DB2605 EV Charging Evaluation Kit

CCU Simulator Guide

Rev 1.0.3, July 2024

Please read this user manual carefully before use and retain it for future reference.

Contents

1 Preparation

The Dropbeats CCU (Charge Control Unit) Simulator uses a Raspberry Pi as the CCU platform and ssh client MobaXterm to work with the DB2605 EV Charging Controller to simulate a charging session.

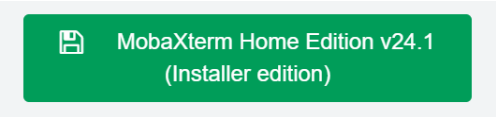
1.1 Raspberry Pi Setup

To find the Raspberry Pi IP address, see
https://raspberrytips.com/find-current-ip-raspberry-pi/

1.2 Raspberry Pi SSH Connection via MobaXterm

MobaXterm Installation

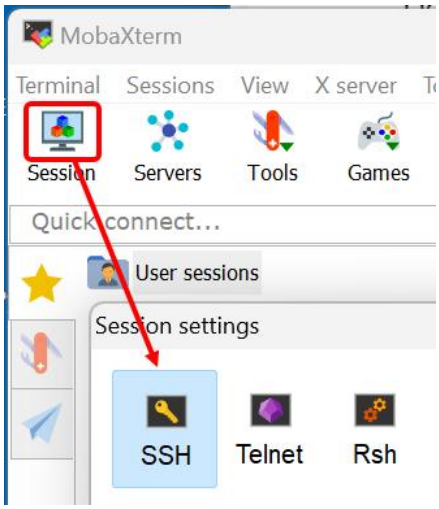
1. Go to https://mobaxterm.mobatek.net/download-home-edition.html and download the MobaXterm Home Edition. Download the Installer Edition, not the Portable Edition.



2. Install it as you would any other Windows program
3. Once MobaXterm is installed, start it

Ssh Connection Setup

1. Click the Session icon in the upper left corner



2. Click the SSH icon
3. Enter your Raspberry Pi IP address in the remote host text area, then click OK
4. At the login window, input Raspberry Pi username and password

   As default, Username: dropbeats Password: db2605

1.3 Pre-installed Image and Tools

1. CCU Simulator path : dropbeats/CCU_Simulator/

   DB2605_CCU_Simulator_Rasp_V1.0.x
2. DB2605 Firmware & File System path : dropbeats/DB2605/Firmware/

   DB2605_EV_Charging_FW_GEN_F00_V1.0.x.bin

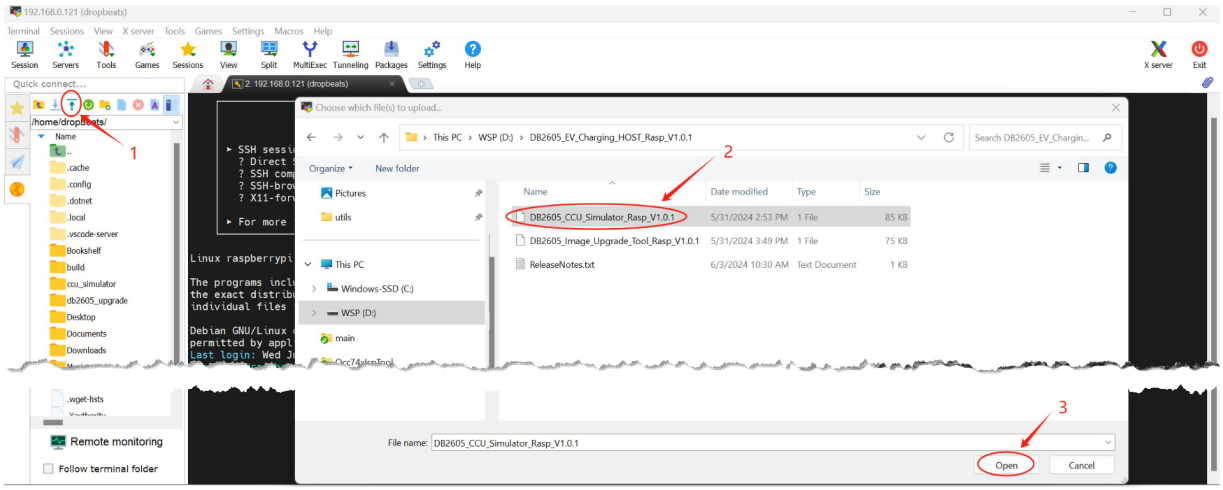
   DB2605_EV_Charging_FS_GEN_F00_V1.0.x.bin
3. Upgrade Tool path : dropbeats/DB2605/Upgrade_Tool/

   DB2605_Image_Upgrade_Tool_Rasp_V1.0.x

1.4 Upgrade CCU Simulator into Raspberry Pi

If new CCU Simulator version is released, the below steps help to upgrade CCU Simulator.

In MobaXterm, click the Upload button (1), select DB2605_CCU_Simulator_Rasp_V1.0.x (2), and click Open (3).



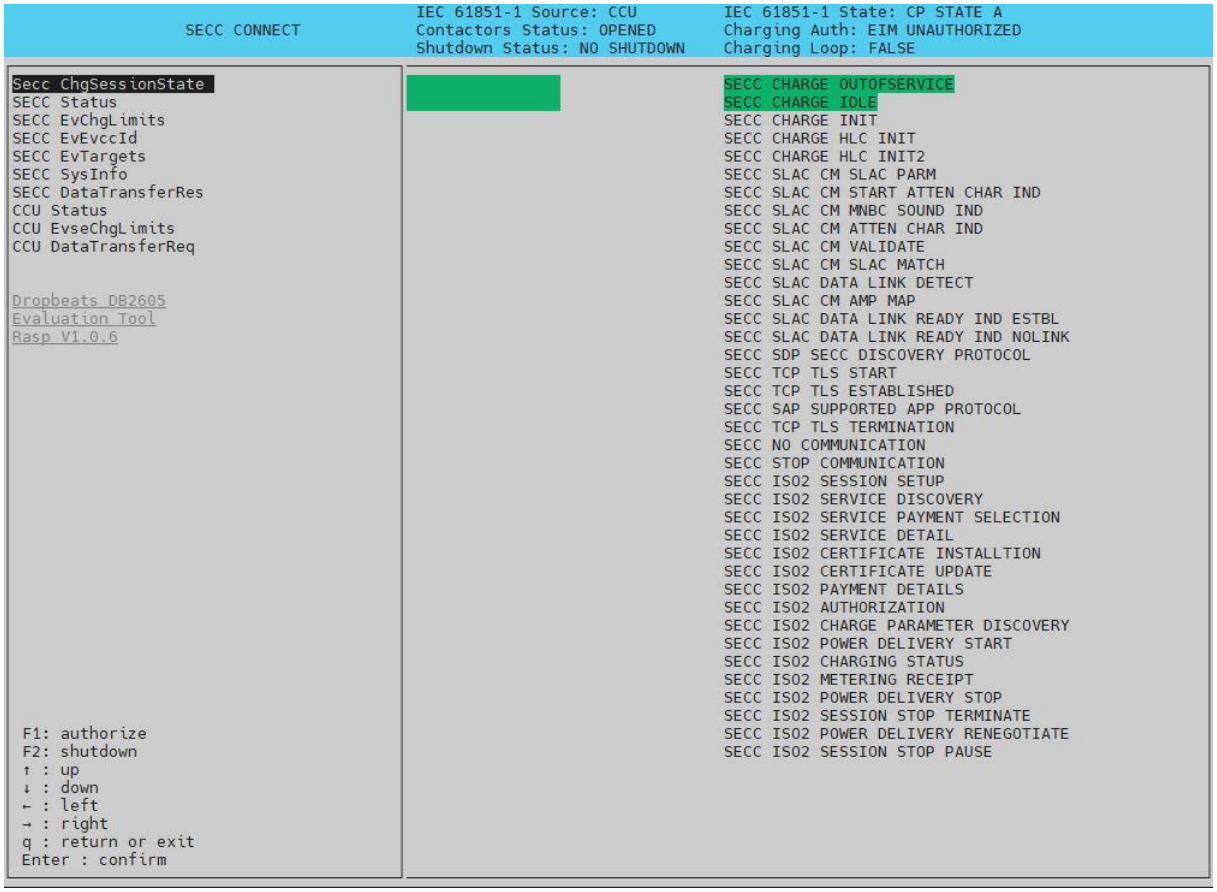
2 CCU Simulator Usage

2.1 Initial Status

Type sudo chmod +x ./DB2605_CCU_Simulator_Rasp_V1.0.x

sudo ./DB2605_CCU_Simulator_Rasp_V1.0.x

The CCU simulator is actively running to facilitate the charging service.



Keyboard Main Functions:

F1： authorize to start a charge session.

F2: shutdown to stop a charge session.

Ribbon Indicators:

SECC CONNECT/RUN:	Indicates SECC connection to Raspberry Pi. Changes to "RUN" with Green color if a charge session starts Initial status: SECC CONNECT
IEC 61851-1 Source:	Indicates whether the IEC 61851-1 source is SECC or CCU. Default Source: CCU

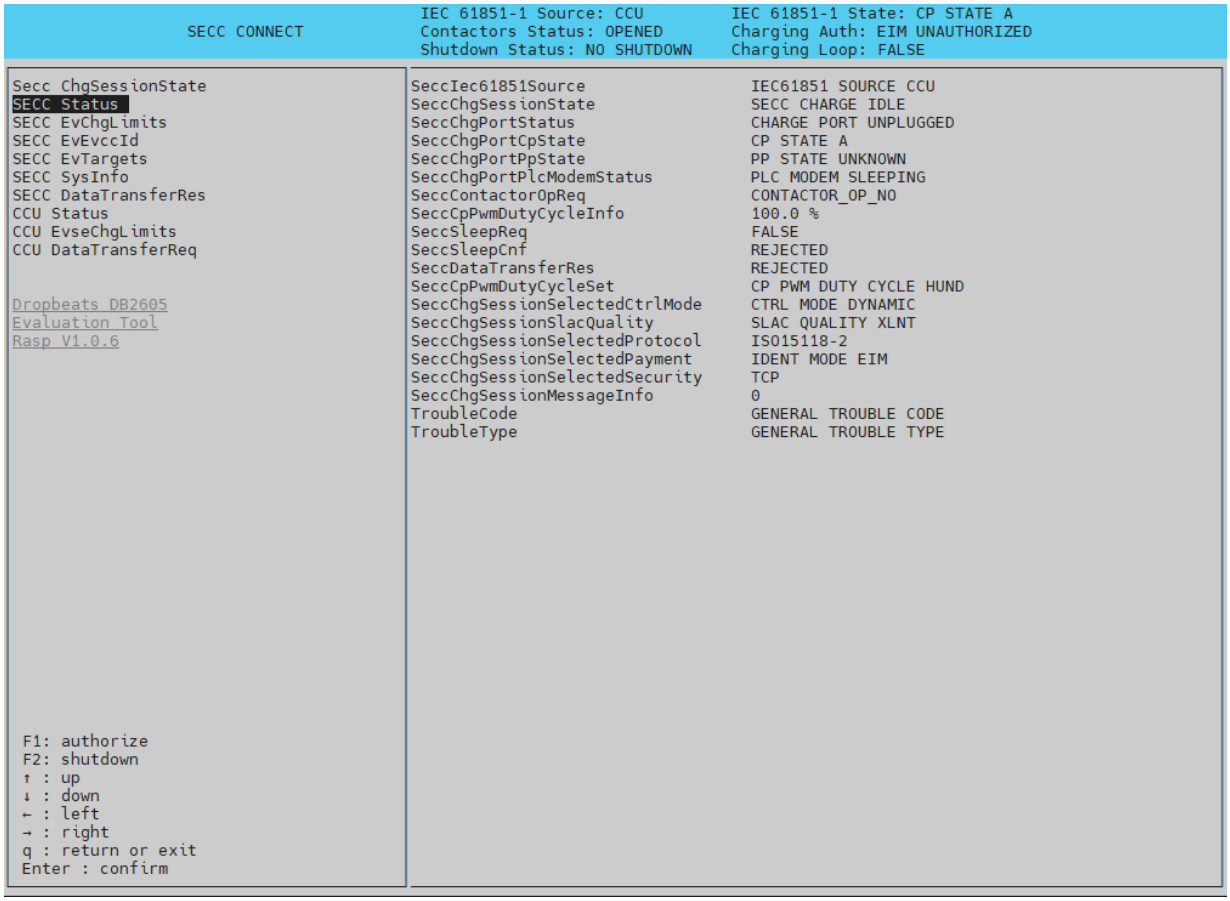
IEC 61851-1 State:	Represents the control pilot state with states A, B, C, D, E, F. Initial status: CP STATE A
Contractors Status:	Shows status as OPENED or CLOSED, indicating the contactors status. Initial status: OPENED
Charging Auth:	Displays EIM UNAUTHORIZED or AUTHORIZED, indicating the authorization status for charging. Initial status: EIM UNAUTHORIZED
Shutdown Status:	Indicates NO SHUTDOWN or NORM SHUTDOWN, showing the shutdown status. Initial status: NO SHUTDOWN
Charging Loop:	Shows TRUE or FALSE, indicating whether the charging loop is active. Initial status: FALSE

Views:

SeccChgSessionState	The signal of the message "SECC_Status". set of states that define the current status of an EV charging session within the SECC(DB2605).
SECC Status	The message, SECC_Status
SECC EvChgLimits	The message, EV charging limits which is indicated in charge parameter discovery.
SECC EvEvccId	The message, EV EVCCID which is indicated in Session Setup.
SECC EvTargets	The message, EV targets which is indicated in charge parameter discovery.
SECC SysInfo	The message, System information of DB2605.
SECC DataTransferRes	The message, the response of data transfer.
CCU Status	The message, CCU_Status
CCU EvseChgLimits	The message, EVSE charging limits.
CCU DataTransferReq	The message, the request of data transfer.

For a detailed definition, please refer to the DB2605 EV Charging Controller Communication Matrix.

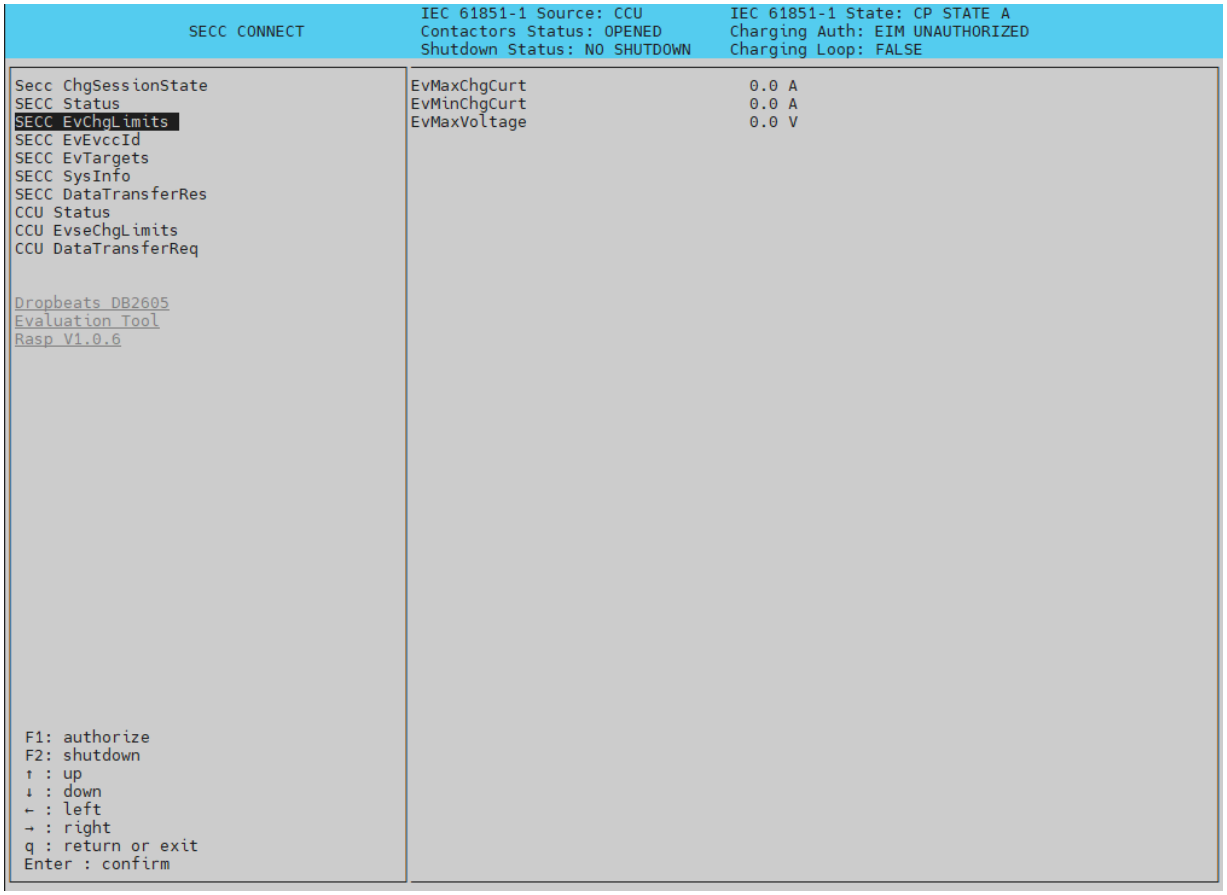
2.2 SECC Status View



SeccIec61851Source	Indicates the source of the IEC 61851-1 control pilot, proximity pilot generation, and measurement. IEC61851_SOURCE_CCU/SECC
SeccChgSessionState	Indicates the current state of a charge session.
SeccChgPortStatus	Indicates the charge port status CHARGE_PORT_UNKNOWN/UNPLUGGED/PLUGGED/DEPRESSED In case that IEC61851 source is CCU, this status is the mirror of signal, CcuChgPortStatus of the message CCU_Status
SeccChgProtCpStatus	Indicates the charge port control pilot status PILOT_ST_UNKNOWN/CP_STATE_A/B/C/D/E/F/ERROR In case that IEC61851 source is CCU, this status is the mirror of signal, CcuChgPortCpStatus of the message CCU_Status.
SeccChgPortPpStatus	Indicates the charge port proximity pilot status PP_STATE_UNKNOWN/DISCONNECTED/CONNECTED/CONNECTED In case that IEC61851 source is CCU, this status is the mirror of signal, CcuChgPortPpStatus of the message CCU_Status
SeccChgPortPlcModemStatus	Indicates PLC modem status.

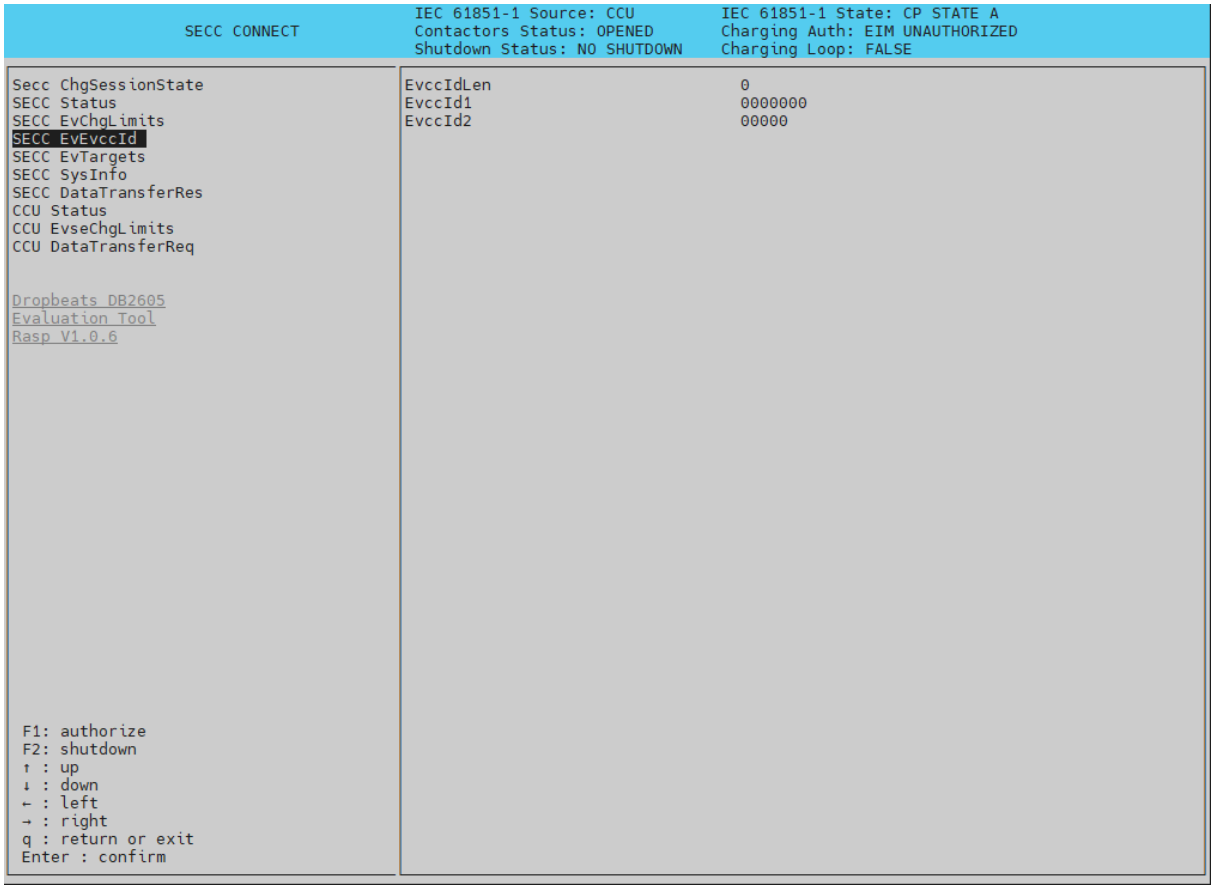
	PLC_MODEM_SLEEPING/SLEEPING
SeccContactorOpReq	Specifies that SECC requests contactors' operation.
	CONTACTOR_OP_NO/CLOSE/OPEN
SeccCpPwmDutyCycleInfo	Indicates PWM duty cycle information.
	0-100%
SeccSleepReq	Specifies whether SECC requests sleep.
	True/False
SeccSleepCnf	Indicates SECC response status to sleep.
	Accepted/Rejected
SeccDataTransferRes	Indicates SECC response status to data transfer.
	Accepted/Rejected
SeccCpPwmDutyCycleSet	Specifies CCU generates the PWM pulse with defined duty cycle.
	CP_PWM_DUTY_CYCLE_UNCH/HUND/NOML/FIVE/ZERO
SeccChgSessionSelectedCtrlMode	Indicates the control mode of ISO1511-20 charge session.
	CTRL_MODE_SCHEDULED/DYNAMIC
SeccChgSessionSlacQuality	Indicates SLAC quality of charge session
	SLAC_QUALITY_XLNT/GOOD/NORM/POOR
SeccChgSessionSelectedProtocol	Indicates which charge protocol is selected for the current charge session.
	ISO15118_2/20
SeccChgSessionSelectedPayment	Indicates which payment mean is selected for the current charge session.
	IDENT_MODE_EIM/PNC
SeccChgSessionSelectedSecurity	Indicates which transport layer protocol is selected for the current charge session.
	TCP/TLS
SeccChgSessionMessageInfo	Indicates whether and how many messages have been received in each state.
TroubleCode	SECC Diagnostic Trouble Code
TroubleType	SECC Diagnostic Trouble Type

2.3 SECC EV Charge Limits View



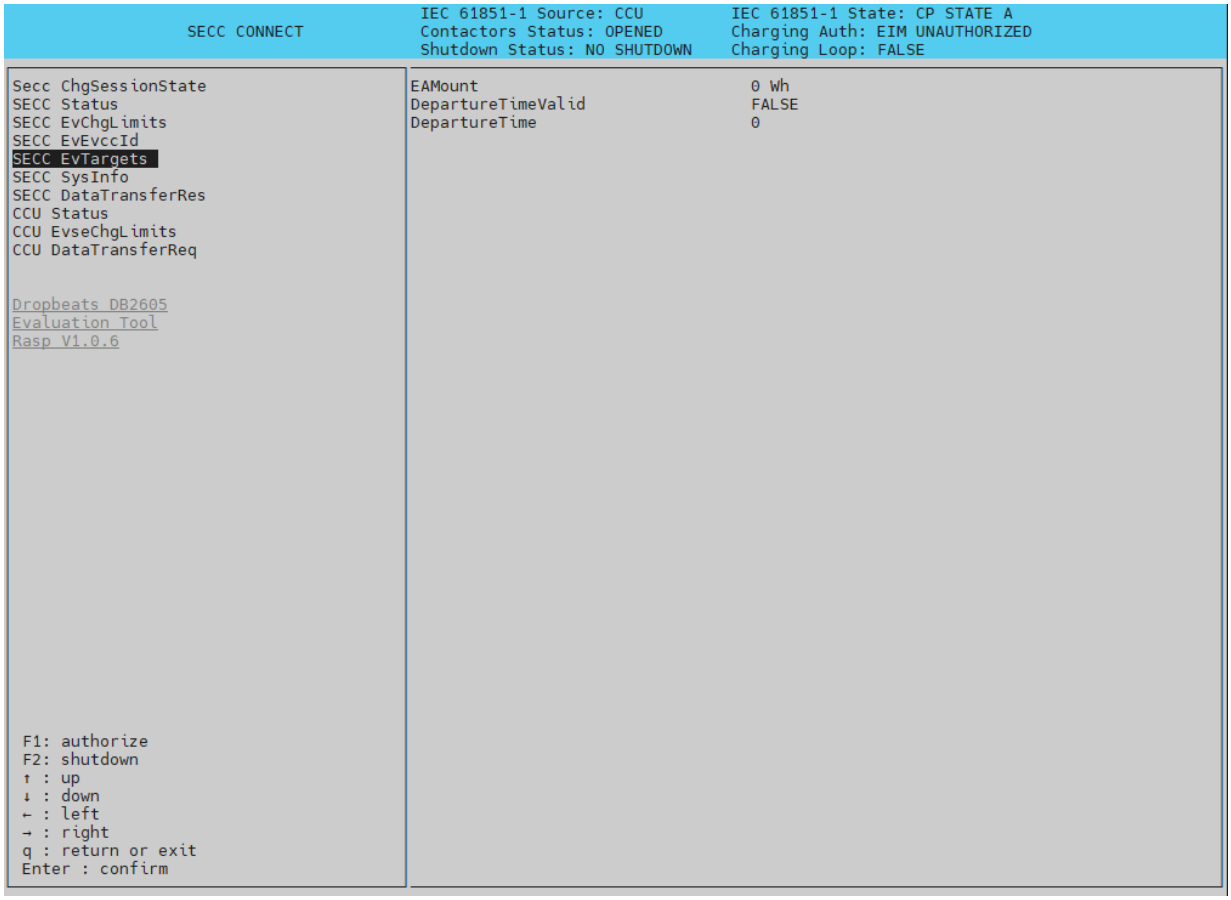
EvMaxChgCurt	Indicates Maximum current supported by the EV per phase. Unit: A; Rang 0-400
EvMinChgCurt	Indicates that charging below this minimum is not energy/cost efficient for the EV. It is recommended that the SECC considers this value during the target setting process (e.g. sale tariff table should account for this value). Unit: A; Rang 0-400
EvMaxVoltage	Indicates the RMS of the maximal nominal voltage the vehicle can accept, measured between one phase and neutral. Unit: V; Rang 0-1000

2.4 SECC EV EVCCID View



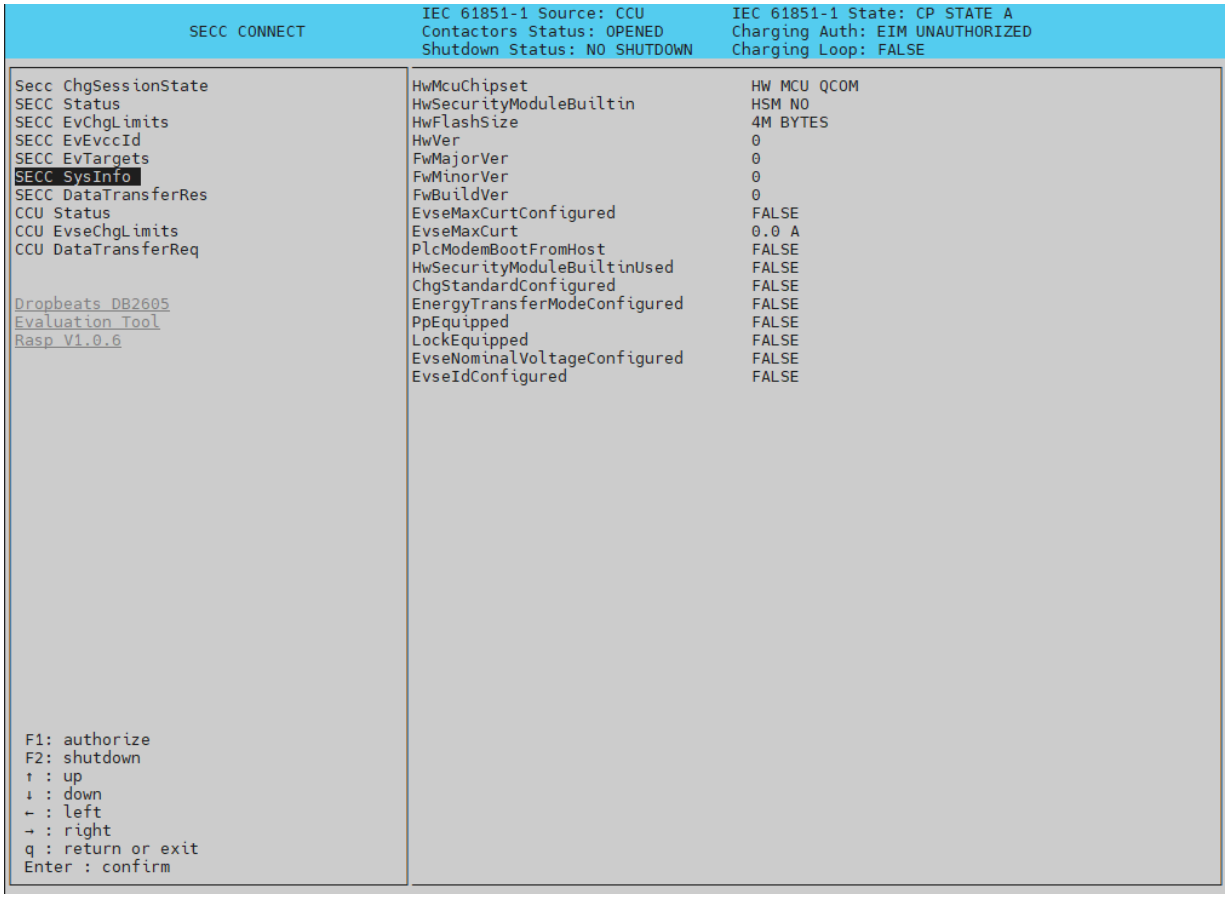
EvccIdLen	Indicates EVCCID length. This element shall have a length of six bytes of the MAC address of the EVCC. Unit: bytes
EvccId1	Indicates EVCC ID for Organizationally Unique Identifier(OUI).
EvccId2	Indicates EVCC ID for the rest.

2.5 SECC EV Target View



EAMount	Indicates the amount of energy reflecting the EV's estimate how much energy is needed to fulfill the user configured charging goal for the current charging session.
DepartureTimeValid	Indicates whether the value of Departure Time signal is valid. True/False
DepartureTime	Indicates when the vehicle intends to finish the charging process. Offset in seconds from the point in time of sending this message.

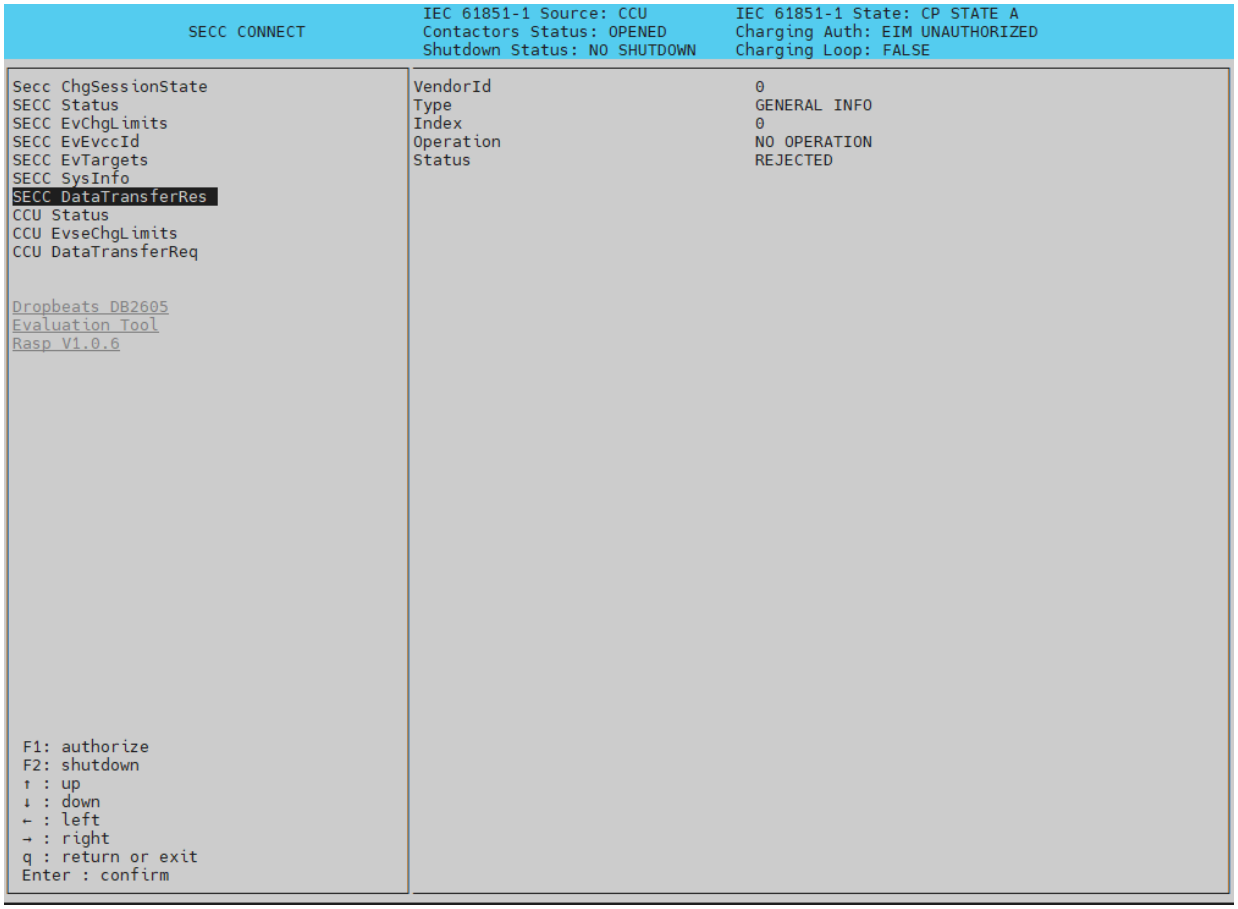
2.6 SECC System Information View



HwMcuChipset	Indicates which the MCU chipset is used. HW_MCU_QCOM
HwSecurityModuleBuiltin	Indicates which built-in hardware security module is used. HSM_NO/TYPE1/TYPE2/TYPE3
HwFlashSize	Indicates the Flash size. 4MByes/8MByes
FwMajorVer	Indicates the firmware version(major).
FwMinorVer	Indicates the firmware version(minor).
FwbuildVer	Indicates the firmware version(build).
EvseMaxCurtConfigured	Indicates whether the EVSE maximal current has been configured.
EvseMaxCurt	Indicates the EVSE maximal current.
PlcModemBootFromHost	Indicates the PLC modem boots from Host.
HwSecurityModuleBuiltinUsed	Indicates the built-in hardware security module is used.
ChgStandardConfigured	Indicates whether the charge standard has been configured.
EnergyTransferModeConfigured	Indicates whether energy transfer mode has been configured.
PpEquipped	Indicates whether the proximity pilot has been equipped, and monitored.

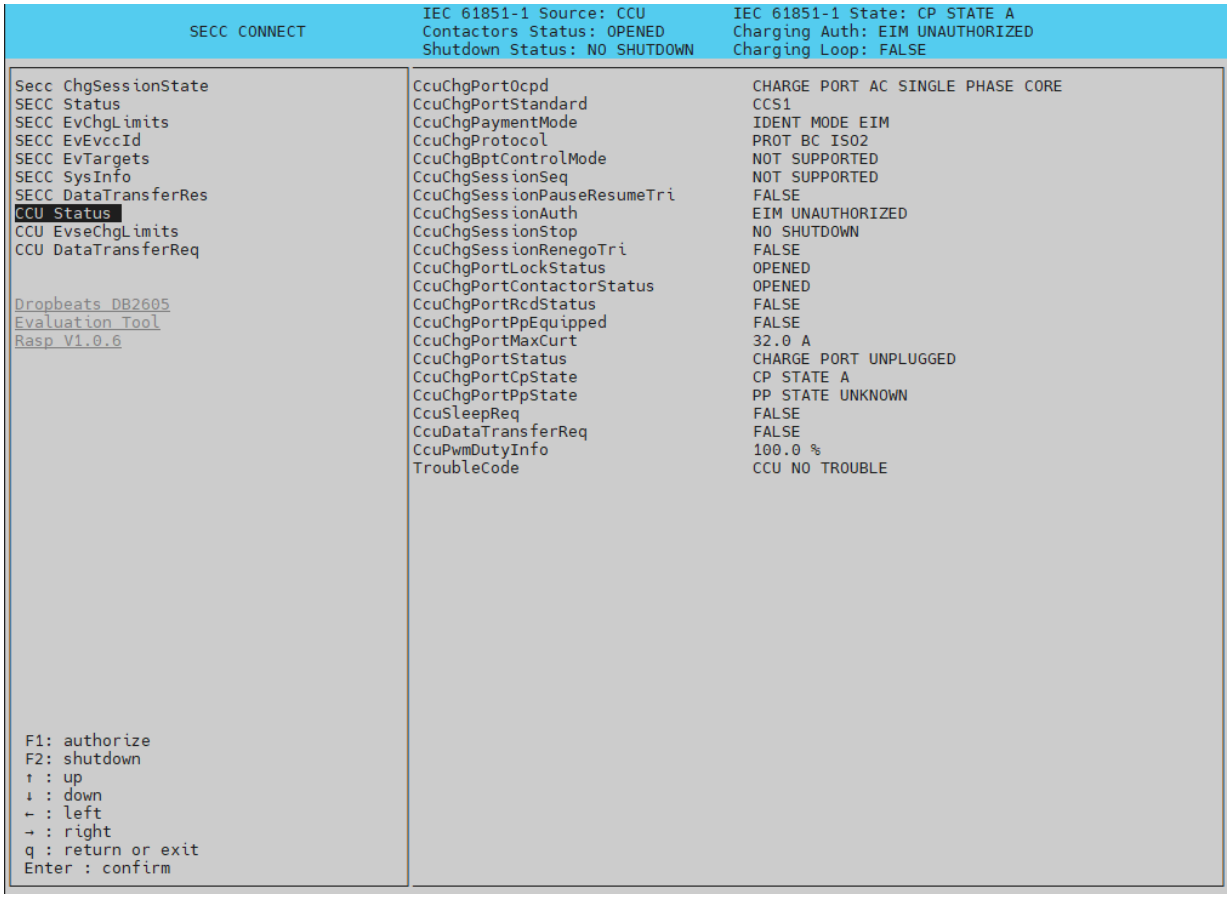
LockEquipped	Indicates whether a locker has been equipped.
EvseNominalVoltageConfigured	Indicates whether EVSE nominal voltage has been configured.
EvseIdConfigured	Indicates whether EVSE ID has been configured.

2.7 SECC Data Transfer Response View



VendorID	Indicates data transfer vendor id.
Type	Indicates data transfer type.
Index	Indicates data transfer index.
Operation	Indicates data transfer operation.
Status	Indicates data transfer response operation status.
	Accepted/Rejected/unknownVendorId/unknownType/unknownIdx /unknownOp/Ongoing /Completed /Failed

2.8 CCU Status View

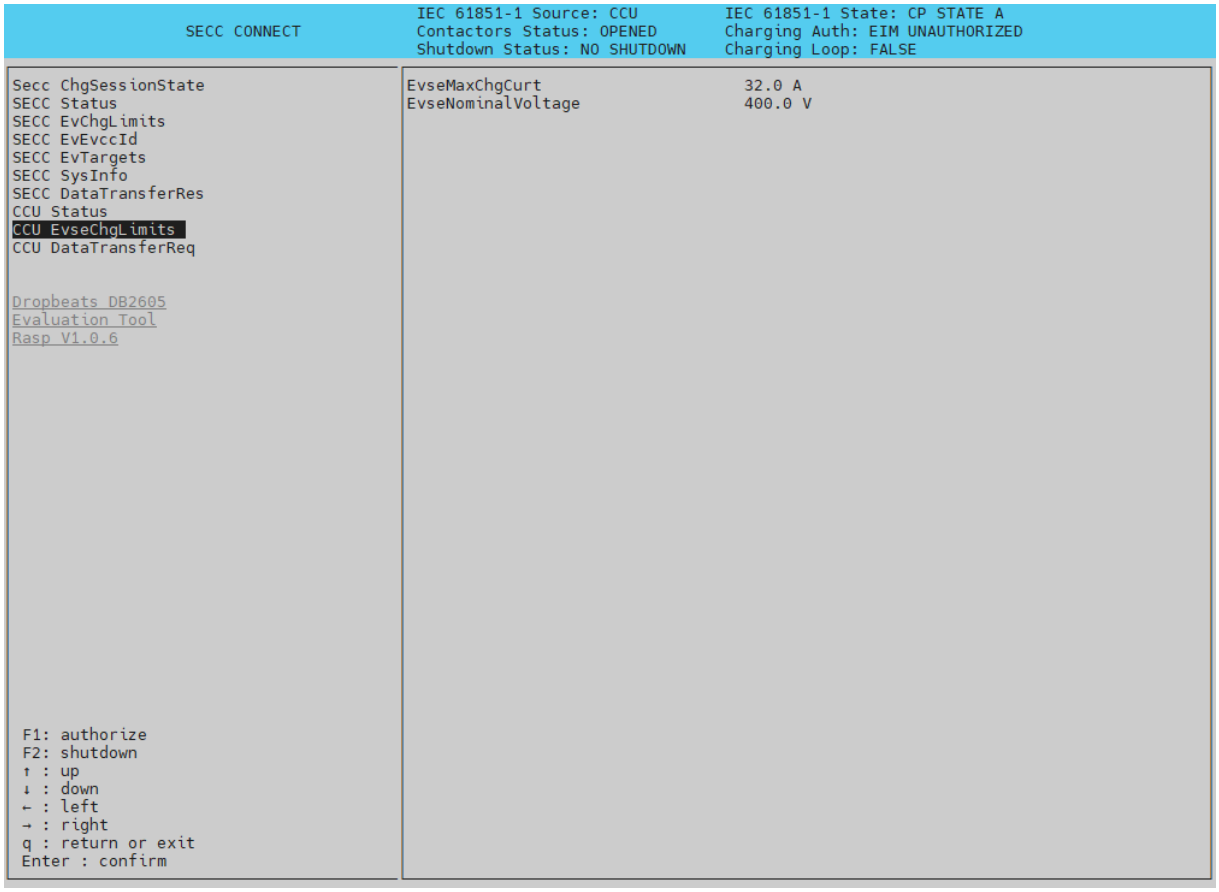


CcuChgPortOcpd	Specifies whether and which type power occupies the charge port. CHARGE_PORT_UNOCCUPIED/AC_SINGLE_PHASE_CORE/ AC_THREE_PHASE_CORE_CASE_B/EXTENDED
CcuChgPortStandard	Specifies the charge standard. CCS1/CCS2
CcuChgPaymentMode	Specifies the charge payment mode. IDENT_MODE_EIM/IDENT_MODE_PNC/IDENT_MODE_BOTH
CcuChgProtocol	Specifies the charge protocol. PROT_BC_ISO2
CcuChgBptControlMode	Specifies Scheduled or/and Dynamic control mode NOT_SUPPORTED/ CTRL_MODE_SCHEDULED /CTRL_MODE_DYNAMIC/CTRL_MODE_SCHEDULED_DYNAMIC
CcuChgSessionSeq	Indicates CCU charge session sequence. This shall be provided by CCU. As default: Not Supported
CcuChgSessionPauseResumeTri	Specifies whether CCU Triggers resume from pause.

	True/False
CcuChgSessionAuth	Specifies the charging session authorization status. EIM_UNAUTHORIZED/EIM_AUTHORIZED/FREE_SERVICE
CcuChgSessionStop	Specifies the charging session stop actions. NO_SHUTDOWN/NORM_SHUTDOWN/EMGY_SHUTDOWN/OTHS_SHUTDOWN
CcuChgSessionRenegoTri	Specifies whether CCU Triggers Renegotiation. True/False
CcuChgPortLockStatus	Specifies the locker status in case of that Locker is equipped. OPENED/COLSED
CcuChgPortContactorStatus	Specifies the Contactor's status. OPENED/COLSED
CcuChgPortRcdStatus	Specifies the current status of the Residual Current Device (RCD). If RCD is equal to true, the RCD has detected an error. If RCD is equal to false, the RCD has not detected an error. This status flag is for informational purpose only. True/False
CcuChgPortPpEquipped	Specifies whether the proximity pilot is equipped or not. True/False
CcuChgPortMaxCurt	Specifies the charge port maximal current. 6-80A
CcuChgPortStatus	Indicates the charge port status CHARGE_PORT_UNKNOWN/UNPLUGGED/PLUGGED/DEPRESSED In case that IEC61851 source is SECC, this status shall be the mirror of signal, SeccChgPortStatus of the message SECC_Status
CcuChgPortCpState	Indicates the charge port control pilot status PILOT_ST_UNKNOWN/CP_STATE_A/B/C/D/E/F/ERROR In case that IEC61851 source is SECC, this status shall be the mirror of signal, SeccChgPortCpStatus of the message SECC_Status.
CcuChgPortPpState	Indicates the charge port proximity pilot status PP_STATE_UNKNOWN/DISCONNECTED/CONNECTED/CONNECTED In case that IEC61851 source is SECC, this status shall be the mirror of signal, SeccChgPortPpStatus of the message SECC_Status.
CcuSleepReq	Specifies the CCU requests to sleep. True/False
CcuDataTransferReq	Specifies the CCU requests data transfer. True/False
CcuCpPwmDutyCycleInfo	Indicates PWM duty cycle information in case of that IEC 61851-1 source is CCU. 0-100%
TroubleCode	CCU trouble codes.

Most of items could be modified by "left" key and then "enter" key.

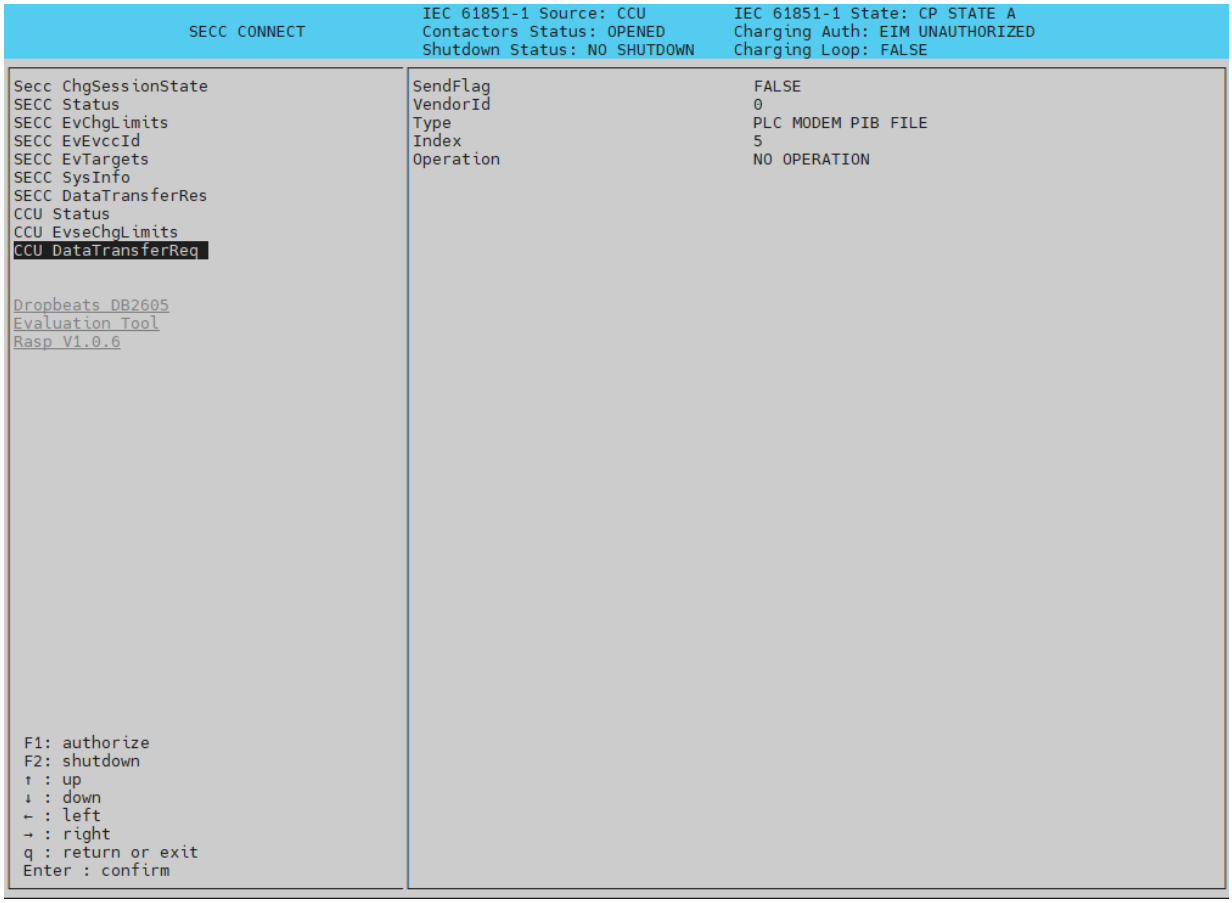
2.9 CCU EVSE Charge Limits View



EvseMaxChgCurt	Specifies the maximum line current per phase the EV can draw. Unit: A; Rang 0-400
EvseNominalVoltage	Specifies the line voltage supported by the EVSE. Unit: V; Rang 0-1000

These two items could be modified by “left” key and then “enter” key.

2.10 CCU Data Transfer Request View



SendFlag	Send Flag
VendorID	Indicates data transfer vendor id.
Type	Indicates data transfer type.
Index	Indicates data transfer index.
Operation	Indicates data transfer operation.

For a detailed definition of VendorID,Type,Index and Operation, please refer to the DB2605 EV Charging Controller Communication Matrix.

After configuring VendorID, Type, Index, Operation, and then changing SendFlag to True, the operation actions will be done.

3 User Cases

3.1 First Plug in, Then Authorize

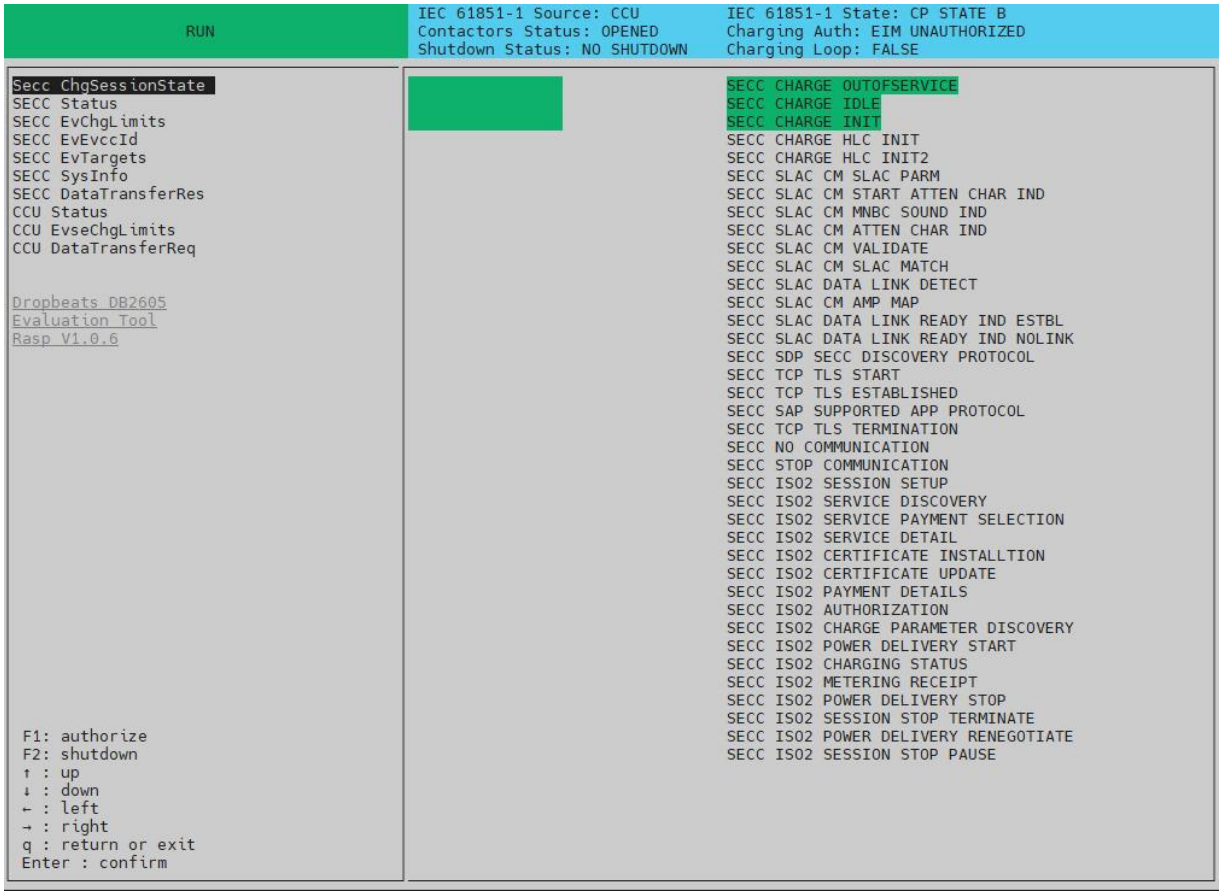
In this user case, the charging session starts with physically connecting the electric vehicle (EV) to the charging system before initiating authorization. Here is a detailed description of the steps:

1. Plug In

- User begins by switching **SW1 ON** on the Vehicle Coupler board to simulate plugging in the EV.

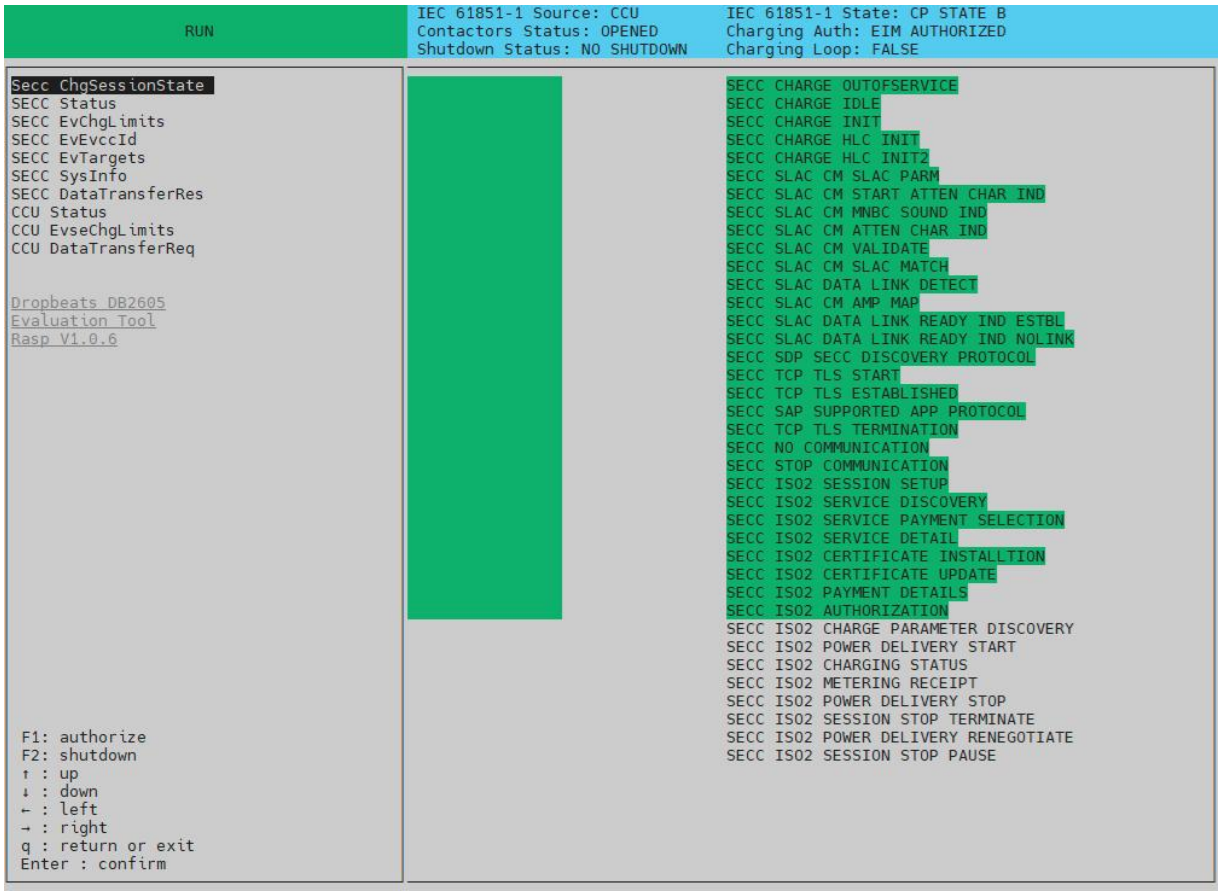
- The system detects the connection, updating the "IEC 61851-1 State" to "CP_STATE_B", indicating that the EV is connected and awaiting further instructions to begin charging.

- Successful periods and messages on the system interface change to green, confirming that the charging process is active.



2. Authorize to start charging

- User then presses **F1** to authorize and start the charging session.
- The system updates the “Charging Auth” status to “EIM AUTHORIZED”, confirming that the EV has been successfully authorized to begin charging.
- At this point, the “Contactors” remain “OPENED” and the “Charging Loop” status is “FALSE” since the actual charging process has not started yet.



3. Begin Charging Session

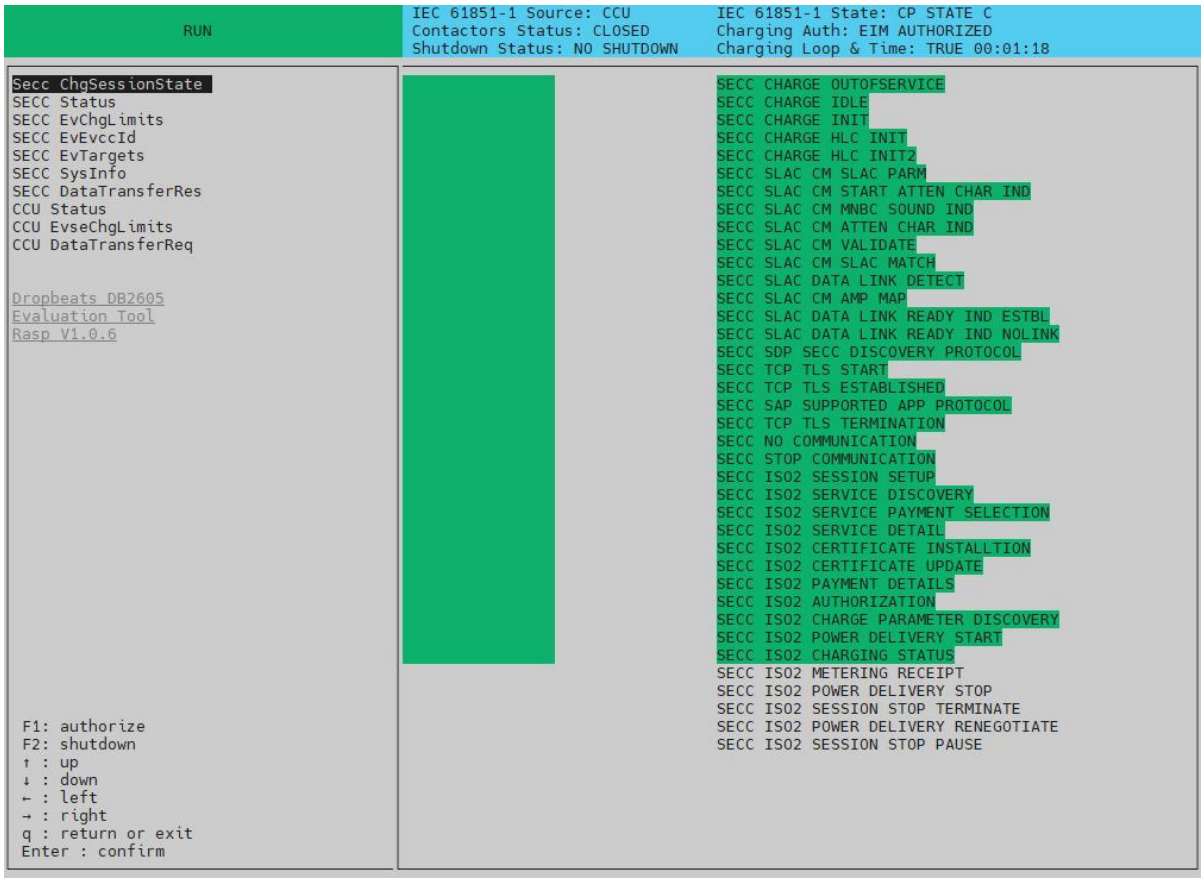
- After pressing **F1**, the charging session starts automatically.

- The “IEC 61851-1 State” transitions to “CP_STATE_C”, indicating that the vehicle is ready to receive power.

- The system closes the “Contactors”, and the “Charging Loop” status updates to “TRUE”, showing that charging is in progress.

- Additionally, the “SECC ISO2/20 CHARGING STATUS” shows that the system is in the V2G charging loop period.

- Notes: The “Contactors” are automatically changed to “CLOSE” status in simulator.



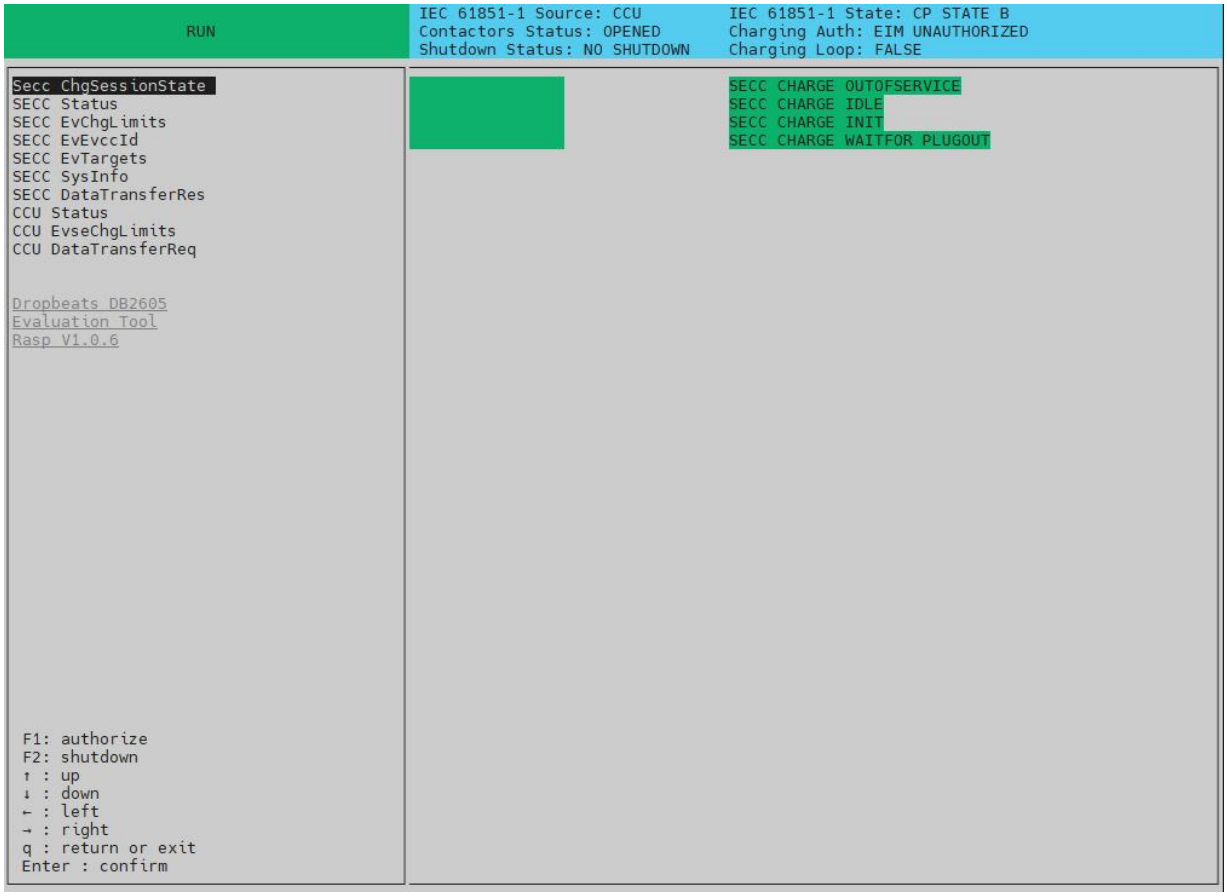
4. Stop Charging

- User presses **F2** to stop the charging process.

- The system responds by changing the “IEC 61851-1 State” back to “CP_STATE_B”, indicating that the EV is no longer ready to charge.

- The “Contactors” open, and the “Charging Loop” status returns to “FALSE”.

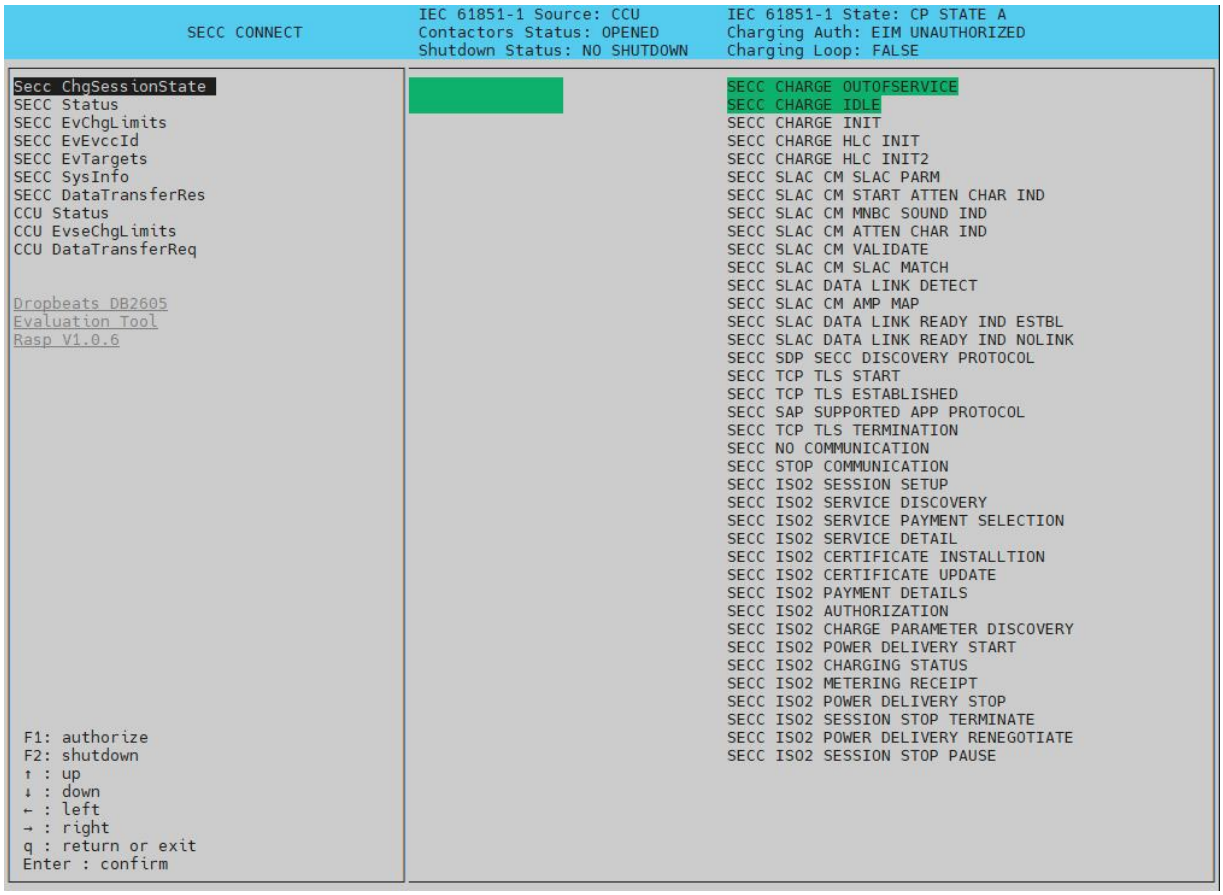
- The “Charging Auth” status is updated to “EIM UNAUTHORIZED”, indicating that the EV is no longer authorized for charging.



5. Plug Out

- Finally, user switches **SW1 OFF** on the Vehicle Coupler board to simulate unplugging the EV.

- The simulator transitions to “SECC CHARGE IDLE”, resetting all parameters and indicating that the system is now idle and ready for the next charging session.



3.2 First Authorize, Then Plug in

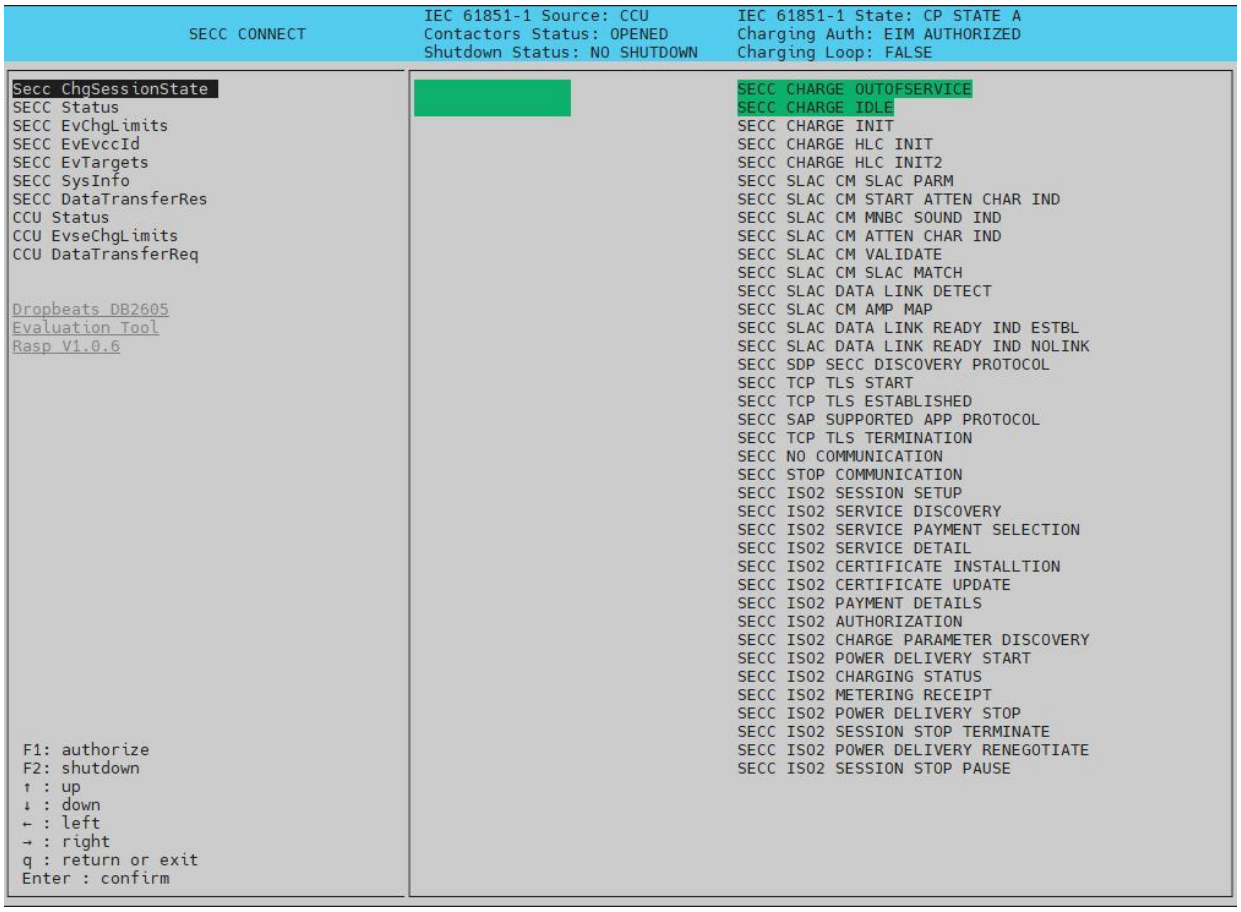
In this user case, the charging session begins with authorization before physically connecting the electric vehicle (EV) to the charging system. Here is a detailed description of the steps:

1. Authorize to start charging session

- User presses **F1** to initiate the authorization process.

- The system updates the "Charging Auth" status to "EIM AUTHORIZED", indicating that the EV has been successfully authorized to begin charging.

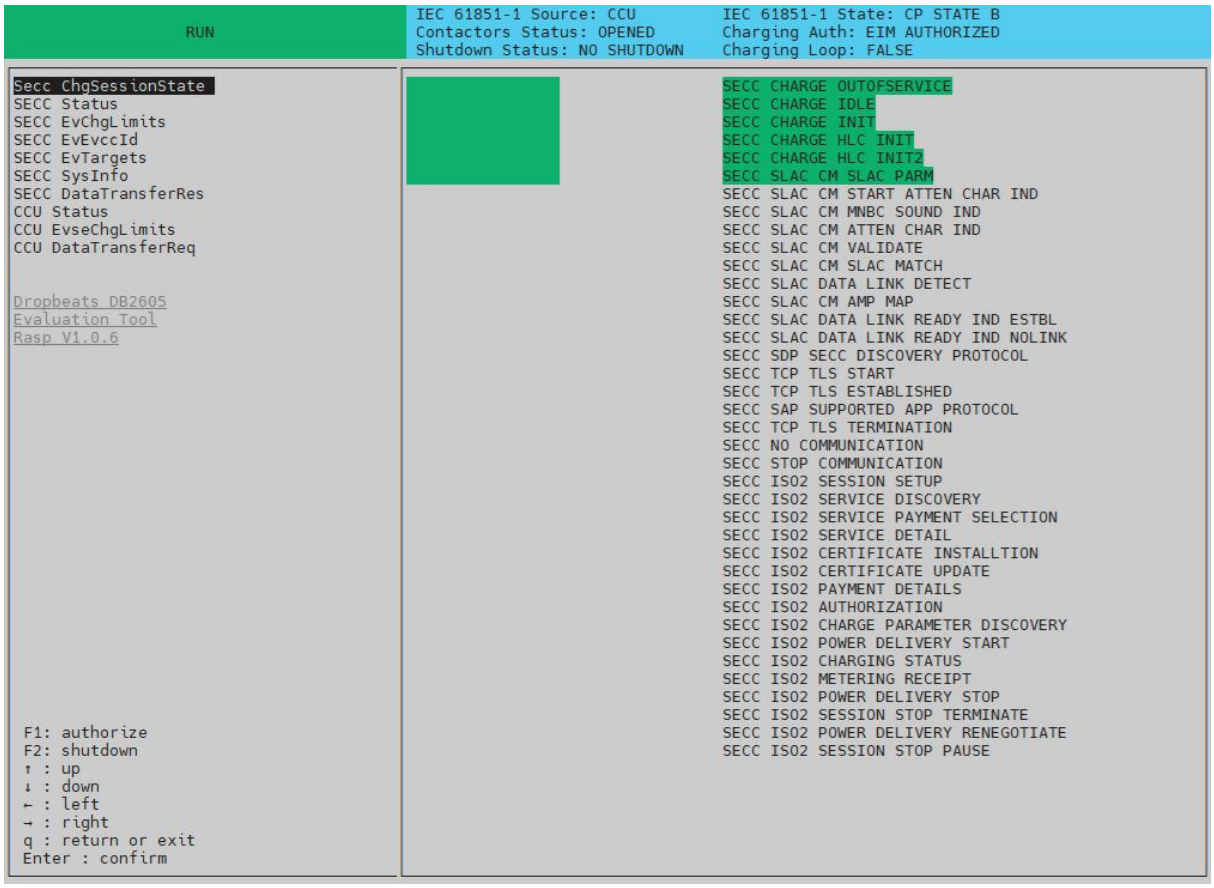
- At this point, the "IEC 61851-1 State" remain "CP_STATE_A", as the EV is not yet physically connected.



2. Plug In

- User then switches **SW1 ON** on the Vehicle Coupler board to simulate plugging in the EV.

- The system detects the connection, changing the “IEC 61851-1 State” to “CP_STATE_B”, which indicates that EV is connected and ready to begin charging.



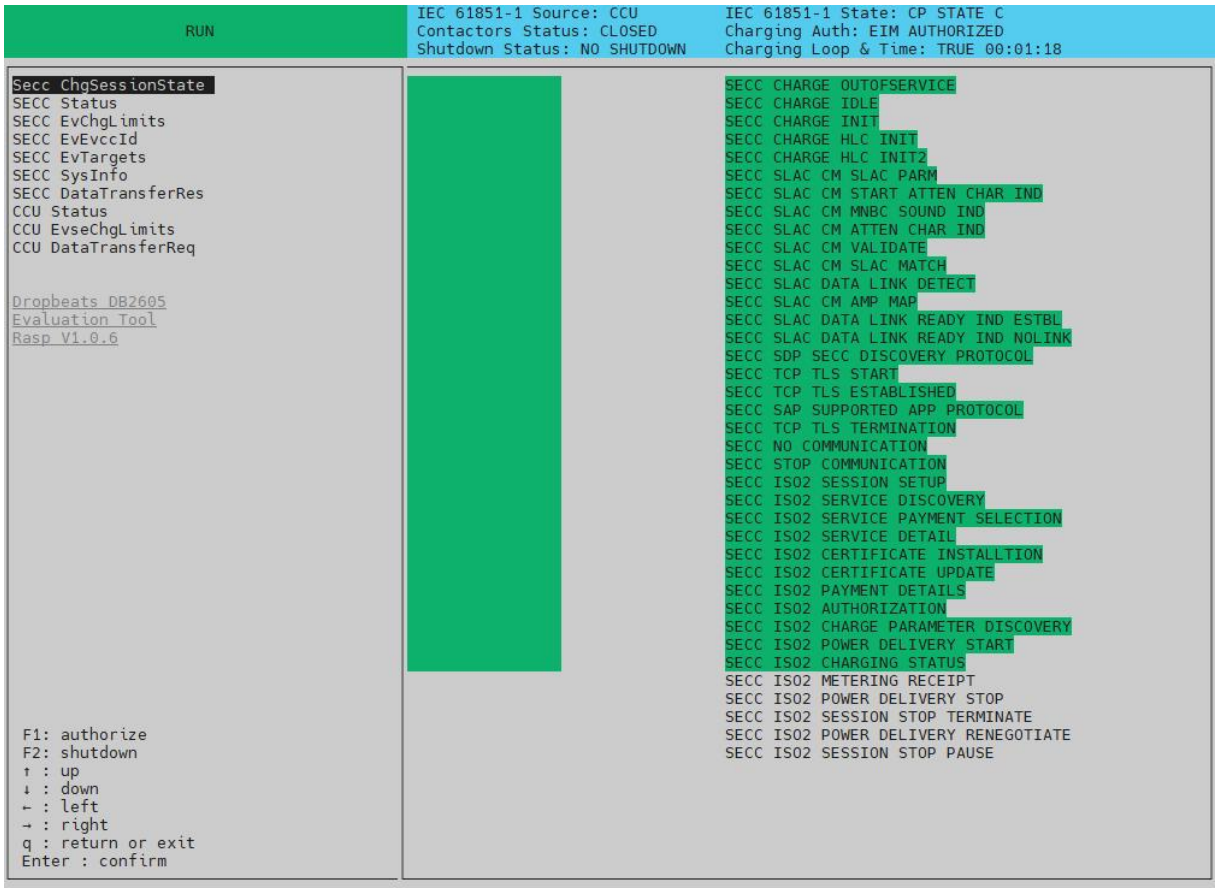
3. Begin charging session

- Once EV is plugged in, the charging session continues automatically.

- The “IEC 61851-1 State” transitions to “CP_STATE_C”, signaling that the EV is ready to receive power.

- The system then closes the “Contactors”, and the “Charging Loop” status updates to “TRUE”, indicating that charging is in progress.

- Additionally, the “SECC ISO2/20 CHARGING STATUS” shows that the system is in the V2G charging loop period.

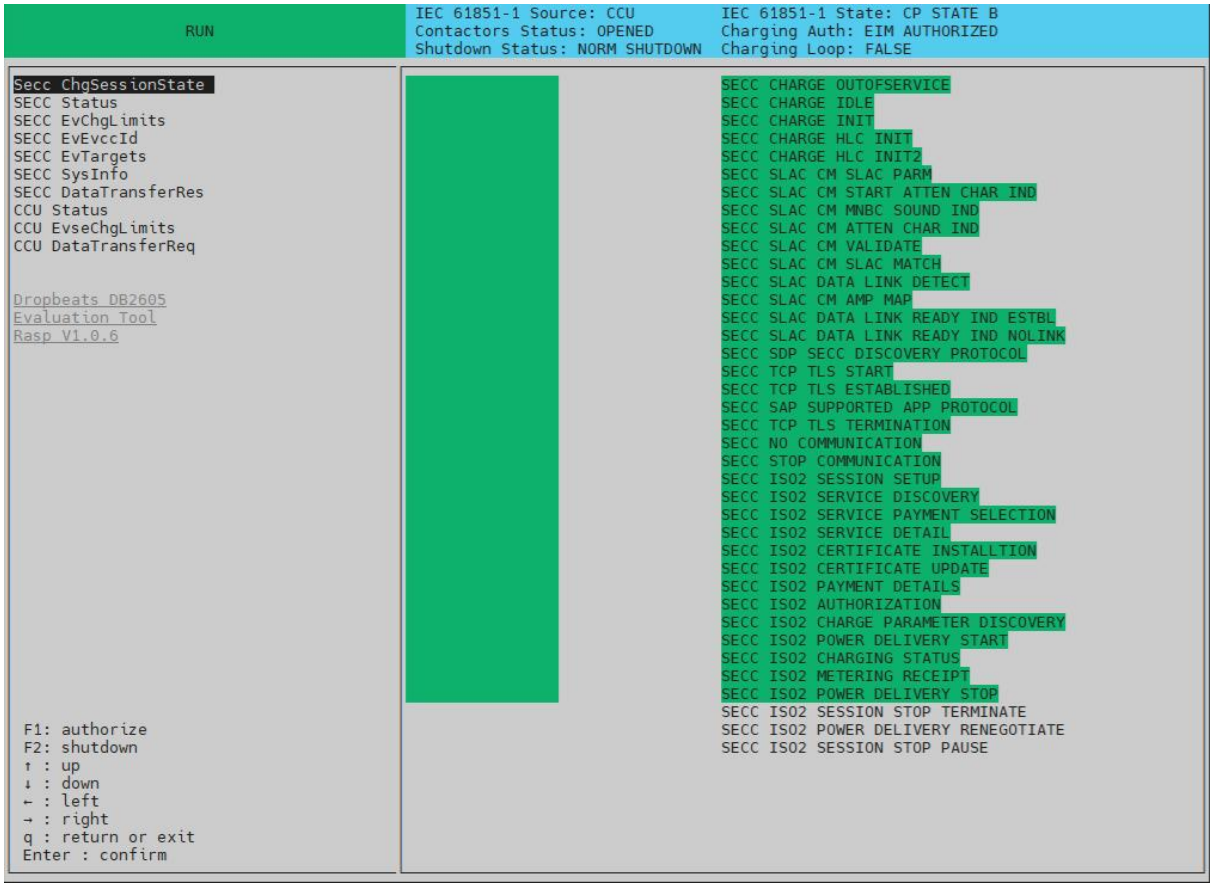


4. Stop Charging

- User presses **F2** to stop the charging session.

- The system responds by changing the "IEC 61851-1 State" back to "CP_STATE_B", showing that the EV is no longer ready to charge.

- The "Contactors" open, and the "Charging Loop" status returns to "FALSE".



5. Plug Out

- Finally, user switches **SW1 OFF** on the Vehicle Coupler board to simulate unplugging the EV.

- The simulator transitions to "SECC CHARGE IDLE", resetting all parameters and indicating that the system is now idle and ready for the next charging session.

3.3 EV initiates shutdown

When the system is in the Charging Loop， press "STOP" button on panel of Kits to shutdown.

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Contacting Dropbeats Technology

Dropbeats Technology
123 Juli Road, Building 4, Shanghai, China
Tel: +86 (21) 5085-0752
Fax: +86 (21) 5085-0753
Document Information: document@drop-beats.com
Corporate Information: info@drop-beats.com
Technical Support: apps@drop-beats.com
Web Site: https://www.drop-beats.com

Revision History

Revision	Date	Descriptions
1.0.0	2024.5.31	Initial
1.0.1	2024.6.4	Changed "DB2605 module" to "DB2605 EV Charging Controller"
1.0.2	2024.7.8	Updated user case
1.0.3	2024.7.18	Added views and updated user cases