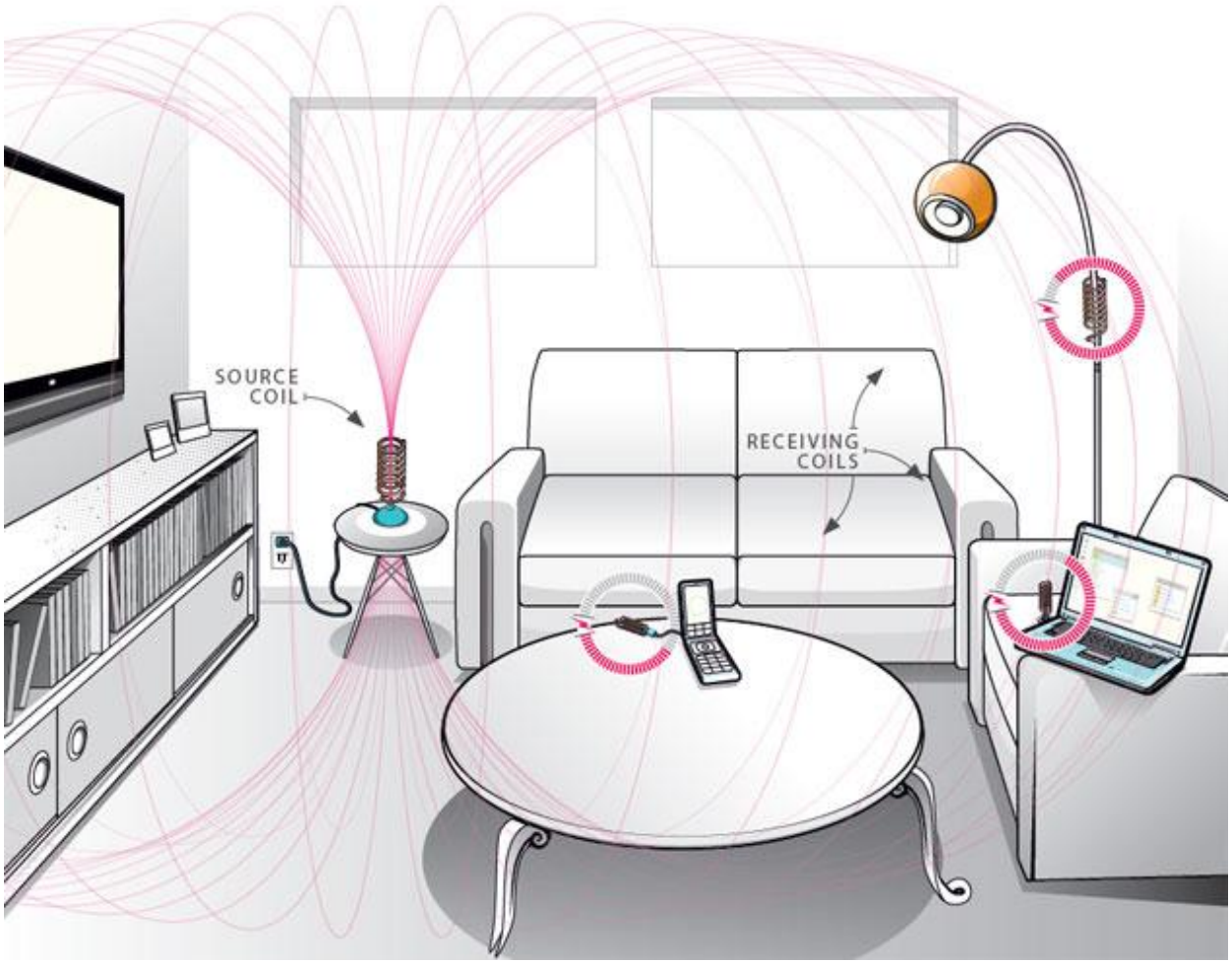
eGaN® FETs in Low Power Wireless Energy Converters

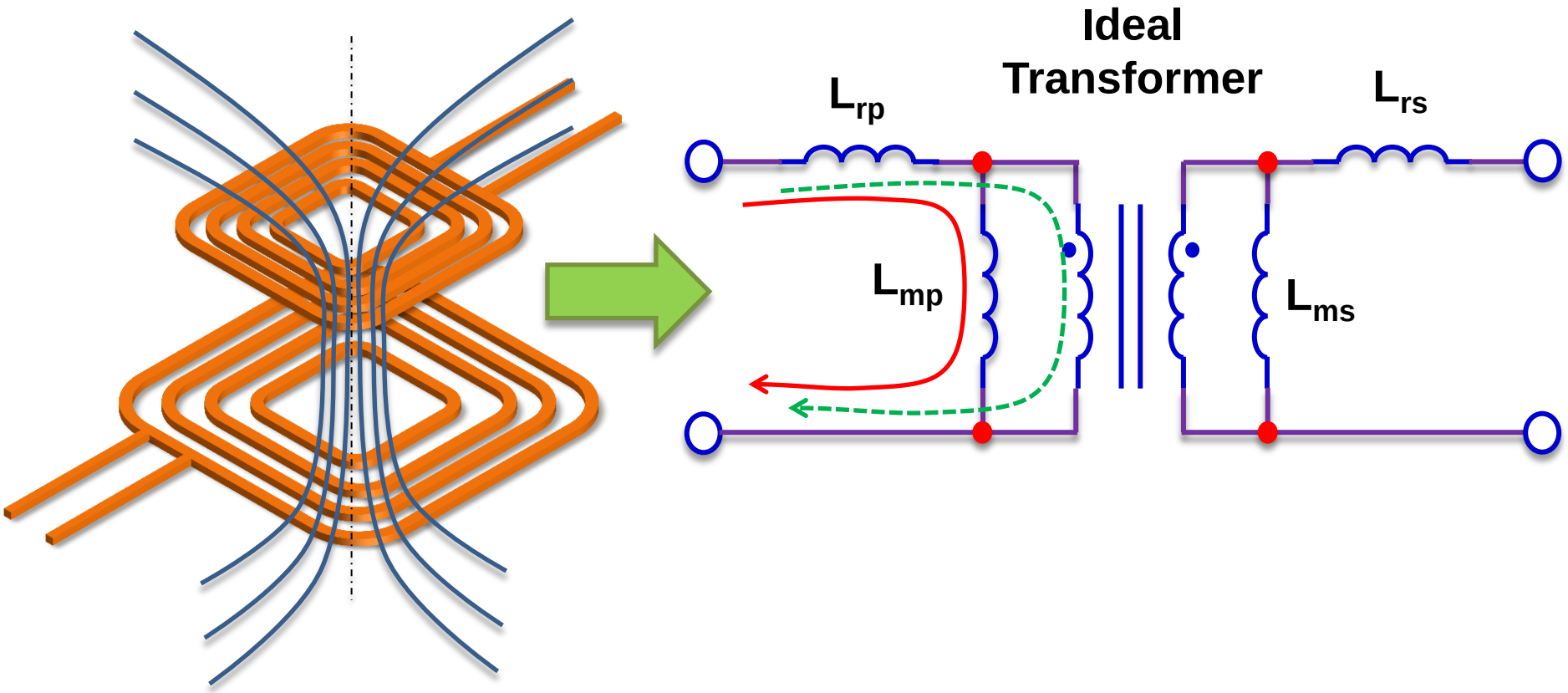
M. A. de Rooij & J. T. Strydom

Efficient Power Conversion

Wireless Power



Equivalent Circuit model for the Coils

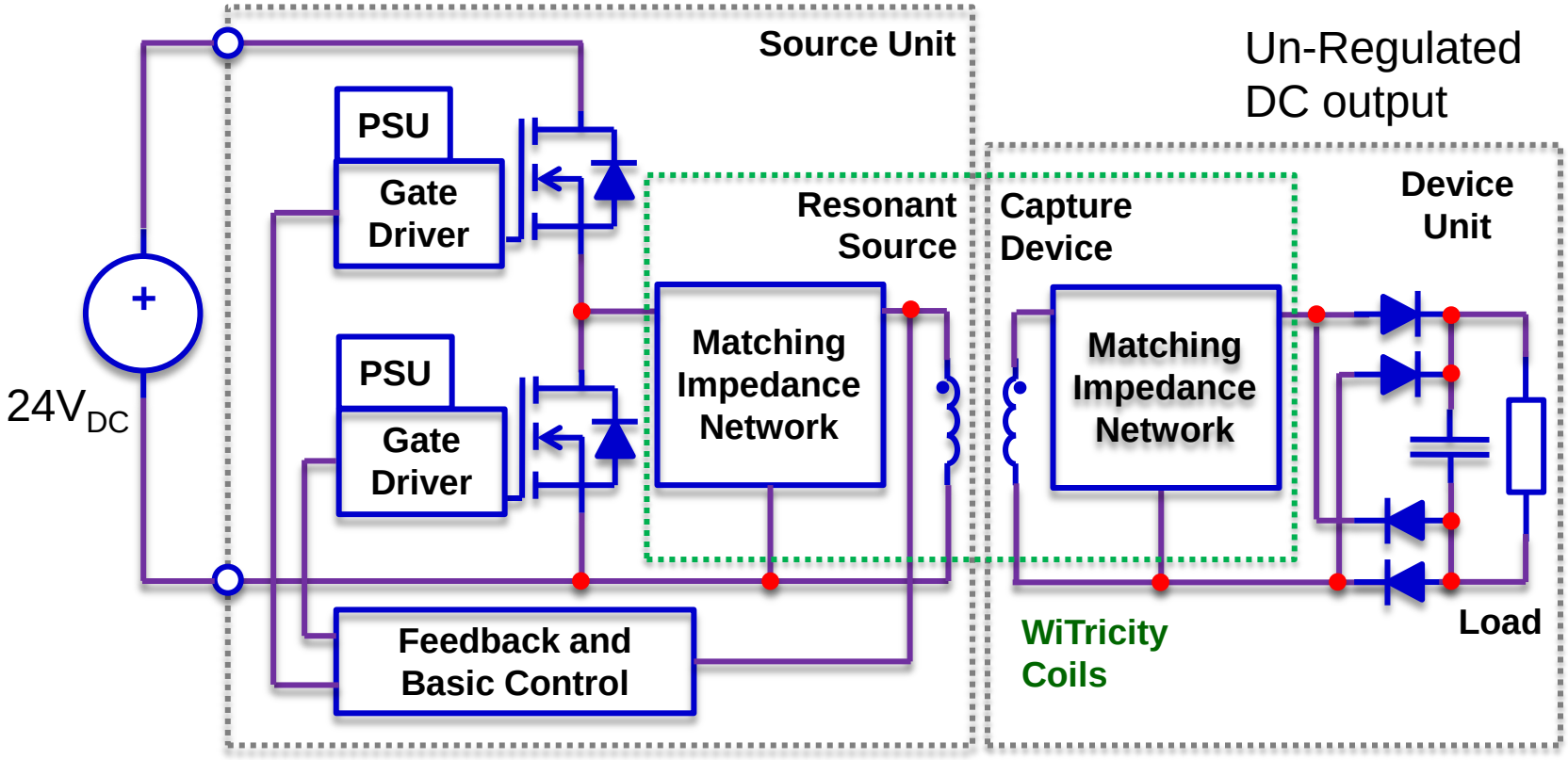


Induction Wireless Energy System Overview

Comprises 4 main sections:

1. An amplifier (a.k.a. a power converter).
2. A transmit coil including matching network.
3. A receive coil including matching network.
4. A rectifier with high frequency filtering

Block Diagram of the Wireless System



Loss Breakdown Considerations

FET:

- Conduction
- Switching
- *Gate*

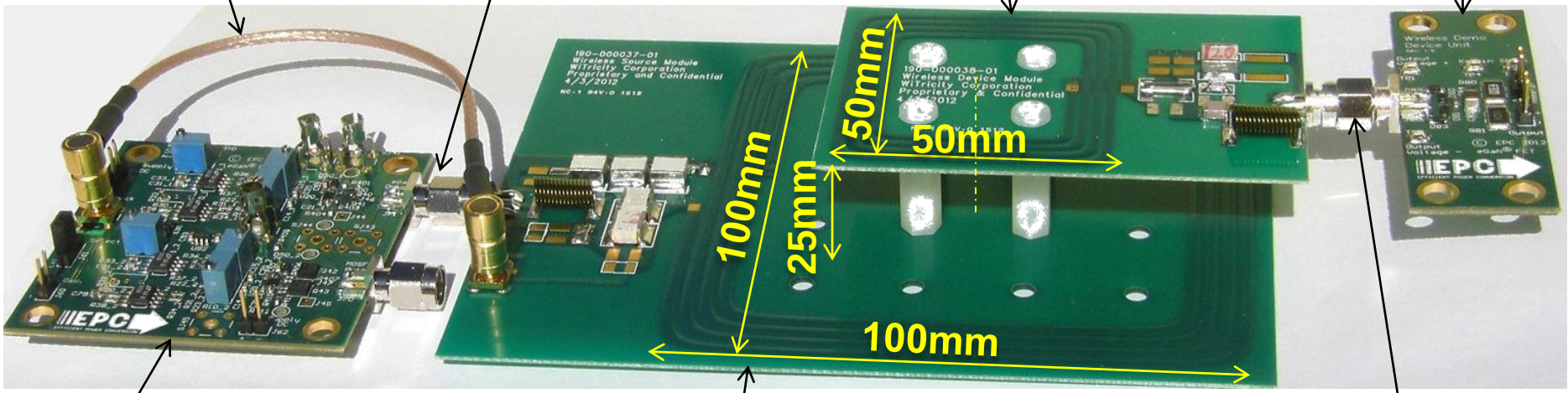
Rectifier:

- Conduction losses
- *Capacitive losses*

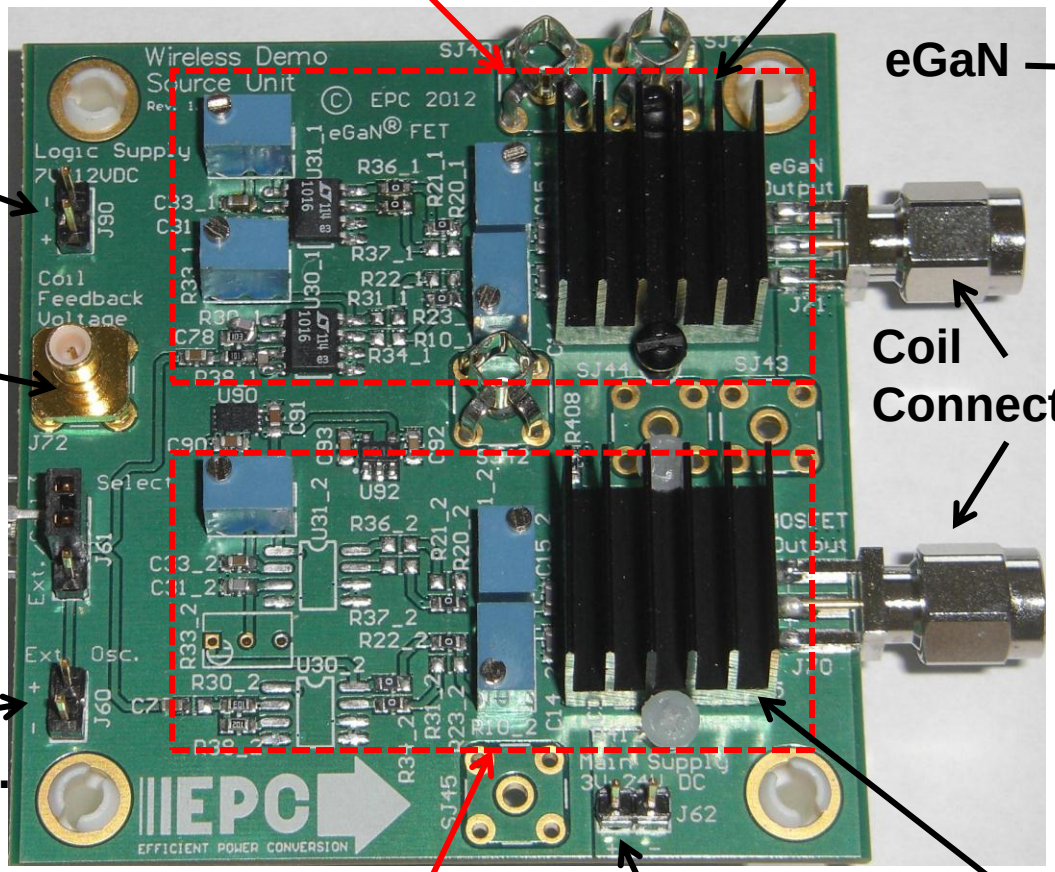
Coil:

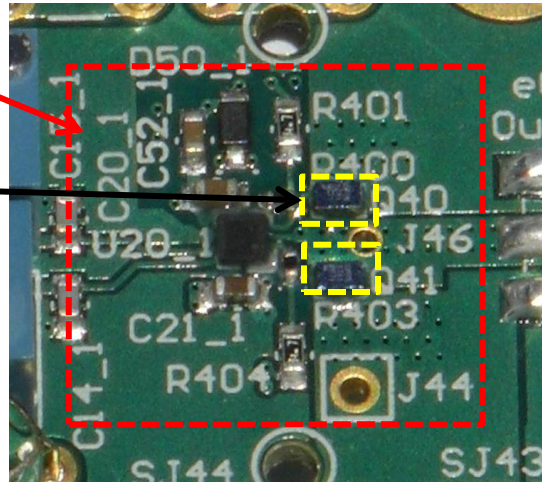
- Conduction losses (skin and proximity effects)

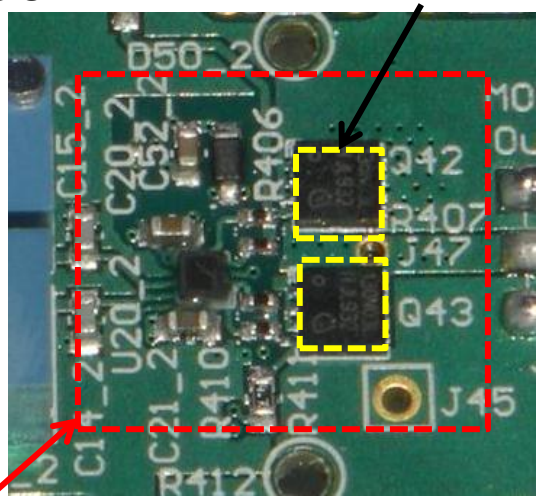
Experimental System Setup



Source Board of the Wireless System







eGaN FET Circuit

eGaN FET Heat-Sink

eGaN

Control Supply

Coil Voltage Feedback

Coil Connection

MOSFET

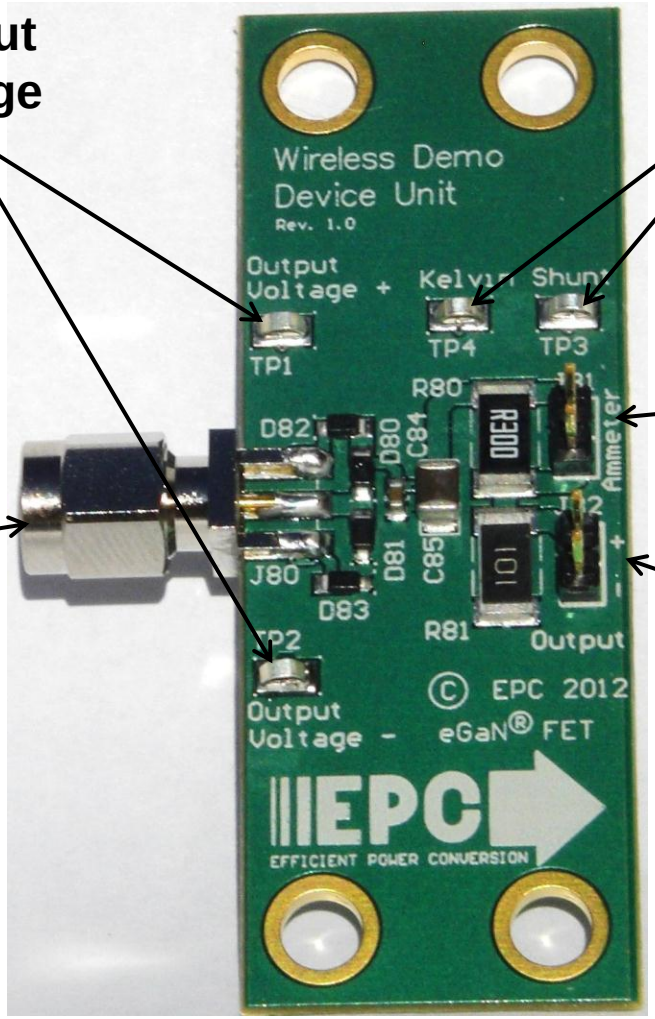
Ext. Osc.

MOSFET Circuit

Main Supply

MOSFET Heat-Sink

Capture Board of the Wireless System



Kelvin Output Voltage

Kelvin Shunt Voltage

*** Ammeter connection**

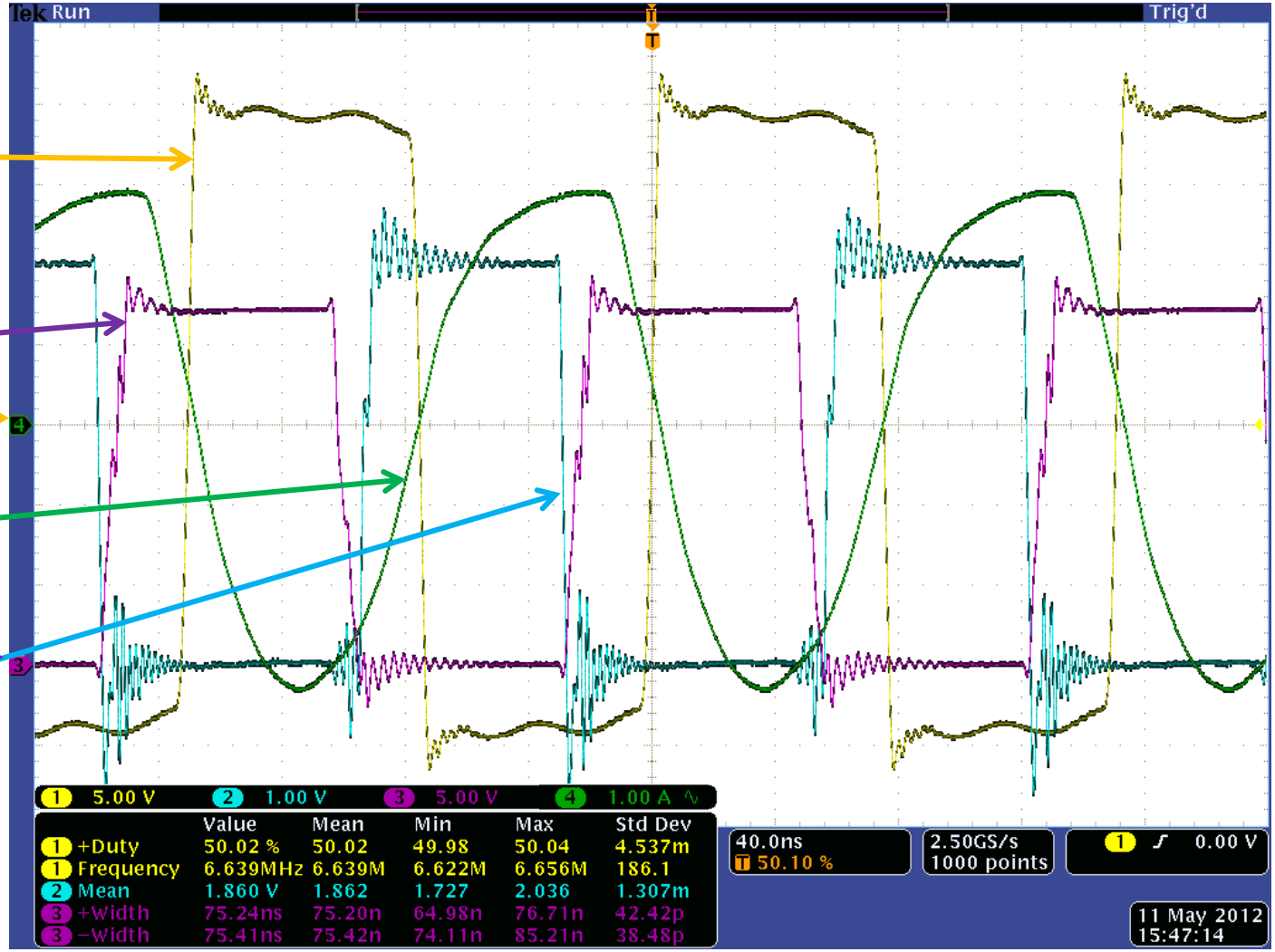
Coil Connection

Output

*** Remove Shunt before using Ammeter**

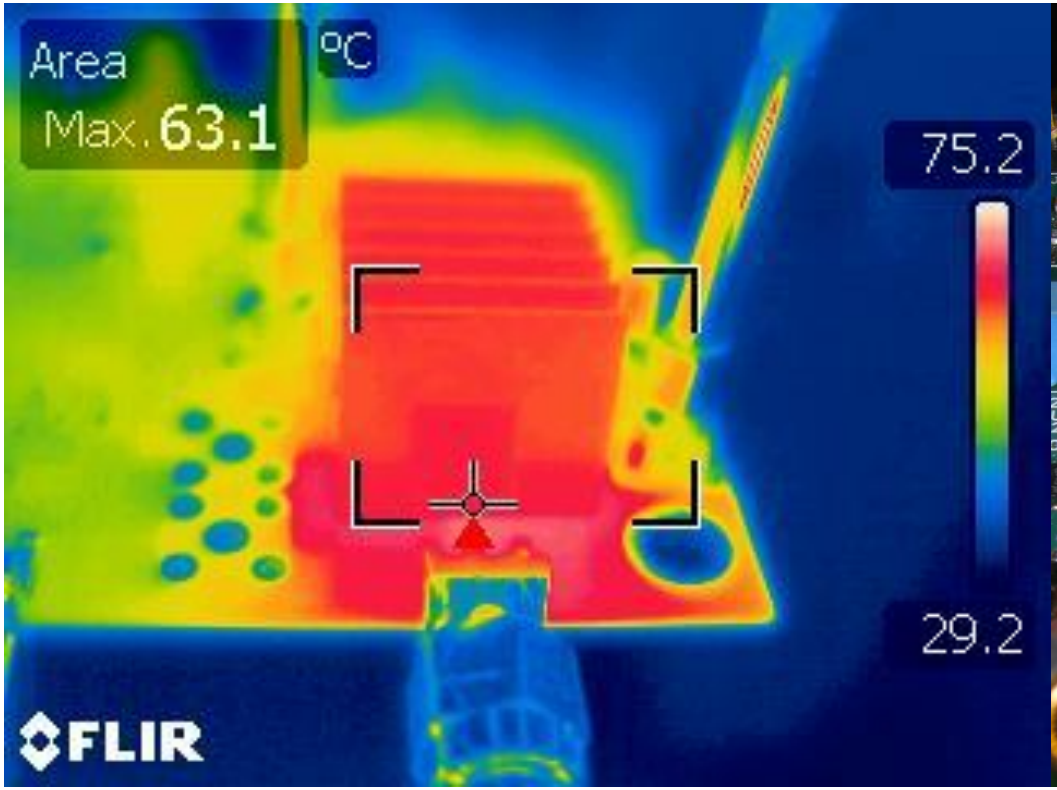
Typical Operating Waveforms

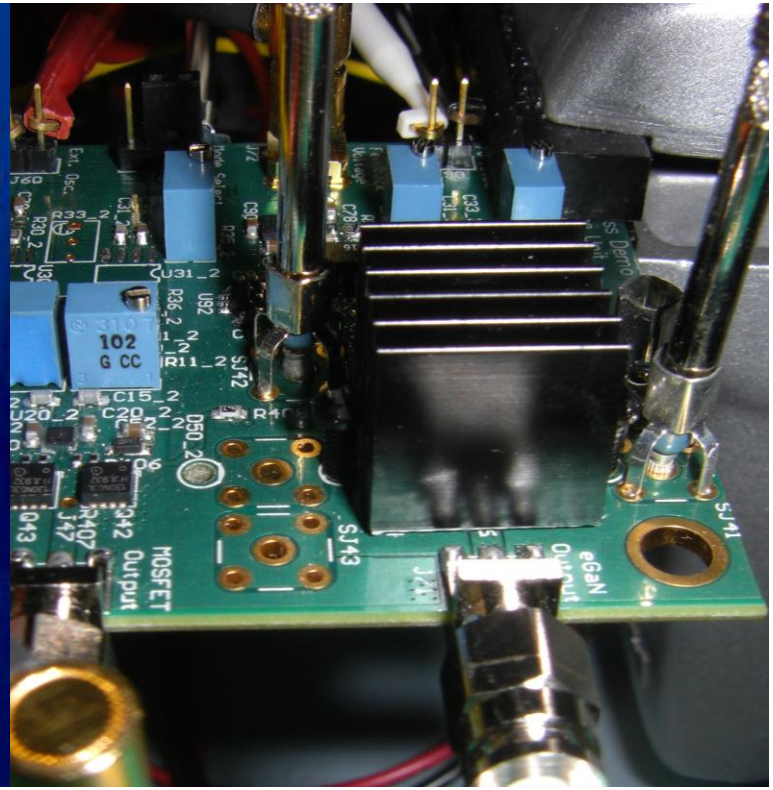
22 V input, 6.639 MHz, 23.6 Ω load (15 W)



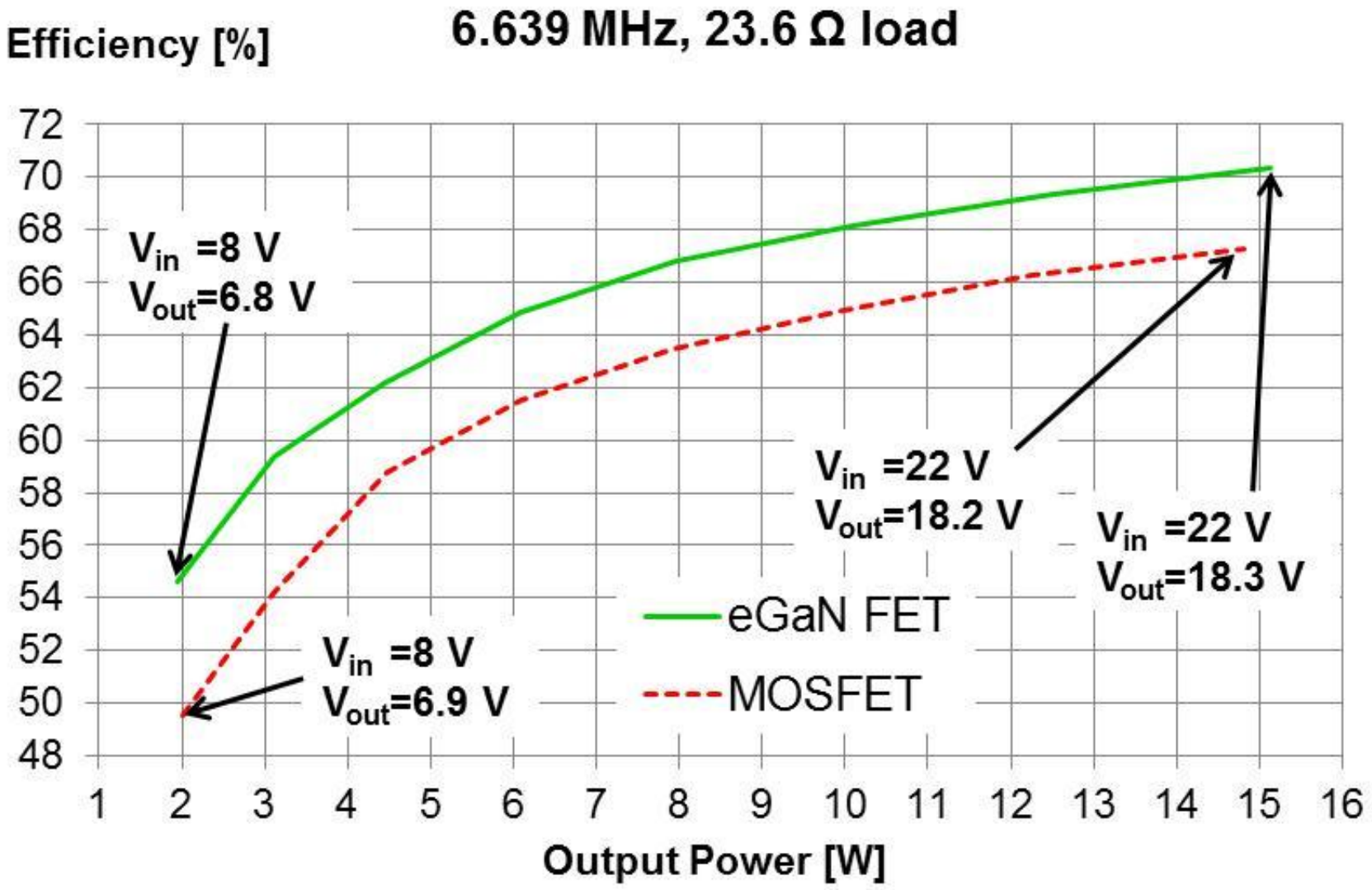
Thermal Performance of the Wireless System

28ºC ambient, No forced air cooling, 20 V input, 6.639 MHz, 23.6 Ω load (12.5 W)

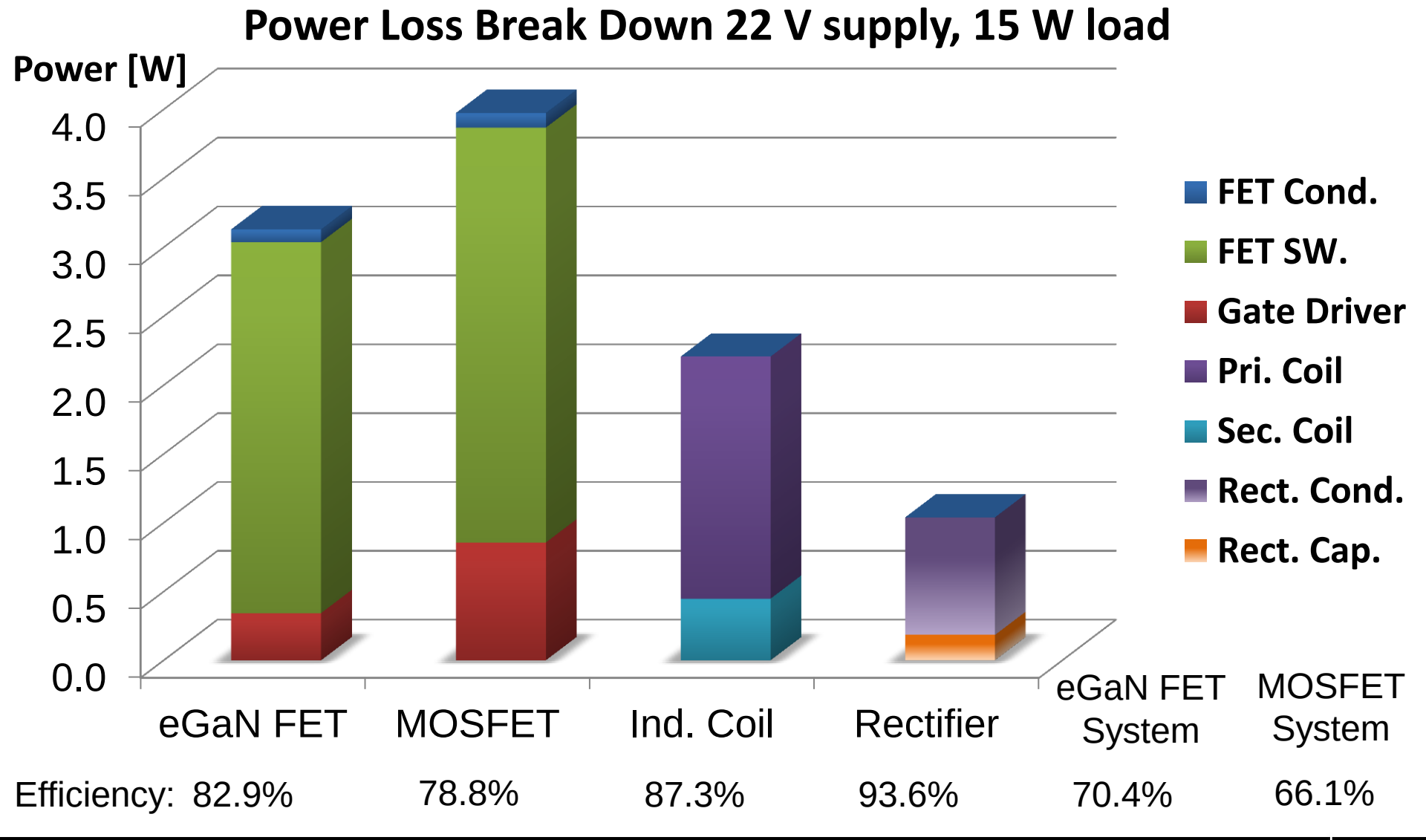




Efficiency as function of Load Power



Loss Breakdown of the Wireless System



Conclusions

High Frequency (6.78 MHz) Class D Wireless Energy Transfer System enabled by using eGaN FETs.

- Low Losses
- Small Size
- Support circuitry available (LM5113 gate driver)

EFFICIENT POWER CONVERSION

The end of the road for silicon…..

is the beginning of the eGaN FET journey!