CONTAINER TRACKING

FIELD OF THE INVENTION

[0001] This invention relates to an arrangement for RF (radio frequency) tracking of a shipping container, such as an intermodal freight container.

BACKGROUND

[0002] Shipping containers, such as intermodal freight containers, typically comprise standardised reusable rectangular steel boxes varying in length from 8 to 56 feet (2.4 to 17 m) and in height from 8 feet to 9 feet 6 inches (2.4 to 2.9 m), and may comply with ISO 6436. Such containers are widely used for transport of goods across sea and land, and it is therefore desirable to be able to identify individual containers, to track their location and/or to receive status information from them.

[0003] Existing wireless solutions for container tracking work well in free space conditions, but less well when the container is located in a stack of containers, for example in a dockside environment or on a ship.

[0004] Patent publication US-A-7414571 discloses a low frequency transmitter tag that exploits near field behaviour in gaps between containers in a stack.

STATEMENT OF THE INVENTION

[0005] According to one aspect of the present invention, there is provided a container tracking system comprising a plurality of containers having metallic walls, at least one of the containers having a radio frequency ('RF') tag mounted on a metallic wall thereof for tracking the container, the RF tag having an antenna arranged to excite a transverse electromagnetic ('TEM') wave relative to a ground plane of the antenna, which is substantially parallel to said metallic wall; the containers being arranged such that the metallic walls of adjacent ones of the containers form a waveguide in which the antenna is arranged to excite the TEM wave with an electric field component thereof perpendicular to the metallic walls.

According to another aspect of the invention, there is provided a method of tracking a container having a metallic wall, comprising:

a. mounting a radio frequency ('RF') tag on the metallic wall, the RF tag having an antenna arranged to excite a transverse electromagnetic ('TEM') wave relative to a ground plane of the antenna, the ground plane being substantially parallel to said metallic wall;

b. arranging said container within a plurality of containers having metallic walls that are substantially parallel and having a gap therebetween, such that the metallic walls form a waveguide; and

c. exciting a transverse electromagnetic ('TEM') wave in the gap, with an electric field component thereof perpendicular to the metallic walls, using the RF tag of said container.

[0006] Embodiments of the invention may use the channels created by the container walls when the containers are stacked, to create a propagation environment similar to that of a transmission wave guide. Studies and investigations into RF propagation in the above environments show that, when using the correct propagation methods, the RF radiated path can be enhanced by the container stack. The channels within the container stack act like waveguide to channel RF radiation creating a positive RF radiation environment.

[0007] When the containers are closely spaced in a closed environment, such as the hull or deck of a ship, the shielded enclosure forms a highly reflective environment for the propagation of radio waves.

[0008] An electromagnetic wave can potentially propagate very efficiently between the spacing of stacked or adjacent containers under specific conditions. The walls of adjacent

CLAIMS

1. A container tracking system comprising a plurality of containers having metallic walls, at least one of the containers having a radio frequency ('RF') tag mounted on a metallic wall thereof for tracking the container, the RF tag having an antenna arranged to excite a transverse electromagnetic ('TEM') wave relative to a ground plane of the antenna, which is substantially parallel to said metallic wall; the containers being arranged such that the metallic walls of adjacent ones of the containers form a waveguide in which the antenna is arranged to excite the TEM wave with an electric field component thereof perpendicular to the metallic walls.

2. The container tracking system of claim 1, wherein the antenna comprises a monopole antenna.

3. The container tracking system of any preceding claim, wherein the antenna comprises an inverted-L antenna.

4. The container tracking system of claim 1 or claim 2, wherein the antenna comprises an inverted-F antenna.

5. The container tracking system of any preceding claim, wherein the ground plane comprises a printed circuit board ('PCB').

6. The container tracking system of any preceding claim, wherein the RF tag includes an RF transmitter connected to the antenna and a processor arranged to control the RF transmitter to transmit data pertaining to the RF tag.

7. The container tracking system of any preceding claim, wherein the containers comprise intermodal freight containers.

8. The container tracking system of any preceding claim, comprising at least one base station for RF communication with the RF tag, and a tracking database for receiving tracking information from the RF tag via the at least one base station.

9. The container tracking system of claim 8, wherein the at least one base station communicates with the tracking database via satellite.

10. A method of tracking a container having a metallic wall, comprising:

a. mounting a radio frequency (‘RF’) tag on the metallic wall, the RF tag having an antenna arranged to excite a transverse electromagnetic (‘TEM’) wave relative to a ground plane of the antenna, the ground plane being substantially parallel to said metallic wall;

b. arranging said container within a plurality of containers having metallic walls that are substantially parallel and having a gap therebetween, such that the metallic walls form a waveguide; and

c. exciting a transverse electromagnetic (‘TEM’) wave in the gap, with an electric field component thereof perpendicular to the metallic walls, using the RF tag of said container.