A. Battery Cell Emulator Requirements		
S No	**General Requirement**	**LV System Master(# 1 System)**
1	Types of Battery	All possible chemistries
2	Cell supply voltage range	0.5V to 5V
3	Voltage Accuracy:	+/- 1mV Resolution
5	Voltage Measurement	Accuracy: <1mV,
		Resolution: 1mV
4	Source Current	1A
7	Sinking Current	1A
5	Current measurement	+/- 1 A with accuracy +/- 1 microA, for individual cells
9	Cell Response Time	<1ms
6	Load Simulation	All
7	Number of Cells	36
8	Temperature Simulation	No Of Channels: 32
		Range: 0 Ohm to 8 M Ohm
		Fault Injection : Yes, All channels
		Resolution : 1 Ohm, Accuracy : +-1 %
		Communication: CAN or Ethernet
9	Failure Simulation	All Cells
10	Communication	CAN Serial Communication
		Ether-CAT
11	Coulomb Measurment	All Cells
11	Safety Requirements	Cell to Cell Isolation: 60V
		Isolated Communication: 2kV
B.Motor Simulation		
1	General Requirement	System should be capable to simulate Inverter, Controller, Motors (PMSM, SRM, IM, BLDC, etc.) at signal level to suit Motor controller development , Verification, Validation and calibration,
		The system should be capable of simulating 4 Motors or higher
2	FPGA Number of Gates	2 - 4 M or Higher
3	Analog Outputs	16
4	Analog inputs	12
5	Digital inputs	32
6	Digital outputs	32
7	PWM Measurement	32
8	Position Sensor Simulation	8

9	I/O Frequencies Support	1 Hz to 2 MHz
10	Analog Angle Simulation	12 Channels
11	Digital Sensor Simulation	12 Channels
12	Failure Insertion Uint	All
C. General I/O		
0	**Processing Unit**	The HIL Systems must be capable of standalone operation as a complete EV HIL System : The processor should be a latest 8-core or equivalent, freq. 3 GHz or more, 8 GB RAM (min) Processor should be later used for distributed computing. Data Transfer rate from Processor to I/O board should be should be through Gigabit Ethernet. Should support Synchronized Time Base for distributed computing.
1	**Analog Inputs**	
2	Number of Channels	16
3	Resolution	**16 bit**
4	**Analog Outputs**	
5	Number of Channels	16
6	Resolution	**16 bit**
7	**Digital Channels**	
8	Digital/PWM Inputs	24
9	Digital/PWM Outputs	24
10	**Resistive Channels**	
11	Resistive Channels	16
12	Current measurement	10
13	**Interface**	
14	CAN	6
15	LIN	1
16	Serial - UART	2
17	TCP/IP	2
18	SPI	2
19	BLE	2
D. Accessories		
12	Power Supply for sourcing BCS units	For sourcing the BCS modules
13	Power Supply for sourcing External Control units	For Sourcing ECU,BMS,MCU
14	Accessories	The required accessories for the functionality of cell emulation shall be provided viz. wiring harness CAN Cables , Breakout box

E. Special Requirements		
14	Warranty	5 Years
15	Software Maintenance	5 Years

F. Generic Requirements		
1	System Voltage	The systems shall integrated and enginered to have 3 systems of 110 V and one system of 300 V
2	Plug and play	The systems shall be capable of integration to cater to a single 600 V system
3	Isolation Emulation	20 K to 70 M Ohm (Optional)
4	EVSE Emulation (Optional)	The system shall emulate the EVSE for the vehicle viz. CP, PP, PE
		The system shall emulate EVSE according to ISO 15118, DIN
		CP Generation: 900 Hz to 1.1 KHz Resolution : 0.1 Hz Voltage : 0 to 15 V Accuracy : +- 1%
		PP Measurement : 0 to 5 V
5	Processing Unit	The HIL Systems must be capable of standalone operation as a complete EV HIL System : The processor should be a latest 8-core or equivalent, freq. 3 GHz or more, 8 GB RAM (min) Processor should be later used for distributed computing. Data Transfer rate from Processor to I/O board should be should be through Gigabit Ethernet. Should support Synchronized Time Base for distributed computing.

6	Modularlity	The systems should be modular and configurable to cater to EV validation requirements from 2 Wheeler to Commercial Vehicles upto 600 V
7	Plant Model Support	The System shall support various off the shelf plant models like Matlab, Amesim, LMS, Batemo etc.
G. Front End Requirements		
1	Operation	The System shall be capable of interfacing with multiple models like matlab, control desk, NI veristand and other off the shelf toolchain
2	Parameter Visualization (GUI)	An interface to view full system status and perform all system control, test, report viewing, and configuration.
3	Automated Test	fully automated test environment, providing the ability to generate stimulus profiles (drive profiles) and test scenarios.
H. Battery Plant Model (Optional)		
1	Cell Model	The Model shall be capable of Multicell modeling for simulating cell clusters (serial circuit)
2	Voltage	The cell model shall output the respective cell voltagaes
3	State of Charge	The Model shall have an inbuilt State-of-charge calculation
4	Temperarure Modeling	Thermal model with temperature simulation of each individual cell
5	Supported Chemistries	Supported battery types: Pb, NiCd, NiMH, Li-Ion (depends on parameterization)
6	Cell Balancing	The model shall be capable Simulation of unbalanced cells
7	Performance	Complexity and simulation performance of the model independent of number of cells
8	Parallel Connections	The model shall be capable of parallel connection to emulate the right battery pack behaviour
9	Development Environment	The model shall have its own development environment or shall interface with industry standard tools like Matlab, Amesim etc.
10	Real Time Capability	The model shall be capable of running in Real time environment