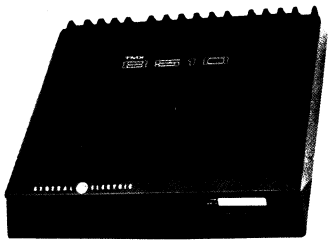
GE Mobile Communications

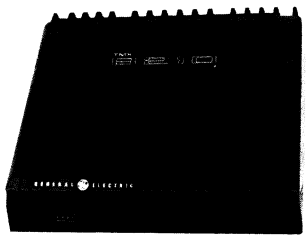
GE-MARC™ V•E

TMX-8210, TMX-8310 AND TMX-8510 800 MHz, 10-WATTS TWO-WAY FM TRUNKED MOBILE RADIO COMBINATION



TMX-8510

HANDSET



TMX-8210

AUDIO SET™ CONTROLLER

INCLUDES

RF BOARD LBI-38299
AUDIO BOARD LBI-38196
LOGIC BOARD LBI-38197
SERVICE SECTION LBI-31657

Maintenance Manual

TABLE OF CONTENTS

ILLLUSTRATIONS

NOTE

The software contained in this device is copyrighted by the General Electric Company. Unpublished rights are reserved under the copyright laws of the United States.

CAUTION

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

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

NOTE

This equipment has been tested and found to comply with the technical specifications in Part 15, Subpart J of FCC rules for a Class A and Class B computing device.

SPECIFICATIONS

System

Width	160.2 mm (6.307 inches)
Length	184.2 mm (7.252 inches)
Height	43.50 mm (1.712 inches)
Weight	1.340 Kg (47.50 ounces)
Color	Black and Gray
Battery Drain:	
Receive	0.5 ampere (typical)
Transmit	3.0 ampere (typical)
Temperature Range	-30°C to +60°C
Humidity	95% at 50°C
Altitude	15,000 Feet
Vibration	USFS

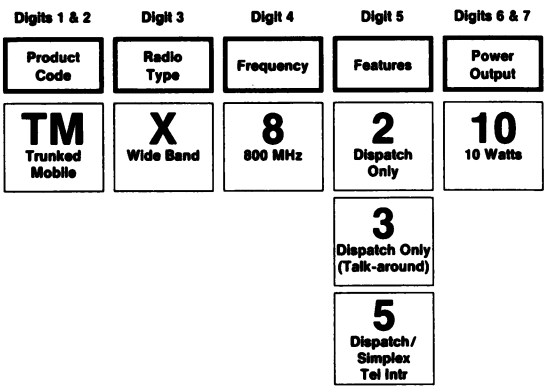
Transmit

Frequency Range (Direct Mode)	806 MHz to 825 MHz (851 MHz to 856 MHz)
Frequency Stability	±2.5 ppm
Output Power	10 Watts (typical)
Spurious & Harmonics	FCC Limits
Hum and Noise	40 dB (typical) (Companion RX)
Audio Distortion	5% Maximum
Duty Cycle	Continuous Transmit Operation Protected by Power Cutback above 70°C
Audio Sensitivity	20 to 40 millivolts

Receive

Frequency Range	851 to 870 MHz
Frequency Stability	±2.5 ppm
Sensitivity (12 dB SINAD)	0.35 uV
Spurious Response	-70 dB (typical) (except image)
Channel Spacing	25 KHz
Adj Channel Select	70 dB (typical)
Intermodulation	70 dB (typical)
Hum and Noise	40 dB (typical)
Modulation Acceptance	±7 KHz
Audio Output Power	1 Watt (8-ohm load) Max.
Audio Distortion	5% (Max)

COMBINATION NOMENCLATURE



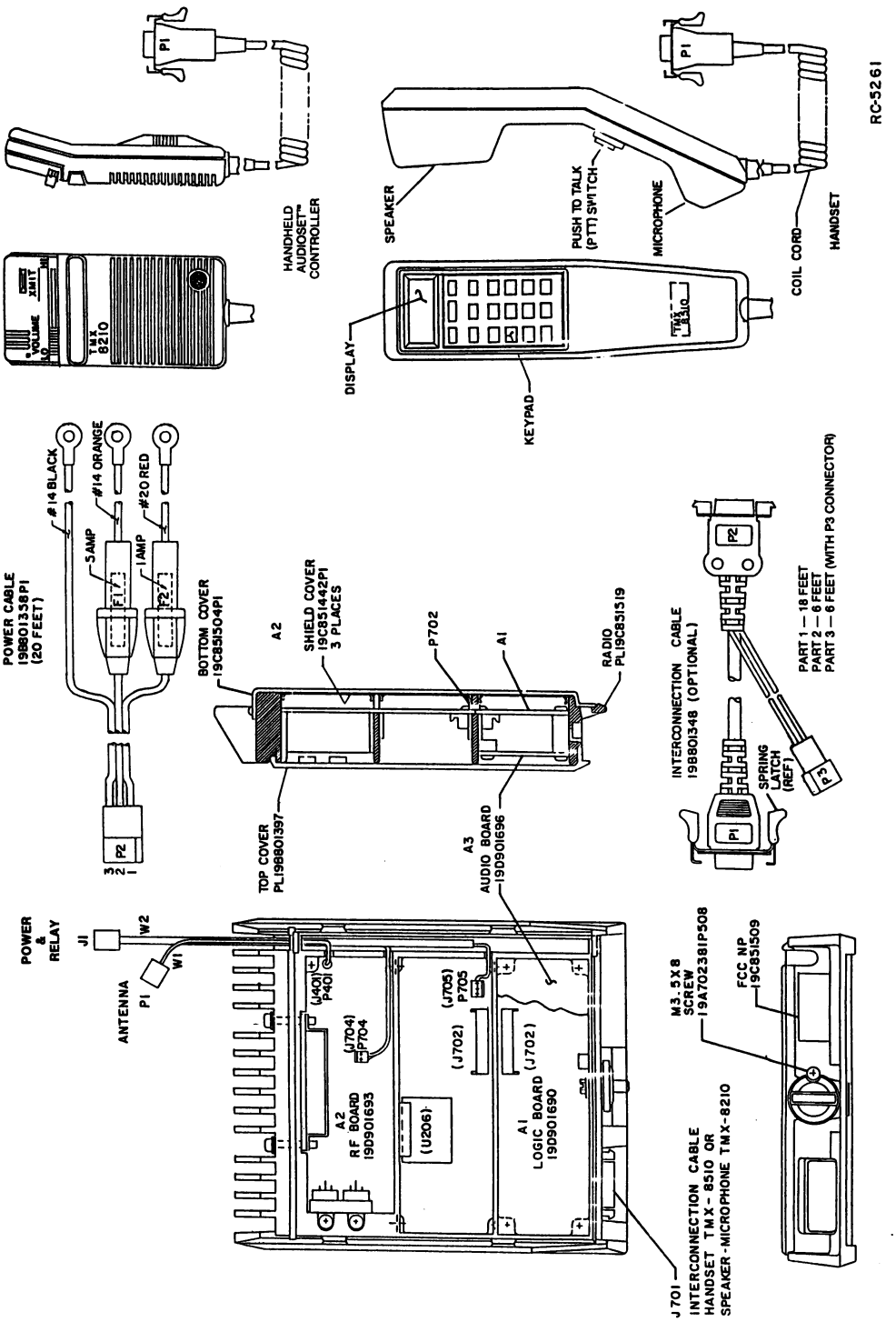


Figure 1 - Mobile Layout Diagram

GENERAL DESCRIPTION

The General Electric™ TMX-8210, TMX-8310, or TMX-8510 GE-MARC™ V•E radio is a synthesized, wide-band radio, utilizing microcomputer technology and integrated circuits to provide 10 watts of RF power, high performance and high reliability operation in the trunked radio system.

This radio is a 19 MHz wide-band radio and can be used under area roaming conditions. It is operated from either a handset or a handheld Audioset™ controller. The handset version (Model TMX-8510) allows telephone interconnect and has a synthesized programmmable 140 channel capability. It can be field programmed to operate in any of nine assigned "areas" with up to 20 channel frequencies within any area. The allocated 19 MHz band is 806 MHz - 825 MHz.

The Audioset controller version with a speaker and microphone (Model TMX-8210 and TMX-8310) allows dispatch within one 20 channel area.

Universal Radio Programmer TQ2310 is used to program or re-program the radio for customer frequencies, customer tones, customer options. The EEPROM, personality PROM, can conveniently be programmed without opening the radio.

A temperature-compensated oscillator module provides ±0.00025% (2.5 PPM) oscillator stability. Digital signal processing provides improved tone detection capability for all Signalling Tones and Busy tone.

A feature of the TMX-8510 and TMX-8310 radio is a Direct Mode "talk around" capability. With a command from the logic circuit, the Voltage Controlled Oscillator (VCO) signal switches to the 851 MHz to 856 MHz band. This allows direct transmission to a nearby vehicle.

The TMX radio is partitioned into three board assemblies as follows:

- Logic Board (A1) 19D901690
- RF Board (A2) 19D901693
- Audio Board (A3) 19D901696

When these boards are assembled and interconnected in the outer housing, the radio becomes one that is easily serviced with both sides of the boards accessible. Refer to Figure 1 - Mobile Layout Diagram.

LOGIC BOARD

The Logic Board contains the microprocessor and associated EPROM memory and latch circuitry which make possible remote control of the radio through the system interface. Internal software functions, such as tone signalling and detection, are provided as well as programmable personalization through the electrically erasable personality PROM (EEPROM).

RF BOARD

The RF Board includes the programmable synthesizer, the RF filter, a PIN diode switch, the transmit and the receive circuits.

Transmit Circuit

The transmit circuit consists of a synthesizer, a fixed-tuned driver module and a power amplifier module. The PA output is fed through a low-pass filter and PIN diode switched to the RF output cable.

All audio processing is done on the audio board. This processed audio is fed to the synthesizer.

The RF power output level is internally adjustable for rated power. Once the level is set, a thermistor control circuit protects the power amplifier.

Drive for the transmit circuit and the receive circuit first mixer injection frequency is derived from the synthesizer circuit. This buffered output drives the parallel combination of exciter module and receiver mixer.

Frequency stability for both the transmit circuit and the receive circuit is maintained by a temperature compensated reference oscillator module (TCXO).

Receive Circuit

The receive circuit consists of an 851 MHz to 870 MHz front end section, a 45 MHz first IF, a 455 KHz second IF and a FM discriminator. There is no squelch circuit present. All audio processing is accomplished on the Audio Board along with audio amplification (one watt into an 8-ohm load).

Frequency Synthesizer

The synthesizer consists of a synthesizer chip, dual modulus counter, a reference oscillator and a voltage controlled oscillator (VCO). The synthesizer frequency is controlled by the microprocessor located on the Logic Board and applied to the RF Board.

AUDIO BOARD

The Audio Board handles post detection processing of the receive audio,

including both voice and tones. Also, it performs the necessary pre-emphasis, limiting and filtering for the transmit audio, which is set up for the transit circuit. As mentioned, all receiver audio processing is done on this board.

HANDSET (TMX-8510)

Handset 19A704950P1 is used with the TMX-8510, 800 MHz, trunked radio combination to provide telephone interconnect through an 18-key keypad. Also, the handset provides the 140 channel capability and the ability to access 20 different channels in nine "areas". The handset features an 8-digit display, a PTT switch, a single volume control and a backlight keypad for night viewing (see Figure 1).

The 18 keys on the keypad consist of the telephone dial keys 0 through 9, "*", and "#" plus six control keys: CL (CANCEL/MON), STO (STORE), E (END/FUNCTION), RCL (RECALL), S (SEND) and a volume up/down rocker. The "*" and the "#" are used to select the desired area and group when the radio is in the "idle" state.

HANDHELD AUDIOSET™ CONTROLLER (TMX-8210 and TMX-8310)

Handheld Audioset controller 19A148926P1 has a push-to-talk (PTT) switch which is used to initiate dispatch calls. Only one area and one group tone sequence (two and/or four tones) is programmed in the personality EEPROM. A maximum of 20 channels is allowed.

TEST POINT ADAPTOR TQ2356

The Test Point Adaptor (TQ2356) allows receive audio monitoring and transmit audio injection without opening the radio. This adaptor connects between the handset and the radio (refer to Service Section, LBI-31657).

AUDIO AMPLIFIER/SPEAKER (OPTION AA01)

Exernal Audio Amplifier/Speaker 19A705968P1 is available for use with either handset or the handheld speaker/microphone when additional volume is required. This amplifier provides five watts to the speaker and is equipped with its own volume control and on/off power switch. Audio is connected to the amplifier by plugging connect P3 of the System Cable 19B801348P3 into connector J3 of the amplifier. Power for this amplifier is provided by splicing into the power cable as shown on Radio Assembly Interconnection Diagram 19C851523.

AUXILIARY POWER/HORN SWITCH (OPTION AU01)

Auxiliary Power/Horn switch assembly 19B801227G1 is available to provide a power on/off switch, not provided with the standard system and an on/off switch for the horn when the alarm relay option is used. Both switches connect in series with the power cable (refer to Radio Assembly Interconnection Diagram 19C851523).

EXTERNAL ALARM RELAY (OPTION SU01)

External Alarm Relay 19B226025G4 is available to sound the horn when a call is received. This relay connects in series with the RED lead of the power cable (refer to Interconnection Diagram 19C851523).

NOISE SUPPRESSION KIT (OPTION PD13)

Noise Suppression Kit 19A148539G1 is available to use when excessive electrical noise, present on the power cable, will not permit the system to operate properly (refer to Interconnection Diagram 19C851523).

INTERCONNECT CABLE, 6 FEET (OPTION CC02)

This optional interconnect cable (19B801348P2) connects between the radio and the handset or handheld controller cable. It is six feet long and does not have external speaker connector P3, like the part three cable (refer to System Interconnection Diagram 19C851523).

INTERCONNECT CABLE, 18 FEET (OPTION CC03)

This optional interconnect cable (19B801348P1) also connects between the radio and the handset or handheld controller cable. It is 18 feet long and like the part two does not have external speaker connector P3 (refer to System Interconnection Diagram 19C851523).

SERVICE CABLE (OPTION CC04)

This optional service cable (19A704875P1) is available to facilitate servicing of the radio by providing an extention between the Audio Board and the Logic Board. It is provided so that both sides of the Audio Board can be accessible while the radio is turned on.

POWER/IGNITION CABLE (OPTION CC05)

This power cable is supplied standard as part of the radio or may be ordered as an option. The power cable (19B801358P1) is twenty feet long and consist of a three jack MOLEX connector and two inline fuseholders, one for a 5 ampere fuse connected in the ORANGE wire

and one for a 1 ampere fuse connected in the RED wire. A lug type terminal is used on the battery end of each #14 and on the horn relay option end of the #20 conductor, BLACK, ORANGE and RED respectively.

Other options connect with the power cable in the system as previously described (refer Interconnection Diagram 19C851523). The power leads for Audio Amplifier, option AA01 are spliced in the ORANGE and BLACK leads of this power cable. The Auxiliary Power and Horn Switch Assembly, option AU01 is connected in series with the RED and ORANGE leads. The Alarm Relay Kit, option SU01 connects in series with the RED lead of the power cable and the Noise Suppression Kit, option PD13 connects between the RED lead and the BLACK lead of the power cable.

SYSTEM DESCRIPTION

The GE-MARC V●E 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 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 of mobiles are assigned the same tones, so that any unit can talk to all other units in the same group.

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 back to the mobile unit. When the interrogating mobile detects the acquisition tone, it then transmits its collect and group tones, which the 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.

OPERATIONAL MODES

The radio will always be in one of three operational modes: idle, wait, or ready. The three operational modes and the conditions that cause the radio to switch from one mode to another are shown in Figure 2.

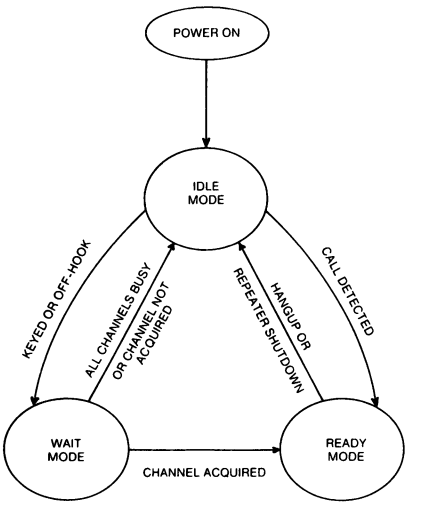


Figure 2 - Operational Modes

The radio enters the idle mode when power is turned on and begins scanning channels for incoming calls. The wait mode is entered when the user places a call. The radio remains in the wait mode until a channel is acquired, or if no channel is available. The ready or conversation mode is indicated by an alert tone and the mode indicator on the control panel.

A tone signalling Timing Diagram is shown in Figure 3.

Sequence Flow Charts for each operational mode are shown in Figures 4 through 6.

IDLE MODE (Figure 4)

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. Upon receipt of a collect tone, the mobile looks for a short interval for the group or individual tones, providing that their collect tones are the same. When no

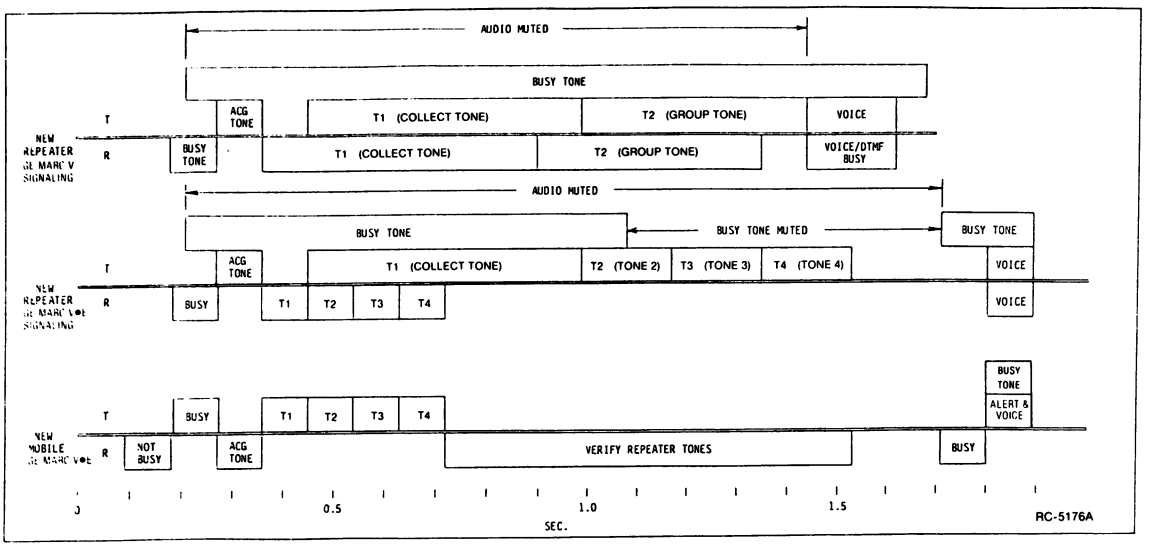


Figure 3 - Tone Signal Timing

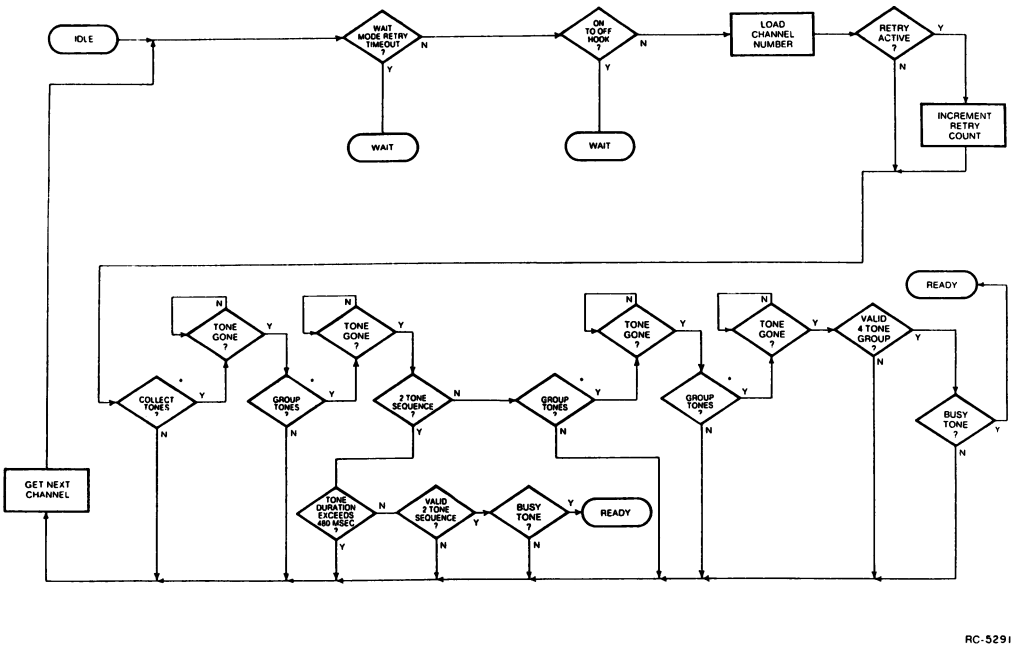


Figure 4 - Idle Mode

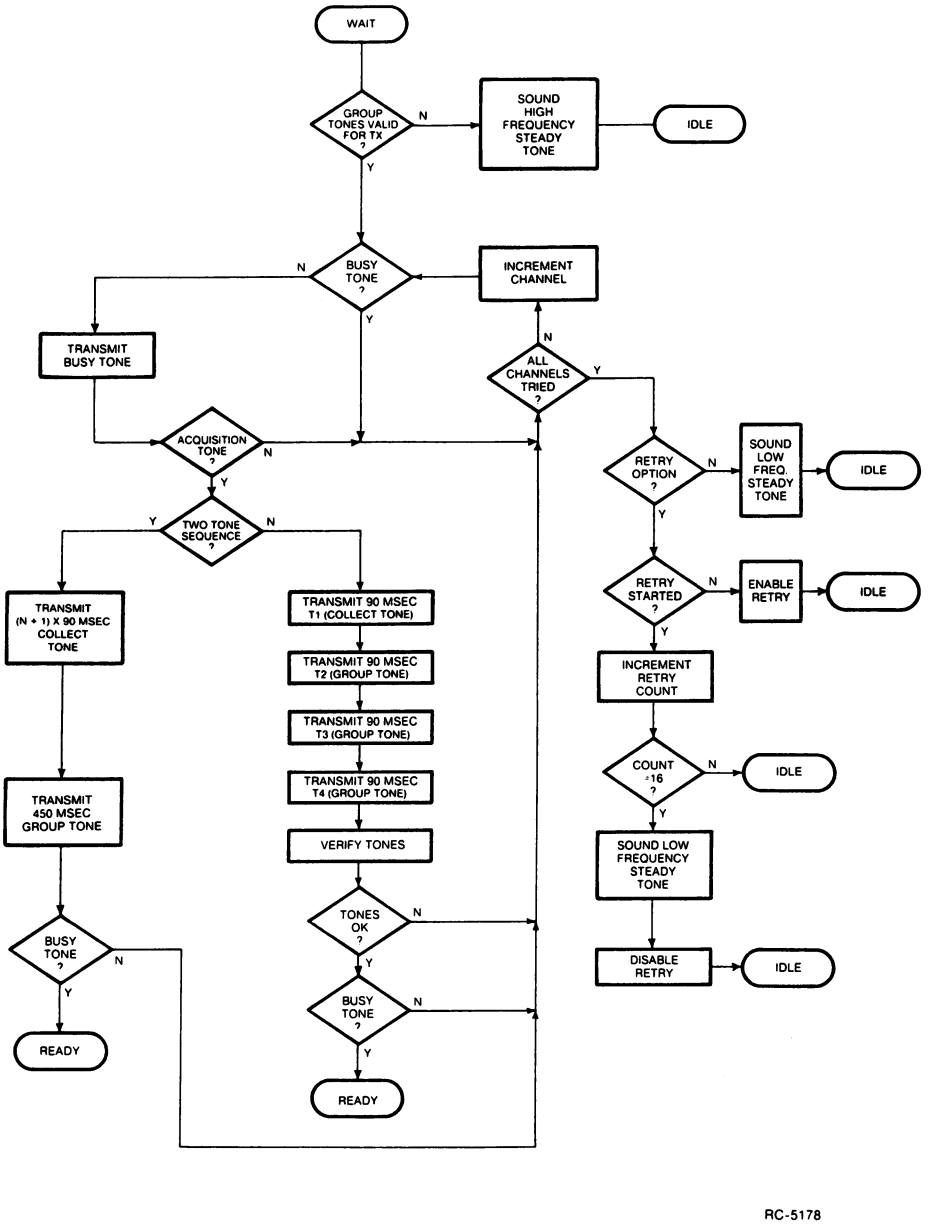


Figure 5 - Wait Mode

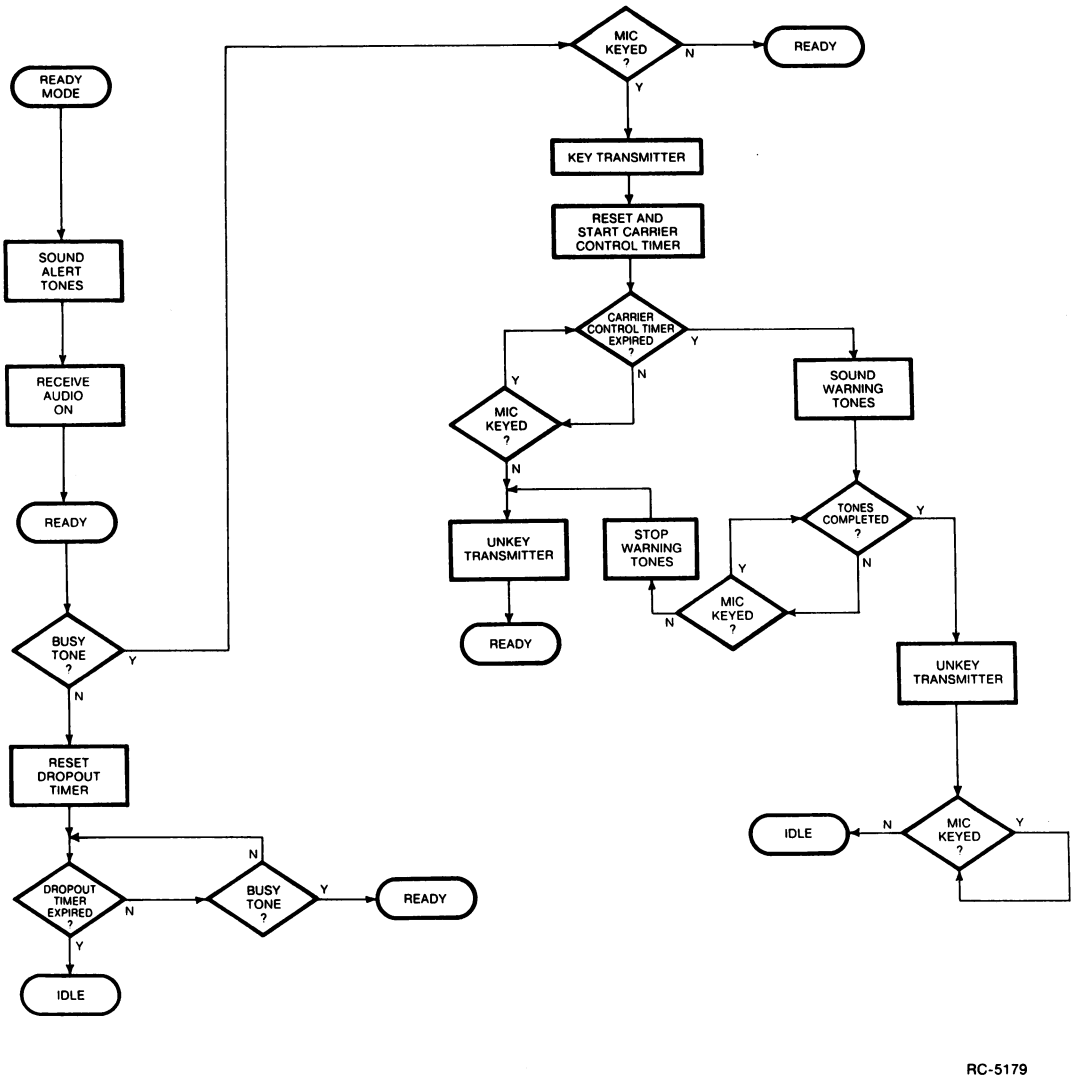


Figure 6 - Ready Mode

valid tone is found, the mobile will resume scanning the channels for an incoming call.

If a group (or individual decode) tone is detected the mobile then looks for busy tone for a 90 millisecond period. If four tones are properly decoded, the mobile will then look for busy tone for 270 milliseconds.

When no valid tones are found, the mobile will resume scanning for a call with the next channel. When 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.

Removing the Handheld Controller or handset from the hanger, pressing the PTT switch or pressing the SEND key on the handset, will cause the radio to enter the Wait Mode.

WAIT MODE (Figure 5)

When the user enters the Wait mode, the group tone is checked to make sure it is a valid call-originate group. If it is not valid, a high-frequency steady tone is heard in GE-MARC™ V•E systems only. If valid, the radio will scan the call-originate frequencies 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 five minutes. If no channel is available at the end of the 5 minute period or the Retry option is not programmed, 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. The repeater then responds with a burst of acquisition tone. Upon receipt of the acquisition tone, the mobile proceeds to transmit the group tones (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 milliseconds 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 isn't valid, the mobile will jump to the next channel in the call originate set and check for busy tone as described above.

READY MODE (Figure 6)

When an incoming call has been detected, or an idle channel has been acquired, the mobile enters the Ready mode. In this mode, the audio and push-to-talk circuits are enabled, the speaker is unmuted, and the operator is alerted an alert tone. The radio can then be used in the conventional push-to-talk manner with the radio remaining on the channel until the operator hangs up or the repeater drops the busy tone, causing the unit to revert to Idle mode.

NOTE

If a call is initiated and a sequence of five beeps is sounded, the user cannot access the radio system due to being out of mobile receive range or being inoperative. Any subsequent call will be ignored for 20 seconds.

OPERATION

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

TMX-8510 HANDSET

(Refer to Figure 7 - Controls and Indicators).

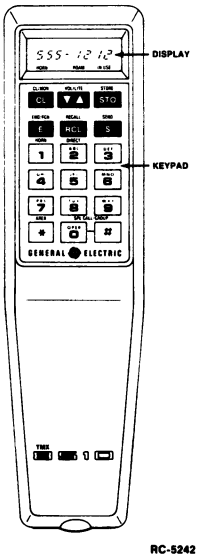


Figure 7 - Handset Controls and Indicators

TO RECEIVE A MESSAGE

1. Turn the vehicle ignition switch on. If the Power Switch Option is installed, place the power switch to the ON position. A self diagnostic test will automatically be performed. If the radio passes this test, a three beep alert signal is sounded and the display will show PASSEd for one second. The mobile will then display the Area and Group which were last selected. Example: (Ar 4 Gr 3). The volume and backlight levels will also be restored.

2. Set the volume level using the volume rocker switch. Each time the volume is changed, a short beep will sound at the selected level. There are four possible volume levels (▲ = up, ▼ = down).

NOTE

An audible alert tone precedes each incoming message.

3. Set the backlight level by pressing E (END/FUNCTION) followed by the volume rocker switch (▲= up, ▼ = down).

4. Select the area and group. The area and group settings can be changed only when the radio is in the "idle" state. To change either area or group the following sequence is required: press * (area/*), followed by the area number, followed by # (group/#), followed by the group number.

NOTE

If either the area or group entered is invalid, the previous area and group will be displayed.

The radio is now ready to receive messages from other radios in the system. When a call is received by the mobile, an alert tone is sounded to alert you to the incoming call (unless the mute receive alert tone option is selected). The alert tone is a one tone alert for a group call and a two tone alert for an individual call. The display will show the user the area and group of the received call until the user changes the display by some operation.

TO TRANSMIT A MESSAGE

1. Turn on the vehicle ignition and set the volume as directed before.

2. Select the desired area and group, also, as before.

Placing a Dispatch Call

Key the PTT switch on the inside of the handset or remove the handset from the cradle in order (programmed option) to originate the call.

The radio will generate a three tone alert when you can begin the conversation or a steady low frequency tone will sound for one second if the call cannot be completed. If this happens, key PTT again to retry the call. This low frequency tone will not be sounded if the call retry option is enabled. If the call retry option is active, the mobile will try to complete the call at approximately twenty second intervals for 15 tries, unless CL (CANCEL/MON) is pressed or the call is completed.

The call can be ended in one of three ways:

1. Hanging up the handset (programmed option).
2. Pressing the E (END/FUNCTION).
3. A system time out.

A short beep is sounded when the channel is dropped. The "IN USE" indicator on the lower right of the display is on whenever the radio is transmitting.

Placing A Telephone Interconnect Call

1. Select an area which is valid for telephone interconnect and group zero. Example: (Ar 2 Phone).

2. Enter the number from the keypad and press S (SEND)

   OR

   Recall a number and press S (SEND)

   OR

   Acquire a channel. After receiving a dial tone, while holding the PTT down, manually dial the number. Numbers that are manually dialed are not stored in the last number redial location. When dialing this way, you must wait until the previous character has been sent before keying in the next character.

3. When the call is finished, hang up the handset or press E (END/FUNCTION).

USING THE REPERTOIRE DIALER

The TMX-8510 repertoire dialer provides the operator with access to three frequently used numbers. These numbers can be telephone interconnect numbers, credit card numbers...etc. Each dialer location can contain up to 15 numbers. The dialer locations are accessed by keys 1, 2 or 3. In addition, the last number successfully sent from memory while the radio is on channel is stored. This is the last number redial location.

To Store A Repertoire Dialer Number

1. Enter the number to be stored (up to 15 digits).
2. Press STO (STORE) followed by the location number (1, 2, or 3).

NOTE

Only eight digits are displayed at one time. As more digits are entered, the first digits will shift off the left of the display.

To Recall A Repertoire Dialer Number

1. Press the RCL (RECALL) key.
2. Press the location of the number in dialer memory (1, 2 or 3).
3. To display the last number redial location, press RCL again.

Once the entire number has been displayed, the number can be sent as described in Placing a Telephone Interconnect Call.

NOTE

If the number exceeds seven digits, the first part will be displayed for one second; then the second part will be displayed.

DIRECT MODE OPERATION

If a direct mode channel is programmed in the personality PROM, you can enter the DIRECT MODE by pressing E (END/FUNCTION) followed by "2". The words "DIRECT" will be displayed on the handset. You can talk/listen by pressing/releasing the PTT switch. The radio will remain squelched until another user talks. To exit DIRECT MODE, press E (END/FUNCTION) and the radio will return to the scanning mode. Push the CL/MON button to monitor the channel before transmitting.

NOTE

No GE-MARC V•E (trunked) calls will be received while in the DIRECT MODE.

EXTERNAL RELAY

If the external relay is connected, you have the option of turning the horn on or off by pressing E (END/FUNCTION) followed by "1". The HORN indicator in the lower left display will come on or off. If the external relay option is selected, the horn will blow for two seconds when a call is received. A local pulsed alarm will sound through the TMX-8510 handset earpiece prior to blowing the horn. This gives you a chance to disable the external alarm by pressing PTT or turning the disable switch off before the horn sounds while driving.

ERROR INDICATOR

If you try to use an unprogrammed feature or location or if an invalid key sequence is entered, "Error" appears in the display, followed by an error tone. After three seconds, the previous area and group are displayed.

TMX-8210, TMX-8310 HANDHELD AUDIOSET™ CONTROLLER

(Refer to Figure 8 - Controls and Indicators).

TURNING THE RADIO ON

NOTE

There is no ON/OFF switch on the radio or controller.

1. Turn the vehicle ignition switch on. If the Power Switch Option is installed, place the power switch to the ON position.
2. When the radio is first turned on, a self diagnostic test is automatically performed. If the radio passes this test, a three beep alert signal is sounded.

NOTE

If the three beep alert does not sound, contact your service representative.

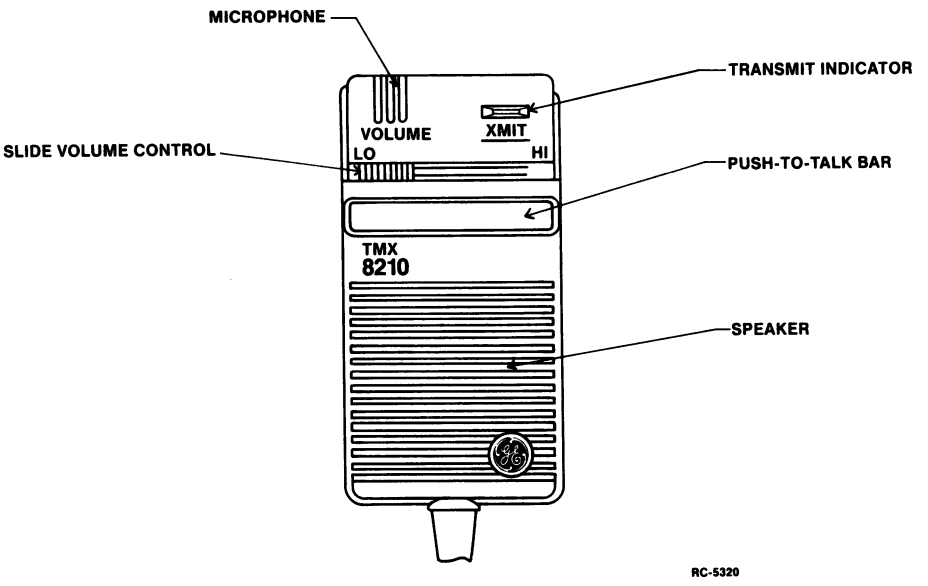


Figure 8 - Handheld Audioset™ Controller Controls and Indicators

TURNING THE RADIO OFF

Turn the vehicle ignition switch off (or if the Power Switch is installed, place the power switch to the OFF position).

CHANNEL ACTIVITY

To provide quick access to communications channels, the GE-MARC V/VoE trunked radio system continually monitors the activity on all channels. If a channel has not been active (microphone keyed) for six seconds or more, the channel is disconnected; i.e., communications are interrupted. If this occurs before the conversation is terminated, the call must be re-initiated. To avoid confusion, it is recommended that a procedure be set up so that the originator of the call is the one designated to re-establish communications.

PLACING A DISPATCH CALL

1. Remove the controller from the hanger and momentarily press the PTT bar on the controller. The RED LED indicator on the top right corner will illuminate each time the PTT bar is pressed.

2. The radio will sound a three tone alert signal when you can begin the conversation. A steady low frequency tone will sound for one second if the call cannot be completed. If this happens, press the PTT bar again to retry the call.

NOTE

If you plan on a long call (or several calls) the vehicle engine should be running to maintain battery charge.

NOTE

If a call is initiated and a sequence of five beeps is sounded, the user cannot access the radio system due to being out of mobile receive range or inoperative. Any subsequent call initiate request at this time will be ignored for 20 seconds.

3. A call is ended automatically by timing out after conversation ends. A short beep is sounded when the channel is dropped.

4. Return controller to its hanger and pull downward firmly to latch into place.

RECEIVING A CALL

When a call is received by the radio, an alert tone is sounded to inform the user of an incoming call (unless the mute receive alert tone option has been previously programmed). A single tone alert indicates a group call and a two tone alert indicates an individual call.

Remove the controller from its hanger and press the PTT bar to answer the incoming call.

AUDIO AMPLIFIER (OPTIONAL)

If the audio amplifier is present, all alert tones will be heard through this amplifier and the speaker in the controller. Power to the audio amplifier is independent of power to the radio unit and is turned on or off by the power switch on the audio amplifier. The audio level from the audio amplifier can be adjusted by using the audio amplifier VOLUME control.

NOTE

The VOLUME control on the controller has no control of the audio level from the audio amplifier. With the handset, the volume adjust does affect speaker volume.

CAUTION

Turn off the power to the audio amplifier when it is not needed to prevent a discharged battery unless power to this audio amplifier is wired through the vehicle ignition switch or the (optional) auxiliary ON/OFF switch.

AUXILIARY ON/OFF AND HORN ALERT SWITCHES (OPTIONAL)

If the Auxiliary ON/OFF and Horn Alert Switch options are present, the radio can be pre-programmed to beep the vehicle horn when a call is received. This option permits the radio to receive calls with the vehicle ignition off and alert persons out of the vehicle when a call is received. Both the switch option and the horn relay option must be present for this function.

The Power Switch Option permits the radio to be turned ON or OFF in lieu of the vehicle ignition switch.

The Auxiliary Horn Alert switch is used to turn on or off the horn beep function.

With the Horn Alert/Power Switch options enabled (turned on) an incoming call will cause a single horn beep that will last for two seconds.

The Horn Alert circuit can be disabled by pressing the PTT bar on the controller or by placing the Horn Alert switch in the OFF position.

CAUTION

To prevent discharging the battery, turn off the Horn Alert and Power Switch Options when they are not being used.

GLOSSARY OF INDICATORS

Idle Mode

In the "standby" condition for a mobile, inactive, but prepared to call or be called, the trunked radios are IDLE until they enter another mode or are turned off.

Wait Mode

In the "attempting origination" condition, the Wait mode is entered from Idle mode (only) as the user presses the PTT switch on the microphone, or comes "off-hook" (removes the handset, of the TMX-8510 only, from the hookswitch). If successful, the unit becomes READY. Otherwise, the unit is IDLE or IDLE/WAIT after all channels are tried.

Ready Mode

In the "operating" condition, Ready 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 completed.

Busy Tone

A "voice-plus" tone (3051.9 Hz standard, 2918 Hz alternate) modulates mobile and repeater transmitters at low level ($\pm$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 milliseconds from

repeater is used as acknowledgement from the repeater of a busy tone that was sent and signals the mobile that signalling tones can now be sent.

Collect Tone

A tone chosen from 38 standardized frequencies ranging from 508.6 Hz to 2792.4 Hz is 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 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 tone for a programmable duration. In the four-tone call, the mobile always sends a 90-millisecond collect tone which the repeater regenerates and sends for the correct duration.

Group/Individual Tones

Tones chosen from the 3 standard frequencies which follow the collect tone. In a two-tone call, the second tone is sent for 450 milliseconds. In a four tone call, the second, third, and fourth tones are sent for 90 milliseconds from the mobile, and 180 milliseconds from the repeater.

Call Received Alert Tones

The "call received" indicator consists of a one or two tone alert sequence signal. A single tone indicates a received group call. A two tone alert indicates a received individual call.

Call Originate Alert Tones

When originating a call, a three tone alert signal is sounded when the channel is ready for normal conversation.

Carrier Control Timer*

The carrier control timer alert signal is a pulsed tone that is sounded when the PTT bar has been pressed continuously for the pre-programmed time. After 9 seconds of pulsing, the transmitter is unkeyed. When the tone is pulsing, the user can release and press the PTT bar again to reset the timer and resume normal conversation.

Channel Busy/No Channel Available

A channel busy/no channel available alert tone is a low frequency tone that is sounded for one second when no channel is available.

Self-Check Test Alert Tone

Three beeps are sounded immediately after the radio is turned ON. This indicates that the radio has passed a self diagnostic test.

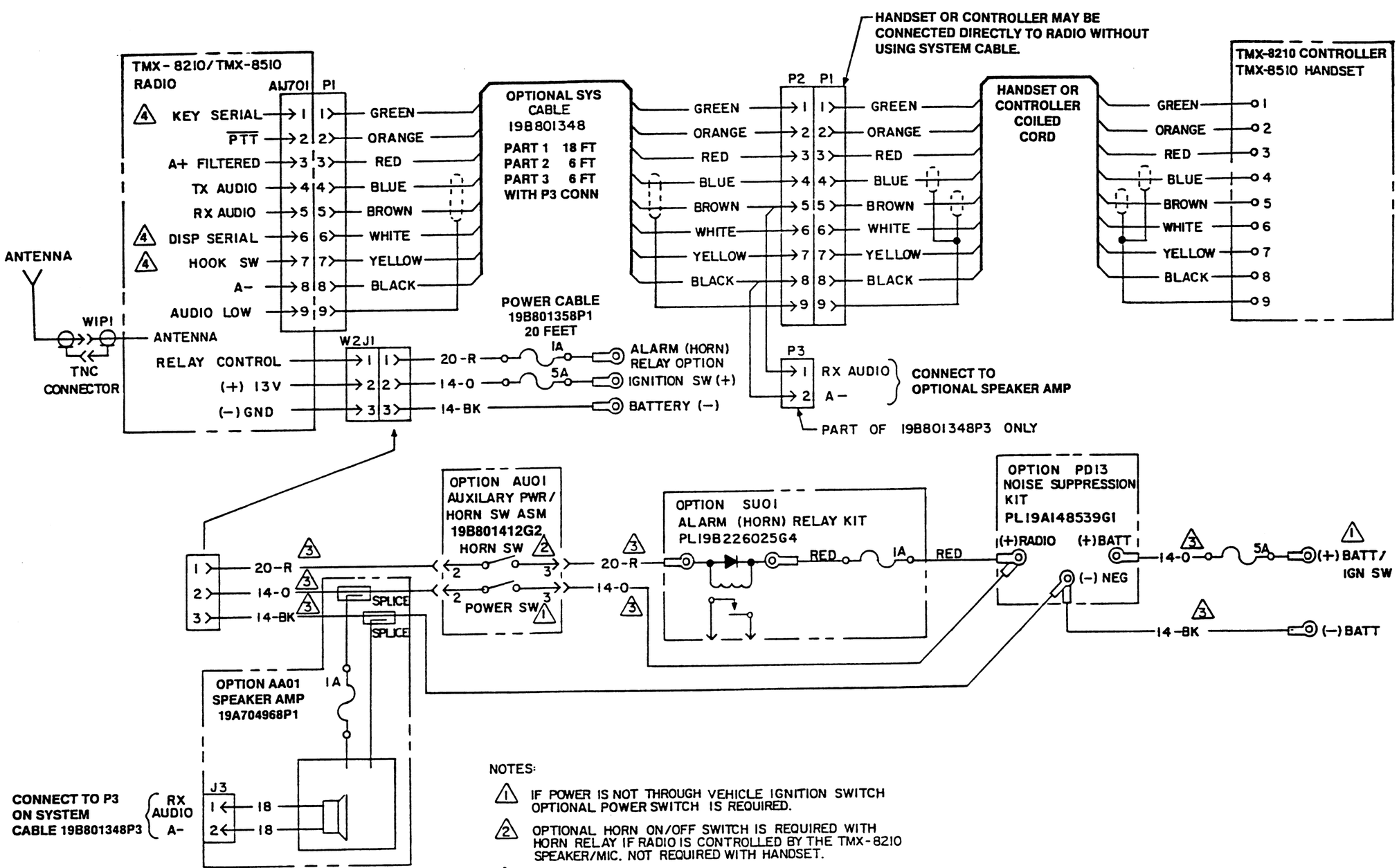
Out-of-Range/Inoperative
(Radio Default Alert)

Five beeps are sounded shortly after communication initiation (PTT). This indicates that the radio is out-of-range of the repeater station. The five beeps sounded when the radio is within known range of the repeater station, indicates the radio is in need of service, even though the turn-on self diagnostic test of logic has passed.

Direct Operation Mode

The Direct Mode call feature provides a low power output, line of sight radio communications link for car-to-car communications.

* Pre-programmed into radio and not controlled by user.



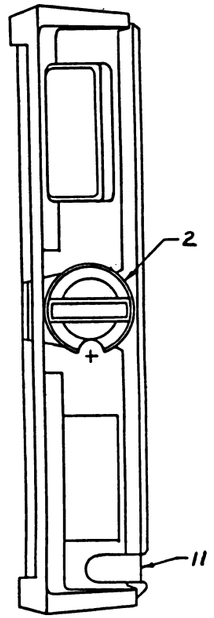
NOTES:

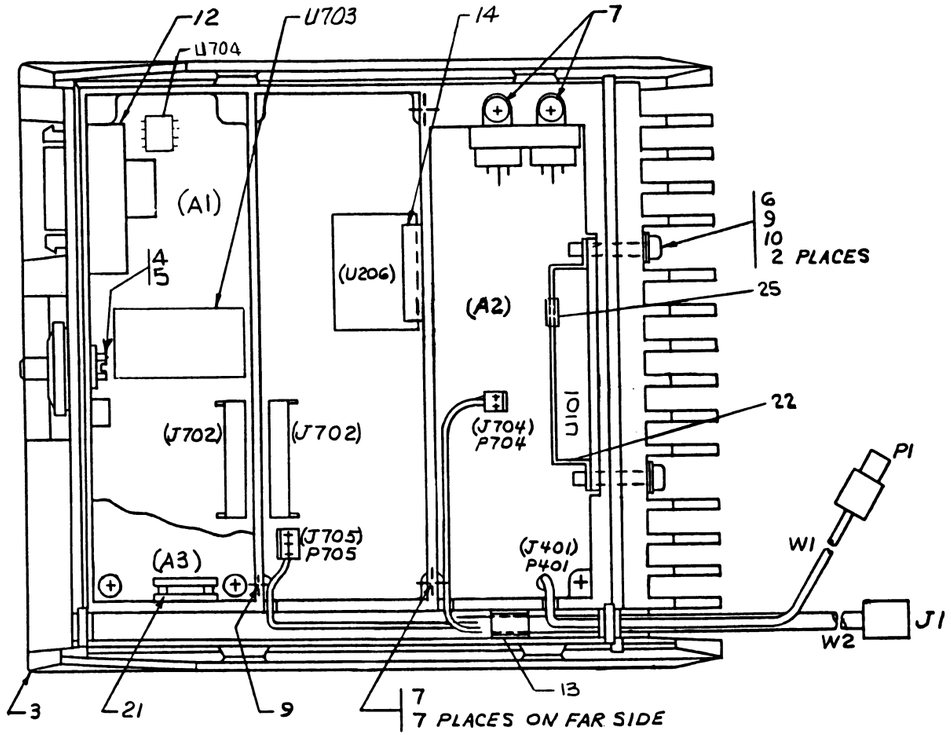
1. IF POWER IS NOT THROUGH VEHICLE IGNITION SWITCH OPTIONAL POWER SWITCH IS REQUIRED.
2. OPTIONAL HORN ON/OFF SWITCH IS REQUIRED WITH HORN RELAY IF RADIO IS CONTROLLED BY THE TMX-8210 SPEAKER/MIC. NOT REQUIRED WITH HANDSET.
3. USE PART OF POWER CABLE 19B801358P1.
4. THESE FUNCTIONS ARE SPARE ON TMX-8210

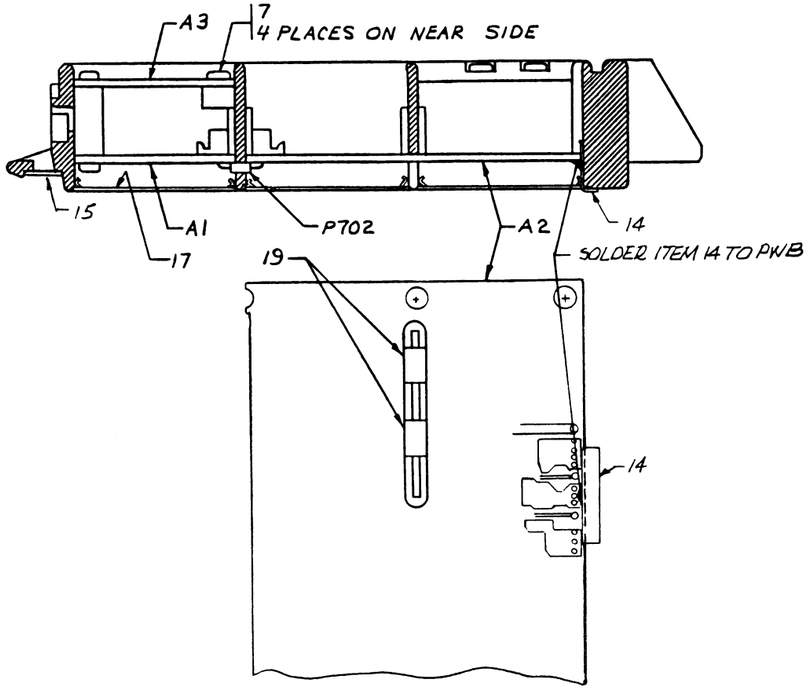
RC-5265A

INTERCONNECTION DIAGRAM

19C851523, Rev. 1







(19C851519, Sh. 1, Rev. 9)

PARTS LIST

TMX RADIO CHASSIS

19C851519G1 TMX-8510
19C851519G2 TMX-8210, TMX-8310

ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CIRCUIT BOARDS - - - - - - - - -
A1	19D901690G5	Logic Board.
A2	19D901693G2	RF Board.
A3	19D901696G2	Audio Board.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P702	19B801359P3	Connector.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U101	19A704891P1	PA Module: sim to: NEC MC5313A.
U703	19A704925G7	TMX-8510 64K CMOS EPROM (Programmed).
U703	19A705686G2	TMX-8210, TMX-8310 64K CMOS EPROM (Programmed).
U704	19A704724P1	Digital: EEPROM; sim to XICOR X2404P.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W1	19A705301P1	RF Cable Assembly.
W2	19C851497P1	Power Cable.
		- - - - - - - - ASSOCIATED PARTS - - - - - - - -
2	19C851505P1	Latch.
3	19D901728G1	Casting.
4	N130P1206B6	Screw, thread forming: No. 6-20 x 3/8.
5	N402P37B6	Flatwasher: No. 6.
6	19A702381P520	Screw, thd. form: TORX Drive, No. M3-0.6 x 20.
7	19A702381P508	Screw, thd. form: No. 3.5-0.6 x 8.
9	19A700033P6	Lockwasher, external tooth, M3.5.
10	19A701312P5	Flatwasher: M3.5.
11	19C851497P2	Cable Relief.
12	19A704941P1	Dust Cap.
13	19A704943P1	Clip.
14	19A704944P1	Clip.
15	19A704889P1	Nameplate.
17	19C851442P1	Bottom Cover.
19	19A705220P1	Clip.
21	19A705282P1	Clip.
22	19B801382G2	PA Support.
25	19A705417P1	Ground Contact.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI-38395

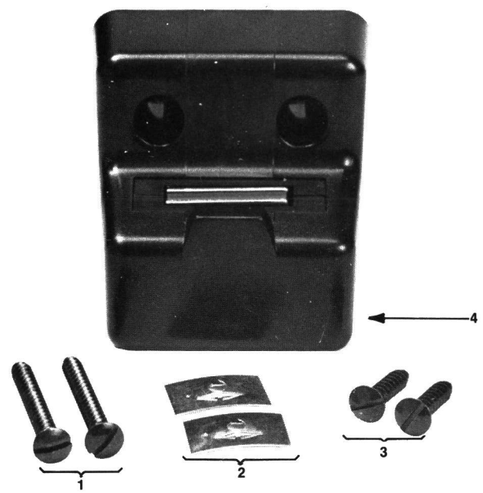
TMX ACCESSORIES

ISSUE 1

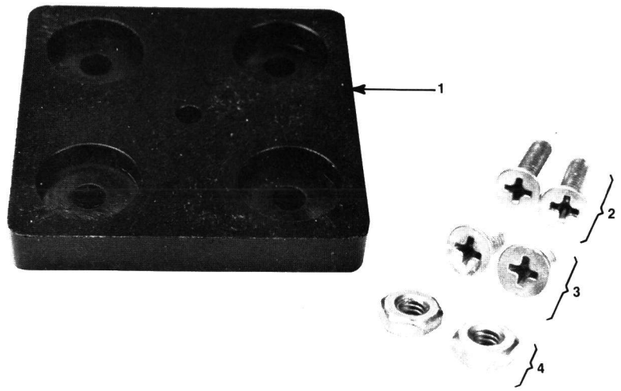
SYMBOL	GE PART NO.	DESCRIPTION
		HANDSET HOLDER 19B801150G1 STANDARD OPTION MN01
1	N133P1412J2	Thread Forming Screw Type AB 8-18 X 3/4"
2	4029387P6	Sheet Nut.
3	N133P1424J2	Thread Forming Screw Type AB 8-18 X 1-1/2"
4	19D901082P1	Handset Holder. Consists of:
	19A703686P1	Magnet
	19A704317P1	Catch
		HANDSET HOLDER 19B801150G2 - WEDGE OPTION MN07
1	19C851368P1	Wedge
2	N84P15010C6	Flat Head Machine Screw 8-32 X 5/8"
3	N84P15006C6	Flat Head Machine Screw 8-32 X 3/8"
4	N210P15C6	Hex Machine Screw Nut 8-32
		HORIZONTAL HANDSET HOLDER 19B801227G1 OPTION MN05
1	19B801234P1	Label Card
2	19C851309P1	Cover, Plastic
3	N193P1424J2	Thread Forming Screw Type AB 8-18 X 1-1/2"
4	N193P1412J2	Thread Forming Screw Type AB 8-18 X 3/4"
5	N84P15007J2	Flat Head Screw 8-32 X 7/16"
6	4029387P6	Sheet Nut
7	19B801226G1	Support
8	19D901301P1	Handset Holder. Consists of:
	19A703686P1	Magnet
	19A704317P1	Catch
	19C851307P1	Bumper
		"Z" BRACKET MOUNT 19A701870G2 OPTION MN04
1	19A701817P2	Non-Metallic Fastner
2	19A701817P1	Non-Metallic Fastner
3	19B800695G3	Support, Top
4	19B201074P405	Thread Forming Screw, Tapping, 8-32 X 5/16"
5	19A701631P610	Hex Head Machine Bolt, Metric, #6 X 10mm
6	4029387P3	Sheet Nut
7	19A701507P124	Thread Forming Screw, Type AB 4.8 X 38.1mm
8	19A701507P112	Thread Forming Screw, Type AB 4.8 X 19.1mm
9	19B209209P408	Thread Forming Screw, Tapping, 8-32 X 1/2"
10	19B800695G2	Support, Bottom
11	19B800639P1	Support
		SWIVEL MOUNT KIT 19B801228G1 OPTION MN06
1	N80P21020C6	Pan Head Machine Screw 1/4-20 X 1.25"
2	N193P1412J2	Thread Forming Screw 8-18 X 3/4"
3	N80P15006C6	Pan Head Machine Screw 8-32 X 3/8"
4	N84P15007J2	Flat Head Machine Screw 8-32 X 7/16"
5	4029387P6	Sheet Nut
6	N193P1424J2	Thread Forming Screw 8-18 X 1-1/2"
7	19D901302P1	Base, Swivel
	19B801229G1	Ball, Swivel
	19B801225G1	Mount, Swivel

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

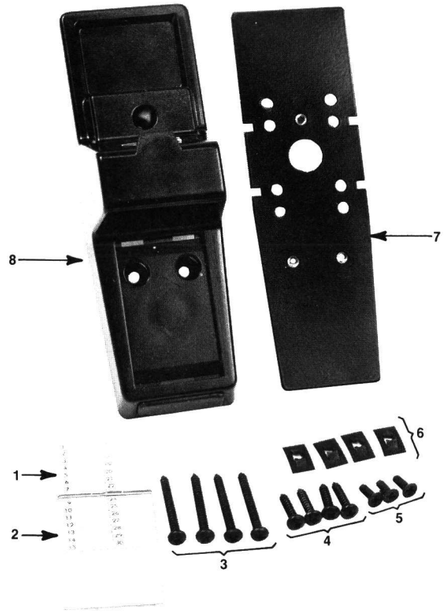
Handset Holder
19B801150G1-Standard



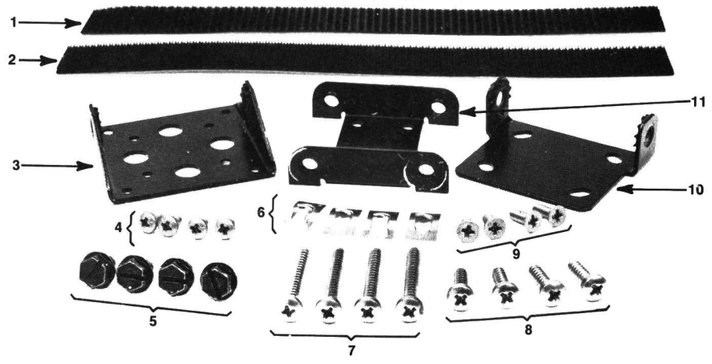
Handset Holder
19B801150G2-Wedge



Horizontal Handset Holder
19B801227G1



"Z" Bracket Mount
19A701870G2



Swivel Mount Kit
19B801228G1