Energy Transmission Systems and EMC

1. Greetings&thanks

- Introduction
- Thanks to organizers

From the idea to realization

- In 2016 – idea of power delivery to flying drones
- Variants of realization: directional and non-directional, near and far field
- Efficiency and weight matters
- Impact of system parts on efficiency
- Choice of optimum frequency

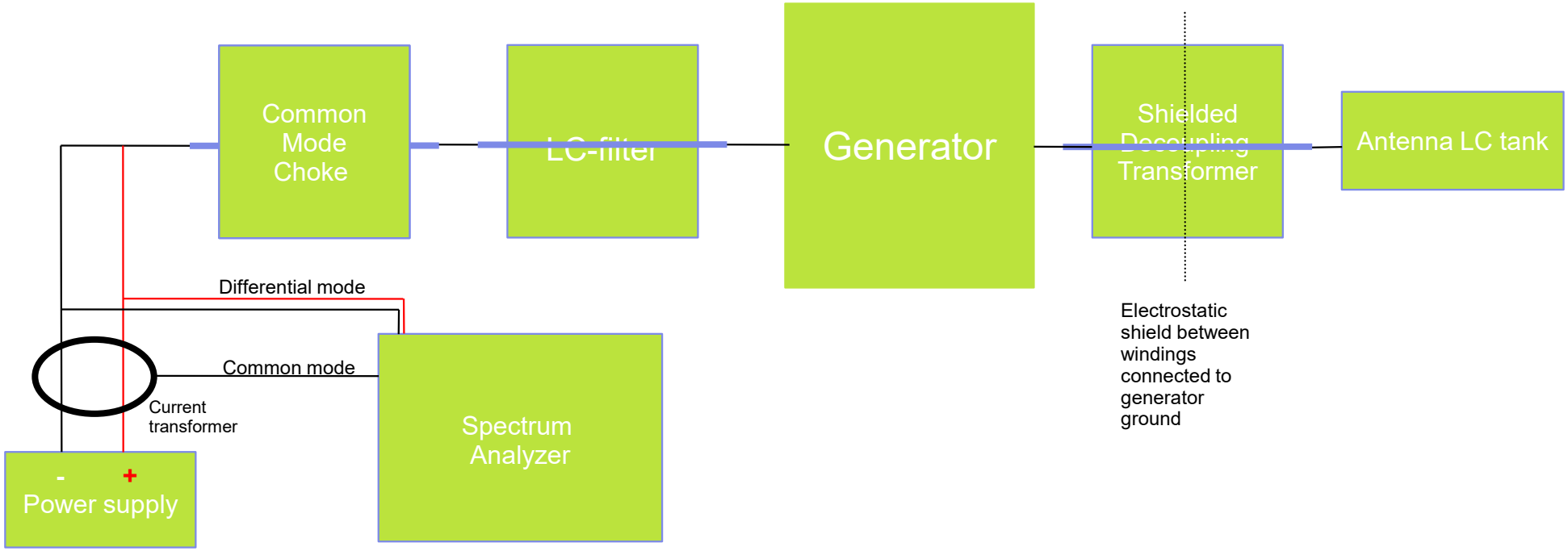
Inductive coupling

- Modern capacitors can reach Q>5000
- Special construction of wires
- Resulting Q of LC tanks reaches 200-800 enabling efficient power transfer with low coupling coefficients. Ck=mutual inductance/$\sqrt{L1*L2}$
- ~1 MVA of reactive power circulating in transmitter LC tank, ~100 kVA – in receiving LC tank

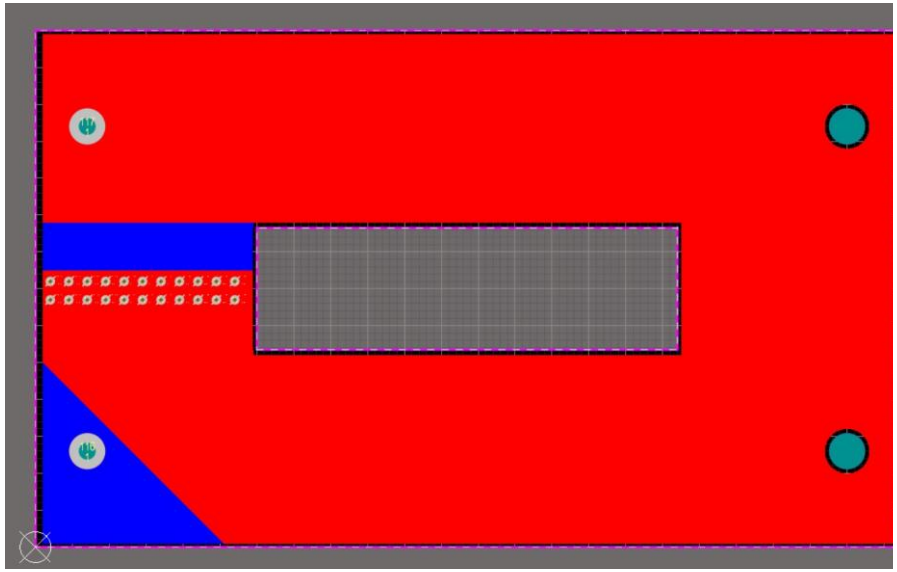
EMC – problems and solutions

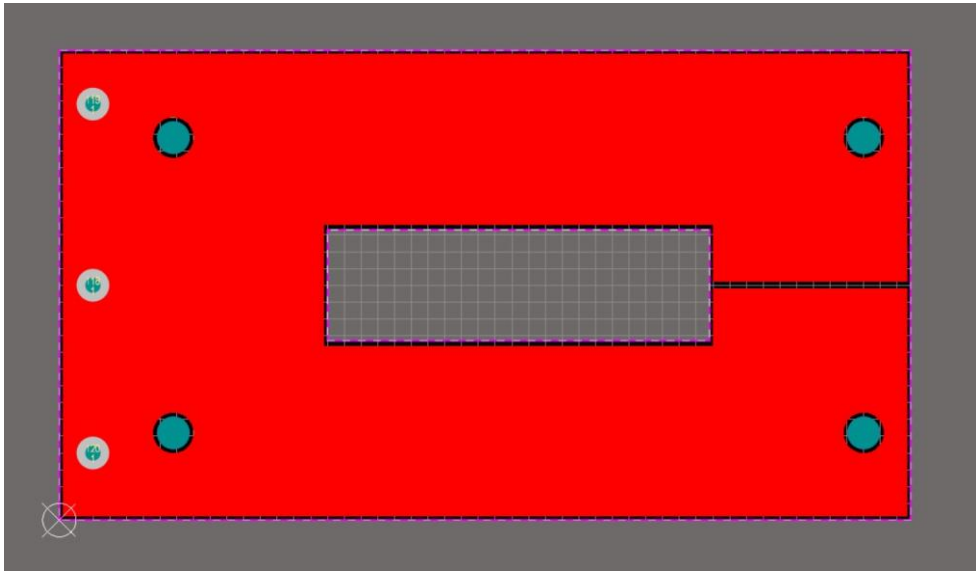
- Modern High efficiency switching transistors shows nanosecond timing
- Transmitting LC tank need to be decoupled for all frequencies except working fundamental frequency
- All oscillations inside transmitting generator needs to be locked inside without significant leakages to power source

Demonstration circuit - transmitter



Decoupling transformer construction





Demonstration experiments

- Decoupling of transmitting LC tank using shielded transformer
- Filtering in-phase emissions to power supply line
- Filtering of in-phase emissions to power supply line
- Best practice is using all reasonable techniques

First drone receiving 300+ W from ground station, 2016

12 kW transmitted to flying drone, 2018

That’s all, folks

- Questions
- Cat! Everybody loves cats.