BiliBili Demo

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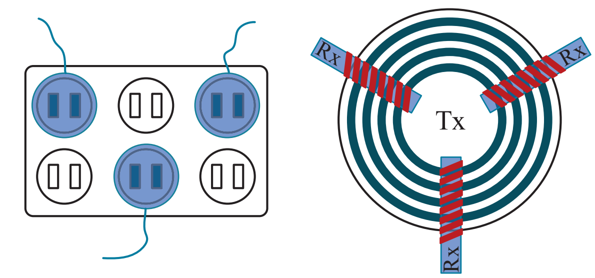
***Abstract*—This is abstract.**

***Index Terms*—BiliBili, powerful, template, latex, sublime.**

I. Introduction

Wireless power transfer (WPT) through magnetic coupling has a profound impact on both consumer electronics and industrial applications [1]. Compared with traditional plug-in systems, WPT systems are free of cables, providing users with a more convenient, safe and efficient experience [2]. Currently, most of commercialized WPT systems operate in kHz band, such as at several hundreds kHz [3]. It is mainly because this frequency band provides a richer selection of power electronics components. However, the kHz operation requires large-size coupling coils and ferrite to achieve enough mutual inductance.

$$\begin{cases} X_{\Pi 1} = X_{T1} + X_{T2} + \frac{X_{T1}X_{T2}}{X_{T3}}, \\ X_{\Pi 2} = X_{T2} + X_{T3} + \frac{X_{T2}X_{T3}}{X_{T1}}, \\ X_{\Pi 3} = X_{T3} + X_{T1} + \frac{X_{T3}X_{T1}}{X_{T2}}. \end{cases} \tag{2}$$



(a) (b)

Fig. 1. Caption. (a) Subcaption1. (b) Subcaption2.

Fig.
rm reffig:socketNew shows...

II. A Novel Method to Design Impedance Matching Networks for MHz WPT Systems

Thus the transformed impedance, i.e., the input impedance of the IMN, can be calculated as:

$$\begin{aligned} Z_{\text{net}} &= R_{\text{net}} + \mathrm{j}X_{\text{net}} = Z_{\text{T1}} + (Z_{\text{load}} + Z_{\text{T2}}) // Z_{\text{T3}} \\ &= \mathrm{j}X_{\text{T1}} + \frac{\int_0^\infty \mathrm{j}X_{\text{T3}} (R_{\text{load}} + \mathrm{j}X_{\text{load}} + \mathrm{j}X_{\text{T2}})}{R_{\text{load}}} \end{aligned} \tag{3}$$

III. Parameter Design

A. System Configuration

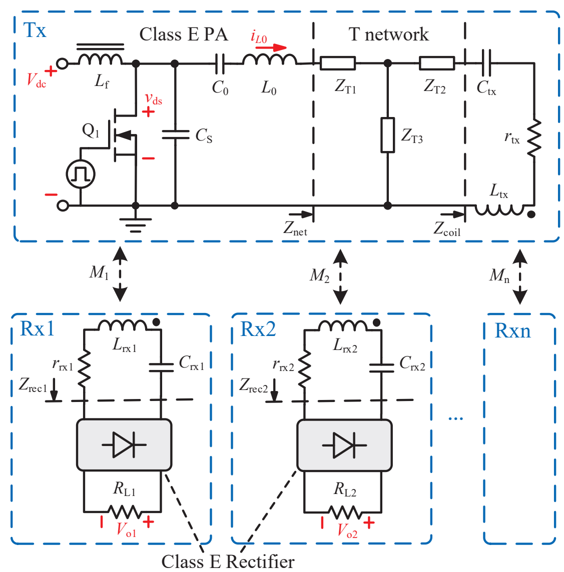
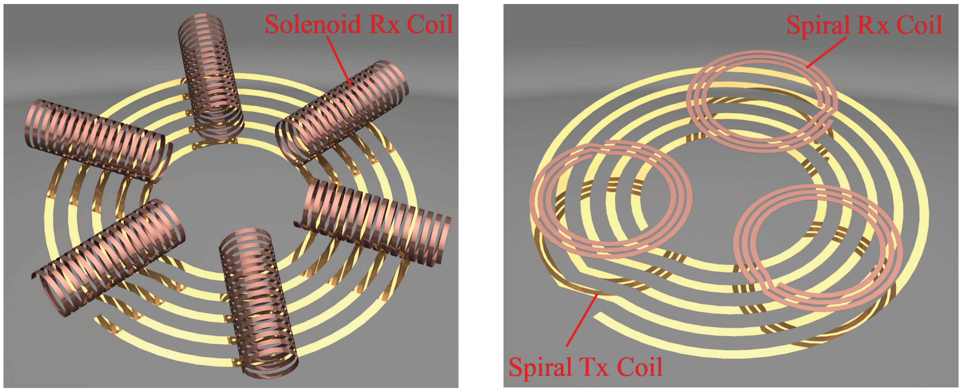


Fig. 2. System configuration of proposed multi-receiver MHz WPT system.

Fig.
rm reffig:system illustrates configuration of the proposed multi-receiver MHz WPT system, which is composed of a PA, an IMN of T-network, a transmitting (Tx) coil and several receiving (Rx) coils connected with corresponding rectifiers. In this system, Class E typology is applied in both the PA and the rectifier, due to its zero voltage switching (ZVS) and zero voltage derivative switching (ZVDS) characteristics. In the figure, $M_1 \sim M_n$ are the mutual inductance between the Tx coil and different Rx coils, with the cross coupling between

$$\begin{aligned} a &= \sqrt{(R_{\text{loadA}} + R_{\text{loadB}})^2 + (X_{\text{loadA}} - X_{\text{loadB}})^2 + 4R_{\text{loadA}}R_{\text{loadB}}\tan^2\theta_{\text{ref}}} \cdot \sqrt{(R_{\text{loadA}} - R_{\text{loadB}})^2 + (X_{\text{loadA}} - X_{\text{loadB}})^2} \\ b &= R_{\text{loadB}}^2 + R_{\text{loadA}}^2 \left(1 + 2\tan^2\theta_{\text{ref}}\right) + (X_{\text{loadA}} - X_{\text{loadB}})^2 + 2R_{\text{loadA}}\left[R_{\text{loadB}}\left(1 + \tan^2\theta_{\text{ref}}\right) + \tan\theta_{\text{ref}}\left(X_{\text{loadB}} - X_{\text{loadA}}\right)\right] \end{aligned} \tag{1}$$



(a) (b)

Fig. 3. Coil shapes. (a) Solenoid. (b) Spiral.

TABLE I
TARGET SETTING AND CALCULATED PARAMETERS OF THE IMN

Original Impedances	
Z_{loadA} (Z_{coilA})	27+0j Ω
Z_{loadB} (Z_{coilB})	9+0j Ω
Target Setting	
Z_{ref}	14.7+12.3j Ω
θ_{ref}	-88°
Calculated T-net	
Z_{T1}	26.7j Ω
Z_{T1}	7j Ω
Z_{T1}	-23.4j Ω

TABLE II
PARAMETERS OF THE EXPERIMENTAL SYSTEM

Parameters	Value	
f	6.78 MHz	
L_f	10 uH	
L_0	2.17 uH	$\Longrightarrow$ Z_{T1} = 26.7j Ω
C_0^*	357 pF	
C_s	287 pF	
L_{tx}	6.65 uH	$\Longrightarrow$ Z_{T2} = 7j Ω
C_{tx}^*	85 pF	
r_{tx}	1.1 Ω	
C_{T3}	1005 pF	$\Longrightarrow$ Z_{T3} = -23.4j Ω
Z_{ref}	9∼27 Ω	
$M_1 \sim M_3$	0.45 uH	
L_r	4.7 uH	
$C_{r1} \sim C_{r3}$	540 pF	
C_L	10 uF	
$R_{L1} \sim R_{L3}$	40 Ω	

the Rx coils ignored. L_{tx} is inductance of the Tx coil and L_{rx1}∼L_{rxn} are the inductances of Rx coils. Their parasitic resistors and compensation capacitors are also shown in the figure. sys sys sys

Table
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IV. HYBRID COUPLING COILS

Based on the above factors and the preliminary simulations, the hybrid coupler has the following 2 advantages:

- Higher receiver capacity;
- Suitable for those receivers with special shapes.

[4]

V. EXPERIMENTAL VERIFICATION

VI. CONCLUSIONS

A multi-receiver MHz WPT system with hybrid coupler is proposed.

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