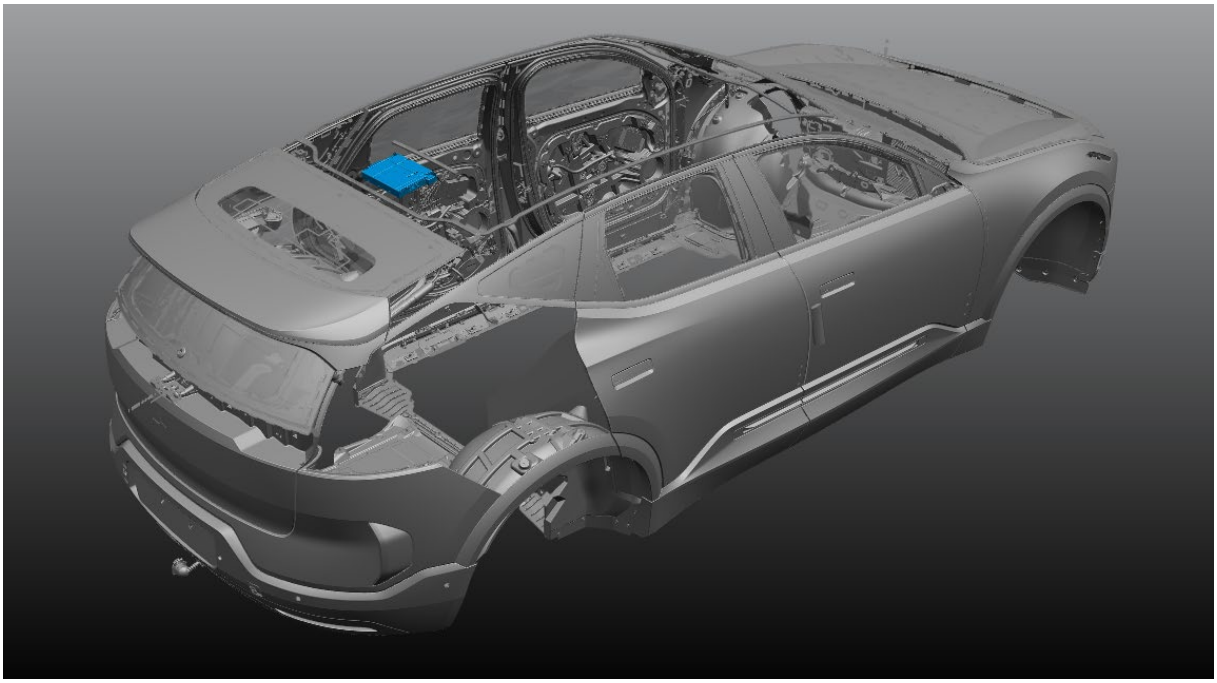
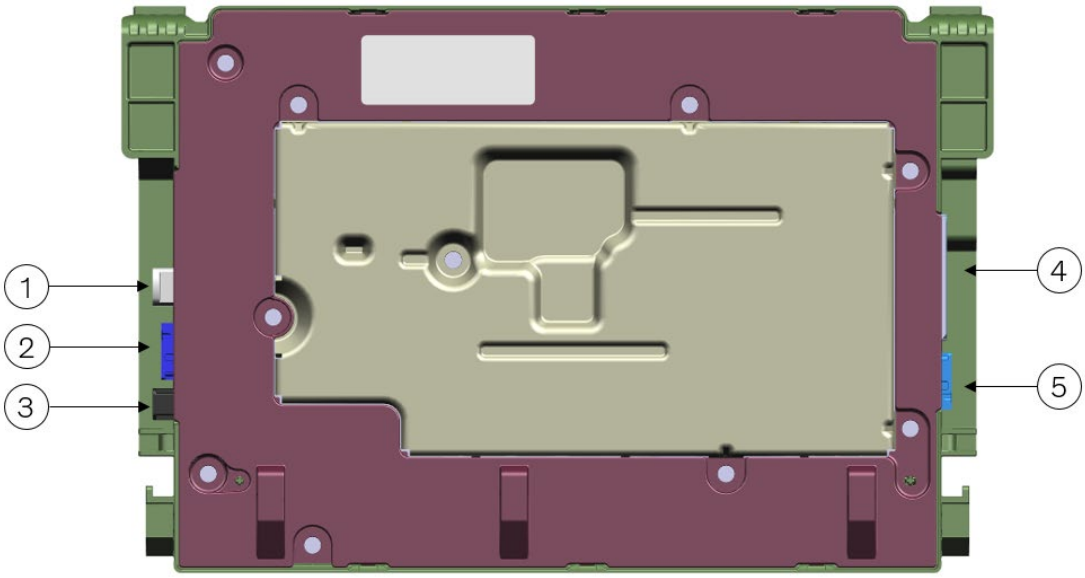
Telematic Connectivity Antenna Module (TCAM2)

A functional description of the TCAM2, used for communication between the vehicle and the outside world.



Description

The Telematic Connectivity Antenna Module (TCAM2) supports communication internally and externally. It is the interface between the vehicle and the outside world. TCAM2 is connected to the Core System through Ethernet and CAN connection. Internally the TCAM2 has two units, TCA and PAK, which are connected to CoreSystem via Connectivity CAN and Connectivity Ethernet.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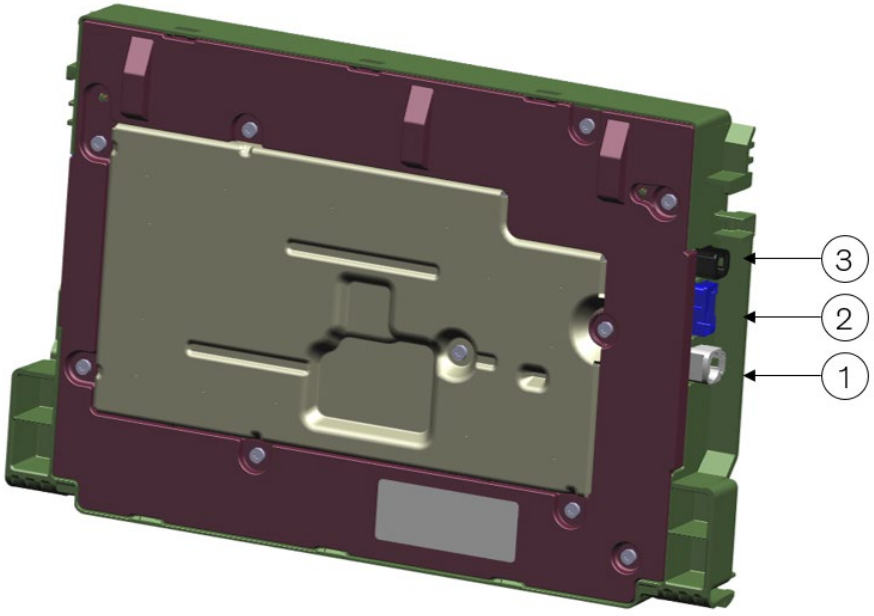
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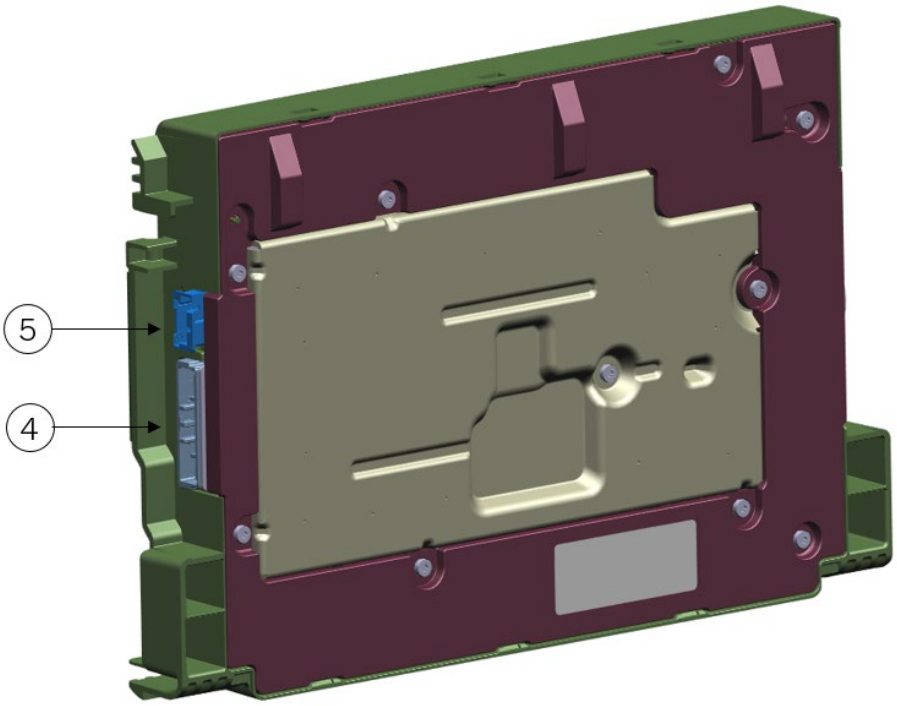

(1) Ethernet

(2) Power supply

(3) Satellite Digital Audio Radio Service (SDARS) (Only US market)

(4) Main connector (CAN , LIN , A2B etc)

(5) BuB connector

Power supply

The 12 V battery supplies TCAM2 with power. In case the 12 V battery is disconnected, or the power supply is broken, the backup battery (BUB) will supply TCAM2 with power.

> ### Note
>
> In order to perform a power reset of TCAM2 it is necessary to disconnect the BUB as well as the 12 V battery.

OHC to TCAM2 Interaction

On the OHC (Overhead Console) is placed the buttons for the following functions, Volvo ONcall and SOS (Emergency call), which are used to execute the call services provided by Volvo and the regulatory Emergency Call.

Antennas

The TCAM2 has antennas for the following communications:

- Bluetooth Low Energy (BLE)
- Cellular
- Global Navigation Satellite System (GNSS)
- Tire Pressure Monitoring System (TPMS)
- Phone as Key (PAK)
- SDARS

Of the above, all receivers are located inside TCAM2, except for the SDARS receiver, which is located in the DHU (IHU).

Bluetooth (BLE)

The BLE antenna in TCAM2 is used for Phone as Key (PAK), key fob and Volvo Cars applications. When PAK or key fob is used for passive entry, the BLE detects the correct user and communicates with the UWBs for localization. When the distance is near enough, the user can open the vehicle. Moreover, BLE communicates with the Volvo Cars application for features such as climate system control and.

> ### Note
>
> Note that the mobile phone application Volvo On Call changes name to Volvo Cars in 21w17.

Cellular

The cellular antenna is used for communication with mobile networks. TCAM2 provides the Infotainment system with internet access by cellular internet connection, which is the default setting. TCAM2 has support for 5G and older technologies as 4G, 3G and 2G. 5G will be used as long as the network supports it. If the network does not support 5G, an older technology, such as 4G will be used instead. Cellular traffic uses a Telematic Subscriber Identity Module (T-SIM) for communication. The T-SIM is used regardless of usage mode.

Global Navigation Satellite System (GNSS)

The supported GNSS technologies are the Global Positioning System (GPS), GLONASS , Beidou and Galileo . TCAM2 sends the GNSS signals to DHU (IHU) via Connectivity Ethernet.

Satellite Digital Audio Radio Service (SDARS) (US only)

TCAM2 does not manage SDARS, TCAM2 has the SDARS antenna but act as passthrough for the signal received.

SDARS exists only on US market.

TPMS (Tire Pressure Monitoring System)

The TCAM implements a fully integrated single-chip RF receiver intended for use in TPMS application. The device is designed for superior RF performance. The receiver is configured to operate with low active and standby power consumption, ideal for battery powered applications. RF Receiver supports for 315, 434, 447, 868 & 915 MHz bands for worldwide usage. It also supports advanced signal monitoring and data management for fast and reliable signal detection and processing.

Function

TCAM2 modes

TCAM2 can enter the following modes:

- Active
- Standby
- NetOff

In Active mode, all TCAM2 functionality is available and remote services, such as climate system operation and software download is possible in this mode. In Standby mode, no applications are running but TCAM2 starts immediately if needed. In NetOff mode TCAM2 is inactive and does not wake up by external communication, such as cellular- or bluetooth communication. It only wakes up if the vehicle starts or if On-Board Diagnostics (OBD) is performed.

> Note
>
> The TCAM2 modes are not the same as the usage modes, but they are also not strictly independent. For instance, TCAM2 will always be in Active in higher usage modes such as Driving . But in usage mode Abandoned , TCAM2 might be in Active , Standby or NetOff depending on the circumstances.

Ability to wake up the vehicle

TCAM2 can wake up the vehicle in different ways. For example through data from cellular traffic or through Bluetooth Low Energy (BLE) using the Volvo Cars application functions. Furthermore, TCAM2 can wake up the vehicle using internal timers, for example when it comes to software update using OTA or when it comes to starting the climate system.

If the vehicle is parked for more than five days, TCAM2 enters NetOff mode, and then TCAM2 cannot wake up the vehicle through external stimuli. Still, it is possible to wake up through vehicle start or through OBD.

> **Note**
>
> The timer is reset when the vehicle enters usage mode Driving. Also, after a new software is installed, TCAM2 assumes NetOff mode and the vehicle must enter usage mode Driving to reset the timer.

Interaction between TCAM2 and the clouds

In order for the vehicle to be identifiable against the cloud (for example during OTA software download), TCAM2 has a certain certificate containing the Vehicle Identification Number (VIN), among other things. The VIN ensures that the particular vehicle receives the correct information.

Volvo Cars application and open internet services

Telematic services, such as Volvo Cars application and SOS, as well as open internet services share the same hardware for communication. Telematic services are available as soon as the customer receives the vehicle. This applies regardless of market/country. But when it comes to the use of open internet services, there may be market regulations stating that the customer needs to approve certain terms and conditions in order to use internet applications

Software download and diagnostics

For software download the TCAM2 must be in Active mode. Regardless of wireless communication (OTA) or On-Board Diagnostic (OBD), the diagnostics management, used for diagnostics and software download, is primary implemented in TCAM2. TCAM2 act mainly as gateway for the data.