

# Wireless Power Transfer

**Lowell Howard, Ph.D.**

Office of In Vitro Diagnostics & Radiological Health

Center for Devices and Radiological Health

U.S. Food and Drug Administration

[lowell.howard@fda.hhs.gov](mailto:lowell.howard@fda.hhs.gov)

# What is Wireless Power Transfer?

- Wireless Power Transfer (WPT) is an old idea that is returning just in time to charge our many battery-operated portable devices
- Chargers can be roughly divided into two categories:
  - Proximity type: the device is in contact with the charger, or there is a gap between charger and device
  - Directed or “beamed” delivery across space

# Potential Benefits of Wireless Power

- Enhanced convenience, reliability, and cleanliness of devices – without connectors, hermetically-sealed devices are simpler to engineer
- Cables are a hazard both at home and in the clinical environment
  - Potentially fewer tripping and choking injuries
- A reduction of battery size can result from more frequent battery charges

# Close Proximity Chargers

- Two coils with magnetic mutual coupling across a small gap act as transformer windings
- A typical phone or wearable device charging application may transfer up to 5 Watts of power
- Competing industry consensus standards have slowed market acceptance due to interoperability issues

# Resonant Proximity Chargers

- Coupling between the charger and the wireless device is enhanced by electrical resonance at the operating frequency
- Range is enhanced by up to about 10 times the dimension of the charging coil – 20 cm is a typical gap but gaps can be greater
- Efficiency can be very high, greater than 90%
- Large amounts of power – up to 20 kW

# Directed or Beamed Power By Laser or Microwaves

- Very high conversion efficiency from microwave to DC using antennas and simple circuits – 84% was achieved 42 years ago by a NASA project
- Laser beaming power systems are already covered under 21 CFR 1040

# Possible Electromagnetic Risks of WPT

- Generally, the highest power products pose a higher risk than lower power products, but near-field electromagnetic evaluation requires more information than a power density specification
- What happens when metal conductors such as rings, implanted medical devices or steel-toe safety shoes are placed inside the proximity-charger's gap?

# FDA Concerns Regarding WPT

- Electromagnetic interference with medical devices or disruption of device communications
- Are engineering controls (if needed) sensitive enough, reliable enough and do they act sufficiently quickly to prevent injury?
- Do current consensus industry standards adequately address electromagnetic safety of new products?



# Relevant FDA regulations and standards

- 21 CFR 1000.15(b) mentions power transmission equipment at both RF and microwave frequencies as examples of electronic products subject to Electronic Product Radiation Control provisions of the FD&C Act
- Laser power transfer products are electronic products and must comply with FDA performance standards 21 CFR 1010 and 1040.10
- IEEE C95.1-2005 standard and ICNIRP Guidelines for RF from 1 Hz to 300 GHz
- SAE J2954 is a new consensus standard for automotive chargers up to 20 kW

# What would FDA like to do?

- Determine if there are significant risks of injury from new wireless power transfer products entering into US commerce
- Determine if a performance standard is necessary, or if conformance to a voluntary consensus standard is sufficient to protect public health

# What would FDA like to do?

- Determine if any special requirements for medical devices or any modifications to existing standards are needed to protect patients, who represent a more vulnerable population than the general public
- Inform manufacturers that they are subject to the electronic product radiation control (EPRC) provisions of the Federal Food, Drug, and Cosmetic (FD&C) Act

# Why Does FDA Want to Investigate?

- We have a mandate to protect the public health and safety from electronic product radiation
- We need to know enough about new technologies to know if more attention is required to assure safety
- WPT will only become part of the public infrastructure if the public can be assured of its safety

# Questions

- What is your opinion of FDA's wireless power transfer safety concerns?
- What recommendations do you have regarding the regulatory path for these products, e.g., a reporting requirement, a performance standard or a voluntary consensus standard?

# Questions

- What special concerns are there for wireless power transfer in the clinical environment?
- Are there any similar products or product types known to the committee that also require attention regarding radiation safety?

