MAINTENANCE MANUAL

800 MHz BOARD ASSEMBLIES

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GENERAL ELECTRIC

DESCRIPTION

The System Control board for RANGR 16 PLUS™ provides all functions for two-way communications.

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

The System Control board contains the audio circuitry, microcomputer, EEPROM, audio processor, and voltage regulators. The microcomputer controls all system functions, supplies frequency data to the frequency synthesizer, and provides all trunked functions. In conventional mode it provides Channel Guard, Scan, and PSLM functions.

All RF frequencies are generated by the frequency synthesizer.

The transmitter PA is mounted on a separte board located along the side of the radio near the heat sink assembly.

In addition to the normal radio functions, the microcomputer contains self-diagnostic maintenance routines to aid in troubleshooting the radio. Details and procedures are included in the Service Section of this manual.

Centralized test points for servicing are accessible from the top of the radio.

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, Public Service Trunked group and individual ID's, and conventional data.

NOTE

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

CIRCUIT ANALYSIS

SYSTEM CONTROL BOARD

DIGITAL CIRCUITRY

RESET CIRCUIT

A reset circuit is provided to reset the Microcomputer (IC601), Custom Audio Chip (IC617), Latch (IC608) and Custom Modem IC (IC607). The reset is provided by IC611. Resistors R605/R606 provide a 2.5-volt bias from the digital +5 volt supply, while R607/R608 provide a bias at 0.29 times battery voltage (SW A+). When SW A+ falls below approximately 9 V, pin 14 of IC611 goes low. This signal is coupled through diode CD601, causing pin 10 of IC611 to remain within 1 volt of ground (below pin 11) and thus causing pin 13 (reset) to be pulled high through R612. When SW A+ is transitioning quickly, the threshold detector may not provide the required pulse width for reset. Therefore, R611/C601 is provided to guarantee that the reset pulse will be of the correct duration. The output of the power-up reset circuit (IC611-13) is routed to the Modem IC (IC607-25) where it is gated with an internal watchdog timer (normally reset by the microcomputer). The reset output of the Modem IC (IC607-3) is used to reset the microcomputer and is inverted by NOR gate IC609. The inverted reset pulse (IC609-10) is used to reset the Latch and the Custom Audio Chip.

PERSONALITY EEPROM

All personality information is stored in Electrically Erasable PROMs (EEPROM) - IC602-1 and IC602-2. Clock and data lines are provided from the microcomputer to read and write from/to the device. The two EEPROMs use the same clock/data lines and are differentiated by the A1 address line (pin 2). The low 512 bytes of the personality are contained in IC602-1 and IC602-2 contains the high 512 bytes. The mobile requires that both EEPROMs remain in the correct sockets in order to function correctly. The data line (SDATA) used to transfer data to and from the EEPROMs is shared with the data line used to transfer data to the Custom Audio Chip.

SERIAL PORT

The heart of the RANGR 16 PLUS™ mobile radio system is its serial port. This three-wire port is used to transfer all data to/from any mobile option to the RANGR 16 PLUS™. All communication takes place on the SER TX DATA and SER RX DATA lines and is originated by the mobile. When control unit (i.e. Control Unit or Vehicular Repeater) have information to transfer to the mobile, they activate (ground) the SER REQ (Serial Request) line. This triggers the mobile to poll the control unit to get the information. Examples of the information transferred on the serial bus are: changes of PTT, Hookswitch/CG disable, CLR (Clear/Monitor). Special Call, System, Group, Scan, Add, Delete, or display information for control heads. Even the desired volume is determined in the control unit and sent serially to the mobile (the actual volume function is done in the mobile not the control unit). The data is transferred at 9600 baud with filters on the Mobile Radio Interface board to smooth the edges to avoid interference.

SYNTHESIZER INTERFACE

The synthesizer interface consists of the following lines: Channel Change (IC610-4), Clock (IC610-10), Data (IC610-8), Enable (TR608/IC608-12). Lock Detect (IC618), SEGW (IC610-6), SEGX (IC610-12), SEGY (TR609/IC608-15), SEGZ (IC610-2), and DPTT (TR606/IC601-5).

Frequency information for trunked and conventional frequencies is stored in the EEPROMs (IC602) and is transferred to the synthesizer via the microcomputer. There are 32 data pulses that are clocked into the Syn shift register. After the 32 bits are loaded, the LATCH ENABLE pulse transferrs the data to the Synthesizer counters. The Channel Change pulse is then activated to allow for bypassing the synthesizer low-pass filter increasing the loop bandwidth to achieve a four-millisecond channel acquisition time. The four lines (SEGW-SEGZ) are used to achieve rapid wideband VCO tuning, extending over 806-825 MHz and 851-870 MHz. Two frequency segments are used (one for 806-825, the other for 851-870). Capacitors are switched in and out of the VCO tank circuit to set the VCO tuning range. Information about the segments is stored in the EEPROMs and is written to the Latch (IC608) when the synthesizer is loaded. The data is summarized as follows:

FREQ SPLIT	SEGW	SEGX	SEGY	SEGZ
TX 806-825	< 1 V	> 6 V	< 1 V	> 6 V
TX 851-870	> 6 V	< 1 V	> 6 V	< 1 V

The Lock Detect line is passed through a monostable multivibrator (one-shot-IC618) to extend the lock pulse so that the microcomputer can correctly read it. The output of the one-shot drives the Out-of-Lock LED (CD610) and is fed to the Custom Audio Chip. The Custom Audio Chip compares the one-shot output voltage to its midrange voltage, and routes the result on the COMP line to the microcomputer (IC601-14). This is done by a one-of-four-input selectable comparator.

One side is selected input and the other side is a D/A converter whose level is set by the microcomputer.

The DPTT line is used to select the transmit or receive VCO. It is driven from the microcomputer (IC601-5). When pin 5 is high (approximately 3 volts), the receive VCO is selected and when low, the transmit VCO is selected.

TRANSMITTER ENABLE

Once the synthesizer is loaded for a transmit frequency, the transmitter PA is energized using the TXENB line (TR607/IC608-9). When TR607 is turned on (a logic 1 on IC608-9), power to the exciter is enabled and the transmitter PA is turned on (by a low level on the TXENB line).

CUSTOM MODEM CHIP

The Custom Modem Chip (IC607) (with watchdog timer circuitry) contains all circuitry necessary to transmit and receive 9600 baud data (used for 16 PLUS™ and Voice Guard ® systems). The chip contains an oscillator which runs at 11.0592 MHz. This is used as the base for generating/detecting 9600 baud data, as well as supplying the microcomputer (IC601) clock. The chip communicates with the microcomputer via the eight-bit address/data bus. As data is received from the 16 PLUS™ System, it is converted from a serial bit-stream to an eight-bit byte which is then read by the microcomputer. The microcomputer is "interrupted" via its INT1 line (IC601-13) going low when the Modem Chip is ready to transfer a byte. The interrupt line is brought high again when the microcomputer has read the available data. When transmitting data, the microcomputer transfers an eight-bit byte to the modem chip. The modem converts the data to a serial data stream (TX DATA) at IC607-21.

MICROCOMPUTER

The microcomputer (IC601) maintains total control of the RANGR 16 PLUS™. The microcode memory is provided by a 27256 EPROM (IC605-32K × 8) whose address is latched via IC604 and the ALE (Address Latch Enable) line from the microcomputer. A 2K × 8 RAM chip (IC606) is provided to allow for additional temporary storage of necessary information. Address decoder IC603 is used to select the RAM chip, Modem chip, or the output Latch, as well as to provide clock signals to the Custom Audio Chip and the Synthesizer.

The microcomputer controls all radio functions. It interfaces with the Custom Audio Chip to select all audio paths and programmable levels. All received data (9600 baud 16 PLUS™ data, Low Speed Data, Tone Channel Guard and Digital Channel Guard) is processed in the microcomputer.

The microcomputer also processes the Squelch, Synthesizer Lock, Ignition A+, and Vehicular Repeater TEST Mode Enable signals. The four signals are processed through the Custom Audio Chip (as COMP A to COMP D). Each is an analog signal in the range of 0 to 5 volts. They all enter the Audio Processor, where one of the four inputs is selected and routed to an on-board comparator. The other comparator input is the output of an on-board D/A converter. The microcomputer programs the level of the D/A converter corresponding to the signal being examined. The output of the comparator (COMP) is routed to the microcomputer (IC601-14) for processing. In the normal receive mode, the microcomputer alternates between checking the Synthesizer Lock and the Squelch level. In the normal transmit mode, the comparator monitors the Synthesizer Lock only. The other two lines are checked only as needed.

An AUX line (IC601-1) is provided for control of external options. Two Walsh bits (IC601-7, 8) are provided for all tone generation and low-speed data.

Walsh Bit 1 is used for generation of Digital Channel Guard while both Walsh bits are used for alert tones and tone Channel Guard.

ANALOG CIRCUITRY

CUSTOM AUDIO CHIP

The Custom Audio Chip is a custom chip designed to handle mobile audio and data requirements. The chip contains circuitry to perform the following functions: Input audio selection, Channel Guard reject, transmit audio limiter, programmable attenuation, post-limiter filter, voice reject filter, Channel Guard limiter, squelch filter (high-pass filter, rectifier), and six open-drain output transistors. The Custom Audio Chip employs switched-capacitor circuit technology. A crystal ocillator circuit (X602, C644, C645) is employed to generate all necessary frequencies for the chip. A 2.5 volt reference generated by R642, R643, and IC613 is used by all circuitry operating on the analog +5 volt supply (IC620). Prior to entering the Audio Processor, the 2.5 volt reference is filtered by R645 and C633.

TRANSMIT AUDIO

The normal transmit audio path is from MIC HI to TXMOD. Microphone bias is provided by R637, R638, C629. OP amp IC613 with R639/C630 provide audio pre-emphasis, and diode CD611 provides hard-limiting of the audio into the Audio Processor (within 1 volt or either side of the 2.5 volt reference). The MIC audio is brought into the Audio Processor (IC617-14) where frequencies below 300 Hz are filtered out (prior to adding Channel Guard). The audio is attenuated by R650/R705 and then limited by the Audio Processor. The on-board limiter is designed to limit the voice audio to one of two levels: voice plus Channel Guard or voice alone. The mobile automatically provides the correct level based on the presence of Channel Guard, so the MIC audio is set to the same level on all radios. Once limited, any subaudible data (tone or digital) from the Tone B (IC617-21) input is added to the MIC audio. The audio is then set via a programmable attenuator to the required level. Prior to leaving the Audio Processor, the audio is passed through a Post-Limiter Filter to remove audio above 3000 Hz at 18 dB/octave. Some additional rolloff is provided by R709/C696/TR611. When transmit audio is selected, SYN DATA (IC610-8) is held at logic 1 activating TR611. This adds the additional rolloff determined by R709/C696. When 16 PLUS data is transmitted, SYN DATA is held at logic 0, removing the effect of R709/C696. The audio is then passed through a Bessel Filter with 5 kHz cutoff in IC615. This filter has no effect on the audio but is used when transmitting the 16 PLUS data. The audio is then amplified by IC612 and routed to the modulator via J703-6.

In addition to microphone audio, the mobile radio is designed to transmit audio from a Vehicular Repeater. This audio is received from the Vehicular Repeater on the VG TX DATA HI line, and routed through IC614 (Analog Switch) and routed to the Audio Processor Receive Audio input (IC617-12). The audio is then routed through the same filters and gain stages as the audio from the microphone.

Sub-audible tones and data are generated by the microcomputer (IC601). The tones are generated by two Walsh bits. The two bits are combined in IC615 and the result is brought out on IC615-10. The alert tone is fed from IC615-10 directly to IC617-15 (TONE C). The subaudible data level is selected by potentiometer RV601 and divider R646/R647. The subaudible tone/data is brought into the Audio Processor on the Channel Guard input (IC617-5) and is filtered

to remove any harmonics of the base tone. The filtered tone is brought out on pin 6 and routed back to TONE B (IC617-21) where it is added to the MIC audio.

TRANSMIT DATA

Transmit data is normally generated by the microcomputer (IC601) and Modem Chip (IC607). The Modem TX DATA is routed via IC614 to IC615. An OP amp is used to set the data level using RV602. The level-adjusted data is then fed to the Audio Processor via TONE A (IC617-20). The data path can then be selected and the data routed to the TX AUD output (IC617-26) of the Audio Processor. The Audio Processor does not filter the data in this mode (except for some rounding of the level transitions due to the nature of the switched capacitor networks). The audio is routed to the data filter in IC615, where all final wave-shaping is done by the four-pole Bessel filter (5 kHz cutoff). This filtering makes maximum use of the allowed bandwidth. The data is then amplified by IC612 and passed to the modulator.

In addition to generating data signals, the mobile has been designed to accept externally generated data from a Vehicular Repeater or Voice Guard® , from its VG TX DATA HI line. The data is biased about 2.5 volts and is limited via IC611. It is then routed via IC614 to IC615 and is processed in the same way as internally generated data.

Internally generated data is also designed to be passed to external devices (e.g. Vehicular Repeater) via the VG RX DATA HI line. The Modem data is inverted by TR601 and routed via IC614 to VG RX DATA HI. The Audio Processor open-drain switch (SW4-pin 37) is used to disable inputs to TR601 and allow the VG RX DATA HI line to operate in a tri-state mode.

RECEIVE AUDIO

Receive audio from the AF OUT line is set by RV603 to 300 mVRMS at IC613-14 (Vol/SQ HI). The audio is then passed through IC613 (level-adjust OP amp) and IC614 (analog switch) to the Audio Processor REC AUD input (IC617-12). The audio is then passed through the Channel Guard Reject filter to remove subaudible data. It is then routed through the programmable attenuator to the RX AUD output (IC617-27). The volume level is set by the microcomputer, based on the level selected in the control unit. The audio is then routed to the de-emphasis circuit in hybrid IC616. The de-emphasized audio is then attenuated and routed to the audio Power Amp (IC619), which supplies 10 watts to the speaker from a differential output stage.

The level of the Vol/SQ HI signal is set by R700 and R701, and fed to the squelch circuit of the Audio Processor. The Audio Processor Squelch circuit consists of a 6500 Hz high-pass filter and rectifier. The filtered signal is integrated by R670, C647, and C648 to provide a DC level between 2.5 and 5 volts, proportional to the noise on the channel. Capacitor C647 is optionally selected via IC617-35 (SW2) to control fast or slow squelch. When SW2 is off, C648 controls the rate at which the mobile adapts to noise (fast squelch). When SW2 is on, both C647 and C648 control the rate at which the mobile adapts to noise (slow squelch). This voltage is then routed to IC617-56 where it is compared with the Audio Processor D/A converter output. The comparator output is then routed to the microcomputer (COMP-IC601-14).

The system control board is also designed to allow the received Vol/SQ HI to be routed from the mobile to optional control units (Desktop Station, Voice Guard® , and Vehicular Repeaters). The audio is routed to VG RX DATA HI via IC614. It provides the receive audio from the Desktop Station, repeat audio for the Vehicular Repeater, or receive data for

Voice Guard® . When a received Voice Guard® signal is detected, it is routed to the mobile via the VG AUDIO HI line and is coupled to the Audio Processor (IC617-13) via C643. It is then processed identically to the receive audio.

The RANGR 16 PLUS™ can also perform a Public Address function. When selected, the pre-emphasized MIC Hi input can be routed through the Audio Processor to the REC AUD output of the Audio Processor (IC617-27). It is then de-emphasized and routed to the Audio Power Amp (IC619). The mobile will direct the control unit to select the external speaker to complete the function.

RECEIVE DATA

Receive data is received on the Vol/SQ HI line from the receiver and passed to the limiter IC611, R663, R664, and C642. Resistor R664 and capacitor C642 establish the DC level to which the Vol/SQ HI signal is compared. The limited data is received from an open-collector output on IC611 (with pull-up R616) and can be disabled when TR602 is turned on by a logic 1 from the microcomputer (IC601-12) LIM DS line. Data is disabled to prevent the modem chip from losing data synchronization when the receiver is absent from the trunked data channel for short intervals. The data is then passed to the Modem IC RX DATA line (IC607-19).

In a Vehicular Repeater mode, receive data is detected in the manner described above. Once detected, it is regenerated via the Modem IC and sent to the Vehicular Repeater via TR601/IC614 to VG RX DATA HI.

POWER DISTRIBUTION

Battery supply A+ enters the radio through the front connector at J750-19. A- enters through J750-21. Figure 1 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 feed through arrangement. A second set of wires is routed through the control unit and supplies power to the audio amnplifier 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.

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 with 33 standard tones and 83 unique digital codes available. These tones/codes are identified in Tables 1 and 2.

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 1 - Channel Guard Tone Frquencies

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	266	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, 474 744
152	366, 415	412	127, 411, 711		
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 2 - Primary and Equivalent Digital Codes (Octal)

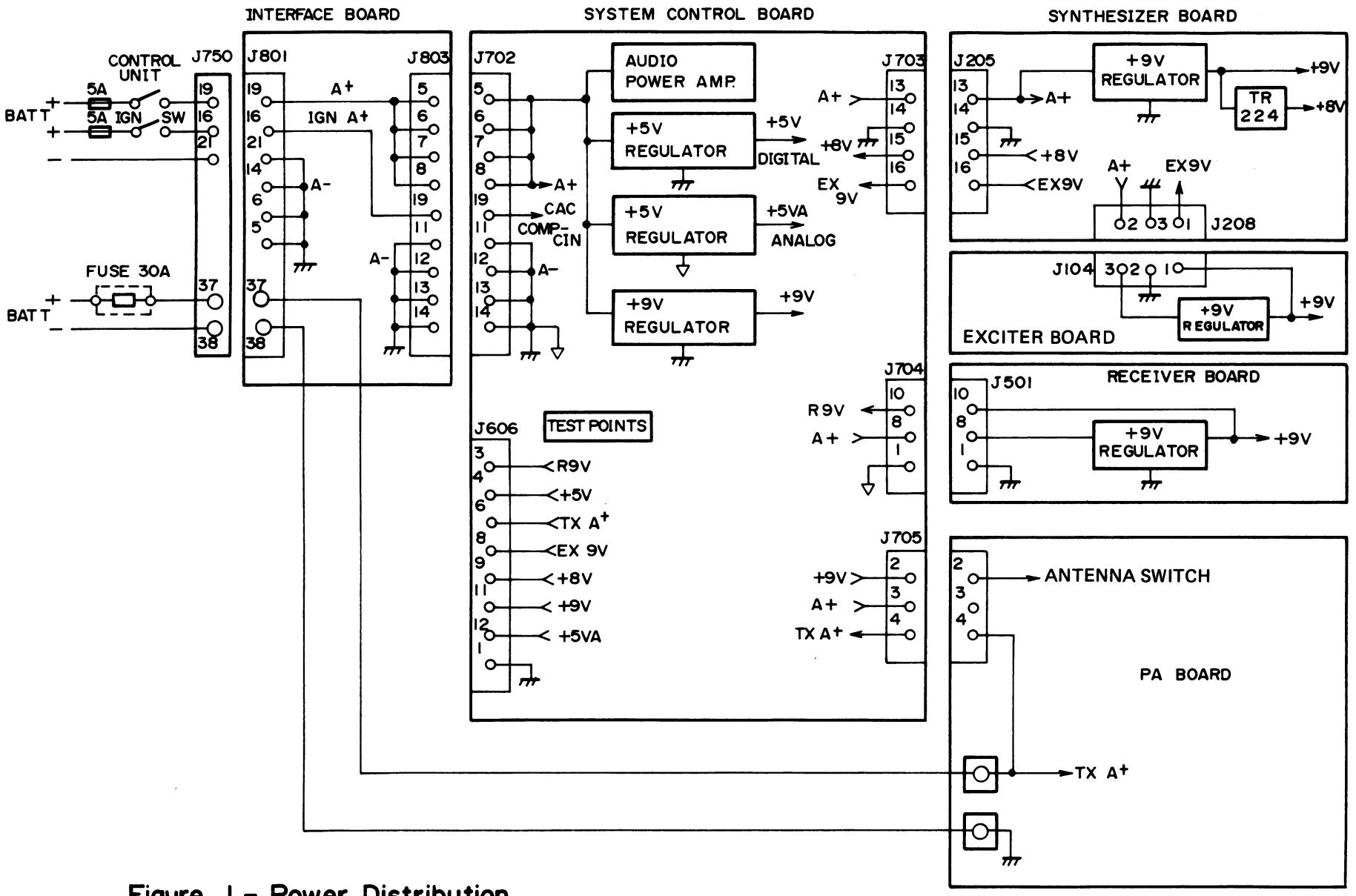

Figure 1 - Power Distribution

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 amplifiers, 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 VCO's operate over a frequency range of 128.13 MHz to 145 MHz.

REFERENCE OSCILLATOR

The reference oscillator consists of a 2 PPM VC-TCXO (Voltage-Controlled, Temperature-Compensated Crystal Oscillator). The standard reference oscillator frequency is 13.2 MHz.

The 2 PPM VC-TCXO receives transmit audio from REF MOD CONTROL RV201. RV201 provides the required audio level and phase to modulate the VC-TCXO. The VC-TCXO is enclosed in an RF shielded can. Access to the oscillator trimmer is made through a hole on the top of the can. The VC-TCXO is compensated by an internal temperature-compensator circuit for both low and high temperatures. With no additional compensation, the oscillators will provide 2 PPM stability from -30°C to +60°C.

CAUTION

VC-TCXOs are individually compensated at the factory and cannot be repaired in the field. Any attempt to repair or change the frequency of a VC-TCXO will void the warranty.

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 of obtain a 4.16 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.

DC OFFSET AND HIGH CURRENT BUFFERS

DC offset buffer TR201 and diode CD201 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 either TR202 or TR203 on. These two transistors control high-current buffers TR204 and TR205. TR204 and TR205 complete a high-current rapid-charge or -discharge path for C207-C209.

If the error voltage decreases, TR203 is turned off and TR205 is turned on, completing a discharge path for C207-C209 through bilateral switches IC204. At the same time TR202 is turned on and TR204 is turned off, blocking the charge path. The opposite conditions exist when the error voltage goes positive. IC204 is turned on for 4 milliseconds when a channel is changed in the receive mode. The time is 20 milliseconds when in transmit and when changing from transmit to receive mode.

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). Oscillator output is typically +10 dBm. The output is applied to the feedback buffers for VCO frequency control and as the Rx injection frequency to the receiver 1st mixer through multipliers TR214-215. The Rx VCO also uses a high-Q resonator coil to achieve superior noise performance. The VCO operates over a frequency range of 128.12-131.3 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 45 MHz as determind by the bandsplit the radio is operating on 806-825 MHz or 851-870 MHz. The varactors in conjunction with the frequency segment selector circuitry (TR216, TR217 and pin diode CD217) provide a voltage-controlled adjustment range that extends across the entire frequency split. Buffer TR221 provides a typical output of +10 dBm to the feedback buffers for VCO frequency control and as the Tx Injection frequency to the exciter.

VCO control switch TR222 turns the Transmit VCO on when DPTT is high.

FEEDBACK BUFFERS/MULTIPLIERS

The RX injection and Tx injection voltage output from the Rx VCO and Tx VCO are supplied to the receiver mixer and the exciter, respectively, and to the feedback buffers/multipliers. Buffering is provided by TR206 and TR207 and the output applied to dual modulus prescaler IC202.

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 128 or 129 under control of M CONT from the synthesizer. The output of the prescaler is applied to the synthesizer where it is divided down to 4.16 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 4.5 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 to near 7.5 VDC and cause the comparator output to decrease. This decrease in voltage turns TR209 off and allows TR208 to be turned on by the 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 IC618 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, R276, R278, R279, varactor CD212, C245 and bypass capacitors C247 and C248. The modulation level is controlled by turning bilateral switch IC205 on or off (under control of IC608). When segment two is selected, the high level on line W turns on bilateral switch IC205, providing a ground return for R276. Resistors R274 and R276 act as a voltage divider, reducing the level of the modulating signal to the TX VCO MOD line.

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. TR217, CD217 and operates under control of the microcomputer through IC610 and TR609. Capacitors C252 and C253 are selected or deselected for operation in a given segment. Table 3 identifies the circuit conditions existing for

SEGMENT	TRANSISTOR SWITCH*		PIN DIODE CD217	SHORTED CAPACITORS GROUNDED
	TR216	TR217		
1	0	1	ON	C251
2	1	0	OFF	NONE

* '1' indicates transistor is turned on.

Table 3 - Capacitor Selection

selection of each segment and the capacitors used.

Reverse bias to turn the PIN diode off is provided by the +8 V filtered supply through R232. Forward bias for the diode and power for the switching transistors are provided by the +8 V source through R231. When segment 1 is selected, transistor TR217 is turned on and TR216 is turned off. CD217 is forward biased causing it to turn on. This effectively places a short across C252 and AC grounds C251 in the Tx VCO.

When segment 2 is selected transistor TR216 is turned on the TR217 is turned off. CD217 is reverse biased causing it to turn off. L218 presents a high impedance to RF frequencies therefore the anode of CD217 is near DC ground and not at AC ground.

EXCITER BOARD

The exciter consists of two multiplier circuits (tripler and doubler) and three wide-band amplifier stages operating over a frequency range of 806-870 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 1 milliwatt.

The exciter amplifies the 1 milliwatt signal from the VCO to provide 400 milliwatts drive to the power amplifier.

The 806/6-870/6 MHz Tx injection input from the Tx VCO is applied to the transistor multiplier TR101 (tripler) through an attenuator pad from J101. R104 and R105 set the bias voltage for TR101. A collector voltage, +9 V, is applied through collector feed network R107, L102 and R108. C103 is a noise decoupling capacitor.

The output of TR101 consists of impedance-matching components C104 and L103, and is coupled to FL101 band-pass filter (pass band 806/2-870/2 MHz).

The output of FL101 is coupled to the transistor multiplier TR102 (doubler) through coupling capacitor C105. R109 and R110 set the bias voltage for TR102.

A collector voltage, +9 V, is applied through collector feed network R112, L105 and R113. C108 is a noise decoupling capacitor.

The output of TR102 is coupled to FL102 band-pass filter (pass band 806-870 MHz) through the coupling capacitor C109.

The output of FL102 is coupled to TR103 through the coupling capacitor C110. R114 and R115 set the bias voltage for TR103.

A collector voltage, +9 V, is applied through collector feed network R117, L108 and R118. C115 is a noise decoupling capacitor.

The output of TR103 is coupled to TR104 through the coupling capacitor C117. R119 and R120 set the bias voltage for TR104.

A +9 V collector voltage is applied through colletor feed network R122, L11 and R123. C120 and C121 are noise decoupling capacitors.

The output of TR104 is coupled to FL104 band-pass filter (pass band 806-870 MHz) through impedance matching components C124 and L112.

The output of FL104 is coupled to the input of attenuator pad (R127-R129) through coupling capacitor C125.

The output of the attenuator pad is coupled to HC101. HC101 amplifies 3 mW input level to 400 mW.

The 9 V power supply for HC101 is applied through R130 and R131. C127 through C130 are noise decoupling capacitors.

A+ supplied from the frequency synthesizer is stabilized to 9 V at IC101 (3-terminal regulator), and +9 V is applied to the Exciter circuit, through switch transistor TR105.

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

Service Note

The output RF level can be measured by connecting a 50-ohm dumy load to J102, feeding a 0 dBm signal to J101 (806/6 to 870/6 MHz) and grounding the $\overline{\text{TX ENB}}$ line.

The exciter is energized by pressing the PTT switch. A regulated 9 V is present on all exciter stages when the transmitter is turned on.

Typical emitter voltages of TR102-TR104 are as follows:

Emitter voltage of TR102: 1.1 V
Emitter voltage of TR103: 2.1 V
Emitter voltage of TR104: 2.1 V

PA BOARD

The PA assembly uses one power module and two RF power transistors to provide 35 watts of output power.

Supply voltage for the PA is obtained from power leads on the front connector to J5 (A+) on the PA board. C84, C85 and C86 prevent RF from getting on the power leads. Diode CD13 will cause the fuse to blow if the polarity of the power leads is reversed. CD12 performs as a surge protector to suppress pulses from the power leads.

TP1 and TP3 are the printed board terminals for control voltage and RF power detecting voltage measurement.

35 W PA BOARD

The exciter output is coupled through J102 on the exciter unit to PA input jack J1.

The RF input (0.4 W) at J1 is coupled to the power module through an attenuator pad (R1 - R3). The power module amplifies this level from 0.4 W to 15 W.

The power module consists of a three-stage RF amplifier. The voltage at the first stage is supplied by the power control circuit.

The RF amplifier consists of two Class C, common base amplifiers.

The 15 watt output is coupled through 50 ohm stripline Z4 to a Wilkinson power splitter consisting of 70 ohm microstrip Z5 and Z6.

The power amplifier stages consist of two identical paralleled Class C power amplifiers (TR1 and TR2).

C28 provides matching between microstrip Z4 and the input of power splitter. C20 and C30 provide DC blocking to TR1 and TR2.

Microstrip Z7 and Z9 (quarter wave transmission line), C21, C22, C31 and C32 make up the broadband impedance-matching circuit in the input of TR1 and TR2. Microstrip Z8 and Z10 serve as RF chokes in the emitters of TR1 and TR2. The ferrite beads (L11 and L21) improve the stability of TR1 and TR2. Supply voltage (A+) for TR1 and TR2 is coupled through collector-feed networks L13, C26, L12, L23, C36 and L22.

The output of TR1 and TR2 are coupled through the broadband impedance-matching circuits consisting of microstrip Z11 and Z12 (quarter wave transmission lines), C24, C25, C34 and C35 to a Wilkinson Power Combiner which consists of microstrip Z13, Z14 and R21. C38 provides matching between the output of the combiner and 50-ohm microstrip Z15. The antenna switch consists of CD3, CD4, CD6, CD7, CD8, CD9, quarter wave 50-ohm microstrip Z17 and Z18 and associated components. The low-pass filter consists of C48 through C54 and microstrip Z19. The filter output is coupled through J3 to the antenna.

The antenna switch, in the TX mode, is supplied power through Z16, C80 and R47.

R66 and R68 set the bias on the emitter of TR7.

When TX ENABLE is low, TR8 is turned on by base current flowing via R80 and CD11. Emitter current flows from TX A+ via R82.

In the RX mode, the RX signal enters from the antenna and is coupled to C47 through the low-pass filter. CD3 and CD4 are open, and RX signal is coupled to J2 through Z17, Z18 and C93.

10 W PA BOARD

The 10 W PA circuit is the same as the 35 W unit, except the 50 ohm output of HC1 is fed directly to the directional coupler, and TR1 and TR2 are not used.

POWER CONTROL CIRCUIT

The power control circuit provides closed-loop RF power leveling and power turndown when it senses high VSWR load conditions.

When the transmitter is keyed, TR8 turns on and supplies current to zener diode CD10, which provides a constant control reference voltage.

TR4, TR5 and TR7 serve as DC amplifiers to supply voltage to the 1st RF driver in the power module HC1. The setting of RV1 determines the current supplied to the base of TR7. As the detected RF power increases, the current to the base of TR7 increases, causing TR7 to pull current away from the base of TR5. This cuts back the drive to TR5 and in turn TR4, which reduces the voltage at the 1st driver in the power module HC1, decreasing RF output power.

RF power is sensed by directional coupler Z15, Z20, Z21 and its associated elements. Forward power is sensed by CD2 and reflected power by CD1. Forward power is determined by the setting of RV1. R42 and R45 set the level of reflected RF power at which the control circuit reduces the RF output.

Thermal protection is provided by R63 (posistor) and its associated elements. R63 is thermally connected to the body of TR2. As the temperature of TR2 rises above 90°C, the resistance of R63 increases, and TR6 turns on. This lowers the emitter voltage of TR7.

The current increases in TR7 which lowers the voltage at the 1st driver in the power module HC1, reducing the RF power output.

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.

RECEIVER BOARD

The FM dual-conversion, super-heterodyne receiver is designed for operation in the 851-870 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 freqeuencies 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 Detector
- Audio PA
- Squelch

RECEIVER FRONT END

An RF signal from the antenna is coupled through the low-pass filter, antenna switch, and dielectric band-pass filter (FL401) to the input of RF amplifier HC401. The output of HC401 is coupled through a dielectric band-pass filter (FL402) to the input of 1st mixer HC402. Front-end selectivity is provided by these dielectric band-pass filters.

RECEIVER INJECTION

Receiver RF injection (384.40 to 393.9 MHz) from the synthesizer VCO is applied to doubler HC403 through J402. The input level at J402 will be between 0.5 and 1.0 milliwatts. Doubler HC403 multiplies the Rx injetion frequency by 2 to provide a mixer injection frequency 82.2 MHz below the received RF frequency to the first mixer HC402. The output of doubler HC403 is coupled to the input of amplifier HC404. The output of amplifier HC404 is filtered by a dielectric filter (FL403). This filter is tuned to pass frequencies in the 768.8-787.8 MHz passband.

1st MIXER

The 1st mixer uses a transistor (HC402) as the active device. This transistor mixer provides high power gain and an output relatively free of intermodulation products.

In the mixer stage, RF from the front-end dielectric filter is applied to the input of the mixer. Injection voltage from the multiplier stages is applied to the input of the mixer. The 82.2 MHz mixer 1st IF output signal is coupled from the output of HC402 through an impedance-matching network (L501 and C503) to a 4-pole crystal filter consisting of FL501-1 and FL501-2.

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 impedance-matching network L503, C505 and C506 to the 1st IF amplifier TR501.

The output of crystal filter FL501 is applied to the base of the 1st IF amplifier TR501, and the amplified signal is taken from the collector. The amplifier provides approximately 20 dB of IF gain. The output is coupled through an impedance-matching network, L504, C512 and R513 that matches the amplifier output to the input of FL502. The output of the filter is coupled through the impedance-matching network L505, C513 and R514 to the 2nd mixer HC501.

2nd MIXER

HC501 and associated circuitry comprise the 2nd oscillator and 2nd mixer.

The 82.2 MHz IF input is applied to pin 7 and mixed with an 82.655 MHz frequency supplied by crystal oscilator 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 TR502. The transistor provides limiting for the 455 kHz IF signal (1.4 Vp-p) to prevent high level overloading of IC501.

IC501 and associated circuitry comprise 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 reapplied to IC501-5. The 2nd IF signal is amplified and limited. L508 shifts the IF signal by 90° and reapplies 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, via the level control RV501.

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

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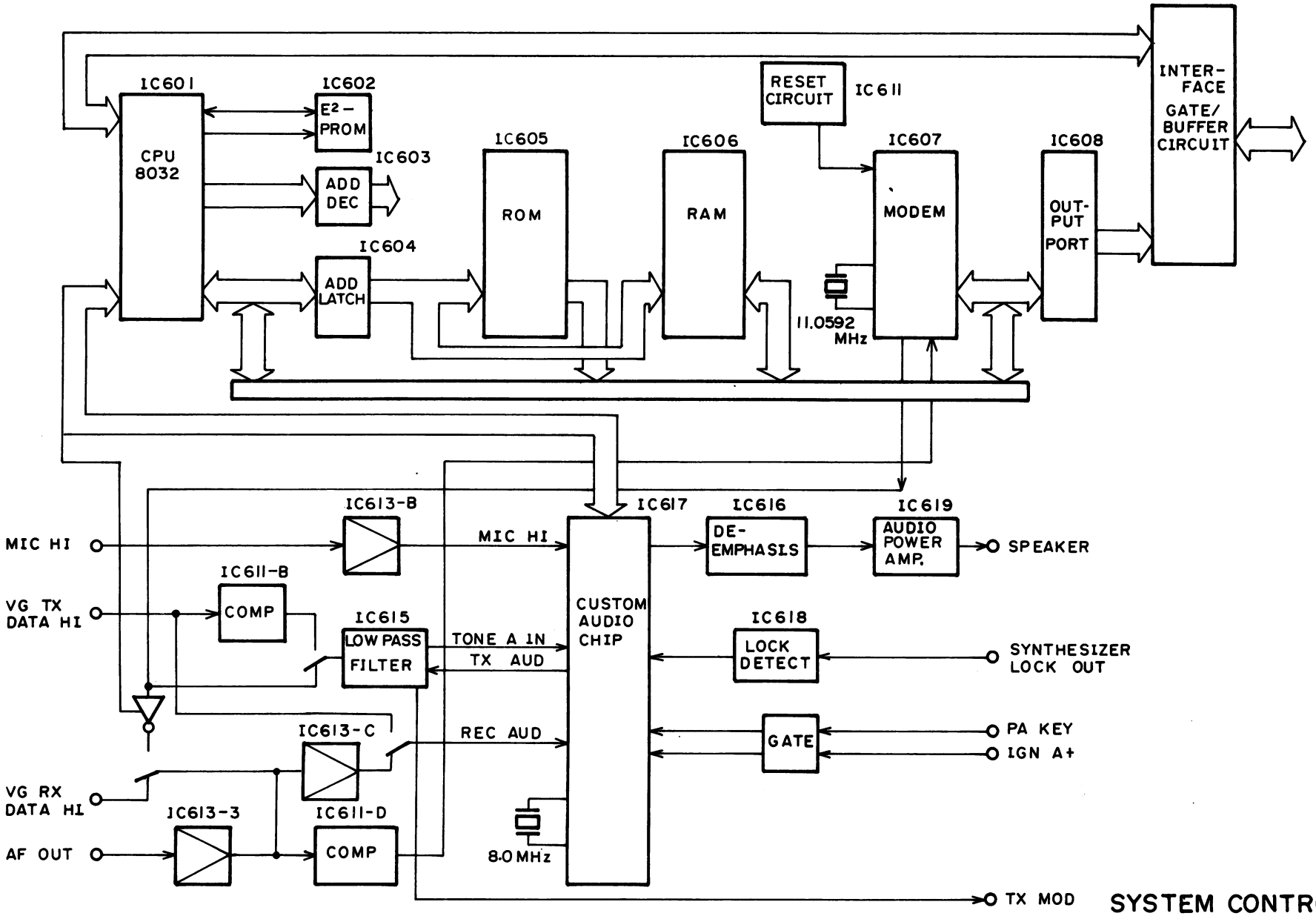
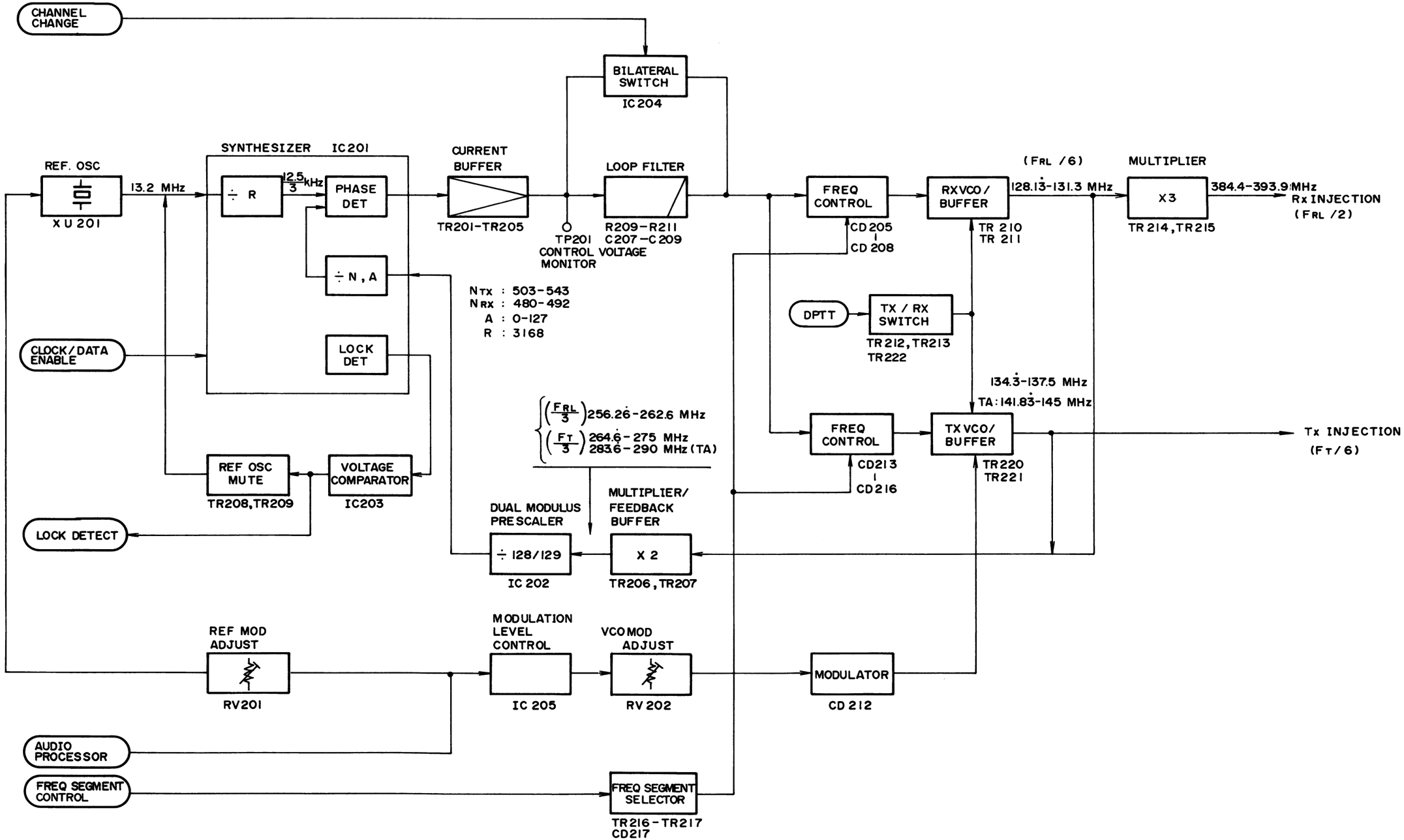


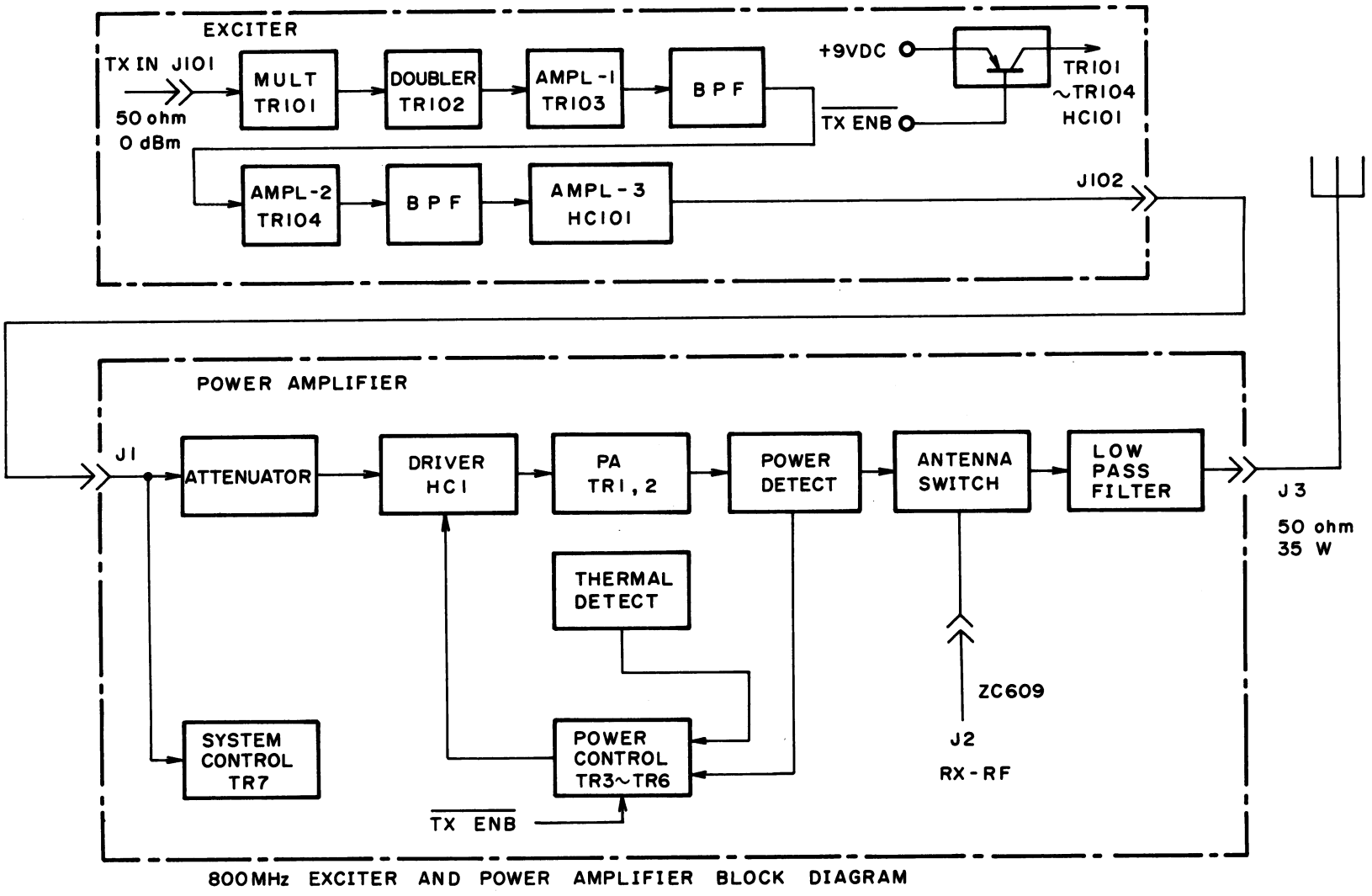
SYSTEM CONTROL
BLOCK DIAGRAM
DAOO-CMC-417



BLOCK DIAGRAM

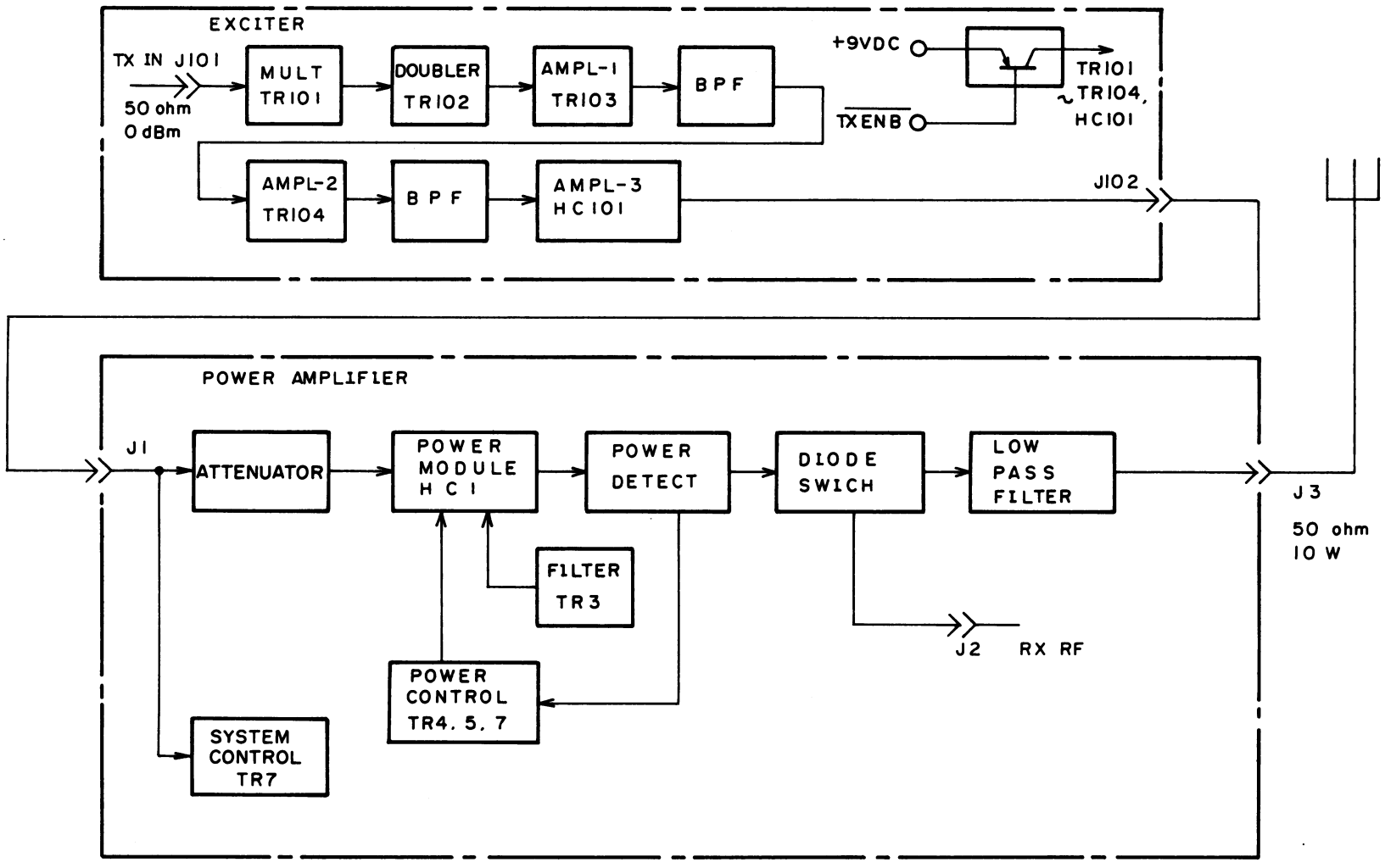
806-825 MHz FREQUENCY SYNTHESIZER
851-870 MHz

DA00-CMG-133



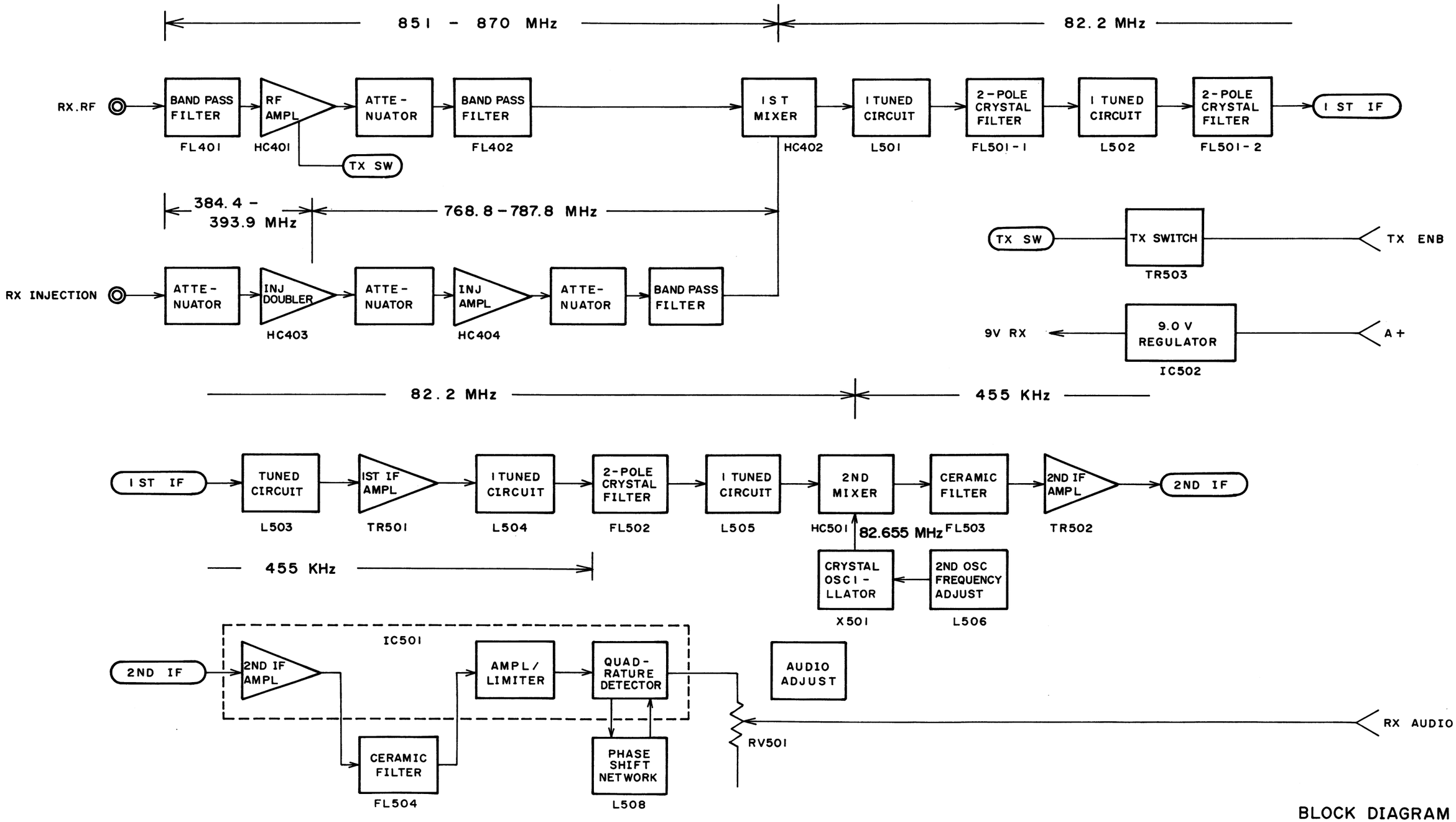
800MHz EXCITER AND POWER AMPLIFIER BLOCK DIAGRAM

EXCITER CAF-257
POWER AMPLIFIER CAH-357

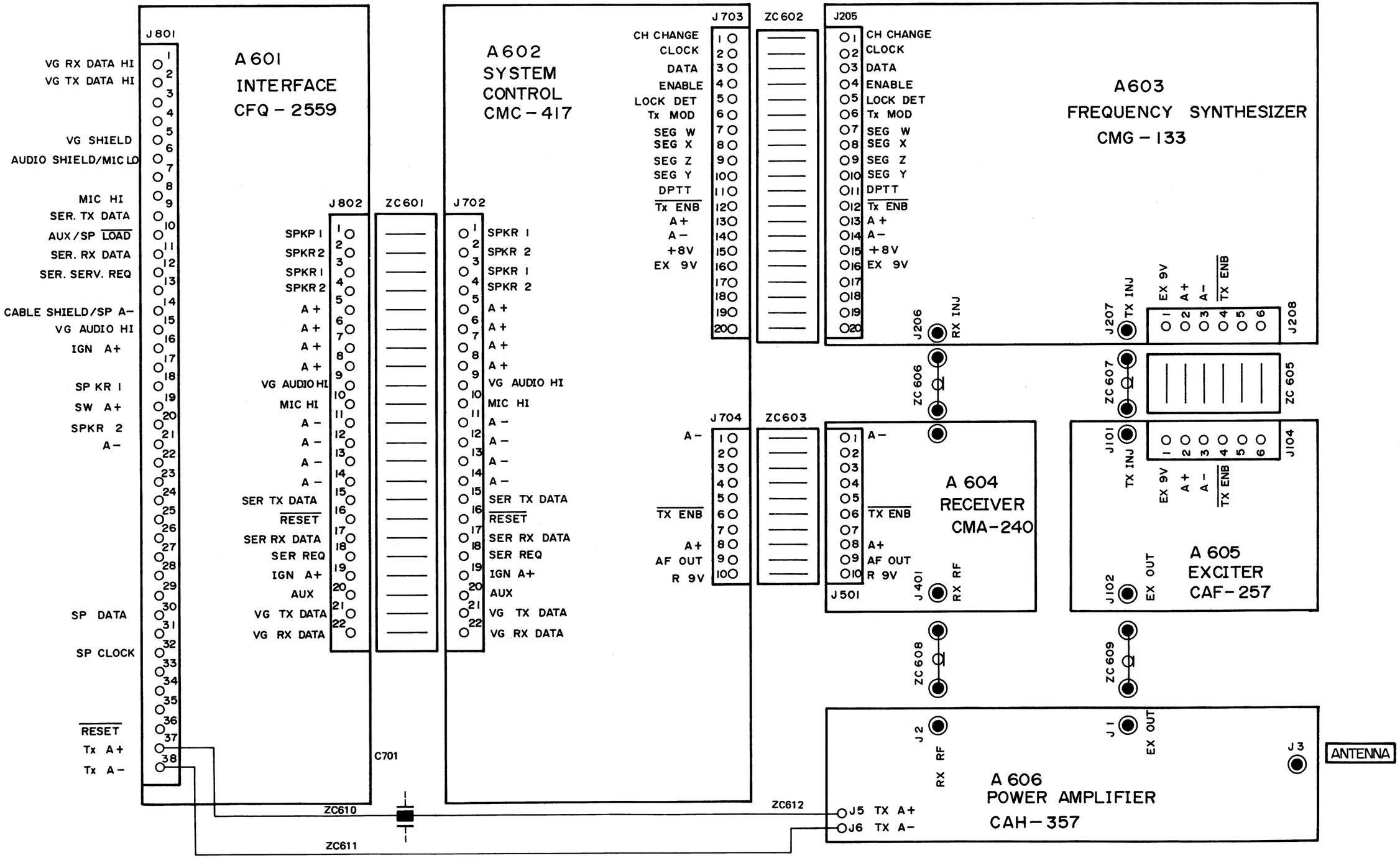


800 MHz EXCITER AND POWER AMPLIFIER BLOCK DIAGRAM

EXCITER CAF-257
POWER AMPLIFIER CAH-293



BLOCK DIAGRAM
800 MHz RECEIVER
DAOO-CMA-240



SCHEMATIC DIAGRAM
INTERCONNECTION
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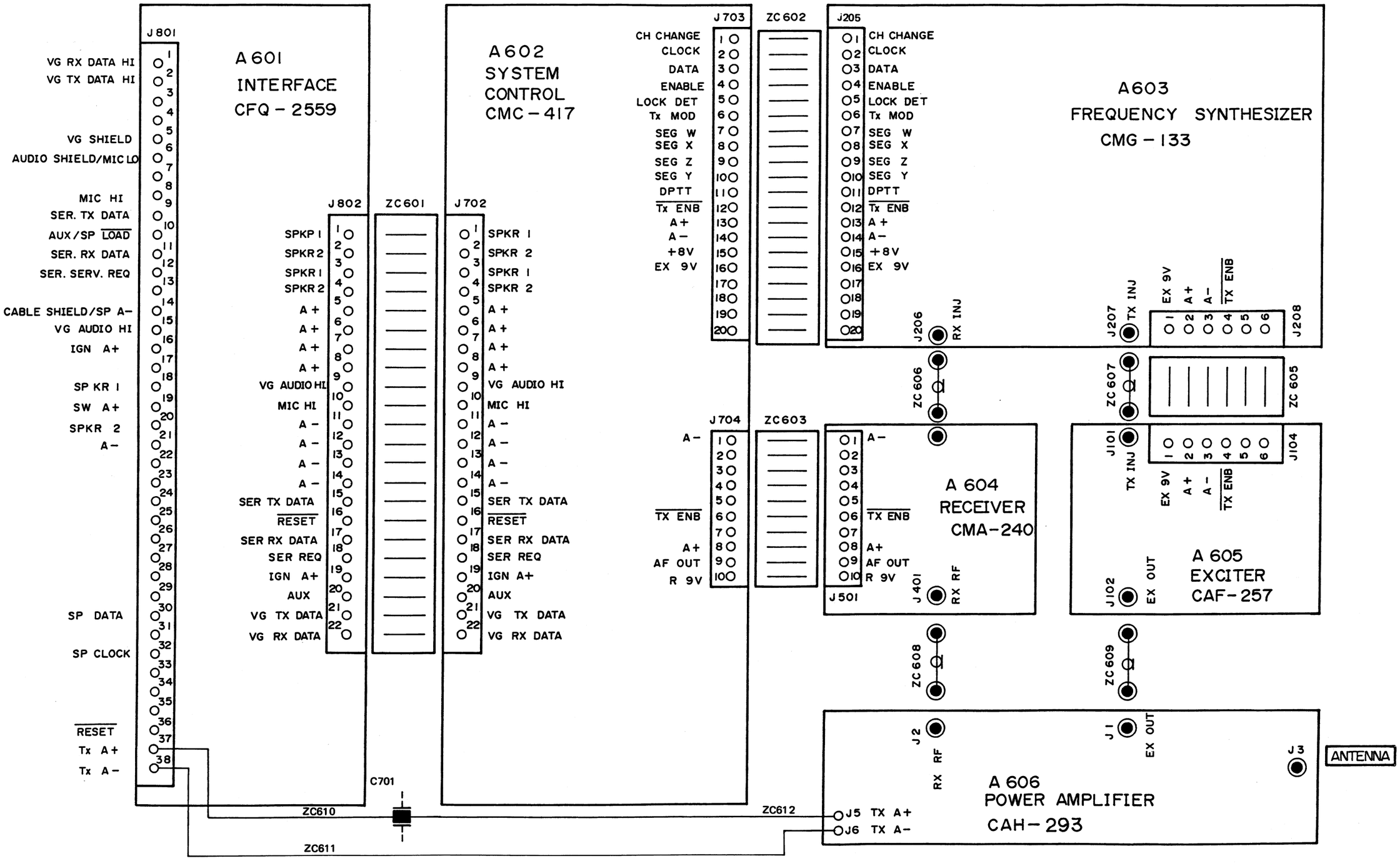
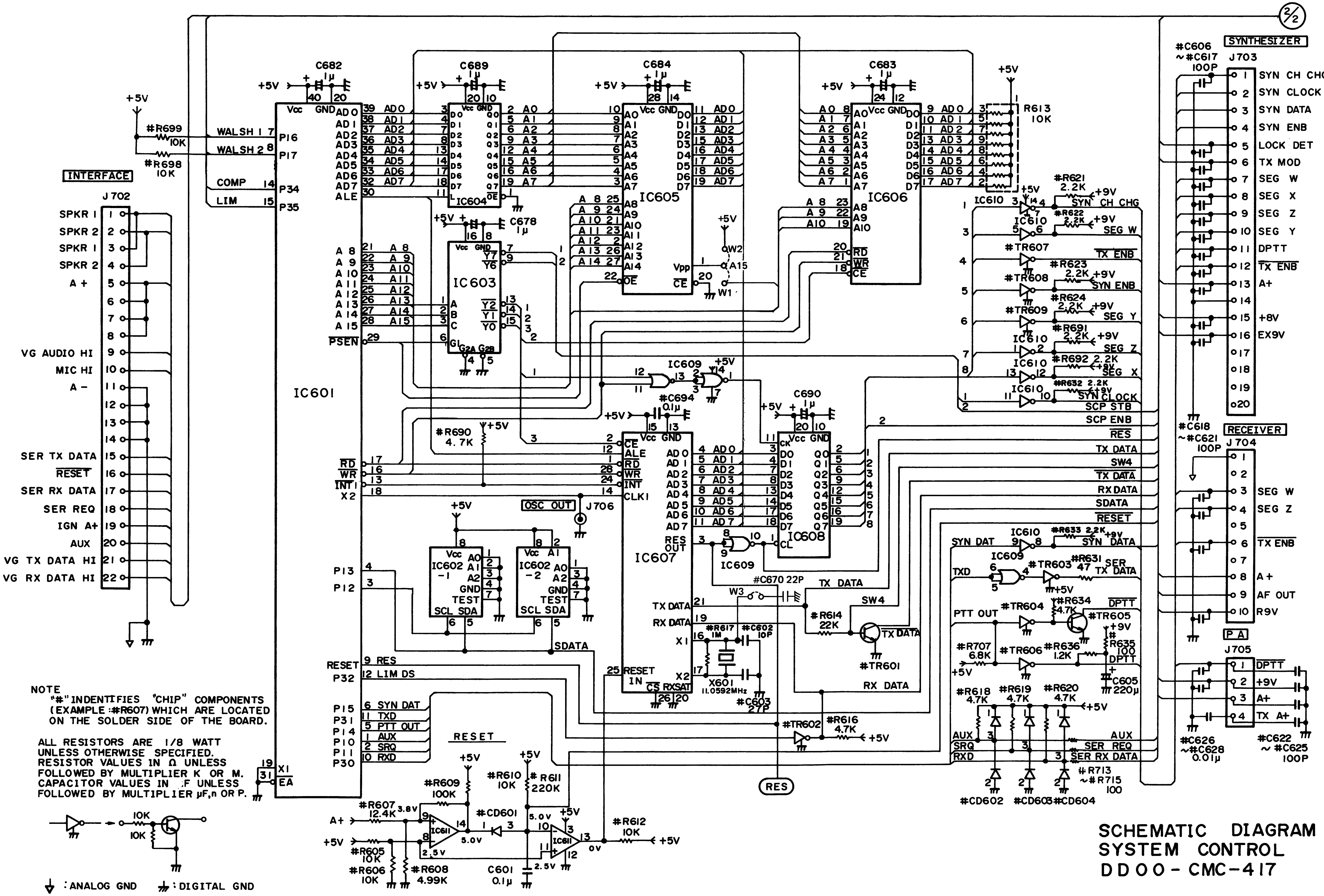


SCHEMATIC DIAGRAM
INTERCONNECTION
DDOO-JHM-853S10



NOTE

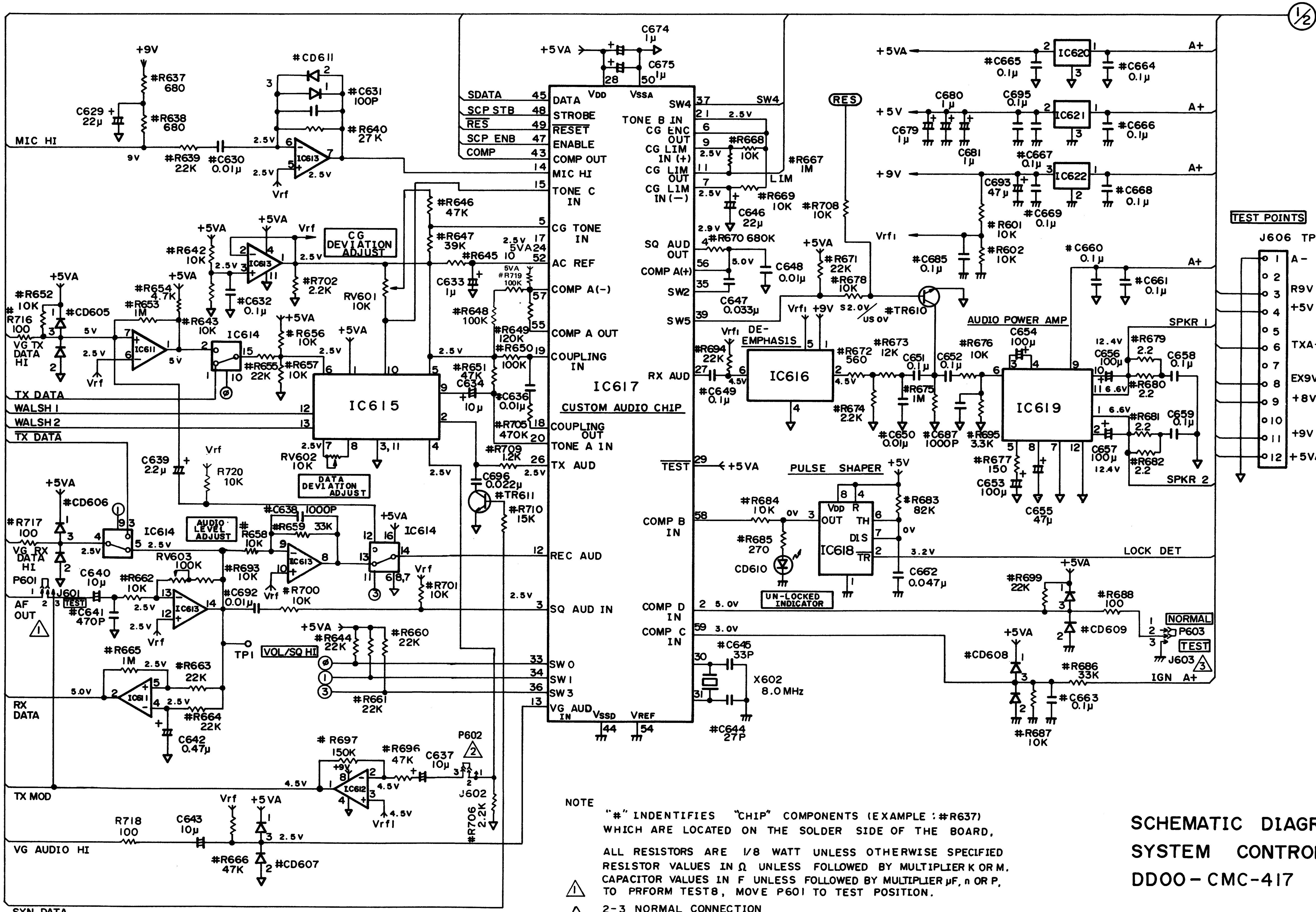
"#" INDENTIFIES "CHIP" COMPONENTS (EXAMPLE :#R607) WHICH ARE LOCATED ON THE SOLDER SIDE OF THE BOARD.

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μF, n OR P.

⏚ : ANALOG GND   ⏚ : DIGITAL GND

SCHEMATIC DIAGRAM SYSTEM CONTROL DD00-CMC-417

1/2



1/2
MIC HI
TX DATA
WALSH 1
WALSH 2
TX DATA
VG TX DATA HI
VG RX DATA HI
AF OUT
RX DATA
TX MOD
VG AUDIO HI
SYN DATA
IC615
IC617
CUSTOM AUDIO CHIP
IC616
IC618
IC619
IC620
IC621
IC622
CG DEVIATION ADJUST
DATA DEVIATION ADJUST
AUDIO LEVEL ADJUST
VOL/SQ HI
DE-EMPHASIS
AUDIO POWER AMP
PULSE SHAPER
UN-LOCKED INDICATOR
LOCK DET
TEST POINTS
J606 TP606
A−
R9V
+5V
TXA+
EX9V
+8V
+9V
+5VA
SPKR 1
SPKR 2
NORMAL
TEST
IGN A+
X602 8.0MHz

▽ : ANALOG GND   ⫨ : DIGITAL GND

NOTE

"#" INDENTIFIES "CHIP" COMPONENTS (EXAMPLE : #R637) WHICH ARE LOCATED ON THE SOLDER SIDE OF THE BOARD.

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M. CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μF, n OR P.

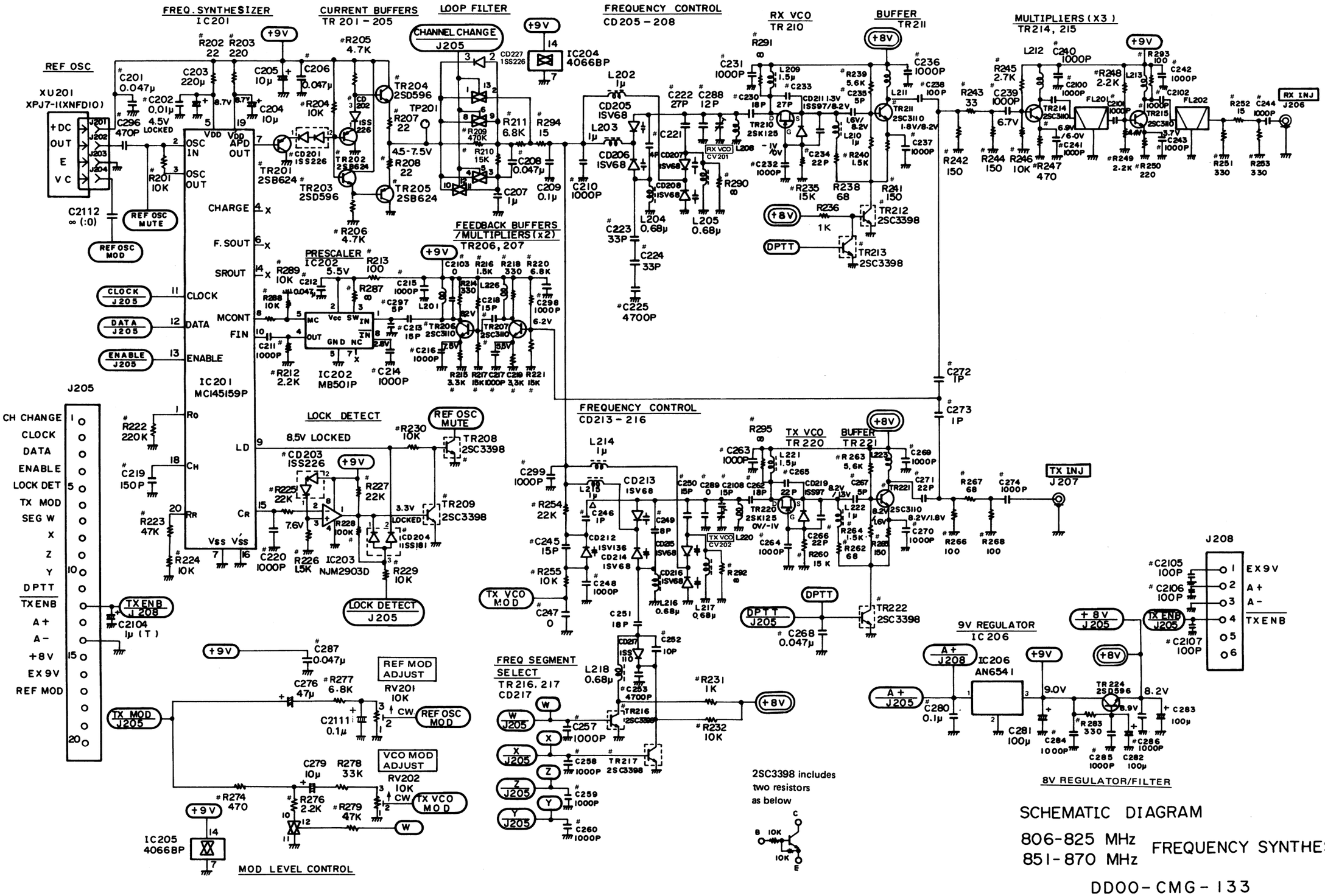
⚠1 TO PRFORM TEST8, MOVE P601 TO TEST POSITION.

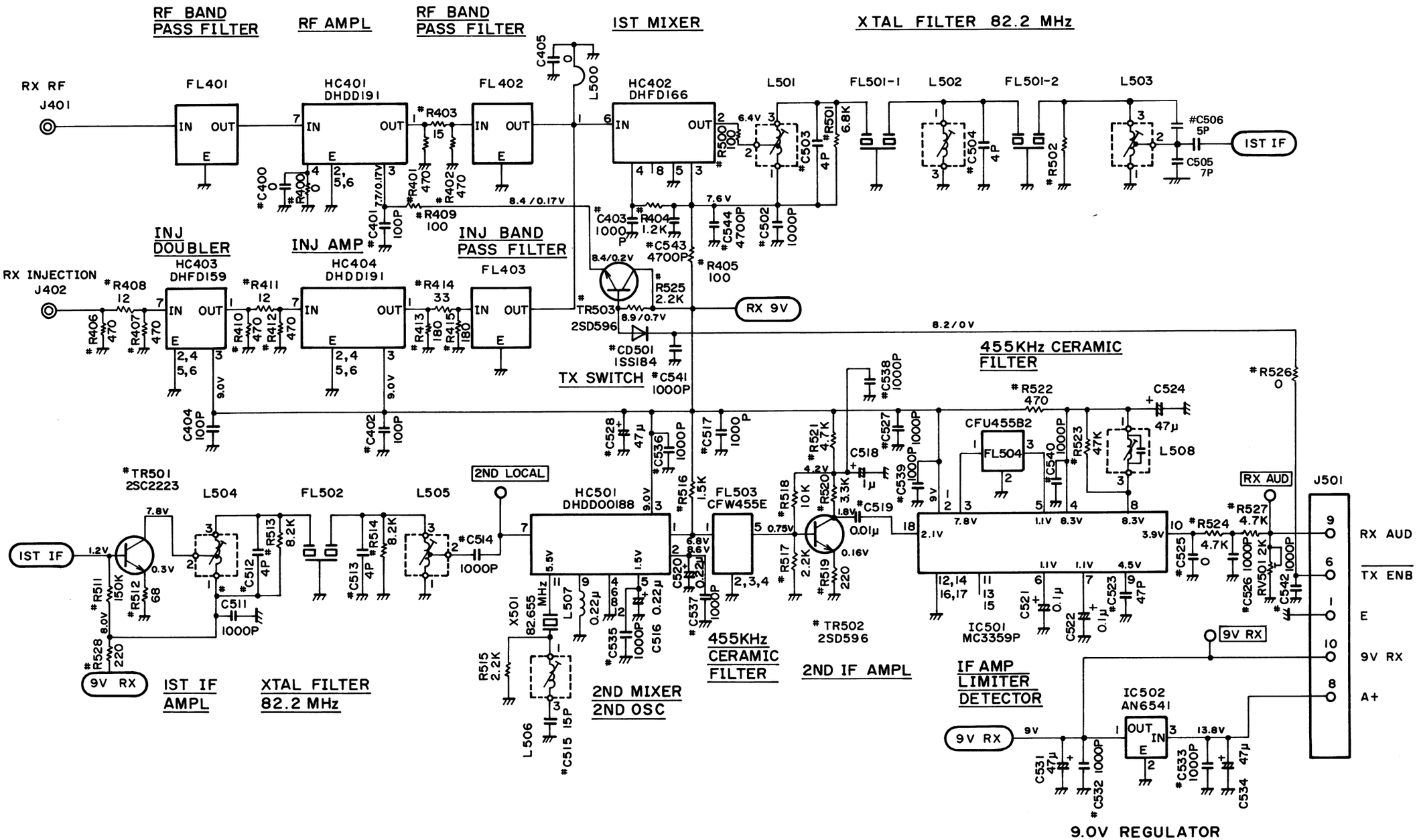
⚠2 2-3 NORMAL CONNECTION
1-2 MODULATION LINE OFF

⚠3 1-2 NORMAL CONNECTION
2-3 VRS TEST MODE

SCHEMATIC DIAGRAM
SYSTEM CONTROL
DDOO-CMC-417

2/2


FREQ. SYNTHESIZER
IC201
CURRENT BUFFERS
TR 201 - 205
LOOP FILTER
CHANNEL CHANGE
J205
FREQUENCY CONTROL
CD205 - 208
RX VCO
TR 210
BUFFER
TR211
MULTIPLIERS (X3)
TR214, 215
REF OSC
XU201
XPJ7-1(XNFDIO)
+DC
OUT
E
V C
REF OSC MUTE
REF OSC MOD
CLOCK J205
DATA J205
ENABLE J205
IC201
MC145159P
CHARGE
F. SOUT
SROUT
MCONT
FIN
PRESCALER
IC202
5.5V
IC202
M8501P
FEEDBACK BUFFERS
/MULTIPLIERS (x2)
TR206, 207
LOCK DETECT
8.5V LOCKED
IC203
NJM2903D
TR208
2SC3398
TR209
2SC3398
LOCK DETECT J205
TXENB J208
J205
CH CHANGE
CLOCK
DATA
ENABLE
LOCK DET
TX MOD
SEG W
X
Z
Y
DPTT
TXENB
A+
A-
+8V
EX 9V
REF MOD
MOD LEVEL CONTROL
IC205
4066BP
TX MOD J205
REF MOD ADJUST
RV201
10K
REF OSC MOD
VCO MOD ADJUST
RV202
10K
TX VCO MOD
FREQUENCY CONTROL
CD213 - 216
TX VCO
TR 220
BUFFER
TR221
TX INJ
J207
TX VCO MOD
DPTT
DPTT J205
TR222
2SC3398
FREQ SEGMENT
SELECT
TR216, 217
CD217
2SC3398 includes
two resistors
as below
9V REGULATOR
IC206
IC206
AN6541
8V REGULATOR/FILTER
J208
EX9V
A+
A-
TXENB
+8V J205
TX ENB J205
RX INJ
J206
SCHEMATIC DIAGRAM
806-825 MHz
851-870 MHz
FREQUENCY SYNTHESIZER
DDOO-CMG-133

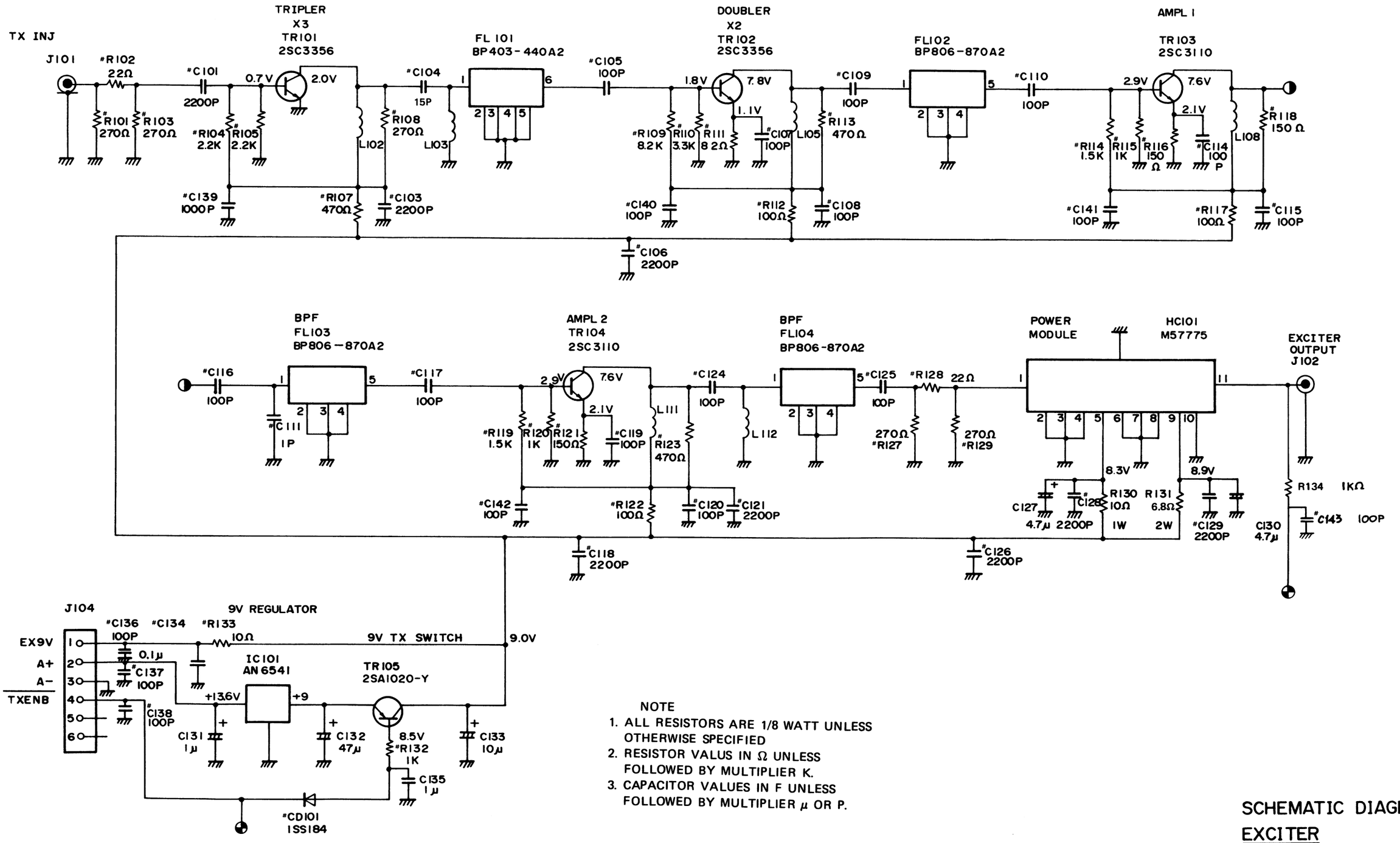


NOTES

IDENTIFIES "CHIP" COMPONENTS (EXAMPLE, #R401)
WHICH ARE LOCATED ON SOLDER SIDE OF PWB.

ALL RESISTORS ARE 1/8 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
800 MHz RECEIVER
DDOO-CMA-240



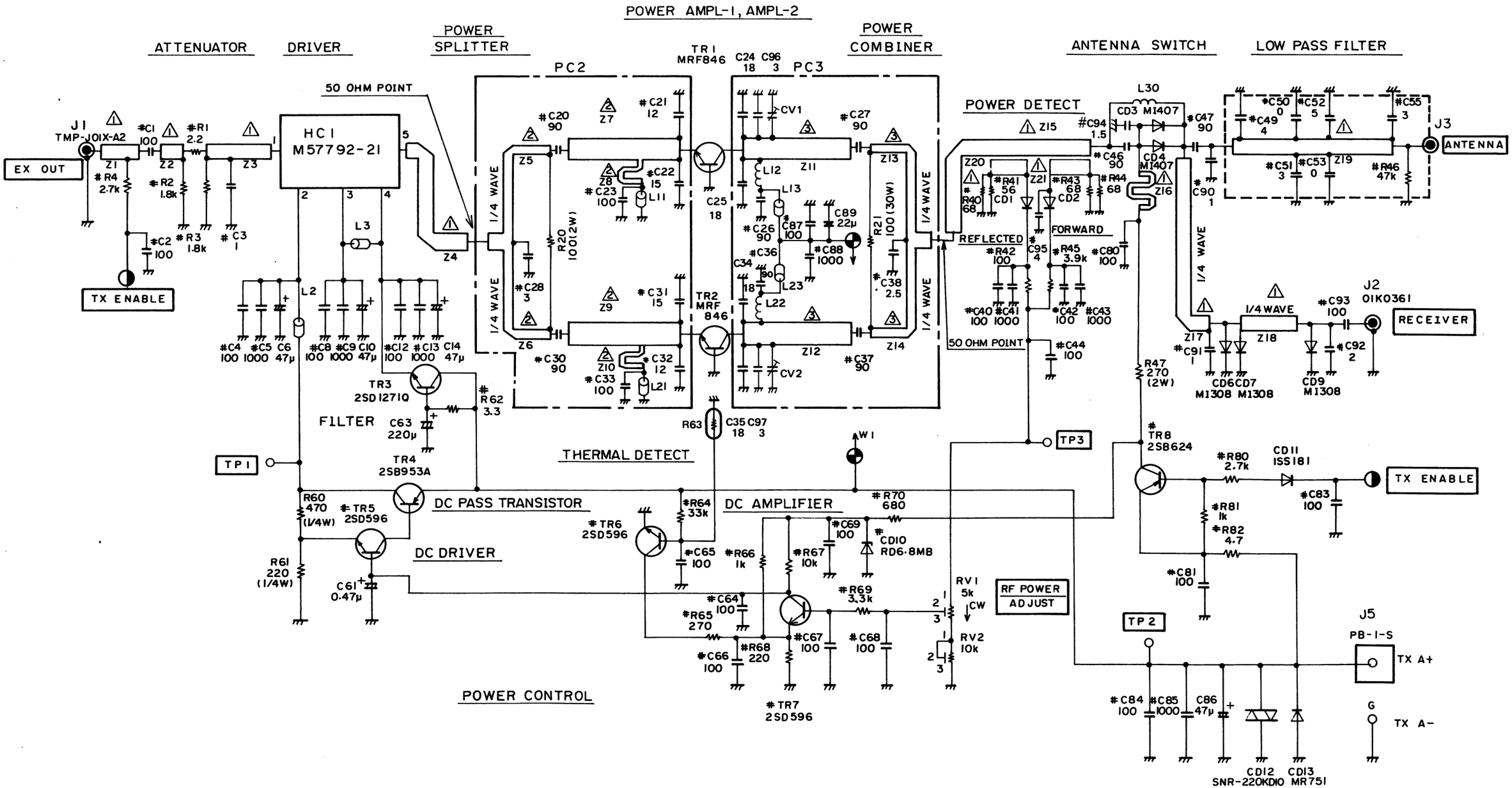
NOTE

1. ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED
2. RESISTOR VALUS IN Ω UNLESS FOLLOWED BY MULTIPLIER K.
3. CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ OR P.

SCHEMATIC DIAGRAM

EXCITER

DDOO-CAF-257



NOTES
"#" IDENTIFIES "CHIP" COMPONENTS (EXAMPLE, #R3) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD.

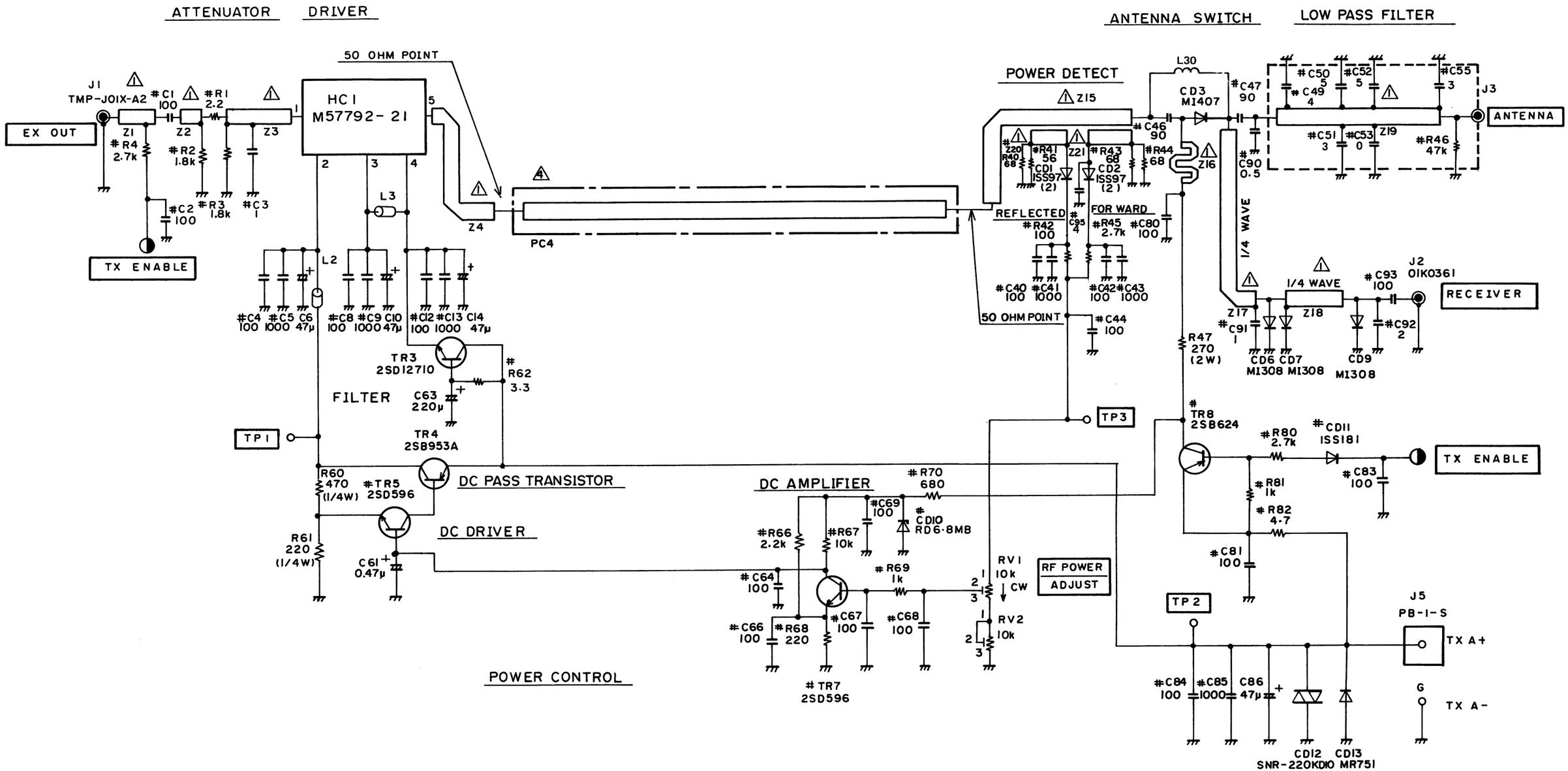
ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN pF UNLESS FOLLOWED BY MULTIPLIER n OR μ.
INDUCTANCE VALUES IN H UNLESSFOLLOWED BY MULTIPLIER m OR μ.

⚠1 STRIPLINE PART OF PC1

⚠2 STRIPLINE PART OF PC2

⚠3 STRIPLINE PART OF PC3

RANGR 800MHz
35 WATT POWER AMPLIFIER
DD00 – CAH – 357



NOTES
"#" IDENTIFIES "CHIP" COMPONENTS (EXAMPLE. #R3) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD.

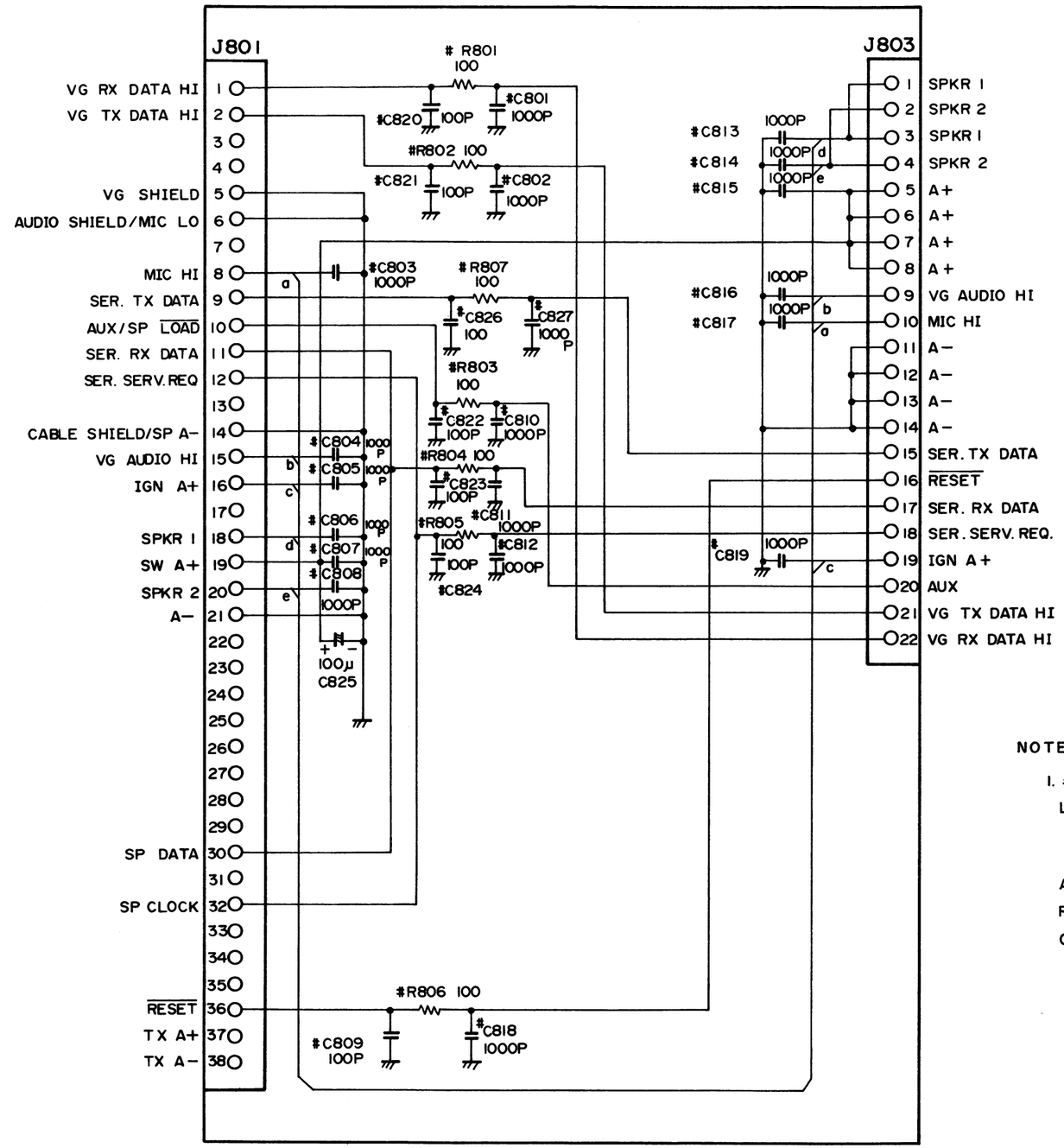
⚠1 STRIPLINE PART OF PC1

⚠4 STRIPLINE PART OF PC4

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

RANGR 800 MHz
10 WATT POWER AMPLIFIER

DD00-CAH-293



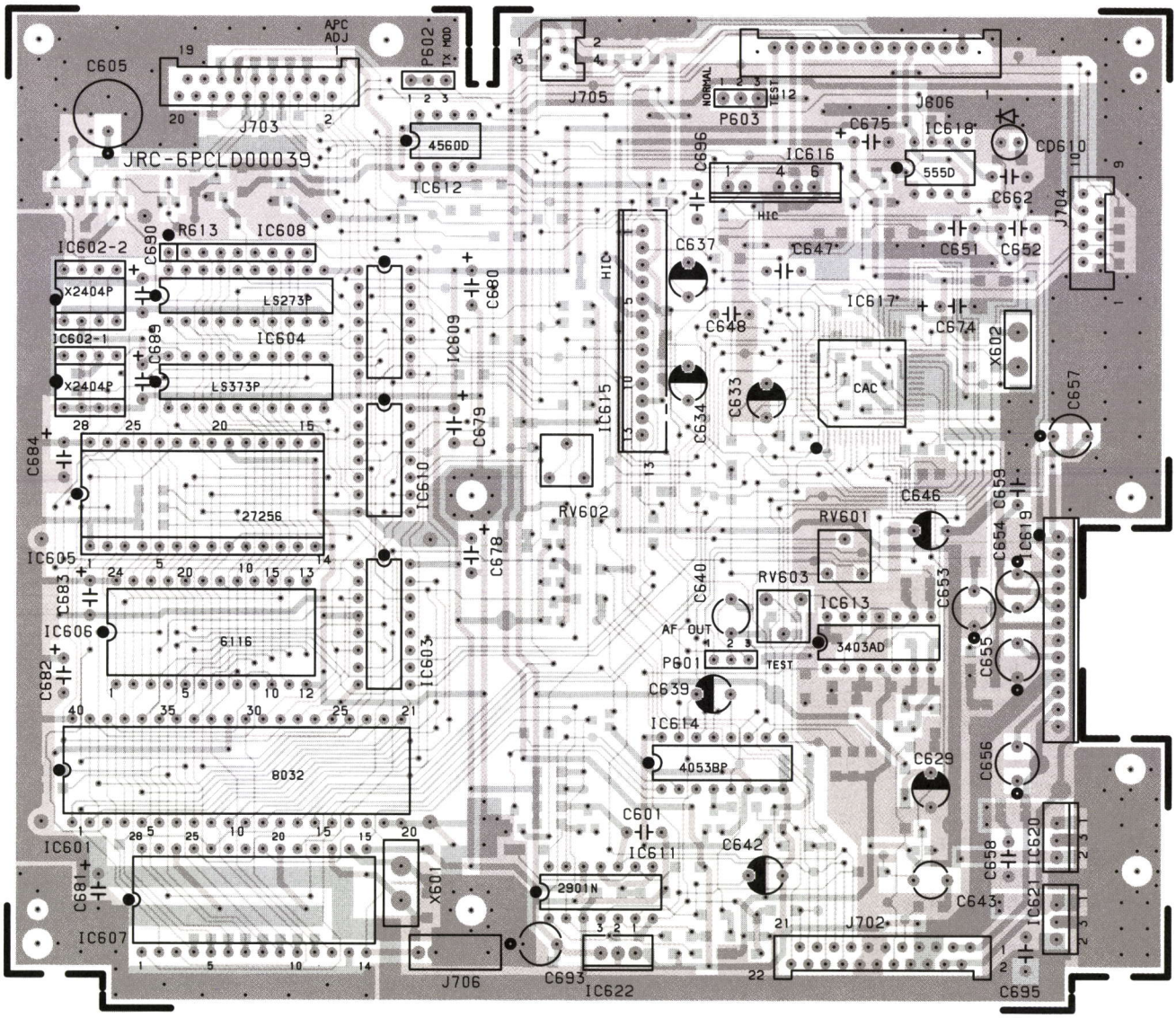
NOTE

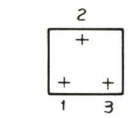
1. # IDENTIFIES CHIP COMPONENTS WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD.

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN PF UNLESS FOLLOWED BY MULTIPLIER µ, n.

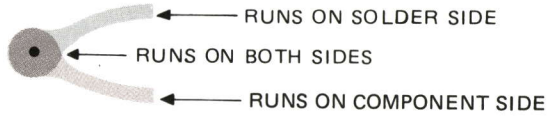
SCHEMATIC DIAGRAM
INTERFACE

DDOO-
CFQ-2559

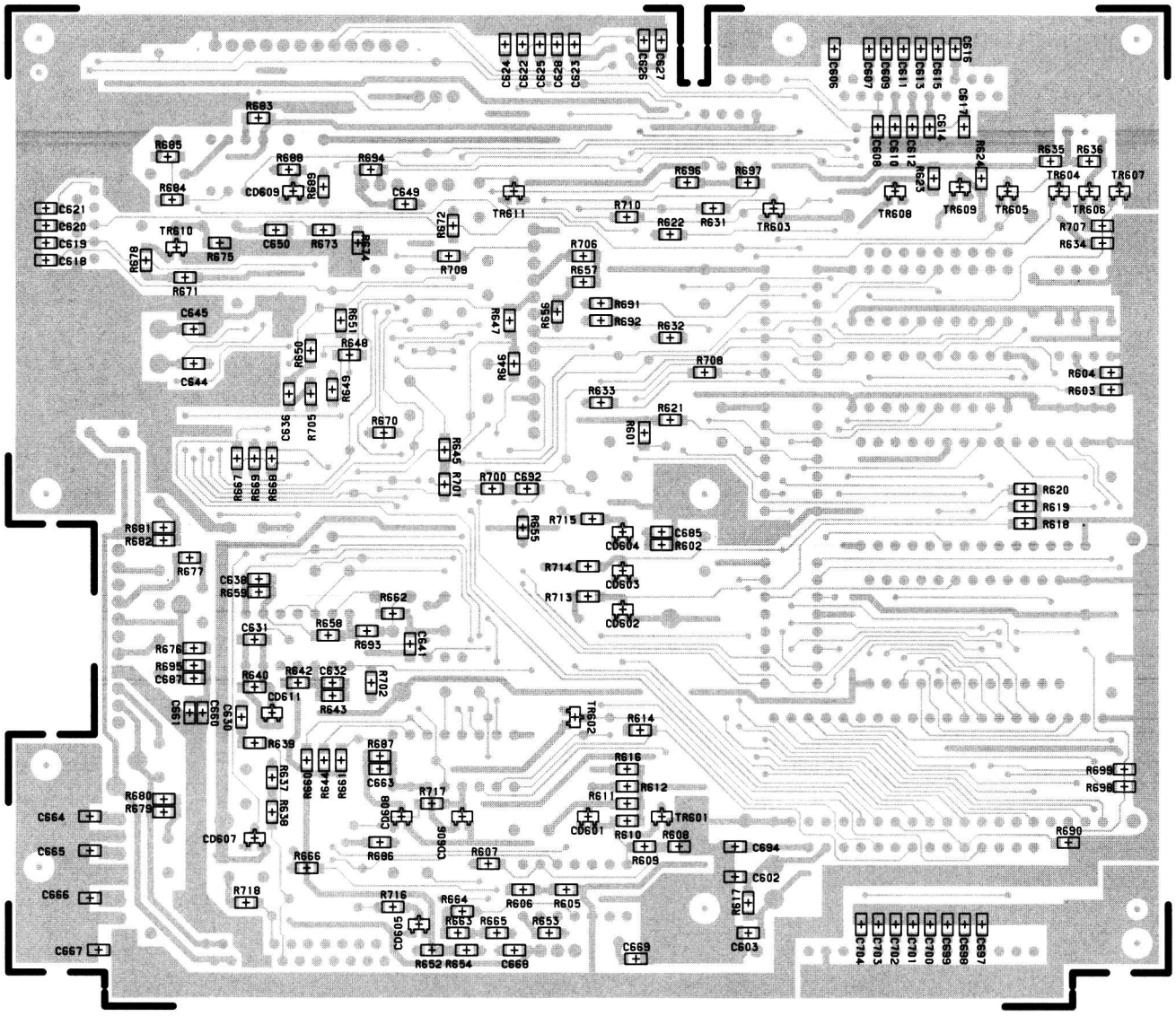




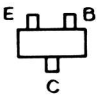
(TOP VIEW)



SYSTEM CONTROL BOARD

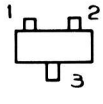


LEAD IDENTIFICATION FOR TRANSISTOR



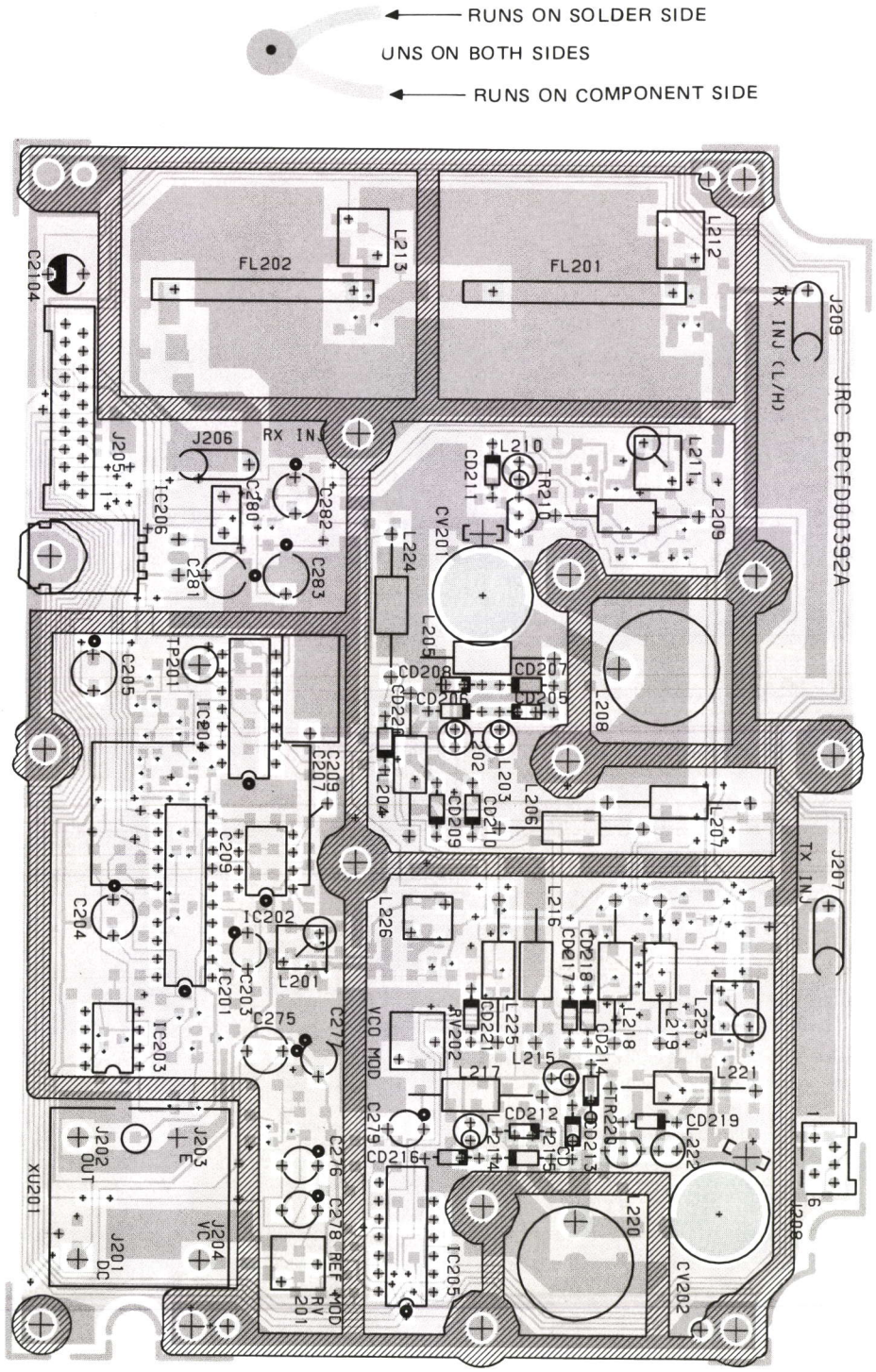
(TOP VIEW)

LEAD IDENTIFICATION FOR DIODES

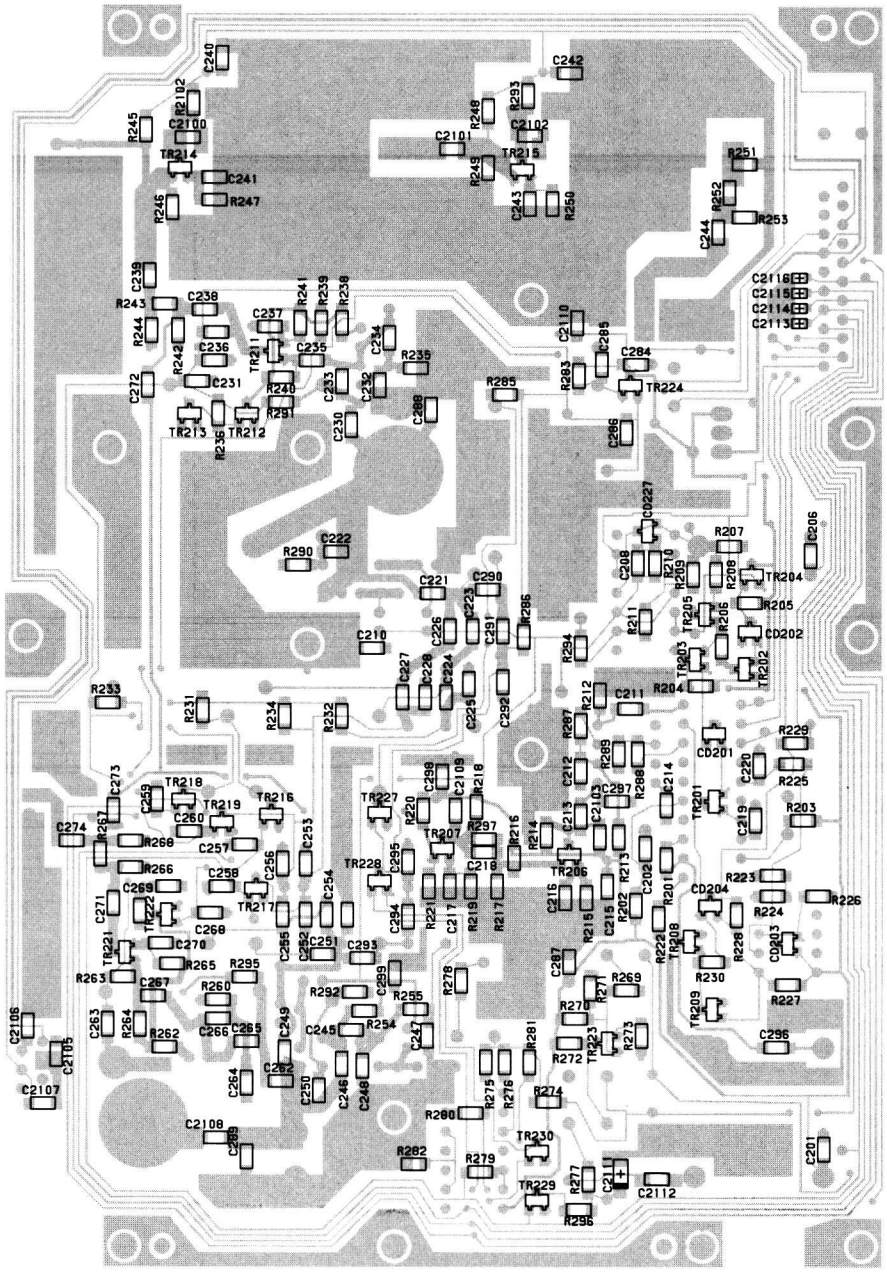


(TOP VIEW)

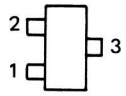
SYSTEM CONTROL BOARD



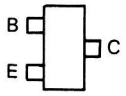
FREQUENCY SYNTHESIZER BOARD



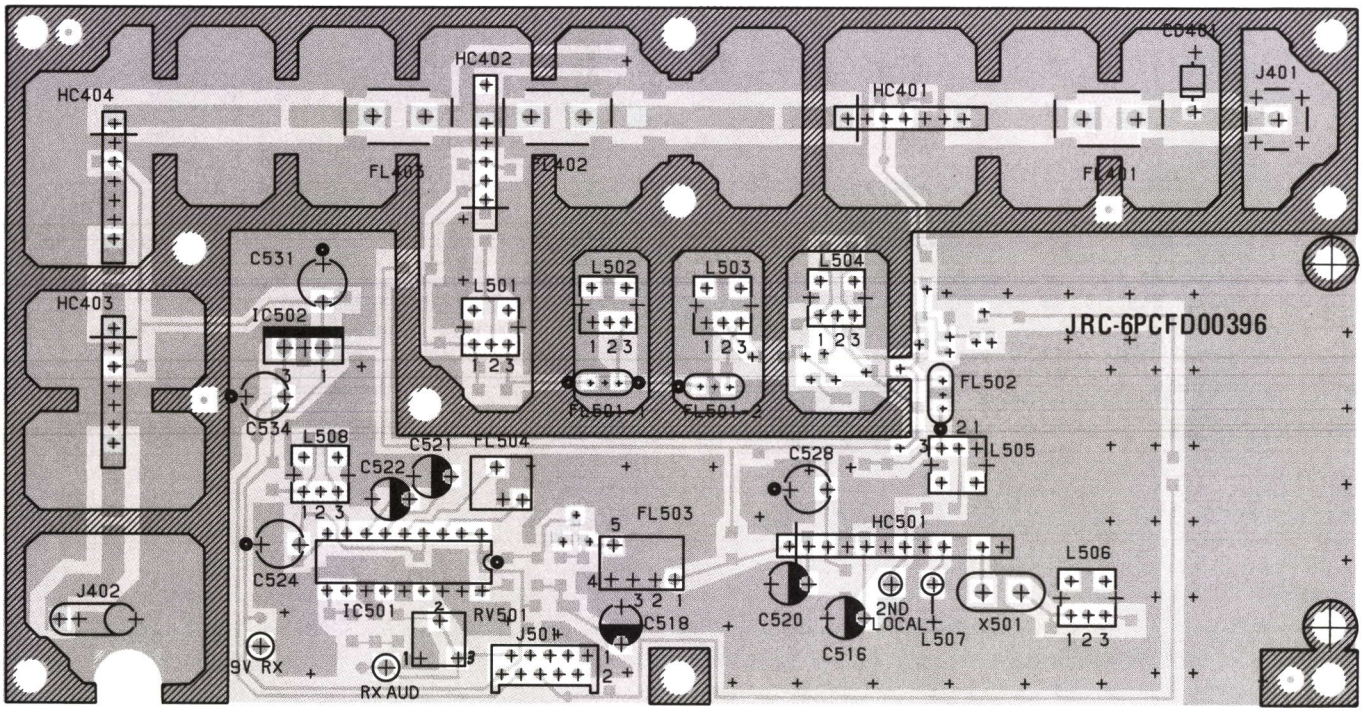
LEAD IDENTIFICATION
FOR DIODES
(TOP VIEW)



LEAD IDENTIFICATION
FOR TRANSISTORS
(TOP VIEW)



FREQUENCY SYNTHESIZER

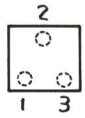


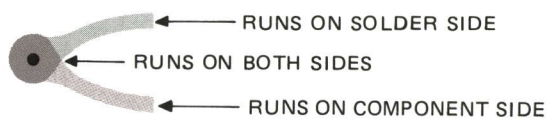
RECEIVER BOARD

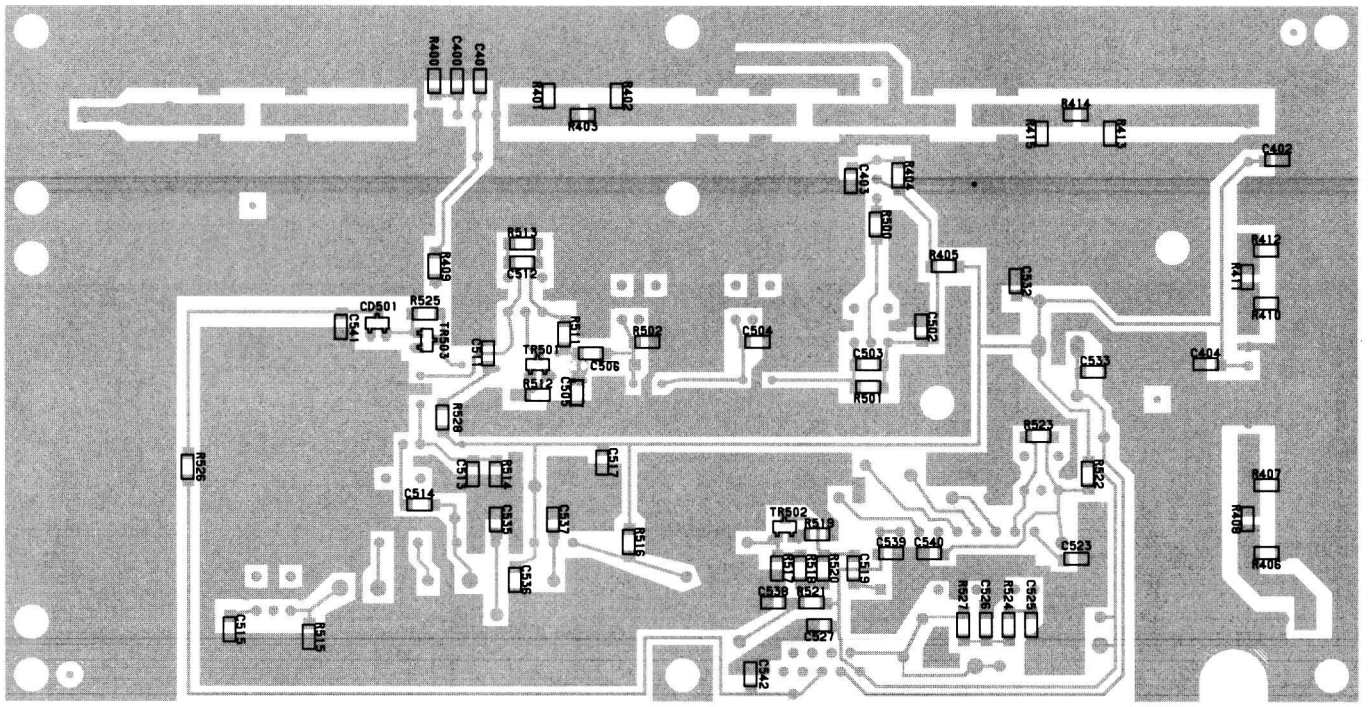
LEAD IDENTIFICATION

FOR RV 501

(TOP VIEW)



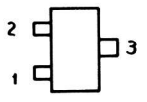




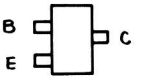
RECEIVER BOARD

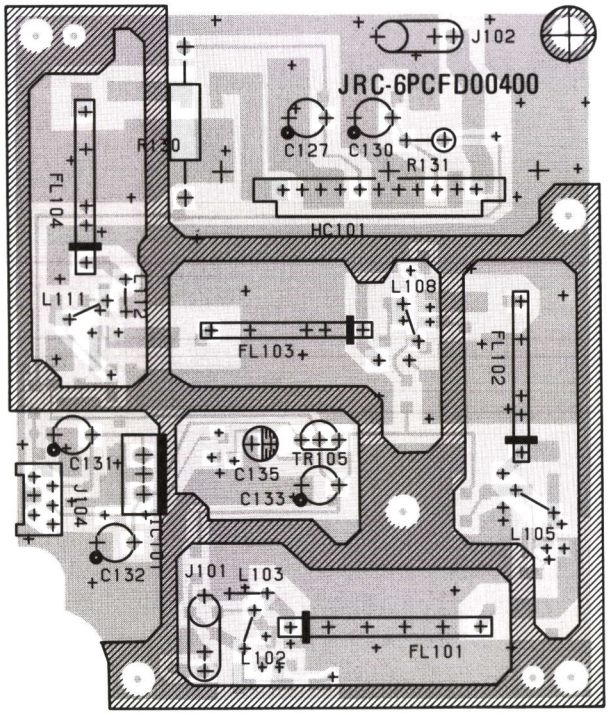
(BACK VIEW OF COMPONENT BOARD)

LEAD IDENTIFICATION
FOR CD 501
(TOP VIEW)

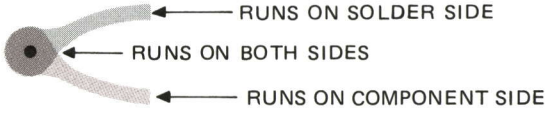


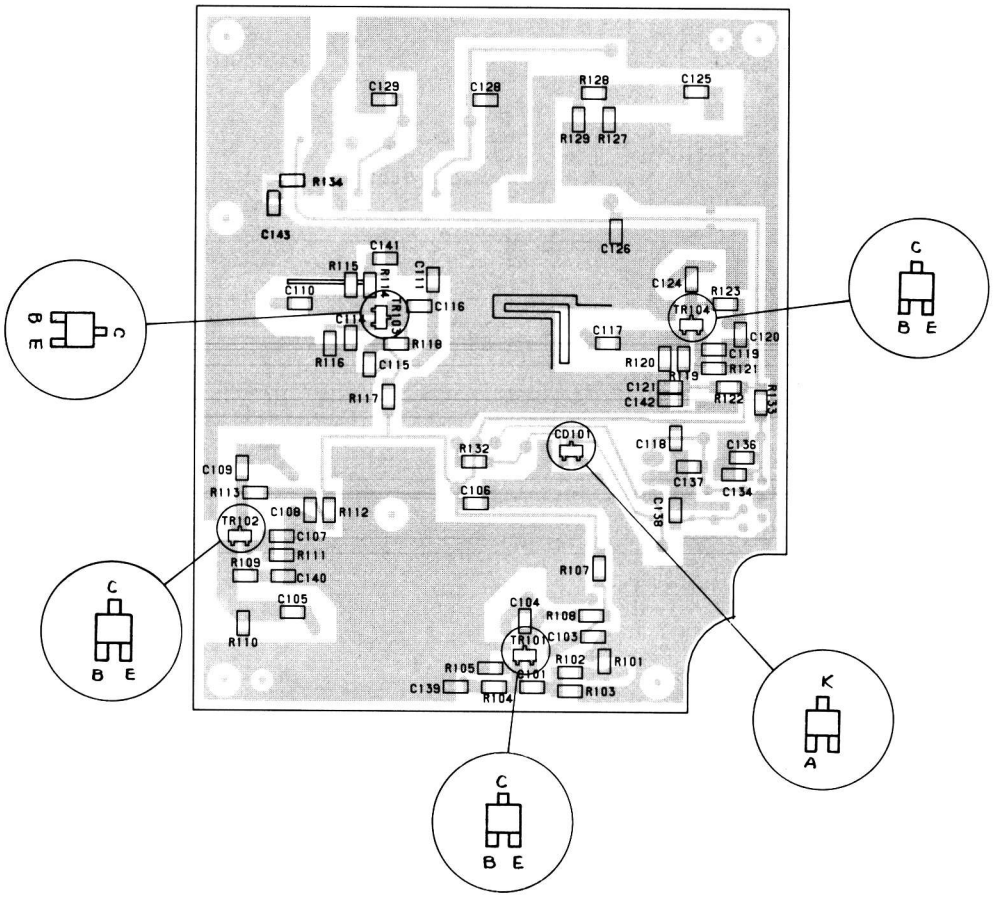
LEAD IDENTIFICATION
FOR TRANSISTORS
(TOP VIEW)





TRANSMIT EXCITER BOARD

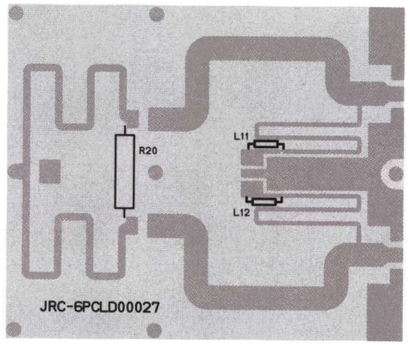




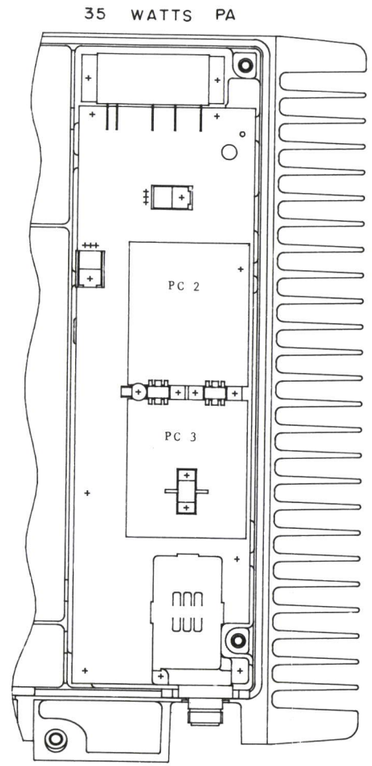
TRANSMIT EXCITER BOARD

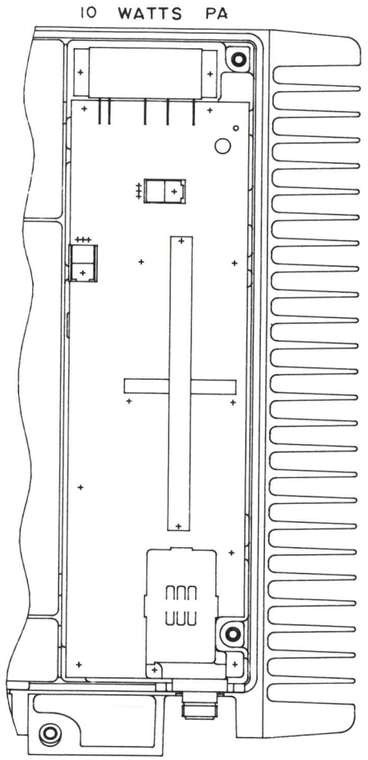
(BACK VIEW OF COMPONENT BOARD)

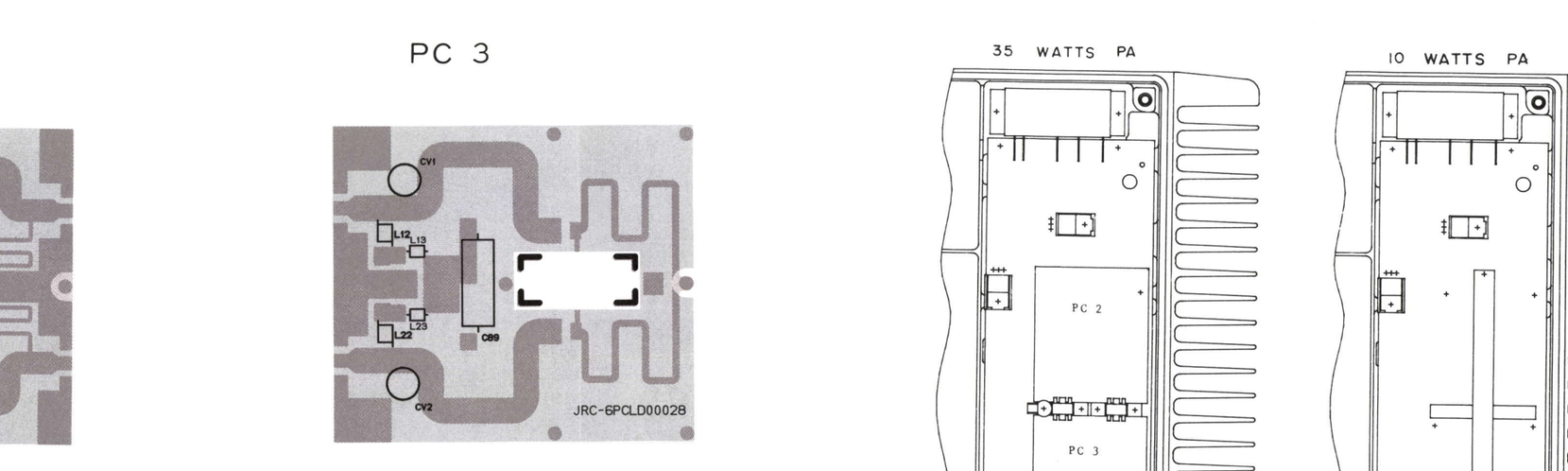
PC 2



PC 3

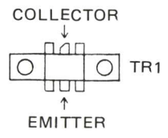




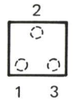


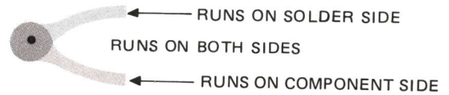
POWER AMPLIFIER BOARD

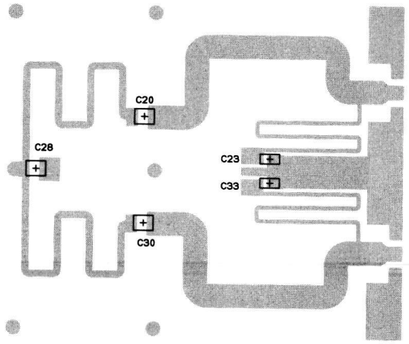
LEAD IDENTIFICATION
FOR TR1, TR2

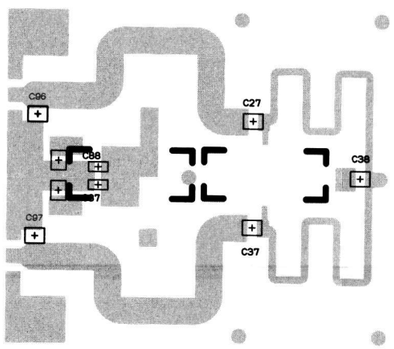


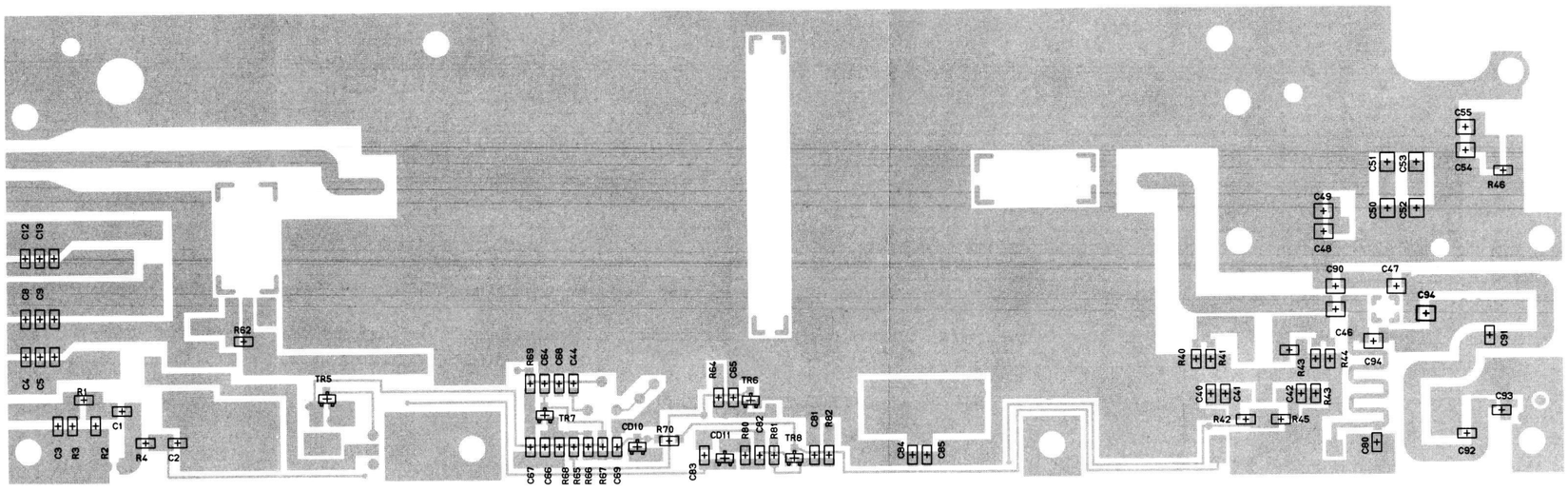
LEAD IDENTIFICATION
FOR RV1, RV2
(TOP VIEW)







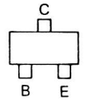


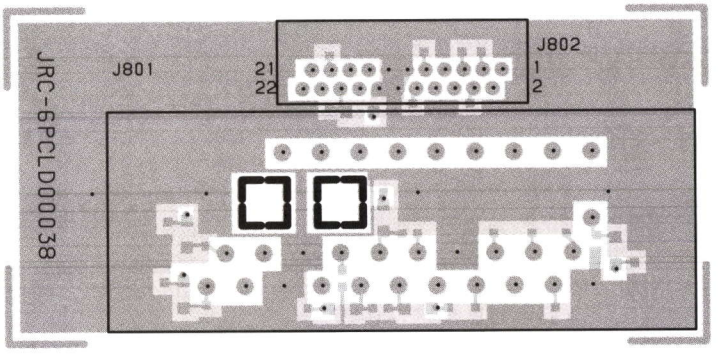


POWER AMPLIFIER BOARD

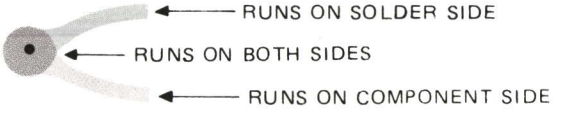
(TOP VIEW OF COMPONENT BOARD)

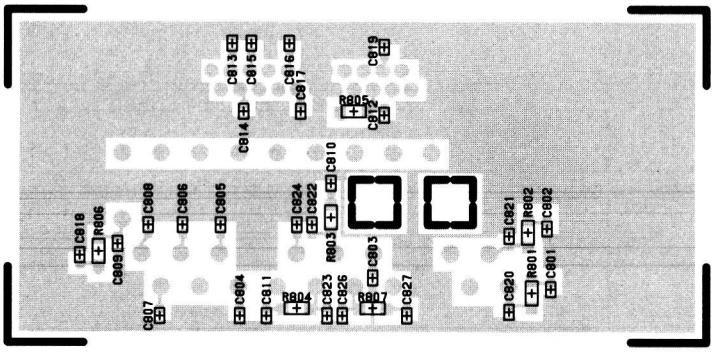
LEAD IDENTIFICATION
FOR TRANSISTORS
(TOP VIEW)





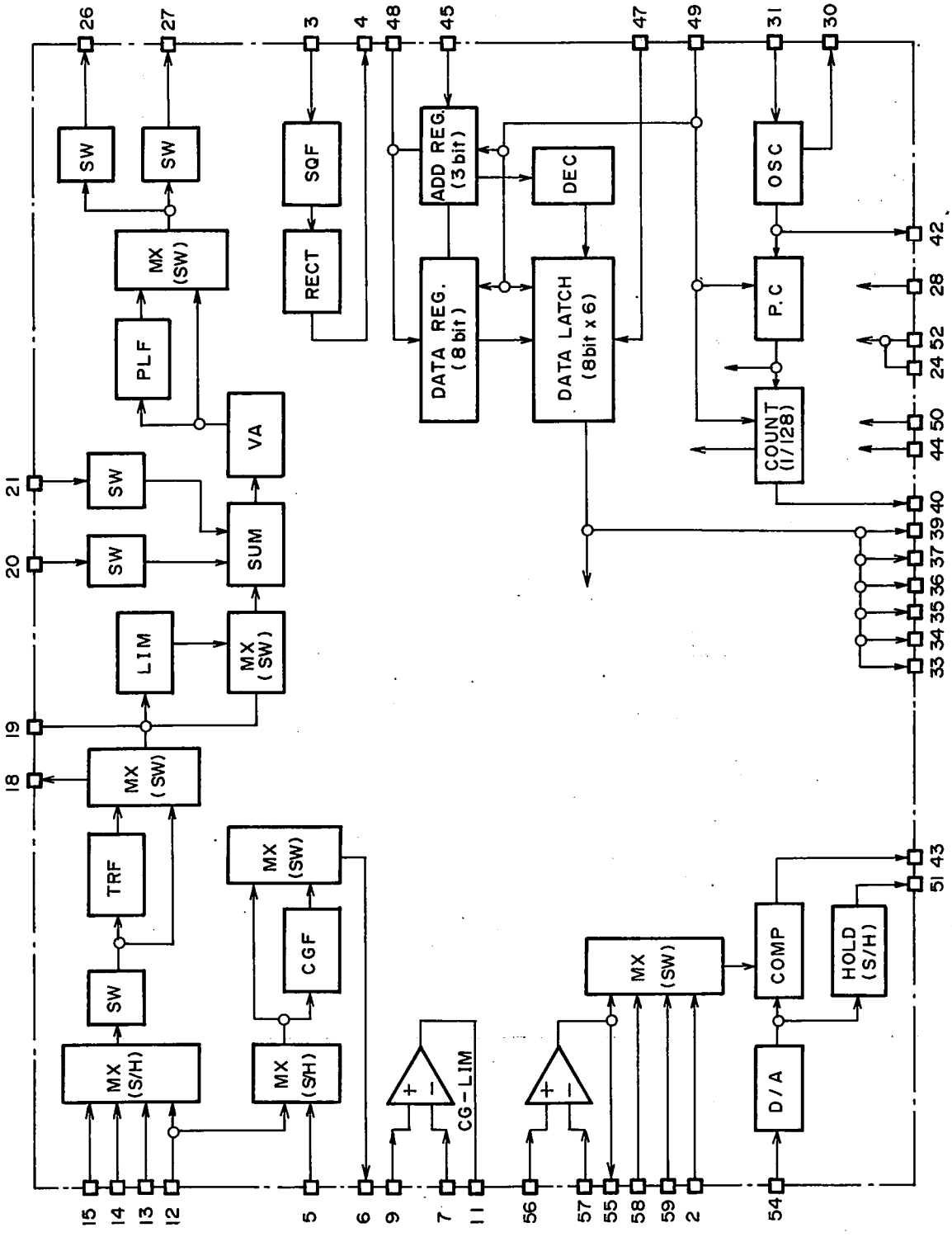
INTERFACE BOARD





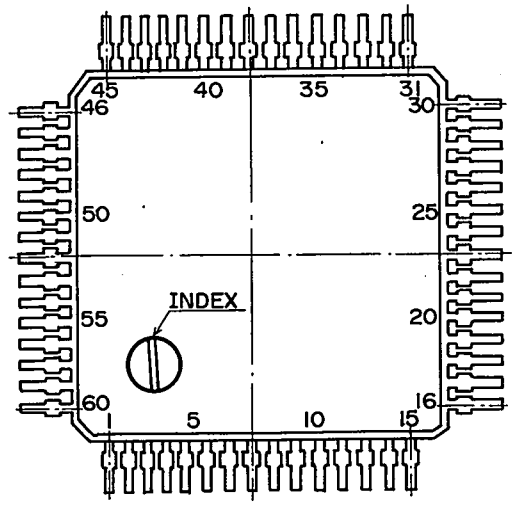
INTERFACE BOARD

STC 9140 F
BLOCK DIAGRAM

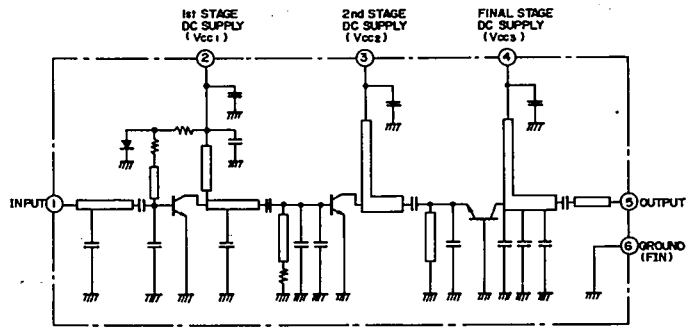
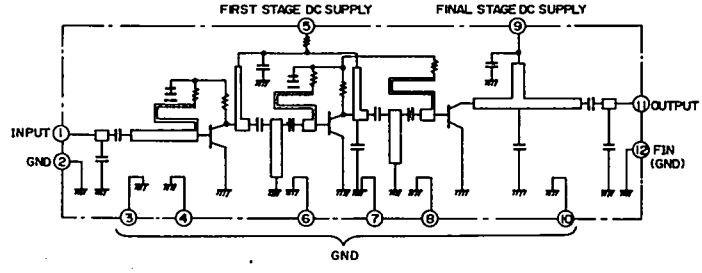
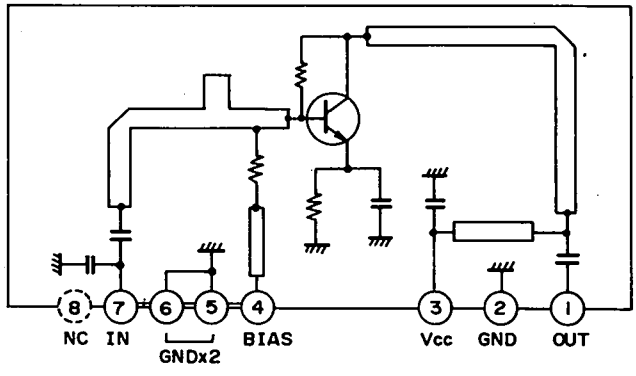
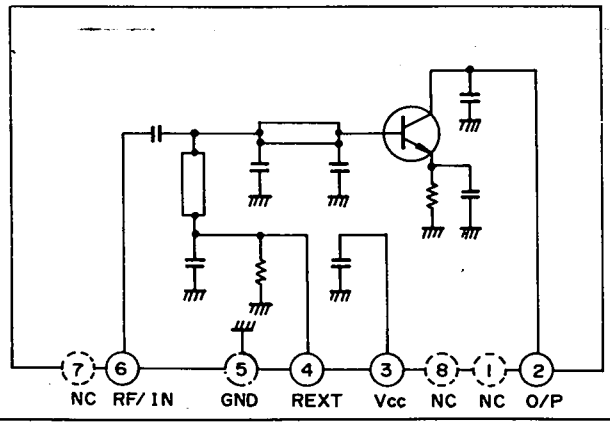


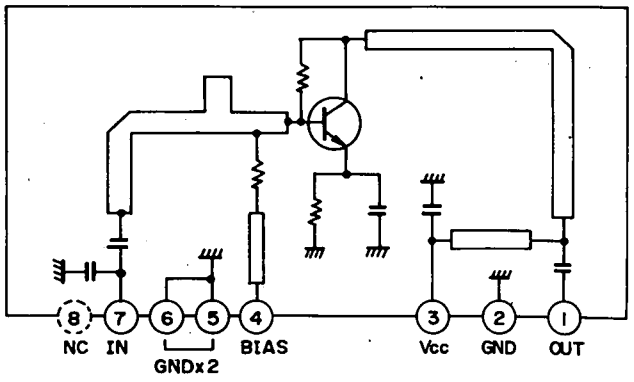
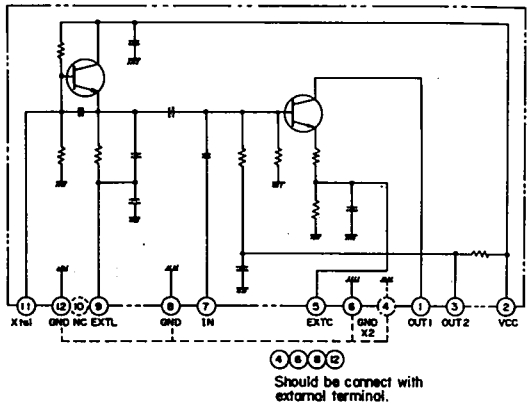
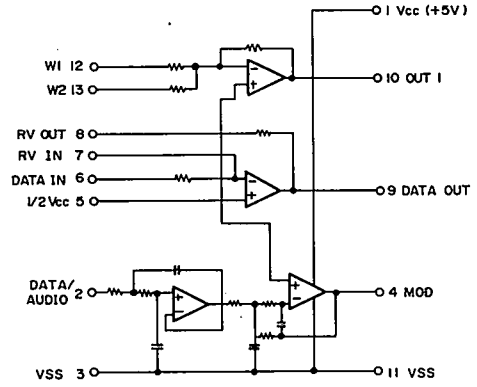
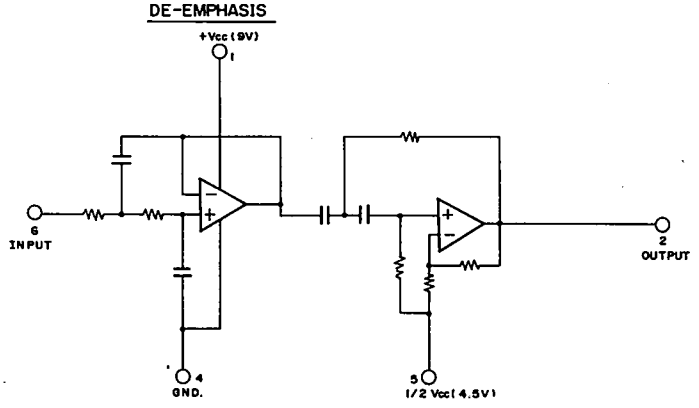
Pin No.	NAME	Pin No.	NAME	Pin No.	NAME	Pin No.	NAME
1	N.C	16	N.C	31	XG	46	N.C
2	COMP D IN	17	Vcc/2	32	N.C	47	ENABL
3	SQL AUD IN	18	COUPLING OUT	33	SW 0	48	STROBE
4	SQL AUD OUT	19	COUPLING IN	34	SW 1	49	RESET
5	CG TONE IN	20	TONE A IN	35	SW 2	50	VSSA
6	CG ENC OUT	21	TONE B IN	36	SW 3	51	D/A OUT
7	CG LIM(-) IN	22	N.C	37	SW 4	52	Vcc/2
8	N.C	23	AUD LIM OUT	38	N.C	53	N.C
9	CG LIM(+) IN	24	Vcc/2	39	SW 5	54	VREF
10	N.C	25	N.C	40	1 kHz OUT	55	COMP A OUT
11	CG LIM OUT	26	Tx AUD OUT	41	N.C	56	COMP A(+) IN
12	REC AUD IN	27	Rx AUD OUT	42	OSC OUT	57	COMP A(-) IN
13	EXT MIC IN	28	VDD	43	COMP OUT	58	COMP B IN
14	INT MIC IN	29	TEST	44	VSSD	59	COMP C IN
15	TONE C IN	30	XD	45	DATA	60	N.C

N.C = OPEN



CUSTOM AUDIO CHIP
STC 9140F

SYMBOL	GE PART NO.	EQUIVALENT CIRCUIT
HC 1	B19/ 5DDAB00216	
HC101	B19/ 5DHAA00020	
HC401 HC404	B19/ 6DHDD00191	
HC402	B19/ 6DHFD00166	

SYMBOL	GE PART NO.	EQUIVALENT CIRCUIT
HC403	B19/ 6DHFD00159	
HC501	B19/ 6DHDD00188	
IC615	B19/ 5DHAR00047	
IC616	B19/ 6DHFD00167	

PARTS LIST

SYMBOL	GE PART NO.	DESCRIPTION
	B19/CAH-357	High Power 35W
	B19/CAH-293	Low Power 10W
C1 and C2	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C3	B19/5CAAD00795	Ceramic: 1pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C4	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C5	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp coef +350 -1000ppm.
C6	B19/5CEAA01817	Electrolytic: 47uF ±20%, 50VDCW.
C8	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C9	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp coef +350 -1000ppm.
C10	B19/5CEAA01817	Electrolytic: 47uF ±20%, 50VDCW,
C12	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C13	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp coef +350 -1000ppm.
C14	B19/5CEAA01817	Electrolytic: 47uF ±20%, 50VDCW.
C20	B19/5CMAB01283	Mica: 90pF ±5%, 500VDCW. (Used in CAH-357).
C21	B19/5CMAB01443	Mica: 12pF ±5%, 500VDCW. (Used in CAH-357).
C22	B19/5CMAB01351	Mica: 15pF ±5%, 500VDCW. (Used in CAH-357).
C23	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.(Used in CAH-357).
C24	B19/5CAAH00022	Mica: 18pF ±5%, 100VDCW. (Used in CAH-357).
C25	B19/5CAAH00022	Mica: 18pF ±5%, 100VDCW. (Used in CAH-357).
C26 and C27	B19/5CMAB01283	Mica: 90pF ±5%, 500VDCW. (Used in CAH-357).
C28	B19/5CMAB01124	Mica: 3pF ±0.25pF, 500VDCW. (Used in CAH-357).
C30	B19/5CMAB01283	Mica: 90pF ±5%, 500VDCW. (Used in CAH-357).
C31	B19/5CMAB01351	Mica: 15pF ±5%, 500VDCW. (Used in CAH-357).
C32	B19/5CMAB01443	Mica: 12pF ±5%, 500VDCW. (Used in CAH-357).
C33	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.(Used in CAH-357).
C34	B19/5CAAH00022	Mica: 18pF ±5%, 100VDCW. (Used in CAH-357).
C35	B19/5CAAH00022	Mica: 18pF ±5%, 100VDCW. (Used in CAH-357).
C36 and C37	B19/5CMAB01283	Mica: 90pF ±5%, 500VDCW. (Used in CAH-357).
C38	B19/5CMAB01169	Mica: 2.5pF ±0.25pF, 500VDCW. (Used in CAH-357).
C40	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C41	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp coef +350 -1000ppm.
C42	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW temp coef 0±60ppm.
C43	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp coef +350 -1000ppm.
C44	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C46 and C47	B19/5CMAB01283	Mica: 90pF ±5% 500VDCW.
C49	B19/5CMAB01397	Mica: 4pF ±0.25pF, 500VDCW.
C51	B19/5CMAB01124	Mica: 3pF ±0.25pF, 500VDCW.
C52	B19/5CMAB01113	Mica: 5pF ±0.25pF 500VDCW.
C55	B19/5CMAB01124	Mica: 3pF ±0.25pF, 500VDCW.
C61	B19/5CSAC01065	Tantalum: 0.47uF ±20%, 35VDCW.
C63	B19/5CEAA02338	Electrolytic: 220uF ±20%, 50VDCW.
C64	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C65	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm. (Used in CAH-357).
C66 thru C69	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C80 and C81	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C83 and C84	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C85	B19/5CAAD01479	Ceramic: 1000pF ±5%, 50VDCW, temp coef -330±60ppm.
C86	B19/5CEAA01817	Electrolytic: 47uF ±20%, 50VDCW.
C87	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.(Used in CAH-357).
C88	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp coef +350 -1000ppm.(Used in CAH-357).
C89	B19/5CEAA00440	Electrolytic: 22uF ±20%, 40VDCW. (Used in CAH-357).
C90	B19/5CMAB01122	Mica: 0.5pF ±0.25pF, 500VDCW.
C91	B19/5CAAD00795	Ceramic: 1pF ±0.25pF, 500VDCW,temp coef 0 ±60ppm.
C92	B19/5CAAD00798	Ceramic: 2pF ±0.25pF, 500VDCW, temp coef 0 ±60ppm.
C93	B19/5CAAD00780	Ceramic: 100pF ±5pF, 500VDCW, temp coef 0 ±60ppm.
C95	B19/5CAAD00801	Ceramic: 4pF ±0.25pF, 50VDCW, Temp coef 0 ±60ppm.
C96	B19/5CMAB01124	Mica: 3pF ±0.25pF, 500VDCW.
C97	B19/5CMAB01124	Mica: 3pF ±0.25pF, 500VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
		---------- DIODES ----------
CD1 and CD2	B19/5TXAA00313	Silicon, (Schottky Barrier); sim to NEC 1SS97 (2).
CD3	B19/5TXAR00051	Silicon, fast recovery. (RF Switch); sim to Mitsubishi MI407.
CD4	B19/5TXAR00051	Silicon, fast recovery. (RF Switch); sim to Mitsubishi MI407 (Used in CAH-357).
CD6 and CD7	B19/5TXAR00041	Silicon, fast recovery. (RF Switch); sim to Mitsubishi MI308.
CD9	B19/5TXAR00041	Silicon, fast recovery. (RF Switch); sim to Mitsubishi MI308.
CD10	B19/5TXAA00402	Zener; sim to NEC RD6.8MB.
CD11	B19/5TXAD00356	Silicon, fast recovry, (2 diodes in series); sim to Toshiba 1SS181.
CD12	B19/5TZAA00104	Ceramic Varistor: Limit voltage 38 to 135V; sim to Sanken SNR-220KD10.
CD13	B19/5TXAM00019	Silicon, fwd current 3A 200PIV; sim to MOTOROLA MR751.
		---------- HYBRID CIRCUITS ----------
HC1	B19/5DDAB00273	RF Power Amplifier; sim to Mitsubishi M57792-21.
		---------- JACKS ----------
J1	B19/5JWCL00045	Connector RF.
J2	B19/5JJBL00025	Connector RF.
J3	B19/5JJBL00026	Connector RF.
J5	B19/5JTCW00060	Terminal.
		---------- COILS ----------
L2 and L3	B19/6LAFD01129	Coil, RF.
L11	B19/6LAFD01114	Coil, RF.(Used in CAH-357).
L12	B19/6LALD00030	Coil, RF.(Used in CAH-357).
L13 and L21	B19/6LAFD01114	Coil, RF.(Used in CAH-357).
L22	B19/6LALD00030	Coil, RF.(Used in CAH-357).
L23	B19/6LAFD01114	Coil, RF.(Used in CAH-357).
L30	B19/6LALD00028	Coil, RF.(Used in CAH-357).
L30	B19/6LALD00029	Coil, RF.(Used in CAH-293).
		---------- CABLES ----------
PC2	B19/6PCLD00027	Printed circuit board.
PC3	B19/6PCLD00028	Printed circuit board.
PC4	B19/6PCLD00041	Printed circuit board.
		---------- RESISTORS ----------
R1	B19/5REAG02210	Metal film: 2.2 ohms ±5%, 200VDCW, 1/8W.
R2 and R3	B19/5REAG01741	Metal film: 1.8K ohms ±5%, 200VDCW, 1/8W.
R4	B19/5REAG01743	Metal film: 2.7K ohms ±5%, 200VDCW, 1/8W.
R20	B19/5REAG00014	Metal film: 100 ohms ±5%, 200VDCW, 2W.(Used in CAH-357).
R21	B19/5RZAB01038	Metal film: 100 ohms 30W, DC to 1 GHz.(Used in CAH-357).
R40	B19/5REAG01724	Metal film: 68 ohms ±5%, 350VDCW, 1/8W.
R41	B19/5REAG01723	Metal film: 56 ohms ±5%, 350VDCW, 1/8W.
R42	B19/5REAG01726	Metal film: 100 ohms ±5%, 350VDCW, 1/8W.
R43 and R44	B19/5REAG01724	Metal film: 68 ohms ±5%, 200VDCW, 1/8W.
R45	B19/5REAG01745	Metal film: 3.9K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-357).
R45	B19/5REAG01743	Metal film: 2.7K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-293).
R46	B19/5REAG01758	Metal film: 47K ohms ±5%, 200VDCW, 1/8W
R47	B19/5REAG01440	Metal film: 270 ohms ±5%, 350VDCW, 2W.
R60	B19/5RDAA01541	Metal film: 470 ohms ±5%, 500VDCW, 1/4W.
R61	B19/5RDAA01543	Metal film: 220 ohms ±5%, 200VDCW, 1/4W.
R62	B19/5REAG02241	Metal film: 3.3 ohms ±5%, 200VDCW, 1/8W.
R63	B19/5RXAE00028	Posistor: 2.2K ohms (Used in CAH-357).
R64	B19/5REAG01756	Metal film: 33K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-357).
R65	B19/5REAG01731	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.(Used in CAH-357).
R66	B19/5REAG01738	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-357).
R66	B19/5REAG01742	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-293).
R67	B19/5REAG01750	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R68	B19/5REAG01730	Metal film: 220 ohms ±5%, 200VDCW, 1/8W.
R69	B19/5REAG01744	Metal film: 3.3K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-357).
R69	B19/5REAG01738	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.(Used in CAH-293).
R70	B19/5REAG01736	Metal film: 680 ohms ±5%, 200VDCW, 1/2W.
R80	B19/5REAG01743	Metal film: 2.7K ohms ±5%, 200VDCW, 1/8W.
R81	B19/5REAG01738	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.
R82	B19/5REAG02284	Metal film: 4.7 ohms ±5%, 200VDCW, 1/8W.
RV1	B19/5RVAB00277	Variable: 5K ohms ±30%, 0.1W, (Used in CAH-357).

SYMBOL	GE PART NO.	DESCRIPTION
RV1	B19/5RVAB00279	Variable: 10K ohms ±30%, 0.1W, (Used in CAH-293).
RV2	B19/5RMAB00053	Variable: 10K ohms ±30%, 0.1W,
		---------- TRANSISTORS ----------
TR1 and TR2	B19/5TZAR00014	Silicon, NPN; Power amplifier, sim to MOTOROLA MRF 846 (Used in CAH-357).
TR3	B19/5TDAR00012	Silicon, PNP; sim to NEC 2SD 1271Q
TR4	B19/5TBAR00001	Silicon, PNP; sim to Matsushita 2SB953A.
TR5	B19/5TDAB00054	Silicon, NPN; sim to NEC 2SD596-T1 (DV3).
TR6	B19/5TDAB00054	Silicon, NPN; sim to NEC 25D596-T1 (DV3).(Used in CAH-357).
TR7	B19/5TDAB00054	Silicon, NPN; sim to NEC 2SD596-T1 (DV3).
TR8	B19/5TBAB00055	Silicon, PNP; sim to NEC 2SB624 (BV3).
W1	B19/6LAFD01301	Coaxial cable.(Used in CAH-357).
	B19/CAF257	EXCITER BOARD
		---------- CAPACITORS ----------
C101 and C103	B19/5CAAD00781	Ceramic: 2200pF ±10%, 50VDCW, temp coef ±10%
C104	B19/5CAAD00787	Ceramic: 15pF ±5%, 50VDCW, temp coef 0±60ppm.
C105	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C106	B19/5CAAD00781	Ceramic: 2200pF ±10%, 50VDCW, temp coef ±10%.
C107 thru C110	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C111	B19/5CAAD00795	Ceramic: 1pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C114 thru C117	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C118	B19/5CAAD00781	Ceramic: 2200pF ±10%, 50VDCW, temp coef ±10%.
C119 and C120	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C121	B19/5CAAD00781	Ceramic: 2200pF ±10%, 50VDCW, temp coef ±10%.
C124 and C125	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C126	B19/5CAAD00781	Ceramic: 2200pF ±10%, 50VDCW, temp coef ±10%.
C127	B19/5CEAA02084	Electrolytic: 4.7uF ±20%, 35VDCW.
C128 and C129	B19/5CAAD00781	Ceramic: 2200pF ±10%, 50VDCW, temp coef ±10%.
C130	B19/5CEAA02084	Electrolytic: 4.7uF ±20%, 35VDCW.
C131	B19/5CEAA01831	Electrolytic: 1uF ±20%, 50VDCW.
C132	B19/5CEAA01982	Electrolytic: 47uF ±20%, 16VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C133	B19/5CEAA01826	Electrolytic: 10uF ±20%, 16VDCW.
C134	B19/5CAAD01056	Ceramic: 0.1uF +80 -20%, 50VDCW.
C135	B19/5CSAC00123	Tantalum: 1uF ±20%, 35VDCW.
C136 thru C138	B19/5CAAD00780	Ceramic: 100pF ±5% 50VDCW temp coef 0±60ppm.
C139	B19/5CAAD00782	Ceramic: 1000pF ±5% 50VDCW temp coef +350 -1000ppm
C140 thru C143	B19/5CAAD00780	Ceramic: 100pF ±5% 50VDCW temp coef 0±60 ppm
		---------- DIODES ----------
CD1	B19/5TXAD00290	Silicon, fast recovery (2 diodes in series); sim to Toshiba 1SS184.
		---------- FILTERS ----------
FL101	B19/5NLAT00016	RF B.P.F.: Pass band 403 to 435 MHz.
FL102 thru FL104	B19/5NLAT00017	RF B.P.F.: Pass band 806 to 870 MHz.
		---------- HYBRID CIRCUITS ----------
HC101	B19/5DHAA00020	RF Power Amplifier; sim to Mitsubishi M57775.
		--------- INTEGRATED CIRCUITS --------
IC101	B19/5DAAR00021	Linear, Positive Voltage Regulator; sim to Matsushita AN6541.
		---------- JACKS ----------
J101 and J102	B19/5JWCL00045	Connector, RF.
J104	B19/5JWBS00174	Connector, 6 pins.
		---------- COILS ----------
L102	B19/6LAFD01144	Coil, RF.
L103	B19/6LAFD01145	Coil, RF.
L105	B19/6LAFD01146	Coil, RF.
L108	B19/6LAFD01157	Coil, RF.
L111	B19/6LAFD01148	Coil, RF.
L112	B19/6LAFD01149	Coil, RF.
		---------- RESISTORS ----------
R101	B19/5RDAC02163	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.
R102	B19/5RDAC02210	Metal film: 22 ohms ±5%, 200VDCW, 1/8W.
R103	B19/5RDAC02163	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.
R104 and R105	B19/5RDAC02124	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R107	B19/5RDAC02257	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R108	B19/5RDAC02163	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R109	B19/5RDAC02158	Metal film: 8.2K ohms ±5%, 200VDCW, 1/8W.
R110	B19/5RDAC02147	Metal film: 3.3K ohms ±5%, 200VDCW, 1/8W.
R111	B19/5RDAC02226	Metal film: 82 ohms ±5%, 200VDCW, 1/8W.
R112	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R113	B19/5RDAC02257	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R114	B19/5RDAC02133	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R115	B19/5RDAC02132	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.
R116	B19/5RDAC02135	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R117	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R118	B19/5RDAC02135	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R119	B19/5RDAC02133	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R120	B19/5RDAC02132	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.
R121	B19/5RDAC02135	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R122	B19/5RDAC02137	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R123	B19/5RDAC02257	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R127	B19/5RDAC02163	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.
R128	B19/5RDAC02210	Metal film: 22 ohms ±5%, 200VDCW, 1/8W.
R129	B19/5RDAC02163	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.
R130	B19/5REAG00295	Metal film: 10 ohms ±5%, 350VDCW, 1W.
R131	B19/5REAG01951	Metal film: 6.8 ohms ±5%, 350VDCW, 2W.
R132	B19/5RDAC02132	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.
R133	B19/5RDAC02141	Metal film: 10 ohms ±5%, 200VDCW, 1/8W.
R134	B19/5RDAC02132	Metal film: 1K ohms ±5%, 200VDCW 1/8W.
		---------- TRANSISTORS ----------
TR101 and TR102	B19/5TCAB00288	Silicon, NPN; sim to NEC 2SC3356.
TR103 and TR104	B19/5TCAG00047	Silicon, NPN; sim to Matsushita 2SC3110.
TR105	B19/5TAAG00093	Silicon, PNP; sim to Toshiba 2SA1020-Y.
	B19/CMG133	SYNTHESIZER BOARD
		---------- CAPACITORS ----------
C201	B19/5CAAD01131	Ceramic: 0.047uF ±10%, 25VDCW.
C202	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW, temp coef ±10%.
C203	B19/5CEAA02119	Electrolytic: 220uF ±20%, 10VDCW.
C204 and C205	B19/5CEAA01826	Electrolytic: 10uF ±20%, 16VDCW.
C206	B19/5CAAD01131	Ceramic: 0.047uF ±10%, 25VDCW.
C207	B19/5CRAX00001	Polypropylene: 1uF ±10%, 100VDCW.
C208	B19/5CAAD01131	Ceramic: 0.047uF ±10%, 25VDCW.
C209	B19/5CRAA00680	Polypropylene: 0.1uF ±5%, 50VDCW.
C210 and C211	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C212	B19/5CAAD01131	Ceramic: 0.047uF ±10%, 25VDCW.
C213	B19/5CAAD00787	Ceramic: 15pF ±5%, 50VDCW, temp coef 0±60ppm.
C214 thru C217	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C218	B19/5CAAD00787	Ceramic: 15pF ±5%, 50VDCW, temp coef 0±60ppm.
C219	B19/5CAAD00870	Ceramic: 150pF ±5%, 50VDCW, temp coef 0±60ppm.
C220	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C221	B19/5CAAD00801	Ceramic: 4pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C222	B19/5CAAD00793	Ceramic: 27pF ±5%, 50VDCW, temp coef 0±60ppm.
C223 and C224	B19/5CAAD00794	Ceramic: 33pF ±5%, 50VDCW, temp coef 0±60ppm.
C225	B19/5CAAD00783	Ceramic: 4700pF ±10%, 50VDCW, temp coef ±10%.
C230	B19/5CAAD00868	Ceramic: 18pF ±5%, 50VDCW, temp coef 0±60ppm.
C231 and C232	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C233	B19/5CAAD00793	Ceramic: 27pF ±5%, 50VDCW, temp coef 0±60ppm.
C234	B19/5CAAD00869	Ceramic: 22pF ±5%, 50VDCW, temp coef 0±60ppm.
C235	B19/5CAAD00800	Ceramic: 5pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C236 and C237	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C238	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C239 thru C244	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C245	B19/5CAAD00787	Ceramic: 15pF ±5%, 50VDCW, temp coef 0±60ppm.
C246	B19/5CAAD00795	Ceramic: 1pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C248	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.

SYMBOL	GE PART NO.	DESCRIPTION
C249	B19/5CAAD00822	Ceramic: 8pF ±0.5pF, 50VDCW, temp coef 0±60ppm.
C250	B19/5CAAD00787	Ceramic: 15pF ±5%, 50VDCW, temp coef 0±60ppm.
C251	B19/5CAAD00868	Ceramic: 18pF ±5%, 50VDCW, temp coef 0±60DDM.
C252	B19/5CAAD00785	Ceramic: 10pF ±0.5pF, 50VDCW, temp coef 0±60ppm.
C253	B19/5CAAD00783	Ceramic: 4700pF ±10%, 50VDCW, temp coef ±10%.
C257 thru C260	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C262	B19/5CAAD00868	Ceramic: 18pF ±5%, 50VDCW, temp coef 0±60ppm.
C263 and C264	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C265 and C266	B19/5CAAD00869	Ceramic: 22pF ±5%, 50VDCW, temp coef 0±60ppm.
C267	B19/5CAAD00800	Ceramic: 5pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C268	B19/5CAAD01131	Ceramic: 0.047uF ±10%, 25VDCW.
C269 and C270	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C271	B19/5CAAD00869	Ceramic: 22pF ±5%, 50VDCW, temp coef 0±60ppm.
C272 and C273	B19/5CAAD00795	Ceramic: 1pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C274	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C276	B19/5CEAA01982	Electrolytic: 47uF ±20%, 16VDCW.
C279	B19/5CEAA01826	Electrolytic: 10uF ±20%, 16VDCW.
C280	B19/5CRAA00576	Metalized Plastic 0.1uF ±5% 50VDCW.
C281 thru C283	B19/5CEAA01827	Electrolytic: 100uF ±20%, 16VDCW.
C284 thru C286	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C287	B19/5CAAD01131	Ceramic: 0.047uF ±10%, 25VDCW.
C288	B19/5CAAD00784	Ceramic: 12pF ±5%, 50VDCW, temp coef 0±60ppm.
C296	B19/5CAAD00797	Ceramic: 470pF ±5%, 50VDCW, temp coef 0±60ppm.
C297	B19/5CAAD00800	Ceramic: 5pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C298 thru C2102	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C2104	B19/5CSAC00982	Tantalum: 1uF ±20%, 35VDCW.
C2105 thru C2107	B19/5CAAD00780	Ceramic: 100pF ±10% 50VDCW, temp coef 0±60ppm.
C2108	B19/5CAAD00787	Ceramic: 15pF ±10%, 50VDCW, temp coef 0±60ppm.

SYMBOL	GE PART NO.	DESCRIPTION
C2111	B19/5CEAA02206	Tantalum: 0.1uF ±20%, 35VDCW.
C2112	B19/5REAG00590	Metal film: 0 ohm.
		---------- DIODES ----------
CD201 thru 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 thru CD208	B19/5TXAE00170	Silicon, Variable Capacitance Diodes; sim to Hitachi 1SV68.
CD211	B19/5TXAA00326	Silicon. (Schottky Barrier); sim to NEC 1SS97.
CD212	B19/5TXAE00453	Silicon. Variable Capacitance Diode sim to Hitachi 1SV136.
CD213 thru CD216	B19/5TXAE00170	Silicon, Variable Capacitance Diodes; sim to Hitachi 1SV68.
CD217	B19/5TXAE00230	Silicon, fast recovery Swittching; sim to Hitachi 1SS110.
CD219	B19/5TXAA00326	Silicon. (Schottky Barrier); sim to NEC 1SS97.
CD227	B19/5TXAD00320	Silicon, fast recovery (2 diodes in series); sim to Toshiba 1SS226.
		---------- CAPACITORS ----------
CV201	B19/5CVAD00165	Variable: 10PF max.
CV202	B19/5CVAD00165	Variable: 10PF max.
		---------- FILTERS ----------
FL201 and FL202	B19/5NLAT00014	RF B.P.F.: Pass Band 384 to 430MHz.
		--------- INTEGRATED CIRCUITS --------
IC201	B19/5DAAJ00328	Synthesizer: C MOS serial input.
IC202	B19/5DDAT00206	Prescaler; sim to Fujitsu MB501P.
IC203	B19/5DAAN00016	Linear, Dual Comparator; sim to NJRC NJM2903D.
IC204 and IC205	B19/5DAAJ00359	Digital, Bilateral switch; sim to Motorola MC14066.
IC206	B19/5DAAR00021	Linear, Positive Voltage Regulator; sim to Matsushita AN6541.
		---------- JACKS ----------
J201 thru J204	B19/5ZJTL00001	Crystal socket.
J205	B19/5JWBS00173	Connector, 20 pins.
J206 and J207	B19/5JWCL00045	Connector, RF.
J208	B19/5JWBS00174	Connector, 6 pins.
		---------- COILS ----------
L201	B19/5LAAC00052	Coil, RF.

SYMBOL	GE PART NO.	DESCRIPTION
L202 and L203	B19/5LCAB00012	Coil, RF: 1uH ±10%.
L204 and L205	B19/5LCAC00174	Coil, RF: 0.68uH ±10%.
L208	B19/5LAAC00049	Coil, RF.
L209	B19/5LCAC00156	Coil, RF: 1.5uH ±10%.
L210	B19/5LCAB00012	Coil, RF: 1uH ±10%.
L211	B19/5LAAC00051	Coil, RF.
L212 and L213	B19/5LAAC00052	Coil, RF.
L214 and L215	B19/5LCAB00012	Coil, RF: 1uH ±10%.
L216 thru L218	B19/5LCAC00174	Coil, RF: 0.68uH ±10%.
L220	B19/5LAAC00047	Coil, RF.
L221	B19/5LCAC00156	Coil, RF: 1.5uH ±10%.
L222	B19/5LCAB00012	Coil, RF: 1uH ±10%.
L223	B19/5LAAC00051	Coil, RF.
L226	B19/5LAAC00050	Coil, RF.
		---------- RESISTORS ----------
R201	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R202	B19/5REAG00619	Metal film: 22 ohms ±5%, 200VDCW, 1/8W.
R203	B19/5REAG00594	Metal film: 220 ohms ±5%, 200VDCW, 1/8W.
R204	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R205 and R206	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R207 and R208	B19/5REAG00619	Metal film: 22 ohms ±5%, 200VDCW, 1/8W.
R209	B19/5REAG00593	Metal film: 470K ohms ±5%, 200VDCW, 1/8W.
R210	B19/5REAG00596	Metal film: 15K ohms ±5%, 200VDCW, 1/8W.
R211	B19/5REAG00577	Metal film: 6.8K ohms ±5%, 200VDCW, 1/8W.
R212	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R213	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R214	B19/5REAG00597	Metal film: 330 ohms ±5%, 200VDCW, 1/8W.
R215	B19/5REAG00589	Metal film: 3.3K ohms ±5%, 200VDCW, 1/8W.
R216	B19/5REAG00574	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R217	B19/5REAG00596	Metal film: 15K ohms ±5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R218	B19/5REAG00597	Metal film: 330 ohms ±5%, 200VDCW, 1/8W.
R219	B19/5REAG00589	Metal film: 3.3K ohms ±5%, 200VDCW, 1/8W.
R220	B19/5REAG00577	Metal film: 6.8K ohms ±5%, 200VDCW, 1/8W.
R221	B19/5REAG00596	Metal film: 15K ohms ±5%, 200VDCW, 1/8W.
R222	B19/5REAG00631	Metal film: 220K ohms ±5%, 200VDCW, 1/8W.
R223	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R224	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R225	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R226	B19/5REAG00574	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R227	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R228	B19/5REAG00587	Metal film: 100K ohms ±5%, 200VDCW, 1/8W.
R229 and R230	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R231	B19/5REAG00572	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.
R232	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R235	B19/5REAG00596	Metal film: 15K ohms ±5%, 200VDCW, 1/8W.
R236	B19/5REAG00572	Metal film: 1K ohms ±5%, 200VDCW, 1/8W.
R238	B19/5REAG00621	Metal film: 68 ohms ±5%, 200VDCW, 1/8W.
R239	B19/5REAG00625	Metal film: 5.6K ohms ±5%, 200VDCW, 1/8W.
R240	B19/5REAG00574	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R241 and R242	B19/5REAG00583	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R243	B19/5REAG00620	Metal film: 33 ohms ±5%, 200VDCW, 1/8W.
R244	B19/5REAG00583	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R245	B19/5REAG00623	Metal film: 2.7K ohms ±5%, 200VDCW, 1/8W.
R246	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R247	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R248 and R249	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R250	B19/5REAG00594	Metal film: 220 ohms ±5%, 200VDCW, 1/8W.
R251	B19/5REAG00597	Metal film: 330 ohms ±5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R252	B19/5REAG00618	Metal film: 15 ohms ±5%, 200VDCW, 1/8W.
R253	B19/5REAG00597	Metal film: 330 ohms ±5%, 200VDCW, 1/8W.
R254	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R255	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R260	B19/5REAG00596	Metal film: 15K ohms ±5%, 200VDCW, 1/8W.
R262	B19/5REAG00621	Metal film: 68 ohms ±5%, 200VDCW, 1/8W.
R263	B19/5REAG00625	Metal film: 5.6K ohms ±5%, 200VDCW, 1/8W.
R264	B19/5REAG00574	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R265	B19/5REAG00583	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R266	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R267	B19/5REAG00621	Metal film: 68 ohms ±5%, 200VDCW, 1/8W.
R268	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R274	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R276	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R277	B19/5REAG00577	Metal film: 6.8K ohms ±5%, 200VDCW, 1/8W.
R278	B19/5REAG00592	Metal film: 33K ohms ±5%, 200VDCW, 1/8W.
R279	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R283	B19/5REAG00597	Metal film: 330 ohms ±5%, 200VDCW, 1/8W.
R288 and R289	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R293	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R294	B19/5REAG00618	Metal film: 15 ohms ±5%, 200VDCW, 1/8W.
RV201 and RV202	B19/5RVAB00279	Variable: 10K ohms ±30%, 0.1W.
		---------- TRANSISTORS ----------
TR201 and TR202	B19/5TBAB00055	Silicon, PNP; sim to NEC 2SB624(BV3).
TR203 and TR204	B19/5TDAB00054	Silicon, NPN; sim to NEC 2SD596 (DV3).
TR205	B19/5TBAB00055	Silicon, PNP; sim to NEC 2SB624 (BV3).
TR206 and TR207	B19/5TCAG00047	Silicon, NPN; sim to Matsushita 2SC3110.
TR208 and TR209	B19/5TCAZ00011	Silicon, NPN; sim to Sanyo 2SC3398.
TR210	B19/5TKAH00002	N-channel, field effect. (Junction Single Gate); sim to Sony 2SK125.
TR211	B19/5TCAG00047	Silicon, NPN; sim to Matsushita 2SC3110.
TR212 and TR213	B19/5TCAZ00011	Silicon, NPN; sim to Sanyo 2SC3398.
TR214 and TR215	B19/5TCAG00047	Silicon, NPN; sim to Matsushita 2SC3110.
TR216 and TR217	B19/5TCAZ00011	Silicon, NPN; sim to Sanyo 2SC3398.
TR220	B19/5TKAH00002	N-channel, field effect. (Junction Single Gate); sim to Sony 2SK125.
TR221	B19/5TCAG00047	Silicon, NPN; sim to Matsushita 2SC3110.
TR222	B19/5TCAZ00011	Silicon, NPN; sim to Sanyo 2SC3398.
TR224	B19/5TDAB00054	Silicon, NPN; sim to NEC 2SD596 (DV3).
		--------- CRYSTAL OSCILLATORS --------
XU201	B19/6XNFD00010	Reference Oscillator unit.
	B19/CMA-240	RECEIVER BOARD
		---------- CAPACITORS ----------
C401 and C402	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C403	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C404	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp coef 0±60ppm.
C502	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C503 and C504	B19/5CAAD00801	Ceramic: 4pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C505	B19/5CAAD00977	Ceramic: 7pF ±0.5pF, 50VDCW, temp coef 0±60ppm.
C506	B19/5CAAD00800	Ceramic: 5pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C511	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C512 and C513	B19/5CAAD00801	Ceramic: 4pF ±0.25pF, 50VDCW, temp coef 0±60ppm.
C514	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C515	B19/5CAAD00787	Ceramic: 15pF ±5%, 50VDCW, temp coef 0±60ppm.
C516	B19/5CSAC00988	Tantalum: 0.22uF ±20%, 35VDCW.
C517	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C518	B19/5CSAC00982	Tantalum: 1uF ±20%, 35VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C519	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW, temp coef ±10%.
C520	B19/5CSAC00988	Tantalum: 0.22uF ±20%, 35VDCW.
C521 and C522	B19/5CSAC01068	Tantalum: 0.1uF ±20%, 35VDCW.
C523	B19/5CAAD00864	Ceramic: 47pF ±5%, 50VDCW, temp coef 0±60ppm.
C524	B19/5CEAA01816	Electrolytic: 47uF ±20%, 25VDCW.
C526 and C527	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C528 and C531	B19/5CEAA01816	Electolytic: 47uF ±20%, 25VDCW.
C532 and C533	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C534	B19/5CEAA01816	Electolytic: 47uF ±20%, 25VDCW.
C535 thru C542	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C543 and C544	B19/5CAAD00783	Ceramic: 4700pF ±10%, 50VDCW, temp coef ±10%
		---------- DIODES ----------
CD501	B19/5TXAD00290	Silicon: Fast recovery 2 diodes with cathode common: Sim to Toshiba 1SS184.
		---------- FILTERS ----------
FL401 and FL402	B19/5NBAH00023	Dielectric RF filter.
FL403	B19/5NBAH00024	Dielectric RF filter.
FL501	B19/5XHAA00780	Crystal filter: 82.2MHz; 4pole, 2 coupled-dual crystals.
FL502	B19/5XHAA00781	Crystal filter: 82.2MHz; 2 pole, coupled-dual crystals.
FL503	B19/5NRAA00094	Ceramic filter: 455KHz; sim to MURATA CFW455E
FL504	B19/5NRAA00041	Ceramic filter: 455KHz; sim to MURATA CFU455B2
		---------- HYBRID CIRCUITS ----------
HC401	B19/6DHDD00191	Linear, RF Amplifier: sim to JRC DHDD191.
HC402	B19/6DHFD00166	Linear, Mixer: sim to JRC DHFD166.
HC403	B19/6DHFD00159	Linear, RF Amplifier: sim to JRC DHFD159.
HC404	B19/6DHDD00191	Linear, RF Amplifier: sim to JRC DHDD191.
HC501	B19/6DHDD00188	Linear, 2'nd Mixer: sim to JRC DHDD188.
		--------- INTEGRATED CIRCUITS --------
IC501	B19/5DDAS00074	Linear, IF Amplifier & Detector; sim to Motorola MC3359P.

SYMBOL	GE PART NO.	DESCRIPTION
IC502	B19/5DAAR00021	Linear, Positive Voltage Regulator; sim to Matsushita AN6541.
		---------- JACKS ----------
J401	B19/5JJBL00025	Connector, RF.
J402	B19/5JWCL00045	Connector, RF.
J501	B19/5JWBS00178	Connector, 10 pins.
		---------- COILS ----------
L501 thru L505	B19/6LADD00553	Coil, RF.
L506	B19/6LADD00554	Coil, RF.
L507	B19/5LCAC00165	Choke coil: 0.22 H ±10%.
L508	B19/6LAFD00877	Coil, RF.
		---------- RESISTORS ----------
R400	B19/5REAG00590	Metal film: 0 ohm.
R401 and R402	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW. 1/8W.
R403	B19/5REAG00618	Metal film: 15 ohms ±5%, 200VDCW, 1/8W.
R404	B19/5REAG00585	Metal film: 1.2K ohms ±5%, 200VDCW, 1/8W.
R405	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R406 and R407	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R408	B19/5REAG00907	Metal film: 12 ohms ±5%, 200VDCW, 1/8W.
R409	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R410	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R411	B19/5REAG00907	Metal film: 12 ohms ±5%, 200VDCW, 1/8W.
R412	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R413	B19/5REAG00908	Metal film: 180 ohms ±5%, 200VDCW, 1/8W.
R414	B19/5REAG00620	Metal film: 33 ohms ±5%, 200VDCW, 1/8W.
R415	B19/5REAG00908	Metal film: 180 ohms ±5%, 200VDCW, 1/8W.
R500	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R501	B19/5REAG00577	Metal film: 6.8K ohms ±5%, 200VDCW, 1/8W.
R502	B19/5REAG00584	Metal film: 8.2K ohms ±5%, 200VDCW, 1/8W.
R511	B19/5REAG00630	Metal film: 150K ohms +5%, 200VDCW, 1/8W.
R512	B19/5REAG00621	Metal film: 68 ohms +5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R513 and R514	B19/5REAG00584	Metal film: 8.2K ohms ±5%, 200VDCW, 1/8W.
R515	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R516	B19/5REAG00574	Metal film: 1.5K ohms ±5%, 200VDCW, 1/8W.
R517	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R518	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R519	B19/5REAG00594	Metal film: 220 ohms ±5%, 200VDCW, 1/8W.
R520	B19/5REAG00589	Metal film: 3.3K ohms ±5%, 200VDCW, 1/8W.
R521	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R522	B19/5REAG00579	Metal film: 470 ohms ±5%, 200VDCW, 1/8W.
R523	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R524	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R525	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R526	B19/5REAG00590	Metal film: 0 ohms, 1/8W.
R527	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R528	B19/5REAG00594	Metal film: 220 ohms ±5%, 200VDCW, 1/8W.
RV501	B19/5RVAB00275	Variable: 2K ohms.
		---------- TRANSISTORS ----------
TR501	B19/5TCAB01107	Silicon, NPN; sim to NEC 2SC2223.
TR502 and TR503	B19/5TDAB00054	Silicon, NPN; sim to NEC 2SD596.
		---------- CRYSTALS ----------
X501	B19/5XHAA00782	Quartz crystal: 82.655MHz.
		---------- SOCKETS ----------
XS501-A and XS501-B	B19/5ZJDF00001	Crystal socket.
	B19/CMC-417	SYSTEM CONTROL BOARD
		---------- CAPACITORS ----------
C601	B19/5CRAA00617	Polyester: 0.1uF ±5%, 50VDCW.
C602	B19/5CAAD00785	Ceramic: 10pF ±0.5pF, 50VDCW, temp comf 0±60ppm.
C603	B19/5CAAD00793	Ceramic: 27pF ±5%, 50VDCW, temp comf 0±60ppm.
C605	B19/5CEAA01786	Electrolytic: 220uF ±20%, 25VDCW.
C606 thru C625	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp comt 0±60ppm.

SYMBOL	GE PART NO.	DESCRIPTION
C626 thru C628	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW, temp comf ± 10%.
C629	B19/5CSAC00939	Tantalum: 22uF ±20%, 16VDCW.
C630	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW, temp comf ±10%.
C631	B19/5CAAD00780	Ceramic: 100pF ±5%, 50VDCW, temp comf 0±60ppm.
C632	B19/5CAAD01237	Ceramic: 0.1uF ±10%, 25VDCW, temp comf ±15%.
C633	B19/5CSAC00982	Tantalum: 1uF ±20%, 35VDCW.
C634	B19/5CSAC00932	Tantalum: 10uF ±20%, 16VDCW.
C636	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW temp coef ±10%.
C637	B19/5CSAC00932	Tantalum: 10uF ±20%, 16VDCW.
C638	B19/5CAAD00878	Ceramic: 1000pF ±10%, 50VDCW, temp coef +350 -1000ppm.
C639	B19/5CSAC01069	Tantalum: 2.2uF ±20%, 35VDCW.
C640	B19/5CEAA01920	Electrolytic: 10uF ±20%, 16VDCW.
C641	B19/5CAAD00797	Ceramic: 470pF ±5%, 50VDCW, temp coef 0±60ppm.
C642	B19/5CSAC01065	Tantalum: 0.47uF ±20%, 35VDCW.
C643	B19/5CEAA01920	Electrolytic: 10uF ±20%, 16VDCW.
C644	B19/5CAAD00793	Ceramic: 27pF ±5%, 50VDCW, temp coef 0±60ppm.
C645	B19/5CAAD00794	Ceramic: 33pF ±5%, 50VDCW, temp coef 0±60ppm.
C646	B19/5CSAC00939	Tantalum: 22uF ±20%, 16VDCW.
C647	B19/5CRAA00804	Polyester: 0.033uF ±5%, 50VDCW.
C648	B19/5CRAA00587	Polyester: 0.01uF ±10%, 50VDCW.
C649	B19/5CAAD01237	Ceramic: 0.1uF ±10%, 25VDCW, temp coef ±15%.
C650	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW, temp coef ±10%.
C651 and C652	B19/5CRAA00617	Polyester: 0.1uF ±5%, 50VDCW.
C653 and C654	B19/5CEAA01827	Electrolytic: 100uF ±20%, 16VDCW.
C655	B19/5CEAA01982	Electrolytic: 47uF ±20%, 16VDCW.
C656 and C657	B19/5CEAA01827	Electrolytic: 100uF ±20%, 16VDCW.
C658 and C659	B19/5CRAA00617	Polyester: 0.1uF ±5%, 50VDCW.
C660 and C661	B19/5CAAD01237	Ceramic: 0.1uF ±10%, 25VDCW, temp coef ±15%
C662	B19/5CRAA00628	Polyester: 0.047uF ±5%, 50VDCW.
C663 thru C669	B19/5CAAD01237	Ceramic: 0.1uF ±10%, 25VDCW, temf ±15%.
C670	B19/5CAAD00869	Ceramic: 22pF ±5%, 50VDCW, temp coef 0±60ppm.

SYMBOL	GE PART NO.	DESCRIPTION
C674 and C675	B19/5CSAC00985	Tantalum: 1uF ±20%, 35VDCW.
C678 thru C684	B19/5CSAC00985	Tantalum: 1uF ±20%, 35VDCW.
C685	B19/5CAAD01237	Ceramic: 0.1uF ±10%, 25VDCW, temp comf ±15%.
C687	B19/5CAAD00782	Ceramic: 1000pF ±5%, 50VDCW, temp comf +350 -1000ppm.
C689 and C690	B19/5CSAC00985	Tantalum: 1uF ±20%, 35VDCW.
C692	B19/5CAAD00789	Ceramic: 0.01uF ±10%, 50VDCW, temp comf ±10%.
C693	B19/5CEAA01816	Electrolytic: 47uF ±20%, 25VDCW.
C694	B19/5CAAD01237	Ceramic: 0.1uF ±10%, 25VDCW, temp comf ±15%.
C695	B19/5CHAD00056	Metalized Polyester: 0.1uF ±20%, 63VDCW.
C696	B19/5CRAA00816	Polyester: 0.022uF ±10%
		---------- DIODES ----------
CD601 thru CD609	B19/5TXAD00330	Silicon, fast recovery (2 diodes in series); sim to Toshiba 1SS226.
CD610	B19/5TZAD00020	Diode, Optoelectronic: red, sim to Toshiba TLR 102A.
CD611	B19/5TXAD00330	Silicon, fast recovery (2 diodes in series); sim to Toshiba 1SS226.
		--------- INTEGRATED CIRCUITS --------
IC601	B19/5DDAK00331	Sim to INTEL TP8032AH
IC602-1 and IC602-2	B19/5DDBY00038	Sim to XICOR X2404PI
IC603	B19/5DDAL00183	Sim to TI SN74LS138N
IC604	B19/5DDAL00347	Sim to TI SN74LS373N
IC605	B19/5DDAB00279	Sim to MITSUBISHI M5L27256K
IC606	B19/5DAAG00106	Sim to HITACHI HM6116LP-3
IC607	B19/5DDEL00001	Sim to MEC 19A704727P2
IC608	B19/5DDAL00189	Sim to TI SN74LS273N
IC609	B19/5DDAL00125	Sim to TI SN74LS02N
IC610	B19/5DDAF00113	Sim to HITACHI HD7406P
IC611	B19/5DAAN00006	Sim to NJRC NJM2901N
IC612	B19/5DAAN00041	Sim to NJRC NJM4560D
IC613	B19/5DAAN00085	Sim to NJRC NJM3403AD
IC614	B19/5DDAS00052	Sim to MOTOROLA MC14053BCP
IC615	B19/5DHAR00047	Sim to MURATA AFM14F7500C1
IC616	B19/6DHFD00167	Sim to MURATA DHFD167
IC617	B19/5DZEA00001	Sim to SEIKO EPSON STC9140F
IC618	B19/5DAAN00049	Linear, Timing Circuit; sim to NJRC NJM555D

SYMBOL	GE PART NO.	DESCRIPTION
IC619	B19/5DAAA00233	Linear, Audio Amplifier; sim to NEC uPC1230H2.
IC620 and IC621	B19/5DAAD00082	Linear, Positive Voltage Regulator; sim to Toshiba TA78005AP.
IC622	B19/5DAAR00021	Linear, Positive Voltage Regulator; sim to Matsushita AN6541.
ICS 602-1 and ICS 602-2	B19/5ZJAB00033	IC Sockets.
ICS605	B19/5ZJAB00028	IC Sockets.
		---------- JACKS ----------
J601 thru J603	B19/5JTCA00137	Contact, electrical.
J606	B19/5JDAG00152	Connector.
J702	B19/5JWBS00179	Connector, 22 pins.
J703	B19/5JWBS00173	Connector, 20 pins.
J704	B19/5JWBS00178	Connector, 10 pins.
J705	B19/5JWBS00176	Connector, 4 pins.
J706	B19/5JWCL00045	Connector RF.
		---------- PLUGS ----------
P601 thru P603	B19/5JDAN00012	Receptacle: 2 position, shorting, rated at 1 amp; sim to Honda DIC-S252.
		---------- RESISTORS ----------
R601 and R602	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R605 and R606	B19/5RDAC02420	Metal film: 10K ohms ±1%, 200VDCW, 1/8W.
R607	B19/5RDAC02527	Metal film: 12.4K ohms ±5%, 200VDCW, 1/8W.
R608	B19/5RDAC02528	Metal film: 4.99K ohms ±5%, 200VDCW, 1/8W.
R609	B19/5REAG00587	Metal film: 100K ohms ±5%, 200VDCW, 1/8W.
R610	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R611	B19/5REAG00631	Metal film: 220K ohms ±5%, 200VDCW, 1/8W.
R612	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R613	B19/5RZAB00136	Quad Resistor array: 10K ohms ±5%, 1/8W.
R614	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R616	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R617	B19/5REAG00772	Metal film: 1M ohms ±5%, 200VDCW, 1/8W.
R618 thru R620	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R621 thru R624	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R631	B19/5REAG00580	Metal film: 47 ohms ±5%, 200VDCW, 1/8W.
R632 and R633	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R634	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R635	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R636	B19/5REAG00585	Metal film: 1.2K ohms ±5%, 200VDCW, 1/8W.
R637 and R638	B19/5REAG00591	Metal film: 680 ohms ±5%, 200VDCW, 1/8W.
R639	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R640	B19/5REAG00626	Metal film: 27K ohms ±5%, 200VDCW, 1/8W.
R642 and R643	B19/5RDAC02420	Metal film: 10K ohms ±1%, 200VDCW, 1/8W.
R644	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R645	B19/5REAG00617	Metal film: 10 ohms ±5%, 200VDCW, 1/8W.
R646	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R647	B19/5REAG01757	Metal film: 39K ohms ±5%, 200VDCW, 1/8W.
R648	B19/5REAG00587	Metal film: 100K ohms ±5%, 200VDCW, 1/8W.
R649	B19/5REAG00629	Metal film: 120K ohms ±5%, 200VDCW, 1/8W.
R650	B19/5REAG00587	Metal film: 100K ohms ±5%, 200VDCW, 1/8W.
R651	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R652	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R653	B19/5REAG00772	Metal film: 1M ohms ±5%, 200VDCW, 1/8W.
R654	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R655	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R656 thru R658	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R659	B19/5REAG00592	Metal film: 33K ohms ±5%, 200VDCW, 1/8W.
R660 and R661	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R662	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R663 and R664	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R665	B19/5REAG00772	Metal film: 1M ohms ±5%, 200VDCW, 1/8W.
R666	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R667	B19/5REAG00772	Metal film: 1M ohms ±5%, 200VDCW, 1/8W.
R668 and R669	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R670	B19/5REAG00633	Metal film: 680K ohms ±5%, 200VDCW, 1/8W.
R671	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R672	B19/5REAG00571	Metal film: 560 ohms ±5%, 200VDCW, 1/8W.
R673	B19/5REAG00681	Metal film: 12K ohms ±5%, 200VDCW, 1/8W.
R674	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R675	B19/5REAG00772	Metal film: 1M ohms ±5%, 200VDCW, 1/8W.
R676	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R677	B19/5REAG00583	Metal film: 150 ohms ±5%, 200VDCW, 1/8W.
R678	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R679 thru R682	B19/5RDAC02223	Metal film: 2.2 ohms ±5%, 200VDCW, 1/8W.
R683	B19/5REAG00879	Metal film: 82K ohms ±5%, 200VDCW, 1/8W.
R684	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R685	B19/5REAG00622	Metal film: 270 ohms ±5%, 200VDCW, 1/8W.
R686	B19/5REAG00592	Metal film: 33K ohms ±5%, 200VDCW, 1/8W.
R687	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R688	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R689	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R690	B19/5REAG00573	Metal film: 4.7K ohms ±5%, 200VDCW, 1/8W.
R691 and R692	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R693	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R694	B19/5REAG00581	Metal film: 22K ohms ±5%, 200VDCW, 1/8W.
R695	B19/5REAG00589	Metal film: 3.3K ohms ±5%, 200VDCW, 1/8W.

SYMBOL	GE PART NO.	DESCRIPTION
R696	B19/5REAG00578	Metal film: 47K ohms ±5%, 200VDCW, 1/8W.
R697	B19/5REAG00630	Metal film: 150K ohms ±5%, 200VDCW, 1/8W.
R698 thru R701	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R702	B19/5REAG00575	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R705	B19/5REAG00593	Metal film: 470K ohms ±5%, 200VDCW, 1/8W.
R706	B19/5REAG01742	Metal film: 2.2K ohms ±5%, 200VDCW, 1/8W.
R707	B19/5REAG00577	Metal film: 6.8K ohms ±5%, 200VDCW, 1/8W.
R708	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W.
R709	B19/5REAG00585	Metal film: 1.2K ohms ±5%, 200VDCW, 1/8W.
R710	B19/5REAG00596	Metal film: 15K ohms ±5%, 200VDCW, 1/8W.
R712 thru R715	B19/5REAG00586	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R716 thru R718	B19/5REAG01726	Metal film: 100 ohms ±5%, 200VDCW, 1/8W.
R719	B19/5REAG00587	Metal film: 100K ohms ±5%, 200VDCW, 1/8W
R720	B19/5REAG00576	Metal film: 10K ohms ±5%, 200VDCW, 1/8W
RV601 and RV602	B19/5RVAB00279	Variable: 10K ohms ±30%, 0.1W.
RV603	B19/5RVAB00276	Variable: 100K ohms ±30%, 0.1W.
		---------- TRANSISTORS ----------
TR601	B19/5TDAB00055	Silicon, NPN; sim to NEC 2SD596 (DV3).
TR602 thru TR604	B19/5TCBC00014	Silicon, NPN; sim to Sanyo 2SC3398.
TR605	B19/5TDAB00055	Silicon, NPN; sim to NEC 2SD596 (DV3).
TR606 thru TR609	B19/5TCBC00014	Silicon, NPN; sim to Sanyo 2SC3398.
TR610 and TR611	B19/5TDAB00055	Silicon, NPN; sim to NEC 2SD596 (DV3).
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X601	B19/5XHAA00830	Crystal: F=11.0592MHz.
X602	B19/5XHAA00831	Crystal: F=8.000MHz.
		---------- SOCKETS ----------
XS601-1 and XS601-2	B19/5ZJDF00001	Crystal Socket.
XS601-3	B19/5XHAA00747	Silicon Dumper.
XS602-1 and XS602-2	B19/5ZJDF00001	Crystal Socket.
XS602-3	B19/5XHAA00747	Silicon Dumper.
	CFQ-2559	INTERFACE BOARD
		---------- CAPACITORS ----------
C701	B19/5CBAB00760	Ceramic: Feed Thru Type 1000pF -0 +200%, 50VDCW.
C801 thru C808	B19/5CAAD00838	Ceramic: 1000pF ±10%, 50VDCW, temp coef ±15%.
C809	B19/5CAAD01325	Ceramic: 100pF ±10%, 50VDCW, temp coef 0±30ppm.
C810 thru C819	B19/5CAAD00838	Ceramic: 1000pF ±10%, 50VDCW, temp coef ±15%.
C820 thru C824	B19/5CAAD01325	Ceramic: 100pF ±10%, 50VDCW, temp coef 0±30ppm.
C825	B19/5CEAA01813	Electrolytic: 100uF ±20%, 25VDCW.
C826	B19/5CAAD01325	Ceramic: 100pF ±10%, 50VDCW, temp coef 0±30ppm.
C827	B19/5CAAD00838	Ceramic: 1000pF ±10%, 50VDCW, temp coef ±15%.
		---------- CONNECTORS ----------
J801	B19/5JCAP00006	Connector; sim to SMK CSC5033-0301R.
J803	B19/5JWBS00175	Connector 22 pins.
		---------- RESISTORS ----------
R801 thru R807	B19/5REAG00586	Metal film: 100 ohms ±5%, 200DVCW, 1/8W.
	JHM853S	
		-------- INTERCONNECTION CABLE -------
ZC601	B19/5ZCCL00036	Flexible Cable: 22 pins.
ZC602	B19/5ZCCL00037	Flexible Cable: 20 pins.
ZC603	B19/5ZCCL00038	Flexible Cable: 10 pins.
ZC605	B19/5ZCCL00040	Flexible Cable: 6 pins.
ZC606	B19/6JJFD00054	Coaxial Cable.
ZC607	B19/6JJFD00065	Coaxial Cable.
ZC608	B19/6JJFD00056	Coaxial Cable.
ZC609	B19/6JJFD00066	Coaxial Cable.
ZC610	B19/6ZCLD00015	Power Cable.
ZC611	B19/6ZCFD00146	Power Cable.
ZC612	B19/6ZCLD00016	Power Cable.
		---------- MISCELLANEOUS ----------
	19B216021G3	Tx Fuse, 20A-Low power.
	19B216021G6	Tx Fuse, 30A-High power.
	B19/MPDM01167	Radio key
	19A704978P1	Keylock Assembly