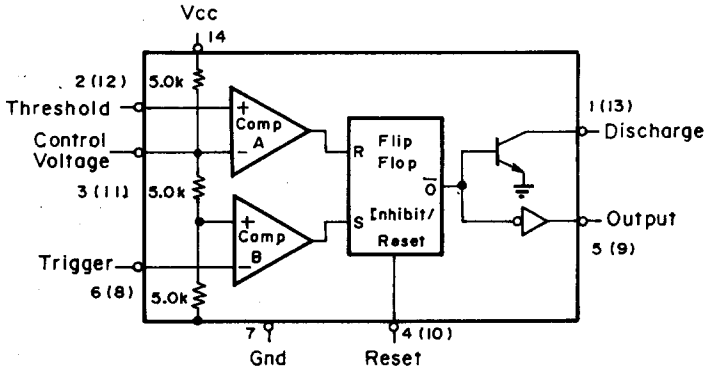
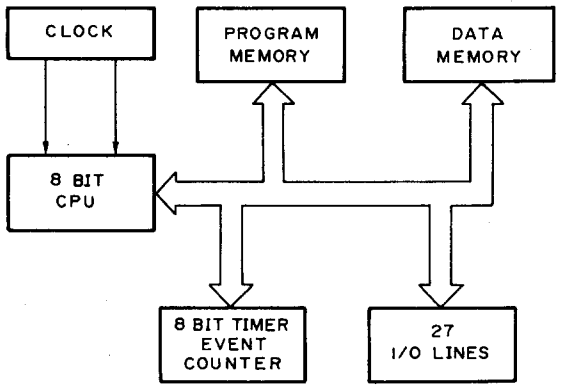
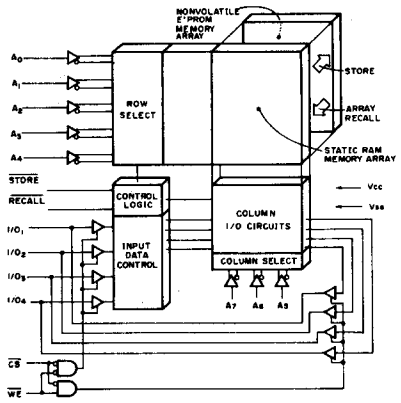
INTERFACE BOARD
(SOLDER SIDE)

(Page D32 is blank)

SYMBOL	GE PART NO	EQUIVALENT CIRCUIT
HC 1	B19/ 5DDAB00247 B19/ 5DDAB00248 B19/ 5DDAB00249	
IC201	B19/ 5CAAJ00328	
IC202	B19/ 5DAAJ00577	
IC207	B19/ 5DAAA00284	

SYMBOL	GE PART NO	EQUIVALENT CIRCUIT
IC208	B19/ 5DAAA00183	
HC401	B19/ 5NZBH00002	
IC501	B19/ 5DAAR00074	
HC601	B19/ 6DHFD00160	

SYMBOL	GE PART NO	EQUIVALENT CIRCUIT
IC602	B19/ 6DHFD00167	
HC603	B19/ 6DHFD00168	
HC604	B19/ 6DHFD00169	
HC605	B19/ 6DHFD00164	

SYMBOL	GE PART NO	EQUIVALENT CIRCUIT
IC602	B19/ 5DAAA00233	
IC701	B19/ 5DAAJ00646	
IC702	B19/ 6DLLD00008	
IC706	B19/ 5DDBY00026	

SYMBOL	GE PART NO.	DESCRIPTION
	B19/CAH-715AL	136-153 MHz 40 W P.A BOARD: AL
	B19/CAH-715AH	136-153 MHz 110 W P.A BOARD: AH
	B19/CAH-715BL	150-174 MHz 40 W P.A BOARD: BL
	B19/CAH-715BH	150-174 MHz 110 W P.A BOARD: BH
		---------- CAPACITORS ----------
C1	B19/5CEAA02283	Electrolytic: 33 uF ±20%, 25 VDCW.
C2	B19/5CAAD01268	Ceramic: 0.1 uF +80-20%, 50 VDCW.
C4	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef 0±15%.
C5	B19/5CAAD01268	Ceramic: 0.1 uF +80-20%, 50 VDCW.
C6	B19/5CEAA01816	Electrolytic: 47 uF ±10%, 25 VDCW.
C8	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH and BH).
C9	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH and BH).
C10	B19/5CAAA03090	Ceramic: 68 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH).
C10	B19/5CAAA03095	Ceramic: 56 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C11	B19/5CAAA03091	Ceramic: 100 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH).
C11	B19/5CAAA03096	Ceramic: 82 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C12 and C13	B19/5CAAA03092	Ceramic: 270 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH).
C12	B19/5CAAA03097	Ceramic: 220 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C13	B19/5CAAA03098	Ceramic: 180 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C14	B19/5CAAA03080	Ceramic: 47 pF ±5%, 500 VDCW. (Used in AH and BH).
C15 and C16	B19/5CMAB01433	Mica: 180 pF ±5%, 500 VDCW (Used in AH).
C15 and C16	B19/5CMAB01471	Mica: 150 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C17	B19/5CAAA03088	Ceramic: 24 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH).
C17	B19/5CAAA03100	Ceramic: 39 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C18	B19/5CAAA03081	Ceramic: 30 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH and BH).
C19	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH and BH).
C20	B19/5CAAA03093	Ceramic: 20 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH).
C20	B19/5CAAA03094	Ceramic: 10 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C21	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH and BH).
C22	B19/5CEAA00451	Electrolytic: 22 uF ±10%, 40 VDCW. (Used in AH and BH).
C23	B19/5CAAA03082	Ceramic: 1000 pF ±10%, 500 VDCW. (Used in AH and BH).
C24	B19/5CAAA03083	Ceramic: 0.1 uF ±10%, 50 VDCW. (Used in AH and BH).

SYMBOL	GE PART NO.	DESCRIPTION
C28	B19/5CAAA03093	Ceramic: 20 pF ±10%, 500 VDCW. (Used in AH).
C28	B19/5CAAA03101	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±60 PPM. (Used in BH).
C29	B19/5CAAA03094	Ceramic: 10 pF ±0.5 pF, 500 VDCW, temp coef (Used in AH).
C29	B19/5CAAA03102	Ceramic: 7 pF ±0.5 pF, 50 VDCW, temp coef 0±60 PPM. (Used in BH).
C30	B19/5CEAA01816	Electrolytic: 47 uF ±10%, 25 VDCW.
C31	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C32	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C33	B19/5CAAA03090	Ceramic: 68 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AL and AH).
C33	B19/5CAAA03095	Ceramic: 56 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C34	B19/5CAAA03091	Ceramic: 100 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AL and AH).
C34	B19/5CAAA03096	Ceramic: 82 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C35 and C36	B19/5CAAA03092	Ceramic: 270 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AL and AH).
C35	B19/5CAAA03098	Ceramic: 180 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C36	B19/5CAAA03097	Ceramic: 220 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C37	B19/5CAAA03080	Ceramic: 47 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C38	B19/5CMAB01433	Mica 180 pF ±5%, 500 VDCW (Used in AL and AH).
C38	B19/5CAAA01471	Ceramic: 150 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C40	B19/5CMAB01433	Mica 180 pF ±5%, 500 VDCW (Used in AL and AH).
C40	B19/5CMAB01471	Mica: 150 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C41	B19/5CAAA03088	Ceramic: 24 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AL and AH).
C41	B19/5CAAA03100	Ceramic: 39 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C42	B19/5CAAA03081	Ceramic: 30 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C43	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C44	B19/5CAAA03093	Ceramic: 20 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AL and AH).
C44	B19/5CAAA03094	Ceramic: 10 pF ±0.5 pF, 500 VDCW, temp coef 0±60 PPM. (Used in BL and BH).
C45	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, temp coef 0±60 PPM.
C46	B19/5CAAA03094	Ceramic: 10 pF ±5%, 500 VDCW, temp coef 0±60 PPM. (Used in AH).
C46	B19/5CAAA03103	Ceramic: 8 pF ±0.5 pF, 500 VDCW, temp coef 0±60 PPM. (Used in BH).
C47	B19/5CEAA00451	Electrolytic: 22 uF ±10%, 40 VDCW.
C48	B19/5CAAA03082	Ceramic: 1000 pF ±10%, 500 VDCW.
C49	B19/5CAAA03083	Ceramic: 0.1 uF ±10%, 500 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C52	B19/5CSAC01180	Tantalum: 3.3 uF, 25 VDCW.
C53	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C54	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C55	B19/5CAAA03090	Ceramic: 68 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH).
C55	B19/5CAAA03095	Ceramic: 56 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C56	B19/5CAAA03091	Ceramic: 100 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH).
C56	B19/5CAAA03096	Ceramic: 82 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C57 and C58	B19/5CAAA03092	Ceramic: 270 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH).
C57	B19/5CAAA03097	Ceramic: 220 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C58	B19/5CAAA03098	Ceramic: 180 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C59	B19/5CAAA03080	Ceramic: 47 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C60 and C61	B19/5CMAB01433	Mica: 180 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH).
C60 and C61	B19/5CMAB01471	Mica: 150 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C63	B19/5CAAA03081	Ceramic: 30 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C64	B19/5CAAA03088	Ceramic: 24 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH).
C64	B19/5CAAA03100	Ceramic: 39 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C65	B19/5CAAA03093	Ceramic: 20 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH).
C65	B19/5CAAA03094	Ceramic: 10 pF ±0.5 pF, 500 VDCW, Temp coef 0±60 PPM. (Used in BH).
C66	B19/5CAAA03079	Ceramic: 27 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C67	B19/5CAAA03078	Ceramic: 120 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C72	B19/5CAAD00853	Ceramic: 3 pF ±0.5 pF, 500 VDCW, Temp coef 0±60 PPM. (Used in BL and BH).
C73	B19/5CAAD00838	Ceramic: 1000 pF ±5%, 500 VDCW, Temp coef 0±60 PPM. (Used in AH and BH).
C74	B19/5CAAA03085	Ceramic: 18 pF ±5%, 500 VDCW. (Used in AH).
C74	B19/5CAAA03101	Ceramic: 15 pF ±5%, 50 VDCW, Temp coef 0±60 PPM. (Used in BH).
C75	B19/5CAAD00952	Ceramic: 27 pF ±5%, 500 VDCW, Temp coef 0±30 PPM. (Used in AL and AH).
C75	B19/5CAAD00840	Ceramic: 22 pF ±5%, 500 VDCW, Temp coef 0±30 PPM. (Used in BL and BH).
C76 thru C78	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef 0±15%.
C79	B19/5CAAD00963	Ceramic: 18 pF ±5%, 500 VDCW, Temp coef 0±30 PPM. (Used in AL and BL).
C79	B19/5CAAD00952	Ceramic: 27 pF ±5%, 500 VDCW, Temp coef 0±30 PPM. (Used in AH).

SYMBOL	GE PART NO.	DESCRIPTION
C79	B19/5CAAD00840	Ceramic: 22 pF ±5%, 500 VDCW, Temp coef 0±30 PPM. (Used in BH).
C80	B19/5CAAA03084	Ceramic: 6 pF ±0.5 pF, 500 VDCW, Temp coef 0±60 PPM.
C81	B19/5CAAA03085	Ceramic: 18 pF ±5%, 500 VDCW, Temp coef 0±60 PPM.
C82	B19/5CAAA03086	Ceramic: 22 pF ±5%, 500 VDCW, Temp coef 0±60 PPM.
C83	B19/5CAAA03087	Ceramic: 5 pF ±0.25 pF, 500 VDCW, Temp coef 0±60 PPM.
C84	B19/5CAAA03081	Ceramic: 30 pF ±5%, 500 VDCW, Temp coef 0±60 PPM.
C85	B19/5CAAA03087	Ceramic: 5 pF ±0.25 pF, 500 VDCW, Temp coef 0±60 PPM.
C86	B19/5CAAA03088	Ceramic: 24 pF ±5%, 500 VDCW.
C87	B19/5CAAA03089	Ceramic: 12 pF ±5%, 500 VDCW.
C88 and C89	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef 0±15%.
C90 and C91	B19/5CAAD00964	Ceramic: 8 pF ±0.5 pF, 500 VDCW, Temp coef 0±30 PPM.
C92	B19/5CAAA03082	Ceramic: 1000 pf ±10%, 500 VDCW.
C93	B19/5CEAA02283	Ceramic: 33 uF ±10%, 25 VDCW.
C96 and C97	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef 0±15%.
C99	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef 0±15%.
		---------- DIODE ----------
CD1 and CD2	B19/5TXAA00313	Silicon: (Schottky Barrier): sim to NEC 1SS97 (2).
CD3 thru CD6	B19/5TXAR00004	Silicon, fast recovery, (RF switch): sim to Mitsubishi MI301.
CD7	B19/5TZAA00104	Ceramic Varistor: sim to SAKEN SNR-220KD10.
CD8	B19/5TXAM00019	Silicon, fwd current 3A, 200 PIV: sim to MOTOROLA MR751.
CD9	B19/5TXAN00068	Silicon: 2001A, sim to Sanken EMOIZW
		---------- JACKS ----------
J1	B19/6JALD00001	Connector.
J2	B19/5JWCL00045	Connector.
J3	B19/5JTCW00060	Connector.
J4	B19/5JWBS00176	Connector.
J5	B19/6JJLD12080	Connector.
		---------- HIC ----------
HC1	B19/5DDAB00270	(Used in AL and AH).
HC1	B19/5DDAB00269	(Used in BL and BH).
HCS1	B19/6ZYLD00002	THERMAL CONDUCTIVE SHEET
		---------- RELAYS ----------
K1	B19/5KLAD00657	Relay: DC9V. drive current 39 mA.
		---------- COIL ----------
L3	B19/6LALD00017	Coil RF (Used in AH).
L3	B19/6LALD00076	Coil RF (Used in BH).

SYMBOL	GE PART NO.	DESCRIPTION
L4	B19/6LALD00058	Coil RF (Used in AH and BH).
L5	B19/6LALD00059	Coil RF (Used in AH and BH).
L6	B19/6LALD00014	Coil RF (Used in AH).
L6	B19/6LALD00075	Coil RF (Used in BH).
L8 and L9	B19/6LAFD01197	Coil RF (Used in AH).
L8 and L9	B19/6LALD00057	Coil RF (Used in BH).
L10	B19/6LALD00017	Coil RF (Used in AL and AH).
L10	B19/6LALD00076	Coil RF (Used in BL and BH).
L11	B19/6LALD00058	Coil RF.
L12	B19/6LALD00059	Coil RF.
L13	B19/6LALD00014	Coil RF (Used in AL and AH).
L13	B19/6LALD00075	Coil RF (Used in BL and BH).
L15	B19/6LALD00017	Coil RF (Used in AH).
L15	B19/6LALD00076	Coil RF (Used in BH).
L16	B19/6LALD00058	Coil RF (Used in AH and BH).
L17	B19/6LALD00059	Coil RF (Used in AH and BH).
L19	B19/6LALD00014	Coil RF (Used in AH).
L19	B19/6LALD00075	Coil RF (Used in BH).
L20	B19/6LALD00064	Coil RF (Used in AL and BL).
L20 and L21	B19/6LAFD01197	Coil RF (Used in AH).
L20 and L21	B19/6LALD00057	Coil RF (Used in BH).
L22 and L23	B19/6LALD00056	Coil RF.
L24	B19/6LALD00060	Coil RF.
L25	B19/6LALD00061	Coil RF.
L26	B19/6LALD00062	Coil RF.
L27	B19/6LALD00078	Coil RF.
L29	B19/6LALD00077	Coil RF.
		---------- RESISTERS ----------
R1 and R2	B19/5RDAC02542	Metal film: 820 ohms ±5%, 100 VDCW, 1/10W.
R3	B19/5RDAC02465	Metal film: 22 ohms ±5%, 100 VDCW, 1/10W.
R4	B19/5RDAC02546	Metal film: 27 ohms ±5%, 100 VDCW, 1/10W.
R5	B19/5RDAC02443	Metal film: 390 ohms ±5%, 200 VDCW, 1/8W.
R6	B19/5REAG00008	Metal film: 1.5 ohms ±5%, 350 VDCW, 1W. (Used in AH and BH).
R7	B19/5REAG00014	Carbon film: 100 ohms ±5%, 350 VDCW, 2W. (Used in AH and BH).
R8	B19/5REAG00008	Metal film: 1.5 ohms ±5%, 350 VDCW, 1W.
R9	B19/5REAG00470	Carbon film: 100 ohms ±5%, 350 VDCW, 3W. (Used in AH and BH).

SYMBOL	GE PART NO.	DESCRIPTION
R10	B19/5REAG00008	Carbon film: 1.5 ohms ±5%, 350 VDCW, 1W. (Used in AH and BH).
R11	B19/5RDAC02226	Metal film: 82 ohms ±5%, 200 VDCW, 1/8W.
R12	B19/5RDAC02127	Metal film: 68 ohms ±5%, 200 VDCW, 1/8W.
R13	B19/5RDAA01175	Metal film: 100 ohms ±5%, 500 VDCW, 1/4W.
R14 and R15	B19/5RDAC02226	Metal film: 82 ohms ±5%, 200 VDCW, 1/8W.
R16 and R17	B19/5RDAC02138	Metal film: 100K ohms ±5%, 200 VDCW, 1/8W.
R18	B19/5RDAC02478	Carbon film: 4.7K ohms ±5%, 100 VDCW, 1/10W. (Used in AL).
R18	B19/5RBAC02458	Carbon film: 6.8K ohms ±5%, 100 VDCW, 1/10W. (Used in BL).
R18	B19/5RDAC02481	Carbon film: 15 ohms ±5%, 100 VDCW, 1/10W. (Used in AH and BH).
R19	B19/5RDAC02458	Carbon film: 6.8K ohms ±5%, 100 VDCW, 1/10W. (Used in AL, AH and BL).
R19	B19/5RDAC02452	Carbon film: 5.6K ohms ±5%, 200 VDCW, 1/10W. (Used in BH).
R21	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R22	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R23	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R24	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R25	B19/5RDAC02552	Carbon film: 560 ohms ±5%, 100 VDCW, 1/10W. (Used in AH and BH).
R26	B19/5RDAC02457	Metal film: 27K ohms ±5%, 100 VDCW, 1/10W. (Used in AH and BH).
R27	B19/5RXAE00028	(Used in AH and BH).
R28 thru R30	B19/5RDAC02142	Metal film: 820 ohms ±5%, 100 VDCW, 1/10W.
R31	B19/5RDAC02146	Metal film: 18 ohms ±5%, 100 VDCW, 1/8W.
R32	B19/5RDAC02142	Metal film: 820 ohms ±5%, 200 VDCW, 1/8W.
RV1	B19/5RVAB00279	Variable: 10K ohms ±30%, 0.1W.
RV2	B19/5RVAB00400	Variable: 5K ohms ±30%, 0.1W.
		---------- TRANSISTERS ----------
TR1	B19/5TCAF00510	Silicon, NPN: sim to TOSHIBA 2SC2782. (Used in AH and BH).
TR2	B19/5TCAF00510	Silicon, NPN: sim to TOSHIBA 2SC2782.
TR3	B19/5TCAF00510	Silicon, NPN: sim to TOSHIBA 2SC2782. (Used in AH and BH).
TR4	B19/5TBAR00001	Silicon, NPN: sim to MATSUSHITA 2SB953A.
TR5	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596-T1 DV3.
TR6	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596-T1 DV3. (Used in AH and BH).
TR7	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596-T1 DV3.

SYMBOL	GE PART NO.	DESCRIPTION
TR8	B19/5TDAR00012	Silicon, NPN: sim to MATSUSHITA 2SD1271-Q.
		---------- WIRES ----------
W1	B19/6JJLD13040	Coaxial cable: (Used in AH and BH).
W2	B19/6LALD00066	Jumper wire:
W3	B19/6LALD00065	Jumper wire:
W4	B19/6JJLD13055	Coaxial cable: (Used in AL and BL).

SYMBOL	GE PART NO.	DESCRIPTION

SYMBOL	GE PART NO.	DESCRIPTION
	B19/CMN-204	RECEIVER/EXCITER BOARD
		---------- CAPACITORS ----------
C101 thru C104	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C105	B19/5CAAD00953	Ceramic: 10 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C106 and C107	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±15%.
C108	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C109	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±15%.
C110	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, temp coef ±15%.
C111 thru C113	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C117	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C119	B19/5CEAA01816	Electrolytic: 47 uF, ±20%, 25 VDCW.
C120	B19/5CSAC00932	Tantalum: 10 uF, ±20%, 16 VDCW.
C121	B19/5CAAD00968	Ceramic: 12 pF, ±5%, 50 VDCW, temp coef 0±30 PPM.
C122	B19/5CAAD00953	Ceramic: 10 pF, ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C123	B19/5CAAD00968	Ceramic: 12 pF, ±5%, 50 VDCW, temp coef 0±30 PPM.
C124	B19/5CAAD00838	Ceramic: 1000 pF, ±10%, 50 VDCW, temp coef ±15%.
C128 and C129	B19/5CAAD00838	Ceramic: 1000 pF, ±10%, 50 VDCW, temp coef ±15%.
C401 and C402	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C403	B19/5CAAD00954	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C404 and C405	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C408 and C409	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C410	B19/5CAAD00954	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C411 thru C414	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C415	B19/5CAAD00954	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C416 and C417	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C418 and C419	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C420	B19/5CAAD00961	Ceramic: 4 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C501	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C502	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±15%.
C503	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C504	B19/5CAAD01054	Ceramic: 1.5 pF ±0.25 pF, 50 VDCW, Temp coef 0±30 PPM.
C505	B19/5CAAD00964	Ceramic: 8 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C506	B19/5CAAD00968	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C507	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C508	B19/5CAAD00951	Ceramic: 7 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C509	B19/5CAAD00962	Ceramic: 6 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C510	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C511	B19/5CAAD00948	Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C512	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C513	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C514	B19/5CAAD00852	Ceramic: 1 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C515	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C516	B19/5CAAD00948	Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C517	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C518	B19/5CZAY00005	Electrolytic: 0.22 uF, ±10%, 16 VDCW.
C519 and C520	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C521 and C522	B19/5CZAY00005	Electrolytic: 0.22 uF, ±10%, 16 VDCW.
C523	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C524 and C525	B19/5CZAY00004	Electrolytic: 0.1 uF, ±10%, 16 VDCW.
C526	B19/5CAAD00854	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C527	B19/5CSAC00932	Tantalum: 10 uF ±20%, 16 VDCW.
C528	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C529	B19/5CEAA02283	Electrolytic: 33 uF ±20%, 25 VDCW.
C530	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C532 thru C536	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C537	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
		---------- DIODES ----------
CD101	B19/5TXAD00291	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.

SYMBOL	GE PART NO.	DESCRIPTION
CD501	B19/5TXAD00291	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.
		---------- HYBRID CIRCUITS ----------
HC401	B19/5NZBH00002	Double Balanced Mixer.
		-------- INTEGRATED CIRCUITS --------
IC101	B19/5DAAR00021	Linear, Positive Voltage Regulator: sim to MATSUSHITA AN6541.
IC501	B19/5DDAS0074	Linear, IF Amplifier & Detector: sim to MOTOROLA MC3359P.
IC502	B19/5DAAR00021	Linear, Positive Voltage Regulator: sim to MATSUSHITA AN6541.
		---------- CONNECTORS ----------
J101	B19/5JWBS00176	Connector, 4 pin FH3-4S-1.25DSA(G).
J102	B19/5JWCL00045	Connector, RF.
J501	B19/5JWBS00178	Connector, 10 pin FH3-10S-1.25DSA(G).
P401	B19/6JJLD12065	Connector, RF.
P402	B19/6JJLD12205	Connector, RF.
		---------- FILTER ----------
FL401 and FL402	B19/5NLAT00061	RF Filter (Used in CMN-204A).
FL401 and FL402	B19/5NBAG00022	RF Filter (Used in CMN-204B).
FL501	B19/5XHAA00780	Crystal F=82.2 MHz B.
FL502	B19/5XHAA00781	Crystal F=82.2 MHz A.
FL503	B19/5NRAA00094	Filter 455 kHz.
FL504	B19/5NRAA00041	Filter 455 kHz.
		---------- COILS ----------
L101	B19/6LALD00090	Coil, RF.
L102	B19/5LCAA00560	Coil, RF.
L103	B19/5LCAA00576	Coil, RF.
L104	B19/5LCAA00050	Coil, RF.
L105 and L106	B19/5LCAA00560	Coil, RF.
L107	B19/6LALD00038	Coil, RF.
L108	B19/6LALD00089	Coil, RF.
L401 thru L403	B19/6LHLD00003	Coil, RF.
L404	B19/6LAFD01187	Coil, RF.
L501	B19/5LAAL00003	Coil, RF.
L502	B19/5LCAA00557	Coil, RF, 1 uF ±10%.
L503 thru L506	B19/5LAAL00003	Coil, RF.
L507	B19/5LCAA00560	Coil, RF, 0.22 uF ±10%.
L508	B19/5LAAL00004	Coil, RF.
L509	B19/5LCAA00557	Coil, RF, 1 uF ±10%.

SYMBOL	GE PART NO.	DESCRIPTION
		---------- RESISTORS ----------
R101 and R102	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R103	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R104	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R105	B19/5RDAC02472	Metal film: 680 ohms ±5%, 100 VDCW, 1/10W.
R106	B19/5RDAC02624	Metal film: 39 ohms ±5%, 100 VDCW, 1/10W.
R107	B19/5RDAC02465	Metal film: 22 ohms ±5%, 100 VDCW, 1/10W.
R108	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R109	B19/5RDAC02470	Metal film: 330 ohms ±5%, 100 VDCW, 1/10W.
R114	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R115	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R116	B19/5RDAA01660	Carbon film: 4.7 ohms ±5%, 500 VDCW, 1/2W.
R117	B19/5RDAA01541	Carbon film: 470 ohms ±5%, 500 VDCW, 1/4W.
R118	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R401	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R402	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R403	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R404	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R405	B19/5RDAC02466	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
R406	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R407	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R408	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R409	B19/5RDAC02555	Metal film: 270 ohms ±5%, 100 VDCW, 1/10W.
R410	B19/5RDAC02464	Metal film: 15 ohms ±5%, 100 VDCW, 1/10W.
R411	B19/5RDAC02555	Metal film: 270 ohms ±5%, 100 VDCW, 1/10W.
R412	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R413	B19/5RDAC02450	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R414	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R415	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R416	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R417	B19/5RDAC02542	Metal film: 820 ohms ±5%, 100 VDCW, 1/10W.
R418	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R419	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R420	B19/5RDAC02545	Metal film: 18 ohms ±5%, 100 VDCW, 1/10W.
R421	B19/5RDAC02555	Metal film: 270 ohms ±5%, 100 VDCW, 1/10W.
R422	B19/5RDAC02578	Metal film: 180 ohms ±5%, 100 VDCW, 1/10W.
R423	B19/5RDAC02472	Metal film: 680 ohms ±5%, 100 VDCW, 1/10W.
R424	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R425	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R426	B19/5RDAC02542	Metal film: 820 ohms ±5%, 100 VDCW, 1/10W.
R427	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R428	B19/5RDAC02446	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
R429	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R430	B19/5RDAC02450	Metal film: 10 ohms ±5%, 100 VDCW, 1/10W.
R431	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R501	B19/5RDAC02468	Metal film: 150 ohms ±5%, 100 VDCW, 1/10W.
R502	B19/5RDAC02466	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
R503	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R504	B19/5RDAC02458	Metal film: 6.8K ohms ±5%, 100 VDCW, 1/10W.
R505	B19/5RDAC02455	Metal film: 150K ohms ±5%, 100 VDCW, 1/10W.
R506	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R507	B19/5RDAC02467	Metal film: 68 ohms ±5%, 100 VDCW, 1/10W.
R508 and R509	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R510	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R511	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R512	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R513	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R514	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R515	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R516	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R517	B19/5RDAC02466	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
R518	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R519	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R520	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R521	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R522	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R523	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R524	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R525	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R526	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R527	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R528 and R529	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R530	B19/5RDAC02475	Metal film: 1.8K ohms ±5%, 100 VDCW, 1/10W.
R531	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R532	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
		---------- TRANSISTER ----------
TR101	B19/5TCAB00287	Silicon, NPN: sim to NEC 2SC3357.
TR102	B19/5TBAB00082	Silicon, PNP: sim to NEC 2SB624.
TR103	B19/5TZAR00019	Silicon, NPN: sim to MOTOROLA MRF559.
TR401 thru TR403	B19/5TCAB00287	Silicon, NPN: sim to NEC 2SC3357.
TR501	B19/5TKAH00006	N-channel, Field Effect: sim to SONY 2SK125.
TR502	B19/5TCAB00239	Silicon, NPN: sim to NEC 2SC2223.
TR503 and TR504	B19/5TCAA00274	Silicon, NPN: sim to HITACHI 2SC2620.
TR505	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596.
TR506	B19/5TBAB00055	Silicon, PNP: sim to 2SB624.
		---------- CRYSTAL ----------
X501	B19/5XHAA00835	Crystal
XS501-1 and XS501-2	B19/5ZJDF00001	Crystal Socket: sim to HAKUTO 75315-001.

SYMBOL	GE PART NO.	DESCRIPTION
	B19/CMG-171A	136-153 MHz SYNTHESIZER BOARD
	B19/CMG-171B	150-174 MHz SYNTHESIZER BOARD
		---------- CAPACITORS ----------
C201	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW.
C202	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C203	B19/5CEAA02119	Electrolytic: 220 uF ±20%, 10 VDCW.
C205	B19/5CEAA02283	Electrolytic: 33 uF ±20%, 25 VDCW.
C206	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW.
C207	B19/5CRAH00066	Metallized Plastic: 1 uF ±10%, 200 VDCW.
C208	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW.
C209	B19/5CRAA00680	Polypropylene: 0.1 uF ±5%, 50 VDCW.
C210 thru C214	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C215	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW.
C216	B19/5CAAD00838	Ceramic: 1000 pF ±10%. 50 VDCW, temp coef ±15%.
C217	B19/5CAAD00968	Ceramic: 12 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C219	B19/5CAAD00958	Ceramic: 150 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C220	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C221	B19/5CAAD00854	Ceramic: 47 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C221	B19/5CAAD00955	Ceramic: 39 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C222	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C222	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C223	B19/5CAAD00962	Ceramic: 6 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C223	B19/5CAAD00964	Ceramic: 8 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C224	B19/5CAAD00852	Ceramic: 1 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C224	B19/5CAAD00949	Ceramic: 2 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C225	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C226	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C226	B19/5CAAD00962	Ceramic: 6 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C227	B19/5CAAD00961	Ceramic: 4 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C227	B19/5CAAD00949	Ceramic: 2 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C228	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C230	B19/5CZAJ00013	Ceramic: 18 pF ±5%, 50 VDCW, temp coef -750±120 PPM. (Used in CMG-171A).
C230	B19/5CAAD01424	Ceramic: 27 pF ±5%, 50 VDCW, temp coef -750±120 PPM. (Used in CMG-171B).

SYMBOL	GE PART NO.	DESCRIPTION
C231 and C232	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C233	B19/5CAAD00868	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C234	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C235	B19/5CAAD00961	Ceramic: 4 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C236 and C237	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C238	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C239	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C245	B19/5CAAD00963	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C245	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C246	B19/5CAAD00949	Ceramic: 2 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C246	B19/5CAAD00853	Ceramic: 3 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C248	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C249	B19/5CZAJ00014	Ceramic: 22 pF ±5%, 50 VDCW, temp coef -750±120 PPM. (Used in CMG-171A).
C249	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C250	B19/5CAAD00969	Ceramic: 56 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C250	B19/5CAAD00960	Ceramic: 82 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C251	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C252	B19/5CAAD00949	Ceramic: 2 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C253	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C254	B19/5CAAD00964	Ceramic: 8 pF ±0.5 pF, 50 VDCW, temp coef 0±30 PPM.
C255	B19/5CAAD00949	Ceramic: 2 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A)
C256 thru C260	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C262	B19/5CAAD01674	Ceramic: 33 pF ±5%, 50 VDCW, temp coef -750±120 PPM. (Used in CMG-171A).
C262	B19/5CAAD01425	Ceramic: 39 pF ±5%, 50 VDCW, temp coef -750±120 PPM. (Used in CMG-171B).
C263 and C264	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C265	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C266	B19/5CAAD00963	Ceramic: 18 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C267	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C268	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C269 and C270	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C271	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
C272 thru C274	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C279	B19/5CEAA01826	Electrolytic: 10 uF ±20%, 16 VDCW.
C280	B19/5CRAA00617	Polyester: 0.1 uF ±5%, 50 VDCW.
C281	B19/5CEAA02283	Electrolytic: 33 uF ±20%, 25 VDCW.
C282 and C283	B19/5CEAA01827	Electrolytic: 100 uF ±20%, 16 VDCW.
C284 thru C286	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C287	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW.
C288	B19/5CAAD00853	Ceramic: 3 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C289	B19/5CAAD00956	Ceramic: 5 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM.
C290	B19/5CAAD00961	Ceramic: 4 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C292	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%. (Used in CMG-171B).
C293	B19/5CAAD00840	Ceramic: 22 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C293	B19/5CAAD00952	Ceramic: 27 pF ±5%, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171B).
C294	B19/5CAAD00949	Ceramic: 2 pF ±0.25 pF, 50 VDCW, temp coef 0±30 PPM. (Used in CMG-171A).
C295	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C296	B19/5CAAD01051	Ceramic: 470 pF ±5%, 50 VDCW, temp coef +350-1000 PPM.
C297 thru C299	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C2104	B19/5CSAG00932	Tantalum: 10 uF ±10%, 16 VDCW.
C2110	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C2112	B19/5CEAA01827	Electrolytic: 100 uF ±20%, 16 VDCW.
C2113 thru C2116	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C2120	B19/5CRAA00419	Polyester: 0.47 uF ±5%, 50 VDCW.
C2122	B19/5CEAA01827	Electrolytic: 100 uF ±20%, 16 VDCW.
C2123 and C2124	B19/5CAAD00950	Ceramic: 15 pF ±5%, 50 VDCW, temp coef 0±30 PPM.
CV201 and CV202	B19/5CVAV00003	Variable; 9 pF max.
		---------- DIODES ----------
CD201	B19/5TXAE00587	Zener, 4.0 V: sim to HITACHI HZ4B3.
CD202 and CD203	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD204	B19/5TXAD00356	Silicon, Fast Recovery (2 diodes, with anode common): sim to TOSHIBA 1SS181.
CD205	B19/5TXAE00566	Zener, 3.0 V: sim to HITACHI HZ3B-2.
CD207 and CD208	B19/5TXAE00691	Silicon, Variable Capacitance Diode: sim to HITACHI 1SV126.
CD209 and CD210	B19/5TXAE00686	Silicon, Epitaxial Planar: sim to HITACHI HSR277.
CD211	B19/5TXAA00326	Silicon, Schottky Barrier: sim to NEC 1SS97.
CD212	B19/5TXAE00692	Silicon, Variable Capacitance Diode: sim to HITACHI 1SV126.
CD215	B19/5TXAE00692	Silicon, Variable Capacitance Diode: sim to HITACHI 1SV126.
CD216	B19/5TXAE00691	Silicon, Variable Capacitance Diode: sim to HITACHI 1SV126.
CD217 and CD218	B19/5TXAE00686	Silicon, Epitaxial Planar: sim to HITACHI HSR277.
CD219	B19/5TXAA00326	Silicon, Schottky Barrier: sim to NEC 1SS97.
CD220	B19/5TXAE00686	Silicon, Epitaxial Planar: sim to HITACHI HSR277. (Used in CMG-171B).
CD221	B19/5TXAE00686	Silicon, Epitaxial Planar: sim to HITACHI HSR277.
CD227 and CD228	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD229 and CD230	B19/5TXAD00290	Silicon, Fast Recovery (2 diodes in Cathode common): sim to TOSHIBA 1SS184.
		-------- INTEGRATED CIRCUITS --------
IC201	B19/5DAAJ00328	Synthesizer: CMOS Serial Input: sim to MOTOROLA MC145159P.
IC202	B19/5DAAJ00577	Prescaler: sim to MOTOROLA MC12017P.
IC203	B19/5DDAB00328	Linear, Dual Comparator: sim to MITSUBISHI M5233L.
IC204 and IC205	B19/5DAAJ00359	Digital, Bilateral Switch: sim to MOTOROLA MC14066BCP.
IC206	B19/5DAAR00021	Linear, Positive Voltage Regulator: sim to MATSUSHITA AN6541.
IC207	B19/5DAAA00284	RF wide-band amplifier: sim to NEC UPC1676G.
IC208	B19/5DAAA00183	RF wide-band amplifier: sim to NEC UPC1656C.
IC209	B19/5DDAB00164	Linear, Dual OP Amp: sim to MITSUBISHI M5223L.
		---------- JACKS ----------
J201 thru J204	B19/5ZJDF00001	Crystal socket: sim to HAKUTO 75315-001.
J205	B19/5JWBS00239	Connector, 14 pins.
J206	B19/5JWCL00045	Connector, RF.
J210	B19/5ZJDF00001	Crystal socket: sim to HAKUTO 75315-001.
		---------- COILS ----------
L201	B19/5LAAC00052	Coil RF.

SYMBOL	GE PART NO.	DESCRIPTION
L202	B19/5LCAC00895	Choke Coil: 0.33 uH ±10%.
L205 thru L207	B19/5LCAC00895	Choke Coil: 0.33 uH ±10%.
L208	B19/5LAAC00064	Coil RF. (Used in CMG-171A).
L208	B19/5LAAC00062	Coil RF. (Used in CMG-171B).
L209	B19/5LCAA00115	Choke Coil: 1 uH ±20%.
L210	B19/5LCAC00887	Choke Coil: 0.47 uH ±10%.
L211	B19/5LAAC00052	Coil RF.
L214	B19/5LCAC00895	Choke Coil: 0.33 uH ±10%.
L217	B19/5LCAC00895	Choke Coil: 0.33 uH ±10%.
L218 and L219	B19/5LCAC00496	Choke Coil: 0.68 uH ±20% (Used in CMG-171A).
L218 and L219	B19/5LCAA00940	Choke Coil: 0.68 uH ±10% (Used in CMG-171B).
L220	B19/5LAAC00063	Coil RF (Used in CMG-171A).
L220	B19/5LAAC00066	Coil RF (Used in CMG-171B).
L221 and L222	B19/5LCAA00115	Choke Coil: 1 uH ±20%.
L223	B19/5LAAC00051	Coil RF.
L224	B19/5LCAC00887	Choke Coil: 0.47 uH ±10% (Used in CMG-171B).
L225	B19/5LCAC00496	Choke Coil: 0.68 uH ±20% (Used in CMG-171A).
L225	B19/5LCAA00940	Choke Coil: 0.68 uH ±10% (Used in CMG-171B).
L227	B19/5LAAC00051	Coil RF.
		---------- RESISTORS ----------
R201	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R202	B19/5RDAC02465	Metal film: 22 ohms ±5%, 100 VDCW, 1/10W.
R204 thru R206	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R207	B19/5RDAA01480	Carbon film: 330 ohms ±5%, 300 VDCW, 1/4W.
R208	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R209	B19/5RDAC02490	Metal film: 470K ohms ±5%, 100 VDCW, 1/10W.
R210	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R211	B19/5RDAC02458	Metal film: 6.8K ohms ±5%, 100 VDCW, 1/10W.
R216	B19/5RDAC02455	Metal film: 150K ohms ±5%, 100 VDCW, 1/10W.
R217 and R218	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R219	B19/5RDAC02461	Metal film: 1M ohms ±5%, 100 VDCW, 1/10W.
R220	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R222	B19/5RDAC02453	Metal film: 220K ohms ±5%, 100 VDCW, 1/10W.
R223	B19/5RDAC02484	Metal film: 39K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171A).
R223	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R224	B19/5RDAC02477	Metal film: 3.9K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171A).
R224	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R225	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R226	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R227	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R228	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R229 and R230	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R231	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R232	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R233	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R234	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R235	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R236	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R238	B19/5RDAC02460	Metal film: 47 ohms ±5%, 100 VDCW, 1/10W.
R239	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R240	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R241	B19/5RDAC02468	Metal film: 150 ohms ±5%, 100 VDCW, 1/10W.
R242	B19/5RDAC02582	Metal film: 82 ohms ±5%, 100 VDCW, 1/10W.
R243	B19/5RDAC02578	Metal film: 180 ohms ±5%, 100 VDCW, 1/10W.
R244	B19/5RDAC02582	Metal film: 82 ohms ±5%, 100 VDCW, 1/10W.
R254	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R255	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R260	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R262	B19/5RDAC02467	Metal film: 68 ohms ±5%, 100 VDCW, 1/10W.
R263	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R264	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R265 and R266	B19/5RDAC02468	Metal film: 150 ohms ±5%, 100 VDCW, 1/10W.
R267	B19/5RDAC02466	Metal film: 33 ohms ±5%, 100 VDCW, 1/10W.
R268	B19/5RDAC02468	Metal film: 150 ohms ±5%, 100 VDCW, 1/10W.
R274	B19/5RDAC02472	Metal film: 680 ohms ±5%, 100 VDCW, 1/10W.
R275	B19/5RDAC02458	Metal film: 6.8K ohms ±5%, 100 VDCW, 1/10W.
R276	B19/5RDAC02476	Metal film: 2.7K ohms ±5%, 100 VDCW, 1/10W.
R277	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R278	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171A).
R278	B19/5RDAC02483	Metal film: 33K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R283	B19/5RDAC02470	Metal film: 330 ohms ±5%, 100 VDCW, 1/10W.
R285 and R286	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R288 and R289	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R292	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R294	B19/5RDAC02464	Metal film: 15 ohms ±5%, 100 VDCW, 1/10W.
R296	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171A).
R296	B19/5RDAC02480	Metal film: 12K ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R298	B19/5RDAC02460	Metal film: 47 ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171A).
R298	B19/5RDAC02465	Metal film: 22 ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R2101	B19/5RDAC02460	Metal film: 47 ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171A).
R2101	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W. (Used in CMG-171B).
R2111	B19/5RDAC02552	Metal film: 560 ohms ±5%, 100 VDCW, 1/10W.
R2112	B19/5RDAC02579	Metal film: 56 ohms ±5%, 100 VDCW, 1/10W.
R2113	B19/5RDAC02469	Metal film: 220 ohms ±5%, 100 VDCW, 1/10W.
R2114	B19/5RDAC02470	Metal film: 330 ohms ±5%, 100 VDCW, 1/10W.
R2115	B19/5RDAC02460	Metal film: 47 ohms ±5%, 100 VDCW, 1/10W.
R2116	B19/5RDAC02554	Metal film: 120 ohms ±5%, 100 VDCW, 1/10W.
R2122	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R2123	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R2124	B19/5RDAC02483	Metal film: 33K ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
RV201 and RV202	B19/5RVAB00399	Variable: 10K ohms ±30%, 0.1 W.
		---------- TRANSISTORS ----------
TR201	B19/5TBAB00055	Silicon, PNP: sim to NEC 2SB624 (BV3).
TR205	B19/5TBAB00055	Silicon, PNP: sim to NEC 2SB624 (BV3).
TR208 and TR209	B19/5TCAZ00011	Silicon, NPN: sim to SANYO 2SC3398.
TR210	B19/5TKAH00006	N-Channel, Field Effect. (Junction Single Gate): sim to SONY 2SK125.
TR211	B19/5TCAB00288	Silicon, NPN: sim to NEC 2SC3356.
TR212 and TR213	B19/5TCAZ00011	Silicon, NPN: sim to SANYO 2SC3398.
TR216 thru TR219	B19/5TCAZ00011	Silicon, NPN: sim to SANYO 2SC3398.
TR220	B19/5TKAH00006	N-Channel, Field Effect. (Junction Single Gate): sim to SONY 2SK125.
TR221	B19/5TCAB00288	Silicon, NPN: sim to NEC 2SC3356.
TR222	B19/5TCAZ00011	Silicon, NPN: sim to SANYO 2SC3398.
TR224	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR227 thru TR230	B19/5TCAZ00011	Silicon, NPN: sim to SANYO 2SC3398.
		---------- CRYSTALS ----------
XU201	B19/6XNLD00005	Reference Oscillator unit. (standard 5 ppm).
XU201	B19/6XNLD00008	Reference Oscillator unit. (option 2 ppm).

SYMBOL	GE PART NO.	DESCRIPTION
	B19/CMC-486B	SYSTEM CONTROL BOARD
		---------- CAPACITORS ----------
C601	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C602	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, temp coef ±15%.
C603	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C604	B19/5CAAD01237	Ceramic: 0.1 uF ±10%, 25 VDCW, temp coef ±15%.
C605	B19/5CRAA00617	Polyester: 0.1 uF ±5%, 50 VDCW.
C606 and C607	B19/5CEAA01827	Electrolytic: 100 uF ±20%, 16 VDCW.
C608	B19/5CEAA01982	Electrolytic: 47 uF ±20%, 16 VDCW.
C609 and C610	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C611 and C612	B19/5CEAA01827	Electrolytic: 100 uF ±20%, 16 VDCW.
C613 and C614	B19/5CRAA00617	Polyester: 0.1 uF ±5%, 50 VDCW.
C615	B19/5CZAY00002	Electrolytic: 0.47 uF ±10%, 16 VDCW.
C616	B19/5CAAD01051	Ceramic: 470 pF ±5%, 50 VDCW, temp coef ±30%.
C617	B19/5CRAA00881	Polyester: 0.068 uF ±5%, 50 VDCW.
C618	B19/5CSAC00982	Tantalum: 1 uF ±10%, 35 VDCW.
C619	B19/5CSAC00939	Tantalum: 22 uF ±20%, 16 VDCW.
C620 and C621	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C622	B19/5CSAC00912	Tantalum: 10 uF ±20%, 35 VDCW.
C623	B19/5CEAA02695	Electrolytic: 22 uF ±20%, 16 VDCW.
C624	B19/5CSAC00939	Tantalum: 22 uF ±20%, 16 VDCW.
C625	B19/5CEAA01816	Electrolytic: 47 uF ±20%, 25 VDCW.
C626 and C627	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C628	B19/5CEAA01816	Electrolytic: 47 uF ±20%, 25 VDCW.
C629	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C630	B19/5CEAA01816	Electrolytic: 47 uF ±20%, 25 VDCW.
C631	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C632	B19/5CSAC00939	Tantalum: 22 uF ±20%, 16 VDCW.
C633	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C635 and C636	B19/5CEAA01982	Electrolytic: 47 uF ±20%, 16 VDCW.
C637	B19/5CRAA00617	Polyester: 0.1 uF ±5%, 50 VDCW.
C638	B19/5CSAC00912	Tantalum: 10 uF ±20%, 35 VDCW.
C639	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C640	B19/5CRAA00585	Polyester: 1000 pF ±5%, 50 VDCW.
C641	B19/5CSAC00939	Tantalum: 22 uF ±20%, 16 VDCW.
C642	B19/5CRAA00585	Polyester: 1000 uF ±5%, 50 VDCW.
C643	B19/5CSAC01069	Tantalum: 2.2 uF ±20%, 35 VDCW.
C644	B19/5CRAA00881	Polyester: 0.068 uF ±5%, 50 VDCW.
C701	B19/5CSAC00982	Tantalum: 1 uF ±20%, 35 VDCW.
C702 and C703	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C704	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C705	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C706	B19/5CRAA00881	Polyester: 0.068 uF ±5%, 50 VDCW.
C707	B19/5CAAD00957	Ceramic: 4700 pF ±10%, 50 VDCW, temp coef ±15%.
C708	B19/5CRAA00881	Polyester: 0.068 uF ±5%, 50 VDCW.
C709 thru C712	B19/5CAAD00854	Ceramic: 47 pF ±10%, 50 VDCW, temp coef ±15%.
C713	B19/5CAAD00953	Ceramic: 10 pF ±10%, 50 VDCW, temp coef ±15%.
C714	B19/5CAAD00950	Ceramic: 15 pF ±10%, 50 VDCW, temp coef ±15%.
C715	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C716	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C717	B19/5CAAD00959	Ceramic: 0.01 uF ±10%, 50 VDCW, temp coef ±15%.
C718	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
C719	B19/5CAAD01131	Ceramic: 0.047 uF ±10%, 25 VDCW, temp coef ±15%.
C720	B19/5CSAC00982	Tantalum: 1 uF ±10%, 35 VDCW.
C721	B19/5CZAY00002	Electrolytic: 0.47 uF ±10%, 16 VDCW.
C722 thru C729	B19/5CAAD00854	Ceramic: 47 pF ±10%, 50 VDCW, temp coef ±15%.
C730 thru C741	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, temp coef ±15%.
C742	B19/5CAAD01586	Ceramic: 0.1 uF +80%, 25 VDCW.
		---------- DIODES ----------
CD601	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD602 and CD603	B19/5TXAD00290	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.
CD604	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD605	B19/5TXAD00290	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.
CD606 and CD607	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD608	B19/5TXAD00290	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.
CD701	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD702	B19/5TXAE00688	Zener, 500 mW, 6.5 V: sim to Hitachi HZ7A2.

SYMBOL	GE PART NO.	DESCRIPTION
CD703	B19/5TXAE00689	Zener, 500 mW, 3.8 V: sim to Hitachi HZ4A1.
CD704 and CD705	B19/5TXAD00290	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.
CD706 and CD707	B19/5TXAD00320	Silicon, Fast Recovery (2 diodes in series): sim to TOSHIBA 1SS226.
CD708 thru CD710	B19/5TXAD00290	Silicon, Fast Recovery (2 diodes in cathode common): sim to TOSHIBA 1SS184.
CD711	B19/5TZAD00242	Diode, optoelectronic, red: sim to TOSHIBA TLR143.
		---------- HYBRID CIRCUIT ----------
HC601	B19/6DHFD00160	Squelch: sim to JRC DHFD160.
HC602	B19/6DHFD00167	Filter: sim to MURATA DHFD167.
HC603	B19/6DHFD00168	Filter: sim to MURATA DHFD168.
HC604	B19/6DHFD00169	Filter: sim to MURATA DHFD169.
HC605	B19/6DHFD00164	Filter: sim to MURATA DHFD164.
		-------- INTEGRATED CIRCUITS --------
IC601	B19/5DAAJ00359	Digital, Bilateral Switch: sim to MOTOROLA MC14066BP.
IC602	B19/5DAAA00233	Linear, Audio Amplifier: sim to NEC PC1230H2.
IC603 and IC604	B19/5DAAJ00615	Linear, Quad OP AMP: sim to MOTOROLA LM2902N.
IC605	B19/5DAAJ00305	Linear, Positive Voltage Regulator: sim to MOTOROLA MC7805CT.
IC606	B19/5DAAR00021	Linear, Positive Voltage Regulator: sim to MATSUSHITA AN6541.
IC607	B19/5DAAF00027	Linear, Dual OP AMP: sim to 4558 type.
IC608	B19/5DAAJ00359	Digital, Bilateral Switch: sim to MOTOROLA MC14066BP.
IC610	B19/5DAAJ00645	Linear, Dual Comparator: sim to MOTOROLA LM2903N.
IC611	B19/5DAAJ00578	Digital, Quad 2-Input NAND Gate: sim to MOTOROLA MC14011BCP.
IC701	B19/5DAAJ00646	Linear, Dual Timer: sim to MOTOROLA MC3456P.
IC702	B19/5DDAB0038	Microcomputer: M5L8049H1-059P
IC703	B19/5DAAJ00390	Digital, Hex 3-state Buffer: sim to MOTOROLA MC14503BCP.
IC704	B19/5DDAF00216	Digital, Hex Inverter Buffer/Driver: sim to HITACHI HD7416.
IC705	B19/5DDAS00142	Digital, Dual D Flip-Flop: sim to MOTOROLA MC14013BCP.
IC706	B19/5DDBY00026	Digital, EEPROM: sim to Xicor X2212AP.
ICS702	B19/5ZJAB00029	IC Sockets: 40 pin.
ICS706	B19/5ZJAB00030	IC Sockets: 18 pin.
		---------- JACKS ----------
J601 thru J607	B19/5JTCA00137	Contact: electrical.
J701	B19/5JWBS00239	Connector: 14 pins.
J702	B19/5JWBS00182	Connector: 24 pins.
J704	B19/5JWBS00239	Connector: 14 pins.
J705	B19/5JWBS00237	Connector: 7 pins.
J706 and J707	B19/5JWBS00137	Contact: electrical.
P601 thru P607	B19/5JDAN00012	Receptacle: 2 position.
P706 and P707	B19/5JDAN00012	Receptacle: 2 position.
		---------- RESISTORS ----------
R601	B19/5RDAC02458	Metal film: 6.8K ohms ±5%, 100 VDCW, 1/10W.
R602	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R603	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R604 thru R609	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R610	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R611	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R612	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R613	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R614	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R615	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R616	B19/5RDAC02453	Metal film: 220K ohms ±5%, 100 VDCW, 1/10W.
R617	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R618	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW, 1/10W.
R619	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R620	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R621	B19/5RDAC02461	Metal film: 1M ohms ±5%, 100 VDCW, 1/10W.
R622 and R623	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R624	B19/5RDAC02468	Metal film: 150 ohms ±5%, 100 VDCW, 1/10W.
R625 thru R628	B19/5RDAC02614	Metal film: 2.2 ohms ±5%, 100 VDCW, 1/10W.
R629	B19/5RDAC02581	Metal film: 0 ohms.
R631	B19/5RDAC02459	Metal film: 180K ohms ±5%, 100 VDCW, 1/10W.
R632	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R633	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R635	B19/5RDAC02459	Metal film: 180K ohms ±5%, 100 VDCW, 1/10W.
R636	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R637	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R638	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R639	B19/5RDAC02486	Metal film: 82K ohms ±5%, 100 VDCW, 1/10W.
R640	B19/5RDAC02453	Metal film: 220K ohms ±5%, 100 VDCW, 1/10W.
R641	B19/5RDAC02482	Metal film: 18K ohms ±5%, 100 VDCW, 1/10W.
R642	B19/5RDAC02460	Metal film: 47 ohms ±5%, 100 VDCW, 1/10W.
R643 and R644	B19/5RDAC02475	Metal film: 1.8K ohms ±5%, 100 VDCW, 1/10W.
R645	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R646	B19/5RDAC02457	Metal film: 27K ohms ±5%, 100 VDCW, 1/10W.
R647	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R648	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R649	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R650	B19/5RDAC02486	Metal film: 82K ohms ±5%, 100 VDCW, 1/10W.
R651 and R652	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R653	B19/5RDAC02590	Metal film: 12.4K ohms ±1%, 100 VDCW, 1/10W.
R654 and R655	B19/5RDAC02589	Metal film: 10K ohms ±1%, 100 VDCW, 1/10W.
R656	B19/5REAG02959	Metal film: 4.12K ohms ±1%, 100 VDCW, 1/10W.
R657	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R658 and R659	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R660 and R661	B19/5RDAC02472	Metal film: 680 ohms ±5%, 100 VDCW, 1/10W.
R662	B19/5RDAC02474	Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R663	B19/5RDAC02456	Metal film: 330K ohms ±5%, 100 VDCW, 1/10W.
R664	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R665	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R666	B19/5RDAC02473	Metal film: 1.2K ohms ±5%, 100 VDCW, 1/10W.
R667	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.

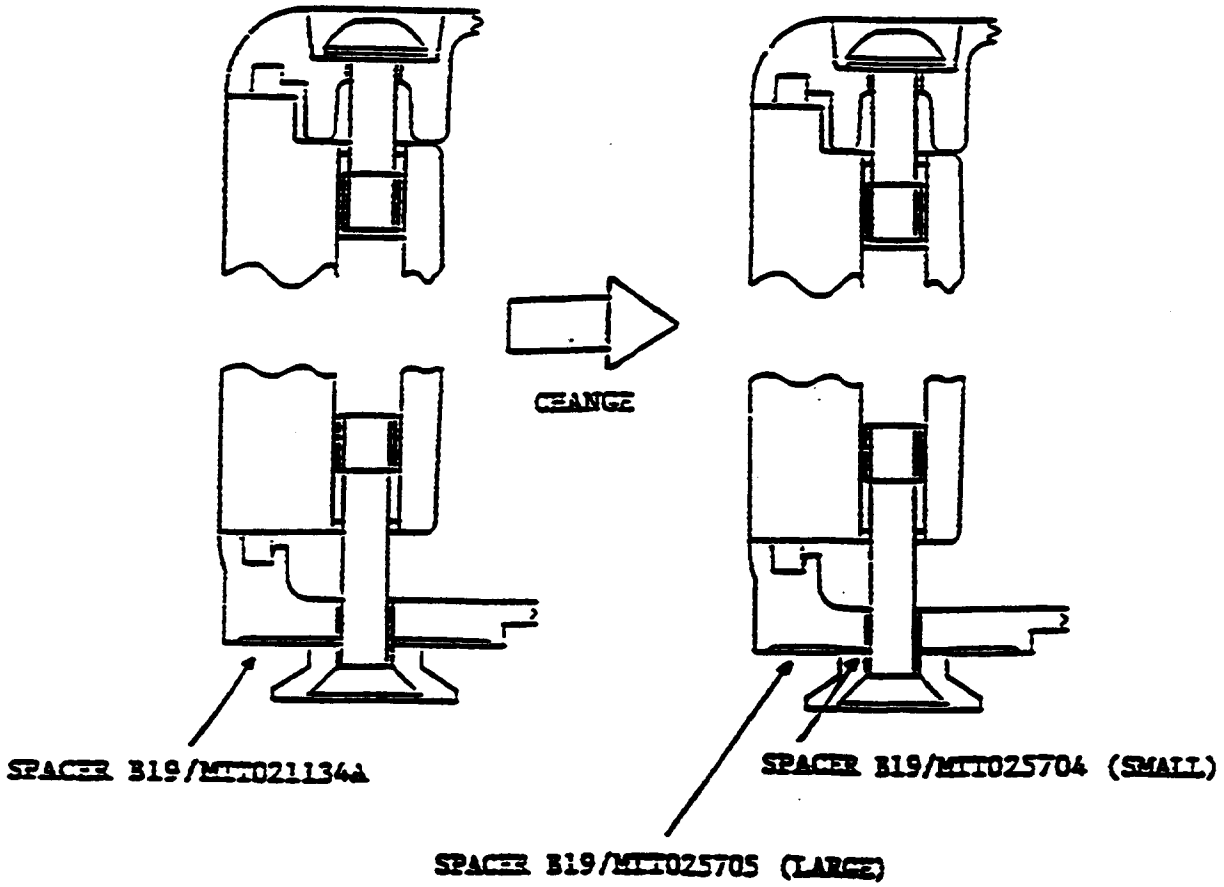
SYMBOL	GE PART NO.	DESCRIPTION
R668	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R669	B19/5RDAC02482	Metal film: 18K ohms ±5%, 100 VDCW, 1/10W.
R670	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R671	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R672	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R673	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R675 and R676	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R677	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R678 thru R686	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R687	B19/5RDAC02457	Metal film: 27K ohms ±5%, 100 VDCW, 1/10W.
R688	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R701	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R702	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R703	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R704	B19/5RDAC02452	Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R705	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R706	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R707	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R708	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R709	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW, 1/10W.
R710	B19/5RDAC02476	Metal film: 2.7K ohms ±5%, 100 VDCW, 1/10W.
R711	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R712 and R713	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R714	B19/5RDAC02486	Metal film: 82K ohms ±5%, 100 VDCW, 1/10W.
R715	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R716	B19/5RDAC02476	Metal film: 2.7K ohms ±5%, 100 VDCW, 1/10W.
R717	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R718	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R719	B19/5RDAC02473	Metal film: 1.2K ohms ±5%, 100 VDCW, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R720 and R721	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R722	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R723	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R724	B19/5RDAC02481	Metal film: 15K ohms ±5%, 100 VDCW, 1/10W.
R725	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R726	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R727	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R728 and R729	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R730	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW, 1/10W.
R731	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW, 1/10W.
R732	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R733 thru R741	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R742	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW, 1/10W.
R743	B19/5RDAC02449	Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R744	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R745	B19/5RDAC02453	Metal film: 220K ohms ±5%, 100 VDCW, 1/10W.
R746	B19/5RDAC02457	Metal film: 27K ohms ±5%, 100 VDCW, 1/10W.
R747 and R748	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R749	B19/5RDAC02457	Metal film: 27K ohms ±5%, 100 VDCW, 1/10W.
R750 and R751	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW, 1/10W.
R752	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW, 1/10W.
R753	B19/5RDAC02555	Metal film: 270 ohms ±5%, 100 VDCW, 1/10W.
RX701 thru RX703	B19/5RZAB00043	Resister array: 10K ohms.
RV601	B19/5RVAB00400	Variable: 5K ohms ±30%, 0.1W.
RV602	B19/5RVAB00401	Variable: 100K ohms ±30%, 0.1W.
RV603 thru RV605	B19/5RVAB00399	Variable: 10K ohms ±30%, 0.1W.
		---------- TRANSISTORS ----------
TR601 thru TR606	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR607	B19/5TBAB00055	Silicon, PNP: sim to NEC 2SB624 (BV3).
TR608 thru TR610	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR701 thru TR707	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
TR708	B19/5TBAB00055	Silicon, PNP: sim to NEC 2SB624 (BV3).
TR709 thru TR713	B19/5TDAB00054	Silicon, NPN: sim to NEC 2SD596 (DV3).
		---------- CRYSTALS ----------
X701	B19/5XHAA00778	Quartz crystal.
X701-A and X701-B	B19/5ZJDF00001	Crystal Socket.
	B19/CMH-813	INTERFACE BOARD
		---------- CAPACITORS ----------
C801 and C852	B19/5CAAD00838	Ceramic: 1000 pF ±10%, 50 VDCW, Temp coef ±15%.
C853	B19/5CEAA01813	Electrolytic: 100 uF ±20%, 50 VDCW.
		---------- JACKS ----------
J801	B19/5JCAP00006	Connector.
J802	B19/5JWBS00241	Connector.
J803	B19/5JWBS00242	Connector.
		INTERCONNECTION
		---------- CAPACITORS ----------
C901 and C902	B19/5CBAB00838	Ceramic: 1000 pF ±200%, 50 VDCW, Temp coef +20.
		---------- CABLES ----------
ZC601	B19/5ZZWF00001	Flexible cable.
ZC602	B19/5ZZWF00002	Flexible cable.
ZC603	B19/5ZZWF00001	Flexible cable.
ZC604	B19/5ZZWF00006	Flexible cable.
ZC605	B19/5ZZWF00004	Flexible cable.
ZC606	B19/6ZCLD00072	Power Cable include C901 and C902
ZC607	B19/6ZCFD00146	Power Cable
		---------- MISCELLANEOUS ----------
	B19/MPDM01167	Radio Key
	19A704978P1	Keylock Assembly
	19A705159P3	2 PPM Kit
	19B216021G3	Tx Fuse, 20 A-low power.
	19B216021G6	Tx Fuse, 30 A-high power.

END OF DOCUMENT

This addendum provides changes to the mounting hardware. To provide a smooth sliding fit into the mounting bracket without scratching the radio unit, the following changes were made:

Deleted B19/MTT021134A - Spacer.
Added B19/MTT025704 - Spacer (small).
B19/MTT025705 - Spacer (large).



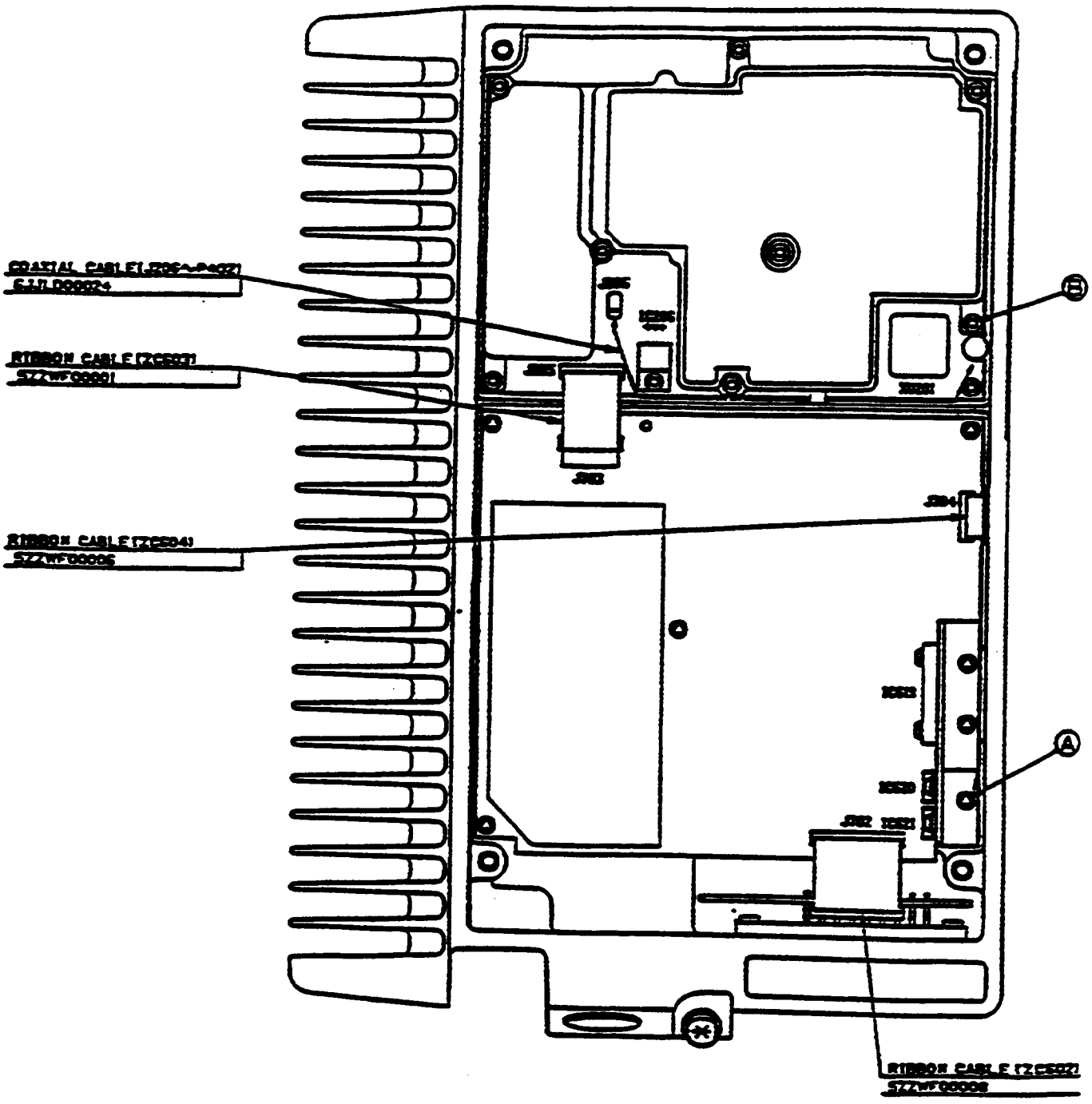
ADDENDUM NO 2 TC LBI-38180A
(PCN9)

This addendum provides corrections to the service accessories listed on page B2 of LBI-38180A.

DESCRIPTION	PART NO.
EXTENSION CABLE 4 CONDUCTOR	B19/CFQ-3175
EXTENSION CABLE 10 CONDUCTOR	B19/CFQ-3177
EXTENSION CABLE 14 CONDUCTOR	B19/CFQ-3178
EXTENSION CABLE 24 CONDUCTOR	B19/CFQ-3179
COAXIAL CABLE	B19/CFQ-3180
COAXIAL CABLE	B19/CFQ-3234

ADDENDUM NO. 3 TO LBI-38180A
(PCN9)

This addendum corrects Figure 1 Disassembly - Top View (page B4) to show the new cable part numbers. Figure 1 is shown below.



Disassembly—Top View

This addendum covers a part number change to the RANGR™ mobile radio TOP COVER ASSEMBLY.

Old part number was: B19/MPBC08460
New part number is: B19/MPBC10234

This part number should be changed on page B27 in the table listing for symbol 36.