Claims

1. A RFID tag (1) configured to transmit a predetermined code (3_{A-K}) as a RF backscattered radiation (2) in response to an impinging RF signal (41),

wherein the RFID tag (1) is configured to react to an impinging signal at a predetermined reference frequency (23) with a reference backscattered signal (2_R), characterized in that

the RFID tag (1) is further configured to react to an impinging signal (41) at any of a group of transmission frequencies (21, 22) with coding backscattered signals (2_{A-G}) whose amplitudes (20_A, 20_B, 20_R) relative to the amplitude (20_R) of the reference backscattered signal define the code (3_{A-K});

the group of transmission frequencies comprises at least a transmission frequency (21, 22), preferably the group of transmission frequencies comprises a plurality of transmission frequencies (21, 22); more preferably the number of transmission frequencies being a power of 2.

2. The RFID Tag according to claim 1, wherein the amplitude (20_R) of the reference backscattered signal (20_R) is either

smaller or larger than the amplitudes of the coding backscattered signals, or

identical than the smallest or largest amplitude of the coding backscattered signals.

3. The RFID tag according to any one of claims 1 to 2, comprising a group of dipole antennas;

the group of dipole antennas comprising one or more coding dipole antennas (24_{A-K}), each coding dipole antenna (24_{A-K}) providing the coding backscattered signal at one transmission frequency of the group of transmission frequencies (22, 23).

4. The RFID tag according to any one of claims 1 to 3, comprising a group of resonating units;

the group of resonating units comprising one or more coding resonating units (25_{A-D}), each comprising a resonator transmission line (251_A, 251_C) electrically connected between two antennas (253_A, 253_C), preferably being monopole

antennas;

each coding resonating unit (25_{A-D}) providing the coding backscattered signal at one transmission frequency of the group of transmission frequencies (22, 23).

5. The RFID tag according to any one of claims 1 to 4, comprising a group of meander line loaded antennas;

the group of meander line loaded antennas comprising one or more coding meander line loaded antennas (26_{A-B}), each coding meander line loaded antenna providing the coding backscattered signal at one transmission frequency of the group of transmission frequencies (22, 23).

6. The RFID tag according to any one of claims 3 to 5, wherein

the group of dipole antennas further comprises a reference dipole antenna (24_R) providing the reference backscattered signal (2_R); or wherein

the group of resonating units further comprises a reference resonating unit (25_R) comprising a resonator transmission line electrically connected between two antennas, the reference resonating unit providing the reference backscattered signal (2_R); or wherein

the group of meander line loaded antennas further comprises a reference meander line loaded antenna (26_R) providing the reference backscattered signal (2_R).

7. The RFID tag according to any one of claims 3 to 6, wherein at least one dipole antennas of said group of dipole antennas and/or at least one resonator transmission line of said group of resonating units and/or at least one meander line loaded antenna of said the group of meander line loaded antennas is printed on a support (10);

preferably a plurality of dipole antennas of said group of dipole antennas and/or a plurality of the resonator transmission lines of said group of resonating units and/or a plurality of meander line loaded antennas of said the group of meander line loaded antennas are printed on a support (10), preferably on a same support (10).

8. The RFID tag according to claim 7, wherein each of said plurality of dipole antennas and/or of said plurality of the resonator transmission lines and/or of

said plurality of meander line loaded antennas comprises a coding portion;

electrical impedances of said coding portions with respect to a reference electrical impedance define the code (3_{A-H});

preferably shapes and/or dimensions and/or materials of said coding portions define the code (3_{A-H});

preferably said reference electrical impedance being related to an electrical impedance of the reference dipole antenna (24_R) and/or of the reference resonating unit and/or of the reference meander line loaded antenna (26_R).

9. The RFID tag according to claim 8, wherein the material of said coding portions is selected within a set of conductible printable materials;

preferably said set of conductible printable materials comprises: a conductive metal, a conductive ceramic and/or a conductive polymer.

10. A RFID reader (4) arranged to emit an interrogation RF signal (41), receive backscattered signals (2) from an RFID tag (1), and reconstruct a code (3_{A-K}) encoded in the backscattered signals, characterized in that

the RFID reader (4) is further arranged to:

measure a reference amplitude (20_R) of a backscattered signal (2_R) at a predetermined reference frequency (23),

measure the coding amplitudes (20_{A-B}) of backscattered signals (2_{A-E}) at any of a group of transmission frequencies (21, 22), and

determine a code (3_{A-K}) of the RFID tag (1) based on the coding amplitude (20_{A-B}) relative to the reference amplitude (20_R).

11. A kit (5) comprising:

a RFID tag (1) according to any one of claims 1 to 9, and

a RFID reader (4) according to claim 10.

12. A method for transmitting a code from a device (1) to a reader (4) as a RF backscattered radiation (2) in response to an impinging RF signal (41) generated by the reader (4), the method comprising:

providing a reference backscattered signal (2_R) in reaction to an impinging signal at a predetermined reference frequency (23); characterized by

providing a coding backscattered signal (2_{A-G}) in reaction to an

impinging signal at a first transmission frequency;

wherein the amplitude (20_A, 20_B, 20_R) of the coding backscattered signal (2_{A-E}) relative to the amplitude (20_R) of the reference backscattered signal defines the code (3_{A-H}).

13. The method according to claim 12, the method further comprising:
in reaction to any impinging signal at one of a groups of transmission frequencies, providing a coding backscattered signal (2_{A-E});

wherein the amplitudes (20_A, 20_B, 20_R) of the coding backscattered signals (2_{A-E}) relative to the amplitude (20_R) of the reference backscattered signal define the code (3_{A-H}).

14. The method according to claim 12 or 13, wherein a modification of the amplitude (20_A, 20_B, 20_R) of each of said coding backscattered signals (2_{A-E}) relative to the amplitude (20_R) of the reference backscattered signal is obtained by modifying the electrical impedance of an electrical conductive portion (29_{A-Q}) of the device (1); said electrical conductive portion (29_{A-Q}) being a portion of an antenna or being an electrical conductive portion electrically connected to one or more antennas.

15. The method according to claim 14, wherein said an electrical conductive portion (29_{A-Q}) is a portion of: a dipole antenna, a resonator transmission line electrically connected between two antennas (28), and/or of meander line loaded antenna (26_A, 26_B,26_R).

16. The method according to claim 14 or 15, wherein said electrical conductive portion (29_{A-Q}) is printed on a support (10).

Abstract

The invention concerns a RFID tag (1) configured to transmit a predetermined code (3_K) as a RF backscattered radiation (2) in response to an impinging RF signal (41).

The RFID tag (1) is configured to react to an impinging signal at a predetermined reference frequency (23) with a reference backscattered signal (2_R). The RFID tag (1) is also configured and to react to an impinging signal (41) at any of a group of transmission frequencies (21, 22) with coding backscattered signals ($2_{F\text{-}G}$) whose amplitudes (20_A, 20_B) relative to the amplitude (20_R) of the reference backscattered signal define the code (3_K).

The invention further concerns a RFID reader (4), a kit (5) and a method for transmitting a message from a device (1) to a reader (4) as a RF backscattered radiation (2) in response to an impinging RF signal (41).

(Fig. 1)