

CLAIMS

1. Apparatus for determining alignment between a source device and a target device, the apparatus comprising the source device, the target device, and a
5 processing system, the source device comprising a first spatially variant field generator for generating a first spatially variant electric field, and a second spatially variant field generator for generating a second spatially variant electric field, wherein the second spatially variant electric field is angularly offset with respect to the first spatially variant electric field, the target device comprising at least one sensor configured to detect a
10 first signal from the first spatially variant electric field and a second signal from the second spatially variant electric field, wherein the processing system determines alignment between the first source device and the target device based on the first and second signals from the first and second spatially variant electric fields detected by the target device.
- 15 2. The apparatus of claim 1, wherein each of the first spatially variant field and the second spatially variant field has a known angular dependence.
3. The apparatus of claim 1 or claim 2, wherein the first spatially variant electric
20 field is angularly offset from the second spatially variant electric field by a preset angle.
4. The apparatus of claim 3, wherein the preset angle is 90°.
5. The apparatus of any preceding claim, wherein the first spatially variant field
25 generator and the second spatially variant field generator are each at least one electrode.
6. The apparatus of claim 5, wherein the at least one electrode of the first spatially variant field generator is arranged to produce the first spatially variant electric
30 field with angular and/or spatial dependence; and wherein the at least one electrode of the second spatially variant field generator is arranged to produce the second spatially variant electric field with angular and/or spatial dependence.
7. The apparatus of claim 6, wherein the first spatially variant electric field and
35 the second spatially variant electric field with angular and/or spatial dependence are

fields independently selected from the group comprising: dipole; quadrupole; and octopole.

8. The apparatus of any of claims 5 to 7, wherein the at least one electrode of
5 the first spatially variant field generator and the at least one electrode second spatially variant field generator are each separately arranged to produce a dipole field.

9. The apparatus of any preceding claim, wherein the processing system is
capable of operating the source device in at least a first mode and a second mode,
10 wherein in the first mode, the first spatially variant field generator generates the first spatially variant electric field, and wherein in the second mode, the second spatially variant field generator generates the second spatially variant field.

10. The apparatus of claim 9, wherein the processing system further comprises a
15 first switching system connected to the first spatially variant field generator and the second spatially variant field generator on the source device, the first switching system configured to switch the source device between the first mode and the second mode.

11. The apparatus of claim 10, wherein the switching system operates the source
20 device sequentially in the first mode and the second mode.

12. The apparatus of claim 11, wherein the source device is operated in the first
mode until coarse alignment is achieved, and then the source device is operated in the
second mode to achieve fine alignment, wherein coarse alignment has a lower degree
25 of accuracy in the angle of alignment of the source device in comparison to fine alignment.

13. The apparatus of any one of claims 9 to 12, wherein the first switching system
toggles between the first mode and second mode so that a signal can be detected
30 from both the first spatially variant field and the second spatially variant field simultaneously.

14. The apparatus of claim 9 or claim 10, wherein the first switching system
operates the source device concurrently in the first mode and the second mode.

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15. The apparatus of claim 14, wherein the first spatially variant electric field and the second spatially variant electric field are distinguishable by the sensor on the target device.

5 16. The apparatus of claim 15, wherein the first spatially variant electric field and the second spatially variant electric field are distinguishable by the sensor on the target device due to the first spatially variant electric field and the second spatially variant electric field having a different carrier frequency.

10 17. The apparatus of any of claims 9 to 16, wherein the sensor on the target device is connected to the processing system via a second switching system, wherein the second switching system diverts the detected spatially variant signal detected at the sensor to one of two memory locations, wherein the second switching system diverts a detected signal to a first memory location of the two memory locations when
15 the first switching system is operating in the first mode, and the second switching system diverts the detected signal to a second memory location of the two memory locations when the first switching system is operating in the second mode.

18. The apparatus of claim 17, wherein the second switching system is of a type
20 selected from the group consisting of: hardware and software.

19. A method for determining an angle of alignment between a source device and a target device, the source device comprising a first spatially variant field generator for generating a first spatially variant electric field, and a second spatially variant field
25 generator for generating a second spatially variant electric field, wherein the second spatially variant electric field is angularly offset with respect to the first spatially variant electric field, the target device comprising at least one sensor configured to detect a first signal from the first spatially variant electric field and a second signal from the second spatially variant electric field, the method comprising:

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- a) generating a first spatially variant electric field from the first spatially variant field generator on the source device;
 - b) detecting the signal of the first spatially variant electric field using the sensor on
35 the target device to provide a first spatially variant signal;

c) generating a second spatially variant electric field from the second spatially variant field generator on the source device;

5 d) detecting the signal of the second spatially variant electric field using the sensor on the target device to provide a second spatially variant signal;

subsequently followed by:

10 e) determining the alignment angle between the source device and the target device as a function of the detected signals for the first spatially variant electric field and the second spatially variant electric field.

20. The method of claim 19, wherein when steps (a) to (d) are performed
15 concurrently.

21. The method of claim 19, wherein when steps (a) to (e) are performed sequentially, after step (b) the first spatially variant electric field is switched off prior to the signal being generated by the second spatially variant electric field.
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22. The method of any one of claims 19 to 21, wherein, steps (a) to (d) are repeated.

23. The method of any of claims 19 to 22, wherein the alignment angle is
25 calculated as a function of the detected signals in steps (b) and (d) using the formula:

alignment angle = function(first spatially variant signal, second spatially variant signal)

30 24 The method of claim 23, wherein when the first spatially variant electric field is angularly offset from the second spatially variant electric field by approximately 90° and wherein the alignment angle is calculated as a function of the detected signals in steps (b) and (d) using the formula:

alignment angle = $\arctan(\text{first spatially variant signal, second spatially variant signal})$.

25. The method of claim 24, wherein the angular dependence of the first spatially
5 variant field and the second spatially variant field is the same.

26. The method of claim 25, wherein the angular dependence of the first spatially
variant field and the second spatially variant field is sinusoidal.

10 27. The method of any one of claims 24 to 26, wherein the desired alignment angle
is offset from that indicated by the first spatially variant electric field and the second
spatially variant electric field by an angle defined by an offset angle, the alignment
angle is calculated as a function of the detected signals in steps (b) and (d) using the
formula:

15 alignment angle = offset angle + $\arctan(\text{first spatially variant signal, second spatially variant signal})$.

28. The method of any one of claims 19 to 27 wherein the alignment angle is
20 displayed on a display.

29. A processing system for use in the apparatus of claims 1 to 18 and/or
configured to perform the method of any of claims 19 to 28.

25 30. The apparatus of any one of claims 1 to 18 or the processing system of claim
29, further comprising a display.