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(54) Title: RADIO FREQUENCY SIGNAL ACQUISITION AND SOURCE LOCATION SYSTEM

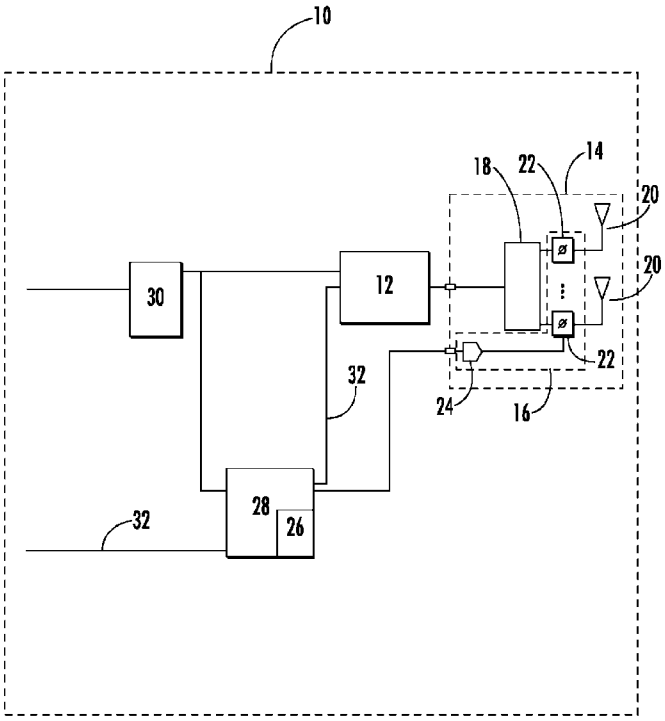

FIG. 1

(57) Abstract: A radio frequency signal acquisition and source location system, including a first signal acquisition and source location module comprising an RF transceiver coupled to an antenna, the antenna provided with a electronic steering circuit. The antenna operative to launch an interrogation signal, the interrogation signal steerable by an electronic steering circuit. A processor operatively coupled to the RF transceiver and the electronic steering circuit, the processor provided with a data storage for storing a signal data record for each of at least one response signal(s) received by the RF transceiver(s). The signal data record including a signal identification, a received signal strength indicator and an RF signal direction along which respective signal(s) are received by the antenna, the RF signal direction derived from the electronic steering circuit. A position logic operative upon the data record(s) deriving a three dimensional signal origin location of each response signal.

NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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— *as to the identity of the inventor (Rule 4.17(i))*
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
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RADIO FREQUENCY SIGNAL ACQUISITION AND SOURCE LOCATION SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of US Provisional Patent Application No.: 60/993,418, titled "Steerable Phase Array Antenna RFID Tag Locator and Tracking System", filed by Graham P. Bloy on September 11, 2007 and hereby incorporated by reference in its entirety.

BACKGROUND

Field of the Invention

The invention generally relates to Radio Frequency (RF) signal acquisition and source location. More particularly, the invention relates to RF signal acquisition and source location in three dimensions.

Description of Related Art

Prior signal acquisition and source location systems, for example radio direction finding systems typically operate on a triangulation basis, where location accuracy is dependent upon the number of signal reception points and their relative distance away from each other and the signal source. Signal interference and false reflected or ghost signals frustrate the use of radio finding systems in smaller target areas. Radio direction finding systems may also apply flight timing as a component of a signal source location system. However,

especially when applied to relatively short distances, the accurate measurement of the associated flight times with the required resolution may be cost prohibitive.

Radio Frequency Identification (RFID) technology is used, in multiple applications, to identify, track and trace physical objects. RFID tags also known as transponders or smart labels may be attached to objects, vehicles or people as a form of electronic label. These tags may contain unique identifiers (serial numbers) or may have a common identifier to identify a class of object such as a particular variety of a commodity.

RFID tags may be read by readers (also known as interrogators) in order to collect the identity of the RFID tags and therefore by association the identity of the item to which the tag is attached. RFID readers may be portable, for close proximity reading of known position RFID tags and / or configured as portals or gateways scanning for the passage of RFID tags passing through, such as a pallet load of materials individually marked with RFID tags entering or leaving a warehouse for inventory feedback and control, providing an entry, presence and or exit signal tracking. This does not provide a specific location and / or direction of travel, other than by transient association between the tags or tagged items and the location of the reader at the time of interrogation.

Multiple gateways and or portals may be applied to improve the general location resolution, but the number of gateways and or portals required to obtain a

worthwhile location accuracy renders a high resolution solution using large numbers of gateway installations cost prohibitive. Also, neighboring gateways create significant interrogation signal interference issues.

A drawback of presence/passage gateways is that the residence time of the RFID tag(s) within the detection field may be relatively short and at the same time as large numbers of other RFID tags, such as where a pallet stacked with RFID tagged items moves past the gateway, during this short residence period it may be difficult to accurately interrogate and then differentiate between each of the resulting response signals and the full data content they each may transmit.

Another signal generating electronic tag responsive to RF interrogation is an electronic article surveillance (EAS) tag. An EAS tag system indicates presence of an EAS tag within an interrogation field, but an EAS tag carries no data to identify the item to which it is attached. Widely used as theft protection systems, EAS tags have the drawback of alarming only as the EAS tag passes through a gateway, typically located at the door of a store. In many jurisdictions, the law does not permit challenging a person once beyond the store property, which frustrates shop-lifting enforcement / property recovery.

Therefore, it is an object of the invention to provide a system and method(s) that overcomes deficiencies in the prior art.

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