WHITE PAPER

WIRELESS SYSTEMS AND RF SAFETY ISSUES

BACKGROUND ON RF SAFETY ISSUES

Concerns about the safety of cellular telephones—whether they create health risks or are safe to use in all operating environments—have spread to other wireless devices, such as the wireless networking equipment (WLANs)* manufactured by Cisco Systems® and Linksys®. These issues are of concern not only to Cisco customers, but to Cisco as well.

There is no correlated proof that these low-power devices pose any health risks to the user or the general public. Further, Cisco and Linksys wireless products are required to be evaluated for compliance with international RF regulations before being placed on the market for sale.

This document discusses the results of research into the possible health effects of RF devices.

Low-Power Wireless Devices Pose No Known Health Risk

Do low-power wireless devices such as WLAN client cards, access points, or RFID tags pose a health threat? Available evidence today suggests that there is no clear correlation between low-power wireless use and health issues.

Recent studies strongly suggest that the use of cellular telephone equipment does not create health risks. Two important recent studies that reached this conclusion are:

- A report written by Dr. John D. Boice, Jr. and Dr. Joseph K. McLaughlin of the International Epidemiology Institute in the United States in September 2002 for the Swedish Radiation Protection Authority.
- A report to the European Commission from the Scientific Committee on Toxicity, Ecotoxicity, and the Environment, titled "Opinion on Possible Effects of Electromagnetic Fields, Radio Frequency Fields, and Microwave Radiation on Human Health."

Few studies deal directly with the affects of WLAN devices. The emission levels of WLAN and RFID tags are below RF emission levels from typical cellular telephones. Therefore, any conclusions relating to the safety of cellular telephone equipment can almost certainly be applied to WLAN or RFID devices**.

The RF emission levels from a typical WLAN are well within the safety emission level thresholds set by the World Health Organization (WHO)***

* These devices are also referred to as RLANs by the ITU-R;, however, this paper refers to these devices as WLANs.

** Though Cisco does not make RFID devices, vendors and customers will require Cisco in some cases to use RFID devices to track products. Hence, the customer needs to be aware of RF issues concerning these devices.

*** The RF emission limits adopted by various national agencies are based on guidelines from the WHO International Commission on Non-Ionizing Radiation Protection (ICNIRP).

CISCO AND LINKSYS COMPLIANCE WITH RF EXPOSURE REQUIREMENTS

All Cisco and Linksys wireless products are evaluated to ensure that they conform to the RF emissions safety limits adopted by agencies in the United States and around the world. These evaluations are in accordance with the various regulations and guidelines adopted or recommended by the Federal Communications Commission (FCC)* and other worldwide agencies**.

Compliance for these devices is typically based on the Maximum Permissible Exposure (MPE) levels for mobile or fixed devices*** or per Specific Absorption Rate (SAR) tests for portable**** devices. Depending on the type of product, compliance is based on modeling, technical analysis, or RF measurement testing. The analysis or testing is performed in accordance with the various national and international standards adopted by independent third-party accredited labs.

Before any wireless device can be placed on the market, Cisco submits MPE technical analysis or SAR test data results to the appropriate agencies for review. These studies and test reports must demonstrate that the devices meet the RF emissions safety limits, or they cannot be placed on the market. Cisco and Linksys make sure that all of their products adhere to the stricter standards imposed by the worst case—the uncontrolled environment that imposes the tightest compliance limits.

The Cisco and Linksys manuals include statements on compliance with the various RF safety regulations, as well as guidance on proper installation and operation of these systems, to ensure that they remain in compliance with all applicable regulations.

IMPACT ON MEDICAL DEVICES

Another concern about cellular telephones has been their potential impact on medical devices. Many hospitals ban such phones from emergency rooms or other sensitive areas. Again, this has led some to question whether wireless networking devices can be used in proximity to medical equipment.

To address these concerns, Cisco wireless networking devices are specifically designed to reduce emissions that could interfere with medical devices. Cisco radio module products meet both the FCC and European Commission emission levels required for devices operating in a medical environment, specifically the EN 55011 emission standards.

In September 1996, an independent test was conducted by a hospital before the installation of a Cisco spread spectrum wireless network. The results showed that the Cisco 2.4-GHz wireless network devices did not interfere with or degrade the performance of heart pacemakers, even when operated at close proximity to these devices. In 2003, Cisco did further research testing with medical implant devices from two major medical equipment manufacturers, and tested its WLAN system with an MRI system at a major hospital research center. The results of the latest research was that the Cisco WLAN systems did not degrade the performance of either the MRI machine, nor degrade the performance of the pacemakers used in the research test. This research is continuing, including testing with Cisco 5-GHz devices whose initial tests are yielding similar results.

* The requirements as referenced are in Office of Engineering and Technology Bulletin 65C Revision 01-01, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.

** Such as ITU-T Recommendation K-52 Guidance on complying with limits with human exposure to electromagnetic fields

*** For discussion purposes, Cisco and Linksys access points and bridges are classified as either mobile or fixed, depending on antenna gain and installation requirements.

**** For discussion purposes, Cisco and Linksys client cards and voice over IP (VoIP) phones are classified as portable devices and may be subject to SAR testing.

OPERATION IN HAZARDOUS ENVIRONMENTS

Another occasional RF safety concern is the use of RF devices in hazardous locations such as oil refineries, mines, or construction sites where explosives are used. Several countries, including Australia and countries in the European Union, have adopted guidelines for operating wireless devices in hazardous environments, although they do not specifically address low-power wireless networking systems.

In most circumstances, low-power radios (such as WLANs) operating at less then 100mW Effective Isotropic Radiated Power (EIRP) and operating at 2.4 and 5.8 GHz should not pose any risk if operated under normal circumstances. However, it is recommended that you first consult the facility's safety administration to determine its policy on the use of RF devices in certain areas. The chances are extremely low that the radio will cause interference that could lead to a safety problem or actually cause a heating effect that can cause an accident; however, caution is urged.

It is recommended that the installation of radio devices in hazardous areas be done by professional installers in accordance with the recommendations of the group responsible for safety at that site.

ADDITIONAL INFORMATION

http://www.fcc.gov/oet/rfsafety/

http://www.fda.gov

http://www.cisco.com

REFERENCES

1. *Questions and Answers About Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields* (Fourth Edition, August 1999). http://www.fcc.gov/oet/info/documents/bulletins/#56
2. *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields* Rev 01-01. http://www.fcc.gov/oet/info/documents/bulletins/#65
3. *A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance*. http://wireless.fcc.gov/siting/FCC_LSGAC_RF_Guide.pdf
4. WHO fact sheet on RF emissions. http://www.who.int/inf/inf-fs/fact183.html
5. Epidemiologic Studies of Cellular Telephones and Cancer Risk: Dr. John Boice and Dr. Joseph Mclaughlin, October 2002.
6. European Commission Report, Scientific Committee on Toxicity, Ecotoxicity, and the Environment: "Opinion on Possible Effects of Electromagnetic Fields, Radio Frequency Fields, and Microwave Radiation on Human Health," 10/30/2001.
7. International Telecommunications Union—Telecom Sector Recommendation K-52 Guidance on complying with limits for human exposure to Electromagnetic Field, September, 2004.

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