

# Electromagnetic compatibility of BIOTRONIK cardiac pacemakers, ICDs and CRT devices

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Electromagnetic fields are generated by electrical devices and procedures and are omnipresent due to the widespread use of modern technology, for example, in professional life, everyday life and medicine. The functionality of pacemakers and implantable cardioverter-defibrillators (ICD), which consists of sensing the cardiac activity and the associated pacing of the heart, can be compromised by electromagnetic fields.

BIOTRONIK pacemakers and defibrillators are protected to the greatest possible extent against this kind of interference. Depending on the strength of the electromagnetic field, a transient effect on the implanted device in the vicinity of electrical devices is nonetheless possible:

- The pacemaker cannot deliver a pacing pulse or unnecessarily accelerates the heart rhythm.
- The ICD is prevented from delivering therapy by strong magnetic fields or induced to deliver undesired defibrillation shocks due to interfering signals from electromagnetic fields.

However, there is no need to be concerned about permanent damage to the implanted device – the cardiac pacemaker/defibrillator will be fully functional once again as soon as the distance to the source of interference increases or the source of interference is switched off.

Please ask your doctor whether there are procedures or devices which you should not use because of your disease and prior to any medical treatments, inform the doctor that you have an implanted electrical device.

Before using electrical devices, observe the manufacturer's warnings for patients with cardiac pacemakers/ICDs.

This guide is intended to help you determine the electromagnetic compatibility (EMC) and thus the assessment of electrical devices and procedures with regard to the interference potential for your implanted device.

A simple color scheme indicates whether a device can be used without hesitation, whether a safety margin during use is needed, or whether the function of the implanted device would be severely compromised as a result of use.



No interference with the implanted device	No interference at the indicated distance from the implanted device	Interference with the device possible Contraindication
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**Household appliances**

Battery charger	<b>15 cm</b>	
Can opener	Household magnet	
Coffee machine	Necklace with magnetic closure	
Dishwasher	Wireless heating base station	
Dryer		
Electric blanket, heating pad	<b>30 cm</b>	
Electric kettle	Induction cooktop	
Electric shaver		
Electric toothbrush, ultrasonic toothbrush		
Emergency button, patient alarm		
Foot warmer		
Hairdryer		
Iron		
Microwave		
Mixer		
Refrigerator		
Robotic lawn mower		
Robotic vacuum cleaner		
Smart meter (electricity, heating)		
Toaster		
Toothbrush charging unit		
Vacuum cleaner		
Washing machine		

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**Telecommunications/office/multimedia**

Bluetooth	Ham radio <sup>1</sup>	
CD, DVD, VCR players, radio		
Computer	<b>15 cm</b>	
Copy machine	CB radio handset (max. 3 W)	
dLAN, PLC, PowerLAN (Powerline Communication)	Cellular phone/smartphone	
e-reader	Cordless landline telephone	
Electronic tag, house arrest anklet	Game console, Wii, PlayStation	
Fax	Hearing aid streamer	
Inductive hearing loop, induction loop system	Modem	
Navigation system/GPS	Multimedia player, mp3 player, iPod	
NFC (near-field communication)	Router	
Printer	Stereo speaker	
Radio headset, headset	Tablet, iPad	
Video games	Walkie-talkie	
Wireless remote control	Wireless remote control (model-making)	
WLAN (2.4 GHz)	WLAN (5.1-5.7 GHz)	
	<b>40 cm</b>	
	CB radio mobile car station (max. 10 W)	
	TETRA radio	

<sup>1</sup> According to approval standard, the following distances from transmitting antennas are recommended for ham radio:

- <3 W = 15 cm
- 3–15 W = 30 cm
- 15–30 W = 60 cm
- 30–50 W = 1 m
- 50–125 W = 2 m
- 125–250 W = 3 m
- 250–500 W = 5 m
- 500–1000 W = 6 m
- 1000–2000 W = 9 m

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**Hobby/sport/travel**

Fitness wristband	PowerPlate*	Go-Kart
Heart rate monitor, smart watch		Mobile metal detector
Sauna, tanning bed	<b>30 cm</b>	
Tattooing	Anti-theft devices	
	Electric bicycle (motor)	
Full-body scanner	Segway (motor)	
Stationary metal detector	Ski pass scanner	
V-pay		
	<b>60 cm</b>	
	Ergometer (magnetic brake)	
	Golf caddy (motor)	
	Treadmill (motor)	
	<b>5 m</b>	
	Maritime radar	

**Tools/motors/electronics**

Battery-operated, cordless power tools	<b>15 cm</b>	Arc welding
Electric car	Corded power tools	Electric fence
Keyless entry system (car)	Fan heater	High-voltage test station
Low-voltage power line (220 V)		
Phase tester	Gasoline-powered tools (chain saw, leaf blower, snow blower, string trimmer)	
	Power wheelchair (motor)	
	<b>60 cm</b>	
	Car battery charger	
	Forklift truck	
	Generator	
	Lawn mower	
	Running car motor	
	<b>3 m</b>	
	Photovoltaic system transformer	
	<b>6 m</b>	
	High-voltage power line (110/220 kV)	
	<b>10 m</b>	
	High-voltage power line (380 kV)	

\* Physician's approval needed because of physical stress and possible rate adaptation of the implanted device

No interference with the implanted device

No interference at the indicated distance from the implanted device

Interference with the device possible  
Contraindication

Medical procedures<sup>2</sup>

Bone density measurement	MRI (magnetic resonance imaging) <sup>3</sup>	Bioresonance therapy
Capsule endoscopy		Current-inducing methods such as:
Diagnostic ultrasound	<b>15 cm</b>	<ul style="list-style-type: none"> <li>▪ Andullation therapy</li> <li>▪ Body fat measurement</li> <li>▪ Diathermy, HF heat therapy</li> <li>▪ Electrocautery</li> <li>▪ Electrolysis</li> <li>▪ Electroshock therapy</li> <li>▪ HF/RF/Ultrasonic ablation</li> <li>▪ Interferential current therapy</li> <li>▪ Iontophoresis</li> <li>▪ Neurostimulation</li> <li>▪ Transcutaneous electrical nerve stimulation (TENS)</li> </ul>
Diagnostic X-ray, e.g.:	Cardioversion/external defibrillation	
<ul style="list-style-type: none"> <li>▪ CT (computed tomography)</li> <li>▪ Mammography</li> <li>▪ PET (positron emission tomography)</li> </ul>	Dental treatment	
	Glucose monitor	
ECG/EMG	Hearing aid streamer	
Hearing aid/cochlear implant	Ultrasonic dental cleaning	
Heart rate monitor		
Laser treatment (eyes/skin)		
Magnetic mat		
Massage mat, massage chair		
		Lithotripsy/shock wave therapy
		Magnetic catheter navigation/Stereotaxis
		Magnetic field therapy
		Radiation therapy
		Therapeutic ultrasound

<sup>2</sup> In the case of contraindicated procedures which must be performed on persons with implanted devices, a careful risk/benefit assessment by the physicians involved is indicated. To avoid long-term damage of the implanted device, precautionary measures should be taken and these should be coordinated with the responsible technical service of BIOTRONIK.

<sup>3</sup> BIOTRONIK ProMRI devices are fully or partially MRI-compatible: [www.promricheck.com](http://www.promricheck.com)

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