

# Understanding EMI

A look at electromagnetic interference-  
and what rehab professionals and consumers need to know about  
its effect on power wheelchairs and scooters.

By Chris W. Carlson, N.C.E.

**R**ecently, the Food and Drug Administration released electromagnetic interference (EMI) immunity recommendations for power wheelchairs and scooters, recognizing that these devices may travel where strong radio frequency signals are present, and if a malfunction should occur, the user's safety could be compromised.

In addition, as of last month, the FDA now requires power wheelchair and scooter manufacturers to put labels concerning EMI on their products. These labels are designed to inform consumers about the EMI immunity characteristics of the specific chair or scooter in comparison with the recommended immunity characteristics. This article will answer some of the questions most often asked about EMI and the safety of power wheelchairs and scooters.

**Q.** *What is EMI?*

**A.** Electromagnetic interference occurs when an electronic device creates radio frequency (RF) energy emissions, or radio waves, which cause malfunctions to occur in another device, usually located nearby.

**Q.** *How should a consumer use the EMI information found on a power wheelchair or scooter label?*

**A.** This comparison information can be useful in selecting a chair or scooter. The FDA's recommended EMI immunity level for a power wheelchair or scooter is currently 20 volts per meter (V/m), which refers to the strength of the electromagnetic field. A cellular telephone transmitting at 600 milliwatts would generate this field strength at a distance of about 10 inches. If a label states that a chair or scooter's immunity level was found to be less than 20 V/m, this particular device might experience problems.

**Q.** *What devices are most likely to cause EMI?*

**A.** Strong radio frequency (RF) signals may be produced by a variety of sources. These include cellular telephones; walkie-talkies; citizens band or ham radios; radios used in police cars, fire trucks, ambulances and taxi cabs; TV or radio broadcast stations; industrial RF heating equipment; microwave ovens; scientific or industrial telemetry links; and magnetic resonance imaging machines in hospitals.

The number of RF sources is increasing rapidly, due to the proliferation of new devices such as wireless Local Area Network (LAN) systems and personal digital assistants with wireless data modems.

However, portable electronic devices such as CD or cassette players and AM/FM radios, and small appliances such as electric shavers and hair dryers are not likely to cause EMI problems because they do not radiate strong RF signals,

**Q.** *How unsafe is EMI?*

**A.** Compared to other risks associated with operating a power wheelchair or scooter, EMI-related risk is relatively small. However, the effects of EMI on power wheelchairs and scooters can indeed present a safety risk to the user. Having tested many devices, I have witnessed severe reactions to RF energy applied at relatively low levels. In one instance, the wheel speed became so erratic that the user would have certainly been thrown from the chair.

Typically, responses are characterized by changes in wheel speed that are unrelated to the joystick or speed control position. For example, a wheelchair may be set to travel forward at a fixed speed equal to about 50 percent of its maximum speed. When an RF signal is radiated toward the wheelchair, the speed of one wheel may increase to 100 percent of maximum, while the speed of the other wheel may decrease to 25 percent.

In one power chair that we tested, one wheel went about 30 percent faster than the maximum possible speed that could be attained with the joystick, while the other wheel actually turned backwards.

**Q.** *How much danger does EMF represent to power wheelchair and scooter users?*

**A.** If a chair or scooter's label states that the immunity level has not been determined, the EMI risks associated with that device may be severe. Many chairs and scooters that have not been modified by manufacturers to be immune to EMI have been found to have immunity levels of less than five V/m. Use of such a device outdoors, where hazards such as busy streets and steep inclines exist, increases the risks associated with malfunction.

If accessories are added to the chair, or if the chair is modified in any way, it may also become more susceptible to EMI. Accessories most likely to cause a device to become more susceptible are those that connect directly to the electrical system, such as headlights, turn signals, computers, or alternate input control devices such as an extra-long joystick, a head control or a sip-and-puff control. However, any modification, even something as passive as a special footrest, may change the EMI characteristics in an unpredictable manner.

Manufacturers cite few, if any, complaints from users. However, this is probably due to the intermittent nature of the problem. In most cases, a malfunction will occur only if the chair or scooter is located within a few yards of the EMI source. As soon as the source moves away, the problem will disappear. The user may experience a problem, but may not even realize that an EMI event has occurred.

**Q.** *What happens to a wheelchair or scooter during an EMI incident?*

**A.** **The very** nature of EMI malfunctions makes them difficult if not impossible to identify with certainty.

Power wheelchair and scooter users should consider any loss of control as an indication that EMI may be affecting their chairs. This would include movement or braking without touching the control, or any change in speed or direction of travel not caused by moving the joystick.

The incident might occur momentarily, such as when a passing police car is using its two-way radio. Or it may be more continuous, such as a pulling to the left or right when traveling near a television transmitting tower. EMI may cause instability in control, such as minor random variations in speed or direction. The effect may suddenly become much more severe if the RF source is approaching.

**Q.** *What should a person do if he or she experiences an EMI incident?*

**A.** **The** FDA recommends that if unintended movement or brake release occurs, the power chair should be turned off as soon as it is safe to do so. In addition, users should be encouraged to report any malfunction to their chair or scooter manufacturer, even if it occurred only for a moment and cannot be demonstrated. The manufacturer should then pass the reported incident on to the FDA through the agency's MEDWATCH hot line at 800/FDA-1088.

**Q.** *Does EMI affect any other electronic devices?*

**A.** EMI problems are not related exclusively to power chairs and scooters. The fact is, EMI can occur in any electronic device. All electronic devices emit some RF energy and all electronic devices have some limit to the level of RF energy they can withstand without experiencing a malfunction.

Some power wheelchair and scooter users may have experienced the effects of RF emissions from their own chairs. For example, they may have noticed that operating the device causes snow on their TV screen, or they may hear static on their cordless telephone.

**Q.** *What is being done to create an EMI testing standard?*

**A.** An American National Standards Institute/RESNA draft standard has been accepted by the FDA for testing chairs and scooters, and will probably be voted on for final acceptance sometime this year. In addition, it appears that the International Standards Organization (ISO) will adopt a standard that is very similar to the ANSI/RESNA proposal. ■

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