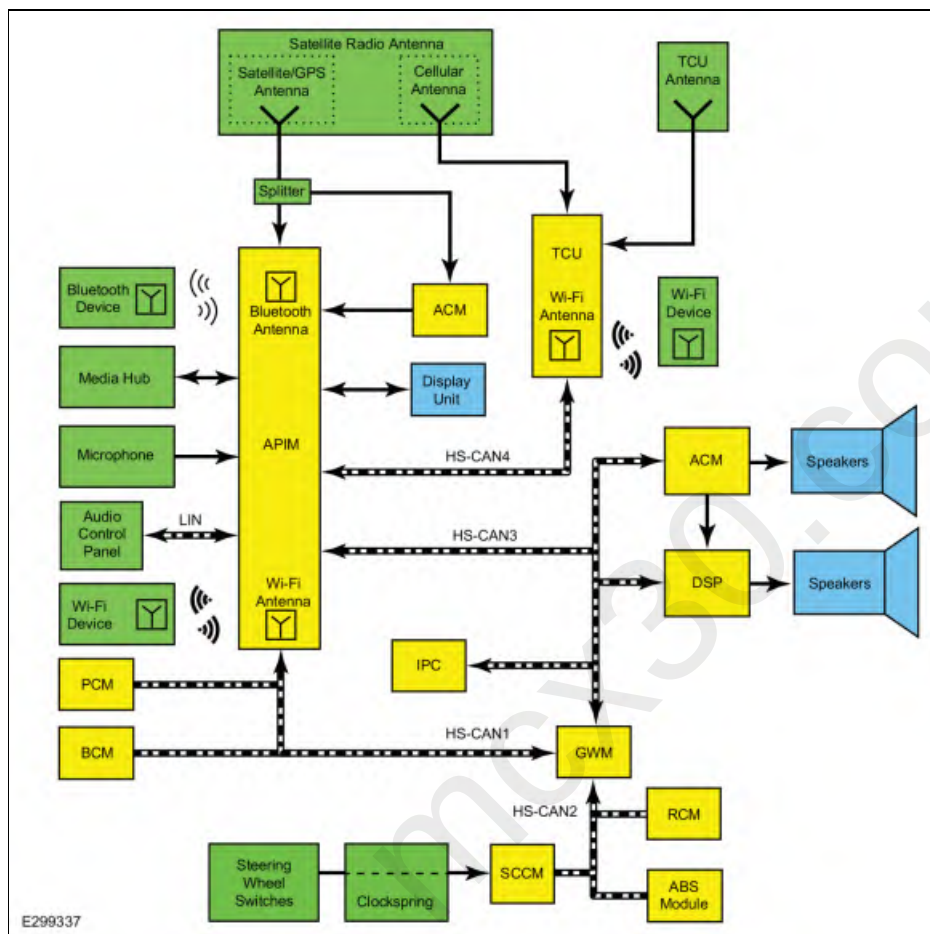


17	ANC Microphones
18	PCM
19	Rear Door Speakers
20	Steering Wheel Switches
21	SCCM
22	Clockspring
23	Audio Control Panel

SYNCA System



Item	Description
1	APIM
2	Display Unit
3	Media Hub
4	Microphone
5	ABS Module
6	RCM
7	GWM
8	BCM
9	PCM
10	Bluetooth Antenna
11	IPC
12	ACM

13	Wi-Fi Antenna
14	Wi-Fi Device
15	Bluetooth Device
16	Speakers
17	Satellite Radio Antenna
18	Cellular Antenna
19	Satellite/GPS Antenna
20	Splitter
21	DSP
22	ACM
23	Speakers
24	TCU
25	TCU Antenna
26	Wi-Fi Device
27	Wi-Fi Antenna
28	Steering Wheel Switches
29	SCCM
30	Clockspring
31	Audio Control Panel

Network Message Chart

ACM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Accelerator pedal position	PCM	Uses the accelerator pedal position percentage for the ANC system operation.
Accessory delay	BCM	Determines the ANC system operating mode.
Battery saver status	BCM	Disables the functionality of the ACM due to the load shedding feature.
Chime controls	IPC	Controls the priority, characteristics, volume, and speaker output of the warning chime tones played through the audio system speakers.
Chime source	IPC	Sets the audio system or IPC as the source for the chime tones.
Engine off status	PCM	Enables/disables the ANC system if the engine is running/off.
Ignition status	BCM	Indicates the ignition mode.
MyKey Belt-Minder audio mute	IPC	Mutes speaker output so the Belt-Minder tone can be more easily heard.
MyKey volume limit status	IPC	Limits the maximum audio system volume when a MyKey restricted key is in use.
Satellite radio request signals	APIM	Carries out out various satellite radio functions using the touchscreen.
Steering wheel switch status	SCCM	Indicates the button press status of the steering wheel switches.
SYNC alerts	APIM	Controls the characteristics, volume, and speaker output of the SYNC notifications [text message, news, sports, weather, satellite radio artist/title favorites (if activated), and traffic alerts].
Vehicle configuration data	BCM	Verifies vehicle configuration data such as the VIN and system module configuration.
Vehicle speed	PCM	Used for the speed compensated volume function.

APIM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
911 Assist override status	IPC	Enable or disables the Always on 911 Assist or emergency assistance MyKey feature as selected through the IPC while using an administrator MyKey.
Airbag deployment status	RCM	Monitors airbag deployment status for 911 Assist or emergency assistance.
Date and time	BCM	Displays the current date and time on the display unit.
Display language selection	IPC	Displays information on the display unit in the language as selected by the user.
Call notification	RCM	Notifies of a 911 Assist or emergency assist call being initiated due to airbag deployment.
Gear lever position	TCM	Verifies the gear selector position for bezel diagnostics.
Ignition status	BCM	Indicates the ignition mode.
Illumination dimming level	BCM	Controls the backlight intensity.
MyKey volume limit status	IPC	Limits the maximum audio system volume when a MyKey restricted key is in use.
Navigation rolling wheel count and direction	ABS module	Provides more accurate vehicle position tracking when the GPS signal is temporarily unavailable.
Steering wheel switch status	SCCM	Indicates the button press status of the steering wheel switches.
Vehicle configuration data	BCM	Verifies vehicle configuration data such as the VIN and system module configuration.
Vehicle speed	PCM	Used for navigation functionality.

DSP Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Chime controls	IPC	Controls the priority, characteristics, volume, and speaker output of the warning chime tones played through the audio system speakers.
Chime source	IPC	Sets the audio system or IPC as the source for the chime tones.
Ignition status	BCM	Indicates the ignition mode.
MyKey Belt-Minder audio mute	IPC	Mutes speaker output so the Belt-Minder tone can be more easily heard.
MyKey volume limit status	IPC	Limits the maximum audio system volume when a MyKey restricted key is in use.
Vehicle configuration data	BCM	Verifies vehicle configuration data such as the VIN and system module configuration.

RCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Call confirmation	APIM	Confirms the configuration of the 911 Assist or emergency assist feature and to confirm the status of the 911 Assist or emergency assist phone call.

TCU Network Input Messages

Broadcast Message	Originating Module	Message Purpose
GPS data	APIM	Indicates the vehicle location via the FordPass mobile application.
Ignition status	BCM	Indicates the ignition mode.
Odometer master value	IPC	Indicates the odometer value via the FordPass mobile application.
Transport mode	BCM	Disables the functionality of the TCU until the vehicle is taken out of transport mode.
Vehicle lock status	BCM	Indicates the vehicle lock/unlock mode.
Wi-Fi request	APIM	Controls various Wi-Fi features, such as password and add/remove device.

Audio System

NOTE: Refer to the Owner Literature for additional details of the audio system.

ACM Operation

The ACM receives and sends network messages over the CAN. A diagnostic scan tool can retrieve Diagnostic Trouble Codes (DTCs), PID data and carry out other diagnostic functions for the ACM via the vehicle DLC.

The ACM is powered at all times and uses the ignition status message to control the on/off mode. The accessory delay feature is controlled by an ignition status message from the BCM.

The ACM takes various inputs such as radio waves and audio signals, conditions, amplifies and converts them to an analog audio signal. This signal can be amplified internally and sent directly to the speakers, or transmitted to a separate amplifier and speaker system.

The ACM uses the BCM ignition status message to temporarily mute audio output during engine cranking. This prevents the normal voltage spikes during engine cranking from producing popping noises in the audio system.

The ACM (or the DSP if equipped with 12 or 14 speakers) receives vehicle speed information from the PCM over the CAN to adapt the volume based on the different vehicle speeds.

AM/ FM/ DAB Radio

NOTE: The DAB equipped Radio is not available in North America. If a concern only exists with the High Definition (HD) radio function, refer to the High Definition (HD) Radio Reception and Station Troubleshooting in the Owner Literature to identify the possible cause of the concern.

When the AM/ FM mode is selected, the radio amplifies radio waves sent from the antenna. It then selects the requested frequency, converts and amplifies the content. These fluctuating audio signals are output as AC output voltage to power the speakers or as an input to a separate amplifier.

If equipped with a FM2 diversity antenna, FM radio waves are collected and sent to be amplified by the FM2 diversity antenna amplifier. A coaxial antenna cable sends the amplified signal to the ACM. An ACM antenna signal comparator uses both antenna signals to reduce or eliminate FM distortion in poor signal environments.

If equipped with High Definition (HD) radio capability, the radio automatically detects and plays back the improved sound quality and multiple programs of HD broadcasts.

If equipped with DAB capability, the radio can provide improved sound quality and multiple programs of digital broadcasts.

Satellite Radio (if equipped)

If equipped with satellite radio capability, satellite signals collected by the satellite radio antenna can be selected and played back over the audio system. The satellite antenna sends satellite radio and GPS data through the satellite radio cable to a splitter (integrated into the cable). The satellite radio signals are separated by the splitter and sent to the satellite radio receiver within the ACM.

SYNC Input

The ACM receives stereo and monaural audio wired inputs from the SYNC system. These include USB or Bluetooth connected music sources,

phone call audio, and more.

When the USB input mode is selected, the radio converts the digital media playback to analog audio signals. It amplifies and sends this output to the speakers.

If a compatible phone is paired with the SYNC system, phone call audio may be heard on the vehicle speakers and the spoken response is transmitted to outgoing phone call audio.

ACM Speaker Output - 4 and 6 Speaker System

The ACM is configured to directly power vehicle speakers. An amplifier in the final stage of the ACM sends an analog AC signal to drive the speakers. Output includes stereo channels. The ACM powers all of the vehicle speakers.

A speaker circuit short to ground or power can be detected by the ACM. The ACM may disable speakers to prevent damage to the internal amplifier. A DTC sets to identify which speaker circuits are causing the concern.

ACM Signal/Speaker Output - 12 and 14 Speaker System

The ACM is configured to directly power some of the vehicle speakers. An amplifier in the final stage of the ACM sends an analog AC signal to drive the speakers. Output includes stereo channels to the front door tweeter and the rear D-pillar speakers.

The ACM outputs audio data over an Automobile Audio Bus (A2B) cable to the DSP. The DSP powers the remaining vehicle speakers. Output includes stereo, center and subwoofer channels.

A speaker circuit short to ground or power can be detected by the ACM and the DSP. The ACM and the DSP may disable speakers to prevent damage to the internal amplifier. A DTC sets to identify which speaker circuits are causing the concern.

ANC (if equipped)

The ANC feature reduces the level of occasional low frequency engine noise which competes with audio system playback.

The ACM determines the noise frequency to be canceled from the cabin by using engine data from the PCM.

While the engine is running, the ANC microphones monitor undesired noise in the passenger compartment. The microphones transmit this noise as analog signals to the ACM. The signals are processed to create an inverted phase sound wave with the same amplitude as the original sound. This noise-canceling sound created by the ACM is transmitted to the ACM outputs and externally to the DSP (if equipped). The final output by the ACM and the DSP is sent as fluctuating AC voltage to the speakers.

Remote Audio Controls

The steering wheel switches contain a series of resistors. Each steering wheel audio function switch has a specific resistance value. The SCCM and switch assembly are connected in a voltage divider circuit. The voltage drop over an internal SCCM resistor is changed by the different audio switch function resistances. The SCCM monitors the resultant voltage drop across its internal resistor to determine which steering wheel switch is pressed. The SCCM transmits the steering wheel switch inputs over the CAN to the ACM, to control audio functions.

SYNC System

NOTE: Refer to the Owner Literature for additional details of the SYNC system.

The APIM contains the SYNC software. The SYNC system connects various inputs over Bluetooth or USB connections to the car audio system. The SYNC system allows driver control of a phone, media device, and vehicle systems (navigation and climate control for example).

The APIM is powered at all times and uses the BCM ignition status message to control the on/off mode. The accessory delay feature is controlled by an ignition status message from the BCM.

SYNC Inputs

- USB - media players or flash drives
- Bluetooth - phones or media players
- Display unit and radio control panel switches
- Steering wheel switches
- Voice microphone input
- GPS data
- Serial data link wired input from the ACM

SYNC Outputs

- Display unit (touchscreen or non-touchscreen) CAN messages
 - Audio system commands from the touchscreen equipped vehicles
 - HVAC commands from touchscreen-equipped vehicles

- Wired outputs to the ACM
 - Stereo (2 channel) audio
 - Monaural voice responses, including navigation guidance (if equipped)
 - Monaural phone call audio and phone ringtone
- Commands to a USB or Bluetooth device
 - Outgoing call commands
 - TTS information for a phone
 - USB device file selection for playback

Remote SYNC Controls

The steering wheel switches contain a series of resistors. Each steering wheel audio function switch has a specific resistance value. The SCCM and switch assembly are connected in a voltage divider circuit. The voltage drop over an internal SCCM resistor is changed by the different audio switch function resistances. The SCCM monitors the resultant voltage drop across its internal resistor to determine which steering wheel switch is pressed. The SCCM transmits the steering wheel switch inputs over the CAN to the APIM to control SYNC functions.

Bluetooth Mode

The APIM supports multiple Bluetooth profiles, allowing the SYNC system to interact with both Bluetooth-enabled phones and Bluetooth-enabled media devices.

USB Mode

The APIM receives serial data input from connected USB devices. The USB cables to the APIM are shielded to prevent interference from electromagnetic sources. The APIM provides 5 volt power for the USB port in the media hub.

Voice Commands

When the steering wheel voice button is pressed, a CAN message is sent to the APIM, initiating the voice command feature.

When voice commands are spoken, the monitored sounds are converted into analog signals by the microphone and sent to the APIM. The APIM software interprets them and outputs a command.

Compass

The GPS antenna (integral to the satellite radio antenna) is used to acquire the compass heading.

The compass data is sent through the GPS cable to the APIM. The APIM uses this data in addition to wheel speed and wheel rotation direction messages from the ABS module to calculate and provide accurate vehicle tracking. The APIM processes the data and transmits it through the LVDS cable to the display unit. In the event the GPS fix or signal is temporarily lost, the APIM continues to use CAN messages from the ABS module to maintain compass accuracy.

Navigation (if equipped)

The APIM receives GPS data from the satellite and the GPS antenna via a coaxial cable. The GPS data is used for the compass heading, vehicle location (in the event of airbag deployment) and navigation guidance. The APIM uses the GPS data along with ABS module wheel speed and rotation direction to provide accurate navigation tracking. In situations where the GPS signal is temporarily lost, the APIM continues to use the ABS module and vehicle acceleration data to continue vehicle tracking.

The navigation map data is stored in the APIM. It can be updated using a USB flash drive. The APIM processes the data and transmits it to the display unit through the LVDS cable.

SIRIUS® Travel Link® (if equipped)

The SIRIUS® Travel Link® is a subscription-based service available on vehicles equipped with navigation. The satellite radio antenna receives digital signals containing Travel Link® data. These signals are routed to the satellite radio receiver (integral to the ACM) from a splitter that is part of the GPS antenna coaxial cable. The satellite receiver decrypts the data and the ACM sends it through wired circuits to the APIM.

Certain date-dependent features (such as sports schedules and scores, movie times, or the 5-day weather forecast) require the use of GPS data for accuracy. The APIM processes the data from the ACM and sends it to display on the touchscreen. The time intervals for each Travel Link category to update the data vary, depending on the category.

Digital Radio Data Link (if equipped)

The digital radio data link is a subscription-free based service available on vehicles equipped with navigation. The DAB radio antenna receives digital signals containing digital radio data. These signals are routed to the radio receiver (integral to the ACM) from audio unit antenna coaxial cable. The digital radio receiver decrypts the data and the ACM sends it through wired circuits to the APIM.

Certain date-dependent features (such as sports schedules and scores, movie times, or the 5-day weather forecast) require the use of GPS data

for accuracy. The APIM processes the data from the ACM and sends it to display on the touchscreen. The time intervals for each category to update the data varies, depending on the category

SYNC Connect (if equipped)

The SYNC Connect system uses the TCU to communicate via the cellular network with a device running the SYNC Connect application. The TCU communicates with other vehicle modules over the CAN to obtain information or to carry out application commands, depending on the request.

The primary means of communication between the TCU and the cellular network uses a cellular antenna integrated into the GPS/Satellite antenna. A separate coaxial cable connects the cellular portion of the antenna to the TCU. The secondary means of communication between the TCU and the cellular network is the TCU antenna. The TCU antenna connects to the TCU via a coaxial cable.

SYNC Connect data is transmitted via the cellular network to a server or customer device with the SYNC Connect application installed. The data received via the cellular network from the device application is processed by the TCU, which can make vehicle system commands via the CAN.

Vehicle Wi-Fi Hotspot (if equipped)

The TCU provides the vehicle Wi-Fi access point.

The TCU communicates to the cellular network by two means. The primary connection is through the cable to the cellular antenna incorporated into the GPS/Satellite antenna. The secondary means is through the cable to the TCU antenna.

Component Description

Audio Unit Antenna

The audio unit antenna (also called the AM/ FM1/ DAB antenna) is an on-glass antenna, mounted to the left side of the rear window. It receives AM/ FM/ DAB radio waves and sends them through the audio unit antenna amplifier to the ACM via the audio unit antenna coaxial cable (also called the AM/ FM1/ DAB antenna coaxial cable).

Audio Unit Antenna Amplifier

The audio unit antenna amplifier (also called the AM/ FM1 antenna amplifier) amplifies AM/ FM radio signals to improve reception. The amplified signal is sent through a coaxial cable to the ACM. The amplifier is powered by the ACM through the coaxial cable.

FM2 Diversity Antenna

The FM2 diversity antenna is an on-glass antenna, mounted to the right side of the rear window. The FM2 diversity antenna improves FM reception in urban areas or anywhere large objects reflect FM signals and create multiple FM signal paths.

FM2 Diversity Antenna Amplifier

The FM2 diversity antenna amplifier amplifies FM radio signals and transmits them through a coaxial cable to the ACM. Voltage for the amplifier is provided by the ACM through the coaxial cable.

GPS/Satellite Radio Antenna

The GPS/satellite radio antenna contains a GPS antenna circuit board that receives radio waves containing GPS and satellite radio data. The data is sent through the coaxial cable to the APIM (GPS data) and through a splitter to the ACM (satellite radio data).

Cellular Antenna

If equipped, the GPS/satellite radio antenna contains a cellular antenna circuit board that receives radio waves containing cellular data. The data is sent through the cellular antenna coaxial cable to the TCU.

TCU Antenna

The TCU antenna boosts reception for incoming and outgoing cellular network data. It is a compact, cellular phone type, planar inverted-F antenna.

Voice Microphone

The voice microphone is connected to the APIM and is mounted to the headliner.

ANC Microphones

The ANC microphones are connected to the ACM.

Steering Wheel Switches

The steering wheel switches contain a series of resistors. Each steering wheel audio function switch has a specific resistance value. The SCCM (or SECM if equipped with adaptive steering) and switch assemblies are connected in a voltage divider circuit.

SCCM

The voltage drop over an internal SCCM resistor is changed by the different audio switch function resistances. The SCCM monitors the voltage drop across its internal resistor to determine which steering wheel switch is pressed. The SCCM transmits the steering wheel switch inputs over the network to the APIM and ACM, to control audio and SYNC system functions.

The SCCM requires PMI when it is replaced.

Media Hub - Vehicles Equipped With A Non-Touchscreen Display

The media hub contains a single USB port and is powered by the APIM. The port consists of two circuit connections for the 5 volt power and two more circuits for digital serial data.

Data is sent from the USB port to the APIM through a single USB cable.

Media Hub - Vehicles Equipped With A Touchscreen Display

The media hub contains two illuminated USB ports, and is powered by the APIM. The media hub has an internal 5 volt power source for the USB ports. Each port consists of two circuit connections for the 5 volt power, plus two more circuits for digital serial data.

Data is sent from the two media hub USB ports to the APIM through a single USB cable. The media hub switch manages the data from the two sources.

LVDS Cable

The four-circuit shielded LVDS cable provides power and ground from the APIM to the display unit. Data is transmitted between the APIM and the display unit via the LVDS cable.

Display Unit

The display unit is also known as the non-touchscreen display (FCDIM) or the touchscreen display (FDIM).

The APIM and the display unit exchange information via the LVDS cable. The APIM can communicate display unit-related Diagnostic Trouble Codes (DTCs) over the CAN. The APIM provides the display unit with power and ground through the LVDS cable. The display unit itself does not communicate over the CAN.

Radio Control Panel

The radio control panel transfers button press data over a dedicated LIN to the APIM.

The radio control panel does not require PMI when it is replaced.

ACM

The ACM requires PMI when it is replaced.

DSP

The DSP is a power amplifier for the vehicle speakers. The audio input signal comes from the ACM via the Automobile Audio Bus (A2B) cable. It may drive all speakers on a vehicle or share the speaker output with the ACM.

The DSP requires PMI when it is replaced.

TCU

The TCU connects the vehicle to a cellular network. It contains a non-serviceable internal SIM card.

The TCU requires PMI when it is replaced.

APIM

The APIM consists of two internal modules: the CIP and the VIP. The modules are integrated into the APIM but can be programmed individually if required.

The CIP connects to user devices via Bluetooth, USB or Wi-Fi.

The VIP provides vehicle information for the CIP and other SYNC Apps or functions. In addition, the VIP obtains information from the modules on the network for Diagnostic Trouble Codes (DTCs) when a vehicle health report is requested.

APIM Programming

The APIM CIP or VIP software can be updated. When directed by Ford service, the VIP programming is done via the CAN using a diagnostic scan tool.

The CIP programming may be done using the diagnostic scan tool, Wi-Fi or the SYNC USB connection.

The CIP may also be programmed by registered owners using the Ford owner website. Updates are written to a USB drive and taken to the vehicle USB for programming. After the update completes, the APIM CIP writes the new software level and VIN to the USB flash drive, which must be transmitted by the vehicle owner via the internet back to Ford.

BCM

The BCM contains the clock software and sends the date/time data information to other modules via the CAN.

The BCM requires PMI when replaced. Additionally, at least 2 keys must be programmed and the parameter reset procedure carried out.

BCM

The BCM contains the clock software and sends the date/time data information to other modules via the CAN.

mcx30.com

Diagnosis and Testing

Information and Entertainment System - Vehicles With: SYNC 3

Diagnostic Trouble Code (DTC) Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Diagnostic Trouble Code Chart

Module	DTC	Description	Action <i>New: hover over Pinpoint Test links to show title</i>
ACM	B116A:01	Handset Microphone:General Electrical Failure	GO to Pinpoint Test X
ACM	B116A:12	Handset Microphone:Circuit Short To Battery	GO to Pinpoint Test X
ACM	B116A:14	Handset Microphone:Circuit Short To Ground or Open	GO to Pinpoint Test X
ACM	B117A:01	Backup Microphone:General Electrical Failure	GO to Pinpoint Test X
ACM	B117A:12	Backup Microphone:Circuit Short To Battery	GO to Pinpoint Test X
ACM	B117A:14	Backup Microphone:Circuit Short To Ground or Open	GO to Pinpoint Test X
ACM	B13F5:01	Microphone 3:General Electrical Failure	GO to Pinpoint Test X
ACM	B13F5:12	Microphone 3:Circuit Short To Battery	GO to Pinpoint Test X
ACM	B13F5:14	Microphone 3:Circuit Short To Ground or Open	GO to Pinpoint Test X
ACM	B150C:01	Automobile Audio Bus (A2B) Node 1:General Electrical Failure	GO to Pinpoint Test D
ACM	B150C:11	Automobile Audio Bus (A2B) Node 1:Circuit Short To Ground	GO to Pinpoint Test D
ACM	B150C:12	Automobile Audio Bus (A2B) Node 1:Circuit Short To Battery	GO to Pinpoint Test D
ACM	B150C:13	Automobile Audio Bus (A2B) Node 1:Circuit Open	GO to Pinpoint Test D
ACM	B150C:55	Automobile Audio Bus (A2B) Node 1:Not Configured	GO to Pinpoint Test D
ACM	B150C:87	Automobile Audio Bus (A2B) Node 1:Missing Message	GO to Pinpoint Test D
ACM	B150C:8F	Automobile Audio Bus (A2B) Node 1:Erratic	GO to Pinpoint Test D
ACM	B150C:95	Automobile Audio Bus (A2B) Node 1:Incorrect Assembly	GO to Pinpoint Test D
ACM	B1511:01	Automobile Audio Bus (A2B) Master Node:General Electrical Failure	GO to Pinpoint Test D
ACM	B1511:11	Automobile Audio Bus (A2B) Master Node:Circuit Short To Ground	GO to Pinpoint Test D
ACM	B1511:12	Automobile Audio Bus (A2B) Master Node:Circuit Short To Battery	GO to Pinpoint Test D
ACM	B1511:13	Automobile Audio Bus (A2B) Master Node:Circuit Open	GO to Pinpoint Test D
ACM	B1511:95	Automobile Audio Bus (A2B) Master Node:Incorrect Assembly	GO to Pinpoint Test D
ACM	B1A01:01	Speaker #1:General Electrical Failure	GO to Pinpoint Test G
ACM	B1A01:01	Speaker #1:General Electrical Failure	GO to Pinpoint Test H
ACM	B1A01:11	Speaker #1:Circuit Short To Ground	GO to Pinpoint Test G
ACM	B1A01:11	Speaker #1:Circuit Short To Ground	GO to Pinpoint Test H
ACM	B1A01:12	Speaker #1:Circuit Short To Battery	GO to Pinpoint Test G
ACM	B1A01:12	Speaker #1:Circuit Short To Battery	GO to Pinpoint Test H
ACM	B1A01:13	Speaker #1:Circuit Open	GO to Pinpoint Test G
ACM	B1A01:13	Speaker #1:Circuit Open	GO to Pinpoint Test H