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(54) **A method of providing a communications link**

(57) The present invention relates to a method of providing a communications link in a mobile communications network, the method operating in a system comprising a processing device having memory; a base transceiver station; and an antenna mounting structure having an antenna and antenna system controller mounted thereon, the antenna being connected to the antenna system controller; wherein the steps of the method comprise

identifying a communications link path between the antenna system controller and base transceiver station; and installing a cable construction comprising a fixed length jumper cable, a fixed length tail cable and a feeder cable assembly along the communications link path so as to form a communications link between the antenna and the base transceiver station. The use of a feeder cable assembly allows for optimisation of the cable features used therein.

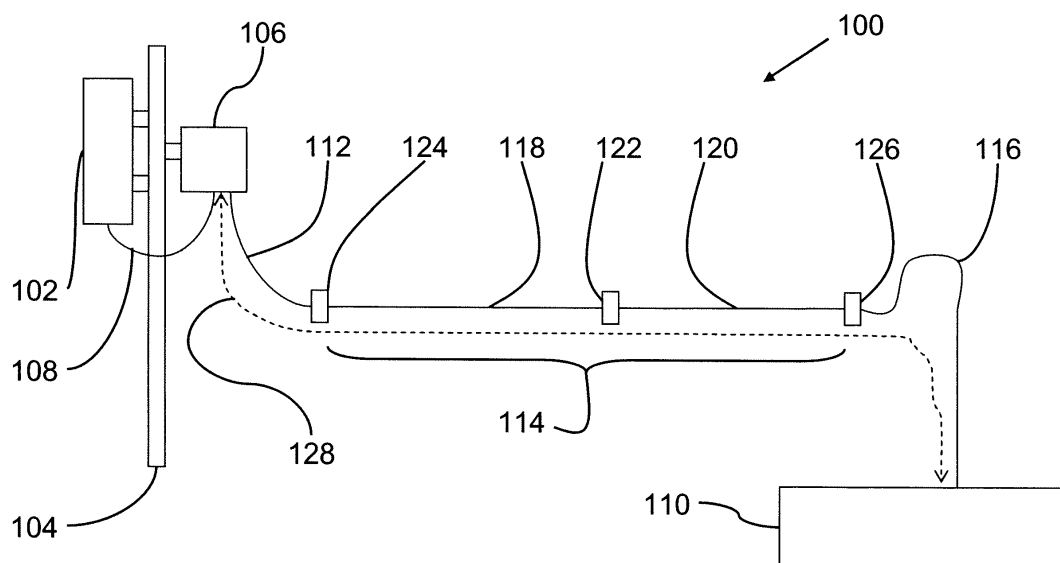


Fig. 1

Description

[0001] The present invention relates to a method of providing a communications link in a mobile communications network, the method operating in a system comprising a processing device having memory; a base transceiver station; and an antenna mounting structure having an antenna and antenna system controller mounted thereon, the antenna being connected to the antenna system controller; wherein the steps of the method comprise identifying a communications link path between the antenna system controller and base transceiver station; and installing a cable construction comprising a fixed length jumper cable, a fixed length tail cable and a feeder cable assembly along the communications link path so as to form a communications link between the antenna and the base transceiver station.

[0002] The installation of the radio frequency equipment used in mobile communications network generally involves the installation of an antenna on an elevated antenna support structure such as a tower or building. The antenna is connected to an Antenna System Controller (ASC) which is also mounted on the antenna support structure. The ASC is then connected to the Base Transceiver Station (BTS) which is used to generate and manage the radio frequency signals passing through the antenna. Ideally, BTS is located as close to the antenna support structure as possible, however, for a number of reasons, including the size of the BTS unit, the BTS will generally be some distance from the antenna support structure, for example, in the range of 20 m to 100 m. The ASC is connected to the BTS by a cable construction comprising a jumper cable coming from the ASC, a feeder cable connected to the jumper cable and a tail cable connecting the feeder cable to the BTS. There are a number of different cable types available for use as the feeder cable and each have different characteristics relating to weight, loss, cost etc.

[0003] The installation of the communications link between antenna and BTS is therefore complicated by the choice of the best cable type for use as a feeder cable. For example, the feeder cable will be partially supported by the antenna support structure, therefore the weight of the selected feeder cable will be relevant to the type of antenna support structure that may be used. If it is necessary to increase the weight bearing load of the antenna support structure because of the weight of the feeder cable, the cost of the communications link project is increased. Furthermore, there may be additional weight-related aspects for further support members used on the path between the ASC and the BTS, wherein heavier cables may again increase the weight-bearing requirements, and consequently the cost of such support members.

[0004] It is an object therefore of the present invention to provide a method that overcomes at least some of the above-mentioned problems.

STATEMENTS OF INVENTION

[0005] According to the invention there is provided a method of providing a communications link in a mobile communications network, the method operating in a system comprising a processing device having memory; a base transceiver station; and an antenna mounting structure having an antenna and antenna system controller mounted thereon, the antenna being connected to the antenna system controller; wherein the steps of the method comprise

(a) identifying a communications link path between the antenna system controller and base transceiver station;

(b) installing a cable construction comprising a fixed length jumper cable, a fixed length tail cable and a feeder cable assembly along the communications link path so as to form a communications link between the antenna and the base transceiver station; characterised in that the method comprises the steps of initial step of

(c) storing a database of components suitable for use in a feeder cable assembly in memory, wherein the components comprise at least one connector type and a plurality of cable types, and the database comprises at least a loss value for the at least one connector type and at least a preference value and loss per unit length value for each cable type, wherein the preference value for the cable types is assigned based on at least the weight per unit length of the cable type; wherein the method comprises the intermediate steps of

(d) receiving a particular communications link specification and storing it in memory, the particular communications link specification comprising a minimum loss value;

(e) measuring the length of the communications link path and storing it in memory;

(f) the processing unit calculating the length of the feeder cable assembly required to form, in combination with the fixed length jumper cable and fixed length tail cable, the communications link along the communications link path;

(g) the processing unit calculating the loss of the fixed length jumper cable and fixed length tail cable and thereby calculating the allowed loss for the feeder cable assembly so that the communications link will meet the minimum loss value of the communications link specification;

(h) the processing unit selecting the components, from the database, to provide the feeder cable assembly of the particular communications link along the communications link path by

- i. selecting components, including a combination of cable types and their associated lengths, that combine to the length of the feeder cable assembly and provide the best preference value,
- ii. calculating the loss for a feeder cable assembly formed from the selected components based on the values stored in the database;
- iii. if the calculated loss meets the allowed loss for the feeder cable assembly, proceeding to step (i)
- iv. if not, decreasing the proposed length of the more preferred cable types by a defined value, increasing the proposed length of the less preferred cable types by the same defined value, and recalculating the loss;
- v. iteratively carrying out step iv until the calculated loss meets the allowed loss for the feeder cable assembly and then proceeding to step (p)

(i) the processing module providing a report listing the selected components, including the lengths of the required cables;

(j) forming the feeder cable assembly from the selected components.

[0006] In this way, an efficient and useful method of providing a communications link between an antenna and a BTS is provided. A feeder cable assembly is provided which is constructed from a combination of cable types so that the advantageous features of the various cable types may be incorporated into the communications link. The concept of combining cables of different types is contrary to long-standing industry practice, for a variety of reasons. These reasons include a perceived lack of efficiency. The method of the invention overcomes this problem by providing an efficient optimisation of the choice of cable type based on the preferred cable type or types. The method of the invention allows a feeder cable assembly to be used, instead of a single main feeder cable. In this way, a reduction in the cost and weight of the feeder cable in the communications link is facilitated. The reduction in the weight of the communications link has a number of advantages associated with it, including a reduction in the weight-bearing requirements for support structures for the feeder cable. Alternatively, the reduction in the weight of the cable construction of the communications link allows further hardware to be installed on support structures that otherwise would not have the weight-bearing capacity. Additionally, the transport and installation of lighter cable is easier than for heavier cable. The method of the inventions result in re-

duced cable wastage as the cable lengths are calculated and can be prepared in advance, instead of being measured and cut on site. Furthermore, the use of a feeder cable assembly facilitates extending the communications link path in the future if necessary, for example, if it was required to move the antenna or the BTS.

[0007] In another embodiment of the invention, there is provided a method in which the cable type components suitable for use in a feeder cable assembly consist of a first cable type and a second cable type. The use of a two cable type solution is particularly suited for use in the installation of communications links of this type.

[0008] In a further embodiment of the invention there is provided a method in which the cable type components suitable for use in a feeder cable assembly consist of a first cable type, a second cable type and a third cable type. In this way, the method of the invention may select an assembly of up to three different cable types for use in the communications link.

[0009] In one embodiment of the invention there is provided a method in which the defined value in part iv. of step (h) is between 0.1 m and 0.6 m inclusive. In this way, the level of efficiency of the method may be adjusted as required.

[0010] In another embodiment of the invention there is provided a method in which the defined value in part iv. of step (h) is 0.25 m. This is particularly suitable adjustment increment, allowing for efficient design and installation of the communications link.

[0011] In a further embodiment of the invention there is provided a method in which the preference value for a cable component is adjusted based on the proposed length of the cable component. In this way, a very efficient method of selecting the proposed components for the feeder cable assembly is provided.

[0012] In an alternative embodiment of the invention there is provided a method in which the in which the preference value comprises two parts, a first part and a second part that is assigned to each proposed length of the cable type.

[0013] In another embodiment of the invention there is provided a method in which the preference value is assigned based on a combination of at least weight per unit length and carbon footprint. In this way, the number of factors that affect the preference value are increased to include the carbon footprint associated with the cable type. This is particularly advantageous as the environmental impact of commercial activities becomes more and more important.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The invention will now be more clearly understood from the following description of an embodiment thereof given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a diagrammatic representation of a system

in which the method according to the invention operates;

Fig. 2 is a block diagram of a processing device used in the method of the invention;

Fig. 3 is an example table that may be used by the method of the invention; and

Fig. 4 is a flow diagram of the operation of the method according to the invention.

[0015] Referring to the drawings, and initially to Fig. 1 thereof, there is shown a portion of a mobile communications network indicated generally by the reference numeral 100, comprising an antenna 102 mounted on an antenna support structure 104. The antenna support structure 104 also mounts an Antenna System Controller (ASC) 106, the antenna 102 being connected to the ASC 106 by way of an antenna connection cable 108. The portion of mobile communications network 100 further comprises a Base Transceiver Station (BTS) 110 wherein the ASC is connected to the BTS by way of cable construction comprising a fixed length jumper cable 112; a feeder cable assembly indicated generally by the reference numeral 114; and a fixed length tail cable 116. The feeder cable assembly 114 comprises a portion of a first cable type 118 and a portion of a second cable type 120, joined together at a feeder connector 122. The jumper cable 112 is connected between the ASC 106 and the feeder cable assembly 114, and is connected to the feeder cable assembly 114 by a first connector 124. The tail cable 116 is connected between the BTS and the feeder cable assembly 114, and is connected to the feeder cable assembly 114 by a second connector 126. The jumper cable 112, feeder cable assembly 114 and tail cable 116 run along the imaginary communications link path 128, indicated by a dashed line, between the ASC 106 and the BTS 110. Together, the jumper cable 112, feeder cable assembly 114 and tail cable 116 form a communications link between the ASC 106 and the BTS 110.

[0016] Referring now to Fig. 2, in which like parts have been given the same reference numerals as before, there is shown a block diagram of the processing device 200 used to implement a portion of the invention. The processing device 200 comprises a processing module 202 and memory 204. In the course of operation of the method of the invention, a database 206 is stored on the memory 204 of the processing device 200.

[0017] Referring now to Fig. 3, in which like parts have been given the same reference numerals as before, there is shown an example of a table indicated generally by the reference numeral 300 from the database 206 forming part of the invention. The table 300 comprises a row for each potential component that may be used to form the feeder cable assembly 114. Each row comprises details on the component name; the class of component, in this case either cable or connector; the preference val-

ue for the component; and a loss value. In the case of cable class components, the loss value corresponds to a loss per unit length, while for connector class components, the loss value represents the total loss for that connector.

[0018] Referring now to Fig. 4, there is shown a flow diagram of the operation of the invention. In step 400, a database 206 of component details is stored in memory 204 on the processing device 200. The database 206 comprises details for each potential component that may be used to form the feeder cable assembly 114. The stored details include the component name; the class of component; the preference value for the component; loss per unit length for the cable class components, and the loss per device for the connector class components. In step 402, a particular communications link specification is provided and the details are stored in memory. The particular communications link specification will specify a minimum signal strength loss permissible along the communications link between the ASC 106 and BTS 110. In step 404, a communication link path 128 is identified by way of a site survey, and in step 406, the length of the communication link path 128 is measured and the result is stored in memory 204. In step 408, the processing unit calculates the length of main feeder assembly required. This is done by subtracting the lengths of the fixed length jumper cable and fixed length tail cable from the overall length of the communication link path. In general, the fixed length jumper cable and fixed length tail cable will each measure 2 m in length, so that the length of the feeder cable assembly is 4 m less than that of the communications link path. In step 410, the processing unit calculates the loss associated with the fixed length jumper cable and fixed length tail cable, and thereafter uses this information to calculate the allowed loss for the feeder cable assembly, according to the specification for the communications link. The loss associated with the fixed length jumper cable and fixed length tail cable may be calculated on a loss per unit length basis, from appropriate values stored in the database, or there may be a defined loss value stored in memory.

[0019] In step 412, the processing unit calculates the optimal components to create the feeder cable assembly 114 for use in the communications link, using an iterative loop. In step 412a, the processing unit chooses a set of components, including lengths for the cables selected. The components with the highest preference values are chosen initially. In step 412b, the processing unit calculates the loss that a feeder cable assembly formed from those components would have. In step 412c, the processing unit checks to see if the loss meets the allowed loss for the feeder cable assembly. If the answer is yes, the method proceeds to step 414. If the answer is no, the method proceeds to step 412d. In step 412d, the processing unit alters the proposed lengths of the selected components, reducing the length of the high preference cables types and increasing the length of the low preference cables. The method alters the proposed

lengths by 0.25 m at each iteration. The method then goes back to step 412b, where the loss for the proposed feeder cable assembly is calculated. The method then moves again to step 412c, where the processing unit checks to see if the loss meets the allowed loss for the feeder cable assembly. The method loops through steps 412d, 412b, and 412c, until an allowable loss for the proposed feeder cable assembly is obtained, and then moves to step 414. In step 414, the processing unit provides a report of the chosen components and in step 416, report is used as the basis for detailed design drawings of the communications link and the components therein. In step 418, the specific cable length and associated connectors are delivered to the communications link site. In step 420, the communications link is assembled using a feeder cable assembly formed based on the detailed design drawings created in the step 416 according the report output by the processing unit in step 414. Finally, in step 422, once installed the loss of the communications link is verified to ensure it meets the communications link specification.

[0020] The preference values may simply comprises an integer rating for a component type as illustrated in Fig. 3. In an alternative embodiment, a cable preference value may comprise two parts, a first part to differentiate between different cable types and a second part may be assigned to each proposed length for each cable type. In this way, the preferred cable type is identified by the first part of the preference value and a cable portion of that cable type having a length 0.25 m would have a second part preference value of 1, while a cable of the same type of length 0.5 m would have a second part preference value of 2. In this example, in a situation with two cable types, the second cable type would not require a second part preference value and the cable construction for the feeder cable assembly would be chosen by minimising the second part preference value for the preferred cable type.

[0021] It will be understood that with only minor adjustments, the method of the invention can be implemented having high preference values for preferred components and aiming to maximise the preference values for the feeder cable assembly, or alternatively, having low preference values for preferred components and aiming to minimise the preference values for the feeder cable assembly. Ideally, the preference values will be simple values such as integer values, or in some cases letters of the alphabet. In the case of integer values, the preference values may be optimised by minimising or maximising the total sum of preference values for the feeder cable assembly. In the case of letters of the alphabet, the preference values may be optimised by choosing components having the lowest or highest letter.

[0022] In some circumstances, the jumper cable and the first portion of the feeder cable assembly may be formed from the same cable type. In this way, the first connector 124 may be omitted. In such cases, minor adjustments to the loss calculations made in the method of

the invention will be implemented. It will be understood that the number of connectors required to form the communications link will be adjusted as required by the processing unit, depending on the cable types and lengths chosen.

[0023] In the situation where the preference value is based on more than one factor such as weight and carbon footprint, the factors may be assigned based on a weighted sum or in other such methods. For example, for a case where minimising the weight of the cable, within the loss parameters, is the main focus for the communications link, but the owners of the communications link would like to take a account of the environmental friendliness of the communications link as well, the preference value may be calculated as $(0.8 \times W) + (0.2 \times C)$, where W is the preference value based on weight, and C is the preference value based on the carbon footprint of the cable. It is clear that in such cases, it is preferable to make use of integer, or at least numerical, preference values.

[0024] It will be understood by the person skilled in the art that the term base transceiver station may refer to a base transceiver station as used in a GSM mobile telecommunications network; a 'Node B' portion of a UMTS mobile telecommunications network; and similar units in 4G, LTE or similar networks.

[0025] In the specification the terms 'comprise', 'comprises', 'comprised' and 'comprising' or any variation thereof and the terms 'include', 'includes', 'included' or 'including' or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation.

[0026] The invention is not limited to the embodiment herein described, but may be varied in both construction and detail within the terms of the claims.

Claims

1. A method of providing a communications link in a mobile communications network, the method operating in a system comprising a processing device having memory, a base transceiver station; and an antenna mounting structure having an antenna and antenna system controller mounted thereon, the antenna being connected to the antenna system controller; wherein the steps of the method comprise

(a) identifying a communications link path between the antenna system controller and base transceiver station;

(b) installing a cable construction comprising a fixed length jumper cable, a fixed length tail cable and a feeder cable assembly along the communications link path so as to form a communications link between the antenna and the base transceiver station;

characterised in that

the method comprises the steps of initial step of

(c) storing a database of components suitable for use in a feeder cable assembly in memory, wherein the components comprise at least one connector type and a plurality of cable types, and the database comprises at least a loss value for the at least one connector type and at least a preference value and loss per unit length value for each cable type, wherein the preference value for the cable types is assigned based on at least the weight per unit length of the cable type; wherein the method comprises the intermediate steps of

(d) receiving a particular communications link specification and storing it in memory, the particular communications link specification comprising a minimum loss value;

(e) measuring the length of the communications link path and storing it in memory;

(f) the processing unit calculating the length of the feeder cable assembly required to form, in combination with the fixed length jumper cable and fixed length tail cable, the communications link along the communications link path;

(g) the processing unit calculating the loss of the fixed length jumper cable and fixed length tail cable and thereby calculating the allowed loss for the feeder cable assembly so that the communications link will meet the minimum loss value of the communications link specification;

(h) the processing unit selecting the components, from the database, to provide the feeder cable assembly of the particular communications link along the communications link path by

i. selecting components, including a combination of cable types and their associated lengths, that combine to the allowed length of the feeder cable assembly and provide the best preference value,

ii. calculating the loss for a feeder cable assembly formed from the selected components based on the values stored in the database;

iii. if the calculated loss meets the allowed loss for the feeder cable assembly, proceeding to step (i)

iv. if not, decreasing the proposed length of the more preferred cable types by a defined value, increasing the proposed length of the less preferred cable types by the same defined value, and recalculating the loss;

v. iteratively carrying out step iv until the calculated loss meets the allowed loss for the feeder cable assembly and then proceeding to step (i)

(i) the processing module providing a report listing the selected components, including the

lengths of the required cables;

(j) forming the feeder cable assembly from the selected components.

- 5 2. A method as claimed in claim 1 in which the cable type components suitable for use in a feeder cable assembly consist of a first cable type and a second cable type.
- 10 3. A method as claimed in claim 1 or 2 in which the cable type components suitable for use in a feeder cable assembly consist of a first cable type, a second cable type and a third cable type.
- 15 4. A method as claimed in any preceding claim in which the defined value in part iv. of step (h) is between 0.1 m and 0.6 m inclusive.
- 20 5. A method as claimed in any preceding claim in which the defined value in part iv. of step (h) is 0.25 m.
- 25 6. A method as claimed in any preceding claim in which the preference value for a cable component is adjusted based on the proposed length of the cable component.
- 30 7. A method as claimed in claim 6 in which the preference value comprises two parts, a first part and a second part that is assigned to each proposed length of the cable type.
- 35 8. A method as claimed in any preceding claim in which the preference value is assigned based on a combination of weight per unit length and carbon footprint.

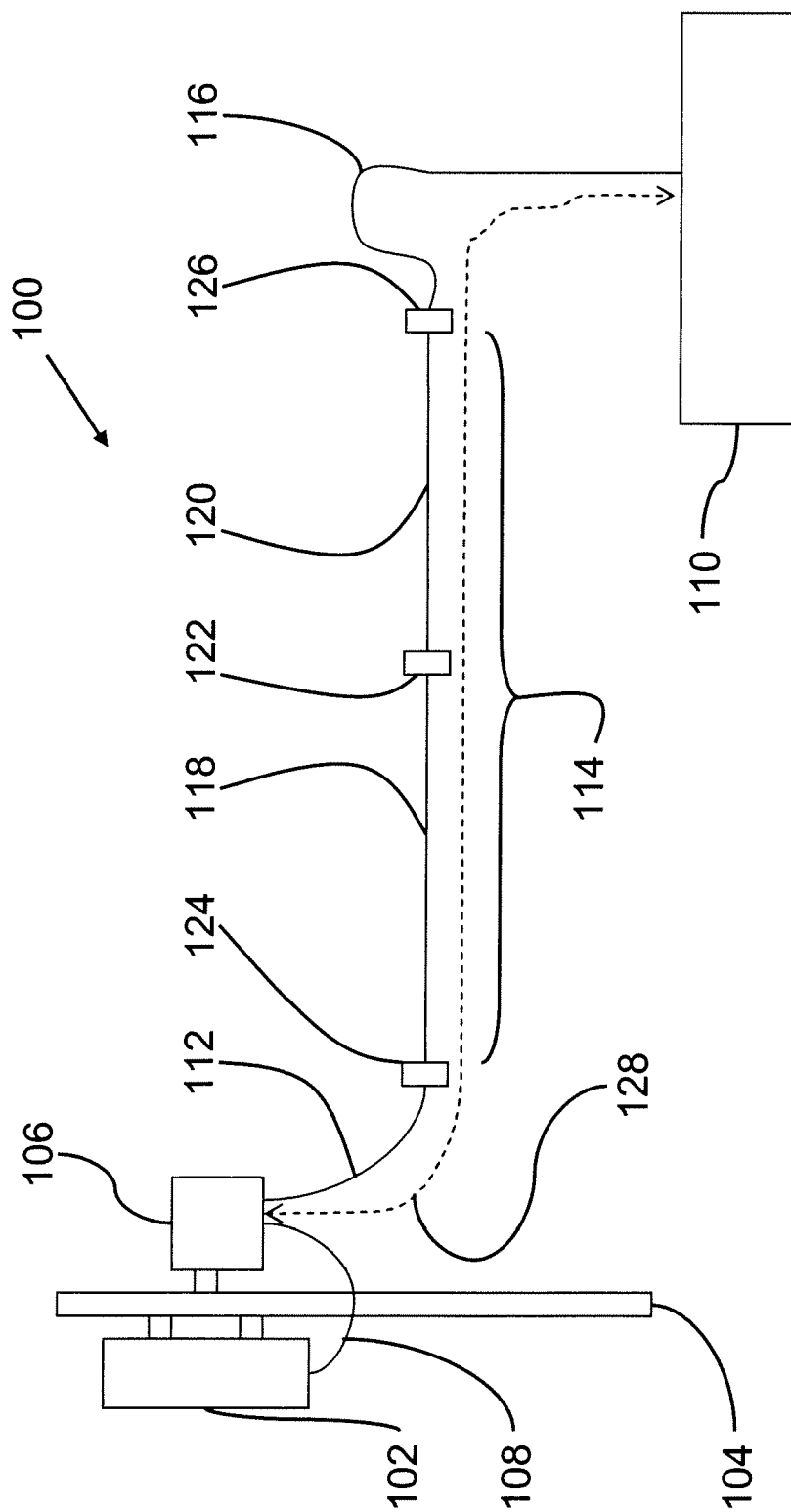


Fig. 1

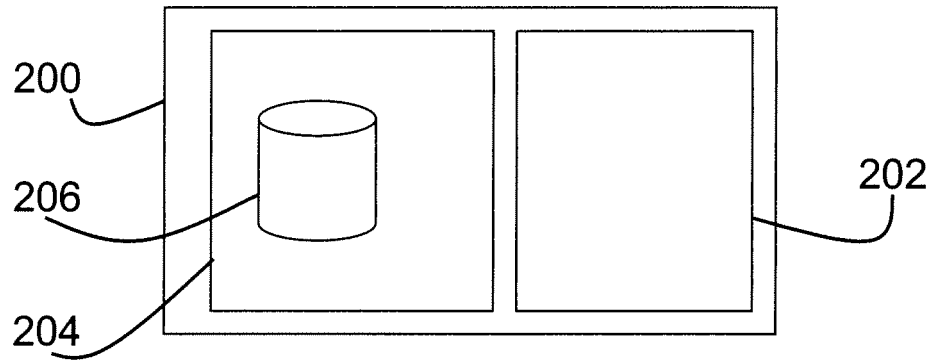


Fig. 2

300

Component Name	Class	Preference Value	Loss
Cable1	Cable	1	0.052
Cable2	Cable	2	0.041
Cable3	Cable	3	0.033
Connector1	Connector	1	0.09
Connector2	Connector	2	0.07

Fig. 3

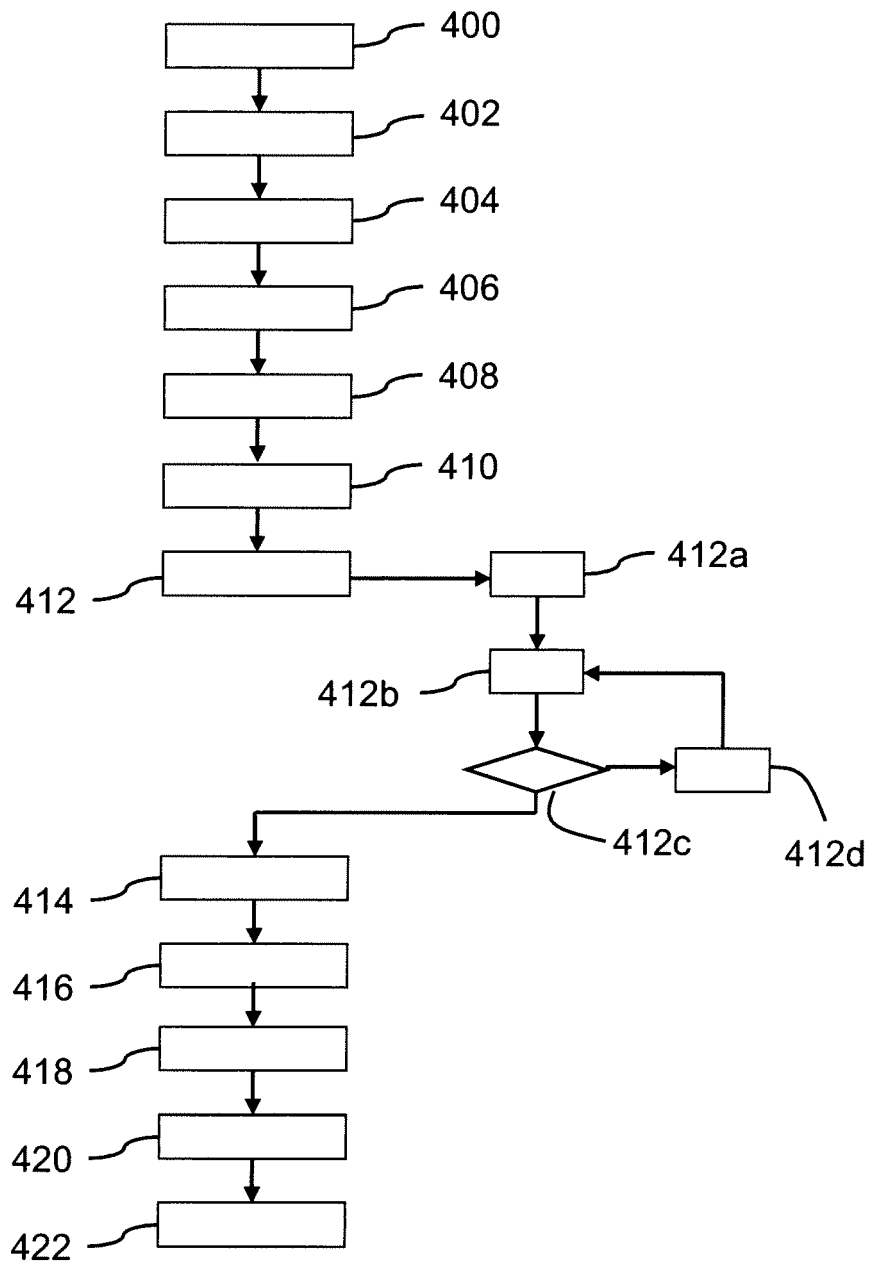


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 10 15 2549

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 7 096 173 B1 (RAPPAPOORT THEODORE [US] ET AL) 22 August 2006 (2006-08-22) * abstract * * column 3, line 47 - column 5, line 19 * * column 8, lines 34-55 * * column 10, lines 23-58 * * column 11, line 58 - column 12, line 15 * * column 12, line 59 - column 15, line 37 * * column 16, line 59 - column 17, line 22 * * column 20, line 51 - column 23, line 7 *	1-8	INV. H01Q1/24
A	US 2002/061763 A1 (WEISSMAN HAIM [IL]) 23 May 2002 (2002-05-23) * abstract; figures 2,5 * * paragraph [0110] - paragraph [0114] *	1-8	
A	US 2007/238416 A1 (WILLIAMS DOUGLAS M [US]) 11 October 2007 (2007-10-11) * figures 2a,2b * * paragraph [0006] - paragraph [0010] * * paragraph [0044] - paragraph [0057] *	1-8	TECHNICAL FIELDS SEARCHED (IPC) H01Q
A	US 2007/093204 A1 (KINCARD DWAYNE [US]) 26 April 2007 (2007-04-26) * paragraphs [0004], [0005] *	1-8	
A	US 2008/311871 A1 (QI YIHONG [CA] ET AL) 18 December 2008 (2008-12-18) * paragraph [0049] - paragraph [0062] *	1-8	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 May 2010	Examiner Unterberger, Michael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 15 2549

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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17-05-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7096173	B1	22-08-2006	NONE

US 2002061763	A1	23-05-2002	AT 381817 T 15-01-2008
		AU 2003902 A 03-06-2002	
		BR 0115494 A 01-02-2005	
		CA 2436785 A1 30-05-2002	
		CN 1483249 A 17-03-2004	
		DE 60132009 T2 04-12-2008	
		EP 1336258 A2 20-08-2003	
		IL 155846 A 15-06-2009	
		JP 3974523 B2 12-09-2007	
		JP 2004515108 T 20-05-2004	
		WO 0243274 A2 30-05-2002	

US 2007238416	A1	11-10-2007	CN 101449266 A 03-06-2009
		EP 2005321 A2 24-12-2008	
		US 2009270041 A1 29-10-2009	
		WO 2007117922 A2 18-10-2007	

US 2007093204	A1	26-04-2007	NONE

US 2008311871	A1	18-12-2008	EP 2003800 A1 17-12-2008
		EP 2109236 A2 14-10-2009	
