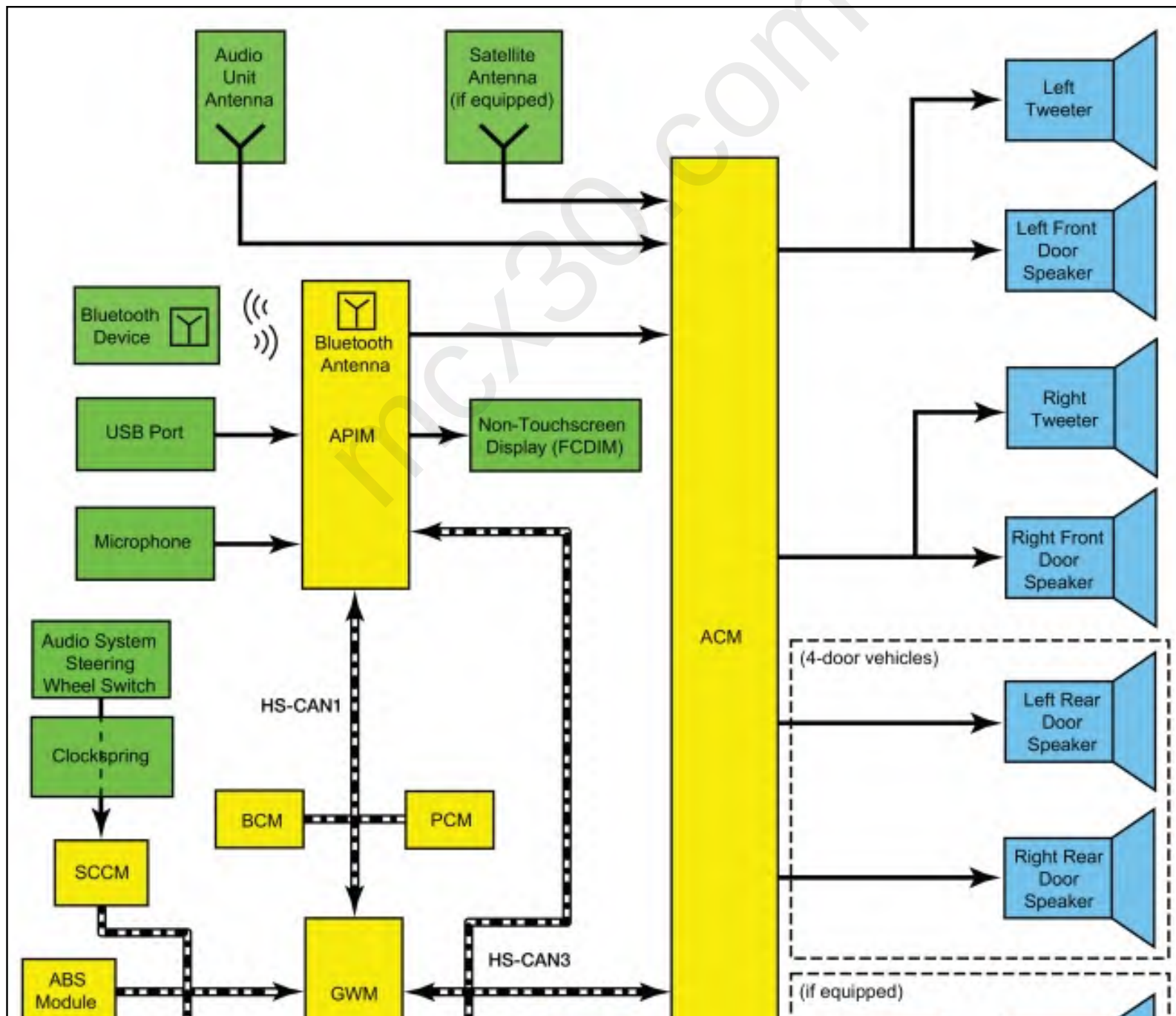
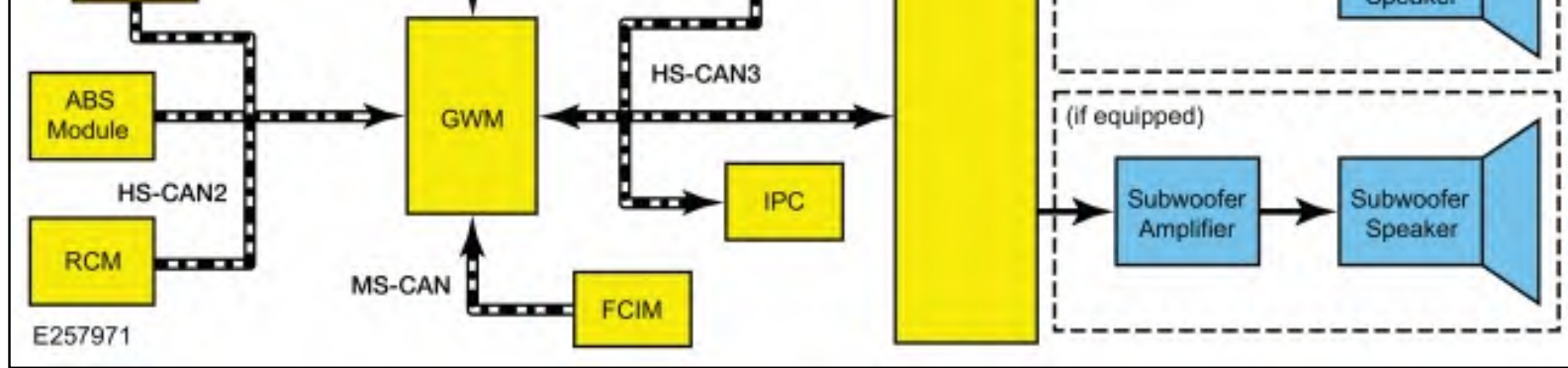


Information and Entertainment System - System Operation and Component Description

System Operation

System Diagram





Network Message Charts

ACMNetwork Input Messages

Broadcast Message	Originating Module	Message Purpose
Audio settings	IPC	Used to select the audio system listening source (AM/ FM or Satellite, etc.).
Battery saver status	BCM	Used to disable the functionality of the ACM due to the load shedding feature.
Chime request	IPC	Used to control the priority, characteristics, volume, and speaker output of the warning chime tones played through the audio system speakers.
Chime source	IPC	Used to set the audio system or IPC as the source for the chime tones.
FCIM button state	FCIM	Used to indicate when a button is pressed on the FCIM.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, CRANK, RUN, and START).
MyKey Belt-Minder audio mute	IPC	Used to mute speaker output so the Belt-Minder tone can be more easily heard.
Satellite radio request signals (if equipped)	FCIM	Used to carry out various satellite radio functions using the FCIM.
SYNC alerts	APIM	Used to control 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	Used to verify vehicle configuration data such as the VIN and system module configuration.
Vehicle speed	PCM	Used for the speed compensated volume function.

Voice recognition audio source request	APIM	Used to select the audio system listening source (AM/ FM, Satellite, USB or Bluetooth audio, etc.) from a voice command.
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APIM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
911 Assist override status	IPC	Used to enable or disable the “Always on” 911 Assist or Emergency Assistance MyKey feature as selected through the IPC while using an administrator MyKey.
Airbag deployment status	RCM	Used to monitor airbag deployment status for 911 Assist or Emergency Assistance feature.
Audio source status	ACM	Used to display the audio system information on the display.
eCall notification	RCM	Used to notify of a 911 Assist or Emergency Assistance call being initiated due to airbag deployment.
Date and time	BCM	Used to display the current date and time on the display.
Display language selection	IPC	Used to display information on the display in the selected language.
FCIM bezel diagnostic status	FCIM	Used to display the requested bezel diagnostics operations in the infotainment display.
FCIM button state	FCIM	Used to indicate when a button is pressed on the FCIM.
Gear lever position	PCM	Used to verify the gear selector position for bezel diagnostics.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START).
Illumination dimming level	BCM	Used to control the backlight intensity.
MyKey volume limit status	IPC	Used to limit the maximum audio system volume when a MyKey restricted key is in use.
Navigation rolling wheel count and direction	ABS module	Used to provide more accurate vehicle position tracking when the GPS signal is temporarily unavailable.

Steering wheel switch status	SCCM	Used to indicate the button press of the steering wheel switches.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.

FCIM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Illumination dimming level	BCM	Used to control the backlight intensity.
Ignition status	BCM	Used to indicate the ignition state (OFF, ACCESSORY, RUN, and START).
Power mode	IPC	Used to disable the functionality of the FCIM due to the load shedding feature.
Vehicle configuration data	BCM	Used to verify vehicle configuration data such as the VIN and system module configuration.

IPC Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Audio source selection	ACM	Used to display the selected audio source on the IPC.
Display language request	APIM	Used to display information on the IPC in the selected language.

RCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
eCall confirmation	APIM	Used to confirm the configuration of the 911 Assist or Emergency Assistance feature and to confirm the status of the 911 Assist or Emergency Assistance phone call.

Audio System

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

AM/ FM Radio

The AM/ FM fender-mounted antenna receives analog radio waves and sends them through the AM/ FM antenna coaxial cable to the ACM. The radio waves are converted into fluctuating AC voltage and sent as left and right analog audio signals to the speakers.

To prevent voltage spikes from producing popping noises through the speakers when the ignition is in the START mode, the ACM receives a voltage signal from the PCM-controlled starting circuit. When the ACM detects the voltage signal from the starting circuit, the audio signal output is muted.

Satellite Radio (if equipped)

The roof-mounted satellite radio antenna receives signals containing metadata (information such as station call letters, artist, album title, song title and genre) and digital satellite radio audio. These signals are sent through the satellite radio antenna coaxial cable to the satellite radio receiver built into the ACM. The metadata is separated from the audio. The metadata is sent to be displayed on the infotainment display and the audio is converted into fluctuating AC voltage sent as left and right analog audio signals to the speakers.

Accessory Delay Feature

The accessory delay feature is a BCM-controlled function that allows the audio system to be operated for a preset period of time after the ignition is turned off and a front door has not been opened.

Battery Load Shed Feature

The BCM uses the battery current sensor to monitor the battery state of charge. When conditions exist to cause the battery load shed feature to activate, the BCM deactivates the battery saver relay (internal to the BCM) and a message is sent over the CAN to turn off selected systems. When activated, this feature turns off the audio system to save the remaining battery charge. To activate the battery saver relay, start the vehicle.

Chimes

Various vehicle systems send chime requests over the CAN to the IPC. The following are determined as the IPC processes these requests:

- Chime characteristics such as tone, tone length, number of repetitions, and time between tones
- Chime output volume
- Priority of the chime request
- Specific speakers (all, front, or rear) to sound the chime

The IPC sends the processed requests over the CAN to the ACM. The ACM outputs the left and right analog chime tones to the appropriate audio system speakers as fluctuating AC voltage.

For specific chime information,
Refer to: [Warning Chimes - Overview](#) (413-01 Instrumentation, Message Center and Warning Chimes, Description and Operation).

Speed Compensated Volume Feature

The ACM compensates for wind and road noise by adjusting the audio system volume based on the vehicle speed provided by the PCM over the CAN and the speed compensated volume setting.

Steering Wheel Audio Controls

The right steering wheel switch contains series of resistors. Each steering wheel switch function corresponds with a specific resistance value within the switch.

The SCCM sends a 5 volt reference voltage to the right steering wheel switch. When a switch is pressed, the voltage is routed through the corresponding resistor, through the return circuit, and then to ground through the SCCM. The SCCM monitors the resultant voltage drop to determine which switch was pressed. The voltage drop varies depending upon the resistance of the specific switch pressed.

The right steering wheel switch inputs are sent as network messages from the SCCM to the ACM to control audio functions.

SYNC System

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

The SYNC system uses Bluetooth, the USB, the FCDIM, the GPS, the microphone and the CAN message APIM inputs to control the entertainment system and some phone functionality.

Audio Inputs

The APIM receives stereo and mono inputs. Stereo inputs include audio from the USB ports, connected Bluetooth-enabled media device and outside device during a phone call. The mono input includes signals from the SYNC microphone.

Audio Outputs

The APIM sends stereo and mono audio signals to the ACM as fluctuating AC voltage. Stereo outputs include audio from the USB ports, connected Bluetooth-enabled media device, ringback tone, outside device during a phone call, voice or tone prompts initiated from the voice steering wheel switch, and instructions or information spoken by the SYNC system when initiated from the voice steering wheel switch. Mono outputs include audio from the TTS feature, incoming call ringtone, instructions or information spoken by the SYNC system when initiated.

Steering Wheel SYNC Controls

The right steering wheel switch contains series of resistors. Each steering wheel switch function corresponds with a specific resistance value within the switch.

The SCCM sends a 5 volt reference voltage to the right steering wheel switch. When a switch is pressed, the voltage is routed through the corresponding resistor, through the return circuit, and then to ground through the SCCM. The SCCM monitors the resultant voltage drop to determine which switch was pressed. The voltage drop varies depending upon the resistance of the specific switch pressed.

The right steering wheel switch inputs are sent as network messages from the SCCM to the APIM to control audio functions.

Bluetooth Mode

Bluetooth is a secure, short-range radio frequency that allows devices to communicate through radio waves. The operating range of a Bluetooth signal is application specific, but has a minimum range of 10 meters (33 feet).

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

Any Bluetooth-enabled device used with the SYNC system must first be paired with the APIM before it can become operational. Pairing a Bluetooth-enabled device is accomplished through the "Add Device" selection of the phone menu. When pairing a device, the SYNC system generates a unique PIN that must be entered on the Bluetooth-enabled device in order for the pairing process to be successful. There are also some device-specific actions that must take place. For information on the pairing process, refer to the Owner Literature.

Multiple Bluetooth-enabled phones and Bluetooth-enabled media devices can be paired to the APIM at the same time. The APIM supports an active connection with one Bluetooth-enabled phone and one Bluetooth-enabled media device at a time. If an additional device of either type is paired and made active, the APIM ends any active connection with an already-paired device and establishes an active connection with the new device.

It is important to understand that while most Bluetooth-enabled devices can pair with the SYNC system, not all Bluetooth-enabled devices have the same level of available features when interacting with the SYNC system. To determine if a Bluetooth-enabled device or feature is supported, review the device compatibility list. Refer to the appropriate Ford website to view a list of compatible devices and features.

For more information, refer to the Owner Literature.

USB Mode

When a portable media device, such as an iPod® with its available cable or portable mass storage such as a USB thumb drive, is connected to the vehicle audio system through a USB port, audio from the device can be played through the vehicle speakers. Functions such as volume, seek, fast forward, pause, etc. can be controlled through the audio controls.

When playing media files stored on a mass storage device such as a flash drive, the SYNC system only plays files that do not have digital rights management protection.

In addition to audio information (track length, track number, etc.), metadata (information such as artist, album title, song title and genre) may also be sent to the APIM from a device connected to the USB port. The APIM uses the metadata to create indexes that can be used to sort for particular music based on the preferences. Not all USB devices can send metadata to the APIM. When a new media device is connected to the SYNC system, the APIM automatically indexes the information. This may take several minutes depending on the amount of data on the device and is considered normal operation. When a device that was previously connected to the SYNC system is reconnected, the APIM updates the index rather than creating a new one. This reduces the time needed to index the device.

The USB port can be used to upload vehicle application upgrades to the APIM from a mass storage device such as a flash drive.

USB Hub

The USB hub is powered by the APIM. The APIM outputs approximately 5 volts on the USB cable to power the USB cable data communication circuits.

The USB hubs can be used to power and/or charge a device if the device supports this feature and does not have a power consumption requirement of more than approximately 5 volts and 2.5 amps (about 13 watts).

The USB hub is used to communicate data between the two USB ports to the APIM using a single USB cable.

Voice Recognition

Voice recognition allows certain phone and audio system functions to be controlled with voice commands to reduce or eliminate the need to interact with the FCIM, the FCDIM and/or device while driving.

When the voice steering wheel button is pressed, an audible prompt is heard from the speakers. Based on the setting, audible prompts are a voice or a simple tone. When interaction mode is set to standard, detailed voice guidance is provided. When interaction mode is set to advanced, most prompts are tones only and minimal voice guidance is provided. The microphone receives the voice commands and sends them to the APIM. Refer to the Owner Literature for more information on voice recognition.

The SYNC microphone receives SYNC system voice commands and outgoing audio during a phone call. The monitored sounds are converted into analog signals by the microphone and sent to the APIM as fluctuating AC voltage

TTS Feature

The TTS feature converts text into an audible speech through the audio system speakers so it does not have to be read from the device while driving. Examples include incoming text message sender information, text messages, and metadata from audio being played via the USB or Bluetooth.

The audio signals for the Text-To-Speech (TTS) and voice prompt features, ringtones, and audio from the outside device during a phone call, are sent from the APIM to the ACM.

Compass

The GPS antenna is used to acquire the compass heading. The compass heading is sent through the GPS coaxial cable to the APIM. The APIM uses this data in addition to wheel speed and wheel rotation direction CAN 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 display on the FCDIM. In the event the GPS fix or signal is temporarily lost, the APIM continues to use the CAN messages from the ABS module as well as information from the internal gyroscope and accelerometer to provide vehicle tracking.

Component Description

Audio Unit Antenna

The audio unit antenna is a fixed-mast antenna mounted to the fender. It receives AM/ FM radio waves and sends them to the ACM via the antenna coaxial cable. The antenna mast is used to amplify the AM/ FM radio waves to improve reception.

Satellite Antenna

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

Subwoofer Amplifier and Speaker Assembly

The subwoofer speaker and subwoofer enclosure are replaced as an assembly. The subwoofer amplifier can be replaced separately.

Steering Wheel Switches

The right steering wheel switch contains series of resistors. Each steering wheel switch function corresponds with a specific resistance value within the switch.

Microphone

The microphone is powered and monitored by the APIM.

USB Hub

The USB hub contains two illuminated USB ports.

The USB hub is powered by circuits from the APIM.

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

LVDS Cable

The four circuit shielded LVDS cable provides power and ground from the APIM to the FCDIM. It is also the means by which data is transmitted between the APIM and the FCDIM.

FCDIM

The FCDIM does not communicate on the CAN. The APIM acts as the proxy for all FCDIM inputs and outputs requiring CAN communication. Communication between the FCDIM and the APIM is accomplished via the LVDS cable. The FCDIM power and ground are also provided by the APIM through this cable.

FCIM

The FCIM requires PMI when it is replaced.

ACM

The satellite radio receiver is integral to the ACM.

The ACM requires PMI when it is replaced.

APIM

The APIM consists of two internal modules: the CIP and the VIP (vehicle interface processor). The modules are not replaceable individually, but can be programmed independently if required.

The CIP interfaces with all of the customer inputs to the APIM. It contains an analog-to-digital-to-analog converter, as well as the Bluetooth/Wi-Fi chipset. Any application upgrades that are available to the consumer are loaded directly to the CIP through a USB port.

The VIP provides an interface between the CIP and the vehicle inputs. The main functions are controlling the APIM power management and translating inbound and outbound signals. Additionally, the VIP queries the modules on the network to retrieve any Diagnostic Trouble Codes (DTCs) when a vehicle health report is requested.

APIM Programming

The APIM requires specific programming procedures for correct operation when it is replaced, when upgrades are available and requested, or when directed by a TSB, FSA, SSM or Electronic Field Communication (EFC) to resolve SYNC performance concerns.

Refer to: [SYNC Module \[APIM\] Programming](#) (415-00B Information and Entertainment System - General Information - Vehicles With: SYNC Without Touchscreen, General Procedures).

BCM

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

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