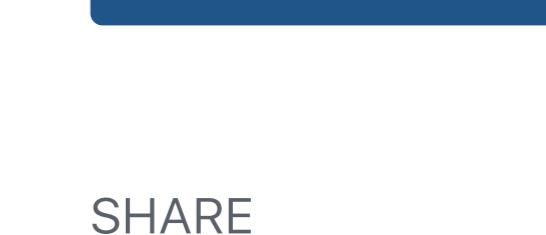
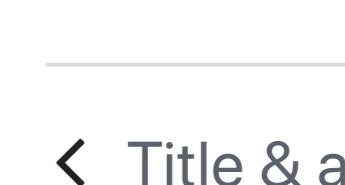


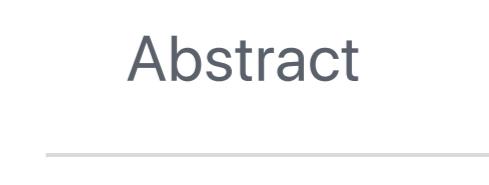
> [Europace](#). 2013 Mar;15(3):388-94. doi: 10.1093/europace/eus345. Epub 2012 Nov 1.

FULL TEXT LINKS

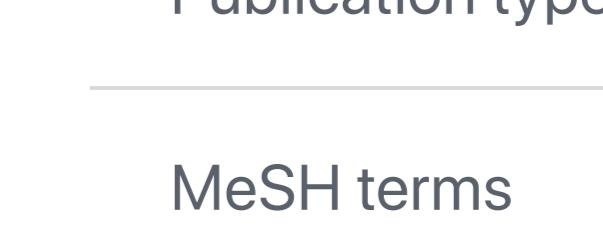


ACTIONS





SHARE



PAGE NAVIGATION

[Title & authors](#)

Abstract

Similar articles

Cited by

Publication types

MeSH terms

Related information

LinkOut - more resources

## Abstract

**Aims:** Electromagnetic interference (EMI) can pose a danger to workers with pacemakers and implantable cardioverter-defibrillators (ICDs). At some workplaces electromagnetic fields are high enough to potentially inflict EMI. The purpose of this *in vivo* study was to evaluate the susceptibility of pacemakers and ICDs to external electromagnetic fields.

**Methods and results:** Eleven volunteers with a pacemaker and 13 with an ICD were exposed to sine, pulse, ramp, and square waveform magnetic fields with frequencies of 2-200 Hz using Helmholtz coil. The magnetic field flux densities varied to 300 µT. We also tested the occurrence of EMI from an electronic article surveillance (EAS) gate, an induction cooktop, and a metal inert gas (MIG) welding machine. All pacemakers were tested with bipolar settings and three of them also with unipolar sensing configurations. None of the bipolar pacemakers or ICDs tested experienced interference in any of the exposure situations. The three pacemakers with unipolar settings were affected by the highest fields of the Helmholtz coil, and one of them also by the EAS gate and the welding cable. The induction cooktop did not interfere with any of the unipolarly programmed pacemakers.

**Conclusion:** Magnetic fields with intensities as high as those used in this study are rare even in industrial working environments. In most cases, employees can return to work after implantation of a bipolar pacemaker or an ICD, after an appropriate risk assessment. Pacemakers programmed to unipolar configurations can cause danger to their users in environments with high electromagnetic fields, and should be avoided, if possible.

## Similar articles

[Electromagnetic interference with implantable cardioverter-defibrillators at power frequency: an \*in vivo\* study.](#)

Napp A, Joosten S, Stunder D, Knackstedt C, Zink M, Bellmann B, Marx N, Schauerte P, Silny J.

Circulation. 2014 Jan 28;129(4):441-50. doi: 10.1161/CIRCULATIONAHA.113.003081. Epub 2013 Oct 25.

PMID: 24163067 Clinical Trial.

[Interference of low frequency magnetic fields with implantable cardioverter-defibrillators.](#)

Tiikkaja M, Alanko T, Lindholm H, Hietanen M, Toivonen L, Hartikainen J.

Scand Cardiovasc J. 2012 Oct;46(5):308-14. doi: 10.3109/14017431.2012.716525. Epub 2012 Aug 21.

PMID: 22834765

[Electromagnetic interference from welding and motors on implantable cardioverter-defibrillators as tested in the electrically hostile work site.](#)

Fetter JG, Benditt DG, Stanton MS.

J Am Coll Cardiol. 1996 Aug;28(2):423-7. doi: 10.1016/0735-1097(96)00147-7.

PMID: 8800120

[Are patients with cardiac implants protected against electromagnetic interference in daily life and occupational environment?](#)

Napp A, Stunder D, Maytin M, Kraus T, Marx N, Driessen S.

Eur Heart J. 2015 Jul 21;36(28):1798-804. doi: 10.1093/eurheartj/ehv135. Epub 2015 Apr 22.

PMID: 25908772 Review.

[Implantable rhythm devices and electromagnetic interference: myth or reality?](#)

Dynda K, Khairy P.

Expert Rev Cardiovasc Ther. 2008 Jul;6(6):823-32. doi: 10.1586/14779072.6.6.823.

PMID: 18570620 Review.

[See all similar articles](#)

## Cited by

[Pacemaker Malfunction Due to Electric Blanket: A Rare Case of Electromagnetic Interference.](#)

Goyal A, Bhyan P, Dalia T, Mufarrij SM, Gujrati R, Pothuru S, Chhabra L.

Kans J Med. 2022 Dec 19;15:446-448. doi: 10.17161/kjm.vol15.18549. eCollection 2022.

PMID: 36578459  No abstract available.

[Cardiac Implantable Electronic Devices and Consumer Electronic Devices: The Proof Is in the Front Pocket.](#)

Ellis CR, King NE.

J Innov Card Rhythm Manag. 2022 Jul 15;13(7):5073-5076. doi: 10.19102/icrm.2022.130706. eCollection 2022 Jul.

PMID: 35949651  No abstract available.

[Inappropriate shock delivery as a result of electromagnetic interference originating from the faulty electrical installation.](#)

Babic MD, Tomovic M, Milosevic M, Djurdjevic B, Zugic V, Nikolic A.

Ann Noninvasive Electrocardiol. 2022 Sep;27(5):e12952. doi: 10.1111/anec.12952. Epub 2022 Apr 25.

PMID: 35467789  No abstract available.

[Occupational Exposure to Electromagnetic Fields and Health Surveillance According to the European Directive 2013/35/EU.](#)

Modenese A, Gobba F.

Int J Environ Res Public Health. 2021 Feb 10;18(4):1730. doi: 10.3390/ijerph18041730.

PMID: 33579004  No abstract available.

[An \*in vitro\* Evaluation of the Effect of Transient Electromagnetic Fields on Pacemakers and Clinical Mitigation Measures.](#)

Huang J, Lin K, Lu W, Ding R, Wu B, Cai M, Nazarian S, Zhao W, Li J, Huang D.

Front Cardiovasc Med. 2020 Dec 23;7:607604. doi: 10.3389/fcvm.2020.607604. eCollection 2020.

PMID: 33426004  No abstract available.

[See all "Cited by" articles](#)

## Publication types

> [Research Support, Non-U.S. Gov't](#)

## MeSH terms

> [Adult](#)

> [Arrhythmias, Cardiac / diagnosis](#)

> [Arrhythmias, Cardiac / physiopathology](#)

> [Arrhythmias, Cardiac / therapy\\*](#)

> [Cooking](#)

> [Defibrillators, Implantable\\*](#)

> [Electromagnetic Fields / adverse effects\\*](#)

> [Electrophysiologic Techniques, Cardiac](#)

> [Environmental Exposure](#)

> [Equipment Design](#)

> [Equipment Failure](#)

> [Equipment Failure Analysis](#)

> [Female](#)

> [Heart Conduction System / physiopathology](#)

> [Humans](#)

> [Male](#)

> [Materials Testing](#)

> [Middle Aged](#)

> [Occupational Exposure](#)

> [Pacemaker, Artificial\\*](#)

> [Prosthesis Design](#)

> [Prosthesis Failure](#)

> [Welding](#)

> [Young Adult](#)

## Related information

[MedGen](#)

## LinkOut – more resources

[Full Text Sources](#)

[Ovid Technologies, Inc.](#)

[Silverchair Information Systems](#)

[Other Literature Sources](#)

[The Lens - Patent Citations](#)

[Medical](#)

[MedlinePlus Health Information](#)

[Research Materials](#)

[NCI CPTC Antibody Characterization Program](#)

NCBI Literature Resources MeSH PMC Bookshelf Disclaimer

FOLLOW NCBI



Connect with NLM



National Library of Medicine

8600 Rockville Pike

Bethesda, MD 20894

Web Policies

FOIA

HHS Vulnerability Disclosure

Help

Accessibility

Careers

NLM | NIH | HHS | USA.gov