The Cordless Kitchen

from concept to industry standard

White paper
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1 Introduction

1.1 The Cordless Kitchen standard

In 2013 the Wireless Power Consortium (WPC) established the Kitchen Work Group to develop a specification for Cordless Kitchen Appliances. This white paper explains the concept and benefits of Cordless Kitchens, featuring small appliances ranging from simple 100 W juicers to heating appliances, such as kettles and pans, that require up to 2,400 W of power.

Our mission is to create a Cordless Kitchen specification that will enable the development of cheaper, safer, and smarter appliances that will reduce clutter, add a level of safety to the home or restaurant, and make handling, cleanup, and storage easier in any kitchen. The specification will leave ample design freedom for makers of transmitter and appliance products, focusing on the aspects of design that ensure interoperability and safety. The Cordless Kitchen specification will be accompanied by a compliance and certification program that will lead to flawless and intuitive interoperability of appliances in kitchens worldwide.

1.2 Invitation to participate

Please consider joining the WPC to participate in developing our game-changing, international standard for Cordless Kitchens if your company is a maker of:

- small kitchen appliances,
- built-in kitchen appliances, such as stoves and induction cooktops,
- components, including coils and ICs,
- cookware,
- kitchen counters, or
- kitchen and dining room furniture

Why join now? The Wireless Power Consortium has reached agreement on the high-level commercial requirements for the specification, and is in the process of defining the Cordless Kitchen standard and features. By joining the Kitchen Work Group, you will be able to present your views and influence the specification. And by becoming a member of the Wireless Power Consortium, you will get early access to draft specifications and other technical resources.

Kitchen retailers, integrators, and other interested parties are also encouraged to contact the WPC for further information, and are cordially invited to attend any of our several trade shows held every year in North America, Europe, and Asia.
2  What is a Cordless Kitchen?

The Cordless Kitchen is a revolution in food preparation and cooking convenience. Small appliances are powered simply by placing them over magnetic power sources (MPS) that are built into a counter, cooktop (hob), or table. These appliances need no power cords that are customarily draped across a counter or table and plugged into an outlet. Power to the appliance is provided by inductive power transfer, in which a permanently-mounted MPS that contains a coil draws power from the Mains and transfers it via magnetic induction to a secondary coil in the appliance. The power is then converted within the appliance back into electrical power and/or heat for cooking as required.

Figure 1. Placing a Cordless Kitchen blender on a built-in, magnetic power source
2.1 Why traditional kitchen appliances will become obsolete

Traditional kitchen appliances—blenders, mixers, rice cookers, slow cookers, toasters, etc.—all share a standard component that has been in use since the early twentieth century: the power cord. While we have all benefitted from the ability to plug virtually any appliance into a wall outlet (an advantage of standards), we have come to live with the inherent inconvenience of power cords.

- The power cord must be long enough to reach the nearest outlet, which means the cord will inevitably clutter up precious counter space behind the appliance.
- When putting the appliance away, power cords seem to take on a life of their own. One can wind up or secure the cord with a tie or rubber band, but it must be undone before it can be used again.

As seen with the phenomenal growth of wireless technologies, such as Bluetooth, Wifi, and Qi wireless charging, people are delighted when they are given an alternative to wires and cables. In the kitchen, one very familiar appliance is an excellent example of the cordless trend—the electric kettle.

When the electric kettle was invented in the early 20th century, the convenience of boiling water rapidly without putting a kettle on a stove was immediately recognized and appreciated. Early electric kettle designers understood that it was both awkward and risky to pour boiling water from a kettle that is plugged into the wall, so some kettles were equipped with a socket in the back to allow the power cord to be removed from the kettle before pouring.

Perhaps it was noticed that leaving a plugged-in power cord was a safety hazard, because manufacturers eventually developed an enclosed power base that remains on a counter or table when the kettle is lifted for pouring. No plugging or unplugging of the power base is necessary to lift the kettle, and the base can remain safely plugged in as long as it is needed in that location. The separate power base concept was such a universally-accepted feature that it is now virtually impossible to find an electric kettle without one.

With the advent of Cordless Kitchen Appliances, convenience takes another leap forward by rendering the plug-in, countertop power base obsolete.
2.2 The Cordless Kitchen difference

Unlike traditional kitchen appliances, Cordless Kitchen Appliances are intelligent: they communicate with the magnetic power source to ensure that the amount of power received remains within the limits of the appliance and according to input from the user. Cooking is much more precise, responsive, and repeatable with Cordless Appliances, and that can make anyone a better chef.

Communication between the Cordless Appliance and MPS is via an embedded, short-range, wireless data channel, and begins as soon as the Cordless Appliance is placed on the MPS. In addition to controlling the amount power that is transferred, the communication enables “smart” features, such as allowing the transmitter to distinguish between Cordless Appliances and other metallic objects that should not be inadvertently heated.

User controls can also be added to Cordless Kitchen pots and pans as an alternative to cooktop controls. Cookware can even be designed to be programmed by a smartphone app that uses temperatures and timings taken directly from recipes. This is a significant paradigm change: precise power management in the appliance replaces analog heat controls on the cooktop. No more guessing whether the temperature in the pan is too hot or too cool. Cordless Appliances may ultimately end cooking disasters like milk boiling over or a meal that is either under-cooked or burned.

2.3 Designing for interoperability

Cordless Kitchen transmitters and appliances are designed to work with each other regardless of brand. Consumers can use any Cordless Appliance on a compatible transmitter in the same room, in a different room, or in a different house—just as a corded appliance can be plugged into any compatible outlet in any building. This interoperability gives the product maker the option to focus on developing transmitters or appliances (not necessarily both), and frees the consumer and integrators from worrying about being locked into a particular brand or proprietary technology. All they have to do is look for the Cordless Kitchen logo when they are shopping for new or replacement products.

As seen with many other open standards, interoperability is a powerful driver of rapid adoption and worldwide market opportunities.

2.4 Power transmitter locations

In general, magnetic power sources for Cordless Appliances will most likely be integrated in new kitchen counters and new furniture, or added to conventional induction cooktops. However, existing kitchen counters and furniture may also be retrofitted with magnetic power sources in most cases.¹

¹ This may require electrical upgrades, which could require a local building or construction permit in some regions, as well as the hiring of a qualified electrician to ensure safe wiring and adequate power circuits.
Since the Cordless Kitchen magnetic power sources are usually installed underneath kitchen counters and tables, the MPS and its wiring are out of sight and protected from spills and accidents. Most commonly-used, non-metallic materials for counters and furniture are fine for Cordless Kitchen use, including granite, wood, and composites up to 3 cm thick (about 1 ¼”).

The MPS are designed to provide up to 2.4 kW of power to easily handle the demands of appliances that heat, such as kettles, hot pots, rice cookers, toasters, etc. While MPS can be installed under counters and tables, they are also ideal in Cordless Kitchen cooktops used for frying, sautéing, boiling, and steaming. The best location for cooktops is often where stoves or other cooktops are normally located—under a ventilating fan or hood and with access to a 200-240 V wall outlet.

NOTE An MPS will normally be connected to a 200-240 Volt AC outlet but could also be designed to work on 100-120 Volt outlets.

### 2.5 Safety improvements

Unlike old-fashioned appliances, Cordless Kitchen Appliances have no inherent risk of electrical shock.

- There is no power cord to fray or cut while it is plugged in.
- Liquids spilled on the appliance or between the appliance and transmitter will have no effect on its operation or safety.
- The appliance immediately stops receiving power if it is knocked over or moved away from the transmitter location.

The Cordless Kitchen standard also requires that the bottom surface of appliances and cookware will never be too hot to touch. The work surface will never get hot due to the operation of a Cordless Appliance.
Safeguards built into the system will also ensure that any metal objects placed on a transmitter, such as a kitchen knife or other utensil, will not be accidentally heated. The transmitter will only provide power when the presence of a compatible appliance is confirmed.

Cordless Appliances are designed to comply with local regulations, including safety, EMC (emissions, disturbances, and immunities), EMF exposure, and energy consumption. The emission levels associated with the MPS will be similar to those of conventional induction cooktops.

### 2.6 Cordless Appliance efficiency

Cordless Kitchen Appliances are required to operate at efficiencies greater than 90% of equivalent appliances that use power cords. The difference in usable power is negligible and is unlikely to be noticed in daily usage.

### 2.7 Examples of Cordless Appliances

Under the WPC Cordless Kitchen specification, virtually any kitchen appliance can be made cordless. Examples include mixers, juicers, kettles, rice cookers, bread makers, coffee makers, wine bottle chillers, slow cookers (crock pots), griddles, toasters, and deep fryers.
2.8 Use cases

This Section describes three common use cases that illustrate the Cordless Kitchen concept.

2.8.1 Hybrid cooktop for pots, pans, and Cordless Appliances

Figure 2 illustrates the use of a hybrid cooktop that combines a Cordless Kitchen transmitter with a traditional induction cooktop. All three of the appliances shown in the illustration draw their power from transmitters underneath the surface of the cooktop, but the front two are traditional induction transmitters and the back one (under the toaster) is a Cordless Kitchen transmitter. This versatility can be a welcome help to a cook when preparing multiple dishes at the same time.

Ordinary induction cookware—the pot and pan in this illustration—do not have an integrated power receiver, and require cooktop controls to manually set the temperatures. Cordless Appliances have their own integrated controls, and in some cases may be programmed remotely using a smartphone or other device.

Figure 2. A versatile cooktop replaces the traditional stove

Note that the toaster is not perfectly aligned on the cooktop. There is roughly a 5 cm (2”) tolerance for placing Cordless Appliances over the transmitter coils, so users do not have to be very precise when they position them.
2.8.2 Using Cordless Appliances on a kitchen counter

Figure 3 illustrates a scenario in which a user—Sue—prepares a meal using Cordless Appliances on her kitchen counter.

The left illustration shows Sue using a cordless food processor to chop vegetables for a stir fry dish. The motor of the food processor starts only when she presses the button. Notice also the close proximity of the appliance to the sink. With a Cordless Kitchen food processor there is no possibility of a power cord dipping into a sink full of water, and there is no possibility of the food processor receiving any electrical power if it is tipped over or removed from the transmitter location and ends up in the sink.

The right side of the illustration shows Sue using a direct heating appliance on her countertop, which eliminates the need for a traditional stove or induction cooktop. Power from the magnetic power source directly heats the induction cookware. The cookware is smart in the sense that it has controls to set the optimal temperature for frying and cooking, and also because it instructs the MPS to provide the appropriate level of power. An ordinary pan without an integrated power receiver would not be able to do this. Cordless pans are also made with a layer of thermal insulation underneath to prevent heat damage to the countertop.

Figure 3. Using Cordless Appliances on a kitchen counter
2.8.3 Using Cordless Appliances at the dining table

Figure 4 illustrates a family using a Cordless Kitchen toaster and egg cooker at the dining table. Note that there are no power cords strung across the table top and dangling between the table and wall outlet. With small children especially, power cords at a dining table can be hazardous.

Any Cordless Kitchen Appliance can be used at a table that is properly equipped with magnetic power sources. Table-top cooking is particularly popular in Asian cuisine, such as Chinese hot pot cooking, Japanese shabu shabu and sukiyaki, and Korean grilling to name a few. Western cooking can also be done at the table with Cordless Appliances—toasting bread, cooking bacon or pancakes with a griddle, heating cheese fondue, etc.

The versatility of Cordless Appliances expands the possibilities of tabletop cooking, and makes it all much easier in terms of set up, clean up, and putting appliances away.

Figure 4. Using appliances at the dining table
3 About the Wireless Power Consortium

The Wireless Power Consortium (WPC) is a worldwide organization that develops and promotes the global interface standard for wireless power transfer. The WPC is best known for Qi wireless power transfer—the use of magnetic induction to deliver power to small devices without plugging them in. Qi wireless power transfer emerged as a game-changing, world-wide standard in 2011 when the first Qi wireless smartphone cases were introduced, followed by smartphones with built-in Qi wireless support in 2012. For many consumers frustrated with the daily ritual of plugging and unplugging charging cables, Qi wireless quickly became a popular smartphone feature.

Interface standards ensure the interoperability of devices that conform to that standard. Supported by more than 200 companies and with over 1000 registered products (as of 2016), Qi has become the international wireless-charging standard for consumer electronics in the Power Class 0 category (flat-surface devices that use up to 30 W of power).

In 2013, the WPC began to investigate the use of wireless power technology as a foundation of Cordless Kitchens. This initiative has been supported by leading corporations in the kitchen and consumer electronics industries, such as Haier, Philips, LG, NXP, Panasonic, Ikea, Würth Electronik, and Bosch.

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Qi (气; qi) is pronounced “chee,” and is the Chinese word for energy flow or life force.