

CLAIMS

1. A system for wireless power transfer comprising:

one or more power receivers configured to be coupled to respective devices for power management of the respective devices; and
- 5 one or more adaptive power transmitters configured to transmit radio-frequency energy having a frequency f_0 or at least a pair of frequencies f_1, f_2 via beam forming to the one or more power receivers and configured to receive status data from the one or more power receivers;

the one or more power receivers being configured to transmit the status data to at least one of the one or more adaptive power transmitters via carrier frequency modulation using a
- 10 harmonic nf_0 , $n=2, 3, \dots$ or an intermodulation product $lf_1 \pm mf_2$, $l=1, 2, \dots$ and $m=1, 2, \dots$; and

wherein the one or more adaptive power transmitters are configured to steer a formed beam of the radio frequency energy toward a target power receiver out of the one or more power receivers for targeted energy transfer to the target power receiver based on the status data received from the target power receiver via the carrier frequency modulation using the
- 15 harmonic or the intermodulation product.
2. The system of claim 1, wherein the one or more adaptive power transmitters are configured to transmit and receive data communication to and from another one of the one or more adaptive power transmitters.
3. The system of claims 1 or 2, wherein the one or more adaptive power transmitters are
 20 configured to execute an algorithm to adjust a power level and radiation pattern of the transmitted radio-frequency energy based on the received status data.
4. The system of claim 3, wherein the algorithm comprises the one or more adaptive power transmitters being configured to operate in a default state and to change to operating in a mode with higher power compared to the default state based on the received status data.
- 25 5. The system of claim 4, wherein the algorithm comprises the one or more adaptive power transmitters being configured to operate in a power saving mode with lower power compared to the default state based on the received status data.
6. The system of any one of claims 1 to 5, wherein the one or more power receivers comprises respective rectifiers for conversion of the radio-frequency to DC and for extracting
 30 the harmonic or the intermodulation product.
7. The system of any one of claims 1 to 6, wherein the one or more power receivers are coupled to the respective devices for receiving information about the device for generating the status data for transmission via the carrier frequency modulation using the harmonic or the intermodulation product.
- 35 8. An adaptive power transmitter comprising:

a transmitter element configured to transmit radio-frequency energy having a frequency f_0 or at least a pair of frequencies f_1, f_2 via beam forming to one or more power receivers;

a receiver element configured to receive status data from the one or more power receivers via carrier frequency modulation using a harmonic nf_0 , $n=2, 3...$ or an intermodulation product $lf_1 \pm mf_2$, $l=1, 2, ...$ and $m = 1, 2, ...$; and

a steering element to steer a formed beam of the radio frequency energy toward a target power receiver out of the one or more power receivers for targeted energy transfer to the target power receiver based on the status data received from the target power receiver via the carrier frequency modulation using the harmonic or the intermodulation product.

9. The adaptive power transmitter of claim 8, configured to transmit and receive data communication to and from another adaptive power transmitter.

10. The adaptive power transmitter of claims 8 or 9, configured to execute an algorithm to adjust a power level and radiation pattern of the transmitted radio-frequency energy based on the received status data.

11. The adaptive power transmitter of claim 10, wherein the algorithm comprises the adaptive power transmitter being configured to operate in a default state and to change to operating in a mode with higher power compared to the default state based on the received status data.

12. The adaptive power transmitter of claim 11, wherein the algorithm comprises the adaptive power transmitter being configured to operate in a power saving mode with lower power compared to the default state based on the received status data.

13. A power receiver comprising:

a receiver element for receiving radio-frequency energy having a frequency f_0 or at least a pair of frequencies f_1, f_2 via beam forming from one or more adaptive power transmitters;

an interface configured to be coupled to a device for power management of the device; and

a transmitter element configured to transmit status data to the one or more adaptive power transmitters via carrier frequency modulation using a harmonic nf_0 , $n=2, 3...$ or an intermodulation product $lf_1 \pm mf_2$, $l=1, 2, ...$ and $m = 1, 2, ...$.

14. The power receiver of claim 13, comprising a rectifier for conversion of the radio-frequency to DC and for extracting the harmonic or the intermodulation product.

15. The power receiver of claims 13 or 14, the interface is configured for receiving information about the device for generating the status data for transmission via the carrier frequency modulation using the harmonic or the intermodulation product.

16. A method for wireless power transfer comprising the steps of:

transmitting, using one or more adaptive power transmitters, radio-frequency energy having a frequency f_0 or at least a pair of frequencies f_1, f_2 via beam forming to one or more power receivers;

5 transmitting, using the one or more power receivers, status data to at least one of the one or more adaptive power transmitters via carrier frequency modulation using a harmonic nf_0 , $n=2, 3...$ or an intermodulation product $lf_1 \pm mf_2$, $l=1,2,...$ and $m = 1,2,...$;

receiving, using the one or more adaptive power transmitters, the status data from the one or more power receivers; and

10 steering, using the one or more adaptive power transmitters, a formed beam of the radio frequency energy toward a target power receiver out of the one or more power receivers for targeted energy transfer to the target power receiver based on the status data received from the target power receiver via the carrier frequency modulation using the harmonic or the intermodulation product.

15 17. A method for wireless power transmission comprising the steps of:

transmitting, using an adaptive power transmitter, radio-frequency energy having a frequency f_0 or at least a pair of frequencies f_1, f_2 via beam forming to one or more power receivers;

20 receiving, using the adaptive power transmitter, status data from the one or more power receivers via carrier frequency modulation using a harmonic nf_0 , $n=2, 3...$ or an intermodulation product $lf_1 \pm mf_2$, $l=1,2,...$ and $m = 1,2,...$; and

25 steering, using the adaptive power transmitter, a formed beam of the radio frequency energy toward a target power receiver out of the one or more power receivers for targeted energy transfer to the target power receiver based on the status data received from the target power receiver via the carrier frequency modulation using the harmonic or the intermodulation product.

18. A method for wireless power reception comprising the steps of:

30 receiving, using a power receiver, radio-frequency energy having a frequency f_0 or at least a pair of frequencies f_1, f_2 via beam forming from one or more adaptive power transmitters; and

transmitting, using the power receiver, status data to the one or more adaptive power transmitters via carrier frequency modulation using a harmonic nf_0 , $n=2, 3...$ or an intermodulation product $lf_1 \pm mf_2$, $l=1,2,...$ and $m = 1,2,...$