



S550 Mustang SYNC System and Technology - A Primer

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

The S550 Accessory Protocol Interface Module (APIM), which contains and hosts the SYNC software, is mounted to the back of the interior center console LCD screen. The LCD panel must be removed to access the APIM and its connectors. 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 (for example, navigation, climate control).



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 Front Controls Interface Module (FCIM) inputs or panel switches
- Steering wheel switches
- Voice microphone input
- GPS data
- Satellite Smart Device Link (SDL) wired input from the Audio Front Control Module (ACM)

SYNC Outputs

- Display unit (touchscreen, Ford Display Module (FDIM) or non-touchscreen (Front Controls Display Interface Module (FCDIM)) Controller Area Network (CAN) messages
- Heating Ventilation Air Conditioning (HVAC) commands (touchscreen-equipped only) CAN messages
- Hard wired stereo and monaural outputs to the ACM
- Stereo (2 channel) audio
- Monaural voice command 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 (TTS) information for a phone
- USB device file selection for playback

SYNC Services and Controls

Remote SYNC Controls

The SYNC steering wheel switches contain a series of resistors. Each steering wheel audio function switch has a specific resistance value. The Steering Column Control Module (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 USB single ports.

Voice Commands

When the steering wheel voice button is pressed, the SCCM sends a message to the APIM over the CAN indicating the request to initiate voice commands. 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 (integrated with 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 to the display unit through the Low Voltage Differential Signaling (LVDS) cable. In the event the GPS fix or signal is temporarily lost, the APIM continues to use the vehicle tracking CAN messages from the Anti-lock Brake System (ABS) module to maintain compass accuracy.

Navigation (if equipped)

The APIM receives GPS data from the satellite and GPS antenna via the coaxial cable. The GPS data is used for the compass, 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. The APIM processes the data and transmits it to the display unit through the LVDS cable.

SIRIUSTM Travel LinkTM

The SIRIUSTM Travel LinkTM is a subscription-based service available on vehicles equipped with navigation. The satellite radio antenna receives digital signals containing Travel LinkTM 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 the display unit. The time intervals for each Travel Link category to update the data vary, depending on the category.

SYNC Connect (if equipped)

The SYNC Connect system uses the Telematics Control Unit (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 located between the rear bumper and body. 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.

SYNC Component Description

Audio Unit Antenna - Coupe

The coupe audio unit antenna is integrated into the rear window. It receives Amplitude Modulated (AM)/ Frequency Modulated (FM) radio waves and sends them through a coaxial cable to the audio unit antenna amplifier

Audio Unit Antenna Amplifier - Coupe

The coupe audio unit antenna amplifier amplifies AM/ FM radio signals from the rear glass antenna to improve reception. The amplified signal is sent through the AM/ FM antenna coaxial cable to the ACM. The ACM provides 12 volt power for the amplifier.

Audio Unit Antenna and Amplifier- Convertible

The convertible audio unit mast antenna with integrated amplifier is mounted to the right quarter panel. It receives AM/ FM radio waves, amplifies the signal, and sends it through the AM/ FM antenna coaxial cable to the ACM. The ACM provides 12 volt power for the amplifier.

FM2 Diversity Antenna

The FM2 diversity antenna is located between the left quarter panel and the rear bumper cover. It receives FM radio waves. It utilizes an antenna amplifier to compensate for FM signal strength loss as the radio waves are transmitted from the antenna to the ACM. If the ACM is equipped with (Digital Audio Broadcasting) DAB capability, the FM2 diversity antenna also contains a DAB antenna.

FM2 Diversity Antenna Amplifier

The FM2 diversity antenna amplifier amplifies FM radio signals to improve reception. The amplified signal is sent through a coaxial cable to the ACM.

GPS/Satellite Radio Antenna

The satellite radio antenna receives GPS and satellite radio signals. The signals are sent through the coaxial cable and splitter (part of the coaxial cable assembly). The splitter is used only on vehicles with GPS/satellite antennas, to separate and distribute the signal to the APIM (GPS data) and the ACM (satellite radio data).

TCU Antenna

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

Cellular Antennas

Two cellular antennas are used. The LH and RH antennas are positioned between the respective quarter panel and the rear bumper cover. They receive the radio waves containing cellular data. The signals are sent through the cellular antenna coaxial cables to a splitter (or combiner) and then to the TCU.

Voice Microphone

The voice microphone is connected to the APIM.

ANC Microphones

The Active Noise Cancelling (ANC) microphones are connected to the Digital Audio Control Module-C (DACMC), integrated into the ACM.

Steering Wheel Switches

The audio/SYNC system 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.

Media Hub

The media hub contains a single, illuminated USB port and connects by a cable to a second, remote USB port. The media hub is powered by 12 volts from the APIM and has an internal power supply which provides 5 volts for the media hub port and the remote USB port. Each port has two circuit connections for the 5 volt power, and two more circuits for digital serial data. Data from each USB port is switched in the media hub and sent to the APIM through a single USB cable.

LVDS Cable

The four-circuit, shielded LVDS cable uses two circuits to provide power and ground from the APIM to the display unit. Two more shielded circuits transmit display data between the APIM and the displays.

Display Unit

The APIM and the display unit exchange information via the LVDS cable. The APIM can communicate bezel test requests, display switch status, and display Diagnostic Trouble Codes (DTCs) over the CAN. The APIM provides the display with power and ground through the LVDS cable. The display does not communicate over the CAN.

FCIM

The control or switch functions of the FCIM are primarily climate control related. The FCIM requires PMI when it is replaced.

ACM

The ACM, commonly known as the radio, is a separate module containing an AM/ FM tuner, satellite receiver (if equipped), CD player (if equipped), input interface (for example, SYNC inputs), and an audio amplifier. If equipped with ANC, the ACM contains the DACMC. The DACMC performs noise canceling to reduce cabin noise. The ACM and if equipped, the DACMC, both require separate PMI procedures when the ACM is replaced.

DSP

The Digital Signal Processing (DSP) module is a power amplifier for the vehicle speakers. The audio input signal comes from the ACM via 4 twisted- pair circuits . It may drive all speakers on a vehicle or share the speaker output with the ACM. The DSP requires Programmable Module Installation (PMI) when it is replaced.

TCU

The TCU is a radio transceiver which connects the vehicle to a cellular network. It is connected to the CAN for exchanging data and commands with other modules. It contains a non-serviceable Subscriber Identity Module (SIM) card. The TCU is assigned to the VIN of the vehicle and will not work in another vehicle. The TCU requires PMI when it is replaced.

APIM

The APIM consists of two internal modules: the Consumer Interface Protocol (CIP) module and the Vehicle Interface Protocol (VIP) module. The modules are not replaceable individually, but can be programmed independently. 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 queries the modules on the network for Diagnostic Trouble Codes (DTCs) when a vehicle health report is requested

APIM Programming

The APIM requires PMI when it is replaced. 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 or Wi-Fi.

Accessory Protocol Interface Module (APIM) programming is a process that updates the APIM Consumer Interface Processor (CIP) and Vehicle Interface Processor (VIP) software. The VIP programming updates the calibration files in the portion of the APIM that interfaces with the Controller Area Network (CAN). The CIP programming updates calibration files in the portion of the APIM that interfaces with mobile phones and other customer devices.

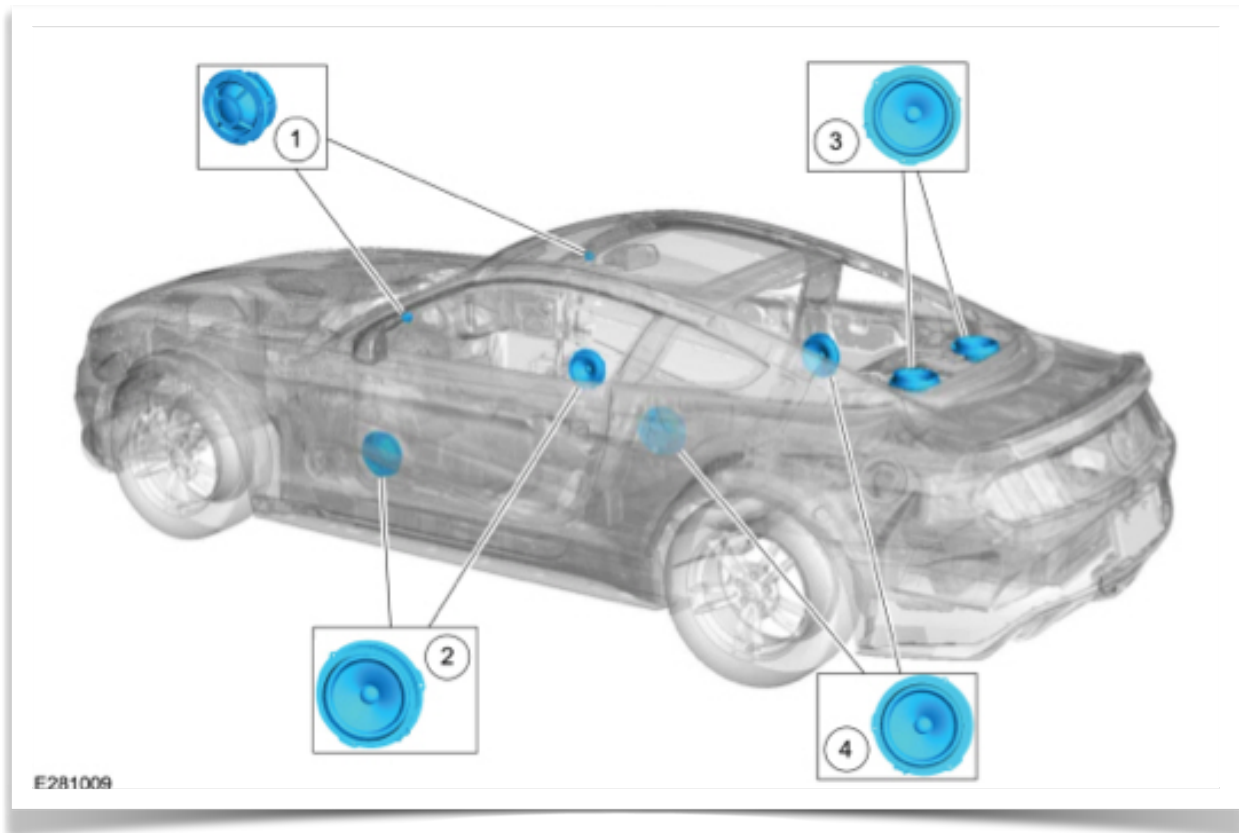
APIM programming uses the Vehicle Communication Module (VCM) to read and program the VIP software through the Data Link Connector (DLC). A web-based On-Line Automotive Service Information System (OASIS) application is used to read and program the CIP software via a Universal Serial Bus (USB) cable between the scan tool and the vehicle USB port. Both the VCM and the OASIS application must be running on the scan tool during APIM programming.

415-00 Information and Entertainment System - General Information 2020 Mustang

SYNC Component Location

NOTE: The available speaker configurations are shown first. The remaining hidden audio/SYNC system components and various cable routings follow the speaker configurations.

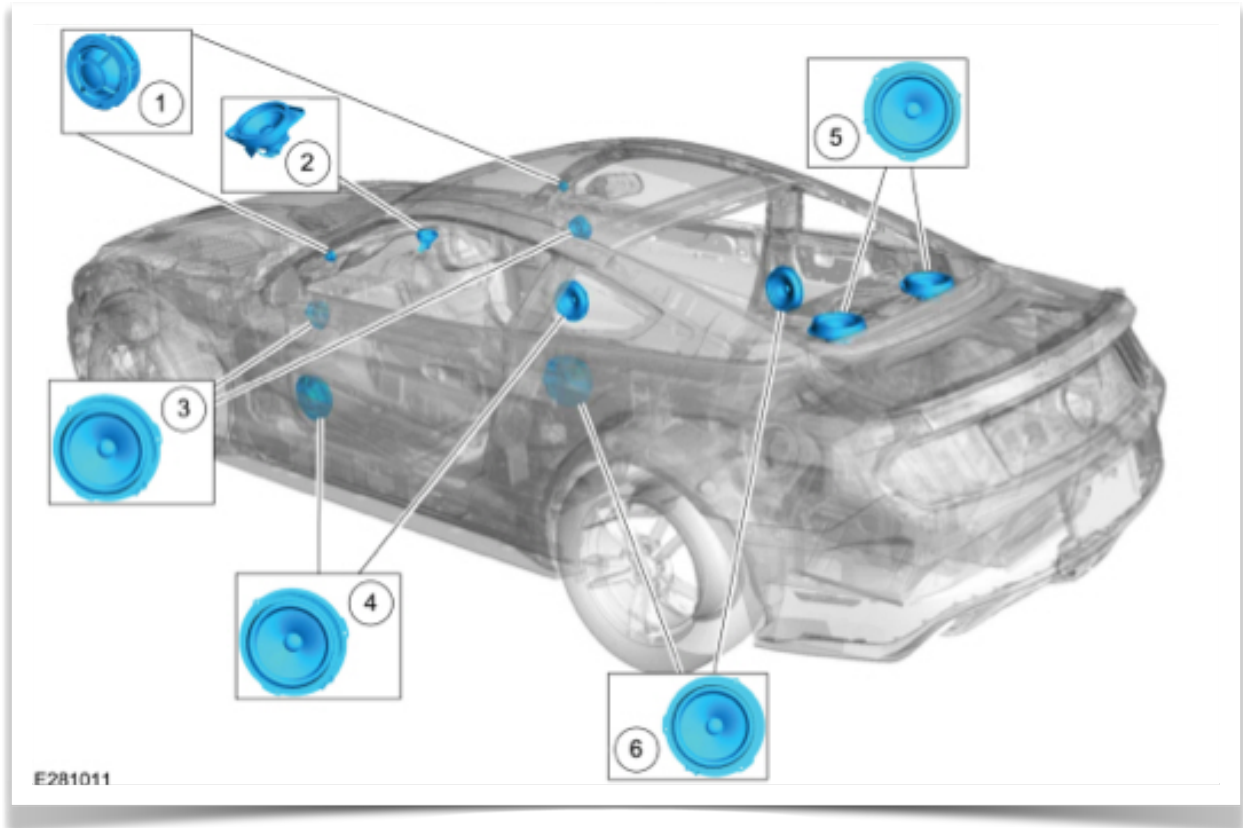
NOTE: Some vehicles may not be equipped with all the optional components shown.
6 Speaker System



4-Speaker System

Item Description

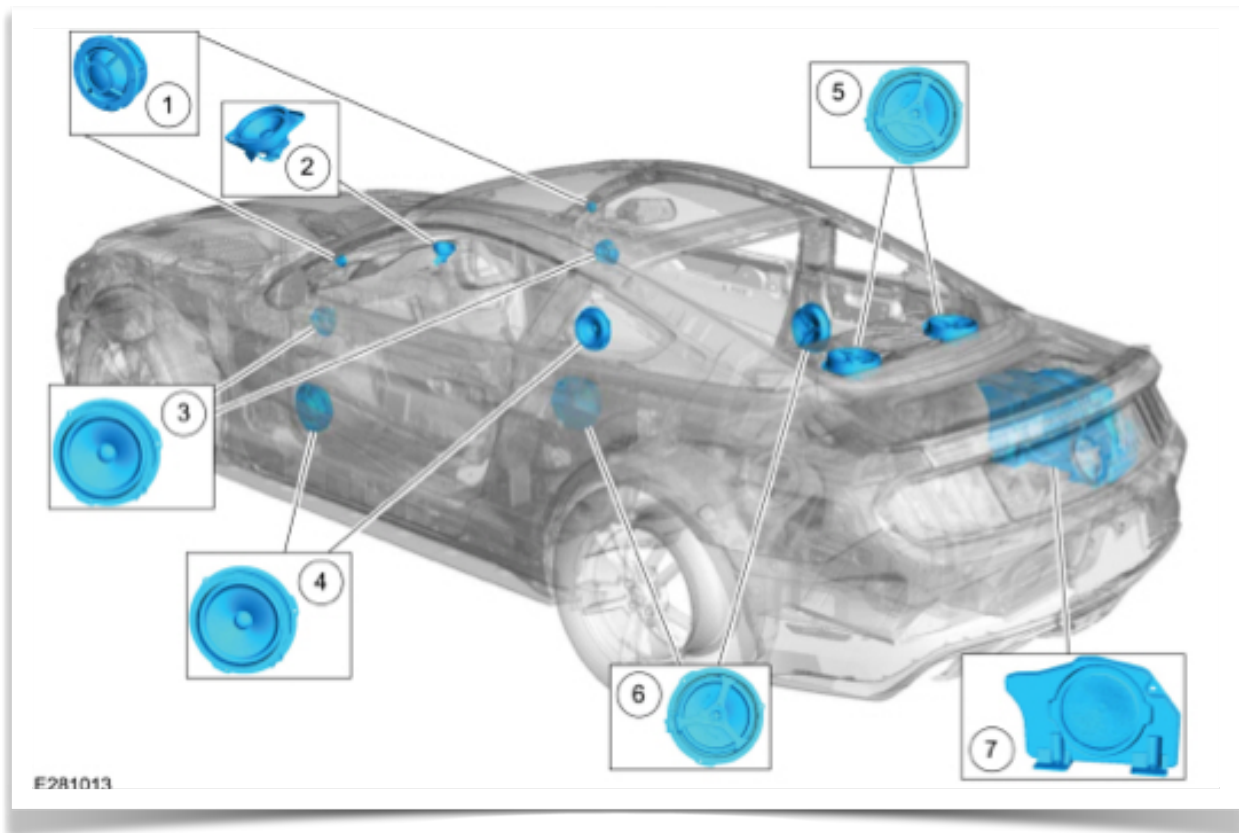
- 1 A-pillar tweeter speakers
- 2 Front door woofer speakers
- 3 Rear speakers (coupe)
- 4 Rear speakers (convertible)



9-Speaker System

Item Description

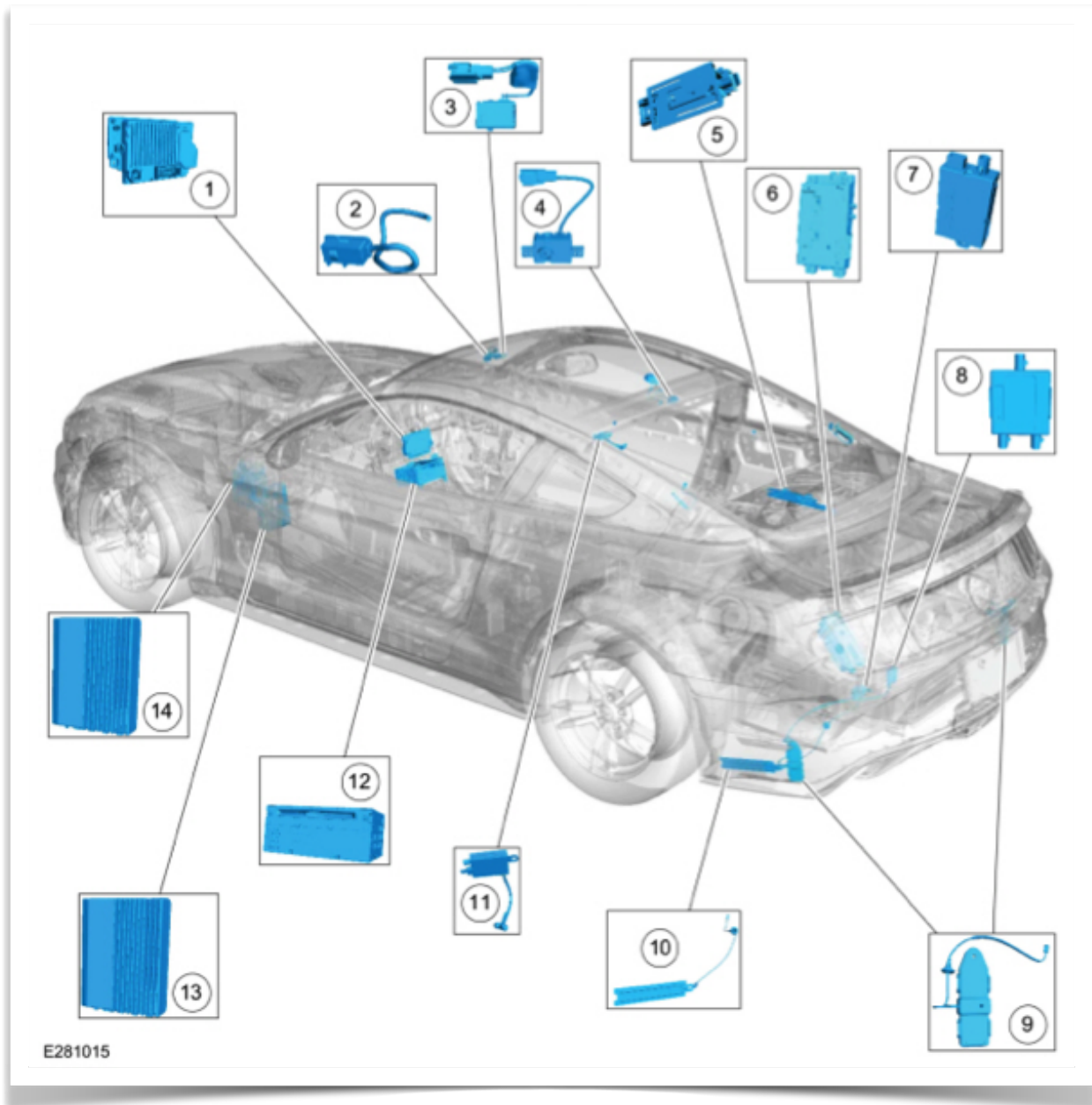
- 1 A-pillar tweeter speakers
- 2 Instrument panel center speaker
- 3 Front door midrange speakers
- 4 Front door woofer speakers
- 5 Rear speakers (coupe)
- 6 Rear speakers (convertible)



12-Speaker System

Item Description

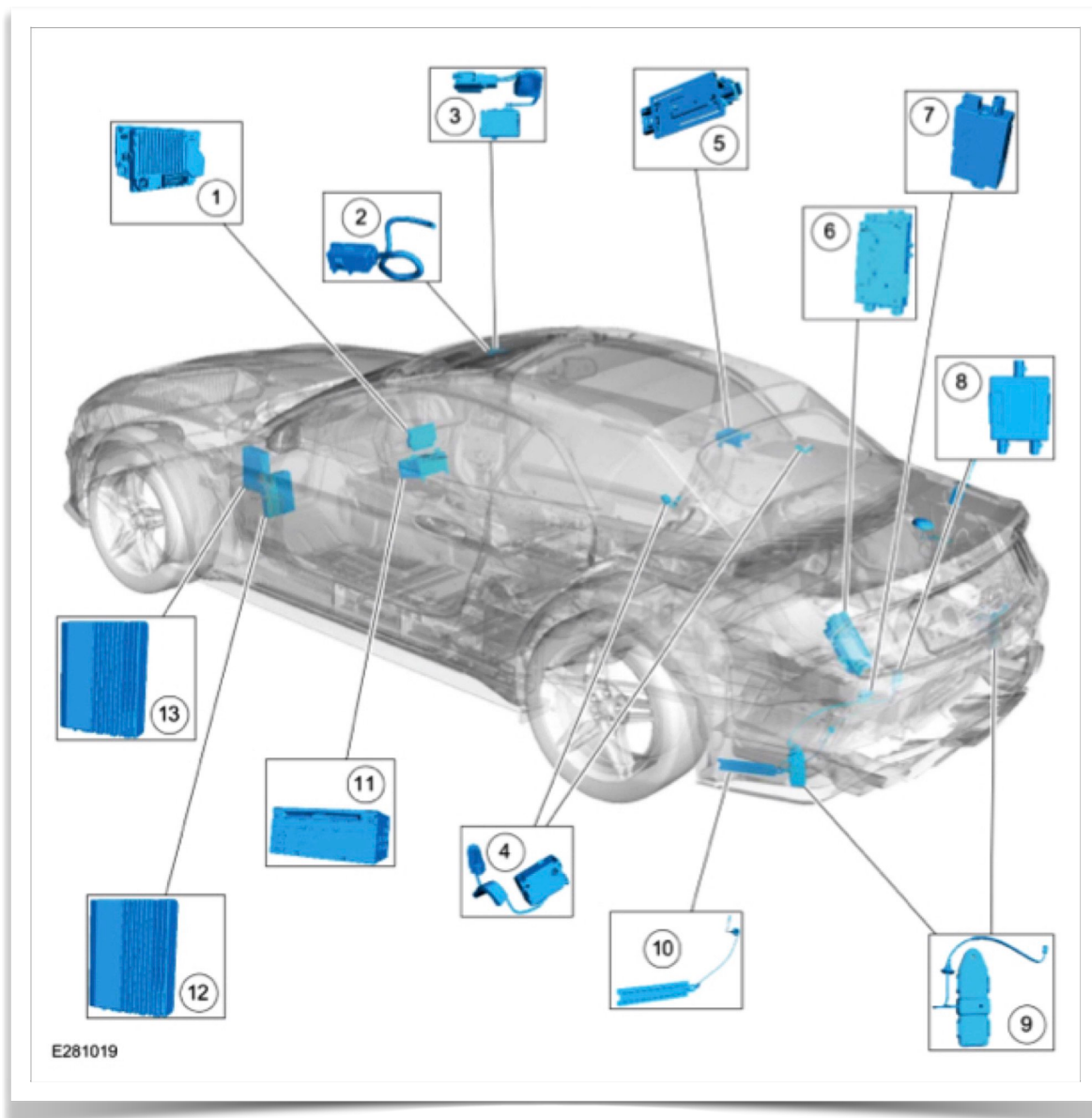
- 1 A-pillar tweeter speakers
- 2 Instrument panel center speaker
- 3 Front door midrange speakers
- 4 Front door woofer speakers
- 5 Rear coaxial speakers (coupe) (counted as 2 speakers each)
- 6 Rear coaxial speakers (convertible) (counted as 2 speakers each)
- 7 Subwoofer speaker



Audio/SYNC System Main Components - Coupe

Item Description

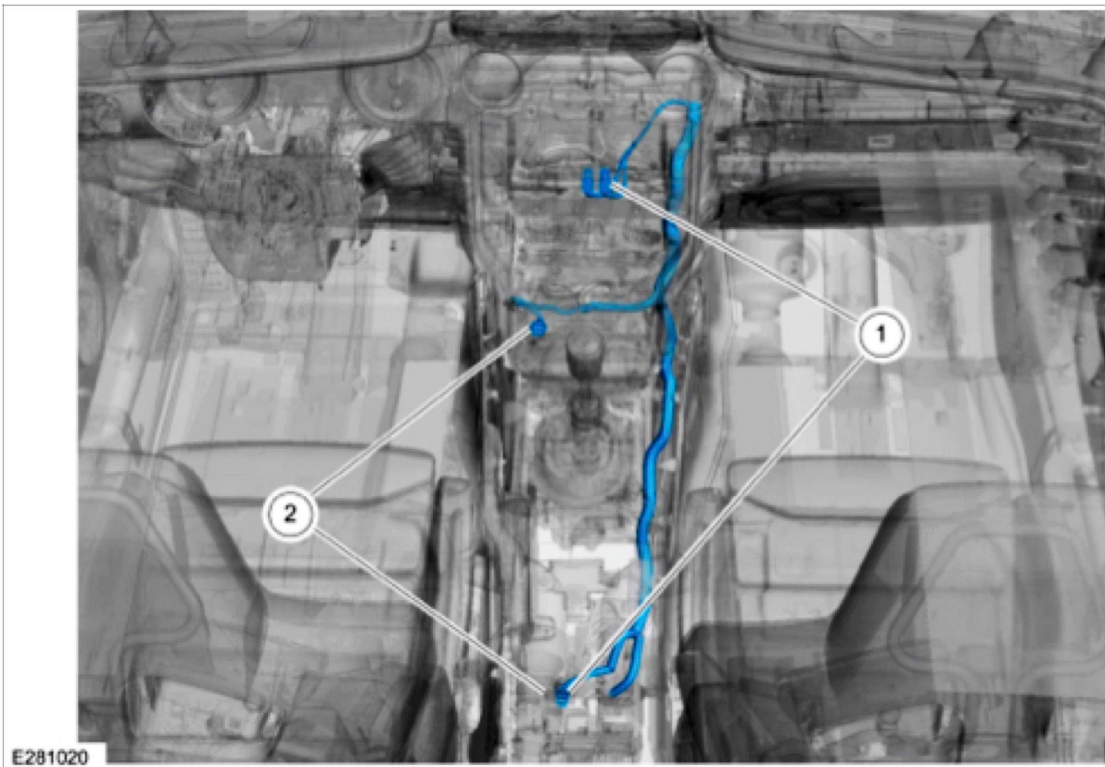
- | | |
|---|-----------------------------------|
| 1 APIM | 8 Cellular antenna cable splitter |
| 2 Voice microphone | 9 Cellular antennas |
| 3 Front ANC microphone | 10 FM2 diversity antenna |
| 4 Rear ANC microphone | 11 AM/ FM1 antenna amplifier |
| 5 TCU antenna | 12 ACM |
| 6 TCU | 13 DSP (RH drive vehicles) |
| 7 FM2 diversity antenna amplifier (if equipped) | 14 DSP (LH drive vehicles) |



Audio/SYNC System Main Components - Convertible

Item Description

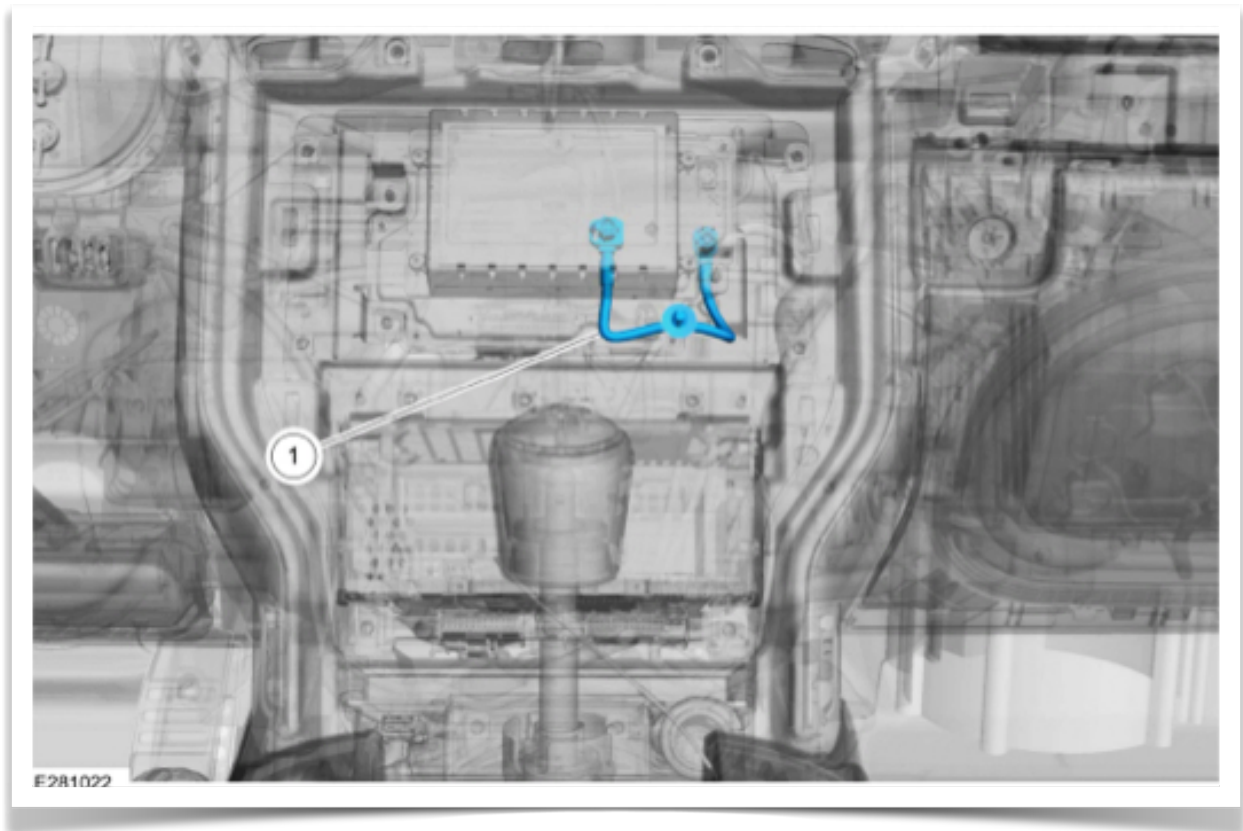
- | | |
|---|-----------------------------------|
| 1 APIM | 8 Cellular antenna cable splitter |
| 2 Voice microphone | 9 Cellular antennas |
| 3 Front ANC microphone | 10 FM2 diversity antenna |
| 4 Rear ANC microphones | 11 ACM |
| 5 TCU antenna | 12 DSP (RH drive vehicles) |
| 6 TCU | 13 DSP (LH drive vehicles) |
| 7 FM2 diversity antenna amplifier (if equipped) | |



USB Cable Routing

Item Description

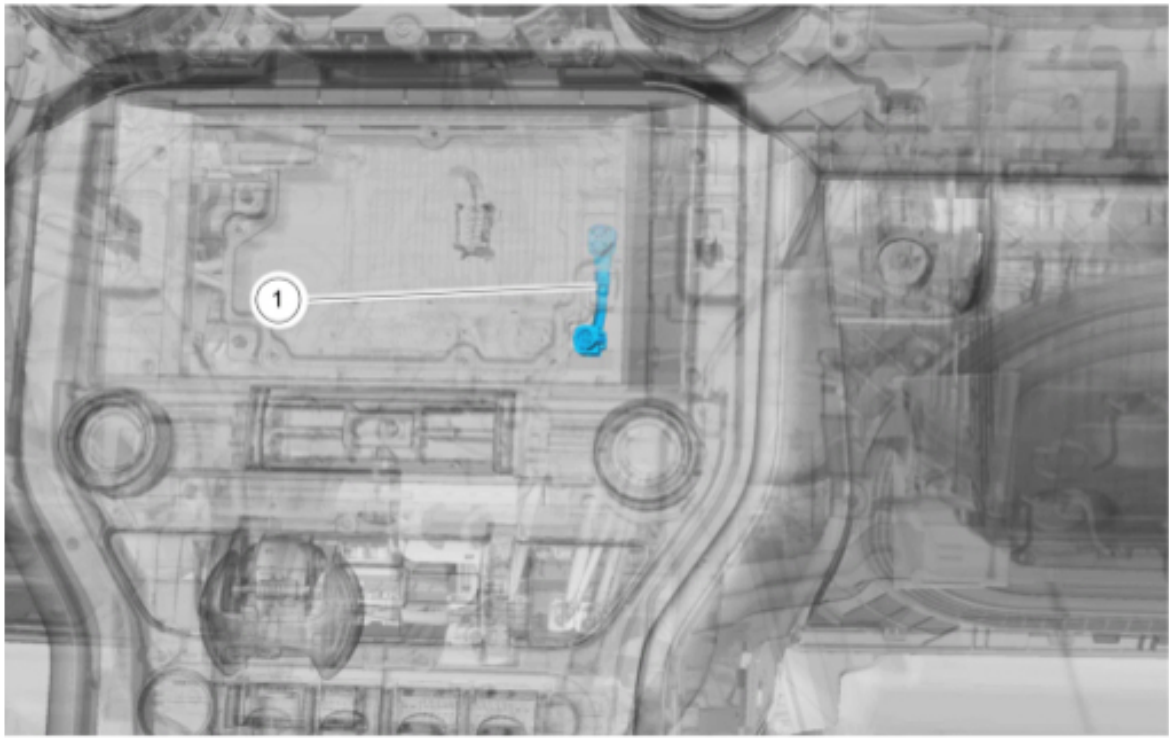
- 1 Front USB Cable
- 2 Rear USB Cable



Non-Touchscreen LVDS Cable Routing

Item Description

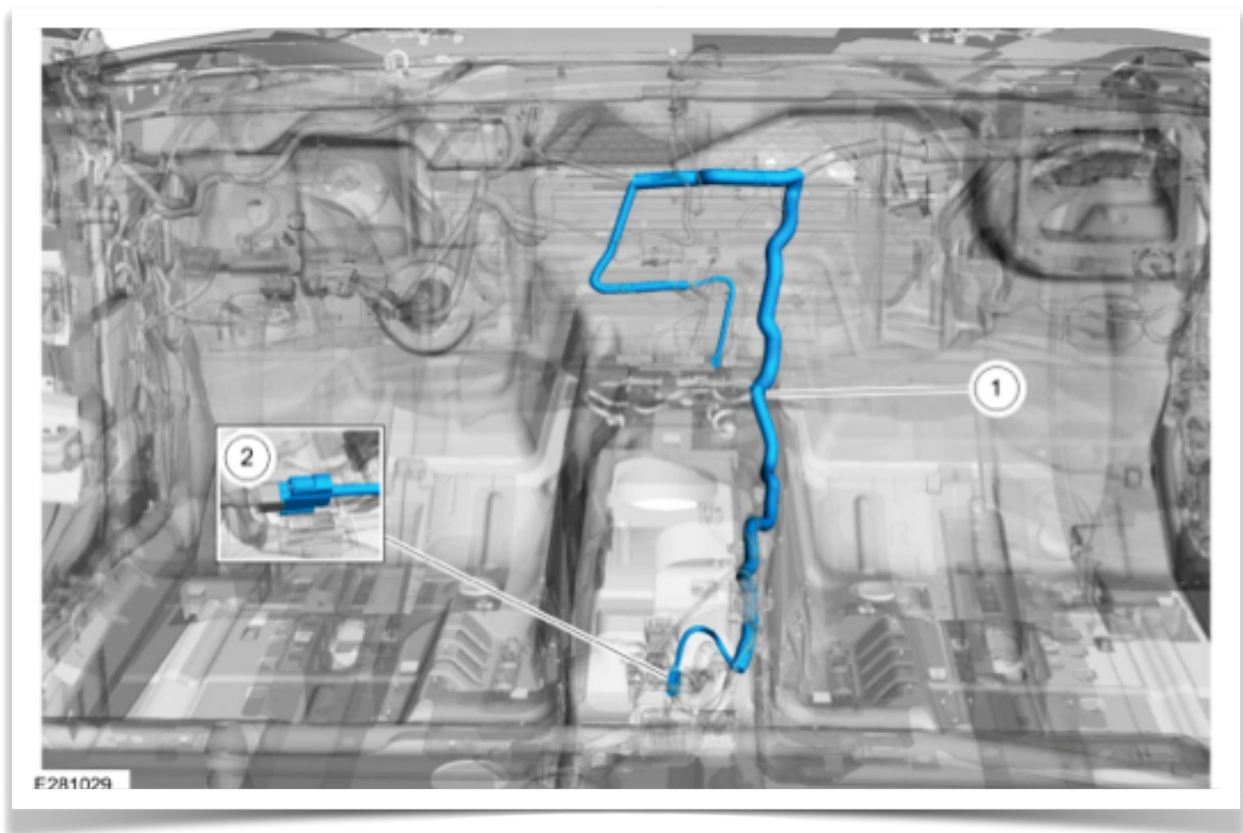
1 LVDS Cable



Touchscreen LVDS Cable Routing

Item Description

1 LVDS Cable

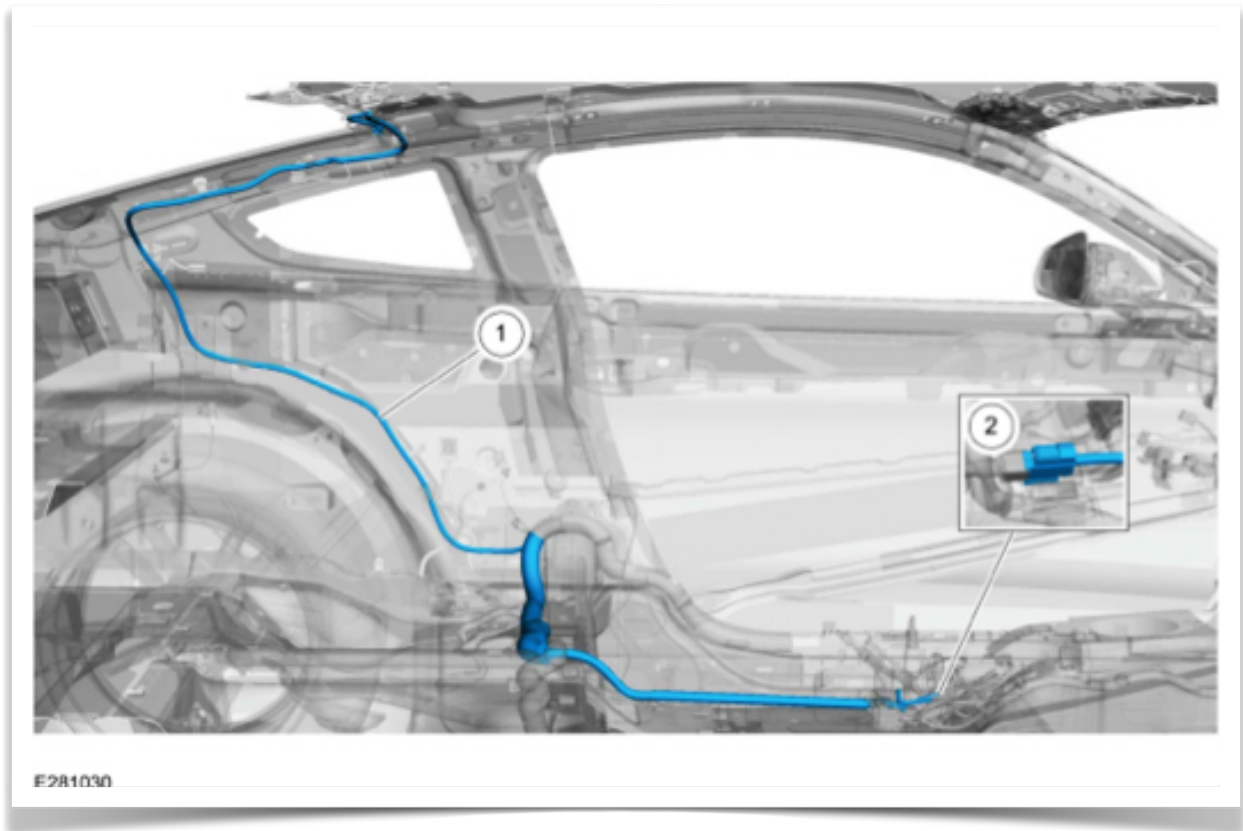


Front Audio Unit (AM/ FM1) Antenna Cable Routing

Item Description

1 Front audio unit antenna cable

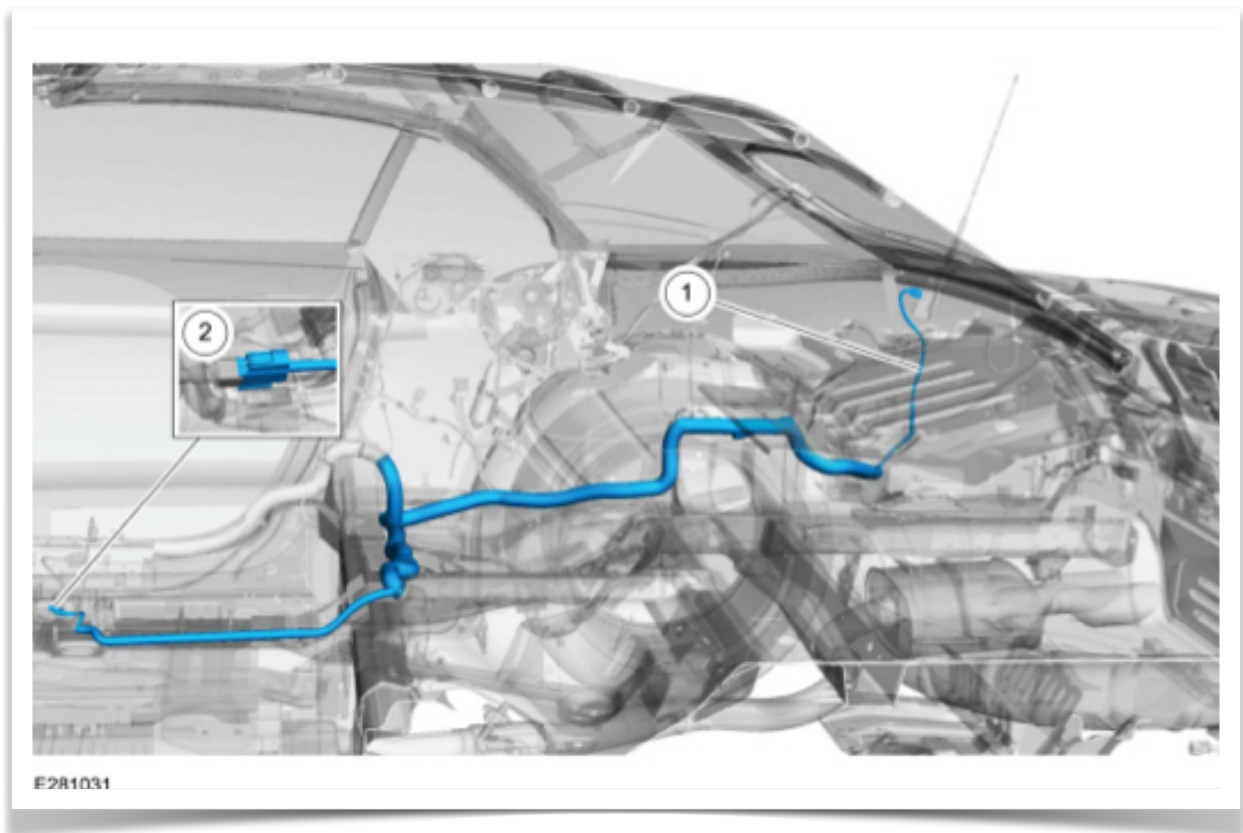
2 Audio unit antenna cable in-line connection (located under the floor console)



Rear Audio Unit (AM/ FM1) Antenna Cable Routing (Coupe)

Item Description

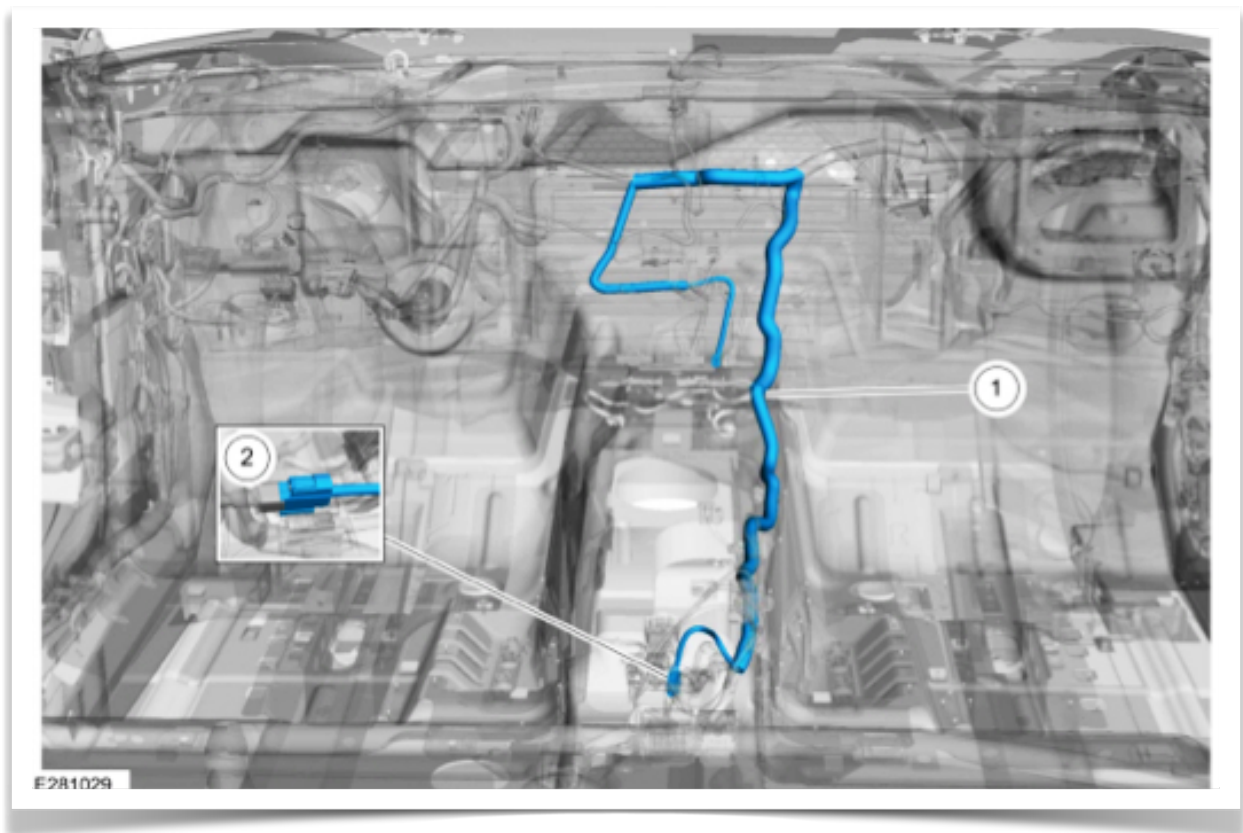
- 1 Rear audio unit antenna cable
- 2 Audio unit antenna cable in-line connection (located under the floor console)



Rear Audio Unit (AM/ FM1) Antenna Cable Routing (Convertible)

Item Description

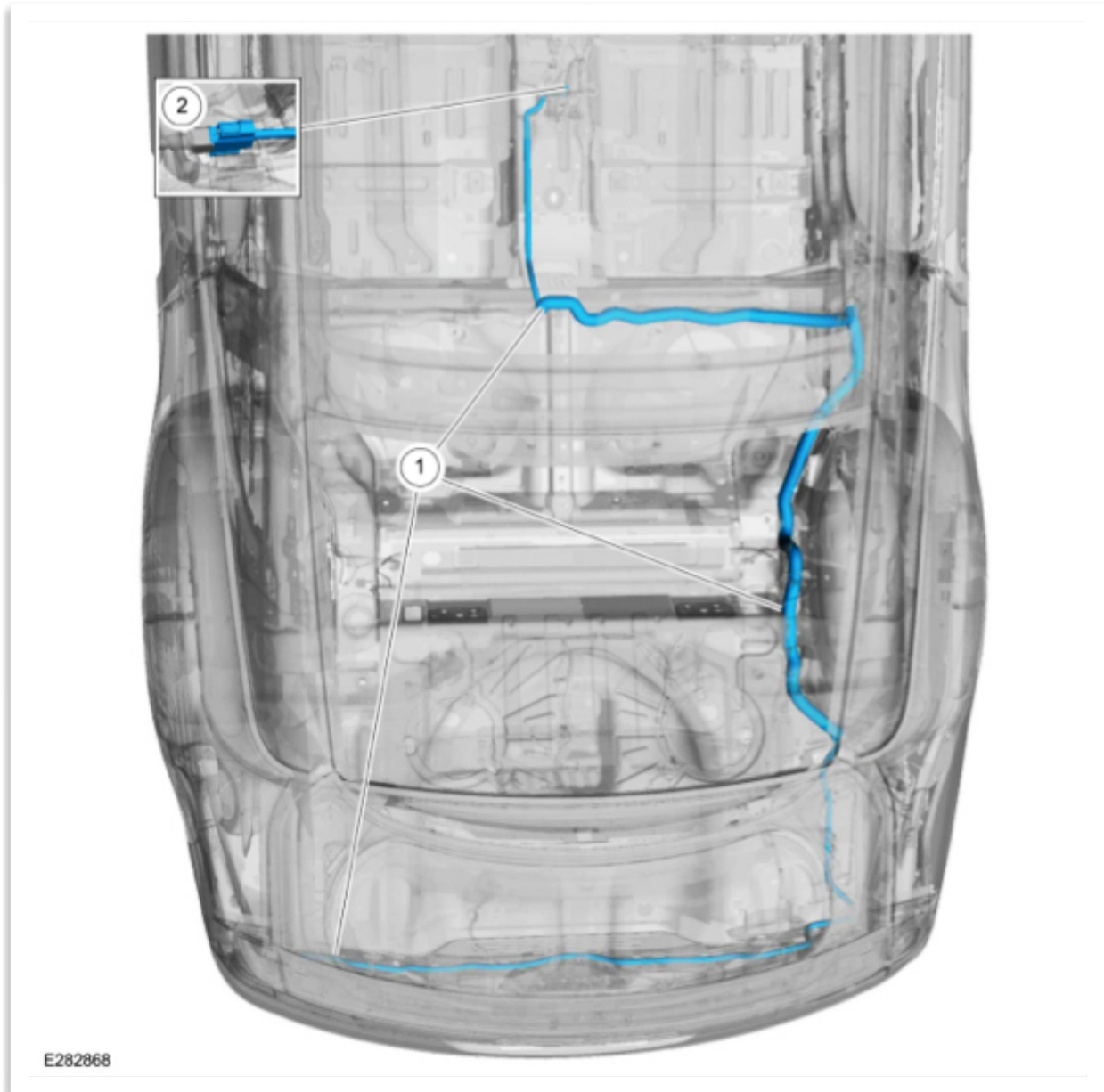
- 1 Rear audio unit antenna cable
- 2 Audio unit antenna cable in-line connection (located under the floor console)



Front FM2 Diversity Antenna Cable Routing

Item Description

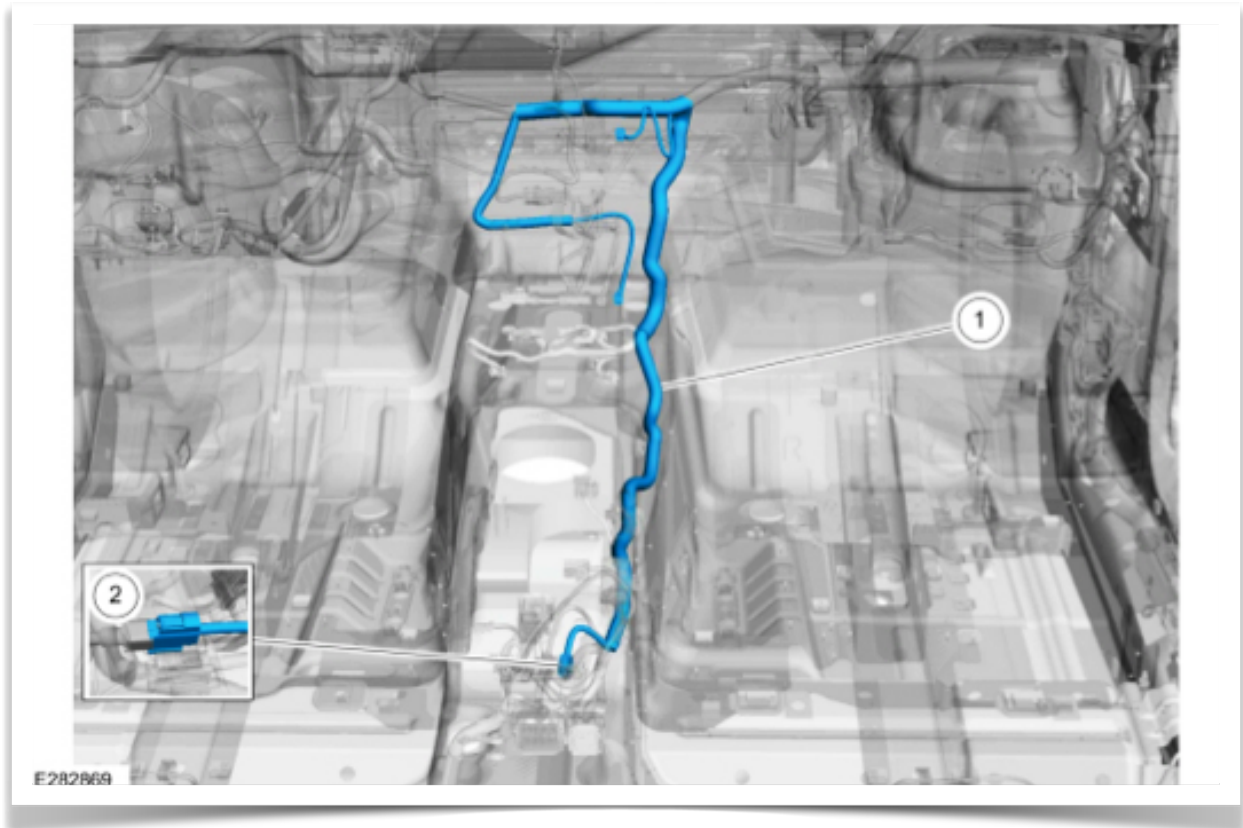
- 1 Front FM2 diversity antenna cable
- 2 FM2 diversity antenna cable in-line connection (located under the floor console)



Rear FM2 Diversity Antenna Cable Routing

Item Description

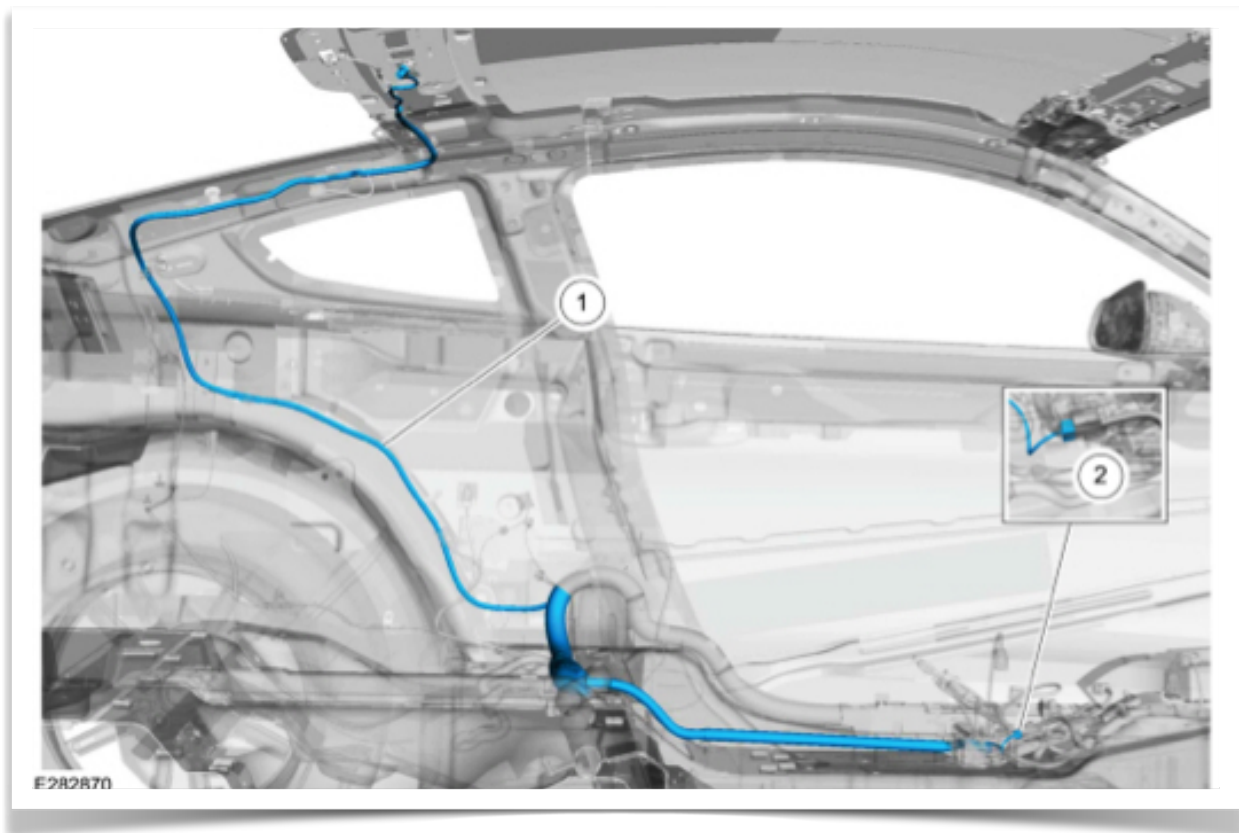
- 1 Rear FM2 diversity antenna cable
- 2 FM2 diversity antenna cable in-line connection (located under the floor console)



Front GPS/Satellite Antenna Cable Routing

Item Description

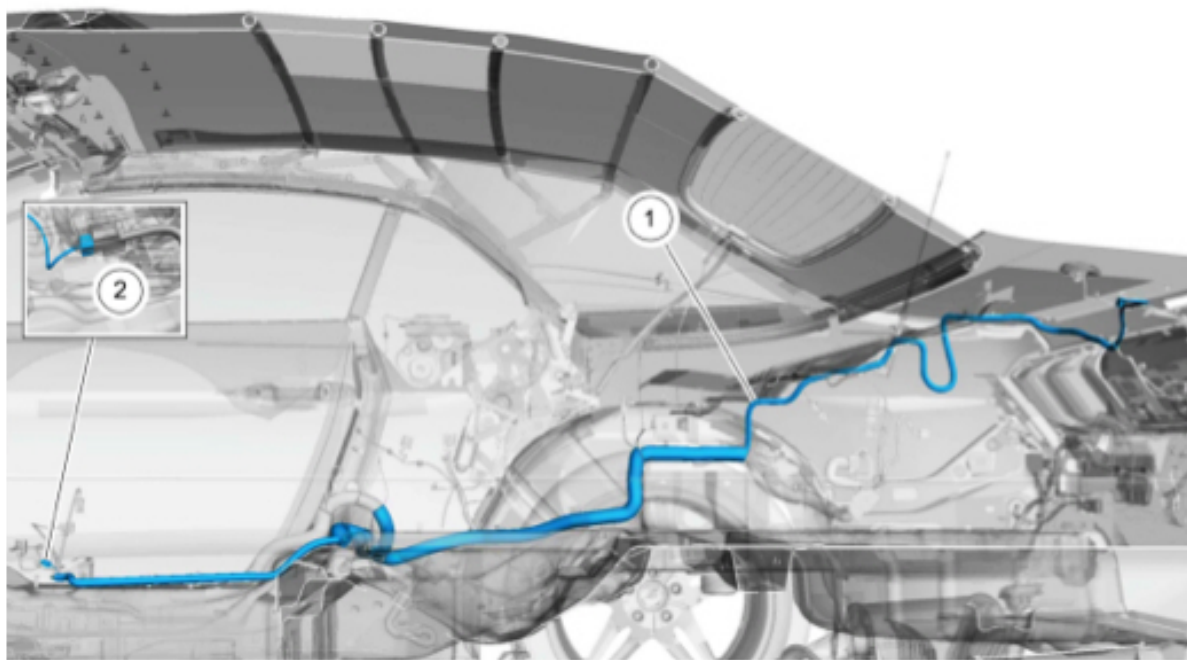
- 1 Front GPS/satellite antenna cable
- 2 GPS/satellite antenna cable in-line connection (located under the floor console)



Rear GPS/Satellite Antenna Cable Routing - Coupe

Item Description

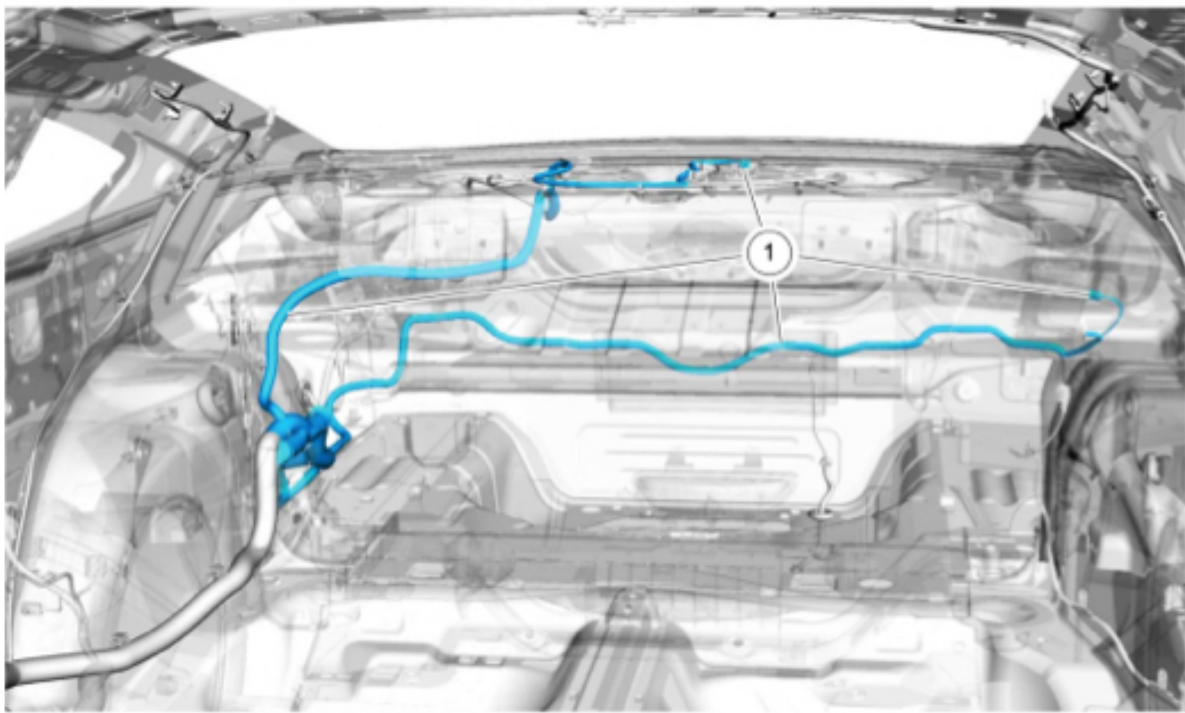
- 1 Upper GPS/satellite antenna cable
- 2 GPS/satellite antenna cable in-line connection (located under the floor console)



Rear GPS/Satellite Antenna Cable Routing - Convertible

Item Description

- 1 Rear GPS/satellite antenna cable
- 2 GPS/satellite antenna cable in-line connection (located under the floor console)

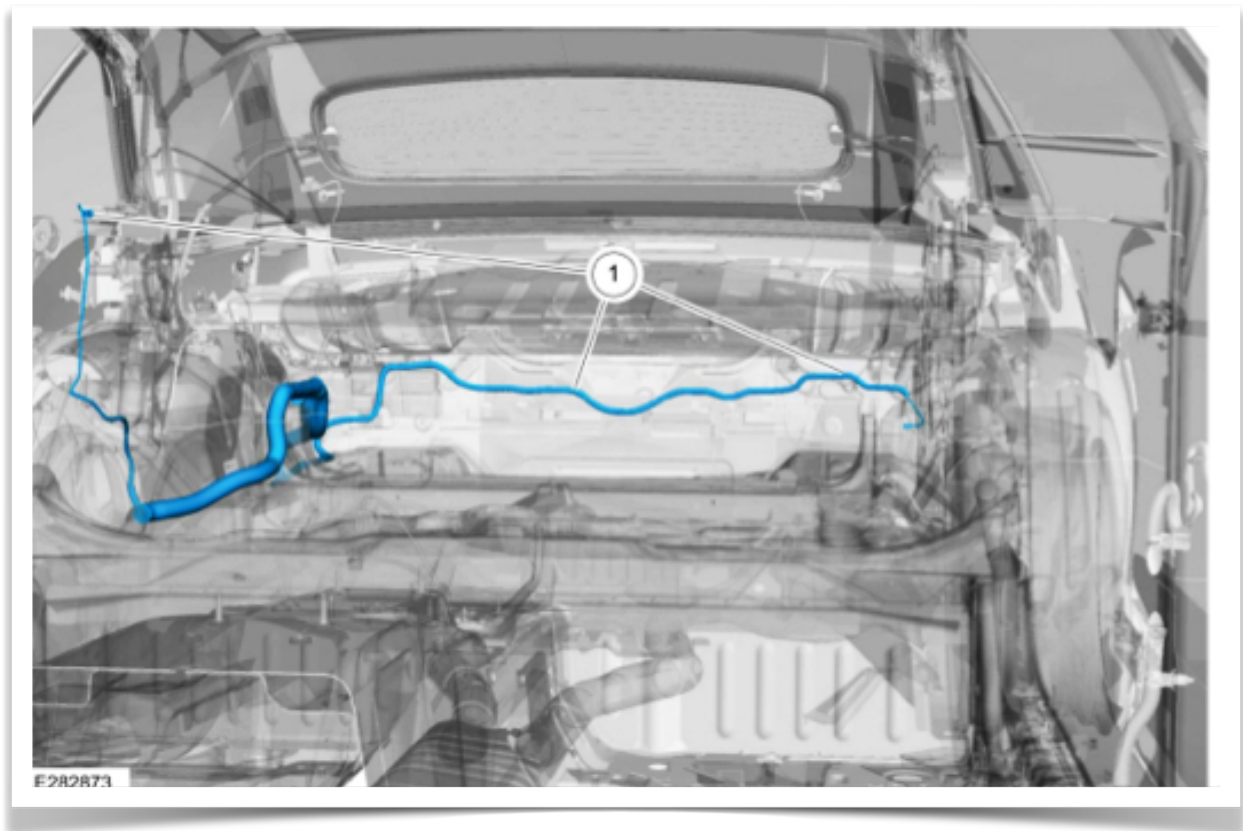


E282872

TCU Antenna Cable Routing - Coupe

Item Description

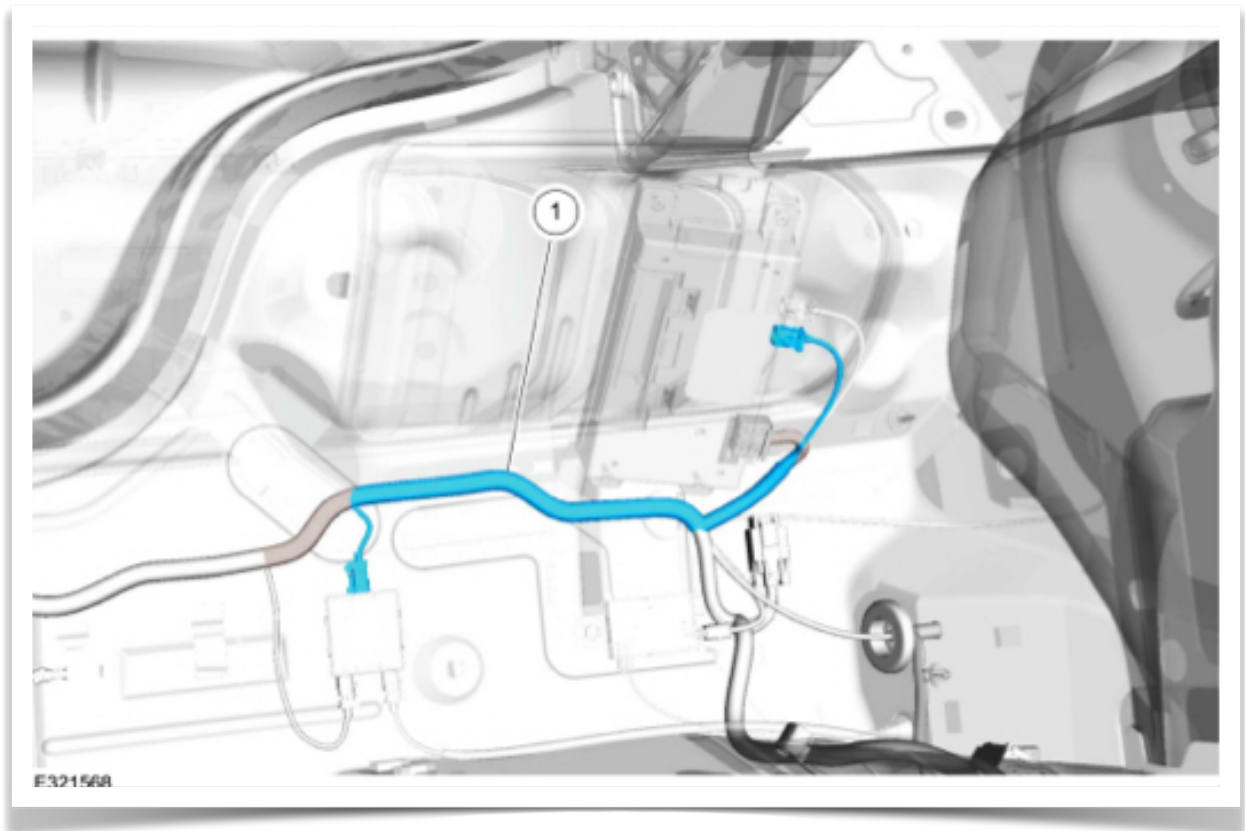
1 TCU antenna cable



TCU Antenna Cable Routing - Convertible

Item Description

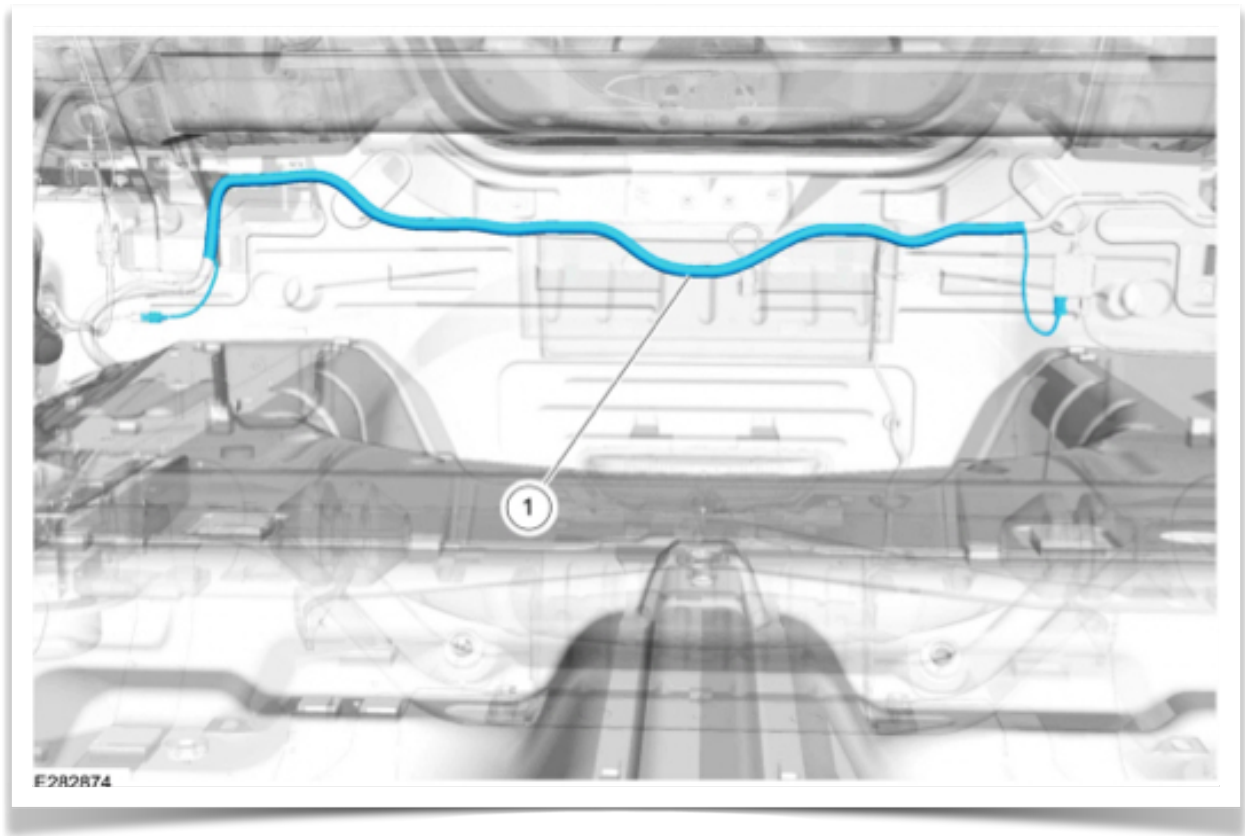
1 TCU antenna cable



Cellular Antenna Cable Routing

Item Description

1 Cellular antenna cable



Cellular Antenna Extension Cable Routing

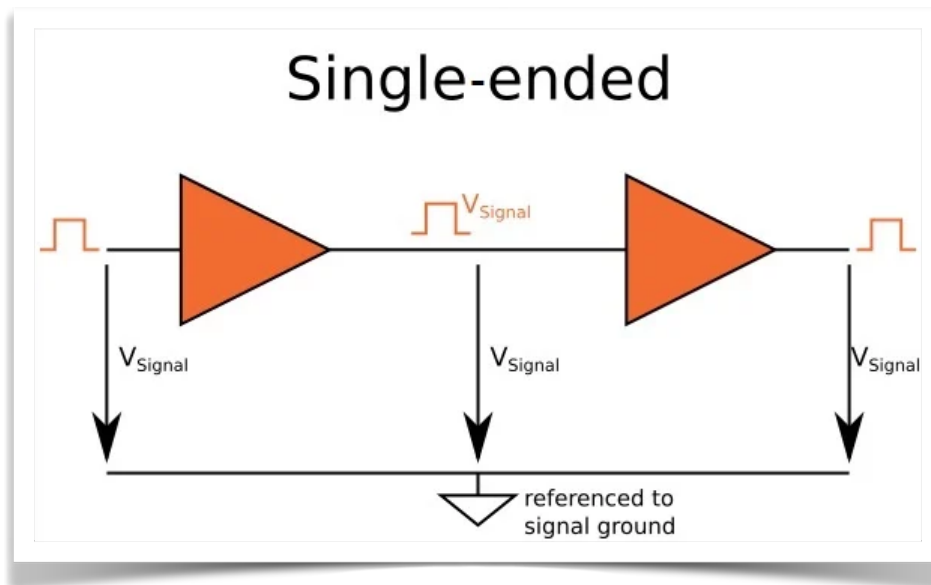
Item Description

1 Cellular antenna extension cable

Low Voltage Differential Signaling (LVDS)

This section will explain what LVDS is and why it is used in audio and communication systems.

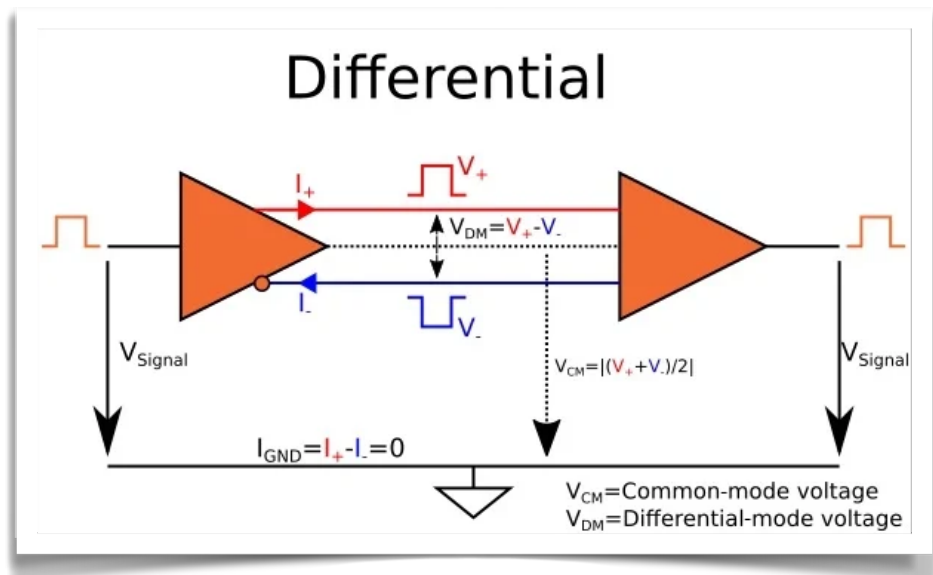
- Differential signaling can minimize electromagnetic interference, crosstalk, and reflections if it is balanced.
- Balanced differential signal pairs carry signals of equal amplitude but with a 180° phase shift.
- Differential signaling requires lower voltages than the levels in a single-ended signaling system to maintain the same signal-to-noise ratio (SNR).



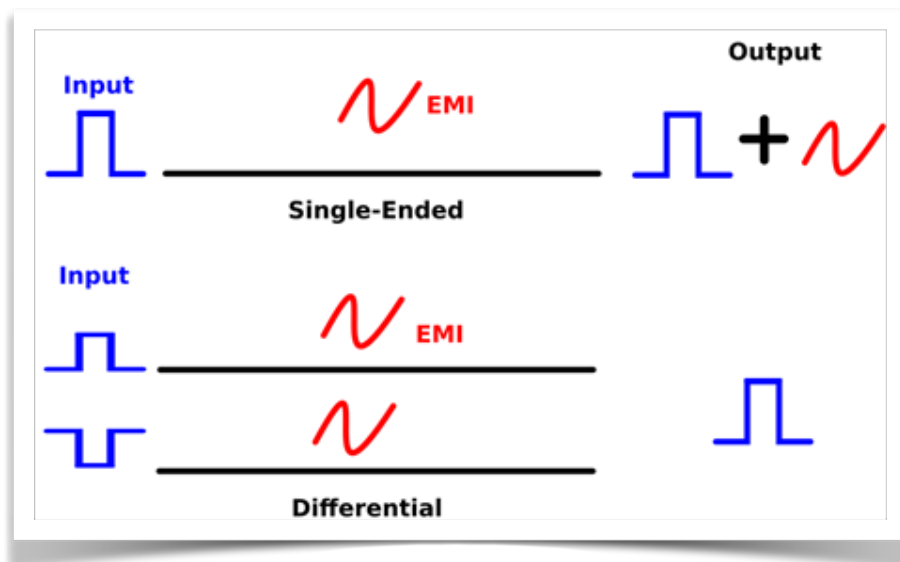
Single-ended signaling is a simple and common way of transmitting an electrical signal from a sender to a receiver. The electrical signal is transmitted by a voltage (often a varying voltage), which is referenced to a fixed potential, usually a 0 V node referred to as "ground."

One conductor carries the signal and one conductor carries the common reference potential. The current associated with the signal travels from sender to receiver and returns to the power supply through the ground connection. If multiple signals are transmitted, the circuit will require one conductor for each signal plus one shared ground connection; thus, for example, 16 signals can be transmitted using 17 conductors.

Differential signaling, which is less common than single-ended signaling, employs two complementary voltage signals in order to transmit one information signal. So one information signal requires a pair of conductors; one carries the signal and the other carries the inverted signal.



The receiver extracts information by detecting the potential difference between the inverted and non-inverted signals. The two voltage signals are "balanced," meaning that they have equal amplitude and opposite polarity relative to a common-mode voltage. The return currents associated with these voltages are also balanced and thus cancel each other out; for this reason, we can say that differential signals have (ideally) zero current flowing through the ground connection.



With differential signaling, the sender and receiver don't necessarily share a common ground reference. However, the use of differential signaling does not mean that differences in ground potential between sender and receiver have no effect on the operation of the circuit.

If multiple signals are transmitted, two conductors are needed for every signal, and it is often necessary or at least beneficial to include a ground connection, even when all the signals are differential. Thus, for example, transmitting 16 signals would require 33 conductors (compared to 17 for single-ended transmission). This demonstrates an obvious disadvantage of differential signaling.

Acronyms

ABS - Anti-Lock Brake System
ACK - ACKnowledgment (See CAN message format, ISO 11898)
ACM - Audio Front Control Module (DACMC, Radio, CD, Speakers)
AM - Amplitude Modulated
ANC - Active Noise Cancelling
APIM - Accessory Protocol Interface Module (SYNC, steering controls, radio, NAV)
BCM - Body Control Module
BCMA - BCM (Interior, right side, near floor)
BCMB - BCM (Trunk, right side, near wheel well)
BECMB - Battery Energy Control Module B (RCM, SRS. Turns off fuel in crash.)
BLIS - Blind Spot Information System
BMS - Battery Management System
CAN - Controller Area Network (See also LIN)
CCA - Cold Cranking Amps
CCM - Cruise Control Module
CIP - Consumer Interface Protocol
CPA - Connector Position Assurance (SRS, airbag connector tabs)
CRC - Cyclic Redundancy Check (See CAN message format, ISO 11898)
DAB - Digital Audio Broadcasting
DACMC - Digital Audio Control Module-C (ACM, Radio, CD, Speakers)
DCM - Door Control Module (aka DDM, PDM, Intelligent Access)
DCSM - Dual Climate Seat Module (Seating Climate Control)
DCT - Dual-Clutch Transmission (Paired, electronically-controlled manuals)
DDM - Driver Door Module (Keyless Entry)
DIAG1 - A physical link, connecting LHD and RHD DLC/GWMs
DIAG2 - A physical link, connecting LHD and RHD DLC/GWMs
DLC - DataLink Connector (OBDII, GWM, both LHD and RHD)
DSM - Driver Seat Module (Seat Memory, Power)
DSP - Audio Digital Signal Processor (DSP) Module
DTC - Diagnostic Trouble Code. The fault code/s, seen by a OBDII scan tool
ECM - Engine Control Module (PCM)
ECU - Engine Control Unit (PCM)
EOF - End Of Frame (See CAN message format, ISO 11898)
EMF - ElectroMotive Force
EMI - Electro-Magnetic Interference
FCIM - Front Controls Interface Module (Center Console Push-Button Controls)
FCDIM - Front Controls Display Interface Module (FCIM Outputs)
FDIM - Ford Display Module (Screen Outputs)
FDRS - Ford Diagnostic and Repair System (Ford diagnostic and programming tool)
FM - Frequency Modulated
FMVSS - Federal Motor Vehicle Safety Standard
FORScan - 3rd party diagnostic and programming tool
GENCOM - Generator Communications

Acronyms (cont.)

GENMON - Generator Monitoring
GSM - Gear Shift Module (GT500 Only)
GWM - GateWay Module (DLC, OBDII, LHD and RHD)
HS-CAN - High-Speed Controller Area Network (1,2,3 and 4)
HSWM - Heated Steering Wheel Module
HUD - Head-Up Display Module
HVAC - Heating, Ventilation, Air Conditioning
IA - Intelligent Access (keyless entry)
ICM - Information Center Module
ID - IDentifier (See CAN message format, ISO 11898)
IPC - Instrument Panel Cluster
IPMA - Image Processing Module A (Camera, Lane Departure)
ISO - International Organization for Standardization (See CAN message, ISO 11898)
kHz - kilo Hertz (frequencies in the thousands)
LF - Low Frequency (30 kHz - 300 kHz)
LHD - Left-Hand Drive (DLC, GWM, LHD and RHD OBDII linked via DIAG1 and 2)
LIN - Local Interconnect Network (low-cost, low-speed, low-reliability CAN supplement)
LVDS - Low Voltage Differential Signaling
MHz - Mega Hertz (frequencies in the millions)
MRCMA - Movable Roof Control Module, Primary (Convertible Roof)
MRCMB - Movable Roof Control Module, Secondary (Convertible Roof)
MS-CAN - Medium-Speed Controller Area Network
OBDII - On-Board Diagnostics, Gen 2 (DLC, GWM)
OCS - Occupant Classification System (Passenger Seat Only)
OCSM - Occupant Classification Systems Module (Passenger Sitting Detect)
OLM - Oil Life Monitor
PAM - Parking Assist Control Module (Backup Assist, Parking Assist)
PATS - Passive Anti-Theft System (Engine Immobilizer)
PCM - Powertrain Control Module
PDM - Passenger Door Module (Keyless Entry)
PMI - Programmable Module Installation
PSCM - Power Steering Control Module
PWM - Pulse Width Modulation
RCM - Restraint Control Module (Seatbelt, SRS, Crash Detect)
RF - Radio Frequency (all frequencies used in wireless communications)
RHD - Right-Hand Drive (DLC, GWM, LHD and RHD OBDII linked via DIAG1 and 2)
RKE - Remote Keyless Entry (IA, or Intelligent Access)
RPM - Revolutions Per Minute
RTM - Radio/Remote Transceiver Module (keyless entry, TPMS, remote start)
SCCM - Steering Column Control Module (High Beams, Turn Signals)
SCME - Seat Climate-controlled Module - E
SDL - Smart Device Link (Infotainment connectivity protocol, apps, systems)
SIM - Subscriber Identity Module

Acronyms (cont.)

SoC - State of Charge

SODL - Side Obstacle Detection Control Module LH (BLIS)

SODR - Side Obstacle Detection Control Module RH (BLIS)

SOF - Start Of Frame (See CAN message format, ISO 11898)

SRS - Supplemental Restraint System

SUMB - Vehicle Dynamics Control Module (VDM, Magneride)

TCM - Transmission Control Module (In GT500, a dedicated unit, attached to trans)

TCU - Telematics Control Unit

TCU - Transmission Control Unit (In GT500, a dedicated unit, attached to trans)

TPMS - Tire Pressure Monitoring System

TTS - Text To Speech

UHF - Ultra-High Frequency (300 MHz - 3 GHz)

VAC - Voltage Alternating Current

VDC - Voltage Direct Current

VDM - Vehicle Dynamics Control Module (Magneride)

VIN - Vehicle Identification Number

VIP - Vehicle Interface Protocol

VPWR - Vehicle PoWeR (PCM manages power needs)

VQM - Voltage Quality Module ("smoothes" voltage to components)

Links and Site References

Alternator

Alternator Animated Video Tutorial

<https://www.youtube.com/watch?v=jdSKlg80DjU>

Antenna

Antenna (Roof) And What They Do

<https://www.mustang6g.com/forums/threads/job-1-vs-job-2-shark-fin-roof-antenna-and-what-they-do.146941/>

Antenna (Shark Fin) PN#

<https://www.mustang6g.com/forums/threads/shark-fin-antenna-part.146564/>

APIM

APIM - YouTube Video Showing APIM and its location

<https://www.youtube.com/watch?app=desktop&v=fl03A9lbYaA>

Links and Site References

Battery

Battery, Lead-Acid, Animation Video Tutorial

<https://www.youtube.com/watch?v=VnPRX5zQWLw>

Battery, Lithium-Ion, Brief Explanation

<https://letstalkscience.ca/educational-resources/stem-explained/how-does-a-lithium-ion-battery-work>

Battery Tender

Battery Tender, Ford (CTEK) Charging Process

<https://www.youtube.com/watch?v=GXsDrRRRqcU&t=4s>

BCM

BCM Location, Diagrams, with Steps on How to Replace (BCMA and BCMB)

<https://www.mustang6g.com/forums/threads/bcm-replacement-help.119035/>

<https://www.mustang6g.com/forums/threads/2018-gauge-cluster-retrofit.74133/page-27>

BCM Partial Pinout, to include Fog Lights

<https://www.mustang6g.com/forums/threads/anyone-have-the-pinout-wiring-diagram-for-2018-up-fog-running-light-assembly.132859/>

BLIS

BLIS, A Step-By-Step Guide To Installing

<https://www.mustang6g.com/forums/threads/step-by-step-guide-to-enabling-blind-spot-information-system-blis-and-cross-traffic-alert-cta.107623/>

BMS

BMS, Characteristics of Lead Acid Batteries

<https://www.pveducation.org/pvcdrom/lead-acid-batteries/characteristics-of-lead-acid-batteries>

B MS, The Concept of Ford's Service

<https://lockdownsecurity.forumbee.com/t/m2gvh9/ford-trucks-bms-battery-monitoring-systems>

B MS: How to Reset in the S550 Mustang

<https://www.mustang6g.com/forums/threads/bms-reset-no-tools-required.151602/>

Links and Site References

CAN

CAN Tutorials, both Document and Video (See also LIN)

<https://dewesoft.com/blog/what-is-can-bus>

<https://www.csselectronics.com/pages/can-bus-intros-tutorials>

<https://www.ti.com/lit/an/sloa101b/sloa101b.pdf>

<https://www.youtube.com/@CSSElectronics-CAN-Logger-X000/videos>

CAN in Ford, Explained In Detail, with Logical Drawings

https://www.fofusion2.com/ford_fusion_communications_network_system_operation_and_component_description_description_and_operation-2613.html (Site explains which module uses which CAN)

<https://www.fordgt500.com/threads/can-bus-2020-2022-gt500.205590/>

<https://www.mustang6g.com/forums/threads/the-how-to-disable-the-data-link-to-ford-thread.146863/page-5#post-3007057>

Links and Site References

DCT

DCT Operation (Also see TCM below)

<https://www.youtube.com/watch?v=t8aGgSbtoJE>

Links and Site References

GWM

GWM Location with Dash Harness Connector Layout, HSWM

<https://www.mustang6g.com/forums/threads/2018-gauge-cluster-retrofit.74133/page-27>

Links and Site References

IA

A- Authenticating in an Unsecured Environment

https://www.youtube.com/watch?v=KXq065YrpiU&list=PLIFyRwBY_4bTwRX__Zn4-letrtpSj1mzY

<https://www.practicalnetworking.net/series/cryptography/diffie-hellman/>

https://www.youtube.com/watch?v=YEBfamv-_do

A- Wireless Power Transfer (Inductive Coupling)

<https://www.nemko.com/blog/wireless-power-transfer>

Links and Site References

LIN

LIN Tutorial (See also CAN)

<https://www.youtube.com/watch?v=TresvW4dxlc>

LVDS

LVDS Tutorials

<https://www.allaboutcircuits.com/technical-articles/the-why-and-how-of-differential-signaling/>

<https://resources.system-analysis.cadence.com/blog/msa2021-the-advantages-of-differential-signaling>

<https://hardwarebee.com/understanding-lvds-low-voltage-differential-signaling/>

Links and Site References

Modules

Modules, Electronic, their locations

<https://www.youtube.com/watch?v=uzLq5AU1rlg>

MRCMA

MRCMA Detailed Document with CAN explanations and Logical Diagrams

https://www.mustang6g.com/forums/attachments/sm_22-pdf.436431/

Links and Site References

PATS

PATS, Re-Initializing, Enabling, so as to Accept New Modules (BCM, etc.)

<https://www.mustang6g.com/forums/threads/engine-immobilizer-lock-pats.166144/#post-3454664>

PCM

PCM, 10R80 Harness Connectors and Connections

<https://www.mustang6g.com/forums/threads/looking-for-trans-pcm-connector-pinout-10r80.147871/>

PCM Control Pack Reference (5.0, 5.2, Harness and Connectors)

<https://performanceparts.ford.com/download/instructionsheets/FordInstShtM-6017-504V.pdf>

<https://www.mustang6g.com/forums/threads/leaked-2019-gt500-5-2l-supercharged-engine-wiring-cad-diagram-from-ford.95772/>

PCM, Fuel Pump Schematic

<https://www.mustang6g.com/forums/threads/fore-wiring-2018-gt.114303/>

PCM Ignition Coil Schematic (5.0)

<https://www.mustang6g.com/forums/threads/dtc-code-p0354.145419/>

PCM Location, Where to Find PCM, Codes Needed by Tuners

<https://www.ortizperformance.com/post/locating-your-vehicle-s-pcm-code-1996-2021-mustangs>

<https://lmr.com/products/ford-mustang-ecu-computer-code-location>

PCM Pinout, with Specific Pin Function

<https://www.mustang6g.com/forums/threads/pcm-pinout-info-for-v6-mustang-and-v8-2016.136824/>

P CM Wiring, Detailed Schematic (2.3L)

<https://www.mustang6g.com/forums/threads/looking-for-a-wire-from-the-ecu.107905/>

Links and Site References

SODL/R

SODL SODR modules (Detailed Guide, with Photos)

<https://www.mustang6g.com/forums/attachments/step-by-step-guide-to-enabling-blis-and-cta-pdf.294019/>

SRS

SRSTutorial (Ford)

<https://www.repairerdrivennews.com/wp-content/uploads/2023/12/On-Target.pdf>

<https://fordcrashparts.com/wp-content/uploads/2020/12/On-Target-2020-Vol.-4-FINAL-12-7-20.pdf>

SRS- YouTube Video Showing RCM and its location

https://www.youtube.com/watch?v=-VjR8bxT_HU

SRS YouTube Video Showing OCSM and its location

<https://www.youtube.com/watch?v=KYgyc7oLLtI>

SRS - YouTube Video Showing APIM and its location

<https://www.youtube.com/watch?app=desktop&v=fl03A9IbYaA>

SYNC Update Thread

SYNC

<https://www.mustang6g.com/forums/threads/official-ford-sync3-3-4-release.145436/>

Links and Site References

TCM

TCM (GT500) (Also see DCT Operation above)

<https://www.motortrend.com/how-to/whats-inside-tremecs-new-seven-speed-dual-clutch-transmission-new-shelby-gt500-mustang/>

<https://www.mustang6g.com/forums/threads/what-is-this-part-number.157159/> (GSM-specific)

TCU

TCU Location (Telematics Control Unit) (location and logical)

<https://www.mustang6g.com/forums/threads/4g-modem-disabling-instructions.146860/>

<https://www.mustang6g.com/forums/threads/the-how-to-disable-the-data-link-to-ford-thread.146863/page-17#post-3028021>

TPMS

TPMS - Federal Motor Vehicle Safety Standard

<https://www.federalregister.gov/documents/2005/09/07/05-17661/federal-motor-vehicle-safety-standards-tire-pressure-monitoring-systems#h-8>

