CLAIMS

1. A method for determining a value of a variable on a radio frequency (RF) transmission model, the method comprising:

identifying a first complex voltage and current measured at an output of an RF generator when the RF generator is coupled to a plasma chamber via an impedance matching circuit, the impedance matching circuit having an input coupled to the output of the RF generator and an output coupled to an RF transmission line;

generating an impedance matching model based on electrical components defined in the impedance matching circuit, the impedance matching model having an input and an output, the input of the impedance matching model receiving the first complex voltage and current, the impedance matching model having one or more elements;

propagating the first complex voltage and current through the one or more elements from the input of the impedance matching model to the output of the impedance matching model to determine a second complex voltage and current, wherein the second complex voltage and current is at the output of the impedance matching model;

generating an RF transmission model based on circuit components defined in the RF transmission line, the RF transmission model having an input and an output, the input of the RF transmission model coupled to the output of the impedance matching model, the RF transmission model having a portion that includes one or more elements, wherein the RF transmission model includes a model of an RF tunnel and a model of an RF strap, the RF tunnel model coupled with the RF strap model; and

propagating the second complex voltage and current through the one or more elements of the RF transmission model portion from the input of the RF transmission

matching model coupled between the input of the impedance matching model and the intermediate node; and

determining the second complex voltage and current based on the intermediate complex voltage and current and characteristics of one or more elements of the impedance matching model coupled between the intermediate node and the output of the impedance matching model.

~~13. The method of claim 1, wherein the RF transmission model includes a model of an RF tunnel and a model of an RF strap, the RF tunnel model coupled with the RF strap model.~~

~~14.~~13. The method of claim 1, wherein the circuit components of RF transmission line include a combination of capacitors and inductors, wherein the elements of the RF transmission model have similar characteristics as that of the circuit components of the RF transmission line.

~~15.~~14. The method of claim 1, wherein propagating the second complex voltage and current through the one or more elements of the RF transmission model portion from the input of the RF transmission model to the output of the RF transmission model portion to determine the third complex voltage and current comprises:

determining an intermediate complex voltage and current within an intermediate node within the RF transmission model portion based on the second complex voltage and current and characteristics of one or more elements of the RF transmission model portion coupled between the input of the RF transmission model and the intermediate node; and

determining the third complex voltage and current based on the intermediate complex voltage and current and characteristics of the one or more elements of the RF transmission model portion coupled between the intermediate node and the output of the RF transmission model portion.

~~16.~~15. A plasma system for determining a value of a variable on a radio frequency (RF) transmission model, comprising:

an RF generator for generating an RF signal, the RF generator associated with a voltage and current probe, wherein the voltage and current probe is configured to measure a first complex voltage and current at an output of the RF generator;

an impedance matching circuit coupled to the RF generator;

a plasma chamber coupled to the impedance matching circuit via an RF transmission line, the impedance matching circuit having an input coupled to the output of the RF generator and an output coupled to the RF transmission line; and

a processor coupled to the RF generator, the processor for:

identifying the first complex voltage and current;

generating an impedance matching model based on electrical components defined in the impedance matching circuit, the impedance matching model having an input and an output, the input of the impedance matching model receiving the first complex voltage and current, the impedance matching model having one or more elements;

propagating the first complex voltage and current through the one or more elements from the input of the impedance matching model to the output of the impedance matching model to determine a second complex voltage and

current, wherein the second complex voltage and current is at the output of the impedance matching model;

generating an RF transmission model based on electrical components defined in the RF transmission line, the RF transmission model having an input and an output, the input of the RF transmission model coupled to the output of the impedance matching model, the RF transmission model having a portion that includes one or more elements, wherein the RF transmission model includes a model of an RF tunnel and a model of an RF strap, the RF tunnel model coupled with the RF strap model;

propagating the second complex voltage and current through the one or more elements of the RF transmission model portion from the input of the RF transmission model to an output of the RF transmission model portion to determine a third complex voltage and current, wherein the third complex voltage and current is at the output of the RF transmission model portion; and

providing the third complex voltage and current for storage to a storage hardware unit.

~~17.~~16. The system of claim ~~16~~15, wherein the voltage and current probe is calibrated to comply with a pre-set formula.

~~18.~~17. The system of claim ~~17~~16, wherein the pre-set formula is a standard, wherein the standard is a National Institute of Standards and Technology (NIST) standard, wherein the voltage and current probe is coupled with an open circuit, a short circuit, or a load to calibrate the voltage and current probe to comply with the NIST standard.

~~19.~~18. A computer system for determining a value of a variable on a radio frequency (RF) transmission model, the computer system comprising:

a processor configured to:

identify a first complex voltage and current measured at an output of an RF generator when the RF generator is coupled to a plasma chamber via an impedance matching circuit, the impedance matching circuit having an input coupled to the output of the RF generator and an output coupled to an RF transmission line;

generate an impedance matching model based on electrical components defined in the impedance matching circuit, the impedance matching model having an input and an output, the input of the impedance matching model receiving the first complex voltage and current, the impedance matching model having one or more elements;

propagate the first complex voltage and current through the one or more elements from the input of the impedance matching model to the output of the impedance matching model to determine a second complex voltage and current, wherein the second complex voltage and current is at the output of the impedance matching model;

generate an RF transmission model based on electrical components defined in the RF transmission line, the RF transmission model having an input and an output, the input of the RF transmission model coupled to the output of the impedance matching model, the RF transmission model having a portion that includes one or more elements, wherein the RF transmission model includes a model of an RF tunnel and a model of an RF strap, the RF tunnel model coupled with the RF strap model; and

propagate the second complex voltage and current through the one or more elements of the RF transmission model portion from the input of the RF transmission model to an output of the RF transmission model portion to determine a third complex voltage and current, wherein the third complex voltage and current is at the output of the RF transmission model portion; and

a memory device coupled to the processor, the memory device configured to store the third complex voltage and current.

~~20.~~19. The computer system of claim ~~19~~18, wherein the first complex voltage and current received is measured at the output of the RF generator with a voltage and current probe, the voltage and current probe calibrated according to a pre-set formula.

~~21.~~20. The computer system of claim ~~20~~19, wherein the voltage and current probe is decoupled from a digital signal processor of the RF generator.