2008 ACCESSORIES & EQUIPMENT

Cellular, Entertainment, and Navigation - Cab & Chassis Sierra, Cab & Chassis Silverado, Sierra & Silverado

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Amplifier Screw	9 N.m	80 lb in
Antenna Assembly Screw	5 N.m	44 lb in
Antenna Mast	6 N.m	53 lb in
Antenna Module Bolt	9 N.m	80 lb in
Front Floor Console Screw	9 N.m	80 lb in
Front Floor Console Bracket Screw	9 N.m	80 lb in
Front Floor Console Speaker Nut	9 N.m	80 lb in
Front Speaker Screw	6 N.m	53 lb in
Front Door Speaker Screw	3 N.m	25 lb in
Mobile Telephone Antenna Bolt	9 N.m	80 lb in
Radio Retaining Screws	2 N.m	18 lb in
Rear Door Speaker Screw	3 N.m	25 lb in
Rear Pillar Speaker Screw	3 N.m	25 lb in
Rear Radio Control Screw	1.5 N.m	13 lb in
Roof Console Screw	2 N.m	18 lb in
Video Display Assembly Screw	2 N.m	18 lb in

SCHEMATIC AND ROUTING DIAGRAMS

RADIO/NAVIGATION SYSTEM SCHEMATICS

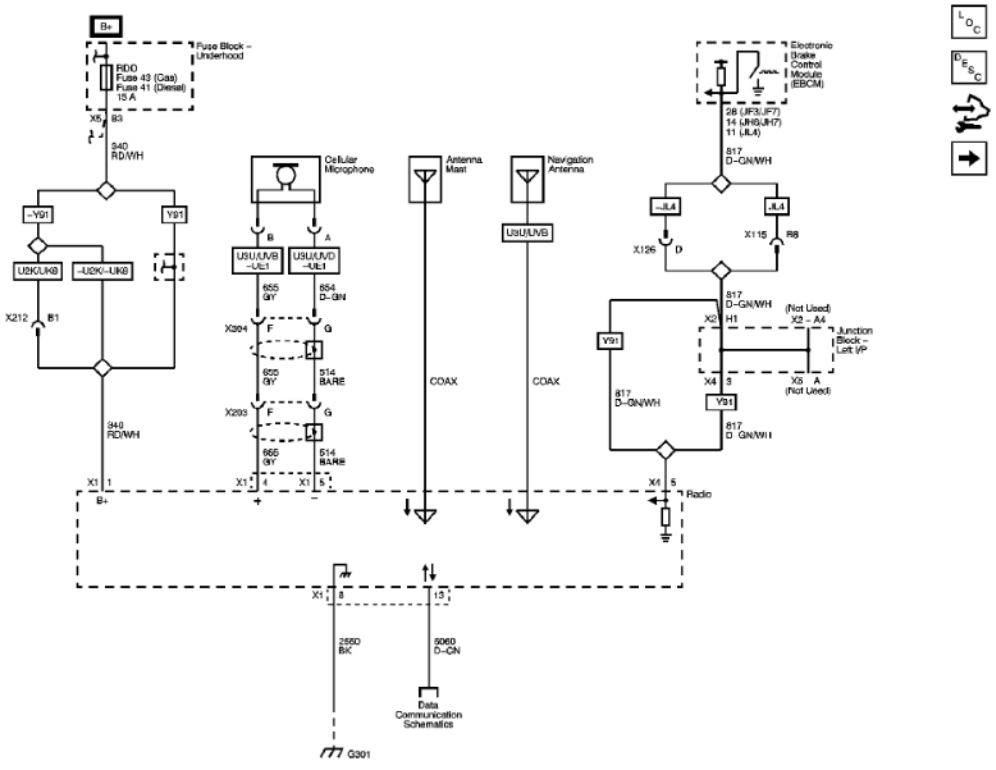


Fig. 1: Radio Power, Ground and Serial Data
Courtesy of GENERAL MOTORS CORP.

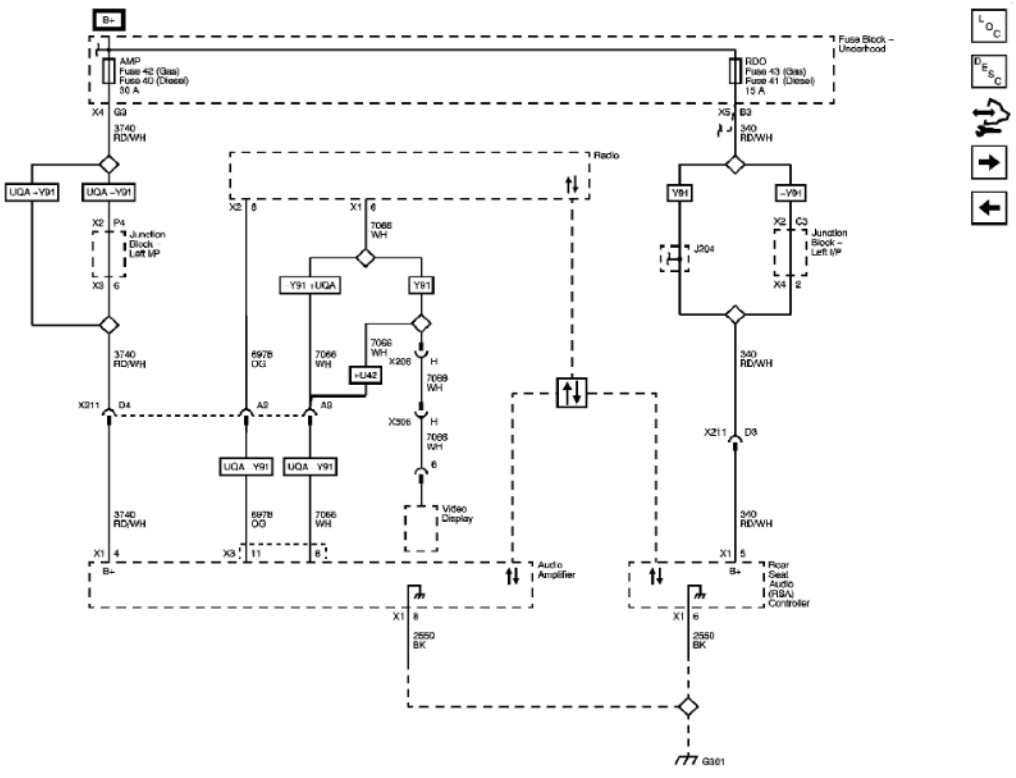


Fig. 2: Amplifier (UQA) and Rear Seat Audio (UK6) Power, Ground and Serial Data
Courtesy of GENERAL MOTORS CORP.

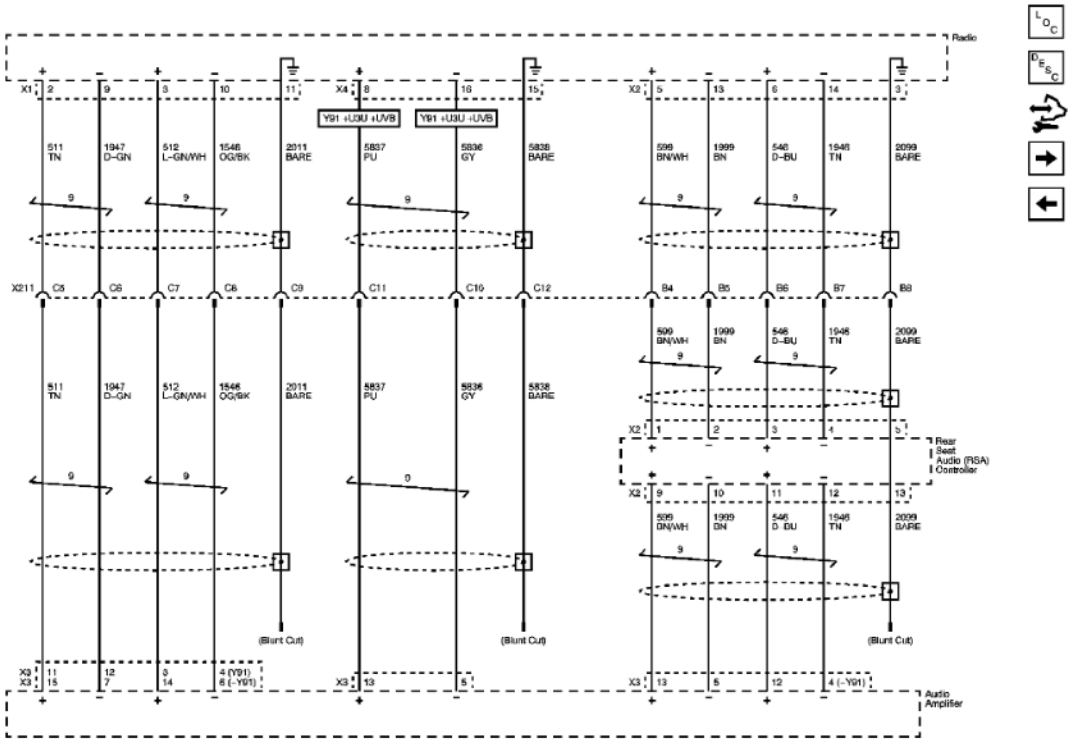


Fig. 3: Amplifier Inputs (UQA)
Courtesy of GENERAL MOTORS CORP.

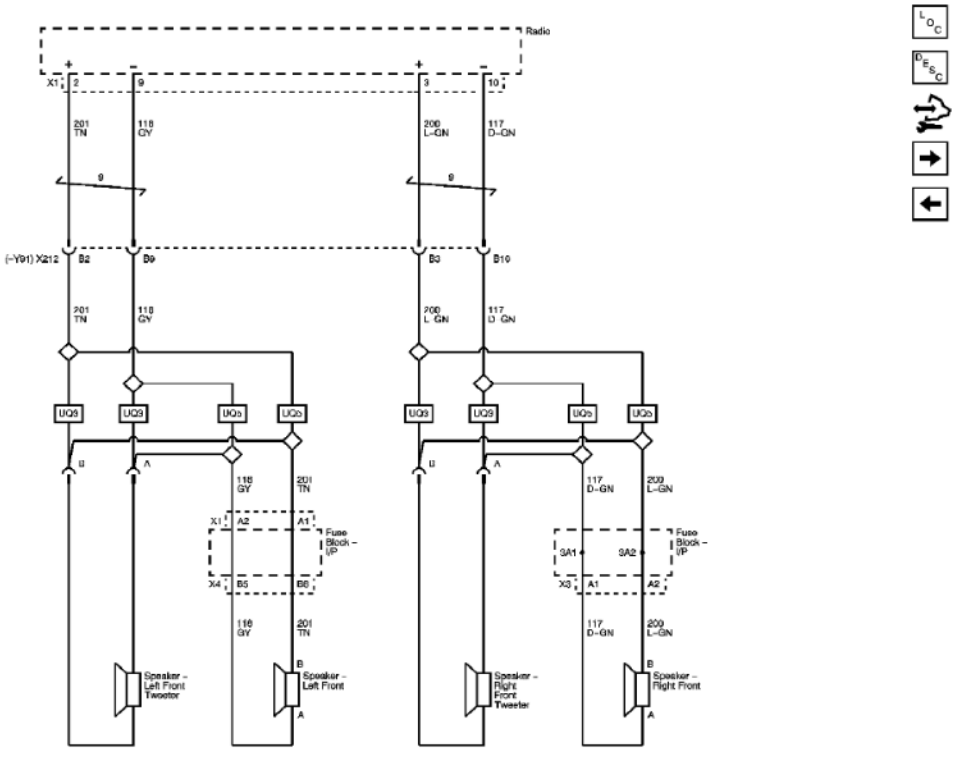


Fig. 4: Front Speakers (UQ3/UQ5)
Courtesy of GENERAL MOTORS CORP.

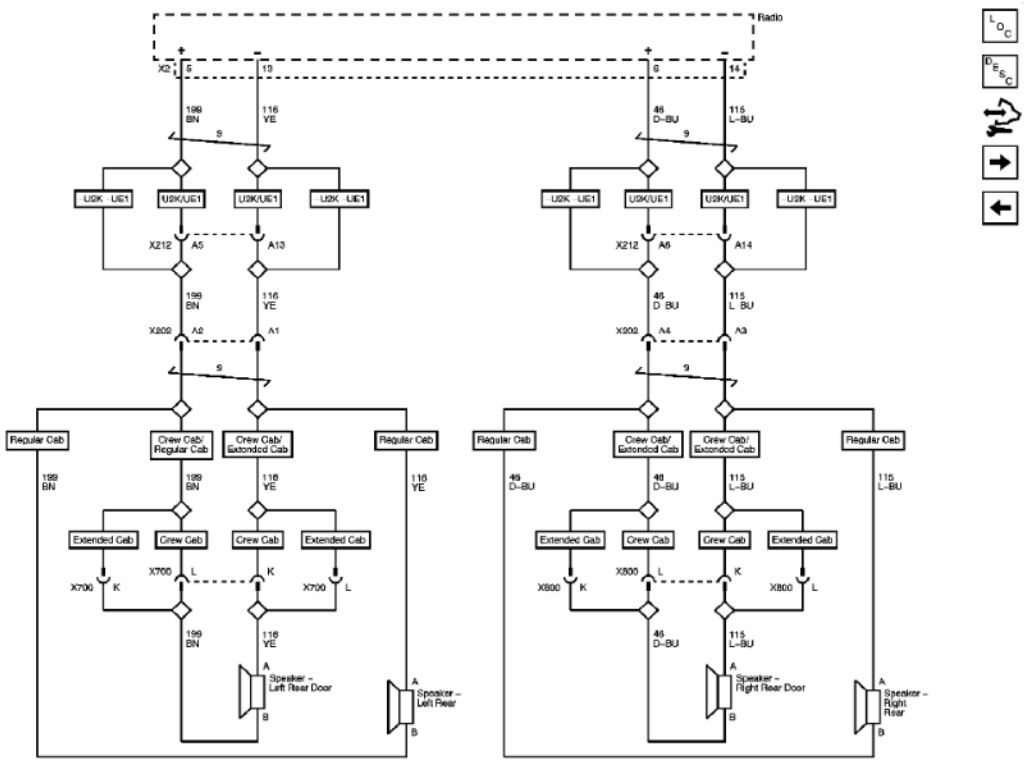


Fig. 5: Rear Speakers (UQ3/UQ5)
Courtesy of GENERAL MOTORS CORP.

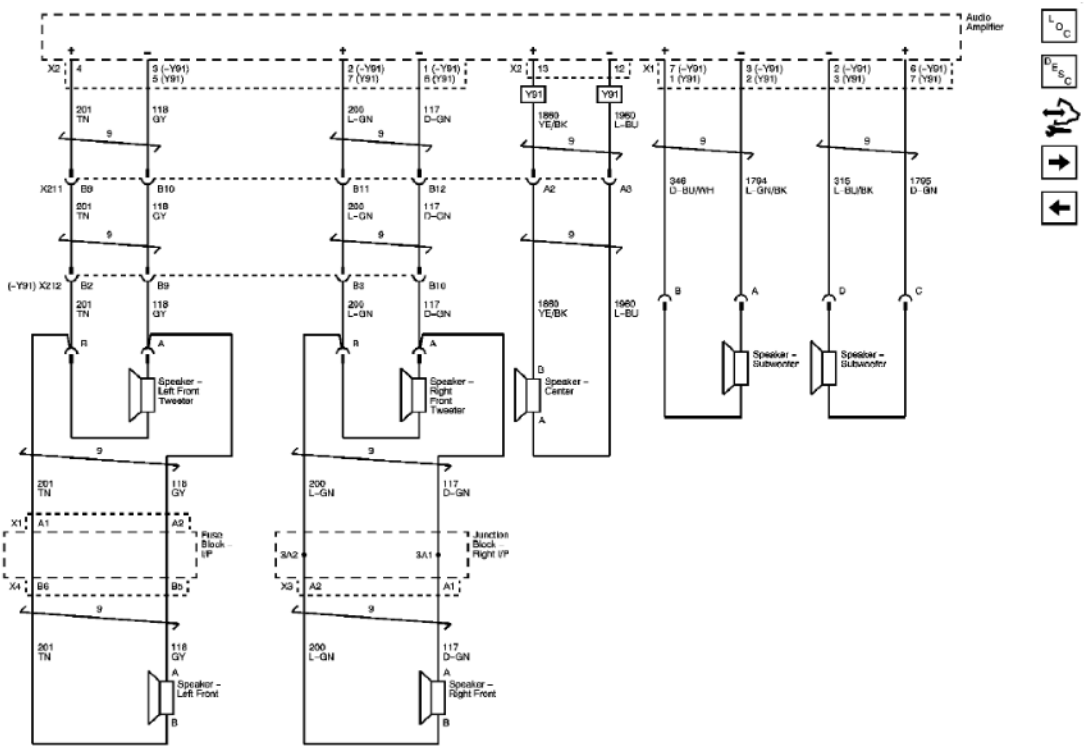


Fig. 6: Front Speakers (UQA)
Courtesy of GENERAL MOTORS CORP.

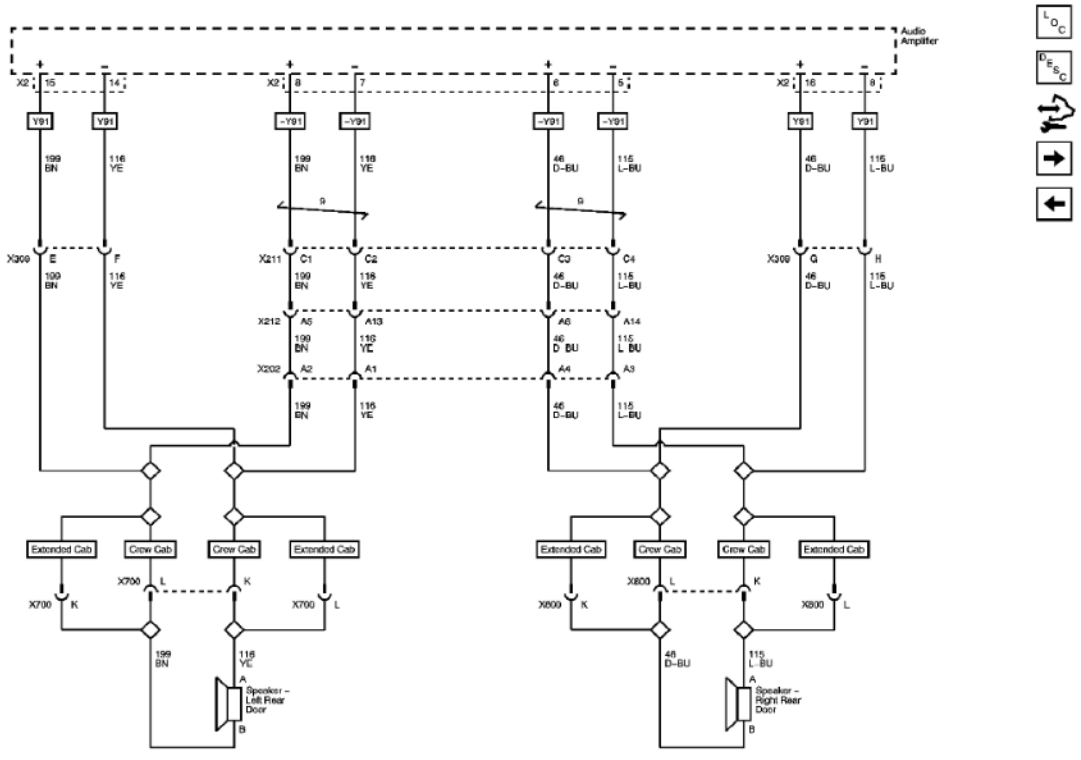


Fig. 7: Rear Speakers (UQA)
Courtesy of GENERAL MOTORS CORP.

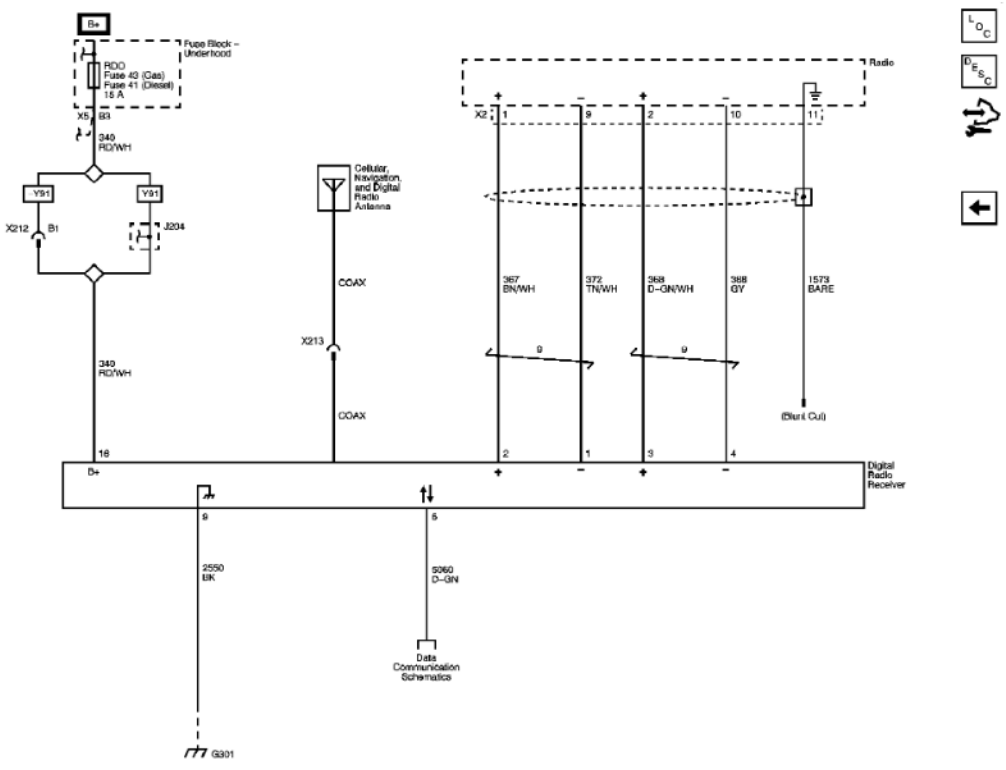


Fig. 8: Digital Radio Receiver (U2K)
Courtesy of GENERAL MOTORS CORP.

ONSTAR SCHEMATICS

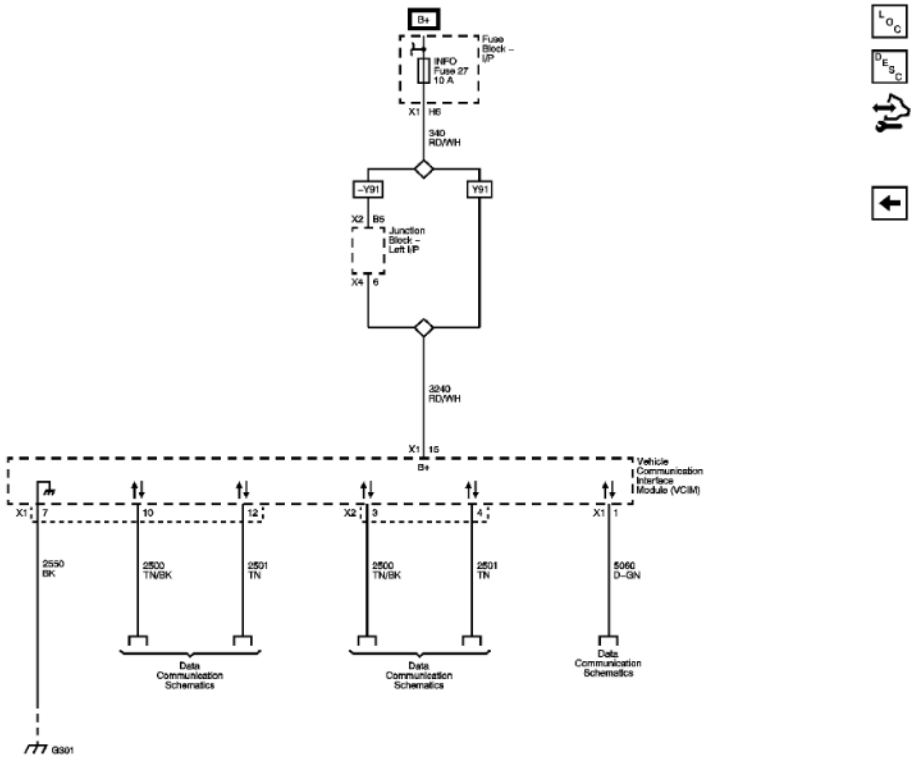


Fig. 9: Module Power, Ground and Serial Data
Courtesy of GENERAL MOTORS CORP.

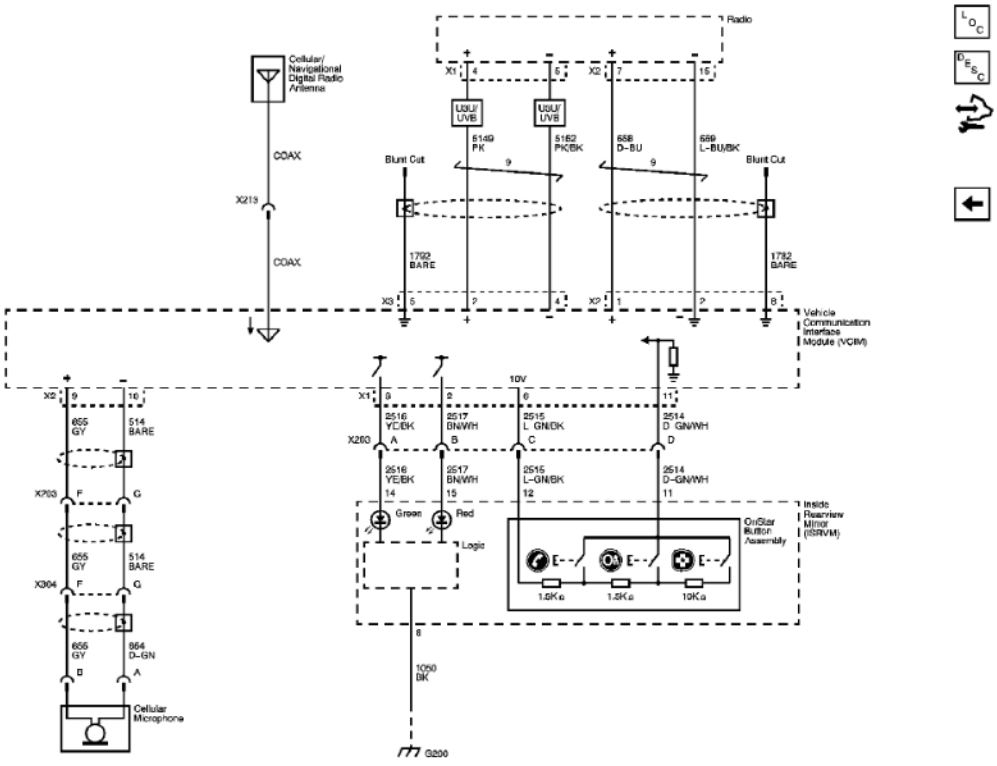


Fig. 10: Communication Signals and Controls
Courtesy of GENERAL MOTORS CORP.

VIDEO SYSTEM SCHEMATICS

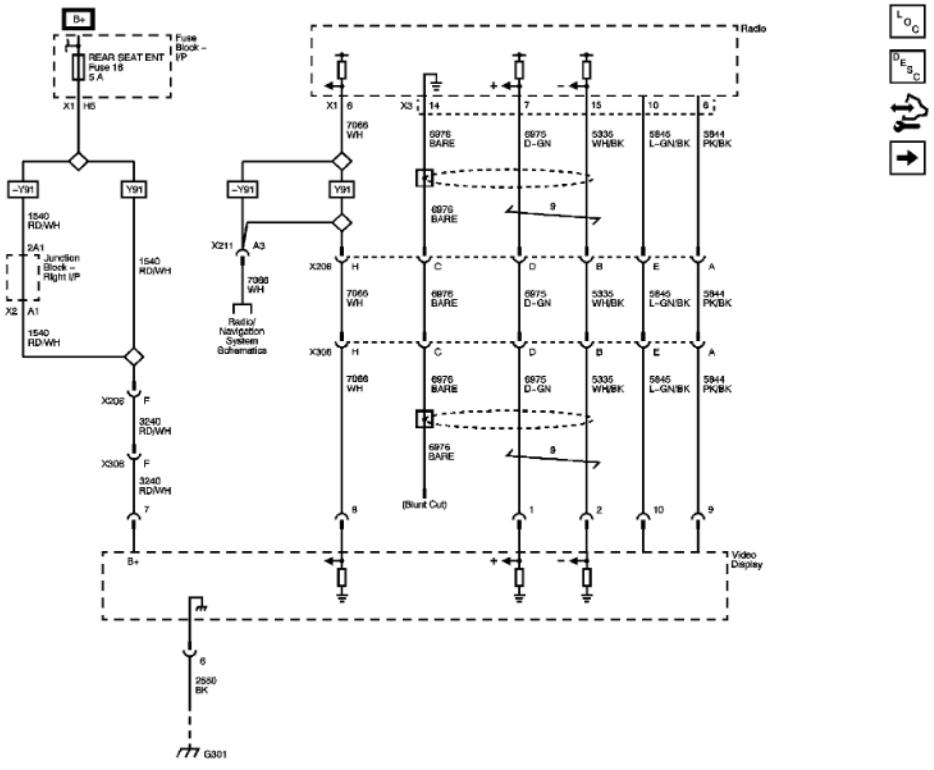


Fig. 11: Display Power, Ground and Video Signals
Courtesy of GENERAL MOTORS CORP.

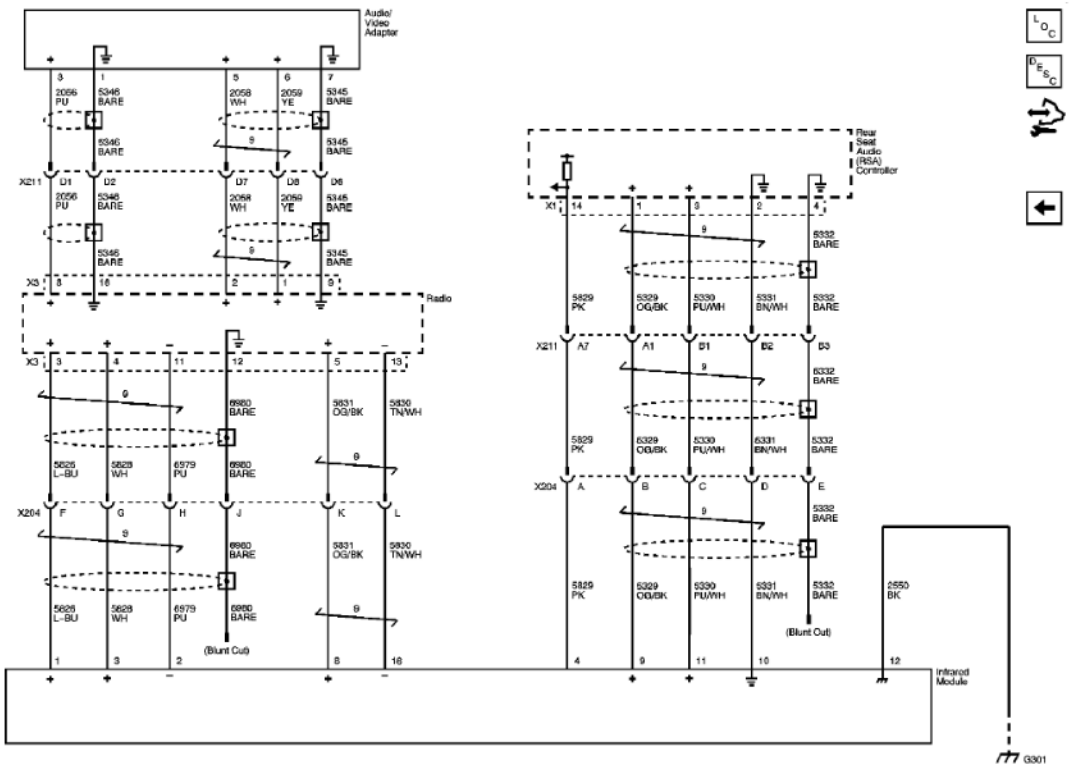


Fig. 12: Audio Signals
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
DTC B0000	B0000 5A: Vehicle Speed Information Circuit Plausibility Failure
DTC B1024	B1024 11: Circuit Board Temperature Sensor Above Maximum Threshold
DTC B1025, B1035, B1045, or B1055	B1025 01: Audio Output 1 Left Front Circuit Short to Battery B1025 02: Audio Output 1 Left Front Circuit Short to Ground B1025 04: Audio Output 1 Left Front Circuit Open B1035 01: Audio Output 2 Right Front Circuit Short to Battery B1035 02: Audio Output 2 Right Front Circuit Short to Ground B1035 04: Audio Output 2 Right Front Circuit Open

	B1045 01: Audio Output 3 Left Rear Circuit Short to Battery B1045 02: Audio Output 3 Left Rear Circuit Short to Ground B1045 04: Audio Output 3 Left Rear Circuit Open B1055 01: Audio Output 4 Right Rear Circuit Short to Battery B1055 02: Audio Output 4 Right Rear Circuit Short to Ground B1055 04: Audio Output 4 Right Rear Circuit Open
DTC B1259	B1259 02: Antenna Ground Circuit Short to Ground B1259 05: Antenna Ground Circuit Short to Battery or Open
DTC B1287	B1287 01: Amplifier Control Signal Circuit Short to Battery B1287 02: Amplifier Control Signal Circuit Short to Ground B1287 04: Amplifier Control Signal Circuit Open
DTC B1288	B1288 01: Video Display Mode Control Signal Short to Battery B1288 02: Video Display Mode Control Signal Short to Ground B1288 04: Video Display Mode Control Signal Open Circuit
DTC B1289	B1289 01: Video Display Brightness Control Signal Short to Battery B1289 02: Video Display Brightness Control Signal Short to Ground B1289 04: Video Display Brightness Control Signal Open Circuit
DTC B2455	B2455 04: Cellular Phone Microphone Circuit Malfunction Open Circuit
DTC B2462	B2462: Global Positioning System (GPS) Signal Error
DTC B2470	B2470 00: Cellular Phone Antenna Circuit Malfunction
DTC B2474	B2474 07: Navigation Display Head Backlighting Performance
DTC B2476 or B2482	B2476 00: Cellular Phone Select Service Switch B2482 00: Cellular Phone Select Service Switch Range/Performance
DTC B2483 or B2484	B2483 00: Global Positioning System (GPS) Antenna Malfunction Short to Ground B2484 00: Global Positioning System (GPS) Antenna Malfunction Open Circuit

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 B0000

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 B0000 5A

Vehicle Speed Information Circuit Plausibility Failure

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Vehicle Speed Signal	B0000 5A	B0000 5A	B0000 5A	B0000 5A

Circuit/System Description

The radio receives a vehicle speed signal from the electronic brake control module (EBCM) in order to correlate actual vehicle speed to the movement of the vehicle calculated by the navigation system and reported serial data.

Conditions for Running the DTC

- Radio ON.
- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

The DTC will set for one or more of the following conditions.

- Vehicle speed from serial data is more than 5 km/h (3 mph) and vehicle speed pulse from the EBCM is 0 km/h (0 mph).
- Vehicle speed calculated from the navigation processing software is more than 36 km/h (22 mph) and vehicle speed pulse from the EBCM is 0 km/h (0 mph) for 10 seconds continuously.

Action Taken When the DTC Sets

- Turn by turn route navigation may be inoperative.
- Vehicle indicated location may be inaccurate.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC clears after 100 malfunction-free ignition cycles.

Reference Information

Schematic Reference

- **Radio/Navigation System Schematics**
- **Antilock Brake System Schematics**

Connector End View Reference

Component Connector End Views

Description and Operation

Navigation System Description and Operation

Electrical Information Reference

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

Circuit/System Testing

IMPORTANT: Diagnose any antilock brake system (ABS) related DTCs before performing this diagnostic.

1. Ignition OFF, disconnect the radio harness connector X4. Connect a DMM to the vehicle speed signal (VSS) circuit terminal 5 and ground.
2. Ignition ON, operate the vehicle drive wheels at 5 mph. Verify 3-7 Hertz on the VSS circuit.
    - If the reading is not as specified, test the VSS circuit for an open, high resistance, short to ground or short to voltage. If the circuit tests normal replace the EBCM.
3. If the circuit tests normal, replace the radio.

Repair Procedures

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

Control Module References for radio or EBCM replacement, setup, and programming

DTC B1024

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 B1024 11

Circuit Board Temperature Sensor Above Maximum Threshold

Circuit/System Description

The audio amplifier monitors the internal circuitry for excessive temperature. When the amplifier senses an internal circuitry temperature greater than 95°C (203°F), the amplifier will set DTC B1024 11 and shut down until the internal circuitry cools below 90°C (194°F).

Conditions for Running the DTC

- Radio ON.
- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

DTC B1024 11 will set when the audio amplifier detects an over-heat condition greater than 95° C (203°F) of the internal amplifier circuitry.

Action Taken When the DTC Sets

The audio amplifier will shut down and all speakers will be inoperative.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

Diagnostic Aids

Extended use or extremely high volume especially in warm weather conditions may cause this DTC to set. Under these conditions it may be normal for this DTC to set to prevent permanent damage to the audio amplifier circuitry.

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 Testing

Ignition ON, with a scan tool, clear all DTCs and operate the audio system within the Conditions for Running the DTC.

- If the DTC resets, replace the audio amplifier.

Repair Procedures

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

Control Module References for audio amplifier replacement, setup, and programming

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** provide an overview of each diagnostic category.

DTC Descriptors

DTC B1025 01

Audio Output 1 Left Front Circuit Short to Battery

DTC B1025 02

Audio Output 1 Left Front Circuit Short to Ground

DTC B1025 04

Audio Output 1 Left Front Circuit Open

DTC B1035 01

Audio Output 2 Right Front Circuit Short to Battery

DTC B1035 02

Audio Output 2 Right Front Circuit Short to Ground

DTC B1035 04

Audio Output 2 Right Front Circuit Open

DTC B1045 01

Audio Output 3 Left Rear Circuit Short to Battery

DTC B1045 02

Audio Output 3 Left Rear Circuit Short to Ground

DTC B1045 04

Audio Output 3 Left Rear Circuit Open

DTC B1055 01

Audio Output 4 Right Rear Circuit Short to Battery

DTC B1055 02

Audio Output 4 Right Rear Circuit Short to Ground

DTC B1055 04

Audio Output 4 Right Rear Circuit Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Speaker Signal Circuits (Front Door and Tweeter)	B1025 02	B1025 04	B1025 01	-
Right Front Speaker Signal Circuits (Front Door and	B1035 02	B1035 04	B1035 01	-

Tweeter)				
Left Rear Speaker Signal Circuits (Rear Door)	B1045 02	B1045 04	B1045 01	-
Right Rear Speaker Signal Circuits (Rear Door)	B1055 02	B1055 04	B1055 01	-

Circuit/System Description

The up-level radio (UQA) supplies 4 channels of audio to an amplifier.

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

Set by Radio

The radio sets a current status for this DTC when a short to ground, short to voltage or an open is detected on any of the 4 speaker channel outputs from the radio.

Set by Bose Amplifier

The DTC will not set during normal amplifier operation. The vehicle must have the ignition OFF for several hours and the fault must be present during amplifier power-up.

DTC B1025 01, B1035 01, B1045 01, B1055 01

A short to voltage is detected on the specified (+) or (-) signal circuit

DTC B1025 02, B1035 02, B1045 02, B1055 02

A short to ground is detected on the specified (+) or (-) signal circuit

DTC B1025 04, B1035 04, B1045 04, B1055 04

An open is detected on the specified (+) or (-) signal circuit

Action Taken When the DTC Sets

No sound is present from one or more of the speakers.

Conditions for Clearing the DTC

Set by Radio

The fault condition becomes history if not present for 0.25 seconds.

Set by Bose Amplifier

The fault condition becomes history after the vehicle ignition has been OFF for several hours and then the ignition turns ON.

Diagnostic Aids

Speakers located in the front A-pillar are connected to the same channel as the speaker in the door. A DTC will only set after the amplifier only on up-level radios.

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

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

IMPORTANT: The DTC can be set by either the radio or the amplifier. If the DTC was set by the radio, diagnose suspect audio input circuits to the speakers or the amplifier (if equipped). Diagnose audio input signals to the speakers from the amplifier if the DTC was set by the amplifier.

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.

With Amplifier

1. Ignition OFF, disconnect the X1(except UQS) or X4(UQS)and X3 harness connectors at the amplifier.
2. Radio ON, test for 5.0-7.5 volts between the appropriate signal circuit terminal listed below and ground.
   - Left front door or tweeter - Connector X2, terminal 3

- Right front door or tweeter - Connector X2, terminal 1
- Left rear speaker - Connector X2, terminal 7
- Left rear subwoofer - Connector X3, terminal 3
- Right rear speaker - Connector X2, terminal 5
- Right rear subwoofer - Connector X3, terminal 2
  - 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. Radio ON, test for 5.0-7.5 volts between the appropriate signal circuit terminal listed below and ground.
   - Left front door or tweeter - Connector X2, terminal 4
   - Right front door or tweeter - Connector X2, terminal 2
   - Left rear speaker - Connector X2, terminal 8
   - Left rear subwoofer - Connector X3, terminal 7
   - Right rear speaker - Connector X2, terminal 6
   - Right rear subwoofer - Connector X3, terminal 6
     - 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, replace the amplifier.

Repair Procedures

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

- **Speaker Replacement Reference**
- **Control Module References** for Amplifier and Radio 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 Descriptors

DTC B1259 02

Antenna Ground Circuit Short to Ground

DTC B1259 05

Antenna Ground Circuit Short to Battery or Open

Circuit/System Description

The digital radio receiver (DRR) receives digital radio information from a specific digital radio antenna located on the outside of the vehicle. The DRR is connected to the digital radio antenna via a shielded coaxial cable. The antenna cable also provides a path for DC current for powering the antenna.

Conditions for Running the DTC

- Radio ON.
- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

B1259 02

The DTC will set when the DRR detects a short to ground in the antenna ground circuit.

B1259 05

The DTC will set when the DRR detects a short to voltage or an open/high resistance in the antenna ground circuit.

Actions Taken When the DTC Sets

- Digital radio reception may be poor or not available.
- The radio displays "No XM Signal" or "Check Antenna".

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.

- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

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. See **Special Tools**.

Circuit/System Testing

IMPORTANT:

- **Ensure the vehicle is outside in an area with an unobstructed view of the southern sky. Turn XM radio ON. Tune the radio to satellite channel 1. XM reception should be clear.**
- **Contact XM radio services at 1-800-852-9696 to verify the customers account status or possible network problems.**

1. Ignition OFF, disconnect the antenna coax from the DRR.
2. Connect the **EL-48028** to the DRR and place it on the roof of the vehicle. See **Special Tools**.
3. Ignition ON, radio tuned to XM, verify XM reception has improved.
    - If the XM reception has not improved, replace the DRR.
4. Ignition OFF, disconnect the antenna coaxial cable from the DRR antenna base.
5. Test for less than 5 ohms between the two ends of the coax cable center conductor.
    - If greater than the specified range, replace the antenna coax cable.
6. Test for less than 5 ohms between the two ends of the coax cable outer shield.
    - If greater than the specified range, replace the antenna coax able.
7. Test for infinite resistance between the antenna coax center conductor and the outer shield.
    - If less than the specified range, replace the antenna coax cable.
8. If all circuits test normal, replace the digital radio antenna.

Repair Procedures

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

- **Mobile Telephone Digital Antenna Replacement**
- **Control Module References** for DRR replacement, setup, and programming

DTC B1287

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 B1287 01

Amplifier Control Signal Circuit Short to Battery

DTC B1287 02

Amplifier Control Signal Circuit Short to Ground

DTC B1287 04

Amplifier Control Signal Circuit Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Antenna 14V Switched Supply Voltage	B1287 02	B1287 04	B1287 01	-

Circuit/System Description

The amplifier receives PWM signals on the antenna 14V switch supply voltage circuit at varying duty cycle percentages for controlling the ON and OFF functions of the amplifier. The radio outputs a low duty cycle signal to produce an ON condition at the amplifier. The radio outputs a high duty cycle signal to produce a OFF condition at the amplifier.

Conditions for Running the DTC

- Radio is ON
- The system voltage is at between 9 volts and 16 volts

Conditions for Setting the DTC

A short to voltage, short to ground, or an open is seen on the remote enable circuit

Action Taken When the DTC Sets

Amplifier functions are disabled

Conditions for Clearing the DTC

- A current DTC clears when the condition for setting the DTC is no longer present
- A history 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

Circuit/System Verification

Radio ON, adjust the fade and balance control to verify audio is present at each individual channel.

Circuit/System Testing

1. Ignition OFF, disconnect the X1 harness connector at the amplifier.
2. Radio ON, test for B+ between the signal circuit terminal 8 and ground.
    - If less than the specified value, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the radio.
3. If all circuits test normal, replace the amplifier.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for radio or amplifier replacement

DTC B1288

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 B1288 01

Video Display Mode Control Signal Short to Battery

DTC B1288 02

Video Display Mode Control Signal Short to Ground

DTC B1288 04

Video Display Mode Control Signal Open Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
DVD Display B+	1	1	1	-
Radio ON Signal	1	1	1	-
Video Display Brightness Signal	B1289 02	B1289 04	B1289 01	-
Video Display Mode Control	B1288 02	B1288 04	B1288 01	-
Video High Signal	1	1	1	-
Video Low Signal	1	1	1	-
DVD Display Ground	-	1	-	-
1. Video Entertainment System Inoperative.				

Circuit/System Description

The radio can control the video display mode on vehicles equipped with rear seat entertainment (RSE) video. The radio varies a pulse with modulated (PWM) signal to the rear entertainment video screen to command the display mode.

Conditions for Running the DTC

- Ignition ON.

- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

The DTC will set when the radio detects a short to voltage, short to ground, or an open/high resistance in the video display mode control circuit 400 ms after the radio activates the remote enable circuit.

Action Taken When the DTC Sets

The radio sets the DTC and defaults the video display to normal mode.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

Reference Information

Schematic Reference

Video System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Video Entertainment 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 Testing

1. Ignition OFF, disconnect the harness connector at the rear video display.
2. Ignition ON, test for 100-300 Hz at the control circuit terminal 10.
    - If not within the specified range, test the control circuit for a short to voltage, short to ground, or an open/high resistance. If the circuit tests normal, replace the radio.
3. If all circuits test normal, replace the rear video display.

Repair Procedures

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

- **Video Display Replacement (Second Row)**
- **Control Module References** for Radio replacement, setup, and programming

DTC B1289

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 B1289 01

Video Display Brightness Control Signal Short to Battery

DTC B1289 02

Video Display Brightness Control Signal Short to Ground

DTC B1289 04

Video Display Brightness Control Signal Open Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
DVD Display B+	1	1	1	-
Radio ON Signal	1	1	1	-
Video Display Brightness Control	B1289 02	B1289 04	B1289 01	-
Video Display Mode Control	B1288 02	B1288 04	B1288 01	-
Video High Signal	1	1	1	-
Video Low Signal	1	1	1	-
DVD Display Ground	-	1	-	-
1. Video Entertainment System Inoperative.				

Circuit/System Description

The radio can control the video display brightness on vehicles equipped with rear seat entertainment (RSE) video. The radio varies a pulse with modulated (PWM) signal to the rear entertainment video screen to command the screen brightness to the desired level.

Conditions for Running the DTC

- Ignition ON.
- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

The DTC will set when the radio detects a short to voltage, short to ground, or an open/high resistance in the video display brightness control circuit 400 ms after the radio activates the remote enable circuit.

Action Taken When the DTC Sets

The radio sets the DTC and defaults the video display to full brightness.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

Reference Information

Schematic Reference

Video System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Video Entertainment 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 Testing

1. Ignition OFF, disconnect the harness connector at the rear video display.
2. Ignition ON, test for 100-300 Hz at the control circuit terminal 9.
    - If not within the specified range, test the control circuit for a short to voltage, short to ground, or an open/high resistance. If the circuit tests normal, replace the radio.
3. If all circuits test normal, replace the rear video display.

Repair Procedures

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

- **Video Display Replacement (Second Row)**
- **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 04

Cellular Phone Microphone Circuit Malfunction Open Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cellular Microphone Signal	B2455 04	B2455 04	B2455 04	-
Cellular Microphone Low Reference	-	B2455 04	1	-
1. OnStar Microphone Inoperative - Caller Cannot Be Heard				

Circuit/System Description

The communication interface module (CIM) provides the cellular microphone with a supplied voltage on the cellular microphone signal circuit. When the microphone is in use, voice data from the user is sent back to the CIM on the signal circuit. The CIM provides a ground for the microphone via 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 CIM detects an open, short to ground or short to voltage in the cellular microphone signal circuit for 10 seconds or greater.
- The CIM detects an open/high resistance in the drain wire circuit for 10 seconds or greater.

Actions Taken When the DTC Sets

- The OnStar® status LED turns red.

- The CIM will not receive a signal from the microphone.
- Calls can be placed but the caller cannot be heard.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 50 consecutive malfunction-free ignition cycles have occurred.

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 Testing

1. Ignition OFF, disconnect the harness connector at the cellular microphone.
2. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
3. Ignition ON, test for 9.5-10.5 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 CIM.

- 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 CIM.

4. Test for test for 9.5-10.5 volts between the signal circuit terminal B and the drain circuit terminal A.
   - If less than the specified range, test the drain circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the CIM.
5. If all circuits test normal, replace the cellular microphone.

Repair Procedures

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

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

DTC B2462

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 B2462

Global Positioning System (GPS) Signal Error

Circuit Description

The global positioning system (GPS) antenna is connected to the navigation radio by a coaxial cable.

Conditions for Running the DTC

The radio must detect one of the following power modes:

- ACC
- ON
- RAP

- RAP UNLK

Conditions for Setting the DTC

- The navigation radio test the GPS antenna every 10 seconds.
- The radio determines there is an open in the GPS antenna.

Actions Taken When the DTC Sets

- Unable to get GPS location updated, the radio uses the last reported position and the vehicle speed signal to calculate the vehicle position.
- Route guidance may be inaccurate.
- This failure has no effect outside the navigation system.

Conditions for Clearing the DTC

- A current DTC clears when the radio does not detect the failure for more than 10 seconds.
- A history DTC clears after 50 ignition cycles with no repeat of the failure.

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

Scan Tool Reference

Control Module References

Circuit/System Testing

1. Ignition OFF, disconnect the GPS coaxial cable from the GPS antenna.
2. Ignition ON, test for 4.0-5.5 volts between the center conductor and the shield of the coaxial cable.
    - If not within the specified range, replace the GPS antenna.
3. Ignition OFF, test for less than 5 ohms or resistance at the GPS coaxial cable center conductor from end to end.
    - If greater than the specified range, replace the GPS coaxial cable.
4. Ignition OFF, test for infinite resistance between the center conductor and the outer conductor of the GPS coaxial cable.
    - If less than the specified range, replace the GPS coaxial cable.
5. If all circuits test normal, replace the radio.

Repair Procedures

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

- **Global Positioning System (GPS) Antenna Replacement**
- **Control Module References** for radio replacement, setup, and programming

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

- 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 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.
- The VCIM receives the clear DTC command from the scan tool.

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

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

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

Component 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. Disconnect the cellular antenna coax connector from the VCIM and the cellular antenna.
2. Test for infinite resistance between the center conductor and the outer metal shield of the cellular antenna coax cable.
    - If meter does not read infinite, replace the cellular antenna coax cable.
3. Test for less than 1 ohm of resistance at the cellular antenna coax connector from end to end.
    - If greater than specified value, replace the cellular antenna coax cable.
4. Ignition OFF, connect a fused jumper wire between coaxial center conductor and the metal outer shield at the VCIM antenna coax cable connector.
5. Ignition ON, verify that DTC B2470 is not current.
    - If DTC B2470 is still current, replace the VCIM.
6. If all circuits test normal, replace the cellular antenna.

Repair Procedures

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

- **Mobile Telephone Digital Antenna Replacement**
- **Control Module References** for VCIM replacement, setup, and programming

DTC B2474

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 B2474 07

Navigation Display Head Backlighting Performance

Circuit Description

The internal backlighting of the navigation display screen located in the navigation radio.

Conditions for Running the DTC

- Radio ON.
- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

- The navigation radio tests the navigation display backlighting every 1 second.
- The radio determines there is a malfunction or overheat condition in the navigation display backlighting.

Action Taken When the DTC Sets

Navigation backlighting may be too bright, dim or blank.

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 50 consecutive malfunction-free ignition cycles have occurred.

Diagnostic Aids

Occasionally it is possible to overheat the navigation display backlighting due to excessive ambient heat inside the vehicle. In this instance it may be necessary to allow time for the display to cool.

Reference Information

Schematic Reference

Radio/Navigation System Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Navigation 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

1. Ignition OFF, allow the navigation display to cool if the ambient temperature inside the vehicle is excessive and the radio is hot to the touch. Verify the navigation display is cool and the DTC has cleared and gone to history.
2. Ignition ON, with a scan tool, clear all DTCs and operate the audio/navigation system within the Conditions for Running the DTC. Verify the DTC does not reset.
    - 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 B2476 OR 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 Descriptors

DTC B2476 00

Cellular Phone Select Service Switch

DTC B2482 00

Cellular Phone Select Service Switch Range/Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Keypad Supply Voltage	B2476 00	B2476 00	B2476 00	-
Keypad Green LED Signal	1	1	2	-
Keypad Red LED Signal	1	1	2	-
Keypad Signal	3	3	-	-
Inside Rearview Mirror Ground	-	1	-	-
1. OnStar® LED Inoperative 2. LED Illuminated At All Times 3. OnStar® Buttons Inoperative				

Circuit/System Description

The OnStar® button assembly consists of 3 buttons, Call/Answer, OnStar® Call Center, and OnStar® Emergency. The communication interface module (CIM) supplies the OnStar® button assembly with 10 volts via 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 CIM over the keypad signal circuit. Depending upon the voltage range returned, the CIM is able to identify which button has been activated.

Conditions for Running the DTC

- Ignition ON.
- Battery voltage must be between 9-16 volts.

Conditions for Setting the DTC

B2476

The CIM detects a short to voltage, short to ground, or an open/high resistance on the keypad supply voltage circuit.

B2482

The CIM detects a valid signal on the keypad signal circuit for longer than 15 seconds. If one of the OnStar® buttons is held or stuck for 15 seconds or greater, the CIM will set this DTC.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 100 consecutive malfunction-free ignition cycles have occurred.

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 Testing

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 than the specified range, test the supply voltage circuit for a short to ground or open/high resistance. If the circuit tests normal, replace the CIM.
    - If greater than the specified range, test the supply voltage circuit for a short to voltage. If the circuit tests normal, replace the CIM.
3. Test for 0 volt between the keypad signal circuit terminal 11 and ground.
    - If greater than the specified range, test the keypad signal circuit for a short to voltage. If the circuit tests normal, replace the CIM.
4. Test for 9.8-10.2 volts between the keypad supply voltage circuit terminal 12 and the keypad signal circuit terminal 11.
    - If less than the specified range, test the keypad signal circuit for an open/high resistance. If the circuit tests normal, replace the CIM.
5. Test for less than 5 ohms between the mirror ground circuit terminal 8 and ground.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
6. Ignition OFF, disconnect the CIM X1 connector. Test for infinite resistance between the keypad signal circuit terminal 11 and ground.
    - If less than the specified range, test the keypad signal circuit for a short to ground.
7. If all circuits test normal, test or replace the button assembly.

Component Testing

1. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
2. Test for infinite resistance between the keypad supply voltage terminal 12 and the keypad signal terminal 11.
    - If less than the specified range, replace the inside rearview mirror.
3. Test for 1.4k-1.6k ohms between the keypad supply voltage terminal 12 and the keypad

signal terminal 11 while pressing the black phone button.
   - If not within the specified range, replace the inside rearview mirror.
4. Test for 2.7k-3.3k ohms between the keypad supply voltage terminal 12 and the keypad signal terminal 11 while pressing the blue On-Star® button.
   - If not within the specified range, replace the inside rearview mirror.
5. Test for 11.7k-14.3k ohms between the keypad supply voltage terminal 12 and the keypad signal terminal 11 while pressing the red emergency button.
   - If not within the specified range, 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

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

Global Positioning System (GPS) Antenna Malfunction Short to Ground

DTC B2484 00

Global Positioning System (GPS) Antenna Malfunction Open Circuit

Circuit/System Description

The communication interface module (CIM) receives information from a specific navigation antenna located on the outside of the vehicle. The navigation antenna is connected to the CIM 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.
- Battery voltage is between 9-16 volts.

Conditions for Setting the DTC

B2483 00

The CIM detects a short to ground on the navigation antenna signal circuit.

B2484 00

The CIM detects an open/high resistance on the navigation antenna signal circuit.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

- The condition responsible for setting the DTC no longer exists.
- A history DTC will clear once 50 consecutive malfunction-free ignition cycles have occurred.

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. Disconnect the navigation antenna coax cable from the CIM.
2. Ignition ON, test for 4.5-5.5 volts between the CIM coax cable connection center conductor and ground.
    - If the reading is not within the specified range, replace the CIM.
3. Reconnect the coax cable to the CIM. Disconnect the coax cable from the navigation antenna.
4. Test for 4.5-5.5 volts between the coax cable center conductor and the outer shield.
    - If the reading is not within the specified range, replace the coax cable.
5. If all circuits test normal, replace the navigation antenna.

Repair Procedures

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

- **Mobile Telephone Digital Antenna Replacement**
- **Control Module References** for CIM replacement, setup, and programming

SYMPTOMS - CELLULAR COMMUNICATION

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

1. Perform the **Diagnostic System Check - Vehicle** . Before using the Symptom Tables, verify that all of the following are true:
    - There are no DTCs set.
    - The control module 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**.
3. Perform the **OnStar Symptom Diagnosis**. This symptom table will enable the user to verify the customer complaint and narrow it to its source.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the system. Refer to **Checking Aftermarket Accessories** .
- Inspect the 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 One or More Buttons Inoperative**
- **OnStar Call Center Remote Function Requests Inoperative**
- **OnStar Microphone Inoperative - Caller Cannot Be Heard**
- **OnStar Steering Wheel Control Functions Inoperative**
- **OnStar Button LED Inoperative**
- **No (or Noisy) OnStar Audio**
- **OnStar Global Positioning System (GPS) Data Not Current or Inaccurate**

SYMPTOMS - ENTERTAINMENT

IMPORTANT: 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 the 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:

- **Speaker Malfunction**
- **Radio Audio Inoperative at Rear Seat Audio (RSA) Control**
- **Radio Displays LOC, LOCKED, or CODE**
- **Radio Displays CAL or CAL ERR**
- **Radio Poor Reception**
- **Radio Controls Inoperative - Rear Seat**
- **Video Display is Poor or Blank**
- **Video Entertainment System Inoperative**
- **Video Entertainment System Remote Control Inoperative**
- **Video Entertainment System Wireless Headphone Inoperative**

SYMPTOMS - NAVIGATION SYSTEMS

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

- 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.
- Review **Navigation System Description and Operation** in order to familiarize yourself with the system functions.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the navigation system components. Refer to **Checking Aftermarket Accessories** .
- Inspect the 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:

- **No Global Positioning System (GPS) Reception**
- For radio/audio related symptoms, refer to **Symptoms - Entertainment**.

AUDIO SYSTEM TROUBLESHOOTING HINTS

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.

- Check for any aftermarket equipment that may have been installed on the vehicle. If aftermarket equipment is found disconnect it and check if the audio noise is still present.

  Inspect 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 check for the following before speaker replacement:
  - Isolate the noise using the **J 39916-A** CD and Cassette Diagnostic Audio Kit. See **Special Tools**.
  - Inspect the speaker connections 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 can 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.

- Inspect 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, to ensure that they are clean and tight.
- Compare the customers vehicle to another of similar model and audio system 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 88-108 FM then 550-1600 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 again with the engine running.
2. Return the ignition switch to the position that the concern was most noticeable.
3. Remove 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. Attempt variations of the following repairs:
        - Add 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 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 (50 V) capacitor GM P/N 1227895-Works well for ignition system related noise.
  - 0.47 micro farad capacitor GM P/N 1227894-Works well for switches and relays.
  - Feed through capacitor GM P/N 477371-Works well for high current situations.
  - Filter package GM P/N 1224205-Works well for low current situations.
  - Fuel pump suppressor GM P/N 25027405
  - 53.34 cm (21 in) braided ground strap GM P/N 8910791
  - 48.26 cm (19 in) braided ground strap GM P/N 6286800
  - 26.67 cm (10.5 in) braided ground strap GM P/N 6287160
  - 21.59 cm (8.5 in) 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. Inspect 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.
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 the 2-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 all of the vehicle systems for proper operation and function.

VIDEO ENTERTAINMENT SYSTEM TROUBLESHOOTING HINTS

Schematic Reference: Video System Schematics

- Many conditions that affect video system operation may be corrected without removing the radio, the digital video disc (DVD) player or the video entertainment overhead console from the vehicle. Make sure to understand all features of system operation before beginning the diagnosis of the system. Verify the condition and follow the diagnostic procedures in order to isolate and correct the condition.
- Be sure the vehicle battery is fully charged before beginning video entertainment system diagnosis.

Video or Audio Distortion

The manufacturing process for producing DVDs does not have the same quality control processes in place that compact disk manufacturing does. If there are video or audio quality problems with an individual DVD, try playing that disk in another DVD player. If the quality is poor for both players, return the disk to the place of purchase and request an exchange. If the quality problem is only seen in one of the players, examine the disk for scratches dirt or smudges and attempt to clean the disk with one of the disk cleaning systems that are commercially available.

Video or audio distortion during auxiliary playback can often be attributed to the DC to AC inverter that is used to power the auxiliary device. The power inverters tend to introduce noisy

signals into the vehicle electrical system.

Video Entertainment System Wireless Headphone Inoperative

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.

1. Volume control on the wireless headphone set is turned all the way down. Adjust the volume control on the headphones.
2. Dead batteries in the wireless headphone set. Turn on power to the headphone set. If the headset indicator does not turn on, replace the batteries in the headset as needed.
3. Faulty headphone set. Test the operation of the system using a known good headphone set. If operation is OK, replace the vehicle headphone set.

Video Entertainment System Remote Control Inoperative

The buttons on the video remote control do not operate the video disc player but the buttons on the video disc player operate normally.

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.

1. Dead batteries in the video remote control. Replace the dead batteries.
2. Faulty remote control. Test the operation of the system using a known good remote control. If operation is OK, replace the remote control.

Discs Will Not Eject

1. Attempt to remove the CDs/DVDs from the radio by pushing the "Eject" button on the radio. If there is a "chatter" noise, go to step two. If there is no chatter noise and the discs will not eject from the radio, send the radio to your authorized Electronic Service Center for repair.
2. Remove the radio from the Instrument Panel of the vehicle but do not remove the electrical connectors. Refer to **Radio Replacement (without RPO SLT)** or **Radio Replacement (with RPO SLT)**.
3. Some versions of these radios have a 9.5 mm x 13 mm oval hole on the top cover of the radio, near the back of the case. If the radio being serviced has this hole, proceed to step four. Otherwise the radio will need to be returned to your authorized Electronic Service

Center for repair.

4. Push the "Eject" button. While the discs are attempting to eject, insert a plastic pen cap, or similar plastic object into the hole to assist the top disc out of the radio.
5. After the top disc is removed, push the "Eject" button again to remove the bottom disc.
6. Check the operation of the radio to see if a CD or DVD can be inserted and then ejected. If a CD or DVD can be inserted and ejected from the radio, then reinstall the radio into the Instrument Panel. If a CD or DVD cannot be inserted and then ejected from the radio, send the radio to your authorized Electronic Service Center for repair.

DIGITAL RADIO MALFUNCTION

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
Left Audio Signal (+)	1	1	1	-
Left Audio Signal (-)	1	1	1	-
Right Audio Signal (+)	2	2	2	-
Right Audio Signal (-)	2	2	2	-
Digital Radio Antenna Coax	3	3	3	-
1. No or distorted audio from left side speakers when listening to digital radio 2. No or distorted audio from right side speakers when listening to digital radio 3. Poor or no digital radio reception				

Circuit/System Description

The digital radio receiver (DRR) receives an XM satellite radio signal via the cellular and digital radio antenna. This signal is passed to the DRR through the digital radio antenna coax. From the DRR, separate left and right audio signals (+ and -) are sent to the radio. The radio then processes these signals and passes the audio to the appropriate speakers or amplifier.

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. See Special Tools.

Circuit/System Verification

1. Tune to a strong AM or FM station and verify each speaker is producing clear and even sound, with no distortion.
    - If any speaker is not producing sound or the sound produced is distorted, refer to Speaker Malfunction.
2. With the vehicle outside in an area with an unobstructed view of the southern sky, tune to XM. Verify XM reception is clear and the No XM Signal message is not displayed on the radio.
    - If the No XM Signal message is displayed or XM reception is poor, refer to Digital Radio Antenna Circuit Malfunction.
3. Radio tuned to XM, use the radio balance function to transfer audio between the left and right side of the vehicle. Verify clear and even sound is heard from each side of the vehicle.
    - If either side of the vehicle is not producing sound or the sound produced is distorted,

refer to Digital Radio Signal Circuit Malfunction.

Circuit/System Testing

Digital Radio Antenna Circuit Malfunction

1. Ignition OFF, disconnect the digital radio antenna coax from the digital radio receiver (DRR). Connect the **EL-48028** to the DRR. See **Special Tools**.
2. Ignition ON, radio tuned to XM, verify XM reception is clear and uninterrupted.
   - If reception is not clear, replace the DRR.
3. Ignition OFF, disconnect the digital radio antenna coax from the digital radio antenna.
4. 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.
5. Test for infinite resistance between the antenna coax center terminal and ground.
   - If less than the specified value, replace the antenna coax.
6. Test for less than 5 ohms of resistance on the antenna coax center circuit from end to end.
   - If greater than the specified range, replace the antenna coax.
7. Test for infinite resistance between the coax center terminal and the outer shield.
   - If less than the specified value, replace the antenna coax.
8. If all circuits test normal, test or replace the digital radio antenna.

Digital Radio Signal Circuit Malfunction

1. Ignition OFF, disconnect the X2 harness connector at the radio.
2. Radio ON, test for 5.0-7.5 volts between the signal circuit terminal 1 and ground.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the DRR.
   - 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 DRR.
3. Test for 5.0-7.5 volts between the signal circuit terminal 2 and ground.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the DRR.
   - 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 DRR.
4. Test for 5.0-7.5 volts between the signal circuit terminal 9 and ground.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the

circuit tests normal, replace the DRR.
- 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 DRR.

5. Test for 5.0-7.5 volts between the signal circuit terminal 10 and ground.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the DRR.
   - 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 DRR.
6. If all circuits test normal, test or replace the radio.

Repair Procedures

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

- **Mobile Telephone Digital Antenna Replacement**
- **Control Module References** for radio or DRR replacement

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 dependant 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

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. Observe the scan tool GPS Signal Status Indicator parameter for at least 10 seconds. Verify the indicator displays Yes.
    - If the indicator does not display Yes, refer to Circuit / System Testing.
2. Call and verify the OnStar advisor receive GPS data.
    - If the advisor did not receive GPS data and the call was a 'fail to voice', contact the GM Technical Assistance Center.
    - If the advisor did not receive GPS data and the call was not a 'fail to voice', refer to Circuit / System 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.
    - If your actual position is not within a reasonable distance from the actual location of the vehicle, replace the VCIM.

Circuit/System 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. Ignition OFF, disconnect the navigation antenna coax from the VCIM module and the navigation 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. Test for infinite resistance between the antenna coax center terminal and ground.
    - If less than the specified value, replace the antenna coax
4. Test for less than 5 ohms of resistance at the antenna coax connector outer shield from end to end.
    - If greater than specified value, replace the antenna coax cable.

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

Repair Procedures

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

- **Mobile Telephone Digital 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 04	B2455 04	B2455 04	-
Cellular Microphone Low Reference	-	B2455 04	1	-
1. OnStar Microphone Inoperative - Caller Cannot Be Heard				

Circuit/System Description

The communication interface module (CIM) provides the cellular microphone with a supplied voltage on the cellular microphone signal circuit. When the microphone is in use, voice data from the user is sent back to the CIM on the signal circuit. The CIM provides a ground for the microphone via the drain wire.

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 Testing

1. Ignition OFF, disconnect the harness connector at the cellular microphone.
2. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
3. Ignition ON, test for 9.5-10.5 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 CIM.
    - 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 CIM.
4. Test for test for 9.5-10.5 volts between the signal circuit terminal B and the drain circuit terminal A.
    - If less than the specified range, test the drain circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the CIM.
5. If all circuits test normal, replace the cellular microphone.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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

NAVIGATION SYSTEM - 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.

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**

Circuit/System Testing

1. Verify the OnStar® voice recognition is operating normally.
    - If the OnStar® voice recognition is inoperative, refer to **OnStar Microphone Inoperative - Caller Cannot Be Heard**.
2. Ignition OFF, disconnect the radio harness connector X1 and VCIM harness connector X3.
3. Test for less than 1 volt on the voice recognition audio signal circuit radio harness connector terminal 4 and ground.
    - If greater than specified value, repair short to voltage.
4. Test for greater than 1 ohm between the voice recognition audio signal circuit radio harness connector terminal 4 and ground.

- If less than specified value, repair short to ground.

5. Test for less than 1 ohm between the voice recognition audio signal circuit radio harness connector terminal 4 and the voice recognition audio signal circuit VCIM harness connector terminal 2.
6. If greater than specified value, repair open circuit.
7. Test for less than 1 volt on the voice recognition audio low reference circuit radio harness connector terminal 5 and ground.
   - If greater than specified value, repair short to voltage.
8. Test for greater than 1 ohm between the voice recognition audio low reference circuit radio harness connector terminal 5 and ground.
   - If less than specified value, repair short to ground.
9. Test for less than 1 ohm between the voice recognition audio low reference circuit radio harness connector terminal 5 and the voice recognition audio low reference signal circuit VCIM harness connector terminal 4.
   - If greater than specified value, repair open circuit.
10. If all circuits test normal, replace the radio.

Repair Procedures

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

Control Module References for radio 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.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cellular Telephone Voice Signal	1	1	1	-
Cellular Telephone Voice	-	1	-	-

Low Reference				
1. No (or Noisy) OnStar® Audio				

Circuit/System Description

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/navigation 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 Testing

1. Ignition OFF, disconnect the X2 harness connector at the CIM.

2. Ignition ON, test for less than 5 mV AC between the signal circuit terminal 1 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.
3. Install a DMM between the signal circuit terminal 1 and ground. Set the DMM to capture AC voltage using the MIN MAX function.
4. Press the voice recognition button. Verify the DMM captured greater than 20 mV AC.
    - 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.
5. Install a DMM between the signal circuit terminal 1 and the low reference circuit terminal 2. Set the DMM to capture AC voltage using the MIN MAX function.
6. Press the voice recognition button. Verify the DMM captured greater than 20 mV AC.
    - If less than the specified range, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the radio.
7. If all circuits test normal, replace the CIM.

Repair Procedures

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

Control Module References for Radio or CIM replacement, setup, and programming

NO GLOBAL POSITIONING SYSTEM (GPS) 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

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

IMPORTANT: The global positioning system (GPS) requires a clear line of sight to the sky to operate properly. In most cases the GPS will not have reception near tall buildings or inside structures.

1. Remove the GPS antenna and cable and place it outside the vehicle. Verify the GPS reception is operational within 5 minutes.
   - If GPS becomes operational, remove any suspect window tint or objects that may obstruct the GPS signal.
2. Replace the GPS antenna. Verify the GPS reception is operational within 5 minutes.
   - If GPS is not operational, replace the radio.

Repair Procedures

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

- **Control Module References** for radio replacement, setup, and programming
- **Global Positioning System (GPS) Antenna Replacement**

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 Supply Voltage	B2476 00	B2476 00	B2476 00	-
Keypad Green LED Signal	1	1	2	-
Keypad Red LED Signal	1	1	2	-
Keypad Signal	3	3	-	-
Inside Rearview Mirror Ground	-	1	-	-
1. OnStar® LED Inoperative 2. LED Illuminated At All Times 3. OnStar® Buttons Inoperative				

Circuit Description

The OnStar® status LEDs are located with the OnStar buttons. 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.
    - 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.
    - 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.
    - 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.
    - 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.
    - 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, 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) has the capability of commanding the horn, initiating door lock/unlock and operating the exterior lamps using the serial data circuits.

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

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.

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, refer to **Diagnostic Starting Point - Horns** , **Symptoms - Lighting** , or **Symptoms - Remote Functions** - Doors respectively.
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.

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.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Keypad Supply Voltage	B2476 00	B2476 00	B2476 00	-
Keypad Green LED Signal	1	1	2	-
Keypad Red LED Signal	1	1	2	-
Keypad Signal	3	3	-	-
Inside Rearview Mirror				

Ground	-	1	-	-

1. OnStar® LED Inoperative
2. LED Illuminated At All Times
3. OnStar® Buttons Inoperative

Circuit/System Description

The OnStar® button assembly consists of 3 buttons, Call/Answer, OnStar® Call Center, and OnStar® Emergency. The communication interface module (CIM) supplies the OnStar® button assembly with 10 volts via 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 CIM over the keypad signal circuit. Depending upon the voltage range returned, the CIM is able to identify which button has been activated.

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: Contact the OnStar® Call Center first before pressing the emergency button in order to notify them of the test.

Ignition ON, press the OnStar® Call buttons one at the time. Verify that all of the OnStar® buttons operate normally.

- If some OnStar® buttons are inoperative but not all, replace the inside rearview mirror.
- If none of the OnStar® buttons operate, refer to circuit/system testing.

Circuit/System Testing

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 than the specified range, test the supply voltage circuit for a short to ground or open/high resistance. If the circuit tests normal, replace the CIM.
    - If greater than the specified range, test the supply voltage circuit for a short to voltage. If the circuit tests normal, replace the CIM.
3. Test for 0 volt between the keypad signal circuit terminal 11 and ground.
    - If greater than the specified range, test the keypad signal circuit for a short to voltage. If the circuit tests normal, replace the CIM.
4. Test for 9.8-10.2 volts between the keypad supply voltage circuit terminal 12 and the keypad signal circuit terminal 11.
    - If less than the specified range, test the keypad signal circuit for an open/high resistance. If the circuit tests normal, replace the CIM.
5. Test for less than 5 ohms between the mirror ground circuit terminal 8 and ground.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
6. Ignition OFF, disconnect the CIM X1 connector. Test for infinite resistance between the keypad signal circuit terminal 11 and ground.
    - If less than the specified range, test the keypad signal circuit for a short to ground.
7. If all circuits test normal, test or replace the button assembly.

Component Testing

1. Ignition OFF, disconnect the harness connector at the inside rearview mirror.
2. Test for infinite resistance between the keypad supply voltage terminal 12 and the keypad signal terminal 11.

- If less than the specified range, replace the inside rearview mirror.

3. Test for 1.4k-1.6k ohms between the keypad supply voltage terminal 12 and the keypad signal terminal 11 while pressing the black phone button.
   - If not within the specified range, replace the inside rearview mirror.
4. Test for 2.7k-3.3k ohms between the keypad supply voltage terminal 12 and the keypad signal terminal 11 while pressing the blue On-Star® button.
   - If not within the specified range, replace the inside rearview mirror.
5. Test for 11.7k-14.3k ohms between the keypad supply voltage terminal 12 and the keypad signal terminal 11 while pressing the red emergency button.
   - If not within the specified range, 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 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 dependant 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 **Control Module References**
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 AUDIO INOPERATIVE AT REAR SEAT AUDIO (RSA) CONTROL

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.

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Center the balance and fade adjustment on the radio.
   - If adjustment of the fade and balance eliminates the concern, review the operation of the radio with the customer.
2. Verify that the wireless headphones are set to the proper channel and are working properly.
   - If the wireless headphones are not operating properly, go to **Video Entertainment System Wireless Headphone Inoperative**.
3. Disconnect the X2 connector of the rear HVAC control module. Connect a DMM between the suspect speaker output circuits (input to the RSA) from the radio. Turn ON the radio and verify there is AC voltage present.
   - If AC voltage is not present, go to **Speaker Malfunction**.
4. Test or repair open, short to ground or short to voltage on the RSA ground circuit and battery positive voltage circuit.
   - If all circuits test normal, replace the rear HVAC control module.

Repair Procedures

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

Rear Seat Audio Control Replacement

RADIO CONTROLS INOPERATIVE - REAR SEAT

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.

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

Test or repair open, short to ground or short to voltage on the RSA ground circuit and battery positive voltage circuit.

- If all circuits test normal, replace the rear HVAC control module.

Repair Procedures

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

Rear Seat Audio Control Replacement

RADIO DISPLAYS CAL OR CAL ERR

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

Circuit/System Testing

Ignition ON, with a scan tool, reprogram the radio.

- If the radio still displays CAL ERR after performing the reprogramming procedure, replace the radio.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for Radio replacement, setup, and programming

RADIO DISPLAYS LOC, LOCKED, OR CODE

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

Circuit/System Testing

Ignition ON, with a scan tool, reprogram the radio.

- If the radio still displays LOCKED after performing the reprogramming procedure, replace the radio.

Repair Procedures

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

Control Module References for Radio 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.

Circuit/System Description

AM and FM radio reception is dependent on the following components:

- Radio antenna
- Coax cable between the radio antenna and the radio antenna module (if equipped).
- Radio antenna module (if equipped)
- Coax cable between the radio antenna module and the radio
- Radio

Diagnostic Aids

Poor AM and FM radio reception is dependent on multiple influences, some of which may not be vehicle related. Areas which have high RF traffic or block the signal path may cause a degradation in radio reception. Radio reception may also be influenced by items within the vehicle, but not part of the radio system. Such examples are aftermarket electrical accessories or other items which may generated noise in the vehicle electrical system.

Diagnosing a poor reception concern will require a systematic approach to isolating the cause. Individual components should each be tested before proceeding with any repair or replacement.

Using a Test Antenna

Use a test mast antenna to check for poor vehicle antenna operation. Disconnect the antenna coax from the radio and plug the test antenna into the radio. Make sure the test antenna base is grounded to the vehicle chassis and keep hands off the mast. Check 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 vehicle antenna and/or lead-in cable.

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 Testing

Antenna Coaxial Cable Testing

1. The antenna coax may have one or two sections between the radio and the mast antenna.

IMPORTANT: For steps 2 - 6, perform the tests on each of the disconnected coax cables.

   - If greater than the specified range, replace the antenna coax.
2. Test for infinite resistance between the antenna coax center terminal and ground.
   - If less than the specified value, replace the antenna coax.
3. Test for less than 5 ohms of resistance on the antenna coax center terminal from end to end.
   - If greater than the specified range, replace the antenna coax.
4. Test for less than 5 ohms of resistance on the antenna coax outer shield from end to end.
   - If greater than the specified range, replace the antenna coax.
5. Test for infinite resistance between the coax center terminal and the outer shield.
   - If less than the specified value, replace the antenna coax.

Rear Glass Antenna Inspection

1. Ignition OFF, disconnect the coax from the antenna located at the rear glass.

2. Verify the coax connector at the back glass is properly secured and free of any damage.
    - If damage is found, repair or replace as necessary.
3. Inspect the antenna on the rear glass. Verify all branches of the antenna are intact, with no scratches or other damage.
    - If damage is found, repair or replace as necessary.

Repair Procedures

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

- **Radio Antenna Replacement**
- **Control Module References** for radio replacement, setup, and programming

RADIO SETUP

Radio setup is completed using Service Programming System (SPS). Refer to **Service Programming System (SPS)** .

SPEAKER REPLACEMENT REFERENCE

Component	Repair Instruction
Front Floor Console Speaker	Refer to **Radio Front Floor Console Speaker Replacement**
Front Speakers	Refer to **Radio Front Speaker Replacement**
Front Door Speakers	Refer to **Radio Front Side Door Speaker Replacement**
Front Pillar Speakers	Refer to **Front Upper Speaker Replacement**
Rear Pillar Speakers	Refer to **Rear Pillar Speaker Replacement**
Rear Door Speakers	Refer to **Radio Rear Side Door Speaker Replacement (Crew Cab)** or **Radio Rear Side Door Speaker Replacement (Extended Cab)**

SPEAKER MALFUNCTION

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.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Left Front Speaker Signal Circuits (Front Door and Tweeter)	B1025 02	B1025 04	B1025 01	-
Right Front Speaker Signal Circuits (Front Door and Tweeter)	B1035 02	B1035 04	B1035 01	-
Left Rear Speaker Signal Circuits (Rear Door)	B1045 02	B1045 04	B1045 01	-
Right Rear Speaker Signal Circuits (Rear Door)	B1055 02	B1055 04	B1055 01	-
Front Center Speaker Signal Circuits (Center IP)	B1065 02	B1065 04	B1065 01	-
Subwoofer Low Level Audio Signal Circuits (Center Console)	B1075 02	B1075 04	B1075 01	-
Left Midrange Speaker Signal Circuits (LR D-Pillar)	B1085 02	B1085 04	B1085 01	-
Right Midrange Speaker Signal Circuits (RR D-Pillar)	B1095 02	B1055 04	B1095 01	-

Circuit/System Description

The up-level radio (UQA) supplies 4 channels of audio to an amplifier. The amplifier supplies 6 input signal channels to 8 speakers.

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.

Diagnostic Aids

The front tweeter speakers are connected to the same channel as the front door speakers.

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, Rear Seat Audio (RSA) OFF(if equipped), 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 (UQ3)

1. Ignition OFF, disconnect the harness connector at the appropriate speaker.
2. Radio ON, test for 5.0-7.5 volts between the speaker circuit terminal A and ground.
   - If greater than the specified range, test the speaker 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 speaker circuit terminal B and ground.
   - If greater than the specified range, test the speaker circuit for a short to voltage. If the circuit tests normal, replace the radio.
   - If less than the specified range, test the speaker circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the radio.
4. If the vehicle is equipped with UK6 Rear Seat Audio and the concern is with a rear speaker, Test the speaker circuits between the radio and the RSA control.
5. If all circuits test normal, test or replace the speaker.

With Amplifier (UQA/UQS)

1. Ignition OFF, disconnect the X1and X3 harness connectors at the amplifier.
2. Radio ON, Rear Seat Audio OFF, test for 5.0-7.5 volts between the appropriate speaker circuit terminal listed below and ground.

With UQA

- Left front speaker control- Connector X2, terminal 4
- Left front speaker control- Connector X2, terminal 3
- Right front speaker control - Connector X2, terminal 2
- Right front speaker control - Connector X2, terminal 1
- Front center speaker control - Connector X2, terminal 13 (w/ Y91)
- Front center speaker control - Connector X2, terminal 1 2(w/ Y91)
- Left subwoofer speaker control- Connector X1, terminal 7
- Left subwoofer speaker control- Connector X1, terminal 3
- Right subwoofer speaker control- Connector X1, terminal 2
- Right subwoofer speaker control- Connector X1, terminal 6

With UQS

- Left front speaker control- Connector X2, terminal 4
- Left front speaker control- Connector X2, terminal 5
- Right front speaker control - Connector X2, terminal 7
- Right front speaker control - Connector X2, terminal 8
- Front center speaker control - Connector X2, terminal 13 (w/ Y91)
- Front center speaker control - Connector X2, terminal 1 2(w/ Y91)
- Left subwoofer speaker control- Connector X1, terminal 1
- Left subwoofer speaker control- Connector X1, terminal 2
- Right subwoofer speaker control- Connector X1, terminal 3
- Right subwoofer speaker control- Connector X1, terminal 7
    - 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.
- 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 Amplifier and Radio 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

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.
   - If different than specified value, replace the cellular antenna coax.
5. Test for less than 1 ohm resistance at the cellular antenna coax center conductor from end to end.
   - 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.

Mobile Telephone Digital Antenna Replacement

VIDEO DISPLAY IS POOR OR BLANK

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

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 Testing

With Third Row Video Screen

IMPORTANT: If rear video display does not turn ON, use diagnostic Video Entertainment System Inoperative.

1. Flip open the rear video displays. With the ignition ON, operate the rear entertainment system using several known good DVD disks. Observe the rear video screens.
   - If both screens turn on but are blank, replace the radio.
2. Note witch screen is malfunctioning. Remove both rear video displays. Swap the positions of the rear video screens and plug in the harness connectors. Operate the rear entertainment and observe the rear video screens.
   - If the malfunctioning screen is not working in a different location, replace the suspect video screen.
   - If the malfunctioning screen operates normally in a different location, Test or repair open, short to ground or short to voltage on the DVD video signal circuits.
3. Test and repair open, short to ground and short to power on the ground and battery positive voltage circuits at both rear video displays.
   - If the video display power and ground circuits test normal, replace the suspected rear video display.

Without Third Row Video Screen

IMPORTANT: If rear video display does not turn ON, use diagnostic Video Entertainment System Inoperative.

1. Flip open the rear video display. With the ignition ON, operate the rear entertainment system using several known good DVD disks. Observe the rear video screen.
   - If the screen turns on but is blank. Test for an open, short to ground and short to power on the DVD video signal circuits to the rear video display. If the DVD video signal circuits test normal, replace the video display.
   - If the video screen is still malfunctioning, replace the radio.

Repair Procedures

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

- **Video Display Replacement (Second Row)**
- **Control Module References** for radio replacement, setup, and programming

VIDEO ENTERTAINMENT SYSTEM 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.

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

IMPORTANT: If rear video display turns ON but the video is blank, use diagnostic Video Display is Poor or Blank.

1. Disconnect the second row video (and third row if equipped) display harness connector. With the ignition ON, operate the rear entertainment system. Verify there is voltage on the remote enable signal circuit.
   - If voltage is not present on the remote enable signal circuit, test and repair open or short to ground.
   - If the enable signal circuit tests normal but there is no voltage, replace the radio.
2. Test and repair open, short to ground and short to power on the ground and battery positive voltage circuits at the second row video (and third row if equipped) display.
   - If the video display power and ground circuits test normal, replace the suspected rear video display.

Repair Procedures

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

Video Display Replacement (Second Row)

VIDEO ENTERTAINMENT SYSTEM REMOTE CONTROL 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.

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

IMPORTANT: Test or replace the remote batteries before performing the circuit/system test.

1. Verify the system works with a known good remote
   - If the known good remote operates properly, replace the suspect remote.
2. Operate the radio and turn on the rear seat audio (RSA). Verify the remote headphones operate normally.
   - If the remote headphones do not operate properly, go to **Video Entertainment System Wireless Headphone Inoperative**.
3. Install a scan tool, monitor the button presses in the radio data display. Verify the radio responds to the remote when the buttons are pressed.
   - If the radio does not respond, test the remote infra-red signal circuits for an open, short to ground or short to B+. If the infra-red signal circuits test normal replace audio system transceiver module.

Repair Procedures

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

- **Audio System Transceiver Module Replacement**
- **Control Module References** for radio replacement, setup, and programming

VIDEO ENTERTAINMENT SYSTEM WIRELESS HEADPHONE 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.

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**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

No Audio From Wireless Headphones

IMPORTANT: Center the balance and fade adjustment on the radio. If adjustment of the fade and balance eliminates the concern, review the operation of the radio with the customer.

1. Turn ON the wireless headphones. Verify the power indicator lamp on the wireless headphone illuminates.
    - If the power indicator lamp does not illuminate on the wireless headphones check or replace the wireless headphone batteries. If the batteries are OK replace the wireless headphones.
2. Activate the RSA. Set both wireless headphones to the proper channel to hear RSA. Adjust the volume up on both wireless headphones. Verify that only one set of wireless headphones operate properly.
    - If only one set of wireless headphones do not have audio, replace the suspect wireless headphone set.
3. With a DMM, verify there is B+ at the infra-red module supply voltage circuit when the RSA is activated.
    - If B+ is not present, test for a open or short to power on the infra-red module supply voltage circuit. If the infra-red module supply voltage circuit tests normal, replace the rear HVAC control module.
4. At the infra-red module connector harness, test for AC voltage between the low reference circuit and the left and right infra-red audio signal circuits. Verify there is AC voltage with the RSA activated.
    - If AC voltage is not present, test for an open, short to ground or short to B+ on the low reference and both left and right infra-red audio signal circuits. If the low reference and audio signals test normal replace the rear HVAC control module.
5. Ignition OFF, Disconnect the harness connector of the infra-red module. Test for less than 1.0 ohm between the ground circuit terminal 12 and ground.
    - If greater than the specified range, repair the ground circuit.
    - If the ground circuit tests normal, replace the infra-red module.

Audio In One Channel of the Wireless Headphones or Distortion

IMPORTANT: Center the balance and fade adjustment on the radio. If adjustment of the fade and balance eliminates the concern, review the operation of the radio with the customer.

1. Activate the RSA. Set both wireless headphones to the proper channel to hear RSA. Adjust the volume up on both wireless headphones. Verify that only one set of wireless headphones operates properly.
    - If only one set of wireless headphones is faulty, replace the suspect wireless headphone set.

2. At the infra-red module connector harness, test for AC voltage between the low reference circuit and the left and right infra-red audio signal circuits. Verify there is AC voltage with the RSA activated.
    - If AC voltage is not present, test for an open, short to ground or short to B+ on the low reference and both left and right infra-red audio signal circuits. If the low reference and audio signals test normal replace the rear HVAC control module.
3. Test for an open, short to ground or short to B+ on the low reference and both left and right infra-red audio signal circuits.
    - If the low reference and audio signals test normal replace the infra-red module.

Repair Procedures

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

Audio System Transceiver Module Replacement

REPAIR INSTRUCTIONS

MOBILE TELEPHONE MICROPHONE REPLACEMENT

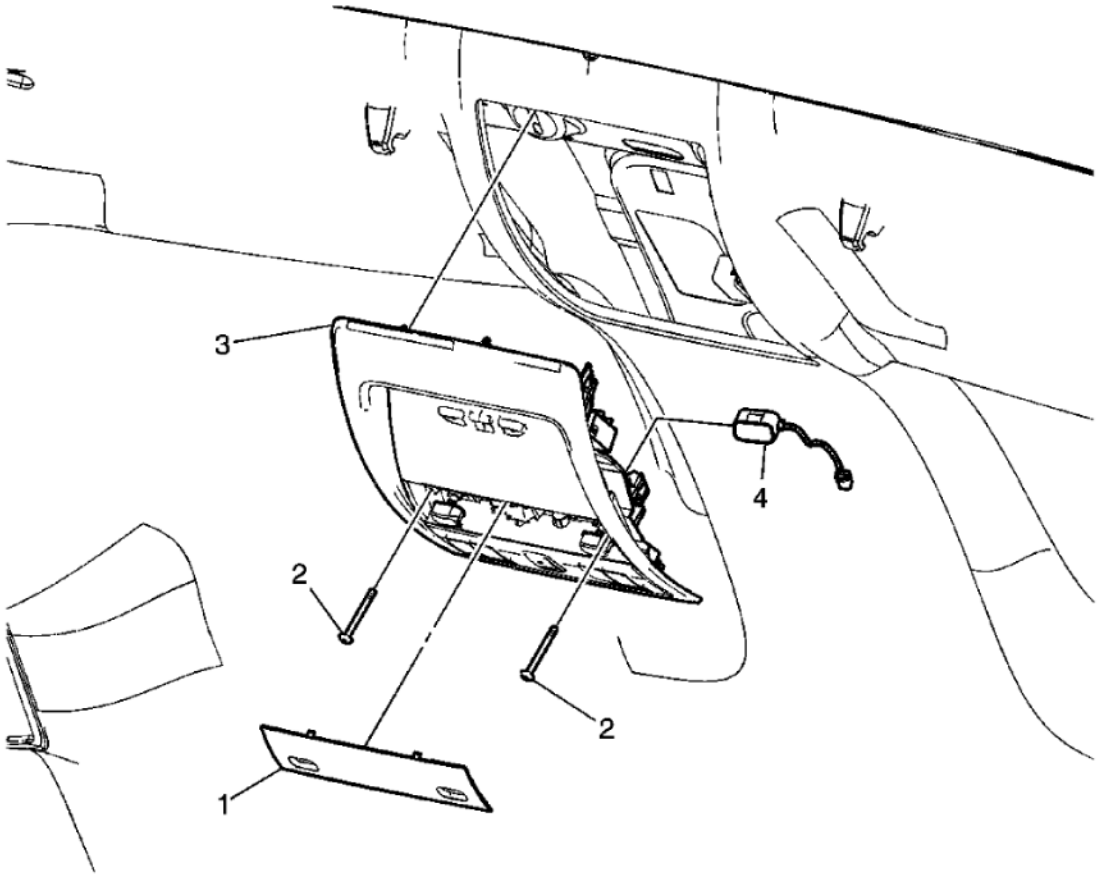


Fig. 13: Mobile Telephone Microphone Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Front Overhead Console Lens
2	Roof Console Screw (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 2 N.m (18 lb in)
3	Roof Console Assembly **Tip:** Disconnect electrical connectors.
4	Mobile Telephone Microphone Assembly

COMMUNICATION INTERFACE MODULE REPLACEMENT (WITHOUT RPO SLT)

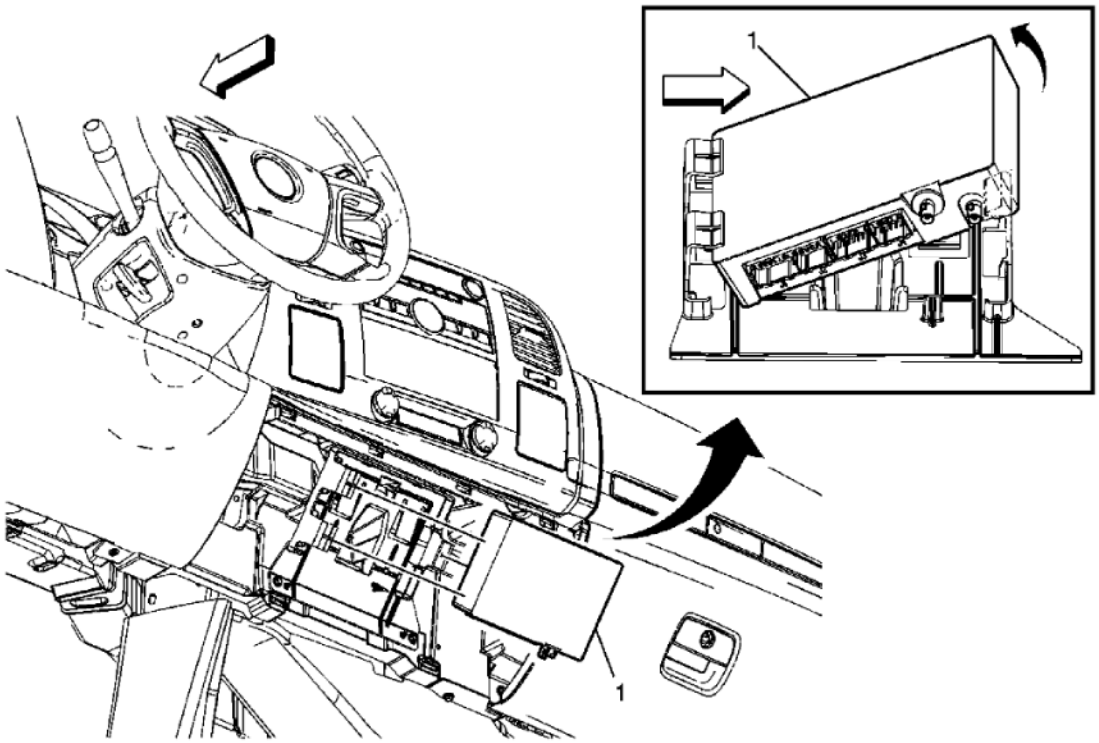


Fig. 14: Communication Interface Module Replacement (without RPO SLT)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the instrument panel lower center panel. Refer to **Instrument Panel Lower Center Trim Replacement** .	
1	Communication Interface Module **Tip:** • Push outward on the tab to release the communication interface module from the bracket. • Disconnect the electrical connectors. • Reprogram the communication interface module after replacement. Refer to **Control Module References** .

COMMUNICATION INTERFACE MODULE REPLACEMENT (WITH RPO SLT)

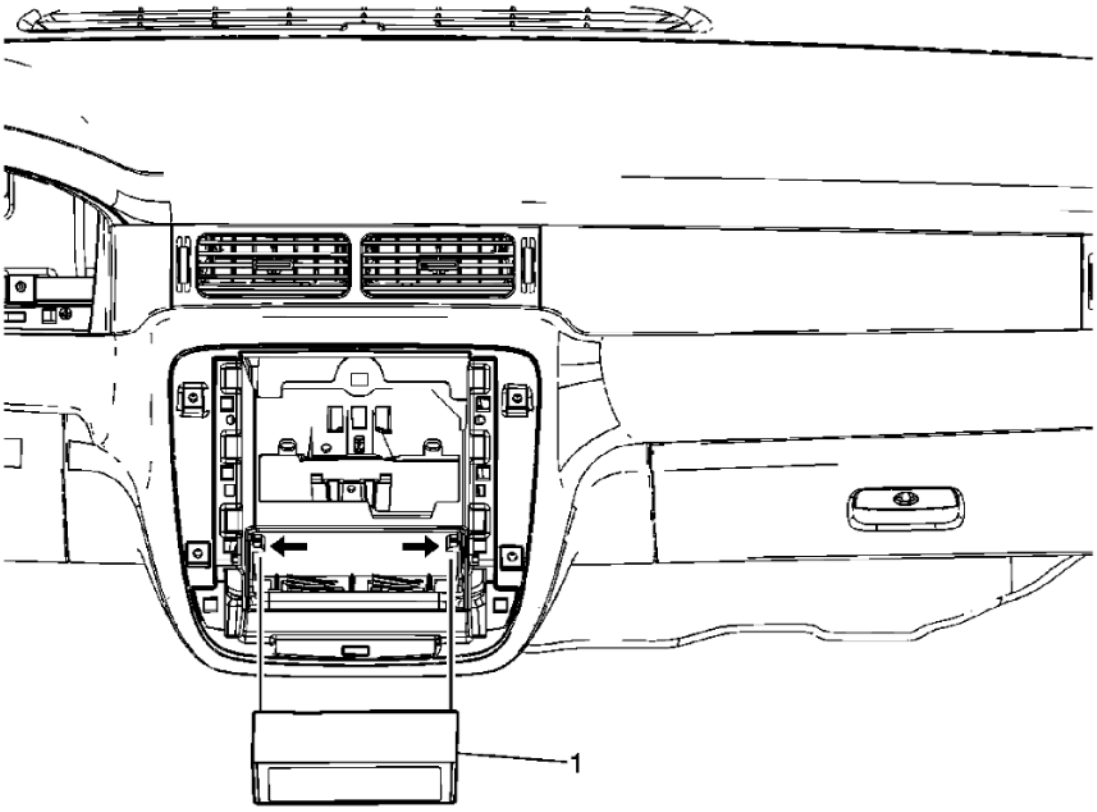


Fig. 15: Communication Interface Module Replacement (with RPO SLT)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Remove the instrument panel accessory trim plate. Refer to **Instrument Panel Accessory Trim Plate Replacement (without RPO SLT)** or **Instrument Panel Accessory Trim Plate Replacement (with RPO SLT)** . 2. Remove the HVAC control module. Refer to **HVAC Control Module Replacement** or **HVAC Control Module Replacement** . 3. Remove the radio. Refer to **Radio Replacement (without RPO SLT)** or **Radio Replacement (with RPO SLT)**.	
1	Communication Interface Module **Tip:** • Push outward on the 2 tabs to release the communication interface module from the bracket.

	• Disconnect the electrical connectors. • Reprogram the communication interface module after replacement. Refer to **Control Module References** .

RADIO REPLACEMENT (WITHOUT RPO SLT)

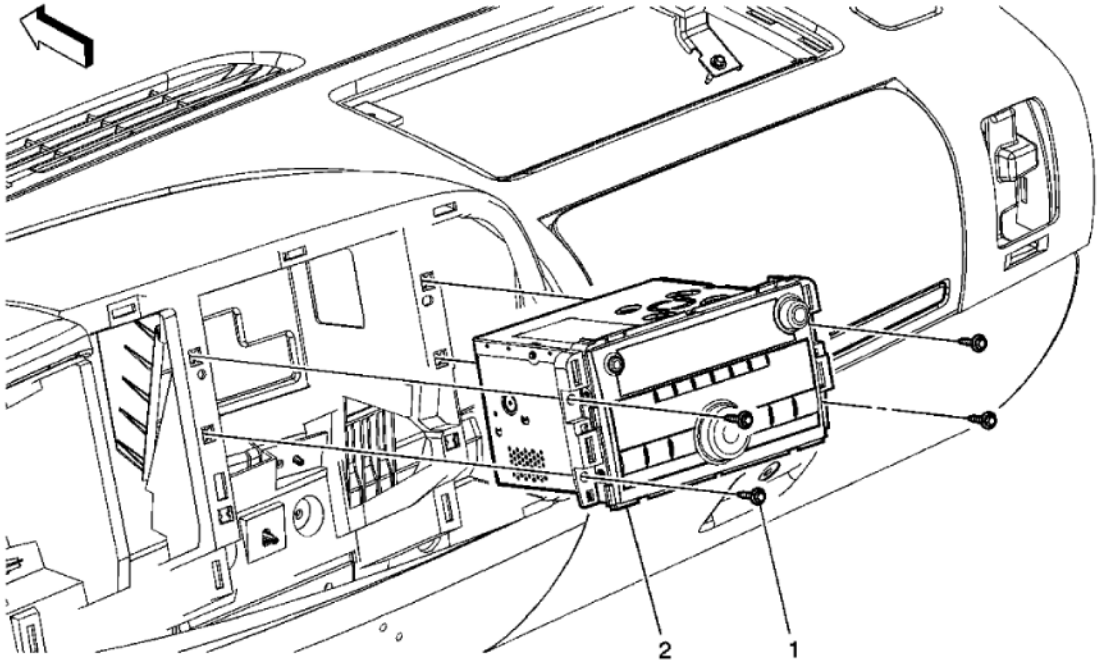


Fig. 16: Radio Replacement (without RPO SLT)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the instrument panel accessory trim plate. Refer to **Instrument Panel Accessory Trim Plate Replacement (without RPO SLT)** or **Instrument Panel Accessory Trim Plate Replacement (with RPO SLT)** .	
1	Radio Screw (Qty: 4) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 2 N.m (18 lb in)
	Radio Assembly

2	**Tip:** • Disconnect the electrical connector. • Disconnect the antenna cable. • Reprogram the radio after replacement. Refer to **Control Module References** .

RADIO REPLACEMENT (WITH RPO SLT)

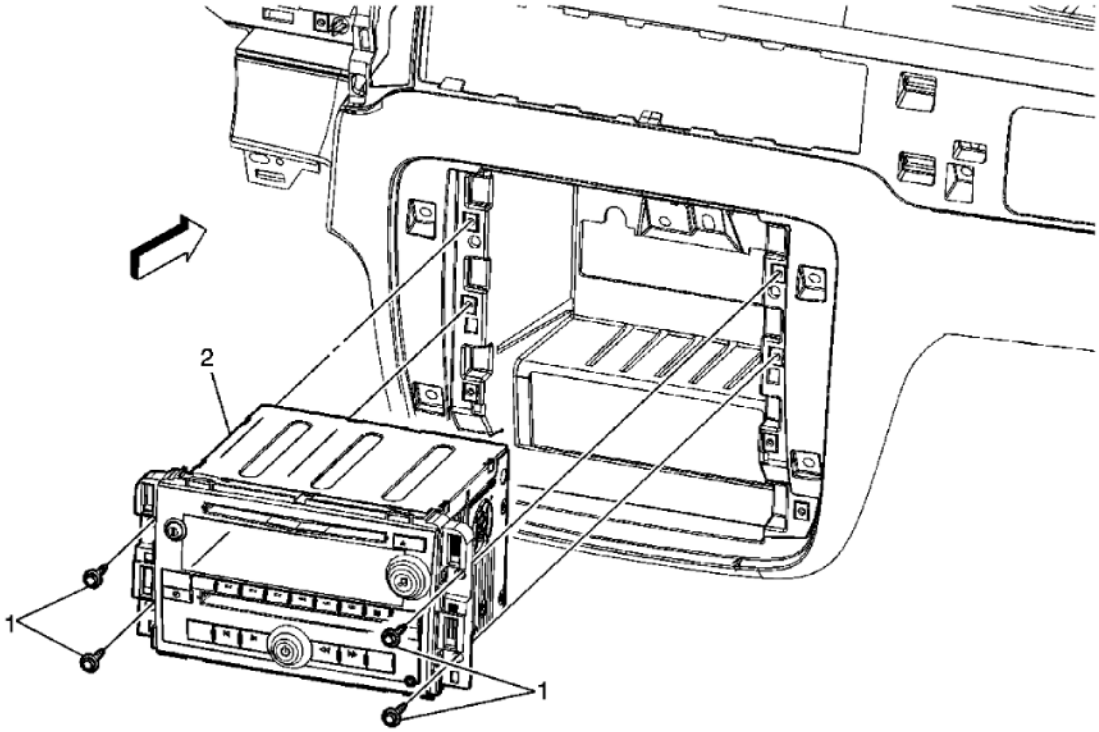


Fig. 17: Radio Replacement (with RPO SLT)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Remove the accessory switch assembly. Refer to **Accessory Switch Replacement (with RPO SLT)** or **Accessory Switch Replacement (without RPO SLT)** . 2. Remove the HVAC control module. Refer to **HVAC Control Module Replacement** or **HVAC Control Module Replacement** .	
	Radio Screw (Qty: 4)

1	**NOTE:** **Refer to Fastener Notice .** **Tighten:** 2 N.m (18 lb in)
2	Radio Assembly **Tip:** • Use a scan tool to retrieve the radio part number before removing the radio from the vehicle. • Disconnect the electrical connector. • Disconnect the antenna cable. • Reprogram the radio after replacement. Refer to **Control Module References** .

DIGITAL RADIO RECEIVER REPLACEMENT

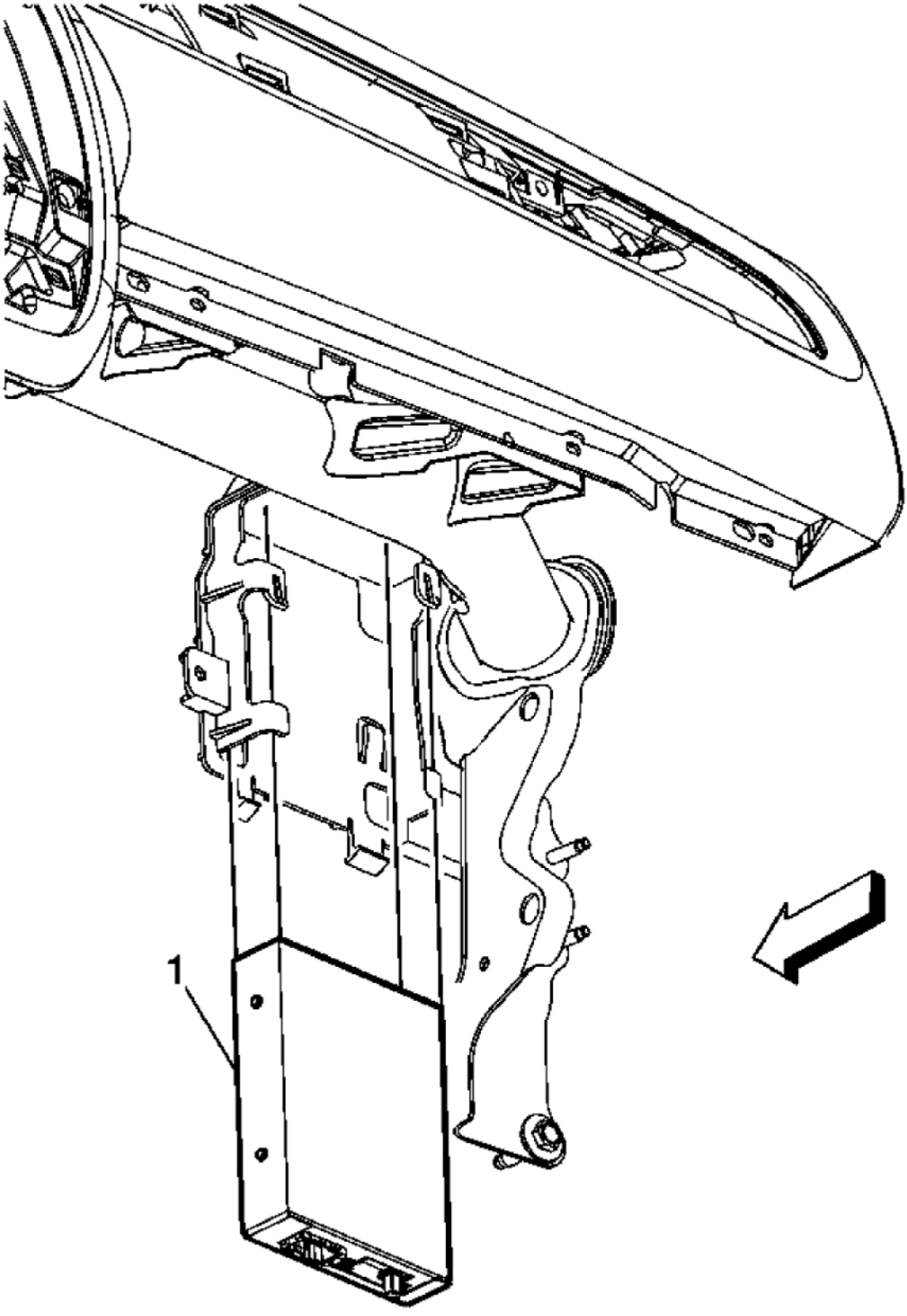


Fig. 18: Digital Radio Receiver Replacement

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the right instrument panel insulator. Refer to **Instrument Panel Insulator Replacement (with RPO SLT)** or **Instrument Panel Insulator Replacement (without RPO SLT)** .	
1	Digital Radio Receiver **Tip:** 1. Disconnect the electrical connectors. 2. Push in on the 2 tabs and pull down to remove the receiver. 3. Perform the Digital Radio Receiver Setup. Refer to **Digital Radio Receiver Setup**.

RADIO SPEAKER AMPLIFIER REPLACEMENT

2008 Chevrolet Silverado 1500

2008 ACCESSORIES & EQUIPMENT Cellular, Entertainment, and Navigation - Cab & Chassis Sierra, Cab & Chassis Silverado, Sierra & Silverado

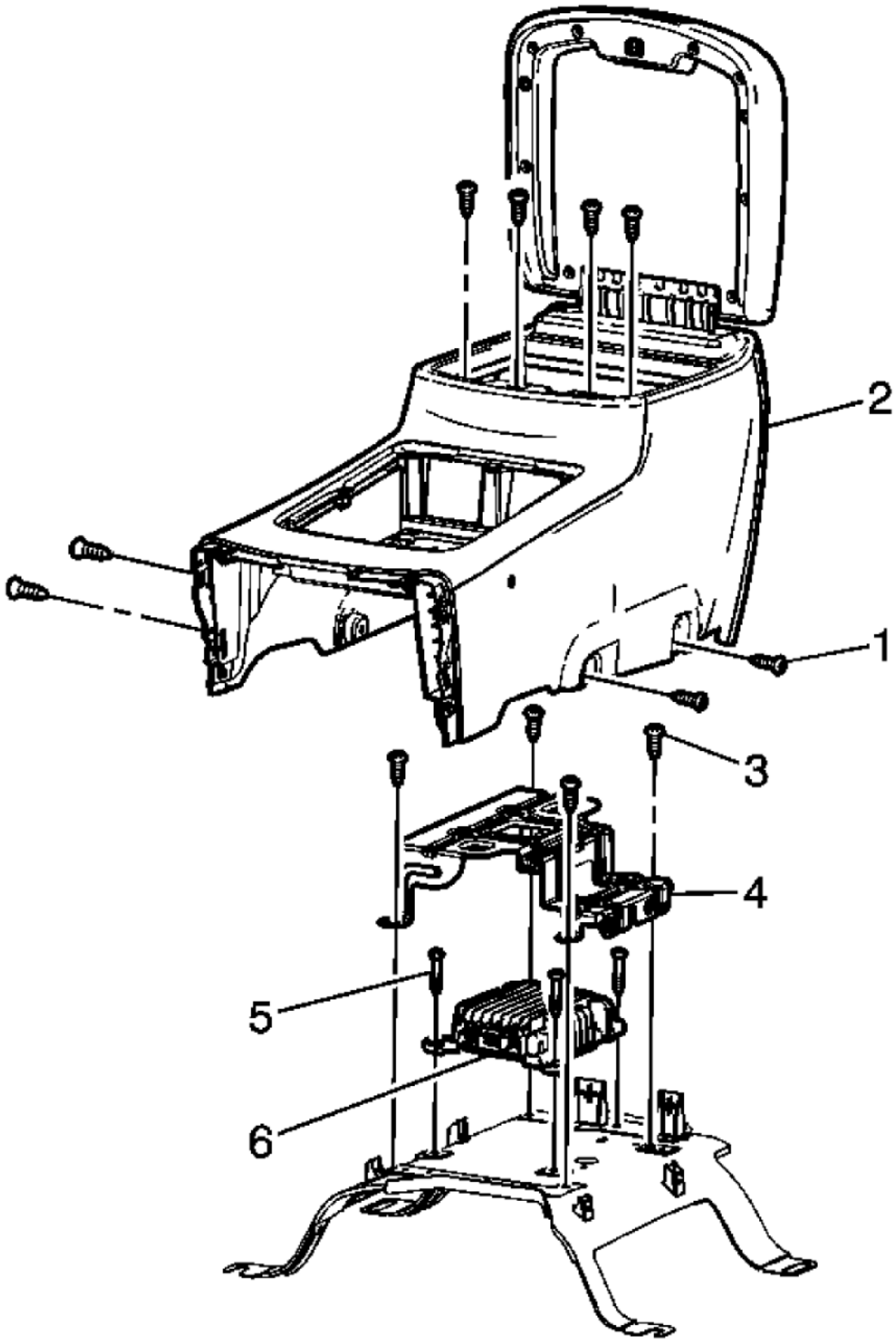


Fig. 19: Radio Speaker Amplifier Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Front Floor Console Screw (Qty: 8) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 9 N.m (80 lb in)
2	Front Floor Console Assembly Refer to **Front Floor Console Replacement (with RPO SLT)** or **Front Floor Console Replacement (without RPO SLT)** .
3	Front Floor Console Bracket Screw (Qty: 4) **Tighten:** 9 N.m (80 lb in)
4	Front Floor Console Bracket
5	Amplifier Screw (Qty: 3) **Tighten:** 9 N.m (80 lb in)
6	Radio Speaker Amplifier Assembly **Tip:** 1. Disconnect the electrical connectors. 2. If replacing the amplifier, program the replacement amplifier. Refer to **Control Module References** .

MOBILE TELEPHONE DIGITAL ANTENNA REPLACEMENT

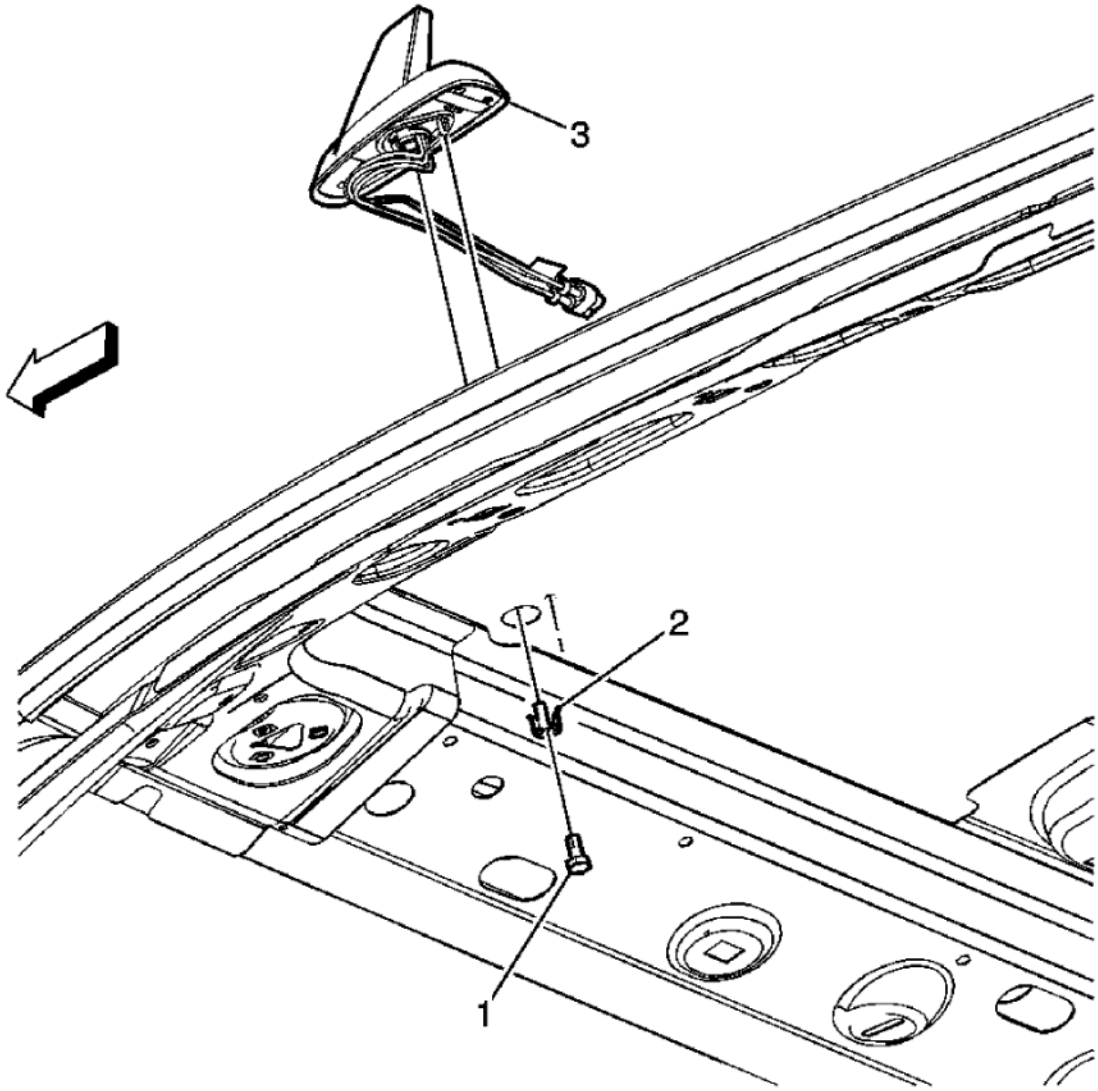


Fig. 20: Mobile Telephone Digital Antenna Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Lower the front of the headliner. Refer to **Headlining Trim Panel Replacement (Regular Cab)** or **Headlining Trim Panel Replacement (Crew Cab)** or **Headlining Trim Panel Replacement (Extended Cab)** .	
1	Mobile Telephone Antenna Bolt **NOTE:** **Refer to Fastener Notice .**

	Tighten: 9 N.m (80 lb in)
2	Mobile Telephone Antenna Expansion Sleeve
3	Mobile Telephone and Navigation Antenna Assembly **Tip:** Disconnect the antenna cable.

RADIO ANTENNA REPLACEMENT

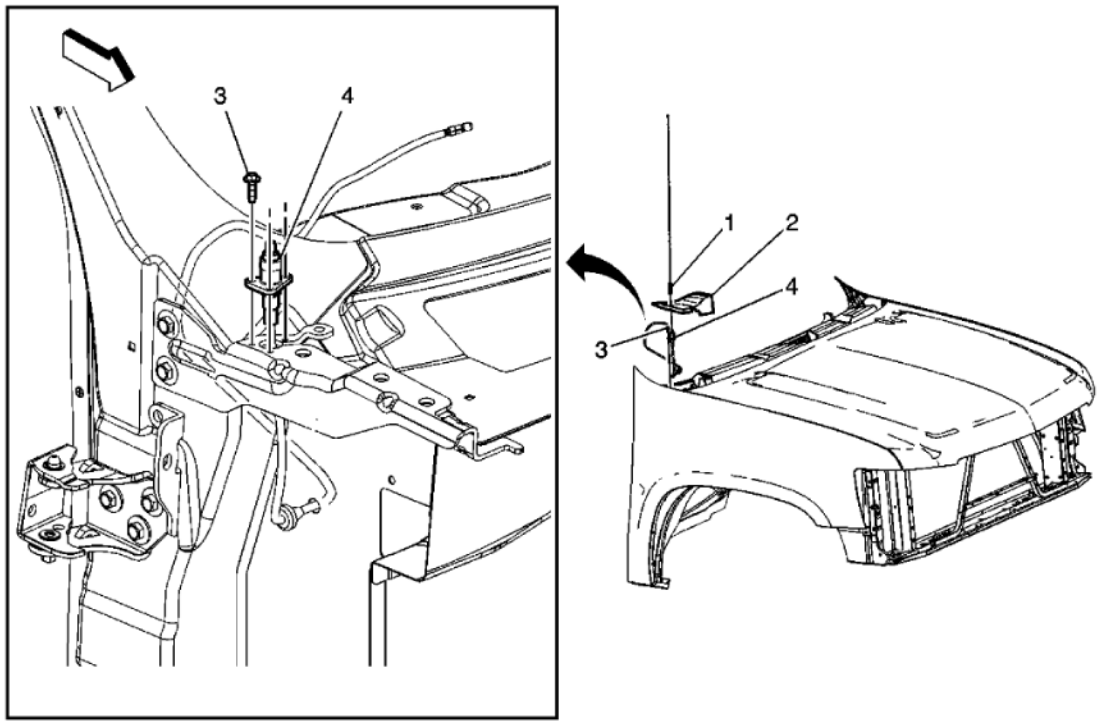


Fig. 21: Radio Antenna Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

Preliminary Procedures

1. Remove the battery. Refer to **Battery Replacement** .
2. Remove the instrument panel (I/P) upper trim pad. Refer to **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (without RPO SLT)** or **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (with RPO SLT)** .
3. Disconnect the upper intermediate steering shaft. Refer to **Upper Intermediate**

Steering Shaft Replacement .

4. Remove the 4 I/P bolts to body bolts.
5. Disconnect the 5 electrical connections on the passenger side.
6. Pull the passenger side of the I/P back approximately 760 mm (2.5 ft) pivoting on the drivers side. Set on floor or seat.
7. Remove the 2 screws from the HVAC recirculation door and push door towards the center of the vehicle. Refer to **Air Inlet Assembly Replacement** .
8. Disconnect the coaxial cable at the junction.
9. Insert a shim between the HVAC and side metal approximately 38 mm (1.5 in).
10. Tape pull wire to the coaxial cable.

1	Radio Antenna Mast **NOTE:** **Refer to Fastener Notice .** **Tighten:** 6 N.m (53 lb in)
2	Air Inlet Grille Outer Cover
3	Radio Antenna Assembly Screw (Qty: 3) **Tighten:** 5 N.m (44 lb in)
4	Radio Antenna Assembly **Tip:** 1. Remove the cable grommet from the body using the screwdriver from top down. 2. Tie a long wire to the antenna cable to aid in installation of new antenna. Use a screwdriver to guide the cable from the inside. 3. Tape a long pull wire to the antenna cable to aid in installation of the new antenna. Use a screwdriver to guide the wire from the inside. 4. Lubricate the grommet to aid in installation.

GLOBAL POSITIONING SYSTEM (GPS) ANTENNA REPLACEMENT

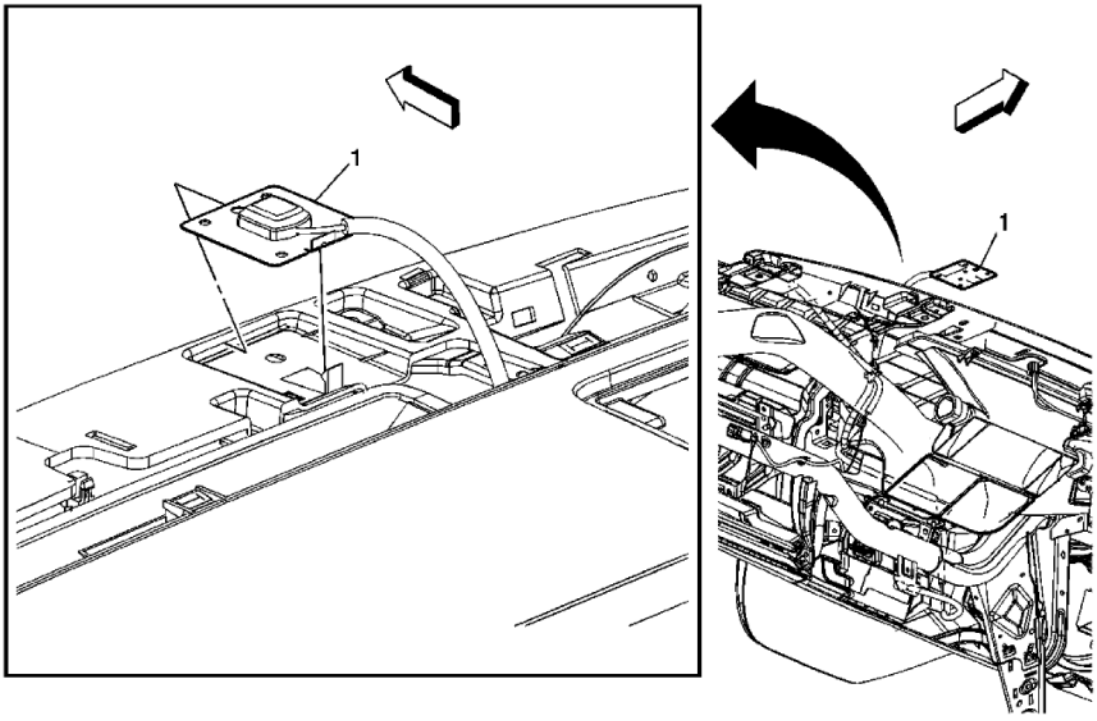


Fig. 22: Global Positioning System (GPS) Antenna Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Remove the instrument panel (I/P) upper trim pad. Refer to **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (without RPO SLT)** or **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (with RPO SLT)** . 2. Remove the radio. Refer to **Radio Replacement (without RPO SLT)** or **Radio Replacement (with RPO SLT)**.	
1	Radio Antenna Module Assembly **Procedure** 1. Disconnect the antenna module from the radio. 2. Disconnect the extension cable from the center HVAC duct.

RADIO ANTENNA CABLE EXTENSION CABLE REPLACEMENT (WITH RPO SLT)

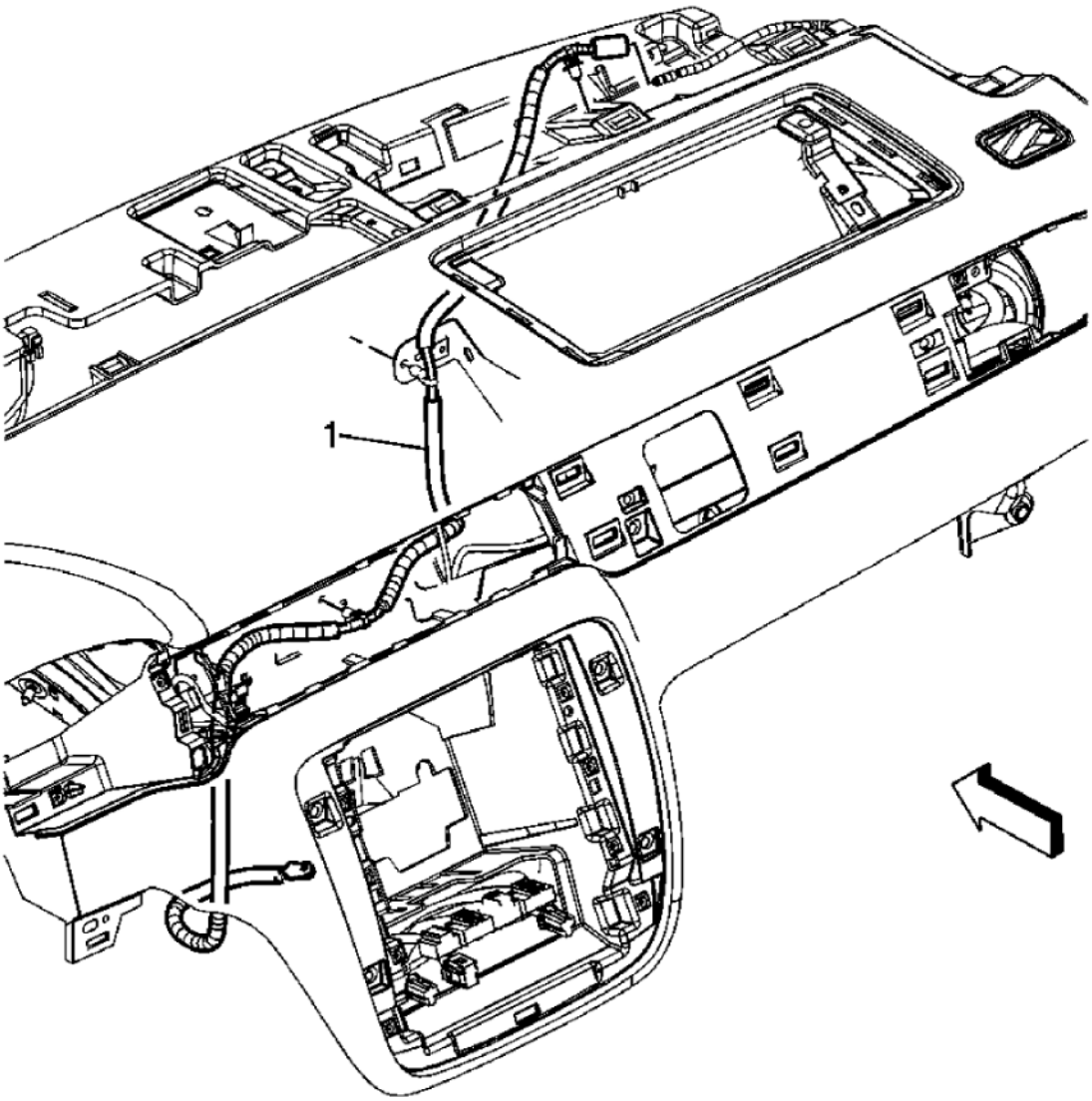


Fig. 23: Radio Antenna Cable Extension Cable Replacement (with RPO SLT)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

Preliminary Procedure

1. Remove the instrument panel upper trim pad. Refer to **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (without RPO SLT)** or **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (with RPO SLT)** .
2. Remove the radio. Refer to **Radio Replacement (without RPO SLT)** or **Radio**

	Replacement (with RPO SLT). 3. Remove the instrument panel center trim panel. Refer to **Instrument Panel Center Trim Panel Replacement (with RPO SLT)** .
1	Radio Antenna Extension Cable Assembly **Tip:** • Disconnect the extension cable from the antenna. • Disconnect the extension cable from the radio. • Disconnect the extension cable from the center HVAC duct.

RADIO ANTENNA CABLE EXTENSION CABLE REPLACEMENT (WITHOUT RPO SLT)

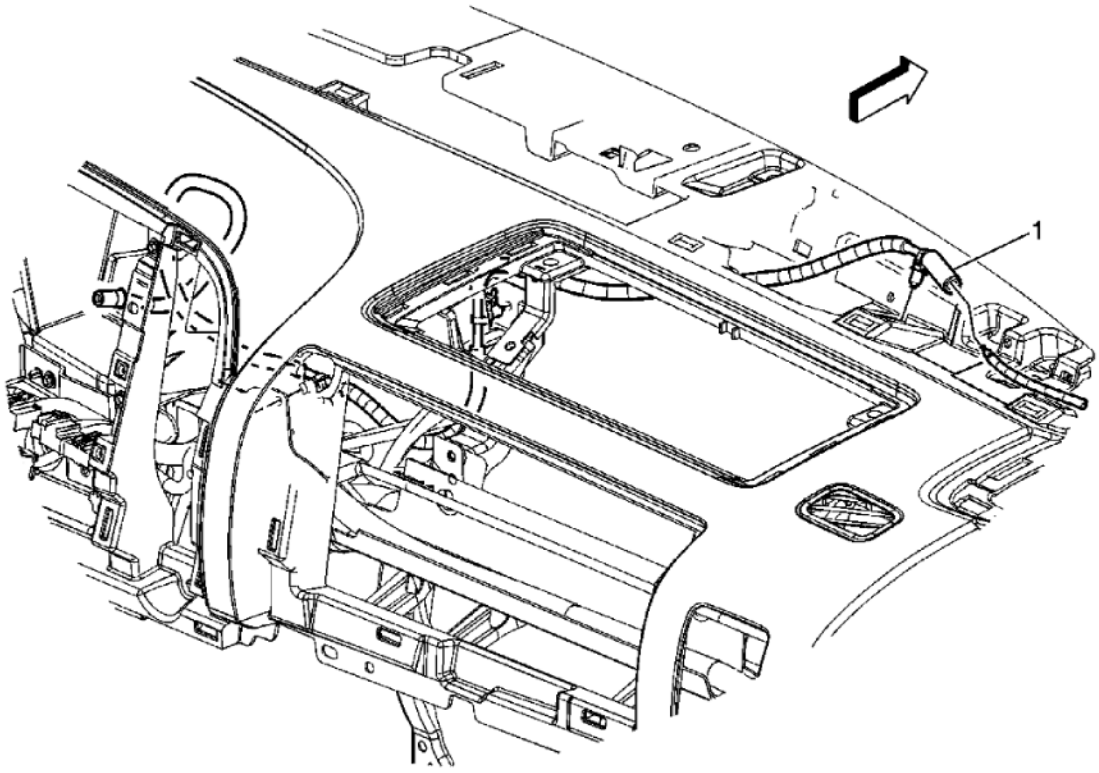


Fig. 24: Radio Antenna Cable Extension Cable Replacement (without RPO SLT)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure 1. Remove the instrument panel upper trim pad. Refer to **Instrument Panel Upper**	

	Trim Panel with Windshield Defroster Nozzle Grille Replacement (without RPO SLT) or **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (with RPO SLT)** . 2. Remove the radio. Refer to **Radio Replacement (without RPO SLT)** or **Radio Replacement (with RPO SLT)**. 3. Remove the instrument panel upper compartment. Refer to **Instrument Panel Upper Compartment Replacement** .
1	Radio Antenna Extension Cable Assembly **Tip:** • Disconnect the extension cable from the antenna. • Disconnect the extension cable from the radio. • Disconnect the extension cable from the center HVAC duct.

MOBILE TELEPHONE AND NAVIGATION ANTENNA COAXIAL CABLE REPLA REPLACEMENT

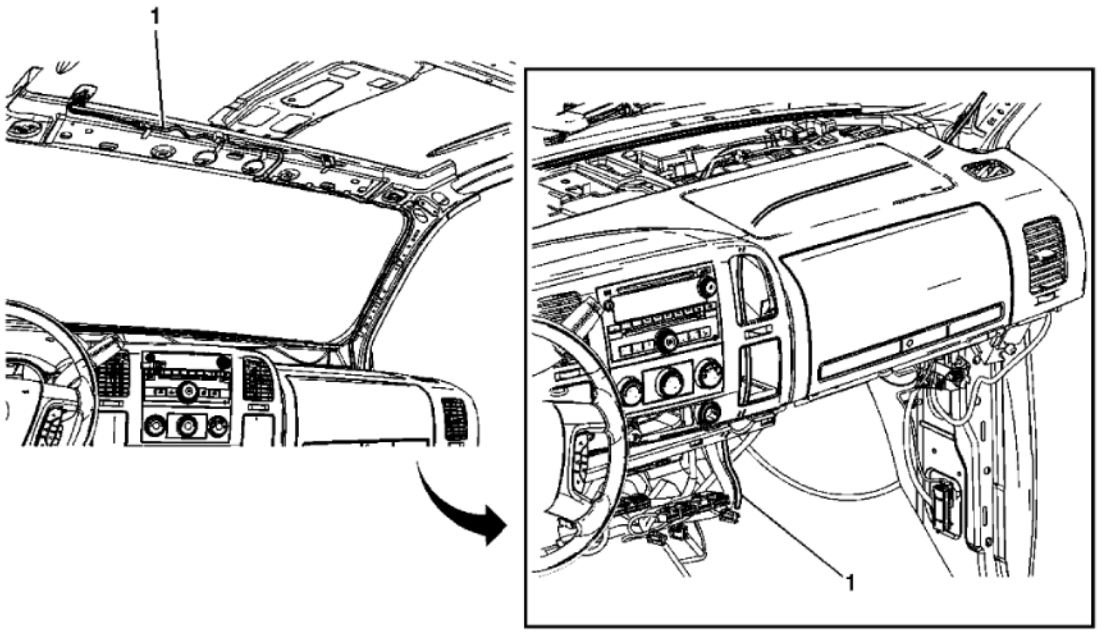


Fig. 25: Mobile Telephone and Navigation Antenna Coaxial Cable Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure	

1. Lower the front of the headliner. Refer to **Headlining Trim Panel Replacement (Regular Cab)** or **Headlining Trim Panel Replacement (Crew Cab)** or **Headlining Trim Panel Replacement (Extended Cab)** .
2. Remove the upper instrument panel (I/P) defroster grille. Refer to **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (without RPO SLT)** or **Instrument Panel Upper Trim Panel with Windshield Defroster Nozzle Grille Replacement (with RPO SLT)** .
3. Remove the instrument panel compartment door. Refer to **Instrument Panel Storage Compartment Replacement** .
4. Remove the interface communication module. Refer to **Communication Interface Module Replacement (without RPO SLT)** or **Communication Interface Module Replacement (with RPO SLT)**.

1	Navigation/Cellular Coaxial Cable **Tip:** 1. If the coaxial antenna cable is taped in the wiring harness then just cut the ends off at the interface communication module and the antenna connection and route the new harness next to the old and use tie straps as needed to secure routing. 2. If needed use a piece of mechanics wire or suitable equivalent to route new cable through windshield pillar and I/P area.

AUDIO SYSTEM TRANSCEIVER MODULE REPLACEMENT

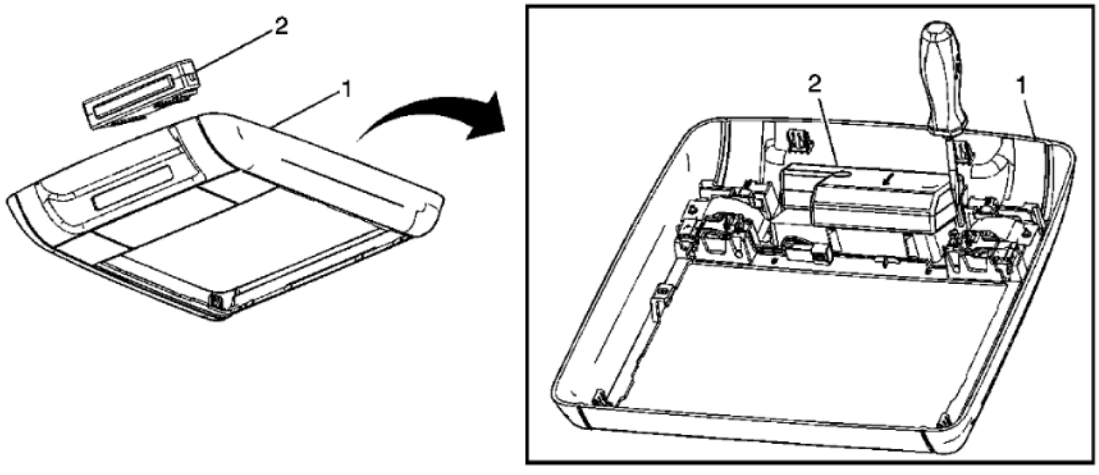


Fig. 26: Audio System Transceiver Module Replacement

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the video display assembly. Refer to **Video Display Replacement (Second Row)**.	
1	Roof Console Assembly Refer to **Roof Rear Console Replacement (with DVD)** .
2	Audio System Transceiver Module Assembly **Tip:** 1. Disconnect the electrical connector. 2. Use a flat bladed tool to release the tabs that secure the module to the roof console on each side of the module. 3. Slide forward and up to release from the roof console.

VIDEO DISPLAY REPLACEMENT (SECOND ROW)

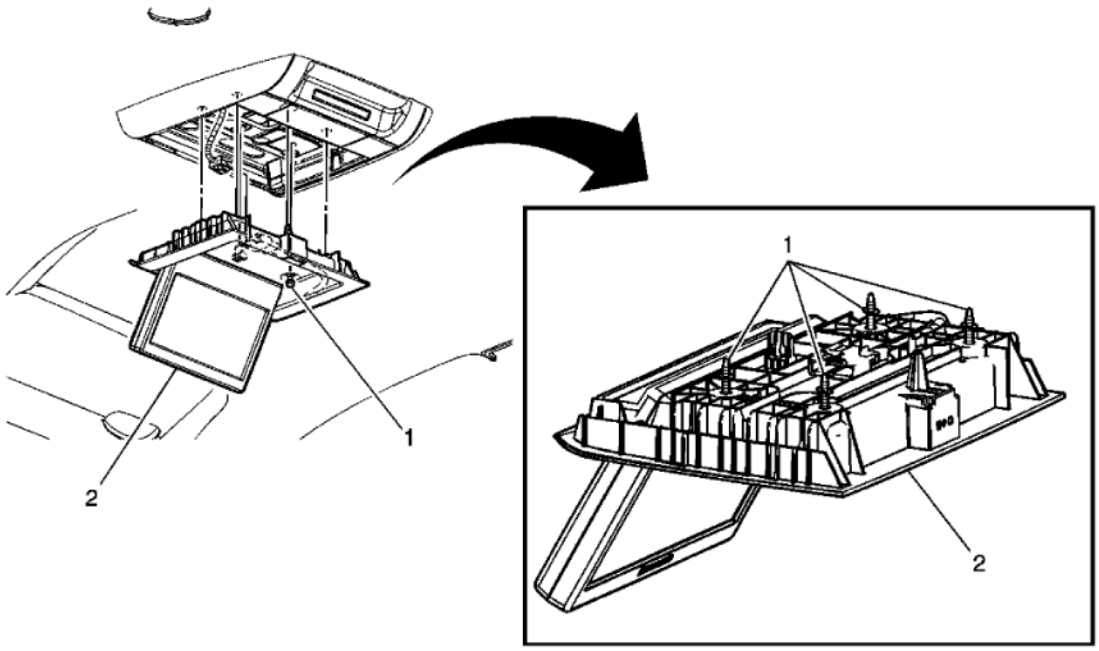


Fig. 27: Video Display Replacement (Second Row)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
	Video Display Assembly Screws (Qty: 4)

1	**NOTE:** **Refer to Fastener Notice .** **Tip:** Make sure that all 4 washers on the 4 mounting screws are accounted for. If any washers are off the screw and loose, discard to prevent a rattle. The washers were required only for assembly plant installation, and can be used if still on the screw or they can be discarded. **Tighten:** 2 N.m (18 lb in)
2	Video Display Assembly **Tip:** 1. Pull down to disengage the retainer clip and remove from the vehicle. 2. Disconnect the electrical connector.

REAR SEAT AUDIO CONTROL REPLACEMENT

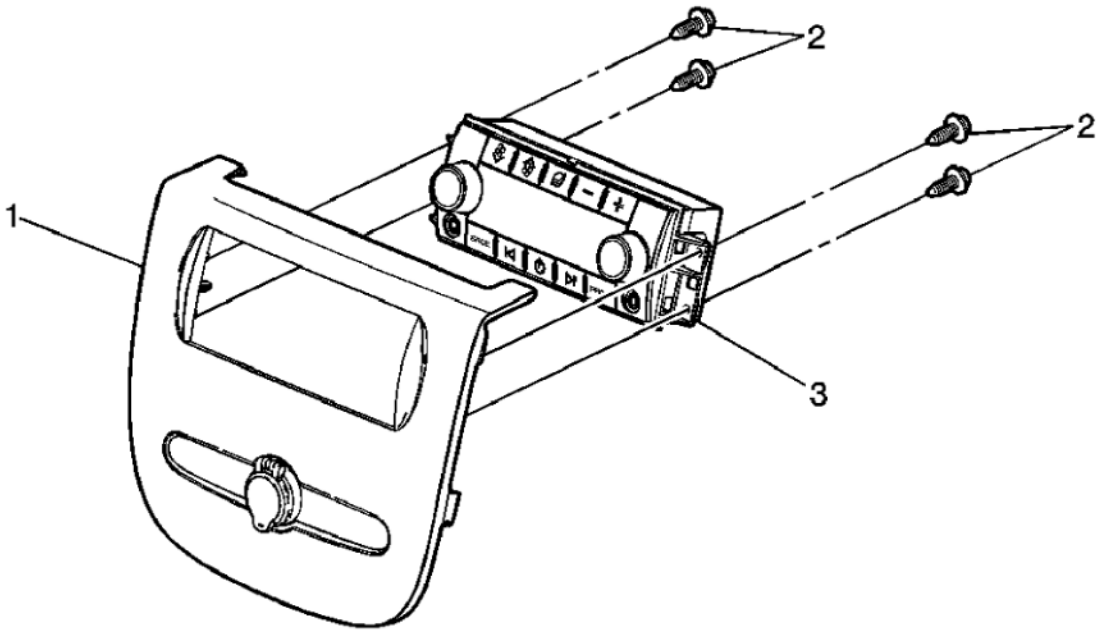


Fig. 28: Rear Seat Audio Control Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

1	Front Floor Console Compartment Bezel Assembly Refer to **Front Floor Console Compartment Bezel Replacement** .
2	Rear Radio Control Assembly Screw (Qty: 4) **NOTE:** **Refer to Fastener Notice .** **Tip:** Tighten the fasteners equally to ensure the control assembly seats evenly. **Tighten:** 1.5 N.m (13 lb in)
3	Rear Radio Control Assembly **Procedure:** Disconnect the electrical connectors from the rear radio control assembly.

RADIO FRONT SPEAKER GRILLE REPLACEMENT

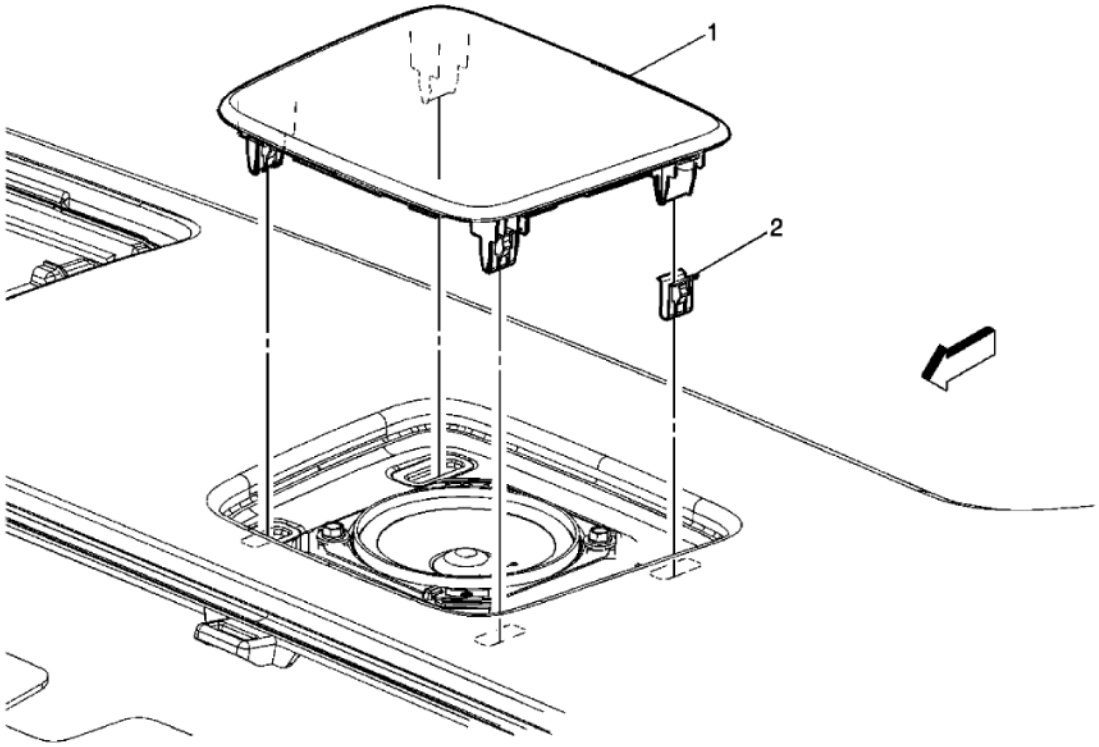


Fig. 29: Radio Front Speaker Grille Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Front Speaker Grille
2	Front Speaker Grille Retainer Clip (Qty: 4)

RADIO FRONT SPEAKER REPLACEMENT

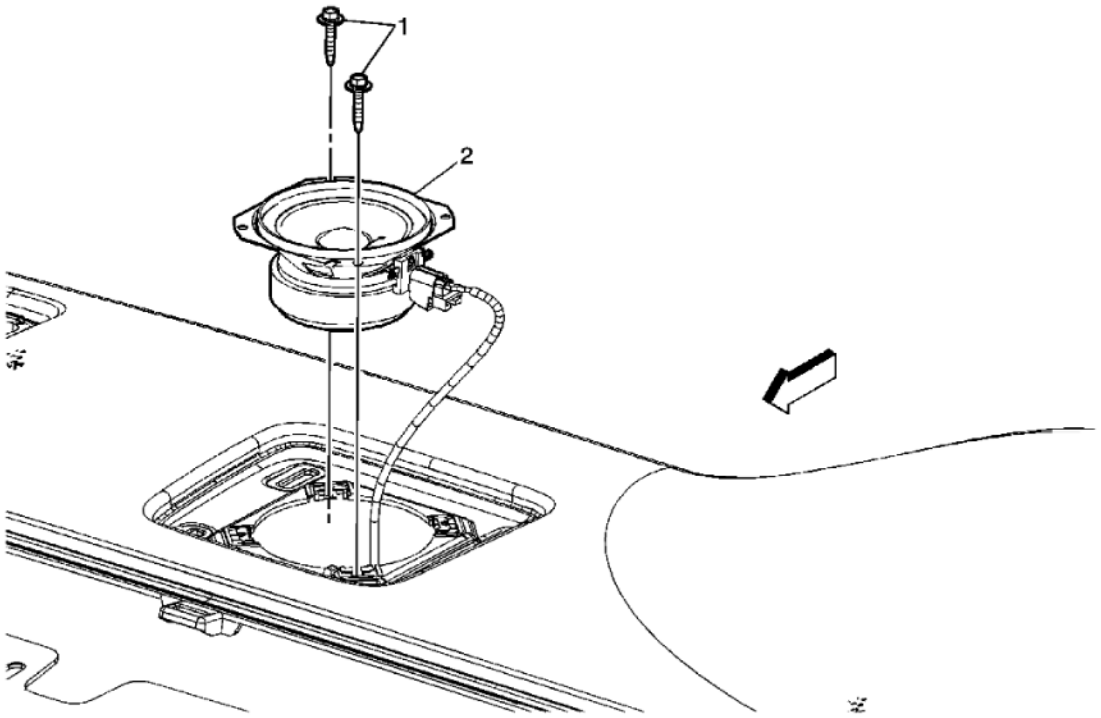


Fig. 30: Radio Front Speaker Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the front speaker grille. Refer to **Radio Front Speaker Grille Replacement**.	
1	Front Speaker Screw (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 6 N.m (53 lb in)
2	Front Speaker Assembly **Tip:** Disconnect the electrical connector.

FRONT UPPER SPEAKER REPLACEMENT

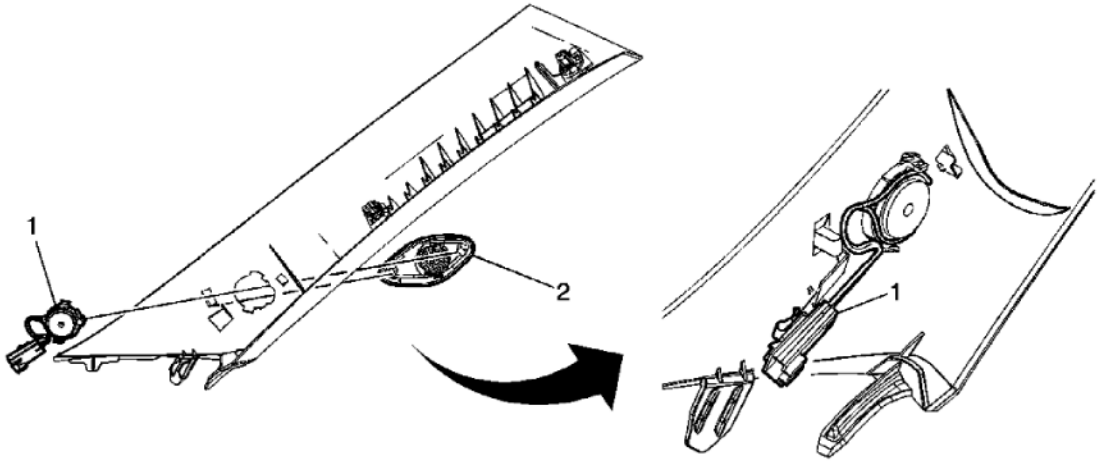


Fig. 31: Front Upper Speaker Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the windshield pillar garnish molding. Refer to **Windshield Pillar Garnish Molding Replacement** .	
1	Radio Windshield Side Garnish Molding Speaker Assembly **Tip:** Press in the tabs on the speaker to release from the windshield pillar.
2	Radio Windshield Side Garnish Molding Speaker Grille **Tip:** Press in on the tabs of the speaker grille to release from the windshield pillar.

RADIO FRONT SIDE DOOR SPEAKER REPLACEMENT

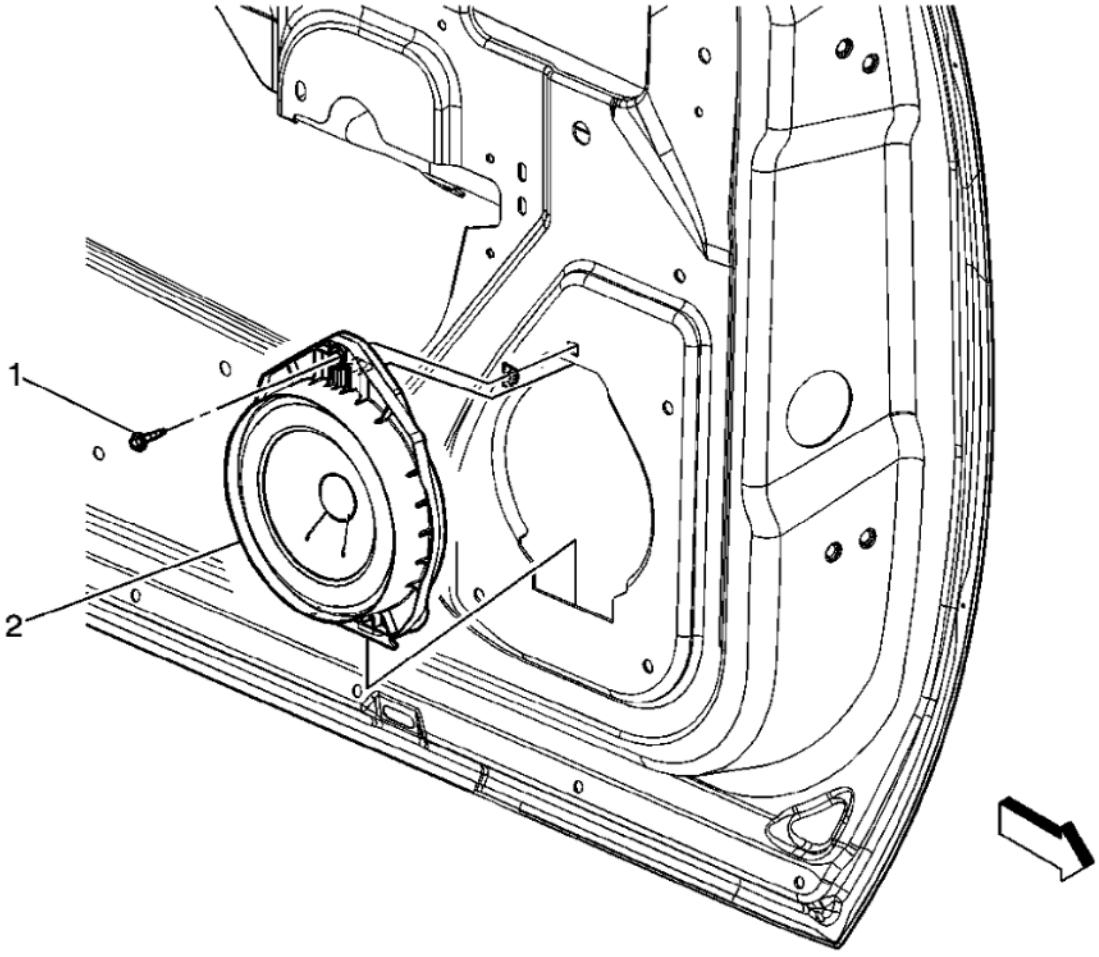


Fig. 32: Radio Front Side Door Speaker Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the front door inner trim panel. Refer to **Front Side Door Trim Panel Replacement (YE9)** or **Front Side Door Trim Panel Replacement (SLT)** .	
1	Front Door Speaker Screw **NOTE:** **Refer to Fastener Notice .** **Tighten:** 3 N.m (25 lb in)
2	Front Door Speaker **Tip:** Disconnect the electrical connectors.

RADIO FRONT FLOOR CONSOLE SPEAKER REPLACEMENT

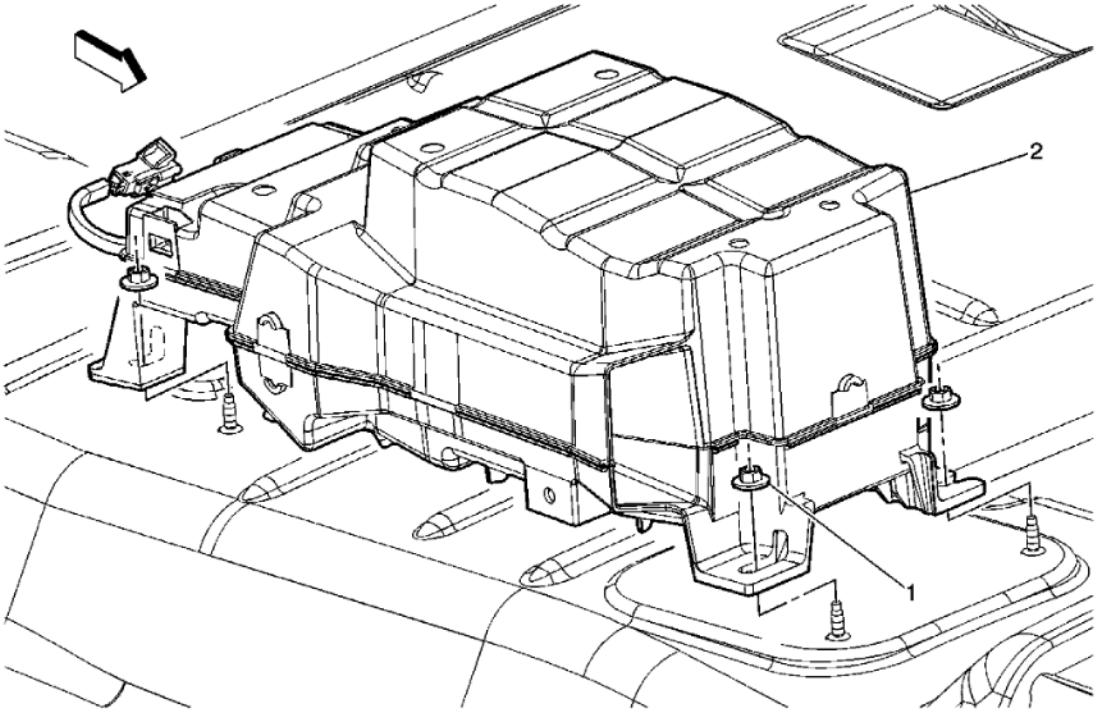


Fig. 33: Radio Front Floor Console Speaker Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the front floor console assembly. Refer to **Front Floor Console Replacement (with RPO SLT)** or **Front Floor Console Replacement (without RPO SLT)** .	
1	Speaker Assembly Nut (Qty: 3) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 9 N.m (80 lb in)
2	Front Floor Console Speaker Assembly **Tip:** Disconnect the electrical connectors.

RADIO REAR SIDE DOOR SPEAKER REPLACEMENT (CREW CAB)

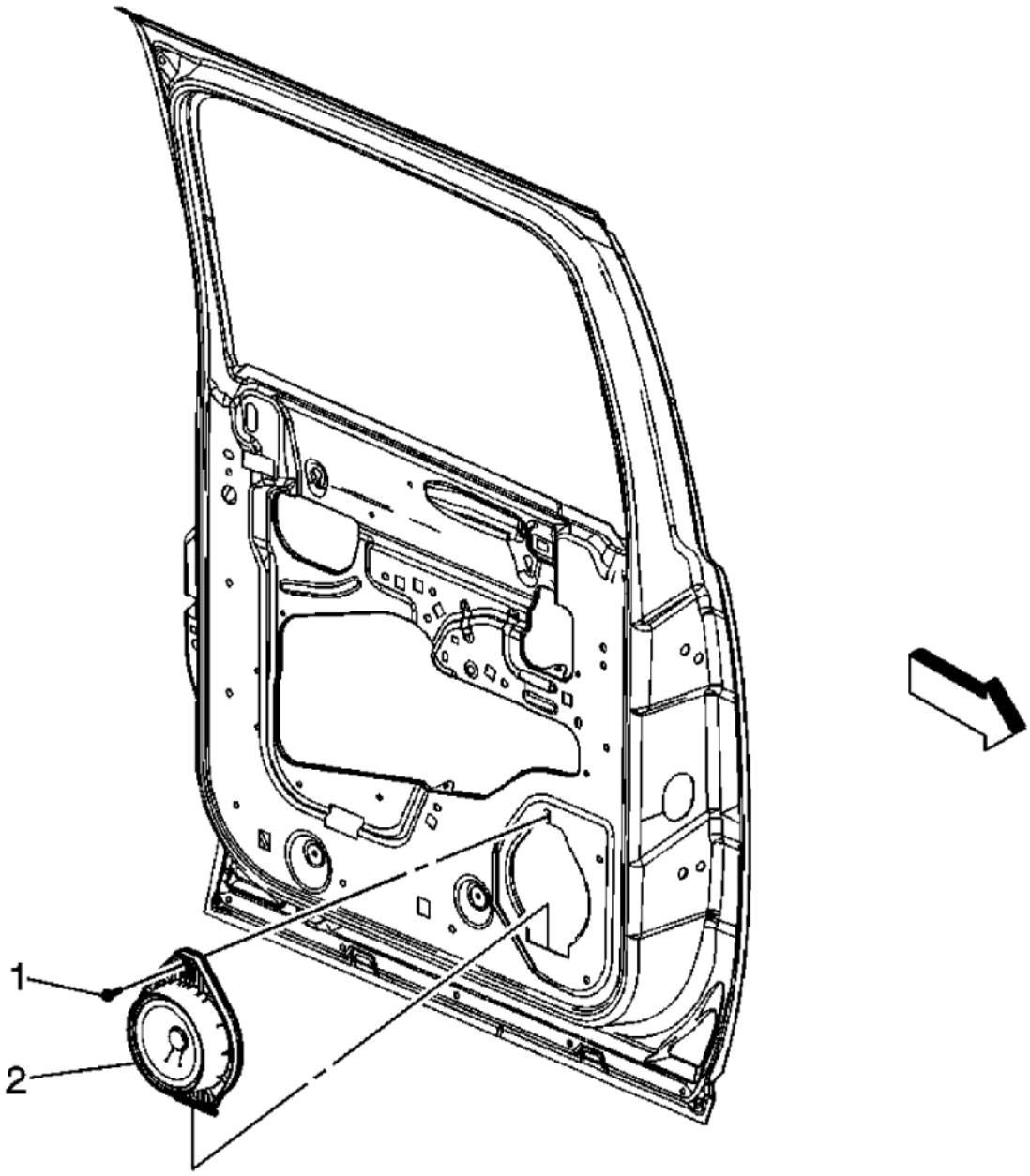


Fig. 34: Radio Rear Side Door Speaker Replacement (Crew Cab)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the rear side door trim panel. Refer to **Rear Side Door Trim Panel Replacement (YE9)** or **Rear Side Door Trim Panel Replacement (SLT)** .	
	Rear Door Speaker Screw

1	**NOTE:** **Refer to Fastener Notice .** **Tighten:** 3 N.m (25 lb in)
2	Rear Door Speaker **Tip:** Disconnect the electrical connectors.

RADIO REAR SIDE DOOR SPEAKER REPLACEMENT (EXTENDED CAB)

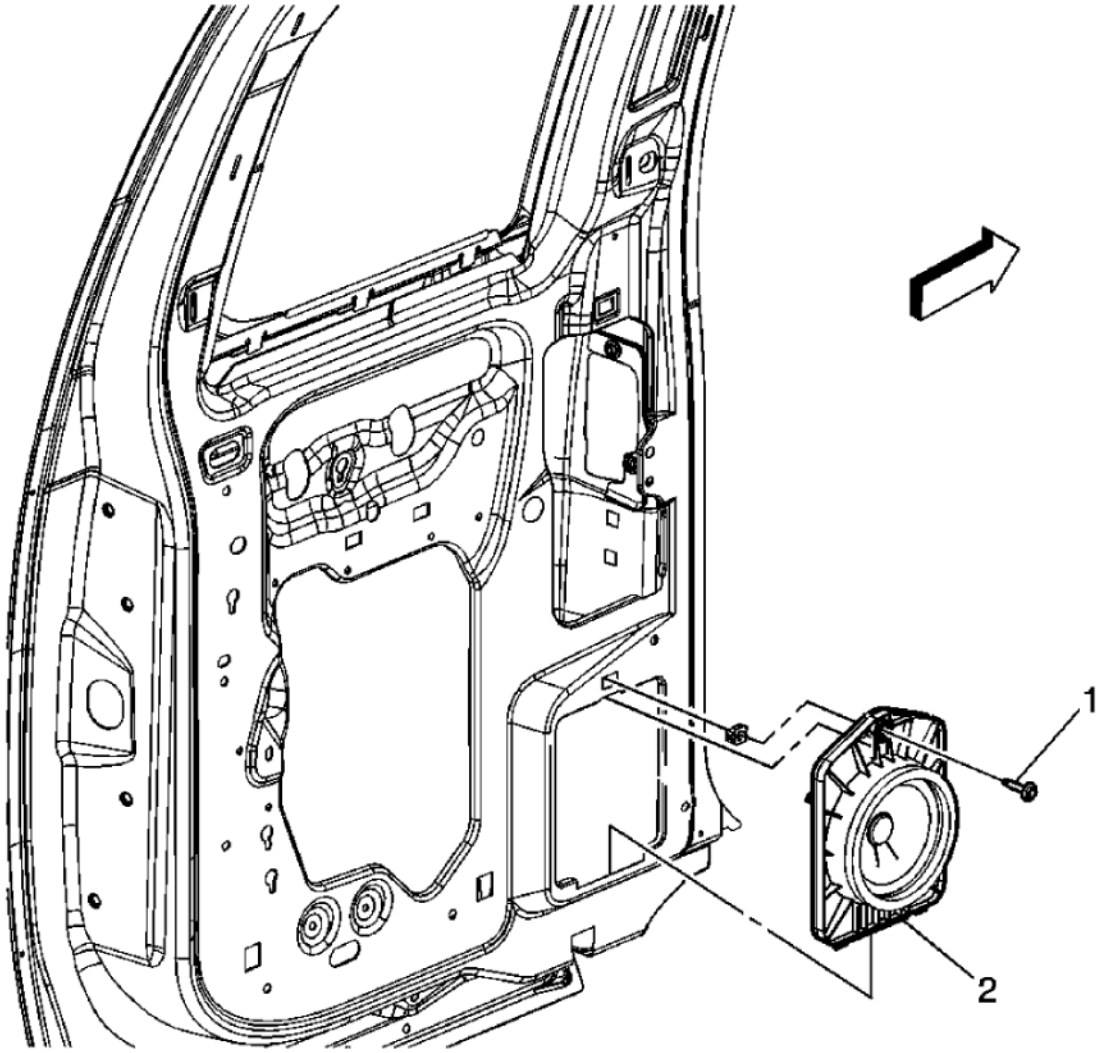


Fig. 35: Radio Rear Side Door Speaker Replacement (Extended Cab)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the rear side access door trim panel. Refer to **Rear Side Access Door Trim Panel Replacement** .	
1	Rear Door Speaker Screw **NOTE:** **Refer to Fastener Notice .** **Tighten:** 3 N.m (25 lb in)
2	Rear Door Speaker **Tip:** Disconnect the electrical connectors.

REAR PILLAR SPEAKER REPLACEMENT

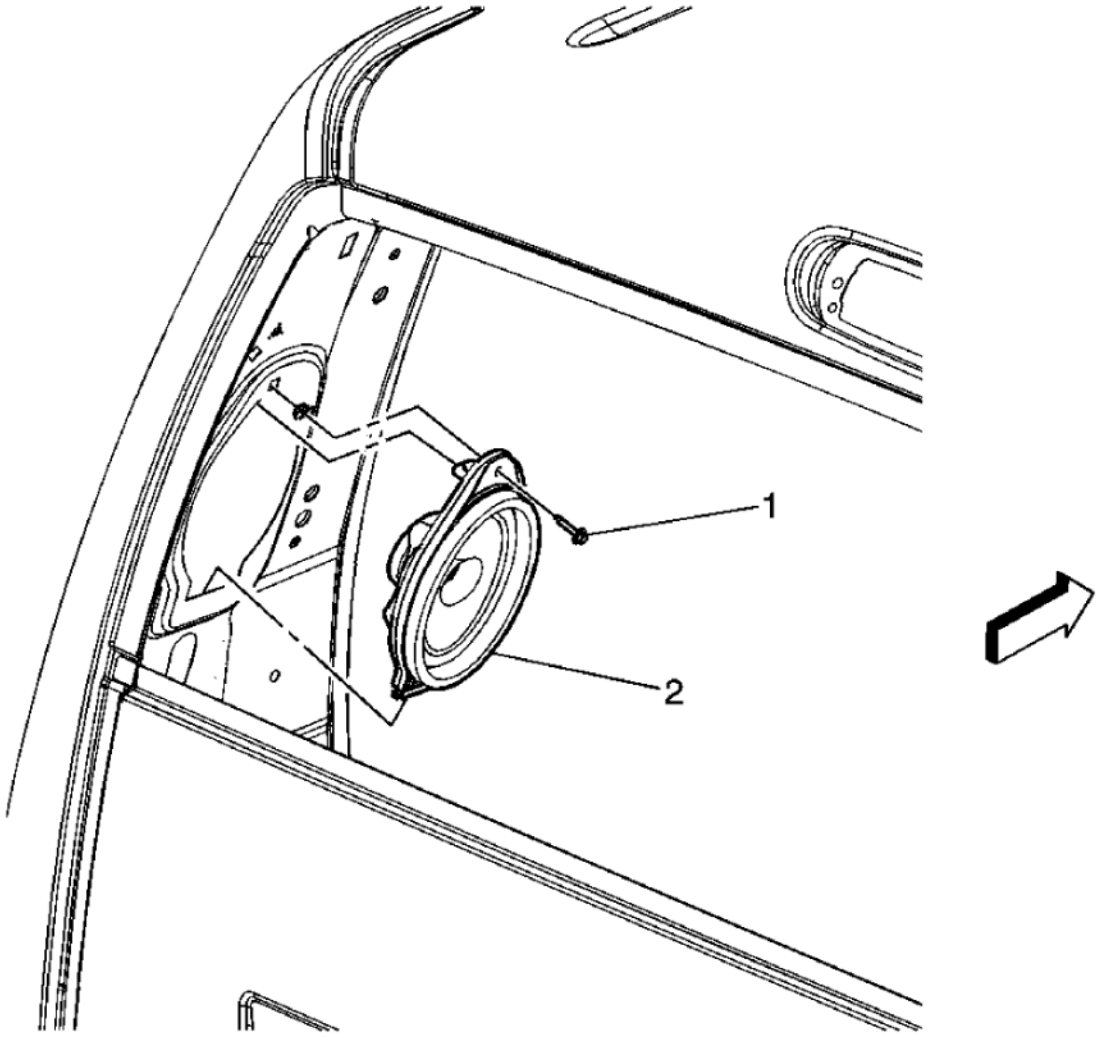


Fig. 36: Rear Pillar Speaker Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Remove the body lock pillar trim. Refer to **Body Lock Pillar Trim Replacement (Crew Cab)** or **Body Lock Pillar Trim Replacement (Regular Cab)** or **Body Lock Pillar Trim Replacement (Extended Cab)** .	
1	Rear Pillar Speaker Screw **NOTE:** **Refer to Fastener Notice .**

	Tighten: 3 N.m (25 lb in)
2	Rear Pillar Speaker **Tip:** Disconnect the electrical connectors.

DESCRIPTION AND OPERATION

NAVIGATION SYSTEM DESCRIPTION AND OPERATION

Operator Controls

Band	Changes between AM/FM1/FM2/WX
Config	Press to change system settings
Eject	Press to eject the map DVD
Map	Press to enter map mode
Repeat	Press to repeat the last voice guidance
Source	Changes between the different
Tilt	Press to tilt the position of the display screen
Tune/Seek	Allows the system to tune to the next preprogrammed station or to seek stations in the area

Navigation System Components

The navigation system contains the following components:

- Navigation radio
- Global positioning system (GPS) antenna
- Auxiliary RCA video jacks

Navigation Radio

This component acts as the operator interface for the navigation system, provides the data input from the operator to the navigation system and provides navigation information to the operator via the display screen. The navigation radio is located in the center of the instrument panel. The navigation radio provides the following:

- A display screen-All navigation, audio and TV functions are displayed on this screen.
- Soft key buttons on the display to allow selection from menus and to operate the navigation system and the audio system
- The navigation system map with routing information displayed on the navigation radio screen

- Provides verbal guidance to the operator

Global Positioning System (GPS) Antenna

The global positioning system (GPS) antenna is located in the upper center of the I/P. The GPS antenna is powered through the same coaxial cable used to send the signals to the NAV.

Voice Recognition

The Navigation System voice recognition allows for hands-free operation of navigation and audio system features. The voice recognition can be used when the ignition is in accessory or ON, or when retained accessory power (RAP) is active. This feature only works if the map DVD is inserted and the AGREE button has been pressed. The memory seats can also be able to be set and selected using the voice recognition feature. For a complete list of available commands, refer to the Owners Manual Navigation Supplement and/or Personalization in the Owners manual.

ONSTAR DESCRIPTION AND OPERATION

This vehicle uses the Generation 7.0 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.

New Features

New Features for this version of OnStar® include Turn by Turn Navigation and the Advisor Record Feature. Turn by Turn Navigation allows the driver to contact OnStar® to obtain directions for driving from a current location to a desired location. The Turn by Turn Navigation system stores your planned route and continually checks your position along that route, when you deviate from the planned route, the system will recognize this and prompt the driver with verbal prompts for how to proceed. The driver then responds verbally to direct the system to continue the current routing or to recalculate the route because of a missed turn. Turn by Turn Navigation instructions are displayed to the driver by the radio display or the driver information center (DIC). The Advisor Record Feature allows the driver to store any information given to you during a call with an OnStar® Advisor.

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 serial data 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 vehicle communication interface module (VCIM) supplies 10 volts to the OnStar® button assembly, on the keypad supply voltage circuit. When pressed, each button completes a circuit across a resister 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 a part of the rearview mirror assembly, or on some vehicle lines, can be a separate, stand alone unit. In either case, the vehicle communication interface module (VCIM) supplies voltage to the microphone on the cellular microphone signal circuit, while voice data from the user is sent back to the 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, standalone 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 VCP 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.

This Generation 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 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 diagnostic information and procedures section.

The default language for the new VCIM is English. Refer to the scan tool, to change to French or Spanish.

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 users 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 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 owners 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, 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 though 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 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 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® 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 can 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. • 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.
'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

Contents

- RPO options
- Circuit description
- Component description
- Theft deterrent feature
- Customer tips

RPO Options

The entertainment system on this vehicle is configured with either a base or uplevel audio system. Both the base and uplevel audio systems contain a radio, antenna, and speakers. The following shows the Entertainment RPOs that are available for this vehicle:

- (UM7) AM/FM Stereo
- (U1C) AM/FM Stereo CD
- (US8) AM/FM Stereo, CD, MP3, RDS, EQ
- (US9) AM/FM Stereo, 6-Disc CD, MP3, RDS, EQ
- (UVA) AM/FM Stereo, CD, DVD, MP3, RSE Video
- (UQ5) Base Four Speaker, No Amplifier
- (UQ3) Uplevel Six Speaker, No Amplifier
- (Y91) Premium (Luxury) GMC Denali
- (UQA w/o Y91) Non GMLAN Bose Amplifier
- (UQA w Y91) GMLAN Bose Amplifier
- (UQS) Cadillac Premium Amplifier
- (U2K) Digital Radio

Circuit Operation

Radio Power

The main radio power is supplied by a 15A fuse located in the underhood fuse block. The radio does not require a discrete ignition feed circuit for power moding. The power moding is accomplished using a structure of Virtual Networks (VN). The Power Mode Master (PMM) transmits the GMLAN power mode signals.

The radio supports the following signals:

- System Power Mode
- Infotainment Operation Allowed

The radio also supports the following GMLAN Vehicle Power Modes:

- OFF
- ACCESSORY
- RUN
- CRANK REQUEST

Radio Ground

A wire in the main radio connector that is connected to battery negative at all times provides the main radio ground. Resistance between the ground pin and the vehicle battery negative terminal must not exceed 0.05 ohm.

Radio Speaker Outputs

At low volume, the plus (+) and minus (-) speaker outputs circuits measure approximately 7-8 volts. If a plus or minus circuit for any speaker output is shorted to ground or voltage, the radio disables the circuit for component protection and sets a diagnostic trouble code (DTC). The radio sets the speaker circuit DTC on non-amplified systems only. As the radio volume increases the voltage on the plus and minus circuits change to create a voltage difference between each other. The difference in voltage is what drives the voice coil of the speaker producing sound.

Radio Head Unit Dimming

GMLAN signal data received by the radio determines the radio dimming and backlighting levels. The radio sets the backlight and VF display dimming to the value indicated by the interior dimming level and interior dimming display level signals in the GMLAN dimming information frame. The radio provides faceplate and control/graphics backlighting in the OFF (RAP inactive) when the exterior lighting virtual network (VN) is activated. The radio display is consistent then

with the surrounding devices that use analog PWM dimming to backlight their control/graphics when the power mode is OFF and the park lights are ON.

Amplifier Interface UQA without Y91(Non-GMLAN)

The main amplifier power is provided by a 20A fuse located in the body control module (BCM). A discrete switched 12-volt output is used to control the power - state of the amplifier. To respond quickly to audio input and control signals, the amplifier is ON in all vehicle power modes except OFF and CRANK Request. However, when the amplifier is asleep it still must allow chime functionality. The internal amplifier bridges are fully powered and unmuted when the amplifier receives the switched 12-volt input.

The radio provides a remote amp mute output circuit to control overall muting of remote non-GMLAN amplifiers with rear seat audio (RSA) applications. The amplifier receives PWM signals on the circuit at varying duty cycle percentages for controlling the muted and unmuted functions of the amplifier. The RSA Enable circuit in the radio enables the rear seat channel muting of the amplifier. A Diag Sense circuit internal to the radio monitors the remote amp mute circuit for faults and sets the appropriate DTC when detected.

The function table below shows the four possible amplifier mute functions.

% Duty Cycle Out	Function
0% (Vlow Vdc)	FOUR_CHANNEL_UNMUTE
50%	REAR_MUTE (input must be 2-channel)
75%	SIX_CHANNEL_UNMUTE
100% (Vhigh Vdc)	ALL_MUTE

Amplifier Interface UQA (GMLAN)

The main amplifier power is provided by a 30A fuse located in the underhood fuse block. For vehicles equipped with UQA, the radio commands the amplifier to perform the following functions through serial data (GMLAN) communication. The radio controls both the overall muting and the rear seat muting via serial data (GMLAN) messaging.

- Volume
- Balance
- Fade
- Bass
- Midrange

- Treble
- DSP Modes
- Volume Compensation
- Chime Output

Amplifier Radio Speaker Inputs

The low-level audio signals (LF, RF, LR, and RR) from the radio are the inputs to the amplifier. The amplifier boosts these inputs and outputs them to the vehicle speakers. If one speaker plus or minus low level audio signal circuit is open between the radio and the amplifier, the input to the amplifier is approximately half. The speakers for that channel then operate at approximately half the normal volume or in some cases no volume.

The low level audio signals from the radio to the amplifier typically measure in the 4-5 volts range.

Amplifier Speaker Outputs

At a low volume, the plus (+) and minus (-) speaker outputs circuits measure approximately 2-7V AC or 7-8V DC at the speaker connector when testing a normal working system. If a plus or minus for any speaker output is shorted to ground or voltage, the amplifier circuitry will turn OFF the front outputs or rear outputs for component protection.

Repeat speaker failure can be caused by a damaged amplifier. Test for a damaged quad bridge output in the amplifier if the wiring between the amplifier and speaker test negative for a short to voltage. Prolonged exposure to DC voltage can cause a speaker coil to short. An early indication of a shorted speaker coil is distortion/noise and eventual failure.

Remote Radio Audio Signal Inputs (UE1 only)

Audio output from the OnStar® communications module connects to the remote audio signal inputs of the radio. When the cellular telephone mute signal goes to 0 volts, the radio over-rides any other audio signal and uses these inputs as the source for the output to the speakers.

Cellular Telephone Mute (UE1 only)

The OnStar® communications module uses the cellular telephone mute signal circuit to over-ride the radio for OnStar® communication. When cellular telephone mute is not active, this circuit is held at 1 volt by the radio. When the cellular telephone mute signal is pulled to ground, the radio over-rides any other audio signal and uses the remote audio signals as the source for output to the speakers. If the radio was OFF when this circuit is pulled low, the radio will turn ON.

Additionally, the radio fades the speakers to full front, adjusts the volume to an initial audible level, and sets an Auto Tone designed for optimal use with OnStar®. When the mute signal is no longer pulled to ground, the radio returns to the mode it was in previously.

Component Description

Antenna System

The antenna system receives broadcast AM or FM stereo signals from free space and sends the signals to the radio receiver for processing via a coaxial antenna cable. Good antenna grounding is important for good radio reception.

Radio

The operator interfaces with the radio system through the radio display and controls. Through these controls the operator is able to control system power, volume, fade, balance, bass, and treble equalizations. Control on the integrated CD, MP3, or XM Satellite Radio system is also available when equipped with these options. A VFD (vacuum florescent display) provides system feedback to the operator.

The radio processes the AM and FM signals from the antenna system or the information from the CD media, amplifies that information and sends the output to the speaker system.

The radio is located in the instrument panel center stack area and is fastened to the instrument panel by fasteners. A rear bullet type guide pin is provided to aid in aligning the radio. An electrical connection to the radio is a 30-way connector that is part of the I/P harness, antenna lead connector, and an additional 16-way harness connector is present on OnStar® equipped vehicles. Additional service length is provided in the radio harnesses to allow connection prior to radio installation.

Radio amplifier outputs to the speakers are protected from damage should speaker leads become shorted to ground or shorted to vehicle power. The radio will sense these conditions and shut down the amplifier outputs in a non-destructive manner. After the short condition is removed, the radio will return to normal operation.

UVA Radio

The UVA radio is a dual play radio that supports the playback of CDR, CDR/W and CDROM media with software decoders for MP3 format.

Speakers

The base model speaker system consists of six speakers. Four 6-inch speakers are mounted in each

of the doors. Two 1-inch tweeter speakers are mounted in the A-pillars. The uplevel speaker system adds two 1-inch tweeter speakers are mounted in the D-pillars, subwoofer and an amplifier.

Auxiliary Jack Socket

The AM/FM Stereo CD radio shall provide a 3.5 mm Auxiliary stereo jack that will allow playback of audio signals from remote devices (e.g., portable tape player, portable CD player or MP3 playback device, etc.).

OnStar®

OnStar® equipped (RPO UE1) vehicles use the radio amplifier and speaker system for voice communication from the OnStar® operator to the vehicle. Voice communication from the vehicle to the OnStar® operator is through the OnStar® microphone and module, which is not a part of the radio system.

When OnStar® begins operation, the radio volume is set to a preset level, auto tone preset for OnStar® becomes active and the fade control is adjusted to the full front speakers. The radio volume control can then be used to adjust the volume to a desired level.

The radio system and OnStar® system are connected through the 16-way connector at the back of the radio. Left and right channel OnStar® audio, mute control of radio functions by OnStar® and the audio signal ground are the circuits provided in the 16-way connector. Disconnecting the 16-way connector from the radio will isolate the radio system from the OnStar® system.

Voice communication from the vehicle to the OnStar® operator could be possible under this condition. However, the vehicle occupant will not be able to hear the OnStar® operator.

For more information regarding radio operation problems, refer to **Symptoms - Entertainment**.

Theft Deterrent

The radio theft deterrent system is intended to disable radio functionality if incorrect vehicle information is received by the radio. The radio disables functionality if the VIN information received by the radio does not match the VIN information that has been learned by the radio. A VIN sequence is the last 6 digits of the VIN. The radio receives this information in a GMLAN frame form.

The radio shall provide the following theft operating modes as part of the radio theft deterrent system:

- No VIN Mode-A radio that has not received or learned a VIN. In this mode the radio has limited functionality.
- Normal Mode-A radio has received a VIN sequence. The radio only learns the VIN sequence if the VIN sequence contained all 6 digits. In this mode the radio has full functionality.
- Theft Detected Mode-A radio that had previously learned a VIN sequence and subsequently received a VIN sequence not matching the learned sequence. In this mode the radio has limited functionality.

Customer Tips

Radio Reception FM

- The best FM fidelity will be obtained from stations within 16-64 km (10-40 mile) range. Noise or distortion may become apparent when attempting to receive stations at distances greater than this range. Suggestion: Reduce treble response when attempting to receive fringe stations.
- Tall buildings or hills may cause a degraded or lost signal. FM signals tend to travel "line of sight". Suggestion: Reduce treble response around tall buildings.
- Although receiver circuits are among the most advanced type available, there are instances where one radio station can interfere with another station. Suggestion: Select another station or switch to a cassette or CD.

Radio Reception AM

AM reception is sensitive to storm disturbances such as lightning. Suggestion: Reduce treble response or switch to FM.

Care of Compact Discs

- Handle compact discs (CDs) carefully. Touch only the outer edges of the CD or the edge of the hole in the center of the CD. Never touch the glossy side of the CD. Fingerprints and scratches will interrupt the "reading" of the information on the disc.
- Store CDs in their protective cases. Store CDs away from sunlight, dirt, dust, and debris.
- Do not attach a label or tape to a CD.
- Always check for scratches and signs of wear on both sides of the CD.
- Never place any marks on the CD with a marker.
- If a CD becomes contaminated, clean it with a clean, damp, soft, lint-free cloth and mild detergent. Wipe the CD in a straight line from the center hole outward. Do not use cleaning

solutions which may damage the CD, such as chemically treated cleaning cloths, benzene, or paint thinners.

Compact Discs Not Appropriate to Use

These CD players were designed to be compatible with round digital audio CDs with the "Compact Disc Digital Audio" label. Other CDs may be incompatible, causing a no-play condition, excessive skips, and "ERR" shown on the radio display or a jam in the loading mechanism. Some incompatible CD types are:

- Special-shaped CDs (any that are not round)
- Re-Writeable CDs (CD-RW type are incompatible)
- Recordable CDs (CD-R type are incompatible, except with US8 or US9 radios)
- Library CDs (with thick bar code labels)
- CD with user-applied labels

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 2 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.

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 serial data 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	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 XMRcvr	Hardware failure

Technical Information for the MP3/CD Radios (US8, US9 and UVA)

The US8 and US9 radios will play both standard audio CDs and CD-Rs or CD-RWs. The CD-R/RWs may contain either standard audio (*.cda) or compressed audio (*.mp3). Customers who record their own music CD-R/RWs should be aware of the following:

- The files can be recorded on a CD-R/RW disc with a maximum capacity of 700 MB.

- The radio will play only compressed audio files recorded in the *.mp3 format. It also supports playlists that can be made and saved with popular MP3 software (in the *.m3u format). A playlist name must be no more than 32 characters in length. If the name of a playlist is longer than 32 characters, the radio will ignore the playlist.
- The radio will only play audio from a CD-R/RW, it cannot record audio.
- The radio will play a mixed mode CD-R/RW (one recorded with both *.cda and *.mp3 files). If a mixed mode CD is inserted in the radio, the radio will assign the standard CD audio to a directory which is listed as ROM audio directory.
- The radio supports multi-session discs, but only the files from the last session will be played.
- There are a total of 20 directories (folders) allowed on a disc. The file structure can be 0-4 directories deep (a folder within a folder, within a folder, etc). Anything more than 20 directories will be ignored. Each directory may have up to 99 files contained within it. Files not having the *.mp3 extension will not be played, but still count toward the maximum. Anything more than the first 99 files within a directory will be ignored. A single disc may have up to 254 files and directories. Anything beyond the 254 limit will be ignored.
- MP3 files must be written to a CD-R/RW in one of the following industry-standard formats:
  - ISO 9660 Level 1
  - ISO 9660 Level 2
  - Joliet
  - Romeo
- ID3 tag information is displayed by the radio, if available. The ID3 tag information can either be version 1 or 2. The radio will display the filename, song name, artist name, album name, directory name, and playlist name, etc.

If the customer does not follow these guidelines when recording a CD-R/RW, the disc may not play in the US8 or US9 radio.

VIDEO ENTERTAINMENT SYSTEM DESCRIPTION AND OPERATION

Display Screen

The rear display screen shows video from either DVD movies, or an AUX input device, such as a video game console or camera. Each video screen has a dedicated video signal circuit to the radio.

AUX Inputs

The AUX input jacks are standard color-coded RCA-style jacks. Video is yellow, right audio is red, and left audio is white. The jacks are located on the rear of the center console. A number of

devices may be plugged into the AUX jacks, including, but not limited to video game consoles, digital cameras, camcorders, or other devices. Audio only sources can be played through the AUX jacks from portable audio devices. Turn on the rear seat audio (RSA), press the SOURCE key repeatedly until AUX is selected or touch the AUX screen button. An auxiliary device must be connected for the AUX screen button to appear as an option to select on the radio.

Rear Seat Audio (RSA)

The rear seat audio (RSA) is integrated into the rear HVAC control module. Audio, video source are controlled by the radio through serial data communication. The rear speaker channels pass through the RSA. The rear seat audio can be muted by the RSA when in use. The rear seat entertainment (RSE) system includes a radio with a DVD player, a video display screen, 2 wireless headphones, and a remote control. Vehicles equipped with a third row video display will include 3 wireless headphones.

Wireless Headphones

Wireless headphones are optional and allow for rear seat passengers to use the rear seat entertainment (RSE) or rear seat audio (RSA) functions without disturbing the listening of front seat passengers. The wireless headphones receive audio signals from the infrared (IR) transmitters on the overhead console. This transmission is line of sight only, so audio quality will be degraded if anything blocks the transmitter signal from reaching the headphones.

The wireless headphones include 2 channels. This allows rear seat passengers to utilize both RSE and RSA functions without disturbing one another. The toggle switch on the right side headphone earpiece switches between channel one and channel 2. RSE is broadcast on channel one, and RSA on channel 2.

To use wireless headphones, turn them on using the power button on the left side headphone earpiece. Adjust volume using the rotary dial on the right side headphone earpiece.

Wired Headphone Jacks

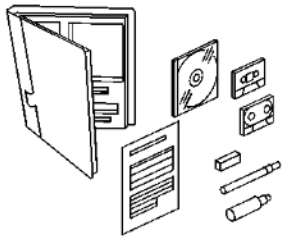
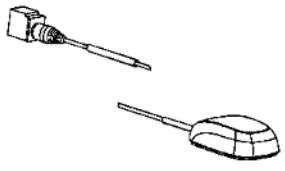
The overhead console is equipped with two 2.5 mm jacks for wired headphones. The headphones can be used to listen to either the rear seat entertainment (RSE) or rear seat audio (RSA) functions. If both RSE and RSA are used at the same time, the wired headphones receive only RSA audio.

To use the wired headphones, plug the headphones into the jacks. Adjust the volume by pressing the headphone button on the left or right side of the RSA face, and then using the FWD or REV buttons to adjust the volume up or down. Visual indicators on the RSA display will indicate volume level. The left headphone button selects the left headphone jack for adjustment, and the

right headphone button selects the right headphone for volume adjustment.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/Description
	J 39916-A CD and Cassette Diagnostic Audio Kit
	EL-48028 Digital Radio Test Antenna