



MOTOROLA

Level 1 and 2 Service Manual

V600

Digital Wireless Telephone



V600
GSM 900/1800 MHz, GPRS

PRELIMINARY

PRELIMINARY

Introduction	5
Product Identification	5
Product Names	5
Product Changes	5
Regulatory Agency Compliance	5
Computer Program Copyrights	6
About This Service Manual	6
Warranty Service Policy	7
Parts Replacement	8
Specifications	9
Product Overview	10
Features	10
General Operation	14
Controls, Indicators, and Input / Output (I/O) Connections	14
User Interface Menu Structure	17
Alert Settings	17
Battery Function	18
Operation	18
Tools and Test Equipment	19
Disassembly	20
Removing and Replacing the Battery Door and Battery	20
Removing and Replacing the Subscriber Identity Module (SIM)	22
Removing and Replacing the Antenna	23
Removing and Replacing the Rear Housing	24
Removing and Replacing the Transceiver Board Assembly	26
Removing and Replacing the Real-Time Clock (RTC) Battery	28
Removing and Replacing the Keypad, Volume/Smart and Voice Buttons	29
Removing and Replacing the Headphone Speaker Jack	30
Removing and Replacing the Polyphonic Speaker Assembly	31
Removing and Replacing the Flip Assembly	32
Removing and Replacing the Flip CLI Lens Assembly	34
Removing and Replacing the Camera Assembly	36
Removing and Replaing the Motor/Vibrator	37
Removing and Replacing the Speaker Assembly	38
Subscriber Identity Module (SIM) and Identification	39
SIM Card	39
Personality Transfer	39
Identification	39
Troubleshooting	41
Manual Test Mode	41
Manual Test Mode Commands	41
Troubleshooting Chart	43
Programming: Software Upgrade and Flexing	45
Part Number Charts	47
Related Publications	47
Exploded View Diagram	48
Exploded View Parts List	49
Accessories	50

Introduction

Motorola® Inc. maintains a worldwide organization that is dedicated to provide responsive, full-service customer support. Motorola products are serviced by an international network of company-operated product-care centers as well as authorized independent service firms.

Available on a contract basis, Motorola Inc. offers comprehensive maintenance and installation programs that allow customers to meet requirements for reliable, continuous communications.

To learn more about the wide range of Motorola service programs, contact your local Motorola products representative or the nearest Customer Service Manager.

Product Identification

Motorola products are identified by the model number on a label usually located under the battery. Use the entire model number when inquiring about the product. Numbers are also assigned to chassis and kits. Use these numbers when requesting information or ordering replacement parts.

Product Names

Product names are listed on the front cover. Product names are subject to change without notice. Some product names, as well as some frequency bands, are available only in certain markets.

Product Changes

When electrical, mechanical or production changes are incorporated into Motorola products, a revision letter is assigned to the chassis or kit affected, for example; -A, -B, or -C, and so on.

The chassis or kit number, complete with revision number, is imprinted during production. The revision letter is an integral part of the chassis or kit number and is also listed on schematic diagrams and printed-circuit board layouts.

Regulatory Agency Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

- This device may not cause any harmful interference
- This device must accept interference received, including interference that may cause undesired operation

This class B device also complies with all requirements of the Canadian Interference-Causing Equipment Regulations (ICES-003).

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Computer Program Copyrights

The Motorola products described in this manual may include Motorola computer programs stored in semiconductor memories or other media that are copyrighted with all rights reserved worldwide to Motorola. Laws in the United States and other countries preserve for Motorola, Inc. certain exclusive rights to the copyrighted computer programs, including the exclusive right to copy, reproduce, modify, decompile, disassemble, and reverse-engineer the Motorola computer programs in any manner or form without Motorola's prior written consent. Furthermore, the purchase of Motorola products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license or rights under the copyrights, patents, or patent applications of Motorola, except for a nonexclusive license to use the Motorola product and the Motorola computer programs with the Motorola product.

About This Service Manual

Use of this manual assures proper installation, operation, and maintenance of Motorola products and equipment. It contains all service information required for the equipment described and is current as of the printing date. Refer questions about this manual to the nearest Customer Service Manager.

Audience

This manual aids service personnel in testing and repairing V600 telephones. Service personnel should be familiar with electronic assembly, testing, and troubleshooting methods, and with the operation and use of associated test equipment.

Scope

This manual provides basic information relating to V600 telephones, and also provides procedures and processes for repairing the phones at Level 1 and 2 service centers including:

- Unit swap out
- Repairing of mechanical faults
- Basic modular troubleshooting
- Testing and verification of unit functionality
- Initiate warranty claims and send faulty modules to Level 3 or 4 repair centers

DRAFT

DRAFT

Conventions

The following special characters and typefaces, are used in this manual to emphasize certain types of information.



Note: Emphasizes additional information pertinent to the subject matter.




Caution: Emphasizes information about actions which may result in equipment damage.



Warning: Emphasizes information about actions which may result in personal injury.



Keys to be pressed are represented graphically. For example, instead of “Press the Menu Key”, you will see “Press 

Information from a screen is shown in text as similar as possible to what displays on the screen. For example, **ALERTS** or **ALERTS**.

Information that you need to type is printed in **boldface type**.

Warranty Service Policy

The product is sold with the standard 12-month warranty terms and conditions. Accidental damage, misuse, and extended warranties offered by retailers are not supported under warranty. Non-warranty repairs are available at agreed fixed repair prices.

Out-of-Box Failure Policy

The standard out-of-box failure criteria applies. Return customer units that fail very early on after the date of sale to Manufacturing for root cause analysis, to guard against epidemic criteria. Manufacturing to bear the costs of early life failure.

Product Support

Customer's original units will be repaired but not refurbished as standard. Appointed Motorola Service Hubs will perform warranty and non-warranty field service for level 2 (assemblies) and level 3 (limited PCB component). Motorola High Tech Centers will perform level-4 (full component) repairs.

Customer Support

Customer support is available through dedicated Call Centers and in-country help desks. Product Service training is available through the local Motorola Support Center.

Parts Replacement

When ordering replacement parts or equipment, include the Motorola part number and description used in the service manual.

When the Motorola part number of a component is not known, use the product model number or other related major assembly along with a description of the related major assembly and of the component in question.

In the U.S.A., to contact Motorola, Inc. on your TTY, call: 800-793-7834.

Accessories and Aftermarket Division (AAD)

Order replacement parts, test equipment, and manuals from AAD.

U.S.A.

Phone: 800-422-4210

FAX: 800-622-6210

Outside U.S.A.

Phone: 847-538-8023

FAX: 847-576-3023

For EMEA spare parts call +44 131 479 1274.

For Asia spare parts call +65 648 62995.

DRAFT

Specifications

General Function	Specification
Frequency Range GSM	880-915 MHz Tx (with EGSM) 925-960 MHz Rx
Frequency Range DCS	1710-1785 MHz Tx 1805-1880 MHz Rx
Channel Spacing	200 kHz
Channels	174 EGSM, 374 DCS
Modulation	GMSK at BT = 0.3
Transmitter Phase Accuracy	5 Degrees RMS, 20 Degrees peak
Duplex Spacing	45 MHz
Frequency Stability	± 0.10 ppm of the downlink frequency (Rx)
Operating Voltage	+3.2V dc to +5.5V dc (battery) +4.8V dc to +6.5V dc (external connector)
Transmit Current Drain	101-260 mA average talk current drain
Stand-by Current drain	5 mA (DRX2), 2 mA (DXR9) typical
Temperature Range	-10° C to +55° C (+15° F to +130° F)
Dimensions, with 500 mAh Li Ion battery	47.3 mm x 87.5 mm x 22.5 mm (1.86 inches x 3.45 inches x 0.89 inches)
Size (Volume)	75 cc (4.58 in ³), with battery
Weight	95 grams (3.35 oz), with battery
Battery Life, with standard 700 mAh Li-Ion Battery	Talk Time 260 to 500 minutes with Blue Tooth off 200 to 320 minutes with Blue Tooth on Standby time 160 to 200 hours with Blue Tooth off 155 to 200 hours with Blue Tooth on All talk and standby times are approximate and depend on network configuration, signal strength, and features selected. Standby times are quoted as a range from DRX=2 to DRX=9. Talk times are quoted as a range from DTX off to DTX on.
Battery Charge Time	4 hours to 90% of 700 mAh capacity
Alert volume	Max 95 dB @5cm, 0.5 Watts input

Transmitter Function	Specification
RF Power Output	32 dBm nominal GSM 900, 29 dBm nominal GSM 1800
Output Impedance	50 ohms nominal
Spurious Emissions	-36 dBm from 0.1 to 1 GHz, -30 dBm from 1 to 4 GHz

Receiver Function	Specification
Receive Sensitivity	Better than -103 dBm
RX Bit Error Rate (100k bits) Type II	< 2%

Speech Coding Function	Specification
Speech Coding Type	Regular pulse excitation/linear predictive coding with long term prediction (RPE LPC with LTP)
Bit Rate	13.0 kbps
Frame Duration	20 ms
Block Length	260 bits
Classes	Class 1 bits = 182 bits; Class 2 bits = 78 bits
Bit Rate with FEC Encoding	22.8 kbps

Product Overview

Motorola V600 telephones are small and lightweight global system for mobile communications (GSM) general packet radio service (GPRS) wireless application protocol (WAP)-enabled mobile phones. The V600 incorporates a new user interface (UI) for easier operation, allows short message service (SMS) text messaging, and includes personal information manager (PIM) functionality. It is a dual band phone that allows roaming within the GSM 900 MHz and (DCS) 1800 MHz digital cellular system.

V600 telephones support GPRS and SMS in addition to traditional circuit switched transport technologies.

V600 telephones have a clam form factor. They feature an anodized aluminum housing with titanium knuckles and have an externally viewable 96 x 32 pixel display for caller identification and date/time, an internal 176 x 220 pixel display, and the speaker located in the flip. At the top of the phone, on the right knuckle, the service indicator (status light) changes color to show the phone's state (incoming call or message received, for example) at a glance. The bottom part of the clam (front housing) contains the keypad, transceiver printed circuit board (PCB), microphone, flex connection, external accessory connector, smart button, volume buttons, and voice button. The standard 500 mAh Lithium Ion (Li Ion) battery fits behind a removable back cover.

The phone accepts both 3V and 5V mini subscriber identity module (SIM) cards which fit into the SIM holder underneath the battery. The antenna is a fixed stub type antenna. Inexpensive direct connection to a computer or handheld device via RS232 or USB for data and fax calls, and for synchronizing phonebook entries with TrueSync® software, can be accomplished by using the optional data cable and soft modem.

Features

V600 telephones use advanced, self-contained, sealed, custom integrated circuits to perform the complex functions required for GSM GPRS communication. Aside from the space and weight advantage, microcircuits enhance basic reliability, simplify maintenance, and provide a wide variety of operational functions.

Features available in this family of telephones include:

- GSM 850/900/1800/1900 MHz GPRS (2U/4D)
- Built in VGA Camera (640x480 pixels)
- 65K TFT Active Color Display
- External CLI Display (Transflective Reversed)
- Polyphonic Speaker
- Speaker Phone
- Bluetooth™
- Metal Housings
- Changeable covers
- Situation Lights
- Video Clip Playback
- 5MB User Memory



DRAFT

Speaker Dependant Voice Activation and Voice Note Recording

Voice tags can be used for voice dialing up to 20 phone numbers in the phone book and for creating up to 5 voice shortcuts for menu items. The phone must be “trained” by the voice tag being read into the phone’s memory twice before it is recognized.

You can add voice tags to the phone’s memory using the usual name addition methods (i.e., via the phone book menu structure or with the shortcut editor).

You cannot place or receive calls while adding voice tags to the phone’s memory.

Because the GSM standard does not provide the option to store voice tags onto the SIM card, voice tags are added to the phone’s memory.



DRAFT

V600 telephones also include a voice note recorder that allows up to 2 minutes of personal messages to be recorded. This feature has a complete set of record, playback, and management tools that make it easy to store and maintain a list of personal memos.

Wireless Access Protocol (WAP) 1.1 Compliancy

In the WAP environment, access to the Internet is initiated in wireless markup language (WML), which is derived from hypertext markup language (HTML). The request is passed to a WAP gateway which retrieves the information from the server in standard HTML (subsequently filtered to WML) or directly in WML if available. The information is then passed to the mobile subscriber via the mobile network.

The V600's microbrowser can be configured for baud, idle timeout, line type, phone number, and connection type.

▶ *Bitmap image data will download as text. If the image is larger than the screen, only part of the image will display.*

▶ *When the user receives a call while in browser mode, the browser will pause and allow the user to resume after completing the call.*

SIM Application Toolkit™ - Class 2

SIM Application Toolkit is a value-added service delivery mechanism that allows GSM operators to customize the services they offer their customers, from the occasional user who requests sports news and traffic alerts, to a high call time business user who receives stock alerts and checks flight times. Operators can now create their own value-added services menu quickly and easily in the phone. The customized menu will appear as the first menu and may be updated over-the-air with new services when customers request them.

Simplified Text Entry

There are three different ways to enter text using the phone keypad:

- iTAP™ predictive text entry. Press a key to generate a character and a dynamic dictionary uses this to build and display a set of word or name options. The iTAP™ feature may not be available on the phone in all languages.
- Tap. Press a key to generate a character.
- Numeric. The keypad produces numeric characters only. For some text areas this is the only method available; for example, phone numbers.

Caller Line Identification

Upon receipt of a call, the calling party's phone number is compared to the phone book. If the number matches a phone book entry, that name will be displayed. If there is no phone book entry, the incoming phone number will be displayed. In the



DRAFT

event that no caller identification information is available, the Incoming Call message is displayed.



User must subscribe to a caller line identification service through their service provider.

Other Features

Detailed descriptions of these and the other V600 features can be found in the appropriate V600 telephone user's guide listed in the "Related Publications" section toward the end of this manual.

General Operation

Controls, Indicators, and Input / Output (I/O) Connections

The V600 telephone's controls are located on the sides of the device and on the keypad. Indicators, in the form of icons, are displayed on the LCD (see Figure 2). Service status is indicated by a tri-color light emitting diode (LED) located at the top of the phone on the right knuckle (Table 1). V600 phones have an audible alert transducer on the top and I/O connectors, consisting of a headset jack and an accessory port, located on the top and bottom of the phone. See Figure 1.



Figure 1. V600 Telephone Controls, indicators, and I/O

031629o




Service Indicator

The service indicator (status light) changes color to show the user the state of the phone as shown in Table 1, below.

Table 1. Service Indicator States

Indication	State
Alternating red / green (fast)	Incoming call
Flashing green	In service, home system
Flashing yellow	Roaming, non-home system
Flashing red (slow)	No service
Flashing red (fast)	Text or voicemail message received but no service
Alternating green (short) / red (long)	Text or voicemail message received, home system
Alternating yellow (short / red (long)	Text or voicemail message received, roaming service

“Soft keys” refer to non-labeled keys that correspond to text options displayed on the screen. The left and right soft keys perform the function shown in the corners of the display. The right key will usually select an option whereas the left key will usually exit a function or return to a previous screen.

The menu key opens the initial menu structure, or allows access to a submenu whenever  appears on the display. See Figure 3 for details of the V600 menu structure.

Color Liquid Crystal Display (LCD)

The color LCD provides a 4096 color backlit display for easy readability in all light conditions. The large bit-mapped 128 x 128 pixel display provides 3 lines of text, 1 line of icons, and 1 line of prompts.

Display zoom allows setting the phone’s display to show either three lines or two lines of text plus soft key labels. Three lines of text display more information, while two lines increase text size for improved visibility.

Display animation makes the phone's menus move smoothly as the user scrolls up and down. Turn animation off to conserve the battery.

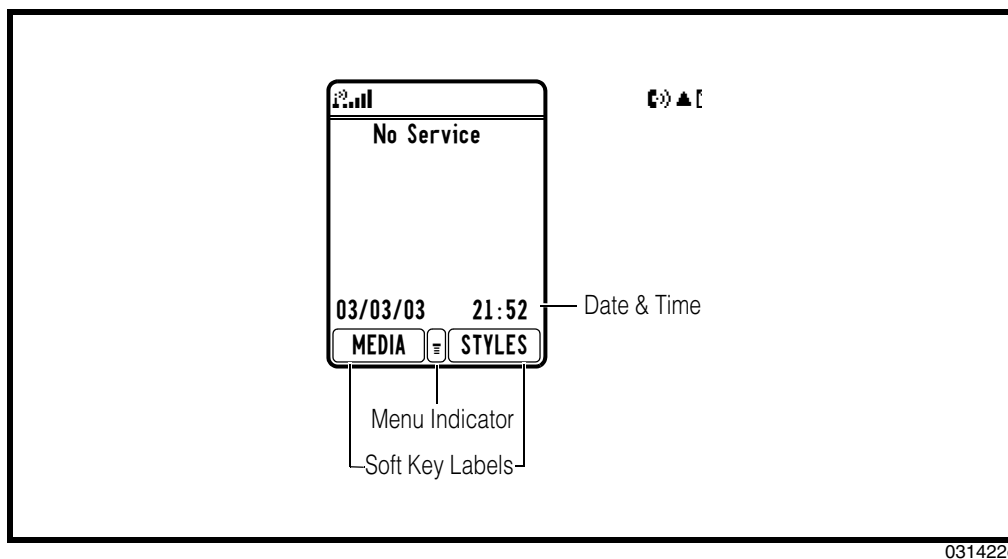


Figure 2. V600 Icon Indicators

0314220



Whether a phone displays all indicators depends on the programming and services to which the user subscribes.

Figure 2 shows some common icons displayed on the LCD.

- **Signal Strength Indicator.** Shows the strength of the phone's connection with the network. Calls cannot be sent or received when the "no signal" indicator is displayed.
- **In Use Indicator.** Appears when a call is in progress.
- **Roam Indicator.**⁵ Appears when the phone uses another network system outside the user's home network. When leaving the home network area, the phone roams, or seeks another network.
- **Message Waiting Indicator.**⁵ Appears when the phone receives a text message. This is a network-dependent feature.
- **Voice Message Waiting Indicator.**¹ Appears when a voicemail message is received. This is a network-dependent feature.
- **Battery Level Indicator.** Shows the amount of charge left in the battery. The more segments visible, the greater the charge. Recharge the battery as soon as possible when the Low Battery warning message appears.
- **Clock.** Shows the current date and time.
- **Menu Indicator.** Indicates the user can press the menu soft key to open a menu.
- **Alert Setting Indicator.** Shows the current selected alert. The default alert setting is a ringer.

1. Network, subscription and SIM card or service provider dependent feature. Not available in all areas.

User Interface Menu Structure

Figure 3 shows the V600 telephone menu structure.

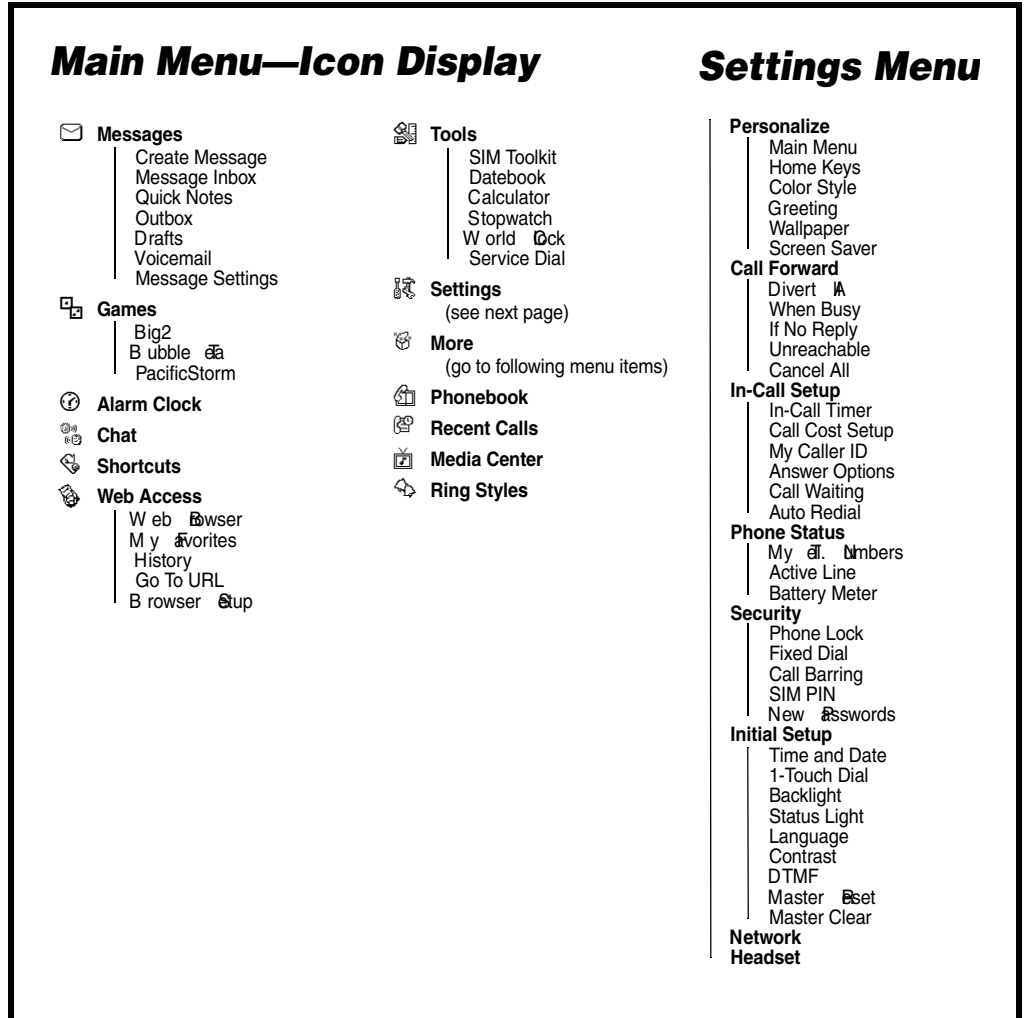


Figure 3. Menu Structure

0314230

Alert Settings

V600 telephones include up to 32 preset alert tones and vibrations that can be applied to all alert events at the same time.



Pressing either volume key will mute the alert.

Battery Function

Battery Gauge

The telephone displays a battery level indicator icon in the idle screen to indicate the battery charge level. The gauge shows four levels: 100%, 66%, 33%, and Low Battery.

Battery Removal

Removing the battery causes the device to immediately shut down and any pending work (for example, partially entered phone book entries or outgoing messages) is lost.



To ensure proper memory retention, turn OFF the phone before removing the battery. Immediately replace the old battery with a fresh battery.



If the battery is removed while receiving a message, the message will be lost.

Operation

For detailed operating instructions, refer to the appropriate User's Guide listed in the Related Publications section toward the end of this manual.

Tools and Test Equipment

The following table lists tools and test equipment recommended for disassembly and reassembly of V600 telephones. Use either the listed items or equivalents.

Table 1. General Test Equipment and Tools

Motorola Part Number ¹	Description	Application
RSX4043-A	Torque Driver	Used to remove and replace screws
--	#0 Cross Point Screwdriver	Used to remove cross point screws in the flip assembly
—	Torque Driver Bit T-5 Plus, Apex 440-6IP Torx Plus or equivalent	Used with torque driver
See Table 7	Rapid Charger	Used to charge battery and to power device
0180386A82	Antistatic Mat Kit (includes 66-80387A95 antistatic mat, 66-80334B36 ground cord, and 42-80385A59 wrist band)	Provides protection from damage to device caused by electrostatic discharge (ESD)
6680388B67	Disassembly tool, plastic with flat and pointed ends (manual opening tool)	Used during assembly/disassembly of device
6680388B01	Tweezers, plastic	Used during assembly/disassembly
—	Digital Multimeter, HP34401A ²	Used to measure battery voltage
8102430Z04	GSM / DCS Test SIM	Used to enable manual test mode

1. To order in North America, contact Motorola Aftermarket and Accessories Division (AAD) at (800) 422-4210 or FAX (800) 622-6210; Internationally, AAD can be reached by calling (847) 538-8023 or faxing (847) 576-3023.

2. Not available from Motorola. To order, contact Hewlett Packard at (800) 452-4844.

Disassembly

The procedures in this section provide instructions for the disassembly of V600 telephones. Tools and equipment used for the phone are listed in Table 1, preceding.



Many of the integrated devices used in this equipment are vulnerable to damage from electrostatic discharge (ESD). Ensure adequate static protection is in place when handling, shipping, and servicing the internal components of this equipment.



Avoid stressing the plastic in any way to avoid damage to either the plastic or internal components.

Removing and Replacing the Battery Door and Battery



All batteries can cause property damage and /or bodily injury such as burns if a conductive material such as jewelry, keys, or beaded chains touch exposed terminals. The conductive material may complete an electrical circuit (short circuit) and become quite hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse, or other container with metal objects.

1. Ensure the phone is turned off.
2. Press in and hold the battery door latch as shown in Figure 1.

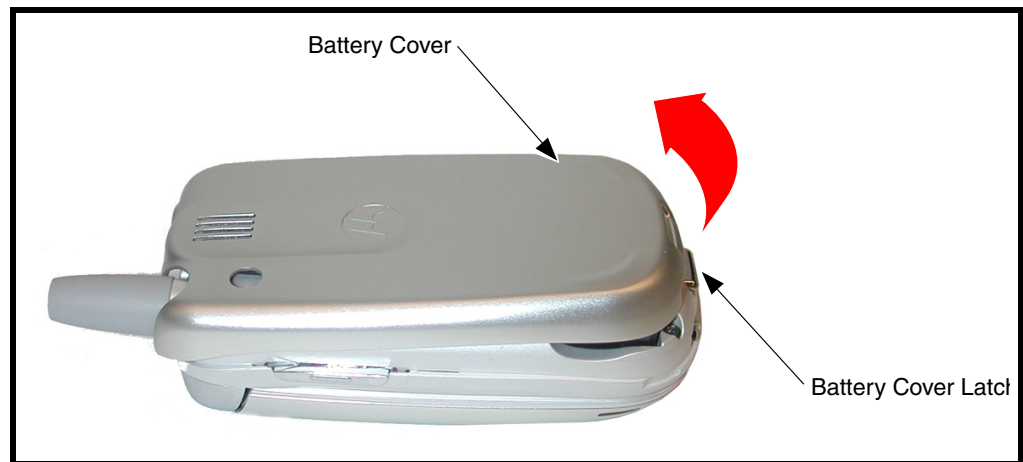
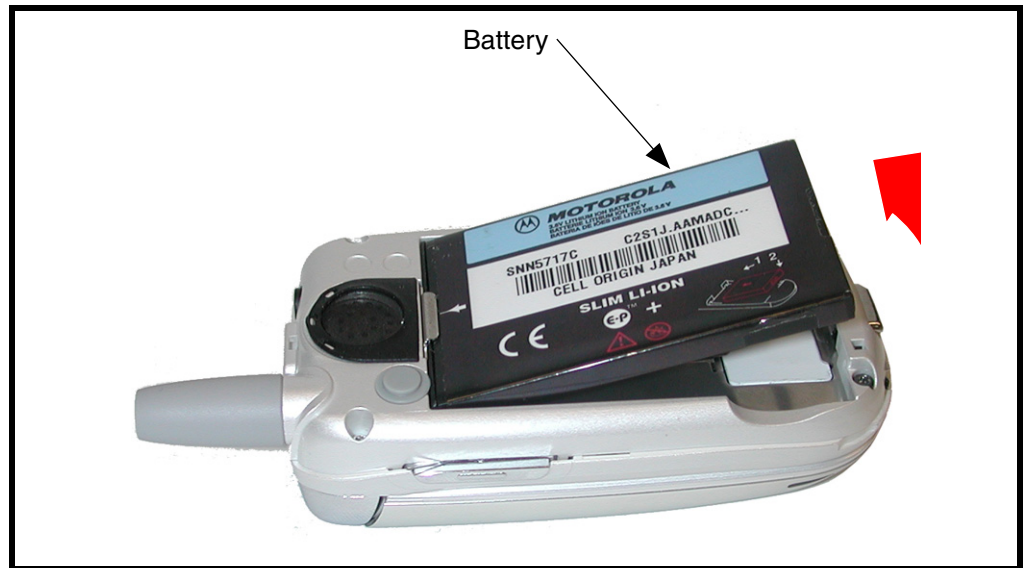


Figure 1. Removing the battery door

3. Slide the battery cover and lift it completely off the phone.

4. Lift the end of the battery and remove it completely. See Figure 2.



031631o

Figure 2. Removing the battery

There is a danger of explosion if the Lithium Ion battery is replaced incorrectly. Replace only with the same type of battery or equivalent as recommended by the battery manufacturer. Dispose of used batteries according to the manufacturer's instructions.

5. To replace, Align the battery with the battery compartment so the contacts on the battery match the battery contacts in the phone.
6. Insert the battery, printed arrow first, into the battery compartment and push down.
7. Insert the ridge at the bottom of the battery housing into the base of the phone, then push the cover down and snap it into place.

DRAFT



Removing and Replacing the Subscriber Identity Module (SIM)

1. Remove the battery door and battery as described in the procedures.

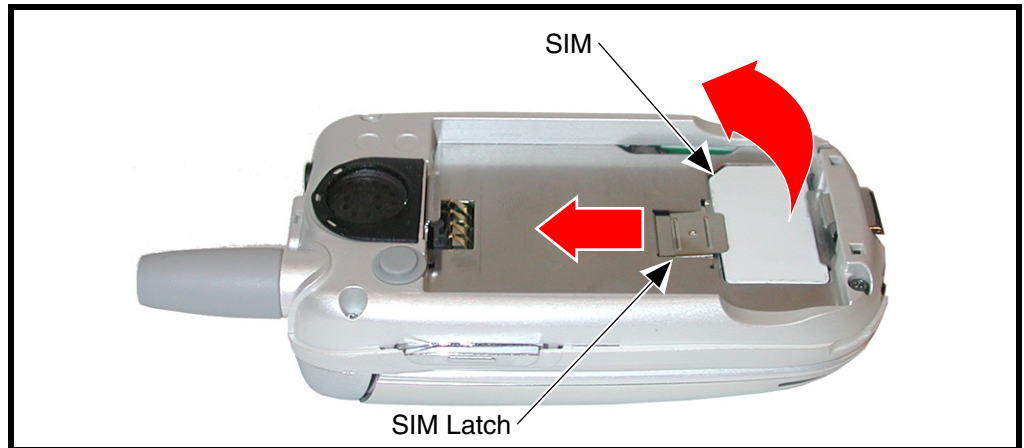


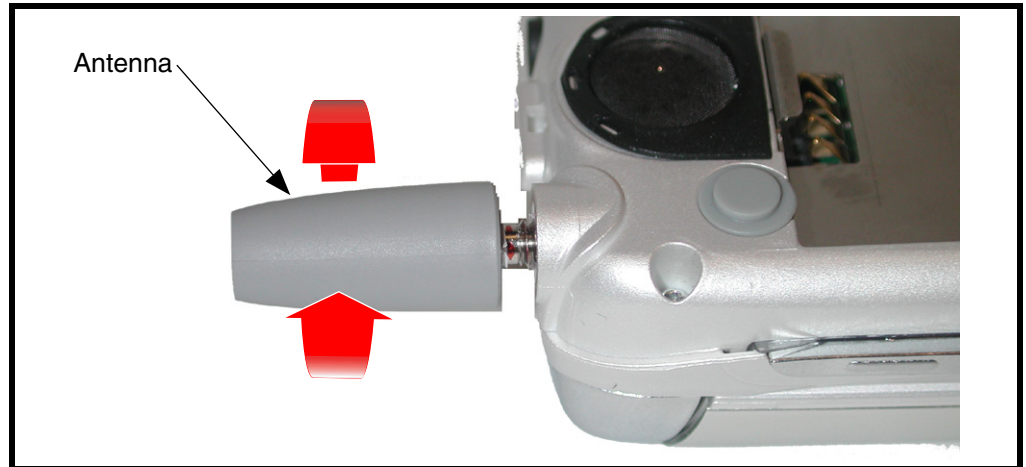
Figure 3. Removing the SIM

2. Slide the SIM holder away from the SIM to unlock as shown in Figure 3.
3. Carefully lift the SIM from its contacts.
4. To replace, insert the SIM into the holder, ensuring the keyed corner of the SIM aligns with the notch molded into the holder.
5. Slide the SIM holder over the SIM to lock.
6. Replace the battery and battery door as described in the procedures.

DRAFT

Removing and Replacing the Antenna

1. Remove the battery door and battery as described in the procedures.
2. By hand, rotate the antenna counterclockwise until loose. See Figure 4.



010628o

Figure 4. Removing the antenna

3. When the antenna threads are completely disengaged, pull the antenna straight out of the phone to remove.



Ensure antenna threads are properly engaged before tightening to prevent damage to the antenna or housing.

4. To replace, insert the threaded end of the antenna carefully into the housing and, after ensuring the threads are properly engaged, rotate clockwise. Tighten firmly by hand.
5. Replace the battery and battery housing as described in the procedures.

DRAFT

Removing and Replacing the Rear Housing



This product contains static-sensitive devices. Use anti-static handling procedures to prevent electrostatic discharge (ESD) and component damage.

1. Remove the battery cover, battery, SIM, and antenna as described in the procedures.



In addition to 4 screws, the rear housing assembly is fastened with plastic latches. These are fragile and should be released with care.



Housing screws in the knuckle are longer than the housing screws at the base of the V600.

2. Using a Torx driver with a T-5 bit, remove the 4 screws at each corner of the rear housing. See Figure 5.

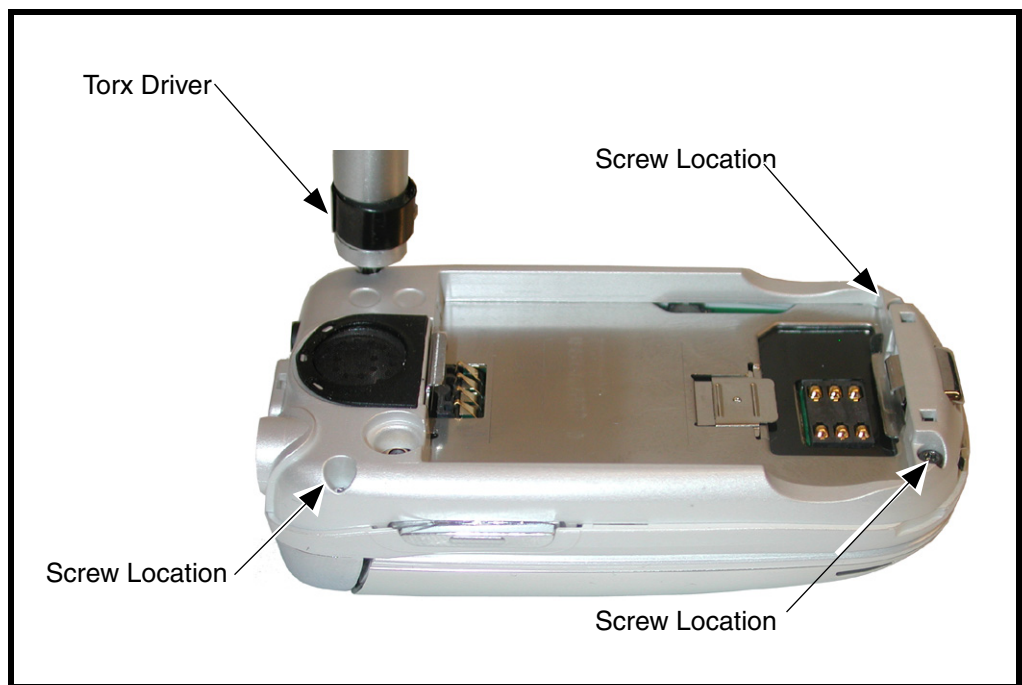
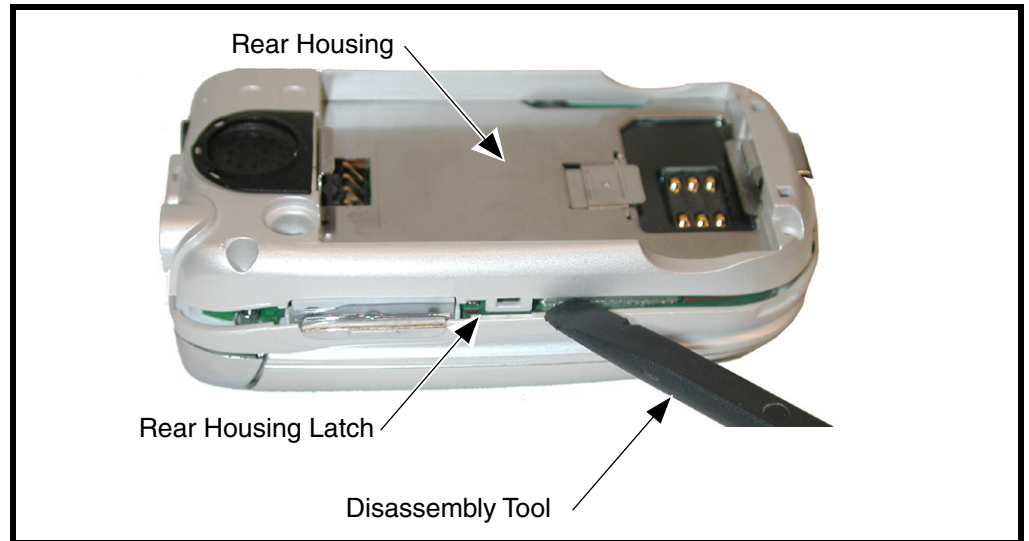


Figure 5. Removing the rear housing screws

DRAFT

3. Using the disassembly tool, release the housing latch on each side of the phone as shown in Figure 6.



0316380

Figure 6. Removing the rear housing

4. Carefully lift the rear housing away from the front housing and flip assembly.



The flip assembly and the front housing can also be removed at this point in the disassembly procedure.

5. To replace, carefully align the rear housing to the front housing and the flip assembly, then press the rear chassis assembly down until the 2 housing catches engage with the corresponding openings on the rear chassis assembly. Press the housings together until the catches snap into place.
6. Replace the 4 transceiver screws and tighten securely. Do not over tighten.
7. Replace the antenna, SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Transceiver Board Assembly



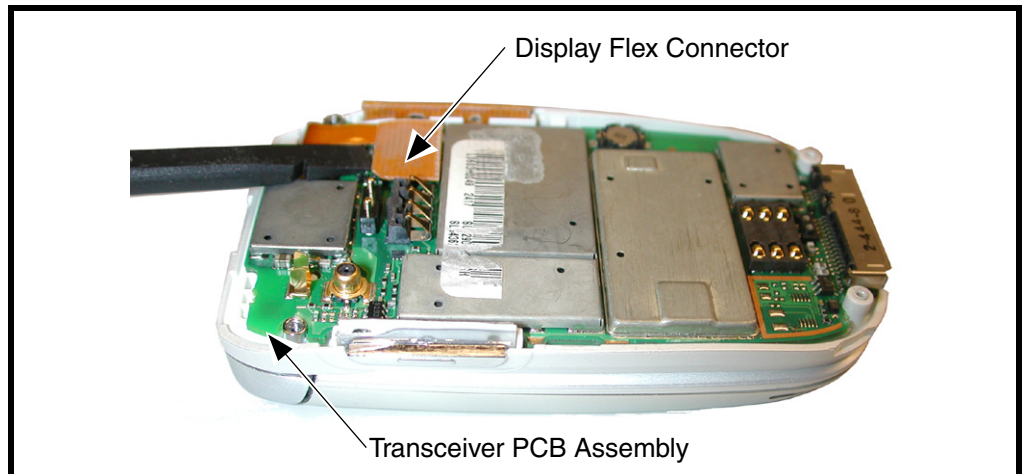
This product contains static-sensitive devices. Use anti-static handling procedures to prevent electrostatic discharge (ESD) and component damage.

1. Remove the battery cover, battery, SIM, antenna, and rear housing as described in the procedures.



The flexible printed cable (FPC) (flex) is easily damaged. Exercise extreme care when handling.

2. Carefully work the flat end of the disassembly tool under the flex connector and remove the connector from the transceiver board. See Figure 7.

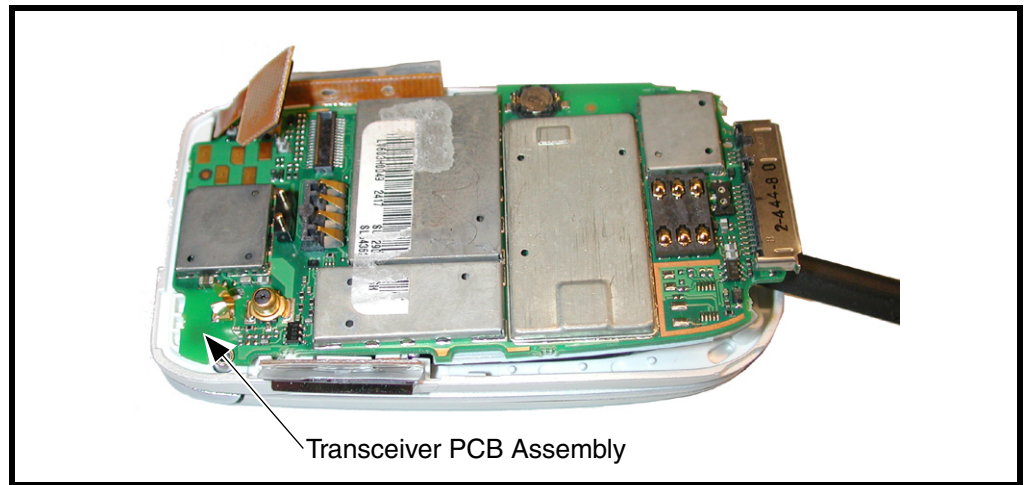


031639o

Figure 7. Disconnecting the flex from the transceiver board

DRAFT

3. Lift the transceiver board assembly out of the front housing. See Figure 8.



0316410

Figure 8. Removing the transceiver board assembly

4. To replace, insert the transceiver board assembly into the front housing with the flex connector on top.

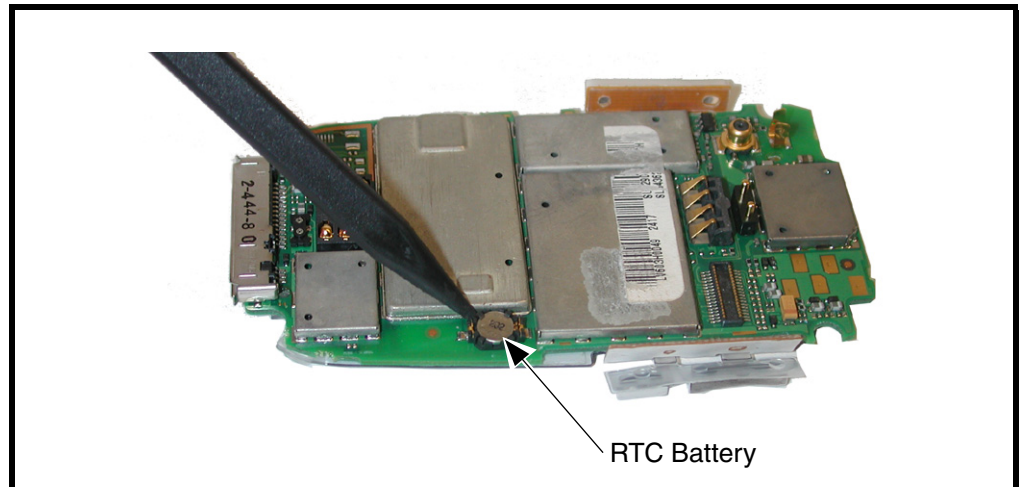
➔ *Be sure the volume / smart buttons and voice button are correctly positioned in relation to the corresponding switches on the transceiver board. Verify operation of the buttons after replacing the transceiver board and rear chassis assembly.*

5. Insert the flex connector squarely into its mating connector on the transceiver board and press firmly until it snaps into place.
6. Replace the rear housing, antenna, SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Real-Time Clock (RTC) Battery

1. Remove the battery cover, battery, SIM, antenna, rear housing, and transceiver board assembly as described in the procedures.
2. Use the disassembly tool to pry the RTC battery out of its socket on the transceiver board (see Figure 9).
3. Remove the RTC battery, while making not of the polarity



031643o

Figure 9. Removing the RTC Battery

4. To replace, align the RTC battery with it's socket on the transceiver board.
5. Press the RTC battery into its socket.
6. Replace the

DRAFT

Removing and Replacing the Keypad, Volume/Smart and Voice Buttons

1. Remove battery cover, battery, SIM, antenna, rear housing, and transceiver board assembly as described in the procedures.
2. Using the disassembly tool, lift the top part of the keypad assembly, which includes the volume/smart buttons, and voice button away from the transceiver board assembly (see Figure 10). The bottom part the keypad assembly is secured by adhesive material. Remove the remainder of the keypad assembly from the transceiver board with caution.

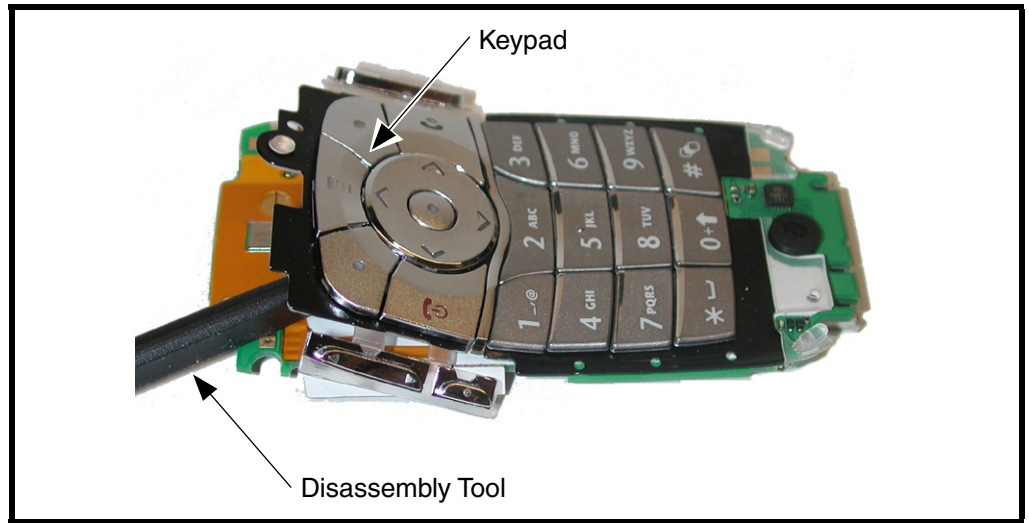


Figure 10. Removing the Keypad, volume/smart, and voice buttons

3. To replace, remove any protective covering to expose the keypad adhesive.
4. Carefully set the keypad volume/smart buttons and voice button assembly onto the metal switchdome assembly. Ensure the volume/smart key keypads will contact the switchdome assembly on the transceiver board when installed.
5. Insert the keypad into the front housing, ensuring the keys align properly with the openings in the front housing.
6. Replace the transceiver board assembly, Display flex connector, rear housing assembly, antenna, SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Headphone Speaker Jack

1. Remove the battery cover, battery, SIM, antenna, and rear housing as described in the procedures.
2. Using the disassembly tool, gently pry up on the headphone speaker jack to remove it from the rear housing as shown in Figure 11. Be careful not to damage the leads.

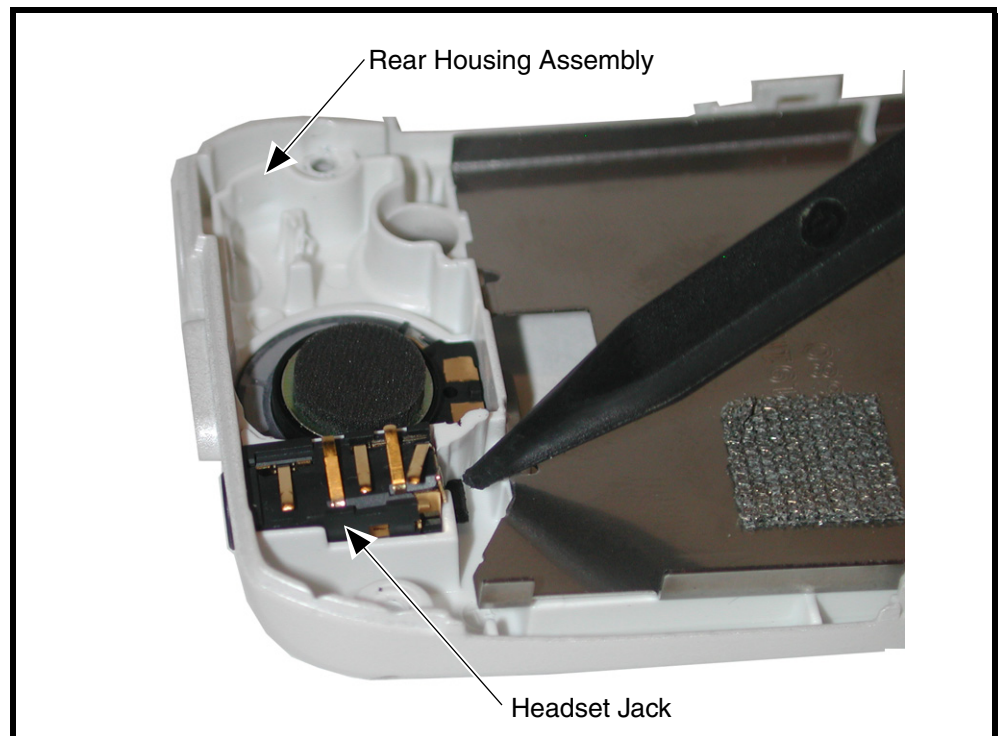


Figure 11. Removing the Headphone Speaker Jack

3. To replace, align the headphone speaker jack to the rear housing assembly.
4. Insert the top end of the headphone speaker jack into the rear housing assembly.
5. Press the bottom end of the headphone speaker jack into the rear housing. Be careful not to damage the headphone jack speaker leads.
6. Ensure headphone jack speaker leads will contact the transceiver board when reassembled.
7. Replace the rear housing, antenna, SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Polyphonic Speaker Assembly

1. Remove the battery cover, battery, SIM, antenna, rear housing, and headphone speaker jack as described in the procedures.
2. Remove the speaker baffle wall as described in Figure 12A.
3. Use the disassembly tool to pry the polyphonic speaker assembly out of the rear housing as shown in Figure 12B.
4. Remove any remaining speaker adhesive residue from the rear housing assembly.

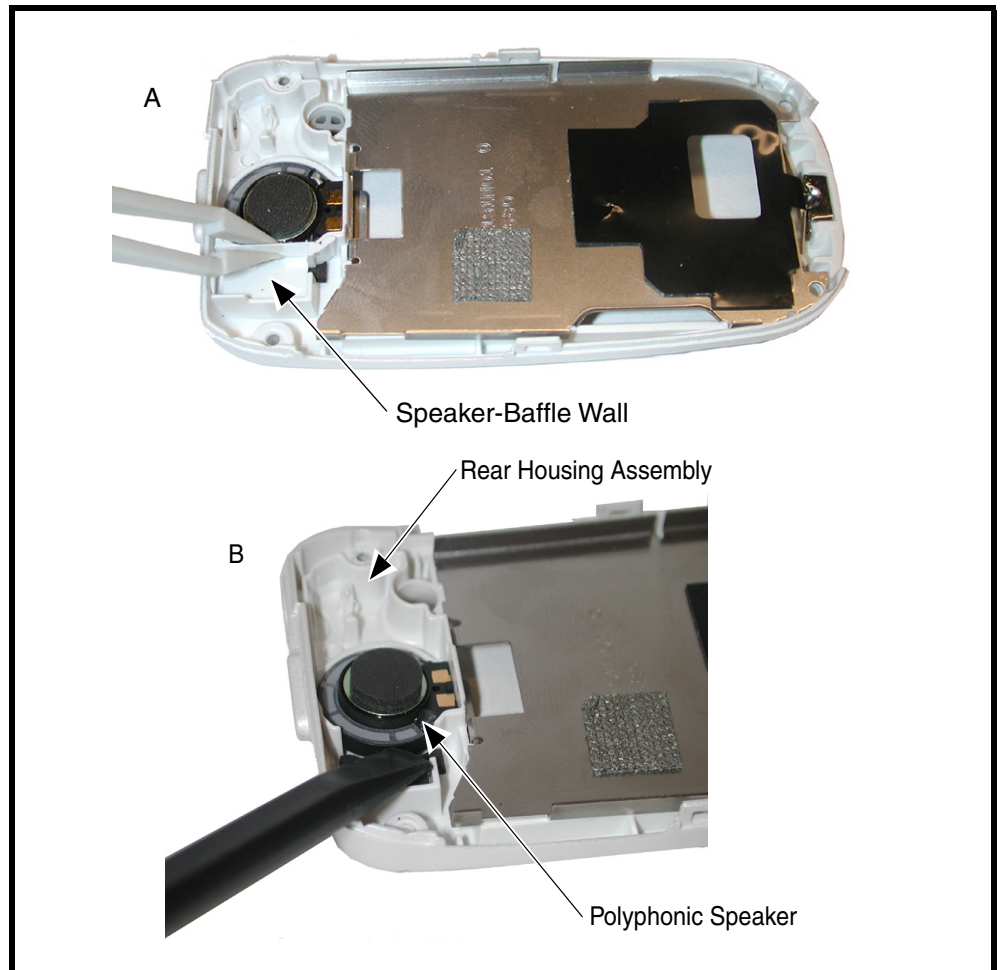


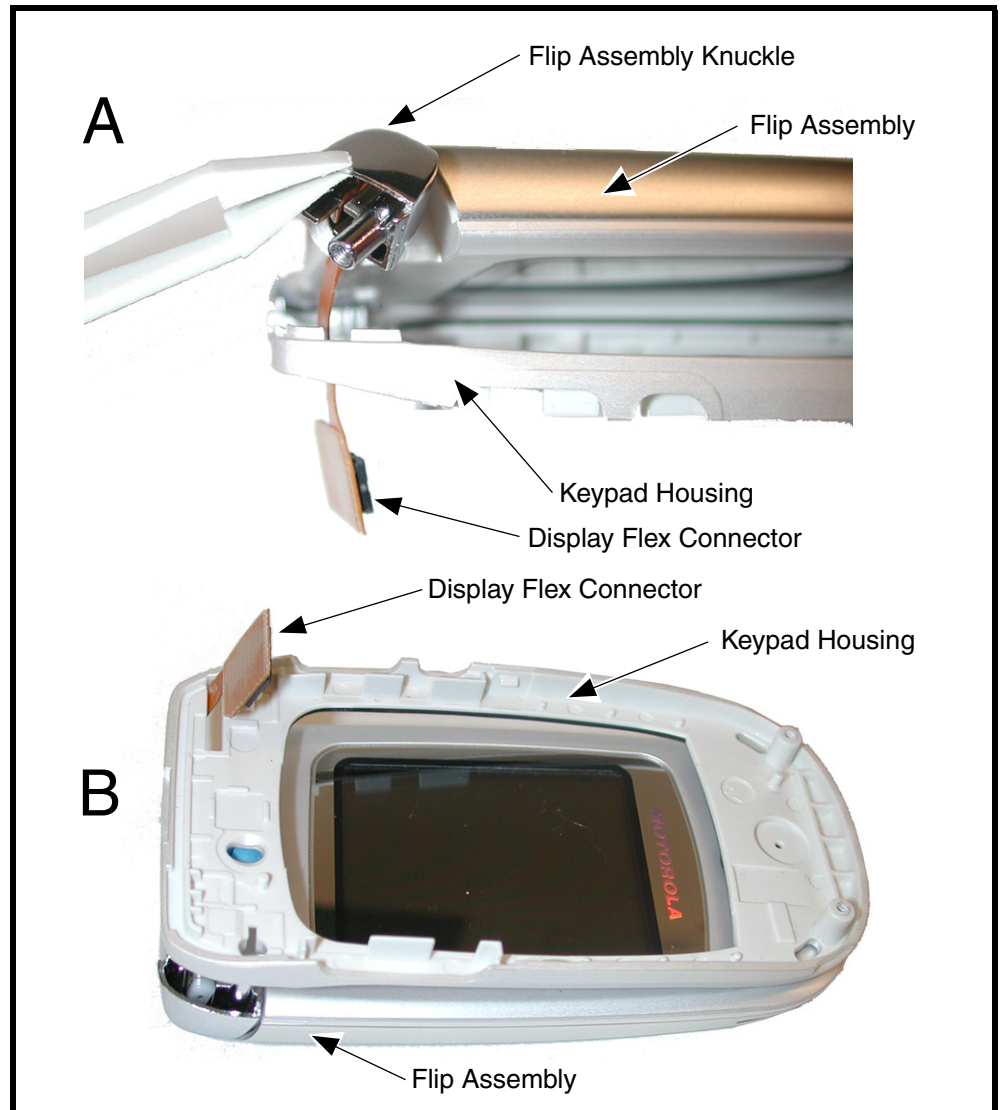
Figure 12. Removing the Polyphonic Speaker Assembly

5. To replace, remove any remaining adhesive residue from speaker cavity.
6. Remove any adhesive protection material from the speaker assembly.
7. Align the speaker assembly to the opening in the rear housing.
8. Carefully press the polyphonic speaker assembly into it's cavity on the rear housing.
9. Replace the headphone speaker jack, rear housing, antenna, SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Flip Assembly

1. Remove the battery cover, battery, SIM, antenna, rear housing, and transceiver board assembly as described in the procedures.
2. Remove the knuckle from the flex cable and flip assembly (see Figure 13A).
3. Carefully slide the display flex cable through the keypad housing assembly (see Figure 13b). Avoid damage to the flex cable.
4. Lift the keypad housing assembly away from the flip assembly. Be careful not to damage the display flex cable.



0316480

Figure 13. Removing the Flip Assembly

5. To replace, carefully thread the display flex connector through the slot on the keypad housing assembly. Avoid damage to the flex cable.
6. Place the flip knuckle over the flex cable and align knuckle to keypad housing.

-
7. Replace the transceiver board assembly, rear housing, antenna, SIM, battery, and battery cover as described in the procedures.



DRAFT

Removing and Replacing the Flip CLI Lens Assembly

1. Remove the battery cover, battery, SIM, antenna, rear housing, and transceiver board assembly and flip assembly as described in the procedures.
2. Remove the flip assembly cover (see Figure 14a).
3. Remove the 4 flip assembly screws (see Figure 14b). Be careful not to loose the flip cover latches attached to 2 screws near the flip assembly hinge. Set the screws and latches aside for re-use.
4. Release the 2 latches on each side of the flip assembly (see Figure 14).
5. Disconnect the CLI flex connector from the flip assembly PCB located under the CLI lens assembly.
6. Lift the CLI lens assembly away from the flip assembly.

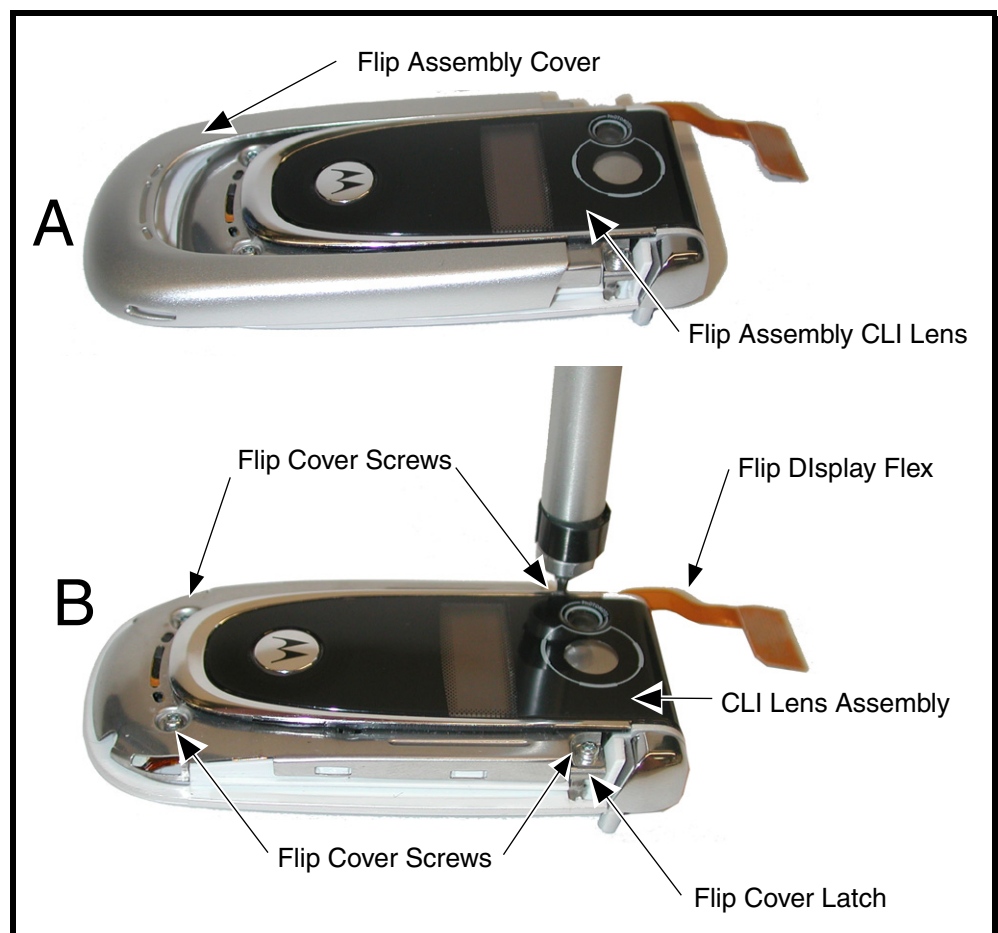


Figure 14. Removing the Flip CLI Lens Assembly Part 1

DRAFT

7. Release the 2 latches on each side of the flip assembly (see Figure 14C).

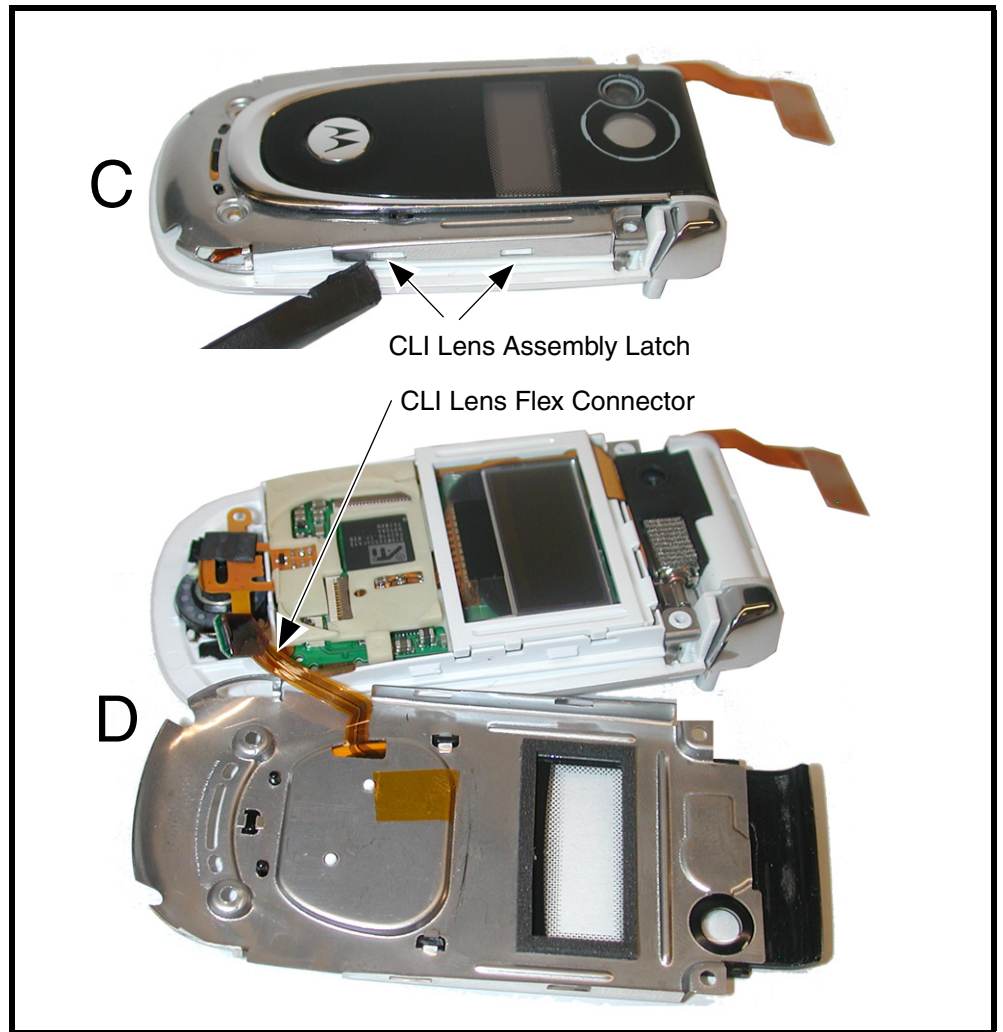


Figure 14. Removing the Flip CLI Lens Assembly Part 2

8. Disconnect the CLI lens flex connector from the flip assembly PCB located under the CLI lens assembly (see Figure 14D).
9. Lift the CLI lens assembly away from the flip assembly
10. To replace, connect the CLI display Flex connector to the flip assembly.
11. Align the CLI display lens assembly to the flip assembly.
12. Carefully press the CLI display lens to the flip assembly to lock the latches on the CLI display lens assembly. Be careful not to damage the CLI display flex or flex connector while re-assembling the CLI display lens assembly.
13. Insert and tighten the 4 flip assembly screws. Ensure that the flip cover latches are attached to the flip assembly.
14. Slide the flip assembly cover onto the flip assembly.
15. Replace flip assembly, transceiver board, rear housing, antenna, SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Camera Assembly

1. Remove the battery cover, battery, SIM, ..., and flip display lens as described in the procedures.
2. Use the tweezers to remove the two flip cover latches on each side of the flip assembly (see Figure 15).
3. Remove the CLI Support frame and display assembly snubber.
4. Unlock and remove the camera assembly flex connector.
5. Use the disassembly tool to gently pry the camera assembly out of its space in the flip assembly.

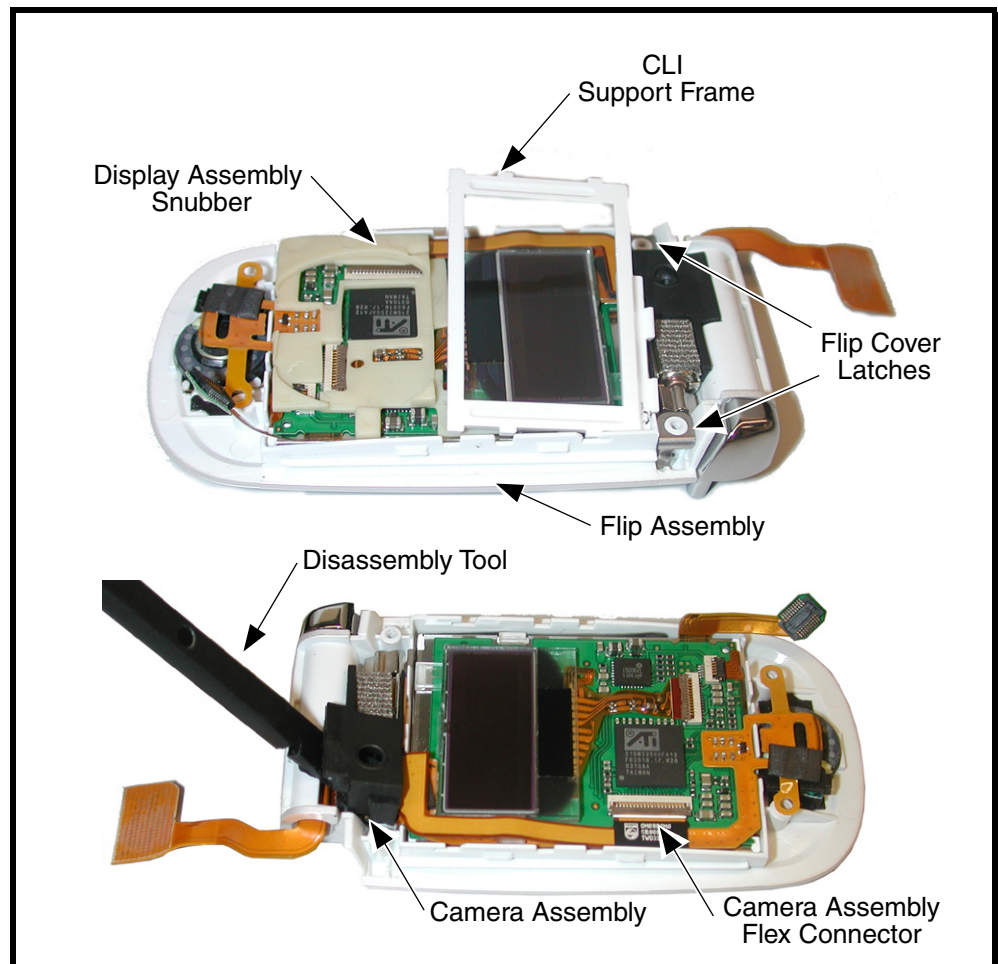
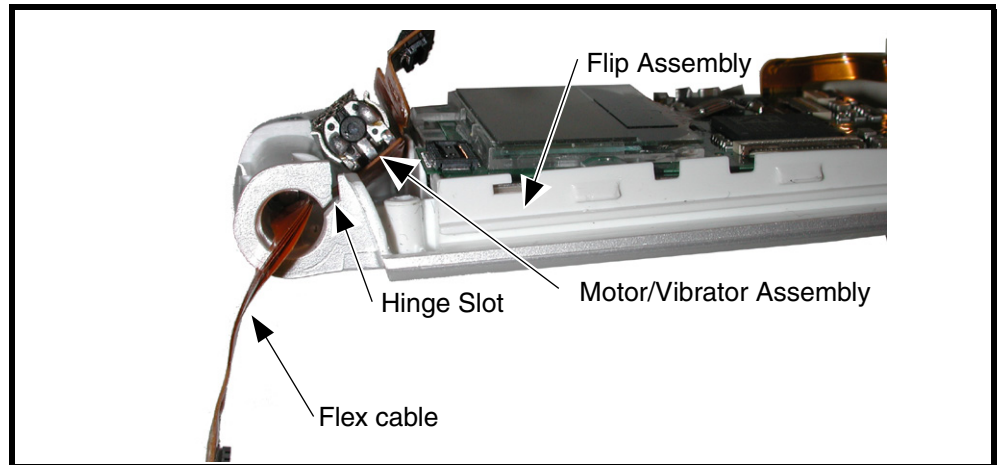


Figure 15. Camera Assembly Removal

6. To replace, carefully press the camera assembly into its slot in the flip assembly.
7. Insert the end of the camera assembly flex cable into its slot in the zif connector on the flip display assembly.
8. Replace the ... SIM, battery, and battery connector as described in the procedures.

Removing and Replacing the Motor/Vibrator

1. Remove the battery cover, battery, SIM, ... and camera assembly as described in the procedures.
2. Lift the flip display flex cable up over the flip display assembly (see Figure 16).
3. Carefully slide the shorter end of the flip display flex cable through the slot in the flip hinge to remove it from the flip display assembly.



031705o

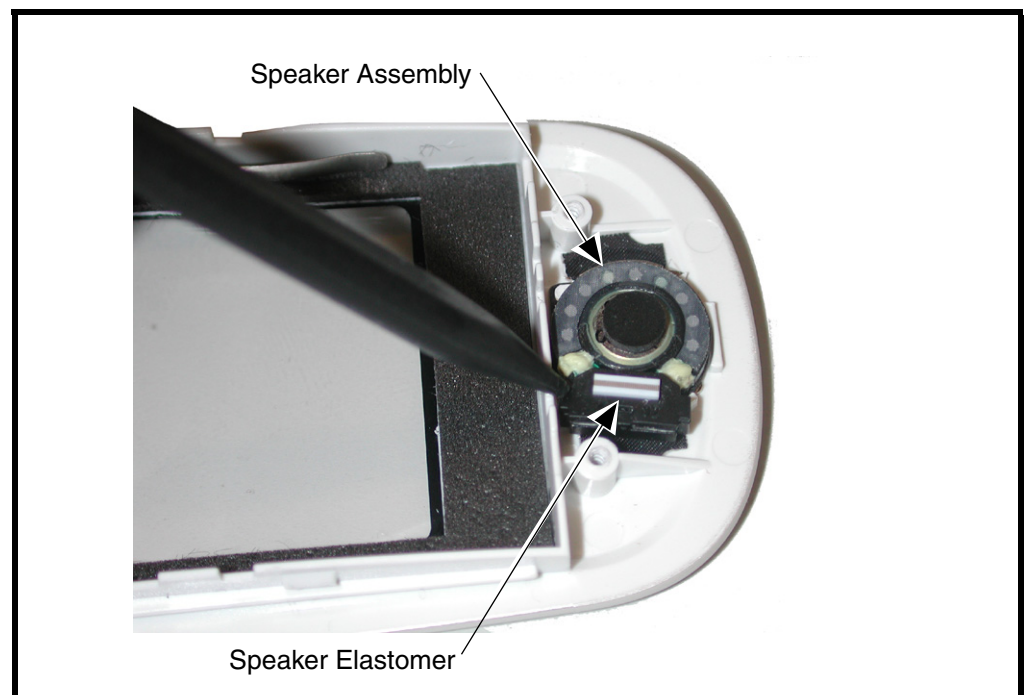
Figure 16. Motor/Vibrator Removal Part

4. To replace, thread the motor/vibrator flex cable through the slot in the hinge of the flip assembly.
5. Lower the motor/vibrator into its position in the flip assembly.
6. Replace the camera assembly... SIM, battery, and battery cover as described in the procedures.

DRAFT

Removing and Replacing the Speaker Assembly

1. Remove the battery cover, battery, SIM, and flip cover as described in the procedures.
2. Lift the snubber away from the bottom of the LCD display assembly. Set the snubber aside for re-use.
3. Use the disassembly tool to release the latch on each side of the flip housing that secures the LCD assembly.
4. Very carefully, lift the top end of the LCD assembly out of the flip assembly. Be careful not to damage any of the flex cables on the LCD assembly.
5. Disconnect the flex connector near the flip assembly hinge and lift the LCD assembly completely out of the flip housing.



0317060

Figure 17. Removing the Speaker Assembly

6. To replace, align the speaker assembly to the flip housing.
7. Press the speaker assembly into the flip assembly.
8. Gently press the speaker elastomer into position over the speaker assembly contacts.
9. Replace the flip assembly cover, ... SIM, battery, and battery cover as described in the procedures.

DRAFT

Subscriber Identity Module (SIM) and Identification

SIM Card

A SIM is required to access the existing local GSM network, or remote networks when traveling (if a roaming agreement has been made with the provider).

The SIM contains:

- All the data necessary to access GSM services.
- The ability to store user information such as phone numbers.
- All information required by the network provider to provide access to the network.

Personality Transfer

A personality transfer is required when a phone is express exchanged or when the main board is replaced. Personality transfers reproduce the customer's original personalized details such as menu and stored memory such as phone books, or even just program a unit with basic user information such as language selection. V600 telephones use TrueSync® synchronization software to effect a personality transfer.

Identification

Each Motorola GSM device is labeled with a variety of identifying numbers. The following information describes the current identifying labels.

Mechanical Serial Number (MSN)

The Mechanical Serial Number (MSN) is an individual unit identity number and remains with the unit throughout the life of the unit.

The MSN can be used to log and track a unit on Motorola's Service Center Database. The MSN is divided into 4 sections as shown in Figure 18.

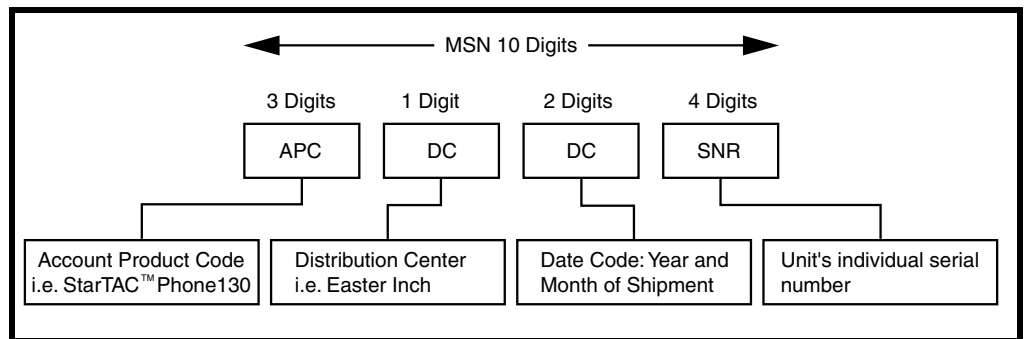


Figure 18. MSN Label breakdown

000807a

International Mobile Station Equipment Identity (IMEI)

The International Mobile station Equipment Identity (IMEI) number is an individual number unique to the PCB and is stored within the unit's memory.

The IMEI uniquely identifies an individual mobile station and thereby provides a means for controlling access to GSM networks based on mobile station types or individual units. The full IMEI structure is listed in Table 2.

Table 2. IMEI Number Breakdown

TAC	Serial Number	Check Digit
NNXXXX YY	ZZZZZZ	A

Where

TAC Type Allocation Code, formerly known as Type Approval Code

NN Reporting body identifier

XXXX Type Identifier

YY YY is set to 00 from 01/01/2003 until 31/03/2004

ZZZZZZ Individual unit serial number

A Phase 1 = 0.
Phase 2 = check digit defined as a function of all other IMEI digits

Other label number configurations present are:

- **TRANSCEIVER NUMBER:** Identifies the product type. Normally the SWF number. (i.e. V100).
- **PACKAGE NUMBER:** Identifies the equipment type, mode, and language in which the product is shipped.

DRAFT

Troubleshooting

Manual Test Mode

Motorola V600 telephones are equipped with a manual test mode capability. This allows service personnel to verify functionality and perform fault isolation by entering keypad commands.

To enter the manual test command mode, a GSM / DCS test SIM must be used.

1. Press **Ⓞ** to turn the phone OFF.
2. Remove the battery as described in the procedures.
3. Remove the customer's SIM card from the phone as described in the procedures.
4. Insert the test SIM into the SIM slot.
5. Replace the battery as described in the procedures.
6. Press **Ⓞ** to turn the phone ON.

Manual Test Mode Commands

Table 3. Manual Test Commands

Key Sequence	Test Function/Name	Remarks
<Menu>048263*	Enter manual test mode	
"End" Key	Exit manual test mode	
54*	Suspend	Required for all Test Mode Operations
0*0*0	Select tone 0	
0*0*1	Select tone 1	
0*0*2	Select tone 2	
0*0*3	Select tone 3	
0*0*4	Select tone 4	
0*0*5	Select tone 5	
0*0*6	Select tone 6	
0*0*7	Select tone 7	
0*0*8	Select tone 8	
0*0*9	Select tone 9	
0*1*X	Disable tone X	
3*0*1	Enable vibrator	
3*0*0	Disable vibrator	
5*0*0	Set audio level 0	
5*0*1	Set audio level 1	
5*0*2	Set audio level 2	
5*0*3	Set audio level 3	
5*0*4	Set audio level 4	
5*0*5	Set audio level 5	
5*0*6	Set audio level 6	
5*0*7	Set audio level 7	

Table 3. Manual Test Commands (Continued)

Key Sequence	Test Function/Name	Remarks
5*0*8	Set audio level 8	
5*0*9	Set audio level 9	
5*0*10	Set audio level 10	
5*0*11	Set audio level 11	
5*0*12	Set audio level 12	
5*0*13	Set audio level 13	
5*0*14	Set audio level 14	
5*0*15	Set audio level 15	
6*2*2*0*0	Set Audio Path. Int Mic, IntSpk, RX unmute, TX unmute	
6*4*6*0*0	Set Audio Path. Boom Mic, Boom Spk, RX unmute, TX unmute	
10*0*3	Set band GSM 900	
10*0*4	Set band DCS 1800	
10*0*5		
10*0*6	Set dual band GSM 900 / 1800	
10*1*0	Read band	3= GSM 4= DCS 5= PCS 6 =GSM/DCS
18*0	Initialize non-volatile memory (Master Reset)	
18*1	Initialize non-volatile memory (Master Clear)	
55*2*001	Test Display. All pixels ON	
55*2*000	Test Display. All pixels OFF	
55*2*002	Test Display. Checkerboard pattern A	
55*2*003	Test Display. Checkerboard pattern B	
55*2*004	Test Display. Border pixels ON	
*#06#	IMEI Check	No Test Mode Required
Phone Set up --> Phone Status --> Other Information	Flex Version / Technology / S-W Version / Readiness Status	No Test Mode Required

Troubleshooting Chart

Table 4. V600 Telephone: Level 1 and 2 Troubleshooting Chart

SYMPTOM	PROBABLE CAUSE	VERIFICATION AND REMEDY
1. Telephone will not turn on or stay on.	a) Battery either discharged or defective.	Measure battery voltage across a 50 ohm (>1 Watt) load. If the battery voltage is <3.25 Vdc, recharge the battery using the appropriate battery charger. If the battery will not recharge, replace the battery. If battery is not at fault, proceed to b.
	b) Battery connectors open or misaligned.	Visually inspect the battery connectors on both the battery and the telephone. Realign and, if necessary, either replace the battery or refer to a Level 3 Service Center for the battery connector replacement. If battery connectors are not at fault, proceed to c.
	c) Transceiver board assembly defective.	Remove the transceiver board assembly. Substitute a known good assembly and temporarily reassemble the unit. Press and hold the PWR button; if unit turns on and stays on, disconnect the dc power source and reassemble the telephone with the new transceiver board assembly. Verify that the fault has been cleared. If the fault has not been cleared then proceed to d.
	d) keyboard assembly failure.	Replace the keyboard assembly. Temporarily connect a +3.6 Vdc supply to the battery connectors. Press and hold the PWR button. If unit turns on and stays on, disconnect the dc power source and reassemble with the new keyboard assembly.
2. Telephone exhibits poor reception or erratic operation such as calls frequently dropping or weak or distorted audio.	a) Antenna assembly defective.	Check to make sure that the antenna pin is properly connected to the transceiver board assembly. If connected properly, substitute a known good antenna. If the fault is still present, proceed to b.
	b) Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.
3. Display is erratic, or provides partial or no display.	a) Transceiver board connections faulty.	Remove rear chassis assembly from unit, check general condition of flexible printed cable (flex). If the flex is good, check that the flex connector is fully pressed down. If not, check connector to transceiver board connections. If faulty connector, replace the transceiver board assembly. If connector is not at fault, proceed to b.
	b) Flip assembly defective.	Temporarily replace the flip assembly with a known good assembly. If fault has been cleared, reassemble with the new flip assembly. If fault not cleared, proceed to c.
	c) Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.

Table 4. V600 Telephone: Level 1 and 2 Troubleshooting Chart (Continued)

SYMPTOM	PROBABLE CAUSE	VERIFICATION AND REMEDY
4. Incoming call alert transducer audio distorted or volume is too low.	Faulty transceiver board assembly.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.
5. Telephone transmit audio is weak. (usually indicated by called parties complaining of difficulty in hearing voice).	a) Microphone connections to the transceiver board assembly defective.	Gain access to the microphone as described in the procedures. Check connections. If connector is faulty proceed to c; if the connector is not at fault, proceed to b.
	b) Microphone defective.	Gain access to microphone. Disconnect and substitute a known good microphone. Place a call and verify improvement in transmit signal as heard by called party. If good, reassemble with new microphone. If microphone is not at fault, reinstall original microphone and proceed to c.
	c) Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.
6. Receive audio from earpiece speaker is weak or distorted.	a) Connections to or from transceiver board assembly defective.	Gain access to the transceiver board assembly as described in the procedures. Check flex and the flex connector from the flip assembly to the transceiver board assembly. If flex is at fault, replace flip assembly. If flex connector is at fault, proceed to d. If connection is not at fault, proceed to b.
	b) Flip assembly defective.	Temporarily replace the flip assembly with a known good assembly. If fault has been cleared, reassemble with the new flip assembly. If fault not cleared, proceed to c.
	c) Antenna assembly defective.	Check to make sure the antenna is installed correctly. If the antenna is installed correctly, substitute a known good antenna assembly. If this does not clear the fault, reinstall the original antenna assembly and proceed to d.
	d) Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble with the new transceiver board assembly.
7. Telephone will not recognize or accept SIM.	a) SIM defective.	Check the SIM contacts for dirt. Clean if necessary and check if fault has been cleared. If the contacts are clean, insert a known good SIM into the telephone. Power up the unit and confirm that the SIM has been accepted. If the fault no longer exists, replace the defective SIM. If the SIM is not at fault, proceed to b.
	b) Flip assembly defective.	Temporarily replace the flip assembly with a known good assembly. If fault has been cleared, reassemble with the new flip assembly. If fault not cleared, proceed to c.
	c) Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.

Table 4. V600 Telephone: Level 1 and 2 Troubleshooting Chart (Continued)

SYMPTOM	PROBABLE CAUSE	VERIFICATION AND REMEDY
8. Phone does not sense when flip is opened or closed (usually indicated by inability to answer incoming calls by opening the flip, or inability to make outgoing calls).	a) Flip assembly defective.	Temporarily replace the flip assembly with a known good assembly. If fault has been cleared, reassemble with the new flip assembly. If fault not cleared, proceed to b.
	b) Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.
9. Vibrator feature not functioning.	Transceiver board assembly defective.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.
10. Internal Charger not working.	Faulty charger circuit on transceiver board assembly.	Test a selection of batteries in the rear pocket of the desktop charger. Check LED display for the charging indications. If these are charging properly, then the internal charger is at fault. Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.
11. Real Time Clock resetting when standard battery is removed.	Lithium button cell in the display board may be depleted.	Refer service to a Level 3 service center for replacement.
12. No or weak audio when using headset.	a) Headset not fully pushed home.	Ensure the headset plug is fully seated in the jack socket. If fault not cleared, proceed to b.
	b) Faulty jack socket on transceiver board assembly.	Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly.

Programming: Software Upgrade and Flexing

Contact your local technical support engineer for information about equipment and procedures for flashing and flexing.

DRAFT

Part Number Charts

The following charts are provided as a reference for the parts associated with V600 telephones.

Related Publications

Motorola V600 User's Guide, English

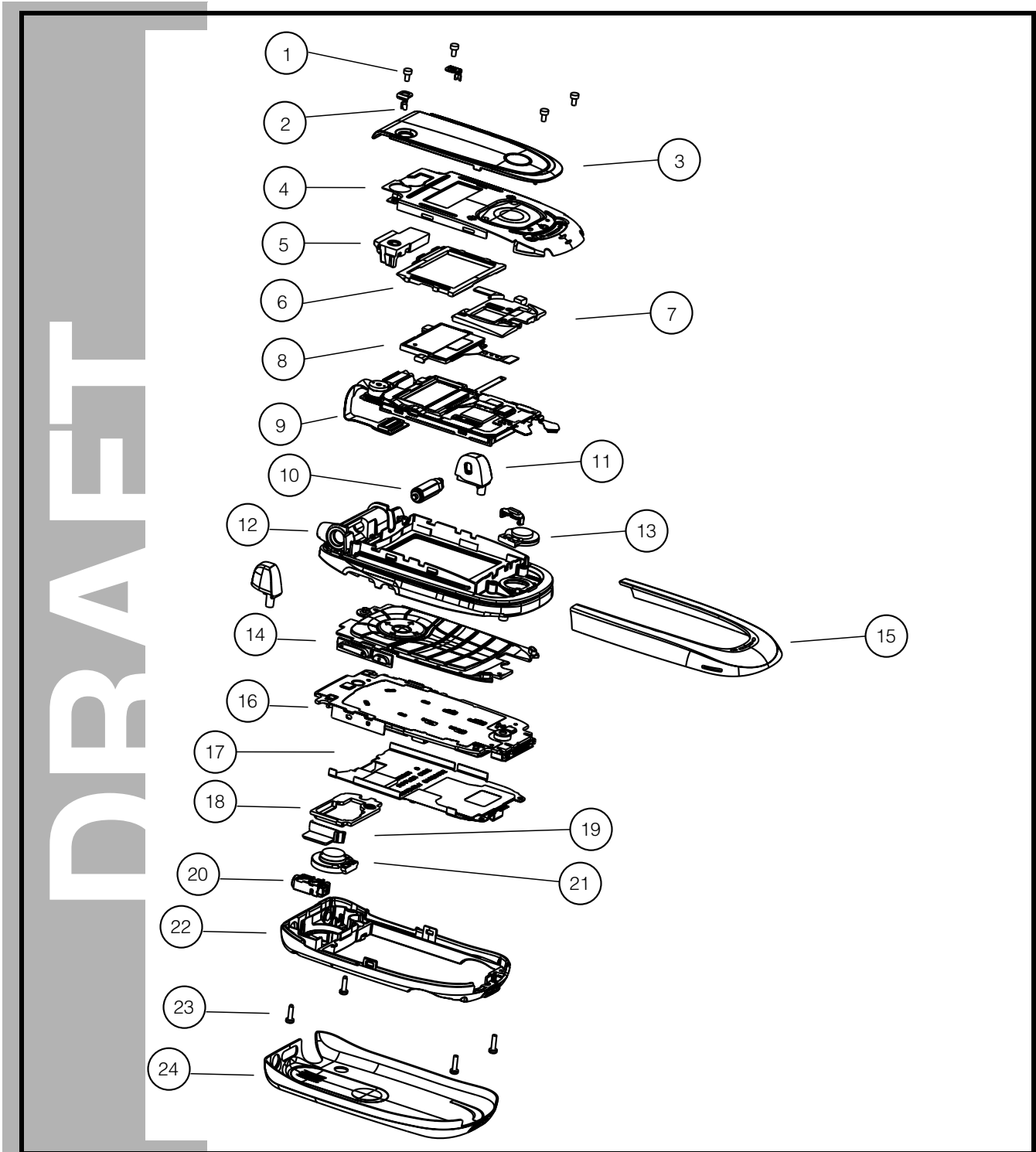
SJJN5272 (6809467A24)

Motorola V600 Reference Guide, English

SJJN5273 (6809467A25)

DRAFT

Exploded View Diagram



031415o

Figure 19. V600 Exploded view diagram

Exploded View Parts List

Table 5. Exploded View Parts List

Item Number	Part Number	Description
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Item Number	Part Number	Description
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

DRAFT



There is a danger of explosion if the Lithium Ion battery pack is replaced incorrectly. Replace only with the same type of battery or equivalent as recommended by the battery manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Accessories**Table 6. Accessories**

Part Description	Part Number
Headset, FM stereo radio	SYN8609
Headset, send / end button	SYN8419
Headset, retractable	SYN8284
Neckloop, hands-free (compatible with T-coil hearing aids)	SYN7875
Holster	SYN8454

A

alert setting indicator 16
alert settings 17
antenna, removing and replacing 23

B

battery
 function 18
 gauge 18
 removing 20
battery housing
 removing 20
battery level indicator 16

C

caller ID 12
camera assembly, removing and replacing 36
Canadian Interference-Causing Equipment regulations 5
changes
 product 5
commands, manual test mode 41
conventions 7
copyrights
 computer software 6

D

disassembly 20
display 15

E

exploded view diagram 48
exploded view parts list 49

F

FCC rules 5
features
 caller ID 12
 SIM Toolkit 12
 text entry 12
 voice recognition 11
 Wireless Access Protocol (WAP) 12
features, product 10
flip assembly cover, removing and replacing 34
flip assembly, removing and replacing 32

H

headphone speaker jack, removing and replacing 30

I

identification 39
 international mobile station equipment identity 40
 mechanical serial number 39
 product 5
IMEI 40
in use indicator 16
indicators
 alert setting 16
 battery level 16
 in use 16
 menu 16
 message waiting 16
 roam 16
 service indicator (status light) 15
 signal strength 16
 voice message waiting 16
Introduction 5

L

liquid crystal display (LCD) 15

M

manual test mode 41
menu
 structure diagram 17
menu indicator 16
message waiting indicator 16
MSN 39

N

names
 product 5

O

operation
 controls, indicators, and I/O 14
operation, general 14
overview, product 10

P

part numbers
 accessories 50
parts 47
 exploded view diagram 48
 exploded view parts list 49
polyphonic speaker assembly, removing and replacing 31
product

- changes 5
- identification 5
- names 5
- publications, related 47

R

- real-time clock battery, removing and replacing 28
- rear housing
 - removing 24
- regulatory agency compliance 5
- related publications 47
- removing
 - antenna 23
 - battery 18, 20
 - battery housing 20
 - camera assembly 36
 - flip assembly 32
 - flip assembly cover 34
 - headphone speaker jack 30
 - polyphonic speaker assembly 31
 - real-time clock battery 28
 - rear housing 24
 - SIM 22
 - transceiver board assembly 26
 - volume/smart buttons 29
- replacement parts
 - contact information 8
- replacing
 - antenna 23
 - battery 20
 - camera assembly 36
 - flip assembly 32
 - flip assembly cover 34
 - headphone speaker jack 30
 - polyphonic speaker assembly 31
 - real-time clock battery 28
 - rear housing 24
 - SIM 22
 - transceiver board assembly 26
 - volume/smart buttons 29
- roam indicator 16

S

- serial number
 - mechanical 39
- service manual
 - about 6
 - revisions 7
 - scope 6
- service policy 7

- customer support 7
 - out of box failure 7
 - product support 7
- service procedure
 - ordering replacement parts 8
- shut down
 - upon battery removal 18
- signal strength indicator 16
- SIM Application Toolkit 12
- SIM card 39
 - personality transfer 39
 - replacing 22
- SIM, removing and replacing 22
- specifications 9
- support
 - customer 7
 - product 7

T

- text entry 12
- tools and test equipment 19
- transceiver board assembly, removing and replacing 26
- troubleshooting 41
 - manual test mode 41
 - manual test mode commands 41

U

- user interface diagrams 17

V

- voice message waiting indicator 16
- voice recognition 11
- volume/smart buttons, removing and replacing 29

W

- warranty service 7
- wireless access protocol (WAP) 12

MOTOROLA, the Stylized M Logo, and all other trademarks indicated as such herein are trademarks of Motorola, Inc.
© Reg. U.S. Pat. & Tm. Off.
TrueSync and Starfish are registered trademarks of Starfish, Inc., a wholly owned independent subsidiary of Motorola, Inc.
All other product or service names are the property of their respective owners.

© 2003 Motorola, Inc.
All rights reserved.
Personal Communications Sector,
Sawgrass International Concourse
789 International Parkway, Mailstop S2C
Sunrise, FL 33325-6222



6809468A79-O

../graphics/000807-A.eps 39
../graphics/031422o.eps 16
../graphics/031423o.eps 17
../graphics/031619o.eps 1
../graphics/031629o.eps 14
../graphics/031630o.eps 20
../graphics/031631o.eps 21
../graphics/031632o.eps 22
../graphics/031633o.eps 23
../graphics/031636o.eps 24
../graphics/031637o.eps 48
../graphics/031638o.eps 25
../graphics/031639o.eps 26
../graphics/031640o.eps 29
../graphics/031641o.eps 27
../graphics/031643o.eps 28
../graphics/031644o.eps 30
../graphics/031645o.eps 31
../graphics/031647o.eps 31
../graphics/031648o.eps 32
../graphics/031649o.eps 32
../graphics/031650o.eps 34
../graphics/031651o.eps 34
../graphics/031653o.eps 35
../graphics/031654o.eps 35
../graphics/031703o.eps 36
../graphics/031704o.eps 36
../graphics/031705o.eps 37
../graphics/031706o.eps 38
../graphics/motvblack.eps 1

PRELIM