1. Electric Vehicle (EV) Battery Charger TCG2000

1.1 Purpose

The primary purpose of the EV Battery Charger TCG2000 convert Low Frequency Alternating Current (LFAC) power to High Frequency Alternating Current (HFAC) charge power (magnetic flux). The coupler of charger provides bi-directional communications link between the Electric Vehicle and the charger.

The Schematic Diagram of EV Battery Charger TCG2000 with EV Battery charging System is illustrated in Fig-1.

1.2 Signal Definition

1.2.1 in AC/DC converter

This converter converts Low Frequency Alternating Current(LFAC) power to high-voltage DC power. The switching frequency is 20kHz. Refer to Table 1.2.1 for a description of high-voltage DC power.

Parameter	Description
Voltage Range	390V DC Peak
Current Range	30A DC Max
Switching Frequency	0.02MHz

Table 1.2.1 High-voltage DC Power Description

1.2.2 HFAC charge power(magnetic flux)

This inverter converts high-voltage DC power to HFAC charge power(magnetic flux). The switching frequency is 0.13MHz-0.37MHz.

The charger transmit HFAC charging power in the form of magnetic flux via an inductive coupling mechanism. The inductive coupling mechanism consists of primary windings located in a Charging Coupler and secondary windings located in the Charge Port(CP). When placed in close proximity, the primary and secondary windings form a transformer which allows HFAC Charge Power to be inductively coupled from the charger to CP. Refer to Table 1.2.2 for a description of HFAC Charge Power(magnetic flux).

Parameter	Description
Voltage Range	475V AC Peak
Current Range	20A AC Max
Maximum Power	6.0kW
Frequency	0.13MHz to 0.37MHz

Table 1.2.2 HFAC Charge Power(magnetic flux) Description

1.2.3 in DC/DC converter

This converter converts high-voltage DC power to low-voltage DC power. This switching frequency is 60kHz. This low-voltage DC power are supplied to controller module. Refer to Table 1.2.3 for a description of low-voltage DC power.

Parameter	Description
Voltage Range	±12V,24V DC
Current Range	6A DC Max
Switching Frequency	60kHz

Table 1.2.3 Low-voltage DC Power Description

1.2.4 Communications

1.2.4.1 General

For charging information exchange is required to allow electric vehicle to control the off-board charger.

The charger/coupler and CP support SAE J-1850 compatible digital communication between the charger controller, and the vehicle charge controller. Both the charger and CP include a radio frequency(RF) transceiver that acts as a repeater. This provide a network connection that, for all practical purposes is the same as if the charge controller and the vehicle charge controller were wired together. In other words, the RF link will be totally transport to both controllers.

1.2.4.2 Medium

The communication medium is bi-directional radio frequency(RF).

For a description of Radio Communication refer to table 1.2.4.2

parameter	Description
Type of interface	RF
Transmit Frequency	915MMHz ± 1 MHz
Modulation	AM (ON/OFF keying)
Transmit Power	+10 dBm
Receiver Sensitivity	-26 dBm

Table 1.2.4.2 Radio Communication

1.2.4.3 Modulation

The RF transceiver shall operate in a half duplex mode (2-way communication, 1-way at a time) using on/off keying. This will support bit-wise, non-destructive collision detection and arbitration.

SAE J-1850 is based on the concept of passive and dominant symbols. On a wired network with multiple nodes, if a nodes, if any one node is transmitting a dominant symbol, then the bus will be in the dominant state. If a node, Node A, is transmitting a passive symbol but sees the bus in a dominant state, Node A, recognizes that a collision has taken place and stops transmitting its message.

The node that was causing the bus to be in the dominant state continues to transmit its message. Node A will transmit its message again at a later time, therefore, no data was lost due to the collision.

When a RF transceiver detects a passive bus state on its wired bus connection, it is in a receive (off) mode. When a

transceiver detects a dominant bus state on its wired bus connection, it is in a transmit (on) mode. When a transceiver, Transceiver A, is in the receive a signal from its associate transceiver, Transceiver B, Transceiver A, drive its wired bus connection to a dominant state.

2. Controller Module (peripheral equipment) (not EUT)

2.1 Purpose

The primary purpose of the Controller Module is to monitor and control the process of charging the EV's Battery Pack. As part of the process, it forms a bi-directional communications link between the EV's Battery Pack and an Inductive Charger.

2.2 Serial Data (cc bus)

The coupler of charger is part of a bi-directional interface for Radio Communications control Data between the controller Module and the Controller Module located in the EV. The coupler to EV RF interface conforms to SAE J-1850 protocol. Refer to Table 2.2 for a description of cc bus.

Parameter	Description
Bus Protocol	SAE J-1850
Data Rate	10.4 Kbit/sec
Direction of Data Flow	Bi-directional

Table 2.2 CC BUS Description

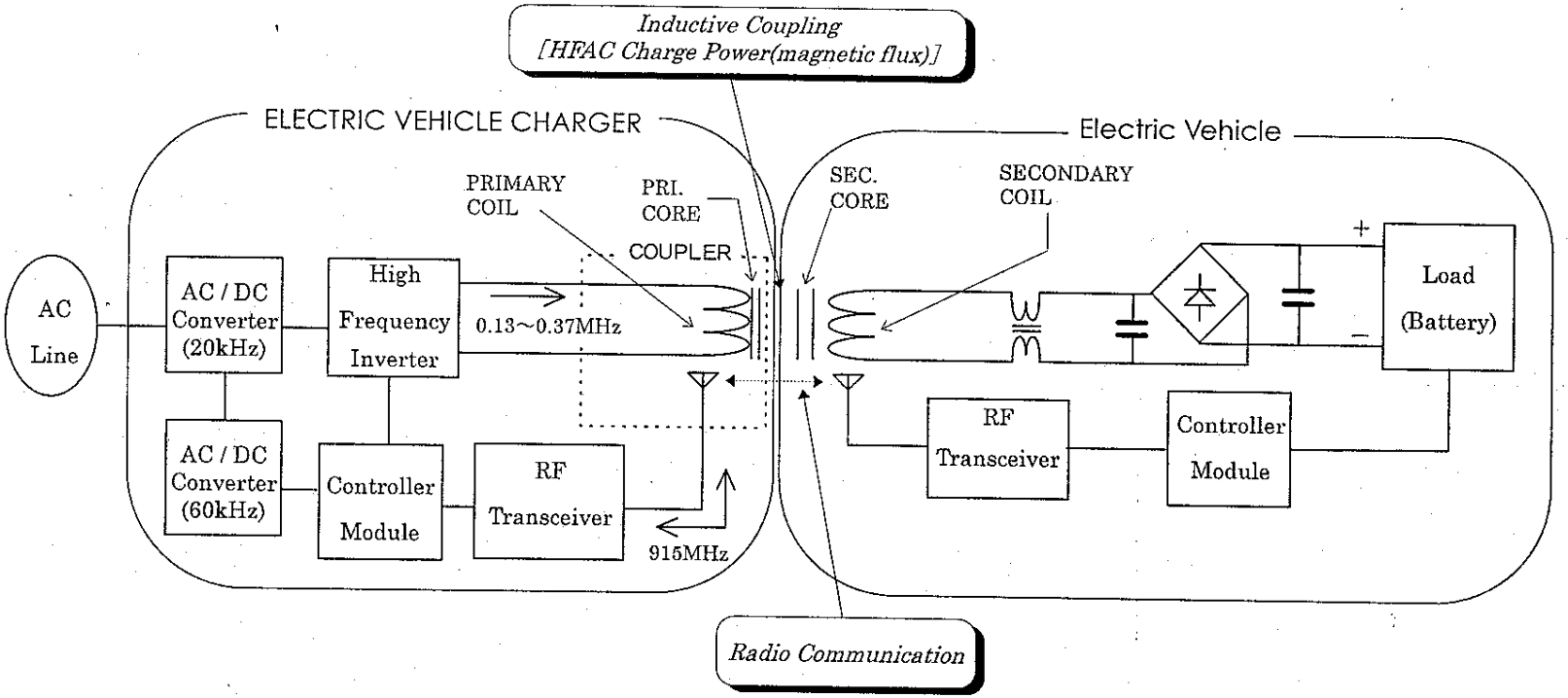

Fig-1. Schematic Diagram of EV Charging System