

- 1 concept
- 2 field distribution in a planar coupler

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## HIGH SPEED DATA LINK

### Wireless near field power and data coupler

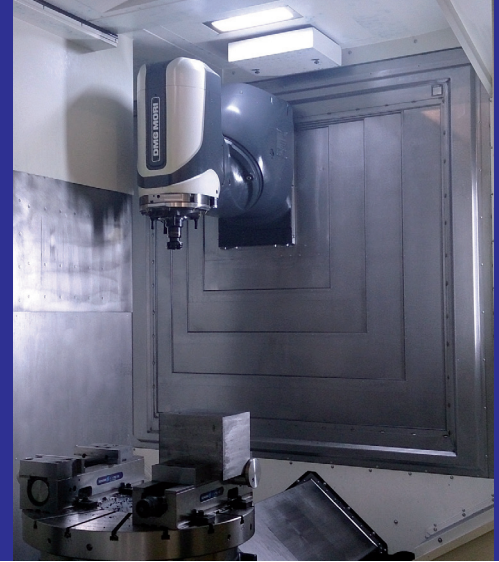
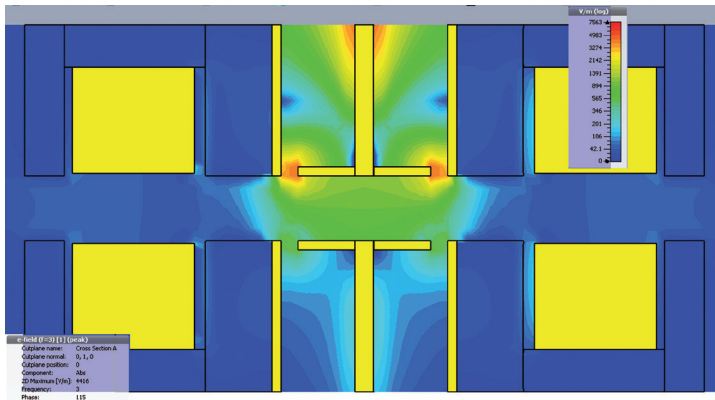
When autarchic components communicate with a manufacturing plant; technical modules autonomously initiate a repair in the case of malfunction; sensors, employees and industrial processes are interconnected intelligently; then we are talking about industry 4.0. Driven by the World Wide Web, the real and virtual worlds increasingly merge to become an "Internet of Things" ("IoT"), and therefore the economy is at the threshold of the fourth industrial revolution. The intelligent interlocking of products with the latest information and communications technology is characterized by a high level of product individualization in highly flexible (high-volume) production. Companies and whole supply chains are to be controlled in real-time and optimized based on smart analysis processes. In accordance with customer demands, customized, high-value products are being manufactured in a cost-efficient way. From the idea stage to the development, production, application and

maintenance right up to the recycling, the upcoming generation of industry will affect all phases of a product's life cycle.

For the flexible and wear-free connection of various sensors and actuators in industrial environments, contactless communication lines are preferred, whether it is robotic units at tool changes or rotary indexing tables at material processing. Where plug connections reach their limits, caused by spatial constraints, dust, soiling or moving and rotating mechanisms, contactless connections represent an alternative solution. This kind of contact without physical touch reduces the maintenance and installation costs. Furthermore, new degrees of freedom are created. Misalignment, for example by increasing the distance, lateral displacement or inclinations, can be tolerated. Additional rotation symmetry is given by a symmetrical structure.

The presented system shows a hybrid solution for contactless short distance transmission of power based on the Qi standard and the transfer of broadband data signals.





For this purpose, an inductive coupler is used for the transfer of power and a broadband coupler for the data transfer. With a transmission range of up to 5 mm it can be used to replace wired connections in many applications, for example for interfacing of sensors in Smart Factory implementations. In contrast to other wireless technologies this solution has a powerful advantage: it is ensured that no other systems in the surroundings are disturbed and multiple short distance transmission systems can be operated close-by in parallel, because the coupler does not occupy any frequency range in the environment.

### Special system properties

- data rates of over 100 Mbit/s possible
- power transfer up to 120 W possible
- robust against broadband and narrow-band interference
- application in heavily EMC charged environments
- low installation costs
- wear-resistant, no galvanic contacts
- 360° rotation symmetry
- degree of freedom of positioning
  - distance of up to 5 mm
  - displacement from the center of up to 4 mm
  - tilting of up to 30°
- maintenance-free because of self-sufficient energy supply
- no occupation of frequency ranges in the environment

### Applications

- sensors in rotating parts
- rotary indexing tables
- automatic tool changes
- instrumentation of cutting machine tools
- instrumentation of straightening benches
- replacement for slip ring transmitters

### System architecture

The overall system consists of the following components:

- radio connection consisting of a transmitter (master device) and receiver (slave device) for a contactless transfer of data and power
- near field coupler for narrow-banded LF energy transmission and parallel broadband data transmission
- broadband communication unit with full or half duplex data transfer
- wireless near field power transmitter based on the Qi standard (master device)
- wireless near field power receiver based on the Qi standard (slave device)

3 field simulation of the coupler

4 machine tool, possible site for application