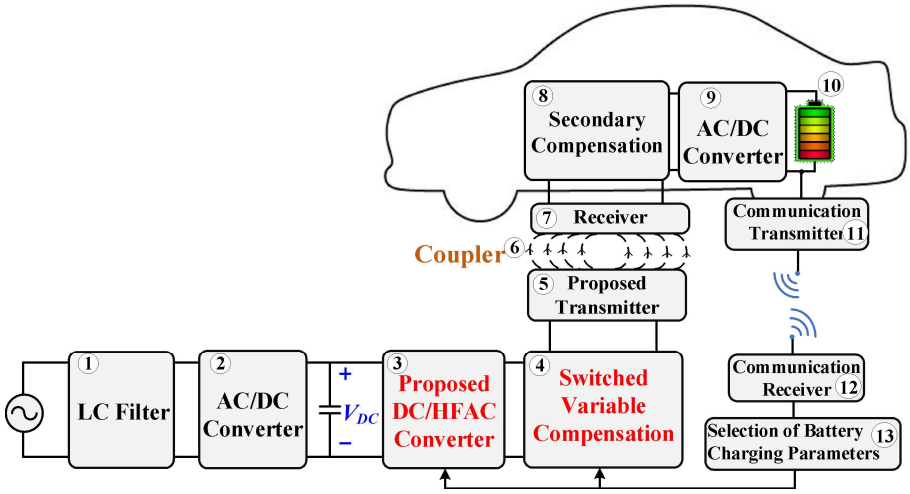


Figure 1

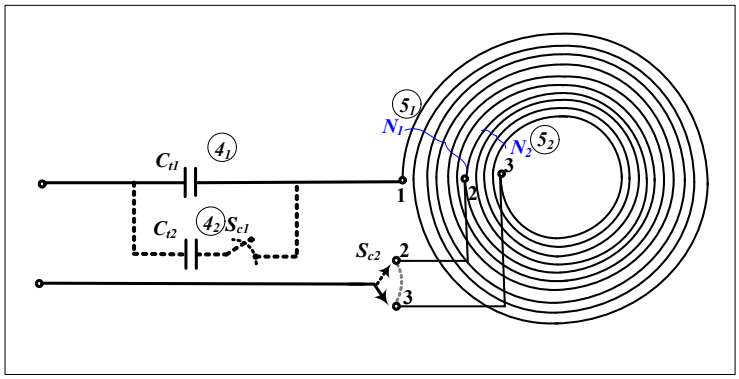


Figure 2

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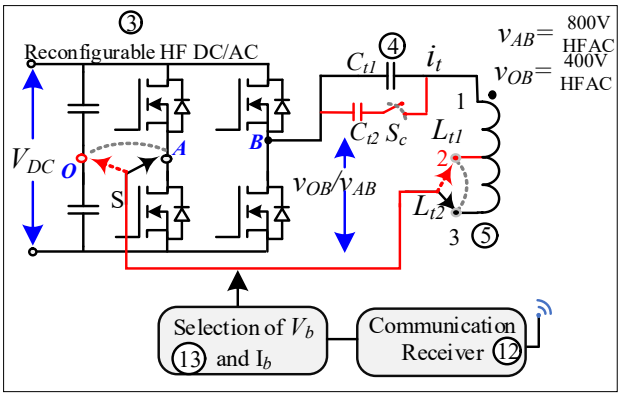


Figure 3

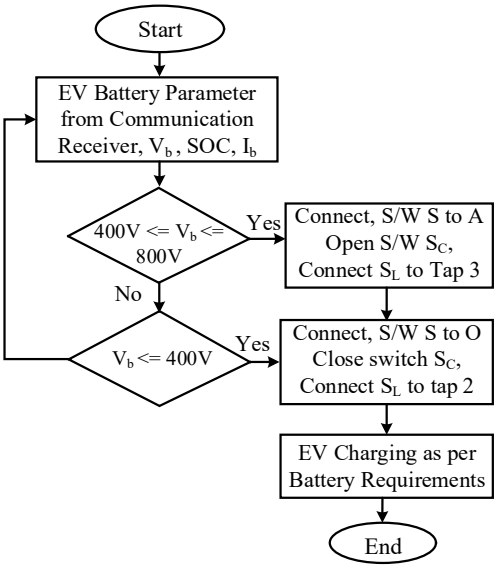


Figure 4

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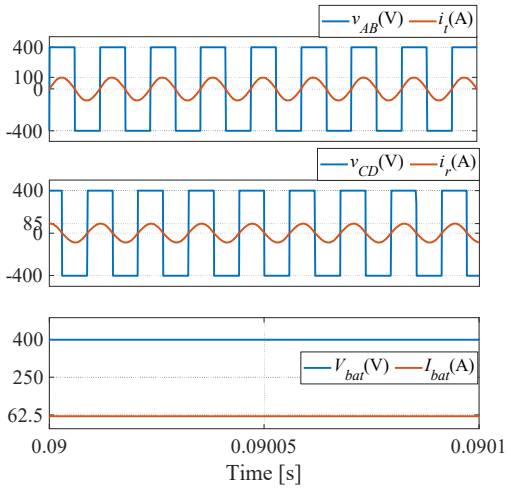


Figure 5

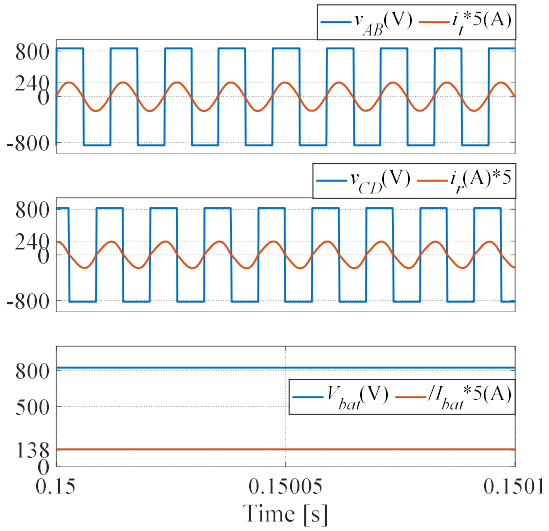


Figure 6

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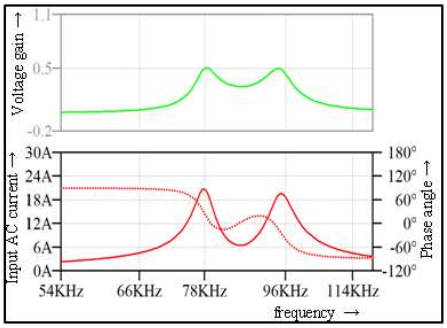


Figure 7a

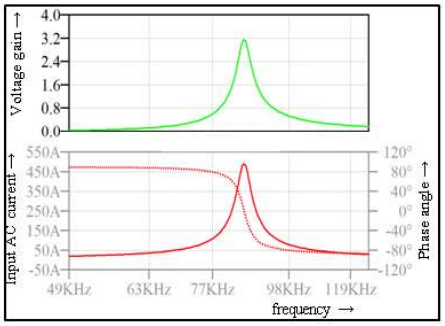


Figure 7b

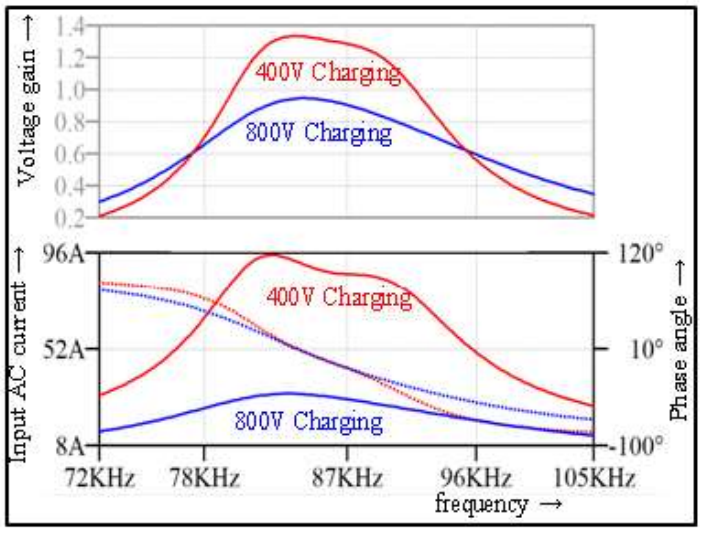


Figure 8

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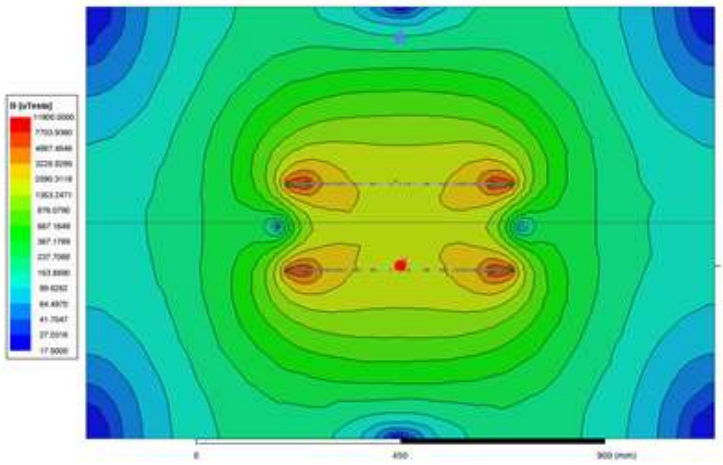


Figure 9

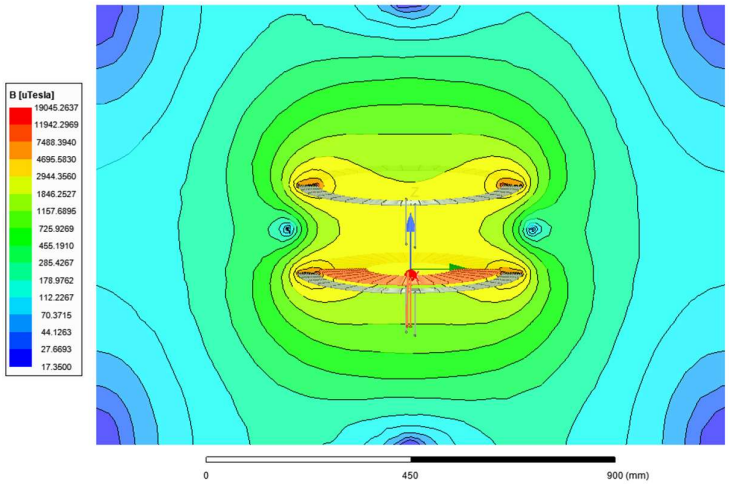


Figure 10

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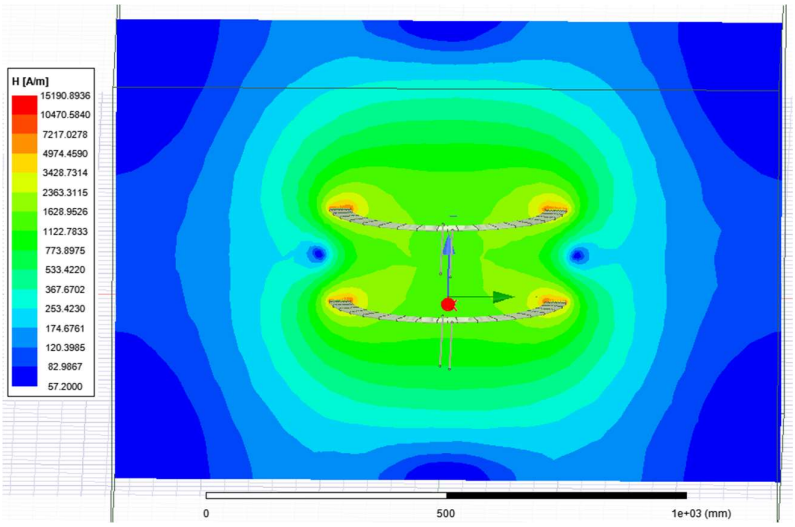


Figure 11

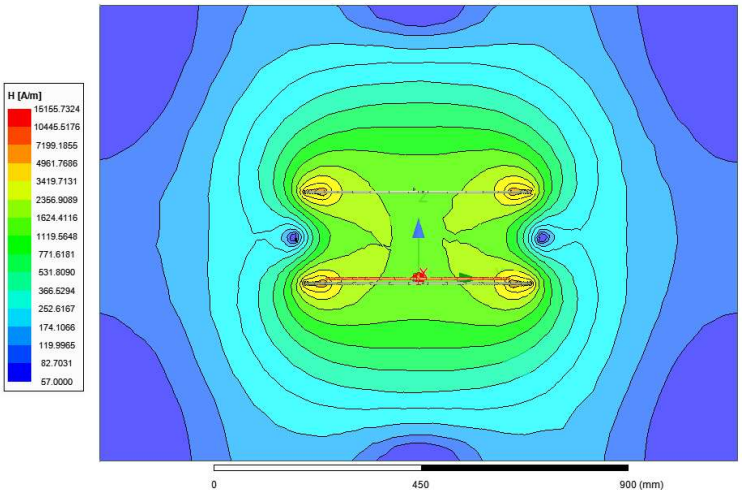


Figure 12

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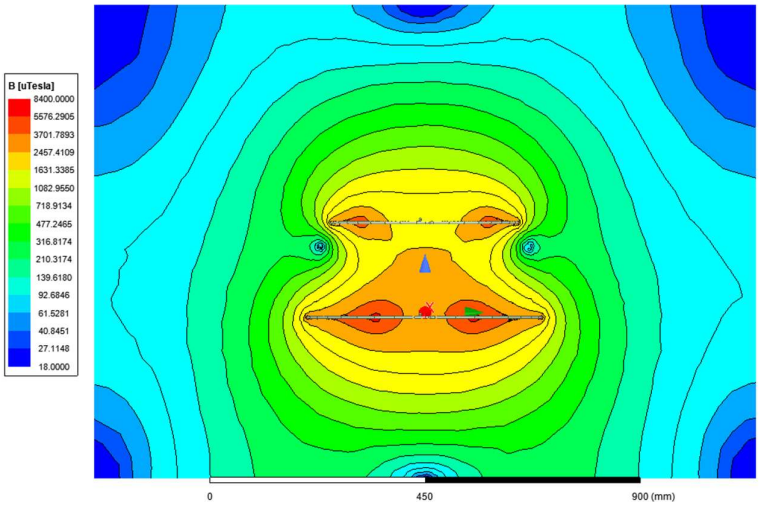


Figure 13

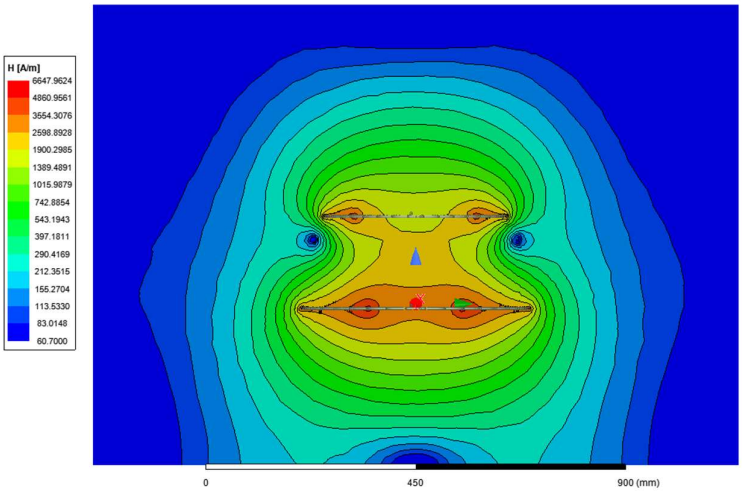


Figure 14

Dated 23rd day of **June, 2022**

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Indian Institute of Technology (IIT)
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FORM-2

The Patent Act 1970

Complete Specification

Section 10

TITLE

"AN INTEROPERABLE TRANSMITTER COIL AND A RECONFIGURABLE POWER CONVERTER FOR WIRELESS CHARGING OF ELECTRIC VEHICLES"

APPLICANTS

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE,

Roorkee-247667, Uttarakhand, India.

The complete specification particularly describes the invention and the manner in which it is to be performed.

FIELD OF INVENTION:

[001] The present invention relates to the field of wireless power transfer for electric vehicle (EV) charging. The present invention, in particular, relates to an interoperable tapping-based transmitter coil and a reconfigurable power converter for conventional 400V and next-generation 800V wireless charging of EVs.

DESCRIPTION OF THE RELATED ART:

[002] The issues related to heavy charging cables used to charge electric vehicles are a big concern, especially in adverse environmental conditions. Inductive power transfer (IPT)-based electric vehicles can provide cable-free EV charging with the solution to existing EV issues and provides inherent galvanic isolation betweenthe charger and the vehicle. The EV battery size can be significantly reduced by utilizing the concept of opportunistic charging. However, to get good benefit from opportunistic charging, the high power wireless charging of EV is required. High power charging at conventional 400V battery charging voltage increases the current in the charging system. Hence the issue of high conduction losses, large field emissions, and heating of the busbar is observed. Furthermore, issues like battery busbar heating can lead to battery thermal breakdown. Hence, switching towards next-generation high voltage, i.e., 800V charging of EV batteries,reduces the conduction losses in chargers. Owing to the fact that all vehicles cannot be compatible with the 800V wireless charging, the reconfigurable charger that can support 400V and 800V wireless charging is researched.

[003] Reference may be made to the following:

[004] IN Publication No. 202141049567 relates to the era of EV and its attaining the peak now-a-days. But the only major drawback of EV is its charging time. This describes EV charging using microwave energy transfer. The plasma antenna-based microwave transmitter is used to generate microwave and vehicle charges while moving.

[005] The present work focuses on resonant IPT-basedwireless charging of the electric vehicle. The transmitter coil is supplied with the high-frequency AC. The mutually coupled secondary coil get induces emf of the same frequency and hence charges the EV battery after rectification. This presents the reconfigurable high-frequency AC (HFAC) converter with a tapping-based transmitter coil for 400V and 800V wireless charging of EV. The power level of charging is taken as 22kW in both cases.

[006] Patent No. US9112364 relates to a system and method for providing a multi-dimensional inductive charger. This focuses on a multi-dimensional inductive charger with one or more transmitter coils to charge multiple devices at the same time. The regulation of power is made by selecting the tap on the receiver coil according to the power required by the device. The receiver coil is associated with the switching magnet to guide the localized flux and controls the power transfer.

[007] The present invention presents the concept of a tapping-based transmitter. The tap selection is made in the transmitter according to the charging voltage required by the EV battery (either 400V or 800V battery charging). The HFAC converter reconfigures itself as a half-bridge for 400V charging and as a full bridge for 800V charging.

[008] Publication No. US2018287405 relates to techniques for wired and wireless charging of electronic devices. This patent used a synchronous rectifier with two legs. This converter operates differently for wireless and wireless charging cases. During the time of wireless charging, the first leg works as a synchronous rectifier, and the second leg works as a buck converter. Whereas, at the time of conductive charging, both the legs are used as a multi-phase buck converter.

[009] This invention uses a reconfigurable converter which will reconfigure itself as a half-bridge inverter at the time of the 400V charging requirement. And can be operated as a full H-bridge inverter during 800V battery charging requirements. In both cases, the DC link voltage will be constant at 800V.

[010] Publication No. US2013249479 relates to systems and methods for enabling efficient wireless power transfer, and charging of devices and batteries, in a manner that allows freedom of placement of the devices or batteries in one or multiple (e.g., one, two or three) dimensions. This patent explains a multi-dimensional wireless charger for charging multiple devices like mobiles, laptops, etc., charging. The receiver performs the charging initiation process with the communication channel by sending information like ID, presence of device, power, and voltage rating to the transmitter unit.

[011] The present invenrtion focuses on 400V and 800V EV charging at the same power level of 22kW using a reconfigurable DC to AC converter and tapping-based transmitter coil for 400V and 800V charging cases. The number of turns selected ensures the bifurcation-free charging of vehicles in both cases.

[012] Publication No. US2011181240 relates to a charging system for an electric vehicle that assists in aligning a primary charging coil and a secondary coil. This patent presents the wireless charging of EVs. The major contribution of this work is the presence of the wheel chock to align the primary coil with the vehicle coil. A signal transmitter garage door opener controls the vehicle charging. The sensor between the primary and secondary coil is used to detect the presence of a living being.

[013] The present invention mainly focuses on a series-series compensated reconfigurable transmitter coil with switched compensation to charge a vehicle wirelessly at 400V and 800V battery voltage without any bifurcation issue during both cases of charging.

[014] Publication No. WO2014042788 relates to a systems, methods and apparatus for wireless power transfer and particularly wireless power transfer to remote systems such as electric vehicles. This invention mainly focuses on a type of transmitting structure for wireless charging applications. A first magnetic field in

response to receiving thefirst-time-varying signal from a power source. The apparatus further includes a second means for generating a second magnetic field in response to receiving a second time-varying signal from the power source. The first and second generating means are positioned to maintain a substantial absence of mutual coupling between the first and second magnetic fields The present invention is different from the given in the transmitter design, which is a circular spiralcoil. The purpose of providing tapping is to charge different EV batteries that require charging at different voltages (400V and 800V) with the same power level. The reconfigurable HFAC converter is used to provide the required charging voltage for the battery to be charged.

[015] Publication No. JP2020127353 relates to a wireless power transfer (WPT) system that can be integrated with an already existing conductive on-board battery charger (OBC) for electric vehicles (EVs). This invention focuses on electric vehicle charging in conductive and inductive wireless hybrid charging. The wireless charging is achieved by the ground assembly (GA) of coilsthat generates the magnetic field and vehicle assembly (VA) coils will have induced emf to charge the vehicle battery. The controlling is done by voltage and current control loops. The present invention only focuses on resonant inductive coupling-based wireless charging of electric vehicles. The present invention mainly focuses on a series-series compensatedreconfigurable transmitter coil with switched compensation to charge a vehicle wirelessly at 400V and 800V battery voltage without any bifurcation issue during both cases of charging.

[016] Publication No. US2016264010 relates to an electrical charging system configured to charge a battery includes a power transmitter, an energy coupling arrangement, an electrical signal shaping device including a controller, and an alignment means. This claims the wireless power transfer for electric vehicle charging hasa transmitter and receiver coil. The communication-based means of alignment are used to align the transmitter with the receiver. The electrical signal shaping device is used to shape electric energy generated in the secondary coil.

[017] The invention work focuses on tapping-based transmitter coil design to charge different EV batteries with different charging voltage requirements. Reconfigurable DC to HFAC converter used at the transmitter side.The reconfigurable transmitter provides the required voltage to charge the vehicle battery.

[018] Publication No. WO2019013626 relates to an electrically driven vehicle with a wireless inductive charging system. This invention focuses on wireless charging systems with multiple transmitters resonating at different frequencies. Similarly, the receiver is designed as a multi-resonant network. The system design is such that the first transmitter resonates with the first resonant frequency of a multi-receiver system and the second transmitter with the second resonant frequency of the multi-resonant receiver, and so on.

[019] The present invention uses a multi-tap transmitter coil, whichresonates at a single frequency. The bifurcation-free operation in both the voltage (400V and 800V charging) is the basis for selecting the number of turns in the primary coil.

[020] Publication No. CN108718116 relates to a wireless charging pile and charger. This work focuses on wireless charging of the battery with a transmitter plate underthe ground and a receiver plate in the vehicle. The transmitter is provided with a telescopic arm that measures the vertical distance between the transmitter and the receiver.

[021] The present invention does not use any sensor for vehicle alignment with the transmitter. The present work uses a multi-tap transmitter coil, which resonates at a single frequency. The bifurcation-free operation in both the voltage (400V and 800V charging) is the basis for selecting the number of turns in the primary coil.

[022] Patent No. US9944190 relates to a method includes: receiving vehicle information from a wireless charging-capable vehicle via a wireless communication means; calculating an air gap between a primary coil of a wireless charging system that is operable to wirelessly charge the vehicle and a secondary coil of the vehicle

based on the received vehicle information; and causing electric current to flow only through a portion of the primary coil having a size that is less than or equal to a size of the entire primary coil. A new tapping-based transmitter coil is claimed based on the coupling coefficient. The selection of the transmitter coil is made according to the coupling coefficient requirement, and the remaining turns open-circuited. The coupling coefficient variation is estimated based on the vertical height between the transmitter and the receiver coils.

[023] The present invention selects the number of turns in the transmitter coil according to the battery charging voltage requirement. The tap selection ensures the bifurcation-free charging of the vehicle battery in 400V and 800Vcharging. The switched capacitor compensation selection is made to resonate the transmitter coil at 85 kHz in both charging cases. The communication link is used to transfer battery information from the vehicle to the supply transmitter coil. The present invention also uses a reconfigurable HFAC converter which can provide the 400V AC and 800V AC voltage according to the EV battery requirements.

[024] Patent No. US10086715 relates to a method includes detecting that a wireless charging-capable vehicle is in a charging position proximate a primary coil of a wireless charging system that is operable to wirelessly charge the vehicle via a secondary coil installed in the vehicle. This focuses on the vertical height-based transmitter turns selection. The sensors are used to estimate the height between the transmitter and the receiver to estimate the coupling coefficient.Hence the number of turns in the primary coil is estimated accordingly.

[025] The present invention selects the taps in the transmitter coil according to the battery charging voltage requirement. The tap selection ensures the bifurcation-free charging of the vehicle battery at 400V and 800V, level-4 charging. The present invention also uses a reconfigurable HFAC converter which can provide the 400V AC and 800V AC voltage according to the EV battery requirements.

[026] Publication No. KR20120109892 relates to a wireless power transmitter for a vehicle to improve charging efficiency of a terminal in the vehicle by fixing the

terminal to a desired position during charging. Wireless power transfer with transmitter coil housed in the grooves provided and arranged with the position adjustment mechanism with the transmitter coil. And hence the lateral direction adjustment of the transmitter coil can be made according to the user's requirement.

[027] The present invention mainly focuses on bifurcation-free series-series compensated coil with switched capacitor compensation for 400V and 800V, EV charging system for the same power level of 22kW. The reconfigurable high-frequency transmitter provides the 400V or 800V high-frequency AC output according to the EV battery requirement.

[028] Publication No. WO2011116394 relates to a wireless charging system. This discloses the concept of power transfer between the mutually coupled coils that come in proximity. One of the transmitters or receiver coil hasa movable mechanism to adjust the vertical height between the transmitter and receiver.

[029] Present invention transfers the power wirelessly by resonant inductive wireless power transfer. The bifurcation-less coil-set is designed for 800V as well as 400V charging of EV battery. Both charging voltages are achieved by reconfigurable DC to high-frequency AC converter. The transmitter is designed for a single resonating frequency operating zone for both voltage levels level-4 (22kW) vehicle charging.

[030] Designing a common transmitter that can operate in conventional 400V as well as next-generation 800V battery systems is still a challenging task. Owing to the risk of bifurcation phenomena in the SS compensated wireless charging system, the tapping-based transmitter coil is designed.

[031] In order to overcome above listed prior art, the present invention aims to provide an interoperable tapping-based transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles, which can charge the vehicle at 400V and 800V battery charging voltage and achieves bifurcation-free operation in

both the cases for same power level (22kW, level-4). This makes the charger efficient and cost-effective.

OBJECTS OF THE INVENTION:

[032] The principal object of the present invention is to provide a single transmitter coil for 400V and 800V charging of EV battery at the same power level of 22kW (level-4 charging). For bifurcation-free operation, the transmitter coil is provided with the taps at the required number of turns. The tap on the transmitter coil with switched compensation resonates at the same frequency of 85kHz (standard frequency for IPT system) in both cases.

[033] Another object of the present invention is to propose configurable DC to HFAC converter with output voltage at 400V and 800V, AC according to the vehicle battery charging requirement. In both cases, the DC link voltage must be constant at its reference value of 800V.

SUMMARY OF THE INVENTION:

[034] The present invention relates to an interoperable tapping-based transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles. The reconfigurable power converter and tapping-based transmitter are proposed to charge 400V and 800V battery charging voltage at a 22kW power level. The proposed transmitter coil achieves the bifurcation-free performance for 400V and 800V, 22kW wireless charging of the EVs. Also, the reconfigurable DC to HFA Cconverter at the transmitter side is proposed, which can configure itself either in 400V or 800V mode, based on the vehicle information. The vehicle information is sent to the transmitter side using a wireless communication link. Subsequently, the tap-in transmitter coil will be adjusted to ensure bifurcation-free charging at the required voltage level. Also, the switched capacitor of compensation is used to resonate the system at standard 85 kHzat both tap positions.

BREIF DESCRIPTION OF THE INVENTION

[035] It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered

for limiting of its scope, for the invention may admit to other equally effective embodiments.

[036] Fig. 1 shows the proposed scheme of inductive power transfer-based EV charging.

[037] Fig. 2 shows the tapping-based transmitter coil with the switched-capacitor compensation.

[038] Fig. 3 shows the proposed DC to HFAC reconfigurable converter for 400V and 800V, HFAC output voltage.

[039] Fig. 4 shows the flowchart for tap selection and converter reconfiguration for 400V and 800V, EV charging requirements.

[040] Fig. 5 shows validation of 400V, level-4 battery charging (RL = 7Ω i.e. 22.8 kW) with the proposed converter.

[041] Fig. 6 shows validation of 800V, level-4 battery charging (RL = 27Ω i.e. 23.7 kW) with the proposed converter.

[042] Fig. 7(a) shows bifurcation condition with 400V, 22kW charging at 800V, and 22kW transmitter coil set.

[043] Fig. 7(b) shows a low coupling coefficient condition with an 800V, 22kW charging system operated at 400V, 22kW transmitter coil set.

[044] Fig. 8 shows the tapped transmitter-based, bifurcation-free charging at 400V and 800V, 22kW power level.

[045] Fig. 9 shows magnetic field emission (B-field) with 400V/22kW charging with the conventional transmitter.

[046] Fig. 10 shows B-field with 400V/22kW charging with the proposed tapping-based transmitter.

[047] Fig. 11 shows magnetic field intensity distribution (H-field) at 400V/22kW charging with the conventional transmitter.

[048] Fig. 12 shows H-field with 400V/22kW charging with the proposed tapping-based transmitter.

[049] Fig. 13 shows B-field at 800V/22kW charging.

[050] Fig. 14 shows H-field at 800V/22kW charging.

DETAILED DESCRIPTION OF THE INVENTION:

[051] The present invention provides an interoperable tapping-based transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles.

[052] Fig. 1 shows the block diagram of IPT-based EV charging. First, the power is taken from the utility grid and sent to the power factor correction (PFC) unit **(1)** in Fig.1. The role of the PFC unit is to make grid supply current in phase with the grid voltage. The power from the utility grid is then rectified by the grid side AC to DC converter **(2)** and makes a common dc link which is at 800V. The power is transferred to the transmitter **(5)** via DC to HFAC converter **(3)**. The switched capacitor series compensation **(4)** is proposed with the transmittercoil to achieve resonance condition at 85 kHz in both 400V and 800V charging cases. The power is transferred from the transmitter to the receiver by virtue of mutual induction **(6).** The transmitter is buried under the ground, and the receiver coil **(7)** is mounted on the vehiclechassis. The receiver is also compensated with the series compensating capacitor **(8).** The HFAC-induced emf in the secondary side is then rectified by a vehicle-side rectifier **(9).** The EV battery **(10)** is charged by the rectified secondary power. The secondary coil inductances and the number of turns can be differentfor the different vehicles requiring either 400V level-4 charging or 800V, level-4 charging. The battery parameters are sent from the vehicleside to the transmitter side via a wireless communication transmitter-receiver set **(11-12).** Accordingly, the vehicle charging voltage is selected **(13),** and a signal is given to the relay, which

reoperates the switches S, $S_{c1,}$ and S_{c2} according to the vehicle battery charging requirements.

[053] The bifurcation phenomenon is observed with the resonant wireless charging system at particular loading and coupling conditions. When the system goes under the bifurcation zone, the zero-phase angle condition is observed with more than one frequency. This is due to the presence of four energy-storing elements (inductors and capacitors) in the system. With bifurcation, the voltage gain at the designed system frequency (85 kHz) reduces, reducing power transfer to the load. Therefore, while designing the coil, it is highly recommended to follow design guidelines to avoid bifurcation for the required load range.

[054] The power level of EV charging is assumed as level4, i.e., 22kW charging. Hence, for bifurcation-free operation in both (400V and 800V charging) cases, the transmitter requires different turns to transfer the same amount of power. The tapping-based transmitter coil design is proposed to solve this issue. The switched capacitor series compensation is used on the transmitter side such that in both cases, the coil should resonate at the same frequency of 85 kHz.

$$\omega_o = \frac{1}{\sqrt{L_{12}(C_{t1}+C_{t2})}}\Bigg|_{\substack{400\ ,22kW \\ Charging}} = \frac{1}{\sqrt{L_{13}C_{t1}}}\Bigg|_{\substack{800V,22kW \\ Charging}}$$

[055] Where L_{12} inductance required for 400V, 22kW charging with N_1 turns (between Tap 1 and 2), L_{13} inductance required for 800V, 22kW charging with (N_1 + N_2) turns (between Tap 1 and 3). And $C_{t1,}C_{t2}$ are switched capacitances. Hence, the proposed configuration provides bifurcation-free wireless charging of EVs with conventional 400V as well as next-generation.

[056] 800V, EV battery charging at 22kW power level. The transmitter coil and associated switched compensation scheme are shown in Fig. 2.

[057] Fig. 3 shows the reconfigurable DC to high-frequency AC converter. The DC link voltage used is taken as 800V. The cases when an EV with 400V charging

comes, the communication link sends this information of battery charging voltage to the transmitter. The switch 'S' pole will be connected to 'O' and make the HFAC converter as a half-bridge inverter, giving the output of 85 kHz, 400V AC. Similarly, when a vehicle with 800V charging comes, the SPDT switch will be connected to point 'A', and the HFAC inverter works as a full bridge inverter with 85 kHz and 800V AC inverter output voltage.

[058] Fig. 4 illustrates the flowchart for the selection of tapping according to EV battery charging voltage requirement.

[059] Fig. 5 shows the MATLAB Simulink validation for 400V, level-4 (22kW) battery charging (RL = 7Ω i.e, 22.8 kW) with the proposed converter. Fig. 6 shows the MATLAB Simulink validation forthe proposed converter for 800V, 22kW battery charging (RL = 27Ω i.e. 23.7 kW). Fig. 7(a) shows the bifurcation condition with 400V charging operated at 800V charging coil set. The voltage gain, in this case, reduces to 0.4 (160V), and the current supplied from the HFAC inverter is 6 A. Hence, the power transferred to the secondary is around 960 watts, nearly 1/23 times the required power. Fig. 7(b) shows the case of low coupling coefficient condition leads to high input current demand with an 800V, 22kW charging operated at 400V, 22kW coil set. The low coupling condition observed during 800V charging at a 400V coil set (for the same power level of 22kW) is because of the reduction in current by half at 800V charging. Thus, a very high input current of nearly 500A is drawn from the supply to transfer the required power to the secondary side. This high current can lead to voltage and frequency deviation in the utility grid and collapse the utility grid. Fig. 7 (a) and (b) are the motivation to switch towards a tapping-based single transmitter coil to get stable charging at 400V as well as 800V battery charging voltage with the same powerlevels.

[060] Fig. 8 shows the bifurcation-free charging of vehicles with the proposed tapped transmitter coil. The proposed coil configuration is suitable for 400V and 800V, 22kW charging. Fig. 9 shows B-field with 400V/22kW charging with the conventional single coil transmitter. Fig. 10 shows B-field with 400V/22kW charging with the proposed tapping-based transmitter. Fig. 10 concludes that the B-

field with the proposed coil configuration is 60% higher than the conventional single-coil system resulting in higher power transfer. Fig. 11 shows H-field with 400V/22kW charging with the conventional transmitter. Fig. 12 shows H-field with 400V/22kW charging with the proposed tapping-based transmitter.Fig. 13 shows B-field with 800V/22kW charging, and Fig. 14 shows H-field with 800V/22kW charging.

[061] The invention provides a tapping-based coil with switched capacitor compensation compatible with 400V and next-generation 800V, 22kW EV charging systems.The proposed transmitter coil achieves the bifurcation-free performance for 400V and 800V, 22kW wireless charging of EV. Also, the reconfigurable HFAC inverter at the transmitter side is proposed, which can provide the 400V as well as 800V inverter output voltage according to the requirement of the EV battery.

[062] With the proposed coil configuration, 60% increased B-field is achieved at 400V/ 22kW charging, as compared to a conventional single coil transmitter without sacrificing the safety region around the coil.

[063] The validation and performance of the coil are done in an Ansys Maxwell environment. The proposed converter charging at 22kW level is validated in MATLAB/Simulink environment. The FEA results for coil and simulation results for converter show their effectiveness and validate the invented design.

[064] Numerous modifications and adaptations of the system of the present invention will be apparent to those skilled in the art, and thus it is intended by the appended claims to cover all such modifications and adaptations which fall within the true spirit and scope of this invention.

Dated 23rd day of **June, 2022**

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

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(APPLICANT)

WE CLAIM:

1. An interoperable tapping-based transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles comprises-

a) Power factor correction (PFC) unit (1) to take the power utility grid wherein the PFC makes utility current in phase with the grid voltage.

b) The grid side AC to DC converter (2), the grid power is rectified in DC form and makes a common dc link of 800V.

c) Reconfigurable DC to HFAC converter (3) to transfer the power to the transmitter (5) switched capacitor series compensation (4) on the primary side provides resonance condition at 85 kHz in both 400V and 800V charging cases.

d) Switched series compensation with the proposed transmitter to achieve stable bifurcation-free charging at 400V and 800V battery charging voltage and the vehicle side rectifier (9) again converts high-frequency AC in the receiver coil to DC and charges the EV battery (10).

e) The wireless communication transmitter (11) sends the battery parameters and information from the vehicle to the transmitter side communication receiver (12) wherein the vehicle charging voltage is selected (13), and a signal is given to the relay, which reoperates the switches S, S_{c1}, and S_{c2} according to the vehicle battery charging requirements.

2. The tapping-based transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles, as claimed in claim 1, wherein the pole of switch '*S*' is linked to 'O' to form a half-bridge inverter that produces an 85 kHz, 400V EV charging output and with 800V charging, the SPDT switch is attached to point 'A,' and the HFAC inverter operates as a full-bridge inverter with an output voltage of 800V AC at 85 kHz.

3. The interoperable transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles, as claimed in claim 1, wherein the reconfigurable power converter and tapping-based transmitter charge 400V and 800V battery EVs at 22kW EV charging.

4. The interoperable transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles, as claimed in claim 1, wherein the proposed transmitter coil achieves the bifurcation-free performance for 400V and 800V, 22kW wireless charging of the electric vehicle.

5. The interoperable transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles, as claimed in claim 1, wherein the present invention achieves 60% higher magnetic field intensity (B-field) between transmitter and receiver in the case of 400V, 22kW charging as compared with conventional single-coil.

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ABSTRACT

AN INTEROPERABLE TRANSMITTER COIL AND A RECONFIGURABLE POWER CONVERTER FOR WIRELESS CHARGING OF ELECTRIC VEHICLES

The present invention relates to an interoperable transmitter coil and a reconfigurable power converter for wireless charging of electric vehicles. The reconfigurable power converter and tapping-based transmitter are proposed to charge 400V and 800V battery EVs at 22kW, EV charging. The proposed transmitter coil achieves the bifurcation-free performance for 400V and 800V, 22kW wireless charging of the electric vehicle. Also, the reconfigurable high-frequency AC (HFAC) inverter at the transmitter side is proposed, which can configure itself either in 400V or 800V mode, based on the vehicle information obtained fromwireless communication links.

Figure 1

Dated 23rd day of June, 2022

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