

February 2, 2023

DEFECT INFORMATION REPORT

1. Vehicle Manufacturer Name:

Toyota Motor Corporation [“TMC”]
1, Toyota-cho, Toyota-city, Aichi-pref., 471-8571, Japan

Affiliated U.S. Sales Company:

Toyota Motor North America, Inc. [“TMNA”]
6565 Headquarters Drive, Plano, TX 75024

Manufacturer of Computer Assembly, Hybrid Vehicle Control:

DENSO CORPORATION
1-1, Showa-cho, Kariya-city, Aichi-pref., 448-8661, Japan
Phone: +81-566-25-5511

Country of Origin: Japan

2. Identification of Involved Vehicles and Affected Components:

Based on production records, we have determined the involved vehicle population as in the table below.

Make/Car Line	Model Year	Manufacturer	Production Period
Toyota / RAV4 Prime (Plug-In Hybrid)	2021	TMC	November 25, 2019 through June 24, 2021

Applicability	Part Number	Part Name	Component Description
MY2021 Toyota RAV4 Prime (Plug-In Hybrid)	89980-42250	Computer Assembly, Hybrid Vehicle Control	Hybrid Vehicle Control ECU (HEV ECU)

Note: (1) Although the involved vehicles are within the above production period range, not all vehicles in this range were sold in the U.S.

(2) This issue only affects MY 2021 RAV4 Prime (Plug-In Hybrid) vehicles equipped with a HEV ECU that contains the software logic described in this report. Other Toyota or Lexus vehicles sold in the U.S. are not equipped with those HEV ECUs.

3. Total Number of Vehicles Potentially Involved:

16,679

4. Percentage of Vehicles Estimated to Actually Contain the Defect:

100% of the involved plug-in hybrid vehicles contain the software logic described in this report. Whether this will actually lead to a hybrid system shut down after rapid accelerator pedal application while driving at higher speeds depends on the battery parameters and the vehicle operating mode at that time.

5. Description of Problem:

The subject plug-in hybrid vehicles contain software in the Hybrid Vehicle Control ECU (HEV ECU) to calculate the Hybrid battery (HV battery) output limits (maximum operating output) by monitoring battery voltage, state of charge (SOC), electrical load, and other parameters for battery protection. Due to certain characteristics of the software logic, the HV battery output may not be limited as required to protect the battery. If the accelerator pedal is rapidly pressed to further accelerate the vehicle after it has been continuously driven in “EV mode” in cold temperature and the HV battery voltage decreases, the voltage may drop rapidly below a specified threshold. If this occurs, the vehicle will display a warning message and the hybrid system will shut down, resulting in loss of motive power. If the vehicle loses motive power while being driven at higher speeds, there could be an increased risk of a crash.

6. Chronology of Principal Events:

March – August 2022

In early-March 2022, Toyota received a field report from Europe which indicated that, as the vehicle was driven on a freeway and the driver intended to accelerate, the vehicle suddenly had no additional throttle response. A dealer inspected the vehicle and found a DTC stored relating to HV battery voltage below threshold. The HV battery voltage was evaluated, but no issues were found. The HEV ECU was replaced. Because the HEV ECU was not recovered, no further analysis could be done.

In mid-March 2022, Toyota received a field report from Japan which described that the vehicle was being driven on an uphill road and then the system went to ready-off. Toyota also received another field report from Europe in April which stated the vehicle was accelerated while driving on a highway and then the vehicle lost motive power. Vehicle inspections were performed, and a DTC for HV battery voltage below threshold was stored. The HV batteries were inspected, but a decrease in HV battery voltage was not found. The HEV ECUs were replaced and sent to the supplier for investigation. However, other than the stored DTC, the supplier could not identify any abnormalities.

Toyota investigated the freeze frame data (FFD) collected from these vehicles and found the vehicles were driven in EV mode in cold temperatures. It was also noted that, when the DTC was stored, the system went to ready-off. The warning message was designed to display when the DTC was stored. Testing was done to attempt to replicate the incidents based on information from the customers and the FFD. A decrease of HV battery voltage was found to be more than expected under high load EV mode operation in cold temperatures when testing the vehicle on a chassis dynamometer; however, the warning messages and hybrid system ready-off could not be reproduced.

September 2022 – January 2023

Additional testing was conducted by rapidly pressing the accelerator pedal. As a result of the testing, when the vehicle was continuously driven in EV mode in cold temperatures and then the accelerator pedal was rapidly pressed to further accelerate the vehicle, the warning message and the system ready-off occurred. Analysis of these results indicated that the HV battery voltage decreased more than expected and the demand output limit information was sent to the HEV ECU for battery protection. However, the calculation of the output limit value by the HEV ECU was not following the output limit demand, and the output limit value was above the output limit demand. In this condition, if the accelerator pedal is pressed rapidly, the actual output is above the output limit demand, causing the voltage of battery cell to rapidly drop below the threshold, resulting in the warning message and system ready-off. Toyota concluded that the software logic in the subject vehicles created this condition.

Toyota collected vehicle data by using remote data retrieval from the market to assess the likelihood of future occurrences. Toyota concluded that voltage reduction due to hybrid battery deterioration over time could contribute to further occurrences.

January 27, 2023

Based on the results of the above investigation, Toyota decided to conduct a voluntary safety recall campaign.

As of January 26, 2023, based on a diligent review of records, Toyota's best engineering judgment is that there are no Toyota Field Technical Reports and 5 warranty claims that have been received from U.S. sources that relate or may relate to this condition and which were considered in the decision to submit this report.

7. Description of Corrective Repair Action:

All known owners of the subject vehicles will be notified to take their vehicles to a Toyota dealer. For all involved vehicles, the dealers will update the Hybrid Vehicle Control ECU software at no cost.

Reimbursement Plan for pre-notification remedies

As the owner notification letters will be mailed out well within the active period of the Toyota New Vehicle Limited Warranty ("Warranty"), all involved vehicle owners for this recall would have been provided a repair at no cost under the warranty.

8. Recall Schedule:

Notifications to owners of the affected vehicles will occur by April 3, 2023. A copy of the draft owner notification will be submitted as soon as it is available.

9. Distributor/Dealer Notification Schedule:

Notifications to distributors/dealers will be sent by February 2, 2023. Copies of dealer communications will be submitted as they are issued.

10. Manufacturer's Campaign Number:

23TA01