

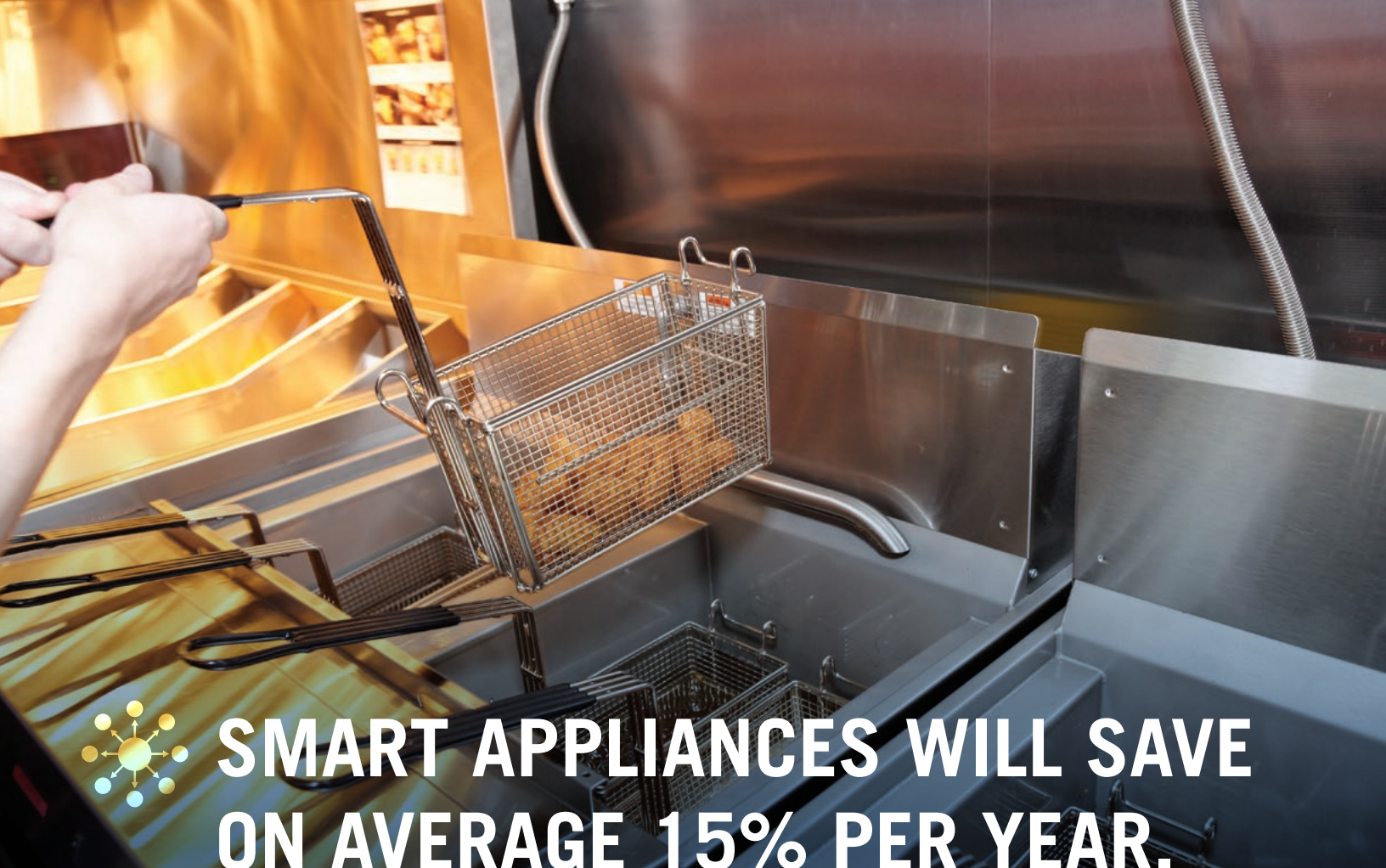


SMART INDUSTRIAL KITCHENS

Connecting Information with Optimized Radio Frequency (RF) Performance

The industrial Internet of Things (IoT) has made it easy to apply multiple sensors/actuators to commercial kitchen devices such as refrigerators, fryers, hot boxes, cook tops to measure everything from thermostats and energy management to food safety, reporting, and regulation controls. In fact, it is predicted by 2020 there will be 50 billion connected “things”¹ improving equipment performance and saving companies time and money. But what is needed to connect appliances in a commercial kitchen?





SMART APPLIANCES WILL SAVE ON AVERAGE 15% PER YEAR.

Connected Kitchen Improves Productivity

By connecting equipment and devices using sensors, restaurants and commercial kitchens can automate operations, improve performance and increase operational efficiencies. Industrial IoT in the kitchen of the future means businesses can:

- Automate standardized operations
- Issue alerts when things are not right
- Anticipate equipment failures
- Identify performance problems and schedule maintenance
- Collect data such as temperature readings for food safety reports
- Push menus to equipment
- Reduce operating costs with real-time reports

Today only about 0.06%¹ of all devices that are able to leverage IoT are doing so, meaning the opportunity to enhance the way commercial kitchens leverage IoT to connect equipment is only just beginning. And according to Gartner, in 2020 food and beverage companies that utilize smart appliances will save on average 15% per year.²

Challenges Connecting Sensors in a Smart Kitchen

There are four main components of a connected kitchen: sensors placed on critical components such as temperature gauges and doors, wireless network and gateways to send and receive the data, software server or cloud application to collect the data, and a user interface to take action on information provided.

To send and receive information from the sensors over the network requires an optimized embedded RF antenna in the appliance. The antenna must meet strict design and space requirements, often operating within stainless steel equipment with electronic compressors, chilling systems and other electronic equipment present. This can pose RF reliability challenges; for example antennas located at the bottom of equipment or near the floor make it more difficult for sensor data to get out of the equipment and reach the network. As a result, the location and optimization of the antenna is vital to an effective smart kitchen appliance design.

Designing the Right Antenna for Your Smart Kitchen Equipment

Receiving data from sensors embedded in equipment begins with a properly optimized antenna. Using an off-the-shelf antenna may not be the best option to maximize signal strength. You need an RF antenna that is built specifically for your equipment and environment.

To meet your most demanding requirements, PCTEL® provides in-house experts in RF design, production and engineering. With experience developing complete embedded IoT wireless products including radio boards, antenna systems and enclosures, we focus on the latest technologies including evolving 802.11 and 802.11ad WiFi standards, LORA-1, 2.4 GHz, Bluetooth®/BLE, WiHart, 4G and 5G wireless.

Answers to Complex RF Requirements

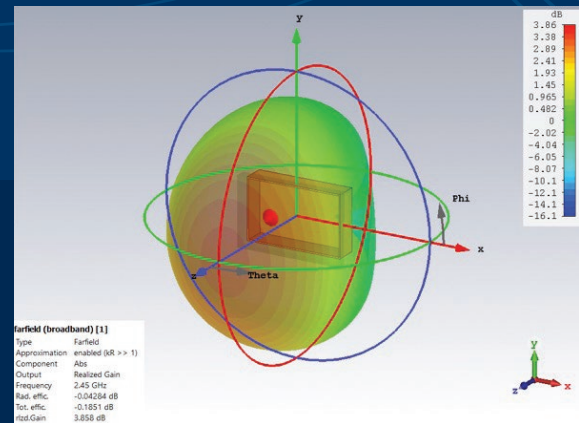
Industrial kitchens are non-static environments with many factors such as stainless steel materials, equipment with compressors, temperature extremes and building location which can create challenges for strong RF propagation. We use sophisticated tools and state-of-the-art modeling programs to create the right, customized antenna to fit your design requirements while minimizing interference. From specification design preparation to radio and motherboard design, to mechanical enclosure design and final test plan execution, we are a full service RF antenna system design team, ready to meet your needs.

Design, Testing and Modeling

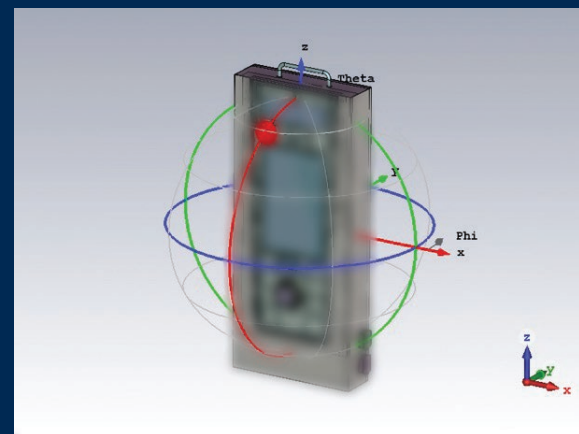
It is important to know how your wireless system will work before you begin placing embedded antennas in your equipment. We provide extensive high fidelity 3D electromagnetic and RF modeling to verify the antenna design before production. Based on the allocated region in the device, we will simulate the antenna performance taking into account the chassis features, location in the unit and any displays. We will show you:

- Proof of concept prototype to demonstrate functionality
- Creative approaches to materials for a cost-effective design
- How your antenna size conforms to space allocated in equipment 3D model
- Noise and interference mitigation to enhance performance

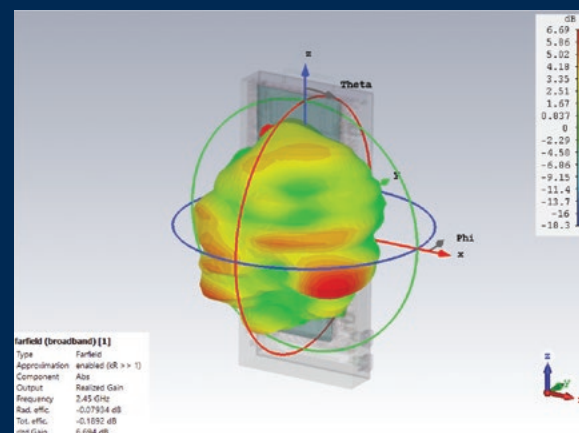
MODEL OF A 2.4 GHz ANTENNA LOCATED IN AN OVEN DISPLAY UNIT



▲ Antenna performance in free space



▲ Mechanical model of oven display unit



▲ Optimized antenna performance within display unit

PCTEL Solves Difficult RF Problems

From public safety and cellular network antennas to small industrial IoT embedded antennas, PCTEL has been a global leader in designing, testing and manufacturing antennas for over 25 years. We understand your wireless product requirements are unique. That's why we work directly with your team throughout the entire design and development cycle, from planning to production ensuring superior RF system performance. We'll create prototype and test plans to take the risk out of development and ensure you have a high quality product that is ready for implementation.

Our design engineers each have over 15+ years of RF system performance experience, providing you with expert Design Verification Testing (DVT) and production testing. When you need to implement embedded antennas as part of your IoT smart kitchen appliances, turn to PCTEL, where you will receive innovative design solutions to your RF challenges and expert attention to detail to improve the performance and efficiencies of your product offering.

Contact us for more information:

► www.pctel.com/kitchens

EMBEDDED IoT ANTENNA DESIGN SERVICES

- Radio, system, mechanical Design Verification Testing (DVT)
- Noise and interference mitigation
- Test plan design and execution
- High fidelity 3D electromagnetic RF modeling
- Sophisticated mechanical modeling including FEA and MES analysis
- Pre-certification testing
- Environmental testing
- Quality control manufacturing in the USA and China

¹ <https://www.newgenapps.com/blog/iot-statistics-internet-of-things-future-research-data>

² <https://www.information-age.com/gartners-internet-things-predictions-123458905/>



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