Boston Scientific Electromagnetic (EMI) Compatibility Table for Pacemakers, Transvenous ICDs, S-ICDs and Heart Failure Devices

TERMS OF USE: The information provided on the Electromagnetic (EMI) Guide should not be considered the exclusive or only source for this information. The table lists a general category of items only and is not intended to be an exhaustive list. The recommendations and precautions may be based on information provided by the manufacturers of the items in question, and specific items within a category may function differently. It is best practice to consult the original manufacturer of the item with potential EMI to verify any specific guidance concerning operation and compatibility with implantable devices. If at any time there is a question about the function and potential for Electromagnetic Compatibility, contact the manufacturer of the item in question for further information. At all times, it is the responsibility of the licensed healthcare professional to exercise medical clinical judgment in a particular circumstance.

The information provided is not intended to be used for medical diagnosis or treatment or as a substitute for professional medical advice. Always seek the advice of your physician or other qualified health provider with any questions you may have regarding a medical condition.

Terminology	
	Safe under normal use: These items are only considered safe from electromagnetic interference with your device when used normally in accordance with their intended use. Check with your doctor for any additional restrictions that you may have for these items. **Use precautions:** When you are near any of these items, you should use precautions. Check with your doctor for detailed information before using these items. **Do not use:** Talk with your doctor.

Recommendations and precautions for transvenous devices also apply to S-ICD devices.

Patient manuals may be found by clicking on the link at the right. www.lifebeatonline.com

Hobbies

Item	Safety precautions: Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use	Similar brands that were not analyzed	A Closer Look Article
Activity Trackers	**Use precautions:** Do not place this item directly over implanted device. This is a device or application that may track steps taken, distance walked or run, calories consumed, and in some cases heartbeat and quality of sleep. The tracker may be synchronized, in many cases wirelessly, to a computer or smartphone. The wireless technology is usually Bluetooth. Bluetooth recommendations apply. In some activity trackers, heart rate is measured 2 ways: 1) By LED lights which reflect onto the skin to detect blood volume changes or 2) by using a chest strap which measures and sends the heart rate to a wrist watch.	FITBIT: Flex, Force, NIKE: Fuel, GARMIN: Vivofit, MISFIT: Shine, Flash, Link, Bolt, Beddit BODY BUGG: Bodybugg Version 3, BASIS: Peak	

Hobbies			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use**	**Similar brands that were not analyzed**	**A Closer Look Article**
Amusement parks, fairs, roller coasters	**Use precautions:** Consult heart doctor. Avoid riding on and/or maintaining Electromagnetic Roller Coasters -- the type that go against gravity . This is a sub-group of roller coasters which use electromagnets to propel them (linear induction motors). Concern with lead dislodgement. Roller coasters can impart high vertical accelerations anywhere from 3.5 - 5 times the earth's gravitational force. (Other rides may have similar high vertical accelerations)		
Bingo Wand	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the wand and the implanted device. Some bingo wands may contain a permanent magnet.		
Casino Slot Machines	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the slot machine and the implanted device.		
Electric Guitars	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the guitar and the implanted device. Magnetic/electrical fields associated with the guitar are very low and will not affect the Pacemaker or ICD.		
Electric Toy Trains	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the transformer and the implanted device. Do not touch power rail, especially with wet hands.		
Electric Golf Cart	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the battery and the implanted device, and at least a 12 inch (30 cm) separation between the AC battery chargers and the device.		
Hydroelectric Dam (Hoover Dam)	**Do not attend tour:** The policy of the Hoover Dam does not recommend that individuals with an ICD go on tour within the dam because of the 50 /60 Hz magnetic field present. Other Hydroelectric dams may have policies for ICD individuals that differ from those of the Hoover Dam. Because of the uncertainty of the magnetic environment within other Hydroelectric plants, we cannot predict the intensity of the magnetic field within any specific dam. There is the potential for Pacemaker or ICD interaction. Consult physician for level of risk that interaction with the device may present. Tours of non hydroelectric dams would pose a low risk of affecting the Pacemaker or ICD.		
Kiln: (Pottery, Jewelry or Glass) AC resistive heating element	**Safe under normal use**: Most of these kilns use resistive type heaters similar to heating elements associated with common electric stoves. Wood or gas fired kilns will have no affect on the Pacemaker or ICD. ICD. The magnetic field associated with the operation of this type of kiln is minimal. In contrast, kilns used in association with inductive heating of metals produce magnetic fields that can extend a much greater distance from the kiln. (Also see Induction Heater/Kiln under 'Home' section)		Click here to see Induction Heater/Kiln

Hobbies			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Laser Tag	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between any magnet in the vest and the implanted device. Low risk of laser tag gun and associated detection circuit in the vest affecting the Pacemaker or ICD. The device uses only light energy; however, some vests may contain magnets and/or a radio frequency transmitter that communicates to a scoreboard.		
Metal Detector	**Use precautions:** Keep the metal detector device head pointed away and at least a 24 inch (60 cm) distance from the implanted device.	Beachcomber	
Rifle/Shot Guns	**Use precautions:** Consult with heart doctor regarding physical impact due to firearm discharge. Recommend using firearm on opposite shoulder of implant to avoid possible damage to your implanted device.		
Scuba Diving	**Use precautions:** Consult with heart doctor. Prior to SCUBA diving the patient's heart doctor should be consulted to assess the potential consequences relative to the patient's specific health condition. It is possible that your physician may suggest that you limit certain activities, such as scuba diving, to a level that is more restrictive based on medical concerns rather than the single factor of pressure tolerance of your pacemaker/ICD. Because of many factors associated with scuba diving, specific depth limitations cannot be provided. Some of the factors include the possibilities of blows to the area of the device during the time the device is under pressure stress, the number of pressure cycles the device is exposed to over the implant time of the device, and the activity or exertional level of the individual during the dives. Our device pressure testing is conducted for compatibility with hyperbaric chamber therapy. We can share with you that a pressure of two and one-half atmospheres absolute is the maximum pressure recommended for hyperbaric chamber therapy.		Elevated Pressure (HBOT/SCUBA) and Implanted Medical Devices
Static Electricity Plasma Ball (Van de Graaff generator)	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the ball and the implanted device. Do not touch the ball.		
Tattoo Machine	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the tattoo machine /related tattoo accessories and the implanted device. Avoid tattoo over implant location.		
Train: Magnetic Levitation / high speed train	**Safe under normal use for passengers.**		
Personal Use			
Ab-Stimulator®	**Do not use:** Muscle Stimulator is fitness-related equipment designed to stimulate muscles to improve muscle definition and fitness. Provides electrodes that are placed on muscles, such as abdominal muscles, and delivers electrical stimulus, usually strong enough to cause the muscle to twitch.		

Personal Use			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Badge (Security) with externally activated electronic circuit	**Use precautions:** Maintain at least a 6 inch (15 cm) separation from wall unit (reader) except for the following devices: Pacemakers: INSIGNIA®, ALTRUA®, PD2®, PDM®: maintain at least 1.5 feet (40 cm) separation between the wall unit and implanted device. RFID readers may be a potential source of EMI and could have temporary effects on implanted cardiac devices. Because the presence of RFID systems may not always be apparent in public and occupational settings, patients who feel symptomatic (e.g., light-headed, fast heart rate) should move away from nearby electrical equipment (or the identifiable RFID system), and call their physician to report the episode.		Radiofrequency Identification and Implantable Pacemakers and Defibrillators
Badge (name tag) with magnetic clasp	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the magnet associated with the badge and the implanted device.		
Blood Pressure Monitor (Wrist)	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the wrist monitor and the implanted device. Wrist Blood Pressure Monitors are ambulatory BP Monitors which are worn on the left wrist. Some of these Wrist BP monitors require the wearer to cross their wrists over their upper sternum. Maintain a 6 inch separation between the wrist monitor and the implanted device.		
Body Fat Scale (Electronic)	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the scale and the implanted device. **Do not use:** Body Fat Analysis scale with bioelectrical Impedance. The percentage of body fat is estimated by passing electrical current through the body. Most manufacturers have disclaimers in their product literature excluding the use of this product for individuals with a Pacemaker or ICD.		
Cars - Electric	**Use precautions:** Do not sit in the car while car is charging from charging tower. Professionals servicing the car should maintain at least 24 inch (60 cm) separation between running motor and implanted device.	Nissan Leaf	
Cars - Hybrid	**Safe under normal use:** Professionals servicing the car should maintain at least 24 inches (60 cm) between running motor and implanted device.		
Electric Blanket	**Safe under normal use:** Do not place transformer over implanted device.		
Electric Fences	**Safe under normal use:** Consult your heart doctor if you receive a shock.		
Electric Toothbrush	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the charging base and the implanted device as radio frequency fields may be present. Refrain from leaning over charger.	Sonicare Toothcare	
Electric grocery cart or personal scooters	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the battery and the implanted device or charger and implanted device.		

Personal Use			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Electric outlet shocks or shocks from any 60 Hertz source (momentary shocks or memorable momentary shocks)	**Recommendation:** If a shock is received from an external source, Boston Scientific recommends that you consult your heart doctor.		
Hair Dryer - Hand held or Salon	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the hair dryer and the implanted device.		
Heart Rate Monitor (monitors that use a chest band)	**Use precautions**: Maintain 6 inches (15 cm) distance between chest strap or wrist monitor. Suggest rotating chest band to opposite side, away from device implant site.	Polar, Omron, Timex, Suunto, Nordic Track, New Balance	Polar Heart Rate Monitors and Implanted Medical Devices
Heating Pad	**Safe under normal use.**		
Home Security Systems - Infrared & Ultrasonic	**Safe under normal use.**		
Home Security Systems - Microwave	**Use precautions:** Maintain 6 inch (15 cm) distance from transmitter. Microwaves emit low energy electromagnetic impulses.	Microguard	
Hot Tub	**Safe under normal use.**	Whirlpool baths	
Ignition Systems -- see Tools	Click here for Ignition Systems		
Induction Stove Top (AC Magnetic Field)	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between stove top and device. This stove differs from the more common electric and gas stoves. With this type of stove, a magnetic field heats the metal pots directly and only when they are placed on the stove top. The stove top remains cool to the touch. The metal in the bottom of the pan interacts with the magnetic field causing heating of the metal. Low risk if not leaning over stove.		
Induction Heater (Furnace/Kiln)	**Use precautions:** Magnetic field intensity should be measured by a worksite survey professional. Contact your doctor to review specific concerns.		
Invisible Fence® for dog - see Dog Shock Collar-Communication	Click here for Dog Shock Collar		
Ionized Bracelet	**Safe under normal use.**	Qray, Balance	
Ionized Air Filter / Air Purifiers	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the air filter and implanted device.		

Personal Use			
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Magnetic Back Brace	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between magnetic brace and implanted device. Magnetic belt worn on lower back.		
Massager chair	**Safe under normal use.**	Homemedics, Shiatsu, Rolling, Vibration, Percussion, Back Massage Cushions, Backrests, Body Mats, Foot Massagers (with no electrical stimulation), Neck and "Spot" Massagers	
Massager - hand held	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the massager and the implanted device. Do not place directly over implanted device. Small motors within hand massager may produce magnetic fields.		
Medical Alert Necklace	**Use precautions:** If necklace has cell phone function, wear on side opposite device. Maintain at least a 6 inch (15 cm) separation between the medical alert necklace and the implanted device.		
Microwave Ovens (both residential and commercial)	**Safe under normal use.**		
Motorcycle	**Use precautions**: Maintain at least a 12 inch (30 cm) separation between the ignition system and the implanted device.		
Motorcycle Vest (Electrically Heated)	**Safe under normal use.** DC current used to heat the vest.	Gen X, Gerbing	
Pest Control - Ultrasonic and Radio Frequency	**Use precautions**: Maintain at least a 6 inch (15 cm) distance between the device plugged into the wall and the implanted device. Ultrasonic pest control unit emits sound energy.		
Sewing Machines / Sewing Sergers	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the motor of the sewing machine or sewing serger and the implanted device.		
Shaver with electrical cord	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the shaver and the implanted device.		
Speakers	**Use precautions:** Maintain at least a 12 inch (30 cm) distance between the speaker and the implanted device. Large stereo speakers often have large magnets.		
TV (Television)	**Safe under normal use.**		

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<tr><td>TV Audio Headset (Radio frequency receiver)</td><td>Use precautions: Maintain at least a 6 inch (15 cm) separation between the transmitter (component usually on or near TV) and the implanted device. Radio Frequency system consists of transmitter and headset. Headset will not affect Pacemaker or ICD. Do not drape cord over implanted device.</td><td></td><td></td></tr>
<tr><td>TV Remote - Infrared (standard)</td><td>Safe under normal use.</td><td>Remote Controls (TV, Garage Door, Stereo, Camera/Video Equipment)</td><td></td></tr>
<tr><td>Tanning Bed</td><td>Safe under normal use. Consult your doctor.</td><td></td><td></td></tr>
<tr><td>Tanning - Magna Tanning</td><td>Safe under normal use. The electrostatic Magna-Tanning booth utilizes a high DC voltage potential at the tanning booth spray nozzles. The high DC voltage potential associated with these nozzles impart small electrical charges on the droplets of the tanning spray mist. The booth is designed in such a way that the person standing in the booth attracts the tanning mist droplets on the skin. This procedure does introduce a very small direct current into the body. The level of this very small current is well below the levels of susceptibility of both the Pacemaker and ICD. (Procedure takes less than one minute to complete)</td><td></td><td></td></tr>
<tr><td>Transformer Box - See Telecommunications</td><td>Click here for Transformer</td><td></td><td></td></tr>
<tr><th colspan="4">Telecommunications</th></tr>
<tr><td>AM/FM Radio</td><td>Safe under normal use.</td><td></td><td></td></tr>
<tr><td>Amateur or Ham Radio Bands and equivalent frequency ranges
80 M = 3.5-4 MHZ
40 M = 7-7.3 MHZ
30 M =10-10.1 MHZ
20 M =14-14.3 MHZ
10 M = 28-29.7 MHZ
6M = 50-54 MHZ
2M = 144-148 MHZ
(Also see Two-Way Radio)</td><td>Use precautions: The following minimum distances, measured between the antenna and the implanted device, and associated power transmission levels are recommended for a low risk of interaction with an implanted device.
<table><tr><th>Power Transmission</th><th>Separation between Antenna and Implanted Device</th></tr><tr><td>Less than 3 watts</td><td>6 inches (15 cm)</td></tr><tr><td>3 - 15 watts</td><td>12 inches (30 cm)</td></tr><tr><td>16 - 30 watts</td><td>24 inches (60 cm)</td></tr><tr><td>31 - 50 watts</td><td>3 feet (1 meter)</td></tr><tr><td>51 - 125 watts</td><td>6 feet (2 meters)</td></tr><tr><td>126 - 250 watts</td><td>9 feet (3 meters)</td></tr><tr><td>251 - 500 watts</td><td>12 feet (4 meters)</td></tr><tr><td>501 - 1000 watts</td><td>20 feet (6 meters)</td></tr><tr><td>1001 - 2000 watts</td><td>30 feet (9 meters)</td></tr></table>
If closer than the minimum recommended distances, for continuous transmissions, there is a potential for device interaction. CW (continuous wave) transmissions</td><td>Click here for Two-Way Radio</td><td></td></tr>
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Telecommunications			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Bluetooth Technology	**Use precautions:** Maintain at least a 6 inch (15 cm) distance between the transmitter/receiver and the implanted device. Wireless communication technology for TV's, radios, computers, and other electronic devices. Radio Frequency waves can communicate/control remote electronic devices. Do not place next to LATITUDE communicator, blood pressure monitor, or weight scale.		
CB Band Radio-dash mounted	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the antenna and the implanted device if operating at 5 watts or less. For CB Band radio operating at >5 watts click link at right.	Click here for Two-Way Radio	
CD/DVD Players	**Safe under normal use.**		Portable Multimedia Players and Implantable Pacemakers and Defibrillators
Cell Phone / PDA / Broadband connectivity	**Use precautions:** Keep at least a 6 inch (15 cm) separation between phone and implanted device. Keep at least a 12 inch (30 cm) separation between cell phone and implanted device if phone/PDA transmits more than 3 watts. Hold phone to ear on the opposite side of the body from device. Do not carry phone in breast pocket or on belt if within 6 inches (15 cm) of device.	iPhone, Blackberry, PalmPilot	Cellular Phones and Implantable Devices
Commercial Cellular Tower Antenna	**Safe under normal use** for public use. Professionals servicing cellular towers should contact your doctor for further information.		
Clearwire Modem-Wireless Broadband /Cell Phone Connected Internet Link	**Use precautions:** Maintain at least a 6 inch (15 cm) separation from the antenna on the modem. Clearwire uses a wireless modem that can be plugged into a desktop computer, laptop, or local network. It works by transmitting signals to and from nearby cellular towers instead of using a traditional phone line.		
Commercial Broadcasting Towers-Radio	Professionals servicing cellular tower should contact Boston Scientific Patient Services for further information.	Digital Television Transmission Tower, TV	
Computer Equipment - Wireless (with radio-frequency link)	**Use precautions:** For modem or wireless card operation within the 2.4-2.5 GHz and 5 GHz bands maintain at least a 6 inch (15 cm) separation between the modem/wireless card and the implanted device.	Personal computers	
Cordless Microphone	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the microphone antenna and the implanted device. Most cordless microphones operate at very low power levels. These guidelines are more dependent on the power output of the microphone than the specific radio frequency associated with the microphone.	Microphone, Lavalier, Wireless Microphone, Portable Microphone	

Telecommunications			
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Cordless Phone and associated base station	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the antenna on the cordless phone and the implanted device. In addition, maintain at least a 6 inch (15cm) separation between the base station of the cordless phone and the implanted device. Do not place cordless phone directly over implanted device. Cordless phones used within the house or yard are low power (usually less than 100 milliwatts).		
Dog Shock Collar (with a central radio frequency transmitter in home)	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the radio frequency transmitting antenna (usually inside the house) and the implanted device. Do not pet the dog in the areas where the shock collar will be activated.		
Dog Shock Collar (wire buried in the ground usually around the edge of the yard)	**Use precautions**: Maintain at least a 12 inch (30 cm) separation between the buried wire and the implanted device. Do not pet the dog where the cable is buried to avoid shock from dog collar.		
Global Positioning System (GPS) Satellite Navigation System	**Safe under normal use.** Device only receives, there is no transmitter. If the GPS is embedded in another device (for example cell phones, radio), refer to the guidelines for that device.	Garmin, Tom Tom, Magellan, OnStar	
GPS - Survey Equipment (Professional use)	**Use precautions:** For standard GPS survey equipment low risk of affecting Pacemaker or ICD.		
GPS - Survey Equipment (Professional use with repeater transmitter)	**Use precautions**: For GPS survey equipment used with repeater transmitter (output power of 25 watts or less), maintain at least a 24 inch (60 cm) separation between the antenna and the implanted device.		
Ham Radio	Click here for Ham Radio		
House Arrest Anklet or Bracelet	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the device and anklet or bracelet.		
Internet connection - In- Building BPL - Broadband over Power line (BPL) or Internet Connection over Power line Carrier (PLC) or Access BPL - Broadband	**Use precautions**: Maintain at least a 6 inch (15 cm) separation between the internal wiring associated with the power distribution system and the implanted device. In-Building BPL (LAN) utilizes electrical power wiring to transmit radio frequency signals to network computers within a building. Access BPL (Broadband) uses electrical power distribution lines to extend a connection to the Internet. The power distribution lines are used to transmit radiofrequency signals to local internet connection points within the neighborhood.		

Telecommunications

Item	Safety precautions: Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.	Similar brands that were not analyzed	A Closer Look Article
Infrared Scanner (barcode scanner)	**Safe under normal use**. Equipment is optical and poses a low risk of affecting Pacemaker or ICD. (used in grocery stores)		
Lie Detector Test - See Medical	Click here for Lie Detector Test		
Marine Radio - Very High Frequency (VHF) and Single Side Band (SSB) and UHF	**Use precautions:** Power Transmission: Separation between Antenna and Implanted Device Less than 3 watts: 6 inches (15 cm) 3 - 15 watts: 12 inches (30 cm) 20 - 25 watts: 24 inches (60 cm)		
Metal Detectors or Magnetometers (in airports, jails, courtrooms, some schools)	**Use precautions:** Tell security personnel you have a device and show medical device ID card. Low risk to walk through archway metal detector. If the archway detects metal in the device, request a hand search. If hand held metal detector wand is to be used, request that the wand not be placed directly over the device. If the security personnel insists on using the wand over the Pacemaker or ICD, request that the exposure of ICD to the magnetic field of the wand be limited to 1- 2 seconds every 30 seconds, and for the Pacemaker limit exposure to 1- 2 seconds every 10 seconds.		Information for the Traveling Pacemaker or Defibrillator Patient
Metal Detector-Body scanner (X-ray)	**Safe under normal use:** The Transportation Security Administration (TSA) currently uses two types of full-body "people scanners" — X-ray scans and millimeter wave scans. Neither type of scanner should affect your implanted pacemaker or defibrillator system. Step away from the scanner if you feel poorly.		Information for the Traveling Pacemaker or Defibrillator Patient
Millimeter Wave Imaging or Scanners (Airports, Jails, Courtrooms, etc.)	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the heart device and the walls of the scanner. Also called a 3D scanner, whole body imaging, or RF / Microwave scanner. The Transportation Security Administration (TSA) currently uses two types of full-body "people scanners" — X-ray scans and millimeter wave scans. Neither type of scanner should affect your implanted pacemaker or		Information for the Traveling Pacemaker or Defibrillator Patient
Nintendo Wii and Wireless Remote Controls	**Safe under normal use:** Do not place control directly over implanted device. The Nintendo Wii uses wireless technology with various handheld controllers. The manual for Nintendo Wii recommends keeping these controllers 9" away from an implanted heart device.		
OnStar® technology	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the antenna and the implanted device. Device found in cars for navigation. Works with cell phone & GPS Technology. Antenna usually on roof, transmitter in glove box.		

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<tr><td>Pagers - Receiver Only</td><td>Safe under normal use.</td><td></td><td></td></tr>
<tr><td>Pagers - 2 Way with receiver and transmitter</td><td>Use precautions: Maintain at least the minimum separation suggested.<table><tr><th>Pager</th><th>Distance between Antenna and Implanted Device</th></tr><tr><td>Less than 3 watts</td><td>6 inches (15 cm)</td></tr><tr><td>3 - 15 watts</td><td>12 inches (30 cm)</td></tr></table></td><td></td><td></td></tr>
<tr><td>Phone Headset (cordless)</td><td>Use precautions: Maintain at least a 6 inch (15 cm) separation between the antenna and the implanted device. Do not place directly over implanted device.</td><td></td><td></td></tr>
<tr><td>Power Lines - high voltage</td><td>Safe under normal use for residential exposure (general public). Low risk of affecting Pacemaker or ICD when walking, driving underneath, or living in a house or building near high voltage power lines. See precautions for occupational exposure.
Use Precautions: Professionals servicing high voltage power lines (occupational exposure) may be susceptible to interaction with their implanted device. For this work environment, contact your doctor to review specific concerns.</td><td></td><td></td></tr>
<tr><td>Radar - small boats</td><td>Use precautions: For radar transmitting from 1 to 4 kilowatts (kW) effective radiated power (ERP) maintain an overhead (vertical) distance of 3 feet (1 meter). Inside radar console display is unlikely to affect the Pacemaker or ICD.</td><td></td><td></td></tr>
<tr><td>Radar - commercial or cruise ships</td><td>Safe under normal use: For passengers on commercial or cruise ships, radar antennas are mounted in a configuration such that they are unlikely to affect Pacemaker or ICD function; for example, when an individual is on a normally accessible deck or bridge area. In other areas, there may be the potential for Pacemaker or ICD interaction.</td><td></td><td></td></tr>
<tr><td>Radar - Cruise Ship (professional)</td><td>Use precautions: For service personnel or crew members, in non-passenger areas, there is the potential for Pacemaker reversion or ICD shock. For this work environment, contact your doctor to review specific concerns.</td><td></td><td></td></tr>
<tr><td>Remote (hands free) Keyless entry (i.e. Smart Key)</td><td>Safe under normal use. Boston Scientific testing suggests that the smart key system remote unit and/or smart key system antennas should not interfere with Boston Scientific CRM implanted pacemakers or defibrillators. Do not place remote (key fob) directly over implanted device.</td><td></td><td>Automobile "Smart Key" Systems and Implantable Pacemakers and Defibrillators</td></tr>
<tr><td>Remote Car Starter</td><td>Safe under normal use. Automatically starts the car. Do not place directly over implanted device.</td><td></td><td></td></tr>
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<tr><td>Remote to unlock car</td><td>Safe under normal use: Do not place directly over implanted device.</td><td></td><td></td></tr>
<tr><td>Residential Satellite Dish -transmitting/ receiving</td><td>Use precautions: Recommend that the antenna be mounted in such a way that at least a 24 inch (60 cm) overhead vertical distance be maintained between the satellite dish and the individual with a Pacemaker or ICD. Avoid direct exposure to the main energy beam.</td><td></td><td></td></tr>
<tr><td>Satellite Dish (residential) - receiving only</td><td>Safe under normal use: For example, Direct TV. This includes the receiving Unit which usually sits next to the TV.</td><td></td><td></td></tr>
<tr><td>Theft Detector pedestals (located at store exits)</td><td>Use precautions: Walk through theft detection systems at a normal pace. Do not lean against or linger near security gates or tag readers that include Radio Frequency Identification (RFID) equipment Theft detectors are used in stores and libraries. These systems are unlikely to affect implanted cardiac device function when walking through security gates at a normal walking pace.</td><td></td><td>Radiofrequency Identification and Implantable Pacemakers and Defibrillators</td></tr>
<tr><td>Theft detection tag deactivators</td><td>Use precautions: Maintain at least a 24 inch (60 cm) separation between the scanner/deactivators that are located on the counter and are used to (1) identify the items to be purchased and (2) deactivate the anti-theft tags at checkout counters in stores. Professionals using the scanner/deactivators should contact your doctor for further information.</td><td></td><td></td></tr>
<tr><td>Transformer Box 50 / 60 Hertz</td><td>Use precautions: Maintain at least a 12 inch (30 cm) separation between transformer and implanted device. These transformer boxes are used in association with underground 60 Hertz power distribution. Typically this is a green box found on the ground. Low risk to walk by or have in backyard.</td><td></td><td></td></tr>
<tr><td>Two Way Portable Radio (Walkie-Talkie) Law Enforcement, Fire, and Emergency Vehicle radios</td><td>Use precautions: The following minimum distances, measured between the antenna and the implanted device, and associated power transmission levels are recommended for a low risk of interaction with an implanted device.

CB and police radios: maintain 24 inch distance from implanted device.
<table><tr><th>Power Transmission</th><th>Separation between Antenna and Implanted Device</th></tr><tr><td>Less than 3 watts</td><td>6 inches (15 cm)</td></tr><tr><td>3 - 15 watts</td><td>12 inches (30 cm)</td></tr><tr><td>16 - 30 watts</td><td>24 inches (60 cm)</td></tr><tr><td>31 - 50 watts</td><td>3 feet (1 meter)</td></tr><tr><td>51 - 125 watts</td><td>6 feet (2 meters)</td></tr></table></td><td></td><td></td></tr>
</table>

<table>
<tr><th colspan="4">Telecommunications</th></tr>
<tr><th>Item</th><th>Safety precautions:
Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.</th><th>Similar brands that were not analyzed</th><th>A Closer Look Article</th></tr>
<tr><td>TV Ears</td><td>Use precautions: Maintain at least a 6 inch (15 cm) separation between the transmitting unit connected to the audio source, the charger, and the implanted heart device.</td><td></td><td></td></tr>
<tr><td>Wi-Fi or Wireless Fidelity</td><td>Use precautions: Maintain at least a 6 inch (15 cm) separation between the Wi-Fi transmitter/receiver antenna (if visible) and the implanted device.</td><td></td><td></td></tr>
<tr><td>Wireless LANS (Local Area Network System)</td><td>Use precautions: Maintain at least a 6 inch (15 cm) separation between the antenna of the LAN transmitter or the LAN transmitter case and the implanted device.</td><td>Peconet</td><td></td></tr>
<tr><th colspan="4">Tools</th></tr>
<tr><td>Alternator</td><td>Use precautions: Maintain at least a 24 inch (60cm) separation from alternator. Patients should avoid leaning over a running engine. Driving or riding in a vehicle maintains a safe distance from a running motor/alternator.</td><td></td><td></td></tr>
<tr><td>Battery Charger (car)</td><td>Use precautions: Maintain at least a 12 inch (30 cm) separation between the battery charger and the implanted device.</td><td></td><td></td></tr>
<tr><td>Chainsaws (gas and electric powered)</td><td>Use precautions: consult heart doctor. Maintain at least a 12 inch (30 cm) distance between electric motor / ignition system of chainsaw and implanted device.</td><td></td><td></td></tr>
<tr><td>Non-industrial Demagnetizers</td><td>Use precautions: Maintain at least a 6 inch (15 cm) separation between demagnetizer and the implanted device when the items to be demagnetized are in a closed container.</td><td></td><td></td></tr>
<tr><td>Electrostatic Spray Gun (hand held)</td><td>Safe under normal use: Do not place directly over implanted device.</td><td></td><td></td></tr>
<tr><td>Generator - Residential AC/DC portable/RVs (gasoline or diesel powered)</td><td>Use precautions: If generator is powered by an engine with an ignition system, maintain at least a 12" (30 cm) separation between the components of the ignition system and the implanted device. Does not include industrial generators.

EMI specifications:
With respect to our 0.1mT (1Gauss) guideline for 60Hz magnetic fields, the resulting fields generated at 100A, 200A, and 400A would be as follows:

<table><tr><td>100 Amps</td><td>8 inches (20 cm)</td></tr><tr><td>200 Amps</td><td>16 inches (40 cm)</td></tr><tr><td>400 Amps</td><td>32 inches (80 cm)</td></tr><tr><td>>400 Amps</td><td>Call for information</td></tr></table></td><td></td><td></td></tr>
</table>

Tools			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Ignition Systems (gasoline powered vehicles	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the components of an operating ignition system and the implanted device. If the device is closer than 12 inches (30 cm), there is the potential for Pacemaker or ICD interaction. Diesel powered vehicles have no effect.		
Jumper Cables	**Use precautions:** During use, maintain at least a 24 inch (60 cm) separation between the jumper cables and the implanted device when starting an engine.		
Soldering Guns / Soldering Irons	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the soldering gun or iron and the implanted device. The soldering gun contains a transformer.		
Stun Guns (hand held only)	**Use precautions**: Implanted device should be checked if patient received electrical pulses from stun gun. If the individual receiving the subduing electrical shocks has a Pacemaker or ICD, their implanted device may be affected. **Safe under normal use:** if the individual with a Pacemaker or ICD is using the stun gun.		See Taser below.
Taser® (hand held gun that shoots two darts propelled by compressed gas cartridge) below)	**Use precautions:** Implanted device should be checked if patient receives electrical pulses from taser. Low risk if the individual with a Pacemaker or ICD is operating the taser. Electrical pulses should not be applied in vicinity of implanted device (typically near heart). One set of electrodes has the ability to project two darts that deliver these high-energy electrical pulses to individuals at a short distance. A second set of back-up electrodes are incorporated into the hand held portion of the taser.		
Tools - Battery powered	**Use precautions:** Consult heart doctor. Maintain at least a 6 inch (15 cm) separation between the battery-powered tool, the charger, and the implanted device. Battery operated home and garden equipment includes: circular saws, drills, hedge clippers, lawnmowers.		
Tools - Bench mounted (electric line powered)	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the motor associated with the power tool and the implanted device. This applies to motors / home workshop tools such as drill presses, table saws, grinders.		
Tools - Hand held or Home & Garden (electric line powered)	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between power tools and the implanted device (i.e. circular saws, drills, sanders, routers, electric hedge clippers, leaf blowers, and edge trimmers). Be sure tools are properly grounded.		

Tools			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
UPS - Uninterrupted Power Source (Commercial power failure back-up system)	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the Uninterrupted Power Source system operating normally and the implanted device. When the UPS system is running on the battery source, maintain at least an 18 inch (45 cm) separation between the UPS system and the implanted device.		
Welding			
Welding	**Use precautions**: Maintain 24 inch (60 cm) distance between the welding machine/cables/arc and the implanted device at current ratings less than or equal to 200 amps. The welding machine/cables/arc produce and carry the current associated with the welding operation. At rated currents greater than 200 amps, we recommend contacting your doctor to discuss the specific welding equipment prior to welding.		Arc Welding and Implanted Medical Devices
EDM-Electromagnetic Discharge Machine	**Use precautions:** Maintain 24 inches (60 cm) distance between the equipment and implanted device.	MIG - metal inert gas TIG - tungsten inert gas Stick, Heli, Arc, plasma cutters, gauging welding instruments	Arc Welding and Implanted Medical Devices
Dental Procedures			
Dental Apex Locator (root locator)	**Safe under normal use:** Instrument used to locate the end of a nerve in a tooth.		Dental Equipment and Implantable Pacemakers and Defibrillators
Dental -Ultrasonic scalers/cleaners	**Safe under normal use.**	Cavitron	Dental Equipment and Implantable Pacemakers and Defibrillators
Dental Pulp Tester	**Use precautions:** This device is disclaimed for use on Pacemaker & ICD patients by most Dental Pulp Tester manufacturers. However, there are several published studies reporting no interaction with Pacemaker and ICD function, which suggests these technologies may be compatible. This instrument is used to check the viability of the nerve in a tooth. Introduces alternating current (AC) into the tooth.		Dental Equipment and Implantable Pacemakers and Defibrillators
Electrocautery (periodontal surgery)	See Electrocautery or Electrosurgery.		
Medical Procedures			
Ablation-Cardiac (Radio frequency)	**Use precautions:** Consult with heart doctor. This procedure introduces electrical current into the body. This process is done to change or interrupt the electrical pathways in the heart. If ablation is performed with the Pacemaker implanted, it is recommended to program the Pacemaker to Asynchronous mode or application of the magnet to provide continuous Pacemaker support during the procedure. If an ICD is implanted, it is recommended to turn off the Tachy therapy either with a magnet or by programming changes.		Radiofrequency Ablation and Implantable Device Systems
Acupuncture - No electrical stimulus	**Safe under normal use.**		

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Acupuncture AC/DC Alternating Current	**Use precautions:** Consult with heart doctor. This procedure introduces electrical current into the body that may affect the implanted devices of individuals. It is recommended that individuals considering this procedure consult their heart doctor to evaluate any possible risks associated with these responses in conjunction with their medical condition.		
Acupuncture DC - Direct Current	**Safe under normal use.**		
Blood bag dielectric sealing equipment	**Use precautions:** Maintain at least a 12 inch (30 cm) separation between the sealer and implanted device. Do not place power source directly over device. Equipment uses high frequency energy to seal blood bags.		
Bone Density test/Scan	Two types are used: X-ray and Ultrasound. **X-ray: Safe under normal use.** **Ultrasound: Use precautions:** Ultrasound technique. Maintain at least a 6 inch (15 cm) separation between the transducer head and the implanted device.		
External Bone Growth Stimulator Alternating Magnetic Field - produced by an alternating current (AC)	**Use precautions:** Consult heart doctor to evaluate any possible risks associated with this equipment in conjunction with patient medical condition. An insulated cuff surrounding the broken bone produces a magnetic field that promotes bone healing. This therapy does not introduce conducted current into the body; however, there is a magnet field that is present in the immediate vicinity of the cuff. A battery is used to deliver a short duration, high intensity current pulse to the coil in the cuff that produces the therapeutic magnetic field. When used on leg poses a low risk of affecting Pacemaker or ICD. For use on wrist or arm maintain at least a 12" (30 cm) separation from the implanted device. Do not use OrthoFix Cervical Stim Bone Growth Stimulator as this is located in close proximity to the implanted device and leads. Do not use the EBI Bone Healing System unless the treatment coil is located at least 12" (30 cm) from the location of the implanted device and leads.		
External Bone Growth Stimulator Direct Current (DC)	**Safe under normal use: See exceptions below.** Low level direct current is not detectable by the Pacemaker or ICD (implanted or external stimulator). **Use precautions: Spinologic Bone Growth Stimulator = 12 inches (30 cm) from implanted device and leads.** **Use precautions: EBI/Biomet SpinalPak and OrthoPak (electrodes) = 12 inches (30 cm) from implanted device and leads.**		

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Internal Bone Growth Stimulator introducing AC current into the body	**Use precautions:** Consult heart doctor to evaluate any possible risks associated with these responses in conjunction with patient medical condition. **See additional precautions below.** This procedure introduces electrical current into the body that may affect the implanted devices of individuals. Low risk when electrodes are placed on an extremity. If the electrodes are placed on the torso there is the potential for Pacemaker or ICD interaction. **Use precautions: DJO Bone Healing System** = 12 inches (30 cm) from implanted device and leads. **Use precautions: Exogen Ultrasound Bone Healing System** = 12 inches (30 cm) from implanted device and leads. Do not place the transducer head directly over the implanted device or leads, or in orientations where the implanted device or leads will be exposed to the ultrasound beam.		
Bravo PH Capsule (used to diagnose reflux disease)	**Safe under normal use:** The Bravo PH capsule is a medical device that is used to monitor for gastroesophageal reflux disease, or GERD. The capsule transmits data for up to 48 hours to a monitor the patient carries with them.		
Capsule Endoscopy-Given model M2A	**Safe under normal use:** The M2A capsule encases a digital camera, light-emitting diodes, batteries, and a transmitter. The M2A capsule emits short bursts of radio frequency energy for twice per second for the eight-hour diagnostic period.		PillCam Capsule Endoscopy and Implantable Device Systems
CAT Scan or CT Scan (Computed Axial Tomography)	**Use precautions:** Consult heart doctor and refer to A Closer Look article. Recommend monitoring heart rate during CT scan.		Computed Tomography (CT) Scanning and Implantable Pacemakers and Defibrillators
Cardioversion	See **A Closer Look** article (right) and Defibrillation-External (below).		CPR and External Defibrillation for Pacemaker and/or Defibrillator Patients
Colonoscopy	**Use precautions:** This diagnostic procedure by itself poses a low risk of affecting the Pacemaker or ICD. However, if polyps are found electrocautery may be used to remove them. See electrocautery guidelines.		Electrocautery and Implantable Device Systems
CyberKnife	**Use precautions:** Robotic radiosurgery system used for treating benign tumors, malignant tumors and other medical conditions. Cyberknife utilizes Radiation Therapy, and Boston Scientific Therapeutic Radiation Recommendations apply. Also see Recommendations for Stereotaxis.		Therapeutic Radiation and Implantable Device Systems

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Defibrillation-External (High energy) Cardioversion (Low energy)	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between paddles and implanted device or device lead system. If external defibrillation or Cardioversion is delivered closer than 6 inches (15 cm) from the implanted device or device lead system, Pacemaker or ICD may be damaged or reprogrammed. It is recommended that device function and programming be thoroughly evaluated after any external defibrillation or cardioversion.		CPR and External Defibrillation for Pacemaker and/or Defibrillator Patients
Diathermy	**Do not use:** Diathermy is NOT recommended. This process heats body tissue and may result in Pacemaker reversion or ICD shock if no precautions are taken.		
Diathermy /Ultrasound	**Use precautions:** Consult heart doctor and maintain a 6 inch (15 cm) separation between the transducer head and the implanted device.		
Digital Infrared Thermal Imaging (DITI)	**Safe under normal use:** This imaging technique monitors infrared radiation emitted from the skin surface. This is a passive device that does not introduce any electrical current into the body.		
ECG/EKG Electrocardiogram	**Safe under normal use:** The ECG/EKG is limited to sensing electrical activity of the heart.	EKG, ECG, 12-lead, twelve-lead	
Echocardiogram	**Use precautions:** Maintain a 6 inch (15 cm) separation between the transducer head and the implanted device. A test in which ultrasound is used to examine the heart.	Transesophageal Echo, TEE, Echocardiography	
ECT (Electroconvulsive Shock Therapy) (Continued below)	**Use precautions: C**onsult with heart doctor to evaluate any possible risks associated with these responses in conjunction with the patient's medical condition. This procedure introduces electrical current into the body that may affect the implanted devices of individuals. ECT is used to treat depression, anxiety and other mental disorders.		
EECP - Enhanced External Counter Pulsation Therapy	**Safe under normal use:** This therapy helps to maintain arterial pressure longer, resulting in better perfusion of the heart and other body organs. No effect on the implantable device electrical sensing.		
EEG - Electroencephalography	**Safe under normal use:** Scan brain wave activity.		
Electrocautery or Electrosurgery	**Use precautions:** consult heart doctor to evaluate any possible risks associated with these in conjunction with patient's medical condition. This procedure is used in surgeries to cut tissue and stop the bleeding of blood vessels. Electrocautery may temporarily affect the function of an implanted pacemaker or defibrillator. During electrocautery use, Boston Scientific defibrillators can be temporarily deactivated and a pacemaker can be programmed to pace asynchronously. The physician who monitors the patient's implantable device should be contacted to discuss the use of electrocautery and the potential impact of these programming options.	Bovie, Hyfrecator, Cautery, Argon Plasma, Electrosurgery, Plasma Knife	Electrocautery and Implantable Device Systems

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Electrolysis - AC	**Do not use**: Consult heart doctor to evaluate any possible risks associated with these responses in conjunction with patient's medical condition. This procedure introduces electrical current into the body that may affect the implanted device.		
Electrolysis - DC - Galvanic	**Do not use:** Consult heart doctor to evaluate any possible risks associated with these responses in conjunction with patient's medical condition. This procedure introduces electrical current into the body that may affect the implanted device.		
ELOS	**Do not use**: Consult heart doctor. Called ReFirme ST Skin Tightening system, developed by Syneron and designed to reduce wrinkles and tighten skin in the face and neck area. It uses 'ELOS' technology which combines three energy sources: laser, infrared and radio frequency. ELOS technology uses a pulse repetition rate of one pulse per second.		
EMG Electromyography-Single Stimulus Manually Activated Test	**Use precautions:** Consult heart doctor to evaluate any possible risks associated with your medical condition. This procedure introduces electrical current into the body that may affect the implanted devices of individuals. This test is used to examine nerve conduction or motor impairment of the nerve.		
Electronystagmography (Audiology - ENG)	**Safe under normal use:** The ENG test is used to assess balance and movement disorders. Passive electrodes are placed on the head to evaluate the electrical potentials associated with eye movement. (Similar to EKG, EEG)	Refer to EEG	
Hyperbaric Chamber	**Use precautions:** Only to be used under medical supervision**.** A chamber large enough to accommodate one or more persons in which pressure is above normal atmospheric pressure. It is used to treat several medical conditions (i.e. carbon monoxide poisoning, infections, burns, pressure related diving injuries).		Elevated Pressure (HBOT/SCUBA) and Implanted Medical Devices
Interferential Electrical Current Therapy	**Use precautions: C**onsult heart doctor to evaluate any possible risks associated with these responses in conjunction with their medical condition. This procedure introduces electrical current into the body that may affect the implanted devices of individuals.		

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Iontophoresis (drug patch)	**Use precautions**: Use only under medical supervision. Do not place electrodes over device or lead tip. Introduction of a low level DC current to enhance the transfer of a drug into the body from an externally applied patch.		
Laser Surgery	Laser (light energy only) poses a low risk of affecting Pacemaker or ICD. Verify laser equipment. If combination of laser and electrocautery, see electrocautery guidelines. **Use precautions:** 3 to 4 feet (90 cm - 120 cm) separation between generator or cabling from implanted device-if distance recommendation for laser generator cannot be met, consider asynchronous pacing of dependent patients. Laser Beam: No restrictions other than eye surgery (see Lasik Eye Surgery recommendations) **Use precautions:** YAG, Odyssey Laser System, Holmium, Pulsed CTH= Laser Generator: 3-4 feet (90 cm - 120 cm) from implanted device-if distance recommendation for laser generator cannot be met, consider asynchronous pacing for dependent patients, inhibit or deactivate tachy therapy via magnet application or PRM. **Safe under normal use:** Laser Beam: No restrictions other than eye surgery (see eye surgery recommendations) **Use precautions:** Eye Surgery, Eye Laser Procedure, Cataract Surgery, Lasik, Radial Keratotomy, Corneal Surgery, Vitrectomy, Pan Retinal Photocolagulation, Blepharoplasty = Inhibit or deactivate tachy therapy via magnet application or PRM (see laser precautions if necessary)	Laser, YAG, Odyssey, Holmium, Argon, CO2 Laser = Laser Generator:	
Lasik Eye Surgery	**Use precautions:** Recommend the application of a magnet to disable ICD detection circuit, or program ICD detection circuit off prior to surgery. These precautions are taken so legitimate therapy will not be delivered during critical portions of this delicate corrective eye procedure. Laser light associated with this procedure has a low risk of affecting the Pacemaker or ICD. A magnet is not used to disable a pacemaker.	Eye Surgery, Eye Laser Procedure, Cataract Surgery, Lasik, Radial Keratotomy, Corneal Surgery, Vitrectomy, Pan Retinal Photocolagulation, Blepharoplasty	A magnet is not used for a pacemaker.
Lie Detector Test	**Safe under normal use:** Lie detector tests introduce only direct current into the body. This direct current poses a low risk of affecting a Pacemaker or ICD.	Polygraph	
Magnetic mattresses	**Do not use:** Magnetic mattresses.		
Mammogram (Diagnostic X-ray)	**Safe under normal use:** Inform technician you have a device to ensure device does not get compressed. X-ray equipment can be adjusted to make individual more comfortable and lessen the pressure on the Pacemaker or ICD.		
Mechanical ventilation with a respiration rate monitor	**Use precautions**: Ventilators are used to help individuals breathe during surgery. Respiration rate monitors are used in conjunction with the ventilators to help verify that an individual's breathing rate is in a normal range during surgery. See A Closer Look article.		Interactions between Hospital Monitoring or Diagnostic Equipment and Pacemakers Using Minute Ventilation Sensors

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Medical Helicopter	**Safe under normal use.**		
MET (Microcurrent Electrical Therapy) Alpha- Stim 100®	**Use precautions:** Consult heart doctor**.** This procedure introduces electrical current into the body that may affect the implanted devices of individuals. It is recommended that individuals considering this procedure consult their heart doctor to evaluate any possible risks associated with these responses in conjunction with their medical condition. Similar to TENS unit with somewhat less current.		
Microcurrent Stimulation	**Use precautions:** Consult heart doctor. Route cables away from the chest. Cardiac monitoring is recommended. Devices which are known as MicroCurrent Stimulators can be used to promote tissue regeneration and healing as well as electronic pain management.		
MRA (Magnetic Resonance Angiography)	**Do not use:** Consult heart doctor**.** The MRA procedure is done within an MRI machine. An MRI examines soft tissues and organs. The MRA is a procedure to examine blood vessels within an MRI machine that may require the injection of an enhancing agent. See MRI recommendations.		Magnetic Resonance Imaging (MRI) and Implanted Medical Devices
MRI (Magnetic Resonance Imaging)	**Do not use:** Consult heart doctor. Not recommended. Even when the MRI is not in use the Pacemaker & ICD may be affected by the static magnet field that is always present near the MRI. There is the potential for Pacemaker magnet rate operation and disabling of ICD detection circuit.		Magnetic Resonance Imaging (MRI) and Implanted Medical Devices
MRI on extremities	**Use precautions:** Consult heart doctor. If the scanning equipment has a 5 Gauss "Fringe Field", keep implanted system outside this line respecting our guidance limit. Five gauss and below are considered 'safe' levels of static magnetic field exposure for the general public. Physician may choose to monitor patient depending on his clinical condition.		
Navigator Bionavigation System	**Do not use:** Consult heart doctor. Used to assist with the placement of central venous catheters and PICC lines. The transmitter is located in a hand-held device which is waved over the patient. The receiver is located within the stylet in the catheter. Related terms: Central Venous Catheter Placement, PICC Line placement.		
Nuclear Stress Test	**Safe under normal use:** This procedure is used to see blood flow in the patient's heart at rest and during activity. A radioactive substance is injected into the patient's bloodstream and viewed with a special scanner. No reported interference with this procedure.		
Neutron Radiation	**Use precautions:** Consult heart doctor. Follow physician guidelines. See A Closer Look article.		Therapeutic Radiation and Implantable Device Systems

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
PET Scan (Positron Emission Tomography)	**Safe under normal use:** Radioactive dye is injected into body. Radiation given off by the body is monitored. Similar to a diagnostic X-ray.		
PFES	**Use precautions:** Consult heart doctor. Incare, produced by Hollister, uses biofeedback and painless electrical stimulation to treat urinary incontinence. Use lowest setting possible, monitor patient's cardiac activity, stopping procedure if interference occurs.		
Pulse Radiation Therapy (Radio frequency)	**Use precautions:** Consult heart doctor to evaluate any possible risks associated with these responses in conjunction with patient's medical condition. This procedure introduces electrical current into the body that may affect the implanted devices of individuals. Magnet application recommended for Pacemaker & ICD. Similar to radiofrequency ablation. This procedure is used to interrupt nerve pathways for pain management.		Radiofrequency Ablation and Implantable Device Systems
Radiation Therapy (External X-ray or Gamma knife)	**Use precautions:** Consult heart doctor. See A Closer Look article.		Therapeutic Radiation and Implantable Device Systems
Radiation Therapy - Surgery (Internal/implants)	**Use precautions:** Consult heart doctor. Prolonged exposure. See A Closer Look article. Recommend physician follow-up post surgery.		Therapeutic Radiation and Implantable Device Systems
Rebuilder	**Do not use:** Consult heart doctor. An electrical stimulation device primarily used for the treatment of neuropathies in the feet, but can be used in the hands. Use on the hands will pose more of a risk for device interaction than use on the feet. The equipment uses a separate footbath for each foot, such that all the current injected into one foot passes through the patient's torso and out the other foot.		
Relief Band®	**Safe under normal use:** Used to prevent motion sickness from traveling. Delivers a small electrical pulse at the wrist area. Low risk of affecting Pacemaker or ICD.		
Rife Wellness Machine	**Do not use:** Consult heart doctor. Rife Wellness Machines use what they term a Mortal Oscillatory Rate (MOR) resulting in destruction of various pathogenic organisms, as well as cancer. Nearly all of these machines send electrical current into the patient's body.		
Sleep Apnea Machine	**Use precautions:** Maintain a 6 inch (15 cm) separation between all power cords and monitor.	CPAP	
Somnoplasty	**Do not use:** Consult heart doctor. A temperature-controlled radiofrequency based technology for use in the treatment of chronic nasal obstruction and sleep disordered breathing. Operates by heating a targeted area of obstructive tissue below the surface. An electrode is used at outputs of 10+ Watts using an operating frequency of 460kHz. A grounding pad is placed on the patient's lower back.		

Medical Procedures			
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Stereotaxis	**Use precautions**: Consult heart doctor. Stereotactic surgery or stereotaxis is a minimally invasive form of surgical intervention which makes use of a three-dimensional coordinate system to locate small targets inside the body and to perform on them some action such as ablation, biopsy, lesion, injection, stimulation, implantation, radiosurgery. There are 2 different methods for developing the three dimensional coordinate system: 1) **MRI: Do not use (see A Closer Look article)** 2) **CAT Scan:** If this method utilizes MRI- **do not use**. For the method utilizing CAT Scan: **follow CT scan Recommendations (see A Closer Look article)**	Magnetic Resonance Imaging (MRI) and Implanted Medical Devices	Computed Tomography (CT) Scanning and Implantable Pacemakers and Defibrillators
TMS (Transcranial Magnetic Stimulation)	**Use precautions:** consult heart doctor and use under medical supervision. This magnetic pulse therapy used in Psychiatry produces a similar effect to Electro-convulsive therapy (ECT) with minimal side effects.		
TUNA Therapy (Transurethral Needle Ablation)	**Do not use:** Recommend consulting with physician for other therapeutic prostate procedures that pose less risk of interacting with a Pacemaker or ICD. Used to treat urinary symptoms caused by an enlarged prostate.		
TENS Unit (Transcutaneous Electrical Nerve Stimulation)	**Do not use**. If you must use, consult heart doctor. TENS involves passing electrical current through the body, and may interfere with pulse generator function. If TENS is medically necessary, evaluate the TENS therapy setting for compatibility with the pulse generator. THE FOLLOWING GUIDELINES MAY REDUCE THE LIKELIHOOD OF INTERACTION: Place the TENS electrodes as close together and as far away from the pulse generator and leads as possible. Use the lowest clinically appropriate TENS energy output. Consider cardiac monitoring during TENS use, especially for pacemaker dependent patient. ADDITIONAL STEPS CAN BE TAKEN TO REDUCE INTERFERENCE DURING IN-CLINIC USE OF TENS: If interference is suspected during in-clinic use, turn off TENS unit. Do not change TENS settings until you have verified that the new settings do not interfere with pulse generator function. IF TENS IS MEDICALLY NECESSARY OUTSIDE THE CLINICAL SETTING (AT-HOME USE), PROVIDE THE FOLLOWING INSTRUCTIONS: Do not change the setting or electrode position unless instructed to do so. End each TENS session by turning off the unit before removing the electrodes. If the patient receives a shock during TENS use, or if they experience symptoms of lightheadedness, dizziness, or loss of consciousness, they should turn off the TENS unit and contact their physician. FOLLOW THESE STEPS TO USE THE PRM TO EVALUATE PULSE GENERATOR FUNCTION DURING TENS USE. 1) Program the pulse generator Tachy Mode to Monitor Only.2) Observe real-time EGM at prescribed TENS output settings, noting when appropriate sensing or interference occurs. **NOTE:** ***Patient triggered monitoring may be used as an additional method to confirm device function during TENS use.*** 3) When finished, turn off the TENS unit and reprogram the Tachy Mode to Monitor + Therapy. You should also perform a thorough follow-up evaluation of the pulse generator following TENS. to ensure that device function has not been compromised.		

Medical Procedures			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
TUMT (Transurethral Microwave Thermotherapeutic Device)	**Do not use:** Consult heart doctor. This is a diathermy-type of therapy. Most manufactures of this type of device contraindicate the use of this therapy with Pacemaker or ICD patients.		
TURP- Prostate test (Transurethral Resection of the Prostate)	**Do not use:** Consult heart doctor to evaluate any possible risks associated with these responses in conjunction with patient's medical condition. This procedure introduces electrical current into the body that may affect the implanted devices of individuals.		
Ultrasound (Diagnostic) or Sonogram	**Use precautions:** Do not place transducer head directly over the implanted device or leads, or in orientations where the implanted device or leads will be exposed to the ultrasound beam. This procedure uses ultrasound technology to create images of organs and other body parts. *A sonogram is a type of diagnostic ultrasound used during pregnancy.	Transcranial Doppler, TCD, Diagnostic Ultrasound, Echo	
Ultrasound (Therapeutic)	**Use precautions**: Do not place transducer head directly over the implanted device.	Transcranial Doppler, TCD, Diagnostic Ultrasound, Echo	
Virtual Colonoscopy performed with CAT Scan (CT Scan)	**Use precautions:** See A Closer Look article for more information. A procedure that is used to diagnose colon and bowel disease, including polyps, diverticulosis, and cancer. The procedure is performed with a CAT SCAN or MRI. The procedure using an MRI is not recommended.		Computed Tomography (CT) Scanning and Implantable Pacemakers and Defibrillators
Virtual Colonoscopy with MRI	**Do not use:** MRI is not recommended. See A Closer Look article. The implanted device may be affected by the static magnet field that is always present near the MRI.		Magnetic Resonance Imaging (MRI) and Implanted Medical Devices
X-ray (Diagnostic)	**Safe under normal use.**		
Hearing Aids			
Assisted listening devices	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the hearing aid and the implanted device. Do not place over implanted device. Hearing aid accessories are worn around the neck in a pendant fashion. These pendants gather sound from conversation, television audio, and cell phones. They transmit the audio to the patient's hearing aids via Bluetooth. Individuals may want to position the pendant on the opposite side of patient's implant site. Boston Scientific's Bluetooth recommendations apply. Suggestions: place in breast pocket on opposite site of implant site; or pin the pendant on opposite side of patient's implant site; or attach pendant on belt loop.	Starkey: PHONAK: ICOM, ComPilot, ComPilot II ComPilot Air II RemoteMic, TVlink streamer. Roger Clip on mIc , Roger Pen, Roger EasyPen STARKEY: Surflink Mobile 2. AVADA: Easylink Streamer.BELLTONE: Direct Phone Link 2, Beltone Direct Personal Audio Link (myPAL0: MIRACLE EAR: MEBluConnect, Pen Remote)	See Bluetooth.

Hearing Aids			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Audio Induction Loop Systems	**Use precautions:** Maintain at least a 6" (15 cm) separation between a hand-held loop receiver and the implant site. Induction Loop: loop of wire around a room or building that generates a magnetic field, allowing sounds to be picked up by a cochlear implant or hearing aid. Also called audiofrequency induction loop or hearing loop.	Senhieser Set. TV Ears, Stethoset	
Cochlear Implant	**Use precautions:** Maintain at least a 6 inch (15 cm) separation between the processor and the implanted device. The processor is either behind the ear or clipped to the waist connected to the implant by hardwire. Make sure the processor is on the opposite side of the pacemaker or ICD. The hard wire to the implant behind the ear should be kept away from the implanted pacemaker/ICD. Most cochlear implants are comprised of two central pieces: a processor that fits behind the ear and an internal piece implanted under the skin.		
Hearing Aid in ear or behind ear	**Safe under normal use**. Behind the ear hearing aids or in the ear ONLY. The distance between the hearing aids and implant site is enough to mitigate any affects from hearing aids...		In-The-Ear (ITE), Behind-The-Ear (BTE), Mini BTE, In-The-Canal (ITC), and Completely-in-Canal (CIC), Mik-in Helix (MIH), Invisible-In-Canal (IIC), Receiver-In-Canal (RIC), Over-the-Ear (OTE)
Hearing Aid in ear or behind ear with a hard wired connection to an acoustical detector worn on the belt or other locations not close to the ear (most Cochlear implants)	**Use Precautions:** Clip the main unit to the waist on the opposite side of the implanted device. Also, the wire from the external acoustical detector to the hearing aid should be kept away from the implant site of the pacemaker/ICD.	William Sound Pocket Talker	
Starkey Radiant Beam Array	**Do not use:** The Radiant Beam Array (RBA) is a multi-microphone array incorporating six spatially separated microphones. The array is worn around the neck with the microphones positioned across the chest. Output from the array is transmitted to hearing instruments. The microphones in this assistive listening device are too close to the implant site.		

Workplace			
Item	**Safety precautions:** **Recommendations are based on normally functioning products. Be sure all items are in good working order and properly grounded. Follow manufacturer's instructions for use.**	**Similar brands that were not analyzed**	**A Closer Look Article**
Forklift (powered by diesel, gasoline, propane, or compressed natural gas (CNG))	**Use precautions:** Maintain a 24 inch (60 cm) separation from the components of the ignition system of the gasoline/propane/CNG engine and the Pacemaker or ICD.		
Forklift (powered by electricity or battery)	**Use precautions:** Maintain a 12 inch (30 cm) separation between the electric motor and the implanted device. The DC/AC current used to power the electric motors and the permanent magnets associated with the motor operation can affect the Pacemaker or ICD.		

TERMS OF USE: The information provided on the Electromagnetic (EMI) Guide should not be considered the exclusive or only source for this information. The table lists a general category of items only and is not intended to be an exhaustive list. The recommendations and precautions may be based on information provided by the manufacturers of the items in question, and specific items within a category may function differently. It is best practice to consult the original manufacturer of the item with potential EMI to verify any specific guidance concerning specific operation and compatibility with implantable devices. If at any time there is a question about the function and potential for Electromagnetic Compatibility, contact the manufacturer of the item in question for further information. At all times, it is the responsibility of the licensed healthcare professional to exercise medical clinical judgment in a particular circumstance.

The information provided is not intended to be used for medical diagnosis or treatment or as a substitute for professional medical advice. Always seek the advice of your physician or other qualified health provider with any questions you may have regarding a medical condition.

Recommendations and precautions for transvenous devices also apply to S-ICD devices.

Patient manuals may be found by clicking on the link at the right. www.lifebeatonline.com