OSSIA®
REAL WIRELESS POWER

OSSIA WHITEPAPER

OSSIA'S COTA® VERSUS OTHER WIRELESS POWER TECHNOLOGIES

A DEFINITION OF REAL WIRELESS POWER

Real Wireless Power is efficient, targeted, mobile, non-line-of-sight, and safe. It is power delivered over distance (or over the air, OTA), while in motion, safely and effectively, with minimal to no user intervention. No pads, no cables, and no complicated algorithms should be required to deliver wireless power efficiently.

Ossia's Cota® is the only available, demonstrably functional technology that fits this definition of Real Wireless Power.

Wireless power may be delivered near-field (less than a few centimeters or inches), mid-field (around 3 feet/1 meter), or far-field (15 feet/<4.5 meters).

MUST-HAVE WIRELESS POWER TECHNOLOGY FEATURES

Manufacturers and service providers must seek out the following five features in their wireless power technology planning to fully take advantage of the future benefits of wireless power delivery:

1. **Efficient:** The power must be focused; it has to only or mostly go directly to your selected devices to provide the performance you need. Over-air energy shouldn't be wasted.
2. **Targeted:** Power should travel over air only to the device of your choice, and not to all devices in the vicinity.
3. **Mobile:** You should be able to move around while the power is delivered without getting disconnected from the power source, without slowing down transfer, and without drawing extra energy away from the power source. The wireless power transmitter should automatically track the devices, without complicated algorithms.
4. **Non-line-of-sight:** You don't have to know where the Wi-Fi hub is placed to receive Internet. Similarly, you should not have to sit still in front of a wireless power transmitter to get power.
5. **Safe:** Wi-Fi and Bluetooth is widely accepted as safe. Wireless power should be at the same safety levels.

Many technologies claim to be a "wireless power" solution, including beamforming, lasers, induction (or pad-based) charging, and ultrasound. Far-field radio frequency power, like Ossia's Cota, is the only wireless power solution that fits all five of these must-have technology features.

Let's take a look at the differences among these different types of wireless power technologies.

RADIO FREQUENCY-BASED WIRELESS POWER (OR RF POWER)

Mid-field radio-frequency wireless power has been approved by the Federal Communications Commission (FCC) to transmit power up to three feet or under a meter, under Part 18 of the regulations, which doesn't limit the amount of power delivered. Energous is an example of mid-field RF power.

Far-field radio frequency-based power, power delivered over air more than 15 feet or 4.5 meters, has been researched and developed for more than a decade. It's just a matter of time before the FCC approves far-field RF power. Cota is considered far-field RF power.

Similar to Wi-Fi, RF-based power leverages the 2.4GHz to 5.8GHz spectrum. With RF, antennas and transmitters can be designed large enough to extend the range beyond the near field. The amount of wattage a device receives depends on how many devices are being charged and how far away they are from the transmitter.

RF power also allows a two-way communication channel, which further enables the world of IoT and intelligent buildings, as well as smart homes, cars, and cities.

MAT-BASED CHARGING

Mat-based, or induction charging, delivers power by a magnetic field between two coils of wire. It requires the device to be touching or almost touching a charging surface, such as a pad or bowl, so it's considered very near-field. Induction charging is efficient and has been around for a long time—your electric wirefree toothbrush is an excellent example. Qi is the standard, and it is currently popular among smartphone and smartphone accessories developers.

Because the power is delivered at such a close range to a plugged-in power source, and the user essentially has to give up the device to receive a charge, it's difficult to continue to think of induction charging as wireless power at all. Rather, it's a complementary charging technology to Real Wireless Power.

RF-BASED BEAMFORMING

RF-based beamforming technologies, like Powercast and Technovator, use directional antennas to deliver wireless power. Beamforming requires complex algorithms to track the receiving device and will stop delivering power if the path is interrupted by objects, due to safety reasons. In other words, it requires line of sight to work.

When the device is moving about, the transmitter may require significant amounts of energy to constantly track the receiver, a slow process which may not be efficient or cost-effective. It may also require an external case or dongle and a large charging station that heats up. This constantly updating, specific-directional path of radiation has very limited safety capacity or efficiency.

Beamforming is typically considered viable with only very low power applications (low microwatts and low milliwatts), and may not be suitable indoors.

ULTRASOUND

Ultrasound-based wireless power technologies, such as uBeam, use electromagnetic (EM) radiation to deliver targeted power over air. Unfortunately, ultrasound requires line of sight to function, and is naturally absorbed by air, so the transmitter would require a significant amount of energy to send a meaningful amount of power over a distance.

For example, ultrasound energy above 60KHz is absorbed by air at a rate of 50% every meter of distance, meaning that 1000W of ultrasound energy going through air will lose 999W over 10 meters on top of the free space path loss. Such losses make ultrasound virtually useless in far-field applications. The National Physical Library provides a calculator that measures absorption of sound by the atmosphere.

What's more, in order to deliver power over a distance, you may need 1000 times the energy used in current applications, such as scanning a human embryo. The safety of such large amounts of ultrasound are unknown.

LASER BEAM

Laser-beam-based wireless power technologies, like Wi-Charge, deliver power via infrared beams of light. The transmitter connects to a standard AC, DC, or USB power source. The receiver unit captures light from the transmitter like a photovoltaic cell. Multiple receivers can be charged simultaneously using an intelligent power-management algorithm embedded in the transmitter.

Lasers are good and sending targeted energy over a distance, however, infrared beams of light require direct line of sight with no obstructions. Also, safety is a concern with lasers. Class 1 infrared lasers are known as safe under normal conditions; however, people can't see infrared, and it's unclear what harm prolonged exposure would cause eyesight. Leveraging laser beams in a room with reflective surfaces, such as windows, monitors, or mirrors may pose further threat, because the light beams may bounce to unintended locations.

Current applications of laser beam technology require heavy and burdensome-looking hardware to function.

HOW COTA WORKS, IN COMPARISON

Ossia's Cota® delivers wireless power without plugs and pads. As convenient, safe, and invisible as wireless internet, Cota can charge dozens of electronic devices within a 30-50 foot/9-15 meter radius, with only one or two transmitters, respectively.

Cota Is Non-Line-of-Sight

Cota doesn't require the transmitter and receiver to be lined up without obstruction or interruption to work. The Cota receiver sends a beacon signal that bounces off of objects, but not organic matter, to communicate with the transmitter, even when the receiver is in motion or behind objects in the room, like furniture or retail displays. Because the receiving device does

not have to be lined up with the transmitter, and power delivery does not stop if something passes in front of the signal; it simply goes "around."

Cota Technology and Safety

Cota transfers power using antennas. Cota's receiver antenna within a device emits a 2.4 GHz beacon signal, part of which reaches the power transmitter quickly and automatically. The transmitter then can send power along the open paths of the incoming signal at the same or a different frequency. The radio waveforms are combined at the receiver antenna and converted into DC power to charge potentially hundreds of devices.

Because the Cota receiver sends a beacon signal that bounces off objects but not organic matter, and the Cota transmitter delivers wireless power along the same paths, the transfer of energy is inherently safe. It naturally avoids people and pets. Cota has proven tested safety results and maintains FCC safety requirements.

Although other technologies use the term "wireless power," they bear little resemblance to Cota, especially with regard to distance, speed, and mobility.

Cota Distance, Speed, and Mobility

One Cota transmitter can continuously deliver power up to 30 feet/9 meters) in all directions (50 feet/15 meters with two linked transmitters) even as multiple devices move within that radius or pass behind objects, such as furniture. What's more, Cota will track and deliver power to devices in motion, even as they are moving at speeds greater than 1 meter per second, without the need for a complex tracking algorithm. Unlike most other wireless power solutions, line of sight is not required.

At 2.4GHz, a single Cota transmitter sends 20 watts. The further away the device, the fewer watts of power the device will receive; however, at the very end of a room, even 1 watt of power will keep devices fully powered. In our current day's system of receiving power by cord and allowing device batteries to drain before charging again, this may not seem like a fast way to receive power. However, in the future with wireless power, the devices will never experience a drain, because the wireless power in the room (or vehicle) will always keep them sufficiently charged. Cota keeps us continually powered up.

The Size of Cota Receivers and Transmitters

Cota receivers are as small as 1 cm2 and can fit in standard batteries and compact devices; this is possible due to the sharp focus of the transmitter array. The Cota system is form factor agnostic and can use any type of antenna based on design requirements, including, for example, standard Bluetooth antennas. Transmitter size is variable and depends on distance and power levels required.

Cota does not require an external dongle to plug into a devices power port or a charging mat or bowl to set the device into to charge. From the user's perspective, it's automatic and invisible.

Cota Economy and Application

Cota excels at delivering power over great distances, because the receiver only only needs to send a low powered beacon to the transmitter. The transmitter does not need to constantly communicate with the receiver. Cota transmitter antennas are bi-directional, which may add a small initial percentage of the overall cost; however, the Cota receiver uses far less energy to receive RF power, which increases the efficiency of the system, and can decrease overall costs over time.

Cota is ideal for smartwatches, mobile phones, sensors (home, medical, automotive, retail, or industrial), wearables, electronic price tags, and other small electronics.

The Cota Cloud

Because of the two-way communication potential of RF-based wireless power, the Cota Cloud provides many automatic as well as managerial and security benefits, such as:

- The software prioritizes which devices need power first
- Administrators can set up and control who receives power and when
- The ability to view which devices have received power, and how much
- The transmitter can sense when there are no devices in range and will go to "sleep" for maximum efficiency

The Cota Cloud will enable administrators to improve energy efficiencies, understand device usage, receive sensor alerts, and increase security.

Cota Advantages over Competing Technologies

Cota technology is highly efficient, scalable, and inherently safe. Powering devices in motion and in non-line-of-sight situations provides a significant advantage, especially within consumer device use cases.

What's more, Cota can be integrated into current battery-operated devices now, by "retrofitting" them with a Cota receiver that's in the shape of a standard AA battery, for instance. The battery will stay perpetually charged as long as it stays within range of a Cota transmitter.

Ossia's focus on building an interconnected ecosystem of manufacturers and service providers as well as ongoing focus on the advancement of Real Wireless Power™ technology creates a strong foundation for Cota, and manufacturers, to thrive.

ADDITIONAL RESOURCES

https://blog.ossia.com/wireless-power-technology-differences

https://www.pcmag.com/article/361628/wireless-power-is-coming

https://www.digitaltrends.com/cool-tech/ossia-cota-forever-battery-ces-2018/

https://gizmodo.com/this-aa-battery-sucks-power-right-out-of-the-air-1821966213

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