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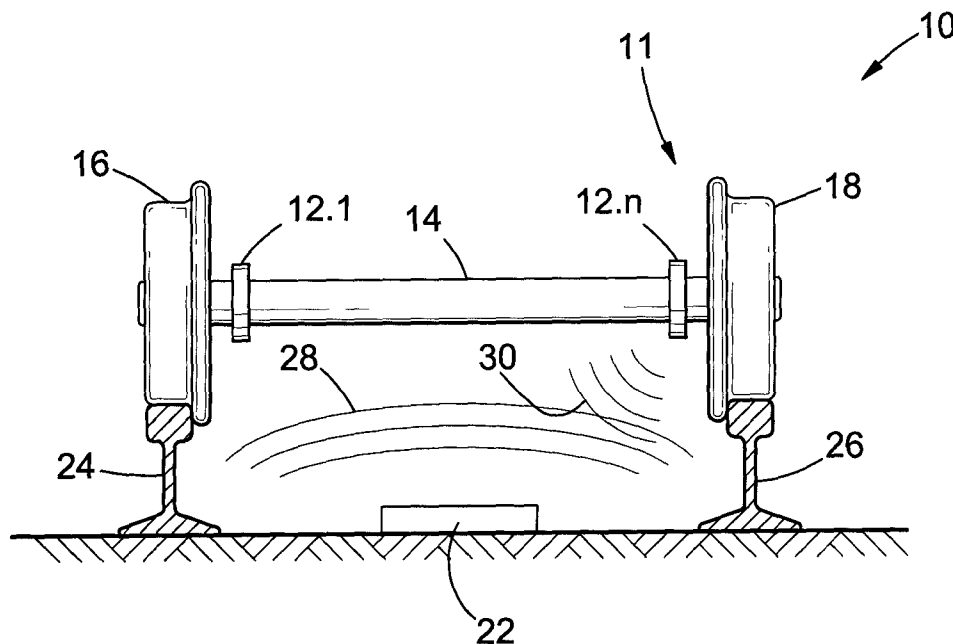
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(54) Title: RFID TAG FOR TRAIN WHEELS



(57) Abstract: A tag 12.1 for a vehicle comprises collar 32 adapted to be fitted on an axle of the vehicle. The collar carries an RF transponder 20.1 comprising transponder circuitry and an antenna 40. The circuitry is connected to a sensor 44 for a parameter associated with the assembly in use. The circuitry is responsive to cause the transponder to transmit a first radio frequency signal when a value of the parameter exceeds a threshold value.

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RFID TAG FOR TRAIN WHEELS

INTRODUCTION AND BACKGROUND

5 This invention relates to radio frequency identification (RFID) systems and more particularly to a tag, system and method for detecting and transmitting data relating to a parameter relating to a wheel assembly of a vehicle, such as a rail vehicle.

10 A known problem associated with the wheels of rail vehicles, such a train, is that due to bearing failure etc, the wheels may become too hot, or, may change shape over a period of time. Should any of these situations occur, advance warning is required to take remedial action, such as to stop the train, to limit damage. Detection systems are
15 known, but they all suffer from one or the other disadvantage, such as that initial capital investment may be too high, they are difficult and costly to maintain, prone to damage and not reliable enough.

OBJECT OF THE INVENTION

20 Accordingly, it is an object of the present invention to provide an RFID tag for a vehicle wheel assembly, a detection system comprising at

least one such a tag and associated methods, with which the applicant believes the aforementioned disadvantages may at least be alleviated.

SUMMARY OF THE INVENTION

5 According to the invention there is provided a tag for a vehicle, the tag comprising a carrier configured to be fitted on a wheel and axle assembly of the vehicle, the carrier carrying a radio frequency (RF) transponder comprising transponder circuitry and an antenna, the circuitry being connected to a sensor for a parameter associated with
10 the assembly in use and being responsive to cause the transponder to transmit a first RF signal when a value of the parameter exceeds a threshold value.

The vehicle is preferably a rail vehicle and the carrier may comprise a
15 collar, which is configured to be mounted on an axle of the assembly.

The collar may comprise a first collar part and a second collar part adapted to be connected to one another, thereby to close the collar and to mount the collar on the axle. The collar may be substantially
20 circular in configuration, the first collar part may comprise a first circle segment part and the second collar part may comprise a second and complementary circle segment part, the first and second parts may be

hinged to one another at respective first ends of the parts and may be releasably connectable to one another at respective opposite ends of the parts by a releasable link.

5 The first and second parts may be made from any suitable material, such as a suitable resinous material.

The parameter may be at least one of temperature, vibration frequency and any other parameter relating to at least part of the assembly in
10 use.

At least part of the circuitry may be integrated on an application specific integrated circuit (ASIC).

15 The antenna and circuitry may be provided in a radially outward region of the collar and the sensor may be provided in a radially inward region of the collar.

Hence in use, when the tag is mounted on the axle, the chip and
20 antenna are spaced from the axle by part of the carrier body and the sensor is in closer proximity to the axle.

The sensor may comprise an element, such as a loop, of a suitable conductive material, which loop is configured such that the loop changes resistance at a predetermined threshold temperature, and wherein the circuitry is configured to sense the change and in response thereto, to transmit said first RF signal.

The first RF signal preferably comprises data relating to an identification code associated with the tag.

Also included within the scope of the present invention is a monitoring system comprising at least one tag as herein defined and/or described; and at least one associated reader adapted to be mounted in proximity of a railway, to be in communication with the transponders on the tags.

Still further included within the scope of the invention is a method of monitoring a parameter associated with a wheel and axle assembly in use, comprising the steps of:

- utilizing a sensor connected to a radio frequency transponder to sense for a change in a parameter associated with the assembly in use; and

- in response to the change, causing the transponder to transmit a first radio frequency signal to a reader.

BRIEF DESCRIPTION OF THE ACCOMPANYING DIAGRAMS

- 5 The invention will now further be described, by way of example only, with reference to the accompanying diagrams wherein
- figure 1 is a diagrammatic front elevation of a wheel and axle assembly of a rail vehicle and a monitoring system according to the invention comprising a tag according to the
- 10 invention;
- figure 2 is a basic block diagram of the monitoring system according to the invention;
- figure 3 is a front elevation of the tag according to the invention, partially in section; and
- 15 figure 4 is an alternative embodiment of the system according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

- A monitoring system for monitoring a parameter associated in use with
- 20 a wheel and axle assembly of a vehicle, such as a rail vehicle, is generally designated by the reference numeral 10 in figure 1.

The system comprises a plurality of tags 12.1 to 12.n adapted to be mounted on a rail vehicle wheel and axle assembly 11, comprising an axle 14 and opposed wheels 16 and 18. Each tag comprises a radio frequency transponder 20.1 to 20.n respectively, as will hereinafter be described. The system 10 further comprises a reader 22 mounted between rails 24 and 26 for reading response signals transmitted by the transponders in use. As illustrated in figures 1 and 2, in use, the reader 22 intermittently transmits an energizing or interrogating radio frequency signal 28. The transponders derive in known manner energy from the energizing signal and transmit, by way of backscatter modulation, a respective first response signal 30 to be received by the reader 22, as will hereinafter be described in more detail.

The transponders may be passive transponders deriving energy as aforesaid, alternatively they may be active transponders, each comprising a suitable power source (not shown).

The tags 12.1 to 12.n are similar in configuration and therefore tag 12.1 only will now further be described with reference to figure 3. The tag 12.1 comprises an openable and closeable collar 32 adapted to be mounted on the axle 14. The collar comprises a first circle segment

part 34 and a second complementary circle segment part 36 hinged to the first part at respective first ends 38 of the parts.

5 A suitable link or clip mechanism 39 at respective second ends of the parts enables the openable and closable collar selectively to be opened, alternatively to be closed. The parts are made of a suitable resinous material. The first part 34 carries the transponder 20.1. The transponder 20.1 comprises an antenna 40 connected to electronic circuitry integrated on a single ASIC 42. The circuitry is connected to
10 a sensor 44 for a parameter relating to the assembly, in use. The parameter is selected from temperature, vibration frequency and any other parameter relating to at least part of the assembly in use. The parameter, in turn, is dependent, for example, on distortion in shape of the wheel. In the embodiment shown, the sensor comprises an
15 element, such as a loop 44 of an electricity conductive material selected and configured such that it would rupture or change in resistance at a predetermined threshold temperature.

The transponder is typically embedded in the first part 34 with the
20 loop located in a cavity 46 defined in the first part. As shown in figure 3, the antenna 40 and chip 42 are preferably located in a radially outward region of the collar 32 and the cavity 46 with loop 44 in a

radially inward region, so that, in use, it is located in as close as possible proximity to and suitable heat communication relationship with the axle 14.

5 The circuitry may be configured such that the transponder only transmits the first response signal and that is when the loop 44 is interrupted. The first signal preferably comprises data and the data preferably comprises an ID code associated with the tag 12.1 and hence axle 14 and preferably wheel 16.

10

Hence, should the bearings of the wheel fail, the resulting heat generated will cause the temperature of the axle 14 in the region of the wheel 16 to rise. When the temperature reaches the threshold value, the loop 44 ruptures or changes resistance, causing the
15 transponder to transmit the first signal. The signal and data backscatter modulated thereon are read by the reader 22, to indentify the tag 20.1, axle 14 and wheel 16. The data may be used immediately to brake the train or to take any other suitable remedial step.

20

In other embodiments, the transponders may be configured to transmit a second signal until the threshold value is reached. In the case of a

passive transponder, upon being energized the transponder responds with the second signal, unless the threshold value has been reached in which event the transponder responds with said first signal.

5 In the embodiment 50 shown in figure 4, a plurality of readers 52 are positioned in spaced relation alongside the railway 54. Data derived from the tags may be collected as they pass the readers and forwarded to a central station 56 for processing and analyses. The data may be used to detect hot wheels as aforesaid or changes in
10 vibrating frequency, which may be indicative of changes in the shape of the wheels.

CLAIMS

1. A tag for a vehicle, the tag comprising a carrier configured to be fitted on a wheel and axle assembly of the vehicle, the carrier carrying a radio frequency (RF) transponder comprising transponder circuitry and an antenna, the circuitry being connected to a sensor for a parameter associated with the assembly in use and being responsive to cause the transponder to transmit a first RF signal when a value of the parameter exceeds a threshold value.
2. A tag as claimed in claim 1 wherein the carrier comprises a collar configured to be mounted on an axle of the assembly.
3. A tag as claimed in claim 2 wherein the collar comprises a first collar part and a second collar part adapted to be connected to one another, thereby to close the collar and to mount the collar on the axle.
4. A tag as claimed in claim 3 wherein the collar is substantially circular in configuration, wherein the first collar part comprises a first circle segment part and the second collar part comprises a second and complementary circle segment part, wherein the

first and second parts are hinged to one another at respective first ends of the parts and are releasably connectable to one another at respective opposite ends of the parts by a releasable link.

5

5. A tag as claimed in any one of claims 1 to 4 wherein the parameter is at least one of temperature, vibration frequency and any other parameter relating to at least part of the assembly in use.

10

6. A tag as claimed in any one of claims 1 to 5 wherein the circuitry is integrated on a chip.

15

7. A tag as claimed in any one of claims 4 to 6 wherein the antenna and circuitry are provided in a radially outward region of the collar and the sensor is provided in a radially inward region of the collar.

20

8. A tag as claimed in any one of the preceding claims wherein the sensor comprises a loop of a suitable conductive material, which loop is configured such that the loop changes resistance at a predetermined threshold temperature, and wherein the circuitry

is configured to sense the change and in response thereto, to transmit said first RF signal.

- 5 9. A tag as claimed in any one of the preceding claims wherein the first RF signal comprises data relating to an identification code associated with the tag.
- 10 10. *A monitoring system comprising at least one tag as claimed in any one of the preceding claims; and at least one associated reader adapted to be mounted in proximity of a railway, to be in communication with the transponders on the tags.*
- 15 11. A method of monitoring a parameter associated with a wheel and axle assembly in use, comprising the steps of:
- utilizing a sensor connected to a radio frequency transponder to sense for a change in a parameter associated with the assembly in use; and
 - in response to the change, causing the transponder to transmit a first radio frequency signal to a reader.

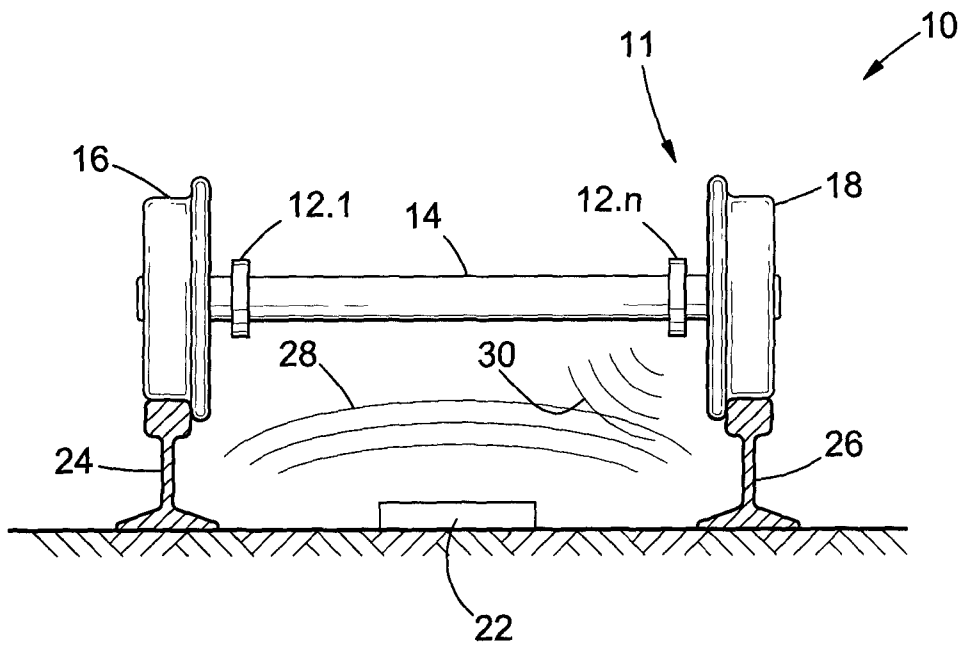


FIGURE 1

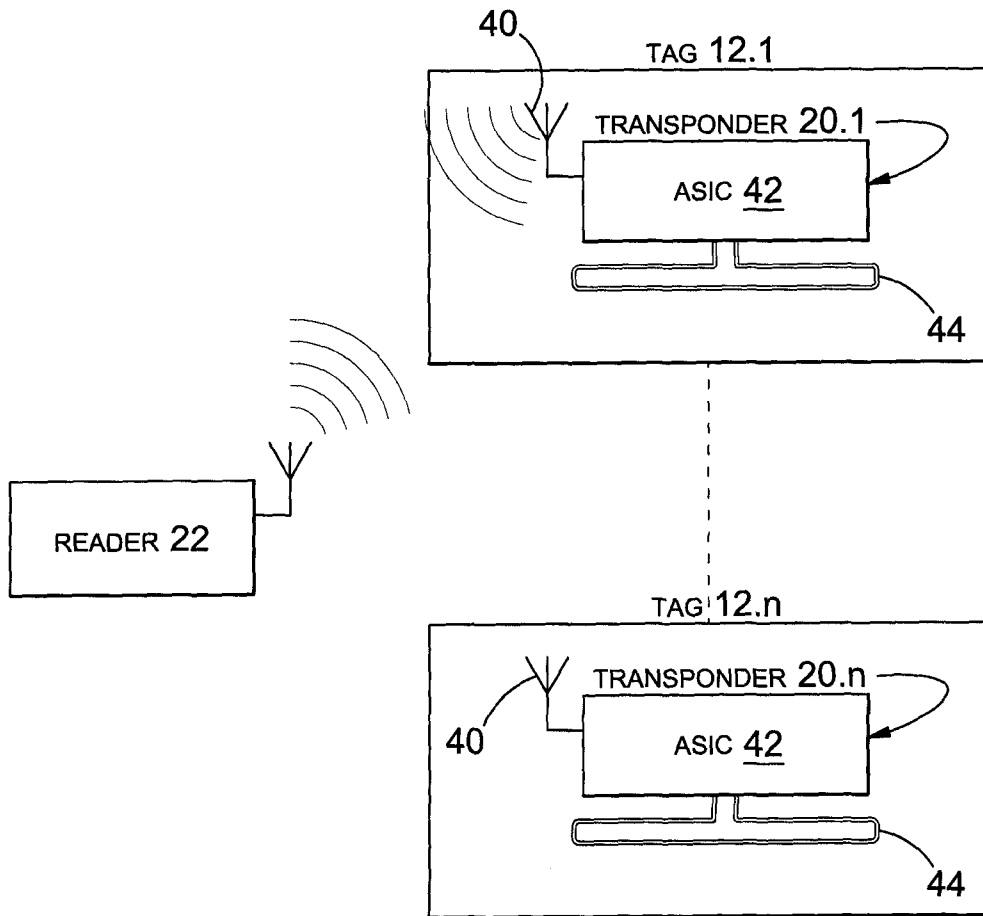


FIGURE 2

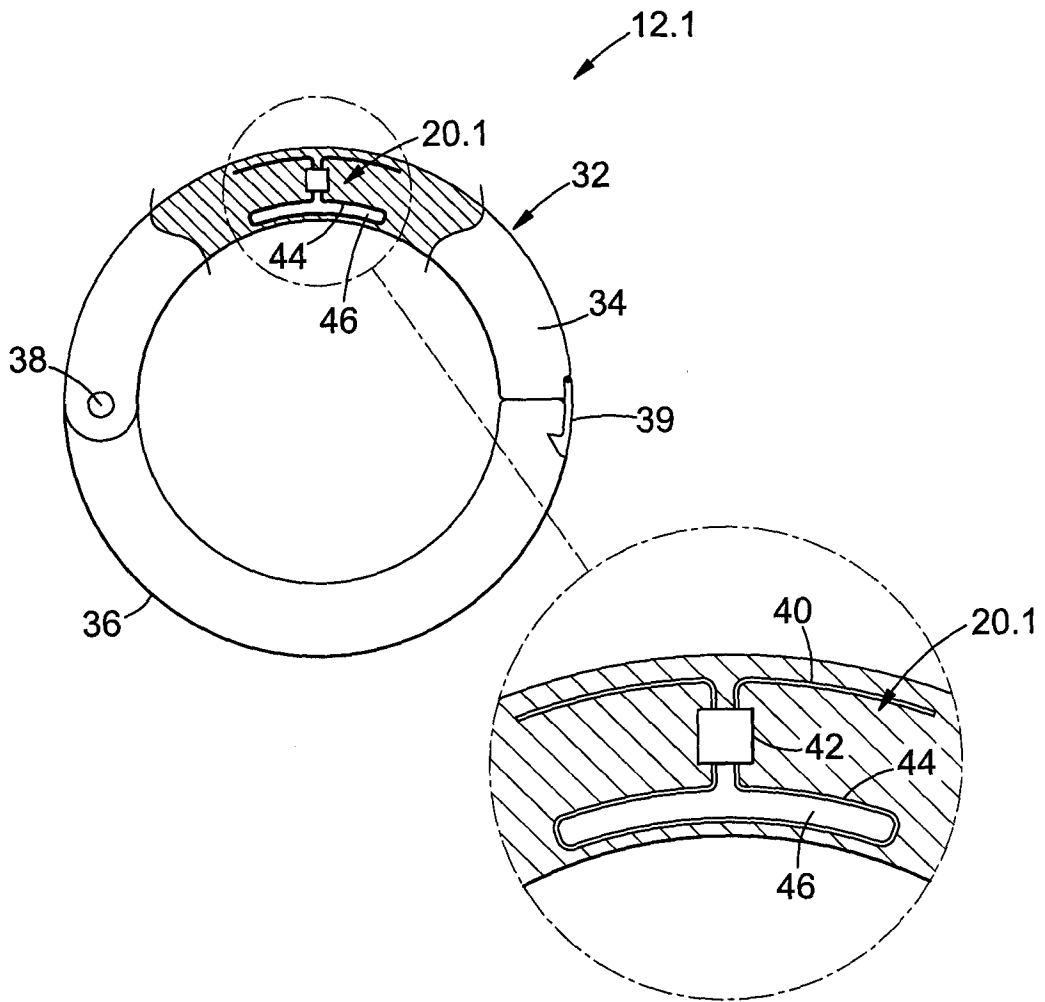


FIGURE 3

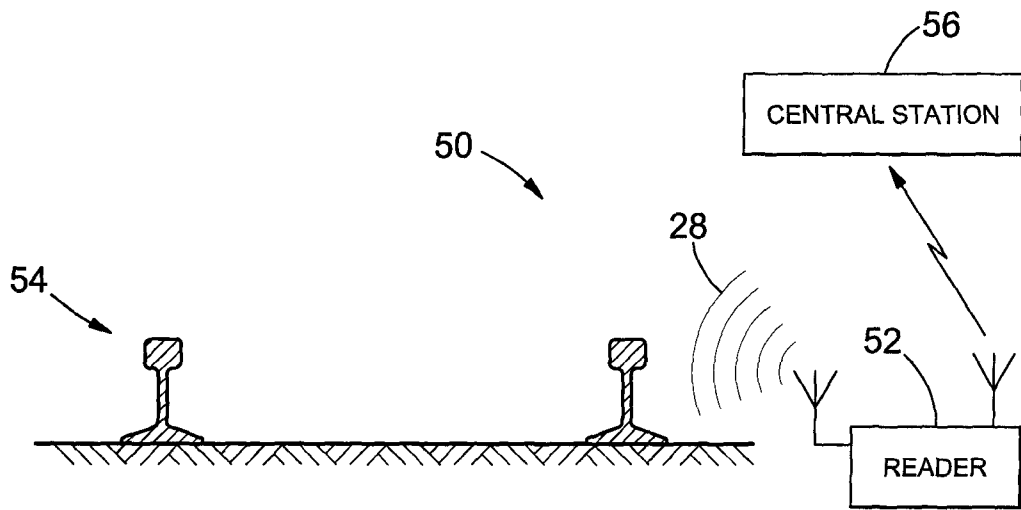


FIGURE 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/051923

A. CLASSIFICATION OF SUBJECT MATTER		
INV. G06K7/00	G06K19/07	B60C23/04 H01Q1/22
According to International Patent Classification (IPC) or to both national classification and IPC		
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Minimum documentation searched (classification system followed by classification symbols) G06K B60C H01Q		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/042577 A (SIEMENS VDO AUTOMOTIVE [FR]; LAURE FREDERIC [FR]; LUCE DOMINIQUE [FR]) 27 April 2006 (2006-04-27)	1-11
Y	page 1, line 10 - line 11 page 2, line 15 - line 22 page 8, lines 2,3,36,37 page 9, line 25 - line 33	1-11
X	DE 101 56 776 A1 (TUEV AUTOMOTIVE GMBH UNTERNEHM [DE]) 28 May 2003 (2003-05-28)	1-11
Y	paragraphs [0024], [0029], [0036], [0038]; figure 2	1-11
X	US 5 573 611 A (KOCH RUSSELL W [US] ET AL) 12 November 1996 (1996-11-12) column 3, line 33 - line 54 column 9, line 37 - column 10, line 3	1-11
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
10 September 2007		18/09/2007
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Heusler, Nikolaus

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2007/051923

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 271 748 B1 (DERBYSHIRE ANDREW JOHN [GB] ET AL) 7 August 2001 (2001-08-07) column 8, line 39 - line 43; figure 6 column 10, line 17 - line 21 column 18, line 24 - line 29; figure 21 -----	1-11
Y	EP 1 607 723 A (SWISSCOM MOBILE AG [CH]) 21 December 2005 (2005-12-21) paragraphs [0004], [0006], [0018], [0021], [0023] -----	1-11
Y	US 6 694 231 B1 (REZK NAGY H [US]) 17 February 2004 (2004-02-17) column 4, line 13 - line 21; figure 1 -----	1-11
A	DE 38 25 653 A1 (BOSCH GMBH ROBERT [DE]) 1 February 1990 (1990-02-01) column 3, line 18 - line 20 column 3, line 43 - line 48 -----	1-11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2007/051923

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2006042577	A	27-04-2006	DE 112005001913 T5	16-08-2007
			FR 2874271 A1	17-02-2006

DE 10156776	A1	28-05-2003	NONE	

US 5573611	A	12-11-1996	AU 694200 B2	16-07-1998
			AU 2030295 A	14-12-1995
			AU 6596998 A	16-07-1998
			BR 9502667 A	02-01-1996
			CA 2150865 A1	04-12-1995
			DE 69509305 D1	02-06-1999
			DE 69509305 T2	02-09-1999
			EP 0689950 A2	03-01-1996
			ES 2130524 T3	01-07-1999
			JP 3683008 B2	17-08-2005
			JP 8067117 A	12-03-1996
			NZ 272255 A	26-06-1998
			US 5500065 A	19-03-1996
			US 5573610 A	12-11-1996
US 5562787 A	08-10-1996			
ZA 9504299 A	24-01-1996			

US 6271748	B1	07-08-2001	AU 3392695 A	22-03-1996
			CA 2197447 A1	07-03-1996
			EP 0778803 A2	18-06-1997
			WO 9606747 A2	07-03-1996
			JP 10504783 T	12-05-1998

EP 1607723	A	21-12-2005	NONE	

US 6694231	B1	17-02-2004	AT 294089 T	15-05-2005
			CA 2436687 A1	08-02-2004
			DE 60300567 D1	02-06-2005
			DE 60300567 T2	23-02-2006
			EP 1388480 A1	11-02-2004
			ES 2242130 T3	01-11-2005
			PT 1388480 T	31-08-2005
			TW 231923 B	01-05-2005
			US 2004030466 A1	12-02-2004

DE 3825653	A1	01-02-1990	WO 9000985 A1	08-02-1990
			EP 0426687 A1	15-05-1991
			JP 3506010 T	26-12-1991
