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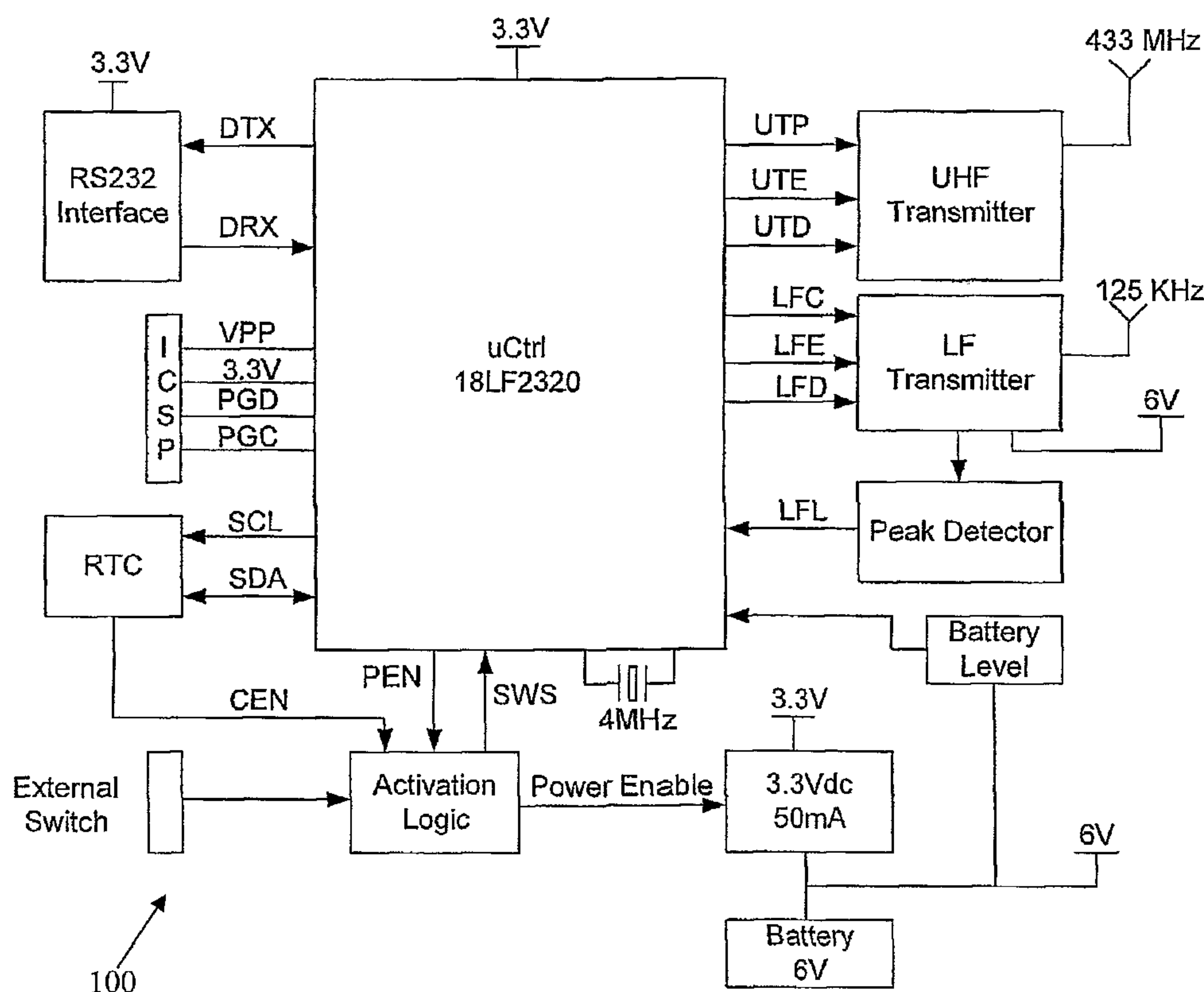
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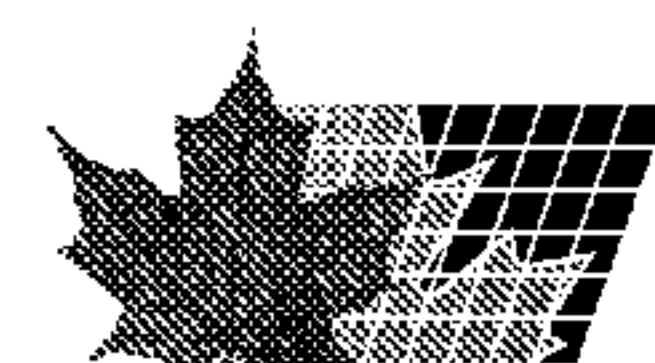
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(57) Abrégé/Abstract:

The present invention relates to a system that will permit the automatic measurement of the efficiencies of a delivery process from end to end. This system uses Radio Frequency based transponders and reader infrastructure to capture data as objects that contain RF transponders pass process points. In particular this invention permits the capture of delivery data automatically at the final end point. This invention is applicable in delivery applications such as those performed by post offices.



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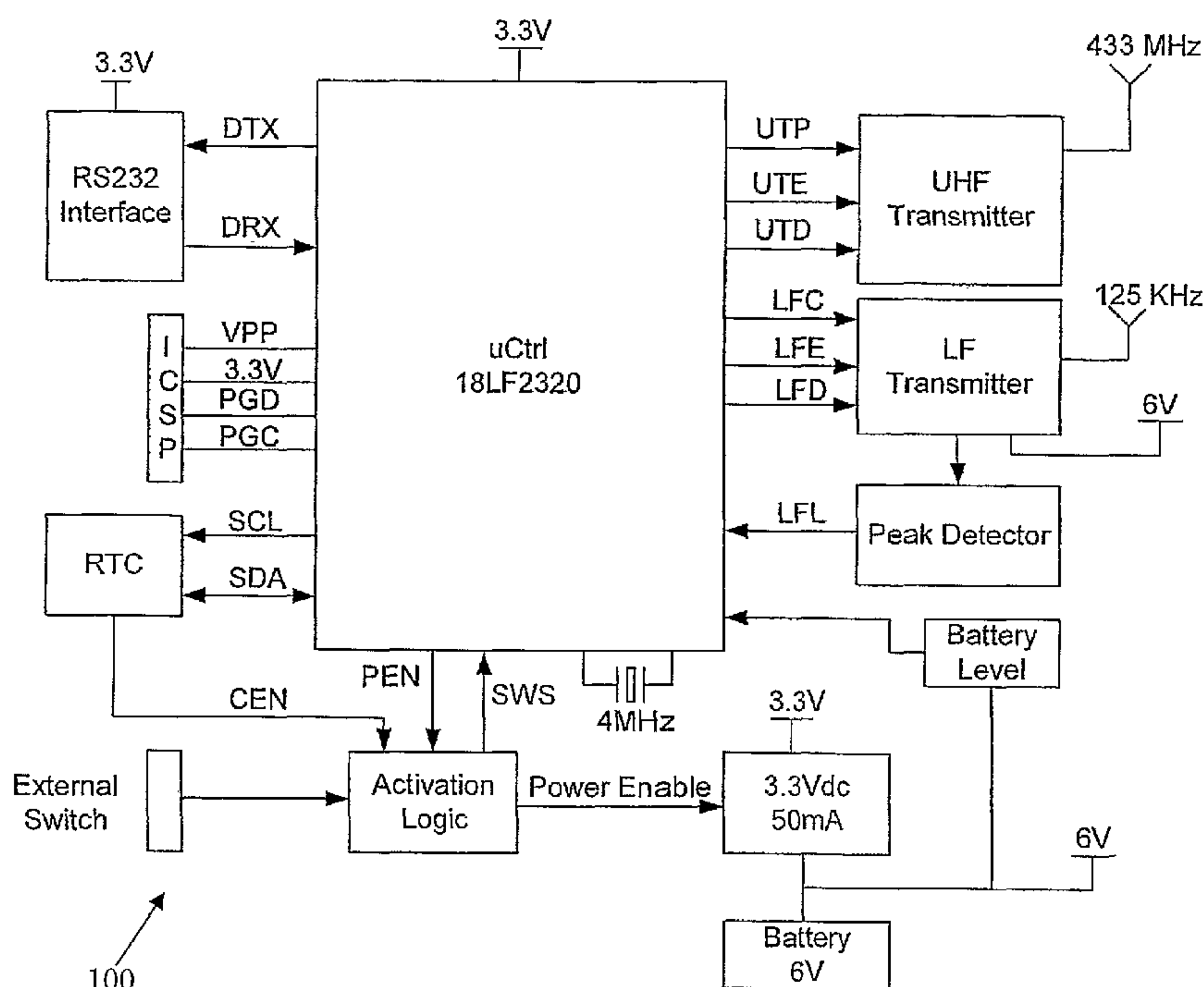
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(57) Abstract: The present invention relates to a system that will permit the automatic measurement of the efficiencies of a delivery process from end to end. This system uses Radio Frequency based transponders and reader infrastructure to capture data as objects that contain RF transponders pass process points. In particular this invention permits the capture of delivery data automatically at the final end point. This invention is applicable in delivery applications such as those performed by post offices.

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MAIL DELIVERY TRACKING SYSTEM AND APPARATUS

Field of the Invention

The present invention relates generally to a system that is used to collect
5 logistical process information, permitting track and trace and statistical analysis,
where Radio Frequency Transponders are used in conjunction with strategically
placed readers throughout a logistical process. In particular this invention relates to
the last delivery measurement point usually at the end customer point whereby the
invention permits the collection of delivery data automatically.

10

Background of the Invention

There are systems in place to collect automatically the time and position of
an object automatically. This equipment is typically installed throughout industrial
and commercial facilities and permits automated collection or measurement of time
15 of arrival data. Having particular regard to international mail, delivery fees are
apportioned amongst co-operating postal services based upon an audit of the
delivery time. Such an audit will involve sample mail pieces delivered to and from
an auditor. According to the prior art, the last automated measurement of a sample
mail piece occurs at the distribution centre. Collection of final delivery data of an
20 object or item is performed manually, as in the case of test mail, or not at all. The
current invention permits the automation of this process whereby this information
can now be collected automatically.

Summary of the Invention

25 According to one aspect of the present invention, there is provided a mail
delivery measurement system comprising:

a excitation unit for installation on a delivery door,
and a remote reader unit,

wherein when a mailpiece is inserted through a slot in said delivery
30 door, said excitation unit excites said mailpiece such that any radio frequency
identification tag contained within the mailpiece communicates a corresponding
identity to said remote reader unit.

According to another aspect of the present invention, there is provided an excitation unit for cooperation with a delivery door comprising:

an actuator for coupling to a flap covering a slot in said delivery door wherein when a mailpiece is inserted in said slot, said actuator is actuated,

5 a switch having a first and second position, coupled to said actuator, wherein when said actuator is actuated, said switch is in moved said first position, and otherwise, said switch remains in said second position,

a low frequency transmitter controlled so as to emit a signal when said switch is in said first position, said signal for the excitation of any radio frequency
10 identification tags contained within said mailpiece.

According to yet another aspect of the present invention, there is provided a mail delivery measurement system comprising:

an excitation unit for installation on a delivery door, the delivery door including a slot for receiving mail and a flap covering the slot,

15 and a remote reader unit,

wherein the excitation unit is configured to excite a mailpiece inserted through the slot when the flap is opened, such that any radio frequency identification tag contained within the mailpiece communicates a corresponding identity to the remote reader unit, and the excitation unit is configured to maintain a power
20 conservation mode until the flap is opened.

According to yet another aspect of the present invention, there is provided a mail delivery measurement system comprising:

an excitation unit for installation on a delivery door, the delivery door including a slot for receiving mail and a flap covering the slot, and

25 a remote reader unit,

wherein the excitation unit is configured to excite a mailpiece inserted through the slot when the flap is opened, such that any radio frequency identification tag contained within the mailpiece communicates a corresponding identity to the remote reader unit,

30 wherein the excitation unit is further configured to transmit diagnostic messages on ultra-high frequency (UHF); and

wherein the remote read unit is capable of indicating reception of the diagnostic messages.

2a

Brief Description of the Drawings

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the attached Figures, wherein:

- Figure 1 shows a block diagram representation of a mail slot exciter,
5 Figure 2 shows a state diagram representation of the mail slot exciter functionality,
Figure 3 shows the UHF message format of the mail slot exciter,
Figure 4 shows a logistical delivery chain according to the art, and
10 Figure 5 shows a delivery chain endpoint according to the present invention.

Detailed Description

According to the present invention the Automatic End Point Measurement system is composed of a remote Reader positioned within the reception range of the
15 point of entry of the object containing an RF transponder and in the case of the delivery of mail, a mail slot, but not limited to mail applications.

A battery operated excitation device is mounted on the inside of the mail slot. Its design is light weight and unobtrusive, easy to install and will accommodate various sizes of mail slots. The purpose of the mail slot exciter is to activate Radio
20 Frequency Identification Transponders as they are passed through the mail slot. The excitation field that activates the RFID transponder device is active when mail passes through the slot. Upon activation the Radio Frequency Identification tag, in

the case of Active tags, transmits a UHF signal and in the case of passive tags, reflects energy back, both signals containing Tag 10. The information transmitted is received by a reader mounted up to tens of meters from the point of entry. The tag identification data is time stamped and stored for later retransmission to a central data base for post processing. Retransmission of data can be either sent via the public telecom network or via wireless cellular service provider.

The reader unit can be battery operated or powered by the mains electrical power source on the premises.

The mail slot exciter 100 is part of an end to end postal application to determine the delivery time of the mail at the end location. In one embodiment, the mail slot exciter 100 is designed to be used together with the RM23 family of readers.

The mail slot exciter 100 unit, as shown in figure 1, is a battery operated unit intended to be installed at the recipient location (dropper house) on the door mail slot. The unit will automatically generate the excitation field (format S21) when the mail slot flap is opened by the incoming mail. This way any tag type T95/T96/PT21, placed in the mail, will be activated and identified by the nearby Reader (such as an RM23) according to the S21 specification. Later on the messages received from tags will be transferred to the central data base using a dial-up or GSM /GPRS modem.

In order to save the battery power, the mail slot exciter 100 is most of the time in sleep conditions. It wakes up only after the mail slot flap is opened and then generates the LF excitation field, or at pre-determined time interval to send on UHF the integrity test messages.

The microcontroller generates signals for controlling the UHF and LF transmitters, the Real Time Clock (RTC), the RS232 interface and the Activation Logic Circuit. Optionally, the microcontroller may be an 18LF2320.

The microcontroller processes the signals received from the LF Peak Detector, the Battery Level Detector and the Activation Logic Circuit to generate the integrity test messages.

The mail slot exciter 100 functionality in the Operation Mode is explained by the states diagram 200 presented in Fig. 2.

In the Setting Mode the exciter EMB23 receives commands through the serial communication link, interprets these commands and executes them.

The mail slot exciter 100 has two main modes of operation: Setting and Operation. The Setting Mode of operation is intended to configure the functionality of the mail slot exciter 100 regarding: Excitation field; UHF Transmitter message format; Integrity test operation.

5 The Operation mode is the normal mode of operating the mail slot exciter 100 for automatic identification of the mail delivery time.

 The functionality of the Exciter mail slot exciter 100 is controlled by a number of parameters and commands. These parameters may be transmitted from a PC running a serial communication program (Procomm) through an RS232
10 communication link and memorized by the exciter during its setting process. Of course, many other terminal sources may be used to deliver the parameters via the RS232 serial port. The same serial connections can be used to configure the Exciter mail slot exciter 100, with the desired functional parameters, or to query their memorized values.

15 The configuration of the exciter mail slot exciter 100 can be performed only in the Setting Mode of operation. This mode of operation can be entered by placing a jumper between the pins 2-4 of the ICSP header EMB23-J 1 and switching on the mail slot exciter 100 power by opening its mail slot flap for at least 0.1s.

 The Operation Mode is active when there is no jumper placed between the
20 pins 2-4 of the ICSP header EMB23-J 1. This is the normal mode of operating Exciter mail slot exciter 100. In the Operation Mode mail slot exciter 100 is most of the time in sleep conditions to save the battery power. It wakes up only after the mail slot flap is open, to generate the LF excitation field, or at pre-determined time interval to send on UHF the integrity test messages.

25 In the Operation Mode mail slot exciter 100 generates automatically the excitation field for about 1 s after the mail slot flap is open; there is a delay of about 0.1s between the moment when the mail slot flap switch power on the mail slot exciter 100 and the moment when the LF excitation field is generated. The excitation field is created by a 125 KHz carrier signal, modulated 00K with the
30 ExcitationID code. The ExcitationID format and supports ID numbers from 0 to 31.

 If the Exciter mail slot exciter 100 is activated in the Setting Mode, it can generate several types of signals, depending on a subsequent command:

 non modulated 125 KHz carrier - command SM1;

125 KHz carrier, OOK modulated with a 600 Hz rectangular wave –
command SM2;

125 KHz carrier, OOK modulated with the ExcitationID - command SM3;
and

5 The modulated carrier is amplified and applied to the LF-PCB antenna.

The level of the LF voltage on the LF antenna is programmable using the
parameter EVX.

An UHF transmission from mail slot exciter 100 is used to automatically test
the functionality of the mail slot exciter 100, to check the reception capabilities of
10 Readers and the UHF channel (434MHz) operability.

In the Normal Mode of operation after the mail slot flap is open, Exciter mail
slot exciter 100 generates the excitation field, and then transmits on the UHF
channel the IntegritySignal. The IntegritySignal is a blink transmission consisting of
a number of identical IntegrityMessages. Each IntegrityMessage reports the mail slot
15 exciter 100 status. The number of IntegrityMessages per blink transmission is
controlled by the parameter TIP.

In the setting mode the Exciter MAIL SLOT EXCITER 100 will transmit on
the UHF channels RF signals as directed by the commands SM4 to SM7 (see Table
1).

20 If in the normal or operational mode of operation the Exciter MAIL SLOT
EXCITER 100 mail slot flap is kept open longer than 20 s, a special LinkSignal will
be generated on the UHF channel. The LinkSignal is intended to check if the
associated Reader RM23 can receive the UHF messages transmitted by E23 from its
specific installation location. The LinkSignal is a blink transmission consisting in a
25 number of identical LinkMessages as described in chapter 5. The number of
IntegrityMessages per blink transmission is controlled by the parameter TIP.

The commands and parameters operate only in the Setting Mode. The mail
slot exciter 100 receives commands through the serial communication link,
interprets these commands and executes them. Some commands set the functional
30 parameters and others define actions.

All parameters, excepting TYYMMDDhhmm (RTC date and time), can be
updated by transmitting to the mail slot exciter 100 (through the R5232 link) a

command including the 3-letters name of the parameter and its value, according to the following syntactical expression:

<Parameter name>=<value><CR>

The TYYMMDDhhmm command (for RTC date and time update) has the
5 syntax:

TYYMMDDhhmm<CR> - to update the RTC

T<CR>-toquerythrRTC

The actual values of the mail slot exciter 100 parameters can be read by transmitting through the RS232 link to the Exciter mail slot exciter 100 a query
10 command including the 3-letter name of the parameter, according to the following syntactical expression:

<Parameter name><CR>

The commands B, C and SMI-5M7 are introduced to define actions.

The Mail box exciter BM23 transmits messages on the 433.92 MHz channel
15 using the format presented in figure 3.

The UserData field has 5 bytes — C/OxFE/xxlxxlxx. The first byte is the character C and the second byte has fix value OxFE. The remaining 3 bytes represent the ExciterID number —unique number allocated from the factory to each unit (expressed in hexadecimal); it can be re-programmed using the parameter TUD.

20 The ExciterStatus field has 2 bytes. The first byte contains the Exciter LF Power Level and the second the status of the mail slot flap (activation switch). The first byte gives the value of the parameter EVA (bits 6 to 0 for the LF Pk-Pk Output Voltage) and an indicator (bit 7) concerning the relation between the value of EVA and the value of the parameter EVT (the LF Pk-Pk Output Voltage Threshold). If the
25 value of bit 7 is "1" then EVA>EVT; if "0" then EVA~EVT.. The second byte informs about the status of the mail slot exciter 100 activation switch - if the value of this byte is 0x54 this means that the switch returned to its normal status (open) in less than 20 seconds. If the value is 0x55 this means that the switch remained closed longer than 20s (out of order situation). Note: the switch is activated by the mail slot
30 flap; it is open only when the flop is closed. The ExcitationID field has one byte and it's controlled by parameter EAD. This field can be used to differentiate between tags excited by different mail slot exciter 100 exciters in close vicinity. Can be used for further developments; factory setting is the default value 0x00.

The CRC and Flags field are identical with S21/S96 UHF message format: CRC field — 2 bytes, Flag field — 1 byte.

5 Having regard to figures 5a and 5b, Mailpiece 310 is delivered to a final destination 301 having a door 320. The position of the endpoint is no different than an endpoint of the prior art (reference 250 of figure 4), a standard postal logistical chain. The door 320 incorporates slot 325. A portable excitation unit 330 (an instance of the exciter 100) is installed on the door slot 325. If the mailpiece 310 in question is for audit purposes, it will incorporate an RFID tag (not shown) included at a previous time in the delivery process.

10 When a mailpiece 310 is placed in the slot 325, the excitation unit is stimulated by the opening of the slot and responsively produces low frequency emissions (see section 3.3) in order to excite the tag included in the mailpiece. Upon activation the tag, transmits a UHF signal (433 Mhz). The signal includes an identification of the mailpiece 310.

15 The UHF signal information is received by a reader 340 (this may be, for example, and RM23 reader) mounted up to tens of meters from the door 320. The mailpiece 310 identification data is time stamped and stored for later retransmission to a central data base 370 for post processing. The database is stored on a server 370, which may be accessed via a wide area network 360. The reader may be connected
20 to a wide area network access point 350 via telephone landline or cellular (GSM/CDMA/GPRS).

What is claimed:

1. A mail delivery measurement system comprising:
an excitation unit for installation on a delivery door, the delivery door
including a slot for receiving mail and a flap covering the slot,
5 and a remote reader unit,
wherein the excitation unit is configured to excite a mailpiece inserted
through the slot when the flap is opened, such that any radio frequency identification
tag contained within the mailpiece communicates a corresponding identity to the
remote reader unit, and the excitation unit is configured to maintain a power
10 conservation mode until the flap is opened.

2. The system of claim 1 wherein when the flap is held in the open
position for a predetermined length of time, the excitation unit communicates directly
with said remote reader unit.

3. The system of claim 2 or claim 3 wherein said remote reader unit
stores the corresponding identity, time stamps the corresponding identity, and relays
the corresponding identity immediately or at a later time for post processing.

4. The system of any one of claims 1 to 3, wherein the excitation unit
reverts to the power conservation mode after the excitation unit communicates the
corresponding identity to the remote reader unit.

5. The system of any one of claims 1 to 4 wherein the integrity of the
25 system is determined by analyzing at least one integrity messages received.

6. The system of any one of claims 1 to 5; wherein said excitation unit is
capable of transmitting diagnostic messages on ultra-high frequency (UHF) and
wherein the remote read unit is capable of indicating reception of the diagnostic
30 messages.

7. The system of claim 6 wherein the diagnostic messages include battery
low messages.

8. A mail delivery measurement system comprising:
an excitation unit for installation on a delivery door, the delivery door including a slot for receiving mail and a flap covering the slot, and
a remote reader unit,
5 wherein the excitation unit is configured to excite a mailpiece inserted through the slot when the flap is opened, such that any radio frequency identification tag contained within the mailpiece communicates a corresponding identity to the remote reader unit,
wherein the excitation unit is further configured to transmit diagnostic
10 messages on ultra-high frequency (UHF); and
wherein the remote read unit is capable of indicating reception of the diagnostic messages.
9. The system of claim 10 wherein the diagnostic messages include
15 battery low messages.
10. The system of any one of claims 1 to 9, wherein the remote reader unit is located remote from the excitation unit.

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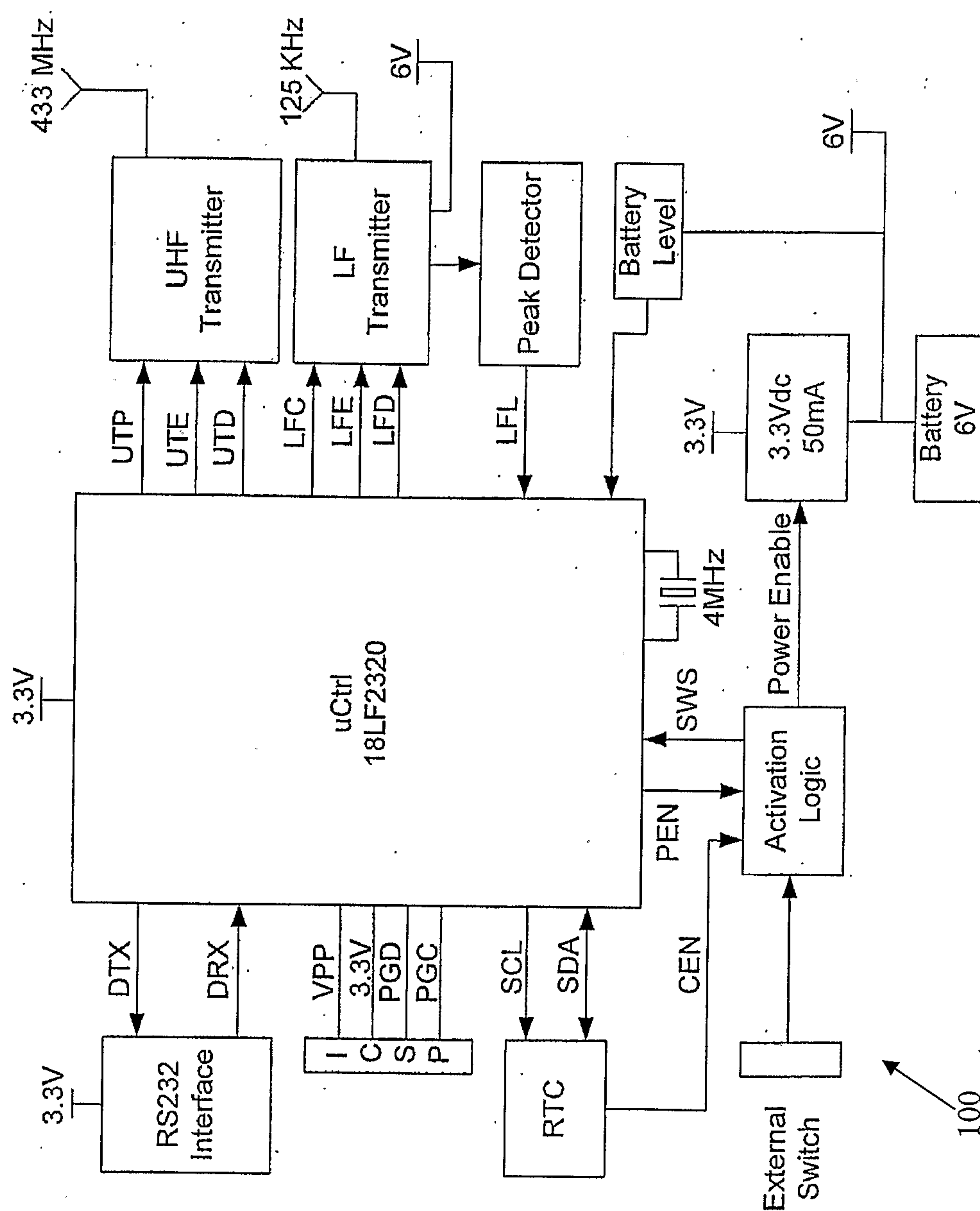


FIGURE 1

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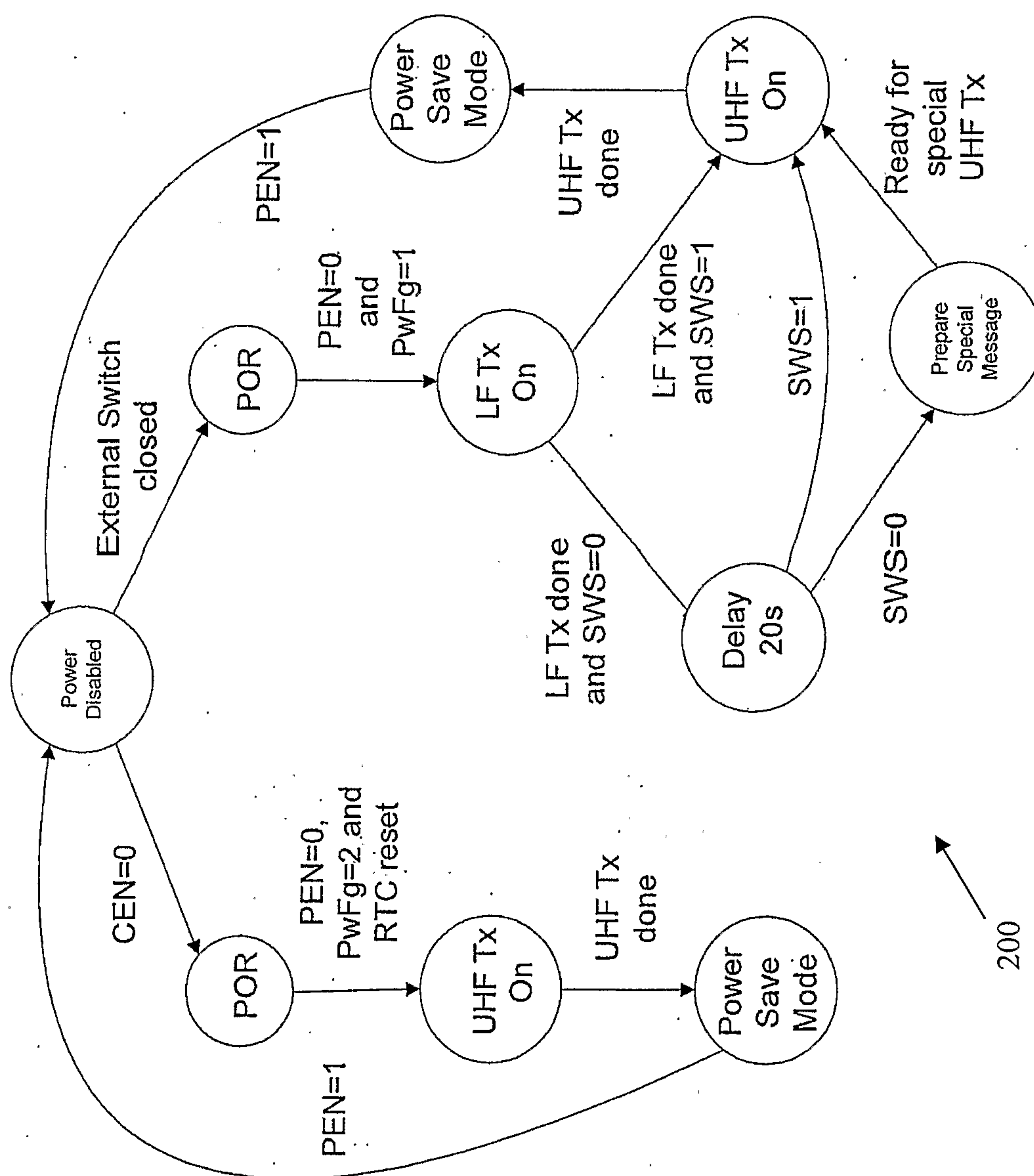


FIGURE 2

200

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UserData [ExciteriD]	ExciterStatus	ExcitationiD	CRC	Flags
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FIGURE 3

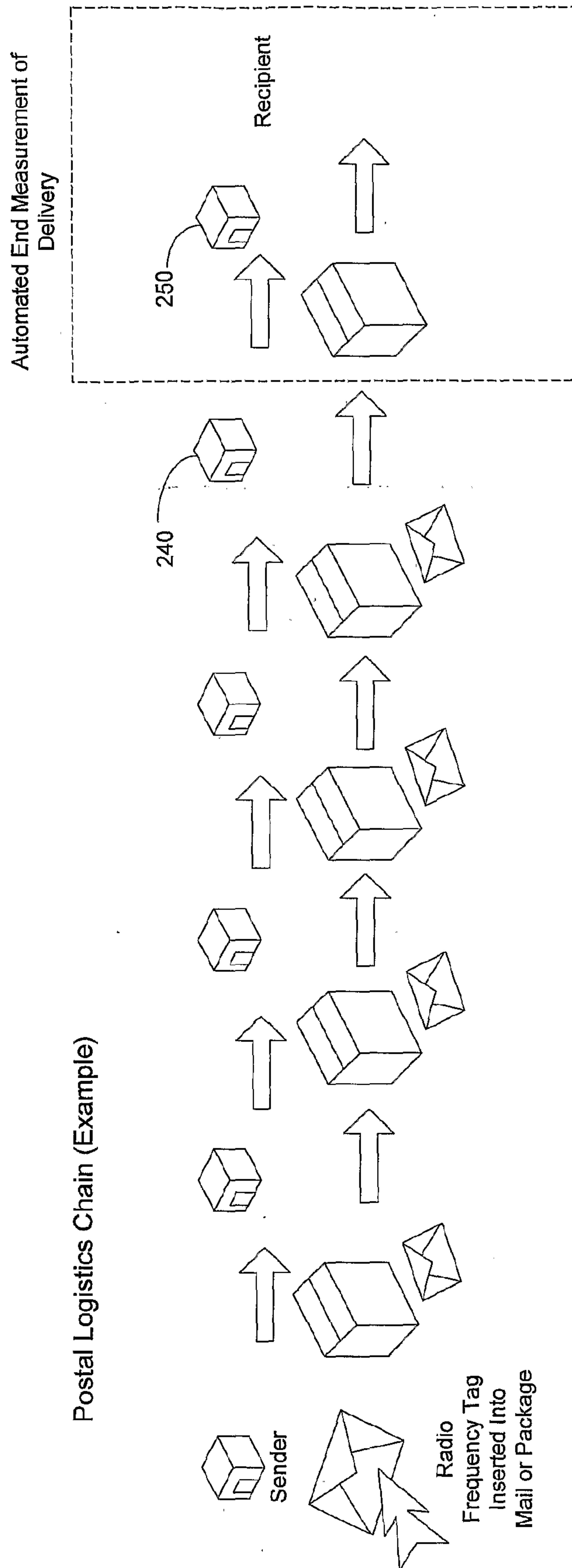


Figure 4 (Prior Art)

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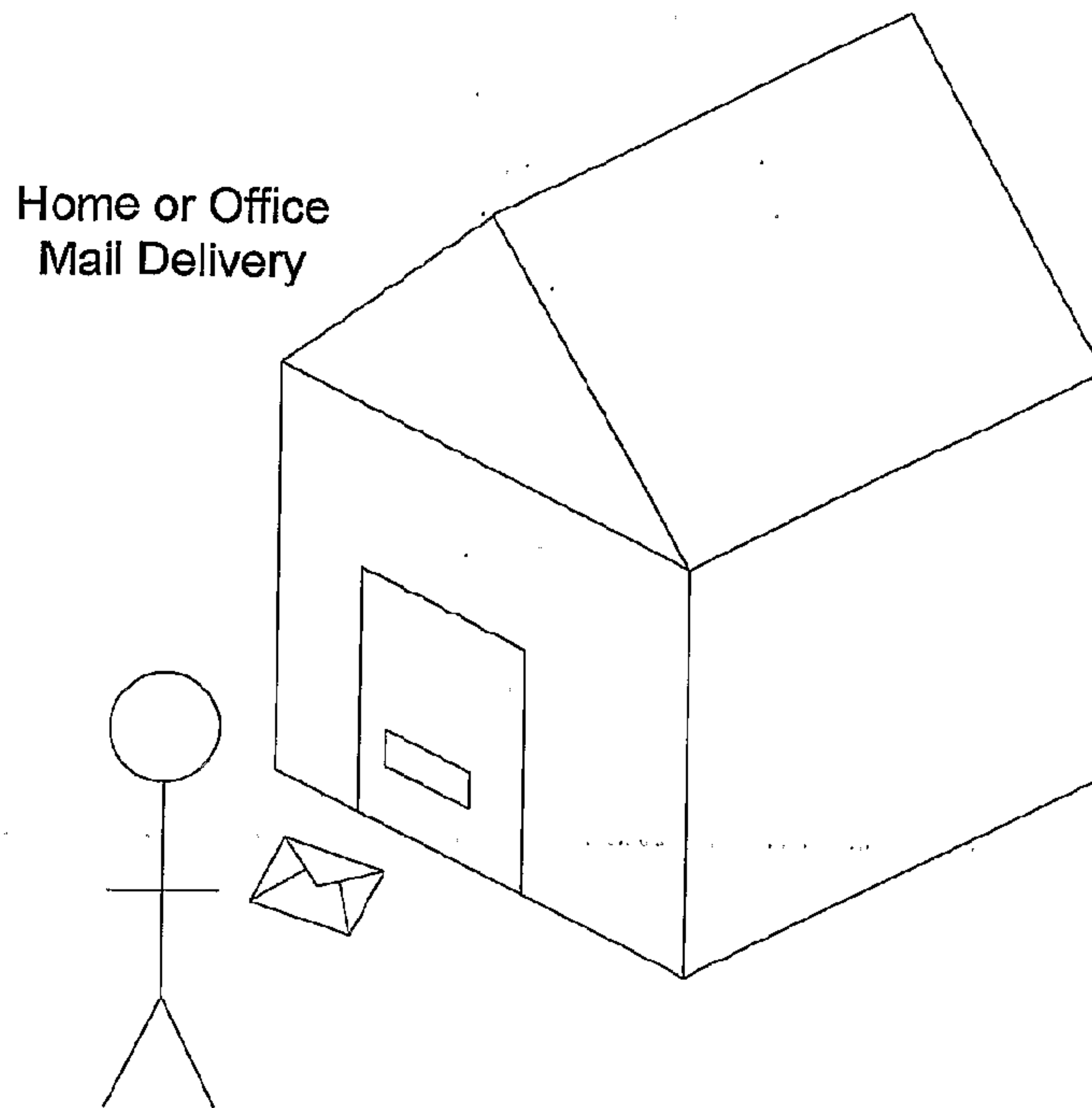


Figure 5a

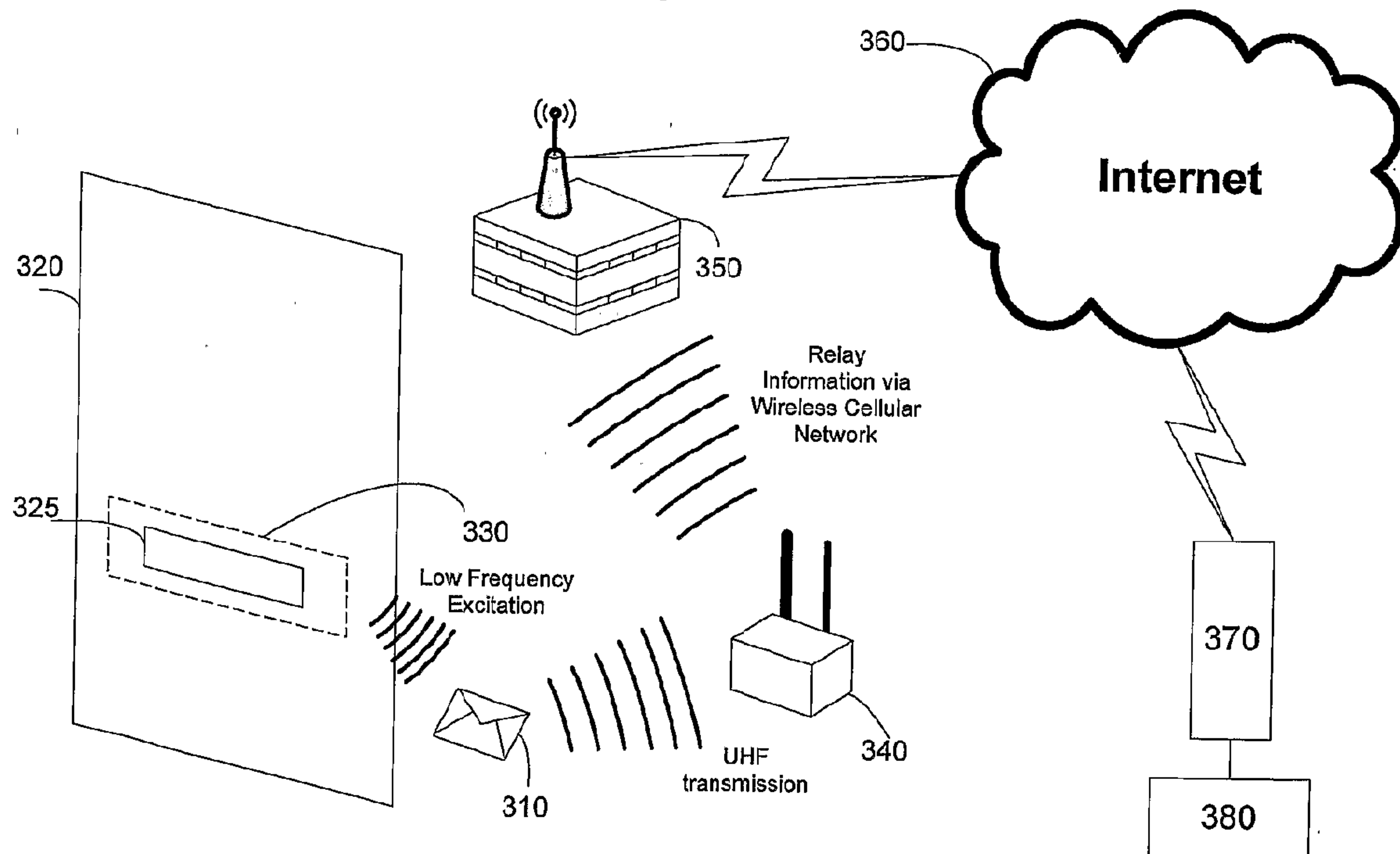


Figure 5b

