

Claims

1. Implantable medical device, comprising a processor, a memory unit, a first detection unit configured to detect an atrial electric signal of a human or animal heart, and a
5 second detection unit configured to detect a ventricular electric signal of the same heart,

characterized

- 10 in that the memory unit comprises a computer-readable program that causes the processor to perform the following step when executed on the processor:

evaluation of atrial events in the atrial electric signal detected by the first detection unit and/or ventricular events in the ventricular electric signal detected by the second
15 detection unit for recognizing a condition of the implantable medical device in which atrial events in the atrial electric signal are detected only insufficiently, wherein the evaluation is carried out on the basis of at least one of the following criteria:

- i) morphology of the detected atrial electric signal,
20 ii) lacking stability of atrial events,
iii) absence of atrial events over a first period of time,
25 iv) detection of an amplitude of the detected atrial electric signal being lower than a predefined threshold value,
v) absence of atrial events during detection of ventricular events at the same time,
30 vi) comparison of atrial events sensed with a first sensing profile of the first detection unit and atrial events sensed with a second sensing profile of the

first detection unit, the second sensing profile being more sensitive than the first sensing profile.

2. Implantable medical device according to claim 1, **characterized** in that the first
5 period of time is a time between 1 and 5 seconds.
3. Implantable medical device according to claim 1 or 2, **characterized** in the at least
one criterion comprises an absence of atrial events over a period of time in which 2
to 5 ventricular events are detected.
- 10 4. Implantable medical device according to any of the preceding claims, **characterized**
in that the evaluation is carried out on the basis of the following criteria: i) stability
of the detected atrial events and ii) absence of atrial events over a first period of time
or absence of atrial events during detection of ventricular events at the same time.
- 15 5. Implantable medical device according to any of the preceding claims, **characterized**
in that the evaluation is carried out on the basis of the following criteria: i) no
detected atrial event while at least 3 ventricular events are detected and lacking
stability of atrial events or ii) no detected P wave during the first period of time or iii)
20 detection of an amplitude of the detected atrial electric signal being lower than a
predefined threshold value.
6. Implantable medical device according to any of the preceding claims, **characterized**
in that the evaluation is carried out on the basis of the following criteria: i) no
25 detected atrial event while at least 3 ventricular events are detected or ii) detection of
an amplitude of the detected atrial electric signal being lower than a predefined
threshold value.
7. Implantable medical device according to any of the preceding claims, **characterized**
30 in that the computer-readable program causes the processor to perform the following
step when executed on the processor: sending a signal to a home monitoring service

center that serves for monitoring a health status of a patient carrying the implantable device.

8. Implantable medical device according to any of the preceding claims, **characterized**
5 in that the computer-readable program causes the processor to perform the following step when executed on the processor: switching the implantable medical device from a multi-chamber detection logic to a one-chamber detection logic.
9. Implantable medical device according to any of the preceding claims, **characterized**
10 in that the computer-readable program causes the processor to perform the following step when executed on the processor: automatically adjusting at least one detection parameter of the first detection unit.
10. Implantable medical device according to any of the preceding claims, **characterized**
15 in that the computer-readable program causes the processor to perform the following step when executed on the processor: automatically switching from a first sensing profile of the first detection unit to a second sensing profile of the first detection unit, the second sensing profile being more sensitive than the first sensing profile.
- 20 11. Implantable medical device according to any of the preceding claims, **characterized** in that the computer-readable program causes the processor to perform the following step when executed on the processor: electronically adding an atrial event to the detected atrial electric signals if a P wave is extracted in course of a morphological evaluation of a far-field potential detected by the first detection unit.
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12. Implantable medical device according to any of the preceding claims, **characterized**
in that the computer-readable program causes the processor to perform the following step when executed on the processor: automatically switching back from an operational mode adopted by the implantable medical device after having recognized
30 an insufficient detection of atrial electric signals to a regular operational mode if a tachycardic rhythm has been terminated or if no insufficient detection of atrial electric signals has been recognized over a second period of time.

13. Method for recognizing a condition of an implantable medical device according to any of the preceding claims in which condition atrial electric signals are detected only insufficiently, the method comprising the following step:

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evaluation of atrial events in the atrial electric signal detected by a first detection unit and/or ventricular events in the ventricular electric signal detected by the second detection unit of the implantable medical device for recognizing a condition of the implantable medical device in which atrial events in the atrial electric signal are
10 detected only insufficiently, wherein the evaluation is carried out on the basis of at least one of the following criteria:

- i) morphology of the detected atrial electric signal,
- 15 ii) lacking stability of atrial events,
- iii) absence of atrial events over a first period of time,
- iv) detection of an amplitude of the detected atrial electric signal being lower
20 than a predefined threshold value,
- v) absence of atrial events during detection of ventricular events with a second detection unit of the implantable medical device at the same time,
- 25 vi) comparison of atrial events sensed with a first sensing profile of the first detection unit and atrial events sensed with a second sensing profile of the first detection unit, the second sensing profile being more sensitive than the first sensing profile.

- 30 14. Computer program product comprising computer-readable code that causes a processor to perform the following step when executed on the processor:

5 evaluation of atrial events in the atrial electric signal detected by a first detection unit and/or ventricular events in the ventricular electric signal detected by the second detection unit of an implantable medical device for recognizing a condition of the implantable medical device in which atrial events in the atrial electric signal are detected only insufficiently, wherein the evaluation is carried out on the basis of at least one of the following criteria:

- i) morphology of the detected atrial electric signal,
- 10 ii) lacking stability of atrial events,
- iii) absence of atrial events over a first period of time,
- iv) detection of an amplitude of the detected atrial electric signal being lower
15 than a predefined threshold value,
- v) absence of atrial events during detection of ventricular events at the same time,
- 20 vi) comparison of atrial electric signals sensed with a first sensing profile of the first detection unit and atrial events sensed with a second sensing profile of the first detection unit, the second sensing profile being more sensitive than the first sensing profile.

- 25 15. Method of treatment of a human or animal patient in need of such treatment by means of an implantable medical device, wherein the implantable medical device comprises a processor, a memory unit, a first detection unit configured to detect an atrial electric signal of a human or animal heart, a second detection unit configured to detect a ventricular electric signal of the same heart, and a stimulation unit
30 configured to stimulate a cardiac region of the same heart, the method comprising the following steps:

- evaluation of atrial events in the atrial electric signal detected by the first detection unit and/or ventricular events in the ventricular electric signal detected by the second detection unit for recognizing a condition of the implantable medical device in which atrial electric signals are detected only insufficiently, wherein the evaluation is carried out on the basis of at least one of the following criteria:
 - i) morphology of the detected atrial electric signal,
 - ii) lacking stability of atrial events,
 - iii) absence of atrial events over a first period of time,
 - iv) detection of an amplitude of the detected atrial electric signal being lower than a predefined threshold value,
 - v) absence of atrial events during detection of ventricular electric signals at the same time,
 - vi) comparison of atrial events sensed with a first sensing profile of the first detection unit and atrial events sensed with a second sensing profile of the first detection unit, the second sensing profile being more sensitive than the first sensing profile.
- automatically adjusting a detection mode of the first detection unit if a condition of the implantable medical device has been recognized in which atrial events are only insufficiently detected,
- stimulating a cardiac region of the of the human or animal heart by applying a stimulation pulse with the stimulation unit if such stimulation is deemed to be necessary upon an evaluation of a cardiac rhythm of the human or animal heart in the adjusted detection mode.