

## Information and Entertainment System - System Operation and Component Description

### System Operation

#### Audio System Overview

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

#### AM / FM Radio

The ACM can operate when the ignition is on or off. The accessory delay feature powers the audio system, after the ignition has been turned off, for a preset time or until a front door is opened. The ACM is connected to the vehicle network, so a scan tool can be used in diagnostics.

When the AM / FM mode is selected, the ACM amplifies the radio waves sent from the antenna. It then selects the requested frequency, converts and amplifies the content. The ACM outputs the signals to the speakers or to the separate DSP (amplifier).

Radio stations may broadcast RDS signals which contain information such as station identification and program information. Radios equipped with RDS can extract this information and also target the station genre (music type, such as Rock) for seek or scan functions.

#### High Definition (HD) Radio or DAB Radio (if equipped)

HD or DAB radio is a free service offered by some radio stations, enabling them to broadcast better sound quality with multiple programs on a single radio frequency.

A DAB -equipped radio also receives data for the traffic announcement services. Due to the higher broadcast frequencies, DAB requires a different antenna from the standard AM / FM antenna.

DAB equipped-radios are not available in North America.

#### Satellite Radio (if equipped)

Satellite radio is a subscription-based service which broadcasts various programs without commercials. The satellite-transmitted signal contains station identification and various program information, including genre and song titles. A satellite equipped radio can display or use this information along with the programming.

Satellite radio receivers contain a required ESN which registers the radio and vehicle with the satellite company.

With an active "All-Access" satellite radio subscription, SIRIUS™ streaming content (includes streaming data) content is available.

#### Extended Audio Play Feature

Extended audio play allows the audio system to operate with the ignition off. When the power button is pressed, the audio system activates and remains active for a period of up to 30 minutes. Extended audio play does not function if the battery load shed is active. Opening a door does not affect the extended audio play feature.

#### Battery Load Shed Feature

The audio system turns off after periods of engine-off activity with low battery state of charge. The display shows Battery Saver - System Off. Restarting the engine and recharging the battery resets the load shed feature.

#### Chimes

The audio system broadcasts chimes and other driver alerts sent by various vehicle systems.

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

### **Speed Compensated Volume Feature**

The adjustable speed-compensated volume can be turned off or set to increase audio system playback level as the vehicle speed increases.

### **Remote Audio Controls**

The steering wheel switches can control some audio system functions. The steering wheel switch consists of multi-button switches that operate various audio system controls.

### **SYNC™ System Overview**

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

**NOTE:** It may be necessary on occasion to carry out a master reset of the SYNC system for correct operation. Accumulated data uploaded from devices may corrupt the SYNC software and resetting the SYNC system clears this data to allow normal operation of the SYNC system.

The SYNC system is a hands-free communication and entertainment system and provides the following functions:

- Send and receive phone calls via a paired Bluetooth-enabled phone
- Send and receive text messages via a paired Bluetooth-enabled phone
- Connect media devices (such as an iPod®, [USB device](#), or Bluetooth-enabled audio device to play audio files
- Initiate a 911 Assist or emergency assistance call if the airbags deploy
- Provide Vehicle Health Reports
- Provide a vehicle Wi-Fi hotspot (if equipped, cellular subscription required)
- Control smart devices using the cellular connection via an app (similar to using Alexa™ or Siri™)
- Provide feedback to Ford about some of the SYNC related systems
- Provide over the air software updates

Not all SYNC system features are supported with every phone/device.

- The vehicle owner can schedule the systems to update wirelessly. The vehicle cannot be started or driven during the update process. The update does not occur unless a time is specified in the settings. Refer to the Owner Literature for details to update the vehicle wirelessly.
  - Some vehicles only have the option to enable or disable the Over The Air update feature. Other vehicles have the additional capability of selecting this update to occur via the cellular signal or a Wi-Fi signal.

When the automatic system updates is enabled, an icon displays on the screen. Tapping the icon brings up prompts to update the vehicle.

Once the update download and installation is complete, an ignition cycle must occur before the update becomes active.

### **Remote SYNC Controls**

The steering wheel switches can control some SYNC system functions. The steering wheel switch consists of multi-button switches that operate various SYNC functions.

### **Bluetooth Mode**

Bluetooth is a secure, short-range (up to 10 meters (33 feet)) wireless connection method used for wireless device communication with the SYNC system. The SYNC system supports multiple Bluetooth profiles, allowing the SYNC system to interact with Bluetooth enabled phones and Bluetooth-enabled media devices. While most Bluetooth-enabled devices can pair with the SYNC system, not all Bluetooth-enabled devices have the same level of SYNC-compatible features. To

determine if a Bluetooth-enabled device or feature is supported, refer to the list of compatible devices and features at the Ford authorized website.

Multiple Bluetooth-enabled phones and Bluetooth-enabled media devices can be paired to the SYNC system at the same time. The SYNC system 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 SYNC system ends any active connection with an already-paired device and establishes an active connection with the new device.

### **USB Mode**

Connecting a portable media device mass storage device (such as a MP3 player or USB flash drive) to a USB port allows media files to be played through the audio system. Playback functions (volume, seek, fast forward, pause) can be controlled with the vehicle audio controls.

SYNC can use media with embedded information (artist, album and song titles, and genre) for search and playback functions, if it is supported and correctly formatted on the media device.

When a new media device is connected, SYNC records where the information resides and uses this information to quickly find requested songs. Indexing the media information and location can take several minutes if the size of the media is large. Future changes to indexed media are updated rather than replacing the entire index, which greatly reduces the time required.

Media files that do not have DRM protection or are not properly formatted on the device, cannot be played on the SYNC system.

Two USB ports in the media hub allow connection and playback of portable media devices and SYNC software updates. The media hub provides standard 5 volt power and charging of portable devices.

### **SYNC AppLink**

The SYNC AppLink supports devices with third party installed applications capable of outside control by voice command, the steering wheel switches, the audio control panel or the display unit. These devices must be paired with SYNC Bluetooth and some devices require a USB connection.

### **Voice Command**

The SYNC voice command capability reduces or eliminates physical interaction with certain vehicle functions or portable device controls. When SYNC is prompted by the steering wheel switch, it responds with a tone or audible response (depending on the SYNC setting) in the audio system. SYNC uses the voice microphone to listen to the driver command and control the vehicle function or portable device.

A wake word can also be used to activate the SYNC system.

### **Text-To-Speech Feature**

The SYNC text-to-speech feature converts text information to speech and broadcasts it through the audio system. Text messages with sender information, media titles, and other information can be read and broadcast through the audio system, helping users maintain driving focus.

### **Emergency Assistance (911 Assist)**

The emergency assistance feature (911 Assist) calls for help in an event where the airbags deploy. This feature must be previously enabled and requires a paired cellular phone to connect with emergency services. If activated by an airbag deployment, the system plays a message in the vehicle indicating an emergency call is about to be placed. If not canceled, it dials the emergency response number and plays a pre-recorded message for the emergency response operator. After the message plays, the vehicle occupant(s) can talk with the operator to give their location and personal information.

### **Compass**

Information from the GPS determines the vehicle compass heading. The compass heading displays in the IPC message center or the display unit.

## Navigation System (if equipped)

**NOTE:** *It may be necessary on occasion to carry out a master reset of the SYNC system for correct operation. Accumulated data uploaded from devices may corrupt the SYNC software and resetting the SYNC system clears this data to allow normal operation of the SYNC system.*

The navigation system uses GPS to display the vehicle location and travel direction on a map, displayed on the touchscreen. Street names, landmarks, and points of interest are included. The driver can enter destination information to obtain automatic map routing and navigation guidance voice directions. This include features such as trailer optimized navigation routing and Live Traffic. Refer to the Owner Literature for details of the all the SYNC navigation system features.

## Traffic Announcement (vehicles equipped with a DAB radio)

The traffic announcement feature is a subscription-free based service available on vehicles equipped with navigation. GPS data is required for certain features.

This feature is not available in North America.

## Android Auto™ or Apple CarPlay™

SYNC supports interaction with Android Auto™ and Apple CarPlay™ enabled phones connected by Bluetooth. This allows the user to access phone capabilities and control features via SYNC voice commands and switches. The features include:

- making calls.
- sending and listening to text messages.
- selecting and playing music.
- using the phone voice assistant.
- using phone maps and navigation.

**NOTE:** *Make sure the appropriate device manufacturer USB cable is used for correct Android Auto™ and Apple CarPlay™ operation.*

Android Auto™ and Apple CarPlay™ disable some SYNC features. Most Android Auto™ or Apple CarPlay™ features use mobile data.

## SYNC Connect (if equipped)

### NOTE:

The SYNC Connect system (when activated) provides remote connectivity through the FordPass mobile phone application. It can monitor certain vehicle systems and carry out vehicle functions such as:

- reading the fuel level and odometer.
- receiving remote alerts and notifications.
- carrying out or scheduling remote starts (if enabled through the IPC).
- using the vehicle locator.
- vehicle lock/unlock control and vehicle lock/unlock status.

## Vehicle Wi-Fi Hotspot (if equipped)

The Wi-Fi hotspot feature allows up to 8 devices to connect to high speed internet access. The network name, password, enable/disable and other settings for the Wi-Fi Hotspot feature are accessed using the settings menu on the display unit (touchscreen).

## Over The Air Updates (if equipped)

**NOTE:** *Refer to the Owner Literature for additional details of the Over The Air update feature.*

The vehicle can be set to receive updates automatically or scheduled to update at a set time. This feature updates the software configuration of modules. For detailed information of the Over The Air feature,

Refer to: [Module Configuration - System Operation and Component Description](#) (418-01B Module Configuration - Vehicles With: Over-the-Air (OTA) Programming, Description and Operation).

## **MyKey™ Audio Feature**

**NOTE:** *Refer to the Owner Literature for additional details of the MyKey features.*

MyKey use can affect audio system functions.

The following MyKey audio effects are always present, regardless of administrator settings, when a MyKey is in use:

- When the seatbelts are not buckled, the audio system mutes and a message informs the driver to buckle up to unmute the audio.
- The satellite radio adult content channels are blocked.

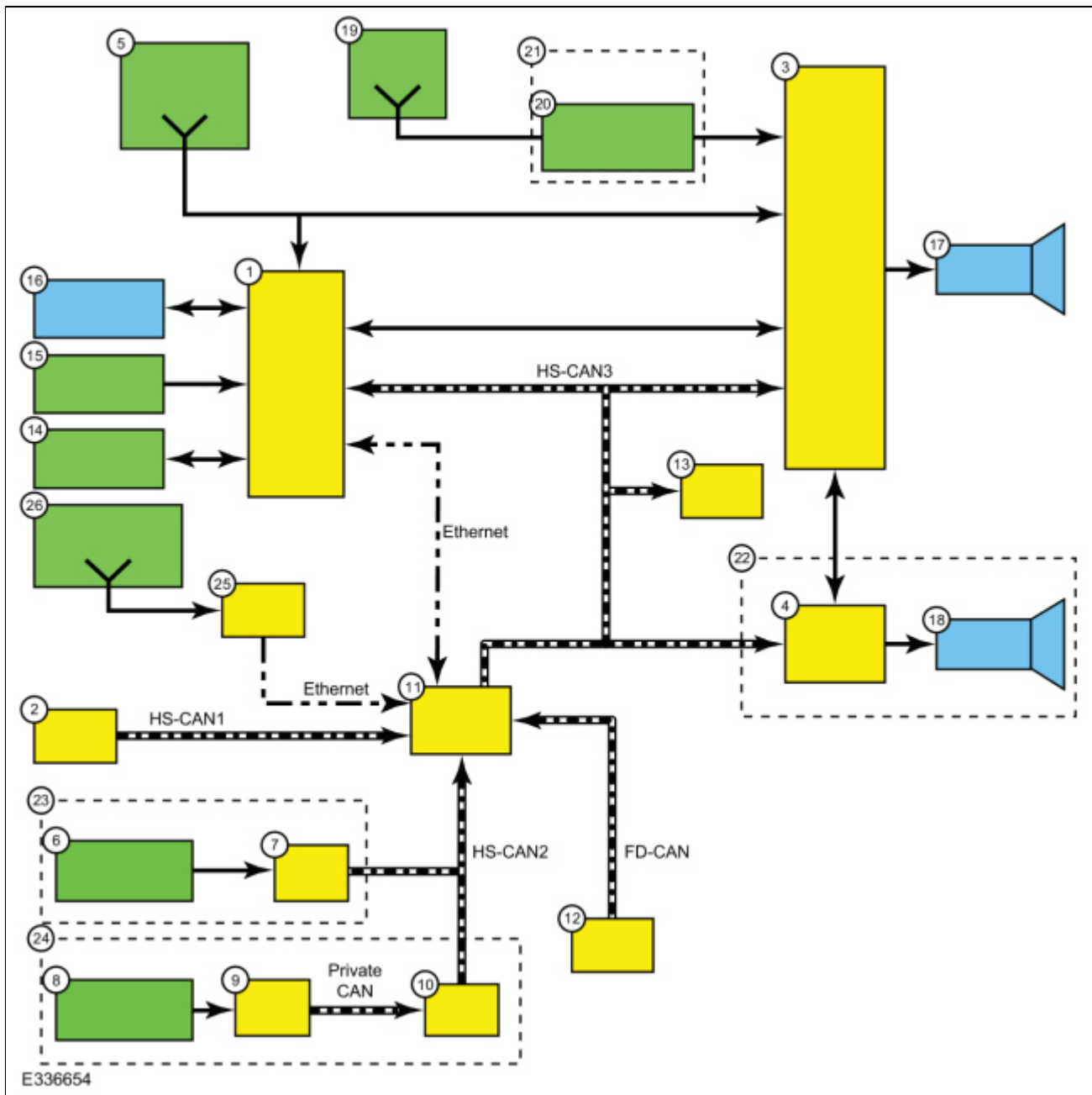
The following audio changes can be set by the MyKey administrator to occur when a MyKey is in use:

- The emergency assistance (911 Assist) can be set to always on and cannot be disabled by the MyKey driver.
- Audio volume can be limited in various circumstances, including turning off speed compensated volume or reducing volume at higher vehicle speeds. The display notifies the MyKey driver when volume has is limited.

## **System Diagram**

**NOTE:** *The system diagrams include all component options. Some components may not be equipped on the vehicle.*

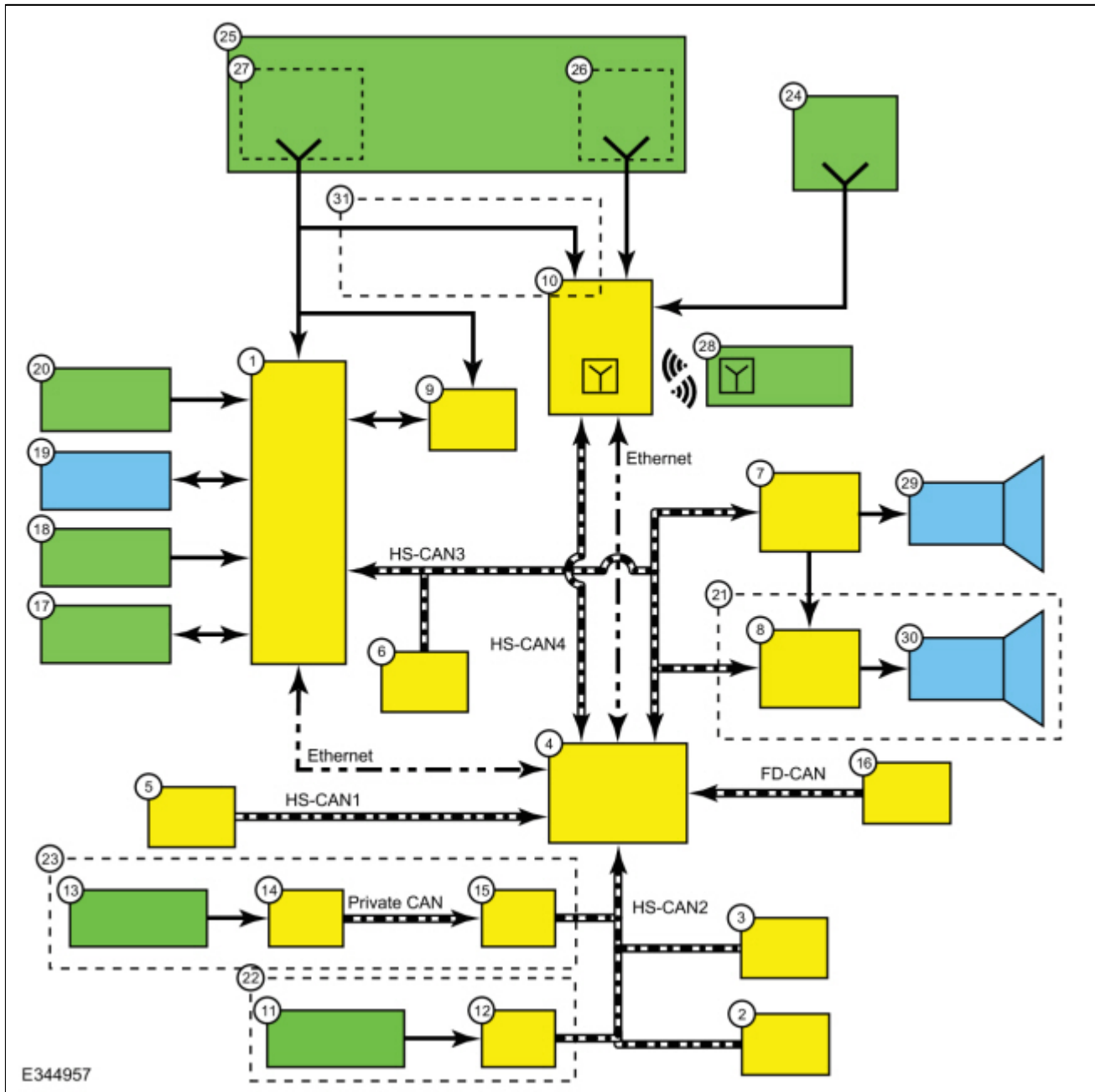
## **Audio System**



Item	Description
1	<u>APIM</u>
2	<u>BCM</u>
3	<u>ACM</u>
4	<u>DSP</u>
5	Satellite/ <u>GPS</u> Antenna
6	Steering Wheel Switches
7	<u>SCCM</u>
8	Steering Wheel Switches
9	<u>SECM</u>
10	<u>SASM</u>
11	<u>GWM</u>
12	<u>PCM</u>
13	<u>IPC</u>
14	Media Hub

15	Audio Controls
16	Display Unit
17	Speakers
18	Speakers
19	<u>AM / FM</u> 1 Antenna
20	<u>DAB</u> Antenna Amplifier
21	(if equipped with <u>DAB</u> 2adio)
22	8 or 18 Speaker System
23	without adaptive steering
24	with adaptive steering
25	<u>TCU</u>
26	Primary Cellular Antenna

**SYNC™ System**



Item	Description
1	<u>APIM</u>
2	<u>ABS Module</u>
3	<u>RCM</u>
4	<u>GWM</u>
5	<u>BCM</u>
6	<u>IPC</u>
7	<u>ACM</u>
8	<u>DSP</u>
9	<u>ACM</u>
10	<u>TCU</u>
11	Steering Wheel Switches
12	<u>SCCM</u>
13	Steering Wheel Switches
14	<u>SECM</u>

15	<u>SASM</u>
16	<u>PCM</u>
17	Media Hub
18	Audio Controls
19	Display Unit
20	Voice Microphone
21	8 or 18 Speaker System
22	without adaptive steering
23	with adaptive steering
24	Primary Cellular Antenna
25	<u>GPS</u> /Satellite Radio/Cellular Antenna
26	Secondary Cellular Antenna
27	Satellite/ <u>GPS</u> Antenna
28	Bluetooth Device
29	Speakers
30	Speakers
31	SYNC 4 Low

## Network Message Chart

### ACM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Battery saver status	<u>BCM</u>	Disables the functionality of the <u>ACM</u> due to the load shedding feature.
Chime controls	<u>IPC</u>	Controls the priority, characteristics, volume, and speaker output of the warning chime tones played through the audio system speakers.
Chime source	<u>IPC</u>	Sets the audio system or <u>IPC</u> as the source for the chime tones.
Ignition status	<u>BCM</u>	Indicates the ignition mode.
MyKey Belt-Minder audio mute	<u>IPC</u>	Mutes speaker output so the Belt-Minder tone can be more easily heard.
MyKey volume limit status	<u>IPC</u>	Limits the maximum audio system volume when a MyKey restricted key is in use.
Satellite radio request signals	<u>APIM</u>	Carries out various satellite radio functions using the touchscreen.
Steering wheel switch status	<u>SCCM</u> / <u>SECM</u>	Indicates the button press status of the steering wheel switches.
SYNC alerts	<u>APIM</u>	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	<u>BCM</u>	Verifies vehicle configuration data such as the <u>VIN</u> and system module configuration.
Vehicle speed	<u>PCM</u>	Used for the speed compensated volume function.

### APIM Network Input Messages

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

### DSP Network Input Messages

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

### TCU Network Input Messages

Broadcast Message	Originating Module	Message Purpose
GPS data	<u>APIM</u>	Indicates the vehicle location via the FordPass mobile application.
Ignition status	<u>BCM</u>	Indicates the ignition mode.

Odometer master value	<u>IPC</u>	Indicates the odometer value via the FordPass mobile application.
Transport mode	<u>BCM</u>	Disables the functionality of the <u>TCU</u> until the vehicle is taken out of transport mode.
Vehicle lock status	<u>BCM</u>	Indicates the vehicle lock/unlock mode.
Wi-Fi request	<u>APIM</u>	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 also receives data from the audio control panel via the APIM over the CAN. Vehicles equipped with a 15 inch center display are not equipped with an audio control panel. All of the audio controls are accessed using the touchscreen.

The ACM uses 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

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 High Definition (HD) radio capability, the radio automatically detects and plays back the improved sound quality and multiple programs of HD broadcasts. HD-equipped radios use the existing standard AM / FM antenna for signal reception. If a concern only exists for the HD radio feature, refer to the troubleshooting guide within the Owner Literature.

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

DAB -equipped radios are not available in North America.

### Satellite Radio (if equipped)

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.

Streaming content (including On Demand) is received by the TCU from the cellular network. The TCU sends this data to the APIM over the Ethernet cables via the GWM.

The satellite radio feature is only available in North America.

## 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, 6, 5 and 7 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. This may cause all audio to be inoperative.

### **ACM Signal/Speaker Output - 8 and 18 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 A-pillar tweeter speakers and, for the 18 speaker system, the rear door 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. This may cause all audio to be inoperative. A DTC sets to identify which speaker circuits are causing the concern.

### **Remote Audio Controls - Vehicles Not Equipped With Adaptive Steering**

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 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.

### **Remote Audio Controls - Vehicles With Adaptive Steering**

The steering wheel switches contain a series of resistors. Each steering wheel audio function switch has a specific resistance value. The SECM and switch assembly are connected in a voltage divider circuit. The voltage drop over an internal SECM resistor is changed by the different audio switch function resistances. The SECM monitors the voltage drop across its internal resistor to determine which steering wheel switch is pressed. The SECM transmits the steering wheel switch inputs over a private CAN to the SASM which relays the message over the HS-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 audio control panel switches
- Steering wheel switches
- Voice microphone input
- GPS data
- Serial data link wired input from the ACM
- Network data input from the CAN

## SYNC Outputs

- Display unit 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
  - Text-to-speech information for a phone
  - USB device file selection for playback

## Remote SYNC Controls - Vehicles Not Equipped With Adaptive Steering

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 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.

## Remote Audio Controls - Vehicles With Adaptive Steering

The steering wheel switches contain a series of resistors. Each steering wheel SYNC function switch has a specific resistance value. The SECM and switch assembly are connected in a voltage divider circuit. The voltage drop over an internal SECM resistor is changed by the different SYNC switch function resistances. The SECM monitors the voltage drop across its internal resistor to determine which steering wheel switch is pressed. The SECM transmits the steering wheel switch inputs over a private CAN to the SASM which relays the message over the HS-CAN to the ACM, 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

**NOTE:** To identify the SYNC system, click on the "ADDITIONAL INFORMATION" link on the OASIS tab on PTS.

SYNC 4 Low is identified by the code IEVAR.

SYNC 4 is identified by the code IEVAQ.

The GPS antenna is used to acquire the compass heading.

### **SYNC 4 Low**

The compass data is sent through the GPS cable to the TCU. The TCU uses this data to calculate and provide accurate vehicle tracking. The TCU processes the data and transmits it through the CAN to the APIM and the IPC for the vehicle location and compass display.

### **SYNC 4**

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.

### **Traffic Announcement (vehicles equipped with a DAB radio)**

The traffic announcement feature 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.

This feature is not available in North America.

### **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 radio 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 secondary cellular ( 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 cellular device with the SYNC Connect application installed. The data received via the cellular network from the device application is processed by the GWM, which can make vehicle system commands via the CAN.

All communication of the GWM to the cloud via the TCU for the Ford Pass feature is done through the Ethernet cable.

### **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 secondary cellular

( TCU ) antenna.

## **Over The Air Updates (if equipped)**

Refer to: [Module Configuration - System Operation and Component Description](#) (418-01B Module Configuration - Vehicles With: Over-the-Air (OTA) Programming, Description and Operation).

## **Component Description**

### **AM / FM 1/ DAB Antenna**

The AM / FM 1/ DAB antenna (also called the audio unit antenna) is an aerial antenna, mounted to the right side of the cowl. 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.

### **DAB Antenna Amplifier**

The DAB antenna amplifier amplifies digital 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.

### **GPS /Satellite Radio/Secondary Cellular Antenna**

#### **GPS Antenna**

The antenna contains a GPS antenna circuit board that receives radio waves containing GPS data. The data is sent through the coaxial cable to the TCU (SYNC 4 Low) or the APIM (SYNC 4). If equipped with a satellite radio, the data is sent through the coaxial cable to a splitter where the data is then sent to the APIM.

#### **Satellite Radio Antenna**

If equipped with a satellite radio the antenna contains a circuit board that receives radio waves containing satellite radio data. The data is sent through the coaxial cable to the ACM through a splitter.

#### **Secondary Cellular Antenna**

The antenna contains a secondary cellular antenna circuit board that receives radio waves containing cellular data. The data is sent through the secondary cellular antenna cable to the TCU.

#### **Primary Cellular Antenna**

The primary cellular antenna boosts reception for incoming and outgoing cellular network data. It is a compact, cellular phone type antenna.

#### **Voice Microphone**

The voice microphone is connected to the APIM and is located in the overhead console or mounted to the headliner.

#### **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 requires PMI when it is replaced.

## **SECM**

The voltage drop over an internal SECM resistor is changed by the different audio switch function resistances. The SECM monitors the voltage drop across its internal resistor to determine which steering wheel switch is pressed.

The SECM requires PMI when it is replaced.

## **Media Hub**

The media hub contains two 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.

The APIM provides the 12 volt power source and ground for the internal USB switch to control data flow between each port. Data is sent from the two media hub USB ports to the APIM through a USB cable.

## **LVDS Cable**

The four-circuit (8 inch monitor) or six-circuit (12 inch monitor) shielded LVDS cable provides power and ground from the APIM to the display unit processor. Data is transmitted between the APIM and the display unit via the LVDS cable.

## **Display Unit**

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 display unit itself does not communicate over the CAN.

The APIM provides the display unit with power and ground through the LVDS cable for vehicles equipped with the 8 inch display unit. A separate connector is used to provide power and ground for vehicles with the 12 inch display unit.

## **Audio Control Panel**

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

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

The audio control panel is not equipped on vehicles with a 15 inch center display.

## **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.

### **Manual APIM Reset**

Simultaneously press and hold the POWER button (in the middle of the volume button) and the RIGHT SEEK button on the audio controls panel to reboot the APIM. As the APIM reboot begins, the display unit turns black before the startup sequence begins.

### **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, over the air with the cellular network or the SYNC USB connection.

The CIP may also be programmed by registered owners using the Ford owner website. Updates can be scheduled to occur wirelessly or are written to a USB drive and taken to the vehicle USB for programming. After the update completes when using a USB drive, the APIM CIP writes the new software level and VIN back to the USB drive. The vehicle owner must transmit this information back to Ford via the internet.

### **BCM**

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

---