I. TariffAndCost

1. Introduction

This Functional Block provides tariff and cost information to an EV Driver, when a Charging Station is capable of showing this on a display.

Before a driver starts charging he needs to be given tariff information, given detailed prices for all the components that make up the tariff plan applicable to this driver at this Charging Station. As this is a human readable text message, it can also be used for other things, like a personal welcome message.

Some business cases might require the EV Driver to be shown the running total cost during charging, updated at a regular, fitting interval. When the EV Driver stops charging, he needs to be shown to the total cost of the just stopped transaction.

All tariffs and costs are in the currency configured in the Configuration Variable Currency.

1.1. Why no structured tariff information?

Because tariff structures can become very complex it will be difficult to convert these to human-readable text in the Charging Station. The CSO is the owner of the tariffs and should be able to provide the Charging Station with a human-readable tariff text. If the CSO is not able to generate human-readable texts from its own tariffs, how can a Charging Station be expected to be able to this. That is why we have kept the complexity of tariffs out of OCPP.

2. Use cases & Requirements

I01 - Show EV Driver-specific Tariff Information

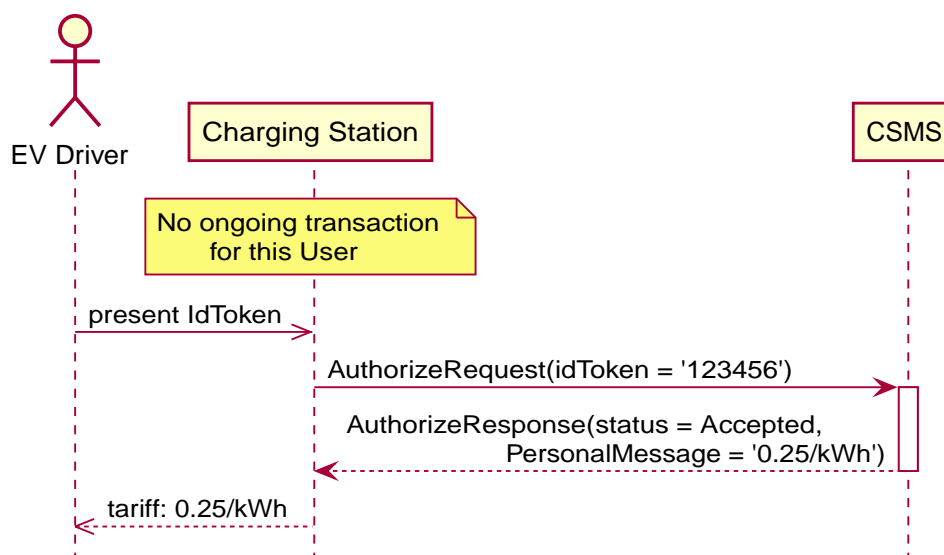| No.	Type	Description
1	**Name**	Show EV Driver-specific Tariff Information
2	**ID**	I01
	Functional block	I. Tariff and Cost
3	**Objective(s)**	To show an EV Driver-specific tariff before the start of a transaction.
4	**Description**	When an EV Driver wants to charge an EV he wants to know how much charging will cost him at the Charging Station he is at. The EV Driver is authenticated by his (RFID) token. The Charging Station asks the CSMS for information about the presented token. The CSMS returns information about the token, including the tariff applicable to this EV Driver.
	Actors	Charging Station, CSMS, EV Driver
	Scenario description	**1.** The EV Driver wants to charge an EV, he presents his IdTokenType. **2.** The Charging Station sends AuthorizeRequest to the CSMS to request authorization. **3.** Upon receipt of AuthorizeRequest, the CSMS responds with AuthorizeResponse. This response message indicates whether or not the IdTokenType is accepted by the CSMS, and reports the EV Driver-specific tariff in the personalMessage field. **4.** The Charging Station shows the EV Driver-specific tariff to the EV Driver.
	Alternative scenario(s)	I04 - Show Fallback Tariff Information
5	**Prerequisite(s)**	The Charging Station supports Tariff Information
6	**Postcondition(s)**	**Successful postcondition:** The EV Driver is authorized, knows which tariff is applicable for him/her and can start charging. **Failure postcondition:** If the authorization status is other than *Accepted*, the EV Driver can *not* start and might not know the tariff.

Figure 84. Sequence Diagram: Show EV Driver-specific tariff information

7	**Error Handling**	n/a
8	**Remarks**	The tariff information presented this way might be equal to any token presented. If known, and applicable, it is advisable to show the tariff information in a language understood by the EV Driver. It is advisable to give the driver the option to cancel the transaction when he does not agree with the tariff. This could be not plugging in the cable, or a cancel button in the user interface etc. As long at it is clear to the driver how a transaction can be canceled.

I01 - Show EV Driver-specific Tariff Information - Requirements

ID.	Precondition	Requirements
I01.FR.01		The CSMS MAY send EV Driver-specific tariff information in the PersonalMessage field of an AuthorizeResponse message.
I01.FR.02		The CSMS SHALL only send the tariff information if the Charging Station supports the tariff or DisplayMessage functionality.
I01.FR.03	I01.FR.01	The Charging Station SHALL show the EV Driver-specific tariff information to the EV Driver.

I02 - Show EV Driver Running Total Cost During Charging

| No.	Type	Description
1	Name	Show EV Driver Running Total Cost During Charging
2	ID	I02
	Functional block	I. Tariff and Cost
3	Objectives	To show an EV Driver the running total cost during charging
4	Description	While a transaction is ongoing, the driver wants to know how much the running total cost is, updated at a relevant interval.
	Actors	Charging Station, CSMS, EV Driver
	Scenario description	**1.** Every Y seconds the CSMS sends a CostUpdatedRequest to the Charging Station to update the current total cost. **2.** Upon receipt of the CostUpdatedRequest, the Charging Station responds with a CostUpdatedResponse. **3.** The Charging Station shows the current total cost to the EV Driver.
5	Prerequisites	The Charging Station supports Tariff Information Ongoing transaction
6	Postcondition(s)	**Successful postcondition:** The EV Driver knows the running total cost during charging. **Failure postcondition:** Total cost not known to the EV Driver during charging.
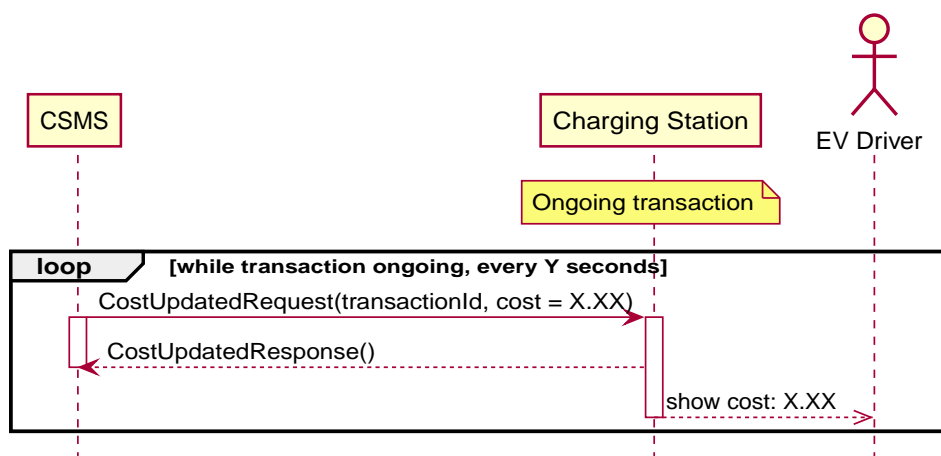
Figure 85. Sequence Diagram: Show EV Driver Running Total Cost During Charging

7	Error Handling	n/a
8	Remarks	Updating the running cost very often will create a lot of messages, which might result in high mobile data cost.

I02 - Show EV Driver Running Total Cost During Charging - Requirements

ID.	Precondition	Requirements
I02.FR.01		The CSMS SHALL send CostUpdatedRequest at a relevant interval/moment, this might depend on the charging speed, running cost, etc.
I02.FR.02	Upon receipt of a CostUpdatedRequest message.	The Charging Station SHALL respond with a CostUpdatedResponse message.
I02.FR.03	I02.FR.02	The Charging Station SHALL show the current total cost to the EV Driver.

I03 - Show EV Driver Final Total Cost After Charging

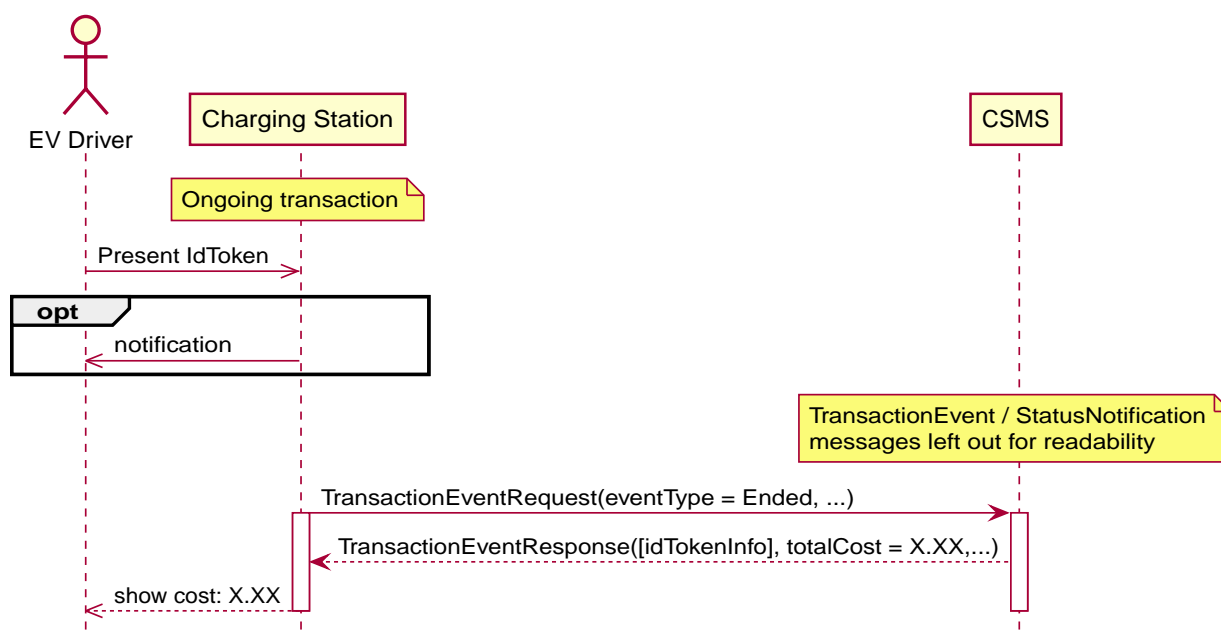| No.	Type	Description
1	Name	Show EV Driver Final Total Cost After Charging
2	ID	I03
	Functional block	I. Tariff and Cost
3	Objectives	To show an EV Driver the total cost after the transaction is finished.
4	Description	An EV Driver stops an ongoing transaction by presenting his identification token (for example RFID). The transaction is stopped and the total cost of the transaction is shown to the EV Driver.
	Actors	Charging Station, CSMS, EV Driver
	Scenario description	**1.** The EV Driver presents an IdTokenType to stop the transaction. **2.** The Charging Station sends TransactionEventRequest (eventType = Ended) **3.** The CSMS responds with TransactionEventResponse containing the total cost of the transaction. **4.** The Charging Station shows the total cost to the EV Driver.
	Alternative scenario's	I05 - Show Fallback Total Cost Message
5	Prerequisites	The Charging Station supports Tariff Information Ongoing transaction
6	Postcondition(s)	**Successful postcondition:** The EV Driver knows the total cost of the transaction. **Failure postcondition:** The EV Driver does NOT know the total cost of the transaction.

Figure 86. Sequence Diagram: Show EV Driver Final Total Cost After Charging

7	Error Handling	n/a
8	Remarks	If the Charging Station was offline when the transaction ended and the TransactionEventResponse with *totalCost* is received when the Charging Station comes back online some time after that, then there is no use in displaying the cost, because the user has likely left already. A similar situation applies when `TxStopPoint` is defined as ParkingBayOccupancy, in which case the EV must leave the Charging Station to cause the transaction to end. The scenario description and sequence diagram above are based on the Configuration Variable for stop transaction being configured as follows. `TxStopPoint`: ParkingBayOccupancy, EVConnected, Authorized This use-case is also valid for other configurations, but then the transaction might stop at another moment, which might change the sequence in which message are send. For more details see the use case: E06 - Stop Transaction options

I03 - Show EV Driver Final Total Cost After Charging - Requirements

ID.	Precondition	Requirements
I03.FR.01	When transaction is stopped	The Charging Station SHALL send a TransactionEventRequest (eventType = Ended) to the CSMS.
I03.FR.02	I03.FR.01 AND When Total Cost is known to the CSMS.	The CSMS SHALL send the total cost of the transaction in the totalCost field of the TransactionEventResponse message.
I03.FR.03	I03.FR.02 AND Charging Station was online when transaction stopped	The Charging Station SHALL display the total cost to the EV Driver.
I03.FR.04		To indicate a free transaction, the CSMS SHALL set *totalCost* to 0.00. Thus omitting *totalCost* does not imply that the transaction was free.
I03.FR.05	I02.FR.02 AND `TxStopPoint` is defined as ParkingBayOccupancy	The Charging Station SHOULD NOT display the total cost to the EV Driver. (Driver has left already).

I04 - Show Fallback Tariff Information

| No.	Type	Description
1	**Name**	Show Fallback Tariff Information
2	**ID**	I04
	Functional block	I. Tariff and Cost
3	**Objective(s)**	To show an EV Driver some information, generic tariff, a message etc., when the Charging Station cannot retrieve tariff information for this EV Driver.
4	**Description**	When an EV Driver wants to charge an EV, he wants an indication of how much charging will cost him at the Charging Station he is at, but the Charging Station cannot get a specific tariff for this EV Driver (for example: the Charging Station is *Offline*, or no EV Driver-specific tariff is available). For such scenarios, a fallback tariff information message can be configured in the Charging Station.
	Actors	Charging Station, EV Driver
	Scenario description	**1.** The EV Driver wants to charge an EV, he presents his IdTokenType. **2.** The Charging Station authorizes the EV Driver against the Authorization Cache **3.** The Charging Station shows the TariffFallbackMessage to the EV Driver.
	Alternative scenario's	I01 - Show EV Driver-specific Tariff Information
5	**Prerequisites**	The Charging Station supports Tariff Information the Configuration Variable: TariffFallbackMessage is configured.
6	**Postcondition(s)**	**Successful postcondition:** EV Driver has been shown the fallback tariff information message **Failure postcondition:** EV Driver has no information about the tariff at this Charging Station.
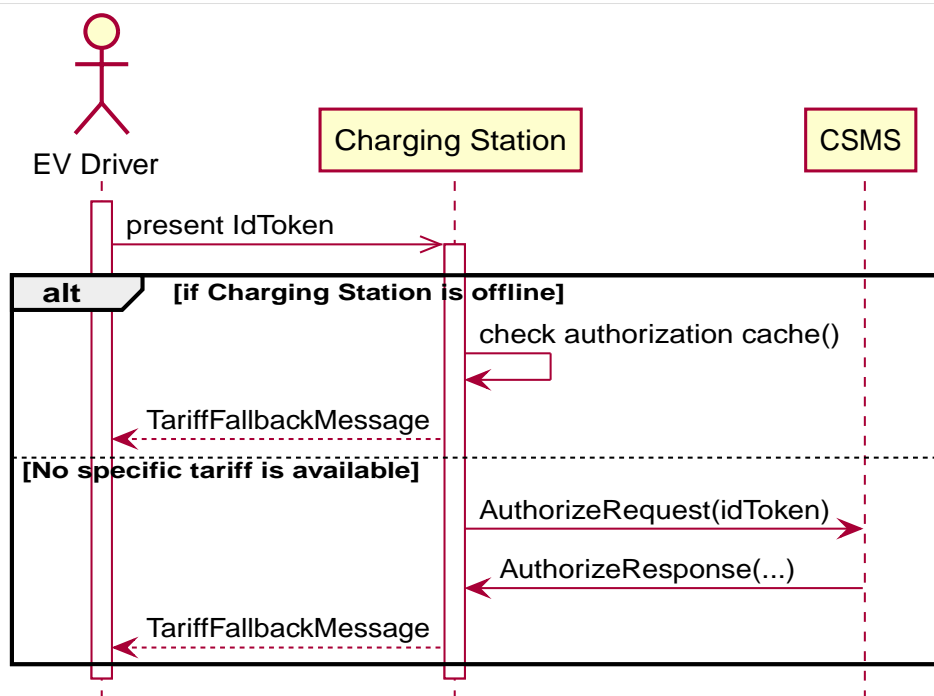
Figure 87. Sequence Diagram: Show Fallback Tariff Information

7	Error Handling	n/a
8	Remarks	n/a

I04 - Show Fallback Tariff Information - Requirements

ID.	Precondition	Requirements
I04.FR.01	When the Charging Station cannot get a specific tariff for the EV Driver (for example: the Charging Station is Offline, or no EV Driver-specific tariff is available.)	The Charging Station SHALL display a fallback tariff information message to the EV Driver, which is configured in the Configuration Variable: `TariffFallbackMessage`.
I04.FR.02		The CSMS MAY configure the TariffFallbackMessage via the Configuration Variable: `TariffFallbackMessage`.

I05 - Show Fallback Total Cost Message

No.	Type	Description
1	Name	Show Fallback Total Cost Message
2	ID	I05
	Functional block	I. Tariff and Cost
3	Objectives	To show an EV Driver a message instead of the actual total cost when the Charging Station is *Offline* when a transaction is stopped.
4	Description	When an EV Driver wants to stop an ongoing transaction, but the Charging Station is *Offline*. The transaction will be stopped as described earlier. The Charging Station cannot retrieve the total cost for the stopped transaction. The EV Driver needs to be given some message, this message can be configured in the Configuration Variable: TotalCostFallbackMessage.
	Actors	Charging Station, EV Driver
	Scenario description	**1.** The EV Driver presents IdTokenType to stop the transaction. **2.** The Charging Station stops the energy offer. **3.** The Charging Station shows the TotalCostFallbackMessage to the EV Driver.
	Alternative scenario's	I03 - Show EV Driver Final Total Cost After Charging
5	Prerequisites	The Charging Station supports Tariff Information The Charging Station is *Offline* the Configuration Variable: `TotalCostFallbackMessage` is configured.

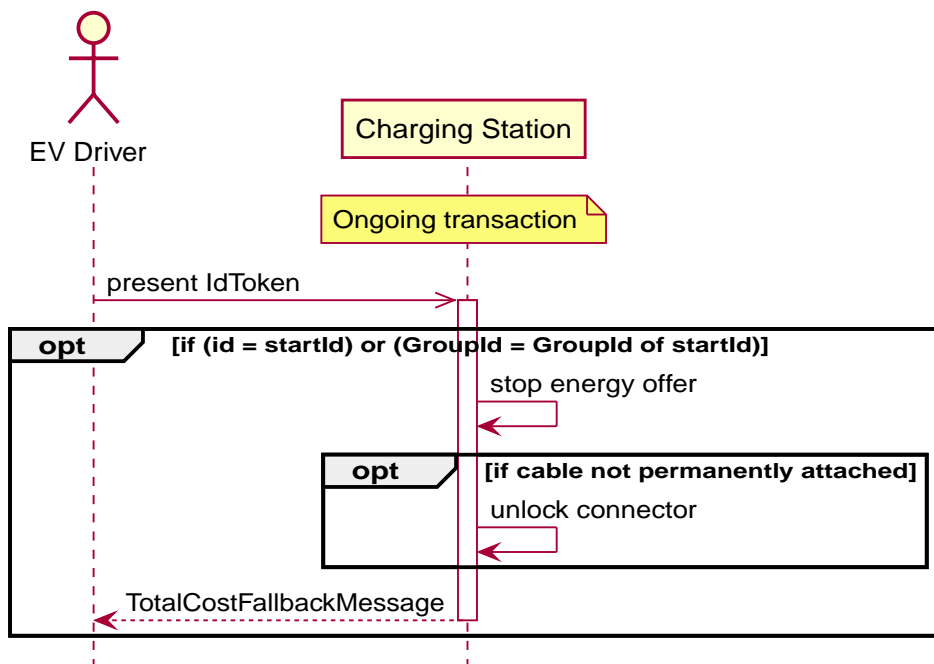| No.	Type	Description
6	Postcondition(s)	**Successful postcondition:** The EV Driver has received a pre-configured fallback message. **Failure postcondition:** The EV Driver has not received a pre-configured fallback message.

Figure 88. Sequence Diagram: Show Fallback Total Cost Message

7	Error Handling	n/a
8	Remarks	n/a

I05 - Show Fallback Total Cost Message - Requirements

ID.	Precondition	Requirements
I05.FR.01		The CSMS MAY configure the fallback total cost information message via the Configuration Variable: `TotalCostFallbackMessage`.
I05.FR.02	When the Charging Station cannot retrieve the total cost for the stopped transaction, because the Charging Station is offline.	The Charging Station SHALL show a fallback total cost information message to the EV Driver.

I06 - Update Tariff Information During Transaction

No.	Type	Description
1	Name	Update Tariff Information During Transaction
2	ID	I06
	Functional block	I. Tariff and Cost
3	Objectives	To show an EV Driver updated tariff information during a transaction.
4	Description	During charging (especially DC fast charging) it might be useful to show the EV driver updated tariff information when it becomes available. Example: If a tariff has a bandwidth: *charging will cost between 0,25 and 0,40 euro/kWh depending on current energy price. Current price is 0,28 euro/kWh.* Then when the price changing, this tariff information needs to be updated: *charging will cost between 0,25 and 0,40 euro/kWh depending on current energy price. Current price is 0,32 euro/kWh.*

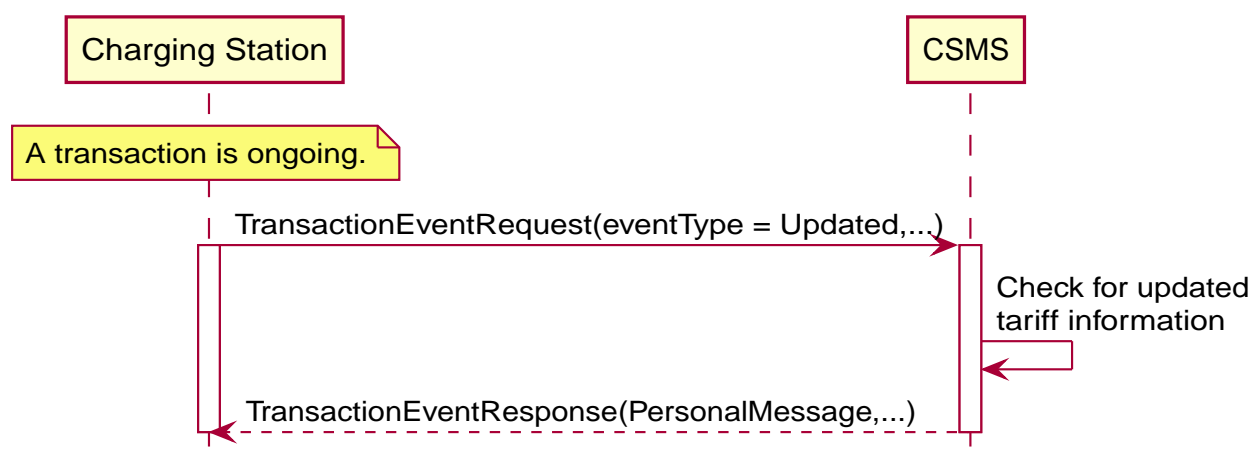| No.	Type	Description
	Scenario description	**1.** The Charging Station sends TransactionEventRequest (eventType = Updated) messages during the transaction. **2.** When the CSMS receives a TransactionEventRequest message it checks if there is updated tariff information available. **3.** The CSMS acknowledges with a TransactionEventResponse message, which contains the updated tariff information if available.
5	Prerequisites	The Charging Station supports Tariff Information There is a transaction ongoing
6	Postcondition(s)	**Successful postcondition:** The updated tariff information is shown to the EV Driver. **Failure postcondition:** The EV Driver has not been shown the updated tariff information.

Figure 89. Sequence Diagram: Update Tariff Information During Transaction

7	Error Handling	n/a
8	Remarks	There may be a policy or a legal requirement in place, that the tariff communicated at the start of the transaction must be used for the entire transaction, in which case no updated tariff information should be sent during the transaction.

I06 - Update Tariff Information During Transaction - Requirements

ID.	Precondition	Requirements
I06.FR.01	When the CSMS receives a TransactionEventRequest (eventType = Updated) from the Charging Station.	The CSMS SHALL check if there is updated tariff information available.
I06.FR.02	I06.FR.01 AND When there is updated tariff information available.	The CSMS SHALL respond with a TransactionEventResponse message to the Charging Station, containing the updated tariff information in the PersonalMessage field.
I06.FR.03	I06.FR.02	The Charging Station SHALL display the updated tariff information to the EV Driver.