

2008 ACCESSORIES & EQUIPMENT

Cellular, Entertainment, and Navigation - LaCrosse

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Antenna Base Bolt	9 N.m	80 lb in
Antenna Module Bolt	3 N.m	27 lb in
Center Speaker Screw	2 N.m	18 lb in
Communication Interface Module Screw	2 N.m	18 lb in
Digital Radio Receiver Bracket Nut	4 N.m	35 lb in
Digital Radio Receiver Nut	5 N.m	44 lb in
Front Door Speaker Screw	2 N.m	18 lb in
Radio Screw	2 N.m	18 lb in
Receiver Bracket Nut	4 N.m	35 lb in

SCHEMATIC AND ROUTING DIAGRAMS

RADIO/NAVIGATION SYSTEM SCHEMATICS

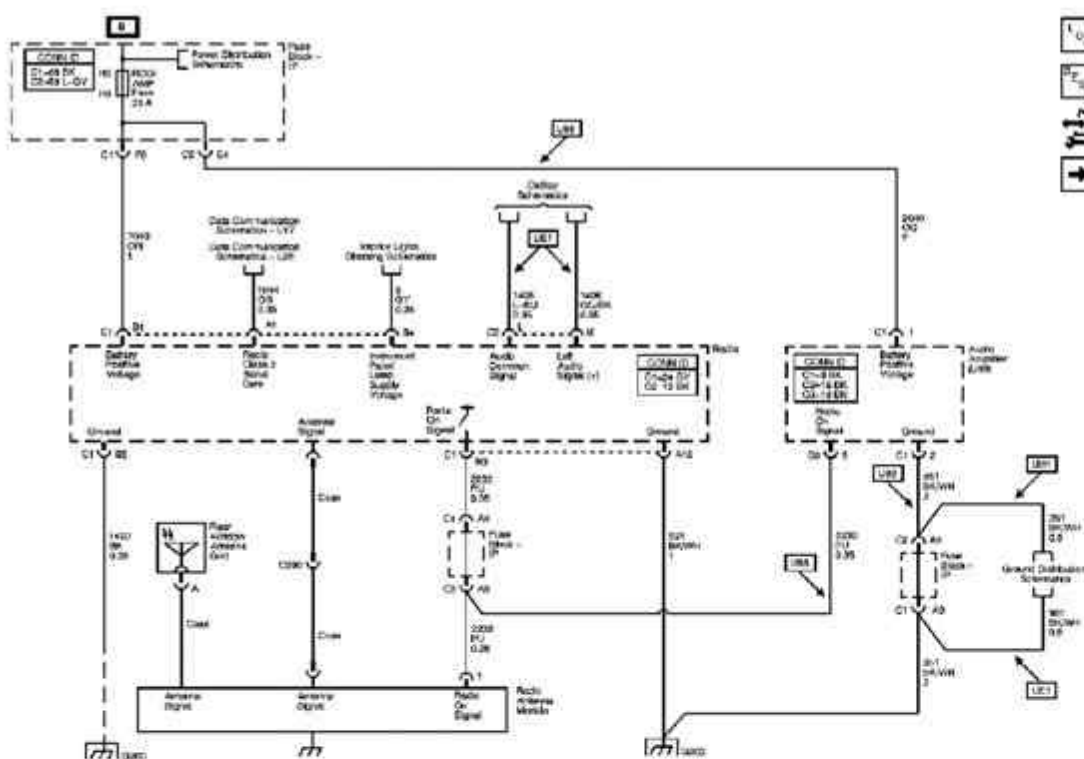


Fig. 1: Power, Ground, Serial Data, and Antenna Module Schematic
 Courtesy of GENERAL MOTORS CORP.

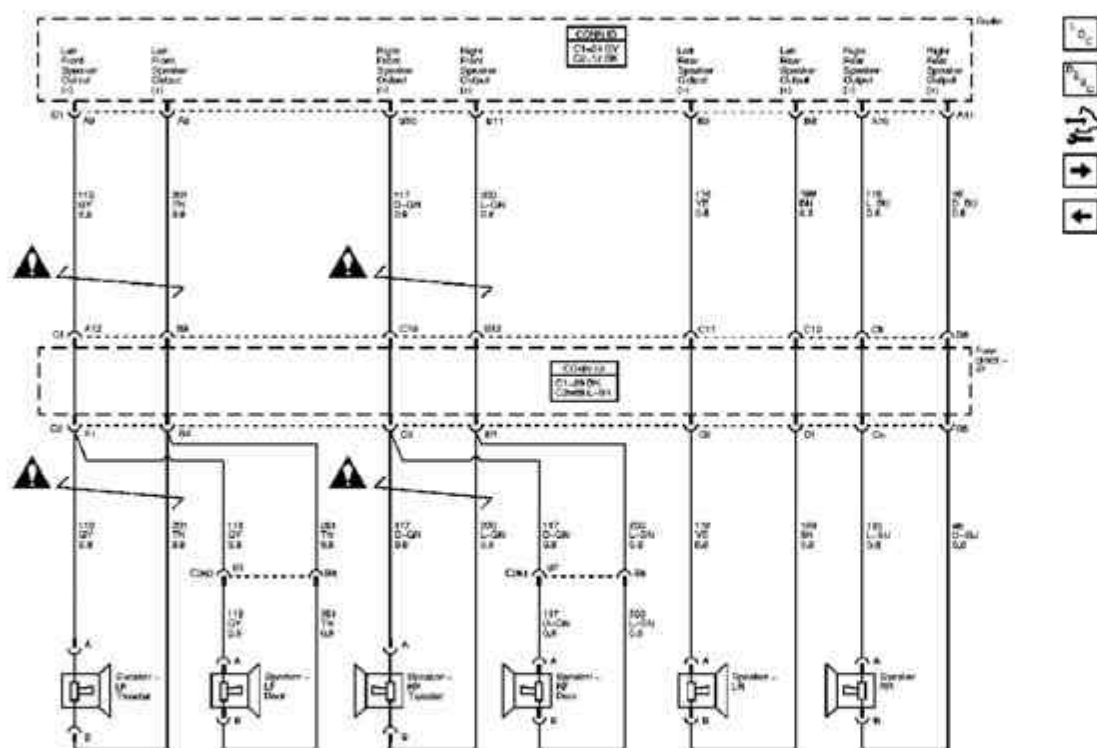


Fig. 2: Speakers Schematic - UW6

Courtesy of GENERAL MOTORS CORP.

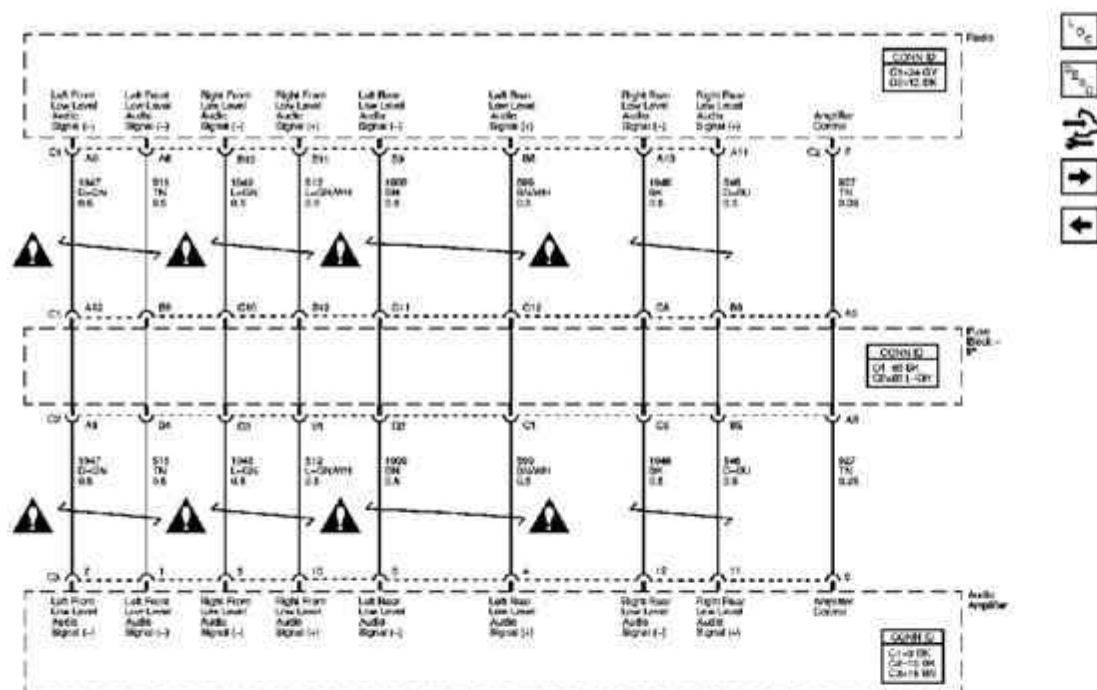


Fig. 3: Radio to Amplifier Schematic - U88

Courtesy of GENERAL MOTORS CORP.

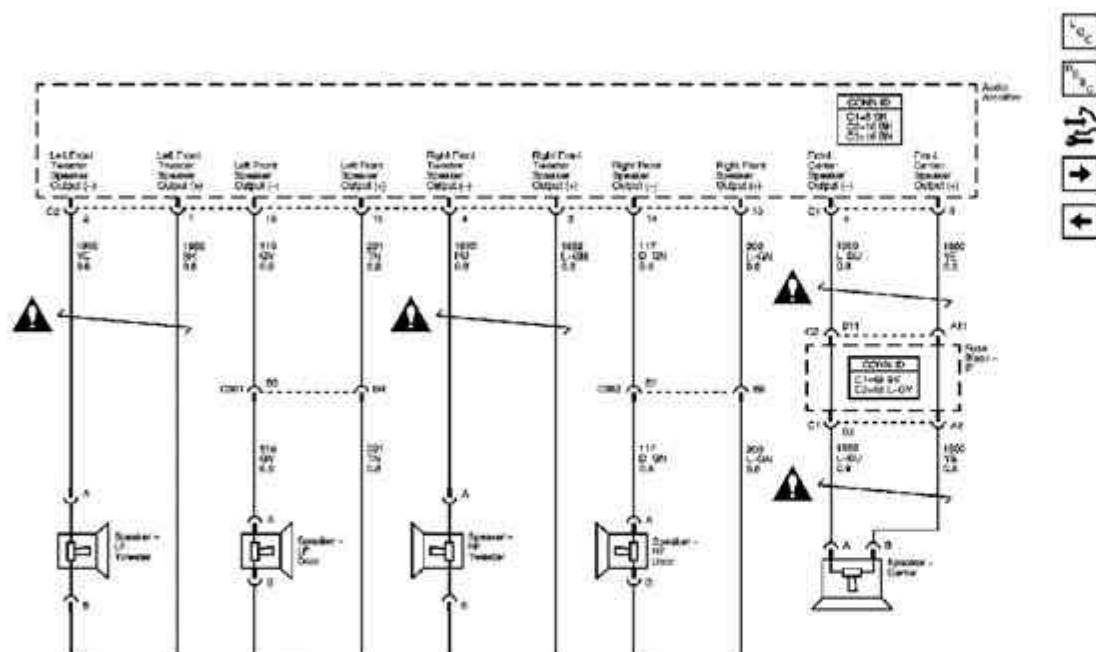


Fig. 4: Front Speakers Schematic - U88
Courtesy of GENERAL MOTORS CORP.

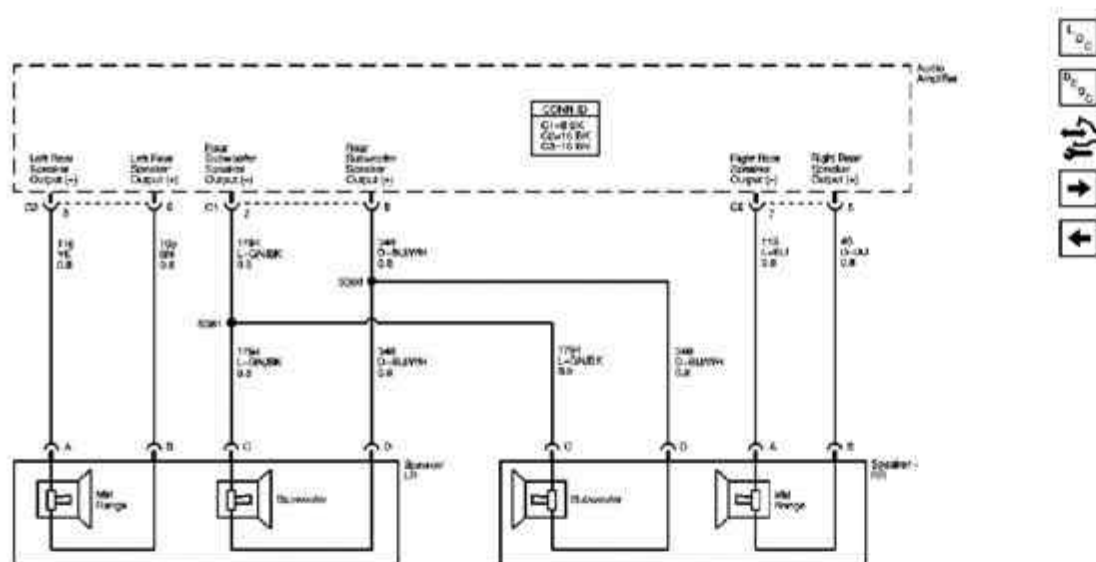
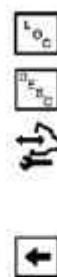


Fig. 5: Rear Speakers Schematic - U88
Courtesy of GENERAL MOTORS CORP.



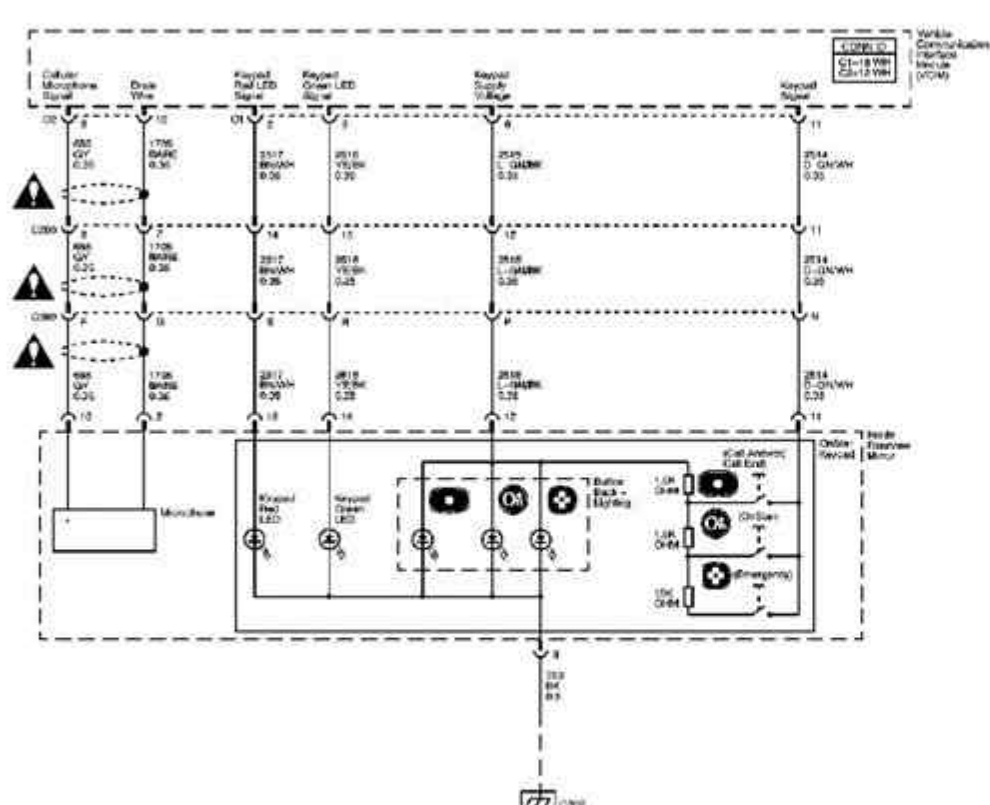


Fig. 8: VCIM to Inside Rearview Mirror Schematic
 Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B1025, B1035, B1045, or B1055	B1025: Speaker Output Shorted
DTC B1259	B1259: Antenna Ground Circuit
DTC B1780	B1780: Theftlock Enabled
DTC B2455	B2455 00: Cellular Phone Microphone Circuit
DTC B2470	B2470 00: Cellular Phone Antenna Circuit Malfunction
DTC B2476	B2476 00: Cellular Phone Select Service Switch Malfunction
DTC B2482	B2482 00: Cellular Phone Select Service Switch Range/Performance
DTC B2483 or B2484	B2483 00: GPS Sensor Circuit Low B2484 00: GPS Sensor Circuit Open

DIAGNOSTIC STARTING POINT - CELLULAR, ENTERTAINMENT, AND NAVIGATION

Begin the system diagnosis with the **Diagnostic System Check - Vehicle**. The Diagnostic System Check - Vehicle will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored DTCs and their status

The use of the Diagnostic System Check - Vehicle will identify the correct procedure for diagnosing the system and where the procedure is located.

DTC B1025, B1035, B1045, OR B1055**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC B1025**

Speaker Output Shorted

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Speaker Output (+)	B1025	1	B1025	-
Left Front Speaker Output (-)	B1025	1	B1025	-
Right Front Speaker Output (+)	B1025	1	B1025	-
Right Front Speaker Output (-)	B1025	1	B1025	-
Left Rear Speaker Output (+)	B1025	1	B1025	-
Left Rear Speaker Output (-)	B1025	1	B1025	-
Right Rear Speaker Output (+)	B1025	1	B1025	-
Right Rear Speaker Output (-)	B1025	1	B1025	-
1. No sound from speaker				

Circuit/System Description

Each of the audio output channel circuits (+) and (-), at the radio and at the amplifier (if equipped) have a DC bias voltage that is one half of the battery voltage. When using a DMM, each of the audio output channel circuits will measure approximately 6.5V DC. The audio being played on the system is produced by a varying AC voltage that is centered around the DC bias voltage on the same circuit. The AC voltage is what causes the speaker cone to move and produce sound. This voltage will vary depending on what type of audio is being listened to, talk or music, and type of music, as well as the volume setting of the system. Low volume and talk settings will measure around 1V AC and less, where constant music may measure 3V AC and slightly higher. In an amplified audio system, these similar AC voltage measurements may be slightly higher on the output of the amplifier, and the typical AC voltage readings at the output of the radio are less than 1V AC.

Conditions for Running the DTC

The radio is ON.

Conditions for Setting the DTC

A short to voltage or a short to ground is detected on the specified (+) or (-) speaker output signal circuit.

Action Taken When the DTC Sets

The radio disables audio output on the appropriate channel

Conditions for Clearing the DTC

- A current DTC will clear when the conditions for setting are no longer seen.

- A history DTC will clear after 100 malfunction free ignition cycles.

Reference Information**Schematic Reference****Radio/Navigation System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Radio/Audio System Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

Radio ON, adjust the fade and balance controls on the radio to test all four channels individually. Each of the four channels should produce clear and even sound.

Circuit/System Testing**Without Amplifier**

1. Ignition OFF, disconnect the harness connector at the appropriate speaker.
2. Radio ON, test for 5.0-7.5 volts between the signal circuit terminal A and ground.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the radio.
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the radio.
3. Test for 5.0-7.5 volts between the signal circuit terminal B and ground.
 - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the radio.
 - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the radio.
4. If all circuits test normal, test or replace the speaker.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Speaker Replacement Reference**

- **Control Module References** for radio or amplifier replacement, setup, and programming

DTC B1259

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1259

Antenna Ground Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Antenna Ground Circuit	B1259	B1259	B1259	-

Circuit/System Description

The antenna signal circuit is a coaxial cable that carries the radio signal information received by the antenna. The antenna cable also provides a path for DC current for powering the antenna.

Conditions for Running the DTC

This test is run every 300 milliseconds.

Conditions for Setting the DTC

The digital radio receiver (DRR) detects an antenna fault.

Action Taken When the DTC Sets

The radio displays "No XM Signal" or "Check Antenna".

Conditions for Clearing the DTC

- The condition must be corrected.
- The DTC clears after 100 malfunction-free ignition cycles.

Reference Information

Schematic Reference

Radio/Navigation System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Radio/Audio System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Special Tools

EL-48028 Digital Radio Test Antenna

Circuit System Verification

Ignition ON, Radio ON tuned to an XM™ station. The vehicle may need to be outside with a clear view of the sky for optimum satellite reception. The XM™ radio should play clearly.

Circuit/System Testing

1. Ignition OFF, disconnect the antenna coax from the digital radio receiver (DRR). Connect the test antenna to the DRR.
2. Turn the ignition ON, radio ON tuned to XM™. Verify that DTC B1259 is not current.
 - If the DTC B1259 is still current, replace the DRR.
3. Ignition is OFF. Disconnect the DRR antenna from the coaxial cable. Test the resistance of the antenna coaxial cable center conductor from end to end. Verify the resistance is less than 5 ohms.
 - If the resistance is greater than 5 ohms, replace the antenna coaxial cable.
4. Test the resistance of the antenna coaxial cable outer shield from end to end. Verify the resistance is less than 5 ohms.
 - If the resistance is greater than 5 ohms, replace the antenna coaxial cable.
5. Test the resistance of the antenna coaxial cable between the center conductor and the outer conductor. Verify there is infinite resistance between both conductors.
 - If there is less than infinite resistance between the inner conductor and the outer conductor of the coaxial cable, replace the antenna coaxial cable. If the coaxial cable tests normal, replace the digital radio antenna.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Digital Radio Antenna Cable Replacement
- Cellular Communications/Digital Radio Antenna Replacement
- Digital Radio Receiver Replacement

DTC B1780

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC B1780**

Theftlock Enabled

Circuit Description

This DTC is generated by the module when the Theft Lock is activated. This occurs when the VIN as received over the class 2 communication circuit and the VIN as stored in the module memory do not match. This also occurs when no VIN is received over the class 2 circuit. The only circuit required is the class 2 communications line.

Conditions for Running the DTC

This test is run every 300 milliseconds.

Conditions for Setting the DTC

This DTC is generated by the module when the VIN as received over the class 2 communication circuit and the VIN as stored in the module memory do not match. This also occurs if no VIN is received over the class 2 circuit. This DTC test runs when the radio changes from OFF to ON.

Action Taken When the DTC Sets

The radio does not function. The radio will display Locked - THEFTLOCK Active.

Conditions for Clearing the DTC

Re-calibration with the correct calibrations for the vehicle and cycling the radio to OFF then to ON will clear the DTC if there is no damage to the radio.

Reference Information**Schematic Reference****Radio/Navigation System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Radio/Audio System Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References**

Circuit/System Testing

1. Install a scan tool.
2. Turn ON the ignition, with the engine OFF.
3. With a scan tool clear the Radio Theft Information.
 - o If the DTC resets, replace the radio.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for radio replacement, setup, and programming.

DTC B2455**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provide an overview of each diagnostic category.

DTC Descriptor**DTC B2455 00**

Cellular Phone Microphone Circuit

Circuit/System Description

The vehicle communication interface module (VCIM) detects that the cellular microphone is connected through the cellular microphone signal circuit and the drain wire.

Conditions for Running the DTC

- The ignition must be in the RUN or ACC position.
- The system voltage is at least 9.5 volts and no more than 15.5 volts.
- All the above conditions are present for greater than 10 seconds.

Conditions for Setting the DTC

- The VCIM detects an open in the drain wire circuit or a short to voltage in the cellular microphone signal circuit.
- The above conditions are present for greater than 10 seconds.

Action Taken When the DTC Sets

- The VCIM will not receive any signal from the microphone.
- Calls can be placed but the caller cannot be heard.
- The OnStar® status LED turns red.

Conditions for Clearing the DTC

- The VCIM detects the microphone connected for 5 consecutive 100 millisecond cycles.
- A history DTC clears after 50 malfunction-free ignition cycles.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
2. Ignition ON, test for greater than 9 volts between the signal circuit terminal 10 and ground.
 - If less than specified range, test the signal circuit for a short to ground, or an open/high resistance. If the circuit tests normal, replace the VCIM.
3. Test for greater than 9 volts between the signal circuit terminal 10 and the drain circuit terminal 2.
 - If less than specified range, test the drain wire for an open/high resistance. If the circuit tests normal, replace the VCIM.
4. If all circuit test normal, test or replace the cellular microphone assembly.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Control Module References for VCIM replacement, setup, and programming
- Mobile Telephone Microphone Replacement

DTC B2470

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptor

DTC B2470 00

Cellular Phone Antenna Circuit Malfunction

Circuit/System Description

The cellular antenna is connected to the vehicle communication interface module (VCIM) with a RG-58 coax

cable. The VCIM polls the data from the cellular antenna once every second.

Conditions for Running the DTC

- Ignition in the RUN or ACC position.
- System voltage is between 9.5 volts and 15.5 volts.
- The above conditions are present for greater than 1 second.

Conditions for Setting the DTC

- The VCIM does not detect the presence of a cellular antenna.
- The above conditions are present for greater than 1 second.

Action Taken When the DTC Sets

- The vehicle is unable to connect to the OnStar® Call Center.
- The OnStar® status LED turns red.

Conditions for Clearing the DTC

- The VCIM detects the presence of a cellular antenna.
- A history DTC clears after 50 malfunction-free ignition cycles.

Reference Information**Schematic Reference****OnStar Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****OnStar Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Verification

Verify that the cellular antenna and cellular antenna coupling assembly are not damaged.

- If the antenna assembly is damaged, replace the cellular antenna.

Circuit/System Testing

IMPORTANT: The vehicle may be equipped with sectioned coax. Test each section and replace only the faulty section, not the entire length of coax.

1. Ignition OFF, disconnect the cellular antenna coax from the VCIM module and the cellular antenna.
2. Ignition ON, test for less than 1 volt between the antenna coax center terminal and ground.
 - o If greater than the specified range, replace the antenna coax.
3. Ignition ON, test for less than 1 volt between the antenna coax outer shield and ground.
 - o If greater than the specified range, replace the antenna coax.
4. Test for infinite resistance between the antenna coax center terminal and ground.
 - o If less than the specified value, replace the antenna coax
5. Test for infinite resistance between the antenna coax outer shield and ground.
 - o If less than the specified value, replace the antenna coax
6. Test for less than 5 ohms at the cellular antenna coax center terminal from end to end.
 - o If greater than specified value, replace the cellular antenna coax cable.
7. Test for less than 5 ohms at the cellular antenna coax outer shield from end to end.
 - o If greater than specified value, replace the cellular antenna coax cable.
8. Test for infinite resistance between the antenna coax center terminal and the outer shield.
 - o If less than specified value, replace the cellular antenna coax cable.
9. If coax cable tests normal, test or replace the cellular antenna.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Cellular Communications/Digital Radio Antenna Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

DTC B2476

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B2476 00

Cellular Phone Select Service Switch Malfunction

Circuit/System Description

The OnStar® button assembly consists of 3 buttons, Call/Answer, OnStar® Call Center and OnStar® Emergency. Ten volts is supplied to the button assembly on the keypad supply voltage circuit. Each of the buttons, when pressed, completes the circuit across a resistor allowing a specific voltage to be returned to the vehicle communication interface module (VCIM) on the keypad signal circuit. Depending upon the voltage range returned, the VCIM is able to identify which button has been pressed.

Conditions for Running the DTC

- The ignition must be in the RUN or ACC position.
- The system voltage is at least 9.5 volts and no more than 15.5 volts.
- All the above conditions are present for greater than 300 milliseconds.

Conditions for Setting the DTC

- The VCIM powers the button assembly through the keypad supply voltage circuit for 11.5 ms, turns the power OFF, then waits for 50 ms and sees a voltage value greater than 1.8 volts on this circuit.
- The above conditions are present for greater than 300 milliseconds.

Action Taken When the DTC Sets

- The VCIM will ignore all inputs from the OnStar® button assembly.
- No calls can be placed.
- The OnStar® status LED turns red.

Conditions for Clearing the DTC

- The VCIM powers the button assembly through the keypad supply voltage circuit for 11.5 ms, turns the power OFF, then waits for 50 ms and sees a voltage value less than 1.8 volts on this circuit.
- A history DTC clears after 50 malfunction-free ignition cycles.

Reference Information**Schematic Reference****OnStar Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****OnStar Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
2. Test for greater than 1 ohm between the keypad supply voltage terminal 12 and ground.
 - If less than specified value, repair short to ground or replace the VCIM.
3. Ignition ON, test for 9.8-10.2 volts between keypad supply voltage terminal 12 and ground.
 - If less than the specified range, repair open circuit or replace the VCIM.
 - If greater than the specified range, repair short to voltage or replace the VCIM.
4. If all circuit test normal, replace the inside rearview mirror.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Inside Rearview Mirror Replacement**

- **Control Module References** for VCIM replacement, setup, and programming

DTC B2482**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC B2482 00**

Cellular Phone Select Service Switch Range/Performance

Circuit/System Description

The OnStar® button assembly consists of 3 buttons, Call/Answer, OnStar® Call Center and OnStar® Emergency. Ten volts is supplied to the button assembly on the keypad supply voltage circuit. Each of the buttons, when pressed, completes the circuit across a resistor allowing a specific voltage to be returned to the vehicle communication interface module (VCIM) on the keypad signal circuit. Depending upon the voltage range returned, the VCIM is able to identify which button has been pressed.

Conditions for Running the DTC

- The ignition must be in the RUN or ACC position.
- The system voltage is at least 9.5 volts and no more than 15.5 volts.
- All the above conditions are present for greater than 15 seconds.

Conditions for Setting the DTC

- A button is pressed or stuck for more than 15 seconds.
- The above conditions are present for greater than 15 seconds.

Action Taken When the DTC Sets

- The VCIM will ignore all inputs from the OnStar® button assembly.
- No calls can be placed.
- The OnStar® status LED turns red.

Conditions for Clearing the DTC

- The button will be declared unstuck after a 50 millisecond normal cycle.
- A history DTC clears after 50 malfunction-free ignition cycles.

Reference Information**Schematic Reference****OnStar Schematics****Connector End View Reference****Component Connector End Views**

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Testing

1. Ignition OFF, disconnect the inside rearview mirror harness connector.
 2. Test for infinite resistance between terminal 12 and 11.
 - o If resistance less than the specified value, replace the rearview mirror.
- If all circuits test normal, replace the VCIM

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Inside Rearview Mirror Replacement
- Control Module References for VCIM replacement, setup, and programming

DTC B2483 OR B2484

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptors

DTC B2483 00

GPS Sensor Circuit Low

DTC B2484 00

GPS Sensor Circuit Open

Circuit/System Description

The navigation radio receives information from a specific navigation antenna located on the outside of the vehicle. The navigation antenna is connected to the vehicle communication interface module (VCIM) via a shielded coaxial cable. The antenna cable also provides a path for DC current for powering the antenna.

Conditions for Running the DTC

- Ignition is in the RUN or ACC position.
- System voltage is between 9.5 volts and 15.5 volts.
- The above conditions are present for greater than 1 second.

Conditions for Setting the DTC

- The VCIM does not detect a navigation signal.
- The above conditions are present for greater than 1 second.

Action Taken When the DTC Sets

- The OnStar® Call Center cannot locate the vehicle.
- The OnStar® status LED turns red.

Conditions for Clearing the DTC

- The VCIM detects the presence of a navigation antenna.
- A history DTC clears after 50 malfunction-free ignition cycles.

Reference Information**Schematic Reference****OnStar Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****OnStar Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Testing

IMPORTANT: The vehicle may be equipped with sectioned coax. Test each section and replace only the faulty section, not the entire length of coax.

1. Ignition OFF, disconnect the cellular antenna coax from the VCIM module and the cellular antenna.
2. Ignition ON, test for less than 1 volt between the antenna coax center terminal and ground.
 - If greater than the specified range, replace the antenna coax.
3. Ignition ON, test for less than 1 volt between the antenna coax outer shield and ground.
 - If greater than the specified range, replace the antenna coax.
4. Test for infinite resistance between the antenna coax center terminal and ground.
 - If less than the specified value, replace the antenna coax
5. Test for infinite resistance between the antenna coax outer shield and ground.
 - If less than the specified value, replace the antenna coax
6. Test for less than 5 ohms of resistance at the cellular antenna coax center terminal from end to end.
 - If greater than specified value, replace the cellular antenna coax cable.

7. Test for less than 5 ohms of resistance at the cellular antenna coax outer shield from end to end.
 - o If greater than specified value, replace the cellular antenna coax cable.
8. Test for infinite resistance between the antenna coax center terminal and the outer shield.
 - o If less than specified value, replace the cellular antenna coax cable.
9. If coax cable tests normal, test or replace the cellular antenna.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Cellular Communications/Digital Radio Antenna Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

SYMPTOMS - CELLULAR COMMUNICATION

IMPORTANT: The following steps must be completed before using the symptom table.

1. Perform the **Diagnostic System Check - Vehicle** , before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **OnStar Description and Operation**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Radio/Audio System. Refer to **Checking Aftermarket Accessories** .
- Inspect for easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **OnStar Global Positioning System (GPS) Data Not Current or Inaccurate**
- **OnStar Microphone Inoperative - Caller Cannot Be Heard**
- **No (or Noisy) OnStar Audio**
- **OnStar Button LED Inoperative**
- **OnStar Call Center Remote Function Requests Inoperative**
- **OnStar One or More Buttons Inoperative**
- **Unable to Contact OnStar Call Center**
- **OnStar Voice Recognition Inoperative**

SYMPTOMS - ENTERTAINMENT

IMPORTANT: The following steps must be completed before using the symptom table.

1. Perform the **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **Radio/Audio System Description and Operation**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Radio/Audio System. Refer to **Checking Aftermarket Accessories**.
- Inspect for easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections**.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Audio System Troubleshooting Hints**
- **Digital Radio Poor or No Reception**
- **Audio Too Loud at Low Settings**
- **Radio Poor Reception**
- **Speakers Inoperative - One or More**
- **Speakers Inoperative - All**
- **Audio Distortion - One or More Speakers**

AUDIO SYSTEM TROUBLESHOOTING HINTS

Tools Required

J 39916-A CD and Cassette Diagnostic Audio Kit

Many conditions that affect radio operation may be corrected without removing the radio from the car. Verify the condition, and follow the diagnostic procedures in order to isolate and correct the condition. In order to properly diagnose any audio system problems, ensure that you have a fully charged battery.

Preliminary Inspections

IMPORTANT: When testing the audio system for poor reception or noise, the vehicle should be outside away from metal buildings and utility lines, with the hood and rear compartment closed.

- Inspect for any aftermarket equipment that may have been installed on the vehicle. If aftermarket equipment is found, disconnect the equipment and verify that the audio noise is still present.

Verify that the antenna connector and the antenna coaxial cable are clean and tight.

- For reception concerns, first determine if the customer is within the listening area of the stations they are attempting to receive.
- Stations at the lower end of the FM band are more susceptible to audio noises than stations at the higher end.
- If the noise is only from one speaker, inspect for the following items before speaker replacement:
 - Isolate the noise using the **J 39916-A**.
 - Inspect the speaker connections in order to ensure they are clean and tight. Refer to **Testing for Intermittent Conditions and Poor Connections**.
 - Inspect for a loose or incorrectly installed speaker or surrounding trim. Loose trim may cause a buzz or flutter which sounds like a malfunctioning speaker.
- Ignition noise on the FM band may be an indication of an ignition system problem.
- Verify that all vehicle grounds are clean, tight, and free of corrosion.
- Inspect the rear defogger grid lines for large breaks or dark spots.
- Inspect the connections at the radio antenna module, if equipped, in order to ensure that they are clean and tight.
- Compare the customer's vehicle to another of similar model and audio system in order to determine if the condition is abnormal.

Identifying Concerns

1. In order to isolate the source of the noise/poor reception, identify the ignition switch position that the concern is most noticeable:
 1. Turn the ignition switch to the accessory position.
 2. Turn ON the radio.
 3. Seek up 88 to 108 FM then 550 to 1600 AM.
 4. Record the number of valid radio stations where the tuner stops.
 5. Repeat these steps with the ignition ON, and the engine OFF, then repeat the steps again with the engine running.
2. Return the ignition switch to the position that the concern was most noticeable.
3. Remove the fuses or circuit breakers, one at a time, until the noise has been eliminated.
4. Identify what systems or components are powered by the fuse.
5. Reinstall all fuses and circuit breakers.
6. Disconnect the components powered by the fuse, one at a time, until the concern has been eliminated.

Corrective Action

- Inspect the ground integrity of the component or system causing the noise.
- Malfunctioning and marginal components such as relays and solenoids may cause noise and/or poor reception.
- Always use a braided ground strap when applying additional grounds and keep the ground strap as short as possible.
- If the noise source is found to be coming from the vehicle harness:
 - Route the antenna cable separately from the wire harness that is emitting the noise.
 - Use aluminum or nickel tape in order to shield the antenna cable. Try variations of the following repairs:
 - Try adding only aluminum or nickel tape before adding a ground strap to the tape.
 - Wrap a ground strap 360 degrees around the tape, securing the other end of the strap to chassis ground.

IMPORTANT: When installing suppression devices, signal wires such as sensor and communication circuits should not be suppressed. Battery and ignition voltage circuits are the best choices for suppressing.

- Capacitors work best on switch pops and low frequency noise.
- Filters work best on high frequency whines and static.
- After adding any suppression device, inspect all of the vehicle systems, including those not related to the audio system, for proper operation and function.
- Whenever possible, make a test harness that includes filters or capacitors. Always inspect the effectiveness and operation before permanent installation.
- If an audible pop is caused due to operating a switch, perform the following repairs as necessary:
 - Add a capacitor across the contacts of the switch.
 - Add a capacitor from the battery positive voltage (B+) side of the switch to chassis ground.
 - Add a capacitor from the ground side of the switch to chassis ground.
- Use the following available noise suppression devices:
 - 220 micro farad (50V) capacitor GM P/N 1227895-This works well for ignition system related noise.
 - 0.47 micro farad capacitor GM P/N 1227894-This works well for switches and relays.
 - Feed through capacitor GM P/N 477371-This works well for high current situations.
 - Filter package GM P/N 1224205-This works well for low current situations.
 - Fuel pump suppressor GM P/N 25027405
 - 21-inch braided ground strap GM P/N 8910791
 - 19-inch braided ground strap GM P/N 6286800
 - 10.5-inch braided ground strap GM P/N 6287160
 - 8.5-inch braided ground strap GM P/N 12091511

Generator Whine Concerns

1. Inspect the ground terminal and cable for high resistance.
2. Inspect the generator and brackets for loose or coated mounting bolts.
3. Verify that the ground straps between the engine and the frame are clean and tight.
4. If the noise is still present, inspect the charging system for proper operation. Refer to **Diagnostic System Check - Vehicle**.
5. Install a filter GM P/N 1224205 in the battery voltage feed circuit to the radio.
6. If the noise is not eliminated, install the filter in each following variation:
 - Install the filter with the single wire side toward the radio and the ground wire attached to chassis ground.
 - Remove the ground to the filter.
 - Reverse the filter so that the two-wire side is toward the radio with the ground wire attached to chassis ground.
 - Remove the ground from the filter.
7. If the filter GM P/N 1224205 causes a delay when turning the radio ON or OFF, or other problems, remove the filter and Install a 0.47 micro farad capacitor to chassis ground.
8. Before reassembling the vehicle, remove any unneeded filters.
9. Test the functionality of all the vehicle systems, including those not related to the audio system, for proper operation and function.

AUDIO DISTORTION - ONE OR MORE SPEAKERS**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Reference Information**Schematic Reference****Radio/Navigation System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Radio/Audio System Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for Scan Tool Information**Special Tools****J 39916-A** CD Diagnostic Audio Kit**Left Channel - Audio Distortion**

IMPORTANT: The following information lists the most probable cause of the concern to the least probable cause followed by the appropriate test for that condition. If the list leads to the replacement of a component, always inspect for a poor connection before proceeding with the replacement.

Left Front Low Level Audio Signal circuit open-Test the left front low level audio signal circuits for an open or high resistance.

Right Channel - Audio Distortion

Right Front Low Level Audio Signal circuit open-Test the right front low level audio signal circuits for an open or high resistance.

One Speaker - Audio Distortion

1. Speaker output from Amplifier open or shorted to voltage-Test the appropriate speaker output for an open or

short to voltage.

2. Defective speaker-Replace the appropriate speaker. Refer to **Speaker Replacement Reference**.
3. Defective Amplifier-Replace the amplifier. Refer to **Control Module References** for replacement, setup or programming.

Audio Distortion from Rear Speaker During 5.1 DSS DVD Playback

Audio output from radio open-Test the appropriate output from the radio for an open. Refer to **Circuit Testing** and **Wiring Repairs**.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Speaker Replacement Reference

AUDIO TOO LOUD AT LOW SETTINGS

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The steering wheel control signal circuit applies a different voltage to the radio based on a resistance that is placed into the circuit when a steering wheel control switch is pressed. These different voltage levels signal the radio to do the appropriate function based on the steering wheel button pressed.

Reference Information

Schematic Reference

Radio/Navigation System Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Testing

1. Turn ignition ON.
2. Turn the radio ON.
3. Test the steering wheel controls signal circuit for a short to voltage.

Repair Procedures

- **Radio Replacement**
- **Steering Wheel Control Switch Assembly Replacement**

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Turn OFF the ignition for 60 seconds.
5. If the repair was related to a DTC, duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if applicable, in order to verify the DTC does not reset. If the DTC resets or another DTC is present, refer to the **Diagnostic Trouble Code (DTC) List - Vehicle** and perform the appropriate diagnostic procedure.

Or

If the repair was symptom related, duplicate the conditions under which the customer concern occurred to verify the repair. If the customer concern reoccurs, return to **Symptoms - Vehicle** and perform the appropriate symptom diagnostic.

DIGITAL RADIO POOR OR NO RECEPTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provide an overview of each diagnostic category.

Circuit/System Description

The antenna signal circuit is a coaxial cable that carries the radio signal information received by the antenna. The antenna cable also provides a path for DC current for powering the antenna.

Reference Information

Schematic Reference

Radio/Navigation System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Radio/Audio System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

• Wiring Repairs

Special Tools

EL-48028 Digital Radio Test Antenna

Circuit/System Verification

Make sure the vehicle is outside in an area with an unobstructed view of the southern sky. Turn ON XM radio. Tune the radio to satellite channel 1. If the reception is not clear, contact XM at 1-800-852-9696 to verify customer account status or possible network problems.

Circuit/System Testing

1. Ignition OFF, disconnect the antenna coax from the digital radio receiver (DRR). Connect the test antenna to the DRR.
2. Turn the ignition ON, radio ON tuned to XM. Is the reception improved?
 - If the reception is not improved, replace the DRR.
3. Ignition OFF. Disconnect the DRR antenna from the coaxial cable. Test the resistance of the antenna coaxial cable center conductor from end to end. Verify the resistance is less than 5 ohms.
 - If the resistance is greater than 5 ohms, replace the antenna coaxial cable.
4. Test the resistance of the antenna coaxial cable outer shield from end to end. Verify the resistance is less than 5 ohms.
 - If the resistance is greater than 5 ohms, replace the antenna coaxial cable.
5. Test the resistance of the antenna coaxial cable between the center conductor and the outer conductor. Verify there is infinite resistance between both conductors.
 - If there is less than infinite resistance between the inner conductor and the outer conductor of the coaxial cable, replace the antenna coaxial cable. If the coaxial cable tests normal, replace the digital radio antenna.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Digital Radio Antenna Cable Replacement**
- **Cellular Communications/Digital Radio Antenna Replacement**
- **Control Module References** for DRR replacement, setup and programming

DIGITAL RADIO RECEIVER SETUP

XM™ Activation

IMPORTANT: After replacement of an XM™ receiver, call XM™ radio to deactivate the receiver that has been removed from the vehicle. The vehicle must be parked in view of a satellite within 24 hours after an activation call.

1. Radio ON, tune to the XM™ channel 0 and record the radio ID. The radio ID will be required for activation of the new receiver.
2. Call XM™ radio to deactivate the faulty receiver and activate the new receiver.
 - US: 1-800-556-3600
 - Canada: 1-877-438-9677
3. Park the vehicle outside in an area with an unobstructed view of the southern sky.

4. Leave the vehicle outside with the ignition switch in the ACC position and the radio ON for 30 minutes to activate XM™ service.
5. Once activated, the radio will receive the remaining XM™ channels.

ONSTAR GLOBAL POSITIONING SYSTEM (GPS) DATA NOT CURRENT OR INACCURATE**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The navigation antenna is connected to the vehicle communication interface module (VCIM) with a RG-174 coax cable. The VCIM polls the data from the navigation antenna once every second.

Diagnostic Aids

- The GPS signal title on the scan tool will display a Yes or No dependent upon whether or not the module sees an increment of the seconds transmitted by GPS signals to the vehicle communication interface module. Upon entering this screen, the GPS signal title will automatically display Yes, regardless of the presence of time increment, for at least 2 seconds, while the algorithm in the scan tool determines the status of the clock. If increment is found, Yes is continually displayed. If the clock remains static, No is displayed. The scan tool looks for increment every second, regardless of current display.
- Inaccurate or aged GPS position concerns which are no longer present may have been due to the temporary loss of GPS signal reception by the vehicle. Conditions such as driving through tunnels or parking structures while making an OnStar® keypress will restrict the navigation antenna from a clear view of the satellites in the sky and may have caused this temporary data loss.

Reference Information**Schematic Reference****OnStar Schematics****Connector End View Reference****Component Connector End Views****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**
- **OnStar Description and Operation**

Scan Tool Reference**Control Module References** for scan tool information**Circuit/System Verification**

1. With the scan tool, observe the GPS signal status indicator for at least 10 seconds. Verify the indicator displays Yes.
 - o If the indicator does not display Yes, go to **Component Testing**.
2. Call and verify the OnStar advisor receive GPS data.
 - o If the advisor did not receive GPS data and the call was a 'fail to voice', contact the GM Technical Assistance Center.
 - o If the advisor did not received GPS data and the call was not a 'fail to voice', go to **Component Testing**.
3. Verify with the OnStar Call Center advisor that your actual position is within a reasonable distance from the actual location of the vehicle.
 - o If your actual position is not within a reasonable distance from the actual location of the vehicle, replace the VCIM.

Component Testing

IMPORTANT: Vehicle may be equipped with sectioned coax. Test each section and replace only the faulty section, not the entire length or coax.

1. Disconnect the navigation antenna coax cable from the navigation antenna within the wiring harness.
2. Disconnect the navigation antenna from the VCIM.
3. Test for infinite resistance between the center conductor of the coax to the metal outer shield.
 - o If it does not read infinite, replace the navigation antenna coax cable.
4. Test for greater than 1 ohm at the navigation antenna coax center conductor from end to end.
 - o If less than specified value, replace the navigation antenna assembly.
 - o If greater specified value, replace the navigation antenna coax cable.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Cellular Communications/Digital Radio Antenna Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

ONSTAR MICROPHONE INOPERATIVE - CALLER CANNOT BE HEARD**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cellular Microphone Signal	B2455 00	B2455 00	B2455 00	-
Cellular Microphone Drain Wire	-	1	1	-
1. OnStar Microphone Inoperative - Caller Cannot Be Heard				

Circuit/System Description

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused, battery voltage circuit connected through the vehicle wiring to the 3-button assembly and the radio, and attached by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN messaging. The module also has the capability of commanding the horn, initiating door lock/unlock and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the cellular telephone voice signal circuit, and returned to the module on the cellular telephone voice low reference circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

IMPORTANT: Perform this diagnostic if the OnStar® Call Center operator can clearly be heard but the operator is unable to hear the caller.

Ignition ON, press the OnStar® Call button. Verify that your voice cannot be heard clearly by the OnStar® Call Center.

- If your voice can be heard clearly, go to Testing for Intermittent Conditions and Poor Connections.

Circuit/System Testing

1. Ignition OFF, disconnect the inside rearview mirror harness connector.
2. Ignition ON, test for 8.5-9.5 volts between the cellular microphone signal circuit terminal 10 and ground.
 - o If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the VCIM.
 - o If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the VCIM.
3. Ignition ON, test for 8.5-9.5 volts between the cellular microphone signal circuit terminal 10 and the drain wire circuit terminal 2.
 - o If less than the specified range, test the drain wire circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the VCIM.
4. If all circuits test normal, replace the inside rearview mirror.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Inside Rearview Mirror Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

NO (OR NOISY) ONSTAR AUDIO

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused battery positive voltage circuit, connected through the vehicle wiring to the inside rearview mirror containing the 3-button assembly and the radio. The VCIM receives its cellular signals by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN messaging. The module also has the capability of commanding the horn, initiating door lock/unlock, and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the left audio signal circuit (+) and the audio common signal circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Verification

1. Ignition ON, radio ON, set volume to comfortable level and press OnStar Center Call button.
2. Verify Connecting to OnStar message is heard clearly through the audio system.
 - o If OnStar message is not heard, go to **Circuit/System Testing**.
3. Tune radio to a known good station and verify that audio is heard clearly through all speaker channels.
 - o If no, refer to **Speakers Inoperative - One or More**.
4. If the radio is replaced, the new radio must have the setup procedure performed. Refer to **Radio Setup**.

Circuit/System Testing

- IMPORTANT:**
- If the audio common circuit is shorted to voltage the VCIM has been damaged and requires replacement.
 - If the vehicle is equipped with the On-Star TTY Interface Module (OTIM), disconnect the OTIM components and restore the connections with the VCIM before continuing diagnosis. If the concern is no longer present with OTIM disconnected, Replace the OTIM system.

1. Disconnect Connector C2 from the VCIM.
2. Test for high resistance at the left audio signal circuit (+) terminal 1 for an open or for a short to ground or for a short to voltage.
3. Test for a high resistance, or for a short to voltage at the audio common circuit terminal 2 for an open.
4. If the circuits test normal, test or replace the VCIM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Cellular Communications/Digital Radio Antenna Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

ONSTAR BUTTON LED INOPERATIVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Keypad 10-Volt Reference	B2476 00	B2476 00	B2476 00	-
Keypad Green LED Signal	1	1	1	-
Keypad Red LED Signal	1	1	1	-
Keypad Signal	B2482 00	B2482 00	B2482 00	-
Inside Rearview Mirror Ground	-	1	-	-
1. OnStar Button LED Inoperative				

Circuit Description

The OnStar® status LEDs are located to the right of the emergency button on the inside rearview mirror assembly. The green LED is illuminated when the system is ON and operating normally. When the green LED is green and flashing, it is an indication that a call is in progress. When the red LED is illuminated, a system malfunction is present. In the event there is a system malfunction and the OnStar® system is still able to make a call, the LED will flash red during the call. The OnStar® LEDs are controlled by the communication interface module (CIM) via the keypad green LED signal circuit and the keypad red LED signal circuit.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, command the Green LED ON and OFF with a scan tool while observing the green LED on the inside rearview mirror. The green LED should turn ON and OFF when commanded.
2. Command the red LED ON and OFF with a scan tool while observing the red LED on the inside rearview mirror. The red LED should turn ON and OFF when commanded.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
2. Doors closed, courtesy lamps OFF, test for less than 5 ohms between the ground circuit terminal 8 and ground.
 - o If greater than the specified range, test the ground circuit for an open/high resistance.
3. Ignition ON, command the green LED OFF with a scan tool. Test for less than 1 volt between the control circuit terminal 14 and ground.
 - o If greater than the specified range, test the control circuit for a short to voltage. If the circuit tests normal, replace the CIM.
4. Command the green LED ON with a scan tool. Test for greater than 9 volts between the control circuit terminal 14 and ground.
 - o If less than the specified range, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the CIM.
5. Command the red LED OFF with a scan tool. Test for less than 1 volt between the control circuit terminal 15 and ground.
 - o If greater than the specified range, test the control circuit for a short to voltage. If the circuit tests normal, replace the CIM.
6. Command the red LED ON with a scan tool. Test for greater than 9 volts between the control circuit terminal 15 and ground.
 - o If less than the specified range, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the CIM.
7. If all circuits test normal, test or replace the inside rearview mirror.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Inside Rearview Mirror Replacement**
- **Control Module References** for CIM replacement, setup, and programming

ONSTAR CALL CENTER REMOTE FUNCTION REQUESTS INOPERATIVE**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused battery positive voltage circuit, connected through the vehicle wiring to the inside rearview mirror containing the 3-button assembly and the radio. The VCIM receives its cellular signals by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN

messaging. The module also has the capability of commanding the horn, initiating door lock/unlock, and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the left audio signal circuit (+) and the audio common signal circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

Diagnostic Aids

The customer concern may have been due to a lack of cellular service in a given area. A failure in the National Cellular Network infrastructure that has since been corrected.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

IMPORTANT: It is necessary to inform the OnStar® Call Center advisor that this call is for vehicle diagnostic purposes.

1. Observe that the horn, lights, and the doors locks on the vehicle operate properly.
 - If the applicable system does not operate properly, go to **Diagnostic Starting Point - Horns** or **Diagnostic Starting Point - Lighting Systems** or **Diagnostic Starting Point - Vehicle Access**
2. Contact the OnStar® Call Center by pressing the blue OnStar® button. Verify with the OnStar® advisor that all of the remote functions (door locks, lights, or horn) work.
 - If the remote functions do not work, use the scan tool to access the STID and ESN and contact the General Motors Technical Assistance Center

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Cellular Communications/Digital Radio Antenna Replacement

ONSTAR ONE OR MORE BUTTONS INOPERATIVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The OnStar® button assembly consists of 3 buttons, Call/Answer, OnStar® Call Center, and OnStar® Emergency. Ten volts is supplied to the button assembly on the keypad supply voltage circuit. Each of the buttons, when pressed, completes the circuit across a resistor allowing a specific voltage to be returned to the vehicle communication interface module (VCIM) on the keypad signal circuit. Depending upon the voltage range returned, the VCIM is able to identify which button has been pressed.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Verification

All Onstar® keypad buttons should operate normally when pressed.

Circuit/System Testing (One or More Buttons Inoperative)

If some OnStar® buttons are inoperative but not all, replace the inside rearview mirror.

Circuit/System Testing (All Buttons Inoperative)

1. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
2. Ignition ON, test for 9.8-10.2 volts between the keypad supply voltage circuit terminal 12 and ground.
 - If less or more than the specified value, repair short to ground, open or replace the VCIM.
3. Ignition OFF, reconnect the harness connector at the inside rearview mirror.
4. Disconnect the X1 VCIM harness connector.
5. Test for 500 to 20K ohms of resistance between X1 VCIM harness connector terminal 6 and 11 when each of

the keypad button is pressed.

- o If resistance is within the specified value when any of the keys are pressed replace the VCIM.
- 6. Disconnect the harness connector at the inside rearview mirror.
- 7. Test for infinite resistance between the inside rearview mirror connector terminal 11 and ground.
 - o If less than infinite resistance repair short to ground on the keypad signal circuit.
- 8. Test for less than 1 ohm between the X1 VCIM connector terminal 11 and the inside rearview mirror connector terminal 11.
 - o If more than the specified value repair open or high resistance on the keypad signal circuit.
 - o If all circuits test normal, replace the keypad.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Inside Rearview Mirror Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

ONSTAR RECONFIGURATION (WITH TIS 2 WEB GEN 4 AND LATER)

IMPORTANT:

- The vehicle communication interface module (VCIM) has a specific set of unique numbers that tie the module to a specific vehicle. These numbers, the 10-digit station identification (STID) and 11-digit electronic serial number (ESN), are used by OnStar® and the cellular network to identify the specific vehicle. Because these numbers are exclusive to the vehicle identification number of the vehicle, these parts should NOT be exchanged with those of another vehicle. After replacing the VCIM, it is essential to reconfigure the OnStar® system. Failure to reconfigure the system will result in an additional customer visit for repair. DO NOT press and hold the white dot button on the keypad as it will not reset this version of the OnStar® system and may result in a DTC to be set, a red LED and limited or incomplete OnStar® services. Use of the TIS 2 Web SPS application and the Tech 2 are required in order to perform the VCIM configuration and setup procedure for this vehicle. The configuration and set-up procedure is now a two step process which enables an automated activation by the OnStar Center, without a button press by the technician to the center.
- It may take up to 24 hours for the OnStar® service to become fully activated after performing the TIS 2 Web and Tech 2 setup procedures. Perform the OnStar® Activation procedure only once. Repeat attempts at performing the procedure may result in a delay of the activation process.

1. Connect the Tech 2 to the vehicle.
2. Connect the Techline Information System (TIS) terminal to the Tech 2.
3. Select the OnStar® Activation programming option using the service programming system (SPS).
4. Upon completion of the OnStar® Activation programming event, disconnect the TIS terminal from the Tech 2 and perform the VCIM/OnStar Set-up Procedure using the Tech 2. The set up procedure is located under the special function menu option.
5. The default language for the new VCIM is English. Changing the language capability to French or Spanish is supported by service programming system (SPS) and by Tech 2 special functions. Changing the language capability is also dependent on the generation of the replacement OnStar module.

Inform the customer that it may take up to 24 hours for the OnStar® service to become fully activated after performing the TIS 2 Web and Tech 2 setup procedures.

ONSTAR STEERING WHEEL CONTROL FUNCTIONS INOPERATIVE

Some vehicles equipped with the OnStar® system have the capability of accessing voice mailboxes and other automated phone systems by means of the steering wheel controls, while the OnStar® Personal Calling (OPC) feature is in use. If the "Talk" or "Mute" button (depending upon the vehicle) on the steering wheel controls is depressed during an OPC call, the vehicle communication interface module (VCIM) receives the message on the class 2 or GMLAN serial data bus from either the radio, driver information module, or body control module (BCM). This message is interpreted as a request to turn any spoken numbers into dual tone multi-frequency (DTMF) tones to be delivered over the airwaves to the phone system the user is communicating with. Complete instructions for operation of these features can be found in the information provided to the customer with the OnStar® system.

The steering wheel controls are a resistor network that consist of multiple momentary contact switches and a series of resistors. The switches and resistor network are arranged so that each switch has a different resistance value. When a switch is pressed, a voltage drop occurs in the resistor network, which produces a specific voltage value unique to the switch selected, to be interpreted by either the radio, dash integration module (DIM), or BCM. In the event the OnStar® steering wheel control functions are inoperative, technicians should refer to **Steering Wheel Controls Inoperative**, to begin diagnosis of the steering wheel control concern.

ONSTAR SYMPTOM DIAGNOSIS

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused, battery positive, voltage circuit connected through the vehicle wiring to the 3-button assembly and the radio, and attached by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN messaging. The module also has the capability of commanding the horn, initiating door lock/unlock and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the left audio signal circuit, and the audio common signal circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

Diagnostic Aids

- The customer concern may have been due to a lack of cellular service in a given area or a failure in the National Cellular Network infrastructure that has since been corrected.
- If the prompt OnStar Request Ended is heard without pressing the white dot button at the end of an OnStar®

keypress, the OnStar® system at one time made a successful cellular connection, but was unable to complete the call. If repeated calls are placed with this result, contact the General Motors Technical Assistance Center.

- An inaccurate or aged GPS position may have been due to the temporary loss of GPS signal reception by the vehicle in instances, such as driving through tunnels or parking structures which restrict the navigation antenna from a clear view of the satellites in the sky.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Verification

- IMPORTANT:**
- To successfully diagnose and repair the OnStar® system it is necessary to comprehend its operation. Technicians should read and understand the OnStar Description and Operation before attempting to repair an OnStar® system. This symptom below will enable the user to verify the customer complaint and narrow it to its source. If there is a concern with voice recognition or OnStar® steering wheel control function, technicians should proceed directly to the applicable diagnostic in Symptoms - Cellular Communication.
 - It is important to have the vehicle in an open outside area where a cellular call can be successfully placed and GPS data can be received from satellites.
 - It is necessary to inform the OnStar® Call Center advisor that this call is for vehicle diagnostic purposes.

1. Ignition ON, observe that the OnStar® status LED turns green.
 - If the LED does not turn green, refer to OnStar Button LED Inoperative.
2. Radio ON, set the volume to a comfortable level.
3. Press the OnStar® Call Center button and observe that the OnStar LED blinks.
 - If the OnStar® LED does not blink, refer to OnStar One or More Buttons Inoperative.
4. Listen that the radio muted and the Connecting to OnStar message played through the audio system.
 - If the radio did not mute or the Connecting to OnStar message did not play, refer to No (or Noisy) OnStar Audio.

5. Wait approximately 10 seconds, then end the call by pressing the white dot button and observe the OnStar LED stops blinking.
 - If the OnStar® LED continues blinking, refer to **OnStar One or More Buttons Inoperative**.
6. Press the OnStar® Call Center button and ensure that a connection was made with OnStar®.
 - If the Unable to Contact OnStar® was heard, refer to **Unable to Contact OnStar Call Center**.
 - If the OnStar® Request Ended was heard, go to **Diagnostic Aids**.
7. Ensure that OnStar® Call Center advisor can hear your voice clearly.
 - If the advisor cannot hear you clearly, refer to **OnStar Microphone Inoperative - Caller Cannot Be Heard**.
8. Ensure that OnStar® Call Center advisor received a data transfer from the vehicle.
9. Ensure with the OnStar® Call Center advisor the vehicle has been configured.
 - If the vehicle has not been configured, refer to **OnStar Reconfiguration (with TIS 2 Web Gen 4 and later)**.
10. Verify with the OnStar® Call Center advisor that the vehicle identification number (VIN) which they have on record matches the actual VIN.
11. Verify that your position with the OnStar® Call Center advisor is within a reasonable distance from the actual location of the vehicle.
 - If not within a reasonable distance, refer to **OnStar Global Positioning System (GPS) Data Not Current or Inaccurate**.
12. Verify with the OnStar® Call Center advisor that the GPS position is marked as Current.
 - If not current, refer to **OnStar Global Positioning System (GPS) Data Not Current or Inaccurate**.
13. Ensure that the customer concern is the inability of the OnStar® Call Center to perform remote functions.
 - If the OnStar® Call Center is able to perform remote functions, go to **Diagnostic Aids**.
14. Refer to **OnStar Call Center Remote Function Requests Inoperative**.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for VCIM replacement, setup, and programming

RADIO POOR RECEPTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Reference Information

Schematic Reference

Radio/Navigation System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Radio/Audio System Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Antenna System Test

IMPORTANT: Always zero out the DMM before taking a resistance measurement in order to ensure an accurate reading.

1. Disconnect the negative battery cable.
2. Disconnect the antenna lead-in connector from the radio receiver.
3. Measure the resistance from the negative battery cable to the coax outer conductor connector.
4. The resistance measured should be 0.2 ohms or less.
5. Test the following when the resistance is greater than 0.2 ohms.
 - Base of the antenna for a poor connection to body ground
 - The coaxial cable interconnects for a poor connection or corrosion.
 - Test for an open or high resistance from the battery negative cable to the body. Refer to **Circuit Testing** and **Wiring Repairs**.
6. After finding and correcting the condition, operate the system in order to verify the repair.

Perform the Antenna Checking Procedures after confirming the integrity of the antenna ground.

Antenna Checking Procedures

Perform the following tests for the type of antenna on the vehicle.

Mast Antennas

Unplug the antenna lead-in connector from the radio receiver and plug a test antenna into the radio. Ensure the antenna base is grounded to the vehicle chassis and keep your hands off the mast.

IMPORTANT: Always zero out the DMM before taking a resistance measurement in order to ensure an accurate reading.

Check the radio reception in an area away from electrical interferences. Tune to several weak and strong AM and FM stations. If the radio reception improved, the problem exists with the antenna and/or lead-in cable. If the reception is still poor, refer to **Audio System Troubleshooting Hints**.

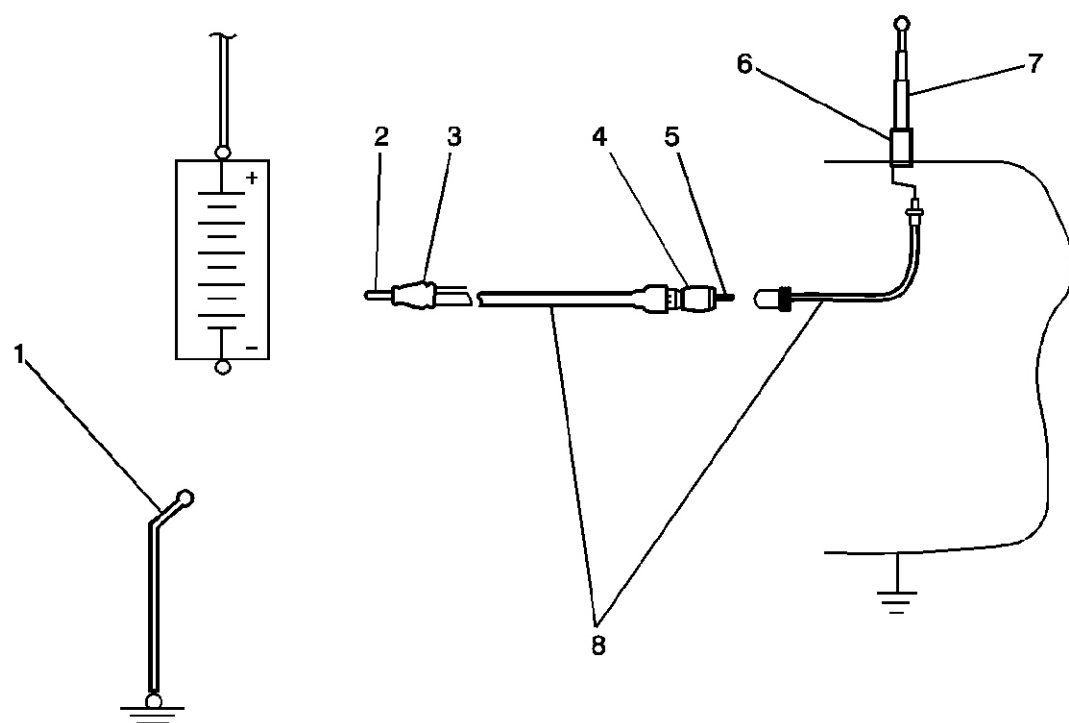


Fig. 9: Identifying Mast Antenna System Components
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Negative Battery Cable
2	Coaxial Cable Conductor - Radio End
3	Coaxial Cable Metal Outer Shield - Radio End
4	Coaxial Cable Metal Outer Shield - Antenna End
5	Coaxial Cable Conductor - Antenna End
6	Antenna Base
7	Antenna Mast
8	Antenna Coaxial Cable

Ohmmeter Probes At Points	Resistance Measured In Ohms
1 and 3	Less than 0.2
1 and 4	Less than 0.2
1 and 6	Less than 0.2
1 and 2	Infinite
1 and 5	Infinite
1 and 7	Infinite
2 and 3	Infinite
2 and 4	Infinite
2 and 6	Infinite
3 and 4	Less than 0.2
3 and 6	Less than 0.2
3 and 5	Infinite
3 and 7	Infinite

Refer to the table when testing the antenna and/or lead-in cable.

1. Measure the resistance from the coax center conductor to antenna mast.
2. Total resistance from end to end of center conductor:
 - RG-58/RG-59 type cable-Less than 0.2 ohm
 - RG-62/RG-62M type cable-Less than 3.5 ohms
3. When checking the resistance, cautiously wiggle the lead-in tip and cable. Refer to **Testing for Intermittent Conditions and Poor Connections**.
4. Measure the resistance from the cable center conductor to metal case.
5. Replace the antenna and/or lead-in cable when the above readings are not obtained.

Diversity Antenna System

IMPORTANT: This diversity antenna system is comprised of 3 glass mounted antennas, a radio antenna module, and an FM impedance matching module. The primary AM and FM antennas are an integral part of the left rear quarter glass and are connected to the radio antenna module. The secondary FM antenna is an integral part of the right rear quarter glass and is connected to the FM impedance matching module. The radio antenna module processes the antenna reception signals and phase aligns them to create one strong signal. The FM impedance matching module boosts the secondary antenna signal and transmits it to the radio antenna module.

The following information lists the most probable cause of the concern to the least probable cause followed by the appropriate test for that condition. If the test leads to the replacement of a component, always inspect for a poor connection before proceeding with the replacement. If the test leads to the replacement of a component, always inspect for a poor connection before proceeding with the replacement. Refer to **Testing for Intermittent Conditions and Poor Connections and Connector Repairs**.

Perform the Antenna System Test and test the antenna coax cable prior to performing any of the following tests.

Poor Reception on Both AM and FM Bands

- The radio antenna module is not grounded properly. The module grounding screws should be clean and tight. The antenna module ground is either a chassis ground or a ground strap. Measure the resistance from the antenna module base plate to a good ground. Resistance should be 0.2 ohms or less. Find and correct the condition if the resistance is out of specification.
- The antenna enable signal is not present at the radio antenna module. This could be caused by an output failure of the radio or an open/shorted antenna enable signal circuit. In order to test the antenna enable signal circuit, the radio must be ON and tuned to the FM band. Disconnect the radio antenna module. Measure the voltage from the antenna enable signal circuit of the radio antenna module to a good ground. Voltage measured should be near 12 volts. If the specified voltage is measured, test the antenna enable signal circuit for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs**. If no failures were found, replace the radio. Refer to **Control Module References** for replacement, setup, and programming.
- The FM composite signal circuit to the radio antenna module is open or shorted to ground. Test the FM composite signal circuit for an open or short to ground. Refer to **Circuit Testing** and **Wiring Repairs**.
- The feed coax at the radio antenna module has been inadvertently swapped with the FM impedance matching module crossover coax. Ensure that the feed coax, marked with a yellow band, is in the correct socket on the radio antenna.
- Improper retention of the antenna cable in the floating retainer-Poor or no connection with the radio will result when the radio is installed if the antenna cable is not properly attached in the floating retainer. Inspect the antenna cable for movement in the floating retainer. Replace the antenna cable if movement is found.

- Defective radio control module-Replace the radio control module. Refer to **Control Module References** for replacement, setup, and programming.

Poor Reception on AM Band Only

- Defective AM antenna
- Defective radio control module-Replace the radio control module. Refer to **Control Module References** for replacement, setup, and programming.

Poor Reception on FM Band Only

- Defective primary or secondary FM antenna
- Defective radio control module-Replace the radio control module. Refer to **Control Module References** for replacement, setup, and programming.
- Defective radio antenna module-Replace the radio antenna module. Refer to **Control Module References** for replacement, setup, and programming.

RADIO SETUP

To set up a new radio for the vehicle, complete the setup procedure under the Special Functions menu of the scan tool.

If the new radio is not properly set up, the radio will display a locked message (LOC) or Calibrate.

SPEAKER REPLACEMENT REFERENCE

Component	Repair Instruction
Front Speaker	Refer to <u>Radio Front Speaker Replacement</u> .
Front Door Speaker	Refer to <u>Radio Front Side Door Speaker Replacement</u> .
Front Upper Speaker	Refer to <u>Front Upper Speaker Replacement</u> .
Rear Speaker	Refer to <u>Radio Rear Speaker Replacement</u> .

SPEAKERS INOPERATIVE - ALL

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Reference Information

Schematic Reference

Radio/Navigation System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Radio/Audio System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References

Special Tools

J 39916-A CD Diagnostic Audio Kit

Circuit/System Testing

IMPORTANT: Diagnose and repair any serial data communication DTCs before performing this diagnostic.

Without Amplifier

1. Ignition ON and radio ON, adjust the volume, balance and fade adjustment on the radio.
 - o If adjustment of the fade and balance eliminates the concern, review the operation of the radio with the customer.
2. If inoperative audio on all speakers persists, replace the radio.

With Amplifier

1. Ignition ON and radio ON, adjust the volume, balance and fade adjustment on the radio.
 - o If adjustment of the fade and balance eliminates the concern, review the operation of the radio with the customer.
2. Ignition OFF, disconnect the X3 (U87) or X1 (UQ3) amplifier harness connector.
3. Ignition ON and radio ON, test for AC voltage between the left front low level audio signal (+) terminal 1 (U87) or 15 (UQ3) and left front low level audio signal (-) terminal 8 (U87) or 7 (UQ3).
 - o If AC voltage is not present, replace the radio.
4. Test for greater than 9 volts at the amplifier harness connector radio audio mute signal circuit, X3 terminal 7 (U87), X1 terminal 11 (UQ3).
 - o If less than specified value repair short to ground or open/high resistance or replace the radio.
5. Ignition OFF, disconnect the amplifier connector harness X1.
6. Test for less than 1 ohm between the X3 amplifier harness connector terminal 8 and ground.
 - o If greater than specified value repair open circuit.
7. Test for greater than 10 volts on X3 amplifier harness connector terminal 4.
 - o If less than specified value repair short to ground or open/high resistance.
8. If all circuits test normal, replace the amplifier.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Control Module References for amplifier and radio replacement

- **Speaker Replacement Reference**

SPEAKERS INOPERATIVE - ONE OR MORE**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

Each of the audio output channel circuits (+) and (-), at the radio and at the amplifier if equipped, have a DC bias voltage that is one half of the battery voltage. Therefore each of the audio output channel circuits will measure approximately 6.5V DC when using a DMM. The audio music or talking being played on the audio system is produced by a varying AC voltage that is centered around the DC bias voltage on the same circuit. The AC voltage measured on these circuits on the output of a radio that is not amplified will be approximately 1-3V AC when using a DMM. The AC voltage is what causes the speaker cone to move and produce the sound. This voltage will vary depending on what type of audio is being listened to, talk or music, and type of music, and the volume setting of the system. Low volume and talk settings will measure around 1V AC and less, where constant music may measure 3V AC and slightly higher. In an amplified audio system, these similar AC voltage measurements may be slightly higher on the output of the amplifier, and the typical AC voltage readings at the output of the radio are less than 1V AC.

Diagnostic Aids

Speakers located in the front A-pillar are connected to the same channel as the speakers in the front doors.

Reference Information**Schematic Reference****Radio/Navigation System Schematics****Connector End View Reference****Component Connector End Views****Description and Operation****Radio/Audio System Description and Operation****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Control Module References** for Scan Tool information**Circuit/System Verification**

Adjust the fade and balance controls on the radio to test all four channels individually. All speakers should function properly.

Circuit/System Testing Only

Digital Radio One or More Speakers Inoperative

1. Ignition OFF, disconnect the radio X2 harness connector.
2. Ignition ON, digital radio ON and tuned to a station, increase the radio volume.
3. Verify AC voltage is not present on the suspect channel audio signal (+) and audio signal (-) from the DRR.
 - o If AC voltage is present, replace the radio.
4. Ignition OFF, disconnect the digital radio harness connector.
5. Test for less than 1 volt on both suspect audio signal (+) and audio signal (-).
 - o If greater than 1 volt repair short to voltage.
6. Test for less than 1 ohm on the suspect audio signal (+) between the radio harness connector and the digital radio X2 harness connector.
 - o If greater than specified value repair open or high resistance.
7. Test for less than 1 ohm on the suspect audio signal (-) between the radio harness connector and the digital radio X2 harness connector.
 - o If greater than specified value repair open or high resistance.
8. If all circuits test normal, replace the digital radio receiver (DRR).

One or More Speakers Inoperative With Amplifier

1. Center the balance and fade adjustment on the radio.
 - o If adjustment of the fade and balance eliminates the concern, review the operation of the radio with the customer.
2. Ignition OFF, Disconnect the suspect amplifier harness connector. If the suspect speaker inputs are contained in the same harness as the battery positive voltage circuit, the ground circuit, the radio amp mute signal, and the antenna switched 14-volt supply circuit. It will be required to re-connect the applicable circuits by using a fused jumper harness.
3. Ignition ON, operate the radio and increase the radio volume.
4. Verify AC voltage is present between the suspect speaker output (+) and speaker output (-) circuits.
 - o If AC voltage is present, replace the amplifier.
5. Reconnect the amplifier harness connector.
6. Disconnect the suspect speaker harness connector.
7. Verify AC voltage is present between the suspect speaker output (+) and speaker output (-) circuits.
 - o If AC voltage is present, replace the suspect speaker.
8. Ignition OFF, disconnect the suspect amplifier harness connector.
9. Test for less than 1 volt on both suspect speaker output (+) and speaker output (-) circuits.
 - o If greater than 1 volt repair short to voltage.
10. Test for less than 1 ohm between the suspect speaker output (+) radio harness connector terminal and the suspect speaker output (+) speaker harness connector terminal.
 - o If greater than specified value repair open or high resistance.
11. Test for less than 1 ohm between the suspect speaker output (-) radio harness connector terminal and the suspect speaker output (-) speaker harness connector terminal.
 - o If greater than specified value repair open or high resistance.
12. If all circuits test normal, replace the amplifier.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Speaker Replacement Reference**
- **Control Module References** for radio or amplifier replacement, setup, and programming

UNABLE TO CONTACT ONSTAR CALL CENTER

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused, battery positive, voltage circuit connected through the vehicle wiring to the 3-button assembly and the radio, and attached by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN messaging. The module also has the capability of commanding the horn, initiating door lock/unlock, and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the cellular telephone voice signal circuit, and returned to the module on the cellular telephone voice low reference circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

Diagnostic Aids

- The customer concern may have been due to a lack of cellular service in a given area. A failure in the National Cellular Network infrastructure at the time of the customers failed connection that has since been repaired may also have been the cause.
- If an OnStar® emergency call is able to successfully connect the vehicle to the OnStar® Call Center when an OnStar® Call Center button press is not, there may be a failure in the ability of the OnStar® system in the vehicle to be recognized by the local cellular carrier.
- If the prompt "OnStar® request ended" is heard, without pressing the white dot button at the end of the OnStar® keypress, the OnStar® system at one time has made a successful cellular connection, but was unable to complete the call. If repeated calls are placed with this result, contact General Motors Technical Assistance Center.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

IMPORTANT:

- It is important to have the vehicle in an open outside area where a cellular call can be successfully placed and GPS data can be received from satellites.
- Placing an emergency call to the OnStar® Call Center should only be made if the diagnosis of the system leads to step 4. Immediately after an OnStar® advisor picks up the call, they should be told that this call is for diagnostic purposes only and there is no emergency.

1. Press the OnStar® Call Center button. Verify a connection is not made with the OnStar® Call Center.
 - If a connection is made with the OnStar® Call Center, go to **Diagnostic Aids**.
2. Listen for other tones or cellular messages rather than the normal progression tones or the Unable to Contact OnStar® prompt.
 - If no other tones or cellular messages are heard other than the normal progression tones or the Unable to Contact OnStar® prompt, go to **Component Testing**.
3. Record all messages heard from the OnStar® Call Center button press.
4. Press the OnStar® emergency button. Verify a connection to the OnStar® Call Center is made within 10 minutes.
 - If a connection is not made within specified time, go to **Component Testing**.
5. Hear all messages during the course of the tests available, and contact the General Motors Technical Assistance Center.

Component Testing

IMPORTANT: Vehicle may be equipped with sectioned coax. Test each section and replace only the faulty section, not the entire length or coax.

1. Verify that there is no exterior damage to the cellular antenna.
 - If damaged, test or replace the cellular antenna assembly.
2. Disconnect the cellular antenna coax from the VCIM.
3. Disconnect the cellular antenna coax from the cellular antenna.

4. Test for infinite resistance between the center conductor of the coax and the outer metal shield.
 - o If different than specified value, replace the cellular antenna coax.
5. Test for less than 1 ohm at the cellular antenna coax center conductor from end to end.
 - o If greater than specified value, replace the cellular antenna coax cable.
6. Contact the General Motors Technical Assistance Center.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Cellular Communications/Digital Radio Antenna Replacement

ONSTAR VOICE RECOGNITION INOPERATIVE

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused, battery positive, voltage circuit connected through the vehicle wiring to the 3-button assembly and the radio, and attached by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN messaging. The module also has the capability of commanding the horn, initiating door lock/unlock and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the cellular telephone voice signal circuit, and returned to the module on the cellular telephone voice low reference circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

Reference Information

Schematic Reference

OnStar Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

OnStar Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Circuit/System Verification

IMPORTANT: The vehicle must be located in a quiet area.

1. Ignition ON, press OnStar® Call button. Verify that your voice cannot be heard clearly by the OnStar® Call Center.
 - o If your voice can not be heard clearly, refer to **OnStar Microphone Inoperative - Caller Cannot Be Heard**.
2. Press the OnStar® Call answer button. Verify that OnStar® system did not recognize any of your hands-free voice commands.
3. Press the OnStar® Call answer button. Verify that OnStar® system did not recognize any of another person voice commands either.
 - o If the voice commands are not recognized by OnStar® system, refer to **OnStar Description and Operation**.
4. If the system is operational, but cannot identify certain word commands due to pronunciation, for tips on proper pronunciation refer to **OnStar Description and Operation**.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for VCIM replacement, setup, and programming

REPAIR INSTRUCTIONS

MOBILE TELEPHONE MICROPHONE REPLACEMENT

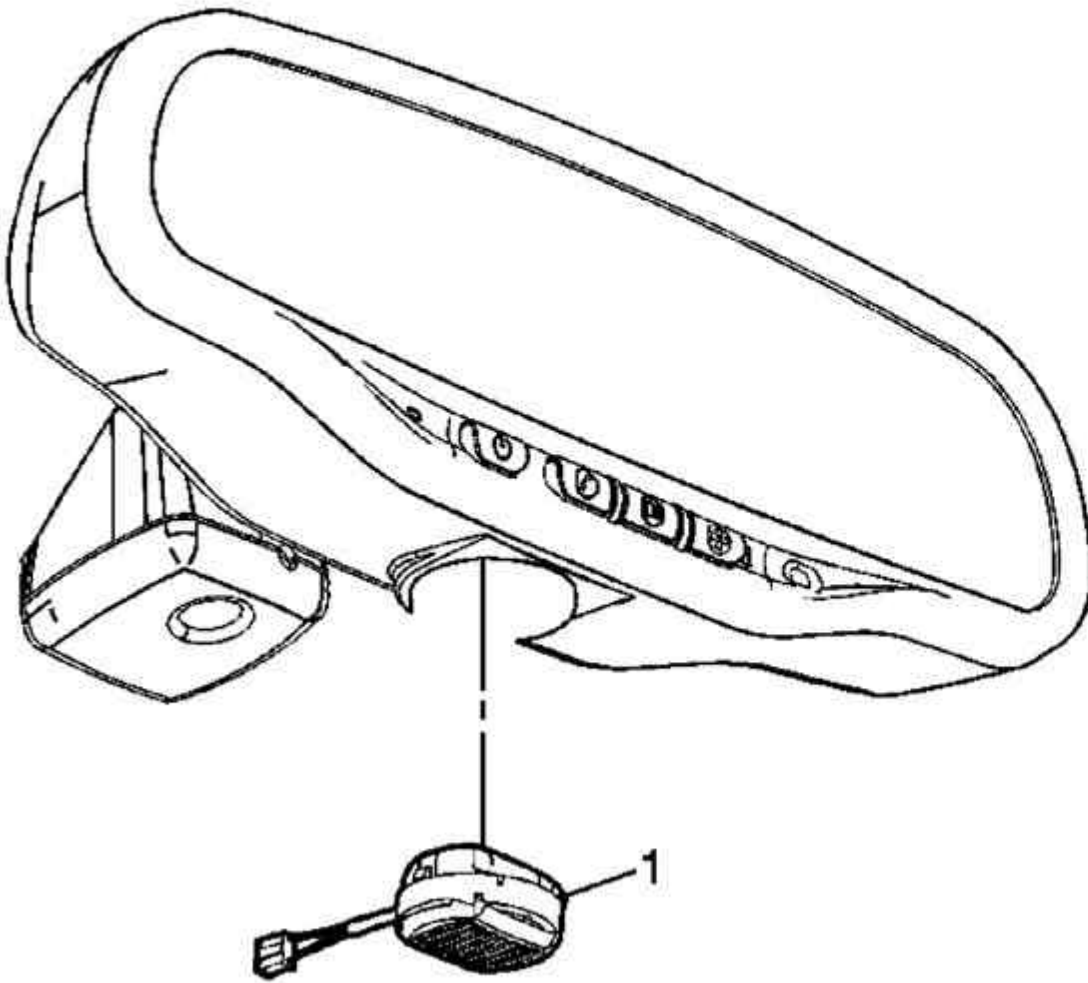


Fig. 10: View of OnStar Microphone
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Mobile Telephone Microphone Assembly Tip: 1. Disengage the tabs of the microphone assembly from the inside rearview mirror assembly using a small flat-bladed tool. 2. Disconnect the electrical connector.

COMMUNICATION INTERFACE MODULE REPLACEMENT

Removal Procedure

1. Remove the center console, if equipped. Refer to **Front Floor Console Replacement**.
2. Remove the HVAC control. Refer to **Heater and Air Conditioning Control Replacement**.

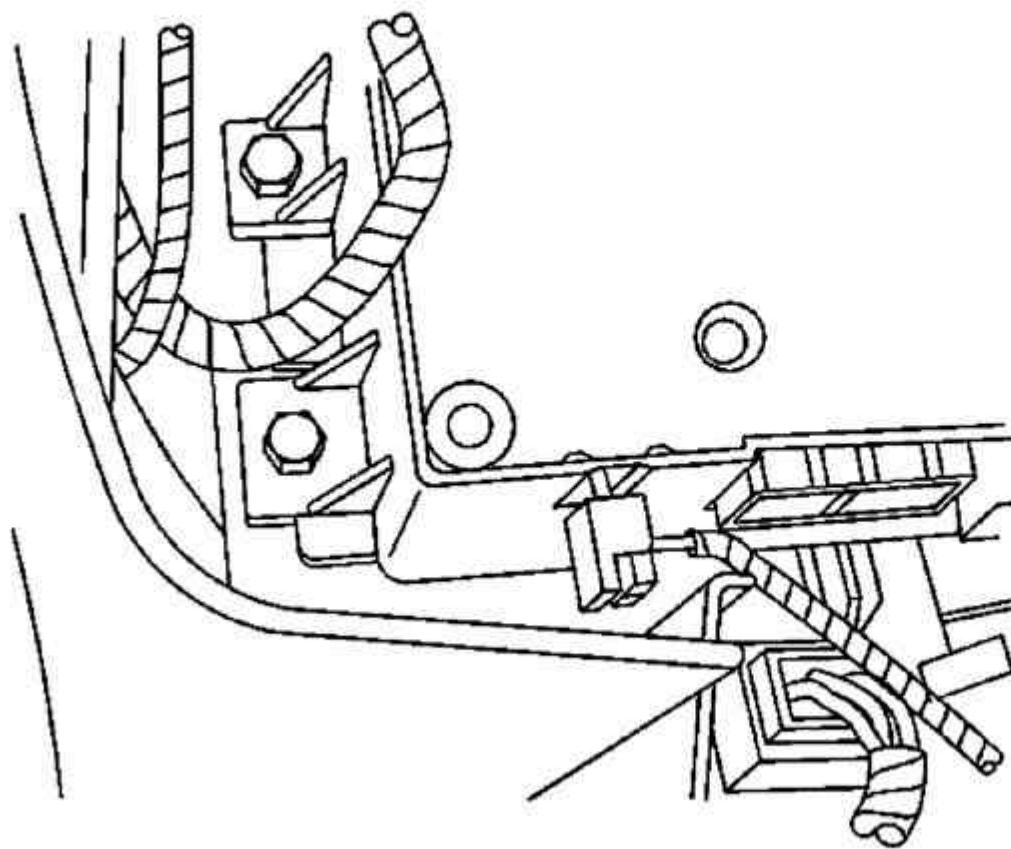


Fig. 11: View Of Communication Interface Module
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The vehicle communication interface module (VCIM) has a specific set of unique numbers that tie the module to each vehicle. These numbers, the 10-digit station identification and the 11-digit electronic serial number, are used by the National Cellular Network and OnStar® to identify the specific vehicle. Because these numbers are tied to the vehicle identification number of the vehicle, you must never exchange these parts with those of another vehicle.

3. Remove the communication interface module screws.

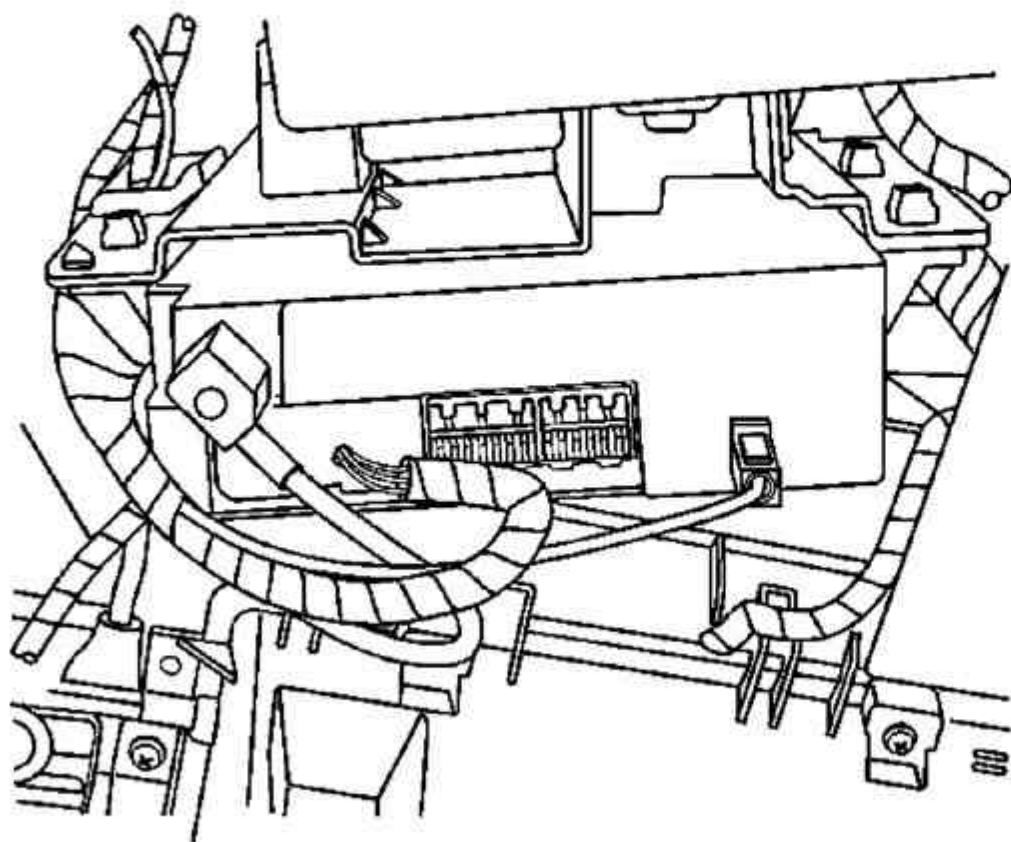


Fig. 12: View Of Communication Interface Module Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the mobile telephone antenna cable from the communication interface module by pulling outward on the square plastic housing.
5. Disconnect the electrical connectors.
6. Disconnect the navigation antenna coaxial antenna cable from the module.
7. Remove the communication interface module.

Installation Procedure

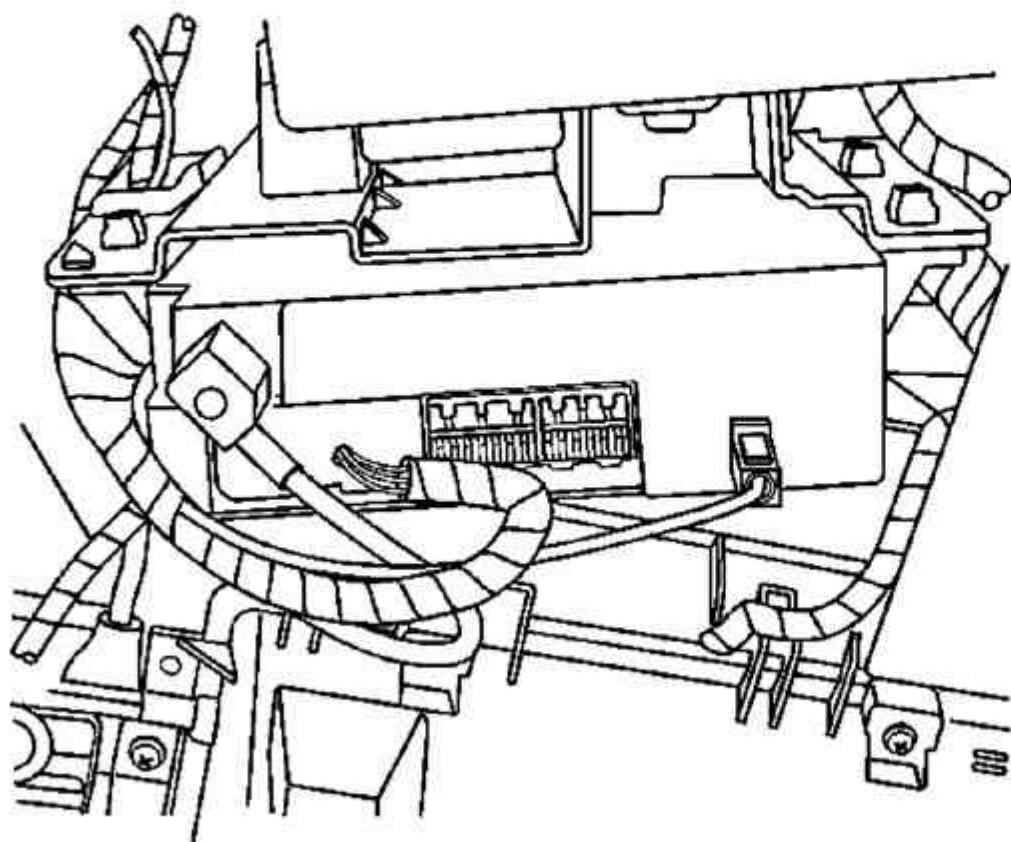


Fig. 13: View Of Communication Interface Module Electrical Connectors
Courtesy of GENERAL MOTORS CORP.

1. If you are replacing the VCIM, record the 10-digit standard identification (STID) number and the 11-digit electronic serial number (ESN) from the labels on the new module.

NOTE: Before you install the antenna cable connector of the global positioning system (GPS) to the vehicle communication interface module (VCM), align the connector properly in order to avoid damaging the connector.

2. Connect the navigation antenna coaxial cable to the module.
3. Connect the electrical connectors.
4. Connect the mobile telephone antenna cable to the module by pushing inward on the square plastic housing.

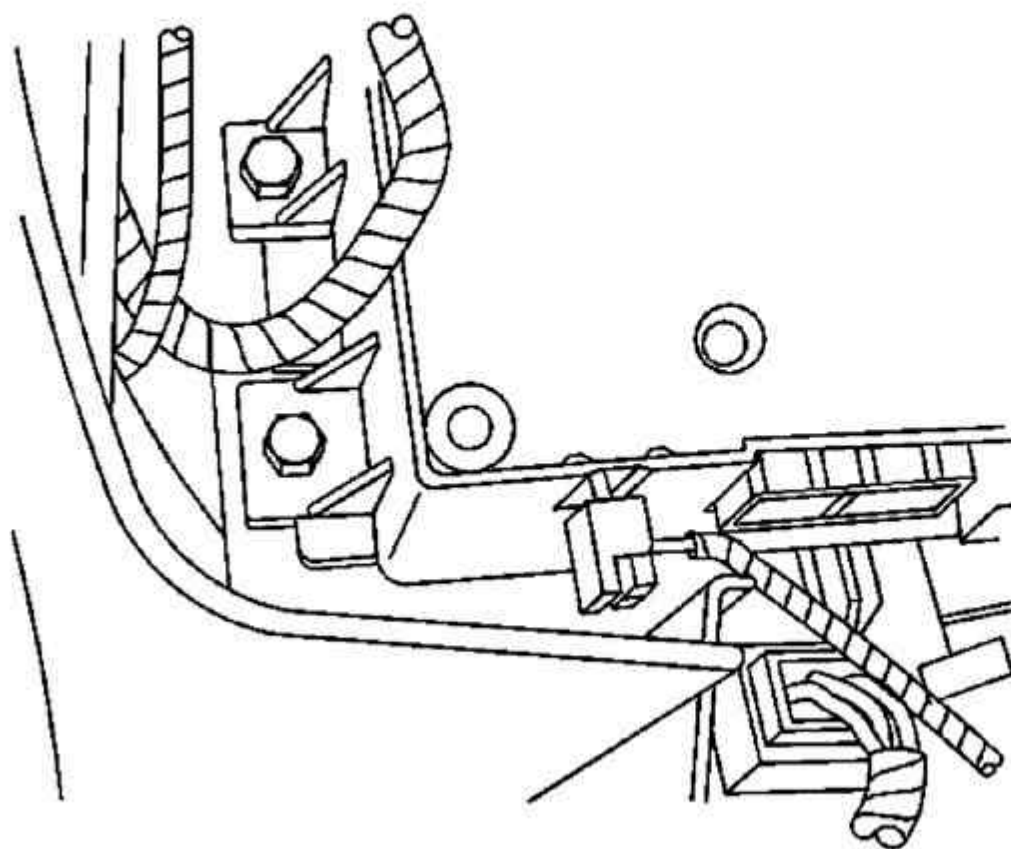


Fig. 14: View Of Communication Interface Module
Courtesy of GENERAL MOTORS CORP.

5. Align the module to the vehicle antenna module bracket.

NOTE: Refer to Fastener Notice .

6. Install the communication interface module screws.

Tighten: Tighten the screws to 2 N.m (18 lb in).

7. Install the HVAC module. Refer to Heater and Air Conditioning Control Replacement .
8. Install the center console. Refer to Front Floor Console Replacement .

IMPORTANT: After replacing the vehicle communication interface module, you must reconfigure the OnStar® system. Failure to reconfigure the system will result in an additional customer visit for repair. In addition, pressing and holding the white dot button on the keypad will NOT reset this version of the OnStar® system. This action will cause a DTC to set.

9. Reconfigure the OnStar® System. Refer to Control Module References for programming and setup information.

COMPACT DISC CARE AND CLEANING

Care of CDs

Handle CDs carefully. Store them in their original cases or other protective cases and away from direct sunlight

and dust. The CD player scans the bottom surface of the disc. If the surface of a CD is damaged, such as cracked, broken, scratched, or wrinkled labeling, the CD will not play properly or not at all. If the surface of a CD is soiled, take a soft, lint free cloth or dampen a clean, soft cloth in a mild, neutral detergent solution mixed with water, and clean it. Make sure the wiping process starts from the center to the edge. Do not touch the bottom side of a CD while handling it. This could damage the surface. Pick up CDs by grasping the outer edges or the edge of the hole and the outer edge.

Care of the CD Player

The use of CD lens cleaners for CD players is not advised, due to the risk of contaminating the internal lens of the CD optics with lubricants.

Stuck CDs

Interrupting the battery power by pulling the fuse will sometimes release a stuck CD. If a CD is stuck, and removed, inspect it for warps, cracks, etc. If the CD is damaged, do not replace the radio.

Labeling CDs

Paper labels can eventually warp and wrinkle, and this will cause the disc to jam inside the CD player. Try labeling the top of the discs with a soft magic marker instead.

RADIO REPLACEMENT**Removal Procedure**

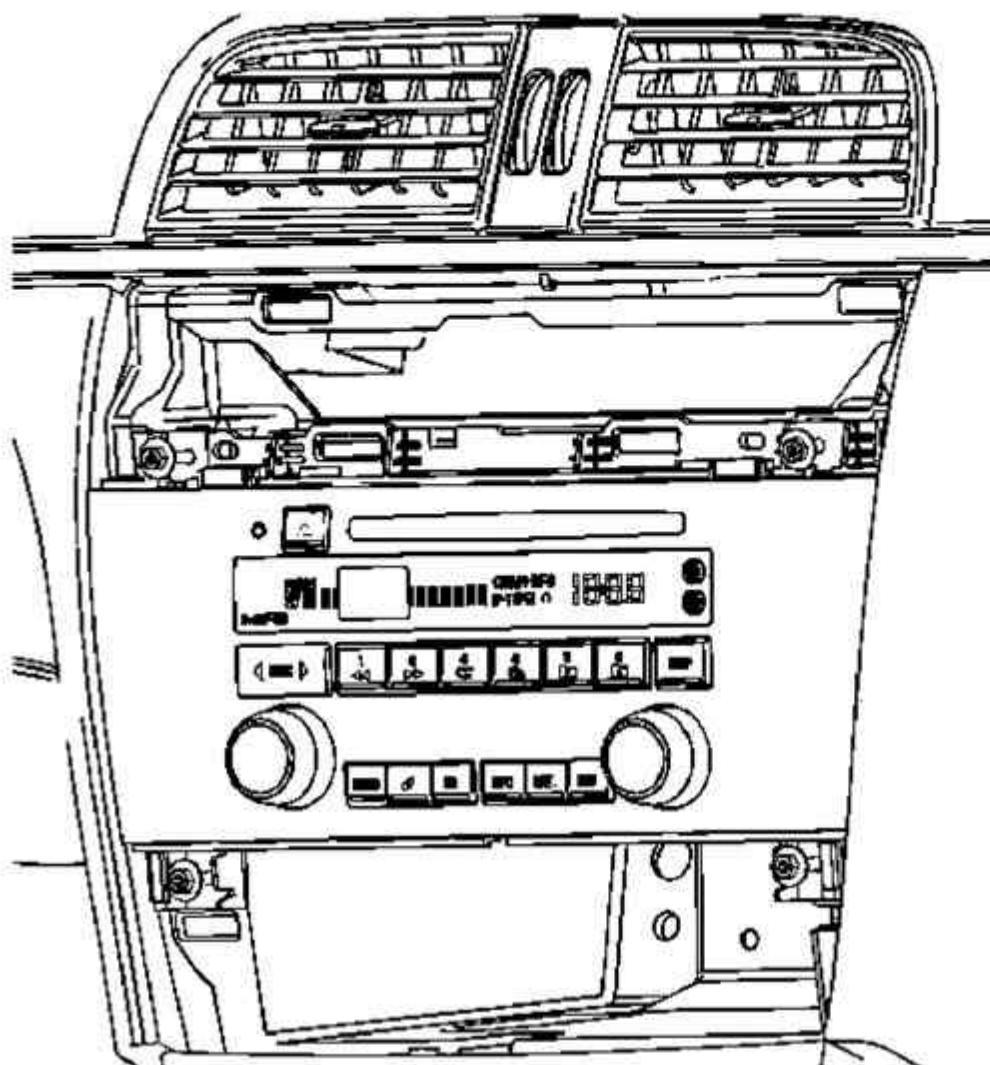


Fig. 15: View of HVAC Control Assembly & Radio
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform the radio set up procedure for new radios. Refer to Control Module References for programming and setup information.

1. Remove the HVAC control assembly. Refer to Heater and Air Conditioning Control Replacement.
2. Remove the drivers information center switch bank. Refer to Driver Information Display Switch Replacement.
3. Remove the radio screws.
4. Pull the radio toward you.

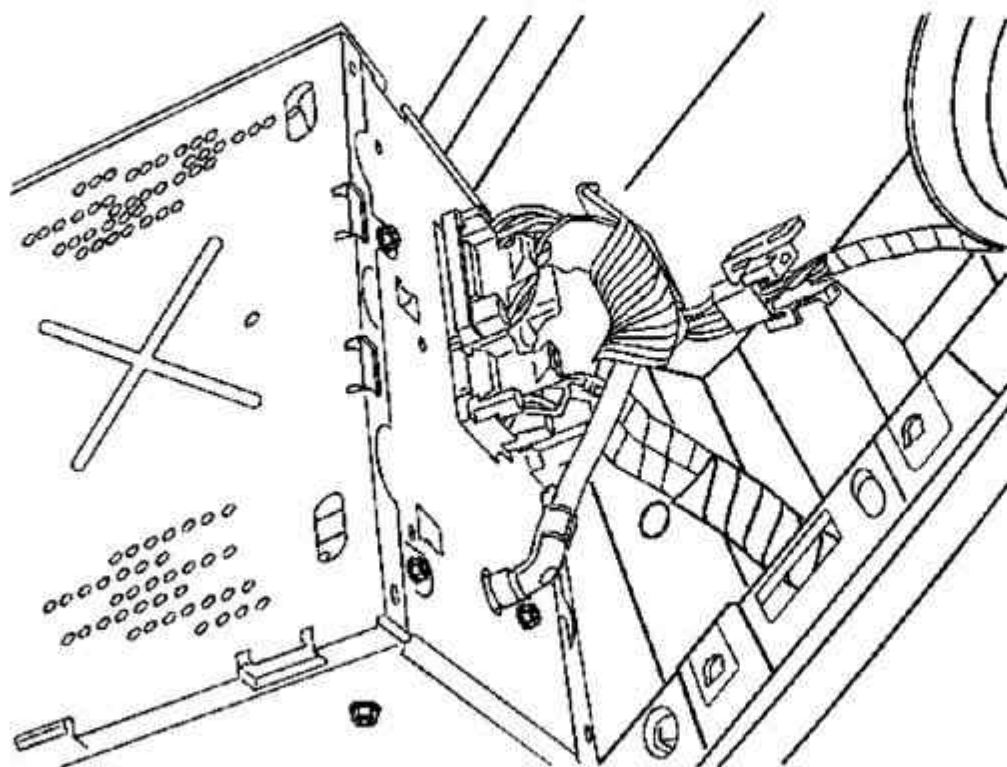


Fig. 16: View Of Instrument Panel Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the instrument panel (I/P) wiring harness connectors and the antenna cable connector from the radio.
6. Remove the radio.

Installation Procedure

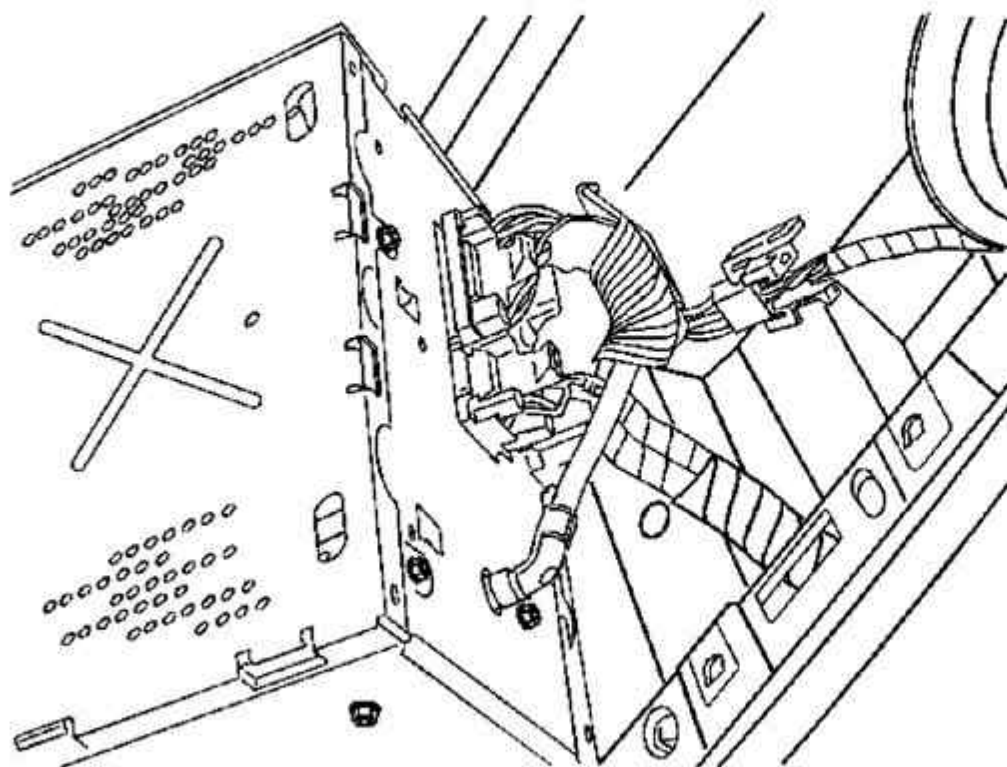


Fig. 17: View Of Instrument Panel Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

1. Position the radio to the I/P.
2. Connect the I/P wiring harness connectors and the antenna cable connector to the radio.

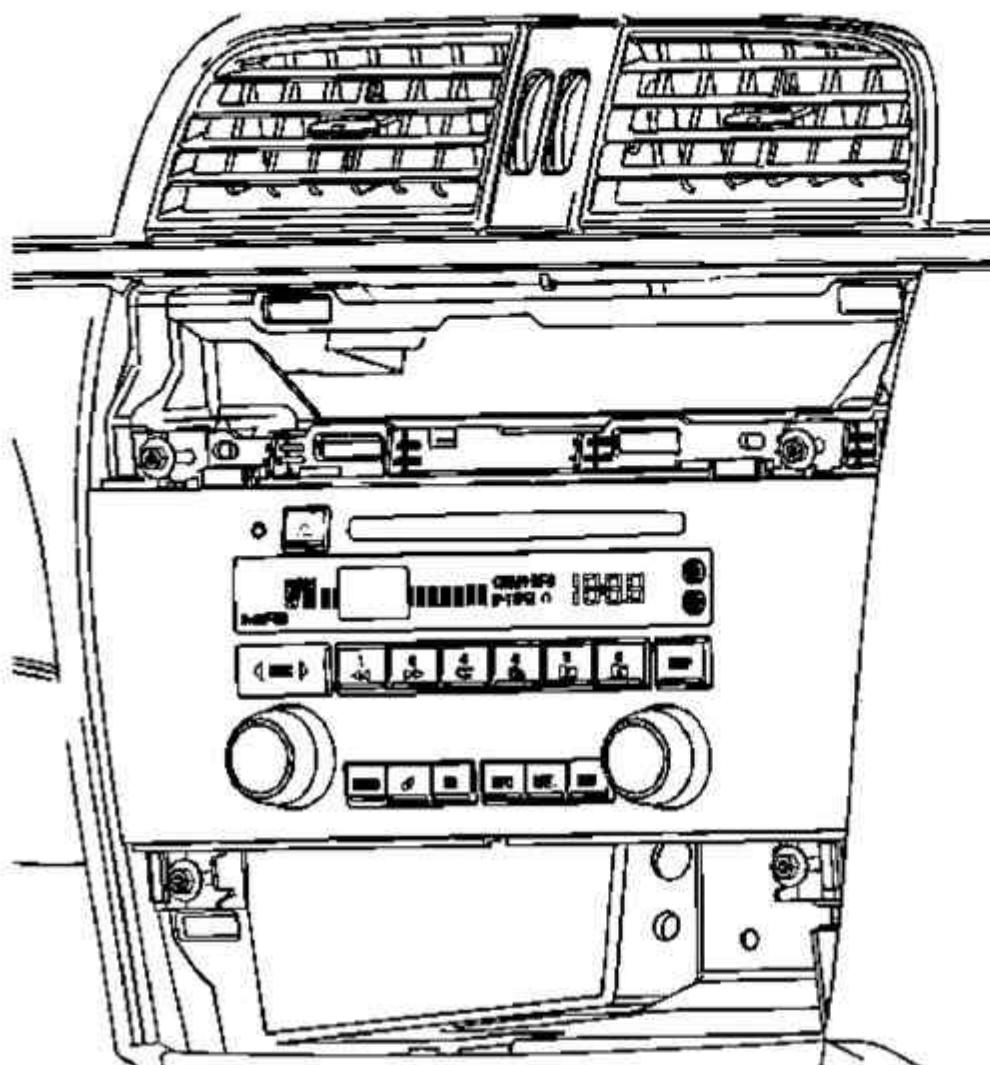


Fig. 18: View of HVAC Control Assembly & Radio
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the radio locator is difficult to align to the I/P locator opening, pull the radio toward you and reposition the antenna cable.

3. Install the radio to the I/P.

Align the radio locator to the hole in the I/P while pressing the radio into position.

NOTE: Refer to Fastener Notice .

4. Install the radio screws.

Tighten: Tighten the screws to 2 N.m (18 lb in).

5. Install the drivers information center switch bank. Refer to Driver Information Display Switch Replacement .
6. Install the HVAC control assembly. Refer to Heater and Air Conditioning Control Replacement .
7. Perform the radio set up procedure for new radios. Refer to Control Module References for programming and setup information.

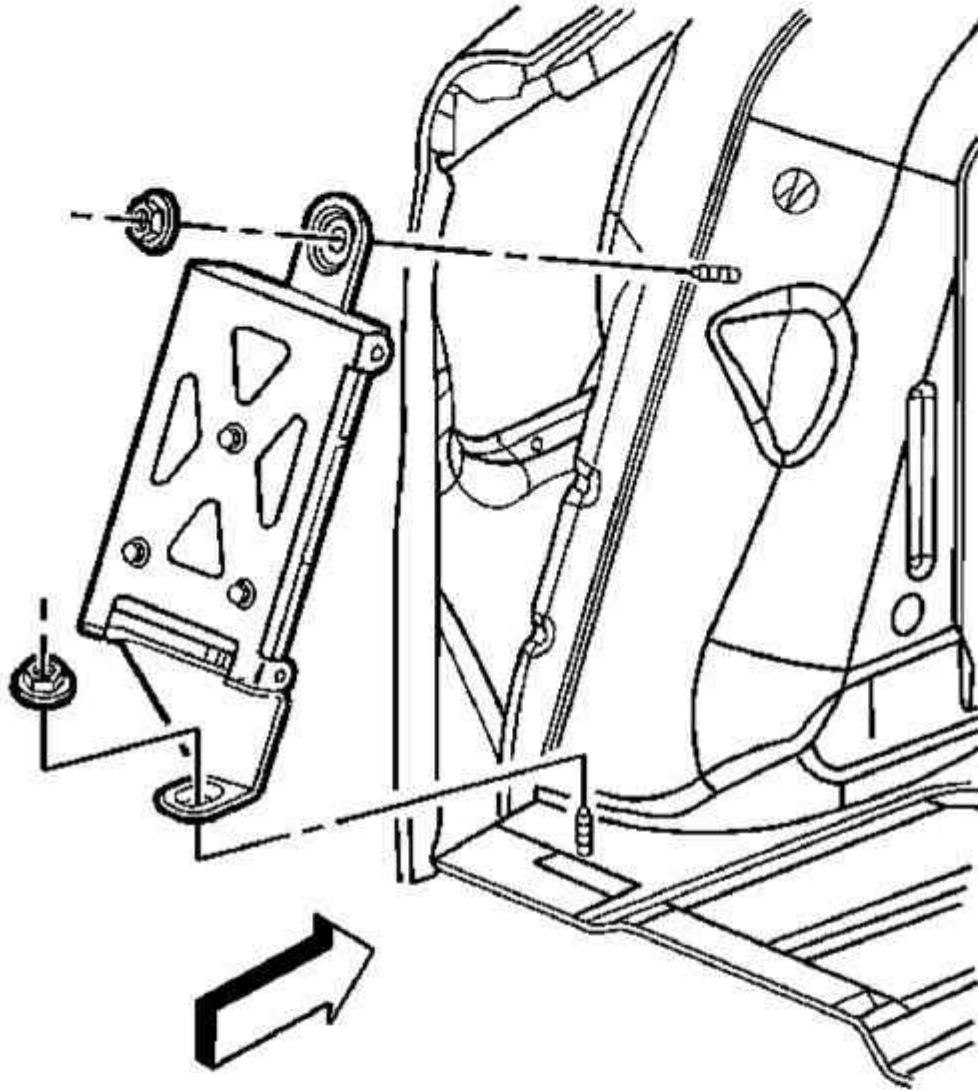
DIGITAL RADIO RECEIVER REPLACEMENT**Removal Procedure**

Fig. 19: View Of Rear Compartment Trim Panel & Receiver Bracket
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do NOT exchange digital radio receivers between vehicles. Exchanging digital receivers between vehicles will activate the digital radio Theftlock. XM Theftlock will be displayed.

1. Adjust the left rear compartment trim panel for access. Refer to **Rear Compartment Trim Panel Replacement**.
2. Remove the receiver bracket nuts.
3. Remove the receiver bracket from the studs.

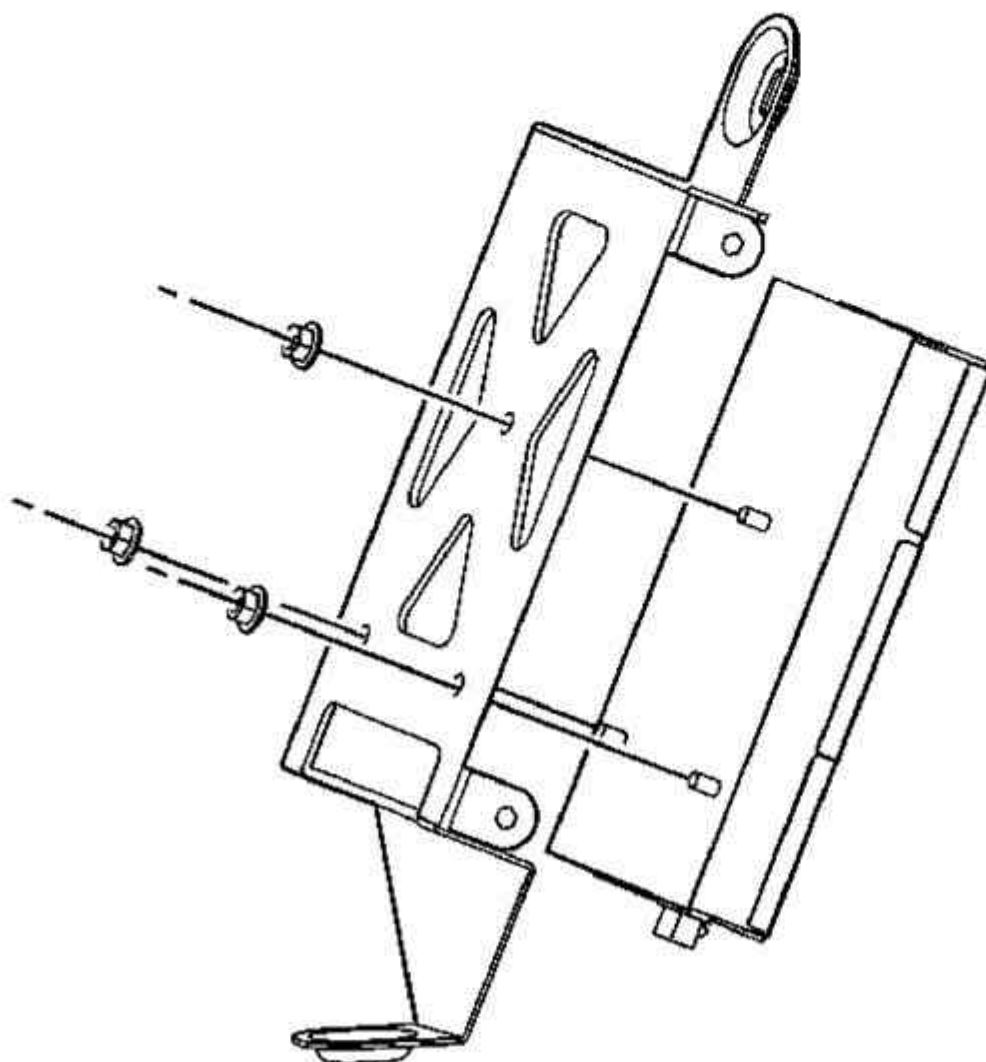


Fig. 20: View Of Digital Radio Receiver & Receiver Bracket
Courtesy of GENERAL MOTORS CORP.

4. Remove the digital radio receiver nuts.
5. Remove the digital radio receiver from the receiver bracket.
6. Disengage the connection position assurance (CPA) from the electrical connector.
7. Disconnect the electrical connector from the digital radio receiver.
8. Disconnect the antenna connector.
9. Remove the digital radio receiver.

Installation Procedure

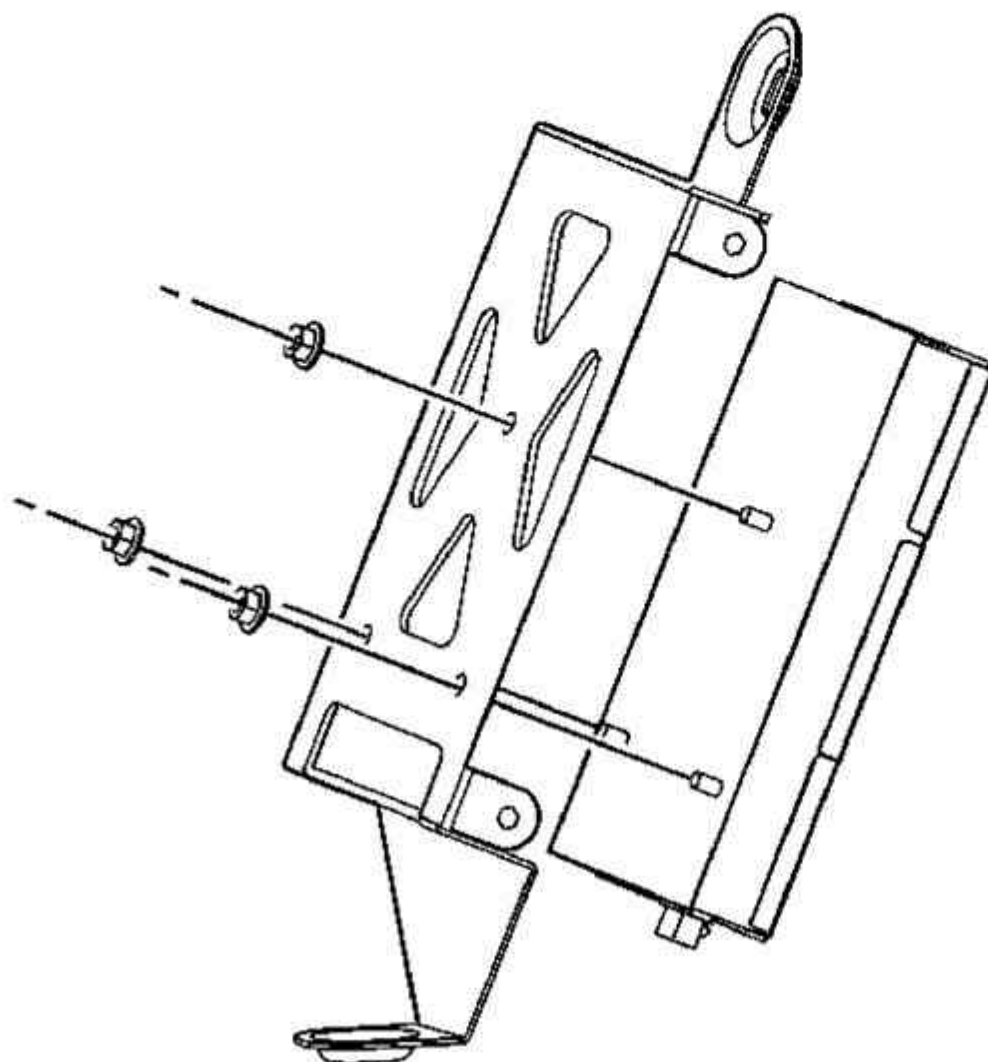


Fig. 21: View Of Digital Radio Receiver & Receiver Bracket
Courtesy of GENERAL MOTORS CORP.

1. Connect the antenna connector.
2. Connect the electrical connector.
3. Install the electrical connector CPA.
4. Install the digital radio receiver to the receiver bracket.

NOTE: Refer to Fastener Notice .

5. Install the digital radio receiver nuts.

Tighten: Tighten the nuts to 5 N.m (44 lb in).

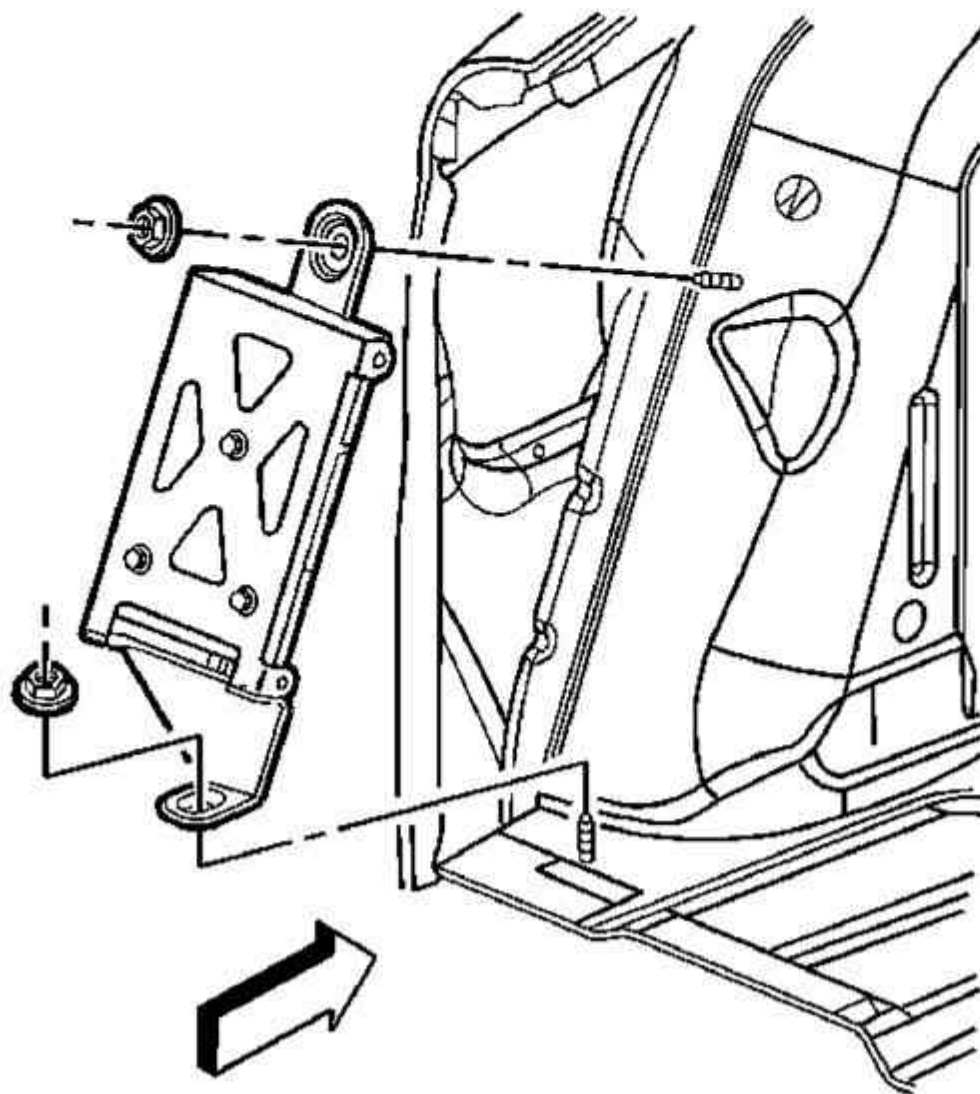


Fig. 22: View Of Rear Compartment Trim Panel & Receiver Bracket
Courtesy of GENERAL MOTORS CORP.

6. Align the receiver and bracket assembly to the studs.
7. Install the receiver bracket nuts.

Tighten: Tighten the nuts to 4 N.m (35 lb in).

8. Install the left rear compartment trim panel. Refer to **Rear Compartment Trim Panel Replacement**.
9. Perform the setup procedure for the digital radio receiver. Refer to **Control Module References** for programming and setup information.

RADIO SPEAKER AMPLIFIER REPLACEMENT

Removal Procedure

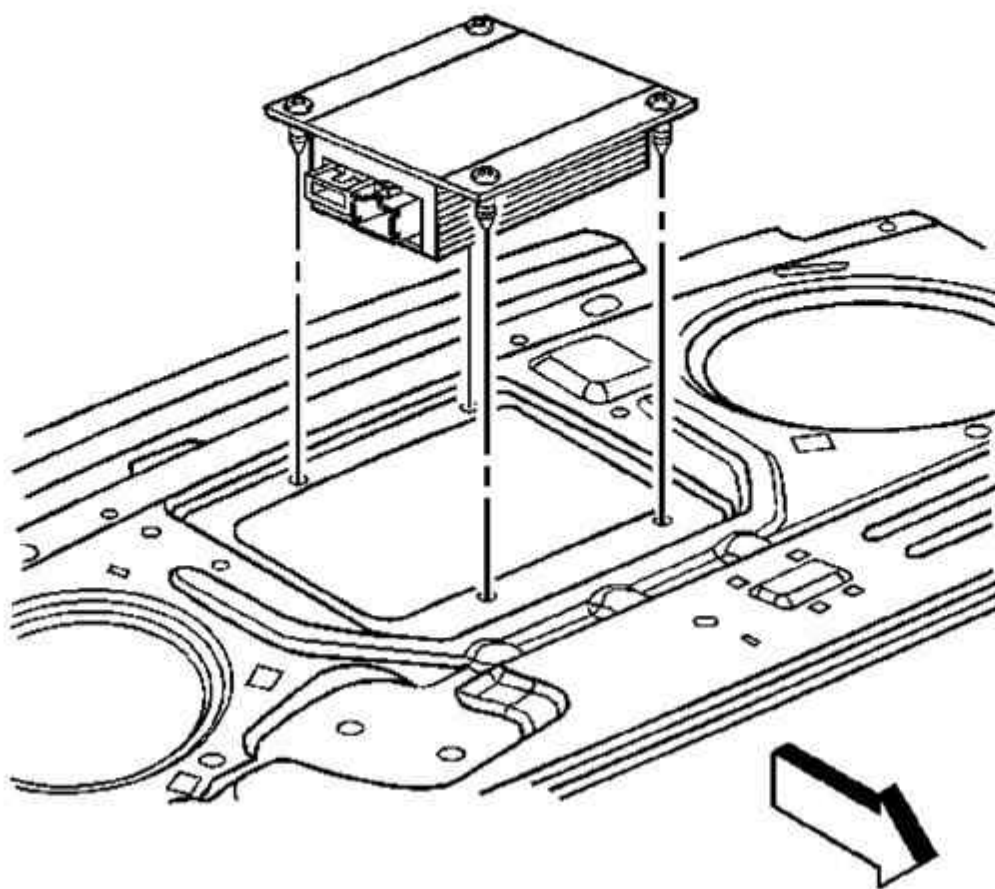


Fig. 23: View Of Audio Amplifier Retainers
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear window trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.
2. Adjust the sound barrier for access.
3. Use a trim pad remover or other suitable tool to remove the audio amplifier retainers.
4. Lift the audio amplifier from the rear shelf.
5. Disconnect the electrical connectors from the audio amplifier.
6. Remove the audio amplifier.

Installation Procedure

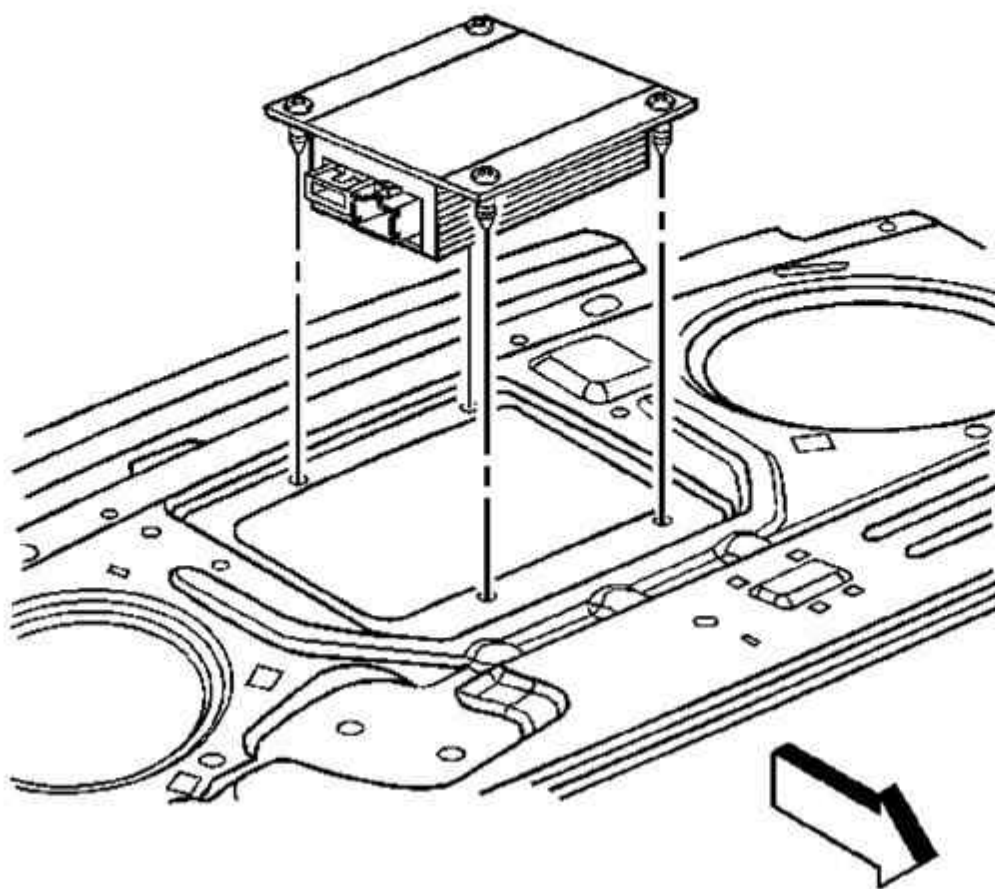


Fig. 24: View Of Audio Amplifier Retainers
Courtesy of GENERAL MOTORS CORP.

1. Connect the electrical connectors to the audio amplifier.
2. Install the audio amplifier to rear shelf.
3. Install the audio amplifier retainers.
4. Install the sound barrier.
5. Install the rear window trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.

MOBILE TELEPHONE DIGITAL ANTENNA REPLACEMENT

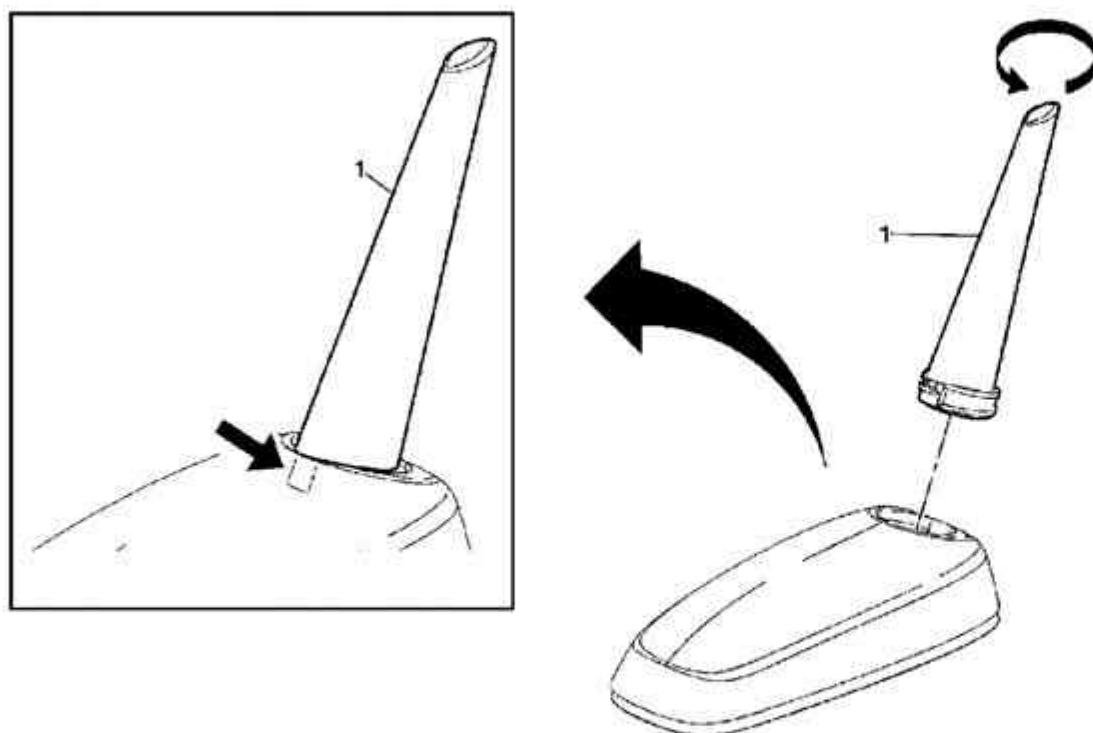


Fig. 25: View Of Mobile Telephone Digital Antenna
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Mobile Telephone Digital Antenna Assembly Tip: - The release tab is not visible with the mast assembled to the antenna base. - Using a small flat-bladed tool, push in and hold the release tab, then rotate the mast counterclockwise in order to release the mast from the antenna base.

CELLULAR COMMUNICATIONS/DIGITAL RADIO ANTENNA REPLACEMENT

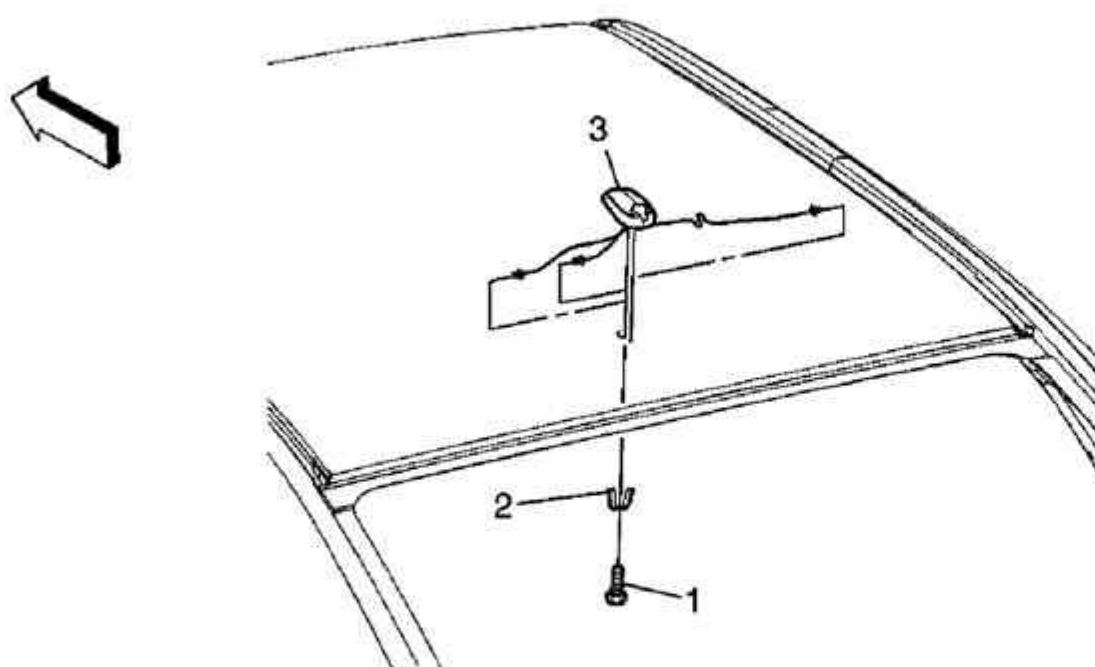
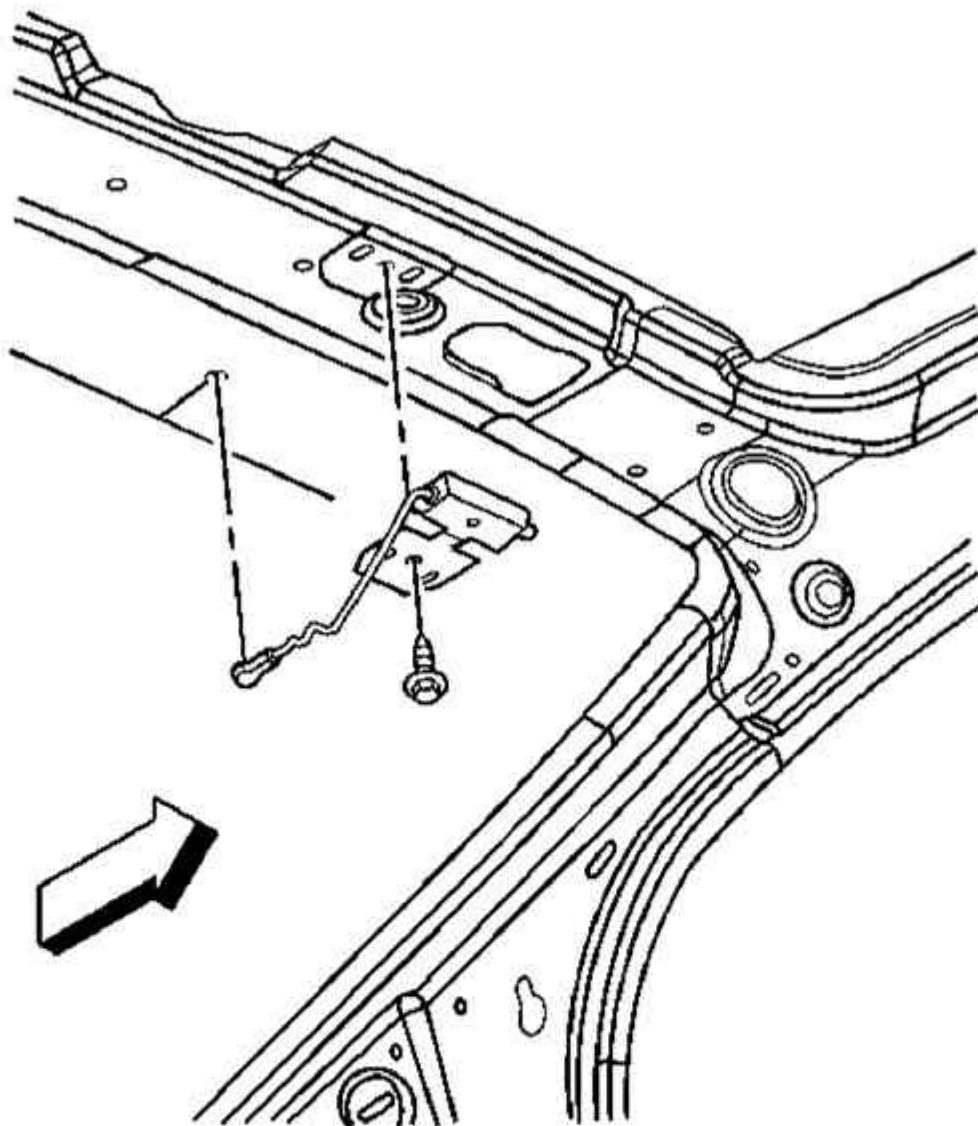


Fig. 26: View Of Antenna - Cellular Communications/Digital Radio
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Lower the rear of the headliner. Refer to Headlining Trim Panel Replacement .	
1	Mobile Telephone and Vehicle Location Antenna Base Bolt NOTE: Refer to Fastener Notice . Tip: Disconnect the electrical connections. Tighten: 9 N.m (80 lb in)
2	Mobile Telephone and Vehicle Location Antenna Base Expansion Sleeve
3	Mobile Telephone and Vehicle Location Antenna Base Assembly

RADIO ANTENNA MODULE REPLACEMENT**Removal Procedure****Fig. 27: View Of Antenna Module**

Courtesy of GENERAL MOTORS CORP.

1. Lower the rear of the headliner. Refer to Headlining Trim Panel Replacement.
2. Remove the antenna module bolt.
3. Disconnect the antenna module electrical connector.
4. Disconnect the antenna coaxial cable.
5. Disconnect the rear window antenna lead from the rear window antenna connector.
6. Remove the antenna module.

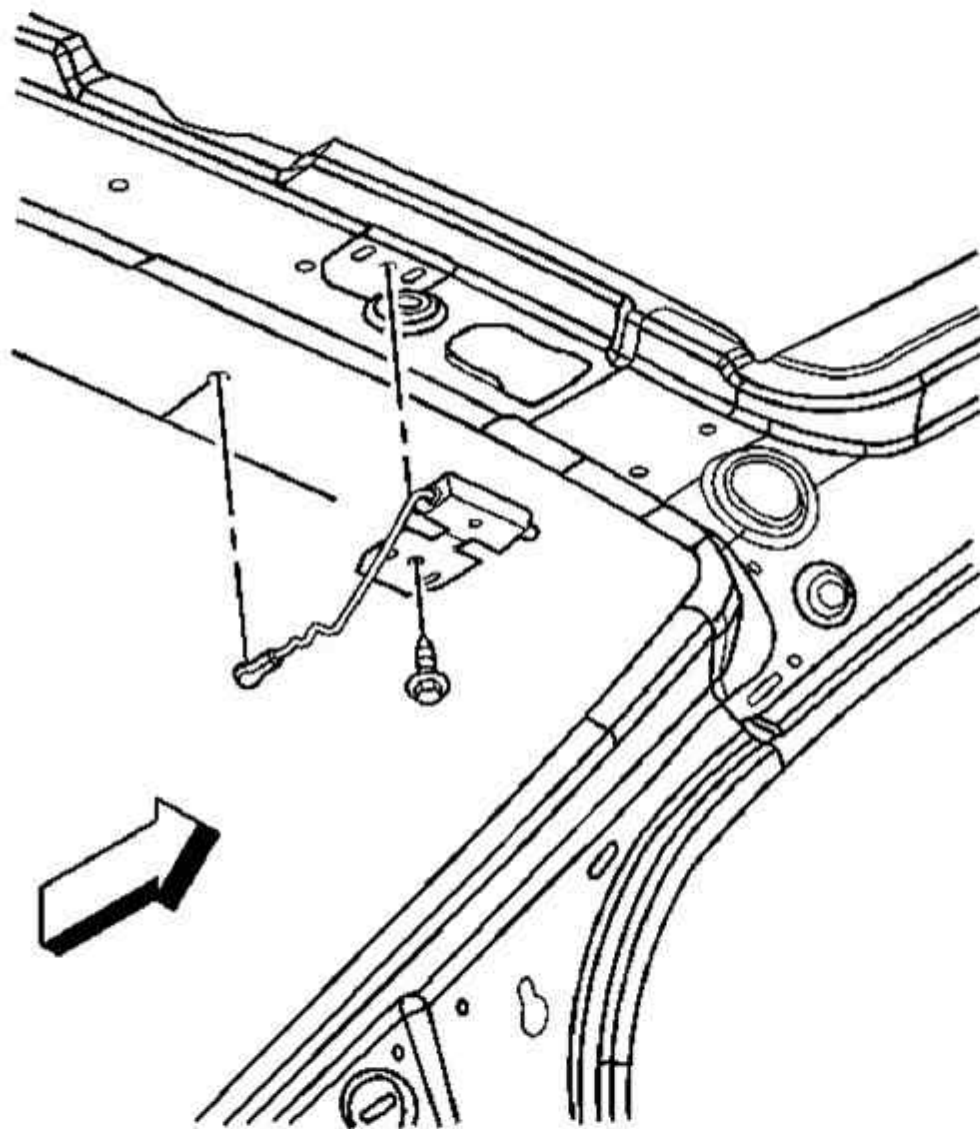
Installation Procedure

Fig. 28: View Of Antenna Module
Courtesy of GENERAL MOTORS CORP.

1. Connect the rear window antenna lead to the rear window antenna connector.
2. Connect the antenna coaxial cable.
3. Connect the antenna module electrical connector.

NOTE: Refer to Fastener Notice .

4. Install the antenna module and the antenna module bolt.

Tighten: Tighten the bolt to 3 N.m (27 lb in).

5. Install the headliner. Refer to Headlining Trim Panel Replacement .

DIGITAL RADIO ANTENNA REPLACEMENT

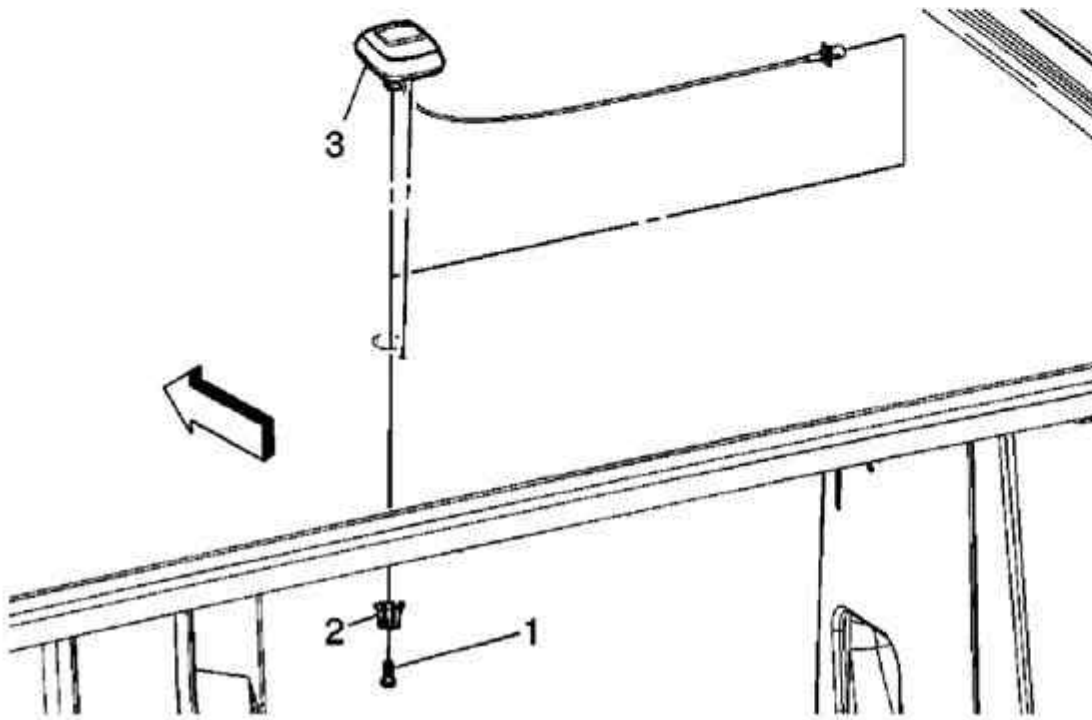


Fig. 29: Identifying Digital Radio Antenna
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Lower the rear of the headliner. Refer to <u>Headlining Trim Panel Replacement</u> .	
1	Digital Radio Antenna Assembly Bolt NOTE: Refer to <u>Fastener Notice</u> . Tip: Disconnect the electrical connections. Tighten: 9 N.m (80 lb in)
2	Digital Radio Antenna Expansion Sleeve
3	Digital Radio Antenna Assembly

DIGITAL RADIO ANTENNA CABLE REPLACEMENT

Removal Procedure

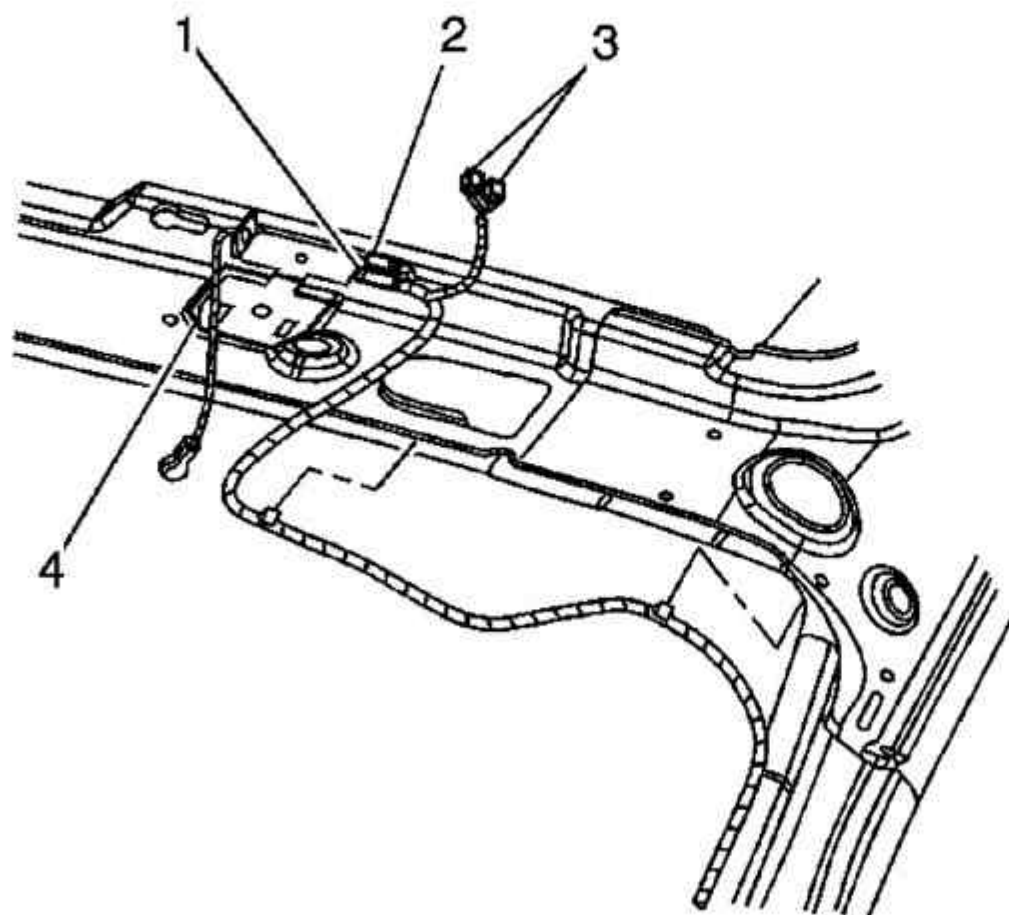


Fig. 30: View Of Radio Antenna Module & Antenna Cable
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear window shelf trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.
2. Lower the rear of the headliner. Refer to **Headlining Trim Panel Replacement**.
3. Disconnect the antenna cable (3) from the antenna base cable connector.
4. Cut off the visible end of the antenna cable.

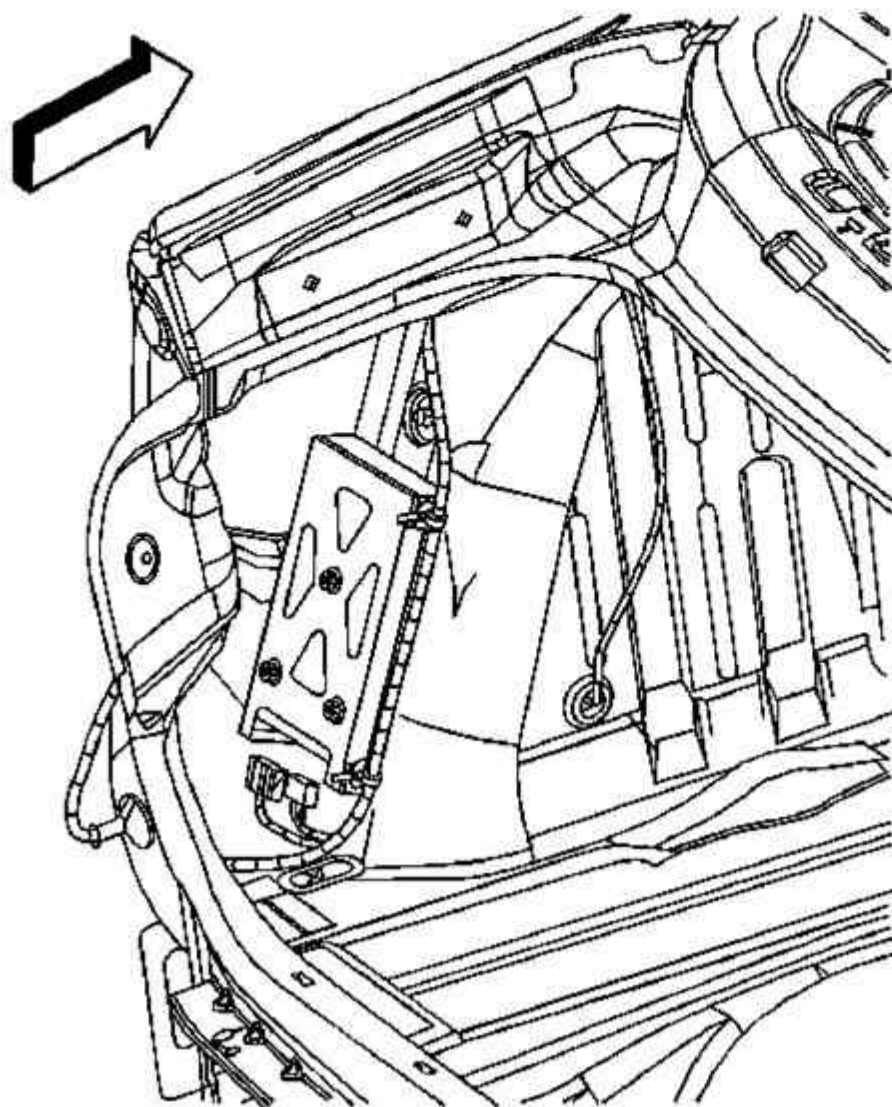


Fig. 31: View Of Digital Radio Receiver
Courtesy of GENERAL MOTORS CORP.

5. Adjust the left rear compartment trim panel for access.
6. Disconnect the antenna cable from the digital radio receiver.
7. Cut off the visible end of the antenna cable.

Installation Procedure

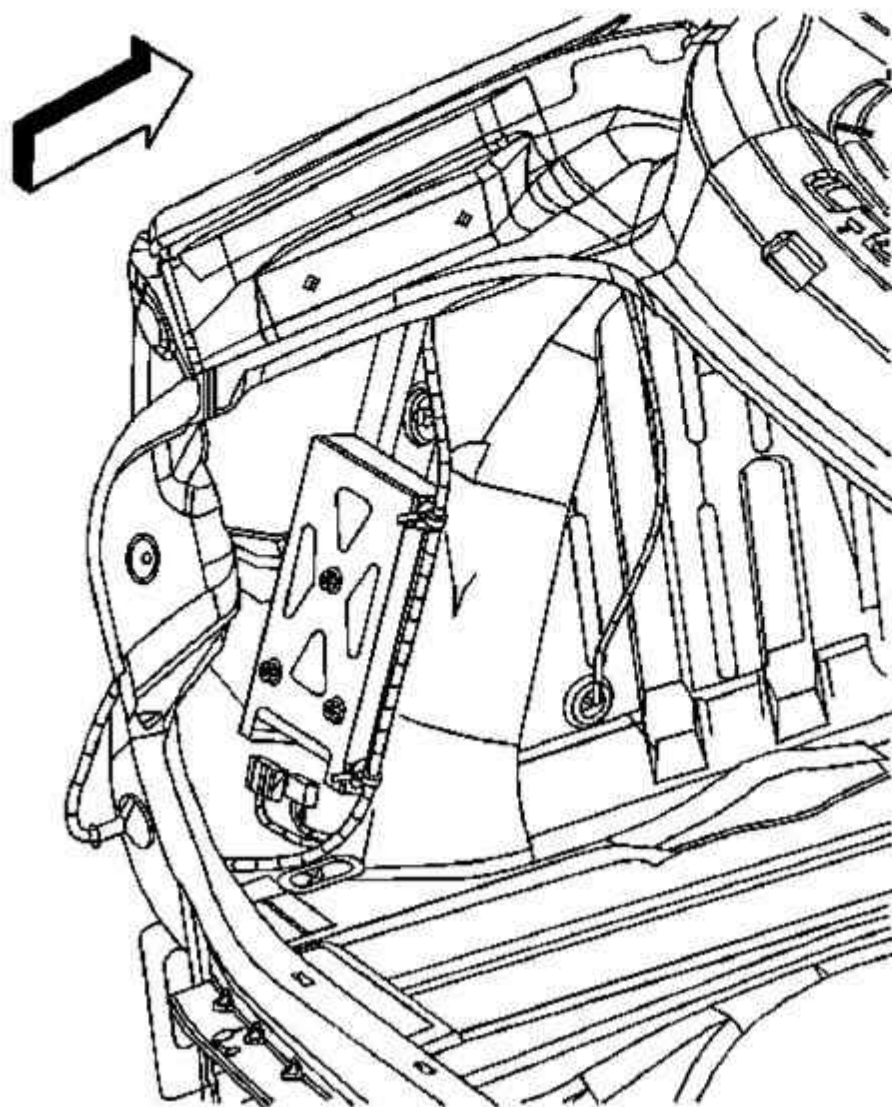


Fig. 32: View Of Digital Radio Receiver
Courtesy of GENERAL MOTORS CORP.

1. Install the new antenna cable to the retainers on the receiver bracket.
2. Connect the antenna cable to the digital radio receiver.
3. Route the antenna cable through the rear seat back pass through into the passenger compartment. Wrap the cable and harness with tape at the pass through to avoid abrasion and rattles.
4. Secure the antenna cable to the wire harness in the rear compartment.
5. Install the rear compartment trim panel.

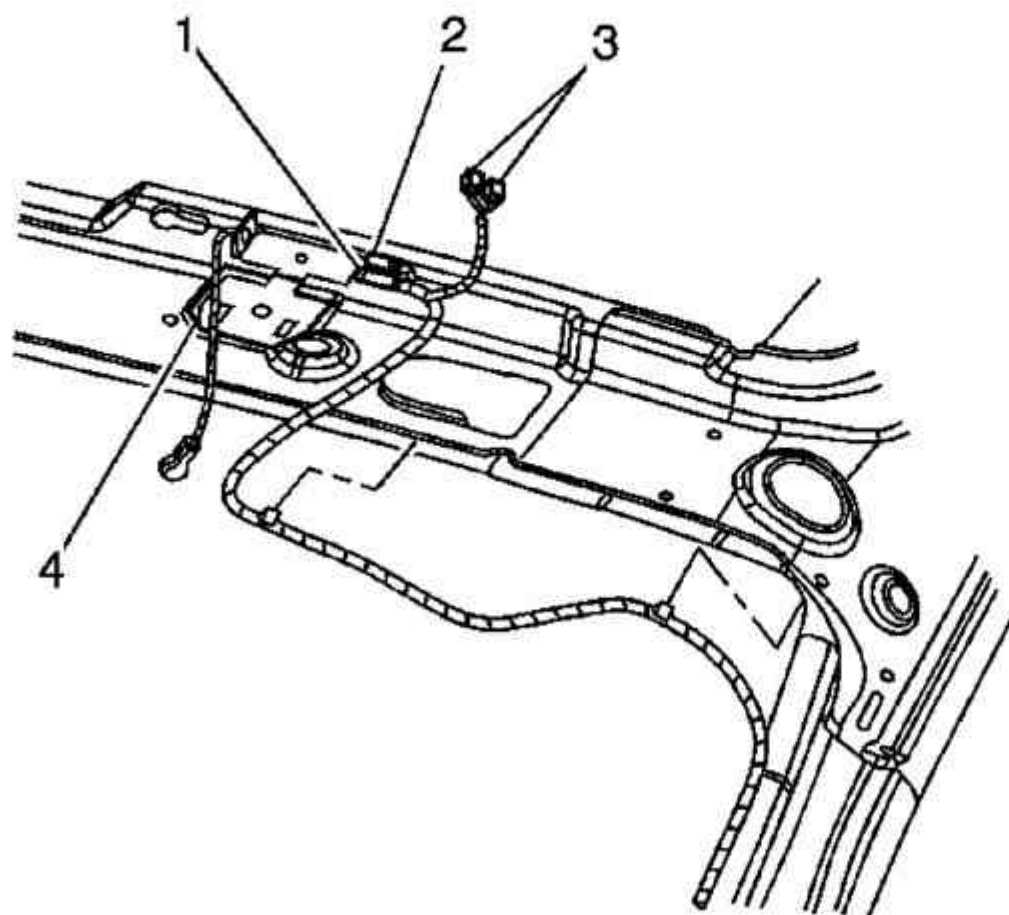


Fig. 33: View Of Radio Antenna Module & Antenna Cable
Courtesy of GENERAL MOTORS CORP.

6. Connect the antenna cable (3) to the antenna base cable connector.
7. Secure the antenna cable to the wire harness.
8. Install the headliner. Refer to **Headlining Trim Panel Replacement**.
9. Install the rear window shelf trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.

ANTENNA CABLE REPLACEMENT

Removal Procedure

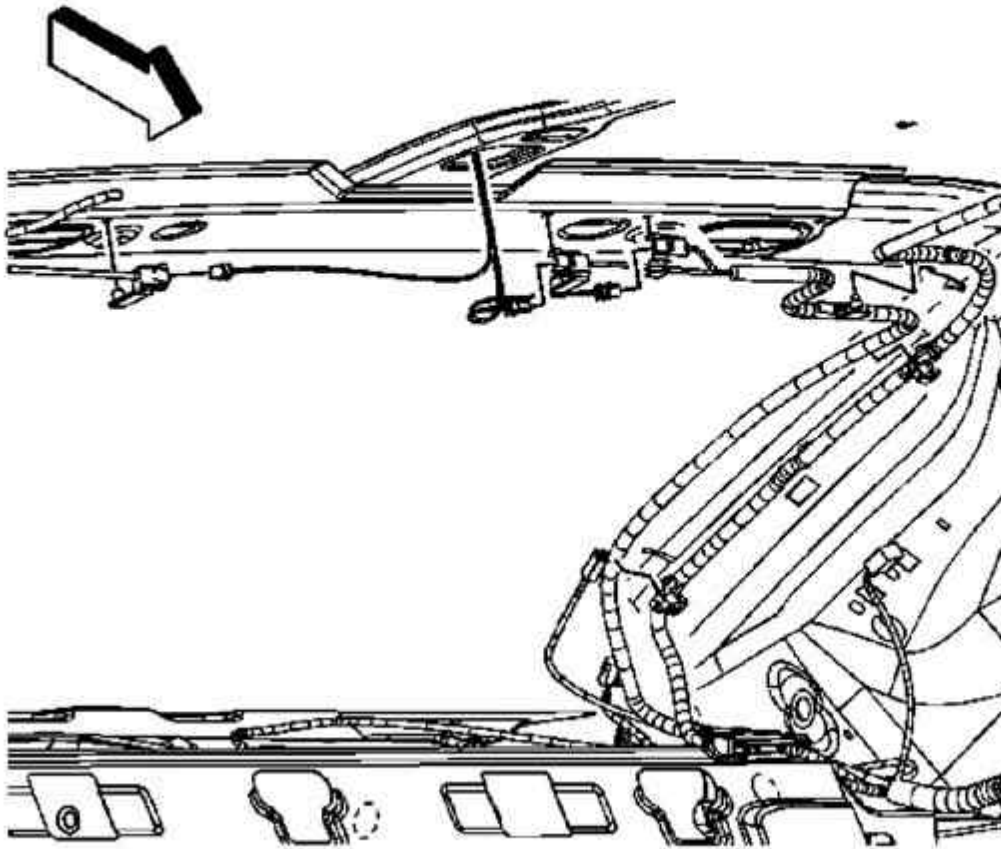


Fig. 34: Locating Antenna Cable & Radio Antenna Module
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear seat cushion. Refer to **Rear Seat Cushion Replacement** .
2. Remove the rear seat back. Refer to **Rear Seat Back Replacement (Folding)** or **Rear Seat Back Replacement (Non-folding)** .
3. Remove the left rear quarter lower panel. Refer to **Rear Quarter Lower Trim Panel Replacement** .
4. Remove the left rear upper quarter trim panel. Refer to **Rear Quarter Upper Trim Panel Replacement** .
5. Lower the rear of the headliner. Refer to **Headlining Trim Panel Replacement** .
6. Disconnect the antenna cable from the radio antenna module.

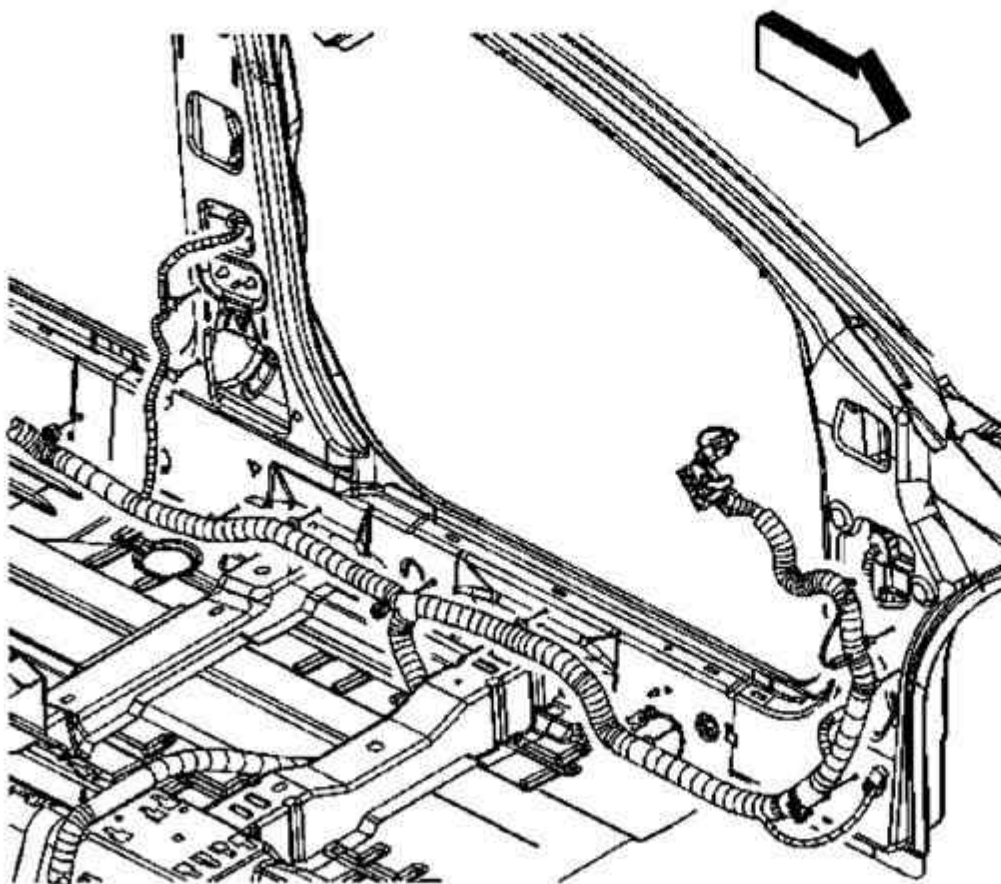


Fig. 35: Identifying Antenna Cable & Body Harness
Courtesy of GENERAL MOTORS CORP.

7. Remove the lower center pillar trim panel. Refer to **Center Pillar Lower Trim Panel Replacement**.
8. Remove the left lower pillar garnish molding. Refer to **Lower Pillar Garnish Molding Replacement**.
9. Adjust the carpet for access to the antenna cable and body harness as required. Refer to **Front Floor Panel Carpet Replacement**.

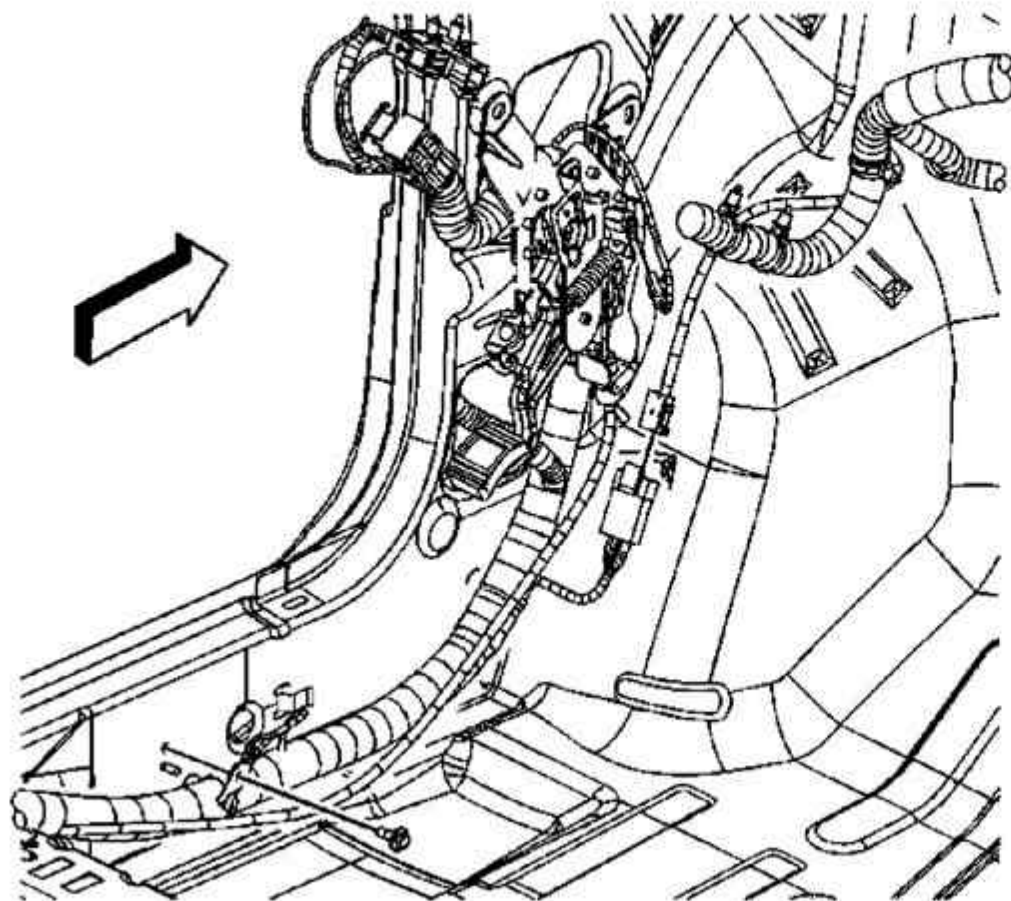


Fig. 36: Identifying Antenna Cable & Antenna Extension Cable
Courtesy of GENERAL MOTORS CORP.

10. Disconnect the antenna cable from the antenna extension cable.
11. Cut off the visible ends of the antenna cable from the wiring harness in the following locations:
 - The lower pillar garnish molding
 - The rear header area

Installation Procedure

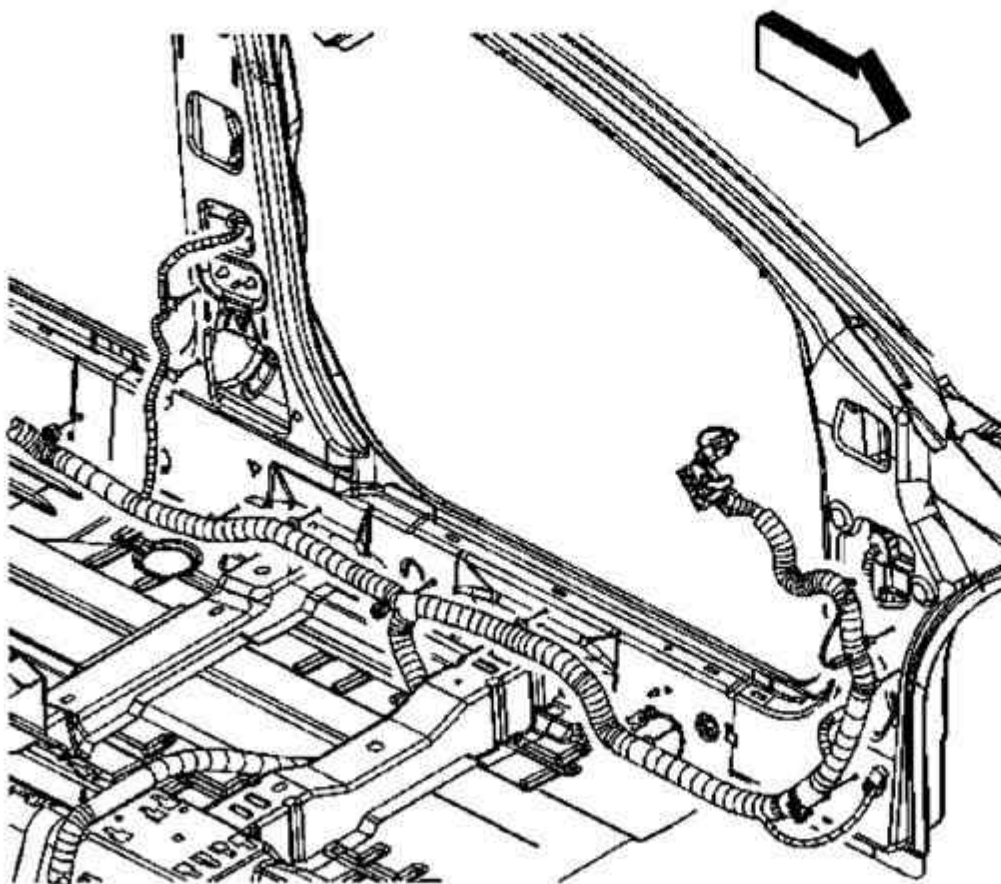


Fig. 37: Identifying Antenna Cable & Body Harness
Courtesy of GENERAL MOTORS CORP.

1. Install the antenna cable to the vehicle. Use electrical tape in order to secure the antenna cable to the top of the wiring harness. Secure the cable to the harness at least every 150 mm (6 in).

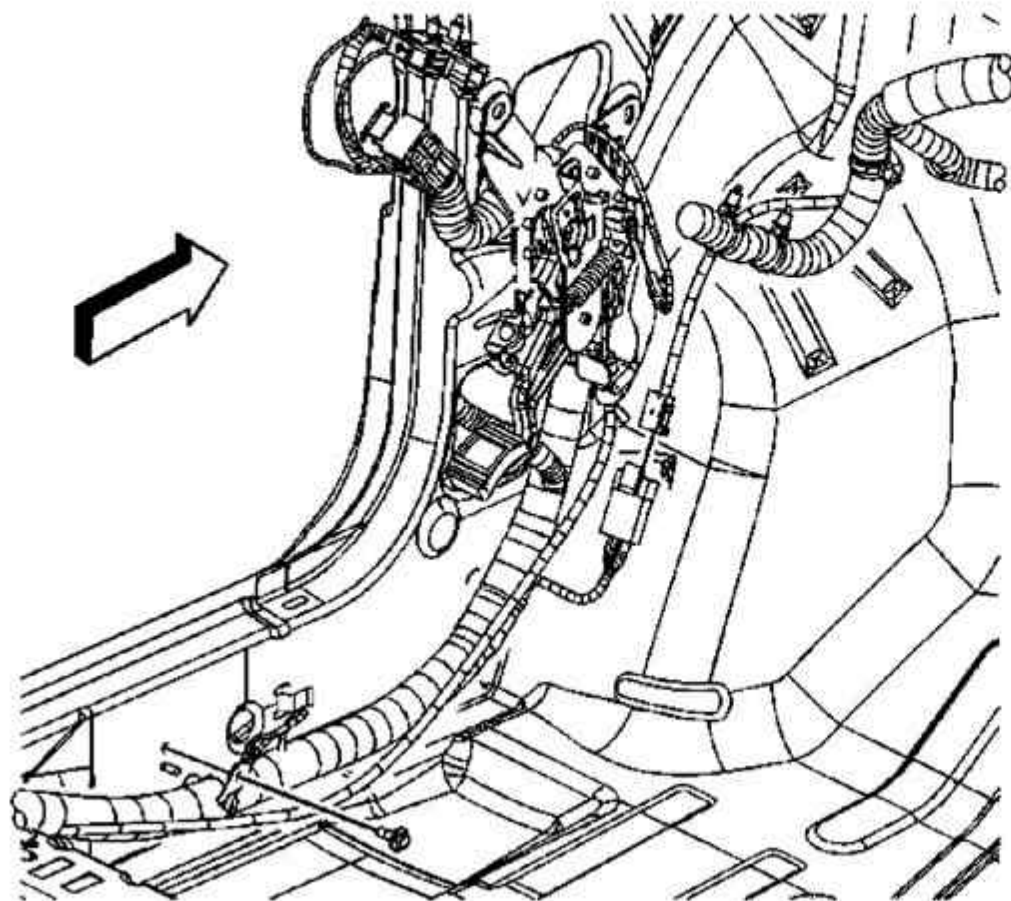


Fig. 38: Identifying Antenna Cable & Antenna Extension Cable
Courtesy of GENERAL MOTORS CORP.

2. Connect the antenna cable to the antenna extension cable.
3. Install the carpet. Refer to **Front Floor Panel Carpet Replacement**.
4. Install the lower center pillar trim panel. Refer to **Center Pillar Lower Trim Panel Replacement**.
5. Install the left lower pillar garnish molding. Refer to **Lower Pillar Garnish Molding Replacement**.

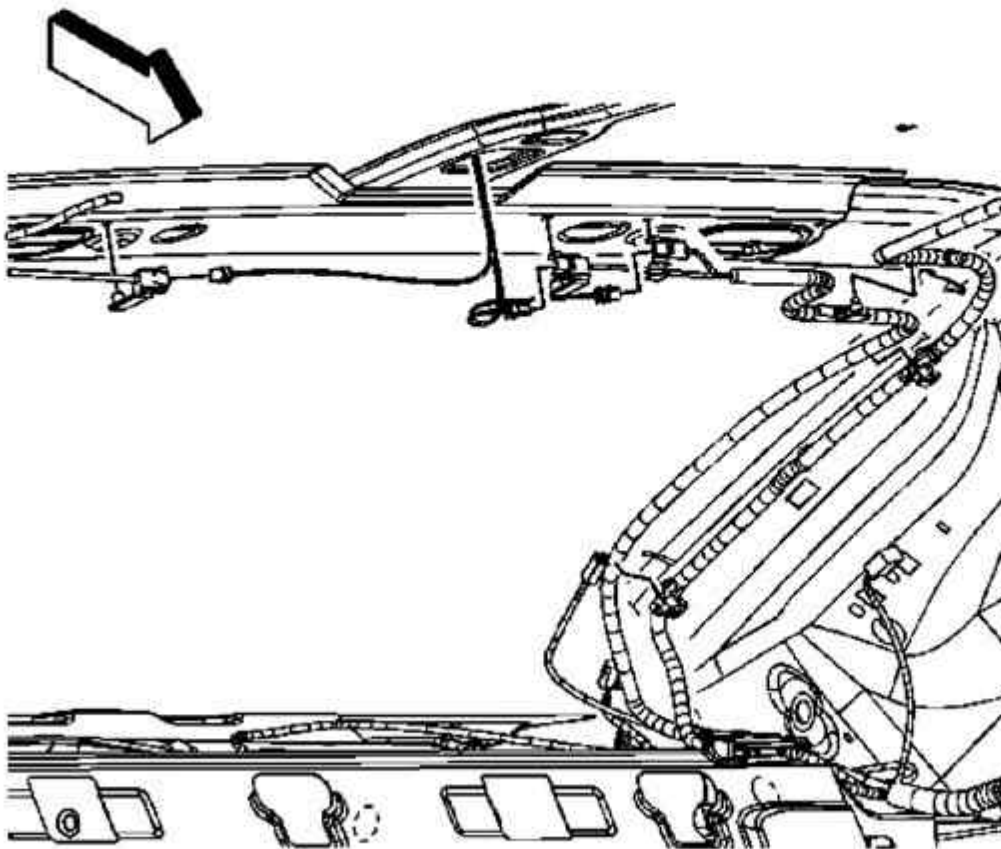


Fig. 39: Locating Antenna Cable & Radio Antenna Module
Courtesy of GENERAL MOTORS CORP.

6. Connect the antenna cable to the radio antenna module
7. Install the headliner. Refer to Headlining Trim Panel Replacement.
8. Install the left rear upper quarter trim panel. Refer to Rear Quarter Upper Trim Panel Replacement.
9. Install the left rear quarter lower trim panel. Refer to Rear Quarter Lower Trim Panel Replacement.
10. Install the rear seat back. Refer to Rear Seat Back Replacement (Folding) or Rear Seat Back Replacement (Non-folding).
11. Install the rear seat cushion. Refer to Rear Seat Cushion Replacement.

RADIO ANTENNA CABLE EXTENSION CABLE REPLACEMENT

Removal Procedure

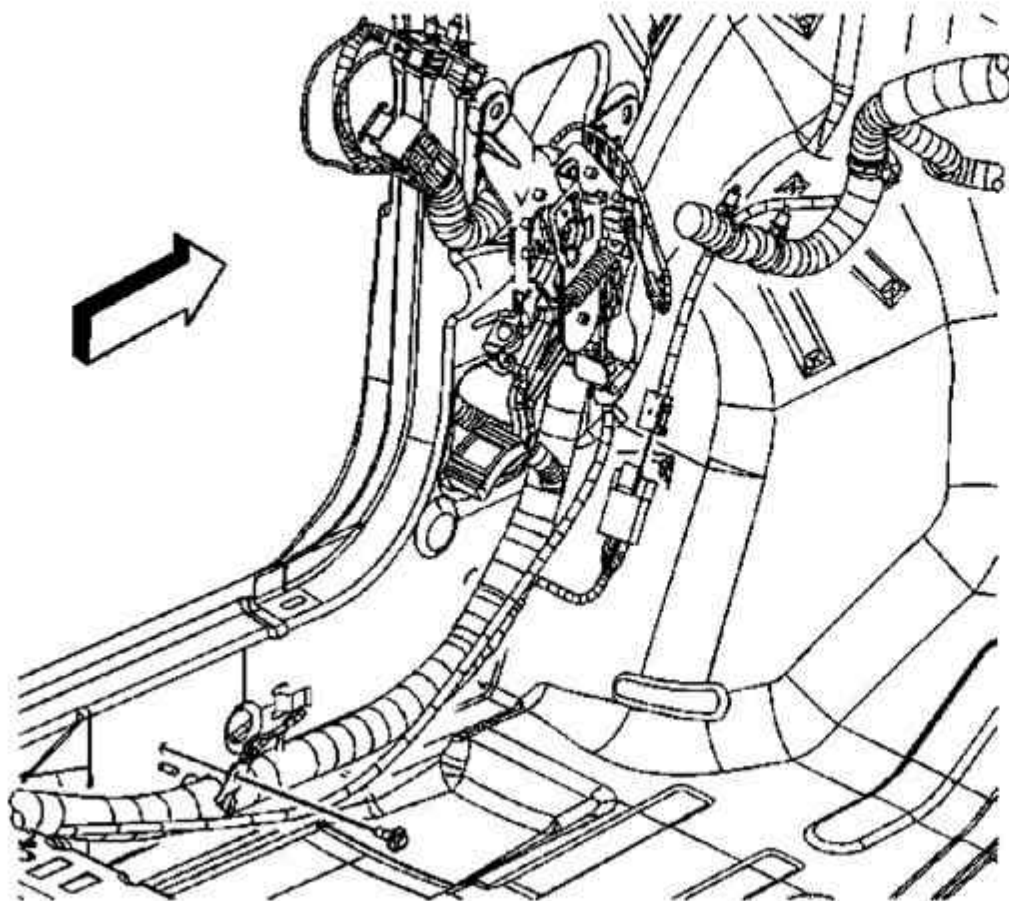


Fig. 40: Identifying Antenna Cable & Antenna Extension Cable
Courtesy of GENERAL MOTORS CORP.

1. Remove the left lower pillar garnish molding. Refer to **Lower Pillar Garnish Molding Replacement**.
2. Remove the left instrument panel (I/P) insulator. Refer to **Instrument Panel Insulator Panel Replacement - Left Side**.
3. Disconnect the antenna extension cable from the antenna cable.

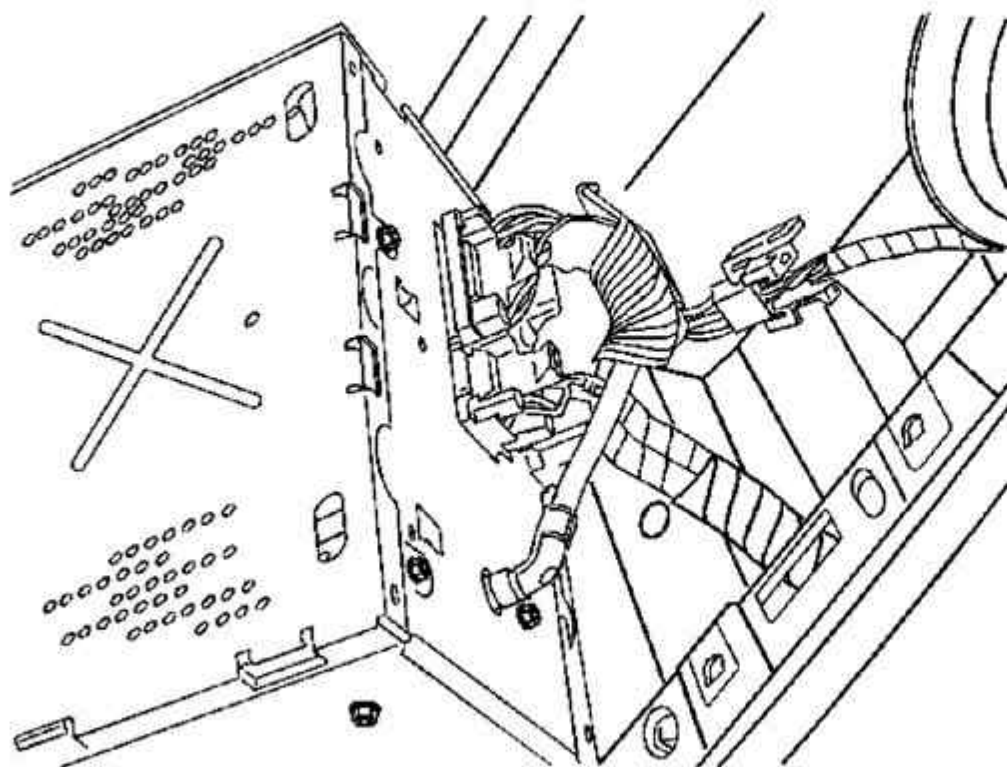


Fig. 41: View Of Instrument Panel Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

4. Remove the radio. Refer to **Radio Replacement**.
5. Cut off the visible ends of the antenna extension cable.

Installation Procedure

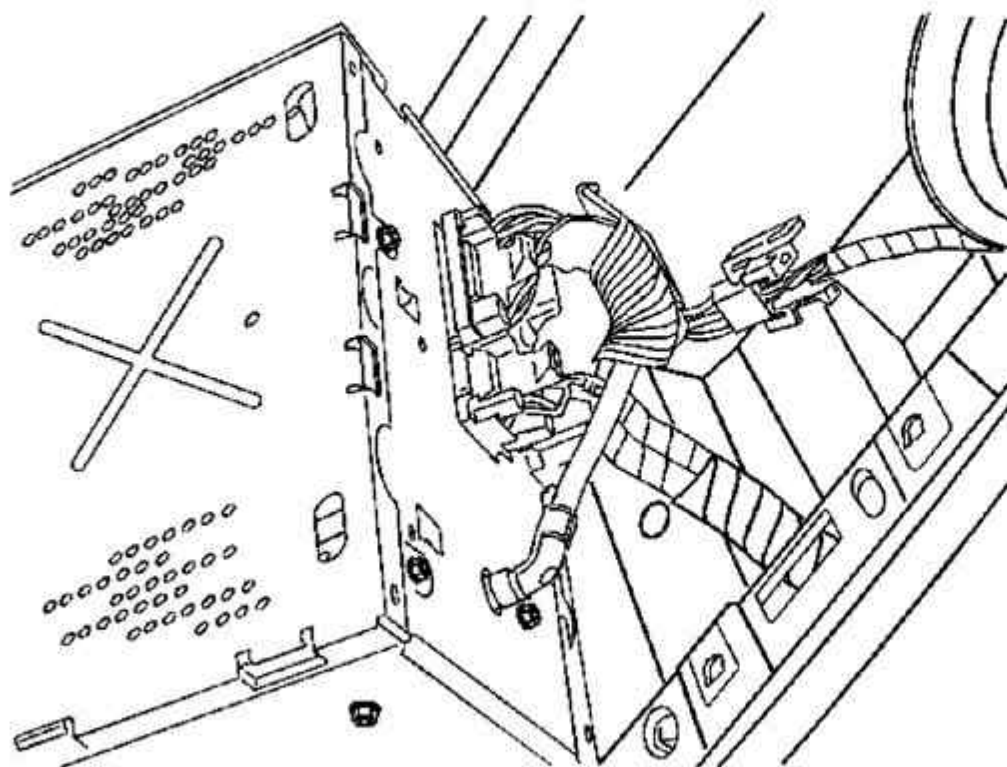


Fig. 42: View Of Instrument Panel Wiring Harness Connectors
Courtesy of GENERAL MOTORS CORP.

1. Route the antenna extension cable. Secure the cable.
2. Connect the antenna extension cable to the radio. Install the radio. Refer to **Radio Replacement**.

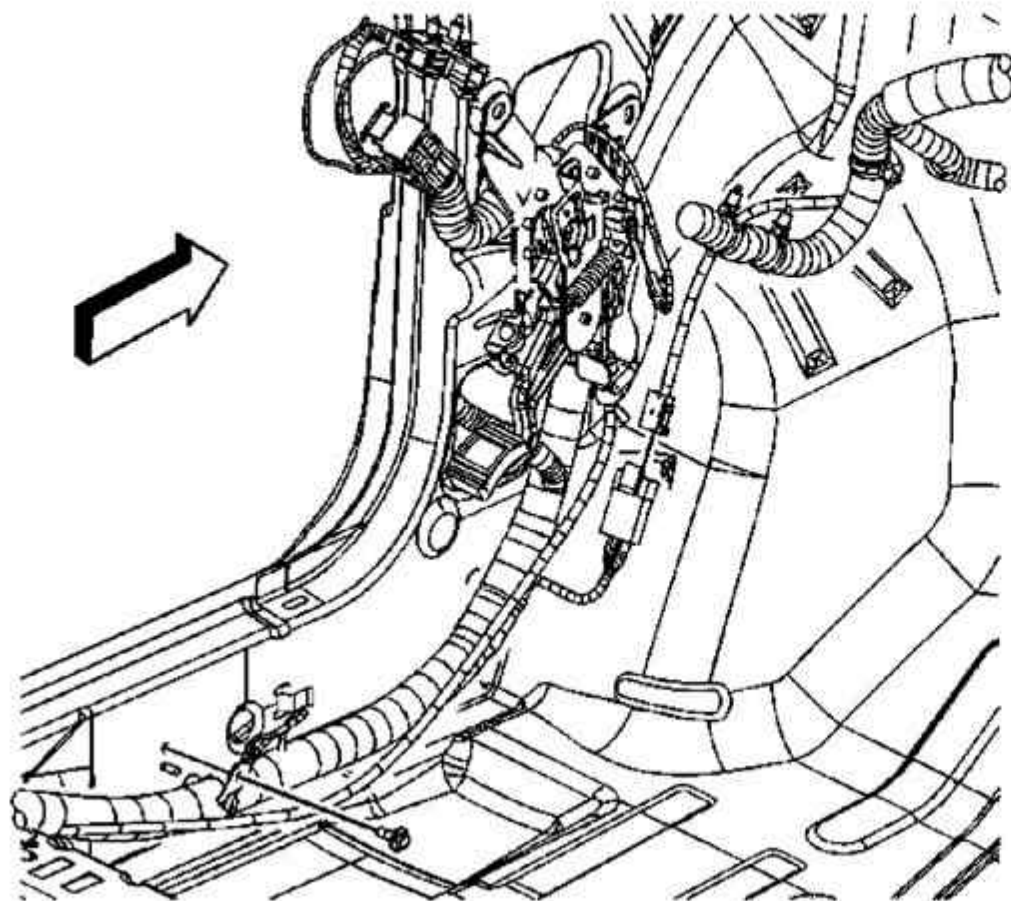


Fig. 43: Identifying Antenna Cable & Antenna Extension Cable
Courtesy of GENERAL MOTORS CORP.

3. Connect the antenna extension cable from the radio to the antenna cable.
4. Install the left lower pillar garnish molding. Refer to **Lower Pillar Garnish Molding Replacement**.
5. Install the left I/P insulator. Refer to **Instrument Panel Insulator Panel Replacement - Left Side**.

MOBILE TELEPHONE AND NAVIGATION ANTENNA COAXIAL CABLE REPLACEMENT

Removal Procedure

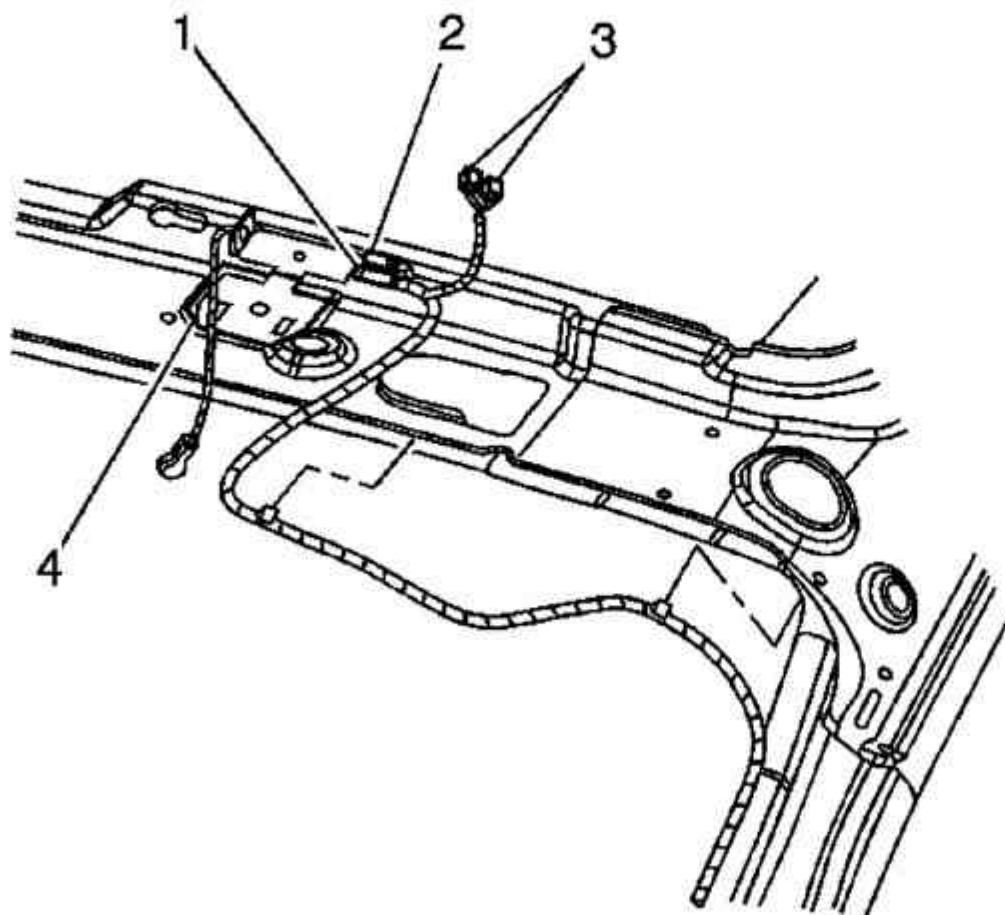


Fig. 44: View Of Radio Antenna Module & Antenna Cable
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear seat cushion. Refer to **Rear Seat Cushion Replacement** .
2. Remove the rear seat back. Refer to **Rear Seat Back Replacement (Folding)** or **Rear Seat Back Replacement (Non-folding)** .
3. Remove the lower pillar trim panel. Refer to **Lower Pillar Garnish Molding Replacement** .
4. Remove the left rear quarter lower panel. Refer to **Rear Quarter Lower Trim Panel Replacement** .
5. Remove the left rear upper quarter trim panel. Refer to **Rear Quarter Upper Trim Panel Replacement** .
6. Lower the rear of the headliner. Refer to **Headlining Trim Panel Replacement** .
7. Disconnect the antenna cable (2) from the radio antenna module.
8. Remove the lower center pillar trim panel. Refer to **Center Pillar Lower Trim Panel Replacement** .
9. Adjust the carpet for access to the antenna cable (1) and body harness as required. Refer to **Front Floor Panel Carpet Replacement** .

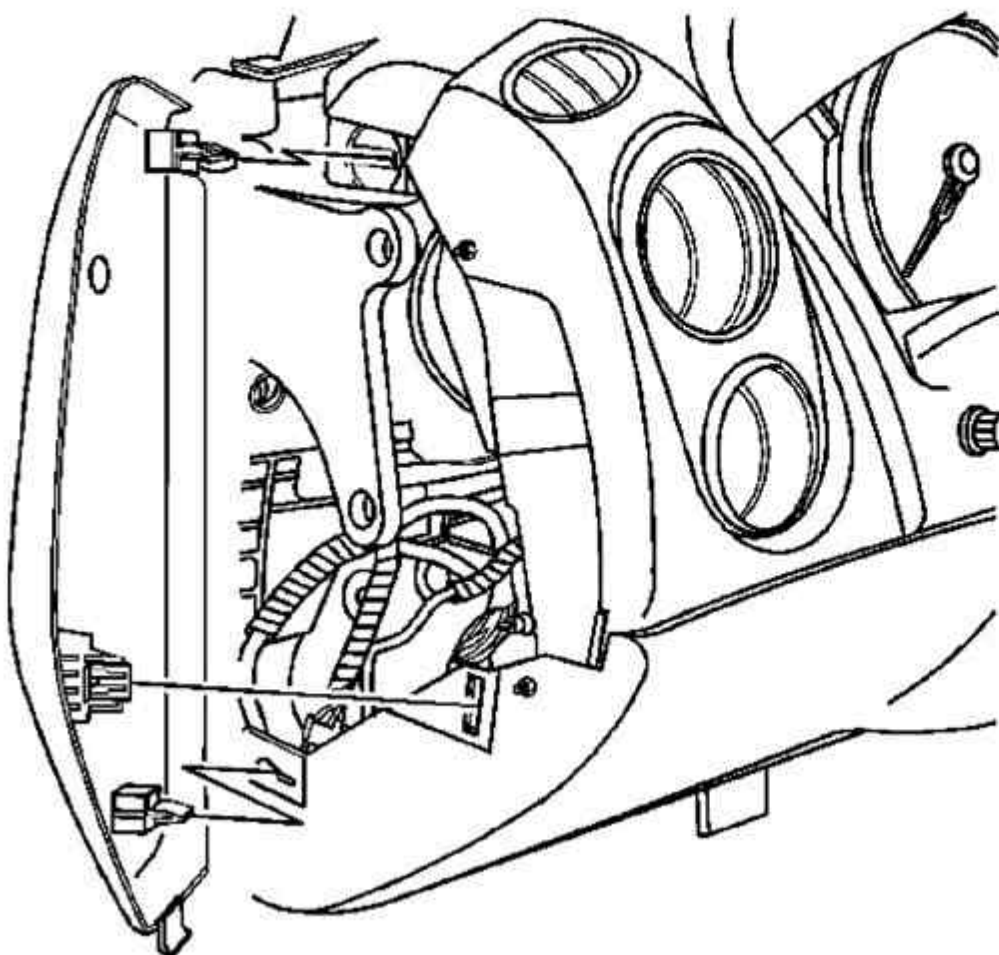


Fig. 45: View Of Left Instrument Panel Outer Trim Cover
Courtesy of GENERAL MOTORS CORP.

10. Remove the left instrument panel (I/P) compartment access hole cover.
11. Disconnect the antenna cable from the antenna extension cable.
12. Cut off the visible ends of the antenna cable from the wiring harness in the following locations:
 - The kick panel area
 - The rear header area

Installation Procedure

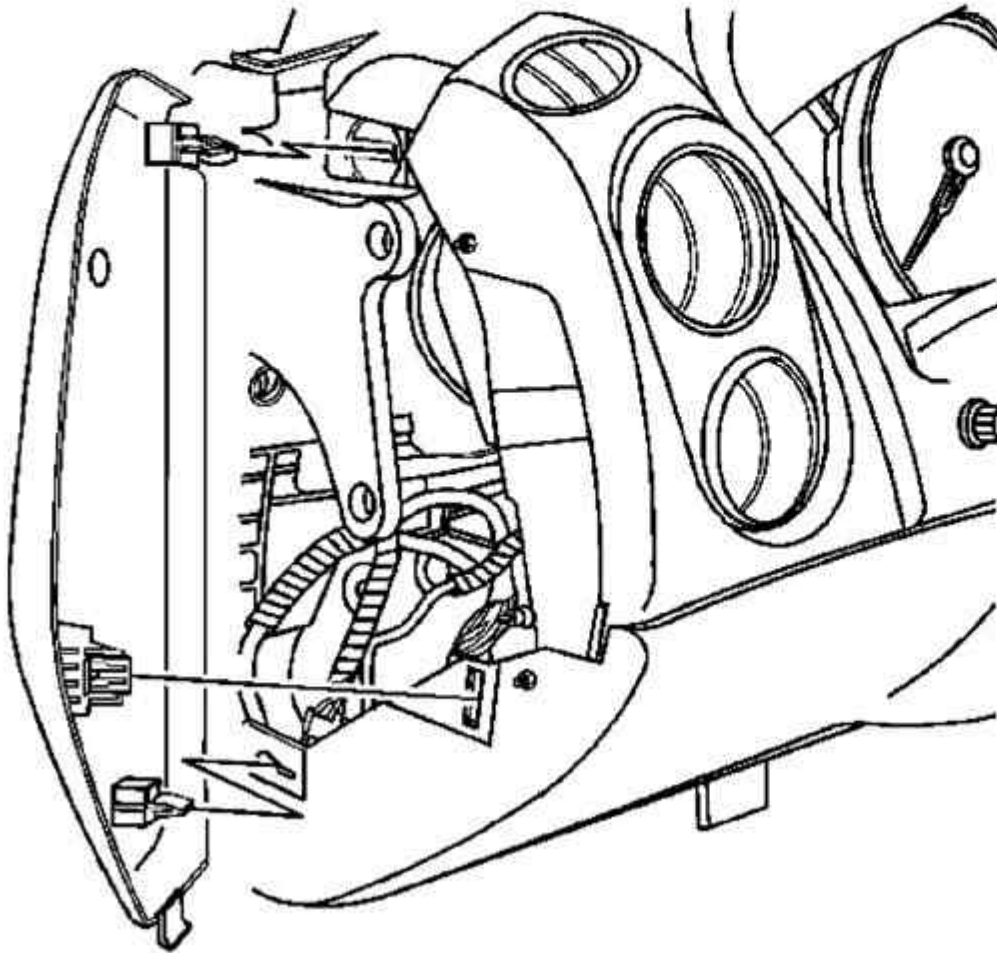


Fig. 46: View Of Left Instrument Panel Outer Trim Cover
Courtesy of GENERAL MOTORS CORP.

1. Install the antenna cable to the vehicle. Use electrical tape in order to secure the antenna cable to the top of the wiring harness. Secure the cable to the harness at least every 150 mm (6 in).
2. Connect the antenna cable to the antenna extension cable.
3. Install the left I/P compartment access hole cover.
4. Install the carpet. Refer to **Front Floor Panel Carpet Replacement**.
5. Install the lower center pillar trim panel. Refer to **Center Pillar Lower Trim Panel Replacement**.

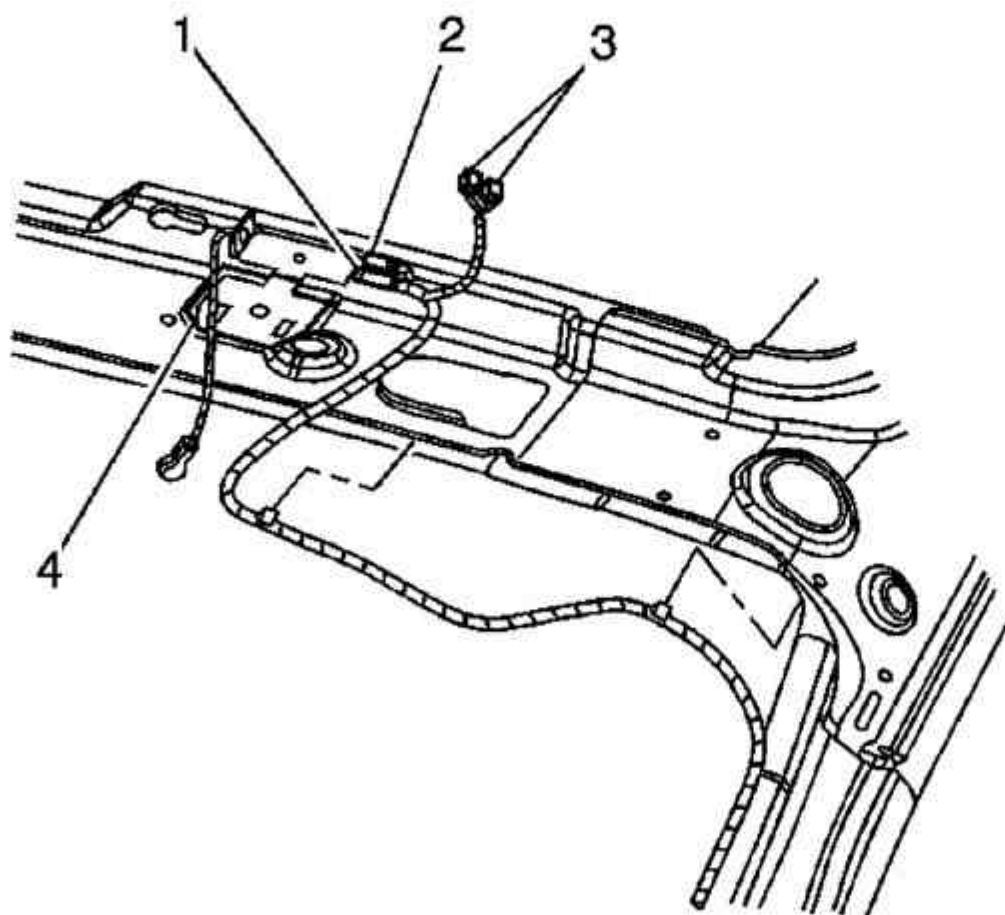


Fig. 47: View Of Radio Antenna Module & Antenna Cable
Courtesy of GENERAL MOTORS CORP.

6. Connect the antenna cable (2) to the radio antenna module
7. Install the headliner. Refer to Headlining Trim Panel Replacement .
8. Install the left rear upper quarter trim panel. Refer to Rear Quarter Upper Trim Panel Replacement .
9. Install the left rear quarter lower panel. Refer to Rear Quarter Lower Trim Panel Replacement .
10. Install the lower pillar trim panel. Refer to Lower Pillar Garnish Molding Replacement .
11. Install the rear seat back. Refer to Rear Seat Back Replacement (Folding) or Rear Seat Back Replacement (Non-folding) .
12. Install the rear seat cushion. Refer to Rear Seat Cushion Replacement .

RADIO FRONT SPEAKER GRILLE REPLACEMENT

Removal Procedure

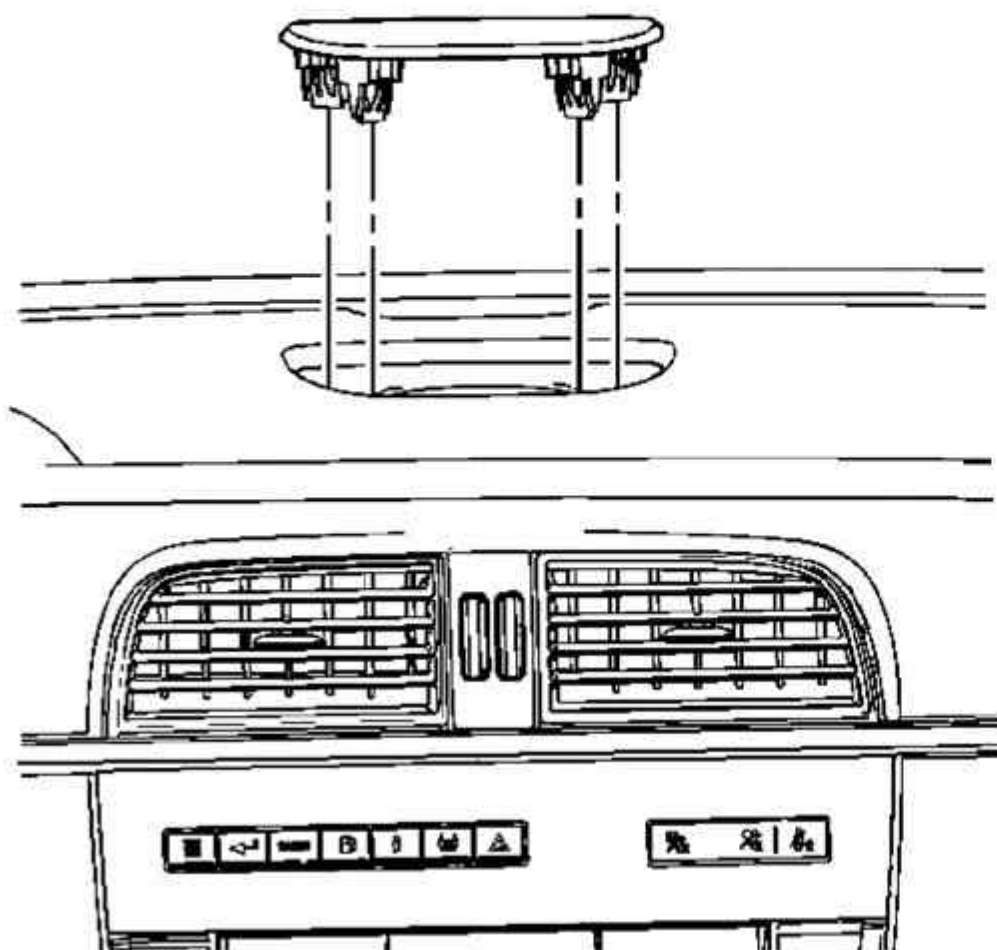


Fig. 48: View Of Front Speaker Grille
Courtesy of GENERAL MOTORS CORP.

1. Carefully disengage the speaker grille retainers.
2. Remove the speaker grille.

Installation Procedure

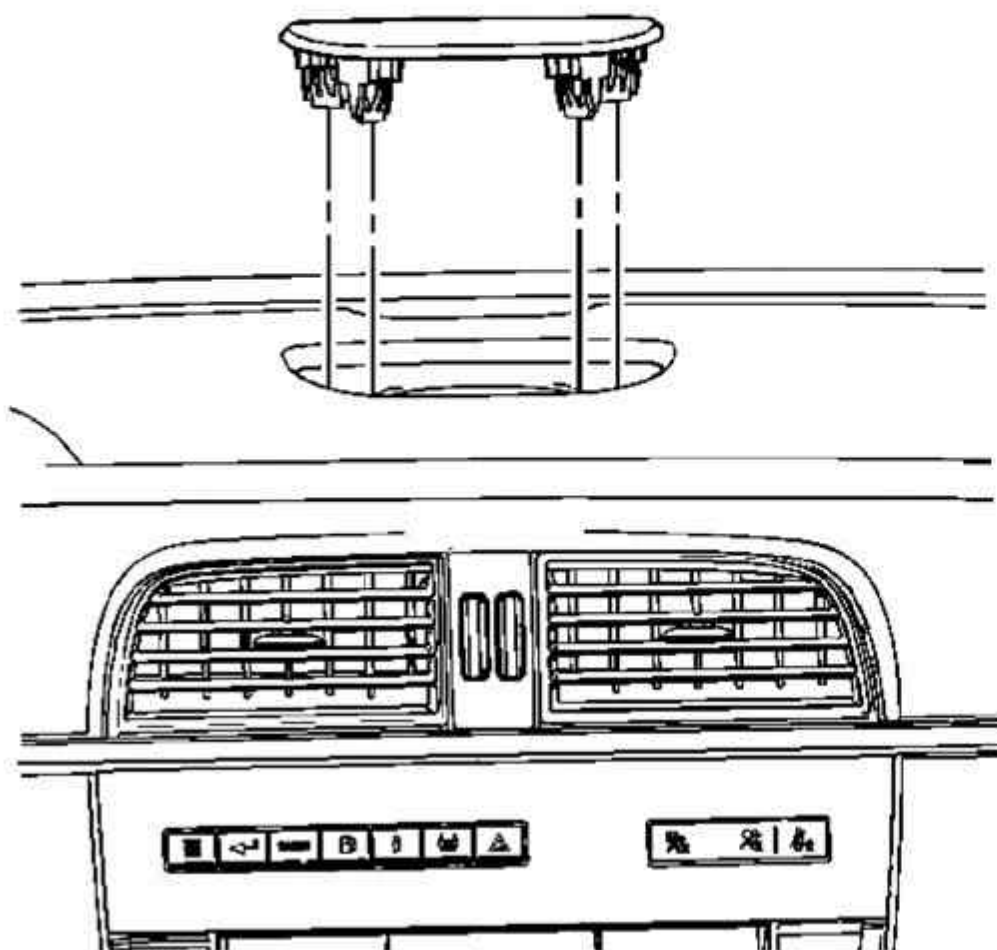


Fig. 49: View Of Front Speaker Grille
Courtesy of GENERAL MOTORS CORP.

1. Align the speaker grille to the instrument panel (I/P). Make sure the logo is facing the driver.
2. Press the speaker grille into the I/P.

RADIO FRONT SIDE DOOR SPEAKER GRILLE REPLACEMENT

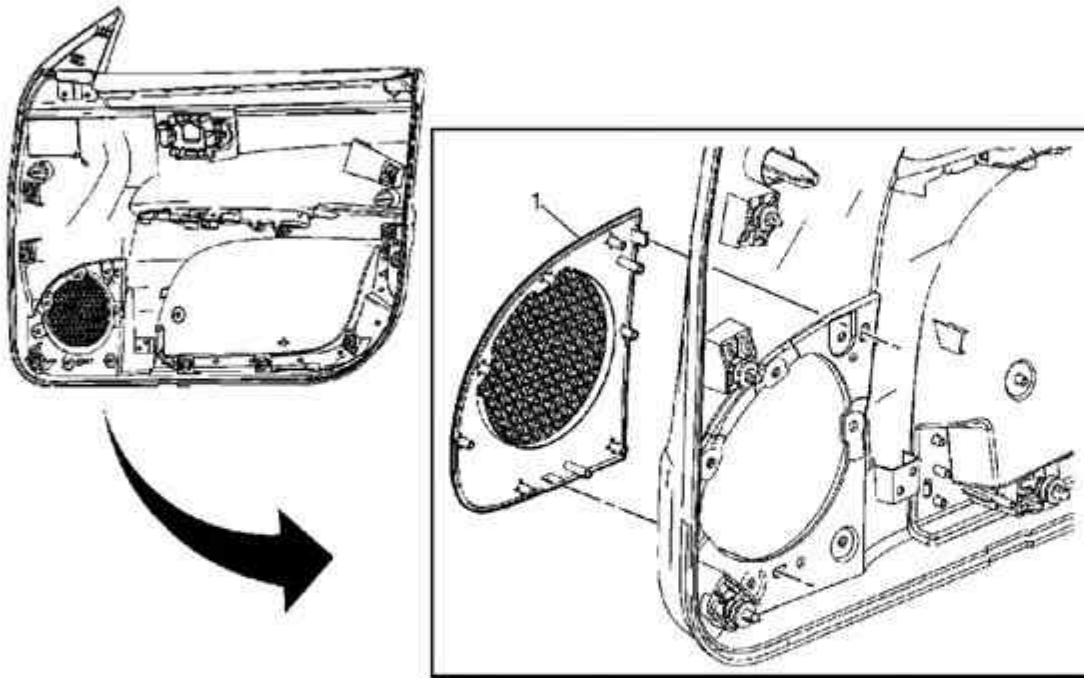


Fig. 50: Identifying Front Door Speaker Grille
 Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the front door trim panel. Refer to Front Side Door Trim Panel Replacement .	
1	Front Side Door Speaker Grille Assembly Tip: 1. Use a 9/32 in (7 mm) drill bit to drill out the heat stakes that retain the speaker grille to the door panel, being careful to not enlarge the hole in the door panel. 2. Push on the integral clips to disengage the grille from the door panel. 3. To install the new speaker grille, hold the grille tight to the panel and use a socket and driver to push the fasteners on all of the posts.

RADIO REAR SPEAKER GRILLE REPLACEMENT

Removal Procedure

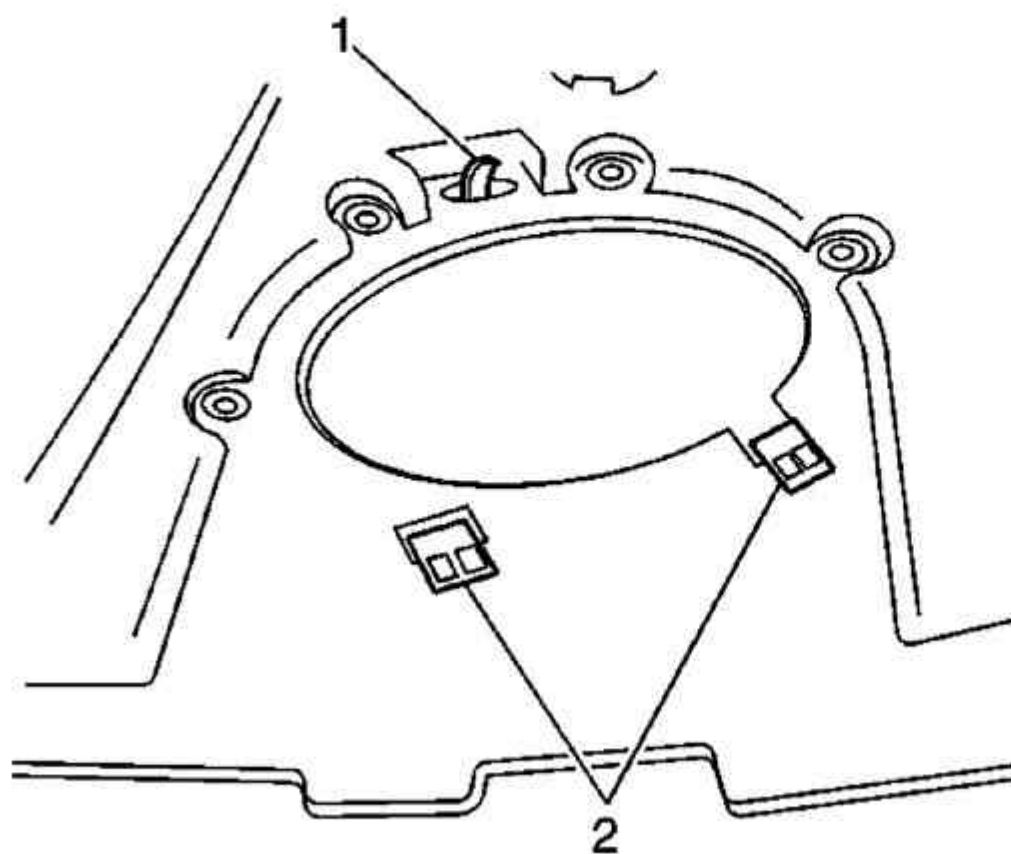


Fig. 51: View Of Rear Speaker Grille
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear window shelf trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.
2. Release the rear speaker grille retainer (1).
3. Remove the rear speaker grille.

Installation Procedure

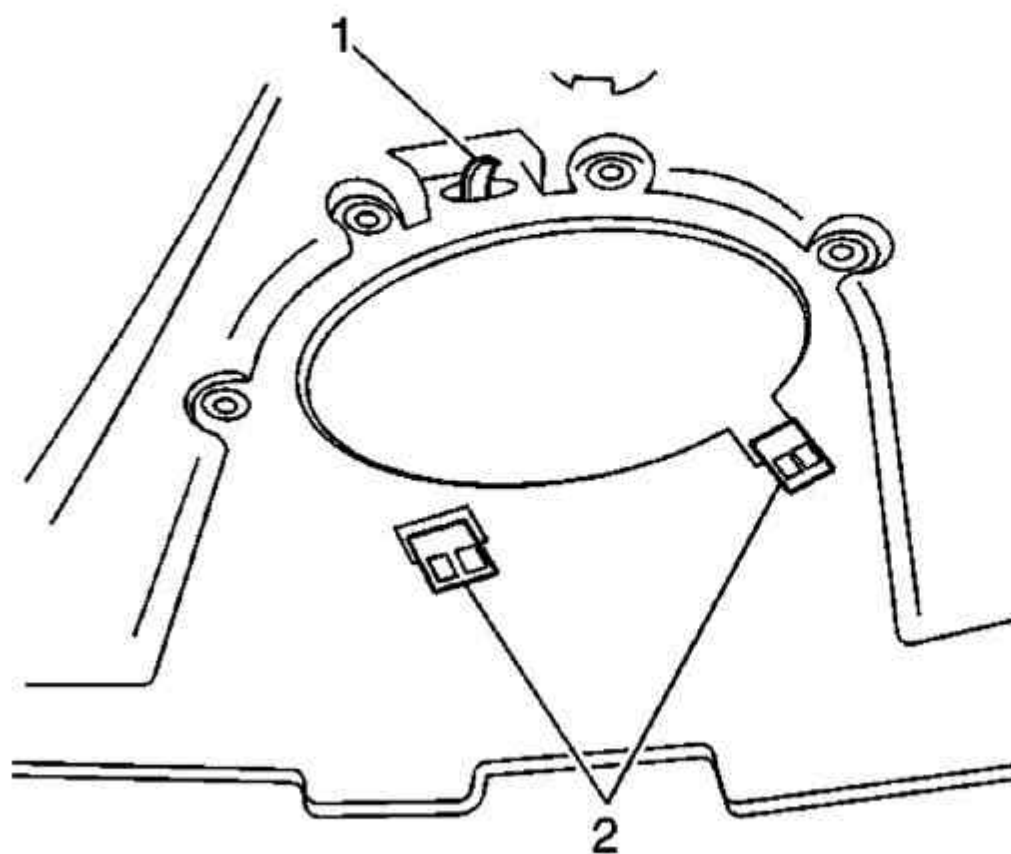


Fig. 52: View Of Rear Speaker Grille
Courtesy of GENERAL MOTORS CORP.

1. Install the rear speaker grille to the rear window shelf trim panel. Ensure the retainer (1) is completely engaged.
2. Install the rear window shelf trim panel. Refer to [Rear Window Shelf Trim Panel Replacement](#) .

RADIO FRONT SPEAKER REPLACEMENT

Removal Procedure

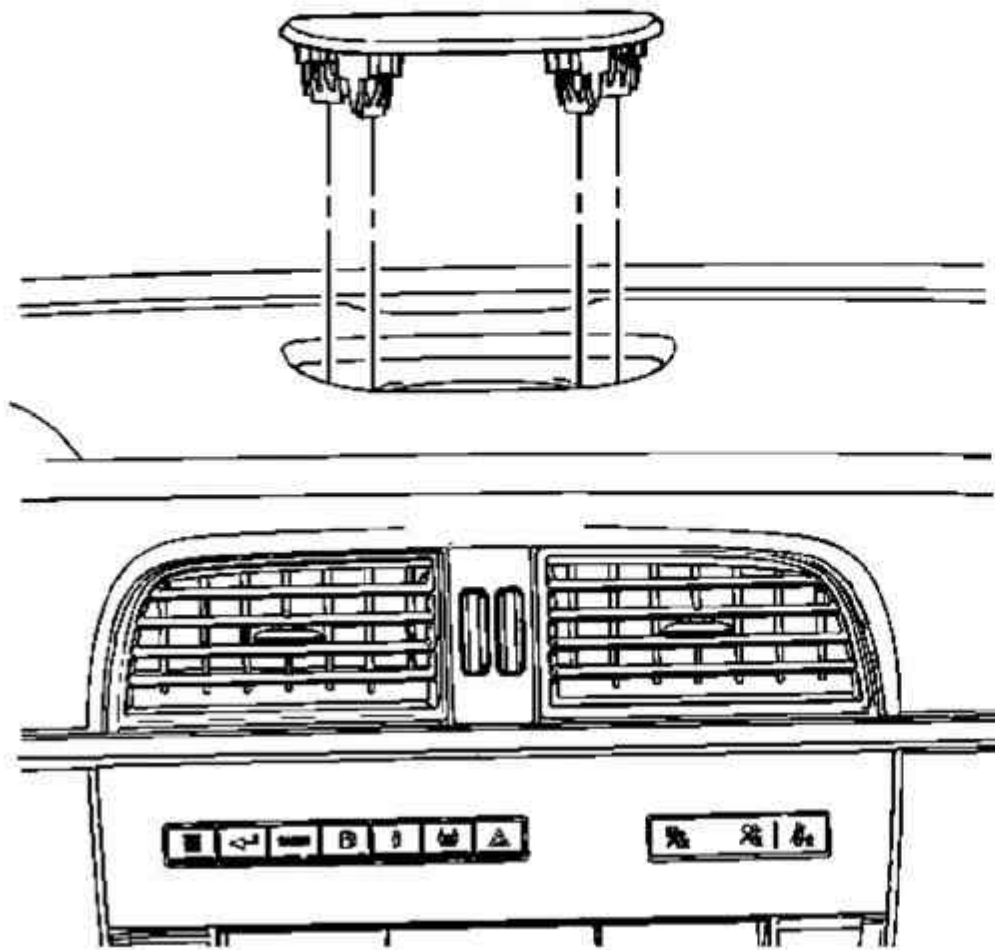


Fig. 53: Identifying Front Speaker Grille
Courtesy of GENERAL MOTORS CORP.

1. Remove the front speaker grille from the instrument panel (I/P).

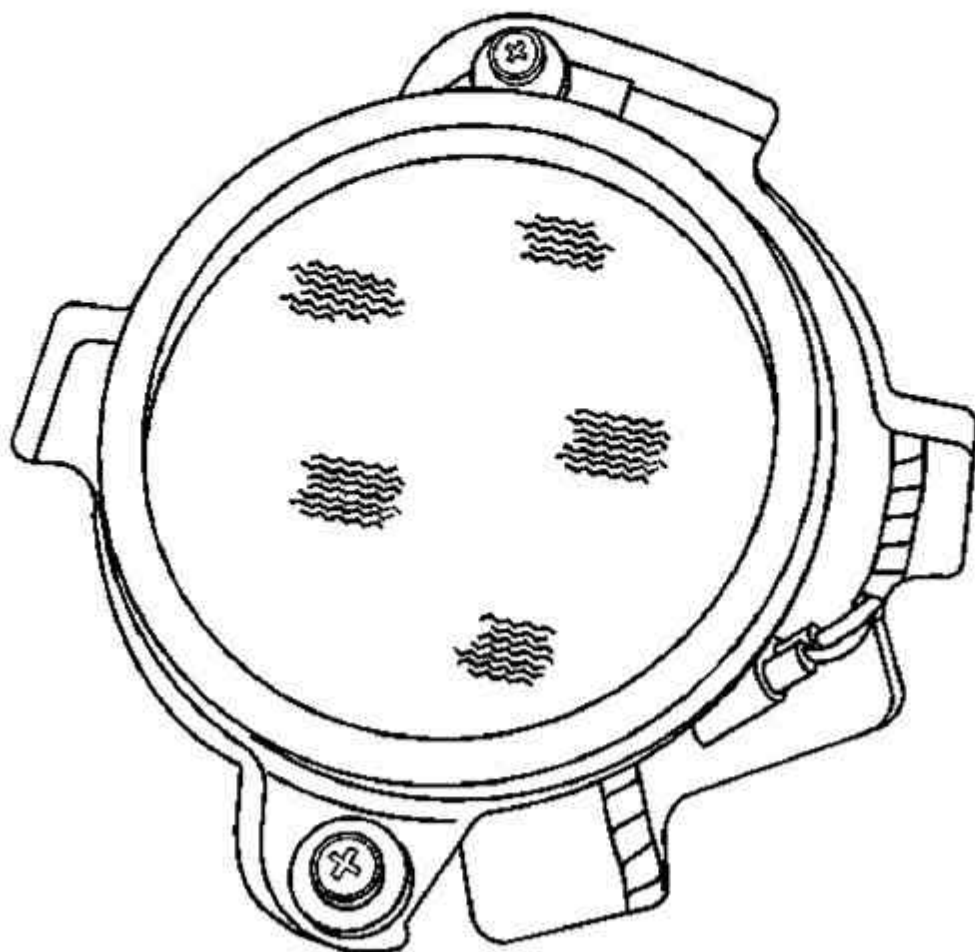


Fig. 54: View Of Center Speaker
Courtesy of GENERAL MOTORS CORP.

2. Remove the front speaker screws.

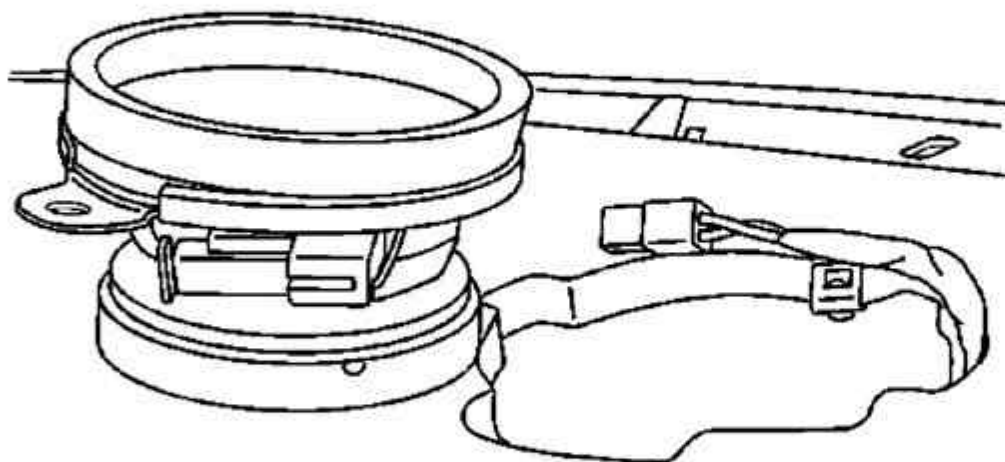


Fig. 55: View Of Center Speaker & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

3. Lift the speaker out of the opening. Disconnect the electrical connector.
4. Remove the center speaker.

Installation Procedure

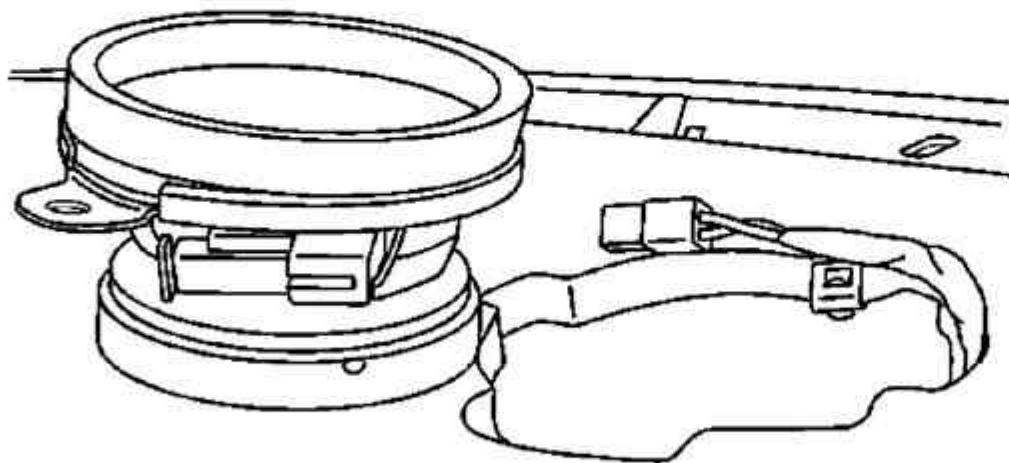


Fig. 56: View Of Center Speaker & Electrical Connector
Courtesy of GENERAL MOTORS CORP.

1. Connect the front speaker electrical connector to the front speaker.

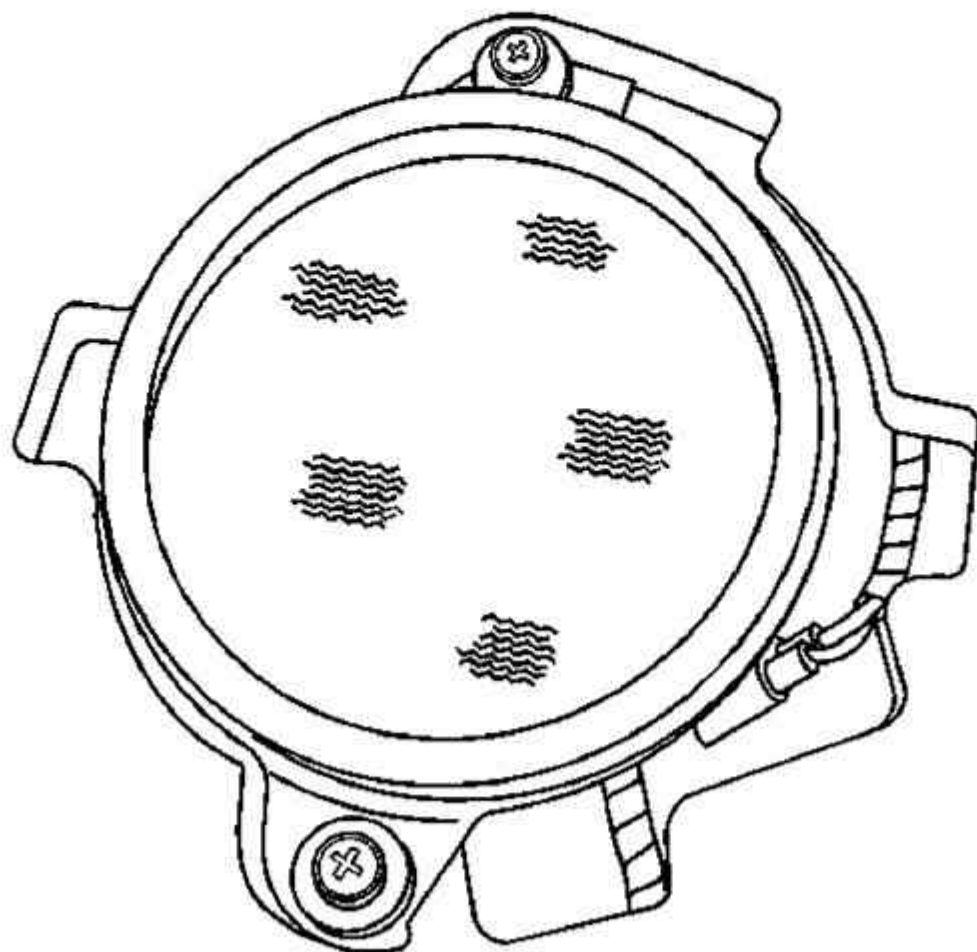


Fig. 57: View Of Center Speaker
Courtesy of GENERAL MOTORS CORP.

2. Lower the speaker into the opening in the I/P.

NOTE: Refer to Fastener Notice .

3. Install the center speaker screws.

Tighten: Tighten the screws to 2 N.m (18 lb in).

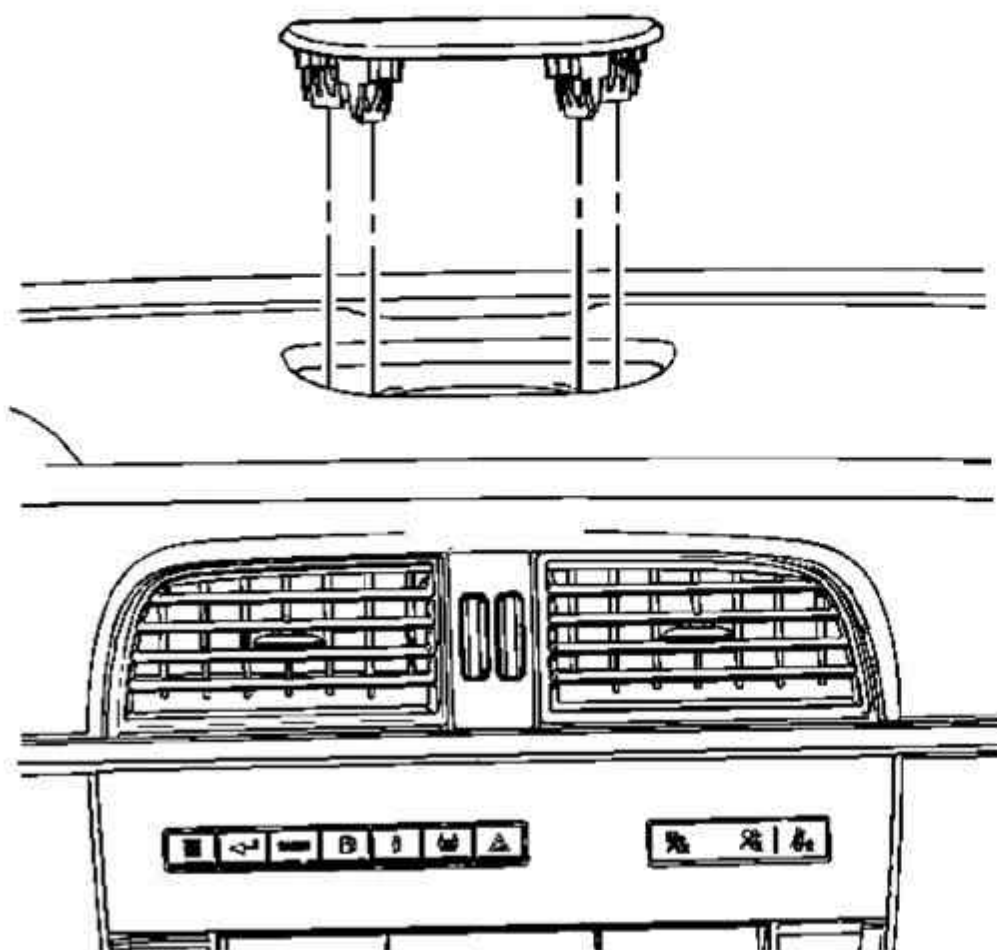


Fig. 58: Identifying Front Speaker Grille
Courtesy of GENERAL MOTORS CORP.

4. Align the speaker grille to the I/P.
5. Press the speaker grille into the I/P.

FRONT UPPER SPEAKER REPLACEMENT

Removal Procedure

1. Remove the end cap on the side of the instrument panel (I/P).
2. Pull out to remove the tweeter speaker wire clip from the I/P.
3. Disconnect the speaker wire from the I/P electrical harness.
4. Remove the windshield garnish molding. Refer to Windshield Pillar Garnish Molding Replacement.

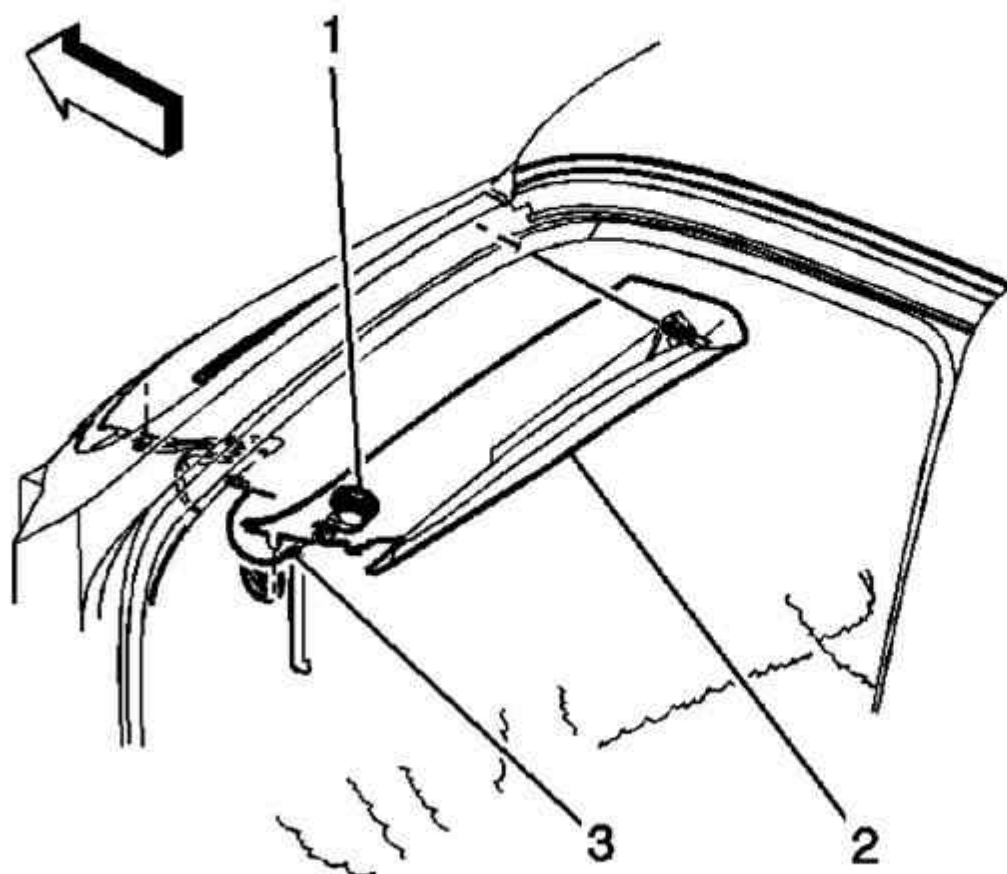


Fig. 59: Identifying Front Windshield Pillar Speaker
Courtesy of GENERAL MOTORS CORP.

5. Pull the speaker wire up through the I/P.
6. Remove the speaker from the vehicle.

Installation Procedure

1. Position the speaker on the I/P.
2. Slide the wire down through the I/P to the end cap.
3. Connect the wire to the I/P harness.
4. Press the wire clip onto the I/P.
5. Press the end cap onto the I/P.

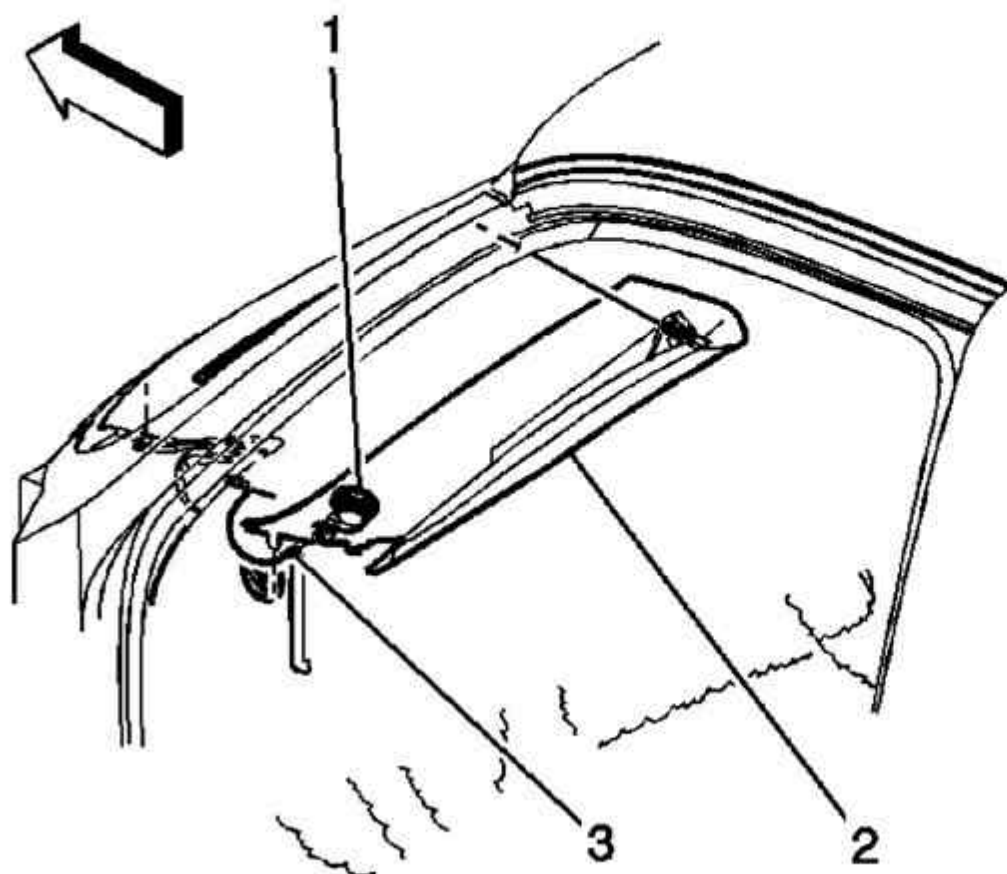


Fig. 60: Identifying Front Windshield Pillar Speaker
Courtesy of GENERAL MOTORS CORP.

6. Press in the speaker (1) until it is fully seated on the garnish molding.
7. Install the windshield garnish molding (2). Refer to Windshield Pillar Garnish Molding Replacement.

RADIO FRONT SIDE DOOR SPEAKER REPLACEMENT

Removal Procedure

1. Remove the front door trim panel. Refer to Front Side Door Trim Panel Replacement.

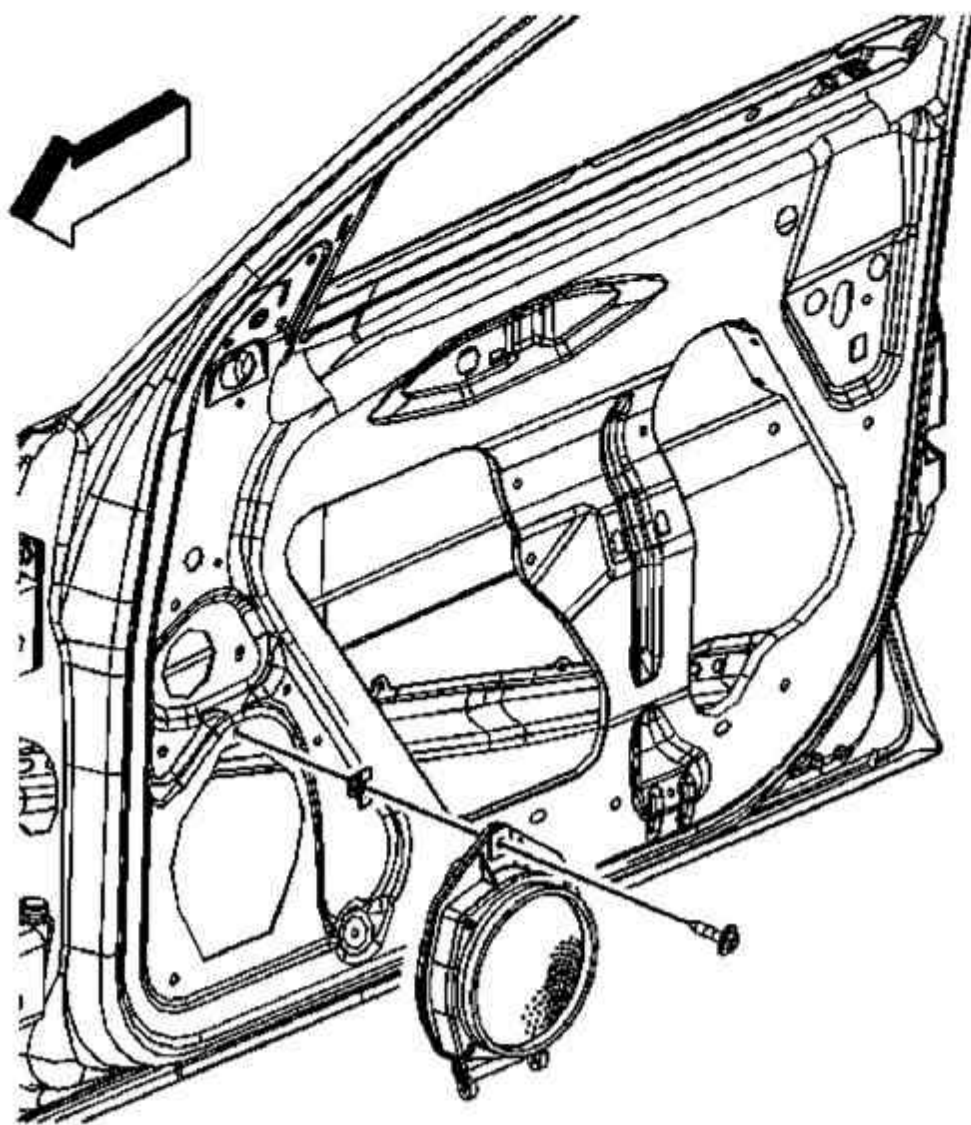


Fig. 61: View Of Front Door Speaker
Courtesy of GENERAL MOTORS CORP.

2. Remove the front door speaker retaining screw.
3. Disconnect the electrical connector from the front door speaker.
4. Remove the speaker from the front door.

Installation Procedure

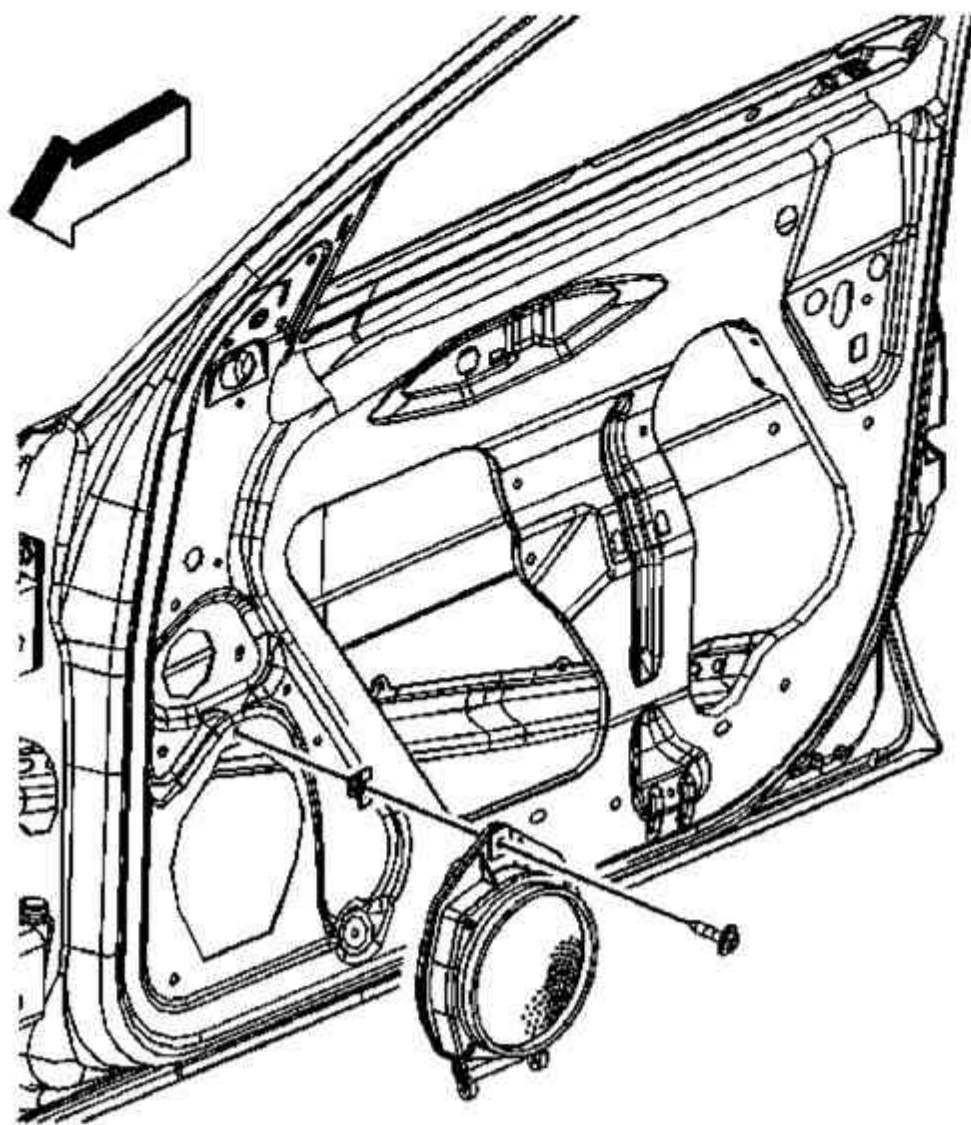


Fig. 62: View Of Front Door Speaker
Courtesy of GENERAL MOTORS CORP.

1. Connect the electrical connector to the front door speaker.
2. Install the speaker to the front door.

NOTE: Refer to Fastener Notice .

3. Install the front door speaker retaining screw.

Tighten: Tighten the front door speaker retaining screw to 2 N.m (18 lb in).

4. Install the front door trim panel. Refer to Front Side Door Trim Panel Replacement .

RADIO REAR SPEAKER REPLACEMENT

Removal Procedure

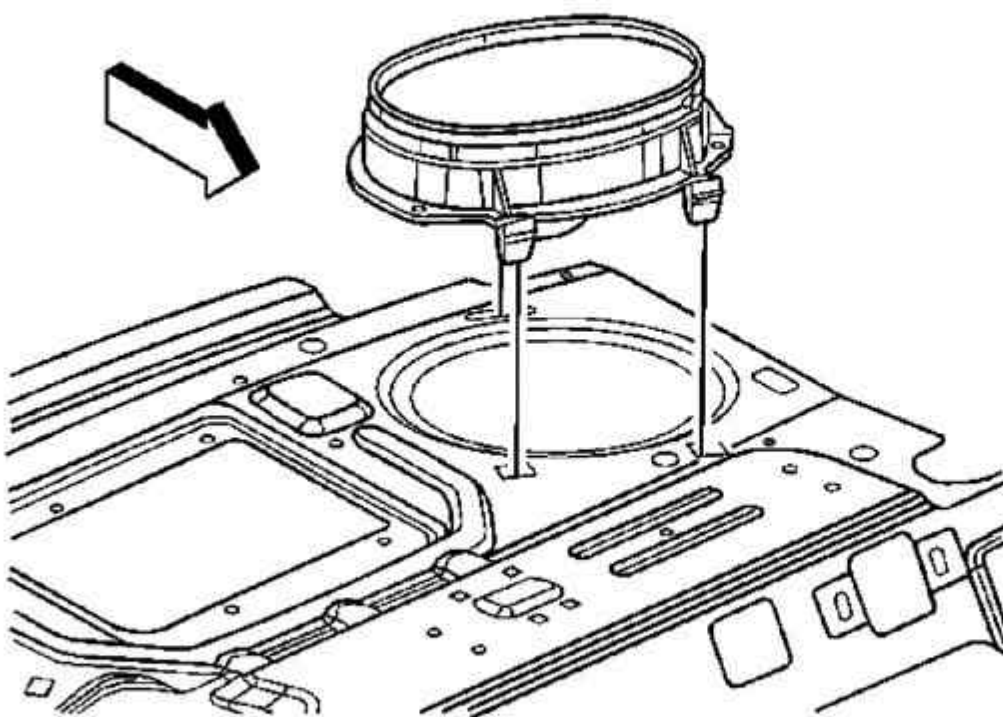


Fig. 63: View Of Speaker Retainer
Courtesy of GENERAL MOTORS CORP.

1. Remove the rear window trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.
2. Disengage the speaker retainer. Lift the speaker upward slightly. Remove the speaker tabs from the openings in the rear window panel.
3. Disconnect the electrical connector from the rear speaker.
4. Remove the rear speaker.

Installation Procedure

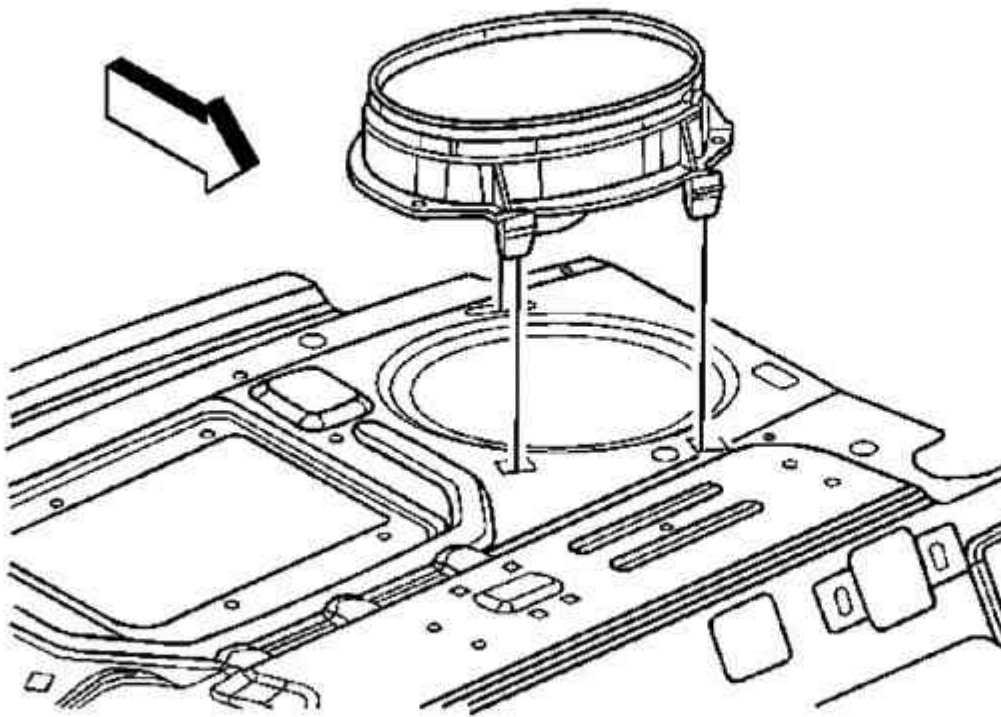


Fig. 64: View Of Speaker Retainer
 Courtesy of GENERAL MOTORS CORP.

1. Connect the electrical connector to the rear speaker.
2. Insert the speaker tabs to the openings in the rear window panel. Engage the speaker retainer.
3. Install the rear window trim panel. Refer to **Rear Window Shelf Trim Panel Replacement**.

DESCRIPTION AND OPERATION

ONSTAR DESCRIPTION AND OPERATION

This vehicle uses the Generation 6.1 version of the OnStar® system. This system consists of the following components:

- Vehicle communication interface module (VCIM)
- OnStar® button assembly
- Microphone
- Cellular antenna
- Navigation antenna

This system also interfaces with the factory installed vehicle audio system.

Vehicle Communication Interface Module (VCIM)

The vehicle communication interface module (VCIM) is a 3-watt cellular device that allows the user to communicate data and voice signals over the national cellular network. It is powered by a fused, battery positive, voltage circuit connected through the vehicle wiring to the 3-button assembly and the radio, and attached by means of coax cables to the cellular and navigation antennas. Ground for the module is accomplished by means of dedicated circuits that are routed with body wiring systems to chassis ground points. The module houses 2 modems, one to process global positioning system (GPS) data, and the other for cellular information. Satellites orbiting

earth are constantly transmitting signals of their current location, from which the OnStar® system is able to pinpoint its own location. The navigation antenna receives these GPS signals and provides the data to the VCIM to be processed. The VCIM communicates with the rest of the vehicle over the class 2 or GMLAN serial data bus, depending upon the serial data architecture of the vehicle. The ignition state is determined by the VCIM through class 2 or GMLAN messaging. The module also has the capability of commanding the horn, initiating door lock/unlock and operating the exterior lamps using the serial data circuits. When an OnStar® keypress is made, a serial data message is sent to the audio system to mute all radio functions and transmit OnStar® originated audio. After the audio system is muted, the OnStar® signals are transmitted to the audio system on the cellular telephone voice signal circuit, and returned to the module on the cellular telephone voice low reference circuit. The cellular modem connects the OnStar® system to the cellular carriers communication system by interacting with the national cellular infrastructure. The module sends and receives all cellular communications over the cellular antenna and cellular antenna coax.

OnStar® Button Assembly

The OnStar® button assembly may be part of the rearview mirror on some vehicles or a separate unit on others. The button assembly is comprised of 3 buttons and a status LED. The buttons are defined as follows:

- The answer/end call button, which is black with a white phone icon allows the user to answer and end calls or initiate the personal calling feature, if equipped.
- The blue OnStar® call center button, which displays the OnStar® logo, allows the user to connect to the OnStar® call center.
- The emergency button, which displays a white cross with a red background, sends a high priority emergency call to the OnStar® call center when pressed.

The OnStar® button assembly receives 10 volts on the keypad supply voltage circuit. When pressed, each button completes a circuit across a resistor allowing a specific voltage to be returned to the vehicle communication interface module (VCIM) on the keypad signal circuit. Depending upon the voltage range returned, the VCIM is able to identify which button has been pressed.

The OnStar® status LED is located to the right of the emergency button on a mirror-mounted assembly and to the left of the answer/end call button when the assembly is mounted on the dash or overhead console. The LED is green when the system is ON and operating normally. When the status LED is green and flashing, it is an indication that a call is in progress. When the LED is red, this indicates a system malfunction is present. In the event there is a system malfunction and the OnStar® system is still able to make a call, the LED will flash red during the call. The OnStar® LED is controlled by the VCIM over the keypad red LED signal circuit and the keypad green LED signal circuit.

OnStar® Microphone

The OnStar®, or cellular microphone can be part of the rearview mirror assembly, or on some vehicle lines, can be a separate, stand alone unit. In either case, the microphone is supplied voltage on the cellular microphone signal circuit, while voice data from the user is sent back to the vehicle communication interface module (VCIM) by means of either a cellular microphone low reference circuit or a drain wire.

Cellular and Navigation Antennas

This vehicle will be equipped with one of the following types of antennas:

- Separate, stand-alone cellular and navigation antennas
- A combination cellular and navigation antenna, which brings the functions of both into a single part
- A cellular, navigation, and digital radio antenna, which also incorporates the functionality of the digital radio receiver satellite and terrestrial antennas (XM)

The cellular antenna is the component that allows the OnStar® system to send and receive data over airwaves by means of cellular technology. This antenna is connected at the base to a coax cable that plugs directly into the vehicle communication interface module (VCIM). The navigation antenna is used to collect the constant signals of the orbiting satellites. Within the antenna, is housed a low noise amplifier that allows for a more broad and precise reception of this data. The current global positioning system (GPS) location is collected by the module every time a keypress is made. The OnStar® Call Center also has the capability of pinging the vehicle during an OnStar® call, which commands the module to retrieve the latest GPS location and transmit it to the OnStar® Call Center. A history location of the last recorded position of the vehicle is stored in the module and marked as aged. In the event the VCI loses, or is removed from power, this history location is used by the OnStar® Call Center as a default. Actual GPS location may take up to 10 minutes to register in the event of a loss of power. This antenna requires a clear and unobstructed path to the satellites in the sky. Window tinting on vehicles may interfere with the GPS sensor functions, depending upon the location of the GPS antenna and the amount of darkening and/or metallic particles that are embedded in the film of the tinting material.

OnStar® Sleep Cycle

The OnStar® system uses a unique sleep cycle to allow the system to receive cellular calls while the ignition is in the OFF position. This cycle enables the vehicle communication interface module (VCIM) to perform remote functions, such as door unlock, as commanded over the air by the OnStar® Call Center, when requested by the customer, and to continue to maintain an acceptable level of battery electrical drain.

The Generation 6.1 version of OnStar® uses 4 states of readiness, depending upon the type of cellular market the vehicle is in when the ignition is put into the OFF state:

- High power
- Low power
- Sleep
- Digital standby

When in an analog cellular market, the high power state is in effect whenever the ignition is in the ON or RUN position, and enables the OnStar® system to send and receive cellular calls and perform all remote functions. The low power state is entered once the vehicle ignition is placed in the OFF position and the retained accessory power (RAP) function has been turned OFF, or times out. This state will last for 1 minute and allows incoming cellular calls to be received. After the 1 minute window, the OnStar® system moves to the sleep state. This state will not recognize or receive incoming cellular calls. At a predetermined time recorded within the VCIM, up to 9 minutes, the system re-enters the low power state to listen for a call from the OnStar® Call Center for 1 minute. After this interval, the system will again return to the sleep state for 9 minutes. After these 9 minutes, the system will again enter the low state of power and listen for any incoming calls that the OnStar® Call Center may be sending. In the event a call is being sent, the OnStar® system will receive the call and immediately go into the high power mode to perform any requested functions. If no call is received during the 1 minute interval, the system will go back into the sleep mode for another 9 minutes. This process will continue for up to 48 hours, after which, the OnStar® system will permanently enter the sleep state until the ignition is once again turned to the ON or RUN position.

In a digital cellular service market the high power state is in effect whenever the ignition is in the ON or RUN position, and also enables the OnStar® system to send and receive cellular calls and perform all remote functions. The digital standby power state is in effect after the vehicle has been shut off and the RAP has timed out. When in digital standby mode, the OnStar module is able to perform all remote functions as commanded by an OnStar advisor at any time, for a continuous 8 hours. After 8 hours, the OnStar module will follow the standard sleep state as though in an analog cellular market (9 minutes OFF, 1 minute of digital standby, based on the time of the global positioning system (GPS) signals).

In the event the OnStar® system loses, or is temporarily removed from battery power, the system will remain in the sleep state while the key is in the OFF position. It will not begin to cycle until the vehicle passes into an open outside area with the ignition ON, where a GPS signal can be acquired, providing a reference for time. The OnStar® Call

Center is able to maintain a record of exactly what time each vehicle will enter the 1 minute low power state by synchronizing their clocks with those of the vehicle, based on GPS signals.

Deactivated OnStar® Accounts

In the event a customer has not renewed their OnStar® account after expiration or the account was never activated, OnStar® will make a discrete cellular call to the vehicle to deactivate the OnStar® system. Before taking this action, customers are notified that the OnStar® system in their vehicle will be deactivated unless they elect to renew the account. After the vehicle has been successfully deactivated, customers will experience the following when attempting to contact OnStar® from their vehicle:

- During an OnStar® Call Center button press, the customer will be connected to a dedicated sales team who can sell an OnStar® subscription and reactivate the vehicle. Depending on the type of OnStar® hardware in the vehicle, the customer may first hear a demonstration message stating there is no current OnStar® subscription for the vehicle, and directing the customer what to do to activate services.
- During an emergency button press, a demo message will be played indicating the service has been deactivated.
- OnStar® personal calling (OPC) will not be available, as this feature requires the customer to have a current OnStar® account. Attempts to use this feature may result in cellular connection failure messages and the inability to connect to the number dialed.

It is of particular note, that when an OnStar® system is successfully deactivated, it will NOT attempt to connect to the OnStar® Call Center in the event of a collision or if the vehicle's front air bags deploy for any other reason.

Certain vehicles that have never had an active OnStar® account, that have been deactivated, may be unable to establish a connection with the OnStar® Call Center. When normal published diagnostic procedures do not indicate a possible cause for the no connect concern, the vehicle may have been deactivated. For deactivated vehicles, a no connect response should be considered normal operation. Further diagnosis and subsequent repair is only necessary should the customer elect to become an active OnStar® subscriber.

OnStar® Reconfiguration Procedure

Within the vehicle communication interface module (VCIM) are a set of unique numbers that identify the OnStar® customer and the specific vehicle the module resides in. These numbers, the station identification number (STID) and the electronic serial number (ESN) are transmitted over the cellular network when an OnStar® keypress is made and are essential for proper identification and connection to the OnStar® Call Center. In the event the VCIM requires replacement, the OnStar® reconfiguration procedure must be performed. This procedure allows for the new STID and ESN within the replacement module to overwrite the old numbers and update customer and vehicle information at the OnStar® Call Center. The reconfiguration process is explained within the VCIM replacement procedure, or the OnStar® Reconfiguration Procedure found in the Cellular Communication diagnostic information and procedures section.

The default language for the new VCIM is English. Refer to Module Setup screen on the scan tool, within the Cellular Information section, if the customer requests French or Spanish Voice Recognition.

OnStar® Cellular, GPS, and Diagnostic Limitations

The proper operation of the OnStar® System is dependent on several elements outside the components integrated into the vehicle. These include the National Cellular Network Infrastructure, the cellular telephone carriers within the network, and the global positioning system (GPS).

The cellular operation of the OnStar® system may be inhibited by factors such as the user's range from an analog or digital cellular tower, the state of the cellular carriers' equipment, and the location where the call is placed. Making an OnStar® keypress in areas that lack sufficient cellular coverage or have a temporary equipment failure will result in either the inability of a call to complete with a data transfer or the complete inability to connect to the

OnStar® Call Center. The OnStar® system may also experience connection issues if the identification numbers for the module, station identification number (STID) and electronic serial number (ESN), are not recognized by the cellular carriers local signal receiving towers. OnStar® cellular connection issues such as these require the assistance of the General Motors Technical Assistance Center OnStar® Group, which coordinates with cellular carriers to resolve connection issues.

The satellites that orbit earth providing the OnStar system with GPS data have almost no failures associated with them. In the event of a no GPS concern, the failure will likely lie with the inability of the system to gain GPS signals because of its location, i.e. in a parking structure, hardware failure, or being mistaken with an OnStar® call which has reached the Call Center without vehicle data.

During diagnostic testing of the OnStar® system, the technician should ensure the vehicle is located in an area that has a clear unobstructed view of the open sky, and preferably, an area where analog or digital cellular calls have been successfully placed. These areas can be found by successfully making an OnStar® keypress in a known good OnStar® equipped vehicle and confirming success with the OnStar® Call Center advisor. Such places can be used as a permanent reference for future OnStar® testing.

OnStar® Personal Calling

The hands free, OnStar® personal calling (OPC) cellular phone feature is an additional option to the OnStar® system. This feature is already embedded within the vehicle communication interface module (VCIM), however, it must be activated by an OnStar® advisor. This is done most often during the initial OnStar® configuration, if the home location of the vehicle is in a geographic area where OnStar® personal calling is available. In the event this feature is not enabled, customers may connect to the OnStar® Call Center by pressing the blue OnStar® button, and asking an advisor if OPC is available in their area. Users of the Generation 6.1 OnStar® system can verify the system has been configured for OnStar® Personal Calling by pressing the answer/end call button, waiting for the system to respond "OnStar Ready" then speaking the word "dial." If the system responds with a failure message, the system has not been configured for OPC. All other responses confirm that OPC has been enabled.

Operation of the Hands Free Cellular Phone

Onstar® personal calling (OPC) operates similar to most hand held cellular phones in that the availability for its usage is based on minutes or units. The customer must have a current OnStar® subscription, as this feature cannot be utilized without it. To use OPC, the customer must also purchase units as outlined in the owner's guide provided with the OnStar® system. When the customer purchases minutes, an OnStar® advisor loads these minutes into the vehicle communication interface module (VCIM) over the airwaves at the time of the request, or through a discrete cellular call to the vehicle at a later time. Once loaded into the module, the units may be used for non-international, outbound cellular phone calls, and connection with the OnStar® virtual advisor. Units begin to deplete, 1 unit is equal to 1 minute, as the customer makes outbound phone calls, answers inbound phone calls, or while connected to the OnStar® virtual advisor. In addition, units also have an expiration date, depending upon the type of units purchased. This date is established when the download is performed, and any remaining units expire when the date within the VCIM, which is based on current date and the time transmitted by global positioning system (GPS) satellites, has passed. At any time, the user can press the answer/end call button, say "Units" and verify the number of units remaining.

During a hands free call, the microphone and audio system operate the same way as a standard OnStar® call. When the answer/end call button is pressed, the audio system will mute; the OnStar® system will then return the prompt "OnStar Ready." At this point there are specific commands set to initiate a cellular call. If the vehicle receives a call when the radio is ON, the audio system will mute and an audible ring will be heard through the speakers. The call will be answered when the answer/end call button is pressed.

The VCIM interprets all of the voice-activated commands. A complete list of these commands is supplied in the information provided to the customer. If the information is not available to reference, at any command prompt the caller can say "HELP" and the VCIM will return an audible list of available commands. If the customer concern is not being understood or not being heard by the OnStar® system, the user should place a call to the OnStar® call

center to verify proper operation of the microphone. Following this description is an example of the commands and the OnStar® system responses. A complete list of commands is supplied in the information provided to the customer with the OnStar® system.

OnStar® Steering Wheel Controls

Some vehicles equipped with the OnStar® system have the capability of accessing voice mailboxes and other automated phone systems by means of the steering wheel controls, while the OnStar® personal calling (OPC) feature is in use. If the Talk or Mute button, depending upon the vehicle, on the steering wheel controls are depressed during an OPC call, the vehicle communication module (VCIM) receives the message on the class 2 serial data bus from either the radio, the driver information module, or the body control module (BCM). This message is interpreted as a request to turn any spoken numbers into dual tone multi-frequency (DTMF) tones to be delivered over the airwaves to the phone system the user is communicating with. Complete instructions for operation of these features can be found in the information provided to the customer with the OnStar® system.

The steering wheel controls are a resistor network that consist of multiple momentary contact switches and a series of resistors. The switches and resistor network are arranged so that each switch has a different resistance value. When a switch is pressed, a voltage drop occurs in the resistor network, which produces a specific voltage value unique to the switch selected, to be interpreted by either the radio, driver information module, or BCM.

OPC Features

The following is an abbreviated list of features that may have an impact for the technician when servicing or diagnosing an OnStar® system. For a full list of OnStar® personal calling (OPC) features, consult the owner's guide provided to the customer with the OnStar® system.

Voice Feedback

The OnStar® personal calling (OPC) system has the capability of responding to the user with either an automated voice response or with a tone or beep. These 2 types of responses can be switched back and forth by pressing the answer/end call button, waiting for the system to respond "OnStar Ready" and speaking the phrase "voice feedback." The system will then respond, "voice feedback is now ON/OFF."

OPC Security/System Lock

Customers have the capability to lock their OnStar® personal calling (OPC) system by pressing the answer/end call button, speaking "security" and entering a 4-digit code. Once this process is complete, the user must enter the code before OnStar® personal calling is available. In the event the customer cannot remember their code and is unable to use their system, they can press the blue OnStar button and speak to an advisor to unlock the system by means of a discrete cellular call to the vehicle.

Nametags

Customers have the ability to store telephone numbers within the module, referenced by a nametag for the convenience of frequently dialed numbers. This process is initiated by pressing the answer/end call button, waiting for the system response, then speaking the response "store". The system will respond with "number please" at which time the user should enter the number desired to be stored. Once complete, saying the word "store" again lets the system know you are finished entering the number. At this time, the system will elicit the user to assign a nametag to that number. From this point forward, the user can dial this number by initiating the OnStar® personal calling (OPC) feature, speaking the word "call," and repeating the nametag assigned. To delete a nametag, the user should initiate OPC, say "delete" then speak the nametag to be removed. In the event a nametag cannot be deleted in spite of repeated attempts from several speakers, the OnStar® module will require replacement.

Mobile Identification Number and Mobile Directory Number

The Generation 6.1 vehicle communication interface module (VCIM) utilizes 2 numbers for cellular device

identification, call routing and connection, a mobile identification number (MIN) and a mobile directory number (MDN). The MIN represents the number used by the cellular carrier for call routing purposes while the MDN represents the number dialed to reach the cellular device. Although technicians have the capability to change these numbers by means of the scan tool, this should ONLY be done at the direction of and with explicit instruction from General Motors Technical Assistance Center (GM TAC).

Placing a Call

To Dial a Number

What You Do	What You Hear
Press the white dot button	"OnStar Ready"
Say "Dial"	"Phone number to dial, please"
Say the entire phone number you wish to dial with no pauses	OnStar will repeat the number, then ask "Yes or No"
Say "Yes" if the phone number was correct, or "No" to try again	"Dialing," and your call will be connected

After 3 unsuccessful tries, or if you simply like it better, you can use the "Digit Dial" command to input digits one at a time. Digit Dial is set up to dial phone numbers like previous OnStar Personal Calling Systems.

To Dial a Number Using Digit Dial

What You Do	What You Hear
Press the white dot button	"OnStar Ready"
Say "Digit Dial"	"First digit to dial, please"
Say the number to be dialed, one digit at a time	OnStar will confirm each digit by repeating it back to you
When finished, say "Dial" again	"Dialing," and your call will be connected

To Place a Call Using a Stored Nametag

What You Do	What You Hear
Press the white dot button	"OnStar Ready"
Say "Call"	"Nametag, please"
Say (stored name)	"Calling"

To Place a Call Using the "Redial" Command

What You Do	What You Hear
Press the white dot button	"OnStar Ready"
Say "Redial"	"Redialing"

Operation of the OnStar® Speech Recognition Systems

OnStar® Generation 6.1 users communicate with 2 speech recognition systems. Speech recognition allows the user to speak to one computer in the vehicle, and one reached over a phone line. The computer tries to understand the users command, and responds by speaking back, or by taking the appropriate action, e.g. dialing the phone.

- Personal Calling uses a speech recognition system that resides in the vehicle. When the user presses the dot button, the system states, Ready, and listens for the user's command. The user can speak commands to control the hands-free phone.
- Virtual advisor is a remote speech recognition system that the caller access by making a phone call. The user connects to virtual advisor by requesting it during personal calling use. The user is then transferred to the virtual advisor server and talks to it via a cellular connection.

The OnStar® speech recognition systems use speech technology that is designed to understand a wide range of American English speakers. Although there is no one right way to speak English, the system will work best when users try to modify their pronunciation should they encounter difficulty. Users who do not obtain good results are advised to try the tips and workarounds found in this section.

General Tips for Better Speech Recognition

Concern	Tip for Better Result
Noise	Noise may confuse the speech recognition system. You usually get better performance from the system in quieter conditions: • The HVAC fan creates noise. Turn it down or OFF for better speech system performance. • Driving at high speeds creates louder engine noise and wind noise. You may get better results at lower speeds. • An open window or an open sunroof allows more noise to enter the vehicle. Close all windows for better results. • Noisy rainstorms can also reduce performance. • If passengers are talking while you use the speech system, it may be confused by their speech. You will get better results if all occupants of the vehicle are quiet while the system is listening for commands.
When to Speak	In Personal Calling, the system is only listening after it prompts you to speak. • When the system prompts you to speak, you have about 5 seconds to respond. If the system does not hear a response, it will prompt you again, or cancel the transaction. • If you begin to speak too soon, it will tell you "Slower, please." Try pausing for a half second before speaking. • In the Virtual Advisor, the system is always listening for commands, even while it is speaking.
How to Speak	Speak forcefully, and clearly. • The noisier the environment, the louder you need to speak. If you are in the driver seat, speak facing the front of the car. If you are a passenger, speak facing the rearview mirror. • Speak calmly, and naturally. The system may sometimes fail your repeated attempts to give a command. If your speech is distorted by shouting or frustration, this may cause more errors. • People with high-pitched voices may have better results by speaking in a deeper, lower-pitched voice. However, do not lower the volume of the voice. • Avoid speaking with a rising intonation, like asking a question. Use a flat or falling intonation, like giving an answer.
What to Say	Personal Calling: One-word commands • The Personal Calling system listens for only one word at a time. There are some exceptions, 2-word phrases that are spoken and understood as a single word, e.g. 'virtual advisor', 'voice feedback', and 'my number'. You can enter phone numbers only one digit at a time, and the system repeats each digit as it hears it. • Say "Help" at the Ready prompt to hear the list of Personal Calling commands.

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	• Virtual Advisor can understand sentences with more than one word. It also expects to hear a 4-digit number all at once when it asks for your PIN. • Say, "What are my choices?" to hear a list of commands that the Virtual Advisor understands.
Entering a phone number	• If you have trouble getting numbers correctly into the system, store your frequently-called number in the directory, so the system will remember them. After you have stored a number with a nametag, then you simply say 'call' and the nametag in order to call the number. • If the system cannot understand your numbers, ask another person to help you enter your frequently-called numbers. This person can speak the numbers, then you can speak the nametag.
Storing or dialing a number	When you have finished speaking your phone number, you do not need to say 'store' or 'dial' to indicate that you are done. If you pause and say nothing, the system will ask you if you want to store or dial. Say 'yes'.
Creating nametags	• Short nametags that are similar may be easily confused by the system. You may get better recognition of your nametags if you make them longer, for example 'George Washington' without pause, instead of 'George' only. • If you want to use nametags while driving, it is best to store the nametag with some vehicle noise in the background. If you are in park while you are storing nametags, you can turn the fan on low or open windows in order to create some background noise.
Virtual Advisor 4-digit PIN	Say the 4 digits in a natural way, without pausing between digits.
Interrupting	• When the Virtual Advisor is speaking, you can interrupt it with another command. The first word in your command helps to get its attention. • If the Virtual Advisor has trouble understanding your commands when you interrupt, try speaking the first word loudly and clearly, then pause for an instant, then continue with the rest of the command. For example: "Get .. my weather" or "Lookup... a quote for General Motors".

Personal Calling Commands

Command	Tip for Better Result
'add'	Emphasize the 'd' at the end of the word.
'call'	Emphasize the 'l' at the end of the word.
'cancel'	Emphasize the 'l' at the end of the word. If you are speaking the 'can' syllable very quickly, try to lengthen it a little.
'clear'	Emphasize the 'r' at the end of the word.
'delete'	Emphasize the 't' at the end of the word. Do not swallow the 'd' at the start of the word.
'dial'	Emphasize the 'l' at the end of the word.
'digit dial' (Gen 6)	Combine the words smoothly and emphasize each syllable.
'directory'	Speak all 4 syllables clearly. Do not swallow the last part of the word.
'help'	Emphasize the 'h' sound at the start of the word. Emphasize the 'p' sound at the end of the word.
'my number'	Emphasize all 3 syllables.
'no'	Speak loudly and slowly. Emphasize the 'n' sound at the start of the word. Draw out the 'o' sound at the end of the word.

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'redial'	Try to emphasize and lengthen the first syllable: reee-dial
'security'	Speak 4 syllables clearly. Do not swallow the 'i' sound in the middle of the word.
'store'	Emphasize the 'o' sound in the middle of the word in order to distinguish from 'star'. Emphasize the 'st' sound at the start of the word in order to distinguish from 'four'.
'units'	Speak loudly and clearly.
'verify'	Speak 3 syllables clearly. Do not swallow the 'i' sound in the middle of the word.
'Virtual Advisor'	Emphasize both words.
'voice feedback'	Emphasize both words.
'yes'	Emphasize the 'y' sound at the start of the word. Emphasize the 's' sound at the end of the word.
'zero', 'oh'	If the system does not understand 'oh', try 'zero', or vice versa.
'one'	Emphasize the 'n' at the end of the word.
'two'	Round your lips for the 'ooo' part of the word. If you are clipping the 'ooo' very short, try to lengthen it, but do not draw it out excessively. Speak in a low pitch. Do not use a rising tone like asking a question; a falling tone like giving an answer is better.
'three'	End the word 'three' in a smile, to draw back your lips. Lengthen the 'eee' sound if you are clipping it very short.
'four'	Emphasize the 'r' at the end of the word.
'five'	Emphasize the 'v' sound.
'six'	Emphasize the 'ks' sound at the end of the word.
'seven'	Emphasize the 'n' at the end of the word. Lengthen the 'sev' syllable.
'eight'	Emphasize the 't' at the end of the word. Lengthen the 'eee' sound at the start of the word.
'nine'	Emphasize the 'n' sounds to distinguish from 'five'.
'star'	Emphasize the 'r' at the end of the word. Emphasize the 'ah' sound in order to distinguish from 'store'.
'pound'	Emphasize the 'p' at the start of the word. Emphasize the 'd' at the end of the word.

RADIO/AUDIO SYSTEM DESCRIPTION AND OPERATION

Battery positive voltage is provided to the radio from the Radio/Amp (25A) fuse in the fuse block. The radio is grounded through a braided cable case ground. The radio is enabled/disabled by class 2 messages from the body control module (BCM). The entertainment system on this vehicle is configured with a base and uplevel system. The base and uplevel systems contain a radio, antenna, speakers, and on some vehicles an audio amplifier.

The uplevel system differs from the base system by providing the customer with enhanced audio system features. Some of those features may include an audio amplifier, and programmable equalizer (EQ). Satellite digital radio (U2K) is available with the uplevel systems.

The following list shows the audio system RPOs available with this vehicle:

- Base Radio (U1C) - AM/FM Stereo, EQ, CD
- Uplevel Radio (UN0) - AM/FM Stereo, Multiple CD, EQ
- Uplevel Radio (U1V) - AM/FM Stereo, EQ, 6-Disc CD
- Uplevel Radio (U3L) - AM/FM Stereo, EQ, CD, MP3

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- Satellite Digital Radio - (U2K)
- Speaker system custom - 6 (UW6)
- Speaker System premium - 9 (U88) - Includes subwoofer and amplifier

Radio Features

Controls	Base U1C	Uplevel UN0	Uplevel U1V	Uplevel U3L
Power	Push PWR/VOL knob to turn radio ON.			
Volume	The volume is adjusted by rotating the PWR/VOL knob.			
Speed Compensated Volume	Press the AUTO VOL button.			
Band	Push the BAND button.			
Tune	Turn the TUNE/SELECT/RCL knob.			
Seek	Momentarily press SEEK/SCAN button.			
Scan	Hold SEEK/SCAN button for 2 seconds, until a single beep is heard.			
Preset Scan	Press and hold SEEK/SCAN button for more than 4 seconds until a double beep is heard.			
Presets	Six AM, Six FM1, and Six FM2.	Six AM, Six FM1, and Six FM2 (also six XM1 and six XM2 if equipped with U2K)		
Preset Saving	Press and hold desired preset button until an audible beep is heard.			
Preset Scan	Press SEEK/SCAN button for more than 4 seconds.			
Set Clock	Press and hold the H button until the correct hour appears on the display. Press and hold the M button until the correct minute appears on the display. The time can be set with the ignition ON or OFF.	Press and hold the H button until the correct hour appears on the display. AM or PM will appear on the display. Press and hold the M button until the correct minute appears on the display. The time can be set with the ignition ON or OFF.		
Recall	Push the DISP button.			
Mute	Push the mute button on the steering wheel controls (if equipped with UK3)			
Fade/Balance	Press the BAL/FADE button to select and adjust with the SELECT knob. To center a setting, press and hold the BAL/FADE button with the desired range selected. To center all ranges, push and hold the BAL/FADE button once, without selecting a range.			
Bass/Treble/Midrange	Press TONE button to select and adjust with the SELECT knob. To center a setting, press and hold the BAL/FADE button with the desired range selected. To center all ranges, push and hold the BAL/FADE button once, without selecting a range.			
Programmable EQ (AUTO TONE)	N/A	Press EQ button.		

CD Features

Controls	Base U1C	Uplevel UN0	Uplevel U1V	Uplevel U3L
Source	Press the CD button to select CD player			
Eject Single CD	Press the EJECT button		Press the EJECT button. Select disc to eject.	Press the EJECT button

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Load Single CD	N/A	Press the LOAD button. Select CD slot to load.	N/A
Eject all CDs	N/A	Press and hold the EJECT button.	N/A
Load all CDs	N/A	Press and hold the LOAD button.	N/A
Fast Forward	Press and hold Fast Forward button.		
Reverse	Press and hold Fast Reverse button.		
Previous	Press the SEEK up button.		
Next	Press the SEEK down button.		
Random	Press the RDM button. Press again to cancel.	Press the RDM button to listen to tracks on selected CD in random order. Press and hold for more than 2 seconds to random play tracks on ALL CDs that are loaded. Press again to cancel.	Press the RDM button. Press again to cancel.
Repeat	N/A	Press the RPT button to repeat track that is currently playing. Press again to cancel. Press and hold RPT button for more than 2 seconds to repeat entire CD that is currently playing.	Press the RPT button to repeat track that is currently playing. Press again to cancel. Press and hold RPT button for more than 2 seconds to repeat entire CD that is currently playing.
Select Disc	N/A	Press the numbered pushbutton (preset button) that corresponds with the desired disc.	N/A

Song List (U1V only)

The 6-disc CD changer has a feature called song list. This feature is capable of saving 20 track selections.

To save tracks into the song list, perform the following steps:

1. Turn the radio ON and load it with at least one CD.
2. Check to see that the CD changer is not in song list mode. S-LIST should not appear in the display. If song list mode is ON, press the song list button to turn it OFF.
3. Select the desired CD by pressing the numbered pushbutton and then use the SEEK left arrow to locate the track to be saved. The track will begin to play.
4. Press and hold the song list button for 2 or more seconds to save the track into memory. When the song list button is pressed, a beep will be heard immediately. After 2 seconds of pressing the button, 2 beeps will sound to confirm that the track has been saved and TRACK (number) ADDED will appear on the display.
5. Repeat steps 3 and 4 for saving other selections.

SONG LIST FULL will appear on the display if your try to save more than 20 selections.

To play the song list, press the song list button. One beep will be heard and SONG LIST will appear on the display. The recorded tracks will begin to play in the order that they were saved.

Seek through the song list by using the SEEK arrows. Seeking past the last saved track will return you to the first saved track.

To delete tracks from the song list, perform the following steps:

1. Turn the CD player ON.
2. Press the song list button to turn song list ON. S-LIST will appear on the display.
3. Press either SEEK arrow to select the desired track to be deleted.
4. Press and hold the song list button for 2 seconds. After 2 seconds of continuously pressing the button, 2 beeps will be heard to confirm that the track has been deleted and TRACK (number) DELETED will appear on the display.

After a track has been deleted, the remaining tracks are moved up list. When another track is added to the song list, the track will be added to the end of the list.

To delete the entire song list, perform the following steps:

1. Turn the CD player ON.
2. Press the song list button to turn song list mode on. S-LIST will appear on the display.
3. Press and hold the song list button for more than 4 seconds. A beep will be heard, followed by 2 beeps after 2 seconds, and a final beep with be heard after 4 seconds. SONG LIST EMPTY will appear on the display, indicating that the song list has been deleted.

If a CD is ejected, and the song list contains saved tracks from the CD, those tracks are automatically deleted from the song list. Any tracks saved to the song list again are added to the bottom of the list.

To end song list mode, press the song list button. One beep will be heard and S-LIST will disappear from the display.

MP3 Features

Controls	Base U1C	Uplevel UN0	Uplevel U1V	Uplevel U3L
Next Track	N/A			Press the Next Track button
Previous Track	N/A			Press the Previous Tack button
Next Folder	N/A			Press the Next Folder button
Previous Folder	N/A			Press the Previous Folder button
Fast Forward	N/A			Press and hold the Fast Forward button
Fast Reverse	N/A			Press and hold the Fast Reverse button
				Press the random button to listen to tracks in selected folder in random

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Random	N/A	order. Press and hold for more than 2 seconds to random play tracks in ALL folders. Press again to cancel. (RDM does not function with playlists.)
Recall	N/A	Press the DISP button
Info	N/A	Press the MSG button for artist, song, and album information, if available.

Each item in the following list represents topics covered in detail below:

- AM/FM Reception
- XM Reception
- Antenna
- Audio Amplifier
- Theft Deterrent
- Radio Data System
- XM Satellite Radio
- XM Advisory Messages
- Radio Chime Level Adjustment
- Tape/CD Player Errors
- Technical Information for MP3 Player (US8)

AM/FM Reception**Radio Signal**

The radio signal is sent from a broadcast station and is then received by an antenna. The strength of the signal received depends on the following:

- The power output, or wattage, of the broadcasting station
- The location of the vehicle, or receiver, relative to the broadcast tower.
- Obstacles between the tower and the receiver
- Atmospheric conditions
- Which band, AM or FM, the station is broadcasting
- Type of antenna and the ground plane

AM Reception

The AM band has a lower frequency range than the FM band. These longer wavelengths:

- Bend around obstacles
- Follow the curvature of the earth
- May reflect, or skip, off of the ionosphere

The AM frequencies have longer range due to the ground wave. The ground wave follows the curvature of the earth and is affected by its conductivity. Greater conductivity equates to less signal loss, thus transmission over water is better than over land. The AM band has a range of 80-320 km (50-200 mi).

FM Reception

The shorter wavelengths of the higher frequency FM band:

- Reflect off obstacles
- Are absorbed by the ground
- Penetrate the ionosphere

Broadcasts in the FM band are limited to "line of sight" reception which is typically 40 km (25 mi). Even when out of a direct line of sight, the signal may be reflected into areas that would be in a "shadow" otherwise. Factors which affect the line of sight include:

- Height of the broadcast antenna
- Height of the receiving antenna
- Terrain and buildings in the broadcast path

XM Reception

XM satellite radio provides digital radio reception. The XM signal is broadcast from two satellites and, where necessary, terrestrial repeaters. The high power satellites allow the antenna to receive the XM signal even when foliage and other partial obstructions block the antennas view of the satellite. Terrestrial repeaters are used in dense urban areas. These repeaters will receive the satellite signal and re-broadcast them at much higher power levels in order to ensure reception in areas with densely packed tall buildings.

Antenna

The antenna system is a rear window defogger grid antenna. Using the defogger grid as an antenna requires circuitry to decouple the RF from the DC heater current. This is accomplished by the radio antenna module.

Audio Amplifier

The purpose of the amplifier is to increase the power of a voltage or current signal. The output signal of an amplifier may consists of the same frequencies as the input signal or it may consist of only a portion of the frequencies of the input signal as in the case of a subwoofer or midrange amplifier.

When the radio is turned ON, it sends a voltage signal to the audio amplifier via the radio on signal circuit. The gain control signal circuit allows the radio to recognize that the amplifier is present. Once the radio detects the amplifier, the radio will output low-level signals to the amplifier. With the amplifier enabled, the signal that drives the speaker is now amplified.

Theft Deterrent

The "Theftlock" theft deterrent system is a feature on all base and uplevel radios. There is no need to program a security code into the radio as in past model years. The theft deterrent system now utilizes class 2 serial data to determine if the radio is in the appropriate vehicle. Each time the radio receives the "run" power mode message, it compares the VIN information it has stored to the VIN information received from a module on the class 2 serial data circuit responsible for transmitting that information. If a mis-match occurs, the radio display will indicate to the user the radio is locked. Once this takes place, a DTC will set, the radio will not respond to any button presses and become inoperative. The two scenarios able to cause this condition are:

- A radio is installed from another vehicle.

- A module which communicates on the class 2 serial data circuit which supplies VIN information to the radio is replaced and not properly setup with the correct VIN information for that vehicle.

The only way to unlock the radio is by using a scan tool. Always refer to **DIAGNOSTIC CODE INDEX** table to diagnose the "Theftlock" DTC for further information.

XM Satellite Radio

XM is a national satellite radio service that offers up to 100 coast to coast channels including music, news, sports, talk and children's programming. XM provides digital quality audio and text information, including song title and artist name. A service fee is required in order to receive the XM service. For more information, contact XM at www.xmradio.com or call 1-800-852-9696.

Digital Radio Receiver

The radio controls communicate with the digital radio receiver via the class 2 communication circuit. The digital radio receiver sends remote radio audio signals to the radio.

Viewing Messages

Press the DISP or RCL button while in XM mode to view various pieces of information related to the current song or channel. By pressing and releasing the DISP or RCL button, you may view four different categories of information: Artist Name/Feature, Song/Program Title, Channel Category, and other Additional Information that may be broadcast on that channel. Additional Information messages may not always be available. If an Additional Information message is being broadcast on the tuned channel, the INFO icon will appear on the display. Each of the four information types may have multiple pages of text. To reach a category, press and release the DISP or RCL button consecutively until the desired type is displayed. If there are multiple pages of text for the selected information type, the radio will automatically display all the pages for that type at a rate of approximately one page every three seconds before timing out and returning to the default display. You may override this feature by pressing the DISP or RCL button to review all of the pages at your own pace.

XM Advisory Messages

Radio Display Message	Condition
Updating	Updating encryption code
No Signal	Loss of signal
Loading XM	Acquiring channel audio (after 4 second delay)
CH Off Air	Channel not in service
CH Unavail	Channel no longer available
No Info	Artist Name/Feature not available
No Info	Song/Program Title not available
No Info	Category name not available
Not Found	No channel available for the chosen category
No Info	No text/informational message available
XM Locked	Theft Lock active
Radio ID	Electronic serial number (ESN) channel 0
Unknown	Radio ID not known (should only be if hardware failure)
Chk XMRevr	Hardware failure

Radio Chime Level Adjustment

The radio is the vehicle chime producer. The chime is audible from the driver's side front door speakers.

To adjust the chime level louder.

1. Turn ON the ignition.
2. Turn OFF the radio.
3. Press and hold preset button 6.

The chime volume level will change from the normal level to loud. The radio displays "LOUD".

To change back to the default or normal setting follow the previous steps. The chime volume level will change from the loud level to normal. The radio displays "NORMAL".

Each time the chime volume is changed, the radio sounds three chimes as an example of the new volume selected.

Tape/CD Player Error Messages

The radio displays an error when any of the following occurs.

- The radio will display error codes for the tape player and integral CD player.
- The radio will display the following tape player error codes for tight tape, broken tape, and wrapped tape. If these conditions are detected, the radio will switch to the radio mode and eject the tape. The error code will be displayed for 5 seconds, followed by the tuner display, then the default.
 - E10 or TIGHT TAPE-Tight tape
 - E11 or BROKEN TAPE-Broken tape
 - E14 or WRAPPED TAPE-Wrapped tape
- The radio will display the following integral CD player error codes. If one of these problems is detected, the unit will switch to the radio mode and eject the CD. The display will show TOD, if the unit is off, or display the radio frequency for 5 seconds, then the default, if the unit is on.
 - E20 or CHECK CD-Optics focus error, maybe due to moisture
 - E21 or CHECK CD-Optics loss of tracking control, maybe due to blemishes on disc
 - E22 or PLAYER ERR-Load/Unload motor problem
 - E23 or PLAYER ERR-Communication problem

Technical Information for MP3 Player (US8, US9, or U3L)

The MP3-capable radio will play both standard audio CDs and CD-Rs. The CD-Rs may contain standard audio format (*.cda) or compressed audio in the *.mp3 format.

Customers who make their own music CD-Rs should be aware of the following:

- The files can be recorded on a CD-R disc with a maximum capacity of 700 MB.
- The MP3 files must be recorded onto the disc in either a fixed bit rate (32 kbps, 40 kbps, 48 kbps, 56 kbps, 64 kbps, 80 kbps, 96 kbps, 112 kbps, 128 kbps, 160 kbps, 192 kbps, 224 kbps, 256 kbps, and 320 kbps), or in a variable bit rate.
- Discs recorded in either one session or in multiple sessions will play. Playlists, such as those created with popular MP3 software, are also supported.
- ID3 tag information is available during playback, providing the information was recorded with ID3 tags, version 1 or version 2. CD text information is not available with the US8 radio.
- The radio does not play mixed media CDs, those that contain files in both the *.mp3 and the *.cda format.
- The radio will not play CD-Rs that contain formats of compressed audio other than *.mp3, such as *.wma, *.asf, or *.aac.
- The radio will support a maximum of 50 folders, 50 playlists, 10 sessions, and 255 files. If the information on

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the disc exceeds these numbers, anything over the maximum allowable will be ignored. Files that are not in the *.mp3 format will not play, but do count toward the maximum number of files.

- The files or playlists can be arranged in folders, up to 11 layers deep, folders within folders, within folders, etc. Anything more than 11 layers deep will be ignored.
- Long names (on files, folders, playlists) or combination of large number of folders and files or playlists may cause player not to be able to read up to the max numbers of folders, playlists, files, or sessions, due to memory limitations. Customers are encouraged to keep shorter names and minimize folder depth for ease of operation.

If these guidelines are not followed, a customer recorded CD may not play. Note that the radio has no ability to record *.mp3 files or any audio to a CD-R, it has only the ability to read information on a CD-R.

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