MOBILE RADIO

DESCRIPTION AND MAINTENANCE
GE-MARC™ V•E CLASSIC II MOBILE RADIO
(SIMPLEX & DUPLEX)

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GENERAL DESCRIPTION

The General Electric GE-MARC™ V•E CLASSIC II trunked mobile radio is 100% solid state -- utilizing both discrete components and integrated circuits (IC's) for high reliability. The radio is a self-contained FM transmitter/receiver using a frequency synthesizer for frequency generation.

The trunked mobile radio enables the users to share up to 200 communications channels. The radio(s) and repeater(s) comprise a basic private channel communications system. A logic board in each mobile controls all commmunication with the repeater and alerts the user to an incoming call.

The personality PROM is capable of being programmed with all 200 channels in the frequency band for which the radio is configured. A plug-in ICOM and a synthesized oscillator provide for 0.00025% oscillator stability. Channel selection is determined by the logic board and frequency synthesizer. RF frequency codes are stored in the personality PROM (type 2816 EEPROM).

GE-MARC V•E CLASSIC II radios operate on one of five channel plans: USA-1, USA-2, Mexico, USA-3, or Australia. The transmit frequency range for each channel plan is identified in the following table. The receive frequencies are always 45.000 MHz higher than the transmit frequencies.

CHANNEL PLAN	TRANSMIT FREQUENCY RANGE (MHz)
USA-1	816.0125 - 820.9875
USA-2	811.0125 - 815.9875
MEXICO	811.0000 - 815.9750
USA-3	806.0125 - 810.9875
AUSTRALIA	820.0125 - 824.9875

The radio consists of an effective, heat-dissipating, aluminum die cast chassis similar to an "H" frame on which circuit boards are mounted. The casting contains a horizontal flat plate located midway between the vertical sides. Cooling fins located on the rear of the chassis provide a means of heat dissipation. The transmitter/receiver board is mounted on the bottom of the chassis and includes the exciter, a separate PA module and receiver circuitry. The synthesizer/

interconnect board is mounted in the top section of the chassis. This board contains the FM ICOM, frequency synthesizer, I/O expander, side tone cancellation circuitry (used in duplex radios), audio circuitry (including codecs (A/D, D/A), timing generator and filtering), and provides all interconnections. The logic board is mounted on the top section of the chassis just above the synthesizer/interconnect board. This board contains the control microprocessor, digital signal processor, watchdog timer, EPROM for the micro code, and the EEPROM which contains the frequency and personality information as well as the repertory dialer numbers.

The circuit boards plug into each other, eliminating the need for all interconnecting wires. The body of the simplex radio is enclosed by interchangeable top and bottom covers and a front cap. Eight screws secure these covers to the chassis. The body of the duplex radio is enclosed by two non-interchangeable covers secured to the chassis via six screws.

No power supply is required since the highest supply voltage used in the radio is provided by the vehicle battery. The radio is designed for operation in 12 Volt, negative ground vehicles.

The radio is of modular construction. All major modules and tuning adjustments are easily accessible on each of the appropriate boards. An optional set of test probes can be plugged onto the test pins on the board for alignment and troubleshooting.

A handset is provided through which all radio functions can be accessed. The handset allows the user to access all of the options which have been programmed into the personality PROM. Any changes to these options require the personality PROM to be reprogrammed. These options may be reprogrammed using the Universal Radio Programmer (URP) by connecting to the back of the radio and programming the PROM without removal from the radio, or by inserting the PROM directly into the I/O module of the URP and then inserting the programmed PROM into the appropriate socket on the logic board.

The various options which are available in the flexible personality PROM can be broken into two types of information - System Data and Area Data.

SYSTEM DATA

Mode List. Collection of areas which can be accessed using area select functions. The area which is displayed is always scanned and any/all areas in a mode can be programmed by the URP to be scanned even if not displayed.

NOTE

Modes should not be programmed with scan active on more channels than the programmed system collect tone - i.e., 20 channels maximum.

Frequency Table. Collection of frequency sets used by the areas. Each area requires a call originate and a call decode set (which may be the same set). The same sets can also be used in different areas. Each set consists of a list of 8 bit codes used to load the synthesizer for each specified channel. For example, a user can be programmed to decode all channels of a system while only originating calls on a few of the channels in that system.

Group Tone Sequence Table. A table of two or four tone sequences which the areas use for encoding and decoding calls. Options are included for enabling the group for duplex, receive enable, transmit enable, and external alarm. A group can be selected as decode only (if the radio is keyed, a 3 kHz tone is generated alerting the user that the sequence is not valid for call originate) or encode only (if the tones are sent, the radio will not decode the call) giving greater control of the group tones in the radio. The duplex feature enables the group to go duplex when entering interconnect if the area being used is enabled for duplex. For the two tone duplex sequences, an option is provided to slow the pulsing of busy tone which will improve the sound quality GE-MARC V●E systems only. The external alarm option activates the alarm relay if the group is decoded and the horn option is active.

MISCELLANEOUS

Carrier Control Timer (CCT). A CCT option is provided to limit the amount of continuous transmit time. The timer is programmable in 30 second increments from 30 seconds to 7.5 minutes. The timer can also be disabled.

Call Retry. Enables automatic retry of "Wait" mode upon failure to get a channel. Retries channel 15 times at approximately 20 second intervals and sounds All Channel Busy tone if channels are still busy after all attempts are made. Mic PTT will override the feature and will reset the retry count.

Radio Lock. Enables a software lock which disables reception and origination of a call. A combination up to 8 digits can be programmed via the URP.

Auto-Numeric Indexing (ANI). ANI, which allows assignment of a unique tone set to a radio, has been incorporated with keying to prevent unauthorized use. The tones, if desired, along with the key are entered via the URP. Areas make use of the ANI by using a 0 for the Special Call and/or Individual Decode tone sets. ANI sequences can not be used in group tone slots.

AREA DATA

Area ID. Two digit number which is displayed when the Area is selected or when a call in that area is decoded.

Area Options.

- Busy tone - 3051.9 Hz standard busy tone or 2918.7 Hz alternate busy tone.
- Duplex - Enable Special Call/ Individual Decode for duplex. Enable Area for duplex so groups can go duplex.
- External Alarm - Enable Individual Decode external alarm (if horn feature on handset is active).
- Dispatch Overdial - Enable overdial feature when area is used to access a channel. If active, allows user to bring other groups onto the channel of a GE-MARC V•E system. This feature should be disabled on all areas accessing GE-MARC V repeater systems.
- Auto Interconnect - Enables dialing functions for auto interconnect on Special Call (should be disabled on GE-MARC V systems since they do not support auto interconnnect). If active and if '*' is the first DTMF character 'sent' from the repertory dialer, it will be skipped. For this feature to function, the GE-MARC V•E system must be correctly programmed (odd grade of service).
- Voter Compatability - Programmable duration of initial busy tone burst (from 90 to 360 msec in 90 msec intervals) to allow voting circuitry to select the best RF path available (90 msec is default).

Frequency Data - Set number for call originate and set number for call decode.

Special Call Tone Set - Tone set number from group tone list which is sent if the Special Call feature is active. If zero, the ANI tones, (if valid) are used. If the tone sequence is not valid, the user can not activate Special Call.

Individual Decode Tone Set - Tone set number from the group tone list which is decoded when the Area is scanned. If zero, the ANI tones (if valid) will be decoded.

Group Tones - List of group tone sequences from the group tone table which should be decoded when the area is scanned. The displayed group and the individual decode group along with any/all of up to the lowest six groups can be simultaneously decoded. The six lowest groups can be decoded even if they are not displayed.

TRANSMITTER/RECEIVER

The transmitter consists of an audio processor, synthesizer, exciter and a broad band, fixed-tuned power amplifier module. In the receive mode, the exciter also serves as the receiver first mixer injection.

The RF power output level is internally adjustable for rated power. Once the output power level is set, a sensing control circuit holds the power constant over temperature and/or voltage variations within specified limits.

Drive for the transmitter PA and the receiver 1st mixer injection are derived from a phase lock loop (PLL) circuit.

Frequency stability for both the transmitter and receiver is maintained by an electronic compensation network in the 2 PPM FM ICOM and a compensated reference oscillator in the synthesizer.

The dual conversion receiver consists of a front end section and two mixer/IF sections operating at 455 kHz and either 45.0000 MHz (Duplex models) or 45.0125 MHz (Simplex models). The receiver also contains a squelch and audio section. The audio section provides a 3 Watt audio output into a 4 ohm load.

FREQUENCY SYNTHESIZER

The frequency synthesizer consists of a synthesizer chip, dual modulus counter, a reference oscillator, and a voltage controlled oscillator (VCO). The synthesized frequency is controlled by the RF frequency loaded from the logic board and applied to the transmit/receive board.

LOGIC

The logic controls the operation of the radio and consists of the microprocessor with EPROM for code, personality PROM, digital signal processor and watchdog timer (all on the logic board). The

A/D, D/A converters (CODEC) and analog filtering as well as the duplex side tone cancellation circuitry and an I/O expander are located on the synthesizer board.

CONTROL UNIT

The control unit consists of a handset with keypad and display. It interfaces with the Synthesizer/Interconnect board via J910 and J911 on the back of the radio. Communication with the handset is accomplished via a 300 baud asynchronous serial port.

EXTERNAL SPEAKER (OPTIONAL)

The optional speaker is contained in a LEXAN housing. A LEXAN bracket is supplied for mounting. The speaker leads are connected to the radio via the control cable by plugging the pins in where the handset plugs into the cable (P3-2,3).

AC POWER SUPPLY (OPTIONAL)

To use the radio in an office environment, optional power supplys are available (120 Volt AC, 60 Hertz or 120/240 Volt AC, 50/60 Hertz). A six-foot cable connects the power supply to the radio. The cable length permits the power supply to be located away from the radio. A green power on LED is located on the front panel of the power supply.

EXTERNAL ALARM RELAY (OPTIONAL)

The optional relay kit contains a relay which can be mounted in the vehicle. Wire is provided to connect the relay to the control cable next to the slots for the external speaker connection (P3-1).

SYSTEM DESCRIPTION

The GE-MARC V•E CLASSIC II trunked mobile radio system permits improved access to available RF channels, freedom from annoyance by other users' conversations and a degree of privacy for the user. The GE-MARC V•E trunked mobile radio system consists of a repeater for each channel and the users' mobile radio units. The system uses tone signalling with each mobile being assigned two and/or four tone group tone sequences. Groups or fleets of mobiles are assigned the same tones, so that any unit can talk to all other units in the same group. A block diagram of the mobile system is shown in Figure 1. A block diagram of the signal processor is shown in Figure 2.

When originating a call, the mobile identifies an idle repeater channel and interrogates it with a single burst of "busy" tone. Upon receipt of the busy tone, the repeater keys its transmitter and sends a burst of "acquisition" tone

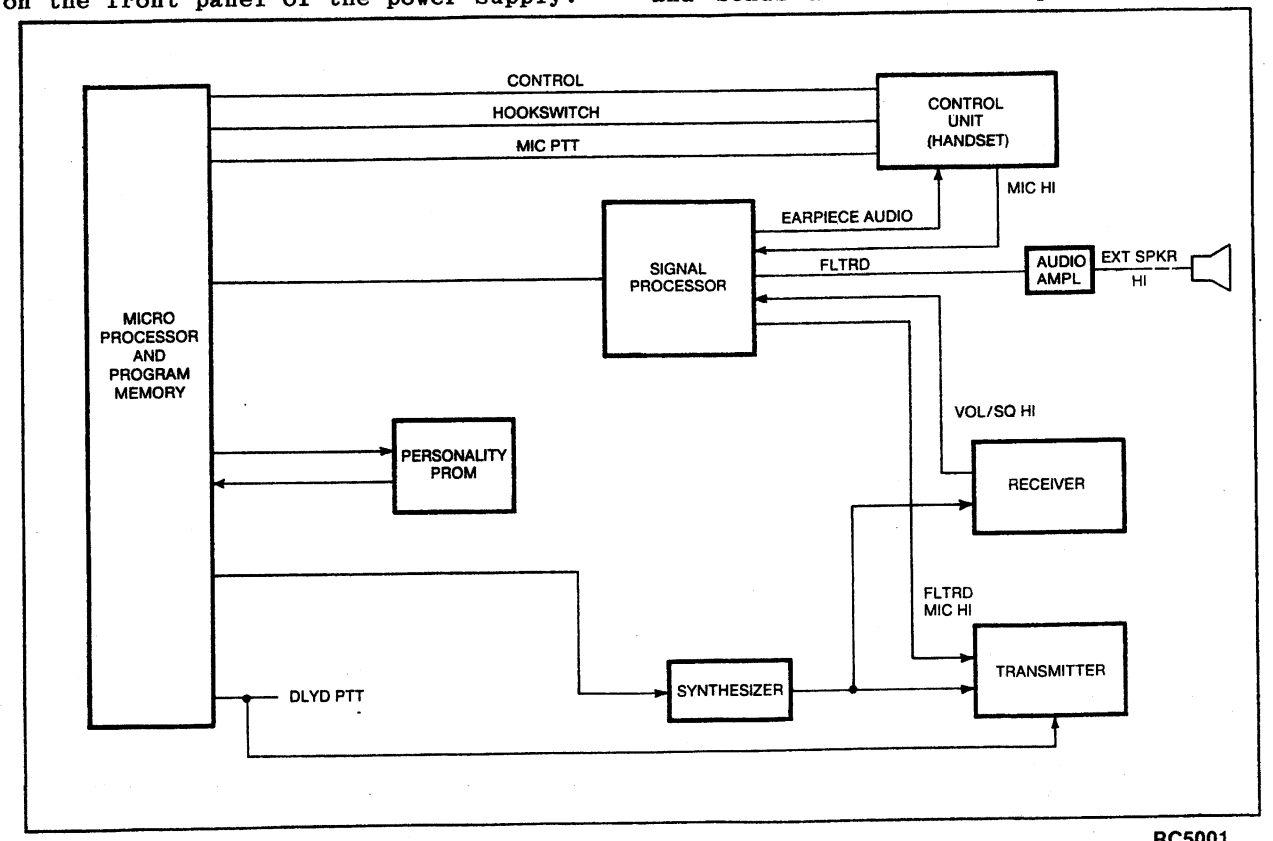


Figure 1 - GE-MARC V•E CLASSIC II BLOCK DIAGRAM

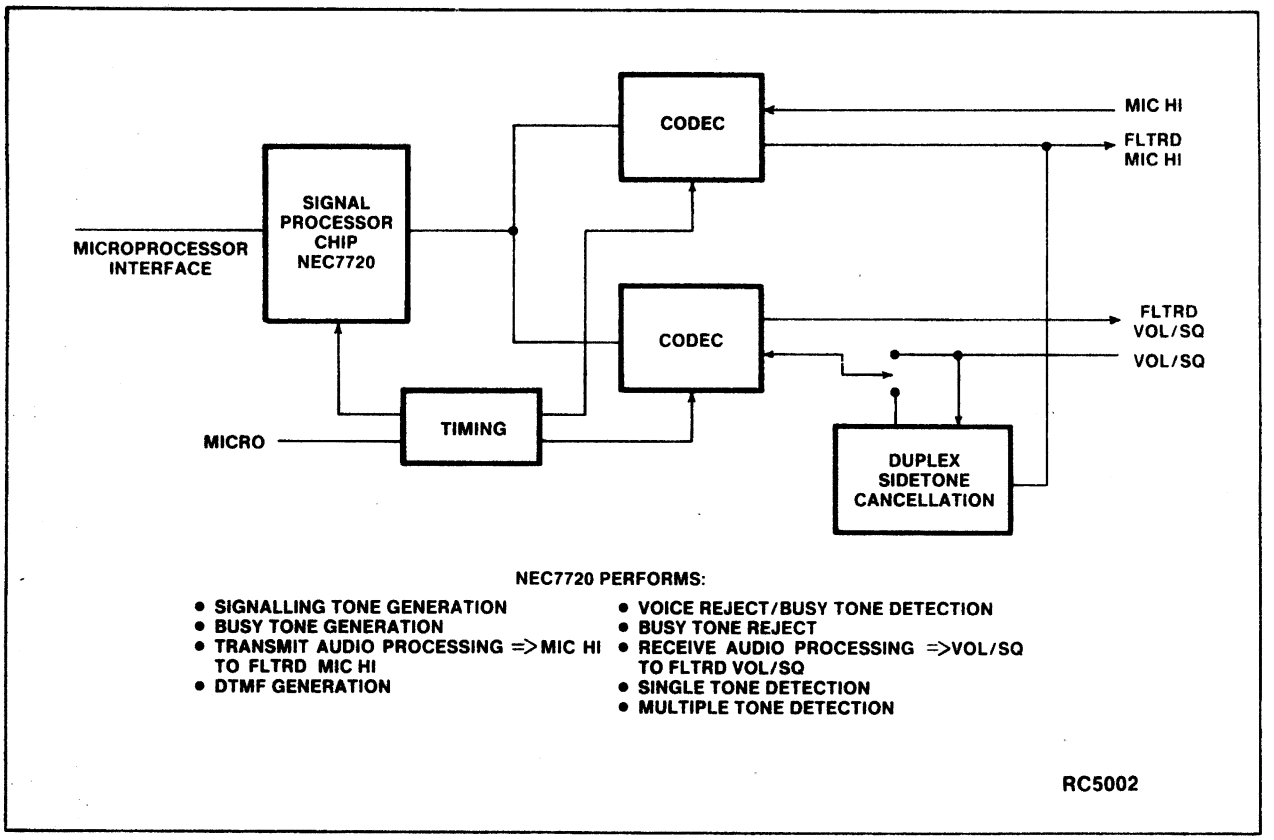
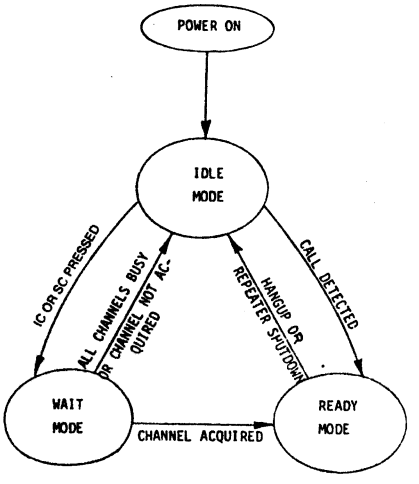


Figure 2 - Microprocessor Block Diagram

back to the mobile unit. When the interrogating mobile detects the acquisition tone, it then transmits its collect and group tones, which the GE-MARC V•E repeater regenerates for all idle mobile units in the system. The idle mobiles, which continually scan all channels, will stop on the active channel if any of the programmed collect tones are detected and wait for group tone(s). If the correct tone sequence is detected, the mobiles will alert the operator of an incoming call and open their audio circuits. If the correct sequence is not detected, the idle mobiles will resume scanning the channels. Once the mobile is "locked" on a channel, it will remain there until the repeater times out or the operator terminates the call.

The radio will always be in one of three operational modes: idle, wait, or ready. The radio enters the idle mode when power is turned on and begins scanning channels for an incoming call once the lock code has been entered. The wait mode is entered when the user places a call. The radio remains in the wait mode until it acquires a channel or it determines that no channel is available. The ready or conversation mode is indicated by an alert tone and the "in use" indicator on the handset.

Figure 3 identifies the three operational modes and the conditions that cause the radio to transfer from one mode to another. Figure 4 defines the signal timing when originating and receiving a call. Figures 5 through 7 are the sequence flow charts for each operational mode.



IDLE MODE - UNIT IS SCANNING CHANNELS FOR CALLS.
WAIT MODE - UNIT ACQUIRES A CHANNEL AND TRANSMITS SIGNALLING TONES.
READY MODE - UNIT IS LOCKED ON A CHANNEL, ALLOWING VOICE COMMUNICATION.

RC 4158A

Figure 3 - Operational Modes

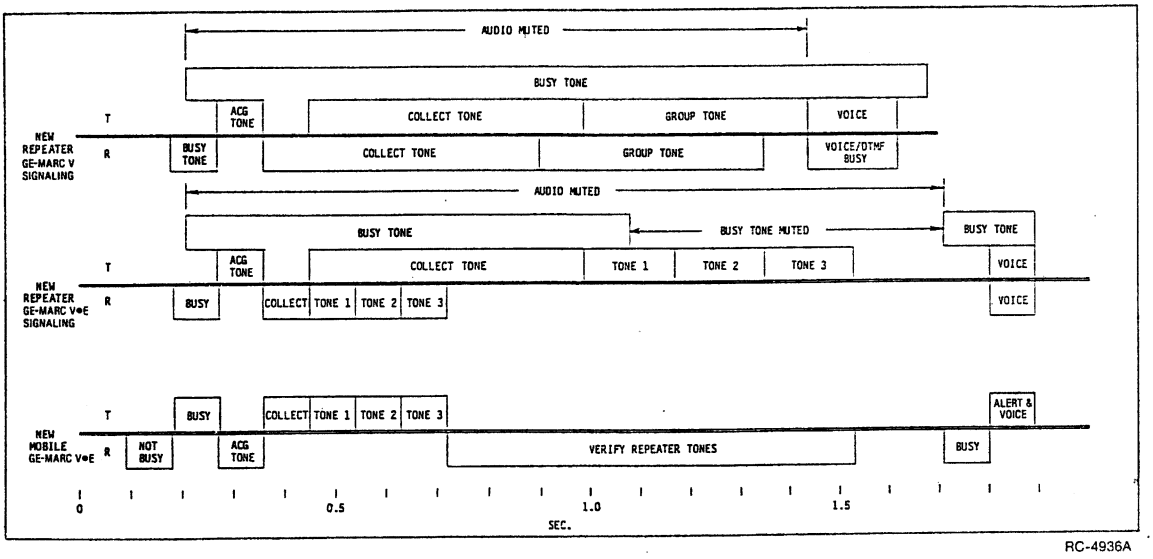


Figure 4 - Signal Timing

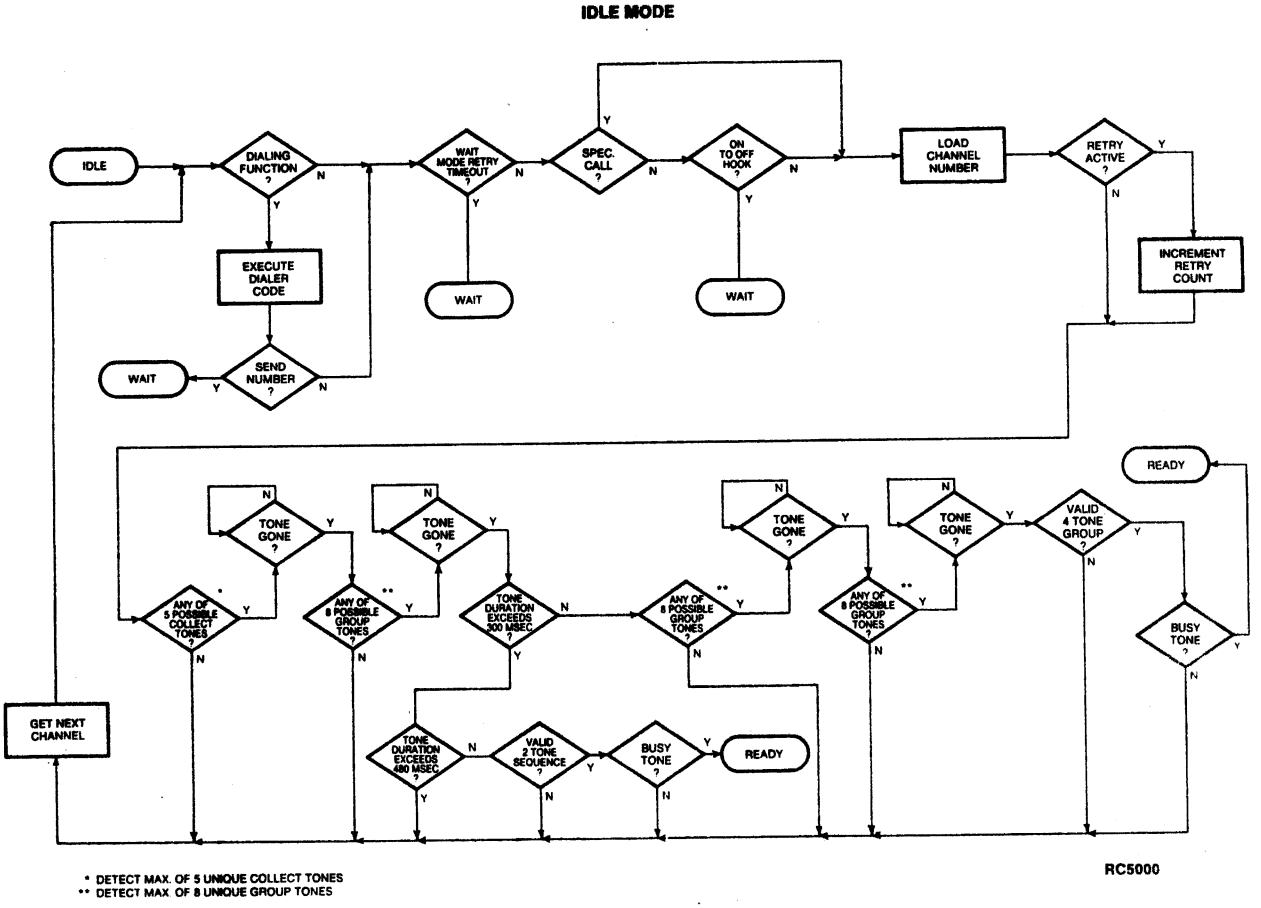


Figure 5 - Idle Mode

IDLE MODE

When the radio is in the Idle mode, the audio is muted and all channels programmed for call decode are sequentially scanned for an incoming call. An incoming call is identified by detecting one of the collect tones programmed in the area. The CLASSIC II mobile allows from one to five collect tones in each area that is scanned. Up to four collects are allowed in the group tone list and one additional is allowed for the individual decode sequence (Note: If numerous collect tones are used, the mobile will stop scanning each time it sees any of the collect tones, increasing the probability of missing a call). Upon receipt of a collect tone, the mobile looks for a short interval for any of one to eight group tones depending on the number of groups in the area. If no valid tone is found, the mobile will resume scanning the channels for an incoming call.

If a group (or individual decode) tone is detected and the duration matches that of a two tone call, the mobile then looks for busy tone for a 90 msec period. If the duration of the tone matches the four tone call, the mobile will look for up to eight group tones in the third slot of the four tone call. If a valid tone is found, the mobile will look for the last tone of any remaining valid groups. If four tones are properly decoded, the mobile will then look for busy tone for 270 msec. If no valid tones are found in any of the time slots, the mobile will resume scanning for a call with the next channel. If a busy tone is found, the mobile will enter the Ready mode. If busy tone is not detected, the mobile remains in the Idle mode and continues scanning channels looking for an incoming call.

If the user presses the PTT button, the radio will enter the Wait mode. The radio also enters the Wait mode if the user comes off hook during a group call (Note: coming off hook in Special Call will not cause the radio to enter the Wait mode). Most of the repertory dialer functions are active in the Idle mode. The Idle mode is the only mode where a user can store numbers into the dialer memory. The user can then recall a number from memory or enter a number directly from the keypad and "send" the number. In order to send the number (i.e. get a channel and dial the number), the user can (1) remove the handset from the cradle, (2) press the PTT switch, or (3) press the SPC (Special Call/Execute) key. This will cause the radio to enter the Wait mode and upon successful acquisition of the channel, send the number.

WAIT MODE

When the user enters the Wait mode, the displayed group (or special call if it is active) is checked to make sure it is a valid call originate group. If it is not valid, a high frequency tone is sounded. If valid, the radio will scan the call originate frequencies of the displayed area for brief intervals until it finds one with no busy tone on it. If no channel is free, the radio will activate the Call Retry state if programmed for this option. This causes the radio to revert to the Idle mode and scan for a call while trying the Wait mode approximately every 20 seconds for about 5 minutes. If no channel is available at the end of the 5 minute period or the Retry option is not active, the mobile will sound a low frequency tone and then return to the Idle mode.

If a channel with no busy tone is found, the mobile transmits a burst of busy tone to acquire the repeater to which the repeater responds with a burst of acquisition tone. Upon receipt of the acquisition tone, the mobile proceeds to transmit the tones corresponding to the displayed group (either two or four tones). If a four tone sequence is sent, the mobile must detect all four tones and busy tone before entering the Ready mode. If a two tone sequence is sent, the busy tone must be present within 90 msec of the last tone in order for the radio to enter the Ready mode. If no busy tone is present, or if the four tone sequence doesn't validate, the mobile will jump to the next channel in the call originate set and check for busy tone as described above.

READY MODE

When an incoming call has been decoded, or an outgoing call has been successfully placed, the mobile enters the Ready mode. The user will be alerted that the radio is in this mode unless the call was originated with a repertory dialer number active (e.g. if on-hook dialing was used to get the channel) or if the receive alert tones are disabled. After the alert tones, if the horn function is active and the decoded tone sequence is programmed for the external alarm, the alarm relay will be activated for 1.5 seconds or until PTT is pressed, whichever comes first. After this period, the user may then use the radio in a conversation mode using the PTT for talking in the dispatch mode. Repertory dialer and manual dialing functions are active in this mode. If the user has a simplex radio, the PTT switch must be used during interconnect. If the user

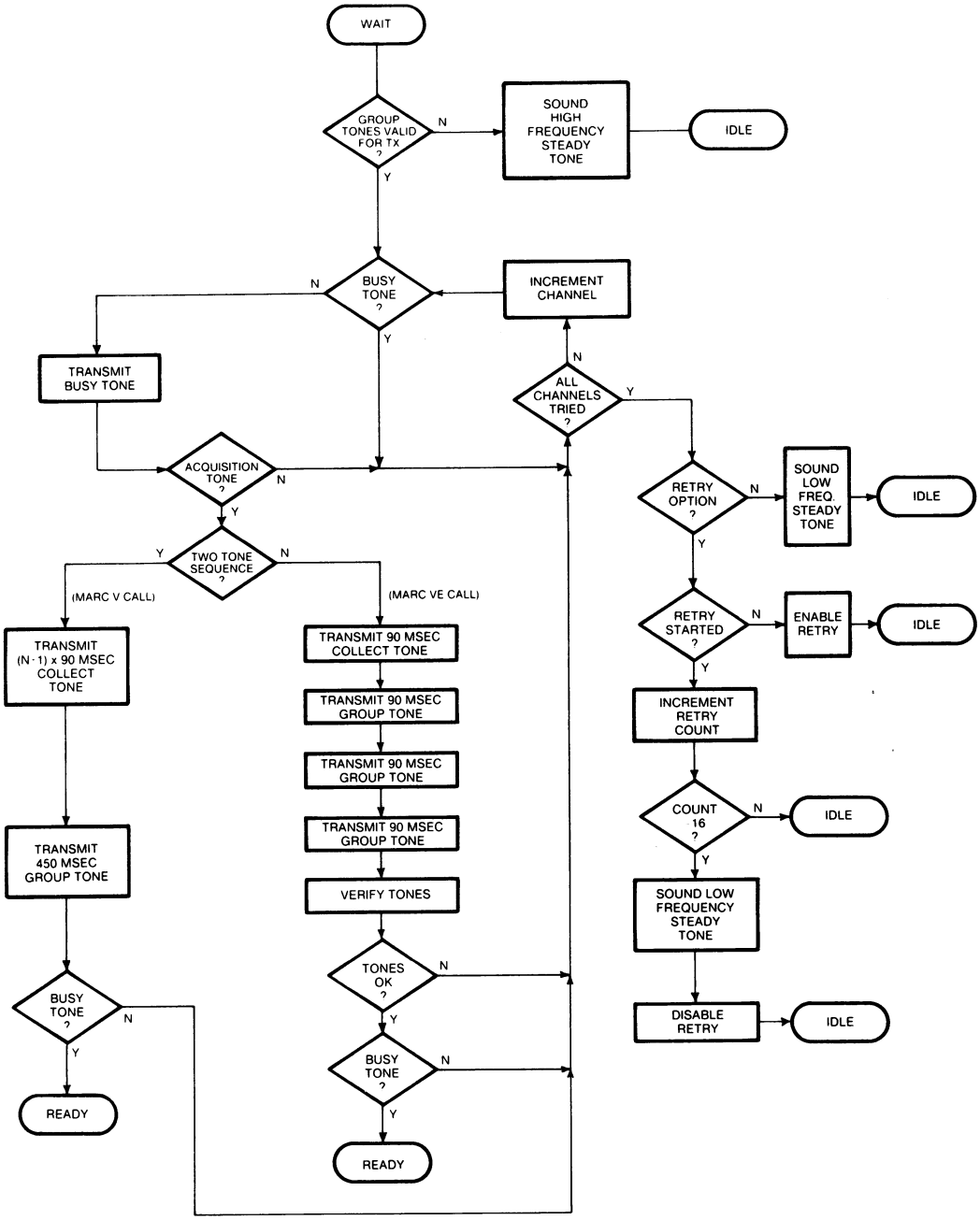


Figure 6 - Wait Mode

has a duplex radio and the tone sequence is programmed for duplex via the URP, the radio will go duplex in interconnect so the user does not have to use the PTT switch (in either radio, the user must always use PTT in dispatch mode). The radio will remain on channel until the user hangs up the handset, pushes the CLR button, or the repeater drops busy tone for approximately 1 second.

POWER DISTRIBUTION SYSTEM

Battery voltage enters the radio through J910-1 (Receive) and J910-11 (Transmit) on the synthesizer/ interconnect board. Both inputs are connected to reverse polarity protection diodes. The ground lead passes through J910-6. A Power Distribution Diagram is shown in Figure 8.

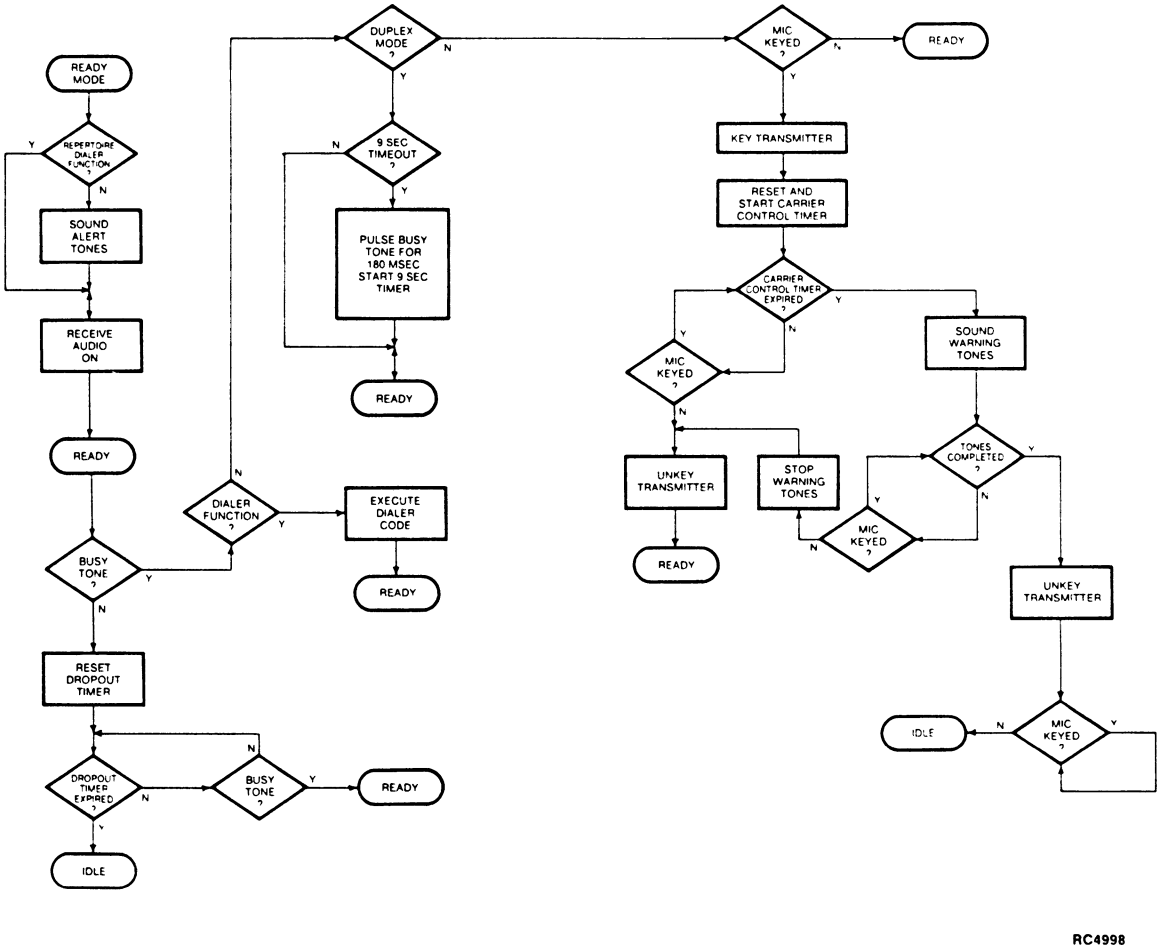


Figure 7 - Ready Mode

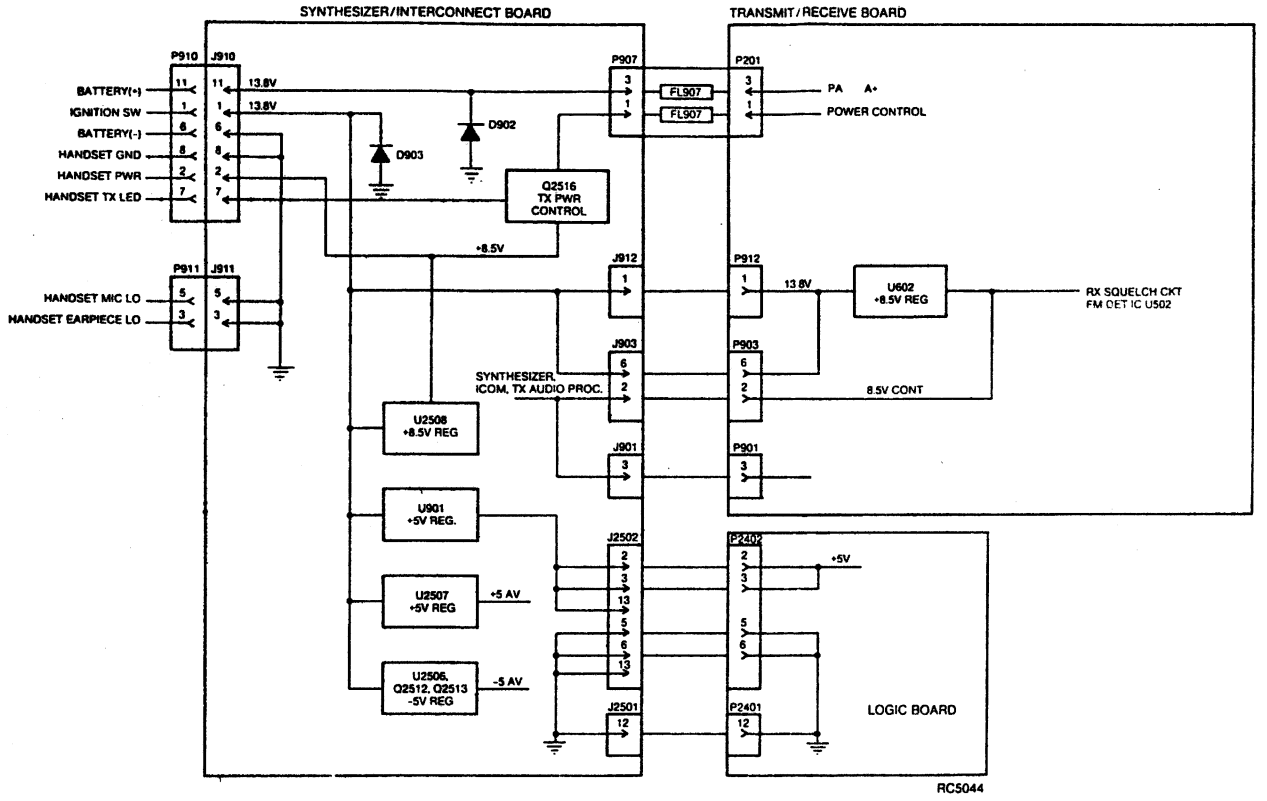


Figure 8 - Power Distribution Diagram

The A+ input goes directly from the synthesizer/interconnect board through a feed through capacitor and molex connector to the RF PA on the Tx/Rx board. The receive A+ input from the synthesizer/interconnect board serves two functions. One branch feeds through to the Tx/Rx board and supplies power for the audio amplifier for the external speaker and the Rx Squelch circuit and FM detect IC. The other branch supplies power to the regulators used for Tx power control, +5 Volts for the logic board and ±5 Volts Analog used in the audio processing circuitry. An additional 5 Volt regulator resides on the logic board to provide memory backup of the volume, backlight, mode, area, and group when the radio is turned off.

GLOSSARY OF GE-MARC VoE SYSTEM TERMS (AS APPLIED TO MOBILES)

IDLE MODE - The "standby" condition for a mobile, inactive, but prepared to call or be called. Trunked mobiles are IDLE until they enter another mode or are turned off.

WAIT MODE - The "attempting origination" condition. Wait mode is entered from idle mode (only) as the user presses PTT, comes "off-hook" or dials a number. If successful, the unit becomes READY. Otherwise, the unit is IDLE or IDLE/WAIT after all channels are tried.

READY MODE - The "operating" condition. Ready mode is entered from Idle mode via Wait mode when calling, or directly from idle when called. Ready mode ends (the radio reverts to idle) when the user disconnects or with loss of received busy tone from the repeater. This normally occurs when the repeater shuts down after communication is complete.

Busy Tone - A "voice-plus" tone (3051.9 Hz standard, 2918 Hz alternate) which modulates mobile and repeater transmitters at low level (±1 khz deviation) continuously. This tone is filtered from received audio and is used to hold the communication channel active. It also excludes other mobiles from using the channel when a call is active.

Acquisition Tone - A tone (1962.9 Hz) sent at full deviation for 50 msec from repeater. It is used as acknowledgement from the repeater of the busy tone that was sent and signals the mobile that signalling tones can now be sent.

Collection Tone - A tone (chosen from 38 standardized frequencies ranging from 508.6 Hz to 2792.4 Hz) used as the first tone in the group tone sequence. The collect tone is used to gather all mobiles with the same collect tone for decoding of a call. The duration of the tone varies as a function of the number of channels which are programmed into the mobile and/or repeater. In a two tone call, the mobile sends the collect for a programmable duration whereas in the four tone call, the mobile always sends a 90 msec collect tone which the repeater regenerates and sends for the correct duration.

GROUP/INDIVIDUAL TONES - Tones (chosen from the 34 standard frequencies) which follow the collect tone. In a two tone call, the second tone is sent for 450 msec. In a four tone call, the second, third, and fourth tones are sent for 90 msec from the mobile and 180 msec from the repeater.

AUDABLE INDICATORS

CALL RECEIVED ALERT TONES - The "Call Received" indicator consists of a one or two tone alert sequence. If the received call is a two tone sequence, the single tone alert is sounded. If the received call is a four tone sequence, the two tone alert is sounded.

CALL ORIGINATE ALERT TONES - When initiating a two tone call a single tone alert is sounded when the channel is ready for normal coversation. When a four tone sequence is used, a three tone alert is sounded.

CARRIER CONTROL TIMER - The Carrier Control timer alert is a pulsed tone that is sounded when the mic has been keyed continuously for the preprogrammed time (0.5 minutes to 7.5 minutes). After 18 seconds of pulsing, the transmitter is turned off and the mobile resumes scanning channels in the idle mode after the user releases PTT. When the tones are pulsing, the user can unkey and key again in order to resume normal conversation. The Carrier Control Timer does not apply to duplex mobiles operating in Duplex interconnect.

CHANNEL BUSY/NO CHANNEL AVAILABLE - The channel "busy"/no channel available tone is a 1 second low frequency tone which occurs at the end of the Wait mode when no channel is found.

INVALID CALL ORIGINATE ALERT - The invalid call originate alert tone is sounded when a user attempts to make a call with a group that is not enabled for call originate. These groups are indicated in the handset by a small "d" in place of the normal "G" in front of the group number. This tone is a high frequency tone which is sounded for 1 second.

DISPATCH OVERDIAL CALLS - Dispatch overdial calls are preceded by a medium frequency tone. Once the tone

information is sent to the repeater, the mobile verifies that the repeater calls the idle mobiles. If the tones are decoded correctly, the user is prompted with a high frequency tone. If the tones are not correctly decoded or the feature is not enabled, the user is prompted with a low frequency tone.

VISUAL INDICATORS

LOCK - If enabled, the mobile will power up locked whenever total power is removed or the user initiates the lock function. The display will show --LLLL--. The user must enter the correct lock combination in order to make or receive calls.

AREA/GROUP - This is the normal display when the radio is in the IDLE mode. The display takes on the format of the area on the left side of the display and the group on the right side of the display. The area is a two digit number preceded by an "A". The group is also a two digit number but it can be preceded by one of three characters. If preceded by a "G", the group is enable for call originate as well as call decode. If preceded by a "b", the group is enable for call originate only (it will not be decoded). If preceded by a "d", the group is enabled for decode only. The area/group display looks like one of the following:

A01 G01
A01 b01
A01 d01

If Special Call is active, the following is displayed:

A01 SP

RECEIVED CALL - When a call is received, the area and group of the call are displayed. If the Individual Decode sequence is decoded, the group number will be replaced by an "id". The received call display looks like one of the following:

01 CL 01 (Area 1, Group 1 call)
01 CL id (Area 1, Individual Decode)

MODE - This display is invoked by the DISPLAY function and the MODE function on the handset. The DISPLAY function causes the current mode to be displayed for 1.5 seconds. After that time, the display returns to the area/group display. The MODE function causes the mobile to increment to the next valid mode and display it for 1.5 seconds. The mode display looks like:

SC01

TELEPHONE/DISPATCH OVERDIAL - When numbers are entered via the keypad, they are displayed as entered. If the special repertory dialer functions are used, the displayed character only indicates the function desired. If "*" is stored in the repertory dialer, the character displayed is a 'P'. If a "#" is stored, the character displayed is a ' '. If the delay function is stored, the character displayed is " ". If the length function is stored, the character displayed is a space (" "). If a dispatch overdial character is stored, it will be displayed as a 'o'.

ERROR - If the user tries to use an unprogrammed personality in the mobile or an error occurs in storing a repertory dialer number, "Err" will appear on the right side of the display.

IN USE - This is an indicator in the lower right corner of the display. It flashes when the Wait or Wait/Idle modes (Retry) are active. When the mobile is in the Ready mode, the INUSE indicator remains on.

HORN - This is an indicator in the lower left corner of the display. It is on when the user actives the Alarm relay function via the HORN function.

OPERATION

CHANNEL DISCONNECT

The repeater continually looks for a busy tone from the mobile or station, to determine if the channel is busy or idle. If a busy tone is not received for approximately five seconds, the repeater assumes the channel is idle and disconnects. If communications were not completed, the call must be placed again. It is suggested that a procedure be established that designates the originator of a call as the one to re-establish communications.

NOTE

It's possible for two or more operators originating a call simultaneously to come up on two different channels. Communications under these conditions are impossible.

Complete operating instructions for the two-way radio are provided in a separate OPERATOR'S MANUAL. The basic procedure for receiving and transmitting messages is as follows:

TO RECEIVE A MESSAGE

1. Turn the radio on.
2. Adjust VOLUME up/down control for a suitable listening level. There are 16 discrete audio levels available.

   The radio is now ready to receive messages from other radios in the system.
3. To clear the radio and return to the Idle mode, press the clear pushbutton or replace the handset.

TO TRANSMIT A MESSAGE

1. Turn the radio on.
2. Select the desired group or Special Call (optional).
3. Select the appropriate area.
4. Select the desired mode of operation.
5. Press and release the PTT switch. The INUSE indicator tells the operator that the system is ready.

NOTE

When a channel is acquired, the INUSE indicator will stay on and an alert tone will be sounded.

INITIAL ADJUSTMENT AND CHECKOUT

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

TRANSMITTER ADJUSTMENT

The adjustments for the transmitter includes measuring the forward and reflected power and adjusting the antenna length for optimum ratio, then setting the transmitter to rated power output. Next, measure the frequency and modulation and record these measurements for further reference. For complete transmitter adjustment, refer to the ALIGNMENT PROCEDURE (see Table of Contents).

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes tuning the input circuit to match the antenna. For the Receiver Adjustment Procedure, refer to the Alignment Procedure (see Table of Contents).

RE-INSTALLATION

If the mobile combination is moved to a different vehicle, always check the battery polarity of the new system.

MAINTENANCE

CAUTION

CMOS components 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.

PREVENTIVE MAINTENANCE

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

DISASSEMBLY

NOTE

If the radio is duplex, you must remove the duplexer to service the Tx/Rx board.

- To remove the duplexer:

  Remove the three TORX head screws securing the duplexer mounting plate to the radio chassis and lift the duplexer out of the way. (The RF transmit and receive BNC connections may be disconnected for complete removal.)
- To service the Transmitter/Receiver (Tx/Rx) board, remove the two screws securing the bottom cover at the rear of the radio. Then slide the cover out from under the edge of the front panel and lift off.

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

- To service the Logic board, remove the two screws at the rear of the radio and slide the cover out from the edge of the front panel and lift off.
- To service the Synthesizer/ Interconnect board, remove the two screws at the rear of the radio and slide the cover out from the edge of the front panel and lift off. Remove the synthesizer shield and the Logic board.
- To remove the Tx/Rx board:

  1. Remove the top and bottom covers.
  2. Remove the two screws holding the antenna connector and unsolder the connector from the board.
  3. Remove the four screws securing the front panel to the "H" frame. Disconnect the speaker plug and remove the panel.
  4. Remove the eight screws securing the RF shield.
  5. Remove the screw in the receiver front end casting.
  6. Remove the two screws securing the PA module.
  7. Remove the nine screws securing the Tx/Rx board and carefully lift the board up off of the interconnection pins.

NOTE

When removing the Tx/Rx board, be sure the seal (silicon grease) between the PA module and the casting is broken to prevent damage to the PA module. Use a scribe (or equivalent) to loosen the PA module from the casting and slowly lift the transmit/receive board out of the radio.

- To remove the Logic board:

  1. Remove the top cover.

2. Remove the two screws securing the board to the Synthesizer/Interconnect board and carefully lift up off the interconnecting pins.

- To remove the Synthesizer/ Interconnect board:

1. Remove the top cover.

2. Remove the front cap, logic board and synthesizer shield.

3. Remove the two hex stand offs on the Synthesizer/ Interconnect board.

4. Remove the 11 screws securing the board and carefully lift the board up to disconnect the interconnection pins.

PA MODULE REPLACEMENT (15 WATT UNITS)

NOTE

Always check out the associated circuitry carefully before replacing the PA module. The PA is a very reliable device and will not normally need to be replaced.

- To remove the PA module:

1. Remove the two PA mounting screws and bend the ground tabs up in a vertical position.

2. Carefully unsolder and remove PA module.

- To install a new PA module:

1. Apply a coating of silicon grease to the mounting surface.

2. Place PA module in its mounting and bend down the ground tabs over the mounting screw holes.

3. Replace the mounting screws using a moderate torque of 1 Newton meter (approximately 9-inch-pounds).

4. Re-solder the PA module.

WARNING

The PA module contains Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, exercise caution since the dust may be hazardous if inhaled. Use care when replacing the PA.

DRIVER MODULE REPLACEMENT (30 WATT UNITS)

NOTE

Always check out the associated circuitry carefully before replacing the module. The module is a very reliable device and normally will not need to be replaced.

- To remove the module:

1. Remove two screws securing U201 to printed wire board. (Refer to Figure 9.)

2. Using a desoldering tool, unsolder the ground strap across the end of U201 and located next to Q201. Leave A201 in place.

3. Unsolder the five leads bridging U201 to the PWB while lifting each lead. NOTE: These leads are soft and can be bent very easily.

4. Lift U201 on the Q201 (PA transistor) side and slip out from under A201. Be careful not to lose the spacer under U201. It may also stick to the chasssis. Clean all old silicone grease from chassis and spacer.

5. To install U201, apply silicone grease to both mounting surfaces of the spacer.

6. Position spacer properly on the chassis.

7. Position U201 properly by slipping the end under A201 and aligning the screw holes and the leads of U201 with the PWB.

8. Replace ground strap across the end of U201.

9. Replace the two screws securing U201 to the PWB and tighten to 0.5 $\pm$0.1 Newton meter (5 inch pounds).

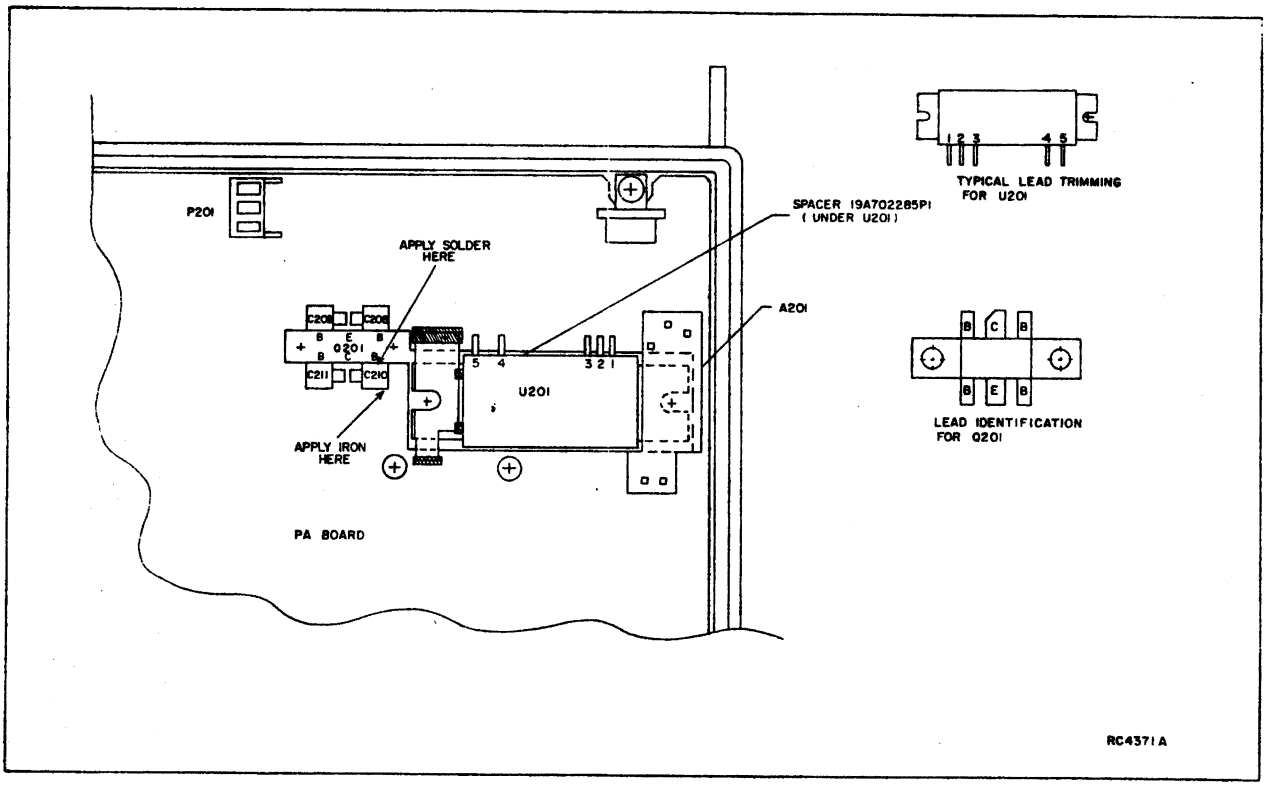


Figure 9 - Lead Forming and Identification

10. Solder ground strap and the five leads of U201.

11. Apply a small amount of silicone seal (or an acceptable substitute) between the case of U201 and the ground strap. This prevents the leads of U201 from bending if the PWB is removed from the chassis.

WARNING

The module contains Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, exercise caution since the dust may be hazardous if inhaled. Use care when replacing the module.

PA TRANSISTOR REPLACEMENT

1. Remove two retaining screws securing PA transistor to chassis assembly.

2. Unsolder and remove capacitors C208 then C211. Use a desoldering tool as necessary while lifting up using a small screwdriver or pick. Discard old capacitors.

3. Unsolder emitter, base and collector leads of transistor and remove.

4. Remove all excess solder from board and clean the holes to allow the new transistor to be positioned properly and the capacitors to snap into proper locations. Refer to Figure 9 and trim leads of Q201 as shown.

5. Apply silicon grease to back of transistor.

6. Place transistor in slot.

7. Torque transistor mounting screws to 0.5 n/m.

8. Tack solder the 4 base wings to the PWB. Use minimum solder.

9. Install C209, C208, C210, C211 into their proper mounting holes flush to the board.

10. Solder the cap bodies to the PWB by first soldering the outside edge, then holding the iron to the outside edge, touch the solder to the inside edge of the capacitor.

11. Solder the emitter and collector connections and capacitor tabs.

12. Remove any flux left on board.

NOTE

Take care in all soldering not to create solder bridges on the front and rear of caps.

REMOVING IC'S

Removing IC's (and all other soldered in components) can be easily accomplished by using a vacuum de-soldering tool. To remove an IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

An alternate method is to use a special soldering tip that heats all of the pins simultaneously.

TEST AND TROUBLESHOOTING PROCEDURES

Maintenance of your GE-MARC V•E radio is facilitated by use of the Troubleshooting Flow Charts and servicing techniques unique to this radio. The Troubleshooting Chart is designed to lead you rapidly to the defective component or circuit. Typical voltage readings are provided on the Schematic Diagram where appliable.

Troubleshooting charts are provided for most major problems that might arise in the radio. Refer to the Table of Contents for information when servicing the transmitter or receiver.

SERVICING TECHNIQUES

The high density plug-in design of the modular radio lends itself well to rapid isolation of malfunctions in the voltage and signal paths. Due to the modular construction of the radio, i.e., transmit/receive board, synthesizer/interconnect board, logic board, etc., a majority of the signals and voltages pass the connectors on the synthesizer/interconnect board. To isolate a signal or voltage path to determine loading effects, locate short circuits, etc., carefully insert an insulator (plastic wand, toothpick) between the appropriate pins of the related molex connector (to create an open circuit). Signal paths that may be isolated include: CAS, MIC HI, VOLUME SQ HI, filtered VOLUME SQUELCH HI, PTT, Rx MUTE, and SPKR HI. Voltage paths may also be opened.

A test probe kit is available to aid in servicing the radio. The kit includes a RF signal probe, Rx RF detector probe, DC probe, various tuning tools and test cables.

CHANNEL PLANS AND FREQUENCIES

GE-MARC V•E radios may operate on one of five channel plans, identified in Table 1. Table 1 also identifies the Transmit/Receive frequency ranges and the associated ICOM.

FREQUENCY PLAN	TRANSMIT FREQ (MHz)	RECEIVE FREQ (MHz)	ICOM FREQ (MHz) U2603	ICOM PART NUMBER
MEXICO	811.0000 815.9750	855.0000 860.9750	60.641667	19A701712G14
USA-3	806.0125 810.9875	851.0125 855.9875	60.234375	19A701712G13
AUST	820.0125 824.9875	865.0125 824.9875	61.40104	19A701712G10
USA-2	811.0125 815.9875	856.0125 860.9875	60.642708	19A701712G11
USA-1	816.0125 820.9875	861.0125 865.9875	61.063542	19A701712G12

TABLE 1 - FREQUENCY PLAN VERSUS SYNTHESIZER/INTERCONNECT BOARD

TEST POINTS

Test points are provided to aid in troubleshooting the radio and to facilitate alignment of the transmitter and receiver. The test points are located on the synthesizer/interconnect board and the transmitter/receiver board and are identified in the table below.

TEST POINT	LOCATION	FUNCTION	TYPICAL READING
TP2601	Synth/Int.	Synthesizer Control	3.75 - 6.0 Volts
TP2602	Synth/Int.	TX FREQ Monitor	41.6 MHZ (Code 00 to U2601)
TP2603	Synth/Int.	Tx AMPL Tuning	0.7 Volts
TP2604	Synth/Int.	Tx Tripler Tuning	0.5 Volts
TP101	Tx/Rx	Tx Doubler Tuning	5.6 Volts
TP103	Tx/Rx	Exciter Tuning	1.6 Volts
TP401	Tx/Rx	1st MIXER	0.16 VRMS (No Signal Input)
TP501	Tx/Rx	2nd IF	2.7 VDC (No Signal Input)
U1-29	Logic Bd.	PSEN	1.3653 MHz Asymmetrical Clock
TP2504-3	Synth/Int.	Vol. Sq. Hi	Approximately 4.25 VDC
J903-7	Synth/Int.	Filtered Vol. Sq. Hi	Approximately 0.0 VDC, 3051.9 Hz 28 dB below level at J2504-3
U7-6	Logic Bd.	8.192 MHz Clock	8.192 MHz clock, 50 $\pm$ 7% duty cycle
U2-18	Logic Bd.	Serial Shift Clock	128 kHz square wave
U1-9	Logic Bd.	Micro Reset	0.0 Volts

	Collector	Base	Emitter	Gate 1	Gate 2	Source	Drain
Q401	3.2 VDC	0.8	GRD				
Q402	-----	---	---	GRD	3.3	0.7	7.3
Q501	-----	---	---	GRD	4.2	0.9	8.4

IC U501

U501-1,14	7.4 VDC
U501-2,13	7.1 VDC
U501-3	3.9 VDC
U501-4	3.2 VDC
U501-6,9	4.1 VDC
U501-7	6.1 VDC
U501-8	7.7 VDC
U501-5,10	GRD
U501-11	2.2 VDC
U501-12	1.4 VDC

RECEIVER DC BIAS VOLTAGES

CAUTION

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

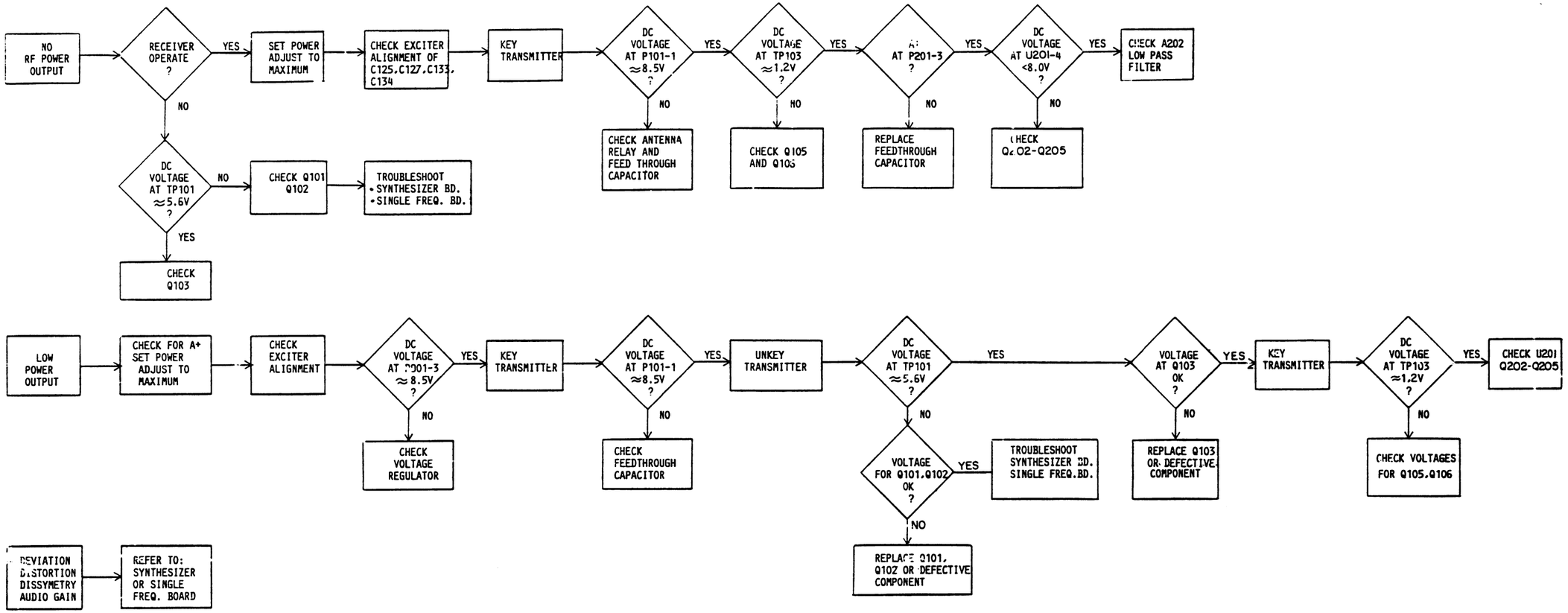
To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed:	20 Volts
Transmitter keyed (50 ohm resistive load):	18 Volts
Transmitter keyed (no load or non-resistive load):	15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limits shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

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

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



TEST PROCEDURE

1. CONNECT AUDIO OSCILLATOR OUTPUT ACROSS J911-4 (MIC HI) AND J911-5 (MIC LO).
2. SET OSCILLATOR FOR 1000 HZ AT 1.0 VRMS AND DEVIATION TO 3.5KHz.

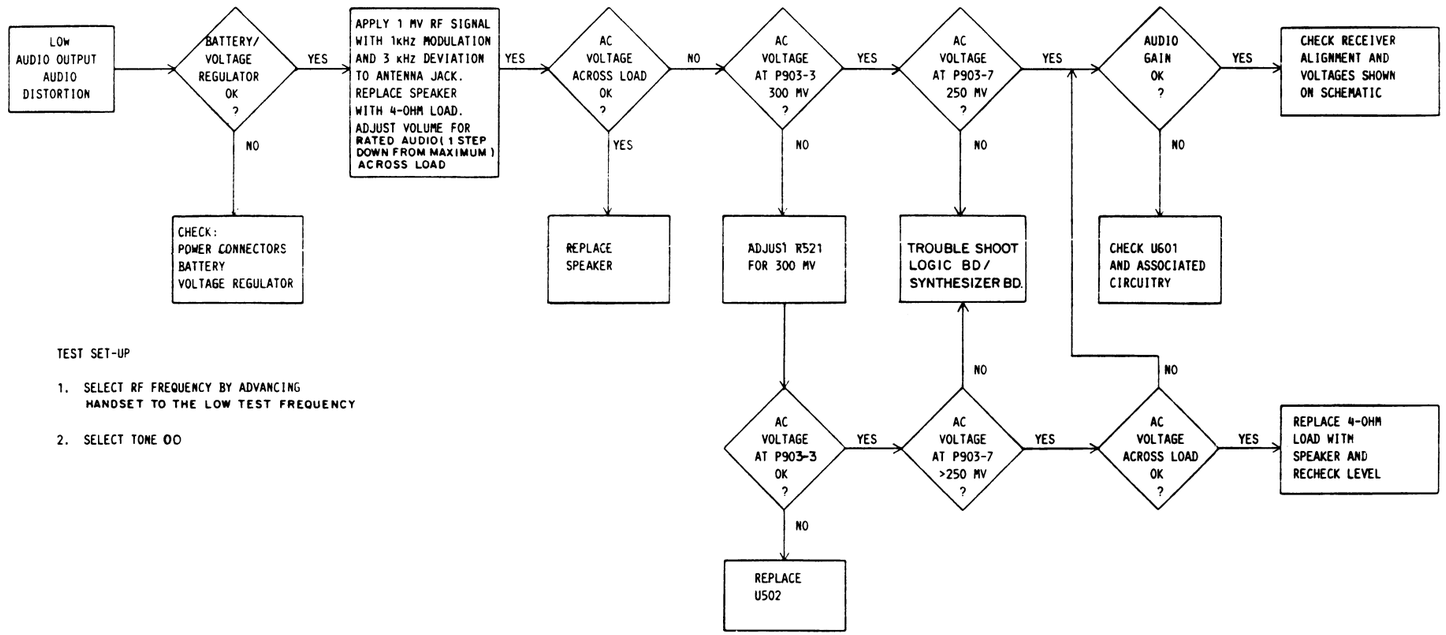
NOTE

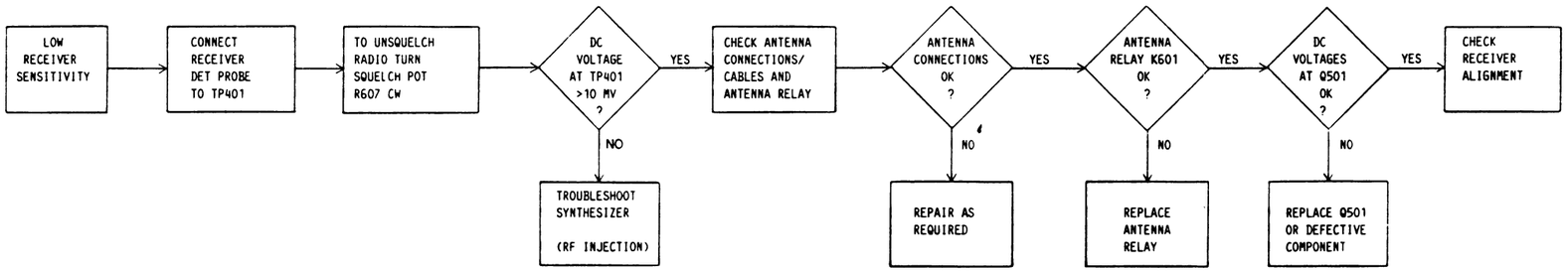
AN RMS OR PEAK READING VOLTOHMETER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READING

3. SET HANDSET CONTROLS TO FOO! AND TONE GOO.

TROUBLESHOOTING PROCEDURE

TRANSMITTER FLOW CHART

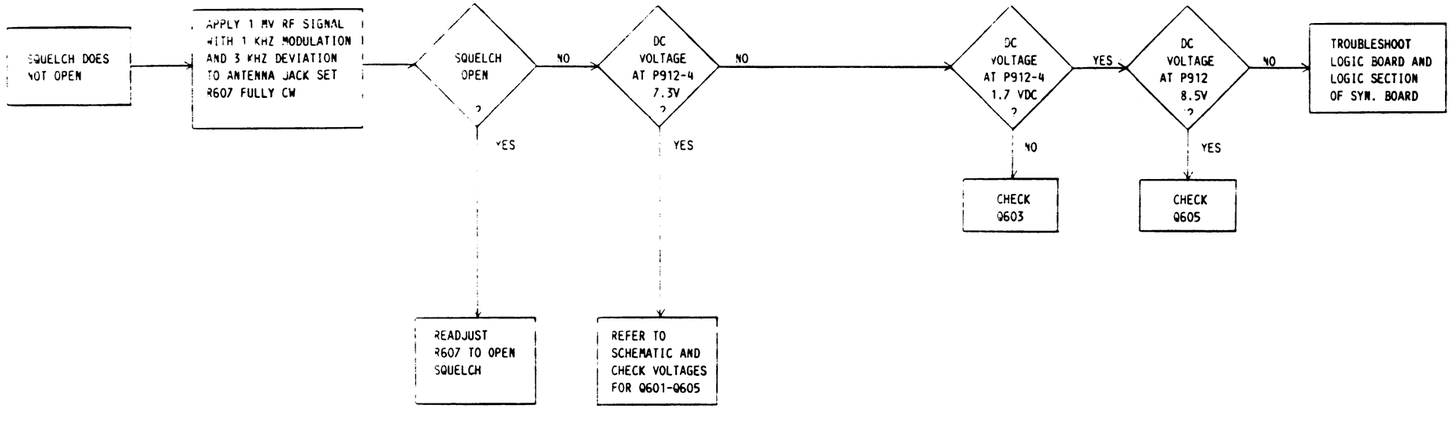


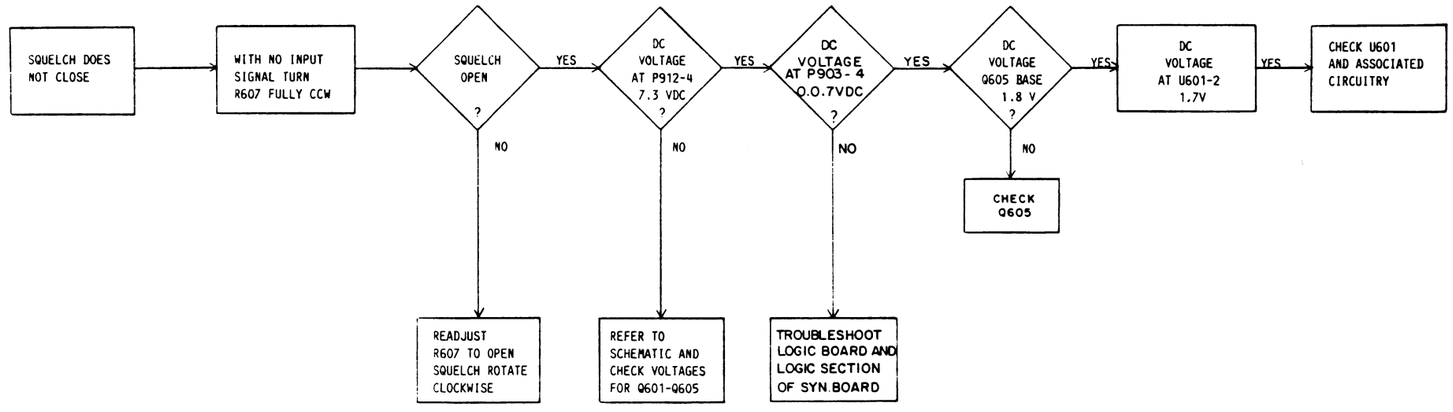


TROUBLESHOOTING PROCEDURE

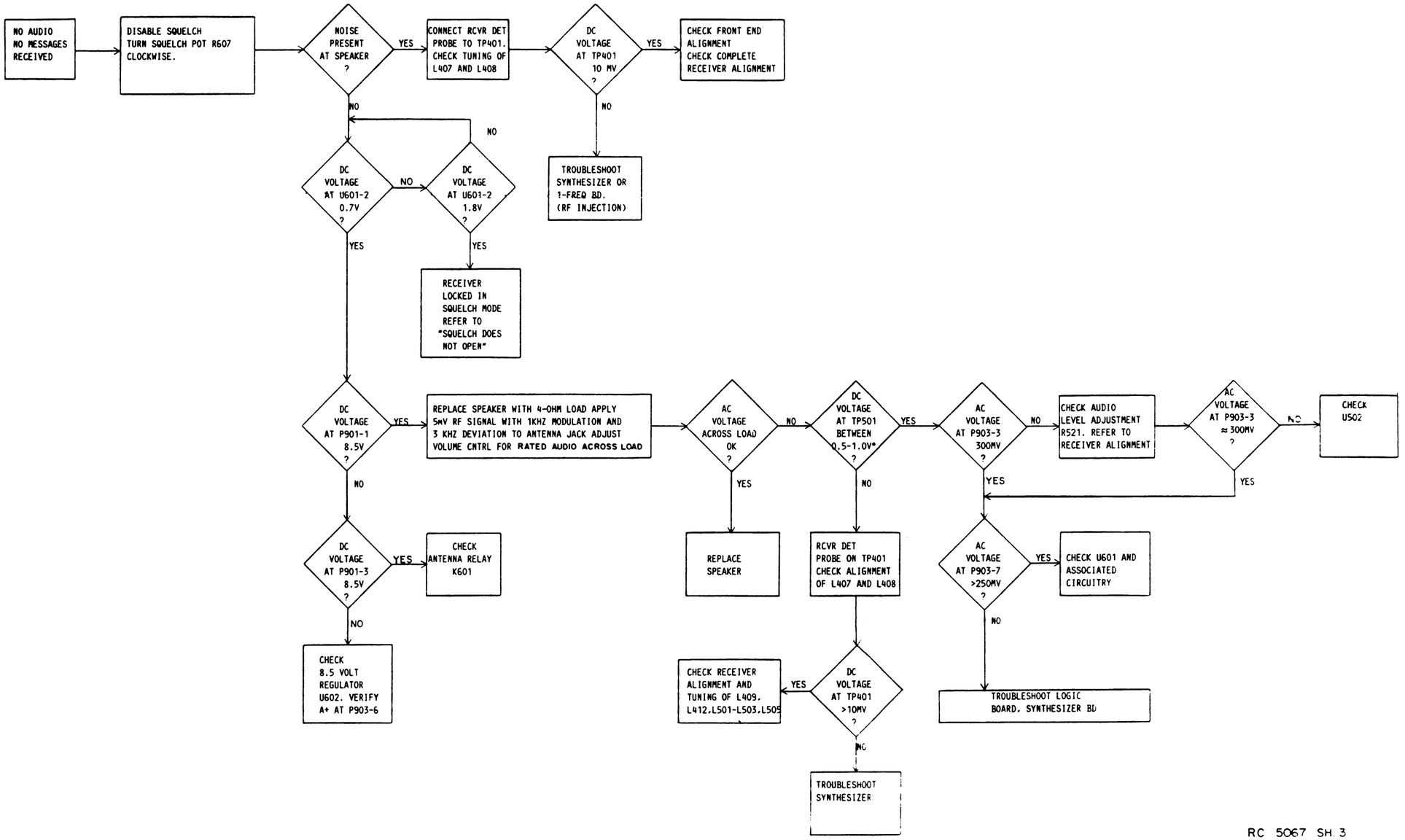
RECEIVER FLOW CHART

RC 5067 SH 1


SQUELCH DOES NOT OPEN
APPLY 1 MV RF SIGNAL WITH 1 KHZ MODULATION AND 3 KHZ DEVIATION TO ANTENNA JACK SET R607 FULLY CW
SQUELCH OPEN ?
NO
YES
READJUST R607 TO OPEN SQUELCH
DC VOLTAGE AT P912-4 7.3V ?
NO
YES
REFER TO SCHEMATIC AND CHECK VOLTAGES FOR Q601-Q605
DC VOLTAGE AT P912-4 1.7 VDC ?
YES
NO
CHECK Q603
DC VOLTAGE AT P912 8.5V ?
NO
YES
CHECK Q605
TROUBLESHOOT LOGIC BOARD AND LOGIC SECTION OF SYN. BOARD

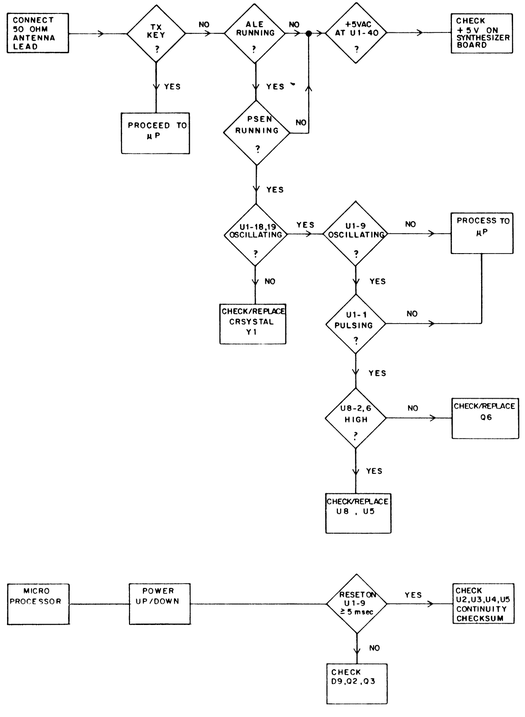

SQUELCH DOES NOT CLOSE
WITH NO INPUT SIGNAL TURN R607 FULLY CCW
SQUELCH OPEN ?
YES
NO
READJUST R607 TO OPEN SQUELCH ROTATE CLOCKWISE
DC VOLTAGE AT P912-4 7.3 VDC ?
YES
NO
REFER TO SCHEMATIC AND CHECK VOLTAGES FOR Q601-Q605
DC VOLTAGE AT P903-4 0.0.7VDC ?
YES
NO
TROUBLESHOOT LOGIC BOARD AND LOGIC SECTION OF SYN.BOARD
DC VOLTAGE Q605 BASE 1.8 V ?
YES
NO
CHECK Q605
DC VOLTAGE AT U601-2 1.7V
YES
CHECK U601 AND ASSOCIATED CIRCUITRY

RC 5067 SH. 2

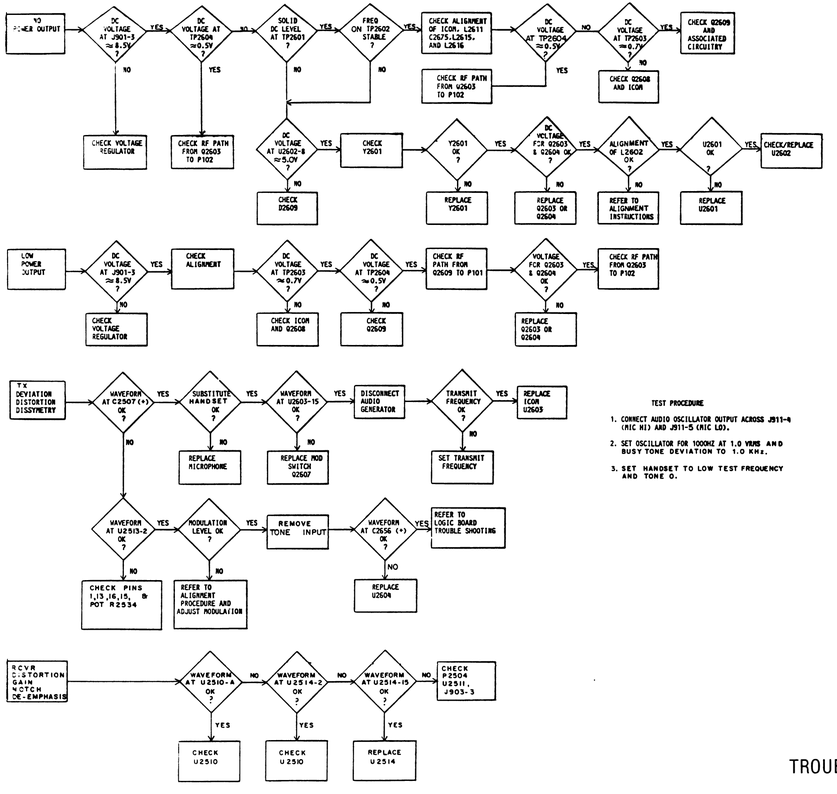

NO AUDIO NO MESSAGES RECEIVED
DISABLE SQUELCH TURN SQUELCH POT R607 CLOCKWISE.
NOISE PRESENT AT SPEAKER ?
YES
CONNECT RCVR DET PROBE TO TP401. CHECK TUNING OF L407 AND L408
DC VOLTAGE AT TP401 10 MV ?
YES
CHECK FRONT END ALIGNMENT CHECK COMPLETE RECEIVER ALIGNMENT
NO
TROUBLESHOOT SYNTHESIZER OR 1-FREQ BD. (RF INJECTION)
NO
DC VOLTAGE AT U601-2 0.7V ?
NO
DC VOLTAGE AT U601-2 1.8V ?
NO
YES
YES
RECEIVER LOCKED IN SQUELCH MODE REFER TO "SQUELCH DOES NOT OPEN"
DC VOLTAGE AT P901-1 8.5V ?
YES
REPLACE SPEAKER WITH 4-OHM LOAD APPLY 5mV RF SIGNAL WITH 1KHZ MODULATION AND 3 KHZ DEVIATION TO ANTENNA JACK ADJUST VOLUME CNTRL FOR RATED AUDIO ACROSS LOAD
AC VOLTAGE ACROSS LOAD OK ?
NO
DC VOLTAGE AT TP501 BETWEEN 0.5-1.0V* ?
YES
AC VOLTAGE AT P903-3 300MV ?
NO
CHECK AUDIO LEVEL ADJUSTMENT R521. REFER TO RECEIVER ALIGNMENT
AC VOLTAGE AT P903-3 ≈ 300MV ?
NO
CHECK U502
NO
YES
YES
YES
YES
DC VOLTAGE AT P901-3 8.5V ?
YES
CHECK ANTENNA RELAY K601
NO
CHECK 8.5 VOLT REGULATOR U602. VERIFY A+ AT P903-6
REPLACE SPEAKER
RCVR DET PROBE ON TP401 CHECK ALIGNMENT OF L407 AND L408
AC VOLTAGE AT P903-7 >250MV ?
YES
CHECK U601 AND ASSOCIATED CIRCUITRY
NO
TROUBLESHOOT LOGIC BOARD. SYNTHESIZER BD
CHECK RECEIVER ALIGNMENT AND TUNING OF L409, L412,L501-L503,L505
YES
DC VOLTAGE AT TP401 >10MV ?
NO
TROUBLESHOOT SYNTHESIZER

RC 5067 SH. 3

LOGIC FLOW CHART



RC 5065



RC 5066

FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set with a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 27.0°C (80.6°F). Refer to Steps 17 thru 19 of the Transmitter Alignment Procedure.

TEST EQUIPMENT

1. 50 ohm load
2. CLASSIC II Handset
3. Frequency Counter
4. RF Signal Probe (19C330129G1)
5. LBI31495 CLASSIC II Test Mode Functions

NOTE

The following procedure assumes the radio has been programmed (via the URP) with frequency set 1 containing the following three channels in the order given.

FS1: Channel 200 (hex code 02)
Channel 100 (hex code 68)
Channel 001 (hex code C8)

To set the frequency:

1. Connect wattmeter and frequency counter to antenna jack.
2. Connect the handset and set to test mode for frequency 001 and tone 00.
3. Install the RF signal probe on TP2602 and connect it to a counter.
4. Adjust C2607 to obtain 41.6 MHz ±10 Hz on the counter. When complete remove the signal probe.
5. Adjust L2602 to obtain 3.75 ±.1 volts on TP2601.
6. Tune L3 of U2603 for a peak voltage reading on TP2603.
7. Key the transmitter and tune 001 (FREQ) of U2603 to the desired frequency in Table 2.
8. Retune L3 (LEVEL) of U2603 for a peak voltage reading at TP2603 and again check the frequency.

MODULATION LEVEL ADJUSTMENT

TEST EQUIPMENT

1. Audio Oscillator
2. Deviation Monitor
3. CLASSIC II Handset

PROCEDURE

1. Connect the handset and set test mode for frequency 001 and tone select to 00.
2. Connect the audio oscillator and the AC voltmeter across audio input terminals J911-4 (Hi) and J911-5 (Lo) on the synthesizer/interconnect board.
3. Adjust the audio oscillator for a 1 Volt RMS at 1000 Hz.
4. Connect 50 ohm load to antenna jack.

AUDIO DEVIATION ADJUSTMENT

NOTE

MOD ADJUST CONTROL R2663 has been adjusted to the proper setting before shipment and normally does not require readjustment. This setting permits approximately 70% modulation for the average voice level.

AUDIO AND TONE DEVIATION ADJUSTMENT

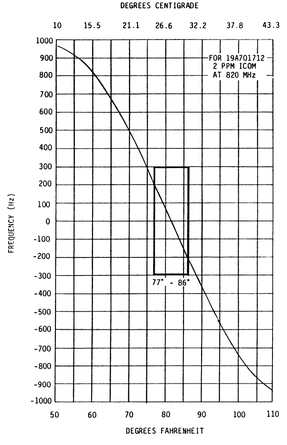
1. On the handset set select tone "41" for busy tone.
2. Key the transmitter and adjust R2534 on the Synthesizer/Interconnect board for 1.0 kHz ±0.1 kHz deviation.
3. Reset the select to 00 (no tone) and step through each tone present in the radio checking deviation for 2.0 kHz to 5.0 kHz. (Deviation for Tones 40 and 41 will be as set in Step 2.)

AUDIO SENSITIVITY

TEST EQUIPMENT

1. Audio Oscillator
2. CLASSIC II Handset
3. AC Voltmeter
4. Deviation Monitor

1. Connect audio oscillator output across J911-4 (MIC HI) and J911-5 (MIC LO). Adjust output for 1000 Hz at 1.0 VRMS.
2. On handset, set to frequency 001 and tone 00 in the test mode.
3. Reduce generator output until deviation falls to 2.25 kHz. Voltage should be less than 120 millivolts.



ICOM FREQUENCY CORRECTION CURVE FOR 820 MHz

RC-4455

TRANSMITTER ALIGNMENT

TEST EQUIPMENT

1. 50 ohm Wattmeter
2. DC Probe (19C330165G1)
3. Voltmeter
4. Power supply (13.8 V Regulated)
5. Audio Signal Generator
6. Frequency Counter
7. RF Signal Probe (19C330129G1)
8. FM Communications Monitor
9. CLASSIC II Handset
10. Thruline Wattmeter

PRELIMINARY CHECKS AND ADJUSTMENT

NOTE

Refer to photographs to locate CONTROLS, TEST POINTS and FM ICOM.

1. Make sure that FM ICOM U2603 is installed.
2. Connect thruline wattmeter and 50 ohm load to antenna jack.
3. Pre-set the following controls:
   a. Set slug in L2602 on the synthesizer/interconnect board to center of coil form.
   b. Set slug of L2611 so top of slug is flush with the top of the coil form.
   c. Set C2675 to minimum capacitance.
   d. Set L2615 and L2616 so that the slugs are tuned out of the casting.
   e. Set slugs of L101, L102 and L103 flush with top of helical casting and then set 1 1/4 turns down.
   f. Set slugs of L107, L108 and L109 out of casting.
   g. Set C125, C127, C133 and C134 to minimum capacitance (plates unmeshed).
   h. Install the RF signal probe on TP2602 and connect it to the frequency counter.
3. Set power adjust control R203 to minimum (fully counterclockwise).
4. Plug the handset into the radio. Set the controls to frequency 001 and tone 00 in the tone select mode.

NOTE

All adjustments are made with the transmitter unkeyed unless directed to key the transmitter.

ALIGNMENT PROCEDURE

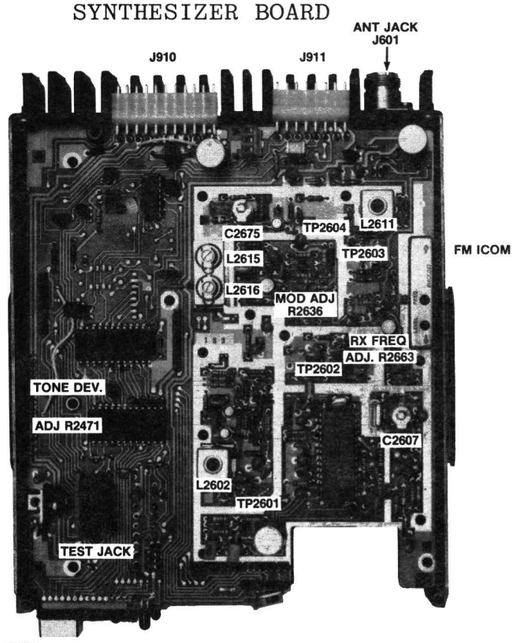
STEP	TEST POINT	TUNING CONTROL	INDICATION	PROCEDURE
				NOTE **The following controls and test points are located on the synthesizer/interconnect board.**
1.				Apply +13.8 Volts to J910-1 and 11. Connect A- to J910-6.
2.	TP2602	C2607	Ref. Osc. Frequency	With the handset test mode on frequency 001 and tone 00, adjust C2607 to obtain 41.6 MHz ±10 Hz on the counter. When complete remove the signal probe.
3.	TP2601	L2602	3.75 VDC	Adjust L2602 to obtain 3.75 ±.1 volts on TP2601.
4.	TP2603	L3 (U2603)	Peak	Tune L3 (Level) of U2603 for a peak voltage reading on TP2603.
5.	TP2604	L2611	Peak	Tune L2611 for a peak voltage reading on TP2604.
6.	TP2604	C2675	Dip	Tune C2675 for a dip in voltage reading on TP2604. The dip will be sharp and of small deviation.
7.	TP2604	L2615	Peak	Tune L2615 for peak in voltage at TP2604. The peak will be sharp and of small deviation.
8.	TP2604	L2616	Dip	Tune L2616 for a dip in voltage at TP2604. The dip will be sharp and of small deviation.

STEP	TEST POINT	TUNING CONTROL	INDICATION	PROCEDURE
				NOTE **The following controls and test points are located on the transmit/receive board.**
9.	TP101	L101, L102, L103	Dip	Select frequency 002 and tone 00. Alternately tune L101 then L102 and L103 for a dip in meter reading.
10.	TP101	L101, L102 L103	Dip	Carefully re-tune L101, L102, and L103 for a maximum dip in meter reading.
11.	TP101	L107	Dip	Tune L107 for a small but sharp dip in meter reading.
12.	TP101	L108	Peak	Tune L108 for a small but sharp peak in meter reading.
13.	TP101	L109	Dip	Tune L109 for a small dip in meter reading. Do NOT retune L107, L108 or L109.
14.	TP103	C125, C127 C133 and C134	Maximum	Key the transmitter and tune C125, C127, C133 and C134 for maximum meter reading. Unkey the transmitter between adjustments to avoid overheating.
15.	TP103	C125, C127 C133 and C134	Maximum	Key the transmitter and slightly retune C125, C127, C133 and C134 for maximum meter reading. Unkey transmitter between adjustments to avoid overheating.
		POWER AMPLIFIER ADJUSTMENT		
16.	Wattmeter at ANT jack J601	R212, R205 POWER CONTROL	See Procedure	Key the transmitter and adjust R203 for rated power output. **NOTE** **R212 is factory preset and normally does not require field adjustment.** **Should it be necessary to adjust R212, disconnect the 50 ohm load from the thruline wattmeter. Key the transmitter and set R212 for 10 watts forward power. Supply current should not exceed 5 amperes. Reconnect wattmeter.**
		FINAL SYNTHESIZER ADJUSTMENTS		
17.	Antenna-jack	L2 (U2603)	Transmit Frequency	Select frequency 001 and tone 00. Key the transmitter and tune L2 (Freq.) of the ICOM to correct transmitter frequency shown in Table 2.
18.	TP2603	L3 (U2603)	Peak	Retune L3 (level) of the ICOM for a peak voltage reading at TP2603 and again check the frequency.
19.	TP401	R2663	RF Injection Frequency	Unkey the transmitter and monitor TP401 on the Tx/Rx board. Adjust R2663 on the Synthesizer/ Interconnect board for the correct RF injection frequency.
20.	Antenna	R2534	1.0 kHz	Select frequency 001 and tone 41. Key the transmitter and adjust R2534 for 1.0 kHz ±0.05 kHz deviation at the transmitter output.

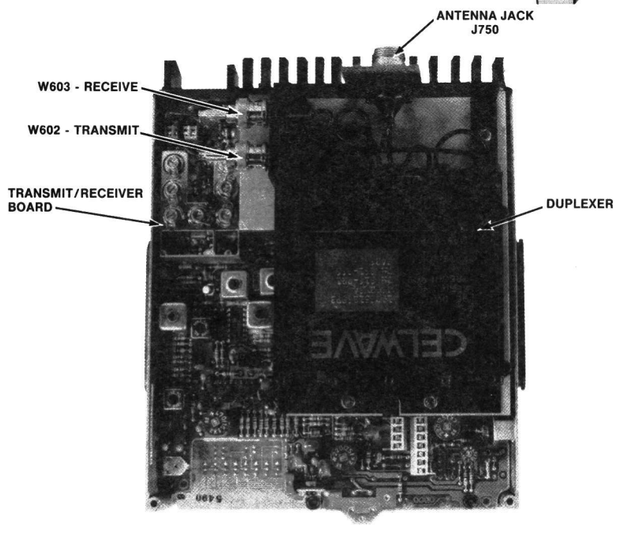
ICOM TRANSMIT FREQUENCY U2603 (L2)		RECEIVER OFFSET FREQUENCY (R2663)
Freq. Plan	Freq. MHz	Freq. MHz
USA-1	816.0125	816.0000
AUSTRALIA	820.0125	820.0000
USA-2	811.0125	811.0000
USA-3	806.0125	806.0000
MEXICO	811.0000	810.9875

TABLE 2 - FREQUENCY IDENTIFICATION

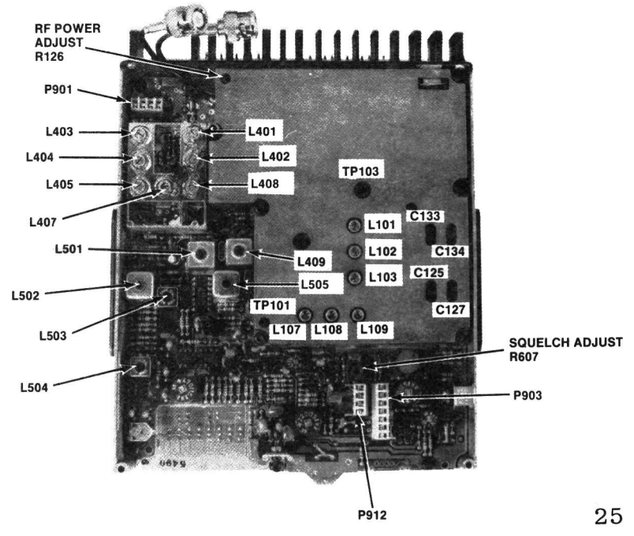
SYNTHESIZER BOARD



TOP VIEW (DUPLEX)



TOP VIEW TRANSMIT/RECEIVER BOARD



RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. RF Signal Generator (45.0000 MHz and 851-870 MHz)
2. Analog DC Voltmeter (with high input impedance and millivolt scale)
3. Frequency counter (up to 1000 MHz with 0.05 Volt sensitivity)
4. Receiver RF Detector Probe 19C330130G1
5. RF Signal Probe 19C330129G1
6. CLASSIC II Handset
7. AC Voltmeter

PRELIMINARY ADJUSTMENTS

1. Connect RF Detector Probe from TP501 to the DC Voltmeter.
2. Connect RF Signal Probe from TP401 to the RF Signal Generator.
3. Preset the slugs in L409, L412, L501, L502 and L505 eight complete turns up from the top of the coil.
4. Preset the slugs in front end coils L401 through L408 flush with the top rim of the casting. Set the Signal Generator for 45.0125 MHz (Simplex) or 45.0000 MHz (Duplex) output with ±3 kHz deviation and 1 kHz modulation.
5. Set the handset to frequency 001 and tone to 00.

NOTE

Keep the Signal Generator adjusted so that the DC voltage reading will remain between 0.5 to 1.0 volt during the alignment procedure.

ALIGNMENT PROCEDURE

STEP	TEST POINT	TUNING CONTROL	METER READING	PROCEDURE
				NOTE **MAKE SURE THAT THE TRANSMITTER IS PROPERLY ALIGNED AND OPERATING BEFORE ALIGNING THE RECEIVER.**
1.	TP501	L412	Maximum	Tune L412 for maximum meter reading.
2.	TP501	L409, L501	Maximum	Alternately tune L409 and L501 for maximum meter reading.
3.	TP501	L502, L503	Maximum	Alternately tune L502 and L503 for maximum meter reading.
4.	TP501	L505	See Procedure	Remove RF detector probe from TP501. Connect RF signal probe from TP501 and to the frequency counter. Remove the modulation from input signal and set the RF signal level to 1 millivolt. Next, tune L505 for a reading of 455 kHz on the counter, and then remove the RF signal probe from TP501.
5.	TP401	L407, L408	Maximum	Remove the RF signal probe from TP401, and connect the RF detector probe from TP401 to the DC voltmeter. Next, alternately tune L407 and L408 for maximum voltage reading (normally a few hundred millivolts).
6.			See Procedure	Re-connect the RF detector probe to TP501. Apply the signal identified in Table 3 to the antenna jack with ±3 kHz deviation and 1 kHz modulation. Keep voltmeter reading between 0.5 and 1 volt DC.
7.	TP501	L401, L402 L403, L404 and L405	Maximum	Alternately tune L403, L404 and L405 for maximum meter reading, then alternately tune L401 and L402 for maximum. Recheck L403-L405.
8.	TP501		See Procedure	Remove the RF detector probe from TP501 and connect the RF signal probe from TP501 to the frequency counter. Remove the modulation from the input signal and increase the input level to 1 millivolt. The frequency counter should read 455 kHz. Service Note: If reading is not 455 kHz ±200 Hz, check the transmitter alignment.
9.	TP501	L409, L412 L501, L502 and L503	Maximum	Remove the RF signal probe and reconnect the RF detector probe to TP501. Re-apply 1 kHz modulation to the input signal and retune L409, L412, L501, L502 and L503 for maximum meter reading, keeping meter reading between 0.5 and 1 volt DC.
10.		L504	Maximum	Connect a 4 ohm load across the external speaker leads. Connect an AC voltmeter across the 4 ohm resistor. Tune L504 for maximum audio output voltage on RMS voltmeter.
11.	P903-3	Audio Level Control R521	See Procedure	Connect the RMS voltmeter to P903-3 (VOL/SQ HI) and adjust R521 for a meter reading of 300 millivolts RMS. With RMS voltmeter across the 4 ohm resistor, adjust VOLUME control for 3 Watts (3.46 VRMS across 4 ohm load. Measure audio distortion using Distortion Analyzer. Distortion should be less than 5%. Disconnect all test equipment.

TABLE 3 - RX FREQUENCY TO ANT. JACK

Frequency Plan	Frequency MHz
USA-1	863.5125
AUSTRALIA	867.5125
USA-2	858.5125
USA-3	853.5125
MEXICO	859.4000

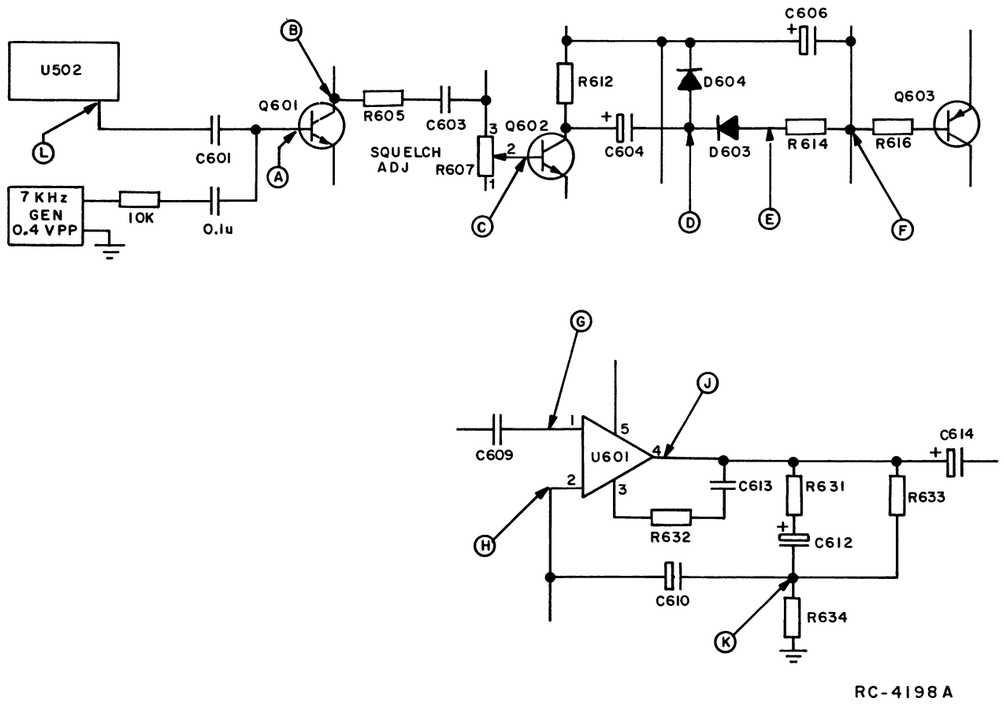
DUPLEX SIDETONE CANCELLATION
(For Duplex operation only)

NOTE

MAKE SURE THE TRANSMITTER AND RECEIVER ARE PROPERLY ALIGNED AND OPERATING BEFORE MAKING THE FOLLOWING ADJUSTMENTS.

1. Select 001 (frequency) and tone 12.
2. Apply an on channel unmodulated carrier that is 20 dB above the 12 dB SINAD level.
3. Key in duplex operation on the handset.
4. Adjust R2549 so that J2504-1 reads a miminum on the AC voltmeter. This reading should be at least 10 dB lower than J2504-3.

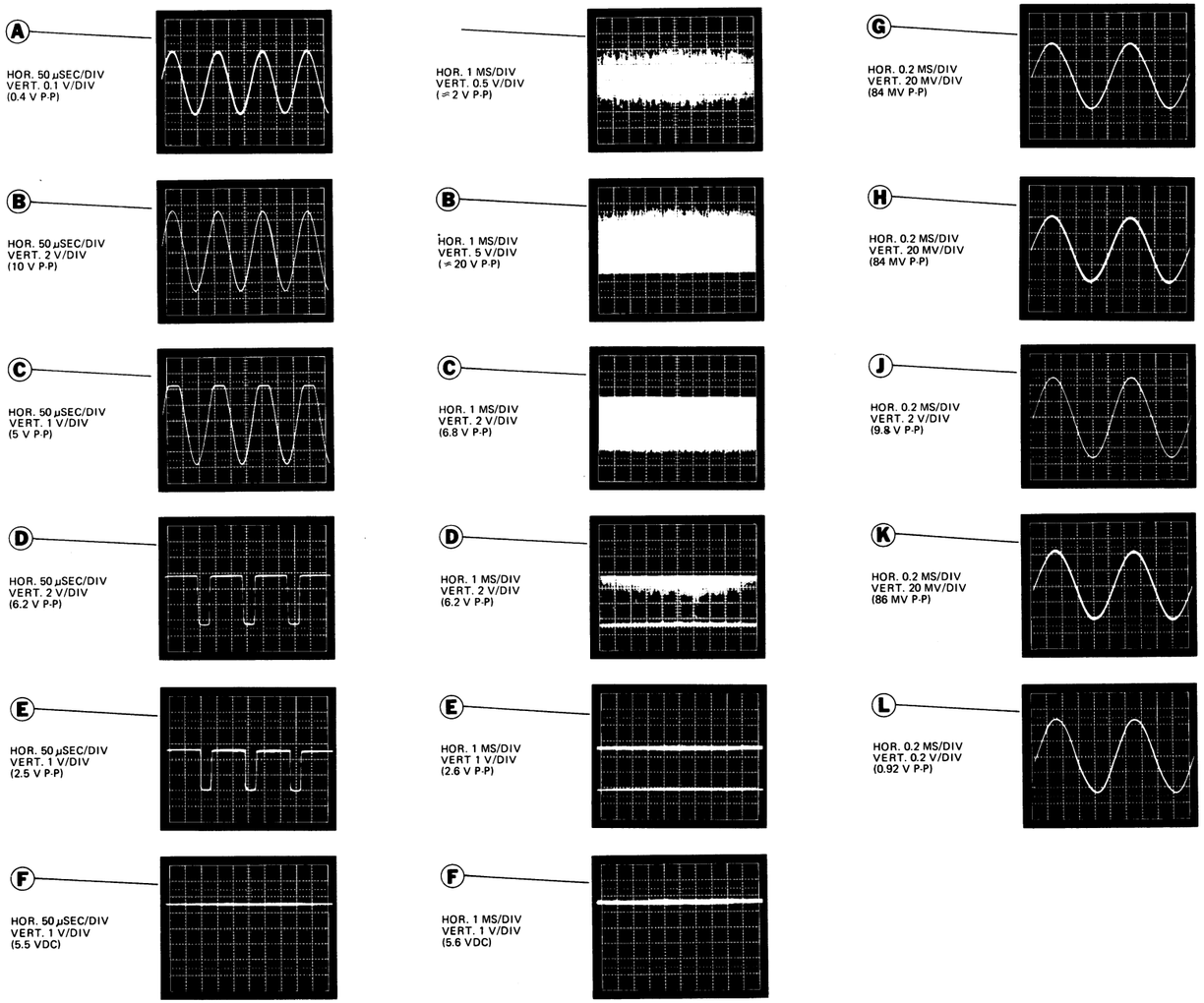
AUDIO AND SQUELCH WAVEFORMS



SQUELCH CIRCUIT TEST WITH 7 kHz SIGNAL

PRELIMINARY STEPS

1. Quiet receiver with 1000 uv unmodulated signal.
2. **Squelch Adjust at maximum squelch.**
3. Monitor pushbutton in OUT position.
4. Use 10 megohm probe.



SQUELCH CIRCUIT CHECKS WITH NOISE

PRELIMINARY STEPS

1. No input signal applied.
2. Squelch Adjust at maximum squelch.
3. Monitor pushbutton in OUT position.
4. Use 10 megohm probe.

AUDIO CIRCUIT CHECKS

PRELIMINARY STEPS

1. Apply 1000 uv on frequency signal with 1000 Hz modulation and 3 kHz deviation to antenna jack J601.
2. Monitor pushbutton "IN".
3. Output set for 3-Watts (3.46 VRMS) into 4 ohm load.
4. Use 1 megohm probe.

RECEIVER AUDIO AND SQUELCH WAVEFORM CHECKS

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

TEST EQUIPMENT REQUIRED

- Distortion Analyzer
- Signal Generator
- 6 dB attenuation pad, and 4.0 ohm, 5 Watt resistor
- CLASSIC II Handset

PRELIMINARY ADJUSTMENTS

NOTE

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

Plug in the handset and select RF frequency for test. There are three test frequencies in every Frequency PROM for each frequency plan.

NOTE

The receive frequency is always 45 MHz above the transmit frequency.

TEST FREQUENCY	USA-1	USA-2	AUSTRALIA	USA-3	MEXICO
Low	811.0125 MHz	820.0125 MHz	820.0125 MHz	806.0125 MHz	811.0000 MHz
Middle	818.5125 MHz	813.5125 MHz	822.5125 MHz	808.5125 MHz	813.5000 MHz
High	820.9875 MHz	815.9875 MHz	824.9875 MHz	810.9875 MHz	815.9750 MHz

STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1000 microvolt, on-frequency test signal modulated by 1,000 Hz with ±3.5 kHz deviation to antenna jack J601.

B. With 3 Watt Speaker

Disconnect speaker if present.

Connect a 4.0 ohm, 5 Watt load resistor across the external speaker leads.

Connect the Distortion Analyzer input across the resistor.

C. Adjust the VOLUME control for rated power output (one step down from maximum setting) using the distortion analyzer as a voltmeter.

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 3 Watts, make the following checks:

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

F. Audio Gain (Refer to Receiver Troubleshooting Procedure).

G. FM Detector Alignment (Refer to Receiver Alignment).

STEP 2

USABLE SENSITIVITY (12 DB SINAD)

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

A. Apply a 1000 microvolt, on-frequency signal modulated by 1000 Hz with 3.5 kHz deviation to J601.

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

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

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

F. The 12 dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 1.5 Watts (0.56 Volts RMS across the 4.0 ohm receiver load using the Distortion Analyzer as a Voltmeter).

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

SERVICE CHECK

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

STEP 3

MODULATION ACCEPTANCE (BANDWIDTH (IF BANDWIDTH)

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

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

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

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

D. The deviation control reading for the 12 dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±6.5 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, refer to the Receiver Troubleshooting Procedure.

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
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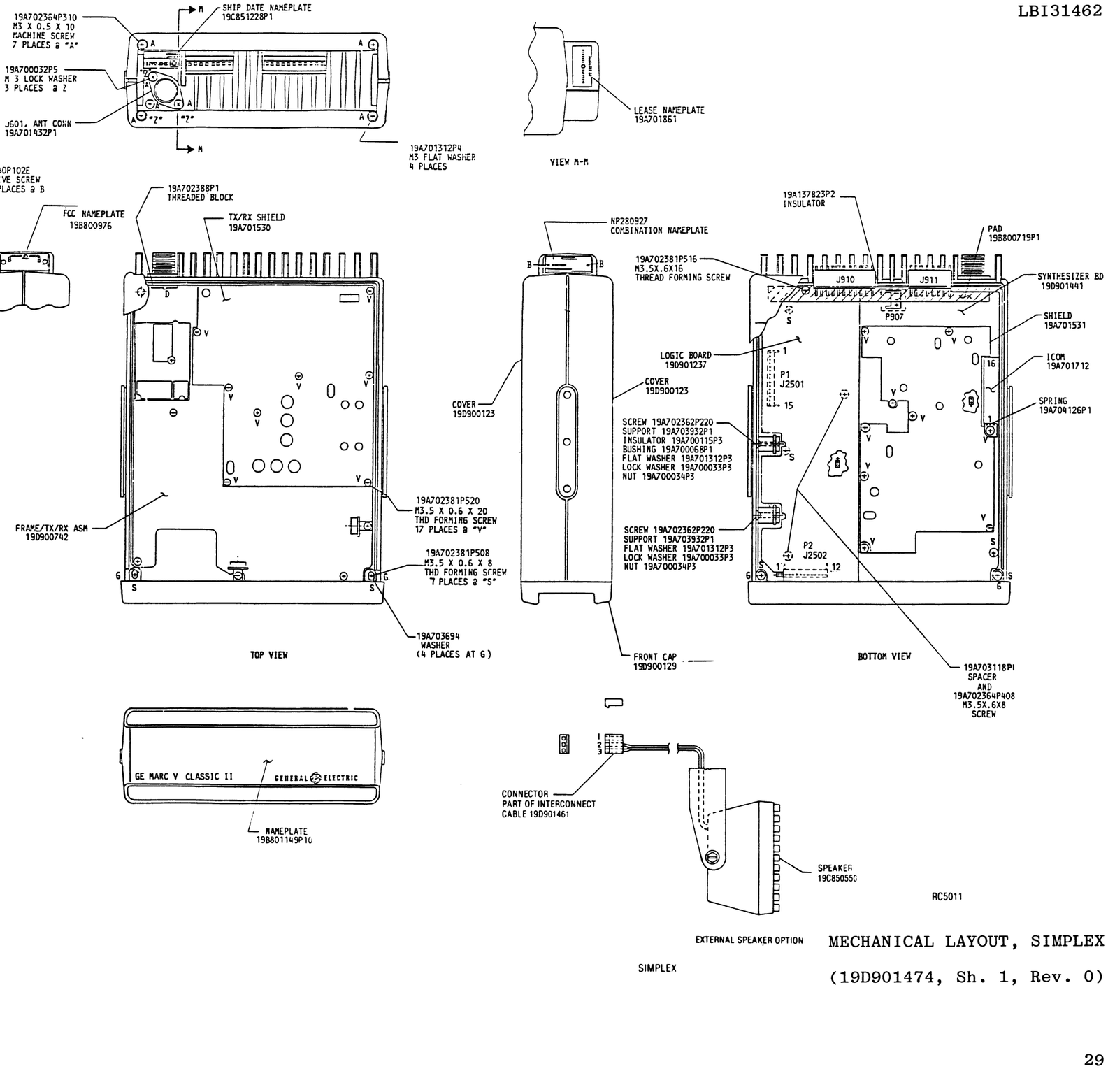
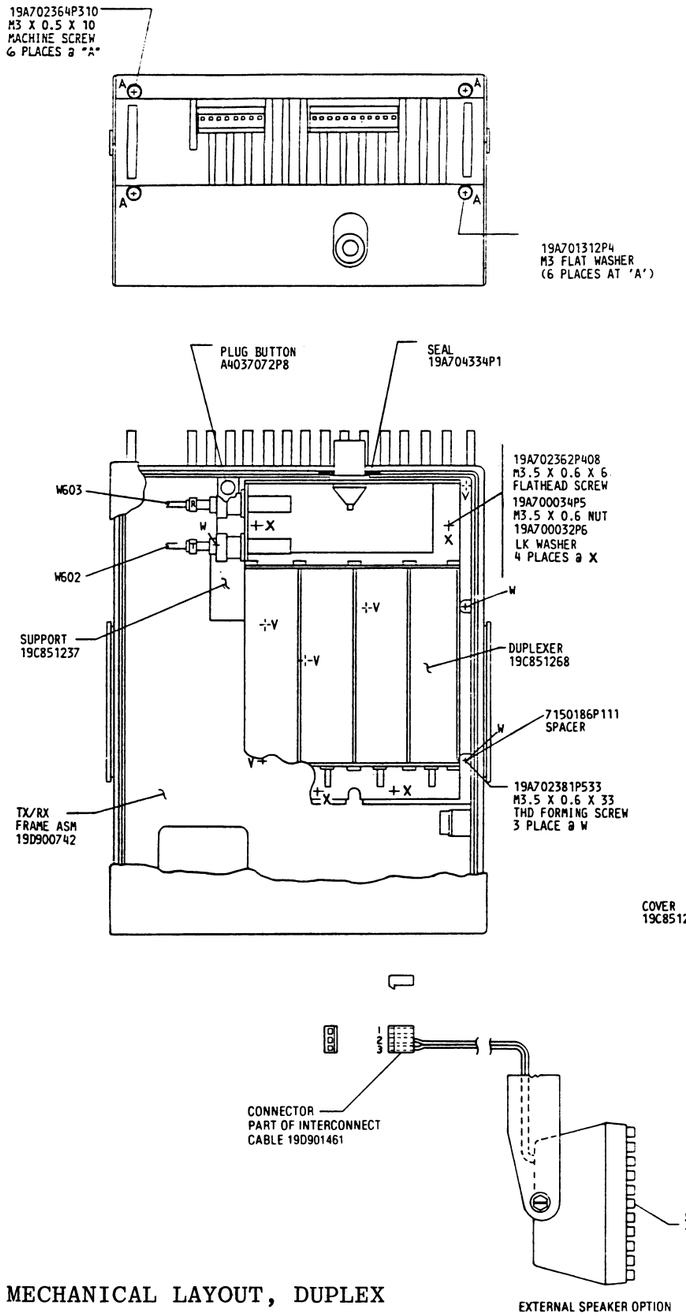
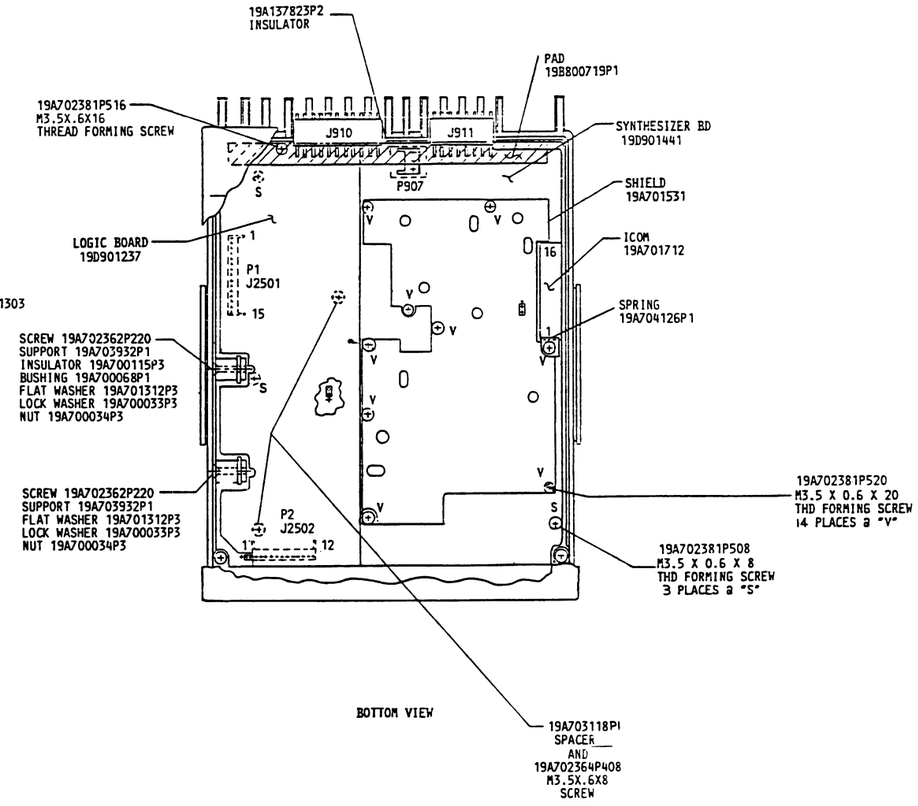


SIMPLEX

MECHANICAL LAYOUT, SIMPLEX

(19D901474, Sh. 1, Rev. 0)



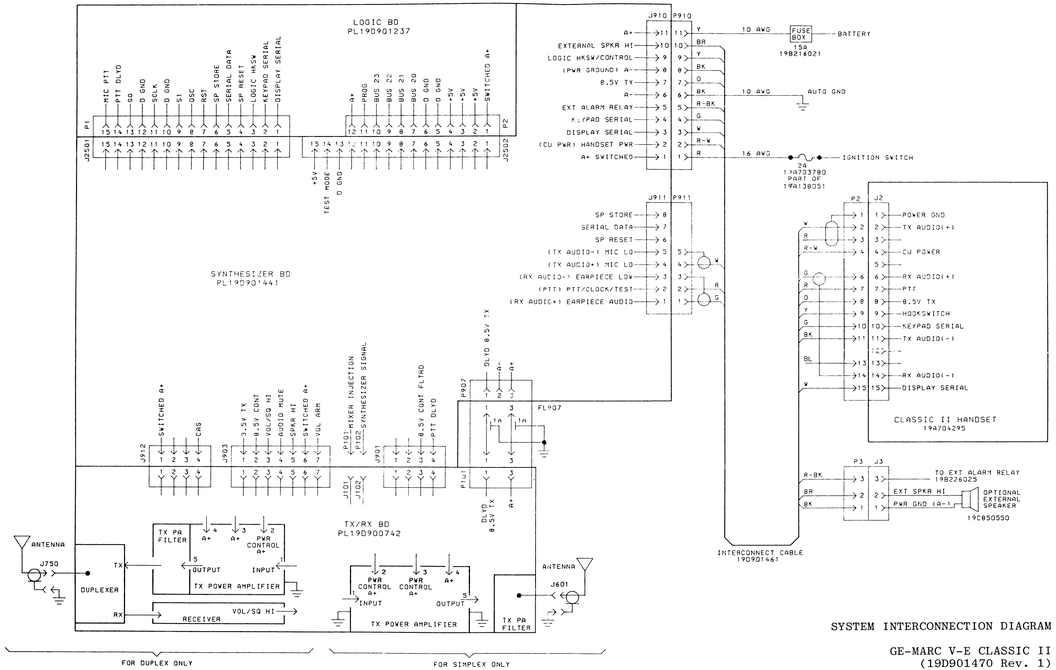


RC5012

MECHANICAL LAYOUT, DUPLEX

(19D901474, Sh. 2, Rev. 0)

DUPLEX



SYSTEM INTERCONNECTION DIAGRAM

GE-MARC V-E CLASSIC II
(19D901470 Rev. 1)

PARTS LIST

LBI30961

GE MARC V4E CLASSIC II
(SINPLEX & DUPLEX)

SYMBOL	GE PART NO.	DESCRIPTION
	19D900123P1	Cover. (Simplex).
	19C851226P2	Cover. (Duplex).
	19B801303G1	Cover. (Duplex).
	19D900129P1	Front Cap. (Simplex).
	19A701530G1	Transmit/Receive shield. (Simplex).
	19A701530G4	Transmit/Receive shield. (Duplex).
	19A701531G1	Shield. (Simplex & Duplex).
	19C851237P1	Mounting plate. (Duplex).
	19A701713G10	Oscillator. 820-825 MHz. 2 PPM. (AUSTRALIA 61.40104 MHz).
	19A701712G11	Oscillator. 811-816 MHz. 2 PPM. (USA-2 60.662708 MHz).
	19A701712G12	Oscillator. 816-820 MHz. 2 PPM. (USA-1 61.063042 MHz).
	19A701712G13	Oscillator. 806-811 MHz. 2 PPM. (USA-3 60.234375 MHz).
	19A701712G14	Oscillator. 811-815.750 MHz. 2 PPM. (MEXICO 60.641667 MHz).
	19C851268P1	Duplexer. (USA-3 60.234375 MHz).
	19C851268P2	Duplexer. (USA-2 60.662708 MHz and MEXICO 60.641667 MHz).
	19C851268P3	Duplexer. (USA-1 61.063542 MHz).
	19C851268P4	Duplexer. (AUSTRALIA 61.40104 MHz).
	19D801461P1	Cable, interconnect.
	19A701861P1	Nameplate. (Lease Nameplate).
	19A702609P1	Nameplate. (Dealer Option).
	19C851228P1	Nameplate, ship.
	NP280927	Nameplate, comb. (Simplex).
	19C851027P1	Nameplate, comb. (Duplex).
	19B800976P13	Nameplate, FCC. (15 Watt Simplex).
	19B800976P14	Nameplate, FCC. (30 Watt Simplex).
		HARDWARE ASSEMBLY KIT 15 AND 30 WATT SINPLEX 19A701522G14
		- - - - - - - - - - JACKS - - - - - - - - - -
J601A	19A701432P1	Receptacle: coax; sim to UG58AU.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A702381P520	Screw, thd. form: TORX®Drive, No. M3-0.6 x 20. (Secures shielding - Quantity 17).
	19A702364P310	Machine screw, TORX®Drive: No. M3-0.5 x 10. (Secures top and bottom covers).
	19A702381P508	Screw, thd. form: No. 2.5-0.6 x 8. (Secures front cap, synthesizer board and logic board).
	NS50P102E	Drive screw: No. 00 x 1/8. (Secures FCC Nameplate).
	19A701312P4	Flatwasher: 3.2 ID. (Secures top and bottom covers).
	19A700032P5	Lockwasher, internal tooth: No. 3MM. (Located behind J601).
	19A702364P408	Machine screw: TORX®Drive, M3.5 - 0.6 x 8. (Secures Logic Board).
	19B800719P1	Dust pad. (Located behind J601, J910, J911).
	19A702388P1	Threaded block. (Mounts J601).
	19A137823P2	Plate, insulator. (Used with P907).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
	19A701312P3	Flatwasher, metric: No. 2.5MM. (Secures U250R and U901).
	19A703693P1	Washer. (Secures front cap).
	19A703932P1	Support. (Secures U250W and U901).
	19A702362P2Z0	Machine screw, TORX®Drive: No. M2.5 - .45 x 20. (Secures U250R and U901).
	19A704129P1	Spring. (Under shield screw at Pin 1 end of ICOM).
	19A700034P3	Hex nut, metric: M2.5 x 0.45. (Secures U250R and U901).
	19A700033P3	Lockwasher, external tooth: M2.5. (Secures U250R and U901).
	19A702115P3	Insulator, plate. (Secures U250R).
	19A700068P1	Insulator, bushing. (Secures U250R).
	19A702381P516	Tap screw, TORX®Drive: No. M3.5 - 0.6 x 16. (Secures Logic Board).
	19A703118P1	Spacer, stud: No. M3.5 - 0.6 x 8, tap: No. M3.5 - 0.6 x 8. (Secures Logic Board).
	19A801149P10	Nameplate. (GE MARC V4E CLASSIC II).
		HARDWARE ASSEMBLY KIT 15 WATT DUPLEX 19A701522G15
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A702381P520	Screw, thd. form: TORX®Drive, No. M3-0.6 x 20. (Secures shielding and Transmitter/Receiver Board).
	19A702364P310	Machine screw, TORX®Drive: No. M3-0.5 x 10. (Secures top and bottom cover).
	19A702381P508	Screw, thd. form: No. 2.5-0.6 x 8. (Secures front cap, Synthesizer Board and Logic Board).
	19A701312P4	Flatwasher: 3.2 ID. (Secures top and bottom covers).
	19A702364P408	Machine screw: TORX®Drive, M3.5 - 0.6 x 8. (Secures Logic Board).
	19A700032P6	Lockwasher, internal tooth: No. 3.5MM. (Secures Duplexer support).
	19B800719P1	Dust pad. (Located behind J601, J910, J911).
	19A137823P2	Plate, insulator. (Used with P907).
	19A701312P3	Flatwasher, metric: No. 2.5MM. (Secures U250R and U901).
	19A702381P533	Screw, thd. forming, TORX®DRIVE; No. 3.5 - 0.6 x 33. (Secures Duplexer spacer).
	19A702362P408	Machine screw: M3.5-0.6 x 8. (Secures Duplexer support).
	19A700034P5	Hex nut: No. M3.5 x 0.6. (Secures Duplexer support).
	19A703932P1	Support. (Secures U250R and U901).
	19A702362P220	Machine screw, TORX®Drive: No. M2.5 - .45 x 20. (Secures U250R and U901).
	403707P17	Button plug. (Quantity 1).
	7150186P111	Spacer, sleeve. (Mounts Duplexer).
	19A704128P1	Spring. (Under shield screw at Pin 1 end of ICOM).
	19A700034P3	Hex nut, metric: M2.5 x 0.45. (Secures U250R and U901).
	19A700033P3	Lockwasher, external tooth: M2.5. (Secures U250R and U901).
	19A700115P3	Insulator, plate. (Secures U250R).
	19A700068P1	Insulator, bushing. (Secures U250R).
	19A702381P516	Tap screw, TORX®Drive: No. M3.5 - 0.6 x 16. (Secures Logic Board).
	19A703118P1	Spacer, stud: No. M3.5 - 0.6 x 8, tap: No. M3.5 - 0.6 x 8. (Secures Logic Board).
	19A704334P1	Seal. (Seals antenna connector).

SYMBOL	GE PART NO.	DESCRIPTION
		SPEAKER, 4 OHM DASH MOUNT 19C850506G6
		- - - - - - - - - SPEAKERS - - - - - - - - -
LS1	19A702080P3	Permanent magnet: 3 x 5 inch, 4 ohms ±10% imp at 400 Hz, 18 w.
		- - - - - - - - - CABLES - - - - - - - - -
W1	19A129414G1	2 conductor cable: approx 5 feet long, includes (2) 19A116781P5 contacts.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A116986P112	Screw, thread forming, assembled washer: Phillips POZIDRIV®, #1-40 thread, No. 7-19 x 3/4. (Secures grille to rear housing).
	19A701631P516	Machine screw: M5-.8 x 16. (Secures speaker to mount).
	19A700033P10	Lockwasher, external tooth: No. 10. (Secures speaker to mount).
	19A701312P7	Lockwasher: No. 10. (Secures speaker to mount).
	19A129461G1	Custom, hardware.
	19B800534G4	Rear housing.
	19C850548P2	Grille.
	19C320016P2	Mounting bracket.
	19A701354P1	Nameplate. (GENERAL ELECTRIC).
		MOUNTING HARDWARE KIT CLASSIC II SINPLEX/DUPLEX 19A136051G10
	19A134653P400R	Bolt, machine, hex: Metric, 4MM. (Quantity 4).
	19J706152P9	Retaining strap; sim to Dennison BAR-LOK 08471.
	19A700032P7	Lockwasher, internal tooth: N4. (Quantity 4).
	N130P1610C6	Screw, thread forming: No. 10-16 x 5/8. (Quantity 6).
	N130P1624C6	Screw, thread forming: No. 10-16 x 1-1/2. (Quantity 4).
	19C850645G1	Mounting bracket.
	19B801271P1	Cable, ground.
	549040T2P2	Grommet.
	402948T2	Terminal, quick disconnect: wire size 14-18 AWG; sim to AMP 41279(LP).
	19A116849P1	Insulated splice.
	19A703786P1	Fuseholder knob.
	19A703786P2	Fuseholder.
	19A703786P3	Fuseholder contacts. (Quantity 2).
	19A703786P4	Fuseholder spring.
	1R16P5	Quick blowing: 2 amp at 250 v; sim to Littelfuse 312002 or Bussmann AGC-2.
	19A115799P13	Solderless terminal. (Quantity 3).
		FUSE MOUNTING ASSEMBLY 19B216021G1
		- - - - - - - - - - FUSES - - - - - - - - - -
F1	1R11P4	Quick blowing: 15 amps, 250 v; sim to Bussmann MDX15.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19D413045P1	Base.
	19D413046P1	Cover.
	19B205950P1	Fuse clip.
	N130P1412C6	Tap screw: No. 8-18 x 3/4.

SYMBOL	GE PART NO.	DESCRIPTION
	NR1P16007C6	Machine screw, recessed, pan head: No. 10-32 x 7/16.
	N117P1508C6	Tap screw, phillips: No. 8-32 x 3/8.
	19A115942P1	Insert, threaded.
	19J706152P8	Retaining strap.
	N412P19C6	Lockwasher, external tooth, bronze: No. 10, size .190.

PARTS LIST

EXTERNAL ALARM RELAY
19B226074G4
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1701	19A704142P2	General Purpose Silicon; sim to 1N4005.
		- - - - - - - - - RELAYS - - - - - - - - -
K1701	7486515P2	Armature, enclosed: 12 VDC nominal, 85 to 90 ohms coil res, 1 form A contact rated at 15 amps.
		FUSED LEAD 19B226454G1
	1R16P3	Quick blowing: 1 amp at 250 v; sim to Littelfuse 312001 or Bussmann AGC-1.
	19A115776P6	Fuseholder: sim to Bussmann 9835.
	19A115776P5	Knob assembly: sim to Bussmann 9953 1/2.
	19A115776P7	Spring: sim to Bussmann 1A1853.
	19A115776P3	Contact: sim to Littelfuse 904-88. (Crimped on wires inside holder).
		WIRE ASSEMBLY 19A129937G2
	19B209260P12	Terminal, solderless: wire range No. 22-16; sim to AMP41310.
	19A116781P5	Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	N80P13005C6	Machine screw: No. 6-32 x 5/16. (Secures relay to support).
	N404P13C6	Lockwasher, internal tooth: No. 6. (Secures relay to support).
	N402P37C13	Flatwasher: No. 6. (Secures relay to support).
	N80P15005C6	Machine screw, phillips head: No. 8-32 x 5/16. (Secures wire to relay terminals).
	19A129833P1	Support. (K1701).
	N130P1608C6	Tap screw: No. 10-16 x 1/2. (Secures relay support).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

3 x 5 INCH SPEAKER
19C850550G1 DASH MOUNT - 4 OHM
19C850550G2 WINDOW MOUNT - 4 OHM
19C850550G3 DASH MOUNT - 8 OHM
19C850550G4 WINDOW MOUNT - 8 OHM
18SUE 4

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS1	19A702080P3	Permanent magnet: 3 x 5 inch, 4 ohms ±10% imp at 400 Hz, 18 w.
LS2	19A702080P4	Permanent magnet: 3 x 5 inch, 8 ohms ±10% imp at 400 Hz, 18 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19A129414G1	2 conductor cable: approx 5 feet long, includes (2) 19A116781P5 contacts.
W2	19B226189G1	Window mount: approx. 17 inches retracted, 84 inches extended. (Includes 2 19A116781P5 contacts).
		BREAKAWAY MOUNTING KIT 19A129461G1
	19C320022P1	Retaining bracket. (With locking jaws).
	19B219578G1	Safety Release Disc. (Mates with mounting surface).
	N187P16010C6	Machine screw, hexhead, slotted: No. 10-32 x 5/8. (Quantity 1 - Used with safety release disc with retaining bracket).
	N130P1612C6	Tap screw, thd. forming: No. 10-16 x 3/4. (Quantity 3 - Used without safety release disc & retaining bracket).
	N130P1624C6	Tap screw, thd. forming: No. 10-16 x 1-1/2. (Quantity 3 - Used without safety release disc & retaining bracket - for extra thick carpet).
	N402AP9C6	Flatwasher: No. 10. (Used with 10-16 thread forming screws).
		DASH MOUNT KIT FOR WINDOW MOUNT SPEAKER OPTION 19A130023G1 & G2
	19B226192G1	Housing. (GI only).
	19B226190P1	Backing plate.
	19B226185P1	Clip bracket.
	N193P1408C6	Tap screw, phillips head: No. 8-18 x 1/2. (Secures backing plate to mounting surface).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B800534G1	Housing. (DASH MOUNT).
	19B800534G2	Housing. (WINDOW MOUNT).
	19C850548P1	Grille.
	19A702464P3	Strain relief. (Used with W1 window mount cable at housing).
	19A701354P2	Nameplate. (GENERAL ELECTRIC).
	19C320016P1	Mounting bracket. (Secures speaker assembly to mounting surface).
	19A701631P516	Machine screw. No. 10-32 x 5/16. (Secures speaker housing to mounting support).
	19A701312P7	Lockwasher: No. 10. (Secures speaker housing to mounting support).
	19A700033P10	Lockwasher, external tooth: No. 10. (Secures speaker housing to mounting support).
	19A116986P112	Screw, thread forming, assembled washer: Phillips POZIDRIV®, #1-32 thread, No. 7-19 x 3/4. (Secures grille to housing).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

800 MHz ANTENNA
19B209058H14

ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		Whip assembly. 06B110-001.
		Whip nut assembly. 06B047-001.
		Base nut assembly. 06B048-001.
		"O" Ring (LARGE). 307059-122.
		Stud assembly. 06B046-001.
	19B209018P5	Plug, Type N; sim to UG536A/U.
		Cable. (Included as part of complete antenna assembly only).