CTA Technical Report

RF Emission Regulations and Applicability to Inductive Wireless Power Systems

CTA-TR-2-A

(Formerly CEA-TR-2-A)

ANSI Accredited Standards Developer

Consumer Technology Association™

RF Emission Regulations and Applicability to Inductive Wireless Power Systems

CEA
Consumer Electronics Association

FOREWORD

This document was developed by the Consumer Electronics Association's (CEA)® R6.3, Wireless Power Subcommittee. It is meant as an informative document about wireless power technology and the relevant Radio Frequency (RF) exposure regulations.

Wireless power systems provide an efficient and convenient method for charging one or more consumer devices that have traditionally used individual plug-in AC power charge adaptors. Wireless power enables the transfer of electrical power from a charging source that is located near or around the device(s) that will use this power without the need for a physical connection.

CEA
Consumer Electronics Association

CEA WHITE PAPER ON RF EXPOSURE REGULATIONS AND APPLICABILITY TO INDUCTIVE WIRELESS POWER SYSTEMS

1. Scope

This brochure describes the RF exposure regulations that are designed to protect the public and the limits that govern the use of devices and systems utilizing Radio Frequency energy such as wireless power systems. The brochure is written for the consumers of electronic devices with limited knowledge of technical and engineering matters.

2. EMF Explanation

Electromagnetic fields (EMF) are ubiquitously present in our environment – the earth, the sun and the ionosphere are all natural sources of electromagnetic fields. The electromagnetic spectrum is split between ionizing and non-ionizing radiation. The ionizing side includes X-rays and other high-energy radiation, which is powerful enough to damage atoms and molecules. Radio waves are non-ionizing, which means the waves are much longer, considered very low-powered and therefore unable to do the type of damage done by ionizing radiation.

Most consumer electronic products ranging from mobile phones to computers to microwave ovens and electric tooth brushes rely on man-made electromagnetic fields (i.e., electromagnetic energy) to provide their functionality.

Wireless charging systems are expected to transfer power at specific, discrete frequencies within a wide range from 10 kHz to 20 MHz. Figure 1 below indicates where wireless charging devices align within the electromagnetic spectrum, relative to other consumer devices.

3. Inductive Wireless Power

Inductive wireless power transfer uses a magnetic field generated by an electrical current traveling through a coil of wire to transfer power to a second coil. When electrical current travels through a coil of wire it generates a magnetic field. This magnetic field, when incident on another coil in relative proximity to the first coil, will in turn generate an electromotive force in the second coil, which can be used to power or charge consumer electronic devices.

Nikola Tesla was granted the first patent for this type of technology in 1901. This type of technology has been in the marketplace for years (e.g., for charging electric toothbrushes). Currently the technology is being engineered for a wider range of consumer applications, for example to power or charge consumer devices such as cell phones, portable music players and computers. A special case of inductive wireless power is known as "loosely-coupled or resonant wireless power." In this case, the two coils are designed in such a way to allow for a greater separation between the two coils. As shown in Figure 1, wireless power technology operates over a range of low frequencies in the electromagnetic spectrum; from tens of kHz to tens of MHz.

4. RF Exposure Guidelines

All technologies using radio waves, including inductive wireless power technologies, must comply with international exposure limits that are designed to protect the public. Independent scientific and professional organizations develop the RF exposure guidelines which are then adopted by countries throughout the world. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines and the Institute of

Loosely-coupled Wireless Power
(Allows for freedom of device alignment)

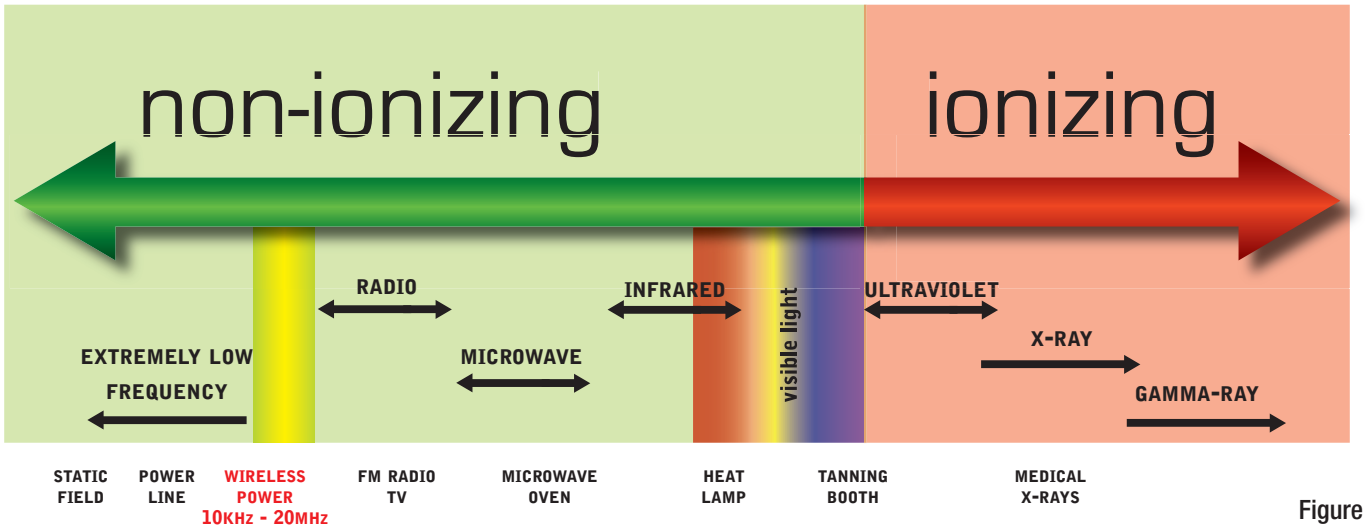

Figure 1

Electrical and Electronics Engineers (IEEE) guidelines comprise the rules used in most countries.

The limits are drawn from scientific studies and reviewed periodically to ensure they represent the latest known scientific data. The limits are presented for a given frequency and field type (electric or magnetic) with considerations for the different tissue parameters in the human body.

5. Scientific research

Over the past five decades there has been a significant amount of scientific research on electromagnetic energy. From studies of power lines and toasters, to cellular telephones and wireless networks, scientists have investigated the effect of electromagnetic fields on human health. The research has been important not only to inform the scientific community but also to develop scientifically grounded exposure guidelines. Reviews of the scientific literature to date by numerous governments, public health institutions and scientific advisory groups are consistent in their assessment that there are no known harmful effects from EMF when used according to the international RF exposure guidelines.

6. Summary

- Wireless power is a convenient way to charge consumer electronics devices without the need to plug in the device. Wireless power also enables the transfer of electric power from a charging source to one or more devices without the need for a physical connection.
- Wireless power uses radio waves to transfer power. Radio waves enable many of today's technologies, such as radio, TV, mobile phones, WiFi and an increasing number of new products and services.
- All products using radio waves, including wireless power, must comply with RF exposure guidelines that govern radio signal exposure to consumers and workers.
- The exposure guidelines are based on extensive scientific literature about radio waves and their effect on human health. The exposure guidelines are reviewed periodically to ensure they represent the latest scientific research.
- Reviews of the scientific literature to date by numerous governments, public health institutions and scientific advisory groups are consistent in their assessment that there are no known harmful effects from radio waves when used according to the RF exposure guidelines.
- CEA wants you to be informed about the subject of wireless technologies and health. U.S. government agencies such as the Federal Communications Commission and the National Institutes of Health publish information on this topic. In addition, some international health and safety organizations also study and report on RF exposure.

7. About CEA and contacts for more information

The Consumer Electronics Association (CEA) is the preeminent trade association promoting growth in the $286 billion U.S. consumer electronics industry. More than 2,000 companies enjoy the benefits of CEA membership, including legislative advocacy, market research, technical training and education, industry promotion, standards development and the fostering of business and strategic relationships. CEA also sponsors and manages CES – The Global Stage for Innovation. All profits from CES are reinvested into CEA's industry services. Find CEA online at CE.org.

For more information about wireless power systems please see

www.howstuffworks.com/wireless-power.htm or contact standards@CE.org.

8. References

[1] ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz), International Commission for Non-Ionizing Radiation Protection, Health Physics, Volume 74, Number 4, April 1998.

[2] ICNIRP Guidelines For Limiting Exposure to Time-Varying Electric and Magnetic Fields (1Hz - 100 kHz), Published in: Health Physics 99(6):818-836; 2010.

[3] IEEE Std. C95.1-2005; IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, Institute of Electrical and Electronics Engineers, April 19, 2006.

[4] 47 CFR FCC Rules, Part 1, Practice and Procedure, Section 1.1310 Radiofrequency radiation exposure limits.

[5] 47 CFR FCC Rules, Part 2, Frequency Allocations and Radio Treaty Matters; General Rules and Regulations, Radiofrequency radiation exposure, Sections 2.1091 and 2.1093.